ICALEPCS 2011

13th International Conference on Accelerator and Large Experimental Physics Control Systems
10-14th October 2011, WTC Grenoble, France.

CONFERENCE SUMMARY

Sunday 9th -

Pre Conference Workshops

09:00-17:30	Open Hardware
09:00-17:30	Common Data Model
09:00-17:30	TANGO
09:00-17:30	Cyber Security
09:00-17:30	jddd
09:00-17:30	FPGA Programming tutorials

Monday 10th

08:30-10:00	Opening Session with: G. Tonelli & P.Tafforeau
10:30-12:15	Status Reports 1
13:30-15:00	Project Management
15:30-16:20	Process Tuning and Feedback Systems
16:30-18:00	Poster Session 1
17:00-17:30	Mini Orals A
17:00-17:30	Mini Orals B

Tuesday 11th

08:30-10:15	Software Technology: M. Völter
10:45-12:30	Hardware 1
13:30-18:00	Tutorials
14:00-15:30	Control System Upgrade
16:00-17:30	Status Reports 2
17:30-18:00	Reports from the Workshops
19:00-20:30	Round Table with B. Eckel, M. Völter, J. Truchard, and V. Baggiolini

Wednesday 12th

08:30-10:25	Software Technology: B. Eckel
10:45-12:15	Infrastructure Management
10:45-12:15	Hardware 2
12:15-12:45	Reports from the Workshops
13:30-15:00	Poster Session 2
13:30-14:00	Mini Orals C
13:30-14:00	Mini Orals D

Thursday 13th

08:30-10:15	Integration of Industrial Devices: Dr. J. Truchard
10:45-12:30	Quality Assurance: M. Livny
10:45-12:30	Operation Tools
14:00-15:30	Data Management 1
14:00-15:30	Embedded + Real Time 1
16:00-16:30	Data Management 2
16:00-17:40	Embedded + Real Time 2

Friday 14th

08:30-10:15	Security and Safety Systems: L. Hatton
10:45-12:15	Process Tuning and Feedback Systems 2
10:45-12:30	Distributed Computing
13:30-14:45	Towards the Future
14:45-15:45	Closing Session

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ESRF

ICALEPCS 2011

Conference
Guide +
Abstracts

The conference guide will be available online at:

http://icalepcs2011.esrf.eu

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- Spring 8
- Struck Innovative Systeme GmbH
- Ville de Grenoble

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Chairman’s welcome

***Bonjour et bienvenue à ICALEPCS 2011!* Welcome to ICALEPCS 2011!**

It is our pleasure to welcome ICALEPCS to France for the first time. Since its beginnings in Villars sur Olons in Switzerland in 1987 the ICALEPCS series of conferences has grown in size and importance to be today's main international controls conference in the field of accelerators and physics experiments. This year ICALEPCS will have a record attendance of over 500 participants! It is an honour to chair such a dynamic conference. My personal involvement in ICALEPCS started in 1991 at the ICALEPCS 1991 held in Tsukuba, Japan. The control systems presented then were quite different from today. In those days the use of Ethernet, PC’s and Unix were considered innovative. Today network embedded devices, Linux and PC’s are taking over many control systems. Previously no control system standard existed. Today EPICS and TANGO are considered to be de facto standards and are used in many institutes. The ICALEPCS series of conference has played a strong role in creating and promoting these standards. The constant change in the field promises to make ICALEPCS 2011 another very interesting conference. We expect to see new standards emerging in the fields of hardware and software.

The Local Organising Committee has been working for over two years on the preparation of ICALEPCS 2011. It has been a pleasure to work with such a highly motivated team. As chairman I want to thank them for their enthusiasm, hard work and professionalism. The LOC has done a great job offering the delegates a chance to discover some of the best of local French culture during the social programmeme.

I would like to thank our Sponsors and Exhibitors for their support, both financial and moral. Their presence at the conference is a sign of the dynamic environment we are working in. A special word of thanks to our biggest sponsor - SPRING8, organisers of ICALEPCS 2009. Japan has been foremost in our thoughts following the worst tsunami in living memory in March 2011 and the consequences thereof.

I would like to thank the ESRF, for hosting ICALEPCS and for all the support they have given us while organising the conference. I encourage delegates to take a look at the October issue of the ESRF Newsletter – the cover topic is control systems.

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

- **Enjoy -** the conference, Grenoble and France!
- **Discover -** new colleagues, ideas, and technologies!
- **Collaborate -** on existing and new projects!

Andy Götz

Director General's welcome

It is my pleasure and honour to welcome you to the ESRF and to Grenoble in the framework of the ICALEPCS Conference!

The ESRF has participated in the ICALEPCS Conferences since the beginning of the series in Villars sur Olons.

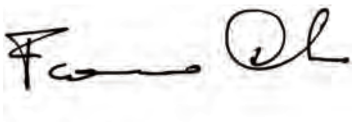
The ESRF - the first 3rd generation synchrotron source - is in operation since 1994, and a key element of its reliability and scientific and technical achievements is the continuous development campaign in the control system of its installations: accelerator complex, X-ray sources and experimental beamlines. We have always been interested and engaged, therefore, in the latest developments in control systems.

We are proud to follow in the footsteps of SPring-8, the prime 3rd generation synchrotron source in Asia, in hosting this year's ICALEPCS 2011 Conference.

Moreover, this conference comes at a very important time as the ESRF is presently in the full swing of an ambitious Upgrade Programme. In fact, a major upgrade of the ESRF is under way and we are not only very interested in finding out about the latest trends in accelerator controls, but also in new technologies for improving the quality of the source, the beamlines and the experiments.

On behalf of all of us at the ESRF, I wish you all a great conference and a pleasant stay in the beautiful town of Grenoble with its magnificent neighbouring sites.

Francesco Sette



Mayor's welcome

M.Destot, mayor of Grenoble

Our city of Grenoble is greatly honoured to host the International Conference on Accelerator and Large Experimental Physics Control Systems (ICALEPCS) 2011 Conference. The previous one was held in Kobe (Japan); the next one will take place in San Francisco in 2013. All well-known cities of innovation.

This large conference brings together a number of control system specialists from accelerator laboratories around the world. It gathers 500 scientists worldwide. This confirms that Grenoble is very attractive in areas of cutting edge technology, of innovation and more largely of scientific issues.

Grenoble, with its 21 000 researchers and its 220 public research laboratories, is a place where for more than two centuries the economic development has been founded on innovation: from hydroelectric power to nanotechnologies, from software to biotechnologies... We are the first research centre in France, after Paris and its surrounding area.

As a Doctor in nuclear physics, a founder and managing director of an innovative company, I am really keen on the subjects that matter for you. In France, we need to have a real policy of innovation in order to deal with the 21st century.

I know that you will be spending a week in Grenoble. I hope you will have time to enjoy our museums, our shops, our city. If you have time, you can also go hiking in the mountains. Grenoble offers a large panel of activities, enjoy them!

I wish you a great conference!

SOLEIL SYNCHROTRON

Established at Saint-Aubin on the plateau of Saclay (Essonne) near Paris, SOLEIL is the French source of synchrotron light.

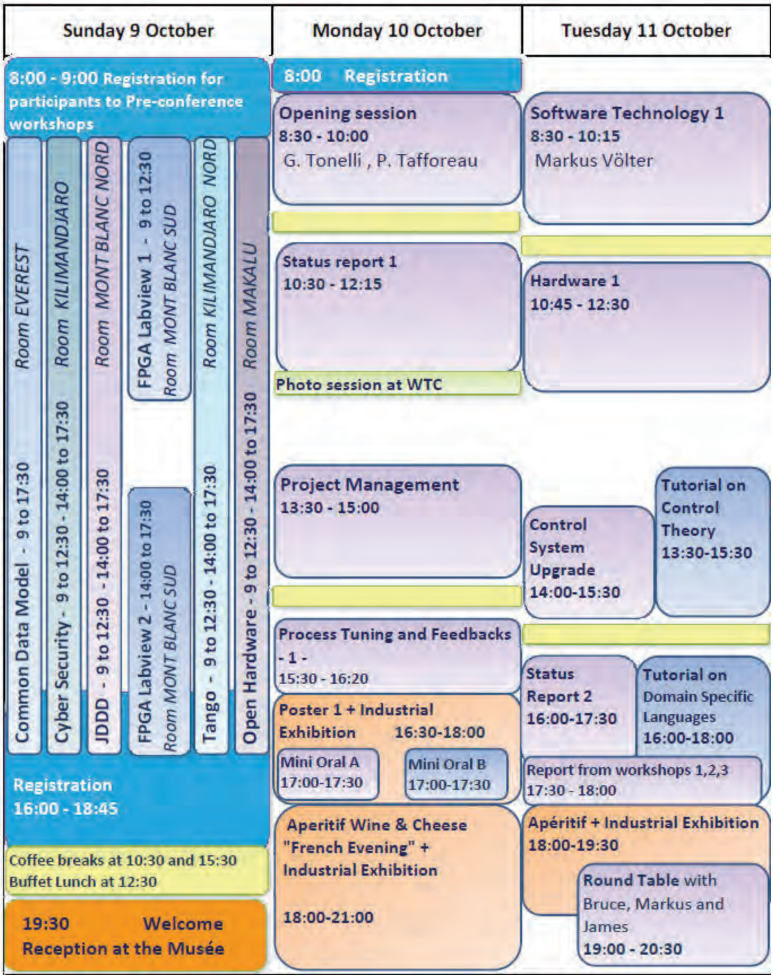
Open to the scientific and industrial communities since January 2008, SOLEIL welcomes more than 2000 users per year. Twenty beamlines, installed around a 2.75 GeV Storage Ring, are available today; six more beamlines are under construction or commissioning.

The international community is unanimous: SOLEIL's performance has become a world reference, due to the stability of its beams (a fraction of a micron) resulting from very strict building and equipment requirements, the effectiveness of the initial injection and continuous electron top-up mode, the lifetime of the beam or the monitoring of instabilities which are always encountered when a very large number of highly charged electrons are accelerated.

On the control and data acquisition side, Synchrotron SOLEIL is the first facility having deployed TANGO at a large scale. SOLEIL has applied methods and technical hardware choices adapted from the industrial world.

Today SOLEIL is involved in the next challenges of the Common Data Model API to access data regardless of data files formats organizations, the data deluge and the open hardware initiative.

Overall programme of the week



Wednesday 12 October	Thursday 13 October	Friday 14 October
Software Technology 2 8:30 - 10:25 Bruce Eckel	Integration of Industrial Devices 8:30 - 10:15 Dr. Truchard	Security and safety 8:30 - 10:15 Les Hatton
Infrastructure Management 10:45-12:15 Hardware 2 10:45-12:15	Operation Tools 10:45 -12:30 Quality Assurance 10:45-12:30 Miron Livny	Process Tuning and Feedbacks - 2 10:45-12:15 Distributed Computing 10:45-12:30
Report from workshops 4,5 12:15 - 12:45		
Poster 2 + Industrial Exhibition 13:30-15:00 Mini Oral C 13:30-14:00 Mini Oral D 13:30-14:00	Data Management 14:00-15:30 Embedded + Real Time 1 14:00-15:30	Towards the Future 13:30 - 14:45 Closing Session 14:45-15:45
Vizille Castle Visit 15:00 - 19:00	Embedded + Real Time 2 16:00 - 17:40 Data Management 2 16:00-16:30	Visits of ESRF or Arc-Nucléart 16:00 - 18:15
	Gala evening 19:00 to midnight	

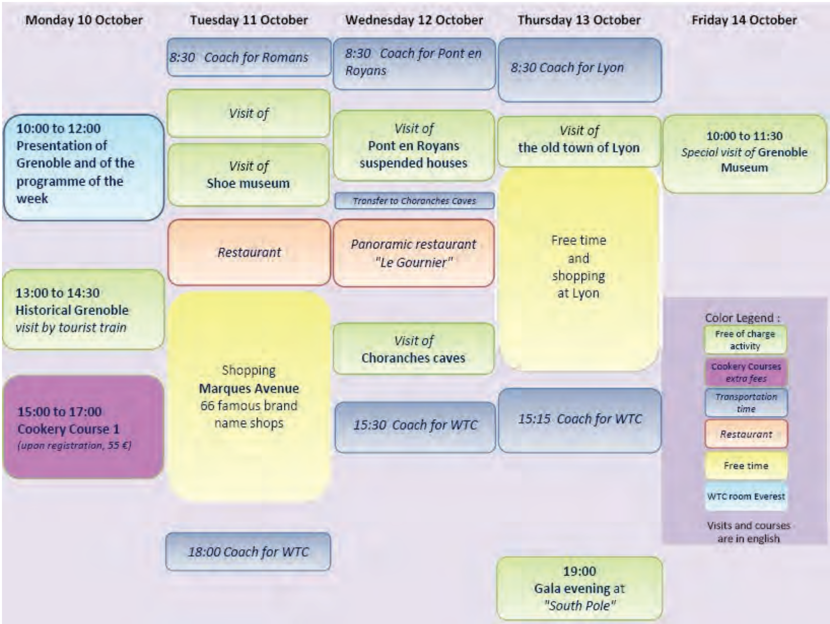
color code for locations:

Coffee breaks

Auditorium | Atrium

External | Makalu

Social programme for accompanying persons



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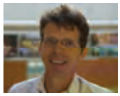
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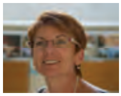
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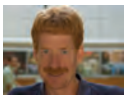
Jens MEYER - Posters

Rainer WILCKE – Posters

Acknowledgments

ICALEPCS 2011 could not have been possible without the help and support of many people. We would like to acknowledge the following people and organisations:

ESRF for hosting the conference and providing the resources to organise it.

The members of the ISAC for choosing the session topics and providing valuable advice.

The members of the PC for setting up an interesting programme.

The proceedings editors – Cindy Cassady (LLNL), Carl Finlay (CLS), Lynda Graham (ESRF), Michaela Marx (DESY), Raphael Müller (GSI), Maria Power (ANL), Marie Robichon (ESRF), Volker Schaa (GSI), Thomas Thuillier (LPSC), Emmanuelle Vernay (LPSC).

The author receptionists: Debbie Davison (ESRF), Kirstin Colvin (ESRF)

Volker Schaa for preparing the abstracts for the conference guide and for assisting in the preparation of the proceedings.

The helpers who assisted the speakers during the conference.

The numerous ESRF staff who helped with the conference directly and indirectly.

The following learned societies for endorsing the conference – European Physical Society / Experimental Physics Control Systems (EPS/EPCS), Institute of Electrical & Electronics Engineers (IEEE), Nuclear & Plasma Science Society (NPSS), French Society of Physics (SFP Interdivision Physique des Accélérateurs et Technologies Associées), Physical Society of Japan (JPS), Association of Asia Pacific Physical Societies (AAPPS).

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The Grenoble Bureau des Congrès and Tourist Office for their support and help while preparing the conference and during the conference.

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Programme tracks

The scientific program is divided in 14 tracks described below

1 - Status reports: the session on status reports presents an overview of new or upgraded, experimental, physics facilities, with a control system perspective. Reports typically cover the early stages of a project within the time frame from the conceptual proposal, to that of being recently commissioned. Presentations include descriptions of the most challenging issues facing the facility.

2 - Quality assurance: this track covers all aspects of the quality process with respect to producing quality control systems, including hardware, software, and support. Quality assurance is the process of assuring that the results of a project meets the specified requirements at time of delivery. In the world of controls, systems are expected to provide high availability/reliability and be easy to configure and maintain, therefore these elements should be reflected in the quality assurance process. The quality process is typically some variation of: Plan, Do, Check, Act. It is also necessary to cover dependencies between systems where a change in the current project affects others.

3 - Project management: this track covers all aspect of project management with the aim of delivering an integrated control system on time and within budget. In particular contributions on managing large and geographical distributed control system projects are encouraged. Methods and strategies to meet challenges like restricted budget and in-kind procurements are of interest.

4 - Integrating Industrial/commercial devices: this track addresses the use of industrial control systems components and devices. It includes technologies such as SCADA systems, PLC, commercial field busses or Commercial-Off-The-Shelf (COTS) devices. The second theme of the track addresses experiences of collaboration with industrial partners, in the various aspects and period of a control system development.

5 - Embedded + Realtime software: this track covers embedded and real-time software which plays a significant role in distributed control systems. Topics include embedded and real-time operating systems, microcontrollers and other embedded platforms, and the management of such systems – with a particular emphasis on hardware and software sharing and collaboration.

6 - Distributed computing: this track covers technologies, frameworks and architectures employed for implementation of the highly distributed control systems, typical for accelerators and large physics experiments. In particular, we aim at identifying trends and emerging technologies in the field of distributed computing together with successfully adopted approaches for their usage and integration with industrial, off-the-shelf technologies for the realization of heterogeneous distributed control systems. Control system architecture**,** middleware**,** performance and scalability**,** integration between low level control and high level coordination.

7 - Process tuning and feedback systems: effective commissioning and operation of modern experimental physics facilities rely on a variety of applications to set up, tune and optimize complex processes. Feedback and feed forward systems are essential for a stable operation and even become indispensable to perform the experiments. The successful implementation of such applications and systems requires the integration of high-level applications, online models, archiving, data visualization and real-time processing into a coherent and functional software environment.

8 - Data and information management: this track is dedicated to all aspects *(technical and organisational)* related to the management of these 2 kinds of data. Control systems generate technical data (settings and readings from hardware, configuration parameters) and scientific data which are used by scientific communities. Because of equipments and detectors evolution, the amount of data generated increases quickly and the “data avalanche” is one of the major challenges of the next year for computing teams of our facilities.

9 - Upgrade of Control Systems: this track will deal with issues involved in upgrading, re-engineering, and maintaining existing control systems in an era of fast-paced technological advances. This track covers the problem of rolling upgrades and legacy control systems, where 'old' and 'new' must operate concurrently and communicate with each other during the upgrade process. Lessons learned from examples of successful upgrades as well as those that were less than successful focusing on planning, development and migration methodology.

10 - Software Technology Evolution: this track presents technical news from the control systems and the software technology to build them. This includes new methods in software engineering as well as new technology 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.

11 – Hardware: this track covers hardware technologies and developments used in control systems. In particular it deals with board-level and FPGA solutions for problems related to signal acquisition and control, synchronization, connecting systems, platform management, etc. with an emphasis in open standards and design sharing.

12 - Protection and Safety Systems: this track considers the role of personnel and environmental protection systems as well as the increasing importance of machine protection systems and their implications on accelerator and physics control systems.

13 - Infrastructure Management and Diagnostics: this track addresses the technologies, tools and methodologies for monitoring performance, resources and alarm conditions across the infrastructure of IOCs, networks, processing nodes, data storage systems and databases in order to achieve this objective. Virtualization and cloud computing technologies are demonstrating ability to meet the needs of dynamic, high-availability large-scale control and computing environments. A variety of software tools are available to monitor these systems.

14 - Operational Tools and Operators View: this track is devoted to both the standard control system tools used every day by machine operators and physicists, and the more specialized control system tools used to commission, turn on, tune, and optimize machine operations. This includes synoptic display managers, plotting and graphing tools, alarm handlers, data logging and replay, parameter save/restore/compare. Electronic log books, Software frameworks.

Programme

Sunday 9th

09:00 - 17:30 Open Hardware Workshop

09:00 - 17:30 Common Data Model Workshop

09:00 - 17:30 TANGO Workshop

09:00 - 17:30 Cyber Security Workshop

09:00 - 17:30 jddd Workshop

09:00 - 17:30 FPGA Programming tutorials

Monday 10th

08:30 - 10:00 Opening Session + Guido Tonelli + Paul Tafforeau

10:30 - 12:15 Status Reports 1

13:30 - 15:00 Project Management

15:30 - 16:20 Process Tuning and Feedback Systems

16:30 - 18:00 Poster Session 1

17:00 - 17:30 Mini Orals A

17:00 - 17:30 Mini Orals B

Tuesday 11th

08:30 - 10:15 Software Technology + Markus Völter

10:45 - 12:30 Hardware

13:30 - 18:00 Tutorial on Control Theory

14:00 - 15:30 Control System Upgrade

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12:15 - 12:45 Reports from the Workshops

13:30 - 15:00 Poster Session 2

13:30 - 14:00 Mini Orals C

13:30 - 14:00 Mini Orals D

Thursday 13th

08:30 - 10:15 Integration of Industrial Devices + Dr. James Truchard

10:45 - 12:30 Quality Assurance + Miron Livny

10:45 - 12:30 Operation Tools

14:00 - 15:30 Data Management 1

14:00 - 15:30 Embedded + Real Time 1

16:00 - 17:40 Embedded + Real Time 2

16:00 - 16:30 Data Management 2

Friday 14th

08:30 - 10:15 Security and Safety Systems + Les Hatton

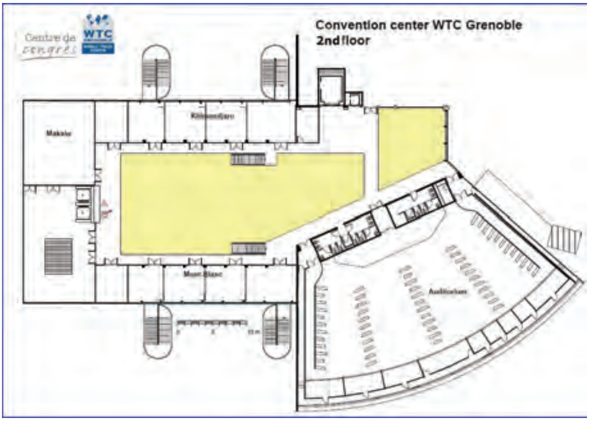
10:45 - 12:15 Process Tuning and Feedback Systems 2

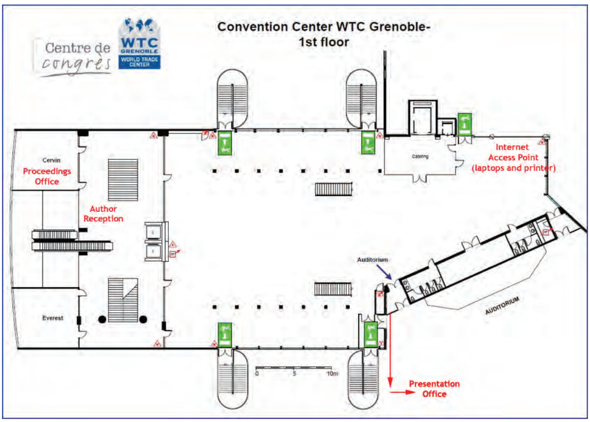
10:45 - 12:30 Distributed Computing

13:30 - 14:45 Towards the Future

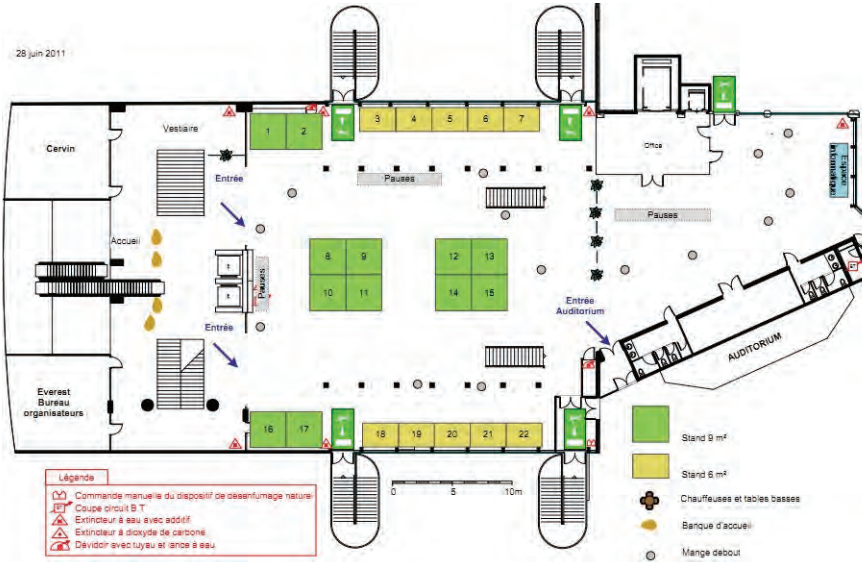
14:45 - 15:45 Closing Session

WTC Convention Centre floor guide





Industrial exhibition plan and list of exhibitors



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15- Cosylab d.d. - http://www.cosylab.com
16- Grenoble Tourist Office + ICALEPCS 2013
17- Beckhoff Automation GmbH - http://www.beckhoffautomation.com/
18- Diamond Detectors Ltd - http://www.diamonddetectors.com/
19- Incaa Computers - http://www.incaacomputers.com/
20- Caen - http://www.caen.it
21- Struck Innovative Systeme GmbH - http://www.struck.de/
22- Instrumentation Technologies - http://www.i-tech.si/

ICALEPCS Conference Series

The 13th International Conference on Accelerator and Large Experimental Physics Control Systems, will be held in Grenoble, France, 10-14 October 2011, at the WTC Convention Center in Grenoble (CICG).

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 organised 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. Most recently, ICALEPCS 2009 was held in Kobe, Japan, hosted by SPRING8.

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 organisations, 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.

Host city: Grenoble, France[1]

Grenoble is a city in south-eastern France, situated at the foot of the French Alps where the river Drac joins the Isère. Located in the Rhône-Alpes region, Grenoble is the capital of the department of Isère. The proximity of the mountains has led to the city being known as the "**Capital of Alps**."

Grenoble's history encompasses a period of more than 2,000 years, and the city has been the capital of the Dauphiné since the 11th century. Grenoble experienced a period of economic expansion in the nineteenth and 20th centuries, which was symbolized by the holding of the 10th Olympic Winter Games in 1968. The city is now a significant scientific center in Europe.
The population of the city (commune) of Grenoble at the 2006 census was 156,107 inhabitants. The population of the Grenoble urban unit at the 2006 census was 427,659 inhabitants. The residents of the city are called "Grenoblois".

[1] http://en.wikipedia.org/wiki/Grenoble

Host institute: European Synchrotron Radiation Facility

The ESRF is a world-leading research centre, set up in 1988 by 12 countries, where researchers use extremely powerful beams of X-rays to explore matter and materials at the nano- and microscale. The research at the ESRF covers physics, chemistry, life and environmental sciences, medicine and palaeontology. Today, 19 countries contribute to its annual budget of 95 million Euros.

7000 scientists from around the globe perform experiments at the ESRF every year, working in close cooperation with 150 staff scientists. The academic output accounts for more than 1800 peer-reviewed publications per year. In 2010, for example, 44 of these were published in Nature or Nature monthly research journals.

The ESRF is the world's best-performing synchrotron X-Ray source which services 41 experimental stations (beamlines) operating more than 5500 hours per year. An Upgrade Programme launched in 2009 will ensure continued world-leadership for many years to come.

The ESRF is located on the GIANT Innovation Campus, benefiting from the vicinity of Grenoble's leading universities and national and international research centres.

Conference venue

The WTC Convention Centre Grenoble is located in the heart of Grenoble, next to the TGV railway station and easily accessible from the main highways (Geneva, Valence, Lyon).

The WTC Convention Centre Grenoble is an exceptional international and business environment in the Europole district, within walking distance of a wide range of accommodation, and close to all facilities.

A to Z Guide

Arriving by plane

From Lyon airport to Grenoble : when arriving at Lyon St-Exupéry airport a shuttle bus (Navette aéroport) links Lyon airport to Grenoble centre (bus station): hourly departures from Lyon airport from 6.30 am to 11.30 pm (1 hour drive) - Tickets must be bought at airport shuttle bus desk: see http://www.faurevercors.fr/pdf/horairesGrely2011_en.pdf for more information.

From Grenoble to Lyon airport : hourly departure from 6.00 am to 11.00 pm.
For any information about bus services from Geneva to Grenoble, use the following link http://www.aerocar.fr/en/schedules-fares/grenoble/.
When arriving at Grenoble railway station you can easily connect to the tram network and access all the hotels booked for the conference.

To and from Geneva : All buses leave from (and return to) Grenoble coach station, reservation is recommended (online, on phone, or at coach station). You can find the current timetables here: http://www.vfd.fr/xarpages/bienvenue-sur-le-nouveau-site-vfd/horaires-timetables/aerocar

Both shuttle buses will drop you at the bus station, which is next to the train station.

Arriving by car:

- Coming from Geneva and Chambéry on the A41 motorway: take the *rocade sud* (Gières toutes direction), follow signs to Lyon by motorway A48, take the exit 2 direction Fontaine, Centre Grenoble - Gare and follow signs to Europole.

- Coming from Lyon on the A48 motorway: take the Europole-Gares and follow signs to Europole

Note that there is a large paying underground car park area just before the WTC Convention Centre.

Arriving by train : the WTC Convention Centre is behind the station. Use the underground passage between the railway station and Europole.

Arriving by tram

Line B, station "Palais de Justice", the WTC Convention Centre is just in front of you.
Line A, station “Gares”, the WTC Convention Centre is behind the station: use the underground passage between the railway station and Europole.

Arriving on foot

When you arrive at the station, by train, shuttle bus from Lyon St Exupéry or Genève or with the Tram A, take the underground passage, direction Europole, place Robert Schumann.

Accommodation

ICALEPCS Local Organising Committee and Insight Outside agency have selected a large number of 2* to 4* hotel slots and negotiated special room rates during the conference. All the hotels are located in the city-center and most of them are close to the WTC Convention Centre. They are all within easy walking distance or a short tram ride.

Badges
Name badges will be distributed at registration throughout the sessions at the reception desk of the WTC Convention Centre.
For security reasons, only the persons wearing conference badges will be allowed access to the WTC Convention Centre.

Banks
Money can be withdrawn from cash dispensers located next to or inside a bank. Banks are open from 9:00 to 18:00 usually. The closest cash dispenser to the conference centre is opposite the Management school, 10 rue Abbé Grégoire. There is also one in front of the train station and many around the main pedestrian zone.

Bastille - In the heart of Grenoble
The first urban cable-car in the world, the famous "bubbles" of Grenoble, will take you in a few minutes from the centre of the town up to the Bastille fortress, a small fortified mountain located at the crossroad of three valleys. From the hilltop, discover the flattest town in Europe in its mountain setting! On a clear day you can see the French Alps including Mont Blanc. When the sun sets and the lights go on in the city, the view is outstanding (http://www.bastille-grenoble.fr/english/index.html).

Bike rental
Despite its mountainous surroundings, Grenoble is one of the flattest cities in Europe, so cycling is an easy way of getting around. Pleasant recreational cycle routes follow the Drac and Isère rivers. A bicycle track along the Isère river passes in front of the town centre, and the main boulevards have dedicated cycle lanes. Bicycles are allowed on some smaller streets, but riders often have to use the same lane as buses.

We recommend two bike rental possibilities:

1. VELO DAYAK : 2 rue Irvoy (not far from the train station). Includes service, helmet, fluorescent jacket, and padlock (28€ for 5 days). Please mention the ICALEPCS conference so that you take advantage of the negotiated price.

2. METRO VELO: Grenoble train station. Includes padlocks (15€ for 5 days).

Currency
The currency in France is the Euro.

Cycling
Grenoble is ideally situated for doing some cycling in the surrounding mountains. Some of the most famous "cols" can be found less than an hour away – Col de la Croix de Fer, Col du Galibier, Col du Lautaret, l'Alpe d'Huez with its famous 21 hairpin bends and many more less well known mountain passes. You can rent a racing bike from Vélo Dayak. More info on the web e.g. http://www.grenoblecycling.com/the-Alps.htm

Credit Cards
International credit cards (e.g. American Express, Diners Club, Mastercard, Visa) are widely accepted in cash dispenser (ATMs), hotels, restaurants and shops.

