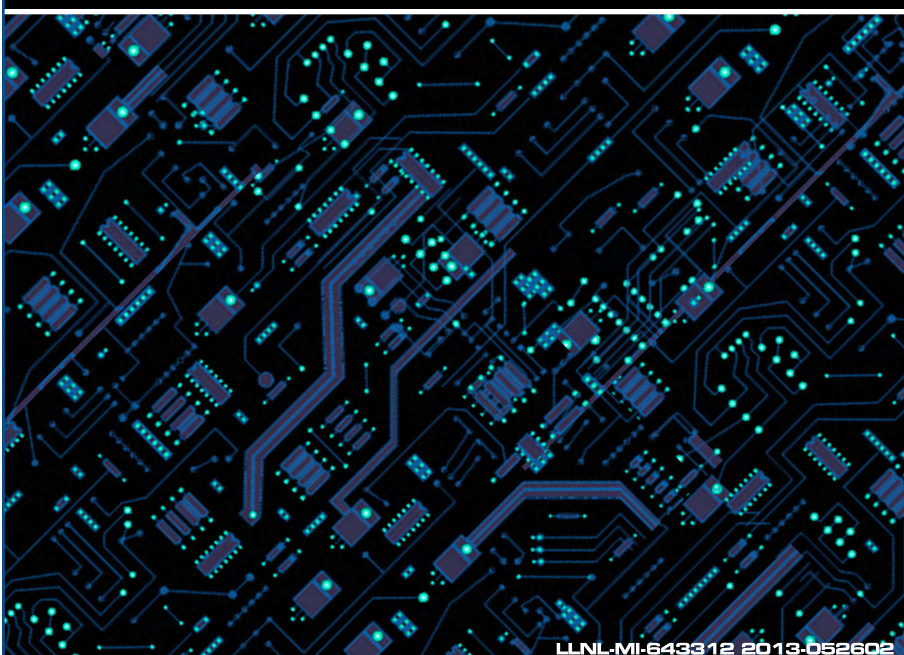
Lawrence Livermore National Laboratory

2013 ICALEPCS

International Conference on Accelerators and Large Experimental Physics Control Systems

HTTP://WWW.ICALEPCS2013.ORG



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NIF

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LLNL-MI-643312_2013-052602

14th International Conference on
Accelerators and Large Experimental Physics Control Systems

The Hyatt Regency Embarcadero Center
San Francisco, California

October 6-11, 2013

Hosted by:

The National Ignition Facility

Lawrence Livermore National Laboratory

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Week at a Glance

8:00 · 9:00 · 10:00 · 11:00 · 12:00 · 13:00 · 14:00 · 15:00 · 16:00 · 17:00 · 18:00 · 19:00 · 20:00 · 21:00 · 22:00

5 Saturday

- EPICS Satellite Meeting
Seacliff

6 Sunday

- Workshops
Seacliff, Bayview, & Plaza
- Registration
Atrium Lobby
- Welcome Meeting and Reception
Atrium Lobby

7 Monday

- Continental Breakfast
Ballroom Foyer
- Opening and Welcome Address
Ballroom A&B
- Keynote Marian Petre
Ballroom A&B
- Project Status Reports-1
Ballroom A&B
- Coffee Break
Pacific Concourse
- Lunch
- Keynote Mike Santori
- Integrating Complex Systems
Ballroom A&B
- Coffee Break
Pacific Concourse
- Workshop Overviews
- Poster-1 + Industrial Exhib.
Pacific Concourse
- Mini Oral-1
Ballroom A&B

8 Tuesday

- Continental Breakfast
Ballroom Foyer
- Keynote Ed Moses
Ballroom A&B
- Project Status Reports-2
Ballroom A&B
- Coffee Break
Pacific Concourse
- Project Management and Collaboration
Ballroom A&B
- Group Photo - Atrium Lobby
- Lunch
- Poster-2 + Industrial Exhib.
Pacific Concourse
- Mini Oral-2
Ballroom A&B
- Refreshments
Pacific Concourse
- Safety and Machine Protection
Ballroom A
- Software Technology Evolution
Ballroom B
- Mobile Platform Roundtable
Ballroom A&B

9 Wednesday

- Continental Breakfast
Ballroom Foyer
- Keynote Charles Elachi
Ballroom A&B
- Experiment Control -1
Ballroom A&B
- Coffee Break
Pacific Concourse
- Data Management
Ballroom A
- Hardware
Ballroom B
- NIF Tour
- Banquet and Awards,
Alexander Rose
One Market

10 Thursday

- Continental Breakfast
Ballroom Foyer
- Keynote Matt Ettus
Ballroom A&B
- User Interfaces and Tools
Ballroom A&B
- Coffee Break
Pacific Concourse
- Lunch
- Poster-3 + Industrial Exhib.
Pacific Concourse
- Mini Oral-3
Ballroom A&B
- Refreshments
Pacific Concourse
- Control Systems Infrastructure
Ballroom A
- Control Systems Upgrades
Ballroom B
- Timing and Syncronization
Ballroom A
- Knowledge Based Techniques
Ballroom B

11 Friday

- Continental Breakfast
Ballroom Foyer
- Keynote Peter Doolan
Ballroom A&B
- Experiment Control - 2
Ballroom A&B
- Coffee Break
Pacific Concourse
- Lunch
- Feedback Systems
Ballroom A&B
- Technical Summary 2013,
Closing Remarks
Ballroom A&B

http://www.icalepcs2013.org/programs/program_calendar.php

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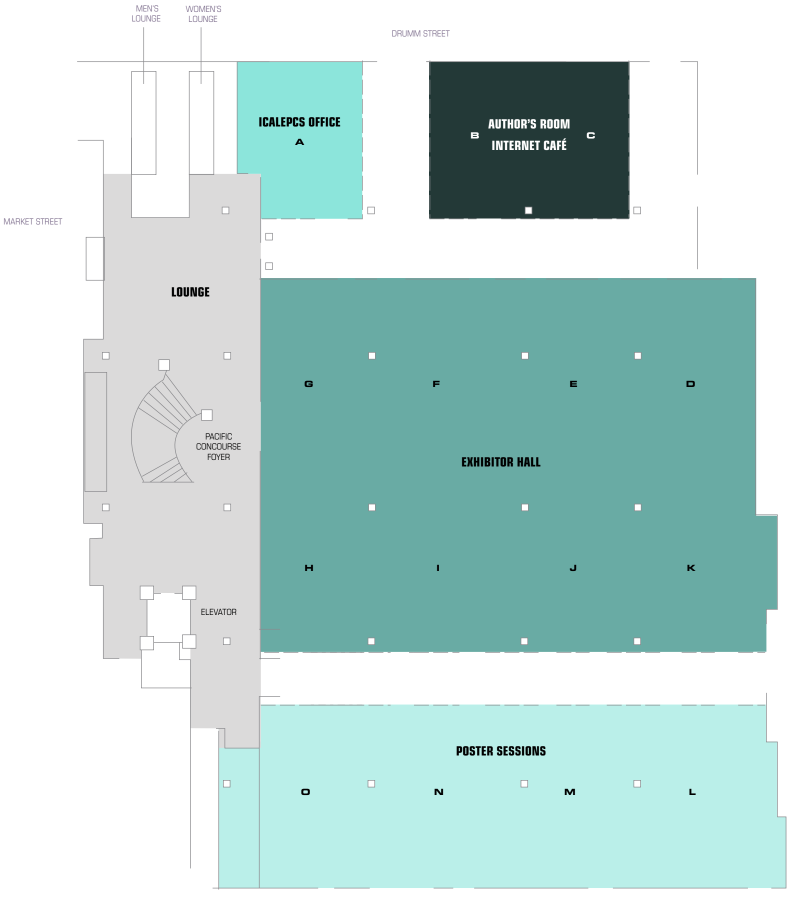
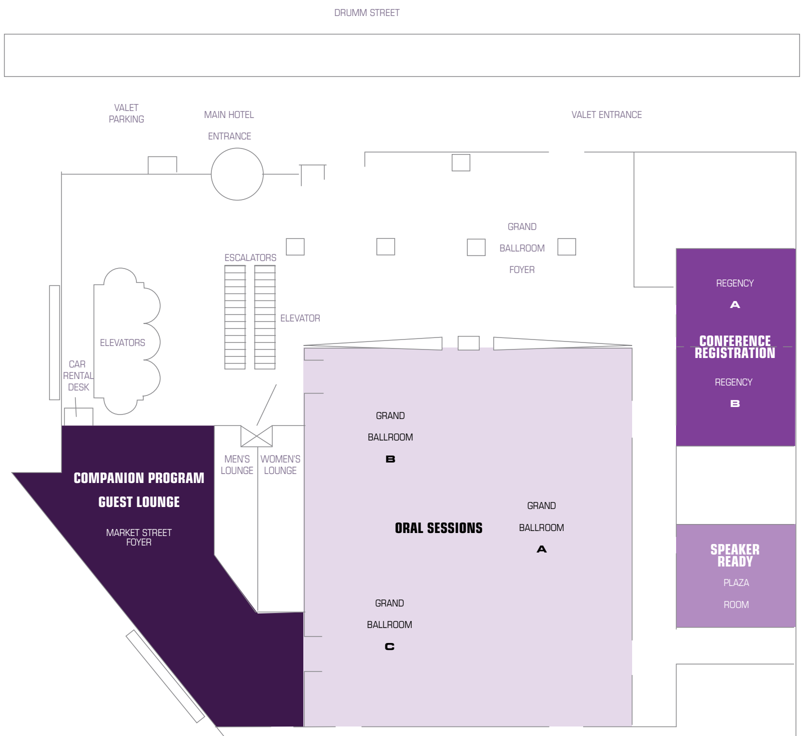
WIENER and HYTEC

Pacific Concourse Level



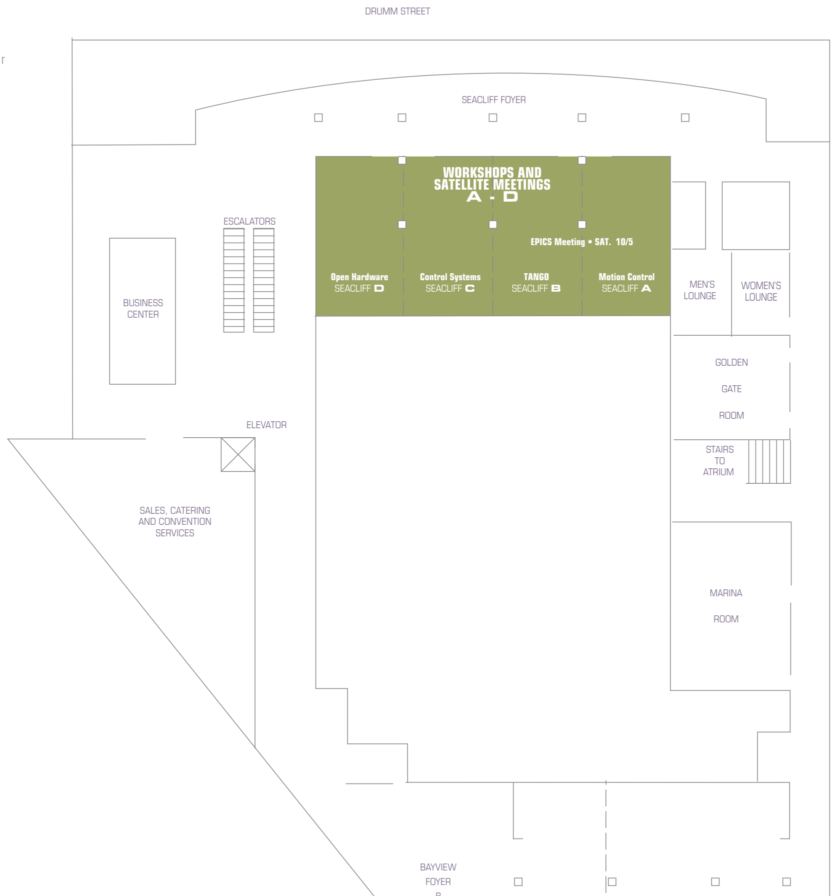
Purpose	Location
Registration	Regency A-B
Speaker Ready	Plaza
Oral Sessions	Ballrooms A-C
Poster Sessions	Pacific Concourse D-H
Exhibitor Hall	Pacific Concourse D-H
Accompanying Persons Program	Market Street Foyer
Author's Room	Pacific Concourse B-C
Internet Café	Pacific Concourse B-C
Editorial Office	Boardroom B
Lounge	Pacific Concourse Foyer
Workshops and Satellite Meetings	Seacliff A-D and Plaza
ICALEPCS Office	Pacific Concourse A

Street Level



Purpose	Location
Registration	Regency A-B
Speaker Ready	Plaza
Oral Sessions	Ballrooms A-C
Poster Sessions	Pacific Concourse D-H
Exhibitor Hall	Pacific Concourse D-H
Accompanying Persons Program	Market Street Foyer
Author's Room	Pacific Concourse B-C
Internet Café	Pacific Concourse B-C
Editorial Office	Boardroom B
Lounge	Pacific Concourse Foyer
Workshops and Satellite Meetings	Seacliff A-D and Plaza
ICALEPCS Office	Pacific Concourse A

Bay Level



Purpose	Location
Registration	Regency A-B
Speaker Ready	Plaza
Oral Sessions	Ballrooms A-C
Poster Sessions	Pacific Concourse D-H
Exhibitor Hall	Pacific Concourse D-H
Accompanying Persons Program	Market Street Foyer
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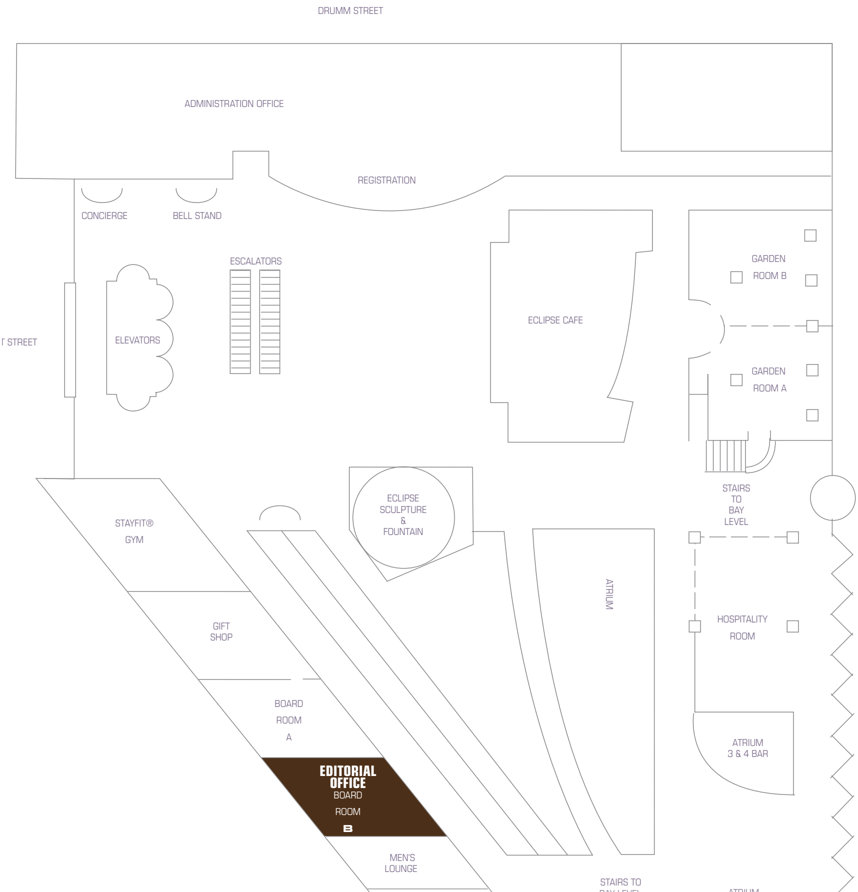
Internet Café	Pacific Concourse B-C
Editorial Office	Boardroom B
Lounge	Pacific Concourse Foyer
Workshops and Satellite Meetings	Seacliff A-D and Plaza
ICALEPCS Office	Pacific Concourse A

These exact assignments could change depending on the final head count for each workshop.

Atrium Level



Purpose	Location
Registration	Regency A-B
Speaker Ready	Plaza
Oral Sessions	Ballrooms A-C
Poster Sessions	Pacific Concourse D-H
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Internet Café	Pacific Concourse B-C
Editorial Office	Boardroom B
Lounge	Pacific Concourse Foyer
Workshops and Satellite Meetings	Seacliff A-D and Plaza
ICALEPCS Office	Pacific Concourse A

Welcome from the ICALEPCS13 Chair

I am very pleased to welcome you to ICALEPCS13, being held for the first time in San Francisco, California. I hope you will be able to enjoy the cultural, gourmet and unique attractions of this lovely city. Since its inception in Switzerland in 1987, the ICALEPCS series of conferences has grown into the main international controls conference in the field of accelerators and physics experiments. It is an honor to chair such a dynamic conference. The ICALEPCS series of conferences has played a strong role in creating and promoting control systems standards. However, due to the constant changes in the field, we expect to see new standards emerging and look forward to hearing about the latest accomplishments presented at ICALEPCS13.

I would like to thank our sponsors, patrons, and exhibitors for their support and presence at this conference. In the end, it is the scientific content of ICALEPCS13 that really counts. The Scientific Program Committee has selected a program that brings out the latest and most interesting topics of the current control system field, and the delegates contributions, posters or contributed orals will provide and in-depth view of the
international field.

Finally, we wish all delegates an excellent conference and hope they experience the three conference goals to their fullest:

- Enjoy - the conference, San Francisco, and California
- Discover - new colleagues, ideas, and technologies
- Collaborate - on existing and new projects

Chris Marshall
ICALEPCS13 Chair
NIF & Photon Science Directorate
Lawrence Livermore National Laboratory

Welcome from the ICALEPCS13 SPC Chair

On behalf of the ICALEPCS13 Scientific Program Committee (SPC), we welcome you to the 14th annual International Conference on Accelerator and Large Experimental Physics Control Systems in San Francisco, California. Following the lead of previous ICALEPCS conferences, the scientific program has been carefully arranged to provide a balanced representation of current research topics, accelerator and experimental physics control systems, and speakers from around the world.

The field of control system science is moving at a very fast pace in many exciting directions. It is our hope you find the program intellectually stimulating and a source of motivation to expand your research endeavors. We encourage you to interact with as many new colleagues as possible to further expand your knowledge and unite the international control system community. Enjoy the conference and take the time to experience some of the many attractions of beautiful San Francisco.

Peg Folta
ICALEPCS13 SPC Chair
NIF & Photon Science Directorate
Lawrence Livermore National Laboratory

NIF Principal Associate Director's Welcome

On behalf of the National Ignition Facility (NIF) and Lawrence Livermore National Laboratory, it is my pleasure to welcome you to the ICALEPCS13 conference and San Francisco. I hope that you will take the opportunity to visit the NIF while at the conference being just 45 minutes east of San Francisco in the Livermore Valley.

The NIF is the world's largest laser system. Its 192 intense laser beams can deliver to a target more than 60 times the energy of any previous laser system. NIF became operational in March 2009. NIF is capable of directing nearly two million joules of ultraviolet laser energy to a target in a few billionths-of-a-second pulse generating unprecedented temperatures and pressures—temperatures of more than 100 million degrees and pressures more than 100 billion times Earth's atmosphere. These conditions are similar to those in the stars and the cores of giant planets. NIF can be used to provide a better understanding of the complex physics of nuclear weapons without testing, to explore basic science such as astrophysical phenomena, materials science, and nuclear science at extreme conditions, and to potentially create fusion ignition and energy gain for future energy production.

The NIF has over 60,000 control points for electronic, optical, and mechanical devices, such as motorized mirrors and lenses, energy and power sensors, video cameras, laser amplifiers, and diagnostic instruments. With about five million lines of code running on more than 850 computers, NIF's control system ensures that all of NIF's 192 laser beams arrive at the target within a few tens of picoseconds of each other and that a host of diagnostic instruments record data in a few billionths of a second. A team of about 100 software developers, engineers, and quality control experts designed a flexible solution for a complex system whose pieces operate individually but, at the time directed, work in unison.

Please come see for yourself this unique national experimental laboratory and enjoy the ICALEPCS13 conference in San Francisco.

Edward Moses
Principal Associate Director
NIF & Photon Science Directorate
Lawrence Livermore National Laboratory

Conference Agenda

Saturday – October 5th

Pre Conference Workshops

09:00-17:00	EPICS Collaboration Satellite Meeting (Seacliff)

Sunday – October 6th

09:00-17:00	Workshops and tutorials (Seacliff, Bayview, & Plaza, MRF starts 30 minutes early)
15:00-19:30	Registration (Atrium Lobby)
17:00-19:30	Welcome Meeting and Reception (Atrium Lobby)

Monday – October 7th

08:00-08:30	Continental Breakfast (Ballroom Foyer)
08:30-09:00	Opening and Welcome Addresses (Ballroom A, B & C)
09:00-09:45	**Keynote Marian Petre** (Ballroom A, B & C)
09:45-12:00	Project Status Reports 1 (Ballroom A, B & C)
10:30-11:00	Coffee Break (Pacific Concourse)
12:00-13:30	Lunch
13:30-14:00	**Keynote Mike Santori** (Ballroom A&B)
14:00-16:15	Integrating Complex or Diverse Systems (Ballroom A, B & C)
15:00-15:30	Coffee Break (Pacific Concourse)
16:15-16:45	Workshop and tutorial Summaries (Ballroom B)
16:45-18:15	Poster 1 and Industrial Exhibition (Pacific Concourse)
16:45-17:15	Mini Oral 1 (Ballroom B)

Tuesday – October 8th

08:00-08:30	Continental Breakfast (Ballroom Foyer)
08:30-09:15	**Keynote Ed Moses** (Ballroom A&B)
09:15-10:15	Project Status Reports 2 (Ballroom A, B & C)
10:15-10:45	Coffee Break (Pacific Concourse)
10:45-12:00	Project Management and Collaboration (Ballroom A, B & C)
12:00-12:30	Group Photo (Atrium Lobby)
12:20-13:30	Lunch
13:30-14:00	Mini Oral 2 (Ballroom B)
13:30-15:00	Poster 2 and Industrial Exhibition (Pacific Concourse)
14:00-15:00	Refreshments (Pacific Concourse)
15:00-17:30	Personnel Safety and Machine Protection (Ballroom A)
15:00-17:30	Software Technology Evolution (Ballroom B)
18:00-19:30	Mobile Platforms Roundtable (Ballroom A)

Wednesday – October 9th

08:00-08:30	Continental Breakfast (Ballroom Foyer)
08:30-09:15	**Keynote Charles Elachi** (Ballroom A, B & C)
09:15-10:15	Experimental Control (Ballroom A, B & C)
10:15-10:45	Coffee Break (Pacific Concourse)
10:45-12:30	Data Management and Processing (Ballroom A)
10:45-12:30	Hardware Technology (Ballroom B)
12:45	Begin bus loading for NIF Tour
12:45-17:30	NIF Tour (NIF/LLNL, 5 buses, check ticket for exact time)
18:30-23:00	Banquet and Awards-Alexander Rose (One Market)

Thursday – October 10th

08:00-08:30	Continental Breakfast (Ballroom Foyer)
08:30-09:15	**Keynote Matt Ettus** (Ballroom A, B & C)
09:15-12:00	User Interfaces and Tools (Ballroom A&B)
10:15-10:45	Coffee Break (Pacific Concourse)
12:00-13:30	Lunch
13:30-14:00	Mini Oral 3 (Ballroom B)
13:30-15:00	Poster 3 and Industrial Exhibition (Pacific Concourse)
14:00-15:00	Refreshments (Pacific Concourse)
15:00-16:30	Control Systems Upgrades (Ballroom B)
15:00-16:30	Control Systems Infrastructure (Ballroom A)
16:30-17:45	Knowledge Based Techniques (Ballroom B)
16:30-17:45	Timing and Sync (Ballroom A)

Friday – October 11th

08:00-08:30	Continental Breakfast (Ballroom Foyer)
08:30-09:00	**Keynote Peter Doolan** (Ballroom A, B & C)
09:00-11:45	Experiment Control (Ballroom A, B & C)
10:15-10:45	Coffee Break (Ballroom Foyer)
12:00-13:30	Lunch
13:30-15:15	Feedback Systems (Ballroom A, B & C)
15:15-16:00	Technical Summary 2013 Closing Remarks (Ballroom A, B & C)

Social Program for Accompanying Person(s)

Lawrence Livermore National Laboratory is happy to welcome you to ICALECPS 2013 companion program. Below is a list of daily activities.

Monday: Alcatraz and Fisherman's Wharf

08:15 – Meet at Market Street Foyer
15:00 – Return to Hyatt Regency

Tuesday: Napa Wine Country Tour

08:15 – Meet at Market Street Foyer
18:00 – Return to Hyatt Regency

Wednesday: Grace Cathedral and ICALEPCS Banquet

08:15 – Meet at Market Street Foyer
10:30 – Return to Hyatt Regency
12:45 – NIF Tour (See ticket for assigned time)
18:00 – Return to Hyatt Regency
19:00 – Banquet at One Market (across the street from the Hyatt)

Thursday: Golden Gate Bridge Overlook and Muir Woods

09:30 – Meet at Market Street Foyer
15:00 – Return to Hyatt Regency

For Details please see page 44

Committees

International Executive Committee

Roland Müller	IEC Chair	HZB
Andy Götz	2011 Conference Chair	ESRF
Christopher Marshall	2013 Conference Chair	NIF/LLNL
Lou Corvetti	2015 Conference Chair	Australian Synchrotron
Ryotaro Tanaka		Spring-8

International Scientific Advisory Committee

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Philippe Gayet		CERN
Juan Guzman		ASKAP/CSIRO
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Mark Heron		Diamond
Larry Hoff		BNL
Kuo-Tung Hsu		NSRRC
Jorg Klora		ALBA
Timo Korhonen		PSI
Lawrence Lagin		NIF/LLNL
Ge Lei		IHEP
Sehn Liren		SSRF/SINAP
Marco Lonza		ELETTRA
John Maclean		Argonne
Mike Mouat		TRIUMF
Niko Neufeld		CERN
Mi-Young Park		KSTAR/KAERI
James Patrick		Fermilab
Stephane Perez		CEA/LMJ

James Piton	LNLS
Javier Serrano	CERN
Hamid Shoaee	SLAC
Shigeru Sudo	NIFS
Ryotaro Tanaka	Spring-8
Anders Wallander	ITER
Karen White	ORNL/SNS
Noboru Yamamoto	KEK

Program Committee

Peg Folta	2013 Program Chair	NIF/LLNL
Christopher Marshall	2013 Conference Chair	NIF/LLNL
Reinhard Bacher	User Interfaces and Tools	DESY
Pascale Betinelli	Project Management and Collaboration	SOLEIL
Matthew Bickley	Data Management and Processing	JLAB
Eric Bjorklund	User Interfaces and Tools	LANL
Gordon Brunton	Integrating Complex or Diverse Systems	LLNL
Enzo Carrone	Personnel Safety and Machine Protection	SLAC
Allan Casey	User Interfaces and Tools	LLNL
Jean-Michel Chaize	Knowledge-based Techniques	ESRF
Gianluca Chiozzi	Software Technology Evolution	ESO
Peter Clout	Control System Upgrades	Vista Control Systems
Lou Corvetti	Project Mgmt. and Collaboration	Australian Synchrotron
David Fernandez-Carreiras	Control System Upgrades	ALBA
Kazuro Furukawa	Timing Sync	KEK
Philippe Gayet	Integrating Complex or Diverse Systems	CERN
Andy Götz	Experiment Control	ESRF
Juan Guzman	Software Technology Evolution	ASKAP/CSIRO
Nick Hauser	Data Management and Processing	ANSTO
Mark Heron	Feedback Systems	Diamond
Larry Hoff	Control Systems Infrastructure	BNL
Joerg Klora	at large	ALBA
Timo Korhonen	Feedback Systems	PSI
Renata Krempaska	Control Systems Infrastructure	PSI
Larry Lagin	Control System Upgrades	LLNL
Patrick Ledu	Control Systems Upgrades	IPNL
Ge Lei	Feedback Systems	IHEP
Marco Lonza	Knowledge-based Techniques	ELETTRA
John Maclean	Project Status Reports	Argonne
Mike Mouat	Personnel Safety and Machine Protection	TRIUMF
Roland Müller	at large	HZB
Niko Neufeld	Experiment Control	CERN
Mi-Young Park	at large	KSTAR/KAERI

James Patrick	Control Systems Infrastructure	Fermilab
Stephane Perez	Timing Sync	CEA/LMJ
Javier Serrano	Hardware Technology	CERN
Hamid Shoaee	Project Status Reports	SLAC
Andrew Starritt	Project Management and Collaboration	ANSTO
Ryotaro Tanaka	Project Status Reports	Spring-8
Daniel Tavares	Hardware Technology	Brazilian light source
Anders Wallander	Project Status Reports	ITER
Karen White	Experiment Control	ORL/SNS
Markus Zerlauth	Personnel Safety and Machine Protection	CERN

Local Organizing Committee

Chris Marshall	Conference Chair
Peg Folta	Scientific Program Chair
Trina Voelker	Local Organizing Chair
Cindy Cassady	Conference Proceedings Editor
Tim Frazier	Sponsorship Co-Chair
Bob Demaret	Sponsorship Co-Chair
John Fisher	IT Chair
Mila Shapovalov	Exhibit Coordinator
Maureen Lewis	Registrant Chair

Useful Phone Numbers

Emergency	911
Walgreens Pharmacy	(415) 861-4010 • 1301 Market Street

ICALEPCS Conference Series

The 14th International Conference on Accelerator and Large Experimental Physics Control Systems will be held in San Francisco, California, USA, October 6-11, 2013, at the Hyatt Regency Embarcadero Center.

ICALEPCS covers all aspects of control and operation of Experimental Physics facilities including particle accelerators, particle detectors, optical telescopes, radio telescopes, nuclear fusion tokomaks, stellarators, and high-power lasers. The series of ICALEPCS conferences started in 1987 in Villars-sur-Ollon in Switzerland. The idea to hold a series of biennial Conferences in the field of controls for Experimental Physics facilities was launched by the European Physical Society's (EPS) Interdivisional Group on Experimental Physics Control Systems (EPCS). It was actually triggered by some earlier initiatives, which started in Berlin (EPS Conference on Computing in Accelerator Design and Operation, September 1983), followed by two specific workshops on accelerator control systems in 1985 at BNL (Brookhaven, USA) and LANL (Los Alamos, USA).

ICALEPCS has moved around the world: the second ICALEPCS, in 1989, was held in Vancouver, hosted by TRIUMF; the 1991 conference was held in Tsukuba, hosted by KEK; in 1993 it was hosted by the HMI in Berlin; in 1995 it was held in Chicago, hosted by both Fermilab and the APS of ANL; in 1997 it was organized by the IHEP in Beijing, China; in 1999 it was hosted by Sincrotrone Trieste, Italy; in 2001 it took place in San Jose (CA, USA) hosted by SLAC; 2003 was held in Gyeongju, South Korea, hosted by the Pohang Accelerator Laboratory and the Pohang University of Science and Technology; in 2007 it took place in Knoxville (TN, USA), hosted by the Spallation Neutron Source; in 2009 it was held in Kobe, Japan, hosted by SPRING8. Most recently, ICALEPCS 2011 was held in Grenoble, France hosted by ESRF.

Over the years ICALEPCS has seen its number of participants growing as well as the number of contributing institutes and countries. There were more than 400 participants at ICALEPCS 1997 in Beijing, and ICALPECS 1999 in Trieste. Control specialists attend from more than 30 different countries covering Europe, North and South America, Asia, Oceania, and Africa, representing well over one hundred organizations, both scientific institutes and industries.

For all those involved worldwide in the challenging field of controls for experimental physics, ICALEPCS offers a unique opportunity to discover the latest developments, new projects, and technologies being applied, to discuss issues with peers from the world's major laboratories, to share solutions, to identify new problems, and to shape future directions for research.

Awards

ICALEPCS 2013
Lifetime Achievement Award

The ICALEPCS Lifetime Achievement Award is meant to honor an individual (or individuals) who throughout their careers have made invaluable and lasting contributions to the field of control systems for large experimental physics facilities. The scope of this award reaches beyond the successful completion of a single project or even several projects. The aim is to recognize those who through their vision, leadership, technical excellence, and a willingness to think beyond a single laboratory or even a country have influenced the international practice of control system development.
Due to the nature of the award, it will not necessarily be presented at every ICALEPCS. This is meant as a recognition and celebration of exceptional and career-long contribution and as such it should be awarded only when such individuals have been clearly identified.

Poster Prizes

As in the previous years, prizes will be given for the best posters. The selection of the winning posters is made by a general vote from the participants of the conference. As there are three poster sessions, three prizes will be given. The prizes will be announced at the closing remarks on Friday, October 11th.

Pre-conference Meeting

The following pre-conference meeting will take place at the conference center from 9am – 5pm on Saturday, October 5, 2013.

EPICS Collaboration Satellite Meeting, organized by **Hamid Shoaee**
Fall 2013 EPICS meeting will provide a chance for developers and managers from the various different sites to come together and discuss their work in progress and make plans for the future. They give a chance to see what is being done at other laboratories, and to review the specifications for new tools or enhancements to existing ones in order to maximize their usefulness to the whole community and avoid duplication of effort.

Pre-conference Workshops

The following pre-conference workshops will take place at the conference center from 9am – 5pm (unless otherwise noted) on Sunday, October 6, 2013.

MRF Timing System Workshop,
organized by **Eric Björklund**, Moderator
This workshop will focus on future directions for the MRF event system. We would like to discuss:

- What requirements are coming up for future projects?
- What problems remain unsolved for current projects?
- What new features are needed?
- Can we set some priorities for the near future?

This workshop will be held from 8am – noon. For more information, contact Eric Björklund.

Open Hardware Workshop,
organized by **Javier Serrano** and **Daniel Tavares**
The workshop will be dedicated to discussing the principles and practice of Open Hardware (OH), a way of designing, licensing and commercializing electronics inspired by the Free and Open Source Software world. It deals also with current OH projects and will serve as a forum to discuss future strategies and collaborations.

Motion Control Applications in Large Facilities Workshop,
organized by **Pascale Betinelli**
Following the success of two workshops on motion control, in May 2010 and in October 2012, this year's workshop is intended to cover a broad range of motion control subjects pertaining to:

- Experiences in motion control at the different sites: radiation damage to encoders, in house development verses industrial product, system performance validation including reliability, obsolescence management.
- Technical solutions in software and in low level hardware: kinematic transforms, complex trajectories, protection including collision avoidance, multi-axes and multi controller synchronization, embedded and/or hosted motion features.
- Motion control challenges: submicron positioning, continuous and synchronous motion control and data detector's acquisition.

For more information, contact morcaf-workshop.

Control System Cyber Security for High Energy Physics Workshop,
organized by **Dr. Stefan Lueders**
This is the 4th workshop on this topic. Interest is high as cyber–security is as relevant as ever.

TANGO Workshop,
organized by **Andy Götz** (ESRF) and **Vincent Hardion** (MAXIV)
TANGO is an object oriented distributed control system based on CORBA and ZMQ and is being developed as a collaborative effort between research institutes in Europe. This workshop will be organized as a set of tutorials and coding sessions and will allow TANGO beginners and advanced users to discover the different features of TANGO thanks to a set of practical examples. An online coding session will be conducted during the workshop. The workshop will include a discussion session on how to best integrate industrial partners and the roadmap for TANGO for the next two years.

Keynote Speakers

SCIENTIFIC SOFTWARE DEVELOPMENT AS A SOCIAL PROCESS

Marian Petre

The Open University, United Kingdom

Software development is often understood as an engineering process. However, the factors that affect the success of a software development project are often human and social. Scientific software in particular is often developed within a complex milieu: the user community is not always cohesive, making it difficult to agree on the concepts or definitions for a basic domain ontology; different stakeholders (funders, managers, developers, users) have different problems and goals, and hence different priorities; scientists who once competed for funding may be asked to collaborate; software may outlive the original project or use; software may be shared or commercialized. Communication and collaboration are crucial: within and between organizations, between users and developers, and among developers. In the absence of communication and collaboration, the disjunctions between scientists and software developers amplify, even though scientific software development often requires the integration of distributed knowledge.

The social context of software design and development is important: it provides social reinforcement for good practice. Study of high-performing software development teams makes it clear that the interplay between designers plays a crucial part both in nurturing creativity and innovation, and in embedding systematic practice and rigour. This talk will present key observations from empirical studies of expert software development that can be applied usefully to scientific software development. It will discuss why matching development practices to the context and purpose of scientific software can improve both software and scientific outcomes. It will draw on research in order to discuss how communication and collaboration can be fostered, and to identify what works (and what doesn't work) in building collaboration in software development teams, whether co-located or distributed.

Biography

Marian Petre is a Professor of Computing at the Open University in the UK. She held a Royal Society Wolfson Research Merit Award, in recognition of her research on the nature of expertise in software design. She 'picks the brains of experts', studying how leading professional software developers reason about, represent, and communicate designs. Her research spans empirical studies of software development, programming paradigms and notations, software visualization, flexible modelling tools, and psychology of programming.

THE NIF: AN INTERNATIONAL USER FACILITY FOR HIGH ENERGY DENSITY AND INERTIAL FUSION SCIENCE

E. I. Moses

Lawrence Livermore National Laboratory, Livermore, CA 94450

The National Ignition Facility (NIF), operational since March 2009, is transitioning to an international user facility for high-energy-density science (HEDS) and inertial confinement fusion (ICF) research. The NIF, the world's largest and most energetic laser facility consists of 192 Nd-glass lasers, a control room and a target chamber. NIF is the first laser system built to demonstrate thermonuclear burn of deuterium-tritium–filled ICF capsules. NIF's high-powered, high-energy lasers can compress and heat material to produce unique states of matter and radiation environments in the laboratory—conditions of interest to HEDS supporting national security and fundamental science. Achieving ignition on NIF will also demonstrate the target physics basis of ICF for energy production. The NIF laser's unprecedented power, precision, and reproducibility, coupled with sophisticated target and diagnostic capabilities, are enabling leading edge experiments in the study of matter at extreme temperatures and pressures—conditions that exists in planetary interiors. This paper describes NIF's unprecedented current and future capabilities and the experimental results achieved so far.

Dr. Edward Moses

Principal Associate Director, Lawrence Livermore National Laboratory

Biography

Dr. Edward Moses is the Principal Associate Director for Lawrence Livermore National Laboratory (LLNL) in Livermore, California responsible for National Ignition Facility and Photon Science (NIF&PS) organization. The National Ignition Facility (NIF) is the world's largest and most energetic laser with applications to issues of strategic security, fundamental science and fusion energy. Dr. Moses is also the Director of the National Ignition Campaign (NIC). The goal of the NIC, an international collaboration of national laboratories, industry and academia, is to achieve fusion ignition in the laboratory — the culmination of a 50-year quest. Dr. Moses has a career in high technology and big science projects reaching back to 1980 which included using high power laser systems to process materials, leading a team that developed the Peregrine Cancer Treatment System and many other technology areas in lasers, optics, control systems, and diagnostics.

Dr. Moses has received many honors, including the Jefferson Award for Public Service, the 2009 Edward Teller Medal for his leadership in the development and completion of the NIF, the Fusion Power Associates 2008 Leadership Award, the Memorial D.S. Rozhdestvensky Medal for Outstanding Contributions to Lasers and Optical Sciences, and the R&D 100 Award for the Peregrine radiation therapy program. Recently, he received the Project of the Year Award, the highest accolade of the Project Management Institute (PMI), for leading the NIF. He has several other awards for outstanding achievements in project management and construction safety.

Dr. Moses is a member of the National Academy of Engineering, a Fellow of the Optical Society of America, a Fellow of the American Association for the Advancement of Science and a Fellow of SPIE. He is a member of the California Council on Science and Technology. Dr. Moses received his B.S. and Ph.D. degrees from Cornell University. He holds patents in laser technology, inertial fusion energy, and computational physics. Dr. Moses and his wife live in Livermore, California. They have three grown children.

TECHNICAL CHALLENGES OF SPACE EXPLORATION

Charles Elachi

NASA Jet Propulsion Laboratory

California Institute of Technology

The landing of the car size rover “Curiosity” on Mars was one of the most challenging engineering achievements in robotic exploration. In this talk, I will describe the innovations and challenges in developing and landing Curiosity, the scientific results during the first year of operations, as well as how it fits in the overall program of planetary exploration and Earth observatories.

Biography

Charles Elachi has been the Director of the Jet Propulsion Laboratory since May, 2001. Dr. Elachi received his B.Sc. ('68) in physics from University of Grenoble, France; the Dipl. Ing. ('68) in engineering from the Polytechnic Institute, Grenoble, and both a M.Sc. ('69) and Ph.D. ('71) degree in electrical sciences from the California Institute of Technology. He also has a M.Sc. ('83) degree in geology from the University of California, Los Angeles, and an MBA ('79) from the University of Southern California.

Dr. Elachi joined JPL in 1970. Prior to becoming Director, Dr. Elachi was JPL's Director for Space and Earth Science Programs (beginning in 1982) where he was responsible for the development of numerous flight missions and instruments for Earth observation, planetary exploration and astrophysics.

He has been a principal investigator on a number of NASA-sponsored studies and flight projects including the Shuttle Imaging Radar series (Science Team Leader), the Magellan Imaging Radar (Team Member), and the Cassini Titan Radar (Team Leader). He is the author of over 230 publications in the fields of active microwave remote sensing and electromagnetic theory, and he holds several patents in those fields.

In 1989 Dr. Elachi was elected to the National Academy of Engineering and has served on a number of academy committees. Dr. Elachi has received numerous awards, including American University of Beirut Honorary Doctorate (2013), the Association of Space Explorers (ASE) Congress Crystal Helmet Award (2012), the Pasadena Arts Council Inaugural AxS (Arts & Sciences) Award (2012), Lebanese American University Honorary Doctorate (2012), National Academy of Engineering Arthur M. Bueche Award (2011), "Chevalier de la Légion d'Honneur, France" (2011), Space Foundation J.E. Hill Lifetime Space Achievement Award (2011), AIAA Carl Sagan Award (2011), Occidental College honorary Doctor of Science degree (2011), Sigma Xi William Procter Prize for Scientific Achievement (2008), International von Kármán Wings Award (2007), the America's Best Leaders by U.S. News & World Report and the Center for Public Leadership at Harvard University's Kennedy School of Government (2006), the Royal Society of London Massey Award (2006), the Lebanon Order of Cedars (2006 and 2012), the Philip Habib Award for Distinguished Public Service (2006), the American Astronautical Society Space Flight Award (2005), the Bob Hope Distinguished Citizen Award (2005), NASA Outstanding Leadership Medal (2004, 2002, 1994), Takeda Award (2002), the Wernher von Braun Award (2002), UCLA Dept. of Earth and Science Distinguished Alumni Award (2002), Dryden Award (2000), NASA Distinguished Service Medal (1999), the COSPAR Nordberg Medal (1996), the NASA Outstanding Leadership Medal (1994), the IEEE Medal of Engineering Excellence (1992), the IEEE Geoscience and Remote Sensing Distinguished Achievement Award (1987) and the NASA Exceptional Scientific Achievement Medal (1982).

GNU RADIO AND THE USRP: BUILDING A COMMUNITY AND AN FPGA-BASED SOFTWARE RADIO

Matt Ettus

Ettus Research, Santa Clara, California

GNU Radio is a free software project for software radio. Matt Ettus joined the project shortly after it was founded in 2001. He soon realized that for the project to be truly successful, it needed low cost hardware on which to build those radios, and so he designed the Universal Software Radio Peripheral (USRP) in 2003 and 2004. Since then, both projects have achieved significant growth and success. In 2010, Matt's company, Ettus Research, was acquired by National Instruments, and it continues to produce products and free software for the community. This talk will cover the history of both projects, some of the technical details of the FPGA-based hardware architecture, and the community experience over its 12 years of active development.

Biography

Matt Ettus is a core contributor to the GNU Radio project, a free framework for Software Radio, and is the creator of the Universal Software Radio Peripheral (USRP). In 2004, Matt founded Ettus Research to develop, support and commercialize the USRP family of products. Ettus Research was acquired by National Instruments in 2010, and Matt continues as its president. USRPs are in use in over 100 countries for everything from cellular and satellite communications to radio astronomy, medical imaging, and wildlife tracking. In 2010, the USRP family won the Technology of the Year award from the Wireless Innovation Forum.

In the past Matt has designed Bluetooth chips, GPS systems, and high performance microprocessors. Before that, he received BSEE and BSCS degrees from Washington University and an MSECE degree from Carnegie-Mellon University. In 2011, Matt was named an eminent member of Eta Kappa Nu. He is based in Mountain View, CA.

MEASUREMENT TECHNOLOGY TRENDS IN INSTRUMENTATION AND CONTROL

Mike Santori

National Instruments, Austin, Texas

Measurement and instrumentation are prime movers in nearly every scientific discipline. To a large extent, new measurement capabilities such as higher speed, better sensitivity, and higher density, have enabled new scientific advancements. The concept of heterogeneous computing with FPGAs, multi-core processors, and GPUs, has further impacted instrumentation and control. As these different
systems come together, tools and platform vendors have to work together to reduce the barrier to entry to these latest technologies. Abstraction at the appropriate level, combined with a platform-based system approach, enables domain experts such as particle physicists and fusion scientists to focus on innovation and discovery while leveraging the latest available technologies.

This keynote talk will focus on industry trends and advances that improve instrumentation and control and offer insights on what lies ahead.

Biography

As Business & Technology Fellow in charge of Product Marketing, Mike Santori leads the National Instruments organizations responsible for planning and marketing core measurements, test systems, embedded systems and key application segments. Santori focuses on optimizing the NI product portfolio, leading the definition and management of new products and ensuring high quality technical marketing.

Since joining NI in 1986, Mike Santori has worked closely with R&D and marketing to define new products and capabilities for NI software, including NI LabVIEW, LabWindows/CVI, TestStand and VeriStand, as well as developing marketing strategies for NI's graphical system design platform.

Mike Santori holds a bachelor's degree in electrical engineering from Texas A&M University.

Peter Doolan

Group Vice President & Chief Technologist

Oracle Public Sector Software Oracle USA

Biography

Peter Doolan is the GVP for Oracle Public Sector Software. His organization includes the technical and business applications professionals that support Oracle's sales to Government customers in the United States and Canada. The product and industry experts on his staff help Public Sector organizations exploit information by designing and building comprehensive information management solutions. Many of their innovations have become part of the Oracle product line and are used extensively by Oracle's customers throughout the world. As the Group Vice President for Oracle Public Sector, Mr. Doolan is also a spokesperson for Oracle on technical and industry issues. His main talent lies in describing sophisticated concepts in accessible language. He represents Oracle with customers, at conferences and in the media. Mr. Doolan joined Oracle UK in 1991 as a database support engineer assisting customers with mission critical business continuity issues across the world. In 1998 he relocated to the United States where he joined the Oracle Applications development organization. After several years assisting global customers with Oracle E-Business Suite projects he joined the Oracle Public Sector team based in Reston, VA. This breadth of experience has allowed him to develop the technical, business and social perspectives required to offer practical solutions to Oracle customers within the Public Sector community.

He resides with his wife Angela in Bethesda, MD. Peter is an active Scuba diver and enjoys competing in triathlon events across the country.

Sessions

1. **Project Status Reports**
2. **Project Management and Collaboration**
3. **Integrating Complex or Diverse Systems**
4. **Knowledge-based Techniques**
5. **Personnel Safety and Machine Protection**
6. **Hardware Technology**
7. **Timing and sync**
8. **Software Technology Evolution**
9. **Experiment Control**
10. **Feedback Systems**
11. **User Interfaces and Tools**
12. **Data Management and Processing**
13. **Control Systems Infrastructure**
14. **Control Systems Upgrades**

1. **Project Status Reports**
   Co-chairs: **John Maclean, Hamid Shoaee, Anders Wallander & Ryotaro Tanak**

   The Status Reports track presents an overview of new or upgraded experimental physics facilities with a control system perspective. Status Reports typically cover the stages of a project from the conceptual proposal through commissioning. Appropriate candidate topics include reports on facilities such as particle accelerators and detectors, fusion devices, light sources, telescopes and gravitational wave detectors. Presentations should include descriptions of the most challenging issues facing the facility. Projects that involve novel or unusually complex or demanding control systems are strongly encouraged.

2. **Project Management and Collaboration**
   Co-chairs: **Pascale Betinelli, Lou Corvetti & Andrew Starritt**

   This track encompasses three areas. In the first, **Project Management**, time, cost, quality, and system engineering processes are covered. In addition, good practices within our community and good practices with respect to tools coming from industry that work in our community will be discussed, as well as quality assurance in terms of how to meet the needs of the customers and users.

   Software Management Tools is the second area in this track, which includes software configuration management, issue tracking, and quality test and deployment.

Collaboration is the third topic, which encompasses sharing a goal between people in different institutes and countries, as well as between institutes and industries. How collaboration can influence industries is considered, along with managing issues and success. An example of good collaboration should be presented: what is working, which process should be followed.

Addressing complexity with scarce resources will also be discussed. For example, exchange programs for resource facilities, collaboration, teaching, and mentoring, including examples of collaborations with outcomes and examples of managing a changing requirement.

3. **Integrating Complex or Diverse Systems**
Co-chairs: **Phillippe Gayet & Gordon Brunton**

This track deals with issues involved in designing control systems for a new or upgraded facility, as well as re-engineering and maintaining existing control systems. It covers architectures, technologies, frameworks or methods employed for implementation of:

- complex control systems incorporating heterogeneous components
- integration of heterogeneous control systems, such as accelerator and utility controls systems

As control systems are often built with a mixture of industrial off-the-shelf and homemade heterogeneous components, the goal is to identify trends and emerging technologies together with successfully adopted approaches and answers to the following questions:

- What is the driving paradigm to design the control system?
- What is the best method for creating control system coupling level analysis, i.e., what is the level of integration required between process control and the protection and safety systems?
- Could developers just rely on the application of standards (middleware, industrial protocol,
international standards...)?
- What is the level of customization needed when using
off-the-shelf components?
- What is the best approach for dealing with heterogeneous components and real-time performance requirements when users and systems span long physical distances?
- How should scalability issues be tackled?
- How are low-level controls components integrated together and coordinated at a higher level?
- In the present era of fast-paced technological advances, how can further evolution be considered?

4. **Knowledge-based Techniques**
Co-chairs: **Jean-Michel Chaize & Marco Lonza**
It is a common belief that computer systems can perform better than humans if provided with human-like capabilities such as learning, adaptation, understanding and abstraction. This track covers a wide spectrum of techniques used to address the commissioning and operation of complex plants, where simple data representation and analysis are not sufficient. These techniques make use of acquired knowledge and previously gained experience to understand and interpret behaviors or phenomena and eventually help humans or computers to solve problems or make decisions. Heuristic and knowledge-based processes and methodologies for tuning and optimizing experimental physics facilities are also of interest. Possible topics for this track would include:

- Use of models and simulators
- Optimization techniques
- Adaptive correction systems
- Predictive analysis and diagnosis
- Statistical and post mortem analysis
- Complex indicators for preventive maintenance
- Decision making and problem solving
- Fuzzy logic, neural networks, genetic algorithms
- Artificial Intelligence and Expert Systems

5. **Personnel Safety and Machine Protection**
Co-chairs: **Mike Mouat, Enzo Carrone & Markus Zerlauth**

This track presents the role and implications of personnel, environmental and machine protection systems in large, experimental physics control systems. Topical areas, such as the following, will be included:

Aspects of Safety/Protection Systems: This area discusses topics such as the specification/design/implementation/commissioning processes and details, interlock considerations, interactions with other facility controls systems, required reliability, machine up-time, availability and maintainability.

Operational Experience/Lessons learned: What has gone wrong/ can go wrong in control systems and what can we learn, including incorrect specifications, omitted safety requirements, random hardware failures, systematic hardware failures, software errors, common cause failures and environmental influences?

Human Factors: This area addresses ensuring that the man/machine interface contributes positively to successful, reduced-risk operation and ease of use.

6. Hardware Technology

Co-chairs: **Javier Serrano & Daniel Tavares**

This track focuses on hardware design as applied to the operation of large physics facilities, with an emphasis on collaborative efforts among laboratories and companies using Open Source Hardware practices. The following topics will be highlighted:

- Hardware standards: FMC, VME, VXS, VPX, xTCA, PCI/PCIe, PXI/PXIe...
- Printed circuit board (PCB) design
- Programmable logic design, System-on-Chip (SoC) design, including embedded processors in Field Programmable Gate Arrays (FPGA)
- Data links for distributed controls and data acquisition
- Radiation-hardened design
- Design tools
- Reliability and Electromagnetic Compatibility (EMC)
- Commercial-Off-The-Shelf (COTS) systems, both open source and proprietar
- Upgrade and maintenance strategies

7. Timing and sync

Co-chairs: **Stephane Perez & Kazuro Furukawa**

This track covers timing and synchronization issues in data acquisition and controls for burst, one shot or continuous systems. High precision timestamping as well as synchronization are main issues in Big Physics installations.

As examples, telescopes need long-term stability for data acquisitions, and synchrotrons and accelerators need to synchronize beams and timestamp numerous events. Laser experiments are also concerned with picosecond ranges.

Papers should demonstrate the way precision, stability and jitter are handled in applications that need femtosecond as well as several seconds, possibly, in the wide area up to kilometers range. The following elements are of particular interest:

- Temperature control issue
- The use of hardware platforms like the CERN White Rabbit, pr MRF event system
- Software processing
- Network Time Protocol (NTP)
- Standard protocols for timing systems (IEEE 1588, 802.1AS)
- Global Positioning Systems (GPS)
- Hardware effects

8. **Software Technology Evolution**
Co-chairs: **Juan Guzman & Gianluca Chiozzi**

This track covers what is new or in plan for control systems and the software technologies to build them. This includes new methods in software engineering as well as new technologies and products that can be used in controls. Of particular interest is experience gained and lessons learned from applying these new approaches in practical software development projects. The following topics are discussed:

Control System Evolution: Reports on evolution of or newest additions and performance improvements to control system toolkits (EPICS, TANGO, DOOCS, ALMA ACS, ACNET, ...)

Middleware Technology: Reports on performance and scalability of middleware and the usage of web services and service-oriented architecture (SOA)

Advanced Software Development Techniques: New programming languages (Scala, CoffeScript, etc.), compilers, software deployment, business Intelligence, model-based development, domain-specific languages and code generation

Realtime Software: Reports on the evolution of Realtime OS and Realtime software programming. Note: GUI toolkits, web tools and integration of low and high-level components are covered in other tracks.

9. **Experiment Control**
Co-chairs: **Andy Götz, Karen White & Niko Neufeld**

This track is dedicated to papers on the issues specific to the control of large and small experiments. Experiment control means solving problems requiring a high degree of flexibility of the hardware and software, very high data rates, devices specific to experiments like sample environment control, interactions with the source of radiation/particles, flexible data acquisition sequences, synchronization timing of data acquisition, data and metadata management, online and offline data reduction and visualization for a large and heterogeneous user community. Topics for this track include:

- Sequencers for data acquisition
- Experiment automation and scanning
- Sample environment control including robotics
- Data analysis and visualization
- Data formats and metadata
- User Information Systems
- Unattended operation

- Remote monitoring
- Sample management
- Data policy

10. Feedback Systems

Co-chairs: **Mark Heron, Timo Korhonen & Ge Lei**

Effective commissioning and operation of modern experimental physics facilities rely on a variety of feedback and feed-forward systems. These are essential for stable operation and even become indispensable to perform the experiments. The computation requires real-time performance, achieved through processors or FPGAs. Distributed feedback systems need low latency and deterministic transport systems, together with synchronization. The successful implementation of such systems requires the integration with high-level applications, online models, archiving, data visualization and to set up, tune and optimize performance.

- Feedback
- Feed-forward
- Algorithms
- Model
- Archiving
- Data visualization
- Tuning
- Optimization
- Latency
- Deterministic
- Commissioning

11. User Interfaces and Tools

Co-chairs: **Eric Bjorklund, Reinhard Bacher & Alan Casey**

This track focuses on how human beings interact with control systems. Topics covered in this track will include:

- Data visualization tools (such as archive and alarm viewers, dash-boards, overview panels, graphing and plotting tools)
- Interface building tools (such as CSS, JDDD, and Web tools)
- Reporting tools (such as electronic log books and user feedback collection tools)
- Remote operation and collaboration tools
- Emerging interface trends (such as virtual displays, voice and gesture controls, intelligent data display, and mobile device "Apps")

12. Data Management and Processing
Co-chairs: **Nick Hauser & Matthew Bickley**

Large experimental physics facilities have large and numerous datasets of configuration and experimental data. This track will address the issues arising from the storage, processing, indexing, search, retrieval and dissemination of these datasets and the hardware and software architectures, networks and tools implemented to deal with these issues. This conference will focus on policies implemented for data access, curation and deletion, and whether these policies are coping with the 'data deluge'.

13. Control Systems Infrastructure
Co-chairs: **Larry Hoff, James Patrick & Renata Krempaska**

This track addresses the technologies, tools and methodologies for optimizing performance, managing resources, and addressing off-normal situations across the infrastructure of networks, processing nodes, data storage systems and databases. It includes issues related to managing and accessing large archived data sets, cyber security, and the role of technologies such as virtualization as well as unified operating system installation and configuration of control system computers to meet these aims.

14. Control System Upgrades
Co-chairs: **Larry Lagin, David Fernandez-Carreiras, Peter Clout, Patrick Ledu**

The control systems often experience various changes in order to carry out new experiments and get the maximum performance e from the scientific installation. This track focuses on the enlargement, modifications or implementation of new capabilities in existing control systems or existing platforms and frameworks, by using new techniques and covering new domains. It also assesses the change control process and the optimization of the transition to the upgraded systems.

Social Program for Accompanying Person(s)

Lawrence Livermore National Laboratory is happy to welcome you to ICALECPS 2013 companion program. Below is a list of daily activities.

Monday: Alcatraz and Fisherman's Wharf

- We will start our morning by riding San Francisco's historic streetcars (sometimes called trolleys or trams) to Fisherman's Wharf.
- Often referred to as "The Rock", the small island was developed with facilities for a lighthouse, a military fortification, a military prison (1868), and a federal prison from 1933 until 1963. The entire Alcatraz Island was listed on the National Register of Historic Places in 1976, and we further declared a National Historic Landmark in 1986. On arriving at the Alcatraz dock you will be greeted by a National Pat Service representative who will give you a brief orientation including information on any special activities available that day.
- Upon return to Pier 33, we will return to the San Francisco Ferry building via historic streetcar where we will have lunch at Gott's Roadside.
- The Ferry Building Marketplace is a vibrant gathering of local farmers, artisan producers, and independently owned and operated food businesses. We welcome you to shop, explore and enjoy all this location has to offer. You are welcome to return to the hotel, approximately one block from the Ferry building, at your leisure.

Tuesday: Napa Wine Country Tour

- Our first stop will be at Robert Mondavi Winery in the heart of Napa. Robert Mondavi established his namesake winery in 1966 with a vision to create Napa Valley wines that would stand in the company of the world's finest. We will enjoy a private tour of the estate and specialty tasting.
- Rising castle-like on the western hills, the CIA at Greystone is one of the Napa Valley's most historic and majestic properties. It's also one of the world's most unique and inspiring campuses for culinary education. Perhaps no other destination in wine country offers a richer food and wine experience in one location. We will have lunch at the Wine Spectator at Greystone followed by a tour of the Culinary Institute.
- St. Helena is also known as "Napa Valley's Main Street". Our two hour stop here will give you plenty of time to shop for one-of-a-kind keepsakes in the boutiques, browse one of the many art galleries, wine taste at a St. Helena winery or simply have a seat at a café and take in the wonderful view and atmosphere.

Wednesday: Grace Cathedral and ICALEPCS Banquet

- The San Francisco cable car system is the world's last manually operated cable car system. An icon of San Francisco, California, the cable car system forms part of the intermodal urban transport network operated by the San Francisco Municipal Railway. We will ride these historic cable cars to the Grace Cathedral Church.
- Grace Cathedral is an Episcopal cathedral located on Nob Hill in San Francisco. It is the cathedral church of the Episcopal Diocese of California. The cathedral has become an international pilgrimage center for church-goers and visitors alike, famed for its mosaics by De Rosen, a replica of Ghiberti's Gates of Paradise, two labyrinths, varied stained glass windows, Keith Haring AIDS Chapel altarpiece, and medieval and contemporary furnishings, as well as its 44 bell carillon, three organs, and choirs. We will take a 30 minute self-guided tour.
- Upon return to the hotel you will have time to get ready for the NIF tour and banquet. Your departure time may vary from one another. Please refer to the bus time assigned to you at the registration check in desk.
- The ICALECPS 2013 banquet will be held at One Market in San Francisco.

Thursday: Golden Gate Bridge Overlook and Muir Woods

- We will travel to the Golden Gate Bridge overlook in Sausalito. This overlook affords the classic view of the Golden Gate Bridge and the San Francisco skyline—the one you see on postcards, on television and in the movies, in all the coffee table picture books. Don't forget your camera. This is a wonderful opportunity to take some breathtaking photos.

Note: For schedule, please see page 21.

Host Institute:
Lawrence Livermore National Laboratory and the National Ignition Facility

Lawrence Livermore National Laboratory has a mission of strengthening the United States' security through development and application of world-class science and technology to:

- Enhance the nation's defense;
- Reduce the global threat from terrorism and weapons of mass destruction;
- And respond with vision, quality, integrity and technical excellence to scientific issues of national importance.

The National Ignition Facility (NIF) is the world's largest laser. NIF's 192 intense laser beams can deliver to a target more than 60 times the energy of any previous laser system. NIF became operational in March 2009 and is capable of directing nearly two million joules of ultraviolet laser energy in billionth-of-a-second pulses to the target chamber center.

Conference Venue

HYATT REGENCY SAN FRANCISCO

5 Embarcadero Center • San Francisco, California, USA, 94111

Tel: +1 415 788 1234

The Embarcadero Center waterfront hotel offers comfortable guestrooms with amenities to please every guest, while our ideal setting – just minutes from downtown – places you in the heart of many famous sights. You'll find the historic Ferry Building on one side of the hotel and the ferry to Alcatraz and the Bay on the other, with stunning views all around. Or hop on a cable car – across the street from our Hyatt hotel at Fisherman's Wharf – and visit Union Square, Chinatown and North Beach. From our well-designed event space to custom service, experience this landmark-favorite choice of San Francisco hotels. It is also definitely a fun spot for those anxious to experience the best of San Francisco. The hotel represents and warrants that its guest and meeting room facilities, and all public areas of the Hotel are or shall be, at the time of the meeting dates, in compliance with both Titles II (public agencies) and III (public accommodations) of the Americans with Disabilities Act and all other applicable laws and regulations.

Weather

In October, San Francisco temperatures average a high of 69° F. Fog sometimes rolls in around 5:00 p.m. in the evening and departs before noon the next day. The air conditioning in the conference rooms can be quite cool and the foggy evenings can be cold. Please plan to bring a light jacket or sweater to keep warm.

Parking

Due to the high cost of daily parking in San Francisco (~$45.00/day), we strongly encourage ICALEPCS 2013 attendees and their guests to consider taking public transportation from Bay Area airports to the Hyatt Regency Embarcadero. For information on public transportation please visit the Hyatt Regency Guest Services page.

A to Z Guide

Arriving by plane, then by car

- **From South Bay or San Francisco Int'l Airport (SFO) (14 miles):**
  Take Hwy 101 North, follow signs to Bay Bridge. Before you cross the Bay Bridge, take 7th St. exit. Turn left on 7th St. Turn right on Market St. Continue 1 mile and turn left on Drumm St. Our San Francisco California hotel is on the corner of Market St. and Drumm St.
  OR
  Take Hwy 280 North until it turns into King St. Continue on King St. and turn left at 3rd St. Continue on 3rd St. across Market St., where 3rd St. turns into Kearny St. Turn right on California St. Turn left on Drumm St. Our San Francisco luxury hotel is on the corner of Market St. and Drumm St.
- **From East Bay or Oakland Int'l Airport (OAK) (19 miles):**
  Take Hwy 80 across the Bay Bridge ($4 toll). Take the Fremont St. Ext. Follow Fremont St. across Market St., where Fremont St. turns into Front St. Turn right on California St. California St. will dead end at Drumm St. Hotel is on the corner of Market St. and Drumm St.
- **From North Bay:**
  Take Hwy 101 South across the Golden Gate Bridge ($5 toll). Follow the signs to Lombard St. Take Lombard St. to Van Ness Ave. and turn right. Continue one mile on Van Ness and turn left on Clay St. Clay St. will dead end at Drumm Street, where you will turn right and continue one block to the hotel. Hotel is on the corner of Market St. and Drumm St.

Badges

Name badges will be distributed at registration throughout the sessions at the reception desk of the Hyatt Regency Embarcadero. For security reasons, only persons wearing conference badges will be allowed access to the conference sessions.

Banks

ATM/banking is available at the conference venue, Hyatt Regency Embarcadero. Most banks are open 9 am to 6 pm. There is a Bank of America nearby at One Market Plaza.

Doctor and Dentist

A list of local doctors and dentists is available during the conference at the registration desk.

Parking

Embarcadero Valet Parking Information

- Embarcadero parking cost: $61 inclusive of tax.
- Maximum clearance for indoor parking is 6’4”, which will accommodate regular vans and SUV’s.

Registration desk

Will be open on:
Sunday, October 6, 2013 - Friday, October 11, 2013
3:00 PM - 5:00 PM
Pacific Standard Time

Transportation

Taxis are readily available with no reservation required. The cost from the San Francisco International Airport (SFO) to downtown San Francisco is approximately $45 per taxi. The cost from the Oakland International Airport (OAK) to downtown San Francisco is approximately $60 per taxi.

SuperShuttle serves both San Francisco and Oakland airports. To make a reservation, please call (800) 258-3826. The cost from SFO to downtown San Francisco is approximately $16 per person. The cost from Oakland to downtown San Francisco is approximately $25 per person. On-line reservations can be made using the Airport Transportation Web Reservation Portal.

Proceedings

The deadline for the receipt of contributions to the Proceedings of ICALEPCS 2013 is Monday, September 16, 2013.

The Conference Proceedings will be prepared electronically and published at the JACoW site (http://www.jacow.org). Contributed papers may be up to 4 pages long and invited papers up to 6 pages. More information can be found on the conference website (http://icalepcs2011.esrf.fr/authors-info/).

All contributions should be submitted via the Internet according to the Paper Submission Instructions (http://www.icalepcs2013.org/authors_information/paper_submission_instructions.php). Authors are reminded that, since no contributions are accepted for publication only, any paper accepted for presentation, which is not presented by one of the authors at the conference, will be excluded from the proceedings.

Furthermore, the Scientific Programme Committee reserves the right to refuse papers for publication which have not been properly presented in the poster sessions. Manuscripts of contributions to the proceedings (or enlargements of them) are not considered as posters and papers presented in this way will not be accepted for publication.

Manuscripts

Authors are advised to use the required templates and consult the instructions on their use. The templates contain styles which, when applied, will automatically ensure correct typesetting and layout. Use the JACoW Styles and Macros pull-down in the MS Word toolbar.

- MS Word, http://www.jacow.org/index.php?n=Authors.MSWord
- LaTex, http://www.jacow.org/index.php?n=Authors.LaTeX
- OpenDocument, http://www.jacow.org/index.php?n=Authors.OpenDocument

Authors are strongly advised to use the template corresponding to the correct version of MS Word and not to transport the document across different platforms, e.g., Mac <-> PC or across different version of MS Word on the same platform.

Length of Contribution

Papers for both contributed oral and poster presentation may be up to 4 pages long and only invited oral presentations may be up to 5 pages.

Program Codes – Identification of Contributions

The date, type, place and time of the posters and oral presentations can easily be identified from the program code.

Oral Presentations - Keynote Sessions

Using the format DDTRRPP## (e.g., TUCOBAB03)

- First two letters indicate the day (DD) of the week:
  - MO, TU, WE, TH, FR
- The next 1-3 characters indicates the type of presentation:
  - **COA** – Contributed Oral Presentation A
  - **COB** – Contributed Oral Presentation B
  - **COC** – Contributed Oral Presentation C
  - **K** – Keynote
  - **MI** – Mini Oral Presentation
  - **P** – Poster
- The next 1-2 characters indicate the room (RR)
  - **A** – Ballroom A
  - **AB** – Ballroom A & B
  - **B** – Ballroom B
- Finally, the sequence number within the session
- *Example*

  TUCOBAB03 – *Tuesday, Contributed Oral Presentation B, in the Ballroom A&B, third talk*

Poster Presentations

Using the format DDPRR### (e.g., TUPPC006):

- First two letters indicate the day (DD) of the week:
  - **MO, TU, TH**
- The third character (P) indicates that it is a poster session
- The following (PC) indicated that it is in the Pacific Concourse room
- Finally, the sequence number within the session
  - *Example*

    TUPPC008 – *Tuesday, poster session, in the Pacific Concourse, poster board no. 008*

Posters with Mini-Oral Presentations

Two entries exist for those with posters and a corresponding mini oral presentation; see the above section regarding the poster.

For the mini-oral, using the format DDMIB### (e.g., TUMIB04):

- First two letters indicate the day (DD) of the week:
  - **MO, TU, TH**
- The third and fourth characters (MI) indicates that it is a poster with a mini-oral presentation
- The fifth character (B) indicates that the presentation is in Ballroom B
- Finally, the sequence number within the session
  - *Example*

    TUMIB008 – *Tuesday, Mini Oral Presentation, in Ballroom B, poster board no. 008*

Speaker Presentation Information

Oral Presentations

Details of all oral contributions (keynotes, invited, contributed and mini) are given in this guide.

Oral presentations will take place in either Ballroom A or B.

Guidelines for Speakers

Visual presentations should be made electronically using the projection equipment provided by the conference hotel. All presentations must be uploaded via user profiles in the conference instance of the SPMS the day before the presentation in order to allow time for verification and transfer to the conference hotel's system. Any special requirements concerning visual aids should be addressed to the local organizers (voelker4@llnl.gov). More information can be found on the conference website (**http://www.icalepcs2013.org/**).

Speakers can check that their presentations behave correctly on the laptops at the Internet Access point located close to the Auditorium. These laptops will have the same configuration as that of the Speakers laptops.

The Speaker Ready room is located in the Plaza. This room is down the hall past Registration next to Ballroom A.

During the Presentation

The Scientific Secretary on the podium will help you with your presentation. Please get in contact with him before the session that your talk starts.

At the podium you will be presented with a laptop displaying your presentation, a laser pointer and a simple remote to control your presentation. The remaining time of your talk will be displayed on a second screen located at the front of the stage.

In case you have any problems, the Scientific Secretary will be in contact with the Conference Center technical staff that will have complete control over your presentation.

Guidelines at the Conference

Those speakers who have not uploaded their files in advance should deliver them to the Speaker's Office. Here the presentations can be checked and loaded on the Conference Centre's computers. Before your session, check back that everything has been loaded ok. Slides that have been successfully captured will be published on the web without further action on your part.

Poster Sessions

The poster session is an essential component of the ICALEPCS conference. Posters are both a good complement to the oral presentations in the parallel sessions and a good opportunity for exposure for younger colleagues. This year, about 450 posters will be on display in two sessions.

Poster Publication

Each poster will be guaranteed a 4-page contribution in the conference proceedings. Please be aware that according to the ICALEPCS rules at least one author has to be present at the poster during the poster session, otherwise the poster will not be included in the proceedings.

Participants in the poster sessions are invited to upload an electronic version of their posters (in pdf format) via user profiles in the conference instance of the SPMS system for public remote access.

Poster Sessions, Setup and Removal

The posters will be on display in three sessions in one room at the conference center: Pacific Concourse Level.

Monday, October 7th, 4:15 p.m. - 6:15 p.m.

- Setup on Monday from 1:00 p.m. to 4:00 p.m.
- Removal by Tuesday 9:00 a.m.

Tuesday, October 8th, 1:30 p.m. - 3:00 p.m.

- Setup on Tuesday from 10:00 a.m. to 1:00 p.m.
- Removal by Wednesday 5:00 p.m.

Thursday, October 10th, 1:30 p.m. - 3:00 p.m.

- Setup on Thursday from 10:00 a.m. to 1:00 p.m.
- Removal by Friday 2:00 p.m.

If you want to recover your poster after the session, please respect these times, otherwise the poster may have to be discarded. This is particularly important on Tuesday morning when there will be a tight schedule to take down the old posters and put up the new ones.

You're assigned poster program code (e.g. MOMAU006) is the same number as on your abstract. These code numbers will also be shown on the poster frames. Please mount your poster on the board labeled with your number.

Instructions for Poster Display

Poster must fit within dimensions 1170 mm width x 1170 mm height and will be mounted by push pins, which will be supplied. Participants are asked to bring with them a printed copy of their posters as no poster printers will be available at the conference.

To conform to the rules of the conference center, poster fixations will be provided to the participants at the location of the display. Personal fixation mechanisms cannot be used.

Participants of the Monday poster session are kindly asked to leave the fixation mechanism on the poster frames when they take down their posters, as they will be used by the Tuesday and Thursday poster sessions.

Participants of the Thursday poster session are kindly asked to remove the fixation mechanism from the poster frames when they take down their posters. This will be a great help for the organizers.

Poster Attendance

Official staff will check for the attendance of the presenter of each poster and if the staff cannot find the presenter, the presentation will not be included in the conference proceedings.

The presenter must be one of the authors.

Best Poster Voting

As in the previous years, at ICALEPCS 2013 prizes will be given for the best posters. For the first time the winners will be selected by a general vote in which all participants of the conference are encouraged to participate. As there are three poster sessions, three prizes will be given.

To vote:

- Fill in the vote ballot below with the poster number of your choice of the best poster for Monday, Tuesday and Thursday respectively.
- Give your name and institute.
- Tear out the voting ballot and drop it in one of the voting boxes situated near the entrances to the Pacific Concourse.
- Voting ballots are the last 3 pages of your abstract book.

VOTE before 4:00 p.m. on Thursday October 10

Thank you for your vote!
The ICALEPCS Organizing Team

Ballots are located in this book starting on page 433.

Session Info >>>

Session Info

MOOBF **Continental Breakfast**
07-OCT-13 00:00 08:00 - 08:30
Ballroom Foyer

MOOAB **Opening and Welcome Addresses**
07-OCT-13 00:00 08:30 - 09:00
Ballroom A&B

MOOAB01 **Opening Remarks and Welcome Address**
Christopher David Marshall - Lawrence Livermore National Laboratory National Ignition Facility Programs Directorate National Ignition Facility Project

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MOKAB Keynote Marian Petre
07-OCT-13 00:00 09:00 - 09:45
Ballroom A&B

MOKAB01 **Scientific software development as a social process**
Marian Petre - The Open University Department of Physical Sciences

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MOCOAAB **Project Status Reports 1**
07-OCT-13 00:00 09:45 - 12:00
Ballroom A&B

MOCOAAB01 The First Running Period of the CMS Detector Controls System - A Success Story
Frank Glege - European Organization for Nuclear Research

MOCOAAB02 Design and Status of the SuperKEKB Accelerator Control System
Masako Iwasaki - High Energy Accelerator Research Organization

MOCOAAB03 The Spiral2 Control System Progress Towards the Commission Phase
Christophe Haquin - Grand Accélérateur Nat. d'Ions Lourds

MOCOAAB04 The Integrated Control System at ESS
Miha Rescic - Cosylab, Inc.

MOCOAAB05 Keck Telescope Control System Upgrade Project Status
Jimmy Johnson - W.M. Keck Observatory

MOCOAAB06 MeerKAT Control and Monitoring - Design Concepts and Status
Lize Van den Heever - SKA South Africa National Research Foundation of South Africa Department of Science and Technology

MOCOAAB07 Real Time Control for KAGAR, 3km Cryogenic Gravitational Wave Detector in Japan
Miyakawa Osamu - Institute for Cosmic Ray Research, University of Tokyo

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MOCBBLPC **Coffee Break**
07-OCT-13 00:00 10:30 - 11:00
Pacific Concourse

MOO **Lunch**
07-OCT-13 00:00 12:00 - 13:30
External

MOPLAB **Keynote Mike Santori**
07-OCT-13 00:00 13:30 - 14:00
Ballroom A&B

MOPLAB01 TBD
Mike Santori - National Instruments

MOCOBAB **Integrating Complex or Diverse Systems**
07-OCT-13 00:00 14:00 - 16:15
Ballroom A&B

MOCOBAB01 FNew Electrical Network Supervision for CERN: Simpler, Safer, Faster, and Including New Modern Features
Jean-Charles Tournier - European Organization for Nuclear Research Engineering Department (EN)

MOCOBAB02 Integration of PLC with EPICS IOC for SuperKEKB Control System
Jun-Ichi Odagiri - High Energy Accelerator Research Organization

MOCOBAB03 The Laser MegaJoule ICCS Integration Platform
Jean Fleury - Commissariat à l'énergie atomique et aux énergies alternatives CEA /CESTA

MOCOBAB04 The Advanced Radiographic Capability, a Major Upgrade of the Computer Controls for the National Ignition Facility*
Gordon Brunton - Lawrence Livermore National Laboratory National Ignition Facility Programs Directorate Photon Science and Applications Program

MOCOBAB05 How to Successfully Renovate a Controls System - Lessons Learned from the Renovation of the CERN Injectors' Controls Software
Grzegorz Kruk - European Organization for Nuclear Research Beams Department (BE)

MOCOBAB06 Integrated Monitoring and Control Specification Environment
Subhrojyoti Roy Chaudhuri - Tata Research Development and Design Centre

MOCOBAB07 Building a Maintenance and Refresh Strategy to Address Controls Hardware Diversity for the National Ignition Facility (NIF) Computer Controls System*
Robert Demaret - Lawrence Livermore National Laboratory National Ignition Facility Programs Directorate National Ignition Facility Project

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MOCBALPC **Coffee Break**
07-OCT-13 00:00 15:00 - 15:30
Pacific Concourse

MOOB **Workshop and Tutorial Summaries**
07-OCT-13 00:00 16:15 - 16:45
Ballroom B

MOOB01 Summary of the 4th Workshop on Control System Cyber-Security in HEP
Stefan Lueders - European Organization for Nuclear Research

MOOB02 Summary of Open Hardware Workshop
Javier Serrano - European Organization for Nuclear Research Beams Department (BE)

MOOB03 Summary of Tango Workshop
Andrew Gotz - European Synchrotron Radiation Facility

MOOB04 Summary of EPICS Collaboration Satellite Meeting
Hamid Shoaee - SLAC National Accelerator Laboratory

MOOB05 Summary of Motion Control Applications in Large Facilities Workshop
Pascale Betinelli-Deck - Synchrotron Soleil

MOOB06 Summary of MRF Timing System Workshop
Eric Bjorklund - Los Alamos National Laboratory AOT Division

MOPPC **Poster 1 and Industrial Exhibition**
07-OCT-13 00:00 16:45 - 18:15
Pacific Concourse

MOPPC010 A Semi-Automated, Formal Method to Integrate Accelerator Devices in the MedAustron Control System
Jasna Junuzovic - EBG MedAustron GmbH

MOPPC012 Interface and Configuration Data Management for the Laser Megajoule
Joel Irenee Nicoloso - Commissariat à l'Energie Atomique DAM DIF

MOPPC013 Revolution in Motion Control at SOLEIL: How to Balance Performance and Cost
Dominique Corruble - Synchrotron Soleil

MOPPC014 Diagnostic Use Case Examples for ITER Plant Instrumentation and Control
Stefan Simrock - ITER Organization

MOPPC015 BeagleBone for Embedded Control System Applications
Stefano Cleva - Elettra-Sincrotrone Trieste S.C.p.A.

MOPPC016 IFMIF EVEDA RFQ Local Control System to Power Tests
Mauro Giacchini - Istituto Nazionale di Fisica Nucleare Laboratori Nazionali di Legnaro

MOPPC017 Upgrade of J-PARC/MLF General Control System Based on EPICS/CSS
Motoki Ooi - Japan Atomic Energy Agency J-PARC Center

MOPPC019 The HLS Water Cooling System Based on NI CompactRIO
Gongfa Liu - University of Science and Technology of China National Synchrotron Radiation Laboratory

MOPPC020 New Automated Control System at the Kurchatov Synchrotron Radiation Source Based on SCADA System Citect
Yevgeniy Fomin - National Research Center "Kurchatov Institute"

MOPPC021 Configuration System of the NSLS-II Booster Control System Electronics
Pavel Borisovich Cheblakov - Russian Academy of Sciences The Budker Institute of Nuclear Physics

MOPPC022 Remote Control of Heterogeneous Sensors for 3D LHC Collimator Alignment
Cedric Charrondière - European Organization for Nuclear Research Engineering Department (EN)

MOPPC023 Centralized Data Engineering for the Monitoring
Jean-Charles Tournier - European Organization for Nuclear Research

MOPPC024 An Event Driven Communication Protocol for Process Control: Performance Evaluation and Redundant Capabilities
Jeronimo Ortola Vidal - European Organization for Nuclear Research Engineering Department (EN)

MOPPC025 A Movement Control System for Roman Pots at the LHC
Ben Farnham - European Organization for Nuclear Research Engineering Department (EN)

MOPPC026 Bake-out Mobile Controls for Large Vacuum Systems
Paulo Gomes - European Organization for Nuclear Research Technology Department (TE)

MOPPC027 The Control System of CERN Accelerators Vacuum [Current Projects & LS1 Activities]
Paulo Gomes - European Organization for Nuclear Research Technology Department (TE)

MOPPC028 High-Density Power Converter Real-Time Control for the MedAustron Synchrotron
Johannes Gutleber - European Organization for Nuclear Research

MOPPC029 Internal Post Operation Check System for Kicker Magnet Current Waveforms Surveillance
Nicolas Magnin - European Organization for Nuclear Research Technology Department (TE)

MOPPC030 Developments on the SCADA of CERN Accelerators Vacuum
Fabien Antoniotti - European Organization for Nuclear Research Technology Department (TE)

MOPPC031 IEPLC Framework: Automated Communication in a Heterogeneous Control System Environment
Frank Locci - European Organization for Nuclear Research

MOPPC032 OPC Unified Architecture within the Control System of the ATLAS Experiment
Piotr Nikiel - European Organization for Nuclear Research

MOPPC033 CoDeSys in UNICOS: Opening the Floor to PLCs and Industrial PCs
Enrique Blanco Vinuela - European Organization for Nuclear Research Engineering Department (EN)

MOPPC034 Control Sytem Hardware Upgrade
Guido Janser - Paul Scherrer Institut

MOPPC035 Re-integration and Consolidation of the Compact Muon Solenoid Electromagnetic Calorimeter Detector Control System
Oliver Holme - ETH Zurich Institute for Particle Physics

MOPPC036 The BPM Integration in the Taiwan Photon Source
Yung-Sen Cheng - National Synchrotron Radiation Research Center

MOPPC037 Control Programs for the MANTRA Project at the ATLAS Superconducting Accelerator
Maria A. Power - Argonne National Laboratory Physics Division

MOPPC038 Rapid Software Prototyping into Large Scale Controls Systems*
Barry Fishler - Lawrence Livermore National Laboratory National Ignition Facility Programs Directorate National Ignition Facility Project

MOPPC039 Hardware Interface Independent Serial Communication (IISC)
Prerana Kankiya - Brookhaven National Laboratory Collider-Accelerator Department

MOPPC040 A Hazard Driven Approach to Accelerator Safety System Design - How CLS Successfully Applied ALARP in the Design of Safety Systems
Elder Matias - Canadian Light Source Inc.
University of Saskatchewan

MOPPC041 Machine Protection System for TRIUMF's ARIEL Facility
Don Dale - TRIUMF Canada's National Laboratory for Particle and Nuclear Physics

MOPPC042 Machine Protection System for the SPIRAL2 Facility
Cyrille Berthe - Grand Accélérateur Nat. d'Ions Lourds

MOPPC043 Development of the Thermal Beam Loss Monitors of the Spiral2 Control System
Christophe Haquin - Grand Accélérateur Nat. d'Ions Lourds

MOPPC044 Cilex-Apollon Personnel Safety System
Jean-Luc Veray - Ecole Polytechnique Laboratoire pour l'Utilisation des Lasers Intenses

MOPPC045 Cilex-Apollon Synchronization and Security System
Mickael Pina - Ecole Polytechnique Laboratoire pour l'Utilisation des Lasers Intenses

MOPPC047 A New PSS for the ELBE Accelerator Facility
Matthias Justus - Helmholtz-Zentrum Dresden-Rossendorf Institute of Radiation Physics Radiation Source ELBE

MOPPC048 Evaluation of the Beamline Personnel Safety System at ANKA under the Aegis of the 'Designated Architectures' Approach
Karlheinz Cerff - Forschungszentrum Karlsruhe GmbH Institute for Synchrotron Radiation

MOPPC049 Radiation and Laser Safety Systems for the FERMI@Elettra Free Electron Laser
Fabio Giacuzzo - Elettra-Sincrotrone Trieste S.C.p.A.

MOPPC050 Design of Machines Fast Protection System Based on FPGA
Yuhui Guo - Chinese Academy of Sciences Institute of Modern Physics

MOPPC051 NSLS-II Booster Interlock System
Ruslan Kadyrov - Russian Academy of Sciences The Budker Institute of Nuclear Physics

MOPPC052 ESS Bilbao Interlock System Approach
Daniel Piso - ESS Bilbao Consortium

MOPPC053 A Safety System for Experimental Magnets Based on CompactRIO
Sylvain Ravat - European Organization for Nuclear Research

MOPPC054 Application of Virtualization to CERN Access and Safety Systems
Timo Hakulinen - European Organization for Nuclear Research

MOPPC055 Revisiting CERN Safety System Monitoring (SSM)
Timo Hakulinen - European Organization for Nuclear Research

MOPPC056 The Detector Safety System of NA62 Experiment
Gilles Maire - European Organization for Nuclear Research Physics Department (PH)

MOPPC057 Data Management and Tools for the Access to the Radiological Areas at CERN
Eva Sanchez-Corral Mena - European Organization for Nuclear Research

MOPPC058 Design, Development and Implementation of a Dependable Interlocking Prototype for the ITER Superconducting Magnet Powering System
Markus Zerlauth - European Organization for Nuclear Research

MOPPC059 Refurbishing of the CERN PS Complex Personnel Protection System
Pierre Ninin - European Organization for Nuclear Research TS Department

MOPPC060 Large Protection Systems with Programmable Logic Controllers: Safety, Redundancy and Availability
Tomasz Ladzinski - European Organization for Nuclear Research

MOPPC061 Achieving a Highly Configurable Personnel Protection System for Experimental Areas
Frederic Havart - European Organization for Nuclear Research

MOPPC062 Real-Time System Supervision for the LHC Beam Loss Monitoring System at CERN
Christos Zamantzas - European Organization for Nuclear Research Beams Department (BE)

MOPPC063 Radiation and Environment Monitoring Unified Supervision at CERN
Gustavo Segura - European Organization for Nuclear Research DG

MOPPC064 A New Spark Detection System for the SPS North Area Beam Extraction Electrostatic Septa
Roger Andrew Barlow - European Organization for Nuclear Research Technology Department (TE)

MOPPC065 Hardware Interlock and/or Software Interlock: What to Choose?
Bruno Puccio - European Organization for Nuclear Research Technology Department (TE)

MOPPC066 Reliability Analysis of the LHC Beam Dumping System Taking into Account the Operational Experience during LHC Run 1
Roberto Filippini - European Organization for Nuclear Research AB Department

MOPPC067 Personnel Protection of the CERN SPS North Hall in Fixed Target Primary Ion Mode
Timo Hakulinen - European Organization for Nuclear Research

MOPPC068 Operational Experience of a PLC Based Positioning System for the TCDQ
Christophe Boucly - European Organization for Nuclear Research Technology Department (TE)

MOPPC069 Operational Experience with the LHC Software Interlock System
Laurette Ponce - European Organization for Nuclear Research Beams Department (BE)

MOPPC070 The Vacuum Protect System for the TPS Storage Ring
Yi-Chen Yang - National Synchrotron Radiation Research Center

MOPPC071 Development of the Machine Protection System for FERMILAB'S ASTA Facility
Linden Ralph Carmichael - Fermi National Accelerator Laboratory Accelerator Division

MOPPC072 LCLS Hutch Protection System User Interface
Alan Hill - SLAC National Accelerator Laboratory

MOPPC073 Mobile Oxygen Deficiency Hazard Detection System
Percy Harrell - Thomas Jefferson National Accelerator Facility

MOPPC074 Signal Processing Board for Beam Loss Monitor
Jianxun Yan - Thomas Jefferson National Accelerator Facility

MOPPC075 A Monte Carlo Simulation Approach to the Reliability Modeling of the Beam Permit System of Relativistic Heavy Ion Collider (RHIC) at BNL
Prachi Chitnis - Stony Brook University Electrical & Computer Engineering Department

MOPPC076 Quantitative Fault Tree Analysis of the Beam Permit System Elements of Relativistic Heavy Ion Collider (RHIC) at BNL
Prachi Chitnis - Stony Brook University Electrical & Computer Engineering Department

MOPPC077 Open Hardware Collaboration: A Way to Improve Efficiency for a Team
Yves-Marie Abiven - Synchrotron Soleil

MOPPC078 TANGO Steps Toward Industry
Jean-Michel Chaize - European Synchrotron Radiation Facility

MOPPC079 CODAC Core System, the ITER Software Distribution for I&C
Franck Di Maio - ITER Organization

MOPPC080 Controls for the new FAIR Accelerator Facility – Status and Development Strategies
Ralph C. Baer - GSI Helmholtzzentrum für Schwerionenforschung GmbH

MOPPC081 The Case of MTCA.4: Managing the Introduction of a New Modular Electronic Crate Standard at Large Scale Facilities and Beyond
Thomas Walter - Deutsches Elektronen-Synchrotron

MOPPC082 Automated Verification Environment for TwinCAT PLC Programs
Andreas Beckmann - European XFEL GmbH

MOPPC083 Managing by Objectives a Research Infrastructure
Roberto Pugliese - Elettra-Sincrotrone Trieste S.C.p.A.

MOPPC084 ESS Integrated Control System and the Agile Methodology
Miha Rescic - Cosylab, Inc.