Dinner
France is famous for its food. It comes as no surprise that the French gastronomic meal is on the

UNESCO list of Intangible Cultural Heritage. A typical French evening meal consists of 4 courses – starter, main course, cheese and dessert. Grenoble has a wide range of good restaurants. Ask the Tourist Office at the conference to recommend you one. You can also ask them to book a table for you (advisable in most good restaurants).

Doctor and Dentist
A list of English speaking Doctors and Dentists is available during the conference at the registration desk

Gala evening
The Gala evening will be held at Pôle Sud on Thursday 13th at 19:00. You can get there with tram line A, direction Echirolles Denis Papin / Station: Pôle Sud – Alpexpo. The Pôle Sud building is just in front of you, opposite the Grand'place shopping centre. If you plan to come by car take exit 6 Alpexpo on the Rocade Sud:

Grenoble

1. **IN Grenoble**:
   La Bastille (Vauban fortress) – see above at "Bastille"|
   Musée de Grenoble, www.museedegrenoble.fr
   Expo Supra (science exhibition) - La Casemate - http://www.ccsti-grenoble.org/
   Hannibal (history exhibition) - Musée Dauphinois - http://www.musee-dauphinois.fr/
   Musée Archéologique (archaeological museum) - http://www.musee-archeologique-grenoble.fr/
   For more ideas visit : http://www.grenoble-tourism.com/

2. **NEAR Grenoble:**
   Visit the following tourist information sites for more about sights around Grenoble:
   Lyon - http://www.en.lyon-france.com/
   Valence - http://www.valencetourisme.com/gb/accueil.html
   Chambery - http://www.chambery-tourisme.com/
   Annecy - http://www.lac-annecy.com/gb/index.html
   Les Ecrins - http://www.paysdesecrins.com/uk/ (south of Grenoble)

Guides
In addition to the many books there are some free guides on the web at these addresses: http://www.arrivalguides.com/en/TravelGuides/Europe/France/GRENOBLE, and on Wikitravel: http://wikitravel.org/en/Grenoble.

Hiking
Hiking is probably after skiing the most favourite pastime of the "Grenoblois". Grenoble is at the foothills of three mountains ranges – Belledonne, Chartreuse and Vercors. Many hikes are accessible directly from

Grenoble or after a short bus ride. Enquire at the Tourist Office counter at the conference for more information.

Jogging
If you want to go jogging you can either go on the Bastille which has nice jogging tracks or if you prefer the flats you can jog on the bicycle track next to the Isère river. Both tracks are less than a kilometre of the conference centre.

Language tips
Even if you don't speak French a few words of French will be appreciated in shops, downtown, at the hotel etc. Always start a conversation with "Bonjour" ("Good morning" or "afternoon" or "evening") even if you are just asking a question. To get the bill ask for "l'addition s'il vous plait". Use "merci" to say thank you. "Merci beaucoup" means "Thank you very much". "Au revoir" means "Goodbye". You can find many more useful phrases on the web.

Lunches
Except for lunch on Sunday 9 and Wednesday 12 October, lunches are not included in the registration fees.

Should you wish to stay at the WTC Convention Centre, sandwiches and snacks will be on sale in the Atrium at the conference centre at lunchtime.

The WTC Convention Centre is surrounded by a number of restaurants where you can have a meal for less than 15 €. The Tourist Office hostess at the conference can help you book a table, which is recommended, due to the large number of people having lunch at the same time in this area. A map of the area is available.

Selection of restaurants offering a coffee to ICALEPCS badge holders:

1 - *Le Petit Bouchon Gascon*, 2 rue du Vercors, - Tél : 04 76 24 40 72
2 - *Le Col Vert* , 2 rue du Vercors, tél : 04 38 49 28 69
3 - *Pizzeria Via Europa*, 9 rue du Vercors, Tél 04 76 49 33 92
4 - *Novotel*, 5 place Robert Shumann, Tél 04 76 70 84 84
5 - *Planetalis*, 10 place Robert Shumann, Tél 04 76 22 21 90
6 - *La Fleur de Thym*, 14 rue Abbé Gregoire, Tél 04 76 09 71 82
7 - *La City*, 102 Cours Berriat, Tél 04 76 21 24 03
8 - *Le Loft*, 3 rue d'Alembert, Tél 04 76 48 62 83

More restaurants around the corner :

9 - *L'aiguillage*, 14 rue Abbé Grégoire, Tél 04 38 12 87 05
10 - *La Brasserie du Palais*, 29 rue Pierre Sémard, Tél 04 76 49 51 52
11 - *L'Epicerie Comptoir*, 4 Place Robert Schumann, Tél 04 38 49 57 31
12 - *Bistrot d'Emile*, 1 rue d'Alembert, Tél 04 85 02 22 89

The numbers refer to the map below :

Markets
There are several markets in Grenoble like *Place aux Herbes*. This square was the main gathering place for Grenoble's inhabitants and today still welcomes a farmers' market on Tuesday and Sunday mornings. *Les halles Sainte-Claire*, this covered market, built in 1874, stands on a site once occupied by the Clarisses nuns in the 15th century. “*Marché de l'Estacade*” is a big market place with a part dedicated to local farmers. It is the biggest market in Grenoble and is located under the railway bridge a few minutes away from the station.

Public transport ticket
6-days passes valid on the Bus and Tramway network of Grenoble will be on sale at the Registration desk during the conference. Special Rate of 10 € for all participants of the conference and accompanying person – **only cash payment will be accepted**.

Registration desk
Will be open on:

- Sunday from 8:00 to 9:00, for participants attending to the pre-conference workshops
- Sunday from 16:00 to 18:45, for all other participants
- Monday to Friday from 8:00 to 9:00

Shopping
Grenoble has many shops downtown including shopping malls a bit further out of town like Grand'place,

Espace Comboire. Typical specialities from Grenoble include chocolates, local liquors, walnuts etc. Ask at the Tourist Office counter at the WTC Convention Centre if you are looking for something special to buy.

Shuttle services to and from airport
See above in the section Arriving by.

Taxis
Taxis grenoblois
Tel: +33 476 54 42 54

Tourist Office
The Tourist Office in the centre of Grenoble can provide you with information about Grenoble and the surroundings.
Opening times: from Monday to Saturday, 9:00 am to 6:30 pm, on Sunday, 10:00 am to 1:00 pm.
14 rue de la République - 38000 Grenoble - www.grenoble-tourism.com

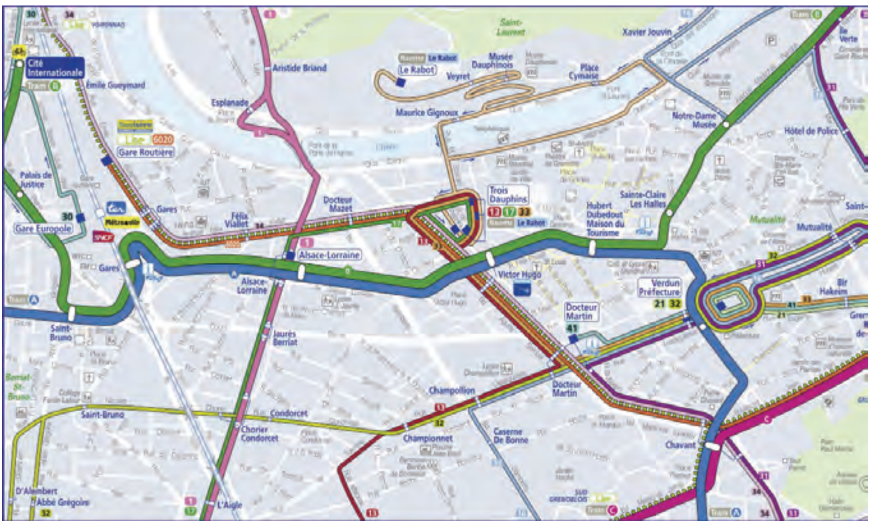
A representative of the Tourist Office will be at the WTC Convention Centre during the conference.

Transport in town
Except for the visit of Vizille Castle and the ESRF visit on Friday, transport to the various venues of the conference is to be organised by yourself. All venues are accessible via the tram network:

Walnut
The Grenoble area is well known for its walnuts. In French they are known as “Noix de Grenoble”.

Welcome reception
The Welcome reception will be held at the Musée de Grenoble at 19:30. You can get there with the tram line B, direction Gieres / Station Notre Dame-Musée

More information about local transport on www.semitag.com



WIFI
Free wifi is available in the Convention Centre area. Network SSID = **ESPACE-CONGRES** Open your browser and you should be directed to a captive portal. Login with Username = ***visitor*** (small letters !) and Password = ***ICALEPCS*** (all capitalized !)

Proceedings

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/).

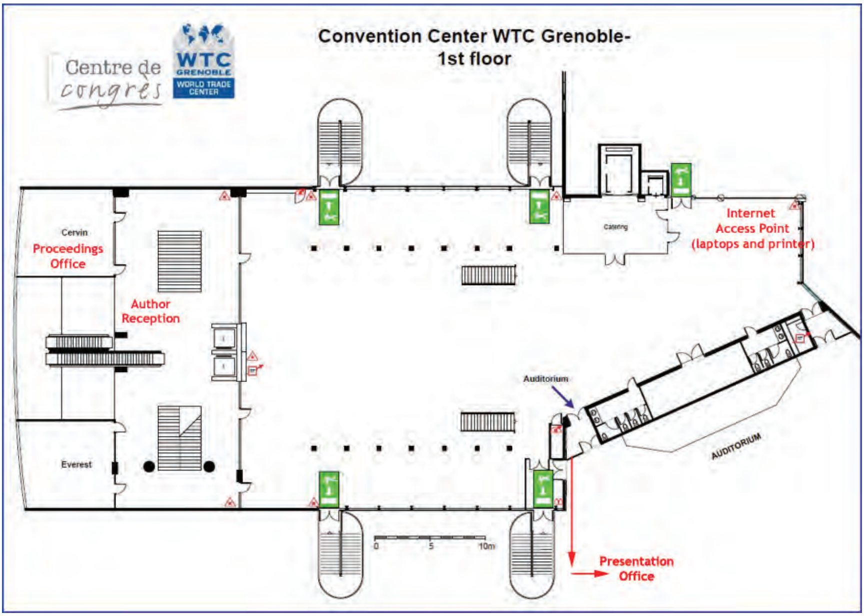
The electronic files of contributions to the Proceedings will be processed prior to and during the Conference. Authors can check processing status via their profiles, via an "electronic dotting board" located outside of the Proceedings Office or by consulting the author receptionists.

Publication policy

Authors are reminded that no contributions are accepted for publication only. Any paper accepted for presentation, which is not presented at the conference, either orally or by a poster, will be excluded from the proceedings.

Proceedings Office, Author Reception and Paper Status Display

The Proceedings Office is located in the Cervin Room on the 1st floor of the WTC Convention Centre. Author reception is located in the lobby outside the Cervin Room. The processing status of papers is displayed via an "electronic dotting board" located next to Author Reception.



Programme Codes - Identification of Contributions

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

Oral presentations - plenary sessions

Using the format DDTRRPP## (e.g. **MOBAUST01)**

- First two letters indicate the day (DD) of the week:
    - **MO, TU, WE, TH, FR**

- The third character indicates the time (T) of day for Oral presentations:
    - **A** (Before morning coffee)
    - **B** (After morning coffee)
    - **C** (Before afternoon coffee)
    - **D** (After afternoon coffee

- The fourth and fifth characters indicate the room (RR)
    - **AU** (Auditorium)
    - **MU** (Makalu)

- The sixth and seventh characters indicate the type of Presentation (PP):
    - **ST** (Short Talk - 15 minutes)
    - **LT** (Long Talk - 20 minutes)
    - **IO** (Invited Oral)
    - **KP** (Keynote Presentation)

- Finally, the sequence number within the session

Example: **MOBAUST01** *- Monday, session in the morning before coffee, in the Auditorium, first short talk*

Oral presentations - parallel sessions

Using the format DDTHRRPP## (e.g. **THCHAUST01)**

- First two letters indicate the day (DD) of the week:
    - **MO, TU, WE, TH, FR**

- The third character indicates the time (T) of day for Oral presentations:
    - **A** (Before morning coffee)
    - **B** (After morning coffee)
    - **C** (Before afternoon coffee)
    - **D** (After afternoon coffee

- The fourth character **H** indicates that it is a parallel session
- The fifth and sixth characters indicate the room (RR)
    - **AU** (Auditorium)
    - **MU** (Makalu)

- The seventh and eighth characters indicate the type of Presentation (PP):
    - **ST** (Short Talk - 15 minutes)
    - **LT** (Long Talk - 20 minutes)
    - **IO** (Invited Oral)

    - **KP** (Keynote Presentation)

- Finally, the sequence number within the session

Example: **THCHAUST01**- *Thursday, parallel session in the afternoon before coffee, in the Auditorium, first short talk*

Poster presentations

Using the format DDPRR### (e.g. MOPKN001**)**:

- First two letters indicate the day (DD) of the week:
    - **MO, WE**

- The third character P indicates that it is a poster session

- The fourth and fifth characters indicate the room (RR)
    - **KN** (Kilimanjaro Nord)
    - **KS** (Kilimanjaro Sud)
    - **MN** (Mont Blanc Nord)
    - **MS** (Mont Blanc Sud)
    - **MU** (Makalu hall)

- Finally, the sequence number within the session

Example: **MOPKN001** - *Monday, poster session, in Kilimanjaro North, poster board no. 001*

Posters with mini-oral presentations

Using the format DDMRR### (e.g. MOMAU002**)**:

- First two letters indicate the day (DD) of the week:
    - **MO, WE**

- The third character M indicates that it is a poster with mini-oral presentation

- The fourth and fifth characters indicate the room (RR) where the mini-oral presentation will take place
    - **AU** (Auditorium)
    - **MU** (Makalu)

NB: The posters with mini-oral presentations do not have an indication in their presentation codes of the location where they will be displayed. These posters will be displayed together in either **KN**, **KS, MN, MS, MU** (Kilimanjaro Nord or Sud, Mont Blanc Nord or Sud, Makalu). Please see the table in the poster session section for more information of their location.

- Finally, the sequence number within the session

Example: **MOMAU002** - *Monday, poster with mini-oral presentation in the Auditorium, poster board no. 002*

WIFI and Internet Access Point

During your stay at the WTC Convention Centre, we offer an access to the internet via either the free WiFi or via the Internet Access Point for those without internet access devices.

The WiFi is an open WiFi with a captive portal.
Connect to the Network **ESPACE-CONGRES** (the SSID).
Note: This network has no security settings, so you might need to confirm the connection.

Once you are connected, please launch a browser of your choice and log in:
Username: ***visitor*** (lower case!)
Password: ***ICALEPCS*** (upper case!)

In addition to the WiFi network, you also have an Internet Access Point at your disposal. It is located in the Atrium, near the catering area. Here you will find 5 laptops with a 14" screen connected to the Internet. They are running Windows 7 and have Internet Explorer and Firefox installed along with your familiar office products: Microsoft Office, LibreOffice and OpenOffice.

There is a black and white printer at your disposal that is accessible from the Internet Access Point laptops for small printing volumes (e.g. printing of your electronic plane tickets, etc.)

Pre-conference workshops

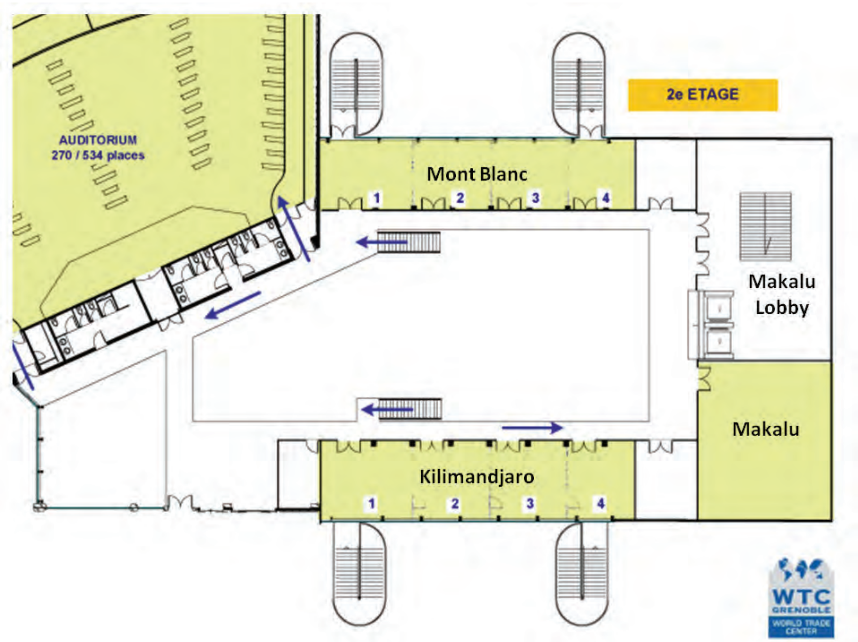
Five pre-conference workshops will take place on Sunday the 9th October 2011. They will take place at the same venue as the conference – the WTC Convention Centre. The five workshops are:

1. ***Common Data Model*** – Everest
2. ***Cyber Security*** – Kilimandjaro 1 & 2
3. ***JDDD*** – Mont Blanc 1 & 2
4. ***TANGO*** – Kilimandjaro 3 & 4
5. ***Open Hardware Initiative*** – Makalu

The five workshops will be held in parallel. Coffee will be served in the Atrium as well as a buffet lunch. A lunch voucher is included in your registration pack.

Two tutorial sessions will be held, one in the morning and one in the afternoon on "**Programming EPICS-enabled Real-Time and FPGA Systems**". These tutorials are kindly offered by National Instruments free of charge. The tutorials will take place in Mont Blanc 3 & 4.

Layout of rooms for pre-conference workshops:



- **Open Hardware Initiative** workshop organised by **Javier Serrano** (CERN) .The workshop is 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.

- **Cyber-Security** workshop organised by **Stefan Lueders**.(CERN). This is the 3rd workshop on this topic. Interest is high as cyber- security is as relevant as ever.

- **TANGO** workshop organised by **Emmanuel Taurel** (ESRF). TANGO is an object oriented distributed control system developed as a collaborative effort between several institutes. This workshop will be organised as a set of tutorials and will allow TANGO beginners to discover the different features of TANGO with the help of a practical example using an Arduino board.

- **jddd** workshop organised by **Elke Sombrowski** and **Kay Rehlich** (DESY). jddd is an editor for control system panels. The goal of this workshop is to promote jddd as an advanced tool for designing and running control panels. jddd beginners will be introduced in working with the panel editor and basic features. jddd experts will be instructed in the creation of complex control panels using dynamic jddd widgets/components. The workshop will include practical exercises on control panel development.

- **CDM** (Common Data Model) workshop organised by **Alain Buteau** (SOLEIL) and **Nick Hauser** (ANSTO). Standardization of data files formats appears up to now as the only way to be able to share scientific data analysis applications and exchanging data files between facilities (neutron and synchrotron sources). By introducing a new level of indirection for data access, the CommonDataModel (CDM) API offers an alternative to this long standardisation process by allowing to share development efforts and responsibilities between institutes. Using an innovative “mapping” system between applications definitions and physical data organisations, CDM allows data reduction applications to be developed regardless of data file formats. This workshop will describe the CDM project. You will be shown how to write a CDM based data analysis application and how to adapt your own data to CDM. You will be introduced to some examples of generic tools for data browsing and data reduction.

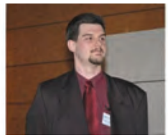
- **Programming EPICS-enabled Real-Time and FPGA Systems**: organised by **National Instruments.** In this tutorial you will be taught you how to use EPICS server and client to communicate with COTS hardware. See how to use LabVIEW to develop RTOS applications and deploy them on hardware. Learn to use multi-core processors with parallel programming techniques. Use high-level graphical programming to design your own custom reconfigurable FPGA hardware.

Keynote speakers

The following speakers will give keynote talks :

Monday 10th, morning

Guido Tonelli, CERN CMS Experiment spokeperson
will give us the first physics results from LHC and expectations for the near future.



Paul Tafforeau, Paleontologist at ESRF
will show us the spectacular progress of paleontology thanks to synchrotron light in his talk entitled "**X-ray synchrotron imaging: a revolution in palaeontology**".

Tuesday 11th, morning

Markus Völter, the guru of Domain Specific Languages
will describe the major trends over these last few years in programming languages and the development of Domain Specific Languages.

Wednesday 12th, morning

Bruce Eckel author of numerous books and articles about computer programming will show us how to cross the language boundaries to achieve the best possible results in a talk entitled "***The power of Hybridization***".

Thursday 13th, morning

James Truchard President, CEO and co-founder of National Instruments will show us how engineers can customize FPGA or GPU technologies while keeping costs low to achieve faster computing through partnerships between industry and research facilities.

Miron Livny Computer science professor at the University of Wisconsin at Madison. He leads a national initiative that uses this ability to collect and divide data from the LHC among many universities and institutions. He will give his talk on Distributed Software Infrastructure for Scientific Applications.

Friday 14th, morning

Les Hatton, Professor of Forensic Software Engineering at Kingston University will show us some scientific methods on how to build High-Integrity Software in embedded systems.

Tutorials

Tuesday 11th 13:30 to 18:00

Control Theory: from 13:30 to 15:30

Stefan Simrock, ITER

Feedback control plays an important role in the design and operation of modern accelerators and fusion devices. Feedback is required to stabilize inherently unstable system dynamics and processes and to improve machine performance. To better understand the theory of feedback control and be able to design feedback controllers this tutorial will consist of 3 parts:

1. Introduction to control theory (60 min)
2. Examples for control applications in accelerators and fusion devices (30 min)
3. Demonstration of control system analysis and design tools in the MATLAB / Simulink environment. (30 min)

Domain Specific Languages: from 16:00 to 18:00

Markus Völter, voelter.de

This tutorial is an introduction to development of domain-specific languages, based on the **'Trends in Programming Languages'** talk in Tuesday morning. He will show a couple of example DSLs used in various technical domains, then provide details on two language workbenches: Eclipse XText and JetBrains MPS. Both are Java-based Open Source products that support the rapid development of DSLs, but they use radically different approaches: Xtext is parser-based, MPS is a projectional editor.
The goal of the tutorial is to illustrate the usefulness of DSLs, showcase the productivity of language workbenches for developing languages, and give participants a head start in using Xtext and MPS. The tutorial is mostly example-based: it will demonstrate the implementation of a small DSL in each of the tools.

Round Table

Tuesday 11th October evening

A round table will be organised on Tuesday the 11th October at 7 pm in the auditorium. The topic of the round table is:

When and how to mix languages. If not why not?

The panel will be composed of three keynote speakers and a specialist from the accelerator controls field:

- **Bruce Eckel**, *mindscape.com*
- **Markus Voelter**, *voelter.de*
- **Dr. James Truchard**, *National Instruments*
- **Vito Baggiolini**, *CERN*

Today programmers are increasingly faced with a choice of programming languages. With this choice comes the question whether to use only one language or to use more than one language and mix them. Some specialists say that the future is language oriented programming with more Domain Specific Languages (DSLs) and even meta-languages. One of the topics of the conference is the hybridization of systems i.e. mixing of languages. Should control systems engineers embrace this development. How to prepare for it ? What are the pitfalls? We are lucky to have a number of keynote speakers who are specialists in the domain of languages and their evolution. We invite you to join the Round Table on this topic. In preparation of the RT we propose you reflect on the following questions :

- How much does language influence the design of a system?
- What are the advantages of one language versus a hybrid system?
- Which domains are the common languages like C/C++, Java, Python, etc. best suited to?
- What are the next languages to watch and adopt – Erlang, Scala, etc.?
- Are Domain Specific Languages on the increase?
- Are language oriented systems the future?
- Your questions?

Prizes

Lifetime Achievement Award

The ICALEPCS Lifetime Achievement Award is meant to honour 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.

EPCS Award

The prize will be awarded to one or more young scientists who made outstanding contributions in the field of Experimental Physics Control Systems. The prize will be awarded without restrictions on nationality, race or religion. The prize will consist of a financial contribution and a certificate. Only works that are original and that have printed versions can be considered in the proposals for candidates to the prize. Persons who have deceased since the work was performed cannot be nominated for the prize.

Poster Prize

A prize will be awarded for the best poster at each of the two poster sessions. For the first time the prize will be voted by the delegates. A vote ballot can be found after the poster section in this guide. Please follow the instructions.

Conference social programme

Welcome Reception - Sunday, 9th - 19:30 to 22:00

The Mayor is happy to welcome the ICALEPCS2011 participants and their spouses to an exceptional Opening Reception at the Museum of Art. Access via tram B, stop "Notre Dame Musée".

French Evening at the WTC Convention Centre - Monday, 10th - 18:00 to 21:00
After a long day's work, it is time to unwind and discuss around some typical French specialities. Expert oenologists will present a wide range of French wines and cheeses. After this tasting party be prepared for another surprise...

Aperitif at the WTC Convention Centre - Tuesday 11th - 18:00 to 19:30
Another relaxing moment to get together and discover even more specialities from our surrounding mountains.

Wednesday 12th - **Château de Vizille** Vizille Castle (for delegates only)

15:00 Coach departure from WTC Convention Centre

1789 is the official starting date of the "Revolution Française", but it actually started a year before in Vizille, in the Château de Vizille. You will visit the French Revolution Museum, the Castle and its splendid park.

Gala Evening at Pole Sud – Thursday 13th - 19:00 to 00:00

All participants and their spouses are invited to join this exceptional reception in an unusual venue for a Gala Dinner!

ESRF Site Visit or **Arc-Nucleart** - Friday 14th - 16:00 to 18:00
ESRF Site visit : you will have the opportunity to visit the ESRF Experimental Hall in small groups with a guide.This is a technical visit open to 120 participants.

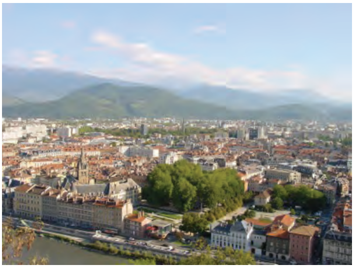
Arc Nucleart : a particularly spectacular application of the nuclear techniques used to preserve artistic work of art from the damages of time, worms, water, dust, etc. The visit (in English) is open to 20 participants.

For these two visits, participants must have signed up when they registered. The buses for the ESRF visit will leave the WTC Convention Centre at 16:00.

Visitors to Art Nucleart have a 10 minute walk from the WTC Convention Centre to access the site.

Social programme for accompanying person(s)

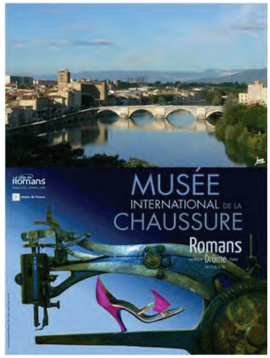
Monday 10: Discover the Programme, Grenoble and French cooking



10:00-12:00 WTC Convention Centre
English presentation of Grenoble and of the programme of the week by the Grenoble Congress Office.
13:30-14:30 Discovery of historical Grenoble by tourist train with an English Speaking guide.
15:00-17:00 Cookery Course (on registration, 55 €)

Tuesday 11: Let's go to Romans

08:30 Coach departure from WTC Convention Centre
09:30 Pogne (local brioche) museum
10:30 Shoe Museum: 4000 years of ancient history
12:00 Lunch in a restaurant
14:30-18:00 Shopping at *Marques Avenue*
19:00 Arrival at WTC Convention Centre



Wednesday 12: The Vercors

08:30 Coach departure from WTC Convention Centre for Pont en Royans
10:00 Visit of the suspended houses and transfer to Choranches Caves
11:30 Arrival at Choranches, lunch in the panoramic restaurant "le Gournier"
14:00 to 15:00 Visit of the caves
16:30 Arrival at WTC Convention Centre

Thursday 13: Lyon

08:30 Departure by coach from WTC Convention Centre
10:00-11:00 Visit of the old town of Lyon
11:00 -15:00 Shopping and free time
16:30 Arrival at WTC Convention Centre

Friday 14: back to Grenoble

10:00-11:30 Special visit of Grenoble's Museum "on the trail of Masterpieces".

Speaker presentation information

Oral Presentations

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

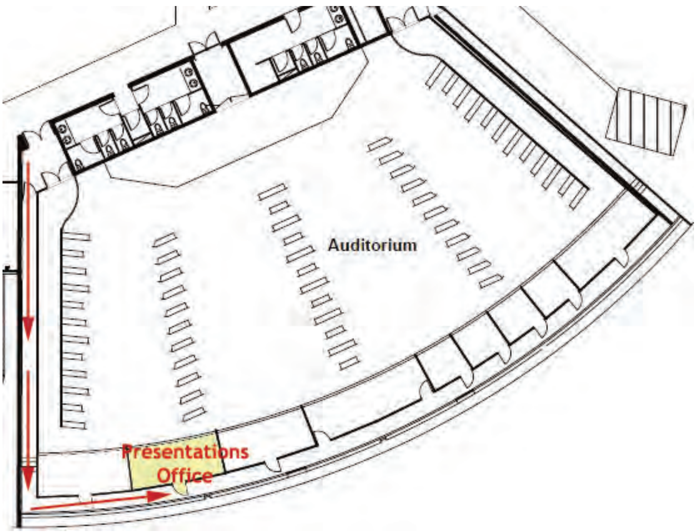
Oral presentations will take place in either the Auditorium or the Makalu room.

Guidelines for Speakers

Visual presentations should be made electronically using the projection equipment provided by the conference centre. 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 centre's system. Any special requirements concerning visual aids should be addressed to the local organisers (icalepcs2011-loc@esrf.fr). More information can be found on the conference website (http://icalepcs2011.esrf.fr/authors-info/presentation-guidelines).

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.

A Presentations Office is located above the auditorium to check presentations on PC. Access is via a corridor to the right of the Auditorium access doors (see floor plan below).



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 a good opportunity for exposure for younger colleagues. This year, about 350 posters will be on display in two sessions.

The program code numbers of the posters are also used to mark the poster display location. These numbers will be shown on the poster frames. Please mount your poster on the board labelled with that number.

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 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 two poster sessions, two prizes will be given. More details and a voting form are provided in the Conference Guide that each participant will receive at the conference. The prizes will be awarded at the Gala Evening on Thursday October 13.

Time Schedule

The posters will be on display in three rooms at the conference center: "Makalu", "Mont Blanc" and "Kilimandjaro". The schedule for installation and dismounting is:

- for the Monday 10 October session, poster installation will commence on Monday at 13:00, and dismounting has to be done by Wednesday 12 October 09:00;

- for the Wednesday 12 October session, poster installation will commence on Wednesday 10:30, and dismounting has to be done by Friday 14 October 13:00.

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 Wednesday morning when there will be a tight schedule to take down the old posters and put up the new ones.