MOPPC085 Using Prince2 and ITIL Practices for Computing Projects and Service Management in a Scientific Installation
David Fernandez-Carreiras - CELLS-ALBA Synchrotron

MOPPC086 Manage the MAX IV Laboratory Control System as an Open Source Project
Vincent Hardion - MAX-lab, Lund University

MOPPC087 Tools and Rules to Encourage Quality for C/C++ Software
Wojciech Sliwinski - European Organization for Nuclear Research Beams Department (BE)

MOPPC088 Improving Code Quality of the Compact Muon Solenoid Electromagnetic Calorimeter Control Software to Increase System Maintainability
Oliver Holme - ETH Zurich Institute for Particle Physics

MOPPC089 An Update on Quality Program Progress and Plans for National Ignition Facility Control Systems
Suzanna Townsend - Lawrence Livermore National Laboratory National Ignition Facility Programs Directorate National Ignition Facility Project

MOPPC090 Managing a Product Called NIF*
Darwin Dobson - Lawrence Livermore National Laboratory National Ignition Facility Programs Directorate National Ignition Facility Project

MOPPC091 National Ignition Facility (NIF) PLM Landscape Evolution
Al Churby - Lawrence Livermore National Laboratory National Ignition Facility Programs Directorate National Ignition Facility Project

MOPPC092 Commissioning the MedAustron Accelerator with ProShell
Roland Moser - EBG MedAustron GmbH

MOPPC093 Sirius Control System: Conceptual Design
José Guilherme Ribas Sophia Franco - Brazilian Synchrotron Light Laboratory

MOPPC094 ARIEL Control System at TRIUMF – Project Update
Rod Nussbaumer - TRIUMF Canada's National Laboratory for Particle and Nuclear Physics

MOPPC095 PETAL Control System Status Report
Cyril Present - Commissariat à l'énergie atomique et aux énergies alternatives CEA /CESTA

MOPPC096 Design and Implementation Aspects of the Control System at FHI FEL
Heinz Junkes - Fritz-Haber-Institut der Max-Planck-Gesellschaft

MOPPC097 The FAIR Control System - System Architecture and First Implementations
Ralf Huhmann - GSI Helmholtzzentrum für Schwerionenforschung GmbH

MOPPC098 The EPICS-based Accelerator Control System of the S-DALINAC
Christoph Burandt - Technische Universitaet Darmstadt Institut fuer Kernphysik Fachbereich 05

MOPPC099 The ANKA Control System: On a Path to the Future
Nigel John Smale - Karlsruhe Institute of Technology

MOPPC100 SKA Monitioring and Control Progress Status
Yogesh Wadadekar - National Centre for Radio Astrophysics

MOPPC101 The Control Architecture of Large Scientific Facilities: ITER and LHC lessons for IFMIF
Alvaro Marqueta Barbero - IFMIF/EVEDA Project Team International Fusion Energy Research Centre

MOPPC102 Development Status of Control System for Linear IFMIF Prototype Accelerator
Hiroki Takahashi - Japan Atomic Energy Agency (JAEA) International Fusion Energy Research Center (IFERC) IFMIF Accelerator Facility Development Group

MOPPC103 Status of the RIKEN RI Beam Factory Control System
Misaki Komiyama - RIKEN Nishina Center

MOPPC104 Developing Control System for SESAME Booster
Abdallah Ismail - Synchrotron-light for Experimental Science and Applications in the Middle East

MOPPC105 100KW/100MeV Accelerator Control System
XiangCheng Kong - Chinese Academy of Sciences Institute of High Energy Physics

MOPPC106 Status Report of RAON Accelerator Control System
Soo Ryu - Institute for Basic Science

MOPPC107 RF-Generators Control Tools For Kurchatov Synchrotron Radiation Sourse
Yury Krylov - Russian Research Center Kurchatov Institute Kurchatov Center of Synchrotron Radiation

MOPPC108 Status of the NSLS-II Booster Control System
Sergey Evgenyevich Karnaev - Russian Academy of Sciences The Budker Institute of Nuclear Physics

MOPPC109 Status of the MAX IV Laboratory Control System
Julio Lidon-Simon - MAX-lab, Lund University

MOPPC110 The Control System for the CO2 Cooling Plants for Physics Experiments
Lukasz Zwalinski - European Organization for Nuclear Research

MOPPC111 Overview of LINAC4 Beam Instrumentation Software for Beam Commissioning
Lars K. Jensen - European Organization for Nuclear Research Beams Department (BE)

MOPPC112 Status and Perspectives of the SwissFEL Injector Test Facility Control System
Pavel Chevtsov - Paul Scherrer Institut

MOPPC113 Development Status of the TPS Control System
Yung-Sen Cheng - National Synchrotron Radiation Research Center

MOPPC114 Control System of X-ray Generator NESTOR
Andrey Yurij Zelinsky - National Science Centre Kharkov Institute of Physics and Technology

MOPPC115 Control System of the NSC KIPT Neutron Source on the Base of Subcritical Assembly Driven with a Linear Accelerator
Andrey Yurij Zelinsky - National Science Centre Kharkov Institute of Physics and Technology

MOPPC116 Evolution of Control System Standards on the Diamond Synchrotron Light Source
Mark Heron - Diamond Light Source Ltd

MOPPC117 MaRIE Injector Test-Stand Instrumentation & Control System Conceptual Design
Martin Pieck - Los Alamos National Laboratory AOT Division

MOPPC118 Development of EPICS Accelerator Control System for the IAC 44 MeV Linac
Anthony Andrews - Idaho Accelerator Center

MOPPC119 Development of an EPICS System to Control Oscilloscopes for the Idaho Accelerator Center
Trevor Lee Downer - Idaho Accelerator Center

MOPPC120 Current Commissioning Status of Vacuum Control System in NSLS-II
Huijuan Xu - Brookhaven National Laboratory
National Synchrotron Light Source II

MOPPC121 Control Systems Issues and Planning for eRHIC
Kevin A. Brown - Brookhaven National Laboratory
Collider-Accelerator Department

MOPPC122 EPICS Interface and Control of NSLS-II Residual Gas Analyzer System
Huijuan Xu - Brookhaven National Laboratory National Synchrotron Light Source II

MOPPC123 Extending WinCC OA for Use as Accelerator Control System Core
Markus Marchhart - EBG MedAustron GmbH

MOPPC124 Optimizing EPICS for Multi-Core Architectures
Ralph Lange - ITER Organization

MOPPC125 HDB++: A New Archiving System for Tango
Lorenzo Pivetta - Elettra-Sincrotrone Trieste S.C.p.A.

MOPPC126 !CHAOS: the “Control Server” Framework for Controls
Luciano Catani - Istituto Nazionale di Fisica Nucleare Sezione di Roma II Dipartimento di Fisica

MOPPC127 An OPC-UA Based Architecture for the Control of the ESPRESSO Spectrograph @ VLT
Roberto Cirami - INAF-Osservatorio Astronomico di Trieste

MOPPC128 Real-Time Process Control on Multi-Core Processors
Miho Ishii - Japan Synchrotron Radiation Research Institute Controls and Computing Division

MOPPC129 MADOCA II Interface for LabVIEW
Yukito Furukawa - Japan Synchrotron Radiation Research Institute SPring-8 Joint-Project for XFEL

MOPPC130 A New Message-Based Data Acquisition System for Accelerator Control
Akihiro Yamashita - Japan Synchrotron Radiation Research Institute Controls and Computing Division

MOPPC131 Experience of Virtual Machines in J-PARC MR Control
Norihiko Kamikubota - Japan Proton Accelerator Research Complex High Energy Accelerator Research Organization Tokai Campus

MOPPC132 Evaluating Live Migration Performance of a KVM-Based EPICS
Jian Zhuang - Chinese Academy of Sciences Institute of High Energy Physics

MOPPC133 Performance Improvement of KSTAR Networks for Long Distance Collaborations
Jinseop Park - National Fusion Research Institute

MOPPC134 EPICS Real Time Processing on GNU/Linux with Xenomai Support
Hinko Kocevar - Instrumentation Technologies

MOPPC135 Upgrading ALBA to Tango8, Offline Testing and Continuous Integration
Zbigniew Reszela - CELLS-ALBA Synchrotron

MOPPC136 SCADA Systems for Scientific Institutes Based on Sardana
David Fernandez-Carreiras - CELLS-ALBA Synchrotron

MOPPC137 IEC 61850 Industrial Communication Standards under Test
Filippo Maria Tilaro - European Organization for Nuclear Research Engineering Department (EN)

MOPPC138 Continuous Integration for Automated Code Generation Tools
Ivan Prieto Barreiro - European Organization for Nuclear Research Engineering Department (EN)

MOPPC139 A Framework for Off-line Verification of Beam Instrumentation Systems at CERN
Stephen Jackson - European Organization for Nuclear Research AB Department

MOPPC140 High-Availability Monitoring and Big Data: Using Java Clustering and Caching Technologies to Meet Complex Monitoring Scenarios
Matthias Bräger - European Organization for Nuclear Research General Infrastructure Services Department (GS)

MOPPC141 The Ultimate Linux I/O Framework
Tomasz Wlostowski - European Organization for Nuclear Research Beams Department (BE)

MOPPC142 Building a Groovy-Based Domain-Specific Language (DSL) in Software Interlock System (SIS)
Jakub Pawel Wozniak - European Organization for Nuclear Research Beams Department (BE)

MOPPC143 Plug-in Based Analysis Framework for LHC Post-Mortem Analysis
Roman Gorbonosov - European Organization for Nuclear Research Beams Department (BE)

MOPPC144 Continuous Integration Using LabVIEW, SVN and Hudson
Odd Oyvind Andreassen - European Organization for Nuclear Research Engineering Department (EN)

MOPPC145 Mass-Accessible Controls Data for Web Consumers
Odd Oyvind Andreassen - European Organization for Nuclear Research Engineering Department (EN)

MOPPC146 MATLAB Objects for EPICS Channel Access
Jan Chrin - Paul Scherrer Institut

MOPPC147 Controls Algorithm Development and Testing for the IFC-1210 Controller at the Paul Scherrer Institute
Timo Korhonen - Paul Scherrer Institut

MOPPC148 Not Dead Yet: Recent Enhancements and Future Plans for EPICS Version 3
Andrew Nicholas Johnson - Argonne National Laboratory
Advanced Photon Source

MOPPC149 A Messaging-Based Data Access Layer for Client Applications
James Patrick - Fermi National Accelerator Laboratory
Accelerator Division

MOPPC150 Channel Access in Erlang
Dennis J. Nicklaus - Fermi National Accelerator Laboratory
Accelerator Division

MOPPC151 PyDDS: a New Real-Time High-Performance Data-Driven Python Middleware
Svetlana Shasharina - Tech-X Corporation

MOPPC152 Accelerator Lattice and Model Services
Chungming Paul Chu - Facility for Rare Isotope Beams
Michigan State University Cyclotron Laboratory

MOPPC154 Technology Refresh for the National Ignition Facility's Front-End Processors
Chris Estes - Lawrence Livermore National Laboratory
National Ignition Facility Programs Directorate
National Ignition Facility Project

MOPPC155 NSLS II Middlelayer Services
Guobao Shen - Brookhaven National Laboratory National Synchrotron Light Source II

MOPPC156 Virtual Accelerator at NSLS II Project
Guobao Shen - Brookhaven National Laboratory National Synchrotron Light Source II

MOPPC157 Application of Transparent Proxy Servers in Control Systems
Bartosz Frak - Brookhaven National Laboratory
Collider-Accelerator Department

MOPPC158 Application of Modern Programming Techniques in Existing Control System Software
Bartosz Frak - Brookhaven National Laboratory Collider-Accelerator Department

MOMIB **Mini Oral 1**
07-OCT-13 00:00 16:45 - 17:15
Ballroom B

MOMIB01 Sirius Control System: Conceptual Design
José Guilherme Ribas Sophia Franco - Brazilian Synchrotron Light Laboratory

MOMIB02 Development Status of the TPS Control System
Yung-Sen Cheng - National Synchrotron Radiation Research Center

MOMIB03 Control Systems Issues and Planning for eRHIC
Kevin A. Brown - Brookhaven National Laboratory

MOMIB04 A Semi-Automated, Formal Method to Integrate Accelerator Devices in the MedAustron Control System
Jasna Junuzovic - EBG MedAustron GmbH

MOMIB05 BeagleBone for Embedded Control System Applications
Lorenzo Pivetta - Elettra-Sincrotrone Trieste S.C.p.A.

MOMIB06 Personnel Protection of the CERN SPS North Hall in Fixed Target Primary Ion Mode
Timo Hakulinen - European Organization for Nuclear Research

MOMIB07 An OPC-UA Based Architecture for the Control of the ESPRESSO Spectrograph @ VLT
Roberto Cirami - INAF-Osservatorio Astronomico di Trieste

MOMIB08 Continuous Integration Using LabVIEW, SVN and Hudson
Odd Oyvind Andreassen - European Organization for Nuclear Research Engineering Department (EN)

MOMIB09 ZIO: The Ultimate Linux I/O Framework
Tomasz Wlostowski - European Organization for Nuclear Research Beams Department (BE)

TUOBF **Continental Breakfast**
08-OCT-13 00:00 08:00 - 08:30
Ballroom Foyer

TUKAB **Keynote Ed Moses**
08-OCT-13 00:00 08:30 - 09:15
Ballroom A&B

TUKAB01 The NIF: an International User Facility for High Energy Density and Inertial Fusion Science
Edward Moses - Lawrence Livermore National Laboratory

TUCOAAB **Project Status Reports 2**
08-OCT-13 00:00 09:15 - 10:15
Ballroom A&B

TUCOAAB01 Status of the National Ignition Facility Integrated Computer Control and Information Systems*
Lawrence Lagin - Lawrence Livermore National Laboratory
National Ignition Facility Programs Directorate
National Ignition Facility Project

TUCOAAB02 The Laser Megajoule Facility: Control System Status Report
Jean Paul Arnoul - Commissariat à l'énergie atomique et aux énergies alternatives CEA /CESTA

TUCOAAB03 Approaching Final Design of ITER Control System
Anders Wallander - ITER Organization

TUCOAAB04 The MedAustron Accelerator Control System: Design, Installation and Commissioning
Johannes Gutleber - European Organization for Nuclear Research

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TUCBBLPC **Coffee Break**
08-OCT-13 00:00 10:15 - 10:45
Pacific Concourse

TUCOBAB **Project Management and Collaboration**
08-OCT-13 00:00 10:45 - 12:00
Ballroom A&B

TUCOBAB01 A Small but Efficient Collaboration for the Spiral2 Control System Development
Eric Lecorche - Grand Accélérateur Nat. d'Ions Lourds

TUCOBAB02 The Mantid Project: Notes from an International Software Collaboration
Nicholas James Draper - Tessella

TUCOBAB03 Utilizing Atlassian JIRA for Large-Scale Software Development Management*
John Fisher - Lawrence Livermore National Laboratory
National Ignition Facility Programs Directorate
National Ignition Facility Project

TUCOBAB04 Evaluation of Issue Tracking and Project Management Tools for Use Across All CSIRO Radio Telescope Facilities
Juan Carlos Guzman - Commonwealth Scientific and Industrial Research Organisation (CSIRO) Australia Telescope National Facility

TUCOBAB05 A Rational Approach to Control System Development Projects That Incorporates Risk Management
Elder Matias - Canadian Light Source Inc.
University of Saskatchewan

TUOAL **Group Photo**
08-OCT-13 00:00 12:00 - 12:20
Atrium Lobby

TUOE **Lunch**
08-OCT-13 00:00 12:20 - 13:30
External

TUMIB **Mini Oral 2**
08-OCT-13 00:00 13:30 - 14:00
Ballroom B

TUMIB01 Using Prince2 and ITIL Practices for Computing Projects and Service Management in a Scientific Installation
David Fernandez-Carreiras - CELLS-ALBA Synchrotron

TUMIB02 A Control System for the ESRF Synchrotron Radiation Therapy Clinical Trials
Christian Nemoz - European Synchrotron Radiation Facility

TUMIB03 The Detector Control System for Daya Bay Neutrino Experiment
Xiaonan Li - Institute of High Energy Physics Chinese Academy of Sciences Experimental Physics Center

TUMIB04 Migrating to an EPICS Based Instrument Control System at the ISIS Spallation Neutron Source
Frederick Anthony Akeroyd - Science and Technology Facilities Council Rutherford Appleton Laboratory ISIS Department

TUMIB05 ANSTO and Australian Synchrotron Metadata Catalogues and the Australian National Data Service
Nick Hauser - Australian Nuclear Science and Technology Organisation

TUMIB06 Development of a Scalable and Flexible Data Logging System Using NoSQL Databases
Masahiro Kago - Japan Synchrotron Radiation Research Institute Controls and Computing Division

TUMIB07 RASHPA: a Data Acquisition Framework for 2D XRays Detectors
Fabien Le Mentec - European Synchrotron Radiation Facility

TUMIB08 ITER Contribution to Control System Studio (CSS) Development Effort
Nadine Utzel - ITER Organization

TUMIB09 jddd: A Tool for Operators and Experts to Design Control System Panels
Elke Sombrowski - Deutsches Elektronen-Synchrotron

TUMIB10 Performance Testing of EPICS User Interfaces - an Attempt to Compare the Performance of MEDM, EDM, CSS-BOY, CaQtDM, and EPICS-Qt
Richard Ian Farnsworth - Argonne National Laboratory Advanced Photon Source

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TUPPC **Poster 2 and Industrial Exhibition**
08-OCT-13 00:00 13:30 - 15:00
Pacific Concourse

TUPPC001 ANSTO and Australian Synchrotron Metadata Catalogues and the Australian National Data Service
Nick Hauser - Australian Nuclear Science and Technology Organisation

TUPPC002 Online Data Reduction for High Throughput Beamlines
Majid Ounsy - Synchrotron Soleil

TUPPC003 SDD toolkit : ITER CODAC Platform for Configuration and Development
Lana Abadie - ITER Organization

TUPPC004 Scalable Archiving with the Cassandra Archiver for CSS
Sebastian Marsching - Aquenos GmbH

TUPPC005 Implementation of an Overall Data Management at the Tomography Station at ANKA
David Haas - Karlsruhe Institute of Technology ANKA Synchrotron Radiation Facility

TUPPC006 Identifying Control Equipment
Matthias R. Clausen - Deutsches Elektronen-Synchrotron

TUPPC007 Evaluation and Optimization of Data Transfer Performance in MicroTCA Based Systems
Wojciech Jalmuzna - Embedded Integrated Control Systems GmbH

TUPPC008 A New Flexible Integration of NeXus Datasets to ANKA by Fuse File Systems
Wolfgang Mexner - Karlsruhe Institute of Technology Institute for Synchrotron Radiation

TUPPC009 The EXFOR Compilation of Nuclear Data
Ranjita Mandal - Indian Institute of Technology Kharagpur Department of Geology and Geophysics

TUPPC010 Problems and Solutions for Large Volume Scientific Data Management in Experimental Physics: the Case of FERMI@Elettra Free Electron Laser Facility
Milan Prica - Elettra-Sincrotrone Trieste S.C.p.A.

TUPPC011 Development of an Innovative Storage Manager for a Distributed Control System
Matteo Mara - Istituto Nazionale di Fisica Nucleare Amministrazione Centrale

TUPPC012 Development of a Scalable and Flexible Data Logging System Using NoSQL Databases
Masahiro Kago - Japan Synchrotron Radiation Research Institute Controls and Computing Division

TUPPC013 Scaling Out of the MADOCA Database System for SACLA
Toko Hirono - Japan Synchrotron Radiation Research Institute Controls and Computing Division

TUPPC014 Development of SPring-8 Experimental Data Repository System for Management and Delivery of Experimental Data
Hisanobu Sakai - Japan Synchrotron Radiation Research Institute Controls and Computing Division

TUPPC015 On-line and Off-line Data Analysis System for SACLA Experiments
Takashi Sugimoto - Japan Synchrotron Radiation Research Institute Controls and Computing Division

TUPPC016 Data Access and Management for Neutron Scattering Experiments in J-PARC/MLF
Kentaro Moriyama - Japan Proton Accelerator Research Complex (J-PARC) Japan Atomic Energy Agency JAEA and KEK Joint Project (J-PARC)

TUPPC017 Development of J-PARC Time-Series Data Archiver Using Distributed Database System
Nobuhiro Kikuzawa - Japan Proton Accelerator Research Complex (J-PARC) Japan Atomic Energy Agency JAEA and KEK Joint Project (J-PARC)

TUPPC018 A Data Acquisition and Query System in BEPCII
ChunHong Wang - Chinese Academy of Sciences Institute of High Energy Physics Accelerator Center

TUPPC019 Performance Evaluation of the Relational Database Archive System in Control System Studio
Sangwon Yun - National Fusion Research Institute

TUPPC020 Development of PLS-II IOC Data Archive System
Jae Myung Kim - Pohang Accelerator Laboratory

TUPPC021	Monitoring and Archiving of NSLS-II Booster Synchrotron Parameters Anton Anatolievich Derbenev - Russian Academy of Sciences The Budker Institute of Nuclear Physics
TUPPC022	Centralized Software and Hardware Configuration Tool for Large and Small Experimental Physics Facilities Alexander Vladimirovich Makeev - Russian Academy of Sciences The Budker Institute of Nuclear Physics
TUPPC023	MeerKAT Poster and Demo Charles de Villiers - SKA South Africa National Research Foundation of South Africa Department of Science and Technology
TUPPC024	Challenges to Providing a Successful Central Configuration Service to Support CERN's New Controls Diagnostics and Monitoring System Zornitsa Zaharieva - European Organization for Nuclear Research Beams Department (BE)
TUPPC025	Advantages and Challenges to the Use of On-line Feedback in CERN's Accelerators Controls Configuration Management Zornitsa Zaharieva - European Organization for Nuclear Research Beams Department (BE)
TUPPC026	Concept and Prototype for a Distributed Analysis Framework for the LHC Machine Data Jean-Christophe Garnier - European Organization for Nuclear Research Technology Department (TE)
TUPPC027	Quality Management of CERN Vacuum Controls Fabien Antoniotti - European Organization for Nuclear Research Technology Department (TE)
TUPPC028	The CERN Accelerator Logging Service - 10 Years in Operation: A Look at the Past, Present, and Future Chris Roderick - European Organization for Nuclear Research Beams Department (BE)
TUPPC029	Integration, Processing, Analysis Methodologies and Tools for Ensuring High Data Quality and Rapid Data Access in the TIM* Monitoring System Anna Suwalska - European Organization for Nuclear Research

TUPPC030 System Dependency Management and Status tracking for CERN Accelerator Systems
Jean-Christophe Garnier - European Organization for Nuclear Research Physics Department (PH)

TUPPC031 Proteus: FRIB Controls Database
Vasu Vuppala - Michigan State University National Superconducting Cyclotron Laboratory

TUPPC032 Database-Backed Configuration Service
Jeff Allan Mader - W.M. Keck Observatory

TUPPC033 Data Storage Taxonomies For Fusion Control Systems*
Phillip Adams - Lawrence Livermore National Laboratory National Ignition Facility Programs Directorate National Ignition Facility Project

TUPPC034 Experience Improving the Performance of Reading and Displaying Very Large Datasets
Ted D'Ottavio - Brookhaven National Laboratory Collider-Accelerator Department

TUPPC035 The New EPICS Archiver
Nikolay Malitsky - Brookhaven National Laboratory National Synchrotron Light Source II

TUPPC036 A Status Update for Hyppie – a Hyppervisored PXI for Physics Instrumentation under EPICS
James Rezende Piton - Brazilian Synchrotron Light Laboratory

TUPPC037 LabWeb - LNLS Beamlines Remote Operation System
Hugo Henrique Slepicka - Brazilian Synchrotron Light Laboratory

TUPPC038 Simultaneous On-line Ultrasonic Flowmetery and Binary Gas Mixture Analysis for the ATLAS Silicon Tracker Cooling Control System
Martin Doubek - Czech Technical University in Prague Faculty of Mechanical Engineering

TUPPC039 Development of a High Speed Diagnostics Package for the 0.2 J, 20 fs, 1 KHz Repetition Rate Laser at ELI-Beamlines
Jack Naylon - ELI Beamlines Czech Republic Institute of Physics

TUPPC040 Saclay GBAR Control Command
Paul Lotrus - Commissariat à l'Energie Atomique Centre d'Etudes Nucléaires de Saclay Institut de Recherche Fondamentale

TUPPC041 A Control System for the ESRF Synchrotron Radiation Therapy Clinical Trials
Christian Nemoz - European Synchrotron Radiation Facility

TUPPC042 Prototype of a Simple ZeroMQ-Based RPC in Replacement of CORBA in NOMAD
Paolo Mutti - Institut Laue-Langevin

TUPPC043 Controlling Cilex-Apollon Laser Beams Alignment and Diagnostics Systems with Tango
Mickael Pina - Ecole Polytechnique Laboratoire pour l'Utilisation des Lasers Intenses

TUPPC044 When Hardware and Software Work in Concert
Matthias Vogelgesang - Karlsruhe Institute of Technology Institute for Data Processing and Electronics

TUPPC045 Software Development for High Speed Data Recording and Processing
Djelloul Boukhelef - European XFEL GmbH

TUPPC046 Control Using Beckhoff Distributed Rail Systems at the European XFEL
Nicola Coppola - European XFEL GmbH

TUPPC047 The New TANGO-based Control and Data Acquisition System of the GISAXS Instrument GALAXI at Forschungszentrum Jülich
Harald Kleines - Forschungszentrum Jülich GmbH

TUPPC048 Adoption of the "PyFRID" Python Framework for Neutron Scattering Instruments
Matthias Drochner - Forschungszentrum Jülich GmbH

TUPPC049 Towards a Global Architecture for Operating and Controlling the Cherenkov Telescope Array
Matthias Fuessling - Universität Potsdam Institut für Physik und Astronomie

TUPPC050 Control, Safety and Diagnostics for Future ATLAS Pixel Detectors
Susanne Kersten - Bergische Universitaet Wuppertal Fachbereich Physik

TUPPC052 Automation of the Wavelength Change for the FERMI@Elettra Free Electron Laser
Claudio Scafuri - Elettra-Sincrotrone Trieste S.C.p.A.

TUPPC053 New Control System for the SPES Off-Line Laboratory at LNL-INFN Using EPICS IOCs Based on the Raspberry Pi
Jesus Alejandro Vasquez - Istituto Nazionale di Fisica Nucleare Laboratori Nazionali di Legnaro

TUPPC054 A PLC-Based System for the Control of an Educational Observatory
Veronica Baldini - INAF-Osservatorio Astronomico di Trieste

TUPPC055 Developing of the Pulse Motor Controller Electronics for Running under Weak Radiation Environment
Miyuki Ishizuka - Hitachi Zosen Electronic System Engineering Department

TUPPC056 The Detector Control System for Daya Bay Neutrino Experiment
Xiaonan Li - Institute of High Energy Physics Chinese Academy of Sciences Experimental Physics Center

TUPPC057 New Development of EPICS-based Data Acquisition System for Electron Cyclotron Emission Diagnostics in KSTAR Tokamak
Tae Gu Lee - National Fusion Research Institute

TUPPC058 Automation of Microbeam Focusing for X-Ray Micro-Experiments at the 4B Beamline of Pohang Light Source-II
Kyehwan Gil - Pohang Accelerator Laboratory

TUPPC059 Nominal Data Acquisition Device Support for EPICS
Vyacheslav Alexandrovich Isaev - Cosylab, Inc.

TUPPC060 Implementation of Continuous Scans Used in Beamline Experiments at Alba Synchrotron
Zbigniew Reszela - CELLS-ALBA Synchrotron

TUPPC061 BL13-XALOC, MX experiments at Alba: Current Status and Ongoing Improvements
Guifre Cuni - CELLS-ALBA Synchrotron

TUPPC062 High-Speed Data Acquisition of Sensor Signals for Physical Model Verification at CERN HiRadMat (SHC-DAQ)
Cedric Charrondière - European Organization for Nuclear Research Engineering Department (EN)

TUPPC063 Control and Monitoring of the Online Computer Farm for Offline Processing in LHCb
Luis Granado Cardoso - European Organization for Nuclear Research Physics Department (PH)

TUPPC064 Reusing the Knowledge from the LHC Experiments to Implement the NA62 Run Control
Fernando Varela - European Organization for Nuclear Research

TUPPC065 LHC Detector Control Systems Through the Years, a Better Future Through Lessons from the Past
Andre Augustinus - European Organization for Nuclear Research Physics Department (PH)

TUPPC066 10 Years of Experiment Control at SLS Beam Lines: an Outlook to SwissFEL
Juraj Krempasky - Paul Scherrer Institute Swiss Light Source

TUPPC067 TECII - A Distributed Sample Environment Control and Diagnostics System Proposal for ISIS
Matt Richard William North - Science and Technology Facilities Council Rutherford Appleton Laboratory ISIS Department

TUPPC068 Migrating to an EPICS Based Instrument Control System at the ISIS Spallation Neutron Source
Frederick Anthony Akeroyd - Science and Technology Facilities Council Rutherford Appleton Laboratory ISIS Department

TUPPC069 ZEBRA, a Flexible Solution for Controlling Scanning Experiments
Tom Cobb - Diamond Light Source Ltd

TUPPC070 Detector Controls for the NOvA Experiment Using Acnet-in-a-Box
Dennis J. Nicklaus - Fermi National Accelerator Laboratory Accelerator Division

TUPPC071 Muon Ionization Cooling Experiment: Controls and Monitoring
Pierrick M. Hanlet - Illinois Institute of Technology BCPS (Physics)

TUPPC072 Flexible Data Driven Experimental Data Analysis at the National Ignition Facility*
Rita Carol Bettenhausen - Lawrence Livermore National Laboratory National Ignition Facility Programs Directorate National Ignition Facility Project

TUPPC073 National Ignition Facility (NIF) Dilation X-ray Imager (DIXI) Diagnostic Instrumentation and Control System*
Jarom Nelson - Lawrence Livermore National Laboratory National Ignition Facility Programs Directorate National Ignition Facility Project

TUPPC074 Meeting User Needs on the National Ignition Facility Using a Hiearchy of Structure and Data Driven Flexibility*
Benjamin Horowitz - Lawrence Livermore National Laboratory National Ignition Facility Programs Directorate National Ignition Facility Project

TUPPC075 Database Centric Event Mode Neutron Scattering Data Acquisition and Instruments Control Systems
Madhan Sundaram - Oak Ridge National Laboratory Spallation Neutron Source

TUPPC076 SNS Instrument Data Acquisition and Controls
Steven M. Hartman - Oak Ridge National Laboratory Spallation Neutron Source

TUPPC077 Experiment Automation with a Robot Arm Using the Liquids Reflectometer Instrument at the Spallation Neutron Source
Bogdan Vacaliuc - Oak Ridge National Laboratory Spallation Neutron Source Research Accelerator Division

TUPPC078 First EPICS/CSS Based Instrument Control and Data Acquisition System at ORNL
Xiaosong Geng - Oak Ridge National Laboratory Spallation Neutron Source

TUPPC079 Development of an Experiment-wide Finite State Machine for STAR
Jiro Fujita - Creighton University

TUPPC080 RASHPA: a Data Acquisition Framework for 2D XRays Detectors
Fabien Le Mentec - European Synchrotron Radiation Facility

TUPPC081 IcePAP: An Advanced Motor Controller for Scientific Applications in Large User Facilities
Nicolas Janvier - European Synchrotron Radiation Facility

TUPPC082 DSP Design Using System Generator
Jean Marc Koch - European Synchrotron Radiation Facility

TUPPC083 FPGA Implementation of a Digital Constant Fraction for Fast Timing Studies in the Picosecond Range
Paolo Mutti - Institut Laue-Langevin

TUPPC084 Virtualization of Complex VME Boards Using FPGA Technology to Address Obsolescence
Christian Raymond Lucuix - European Organisation for Astronomical Research in the Southern Hemisphere

TUPPC085 Modular, Scalable ATCA-based Data Acquisition System
Wojciech Jalmuzna - Embedded Integrated Control Systems GmbH

TUPPC086 Electronics Developments for High Speed Data Throughput and Processing
Christopher Youngman - European XFEL GmbH

TUPPC087 High Level FPGA Programming Framework Based on Simulink
Bruno Fernandes - European XFEL GmbH

TUPPC088 Development of MicroTCA-based Image Processing System at SPring-8
Akio Kiyomichi - Japan Synchrotron Radiation Research Institute Controls and Computing Division

TUPPC089 Upgrade of the Power Supply Interface Controller Module for SuperKEKB
Tatsuro Nakamura - High Energy Accelerator Research Organization

TUPPC090 Digital Control System of High Extensibility for KAGRA
Hiroaki Kashima - Hitachi Zosen Electronic System Engineering Department

TUPPC091 An Embedded IOC for 100-MeV Cyclotron RF Control
Zhiguo Yin - China Institute of Atomic Energy

TUPPC092 A VME Single Computer Based on Loongson2F CPU
Jian Zhuang - State Key laboratory of Particle Detection and Electronics of China

TUPPC093 Electronics Development of Si+CsI Prototype Detector for RAON
Yonghak Kim - Institute for Basic Science

TUPPC094 Em# Project. Improvement of Low Current Measurements at Alba Synchrotron
Xavier Serra-Gallifa - CELLS-ALBA Synchrotron

TUPPC095 Low Cost FFT Scope Using LabVIEW cRIO and FPGA
Odd Oyvind Andreassen - European Organization for Nuclear Research Engineering Department (EN)

TUPPC096 Migration from WorldFIP to a Low-Cost Ethernet Fieldbus for Power Converter Control at CERN
Stephen Page - European Organization for Nuclear Research Technology Department (TE)

TUPPC097 Design of a Radio Frequency Phase Detector and Controller for the APS Linac
Anthony Pietryla - Argonne National Laboratory Advanced Photon Source

TUPPC098 Advanced Light Source Control System Upgrade – Intelligent Local Controller Replacement
Eric Norum - Lawrence Berkeley National Laboratory

TUPPC100 Recent Changes to Beamline Software at the Canadian Light Source
Glen Wright - Canadian Light Source Inc.
University of Saskatchewan

TUPPC101 Scaling of EPICS edm Display Pages at ISAC
Rolf Keitel - TRIUMF Canada's National Laboratory for Particle and Nuclear Physics

TUPPC102 User Interfaces for the Spiral2 Machine Protection System
Laurent Philippe - Grand Accélérateur Nat. d'Ions Lourds

TUPPC103 ITER Contribution to Control System Studio (CSS) Development Effort
Nadine Utzel - ITER Organization

TUPPC104 jddd: A Tool for Operators and Experts to Design Control System Panels
Elke Sombrowski - Deutsches Elektronen-Synchrotron

TUPPC105 Karabo GUI: A Multi-purpose Graphical Front End for the Karabo Framework
Burkhard Heisen - European XFEL GmbH

TUPPC106 Development of a Web-based Shift Reporting Tool for Accelerator Operation at the Heidelberg Ion Therapy Center
Klaus Höppner - Heidelberg Ionenstrahl-Therapie Centrum HIT Betriebs GmbH am Universitätsklinikum Heidelberg

TUPPC107 Data Management and Analysis for Beam Dynamics Simulation
Denis Zyuzin - Forschungszentrum Jülich GmbH Institut für Kernphysik

TUPPC108 Using Web Syndication for Flexible Remote Monitoring
Ombretta Pinazza - Istituto Nazionale di Fisica Nucleare Sezione di Bologna

TUPPC109 MacspeechX.py Module and Its Use in Accelertor Control Systems
Noboru Yamamoto - High Energy Accelerator Research Organization

TUPPC110 Operator Intervening System for Remote Accelerator Diagnostics and Support
Akito Uchiyama - Sokendai, the Graduate University for Advanced Studies Department of Accelerator Science

TUPPC111 Online Status and Settings Monitoring for the LHC Collimators
Gianluca Valentino - University of Malta Information and Communication Technology

TUPPC112 GeoSynoptic Panel
Lukasz Zytniak - National Synchrotron Radiation Centre at Jagiellonian University

TUPPC113 Development of an EPICS Alarm System for the ANKA Synchrotron Light Source
Igor Kriznar - Cosylab, Inc.

TUPPC114 Making It All Work for Operators
Igor Kriznar - Cosylab, Inc.

TUPPC115 Hierarchies of Alarms for Large Distributed Systems
Manuel Gonzalez-Berges - European Organization for Nuclear Research

TUPPC116 Cheburashka: A Tool for Consistent Memory Map Configuration Across Hardware and Software
Anthony Rey - European Organization for | Nuclear Research AB Department

TUPPC117 Unifying Data Diversity and Conversion to Common Engineering Analysis Tools
Hubert Reymond - European Organization for Nuclear Research AB Department

TUPPC119 Exchange of Crucial Information between Accelerator Operation, Equipment Groups and Technical Infrastructure at CERN
Isabelle Laugier - European Organization for Nuclear Research Beams Department (BE)

TUPPC120 LHC Collimator Alignment Operational Tool
Gianluca Valentino - European Organization for Nuclear Research Beams Department (BE)

TUPPC121 caQtDM, an EPICS Display Manager with Qt
Anton Mezger - Paul Scherrer Institut

TUPPC122 Progress of the TPS Control Applications Development
Yung-Sen Cheng - National Synchrotron Radiation Research Center

TUPPC123 User Interfaces Development of Imaging Diagnostics Devices for TPS
Chih-Yu Liao - National Synchrotron Radiation Research Center

TUPPC124 Distributed Network Monitoring Made Easy - An Application for Accelerator Control System Process Monitoring
Christopher Peters - Argonne National Laboratory

TUPPC125 Performance Testing of EPICS User Interfaces - an Attempt to Compare the Performance of MEDM, EDM, CSS-BOY, CaQtDM, and EPICS-Qt
Richard Ian Farnsworth - Argonne National Laboratory Advanced Photon Source

TUPPC126 Visualization of Experimental Data at the National Ignition Facility*
Matthew Hutton - Lawrence Livermore National Laboratory

TUPPC127 National Ignition Facility Use of Barcoding to Streamline Optic Processing*
Cemil Bruce Foxworthy - Lawrence Livermore National Laboratory National Ignition Facility Programs Directorate National Ignition Facility Project

TUPPC128 Machine History Viewer for the Integrated Computer Control System of the National Ignition Facility*
Eric Wilson - Lawrence Livermore National Laboratory National Ignition Facility Programs Directorate National Ignition Facility Project

TUPPC129 Improving Control System Uptime and Reliability by Detecting and Reporting Failed Devices Quickly*
Russell Fleming - Lawrence Livermore National Laboratory National Ignition Facility Programs Directorate National Ignition Facility Project

TUPPC130 The Design of NSLS-II High Level Physics Applications
Lingyun Yang - Brookhaven National Laboratory National Synchrotron Light Source II

TUPPC131 Synoptic Displays and Rapid Visual Application Development
Bartosz Frak - Brookhaven National Laboratory Collider-Accelerator Department

TUPPC132 Accelerator Control Data Visualization with Google Map
Wenge Fu - Brookhaven National Laboratory
Collider-Accelerator Department

TUPPC133 Graphene: A Java Library for Real-Time Scientific Graphs
Gabriele Carcassi - Brookhaven National Laboratory National
Synchrotron Light Source II

TUPPC134 Pvmanager: A Java Library for Real-Time Data Processing
Gabriele Carcassi - Brookhaven National Laboratory National
Synchrotron Light Source II

TUOPC **Refreshments**
08-OCT-13 00:00 14:00 - 15:00
Pacific Concourse

TUCOCA **Personnel Safety and Machine Protection**
08-OCT-13 00:00 15:00 - 17:30
Ballroom A

TUCOCA01 XFEL Machine Protection System (MPS) Based on uTCA
Sven Karstensen - Deutsches Elektronen-Synchrotron

TUCOCA02 The ITER Interlock System
Antonio Vergara-Fernandez - ITER Organization

TUCOCA03 Machine Protection Issues for eRHIC
Kevin A. Brown - Brookhaven National Laboratory

TUCOCA04 Formal Methodology for Safety-
Critical Systems Engineering at CERN
Francesco Valentini - European Organization for
Nuclear Research

TUCOCA05 EPICS-based Control System for a Radiation Therapy Machine
Jonathan Paul Jacky - University of Washington Medical Center
Radiation Oncology

TUCOCA06 Current Status of a Carborne Survey System, KURAMA
Minoru Tanigaki - Kyoto University Research Reactor Institute

TUCOCA07 A Streamlined Architecture of LCLS-II
Beam Containment System
Enzo Carrone - SLAC National Accelerator Laboratory

TUCOCA08 Personnel and Machine Protection Systems in The
National Ignition Facility*
Robert Reed - Lawrence Livermore National Laboratory
National Ignition Facility Programs Directorate
National Ignition Facility Project

TUCOCA09 Klystron Measurement and Protection System for XFEL on the
uTCA Architecture
Lukasz Butkowski - Deutsches Elektronen-Synchrotron

TUCOCA10 Improvements of T2K Primary Beamline Control System
Kazuo Nakayoshi - High Energy Accelerator Research Organization Institute of Particle and Nuclear Studies

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TUCOCB **Software Technology Evolution**
08-OCT-13 00:00 15:00 - 17:30
Ballroom B

TUCOCB01 Next-Generation MADOCA for SPring-8 Control Framework
Takahiro Matsumoto - Japan Synchrotron Radiation Research
Institute Controls and Computing Division

TUCOCB02 Middleware Proxy: A Request-Driven Messaging Broker for
High Volume Data Distribution
Wojciech Sliwinski - European Organization for
Nuclear Research Beams Department (BE)

TUCOCB03 A Practical Approach to Ontology-Enabled Control Systems for
Astronomical Instrumentation
Wim Pessemier - Katholieke Universiteit Leuven Department of
Physics and Astronomy

TUCOCB04 EPICS Version 4 Progress Report
Timo Korhonen - Paul Scherrer Institut

TUCOCB05 Device Definition and Composite Device Views on Top of the Flat EPICS Namespace
Leo Bob Dalesio - Brookhaven National Laboratory
National Synchrotron Light Source II

TUCOCB06 Designing and Implementing LabVIEW Solutions for Re-Use*
MIchael Flegel - Lawrence Livermore National Laboratory
National Ignition Facility Programs Directorate
National Ignition Facility Project

TUCOCB07 TANGO - Can ØMQ Replace CORBA ?
Andrew Gotz - European Synchrotron Radiation Facility

TUCOCB08 Reimplementing the Bulk Data System with DDS in ALMA ACS
Bogdan Jeram - European Organisation for Astronomical Research in the Southern Hemisphere

TUCOCB09 Internet of Things and Control System
Vincent Hardion - MAX-lab, Lund University

TUCOCB10 TANGO V8 - Another Turbo Charged Major Release
Jens Meyer - European Synchrotron Radiation Facility

TUOA **Mobile Platforms Roundtable**
08-OCT-13 00:00 18:00 - 19:30
Ballroom A

WEOBF **Continental Breakfast**
09-OCT-13 00:00 08:00 - 08:30
Ballroom Foyer

WEKAB **Keynote Charles Elachi**
09-OCT-13 00:00 08:30 - 09:15
Ballroom A&B

WEKAB01 Technical Challenges of Space Exploration
Charles Elachi - Jet Propulsion Laboratory

WECOAAB	**Experiment Control -1** 09-OCT-13 00:00 09:15 - 10:15 Ballroom A&B
WECOAAB01	An Overview of the LHC Experiments' Control Systems Clara Gaspar - European Organization for Nuclear Research Physics Department (PH)
WECOAAB02	Status of the ACS-based Control System of the Mid-size Telescope Prototype for the Cherenkov Telescope Array (CTA) Peter Andreas Roland Wegner - Deutsches Elektronen-Synchrotron DESY at Zeuthen
WECOAAB03	Synchronization of Motion and Detectors and Continuous Scans as the Standard Data Acquisition Technique David Fernandez-Carreiras - CELLS-ALBA Synchrotron

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WECBBLPC	**Coffee Break** 09-OCT-13 00:00 10:15 - 10:45 Pacific Concourse

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WECOBA	**Data Management and Processing** 09-OCT-13 00:00 10:45 - 12:30 Ballroom A
WECOBA01	Algebraic Reconstruction of Ultrafast Tomography Images at the Large Scale Data Facility Xiaoli Yang - Karlsruhe Institute of Technology Institute for Data Processing and Electronics
WECOBA02	Distributed Information Services for Control Systems Vasu Vuppala - Michigan State University National Superconducting Cyclotron Laboratory
WECOBA03	eResearch Tools for the Australian Synchrotron Research Community Claus Ulrich Felzmann - Synchrotron Light Source Australia
WECOBA04	Effective End-to-end Management of Data Acquisition and Analysis for X-ray Photon Correlation Spectroscopy Faisal Khan - Argonne National Laboratory Advanced Photon Source

WECOBA05 Understanding NIF Experimental Results: NIF Target Diagnostic Automated Analysis Recent Accompolishments*
Judith A. Liebman - Lawrence Livermore National Laboratory
National Ignition Facility Programs Directorate
National Ignition Facility Project

WECOBA06 Exploring No-SQL Alternatives for ALMA Monitoring System
Tzu-Chiang Shen - ALMA Joint ALMA Observatory

WECOBA07 High Speed Detectors: Problems and Solutions
Nick Rees - Diamond Light Source Ltd

WECOCB **Hardware Technology**
09-OCT-13 00:00 10:45 - 12:30
Ballroom B

WECOCB01 CERN's FMC Kit
Matthieu Cattin - European Organization for Nuclear Research
Beams Department (BE)

WECOCB02 ARM Based Embedded EPICS Controller for Beam Diagnostics of Cyclotrons at VECC
Shantonu Sahoo - Department of Atomic Energy Variable Energy Cyclotron Centre

WECOCB03 Development of a Front-end Data-Acquisition System with a Camera Link FMC for High-Bandwidth X-Ray Imaging Detectors
Choji Saji - Japan Synchrotron Radiation Research Institute
Controls and Computing Division

WECOCB04 The LASNCE FPGA Embedded Signal Processing Framework
Jeffrey Owen Hill - Los Alamos National Laboratory
LANSCE Division

WECOCB05 Modern Technology in Disguise
Timo Korhonen - Paul Scherrer Institute Swiss Light Source

WECOCB06 Saving Costs and Increasing Data Throughput in MicroTCA.4 by Hardware Concept Extension and Optimization of Data Transfer Performance
Vollrath Dirksen - Deutsches Elektronen-Synchrotron

WECOCB07 Development of an Open-Source Hardware Platform for Sirius BPM and Orbit Feedback
Daniel de Oliveira Tavares - Brazilian Synchrotron Light Laboratory

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WEOE **Lunch**
09-OCT-13 00:00 12:30 - 13:30
External

WEON **NIF Tour**
09-OCT-13 00:00 12:45 - 17:30
NIF (See bus ticket for exact time)

WEOOM **Banquet and Awards-Alexander Rose**
09-OCT-13 00:00 18:30 - 23:00
One Market

WEOOM01 Designing for Longevity
Alexander Rose - The Long Now Foundation

THOBF **Continental Breakfast**
10-OCT-13 00:00 08:00 - 08:30
Ballroom Foyer

THKAB **Keynote Matt Ettus**
10-OCT-13 00:00 08:30 - 09:15
Ballroom A&B

THKAB01 TBD
Matt Ettus - Ettus Research

THCOAAB **User Interfaces and Tools**
10-OCT-13 00:00 09:15 - 12:00
Ballroom A&B

THCOAAB01 A Scalable and Homogeneous Web-Based Solution for Presenting CMS Control System Data
Lorenzo Masetti - European Organization for Nuclear Research Physics Department (PH)

THCOAAB02 Enhancing the Man-Machine-Interface of Accelerator Control Applications with Modern Consumer Market Technologies
Reinhard Bacher - Deutsches Elektronen-Synchrotron

THCOAAB03 Bringing Control System User Interfaces to the Web
Xihui Chen - Oak Ridge National Laboratory
Spallation Neutron Source

THCOAAB04 Synchrobots: Experiments with Telepresence and Tele-operated Mobile Robots in a Synchrotron Radiation Facility
Roberto Pugliese - Elettra-Sincrotrone Trieste S.C.p.A.

THCOAAB05 Rapid Application Development Using Web 2.0 Technologies
Scott Reisdorf - Lawrence Livermore National Laboratory
National Ignition Facility Programs Directorate
National Ignition Facility Project

THCOAAB06 Achieving a Successful Alarm Management Deployment – The CLS Experience
Elder Matias - Canadian Light Source Inc.
University of Saskatchewan

THCOAAB07 NIF Electronic Operations: Improving Productivity with iPad Application Development*
Dan Potter - Lawrence Livermore National Laboratory
National Ignition Facility Programs Directorate
National Ignition Facility Project

THCOAAB08 NOMAD Goes Mobile
Paolo Mutti - Institut Laue-Langevin

THCOAAB09 Olog and Control System Studio: A Rich Logging Environment
Kunal Shroff - Brookhaven National Laboratory National Synchrotron Light Source II

THCBBLPC **Coffee Break**
10-OCT-13 00:00 10:15 - 10:45
Pacific Concourse

THOE **Lunch**
10-OCT-13 00:00 12:00 - 13:30
External

THMIB **Mini Oral 3**
10-OCT-13 00:00 13:30 - 14:00
Ballroom B

THMIB01 CLIC-ACM: Acquisition and Control System
Bartosz Przemysław Bielawski - European Organization for Nuclear Research CERN Accelerator School

THMIB02 Low-cost Motion Control Alternative for Complex Multi-axis Systems
Wesley Moore - Thomas Jefferson National Accelerator Facility

THMIB03 From Real to Virtual - How to Provide a High-Avaliblity Computer Server Infrastructure
Rene Kapeller - Paul Scherrer Institut

THMIB04 Optimizing Blocker Usage on NIF Using Image Analysis and Machine Learning*
Laura Mascio Kegelmeyer - Lawrence Livermore National Laboratory National Ignition Facility Programs Directorate National Ignition Facility Project

THMIB05 Single Photon THz Timer
Amur Tevatros Margaryan - A.I. Alikhanyan National Science Laboratory

THMIB06 Development Status of SINAP Timing System
Ming Liu - Shanghai Institute of Applied Physics

THMIB07 Fast Orbit Feedback Control in Mode Space
Sandira Gayadeen - University of Oxford Engineering Science

THMIB08 Orbit Correction Systems for Indus-2
Pravin Fatnani - Raja Ramanna Centre For Advanced Technology Accelerator Controls Department

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THPPC Poster 3 and Industrial Exhibition
10-OCT-13 00:00 13:30 - 15:00
Pacific Concourse

THPPC001 Overview of “The Scans” in the Central Control System of TRIUMF’s 500 MeV Cyclotron
Juan Pon - TRIUMF Canada’s National Laboratory for Particle and Nuclear Physics

THPPC002 Configuration Management for Beam Delivery at TRIUMF/ISAC
Jane E Richards - TRIUMF Canada’s National Laboratory for Particle and Nuclear Physics

THPPC004 CODAC Standardisation of PLC Communication
Sopan Pande - ITER Organization

THPPC005 Visualization Infrastructure within the Controls Environment of the Light Sources at HZB
Dennis Brian Engel - Helmholtz-Zentrum Berlin für Materialien und Energie GmbH Elektronen-Speicherring BESSY II

THPPC006 REMBRANDT - REMote Beam instRumentation And Network Diagnosis Tool
Tobias Hoffmann - GSI Helmholtzzentrum für Schwerionenforschung GmbH

THPPC007 Planning, Inventory, Administration and Control of the Electronics Racks Complex for the European XFEL
Evgueni Negodin - Deutsches Elektronen-Synchrotron MPY

THPPC008 Management of the FERMI@Elettra Control System Infrastructure
Lorenzo Pivetta - Elettra-Sincrotrone Trieste S.C.p.A.

THPPC009 Design and Status of the SuperKEKB Accelerator Control Network System
Masako Iwasaki - High Energy Accelerator Research Organization

THPPC010 Upgrade Server System using Virtualization Technology in RIBF Control System
Akito Uchiyama - RIKEN Nishina Center

THPPC011 High Availability Software Architecture of the Control System of ADS
Pengfei Wang - Chinese Academy of Sciences Institute of High Energy Physics Accelerator Center

THPPC012 The Equipment Database for the Control System of the NICA Accelerator Complex
Georgy Sergeevich Sedykh - Joint Institute for Nuclear Research Veksler and Baldin Laboratory of High Energy Physics

THPPC013 Configuration Management for the Future MAX IV Laboratory Control System
Vincent Hardion - MAX-lab, Lund University

THPPC014 CMX - A Generic In-Process Monitoring Solution for C and C++ Applications
Peter Jurcso - European Organization for Nuclear Research Beams Department (BE)

THPPC015 Managing infrastructure in the ALICE Detector Control System
Mateusz Lechman - European Organization for Nuclear Research Physics Department (PH)

THPPC017 Control System Configuration Management at PSI Large Research Facilities
Renata Alica Krempaska - Paul Scherrer Institut

THPPC018 Construction of the TPS Network System
Yung-Sen Cheng - National Synchrotron Radiation Research Center

THPPC019 TBD
Marvin Christensen - Lawrence Livermore National Laboratory National Ignition Facility Programs Directorate National Ignition Facility Project

THPPC020 13 Ways Through Industrial Firewalls - What You Don't Know WILL Hurt You
Andrew Ginter - Waterfall Security Solutions

THPPC021 Beam Viewer Controls at Jefferson Lab
Michael Johnson - Thomas Jefferson National Accelerator Facility

THPPC022 Securing Mobile Control System Devices: Development and Testing
Stefani P. Banerian - University of Washington Medical Center Radiation Oncology

THPPC023 Integration of Windows Binaries in the UNIX-based RHIC Control System Environment
Prerana Kankiya - Brookhaven National Laboratory Collider-Accelerator Department

THPPC024 Operating System Upgrades at RHIC
Severino Binello - Brookhaven National Laboratory Collider-Accelerator Department

THPPC025 The Interaction between Safety Interlock and Motion Control Systems on the Dingo Radiography Instrument at the OPAL Research Reactor
Paul Nicholas Barron - Australian Nuclear Science and Technology Organisation

THPPC026 Diagnostic Controls of IFMIF-EVEDA Prototype Accelerator
Jean Francois Denis - Commissariat à l'Energie Atomique Direction des Sciences de la Matière Institut de recherche sur les lois fondamentales de l'Univers

THPPC027 A New EPICS Device Support for S7 PLCs
Sebastian Marsching - Aquenos GmbH

THPPC028 Parameter Deviation Alarms System for Indus-2
Rajesh Kumar Agrawal - Raja Ramanna Center for Advanced Technology Department of Atomic Energy Government of India

THPPC029 Synchronous Ramp-Data Capture Scheme for Indus-2 Magnet Power Supply Control System
Amit Chauhan - Raja Ramanna Center for Advanced Technology Department of Atomic Energy Government of India

THPPC030 A Wireless Control System for the IUAC High Current Injector
Rajendra Nath Dutt - Inter University Accelerator Centre

THPPC031 The New Control Software of PIAVE Beam Diagnostics System at LNL
Mauro Giacchini - Istituto Nazionale di Fisica Nucleare Laboratori Nazionali di Legnaro

THPPC032 Embedded EPICS Controller for KEK Linac Screen Monitor System
Masanori Satoh - High Energy Accelerator Research Organization Accelerator Laboratory

THPPC033 Upgrade of BPM DAQ System for SuperKEKB Injector Linac
Masanori Satoh - High Energy Accelerator Research Organization Accelerator Laboratory

THPPC034 A Novel Analysis of Time Evolving Betatron Tune
Shuei Yamada - Japan Proton Accelerator Research Complex High Energy Accelerator Research Organization Tokai Campus

THPPC035 RF Signal Switching System for Electron Beam Position Monitor Utilizing ARM Microcontroller
Tomonori Toyoda - Institute for Molecular Science (Area B)

THPPC036 EPICS Control System for the FFAG Complex at KURRI
Yasutoshi Kuriyama - Kyoto University Research Reactor Institute

THPPC037 EPICS-based Control System for New Skew Quadrupole Magnets in J-PARC MR
Kenichi Sato - Japan Proton Accelerator Research Complex (J-PARC) Japan Atomic Energy Agency JAEA and KEK Joint Project (J-PARC)

THPPC038 HI-13 Tandem Accelerator Beam Lines Vacuum Control System
Xiaofei Wang - China Institute of Atomic Energy

THPPC039 Beam Energy Spread Measurement Using Stripline-lame Screen Monitor
Jingxia Zhao - Chinese Academy of Sciences Institute of High Energy Physics Accelerator Center

THPPC040 Wire-Scanner Readout for the CSNS Front-End
Fang Li - Chinese Academy of Sciences Institute of High Energy Physics Accelerator Center

THPPC043 Implement an Interface for Control System to Interactive with Oracle Database at SSC-LINAC
Shi An - Chinese Academy of Sciences Institute of Modern Physics

THPPC044 An Ethernet Interfaced Devices Control Implementation for SSC_LINAC by Using EPICS
Kewei Gu - Chinese Academy of Sciences Institute of Modern Physics

THPPC045 The SSC-Linac Control System
Wei Zhang - Chinese Academy of Sciences Institute of Modern Physics

THPPC046 The Control System of the Water-cooled DCM in SSRF
Wenhong Jia - Shanghai Institute of Applied Physics

THPPC047 Preliminary Design of the SXFEL Control System
Jianguo Ding - Shanghai Institute of Applied Physics

THPPC048 Upgrade of the Nuclotron Injection Control and Diagnostics System
Evgeny V. Gorbachev - Joint Institute for Nuclear Research

THPPC049 The Power Supply System for Electron Beam Orbit Correctors and Focusing Lenses of Kurchatov Synchrotron Radiation Source
Nikolai Moseiko - National Research Center "Kurchatov Institute"

THPPC050 Upgrade System of Vacuum Monitoring of Synchrotron Radiation Sources of NRC Kurchatov Institute
Nikolai Moseiko - National Research Center "Kurchatov Institute"

THPPC051 First Operation of New Electron Beam Orbit Measurement System at SIBERIA-2
Yevgeniy Fomin - National Research Center "Kurchatov Institute"

THPPC052 The Measurement and Monitoring of Spectrum and Wavelength of Coherent Radiation at Novosibirsk Free Electron Laser
Stanislav Sergeevich Serednyakov - Russian Academy of Sciences The Budker Institute of Nuclear Physics

THPPC053 NSLS-II Booster Ramp Handling
Pavel Borisovich Cheblakov - Russian Academy of Sciences The Budker Institute of Nuclear Physics

THPPC054 The Control of Pulsed Magnets of the NSLS-II Booster Synchrotron
Evgeny Simonov - Russian Academy of Sciences The Budker Institute of Nuclear Physics

THPPC055 The Software Tools and Capabilities of Diagnostic System for Stability of Magnet Power Supplies at Novosibirsk Free Electron Laser
Stanislav Sergeevich Serednyakov - Russian Academy of Sciences The Budker Institute of Nuclear Physics

THPPC056 Design and Implementation of Linux Drivers for National Instruments IEEE 1588 Timing and General I/O Cards
Klemen Zagar - Center of Excellence for Biosensors, Instrumentation and Process Control

THPPC057 The Data Validation of the LHC Layout Database for the Upgrade of UNICOS Continuous Process Control Package
Marco Pezzetti - European Organization for Nuclear Research Technology Department (TE)

THPPC058 LSA - the High Level Application Software of the LHC - and Its Performance During the First Three Years of Operation
Delphine Jacquet - European Organization for Nuclear Research Beams Department (BE)

THPPC059 CLIC-ACM: Acquisition and Control System
Bartosz Przemysław Bielawski - European Organization for Nuclear Research

THPPC060 A PXI-Based Low Level Control for the Fast Pulsed Magnets in the CERN PS Complex
Jan Schipper - European Organization for Nuclear Research Technology Department (TE)

THPPC061 SwissFEL Magnet Test Setup and Its Controls at PSI
Pavel Chevtsov - Paul Scherrer Institut

THPPC062 Control Environment of BPM and Power Supply for TPS Booster Synchrotron
Yung-Sen Cheng - National Synchrotron Radiation Research Center

THPPC063 Status of the TPS Insertion Devices Controls
Yung-Sen Cheng - National Synchrotron Radiation Research Center

THPPC064 The HiSPARC Control System
Robert Hart - National Institute for Subatomic Physics

THPPC065 Software System for Monitoring and Control at the Solenoid Test Facility
Jerzy Nogiec - Fermi National Accelerator Laboratory Technical Division

THPPC066 ACSys Camera Implementation Utilizing an Erlang Framework to C++ Interface
Charlie Briegel - Fermi National Accelerator Laboratory Accelerator Division

THPPC067 New EPICS Drivers for Keck TCS Upgrade
Jimmy Johnson - W.M. Keck Observatory

THPPC068 Switching Solution – Upgrading a Running System
Kevin Tsubota - W.M. Keck Observatory

THPPC069 Low-cost Motion Control Alternative for Complex Multi-axis Systems
Wesley Moore - Thomas Jefferson National Accelerator Facility

THPPC071 Machine Protection Diagnostics on a Rule Based System
Marcus Walla - Deutsches Elektronen-Synchrotron

THPPC072 Superconducting Cavity Quench Detection and Prevention for the European XFEL
Julien Branlard - Deutsches Elektronen-Synchrotron

THPPC073 Determining Accelerator Reliability by Automatic Dataset Analysis
George Alexandrovitch Fatkin - Russian Academy of Sciences The Budker Institute of Nuclear Physics

THPPC075 LIPAc LLRF PI Loop Parameters Definition Using Artificial Intelligence Tools
Julio Calvo - Centro de Investigaciones Energéticas, Medioambientales y Tecnológicas

THPPC076 Re-Engineering Control Systems Using Automatic Generation Tools and Process Simulation: the LHC Water Cooling Case
Enrique Blanco Vinuela - European Organization for Nuclear Research Engineering Department (EN)

THPPC077 A Fuzzy-Oriented Solution for Automatic Distribution of Limited Resources According to Priority Lists
Marco Pezzetti - European Organization for Nuclear Research Technology Department (TE)

THPPC078 The AccTesting Framework: An Extensible Framework for Accelerator Commissioning and Systematic Testing
Jean-Christophe Garnier - European Organization for Nuclear Research Physics Department (PH)

THPPC079 Using a Java Embedded DSL for LHC Test Analysis
Jean-Christophe Garnier - European Organization for Nuclear Research Physics Department (PH)

THPPC080 Testing and verification of PLC code for process control
Enrique Blanco Vinuela - European Organization for Nuclear Research Engineering Department (EN)

THPPC081 High-level Functions for Modern Control Systems: A Practical Example
Fernando Varela - European Organization for Nuclear Research

THPPC082 Monitoring of the National Ignition Facility Integrated Computer Control System*
John Fisher - Lawrence Livermore National Laboratory National Ignition Facility Programs Directorate Photon Science and Applications Program

THPPC083 Software Tool Leverages Existing Image Analysis Results to Provide In-Situ Transmission of the National Ignition Facility (NIF) Disposable Debris Shields*
Victoria Miller Kamm - Lawrence Livermore National Laboratory National Ignition Facility Programs Directorate National Ignition Facility Project

THPPC084 Optimizing Blocker Usage on NIF Using Image Analysis and Machine Learning*
Laura Mascio Kegelmeyer - Lawrence Livermore National Laboratory National Ignition Facility Programs Directorate National Ignition Facility Project

THPPC085 Image Analysis for the Automated Alignment of the Advanced Radiography Capability (ARC) Diagnostic Path*
Randy Roberts - Lawrence Livermore National Laboratory National Ignition Facility Programs Directorate National Ignition Facility Project

THPPC086 Analyzing Off-Normals in Large Distributed Control Systems Using Deep Packet Inspection and Data Mining Techniques*
Mikhail Fedorov - Lawrence Livermore National Laboratory

THPPC087 Multi-objective Optimization for LANSCE Linac Operations
Xiaoying Pang - Los Alamos National Laboratory AOT Division

THPPC088 Single Photon THz Timer
Amur Tevatros Margaryan - A.I. Alikhanyan National Science Laboratory

THPPC089 High Repetition Rate Laser Beamline Control System
Tomas Mazanec - ELI Beamlines Czech Republic Institute of Physics

THPPC090 Picoseconds Timing System
Dominique Monnier-Bourdin - GreenField Technology

THPPC091 A White Rabbit-Based Data Acquisition System for Large-Scale Astroparticle Experiments with Sub-nsec Synchronization, Time Stamping and Time Calibration
Martin Brückner - Humboldt-University Berlin Signalverarbeitung und Mustererkennung Institut für Informatik

THPPC092 FAIR Timing System Developments Based on White Rabbit
Cesar Prados - GSI Helmholtzzentrum für Schwerionenforschung GmbH

THPPC093 The New Timing System for the European XFEL
Kay Rehlich - Deutsches Elektronen-Synchrotron

THPPC094 Managed Precision Clock and RF Signal Distribution over Custom RF-backplane in MTCA.4 Crate
Tomasz Jezynski - Deutsches Elektronen-Synchrotron

THPPC095 A Proof of Principle Study of a Synchronous Movement of an Array of Undulators Using an EtherCAT Bus at European XFEL
Suren Karabekyan - European XFEL GmbH

THPPC096 Development of New Tag Supply System for DAQ for SACLA User Experiments
Toshinori Abe - RIKEN SPring-8 Center Innovative Light Sources Division

THPPC097 Incorporation of New SINAP Event Modules with the Existent MRF System at SuperKEKB
Kazuro Furukawa - High Energy Accelerator Research Organization

THPPC098 CSNS-RCS Timing System Design and Implementation
Peng Zhu - Chinese Academy of Sciences Institute of High Energy Physics

THPPC099 A New Kind of Test of Timestamp Module
Jian Zhuang - Chinese Academy of Sciences Institute of High Energy Physics

THPPC100 Event-Driven Timing System Based upon MRF cPCI Hardware for HLS
Chuan Li - University of Science and Technology of China National Synchrotron Radiation Laboratory

THPPC101 Development Status of SINAP Timing System
Chongxian Yin - Shanghai Institute of Applied Physics

THPPC102 Synchronization Techniques in Synchrotron Beamlines
Oscar Matilla - CELLS-ALBA Synchrotron

THPPC103 Timing System at MAX IV
Jerzy Jan Jamroz - MAX-lab, Lund University

THPPC104 A Timing System for Cycle Based Accelerators
Johannes Gutleber - European Organization for Nuclear Research

THPPC105 The LHC Injection Sequencer
Delphine Jacquet - European Organization for Nuclear Research Beams Department (BE)

THPPC106 A Generic Timing Software for Fast Pulsed Magnet Systems at CERN
Christophe Chanavat - European Organization for Nuclear Research Technology Department (TE)

THPPC107 Timing and Synchronization at Beam Line Experiments
Helena Blaettler Pruchova - Paul Scherrer Institut

THPPC108 Jitter Studies and Measurement System for the Injector Laser at SwissFEL
Helena Blaettler Pruchova - Paul Scherrer Institut

THPPC109 Status of the TPS Timing System
Yung-Sen Cheng - National Synchrotron Radiation Research Center

THPPC110 Timing of the ALS Booster Injection and Extraction
Carlos Serrano - Lawrence Berkeley National Laboratory

THPPC111 ALS Timing System Upgrade
Jonah Weber - Lawrence Berkeley National Laboratory

THPPC112 The LANSCE Timing Reference Generator
Robert B. Merl - Los Alamos National Laboratory

THPPC113 Integrated Timing System for the EBIS Pre-Injector
Severino Binello - Brookhaven National Laboratory Collider-Accelerator Department

THPPC114 Beam Based Feedback Software Controller for the Linac Coherent Light Source
Luciano Piccoli - SLAC National Accelerator Laboratory

THPPC115 Fast Orbit Feedback implementation at Alba Synchrotron
Xavier Serra-Gallifa - CELLS-ALBA Synchrotron

THPPC116 Temperature Precise Control in a Large Scale Helium Refrigerator
jihao wu - Technical Institute of Physics and Chemistry Chinese Academy of Science

THPPC117 A Control Strategy for Highly Regulated Magnet Power Supplies Using a LQR Approach
Saurabh Srivastava - Department of Atomic Energy Variable Energy Cyclotron Centre

THPPC118 Realisation Of Servo & Active Mirror Control System(AMCS) for the Indian MACE Telescope
Nandini Gupta - Bhabha Atomic Research Centre Reactor & Control Division

THPPC119 Software Architechture for the LHC Beam-based Feedback System
Lars K. Jensen - European Organization for Nuclear Research Beams Department (BE)

THPPC120 A Simplified Model of the International Linear Collider Final Focus System
Marco Oriunno - SLAC National Accelerator Laboratory

THPPC121 Feedbacks and Automation at the Free Electron Laser in Hamburg (FLASH)
Raimund Kammering - Deutsches Elektronen-Synchrotron

THPPC122 High Performance and Low Latency Single Cavity RF Control Based on MTCA.4
Christian Schmidt - Deutsches Elektronen-Synchrotron

THPPC123 Online Luminosity Optimization at the LHC
Fabio Follin - European Organization for Nuclear Research Beams Department (BE)

THPPC124 Progress on LLRF Control System for TTX
Beibei Shao - Tsinghua University Engineering Physics

THPPC125 Evaluation and Implementation of Advanced Process Control with the cRIO Material of National Instrument
Gilles Maire - European Organization for Nuclear Research Physics Department (PH)

THPPC126 Fast Orbit Control System for INDUS-2
Rishipal Yadav - Raja Ramanna Center for Advanced Technology Department of Atomic Energy Government of India

THPPC127 Laser Position Feedback Control at the SwissFEL Test Injector
Trivan Pal - Paul Scherrer Institut

THPPC128 The Feedback System for Dumping Coherent Betatron and Synchrotron Oscillations of Electron Beam at Dedicated Synchrotron Radiation Source SIBERIA-2.
Antonina Smygacheva - National Research Center "Kurchatov Institute"

THPPC129 Evolution of the FERMI@Elettra Fast Beam Based Feedbacks
Giulio Gaio - Elettra-Sincrotrone Trieste S.C.p.A.

THPPC131 Fast Orbit Feedback Control in Mode Space
Sandira Gayadeen - University of Oxford Engineering Science

THPPC132 Orbit Correction Systems for Indus-2
Pravin Fatnani - Raja Ramanna Center for Advanced Technology Department of Atomic Energy Government of India

THPPC133 Design and Test of an Auto-locking System in a Girder at NSRRC
Huai-San Wang - National Synchrotron Radiation Research Center

THPPC134 Drift Tube Linac Water Cooling Control System
Pilar Sotero Marroquin - Los Alamos National Laboratory AOT Division

THPPC135 From Pulse to Continuous Wave Operation of TESLA Cryomodules – LLRF System Software Modification and Development
Wojciech Cichalewski - Technical University of Lodz Department of Microelectronics and Computer Science

THPPC136 Stabilizing the Beam Current Split Ratio in TRIUMF's 500 MeV Cyclotron with High Level Software
Juan Pon - TRIUMF Canada's National Laboratory for Particle and Nuclear Physics

THPPC137 Time Domain Simulation Software of the APS Storage Ring Orbit Real-time Feedback System
Hairong Shang - Argonne National Laboratory

THPPC138 Automation of Cavity Phase Locking in IUAC Superconducting LINAC Booster
Rajendra Nath Dutt - Inter University Accelerator Centre

THPPC139 Control Systems Development for the Thomas Jefferson National Accelerator Facility Free Electron Laser & Energy Recovery Linac: Analysis of Trajectory Response Data & Initial Feedback Control Testing
Auralee Morin - Colorado State University Department of Electrical and Computer Engineering

THPPC140 uTCA Upgrade of the Readout Electronics for the Bunch Arrival Time Monitor at FLASH
Jaroslaw Szewinski - National Centre for Nuclear Research

THPPC141 Automatic Alignment Upgrade of Advanced Radiographic Capability for the National Ignition Facility*
Karl Child Wilhelmsen - Lawrence Livermore National Laboratory National Ignition Facility Programs Directorate National Ignition Facility Project

THPPC142 The Low Level RF Control System of the RF System for PLS-II
In-Ha Yu - Pohang Accelerator Laboratory

THPPC143 Status of SSRF Fast Orbit Feedback System
Chongxian Yin - Shanghai Institute of Applied Physics

THOPC **Refreshments**
10-OCT-13 00:00 14:00 - 15:00
Pacific Concourse

THCOBB **Control Systems Upgrades**
10-OCT-13 00:00 15:00 - 16:30
Ballroom B

THCOBB01 An Upgraded ATLAS Central Trigger for 2015 LHC Luminosities
Christian Ohm - Stockholm University Department of Physics

THCOBB02 Recent Hardware and Software Achievements for the European XFEL
Kay Rehlich - Deutsches Elektronen-Synchrotron

THCOBB03 Automating Control of the Beams for the NASA Space Radiation Laboratory
Kevin A. Brown - Brookhaven National Laboratory

THCOBB04	Overview of the ELSA Accelerator Control System Dennis Proft - Bonn University Physics Institute ELSA Department
THCOBB05	Switching Solution – Upgrading a Running System Kevin Tsubota - W.M. Keck Observatory

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THCOBA	**Control Systems Infrastructure** 10-OCT-13 00:00 15:00 - 16:30 Ballroom A
THCOBA01	Evolution of the Monitoring in the LHCb Online System Christophe Haen - European Organization for Nuclear Research Physics Department (PH)
THCOBA02	Unidirectional Security Gateways: Stronger Than Firewalls Andrew Ginter - Waterfall Security Solutions
THCOBA03	DIAMON2 – Improved Monitoring of CERN's Accelerator Controls Infrastructure Peter Jurcso - European Organization for Nuclear Research Beams Department (BE)
THCOBA04	Evolution Of IT Infrastructure For Fusion Control Systems* Timothy Frazier - Lawrence Livermore National Laboratory National Ignition Facility Programs Directorate National Ignition Facility Project
THCOBA05	Control System Virtualization for the LHCb Online System Enrico Bonaccorsi - European Organization for Nuclear Research Physics Department (PH)
THCOBA06	Server Virtualization and Deployment Management for the KAT-7 / MeerKAT Control and Monitoring System Neilen Marais - SKA South Africa National Research Foundation of South Africa Department of Science and Technology

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THCOCB	**Knowledge Based Techniques** 10-OCT-13 00:00 16:30 - 17:45 Ballroom B
THCOCB01	GPU Accelerated Online Multi-particle Beam Dynamics Simulator for the LANSCE Linac Xiaoying Pang - Los Alamos National Laboratory AOT Division
THCOCB02	The Role of Data Driven Models in Optimizing the Operation of the National Ignition Facility* Kathleen McCandless - Lawrence Livermore National Laboratory
THCOCB03	Fast Automatic Beam-based Alignment of the LHC Collimation System Gianluca Valentino - European Organization for Nuclear Research Beams Department (BE)
THCOCB04	Using an Expert System for Accelerators Tuning and Automation of Operating Failure Checks Majid Ounsy - Synchrotron Soleil
THCOCB05	The LHCb Online Luminosity Control and Monitoring Richard Jacobsson - European Organization for Nuclear Research

THCOCA	**Timing and Sync** 10-OCT-13 00:00 16:30 - 17:45 Ballroom A
THCOCA01	A Design of Sub-Nanosecond Timing and Data Acquisition Endpoint for LHAASO Project Weibin Pan - Tsinghua University Engineering Physics
THCOCA02	White Rabbit Status and Prospects Javier Serrano - European Organization for Nuclear Research Beams Department (BE)
THCOCA03	High-Precision Timing of Gated X-Ray Imagers at the National Ignition Facility* Steven Glenn - Lawrence Livermore National Laboratory National Ignition Facility Programs Directorate National Ignition Facility Project

THCOCA04 Upgrade of Event Timing System at SuperKEKB
Hiroshi Kaji - High Energy Accelerator Research Organization Accelerator Laboratory

THCOCA05 Integrated Timing and Triggering System Management Software
Jean-Jacques Dupas - Commissariat à l'Energie Atomique et aux Energies Alternatives CEA DAM Ile de France

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FROBF **Continental Breakfast**
11-OCT-13 00:00 08:00 - 08:30
Ballroom Foyer

FRPLAB **Keynote Peter Doolan**
11-OCT-13 00:00 08:30 - 09:00
Ballroom A&B

FRPLAB01 TBD
Peter Doolan - Oracle

FRCOAAB **Experiment Control -2**
11-OCT-13 00:00 09:00 - 11:45
Ballroom A&B

FRCOAAB01 CSS Scan System
Kay-Uwe Kasemir - Oak Ridge National Laboratory Spallation Neutron Source

FRCOAAB02 Karabo: An Integrated Software Framework Combining Control, Data Management, and Scientific Computing Tasks
Burkhard Heisen - European XFEL GmbH

FRCOAAB03 Experiment Control and Analysis for High-Resolution Tomography
Faisal Khan - Argonne National Laboratory Advanced Photon Source

FRCOAAB04 Data-Driven Campaign Management at the National Ignition Facility (NIF)*
Douglas Edward Speck - Lawrence Livermore National Laboratory

FRCOAAB05 JOGL Live Rendering Techniques in Data Acquisition Systems
Paolo Mutti - Institut Laue-Langevin

FRCOAAB06 A Common Software Framework for FEL Data Acquisition and Experiment Management at FERMI@Elettra
Roberto Borghes - Elettra-Sincrotrone Trieste S.C.p.A.

FRCOAAB07 Operational Experience with the ALICE Detector Control System
Peter Chochula - European Organization for Nuclear Research

FRCOAAB08 The LIMA Project Update
Alejandro Homs - European Synchrotron Radiation Facility

FRCBBLBF **Coffee Break**
11-OCT-13 00:00 10:15 - 10:45
Ballroom Foyer

FROE **Lunch**
11-OCT-13 00:00 12:00 - 13:30
External

FRCOBAB **Feedback Systems**
11-OCT-13 00:00 13:30 - 15:15
Ballroom A&B

FRCOBAB01 Feedback and Feed-Forward Systems Improve the Reliability and Performance of the Heidelberg Ion Beam Therapy Center
Thomas Haberer - Heidelberg Ionenstrahl-Therapie Centrum HIT Betriebs GmbH am Universitätsklinikum Heidelberg

FRCOBAB02 Ultra-fast Longitudinal Feedbacks for the European XFEL
Holger Schlarb - Deutsches Elektronen-Synchrotron

FRCOBAB03 The New Multicore Real-time Control System of the RFX-mod Experiment
Gabriele Manduchi - Consorzio RFX Associazione Euratom-ENEA sulla Fusione

FRCOBAB04 Beam Feedback System Challenges at SuperKEKB Injector Linac
Kazuro Furukawa - High Energy Accelerator Research Organization

FRCOBAB05 Distributed Feedback Loop Implementation in the RHIC Low Level RF Platform
Freddy Severino - Brookhaven National Laboratory

FRCOBAB07 Model Independent Feedback Control
Alexander Scheinker - Los Alamos National Laboratory AOT Division

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FROAB **Technical Summary 2013 Closing Remarks**
11-OCT-13 00:00 15:15 - 16:00
Ballroom A&B

FROAB01 Technical Summary and Wrap up of ICALEPCS 2013
Peg Ann Folta - Lawrence Livermore National Laboratory

FROAB02 ICALEPCS 2015
Lou Corvetti - Australian Synchrotron Company

FROAB03 ICALEPCS 2017
Christopher David Marshall - Lawrence Livermore National Laboratory National Ignition Facility Programs Directorate National Ignition Facility Project

FROAB04 Final Remarks
Christopher David Marshall - Lawrence Livermore National Laboratory National Ignition Facility Programs Directorate National Ignition Facility Project

Abstracts >>>

Oral Preferred

MOOAB01

Opening Remarks and Welcome Address

Opening and Closing Remarks

Christopher David Marshall, Peg Ann Folta (LLNL, Livermore, California)

Opening Remarks and Welcome Address will be presented

Invited Oral

MOKAB01

Scientific software development as a social process

Keynote

Marian Petre (The Open University, Milton Keynes)

Software development is often understood as an engineering process. However, the factors that affect the success of a software development project are often human and social. The social context of software design and development is important: it provides social reinforcement for good practice. Study of high-performing software development teams makes it clear that the interplay between designers plays a crucial part both in nurturing creativity and innovation, and in embedding systematic practice and rigor. This talk will present key observations from empirical studies of expert software development that can be applied usefully to scientific software development. It will discuss why matching development practices to the context and purpose of scientific software can improve both software and scientific outcomes. It will draw on research in order to discuss how communication and collaboration can be fostered, and to identify what works (and what doesn't work) in building collaboration in software development teams, whether co-located or distributed.

Contributed Oral

MOCOAAB01

The First Running Period of the CMS Detector Controls System - A Success Story

Project Status Reports

Frank Glege, Dupont Aymeric, Olivier Chaze, Sergio Cittolin, Jose Antonio Coarasa, Christian Deldicque, Marc Dobson, Dominique Gigi, Robert Gomez-Reino, Christian Hartl, Lorenzo Masetti, Frans Meijers, Emilio Meschi, Srecko Morovic, Carlos Nunez-Barranco-Fernandez, Luciano Orsini, Wojciech Ozga (CERN, Geneva), Ulf Behrens (DESY, Hamburg), Remigius K. Mommsen, Vivian O'Dell (Fermilab, Batavia), Gerry Bauer (MIT, Cambridge, Massachusetts), Samim Erhan (UCLA, Los Angeles, California), James Branson, Andre Holzner (UCSD, La Jolla, California)

After only three months of commissioning, the CMS detector controls system (DCS) was running at close to 100% efficiency. Despite millions of parameters to control and the HEP typical distributed development structure, only minor problems were encountered. The system can be operated by a single person and the required maintenance effort is low. A well factorized system structure and development are keys to success as well as a centralized, service like deployment approach. The underlying controls software PVSS has proven to work in a DCS environment. Converting the DCS to full redundancy will further reduce the need for interventions to a minimum.

Contributed Oral

MOCOAAB02

Design and Status of the SuperKEKB Accelerator Control System

Project Status Reports

Masako Iwasaki, Atsuyoshi Akiyama, Kazuro Furukawa, Hiroshi Kaji, Takashi Naito, Tatsuro Nakamura, Jun-Ichi Odagiri, Shinya Sasaki (KEK, Ibaraki), Tomohiro Okazaki, Naoki Yoshifuji (EJIT, Hitachi, Ibaraki), Masaya Hirose, Katsumi Iwase (KIS, Ibaraki), Tomohiro Aoyama, Makoto Fujita, Takuya Nakamura, Naoki Tanaka, Kenzi Yoshii (Mitsubishi Electric System & Service Co., Ltd, Tsukuba)

SuperKEKB is the upgrade of the KEKB asymmetric energy e+e- collider, for the B-factory experiment in Japan, designed to achieve a 40-times higher luminosity than the world record by KEKB. The KEKB control system was based on EPICS at the equipment layer and scripting languages at the operation layer. The SuperKEKB control system continues to employ those features, while we implement additional technologies for the successful operation at such a high luminosity. In the accelerator control network system, we introduce 10GbE for the wider bandwidth data transfer, and redundant configurations for reliability. The network security is also enhanced. For the SuperKEKB construction, the wireless network is installed into the beamline tunnel. In the timing system, the new configuration for positron beams is required. We have developed the faster response beam abort system, interface modules to control thousands magnet power supplies, and the monitoring system for the final focusing superconducting magnets to assure stable operations. We introduce the EPICS embedded PLC, where EPICS runs on a CPU module. The design and status of the SuperKEKB accelerator control system will be presented.

MOCOAAB03

The Spiral2 Control System Progress Towards the Commission Phase

Project Status Reports

Eric Lecorche, Pascal Gillette, Christophe Haquin, Evelyne Lemaitre, Guillaume Normand, Charles Henry Patard, Laurent Philippe, Dominique Touchard (GANIL, Caen), Jean Francois Denis, Francoise Gougnaud, Jean-François Gournay, Yves Lussignol (CEA/DSM/IRFU,), Jerome Hosselet, Chaker Maazouzi (IPHC, Strasbourg Cedex 2)

The commissioning of the Spiral2 Radioactive Ion Beams facility at Ganil will soon start, so requiring the control system components to be delivered in time. Yet, parts of the system were validated during preliminary tests performed with ions and deuterons beams at low energy. The control system development results from the collaboration between Ganil, CEA/IRFU, CNRS/IPHC laboratories, using appropriate tools and approach. Based on Epics, the control system follows a classical architecture. At the lowest level, Modbus/TCP protocol is considered as a field bus. Then, equipment are handled by IOCs (soft or VME/VxWorks) with a software standardized interface between IOCs and clients applications on top. This last upper layer consists of Epics standard tools, CSS/BOY user interfaces within the so-called CSSop Spiral2 context suited for operation and, for machine tunings, high level applications implemented by Java programs developed within a Spiral2 framework derived from the open-Xal one. Databases are used for equipment data and alarms archiving, to configure equipment and to manage the machine lattice and beam settings. A global overview of the system is therefore here proposed.

Contributed Oral

MOCOAAB04

The Integrated Control System at ESS

Project Status Reports

Garry Trahern (ESS, Lund), Miha Rescic (Cosylab, Ljubljana)

The European Spallation Source (ESS) is a high current proton LINAC to be built in Lund, Sweden. The LINAC delivers 5 MW of power to the target at 2500 MeV, with a nominal current of 50 mA. The project entered Construction phase on January 1st 2013. In order to design, develop and deliver a reliable, well-performing and standardized control system for the ESS facility, the Integrated Control System (ICS) project has been established. The ICS project also entered Construction phase on January 1st. ICS consists of four distinct Core components (Physics, Software Services, Hardware and Protection) that make up the essence of the control system. Integration Support activities support the stakeholders and users, and the Control System Infrastructure provides the required underlying infrastructure for operating the control system and the facility. The current state of the control system project and key decisions are presented as well as immediate challenges and proposed solutions.

MOCOAAB05

Keck Telescope Control System Upgrade Project Status

Project Status Reports

Jimmy Johnson (W.M. Keck Observatory, Kamuela)

The Keck telescopes, located at one of the world's premier sites for astronomy, were the first of a new generation of very large ground-based optical/infrared telescopes with the first Keck telescope beginning science operations in May of 1993, and the second in October of 1996. The components of the telescopes and control systems are more than 15 years old. The upgrade to the control systems of the telescopes consists of mechanical, electrical, software and network components with the overall goals of improving performance, increasing reliability, addressing serious obsolescence issues and providing a knowledge refresh. The telescope encoder systems will be replaced to fully meet demanding science requirements and electronics will be upgraded to meet the needs of modern instrumentation. The upgrade will remain backwards compatible with remaining Observatory subsystems to allow for a phased migration to the new system. This paper describes where Keck is in the development processes, key decisions that have been made, covers successes and challenges to date and presents an overview of future plans.

Contributed Oral

MOCOAAB06

MeerKAT Control and Monitoring - Design Concepts and Status

Project Status Reports

Lize Van den Heever, CAM Team (SKA South Africa, Cape Town)

This presentation gives a status update of the MeerKAT Control & Monitoring subsystem focusing on the development philosophy, design concepts, technologies and key design decisions. The presentation will be supplemented by a poster (if accepted) with **live demonstation** of the current KAT-7 Control&Monitoring system. The vision for MeerKAT includes to a) use Offset Gregorian antennas in a radio telescope array combined with optimized receiver technology in order to achieve superior imaging and maximum sensitivity, b) be the most sensitive instrument in the world in L-band, c) be an instrument that will be considered the benchmark for performance and reliability by the scientific community at large, and d) be a true precursor for the SKA that will be integrated into the SKA-mid dish array. The 7-dish engineering prototype (KAT-7) for MeerKAT is already producing exciting science and is being operated 24x7. The first MeerKAT antenna will be on site by the end of this year and the first two Receptors will be fully integrated and ready for testing by April 2014. By December 2016 hardware for all 64 receptors will be installed and accepted and 32 antennas will be fully commissioned.

Contributed Oral

MOCOAAB07

Real Time Control for KAGAR, 3km Cryogenic Gravitational Wave Detector in Japan

Project Status Reports

Miyakawa Osamu (ICRR, Chiba)

KAGRA is a 3km cryogenic interferometer for gravitational wave detection located underground Kamioka-mine in Japan. The next generation large scale interferometric gravitational wave detectors require very complicated control topologies for the optical path length between mirrors, and very low noise feedback controls in order to detect an extremely tiny motion between mirrors excited by gravitational waves. The interferometer consists of a Michelson interferometer with Fabry-Perot cavities on its arms, and other two mirrors as, so called, a power recycling and a resonant sideband extraction technique. In total, 5 degrees of freedom for length between 7 mirrors should be controlled at a time, and the control must be continuously kept during the observation of gravitational waves. We are currently developing a real time controls system using computers for KAGRA. In this talk, we report how the control system works.

Invited Oral

MOPLAB01

Measurement Technology Trends in Instrumentation and Control

Keynote

Mike Santori (National Instruments, Austin)

Measurement and instrumentation are prime movers in nearly every scientific discipline. To a large extent, new measurement capabilities such as higher speed, better sensitivity, and higher density, have enabled new scientific advancements. The concept of heterogeneous computing with FPGAs, multi-core processors, and GPUs, has further impacted instrumentation and control. As these different systems come together, tools and platform vendors have to work together to reduce the barrier to entry to these latest technologies. Abstraction at the appropriate level, combined with a platform-based system approach, enables domain experts such as particle physicists and fusion scientists to focus on innovation and discovery while leveraging the latest available technologies. This keynote talk will focus on industry trends and advances that improve instrumentation and control and offer insights on what lies ahead.

Contributed Oral

MOCOBAB01

FNew Electrical Network Supervision for CERN: Simpler, Safer, Faster, and Including New Modern Features

Integrating Complex or Diverse Systems

Jean-Charles Tournier, Georges Burdet, Manuel Gonzalez-Berges, Sonia Infante, Fernando Varela (CERN, Geneva)

Since 2012, an effort started to replace the ageing electrical supervision system (managing more than 200,000 tags) currently in operation with a WinCC OA-based supervision system in order to unify the monitoring systems used by CERN operators and to leverage the internal knowledge and development of the products (JCOP, UNICOS, etc.). Along with the classical functionalities of a typical SCADA system (alarms, event, trending, archiving, access control, etc.), the supervision of the CERN electrical network requires a set of domain specific applications gathered under the name of EMS (Energy Management System). Such applications include network coloring, state estimation, power flow calculations, contingency analysis, optimal power flow, etc. Additionally, as electrical power is a critical service for CERN, a high availability of its infrastructure, including its supervision system, is required. The supervision system is therefore redundant along with a disaster recovery system which is itself redundant. In this paper, we will present the overall architecture of the future supervision system with an emphasis on the parts specific to the supervision of electrical network.

Contributed Oral

MOCOBAB02

Integration of PLC with EPICS IOC for SuperKEKB Control System

Integrating Complex or Diverse Systems

Jun-Ichi Odagiri, Kazuro Furukawa, Tatsuro Nakamura (KEK, Ibaraki)

Recently, more and more PLCs are adopted for various frontend controls of accelerators. It is common to connect the PLCs with higher level control layers by the network. As a result, control logic becomes dispersed over separate layers, one of which is implemented by ladder programs on PLCs, and the other is implemented by higher level languages on frontend computers. EPICS-based SuperKEKB accelerator control system, however, take a different approach by using FA-M3 PLCs with a special CPU module (F3RP61), which runs Linux and functions as an IOC. This consolidation of PLC and IOC enables higher level applications to directly reach every PLC placed at frontends by Channel Access. In addition, most of control logic can be implemented by the IOC core program and/or EPICS sequencer to make the system more homogeneous resulting in easier development and maintenance of applications. This type of PLC-based IOCs are to be used to monitor and control many subsystems of SuperKEKB, such as personnel protection system, vacuum system, RF system, magnet power supplies, and so on. This paper describes the applications of the PLC-based IOCs to the SuperKEKB accelerator control system.

Contributed Oral

MOCOBAB03

The Laser MegaJoule ICCS Integration Platform

Integrating Complex or Diverse Systems

Jean Fleury, Jean Paul Arnoul, Alain Mugnier (CEA, LE BARP cedex), Joel Irenee Nicoloso (CEA/DAM/DIF, Arpajon)

The French Atomic Energy Commission(CEA)has just built an integration platform outside the LMJ facility in order to assemble the various components of the Integrated Control Command System(ICCS). The talk gives an overview of this integration platform and the qualification strategy based on the use of equipment simulators, and focuses on several tools that have been developed to integrate each sub-system and qualify the overall behavior of the ICCS. Each delivery kit of a sub-system component(Virtual Machine, WIM, PLC,.) is scanned by antivirus software and stored in the delivery database. A specific tool allows the deployment of the delivery kits on the hardware platform (a copy of the LMJ hardware platform). Then, the TMW(Testing Management Workstation) performs automatic tests by coordinating the equipment simulators behavior and the operator's behavior. The tests configurations, test scenarios and test results are stored in another database. Test results are analyzed, every dysfunction is stored in an event data base which is used to perform reliability calculation of each component. The qualified software is delivered on the LMJ to perform the commissioning of each bundle.

Contributed Oral

MOCOBAB04

The Advanced Radiographic Capability, a Major Upgrade of the Computer Controls for the National Ignition Facility*

Integrating Complex or Diverse Systems

Gordon Brunton, Adrian Barnes, Greg Bowers, Chris Estes, John Fisher, Barry Fishler, Benjamin Horowitz, Laura Mascio Kegelmeyer, Lawrence Lagin, Arthur Peter Ludwigsen, Donna Maloy, Christopher David Marshall, David Mathisen, JoAnn Matone, David McGuigan, Mitanu Paul, Randy Roberts, Greg Tietbohl, Karl Child Wilhelmsen (LLNL, Livermore, California)

The Advanced Radiographic Capability (ARC) currently under development for the National Ignition Facility (NIF) will provide short (1-50 picoseconds) ultra high power (>1 Petawatt) laser pulses used for a variety of diagnostic purposes on NIF ranging from a high energy x-ray pulse source for backlighter imaging to an experimental platform for fast-ignition. A single NIF Quad (4 beams) is being upgraded to support experimentally driven, autonomous operations using either ARC or existing NIF pulses. Using its own seed oscillator, ARC generates short, wide bandwidth pulses that propagate down the existing NIF beamlines for amplification before being redirected through large aperture gratings that perform chirped pulse compression, generating a series of high-intensity pulses within the target chamber. This significant effort to integrate the ARC adds 40% additional control points to the existing NIF Quad and will be deployed in several phases over the coming year. This talk discusses some new unique ARC software controls used for short pulse operation on NIF and integration techniques being used to expedite deployment of this new diagnostic.

Contributed Oral

MOCOBAB05

How to Successfully Renovate a Controls System - Lessons Learned from the Renovation of the CERN Injectors' Controls Software

Integrating Complex or Diverse Systems

Grzegorz Kruk, Stephane Deghaye, Marine Pace, Pablo Pera Mira, Eric Roux, Jakub Pawel Wozniak (CERN, Geneva)

Renovation of the control system of the CERN LHC injectors was initiated in 2007 in the scope of the Injector Controls Architecture (InCA) project. One of its main objectives was to homogenize the controls software across CERN accelerators and reuse as much as possible the existing modern sub-systems, such as the settings management used for the LHC. The project team created a platform that would permit coexistence and intercommunication between old and new components via a dedicated gateway, allowing a progressive replacement of the former. Dealing with a heterogeneous environment, with many diverse and interconnected modules, implemented using different technologies and programming languages, the team had to introduce all the modifications in the smoothest possible way, without causing machine downtime. After a brief description of the system architecture, the paper discusses the technical and non-technical sides of the renovation process such as validation and deployment methodology, operational applications and diagnostic tools characteristics and finally users' involvement and human aspects, outlining good decisions, pitfalls and lessons learned over the last five years.

Contributed Oral

MOCOBAB06

Integrated Monitoring and Control Specification Environment

Integrating Complex or Diverse Systems

Subhrojyoti Roy Chaudhuri, Harshal Hayatnagarkar, Swaminathan Natarajan (TRDDC, Pune)

Monitoring and control solutions for large one-off systems are typically built in silos using multiple tools and technologies. Functionality such as data processing logic, alarm handling, UIs, device drivers are implemented by manually writing configuration code in isolation and their cross dependencies maintained manually. The correctness of the created specification is checked using manually written test cases. Non-functional requirements – such as reliability, performance, availability, reusability and so on – are addressed in ad hoc manner. This hinders evolution of systems with long lifetimes. For ITER, we developed an integrated specifications environment and a set of tools to generate configurations for target execution platforms, along with required glue to realize the entire M&C solution. The SKA is an opportunity to enhance this framework further to include checking for functional and engineering properties of the solution based on domain best practices. The framework includes three levels: domain-specific, problem-specific and target technology-specific. We discuss how this approach can address three major facets of complexity: scale, diversity and evolution.

MOCOBAB07

Building a Maintenance and Refresh Strategy to Address Controls Hardware Diversity for the National Ignition Facility (NIF) Computer Controls System*

Integrating Complex or Diverse Systems

Robert Demaret, Bart Beeman, Drew Casavant, Mark Miller (LLNL, Livermore, California)

The National Ignition Facility (NIF) at LLNL is a 2.0 Mega joule laser with ~100,000 control points managed by ~2,000 networked computers. The installation of the controls system began in 2002 with prototype controls for one quad. By 2004 the controls system build-out began and over the next 6 years the remainder was installed and activated. The NIF has now transitioned to a user facility with a 30 year operational lifespan. As with many large, long duration projects the controls system diversity has created maintenance issues and components have reached end-of-life. This requires the controls team to develop and execute a controls hardware refresh cycle to replace aging components before reliability issues interfere with facility operations. This refresh also affects the controls system software since modernization of controls hardware and operating system require corresponding software changes and possibly coding language changes. This talk addresses the NIF controls system maintenance and refresh strategy, including plans to evolve towards a more homogenous controls posture, and also discusses the extended schedule required to transition to the new platform base.

MOOB01

Summary of the 4th Workshop on Control System Cyber-Security in HEP

Oral Workshop Summary

Stefan Lueders (CERN, Geneva)

Over the last decade modern accelerator and experiment control systems have increasingly been based on commercial-off-the-shelf products (VME crates, PLCs, SCADA systems, etc.), on Windows or Linux PCs, and on communication infrastructures using Ethernet and TCP/IP. Despite the benefits coming with this (r)evolution, new vulnerabilities are inherited, too: Attackers against control systems are now regularly reported. Unfortunately, control PCs cannot be patched as fast as office PCs. Even worse, vulnerability scans using standard IT tools have shown that commercial automation systems lack fundamental security precautions: Some systems crashed during the scan, others could easily be stopped or their process data being altered. The 4th (CS)2/HEP workshop held the weekend before the ICALEPCS2013 conference was intended to raise awareness; exchange good practices, ideas, and implementations; discuss what works & what not as well as their pros & cons; report on security events, lessons learned & successes; and update on progresses made at HEP laboratories around the world in order to secure control systems. This presentation will give a summary.

Oral Preferred

MOOB02

Summary of Open Hardware Workshop

Oral Workshop Summary

Javier Serrano (CERN, Geneva)

Summarizing the Open Hardware Workshop, held Sunday, October 6th

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Oral Preferred

MOOB03

Summary of Tango Workshop

Oral Workshop Summary

Andrew Gotz (ESRF, Grenoble)

Summarizing the Tango Workshop, held Sunday, October 6th

Oral Preferred

MOOB04

Summary of EPICS Collaboration Satellite Meeting

Oral Workshop Summary

Hamid Shoaee (SLAC, Menlo Park, California)

Summarizing the EPICS Collaboration Satellite Meeting, held Saturday, October 5th.

Oral Preferred

MOOB05

Summary of Motion Control Applications in Large Facilities Workshop

Oral Workshop Summary

Pascale Betinelli-Deck, Dominique Corruble (SOLEIL, Gif-sur-Yvette), Guifre Cuni (CELLS-ALBA Synchrotron, Cerdanyola del Vallès), Brian James Nutter (Diamond, Oxfordshire), William (Rick) Frederick Steele (LBNL, Berkeley, California), Matthew Pearson (ORNL, Oak Ridge, Tennessee)

Summarizing the Motion Control Applications in Large Facilities Workshop, held Sunday, October 6th

MOOB06

Summary of MRF Timing System Workshop

Oral Workshop Summary

Eric Bjorklund (LANL, Los Alamos, New Mexico)

Summarizing the MRF Timing System Workshop, held Sunday, October 6th.

Poster

MOPPC010

A Semi-Automated, Formal Method to Integrate Accelerator Devices in the MedAustron Control System

Integrating Complex or Diverse Systems

Jasna Junuzovic, Angela Brett, Markus Marchhart, Roland Moser, Hannes Pavetits (EBG MedAustron, Wr. Neustadt), Johannes Gutleber, Markus Hager, Muhamed Junuzovic, Cesar Torcato de Matos (CERN, Geneva)

It is good practice to integrate accelerator front-end devices into the control system via a formal, model driven design mechanism. Several frameworks (FESA, EPICS, Tango) implement such a scheme. Devices are described by their interfaces and glue code is programmed to plug the device into the control system via some standardized communication protocol. The approach is affected by two limitations: first, the specification is framework specific, locking the project into a specific tool and second, behavioral descriptions may not be captured. Sometimes a device component may only be virtual, representing a collection of different basic fronted devices. Such higher-level components are vital for the creation of automated commissioning and operation procedures. We at CERN have developed a formal scheme that is accompanied by device-specific documents in human readable form and a defined integration process that takes into consideration also aspects that cannot be fully covered by an automated integration approach. This scheme has successfully been applied in the development of the MedAustron project, a synchrotron built for hadron therapy under the guidance of CERN.

Poster

MOPPC012

Interface and Configuration Data Management for the Laser Megajoule

Integrating Complex or Diverse Systems

Joel Irenee Nicoloso (CEA/DAM/DIF, Arpajon)

This presentation gives an overview of the set of tools used on the Laser Megajoule to manage interface and configuration data. The main goal here is to insure that all the software is developed according to well defined interfaces, and to allow our different contractors to build their own configuration database and then deliver it in a central repository. First of all, the interfaces between control command subsystems are defined as object models in an SQL server database. Each control command subsystem is depicted as a tree of objects related with each others with different kinds of relationships. These models are exported to our contractors as xml files that allow them to generate skeletons of their control command applications and configuration database. We also provide edition tools that are used by contractors to add to the public objects defined in the interface files all the private data needed to configure their own software. Finally these private repositories feed the central configuration database, which is used in operation to define objects relationships and settings.

Poster

MOPPC013

Revolution in Motion Control at SOLEIL: How to Balance Performance and Cost

Integrating Complex or Diverse Systems

Dominique Corruble, Yves-Marie Abiven, Fahd Ben Zekri, Pascale Betinelli-Deck, Matthieu Cerato, Christer Engblom, Raphaël Millet (SOLEIL, Gif-sur-Yvette)

SOLEIL * is a third generation Synchrotron radiation source located near Paris in France. REVOLUTION (REconsider Various contrOLler for yoUr moTION) is the motion controller upgrade project at SOLEIL. It was initiated by the first « Motion control workshop in radiation facilities » in May 2011 that allowed development of an international motion control community in large research facilities. The next meeting will take place during pre-ICALEPS workshop: Motion Control Applications in Large Facilities **. As motion control is an essential key element in assuring optimal results, but also at a competitive price, the REVOLUTION team selected alternatives by following a theoretical and practical methodology: advanced market analysis, tests, measures and impact evaluation. Products from two major motion control manufacturers are on the short list. They must provide the best performance for a small selection of demanding applications, and the lowest global cost to maintain operational conditions for the majority of applications at SOLEIL. The search for the best technical, economical and organizational compromise to face our challenges is detailed in this paper.

* : www.synchrotron-soleil.fr ** : http://www.synchrotron-soleil.fr/Workshops/2013/motioncontrol

MOPPC014

Poster

Diagnostic Use Case Examples for ITER Plant Instrumentation and Control

Integrating Complex or Diverse Systems

Stefan Simrock, Lana Abadie, Jean-Yves Journeaux, Petri Makijarvi, Denis Stepanov, Anders Wallander, Izuru Yonekawa (ITER Organization, St. Paul lez Durance)

ITER requires extensive diagnostics to meet the requirements for machine operation, protection, plasma control and physics studies. The realization of these systems is a major challenge not only because of the harsh environment and the nuclear requirements but also with respect to plant system Instrumentation and Control (I&C) of all the 45 diagnostics systems since the procurement arrangements of the ITER diagnostics with the domestic agencies require a large number of high performance fast controllers whose choice is based on guidelines and catalogues published by the ITER Organization (IO). The goal is to simplify acceptance testing and commissioning for both domestic agencies and the IO. For this purpose several diagnostic use case examples for plant system I&C documentation and implementation are provided by IO to the domestic agencies. Their implementations cover major parts of the diagnostic plant system I&C such as multi-channel high performance data and image acquisition, data processing as well as real-time and data archiving aspects. In this paper, the current status and achievements in implementation and documentation for the use case examples are presented.

MOPPC015

Poster

BeagleBone for Embedded Control System Applications

Integrating Complex or Diverse Systems

Stefano Cleva, Lorenzo Pivetta, Paolo Sigalotti (Elettra-Sincrotrone Trieste S.C.p.A., Basovizza)

The control system architecture of modern experimental physics facilities needs to meet the requirements of the ever increasing complexity of the controlled devices. Whenever feasible, moving from a distributed architecture based on powerful but complex and expensive computers to an even more pervasive approach based on simple and cheap embedded systems, allows shifting the knowledge close to the devices. The BeagleBone computer, being capable of running a full featured operating system such as GNU/Linux, integrates effectively into the existing control systems and allows executing complex control functions with the required flexibility. The paper discusses the choice of the BeagleBone as embedded platform and reports some examples of control applications recently developed for the ELETTRA and FERMI@Elettra light sources.

MOPPC016

IFMIF EVEDA RFQ Local Control System to Power Tests

Integrating Complex or Diverse Systems

Mauro Giacchini, Loris Antoniazzi, Maurizio Montis (INFN/LNL, Legnaro (PD))

In the IFMIF EVEDA project, normal conducting Radio Frequency Quadrupole (RFQ) is used to bunch and accelerate a 130 mA steady beam to 5 MeV. RFQ cavity is divided into three structures, named super-modules. Each super-module is divided into 6 modules for a total of 18 modules for the overall structure. The final three modules have to be tested at high power to test and validate the most critical RF components of RFQ cavity and, on the other hand, to test performances of the main ancillaries that will be used for IFMIF EVEDA project (vacuum manifold system, tuning system and control system). The choice of the last three modules is due to the fact that they will operate in the most demanding conditions in terms of power density (100 kW/m) and surface electric field (1.8*Ekp). The Experimental Physics and Industrial Control System (EPICS) environment [1] provides the framework for monitoring any equipment connected to it. This paper report the usage of this framework to the RFQ power tests at Legnaro National Laboratories [2][3].

[1] http://www.aps.anl.gov/epics/ [2] http://www.lnl.infn.it/ [3] http://www.lnl.infn.it/~epics/joomla/

MOPPC017

Upgrade of J-PARC/MLF General Control System Based on EPICS/CSS

Integrating Complex or Diverse Systems

Motoki Ooi (JAEA/J-PARC, Tokai-mura), Kenji Sakai (JAEA, Ibaraki-ken), Atsushi Akutsu, Shin-ichiro Meigo, Hiroshi Takada, Akihiko Watanabe (JAEA/J-PARC, Tokai-Mura, Naka-Gun, Ibaraki-Ken)

A general control system of the Materials and Life science experimental Facility (MLF-GCS) consists of programmable logic controllers (PLCs), operator interfaces (OPI) of iFix, data servers, and so on. It is controlling various devices such as a mercury target and a personnel protection system. The present system has been working well but there are problems in view of maintenance and update because of poor flexibility of OS and version compatibility. To overcome the weakness of the system, we decided to replace it to an advanced system based on EPICS and CSS as a framework and OPI software, which has advantages of high scalability and usability. Then we built a prototype system, connected it to the current MLF-GCS, and examined its performance. As the result, the communication between the EPICS/CSS system and the PLCs was successfully implemented by mediating a Takebishi OPC server, true data of 7000 were stored with suitable speed and capacity in a new data storage server based on a PostgreSQL, and OPI functions of the CSS were verified. We concluded through these examinations that the EPICS/CSS system had function and performance specified to the advanced MLF-GCS.

MOPPC019

Poster

The HLS Water Cooling System Based on NI CompactRIO

Integrating Complex or Diverse Systems

Gongfa Liu, Chuan Li, Ji Gang Wang, Ke Xuan (USTC/NSRL, Hefei, Anhui)

Hefei Light Source(HLS) is a VUV light source, which is upgrading now to improve the performance. The water cooling system is a part of the HLS upgrade project. The CompactRIO from National Instruments is adopted to monitor about 2000 signals in the new water cooling system. The software is developed under LabVIEW, and downloaded to the CompactRIO Chassis, which is running under vxWorks. The driver for EPICS IO Server from NI is used to integrate the system into EPICS. The whole system is easy to operate, maintain and large-scale deploy with low cost.

MOPPC020

Poster

New Automated Control System at the Kurchatov Synchrotron Radiation Source Based on SCADA System Citect

Integrating Complex or Diverse Systems

Yevgeniy Fomin, Vlad Dombrovsky, Yuriy Efimov, Evgeny Valeryevich Kaportsev, Vladimir Korchuganov, Yury Krylov, Kirill Moseev, Nikolai Moseiko, Alexander Valentinov (NRC, Moscow), Lidiya Andreevna Moseiko (RRC, Moscow)

The description of new automated control system of Kurchatov synchrotron radiation source which is realized at present time is presented in the paper. The necessity of automated control system modernization is explained by the equipment replacement in which we take state of art hardware decisions for facility control and increase the performances of facility control system. In particular, the number of control channels are increase, the processing and transmitting data speed are considerably increase and the requirements to measurement accuracy are become more strict. The paper presents the detailed description of all control levels (lower, server and upper) of new automated control system and integration of SCADA-system Citect into facility control system which provides the facility control, alarms notify, detailed reports preparation, acquisition and storage of historical data et al.

Poster

MOPPC021

Configuration System of the NSLS-II Booster Control System Electronics

Integrating Complex or Diverse Systems

Pavel Borisovich Cheblakov, Dmitry Bolkhovityanov, Sergey Evgenyevich Karnaev, Alexander Vladimirovich Makeev (BINP SB RAS, Novosibirsk)

The National Synchrotron Light Source II is under construction at Brookhaven National Laboratory, Upton, USA. NSLS-II consists of linac, transport lines, booster synchrotron and the storage ring. The main features of booster are 1 or 2 Hz cycle and beam energy ramp from 200 MeV up to 3 GeV in 300 msec.EPICS is chosen as a base for the NSLS-II Control System. The booster control system covers all parts of the facility such as power supplies, timing system, diagnostics, vacuum system and many others. Each part includes a set of various electronic devices and a lot of parameters which shall be fully defined for the control system software.This paper considers an approach proposed for defining some equipment of the NSLS-II Booster. It provides a description of different entities of the facility in a uniform way. This information is used to generate configuration files for EPICS IOCs.The main goal of this approach is to put information in one place and elimination of data duplication. Also this approach simplifies configuration and modification of the description and makes it more clear and easily usable by engineers and operators.

Poster

MOPPC022

Remote Control of Heterogeneous Sensors for 3D LHC Collimator Alignment

Integrating Complex or Diverse Systems

Cedric Charrondière, Patrick Bestmann, Thierry Feniet (CERN, Geneva)

Periodically the alignment of LHC collimators needs to be verified. Access for personnel is limited due to the level of radiation close to the collimators. The required measurements precision must be comparable to the other equipment in the LHC tunnel, meaning 0.15 mm in a sliding window of 200 m. Hence conventional measurements would take 4 days for a team of 3 people. This presentation covers the design, development and commissioning of a remotely controlled system able performs the same measurements in 1 h with one operator. The system includes the integration of a variety of industrial devices ranging from position sensors, inclination sensors to video cameras, all linked to a PXI system running LabVIEW. The control of the motors is done through a PLC based system. The overall performance and user experience are reported.

MOPPCO23

Centralized Data Engineering for the Monitoring

Integrating Complex or Diverse Systems

Jean-Charles Tournier, Piotr Golonka, Manuel Gonzalez-Berges, Sonia Infante, Anargyros Kiourkos (CERN, Geneva)

The monitoring and control of the CERN electrical network involves a large variety of devices and software: it ranges from acquisition devices to data concentrators, supervision systems as well as power network simulation tools. The main issue faced nowadays for the engineering of such large and heterogeneous system including more than 20,000 devices and 200,000 tags is that all devices and software have their own data engineering tool while many of the configuration data have to be shared between two or more devices: the same data needs to be entered manually to the different tools leading to duplication of effort and many inconsistencies. This paper presents a tool called ENSDM aiming at centralizing all the data needed to engineer the monitoring and control infrastructure into a single database from which the configuration of the various devices is extracted automatically. Such approach allows the user to enter the information only once and guarantee the consistency of the data across the entire system. The paper will focus more specifically on the configuration of the remote terminal unit) devices, the global supervision system (SCADA) and the power network simulation tools.

Poster

MOPPCO24

An Event Driven Communication Protocol for Process Control: Performance Evaluation and Redundant Capabilities

Integrating Complex or Diverse Systems

Jeronimo Ortola Vidal, Enrique Blanco Vinuela, Marco Boccioli, Tiago Nunes da Rocha (CERN, Geneva)

The CERN Unified Industrial Control System framework (UNICOS) with its Continuous Control Package (UNICOS CPC) is the CERN standard solution for the design and implementation of continuous industrial process control applications. The in-house designed communication mechanism, based on the Time Stamp Push Protocol (TSPP) provides event driven high performance data communication between the control and supervision layers of a UNICOS CPC application. In its recent implementation of full redundant capabilities for both control and supervision layers, the TSPP protocol has reached maturity. This paper presents the design of the redundancy, the architecture, the current implementation as well as a comprehensive evaluation of its performance for SIEMENS PLCs in different test scenarios.

Poster

MOPPC025

A Movement Control System for Roman Pots at the LHC

Integrating Complex or Diverse Systems

Ben Farnham, Odd Oyvind Andreassen, Ivan Atanassov, Joachim Baechler, Brice Copy, Mario Deile, Patrick Fassnacht, Sebastien Franz, Sune Jakobsen, Fernando Lucas Rodriguez, Xavier Pons, Ernst Radermacher, Sylvain Ravat, Federico Ravotti, Stefano Redaelli (CERN, Geneva), Karlheinz Hiller (DESY Zeuthen, Zeuthen)

This paper describes the movement control system for detector positioning based on the Roman Pot design used by the ATLAS/ALFA and TOTEM experiments at the LHC. A key system requirement is that the LHC machine protection rules are obeyed: the position is surveyed every 20ms with an accuracy of 15um. If the detectors move too close to the beam (outwith limits set by the LHC Operators) the LHC interlock system is triggered to dump the beam. LHC Operators in the CERN Control Centre drive the system via an HMI provided by a custom built Java application which uses Common Middleware (CMW) to interact with lower level components. Low-level motorization control is executed using National Instruments PXI devices. The DIM protocol provides the software interface to the PXI layer. A FESA gateway server provides a communication bridge between CMW and DIM. A cut down laboratory version of the system was built to provide a platform for verifying the integrity of full chain, with respect to user and machine protection requirements, and validating new functionality before deploying to the LHC. The paper contains a detailed system description, test bench results and foreseen system improvements.

Poster

MOPPC026

Bake-out Mobile Controls for Large Vacuum Systems

Integrating Complex or Diverse Systems

Sebastien Blanchard, François Bellorini, Paulo Gomes, Helder Pereira (CERN, Geneva), Leonid Kopylov, Sergey Merker, Mikhail Sergeevich Mikheev (IHEP, Moscow Region)

More than 7 km of the large vacuum systems at CERN (Large Hadron Collider, Low Energy Ion Rings...) require a heating cycle, so-called ‘bake-out’, to achieve ultra-high vacuum specifications. The bake-out cycle is applied to decrease the outgassing rate of the vacuum vessel wall and to activate the Non-Evaporable Getter (NEG) thin film. Combined bake-out and NEG activation cycles take several days, requiring Proportional-Integral-Derivative regulation, complex recipes, interlocks and troubleshooting management, and remote control functions. The control system is composed of mobile Programmable Logic Controller (PLC) cabinets, fieldbus network and Supervisory Control and Data Acquisition (SCADA) application. Mobile PLC-based cabinets are installed close to the vacuum beam pipe during the period of the bake-out cycle and are removed, to be applied elsewhere, in any of the CERN vacuum systems. The fieldbus network and SCADA application allow remote monitoring and control. Mobile PLC-based cabinets significantly reduce the cost of the vacuum control system.

Poster

MOPPC027

The Control System of CERN Accelerators Vacuum [Current Projects & LS1 Activities]

Integrating Complex or Diverse Systems

Paulo Gomes, Fabien Antoniotti, François Bellorini, Sebastien Blanchard, Jean-Pierre Boivin, Jose Gama, Gael Girardot, Gregory Pigny, Benoit Rio, Henrik Vestergard (CERN, Geneva), Leonid Kopylov, Sergey Merker, Mikhail Sergeevich Mikheev (IHEP, Moscow Region)

After 3 years of operation, the LHC entered its first Long Shutdown period (LS1), in February 2013. Major consolidation and maintenance works will be performed across the whole CERN's accelerator chain, in order to prepare the LHC to restart at higher energy, in 2015. The rest of the accelerator complex shall resume in mid-2014. We report on the recent and on-going vacuum-controls projects. Some of them are associated with the consolidations of the vacuum systems of LHC and of its injectors; others concern the complete renovation of the controls of some machines; and there are also some completely new installations. Due to the wide age-span of the existing vacuum installations, there is a mix of design philosophies and of control-equipment generations. The renovation and the novel projects offer an opportunity to improve the Quality Assurance of vacuum controls by: identifying, documenting, naming and labelling all pieces of equipment; minimising the number of equipment versions with similar functionality; homogenising the control architectures, while converging to a single software framework.

Poster

MOPPC028

High-Density Power Converter Real-Time Control for the MedAustron Synchrotron

Integrating Complex or Diverse Systems

Johannes Gutleber (CERN, Geneva), Angela Brett, Markus Hager, Jasna Junuzovic, Muhamed Junuzovic, Markus Marchhart, Roland Moser, Hannes Pavetits, Cesar Torcato de Matos (CERN, Geneva; EBG MedAustron, Wr. Neustadt), Joze Dedic, Mehle Marko, Luka Sepetavc (Cosylab, Ljubljana), Kristian Ambrosch, Philipe Fraboulet (EBG MedAustron, Wr. Neustadt)

The MedAustron accelerator is a synchrotron for light-ion therapy, developed under the guidance of CERN within the MedAustron-CERN collaboration. Procurement of 7 different power converter families and development of the control system were carried out concurrently. Control is optimized for unattended routine clinical operation. Therefore, finding a uniform control solution was paramount to fulfill the ambitious project plan. Another challenge was the need to operate with about 5'000 cycles initially, achieving pipelined operation with pulse-to-pulse re-configuration times smaller than 250 msec. This contribution shows the architecture and design and gives an overview of the system as built and operated. It is based on commercial-off-the-shelf processing hardware at front-end level and on the CERN function generator design at equipment level. The system is self contained, permitting use of parts and the whole is other accelerators. Especially the separation of the power converter from the real-time regulation using CERN's Converter Regulation Board makes this approach an attractive choice for integrating existing power converters in new configurations.

Poster

MOPPC029

Internal Post Operation Check System for Kicker Magnet Current Waveforms Surveillance

Integrating Complex or Diverse Systems

Nicolas Magnin, Etienne Carlier, Brennan Goddard, Volker Mertens, Jan Uythoven (CERN, Geneva)

A software framework, called Internal Post Operation Check (IPOC), has been developed to acquire and analyse kicker magnet current waveforms. It was initially aimed at performing the surveillance of LHC beam dumping system (LBDS) extraction and dilution kicker current waveforms and was subsequently also deployed on various other kicker systems at CERN.
It has been implemented using the Front-End Software Architecture (FESA) framework, and uses many CERN control services. It provides a common interface to various off-the-shelf digitiser cards, allowing a transparent integration of new digitiser types into the system. The waveform analysis algorithms are provided as external plug-in libraries, leaving their specific implementation to the kicker system experts. The general architecture of the IPOC system is presented in this paper, along with its integration within the control environment at CERN. Some application examples are provided, including the surveillance of the LBDS kicker currents and trigger synchronisation, and a closed-loop configuration to guarantee constant switching characteristics of high voltage thyratron switches.

Poster

MOPPC030

Developments on the SCADA of CERN Accelerators Vacuum

Integrating Complex or Diverse Systems

Fabien Antoniotti, Sebastien Blanchard, Marco Boccioli, Paulo Gomes, Helder Pereira (CERN, Geneva), Leonid Kopylov, Sergey Merker, Mikhail Sergeevich Mikheev (IHEP, Moscow Region)

During the first 3 years of LHC operation, the priorities for the vacuum controls SCADA were to attend to user requests, and to improve its ergonomics and efficiency. We now have reached: information access simplified and more uniform; automatic scripts instead of fastidious manual actions; functionalities and menus standardized across all accelerators; enhanced tools for data analysis and maintenance interventions. Several decades of cumulative developments, based on heterogeneous technologies and architectures, have been asking for a homogenization effort. The Long Shutdown (LS1) provides the opportunity to further standardize our vacuum controls systems, around Siemens-S7 PLCs and PVSS SCADA. Meanwhile, we have been promoting exchanges with other Groups at CERN and outside Institutes: to follow the global update policy for software libraries; to discuss philosophies and development details; and to accomplish common products. Furthermore, while preserving the current functionalities, we are working on a convergence towards the CERN UNICOS framework.

Poster

MOPPCO31

IEPLC Framework: Automated Communication in a Heterogeneous Control System Environment

Integrating Complex or Diverse Systems

Frank Locci, Stefano Magnoni (CERN, Geneva)

Programmable Logic Controllers (PLCs, PXI systems and other micro-controller families) are essential components of CERN control's system. They typically present custom communication interfaces which make their federation a difficult task. Dependency from specific protocols makes code not reusable and the replacement of old technology a tedious problem. IEPLC proposes a uniform and hardware independent communication schema. It automatically generates all the resources needed on master and slave side to implement a common and generic Ethernet communication. The framework consists of a set of tools, scripts and a C++ library. The JAVA configuration tool allows the description and instantiation of the data to be exchanged with the controllers. The Python scripts generate the resources necessary to the final communication while the C++ library, eventually, allows sending and receiving data at run-time from the master process. This paper describes the product by focusing on its main objectives: the definition of a clear and standard communication interface; the reduction of user's developments and configuration time.

Poster

MOPPCO32

OPC Unified Architecture within the Control System of the ATLAS Experiment

Integrating Complex or Diverse Systems

Piotr Nikiel, Ben Farnham, Sebastien Franz, Stefan Schlenker (CERN, Geneva), Henk Boterenbrood (NIKHEF, Amsterdam), Viatcheslav Filimonov (PNPI, Gatchina, Leningrad District)

The Detector Control System (DCS) of the ATLAS experiment at the LHC has been using the OPC DA standard as interface for controlling various standard and custom hardware components and their integration into the SCADA layer. Due to its platform restrictions and expiring long-term support, OPC DA will be replaced by the succeeding OPC Unified Architecture (UA) standard. OPC UA offers powerful object-oriented information modeling capabilities, platform independence, secure communication and allows server embedding into custom electronics. We present an OPC UA server implementation for CANopen devices which is used in the ATLAS DCS to control dedicated IO boards distributed within and outside the detector. Architecture and server configuration aspects are detailed and the server performance is evaluated and compared with the previous OPC DA server. Furthermore, based on the experience with the first server implementation, OPC UA is evaluated as standard middleware solution for future use in the ATLAS DCS and beyond.

Poster

MOPPC033

CoDeSys in UNICOS: Opening the Floor to PLCs and Industrial PCs

Integrating Complex or Diverse Systems

Jacques Rochez, Enrique Blanco Vinuela, Maria Koutli, Theodora Petrou (CERN, Geneva)

This paper presents the integration of a third industrial platform for process control applications with the UNICOS (Unified Industrial Control System) framework at CERN. The UNICOS framework is widely used in many process control domains (e.g. Cryogenics, Cooling, Ventilation, Vacuum…) to produce highly structured standardised control applications for the two CERN approved industrial PLC product families, Siemens and Schneider. The CoDeSys platform, developed by the 3S (Smart Software Solution), provides an independent IEC 6131-3 programming environment for industrial controllers. The complete CoDeSys based development includes: (1) a dedicated Java™ module plugged in an automatic code generation tool, the UAB (UNICOS Application Builder), (2) the associated UNICOS baseline library for industrial PLCs and IPCs (Industrial PC) CoDeSys v3 compliant, and (3) the Python-based templates to deploy device instances and control logic. The availability of this development opens the UNICOS framework to a wider community of industrial PLC manufacturers (e.g. ABB, WAGO…) and, as the CoDeSys control Runtime works in standard Operating Systems (Linux, W7…), UNICOS could be deployed to any IPC.

Poster

MOPPC034

Control Sytem Hardware Upgrade

Integrating Complex or Diverse Systems

Guido Janser, Gregor Dzieglewski, Walter Hugentobler, Francois Kreis (PSI, Villigen PSI)

The Paul Scherrer Institute builds, runs and maintains several particle accelerators. The proton accelerator HIPA, the oldest facility, was mostly equipped with CAMAC components until a few years ago. In several phases CAMAC was replaced by VME hardware and involved about 60 VME crates with 500 cards controlling a few hundred power supplies, motors, and digital as well as analog input/output channels. To control old analog and new digital power supplies with the same new VME components, an interface, so called Multi-IO, had to be developed. In addition, several other interfaces like accommodating different connectors had to be build. Through a few examples the upgrade of the hardware will be explained.

MOPPC035

Poster

Re-integration and Consolidation of the Compact Muon Solenoid Electromagnetic Calorimeter Detector Control System

Integrating Complex or Diverse Systems

Oliver Holme, Diogo Raphael da Silva Di Calafiori, Guenther Dissertori, Lubomir Djambazov, Werner Lustermann (ETH, Zurich), Serguei Zelepoukine (ETH, Zurich; UW-Madison/PD, Madison, Wisconsin)

The current shutdown of the Large Hadron Collider (LHC), following three successful years of physics data-taking, provides an opportunity for major upgrades to be performed on the Detector Control System (DCS) of the Electromagnetic Calorimeter (ECAL) of the Compact Muon Solenoid (CMS) experiment. The upgrades involve changes to both hardware and software, with particular emphasis on taking advantage of more powerful servers and updating third-party software to the latest supported versions. The considerable increase in available processing power enables a reduction from fifteen to three or four servers. To host the control system on fewer machines and to ensure that previously independent software components could run side-by-side without incompatibilities, significant changes in the software and databases were required. Additional work was undertaken to modernise and concentrate I/O interfaces. The challenges to prepare and validate the hardware and software upgrades are described along with details of the experience of migrating to this newly consolidated DCS.

MOPPC036

Poster

The BPM Integration in the Taiwan Photon Source

Integrating Complex or Diverse Systems

Changhor Kuo, Yung-Sen Cheng, Pei-Chen Chiu, Kuo-Tung Hsu, Kuo Hwa Hu (NSRRC, Hsinchu)

TPS (Taiwan Photon Source) is a 3 GeV synchrotron light source which is being in construction at NSRRC. The TPS BPM is based on xTCA platform, is used for various request and function reasons. These functions will be discussed. Another purpose is for orbit feedback system. The tradition BPM electronic is separated from orbit feedback system, is just monitor. In the TPS, the orbit feedback system is embedded in the BPM crate with FPGA modules. High throughput backplane, data transfer and processing support rich function for waveform recorder, diagnostic, beam study and transient analysis. The implementation result of the BPM system will be reported in this conference.

MOPPC037

Control Programs for the MANTRA Project at the ATLAS Superconducting Accelerator

Integrating Complex or Diverse Systems

Maria A. Power, Chithra Nair, Tala Palchan, Richard Claude Pardo, Christopher Peters, Ken Teh, Richard Vondrasek (ANL, Argonne)

The AMS (Accelerator Mass Spectrometry) project at ATLAS (Argonne Tandem Linac Accelerator System) complements the MANTRA (Measurement of Actinides Neutron TRAnsmutation) experimental campaign. To improve the precision and accuracy of AMS measurements at ATLAS, a new overall control system for AMS measurements needs to be implemented to reduce systematic errors arising from changes in transmission and ion source operation. The system will automatically and rapidly switch between different m/q settings, acquire the appropriate data and move on to the next setting. In addition to controlling the new multi-sample changer and laser ablation system, a master control program will communicate via the network to integrate the ATLAS accelerator control system, FMA control computer, and the data acquisition system.

MOPPC038

Rapid Software Prototyping into Large Scale Controls Systems*

Integrating Complex or Diverse Systems

Barry Fishler, Gordon Brunton, Alan Conder, JoAnn Matone, Mitanu Paul, Matthew Rever, Eddy Tse (LLNL, Livermore, California)

The programmable spatial shaper (PSS) within the National Ignition Facility (NIF) reduces energy on isolated optic flaws in order to lower the optics maintenance costs. This will be accomplished by using a closed-loop system for determining the optimal liquid-crystal-based spatial light pattern for beamshaping and placement of variable transmission blockers. A stand-alone prototype was developed and successfully run in a lab environment as well as on a single quad of NIF lasers following a temporary hardware reconfiguration required to support the test. Several challenges exist in directly integrating the C-based PSS engine written by an independent team into the Integrated Computer Control System (ICCS) for proof on concept on all 48 NIF laser quads. ICCS is a large-scale data-driven distributed control system written primarily in Java using CORBA to interact with +60K control points. The project plan and software design needed to specifically address the engine interface specification, configuration management, reversion plan for the existing 0% transmission blocker capability, and a multi-phase integration and demonstration schedule.

Poster

MOPPC039

Hardware Interface Independent Serial Communication (IISC)

Integrating Complex or Diverse Systems

Prerana Kankiya, James Jamilkowski (BNL, Upton, Long Island, New York), Lawrence T. Hoff (BNL, Upton, New York)

The communication framework for the in-house controls system in the Collider-Accelerator Department at BNL depends on a variety of hardware interfaces and protocols including RS232, GPIB, USB and Ethernet to name a few. IISC is a client software library, which can be used to initiate, communicate and terminate data exchange sessions with devices over the network. It acts as a layer of abstraction allowing developers to establish communication with these devices without having to be concerned about the particulars of the interfaces and protocols involved. Details of implementation and a performance analysis will be presented.

Poster

MOPPC040

A Hazard Driven Approach to Accelerator Safety System Design - How CLS Successfully Applied ALARP in the Design of Safety Systems

Personnel Safety and Machine Protection

Elder Matias, Mohamed Benmerrouche, Grant Cubbon, Allen Hodges, Hao Zhang (CLS, Saskatoon, Saskatchewan)

All large scale particle accelerator facilities end up utilising computerised safety systems for the accelerator access control and interlock system including search lockup sequences and other safety functions. Increasingly there has been a strong move toward IEC 61508 based standards in the design of these systems. CLS designed and deployed its first IEC 61508 based system nearly 10 years ago. The challenge has increasingly been to manage the complexity of requirements and ensure that features being added into such systems were truly requirements to achieve safety. Over the past few years CLS has moved to a more structured Hazard Analysis technique that is tightly coupled and traceable through the design and verification of its engineered safety systems. This paper presents the CLS approach and lessons learned.

MOPPC041

Machine Protection System for TRIUMF's ARIEL Facility

Personnel Safety and Machine Protection

Don Dale, Daryl Bishop, Kevin Langton, Rod Nussbaumer, Jane E Richards, Graham Waters (TRIUMF, Vancouver)

Phase 1 of the Advanced Rare Isotope & Electron Linac (ARIEL) facility at TRIUMF is scheduled for completion in 2014. It will utilize an electron linear accelerator (eLinac) capable of currents up to 10mA and energy up to 75MeV. The eLinac will provide CW as well as pulsed beams with durations as short as 10uS. A Machine Protection System (MPS) will protect the accelerator and the associated beamline equipment from the nominal 500kW beam. Hazardous situations require the beam to be extinguished at the electron gun within 10uS of detection. Beam loss accounting is an additional requirement of the MPS. The MPS consists of an FPGA based controller module, Beam Loss Monitor VME modules developed by JLAB, and EPICS -based controls to establish and enforce beam operating modes. This paper describes the design, architecture, and implementation of the MPS.

MOPPC042

Machine Protection System for the SPIRAL2 Facility

Personnel Safety and Machine Protection

Cyrille Berthe, Eric Lecorche, M.H. Moscatello, Guillaume Normand (GANIL, Caen)

The phase 1 of the SPIRAL2 facility, the extension project of the GANIL laboratory, is under construction in Caen, France.The accelerator is based on a linear solution, mainly composed of a normal conducting RFQ and a superconducting linac. One of its specificities is to be designed to accelerate high power deuteron and heavy ion beams from 40 to 200kW, and medium intensity heavy ion beams as well to a few kW. A Machine Protection System, has been studied to control and protect the accelerator from thermal damages for a very large range of beam intensities and powers. This paper presents the technical solutions chosen for this system which is based on two technical subsystems: one dedicated to thermal protection which requires a first PLC associated with a fast electronic system and a second dedicated to enlarged protection which is based on a safety products.

Poster

MOPPC043

Development of the Thermal Beam Loss Monitors of the Spiral2 Control System

Personnel Safety and Machine Protection

Christophe Haquin (GANIL, Caen), Florin Negoita (IFIN, Magurele- Bucuresti)

The Spiral2 linear accelerator will drive high intensity beams, up to 5mA, to up to 200kW at linac exit. Such beams can seriously damage and activate the machine ! To prevent from such situation, the Machine Protection System (MPS) has been designed. This system is connected to diagnostics indicating if the beam remains under specific limits. As soon as a diagnostic detects its limit is crossed, it informs the MPS which will in turn take actions that can lead to a beam cut-off in appropriated timing requirements. In this process, the Beam Loss Monitors (BLM) are involved in monitoring prompt radiation generated by beam particles interactions with beam line components and responsible for activation, on one side, and thermal effects, on the other side. BLM system relies mainly on scintillator detectors, NIM electronics and a VME subsystem monitoring the heating of the machine. This subsystem, also called «Thermal BLM», will be integrated in the Spiral2 EPICS environment. For its development, a specific project organization has been setup since the development is subcontracted to Cosylab. This paper focuses on the Thermal BLM controls aspects and describes this development process.

Poster

MOPPC044

Cilex-Apollon Personnel Safety System

Personnel Safety and Machine Protection

Jean-Luc Veray, Jean-Luc Paillard (LULI, Palaiseau)

Cilex-Apollon is a high intensity laser facility delivering at least 5 PW pulses on targets at one shot per minute, to study physics such as laser plasma electron or ion accelerator and laser plasma X-Ray sources. Under construction, Apollon is a four beam laser installation with two target areas. Such a facility causes many risks, in particular laser and ionizing radiations. The Personal Safety System (PSS) ensures to both decrease impact of dangers and limit exposure to them. Based on a risk analysis, Safety Integrity Level (SIL) has been assessed respecting international norms IEC 62061 and IEC 61511-3. To conceive a high reliability system a SIL 2 is required. The PSS is based on four laser risk levels corresponding to the different uses of Apollon. The study has been conducted according to norm EN 60825. Independent from the main command -control network the distributed system is made of a safety PLC and equipment, communicating through a safety network. The article presents the concepts, the architecture the client-server architecture, from control screens to sensors and actuators and interfaces to the access control system and the synchronization and sequence system.

Poster

MOPPC045

Cilex-Apollon Synchronization and Security System

Personnel Safety and Machine Protection

Mickael Pina (LULI, Palaiseaux), Jean-Luc Paillard (LULI, Palaiseau)

Cilex-Apollon is a high intensity laser facility delivering at least 5 PW pulses on targets at one shot per minute, to study physics such as laser plasma electron or ion accelerator and laser plasma X-Ray sources. Under construction, Apollon is a four beam laser installation with two target areas. Apollon control system is based on Tango. The Synchronization and Security System (SSS) is the heart of this control system and has two main functions. First one is to deliver triggering signals to lasers sources and diagnostics and the second one is to ensure machine protection to guarantee optic components integrity by avoiding damages caused by abnormal operational modes. The SSS is composed of two distributed systems. Machine protection system is based on a distributed I/O system running a Labview real time application and the synchronization part is based on the distributed Greenfield Technology system. The SSS also delivers shots to the experiment areas through programmed sequences. The SSS are interfaced to Tango bus. The article presents the architecture, functionality, interfaces to others processes, performances and feedback from a first deployment on a demonstrator.

Poster

MOPPC047

A New PSS for the ELBE Accelerator Facility

Personnel Safety and Machine Protection

Matthias Justus, Isabel Koesterke (HZDR, Dresden), Stephan Kraft (Helmholtz-Zentrum Dresden-Rossendorf (HZDR), Dresden), Stephan Lenk (SAAS, Bannewitz)

The ELBE facility with its 40 MeV C.W. LINAC has been upgraded towards a Center for High-Power Radiation Sources in conjunction with TW & PW femtosecond lasers. It now offers a wider range of experimental sites, such as high intensity THz beam lines, monoenergetic positron spectroscopy, a redesigned neutron ToF facility and before long an electron-laser interaction chamber. Topological facility expansion, increased number of radiation sources and laser safety requirement made a replacement of the outdated S5 system necessary. The new PSS based on failsafe PLCs was designed to cover all aspects of radiation protection according to effective German law. It combines laser and radiation safety for the new laser based particle sources. Concept and specifications were defined in-house, while detailed design and installation were done by an outside firm. The article describes functions, architecture and technical features of the new ELBE PSS. Special focus is on the implementation of EN 61508 and the project track. The system was integrated in an existing (and mostly running) facility and is liable to third party approval. Operational experience after one year of run-time is also given.

MOPPC048

Evaluation of the Beamline Personnel Safety System at ANKA under the Aegis of the 'Designated Architectures' Approach

Personnel Safety and Machine Protection

Karlheinz Cerff, Michael Hagelstein (FZK, Karlsruhe), Denis Jakel, Richard Stricker (KIT, Eggenstein-Leopoldshafen), Ingrid Birkel (KIT, Karlsruhe)

The Beamline Personnel Safety System (BPSS) at Angstroemquelle Karlsruhe (ANKA) started operation in 2003. The paper describes the safety related design and evaluation of serial, parallel and nested radiation safety areas, which allows the flexible plug-in of experimental setups at ANKA-beamlines. It evaluates the resulting requirements for safety system hard- and software and the necessary validation procedure defined by current national and international standards, based on probabilistic reliability parameters supplied by component libraries of manufacturers and an approach known as 'Designated Architectures', defining safety functions in terms of sensor-logic-actor chains. An ANKA-beamline example is presented with special regards to features like (self-) Diagnostic Coverage (DC) of the control system, which is not part of classical Markov process modelling of systems safety.

Poster

MOPPC049

Radiation and Laser Safety Systems for the FERMI@Elettra Free Electron Laser

Personnel Safety and Machine Protection

Fabio Giacuzzo, Luigino Battistello, Katia Casarin, Marco Lonza, Graziano Scalamera, Alessandro Vascotto, Lucio Zambon (Elettra-Sincrotrone Trieste S.C.p.A., Basovizza), Giorgio Marega (Studio di Ingegneria Giorgio Marega, Trieste)

FERMI@Elettra is a Free Electron Laser (FEL) users facility based on a 1.5 GeV electron linac. The personnel safety systems allow entering the restricted areas of the facility only when safety conditions are fulfilled, and set the machine to a safe condition in case any dangerous situation is detected. Hazards are associated with accelerated electron beams and with an infrared laser used for pump-probe experiments. The safety systems are based on PLCs providing redundant logic in a fail-safe configuration. They make use of a distributed architecture based on fieldbus technology and communicate with the control system via Ethernet interfaces. The paper describes the architecture, the operational modes and the procedures that have been implemented. The experience gained in the recent operation is also reported.

Poster

MOPPC050

Design of Machines Fast Protection System Based on FPGA

Personnel Safety and Machine Protection

Yuhui Guo, Chunlei Yu (IMP, Lanzhou)

In the intense beam proton linac running process, the beam power is high, so the beam loss is likely to damage equipment online which cause accelerators not run properly. In order to protect critical equipment component in the system from damage, the control system needs to provide fast and reliable interlock protection methods. When the beam offset or loss seriously, the system can cut off the beam source to protect the equipment in safety operation. The software response time is long in most traditional machine protection system based on software decision, and the response time is in the order of ms. The requirement of response time is in order of us or ns, so it can only be used by the FPGA and optical fiber communication technology. Based on cPCI bus, we design a master-slave FPGA control module to meet the requirement. Main FPGA module mainly realizes control decision of the whole machine protection system, and slave FPGA module mainly achieves the fault signal acquisition of the field equipment and high speed fiber optic transmission capability.The whole fault processing time can be less than 10 us, which fully meets the requirement of the ADS injector II Linear Accelerator.

Poster

MOPPC051

NSLS-II Booster Interlock System

Personnel Safety and Machine Protection

Ruslan Kadyrov, Pavel Borisovich Cheblakov, Anton Anatolievich Derbenev, Sergey Evgenyevich Karnaev, Stanislav S. Serednyakov, Evgeny Simonov (BINP SB RAS, Novosibirsk)

Being responsible for 3 GeV booster synchrotron for the National Synchrotron Light Source (NSLS-II, BNL, USA) design and manufacture, Budker Institute of Nuclear Physics also designs the booster control and diagnostic system. Among others, the system includes interlock system consisting of equipment protection system, vacuum level and vacuum chamber temperature control system, beam diagnostic service system. These subsystems are to protect facility elements in case of vacuum leakage or chamber overheating and to provide subsidiary functions for beam diagnostics. Providing beam interlocks, it processes more then 150 signals from thermocouples, cold and hot cathode vacuum gauges and ion pump controllers. The subsystems contain nine 5U 19” chassis with hardware of each based on Allen-Bradley CompactLogix Programmable Logic Controller. All the interlock related connections are made with dry contacts, whereas system status and control is available through EPICS channel access. All operator screens are developed with Control System Studio tooling. This paper describes configuration and operation of the booster interlock system.

MOPPC052

Poster

ESS Bilbao Interlock System Approach

Personnel Safety and Machine Protection

Daniel Piso, Mikel Eguiraun (ESS Bilbao, Zamudio), Iñigo Arredondo, Seadat Varnasseri (ESS Bilbao, LEIOA)

This paper describes the approach used at ESS Bilbao initiative for the implementation of the Interlock System. The system is divided into two parts depending on the required speed for the system response: Slow Interlocks (>100 msec.) and Fast Interlocks (<100 msec.). Besides, both interlocks parts are arranged in two layers: Local Layer and Master Layer. The Slow Interlocks subsystem is based on PLCs. This solution is being tested in the ESS Bilbao ECR ion source with positive results and the first version design is now complete for the LEBT system. For the Fast Interlocks local layer part, a solution based on NI cRIO has been designed and tested. In these tests a maximum response time of 3.5 usec. was measured for analog acquisition, threshold comparison and signal generation. For digital signals the maximum time response of a similar process was 500 nsec. . These responses are considered valid for the standard need of the project. Finally, to extract information from the interlocks system and monitor it, the Modbus/EPICS interface is used for Slow Interlocks, while EPICS output is produced by NI cRIO. Hence, it is planned to develop a light pyQT solution to perform this task.

MOPPC053

Poster

A Safety System for Experimental Magnets Based on CompactRIO

Personnel Safety and Machine Protection

Sylvain Ravat, Laurent Deront, Antoine Kehrli, Xavier Pons (CERN, Geneva)

This paper describes the development of a new safety system for experimental magnets using National Instruments CompactRIO devices. The design of the custom Magnet Safety System (MSS) for the large LHC experimental magnets began in 1998 and it was first installed and commissioned in 2002. Some of its components like the isolation amplifier or ALTERA Reconfigurable Field-Programmable Gate Array (FPGA) are not available on the market any longer. A review of the system shows that it can be modernized and simplified by replacing the Hard-wired Logic Module (HLM) by a CompactRIO device. This industrial unit is a reconfigurable embedded system containing a processor running a real-time operating system (RTOS), a FPGA, and interchangeable industrial I/O modules. A prototype system, called MSS2, has been built and successfully tested using a test bench based on PXI crate. Two systems are currently being assembled for two experimental magnets at CERN, for the COMPASS solenoid and for the M1 magnet at the SPS beam line. This paper contains a detailed description of MSS2, the test bench and results from a first implementation and operation with real magnets.

MOPPC054

Application of Virtualization to CERN Access and Safety Systems

Personnel Safety and Machine Protection

Timo Hakulinen, Jorge Breogan Lopez Costa, Pierre Ninin, Henrik Nissen, Rui Nunes (CERN, Geneva)

Access and safety systems are by nature heterogeneous: different kinds of hardware and software, commercial and home-grown, are integrated to form a working system. This implies many different application services, for which separate physical servers are allocated to keep the various subsystems isolated. Each such application server requires special expertise to install and manage. Furthermore, physical hardware is relatively expensive and presents a single point of failure to any of the subsystems, unless designed to include often complex redundancy protocols. We present the Virtual Safety System Infrastructure project (VSSI), whose aim is to utilize modern virtualization techniques to abstract application servers from the actual hardware. The virtual servers run on robust and redundant standard hardware, where snapshotting and backing up of virtual machines can be carried out to maximize availability. Uniform maintenance procedures are applicable to all virtual machines on the hypervisor level, which helps to standardize maintenance tasks. This approach has been applied to the servers of CERN PS and LHC access systems as well as to CERN Safety Alarm Monitoring System (CSAM).

MOPPC055

Revisiting CERN Safety System Monitoring (SSM)

Personnel Safety and Machine Protection

Timo Hakulinen, Rui Nunes, Tono Riesco (CERN, Geneva)

CERN Safety System Monitoring (SSM) is a system for monitoring state-of-health of the various access and personnel safety systems at CERN since more than three years. SSM implements monitoring of different operating systems, network equipment, storage, and special devices like PLCs, front ends, etc. It is based on the monitoring framework Zabbix, which supports alert notifications, issue escalation, reporting, distributed management, and automatic scalability. The emphasis of SSM is on the needs of maintenance and system operation, where timely and reliable feedback directly from the systems themselves is important to quickly pinpoint immediate or creeping problems. A new application of SSM is to anticipate availability problems through predictive trending that allows to visualize and manage upcoming operational issues and infrastructure requirements. Work is underway to extend the scope of SSM to all access and safety systems managed by the access and safety team with upgrades to the monitoring methodology as well as to the visualization of results.

Poster

MOPPC056

The Detector Safety System of NA62 Experiment

Personnel Safety and Machine Protection

Gilles Maire, Sylvain Ravat (CERN, Geneva), Herve Coppier (ESIEE, Amiens)

The aim of the NA62 experiment is the study of the rare decay K+->pi+ - at the CERN SPS. The Detector Safety System (DSS) developed at CERN is responsible for assuring the protection of the experiment's equipment. DSS requires a high degree of availability and reliability. It is composed of a Front-End and a Back-End part, the Front-End being based on a National Instruments cRIO system, to which the safety critical part is delegated. The cRIO Front-End is capable of running autonomously and of automatically taking predefined protective actions whenever required. It is supervised and configured by the standard CERN PVSS SCADA system. This DSS system can easily adapt to evolving requirements of the experiment during the construction, commissioning and exploitation phases. The NA62 DSS is being installed and has been partially commissioned during the NA62 Technical Run in autumn 2012, where components from almost all the detectors as well as the trigger and the data acquisition systems were successfully tested. The paper contains a detailed description of this innovative and performing solution, and demonstrates a good alternative to the LHC systems based on redundant PLCs.

Poster

MOPPC057

Data Management and Tools for the Access to the Radiological Areas at CERN

Personnel Safety and Machine Protection

Eva Sanchez-Corral Mena, Gerald Dumont, Katy Foraz, Timo Hakulinen, Maciej Piotr Kepinski, Sonia Mallon Amerigo, Pedro Martel, Pierre Ninin, Rui Nunes, Francesco Valentini, Joachim Vollaire (CERN, Geneva)

As part of the refurbishment of the PS Personnel Protection system, the radioprotection (RP) buffer zones & equipment have been incorporated into the design of the new access points providing an integrated access concept to the radiation controlled areas of the PS complex. The integration of the RP and access control equipment has been very challenging due to the lack of space in many of the zones. Although successfully carried out, our experience from the commissioning of the first installed access points shows that the integration should also include the software tools and procedures. This paper presents an inventory of all the tools and data bases currently used (*) in order to ensure the access to the CERN radiological areas according to CERN's safety and radioprotection procedures. We summarize the problems and limitations of each tool as well as the whole process, and propose a number of improvements for the different kinds of users including changes required in each of the tools. The aim is to optimize the access process and the operation & maintenance of the related tools by rationalizing and better integrating them.

(*) Access Distribution and Management, Safety Information Registration, Works Coordination, Access Control, Operational Dosimeter, Traceability of Radioactive Equipment, Safety Information Panel.

Poster

MOPPC058

Design, Development and Implementation of a Dependable Interlocking Prototype for the ITER Superconducting Magnet Powering System

Personnel Safety and Machine Protection

Manuel Zaera-Sanz (GSI, Darmstadt), Jonathan Burdalo Gil, Iván Romera, Ruediger Schmidt, Markus Zerlauth (CERN, Geneva)

Based on the experience with an operational interlock system for the superconducting magnets of the LHC, CERN has developed a prototype for the ITER magnet central interlock system in collaboration with ITER. A total energy of more than 50 Giga Joules is stored in the magnet coils of the ITER Tokamak. Upon detection of a quench or other critical powering failures, the central interlock system must initiate the extraction of the energy to protect the superconducting magnets and, depending on the situation, request plasma disruption mitigations to protect against mechanical forces induced between the magnet coils and the plasma. To fulfil these tasks with the required high level of dependability the implemented interlock system is based on redundant PLC technology making use of hardwired interlock loops in 2-out-of-3 redundancy, providing the best balance between safety and availability. In order to allow for simple and unique connectivity of all client systems involved in the safety critical protection functions as well as for common remote diagnostics, a dedicated user interface box has been developed.

Poster

MOPPC059

Refurbishing of the CERN PS Complex Personnel Protection System

Personnel Safety and Machine Protection

Pierre Ninin, Didier Chapuis, Fabrice Chapuis, Christophe Delamare, Serge Di Luca, Jose-Luis Duran-Lopez, Timo Hakulinen, Louis Hammouti, Jean-Francois Juget, Tomasz Ladzinski, Boris Morand, Miriam Munoz-Codoceo, Eva Sanchez-Corral Mena, Franck Schmitt, Gregory Smith, Rende Steerenberg, Francesco Valentini (CERN, Geneva)

In 2010, the refurbishment of the Personnel Protection System of the CERN Proton Synchrotron complex primary beam areas started. This large scale project was motivated by the obsolescence of the existing system and the objective of rationalizing the personnel protection systems across the CERN accelerators to meet the latest recommendations of the regulatory bodies of the host states. A new generation of access points providing biometric identification, authorization and co-activity clearance, reinforced passage check, and radiation protection related functionalities will allow access to the radiologically classified areas. Using a distributed fail-safe PLC architecture and a diversely redundant logic chain, the cascaded safety system guarantees personnel safety in the 17 machine of the PS complex by acting on the important safety elements of each zone and on the adjacent upstream ones. It covers radiological and activated air hazards from circulating beams as well as laser, and electrical hazards. This paper summarizes the functionalities provided, the new concepts introduced, and, the functional safety methodology followed to deal with the renovation of this 50 year old facility.

Poster

MOPPC060

Large Protection Systems with Programmable Logic Controllers: Safety, Redundancy and Availability

Personnel Safety and Machine Protection

Tomasz Ladzinski, Frederic Havart (CERN, Geneva), Juan Luis Fernandez-Hernando, Antonio Vergara-Fernandez (ITER Organization, St. Paul lez Durance)

Modern interlock systems for personnel safety and machine protection are often built with Programmable Logic Controllers (PLC) certified for systems with Safety Integrity Level 3 (SIL3) requirements. In order to increase the process availability, engineers tend to use the controllers in redundant configurations. Conversely, such an approach introduces additional complexity which increases the probability of triggering the fail-safe mode of the controller, thereby reducing the process availability. This paper addresses the rationale of using redundant fail-safe programmable logic controllers in large scale protection and safety systems. Possible gain in process up-time due to resistance of redundant architectures to single controller failure is compared with a potential down-time due to fallback mode, in particular resulting from synchronization failures. Various process constraints and different architectural options are discussed. The current LHC Access Safety System and the proposed ITER Interlock Control System architectures are used as examples.

Poster

MOPPC061

Achieving a Highly Configurable Personnel Protection System for Experimental Areas

Personnel Safety and Machine Protection

Frederic Havart, Didier Chapuis, Rui Nunes, Didier Vaxelaire (CERN, Geneva)

The personnel protection system of the secondary beam experimental areas at CERN manages the beam and access interlocking mechanism. Its aim is to guarantee the safety of the experimental area users against the hazards of beam radiation and laser light. The highly configurable, interconnected, and modular nature of those areas requires a very versatile system. In order to follow closely the operational changes and new experimental setups and to still keep the required level of safety, the system was designed with a set of matrices which can be quickly reconfigured. Through a common paradigm, based on industrial hardware components, this challenging implementation has been made for both the PS and SPS experimental halls, according to the IEC 61508 standard. The current system is based on a set of hypotheses formed during 25 years of operation. Conscious of the constant increase in complexity and the broadening risk spectrum of the present and future experiments, we propose a framework intended as a practical guide to structure the design of the experimental layouts based on risk evaluation, safety function prescriptions and field equipment capabilities.

Poster

MOPPC062

Real-Time System Supervision for the LHC Beam Loss Monitoring System at CERN

Personnel Safety and Machine Protection

Christos Zamantzas, Bernd Dehning, Ewald Effinger, Jonathan Emery, Stephen Jackson (CERN, Geneva)

The strategy for machine protection and quench prevention of the Large Hadron Collider (LHC) at the European Organisation for Nuclear Research (CERN) is mainly based on the Beam Loss Monitoring (BLM) system. The LHC BLM system is one of the most complex and large instrumentation systems deployed in the LHC. In addition to protecting the collider, the system also needs to provide a means of diagnosing machine faults and deliver feedback of the losses to the control room as well as to several systems for their setup and analysis. In order to augment the dependability of the system several layers of supervision has been implemented internally and externally to the system. This paper describes the different methods employed and the achieved results in availability and system fault detection.

Poster

MOPPC063

Radiation and Environment Monitoring Unified Supervision at CERN

Personnel Safety and Machine Protection

Gustavo Segura, Nuno Jacinto, Adrien Ledeul (CERN, Geneva)

CERN operates a complex radiation and environment monitoring system covering accelerators and experimental areas. The Organization is building the REMUS System (Radiation and Environment Monitoring Unified Supervision) that will supervise the entire monitoring infrastructure. CERN Radiation and Environment monitoring system is on constant change. The size, complexity and heterogeneity of the accelerators and experiments of the organization and the continuous changes in these infrastructures force the monitoring system to be in continuous evolution. REMUS addresses this changing context by providing a mechanism that allows administrators and advanced users to make application descriptions that are used for automatic generation of tailored supervision applications. The validation of these applications is ensured by the generation mechanism itself reducing the time necessary for verification, test and acceptance of these applications. REMUS supplies an easy and quick way of creating and modifying user tailored radiation and environment supervision applications and simplifies the validation and verification process of this kind of safety related software.

Poster

MOPPC064

A New Spark Detection System for the SPS North Area Beam Extraction Electrostatic Septa

Personnel Safety and Machine Protection

Roger Andrew Barlow, Bruno Balhan, Jan Borburgh, Etienne Carlier, Christophe Chanavat, Bernard Pinget (CERN, Geneva)

Electrostatic septa (ZS) are used in the extraction of the particle beams from the CERN SPS to the North Area experimental zone. These septa employ high electric fields, generated from a 300 kV power supply, and are particularly prone to internal sparking around the cathode structure. This sparking degrades the electric field quality, consequently affecting the extracted beam, vacuum and equipment performance. To mitigate these effects, a Spark Detection System (SDS) has been realised, which is based on an industrial SIEMENS S7-400 programmable logic controller and deported Boolean processors modules interfaced through a PROFINET fieldbus. The SDS interlock logic uses a moving average spark rate count to determine if the ZS performance is acceptable. Below a certain spark rate it is probable that the ZS septa tank vacuum can recover, thus avoiding transition into a state where rapid degradation would occur. Above this level an interlock is raised and the high voltage is switched off. Additionally, all spark signals acquired by the SDS are sent to a front-end computer to allow further analysis such as calculation of spark rates and production of statistical data.

Poster

MOPPC065

Hardware Interlock and/or Software Interlock: What to Choose?

Personnel Safety and Machine Protection

Bruno Puccio, Andrea Apollonio, Christophe Martin, Bettina Mikulec, Jose-Luis Sanchez Alvarez, Jorg Wenninger, Jakub Pawel Wozniak (CERN, Geneva)

A Hardware Interlock System, namely the Beam Interlock System (BIS) and a Software Interlock System (SIS) have been both designed to protect the LHC machine from an accidental release of the stored energy in the particle beams. By design, the BIS is highly reliable, safe and fast. To meet these requirements it has been based on purpose on the execution of simple interlock conditions on a hardware level. On the other hand, the SIS provides additional protection by handling more complex interlock conditions, which on the contrary are not very time-critical. There are more differences between the two Interlock systems, but their own strengths and weaknesses make them more than complementary. BIS and SIS are both operational since a few years in the LHC and in its final injector. The same combination of interlock systems is proposed to protect the future linear accelerator (Linac4) replacing Linac2 as the first element in the LHC proton injector chain. This paper describes the main differences between Hardware & Software Interlocks, reports on the operational experience and explains the choices, limitations and the boundary conditions for a new deployment using the Linac4 case.

Poster

MOPPC066

Reliability Analysis of the LHC Beam Dumping System Taking into Account the Operational Experience during LHC Run 1

Personnel Safety and Machine Protection

Roberto Filippini, Etienne Carlier, Nicolas Magnin, Jan Uythoven (CERN, Geneva)

The LHC beam dumping system operated reliably during the Run 1 period of the LHC (2009 – 2013). As expected, there were a number of internal failures of the beam dumping system which, because of in-built safety features, resulted in safe removal of the particle beams from the machine. These failures (i.e. “false” beam dumps) have been appointed to the different failure modes and are compared to the predictions made by a reliability model established before the start of LHC operation. A statistically significant difference between model and failure data identifies those beam dumping system components that may have unduly impacted on the LHC availability and safety or might have been out of the scope of the initial model. An updated model of the beam dumping system reliability is presented, taking into account the experimental data presented and the foreseen system changes to be made in the 2013 – 2014 LHC shutdown.

Poster

MOPPC067

Personnel Protection of the CERN SPS North Hall in Fixed Target Primary Ion Mode

Personnel Safety and Machine Protection

Timo Hakulinen, Jerome Axensalva, Frederic Havart, Steve Hutchins, Lars K. Jensen, Django Manglunki, Pierre Ninin, Patrick Odier, Stephane Reignier, James Ridewood, Lars Soby, Christian Theis, Francesco Valentini, Didier Vaxelaire, Helmut Vincke (CERN, Geneva)

While CERN’s Super Proton Synchrotron (SPS) is able to deliver both secondary proton and primary ion beams to fixed targets in the North Area, the experimental areas (North Hall) are widely accessible during beam. In ion mode all normal safety elements involved in producing secondary beams are removed, so that an accidental extraction of a high-intensity proton beam into the North Hall would expose personnel present there to a radiation hazard. This has required an injector reconfiguration restricting operation to either ions or protons. However, demands for operational flexibility of CERN accelerators have led to a need to mix within the same SPS super-cycle both high-intensity proton cycles for LHC or HiRadMat and ion cycles for the North Area. We present an active interlock designed to mitigate this hazard: Beam Current Transformers are used to measure the level of beam intensity, and if above a set threshold, pulsing of the extraction septa is vetoed. The safety function is implemented by means of two logically equivalent but diverse and separate interlock chains. This interlock is expected to be in place once the SPS resumes operation after the first Long Shutdown in 2014.

MOPPC068

Operational Experience of a PLC Based Positioning System for the TCDQ

Personnel Safety and Machine Protection

Christophe Boucly, Jan Borburgh, Chiara Bracco, Etienne Carlier, Nicolas Magnin, Nicolas Voumard (CERN, Geneva)

The LHC Beam Dumping System (LBDS) nominally dumps the beam synchronously with the passage of the particle free beam abort gap at the beam dump extraction kickers. In the case of an asynchronous beam dump, the TCDQ absorber protects the machine aperture. This is a single sided collimator, positioned close to the beam, which has to follow the beam position and beam size during the energy ramp. The TCDQ positioning control is implemented within a SIEMENS S7-300 Programmable Logic Controller (PLC). A positioning accuracy better than 30 μm is achieved through a PID based servo algorithm. Errors that can lead to a wrong position of the TCDQ w.r.t. beam energy and size generate interlock conditions to the LHC machine protection system. Additionally, the correct position of the TCDQ w.r.t the beam position in the extraction region is cross-checked after each dump at the level of the LBDS eXternal Post Operational Check (XPOC). This paper presents the experience gained during LHC Run 1 and describes improvements that will be applied during the 2013 – 2014 LHC shutdown.

Poster

MOPPC069

Operational Experience with the LHC Software Interlock System

Personnel Safety and Machine Protection

Laurette Ponce, Jorg Wenninger, Jakub Pawel Wozniak (CERN, Geneva)

The Software Interlock System (SIS) is a JAVA software project developed for the CERN accelerators complex. The core functionality of SIS is to provide a framework to program high level interlocks based on the surveillance of a large number of accelerator device parameters. The interlock results are exported to trigger beam dumps, inhibit beam transfers or abort the main magnets powering. Since its deployment in 2008, the LHC SIS has demonstrated that it is a reliable solution for complex interlocks involving multiple or distributed systems and when quick solutions for un-expected situations is needed. This paper is presenting the operational experience with software interlocking in the LHC machine, reporting on the overall performance and flexibility of the SIS, mentioning the risks when SW interlocks are used to patch missing functionalities for personal safety or machine protection.

Poster

MOPPC071

Development of the Machine Protection System for FERMILAB'S ASTA Facility

Personnel Safety and Machine Protection

Linden Ralph Carmichael, Richard Neswold, Arden Warner, Jin-Yuan Wu (Fermilab, Batavia)

The Fermilab Advance Superconducting Test Accelerator (ASTA) under development will be capable of delivering an electron beam with up to 3000 bunches per macro-pulse, 5Hz repetition rate and 1.5 GeV beam energy in the final phase. The completed machine will be capable of sustaining an average beam power of 72 KW at the bunch charge of 3.2 nC. A robust Machine Protection System (MPS) capable of interrupting the beam within a macro-pulse and that interfaces well with new and existing controls system infrastructure is being developed to mitigate and analyze faults related to this relatively high damage potential. This paper will describe the component layers of the MPS system, including a FPGA-based Laser Pulse Controller, the Beam Loss Monitoring system design and the controls and related work done to date.

Poster

MOPPC072

LCLS Hutch Protection System User Interface

Personnel Safety and Machine Protection

Alan Hill, Enzo Carrone, Matt Cyterski (SLAC, Menlo Park, California)

Following the initial commissioning of the LCLS Near Experimental Hall (NEH) Hutch Protection Systems, several design improvements were identified. These improvements include the addition of Mode Switching, allowing x-rays to be delivered through a shutter to terminate in more than one hutch. Configuration Controls for the x-ray beam lines were also added, allowing various configurations depending on the mode switch position. These changes identified a need for a higher level of user interface flexibility, not achievable using buttons and LED indicators: The hardwired interface was becoming insufficient to account for all the possible combinations of x-ray delivery. A touch panel PC was chosen to replace the existing interface with an EPICS interface. The touch panel communicates directly with a soft Input-Output Controller (IOC) which, then, routes status and control to the PLCs responsible for the hutches' safety interlocks. The touch panel does not provide safety functions, thus allowing modifications to the interface without interrupting the safety controller.

Poster

MOPPC073

Mobile Oxygen Deficiency Hazard Detection System

Personnel Safety and Machine Protection

Percy Harrell, Kelly Mahoney (JLAB, Newport News, Virginia)

Key Words: Oxygen Deficiency, ODH, Safety System, Wireless, Gas Monitoring, This paper describes the development and performance of a mobile wireless oxygen monitoring system developed at Jefferson Lab. The mobile system is deployed in areas where temporary coverage is needed such as in service buildings above open service penetrations and where new fixed monitoring is required but not yet installed. The mobile system is fully integrated with the fixed monitoring system to include central alarming and integration into the JLab EPICS display and archiver functions. Using reliable wireless industrial controls, the mobile system eliminates the need to maintain the infrastructure of dozens of rarely used fixed monitors and allows for rapid deployment when required. Performance of the mobile system includes a wireless range of over 300 meters, both local and central alarms, UPS backup, and quick connectivity. By going to a wireless mobile system, Jefferson Lab was able to redistribute the existing service building infrastructure to upgrade the tunnel ODH systems at minimal cost while still providing coverage for maintenance downs and the 12GeV upgrade project.

Poster

MOPPC074

Signal Processing Board for Beam Loss Monitor

Personnel Safety and Machine Protection

Jianxun Yan, Trent Allison (JLAB, Newport News, Virginia)

This paper describes a new VME based machine protection Beam Loss Monitor (BLM) signal processing board designed at Jefferson Lab which features high sensitivity, high resolution, and low cost per channel. This double-wide VME board provides eight-channel signal processing with each channel having linear, logarithmic, and integrating amplifiers that simultaneously provide the optimal signal processing for both machine protection and beam diagnostics. Amplified signals are independently sampled by 16-bit, fast ADCs and then further processed through a Field Programmable Gate Array (FPGA). It also has features of fast shutdown interface (FSD), beam sync interface, built-in-self-test, remotely controlled bias signals, and on-board memory buffer. The initial experimental test shows that the BLM board has fast response (<< 1us) for integrating and wide dynamic range from 10 nA to 1 mA (>50 dB) for logarithmic signals. The board is suitable for signal processing from photomultiplier (PMT) and ion chamber detectors.

Poster

MOPPC075

A Monte Carlo Simulation Approach to the Reliability Modeling of the Beam Permit System of Relativistic Heavy Ion Collider (RHIC) at BNL

Personnel Safety and Machine Protection

Prachi Chitnis, Thomas G Robertazzi (Stony Brook University, Stony Brook, New York), Kevin A. Brown (BNL, Upton, Long Island, New York)

The RHIC Beam Permit System (BPS) monitors the health of RHIC subsystems and takes active decisions regarding beam-abort and magnet power dump, upon a subsystem fault. The reliability of BPS directly impacts the RHIC downtime, and hence its availability. This work assesses the probability of BPS failures that could lead to substantial downtime. A fail-safe condition imparts downtime to restart the machine, while a failure to respond to an actual fault can cause potential machine damage and impose significant downtime. This paper illustrates a modular multistate reliability model of the BPS, with modules having exponential lifetime distributions. The model is based on the Competing Risks Theory with Crude Lifetimes, where multiple failure modes compete against each other to cause a final failure, and simultaneously influence each other. It is also dynamic in nature as the number of modules varies based on the fault trigger location. The model is implemented as a Monte Carlo simulation in Java, and analytically validated. The eRHIC BPS will be an extension of RHIC BPS. This analysis will facilitate building a knowledge base rendering intelligent decision support for eRHIC BPS design.

Poster

MOPPC076

Quantitative Fault Tree Analysis of the Beam Permit System Elements of Relativistic Heavy Ion Collider (RHIC) at BNL

Personnel Safety and Machine Protection

Prachi Chitnis, Thomas G Robertazzi (Stony Brook University, Stony Brook, New York), Kevin A. Brown, Charles Theisen (BNL, Upton, Long Island, New York)

The RHIC Beam Permit System (BPS) plays a key role in safeguarding against the anomalies developing in the collider during a run. The BPS collects RHIC subsystem statuses to allow the beam entry and its existence in the machine. The building block of BPS is the Permit Module (PM), which incorporates various electronic boards based on VME specification. This paper presents a quantitative Fault Tree Analysis (FTA) of the PM, analyzing its three top failures, namely a “False Beam Abort”, a “False Quench” and a “Blind” failure, yielding their failure rates. The FTA helps tracing down the top failure of the module to a component level failure (such as an IC or resistor). The fault trees are constructed for all PM variants and are probabilistically evaluated using an analytical solution approach. The component failure rates are calculated using manufacturer datasheets and MIL-HDBK-217F. The apportionment of failure modes for components is calculated using FMD-97. The aim of this work is to understand the importance of individual components of the RHIC BPS regarding its reliable operation, and evaluate their impact on the operation of BPS.

MOPPC077

Poster

Open Hardware Collaboration: A Way to Improve Efficiency for a Team

Project Management and Collaboration

Yves-Marie Abiven, Pascale Betinelli-Deck, Jerome Bisou, Frederic Blache, Guillaume Renaud, Shu Zhang (SOLEIL, Gif-sur-Yvette)

SOLEIL* is a third generation Synchrotron radiation source located near Paris in France. Today, the Storage Ring delivers photon beam to 26 beamlines. In order to improve the machine and beamlines performance, new electronics requirements are identified. For these improvements, up-to-date commercial products are preferred but sometimes custom hardware designs become essential. At SOLEIL, the electronic team (8 people) is in charge of design, implementation and maintenance of 2000 electronics installed for control and data acquisition. This large basement and small team mean there is only little time left to focus on the development of new hardware designs. As alternative, we focus our development on the open Hardware (OHWR) initiative from the CERN dedicated for electronics designers at experimental physics facilities to collaborate on hardware designs. We collaborate as an evaluator and a contributor. We share some boards in the project SPI BOARDS PACKAGE**, developed to face our current challenges. We evaluated TDC core project, and we plan to evaluate FMC carrier. We will present our approach on how to be more efficient with developments, issues to face and the benefit we get.

*: www.synchrotron-soleil.fr **: www.ohwr.org/projects/spi-board-package

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MOPPC078

Poster

TANGO Steps Toward Industry

Project Management and Collaboration

Andrew Gotz, Jean-Michel Chaize (ESRF, Grenoble), Alexandre Delorme (Gravit, Grenoble)

TANGO has proven its excellent reliability by controlling several huge scientific installations in a 24*7 mode. Even if it has originally been built for particle accelerators and scientific experiments, it can be used to control any equipment from small domestic applications to big industrial installations. In the last years the interest around TANGO has been growing and several industrial partners in Europe propose services for TANGO. The TANGO industrialization project aims to increase the visibility of the system fostering the economic activity around it. It promotes TANGO as an open-source flexible solution for controlling equipment as an alternative to proprietary SCADA systems. To achieve this goal several actions have been started, such as the development of an industrial demonstrator, better packaging, integrating OPC-UA and improving the communication around TANGO. The next step will be the creation of a TANGO software Foundation able to engage itself as a legal and economical partner for industry. This foundation will be funded by industrial partners, scientific institutes and grants. The goal is to foster and nurture the growing economic eco-system around TANGO.

Poster

MOPPC079

CODAC Core System, the I
TER Software Distribution for I&C

Project Management and Collaboration

Franck Di Maio, Lana Abadie, Changseung Kim, Kirti Mahajan, Denis Stepanov, Nadine Utzel (ITER Organization, St. Paul lez Durance)

In order to support the adoption of the ITER standards for the Instrumentation & Control (I&C) and to prepare for the integration of the plant systems I&C developed by many distributed suppliers, the ITER Organization is providing the I&C developers with a software distribution named CODAC Core System. This software has been released as incremental versions since 2010, starting from preliminary releases and with stable versions since 2012. It includes the operating system, the EPICS control framework and the tools required to develop and test the software for the controllers, central servers and operator terminals. Some components have been adopted from the EPICS community and adapted to the ITER needs, in collaboration with the other users. This is the case for the CODAC services for operation, such as operator HMI, alarms or archives. Other components have been developed specifically for the ITER project. This applies to the Self-Description Data configuration tools. This paper describes the current version (4.0) of the software as released in February 2013 with details on the components and on the process for its development, distribution and support.

Poster

MOPPC080

Controls for the new FAIR Accelerator Facility – Status and Development Strategies

Project Management and Collaboration

Ralph C. Baer, Dietrich Hans Beck, Christine Betz, Guenther Froehlich, Udo Krause, Matthias Thieme, Rosemarie Vincelli (GSI, Darmstadt)

After years of careful planning, construction works for the new international accelerator complex FAIR (Facility for Antiprotons and Ion Research) has seriously been started in 2012. The FAIR accelerators will extend the present GSI accelerator chain, then being used as injector, and provide anti-proton, ion, and rare isotope beams with unprecedented intensity and quality for a variety of research programs. For FAIR, a new accelerator control system is under development that addresses all aspects of the future functionality to operate the GSI/FAIR machines and moreover integrates the present GSI controls infrastructure. This presentation shortly summarizes the general status of the FAIR project and focuses on organization and project management aspects of the control system development. Major challenges following from being an international project, decisions and collaborative efforts taken in order to reduce development work, standardization efforts, and development methodologies and the engineering process will be reviewed.

Poster

MOPPC081

The Case of MTCA.4: Managing the Introduction of a New Modular Electronic Crate Standard at Large Scale Facilities and Beyond

Project Management and Collaboration

Thomas Walter, Frank Ludwig, Kay Rehlich, Holger Schlarb (DESY, Hamburg)

The demands on hardware for control and data acquisition at large-scale research organizations have increased considerably in recent years. In response, modular systems based on the new MTCA.4 standard, jointly developed by large Public Research Organizations and industrial electronics manufacturers, have pushed the boundary of system performance in terms of analog/digital data processing performance, remote management capabilities, timing stability, signal integrity, redundancy and maintainability. Whereas such public-private collaborations are not entirely new, novel instruments are in order to test the acceptance of the MTCA.4 standard beyond the physics community, identify gaps in the technology portfolio and align collaborative R&D programs accordingly. We describe the ongoing implementation of a time-limited validation project as means towards this end, highlight the challenges encountered so far and present solutions for a sustainable division of labor along the industry value chain.

Poster

MOPPC082

Automated Verification Environment for TwinCAT PLC Programs

Project Management and Collaboration

Andreas Beckmann (XFEL.EU, Hamburg)

The European XFEL will have three undulator systems SASE1, SASE2, and SASE3 to produce extremely brilliant, ultra-short pulses of x-rays with wavelengths down to 0.1 nm. The undulator gap is adjustable in order to vary photon beam energy. The corresponding motion control is implemented with industrial PCs running Beckhoff TwinCAT Programmable Logic Controllers (PLCs). So far, the functionality of the PLC programs has been verified on system level with the final hardware. This is a time-consuming manual task, but may also damage the hardware in case of severe program failures. To improve the verification process of PLC programs, a test environment with simulated hardware has been set up. It uses a virtual machine to run the PLC program together with a verification program that simulates the behavior of the hardware. Test execution and result checking is automated with the help of scripts, which communicate with the verification program to stimulate the PLC program. Thus, functional verification of PLC programs is reduced to running a set of scripts, without the need to connect to real hardware and without manual effort.

Poster

MOPPC083

Managing by Objectives a Research Infrastructure

Project Management and Collaboration

Roberto Pugliese (Elettra-Sincrotrone Trieste S.C.p.A., Basovizza)

Elettra (*) is a research center operating a research infrastrutcure with two light sources: a synchrotron radiation facility (Elettra) and a free electron laser (FERMI@Elettra). With the mission to promote cultural and socio economical growth of Italy and Europe through basic and applied research, technical and scientific training and technology transfer, few years ago it has adopted a balanced matrix organization. This paper describes the tools, techniques and practices we used to manage this change and the results obtained. We will describe the Virtual Unified Office (VUO) (**) based on the Project Management Institute (***) standards, that todays allow us to manage by objectives the whole research infrastructure and in particular, the integrated management of initiatives (projects, contracts, operating activities, staff commitments, skills, appointment letters and of the assessment procedures. We will also describe how the VUO integrates the various source of information to manage a set of company indicators and a balanced scorecard which allow us to execute the strategy.

(*) http://www.elettra.eu (**) http://vuo.elettra.trieste.it (***) http://www.pmi.org

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Poster

MOPPC084

ESS Integrated Control System and the Agile Methodology

Project Management and Collaboration

Miha Rescic (Cosylab, Ljubljana), Leandro Fernandez (ESS, Lund)

The stakeholders of the ESS Integrated Control System (ICS) reside in four parts of the ESS machine: accelerator, target, neutron instruments and conventional facilities. ICS plans to meet the stakeholders' needs early in the Construction phase, to accelerate and facilitate the Commissioning process by providing and delivering required tools earlier. This introduces the risk that stakeholders will not have had the full set of information required available early enough for the development of the interfacing systems (e.g. missing requirements, undecided design etc.) In order for ICS to accomplish its objectives it is needed to establish a development process that allows a quick adaptation to any change in the requirements with a minimum impact in the execution of the projects. Agile Methodology is well known for its ability to adapt quickly to change, as well as for involving users in the development process and producing working and reliable software from a very early stage in the project. The paper will present the plans, the tools, the organization of the team and the preliminary results of the setup work.

Poster

MOPPC085

Using Prince2 and ITIL Practices for Computing Projects and Service Management in a Scientific Installation

Project Management and Collaboration

David Fernandez-Carreiras (CELLS-ALBA Synchrotron, Cerdanyola del Vallès)

The conscientious project management during the installation is a key factor keeping the schedule and costs in specifications. Methodologies like Prince2 for project management or ITIL best practices for service management, supported by tools like Request Tracker, Redmine or Track, improve the communication between scientists and support groups, speed up the time to respond, and increase the satisfaction and quality perceived by the user. In the same way, during operation, some practices complemented with software tools, may increase substantially the quality of the service with the resources available. This paper describes the use of these processes and methodologies in a scientific installation such as the synchrotron Alba. It also evaluates the strengths and the risks associated to the implementation as well as the achievements and the failures, proposing some improvements.

Poster

MOPPC086

Manage the MAX IV Laboratory Control System as an Open Source Project

Project Management and Collaboration

Vincent Hardion, Julio Lidon-Simon, Mirjam Lindberg, Antonio Milan, Andreas Persson,
Darren Paul Spruce (MAX-lab, Lund)

Free Open Source Software (FOSS) is now deployed and used in most of the big facilities. It brings a lot of qualities that can compete with proprietary software like robustness, reliability and functionality. Arguably the most important quality that marks the DNA of FOSS is Transparency. This is the fundamental difference compared to its closed competitors and has a direct impact on how projects are managed. As users, reporters, contributors are more than welcome the project management has to have a clear strategy to promote exchange and to keep a community. The Control System teams have the chance to work on the same arena as their users and, even better, some of the users have programming skills. Unlike a fortress strategy, an open strategy may benefit from the situation to enhance the user experience. In this topic we will explain the position of the MaxIV KITS team. How "Tango install party" and "coding dojo" have been used to promote the contribution to the control system software and how our projects are structured in terms of process and tools (SARDANA, GIT...) to make them more accessible for inhouse collaboration as well as from other facilities or even subcontractors.

Poster

MOPPC087

Tools and Rules to Encourage Quality for C/C++ Software

Project Management and Collaboration

Wojciech Sliwinski, Vito Baggiolini, Jean-Claude Bau, Stephane Deghaye, Juan David Gonzalez Cobas, Jeremy Nguyen Xuan, Katarina Sigerud, Ilia Yastrebov (CERN, Geneva)

Inspired by the success of the software improvement process for Java projects, in place since several years in the CERN accelerator controls group, it was agreed in 2011 to apply the same principles to the C/C++ software developed in the group, an initiative we call the Software Improvement Process for C/C++ software (SIP4C/C++). The objectives of the SIP4C/C++ initiative are: 1) agree on and establish best software quality practices, 2) choose tools for quality and 3) integrate these tools in the build process. After a year we have reached a number of concrete results, thanks to the collaboration between several involved projects, including: common build tool (based on GNU Make), which standardizes the way to build, test and release C/C++ binaries; unit testing with Google Test & Google Mock; continuous integration of C/C++ products with the existing CI server (Atlassian Bamboo); static code analysis (Coverity); generation of manifest file with dependency information; and runtime in-process metrics. This work presents the SIP4C/C++ initiative in more detail, summarizing our experience and the future plans.

Poster

MOPPC088

Improving Code Quality of the Compact Muon Solenoid Electromagnetic Calorimeter Control Software to Increase System Maintainability

Project Management and Collaboration

Oliver Holme, Diogo Raphael da Silva Di Calafiori, Guenther Dissertori, Lubomir Djambazov, Werner Lustermann (ETH, Zurich), Serguei Zelepoukine (ETH, Zurich; UW-Madison/PD, Madison, Wisconsin)

The Detector Control System (DCS) software of the Electromagnetic Calorimeter (ECAL) of the Compact Muon Solenoid (CMS) experiment at CERN is designed primarily to enable safe and efficient operation of the detector during Large Hadron Collider (LHC) data-taking periods. Through a manual analysis of the code and the adoption of ConQAT*, a software quality assessment toolkit, the CMS ECAL DCS team has made significant progress in reducing complexity and improving code quality, with observable results in terms of a reduction in the effort dedicated to software maintenance. This paper explains the methodology followed, including the motivation to adopt ConQAT, the specific details of how this toolkit was used and the outcomes that have been achieved.

* ConQAT, https://www.conqat.org/

MOPPC090

Managing a Product Called NIF*

Project Management and Collaboration

Darwin Dobson, Al Churby, Ed Krieger, Leslie Ngo, Kevin Scott White (LLNL, Livermore, California)

Product lifecycle management (PLM) is the process of managing the entire lifecycle of a product from its conception, through design and manufacture, to service and disposal. The National Ignition Facility (NIF) can be considered one enormous product that is made up of hundreds of millions of individual parts and components (or products). The ability to manage and control the physical definition, status and configuration of the sum of all of these products is a monumental undertaking yet critical to the validity of the shot experiment data and the safe operation of the facility. NIF is meeting this challenge by utilizing an integrated and graded approach to implement a suite of commercial and custom enterprise software solutions to address PLM and other facility management and configuration requirements. It has enabled the passing of needed elements of product data into downstream enterprise solutions while at the same time minimizing data replication. Strategic benefits have been realized using this approach while validating the decision for an integrated approach where more than one solution may be required to address the entire product lifecycle management process.

MOPPC091

National Ignition Facility (NIF) PLM Landscape Evolution

Project Management and Collaboration

Al Churby, Darwin Dobson, Leslie Ngo (LLNL, Livermore, California)

Just as the NIF evolves through its various stages of life, so do the systems that support it. NIF's current PLM (Product Lifecycle Management) environment is at a point where there are tremendous opportunities to bring about some long-term improvements. The next generation of PLM will emphasize the following enhancements: Merging of fragmented systems,Connecting the extended enterprise,Easier to access single source of data,More modern/easier-to-use applications,Application consolidation,More cost-effective overall system,Sustainability. These advances will be made possible due to a number of factors including vendor software maturity and NIF's improved understanding of PLM. The scope of the new PLM environment will not be just NIF project specific, but will be institutional for LLNL as a whole. It will have the ability to go beyond its current configuration of just Engineering Design,Data Mgmt, and Change Mgmt to also include areas such as Requirements Mgmt, Components Mgmt, Business Reporting, Manufacturing Mgmt, Embedded Software Mgmt, etc.. We are laying a PLM foundation that will support continued growth not only for NIF,but for LLNL as a whole for many years to come.