Instructions for Poster Display

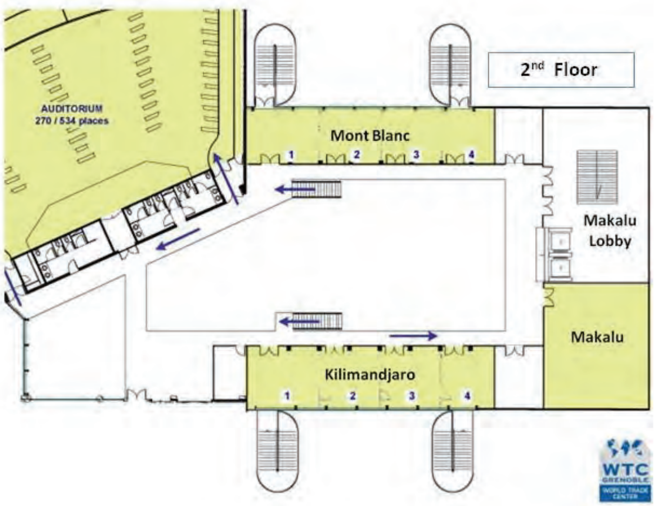
The poster format is strictly portrait A0. Participants are asked to bring with them a A0 printed copy of their posters as no poster printers will be available at the conference.

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

Participants of the Monday poster session are kindly asked to leave the mounting mechanism on the poster frames when they take down their posters, as they will be used by the Wednesday poster session.

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

Poster location



Poster Session 1 - Monday 10.10.2011 16:00 to 18:00

Kilimandjaro:

Data and Information Management

MOPKNxxx + MOMAU002, MOMAU003, MOMAU004, MOMAU005

Process Tuning and Feedback Systems

MOPKSxxx + MOMMU005, MOMMU006

Project Management

MOPKSxxx + MOMAU007, MOMAU008, MOMAU009

Mont Blanc :

Operational Tools and Operator's View

MOPMNxxx + MOMMU001, MOMMU002, MOMMU003

Upgrade of Control Systems

MOPMSxxx

Makalu Lobby :

Upgrade of Control Systems

MOPMUxxx + MOMMU009, MOMMU010, MOMMU012

Status Reports

MOPMUxxx

Poster Session 2 - Wednesday 12.10.2011 13:00 to 15:00

Kilimandjaro:

Distributed Computing

WEPKNxxx + WEMAU001, WEMAU002, WEMAU003

Integrating Industrial/Commercial Devices

WEPKNxxx + WEMAU004, WEMAU005, WEMAU006, WEMAU007

Software Technology Evolution

WEPKSxxx + WEMAU009, WEMAU010, WEMAU011, WEMAU012

Mont Blanc:

Embedded and Realtime Software

WEPMNxxx

Hardware

WEPMSxxx + WEMMU001, WEMMU002, WEMMU004

Quality Assurance

WEPMSxxx

Makalu Lobby:

Infrastructure Management and Diagnostics

WEPMUxxx + WEMMU005, WEMMU006

Protection and Safety Systems

WEPMUxxx + WEMMU007, WEMMU009, WEMMU010, WEMMU011

Posters with Mini Oral

Poster Session 1 - Monday 10.10.2011 16:00

Reference	Classification	Poster Location	Mini Oral Location
MOMAU002	Data and Information Management	Kilimandjaro	Auditorium
MOMAU003	Data and Information Management	Kilimandjaro	Auditorium
MOMAU004	Data and Information Management	Kilimandjaro	Auditorium
MOMAU005	Data and Information Management	Kilimandjaro	Auditorium
MOMAU007	Project Management	Kilimandjaro	Auditorium
MOMAU008	Project Management	Kilimandjaro	Auditorium
MOMAU009	Project Management	Kilimandjaro	Auditorium
MOMMU001	Operational Tools and Operator's View	Mont Blanc	Makalu
MOMMU002	Operational Tools and Operator's View	Mont Blanc	Makalu
MOMMU003	Operational Tools and Operator's View	Mont Blanc	Makalu
MOMMU005	Process Tuning and Feedback Systems	Kilimandjaro	Makalu
MOMMU006	Process Tuning and Feedback Systems	Kilimandjaro	Makalu
MOMMU009	Upgrade of Control Systems	Makalu Lobby	Makalu
MOMMU010	Upgrade of Control Systems	Makalu Lobby	Makalu
MOMMU012	Upgrade of Control Systems	Makalu Lobby	Makalu

Poster Session 2 - Wednesday 12.10.2011 13:00

Reference	Classification	Poster Location	Mini Oral Location
WEMAU001	Distributed Computing	Kilimandjaro	Auditorium
WEMAU002	Distributed Computing	Kilimandjaro	Auditorium
WEMAU003	Distributed Computing	Kilimandjaro	Auditorium
WEMAU004	Integrating Industrial/Commercial Devices	Kilimandjaro	Auditorium
WEMAU005	Integrating Industrial/Commercial Devices	Kilimandjaro	Auditorium
WEMAU006	Integrating Industrial/Commercial Devices	Kilimandjaro	Auditorium
WEMAU007	Integrating Industrial/Commercial Devices	Kilimandjaro	Auditorium
WEMAU009	Software Technology Evolution	Kilimandjaro	Auditorium
WEMAU010	Software Technology Evolution	Kilimandjaro	Auditorium
WEMAU011	Software Technology Evolution	Kilimandjaro	Auditorium
WEMAU012	Software Technology Evolution	Kilimandjaro	Auditorium
WEMMU001	Hardware	Mont Blanc	Makalu
WEMMU002	Hardware	Mont Blanc	Makalu
WEMMU004	Hardware	Mont Blanc	Makalu
WEMMU005	Infrastructure Management and Diagnostics	Makalu Lobby	Makalu
WEMMU006	Infrastructure Management and Diagnostics	Makalu Lobby	Makalu
WEMMU007	Protection and Safety Systems	Makalu Lobby	Makalu
WEMMU009	Protection and Safety Systems	Makalu Lobby	Makalu
WEMMU010	Protection and Safety Systems	Makalu Lobby	Makalu
WEMMU011	Protection and Safety Systems	Makalu Lobby	Makalu

Poster Vote

As in the previous years, at ICALEPCS 2011 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 two poster sessions, two 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 and Wednesday respectively
- give your name and institute
- tear out the vote ballot and drop it in one of the voting boxes situated near the entrances to the auditorium

before 16:00 on Thursday 13 October

Thank you for your vote!

The ICALEPCS Organising Team

Notes

BEST POSTER - VOTE

Best poster Monday session: **MO**……………………………

Best poster Wednesday session: **WE**……………………………

Your name: …………………………………………………...

Your institute: …………………………………………………...

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10-Oct-11	08:30 – 10:00	Opening session	Auditorium

MOOAU — Opening Session
Chair: R. Mueller (HZB)

MOOAUKP01 08:30

Opening and Welcome Address – *A. Gotz (ESRF), J.M. Chaize (ESRF)*
Official ICALEPCS 2011 Opening and Welcome address

MOOAUKP02 09:00

First Physics Results from LHC and Expectations for the Near Future – *G. Tonelli (CERN)*
After a very successful commissioning period, all detectors running at the CERN Large Hadron Collider (LHC) are now producing new physics results. Collisions of high energy protons at a center-of-mass energy of 7 TeV are being used to produce the first measurements in a new, so far in-explored energy regime. Measurements of the main Standard Model processes will be presented together with searches for new physics including the search for supersymmetric particles and for new exotic states of matter hinting at extra-dimensions. The most recent studies and perspectives on the search for the Standard Model Higgs Boson will be described in some detail. A short summary of the major results obtained with heavy-ion collisions at LHC will be also presented.

MOOAUKP03 09:30

X-RAY Synchrotron Imaging: A Revolution in Paleontology – *P. Tafforeau (ESRF)*
In palaeontology, external morphological investigations are often insufficient. Both external and internal anatomical characters have to be taken into account in order to fully understand a fossil organism. Moreover, different scales of study have to be used, from the general morphological ones to the histological ones. Initiated at the ESRF in 2000, synchrotron based investigations enable very high quality three-dimensional non-destructive X-ray imaging of various fossils. These methods reveal fossil internal structures with incomparable accuracy and sensitivity. It therefore allows the study of fossils that cannot be investigated by conventional microtomography either due to a high degree of mineralization or low absorption contrast. Among many applications, let's cite: identification of insects trapped in opaque amber, dental developmental pattern of fossil hominids, imaging of microscopic fossils, high quality imaging of large fossils, research of fossil embryos in ovo… Through the strong development of palaeontology, and the running projects to improve dramatically the possibilities for fossils investigations, the ESRF appear nowadays as the most powerful and sensitive tool for non-destructive 3D imaging on fossils. Nevertheless technical possibilities offered by synchrotrons are evolving rapidly, especially within the time scale of paleontology.

10-Oct-11 10:30 – 12:15	Plenary Oral	Auditorium

MOBAU — Status Reports 1
Chair: H. Shoaee (SLAC)

MOBAUST01 10:30

News from ITER Controls - A Status Report – *W.-D. Klotz (ITER Organization), A. Wallander (ITER Organization)*
Construction of ITER has started at the Cadarache site in southern France. The first buildings are taking shape and more than 60 % of the in-kind procurement has been committed by the seven ITER member states (China, Europe, India, Japan, Korea, Russia and Unites States). The design and manufacturing of the main components of the machine is now underway all over the world. Each of these components comes with a local control system, which must be integrated in the central control system. The control group at ITER has developed two products to facilitate this; the plant control design handbook (PCDH) and the control, data access and communication (CODAC) core system. PCDH is a document which prescribes the technologies and methods to be used in developing the local control system and sets the rules applicable to the in-kind procurements. CODAC core system is a software package, distributed to all in-kind procurement developers, which implements the PCDH and facilitates the compliance of the local control system. In parallel, the ITER control group is proceeding with the design of the central control system to allow fully integrated and automated operation of ITER. In this paper we report on the progress of design, technology choices and discuss justifications of those choices. We also report on the results of some pilot projects aiming at validating the design and technologies.

MOBAUST02
10:45

The ATLAS Detector Control System – *S. Schlenker (CERN), S. Arfaoui, S. Franz, O. Gutzwiller, C.A. Tsarouchas (CERN) G. Aielli, F. Marchese (Università di Roma II Tor Vergata) G. Arabidze (MSU) E. Banas, Z. Hajduk, J. Olszowska, E. Stanecka (IFJ-PAN) T. Barillari, J. Habring, J. Huber (MPI) M. Bindi, A. Polini (INFN-Bologna) H. Boterenbrood, R.G.K. Hart (NIKHEF) H. Braun, D. Hirschbuehl, S. Kersten, K. Lantzsch (Bergische Universität Wuppertal) R. Brenner (Uppsala University) D. Caforio, C. Sbarra (Bologna University) S. Chekulaev (TRIUMF, Canada's National Laboratory for Particle and Nuclear Physics) S. D'Auria (University of Glasgow) M. Deliyergiyev, I. Mandić (JSI) E. Ertel (Johannes Gutenberg University Mainz, Institut für Physik) V. Filimonov, V. Khomutnikov, S. Kovalenko (PNPI) V. Grassi (SBU) J. Hartert, S. Zimmermann (Albert-Ludwig Universität Freiburg) D. Hoffmann (CPPM) G. Iakovidis, K. Karakostas, S. Leontsinis, E. Mountricha (National Technical University of Athens) P. Lafarguette (Université Blaise Pascal) F. Marques Vinagre, G. Ribeiro, H.F. Santos (LIP) T. Martin, P.D. Thompson (Birmingham University) B. Mindur (AGH University of Science and Technology) J. Mitrevski (SCIPP) K. Nagai (University of Tsukuba, Graduate School of Pure and Applied Sciences,) S. Nemecek (Czech Republic Academy of Sciences, Institute of Physics) D. Oliveira Damazio, A. Poblaguev (BNL) P.W. Phillips (STFC/RAL) A. Robichaud-Veronneau (DPNC) A. Talyshev (BINP) G.F. Tartarelli (Università degli Studi di Milano & INFN) B.M. Wynne (Edinburgh University)*

The ATLAS experiment is one of the multi-purpose experiments at the Large Hadron Collider (LHC), constructed to study elementary particle interactions in collisions of high-energy proton beams. Twelve different sub-detectors as well as the common experimental infrastructure are supervised by the Detector Control System (DCS). The DCS enables equipment supervision of all ATLAS sub-detectors by using a system of 140 server machines running the industrial SCADA product PVSS. This highly distributed system reads, processes and archives of the order of 10^6 operational parameters. Higher level control system layers based on the CERN JCOP framework allow for automatic control procedures, efficient error recognition and handling, manage the communication with external control systems such as the LHC controls, and provide a synchronization mechanism with the ATLAS physics data acquisition system. A web-based monitoring system allows accessing the DCS operator interface views and browse the conditions data archive worldwide with high availability. This contribution firstly describes the status of the ATLAS DCS and the experience gained during the LHC commissioning and the first physics data taking operation period. Secondly, the future evolution and maintenance constraints for the coming years and the LHC high luminosity upgrades are outlined.

MOBAUST03 11:00

The MedAustron Accelerator Control System – *J. Gutleber (CERN), M. Benedikt (CERN) A.B. Brett, A. Fabich, M. Marchhart, R. Moser, M. Thonke, C. Torcato de Matos (EBG MedAustron) J. Dedic (Cosylab)*

This paper presents the architecture and design of the MedAustron particle accelerator control system. The facility is currently under construction in Wr. Neustadt, Austria. The accelerator and its control system are designed at CERN. Accelerator control systems for ion therapy applications are characterized by rich sets of configuration data, real-time reconfiguration needs and high stability requirements. The machine is operated according to a pulse-to-pulse modulation scheme and beams are described in terms of ion type, energy, beam dimensions, intensity and spill length. An irradiation session for a patient consists of a few hundred accelerator cycles over a time period of about two minutes. No two cycles within a session are equal and the dead-time between two cycles must be kept low. The control system is based on a multi-tier architecture with the aim to achieve a clear separation between front-end devices and their controllers. Off-the-shelf technologies are deployed wherever possible. In-house developments cover a main timing system, a light-weight layer to standardize operation and communication of front-end controllers, the control of the power converters and a procedure programming framework for automating high-level control and data analysis tasks. In order to be able to roll out a system within a predictable schedule, an"off-shorin" project management process was adopted: A frame agreement with an integrator covers the provision of skilled personnel that specifies and builds components together with the core team.

MOBAUST04 11:15

The RHIC and RHIC Pre-Injectors Controls Systems: Status and Plans – *K.A. Brown (BNL), Z. Altinbas, J. Aronson, S. Binello, I.G. Campbell, M.R. Costanzo, T. D'Ottavio, W. Eisele, A. Fernando, B. Frak, W. Fu, C. Ho, L.T. Hoff, J.P. Jamilkowski, P. Kankiya, R.A. Katz, S.A. Kennell, J.S. Laster, R.C. Lee, G.J. Marr, A. Marusic, M.P. Menga, R.J. Michnoff, J. Morris, S. Nemesure, B. Oerter, R.H. Olsen, J. Piacentino, G. Robert-Demolaize, V. Schoefer, R.F. Schoenfeld, S. Tepikian, C. Theisen, C.M. Zimmer (BNL)*

Brookhaven National Laboratory (BNL) is one of the premier high energy and nuclear physics laboratories in the world and has been a leader in accelerator based physics research for well over half a century. For the past ten years experiments at the Relativistic Heavy Ion Collider (RHIC) have recorded data from collisions of heavy ions and polarized protons, leading to major discoveries in nuclear physics and the spin dynamics of quarks and gluons. BNL is also the site of one of the oldest alternating gradient synchrotrons, the AGS, which first operated in 1960. The accelerator controls systems for these instruments span multiple generations of technologies. In this report we will describe the current status of the Collider-Accelerator Department controls systems, which are used to control seven different accelerator facilities (from the LINAC and Tandem van de Graafs to RHIC) and multiple science programs (high energy nuclear physics, high energy polarized proton physics, NASA programs, isotope production, and multiple accelerator research and development projects). We will describe the status of current projects, such as the just completed Electron Beam Ion Source (EBIS), our R&D programs in superconducting RF and an Energy Recovery LINAC (ERL), innovations in feedback systems and bunched beam stochastic cooling at RHIC, and plans for future controls system developments.

MOBAUST05
11:30

Control System Achievement at KEKB and Upgrade Design for SuperKEKB –
K. Furukawa (KEK), A. Akiyama, E. Kadokura, M. Kurashina, K. Mikawa, F. Miyahara, T.T. Nakamura, J.-I. Odagiri, M. Satoh, T. Suwada (KEK) T. Kudou, S. Kusano, T. Nakamura, K. Yoshii (MELCO SC) T. Okazaki (EJIT)
SuperKEKB electron-positron asymmetric collider is being constructed after a decade of successful operation at KEKB for B physics research. KEKB completed all of the technical milestones, and had offered important insights into the flavor structure of elementary particles, especially the CP violation. The combination of scripting languages at the operation layer and EPICS at the equipment layer had led the control system to successful performance. The new control system in SuperKEKB will continue to employ those major features of KEKB, with additional technologies for the reliability and flexibility. The major structure will be maintained especially the online linkage to the simulation code and slow controls. However, as the design luminosity is 40-times higher than that of KEKB, several orders of magnitude higher performance will be required at certain area. At the same time more controllers with embedded technology will be installed to meet the limited resources.

MOBAUST06
11:45

The LHCb Experiment Control System: on the Path to Full Automation –
C. Gaspar (CERN), F. Alessio, L.G. Cardoso, M. Frank, J.C. Garnier, R. Jacobsson, B. Jost, N. Neufeld, R. Schwemmer, E. van Herwijnen (CERN) O. Callot (LAL) B. Franek (STFC/RAL)
LHCb is a large experiment at the LHC accelerator. The experiment control system is in charge of the configuration, control and monitoring of the different sub-detectors and of all areas of the online system: the Detector Control System (DCS), sub-detector's voltages, cooling, temperatures, etc.; the Data Acquisition System (DAQ), and the Run-Control; the High Level Trigger (HLT), a farm of around 1500 PCs running trigger algorithms; etc. The building blocks of the control system are based on the PVSS SCADA System complemented by a control Framework developed in common for the 4 LHC experiments. This framework includes an"expert syste" like tool called SMI++ which we use for the system automation. The full control system runs distributed over around 160 PCs and is logically organised in a hierarchical structure, each level being capable of supervising and synchronizing the objects below. The experiment's operations are now almost completely automated driven by a top-level object called Big-Brother which pilots all the experiment's standard procedures and the most common error-recovery procedures. Some examples of automated procedures are: powering the detector, acting on the Run-Control (Start/Stop Run, etc.) and moving the vertex detector in/out of the beam, all driven by the state of the accelerator or recovering from errors in the HLT farm. The architecture, tools and mechanisms used for the implementation as well as some operational examples will be shown.

10-Oct-11 13:30 – 15:00	Plenary Oral	Auditorium

MOCAU — Project Management

Chair: P. Betinelli (SOLEIL)

MOCAULT01 13:30

Managing Mayhem – *K.S. White (ORNL)*

In research institutes, scientists and engineers are often promoted to managerial positions based on their excellence in the technical aspects of their work. Once in the managerial role, they may discover they lack the skills or interest necessary to perform the management functions that enable a healthy, productive organization. This is not really surprising when one considers that scientists and engineers are trained for quantitative analysis while the management arena is dominated by qualitative concepts. Management is generally considered to include planning, organizing, leading and controlling. This paper discusses the essential management functions and techniques that can be employed to maximize success in a research and development organization.

MOCAULT02 13:50

Managing the Development of Plant Subsystems for a Large International Project – *D.P. Gurd (Private Address)*

ITER is an international collaborative project under development by nations representing over one half of the world's population. Major components will be supplied by"Domestic Agencie" representing the various participating countries. While the supervisory control system, known as"CODA", will be developed at the project site in the south of France, the EPICS and PLC-based plant control subsystems are to be developed and tested locally, where the subsystems themselves are being built. This is similar to the model used for the development of the Spallation Neutron Source (SNS), which was a US national collaboration. However the far more complex constraints of an international collaboration, as well as the mandated extensive use of externally contracted and commercially-built subsystems, preclude the use of many specifics of the SNS collaboration approach which may have contributed to its success. Moreover, procedures for final system integration and commissioning at ITER are not yet well defined. This paper will outline the particular issues either inherent in an international collaboration or specific to ITER, and will suggest approaches to mitigate those problems with the goal of assuring a successful and timely integration and commissioning phase.

MOCAULT03 14:10

The Challenges of Managing a Big Upgrade – *J. Susini (ESRF), P. Duru, A. Gotz (ESRF)*

After 20 years of building up one of the world's first 3rd generation synchrotron sources the ESRF has embarked on an ambitious Upgrade Program. The Upgrade Program includes a major upgrade of the accelerator complex the RF system and insertion devices, 8 new beamlines and a number of extended beamlines. The ESRF has been reorganised to manage the upgrade. At the same time as the Upgrade Program started the Instrumentation and Services Division (ISDD) has been setup. The ISDD regroups all competences required to build advanced instrumentation needed by the beamlines and accelerators. To manage the Upgrade Program and building the new beamlines the ESRF and the ISDD in particular has decided to introduce project management. This paper will describe what project management techniques have been adopted and the challenges and difficulties encountered while doing so. It will also describe the challenges encountered trying to unify solutions and modernise after 20 years of separate development. The project management and technical solutions adopted will be presented.

MOCAUIO04
14:30

The SESAME Project – *A. Nadji (SESAME), S. Abu Ghannam (SESAME) P. Betinelli, L.S. Nadolski (SOLEIL) J.-F. Gournay (CEA/IRFU) M.T. Heron (Diamond) B. Kalantari (PSI) E. Matias, G. Wright (CLS)*

SESAME (Synchrotron-light for Experimental Science and Applications in the Middle East) is a third generation synchrotron light source under construction near Amman (Jordan), which is expected to begin operation in 2015. SESAME will foster scientific and technological excellence in the Middle East and the Mediterranean region, build scientific bridges between neighbouring countries and foster mutual understanding through international cooperation. The members of SESAME are currently Bahrain, Cyprus, Egypt, Iran, Israel, Jordan, Pakistan, the Palestinian Authority and Turkey. An overview about the progress of the facility and the general plan will be given in this talk. Then I will focus on the control system by explaining how this part is managed: the technical choice, the main deadlines, the local staff, the international virtual control team, and the first results.

10-Oct-11 15:30 – 16:20	Plenary Oral	Auditorium

MODAU — Process Tuning and Feedback Systems

Chair: M. Lonza (ELETTRA)

MODAULT01 15:30

TMT Adaptive Optics Computing Challenges – *C. Boyer (TMT), B.L. Ellerbroek, L. Gilles, L. Wang (TMT) S. Browne (The Optical Sciences Company) G.J. Hovey (DRAO)*

The Thirty Meter Telescope (TMT) will be used with Adaptive Optics (AO) systems to allow near diffraction-limited performance in the near-infrared and achieve the main TMT science goals. Adaptive optics systems reduce the effect of the atmospheric distortions by dynamically measuring the distortions with wavefront sensors, performing wavefront reconstruction with a Real Time Controller (RTC), and then compensating for the distortions with wavefront correctors. The requirements for the RTC subsystem of the TMT first light AO system will represent a significant advance over the current generation of astronomical AO control systems. Memory and processing requirements would be at least 2 orders of magnitude greater than the currently most powerful AO systems using conventional approaches, so that innovative wavefront reconstruction algorithms and new hardware approaches will be required. In this paper, we will first present the requirements and challenges for the RTC of the first light AO system, together with the algorithms that have been developed to reduce the memory and processing requirements, and then two possible hardware architectures based on Field Programmable Gate Array (FPGA).

MODAUIO02 15:50

Global Real Time Functions of the"Plasma Syste": Plasma Control and Machine Protection – *F. Sartori (F4E), M. Cavinato (F4E) G. De Tommasi (CREATE) A. Neto (IPFN)*

One of the most promising lines of research in the area of energy generation by means of nuclear fusion is Tokamak high temperature magnetic fusion. Tokamak devices are complex machines where very hot plasma is formed, controlled and heated thanks to collaboration of several systems. Many of these systems are involved directly with the management of the plasma and the reaching of the target fusion performances: diagnostics, machine instrumentation, plasma heating systems, and magnets. Especially close and real-time coordination among these systems and the plasma is required for safe and efficient operation of the device. This overall"plasma syste" has recently emerged as one of the most important areas of research and development as performance in a large and advanced tokamak device strongly depends on it. This talk will first provide an introductory overview to the"plasma syste" especially highlighting its most important requirements. The focus will then be then given to the functions required to support real time coordination among the systems: plasma control and machine protection. The talk will try to exemplify the range of problems encountered in this area using JET experience as a model. Finally an example of present architecture and a methodology addressing the above problems will be presented.

10-Oct-11 17:00 – 17:30	Mini oral	Auditorium

MOMAU — Mini Orals A

Chair: J.M. Meyer (ESRF)

Data and information management

MOMAU002 **Improving Data Retrieval Rates Using Remote Data Servers** – *T. D'Ottavio (BNL), B. Frak, J. Morris, S. Nemesure (BNL)*

The power and scope of modern Control Systems has led to an increased amount of data being collected and stored, including data collected at high (kHz) frequencies. One consequence is that users now routinely make data requests that can cause gigabytes of data to be read and displayed. Given that a users patience can be measured in seconds, this can be quite a technical challenge. This paper explores one possible solution to this problem - the creation of remote data servers whose performance is optimized to handle context-sensitive data requests. Methods for increasing data delivery performance include the use of high speed network connections between the stored data and the data servers, smart caching of frequently used data, and the culling of data delivered as determined by the context of the data request. This paper describes decisions made when constructing these servers and compares data retrieval performance by clients that use or do not use an intermediate data server.

MOMAU003 **The Computing Model of the Experiments at PETRA III** – *T. Kracht (DESY), M. Flemming, T. Nunez, A. Rothkirch, F. Schluenzen, P. van der Reest (DESY)*

The PETRA storage ring at DESY in Hamburg has been refurbished to become a highly brilliant synchrotron radiation source (now named PETRA III). Commissioning of the beamlines started in 2009, user operation in 2010. In comparison with our DORIS beamlimes, the PETRA III experiments have larger complexity, higher data rates and require an integrated system for data storage and archiving, data processing and data distribution. Tango [1] and Sardana [2] are the main components of our online control system. Both systems are developed by international collaborations. Tango serves as the backbone to operate all beamline components, certain storage ring devices and equipment from our users. Sardana is an abstraction layer on top of Tango. It standardizes the hardware access, organizes experimental procedures, has a command line interface and provides us with widgets for graphical user interfaces. Other clients like Spectra, which was written for DORIS, interact with Tango or Sardana. Modern 2D detectors create large data volumes. At PETRA III all data are transferred to an online file server which is hosted by the DESY computer center. Near real time analysis and reconstruction steps are executed on a CPU farm. A portal for remote data access is in preparation. Data archiving is done by the dCache [3]. An offline file server has been installed for further analysis and inhouse data storage.

MOMAU004 **Database Foundation for the Configuration Management of the CERN Accelerator Controls Systems** – *Z. Zaharieva (CERN), M. Martin Marquez, M. Peryt (CERN)*

The Controls Configuration DB (CCDB) and its interfaces have been developed over the last 25 years in order to become nowadays the basis for the Configuration Management of the Controls System for all accelerators at CERN. The CCDB contains data for all configuration items and their relationships, required for the correct functioning of the Controls System. The configuration items are quite heterogeneous, depicting different areas of the Controls System – ranging from 3000 Front-End Computers, 75 000 software devices allowing remote control of the accelerators, to valid states of the Accelerators Timing System. The article will describe the different areas of the CCDB, their interdependencies and the challenges to establish the data model for such a diverse configuration management database, serving a multitude of clients. The CCDB tracks the life of the configuration items by allowing their clear identification, triggering change management processes as well as providing status accounting and audits. This necessitated the development and implementation of a combination of tailored processes and tools. The Controls System is a data-driven one - the data stored in the CCDB is extracted and propagated to the controls hardware in order to configure it remotely. Therefore a special attention is placed on data security and data integrity as an incorrectly configured item can have a direct impact on the operation of the accelerators.

MOMAU005 **Integrated Approach to the Development of the ITER Control System Configuration Data** – *D. Stepanov (ITER Organization) G. Auge, J. Bertin, G. Bourguignon, G. Darcourt (Sopra Group)*

ITER control system (CODAC) is steadily going into the implementation phase. A design guidelines handbook and a software development toolkit, named CODAC Core System, were produced in February 2011. They are ready to be used off-site, in the ITER domestic agencies and associated industries, in order to develop first control"island" of various ITER plant systems. In addition to the work done off-site there is wealth of I&C related data developed centrally at ITER, but scattered through various sources. These data include I&C design diagrams, 3-D data, volume allocation, inventory control, administrative data, planning and scheduling, tracking of deliveries and associated documentation, requirements control, etc. All these data have to be kept coherent and up-to-date, with various types of cross-checks and procedures imposed on them. A"plant system profil" database, currently under development at ITER, represents an effort to provide integrated view into the I&C data. Supported by a platform-independent data modeling, done with a help of XML Schema, it accumulates all the data in a single hierarchy and provides different views for different aspects of the I&C data. The database is implemented using MS SQL Server and Java-based web interface. Import and data linking services are implemented using Talend software, and the report generation is done with a help of MS SQL Server Reporting Services. This paper will report on the first implementation of the database, the kind of data stored so far, typical work flows and processes, and directions of further work.

Project management

MOMAU007 **How to Manage Hundreds of Controls Computers Offering Different Functionalities with Only Two System Administrators.** – *R.A. Krempaska (PSI-LRF)*
The Controls section in PSI is responsible for the Control Systems of four Accelerators: two proton accelerators HIPA and PROSCAN, Swiss Light Source SLS and the Free Electron Laser (SwissFEL) Test Facility. On top of that, we have 18 additional SLS beamlines to control. The controls system is mainly composed of the so called Input Output Controllers (IOCs) which require a complete and complex computing infrastructure in order to boot, being developed, debugged and monitored. This infrastructure consists currently mainly of Linux computers like boot server, port server, or configuration server (called save and restore server). Overall, the constellation of computers and servers which compose the control system counts about five hundred Linux computers which can be split into 38 different configurations based on the work each of this system need to provide. For the administration of all this we do employ only two system administrators who are responsible for the installation, configuration and maintenance of those computers. This paper shows which tools are used to squash this difficult task: like Puppet (an open source Linux tool we further adapted) and many in-house developed tools offering an overview about computers, installation status and relations between the different servers / computers.

MOMAU008 **Integrated Management Tool for Controls Software Problems, Requests and Project Tasking at SLAC** – *D. Rogind (SLAC), B. Allen, W.S. Colocho, G. DeContreras, P. Pandey, H. Shoaee (SLAC)*
The Controls Department at SLAC, with its service center model, continuously receives engineering requests to design, build and support controls for accelerator systems lab-wide. Each customer request can vary in complexity from installing a minor feature to enhancing a major subsystem. Departmental accelerator improvement projects, along with DOE-approved construction projects, also contribute heavily to the work load. These various customer requests and projects, paired with the ongoing operational maintenance and problem reports, place a demand on the department that usually exceeds the capacity of available resources. An integrated, centralized repository - comprised of all problems, requests, and project tasks - available to all customers, operators, managers, and engineers alike - is essential to capture, communicate, prioritize, assign, schedule, track progress, and finally, commission all work components. The Controls software group has recently integrated its request/task management into its online problem tracking"Comprehensive Accelerator Tool for Enhancing Reliabilit" (CATER) tool. This paper discusses the new integrated software problem/request/task management tool - its work-flow, reporting capability, and its many benefits.