Poster

MOPPC092

Commissioning the MedAustron Accelerator with ProShell

Project Status Reports

Roland Moser, Angela Brett, Ulrich Dorda, Mathias Eichinger, Markus Hager, Mindaugas Janulis, Jasna Junuzovic, Muhamed Junuzovic, Markus Marchhart, Hannes Pavetits, Cesar Torcato de Matos (CERN, Geneva; EBG MedAustron, Wr. Neustadt), Johannes Gutleber (CERN, Geneva)

MedAustron is a synchrotron based centre for light ion therapy under construction in Austria. The accelerator and its control system entered the on-site commissioning phase in January 2013. This contribution presents the current status of the accelerator operation and commissioning procedure framework called ProShell. It is used to model measurement procedures for commissioning and operation with Petri-Nets. Beam diagnostics device adapters are implemented in C#. To illustrate its use for beam commissioning, procedures currently in use are presented including their integration with existing devices such as ion source, power converters, slits, wire scanners and profile grid monitors. The beam spectrum procedure measures distribution of particles generated by the ion source. The phase space distribution procedure performs emittance measurement in beam transfer lines. The trajectory steering procedure measures the beam position in each part of the machine and aids in correcting the beam positions by integrating MAD-XX optics calculations. Additional procedures and (beam diagnostic) devices are defined, implemented and integrated with ProShell on demand as commissioning progresses.

Poster

MOPPC093

Sirius Control System: Conceptual Design

Project Status Reports

José Guilherme Ribas Sophia Franco, Marcelo Bacchetti, Bruno Valdrighi Luvizotto, Bruno Seiva Martins, Joao Paulo Scalao Martins, Patricia Henriques Nallin, Ricardo Rodrigues, Raul Pinheiro da Silva (LNLS, Campinas)

Sirius is a new 3 GeV synchrotron light source currently being designed at the Brazilian Synchrotron Light Laboratory (LNLS) in Campinas, Brazil. The Control System will be heavily distributed and digitally connected to all equipments in order to avoid analog signals cables. A three-layer control system is being planned. The equipment layer uses RS485 serial networks, running at 10Mbps, with a very light proprietary protocol, in order to achieve good performance. The middle layer, interconnecting these serial networks, is based on Single Board Computers, PCs and commercial switches. Operation layer will be composed of PC's running Control System's client programs. Special topology will be used for Fast Orbit Feedback with one 10Gbps switch between the beam position monitors electronics and a workstation for corrections calculation and orbit correctors. At the moment, EPICS is the best candidate to manage the Control System.

MOPPC094

Poster

ARIEL Control System at TRIUMF – Project Update

Project Status Reports

Rod Nussbaumer, Don Dale, David Morris, Kazuya Negishi, Juan Pon, Jane E Richards, Graham Waters, Priscilla Yogendran (TRIUMF, Vancouver)

The Advanced Rare Isotope & Electron Linac (ARIEL) facility at TRIUMF, scheduled for Phase 1 completion in 2014, will use a control system based on EPICS. Discrete subsystems within the accelerator, beamlines and conventional facilities have been clearly identified. Control system strategies for each identified subsystem have been developed, and components have been chosen to satisfy the unique requirements of each system. The ARIEL control system will encompass methodology already established in the TRIUMF ISAC & ISAC-II facilities in addition to adoption of a number of technologies previously unused at TRIUMF. The scope includes interface with other discrete subsystems such as cryogenics and power distribution, as well as complete subsystem controls packages.

MOPPC095

Poster

PETAL Control System Status Report

Project Status Reports

Cyril Present (CEA, LE BARP cedex)

The PETAL laser facility is a high energy multi-petawatt laser beam being installed in the Laser MegaJoule building facility. PETAL is designed to produce a laser beam at 3 kilojoules of energy for 0.5 picoseconds of duration. The autonomous commissioning began in 2013. In the long term, PETAL's Control System is to be integrated in the LMJ's Control System for a coupling with its 192 nanoseconds laser beams. The presentation gives an overview of the general control system architecture, and focuses on the use of TANGO framework in some of the subsystems software. Then the presentation explains the steps planned to develop the control system from the first laser shoots in autonomous exploitation to the merger in the LMJ's facility.

MOPPC096

Design and Implementation Aspects of the Control System at FHI FEL

Project Status Reports

Heinz Junkes, Wieland Schöllkopf, Mike Wesemann (FHI, Berlin), Ralph Lange (AES, Princeton, New Jersey; HZB, Berlin)

A new mid-infrared FEL has been commissioned at the Fritz-Haber-Institut in Berlin. It will be used for spectroscopic investigations of molecules, clusters, nanoparticles and surfaces. The oscillator FEL is operated with 15 - 50 MeV electrons from a normal-conducting S-band linac equipped with a gridded thermionic gun and a chicane for controlled bunch compression. Construction of the facility building with the accelerator vault began in April 2010. First lasing was observed on Februar 15th, 2012. * The EPICS software framework was chosen to build the control system for this facility. The industrial utility control system is integrated using BACnet/IP. Graphical operator and user interfaces are based on the Control System Studio package. The EPICS channel archiver, an electronic logbook, a web based monitoring tool, and a gateway complete the installation. This paper presents design and implementation aspects of the control system, its capabilities, and lessons learned during local and remote commissioning.

* W. Schöllkopf et al., FIRST LASING OF THE IR FEL AT THE FRITZ-HABER-INSTITUT, BERLIN, Conference FEL12

MOPPC097

The FAIR Control System - System Architecture and First Implementations

Project Status Reports

Ralf Huhmann, Ralph C. Baer, Dietrich Hans Beck, Jutta Fitzek, Guenther Froehlich, Ludwig Hechler, Udo Krause, Matthias Thieme (GSI, Darmstadt)

The paper presents the architecture of the FAIR control system currently under development. The FAIR control system comprises the full electronics, hardware and in particular software to control, commission, and operate the FAIR accelerator complex. It takes advantage of collaborations with CERN in using proven framework solutions like FESA, LSA, White Rabbit, etc. The components of the FAIR control system stack are categorized in layers. The equipment layer consists of equipment interfaces, embedded system controllers, and software representations of the equipment (FESA). A dedicated real time network based on White Rabbit is used to synchronize and trigger actions on equipment level. The middle layer provides service functionality both to the equipment layer and the application layer through the TCP/IP control system network. LSA is used for data setting generation. The application layer combines the applications for operators as GUI applications or command line tools typically written in Java. For validation of concepts already in 2014 FAIR's proton injector at CEA/France and CRYRING at GSI will be commissioned with limited implementations of the FAIR control system stack.

Poster

MOPPC098

The EPICS-based Accelerator Control System of the S-DALINAC

Project Status Reports

Christoph Burandt, Uwe Bonnes, Joachim Enders, Florian Hug, Martin Konrad, Norbert Pietralla, Thomas Schösser (TU Darmstadt, Darmstadt)

The S-DALINAC (Superconducting Darmstadt Linear Accelerator) is an electron accelerator for energies from 3 MeV up to 130 MeV. It supplies beams of either spin-polarized or unpolarized electrons for experiments in the field of nuclear structure physics and related areas of fundamental research. The migration of the Accelerator Control System to an EPICS-based system started three years ago and has essentially been done in parallel to regular operation. While it has not been finished yet it already pervades all the different aspects of the control system. The hardware is interfaced by EPICS Input/Output Controllers. User interfaces are designed with Control System Studio (CSS) and BOY (Best Operator Interface Yet). Latest activities are aimed at the completion of the migration of the beamline devices to EPICS. Furthermore, higher-level aspects can now be approached more intensely. This includes the introduction of efficient alarm-handling capabilities as well as making use of interconnections between formerly separated parts of the system. This contribution will outline the architecture of the S-DALINAC's Accelerator Control System and report about latest achievements in detail.

Poster

MOPPC099

The ANKA Control System: On a Path to the Future

Project Status Reports

Nigel John Smale, Edmund Hertle, Erhard Huttel, Wolfgang Mexner, Anke-Susanne Mueller (KIT, Karlsruhe), Sebastian Marsching (Aquenos GmbH, Baden-Baden), Igor Kriznar (Cosylab, Ljubljana)

The machine control system of the synchrotron radiation source ANKA at KIT (Karlsruhe Institute of Technology) is migrating from dedicated I/O microcontroller boards that utilise the LonWorks field bus and are visualised with the ACS Corba based control system to Ethernet TCP/IP devices with an EPICS server layer and visualisation by Control System Studio (CSS). This migration is driven by the need to replace ageing hardware, and in order to move away from the outdated microcontroller's embedded LonWorks bus. Approximately 500 physical devices, such as power supplies, vacuum pumps etc, will need to be replaced (or have their I/O hardware changed) and be integrated to the new EPICS/CSS control system. In this paper we report on the technology choices and discuss justifications of those choices, the progress of migration, and how such a task can be achieved in a transparent way with a fully user operational machine. We also report on the benefits reaped from using EPICS, CSS and BEAST alarming.

Poster

MOPPC100

SKA Monitioring and Control Progress Status

Project Status Reports

Yashwant Gupta, Yogesh Wadadekar (NCRA, Pune), Juan Carlos Guzman (CSIRO ATNF, Epping), Thierry Coiffard (GTD, Barcelona), Vivek Mohile (PSL, Pune), Alan Bridger (ROE, UTAC,), Lize Van den Heever (SKA South Africa, Cape Town), Swaminathan Natarajan, Subhrojyoti Roy Chaudhuri (TRDDC, Pune)

The Monitoring and Control system for the SKA radio telescope is now moving from the conceptual design to the system requirements and design phase, with the formation of a consortium geared towards delivering the Telescope Manager (TM) work package. Recent program decisions regarding hosting of the telescope across two sites, Australia and South Africa, have brought in new challenges from the TM design perspective. These include strategy to leverage the individual capabilities of autonomous telescopes, and also integrating the existing precursor telescopes (ASKAP and MeerKat) with heterogenous technologies and approaches into the SKA. A key design goal from the viewpoint of minimizing development and lifecycle costs is to have a uniform architectural approach across the telescopes, and to maximize standardization of software and instrumentation across the systems, despite potential variations in system hardware and procurement arrangements among the participating countries. This paper discusses some of these challenges, and their mitigation approaches that the consortium intends to work upon, along with an update on the current status and progress on the overall TM work.

Poster

MOPPC101

The Control Architecture of Large Scientific Facilities: ITER and LHC lessons for IFMIF

Project Status Reports

Alvaro Marqueta Barbero, Juan Knaster, Hiroshi Matsumoto, Koichi Nishiyama (IFMIF/EVEDA, Rokkasho), Markus Zerlauth (CERN, Geneva), Angel Ibarra (CIEMAT, Madrid), Antonio Vergara-Fernandez, Anders Wallander (ITER Organization, St. Paul lez Durance)

The development of an intense source of neutrons with the spectrum of DT fusion reactions is indispensable to qualify suitable materials for the First Wall of the nuclear vessel in fusion power plants. The FW, overlap of different layers, is essential in future reactors; they will convert the 14 MeV of neutrons to thermal energy and generate T to feed the DT reactions. IFMIF will reproduce those irradiation conditions with two parallel 40 MeV CW deuteron Linacs, at 2x125 mA beam current, colliding on a 25 mm thick Li screen flowing at 15 m/s and producing a n flux of 10^18 m2/s in 500 cm^3 volume with a broad peak energy at 14 MeV. The design of the control architecture of a large scientific facility is dependent on the particularities of the processes in place or the volume of data generated; but it is also tied to project management issues. LHC and ITER are two complex facilities, with ~10^6 process variables, with different control systems strategies, from the modular approach of CODAC, to the more integrated implementation of CERN Technical Network. This paper analyzes both solutions, and extracts conclusions that shall be applied to the future control architecture of IFMIF.

MOPPC103

Status of the RIKEN RI Beam Factory Control System

Project Status Reports

Misaki Komiyama, Nobuhisa Fukunishi, Akito Uchiyama, Masanori Wakasugi (RIKEN Nishina Center, Wako), Makoto Hamanaka, Makoto Nishimura (SHI Accelerator Service Ltd., Tokyo)

RIKEN Radioactive Isotope Beam Factory (RIBF) is a heavy-ion accelerator facility producing unstable nuclei and studying their properties. After the first beam extraction from Superconducting Ring Cyclotron (SRC), the final stage accelerator of RIBF, in 2006, several kinds of updates have been performed. We will here present two projects of large-scale experimental instrumentations to be introduced in RIBF that offer new type of experiments. One is an isochronous storage ring aiming at precise mass measurements of short-lived nuclei (Rare RI ring), and the other is construction of a new beam transport line dedicated to more effective generation of seaweed mutation induced by energetic heavy ions. In order to control them, the EPICS-based RIBF control system is now under upgrading. Each device used in new experimental instrumentations is controlled by the same kind of controllers as those existing, such as Programmable Logic Controllers (PLCs). On the other hand, we have first introduced Control System Studio (CSS) for operator interface. We plan to set up the CSS not only for new projects but also for the existing RIBF control system step by step.

MOPPC104

Developing Control System for SESAME Booster

Project Status Reports

Zia-ul-Haque Muhammad Qazi, Abdallah Ismail, Ibrahim Saleh (SESAME, Allan), Jean-François Gournay (CEA/DSM/IRFU,), Elder Matias (CLS, Saskatoon, Saskatchewan), Mark Heron (Diamond, Oxfordshire), Babak Kalantari (PSI, Villigen PSI), Amor Nadji (SESAME, Amman; SOLEIL, Gif-sur-Yvette), Pascale Betinelli-Deck (SOLEIL, Gif-sur-Yvette)

SESAME is a synchrotron light source under installation located in Allan, Jordan. It consists of 2.5 GeV storage-ring, a 800 MeV Booster-Synchrotron and a 22 MeV Microtron as Pre-Injector. SESAME succeeded to get the first beam from Microtron, the booster is expected to be commissioned by the end of 2013, the storage-ring by the end of 2015 and the first beamlines in 2016. This paper presents building of control systems of SEAME booster. EPICS is the main control-software tool and EDM for building GUIs which is being replaced by CSS. PLCs are used mainly for the interlocks in the vacuum system and power-supplies of the magnets, and in diagnostics for florescent screens and camera- switches. Soft IOCs are used for different serial devices (e.g. vacuum gauge controllers) through Moxa terminal servers and Booster power supplies through Ethernet connection. Libera Electron modules with EPICS tools (IOCs and GUIs) from Diamond Light Source are used for beam position monitoring. The timing System consists of one EVG and three EVR cards from Micro Research Finland (MRF). A distributed version control repository using Git is used at SESAME to track development of the control subsystems.

MOPPC105

100KW/100MeV Accelerator Control System

Project Status Reports

XiangCheng Kong, Yunlong Chi, Dapeng Jin, Qi Le (IHEP, Beijing), Shuhuan Sun (IHEP,), Xueting Wu (Wu, shijingshan)

100KW/100MeV Accelerator is a high-average-power accelerator constructed by IHEP, finally installed and running on KIPT(Kharkov,Ukraine). This paper introduces the control system of the accelerator based on EPICS, which is primarily composed by the following sections: the particular installation and configuration of the EPICS, the development of the device support, the control interface applications based on CSS, and the Qt-based control programs. At the end of the article, the application of the characteristic ARM+FPGA (CPLD)-Structure front-end IO would be introduced.   Environment configuration of the EPICS system: The latest 4-core commercial desktop HP-PC; Scientific Linux system of CERN6.3; EPICS base-3.14.11; ChannelArchiver-2.8.1; CSS-3.1.2 Qt4.7.   The devices are primarily selected with Ethernet-bus port and protocol. If no Ethernet interface, Ethernet-232/485 converters are responsible for the communication bridge, then bring that device to Ethernet. The first accelerator tube facility has passed the examinations and test in IHEP. As for control system, most of the units have gone through the local tests with the expected performance.

Poster

MOPPC106

Status Report of RAON Accelerator Control System

Project Status Reports

Soo Ryu, Dong-O Jeon, Jeong Han Lee (IBS, Daejeon)

RAON is a new heavy ion accelerator under construction in Korea, which is to produce variety of stable and rare isotope beams to support various researches of the basic science and applied research applications. To produce the isotopes to fulfill the requirements we adopted the seven modes of operation scheme which require fine-tuned synchronous controls, asynchronous controls, or both among the accelerator complexes. The basic idea and development progress for the control system as well as the future plans are presented.

MOPPC107

RF-Generators Control Tools For Kurchatov Synchrotron Radiation Sourse

Project Status Reports

Yury Krylov (RRC, Moscow), Yuriy Efimov, Yevgeniy Fomin, Evgeny Valeryevich Kaportsev, Dmitry Konyakhin, Kirill Moseev, Nikolai Moseiko, Alexander Vernov (NRC, Moscow)

Now the technology equipment of the Kurchatov Synchrotron Radiation Source (KSRS) is upgraded. At the same time, new equipment and software solutions for the control system are implemented. The KSRS main ring is the electron synchrotron with two 181 MHz RF-generators, their control system provides measurement of parameters of generation, regulation of tuning elements in wave guides and resonators, output of alarm messages. At the execution level the VME standard equipment is used. Server level is supported by Citect SCADA and the SQL historian server. The operator level of control system is implemented, as a PC local network. It allowed to expand number of measuring channels, to increase speed of processing and data transfers, to have on demand historical data with the big frequency of inquiry, and also to improve the accuracy of measurements. In article the control system structure by KSRS RF-generators, including the description of all levels of control is provided. Examples of implementation of the operator interface are given.

Poster

MOPPC108

Status of the NSLS-II Booster Control System

Project Status Reports

Sergey Evgenyevich Karnaev, Pavel Borisovich Cheblakov, Anton Anatolievich Derbenev, Ruslan Kadyrov, Stanislav S. Serednyakov, Evgeny Simonov (BINP SB RAS, Novosibirsk), Joseph De Long (BNL, Upton, Long Island, New York)

The booster control system is an integral part of the NSLS-II control system and is developed under EPICS. The booster control system includes six IBM Systems x3250 M3 and four VME3100 controllers connected via Gigabit Ethernet. These computers provide running IOCs for power supplies control, timing, beam diagnostics and interlocks. Also cPCI ADCs located in cPCI crate are used for beam diagnostics. Front-end electronics for vacuum control and interlocks are Allen-Bradley programmable logic controllers and I/O devices. Timing system is based on use of Micro-Research Finland Oy products: EVR 230RF and PMC EVR. Power supplies control use BNL developed set of a Power Supply Interface (PSI) which is located close to power supplies and a Power Supply Controller (PSC) which is connected to a front-end computer via 100 Mbit Ethernet. Each PSI is connected to its PSC via fiber-optic link. High Level Applications developed in Control System Studio and python run in Operator Consoles located in the Control Room. This paper describes the final design and status of the booster control system. The functional block diagrams are presented.

Poster

MOPPC109

Status of the MAX IV Laboratory Control System

Project Status Reports

Julio Lidon-Simon, Vincent Hardion, Andreas Persson, Darren Paul Spruce (MAX-lab, Lund)

The MAX IV Laboratory is a new synchrotron light source being built in Lund, south Sweden. The whole accelerater complex consists of a 3GeV 300m long full energy linac, two Storage Rings of 1.5GeV and 3GeV and a Short Pulse Facility for pump and probe experiments with bunches around 100fs long. First x-rays for the users is expected to be delivered in 2015 for the SPF and 2016 for the Storage Rings. This paper describes the progress in the design of the control system for the accelerator and the different solutions adopted for data acquisition, synchronisation, networking, safety and other aspects related to the control system

Poster

MOPPC110

The Control System for the CO2 Cooling Plants for Physics Experiments

Project Status Reports

Lukasz Zwalinski, Jerome Daguin, Jan Godlewski, Joao Noite, Maciej Ostrega, Steven Pavis, Paolo Petagna, Paola Tropea (CERN, Geneva), Bart Verlaat (CERN, Geneva; NIKHEF, Amsterdam)

CO2 cooling has become interesting technology for current and future tracking particle detectors. A key advantage of using CO2 as refrigerant is the high heat transfer capabilities allowing a significant material budget saving, which is a critical element in state of the art detector technologies. Several CO2 cooling stations, with cooling power ranging from 100W to several kW, have been developed at CERN to support detector testing for future LHC detector upgrades. Currently, two CO2 cooling plants for the ATLAS Pixel Insertable B-Layer and the Phase I Upgrade CMS Pixel detector are under construction. This paper describes the control system design and implementation using the UNICOS framework for the PLCs and SCADA. The control philosophy, safety and interlocking standard, user interfaces and additional features are presented. CO2 cooling is characterized by high operation stability and accurate evaporation temperature control over large distances. Implemented split range PID controllers with dynamically calculated limiters, multi-level interlocking and new software tools like CO2 online p-H diagram, jointly enable the cooling to fulfill the key requirements of reliable system.

MOPPC111

Poster

Overview of LINAC4 Beam Instrumentation Software for Beam Commissioning

Project Status Reports

Lars K. Jensen, Maxim Andersen, Stephane Bart Pedersen, Ana Guerrero, Michael Ludwig, Uli Raich, Federico Roncarolo (CERN, Geneva)

This paper presents an overview of results from the recent LINAC4 commissioning with H- beam at CERN. It will cover beam instrumentation systems acquiring beam position, intensity, size and emittance starting from the project proposal to commissioning results.

MOPPC112

Poster

Status and Perspectives of the SwissFEL Injector Test Facility Control System

Project Status Reports

Pavel Chevtsov, Helge Brands, Miroslaw Dach, Edwin Divall, Martin Heiniger, Markus Janousch, Guido Janser, Gaudenz Jud, Babak Kalantari, Roger Kalt, Boris Keil, Timo Korhonen, Renata Alica Krempaska, Dirk Zimoch, Elke Zimoch (PSI, Villigen PSI)

The Free Electron Laser (SwissFEL) Injector Test Facility at Paul Scherrer Institute has been in operations for more than three years. The Injector Test Facility machine is a valuable development and validation platform for all major SwissFEL subsystems including controls. Based on the experience gained from the Test Facility operations support, the paper presents the most perspective controls solutions for the future SwissFEL project.

Poster

MOPPC113

Development Status of the TPS Control System

Project Status Reports

Yung-Sen Cheng, Yin-Tao Chang, Jenny Chen, Pei-Chen Chiu, Kuo-Tung Hsu, San-Yuang Hsu, Kuo Hwa Hu, Changhor Kuo, Demi Lee, Chih-Yu Liao, Chii-Jung Wang, Chunyi Wu (NSRRC, Hsinchu)

The EPICS was chosen as control system framework for the new project of 3 GeV synchrotron light source (Taiwan Photon Source, TPS). The standard hardware and software components had been defined, and the various IOCs (Input Output Controller) are gradually implemented as various subsystems control platforms. The subsystems control interfaces include event based timing system, Ethernet based power supply control, corrector power supply control, PLC based pulse magnet power supply control and machine protection system, insertion devices motion control system, various diagnostics, and etc. Integration with the linear accelerator system which are installed and commissioned at the temporary site for acceptance test was done in 2011. Development of the infrastructure of high level and low level software are on-going. Installation and integration test are in proceeding. Progress will be summarized in the paper.

Poster

MOPPC114

Control System of X-ray Generator NESTOR

Project Status Reports

Andrey Yurij Zelinsky, Oleksandr Bezditko, Denis Korzhov, Vadim Lyashchenko, Andriy Mytsykov, Dmytro Vyacheslavovych Tarasov (NSC/KIPT, Kharkov)

X-ray generator on the base of Compton scattering is under commissioning in NSC KIPT, Kharkov, Ukraine. The main parts of the facility are 60 MeV electron linear accelerator injector, 40-200 MeV storage ring with complicate lattice and laser optical system. In the paper the main features and current status of the facility control system are presented.

MOPPC115

Control System of the NSC KIPT Neutron Source on the Base of Subcritical Assembly Driven with a Linear Accelerator

Project Status Reports

Andrey Yurij Zelinsky, Dmytro Vyacheslavovych Tarasov (NSC/KIPT, Kharkov), Yousry Gohar (ANL, Argonne), Vladislav Loginov (Affiliation Request Rejected,), Yunlong Chi, XiangCheng Kong (IHEP, Beijing)

In NSC KIPT, Kharkov, Ukraine the Neutron Source on the base of Subcritical Assembly driven with 100 MeV/ 100 kW electron linear accelerator is under design and development. The facility is hybrid nuclear-accelerator installation, that make special requirements to the control system content, architecture, logic of operation and interlocks. In the paper the mane control system project solutions and system current status are described.

MOPPC116

Evolution of Control System Standards on the Diamond Synchrotron Light Source

Project Status Reports

Mark Heron, Tom Cobb, Ronaldo Mercado, Nick Rees, Isa Servan Uzun, Kevin Wilkinson (Diamond, Oxfordshire)

Control system standards for the Diamond synchrotron light source were initially developed in 2003. They were largely based on Linux, EPICS and VME and were applied fairly consistently across the three accelerators and first twenty photon beamlines. With funding for further photon beamlines in 2011 the opportunity was taken to redefine the standards to be largely based on Linux, EPICS, PC's and Ethernet. The developments associated with this will be presented, together with solutions being developed for requirements that fall outside the standards.

MOPPC117

MaRIE Injector Test-Stand Instrumentation & Control System Conceptual Design

Project Status Reports

Martin Pieck, Dolores Baros, Eric Bjorklund, John A. Faucett, J. Douglas Gilpatrick, Jerome Dennis Paul, Fred E. Shelley (LANL, Los Alamos, New Mexico)

Los Alamos National Laboratory (LANL) has defined a signature science facility Matter-Radiation Interactions in Extremes (MaRIE) that builds on the existing Los Alamos Neutron Science Center (LANSCE) facility to provide unique experimental tools to develop next-generation materials that will perform predictably and on demand for currently unattainable lifetimes in extreme environments. At its core a new to be developed 50keV XFEL will be coupled with a MW class proton accelerator. While the larger MaRIE project is working on a pre-conceptual design a smaller LANL team is working on an injector test-stand to be constructed at LANL in the course of preparation for MaRIE. The test stand will consist of a photoinjector and an initial accelerating section driven by a single klystron. The goal of this facility will be to carry out studies that will determine optimal design parameters for the prototype injector, and to facilitate a direct demonstration of the required beam characteristics for MaRIE. This paper will give a brief overview of the proposed MaRIE facility and present the conceptual design for the injector test stand with the focus on the instrumentation and control system.

LA-UR-13-22237

Poster

MOPPC118

Development of EPICS Accelerator Control System for the IAC 44 MeV Linac

Project Status Reports

Anthony Andrews, Brian Berls, Trevor Lee Downer, Christopher Frank Eckman, Kevin Folkman, Alan Hunt, Mahbub Khandaker, Chad O'Neill, John Ralph (IAC, Pocatello, IDAHO), Yujong Kim (IAC, Pocatello, IDAHO; ISU, Pocatello, Idaho), Pikad Buaphad (ISU, Pocatello, Idaho)

The Idaho Accelerator Center (IAC) of Idaho State University (ISU) has been operating nine low energy accelerators. Since the beginning of the fall semester of 2012, the ISU Advanced Accelerator and Ultrafast Beam Lab (AAUL) group has been working to develop a new EPICS system to control 47 magnet power supplies for an IAC 44 MeV L-band linear accelerator. Its original control system was fully analog, which had several limitations to get good reproducibility and stability during the accelerator operation. This paper describes our group's team effort and accomplishment in developing a new EPICS system to control 15 Lambda EMS and 32 TDK-Lambda ZUP power supplies for the IAC L-band linear accelerator. In addition, we also describe several other useful tools such as the save and restore function.

Poster

MOPPC119

Development of an EPICS System to Control Oscilloscopes for the Idaho Accelerator Center

Project Status Reports

Trevor Lee Downer, Anthony Andrews, Christopher Frank Eckman, Kevin Folkman, Alan Hunt, Mahbub Khandaker, Chad O'Neill (IAC, Pocatello, IDAHO), Yujong Kim (IAC, Pocatello, IDAHO; ISU, Pocatello, Idaho; JLAB, Newport News, Virginia), Pikad Buaphad (ISU, Pocatello, Idaho)

The Idaho Accelerator Center (IAC) of Idaho State University (ISU) has been operating nine low energy accelerators. The ISU Advanced Accelerator and Ultrafast beam Lab (AAUL) group has recently been converting many of the analog control systems to digital computer based EPICS ones. To measure beam charge and beam position of those accelerators automatically, we have developed an EPICS control system for Tektronix TDS 3000 series oscilloscopes. In this paper, we describe our development of an EPICS control system for Tektronix TDS 3000 oscilloscopes, which are used at a 50 MeV S-band linac and a 16 MeV S-band linac at the IAC.

Poster

MOPPC120

Current Commissioning Status of Vacuum Control System in NSLS-II

Project Status Reports

Huijuan Xu, Hsiao-Chaun Hseuh, Susan Leng, Doug Zigrosser (BNL, Upton, Long Island, New York)

The National Synchrotron Light Source II (NSLS-II) is a state-of-the-art 3 Gev third generation light source currently under construction at Brookhaven National Laboratory. The 200 Mev Linac and Linac to Booster Transport line have been installed for Linac commissioning. The 3-Gev Booster Ring and the 3-GeV Storage Ring are undergoing installation and testing. The vacuum systems are monitored by vacuum gauges and ion pump current. The gate valves are operated through and controlled by programmable logic controllers using voting scheme. EPICS application codes provide the high level monitoring and control through the input-output controllers. This paper will discuss the commissioning status of the various aspects of vacuum control system.

MOPPC121

Control Systems Issues and Planning for eRHIC

Project Status Reports

Kevin A. Brown, Prachi Chitnis, Ted D'Ottavio, James Jamilkowski, Jonathan S. Laster, John Morris, Seth Nemesure, Charles Theisen (BNL, Upton, Long Island, New York)

The next generation of high-energy nuclear physics experiments involve colliding high-energy electrons with ions, as well as colliding polarized electrons with polarized protons and polarized helions (Helium-3 nuclei). The eRHIC project proposes to add an electron accelerator to the RHIC complex, thus allowing all of these types of experiments to be done by combining existing capabilities with high energy and high intensity electrons. In this paper we describe the controls systems requirements for eRHIC, the technical challenges, and our vision of a control system ten years into the future. What we build over the next ten years will be what is used for the ten years following the start of operations. This presents opportunities to take advantage of changes in technologies but also many challenges in building reliable and stable controls and integrating those controls with existing RHIC systems. This also presents an opportunity to leverage on state of the art innovations and build collaborations both with industry and other institutions, allowing us to build the best and most cost effective set of systems that will allow eRHIC to achieve its goals.

Poster

MOPPC122

EPICS Interface and Control of NSLS-II Residual Gas Analyzer System

Project Status Reports

Huijuan Xu, Hsiao-Chaun Hseuh, King Wilson, Doug Zigrosser (BNL, Upton, Long Island, New York), Marcelo Juni Ferreira (SLAC, Menlo Park)

Residual Gas Analyzers (RGAs) have been widely used in accelerator vacuum systems for monitoring and trouble-shooting, and play an important role in vacuum diagnostics. The National Synchrotron Light Source II (NSLS-II) vacuum system adopts Hiden RC-100 RGA which supports remote electronics, thus allowing real-time diagnostics with beam operation as well as archives and off-line analysis. This paper describes the interface and operation of these RGAs with EPICS based control system.

Poster

MOPPC123

Extending WinCC OA for Use as Accelerator Control System Core

Software Technology Evolution

Markus Marchhart, Angela Brett, Markus Hager, Mindaugas Janulis, Jasna Junuzovic, Muhamed Junuzovic, Roland Moser, Cesar Torcato de Matos (CERN, Geneva; EBG MedAustron, Wr. Neustadt), Johannes Gutleber (CERN, Geneva)

The accelerator control system for the MedAustron light-ion medical particle accelerator has been designed under the guidance of CERN in the scope of an EBG MedAustron/CERN collaboration agreement. The core is based on the SIMATIC WinCC OA SCADA tool. Its open API and modular architecture permitted CERN to extend the product with features that go beyond traditional supervisory control and that are vital for directly operating a particle accelerator. Several extensions have been introduced to make WinCC OA fit for accelerator control: (1) Near real-time data visualization, (2) external application launch and monitoring, (3) accelerator settings snapshot and consistent restore, (4) generic panel navigation supporting role based permission handling, (5) native integration with interactive 3D engineering visualization, (6) integration with National Instruments based front-end controllers. The major drawback identified is the lack of support of callbacks from C++ extensions. This prevents asynchronous functions, multithreaded implementations and soft real-time behaviour. We are therefore striving to search for support in the user community to trigger the implementation of this function.

Poster

MOPPC124

Optimizing EPICS for Multi-Core Architectures

Software Technology Evolution

Ralph Lange (HZB, Berlin; ITER Organization, St. Paul lez Durance), Franck Di Maio (ITER Organization, St. Paul lez Durance)

EPICS is a widely used software framework for real-time controls in large facilities, accelerators and telescopes. Its multithreaded IOC (Input Output Controller) Core software has been developed on traditional single-core CPUs. The ITER project will use modern multi-core CPUs, running the RHEL Linux operating system in its MRG-R real-time variant. An analysis of the thread handling in IOC Core shows different options for improving the performance and real-time behavior, which are discussed and evaluated. The implementation is split between improvements inside EPICS Base, which have been merged back into the main distribution, and a support module that makes full use of these new features. This paper describes design and implementation aspects, and presents results as well as lessons learned.

Poster

MOPPC125

HDB++: A New Archiving System for Tango

Software Technology Evolution

Lorenzo Pivetta, Claudio Scafuri (Elettra-Sincrotrone Trieste S.C.p.A., Basovizza), Jean-Michel Chaize, Jens Meyer (ESRF, Grenoble)

The new TANGO release 8 leads to several enhancements, including the adoption of the ZeroMQ library for faster and light weight event-driven communication. Exploiting these improved capabilities, a high performance, event-driven archiving system written in C++ is under development. It inherits the database structure from the existing TANGO Historical Data Base (HDB) and introduces a new storage architecture, better internal diagnostic capabilities and an optimized API. The paper describes the software design of the new HDB++ archiving system, the current state of the implementation and gives some preliminary performance figures.

Poster

MOPPC126

!CHAOS: the "Control Server" Framework for Controls

Software Technology Evolution

Luciano Catani (INFN-Roma II, Roma), Flaminio Antonucci, Claudio Bisegni, Andrea Capozzi, Giampiero Di Pirro, Luca Gennaro Foggetta, Francesco Iesu, Nicola Licheri, Giovanni Mazzitelli, Alessandro Stecchi (INFN/LNF, Frascati (Roma)), Matteo Mara (Istituto Nazionale di Fisica Nucleare, Frascati)

We report on the progress of !CHAOS*, a framework for the development of control and data acquisition services for particle accelerators and large experimental apparatuses. !CHAOS introduces to the world of controls a new approach for designing and implementing communications and data distribution among components and for providing the middle-layer services for a control system. Based on software technologies borrowed from high-performance Internet services !CHAOS offers by using a centralized, yet highly-scalable, cloud-like approach all the services needed for controlling and managing a large infrastructure. It includes a number of innovative features such as high abstraction of services, devices and data, easy and modular customization, extensive data caching for enhancing performances, integration of all services in a common framework. Since the !CHAOS conceptual design was presented two years ago the INFN group have been working on the implementations of services and components of the software framework. Most of them have been completed and tested for evaluating performance and reliability. Some services are already installed and operational in experimental facilities at LNF.

* "Introducing a new paradigm for accelerators and large experimental apparatus control systems", L. Catani et.al., Phys. Rev. ST Accel. Beams, http://prst-ab.aps.org/abstract/PRSTAB/v15/i11/e112804

Poster

MOPPC127

An OPC-UA Based Architecture for the Control of the ESPRESSO Spectrograph @ VLT

Software Technology Evolution

Roberto Cirami, Veronica Baldini, Igor Coretti, Stefano Cristiani, Paolo Di Marcantonio, Marco Mannetta, Paolo Santin (INAF-OAT, Trieste), Filippo Zerbi (INAF-Osservatorio Astronomico di Brera, Merate), Denis Mégevand (Université de Genève, Versoix)

ESPRESSO is a fiber-fed, cross-dispersed, high-resolution echelle spectrograph for the ESO Very Large Telescope (VLT). The instrument is designed to combine incoherently the light coming from up to 4 VLT Unit Telescopes. To ensure maximum stability the spectrograph is placed in a thermal enclosure and a vacuum vessel. Abandoning the VME-based technologies previously adopted for the ESO VLT instruments, the ESPRESSO control electronics has been developed around a new concept based on industrial COTS PLCs. This choice ensures a number of benefits like lower costs and less space and power consumption requirement. Moreover it makes possible to structure the whole control electronics in a distributed way using building blocks available commercially off-the-shelf and minimizing in this way the need for custom solutions. The main adopted PLC brand is Beckhoff, whose product lineup satisfies the requirements set by the instrument control functions. OPC-UA is the chosen communication protocol between the PLCs and the instrument control software, which is based on the VLT Control Software package.

Poster

MOPPC128

Real-Time Process Control on Multi-Core Processors

Software Technology Evolution

Miho Ishii, Yukito Furukawa, Takahiro Matsumoto (JASRI/SPring-8, Hyogo-ken)

A real-time control is an essential for a low level RF and timing system to have beam stability in the accelerator operation. It is difficult to optimize priority control of multiple processes with real-time class and time-sharing class on a single-core processor. For example, we can't log into the operating system if a real-time class process occupies the resource of a single-core processor. Recently multi-core processors have been utilized for equipment controls. We studied the process control of multiple processes running on multi-core processors. After several tunings, we confirmed that an operating system could run stably under heavy load on multi-core processors. It would be possible to achieve real-time control required milliseconds order response under the fast control system such as an event synchronized data acquisition system. Additionally we measured the response performance between client and server processes using MADOCA II framework that is the next-generation MADOCA. In this paper we present about the tunings for real-time process control on multi-core processors and performance results of MADOCA II.

MOPPC129

MADOCA II Interface for LabVIEW

Software Technology Evolution

Yukito Furukawa, Takahiro Fujita, Miho Ishii, Takahiro Matsumoto (JASRI/SPring-8, Hyogo-ken)

LabVIEW is widely used for experimental station control in SPring-8. LabVIEW is also partially used for accelerator control, while most software of the SPring-8 accelerator and beamline control are built on MADOCA control framework. As synchrotron radiation experiments advances, there is requirement of complex data exchange between MADOCA and LabVIEW control systems which was not realized. We have developed next generation MADOCA called MADOCA II, as reported in this ICALEPCS (T.Matsumoto et.al.). We ported MADOCA II framework to Windows and we developed MADOCA II interface for LabVIEW. Using the interface, variable length data can be exchanged between MADOCA and LabVIEW based softwares. As a first application, we developed a readout system for an electron beam position monitor with NI's PCI-5922 digitizers. A client software sends a message to a remote LabVIEW based digitizer readout software via the MADOCA II midlleware and the readout system sends back waveform data to the client. We plan to apply the interface various accelerator and synchrotron radiation experiment controls.

Poster

MOPPC130

A New Message-Based Data Acquisition System for Accelerator Control

Software Technology Evolution

Akihiro Yamashita, Masahiro Kago (JASRI/SPring-8, Hyogo-ken)

The data logging system for SPring-8 accelerator complex has been operating for 16 years as a part of MADOCA system. Collector processes periodically request distributed computers to collect sets of data by synchronous ONC-RPC protocol at fixed cycles. On the other hand, we also developed another MyDAQ system for casual or temporary data acquisition. A data acquisition process running on a local computer pushes one BSD socket stream into a server at random time. Its "one stream per one signal" strategy made data management simple while the system has no scalability. We developed a new data acquisition system which has super-MADOCA scale and MyDAQ's simplicity for new generation accelerator project. The new system based on ZeroMQ messaging library and MessagePack serialization library has high availability, asynchronous messaging, flexibility in data expression and scalability. The input/output plug-ins accept multi protocols and send data to various data systems. This paper describes design, implementation, performance, reliability and deployment of the system.

MOPPC131

Experience of Virtual Machines in J-PARC MR Control

Software Technology Evolution

Norihiko Kamikubota, Shuei Yamada, Noboru Yamamoto (J-PARC, KEK & JAEA, Ibaraki-ken), Hiroyuki Nemoto (ACMOS INC., Tokai-mura, Ibaraki), Kenichi Sato (JAEA/J-PARC, Tokai-Mura, Naka-Gun, Ibaraki-Ken), Takao Iitsuka, Shigenobu Motohashi, Susumu Yoshida (Kanto Information Service (KIS), Accelerator Group, Ibaraki), Daisuke Takahashi (Mitsubishi Electric System & Service Co., Ltd, Tsukuba)

At the J-PARC Main Ring (MR), we have used virtual-machine environment extensively in our accelerator control. In 2011, we developed a virtual-IOC, an EPICS In/Out Controller running on a virtual machine [1]. Now in 2013, about 20 virtual-IOCs are used in daily MR operation. In the summer of 2012, we updated our operating system from Scientific Linux 4 (SL4) to Scientific Linux 6 (SL6). In the SL6, KVM virtual-machine environment is supported as a default service. This fact encouraged us to port basic control services (ldap, dhcp, tftp, rdb, achiver, etc.) to multiple virtual machines. Each virtual machine has one service. Virtual machines are running on a few (not many) physical machines. This scheme enables easier maintenance of control services than before. In this paper, our experiences using virtual machines during J-PARC MR operation will be reported.

[1] VIRTUAL IO CONTROLLERS AT J-PARC MR USING XEN, N.Kamikubota et. al., ICALEPCS 2011

MOPPC132

Evaluating Live Migration Performance of a KVM-Based EPICS

Software Technology Evolution

Lei Hu, Xu Jun, Jiajie Li, YaLi Liu (IHEP, Beijing), Jian Zhuang (IHEP, Beijing; IHEP, Bejing; State Key laboratory of Particle Detection and Electronics of China, Beijing), Yuanping Chu, Dapeng Jin (IHEP, Beijing; State Key laboratory of Particle Detection and Electronics of China, Beijing), Libin Ding (IHEP, Bejing)

In this paper we present some results about live migration performance evaluation of a KVM-Based EPICS on PC.About PC,we care about the performance of storage,network and CPU.EPICS is a control system. we make a demo control system for evaluation, and it is lightweight. For time measurement, we set a monitor PV, and the PV can automatics change its value at regular time intervals.Data Browser can display the values of ‘live’ PVs and can measure the time. In the end, we get the evaluation value of live migration time using Data Browser.

MOPPC133

Performance Improvement of KSTAR Networks for Long Distance Collaborations

Software Technology Evolution

Jinseop Park, Ali Kashif Bashir, Dosub Lee, Sangil Lee, Tae Gu Lee (NFRI, Daejon), Buseung Cho (KISTI, Daejeon)

KSTAR (Korea Superconducting Tokamak Advanced Research) has completed its 5th campaign. Every year, it produces enormous amount of data that need to be forwarded to international collaborators shot by shot for run-time analysis. Analysis of one shot helps in deciding parameters for next shot. Many shots are conducted in a day, therefore, this communication need to be very efficient. Moreover, amount of KSTAR data and number of international collaborators are increasing every year. In presence of big data and various collaborators exists in all over the world, communicating at run-time will be a challenge. To meet this challenge, we need efficient ways of communications to transfer data that exists in HDF5 file format and snapshots of servers. Therefore, in this paper, we will optimize paths among internal and external networks of KSTAR for efficient communication. We will also discuss transmission and remote access solutions for environment construction and evaluate performance for long distance collaborations.

Jinseop Park *, Sangil Lee*, Taegu Lee*, Ali Kashif Bashir* and Dosub Lee* Buseung Cho** *National Fusion Research Institute **Korea Institute of Science and Technology Information

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MOPPC134

EPICS Real Time Processing on GNU/Linux with Xenomai Support

Software Technology Evolution

Hinko Kocevar, Ales Bardorfer (I-Tech, Solkan), Primoz Lemut (COBIK, Solkan)

This article describes processing of the EPICS data in a deterministic manner using GNU/Linux with Xenomai RT support. Mainline Linux kernel does not guarantee real time responses, this can be achieved by patching the the kernel code. EPICS utilizes CA (Channel Access) protocol to distribute the data (process variables) between the EPICS IOCs. Deterministic reaction on the PV value changes over the TCP/IP network was desired in our case. The system sets the gain according to the value obtained in a EPICS PV, at a rate of 50 Hz. GNU/Linux kernel version 2.6 was used. To achieve the real time performance the source was patched with ipipe/Adeos support found in Xenomai 2.6.0 framework. Minor modification of the existing user space software was needed to utilize the POSIX skin that Xenomai provides. The system is capable of real-time processing of an EPICS PV value change at a moderately high rates (> 50 Hz) over the non-deterministic TCP/IP network medium.

MOPPC135

Upgrading ALBA to Tango8, Offline Testing and Continuous Integration

Software Technology Evolution

Sergi Rubio-Manrique, David Fernandez-Carreiras, Jorg Klora [on leave], Zbigniew Reszela, Tomasz Rogucki [on leave] (CELLS-ALBA Synchrotron, Cerdanyola del Vallès), Tiago Coutinho, Emmanuel Taurel (ESRF, Grenoble)

The 3Gev ALBA Synchrotron* located in Barcelona, Spain, was inaugurated in 2010 and its 7 beamlines are already open to science. In 2013 all Tango control systems in ALBA accelerators and beamlines are being upgraded to Tango 8**. This new release introduces significant changes in the Tango event system in which ALBA experiments control framework, Sardana***, heavily relies. A Continuous Integration and Testing platform has been implemented to test 475 Tango classes and client packages for our 320 control hosts; verifying all dependencies prior to deployment. The dinamicity of Python and PyTango**** has been used to capture and emulate the behavior of running systems; enabling virtual testing of software that otherwise would have required a hardware platform to be tested. This paper describes the upgrade process and the testing platform developed to perform the upgrade, reporting what worked well and what will need improvement for OS upgrades scheduled in 2014.

* www.cells.es ** www.tango-controls.org *** www.sardana-controls.org **** S.Rubio et al. "Dynamic Attributes and Other Functional Flexibilities of PyTango", Icalepcs 2009, Kobe, Japan

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MOPPC137

IEC 61850 Industrial Communication Standards under Test

Software Technology Evolution

Filippo Maria Tilaro, Brice Copy (CERN, Geneva)

IEC 61850, as part of the International Electro-technical Commission's Technical Committee 57, defines an international and standardized methodology to design electric power automation substations. It specifies a common way of communicating and integrating heterogeneous systems based on multivendor intelligent electronic devices (IEDs). They are connected to Ethernet network and according to IEC 61850 their abstract data models have been mapped to specific communication protocols: MMS, GOOSE, SV and possibly in the future Web Services. All of them can run over TCP/IP networks, so they can be easily integrated with Enterprise Resource Planning networks; while this integration provides economical and functional benefits for the companies, on the other hand it exposes the industrial infrastructure to the external existing cyber-attacks. Within the Openlab collaboration between CERN and Siemens, a test-bench has been developed specifically to evaluate the robustness of industrial equipment (TRoIE). This paper describes the design and the implementation of the testing framework focusing on the IEC 61850 previously mentioned protocols implementations.

Poster

MOPPC138

Continuous Integration for Automated Code Generation Tools

Software Technology Evolution

Ivan Prieto Barreiro, William Booth, Brice Copy (CERN, Geneva)

The UNICOS* (UNified Industrial COntrol System) framework was created back in 1998 as a solution to build object-based industry-like control systems. The Continuous Process Control package (CPC**) is a UNICOS component that provides a methodology and a set of tools to design and implement industrial control applications. UAB** (UNICOS Application Builder) is the software factory used to develop UNICOS-CPC applications. The constant evolution of the CPC component brought the necessity of creating a new tool to validate the generated applications and to verify that the modifications introduced in the software tools do not create any undesirable effect on the existing control applications. The uab-maven-plugin is a plug-in for the Apache Maven build manager that can be used to trigger the generation of the CPC applications and verify the consistency of the generated code. This plug-in can be integrated in continuous integration tools - like Hudson or Jenkins – to create jobs for constant monitoring of changes in the software that will trigger a new generation of all the applications located in the source code management.

* "UNICOS a framework to build industry like control systems: Principles & Methodology". ** "UNICOS CPC6: Automated code generation for process control applications".

Poster

MOPPC139

A Framework for Off-line Verification of Beam Instrumentation Systems at CERN

Software Technology Evolution

Stephen Jackson (CERN, Geneva)

Many beam instrumentation systems require checks to confirm their beam readiness, detect any deterioration in performance and to identify physical problems or anomalies. Such tests have already been developed for several LHC instruments using the LHC sequencer task framework, but the scope of this framework doesn't extend to all systems; notably absent in the pre-LHC injector chain. Furthermore, the operator-centric nature of the LHC sequencer means that sequencer tasks aren't accessible by hardware and software experts who are required to execute similar tests on a regular basis. As a consequence, ad-hoc solutions involving modularisation, code sharing and in extreme cases code duplication have evolved to satisfy the various use-cases. In terms of long term maintenance, this is undesirable due to the often short-term nature of developers at CERN alongside the importance of uninterrupted stability of CERN's accelerators. This paper will outline proposals for a new framework which will allow the sharing of a developer's code-base between existing frameworks, making specific references to the LHC sequencer framework and the Beam Instrumentation group's Expert GUI framework.

Poster

MOPPC140

High-Availability Monitoring and Big Data: Using Java Clustering and Caching Technologies to Meet Complex Monitoring Scenarios

Software Technology Evolution

Matthias Bräger, Mark Brightwell, Emmanouil Koufakis, Robin Martini, Anna Suwalska (CERN, Geneva)

Monitoring and control solutions face ever more demanding requirements: as both data sets and data rates continue to increase, non-functional requirements such as performance, availability and maintainability are equally in-demand. C2MON is a monitoring platform developed at CERN over the past few years. Making use of modern Java caching and clustering technologies, the platform supports multiple deployment architectures, from a simple 3-tier system to highly complex clustered solutions. In this paper we consider various monitoring scenarios and how the C2MON deployment strategy can be adapted to meet them.

Poster

MOPPC141

The Ultimate Linux I/O Framework

Software Technology Evolution

Alessandro Rubini, Simone Nellaga (University of Pavia, Pavia), Juan David Gonzalez Cobas, Tomasz Wlostowski (CERN, Geneva), Federico Vaga (GNUDD, Pavia)

ZIO (with Z standing for "The Ultimate I/O" Framework) was developed for CERN with the specific needs of physics labs in mind, which are poorly addressed in the mainstream Linux kernel. ZIO provides a framework for industrial, high-throughput, high-channel count I/O device drivers (digitizers, function generators, timing devices like TDCs) with performance, generality and scalability as design goals. Among its many features, it offers abstractions for - input and output channels, and channel sets - configurable trigger types - configurable buffer types - interface via sysfs attributes, control and data device nodes - a socket interface (PF_ZIO) which provides enormous flexibility and power for remote control In this paper, we discuss the design and implementation of ZIO, and describe representative cases of driver development for typical and exotic applications (FMC ADC 100Msps digitizer, FMC TDC timestamp counter, FMC DEL fine delay).

Poster

MOPPC142

Building a Groovy-Based Domain-Specific Language (DSL) in Software Interlock System (SIS)

Software Technology Evolution

Jakub Pawel Wozniak, Mateusz Polnik (CERN, Geneva)

The SIS, in operation since over 7 years, is a mission-critical component of the CERN accelerator control system, covering areas from general machine protection to diagnostics. The growing number of instances and the size of the existing installations have increased both the complexity and maintenance cost of running the SIS infrastructure. Also the domain experts have considered the XML and Java mixture for configuration as difficult and suitable only for software engineers. To address these issues, new ways of configuring the system have been investigated aiming at simplifying the process by making it faster, more user-friendly and adapted for a wider audience. From all the existing DSL choices (fluent Java APIs, external/internal DSLs), the Groovy scripting language has been considered as being particularly well suited for writing a custom DSL due to its built-in language features: Java compatibility, native syntax constructs, command chain expressions, hierarchical structures with builders, closures or AST transformations. This paper explains best practices and lessons learned while building the accelerators domain-oriented DSL for the configuration of the interlock system.

Poster

MOPPC143

Plug-in Based Analysis Framework for LHC Post-Mortem Analysis

Software Technology Evolution

Roman Gorbonosov, Vito Baggiolini, Markus Zerlauth (CERN, Geneva)

Plug-in based software architectures are extensible, enforce modularity and allow several teams to work in parallel. But they have certain technical and organizational challenges, which we discuss in this paper. We gained our experience when developing the Post-Mortem Analysis (PMA) system, which is a mission-critical system for the Large Hadron Collider (LHC). We used a plugin-based architecture with a general-purpose analysis engine, for which physicists and equipment experts code plug-ins containing the analysis algorithms. We have over 45 analysis plug-ins developed by a dozen of domain experts. This paper focuses on the design challenges we faced in order to mitigate the risks of executing third-party code: assurance that even a badly written plug-in doesn't perturb the work of the overall application; plug-in execution control which allows to detect plug-in misbehavior and react; robust communication mechanism between plug-ins, diagnostics facilitation in case of plug-in failure; testing of the plug-ins before integration into the application, etc.

https://espace.cern.ch/be-dep/CO/DA/Services/Post-Mortem%20Analysis.aspx

Poster

MOPPC144

Continuous Integration Using LabVIEW, SVN and Hudson

Software Technology Evolution

Odd Oyvind Andreassen, Alfiya Tarasenko (CERN, Geneva)

In the accelerator domain there is a need of integrating industrial devices and creating control and monitoring applications in an easy and yet structured way. The LabVIEW-RADE framework provides the method and tools to implement these requirements and also provides the essential integration of these applications into the CERN controls infrastructure. Building and distributing these core libraries for multiple platforms, e.g.Windows, Linux and Mac, and for different versions of LabVIEW, is a time consuming task that consist of repetitive and cumbersome work. All libraries have to be tested, commissioned and validated. Preparing one package for each variation takes almost a week to complete. With the introduction of Subversion version control (SVN) and Hudson continuous integration server (HCI) the process is now fully automated and a new distribution for all platforms is available within the hour. In this paper we are evaluating the pros and cons of using continuous integration, the time it took to get up and running and the added benefits. We conclude with an evaluation of the framework and indicate new areas of improvement and extension.

Poster

MOPPC145

Mass-Accessible Controls Data for Web Consumers

Software Technology Evolution

Brice Copy, Odd Oyvind Andreassen, Mirjam Labrenz, Rafal Piotr Niesler, Adriaan Rijllart (CERN, Geneva)

The past few years in computing have seen the emergence of smart mobile devices, sporting multi-core embedded processors, powerful graphical processing units, and pervasive high-speed network connections (supported by WIFI or EDGE/UMTS). The relatively limited capacity of these devices requires relying on dedicated embedded operating systems (such as Android, or iOS), while their diverse form factors (from mobile phone screens to large tablet screens) require the adoption of programming techniques and technologies that are both resource-efficient and standards-based for better platform independence. We will consider what are the available options for hybrid desktop / mobile web development today, from native software development kits (Android, iOS) to platform-independent solutions (mobile Google Web toolkit [3], JQuery mobile, Apache Cordova[4], Opensocial). Through the authors' successive attempts at implementing a range of solutions for LHC-related data broadcasting, from data acquisition systems, LHC middleware such as DIP and CMW, on to the World Wide Web, we will investigate what are the valid choices to make and what pitfalls to avoid in today's web development landscape.

Poster

MOPPC146

MATLAB Objects for EPICS Channel Access

Software Technology Evolution

Jan Chrin (PSI, Villigen PSI)

With the substantial dependence on MATLAB for application development at the SwissFEL Injector Test Facility, the requirement for a robust and extensive EPICS Channel Access (CA) interface became increasingly imperative. To this effect, a new MATLAB Executable (Mex) file has been developed around an in-house C++ CA interface library (CAFE), which serves to expose comprehensive CA functionality to within the MATLAB framework. Immediate benefits include support for all MATLAB data types, a rich set of synchronous and asynchronous methods, a further physics oriented abstraction layer that uses CA synchronous groups, and compilation on 64-bit architectures. An account of the mocha (Matlab Objects for CHannel Access) interface is presented.

Poster

MOPPC147

Controls Algorithm Development and Testing for the IFC-1210 Controller at the Paul Scherrer Institute

Software Technology Evolution

Timo Korhonen, Trivan Pal (PSI, Villigen PSI)

The Large Research Facilities Department at the Paul Scherrer Institute (PSI), comprising the Controls group, has developed, with industry a VME64x, FPGA-centric, single board computer (IFC), for the control requirements and data challenges of the forthcoming SwissFEL facility as well as an upgrade for other PSI accelerator facilities. In our configuration, the IFC will run EPICS control system on the PowerPC. In this paper we concentrate on the workflow consisting of developing applications using MATLAB/SIMULINK tools, and generating c code, for the IFC. The c code generation uses the code generation utilities in the aforementioned Mathworks suite. Our emphasis, at present, has been to develop an adequate sequence for rapid prototyping, in terms of procedures, maintainability and code reusability. Likewise, to quantify the procedure of benchmarking typical components for applications, in terms of performance (principally execution time and accuracy). The categories of components include convolution integrals, fast fourier transforms, trigonometric functions and data filtering algorithms. We report on (preliminary) results concerning our experience and outlook for the future.

MOPPC148

Not Dead Yet: Recent Enhancements and Future Plans for EPICS Version 3

Software Technology Evolution

Andrew Nicholas Johnson, Janet Barbara Anderson (ANL, Argonne), Michael Davidsaver (BNL, Upton, New York), Ralph Lange (HZB, Berlin)

The EPICS Version 4 development effort* is not planning to replace the current Version 3 IOC Database or its use of the Channel Access network protocol in the near future. Interoperability is a key aim of the V4 development, which is building upon the older IOC implementation. EPICS V3 continues to gain new features and functionality on its Version 3.15 development branch, while the Version 3.14 stable branch has been accumulating minor tweaks, bug fixes, and support for new and updated operating systems. This paper describes the main enhancements provided by recent and upcoming releases of EPICS Version 3 for control system applications.

* Korhonen et al, "EPICS Version 4 Progress Report", this conference.

Poster

MOPPC149

A Messaging-Based Data Access Layer for Client Applications

Software Technology Evolution

James Patrick (Fermilab, Batavia)

The Fermilab Accelerator Control system has recently integrated use of a publish/subscribe infrastructure as a means of communication between Java client applications and data acquisition middleware. This supercedes a previous implementation based on Java Remote Method Invocation (RMI). The RMI implementation had issues with network firewalls, misbehaving client applications affecting the middleware, lack of portability to other platforms, and cumbersome authentication. The new system uses the AMQP messaging protocol and RabbitMQ data brokers. This decouples the client and middleware, is more portable to other languages, and has proven to be much more reliable. A Java client library provides for single synchronous operations as well as periodic data subscriptions. This new system is now used by the general synoptic display manager application as well as a number of new custom applications. Also a web service has been written that provides easy access to control system data from many languages.

MOPPC150

Channel Access in Erlang

Software Technology Evolution

Dennis J. Nicklaus (Fermilab, Batavia)

We have developed an Erlang language implementation of the Channel Access protocol. Included are low-level functions for encoding and decoding Channel Access protocol network packets as well as higher level functions for monitoring or setting EPICS Process Variables. This provides access to EPICS process variables for the Fermilab Acnet control system via our Erlang-based front-end architecture without having to interface to C/C++ programs and libraries. Erlang is a functional programming language originally developed for real-time telecommunications applications. Its network programming features and list management functions make it particularly well-suited for the task of managing multiple Channel Access circuits and PV monitors.

MOPPC151

PyDDS: a New Real-Time High-Performance Data-Driven Python Middleware

Software Technology Evolution

Svetlana Shasharina, Nanbor Wang (Tech-X, Boulder, Colorado)

The Data Distribution Service is an Object Management Group standard for real-time high-performance middleware, which aims to deliver data-driven communication suitable for the mission-critical defense and aerospace applications. Several implementations of DDS provide bindings in Java, C and C++. PyDDS is the DDS implementation that allows developing data-distribution applications using a friendly Python API. This extends DDS's benefits to multiple scientific areas taking advantage of Python data analysis tools and Python's quick prototyping abilities enabling design new generation control and DAQ systems. In this presentation we describe the goals, design and status of PyDDS and show examples of its use.

Poster

MOPPC152

Accelerator Lattice and Model Services

Software Technology Evolution

Chungming Paul Chu (FRIB, East Lansing, Michigan), Guobao Shen (BNL, Upton, Long Island, New York), Fengqin Guo, Huihui Lv, ChunHong Wang, Zhuo Zhao (IHEP, Beijing)

Physics model based beam tuning applications are essential for complex accelerators. Traditionally, such applications acquire lattice data directly from a persistent data source and then carry out model computation within the applications. However, this approach often suffers from poor performance and modeling tool limitation. A better architecture is to offload heavy database query and model computation from the application instances. A database has been designed for hosting lattice and physics modeling data while a set of web based services then provide lattice and model data for the beam tuning applications to consume. Preliminary lattice and model services are based on standard J2EE Glassfish platform with MySQL database as backend data storage. Such lattice and model services can greatly improve the performance and reliability of physics applications.

Poster

MOPPC155

NSLS II Middlelayer Services

Software Technology Evolution

Guobao Shen (BNL, Upton, Long Island, New York)

A service oriented architecture has been designed for NSLS II project for its beam commissioning and daily operation. Middle layer services have been actively developing, and some of them have been deployed into NSLS II control network to support our beam commissioning. The services are majorly based on 2 technologies, which are web-service/RESTful and EPICS V4 respectively. The services provides functions to take machine status snapshot, convert magnet setting between different unit system, or serve lattice information and simulation results. This paper presents the latest status of services development at NSLS II project, and our future development plan.

Poster

MOPPC156

Virtual Accelerator at NSLS II Project

Software Technology Evolution

Guobao Shen (BNL, Upton, Long Island, New York)

A virtual accelerator has been developed at NSLS II to support tools development from physics study and beam commissioning to beam operation. The physics results are provided using Tracy simulation code thru EPICS process variables, which was implemented originally by Diamond Light Source. The latest virtual accelerator supports all major accelerator components including all magnets (Dipole, Quadrupole, Sextuple), RF cavity, insertion device, and other diagnostics devices (BPM for example), and works properly for both linear machine and synchrotron ring. Two error mechanisms are implemented, which are random error for each magnet setting, and systematic error to simulate misalignment. Meanwhile, it also provides sort of online model functions including serving beta function, and close orbit data. In NSLS II, there are 5 virtual accelerators deployed, and 3 of them are running simultaneously. Those virtual accelerators have been effectively supporting the tools development such as physics applications, and other services such as Channel Finder. This paper presents the latest status of virtual accelerator, and our plan for its future development and deployment.

Poster

MOPPC157

Application of Transparent Proxy Servers in Control Systems

Software Technology Evolution

Bartosz Frak, Ted D'Ottavio, Margaret Harvey, James Jamilkowski, John Morris (BNL, Upton, Long Island, New York)

Proxy servers (Proxies) have been a staple of the World Wide Web infrastructure since its humble beginning. They provide a number of valuable functional services like access control, caching or logging. Historically, controls system have had little need for full fledged proxied systems as direct, unimpeded resource access is almost always preferable. This still holds true today, however unbound direct asset access can lead to performance issues, especially on older, underpowered systems. This paper describes an implementation of a fully transparent proxy server used to moderate asynchronous data flow between selected front end computers (FECs) and their clients as well as infrastructure changes required to accommodate this new platform. Finally it ventures into the future by examining additional untapped benefits of proxied control systems like write-through caching and runtime read-write modifications.

MOPPC158

Poster

Application of Modern Programming Techniques in Existing Control System Software

Software Technology Evolution

Bartosz Frak, Ted D'Ottavio, Wenge Fu, Seth Nemesure (BNL, Upton, Long Island, New York)

Accelerator Device Object (ADO) specification and its original implementation are almost 20 years old. In those last two decades ADO development methodology has changed very little, which is a testament to its robust design, however during this time frame we've seen introduction of many new technologies and ideas, many of which with applicable and tangible benefits to control system software. This paper describes how some of these concepts like convention over configuration, aspect oriented programming (AOP) paradigm, which coupled with powerful techniques like bytecode generation and manipulation tools can greatly simplify both server and client side development by allowing developers to concentrate on the core implementation details without polluting their code with: 1) synchronization blocks 2) supplementary validation 3) asynchronous communication calls or 4) redundant bootstrapping. In addition to streamlining existing fundamental development methods we introduce additional concepts, many of which are found outside of the majority of the controls systems. These include 1) ACID transactions 2) client and servers-side dependency injection and 3) declarative event handling.

MOMIB01

Mini Oral with Poster

Sirius Control System: Conceptual Design

Project Status Reports

José Guilherme Ribas Sophia Franco, Marcelo Bacchetti, Bruno Valdrighi Luvizotto, Bruno Seiva Martins, Joao Paulo Scalao Martins, Patricia Henriques Nallin, Ricardo Rodrigues, Raul Pinheiro da Silva (LNLS, Campinas)

Sirius is a new 3 GeV synchrotron light source currently being designed at the Brazilian Synchrotron Light Laboratory (LNLS) in Campinas, Brazil. The Control System will be heavily distributed and digitally connected to all equipments in order to avoid analog signals cables. A three-layer control system is being planned. The equipment layer uses RS485 serial networks, running at 10Mbps, with a very light proprietary protocol, in order to achieve good performance. The middle layer, interconnecting these serial networks, is based on Single Board Computers, PCs and commercial switches. Operation layer will be composed of PC's running Control System's client programs. Special topology will be used for Fast Orbit Feedback with one 10Gbps switch between the beam position monitors electronics and a workstation for corrections calculation and orbit correctors. At the moment, EPICS is the best candidate to manage the Control System.

MOMIB02

Development Status of the TPS Control System

Project Status Reports

Yung-Sen Cheng, Yin-Tao Chang, Jenny Chen, Pei-Chen Chiu, Kuo-Tung Hsu, San-Yuang Hsu, Kuo Hwa Hu, Changhor Kuo, Demi Lee, Chih-Yu Liao, Chii-Jung Wang, Chunyi Wu (NSRRC, Hsinchu)

The EPICS was chosen as control system framework for the new project of 3 GeV synchrotron light source (Taiwan Photon Source, TPS). The standard hardware and software components had been defined, and the various IOCs (Input Output Controller) are gradually implemented as various subsystems control platforms. The subsystems control interfaces include event based timing system, Ethernet based power supply control, corrector power supply control, PLC based pulse magnet power supply control and machine protection system, insertion devices motion control system, various diagnostics, and etc. Integration with the linear accelerator system which are installed and commissioned at the temporary site for acceptance test was done in 2011. Development of the infrastructure of high level and low level software are on-going. Installation and integration test are in proceeding. Progress will be summarized in the paper.

MOMIB03

Mini Oral with Poster

Control Systems Issues and Planning for eRHIC

Project Status Reports

Kevin A. Brown, Prachi Chitnis, Ted D'Ottavio, James Jamilkowski, Jonathan S. Laster, John Morris, Seth Nemesure, Charles Theisen (BNL, Upton, Long Island, New York)

The next generation of high-energy nuclear physics experiments involve colliding high-energy electrons with ions, as well as colliding polarized electrons with polarized protons and polarized helions (Helium-3 nuclei). The eRHIC project proposes to add an electron accelerator to the RHIC complex, thus allowing all of these types of experiments to be done by combining existing capabilities with high energy and high intensity electrons. In this paper we describe the controls systems requirements for eRHIC, the technical challenges, and our vision of a control system ten years into the future. What we build over the next ten years will be what is used for the ten years following the start of operations. This presents opportunities to take advantage of changes in technologies but also many challenges in building reliable and stable controls and integrating those controls with existing RHIC systems. This also presents an opportunity to leverage on state of the art innovations and build collaborations both with industry and other institutions, allowing us to build the best and most cost effective set of systems that will allow eRHIC to achieve its goals.

MOMIB04

A Semi-Automated, Formal Method to Integrate Accelerator Devices in the MedAustron Control System

Integrating Complex or Diverse Systems

Jasna Junuzovic, Angela Brett, Markus Marchhart, Roland Moser, Hannes Pavetits (EBG MedAustron, Wr. Neustadt), Johannes Gutleber, Markus Hager, Muhamed Junuzovic, Cesar Torcato de Matos (CERN, Geneva)

It is good practice to integrate accelerator front-end devices into the control system via a formal, model driven design mechanism. Several frameworks (FESA, EPICS, Tango) implement such a scheme. Devices are described by their interfaces and glue code is programmed to plug the device into the control system via some standardized communication protocol. The approach is affected by two limitations: first, the specification is framework specific, locking the project into a specific tool and second, behavioral descriptions may not be captured. Sometimes a device component may only be virtual, representing a collection of different basic fronted devices. Such higher-level components are vital for the creation of automated commissioning and operation procedures. We at CERN have developed a formal scheme that is accompanied by device-specific documents in human readable form and a defined integration process that takes into consideration also aspects that cannot be fully covered by an automated integration approach. This scheme has successfully been applied in the development of the MedAustron project, a synchrotron built for hadron therapy under the guidance of CERN.

MOMIB05

BeagleBone for Embedded Control System Applications

Integrating Complex or Diverse Systems

Stefano Cleva, Lorenzo Pivetta, Paolo Sigalotti (Elettra-Sincrotrone Trieste S.C.p.A., Basovizza)

The control system architecture of modern experimental physics facilities needs to meet the requirements of the ever increasing complexity of the controlled devices. Whenever feasible, moving from a distributed architecture based on powerful but complex and expensive computers to an even more pervasive approach based on simple and cheap embedded systems, allows shifting the knowledge close to the devices. The BeagleBone computer, being capable of running a full featured operating system such as GNU/Linux, integrates effectively into the existing control systems and allows executing complex control functions with the required flexibility. The paper discusses the choice of the BeagleBone as embedded platform and reports some examples of control applications recently developed for the ELETTRA and FERMI@Elettra light sources.

MOMIB06

Personnel Protection of the CERN SPS North Hall in Fixed Target Primary Ion Mode

Personnel Safety and Machine Protection

Timo Hakulinen, Jerome Axensalva, Frederic Havart, Steve Hutchins, Lars K. Jensen, Django Manglunki, Pierre Ninin, Patrick Odier, Stephane Reignier, James Ridewood, Lars Soby, Christian Theis, Francesco Valentini, Didier Vaxelaire, Helmut Vincke (CERN, Geneva)

While CERN's Super Proton Synchrotron (SPS) is able to deliver both secondary proton and primary ion beams to fixed targets in the North Area, the experimental areas (North Hall) are widely accessible during beam. In ion mode all normal safety elements involved in producing secondary beams are removed, so that an accidental extraction of a high-intensity proton beam into the North Hall would expose personnel present there to a radiation hazard. This has required an injector reconfiguration restricting operation to either ions or protons. However, demands for operational flexibility of CERN accelerators have led to a need to mix within the same SPS super-cycle both high-intensity proton cycles for LHC or HiRadMat and ion cycles for the North Area. We present an active interlock designed to mitigate this hazard: Beam Current Transformers are used to measure the level of beam intensity, and if above a set threshold, pulsing of the extraction septa is vetoed. The safety function is implemented by means of two logically equivalent but diverse and separate interlock chains. This interlock is expected to be in place once the SPS resumes operation after the first Long Shutdown in 2014.

MOMIB07

An OPC-UA Based Architecture for the Control of the ESPRESSO Spectrograph @ VLT

Software Technology Evolution

Roberto Cirami, Veronica Baldini, Igor Coretti, Stefano Cristiani, Paolo Di Marcantonio, Marco Mannetta, Paolo Santin (INAF-OAT, Trieste), Filippo Zerbi (INAF-Osservatorio Astronomico di Brera, Merate), Denis Mégevand (Université de Genève, Versoix)

ESPRESSO is a fiber-fed, cross-dispersed, high-resolution echelle spectrograph for the ESO Very Large Telescope (VLT). The instrument is designed to combine incoherently the light coming from up to 4 VLT Unit Telescopes. To ensure maximum stability the spectrograph is placed in a thermal enclosure and a vacuum vessel. Abandoning the VME-based technologies previously adopted for the ESO VLT instruments, the ESPRESSO control electronics has been developed around a new concept based on industrial COTS PLCs. This choice ensures a number of benefits like lower costs and less space and power consumption requirement. Moreover it makes possible to structure the whole control electronics in a distributed way using building blocks available commercially off-the-shelf and minimizing in this way the need for custom solutions. The main adopted PLC brand is Beckhoff, whose product lineup satisfies the requirements set by the instrument control functions. OPC-UA is the chosen communication protocol between the PLCs and the instrument control software, which is based on the VLT Control Software package.

MOMIB08

Continuous Integration Using LabVIEW, SVN and Hudson

Software Technology Evolution

Odd Oyvind Andreassen, Alfiya Tarasenko (CERN, Geneva)

In the accelerator domain there is a need of integrating industrial devices and creating control and monitoring applications in an easy and yet structured way. The LabVIEW-RADE framework provides the method and tools to implement these requirements and also provides the essential integration of these applications into the CERN controls infrastructure. Building and distributing these core libraries for multiple platforms, e.g.Windows, Linux and Mac, and for different versions of LabVIEW, is a time consuming task that consist of repetitive and cumbersome work. All libraries have to be tested, commissioned and validated. Preparing one package for each variation takes almost a week to complete. With the introduction of Subversion version control (SVN) and Hudson continuous integration server (HCI) the process is now fully automated and a new distribution for all platforms is available within the hour. In this paper we are evaluating the pros and cons of using continuous integration, the time it took to get up and running and the added benefits. We conclude with an evaluation of the framework and indicate new areas of improvement and extension.

Mini Oral with Poster

MOMIB09

ZIO: The Ultimate Linux I/O Framework

Software Technology Evolution

Alessandro Rubini, Simone Nellaga (University of Pavia, Pavia), Juan David Gonzalez Cobas, Tomasz Wlostowski (CERN, Geneva), Federico Vaga (GNUDD, Pavia)

ZIO (with Z standing for “The Ultimate I/O” Framework) was developed for CERN with the specific needs of physics labs in mind, which are poorly addressed in the mainstream Linux kernel. ZIO provides a framework for industrial, high-throughput, high-channel count I/O device drivers (digitizers, function generators, timing devices like TDCs) with performance, generality and scalability as design goals. Among its many features, it offers abstractions for - input and output channels, and channel sets - configurable trigger types - configurable buffer types - interface via sysfs attributes, control and data device nodes - a socket interface (PF_ZIO) which provides enormous flexibility and power for remote control In this paper, we discuss the design and implementation of ZIO, and describe representative cases of driver development for typical and exotic applications (FMC ADC 100Msps digitizer, FMC TDC timestamp counter, FMC DEL fine delay).

TUKAB01

The NIF: an International User Facility for High Energy Density and Inertial Fusion Science

Keynote

Edward Moses (LLNL, Livermore, California)

The National Ignition Facility (NIF), operational since March 2009, is transitioning to an international user facility for high-energy-density science (HEDS) and inertial confinement fusion (ICF) research. The NIF, the world's largest and most energetic laser facility consists of 192 Nd-glass lasers, a control room and a target chamber. NIF is the first laser system built to demonstrate thermonuclear burn of deuterium-tritium–filled ICF capsules. NIF's high-powered, high-energy lasers can compress and heat material to produce unique states of matter and radiation environments in the laboratory—conditions of interest to HEDS supporting national security and fundamental science. Achieving ignition on NIF will also demonstrate the target physics basis of ICF for energy production. The NIF laser's unprecedented power, precision, and reproducibility, coupled with sophisticated target and diagnostic capabilities, are enabling leading edge experiments in the study of matter at extreme temperatures and pressures—conditions that exists in planetary interiors. This paper describes NIF's unprecedented current and future capabilities and the experimental results achieved so far.

Contributed Oral

TUCOAAB01

Status of the National Ignition Facility Integrated Computer Control and Information Systems*

Project Status Reports

Lawrence Lagin, Gordon Brunton, Drew Casavant, Allan Casey, Robert Demaret, John Fisher, Barry Fishler, Arthur Peter Ludwigsen, Christopher David Marshall, Robert Reed, Randy Shelton, Suzanna Townsend (LLNL, Livermore, California)

The National Ignition Facility (NIF) is operated by the Integrated Computer Control System in an object-oriented, CORBA-based system distributed among over 1800 front-end processors, embedded controllers and supervisory servers. At present, NIF operates 24x7 and conducts a variety of fusion, high energy density and basic science experiments. During the past year, the control system was expanded to include a variety of new diagnostic systems, and programmable laser beam shaping and parallel shot automation for more efficient shot operations. The system is also currently being expanded with an Advanced Radiographic Capability, which will provide short (<10 picoseconds) ultra-high power (>1 Petawatt) laser pulses that will be used for a variety of diagnostic and experimental capabilities. Additional tools have been developed to support experimental planning, experimental setup, facility configuration and post shot analysis, using open-source software, commercial workflow tools, database and messaging technologies. This talk discusses the current status of the control and information systems to support a wide variety of experiments being conducted on NIF including ignition experiments.

TUCOAAB02

Contributed Oral

The Laser Megajoule Facility: Control System Status Report

Project Status Reports

Jean Paul Arnoul (CEA, LE BARP cedex), Joel Irenee Nicoloso (CEA/DAM/DIF, Arpajon)

The French Commissariat à l'Énergie Atomique (CEA) is currently building the Laser Megajoule (LMJ), a 176-beam laser facility, at the CEA Laboratory CESTA near Bordeaux. It is designed to deliver about 1.4 MJ of energy to targets for high energy density physics experiments, including fusion experiments. The assembly of the first lines of amplification is almost achieved and functional tests are planed for next year. The first part of the presentation is a photo album of the progress of the assembly of the bundles in the four laser bay, and the equipements in the target bay. The second part of the presentation illustrates a particularity of the LMJ commissioning: a secondary control room is dedicated to successive bundles commissioning, while the main control room allows shots and fusion experiments with already commissioned bundles

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TUCOAAB03

Contributed Oral

Approaching Final Design of ITER Control System

Project Status Reports

Anders Wallander, Lana Abadie, Franck Di Maio, Bruno Evrard, Carlos Fernandez Robles, Juan Luis Fernandez-Hernando, Jean-Marc Fourneron, Jean-Yves Journeaux, Changseung Kim, Kirti Mahajan, Petri Makijarvi, Sopan Pande, Mikyung Park, Vishnukumar Patel, Pierre Petitbas, Nicholas Pons, Antoni Simelio, Stefan Simrock, Denis Stepanov, Nadine Utzel, Antonio Vergara-Fernandez, Axel Winter, Izuru Yonekawa (ITER Organization, St. Paul lez Durance)

The control system of ITER (CODAC) is subject to a final design review early 2014, with a second final design review covering high-level applications scheduled for 2015. The system architecture has been established and all plant systems required for first plasma have been identified. Interfaces are being detailed, which is a key activity to prepare for integration. A built to print design of the network infrastructure covering the full site is in place and installation is expected to start next year. The common software deployed in the local plant systems as well as the central system, called CODAC Core System and based on EPICS, has reached maturity providing most of the required functions. It is currently used by 55 organizations throughout the world involved in the development of plant systems and ITER controls. The first plant systems are expected to arrive on site in 2015 starting a five-year integration phase to prepare for first plasma operation. In this paper, we report on the progress made on ITER control system over the last two years and outline the plans and strategies allowing us to integrate hundreds of plant systems procured in-kind by the seven ITER members.

TUCOAAB04

The MedAustron Accelerator Control System: Design, Installation and Commissioning

Project Status Reports

Johannes Gutleber (CERN, Geneva), Roland Moser [on leave] (CERN, Geneva; EBG MedAustron, Wr. Neustadt)

MedAustron is a light-ion accelerator cancer treatment facility built on the green field in Austria. The accelerator, its control systemand protection systems have been designed under the guidance of CERN within the MedAustron – CERN collaboration. Building construction has been completed in October 2012 and accelerator installation has started in December 2012. Readiness for accelerator control deployment was reached in January 2013. This contribution gives an overview of the accelerator control system project. It reports on the current status of commissioning including the ion sources, low-energy beam transfer and injector. The major challenge so far has been the readiness of the industry supplied IT infrastructure on which accelerator controls relies heavily due to its distributed and virtualized architecture. After all, the control system has been successfully released for accelerator commissioning within time and budget. The need to deliver a highly performant control system to cope with thousands of cycles in real-time, to cover interactive commissioning and unattended medical operation were mere technical aspects to be solved during the development phase.

Contributed Oral

TUCOBAB01

A Small but Efficient Collaboration for the Spiral2 Control System Development

Project Management and Collaboration

Eric Lecorche, Cyrille Berthe, Frederic Bucaille, Pascal Gillette, Christophe Haquin, Evelyne Lemaitre, Jean-Marie Loyant, Guillaume Normand, Charles Henry Patard, Laurent Philippe, Jean-François Roze, Dominique Touchard, Arnaud Trudel (GANIL, Caen), Jean Francois Denis, Francoise Gougnaud, Jean-François Gournay, Yves Lussignol, Arnaud Roger, Robert Touzery (CEA/DSM/IRFU,), Philippe Graehling, Jerome Hosselet, Chaker Maazouzi (IPHC, Strasbourg Cedex 2)

The Spiral2 radioactive ion beam facility to be commissioned in 2014 at Ganil (Caen) is built within international collaborations. This also concerns the control system development shared by three laboratories: Ganil has to coordinate the control and automated systems work packages, CEA/IRFU is in charge of the “injector” (sources and low energy beam lines) and the LLRF, CNRS/IPHC provides the emittancemeters and a beam diagnostics platform. Besides the technology Epics based, this collaboration, although being handled with a few people, nevertheless requires an appropriate and tight organization to reach the objectives given by the project. This contribution describes how, started in 2006, the collaboration for controls has been managed both from the technological point of view and the organizational one, taking into account not only the previous experience, technical background or skill of each partner, but also their existing working practices and “cultural” approaches. A first feedback comes from successful beam tests carried out at Saclay and Grenoble; a next challenge is the migration to operation, Ganil having to run Spiral2 as the other members are moving to new projects.

TUCOBAB02

The Mantid Project: Notes from an International Software Collaboration

Project Management and Collaboration

Nicholas James Draper (Tessella, Abingdon)

The Mantid project was started by ISIS in 2007 to provide a framework to perform data reduction and analysis for neutron and muon data. The SNS and HFIR joined the Mantid project in 2009 adding event processing and other capabilities to the Mantid framework. The Mantid software is now supporting the data reduction needs of most of the instruments at ISIS, the SNS and some at HFIR, and is being evaluated by other facilities. The scope of data reduction and analysis challenges, together with the need to create a cross platform solution, fuels the need for Mantid to be developed in collaboration between facilities. Mantid has from inception been an open source project, built to be flexible enough to be instrument and technique independent, and initially planned to support collaboration with other development teams. Through the collaboration with the SNS development practices and tools have been further developed to support the distributed development team in this challenge. This talk will describe the building and structure of the collaboration, the stumbling blocks we have overcome, and the great steps we have made in building a solid collaboration between these facilities.

Mantid project website: www.mantidproject.org ISIS: http://www.isis.stfc.ac.uk/ SNS & HFIR: http://neutrons.ornl.gov/

Contributed Oral

TUCOBAB03

Utilizing Atlassian JIRA for Large-Scale Software Development Management*

Project Management and Collaboration

John Fisher, Dan Koning, Arthur Peter Ludwigsen (LLNL, Livermore, California)

Used actively by the National Ignition Facility since 2004, the JIRA issue tracking system from Atlassian is now used for 63 different projects. NIF software developers and customers have created over 80,000 requests (issues) for new features and bug fixes. The largest NIF software project in JIRA is the Integrated Computer Control system (ICCS), with nearly 40,000 issues. In this paper, we'll discuss how JIRA has been customized to meet our software development process. ICCS developed a custom workflow in JIRA for tracking code reviews, recording test results by both developers and a dedicated Quality Control team, and managing the product release process. JIRA's advanced customization capability have proven to be a great help in tracking key metrics about the ICCS development efforts (e.g. developer workload). ICCS developers store software in a configuration management tool called AccuRev, and document all software changes in each JIRA issue. Specialized tools developed by the NIF Configuration Management team analyze each software product release, insuring that each software product release contains only the exact expected changes.

TUCOBAB04

Evaluation of Issue Tracking and Project Management Tools for Use Across All CSIRO Radio Telescope Facilities

Project Management and Collaboration

Juan Carlos Guzman (CSIRO ATNF, Epping)

CSIRO's radio astronomy observatories are collectively known as the Australia Telescope National Facility (ATNF). The observatories include the 64-metre dish at Parkes, the Australia Telescope Compact Array (ATCA) in Narrabri, the Mopra 22-metre dish near Coonabarabran and the ASKAP telescope located in Western Australia and in early stages of commissioning. In January 2013 a new group named Software and Computing has been formed. This group, part of the ATNF Operations Program brings all the software development expertise under one umbrella and it is responsible for the development and maintenance of the software for all ATNF facilities, from monitoring and control to science data processing and archiving. One of the first task of the new group is to start homogenising the way software development is done across all observatories. This paper presents the results of the evaluation of several issue tracking and project management tools, including Redmine and JIRA to be used as a software development management tool across all ATNF facilities. It also describes how these tools can potentially be used for non-software type of applications such as fault reporting and tracking system.

Contributed Oral

TUCOBAB05

A Rational Approach to Control System Development Projects That Incorporates Risk Management

Project Management and Collaboration

Elder Matias (CLS, Saskatoon, Saskatchewan)

Over the past year CLS has migrated towards a project management approach based on the Project Management Institute (PMI) guidelines as well as adopting an Enterprise Risk Management (ERM) program. Though these are broader organisational initiatives they do impact how controls systems and data acquisition software activities and planned, executed and integrated into larger scale projects. Synchrotron beamline development and accelerator upgrade projects have their own special considerations that require adaptation of the more standard techniques that are used. Our ERM processes integrate in two ways: (1) in helping to identify and prioritising those projects that we should be undertaking and (2) in helping identify risks that are internal to the project. These broader programs are resulting in us revising and improving processes we have in place for control and data acquisition system development and maintenance. This paper examines the approach we have adopted, our preliminary experience and our plans going forward.

TUMIB01

Using Prince2 and ITIL Practices for Computing Projects and Service Management in a Scientific Installation

Project Management and Collaboration

David Fernandez-Carreiras (CELLS-ALBA Synchrotron, Cerdanyola del Vallès)

The conscientious project management during the installation is a key factor keeping the schedule and costs in specifications. Methodologies like Prince2 for project management or ITIL best practices for service management, supported by tools like Request Tracker, Redmine or Track, improve the communication between scientists and support groups, speed up the time to respond, and increase the satisfaction and quality perceived by the user. In the same way, during operation, some practices complemented with software tools, may increase substantially the quality of the service with the resources available. This paper describes the use of these processes and methodologies in a scientific installation such as the synchrotron Alba. It also evaluates the strengths and the risks associated to the implementation as well as the achievements and the failures, proposing some improvements.

Mini Oral with Poster

TUMIB02

A Control System for the ESRF Synchrotron Radiation Therapy Clinical Trials

Experiment Control

Christian Nemoz, Paul Berkvens, Gilles Berruyer, Thierry Brochard, Hervé Gonzalez, Ricardo Hino, Michel Renier (ESRF, Grenoble), Helène Elleaume (INSERM, La Tronche), Jean-Francois Adam (Université Joseph Fourier, Saint Martin d'Hères)

The bio-medical beamline of the European Syncrotron Radiation Facility (ESRF) located in Grenoble, France, has recently started the Phase I-II Stereotactic Synchrotron Radiation Therapy (SSRT) clinical trials targeting brain tumours. This very first SSRT protocol consists in a combined therapy where monochromatic X-rays are delivered to the tumour pre-loaded with high Z element. The challenges of this technique are the accurate positioning of the target tumour with respect to the beam and the precision of the dose delivery whilst fully assuring the patient safety. The positioning system used for previous angiography clinical trials has been adapted to this new modality. 3-D imaging is performed for positionning purpose to fit to the treatment planning. The control system of this experiment will be described from the hardware and software point of view with emphasis on the constraints imposed by the Patient Safety System.

TUMIB03

The Detector Control System for Daya Bay Neutrino Experiment

Experiment Control

Mei Ye, Xiaonan Li (IHEP, Bejing)

The Daya Bay reactor neutrino experiment was designed to determine precisely the neutrino mixing angle 13 with a sensitivity better than 0.01 in the parameter sin22 13 at the 90% confidence level. To achieve this goal, the collaboration built eight functionally identical antineutrino detectors. The detectors are immersed in water pools that provide active and passive shielding against backgrounds. The experiment has been taking data for almost 1.5 years and the first results have already been released. The detector control and monitoring system(DCS) was developed to support a variety of hardware systems, such as high voltage crates, front end electronic crates, water system, gas system, low voltage crates, temperature and humidity of the environment. A global control system was developed to monitor and control the whole experiment. The paper present the dayabay experiment and control system as well.

Mini Oral with Poster

TUMIB04

Migrating to an EPICS Based Instrument Control System at the ISIS Spallation Neutron Source

Experiment Control

Frederick Anthony Akeroyd, Kathryn Baker, Matt Clarke, Gareth Howells, David Keymer, Kevin John Knowles, Christopher Moreton-Smith (STFC/RAL/ISIS, Chilton, Didcot, Oxon), Kevin Woods (Tessella, Abingdon)

The beamline instruments at the ISIS spallation neutron source have been running successfully for many years using an in-house developed control system. The advent of new instruments and the desire for more complex experiments has led to a project being created to determine how best to meet these challenges. Though it would be possible to enhance the existing system, migrating to an EPICS-based system offers many advantages in terms of flexibility, software reuse and the potential for collaboration. While EPICS is well established for accelerator and synchrotron beamline control, is it not currently widely used for neutron instruments, but this is changing. The new control system is being developed to initially run in parallel with the existing system, a first version being scheduled for testing on two newly constructed instruments starting summer 2013. In this paper, we will discuss the design and implementation of the new control system, including how our existing National Instruments LabVIEW controlled equipment was integrated, and issues that we encountered during the migration process.

TUMIB05

ANSTO and Australian Synchrotron Metadata Catalogues and the Australian National Data Service

Data Management and Processing

Nick Hauser, Saliya Wimalaratne (ANSTO, Menai), Claus Ulrich Felzmann (SLSA, Clayton)

Data citation, management and discovery are important to ANSTO, the Australian Synchrotron and the scientists that use them. Gone are the days when raw data is written to a removable media and subsequently lost. The metadata catalogue *MyTardis is being used by both ANSTO and the Australian Synchrotron. Metadata is harvested from the neutron beam and X-ray instruments raw experimental files and catalogued in databases that are local to the facilities. The data is accessible via a web portal. Data policies are applied to embargo data prior to placing data in the public domain. Public domain data is published to the Australian Research Data Commons using the OAI-PMH standard. The Commons is run by the Australian National Data Service (ANDS), who was the project sponsor. The Commons is a web robot friendly site. ANDS also sponsors digital object identifiers (DOI) for deposited datasets, which allows raw data to now be a first class research output, allowing scientists that collect data to gain recognition in the same way as those who publish journal articles. Data is being discovered, cited, reused and collaborations initiated through the Commons.

Mini Oral with Poster

TUMIB06

Development of a Scalable and Flexible Data Logging System Using NoSQL Databases

Data Management and Processing

Masahiro Kago, Akihiro Yamashita (JASRI/SPring-8, Hyogo-ken)

We have developed a scalable and flexible data logging system for SPring-8 accelerator control. The current SPring-8 data logging system powered by a relational database management system (RDBMS) has been storing log data for 16 years. With the experience, we recognized the lack of RDBMS flexibility on data logging such as little adaptability of data format and data acquisition cycle, complexity in data management and no horizontal scalability. To solve the problem, we chose a combination of two NoSQL databases for the new system; Redis for real time data cache and Apache Cassandra for perpetual archive. Logging data are stored into both database serialized by MessagePack with flexible data format that is not limited to single integer or real value. Apache Cassandra is a scalable and highly available column oriented database, which is suitable for time series logging data. Redis is a very fast on-memory key-value store that complements Cassandra's eventual consistent model. We developed a data logging system with ZeroMQ message and have proved its high performance and reliability in long term evaluation. It will be released for partial control system this summer.

TUMIB07

RASHPA: a Data Acquisition Framework for 2D XRays Detectors

Hardware Technology

Fabien Le Mentec, Pablo Fajardo, Christian Herve, Alejandro Homs, Thierry Le Caer (ESRF, Grenoble)

ESRF research programs, along with the foreseen accelerator sources upgrade, require state-of-the-art instrumentation devices with high data flow acquisition systems. This paper presents RASHPA, a data acquisition framework targeting 2D XRay detectors. By combining a highly configurable multi link PCI Express over cable based data transmission engine and a carefully designed LINUX software stack, RASHPA aims at reaching the performances required by current and future detectors.

TUMIB08

ITER Contribution to Control System Studio (CSS) Development Effort

User Interfaces and Tools

Nadine Utzel, Lana Abadie, Franck Di Maio, Jean-Yves Journeaux, Anders Wallander, Izuru Yonekawa (ITER Organization, St. Paul lez Durance)

In 2010, CODAC - ITER control system - team chose Control System Studio as the development and runtime integrated environment for plant system local control and decided to contribute to CSS development effort. After all, CODAC team wants to be sure that the tools that are being used by the seven ITER Domestic Agencies all over the world continue to be available and to be improved. In order to integrate CSS main components in its software suite, CODAC team needed first to adapt them to its standard platform based on Linux 64-bits and PostgreSQL database. Then, user feedbacks started to emerge as well as the need of an industrial symbol library to represent pump, valve or electrical breaker state on the operator interface or the requirement to send automatically an email when a new alarm is triggered. It also soon became important for CODAC team to be able to publish quickly its contributions and to adapt its own infrastructure for that. This paper describes ITER increasing contribution to CSS development effort and the future plans to address factory and site acceptance tests of the local control systems.

TUMIB09

jddd: A Tool for Operators and Experts to Design Control System Panels

User Interfaces and Tools

Elke Sombrowski, Anna Petrosyan, Kay Rehlich, Winfried Schütte (DESY, Hamburg)

jddd, a graphical tool for control system panel design, has been developed at DESY to allow machine operators and experts the design of complex panels. No knowledge of a programming language nor compiling steps are required to generate highly dynamic panels with the jddd editor. After 5 years of development and implementing requirements for DESY-specific accelerator operations, jddd has become mature and is increasingly used at DESY. The focus meanwhile has changed from pure feature development to new tasks as archiving/managing a huge number of control panels, finding panel dependencies, automatic refactoring of panel names, book keeping and evaluation of panel usage and collecting Java exception messages in an automatic manner. Therefore technologies of the existing control system infrastructure like Servlets, JMS, Lucene, SQL, SVN are used. The concepts and technologies to further improve the quality and robustness of the tool are presented in this paper.

TUMIB10

Performance Testing of EPICS User Interfaces - an Attempt to Compare the Performance of MEDM, EDM, CSS-BOY, CaQtDM, and EPICS-Qt

User Interfaces and Tools

Richard Ian Farnsworth, John Paul Hammonds, Bryan James Orr (ANL, Argonne),
Andrew Rhyder (ASCo, Clayton, Victoria)

Upgrading of the display manger or graphical user interface at EPICS sites reliant on older display technologies, typically MEDM or EDM, requires attention not only to functionality but also performance. For many sites, performance is not an issue - all display managers will update small numbers of process variables at rates exceeding the human ability to discern changes; but for certain applications typically found at larger sites, the ability to respond to updates rates at sub-Hertz frequencies for thousands of process variables is a requirement. This paper describes a series of tests performed on both older display managers — MEDM and EDM — and also the newer display managers CSS-BOY, epicsQT, and CaQtDM. Modestly performing modern hardware is used.

TUPPC001

ANSTO and Australian Synchrotron Metadata Catalogues and the Australian National Data Service

Data Management and Processing

Nick Hauser, Saliya Wimalaratne (ANSTO, Menai), Claus Ulrich Felzmann (SLSA, Clayton)

Data citation, management and discovery are important to ANSTO, the Australian Synchrotron and the scientists that use them. Gone are the days when raw data is written to a removable media and subsequently lost. The metadata catalogue *MyTardis is being used by both ANSTO and the Australian Synchrotron. Metadata is harvested from the neutron beam and X-ray instruments raw experimental files and catalogued in databases that are local to the facilities. The data is accessible via a web portal. Data policies are applied to embargo data prior to placing data in the public domain. Public domain data is published to the Australian Research Data Commons using the OAI-PMH standard. The Commons is run by the Australian National Data Service (ANDS), who was the project sponsor. The Commons is a web robot friendly site. ANDS also sponsors digital object identifiers (DOI) for deposited datasets, which allows raw data to now be a first class research output, allowing scientists that collect data to gain recognition in the same way as those who publish journal articles. Data is being discovered, cited, reused and collaborations initiated through the Commons.

TUPPC002

Online Data Reduction for High Throughput Beamlines

Data Management and Processing

Majid Ounsy, Raphaël Girardot, Katy Saintin, Gregory Viguier (SOLEIL, Gif-sur-Yvette)

As detectors data rates grow exponentially it becomes mandatory for the end user to have visualisation tools for processing data while they are produced (to perform data reduction) or offline (to perform data analysis). As algorithms for reducing data may be different for each beamline the Soleil software team decided to address all these kind of needs based on a common Framework named FUSION. The aim of this framework is to provide data reduction and analysis applications developers with reusable building blocks for spectrum and image visualization and processing and for accessing data in different data format and multiple flavours of data organization in files. This paper will present the FUSION framework architecture based itself on top of three major frameworks: the SOLEIL graphical framework COMETE*, the open source CDMA** common data model access project and the open source ImageJ*** image processing project adapted to be used as a component library. It will also explain how all FUSION building blocks can be used to develop a data reduction application with examples of application for experimental data browsing and processing.

*http://sourceforge.net/projects/comete/ **https://code.google.com/p/cdma/ ***http://rsb.info.nih.gov/ij/

Poster

TUPPC003

SDD toolkit : ITER CODAC Platform for Configuration and Development

Data Management and Processing

Lana Abadie, Franck Di Maio, Denis Stepanov, Anders Wallander (ITER Organization, St. Paul lez Durance), Anze Zagar (Cosylab, Ljubljana), Gregory Darcourt (Sopra Group, Aix-en-Provence), Aurelien Mariage (Sopra Group, Merignac), Krishna Bandaru, Hemlata Deshmukh, Pradnya Nanware, Ronak Patel (TCS France, Puteaux)

ITER will consist of roughly 200 plant systems I&C (in total millions of variables) delivered in kind which need to be integrated into the ITER control infrastructure. To integrate them in a smooth way, CODAC team releases every year the Core Software environment which consists of many applications. This paper focuses on the self description data toolkit implementation, a fully home-made ITER product. The SDD model has been designed with Hibernate/Spring to provide required information to generate configuration files for CODAC services such as archiving, EPICS, alarm, SDN, basic HMIs, etc. Users enter their configuration data via GUIs based on web application and Eclipse. Snapshots of I&C projects can be dumped to XML. Different levels of validation corresponding to various stages of development have been implemented: it enables during integration, verification that I&C projects are compliant with our standards. The development of I&C projects continues with Maven utilities. In 2012, a new Eclipse perspective has been developed to allow user to develop codes, to start their projects, to develop new HMIs, to retrofit their data in SDD database and to checkout/commit from/to SVN.

Poster

TUPPC004

Scalable Archiving with the Cassandra Archiver for CSS

Data Management and Processing

Sebastian Marsching (Aquenos GmbH, Baden-Baden)

An archive for process-variable values is an important part of most supervisory control and data acquisition (SCADA) systems, because it allows operators to investigate past events, thus helping in identifying and resolving problems in the operation of the supervised facility. For large facilities like particle accelerators there can be more than one hundred thousand process variables that have to be archived. When these process variables change at a rate of one Hertz or more, a single computer system can typically not handle the data processing and storage. The Cassandra Archiver has been developed in order to provide a simple to use, scalable data-archiving solution. It seamlessly plugs into Control System Studio (CSS) providing quick and simple access to all archived process variables. An Apache Cassandra database is used for storing the data, automatically distributing it over many nodes and providing high-availability features. This contribution depicts the architecture of the Cassandra Archiver and presents performance benchmarks outlining the scalability and comparing it to traditional archiving solutions based on relational databases.

Poster

TUPPC005

Implementation of an Overall Data Management at the Tomography Station at ANKA

Data Management and Processing

David Haas, Wolfgang Mexner, Halil Pasic, Thomas Spangenberg (KIT, Eggenstein-Leopoldshafen)

New technologies and research methods increase the complexity of data management at the beamlines of a synchrotron radiation facility. The diverse experimental data such as user and sample information, beamline status and parameters and experimental datasets, has to be interrelated, stored and provided to the user in a convenient way. The implementation of these requirements leads to challenges in fields of data life-cycle, storage, format and flow. At the tomography station at the ANKA a novel data management system has been introduced, representing a clearly structured and well organized data flow. The first step was to introduce the Experimental Coordination Service ECS, which reorganizes the measurement process and provides automatic linking of meta-, logging- and experimental-data. The huge amount of data, several TByte/week, is stored in NeXus files. These files are subsequently handled regarding storage location and life cycle by the WorkSpaceCreator development tool. In a further step ANKA will introduce the European single sign on system Umbrella and the experimental data catalogue ICAT as planned as the European standard solution in the PaNdata project.

Poster

TUPPC006

Identifying Control Equipment

Data Management and Processing

Matthias R. Clausen, Markus Moeller (DESY, Hamburg)

The cryogenic installations at DESY are widely spread over the DESY campus. Many new components have been and will be installed for the new European XFEL. Commissioning and testing takes a lot of time. Local tag labels help identify the components but it is error prone to type in the names. Local bar-codes and/or datamatrix codes can be used in conjunction with intelligent devices like smart (i)Phones to retrieve data directly from the control system. The developed application will also show information from the asset database. This will provide the asset properties of the individual hardware device including the remaining warranty. Last not least cables are equipped with a bar-code which helps to identify start and endpoint of the cable and the related physical signal. This paper will describe our experience with the mobile applications and the related background databases which are operational already for several years.

Poster

TUPPC007

Evaluation and Optimization of Data Transfer Performance in MicroTCA Based Systems

Data Management and Processing

Wojciech Jalmuzna (Embedded Integrated Control Systems GmbH, Hamburg), Adam Piotrowski (TUL-DMCS, Lodz)

MicroTCA standard and its MTCA.4 extension is becoming more and more popular for implementation of control and acquisition systems in high energy physics experiments. Such systems can use hardware offered by many vendors to create several unique configurations. To optimize performance of the system (in terms of data transfer bandwidth and latency) each configuration requires different approach on firmware/software layer. The paper presents several concepts of data transfer implementation in PCIe environment and demonstrates their applications in an example uTCA system. Implementations include firmware level interfaces, driver to operating system interfaces and interfaces to common control systems (such as EPICS and DOOCS). For each scheme advantages and disadvantages are discussed and overall performance evaluation is done. The results presented in the paper can be used during system design process to select appropriate hardware/firmware configuration according to application's specific needs.

Poster

TUPPC008

A New Flexible Integration of NeXus Datasets to ANKA by Fuse File Systems

Data Management and Processing

Wolfgang Mexner (KIT, Karlsruhe), Egor Iurchenko, Halil Pasic, Thomas Spangenberg (KIT, Eggenstein-Leopoldshafen)

In the high data rate initiative (HDRI) german accelerator and neutron facilities of the Helmholtz Association agreed to use NeXus as a common data format. The synchrotron radiation source ANKA decided in 2012 to introduce NeXus as common data format for all beam lines. Nevertheless it is a challenging work to integrate a new data format in existing data processing work flows. Scientists relay on existing data evaluation kits which require specific data formats. To solve this obstacle, for linux a filesystem in userspace (FUSE) was developed, allowing to mount NeXus-Files as a filesystem. Easy in XML configurable filter rules allow a very flexible view to the data. Tomography data frames can be directly accessed as TIFF files by any standard picture viewer or scan data can be presented as a virtual ASCII file compatible to spec.

Poster

TUPPC009

The EXFOR Compilation of Nuclear Data

Data Management and Processing

Ranjita Mandal, Debashish Sengupta (I.I.T. Kharapur,)

EXFOR is a nuclear database consisting of data of charged particle, neutrons and photon induced reactions and is managed by the IAEA(International Atomic energy agency). This format has an easy to access data. This is continuously refined and expanded to include new types of data as the need arises. This format allows a large variety of numerical data tables with associated textual information, i.e. bibliographic and descriptive information, to be transmitted in a format: a) that is machine readable (for checking and processing); b) that can be read easily by personnel (for updating, evaluating, etc.) The format was designed for flexibility in order to allow a wide range of data types to be exchanged and stored. A series of keywords and codes defined in the EXFOR dictionaries have been designed to implement this. The working language of EXFOR is English. Nuclear reaction data is exchanged within the EXFOR system on EXFOR exchange files (transmissions). The format and how data can be put in this is shown through an example of compilation of nuclear cross-section data to EXFOR with accession number D6167 which is a number given by the IAEA for this particular data set.

Poster

TUPPC010

Problems and Solutions for Large Volume Scientific Data Management in Experimental Physics: the Case of FERMI@ Elettra Free Electron Laser Facility

Data Management and Processing

Milan Prica, Roberto Borghes, Alessio Curri, Georgios Kourousias, Marco Lonza, Roberto Pugliese (Elettra-Sincrotrone Trieste S.C.p.A., Basovizza)

Big Data producers such as certain experimental physics facilities, need to be on the frontier of data management in order to prevent data deluge; where the increase of the data volume, outpaces that of the capacity to handle it. The three operating experimental stations of the Free Electron Laser (FEL) facility FERMI@Elettra produce vast quantities of data. The problem has been analyzed and a set of technologies has been adopted. This paper examines specific FEL related issues like high-frequency data acquisition while describes technological solutions related to data & metadata formats, storage, cataloging, and provenance. Finally, special attention is drawn to broader Data Policy topics and their implications in the future of scientific data management.

TUPPC011

Development of an Innovative Storage Manager for a Distributed Control System

Data Management and Processing

Claudio Bisegni, Giampiero Di Pirro, Luca Gennaro Foggetta, Giovanni Mazzitelli, Alessandro Stecchi (INFN/LNF, Frascati (Roma)), Luciano Catani (INFN-Roma II, Roma; Università di Roma II Tor Vergata, Roma), Matteo Mara (Istituto Nazionale di Fisica Nucleare, Frascati), Nicola Licheri (University of Cagliari, Cagliari)

The !CHAOS(*) framework will provide all the services needed for controlling and managing a large scientific infrastructure, including a number of innovating features such as abstraction of services, devices and data, easy and modular customization, extensive data caching for performance boost, integration of all functionalities in a common framework. One of most relevant innovation in !CHAOS resides in the History Data Service (HDS) for a continuous acquisition of operating data pushed by devices controllers. The core component of the HDS is the History engine(HST). It implements the abstraction layer for the underneath storage technology and the logics for indexing and querying data. The HST drivers are designed to provide specific HDS tasks such as Indexing, Caching and Storing, and for wrapping the chosen third-party database API with !CHOAS standard calls. Indeed, the HST allows to route to independent channels the different !CHAOS services data flow in order to improve the global efficiency of the whole data acquisition system.

* - http://chaos.infn.it * - http://prst-ab.aps.org/abstract/PRSTAB/v15/i11/e112804

TUPPC012

Development of a Scalable and Flexible Data Logging System Using NoSQL Databases

Data Management and Processing

Masahiro Kago, Akihiro Yamashita (JASRI/SPring-8, Hyogo-ken)

We have developed a scalable and flexible data logging system for SPring-8 accelerator control. The current SPring-8 data logging system powered by a relational database management system (RDBMS) has been storing log data for 16 years. With the experience, we recognized the lack of RDBMS flexibility on data logging such as little adaptability of data format and data acquisition cycle, complexity in data management and no horizontal scalability. To solve the problem, we chose a combination of two NoSQL databases for the new system; Redis for real time data cache and Apache Cassandra for perpetual archive. Logging data are stored into both database serialized by MessagePack with flexible data format that is not limited to single integer or real value. Apache Cassandra is a scalable and highly available column oriented database, which is suitable for time series logging data. Redis is a very fast on-memory key-value store that complements Cassandra's eventual consistent model. We developed a data logging system with ZeroMQ message and have proved its high performance and reliability in long term evaluation. It will be released for partial control system this summer.

Poster

TUPPC013

Scaling Out of the MADOCA Database System for SACLA

Data Management and Processing

Toko Hirono, Takashi Hamano, Akihiro Yamashita (JASRI/SPring-8, Hyogo-ken), Toru Fukui, Kazushi Hagihara, Toshiyuki Maruyama, Kunio Nemoto, Mitsuhiro Yamaga (RIKEN/SPring-8, Hyogo)

MADOCA was adopted for the control system of SACLA, and the MADOCA database system was designed as a copy of the database system in SPring-8. The system realized a high redundancy because the system had already tested in SPring-8. However the signals which the MADOCA system handles in SACLA are increasing drastically. And GUIs that require frequent database accesses were developed. The load of the database system increased, and the response of the systems delayed in some occasions. We investigated the bottle neck of the system. From the results of the investigation, we decided to distribute the access to two servers. The primary server handles present data and signal properties. The other handles archived data, and the data was mounted to the primary server as a proxy table. In this way, we could divide the load into two servers and clients such as GUI do not need any changes. We have tested the load and response of the system by adding 40000 signals to present 45000 signals, of which data acquisition intervals are typically 2 sec. The system was installed successfully and operating without any interruption which is caused by the high load of the database.

Poster

TUPPC014

Development of SPring-8 Experimental Data Repository System for Management and Delivery of Experimental Data

Data Management and Processing

Hisanobu Sakai, Yukito Furukawa, Toru Ohata (JASRI/SPring-8, Hyogo-ken)

SPring-8 experimental Data Repository system (SP8DR) is an online storage service, which is built as one of the infrastructure services of SPring-8. SP8DR enables experimental user to obtain his experimental data, which was brought forth at SPring-8 beamline, on demand via the Internet. To make easy searching for required data-sets later, the system stored experimental data with meta-data such as experimental conditions. It is also useful to the post-experiment analysis process. As a framework for data management, we adopted DSpace that is widely used in the academic library information system. We made two kind of application software for registering an experimental data simply and quickly. These applications are used to record metadata-set to SP8DR database that has relations to experimental data on the storage system. This data management design allowed applications to high bandwidth data acquisition system. In this presentation, we report about the SPring-8 experimental Data Repository system that began operation in SPring-8 beamline.

TUPPC015

On-line and Off-line Data Analysis System for SACLA Experiments

Data Management and Processing

Takashi Sugimoto, Yukito Furukawa, Kensuke Okada, Ryotaro Tanaka, Mitsuhiro Yamaga (JASRI/SPring-8, Hyogo-ken), Yasumasa Joti, Takashi Kameshima (JASRI/SPring-8, Hyogo), Toshinori Abe (RIKEN SPring-8 Center, Hyogo)

The X-ray Free-Electron Laser facility, SACLA, has delivered X-ray laser beams to users from March 2012 [1]. Typical user experiments utilize two-dimensional-imaging sensors, which generate 10 MBytes per accelerator beam shot. At 60 Hz beam repetition, the experimental data at the rate of 600 MBytes/second are accumulated using a dedicate data-acquisition (DAQ) system [2]. To analyze such a large amount of data, we developed data-analysis system for SACLA experiments. The system consists of on-line and off-line sections. The on-line section performs on-the-fly filtering using data handling servers, which examine data qualities and records the results onto the database with event-by-event basis. By referring the database, we can select good events before performing off-line analysis. The off-line section performs precise analysis by utilizing high-performance computing system, such as physical image reconstruction and rough three-dimensional structure analysis of the data samples. For the large-scaled image reconstructions, we also plan to use external supercomputer. In this paper, we present overview and future plan of the SACLA analysis system.

[1] T. Ishikawa et al., Nature Photonics 6, 540-544 (2012). [2] M. Yamaga et al., ICALEPCS 2011, TUCAUST06, 2011.

Poster

TUPPC016

Data Access and Management for Neutron Scattering Experiments in J-PARC/MLF

Data Management and Processing

Kentaro Moriyama, Yasuhiro Inamura, Takeshi Nakatani (JAEA/J-PARC, Tokai-Mura, Naka-Gun, Ibaraki-Ken), Toshiya Otomo (KEK, Ibaraki)

J-PARC/MLF is the large experimental facility for neutron scattering experiment, providing the world highest intensity pulsed neutron beam. Eighteen neutron instruments equipped with large—area neutron detector systems and various sample environmental devices are currently in operation. A high intensity beam allows a lot of measurements in short time under a variety of conditions. These measurements produce data of petabyte order per year. In order to reliably manage the enormous data and provide effective data access for scientists, we are developing an integrated data management system, named MLF Experimental Database, based on a commercial XML database system suitable for semi-structured and flexible data such as experimental metadata. It is capable of real–time cataloging of raw data along with experimental metadata and other contextual information on proposal, sample and user, central management of raw data reposition, backup and archiving, and web-based data access. The web portal provides data searching/browsing/downloading interfaces and simple functions for data reduction and visualization. The current status and issues will be presented.

Poster

TUPPC017

Development of J-PARC Time-Series Data Archiver Using Distributed Database System

Data Management and Processing

Nobuhiro Kikuzawa, Yuko Kato, Akinobu Yoshii (JAEA/J-PARC, Tokai-Mura, Naka-Gun, Ibaraki-Ken), Hiroshi Ikeda (JAEA, Ibaraki-ken)

J-PARC(Japan Proton Accelerator Research Complex) is consists of much equipment. In Linac and 3GeV synchrotron, the data of over the 64,000 EPICS records for these apparatus control is being collected. The data has been being stored by a RDB system using PostgreSQL now, but it is not enough in availability, performance, and extendibility. Therefore, the new system architecture is required, which is rich in the pliability and can respond to the data increasing continuously for years to come. In order to cope with this problem, we considered adoption of the distributed database archtecture and constructed the demonstration system using Hadoop/HBase. We present results of these demonstration.

Poster

TUPPC018

A Data Acquisition and Query System in BEPCII

Data Management and Processing

ChunHong Wang, LuoFeng Li (IHEP, Beijing)

Data acquisition and data display are very important in the accelerator control system. They should meet the requirements of the beam commissioning. This paper reviews EPICS data acquiring and query system (DAQS) based on Oracle. The authors imports the technology of table-space and table-partition to build a special database schema in Oracle. In addition, based on RCP and Java, EPICS data acquiring system is developed successfully with a very friendly user interface.It's easy for users to look up the status of each PV's connection, manage or maintain the system. Meanwhile, the authors also develop the system of data query, which provides many functions including data query, data plotting, data exporting, data zooming, etc. The new data acquisition and data query system using Oracle has been tested for a half year. The performance and test results have also been discussed.

Poster

TUPPC019

Performance Evaluation of the Relational Database Archive System in Control System Studio

Data Management and Processing

Sangwon Yun, Sangil Lee, Mikyung Park (NFRI, Daejon), Anders Wallander (ITER Organization, St. Paul lez Durance)

The Channel Archiver provided as one of EPICS extensions has been used for archiving and retrieval of operation data at the Korea Superconducting Advanced Research (KSTAR). The Channel Archiver collects data from Channel Access Server (CAS) and stores the collected data to the binary files. On the contrary the ITER has adopted the Relational Database (RDB) based archive system, Best Ever Archive Utility, Yet (BEAUTY), that is one of Control System Studio (CSS) services. The RDB Archive system stores collected data and configuration to RDB. Accordingly, the RDB Archive system provides higher maintainability and accessibility but lower performance than the file based Channel Archiver. So, more intensive evaluation is required to verify whether the RDB based archive system CSS BEAUTY satisfies the high performance requirement of the large experimental facility ITER. Through the evaluation, Performance improvement factors can be deduced and the efficient operation direction can be presented. This paper describes the results of performance evaluation of the file based Channel Archiver and the RDB Archive system, and the approaches to improve the performance of RDB Archive based system.

Poster

TUPPC020

Development of PLS-II IOC Data Archive System

Data Management and Processing

Jae Myung Kim, Moo-Hyun Cho, Jung Yun Huang, Woon Ha Hwang, Eun Hee Lee, Sang Hoon Nam, Seunghwan Shin (PAL, Pohang, Kyungbuk)

Goal of PLS-II Data is to store all the IOC data. The data is stored in the mySQL database. To store the data in the interval time is 1 second, because the storage space and process time. All of stored data is query with graphical display. Table lookup method for each of the sub-System data and numerical lookup method, Other optional so you can check how the interrelationships among the data display. In this paper describe how to designed database, how to store the low-data to database and how to manage data display web-page.

Data archive, Accelerator Operation Data Archive,Accelerator Web Monitoring System

TUPPC021

Monitoring and Archiving of NSLS-II Booster Synchrotron Parameters

Data Management and Processing

Anton Anatolievich Derbenev, Pavel Borisovich Cheblakov, Ruslan Kadyrov, Sergey Evgenyevich Karnaev, Stanislav Sergeevich Serednyakov, Evgeny Simonov (BINP SB RAS, Novosibirsk)

When operating a multicomponent system, it is always necessary to observe the state of a whole installation as well as of its components. Tracking data is essential to perform tuning and troubleshooting, so records of a work process generally have to be kept. As any other machine, the NSLS-II booster should have an implementation of monitoring and archiving schemes as a part of the control system. Because of the booster being a facility with a cyclical operation mode, there were additional challenges when designing and developing monitoring and archiving tools. Thorough analysis of available infrastructure and current approaches to monitoring and archiving was conducted to take into account additional needs that come from booster special characteristics. A software extension for values present in the control system allowed to track the state of booster subsystems and to perform an advanced archiving with multiple warning levels. Time stamping and data collecting strategies were developed as a part of monitoring scheme in order to preserve and recover read-backs and settings as consistent data sets. This paper describes relevant solutions incorporated in the booster control system.

Poster

TUPPC022

Centralized Software and Hardware Configuration Tool for Large and Small Experimental Physics Facilities

Data Management and Processing

Alexander Vladimirovich Makeev, Dmitry Bolkhovityanov, Pavel Borisovich Cheblakov, Sergey Evgenyevich Karnaev (BINP SB RAS, Novosibirsk)

All software of control system, starting from hardware drivers and up to user space PC applications, needs configuration information to work properly. This information includes such parameters as channels calibrations, network addresses, servers responsibilities and other. Each software subsystem requires a part of configuration parameters, but storing them separately from whole configuration will cause usability and reliability issues. On the other hand, storing all configuration in one centralized database will decrease software development speed, by adding extra central database querying. The paper proposes configuration tool that has advantages of both ways. Firstly, it uses a centralized configurable graph database, that could be manipulated by web-interface. Secondly, it could automatically export configuration information from centralized database to any local configuration storage. The tool has been developed at BINP (Novosibirsk, Russia) and is used to configure VEPP-2000 electron-positron collider (BINP, Russia), Electron Linear Induction Accelerator (Snezhinsk, Russia) and NSLS-II booster synchrotron (BNL, USA).

TUPPC023

MeerKAT Poster and Demo

Data Management and Processing

Charles de Villiers (SKA South Africa, Cape Town)

The 64-dish MeerKAT Karoo Array Telescope, currently under development, will become the largest and most sensitive radio telescope in the Southern Hemisphere until the Square Kilometre Array (SKA) is completed around 2024. MeerKAT will ultimately become an integral part of the SKA. The MeerKAT project will build on the techniques and experience acquired during the development of KAT-7, a 7-dish engineering prototype that has already proved its worth in practical use, operating 24/7 to deliver useful science data in the Karoo. Much of the MeerKAT development will centre on further refinement and scaling of the technology, using lessons learned from KAT-7. The poster session will present the proposed MeerKAT CAM (Control & Monitoring) architecture and highlight the solutions we are exploring for system monitoring, control and scheduling, data archiving and retrieval, and human interaction with the system. We will supplement the poster session with a live demonstration of the present KAT-7 CAM system. This will include a live video feed from the site as well as the use of the current GUI to generate and display the flow of events and data in a typical observation.

TUPPC024

Challenges to Providing a Successful Central Configuration Service to Support CERN's New Controls Diagnostics and Monitoring System

Data Management and Processing

Zereyakob Makonnen, Mark Buttner, Zornitsa Zaharieva (CERN, Geneva)

The Controls Diagnostic and Monitoring service (DIAMON) provides monitoring and diagnostics tools to the operators in the CERN Control Centre. A recent reengineering presented the opportunity to restructure its data management and to integrate it with the central Controls Configuration Service (CCS). The CCS provides the Configuration Management for the Controls System for all accelerators at CERN. The new facility had to cater for the configuration management of all agents monitored by DIAMON, (>3000 computers of different types), provide deployment information, relations between metrics, and historical information. In addition, it had to be integrated into the operational CCS, while ensuring stability and data coherency. An important design decision was to largely reuse the existing infrastructure in the CCS and adapt the DIAMON data management to it e.g. by using the device/property model through a Virtual Devices framework to model the DIAMON agents. This article will show how these challenging requirements were successfully met, the problems encountered and their resolution. The new service architecture will be presented: database model, new and tailored processes and tools.

Poster

TUPPC025

Advantages and Challenges to the Use of On-line Feedback in CERN's Accelerators Controls Configuration Management

Data Management and Processing

Zornitsa Zaharieva, Steen Jensen, Jose Rolland Lopez De Coca, Antonio Romero Marin (CERN, Geneva)

The Controls Configuration Service (CCS) provides the Configuration Management facilities for the Controls System for all CERN accelerators. It complies with Configuration Management standards, tracking the life of configuration items and their relationships by allowing identification and triggering change management processes. Data stored in the CCS is extracted and propagated to the controls hardware for remote configuration. The article will present the ability of the CCS to audit items and verify conformance to specification with the implementation of on-line feedback focusing on Front-End Computers (FEC) configurations. Long-standing problems existed in this area such as discrepancies between the actual state of the FEC and the configuration sent to it at reboot. This resulted in difficult-to-diagnose behaviour and disturbance for the Operations team. The article will discuss the solution architecture (tailored processes and tools), the development and implementation challenges, as well as the advantages of this approach and the benefits to the user groups – from equipment specialists and controls systems experts to the operators in the Accelerators Controls Centre.

Poster

TUPPC026

Concept and Prototype for a Distributed Analysis Framework for the LHC Machine Data

Data Management and Processing

Kajetan Fuchsberger, Jean-Christophe Garnier (CERN, Geneva)

The Large Hadron Collider (LHC) at CERN produces more than 50 TB of diagnostic data every year, shared between normal running periods as well as commissioning periods. The data is collected in different systems, like the LHC Post Mortem System (PM), the LHC Logging Database and different file catalogues. To analyse and correlate data from these systems it is necessary to extract data to a local workspace and to use scripts to obtain and correlate the required information. Since the amount of data can be huge (depending on the task to be achieved) this approach can be very inefficient. To cope with this problem, a new project was launched to bring the analysis closer to the data itself. This paper describes the concepts and the implementation of the first prototype of an extensible framework, which will allow integrating all the existing data sources as well as future extensions, like hadoop* clusters or other parallelization frameworks.

*http://hadoop.apache.org/

Poster

TUPPC027

Quality Management of CERN Vacuum Controls

Data Management and Processing

Fabien Antoniotti, Jean-Pierre Boivin, Eve Fortescue-Beck, Jose Gama, Paulo Gomes, Pascal Le Roux, Helder Pereira, Gregory Pigny (CERN, Geneva)

The vacuum controls team is in charge of the monitoring, maintenance & consolidation of the control systems of all accelerators and detectors in CERN; this represents 6 000 instruments distributed along 128 km of vacuum chambers, often of heterogeneous architectures. In order to improve the efficiency of the services we provide, to vacuum experts and to accelerator operators, a Quality Management Plan is being put into place. The first step was the gathering of old documents and the centralisation of information concerning architectures, procedures, equipment and settings. It was followed by the standardisation of the naming convention across different accelerators. The traceability of problems, request, repairs, and other actions, has also been put into place. It goes together with the effort on identification of each individual device by a coded label, and its registration in a central database. We are also working on ways to record, retrieve, process, and display the information across several linked repositories; then, the quality and efficiency of our services can only improve, and the corresponding performance indicators will be available.

Poster

TUPPC028

The CERN Accelerator Logging Service - 10 Years in Operation: A Look at the Past, Present, and Future

Data Management and Processing

Chris Roderick (CERN, Geneva)

During the 10 years since it's first operational use, the scope and scale of the CERN Accelerator Logging Service (LS) has evolved significantly: from an LHC specific service expected to store 1TB / year; to a CERN-wide service spanning the complete accelerator complex (including related sub-systems and experiments) currently storing more than 50 TB / year on-line for some 1 million signals. Despite the massive increase over initial expectations the LS remains reliable, and highly usable - this can be attested to by the 5 million daily / average number of data extraction requests, from close to 1000 users. Although a highly successful service, demands on the LS are expected to increase significantly as CERN prepares LHC for running at top energy, which is likely to result in at least doubling current data volumes. Furthermore, focus is now shifting firmly towards a need to perform complex analysis on logged data, which in-turn presents new challenges. This paper reflects on 10 years as an operational service, in terms of how it has managed to scale to meet growing demands, what has worked well, and lessons learned. On-going developments, and future evolution will also be discussed.

TUPPC029

Integration, Processing, Analysis Methodologies and Tools for Ensuring High Data Quality and Rapid Data Access in the TIM* Monitoring System

Data Management and Processing

Anna Suwalska, Matthias Bräger, Mark Brightwell, Emmanouil Koufakis, Robin Martini, Peter Sollander (CERN, Geneva)

Processing, storing and analysing large amounts of real-time data is a challenge for every monitoring system. The entire well-being of the system strongly depends on high quality configuration data and the ability of the system to cope with data anomalies. TIM addresses data quality issues by enforcing a workflow of strict procedures to integrate or modify data tag configurations. TIM's data acquisition layer architecture allows real-time selecting and rejecting of irrelevant data. The discarded raw data (90,000,000/day) are stored in a temporary database, then analysed and purged as soon as statistics are collected. The remaining operational data (2,000,000/day) are transferred to a server running Terracotta in-memory database, ensuring its rapid processing. This data is then stored for a limited duration allowing ad hoc historical data analysis. In this paper we describe the methods and tools used to guarantee the quality of configuration data and highlight the advanced architecture that ensures optimal access to operational data as well as the tools used to perform off-line data analysis.

* Technical Infrastructure Monitoring system

TUPPC030

System Dependency Management and Status tracking for CERN Accelerator Systems

Data Management and Processing

Maxime Audrain, Donat Csikos, Kajetan Fuchsberger, Jean-Christophe Garnier, Arkadiusz Andrzej Gorzawski, Steen Jensen, Jacek Suchowski, Paula Cristina Turcu, Markus Zerlauth (CERN, Geneva)

The Large Hadron Collider (LHC) at CERN requires many systems to work in close interplay to allow reliable operation and at the same time ensure the correct functioning of the protection systems required when operating with large energies stored in magnet system and particle beams. Examples for systems are e.g. magnets, power converters, quench protection systems as well as higher level systems like java applications or server processes. All these systems have numerous and different kind of links (dependencies) between each other. The knowledge about the different dependencies is available from different sources, like Layout databases, Java imports, proprietary files, etc.... Retrieving consistent information is difficult due to the lack of a unified way of retrieval for the relevant data. This paper describes a new approach to establish a central server instance, which allows collecting this information and providing it to different clients used during commissioning and operation of the accelerator. Furthermore, it explains future visions for such a system, which includes additional layers for distributing system information like operational status, issues or faults.

Poster

TUPPC031

Proteus: FRIB Controls Database

Data Management and Processing

Vasu Vuppala (NSCL, East Lansing, Michigan), Sheng Peng (FRIB, East Lansing)

Distributed Information Services for Control Systems (DISCS) is a framework for developing high-level information systems for a Experimental Physics Facility. It comprises of a set of cooperating components. Each component of the system has a database, an API, and several applications. One of DISCS' core components is the Configuration Module. It is responsible for the management of devices, their layout, measurements, alignment, calibration, signals, and inventory. In this paper we describe FRIB's implementation of the Configuration Module - Proteus. We describe its architecture, database schema, web-based GUI, EPICS V4 and REST services, and Java/Python APIs. It has been developed as a product that other labs can download and use. It can be integrated with other independent systems. We describe the challenges to implementing such a system, our technology choices, and the lessons learnt.

Poster

TUPPC032

Database-Backed Configuration Service

Data Management and Processing

Jeff Allan Mader, Jimmy Johnson (W.M. Keck Observatory, Kamuela)

Keck Observatory is in the midst of a major telescope control system upgrade. This upgrade will include a new database-backed configuration service which will be used to manage the many aspects of the telescope that need to be configured (e.g. site parameters, control tuning, limit values) for its control software and it will keep the configuration data persistent between IOC restarts. This paper will discuss this new configuration service, including its database schema, iocsh API, rich user interface and the many other provided features. The solution provides automatic time-stamping, a history of all database changes, the ability to snapshot and load different configurations and triggers to manage the integrity of the data collections. Configuration is based on a simple concept of controllers, components and their associated mapping. The solution also provides a failsafe mode that allows client IOCs to function if there is a problem with the database server. It will also discuss why this new service is preferred over the file based configuration tools that have been used at Keck up to now.

TUPPC033

Data Storage Taxonomies For Fusion Control Systems*

Data Management and Processing

Phillip Adams (LLNL, Livermore, California)

The National Ignition Facility (NIF) at the Lawrence Livermore National Laboratory is a stadium-sized facility that contains a 192-beam, 1.8-Megajoule, 500-Terawatt, ultraviolet laser system that provides a scientific center to study Inertial Confinement Fusion and matter at extreme energy densities and pressures. NIF uses over 700TB of distributed storage, in a combination of network file systems and large databases, to provide the capabilities that support a wide variety of scientific and facility operation uses cases, a number of disparate data types, varying degrees of centralization and collaboration by the scientific community. The requirements that led to NIF's data architecture and the organizing principles used to manage NIF's growing data footprint will be discussed.

Poster

TUPPC034

Experience Improving the Performance of Reading and Displaying Very Large Datasets

Data Management and Processing

Ted D'Ottavio, Bartosz Frak, John Morris, Seth Nemesure (BNL, Upton, Long Island, New York)

There has been an increasing need over the last 5 years within the BNL accelerator community (primarily within the RF and Instrumentation groups) to collect, store and display data at high frequencies (1-10 kHz). Data throughput considerations when storing this data are manageable. But requests to display gigabytes of the collected data can quickly tax the speed at which data can be read from storage, transported over a network, and displayed on a users computer monitor. This paper reports on efforts to improve the performance of both reading and displaying data collected by our data logging system. Our primary means of improving performance was to build an Data Server – a hardware/software server solution built to respond to client requests for data. It's job is to improve performance by 1) improving the speed at which data is read from disk, and 2) culling the data so that the returned datasets are visually indistinguishable from the requested datasets. This paper reports on statistics that we've accumulated over the last two years that show improved data processing speeds and associated increases in the number and average size of client requests.

Poster

TUPPC035

The New EPICS Archiver

Data Management and Processing

Nikolay Malitsky, Donald Dohan (BNL, Upton, Long Island, New York)

This report presents a large-scale high-performance distributed data storage system for acquiring and processing time series data of modern accelerator facilities. Derived from the original EPICS Channel Archiver, this version consistently extends it through the integration of the deliberately selected technologies, such as the HDF5 file format, the SciDB chunk-oriented interface, and the RDB-based representation of the DDS X-Types specification. The changes allowed to scale the performance of the new version towards the data rates of 500 K scalar samples per seconds. Moreover, the new EPICS Archiver provides a common platform for managing both the EPICS 3 records and composite data types, like images, of EPICS 4 applications.

Poster

TUPPC036

A Status Update for Hyppie – a Hyppervisored PXI for Physics Instrumentation under EPICS

Experiment Control

James Rezende Piton, Marcio P. Donadio, Diego de Oliveira Omitto, Marco Antonio Raulik (LNLS, Campinas)

Beamlines at LNLS are moving to the concept of distributed control under EPICS. This has being done by reusing available code from the community and/or by programming hardware access in LabVIEW integrated to EPICS through Hyppie. Hyppie is a project to make a bridge between EPICS records and corresponding devices in a PXI chassis. Both EPICS/Linux and LabVIEW Real-Time run simultaneously in the same PXI controller, in a virtualization system with a common memory block shared as their communication interface. A number of new devices were introduced in the Hyppie suite and LNLS beamlines are experiencing a smooth transition to the new concept.

Poster

TUPPC037

LabWeb - LNLS Beamlines Remote Operation System

Experiment Control

Hugo Henrique Slepicka, Marcio Alexandre Barbosa (LNLS, Campinas)

LabWeb is a software developed to allow remote operation of beamlines at LNLS, in a partnership with Petrobras Nanotechnology Network. Being the only light source in Latin America, LNLS receives many researchers and students interested in conducting experiments and analyses in these lines. The implementation of LabWeb allow researchers to use the laboratory structure without leaving their research centers, reducing time and travel costs in a continental country like Brazil. In 2010, the project was in its first phase in which tests were conducted using a beta version. Two years later, a new phase of the project began with the main goal of giving the operation scale for the remote access project to LNLS users. In this new version, a partnership was established to use the open source platform Science Studio developed and applied at the Canadian Light Source (CLS). Currently, the project includes remote operation of three beamlines at LNLS: SAXS1 (Small Angle X-Ray Scattering), XAFS1 (X-Ray Absorption and Fluorescence Spectroscopy) and XRD1 (X-Ray Diffraction). Now, the expectation is to provide this new way of realize experiments to all the other beamlines at LNLS.

Poster

TUPPC038

Simultaneous On-line Ultrasonic Flowmetery and Binary Gas Mixture Analysis for the ATLAS Silicon Tracker Cooling Control System

Experiment Control

M. Doubek, V. Vacek, M.Vitek, M. Battistin, S. Berry, J. Berthoud, P. Bonneau, J. Botelho-Direito, G. Bozza, E. Da Riva, B. Di Girolamo, D. Giugni, J. Godlewski, E. Perez-Rodriguez, L. Zwalinski, N. Bousson, G. Hallewell, M. Mathieu, A. Rozanov, C. Deterre, C. Degeorge, S. Katunin, S. McMahon, R. Bates, A. Bitadze, G. Boyd, K. Nagai, C. Rossi

We describe a combined ultrasonic instrument for continuous gas flow measurement and simultaneous real-time binary gas mixture analysis. The analysis algorithm compares real time measurements with a stored data base of sound velocity vs. gas composition. The instrument was developed for the ATLAS silicon tracker evaporative cooling system where C3F8 refrigerant may be replaced by a blend with 25% C2F6, allowing a lower evaporation temperature as the LHC luminosity increases. The instrument has been developed in two geometries. A version with an axial sound path has demonstrated a 1 % Full Scale precision for flows up to 230 l/min. A resolution of 0.3% is seen in C3F8/C2F6 molar mixtures, and a sensitivity of better than 0.005% to traces of C3F8 in nitrogen, during a 1 year continuous study in a system with sequenced multi-stream sampling. A high flow version has demonstrated a resolution of 1.9 % Full Scale for flows up to 7500 l/min. The instrument can provide rapid feedback in control systems operating with refrigerants or binary gas mixtures in detector applications. Other uses include anesthesia, analysis of hydrocarbons and vapor mixtures for semiconductor manufacture.

* Comm. author: martin.doubek@cern.ch Refs R. Bates et al. Combined ultrasonic flow meter & binary vapour analyzer for ATLAS 2013 JINST 8 C01002

Poster

TUPPC039

Development of a High Speed Diagnostics Package for the 0.2 J, 20 fs, 1 KHz Repetition Rate Laser at ELI-Beamlines

Experiment Control

Jack Naylon (ELI-BEAMS, Prague)

The ELI-Beamlines facility aims to provide a selection of high repetition rate TW-PW femtosecond laser pulses, with applications in plasma research, particle acceleration, high-field physics and high intensity XUV/X-ray generation. The highest rate laser in the facility will be a 1 KHz femtosecond laser with pulse energy of 200 mJ. This high repetition rate presents unique challenges for the control system, particularly the diagnostics package. This is tasked with measuring key laser parameters such as pulse energy, pointing accuracy, and beam profile. Not only must this system be capable of relaying individual pulse measurements in real-time to the six experimental target chambers, it must also respond with microsecond latency to any aberrations indicating component damage or failure. We discuss the development and testing of a prototype near-field camera profiling system forming part of this diagnostics package consisting of a 1000 fps high resolution camera and FPGA-based beam profile and aberration detection system.

Poster

TUPPC040

Saclay GBAR Control Command

Experiment Control

Paul Lotrus (CEA, Gif-sur-Yvette), Gilles Andre Durand (CEA/DSM/IRFU,)

GBAR experiment will be installed at the ELENA extension of the Antiproton Decelerator at CERN in 2016 and will measure the free fall acceleration of neutral antihydrogen atoms. Before construction of GBAR, the CEA/Irfu institute has built a beam line to guide positrons pioneering produce by a Linac through either a material line or a Penning trap. The experiment control command is mainly based on Programmable Logical Controllers (PLC). A CEA/Irfu-developed Muscade SCADA is installed on a Windows 7 embedded shoebox PC. It manages local and remote GUI, and is responsible for archiving and alarms. Muscade was used because it is rapidly and easily configurable. The project required that Muscade communicates with three different types of PLC: Schneider, National Instruments (NI) and Siemens. Communication is based on Modbus/TCP as well as an in-house protocol optimize for the Siemens PLC. To share information between fast and slow control, a LabVIEW PC dedicated to the trap fast control communicates with a PLC dedicated to security via Profinet fieldbus.

TUPPC041

A Control System for the ESRF Synchrotron Radiation Therapy Clinical Trials

Experiment Control

Christian Nemoz, Paul Berkvens, Gilles Berruyer, Thierry Brochard, Hervé Gonzalez, Ricardo Hino, Michel Renier (ESRF, Grenoble), Helène Elleaume (INSERM, La Tronche), Jean-Francois Adam (Université Joseph Fourier, Saint Martin d'Hères)

The bio-medical beamline of the European Syncrotron Radiation Facility (ESRF) located in Grenoble, France, has recently started the Phase I-II Stereotactic Synchrotron Radiation Therapy (SSRT) clinical trials targeting brain tumours. This very first SSRT protocol consists in a combined therapy where monochromatic X-rays are delivered to the tumour pre-loaded with high Z element. The challenges of this technique are the accurate positioning of the target tumour with respect to the beam and the precision of the dose delivery whilst fully assuring the patient safety. The positioning system used for previous angiography clinical trials has been adapted to this new modality. 3-D imaging is performed for positionning purpose to fit to the treatment planning. The control system of this experiment will be described from the hardware and software point of view with emphasis on the constraints imposed by the Patient Safety System.

TUPPC042

Prototype of a Simple ZeroMQ-Based RPC in Replacement of CORBA in NOMAD

Experiment Control

Yannick Le Goc, Franck Cecillon, Cristina Cocho, Abdelali Elaazzouzi, Jerome Locatelli, Paolo Mutti, Helene Ortiz, Jacques Ratel (ILL, Grenoble)

The NOMAD instrument control software of the Institut Laue-Langevin is a client server application. The communication between the server and its clients is performed with CORBA, which has now major drawbacks like the lack of support and a slow or non-existing evolution. The present paper describes the implementation of the recent and promising ZeroMQ technology in replacement to CORBA. We present the prototype of a simple RPC built on top of ZeroMQ and the performant Google Protocol Buffers serialization tool, to which we add a remote method dispatch layer. The final project will also provide an IDL compiler restricted to a subset of the language so that only minor modifications to our existing IDL interfaces and class implementations will have to be made to replace the communication layer in NOMAD.

Poster

TUPPC043

Controlling Cilex-Apollon Laser Beams Alignment and Diagnostics Systems with Tango

Experiment Control

Mickael Pina (LULI, Palaiseaux), Bastien Breteau, Jean-Luc Paillard, Jean-Luc Veray (LULI, Palaiseau)

Cilex-Apollon is a high intensity laser facility delivering at least 5 PW pulses on targets at one shot per minute, to study physics such as laser plasma electron or ion accelerator and laser plasma X-Ray sources. Under construction, Apollon is a four beam laser installation with two target areas. To control the laser beam characteristics and alignment, more than 75 CCD cameras and 100 motors are dispatched in the facility and controlled through a Tango bus. The image acquisition and display are made at 10 Hz. Different operations are made on line, at the same rate on acquired images like binarisation, centroid calculation, size and energy of laser beam. Other operations are made off line, on stored images. The beam alignment can be operated manually or automatically. The automatic mode is based on a close loop using a transfer matrix and can correct the laser beam centering and pointing 5 times per second. The article presents the architecture, functionality, performances and feedback from a first deployment on a demonstrator.

Poster

TUPPC044

When Hardware and Software Work in Concert

Experiment Control

Matthias Vogelgesang, Tomy dos Santos Rolo, Tomas Farago, Andreas Kopmann (KIT, Eggenstein-Leopoldshafen), Tilo Baumbach (KIT, Karlsruhe)

Integrating control and high-speed data processing is a fundamental requirement to operate a beam line efficiently and improve user's beam time experience. Implementing such control environments for data intensive applications at synchrotrons has been difficult because of vendor-specific device access protocols and distributed components. Although TANGO addresses the distributed nature of experiment instrumentation, standardized APIs that provide uniform device access, process control and data analysis are still missing. Concert is a Python-based framework for device control and messaging. It implements these programming interfaces and provides a simple but powerful user interface. Our system exploits the asynchronous nature of device accesses and performs low-latency on-line data analysis using GPU-based data processing. We will use Concert to conduct experiments to adjust experimental conditions using on-line data analysis, e.g. during radiographic and tomographic experiments. Concert's process control mechanisms and the UFO processing framework* will allow us to control the process under study and the measuring procedure depending on image dynamics.

* Vogelgesang, Chilingaryan, Rolo, Kopmann: "UFO: A Scalable GPU-based Image Processing Framework for On-line Monitoring"

Poster

TUPPC045

Software Development for High Speed Data Recording and Processing

Experiment Control

Djelloul Boukhelef, Janusz Szuba, Krzysztof Wrona, Christopher Youngman (XFEL.EU, Hamburg)

The European XFEL beam delivery defines a unique time structure that requires acquiring and processing data in short burst of up to 2700 images every 100ms. The 2D pixel detectors being developed produce up to 10GB/s/Mpx of image data and efficient handling of the huge data volumes requires large network bandwidth and computing capabilities. The architecture of the DAQ system is hierarchical and modular. The DAQ network uses 10GbE switched links to provide large bandwidth data transport between the front-end electronics interfaces, data handling PC layer servers, and storage and analysis clusters. Front-end interfaces are required to build images acquired during a burst into pulse ordered image trains and forward them to PC layer server. The PC layer consists of dedicated high-performance computers for raw data monitoring, processing and filtering, and aggregates the data files that are distributed to on-line storage and data analysis clusters. In this contribution we give an overview of the DAQ system architecture, communication protocols, as well as software stack for data acquisition pre-processing, monitoring, storage and analysis.

Poster

TUPPC046

Control Using Beckhoff Distributed Rail Systems at the European XFEL

Experiment Control

Nicola Coppola, Jan Tolkiehn, Christopher Youngman (XFEL.EU, Hamburg)

The European XFEL project is a 4th generation light source producing spatially coherent 80fs short photon x-ray pulses with a peak brilliance of 1032-1034 photons/s/mm2/mrad2/0.1% BW in the energy range from 0.26 to 24 keV at an electron beam energy 14 GeV. Six experiment stations will start data taking in fall 2015. In order to provide a simple, homogeneous solution, the DAQ and control systems group at the European XFEL are standardizing on COTS control hardware for use in experiment and photon beam line tunnels. A common factor within this standardization requirement is the integration with the Karabo software framework of Beckhoff TwinCAT 2.11 or TwinCAT3 PLCs and EtherCAT. The latter provides the high degree of reliability required and the desirable characteristics of real time capability, fast I/O channels, distributed flexible terminal topologies, and low cost per channel. In this contribution we describe how Beckhoff PLC and EtherCAT terminals will be used to control experiment and beam line systems. This allows a high degree of standardization for control and monitoring of systems.

Hardware Technology - POSTER

TUPPC047

The New TANGO-based Control and Data Acquisition System of the GISAXS Instrument GALAXI at Forschungszentrum Jülich

Experiment Control

Harald Kleines, Matthias Drochner, Lydia Fleischhauer-Fuss, Peter Kaemmerling, Frank Suxdorf, Stefan van Waasen, Michael Wagener (FZJ, Jülich), Axel Ackens, Manfred Bednarek, Klaus Bussmann, Michael Heinzler, Franz-Josef Kayser, Sabrina Kirstein, Karl-Heinz Mertens, Rolf Möller, Ulrich Rücker (FZJ, Juelich)

Forschungszentrum Jülich operated the SAXS instrument JUSIFA at DESY in Hamburg for more than twenty years. With the shutdown of the DORIS ring JUSIFA was relocated to Jülich. Based on most JUSIFA components (with major mechanical modifications) and a MetalJet high performance X-Ray source from Bruker AXS the new GISAXS instrument GALAXI was built by JCNS (Jülich Centre for Neutron Science). GALAXI was equipped with new electronics and a completely new control and data acquisition system by ZEA-2 (Zentralinstitut für Engineering, Elektronik und Analytik 2 – Systeme der Elektronik, formely ZEL). On the base of good experience with the TACO control system, ZEA-2 decided that GALAXI should be the first instrument of Forschungszentrum Jülich with the successor system TANGO. The application software on top of TANGO is based on pyfrid. Pyfrid was originally developed for the neutron scattering instruments of JCNS and provides a scripting interface as well as a Web GUI. The design of the new control and data acquisition system is presented and the lessons learned by the introduction of TANGO are reported.

TUPPC048

Adoption of the “PyFRID” Python Framework for Neutron Scattering Instruments

Experiment Control

Matthias Drochner (FZJ, Jülich)

M.Drochner, L.Fleischhauer-Fuss, H.Kleines, D.Korolkov, M.Wagener, S.v.Waasen Adoption of the “PyFRID” Python Framework for Neutron Scattering Instruments To unify the user interfaces of the JCNS (Juelich Centre for Neutron Science) scattering instruments, we are adapting and extending the “PyFRID” framework. “PyFRID” is a high-level Python framework for instrument control. It provides a high level of abstraction, particularly by use of aspect oriented (AOP) techniques. Users can use a builtin command language or a web interface to control and monitor motors, sensors, detectors and other instrument components. The framework has been fully adopted at two instruments, and work is in progress to use it on more.

Poster

TUPPC049

Towards a Global Architecture for Operating and Controlling the Cherenkov Telescope Array

Experiment Control

Matthias Fuessling (Universität Potsdam, Potsdam-Golm), Josep Colome (CSIC-IEEC, Bellaterra), THE CTA CONSORTIUM (CTA, Heidelberg), Torsten Schmidt, Peter Andreas Roland Wegner (DESY Zeuthen, Zeuthen), Igor Oya, Ullrich Schwanke (Humboldt University Berlin, Berlin), Gino Tosti (INFN-PG, Perugia)

CTA (Cherenkov Telescope Array) is an initiative to build the next generation ground-based gamma-ray instrument. The CTA array will allow studies in the very-high-energy domain in the gamma-ray range from a few tens of GeV to more than a hundred TeV. CTA will comprise two arrays (one in the Northern hemisphere and one in the Southern hemisphere) for full sky coverage and will be operated as an open observatory. The increased complexity in operation, control and monitoring of such a large distributed multi-telescope array leads to new challenges for the central array control system which have to be met to guarantee required overall CTA performance. Among other challenges, the control software must be flexible enough to: allow for the simultaneous operation of multiple sub-arrays of telescopes of different types; be ready to react in short timescales to an altered observation schedule due to changing weather conditions or due to automatic alarms for transient phenomena; and be able to operate with a minimum crew on the observatory installation. Based on the physics and performance requirements of CTA, possible design concepts for the central array control system will be presented.

Poster

TUPPC050

Control, Safety and Diagnostics for Future ATLAS Pixel Detectors

Experiment Control

Susanne Kersten, Peter Kind, Peter Maettig, Lukas Puellen, Sebastian Weber, Christian Zeitnitz (Bergische Universitaet Wuppertal, Wuppertal), Sergey Kovalenko, Kerstin Lantzsch (CERN, Geneva), Fabrice Gensolen (CPPM, Marseille)

To ensure the excellent performance of the ATLAS Pixel detector during the next run periods of the LHC, with increasing demands, two upgrades of the pixel detector are foreseen. One takes place in the first long shutdown, which is currently on-going. During this period an additional layer, the Insertable B-Layer, will be installed. The second upgrade will replace the entire pixel detector and is planed for 2020, when the LHC will be upgraded to HL-LHC. As once installed no access is possible over years, a highly reliable control system is required. It has to supply the detector with all entities required for operation, protect it at all times, and provide detailed information to diagnose the detector's behaviour. Design constraints are the sensitivity of the sensors and reduction of material inside the tracker volume. We report on the construction of the control system for the Insertable B Layer and present a concept for the control of the pixel detector at the HL-LHC. While the latter requires completely new strategies, the control system of the IBL includes single new components, which can be developed further for the long-term upgrade.

Poster

TUPPC052

Automation of the Wavelength Change for the FERMI@Elettra Free Electron Laser

Experiment Control

Claudio Scafuri, Bruno Diviacco (Elettra-Sincrotrone Trieste S.C.p.A., Basovizza)

FERMI@Elettra is a users facility based on a seeded Free Electron Laser (FEL). A unique feature of FERMI@Elettra in this new class of light sources is the tunability of the emitted photon beam both in terms of wavelength and polarization. Tuning is obtained by choosing the appropriate gap and phasing of the undulators in the chain and by opportunely setting the seed laser wavelength. A series of adjustments are then necessary in order to keep constant the machine parameters and optimize the radiation characteristics. We have developed a software application, named SuperGap, which does all the calculations and coordinates the operations required to set the desired wavelength and polarization. SuperGap allows operators to perform this procedure in seconds. The speed and accuracy of the wavelength change have been largely exploited during user dedicated shifts to perform various types of scans in the experimental stations. The paper describes the algorithms and numerical techniques used by SuperGap and its architecture based on the Tango control system.

Poster

TUPPC053

New Control System for the SPES Off-Line Laboratory at LNL-INFN Using EPICS IOCs Based on the Raspberry Pi

Experiment Control

Jesus Alejandro Vasquez, Alberto Andrighetto (INFN/LNL, Legnaro (PD)), Matteo Bertocco (UNIPD, Padova (PD))

SPES (Selective Production of Exotic Species) is an ISOL type RIB facility of the LNL-INFN at Italy dedicated to the production of neutron-rich radioactive nuclei by uranium fission. At the LNL, for the last four years, an off-line laboratory has been developed in order to study the target front-end test bench. The instrumentation devices are controlled using EPICS. A new flexible, easy to adapt, low cost and open solution for this control system is being tested. It consists on EPICS IOCs developed at the LNL which are based on the low cost computer board Raspberry Pi with custom-made expansion boards. The operating system is a modify version of Debian Linux running EPICS soft IOCs that communicates with the expansion board using home-made drivers. The expansion boards consist on multi-channel 16bits ADCs and DACs, digital inputs and outputs and stepper motor drivers. The idea is to have a distributed control system using customized IOC for controlling the instrumentation devices on the system as well as to read the information from the detectors using the EPICS channel access as communication protocol. This solution will be very cost effective and easy to customize.

TUPPC054

A PLC-Based System for the Control of an Educational Observatory

Experiment Control

Veronica Baldini, Roberto Cirami, Igor Coretti, Paolo Di Marcantonio, Samuele Galeotta, Giulia Iafrate, Marco Mannetta, Paolo Santin (INAF-OAT, Trieste)

An educational project that aims to involve young students in astronomical observations has been developed in the last decade at the Basovizza branch station of the INAF-Astronomical Observatory of Trieste. The telescope used is a 14" reflector equipped with a robotic Paramount ME equatorial mount and placed in a non-automatic dome. The new-developing control system is based on Beckhoff PLC. The control system will mainly allow to remotely control the three-phase synchronous motor of the dome, the switching of the whole instrumentation and the park of the telescope. Thanks to the data coming from the weather sensor, the PLC will be able to ensure the safety of the instruments. A web interface is used for the communication between the user and the instrumentation. In this paper a detailed description of the whole PLC-based control system architecture will be presented.

TUPPC055

Developing of the Pulse Motor Controller Electronics for Running under Weak Radiation Environment

Experiment Control

Miyuki Ishizuka, Natsuji Araki, Hiroaki Kashima, Hiroyuki Mukai (Hitachi Zosen, Osaka)

Hitz Hitachi Zosen has developed new pulse motor controller. This controller which controls two axes per one controller implements high performance processor, pulse control device and peripheral interface. This controller has simply extensibility and various interface and realizes low price. We are able to operate the controller through Ethernet TCP/IP(or FL-net). Also, the controller can control max 16 axes. In addition, we want to drive the motor controller in optics hatch filled with weak radiation. If we can put the controller in optics hatch, wiring will become simple because of closed wiring in optics hatch . Therefore we have evaluated controller electronics running under weak radiation.

Poster

TUPPC056

The Detector Control System for Daya Bay Neutrino Experiment

Experiment Control

Mei Ye, Xiaonan Li (IHEP, Bejing)

The Daya Bay reactor neutrino experiment was designed to determine precisely the neutrino mixing angle Θ13 with a sensitivity better than 0.01 in the parameter sin22Θ13 at the 90% confidence level. To achieve this goal, the collaboration built eight functionally identical antineutrino detectors. The detectors are immersed in water pools that provide active and passive shielding against backgrounds. The experiment has been taking data for almost 1.5 years and the first results have already been released. The detector control and monitoring system(DCS) was developed to support a variety of hardware systems, such as high voltage crates, front end electronic crates, water system, gas system, low voltage crates, temperature and humidity of the environment. A global control system was developed to monitor and control the whole experiment. The paper present the dayabay experiment and control system as well.

Poster

TUPPC057

New Development of EPICS-based Data Acquisition System for Electron Cyclotron Emission Diagnostics in KSTAR Tokamak

Experiment Control

Tae Gu Lee, Kyu-Dong Lee, Sangil Lee, Woongryol Lee, Mikyung Park (NFRI, Daejon)

Korea Superconducting Tokamak Advanced Research (KSTAR) will be operated in the 6nd campaign in 2013 after achievement of first plasma in 2008. Many diagnostic devices have been installed for measuring the various plasma properties in the KSTAR tokamak during the campaigns. From the first campaign, a data acquisition system of Electron Cyclotron Emission (ECE) Heterodyne Radiometer (HR) has been operated to measure the radial profile of electron temperature. The DAQ system at the beginning was developed with a VME-form factor digitizer in Linux OS platform. However, this configuration had some limitations that it could not acquire over 100,000 samples per second due to its unstable operation during the campaigns. In order to overcome these weak points, a new ECE HR DAQ system is under development with a cPCI-form factor in Linux OS platform and the main control application will be developed based on EPICS framework like other control systems installed in KSTAR. Besides solving the described problems main advantages of the new ECE HR DAQ system are capabilities of calculating plasma electron temperature during plasma shot and displaying it in run-time.

TUPPC058

Automation of Microbeam Focusing for X-Ray Micro-Experiments at the 4B Beamline of Pohang Light Source-II

Experiment Control

Kyehwan Gil, Hyojin Choi, Jung Yun Huang, Jae-Hong Lim (PAL, Pohang, Kyungbuk)

The 4B beamline of the Pohang Light Source-II performs X-ray microdiffraction and micro-fluorescence experiments using X-ray microbeams. The microbeam has been focused down to FWHM sizes of less than 3 Mμ by manually adjusting the vertical and horizontal focusing mirrors of a K-B (Kirkpatrick-Baez) mirror system. In this research, a microbeam-focusing automation software was developed to automate the old complex and cumbersome process of beam focusing which may take about a day. The existing controllers of the K-B mirror system were replaced by products with communication functions and a motor-driving routine by means of proportional feedback control was constructed. Based on the routine and the outputs of two ionization chambers arranged in front and rear of the K-B mirror system, the automation software to perform every step of the beam focusing process was completed as LabVIEW applications. The developed automation software was applied to the 4B beamline and showed the performance of focusing an X-ray beam with a minimal size within an hour. This presentation introduces the details of the algorithms of the automation software and examines its performances.

Poster

TUPPC059

Nominal Data Acquisition Device Support for EPICS

Experiment Control

Vyacheslav Alexandrovich Isaev (Cosylab, Ljubljana), Klemen Zagar (COBIK, Solkan)

A large number of devices offer a similar kind of capabilities. For example, data acquisition all offer sampling at some rate. If each such device were to have a different interface, engineers using them would need to be familiar with each device specifically, inhibiting transfer of know-how from working with one device to another and increasing the chance of engineering errors due to a miscomprehension or incorrect assumptions. In the Nominal Device Model (NDM) model, we propose to standardize the EPICS interface of the analog and digital input and output devices, and image acquisition devices. The model describes an input/output device which can have digital or analog channels, where channels can be configured for output or input. Channels can be organized in groups that have common parameters. NDM is implemented as EPICS Nominal Device Support library (NDS). It provides a C++ interface to developers of device-specific drivers. NDS itself inherits well-known asynPortDriver. NDS hides from the developer all the complexity of the communication with asynDriver and allows to focus on the business logic of the device itself.

TUPPC060

Poster

Implementation of Continuous Scans Used in Beamline Experiments at Alba Synchrotron

Experiment Control

Zbigniew Reszela, Guifre Cuni, David Fernandez-Carreiras, Carlos Pascual-Izarra (CELLS-ALBA Synchrotron, Cerdanyola del Vallès), Tiago Coutinho (ESRF, Grenoble)

The control system of the Alba synchrotron is based on Sardana*, which is a software package implemented in Python, built on top of Tango** and oriented to beamline and accelerator control and data acquisition. Sardana provides an advanced scan framework, which is commonly used in all the beamlines of Alba as well as other institutes. This framework provides standard macros and comprises various scanning modes: step, hybrid and software-continuous, however no hardware-continuous. The continuous scans speed up the data acquisition, making it a great asset for most experiments and due to time constraints, mandatory for few of them. A continuous scan has been developed and installed in 2 Alba beamlines. BL04*** HRPD experiments are now performed in less than one hour (step scan mode ~10 h) and BL22**** EXAFS in just a few minutes (step scan mode ~45 min). Furthermore the continuous scan developed in this project can be easily adapted to any other experiment, and will be used as a base for developing a generic continuous scan for the scan framework of Sardana. This article describes requirements, plan and implementation of the project as well as its results and possible improvements.

*"Sardana, The Software for Building SCADAS in Scientific Environments" T.M. Coutinho, ICALEPCS2011 **www.tango-controls.org ***www.cells.es/Beamlines/MSPD ****www.cells.es/Beamlines/CLAESS

TUPPC061

Poster

BL13-XALOC, MX experiments at Alba: Current Status and Ongoing Improvements

Experiment Control

Guifre Cuni, David Fernandez-Carreiras, Carlos Pascual-Izarra, Zbigniew Reszela (CELLS-ALBA Synchrotron, Cerdanyola del Vallès), Tiago Coutinho [on leave] (ESRF, Grenoble)

BL13-XALOC is the only Macromolecular Crystallography (MX) beamline at the 3-GeV ALBA synchrotron. The control system is based on Tango * and Sardana **, which provides a powerful python-based environment for building and executing user-defined macros, a comprehensive access to the hardware, a standard Command Line Interface based on ipython, and a generic and customizable Graphical User Interface based on Taurus ***. Currently, the MX experiments are performed through panels that provide control to different beamline instrumentation. Users are able to collect diffraction data and solve crystal structures, and now it is time to improve the control system by combining the feedback from the users with the development of the second stage features: group all the interfaces (i.e. sample viewing system, automatic sample changer, fluorescence scans, and data collections) in a high-level application and implement new functionalities in order to provide a higher throughput experiment, with data collection strategies, automated data collections, and workflows. This article describes the current architecture of the XALOC control system, and the plan to implement the future improvements.

* http://www.tango-controls.org/ ** http://www.sardana-controls.org/ *** http://www.tango-controls.org/static/taurus/

Poster

TUPPC062

High-Speed Data Acquisition of Sensor Signals for Physical Model Verification at CERN HiRadMat (SHC-DAQ)

Experiment Control

Cedric Charrondière, Michael Guinchard, Sergio Marques Dos Santos (CERN, Geneva)

A high-speed data acquisition system was successfully developed and put into production in a harsh radiation environment in a couple of months to test new materials impacted by proton beams for future use in beam intercepting devices. A 4 MHz ADC with high impedance and low capacitance was used to digitize the data at a 2 MHz bandwidth. The system requirements were to design a full speed data streaming on a trigger during up to 30 ms and then reconfigure the hardware in less than 500 ms to perform a 100 Hz acquisition for 30 seconds. Experimental data were acquired, using LabVIEW real-time, relying on extensive embedded instrumentation (strain gauges and temperature sensors) and on acquisition boards hosted on a PXI crate. The data acquisition system has a dynamic range and sampling rate that are sufficient to acquire the very fast and intense shock waves generated by the impact. This presentation covers the requirements, the design, development and commissioning of the system. The overall performance, user experience and preliminary results will be reported.

Poster

TUPPC063

Control and Monitoring of the Online Computer Farm for Offline Processing in LHCb

Experiment Control

Luis Granado Cardoso, Philippe Charpentier, Joel Closier, Markus Frank, Clara Gaspar, Beat Jost, Guoming Liu, Niko Neufeld (CERN, Geneva), Olivier Callot (LAL, Orsay)

LHCb, one of the 4 experiments at the LHC accelerator at CERN, uses approximately 1500 PCs (averaging 12 cores each) for processing the High Level Trigger (HLT) during physics data taking. During periods when data acquisition is not required most of these PCs are idle. In these periods it is possible to profit from the unused processing capacity to run offline jobs, such as Monte Carlo simulation. The LHCb offline computing environment is based on LHCbDIRAC (Distributed Infrastructure with Remote Agent Control). In LHCbDIRAC, job agents are started on Worker Nodes, pull waiting tasks from the central WMS (Workload Management System) and process them on the available resources. A Control System was developed which is able to launch, control and monitor the job agents for the offline data processing on the HLT Farm. This control system is based on the existing Online System Control infrastructure, the PVSS SCADA and the FSM toolkit. It has been extensively used launching and monitoring 22.000+ agents simultaneously and more than 850.000 jobs have already been processed in the HLT Farm. This paper describes the deployment and experience with the Control System in the LHCb experiment.

Poster

TUPPC064

Reusing the Knowledge from the LHC Experiments to Implement the NA62 Run Control

Experiment Control

Fernando Varela, Manuel Gonzalez-Berges (CERN, Geneva), Nicolas Lurkin (UCL, Louvain-la-Neuve)

NA62 is an experiment designed to measure very rare kaon decays at the CERN SPS planned to start operation in 2014. Until this date, several intermediate run periods have been scheduled to exercise and commission the different parts and subsystems of the detector. The Run Control system monitors and controls all processes and equipment involved in data-taking. This system is developed as a collaboration between the NA62 Experiment and the Industrial Controls and Engineering (EN-ICE) Group of the Engineering Department at CERN.
In this paper, the contribution of EN-ICE to the NA62 Run Control project is summarized. EN-ICE has promoted the utilization of standardized control technologies and frameworks at CERN, which were originally developed for the controls of the LHC experiments. This approach has enabled to deliver a working system for the 2013 Technical Run that exceeded the initial requirements, in a very short time and with limited manpower.

Poster

TUPPC065

LHC Detector Control Systems Through the Years, a Better Future Through Lessons from the Past

Experiment Control

Andre Augustinus, Peter Chochula, Alexander Kurepin, Mateusz Lechman, Peter Rosinsky (CERN, Geneva), Ombretta Pinazza (INFN-Bologna, Bologna)

The design of the Detector Control Systems of the LHC experiments was largely based on the experience gained in the operation of the previous generation of HEP experiments, notably the LEP experiments at CERN. Architectural concepts were transposed to the new control systems, and several tools were re-used in the current control systems. This paper will put the current Detector Control Systems in a historical context, using the ALICE DCS as an example. It will describe the evolution from ‘slow control’ systems of the LEP era to the ones from the LHC era. We will highlight the how tools that proved their strength during years of operation were re-used in the modern control environment and how technology and culture changed between the generations. We will conclude with an outlook and describe how Detector Control Systems could evolve in the future, describing some of the new technologies and concepts

TUPPC066

10 Years of Experiment Control at SLS Beam Lines: an Outlook to SwissFEL

Experiment Control

Juraj Krempasky, Uwe Flechsig, Babak Kalantari, Xiaoqiang Wang (PSI, Villigen PSI), Tim Mooney (ANL, Argonne), Mark Lloyd Rivers (CARS, Argonne, Ilinois)

Today, after nearly 10 years of consolidated user operation at the Swiss Light Source (SLS) with up to 18 beam lines, we are looking back to briefly describe the success story based on EPICS controls toolkit and give an outlook towards the X-ray free-electron laser SwissFEL, the next challenging PSI project. We focus on SLS spectroscopy beam lines with experimental setups rigorously based on the SynApps "Positioner-Trigger-Detector" (PTD) anatomy [2]. We briefly describe the main beam line "Positioners" used inside the PTD concept. On the "Detector" side an increased effort is made to standardize the control within the areaDetector (AD) software package [3]. For the SwissFEL two detectors are envisaged: the Gotthard 1D and Jungfrau 2D pixel detectors, both built at PSI. Consistently with the PTD-anatomy, their control system framework based on the AD package is in preparation. In order to guarantee data acquisition with the SwissFEL nominal 100 Hz rate, the "Trigger" is interconnected with the SwissFEL timing system to guarantee shot-to-shot operation [4]. The AD plug-in concept allows significant data reduction; we believe this opens the doors towards on-line FEL experiments.

[1] Krempaský et al, ICALEPCS 2001 [2] www.aps.anl.gov/bcda/synApps/index.php [3] M. Rivers, SRI 2009, Melbourne [4] B. Kalantari et al, ICALEPCS 2011

Poster

TUPPC067

TECII - A Distributed Sample Environment Control and Diagnostics System Proposal for ISIS

Experiment Control

Matt Richard William North (STFC/RAL/ISIS, Chilton, Didcot, Oxon)

This paper puts forward a strategy for the implementation of a Technicians Experimental Control and Instrumentation Interface (TECII) principally for the control, automation and diagnostics of sample environment equipment distributed across the ISIS Neutron & Muon source facility. ISIS, located at the Rutherford Appleton Laboratory in the UK is a spallation neutron & muon source designed with two targets stations servicing 33 beamline instruments and over 1800 visiting users. A well-defined control system exists for instrument scientists and beamline users; however there is little scope for this system to be expanded for the needs of technicians and engineers. There is great potential in improving the operational capability of ISIS by providing a system which is focussed on the control and diagnostics of the operational aspects of sample environment equipment. The main challenge is the implementation of technology that provides adequate configurability and flexibility to meet the ever changing requirements of modern experimental setups.

TUPPC068

Migrating to an EPICS Based Instrument Control System at the ISIS Spallation Neutron Source

Experiment Control

Frederick Anthony Akeroyd, Kathryn Baker, Matt Clarke, Gareth Howells, David Keymer, Kevin John Knowles, Christopher Moreton-Smith (STFC/RAL/ISIS, Chilton, Didcot, Oxon), Kevin Woods (Tessella, Abingdon)

The beamline instruments at the ISIS spallation neutron source have been running successfully for many years using an in-house developed control system. The advent of new instruments and the desire for more complex experiments has led to a project being created to determine how best to meet these challenges. Though it would be possible to enhance the existing system, migrating to an EPICS-based system offers many advantages in terms of flexibility, software reuse and the potential for collaboration. While EPICS is well established for accelerator and synchrotron beamline control, is it not currently widely used for neutron instruments, but this is changing. The new control system is being developed to initially run in parallel with the existing system, a first version being scheduled for testing on two newly constructed instruments starting summer 2013. In this paper, we will discuss the design and implementation of the new control system, including how our existing National Instruments LabVIEW controlled equipment was integrated, and issues that we encountered during the migration process.

TUPPC069

ZEBRA, a Flexible Solution for Controlling Scanning Experiments

Experiment Control

Tom Cobb, Yuri Chernousko, Isa Servan Uzun (Diamond, Oxfordshire)

This paper presents the ZEBRA product developed at Diamond Light Source. ZEBRA is a stand-alone event handling system with interfaces to multi-standard digital I/O signals (TTL, LVDS, PECL, NIM and Open Collector) and RS422 quadrature incremental encoder signals. Input events can be triggered by input signals, encoder position signals or repetitive time signals, and can then be combined using logic gates in an FPGA to generate and output other events. The positions of all 4 encoders can be captured at the time of a given event and made available to the controlling system. All control and status is available through a serial protocol, so there is no dependency on a specific higher level control system. We have found it has applications on virtually all Diamond beamlines from applications as simple as signal level shifting to, for example, using it for all continuous scanning experiments. The internal functionality is all reconfigurable on the fly through user interface and can be saved to static memory. It provides a flexible solution to interface different third party hardware (detectors and motion controllers) and to configure the required functionality as part of the experiment.

Poster

TUPPC070

Detector Controls for the NOvA Experiment Using Acnet-in-a-Box

Experiment Control

Dennis J. Nicklaus, Linden Ralph Carmichael, Denise Finstrom, Brian Hendricks, Charlie King, William Marsh, Richard Neswold, James Patrick, James Smedinghoff, Jianming You (Fermilab, Batavia)

In recent years, we have packaged the Fermilab accelerator control system, Acnet, so that other instances of it can be deployed independent of the Fermilab infrastructure. This encapsulated "Acnet-in-a-Box" is installed as the detector control system at the NOvA Far Detector. NOvA is a neutrino experiment using a beam of particles produced by the Fermilab accelerators. There are two NOvA detectors: a 330 ton ``Near Detector" on the Fermilab campus and a 14000 ton ``Far Detector" 735 km away. All key tiers and aspects of Acnet are available in the NOvA instantiation, including the central device database, java Open Access Clients, erlang front-ends, application consoles, synoptic displays, data logging, and state notifications. Acnet at NOvA is used for power-supply control, monitoring position and strain gauges, environmental control, PLC supervision, relay rack monitoring, and interacting with Epics PVs instrumenting the detector's avalanche photo-diodes. We discuss the challenges of maintaining a control system in a remote location, synchronizing updates between the instances, and improvements made to Acnet as a result of our NOvA experience.

Poster

TUPPC071

Muon Ionization Cooling Experiment: Controls and Monitoring

Experiment Control

Pierrick M. Hanlet (IIT, Chicago, Illinois)

The Muon Ionization Cooling Experiment is a demonstration experiment to prove the feasibility of cooling a beam of muons for use in a Neutrino Factory and/or Muon Collider. The MICE cooling channel will produce a 10% reduction in beam emittance which will be measured with a 1% resolution, and this level of precision requires strict controls and monitoring of all experimental parameters to minimize systematic errors. The MICE Controls and Monitoring system is based on EPICS and integrates with the DAQ, data monitoring systems, a configuration database, and state machines for device operations. Run Control has been developed to ensure proper sequencing of equipment and use of system resources to protect data quality. State machines are used in test operations of cooling channel superconducting solenoids to set parameters for monitoring, alarms, and data archiving. A description of this system, its implementation and performance during both muon beam data collection and magnet training will be discussed.

Poster

TUPPC072

Flexible Data Driven Experimental Data Analysis at the National Ignition Facility*

Experiment Control

Allan Casey, Rita Carol Bettenhausen, Essex J. Bond, Robert Nethercott Fallejo, Matthew Hutton, Judith A. Liebman, Amber A. Marsh, Thomas M. Pannell, Scott Reisdorf, Abbie L. Warrick (LLNL, Livermore, California)

After each target shot at the National Ignition Facility (NIF), scientists require data analysis within 30 minutes from ~50 diagnostic instrument systems. To meet this goal, NIF engineers created the Shot Data Analysis (SDA) Engine based on the Oracle Business Process Execution Language (BPEL) platform. While this provided for a very powerful and flexible analysis product, it still required engineers conversant in software development practices in order to create the configurations executed by the SDA engine. As more and more diagnostics were developed and the demand for analysis increased, the development staff was not able to keep pace. To solve this problem, the Data Systems team took the approach of creating a database table based scripting language that allows users to define an analysis configuration of inputs, input the data into standard processing algorithms and then store the outputs in a database. The creation of the Data Driven Engine (DDE) has substantially decreased the development time for new analysis and simplified maintenance of existing configurations. The architecture and functionality of the Data Driven Engine will be presented along with examples.

Poster

TUPPC073

National Ignition Facility (NIF) Dilation X-ray Imager (DIXI) Diagnostic Instrumentation and Control System*

Experiment Control

Jarom Nelson, Jay Ayers, Sukhdeep Heerey, Randy Shelton (LLNL, Livermore, California)

X-ray cameras on inertial confinement fusion facilities can determine the implosion velocity and symmetry of NIF targets by recording the emission of X-rays from the target gated as a function of time. To capture targets that undergo ignition and thermonuclear burn, however, cameras with less than 10 picosecond shutter times are needed. A Collaboration between LLNL, General Atomics and Kentech Instruments has resulted in the design and construction of an X-ray camera which converts an X-ray image to an electron image, which is stretched, and then coupled to a conventional shuttered electron camera to meet this criteria. This talk discusses target diagnostic instrumentation and software used to control the DIXI diagnostic and seamlessly integrate it into the National Ignition Facility (NIF) Integrated Computer Control System (ICCS).

Poster

TUPPC075

Database Centric Event Mode Neutron Scattering Data Acquisition and Instruments Control Systems

Experiment Control

Madhan Sundaram, Piotr Zolnierczuk (ORNL, Oak Ridge, Tennessee), Andre Parizzi, Yanyan Carol Tang, Bogdan Vacaliuc (ORNL RAD, Oak Ridge, Tennessee)

NoSQL databases have become very popular for their simplicity and capacity to handle large amount of loosely related data. Today we find them behind many web applications like Twitter or Amazon Cloud. Databases have long been employed in control systems, performing functions such as persistent storage or logging. We investigate a novel concept of building entire data acquisition and control systems (DACS) with a true publish-subscribe model for neutron scattering beam-lines around a NoSQL database, i.e. use it as a central part of the DACS for communication, neutron event data acquisition, fast and slow meta-data acquisition, instrument automation control, and systems logging. In this study, we present results obtained with a prototype system based on the open source MongoDB NoSQL database, chosen for its high throughput, low latency, scalability and load balancing capabilities. We will present the architecture and some preliminary studies and benchmarks of this system.

Poster

TUPPC076

SNS Instrument Data Acquisition and Controls

Experiment Control

Steven M. Hartman (ORNL, Oak Ridge, Tennessee)

The data acquisition (DAQ) and control systems for the neutron beam line instruments at the Spallation Neutron Source (SNS) are undergoing upgrades addressing three critical areas: data throughput and data handling from DAQ to data analysis, instrument controls including user interface and experiment automation, and the low-level electronics for DAQ and timing. This paper will outline the status of the upgrades and will address some of the challenges in implementing fundamental upgrades to an operating facility concurrent with commissioning of existing beam lines and construction of new beam lines.

TUPPC077

Poster

Experiment Automation with a Robot Arm Using the Liquids Reflectometer Instrument at the Spallation Neutron Source

Experiment Control

Bogdan Vacaliuc, Gayle Greene, Andre Parizzi, Madhan Sundaram (ORNL RAD, Oak Ridge, Tennessee), John Francis Ankner, James Browning, Candice Halbert, Michael Hoffmann, Piotr Zolnierczuk (ORNL, Oak Ridge, Tennessee)

The Liquids Reflectometer instrument installed at the Spallation Neutron Source (SNS) enables observations of chemical kinetics, solid-state reactions and phase-transitions of thin film materials at both solid and liquid surfaces. Effective measurement of these behaviors requires each sample to be calibrated dynamically using the neutron beam and the data acquisition system in a feedback loop. Since the SNS is an intense neutron source, the time needed to perform the measurement can be the same as the alignment process, leading to a labor-intensive operation that is exhausting to users. An update to the instrument control system, completed in March 2013, implemented the key features of automated sample alignment and robot-driven sample management, allowing for unattended operation over extended periods, lasting as long as 20 hours. We present a case study of the effort, detailing the mechanical, electrical and software modifications that were made as well as the lessons learned during the integration, verification and testing process.

TUPPC078

Poster

First EPICS/CSS Based Instrument Control and Data Acquisition System at ORNL

Experiment Control

Xiaosong Geng, Xihui Chen, Kay-Uwe Kasemir (ORNL, Oak Ridge, Tennessee)

The neutron imaging prototype beamline (CG-1D) at the Oak Ridge National Laboratory High Flux Isotope Reactor (HFIR) is used for many different applications necessitating a flexible and stable instrument control system. Beamline scientists expect a robust data acquisition system. They need a clear and concise user interface that allows them to both configure an experiment and to monitor an ongoing experiment run. Idle time between acquiring consecutive images must be minimized. To achieve these goals, we implement a system based upon EPICS, a newly developed CSS scan system, and CSS BOY. This paper presents the system architecture and possible future plans.

Poster

TUPPC080

RASHPA: a Data Acquisition Framework for 2D XRays Detectors

Hardware Technology

Fabien Le Mentec, Pablo Fajardo, Christian Herve, Alejandro Homs, Thierry Le Caer (ESRF, Grenoble)

ESRF research programs, along with the foreseen accelerator sources upgrade, require state-of-the-art instrumentation devices with high data flow acquisition systems. This paper presents RASHPA, a data acquisition framework targeting 2D XRay detectors. By combining a highly configurable multi link PCI Express over cable based data transmission engine and a carefully designed LINUX software stack, RASHPA aims at reaching the performances required by current and future detectors.

Poster

TUPPC081

IcePAP: An Advanced Motor Controller for Scientific Applications in Large User Facilities

Hardware Technology

Nicolas Janvier, Jose-Maria Clement, Pablo Fajardo (ESRF, Grenoble), Guifre Cuni (CELLS-ALBA Synchrotron, Cerdanyola del Vallès)

Synchrotron radiation facilities and in particular large hard X-ray sources such as the ESRF are equipped with thousands of motorized position actuators. Combining all the functional needs found in those facilities with the implications related to personnel resources, expertise and cost makes the choice of motor controllers a strategic matter. Most of the large facilities adopt strategies based on the use of off-the-shelf devices packaged using standard interfaces. As this approach implies severe compromises, the ESRF decided to address the development of IcePAP, a motor controller designed for applications in a scientific environment. It optimizes functionality, performance, ease of deployment, level of standardization and cost. This device is adopted as standard and is widely used at the beamlines and accelerators of ESRF and ALBA. This paper provides details on the architecture and technical characteristics of IcePAP as well as examples on how it implements advanced features. It also presents ongoing and foreseen improvements as well as introduces the outline of an emerging collaboration aimed at further development of the system making it available to other research labs.

Poster

TUPPC082

DSP Design Using System Generator

Hardware Technology

Jean Marc Koch (ESRF, Grenoble)

When designing a real time control system, a fast data transfer between the different pieces of hardware must be guaranteed since synchronization and determinism have to be respected. One efficient solution to cope with these constraints is to embed the data collection, the signal-processing and the driving of the acting devices in FPGAs. Although this solution imposes that the whole design is being developed for an FPGA, in pure hardware, it is possible to open the part dedicated to the signal processing to non HDL (Hardware Description Language) specialists; the choice has been made here to develop this part under System Generator, in Simulink. Another challenge in such system design is the integration of real time models on already pre-configured hardware platforms. This paper describes with few examples how to interface such hardware with HDL System Generator control systems blocks. The advantages of Simulink for the simulation phase of the design as well as the possibility to introduce models dedicated to the tests are also presented.

Poster

TUPPC083

FPGA Implementation of a Digital Constant Fraction for Fast Timing Studies in the Picosecond Range

Hardware Technology

Paolo Mutti, Jacques Ratel, Franck Rey, Emilio Ruiz-Martinez (ILL, Grenoble)

Thermal or cold neutron capture on different fission systems is an excellent method to produce a variety of very neutron-rich nuclei. Since neutrons at these energies bring in the reaction just enough energy to produce fission, the fragments remain neutron-rich due to the negligible neutron evaporation thus allowing detailed nuclear structure studies. In 2012 and 2013 a combination of EXOGAM, GASP and Lohengrin germanium detectors has been installed at the PF1B cold neutron beam of the Institut Laue-Langevin. The present paper describes the digital acquisition system used to collect information on all gamma rays emitted by the decaying nuclei. Data have been acquired in a trigger-less mode to preserve a maximum of information for further off-line treatment with a total throughput of about 10 MByte/sec. Special emphasis is devoted to the FPGA implementation of an on-line digital constant fraction algorithm allowing fast timing studies in the pico second range.

TUPPC084

Virtualization of Complex VME Boards Using FPGA Technology to Address Obsolescence

Hardware Technology

Christian Raymond Lucuix (ESO, Garching bei Muenchen), Raquel Fernandez Ramos (Universidad de Málaga, Malaga)

The ESO Very large Telescopes at Paranal (Chile) are now in operation since nearly 15 years with most of their first generation instruments still in operation. The control HW design of these early instruments was based on VME bus control boards that are now completely obsolete. While replacing general I/O boards is an easy task, for more sophisticated functions like motion controller this is another level of complexity. This comes partially from the strong coupling that does exist between the HW and the motion control SW, and for the other part from the motor cabling interfaces that can't be changed without a complete stop and re-commissioning of the instrument. Our approach was then to evaluate the possibility to "virtualize" the obsolete motion controllers HW inside an FPGA based board that would respect the HW interfaces and execute the original firmware. One advantage of such strategy is that, even without a full knowledge of the original system, we were able to create a fully functional replacement board. This article will describe the different approaches, strategies and design steps we have used during this project to develop the first FPGA board prototype.