MOMAU009 **Laser Inertial Fusion Energy Control Systems** – *C.D. Marshall (LLNL), R.W. Carey, R. Demaret, O.D. Edwards, L.J. Lagin, P.J. Van Arsdall (LLNL)*
A Laser Inertial Fusion Energy (LIFE) facility point design is being developed at LLNL to support an Inertial Confinement Fusion (ICF) based energy concept. This will build upon the technical foundation of the National Ignition Facility (NIF), the world's largest and most energetic laser system. NIF is designed to compress fusion targets to conditions required for thermonuclear burn. The LIFE control systems will have an architecture partitioned by sub-systems and distributed among over 1000's of front-end processors, embedded controllers and supervisory servers. LIFE's automated control subsystems will require interoperation between different languages and target architectures. Much of the control system will be embedded into the subsystem with well defined interface and performance requirements to the supervisory control layer. An automation framework will be used to orchestrate and automate start-up and shut-down as well as steady state operation. The LIFE control system will be a high parallel segmented architecture. For example, the laser system consists of 384 identical laser beamlines in a"bo". The control system will mirror this architectural replication for each beamline with straightforward high-level interface for control and status monitoring. Key technical challenges will be discussed such as the injected target tracking and laser pointing feedback. This talk discusses the the plan for controls and information systems to support LIFE.

10-Oct-11 17:00 – 17:30	Mini oral	Makalu

MOMMU — Mini Orals B
Chair: R. Wilcke (ESRF)

Operational tools and operators' view

MOMMU001 **Extending Alarm Handling in Tango** – *S. Rubio-Manrique (CELLS-ALBA Synchrotron), F. Becheri, D.F.C. Fernandez-Carreiras, J. Klora, L. Krause, A. Milán Otero, Z. Reszela, L. Zytniak (CELLS-ALBA Synchrotron)*
This paper describes the alarm system developed at Alba Synchrotron, built on Tango Control System. It describes the tools used for configuration and visualization, its integration in user interfaces and its approach to alarm specification; either assigning discrete Alarm/Warning levels or allowing versatile logic rules in Python. This paper also covers the life cycle of the alarm (triggering, logging, notification, explanation and acknowledge) and the automatic control actions that can be triggered by the alarms.

MOMMU002 **NFC Like Wireless Technology for Monitoring Purposes in Scientific/ Industrial Facilities** – *I. Badillo (ESS-Bilbao), M. Eguiraun (ESS-Bilbao) J. Jugo (University of the Basque Country, Faculty of Science and Technology)*
Wireless technologies are becoming more and more used in large industrial and scientific facilities like particle accelerators for facilitating the monitoring and indeed sensing in these kind of large environments. Cabled equipment means little flexibility in placement and is very expensive in both money an effort whenever reorganization or new installation is needed. So, when cabling is not really needed for performance reasons wireless monitoring and control is a good option, due to the speed of implementation. There are several wireless flavors to choose, as Bluetooth, Zigbee, WiFi, etc. depending on the requirements of each specific application. In this work a wireless monitoring system for EPICS (Experimental Physics and Industrial Control System) is presented, where desired control system variables are acquired over the network and published in a mobile device, allowing the operator to check process variables everywhere the signal spreads. In this approach, a Python based server will be continuously getting EPICS Process Variables via Channel Access protocol and sending them through a WiFi standard 802.11 network using ICE middleware. ICE is a toolkit oriented to build distributed applications. Finally the mobile device will read the data and show it to the operator. The security of the communication can be assured by means of a weak wireless signal, following the same idea as in NFC, but for more large distances. With this approach, local monitoring and control applications, as for example a vacuum control system for several pumps, are easily implemented.

MOMMU003 **The Aperture Meter for the Large Hadron Collider** – *G.J. Müller (CERN), K. Fuchsberger, S. Redaelli (CERN)*

The control of the high intensity beams of the CERN Large Hadron Collider (LHC) is particular challenging and requires a good modeling of the machine and monitoring of various machine parameters. During operation it is crucial to ensure a minimal distance between the beam edge and the aperture of sensitive equipment, e.g. the superconducting magnets, which in all cases must be in the shadow of the collimators that protect the machine. Possible dangerous situations must be detected as soon as possible. In order to provide the operator with information about the current machine bottlenecks an aperture meter application was developed based on the LHC online modeling toolchain. The calculation of available free aperture takes into account the best available optics and aperture model as well as the relevant beam measurements. This paper describes the design and integration of this application into the control environment and presents results of the usage in daily operation and from validation measurements.

Process tuning and feedback systems

MOMMU005 **Stabilization and Positioning of CLIC Quadrupole Magnets with sub-Nanometre Resolution** – *S.M. Janssens (CERN), K. Artoos, C.G.R.L. Collette, M. Esposito, P. Fernandez Carmona, M. Guinchard, C. Hauviller, A.M. Kuzmin, R. Leuxe, R. Moron Ballester (CERN)*

To reach the required luminosity at the CLIC interaction point, about 2000 quadrupoles along each linear collider are needed to obtain a vertical beam size of 1 nm at the interaction point. Active mechanical stabilization is required to limit the vibrations of the magnetic axis to the nanometre level in a frequency range from 1 to 100 Hz. The approach of a stiff actuator support was chosen to isolate from ground motion and technical vibrations acting directly on the quadrupoles. The actuators can also reposition the quadrupoles between beam pulses with nanometre resolution. A first conceptual design of the active stabilization and nano positioning based on the stiff support and seismometers was validated in models and experimentally demonstrated on test benches. Lessons learnt from the test benches and information from integrated luminosity simulations using measured stabilization transfer functions lead to improvements of the actuating support, the sensors used and the system controller. The controller electronics were customized to improve performance and to reduce cost, size and power consumption. The outcome of this R&D is implemented in the design of the first prototype of a stabilized CLIC quadrupole magnet.

MOMMU006 **A Novel Control System Based on Digital Estimation for Regulation of Amplitude and Phase Variation.** – *L.V. Krishnan (DAE/VECC), S. Bandyopadhyay, M. Das, S. Saha, S. Srivastav (DAE/VECC)*

This paper presents a unique digital controller design based on kalman filter for the real time regulation of amplitude and phase of a specific frequency, when it varies in a system under focus. This controller design has wide areas of application in accelerator systems like cyclotron Dee voltage regulation, linac cavity output regulation. This paper describes the controller design from the view point of SMES (Super Conducting Magnetic Energy Storage system) application. In SMES system the variation of line voltage such as sag, swell, interruptions has to be detected and its characteristics such as amount of variation, and variation in phase or amplitude or both has to be found and according to that a compensation signal is generated for the period of variation. Hence the controller has three main blocks 1.Detection and Estimation of Voltage variation characteristics estimation, 2.compensation signal generation and regulation 3.phase locking or synchronization. The devised controller has an initial convergence time of less than 0.5 of a cycle. The instantaneous compensation signal mitigate the variation in nearly 0.3 of a cycle. In this devised phase locking technique there is no need for a stable reference signal for synchronization. The phase locking method synchronizes itself from the observed signal even when the observed signal has any kind of error or deviation,accordingly internal phase of modeled kalman filter regulates itself. The above controller's algorithm was modeled and tested by acquiring signals from main line into simulink.

Upgrade of control systems

MOMMU009 **Upgrade of the Server Architecture for the Accelerator Control System at the Heidelberg Ion Therapy Center** – *J.M. Mosthaf (HIT), Th. Haberer, S. Hanke, K. Höppner, A. Peters, S. Stumpf (HIT)*

The Heidelberg Ion Therapy Center (HIT) is a heavy ion accelerator facility located at the Heidelberg university hospital and intended for cancer treatment with heavy ions and protons. It provides three treatment rooms for therapy of which two using horizontal beam nozzles are in use and the unique gantry with a 360^{o} rotating beam port is currently under commissioning. The proprietary accelerator control system runs on several classical server machines, including a main control server, a database server running Oracle, a device settings modeling server (DSM) and several gateway servers for auxiliary system control. As the load on some of the main systems, especially the database and DSM servers, has become very high in terms of CPU and I/O load, a change to a more up to date blade server enclosure with four redundant blades and a 10Gbit internal network architecture has been decided. Due to budgetary reasons, this enclosure will at first only replace the main control, database and DVM servers and consolidate some of the services now running on auxiliary servers. The internal configurable network will improve the communication between servers and database. As all blades in the enclosure are configured identically, one dedicated spare blade is used to provide redundancy in case of hardware failure. Additionally we plan to use virtualization software to further improve redundancy and consolidate the services running on gateways and to make dynamic load balancing available to account for different performance needs e.g. in commissioning or therapy use of the accelerator.

MOMMU010 **Control and Synchronization System for the PLS-II** – *J.W. Lee (PAL), J.Y. Huang, J.M. Kim, K.R. Kim, E.H. Lee, S.H. Nam, B.R. Park, S. Shin, J.C. Yoon (PAL)*

A control and synchronization system is being developed for the precise remote operation of the PLS-II 3-Gev synchrotron light source. The PLS-II is the upgrade of the old PLS machine and is currently under construction. Most of the PLS-II control and synchronization system is redesigned and rebuilt replacing the old one. It consists of four parts; high-level operation control, device input/output control, machine synchronization control, and data communication network. EPICS is used as the tool-kit to build the entire system. High-level system provides various graphic GUI panels. It also provides data management services using various servers such as MML server, EPICS Gateway server, Oracle database server, etc.. Linux-PCs and Solaris-workstations are used for the main hardware platforms of the high-level system. Device input/ouput system uses EPICS IOCs for the input and output control of the devices in the field. These IOCs are mostly implemented with vxWorks-VMEs, Linux-PCs, and embedded IOC controllers. The synchronization system uses the event generation and receiving technique to provide the trigger and clock signals for the synchronous operation of the machine. All computers are connected through the Ethernet(TCP/IP) for the data communication between them. This paper presents general system structure and implementation of the control and synchronization system.

MOMMU012 **A FPGA Based Base-band RF Control System*** – *M. Konrad (TU Darmstadt), U. Bonnes, C. Burandt, R. Eichhorn, N. Pietralla (TU Darmstadt)*

The analog rf control system of the S-DALINAC has been replaced by a new digital system recently. The new hardware consists of an rf module and a FPGA board which have been developed in-house. A custom CPU implemented in the FPGA executing the control algorithm makes changes of the algorithm possible without time-consuming synthesis. Another microcontroller connects the FPGA board to a standard PC server via CAN bus. This connection is used to adjust control parameters as well as for transmitting commands from the rf control system to the cavity tuner power supplies. The PC runs Linux and an EPICS IOC. The latter is connected to the CAN bus with a device support that uses the SocketCAN network stack included in recent Linux kernels making the IOC independent of the CAN controller hardware. A diagnostic server streams signals from the FPGAs to clients on the network. Clients used for diagnosis include a software oscilloscope as well as a software spectrum analyzer. The parameters of the controllers can be changed with synoptic displays implemented with Control System Studio. We will present the architecture of the rf control system as well as the functionality of its components.

10-Oct-11 16:30 – 18:00	Poster	Kilimanjaro Nord

MOPKN — Poster

Chair: R. Wilcke (ESRF)

Data and information management

MOPKN002 **The LHC Supertable** – *M. Pereira (CERN), M. Lamont, D.D. Teixeira (CERN) T.E. Lahey (SLAC) E.S.M. McCrory (Fermilab)*

LHC operations generate enormous amounts of data. These data are being stored in many different databases. Hence, it is difficult for operators, physicists, engineers and management to have a clear view on the overall accelerator performance. Until recently the logging database, through its desktop interface TIMBER, was the only way of retrieving information on a fill-by-fill basis. The LHC Supertable has been developed to provide a summary of key LHC performance parameters in a clear, consistent and comprehensive format. The columns in this table represent main parameters that describe the collider's operation such as luminosity, beam intensity, emittance, etc. The data is organized in a tabular fill-by-fill manner with different levels of detail. A particular emphasis was placed on data sharing by making data available in various open formats. Typically the contents are calculated for periods of time that map to the accelerator's states or beam modes such as Injection, Stable Beams, etc. Data retrieval and calculation is triggered automatically after the end of each fill. The LHC Supertable project currently publishes 80 columns of data on around 100 fills.

MOPKN004 **VEPP-2000 Logging System** – *A.I. Senchenko (BINP SB RAS), D.E. Berkaev (BINP SB RAS)*

Electron-positron collider VEPP-2000 was constructed in the Budker INP at the beginning of 2007. Tuning and calibration of subsystems are finished now and first experiments on high-energy physics has been started at the end of 2009. Collider state is characterized by many parameters which have to be tracked. These parameters could be divided into two groups: continuous (like beam current or beam energy) with typical speed of change from twice per second up to once every ten minutes and pulsed which are related to a certain beam transport event called "Shot". There are approximately 3000 continuous channels and about 500 pulsed channels at VEPP-2000 facility. Logging system consists of server layer and client layer. Server side are a specialized server with an intermediate embedded database aimed to save data in case of external permanent database fault. Client layer provide data access via API, CLI and WUI. The system has been deployed and is used as primary logging system on VEPP2000.

MOPKN005 **Construction of New Data Archive System in RIKEN RI Beam Factory** – *M. Komiyama (RIKEN Nishina Center), N. Fukunishi (RIKEN Nishina Center) A. Uchiyama (SHI Accelerator Service ltd.)*
The control system of RIKEN RI Beam Factory (RIBF) is based on EPICS and three kinds of data archive system have been in operation. Two of them are EPICS applications and the other is MyDAQ2 developed by SPring-8 control group. MyDAQ2 collects data such as cooling-water temperature and magnet temperature etc and is not integrated into our EPICS control system. In order to unify the three applications into a single system, we have started to develop a new system since October, 2009. One of the requirements for this RIBF Control data Archive System (RIBFCAS) is that it routinely collects more than 3000 data from 21 EPICS Input/Output Controllers (IOC) at every 1 to 60 seconds, depending on the type of equipment. An ability to unify MyDAQ2 database is also required. To fulfill these requirements, a Java-based system is constructed, in which Java Channel Access Light Library (JCAL) developed by J-PARC control group is adopted in order to acquire large amounts of data as mentioned above. The main advantage of JCAL is that it is based on single threaded architecture for thread safety and user thread can be multi-threaded. The RIBFCAS hardware consists of an application server, a database server and a client-PC. The client application is executed on the Adobe AIR runtime. At the moment, we succeeded in getting about 3000 data from 21 EPICS IOCs at every 10 seconds for one day, and validation tests are proceeding. Unification of MyDAQ2 is now in progress and it is scheduled to be completed in 2011.

MOPKN006 **Algorithms and Data Structures for the EPICS Channel Archiver** – *J. Rowland (Diamond), M.T. Heron, M.A. Leech, S.J. Singleton, K. Vijayan (Diamond)*
Diamond Light Source records 3GB of process data per day and has a 15TB archive on line with the EPICS Channel Archiver. This paper describes recent modifications to the software to improve performance and usability. The file-size limit on the R-Tree index has been removed, allowing all archived data to be searchable from one index. A decimation system works directly on compressed archives from a backup server and produces multi-rate reduced data with minimum and maximum values to support time efficient summary reporting and range queries. The XMLRPC interface has been extended to provide binary data transfer to clients needing large amounts of raw data.

MOPKN007 **LHC Dipole Magnet Splice Resistance from SM18 Data Mining** – *H. Reymond (CERN), P. Bloch, C. Charrondiere, G. Lehmann Miotto, L. Mapelli, A. Rijllart, D. Scannicchio, J.G. Von Der Schmitt (CERN)*
The splice incident which happened during commissioning of the LHC on the 19th of September 2008 caused damage to several magnets and adjacent equipment. This raised not only the question of how it happened, but also about the state of all other splices. The inter magnet splices were studied very soon after with new measurements, but the internal magnet splices were also a concern. At the Chamonix meeting in January 2009, the CERN management decided to create a working group to analyse the provoked quench data of the magnet acceptance tests and try to find indications for bad splices in the main dipoles. This resulted in a data mining project that took about one year to complete. This presentation describes how the data was stored, extracted and analysed reusing existing LabVIEW^{TM} based tools. We also present the encountered difficulties and the importance of combining measured data with operator notes in the logbook.

MOPKN008 **History of the Data Archiving in the KEKB Accelerator Control System** – *T.T. Nakamura (KEK), K. Furukawa, N. Yamamoto (KEK)*
A data archiving system"KEKBLo" was developed in KEK for the KEKB accelerators. The software structure of KEKBLog is simple. It consists of a simple archiving program, which is based on EPICS channel access protocol, and retrieving tools. KEKBLog has accumulated a large amount of archive data and has served them for daily operation of the KEKB accelerators since 1998, the beginning of the commissioning of KEKB. For the KEKBLog system, many improvements have been made during this decade. We report the history of the KEKBLog system and the management of the archive data. The future plan toward the SuperKEKB is also discussed.

MOPKN009 **The CERN Accelerator Measurement Database: On the Road to Federation** – *C. Roderick (CERN), R. Billen, M. Gourber-Pace, N. Hoibian, M. Peryt (CERN)*
The Measurement database, acting as short-term central persistence and front-end of the CERN accelerator Logging Service, receives billions of time-series data per day for 200,000+ signals. A variety of data acquisition systems on hundreds of front-end computers publish source data that eventually end up being logged in the Measurement database. As part of a federated approach to data management, information about source devices are defined in a Configuration database, whilst the signals to be logged are defined in the Measurement database. A mapping, which is often complex and subject to change and extension, is therefore required in order to subscribe to the source devices, and write the published data to the corresponding named signals. Since 2005, this mapping was done by means of dozens of XML files, which were manually maintained by multiple persons, resulting in a configuration that was error prone. In 2010 this configuration was improved, such that it becomes fully centralized in the Measurement database, reducing significantly the complexity and the number of actors in the process. Furthermore, logging processes immediately pick up modified configurations via JMS based notifications sent directly from the database, allowing targeted device subscription updates rather than a full process restart as was required previously. This paper will describe the architecture and the benefits of current implementation, as well as the next steps on the road to a fully federated solution.

MOPKN010 **Database and Interface Modifications: Change Management Without Affecting the Clients** – *M. Peryt (CERN), R. Billen, M. Martin Marquez, Z. Zaharieva (CERN)*
The first Oracle-based Controls Configuration Database (CCDB) was developed in 1986, by which the controls system of CERN's Proton Synchrotron became data-driven. Since then, this mission-critical system has evolved tremendously going through several generational changes in terms of the increasing complexity of the control system, software technologies and data models. Today, the CCDB covers the whole CERN accelerator complex and satisfies a much wider range of functional requirements. Despite its online usage, everyday operations of the machines must not be disrupted. This paper describes our approach with respect to dealing with change while ensuring continuity. How do we manage the database schema changes? How do we take advantage of the latest web deployed application development frameworks without alienating the users? How do we minimize impact on the dependent systems connected to databases through various API's? In this paper we will provide our answers to these questions, and to many more.

MOPKN011 **CERN Alarms Data Management: State & Improvements** – *Z. Zaharieva (CERN), M. Buttner (CERN)*

The CERN Alarms System - LASER is a centralized service ensuring the capturing, storing and notification of anomalies for the whole accelerator chain, including the technical infrastructure at CERN. The underlying database holds the pre-defined configuration data for the alarm definitions, for the Operators alarms consoles as well as the time-stamped, run-time alarm events, propagated through the Alarms Systems. The article will discuss the current state of the Alarms database and recent improvements that have been introduced. It will look into the data management challenges related to the alarms configuration data that is taken from numerous sources. Specially developed ETL processes must be applied to this data in order to transform it into an appropriate format and load it into the Alarms database. The recorded alarms events together with some additional data, necessary for providing events statistics to users, are transferred to the long-term alarms archive. The article will cover as well the data management challenges related to the recently developed suite of data management interfaces in respect of keeping data consistency between the alarms configuration data coming from external data sources and the data modifications introduced by the end-users.

MOPKN012 **HyperArchiver: an EPICS Archiver Prototype Based on Hypertable** – *M.G. Giacchini (INFN/LNL), A. Andrighetto, G. Bassato, L.G. Giovannini, M. Montis, G.P. Prete, J.A. Vasquez (INFN/LNL) J. Jugo (University of the Basque Country, Faculty of Science and Technology) K.-U. Kasemir (ORNL) R. Lange (HZB) R. Petkus (BNL) M. del Campo (ESS-Bilbao)*

This work started in the context of NSLS2 project at Brookhaven National Laboratory. The NSLS2 control system foresees a very high number of PV variables and has strict requirements in terms of archiving/retrieving rate: our goal was to store 10K PV/sec and retrieve 4K PV/sec for a group of 4 signals. The HyperArchiver is an EPICS Archiver implementation engined by Hypertable, an open source database whose internal architecture is derived from Google's Big Table. We discuss the performance of HyperArchiver and present the results of some comparative tests.

MOPKN013 **Image Acquisition and Analysis for Beam Diagnostics Applications of the Taiwan Photon Source** – *C.-Y. Liao (NSRRC), J. Chen, Y.-S. Cheng, K.T. Hsu, K.H. Hu, C.H. Kuo, C.Y. Wu (NSRRC)*

Design and implementation of image acquisition and analysis is in process for the Taiwan Photon Source (TPS) diagnostic applications. The optical system contains screen, lens, and lighting system. A CCD camera with Gigabit Ethernet interface (GigE Vision) will be a standard image acquisition device. Image acquisition will be done on EPICS IOC via PV channel and will analyse the properties by using Matlab tool to evaluate the beam profile (sigma), beam size position and tilt angle et al. Progress of the project will be summarized in this report.

MOPKN014 **Research And Implementation of a Web-based RealTime Monitoring System On EPICS Data** – *L. Li (IHEP Beijing), C.H. Wang (IHEP Beijing)*

This paper studies and implements a real time Monitoring EPICS system based on Web, using Flex and BlazeDS technology. This system takes BEPCII running parameters including energy, beam current, lifetime and luminosity as example and fetches these EPICS data through CAJ interface. These parameters can be displayed in IE in a real time curve which can be updated automatically. On the web page, it's easy for users to adjust the time span and zoom the chart.

MOPKN015 **Managing Information Flow in ALICE** – *O. Pinazza (INFN-Bologna) A. Augustinus, P.Ch. Chochula, L.S. Jirden, A.N. Kurepin, M. Lechman, P. Rosinsky (CERN) G. De Cataldo (INFN-Bari) A. Moreno (Universidad Politécnica de Madrid, E.T.S.I Industriales)*

ALICE is one of the experiments at the Large Hadron Collider (LHC), CERN (Geneva, Switzerland). The ALICE detector control system is an integrated system collecting 18 different subdetectors' controls and general services and is implemented using the commercial SCADA package PVSS. Information of general interest, beam and ALICE condition data, together with data related to shared plants or systems, are made available to all the subsystems through the distribution capabilities of PVSS. Great care has been taken during the design and implementation to build the control system as a hierarchical system, limiting the interdependencies of the various subsystems. Accessing remote resources in a PVSS distributed environment is very simple, and can be initiated unilaterally. In order to improve the reliability of distributed data and to avoid unforeseen dependencies, the ALICE DCS group has enforced the centralization of the publication of global data and other specific variables requested by the subsystems. As an example, a specific monitoring tool will be presented that has been developed in PVSS to estimate the level of interdependency and to understand the optimal layout of the distributed connections, allowing for an interactive visualization of the distribution topology.

MOPKN016 **Tango Archiving Service Status** – *G. Abeille (SOLEIL), A. Buteau, J. Guyot, M. Ounsy, S. Pierre-Joseph Zephir (SOLEIL) R. Passuello, G. Strangolino (ELETTRA) S. Rubio-Manrique (CELLS-ALBA Synchrotron)*

In modern scientific instruments like ALBA, ELETTRA or Synchrotron Soleil the monitoring and tuning of thousands of parameters is essential to drive high-performing accelerators and beamlines. To keep tracks of these parameters and to manage easily large volumes of technical data, an archiving service is a key component of a modern control system like Tango [1]. To do so, a high-availability archiving service is provided as a feature of the Tango control system. This archiving service stores data coming from the Tango control system into MySQL [2] or Oracle [3] databases. Tree sub-services are provided: An historical service with an archiving period up to 10 seconds; a short term service providing a few weeks retention with a period up to 100 milliseconds; a snapshot service which takes"picture" of Tango parameters and can reapply them to the control system on user demand. This paper presents how to obtain a high-performance and scalable service based on our feedback after years of operation. Then, the deployment architecture in the different Tango institutes will be detailed. The paper conclusion is a description of the next steps and incoming features which will be available in the next future.

MOPKN017 **From Data Storage towards Decision Making: LHC Technical Data Integration and Analysis** – *A. Marsili (CERN)*

The monitoring of the beam conditions, equipment conditions and measurements from the beam instrumentation devices in CERN's Large Hadron Collider (LHC) produces more than 100 Gb/day of data. Such a big quantity of data is unprecedented in accelerator monitoring and new developments are needed to access, process, combine and analyse data from different equipments. The Beam Loss Monitoring (BLM) system has been one of the most reliable pieces of equipment in the LHC during its 2010 run, issuing beam dumps when the detected losses were above the defined abort thresholds. Furthermore, the BLM system was able to detect and study unexpected losses, requiring intensive offline analysis. This article describes the techniques developed to: access the data produced (~ 50.000 values/s); access relevant system layout information; access, combine and display different machine data.

MOPKN018 **Computing Architecture of the ALICE Detector Control System** – *P.Ch. Chochula (CERN), A. Augustinus, L.S. Jirden, A.N. Kurepin, M. Lechman, P. Rosinsky (CERN) A. Moreno (Universidad Politécnica de Madrid, E.T.S.I Industriales) O. Pinazza (INFN-Bologna)*

The ALICE Detector Control System (DCS) is based on a commercial SCADA product, running on a large Windows computer cluster. It communicates with about 1200 network attached devices to assure safe and stable operation of the experiment. In the presentation we focus on the design of the ALICE DCS computer systems. We describe the management of data flow, mechanisms for handling the large data amounts and information exchange with external systems. One of the key operational requirements is an intuitive, error proof and robust user interface allowing for simple operation of the experiment. At the same time the typical operator task, like trending or routine checks of the devices, must be decoupled from the automated operation in order to prevent overload of critical parts of the system. All these requirements must be implemented in an environment with strict security requirements. In the presentation we explain how these demands affected the architecture of the ALICE DCS.

MOPKN019 **DCS Data Viewer, an Application that Accesses ATLAS DCS Historical Data.** – *C.A. Tsarouchas (CERN), S.X. Roe, S. Schlenker (CERN) S.X. Auria (University of Glasgow) U.X. Bitenc, M.L. Fehling-Kaschek, S.X. Winkelmann (Albert-Ludwig Universität Freiburg) D. Hoffmann, O.X. Pisano (CPPM)*

The ATLAS experiment at CERN is one of the four Large Hadron Collider ex- periments. ATLAS uses a commercial SCADA system (PVSS) for its Detector Control System (DCS) which is responsible for the supervision of the detector equipment, the reading of operational parameters, the propagation of the alarms and the archiving of important operational data in a relational database. DCS Data Viewer (DDV) is an application that provides access to historical data of DCS parameters written to the database through a web interface. It has a modular and flexible design and is structured using a client-server architecture. The server can be operated stand alone with a command-like interface to the data while the client offers a user friendly, browser independent interface. The selection of the metadata of DCS parameters is done via a column-tree view or with a powerful search engine. The final visualisation of the data is done using various plugins such as"value over tim" charts, data tables, raw ASCII or structured export to ROOT. Excessive access or malicious use of the database is prevented by dedicated protection mechanisms, allowing the exposure of the tool to hundreds of inexperienced users. The metadata selection and data output features can be used separately by XML configuration files. Security constraints have been taken into account in the implementation allowing the access of DDV by collaborators worldwide. Due to its flexible interface and its generic and modular approach, DDV could be easily used for other experiment control systems that archive data using PVSS.

MOPKN020 **The PSI Web Interface to the EPICS Channel Archiver** – *G. Jud (PSI-LRF), A. Luedeke, W. Portmann (PSI-LRF)*
The EPICS channel archiver is a powerful tool to collect control system data of thousands of EPICS process variables with rates of many Hertz each to an archive for later retrieval. *) Within the package of the channel archiver version 2 you get a Java application for graphical data retrieval and a command line tool for data extraction into different file formats. For the Paul Scherrer Institute we wanted a possibility to retrieve the archived data from a web interface. It was desired to have flexible retrieval functions and to allow to interchange data references by e-mail. This web interface has been implemented by the PSI controls group and has now been in operation for several years. This presentation will highlight the special features of this PSI web interface to the EPICS channel archiver.

MOPKN021 **Asynchronous Data Notification between Database Server and Accelerator Control Systems** – *W. Fu (BNL), J. Morris, S. Nemesure (BNL)*
Databases are an essential component for an accelerator control system. In the Collider-Accelerator Department at Brookhaven National Laboratory millions of control setpoints and measurements are stored in databases daily. Sometimes it is necessary for immediate notification to be given when the data from a database is changed manually by a user or automatically by a controls program. This paper describes a method for asynchronous data notification between a database and an interested client. The basic components of the method consist of three parts. i. A database which stores the controls data. ii. A specially designed database trigger which fires whenever the target control data has been updated. (The trigger can be setup to provide notification or execute a pre-defined system action.) iii. A generic server that listens for the trigger and transmits the update to interested clients. This method has been successfully used within the Collider-Accelerator Department at Brookhaven National Laboratory.

MOPKN022 **User Interface Design for Archive Data Searching in SSRF** – *X. Ao (SSRF), C. Hu (SSRF) Z. Hu (SINAP)*
The interface of archive data used in previous release[1] is hard to maintain, if there is any change of beamline archived PV, the code of web page should be modified to reflect that change. Also, the interface does reflect the user's query pattern, e.g, it does not remember the history of user entered; Also, the cascade of entering the PV (processed variable) name is not flexible enough to contain different naming conventions. To improve that, we incorporated web 2.0 interface features on the archive search system. An PV name suggestion interface replaced the cascade selecting menu, it combined with the PV history of users to provide a shortcut to enter what the user wants.

MOPKN023 **The MedAustron Control System Configuration Management System** – *R. Moser (EBG MedAustron), A.B. Brett, M. Marchhart, M. Thonke, C. Torcato de Matos (EBG MedAustron) L. Casalegno (CNAO Foundation) J. Gutleber (CERN)*
This contribution presents the particle accelerator configuration management system of the MedAustron facility. This ion beam cancer therapy and research centre is currently under construction in Wiener Neustadt, Austria. It features a synchrotron particle accelerator for light ions that is characterized by large sets of configuration data due to the number of possible beam cycle definitions. In addition, quality management requirements apply to document the evolution of configuration data throughout the project's lifecycle. Consequently, we base the configuration management system on CNAO repository management software (RMS). MedAustron and CNAO entered in a partnership with the goal to adapt this software to the MedAustron needs and to extend its functionality. RMS is a database application to capture and version all device and their settings that are relevant to the operation of the particle accelerator. It includes, but is not limited to electronics and computing equipment definition, magnets and their calibration data, beam diagnostics equipment and their calibration data, software components, power converter settings, alarm definitions, timing sequences, communication interface definitions, permissions and parameter thresholds. It also exports versioned sets of data to configure the accelerator control system This contribution presents the scope of RMS and the workflow that has been implemented to manage configuration data from device description to deployment in the running system.

MOPKN024 **The Integration of the LHC Cyrogenics Control System Data into the CERN Layout Database** – *E. Fortescue-Beck (CERN), R. Billen, P. Gomes (CERN)*
The Large Hadron Collider's Cryogenic Control System makes extensive use of several databases to manage data appertaining to over 34,000 cryogenic instrumentation channels. This data is essential for populating the firmware of the PLCs which are responsible for maintaining the LHC at the appropriate temperature. In order to reduce the number of data sources and the overall complexity of the system, the databases have been rationalised and the automatic tool, that extracts data for the control software, has been simplified. This paper describes the main improvements that have been made and evaluates the success of the project.

MOPKN025 **Integrating the EPICS IOC Log into the CSS Message Log** – *K.-U. Kasemir (ORNL), E. Danilova (ORNL)*
The Experimental Physics and Industrial Control System (EPICS) includes the"IOCLogServe", a tool that logs error messages from front-end computers (Input/Output Controllers, IOCs) into a set of text files. Control System Studio (CSS) includes a distributed message logging system with relational database persistence and various log analysis tools. We implemented a log server that forwards IOC messages to the CSS log database, allowing several ways of monitoring and analyzing the IOC error messages.

MOPKN026 **ESS Parameter List Database and Web Interface Tools** – *K. Rathsman (ESS), S. Peggs, G. Trahern (ESS)*
The European Spallation Source ESS is an intergovernmental project building a multi-disciplinary research laboratory based upon the world's most powerful neutron source. The spallation source mainly consists of a proton linac generating projectiles, a target where neutrons are spalled and instruments with samples and detectors used by the researchers. The main facility will be built in Lund, Sweden, with a Data Management Centre in Copenhagen, Denmark,

at an investment cost of 1.4 B€. Construction is expected to start around 2013 and the first neutrons are expected to be produced in 2019. In the operations phase ESS will have about 450 employees who will operate and support a user community of 5000 researchers. The ESS linac delivers 5 MW of power to the target at 2.5 GeV, with a nominal current of 50 mA. The Accelerator Design Update (ADU) collaboration of mainly European institutions will deliver a Technical Design Report at the end of 2012. To ensure consistency of the information being used amongst all subgroups throughout the period of accelerator design and construction, a parameter list database and web interface have been proposed. The main objective is to provide tools to identify inconsistencies among parameters and to enforce groups as well as individuals to work towards the same solution. Another goal is to make the Parameter Lists a live and credible endeavor so that the data and supporting information shall be useful to a wider audience such as external reviewers as well as being easily accessible.

MOPKN027 **BDNS - the BESSY Device Name Service** – *D.B. Engel (HZB), P. Laux, R. Müller (HZB)*

Initially the relational database (RDB) for control system configuration at BESSY has been built around the device concept [1]. Maintenance and consistency issues as well as complexity of scripts generating the configuration data, triggered the development of a novel, generic RDB structure based on hierarchies of named nodes with attribute/value pair [2]. Unfortunately it turned out that usability of this generic RDB structure for a comprehensive configuration management relies totally on sophisticated data maintenance tools. On this background BDNS, a new database management tool has been developed within the framework of the Eclipse Rich Client Platform. It uses the Model View Control (MVC) layer of Jface to cleanly dissect retrieval processes, data path, data visualization and actualization. It is based on extensible configurations described in XML allowing to chain SQL calls and compose profiles for various use cases. It solves the problem of data key forwarding to the subsequent SQL statement. BDNS and its potential to map various levels of complexity into the XML configurations allows to provide easy usable, tailored database access to the configuration maintainers for the different underlying database structures. Based on Eclipse the integration of BDNS into Control System Studio is straight forward.

MOPKN029 **Design and Implementation of the CEBAF Element Database** – *T. L. Larrieu (JLAB), M.E. Joyce, C.J. Slominski (JLAB)*

With inauguration of the CEBAF Element Database(CED) in Fall 2010, Jefferson Lab computer scientists have taken a first step toward the eventual goal of a model-driven accelerator. Once fully populated, the database will be the primary repository of information used for everything from generating lattice decks to booting front-end computers to building controls screens. A particular requirement influencing the CED design is that it must provide consistent access to not only present, but also future, and eventually past, configurations of the CEBAF accelerator. To accomplish this, an introspective database schema was designed that allows new elements, element types, and element properties to be defined on-the-fly without changing table structure. When used in conjunction with the Oracle Workspace Manager, it allows users to seamlessly query data from any time in the database history with the exact same tools as they use for querying the present configuration. Users can also check-out workspaces and use them as staging areas for upcoming machine configurations. All Access to the CED is through a well-documented API that is translated automatically from original C++ into native libraries for script languages such as perl, php, and TCL making access to the CED easy and ubiquitous.

10-Oct-11 16:30 – 18:00	Poster	Kilimanjaro Sud

MOPKS — Poster
Chair: R. Wilcke (ESRF)

Process tuning and feedback systems

MOPKS001 **Diamond Light Source Booster Fast Orbit Feedback System** – *S. Gayadeen (University of Oxford), S. Duncan (University of Oxford) C. Christou, M.T. Heron, J. Rowland (Diamond)*
The Fast Orbit Feedback system that has been installed on the Diamond Light Source storage ring has been replicated on the booster synchrotron. This provides a test bed for the development of the storage ring controller design. To realise this the booster is operated in DC mode. The electron beam is regulated in two planes using the Fast Orbit feedback system, which takes the beam position from 22 Libera beam position monitors for each plane, and calculates offsets to 44 corrector power supplies at a sample rate of 10kHz. This paper describes the design and realization of the controller for the booster Fast Orbit Feedback, presents results from the implementation and considers future developments.

MOPKS002 **Laser Pointing Feedback Control at the SwissFEL Test Injector** – *T. Pal (PSI), M. Dach, T. Korhonen (PSI)*
The Paul Scherrer Institute is presently engaged in development studies for a Free Electron Laser (SwissFEL). As part of this effort, a 250 MeV (test) injector accelerator has been in operation since one year, with a goal to allow detailed verification and optimization for an injector concept with associated instrumentation. One, such instrument, is a laser system capable of generating 200 pC of photoelectrons from a copper surface cathode, with tight limits on the temporal and spatial pulse shapes. Furthermore, it is required to have a high pointing stability of the laser spot on the cathode, from pulse-to-pulse for electron production. Sources contributing to the instabilities arise from thermal effects coupled with the mechanical mountings of components in the laser optics. This paper describes the application developed in the context of our EPICS-based control system for implementing pointing stability, using PID feedback loops. The main features of the algorithm consist of: i) Computing intensity weighted centroid coordinates of the laser spot after background subtraction, from the readout of a CCD camera (768 x 1024 pixels), acting as a 'virtual cathode'; ii) The feedback algorithm itself, including calibration techniques to determine the feedback constants; iii) The analysis of the projected laser spot distributions in terms of online fitting procedures to Gaussian and flat-top profiles. The preliminary results obtained are also discussed.

MOPKS003 **High Resolution Ion Beam Profile Measurement System** – *J.G. Lopes (ISEL) F.A. Alegria (IT) J.G. Lopes, L.M. Redondo (CFNUL) J. Rocha (ITN)*
A high resolution system designed for measuring the ion beam profile in the ion implanter installed at the Ion Beam Laboratory of the Technological Nuclear Institute (ITN) is described. Low energy, high current ion implantation is becoming increasingly important in todays technology. In order to achieve this, the use of electrostatic lens to decelerate a focused ion beam is essential, but one needs to measure, with high resolution, the 2D beam profile. Traditional beam profile monitors using a matrix of detectors, like Faraday Cups, were used. They are, in essence, discrete systems since they only measure the beam intensity in fixed

positions. In order to increase the resolution further, a new system was developed that does a continuous measurement of the profile, made of a circular aluminum disc with a curved slit which extends approximately from the center of the disc to its periphery. The disc is attached to the ion implanter target, which is capable of rotating on its axis. A cooper wire, positioned behind the slit, works like a Faraday Cup and the current generated, proportional to the beam intensity, is measured. As the ion implanter is capable of scanning the beam over the target, the combination of vertical beam scanning with aluminum disc rotation allows the beam profile to be measured continuously in two dimensions. Hence, the developed system including the computer controlled positioning of the beam over the moving curved slit, the data acquisition and the beam profile representation, is described.

MOPKS004 **NSLS-II Beam Diagnostics Control System** – *Y. Hu (BNL), L.R. Dalesio, O. Singh (BNL)*

EPICS-based control system for NSLS-II beam diagnostics is presented. Diagnostics control interfaces including classifications of diagnostics, electronics for different types of beam monitors, interfaces to other subsystems, etc. are described. Control requirements and diagnostic device counts are also briefly introduced.

MOPKS006 **Application of Integral Separated PID Algorithm in Orbit Feedback** – *K. Xuan (USTC/NSRL), X. Bao, C. Li, W. Li, G. Liu, J.G. Wang, L. Wang (USTC/NSRL)*

The algorithm in the feedback system has important influence on the performance of the beam orbit. PID algorithm is widely used in the orbit feedback system; however the deficiency of PID algorithm is big overshooting in strong perturbations. In order to overcome the deficiencies, Integral Separated PID algorithm is developed. When the closed orbit distortion is too large, it cancels integration action until the closed orbit distortions are lower than the threshold value. The implementation of Integral Separated PID algorithm with MATLAB is described in this paper. The simulation results show that this algorithm can improve the control precision.

MOPKS007 **Design of a Digital Controller for ALPI 80 MHz Resonators** – *S.V. Barabin (ITEP) G. Bassato (INFN/LNL)*

We discuss the design of a resonator controller completely based on digital technology. The controller is currently operating at 80 MHz but can be easily adapted to frequencies up to 350MHz; it can work either in"Generator Drive" and in"Self Excited Loo" mode. The signal processing unit is a commercial board (Bittware T2-Pci) with 4 TigerSharc DSPs and a Xilinx Virtex II-Pro FPGA. The front-end board includes five A/D channels supporting a sampling rate in excess of 100M/s and a clock distribution system with a jitter less than 10ps, allowing direct sampling of RF signals with no need of analog downconversion. We present the results of some preliminary tests carried out on a 80 MHz quarter wave resonator installed in the ALPI Linac accelerator at INFN-LNL and discuss possible developments of this project.

MOPKS008 **Development of Automatic RF Low-Level Control System for KIRAMS-30 Cyclotron** – *Y.S. Park (KIRAMS), S.S. Hong, I.S. Jung, K.U. Kang (KIRAMS)*
We have developed and installed KIRAMS-30 cyclotron at KAERI-ARTI(Korea Atomic Energy Research Institute / Advanced Radiation Technology Institute) of Jeongeup city area. KIRAMS-30 is able to accelerate proton particles up to 30MeV, which will be primarily used for high current beam extraction. We have been now commissioning and testing it to arrange and meet the required beam conditions after moving it to the main cyclotron building from temporary one. In this work, we developed an automatic RF low-level control system for KIRAMS-30 cyclotron. RF low-level signal is constantly controlled during beam extraction by adjusting the motorized fine tuner automatically considering the feedback grid voltage signal of RF power amplifier. At this system, even if RF signal is lost due to the unstable RF power amplifier status, it can be recovered automatically. Meanwhile, automatic RF low-level control part has been realized as an application of software program using LabVIEW graphical language.

MOPKS009 **Automation of K-130 Main Magnet Control Using Beam Current Feedback at VECC** – *T. Bhattacharjee (DAE/VECC), S. Bandyopadhyay, R.B. Bhole, P.S. Chakraborty, S. Chattopadhyay, S. Pal (DAE/VECC)*
The main electro-magnet of K-130 cyclotron at Variable Energy Cyclotron Centre uses a 2000A DC power supply to generate magnetic field during acceleration of the ion beams. The remote computer control of this power supply is unified in EPICS based control architecture and a digital knob is being used to tune the magnet manually from the main control room. The archived tuning data of the main magnet current with respect to a given beam energy does not reproduce the exact magnetic field every-time when the beam energy is changed or the machine is re-started after shutdown because of magnetic hysteresis. This necessitates the re-searching of the power supply current to generate the desired magnetic field. To overcome this problem, a control routine has been developed for automated tuning of the main magnet power supply using current feedback from 'dee' probe of the cyclotron. This paper describes the details of this automation routine and elaborates the underlying theory of the developed logic. The advantages of using such control in cyclotron beam tuning have also been described in this paper.

MOPKS010 **Fast Orbit Correction for the ESRF Storage Ring** – *J.M. Koch (ESRF), F. Epaud, E. Plouviez, K.B. Scheidt (ESRF)*
Up to now, at the ESRF, the correction of the orbit position has been performed with two independent systems: one dealing with the slow movements and one correcting the motion in a range of up to 200Hz but with a limited number of fast BPMs and steerers. These latter will be removed and one unique system will cover the frequency range from DC to 200Hz using all the 224 BPMs and the 96 steerers. Indeed, thanks to the procurement of Libera Brilliance units and the installation of new AC power supplies, it is now possible to access all the Beam positions at a frequency of 10 kHz and to drive a small current in the steerers in a 200Hz bandwidth. The first tests of the correction of the beam position have been performed and will be presented. The data processing will be presented as well with a particular emphasis on the development inside the FPGA.

MOPKS011 **Beam Synchronous Data Acquisition for SwissFEL Test Injector** – *B. Kalantari (PSI), T. Korhonen (PSI)*
A 250 MeV injector facility at PSI has been constructed to study the scientific and technological challenges of the SwissFEL project. Since in such pulsed machines in principle every beam can have different characteristics, due to varying

machine parameters and/or conditions, it is very crucial to be able to acquire and distinguish control system data from one pulse to the next. In this paper we describe the technique we have developed to perform beam synchronous data acquisition at 100 Hz rate. This has been particularly challenging since it has provided us with a reliable and real-time data acquisition method in a non real-time control system. We describe how this can be achieved by employing a powerful and flexible timing system with well defined interfaces to the control system.

MOPKS012 **Design and Test of a Girder Control System in NSRRC** – *H.S. Wang (NSRRC)*
A girder control system was proposed adjusting the attitudes of all girders in the storage ring quickly and precisely with little manpower at the Taiwan Photon Source (TPS) project in National Synchrotron Radiation Research Center (NSRRC). In this control girder system, six motorized cam movers supporting a girder are driven on three pedestals to perform six-axis adjustments of a girder. A Nivel 202 monitoring the pitch and roll of each girder, several touch sensors measuring the relative displacement between consecutive girders, and a laser position sensitive detector (PSD) system measuring the relative displacement between straight-section girders are included in this girder control system. Operators use MATLAB tools to control every local girder control system via intranet. This paper presents details of designs and tests of the girder control system.

MOPKS013 **Beam Spill Structure Feedback Test in HIRFL-CSR** – *R.S. Mao (IMP), J.X. Wu, J.W. Xia, J.C. Yang, Y.J. Yuan, T.C. Zhao, Z.Z. Zhou (IMP)*
The slow extraction beam from HIRFL-CSR is used in nuclear physics experiments and heavy ion therapy. 50Hz ripple and harmonics are observed in beam spill. To improve the spill structure, the first set of control system consisting of fast Q-magnet and feedback device based FPGA is developed and installed in 2010, and spill structure feedback test also has been started. The commissioning results with spill feedback system are presented in this paper.

MOPKS014 **Architecture and Control of the Fast Orbit Correction for the ESRF Storage Ring** – *F. Epaud (ESRF)*
Two years ago, the electronics of all the 224 Beam Position Monitors (BPM) of the ESRF Storage Ring were replaced by the commercial Libera Brilliance units to drastically improve the speed and position resolution of the Orbit measurement. Also, at the start of this year, all the 96 power supplies that drive the Orbit steerers have been replaced by new units that now cover a full DC-AC range up to 200Hz. We are now working on the replacement of the previous Fast Orbit Correction system. This new architecture will also use the 224 Libera Brilliance units and in particular the 10 KHz optical links handled by the Diamond Communication Controller (DCC) which has now been integrated within the Libera FPGA as a standard option. The 224 Liberas are connected together with the optical links to form a redundant network where the data are broadcast and are received by all nodes within 40 μS. The 4 corrections stations will be based on FPGA cards (2 per station) also connected to the FOFB network as additional nodes and using the same DCC firmware on one side and are connected to the steerers power supplies using RS485 electronics standard on the other side. Finally two extra nodes have been added to collect data for diagnostics and to give BPMs positions to the beamlines at high rate. This paper will present the network architecture and the control software to operate this new equipment.

MOPKS015 **Diagnostics Control Requirements at NSLS-II** – *Y. Hu (BNL), L.R. Dalesio, O. Singh (BNL)*
To measure various beam parameters such as beam position, beam size, circulating current, beam emittance, etc., a variety of diagnostic monitors will be deployed at NSLS-II. The Diagnostics Group and the Controls Group are working together on control requirements for the beam monitors. The requirements are originated from and determined by accelerator physics. An attempt of analyzing and translating physics needs into control requirements is made. The basic functionalities and applications of diagnostics controls are also presented.

MOPKS016 **Suppression of Phase Oscillation in the VEPP-3 Storage Ring by RF- Cavitiy Temperature Tuning.** – *I.I. Morozov (BINP SB RAS)*
The VEPP-3 is a storage ring with perimeter 74.4 m, injection energy 350 MeV, maximal energy 2000 MeV. Main applications are booster for the VEPP-4M collider and synchrotron radiation production for users. Beam current at two bunches mode is limited by the increase of the phase oscillation during acceleration. The reason of excitation of phase oscillation is the higher harmonics occurrence in the RF- cavity because of change of its geometrical sizes. This change is caused by RF cavity temperature variation. This problem has been resolved by tuning and stabilization of the cavities temperature. The flowing water heater with PID regulator was applied.

MOPKS017 **Development of Low Level RF System for 9 MeV Cyclotron** – *T. Zhou (SKKU), J.-S. Chai (SKKU)*
A low level radio frequency (LLRF) system for 9 MeV cyclotron which is used as the driver for accelerator producing radioisotope (RI) for medicine will be designed. For reducing the size and cost of the hardware, increasing the flexibility and reliability, the RF system implements signal processing in the digital domain, utilizes IQ sampling and IQ modulation method. Commercial DDS generates precise LO and CLK signal. FPGA and high-speed ADCs and DACs deal with the feedback signals. In order to obtain optimization, RF system is required to maintain stability for the signals within the range of in amplitude and in phase respectively. So we will describe the preliminary design and modeling of LLRF control system in this paper.

MOPKS019 **Electro Optical Beam Diagnostics System and its Control at PSI** – *P. Chevtsov (PSI-LRF) F. Mueller, P. Peier, V. Schlott, D.M. Treyer (PSI) B. Steffen (DESY)*
Electro Optical (EO) techniques are very promising non-invasive methods for measuring extremely short (in a sub-picosecond range) electron bunches. A prototype of an EO Bunch Length Monitoring System (BLMS) for the future SwissFEL facility is created at PSI. The core of this system is an advanced fiber laser unit with pulse generating and mode locking electronics. The system is integrated into the EPICS based PSI controls, which significantly simplifies its operations. The paper presents main components of the BLMS and its performance.

MOPKS020 **Low Level RF Control System for Cyclotron 10Mev** – *J. Huang (HUST), T. Hu, D. Li, K.F. Liu (HUST)*
The low level RF control system consists of a 101MHz signal generator, three feedback loops, an interlock and a protection system. The stability of control system is one of the most important indicators in the cyclotron design, especially when the whole system has a high current. Due to the hugeness of the RF system and the complexity of control objects, the low level RF control system must combine the basic theory with the electronic circuit to optimize the whole system. The major obstacles in the research, which rarely exist in other control systems, lay in the coupling of beam and resonant cavity, requiring to be described by the transfer function between beam and cavity, the complex coupling between microwave devices and the interference signals of all loops. By introducing the three feedback loops (tuning loop, amplitude loop and phase loop) and test results from some parts of electric circuits, this paper unfolds the performance index and design of low level RF control system, which may contribute to the design of cyclotron with a high and reliable performance.

MOPKS021 **High-speed Data Handling Using Reflective Memory Thread for Tokamak Plasma Control** – *S.Y. Park (NFRI), S.H. Hahn (NFRI)*
The KSTAR plasma control system (PCS) is defined as a system consisting of electronic devices and control software that identifies and diagnoses various plasma parameters, calculates appropriate control signals to each actuator to keep the plasma sustained in the KSTAR operation regime. Based on the DIII-D PCS, the KSTAR PCS consists of a single box of multiprocess Linux system which can run up to 8 processes, and both digital and analog data acquisition methods are adapted for fast real-time data acquisition up to 20 kHz. The digital interface uses a well-known shared memory technology, the reflective memory (RFM), which can support data transmission up to 2Gbits/s. An RFM technology is adopted for interfacing the actuators, 11 PF power supplies and 1 IVC power supply, and the data acquisition system for plasma diagnostics. To handle the fast control of the RFM data transfer, the communication using the RFM with the actuators and diagnostics system is implemented as thread. The RFM thread sends commands like target current or voltage which is calculated by the PCS to the actuators area of RFM for plasma control and receives measured data by the magnet power supply. The RFM thread also provides the method for monitoring signal in real time by sharing data of diagnostics system. The RFM thread complete all data transfer within 50us so that data process can be completed within the fastest control cycle time of the PCS. This paper will describe the design, implementations, performances of RFM thread and applications to the tokamak plasma controls utilizing the technique.

MOPKS022 **BPM System for the Taiwan Photon Source** – *C.H. Kuo (NSRRC), P.C. Chiu, K.T. Hsu, K.H. Hu (NSRRC)*
Taiwan Photon Source (TPS) is a 3 GeV synchrotron light source which is in construction at NSRRC. Latest generation BPM electronics with FPGA enhanced functionality of current generation products was adopted. The prototype is under testing. To achieve its design goal of the TPS and eliminate beam motions due to various perturbation sources, orbit feedback is designed with integration of BPM and corrector control system . The design and implementation of the BPM system will be summarized in this report.

MOPKS023 **Alignment and Stabilization of the Thirty Meter Telescope Primary Mirror** – *M.J. Sirota (TMT), D.G. MacMynowski (TMT) G.A. Chanan (UCI) M.M. Colavita, C. Lindensmith, C. Shelton, M. Troy (JPL) T.S. Mast, J. Nelson (UCSC) P.M. Thompson (STI)*

The primary, secondary and tertiary mirrors of the Thirty Meter Telescope (TMT), taken together, have over 10,000 degrees of freedom. The vast majority of these are associated with the 492 individual primary mirror segments. The individual segments are converted into the equivalent of a monolithic thirty meter primary mirror via the Alignment and Phasing System (APS) and the M1 Control System (M1CS). The APS uses starlight and a variety of Shack-Hartmann based measurement techniques to position the segments in piston, tip, and tilt, as well as measure and correct the individual segment figures. The M1CS maintains the overall shape of the segmented primary mirror despite structural deformations caused by temperature and gravity, and disturbances from wind and vibrations (observatory-generated and seismic). The M1CS can be considered a stabilization system that works to maintain the shape of the primary mirror based on set-points, which vary as a function of zenith angle and temperature, previously determined by the APS. The TMT primary mirror control strategy is an evolutionary improvement on the successful strategy used at the two Keck Telescopes. In this paper we summarize the overall optical alignment and control strategy for the TMT. In particular we focus on the quasi-static and dynamic alignment and control challenges associated with the thirty meter 492 segment TMT primary mirror as compared to the ten meter 36 segment Keck primary mirror. We present top level requirements, alignment and control algorithms, architectures, designs, and predicted performance.

MOPKS024 **A Digital System for Longitudinal Emittance Blowup in the LHC** – *M. Jaussi (CERN), M. E. Angoletta, P. Baudrenghien, A.C. Butterworth, J. Sanchez-Quesada, E.N. Shaposhnikova, J. Tuckmantel (CERN)*

In order to preserve beam stability above injection energy in the LHC, longitudinal emittance blowup is performed during the energy ramp by injecting band-limited noise around the synchrotron frequency into the beam phase loop. The noise is generated continuously in software and streamed digitally into the DSP of the Beam Control system. In order to achieve reproducible results, a feedback system on the observed average bunch length controls the strength of the excitation, allowing the operator to simply set a target bunch length. The frequency spectrum of the excitation depends on the desired bunch length, and as it must follow the evolution of the synchrotron frequency spread through the ramp, it is automatically calculated by the LHC settings management software from the energy and RF voltage. The system is routinely used in LHC operation since August 2010. We present here the details of the implementation in software, FPGA firmware and DSP code, as well as some results with beam.

MOPKS025 **Simulation of the APS Storage Ring Orbit Real-time Feedback System Upgrade Using MATLAB *** – *S. Xu (ANL), G. Decker, R.I. Farnsworth, F. Lenkszus, X. Sun (ANL)*

The Advanced Photon Source (APS) storage ring orbit real-time feedback (RTFB) system plays an important role in stabilizing the orbit of the stored beam. An upgrade is planned that will improve beam stability by increasing the correction bandwidth to 200 Hz or higher. To achieve this, the number of available steering correctors and beam position monitors (BPMs) will be increased, and the sample rate will be increased by an order of magnitude. An additional benefit will be the replacement of aging components. Simulations have been performed to quantify the effects of different system configurations on performance.

MOPKS026 **Performance Enhancements for the Transverse Feedback System at the Advance Photon Source** – *N.P. Di Monte (ANL), A.J. Scaminaci, C. Yao (ANL)*
With the success of the transverse feedback system at the Advance Photon Source (APS) an upgrade to this system is being developed. The current system is operating at a third of the storage ring bunch capacity, or 324 of the available 1296. This upgrade will allow the sampling of all 1296 bunches and make corrections for all selected bunches in a single storage ring turn. To facilitate this upgrade a new analog I/O board capable of 352 MHz operation is being developed along with a P0 bunch cleaning circuit. The clock cleaning circuit is also needed for the high speed analog output circuit which is transmitted about 200ft to a separate DAC unit in real time. This remote DAC will have its transceiver data rate triple from 2.3G-bits to about 7G-bits on a fiber optic link. This paper will discuss some of the challenges in reducing the clock jitter from the system P0 bunch clock along with the necessary FPGA hardware upgrades and algorithm changes, all of which is required for the success of this upgrade.

MOPKS027 **Operational Status of theTransverse Multibunch Feedback System at Diamond** – *I. Uzun (Diamond), M.G. Abbott, M.T. Heron, A.F.D. Morgan, G. Rehm (Diamond)*
A transverse multibunch feedback (TMBF) system is in operation at Diamond Light Source to damp coupled-bunch instabilities up to 250 MHz in both the vertical and horizontal planes. It comprises an in-house designed and built analogue front-end combined with a Libera Bunch-by-Bunch feedback processor and output stripline kickers. FPGA-based feedback electronics is used to implement several diagnostic features in addition to the basic feedback functionality. This paper reports on the current operational status of the TMBF system along with its characteristics. Also discussed are operational diagnostic functionalities including continuous measurement of the betatron tune and chromaticity.

MOPKS028 **Using TANGO for Controlling a Microfluidic System with Automatic Image Analysis and Droplet Detection** – *O. Taché (CEA/DSM/IRAMIS/SIS2M), F. Malloggi (CEA/DSM/IRAMIS/SIS2M)*
Microfluidics allows one to manipulate small quantities of fluids, using channel dimensions of several micrometers. At CEA / LIONS, microfluidic chips are used to produce calibrated complex microdrops. This technique requires only a small volume of chemicals, but requires the use a number of accurate electronic equipment such as motorized syringes, valve and pressure sensors, video cameras with fast frame rate, coupled to microscopes. We use the TANGO control system for all heterogeneous equipment in microfluidics experiments and video acquisition. We have developed a set of tools that allow us to perform the image acquisition, allows shape detection of droplets, whose size, number, and speed can be determined, almost in real time. Using TANGO, we are able to provide feedback to actuators, in order to adjust the microfabrication parameters and time droplet formation.

Project management

MOPKS029 **The CODAC Software Distribution for the ITER Plant Systems** – *F. Di Maio (ITER Organization), L. Abadie, C. Kim, K. Mahajan, P. Makijarvi, D. Stepanov, N. Utzel, A. Wallander (ITER Organization)*

Most of the different components, or plant systems, that constitute the ITER plant will be built off-site and supplied by the ITER domestic agencies. Each system requires its own control system, called plant system I&C, for Instrumentation and Control. For reducing heterogeneity and allowing integration and operation, the CODAC group, that is in charge of the ITER control system, is promoting standardized solutions at project level and makes available, as a support for these standards, the software for the development and tests of the plant system I&C. This software, called CODAC Core System is built by the ITER Organization and distributed to all ITER partners. It includes the ITER standard operating system, RHEL and the ITER standard control framework, EPICS as well as some ITER specific tools, mostly for configuration management, and ITER specific software modules, such as drivers for standard I/O boards. A preliminary version has been distributed in February 2010. The organization for the distribution and support has been also set-up at this time. It is planned to update this software distribution every year in order to cope with the evolving needs of the project. As a result, a second release has been issued on February 2011 and a third one is prepared for February 2012. It is expected that many plant system I&C development will be based on the 2012 version. In this report, we describe the current scope and roadmap of this software package and the process we have adopted for the development, tests, distribution and support of this software.

10-Oct-11 16:30 – 18:00	Poster	Mont Blanc Nord

MOPMN — Poster

Chair: J.M. Meyer (ESRF)

Operational tools and operators' view

MOPMN001 **Beam Sharing between the Therapy Treatment and a Secondary User** – *K.J. Gajewski (TSL)*

The 180 MeV proton beam from the cyclotron at The Svedberg Laboratory is primarily used for a patient treatment. Because of the fact that the proton beam is needed only during a small fraction of time scheduled for the treatment, there is a possibility to divert the beam to another location to be used by a secondary user. The therapy staff (primary user) controls the beam switching process after an initial set-up which is done by the cyclotron operator. They have an interface that allows controlling the accelerator and the beam line in all aspects needed for performing the treatment. The cyclotron operator is involved only if any problem occurs. The secondary user has its own interface that allows a limited access to the accelerators control system. Using this interface it is possible to start and stop the beam when it is not used for the therapy, grant access to the experimental hall and monitor the beam properties. The tools and procedures for the beam sharing between the primary and the secondary user are presented in the paper.

MOPMN002 **Integration of the Moment Based Beam Dynamics Simulation Tool V-Code into the S-DALINAC Control System** – *S. Franke (TEMF, TU Darmstadt), W. Ackermann, T. Weiland (TEMF, TU Darmstadt) R. Eichhorn, F. Hug, C. Klose, N. Pietralla, M. Platz (TU Darmstadt)*
Within accelerator control systems fast and accurate beam dynamics simulation programs can advantageously assist the operators to get a more detailed insight into the actual machine status. The V-Code simulation tool implemented at TEMF is a fast tracking code based on the Vlasov equation. Instead of directly solving this partial differential equation the considered particle distribution function is represented by a discrete set of characteristic moments. The accuracy of this approach is adjustable with the help of the considered order of moments and by representing the particle distribution through multiple sets of moments in a multi-ensemble environment. In this contribution an overview of the numerical model is presented together with implemented features for its dedicated integration into the control system of the Superconducting Linear Accelerator S-DALINAC.

MOPMN003 **A Bottom-up Approach to Automatically Configured Tango Control Systems.** – *S. Rubio-Manrique (CELLS-ALBA Synchrotron), D.B. Beltran, I. Costa, D.F.C. Fernandez-Carreiras, J.V. Gigante, J. Klora, O. Matilla, R. Ranz, J. Ribas, O. Sanchez (CELLS-ALBA Synchrotron)*
Alba maintains a central repository, so called"Cabling and Controls databas" (CCDB), which keeps the inventory of equipment, cables, connections and their configuration and technical specifications. The valuable information kept in this MySQL database enables some tools to automatically create and configure Tango devices and other software components of the control systems of Accelerators, beamlines and laboratories. This paper describes the process involved in this automatic setup.