Poster

TUPPC085

Modular, Scalable ATCA-based Data Acquisition System

Hardware Technology

Wojciech Jalmuzna (Embedded Integrated Control Systems GmbH, Hamburg)

The described system has been developed for systems, which require a high count of analog channels, high bandwidth, fast communication links and relatively large computation power based on Virtes-6 FPGAs. A single ATCA blade consists of two proprietary mezzanine slots and two Virtex-6 FPGA for serving mezzanines. The blades can be operated in a single-slot ATCA crate up to 14-slot crate. Each mezzanine offers 24 analog channels with 12-bit resolution and sampling rate up to 40 MHz. Blades communicate over backplane, but optionally it is possible to send data over 10G links available on RTM. Clock and trigger signals are distributed over backplane or RTM. An example application for detector readout is presented.

Poster

TUPPC086

Electronics Developments for High Speed Data Throughput and Processing

Hardware Technology

Patrick Gessler, Bruno Fernandes, Christopher Youngman (XFEL.EU, Hamburg)

The European XFEL DAQ system has to acquire and process data in short bursts every 100ms. Bursts lasts for 600us and contain a maximum of 2700 x-ray pulses with a repetition rate of 4.5MHz which have to be captured and processed before the next burst starts. This time structure defines the boundary conditions for almost all diagnostic and detector related DAQ electronics required and currently being developed for start of operation in fall 2015. Standards used in the electronics developments are: MicroTCA.4 and AdvancedTCA crates, use of FPGAs for data processing, transfer to backend systems via 10Gbps (SFP+) links, and feedback information transfer using 3.125Gbps (SFP) links. Electronics being developed in-house or in collaboration with external institutes and companies include: a Train Builder ATCA blade for assembling and processing data of large-area image detectors, a VETO MTCA.4 development for evaluating pulse information and distributing a trigger decision to detector front-end ASICs and FPGAs with low-latency, a MTCA.4 digitizer module, interface boards for timing and similar synchronization information, etc.

Poster

TUPPC087

High Level FPGA Programming Framework Based on Simulink

Hardware Technology

Bruno Fernandes, Patrick Gessler, Christopher Youngman (XFEL.EU, Hamburg)

Modern diagnostic and detector related data acquisition and processing hardware are increasingly being implemented with Field Programmable Gate Array (FPGA) technology. The level of flexibility allows for simpler hardware solutions together with the ability to implement functions during the firmware programming phase. The technology is also becoming more relevant in data processing, allowing for reduction and filtering to be done at the hardware level together with implementation of low-latency feedback systems. However, this flexibility and possibilities require a significant amount of design, programming, simulation and testing work usually done by FPGA experts. A high-level FPGA programming framework is currently under development at the European XFEL in collaboration with the Oxford University within the EU CRISP project. This framework allows for people unfamiliar with FPGA programming to develop and simulate complete algorithms and programs within the MathWorks Simulink graphical tool with real FPGA precision. Modules within the framework allow for simple code reuse by compiling them into libraries, which can be deployed to other boards or FPGAs.

Poster

TUPPC088

Development of MicroTCA-based Image Processing System at SPring-8

Hardware Technology

Akio Kiyomichi, Mitsuhiro Masaki, Takemasa Masuda, Souroku Ueda (JASRI/SPring-8, Hyogo-ken)

In SPring-8, various CCD cameras have been utilized for electron beam diagnostics of accelerators and x-ray imaging experiments. PC-based image processing systems are mainly used for the CCD cameras with Cameralink I/F. We have developed a new image processing system based on MicroTCA platform, which has an advantage over PC in robustness and scalability due to its hot-swappable modular architecture. In order to reduce development cost and time, the new system is built with COTS products including a user-configurable Spartan6 AMC with an FMC slot and a Cameralink FMC. The Cameralink FPGA core is newly developed in compliance with the AXI4 open-bus to enhance reusability. The MicroTCA system will be first applied to upgrade of the two-dimensional synchrotron radiation interferometer[1] operating at the SPring-8 storage ring. The sizes and tilt angle of a transverse electron beam profile with elliptical Gaussian distribution are extracted from an observed 2D-interferogram. A dedicated processor AMC (PrAMC) that communicates with the primary PrAMC via backplane is added for fast 2D-fitting calculation to achieve real-time beam profile monitoring during the storage ring operation.

[1] "Two-dimensional visible synchrotron light interferometry for transverse beam-profile measurement at the SPring-8 storage ring", M.Masaki and S.Takano, J. Synchrotron Rad. 10, 295 (2003).

Poster

TUPPC089

Upgrade of the Power Supply Interface Controller Module for SuperKEKB

Hardware Technology

Tatsuro Nakamura, Atsuyoshi Akiyama, Kazuro Furukawa, Masako Iwasaki, Hiroshi Kaji, Shinya Sasaki (KEK, Ibaraki)

There were more than 2500 magnet power supplies for KEKB storage rings and injection beam transport lines. For the remote control of such a large number of power supplies, we have developed the Power Supply Interface Controller Module (PSICM), which is plugged into each power supply. It has a microprocessor, ARCNET interface, trigger signal input interface, and parallel interface to the power supply. The PSICM is not only an interface card but also controls synchronous operation of the multiple power supplies with an arbitrary tracking curve. For SuperKEKB, the upgrade of KEKB, most of the existing power supplies continues while handreds of new power suplies are also installed. Although the PSICMs have worked without serious problem for 12 years, it seems too hard to keep maintenance for the next decade because of the discontinued parts. Thus we have developed the upgraded version of the PSICM. The new PSICM has the fully backward compatible interface to the power supply. The enhanced features are high speed ARCNET communication and redundant trigger signals. The design and the status of the upgraded PSICM are presented.

Poster

TUPPC090

Digital Control System of High Extensibility for KAGRA

Hardware Technology

Hiroaki Kashima, Natsuji Araki, Toshikatsu Masuoka, Hiroyuki Mukai (Hitachi Zosen, Osaka), Miyakawa Osamu (ICRR, Chiba)

KAGRA is the large scale cryogenic gravitational wave telescope project in Japan which is developed and constructed by ICRR. of The University of Tokyo. Hitz Hitachi Zosen produced PCI Express I/O chassis and the anti-aliasing/anti-imaging filter board for KAGRA digital control system. These products are very important for KAGRA interferometer from the point of view of low noise operations. This paper reports the performance of these products.

Poster

TUPPC091

An Embedded IOC for 100-MeV Cyclotron RF Control

Hardware Technology

Zhiguo Yin, Lei Cao, Shigang Hou, Bin Ji, Pengzhan Li, Tianjue Zhang (CIAE, Beijing)

An ARM9 based embedded controller for 100MeV cyclotron RF control has been successfully developed and tested with EPICS control software. The controller is implemented as a 3U VME long card, located in the first slot of the LLRF control crate, as a supervise module that continuously monitors the status of the RF system through a costume designed backplane and related ADCs located on other boards in the crate. For high components density and signal integrate considerations, the PCB layout adopts a 4 layer design. The Debian GNU/Linux distribution for the ARM architecture has been selected as operating system for both robustness and convenience. EPICS device support as well as Linux driver routings has been written and tested to interface database records to the on board 12 multichannel 16bits ADCs and DACs. In the meantime, a chip selecting encoding-decoding strategy has been implemented from both software and hardware aspects to extend the SPI bus of the AT91SAM9g20 processor. The detailed software as well as hardware designed will be reported in this paper.

TUPPC092

A VME Single Computer Based on Loongson2F CPU

Hardware Technology

Jian Zhuang, Yuanping Chu, Dapeng Jin (State Key laboratory of Particle Detection and Electronics of China, Beijing; IHEP, Beijing), Lei Hu (IHEP, Beijing), Kejun Zhu (State Key laboratory of Particle Detection and Electronics of China, Beijing; IHEP, Bejing)

VME system is widely used in distribute control system of large scientific plant as IOC. Design a customized VME controller will help to increase flexibility of whole control system. Loongson 2F CPU is a high performance general CPU designed by institute of computing technology, Chinese academy of science. DDR2 controller and PCI-X controller are integrated on this chip. This paper introduces the design of a single board computer based on Loongson 2F CPU. This computer can be used as VME bus controller in VME system, or used alone. Universe IID is on the board and functions as PCI-VME interface. And Intel 82541er Ethernet controller is also on this board. PMON software functions as bootloader on this board. Linux operation system is migrated to this board. RTEMS is also migrated to this board as the alternatives. The CPU performance and network performance are obtained on this board. The performance of EPICS on this board is also presented in this paper.

Poster

TUPPC093

Electronics Development of Si+CsI Prototype Detector for RAON

Hardware Technology

Yonghak Kim, Young Jin Kim, Youngjin Kim (IBS, Daejeon)

The Rare Isotope Science Project (RISP) was established in December 2011 in order to carry out the technical design and the establishment of the accelerator complex (RAON) for the rare isotope science. RAON is a rare isotope accelerator and it will be constructed in Daejeon, Korea. For heavy ion collision experiment, Si+CsI detector will be used for measuring charge particles by ΔE-E technique. Si detector measures energy loss of charged particle in the detector material(ΔE) and CsI detector measures energy of charged particle(E). Recently, Si+CsI prototype detector and readout electronics are designed and they are going to be built for testing. For readout of Si detector, electronics system consists of analog board, power board, control board based on FPGA and ARM-core-processor board. For readout of CsI detector, electronics system consists of analog board and commercial products. The design of each board is aiming to improve its performance in terms of power consumption, noise reduction, readout speed, etc. as compared with existing other Si+CsI readout systems. The development result of Si+CsI readout electronics system will be shown in this presentation.

TUPPC094

Poster

Em# Project. Improvement of Low Current Measurements at Alba Synchrotron

Hardware Technology

Xavier Serra-Gallifa, Jerzy Jan Jamroz [on leave], Oscar Matilla (CELLS-ALBA Synchrotron, Cerdanyola del Vallès)

After two years with 50 four electrometer channels measurement units working successfully at Alba beamlines, new features implementation have forced a complete instrument architecture change. This new equipment is taking advantatge of the targets achieved as the remarkable low noise in the current amplifier stage and implements new features currently not available in the market. First an embedded 18 bits SAR ADC able to work under up to 1kV biasing has been implemented looking for the highest possible accuracy. The data stream is analyzed by a flexible data processing based on a FPGA which is able to execute sample-by-sample real-time calculation aimed to be applied in experiments as the current normalization absortion between two channel acquisitions; being able to optimize the SNR of an absortion spectrum. The equipment is oriented from the design stage to be integrated in continuous scans setups, implementing low level timestamp compatible with multiple clock sources standards using an SFP port. This port could also be used in the future to integrate XBPM measures into the FOFB network for the accelerator beam position correction.

TUPPC095

Poster

Low Cost FFT Scope Using LabVIEW cRIO and FPGA

Hardware Technology

Odd Oyvind Andreassen, Luca Arnaudon, Iikka Tapani Matasaho, Adriaan Rijllart (CERN, Geneva)

At CERN, many digitizers and scopes are starting to age and should be replaced. Much of the equipment is custom made or not available on the market anymore. Replacing this equipment with the equivalent of today would either be time consuming or expensive. This paper looks at the pros and cons of using COTS systems like NI-cRIO and NI-PXIe and their FPGA capabilities as flexible instruments, replacing costly spectrum analyzers and older scopes. It adds some insight on what had to be done to integrate and deploy the equipment in the unique CERN infrastructure, and the added value of having a fully customizable platform, that makes it possible to stream, store and align the data without any additional equipment.

Poster

TUPPC096

Migration from WorldFIP to a Low-Cost Ethernet Fieldbus for Power Converter Control at CERN

Hardware Technology

Stephen Page, Quentin King, Hugo Lebreton, Philippe Francois Semanaz (CERN, Geneva)

Power converter control in the LHC uses embedded computers called Function Generator/Controllers (FGCs) which are connected to WorldFIP fieldbuses around the accelerator ring. The FGCs are integrated into the accelerator control system by x86 gateway front-end systems running Linux. With the LHC now operational, attention has turned to the renovation of older control systems as well as a new installation for Linac 4. A new generation of FGC is being deployed to meet the needs of these cycling accelerators. As WorldFIP is very limited in data rate and is unlikely to undergo further development, it was decided to base future installations upon an Ethernet fieldbus with standard switches and interface chipsets in both the FGCs and gateways. The FGC communications protocol that runs over WorldFIP in the LHC was adapted to work over raw Ethernet, with the aim to have a simple solution that will easily allow the same devices to operate with either type of interface. This paper describes the evolution of FGC communications from WorldFIP to dedicated Ethernet networks and presents the results of initial tests, diagnostic tools and how real-time power converter control is achieved.

Poster

TUPPC097

Design of a Radio Frequency Phase Detector and Controller for the APS Linac

Hardware Technology

Anthony Pietryla, Richard Ian Farnsworth, Arthur Grelick, Robert Laird, Hengjie Ma, Anthony J Scaminaci, Steven Shoaf (ANL, Argonne)

The Advanced Photon Source Linac uses an rf phase detector system that is now more that twenty years old. The existing design is based on an analog vector detector module that has become difficult to maintain due to component obsolescence. A preliminary design is underway to replace the existing analog phase measurement system with a digital In-phase and Quadrature-phase (I/Q) methodology. A custom-designed module is proposed that will feature eight analog input channels digitized at fourteen bits, four analog output channels, and an input-output controller (IOC) embedded within a field-programmable gate array (FPGA). A pin-selectable sampling frequency scheme and several trigger options are incorporated into the system for maximum flexibility. This paper discusses the proposed design and shows preliminary results.

Poster

TUPPC098

Advanced Light Source Control System Upgrade – Intelligent Local Controller Replacement

Hardware Technology

Eric Norum, Richard Lellinger, Gregory James Portmann (LBNL, Berkeley, California)

As part of the control system upgrade at the Advanced Light Source (ALS) the existing intelligent local controller (ILC) modules have been replaced. These remote input/output modules provide real-time updates of control setpoints and monitored values. This paper describes the 'ILC Replacement Modules' which have been developed to take on the duties of the existing modules. The new modules use a 100BaseT network connection to communicate with the ALS Experimental Physics and Industrial Control System (EPICS) and are based on a commercial FPGA evaluation board running a microcontroller-like application. In addition to providing remote ana log and digital input/output points the replacement modules also provide some rudimentary logic operations, analog slew rate limiting and accurate time stamping of acquired data. Results of extensive performance testing and experience gained now that the modules have been in service for several months are presented.

Poster

TUPPC100

Recent Changes to Beamline Software at the Canadian Light Source

User Interfaces and Tools

Glen Wright, David Beauregard, Russ Berg, Gillian Black, David K Chevrier, Robert Deranian, Ru Igarashi, Elder Matias, Denise Miller (CLS, Saskatoon, Saskatchewan)

The Canadian Light Source has ongoing work to improve the user interfaces at the beamlines. Much of the direction has made use of Qt and EPICS, using both C++ and Python in providing applications. Continuing work on the underlying data acquisition and visualization tools provides a commonality for both development and operation, and provisions for extending tools allow flexibility in types of experiments being run.

TUPPC101

Scaling of EPICS edm Display Pages at ISAC

User Interfaces and Tools

Rolf Keitel (TRIUMF, Vancouver)

The EPICS-based control system of the ISAC facility at TRIUMF uses the edm display editor / display manager to create and render the Operator interface displays. edm displays are expressed in pixel coordinates and edm does not scale the display page when a window is re-sized. A simple scheme was implemented to allow operators to switch page magnifications using a set of pre-selected scaling factors. Possible extensions of the scheme and its limitations will be discussed.

Poster

TUPPC102

User Interfaces for the Spiral2 Machine Protection System

User Interfaces and Tools

Laurent Philippe, Pascal Gillette, Eric Lecorche, Evelyne Lemaitre, Guillaume Normand (GANIL, Caen)

Spiral2 accelerator is designed to accelerate protons, deuterons, ions with a power from hundreds of Watts to 200kW. Therefore, it is important to monitor and anticipate beam losses to maintain equipment integrities by triggering beam cuts when beam losses or equipment malfunctions are detected; the MPS (Machine Protection System) is in charge of this function. The MPS has also to monitor and limit activations but this part is not addressed here. Linked to the MPS, five human machine interfaces will be provided. The first, “MPS” lets operators and accelerator engineers monitor MPS states, alarms and tune some beam losses thresholds. The second “beam power rise” defines successive steps to reach the desired beam power. Then, “interlock” is a synoptic to control beam stops state and defaults; the “beam losses” one displays beam losses, currents and efficiencies along the accelerator. Finally, “beam structure” lets users interact with the timing system by controlling the temporal structure to obtain a specific duty cycle according to the beam power constraints. In this paper, we introduce these human machine interfaces, their interactions and the method used for software development.

Poster

TUPPC103

ITER Contribution to Control System Studio (CSS) Development Effort

User Interfaces and Tools

Nadine Utzel, Lana Abadie, Franck Di Maio, Jean-Yves Journeaux, Anders Wallander, Izuru Yonekawa (ITER Organization, St. Paul lez Durance)

In 2010, CODAC - ITER control system - team chose Control System Studio as the development and runtime integrated environment for plant system local control and decided to contribute to CSS development effort. After all, CODAC team wants to be sure that the tools that are being used by the seven ITER Domestic Agencies all over the world continue to be available and to be improved. In order to integrate CSS main components in its software suite, CODAC team needed first to adapt them to its standard platform based on Linux 64-bits and PostgreSQL database. Then, user feedbacks started to emerge as well as the need of an industrial symbol library to represent pump, valve or electrical breaker state on the operator interface or the requirement to send automatically an email when a new alarm is triggered. It also soon became important for CODAC team to be able to publish quickly its contributions and to adapt its own infrastructure for that. This paper describes ITER increasing contribution to CSS development effort and the future plans to address factory and site acceptance tests of the local control systems.

Poster

TUPPC104

jddd: A Tool for Operators and Experts to Design Control System Panels

User Interfaces and Tools

Elke Sombrowski, Anna Petrosyan, Kay Rehlich, Winfried Schütte (DESY, Hamburg)

jddd, a graphical tool for control system panel design, has been developed at DESY to allow machine operators and experts the design of complex panels. No knowledge of a programming language nor compiling steps are required to generate highly dynamic panels with the jddd editor. After 5 years of development and implementing requirements for DESY-specific accelerator operations, jddd has become mature and is increasingly used at DESY. The focus meanwhile has changed from pure feature development to new tasks as archiving/managing a huge number of control panels, finding panel dependencies, automatic refactoring of panel names, book keeping and evaluation of panel usage and collecting Java exception messages in an automatic manner. Therefore technologies of the existing control system infrastructure like Servlets, JMS, Lucene, SQL, SVN are used. The concepts and technologies to further improve the quality and robustness of the tool are presented in this paper.

TUPPC105

Karabo GUI: A Multi-purpose Graphical Front End for the Karabo Framework

User Interfaces and Tools

Burkhard Heisen, Kerstin Weger, Christopher Youngman (XFEL.EU, Hamburg)

The Karabo GUI allows the complete management of the Karabo distributed system. Remote applications (devices) can be instantiated, configured, viewed, operated, and terminated. Devices of the distributed system are available for navigation and a default panel for configuration and control is automatically generated using the device inherent self-description. The central widget of the GUI behaves like a PowerPoint slide. Expert panels can be built by intermixing static graphical elements (text, lines, shapes, etc.) with dynamic widgets connected to parameters of the distributed system. The same panel can also be used to configure and execute scientific workflows. Other features are an embedded IPython scripting console, online documentation and issue tracking, macro recording, aggregated logging, notification and alarm handling, etc. The GUI is user-centered and will restrict displaying or editing capability according to the user's role and to the current device state. The GUI is based on PyQt technology and acts as a thin network client to a central Karabo GUI-Server.

Poster

TUPPC106

Development of a Web-based Shift Reporting Tool for Accelerator Operation at the Heidelberg Ion Therapy Center

User Interfaces and Tools

Klaus Höppner, Rainer Cee, Michael Galonska, Thomas Haberer, Jörg Martin Mosthaf, Andreas Peters, Stefan Scheloske (HIT, Heidelberg)

The HIT (Heidelberg Ion Therapy) center is the first dedicated European accelerator facility for cancer therapy using both carbon ions and protons, located at the university hospital in Heidelberg. It provides three fully operational therapy treatment rooms, two with fixed beam exit and a gantry. We are currently developing a web based reporting tool for accelerator operations. Since medical treatment requires a high level of quality assurance, a detailed reporting on beam quality, device failures and technical problems is even more needed than in accelerator operations for science. The reporting tools will allow the operators to create their shift reports with support from automatically derived data, i.e. by providing pre-filled forms based on data from the Oracle database that is part of the proprietary accelerator control system. The reporting tool is based on the Python-powered CherryPy web framework, using SQLAlchemy for object relational mapping. The HTML pages are generated from templates, enriched with jQuery to provide a desktop-like usability. We will report on the system architecture of the tool and the current status, and show screenshots of the user interface.

[1] Th. Haberer et al., "The Heidelberg Ion Therapy Center", Rad. & Onc.,

TUPPC107

Poster

Data Management and Analysis for Beam Dynamics Simulation

User Interfaces and Tools

Denis Zyuzin (FZJ, Jülich), Serge Andrianov (St. Petersburg State University, St. Petersburg)

Computer simulation of modern accelerator system is based on a number of specialized computer codes. Complexity of concerned processes and interpretation of simulation results requires comfortable and effective tools to design accelerator structure and beam characteristics, carry out computer experiments, process and visualize data. This paper proposes a prototype system with web-interface which allows the full research cycle: from lattice generation to data visualization. This approach represents a valuable tool for beam physicist providing methods to benchmark simulation engines as well as providing additional instruments for understanding physical processes in accelerator. The corresponding tools were used in application to the spin-orbit motion problems in electrostatic accelerators.

TUPPC108

Poster

Using Web Syndication for Flexible Remote Monitoring

User Interfaces and Tools

Ombretta Pinazza (INFN-Bologna, Bologna), Andre Augustinus, Peter Chochula, Mateusz Lechman, Peter Rosinsky (CERN, Geneva), Alexander Kurepin (RAS/INR, Moscow)

With the experience gained in the first years of running the ALICE apparatus we have identified the need of collecting and aggregating different data to be displayed to the user in a simplified, personalized and clear way. The data comes from different sources in several formats, can contain data, text, pictures or can simply be a link to an extended content. This paper will describe the idea to design a light and flexible infrastructure, to aggregate information produced in different systems and offer them to the readers. In this model, a reader is presented with the information relevant to him, without being obliged to browse through different systems. The project consists of data production, collection and syndication, and is being developed in parallel with more traditional monitoring interfaces, with the aim of offering the ALICE users an alternative and convenient way to stay updated about their preferred systems even when they are far from the experiment.

Poster

TUPPC109

MacspeechX.py Module and Its Use in Accelertor Control Systems

User Interfaces and Tools

Noboru Yamamoto (KEK, Ibaraki)

macspeechX.py is a Python module to accels speech systehsis library on MacOSX. This module have been used in the vocal alert system in KEKB and J-PARC accelrator cotrol system. Recent upgrade of this module allow us to handle non-English lanugage, such as Japanse, through this module. Implementation detail will be presented as an example of Python program accessing system library.

Poster

TUPPC110

Operator Intervening System for Remote Accelerator Diagnostics and Support

User Interfaces and Tools

Akito Uchiyama (Sokendai, Ibaraki), Kazuro Furukawa (KEK, Ibaraki), Yoshihide Higurashi, Takahide Nakagawa (RIKEN Nishina Center, Wako)

In a large experimental physics project such as ITER and LHC, the project has managed by an international collaboration. Similarly, ILC (International Linear Collider) as next generation project will be started by a collaboration of many institutes from three regions. After the collaborative construction, any collaborators except a host country will need to have some methods for remote maintenances by control and monitoring of devices. For example, the method can be provided by connecting to the control system network via WAN from their own countries. On the other hand, the remote operation of an accelerator via WAN has some issues from a practical application standpoint. One of the issues is that the accelerator has both experimental device and radiation generator characteristics. Additionally, after miss operation in the remote control, it will cause breakdown immediately. For this reason, we plan to implement the operator intervening system for remote accelerator diagnostics and support, and then it will solve the issues of difference of between the local control room and other locations. In this paper, we report the system concept, the development status, and the future plan.

Poster

TUPPC111

Online Status and Settings Monitoring for the LHC Collimators

User Interfaces and Tools

Gianluca Valentino (University of Malta, Msida), Ralph Wolfgang Assmann, Delphine Jacquet, Stefano Redaelli, Eric Veyrunes (CERN, Geneva)

The Large Hadron Collider is equipped with 100 movable collimators. The LHC collimator control system is responsible for the accurate synchronization of around 500 axes of motion at the microsecond level, and with the precision of a few micrometres. The status and settings of the collimators can be monitored by three displays in the CERN Control Center, each providing a different viewpoint onto the system and a different level of abstraction, such as the positions in mm or beam size units. Any errors and warnings are also displayed. In this paper, the display operation is described, as well as the interaction that occurs when an operator is required to identify and understand an error in the collimator settings.

Poster

TUPPC112

GeoSynoptic Panel

User Interfaces and Tools

Lukasz Zytniak, Piotr Pawel Goryl (Solaris, Krakow)

Solaris is a third generation Polish Synchrotron under construction at the Jagiellonian University in Krakow. Furthermore, National Synchrotron Radiation Center is member of the Tango Collaboration. The project is based on the 1.5 GeV storage ring being at the simultaneously built for the MAX IV project in Lund, Sweden. The Solaris project is a prime example of the benefits of use EU regional development funds and sharing of knowledge and resources for the rapid establishment of a national research infrastructure. The Solaris develops highly customizable and adaptable application called the GeoSynoptic Panel. Main goal of the GeoSynoptic Panel is to provide a graphical map of devices based on information stored in the Tango database. It is achieved by providing additional device/class properties which describe location and graphical components (such as icons and particular GUI window) related to a particular device or class . The application is expected to reduce time needed for preparation of synoptic applications for each individual (part of) machines or subsystems and to reduce effort related to debugging and change management.

Poster

TUPPC113

Development of an EPICS Alarm System for the ANKA Synchrotron Light Source

User Interfaces and Tools

Igor Kriznar (Cosylab, Ljubljana), Sebastian Marsching (Aquenos GmbH, Baden-Baden), Edmund Hertle, Erhard Huttel, Wolfgang Mexner, Anke-Susanne Mueller, Nigel John Smale (KIT, Karlsruhe)

The control system of the ANKA synchrotron radiation source at KIT (Karlsruhe Institute of Technology) is adopting new, and converting old, devices into an EPICS control system. New GUI panels are developed in Control System Studio (CSS). EPICS alarming capabilities in connection with the BEAST alarm server tool-kit from the CSS bundle are used as an alarming solution. To accommodate ANKA future requirements as well as ANKA legacy solutions, we have decided to extend the basic functionality of BEAST with additional features in order to manage the alarming for different machine operation states. Since the database of alarm sources is been populated from scratch, we have been able to automate the management and creation of alarm sources to build-up their alarm trees.

Poster

TUPPC114

Making It All Work for Operators

User Interfaces and Tools

Igor Kriznar (Cosylab, Ljubljana), Sebastian Marsching (Aquenos GmbH, Baden-Baden), Nigel John Smale (KIT, Eggenstein-Leopoldshafen), Edmund Hertle, Erhard Huttel, Wolfgang Mexner, Anke-Susanne Mueller (KIT, Karlsruhe)

As the control system of the ANKA synchrotron radiation source at KIT (Karlsruhe Institute of Technology) is being slowly upgraded it can become, at key stages, temporarily a mosaic of old and new panels while the operator learns to move across to the new system. With the development of general purpose tools, and careful planning of both the final and transition GUIs, we have been able to actually simplify the working environment for machine operators. In this paper we will explain concepts, guides and tools in which GUIs for operators are developed and deployed at ANKA.

TUPPC115

Hierarchies of Alarms for Large Distributed Systems

User Interfaces and Tools

Marco Boccioli, Manuel Gonzalez-Berges, Vasileios Martos (CERN, Geneva), Oliver Holme (ETH, Zurich)

The control systems of most of the infrastructure at CERN makes use of the SCADA package WinCC OA by ETM, including successful projects to control large scale systems (i.e. the LHC accelerator and associated experiments). Each of these systems features up to 150 supervisory computers and several millions of parameters. To handle such large systems, the control topologies are designed in a hierarchical way (i.e. sensor, module, detector, experiment) with the main goal of supervising a complete installation with a single person from a central user interface. One of the key features to achieve this is alarm management (generation, handling, storage, reporting). Although most critical systems include automatic reactions to faults, alarms are fundamental for intervention and diagnostics. Since one installation can have up to 250k alarms defined, a major failure may create an avalanche of alarms that is difficult for an operator to interpret. Missing important alarms may lead to downtime or to danger for the equipment. The paper presents the developments made in recent years on WinCC OA to work with large hierarchies of alarms and to present summarized information to the operators.

Poster

TUPPC116

Cheburashka: A Tool for Consistent Memory Map Configuration Across Hardware and Software

User Interfaces and Tools

Anthony Rey, Andrew Butterworth, Frederic Dubouchet, Michael Jaussi, John Cornelis Molendijk, Andrey Pashnin (CERN, Geneva)

The memory map of a hardware module is defined by the designer at the moment when the firmware is specified. It is then used by software developers to define device drivers and front-end software classes. Maintaining consistency between hardware and its software is critical. In addition, the manual process of writing VHDL firmware on one side and the C++ software on the other is labour-intensive and error-prone. Cheburashka* is a software tool which eases this process. From a unique declaration of the memory map, created using the tool's graphical editor, it allows to generate the memory map VHDL package, the Linux device driver configuration for the front-end computer, and a FESA** class for debugging. An additional tool, GENA, is being used to automatically create all required VHDL code to build the associated register control block. These tools are now used by the hardware and software teams for the design of all new interfaces from FPGAs to VME or on-board DSPs in the context of the extensive program of development and renovation being undertaken in the CERN injector chain during LS1***. Several VME modules and their software have already been deployed and used in the SPS.

(*) Cheburashka is developed in the RF group at CERN (**)FESA is an acronym for Front End Software Architecture, developped at CERN (***)LS1 : LHC Long Shutdown 1, from 2013 to 2014

Poster

TUPPC117

Unifying Data Diversity and Conversion to Common Engineering Analysis Tools

User Interfaces and Tools

Hubert Reymond, Odd Oyvind Andreassen, Cedric Charrondière, Maria De Fatima Gomez De La Cruz, Adriaan Rijllart (CERN, Geneva)

The large variety of systems for the measurement of insulation, conductivity, RRR, quench performance, etc. in superconducting magnet test facilities generate a diversity of data formats; this poses a problem when the measurements need to be correlated. Each measurement application has a data analysis tool associated to it to validate the results, but there is no application that has universal access to the raw data. Since the LHC startup, the superconducting magnet test facility hosts new R&D measurements on a multitude of superconducting components in the framework of international collaborations. This has created a greater need to get access to the raw data for many common engineering analysis tools, such as Matlab, Matcad, DIAdem, Excel, Root, … This paper describes the technical solutions developed for the unification of data formats in the CERN magnet test facility and reviews the present status.

Poster

TUPPC119

Exchange of Crucial Information between Accelerator Operation, Equipment Groups and Technical Infrastructure at CERN

User Interfaces and Tools

Isabelle Laugier, Peter Sollander (CERN, Geneva)

During CERN accelerator operation, a large amount of events occur with different criticality. All these events are detected, diagnosed and managed by the Technical Infrastructure service (TI) in the CERN Control Centre (CCC); equipment groups concerned have to solve the problem with a minimal impact on accelerator operation. A new database structure and new interfaces have to be implemented to share information received by TI, to improve communication between the control room and equipment groups, to help post-mortem studies and to correlate events with accelerator operation incidents. Different tools like alarm screens, logbooks, maintenance plans and work orders exist and are used today. The goal of this project is to integrate and standardize information in a common repository to be used by the different stakeholders through dedicated user interfaces.

Poster

TUPPC120

LHC Collimator Alignment Operational Tool

User Interfaces and Tools

Gianluca Valentino, Ralph Wolfgang Assmann, Stefano Redaelli (CERN, Geneva), Nicholas Sammut (University of Malta, Msida)

Beam-based LHC collimator alignment is necessary to determine the beam centers and beam sizes at the collimator locations for various machine configurations. Fast and automatic alignment is provided through an operational tool has been developed for use in the CERN Control Center, which is described in this paper. The tool is implemented as a Java application, and acquires beam loss and collimator position data from the hardware through a middleware layer. The user interface is designed to allow for a quick transition from application start up, to selecting the required collimators for alignment and configuring the alignment parameters. The measured beam centers and sizes are then logged and displayed in different forms to help the user set up the system.

Poster

TUPPC121

caQtDM, an EPICS Display Manager with Qt

User Interfaces and Tools

Anton Mezger (PSI, Villigen PSI)

At the Paul Scherrer Institut (PSI) the display manager MEDM was used until recently for all synoptic displays at our facilities, not only for EPICS but also for another, in house built control system ACS. However MEDM is based on MOTIF and Xt/X11, systems/libraries that are getting into age. Moreover MEDM is difficult to extend with new entities. Therefore a new tool has been developed based on Qt reproducing the functionality of MEDM and is now in use at several facilities. Qt being supported on several platforms, this tool will also run on Microsoft Windows. The MEDM data files (.adl) were used as an initial set for the new system and are converted into the new xml format using the parser tool adl2ui. These can then be edited further with the Qt-designer and displayed with the new Qt-Manager caQtDM. The integration of new entities into the Qt designer and therefore into the Qt based applications is very easy, so that the system can easily be enhanced with new widgets. New features needed for our facility were implemented. The caQtDM application uses a basic C++ class performing the data acquisition and display; this class can also be integrated into other applications.

Poster

TUPPC122

Progress of the TPS Control Applications Development

User Interfaces and Tools

Yung-Sen Cheng, Jenny Chen, Pei-Chen Chiu, Kuo-Tung Hsu, Changhor Kuo, Chih-Yu Liao, Chunyi Wu (NSRRC, Hsinchu)

The TPS (Taiwan Photon Source) is the latest generation 3 GeV synchrotron light source which is in installation phase. Commissioning is estimated in 2014. The EPICS is adopted as control system framework for the TPS. The various EPICS IOCs have implemented for each subsystem at this moment. Development and integration of specific control operation interfaces are in progress. The operation interfaces mainly include the function of setting, reading, save, restore and etc. Development of high level applications which are depended upon properties of each subsystem is on-going. The archive database system and its browser toolkits gradually have been established and tested. The Web based operation interfaces and broadcasting are also created for observing the machine status. The efforts will be summarized at this report.

Poster

TUPPC123

User Interfaces Development of Imaging Diagnostics Devices for TPS

User Interfaces and Tools

Chih-Yu Liao, Chunyi Wu (NSRRC, Hsinchu)

Taiwan Photon Source (TPS) is a 3 GeV synchrotron light source which is being construction at campus of National Synchrotron Radiation Research Center (NSRRC) in Taiwan. Many diagnostic devices are used for the implementation and will be deployed in the future to assist commissioning and operating the TPS. The imaging diagnostics devices, includes screen monitor (SM), streak camera (SC), and intensified charge coupled device (ICCD) are used and its user interfaces are plan to develop. The EPICS IOC is the main control framework for these applications. The windows OS based system, such as SC and ICCD, are controlled respectively through the Matlab (combined with LabCA module) and LabVIEW (combined with DSC module) tools and share the data as EPICS PVs. The main user interfaces and data analysis are constructed by Matlab GUIDE toolbox. The progress of the plans will be summarized in this report.

TUPPC124

Poster

Distributed Network Monitoring Made Easy - An Application for Accelerator Control System Process Monitoring

User Interfaces and Tools

Christopher Peters, Maria A. Power (ANL, Argonne)

As the complexity and scope of distributed control systems increase, so does the need for an ever increasing level of automated process monitoring. The goal of this paper is to demonstrate one method whereby the SNMP protocol combined with open-source management tools can be quickly leveraged to gain critical insight into any complex computing system. Specifically, we introduce an automated, fully customizable, web-based remote monitoring solution which has been implemented at the Argonne Tandem Linac Accelerating System (ATLAS). This collection of tools is not limited to only monitoring network infrastructure devices, but also to monitor critical processes running on any remote system. The tools and techniques used are typically available pre-installed or are available via download on several standard operating systems, and in most cases require only a small amount of configuration out of the box. High level logging, level-checking, alarming, notification and reporting is accomplished with the open source network management package OpenNMS, and normally requires a bare minimum of implementation effort by a non-IT user.

TUPPC125

Poster

Performance Testing of EPICS User Interfaces - an Attempt to Compare the Performance of MEDM, EDM, CSS-BOY, CaQtDM, and EPICS-Qt

User Interfaces and Tools

Richard Ian Farnsworth, John Paul Hammonds, Bryan James Orr (ANL, Argonne),
Andrew Rhyder (ASCo, Clayton, Victoria)

Upgrading of the display manger or graphical user interface at EPICS sites reliant on older display technologies, typically MEDM or EDM, requires attention not only to functionality but also performance. For many sites, performance is not an issue - all display managers will update small numbers of process variables at rates exceeding the human ability to discern changes; but for certain applications typically found at larger sites, the ability to respond to updates rates at sub-Hertz frequencies for thousands of process variables is a requirement. This paper describes a series of tests performed on both older display managers — MEDM and EDM — and also the newer display managers CSS-BOY, epicsQT, and CaQtDM. Modestly performing modern hardware is used.

Poster

TUPPC126

Visualization of Experimental Data at the National Ignition Facility*

User Interfaces and Tools

Matthew Hutton, Rita Carol Bettenhausen, Essex J. Bond, Allan Casey, Robert Nethercott Fallejo, Judith A. Liebman, Amber A. Marsh, Thomas M. Pannell, Scott Reisdorf, Abbie L. Warrick (LLNL, Livermore, California)

An experiment on the National Ignition Facility (NIF) may produce hundreds of gigabytes of target diagnostic data. Raw and analyzed data are accumulated into the NIF Archive database. The Shot Data Systems team provides alternatives for accessing data including a web-based data visualization tool, a virtual file system for programmatic data access, a macro language for data integration, and a Wiki to support collaboration. The data visualization application in particular adapts dashboard user-interface design patterns popularized by the business intelligence software community. The dashboard canvas provides the ability to rapidly assemble tailored views of data directly from the NIF archive. This design has proven capable of satisfying most new visualization requirements in near real-time. The separate file system and macro feature-set support direct data access from a scientist's computer using scientific languages such as IDL, Matlab and Mathematica. Underlying all these capabilities is a shared set of web services that provide APIs and transformation routines to the NIF Archive. The overall software architecture will be presented with an emphasis on data visualization.

Poster

TUPPC127

National Ignition Facility Use of Barcoding to Streamline Optic Processing*

User Interfaces and Tools

Cemil Bruce Foxworthy (LLNL, Livermore, California)

The National Ignition Facility (NIF) at the Lawrence Livermore National Laboratory is a stadium-sized facility with a 192-beam, 2.0-Megajoule, 500-Terawatt, ultraviolet laser based around a 10-meter diameter target chamber. In its current configuration, 1056 large 0.4m x 0.4m optics are in use at any one time. After a period of use, an optic needs to have any surface flaws mitigated and its finish restored. The Optics Processing Facility (OPF) handles about two hundred optics per month. That work uses, on average, 700 work orders, which describe the work and route the optic across work centers. As the workload increased, it became important to streamline the process. Barcodes were chosen to reduce data entry errors and increase efficiency. The system design evolved as lessons were learned from operational use. System architecture and implementation decisions will be presented.

TUPPC128

Poster

Machine History Viewer for the Integrated Computer Control System of the National Ignition Facility*

User Interfaces and Tools

Eric Wilson (LLNL, Livermore, California)

The Machine History Viewer is a recently developed capability of the Integrated Computer Control System (ICCS) software to the National Ignition Facility (NIF) that introduces the capability to analyze machine history data to troubleshoot equipment problems and to predict future failures. Flexible time correlation, text annotations, and multiple y-axis scales will help users determine cause and effect in the complex machine interactions at work in the NIF. Report criteria can be saved for easy modification and reuse. Integration into the already-familiar ICCS GUIs makes reporting easy to access for the operators. Reports can be created that will help analyze trends over long periods of time that lead to improved calibration and better detection of equipment failures. Faster identification of current failures and anticipation of potential failures will improve NIF availability and shot efficiency. A standalone version of this application is under development that will provide users remote access to real-time data and analysis allowing troubleshooting by experts without requiring them to come on-site.

TUPPC129

Poster

Improving Control System Uptime and Reliability by Detecting and Reporting Failed Devices Quickly*

User Interfaces and Tools

Russell Fleming, John Fisher (LLNL, Livermore, California)

The Integrated Computer Control System (ICCS) at the National Ignition Facility (NIF) uses Front-End Processors (FEP) controlling over 60,000 devices. Often device faults are not discovered until a device is needed during a shot, creating run-time errors that delay the laser shot. This paper discusses a new ICCS framework feature for FEPs to monitor devices and report its overall health, allowing for problem devices to be identified before they are needed. Each FEP has different devices and a unique definition of healthy. The ICCS software uses an object oriented approach using polymorphism so FEP's can determine their health status and report it in a consistent way. This generic approach provides consistent GUI indication and the display of detailed information of device problems. It allows for operators to be informed quickly of faults and provides them with the information necessary to pin point and resolve issues. Operators now know before starting a shot if the control system is ready, thereby reducing time and material lost due to a failure and improving overall control system reliability and availability.

TUPPC130

The Design of NSLS-II High Level Physics Applications

User Interfaces and Tools

Lingyun Yang, Jinhyuk Choi, Yoshiteru Hidaka, Guobao Shen, Guimei Wang (BNL, Upton, Long Island, New York)

The NSLS-II high level physics applications are an effort from both controls and accelerator physics group. They are developed with the client-server approach, where the services are mainly provided by controls group in terms of web service or libraries.

Poster

TUPPC131

Synoptic Displays and Rapid Visual Application Development

User Interfaces and Tools

Bartosz Frak, Ted D'Ottavio, Margaret Harvey, Seth Nemesure (BNL, Upton, Long Island, New York)

For a number of years there has been an increasing desire to adopt a synoptic display suite within BNL accelerator community. Initial interest in the precursors to the modern display suites like MEDM quickly fizzled out as our users found them aesthetically unappealing and cumbersome to use. Subsequent attempts to adopt Control System Studio (CSS) also fell short when work on the abstraction bridge between CSS and our control system stalled and was eventually abandoned. Most recently, we tested the open source version of a synoptic display developed at Fermilab. It, like its previously evaluated predecessors, also seemed rough around the edges, however a few implementation details made it more appealing than every single previously mentioned solution and after a brief evaluation we settled on Synoptic as our display suite of choice. This paper describes this adoption process and goes into details on several key changes and improvements made to the original implementation – a few of which made us rethink how we want to use this tool in the future.

Poster

TUPPC132

Accelerator Control Data Visualization with Google Map

User Interfaces and Tools

Wenge Fu, Seth Nemesure (BNL, Upton, Long Island, New York)

Using geological map data to serve as a visualization for components of a Controls System provides Main Control Room Operators an easy way to both identify and locate conditions within specific parts of an accelerator complex that may require attention. Google's Map API provides a simple and convenient way to display some of C-AD's Controls System data and provide location and status feedback using dynamic symbols and animations. This paper describes the details of how chipmunk and beam loss data visualization can be implemented for the AGS/RHIC Controls system. Most of the server side and client site software can be easily adapted to many other similar types of data visualizations.

Wenge Fu, Seth Nemesure, Brookhaven National Laboratory, Upton, NY 11973, USA

Poster

TUPPC133

Graphene: A Java Library for Real-Time Scientific Graphs

User Interfaces and Tools

Gabriele Carcassi, Kunal Shroff (BNL, Upton, Long Island, New York)

While there are a number of open source charting library available in Java, none of them seem to be suitable for real time scientific data, such as the one coming from control systems. Common shortcomings include: inadequate performance, too entangled with other scientific packages, concrete data object (which require copy operations), designed for small datasets, required running UI to produce any graph. Graphene is our effort to produce graphs that are suitable for scientific publishing, can be created without UI (e.g. in a web server), work on data defined through interfaces that allow no copy processing in a real time pipeline and are produced with adequate performance. The graphs are then integrated using pvmanager within Control System Studio.

TUPPC134

Pvmanager: A Java Library for Real-Time Data Processing

User Interfaces and Tools

Gabriele Carcassi (BNL, Upton, Long Island, New York)

Increasingly becoming the standard connection layer in Control System Studio, pvmanager is a Java library that allows to create well behaved applications that process real time data, such as the one coming from a control system. It takes care of the caching, queuing, rate decoupling and throttling, connection sharing, data aggregation and all the other details needed to make an application robust. Its fluent API allows to specify the detail for each pipeline declaratively in a compact way.

Contributed Oral

TUCOCA01

XFEL Machine Protection System (MPS) Based on uTCA

Personnel Safety and Machine Protection

Sven Karstensen, Maria Elena Castro Carballo, Jürgen M. Jäger, Martin Staack (DESY, Hamburg)

The European X-Ray Free Electron Laser (XFEL) linear accelerator will provide an electron beam with energies of up to 17.5 GeV and will use it to generate extremely brilliant pulses of spatially coherent xrays. With a designated average beam power of up to 600 kW and beam spot sizes down to few micrometers, the machine will hold a serious damage potential. To ensure safe operation of the accelerator it is necessary to detect dangerous situations by closely monitoring beam losses and the status of critical components. This is the task of the uTCA* based machine protection system (MPS). Many design features of the system have been influenced by experience from existing facilities, particularly the Free Electron Laser in Hamburg (FLASH), which is a kind of 1:10 prototype for the XFEL. A high flexibility of the MPS is essential to guarantee a minimum downtime of the accelerator. The MPS is embedded in the DOOCS** control system.

* uTCA: Micro Telecommunications Computing Architecture ** DOOCS: Distributed Object Oriented Control System

Contributed Oral

TUCOCA02

The ITER Interlock System

Personnel Safety and Machine Protection

Antonio Vergara-Fernandez, Juan Luis Fernandez-Hernando, Carlos Fernandez-Robles, Anders Wallander, Izuru Yonekawa (ITER Organization, St. Paul lez Durance), Sabrina Sayas (ARKADIA Technology, Aix en Provence), Marion Savouillan (Assystem E&OS, Pertuis), Alvaro Marqueta Barbero, Ignacio Prieto Díaz (IBERINCO, Madrid)

ITER is formed by systems which shall be pushed to their performance limits in order to successfully achieve the scientific goals. The scientists in charge of exploiting the tokamak will require enough operational flexibility to explore as many plasma scenarios as possible while being sure that the integrity of the machine and safety of the environment and personnel are not compromised. The I&C Systems of ITER has been divided in three separate tiers: the conventional I&C, the safety system and the interlock system. This paper focuses on the latter. The design of the ITER interlocks has to take into account the intrinsic diversity of ITER systems, which implies a diversity of risks to be mitigated and hence the impossibility to implement a unique solution for the whole machine. This paper presents the chosen interlock solutions based on PLC, FPGA, and hardwired technologies. It also describes how experience from existing tokamaks has been applied to the design of the ITER interlocks, as well as the ITER particularities that have forced the designers to evaluate some technical choices which historically have been considered as non-suitable for implementing interlock functions.

Contributed Oral

TUCOCA03

Machine Protection Issues for eRHIC

Personnel Safety and Machine Protection

Kevin A. Brown, Prachi Chitnis, Charles Theisen, Gang Wang (BNL, Upton, Long Island, New York)

The eRHIC electron beams will be damaging both directly and as a result of synchrotron radiation. The machine protection and abort systems will be designed to prevent any equipment damage from the electron beams. In this paper we will review the requirements for the machine protection systems and the plans we have put into place to better evaluate the failure probabilities, beam abort systems designs, and overall machine protection systems designs. The machine protection systems will include a beam permit system that has inputs from loss monitors, power supplies, superconducting RF monitors, vacuum chamber heating monitors, water temperature, quench detectors, access controls systems, vacuum monitors, and longer term beam lifetime or slow loss monitors. There are three systems associated with the machine protection and beam abort systems; the beam permit link, the abort kicker systems, and the beam dumps. We describe the requirements for these systems and present our current plans for how to meet the requirements.

TUCOCA04

Formal Methodology for Safety-Critical Systems Engineering at CERN

Personnel Safety and Machine Protection

Francesco Valentini, Timo Hakulinen, Louis Hammouti, Tomasz Ladzinski, Pierre Ninin (CERN, Geneva)

A Safety-Critical system is a system whose failure or malfunctioning may lead to an injury or loss of human life or may have serious environmental consequences. The Safety System Engineering section of CERN is responsible for conception of systems capable of performing, in an extremely safe way, a predefined set of Instrumented Functions preventing any human presence inside areas where a potential hazardous event may occur. This paper describes the formal approach followed in the engineering of the new Personnel Safety System of the PS accelerator complex at CERN. Starting from applying the generic guidelines of the safety standards IEC-61508 and IEC-61513, we have defined a novel formal approach particularly useful to express the complete set of Safety Functions in a rigorous and unambiguous way. We present the main advantages offered by this formalism and, in particular, we will show how this has been effective in solving the problem of the Safety Functions testing, leading to a major reduction of time for the test pattern generation.

Contributed Oral

TUCOCA05

EPICS-based Control System for a Radiation Therapy Machine

Personnel Safety and Machine Protection

Jonathan Paul Jacky (University of Washington Medical Center, Seattle)

The clinical neutron therapy system (CNTS) at the University of Washington Medical Center (UWMC) has been treating patients since 1984. Its new control system retains the original safety philosophy and delegation of functions among nonprogrammable hardware, PLCs, microcomputers with programs in ROM, and finally general-purpose computers. The latter are used only for data-intensive, prescription-specific functions. For these, a new EPICS-based control program replaces a locally-developed C program used since 1999. The therapy control portion uses a single soft IOC for control and a single EDM session for the operator's console. Prescriptions are retrieved from a PostgreSQL database and loaded into the IOC by a Python program; another Python program stores treatment records from the IOC back into the database. The system remains safe if the general-purpose computers or their programs crash or stop producing results. Different programs at different stages of the computation check for invalid data. Development activities including formal specifications and automated testing avoid, then check for, design and programming errors.

TUCOCA06

Contributed Oral

Current Status of a Carborne Survey System, KURAMA

Personnel Safety and Machine Protection

Minoru Tanigaki, Yasuhiro Kobayashi, Ryo Okumua, Nobuhiro Sato, Koichi Takamiya, Hisao Yoshinaga, Hirofumi Yoshino (Kyoto University, Osaka)

A carborne survey system named as KURAMA (Kyoto University RAdiation MApping system) has been developed as a response to the nuclear accident at TEPCO Fukushima Daiichi Nuclear Power Plant in 2011. Now the system evolved into a CompactRIO-based KURAMA-II, and serves for the various types of applications. More than a hundred of KURAMA-II are deployed for the periodical drawing of the radiation map in the East Japan by Japanese government. A continuous radiation monitoring by KURAMA-II on local buses is started in Fukushima prefecture as the collaboration project among Kyoto University, Fukushima prefectural government, and JAEA. Extended applications such as precise radiation mappings in farmlands and parks are also on the way. The present status and future prospects of KURAMA and KURAMA-II are introduced.

TUCOCA07

Contributed Oral

A Streamlined Architecture of LCLS-II Beam Containment System

Personnel Safety and Machine Protection

Enzo Carrone, Keith Belt, James Matthew Murphy, Feng Tao (SLAC, Menlo Park, California)

With the construction of LCLS-II, SLAC is developing a new Beam Containment System (BCS) to replace the aging hardwired system. This system will ensure that the beam is confined to the design channel at an approved beam power to prevent unacceptable radiation levels in occupable areas. Unlike other safety systems deployed at SLAC, the new BCS is distributed and has explicit response time requirements, which impose design constraints on system architecture. The design process complies with IEC 61508 and the system will have systematic capability SC3. This paper discusses the BCS built on Siemens S7-300F PLC. For those events requiring faster action, a hardwired shutoff path is provided in addition to peer safety functions within PLC; safety performance is enhanced, and the additional diagnostic capabilities significantly relieve operational cost and burden. The new system is also more scalable and flexible, featuring improved configuration control, simplified EPICS interface and reduced safety assurance testing efforts. The new architecture fully leverages the safety PLC capabilities and streamlines design and commissioning through a single-processor single-programmer approach.

TUCOCA08

Personnel and Machine Protection Systems in The National Ignition Facility*

Personnel Safety and Machine Protection

Robert Reed, Jayce Bell (LLNL, Livermore, California)

The National Ignition Facility (NIF) is the world's largest and most energetic laser system and has the potential to generate significant levels of ionizing radiation. The NIF employs real time safety systems to monitor and mitigate the potential hazards presented by the facility. The Machine Safety System (MSS) monitors key components in the facility to allow operations while also protecting against configurations that could damage equipment. The NIF Safety Interlock System (SIS) monitors for oxygen deficiency, radiological alarms, and controls access to the facility preventing exposure to laser light and radiation. Together the SIS and MSS control permissives to the hazard generating equipment and annunciate hazard levels in the facility. To do this reliably and safely, the SIS and MSS have been designed as fail safe systems with a proven performance record now spanning over 12 years. This presentation discusses the SIS and MSS, design, implementation, operator interfaces, validation/verification, and the hazard mitigation approaches employed in the NIF. A brief discussion of common failures encountered in the design of safety systems and how to avoid them will be presented.

Contributed Oral

TUCOCA09

Klystron Measurement and Protection System for XFEL on the uTCA Architecture

Personnel Safety and Machine Protection

Lukasz Butkowski, Holger Schlarb, Vladimir Vogel (DESY, Hamburg)

The European XFEL free-electron laser is under construction at the DESY. The driving engine of the superconducting accelerator will be 27 RF station. Each of an underground RF station consist from multi beam horizontal klystron which can provide up to 10MW of power at 1.3GHz. The XFEL should work continuously over 20 years with only 1 day per month for maintenance. In order to meet so demanding requirement lifetime of the MBK should be as long as possible. In the real operation the lifetime of tube can be thoroughly reduced by service conditions. To minimize the influence of service conditions to the klystrons lifetime the special fast protection system named as Klystron Lifetime Management System (KLM) has been developed, the main task of this system is to detect all events which can destroy the tube as quickly as possible, and then stop input power to the tube and send signal to stop HV pulse. The tube recovery procedure should depend on the kind of events has happened. KLM is based on the standard LLRF uTCA system for XFEL with additional DC channels. This article gives an overview of implementation of measurement and protection system installed at klystron test stand.

Contributed Oral

TUCOCA10

Improvements of T2K Primary Beamline Control System

Personnel Safety and Machine Protection

Kazuo Nakayoshi (KEK, Tsukuba), Yoshiaki Fujii, Ken Sakashita (KEK, Ibaraki)

T2K is a long-baseline neutrino experiment in Japan which studies neutrino oscillations. We produce a high intensity beam of muon neutrinos and allow them to propagate 295km, from J-PARC to Super-Kamiokande. We report recent improvements in the primary neutrino beamline control system. With the goal of stable operation of a high intensity (~MW) beam, we made two improvements. The first improvement is a new interlock system for the current fluctuation of the magnet power supplies. The T2K primary beamline has twenty-two normal-conducting-magnet power supplies. To prevent the intense beam from possibly hitting beamline equipment due to a current trip of a magnet power supply, we continuously monitor the power supply current using panel-meters. If the operating current falls outside of the set upper or lower limit, an alarm is activated. The second improvement is a new PLC-based control system for the power supplies. We plan to replace all of the normal-conducting-magnet power supplies and power-supply control systems. PLC-based control systems for ready-made power supplies are being considered as a candidate. We will also discuss the actual implementation of these improvements.

Contributed Oral

TUCOCB01

Next-Generation MADOCA for SPring-8 Control Framework

Software Technology Evolution

Takahiro Matsumoto, Yukito Furukawa, Miho Ishii (JASRI/SPring-8, Hyogo-ken)

MADOCA control framework* was developed for SPring-8 accelerator control and has been utilized in several facilities since 1997. As a result of increasing demands in controls, now we need to treat various data including image data in beam profile monitoring, and also need to control specific devices which can be only managed by Windows drivers. To fulfill such requirements, next-generation MADOCA (MADOCA II) was developed this time. MADOCA II is also based on message oriented control architecture, but the core part of the messaging is completely rewritten with ZeroMQ socket library. Main features of MADOCA II are as follows: 1) Variable length data such as image data can be transferred with a message. 2) The control system can run on Windows as well as other platforms such as Linux and Solaris. 3) Concurrent processing of multiple messages can be performed for fast control. In this paper, we report on the new control framework especially from messaging aspects. We also report the status on the replacement of the control system with MADOCA II. Partial control system of SPring-8 was already replaced with MADOCA II last summer and has been stably operated.

*R.Tanaka et al., "Control System of the SPring-8 Storage Ring", Proc. of ICALEPCS'95, Chicago, USA, (1995)

TUCOCB02

Middleware Proxy: A Request-Driven Messaging Broker for High Volume Data Distribution

Software Technology Evolution

Wojciech Sliwinski, Andrzej Dworak, Ilia Yastrebov (CERN, Geneva)

Nowadays, all major infrastructures and data centers (commercial and scientific) make an extensive use of the publish-subscribe messaging paradigm, which helps to decouple the message sender (publisher) from the message receiver (consumer). This paradigm is also heavily used in the CERN Accelerator Control system, in Proxy broker - critical part of the Controls Middleware (CMW) project. Proxy provides the aforementioned publish-subscribe facility and also supports execution of synchronous read and write operations. Moreover, it enables service scalability and dramatically reduces the network resources and overhead (CPU and memory) on publisher machine, required to serve all subscriptions. Proxy was developed in modern C++, using state of the art programming techniques (e.g. Boost) and following recommended software patterns for achieving low-latency and high concurrency. The outstanding performance of the Proxy infrastructure was confirmed during the last 3 years by delivering the high volume of LHC equipment data to many critical systems. This work describes in detail the Proxy architecture together with the lessons learnt from operation and the plans for the future evolution.

Contributed Oral

TUCOCB03

A Practical Approach to Ontology-Enabled Control Systems for Astronomical Instrumentation

Software Technology Evolution

Wim Pessemier, Gert Raskin, Hans Van Winckel (KU Leuven, Leuven), Geert Deconinck (KU Leuven, Heverlee (Leuven)), Philippe Saey (Katholieke Hogeschool Sint-Lieven, Gent)

Even though modern service-oriented and data-oriented architectures promise to deliver loosely coupled control systems, they are inherently brittle as they commonly depend on a priori agreed interfaces and data models. At the same time, the Semantic Web and a whole set of accompanying standards and tools are emerging, advocating ontologies as the basis for knowledge exchange. In this paper we aim to identify a number of key ideas from the myriad of knowledge-based practices that can readily be implemented by control systems today. We demonstrate with a practical example (a three-channel imager for the Mercator Telescope) how ontologies developed in the Web Ontology Language (OWL) can serve as a meta-model for our instrument, covering as many engineering aspects of the project as needed. We show how a concrete system model can be built on top of this meta-model via a set of Domain Specific Languages (DSLs), supporting both formal verification and the generation of software and documentation artifacts. Finally we reason how the available semantics can be exposed at run-time by adding a "semantic layer" that can be browsed, queried, monitored etc. by any OPC UA-enabled client.

TUCOCB04

EPICS Version 4 Progress Report

Software Technology Evolution

Timo Korhonen (PSI, Villigen PSI), Leo Bob Dalesio, Nikolay Malitsky, Guobao Shen (BNL, Upton, Long Island, New York), Matej Sekoranja (Cosylab, Ljubljana), David Gareth Hickin, James Rowland (Diamond, Oxfordshire), Ralph Lange (HZB, Berlin), Greg White [on leave] (SLAC, Menlo Park, California), Martin Richard Kraimer (Self Employment, Private address)

EPICS Version 4 is the next major revision of the Experimental Physics and Industrial Control System, a widely used software framework for controls in large facilities, accelerators and telescopes. The primary goal of Version 4 is to improve support for scientific applications by augmenting the control-centered EPICS Version 3 with an architecture that allows building scientific services on top of it. Version 4 provides a new standardized wire protocol, support of structured types, and parametrized queries. The long-term plans also include a revision of the IOC core layer. The first set of services like directory, archive retrieval, and save set services aim to improve the current EPICS architecture and enable interoperability. The first services and applications are now being deployed in running facilities. We present the current status of EPICS V4, the interoperation of EPICS V3 and V4, and how to create services such as accelerator modelling, large database access, etc. These enable operators and physicists to write thin and powerful clients to support commissioning, beam studies and operations, and opens up the possibility of sharing applications between different facilities.

TUCOCB05

Device Definition and Composite Device Views on Top of the Flat EPICS Namespace

Software Technology Evolution

Leo Bob Dalesio, Kunal Shroff, Lingyun Yang (BNL, Upton, Long Island, New York), Ralph Lange (HZB, Berlin)

The EPICS (Experimental Physics and Industrial Control System) IOC (Input Output Controller) Core database represents a process on signal level, presenting a flat view of possibly complex devices. This signal level interface is an easily agreed upon common denominator, allowing drivers, signal records, and processes on these signals to be standardized across EPICS installations. However, it is also necessary to represent a device in its different aspects. Currently this requires a-priori knowledge of all individual channels that are included in a device by each client. This paper discusses device orientation based on the new EPICS Version 4 database and middle layer services along with the ecosystem to manage these views.

Contributed Oral

TUCOCB06

Designing and Implementing LabVIEW Solutions for Re-Use*

Software Technology Evolution

MIchael Flegel (LLNL, Livermore, California)

Many of our machines have a lot in common – they drive motors, take pictures, generate signals, toggle switches, and observe and measure effects. In a research environment that creates new machines and expects them to perform for a production assembly line, it is important to meet both schedule and quality. NIF has developed a LabVIEW layered architecture of Support, general Frameworks, Controllers, Devices, and User Interface Frameworks. This architecture provides a tested and qualified framework of software that allows us to focus on developing and testing the external interfaces (hardware and user) of each machine.

Contributed Oral

TUCOCB07

TANGO - Can ØMQ Replace CORBA ?

Software Technology Evolution

Andrew Gotz, Emmanuel Taurel, Pascal Verdier (ESRF, Grenoble)

TANGO (http://www.tango-controls.org) is a modern distributed device oriented control system toolkit used by a number of facilities to control synchrotrons, lasers and a wide variety of equipment for doing physics experiments. The performance of the network protocol used by TANGO is a key component of the toolkit. For this reason TANGO is based on the omniORB implementation of CORBA. CORBA offers an interface definition language with mappings to multiple programming languages, an efficient binary protocol, a data representation layer, and various services. In recent years a new series of binary protocols based on AMQP have emerged from the high frequency stock market trading business. A simplified version of AMQP called ØMQ (http://www.zeromq.org/) was open sourced in 2010. In 2011 the TANGO community decided to take advantage of ØMQ. In 2012 the kernel developers successfully replaced the CORBA Notification Service with ØMQ in TANGO V8. The first part of this paper will present the software design, the issues encountered and the resulting improvements in performance. The second part of this paper will present a study of how ØMQ could replace CORBA completely in TANGO.

Contributed Oral

TUCOCB08

Reimplementing the Bulk Data System with DDS in ALMA ACS

Software Technology Evolution

Bogdan Jeram, Gianluca Chiozzi, Rodrigo Javier Tobar (ESO, Garching bei Muenchen), Manabu Watanabe (NAOJ, Tokyo), Rodrigo Amestica (NRAO, Charlottesville)

Bulk Data(BD) is a service in the ALMA Common Software to transfer a high amount of astronomical data from many-to-one, and one-to-many computers. Its main application is the Correlator SW (processes raw lags from the Correlator HW into science visibilities). The Correlator retrieves data from antennas on up to 32 computers. Data is forwarded to a master computer and combined to be sent to consumers. The throughput requirement both to/from the master is 64 MBytes/sec, differently distributed based on observing conditions. Requirements for robustness make the application very challenging. The first implementation, based on the CORBA A/V Streaming service, showed weaknesses. We therefore decided to replace it, even if we were approaching start of operations, making provision for careful testing. We have chosen as core technology DDS (Data Distribution Service), being a well supported standard, widespread in similar applications. We have evaluated mainstream implementations, with emphasis on performance, robustness and error handling. We have successfully deployed the new BD, making it easy switching between old and new for testing purposes. We discuss challenges and lessons learned.

Contributed Oral

TUCOCB09

Internet of Things and Control System

Software Technology Evolution

Vincent Hardion (MAX-lab, Lund)

A recent huge interest in Machine to Machine communication is known as the Internet Of Things (IOT), to allow the possibility for autonomous devices to use Internet for exchanging the data. Internet and the Web have been a Revolution regarding the communication between the people, borned from the need to exchange the scientific resources between institutes. Several universities and industrial predicts the same impact IOT would have in our life. The same issues as for human communication are in discussion like protocols, representations and resources are being tested by different institutes, companies and start-up. But already the usage have been found by the smart cities in example. In parallel the domain of Control Systems for big research facilities has already acquired lot of knowledge to build the connection between thousand of devices, more and more provided with a TCP/IP connection. The purpose of this topic is to understand the possible convergence between Control System and IOT.

TUCOCB10

TANGO V8 - Another Turbo Charged Major Release

Software Technology Evolution

Andrew Gotz, Jean-Michel Chaize, Tiago Coutinho, Jens Meyer, Faranguiss Poncet, Emmanuel Taurel, Pascal Verdier (ESRF, Grenoble), Stephane Perez (CEA, Arpajon), David Fernandez-Carreiras, Sergi Rubio-Manrique (CELLS-ALBA Synchrotron, Cerdanyola del Vallès), Stefano Cleva, Marco Lonza, Lorenzo Pivetta, Claudio Scafuri (Elettra-Sincrotrone Trieste S.C.p.A., Basovizza), Igor Alexandrovich Khokhriakov (HZG, Geesthacht), Darren Paul Spruce (MAX-lab, Lund), Gwenaelle Abeille, Alain Buteau, Nicolas Leclercq, Frédéric Emmanuel Picca (SOLEIL, Gif-sur-Yvette)

The TANGO (http://tango-controls/org) collaboration continues to evolve and improve the TANGO kernel. A latest release has made major improvements to the protocol and, the language support in Java. The replacement of the CORBA Notificaton service with ZMQ for sending events has allowed a much higher performance, a simplification of the architecture and support for multicasting to be achieved. A rewrite of the Java device server binding using the latest features of the Java language has made the code much more compact and modern. Guidelines for writing device servers have been produced so they can be more easily shared. The test suite for testing the TANGO kernel has been re-written and the code coverage drastically improved. TANGO has been ported to new embedded platforms running Linux and mobile platforms running Android and iOS. Packaging for Debian and bindings to commercial tools have been updated and a new one (Panorama) added. The graphical layers have been extended. The latest figures on TANGO performance will be presented. Finally the paper will present the roadmap for the next major release.

Oral Preferred

TUOA01

Mobile Platforms Roundtable

Keynote

Andrew Gotz (ESRF, Grenoble), Eric Bjorklund (LANL, Los Alamos, New Mexico)

Roundtable panel discussion on the use of mobile devices in control systems. Topics include:- Are mobile devices really useful for controlling experimental equipment? - What are the pros and cons of using mobile devices for operator interfaces? - What are the pros and cons of each platform? - Are there applications for which mobile devices are better suited? - Are there applications for which mobile devices are not very well suited? - Native apps versus html5 - is there a clear advantage? - How to deploy apps - Which devices are most common tablets or phones? - Is supporting one platform enough? - What tools are people using to develop with? - What are the security concerns and how can they be mitigated? Panel moderators Andy Götz, European Synchrotron Radiation Facility, Grenoble, France Eric Björklund, Los Alamos Neutron Science Center, Los Alamos, New Mexico, USA Participating panelists Reinhard Bacher, Deutsches Elektronon-Synchrotron, Hamburg, Germany Kay-Uwe Kasemir, Spallation Neutron Source, Oak Ridge, Tennessee, USA Paolo Mutti, Institut Laue-Langevin, Grenoble, France, Scott Reisdorf, National Ignition Facility, Livermore, California, USA

WEKAAB01

Invited Oral

Technical Challenges of Space Exploration

Keynote

Charles Elachi (JPL, Pasadena, California)

The landing of the car size rover "Curiosity" on Mars was one of the most challenging engineering achievements in robotic exploration. In this talk, I will describe the innovations and challenges in developing and landing Curiosity, the scientific results during the first year of operations, as well as how it fits in the overall program of planetary exploration and Earth observatories.

WECOAAB01

Invited Oral

An Overview of the LHC Experiments' Control Systems

Experiment Control

Clara Gaspar (CERN, Geneva)

Although they are LHC experiments, the four experiments, either by need or by choice, use different equipment, have defined different requirements and are operated differently. This led to the development of four quite different Control Systems. Although a joint effort was done in the area of Detector Control Systems (DCS) allowing a common choice of components and tools and achieving the development of a common DCS Framework for the four experiments, nothing was done in common in the areas of Data Acquisition or Trigger Control (normally called Run Control). This talk will present an overview of the design principles, architectures and technologies chosen by the four experiments in order to perform the Control System's tasks: Configuration, Control, Monitoring, Error Recovery, User Interfacing, Automation, etc.

WECOAAB02

Status of the ACS-based Control System of the Mid-size Telescope Prototype for the Cherenkov Telescope Array (CTA)

Experiment Control

Peter Andreas Roland Wegner, Bagmeet Behera, David Melkumyan, Stefan Schlenstedt, Torsten Schmidt, Ronny Sternberger, Stephan Wiesand (DESY Zeuthen, Zeuthen), Oguzhan Anguner, Emrah Birsin, Igor Oya, Ullrich Schwanke (Humboldt University Berlin, Berlin), Matthias Fuessling (Universität Potsdam, Potsdam-Golm)

CTA as the next generation ground-based very-high-energy gamma-ray observatory is defining new areas beyond those related to physics; it is also creating new demands on the control and data acquisition system. With on the order of 100 telescopes spread over large area with numerous central facilities, CTA will comprise a significantly larger number of devices than any other current imaging atmospheric Cherenkov telescope experiment. A prototype for the Medium Size Telescope (MST) of a diameter of 12 m has been installed in Berlin and is currently being commissioned. The design of the control software of this telescope incorporates the main tools and concepts under evaluation within the CTA consortium in order to provide an array control prototype for the CTA project. The readout and control system for the MST prototype is implemented within the ALMA Common Software (ACS) framework. The interfacing to the hardware is performed via the OPen Connectivity-Unified Architecture (OPC UA). The archive system is based on MySQL and MongoDB. In this contribution the architecture of the MST control and data acquisition system, implementation details and first conclusions are presented.

WECOAAB03

Synchronization of Motion and Detectors and Continuous Scans as the Standard Data Acquisition Technique

Experiment Control

David Fernandez-Carreiras, Fulvio Becheri, Guifre Cuni, Gabriel Jover-Mañas, Carlos Pascual-Izarra, Zbigniew Reszela (CELLS-ALBA Synchrotron, Cerdanyola del Vallès), Tiago Coutinho (ESRF, Grenoble)

This paper describes the model, objectives and implementation of a generic data acquisition structure for an experimental station, which integrates the hardware and software synchronization of motors, detectors, shutters and in general any experimental channel or events related with the experiment. The implementation involves the management of hardware triggers, which can be derived from time, position of encoders or even events from the particle accelerator, combined with timestamps for guaranteeing the correct integration of software triggered or slow channels. The infrastructure requires a complex management of buffers of different sources, centralized and distributed, including interpolation procedures. ALBA uses Sardana built on TANGO as the generic control system, which provides the abstraction and communication with the hardware, and a complete macro edition and execution environment.

WECOBA01

Contributed Oral

Algebraic Reconstruction of Ultrafast Tomography Images at the Large Scale Data Facility

Data Management and Processing

Xiaoli Yang, Tomy dos Santos Rolo, Thomas Jejkal, Halil Pasic, Rainer Stotzka, Achim Streit, Thomas van de Kamp (KIT, Eggenstein-Leopoldshafen)

An ultrafast tomography system is being built up at the ANKA Synchrotron Light Source at KIT to study moving biological objects with high temporal and spatial resolution. The resulting amounts of data are challenging in terms of reconstruction algorithm, automatic processing software and hardware computing. The standard and manually operated reconstruction method with GPU acceleration performs relatively poorly because of much fewer projections obtained from the ultrafast tomography. Thus an algebraic reconstruction technique based on a more precise forward transform model and compressive sampling theory is studied. It results in high quality images, but is computational very expensive. Instead of GPU acceleration, an automatic workflow at the Large Scale Data Facility (LSDF) is built up to connect the tomography beamline of ANKA. It will highly enhance the data storage and archiving, provide better reconstruction results and higher data analysis efficiency to users. This study contributes to the construction of the world fastest tomography system at ANKA and will enhance its application in fields of chemistry, biology and new materials.

WECOBA02

Contributed Oral

Distributed Information Services for Control Systems

Data Management and Processing

Vasu Vuppala, Eric Thomas Berryman (NSCL, East Lansing, Michigan), Leo Bob Dalesio, Donald Dohan, Guobao Shen, Kunal Shroff (BNL, Upton, Long Island, New York), Miha Vitorovič, Klemen Zagar (Cosylab, Ljubljana), Karin Rathsman, Garry Trahern (ESS, Lund), Dong Liu (FRIB, East Lansing), Chungming Paul Chu, Sheng Peng (FRIB, East Lansing, Michigan), Huihui Lv, ChunHong Wang, Zhuo Zhao (IHEP, Beijing)

During the design and construction of an experimental physics facility (EPF), a heterogeneous set of engineering disciplines, methods, and tools is used, making subsequent exploitation of data difficult. In this paper, we describe a framework (DISCS) for building high-level applications for commissioning, operation, and maintenance of an EPF that provides programmatic as well as graphical interfaces to its data and services. DISCS is a collaborative effort of BNL, FRIB, Cosylab, IHEP, and ESS. It is comprised of a set of cooperating services and applications, and manages data such as machine configuration, lattice, measurements, alignment, cables, machine state, inventory, operations, calibration, and design parameters. The services/applications include Channel Finder, Logbook, Traveler, Unit Conversion, Online Model, and Save-Restore. Each component of the system has a database, an API, and a set of applications. The services are accessed through REST and EPICS V4. We also discuss the challenges to developing database services in an environment where requirements continue to evolve and developers are distributed among different laboratories with different technology platforms.

Contributed Oral

WECOBA03

eResearch Tools for the Australian Synchrotron Research Community

Data Management and Processing

Claus Ulrich Felzmann (SLSA, Clayton)

The Australian Synchrotron (AS) supports a large and growing sector of the Australian and New Zealand research communities. Research conducted at the facility strongly enhances programs in a broad range of sciences including fields as diverse as medicine, materials science, electronics, clean fuels, agriculture, art conservation and forensics. The steady growth in user numbers and rise in synchrotron applications and science output can only be maintained with matching growth in information technologies. In particular, collaborative approaches for data analysis are needed to account for the geographic spread of synchrotron users. As a consequence, the AS is a recognized pioneer in the use of cyber-infrastructure in Australia. Currently the AS is in partnership with "NeCTAR", an Australian Government project to develop "eResearch Tools for the Australian Synchrotron research community". The project focuses on automating technique-specific workflows for data processing, heavily utilizing local HPC and Cloud resources, and making these capabilities remotely accessible. Here we present the deliverables, the impact on the research community, and the measured uptake of this project.

Contributed Oral

WECOBA04

Effective End-to-end Management of Data Acquisition and Analysis for X-ray Photon Correlation Spectroscopy

Data Management and Processing

Faisal Khan, John Paul Hammonds, Suresh Narayanan, Alec Sandy, Nicholas Schwarz (ANL, Argonne)

Low latency between data acquisition and analysis is of critical importance to any experiment. The combination of a faster parallel algorithm and a data pipeline for connecting disparate components (detectors, clusters, file formats) enabled us to greatly enhance the operational efficiency of the x-ray photon correlation spectroscopy experiment facility at the Advanced Photon Source. The improved workflow starts with raw data (120 MB/s) streaming directly from the detector camera, through an on-the-fly discriminator implemented in firmware to Hadoop's distributed file system in a structured HDF5 data format. The user then triggers the MapReduce-based parallel analysis. For effective bookkeeping and data management, the provenance information and reduced results are added to the original HDF5 file. Finally, the data pipeline triggers user specific software for visualizing the data. The whole process is completed shortly after data acquisition – a significant improvement of operation over previous setup. The faster turn-around time helps scientists to make near real-time adjustments to the experiments.

WECOBA05

Understanding NIF Experimental Results: NIF Target Diagnostic Automated Analysis Recent Accompolishments*

Data Management and Processing

Judith A. Liebman, Essex J. Bond, Abbie L. Warrick (LLNL, Livermore, California)

The National Ignition Facility (NIF) at the Lawrence Livermore National Laboratory is the most energetic laser system in the world. During a NIF laser shot, a 20-ns ultraviolet laser pulse is split into 192 separate beams, amplified, and directed to a millimeter-sized target at the center of a 10-m target chamber. To achieve the goals of studying energy science, basic science, and national security, NIF laser shot performance is being optimized around key metrics such as implosion shape and fuel mix. These metrics are accurately quantified after each laser shot using automated signal and image processing routines to analyze raw data from over 50 specialized diagnostics that measure x-ray, optical and nuclear phenomena. Each diagnostic's analysis is comprised of a series of inverse problems, timing analysis, and specialized processing. This talk will review the framework for general diagnostic analysis, give examples of specific algorithms used, and review the diagnostic analysis team's recent accomplishments. The automated diagnostic analysis for x-ray, optical, and nuclear diagnostics provides accurate key performance metrics and enables NIF to achieve its goals.

Contributed Oral

WECOBA06

Exploring No-SQL Alternatives for ALMA Monitoring System

Data Management and Processing

Tzu-Chiang Shen, Alvaro Aguirre, Alejandro Javier Barrientos, Marcelo Bartsch, Jorge Ibsen, Patricio Merino, Leonel Ignacio Peña, Ruben Soto (ALMA, Santiago)

The Atacama Large Millimeter /submillimeter Array (ALMA) will be a unique research instrument composed of at least 66 reconfigurable high-precision antennas, located at the Chajnantor plain in the Chilean Andes at an elevation of 5000 m. This paper describes the experience gained after several years working with the monitoring system, which has the fundamental requirement to collect and storage up to 100K variables. The original design is built on top of a cluster of relational database server and network attached storage with fiber channel interface. As the number of monitoring points increases with the number of antennas included in the array, the current monitoring system has demonstrated to be able to handle the increased data rate in the collection and storage area, but the data query interface has started to suffered serious performance degradation. A solution based on no-SQL platform was explored as an alternative of the current long-term storage system, specifically mongoDB has been chosen. Intermediate cache servers based on Redis are also introduced to allow faster online data streaming of the most recent data to data analysis application and web based charts applications

WECOBA07

Contributed Oral

High Speed Detectors: Problems and Solutions

Data Management and Processing

Nick Rees, Mark Basham, Frederik Ferner, Ulrik Kofoed Pedersen, Tobias Stefan Richter, Jonathan Andrew Thompson (Diamond, Oxfordshire)

Diamond has an increasing number of high speed detectors primarily used on Macromolecular Crystallography, Small Angle X-Ray Scattering and Tomography beamlines. Recently, the performance requirements have exceeded the performance available from a single threaded writing process on our Lustre parallel file system, so we have had to investigate other file systems and ways of parallelising the data flow to mitigate this. We report on the some comparative tests between Lustre and GPFS, and some work we have been leading to enhance the HDF5 library to add features that simplify the parallel writing problem.

WECOCB01

Contributed Oral

CERN's FMC Kit

Hardware Technology

Erik Van der Bij, Matthieu Cattin, Evangelia Gousiou, Javier Serrano, Tomasz Wlostowski (CERN, Geneva)

In the frame of the renovation of controls and data acquisition electronics for accelerators, the BE-CO-HT section at CERN has designed a kit based on carriers and mezzanines following the FPGA Mezzanine Card (FMC, VITA 57) standard. Carriers exist in VME64x and PCIe form factors, with a PXIe carrier underway. Mezzanines include an Analog to Digital Converter (ADC), a Time to Digital Converter (TDC) and a fine delay generator. All of the designs are licensed under the CERN Open Hardware Licence (OHL) and commercialized by companies. The paper discusses the benefits of this carrier-mezzanine strategy and of the Open Hardware based commercial paradigm, along with performance figures and plans for the future.

WECOCB02

ARM Based Embedded EPICS Controller for Beam Diagnostics of Cyclotrons at VECC

Hardware Technology

Shantonu Sahoo, Tanushyam Bhattacharjee, Rajendra Balkrishna Bhole, Niraj Chaddha, Sarbajit Pal, Anindya Roy (VECC, Kolkata)

ARM based controller with embedded EPICS has been developed for beam diagnostics purpose in K-130 Room Temperature Cyclotron and K-500 Superconducting Cyclotron at Variable Energy Cyclotron Center. The beam diagnostics system in these cyclotrons consists of many hardware devices to be controlled and monitored. Presently, these hardware modules are interfaced with PC based systems using serial communication line. The ARM based embedded controller card is developed to replace the existing PC based systems with a small plug-in module that will contain the EPICS IOC and the database having the control parameters. This will have an obvious advantage of integrating the control system inside the hardware itself thus reducing the overall hardware complexities which was involved in the PC based systems. The paper explains the steps involved in designing the ARM based controller for beam diagnostics and Graphical User Interface (GUI) for Operator Interface. EPICS Channel Access embedded ActiveX components along with Microsoft Visual Basic (VB) is chosen as the OPI development platform.

Contributed Oral

WECOCB03

Development of a Front-end Data-Acquisition System with a Camera Link FMC for High-Bandwidth X-Ray Imaging Detectors

Hardware Technology

Choji Saji, Toru Ohata, Takashi Sugimoto, Ryotaro Tanaka, Mitsuhiro Yamaga (JASRI/SPring-8, Hyogo-ken), Toshinori Abe (RIKEN SPring-8 Center, Hyogo), Togo Kudo (RIKEN SPring-8 Center, Sayo-cho, Sayo-gun, Hyogo)

X-ray imaging detectors are indispensable for synchrotron radiation experiments and growing up with larger number of pixels and higher frame rate to acquire more information on the samples. The novel detector with data rate of up to 8 Gbps/sensor, SOPHIAS, is under development at SACLA facility. Therefore, we have developed a new front-end DAQ system with high data rate beyond the present level. The system consists of an FPGA-based evaluation board and a FPGA mezzanine card (FMC). As the FPGA interface, FMC was adopted for supporting variety of interfaces and considering COTS system. Since the data transmission performance of the FPGA board in combination with the FMCs was already evaluated as about 20 Gbps between boards, our choice of devices has the potential to meet the requirements of SOPHIAS detector*. We made a FMC with Camera Link (CL) interface to support 1st phase of SOPHIAS detector. Since almost CL configurations are supported, the system handles various types of commercial cameras as well as new detector. Moreover, the FMC has general purpose input/output to satisfy various experimental requirements. We report the design of new front-end DAQ and results of evaluation.

* A Study of a Prototype DAQ System with over 10 Gbps Bandwidth for the SACLA X-Ray Experiments, C. Saji, T. Ohata, T. Sugimoto, R. Tanaka, and M. Yamaga, 2012 IEEE NSS and MIC, p.1619-p.1622

Contributed Oral

WECOCB04

The LASNCE FPGA Embedded Signal Processing Framework

Hardware Technology

Jeffrey Owen Hill (LANL, Los Alamos, New Mexico)

During our replacement of some LANSCE LINAC instrumentation systems we have developed a common architecture for timing system synchronized embedded signal processing systems. Our design follows trends of increasing levels of electronics system integration; a single commercial-off-the-shelf (COTS) board assumes the roles of analog-to-digital conversion and advanced signal processing while also providing the LAN attached EPICS IOC functionality. These systems are based on agile FPGA-based COTS VITA VPX boards with an VITA FMC mezzanine site. Our signal processing is primarily developed at a high level specifying numeric algorithms in software source code to be integrated together with COTS signal processing intellectual property components for synthesis of hardware implementations. We will discuss our requirements, our decision point selecting the VPX together with the FMC industry standards, the benefits along with costs of system integrating multi-vendor COTS components, the design of some our signal processing algorithms, and the benefits along with costs of embedding the EPICS IOC within an FPGA.

Contributed Oral

WECOCB05

Modern Technology in Disguise

Hardware Technology

Timo Korhonen, Damir Anicic, Babak Kalantari, Roger Kalt, Michael Laznovsky, Thomas Schilcher, Dirk Zimoch (PSI, Villigen PSI)

A modern embedded system for fast systems has to incorporate technologies like multicore CPUs, fast serial links and FPGAs for interfaces and local processing. Those technologies are still relatively new and integrating them in a control system infrastructure that either exists already or has to be planned for long-term maintainability is a challenge that needs to be addressed. At PSI we have, in collaboration with an industrial company (IOxOS SA)[*], built a board and infrastructure around it solving issues like scalability and modularization of systems that are based on FPGAs and the FMC standard, simplicity in taking such a board in operation and re-using parts of the source code base for FPGA. In addition the board has several state-of-the-art features that are typically found in the newer bus systems like MicroTCA, but can still easily be incorporated in our VME64x-based infrastructure. In the presentation we will describe the system architecture, its technical features and how it enables us to effectively develop our different user applications and fast front-end systems.

* IOxOS SA, Gland, Switzerland, http://www.ioxos ch

Contributed Oral

WECOCB06

Saving Costs and Increasing Data Throughput in MicroTCA.4 by Hardware Concept Extension and Optimization of Data Transfer Performance

Hardware Technology

Vollrath Dirksen (DESY, Hamburg), Wojciech Jalmuzna (TUL-DMCS, Lodz)

MicroTCA has found many uses in applications requiring a modular open standard that is smaller and cheaper than AdvancedTCA. Although MTCA.4 has closed the functional gap between ATCA and MicroTCA, the system and slot costs still are key to success, especially for smaller systems. A new hardware concept utilizing the capabilities of the MCH slot in a MTCA.4 system addresses this issue and helps to build more cost efficient solutions without degradation of the performance. At the same time this new hardware concept allows the customer to select from an even larger ecosystem of solutions than what was available so far. This presentation introduces new possibilities of MTCA.4 system configuration and presents first evaluation of the data transfer performance. To optimize performance of the system (in terms of data transfer bandwidth and latency) each configuration requires different approach on firmware/software layer. The presentation shows several concepts of data transfer implementation in PCIe environment and demonstrates their applications in an example uTCA system. Implementations include firmware level interfaces, driver to OS and interfaces to common control systems .

MTCA.4, RTM, more performance, cost saving, PCIexpress, EPICS and DOOCS

Contributed Oral

WECOCB07

Development of an Open-Source Hardware Platform for Sirius BPM and Orbit Feedback

Hardware Technology

Daniel de Oliveira Tavares, Rafael Antonio Baron, Fernando Henrique Cardoso, Sergio Rodrigo Marques, Lucas Maziero Russo (LNLS, Campinas), Adrian Pawel Byszuk, Grzegorz Kasprowicz (Warsaw University of Technology, Warsaw)

Generic data acquisition and controls platform for BPM and Orbit Feedback systems in PICMG(R) AMC/MicroTCA.4 and ANSI/VITA FMC form factors, licensed under the CERN Open Hardware License (OHL) and GPL/LGPL. The paper describes the development and prototype test results of 3 open-source boards and their accompanying low-level firmware/software: (i) FPGA board with 2 high-pin count FMC slots in AMC form factor with DDR3 SDRAM as well as PCIe and 1 GbE connectivity to the backplane, used as digital back-end for BPM digital signal processing and orbit feedback processing node; (ii) 4-channel 130 MS/s 16-bit ADC FMC mezzanine board for RF BPM 500 MHz signals direct sampling; (iii) 4-channel 250 MS/s 16-bit ADC FMC mezzanine board for RF BPM 500 MHz signals direct sampling. The experience of integrating the system prototype in a COTS MicroTCA.4 crate with a AMC CPU used as EPICS IOC is also reported. Finally, the first version of the open-source analog front-end board designed for the Sirius RF BPMs is briefly presented.

WEOOM01

Designing for Longevity

Keynote

Alexander Rose (The Long Now Foundation, San Francisco)

How do you build an monument scale sculptural machine that will last as long as civilization? How do you engage the people that visit it? For the last fifteen years The Long Now Foundation and Alexander Rose have been working on building this icon of long-term thinking. Rose is currently managing the 10,000 Year Clock project underway in West Texas where they have used purpose designed robots and explosives to excavate over 500 vertical feet through solid rock to house the Clock. Alexander will discuss the research and design process that has taken him as far as the arctic Seed Vault in Svalbard, to the ultra-secret Mormon geneological vaults in Salt Lake City. He will show the building process now underway for the 10,000 Year Clock that includes fabrication of the massive Clock itself.

Invited Oral

THKAB01

GNU Radio and the USRP: Building a community and an FPGA-based Software Radio

Keynote

Matt Ettus (Ettus Research, Santa Clara)

GNU Radio is a free software project for software radio. Matt Ettus joined the project shortly after it was founded in 2001. He soon realized that for the project to be truly successful, it needed low cost hardware on which to build those radios, and so he designed the Universal Software Radio Peripheral (USRP) in 2003 and 2004. Since then, both projects have achieved significant growth and success. In 2010, Matt's company, Ettus Research, was acquired by National Instruments, and it continues to produce products and free software for the community. This talk will cover the history of both projects, some of the technical details of the FPGA-based hardware architecture, and the community experience over its 12 years of active development.

THCOAAB01

A Scalable and Homogeneous Web-Based Solution for Presenting CMS Control System Data

User Interfaces and Tools

L. Masetti, O. Chaze, J. A. Coarasa, C. Deldicque, M. Dobson, A. Dupont, D. Gigi, F. Glege, R. Gomez-Reino, C. Hartl, F. Meijers, E. Meschi, S. Morovic, C. Nunez-Barranco-Fernandez, L. Orsini, W. Ozga, A. Petrucci, G. Polese, A. Racz, H. Sakulin, C. Schwick, A. C. Spataru, C. C. Wakefield, P. Zejdi, U. Behrens, R. K. Mommsen, V. O'Dell, O. Raginel, F. Stoeckli, G. Bauer, C. Paus, K. Sumorok, S. Erhan, J. Branson, S. Cittolin, A. Holzner, M. Pieri, M. Sani

The Control System of the CMS experiment ensures the monitoring and safe operation of over 1M parameters. The high demand for access to online and historical Control System Data calls for a scalable solution combining multiple data sources. The advantage of a Web solution is that data can be accessed from everywhere with no additional software. Moreover, existing visualization libraries can be reused to achieve a user-friendly and effective data presentation. Access to the online information is provided with minimal impact on the running control system by using a common cache in order to be independent of the number of users. Historical data archived by the SCADA software is accessed via an Oracle Database. The web interfaces provide mostly a read-only access to data but some commands are also allowed. Moreover, developers and experts use web interfaces to deploy the control software and administer the SCADA projects in production. By using an enterprise portal, we profit from single sign-on and role-based access control. Portlets maintained by different developers are centrally integrated into dynamic pages, resulting in a consistent user experience.

Contributed Oral

THCOAAB02

Enhancing the Man-Machine-Interface of Accelerator Control Applications with Modern Consumer Market Technologies

User Interfaces and Tools

Reinhard Bacher (DESY, Hamburg)

The paradigms of human interaction with modern consumer market devices such as tablets, smartphones or video game consoles are currently undergoing rapid and serious changes. Device control by multi-finger touch gesture or voice recognition has now become standard. Even further advanced technologies such as 3D-gesture recognition are becoming routine. Smart enhancements of head-mounted display technologies are beginning to appear on the consumer market. In addition, the look-and-feel of mobile apps and classical desktop applications are becoming remarkably similar to one another. We have used Web2cToGo to investigate the consequences of the above-mentioned technologies and paradigms with respect to accelerator control applications. Web2cToGo is a framework which is being developed at DESY. It provides a common, platform-independent Web application capable of running on widely-used mobile as well as common desktop platforms. This paper reports the basic concept of the project and presents the results achieved so far and discusses the next development steps.

Contributed Oral

THCOAAB03

Bringing Control System User Interfaces to the Web

User Interfaces and Tools

Xihui Chen, Kay-Uwe Kasemir (ORNL, Oak Ridge, Tennessee)

With the evolution of web based technologies, especially HTML5[1], it becomes possible to create web-based control system user interfaces (UI) that are cross-browser and cross-device compatible. This article describes two technologies that facilitate this goal. The first one is the WebOPI [2], which can seamlessly display CSS BOY[3] Operator Interfaces (OPI) in web browsers without modification to the original OPI file. The WebOPI leverages the powerful graphical editing capabilities of BOY, it provides the convenience of re-using existing OPI files. On the other hand, it uses auto-generated JavaScript and a generic communication mechanism between the web browser and web server. It is not optimized for a control system, which results in unnecessary network traffic and resource usage. Our second technology is the WebSocket-based Process Data Access (WebPDA). It is a protocol that provides efficient control system data communication using WebSockets[4], so that users can create web-based control system UIs using standard web page technologies such as HTML, CSS and JavaScript. The protocol is control system independent, so it potentially can support any type of control system.

[1]http://en.wikipedia.org/wiki/HTML5 [2]https://sourceforge.net/apps/trac/cs-studio/wiki/webopi [3]https://sourceforge.net/apps/trac/cs-studio/wiki/BOY [4] http://en.wikipedia.org/wiki/WebSocket

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Contributed Oral

THCOAAB04

Synchrobots: Experiments with Telepresence and Tele-operated Mobile Robots in a Synchrotron Radiation Facility

User Interfaces and Tools

Roberto Pugliese (Elettra-Sincrotrone Trieste S.C.p.A., Basovizza)

Synchrobot is an autonomous mobile robot that supports the machine operators of Elettra (*), a synchrotron radiation facility, in tasks such as diagnostic and measurement campaigns being capable of moving in the restricted area when the machine is running. In general, telepresence robots are mobile robot platforms capable of providing two way audio and video communication. Recently many companies are entering the business of telepresence robots. This paper describes our experience with tools like synchrobot and also commercially available telepresence robots. Based on our experience, we present a set of guidelines for using and integrating telepresence robots in the daily life of a research infrastructure and explore potential future development scenarios.

http://www.elettra.eu

Contributed Oral

THCOAAB05

Rapid Application Development Using Web 2.0 Technologies

User Interfaces and Tools

Scott Reisdorf, Bruce Conrad, Daniel Potter, Paul Reisdorf (LLNL, Livermore, California)

The National Ignition Facility (NIF) strives to deliver reliable, cost effective applications that can easily adapt to the changing business needs of the organization. We use HTML5, RESTful web services, AJAX, jQuery, and JSF 2.0 to meet these goals. WebGL and HTML5 Canvas technologies are being used to provide 3D and 2D data visualization applications. JQuery's rich set of widgets along with technologies such as HighCharts and Datatables allow for creating interactive charts, graphs, and tables. PrimeFaces enables us to utilize much of this Ajax and JQuery functionality while leveraging our existing knowledge base in the JSF framework. RESTful Web Services have replaced the traditional SOAP model allowing us to easily create and test web services. Additionally, new software based on NodeJS and WebSocket technology is currently being developed which will augment the capabilities of our existing applications to provide a level of interaction with our users that was previously unfeasible. These Web 2.0-era technologies have allowed NIF to build more robust and responsive applications. Their benefits and details on their use will be discussed.

Contributed Oral

THCOAAB06

Achieving a Successful Alarm Management Deployment – The CLS Experience

User Interfaces and Tools

Elder Matias, Laurier Baribeau, Tonia Batten, Jianwei Li, Ward A Wurtz (CLS, Saskatoon, Saskatchewan)

Alarm management systems promise to improve situational awareness, aid operational staff in correcting responding to accelerator problems and reduce downtime. Many facilities, including the Canadian Light Source (CLS), have been challenged in achieving this goal. At CLS past attempts focusing on software features and capabilities. Our third attempt switched gears and instead focused on human factors engineering techniques and the associated response processes to the alarm. Aspects of ISA 18,2, EEMUA 191 and NREG-700 standards were used. CLS adopted the CSS BEAST alarm handler software. Work was also undertaken to identify bad actors and analyzing alarm system performance and to avoid alarm flooding. The BEAST deployment was augmented with a locally developed voice annunciation system for a small number of critical high impact alarms and auto diallers for shutdown periods when the control room is not staffed. This paper summaries our approach and lessons learned.

THCOAAB07

NIF Electronic Operations: Improving Productivity with iPad Application Development*

User Interfaces and Tools

Scott Reisdorf, Daniel Potter (LLNL, Livermore, California)

In an experimental facility like the National Ignition Facility (NIF), thousands of devices must be maintained during day to day operations. Teams within NIF have documented hundreds of procedures, or checklists, detailing how to perform this maintenance. These checklists have been paper based, until now. NIF Electronic Operations (NEO) is a new web and iPad application for managing and executing checklists. NEO increases efficiency of operations by reducing the overhead associated with paper based checklists, and provides analysis and integration opportunities that were previously not possible. NEO's data driven architecture allows users to manage their own checklists and provides checklist versioning, real-time input validation, detailed step timing analysis, and integration with external task tracking and content management systems. Built with mobility in mind, NEO runs on an iPad and works without the need for a network connection. When executing a checklist, users capture various readings, photos, measurements and notes which are then reviewed and assessed after its completion. NEO's design, architecture, iPad application and uses throughout the NIF will be discussed.

Contributed Oral

THCOAAB08

NOMAD Goes Mobile

User Interfaces and Tools

Jerome Locatelli, Franck Cecillon, Cristina Cocho, Abdelali Elaazzouzi, Yannick Le Goc, Paolo Mutti, Helene Ortiz, Jacques Ratel (ILL, Grenoble)

The commissioning of the new instruments at the Institut Laue-Langevin (ILL) has shown the need to extend instrument control outside the classical desktop computer location. This, together with the availability of reliable and powerful mobile devices such as smartphones and tablets has triggered a new branch of development for NOMAD, the instrument control software in use at the ILL. Those devices, often considered only as recreational toys, can play an important role in simplifying the life of instrument scientists and technicians. Performing an experiment not only happens in the instrument cabin but also from the office, from another instrument, from the lab and from home. The present paper describes the development of a remote interface, based on Java and Android Eclipse SDK, communicating with the NOMAD server using CORBA via wireless network. Moreover, the application is distributed on "Google Play" to minimise the installation and the update procedures.

THCOAAB09

Contributed Oral

Olog and Control System Studio: A Rich Logging Environment

User Interfaces and Tools

Kunal Shroff, Arman Arkilic (BNL, Upton, Long Island, New York), Eric Thomas Berryman (NSCL, East Lansing, Michigan)

Leveraging the features provided by Olog and Control System Studio, we have developed a logging environment which allows for the creation of rich log entries. These entries in addition to text and snapshots images store context which can comprise of information either from the control system (process variables) or other services (directory, ticketing, archiver). The client tools using this context provide the user the ability to launch various applications with their state initialized to match those while the entry was created.

THMIB02

Mini Oral with Poster

Low-cost Motion Control Alternative for Complex Multi-axis Systems

Control System Upgrades

Wesley Moore (JLAB, Newport News, Virginia)

Motion controllers can be purchased to drive numerous axes and have the capability of handling a wide range of I/O. However, these systems are often costly and excessive for less demanding applications. Prototypes or experimental systems with low to moderate requirements do not necessarily imply a sacrifice in overall complexity, calling for intelligent controls. In such cases, LinuxCNC may provide a valuable option compared to normal hardware solutions. LinuxCNC offers an open-source software alternative, allowing synchronized motion control of up to 9 axes and boasts custom kinematics modules for non-Cartesian motion systems. Only using a low-end PC, LinuxCNC is capable of generating pulse-width modulation (PWM) frequencies of 20-50 kHz, including closed-loop control with encoder feedback. With the addition of an inexpensive PCI card, frequencies up to 10 MHz can be achieved. This paper will examine leveraging the features of LinuxCNC for a hexapod prototype, along with EPICS integration for distributed control.

THMIB03

From Real to Virtual - How to Provide a High-Avaliblity Computer Server Infrastructure

Control System Infrastructure

Rene Kapeller (PSI, Villigen PSI)

During the commissioning phase of the Swiss Light Source (SLS) at the Paul Scherrer Institut (PSI) we decided in 2000 for a strategy to separate individual services for the control system. The reason was to prevent interruptions due to network congestion, misdirected control, and other causes between different service contexts. This concept proved to be reliable over the years. Today, each accelerator facility and beamline of PSI resides on a separated subnet and uses its dedicated set of service computers. As the number of beamlines and accelerators grew, the variety of services and their quantity rapidly increased. Fortunately, about the time when the SLS announced its first beam, VMware introduced its VMware Virtual Platform for Intel IA_32 architecture. This was a great opportunity for us to start with the virtualization of the controls services. Currently, we have about 200 of such systems. In this presentation we discuss the way how we achieved the high-level-virtualization controls infrastructure, as well as how we will proceed in the future.

Mini Oral with Poster

THMIB04

Optimizing Blocker Usage on NIF Using Image Analysis and Machine Learning*

Knowledge-based Techniques

Laura Mascio Kegelmeyer, Alan Conder, Laurie Lane, Mike Nostrand, Joshua Senecal, Pamela Whitman (LLNL, Livermore, California)

To optimize laser performance and minimize operating costs for high energy laser shots it is necessary to locally shadow, or block, flaws from laser light exposure in the beamline optics. Blockers are important for temporarily shadowing a flaw on an optic until the optic can be removed and repaired. To meet this need, a combination of image analysis and machine learning techniques have been developed to accurately define the list of locations where blockers should be applied. The image analysis methods extract and measure evidence of flaw candidates and their correlated downstream hot spots and this information is passed to machine learning algorithms which rank the probability that candidates are flaws that require blocking. Preliminary results indicate this method will increase the percentage of true positives from less than 20% to about 90%, while significantly reducing recall – the total number of candidates brought forward for review.

THMIB05

Single Photon THz Timer

Timing and Sync

Amur Tevatros Margaryan, Robert Ayvazyan, Ashot A. Chilingarian, Lekdar A. Gevorgyan, Vanik H Kakoyan (ANSL, Yerevan), John Annand (University of Glasgow, Glasgow)

The principles of a timing technique based on a novel photon detector, the radio frequency photomultiplier tube* (RFPMT) are presented. The single-photon time resolution and minimum time bin of this technique are about 1 ps. In principle the RFPMT could be operated synchronously with an optical clock to achieve around 10 fs stability and separate timing systems could be synchronized to ps precision**. The RFPMT, equipped with a spiral-scanning radio-frequency system, could in principle achieve counting rates of around 1 THz. Potentially it could also be used as an amplitude digitizer of optical pulses with a ps time bins. In prototype devices the detection and readout systems are based on commercial multichannel plates, electron bombardment, avalanche photodiodes and standard nanosecond-risetime electronics. Experimental results demonstrating the validity of the operational principles of the RFPMT and the spiral-scanning radio-frequency system are presented.

*A. Margaryan et al., Nucl. Instr. & Meth. A566 (2006) 321. **A. Margaryan, Nucl. Instr. & Meth. A652 (2011) 504.

Mini Oral with Poster

THMIB06

Development Status of SINAP Timing System

Timing and Sync

Chongxian Yin, Ming Liu, Liying Zhao (SINAP, Shanghai)

After successful implementation of SINAP timing solution at Pohang Light Source in 2011, the development of SINAP timing system version-II was finished by the end of 2012. The hardware of version-II is based on Virtex-6 FPGA chip, and bidirectional event frame transfer is realized in a 2.5Gbps fiber network. In event frame, data transfer functionality substitutes for distributed bus. The structure of timing system is also modified, where a new versatile EVO could be configured as EVG, FANOUT and EVR with optical outputs. Besides standard VME modules, we designed PLC-EVR as well, which is compatible with Yokogawa F3RP61 series. Based on brand new hardware architecture, the jitter performance of SINAP timing system version-II is improved remarkably.

THMIB07

Fast Orbit Feedback Control in Mode Space

Feedback Systems

Sandira Gayadeen, Stephen Duncan (University of Oxford, Oxford), Mark Heron (Diamond, Oxfordshire)

This paper describes the design and implementation of fast orbit feedback control in mode space. Singular Value Decomposition (SVD) of the response matrix is used to decouple the multiple-input, multiple-output problem into spatial modes that can be controlled independently. In this paper controller dynamics for each spatial mode are selected by considering the disturbance at each frequency within each of the spatial modes. Most orbit feedback systems apply only different gains to each mode however mode space control gives greater flexibility in control design and can lead to enhanced disturbance suppression. Implementation details and performance of the mode space controller on the Booster synchrotron at Diamond Light Source are presented.

Mini Oral with Poster

THMIB09

Management of the FERMI@Elettra Control System Infrastructure

Control System Infrastructure

Lorenzo Pivetta, Alessio Igor Bogani, Roberto Passuello (Elettra-Sincrotrone Trieste S.C.p.A., Basovizza)

Efficiency, flexibility and simplicity of management have been some of the design guidelines of the control system for the FERMI@Elettra Free Electron Laser. Out-of-band system monitoring devices, remotely operated power distribution units and remote management interfaces have been integrated into the Tango control system, leading to an effective control of the infrastructure. The Open Source tool Nagios has been deployed to monitor the functionality of the control system computers and the status of the application software for an easy and automatic identification and report of troubles.

Poster

THPPC001

Overview of "The Scans" in the Central Control System of TRIUMF's 500 MeV Cyclotron

Control System Infrastructure

Juan Pon, Ka Sing Lee, Michael Mouat, Priscilla Yogendran (TRIUMF, Vancouver), Brenda Davison (SFU, Burnaby, BC)

The Central Control System of TRIUMF's 500 MeV Cyclotron developed, runs and maintains a software application known as the scans whose purpose is to: 1) Log events, 2) Enunciate alarms and warnings, 3) Perform simple actions on the hardware, and 4) Provide software interlock for machine protection. Since its inception more than 20 years ago, the scans have increasingly become an essential part for the proper operation of the Cyclotron. This paper gives an overview of the scans, its advantages and limitations, and desired improvements.

Poster

THPPC002

Configuration Management for Beam Delivery at TRIUMF/ISAC

Control System Infrastructure

Jane E Richards, Keiko Ezawa, Rolf Keitel (TRIUMF, Vancouver)

The ISAC facility at TRIUMF delivers simultaneous beams from different ion sources to multiple destinations. More beams will be added by the ARIEL facility which is presently under construction. To ensure co-ordination of beam delivery, beam path configuration management has been implemented. The process involves beam path selection, configuration setup and configuration monitoring. In addition save and restore of beam line device settings, scaling of beam optic devices for beam energy and mass, beam path specific operator displays, the ability to compare present and previous beam tunes, and alarm enunciation of device readings outside prescribed ranges are supported. Design factors, re-usability strategies, and results are described.

THPPC003

Management of the FERMI@Elettra Control System Infrastructure

Control System Infrastructure

Lorenzo Pivetta, Alessio Igor Bogani, Roberto Passuello (Elettra-Sincrotrone Trieste S.C.p.A., Basovizza)

Efficiency, flexibility and simplicity of management have been some of the design guidelines of the control system for the FERMI@Elettra Free Electron Laser. Out-of-band system monitoring devices, remotely operated power distribution units and remote management interfaces have been integrated into the Tango control system, leading to an effective control of the infrastructure. The Open Source tool Nagios has been deployed to monitor the functionality of the control system computers and the status of the application software for an easy and automatic identification and report of troubles.

Poster

THPPC004

CODAC Standardisation of PLC Communication

Control System Infrastructure

Sopan Pande, Franck Di Maio, Bruno Evrard, Kirti Mahajan, Prasad Sawantdesai, Antoni Simelio, Anders Wallander, Izuru Yonekawa (ITER Organization, St. Paul lez Durance)

As defined by the CODAC Architecture of ITER, a Plant System Host (PSH) and one or more Slow Controllers (SIEMENS PLCs) are connected over a switched Industrial Ethernet (IE) network. An important part of Software Engineering of Slow Controllers is the standardization of communication between PSH and PLCs. Based on prototyping and performance evaluation, Open IE Communication over TCP was selected. It is implemented on PLCs to support the CODAC data model of 'State', 'Configuration' and 'Simple Commands'. The implementation is packaged in Standard PLC Software Structure(SPSS) as a part of CODAC Core System release. SPSS can be easily configured by the SDD Tools of CODAC. However Open IE Communication is restricted to the PLC CPUs. This presents a challenge to implement redundant PLC architecture and use remote IO modules. Another version of SPSS is developed to support communication over Communication Processors(CP). The EPICS driver is also extended to support redundancy transparent to the CODAC applications. Issues of PLC communication standardization in the context of CODAC environment and future development of SPSS and EPICS driver are presented here.

THPPC005

Visualization Infrastructure within the Controls Environment of the Light Sources at HZB

Control System Infrastructure

Dennis Brian Engel, Roland Mueller, Peter Stange (HZB, Berlin)

The advantages of visualization techniques and infrastructures with respect to configuration management, high availability and resource management have become obvious also for controls applications. Today a choice of powerful products are easy-to-use and support desirable functionality, performance, usability and maintainability at very matured levels. This paper presents the architecture of the virtual infrastructure and its relations to the hardware based counterpart as it has emerged for BESSY II and MLS controls within the past decade. Successful experiences as well as abandoned attempts and caveats on some intricate troubles are summarized.

THPPC006

REMBRANDT - REMote Beam instRumentation And Network Diagnosis Tool

Control System Infrastructure

Tobias Hoffmann, Harald Bräuning (GSI, Darmstadt)

As with any other large accelerator complex in operation today, the beam instrumentation devices and associated data acquisition components for the coming FAIR accelerators will be distributed over a large area and partially installed in inaccessible radiation exposed areas. Besides operation of the device itself, like acquisition of data, it is mandatory to control also the supporting LAN based components like VME/µTCA crates, front-end computers (FEC), middle ware servers and more. Fortunately many COTS systems provide means for remote control and monitoring using a variety of standardized protocols like SNMP, IPMI or iAMT. REMBRANDT is a Java framework, which allows the authorized user to monitor and control remote systems while hiding the underlying protocols and connection information such as ip addresses, user-ids and passwords. Beneath voltage and current control, the main features are the remote power switching of the systems and the reverse telnet boot process observation of FECs. REMBRANDT is designed to be easily extensible with new protocols and features. The software concept, including the client-server part and the database integration, will be presented.

THPPC007

Planning, Inventory, Administration and Control of the Electronics Racks Complex for the European XFEL

Control System Infrastructure

Evgueni Negodin (DESY, Hamburg)

The European X-Ray Free Electron Laser is currently under construction and planned to be commissioned end of 2015. The facility is built deep under the ground – from 6 to 38 m. The total length of the facility tunnels is 3,4 km. The main LINAC alone is 2 km long. Since a major fraction of the control equipment will be installed in the tunnels, around 200 special cabinets or racks are necessary for that. These cabinets must to fulfill a number of strong criteria to ensure stable and reliable operation of the facility. For example, they have to provide radiation and EMI shielding for the electronic components and need to be climatized. At the same time the cabinets must be compact and need to have very good vibrostability. This paper describes the technologies, tools and methodologies used for the planning, inventory administration and control of electronics storage infrastructure of the European XFEL.

Poster

THPPC009

Design and Status of the SuperKEKB Accelerator Control Network System

Control System Infrastructure

Masako Iwasaki, Kazuro Furukawa, Hiroshi Kaji, Katsuhiko Mikawa, Tatsuro Nakamura, Takashi Obina, Masanori Satoh (KEK, Ibaraki), Tomohiro Aoyama, Makoto Fujita, Shiro Kusano, Takuya Nakamura, Naoki Tanaka, Kenzi Yoshii (Mitsubishi Electric System & Service Co., Ltd, Tsukuba)

SuperKEKB is the upgrade of the KEKB asymmetric energy electron-positron collider, for the next generation B-factory experiment in Japan. It is designed to achieve a luminosity of 8x10^35/cm2/s, 40 times higher than the world highest luminosity record at KEKB. For SuperKEKB, we upgrade the accelerator control network system, which connects all devices in the accelerator. To construct the higher performance network system, we install the network switches based on the 10 gigabit Ethernet (10GbE) for the wider bandwidth data transfer. Additional optical fibers, for the reliable and redundant network and for the robust accelerator control timing system, are also installed. For the KEKB beamline construction and accelerator components maintenance, we install the new wireless network system based on the Leaky Coaxial (LCX) cable antennas into the 3 km circumference beamline tunnel. We reconfigure the network design to enhance the reliability and security of the network. In this paper, the design and current status of the SuperKEKB accelerator control network system will be presented.

Poster

THPPC010

Upgrade Server System using Virtualization Technology in RIBF Control System

Control System Infrastructure

Akito Uchiyama, Nobuhisa Fukunishi, Misaki Komiyama (RIKEN Nishina Center, Wako)

In the RIBF project (RIKEN RI Beam Factory), the EPICS (Experimental Physics and Industrial Control System) -based control system was implemented by using GNU/Linux, commercial UNIX system (HP-UX), and vxWorks since 2001. In order to realize the service reliability enhancement of NFS, FTP, and PosgreSQL, we constructed an HA (High-Availability) System by using Heartbeat and DRBD in 2008. Because of the life cycle of the server hardware, the aging servers should be replaced periodically. Virtualization technology, such as KVM, Xen, and VMware is widely used in many situation, for example cloud computing. Therefore, we adapted VMware vSphere 5 as virtualization environment for construction servers, and NAS (Network Attached Storage) manufactured by NetApp as shared storage with an HA system was implemented. Currently, Linux IOCs (Input Output Controllers), DNS (domain name system), CA (Channel Access) gateway, backup systems, and application servers were implemented in virtualization environment. As a result, it is successful to replace the aging servers with virtualization environment with HA, and we can make efficient use of server resources as well as reducing operational costs.

Poster

THPPC011

High Availability Software Architecture of the Control System of ADS

Control System Infrastructure

Pengfei Wang (IHEP, Beijing)

The control system of Accelerator Driven Sub-critical System (ADS) should be strictly reliable and stable, due to the potential utilizations of the ADS, such as nuclear energy generation. This paper discusses the main contributions to the reliability and stability by four software, which are 1)low floor communication and control system---EPICS, 2) data storage and service infrastructure---high availability database and linux cluster, 3) hierarchal programming framework of the accelerator---XAL, 4) monitoring and operating large scale control systems---CSS. In addition, the recent development in the control system of ADS is briefly introduced in this paper.

THPPC012

Poster

The Equipment Database for the Control System of the NICA Accelerator Complex

Control System Infrastructure

Georgy Sergeevich Sedykh (JINR/VBLHEP, Dubna, Moscow region), Evgeny V. Gorbachev (JINR, Dubna, Moscow Region)

The report describes the database of equipment for the control system of Nuclotron-based Ion Collider fAcility (NICA, JINR, Russia). The database will contain information about hardware, software, computers and network components of control system, their main settings and parameters, and the responsible persons. The equipment database should help to implement the Tango system as a control system of NICA accelerator complex. The report also describes a web service to display, search, and manage the database.

THPPC013

Poster

Configuration Management for the Future MAX IV Laboratory Control System

Control System Infrastructure

Vincent Hardion, Julio Lidon-Simon, Mirjam Lindberg, Antonio Milan, Andreas Persson,
Darren Paul Spruce (MAX-lab, Lund)

The control system of big research facilities like synchrotron involves a lot of work to keep hardware and software synchronised to each other to have a good coherence. Modern Control System middleware Infrastructures like Tango use a database to store all values necessary to communicate with the devices. Nevertheless it is necessary to configure the driver of a PowerSupply or a Motor controller before being able to communicate with any software of the control system. This is part of the configuration management which involves keeping track of thousands of equipments and their properties. In recent years, several DevOps tools like Chef, Puppet, Ansible or SpaceMaster have been developed by the OSS community. They are now mandatory for the configuration of thousands of servers to build clusters or cloud servers. Define a set of coherent components, enable Continuous Deployment in synergy with Continuous Integration, reproduce a control system for simulation, rebuild and track changes even in the hardware configuration are among the use cases. We will explain the strategy of MaxIV on this subject, regarding the configuration management.

Poster

THPPC014

CMX - A Generic In-Process Monitoring Solution for C and C++ Applications

Control System Infrastructure

Felix Ehm, Georgia-Maria Gorgogianni, Steen Jensen, Peter Jurcso (CERN, Geneva)

CERN's Accelerator Control System is built upon a large number of C, C++ and Java services that are required for daily operation of the accelerator complex. The knowledge of the internal state of these processes is essential for problem diagnostic as well as for constant monitoring for pre-failure recognition. The CMX library follows similar principles as JMX (Java Management Extensions) and provides similar monitoring capabilities for C and C++ applications. It allows registering and exposing runtime information as simple counters, floating point numbers or character data. This can be subsequently used by external diagnostics tools for checking thresholds, sending alerts or trending. CMX uses shared-memory to ensure non-blocking read/update actions, which is an important requirement for real-time processes. This paper introduces the topic of monitoring C/C++ applications and presents CMX as a building block to achieve this goal.

Poster

THPPC015

Managing infrastructure in the ALICE Detector Control System

Control System Infrastructure

Mateusz Lechman, Andre Augustinus, Peter Chochula, Peter Rosinsky (CERN, Geneva), Ombretta Pinazza (CERN, Geneva; INFN-Bologna, Bologna), Alexander Kurepin (CERN, Geneva; RAS/INR, Moscow)

The main role of the ALICE Detector Control System (DCS) is to ensure safe and efficient operation of one of the large high energy physics experiments at CERN. The DCS design is based on the commercial SCADA software package WinCC Open Architecture. The system includes over 270 VME and power supply crates, 1200 network devices, over 1,000,000 monitored parameters as well as numerous pieces of front-end and readout electronics. This paper summarizes the computer infrastructure of the DCS as well as the hardware and software components that are used by WinCC OA for communication with electronics devices. The evolution of these components and experience gained from the first years of their production use are also described. We also present tools for the monitoring of the DCS infrastructure and supporting its administration together with plans for their improvement during the first long technical stop in LHC operation.

THPPC017

Control System Configuration Management at PSI Large Research Facilities

Control System Infrastructure

Renata Alica Krempaska, Alain Bertrand, Hubert Lutz (PSI, Villigen PSI)

The control system of the PSI accelerator facilities and their beamlines consists mainly of the so called Input Output Controllers (IOCs) running EPICS. There are several flavors of EPICS IOCs at PSI running on different CPUs, different underlying operating systems and different EPICS versions. We have hundreds of IOCs which control the facilities at PSI. The goal of the Control system configuration management is to provide a set of tools to allow a consistent and uniform configuration for all IOCs. In this context the Oracle database contains all hardware-specific information including the CPU type, operating system or EPICS version. The installation tool connects to Oracle database. Depending on the IOC-type a set of files (or symbolic links) are created which connect to the required operating system, libraries or EPICS configuration files in the boot directory. In this way a transparent and user-friendly IOC installation is achieved. The control system export can check the IOC installation, boot information, as well as the status of loaded EPICS process variables by using Web applications.

Poster

THPPC018

Construction of the TPS Network System

Control System Infrastructure

Yung-Sen Cheng, Yin-Tao Chang, Jenny Chen, Kuo-Tung Hsu, Changhor Kuo (NSRRC, Hsinchu)

Project of 3 GeV Taiwan Photon Source (TPS) need a reliable, secure and high throughput network to ensure facility operate routinely and to provide better service for various purposes. Re-arrangement of the existed network system is needed to integrate with the new network infrastructure. The new network system includes the office network, the beamline network and the accelerator control network for the TPS and the TLS (Taiwan Light Source) sites at NSRRC. Combining cyber security technologies such as firewall, NAT and VLAN will be adopted to define the tree network topology for isolating the accelerator control network, beamline network and subsystem components. Various network management tools are used for maintenance and troubleshooting. The new TPS network system architecture, cabling topology, redundancy and maintainability are described in this report.

Poster

THPPC019

Data Driven Data Center at the National Ignition Facility (NIF)

Control System Infrastructure

Marvin Christensen, Phillip Adams, Timothy Frazier (LLNL, Livermore, California)

NIF's Information Technology (IT) team focused on providing reliable network and computer resources by improving NIF ITs processes, architecture, and continuous monitoring capabilities. The first phase targeted NIF assets by maintaining a database containing all of NIF assets that connect to the NIF network. Processes were adapted as NIF virtualized servers as an approach to increase resources without expanding physical infrastructure. The next phase targeted NIF application resources such as CPU, memory, and IO. Selecting the correct vendor application tool is difficult because they all have limitations and the one selected must integrate into the existing environment. The final phase implemented a continuous monitoring capability of NIF IT resources. The common real-time monitoring capability enabled the management of NIF systems and applications. Aggregation and correlation of data from NIF applications lead to intelligent capacity planning and provides performance and resource utilization information.

Poster

THPPC020

13 Ways Through Industrial Firewalls - What You Don't Know WILL Hurt You

Control System Infrastructure

Andrew Ginter (Waterfall Security Solutions, New York)

Firewalls are a given - everyone assumes that every security posture for control system networks includes a firewall. But are they really secure? Join us to see 13 kinds of ways to break through an industrial firewall. Attacks include: walking a USB stick past the firewall, phishing attacks, stealing a password, using essential connections to compromise servers, piggy-backing on a VPN, split tunneling, firewall vulnerabilities, firewall configuration errors and omissions, forging an IP address, using default passwords, standing up wireless access points inside the protected network, and using vendor back-doors. Note: Several scenarios will be live demos, the remainder will be discussion only. For each scenario, compensating measures are briefly discussed and compared: two-factor authentication, encryption, firewall ruleset changes, host intrusion detection/prevention systems, network intrusion detection/prevention systems, security updates/patches, and unidirectional security gateways.

Poster

THPPC021

Beam Viewer Controls at Jefferson Lab

Control System Infrastructure

Michael Johnson (JLAB, Newport News, Virginia)

The beam viewer system at Jefferson Lab provides operators and beam physicists with qualitative and quantitative information on the transverse electron beam properties. There are over 140 beam viewers installed on the 12GeV CEBAF accelerator. This paper describes an upgrade consisting of replacing the EPICS based system tasked with managing all viewers with a mixed system utilizing EPICS and high level software. Most devices, particularly the beam viewers, cannot be safely inserted into the beam line during high-current beam operations. Software is partly responsible for protecting the machine from untimely insertions. The variety and number of beam-blocking and beam-vulnerable devices motivate us to try a data-driven approach. A single program reads in configuration data describing the type, position, and interaction with beam of every device. Management and protection is achieved twofold, using EPICS records and feedback loops. This paper will describe in detail the software application, EPICS templates, C++ architecture, and information flow. In addition, improvements in accommodating hardware failure will be described.

Authored by Jefferson Science Associates, LLC under U.S. DOE Contract No. DE-AC05-06OR23177.

Poster

THPPC022

Securing Mobile Control System Devices: Development and Testing

Control System Infrastructure

Stefani P. Banerian (University of Washington Medical Center, Seattle)

Recent advances in portable devices allow end users convenient wasy to access data over the network. Networked control systems have traditionally been kept on local or internal networks to prevent external threats and isolate traffic. The UMWC Clinical Neutron Therapy System has its control system on such an isolated network. Engineers have been updating the control system with EPICS, and have developed EDM-based interfaces for control and monitoring. This project describes a tablet-based monitoring device being developed to allow the engineers to monitor the system, while, e.g. moving from rack to rack, or room to room. EDM is being made available via the tablet. Methods to maintain security of the control system and tablet, while providing ease of access and meaningful data for management are being created. In parallel with the tablet development, security and penetration tests are also being produced.

Poster

THPPC023

Integration of Windows Binaries in the UNIX-based RHIC Control System Environment

Control System Infrastructure

Prerana Kankiya, James Jamilkowski (BNL, Upton, Long Island, New York), Lawrence T. Hoff (BNL, Upton, New York)

Since its inception, the RHIC control system has been built-up on UNIX or LINUX and implemented primarily in C++. Sometimes equipment vendors include software packages developed in the Microsoft Windows operating system. This leads to a need to integrate these packaged executables into existing data logging, display, and alarms systems. This paper will describe an approach to incorporate such non-UNIX binaries seamlessly into the RHIC control system with minimal changes to the existing code base, allowing for compilation on standard LINUX workstations through the use of a virtual machine. The implementation resulted in the successful use of a windows dynamic linked library (DLL) to control equipment remotely while running a synoptic display interface on a LINUX machine.

Poster

THPPC024

Operating System Upgrades at RHIC

Control System Infrastructure

Severino Binello, Arthur Fernando, Roger Katz, Jonathan S. Laster,
Joseph Piacentino (BNL, Upton, Long Island, New York)

Upgrading hundreds of machines to the next major release of an Operating System while keeping the accelerator complex running, presents a considerable challenge. Even before addressing the challenges that an upgrade represents, there are critical questions that must be answered. Why should an upgrade be considered? (An upgrade is labor intensive and includes potential risks due to defective software.) When is it appropriate to make incremental upgrades to the OS? (Incremental upgrades can also be labor intensive and include similar risks.) When is the best time to perform an upgrade? (An upgrade can be disruptive.) Should all machines be upgraded to the same version at the same time? (This can create scheduling deadlines.) Should non critical machines also be upgraded? (There may not be much reason to upgrade certain machines.) Should the compiler be upgraded at the same time? (A compiler upgrade can introduce risks at the software application level.) This paper examines our answers to these questions, describes how upgrades to the RedHat Linux OS are implemented by the Controls group at RHIC, and describes our experiences.

Poster

THPPC025

The Interaction between Safety Interlock and Motion Control Systems on the Dingo Radiography Instrument at the OPAL Research Reactor

Control System Upgrades

Paul Nicholas Barron (ANSTO, Menai)

A neutron radiography/tomography instrument (Dingo) has recently been commissioned at the Bragg Institute, ANSTO. It utilizes thermal beam HB2 of the OPAL research reactor with flux up to 4.75 x 107 neutrons cm-2 s-1 at the sample. One component of the instrument is a 2.5 tonne selector wheel filled with a wax/steel shielding mixture which requires complex interaction between the safety interlock and motion control systems. It provides six apertures which are equipped with various neutron beam optics plus a solid 'shutter' section to block the beam. A standardized Galil based motion system precisely controls the movement of the wheel while a Pilz safety PLC specifies the desired position and handles other safety aspects of the instrument. A shielded absolute SSI encoder is employed to give high accuracy feedback on the position in conjunction with a number or limit switches. This paper details the challenges of creating a motion system with inherent safety, verifying the wheel meets specifications and the considerations in selecting components to withstand high radiation environments.

Poster

THPPC026

Diagnostic Controls of IFMIF-EVEDA Prototype Accelerator

Control System Upgrades

Jean Francois Denis, Daniel Bogard, Jean-François Gournay, Yves Lussignol, Pierre Mattei (CEA/DSM/IRFU,)

The Linear IFMIF prototype accelerator (LIPac) will accelerate a 9 MeV, 125 mA, CW deuteron beam in order to validate the technology that will be used for the future IFMIF accelerator (International Fusion Materials Irradiation Facility). This facility will be installed in Rokkasho (Japan) and Irfu-Saclay has developed the control system for several work packages like the injector and a set of the diagnostic subsystem. At Irfu-Saclay, beam tests were carried out on the injector with its diagnostics. Diagnostic devices have been developed to characterize the high beam power (more than 1MW) along the accelerator: an Emittance Meter Unit (EMU), Ionization Profile Monitors (IPM), Secondary Electron Emission Grids (SEM-grids), Beam Loss Monitors (BLoM and µLoss), and Current Transformers (CT). This control system relies on COTS and an EPICS software platform. A specific isolated fast acquisition subsystem running at high sampling rate (about 1 MS/s), triggered by the Machine Protection System (MPS), is dedicated to the analysis of post-mortem data produced by the BLoMs and current transformer signals.

THPPC027

A New EPICS Device Support for S7 PLCs

Control System Upgrades

Sebastian Marsching (Aquenos GmbH, Baden-Baden)

S7 series programmable logic controllers (PLCs) are commonly used in accelerator environments. A new EPICS device support for S7 PLCs that is based on libnodave has been developed. This device support allows for a simple integration of S7 PLCs into EPICS environments. Developers can simply create an EPICS record referring to a memory address in the PLC and the device support takes care of automatically connecting to the PLC and transferring the value. This contribution presents the concept behind the s7nodave device support and shows how simple it is to create an EPICS IOC that communicates with an S7 PLC.

Poster

THPPC030

A Wireless Control System for the IUAC High Current Injector

Control System Upgrades

Rajendra Nath Dutt, Dinakar Kanjilal, P.S Lakshmy, Yaduvansh Mathur, Unnam Koteshwar Rao, Gerard Oscar Rodrigues (IUAC, New Delhi)

The control system for the ECR ion source of the IUAC High Current Injector is a MODBUS based system with wireless isolation channels. Industrial control modules are used to provide an excellent cost to performance ratio. Accelerator intergration uses a client server operation mode. The round the clock reliability control of the PKDELIS source+LEBT has proven its for more than three years.

D.Kanjilal et al Rev.Sci.Instrum.,77(2006)03A317 G.Rodrigues et al OP EXP WITH 18 GHz HTS-ECRIS,Proc ECRIS08,Chicago R.N.Dutt et al Wireless control system for the HTSECRIS,Proc PCAPAC2012 Kolkata

THPPC031

The New Control Software of PIAVE Beam Diagnostics System at LNL

Control System Upgrades

Baojie Liu (CIAE, Beijing), Giorgio Bassato, Mauro Giacchini, Marco Poggi (INFN/LNL, Legnaro (PD))

PIAVE (Positive Ion Accelerator for Very low Energy beams) is the accelerating structure installed at LNL[1][2] to inject the positive ion beams produced by an ECR source into the superconducting linac ALPI. The injector, in operation since 2005, is based on a RFQ module and on a set of 8 QWR cavities housed in two cryostats. The beam diagnostics system is made of 9 modules each one including a faraday cup and a beam profiler based on a couple of 40 wire grids. The software of beam diagnostics (either on server and user interface side) has been rebuilt from scratch using EPICS[3] tools, while most of the VME hardware used for data acquisition has been left unchanged to reduced the upgrade cost. New features, like the installation of a Channel Archiver, have greatly improved the diagnosis capabilities during the transport tests of new beams. We plan to reuse the software architecture implemented in PIAVE by extending it to the ALPI accelerator within the current year.

[1] http://www.lnl.infn.it/ [2] http://www.lnl.infn.it/~epics/joomla/ [3] http://www.aps.anl.gov/epics/

Poster

THPPC032

Embedded EPICS Controller for KEK Linac Screen Monitor System

Control System Upgrades

Masanori Satoh, Kazuro Furukawa, Katsuhiko Mikawa, Fusashi Miyahara (KEK, Ibaraki), Takuya Kudou, Shiro Kusano (Mitsubishi Electric System & Service Co., Ltd, Tsukuba)

The screen monitor (SC) of the KEK linac is a beam diagnostics device to measure transverse beam profiles with a fluorescent screen. The screen material is made of 99.5% Al2O3 and 0.5% CrO3, with which a sufficient amount of fluorescent light can be obtained when electron and positron beams impinge on the screen. the fluorescent light with a camera embedded with a charge-coupled device (CCD), the transverse spatial profiles of the beam can be easily measured. Compact SCs were previously developed in 1995 for the KEKB project. About 110 compact SCs were installed into the beam line at that time. VME-based computer control system was also developed in order to perform fast and stable control of the SC system. However, the previous system becomes obsolete and hard to maintain. Recently, a new screen monitor control system for the KEK electron/positron injector linac has been developed and fully installed. The new system is an embedded EPICS IOC based on the Linux/PLC. In this paper, we present the new screen monitor control system in detail.

THPPC033

Poster

Upgrade of BPM DAQ System for SuperKEKB Injector Linac

Control System Upgrades

Masanori Satoh, Kazuro Furukawa, Fusashi Miyahara, Tsuyoshi Suwada (KEK, Ibaraki), Takuya Kudou, Shiro Kusano (Mitsubishi Electric System & Service Co., Ltd, Tsukuba)

The non-destructive beam position monitor (BPM) is indispensable diagnostic tool for the stable beam operation. In the KEK Linac, approximately nineteen BPMs with the strip-line type electrodes are used for the beam orbit measurement and feedback. In addition, some of them are also used for the beam energy feedback loops. The current data acquisition (DAQ) system consists of the fast digital oscilloscopes. A signal from each electrode is analyzed with a predetermined response function up to 50 Hz. In the present DAQ system, the measurement precision of beam position is limited to around 0.5 mm because of ADC resolution. Towards SuperKEKB project, we have a plan to upgrade the BPM DAQ system since the Linac should provide the smaller emittance beam in comparison with previous KEKB Linac. We will report the system description of the new DAQ system and the results of performance test in detail.

THPPC034

Poster

A Novel Analysis of Time Evolving Betatron Tune

Control System Upgrades

Shuei Yamada (J-PARC, KEK & JAEA, Ibaraki-ken)

J-PARC Main Ring (MR) is a high-intensity proton synchrotron and since 2009 delivering beam to the T2K neutrino experiment and hadron experiments. It is essential to measure time variation of betatron tune accurately throughout from beam injection at 3 GeV to extraction at 30 GeV. The tune measurement system of J-PARC MR consist of a stripline-kicker, beam position monitors, and a waveform digitizer. Betatron tune appears as sidebands of harmonics of revolution frequency in the turn-by-turn beam position spectrum. Excellent accuracy of measurement and high immunity against noise were achieved by exploiting a wide-band spectrum covering multiple harmonics.

Poster

THPPC035

RF Signal Switching System for Electron Beam Position Monitor Utilizing ARM Microcontroller

Control System Upgrades

Tomonori Toyoda (IMS, Okazaki), Kenji Hayashi, Masahiro Katoh (UVSOR, Okazaki)

ARM microcontrollers have high processing speed and low power consumption because they work efficiently with less memory by their own instruction set. Therefore, ARM microcontrollers are used not only in portable devices but also other commercial electronic devices. In recent years, free development environments and low-cost development kits are provided by many companies. The “mbed” provided by NXP is one of them. The “mbed” provides an environment where we can develop a product easily even if we are not familiar with electronics or microcontrollers. We can supply electric power and can transfer the program that we have developed by connecting to a PC via USB. We can use USB and LAN that, in general, require high level of expertise. The “mbed” has also a function as a HTTP server. By combining with JavaScript library, we can control multiple I/O ports at the same time through LAN. In the presentation, we will report the results that we applied the “mbed” to develop an RF signal switching system for a turn-by-turn beam position monitor (BPM) at a synchrotron light source, UVSOR-III.

Poster

THPPC036

EPICS Control System for the FFAG Complex at KURRI

Control System Upgrades

Yasutoshi Kuriyama, Yoshihiro Ishi, Jean-Baptiste Lagrange, Yoshiharu Mori, Tomonori Uesugi (Kyoto University, Osaka)

In Kyoto University Research Reactor Institute (KURRI), a fixed-field alternating gradient (FFAG) proton accelerator complex, which is consists of the three FFAG rings, had been constructed to make an experimental study of accelerator driven sub-critical reactor (ADSR) system with spallation neutrons produced by the accelerator. The world first ADSR experiment was carried out in March of 2009. In order to increase the beam intensity of the proton FFAG accelerator, a new injection system with H– linac has been constructed in 2011. To deal with these developments, a control system of these accelerators should be easy to develop and maintain. The first control system was based on LabVIEW and the development had been started seven years ago. Thus it is necessary to update the components of the control system, for example operating system of the computer. And the first control system had some minor stability problems and it was difficult for non-expert of LabVIEW to modify control program. Therefore the EPICS toolkit has been started to use as the accelerator control system in 2009. The present control system of the KURRI FFAG complex is explained.

THPPC037

Poster

EPICS-based Control System for New Skew Quadrupole Magnets in J-PARC MR

Control System Upgrades

Kenichi Sato (JAEA/J-PARC, Tokai-Mura, Naka-Gun, Ibaraki-Ken), Norihiko Kamikubota, Junpei Takano, Shuei Yamada, Noboru Yamamoto (J-PARC, KEK & JAEA, Ibaraki-ken), Susumu Igarashi (KEK, Ibaraki), Susumu Yoshida (Kanto Information Service (KIS), Accelerator Group, Ibaraki)

In J-PARC Main Ring (MR), a control system for new skew quadrupole magnets has been constructed. This system is based on EPICS (Experimental Physics and Industrial Control System). The system comprises a YOKOGAWA F3RP61-2L (a PLC controller running Linux), a function generator (Tektronix AFG3000), and a commercial bipolar-DC Amplifier. The function generator is controlled using VXI-11 protocol over Ethernet, and the amplifier is connected to PLC I/O modules with hardwire. Both devices are controlled by the F3RP61-2L. The Function Generator produces a ramp waveform at each machine cycle of 2.48 seconds. The DC amplifire drives the magnet. The control system for skew quadrupole magnets was developed in 2012, and has been in opeation since January, 2013.

THPPC038

Poster

HI-13 Tandem Accelerator Beam Lines Vacuum Control System

Control System Upgrades

Xiaofei Wang (CIAE, Beijing)

Upgrading of the beam line vacuum pumping system now operated in HI-13 Tandem accelerator involved in replacement of ion pumps with molecular pumps and rebuilding of vacuum pumping control system .An integration unit was designed to provide power supply as well as signal communication function. The no-switching control mode fulfill switch from “REMOTE” to “LOCAL” .Vacuum interlock executed by local devices for safety reason and the PLC control system established for more easy control and full display.

Poster

THPPC039

Beam Energy Spread Measurement Using Stripline-lame Screen Monitor

Control System Upgrades

Jingxia Zhao, Jianshe Cao, Lin Wang (IHEP, Beijing)

A type of stripline-lame screen monitor was designed for the KIPT linac to measure the energy spread of the beam, where the beam energy is 100MeV, the pulse width is 2.7us, and the pulse current is about 0.8A. There are up to 26 stripline-lame electrodes on the monitor, together with 1 earthed flatform and 1 high-voltage grid. Carbon fibre braids are used for the electrodes. A 32-channel, 20MSa/s synchronous data acquisition system is used for this monitor. Futhermore, the control of the screen's motor, the high-voltage filed and the database records on the EPICS are realized together with the data processing in one application.

Poster

THPPC040

Wire-Scanner Readout for the CSNS Front-End

Control System Upgrades

Fang Li, Peng Li, Jilei Sun, Anxin Wang, Taoguang Xu (IHEP, Beijing)

The linac wire scanner system (WS) for the China Spallation Neutron Source (CSNS) calls for 4 units in the Medium Energy Beam Transport (MEBT), which will be used in beam profile measurements. In this paper we designed a readout system based on EPICS of WS, including the readout of wire position information and the beam profile information through ADC, and the selection of different electronics range, broken wire detection through DIO (Digital Input Output) signal.

THPPC043

Implement an Interface for Control System to Interactive with Oracle Database at SSC-LINAC

Control System Upgrades

Shi An, Kewei Gu, Xiaojun Liu, Junqi Wu, Wei Zhang (IMP, Lanzhou)

SSC-LINAC control system is based on EPICS architecture. The control system includes ion sources, vacuum, digital power supplies, etc. In these subsystems, some of those need to interactive with Oracle database, such as power supplies control subsystem, who need to get some parameters while power supplies is running and also need to store some data with Oracle. So we design and implementation an interface for EPICS IOC to interactive with Oracle database. The interface is a soft IOC which is also bases on EPICS architecture, so others IOC and OPI can use the soft IOC interactive with Oracle via Channel Access protocol.

Poster

THPPC044

An Ethernet Interfaced Devices Control Implementation for SSC_LINAC by Using EPICS

Control System Upgrades

Kewei Gu, Shi An, Xiaojun Liu, Wei Zhang (IMP, Lanzhou)

The SSC_LINAC Ethernet interfaced devices require that the control system interacts with them through Ethernet. This paper presents an implementation of the control system in which all the needed works are done in EPICS. EPICS map a PV variable to each device channel. In this implementation, in addition to using Asynrecord to transform data, a new record type is developed to analysis data and form commands accordingly. This method simplifies the data structures which are used by the client and reduces the network flow.

THPPC045

The SSC-Linac Control System

Control System Upgrades

Wei Zhang, Shi An, Shizhe Gou, Kewei Gu, Xiaojun Liu, Min Yue (IMP, Lanzhou)

This article gives a brief description of the SSC-Linac control system for Heavy Ion Research Facility of Lanzhou(HIRFL). It describes in detail mainly of the overall system architecture, hardware and software. The overall system architecture is the distributed control system. We have adopted the the EPICS system as the system integration tools to develop the control system of the SSC-Linac. We use the NI PXIe chassis and PXIe bus master as a front-end control system hardware. Device controllers for each subsystem were composed of the commercial products or components designed by subsystems. The operating system in OPI and IOC of the SSC-Linac control system will use Linux.

THPPC046

The Control System of the Water-cooled DCM in SSRF

Control System Upgrades

Wenhong Jia, Ping Liu (SINAP, Shanghai), Zhaohong Zhang, Lifang Zheng (SSRF, Shanghai)

This paper introduces the principle of the Water-cooled Double Crystal Monochromator (DCM) in SSRF (Shanghai Synchrotron Radiation Facility). There are two stepper motors, three DC servo motors and two Piezos. One VME/IOC is used to control the stepper motors, and one PC/IOC is used to control others. The software is developed with EPICS. The functions of the control system include moving single motor, fixing the height of two crystals while scanning the Bragg angle, saving and restoring the physical parameters. The trial results have revealed the stability and reliability of the system.

THPPC047

Poster

Preliminary Design of the SXFEL Control System

Control System Upgrades

Jianguo Ding, Shou Ming Hu, Haifeng Miao, Huan Zhao (SINAP, Shanghai)

Shanghai Soft X-ray Free Electron Laser (SXFEL) experimental facility will be built at Zhangjiang campus of Shanghai Institute of Applied Physics (SINAP) in the next three years. The facility consists of a photocathode injector, an 840MeV Linac, an FEL amplifier segment, and a FEL optical diagnostic line. A variety of the components such as the photocathode gun, modulators, magnet power supplies, vacuum gauges, undulators, optical devices distributed over the facility must be operated by the SXFEL control system. EPICS toolkit will be used for the control system development. In this paper the preliminary design of the SXFEL control system will be introduced. Solutions of the device controls, timing system, machine protection system as well as network strategy, software environment of the central control room will be described.

THPPC048

Poster

Upgrade of the Nuclotron Injection Control and Diagnostics System

Control System Upgrades

Evgeny V. Gorbachev, Alexander Kirichenko, Sergey Romanov, Tatyana Vladimirovna Rukoyatkina, Vladimir Tarasov, Valery Volkov (JINR, Dubna, Moscow Region), Georgy Sergeevich Sedykh (JINR/VBLHEP, Dubna, Moscow region)

Nuclotron is a 6 GeV/n superconducting synchrotron operating at JINR, Dubna since 1993. It will be the core of the future accelerating complex NICA which is under development now. The report presents details of the Nuclotron injection hardware and software upgrade to operate under future NICA control system based on Tango. The designed system provides control and synchronization of electrostatic and magnetic inflector devices and diagnostics of the ion beam injected from 20MeV linear accelerator to Nuclotron. The hardware consists of few controllable power supplies, various National Instruments acquisition devices, custom-designed controller module. The software consists of few C++ Tango device servers and NI LabView client applications.

Poster

THPPC049

The Power Supply System for Electron Beam Orbit Correctors and Focusing Lenses of Kurchatov Synchrotron Radiation Source

Control System Upgrades

Nikolai Moseiko, Yuriy Efimov, Vladimir Korchuganov, Vladimir Kordhikov, Sergey Georgievich Pesterev, Alexander Valentinov (NRC, Moscow), Alexander Chepurnov, Alexey Nikolaev (MSU SINP, Moscow), Igor Gribov (MSU, Moscow), Ivan Akimenkov, Alexander Fedorovich Shamarin (Marathon Ltd., Moscow), Yury Krylov, Lidiya Andreevna Moseiko (RRC, Moscow)

The modernization project of the low-current power supply system of Kurchatov Synchrotron Radiation Source has been designed and is under implementation now. It includes transition to the new power suppliers to feed electron beam orbit correctors and focusing lenses. Multi-level control system, based on CAN/CANopen fieldbus, has been developed for specific accelerator applications, which allows startup and continuous run of hundreds of power supplies together with the other subsystems of the accelerator. The power sources data and status are collected into the archive with the Sitect SCADA 7.2 Server SCADA Historian Server. The following operational parameters of the system are expected: current control resolution - 0.05% of IMAX; current stability - 5*10-4 ; 10 hours current variance - 100 ppm of IMAX ; temperature drift - 40ppm/K of IMAX.

Poster

THPPC050

Upgrade System of Vacuum Monitoring of Synchrotron Radiation Sources of NRC Kurchatov Institute

Control System Upgrades

Nikolai Moseiko, Vlad Dombrovsky, Yuriy Efimov, Vladimir Korchuganov, Yury Krylov, Dmitry Odintsov (NRC, Moscow), Boris Semenov (RRC KI, Moscow), Lidiya Andreevna Moseiko, Andrey Vladimirovich Shirokov (RRC, Moscow)

Modernization project of the vacuum system of the synchrotron radiation source at the National Research Centre Kurchatov Institute (NRC KI) has been designed and implemented. It includes transition to the new high-voltage power sources for NMD and PVIG–0.25/630 pumps. The system is controlled via CAN-bus, and the vacuum is controlled by measuring pump currents in a range of 0.0001–10 mA. Status visualization, data collection and data storage is implemented on Sitect SCADA 7.2 Server and SCADA Historian Server. The system ensures a vacuum of 10–7 Pa. The efficiency and reliability of the vacuum system is increased by this work, making it possible to improve the main parameters of the SR source.

Poster

THPPC051

First Operation of New Electron Beam Orbit Measurement System at SIBERIA-2

Control System Upgrades

Yevgeniy Fomin, Vladimir Korchuganov, Nikolai Moseiko, Sergey Tomin, Alexander Valentinov (NRC, Moscow), Rok Hrovatin, Peter Leban (I-Tech, Solkan)

The paper focuses on the results of commission and usage of the electron beam orbit measurement system at synchrotron radiation source SIBERIA-2 realized at present time at Kurchatov Institute. The main purpose of new orbit measurement system creation is an improvement of the electron beam diagnostic system at the storage ring. This system provides continuous measurements of the electron beam closed orbit during storing, ramping and operation for users. Besides, with the help of the system it is possible to carry out turn-by-turn measurements of the electron beam trajectory during injection process. After installation of new orbit measurement system we obtained a very good instrument to study electron beam dynamics into the main storage ring in detail. The paper describes the new orbit measurement system, its technical performance, the results of commission and our experience.

Poster

THPPC052

The Measurement and Monitoring of Spectrum and Wavelength of Coherent Radiation at Novosibirsk Free Electron Laser

Control System Upgrades

Stanislav Sergeevich Serednyakov, Vitaly V. Kubarev (BINP SB RAS, Novosibirsk)

The architecture and capabilities of free electron laser radiation spectrum measurement system described in details in this paper. For execution of the measurements the monochromator and step-motor with radiation power sensor are used. As the result of the measurements, the curve of spectrum of radiation is transmitted to control computer. As this subsystem is fully integrated to common FEL control system, the results of measurements – spectrum graph, average wavelength, calculated radiation power, are able to transmit to any another computer on FEL control local area network and also on user stations computers

Poster

THPPC053

NSLS-II Booster Ramp Handling

Control System Upgrades

Pavel Borisovich Cheblakov, Anton Anatolievich Derbenev, Ruslan Kadyrov, Sergey Evgenyevich Karnaev, Stanislav S. Serednyakov, Evgeny Simonov (BINP SB RAS, Novosibirsk), Timur Shaftan, Yuke Tian (BNL, Upton, Long Island, New York)

The NSLS-II booster is a full-energy synchrotron with the range from 200 MeV up to 3 GeV. The ramping cycle is 1 second. A set of electronics developed in BNL fro the NSLS-II project was modified for the booster Power Supplies (PSs) control. The set includes Power Supply Interface which is located close to a power supply and a Power Supply Controller (PSC) which is connected to EPICS IOC running in a front-end computer via 100 Mbit Ethernet. A table of 10k setpoints uploaded to the memory of PSC defines a behavior of a PS in the machine cycle. A special software is implemented in IOC to provide a smooth shape of the ramping waveform in the case of the waveform change. A Ramp Manager (RM) high level application is developed in python to provide an easy change, compare, copy the ramping waveforms, and upload them to process variables. The RM provides check of a waveform derivative, manual adjusting of the waveform in graph and text format, and includes all specific features of the booster PSs control. This paper describes software for the booster ramp handling.

Poster

THPPC054

The Control of Pulsed Magnets of the NSLS-II Booster Synchrotron

Control System Upgrades

Evgeny Simonov, Alexander M. Batrakov, Pavel Borisovich Cheblakov, Anton Anatolievich Derbenev, Ruslan Kadyrov, Sergey Evgenyevich Karnaev, Andrey Korepanov, Anton Vladimirovich Pavlenko, Dmitriy Senkov, Stanislav S. Serednyakov (BINP SB RAS, Novosibirsk), Michael Davidsaver (BNL, Upton, New York)

The NSLS-II booster synchrotron is planned to operate with a frequency of 1 or 2 Hz. Three types of magnets are used for a beam injection and extraction: septum magnets (the pulse length is about 100 us) for beam deflection to/from the vacuum chamber, “fast” kicker magnets (the pulse length is about 500 ns) for beam deflection to/from the close orbit, and “slow” bump magnets for deflection of the close orbit for the beam extraction. A double injection (stacking) is supported to receive a lager charge of injected beam current in 1 Hz operation mode. A sequence of triggers locked to the booster cycle is provided for triggering of the pulsed magnets. Because of the special features of the injection septum and kickers power supplies charging in the stacking mode of operation additional investigations were done to match the accuracy and stability requirements. BINP developed electronics are used for observation and stabilization of the magnetic field values: 200 MHz ADC for observation of the kickers current and a volt-second integrator for measuring of the magnetic field in septum and bump magnets. This paper describes hardware and software configuration of the pulsed magnets controls.

THPPC055

The Software Tools and Capabilities of Diagnostic System for Stability of Magnet Power Supplies at Novosibirsk Free Electron Laser

Control System Upgrades

Stanislav Sergeevich Serednyakov (BINP SB RAS, Novosibirsk)

The magnetic system of Novosibirsk Free electron laser containing large amount of magnetic elements, feed by power supplies of different types. The time stability of output current of these power supplies is directly influence on coherent radiation parameters, and operation of whole FEL facility. Therefore, system for diagnostics of power supplies state, integrated to common FEL control system, was developed. The main task of this system is to analyze output current of power supply, determinate its time stability value. Also this system is able to determinate the amplitude and frequency of output current ripples, if they have a place for particular power supply, and display obtained results. The main architecture, some other capabilities, and results of usage of this system, are described in this paper

Poster

THPPC056

Design and Implementation of Linux Drivers for National Instruments IEEE 1588 Timing and General I/O Cards

Control System Upgrades

Kevin Meyer, Klemen Vodopivec (Cosylab, Ljubljana), Klemen Zagar (COBIK, Solkan)

Cosylab is developing GPL Linux device drivers to support several National Instruments (NI) devices. In particular, drivers have already been developed for the NI PCI-1588, PXI-6682 (IEEE1588/PTP) devices and the NI PXI-6259 I/O device. These drivers are being used in the development of the latest plasma fusion research reactor, ITER, being built at the Cadarache facility in France. In this paper we discuss design and implementation issues, such as driver API design (device file per device versus device file per functional unit), PCI device enumeration, handling reset, etc. We also present various use-cases demonstrating the capabilities and real-world applications of these drivers.

Poster

THPPC057

The Data Validation of the LHC Layout Database for the Upgrade of UNICOS Continuous Process Control Package

Control System Upgrades

Antonio Tovar, Christoph Balle, Enrique Blanco Vinuela, Czeslaw Fluder, Eve Fortescue-Beck, Paulo Gomes, Vitaliano Inglese, Marco Pezzetti (CERN, Geneva)

The control system of the Large Hadron Collider cryogenics manages over 34,000 instrumentation channels which are essential for populating the software of the PLCs (Programmable Logic Controller) and SCADA (Supervisory Control and Data Acquisition) responsible for maintaining the LHC at the appropriate operating conditions. The control system specification's are generated by the CERN UNICOS (Unified Industrial Control System) framework using a set of information of database views extracted from the LHC layout database. The LHC layout database is part of the CERN database managing centralized and integrated data, documenting the whole CERN infrastructures (Accelerator complex) by modeling their topographical organization ("layouts"), and defining their components (functional positions) and the relationships between them. This paper describes the methodology of the data validation process, including the development of different software tools used to update the database from original values to manually adjusted values after three years of machine operation, as well as the update of the data to accommodate the upgrade of the UNICOS Continuous Process Control package(CPC).

Poster

THPPC058

LSA - the High Level Application Software of the LHC - and Its Performance During the First Three Years of Operation

Control System Upgrades

Delphine Jacquet (CERN, Geneva)

The LSA (LHC software architecture) project was started in 2001 with the aim of developing the high level core software for the control of the LHC accelerator. It has now been deployed widely across the CERN accelerator complex and has been largely successful in meeting its initial aims. The main functionality and architecture of the system is recalled and its use in the commissioning and exploitation of the LHC is elucidated.

THPPC060

A PXI-Based Low Level Control for the Fast Pulsed Magnets in the CERN PS Complex

Control System Upgrades

Jan Schipper, Etienne Carlier, Tony Fowler, Thierry Gharsa (CERN, Geneva)

Fast pulsed magnet (kicker) systems are used for beam injection and extraction in the CERN PS complex. A novel approach, based on off-the-shelf PXI components, has been used for the consolidation of the low level part of their control system. Typical functionalities required like interlocking, equipment state control, thyratron drift stabilisation and protection, short circuit detection in magnets and transmission lines, pulsed signal acquisition and fine timing have been successfully integrated within a PXI controller. The controller comprises a National Instruments NI PXI-810x RT real time processor, a multifunctional RIO module including a Virtex-5 LX30 FPGA, a 1 GS/s digitiser and a digital delay module with 1 ns resolution. National Instruments LabVIEW development tools have been used to develop the embedded real time software as well as FPGA configuration and expert application programs. The integration within the CERN controls environment is performed using the Rapid Application Development Environment (RADE) software tools, developed at CERN.

Poster

THPPC061

SwissFEL Magnet Test Setup and Its Controls at PSI

Control System Upgrades

Pavel Chevtsov, Walter Hugentobler, Detlef Vermeulen, Vjeran Vrankovic (PSI, Villigen PSI)

High brightness electron bunches will be guided in the future Free Electron Laser (SwissFEL) at Paul Scherrer Institute (PSI) with the use of several hundred magnets. The SwissFEL machine imposes very strict requirements not only to the field quality but also to mechanical and magnetic alignments of these magnets. To ensure that the magnet specifications are met and to develop reliable procedures for aligning magnets in the SwissFEL and correcting their field errors during machine operations, the PSI magnet test system was upgraded. The upgraded system is a high precision measurement setup based on Hall probe, rotating coil, vibrating wire and moving wire techniques. It is fully automated and integrated in the PSI controls. The paper describes the main controls components of the new magnet test setup and their performance.

THPPC062

Control Environment of BPM and Power Supply for TPS Booster Synchrotron

Control System Upgrades

Pei-Chen Chiu, Jenny Chen, Yung-Sen Cheng, Kuo-Tung Hsu, Kuo Hwa Hu, Changhor Kuo, Chunyi Wu (NSRRC, Hsinchu)

The TPS is a latest generation of high brightness synchrotron light source and scheduled to be commissioning in 2014. Its booster is designed to ramp electron beams from 150 MeV to 3 GeV in 3 Hz. The control environments based on EPICS framework are gradually developed and built. This report summarizes the efforts on control environment of BPM and power supply for TPS booster synchrotron.

Poster

THPPC063

Status of the TPS Insertion Devices Controls

Control System Upgrades

Chunyi Wu, Jenny Chen, Yung-Sen Cheng, Kuo-Tung Hsu, Chih-Yu Liao (NSRRC, Hsinchu)

The Insertion devices (ID) for Taiwan Photon Source are under construction. There are eight insertion devices are under construction. These devices include in-vacuum undulators with or without taper, elliptical polarized undulators. Control framework for all IDs was developed. Hardware and software components are use common as possible. Motion control functionality for gap and phase adjustment supports servo motors, stepper motors, and absolute encoders. The control system for all IDs is based on the EPICS architecture. Trimming power supply for corrector magnets, phase shifter control functionality are also address. Miscellaneous controls include ion pumpers and BA gauges for vacuum system, temperature sensors for ID environmental monitoring and baking, limit switches, emergency button. User interface for ID beamline users are included to help them to do experiment, such as ID gap control and on-the fly experimental. The progress of IDs control system will be summary in the report.

THPPC064

Poster

The HiSPARC Control System

Control System Upgrades

Robert Hart, Arne de Laat, David Fokkema, Bob van Eijk (NIKHEF, Amsterdam)

The purpose of the HiSPARC project is twofold. First the physics goal: detection of high-energy cosmic-rays. Secondly, offer an educational program in which high-school students participate by building their detection station and analyzing their data. Around 70 high-schools, spread over the Netherlands, are participating. Data are centrally stored at Nikhef in Amsterdam. The detectors, located on the roof of the high-schools, are connected by means of a USB interface to a Windows-PC, which itself is connected to the high-school network and further on to the global internet. Each station is equipped with GPS providing exact location and accurate timing. Services like VPN and VNC enable to control and monitor the stations. This paper covers the setup, building and usage of the station-software. It contains a LabVIEW run-time engine, the services mentioned above, a series of Python scripts and a local buffer. An important task of the station-software is to control the data-flow, event building and submission to the central database. Furthermore, several global aspects are described, like the source repository, the station-software installer and organization.

Windows, USB, FTDI, LabVIEW, VPN, VNC, Python, Nagios, NSIS, Django

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THPPC065

Poster

Software System for Monitoring and Control at the Solenoid Test Facility

Control System Upgrades

Jerzy Nogiec (Fermilab, Batavia)

The architecture and implementation aspects of the control and monitoring system developed for Fermilab's new Solenoid Test Facility will be presented. At the heart of the system lies a highly configurable scan subsystem targeted at precise measurements of low temperatures with uniformly incorporated control elements. A multi-format archival system allows for the use of flat files, XML, and a relational database for storing data, and a Web-based application provides access to historical trends. The DAQ and computing platform includes COTS elements. The layered architecture separates the system into Windows operator stations, the real-time operating system-based DAQ and controls, and the FPGA-based time-critical and safety elements. The use of the EPICS CA protocol with LabVIEW opens the system to many available EPICS utilities .

THPPC066

ACSys Camera Implementation Utilizing an Erlang Framework to C++ Interface

Control System Upgrades

Charlie Briegel (Fermilab, Batavia)

Multiple cameras are integrated into the Accelerator Control System utilizing an Erlang framework. Message passing is implemented to provide access into C++ methods. The framework runs in a multi-core processor running Scientific Linux. The system provides full access to any 3 cameras out of approximately 20 cameras collecting 5 Hz frames. JPEG images in memory or as files providing for visual information. PNG files are provided in memory or as files for analysis. Histograms over the X & Y coordinates are filtered and analyzed. This implementation is described and the framework is evaluated.

Poster

THPPC067

New EPICS Drivers for Keck TCS Upgrade

Control System Upgrades

Jimmy Johnson (W.M. Keck Observatory, Kamuela)

Keck Observatory is in the midst of a major telescope control system upgrade. This involves migrating from a VME based EPICS control system originally deployed on Motorola FRC40s VxWorks 5.1 and EPICS R3.13.0Beta12 to a distributed 64-bit X86 Linux servers running RHEL 2.6.33.x and EPICS R3.14.12.x. This upgrade brings a lot of new hardware to the project which includes Ethernet/IP connected PLCs, the ethernet connected DeltaTau Brick controllers, National Instruments MXI RIO, Heidenhain Encoders (and the Heidenhain ethernet connected Encoder Interface Box in particular), Symmetricom PCI based BC635 timing and synchronization cards, and serial line extenders and protocols. Keck has chosen to implement all new drivers using the ASYN framework. This paper will describe the various drivers used in the upgrade including those from the community and those developed by Keck which include BC635, MXI and Heidenhain EIB. It will also discuss the use of the BC635 as a local NTP reference clock and a service for the EPICS general time.

THPPC068

Switching Solution – Upgrading a Running System

Control System Upgrades

Kevin Tsubota, Jimmy Johnson (W.M. Keck Observatory, Kamuela)

At Keck Observatory, we are upgrading our existing operational telescope control system and must do it with as little operational impact as possible. This paper describes our current integrated system and how we plan to create a more distributed system and deploy it subsystem by subsystem. This will be done by systematically extracting the existing subsystem then replacing it with the new upgraded distributed subsystem maintaining backwards compatibility as much as possible to ensure a seamless transition. We will also describe a combination of cabling solutions, design choices and a hardware switching solution we've designed to allow us to seamlessly switch signals back and forth between the current and new systems.

Poster

THPPC069

Low-cost Motion Control Alternative for Complex Multi-axis Systems

Control System Upgrades

Wesley Moore (JLAB, Newport News, Virginia)

Motion controllers can be purchased to drive numerous axes and have the capability of handling a wide range of I/O. However, these systems are often costly and excessive for less demanding applications. Prototypes or experimental systems with low to moderate requirements do not necessarily imply a sacrifice in overall complexity, calling for intelligent controls. In such cases, LinuxCNC may provide a valuable option compared to normal hardware solutions. LinuxCNC offers an open-source software alternative, allowing synchronized motion control of up to 9 axes and boasts custom kinematics modules for non-Cartesian motion systems. Only using a low-end PC, LinuxCNC is capable of generating pulse-width modulation (PWM) frequencies of 20-50 kHz, including closed-loop control with encoder feedback. With the addition of an inexpensive PCI card, frequencies up to 10 MHz can be achieved. This paper will examine leveraging the features of LinuxCNC for a hexapod prototype, along with EPICS integration for distributed control.

THPPC071

Machine Protection Diagnostics on a Rule Based System

Knowledge-based Techniques

Marcus Walla, Timmy Lensch, Yuri Nechaev, Winfried Schütte, Victor Soloviev, Matthias Werner (DESY, Hamburg)

Since commissioning the high-brilliance, third generation light source PETRA 3 in 2009 the operation of the accelerator ring is well defined, smooth, and becoming routine, especially regarding the control system hardware and software. Guarding the machine against damage is a Machine Protection System (MPS)[*]. In addition to general equipment protection, both alarms and beam information are collected by the MPS, which can be used to analyze beam losses and dumps. The MPS triggers the MPS visual diagnostic software. The purpose of the diagnostic software is the analysis and text-based description of the hardware dump cause. The diagnostic software used is based on a Domain Specific Language (DSL) architecture. The MPS diagnostic application is designed with a server-client architecture in the computer language Java. The communication protocol is based on TINE. We characterize the data flow of the alarms and the DSL specification and describe the composition from the delivered structure to a single, human understandable message.

* T. Lensch, M. Werner, "Commissioning Results and Improvements of the Machine Protection System for PETRA III", BIW10, New Mexico, US, 2010

Poster

THPPC072

Superconducting Cavity Quench Detection and Prevention for the European XFEL

Knowledge-based Techniques

Julien Branlard, Valeri Ayvazyan, Olaf Hensler, Holger Schlarb, Christian Schmidt (DESY, Hamburg), Wojciech Cichalewski (TUL-DMCS, Lodz)

Due to its large scale, the European X-ray Free Electron Laser accelerator (XFEL) requires a high level of automation for commissioning and operation. Each of the 800 superconducting RF cavities simultaneously running during normal operation can occasionally quench, potentially tripping the cryogenic system and resulting into machine down-time. A fast and reliable quench detection system is then a necessity to rapidly detect individual cavity quenches and take immediate action, thus avoiding interruption of machine operation. In this paper, the mechanisms implemented in the low level RF system (LLRF) to prevent quenches and the algorithms developed to detect if a cavity quenches anyways are explained. In particular, the different types of cavity quenches and the techniques developed to identify them are shown. Experimental results acquired during the testing of XFEL cryomodules prototypes at DESY are presented, demonstrating the performance and efficiency of this machine operation and cavity protection tool.

Poster

THPPC073

Determining Accelerator Reliability by Automatic Dataset Analysis

Knowledge-based Techniques

George Alexandrovitch Fatkin (BINP SB RAS, Novosibirsk)

LIA-2 is an impulse X-Ray accelerator facility with applications that require high reliability. Control system has a high number of control objects (most of which are high-voltage elements) and monitoring channels. The reliability can not be achieved by an interlock subsystem because of the complex behaviour. An automatical system has been devised to determine and improve reliability of facility elements by analysing and comparing data shot-by-shot. This system is built on top of hdf5 storage, numpy, scipy, pytables and matplotlib. It also allows to perform manual data mining and visualisation.

Poster

THPPC076

Re-Engineering Control Systems Using Automatic Generation Tools and Process Simulation: the LHC Water Cooling Case

Knowledge-based Techniques

William Booth, Enrique Blanco Vinuela, Benjamin Bradu, Luis Gomez Palacin (CERN, Geneva)

This paper presents the approach used at CERN (European Organization for Nuclear Research) for the re-engineering of the control systems for the water cooling systems of the LHC (Large Hadron Collider). Due to a very short, and therefore restrictive, intervention time for these control systems, each PLC had to be completely commissioned in only two weeks. To achieve this challenge, automatic generation tools were used with the CERN control framework UNICOS (Unified Industrial Control System) to produce the PLC code. Moreover, process dynamic models using the simulation software EcosimPro were developed to carry out the 'virtual' commissioning of the new control systems for the most critical processes thus minimizing the real commissioning time on site. The re-engineering concerns around 20 PLCs managing 11000 Inputs/Outputs all around the LHC. These cooling systems are composed of cooling towers, chilled water production units and water distribution systems.

Poster

THPPC077

A Fuzzy-Oriented Solution for Automatic Distribution of Limited Resources According to Priority Lists

Knowledge-based Techniques

Marco Pezzetti, Vitaliano Inglese, Antonio Tovar (CERN, Geneva), Herve Coppier (ESIEE, Amiens), Marcelino Mendes Almeida (UFMG, Belo Horizonte)

This paper proposes a solution for resources allocation when limited resources supply several clients in parallel. The lack of a suitable limitation mechanism in the supply system can lead to the depletion of the resources if the total demand exceeds the availability. To avoid this situation, an algorithm for priority handling which relies on the Fuzzy Systems Theory is used. The Fuzzy approach, as a problem-solving technique, is robust with respect to model and parameter uncertainties and is well-adapted to systems whose mathematical formulation is difficult or impossible to obtain. The aim of the algorithm is to grant a fair allocation if the resources availability is sufficient for all the clients, or, in case of excess of demand, on the basis of priority lists, to assure enough resources only to the high priority clients in order to allow the completion of the high priority tasks. Besides the general algorithm, this paper describes the Fuzzy approach applied to a cryogenic test facility at CERN. Simulation tools are employed to validate the proposed algorithm and to characterize its performance.

Poster

THPPC078

The AccTesting Framework: An Extensible Framework for Accelerator Commissioning and Systematic Testing

Knowledge-based Techniques

Kajetan Fuchsberger, Maxime Audrain, Jean-Christophe Garnier, Roman Gorbonosov, Arkadiusz Andrzej Gorzawski, Adam Jalal, Jacek Suchowski, Paula Cristina Turcu, Markus Zerlauth (CERN, Geneva)

The Large Hadron Collider (LHC) at CERN requires many systems to work in close interplay to allow reliable operation and at the same time ensure the correct functioning of the protection systems required when operating with large energies stored in magnet system and particle beams. The systems for magnet powering and beam operation are qualified during dedicated commissioning periods and retested after corrective or regular maintenance. Based on the experience acquired with the initial commissioning campaigns of the LHC magnet powering system, a framework was developed to orchestrate the thousands of tests for electrical circuits and other systems of the LHC. The framework was carefully designed to be extendable. Currently, work is on-going to prepare and extend the framework for the re-commissioning of the machine protection systems at the end of 2014 after the LHC Long Shutdown. This paper describes concept, current functionality and vision of this framework to cope with the required dependability of test execution and analysis.

THPPC079

Using a Java Embedded DSL for LHC Test Analysis

Knowledge-based Techniques

Jean-Christophe Garnier, Maxime Audrain, Kajetan Fuchsberger, Roman Gorbonosov, Arkadiusz Andrzej Gorzawski, Adam Jalal, Jacek Suchowski, Paula Cristina Turcu, Markus Zerlauth (CERN, Geneva)

The Large Hadron Collider (LHC) at CERN requires many systems to work in close cooperation. All systems for magnet powering and beam operation are qualified during dedicated commissioning periods and retested after corrective or regular maintenance. Already for the first commissioning of the magnet powering system in 2006, the execution of such tests was automated to a high degree to facilitate the execution and tracking of the more than 10.000 required test steps. Most of the time during today's commissioning campaigns is spent in analysing test results, to a large extend still done manually. A project was launched to automate the analysis of such tests as much as possible. A dedicated Java embedded Domain Specific Language (eDSL) was created, which allows system experts to describe desired analysis steps in a simple way. The execution of these checks results in simple decisions on the success of the tests and provides plots for experts to quickly identify the source of problems exposed by the tests. This paper explains the concepts and vision of the first version of the eDSL.

Poster

THPPC080

Testing and verification of PLC code for process control

Knowledge-based Techniques

Enrique Blanco Vinuela, Benjamin Bradu, Borja Fernandez Adiego, Alexey Merezhin (CERN, Geneva)

Functional testing of PLC programs has been historically a challenging task for control systems engineers. This paper presents the analysis of different mechanisms for testing PLCs programs developed within the UNICOS (Unified Industrial COntrol System) framework. The framework holds a library of objects, which are represented as Function Blocks in the PLC application. When a new object is added to the library or a correction of an existing one is needed, exhaustive validation of the PLC code is needed. Testing and formal verification are two distinct approaches selected for eliminating failures of UNICOS objects. Testing is usually done manually or automatically by developing scripts at the supervision layer using the real control infrastructure. Formal verification proofs the correctness of the system by checking weather a formal model of the system satisfies some properties or requirements. The NuSMV model checker has been chosen to perform this task. The advantages and limitations of both approaches are presented and illustrated with a case study, validating a specific UNICOS object.

Poster

THPPC081

High-level Functions for Modern Control Systems: A Practical Example

Knowledge-based Techniques

Fernando Varela, Piotr Golonka, Manuel Gonzalez-Berges, Lyuba Borislavova Petrova (CERN, Geneva)

Modern control systems make wide usage of different IT technologies and complex computational techniques to render the data gathered accessible from different locations and devices, as well as to understand and even predict the behavior of the systems under supervision. The Industrial Controls Engineering (ICE) Group of the EN Department develops and maintains more than 150 vital controls applications for a number of strategic sectors at CERN like the accelerator, the experiments and the central infrastructure systems. All these applications are supervised by MOON, a very successful central monitoring and configuration tool developed by the group that has been in operation 24/7 since 2011. The basic functionality of MOON was presented in previous editions of these series of conferences. In this contribution we focus on the high-level functionality recently added to the tool to grant access to multiple users through the web and mobile devices to the data gathered, as well as a first attempt to data analytics with the goal of identifying useful information to support developers during the optimization of their systems and help in the daily operations of the systems.

Poster

THPPC082

Monitoring of the National Ignition Facility Integrated Computer Control System*

Knowledge-based Techniques

John Fisher, Michael Arrowsmith, Eric Stout (LLNL, Livermore, California)

The Integrated Computer Control System (ICCS), used by the National Ignition Facility (NIF) provides comprehensive status and control capabilities for operating approximately 100,000 devices through 2,600 processes located on 1,800 servers, front end processors and embedded controllers. Understanding the behaviors of complex, large scale, operational control software, and improving system reliability and availability, is a critical maintenance activity. In this paper we describe the ICCS diagnostic framework, with tunable detail levels and automatic rollovers, and its use in analyzing system behavior. ICCS recently added Splunk as a tool for improved archiving and analysis of these log files (about 20GB, or 35 million logs, per day). Splunk now continuously captures all ICCS log files for both real-time examination and exploration of trends. Its powerful search query language and user interface provides allows interactive exploration of log data to visualize specific indicators of system performance, assists in problems analysis, and provides instantaneous notification of specific system behaviors.

THPPC083

Software Tool Leverages Existing Image Analysis Results to Provide In-Situ Transmission of the National Ignition Facility (NIF) Disposable Debris Shields*

Knowledge-based Techniques

Victoria Miller Kamm, Abdul Awwal, Jean-Michel Di Nicola, Pascale Di Nicola, Sham Dixit, David McGuigan, Brett Raymond, Karl Child Wilhelmsen (LLNL, Livermore, California)

The Disposable Debris-Shield (DDS) Attenuation Tool is software that leverages Automatic Alignment image analysis results and takes advantage of the DDS motorized insertion and removal to compute the in-situ transmission of the 192 NIF DDS. The NIF employs glass DDS to protect the final optics from debris and shrapnel generated by the laser-target interaction. Each DDS transmission must be closely monitored and replaced when its physical characteristics impact laser performance. The tool was developed to calculate the transmission by obtaining the total pixel intensity of acquired images with the debris shield inserted and removed. These total intensities existed in the Automatic Alignment image processing algorithms. The tool uses this data, adding the capability to specify DDS to test, moves the DDS, performs calculations, and saves data to an output file. It operates on all 192 beams of the NIF in parallel, and has shown a discrepancy between laser predictive models and actual. As qualification the transmission of new DDS were tested, with known transmissions supplied by the vendor. This demonstrated the tool capable of measuring in-situ DDS transmission to better than 0.5% rms.

Poster

THPPC084

Optimizing Blocker Usage on NIF Using Image Analysis and Machine Learning*

Knowledge-based Techniques

Laura Mascio Kegelmeyer, Alan Conder, Laurie Lane, Mike Nostrand, Joshua Senecal, Pamela Whitman (LLNL, Livermore, California)

To optimize laser performance and minimize operating costs for high energy laser shots it is necessary to locally shadow, or block, flaws from laser light exposure in the beamline optics. Blockers are important for temporarily shadowing a flaw on an optic until the optic can be removed and repaired. To meet this need, a combination of image analysis and machine learning techniques have been developed to accurately define the list of locations where blockers should be applied. The image analysis methods extract and measure evidence of flaw candidates and their correlated downstream hot spots and this information is passed to machine learning algorithms which rank the probability that candidates are flaws that require blocking. Preliminary results indicate this method will increase the percentage of true positives from less than 20% to about 90%, while significantly reducing recall – the total number of candidates brought forward for review.

Poster

THPPC085

Image Analysis for the Automated Alignment of the Advanced Radiography Capability (ARC) Diagnostic Path*

Knowledge-based Techniques

Randy Roberts, Abdul Awwal, Erlan Bliss, Richard Leach, Michael Rushford,
Karl Child Wilhelmsen (LLNL, Livermore, California)

The Advanced Radiographic Capability (ARC) at the National Ignition Facility was developed to produce a sequence of short laser pulses that are used to backlight an imploding fuel capsule. This backlighting capability will enable the creation of a sequence of radiographs during capsule implosion and provide an unprecedented view into the dynamics of the implosion. A critical element of the ARC is the diagnostic instrumentation used to assess the quality of the pulses. Pulses are steered to the diagnostic package through a complex optical path that requires precision alignment. A central component of the alignment system is the image analysis algorithms, which are used to extract information from alignment imagery and provide feedback for the optical alignment control loops. Alignment imagery consists of complex patterns of light resulting from the diffraction of pilot beams around cross-hairs and other fiducials placed in the optical path. This paper describes the alignment imagery, and the image analysis algorithms used to extract the information needed for proper operation of the ARC automated alignment loops.

Poster

THPPC086

Analyzing Off-Normals in Large Distributed Control Systems Using Deep Packet Inspection and Data Mining Techniques*

Knowledge-based Techniques

Mikhail Fedorov, Gordon Brunton, Chris Estes, John Fisher, Christopher David Marshall,
Eric Stout (LLNL, Livermore, California)

Network packet inspection using port mirroring provides the ultimate tool for understanding complex behaviors in large distributed control systems. The timestamped captures of network packets embody the full spectrum of protocol layers and uncover intricate and surprising interactions. No other tool is capable of penetrating through the layers of software and hardware abstractions to allow the researcher to analyze an integrated system composed of various operating systems, closed-source embedded controllers, software libraries and middleware. Being completely passive, the packet inspection does not modify the timings or behaviors. The completeness and fine resolution of the network captures present an analysis challenge, due to huge data volumes and difficulty of determining what constitutes the signal and noise in each situation. We discuss the development of a deep packet inspection toolchain and application of the R language for data mining and visualization. We present case studies demonstrating off-normal analysis in a distributed real-time control system.
In each case, the toolkit pinpointed the problem root cause which had escaped traditional software debugging techniques.

THPPC087

Poster

Multi-objective Optimization for LANSCE Linac Operations

Knowledge-based Techniques

Xiaoying Pang, Lawrence Rybarcyk (LANL, Los Alamos, New Mexico)

Multi-objective optimization (MO) problems are very common in accelerator physics and engineering due to its multi-criteria nature where two or more competing objectives have to be optimized simultaneously. In the face of MO, traditional gradient-based techniques fail due to the inherent difficulty in dealing with local minima and aggregating multiple objectives. The multi-objective genetic algorithm (MOGA) and the multi-objective particle swarm optimization (MOPSO) are well suited to solve MO problems. MOGA follows the way biological systems use to improve their ability to survive. MOPSO, inspired by the behavior of birds within flocks, models social behavior to guide the swarm of individuals toward promising regions of a solution space. In this work, we apply both methods to optimization of LANSCE linac operating parameters where multiple objectives are present. We employ our newly developed GPU-accelerated beam dynamics simulator, which is being developed for use in the LANSCE control room. It can serve as a virtual beam diagnostic and predict in pseudo real-time beam properties along the linac. Details about the algorithms, performance comparison and results will be presented.

THPPC088

Poster

Single Photon THz Timer

Timing and Sync

Amur Tevatros Margaryan, Robert Ayvazyan, Ashot A. Chilingarian, Lekdar A. Gevorgyan, Vanik H Kakoyan (ANSL, Yerevan), John Annand (University of Glasgow, Glasgow)

The principles of a timing technique based on a novel photon detector, the radio frequency photomultiplier tube* (RFPMT) are presented. The single-photon time resolution and minimum time bin of this technique are about 1 ps. In principle the RFPMT could be operated synchronously with an optical clock to achieve around 10 fs stability and separate timing systems could be synchronized to ps precision**. The RFPMT, equipped with a spiral-scanning radio-frequency system, could in principle achieve counting rates of around 1 THz. Potentially it could also be used as an amplitude digitizer of optical pulses with a ps time bins. In prototype devices the detection and readout systems are based on commercial multichannel plates, electron bombardment, avalanche photodiodes and standard nanosecond-risetime electronics. Experimental results demonstrating the validity of the operational principles of the RFPMT and the spiral-scanning radio-frequency system are presented.

*A. Margaryan et al., Nucl. Instr. & Meth. A566 (2006) 321. **A. Margaryan, Nucl. Instr. & Meth. A652 (2011) 504.

Poster

THPPC089

High Repetition Rate Laser Beamline Control System

Timing and Sync

Tomas Mazanec (ELI-BEAMS, Prague)

ELI-Beamlines will be a high-energy, high repetition-rate laser pillar of the ELI (Extreme Light Infrastructure) project. It will be an international user facility for both academic and applied research, slated to provide user capability from the beginning of 2017. As part of the development of L1 laser beamline we are developing a prototype of control system. Beamline repetition rate of 1kHz with its femtosecond pulse accuracy puts demanding requirements on both control and synchronization systems. Low-jitter high-precision commercial timing system will be deployed to accompany both EPICS and LabView based control system nodes which will be in majority enhanced for real-time responsiveness. Data acquisition will have to be supported by in-house time-stamping mechanisms relying on sub-millisecond system responses. Synergy of LabView Real-Time and EPICS within particular nodes should be secured by advanced techniques to achieve both fast responsiveness and high data-throughput. Further, beamline operation will require for instance dozens of cameras utilized for both monitoring and closed loop control.

Poster

THPPC090

Picoseconds Timing System

Timing and Sync

Dominique Monnier-Bourdin, Bernard Riondet (GreenField Technology, Breuillet), Stephane Perez (CEA, Arpajon)

The instrumentation of large physics experiments needs to be synchronized down to few picoseconds. These experiments require different sampling rates for multi shot or single shot on each instrument distributed on a large area. Greenfield Technology presents a commercial solution with a Picoseconds Timing System built around a central Master Oscillator which delivers a serial data stream over an optical network to synchronize local multi channel delay generators. This system is able to provide several hundreds of trigger pulses within a 1ps resolution and a jitter less than 15 ps distributed over an area up to 10 000 m^2. The various qualities of this Picoseconds Timing System are presented with measurements and functions and have already been implemented in French facilities (Laser MegaJoule prototype - Ligne d'Intégration Laser- , petawatt laser applications and synchrotron Soleil). This system with different local delay generator form factors (box, 19" rack, cPCI or PXI board) and many possibilities of trigger pulse shape is the ideal solution to synchronize Synchrotron, High Energy Laser or any Big Physics Experiments.

THPPC091

A White Rabbit-Based Data Acquisition System for Large-Scale Astroparticle Experiments with Sub-nsec Synchronization, Time Stamping and Time Calibration

Timing and Sync

Martin Brückner (Humboldt-University Berlin, Berlin), Ralf Wischnewski (DESY Zeuthen, Zeuthen)

For large scale astroparticle experiments, time synchronization between detectors distributed over km-scale is a typical challenge. We adapted the White Rabbit technology, a sub-nsec time synchronization system based on 1000BASE-BX10 ethernet, to build up a prototype system for precision trigger time stamping and test-pulse injection in a distributed data acquisition system. We present our hardware design, system setup and extended laboratory test results, showing a very stable and precise technology ready for applications in next generation gamma-ray or cosmic-ray experiments like HiSCORE or CTA.