MOPMN005 **ProShell – The MedAustron Accelerator Control Procedure Framework** – *R. Moser (EBG MedAustron), A.B. Brett, M. Marchhart, M. Thonke, C. Torcato de Matos (EBG MedAustron) J. Dedic, S. Sah (Cosylab) J. Gutleber (CERN)*
MedAustron is a centre for ion-therapy and research in currently under construction in Austria. It features a synchrotron particle accelerator for proton and carbon-ion beams. This paper presents the architecture and concepts for implementing a procedure framework called ProShell. Procedures to automate high level control and analysis tasks for commissioning and during operation are modelled with Petri-Nets and user code is implemented with C#. It must be possible to execute procedures and monitor their execution progress remotely. Procedures include starting up devices and subsystems in a controlled manner, configuring, operating O(1000) devices and tuning their operational settings using iterative optimization algorithms. Device interfaces must be extensible to accommodate yet unanticipated functionalities. The framework implements a template for procedure specific graphical interfaces to access device specific information such as monitoring data. Procedures interact with physical devices through proxy software components that implement one of the following interfaces: (1) state-less or (2) state-driven device interface. Components can extend these device interfaces following an object-oriented single inheritance scheme to provide augmented, device-specific interfaces. As only two basic device interfaces need to be defined at an early project stage, devices can be integrated gradually as commissioning progresses. We present the architecture and design of ProShell and explain the programming model by giving the simple example of the ion source spectrum analysis procedure.

MOPMN007 **HMI Redesign of SARAF MCS** – *I.G. Gertz (Soreq NRC), I. Eliyahu, I. Mardor, A. Perry, E. Reinfeld, L. Weissman (Soreq NRC)*

The Soreq Applied Research Accelerator Facility (SARAF) is a 5-40 MeV, 0.04-2 mA proton/deuteron RF superconducting linear accelerator, which is under commissioning at Soreq NRC. SARAF will be a multi-user facility, whose main activities will be neutron physics and applications, radio-pharmaceuticals development and production, and basic nuclear physics research. The SARAF Control System is based mainly on National Instruments and hardware and software. Since the system has been recently commissioned and integrated, the applications are designed as stand-alone VI's with full system expert authorization, except for the LLRF application, which is designed in expert/operator architecture. This paper presents an overview of the SARAF HMI redesign concepts and future implementation.

MOPMN008 **LASSIE: The Large Analogue Signal and Scaling Information Environment for FAIR** – *T. Hoffmann (GSI), H. Bräuning, R. Haseitl (GSI)*

At FAIR, the Facility for Antiproton and Ion Research, several new accelerators such as the SIS 100, HESR, CR, the inter-connecting HEBT beam lines, S-FRS and experiments will be built. All of these installations are equipped with beam diagnostic devices and other components which deliver time-resolved analogue signals to show status, quality, and performance of the accelerators. These signals can originate from particle detectors such as ionization chambers and plastic scintillators, but also from adapted output signals of transformers, collimators, magnet functions, RF cavities, and others. To visualize and precisely correlate the time axis of all input signals a dedicated FESA based data acquisition and analysis system named LASSIE, the Large Analogue Signal and Scaling Information Environment, is under way. As the main operation mode of LASSIE, pulse counting with adequate scaler boards is used, without excluding enhancements for ADC, QDC, or TDC digitization in the future. The concept, features, and challenges of this large distributed DAQ system will be presented.

MOPMN009 **First Experience with the MATLAB Middle Layer at ANKA** – *S. Marsching (Aquenos GmbH) E. Huttel, M. Klein, A.-S. Mueller, N.J. Smale (KIT)*

The MATLAB Middle Layer has been adapted for use at ANKA. It was finally commissioned in March 2011. It is used for accelerator physics studies and regular tasks like beam-based alignment and response matrix analysis using LOCO. Furthermore, we intend to study the MATLAB Middle Layer as default orbit correction tool for user operation. We will report on the experience made during the commissioning process and present the latest results obtained while using the MATLAB Middle Layer for machine studies.

MOPMN010 **Development of a Surveillance System with Motion Detection and Self-location Capability** – *M. Tanigaki (KURRI), S. Fukutani, Y. Hirai, H. Kawabe, Y. Kobayashi, Y. Kuriyama, M. Miyabe, Y. Morimoto, T. Sano, N. Sato (KURRI)*

A surveillance system with the motion detection and the location measurement capability has been in development for the help of effective security control of facilities in our institute. The surveillance cameras and sensors placed around the facilities and the institute have the primary responsibility for preventing unwanted accesses to our institute, but there are some cases where additional temporary surveillance cameras are used for the subsidiary purposes. Problems in these additional surveillance cameras are the detection of such unwanted accesses and the determination of their respective locations. To eliminate such problems, we are constructing a surveillance camera system with motion detection and self-locating features based on a server-client scheme. A client, consisting of a network camera, wi-fi and GPS modules, acquires its location measured by use of GPS or the radio wave from surrounding wifi access points, then sends its location to a remote server along with the motion picture over the network. The server analyzes such information to detect the unwanted access and serves the status or alerts on a web-based interactive map for the easy access to such information. We report the current status of the development and expected applications of such self-locating system beyond this surveillance system.

MOPMN012 **A New Electronic Logbook for LNL Accelerators** – *S. Canella (INFN/LNL), O. Carletto (INFN/LNL)*

In spring 2009 all run-time data concerning the particle accelerators at LNL (Laboratori Nazionali di Legnaro) were still registered mainly on paper. TANDEM and its Negative Source data were logged on a large format paper logbook, for ALPI booster and PIAVE injector with its Positive ECR Source a number of independent paper notebooks were used, together with plain data files containing raw instant snapshots of each RF superconductive accelerators. At that time a decision was taken to build a new tool for a general electronic registration of accelerators run-time data. The result of this effort, the LNL electronic logbook, is presented here .

MOPMN013 **Operational Status Display and Automation Tools for FERMI@Elettra** – *C. Scafuri (ELETTRA), F. Asnicar (ELETTRA)*

Detecting and locating faults and malfunctions of an accelerator is a difficult and time consuming task. The situation is even more difficult during the commissioning phase of a new accelerator, when physicists and operators are still acquiring confidence with the plant. On the other hand a fault free machine does not imply that it is ready to run: the definition of"readines" depends on what is the expected behavior of the plant. In the case of FERMI@Elettra, in which the electron beam goes to different branches of the machine depending on the programmed activity, the configuration of the plant determines the rules for understanding whether the activity can be carried out or not. In order to help the above task and display the global status of the plant, a tool known as the"matri" has been developed. It is composed of a graphical front-end, which displays a synthetic view of the plant status grouped by subsystem and location along the accelerator, and by a back-end made of Tango servers which reads the status of the machine devices via the control system and calculates the rules. The back-end also includes a set of objects known as"sequencer" that perform complex actions automatically for actively switching from one accelerator configuration to another.

MOPMN014 **Detector Control System for the ATLAS Muon Spectrometer: Operational Experience from the First Year of LHC Data Taking** – *S. Zimmermann (Albert-Ludwig Universität Freiburg) G. Aielli (Università di Roma II Tor Vergata) M. Bindi, A. Polini (INFN-Bologna) S. Bressler, E. Kajomovitz, S. Tarem (Technion) R.G.K. Hart (NIKHEF) G. Iakovidis, E. Ikarios, K. Karakostas, S. Leontsinis, E. Mountricha (National Technical University of Athens)*
Muon Reconstruction is a key ingredient in any of the experiments at the Large Hadron Collider LHC. The muon spectrometer of ATLAS comprises Monitored Drift Tube (MDTs) and Cathode Strip Chambers (CSCs) for precision tracking as well as Resistive Plate (RPC) and Thin Gap (TGC) Chambers as muon trigger and for second coordinate measurement. Together with a strong magnetic field provided by a super conducting toroid magnet and an optical alignment system a high precision determination of muon momentum up to the highest particle energies accessible by the LHC collisions is provided. The Detector Control System (DCS) of each muon sub-detector technology must efficiently and safely manage several thousands of LV and HV channels, the front-end electronics initialization as well as monitoring of beam, background, magnetic field and environmental conditions. This contribution will describe the chosen hardware architecture, which as much as possible tries to use common technologies, and the implemented controls hierarchy. In addition the muon DCS human machine interface (HMI) layer and operator tools will be covered. Emphasis will be given to reviewing the experience from the first year of LHC and detector operations, and to lessons learned for future large scale detector control systems. We will also present the automatic procedures put in place during last year and review the improvements gained by them for data taking efficiency. Finally, we will describe the role DCS plays in assessing the quality of data for physics analysis and in online optimization of detector conditions.

MOPMN015 **Multi Channel Applications for Control System Studio (CSS)** – *K. Shroff (BNL), G. Carcassi (BNL) R. Lange (HZB)*
This talk will present a set of applications for CSS built on top of the services provided by the ChannelFinder, a directory service for control system, and PVManager, a client library for data manipulation and aggregation. ChannelFinder Viewer allows for the querying of the ChannelFinder service, and the sorting and tagging of the results. Multi Channel Viewer allows the creation of plots from the live data of a group of channels.

MOPMN016 **The Spiral2 Radiofrequency Command Control** – *D.T. Touchard (GANIL), C. Berthe, M. Di Giacomo, P. Gillette, M. Lechartier, E. Lecorche, G. Normand (GANIL) Y. Lussignol, D. Uriot (CEA/DSM/IRFU)*
Mainly for carrying out nuclear physics experiences, the SPIRAL2 facility based at Caen in France will aim to provide new radioactive rare ion or high intensity stable ion beams. The driver accelerator uses several radiofrequency systems: RFQ, buncher and superconducting cavities, driven by independent amplifiers and controlled by digital electronics. This low level radiofrequency subsystem is integrated into a regulated loop driven by the control system. A test of a whole system is foreseen to define and check the computer control interface and applications. This paper describes the interfaces to the different RF equipment into the EPICS based computer control system. CSS supervision and foreseen high level tuning XAL/JAVA based applications are also considered.

MOPMN017 **Generic Equipment Access in Python for the GSI Control System** – *B. Besser (GSI), S. Matthies (GSI)*

To support GSI's front-end software developers and equipment specialists, tools had to be provided that allow guided access to all of the facility's equipment. Using the Python language a wide interface to the exposed functionality as well as hierarchical access to all exposed data was implemented. This allows for easy interactive communication and scripting. A graphical user interface on top generically presents all equipments' functionality. To simplify the display of complex data structures the software provides a plug-in mechanism to replace generic views with customized ones. As part of the general front-end modernization project, the tool will replace the existing NODAL maintenance utilities still widely used at GSI.

MOPMN018 **Toolchain for Online Modeling of the LHC** – *G.J. Müller (CERN), X. Buffat, K. Fuchsberger, M. Giovannozzi, S. Redaelli, F. Schmidt (CERN)*

The control of high intensity beams in a high energy, superconducting machine with complex optics like the CERN Large Hadron Collider (LHC) is challenging not only from the design aspect but also for operation. To support the LHC beam commissioning, operation and luminosity production, efforts were recently devoted towards the design and implementation of a software infrastructure aimed to use the computing power of the beam dynamics code MADX-X in the framework of the Java-based LHC control and measurement environment. Alongside interfacing to measurement data as well as to settings of the control system, the best knowledge of machine aperture and optic models is provided. In this paper, we present the status of the toolchain and illustrate how it has been used during commissioning and operation of the LHC. Possible future implementations are also discussed.

MOPMN019 **Controling and Monitoring the Data Flow of the LHCb Read-out and DAQ Network** – *R. Schwemmer (CERN), C. Gaspar, N. Neufeld, D. Svantesson (CERN)*

The LHCb readout uses a set of 320 FPGA based boards as interface between the on-detector hardware and the GBE DAQ network. The boards are the logical Level 1 (L1) read-out electronics and aggregate the experiment's raw data into event fragments that are sent to the DAQ network. To control the many parameters of the read-out boards, an embedded PC is included on each board, connecting to the boards ICs and FPGAs. The data from the L1 boards is sent through an aggregation network into the High Level Trigger farm. The farm comprises approximately 1500 PCs which at first assemble the fragments from the L1 boards and then do a partial reconstruction and selection of the events. In total there are approximately 3500 network connections. Data is pushed through the network and there is no mechanism for resending packets. Loss of data on a small scale is acceptable but care has to be taken to avoid data loss if possible. To monitor and debug losses, different probes are inserted throughout the entire read-out chain to count fragments, packets and their rates at different positions. To keep uniformity throughout the experiment, all control software was developed using the common SCADA software, PVSS, with the JCOP framework as base. The presentation will focus on the low level controls interface developed for the L1 boards and the networking probes, as well as the integration of the high level user interfaces into PVSS. We will show the way in which the users and developers interact with the software, configure the hardware and follow the flow of data through the DAQ network.

MOPMN020 **Integrating Controls Framework: the NA62 Detector Control System Project** – *J.A.R. Arroyo Garcia (CERN), P. Golonka, M. Gonzalez-Berges, H. Milcent (CERN) O. Holme (ETH)*
The detector control system for the NA62 experiment at CERN, to be ready for physics data-taking in 2014, is going to be built based on control technologies recommended by the CERN Engineering group. A rich portfolio of the technologies is planned to be showcased and deployed in the final application, and synergy between them is needed. In particular two approaches to building controls application need to play in harmony: the use of the high-level application framework called UNICOS, and a bottom-up approach of development based on the components of PVSS JCOP Framework. By combining the features provided by the two frameworks we want to avoid duplication of functionality and minimize the maintenance and development effort for future control applications. In the paper we present the result of the integration efforts obtained so far: the control applications developed for beam-testing of NA62 detector prototypes. Even though the delivered applications are simple, significant conceptual and development work was required to bring the smooth inter-play between the two frameworks, while assuring the possibility of unleashing their full power. We also discuss the current open issues, and namely the viability of the approach we have taken for larger-scale applications of high complexity, such as the complete detector control system for the NA62 detector.

MOPMN021 **Benefits and Drawbacks of MATLAB Applications for Accelerator Operation** – *E. Zimoch (PSI-LRF) B. Beutner, R. Ischebeck, T. Korhonen (PSI)*
Having physicists writing applications for accelerator operation for example in MATLAB has many advantages and can greatly speed up machine commissioning. However, it can also have some undesirable side effects like problems with stability or maintenance. This paper describes a MATLAB programming environment for system experts and presents some countermeasures to reduce the disadvantages.

MOPMN022 **Database Driven Control System Configuration for the PSI Proton Accelerator Facilities** – *H. Lutz (PSI)*
At PSI there are two facilities with proton cyclotron accelerators. The machine control system for PROSCAN which is used for medical patient therapy, is running with EPICS. The High Intensity Proton Accelerator (HIPA) is mostly running under the in-house control system ACS. Dedicated parts of HIPA are under EPICS control. Both these facilities are configured through an Oracle database application suite. This paper presents the concepts and tools which are used to configure the control system directly from the database-stored configurations. Such an approach has advantages which contribute for better control system reliability, overview and consistency.

MOPMN023 **Preliminary Design and Integration of EPICS Operation Interface for the Taiwan Photon Source** – *Y.-S. Cheng (NSRRC), J. Chen, P.C. Chiu, K.T. Hsu, C.H. Kuo, C.-Y. Liao, C.Y. Wu (NSRRC)*
The TPS (Taiwan Photon Source) is the latest generation of 3 GeV synchrotron light source which has been in construction since 2010. The EPICS framework is adopted as control system infrastructure for the TPS. The EPICS IOCs (Input Output Controller) and various database records have been gradually implemented to control and monitor each subsystem of TPS. The subsystem includes timing, power supply, motion controller, miscellaneous Ethernet-compliant devices etc. Through EPICS PVs (Process Variables) channel access, remote access

I/O data via Ethernet interface can be observed by the useable graphical toolkits, such as the EDM (Extensible Display Manager) and MATLAB. The operation interface mainly includes the function of setting, reading, save, restore and etc. Integration of operation interfaces will depend upon properties of each subsystem. In addition, the centralized management method is utilized to serve every client from file servers in order to maintain consistent versions of related EPICS files. The efforts will be summarized at this report.

MOPMN024 **A VME based Health Monitoring System** – *Y.M. Huang (IHEP Beijing), C.H. Wang (IHEP Beijing)*

This paper introduces a VME based health system for monitoring the working status of VME crates in the BEPCII. It consists of a PC and a VME crate where a CMM (Classic Monitor System) is installed. The CMM module is responsible for collecting data from the power supply and temperature as well as fan speed inside the VME crate and sending these data to the PC via the serial port. The author developed EPICS asynchronous driver by using a character-based device protocol StreamDevice. The data is saved into EPICS IOC database in character. Man-machine interface which is designed by BOY displays the running status of the VME crate including the power supply and temperature as well as fan speed. If the value of records displays unusually, the color of the value will be changed into red. This can facilitate the maintenance of the VME crates.

MOPMN025 **New SPring-8 Control Room; Towards Unified Operation with SACLA and SPring-8 II Era.** – *A. Yamashita (JASRI/SPring-8), R. Fujihara, N. Hosoda, Y. Ishizawa, H. Kimura, T. Masuda, C. Saji, T. Sugimoto, S. Suzuki, M. Takao, R. Tanaka (JASRI/SPring-8) T. Fukui, Y. Otake (RIKEN/SPring-8)*

We have renovated the SPring-8 control room. This is the first major renovation since its inauguration in 1997. In 2011, the construction of SACLA (SPring-8 Angstrom Compact Laser Accelerator) was completed and it is planned to be controlled from the new control room for close cooperative operation with the SPring-8 storage ring. It is expected that another SPring-8 II project will require more workstations than the current control room. We have extended the control room area for these foreseen projects. In this renovation we have employed new technology which did not exist 14 years ago, such as a large LCD and silent liquid cooling workstations for comfortable operation environment. We have incorporated many ideas which were obtained during the 14 years experience of the design. The operation in the new control room began in April 2011 after a short period of the construction.

MOPMN026 **Small Angle Data Acquisition and Treatment in GDA** – *T.S. Richter (Diamond), I. Sikharulidze, D. Sneddon (Diamond) G.R. Mant (STFC/DL)*

The data acquisition framework GDA and the analysis components of SDA are used on almost all beamlines at Diamond for commissioning, experiments, visualisation and analysis. The integrated product makes use of the Eclipse RCP plugin system that allows developers to easily create a domain specific application from generic components. Due to its unique feature set, the active development and the open source license it has also found adoption in other facilities. Namely these are the small angle scattering beamlines DUBBLE at the ESRF and BioCAT at the APS, therefore covering both TANGO and EPICS as underlying control layer. We report on the current status with a focus on the small angle scattering implementations. Experimental control as well as online data display and processing in the light of high data rate area detectors will be highlighted.

MOPMN027 **The LHC Sequencer** – *R. Alemany-Fernandez (CERN), V. Baggiolini, R. Gorbonosov, D. Khasbulatov, M. Lamont, P. Le Roux, C. Roderick, R. Sanchez Lopez (CERN)*

The Large Hadron Collider (LHC) at CERN is a highly complex system made of many different sub-systems whose operation implies the execution of many tasks with stringent constraints on the order and duration of the execution. To be able to operate such a system in the most efficient and reliable way the operators in the CERN control room use a high level control system: the LHC Sequencer. The LHC Sequencer system is composed of several components, including an Oracle database where operational sequences are configured, a core server that orchestrates the execution of the sequences, and two graphical user interfaces: one for sequence edition, and another for sequence execution. This paper describes the architecture of the LHC Sequencer system, and how the sequences are prepared and used for LHC operation.

MOPMN028 **Automated Voltage Control in LHCb** – *L.G. Cardoso (CERN), C. Gaspar, R. Jacobsson (CERN)*

LHCb is one of the 4 LHC experiments. In order to ensure the safety of the detector and to maximize efficiency, LHCb needs to coordinate its own operations, in particular the voltage configuration of the different sub-detectors, according to the accelerator status. A control software has been developed for this purpose, based on the Finite State Machine toolkit and the SCADA system used for control throughout LHCb (and the other LHC experiments). This software permits to efficiently drive both the Low Voltage (LV) and High Voltage (HV) systems of the 10 different sub-detectors that constitute LHCb, setting each sub-system to the required voltage (easily configurable at run-time) based on the accelerator state. The control software is also responsible for monitoring the state of the Sub-detector voltages and adding it to the event data in the form of status-bits. Safe and yet flexible operation of the LHCb detector has been obtained and automatic actions, triggered by the state changes of the accelerator, have been implemented. This paper will detail the implementation of the voltage control software, its flexible run-time configuration and its usage in the LHCb experiment.

MOPMN029 **Spiral2 Control System: First High-level Java Applications Based on the OPEN-XAL Library** – *P. Gillette (GANIL), E. Lemaitre, G. Normand, L. Philippe (GANIL)*
The Radioactive Ions Beam SPIRAL2 facility will be based on a supra-conducting driver providing deuterons or heavy ions beams at different energies and intensities. Using then the ISOLD method, exotic nuclei beams will be sent either to new physics facilities or to the existing GANIL experimental areas. To tune this large range of beams, high-level applications will be mainly developed in Java language. The choice of the OPEN-XAL application framework, developed at the Spallation Neutron Source (SNS), has proven to be very efficient and greatly helps us to design our first software pieces to tune the accelerator. The first part of this paper presents some new applications:"Minimisatio" which aims at optimizing a section of the accelerator; a general purpose software named"Hoo" for interacting with equipment of any kind; and an application called"Profil" to visualize and control the Spiral2 beam wire harps. As tuning operation has to deal with configuration and archiving issues, databases are an effective way to manage data. Therefore, two databases are being developed to address these problems for the SPIRAL2 command control: one is in charge of device configuration upstream the Epics databases while another one is in charge of accelerator configuration (lattice, optics and set of values). The last part of this paper aims at describing these databases and how java applications will interact with them.

10-Oct-11 16:30 – 18:00	Poster	Mont Blanc Sud

MOPMS — Poster
Chair: J.M. Meyer (ESRF)

Upgrade of control systems

MOPMS001 **The New Control System for the Vacuum of ISOLDE at CERN** – *S. Blanchard (CERN), F. Bellorini, F.B. Bernard, E. Blanco, P. Gomes, H. Vestergard, D. Willeman (CERN)*
The On-Line Isotope Mass Separator (ISOLDE) is a facility dedicated to the production of radioactive ion beams for nuclear and atomic physics. From ISOLDE vacuum sectors to the pressurized gases storage tanks there are up to five stages of pumping for a total of more than one hundred pumps including turbo-molecular, cryo, dry, membrane and oil pumps. The ISOLDE vacuum control system is critical; the volatile radioactive elements present in the exhaust gases and the High and Ultra High Vacuum pressure specifications require a complex control and interlocks system. This paper describes the reengineering of the control system developed using the CERN UNICOS-CPC framework. An additional challenge has been the usage of the UNICOS-CPC in a vacuum domain for the first time. The process automation provides multiple operating modes (Rough pumping, bake-out, high vacuum pumping, regeneration for cryo-pumped sectors, venting, etc). The control system is composed of local controllers driven by PLC (logic, interlocks) and a SCADA application (operation, alarms monitoring and diagnostics).

MOPMS002 **LHC Survey Laser Tracker Controls Renovation** – *C. Charrondiere (CERN), M. Nybo, A. Rijllart (CERN)*
The LHC survey laser tracker control system is based on an industrial software package (Axyz) from Leica Geosystems^{TM} that has an interface to Visual Basic 6.0^{TM}, which we used to automate the geometric measurements for the LHC magnets. As the Axyz package is no longer supported and the Visual Basic 6.0^{TM} interface would need to be changed to Visual Basic. Net^{TM} we have taken the decision to recode the automation application in LabVIEW^{TM} interfacing to the PC-DMIS software, proposed by Leica Geosystems. This presentation describes the existing equipment, interface and application showing the reasons for our decisions to move to PC-DMIS and LabVIEW. We present the experience with the first prototype and make a comparison with the legacy system.

MOPMS003 **The Evolution of the Control System for the Electromagnetic Calorimeter of the Compact Muon Solenoid Experiment at the Large Hadron Collider** – *O. Holme (ETH), D.R.S. Di Calafiori, G. Dissertori, W. Lustermann (ETH) S. Zelepoukine (UW-Madison/PD)*
This paper discusses the evolution of the Detector Control System (DCS) designed and implemented for the Electromagnetic Calorimeter (ECAL) of the Compact Muon Solenoid (CMS) experiment at the Large Hadron Collider (LHC) as well as the operational experience acquired during the LHC physics data taking period of 2010. The current implementation in terms of functionality and planned hardware upgrades are presented. Furthermore, a project for reducing the long-term software maintenance, including a year-long detailed analysis of the existing applications, is put forward and the current outcomes which have informed the design decisions for the next CMS ECAL DCS software generation are described. The goal for the new version is to minimize external dependencies enabling smooth migration to new hardware and software platforms and

to maintain the existing functionality whilst dramatically reducing support and maintenance effort through homogenization, simplification and standardization of the control system software.

MOPMS004 **First Experience with VMware Servers at HLS** – *G. Liu (USTC/NSRL), X. Bao, C. Li, J.G. Wang, K. Xuan (USTC/NSRL)*

Hefei Light Source(HLS) is a dedicated second generation VUV light source, which was designed and constructed two decades ago. In order to improve the performance of HLS, especially getting higher brilliance and increasing the number of straight sections, an upgrade project is undergoing, accordingly the new control system is under construction. VMware vSphere 4 Enterprise Plus is used to construct the server system for HLS control system. Four DELL PowerEdge R710 rack servers and one DELL Equallogic PS6000E iSCSI SAN comprises the hardware platform. Some kinds of servers, such as file server, web server, database server, NIS servers etc. together with the softIOC applications are all integrated into this virtualization platform. The prototype of softIOC is setup and its performance is also given in this paper. High availability and flexibility are achieved with low cost.

MOPMS005 **The Upgraded Corrector Control Subsystem for the Nuclotron Main Magnetic Field** – *V. Andreev (JINR/VBLHEP), V. Isadov, V. Volkov (JINR/VBLHEP) A. Kirichenko, S. Romanov, G.V. Trubnikov (JINR)*

This report discusses a control subsystem of 40 main magnetic field correctors which is a part of the superconducting synchrotron Nuclotron Control System. The subsystem is used in static and dynamic (corrector's current depends on the magnetic field value) modes. Development of the subsystem is performed within the bounds of the Nuclotron-NICA project. Principles of digital (PSMBus/RS-485 protocol) and analog control of the correctors' power supplies, current monitoring, remote control of the subsystem via IP network, are also presented. The first results of the subsystem commissioning are given.

MOPMS006 **SARAF Beam Lines Control Systems Design** – *E. Reinfeld (Soreq NRC), D. Berkovits, I. Eliyahu, I.G. Gertz, A. Grin, I. Mardor, A. Perry, L. Weissman (Soreq NRC)*

The first beam lines addition to the SARAF facility was completed in phase I and introduced new hardware to be controlled. This article will describe the beam lines vacuum, magnets and diagnostics control systems and the design methodology used to achieve a reliable and reusable control system. The vacuum control systems of the accelerator and beam lines have been integrated into one vacuum control system which controls all the vacuum control hardware for both the accelerator and beam lines. The new system fixes legacy issues and is designed for modularity and simple configuration. Several types of magnetic lenses have been introduced to the new beam line to control the beam direction and optimally focus it on the target. The control system was designed to be modular so that magnets can be quickly and simply inserted or removed. The diagnostics systems control the diagnostics devices used in the beam lines including data acquisition and measurement. Some of the older control systems were improved and redesigned using modern control hardware and software. The above systems were successfully integrated in the accelerator and are used during beam activation.

MOPMS007 **Deep-Seated Cancer Treatment Spot-Scanning Control System** – *W. Zhang (IMP), S. An, G.H. Li, W.F. Liu, W.M. Qiao, Y.P. Wang, F. Yang (IMP)*
System is mainly composed of hardware, the data for a given waveform scanning power supply controller, dose-controlled counting cards, and event generator system. Software consists of the following components: generating tumor shape and the corresponding waveform data system, waveform controller (ARM and DSP) program, counting cards FPGA procedures, event and data synchronization for transmission COM program.

MOPMS008 **SARAF New Target Control Systems** – *I. Eliyahu (Soreq NRC), D. Berkovits, I.G. Gertz, S. Halfon, N. Hazenshprung, D. Kijel, E. Reinfeld, I. Silverman, L. Weissman (Soreq NRC)*
The first beam line addition to the SARAF facility was completed in phase I. two experiments are planned in this new beam line, the Liquid Lithium target and the Foils target. For those we are currently building hardware and software for their control systems. The Liquid Lithium target is planned to be a powerful neutron source for the accelerator, based on the proton beam of the SARAF phase I. The concept of this target is based on a liquid lithium that spins and produces neutron by the reaction Li7(p,n)Be7. This target was successfully tested in the laboratory and is intended to be integrated into the accelerator beam line and the control system this year. The Foils Target is planned for a radiation experiment designed to examine the problem of radiation damage to metallic foils. To accomplish this we have built a radiation system that enables us to test the foils. The control system includes varied diagnostic elements, vacuum, motor control, temp etc, for the two targets mentioned above. These systems were built to be modular, so that in the future new targets can be quickly and simply inserted. This article will describe the different control systems for the two targets as well as the design methodology used to achieve a reliable and reusable control on those targets.

MOPMS009 **Epics Device Support for FPGA Boards on an LLRF System** – *J.C. Calvo (CIEMAT), A. Ibarra, A. Salom (CIEMAT) M.A. Patricio (UCM) M.L. Rivers (ANL)*
The IFMIF-EVEDA (International Fusion Materials Irradiation Facility - Engineering Validation and Engineering Design Activity) linear accelerator will be a 9 MeV, 125mA CW (Continuous Wave) deuteron accelerator prototype to validate the technical options of the accelerator design for IFMIF. The RF (Radio Frequency) power system of IFMIF-EVEDA consists of 18 RF chains working at 175MHz with three amplification stages each; each one of the required chains for the accelerator prototype is based on several 175MHz amplification stages. The LLRF system provides the RF Drive input of the RF plants. It controls the amplitude and phase of this signal to be synchronized with the beam and it also controls the resonance frequency of the cavities. The system is based on a commercial cPCI FPGA Board provided by Lyrtech and controlled by a Windows Host PC. For this purpose, it is mandatory to communicate the cPCI FPGA Board with an EPICS Channel Access, building an IOC (Input Output Controller) between Lyrtech board and EPICS. A new software architecture to design a device support, using AsynPortDriver class and CSS as a GUI (Graphical User Interface), is presented.

MOPMS010 **LANSCE Control System Front-End and Infrastructure Hardware Upgrades** – *M. Pieck (LANL), D. Baros, T. Madison, P.S. Marroquin, P.D. Olivas, F.E. Shelley, D.S. Warren, W. Winton (LANL)*
The Los Alamos Neutron Science Center (LANSCE) linear accelerator drives user facilities for isotope production, proton radiography, ultra-cold neutrons, weapons neutron research and various sciences using neutron scattering. The LANSCE Control System (LCS), which is in part 30 years old, provides control and data monitoring for most devices in the linac and for some of its associated experimental-area beam lines. In Fiscal Year 2011, the control system went through an upgrade process that affected different areas of the LCS. We improved our network infrastructure and we converted part of our front-end control system hardware to Allen Bradley ControlsLogix 5000 and National Instruments Compact RIO programmable automation controller (PAC). In this paper, we will discuss what we have done, what we have learned about upgrading the existing control system, and how this will affect our future planes.

MOPMS011 **The Evolution of the HADES Slow Control System** – *B.W. Kolb (GSI)*
The EPICS based slow control system of the HADES detector evolved in the last 12 years going from CAMAC and VME modules to custom built boards distributed over the whole detector. Only few commercial components like HV and LV power supplies are still used. The development was mainly driven by the demands from the data acquisition for faster and more parallel readout. A new plastic optical fiber network for data acquisition, trigger and slow control will be described.

MOPMS012 **Development of RF Control System for PLS-II** – *J.C. Yoon (PAL), J.W. Lee, H.J. Park (PAL)*
The PLS SR RF control system of the currently operating accelerator storage ring experienced improvements to the performance of the control system between 2004 and 2009. As the RF number 5 cavity installation is completed, the existing RF VME control system's improvement was required for enhancing RF function in PLS. Improvements required operating the existing system as an RF control system and were applied to hardware and application program. The PLS-II RF control system can be designed and upgraded in some ways. The RF control system will be consisting of the compactPCI based IOCs and the Embedded IOC. According to design status of the RF cavity type such as adding NC cavities or new super conductivity (SC) RF cavities, the high power RF system will be different and adding some high power sources from present status. We describe the design status of PLS-II RF control system using Embedded IOC, cPCI IOC, an EPICS development environment, and OPI Extension software.

MOPMS013 **Progress in the Conversion of the In-house Developed Control System to EPICS at iThemba LABS** – *I.H. Kohler (iThemba LABS), M.A. Crombie, C. Ellis, M.E. Hogan, H.W. Mostert, M. Mvungi, O. Oliva, J.V. Pilcher, N. Stodart (iThemba LABS)*

This presentation highlights the following challenges: 1.Maintaining an aging control system based on a LAN of PC's running OS/2, in-house developed C-code, CAMAC as well as locally manufactured interface hardware. 2.The transition to EPICS 3.The running of parts of both systems during the transition period and 4.The conclusion that it was a good decision to move over to EPICS given the support from the community, the stability of EPICS components and it being able to run effectively on low cost off the shelf PC's and was flexible enough to be adapted to our I/O infrastructure. A brief description would be given of control system requirements for the iThemba LABS cyclotron facility at Faure, South Africa including about 3000 devices requiring approximately 30000 process variables. The decision to move over to EPICS rather than to try and re-invent another home grown solution. The challenges this imposed resulting in the writing of LINUX drivers and EPICS ASYN interfaces to our existing interface hardware. Further challenges in running the two systems side-by-side by writing bridges between the systems and being able to display both old and new process variables on both user interface screens. A description would be given on the state of the transition, in that all new projects have be done directly in EPICS and older process variables and functionality is slowly being moved over to EPICS.

MOPMS014 **GSI Operation Software: Migration from OpenVMS to Linux** – *R. Huhmann (GSI), G. Froehlich, S. Jülicher, V.RW. Schaa (GSI)*

The current operation software at GSI controlling the linac, beam transfer lines, synchrotron and storage ring, has been developed over a period of more than two decades using OpenVMS now on Alpha-Workstations. The GSI accelerator facilities will serve as a injector chain for the new FAIR accelerator complex for which a control system is currently developed. To enable reuse and integration of parts of the distributed GSI software system, in particular the linac operation software, within the FAIR control system, the corresponding software components must be migrated to Linux. The interoperability with FAIR controls applications is achieved by adding a generic middleware interface accessible from Java applications. For porting applications to Linux a set of libraries and tools has been developed covering the necessary OpenVMS system functionality. Currently, core applications and services are already ported or rewritten and functionally tested but not in operational usage. This paper presents the current status of the project and concepts for putting the migrated software into operation.

MOPMS015 **Beamline Control with EtherCat and TINE** – *U.R. Ristau (EMBL), M. DiCastro, S. Fiedler (EMBL)*

The EMBL-Hamburg has just started operation of 3 beamlines at the new Petra3 Synchroton at DESY. The beamline control software, the control system and control electronic will be discussed. The PETRA3 accelerator control system TINE is used the first time for beamline control. The open source realtime software fieldbus protocol EtherCat and Beckhoff TwinCat together with Beckhoff electronic are used for motor control, DAQ and signal synchronization. About 10 distributed TwinCat master installations for device control (monochromator, mirror, slits etc) are connected with each other to allow synchronization of all signals in the range ofμseconds. New add on tools to the control system suite

TINE like the motor and scan server will be presented.

MOPMS016 **The Control System of CERN Accelerators Vacuum - Current Status and Recent Improvements** – *P. Gomes (CERN), F. Antoniotti, S. Blanchard, M. Boccioli, G. Girardot, H. Vestergard (CERN) L. Kopylov, M.S. Mikheev (IHEP Protvino)*
The vacuum control system of most of the CERN accelerators is based on Siemens PLCs and on PVSS SCADA. The application software for both PLC and SCADA started to be developed specifically by the vacuum group; with time, it included a growing number of building blocks from the UNICOS framework. After the transition from the LHC commissioning phase to its regular operation, there has been a number of additions and improvements to the vacuum control system, driven by new technical requirements and by feedback from the accelerator operators and vacuum specialists. New functions have been implemented in PLC and SCADA: for the automatic restart of pumping groups, after power failure; for the control of the solenoids, added to reduce e-cloud effects; and for PLC power supply diagnosis. The automatic recognition and integration of mobile slave PLCs has been extended to the quick installation of pumping groups with the electronics kept in radiation-free zones. The ergonomics and navigation of the SCADA application have been enhanced; new tools have been developed for interlock analysis, and for device listing and selection; web pages have been created, summarizing the values and status of the system. The graphical interface for windows clients has been upgraded from ActiveX to QT, and the PVSS servers will soon be moved from Windows to Linux.

MOPMS017 **Simulation of Profibus based I/O using WinMod** – *O. Korth (DESY), T. Boeckmann, M.R. Clausen (DESY) Q. Meng (USST)*
One third of the cryogenic plant at DESY which originally was built to supply liquid helium for HERA went recently through a refurbishment process which included the complete replacement of the control system (*). After the successful commissioning of the plant, it immediately went into continuous 24/7 operations for FLASH. Elaborate tests of software changes in either the system software (e.g. drivers) or the process control part were not possible any more. Since all of the I/O is connected to the Profibus field bus a commercial Profibus simulation application (WinMod) went into operation. The configuration of WinMod can be applied by XML files. These files are created by an upgraded version of the I/O configuration tool which also creates the XML configuration fires for the Profibus lines connected to the EPICS IOC's. After the initial step of simulating the whole Profibus address space with all the individual I/O components and types also the process behavior of individual I/O channels was simulated. While the correct address space mapping is mandatory for testing system resources like drivers etc. it is important to simulate the I/O process behavior for e.g., state notation language programs which control the process. With this setup it is possible to run the original process control configuration on the EPICS IOC's against the simulator and test new functionalities without having to run the real process. Moreover the results can be displayed on the original operator consoles based on Control System Studio (CSS) and the control displays in WinMod in parallel.

MOPMS018 **New Timing System Development at SNS** – *D. Curry (ORNL RAD) X.H. Chen, R. Dickson, J.C. Patterson, D.H. Thompson (ORNL) J. Dedic (Cosylab)*
The timing system at the Spallation Neutron Source (SNS) has recently been updated to support the long range production and availability goals of the facility. A redesign of the hardware and software provided us with an opportunity to significantly reduce the complexity of the system as a whole and consolidate the functionality of multiple cards into single units eliminating almost half of our operating components in the field. It also presented a prime opportunity to integrate new system level diagnostics, previously unavailable, for experts and operations. These new tools provide us with a clear image of the health of our distribution links and enhance our ability to quickly identify and isolate errors.

MOPMS019 **New Beam Position System of PLS-II Storage Ring** – *E.H. Lee (PAL), J.W. Lee, S. Shin (PAL)*
The Pohang Accelerator Laboratory (PAL) is pursuing the second major upgrade plan, called PLS-II. In PLS-II, 96 Libera Brilliance have replaced the former beam position system. Libera Brilliance is a standard Beam Position Processor system. It provides data flows at different sampling rates(10Hz, ~10kHz).

MOPMS020 **High Intensity Proton Accelerator Controls Network Upgrade** – *R.A. Krempaska (PSI-LRF)*
The High Intensity Proton Accelerator (HIPA) control system network is spread through about six buildings and has grown historically in an unorganized way. It consisted of about 25 network switches, 150 nodes and 20 operator consoles. The miscellaneous hardware infrastructure and the lack of the documentation and components overview could not guarantee anymore the reliability of the control system and facility operation. Therefore, a new network, based on modern network topology, PSI standard hardware with monitoring and detailed documentation and overview was needed. We would like to present the process how we successfully achieved this goal and the advantages of the clean and well documented network infrastructure.

MOPMS021 **Detector Control System of the ATLAS Insertable B-Layer** – *S. Kersten (Bergische Universität Wuppertal), P. Kind, K. Lantzsch, P. Maettig, C. Zeitnitz (Bergische Universität Wuppertal) M. Citterio, C. Meroni (Universita' degli Studi di Milano e INFN) S. Kovalenko (CERN) B. Verlaat (NIKHEF)*
To improve tracking robustness and precision of the ATLAS inner tracker an additional fourth pixel layer is foreseen, called Insertable B-Layer (IBL). It will be installed between the innermost present Pixel layer and a new smaller beam pipe and is presently under construction. As, once installed into the experiment, no access is available, a highly reliable control system is required. It has to supply the detector with all entities required for operation and protect it at all times. Design constraints are the high power density inside the detector volume, the sensitivity of the sensors against heatups, and the protection of the front end electronics against transients. We present the architecture of the control system with an emphasis on the CO2 cooling system, the power supply system and protection strategies. As we aim for a common operation of pixel and IBL detector, the integration of the IBL control system into the Pixel one will be discussed as well.

MOPMS023 **LHC Magnet Test Benches Controls Renovation** – *A. Raimondo (CERN), D. Kudryavtsev, A. Rijllart, E. Zorin (CERN)*
The LHC magnet test benches controls were designed in 1996. They were based on VME data acquisition systems and Siemens PLCs control and interlocks systems. During a review of renovation of superconducting laboratories at CERN in 2009 it was decided to replace the VME systems with PXI and the obsolete Sun/Solaris workstations with Linux PCs. This presentation covers the requirements for the new systems in terms of functionality, security, channel count, sampling frequency and precision. We will report on the experience with the commissioning of the first series of fixed and mobile measurement systems upgraded to this new platform, compared to the old systems. We also include the experience with the renovated control room.

MOPMS024 **Evolution of the Argonne Tandem Linear Accelerator System (ATLAS) Control System** – *M.A. Power (ANL), F.H. Munson (ANL)*
Given that the Argonne Tandem Linac Accelerator System (ATLAS) recently celebrated its 25th anniversary, this paper will explore the past, present and future of the ATLAS Control System and how it has evolved along with the accelerator and control system technology. ATLAS as we know it today, originated with a Tandem Van de Graff in the 1960's. With the addition of the Booster section in the late 1970's, came the first computerized control. ATLAS itself was placed into service on June 25, 1985 and was the world's first superconducting linear accelerator for ions. Since its dedication as a National User Facility, more than a thousand experiments by more than 2,000 users world-wide, have taken advantage of the unique capabilities it provides. Today, ATLAS continues to be a user facility for physicists who study the particles that form the heart of atoms. Its most recent addition, CARIBU (Californium Rare Isotope Breeder Upgrade), creates special beams that feed into ATLAS. ATLAS is similar to a living organism, changing and responding to new technological challenges and research needs. As it continues to evolve, so does the control system: from the original days using a DEC PDP-11/34 computer and 2 CAMAC crates, to a DEC Alpha computer running Vsystem software and more than twenty CAMAC crates, to distributed computers and VME systems. Future upgrades are also in the planning stages that will continue to evolve the control system.

MOPMS025 **Migration from OPC-DA to OPC-UA** – *B. Farnham (CERN), R. Barillere (CERN)*
The OPC-DA specification of OPC has been a highly successful interoperability standard for process automation since 1996, allowing communications between any compliant components regardless of vendor. CERN has a reliance on OPC-DA Server implementations from various 3rd party vendors which provide a standard interface to their hardware. The OPC foundation finalized the OPC-UA specification and OPC-UA implementations are now starting to gather momentum. This presentation gives a brief overview of the headline features of OPC-UA and a comparison with OPC-DA and outlines the necessity of migrating from OPC-DA and the motivation for migrating to OPC-UA. Feedback from research into the availability of tools and testing utilities will be presented and a practical overview of what will be required from a computing perspective in order to run OPC-UA clients and servers in the CERN network.

MOPMS026 **J-PARC Control toward Future Reliable Operation** – *N. Kamikubota (J-PARC, KEK & JAEA)*
J-PARC accelerator complex comprises Linac, 3-GeV RCS (Rapid Cycle Synchrotron), and 30-GeV MR (Main Ring). The J-PARC is a joint project between JAEA and KEK. Two control systems, one for Linac and RCS and another for MR, were developed by two institutes. Both control systems use the EPICS toolkit, thus, inter-operation between two systems is possible. After the first beam in November, 2006, beam commissioning and operation have been successful. However, operation experience shows that two control systems often make operators distressed: for example, different GUI look-and-feels, separated alarm screens, independent archive systems, and so on. Considering demands of further power upgrade and longer beam delivery, we need something new, which is easy to understand for operators. It is essential to improve reliability of operation. We, two control groups, started to discuss future directions of our control systems. Ideas to develop common GUI screens of status and alarms, and to develop interfaces to connect archive systems to each other, are discussed. Progress will be reported.

MOPMS027 **Fast Beam Current Transformer Software for the CERN Injector Complex** – *M. Andersen (CERN)*
The Fast transfer-line BCTs in CERN injector complex are undergoing a complete consolidation to eradicate obsolete, maintenance intensive hardware. The corresponding low-level software has been designed to minimise the effect of identified error sources while allowing remote diagnostics and calibration facilities. This paper will present the front-end and expert application software with the results obtained.

MOPMS028 **CSNS Timing System Prototype** – *G.X. Xu (IHEP Beijing), G. Lei (IHEP Beijing)*
Timing system is important part of CSNS. Timing system prototype developments are based on the Event System 230 series. I use two debug platforms, one is EPICS base 3.14.8. IOC uses the MVME5100, running vxworks5.5 version; the other is EPICS base 3.13, using vxworks5.4 version. Prototype work included driver debugging, EVG/EVR-230 experimental new features, such as CML output signals using high-frequency step size of the signal cycle delay, the use of interlocking modules, CML, and TTL's Output to achieve interconnection function, data transmission functions. Finally, I programed the database with the new features and in order to achieve OPI.

MOPMS029 **The BPM DAQ System Upgrade for SuperKEKB Injector Linac** – *M. Satoh (KEK), K. Furukawa, T. Suwada (KEK) T. Kudou, S. Kusano (MELCO SC)*

The KEK injector linac provides beams with four different rings: a KEKB high-energy ring (HER; 8 GeV/electron), a KEKB low-energy ring (LER; 3.5 GeV/positron), a Photon Factory ring (PF; 2.5 GeV/electron), and an Advanced Ring for Pulse X-rays (PF-AR; 3 GeV/electron). For the three rings except PF-AR, the simultaneous top-up injection has been completed since April 2009. In the simultaneous top-up operation, the common DC magnet settings are utilized for the beams with different energies and amount of charges, whereas the different optimized settings of RF timing and phase are applied to each beam acceleration by using a fast low-level RF (LLRF) phase and trigger delay control up to 50 Hz. The non-destructive beam position monitor (BPM) is an 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 DAQ system consists of the digital oscilloscopes (Tektronix DPO7104, 10 GSa/s). A signal from each electrode is analyzed with a predetermined response function up to 50 Hz. The beam position resolution of the current system is limited to about 0.1 mm because of ADC resolution. For the SuperKEKB project, we have a plan to upgrade the BPM DAQ system since the Linac should provide the smaller emittance beam. We will report on the system description of the new DAQ system and the results of performance test in detail.

MOPMS030 **Improvement of the Oracle Setup and Database Design at the Heidelberg Ion Therapy Center** – *K. Höppner (HIT), Th. Haberer, J.M. Mosthaf, A. Peters (HIT) G. Froehlich, S. Jülicher, V.RW. Schaa, W. Schiebel, S. Steinmetz (GSI) M. Thomas, A. Welde (Eckelmann AG)*

The HIT (Heidelberg Ion Therapy) center is an accelerator facility for cancer therapy using both carbon ions and protons, located at the university hospital in Heidelberg. It provides three therapy treatment rooms: two with fixed beam exit (both in clinical use), and a unique gantry with a rotating beam head, currently under commissioning. The backbone of the proprietary accelerator control system consists of an Oracle database running on a Windows server, storing and delivering data of beam cycles, error logging, measured values, and the device parameters and beam settings for about 100,000 combinations of energy, beam size and particle number used in treatment plans. Since going operational, we found some performance problems with the current database setup. Thus, we started an analysis in cooperation with the industrial supplier of the control system (Eckelmann AG) and the GSI Helmholtzzentrum für Schwerionenforschung. It focused on the following topics: hardware resources of the DB server, configuration of the Oracle instance, and a review of the database design that underwent several changes since its original design. The analysis revealed issues on all fields. The outdated server will be replaced by a state-of-the-art machine soon. We will present improvements of the Oracle configuration, the optimization of SQL statements, and the performance tuning of database design by adding new indexes which proved directly visible in accelerator operation, while data integrity was improved by additional foreign key constraints.

MOPMS031 **Did We Get What We Aimed for 10 Years Ago?** – *P.Ch. Chochula (CERN), A. Augustinus, L.S. Jirden, A.N. Kurepin, M. Lechman, P. Rosinsky (CERN) O. Pinazza (INFN-Bologna)*

The ALICE Detector Control System (DCS) is in charge of control and operation of one of the large high energy physics experiments at CERN in Geneva. The DCS design which started in 2000 was partly inspired by the control systems of the previous generation of HEP experiments at the LEP accelerator at CERN. However, the scale of the LHC experiments, the use of modern,"intelligen" hardware and the harsh operational environment led to an innovative system design. The overall architecture has been largely based on commercial products like PVSS SCADA system and OPC servers extended by frameworks. Windows has been chosen as operating system platform for the core systems and Linux for the frontend devices. The concept of finite state machines has been deeply integrated into the system design. Finally, the design principles have been optimized and adapted to the expected operational needs. The ALICE DCS was designed, prototyped and developed at the time, when no experience with systems of similar scale and complexity existed. At the time of its implementation the detector hardware was not yet available and tests were performed only with partial detector installations. In this paper we analyse how well the original requirements and expectations set ten years ago comply with the real experiment needs after two years of operation. We provide an overview of system performance, reliability and scalability. Based on this experience we assess the need for future system enhancements to take place during the LHC technical stop in 2013.

MOPMS032 **Re-engineering of the SPring-8 Radiation Monitor Data-acquisition System** – *T. Masuda (JASRI/SPring-8), M. Ishii, K. Kawata, T. Matsushita, C. Saji (JASRI/SPring-8)*

We have re-engineered the data acquisition system for the SPring-8 radiation monitors. Around the site, 81 radiation monitors are deployed. Seventeen of them are utilized for the radiation safety interlock system for the accelerators. The old data-acquisition system consisted of dedicated NIM-like modules linked with the radiation monitors, eleven embedded computers for data acquisition from the modules and three programmable logic controllers (PLCs) for integrated dose surveillance. The embedded computers periodically collected the radiation data from GPIB interfaces with the modules. The dose-surveillance PLCs read analog outputs in proportion to the radiation rate from the modules. The modules and the dose-surveillance PLCs were also interfaced with the radiation safety interlock system. These components in the old system were dedicated, black-boxed and complicated for the operations. In addition, GPIB interface was legacy and not reliable enough for the important system. We, therefore, decided to replace the old system with a new one based on PLCs and FL-net, which were widely used technologies. We newly deployed twelve PLCs as substitutes for all the old components. Another PLC with two graphic panels is installed near a central control room for centralized operations and watches for the all monitors. All the new PLCs and a VME computer for data acquisition are connected through FL-net. In this paper, we describe the new system and the methodology of the replacement within the short interval between the accelerator operations.

MOPMS033 **Status, Recent Developments and Perspective of TINE-powered Video System, Release 3** – *S. Weisse (DESY Zeuthen), D. Melkumyan (DESY Zeuthen) P. Duval (DESY)*
Experience has shown that imaging software and hardware installations at accelerator facilities need to be changed, adapted and updated on a semi-permanent basis. On this premise, the component-based core architecture of Video System 3 was founded. In design and implementation, emphasis was, is, and will be put on flexibility, performance, low latency, modularity, interoperability, use of open source, ease of use as well as reuse, good documentation and multi-platform capability. In the last year, a milestone was reached as Video System 3 entered production-level at PITZ, Hasylab and PETRA III. Since then, development path is stronger influenced by production-level experience and customer feedback. In this contribution, we describe the current status, layout, recent developments and perspective of the Video System. Focus will be put on integration of recording and playback of video sequences to Archive/DAQ, a standalone installation of the Video System on a notebook as well as experiences running on Windows 7-64bit. In addition, new client-side multi-platform GUI/application developments using Java are about to hit the surface. Last but not least it must be mentioned that although the implementation of Release 3 is integrated into the TINE control system, it is modular enough so that integration into other control systems can be considered.

MOPMS034 **Software Renovation of CERN's Experimental Areas** – *J. Fullerton (CERN)*
The experimental areas at CERN (AD, PS and SPS) have undergone a wide-spread electronics and software consolidation based on modern techniques allowing them to be used in the many years to come. This paper will describe the scale of the software renovation and how the issues were overcome in order to ensure a complete integration into the respective control systems.

MOPMS035 **A Beam Profiler and Emittance Meter for the SPES Project at INFN-LNL** – *G. Bassato (INFN/LNL), A. Andrighetto, N. Conforto, M.G. Giacchini, J.A. Montano, M. Poggi, J.A. Vasquez (INFN/LNL)*
The beam diagnostics system currently in use at LNL in the superconducting Linac has been upgraded for the SPES project. The control software has been rewritten using EPICS tools and a new emittance meter has been developed. The beam detector is based on wire grids, the IOC is implemented in a VME system running under Vxworks and the graphic interface is based on CSS. The system is now in operation in the SPES Target Laboratory for the characterization of beams produced by the new ion source.

MOPMS036 **Upgrade of the Nuclotron Extracted Beam Diagnostic Subsystem.** – *E.V. Gorbachev (JINR), N.I. Lebedev, N.V. Pilyar, S. Romanov, T.V. Rukoyatkina, V. Volkov (JINR)*
The subsystem is intended for the Nuclotron extracted beam parameters measurement. Multiwire proportional chambers are used for transversal beam profiles mesurements in four points of the beam transfer line. Gas amplification values are tuned by high voltage power supplies adjustments. The extracted beam intensity is measured by means of ionization chamber, variable gain current amplifier DDPCA-300 and voltage-to-frequency converter. The data is processed by industrial PC with National Instruments DAQ modules. The client-server distributed application written in LabView environment allows operators to control hardware and obtain measurement results over TCP/IP network.

MOPMS037 **A Customizable Platform for High-availability Monitoring, Control and Data Distribution at CERN** – *M. Brightwell (CERN), M. Bräger, A. Lang, A. Suwalska (CERN)*

In complex operational environments, monitoring and control systems are asked to satisfy ever more stringent requirements. In addition to reliability, the availability of the system has become crucial to accommodate for tight planning schedules and increased dependencies to other systems. In this context, adapting a monitoring system to changes in its environment and meeting requests for new functionalities are increasingly challenging. Combining maintainability and high-availability within a portable architecture is the focus of this work. To meet these increased requirements, we present a new modular system developed at CERN. Using the experience gained from previous implementations, the new platform uses a multi-server architecture to allow running patches and updates to the application without affecting its availability. The data acquisition can also be reconfigured without any downtime or potential data loss. The modular architecture builds on a core system that aims to be reusable for multiple monitoring scenarios, while keeping each instance as lightweight as possible. Both for cost and future maintenance concerns, open and customizable technologies have been preferred.

10-Oct-11 16:30 – 18:00	Poster	Makalu

MOPMU — Poster

Chair: J.M. Meyer (ESRF)

Status reports

MOPMU001 **Software and Capabilities of the Beam Position Measurement System for Novosibirsk Free Electron Laser** – *S.S. Serednyakov (BINP SB RAS), E.N. Dementyev, A.S. Medvedko, E. Shubin, V.G. Tcheskidov, N. Vinokurov (BINP SB RAS)*

The system that measures the electron beam position in Novosibirsk free electron laser with the application of electrostatic pick-up electrodes is described. The measuring hardware and main principles of measurement are considered. The capabilities and different operation modes of this system are described. In particular, the option of simultaneous detection of accelerated and decelerated electron beams at one pick-up station is considered. Besides, the operational features of this system at different modes of FEL performance (the 1st, 2nd, and 3rd stages) are mentioned.

MOPMU002 **Progress of the TPS Control System Development** – *J. Chen (NSRRC), Y.-T. Chang, Y.K. Chen, Y.-S. Cheng, P.C. Chiu, K.T. Hsu, S.Y. Hsu, K.H. Hu, C.H. Kuo, S.H. Lee, C.-Y. Liao, Y.R. Pan, C.-J. Wang, C.Y. Wu (NSRRC)*

The Taiwan Photon Source (TPS) is a low-emittance 3-GeV synchrotron light source which is in construction on the National Synchrotron Radiation Research Center (NSRRC) campus. The control system for the TPS is based upon EPICS framework. The standard hardware and software components have been defined. The prototype of various subsystems is on going. The event based timing system has been adopted. The power supply control interface accompanied with orbit feedback support have also been defined. The machine protection system is in design phase. Integration with the linear accelerator system which are installed and commissioned at temporary site for acceptance test has already been done. The interface to various systems is still on going. The infrastructures of high level and low level software are on going. Progress will be summarized in the report.

MOPMU004 **Upgrade of the U-70 Proton Synchrotron Extracted Beamlines Control System: Multiple Access and Data Presentation** – *I. Lobov (IHEP Protvino), V. Alferov, Y.V. Bordanovski, V. Lagutin, A. Lutchev (IHEP Protvino)*
The U-70 extracted beam lines system includes about 130 magnet dipoles and quadrupoles, with power provided by 112 power supplies (PS). Each PS is controlled by an individual Analog Device's based controller. Since a number of used magnets may vary and exceeds the number of available PSs, the commutation is used. Controllers are connected to a front-end computer by means of four CAN field buses. The software for the controllers is tuned to a specific type of the PS and a specific inductive load of the magnet. The Dell PowerEdge T710 server is used for the PS control with multiple access from several client workstations which controls PSs for a particular beam line. All client workstations along with the server and front-end computer are connected together with a dedicated LAN. The server grants different users different permissions to control their own PSs only. Every four seconds the measured data are stored in an archive. Operating commands are archived as well to keep a history of all user's actions. The software is based on the National Instruments Developer Suite Core and MS Office Web Components packages.

MOPMU005 **Overview of the Spiral2 Control System Progress** – *E. Lecorche (GANIL), P. Gillette, C.H. Haquin, E. Lemaitre, L. Philippe, D.T. Touchard (GANIL) J.F. Denis, F. Gougnaud, J.-F. Gournay, Y. Lussignol, P. Mattei (CEA/DSM/IRFU) P.G. Graehling, J.H. Hosselet, C. Maazouzi (IPHC)*
Spiral2 whose construction physically started at the beginning of this year at Ganil (Caen, France) will be a new Radioactive Ion Beams facility to extend scientific knowledge in nuclear physics, astrophysics and interdisciplinary researches. The project consists of a high intensity multi-ion accelerator driver delivering beams to a high power production system to generate the Radioactive Ion Beams being then post-accelerated and used within the existing Ganil complex. Resulting from the collaboration between several laboratories, Epics has been adopted as the standard framework for the control command system. At the lower level, pieces of equipment are handled through VME/VxWorks chassis or directly interfaced using the Modbus/TCP protocol; also, Siemens programmable logic controllers are tightly coupled to the control system, being in charge of specific devices or hardware safety systems. The graphical user interface layer integrates both some standard Epics client tools (EDM, CSS under evaluation, etc ...) and specific high level applications written in Java, also deriving developments from the Xal framework. Relational databases are involved into the control system for equipment configuration (foreseen), machine representation and configuration, CSS archivers (under evaluation) and Irmis (mainly for process variable description). The first components of the Spiral2 control system are now used in operation within the context of the ion and deuteron sources test platforms. The paper also describes how software development and sharing is managed within the collaboration.

MOPMU006 **The Commissioning of the Control System of the Accelerators and Beamlines at the Alba Synchrotron** – *D.F.C. Fernandez-Carreiras (CELLS-ALBA Synchrotron)*

Alba is a third generation synchrotron located near Barcelona in Spain. The final commissioning of all accelerators and beamlines started the 8th of March 2011. The Alba control system is based on the middle layer and tools provided by TANGO. It extensively uses the Sardana Framework, including the Taurus graphical toolkit, based on Python and Qt. The control system of Alba is highly distributed. The design choices made five years ago, have been validated during the commissioning. Alba uses extensively Ethernet as a Fieldbus, and combines diskless machines running Tango on Linux and Windows, with specific hardware based in FPGA and fiber optics for fast real time transmissions and synchronizations. B&R PLCs, robust, reliable and cost-effective are widely used in the different components of the machine protection system. In order to match the requirements in terms of speed, these PLCs are sometimes combined with the MRF Timing for the fast interlocks. This paper describes the design, requirements, challenges and the lessons learnt in the installation and commissioning of the control system.

MOPMU007 **ISHN Ion Source Control System Overview** – *M. Eguiraun (ESS-Bilbao), I. Arredondo, J. Feuchtwanger, G. Harper, M. del Campo (ESS-Bilbao) J. Jugo (University of the Basque Country, Faculty of Science and Technology)*

ISHN project consists of a Penning ion source which will deliver up to 65mA of H^- beam pulsed at 50 Hz with a diagnostics vessel for beam testing purposes. The present work analyzes the control system of this research facility. The main devices of ISHN are the power supplies for high density plasma generation and beam extraction, the H2 supply and Cesium heating system, plus refrigeration, vacuum and monitoring devices. The control system implemented with LabVIEW is based on PXI systems from National Instruments, using two PXI chassis connected through a dedicated fiber optic link between HV platform and ground. Source operation is managed by a real time processor at ground, while additional tasks are performed by means of an FPGA located at HV. The real time system manages the control loop of heaters, the H2 pulsed supply for a stable pressure in the plasma chamber, data acquisition from several diagnostics and sensors and the communication with the control room. The FPGA generates the triggers for the different power supplies and H2 flow as well as some data acquisition at high voltage. A PLC is in charge of the vacuum control (two double stage pumps and two turbo pumps), and it is completely independent of the source operation for avoiding risky failures. A dedicated safety PLC is installed to handle personnel safety issues. Current running diagnostics are, ACCT, DCCT, Faraday Cup and a pepperpot. In addition, a MySQL database stores the whole operation parameters while source is running. The aim is to test and train in accelerator technologies for future developments.