Poster

THPPC092

FAIR Timing System Developments Based on White Rabbit

Timing and Sync

Cesar Prados, Ralph C. Baer, Dietrich Hans Beck, Jan Hoffmann, Stefan Rauch, Wesley W. Terpstra, Marcus Zweig (GSI, Darmstadt), Mathias Kreider (GSI, Darmstadt; Glyndčr University, Wrexham)

A new timing system based on White Rabbit (WR) is being developed for the upcoming FAIR facility at GSI, in collaboration with CERN, other institutes and industry partners. The timing system is responsible for the synchronization of nodes with nanosecond accuracy and distribution of timing messages, which allows for real-time control of the accelerator equipment. WR is a fully deterministic Ethernet-based network for general data transfer and synchronization, which is based on Synchronous Ethernet and PTP. The ongoing development at GSI aims for a miniature timing system, which is part of a control system of a proton source, that will be used at one of the accelerators at FAIR. Such a timing system consists of a Data Master generating timing messages, which are forwarded by a WR switch to a handful of timing receiver. The next step is an enhancement of the robustness, reliability and scalability of the system. These features will be integrated in the forthcoming CRYRING control system in GSI. CRYRING serves as a prototype and testing ground for the final control system for FAIR. The contribution presents the overall design and status of the timing system development.

THPPC093

The New Timing System for the European XFEL

Timing and Sync

Kay Rehlich, Arthur Aghababyan, Holger Kay, Gevorg Petrosyan, Lyudvig Petrosyan, Vahan Petrosyan, Christoph Stechmann (DESY, Hamburg), Christian Bohm, Attila Hidvegi (Stockholm University, Stockholm), Patrick Gessler (XFEL.EU, Hamburg)

The European XFEL will run with up to 27 000 bunches per second. Bunches with different parameters can be delivered to several experiments in parallel. A hardware based synchronization scheme to reliably control all subsystems has been developed. It is based on delay compensated fiber links in a multi-start topology. Precision clocks, triggers, and configuration parameters are distributed from a central place to about 200 slave nodes distributed along the 3 km long facility. A versatile protocol to synchronize all parts of the accelerator is used to prepare fast feedbacks, the machine protection systems, and the data acquisition before the subsequent bunch train. The timing system is based on the advanced features of the MicroTCA (MTCA.4) standard. First experiences with this system at FLASH will be described.

Poster

THPPC094

Managed Precision Clock and RF Signal Distribution over Custom RF-backplane in MTCA.4 Crate

Timing and Sync

Tomasz Jezynski, Frank Ludwig, Holger Schlarb (DESY, Hamburg), Vollrath Dirksen (N.A.T. Gmbh, Bonn), Krzysztof Czuba (Warsaw University of Technology, Warsaw)

Low Level RF and beam diagnostic systems require low jitter clock and low noise RF signal distribution. To fulfill their requirements a custom RF backplane and a new version of RTM has been developed. To provide hot-swap functionality an IPMI controller has been extended to support e-keying functionality for the custom backplane. The presented system is fully compatible with MTCA.4. Details of a design and an example application are presented.

Poster

THPPC095

A Proof of Principle Study of a Synchronous Movement of an Array of Undulators Using an EtherCAT Bus at European XFEL

Timing and Sync

Suren Karabekyan, Andreas Beckmann, Joachim Pflueger (XFEL.EU, Hamburg)

The European XFEL project is a 4th generation X-ray light source. The undulator systems SASE 1, SASE 2 and SASE 3 are used to produce photon beams. Each undulator system consists of an array of up to 35 undulator cells installed in a row along the electron beam. For the controls of the undulator system state of the art industrial control equipment based on the EtherCAT bus is used. The EtherCAT protocol supports the real time synchronization of many axes. It is planned to use this property synchronize the individual Cells in an Undulator System. This paper describes the required technical design and software implementation. The results of an on-going proof-of-principle study of the synchronous movement of four undulator cells are presented.

Poster

THPPC096

Development of New Tag Supply System for DAQ for SACLA User Experiments

Timing and Sync

Toshinori Abe (RIKEN SPring-8 Center, Hyogo), Arnaud Amselem, Kensuke Okada, Ryotaro Tanaka, Mitsuhiro Yamaga (JASRI/SPring-8, Hyogo-ken)

This paper presents development of a new tag supply system for the data-acquisition (DAQ) system for SACLA user experiments. The X-ray Free-Electron Laser facility in SPring-8, SACLA, has delivered X-ray laser beams to users since March 2012 [1]. For the user experiments at SACLA, a dedicated DAQ system has been developed. The DAQ system is currently capable to operate with maximum ten sensors of multiport Charge-Coupled Device (MPCCD) for X-ray detection. The data of ten sensors are read out with individual readout modules. We implement a new tag supply system to ensure the reconstruction of the diffraction image of the user experiments. The tag data are used to synchronize the data. One master server receives a signal given by accelerator and the delivery of the tag data follows to five experimental halls at SACLA and some of monitors at SACLA accelerator. We employ dedicated communication lines to deliver the tag data. The longest distance to deliver the tag data is about one kilometer. We need to update entire softwares of DAQ system for the implementation. We will implement the new system to the DAQ system in the coming summer.

[1] T. Ishikawa et al., "A compact X-ray free-electron laser emitting in the sub-angstrom region", Nature Photonics 6, 540-544 (2012).

THPPC097

Incorporation of New SINAP Event Modules with the Existent MRF System at SuperKEKB

Timing and Sync

Kazuro Furukawa, Ryo Ichimiya, Hiroshi Kaji, Fusashi Miyahara, Tatsuro Nakamura, Masanori Satoh (KEK, Ibaraki), Ming Liu, Chongxian Yin, Liying Zhao (SINAP, Shanghai)

SuperKEKB electron/positron asymmetric collider is under construction in order to elucidate new physics beyond the standard model of elementary particle physics. The injector linac should inject variety of electron/positron beams into SuperKEKB HER and LER rings as well as PF and PF-AR light sources. Emittance of positron beam will be damped using a newly installed damping ring at the middle of injector linac. The linac should be operated with precise beam controls, where EPICS and MRF event systems are enhanced to support pulse-to-pulse beam modulation (PPM) at 50Hz. A virtual accelerator (VA) concept is introduced to enable a single linac behaving as several VAs switched by PPM, where each VA corresponds to one of several injections into ring accelerators. In order to improve the event and timing controls, we will incorporate newly developed modules at SINAP. Those modules are designed to be compatible with existent MRF systems, and they have special features such as cascaded systems with different operating frequencies, and embedded event receivers in PLCs. We will report on the status of the design and test with new SINAP event modules.

Poster

THPPC098

CSNS-RCS Timing System Design and Implementation

Timing and Sync

Peng Zhu (IHEP, Beijing)

CSNS was the first Proton Accelerator designed in China based on actual conditions and the construction, a 100kw power, pulse frequency is 25Hz, consisting of hydrogen linear accelerators and faster cycling Proton Synchrotron. CSNS-RCS timing system provide a stable trigger signal and clock signals for injecting pulse magnet power supply, RF low level, extraction pulse magnet power supply and other equipment. This paper describes the design loop timing system including hardware and software design, and the implementation of synchronous extraction plug-in.

THPPC099

A New Kind of Test of Timestamp Module

Timing and Sync

Jiajie Li, Lei Hu, YaLi Liu (IHEP, Beijing), Jian Zhuang (IHEP, Beijing; IHEP, Bejing; State Key laboratory of Particle Detection and Electronics of China, Beijing), Yuanping Chu, Dapeng Jin (IHEP, Beijing; State Key laboratory of Particle Detection and Electronics of China, Beijing)

Beckhoff Automation Company launched a new series of XFC* module,including the functions of oversampling and timestamp. The error of clock synchronization between the module is less than 1us. The extreme I/O module with the timestamp recognizes the change of the signal or executes output within 1us ,which is marked by 1ns accuracy. This technology can realize the high accuracy sampling and output the digital signal accurately. In order to test the function of extreme module and evaluate its accuracy,we have made some error tests, which are the differences between modules or channels in the module to evaluate the possibility of applying in Time Measuring system of high accuracy in CSNS**

XFC* extreme fast control CSNS** China Spallation Neutron Source

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THPPC100

Event-Driven Timing System Based upon MRF cPCI Hardware for HLS

Timing and Sync

Chuan Li, Jingyi Li, Wei-min Li, Gongfa Liu, Ji Gang Wang, Lin Wang, Ke Xuan (USTC/NSRL, Hefei, Anhui)

The Hefei Light Source (HLS) is a VUV synchrotron light source. It consists of an 800 MeV Linac and storage ring. It has been upgraded to improve the light source performance since 2010. As a part of the upgrade project, the HLS timing system is re-built using the cPCI event-driven hardware to meet the synchronization requirement of the machine. The cPCI event-driven products from Micro-Research Finland Oy (MRF) are adopted to achieve about 100 output signals with different interfaces. We develop the device supports and drivers to access the registers of the hardware using common EPICS records. The software is developed and managed in a central virtual server with Linux operation system, and is running on distributed IOCs in cPCI chassis. The off-line test shows that the resolutions are better than 10 ns for most channels and 10 ps for the electron gun triggering respectively, and the maximum jitter of output signals is less than 50 ps.

THPPC101

Poster

Development Status of SINAP Timing System

Timing and Sync

Chongxian Yin, Ming Liu, Liying Zhao (SINAP, Shanghai)

After successful implementation of SINAP timing solution at Pohang Light Source in 2011, the development of SINAP timing system version-II was finished by the end of 2012. The hardware of version-II is based on Virtex-6 FPGA chip, and bidirectional event frame transfer is realized in a 2.5Gbps fiber network. In event frame, data transfer functionality substitutes for distributed bus. The structure of timing system is also modified, where a new versatile EVO could be configured as EVG, FANOUT and EVR with optical outputs. Besides standard VME modules, we designed PLC-EVR as well, which is compatible with Yokogawa F3RP61 series. Based on brand new hardware architecture, the jitter performance of SINAP timing system version-II is improved remarkably.

THPPC102

Poster

Synchronization Techniques in Synchrotron Beamlines

Timing and Sync

Oscar Matilla, David Fernandez-Carreiras, Xavier Serra-Gallifa (CELLS-ALBA Synchrotron, Cerdanyola del Vallès)

Synchrotron beamlines are complex systems that require leading technology for its control. One of the challenges to be solved is data synchronization between the radically different elements that compose the system. Analyzing synchronization techniques tendencies in the market is easy to notice that the new market trends are not as dynamically applied to the beamlines control as one could expect. The architecture presently used is mostly a pure wholesale transfer and timestamping techniques are quite unusual. One of the reasons of this fact could be that beamlines data synchronization specifications are usually dealt in a “two steps” scenario: first with relaxed specifications that allow focusing in other fundamental control problems and, once the beamline is already functional, trying to increase the speed for solving the need of more challenging data synchronization specifications. One of the most typical examples is the continuous scans implementation. The objective of this paper is to analyze the present scenario, propose some low level implementations to ease a more flexible synchronization architecture and detail the steps in that direction done at Alba Synchrotron.

THPPC103

Timing System at MAX IV

Timing and Sync

Jerzy Jan Jamroz, Vincent Hardion, Julio Lidon-Simon, Antonio Milan, Darren Paul Spruce (MAX-lab, Lund)

The MAX IV Laboratory is the successor of the MAX-lab national laboratory in Sweden. The facility is being constructed at Brunnshög in the North Eastern part of Lund and will contain one 300m long linac, two storage rings (1.5GeV and 3GeV) and a short pulse facility (SPF) to be further developed into a free electron laser (FEL). This paper describes the design status of the timing system in 2013 and other projects associated to it.

Poster

THPPC104

A Timing System for Cycle Based Accelerators

Timing and Sync

Johannes Gutleber (CERN, Geneva), Ziga Croflic, Joze Dedic, Rok Stefanic (Cosylab, Ljubljana)

Synchrotron accelerators with multiple ion sources and beam lines require a high degree of flexibility to define beam cycle timing sequences. We have therefore decided to design a ready-to-use accelerator timing system based on off-the-shelf hardware and software that can fit mid-size accelerators and that is easy to adapt to specific user needs. This Real Time Event Distribution Network (REDNet) has been developed under the guidance of CERN within the MedAustron-CERN collaboration. The system based on the MRF transport layer has been implemented by Cosylab. While we have used hardware on NI PXIe platform, it is straightforward to obtain it for other platforms such as VME. The following characteristics are key to its readiness for use: (1) turn-key system comprising hardware, transport layer, application software and open integration interfaces, (2) performance suitable for a wide range of accelerators, (3) multiple virtual timing systems in one physical box, (4) documentation developed according to V-model. Given the maturity of the development, we have decided to make REDNet available as a product through our industrial partner.

THPPC105

Poster

The LHC Injection Sequencer

Timing and Sync

Delphine Jacquet (CERN, Geneva)

The LHC is the largest accelerator at CERN. The 2 beams of the LHC are colliding in four experiments, each beam can be composed up to 2808 high intensity bunches.The beams are produced at the LINAC, is shaped and accelerated in the LHC injectors to 450GeV. The injected beam contains up to 288 high intensity bunches, corresponding to a stored energy of 2MJ. To build for each LHC ring the complete bunch scheme that ensure a desired number of collision for each experiment, several injections are needed from the SPS to the LHC. The type of beam that is needed and the longitudinal emplacement of each injection have to be defined with care. This process is controlled by the injection sequencer and it orchestrates the beam requests. Predefined filling schemes stored in a database are used to indicate the number of injection, the type of beam and the longitudinal place of each. The injection sequencer sends the corresponding beam requests to the CBCM, the central timing manager which in turn synchronizes the beam production in the injectors. This paper will describe how the injection sequencer is implemented and its interaction with the other systems involved in the injection process.

THPPC106

Poster

A Generic Timing Software for Fast Pulsed Magnet Systems at CERN

Timing and Sync

Christophe Chanavat, Michel Arruat, Etienne Carlier (CERN, Geneva)

At CERN, fast pulsed magnet (kicker) systems are used to inject, extract, dump and excite beams. Depending on their operational functionalities and as a result of the evolution of controls solutions over time, the timing controls of these systems are based on different hardware architectures that result in a large disparity of software solutions. A Kicker Timing Software (KiTS), based on a modular hardware and software architecture, has been developed with the objective to increase the homogeneity of fast and slow timing control for fast pulsed magnet systems. The KiTS uses a hardware abstraction layer and a configurable software model implemented within the Front-End Software Architecture (FESA) framework. It has been successfully deployed in the control systems of the LHC and SPS injection kickers, the SPS extraction kickers and the SPS tune measurement kickers.

Poster

THPPC107

Timing and Synchronization at Beam Line Experiments

Timing and Sync

Helena Blaettler Pruchova, Timo Korhonen (PSI, Villigen PSI)

Some experiment concepts require a control system with the individual components working synchronously. At PSI the control system for X-ray experiments is distributed in several VME crates, on several EPICS soft ioc servers and linux nodes, which need to be synchronized. The timing network using fibre optics, separated from standard network based on TCP/IP protocol, is used for distributing of time stamps and timing events. The synchronization of all control components and data acquisition systems has to be done automatically with sufficient accuracy and is done by event distribution and/or by synchronization by I/O trigger devices. Data acquisition is synchronized by hardware triggers either produced by sequences in event generator or by motors in case of on-the-fly scans. Some detectors like EIGER with acquisition rate close to 20kHz, fast BPMs connected to current measuring devices like picoammmeters with sampling frequences up to 26 kHz and photodiodes are integrated to measure beam properties and radiation exposures. The measured data are stored on various file servers situated within one BL subnetwork. In this paper we describe a concept for implementing such a system.

Poster

THPPC108

Jitter Studies and Measurement System for the Injector Laser at SwissFEL

Timing and Sync

Helena Blaettler Pruchova, Marta Csatari Divall (PSI, Villigen PSI)

Arrival time and bunch energy at compressor chicane entry is crucial for good compression and for the overall performance of SwissFEL. One of the main contributions to this jitter is the injector laser system. At the first stage of the project the Oscilloscope(LeCroy) with sampling rate of 40GS/s and bandwidth 16GHz and several fast photodiodes (rise time < 50ps, spectral range 170-1100nm) were used to perform measurements of timing jitter and drift. We are reporting on long term measurements, which were performed with RF reference signals(about 10fs jitter) - RF versus laser, laser versus delayed laser signal, IR and UV response to localize the contributors to the jitter and to perform the noise analysis. As a result several passive stabilization measures were taken to minimize long term drifts. In the next stage the feasibility study of slow drift measurement system based on fast photodiodes and fast ADCs is following with the aim to implement the slow drift measurement system.

Poster

THPPC109

Status of the TPS Timing System

Timing and Sync

Chunyi Wu, Jenny Chen, Yung-Sen Cheng, Kuo-Tung Hsu (NSRRC, Hsinchu)

Implementation of timing system of the Taiwan Photon Source (TPS) is underway. Timing system provides synchronization for electron gun, modulators of linac, pulse magnet power supplies, booster power supply ramp trigger, bucket addressing of storage ring, diagnostic equipments, beamline gating signal for top-up injection, synchronize for the time-resolved experiments. The system is based on event distribution system that broadcasts the timing events over optic fiber network, and decodes and processes them at the timing event receivers. The system supports uplink functionality which will be used for the fast interlock system to distribute signals like beam dump and post-mortem trigger with less than 5 sec response time. Software support is in preceded. Time sequencer to support various injection modes is in development. Timing solutions for the TPS project will summary in following paragraphs.

Poster

THPPC110

Timing of the ALS Booster Injection and Extraction

Timing and Sync

Carlos Serrano, Jonah Weber (LBNL, Berkeley, California)

The Advanced Light Source (ALS) timing system upgrade introduces a complete replacement of both the hardware and the technology used to drive the timing of the accelerator. The implementation of a new strategy for the booster injection and extraction mechanisms is conceptually similar to the one in place today, but fundamentally different due to the replacement of the technology. Here we describe some of the building blocks of this new implementation as well as an example of how the system can be configured to provide timing for injection and extraction of the ALS booster.

Poster

THPPC111

ALS Timing System Upgrade

Timing and Sync

Jonah Weber, Carlos Serrano (LBNL, Berkeley, California)

The Advanced Light Source (ALS) is in the process of upgrading its timing system as a part of the ALS Instrumentation and Controls Upgrade project. The timing system built upon construction of the machine at the beginning of the 1990s is still in operation today, and a replacement of the machine timing system is under way based on a commercially available solution, benefiting from 20 years of improvements in the fields of digital electronics and optical communications. An overview of the new timing system architecture based on a Micro-Research Finland (MRF) solution is given here.

Poster

THPPC112

The LANSCE Timing Reference Generator

Timing and Sync

Robert B. Merl, Scott Baily, Eric Bjorklund, Robert Charles Clanton, Fred E. Shelley (LANL, Los Alamos, New Mexico)

The Los Alamos Neutron Science Center is an 800 MeV linear proton accelerator at Los Alamos National Laboratory. For optimum performance, power modulators must be tightly coupled to the phase of the power grid. Downstream at the neutron scattering center there is a competing requirement that rotating choppers follow the changing phase of neutron production in order to remove unwanted energy components from the beam. While their powerful motors are actively accelerated and decelerated to track accelerator timing, they cannot track instantaneous grid phase changes. A new timing reference generator has been designed to couple the accelerator to the power grid through a phase locked loop. This allows some slip between the phase of the grid and the accelerator so that the modulators stay within their timing margins, but the demands on the choppers are relaxed. This new timing reference generator is implemented in 64 bit floating point math in an FPGA. Operators in the control room have real-time network control over the AC zero crossing offset, maximum allowed drift, and slew rate - the parameter that determines how tightly the phase of the accelerator is coupled to the power grid.

LA-UR-13-21289

Poster

THPPC113

Integrated Timing System for the EBIS Pre-Injector

Timing and Sync

John Morris, Severino Binello, Charles Theisen (BNL, Upton, Long Island, New York), Lawrence T. Hoff (BNL, Upton, New York)

The Electron Beam Ion Source (EBIS) began operating as a pre-injector in the C-AD RHIC accelerator complex in 2010. Historically, C-AD RHIC pre-injectors, like the 200MeV Linac, have had largely independent timing systems that receive a minimal number of triggers from the central C-AD timing system to synchronize the injection process. The EBIS timing system is much more closely integrated into central C-AD timing, with all EBIS machine cycles included in the master supercycle that coordinates the interoperation of C-AD accelerators. The integrated timing approach allows better coordination of pre-injector activities with other activities in the C-AD complex. Independent pre-injector operation, however, must also be supported by the EBIS timing system. This paper describes the design of the EBIS timing system and evaluates experience in operational management of EBIS timing.

Poster

THPPC114

Beam Based Feedback Software Controller for the Linac Coherent Light Source

Feedback Systems

Luciano Piccoli, Diane Fairley, Josef Frisch, Deborah Rogind (SLAC, Menlo Park, California)

Beam-based feedback control loops are required by the Linac Coherent Light Source (LCLS) program in order to provide fast, single-pulse stabilization of beam parameters. Eight transverse feedbacks, a 6x6 longitudinal feedback, and a loop to maintain the electron bunch charge were successfully commissioned for the LCLS, and have been maintaining stability of the LCLS electron beam at beam rates up to 120Hz. The fast rate feedback loops use a dedicated Ethernet multicast network to receive data from measurement devices (e.g. Beam Position Monitors) and control actuator devices (e.g. Magnets), while slow rate feedbacks use the regular controls network via channel access protocol. The controller is implemented as an EPICS IOC, with the majority of processing happening outside the scope of record processing. This paper discusses the design, configuration and commissioning of the EPICS based controller software developed for the LCLS Fast Feedback System.

Poster

THPPC115

Fast Orbit Feedback implementation at Alba Synchrotron

Feedback Systems

Xavier Serra-Gallifa, David Fernandez-Carreiras, Oscar Matilla, Jairo Moldes (CELLS-ALBA Synchrotron, Cerdanyola del Vallès)

After the successful accelerator commissioning and with the facility already in operation one of the top short term objectives pointed out by accelerator division was the Fast Orbit Feedback implementation (FOFB). The target of the FOFB system is to hold the electron beam position at submicron range both in vertical and horizontal planes correcting the inestabilities up to 120Hz. This increased beam stability performance is considered a major asset for the beamlines user operation. To achieve this target, the orbit position is acquired from the 88 Libera BPMs at a 10KHz sampling rate, distributed through an independent network and the corrections are calculated and sent to the 176 power supplies that drive the corrector coils. All this correction loop is executed at 10 KHz and the total latency of the system is characterized and minimized optimizing the bandwidth response.

Poster

THPPC116

Temperature Precise Control in a Large Scale Helium Refrigerator

Feedback Systems

jihao wu, Qing Li, Wei Pan (TIPC, BeiJing)

Precise control of operating load temperature is a key requirement for application of a large scale helium refrigerator. Strict control logic and time sequence are necessary in the process related to main components including a fine load, turbine expanders and compressors. However control process sequence may become disordered due to improper PID parameter settings and logic equations and causes temperature oscillation, load augmentation or protection of the compressors and cryogenic valve function failure etc. Combination of experimental studies and simulation models, effect of PID parameters adjustment on the control process is present in detail. The methods and rules of general parameter settings are revealed and the suitable control logic equations are derived for temperature stabilization.

Poster

THPPC117

A Control Strategy for Highly Regulated Magnet Power Supplies Using a LQR Approach

Feedback Systems

Saurabh Srivastava, Yashwant Kumar, Anuraag Misra, Vijay Shanker Pandit, Shantonu Sahoo, Sajjan Kumar Thakur (VECC, Kolkata)

A linear quadratic regulator (LQR) based proportional-Integrator-derivative (PID) controller is proposed for the SMPS based magnet power supply of the high current proton injector operational at VECC. The state weighting matrices 'Q' of the LQR based controller is derived analytically using guaranteed dominant pole placement approach with desired ' ' (maximum overshoot) and ' '(rise time). The uniqueness of this scheme is that the controller gives the desired closed loop response with minimum control effort, hence avoiding the actuator saturation by utilizing both optimum behavior of LQR technique and simplicity of the conventional PID controller. The controller and power supply parameter perturbations is studied along with the load disturbance to verify the robustness of proposed control mechanism.

Poster

THPPC118

Realisation Of Servo & Active Mirror Control System(AMCS) for the Indian MACE Telescope

Feedback Systems

Nandini Gupta, Ankit Agarwal, Geetha Andrew, Hari Balakrishna, Vijay Goyal, Y S Mayya, Vivek Sanadhya (BARC, Mumbai), Monika Jian, Ranjith Shaw (ECIL, Hyderabad)

The 21M dia. MACE telescope for the study of very high energy Cosmic Gamma Ray Sources proposed to be set up at Hanle, India(32.8deg N,78.9deg E, 4200 m ASL) is at advanced stage of construction and is expected to see first light in 2014. This 180 ton structure consists of a fully steerable mirror basket with coverage of ±270deg in Az and -26deg to 165deg in El, made up of 356 mirror panels collecting the feeble light and focusing on to the camera made up of PMTs. A servo system helps point the camera at any direction in the sky and then track a celestial source to an a accuracy of 1 arc min. In order to facilitate rigorous validation of the control system software a plant simulator is developed on a PC platform. AMCS provides for small adjustments in the orientation of each mirror panel so as to achieve desired image focus. Design of AMCS is validated through a specially built setup emulating the distributed architecture of cluster of actuators. This paper describes the analysis, design and realization of the hardware and software for the Servo System and AMCS. It presents drive system design, controller design, simulation results, test setups and summary of test results.

THPPC119

Poster

Software Architechture for the LHC Beam-based Feedback System

Feedback Systems

Lars K. Jensen, Maxim Andersen, Stephen Jackson, Ralph Jeffrey Steinhagen, Jorg Wenninger (CERN, Geneva)

This paper presents an overview of beam based feedback systems at the LHC at CERN. It will cover the system architecture which is split into two main parts – a controller (OFC) and a service unit (OFSU). The paper presents issues encountered during beam commissioning and lessons learned including follow-up from a recent review which took place at CERN

THPPC120

Poster

A Simplified Model of the International Linear Collider Final Focus System

Feedback Systems

Marco Oriunno, Thomas Walter Markiewicz (SLAC, Menlo Park, California), Christophe Collette, David Tshilumba (ULB - FSA - SMN, Bruxelles)

Mechanical vibrations are the main sources of Luminosity Loss at the Final Focus System of the future Linear Colliders, where the nanometric beams are required to be extremely stable. Precise models are needed to validate the supporting scheme adopted. Where the beam structure allows it, as for the International Linear Collider (ILC), intra-trains Luminosity Feedback schemes are possible. Where this is not possible, as for the Compact Linear Collider (CLIC), an active stabilization of the doublets is required. Further complications arise from the optics requirements, which place the final doublet very close to the IP (~4m). We present a model of the SID detector, where the QD0 doublet is captured inside the detector and the QF1 magnet is inside the tunnel. Ground Motion measured at the SLD detector at SLAC have been used together with a model of the technical noise. The model predicts that the rms vibration of QDO is below the capture range of the IP feedback system available in the ILC. With the addition of an active stabilization system on QD0, it is also possible to achieve the stability requirements of CLIC. These results can have important implications for CLIC.

THPPC121

Feedbacks and Automation at the Free Electron Laser in Hamburg (FLASH)

Feedback Systems

Raimund Kammering, Christian Schmidt (DESY, Hamburg)

For many years a set of historically grown Matlab scripts and tools have been used to stabilize transversal and longitudinal properties of the electron bunches at the FLASH. Though this Matlab-based approach comes in handy when commissioning or developing tools for certain operational procedures, it turns out to be quite tedious to maintain on the long run as it often lacks stability and performance e.g. in feedback procedures. To overcome these shortcomings of the Matlab-based approach, a server-based C++ solution in the DOOCS* framework has been realized at FLASH. Using the graphical UI designer jddd** a generic version of the longitudinal feedback has been implemented and put very fast into standard operation. The design uses sets of monitors and actuators plus their coupling which easily be adapted operation requirements. The daily routine operation of this server-based FB implementation has proven to offer a robust, well maintainable and flexible solution to the common problem of automation and control for such complex machines as FLASH and will be well suited for the European XFEL purposes.

* see e.g. http://doocs.desy.de ** see e.g. http//jddd.desy.de

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THPPC122

High Performance and Low Latency Single Cavity RF Control Based on MTCA.4

Feedback Systems

Christian Schmidt, Lukasz Butkowski, Matthias Hoffmann, Holger Schlarb (DESY, Hamburg), Adam Piotrowski (TUL-DMCS, Lodz), Igor Rutkowski (Warsaw University of Technology, Warsaw)

The European XFEL project at DESY requires a very precise RF control, fulfilling the objectives of high performance FEL generation. Within the MTCA.4 based hardware framework a LLRF system has been designed to control multi-cavity applications, require large processing capabilities. A generic software structure allows to apply the same design also for single-cavity applications, reducing efforts for maintenance. It has be demonstrated that the MTCA.4 based LLRF controller development achieves XFEL requirement in terms of amplitude and phase control. Due to the complexity of the signal part, which is not essential for a single cavity regulation an alternative framework has been developed, to minimize processing latency which is especially for high bandwidth applications very important. This setup is based on a fast processing advanced mezzanine card (AMC) combined with a down-converter and vector-modulator rear transition module (RTM). Within this paper the system layout and first measurement results are presented, demonstrating capabilities not only for LLRF specific applications.

Poster

THPPC123

Online Luminosity Optimization at the LHC

Feedback Systems

Fabio Follin, Reyes Alemany-Fernandez, Richard Jacobsson (CERN, Geneva)

The online luminosity control of the LHC experiments consists of an automatic slow real-time feedback system controlled by a specific experiment software that communicates directly with an LHC application. The LHC application drives a set of corrector magnets to adjust the transversal beam overlap at the interaction point in order to keep the instantaneous luminosity aligned to the target luminosity provided by the experiment. This solution was proposed by the LHCb experiment and tested first in July 2010. It has been in routine operation during the first two years of physics luminosity data taking, 2011 and 2012, in LHCb. It was also adopted for the ALICE experiment during 2011. The experience provides an important basis for the potential future need of levelling the luminosity in all the LHC experiments. This paper describes the implementation of the LHC application controlling the luminosity at the experiments and the information exchanged that allows this automatic control.

Poster

THPPC124

Progress on LLRF Control System for TTX

Feedback Systems

Haiting Lu, Ying-Chao Du, Wenhui Huang (TUB, Beijing), Qiang Du (LBNL, Berkeley, California), Beibei Shao (Tsinghua University, Beijing)

A digital Low Level RF control system was set up for Tsinghua Thomson scattering X-ray source (TTX) to improve the performance of RF system. The accuracy of Non-IQ sampling method is estimated when amplitude and phase are all changed at the sampling time, which is the actual condition in TTX. A simulation indicates that Non-IQ sampling method is still suitable for TTX working state. RF pulse width in TTX is about 1.5μs, which permits only pulse to pulse feedback. A feed forward method based on high voltage measurement is adopted to improve system's short-term capability. The feed forward method can suppress the 'fast phase noise' caused by variety of high voltage from pulse-to-pulse. With the help of pulse-to-pulse feedback and in-pulse feed forward mechanism, a 0.9deg rms phase jitter @2856MHz is achieved. A deflect cavity is used to verify the effect of the LLRF control system. 30% improvement on phase jitter is observed according to the test result.

Poster

THPPC125

Evaluation and Implementation of Advanced Process Control with the cRIO Material of National Instrument

Feedback Systems

Gilles Maire, Marco Pezzetti (CERN, Geneva), Baptiste Charnier, Herve Coppier (ESIEE, Amiens)

Programmable Logic Controller (PLC) is very commonly used in many industries and research applications for process control. However a very complex process control may require algorithms and performances beyond the capability of PLCs, very high-speed or precision controls may also require other solutions. This paper describes recent research conducted to implement advanced process controls with the cRIO material from National Instruments (decoupling of MIMO process control, steady state feedback, observer, Kalman filter, etc…). The cRIO systems consist of an embedded real-time controller for communication and processing, a Reconfigurable Field Programmable Array (FPGA) and hot-swappable I/O modules. The paper presents experimental results and the ability of the cRIO to treat complex process control.

Poster

THPPC127

Laser Position Feedback Control at the SwissFEL Test Injector

Feedback Systems

Trivan Pal, Miroslaw Dach, Marta Csatari Divall, Timo Korhonen, Matthias Luethi (PSI, Villigen PSI)

A laser system, capable of generating 200 pC of photoelectrons, is an integral part of the SwissFEL, 250 MeV test injector, at the Paul Scherrer Institute. In addition to the tight limits on the temporal and spatial pulse shapes, it is necessary to have high pointing stability of the laser spot on the cathode, from pulse-to-pulse. Sources of instabilities arise principally from thermal effects coupled with the mechanical mountings of components in the laser optics. In this article we describe an application developed within the context of our EPICS-based control system, for implementing the pointing stability using PID feedback loops. Essential features of the algorithm consist in computing the intensity weighted center-of-gravity coordinates of the laser spot, after pedestal subtraction, from the readout of a 768x1024 pixel CCD-camera, acting as a 'virtual cathode'. The techniques employed to determine and tune the PID-loop constants are described, partially using MATLAB/SIMULINK tools, as well as the results obtained in the presence of the electron beam, as measured with the beam position monitors of the transport optics.

Poster

THPPC128

The Feedback System for Dumping Coherent Betatron and Synchrotron Oscillations of Electron Beam at Dedicated Synchrotron Radiation Source SIBERIA-2.

Feedback Systems

Yevgeniy Fomin, Vladimir Korchuganov, Nikolai Moseiko, Antonina Smygacheva, Yury Fedorovich Tarasov, Alexander Valentinov (NRC, Moscow), Robert Cerne, Rok Hrovatin, Dejan Tinta (I-Tech, Solkan)

The description of feedback system for dumping coherent betatron and synchrotron oscillations of the electron beam which is realized at present time at the dedicated synchrotron radiation storage ring SIBERIA-2 in Kurchatov Institute is presented in the paper. The installation of new feedback system into the main ring SIBERIA-2 will allow to improve the quality of synchrotron radiation beams. In particular, at the beam injection energy (450 MeV) with the help of new feedback system we can increase maximum stored beam current and at operation beam energy (2.5 GeV) the system will provide additional electron beam spatial stabilization. The paper describes new feedback system description, the principle of operation and its technical characteristics. As well, we describe in detail the design of kickers (especially for longitudinal plane) used into the system as they are one of the important feedback system components.

Poster

THPPC129

Evolution of the FERMI@Elettra Fast Beam Based Feedbacks

Feedback Systems

Giulio Gaio, Marco Lonza (Elettra-Sincrotrone Trieste S.C.p.A., Basovizza)

Evolution of the FERMI@Elettra Beam Based Feedbacks FERMI@Elettra is the first seeded Free Electron Laser (FEL) users facility. A number of shot-to-shot feedback loops running synchronously at the machine repetition rate stabilize the electron beam trajectory, energy and bunch length, as well as the trajectory of the laser beams used for the seeding and pump-probe experiments. They are based on a flexible real-time distributed framework integrated into the control system. The interdependence between feedback loops and the need to react coordinately to different operating conditions lead to the development of a real-time supervisor capable of controlling each loop depending on critical machine parameters not directly involved in the feedbacks. The overall system architecture, performance and user interfaces are presented.

Poster

THPPC131

Fast Orbit Feedback Control in Mode Space

Feedback Systems

Sandira Gayadeen, Stephen Duncan (University of Oxford, Oxford)

This paper describes the design and implementation of fast orbit feedback control in mode space. Singular Value Decomposition (SVD) of the response matrix is used to decouple the multiple-input, multiple-output problem into spatial modes that can be controlled independently. In this paper controller dynamics for each spatial mode are selected by considering the disturbance at each frequency within each of the spatial modes. Most orbit feedback systems apply only different gains to each mode however mode space control gives greater flexibility in control design and can lead to enhanced disturbance suppression. Implementation details and performance of the mode space controller on the Booster synchrotron at Diamond Light Source are presented.

Poster

THPPC134

Drift Tube Linac Water Cooling Control System

Feedback Systems

Pilar Sotero Marroquin, John Bernardin, Jack Gioia, Michael A. Inbody (LANL, Los Alamos, New Mexico)

The Los Alamos Neutron Science Center (LANSCE) drift tube linac water cooling and temperature control systems that have been in operation for about 40 years are being refurbished and modernized. These systems maintain temperature control of the drift-tube radio-frequency beam acceleration elements such as the copper RF structures (drift-tubes), frequency tuners, post couplers, tank walls, etc. They also maintain temperature control of beam control elements such as electromagnets and diagnostic instrumentation. New water manifolds, pumps, valves, instrumentation and automated control systems will be installed in 2014. The focus of this presentation is on the hardware and software design and implementation of the automated control system. It consists of a National Instruments Compact Reconfigurable Input/Output (cRIO) system in a three-chassis configuration which provides closed-loop control via its Real Time Controller (RTC) and FPGAs utilizing LabVIEW and Experimental Physics and Industrial Control System (EPICS) Input/Output Controller (IOC) for alarm handling and distributed control.

LA-UR-13-22373

THPPC135

From Pulse to Continuous Wave Operation of TESLA Cryomodules – LLRF System Software Modification and Development

Feedback Systems

Wojciech Cichalewski, Wojciech Jalmuzna, Adam Piotrowski, Konrad Przygoda (TUL-DMCS, Lodz), Valeri Ayvazyan, Julien Branlard, Holger Schlarb, Jacek Sekutowicz (DESY, Hamburg), Jaroslaw Szewinski (NCBJ, Swierk/Otwock)

Higher efficiency of TESLA based free electron lasers (FLASH, XFEL) by means of increased quantity of photon bursts can be achieved using continuous wave operation mode. In order to maintain constant beam acceleration in superconducting cavities and keep short pulse to CW operation transition costs reasonably low some substantial modification of accelerator subsystems are necessary. Changes in: RF power source, cryo systems, electron beam source, etc. have to be also accompanied by adjustments in LLRF system. In this paper challenges for well established pulsed mode LLRF system are discussed (in case of CW and LP scenarios). Firmware, software modifications needed for maintaining high performance of cavities field parameters regulation (for 1Hz CW and LP cryo-module operation) are described. Results from studies of vector sum amplitude and phase control in case of resonators high Ql factor settings (Ql~1.5e7) are shown. Proposed modifications implemented in VME and microTCA (MTCA.4) based LLRF system has been tested during studies at CryoModule Test Bench (CMTB) in DESY. Results from this tests together with achieved regulation performance data are also presented and discussed.

Poster

THPPC136

Stabilizing the Beam Current Split Ratio in TRIUMF's 500 MeV Cyclotron with High Level Software

Feedback Systems

Juan Pon, Ka Sing Lee, Michael Mouat, Thomas Planche, Priscilla Yogendran (TRIUMF, Vancouver)

In the pursuit of a progressively more stable beam current at TRIUMF's 500 MeV Cyclotron there was a proposal to regulate the beam current split ratio for two primary beamlines with a closed-loop feedback. Initial runs have shown promising results and have justified further efforts in that direction. This paper describes the software to provide the closed-loop feedback and future developments.

Poster

THPPC137

Time Domain Simulation Software of the APS Storage Ring Orbit Real-time Feedback System

Feedback Systems

Hairong Shang, John Carwardine, Glenn Decker, Louis Emery, Frank Lenkszus, Nicholas Sereno, Shifu Xu (ANL, Argonne)

The APS storage ring real-time feedback (RTFB) system will be upgraded as part of the APS Upgrade project. The time domain simulation software is implemented to find the best parameters of correctors and evaluate the performance of different system configurations. The software includes two parts: the corrector noise model generator and the RTFB simulation. The corrector noise model generates the corrector noise data that are the input for the RTFB simulation. The corrector noise data are generated from the measured APS BPM turn-by-turn noise data, so that simulation actually reproduces the real machine. This paper introduces the algorithm and high-level software development of the corrector noise model generator and the RTFB simulation.

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Poster

THPPC138

Automation of Cavity Phase Locking in IUAC Superconducting LINAC Booster

Feedback Systems

Rajendra Nath Dutt, Gajanan Kaluram Chowdhury, Subhendu Ghosh, Dinakar Kanjilal, Joydeep Karmakar, Ashutosh Pandey, Padmanava Patra, Abhishek Rai, Amit Roy, Bhuban Kumar Sahu (IUAC, New Delhi)

The superconducting LINAC booster of IUAC consists of five cryostats housing a total of 27 Nb quarter wave resonators (QWRs). The QWRs are phase locked against the master oscillator at a frequency of 97 MHz. Cavity frequency tuning is done by a Helium gas based slow tuner. Presently, the frequency tuning and cavity phase locking is done from the control room consoles. To automate the LINAC operation, an automatic phase locking system has been implemented. The slow tuner gas pressure is automatically controlled in response to the frequency error of the cavity. The fast tuner is automatically triggered into phase lock when the frequency is within the lock window. This system has band implemented sucessfully on a few cavities. The system is now being installed for the remaining cavities of the LINAC booster.

[1]S.Ghosh et al Phys. Rev. ST Accel. Beams 12, 040101 (2009).

Poster

THPPC139

Control Systems Development for the Thomas Jefferson National Accelerator Facility Free Electron Laser & Energy Recovery Linac: Analysis of Trajectory Response Data & Initial Feedback Control Testing

Feedback Systems

Auralee Morin, Sandra Biedron, Stephen Milton (CSU, Fort Collins, Colorado), Stephen Vincent Benson, David Douglas, Chris Tennant (JLAB, Newport News, Virginia)

The output of free electron lasers (FELs) is highly sensitive to perturbations in electron beam parameters, and consequently the development and validation of robust control systems for accelerators is of particular importance. Currently, an effort is underway at Colorado State University (CSU) to develop and implement automated beam control for the Jefferson Laboratory FEL and energy recovery linac. Long-term goals of the project include development and testing of more advanced control and optimization schemes (beginning with neural-network based algorithms). Initial work toward implementing feedback control of the beam trajectory at Jefferson Laboratory, including analysis of the trajectory response and initial feedback control tests, are presented here.

Poster

THPPC140

uTCA Upgrade of the Readout Electronics for the Bunch Arrival Time Monitor at FLASH

Feedback Systems

Jaroslaw Szewinski, Stefan Korolczuk (NCBJ, Swierk/Otwock), Samer Bou Habib (Warsaw University of Technology, Warsaw)

Bunch Arrival time Monitor (BAM) is an electro-optical device used at FLASH accelerator in DESY for the high precision, femtosecond scale, measurements of the moment when electron bunch arrives at the reference point in the machine. The arrival time is proportional to the average bunch energy, and is used to calculate the amplitude correction for RF field control. Correction is sent to the LLRF system in less than 10 us, and this creates a secondary feedback loop (over the regular LLRF one), which is focused on beam energy stabilization - beam feedback. This paper presents new uTCA BAM readout electronics design based on the uTCA.4 – “uTCA for Physics” and FMC mezzanine boards standards. Presented solution is a replacement for existing, VME based BAM readout devices. It provides higher efficiency by using new measurement techniques, better components (such as ADCs, FPGAs etc.), and high bandwidth uTCA backplane. uTCA provides also different topology for data transfers in the crate, which all together opens new opportunities for the improvement of the overall system performance.

THPPC141

Automatic Alignment Upgrade of Advanced Radiographic Capability for the National Ignition Facility*

Feedback Systems

Karl Child Wilhelmsen, Erlan Bliss, Gordon Brunton, Barry Fishler, Roger Lowe-Webb, David McGuigan, Randy Roberts, Michael Rushford (LLNL, Livermore, California)

For many experiments planned on the National Ignition Facility (NIF), high-energy x-ray backlighters are an important diagnostic. NIF will be deploying this year a new Advanced Radiographic Capability (ARC) for generating these high-energy short-pulses. The precision of the Automatic Alignment (AA) for ARC is an important element in the success of the enhancement. A key aspect of the ARC AA is integration of the new alignment capabilities without disturbing the existing AA operations of NIF. Small pointing tolerances of 5 micron precision to a 10 micron target are required. After main amplification the beams are shortened by up to 1,000x in time in the ARC compressor vessel and aimed at backlighter targets in the NIF target chamber. Alignment Stability and Verification of the compressor gratings is critical to ensuring the ARC pulses meet their experimental specifications.

Poster

THPPC142

The Low Level RF Control System of the RF System for PLS-II

Feedback Systems

In-Ha Yu (PAL, Pohang, Kyungbuk)

The RF system for the Pohang Light Source (PLS) storage ring was greatly upgraded for PLS-II project of 400mA, 3.0GeV from 200mA, 2.5GeV. The RF system is installed two super-conducting (SC) RF cavities with two 300kW klystrons amplifiers for beam current of 400mA Maximum to December 2013. The third SRF cavity installation plan in 2014 is also in preparation to increase the storage ring current up to 400mA with all 20 insertion. The RF system is designed to provide stable beam through precise RF phase and amplitude requirements to be less than 0.3% in amplitude and 0.3° in phase deviations. This paper describes the operation status, design details and test results.

I.H.Yu,Y.D.Joo,M.H.Chun,Y.Sohn,I.S.Park,H.J,Park,H.G.Kim,S.H.Shin

Poster

THPPC143

Status of SSRF Fast Orbit Feedback System

Feedback Systems

Chongxian Yin, Bocheng Jiang, Liying Zhao (SINAP, Shanghai)

As a 3rd generation light source, Shanghai Synchrotron Radiation Facility (SSRF) is pushing the requirement of beam stability to sub-micron in the range of DC to 100Hz. A fast orbit feedback system was designed and implemented to satisfy this requirement. In this paper, the layout of SSRF fast orbit feedback system, the structure of its electronics system and its hardware and software subsystems are described. The current status of SSRF fast orbit feedback system is presented.

Contributed Oral

THCOBB01

An Upgraded ATLAS Central Trigger for 2015 LHC Luminosities

Control System Upgrades

Christian Ohm (CERN, Geneva; Stockholm University, Stockholm), Fabrizio Salvatore (University of Sussex, Brighton)

The LHC collides protons at a rate of ~40MHz and each collision produces ~1.5MB of data from the ATLAS detector (~60TB of data per second). The ATLAS trigger system reduces the input rate to a more reasonable storage rate of about 400Hz. The Level1 trigger reduces the input rate to ~100kHz with a decision latency of ~2.5us and is responsible for initiating the readout of data from all the ATLAS subdetectors. It is primarily composed of the Calorimeter Trigger, Muon Trigger, and the Central Trigger Processor (CTP). The CTP collects trigger information from all Level1 systems and produces the Level--1 trigger decision. The LHC has now shutdown for upgrades and will return in 2015 with an increased luminosity and a center of mass energy of 14TeV. With higher luminosities, the number and complexity of Level1 triggers will increase in order to satisfy the physics goals of ATLAS while keeping the total Level1 rates at or below 100kHz. In this talk we will discuss the current Central Trigger Processor, the justification for its upgrade, including the plans to satisfy the requirements of the 2015 physics run at the LHC.

The abstract is submitted on behalf of the ATLAS Collaboration. The name of the presenter will be chosen by the collaboration and communicated upon acceptance of the abstract.

THCOBB02

Recent Hardware and Software Achievements for the European XFEL

Control System Upgrades

Kay Rehlich (DESY, Hamburg)

The European XFEL will deliver photon beams to several users in parallel. In the first phase 5 beam lines for experiments are foreseen. A complex bunch distribution and protection system was developed to handle a huge number of bunches. Furthermore, high performance hardware based on MicroTCA together with efficient software to cope with the data rates, have been demonstrated at FLASH. FLASH operates since many years as a FEL with wavelengths down to 4nm. It is an ideal testbed for new hardware and software to be used later in the XFEL. This paper describes the architecture of the layered system with FPGA feedbacks, synchronized front-end hardware / software and data processing up to slow feedbacks running on central servers.

Contributed Oral

THCOBB03

Automating Control of the Beams for the NASA Space Radiation Laboratory

Control System Upgrades

Kevin A. Brown, Severino Binello, Michael Costanzo, Ted D'Ottavio, James Jamilkowski, John Morris, Seth Nemesure, Robert H. Olsen, Charles Theisen (BNL, Upton, Long Island, New York)

The NASA Space Radiation Laboratory (NSRL) at BNL uses many different beams to do experiments associated with evaluating the possible risks to astronauts in space environments. This facility became operational in 2003 and operates from the AGS Booster synchrotron. In order to simulate the space radiation environment some of these experiments need to make use of beams of various energies. To simulate solar flare events, we implemented the Solar Particle Simulator in 2005. This system put in modifications to the accelerator controls to allow beam energies to be changed automatically, enabling target samples to be irradiated with many energies of the same type of ion, without having to make use of degraders. To simulate Galactic Cosmic events, they need to also be able to automatically change the ions used to irradiate a single sample. This project aims to allow NSRL to change ions as well as beam energies within a very short period of time. To do this requires modifications to existing controls as well as building new controls for a laser ion source. In this paper we describe NSRL, our plans to implement the Galactic Cosmic Event Simulator, and the status of the laser ion source.

THCOBB04

Overview of the ELSA Accelerator Control System

Control System Upgrades

Dennis Proft, Frank Frommberger, Wolfgang C.A. Hillert (ELSA, Bonn)

The Electron Stretcher Facility ELSA provides a beam of polarized electrons with a maximum energy of 3.2 GeV for hadron physics experiments. The in-house developed control system has continuously been improved during the last 15 years of operation. Its top layer consists of a distributed shared memory database and several core applications which are running on a linux host. The interconnectivity to hardware devices is built up with a second layer of the control system operating on PCs and VMEs. High level applications are integrated into the control system using C and C++ libraries. An event based messaging system notifies attached applications about parameter updates in near real-time. The overall system structure and specific implementation details of the control system will be presented.

Contributed Oral

THCOBB05

Switching Solution – Upgrading a Running System

Control System Upgrades

Kevin Tsubota, Jimmy Johnson (W.M. Keck Observatory, Kamuela)

At Keck Observatory, we are upgrading our existing operational telescope control system and must do it with as little operational impact as possible. This paper describes our current integrated system and how we plan to create a more distributed system and deploy it subsystem by subsystem. This will be done by systematically extracting the existing subsystem then replacing it with the new upgraded distributed subsystem maintaining backwards compatibility as much as possible to ensure a seamless transition. We will also describe a combination of cabling solutions, design choices and a hardware switching solution we've designed to allow us to seamlessly switch signals back and forth between the current and new systems.

THCOBB06

CLIC-ACM: Acquisition and Control System

Control System Upgrades

Bartosz Przemysław Bielawski, Frank Locci, Stefano Magnoni (CERN, Geneva)

CLIC (Compact Linear Collider) is a world-wide collaboration to study the next "terascale" lepton collider, relying upon a very innovative concept of two-beam-acceleration. In this scheme, the power is transported to the main accelerating structures by a primary electron beam. The Two Beam Module (TBM) is a compact integration with a high filling factor of all components: RF, Magnets, Instrumentation, Vacuum, Alignment and Stabilization. This paper describes the very challenging aspects of designing the compact system to serve as a dedicated Acquisition & Control Module (ACM) for all signals of the TBM. Very delicate conditions must be considered, in particular radiation doses that could reach several kGy in the tunnel. In such severe conditions shielding and hardened electronics will have to be taken into consideration. In addition, with more than 300 channels per ACM and about 21000 ACMs in total, it appears clearly that power consumption will be an important issue. It is also obvious that digitalization of the signals acquisition will take place at the lowest possible hardware level and that neither the local processor, nor the operating system shall be used inside the ACM.

Contributed Oral

THCOBA01

Evolution of the Monitoring in the LHCb Online System

Control System Infrastructure

Christophe Haen, Enrico Bonaccorsi, Niko Neufeld (CERN, Geneva)

The LHCb online system relies on a large and heterogeneous I.T. infrastructure : it comprises more than 2000 servers and embedded systems and more than 200 network devices. The low level monitoring of the equipment was originally done with Nagios. In 2011, we replaced the single Nagios instance with a distributed Icinga setup presented at ICALEPCS 2011. This paper will present with more hindsight the improvements we observed, as well as problems encountered. Finally, we will describe some of our prospects for the future after the Long Shutdown period, namely Shinken and Ganglia.

Contributed Oral

THCOBA02

Unidirectional Security Gateways: Stronger Than Firewalls

Control System Infrastructure

Andrew Ginter (Waterfall Security Solutions, New York)

In the last half decade, application integration via Unidirectional Security Gateways has emerged as a secure alternative to firewalls. The gateways are deployed extensively to protect the safety and reliability of industrial control systems in nuclear generators, conventional generators and a wide variety of other critical infrastructures. Unidirectional Gateways are a combination of hardware and software. The hardware allows information to leave a protected industrial network, and physically prevents any signal whatsoever from returning to the protected network. The result is that the hardware blocks all online attacks originating on external networks. The software replicates industrial servers to external networks, where the information in those servers is available to end users and to external applications. The software does not proxy bi-directional protocols. Join us to learn how this secure alternative to firewalls works, where and how the tecnhology is deployed routinely, and how all of the usual remote support, data integrity and other apparently bi-directional deployment issues are routinely resolved.

Contributed Oral

THCOBA03

DIAMON2 – Improved Monitoring of CERN's Accelerator Controls Infrastructure

Control System Infrastructure

Wojciech Buczak, Mark Buttner, Felix Ehm, Peter Jurcso, Mitko Mitev (CERN, Geneva)

Monitoring of heterogeneous systems in large organizations like CERN is always challenging. CERN's accelerators infrastructure includes large number of equipment (servers, consoles, FECs, PLCs), some still running legacy software like LynxOS 4 or Red Hat Enterprise Linux 4 on older hardware with very limited resources. DIAMON2 is based on CERN Common Monitoring platform. Using Java industry standards, notably Spring, Ehcache and the Java Message Service, together with a small footprint C++ -based monitoring agent for real time systems and wide variety of additional data acquisition components (SNMP, JMS, JMX etc.), DIAMON2 targets CERN's environment, providing easily extensible, dynamically reconfigurable, reliable and scalable monitoring solution. This article explains the evolution of the CERN diagnostics and monitoring environment until DIAMON2, describes the overall system's architecture, main components and their functionality as well as the first operational experiences with the new system, observed under the very demanding infrastructure of CERN's accelerator complex.

THCOBA04

Evolution Of IT Infrastructure For Fusion Control Systems*

Control System Infrastructure

Timothy Frazier, Phillip Adams (LLNL, Livermore, California)

The National Ignition Facility (NIF) at the Lawrence Livermore National Laboratory is a stadium-sized facility that contains a 192-beam, 1.8-Megajoule, 500-Terawatt, ultraviolet laser system that provides a scientific center to study Inertial Confinement Fusion and matter at extreme energy densities and pressures. An Information Technology (IT) infrastructure consisting of some 2,500 servers, 400 network devices and 700 terabytes of storage provides the foundation for NIF's Control System & Data Archive. Over the past 36 months, NIF's infrastructure has been highly consolidated and segmented. This talk discusses the high-level requirements and design principles which guided this effort, the metrics & monitoring tools used to assess the performance and configuration management of the infrastructure, and the processes and procedures used to migrate to a highly virtualized infrastructure. Elements of NIF's approach that might be applicable at other facilities will be discussed.

Contributed Oral

THCOBA05

Control System Virtualization for the LHCb Online System

Control System Infrastructure

Enrico Bonaccorsi, Luis Granado Cardoso, Niko Neufeld (CERN, Geneva), Francesco Sborzacchi (INFN/LNF, Frascati (Roma))

Virtualization provides many benefits such as more efficiency in resource utilization, less power consumption, better management by centralized control and higher availability. It can also save time for IT projects by eliminating dedicated hardware procurement and providing standard software configurations. In view of this virtualization is very attractive for mission-critical projects like the experiment control-system (ECS) of the large LHCb experiment at CERN. This paper describes our implementation of the control system infrastructure on a general purpose server-hardware based on Linux and the RHEV enterprise clustering platform. The paper describes the methods used , our experiences and the knowledge acquired in evaluating the performance of the setup using test systems, constraints and limitations we encountered. We compare these with parameters measured under typical load conditions in a real production system. We also present the specific measures taken to guarantee optimal performance for the SCADA system (WinCC OA), which is the back-bone of our control system.

Contributed Oral

THCOBA06

Server Virtualization and Deployment Management for the KAT-7 / MeerKAT Control and Monitoring System

Control System Infrastructure

Neilen Marais, Charles de Villiers, Paul Stefanus Swart, Lize Van den Heever (SKA South Africa, Cape Town)

To facilitate efficient deployment and management of the Control and Monitoring software of the South African 7-dish Karoo Array Telescope (KAT-7) and the forthcoming Square Kilometer Array (SKA) precursor, the 64-dish MeerKAT Telescope, server virtualization and automated deployment using a host configuration database is used. The advantages of virtualization is well known; adding automated deployment from a configuration database, additional advantages accrue: Server configuration becomes deterministic, development and deployment environments match more closely, system configuration can easily be version controlled and systems can easily be rebuilt when hardware fails. We chose the Debian GNU/Linux based Proxmox VE hypervisor using the OpenVZ single kernel container virtualization method along with Fabric (a Python ssh automation library) based deployment automation and a custom configuration database. This paper presents the rationale behind these choices, our current implementation and our experience with it, and a performance evalution of OpenVZ and KVM. Tests include a comparison of application specific networking performance over 10GbE using several network configurations.

Contributed Oral

THCOCB01

GPU Accelerated Online Multi-particle Beam Dynamics Simulator for the LANSCE Linac

Knowledge-based Techniques

Xiaoying Pang, Scott Baily, Lawrence Rybarcyk (LANL, Los Alamos, New Mexico)

The Los Alamos Neutron Science Center(LANSCE) linac can provide H+ and H- beam up to 800MeV. Due to a lack of direct beam measurement during high power operation, small adjustments to linac operating set points are made primarily on the basis of beam loss along the linac. To provide more insight on the beam distributions inside the linac and to better understand the effects of machine parameter changes on the beam, we are creating a virtual beam diagnostic tool for use in the LANSCE control room. This tool is a Graphics Processing Unit (GPU) accelerated multi-particle simulator whose beam dynamics algorithms are based upon the ion linac design and simulation code PARMILA. The simulator is designed using modern software design techniques and coded in C++. Using NVIDIA's CUDA technology, the algorithms are recast to fully harvest the computing power of a GPU. Once connected to the EPICS control system, the simulator can track the real time machine parameter changes, convert control set points to model quantities and in fast response update the simulation. Details regarding the code structure design, GPU programming and performance, code validation and applications will be presented.

THCOCB02

The Role of Data Driven Models in Optimizing the Operation of the National Ignition Facility*

Knowledge-based Techniques

Kathleen McCandless, Jean-Michel Di Nicola, Sham Dixit, Eyal Feigenbaum, Ron House, Ken Jancaitis, Kai LaFortune, Brian MacGowan, Charles Orth, Richard Sacks, Michael J. Shaw, Clay Widmayer, Steven Yang (LLNL, Livermore, California)

The Virtual Beam Line (VBL) code is essential to operate, maintain and validate the design of laser components to meet the performance goals at Lawrence Livermore National Laboratory's National Ignition Facility (NIF). The NIF relies upon the Laser Performance Operations Model (LPOM), whose physics engine is the Virtual Beam Line (VBL) code, to automate the setup of the laser by simulating the laser energetics of the as-built system. VBL simulates paraxial beam propagation, amplification, aberration and modulation, nonlinear self-focusing and focal behavior. Each of the NIF's 192 beam lines are modeled in parallel on the LPOM Linux compute cluster during shot setup and validation. NIF achieved a record 1.8 MJ shot in July 2012, and LPOM (with VBL) was key to achieving the requested pulse shape. We will discuss some examples of how the VBL physics code is used to model the laser phenomena and operate the NIF laser system.

Contributed Oral

THCOCB03

Fast Automatic Beam-based Alignment of the LHC Collimation System

Knowledge-based Techniques

Gianluca Valentino, Ralph Wolfgang Assmann, Roderik Bruce, Stephen Jackson, Stefano Redaelli, Belen Salvachua, Daniel Wollmann, Christos Zamantzas (CERN, Geneva), Nicholas Sammut (University of Malta, Msida)

Maximum beam cleaning efficiency and LHC machine protection is provided when the collimator jaws are properly adjusted at well-defined distances from the circulating beams. The required settings for different locations around the 27 km long LHC rings are determined through beam-based collimator alignment, which uses feedback from Beam Loss Monitoring (BLM) system. After the first experience with beam, a systematic automation of the alignment procedure was performed. This paper gives an overview of the algorithms developed to speed up the alignment and reduce human errors. The experience accumulated in four years of operation, from 2010 to 2013 is reviewed.

THCOCB04

Using an Expert System for Accelerators Tuning and Automation of Operating Failure Checks

Knowledge-based Techniques

Majid Ounsy, Sandra Pierre-Joseph Zephir (SOLEIL, Gif-sur-Yvette), Erwin De Ley (iSencia Belgium, Gent)

Today at SOLEIL abnormal operating conditions cost many human resources involved in plenty of manual checks on various different tools interacting with different service layers of the control system (archiving system, device drivers, etc.) before recovering a normal accelerators operation. These manual checks are also systematically redone before each beam shutdown and restart. All these repetitive tasks are very error prone and lead to a tremendous lack in the assessment of beam delivery to users. Due to the increased process complexity and the multiple unpredictable factors of instability in the accelerators operating conditions, the existing diagnosis tools and manual check procedures reached their limits to provide practical reliable assistance to both operators and accelerators physicists. The aim of this paper is to show how the advanced expert system layer of the PASERELLE* framework, using the CDMA API** to access in a uniform way all the underlying data sources provided by the control system, can be used to assist the operators in detecting and diagnosing abnormal conditions and thus providing safe guards against these unexpected accelerators operation conditions.

*http://www.isencia.be/services/passerelle **https://code.google.com/p/cdma/

THCOCB05

The LHCb Online Luminosity Control and Monitoring

Feedback Systems

Richard Jacobsson, Reyes Alemany-Fernandez, Fabio Follin (CERN, Geneva)

The LHCb experiment searches for New Physics by precision measurements in heavy flavour physics. The optimization of the data taking conditions relies on accurate monitoring of the instantaneous luminosity, and many physics measurements rely on accurate knowledge of the integrated luminosity. Most of the measurements have potential systematic effects associated with pileup and changing running conditions. To cope with these while aiming at maximising the collected luminosity, a control of the LHCb luminosity was put in operation. It consists of an automatic real-time feedback system controlled from the LHCb online system which communicates directly with an LHC application which in turn adjusts the beam overlap at the interaction point. It was proposed and tested in July 2010 and has been in routine operation during 2011-2012. As a result, LHCb has been operating at well over four times the design pileup, and 95% of the integrated luminosity has been recorded within 3% of the desired luminosity. This paper motivates and describes the implementation and the experience with the online luminosity monitoring and control, including the mechanisms to perform the luminosity calibrations.

THCOCA01

A Design of Sub-Nanosecond Timing and Data Acquisition Endpoint for LHAASO Project

Timing and Sync

Weibin Pan, Qiang Du, Guanghua Gong, Hongming Li, Jianmin Li, Yinong Liu, Beibei Shao (Tsinghua University, Beijing)

The particle detector array (KM2A) of Large High Altitude Air Shower Observatory (LHAASO) project consists of 5631 electron and 1221 muon detection units over 1.2 square km area. To reconstruct the incident angle of cosmic ray, sub-nanosecond time synchronization must be achieved. The White Rabbit (WR) protocol is applied for its high synchronizes precision, automatic delay compensation and intrinsic high band-width data transmit capability. This paper describes the design of a sub-nanosecond timing and data acquisition endpoint for KM2A. It works as a FMC mezzanine mounted on detector specific front-end electronic boards and provides the WR synchronized clock and timestamp. The endpoint supports EtherBone protocol for remote monitor and firmware update. Moreover, a hardware UDP stack is integrated in the FPGA to pack and transmit raw data from detector electronics to readout network. Preliminary test demonstrates a timing precision better than 100ps (RMS) with UDP throughput over 500Mbps.

* The authors are with Key Laboratory of Particle and Radiation Imaging, Department of Engineering Physics, Tsinghua University, Beijing, China, 100084 *

pwb.thu@gmail.com

THCOCA02

White Rabbit Status and Prospects

Timing and Sync

Javier Serrano, Grzegorz Daniluk, Maciej Marek Lipinski, Erik Van der Bij, Tomasz Wlostowski (CERN, Geneva), Dietrich Hans Beck, Jan Hoffmann, Mathias Kreider, Cesar Prados, Stefan Rauch, Wesley W. Terpstra, Marcus Zweig (GSI, Darmstadt)

The White Rabbit (WR) project started off to provide a sequencing and synchronization solution for the needs of CERN and GSI. Since then, many other users have adopted it to solve problems in the domain of distributed hard real-time systems. The paper discusses the current performance of WR hardware, along with present and foreseen applications. It also describes current efforts to standardize WR under IEEE 1588 and recent developments on reliability of timely data distribution. Then it analyzes the role of companies and the commercial Open Hardware paradigm, finishing with an outline of future plans.

Contributed Oral

THCOCA03

High-Precision Timing of Gated X-Ray Imagers at the National Ignition Facility*

Timing and Sync

Steven Glenn, Perry Bell, Laura Robin Benedetti, Mark Bowers, David Bradley, Brad Golick, Joe Holder, Dan Kalantar, Shahab Firasat Khan, Natalia Simanovskaia (LLNL, Livermore, California)

The National Ignition Facility (NIF) at the Lawrence Livermore National Laboratory is a stadium-sized facility that contains a 192-beam, 1.8-Megajoule, 500-Terawatt, ultraviolet laser system together with a 10-meter diameter target chamber. We describe techniques used to synchronize data acquired by gated x-ray imagers with laser beams at the National Ignition Facility (NIF). Synchronization is achieved by collecting data from multiple beam groups with spatial and temporal separation in a single NIF shot. By optimizing the experimental setup and data analysis, repeatable measurements of 15ps or better have been achieved. This demonstrates that the facility timing system, laser, and target diagnostics, are highly stable over year-long time scales.

Contributed Oral

THCOCA04

Upgrade of Event Timing System at SuperKEKB

Timing and Sync

Hiroshi Kaji, Kazuro Furukawa, Masako Iwasaki, Eiji Kikutani, Fusashi Miyahara, Tatsuro Nakamura, Masaaki Suetake, Makoto Tobiyama (KEK, Ibaraki)

The timing system of the KEKB accelerator will be upgraded for the SuperKEKB project. One of difficulties at SuperKEKB is the positron injection. It takes more than 40ms since positron pulse must be stored at newly constructed damping ring for at least 40ms. Timings of whole accelerators are precisely synchronized for such a long period. We must manage highly frequent injections even with this situation. Typically beam pulse is delivered to one of rings at every 20ms. Besides, the new system must have a capability of realtime selection of injection RF-bucket - we call it “Bucket Selection” at KEKB - for equalizing bunch current at main rings. Bucket Selection also will be upgraded to synchronize buckets of damping ring and those of main rings. This includes the expansion of maximum delay time up to 2ms and the pulse-by-pulse shift of RF phase at 2nd half of injection Linac. We plan to upgrade the Event Timing System from “2-layer type”, which simply connect one generator and one receiver, to “cascade type” for satisfying the new injection requirements. We report the basic design of the new timing system and recent studies about key elements of Event Timing System instruments.

Contributed Oral

THCOCA05

Integrated Timing and Triggering System Management Software

Timing and Sync

Jean-Jacques Dupas, Pierre Raybaut (CEA, Arpajon), Jean Paul Arnoul (CEA, LE BARP cedex)

The French Commissariat à l'Énergie Atomique et aux Énergies alternatives (CEA) is currently building the Laser Megajoule (LMJ). This facility is designed to deliver laser energy to targets for high energy density physics experiments, including fusion experiments. The Integrated Timing and Triggering System (ITTS) is one of the critical LMJ components, in charge of timing distribution for synchronizing the laser beams and triggering the shot data acquisitions. The LMJ ITTS Control System provides a single generic interface to its users at the Supervisory level, built around the key concept of "Synchronized Channels Group", a set of delay channels triggered simultaneously. Software common components provide basic mechanisms: communication with its users, channel registration… User-defined delays are specified with respect to a given reference(target chamber center, quadruplet or beam reference times), these delays are then translated into hardware delays according to different parameters such as electronic cards temperatures(for thermal drift correction) and transit delays. Equipments are mainly off-the-shelf timing equipments delivering trigger signals with jitter down to 15ps rms.

Invited Oral

FRPLAB01

Java Embedded Software: Disruptions Ahead

Keynote

Peter Doolan (Oracle, Redwood Shores)

The devices supporting our daily activities are becoming more sophisticated and better connected at an astonishing rate. The Internet of Things is driving an explosion of devices and data, revolutionizing industry, science and commerce. Devices are smarter, faster, and better connected. To support these trends, increasingly sophisticated embedded devices must be developed more quickly, yet must also be secure, robust, and maintainable. Java technology is ideally suited to support this complexity, whether embedded in a lightweight, low-cost secure ID card, supporting multiple systems of a large reactor, or any conceivable application between. This presentation will cover the evolution of the Java language and it's applicability to control systems specialists. Increasingly Java is being adopted within control systems due to its scalability, robustness, portability and developer productivity features. Peter will cover in detail the new capabilities of Java and provide an overview of the roadmap ahead; toward the Internet of Things.

FRCOAAB01

CSS Scan System

Experiment Control

Kay-Uwe Kasemir, Xihui Chen (ORNL, Oak Ridge, Tennessee)

Automation of beam line experiments requires more flexibility than the control of an accelerator. The sample environment devices to control as well as requirements for their operation can change daily. Tools that allow stable automation of an accelerator are not practical in such a dynamic environment. On the other hand, falling back to generic scripts opens too much room for error. The Scan System offers an intermediate approach. Scans can be submitted in numerous ways, from pre-configured operator interface panels, graphical scan editors, scripts, the command line, or a web interface. At the same time, each scan is assembled from a well-defined set of scan commands, each one with robust features like error checking, time-out handling and read-back verification. Integrated into Control System Studio (CSS), scans can be monitored, paused, modified or aborted as needed. We present details of the implementation and first usage experience.

Contributed Oral

FRCOAAB02

Karabo: An Integrated Software Framework Combining Control, Data Management, and Scientific Computing Tasks

Experiment Control

Burkhard Heisen, Djelloul Boukhelef, Sergey George Esenov, Irina Kozlova, Luis Maia, Andrea Parenti, Janusz Szuba, Kerstin Weger, Krzysztof Wrona, Christopher Youngman (XFEL.EU, Hamburg)

The expected very high data rates and volumes at the European XFEL demand an efficient concurrent approach of performing experiments. Data analysis must already start whilst data is still being acquired and initial analysis results must immediately be usable to re-adjust the current experiment setup. We have developed a software framework, called Karabo, which allows such a tight integration of these tasks. Karabo is in essence a pluggable, distributed application management system. All Karabo applications (called "Devices") have a standardized API for self-description/configuration, program-flow organization (state machine), logging and communication. Central services exist for user management, access control, data logging, configuration management etc. The design provides a very scalable but still maintainable system that at the same time can act as a fully-fledged control or a highly parallel distributed scientific workflow system. It allows simple integration and adaption to changing control requirements and the addition of new scientific analysis algorithms, making them automatically and immediately available to experimentalists.

FRCOAAB03

Experiment Control and Analysis for High-Resolution Tomography

Experiment Control

Nicholas Schwarz, Francesco De Carlo, Arthur Glowacki, John Paul Hammonds, Faisal Khan, Ke Yue (ANL, Argonne)

X-ray Computed Tomography (XCT) is a powerful technique for imaging 3D structures at the micro- and nano-levels. Recent upgrades to tomography beamlines at the APS have enabled imaging at resolutions up to 20 nm at increased pixel counts and speeds. As detector resolution and speed increase, the amount of data that must be transferred and analyzed also increases. This coupled with growing experiment complexity drives the need for software to automate data acquisition and processing. We present an experiment control and data processing system for tomography beamlines that helps address this concern. The software, written in C++ using Qt, interfaces with EPICS for beamline control and provides live and offline data viewing, basic image manipulation features, and scan sequencing that coordinates EPICS-enabled apparatus. Post acquisition, the software triggers a workflow pipeline, written using ActiveMQ, that transfers data from the detector computer to an analysis computer, and launches a reconstruction process. Experiment metadata and provenance information is stored along with raw and analyzed data in a single HDF5 file.

Contributed Oral

FRCOAAB04

Data-Driven Campaign Management at the National Ignition Facility (NIF)*

Experiment Control

Douglas Edward Speck, Bruce Conrad, Steve Ronald Hahn, Paul Reisdorf, Scott Reisdorf (LLNL, Livermore, California)

The Campaign Management Tool Suite (CMT) provides tools for establishing the experimental goals, achieving reviews and approvals, and ensuring readiness for a NIF experiment. Over the last 2 years, CMT has significantly increased the number of diagnostics that supports to around 50. Meeting this ever increasing demand for new functionality has resulted in a design whereby more and more of the functionality can be specified in data rather than coded directly in Java. To do this support tools have been written that manage various aspects of the data and to also handle potential inconsistencies that can arise from a data driven paradigm. For example; drop down menus are specified in the Part and Lists Manager, the Shot Setup reports that lists the configurations for diagnostics are specified in the database, the review tool Approval Manager has a rules engine that can be changed without a software deployment, various template managers are used to provide predefined entry of hundreds parameters and finally a stale data tool validates that experiments contain valid data items. The trade-offs, benefits and issues of adapting and implementing this data driven philosophy will be presented.

Contributed Oral

FRCOAAB05

JOGL Live Rendering Techniques in Data Acquisition Systems

Experiment Control

Cristina Cocho, Franck Cecillon, Abdelali Elaazzouzi, Yannick Le Goc, Jerome Locatelli, Paolo Mutti, Helene Ortiz, Jacques Ratel (ILL, Grenoble)

One of the major challenges in instrument control is to provide a fast and scientifically correct representation of the data collected by the detector through the data acquisition system. Despite the availability nowadays of a large number of excellent libraries for off-line data plotting, the real-time 2D and 3D data rendering still suffers of performance issues related namely to the amount of information to be displayed. The current paper describes new methods of image generation (rendering) based on JOGL library used for data acquisition at the Institut Laue-Langevin (ILL) on instruments that require either high image resolution or large number of images rendered at the same time. These new methods involve the definition of data buffers and the usage of the GPU memory, technique known as Vertex Buffer Object (VBO). Implementation of different modes of rendering, on-screen and off-screen, will be also detailed.

Contributed Oral

FRCOAAB06

A Common Software Framework for FEL Data Acquisition and Experiment Management at FERMI@Elettra

Experiment Control

Roberto Borghes, Valentina Chenda, Alessio Curri, Georgios Kourousias, Marco Lonza, Milan Prica, Roberto Pugliese (Elettra-Sincrotrone Trieste S.C.p.A., Basovizza), Gesner Passos (STFC/RAL/ISIS, Chilton, Didcot, Oxon)

After installation and commissioning, the Free Electron Laser facility FERMI@Elettra is now open to users. As of December 2012, three experimental stations dedicated to different scientific areas, are available for user research proposals: Low Density Matter (LDM), Elastic & Inelastic Scattering (EIS), and Diffraction & Projection Imaging (DiProI). A flexible and highly configurable common framework has been developed and successfully deployed for experiment management and shot-by-shot data acquisition. This paper describes the software architecture behind all the experiments performed so far; the combination of the EXECUTER script engine with a specialized data acquisition device (FERMIDAQ) based on TANGO. Finally, experimental applications, performance results and future developments are presented and discussed.

FRCOAAB07

Operational Experience with the ALICE Detector Control System

Experiment Control

Peter Chochula, Andre Augustinus, Mateusz Lechman, Peter Rosinsky (CERN, Geneva), Ombretta Pinazza (CERN, Geneva; INFN-Bologna, Bologna), Alexander Kurepin (CERN, Geneva; RAS/INR, Moscow)

The first LHC run period, lasting 4 year brought exciting physics results and new insight into the mysteries of the matter. One of the key components in this achievements were the detectors, which provided unprecedented amounts of data of the highest quality. The control systems, responsible for their smooth and safe operation, played a key role in this success. The design of the ALICE Detector Control System (DCS) started more than 12 years ago. High level of standardization and pragmatic design led to a reliable and stable system, which allowed for efficient experiment operation. In this presentation we summarize the overall architectural principles of the system, the standardized components and procedures. The original expectations and plans are compared with the final design. Focus is given on the operational procedures, which evolved with time. We explain, how a single operator can control and protect a complex device like ALICE, with millions of readout channels and several thousand control devices and boards. We explain what we learned during the first years of LHC operation and which improvements will be implemented to provide excellent DCS service during the next years.

Contributed Oral

FRCOAAB08

The LIMA Project Update

Experiment Control

Sébastien Petitdemange, Laurent Claustre, Alejandro Homs, Roberto Homs Regojo, Emmanuel Papillon (ESRF, Grenoble)

LIMA, a Library for Image Acquisition, was developed at the ESRF to control high-performance 2D detectors used in scientific applications. It provides generic access to common image acquisition concepts, from detector synchronization to online data reduction, including image transformations and storage management. An abstraction of the low-level 2D control defines the interface for camera plugins, allowing different degrees of hardware optimizations. Scientific 2D data throughput up to 250 MB/s is ensured by multi-threaded algorithms exploiting multi-CPU/core technologies. Eighteen detectors are currently supported by LIMA, covering CCD, CMOS and pixel detectors, and video GigE cameras. Control system agnostic by design, LIMA has become the de facto 2D standard in the TANGO community. An active collaboration among large facilities, research laboratories and detector manufacturers joins efforts towards the integration of new core features, detectors and data processing algorithms. The LIMA 2 generation will provide major improvements in several key core elements, like buffer management, data format support (including HDF5) and user-defined software operations, among others.

FRCOBAB01

Feedback and Feed-Forward Systems Improve the Reliability and Performance of the Heidelberg Ion Beam Therapy Center

Feedback Systems

Thomas Haberer, Stephan Brons, Eike Feldmeier, Jakob Naumann, Ralf Erich Panse, Andreas Peters, Christian Schömers (HIT, Heidelberg)

The linac-synchrotron-system of the Heidelberg Ion Beam Therapy Centre (HIT) routinely delivers pencil beams to the dose delivering rasterscanning devices at 3 treatment rooms, including the worldwide first scanning ion gantry and 1 experimental cave. At HIT the quality-assured library of pencil beam parameters covers roughly 100.000 combinations of the ion, energy, intensity and beam size. In addition, the world-wide first scanning ion gantry allows for 0.1 degree entrance angle selection. Each patient-specific treatment plan defines a subset of these pencil beams being subsequently requested during the dose delivery. Aiming at shortened irradiation times, improved reliability and optimum dose-delivery precision an upgrade program making heavy use of feed-forward as well as feed-back mechanisms is under way. Driven by patient-specific data out of the scanning beam dose delivery process central synchrotron and beam transfer line components are coupled to the therapy control system in order to tailor the beam characteristics in real-time to the clinical requirements. The paper will discuss the functional upgrades and report about the impact on the medical application at HIT.

FRCOBAB02

Ultra-fast Longitudinal Feedbacks for the European XFEL

Feedback Systems

Holger Schlarb, Sven Pfeiffer, Christian Schmidt (DESY, Hamburg)

Free Electron Lasers, like the European XFEL, a 3.5 km long accelerator complex under construction in Hamburg, put stringent demands on the stabilization and the control of the electron beam properties. The pulsed superconducting RF accelerator of the European XFEL can provide more than thirty thousand Angstrom wavelength laser pulses per second to various types of X-ray user experiments. Ideally, these laser pulses have constant properties from shot-to-shot, such as central wavelength, duration, arrival-time and intensity. However, to meet these goals, multiple slow- and fast-feedback loops acting on the RF system have to operate in concert. In this paper, the new MTCA.4 based hardware architecture, MIMO FPGA feedback algorithm, and the cascaded feedback architecture based on RF-signals and beam based measurements relative to a femtosecond synchronization system is presented.

FRCOBAB03

The New Multicore Real-time Control System of the RFX-mod Experiment

Feedback Systems

Gabriele Manduchi, Adriano Luchetta, Cesare Taliercio (Consorzio RFX, Padova)

The real-time control system of RFX-mod nuclear fusion experiment has been in operation since 2004 and has been used to control the plasma position and the MagnetoHydroDinamic (MHD) modes. Over time new and more computing demanding control algorithm shave been developed and the system has been pushed to its limits. Therefore a complete re-design has been carried out in 2012. The new system adopts radically different solutions in Hardware, Operating System and Software management. The VME PowerPc CPUs communicating over Ethernet used in the former system have been replaced by a single multicore server. The VxWorks Operating System , previously used in the VME CPUs has now been replaced by Linux MRG, that proved to behave very well in real-time applications. The previous framework for control and communication has been replaced by MARTe, a modern framework for real-time control gaining interest in the fusion community. Thanks to the MARTe organization, a rapid development of the control system has been possible. In particular, its intrinsic simulation ability of the framework gave us the possibility of carrying out most debugging in simulation, without affecting machine operation.

FRCOBAB04

Beam Feedback System Challenges at SuperKEKB Injector Linac

Feedback Systems

Kazuro Furukawa, Ryo Ichimiya, Masako Iwasaki, Hiroshi Kaji, Fusashi Miyahara, Tatsuro Nakamura, Masanori Satoh, Tsuyoshi Suwada (KEK, Ibaraki)

SuperKEKB electron/positron asymmetric collider is under construction in order to elucidate new physics beyond the standard model of elementary particle physics. This will be only possible by a precise measurement with 40-times higher luminosity compared with that of KEKB. The injector linac should be upgraded to enable a 20-times smaller beam size of 50 nm at the collision point and twice-larger stored beam current with short lifetime of 10 minutes. At the same time two light source rings, PF and PF-AR, should be filled in top-up injection mode. To this end the linac should be operated with precise beam controls. Dual-layer controls with EPICS and MRF event systems are being enhanced to support precise pulse-to-pulse beam modulation (PPM) at 50Hz. A virtual accelerator (VA) concept is introduced to enable a single linac behaving as four VAs switched by PPM, where each VA corresponds to one of four top-up injections into storage rings. Each VA should be accompanied with independent beam orbit and energy feedback loops to maintain the required beam qualities. The requirements from SuperKEKB HER and LER for beam emittance, energy-spread, and charge are especially challenging.

FRCOBAB05

Distributed Feedback Loop Implementation in the RHIC Low Level RF Platform

Feedback Systems

Freddy Severino, Margaret Harvey, Thomas Hayes, Geetha Narayan, Kevin Smith (BNL, Upton, Long Island, New York)

We present a brief overview of distributed feedback systems based on the RHIC LLRF Platform. The general architecture and sub-system components of a complex feedback system are described, emphasizing the techniques and features employed to achieve deterministic and low latency data and timing delivery between local and remote sub-systems: processors, FPGA fabric components and the high level control system. In particular, we will describe how we make use of the platform to implement a widely distributed multi-processor and FPGA based longitudinal damping system, which relies on task sharing, tight synchronization and integration to achieve the desired functionality and performance.

Contributed Oral

FRCOBAB07

Model Independent Feedback Control

Feedback Systems

Alexander Scheinker, Xiaoying Pang, Lawrence Rybarcyk (LANL, Los Alamos, New Mexico), Spencer Jake Gessner (SLAC, Menlo Park, California)

We present a new*, model-independent scheme for automatically, simultaneously tuning coupled particle accelerator components, which is able to guide the trajectory of multiple parameters (such as current, voltage, magnet, etc... settings), to minimize a measurable, but analytically unknown map (beam loss measurements). The main advantages of the method are: 1) ability to handle unknown systems, 2) known and bounded parameter update rates, 3) analytic convergence and stability conditions, and 4) simple digital implementation through EPICS. Being model independt, this scheme may be useful as a fine-tuning supplement for existing accelerator control systems, to handle uncertainty such as coupling, thermal cycling, misalignments, etc. An in-hardware proof of principle of this and a similar**, previous scheme are briefly described, followed by a multi-particle simulation demonstrating the scheme's ability to simultaneously tune 22 quadrupole magnets in the Los Alamos Neutron Science Center (LANSCE) Linear Accelerator's transport region. A detailed outline of implementation in software for optimization, and in hardware for feedback based control/tuning for general systems is given.

* A. Scheinker, Ph.D. thesis, University of California, San Diego, November, 2012. [http://www.alexscheinker.com/Alexander_Scheinker_Thesis_w_Magnets.pdf]

Oral Preferred

FROAB01

Technical Summary and Wrap up of ICALEPCS 2013

Opening and Closing Remarks

Peg Ann Folta (LLNL, Livermore, California)

Technical Summary and Wrap up of ICALEPCS 2013 will be presented.

Oral Preferred

FROAB02

ICALEPCS 2015

Opening and Closing Remarks

Lou Corvetti (ASCo, Clayton, Victoria)

Overview of next ICALEPCS 2015 Conference in Melbourne Australia will be presented.

FROAB03

Oral Preferred

ICALEPCS 2017

Opening and Closing Remarks

To be announced

Update on the ICALEPCS 2017 venue that has now been selected.

FROAB04

Oral Preferred

Final Remarks

Opening and Closing Remarks

Christopher David Marshall (LLNL, Livermore, California)

Final Remarks will be presented. Thank you for attending ICALEPCS 2013!

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Heisen	B.C.	FRCOAAB02, TUPPC105
Hendricks	B.	TUPPC070
Hensler	O.	THPPC072
Heron	M.T.	MOPPC116, MOPPC104, THMIB07
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Tuesday Session: **TU** ______________________________

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Thursday Session: **TH** ____

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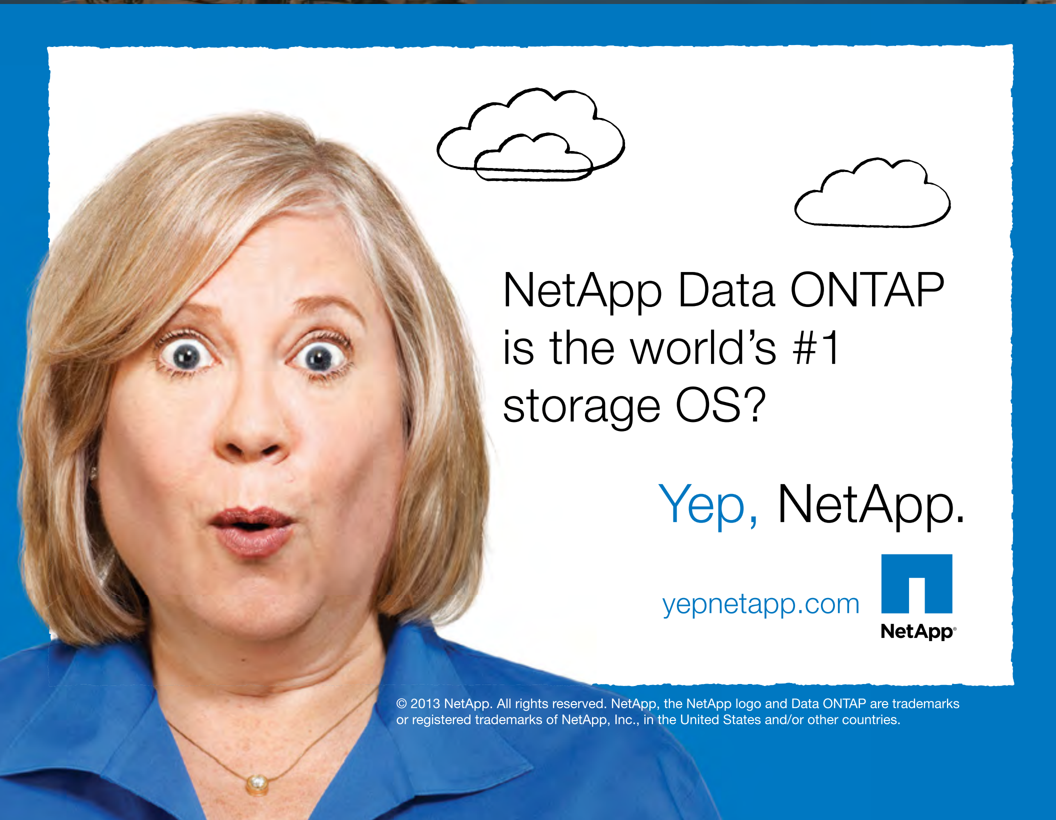
Painted Ladies *near Alamo Square, San Francisco, California*

Powell, Hyde and Beach Cable Car *near Lombard Street, San Francisco, California*
www.cablecarmuseum.org

Palace of Fine Arts *3301 Lyon Street, San Francisco, California*
From 1915 Panama-Pacific International Exposition. The Palace of Fine Arts is the only structure from the fair today that remains on the old fair grounds.



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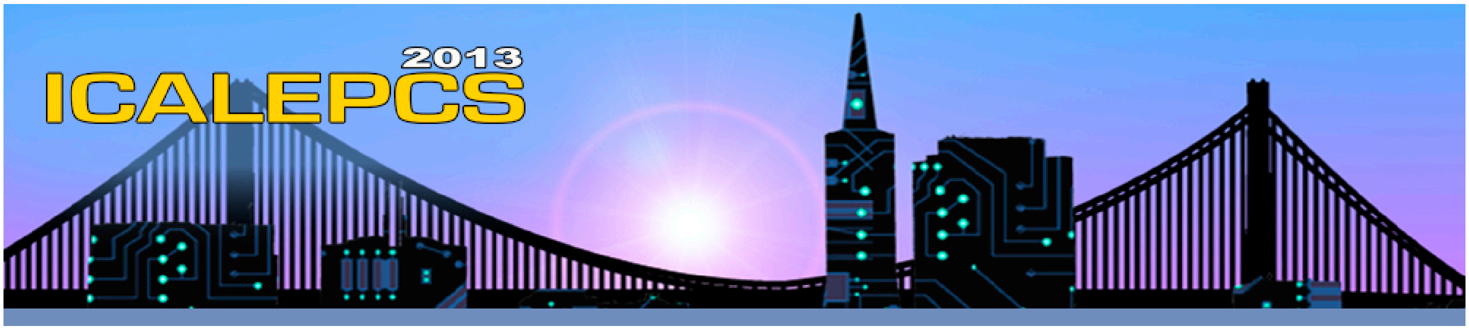

Conference Errata

Keynote

FRPLAB, Henrik Stahl replaces Peter Doolan, “Java Embedded Software: Disruptions Ahead”

Contributed Oral

- Co-presenter: Francoise Gougnaud, TUCOBAB01
- Updated Title: “LMJ Synchronization System”, THCOCA05
- New Presenter: Daniel Potter, THCOAAB07
- New: THCOBB06
- Moved: FRCOBAB06 to THCOCB05
- Withdrawn: FRCOAAB09

Mini Oral

- New: MOMIB04
- Withdrawn: MOMIB04, THMIB02, THMIB06, THMIB08

Posters

- New Presenters: Santanu Sahoo, THPPC138, THPPC117; Phil Adams THPPC019
- New Title: ZIOL – The Ultimate Linux I/O Framework”, MOPPC141
- Withdrawals: MOPPC010, MOPPC011, MOPPC012, MOPPC060, MOPPC070, MOPPC089, MOPPC091, MOPPC102, MOPPC125, MOPPC134, MOPPC135, MOPPC136, MOPPC147, MOPPC151, MOPPC154, TUPPC016, TUPPC033, TUPPC075, TUPPC079, TUPPC093, TUPPC097, TUPPC099, TUPPC105, THPPC028, THPPC029, THPPC030, THPPC038, THPPC039, THPPC041, THPPC042, THPPC059, THPPC068, THPPC069, THPPC075, THPPC088, THPPC102, THPPC126, THPPC127, THPPC132, THPPC133

Consult the ICALEPCS 2013 web site
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for the most up-to-date Conference Program details