MOPMU008 **Solaris Project Status and Challenges** – *P.P. Goryl (Solaris)*

The Polish synchrotron radiation facility, Solaris, is being built in Krakow. The project is strongly linked to the MAX-IV project and the 1.5 GeV storage ring. A overview will be given of activities and of the control system and will outline the similarities and differences between the two machines.

MOPMU009 **The Diamond Control System: Five Years of Operations** – *M.T. Heron (Diamond)*
Commissioning of the Diamond Light Source accelerators began in 2005, with routine operation of the storage ring commencing in 2006 and photon beamline operation in January 2007. Since then the Diamond control system has provided a single interface and abstraction to (nearly) all the equipment required to operate the accelerators and beamlines. It now supports the three accelerators and a suite of twenty photon beamlines and experiment stations. This paper presents an analysis of the operation of the control system and further considers the developments that have taken place in the light of operational experience over this period.

MOPMU010 **LIA-2 Linear Induction Accelerator Control System Software** – *D. Bolkhovityanov (BINP SB RAS), P.B. Cheblakov, A. Panov (BINP SB RAS)*
LIA-2 is an electron Linear Induction Accelerator which can be used for flash radiography and as an injector for low emittance and high intensity induction linacs. Control and measurement electronics is custom-designed in BINP. Most of it is built as CAN-bus and cPCI devices, controlled by a number of cPCI crates with x86-compatible processor modules. These single-board computers run Linux. Control system software is based on CX control system infrastructure, which was designed in BINP for VEPP-5 injection facility and subsequently used in a number of BINP projects. Design of a distributed control system driving a mix of CAN and cPCI hardware in high electromagnetic interference conditions is discussed and its commissionning results are presented.

MOPMU011 **The Design Status of CSNS Experimental Control System** – *J. Zhuang (IHEP Beijing), Y.P. Chu, L. Hu, J. Jin, L. Li, Y.L. Liu, Y.H. Zhang (IHEP Beijing)*
To meet the increasing demand from user community, China decided to build a world-class spallation neutron source, called CSNS(China Spallation Neutron Source). It can provide users a neutron scattering platform with high flux, wide wavelength range and high efficiency. CSNS construction is expected to start in 2011 and will last 6.5 years. The control system of CSNS is divided into accelerator control system and experimental control system. CSNS Experimental Control System is based on EPICS architecture, offering device operating and device debug interface, communication between devices, environment monitor, machine and people protection, interface for accelerator system, control system monitor and database service. The all control system is divided into 4 parts, such as front control layer, Epics global control layer, database and network service. The front control layer is based on YOKOGAWA PLC and other controllers. Epics layer provides all system control and information exchange. Embedded PLC YOKOGAWA RP61 is considered used as communication node between front layer and EPICS layer. Database service provides system configuration and historical data. From the experience of BESIII, MySQL is a option. The system will be developed in Dongguan , Guangdong p province and Beijing, so VPN will be used to help development. Now,there are 9 people working on this system. The system design is completed. We are working on a prototype system now.

MOPMU012 **The Local Control System of an Undulator Cell for the European XFEL** – *S. Karabekyan (European XFEL GmbH), R. Pannier, J. Pflueger (European XFEL GmbH) N. Burandt, J. Kuhn (Beckhoff Automation GmbH) A. Schoeps (DESY)*
The European XFEL project is a 4th generation light source. The first beam will be delivered in the beginning of 2015. At the project startup three light sources SASE 1, SASE 2 and SASE 3 will produce spatially coherent ≤80fs short photon pulses with a peak brilliance of $10^3$2-$10^3$4 photons/s/mm^2/mrad^2/0.1% BW in the energy range from 0.26 to 24keV at an electron beam energy 14GeV. The Undulator systems are used to produce photon beams for SASE 1, SASE 2 and SASE 3. Each undulator system consists of an array of undulator cells installed in a row along the electron beam. The undulator cell itself consists of a planar undulator, a phase shifter, magnetic field correction coils and a quadrupole mover. The local control system of the undulator cell is based on industrial components produced by Beckhoff and on PLC software implemented in TwinCAT system. Four servo motors are installed on each undulator and control the gap between girders with micrometer accuracy. One stepper motor is used for phase shifter control, and two other stepper motors control the position of the quadrupole magnet. The current of magnetic field correction coils as well as the gap of the phase shifter are adjustable as a function of the undulator gap. The high level of synchronization ($<<1\mu$s) for the complete undulator system (for instance SASE2 with 35 undulator cells in total) could be achieved due to implementation of the EtherCAT fieldbus system in the local control. The description of the hardware components and the software functionality of the local control system will be discussed.

MOPMU013 **Phase II and III The Next Generation of CLS Beamline Control and Data Acquisition Systems** – *E. Matias (CLS), D. Beauregard, R. Berg, G. Black, M.J. Boots, W. Dolton, R. Igarashi, C.D. Miller, T. Wilson, G. Wright (CLS)*
The Canadian Light Source is nearing the completion of its suite of phase II Beamlines and in detailed design of its Phase III Beamlines. The paper presents an overview of the overall approach adopted by CLS in the development of beamline control and data acquisition systems. Building on the experience of our first phase of beamlines the CLS has continued to make extensive use of EPICS with EDM and QT based user interfaces. Increasing interpretive languages such as Python are finding a place in the beamline control systems. Web based environment such as ScienceStudio have also found a prominent place in the control system architecture as we move to tighter integration between data acquisition, visualization and data analysis.

MOPMU014 **Development of Distributed Data Acquisition and Control System for Radioactive Ion Beam Facility at Variable Energy Cyclotron Centre, Kolkata.** – *K. Datta (DAE/VECC), C. Datta, D.P. Dutta, T.K. Mandi, H.K. Pandey, D. Sarkar (DAE/VECC) R. Anitha, A. Balasubramanyan, K. Mourougayan (SAMEER)*
To facilitate frontline nuclear physics research, an ISOL (Isotope Separator On Line) type Radioactive Ion Beam (RIB) facility is being constructed at Variable Energy Cyclotron Centre (VECC), Kolkata. The RIB facility at VECC consists of various subsystems like ECR Ion source, RFQ, Rebunchers, LINACs etc. that produce and accelerate the energetic beam of radioactive isotopes required for different experiments. The Distributed Data Acquisition and Control System (DDACS) is intended to monitor and control large number of parameters associated with different sub systems from a centralized location to do the complete operation of beam generation and beam tuning in a user friendly manner. The DDACS has been designed based on a 3-layer architecture namely

Equipment interface layer, Supervisory layer and Operator interface layer. The Equipment interface layer consists of different Equipment Interface Modules (EIMs) which are designed around ARM processor and connected to different equipment through various interfaces such as RS-232, RS-485 etc. The Supervisory layer consists of VIA-processor based Embedded Controller (EC) with embedded XP operating system. This embedded controller, interfaced with EIMs through fiber optic cable, acquires and analyses the data from different EIMs. Operator interface layer consists mainly of PCs/Workstations working as operator consoles. The data acquired and analysed by the EC can be displayed at the operator console and the operator can centrally supervise and control the whole facility.

MOPMU015 **Control and Data Acquisition Systems for the FERMI@Elettra Experimental Stations** – *R. Borghes (ELETTRA), V. Chenda, A. Curri, G. Gaio, G. Kourousias, M. Lonza, G. Passos, R. Passuello, L. Pivetta, M. Prica, M. Pugliese, G. Strangolino (ELETTRA)*

FERMI@Elettra is a single-pass Free Electron Laser (FEL) user-facility covering the wavelength range from 100 nm to 4 nm. The facility is located in Trieste, Italy, nearby the third-generation synchrotron light source Elettra. Three experimental stations, dedicated to different scientific areas, are being installed in 2011: Low Density Matter (LDM), Elastic and Inelastic Scattering (EIS) and Diffraction and Projection Imaging (DiProI). The experiment control and data acquisition system is the natural extension of the machine control system. It integrates a shot-by-shot data acquisition framework with a centralized data storage and analysis system. Low-level applications for data acquisition and online processing have been developed using the Tango framework on Linux platforms. High-level experimental applications can be developed on both Linux and Windows platforms using C/C++, Python, LabView, IDL or Matlab. The Elettra scientific computing portal allows remote access to the experiment and to the data storage system.

MOPMU016 **Control System of NSC KIPT X-ray Source NESTOR** – *A.Y. Zelinsky (NSC/KIPT), V.N. Boriskin, I.M. Karnaukhov, V.P. Lyashchenko, A. Mytsykov, A.A. Shcherbakov, S. Sheyko, V.I. Trotsenko (NSC/KIPT)*

In NSC KIPT, Kharkov, Ukraine an X-ray source NESTOR is under construction. The source NESTOR will generate hard X-rays through Compton scattering of an intense laser beam by relativistic electron beam circulating in a storage ring. The source consists of 60 MeV electron linear accelerator as injector, 225 MeV storage ring, laser system and supporting systems. In the paper the general approach and solutions for NESTOR facility control system design and development are presented. The first results of magnetic and power supply system operations are described.

MOPMU017 **TRIUMF's ARIEL Project** – *J.E. Richards (TRIUMF, Canada's National Laboratory for Particle and Nuclear Physics), K. Ezawa, M. LeRoss, D.B. Morris, K. Negishi, R.B. Nussbaumer, S.A. Rapaz, E. Tikhomolov, G. Waters (TRIUMF, Canada's National Laboratory for Particle and Nuclear Physics)*

The Advanced Rare IsotopE Laboratory (ARIEL) will expand TRIUMF's capabilities in rare-isotope beam physics by doubling the size of the current ISAC facility. Two simultaneous radioactive beams will be available in addition to the present ISAC beam. ARIEL will consist of a 50 MeV, 10 mA CW superconducting electron linear accelerator (E-Linac), an additional proton beam-line from the 520MeV cyclotron, two new target stations, a beam-line connecting to the existing ISAC superconducting linac, and a beam-line to the ISAC low-energy experimental facility. Construction will begin in 2012 with commissioning to start in 2014. The ARIEL Control System will be implemented using EPICS allowing seamless integration with the EPICS based ISAC Control System. The ARIEL control system conceptual design and initial results from a prototype injector control system will be discussed.

MOPMU018 **Update On The Central Control System of TRIUMF's 500 MeV Cyclotron** – *M. Mouat (TRIUMF, Canada's National Laboratory for Particle and Nuclear Physics), E. Klassen, K.S. Lee, J.J. Pon, P.J. Yogendran (TRIUMF, Canada's National Laboratory for Particle and Nuclear Physics)*

The Central Control System of TRIUMF's 500 MeV cyclotron was initially commissioned in the early 1970s. In 1987 a four year project to upgrade the control system was planned and commenced. By 1997 this upgrade was complete and the new system was operating with increased reliability, functionality and maintainability. Since 1997 an evolution of incremental change has existed. Functionality, reliability and maintainability have continued to improve. This paper provides an update on the present control system situation (2011) and possible future directions.

MOPMU019 **The Gateways of Facility Control for SPring-8 Accelerators** – *M. Ishii (JASRI/SPring-8), T. Masuda, R. Tanaka, A. Yamashita (JASRI/SPring-8)*

We integrated the utilities data acquisition into the SPring-8 accelerator control system based on MADOCA framework. The utilities data such as air temperature, power line voltage and temperature of machine cooling water are helpful to study the correlation between the beam stability and the environmental conditions. However the accelerator control system had no way to take many utilities data managed by the facility control system, because the accelerator control system and the facility control system was independent system without an interconnection. In 2010, we had a chance to replace the old facility control system. At that time, we constructed the gateways between the MADOCA-based accelerator control system and the new facility control system installing BACnet, that is a data communication protocol for Building Automation and Control Networks, as a fieldbus. The system requirements were as follows: to monitor utilities data with required sampling rate and resolution, to store all acquired data in the accelerator database, to keep an independence between the accelerator control system and the facility control system, to have a future expandability to control the facilities from the accelerator control system. During the work, we outsourced to build the gateways including data taking software of MADOCA to solve the problems of less manpower and short work period. In this paper we describe the system design and the approach of outsourcing.

MOPMU020 **The Control and Data Acquisition System of the Neutron Instrument BIODIFF** *– H. Kleines (FZJ), M. Drochner, L. Fleischhauer-Fuss, T. E. Schrader, F. Suxdorf, M. Wagener (FZJ) A. Ostermann (TUM/Physik)*
The Neutron instrument BIODIFF is a single crystal diffractometer for biological macromolecules that has been built in a cooperation of Forschungszentrum Jülich and the Technical University of Munich. It is located at the research reactor FRM-II in Garching, Germany, and is in its commissioning phase, now. The control and data acquisition system of BIODIFF is based on the so-called"Jülich-Munich Standar", a set of standards and technologies commonly accepted at the FRM-II, which is based on the TACO control system developed by the ESRF. In future, it is intended to introduce TANGO at the FRM-II. The Image Plate detector system of BIODIFF is already equipped with a TANGO subsystem that was integrated into the overall TACO instrument control system.

MOPMU021 **Control System for Magnet Power Supplies for Novosibirsk Free Electron Laser** *– S.S. Serednyakov (BINP SB RAS), B.A. Dovzhenko, A.A. Galt, V.R. Kozak, E.A. Kuper, L.E. Medvedev, A.S. Medvedko, N. Vinokurov (BINP SB RAS)*
The control system for the magnetic system of the free electron laser (FEL) is described. The characteristics and structure of the power supply system are presented. The power supply control system based on embedded intelligent controllers with the CAN-BUS interface is considered in detail. The control software structure and capabilities are described. Besides, software tools for power supply diagnostics are described.

MOPMU022 **Control System of 100 MeV Electron Linear Accelerator Injector for NSC KIPT X-ray Source NESTOR** *– A.Y. Zelinsky (NSC/KIPT), V.N. Boriskin, V.A. Kushnir, A.A. Shcherbakov (NSC/KIPT)*
In the paper the layout, general approches and the first results of testing and operations of an 100 MeV electron linear accelerator driver control system for X-ray source NESTOR are presented.

MOPMU023 **The MRF Timing System. The Complete Control Software Integration in Tango.** *– J. Moldes (CELLS-ALBA Synchrotron), D.B. Beltran, D.F.C. Fernandez-Carreiras, J.J. Jamroz, O. Matilla, R. Suñé (CELLS-ALBA Synchrotron)*
The deployment of the Timing system based on the MRF hardware has been a important part of the control system. Hundreds of elements are integrated in the scheme, which provides synchronization signals and interlocks, transmitted in the microsecond range and distributed all around the installation. It has influenced several hardware choices and has been largely improved to support interlock events. The operation of the timing system requires a complex setup of all elements. A complete solution has been developed including libraries and stand alone Graphical User Interfaces. Therefore this set of tools is of a great added value, even increased if using Tango, since most high level applications and GUIs are based on Tango Servers. A complete software solution for managing the events, and interlocks of a large installation is presented.

MOPMU024 **Status of ALMA Software** – *T.C. Shen (ALMA, Joint ALMA Observatory), J.P.A. Ibsen, R. Soto (ALMA, Joint ALMA Observatory)*

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. Each antenna contains instruments capable of receiving radio signals from 31.3 GHz up to 950 GHz. These signals are correlated inside a Correlator and the spectral data are finally saved into the Archive system together with the observation metadata. This paper describes the progress in the deployment of the ALMA software, with emphasis on the control software, which is built on top of the ALMA Common Software (ACS), a CORBA based middleware framework. In order to support and maintain the installed software, it is essential to have a mechanism to align and distribute the same version of software packages across all systems. This is achieved rigorously with weekly based regression tests and strict configuration control. A build farm to provide continuous integration and testing in simulation has been established as well. Given the large amount of antennas, it is imperative to have also a monitoring system to allow trend analysis of each component in order to trigger preventive maintenance activities. A challenge for which we are preparing this year consists in testing the whole ALMA software performing complete end-to-end operation, from proposal submission to data distribution to the ALMA Regional Centers. The experience gained during deployment, testing and operation support will be presented.

MOPMU025 **The Implementation of the Spiral2 Injector Control System** – *F. Gougnaud (CEA/DSM/IRFU), J.F. Denis, J.-F. Gournay, Y. Lussignol, P. Mattei, R. Touzery (CEA/DSM/IRFU) P. Gillette, C.H. Haquin (GANIL) J.H. Hosselet, C. Maazouzi (IPHC)*

The EPICS framework was chosen for the Spiral2 project control system [*] in 2007. Four institutes are involved in the command control: Ganil (Caen), IPHC (Strasbourg) and IRFU (Saclay) and LPSC (Grenoble), the IRFU institute being in charge of the Injector controls. This injector includes two ECR sources (one for deuterons and one for A/q= 3 ions) with their associated low-energy beam transport lines (LEBTs). The deuteron source is installed at Saclay and the A/q=3 ion source at Grenoble. Both lines will merge before injecting beam in a RFQ cavity for pre acceleration. This paper presents the control system for both injector beamlines with their diagnostics (Faraday cups, ACCT/DCCT, profilers, emittancemeters) and slits. This control relies on COTS VME boards and an EPICS software platform. Modbus/TCP protocol is also used with COTS devices like power supplies and Siemens PLCs. The Injector graphical user interface is based on Edm while the port to CSS BOY is under evaluation; also high level applications are developed in Java. This paper also emphasizes the EPICS development for new industrial VME boards ADAS ICV10^{8}/178 with a sampling rate ranging from 10^{0} K Samples/s to 1.2 M Samples/s. This new software is used for the beam intensity measurement by diagnostics and the acquisition of sources.

MOPMU026 **A Readout and Control System for a CTA Prototype Telescope** – *I. Oya (Humboldt University Berlin, Institut für Physik), U. Schwanke (Humboldt University Berlin, Institut für Physik) B. Behera, D. Melkumyan, T. Schmidt, P. Wegner, S. Wiesand, M. Winde (DESY Zeuthen)*

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 range from a few tens of GeV to more than hundred TeV, extending the existing energy coverage and increasing by a factor 10 the sensitivity compared to current installations, while enhancing other aspects like angular and energy resolution. These goals require the use of at least three different sizes of telescopes. 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. A prototype for the Medium Size Telescope (MST) type is under development and will be deployed in Berlin by the end of 2011. The MST prototype will consist of the mechanical structure, drive system, active mirror control, four CCD cameras for prototype instrumentation and a weather station. The ALMA Common Software (ACS) distributed control framework has been chosen for the implementation of the control system of the prototype. In the present approach, the interface to some of the hardware devices is achieved by using the OPC Unified Architecture (OPC UA). A code-generation framework (ACSCG) has been designed for ACS modeling. In this contribution the progress in the design and implementation of the control system for the CTA MST prototype is described.

MOPMU027 **Controls System Developments for the ERL Facility** – *J.P. Jamilkowski (BNL), Z. Altinbas, D.M. Gassner, L.T. Hoff, P. Kankiya, D. Kayran, S.A. Kennell, T.A. Miller, R.H. Olsen, C. Schultheiss, B. Sheehy, W. Xu (BNL)*
The BNL Energy Recovery LINAC (ERL) is a high beam current, superconducting RF electron accelerator that is being commissioned to serve as a research and development prototype for a RHIC facility upgrade for electron-ion collision (eRHIC). Key components of the machine include a laser, photocathode, and 5-cell superconducting RF cavity operating at a frequency of 703 MHz. Starting with a foundation based on existing ADO software running on Linux servers and on the VME/VxWorks platforms developed for RHIC, we are developing a controls system that incorporates a wide range of hardware I/O interfaces that are needed for machine R&D. Details of the system layout, specifications, and user interfaces are provided.

MOPMU028 **VEPP-2000 Collider Control System** – *D.E. Berkaev (BINP SB RAS), A.S. Kasaev, I. Koop, V.R. Kozak, A.N. Kyrpotin, A.P. Lysenko, Yu. A. Rogovsky, A.I. Senchenko, P.Yu. Shatunov, Y.M. Shatunov, A.S. Stankevich (BINP SB RAS)*
Electron-positron collider VEPP-2000 has been commissioned at Budker Institute of Nuclear Physics. The first experiments on high energy physics were started at the end of 2009. The paper presents architecture, implementation and functionality of hardware and software of the collider control system. The hardware of the system consists of high current main field power supplies, steering coils power supplies, pulse-elements, RF subsystems and some other special subsystems (such as vacuum, temperature, etc. control subsystems). The system is based on modern industrial protocol CAN-bus and specialized electronic BINP blocks manufactured according to standards. The paper describes implementation of different subsystems based on CANbus devices, and operating characteristics and their possibilities. Other standards and protocols like CAMAC, VME and so on are also used in the system. The software according to hardware system consists of interacting subsystems responding to different acceleration facility parts. Control system software is based on several TCP/IP connected PC platforms under operating system Linux and uses client-server techniques. The paper describes implementation, operating possibilities and perspectives of VEPP-2000 software.

MOPMU029 **MAX IV Laboratory Status Report** – *K. Larsson (MAX-lab), D.P. Spruce (MAX-lab)*

The MAX IV facility is succeeding the present MAX-lab synchrotron light source located in Lund, Sweden. It will consist of two state of the art storage rings; one longer (528 in circumference) operating at an energy of 3 GeV and one shorter (96m in circumference) 1.5 GeV ring optimised for lower photon energies. Both rings will be run in top-up mode using a 300m long full energy linear accelerator (Linac) located under ground. The 3 GeV ring will have an ultra low emittance of 0.24 nmrad and outstanding brilliance in an energy range of 200eV to 30keV. Besides the rings, there will be a Short Pulse Facility (SPF) at the end of the Linac where the electron bunches will be used to produce short (femtoseconds) spontaneous X-ray pulses. This paper will describe the overall control system architecture using TANGO in the integrative layer. It will also cover the challenges that lie ahead, in particular when it comes to using the Linac in continuous mode for the two storage rings and SPF.

MOPMU030 **Control System for Linear Induction Accelerator LIA-2 in Novosibirsk: the Structure and Hardware** – *G.A. Fatkin (BINP SB RAS), P.A. Bak, A.M. Batrakov, P.V. Logachev, A. Panov, A.V. Pavlenko, V.Ya. Sazansky (BINP SB RAS)*

Power Linear Induction Accelerator (LIA) for flash radiography is commissioned in Budker Institute of Nuclear Physics (BINP) in Novosibirsk. It is a facility producing pulsed electron beam with energy 2 MeV, current 1 kA and spot size less than 2 mm. Beam quality and reliability of facility are required for radiography experiments. Features and structure of distributed control system ensuring these demands are discussed. Control system hardware based on CompactPCI and PMC standards is embedded directly into power pulsed generators. CAN-BUS and Ethernet are used as interconnection protocols. Parameters and essential details for measuring equipment and control electronics produced in BINP and available COTS are presented. The first results of the control system commissioning, reliability and hardware vitality are discussed.

Upgrade of control systems

MOPMU031 **LIL and PETAL: New Tango Based Control System for Laser Diagnostics and Laser Beam Alignment.** – *C. Nogues (CEA), Ph. Hostandie (CEA) J. Cazala (Sopra Group)*

The Laser Integration Line (LIL) is the Laser MegaJoule (LMJ) prototype built to validate the major technological choices for the LMJ; it has been in operation since 2002. The PETAL laser facility is a high energy multi-petawatt laser being installed in the LMJ building. The new LIL laser diagnostics control system is intended to replace the old one to permit adding of new diagnostics and easier software maintenance. This system as well as the future PETAL laser diagnostics and laser beam alignment controls systems have been developed using TANGO architecture. Because of similarity, the three developments were led in parallel. The main challenge has been to integrate the low level laser diagnostic and laser beam alignment control system with the higher supervisory control system of LIL and LMJ (for PETAL).

MOPMU032 **An EPICS IOC Builder** – *M.G. Abbott (Diamond), T.M. Cobb (Diamond)*

An EPICS IO controller is typically assembled from a number of standard components each with potentially quite complex hardware or software initialisation procedures intermixed with a good deal of repetitive boilerplate code. Assembling and maintaining a complex IOC can be a quite difficult and error prone process, particularly if the components are unfamiliar. The EPICS IOC builder is a Python library designed to automate the assembly of a complete IOC from a concise component level description. The dependencies and interactions between components as well as their detailed initialisation procedures are automatically managed by the IOC builder through component description files maintained with the individual components. At Diamond Light Source we have a large library of components that can be assembled into EPICS IOCs. The IOC Builder is further finding increasing use in helping non-expert users to assemble an IOC without specialist knowledge.

MOPMU033 **ControlView to EPICS Conversion of the TRIUMF TR13 Cyclotron Control System** – *D.B. Morris (TRIUMF, Canada's National Laboratory for Particle and Nuclear Physics)*

The TRIUMF TR13 Cyclotron Control System was developed in 1995 using Allen Bradley PLCs and ControlView. A console replacement project using the EPICS toolkit was started in Fall 2009 with the strict requirement that the PLC code not be modified. Access to the operating machine would be limited due to production schedules. A complete mock-up of the PLC control system was built, to allow parallel development and testing without interfering with the production system. The deployment allows both systems to operate simultaneously easing verification of all functions. A major modification was required to the EPICS Allen Bradley PLC5 Device Support software to support the original PLC programming schema. EDM screens were manually built to create similar displays to the original ControlView screens, reducing operator re-training. A discussion is presented on some of the problems encountered and their solutions.

MOPMU035 **Shape Controller Upgrades for the JET ITER-like Wall** – *A. Neto (IPFN), D. Alves, I.S. Carvalho (IPFN) G. De Tommasi, F. Maviglia (CREATE) R.C. Felton, P. McCullen (EFDA-JET) P.J. Lomas, F. G. Rimini, A.V. Stephen, K-D. Zastrow (CCFE) R. Vitelli (Università di Roma II Tor Vergata)*

The upgrade of JET to a new all-metal wall will pose a set of new challenges regarding machine operation and protection. One of the key problems is that the present way of terminating a pulse, upon the detection of a problem, is limited to a predefined set of global responses, tailored to maximise the likelihood of a safe plasma landing. With the new wall, these might conflict with the requirement of avoiding localised heat fluxes in the wall components. As a consequence, the new system will be capable of dynamically adapting its response behaviour, according to the experimental conditions at the time of the stop request and during the termination itself. Also in the context of the new ITER-like wall, two further upgrades were designed to be implemented in the shape controller architecture. The first will allow safer operation of the machine and consists of a power-supply current limit avoidance scheme, which provides a trade-off between the desired plasma shape and the current distribution between the relevant actuators. The second is aimed at an optimised operation of the machine, enabling an earlier formation of a special magnetic configuration where the last plasma closed flux surface is not defined by a physical limiter. The upgraded shape controller system, besides providing the new functionality, is expected to continue to provide the first line of defence against erroneous plasma position and current requests. This paper presents the required architectural changes to the JET plasma shape controller system.

MOPMU036 **Upgrade of the CLS Accelerator Control and Instrumentation Systems** – *E. Matias (CLS), L. Baribeau, S. Hu, C.G. Payne, H. Zhang (CLS)*

The Canadian Light Source is undertaking a major upgrade to it's accelerator system in preparation for the eventual migration to top-up and to meet the increasing demanding needs of it's synchrotron user community. These upgrades on the Linac include the development of software for new modulators, RF sections, power supplies and current monitors. On the booster ring the upgrades include the development of new improved BPM instrumentation and improved diagnostics on the extracted beam. For the storage ring these upgrades include fast orbit correct, instrumentation for use by the safety systems and a new transverse feedback system.

MOPMU037 **Upgrade of STAR Accelerator Control System from Windows NT to Windows XP and Development of 110 Magnet Field Control at ANSTO** – *J.G. Wang (ANSTO), D. Lynch (ANSTO)*

STAR is a 2 MV tandem particle accelerator, which is used for AMS and Ion Beam Analysis (IBA). This accelerator was originally produced by High Voltage Engineering Europe (HVEE). The accelerator is fully controlled using C14-OS software package under Windows NT, which was provided by HVEE. The 846 source control system was also provided by HVEE and running in Windows NT environment. The 110 magnet field control is performed by current control depending upon temperature and materials. Control system hardware is set up using Single Board Computer (SBC) interfacing several ISA expansion cards through a passive backplane. C14-OS performs all accelerator control functions as well as AMS data acquisition. Due to ANSTO network security policy, old Windows NT systems are not allowed to use ANSTO network. This carries much trouble for scientists using the control system. Also, Windows NT can be run only on old hardware system. This old system provides poor performance. It is necessary to upgrade accelerator main control system and ion source sample change control system to Windows XP or later operator system. We will report our experience in upgrading C14-OS and 846 ion source control system from Windows NT to Windows XP. An introduction will also be presented for development of Star 110 magnet field control system using our own power supply, Group 3 Loop Control board, CNA, as well as our own software package.

MOPMU039 **ACSys in a Box** – *C.I. Briegel (Fermilab)*

The Accelerator Control System at Fermilab has evolved to enable a relatively large control system to be encapsulated into a"bo" such as a laptop. The goal was to provide an isolated platform from the"onlin" control system. The platform can be used internally for making major upgrades and modifications without impacting operations. It also provides a standalone environment for research and development including a turn-key control system for collaborators. Overtime, the code base running on Scientific Linux has enabled all the salient features of the Fermilab's control system to be captured in an off-the-shelf laptop. The anticipated additional benefits of packaging the system include maintenance, reliability, documentation, and future enhancements.

MOPMU040 **REVOLUTION at SOLEIL: Review and Prospect for Motion Control** – *D. Corruble (SOLEIL), P. Betinelli, F. Blache, J. Coquet, N. Leclercq, R. Millet, A. Tournieux (SOLEIL)*

At any synchrotron facility, motors are numerous: it is a significant actuator of accelerators and the main actuator of beamlines. Since 2003, the Electronic Control and Data Acquisition group of SOLEIL has defined a modular and reliable motion architecture integrating industrial products (Galil controller, Midi Ingénierie and Phytron power boards). Simultaneously, the software control group has developed a set of dedicated Tango devices. At present, more than 1000 motors and 200 motion controller crates are in operation at SOLEIL. Aware that the motion control is important in improving performance as the positioning of optical systems and samples is a key element of any beamline, SOLEIL wants to upgrade its motion controller in order to maintain the facility at a high performance level and to be able to answer to new requirements: better accuracy, complex trajectory and coupling multi-axis devices like a hexapod. This project is called REVOLUTION (REconsider Various contrOLler for yoUr moTION).

11-Oct-11 08:30 – 10:15	Plenary Oral	Auditorium

TUAAU — Software Technology

Chair: V. Baggiolini (CERN)

TUAAUST01 08:30 **GDA and EPICS Working in Unison for Science Driven Data Acquisition and Control at Diamond Light Source** – *P. Gibbons (Diamond), M.T. Heron, N.P. Rees (Diamond)*

Diamond Light Source has recently received funding for an additional 10 photon beamlines, bringing the total to 32 beamlines and around 40 end-stations. These all use EPICS for the control of the underlying instrumentation associated with photon delivery, the experiment and most of the data acquisition hardware. For the scientific users Diamond has developed the Generic Data Acquisition (GDA) application framework to provide a consistent science interface across all beamlines. While each application is customised to the science of its beamline, all applications are built from the framework and predominantly interface to the underlying instrumentation through the EPICS abstraction. We will describe the complete system, illustrate how it can be configured for a specific beamline application, and how other synchrotrons are, and can, adapt these tools for their needs.

TUAAULT02 08:45 **Tango Collaboration and Kernel Status** – *E.T. Taurel (ESRF)*

This paper is divided in two parts. The first part summarises the main changes done within the Tango collaboration since the last Icalepcs conference. This will cover technical evolutions but also the new way our collaboration is managed. The second part will focus on the evolution of the so-called Tango event system (asynchronous communication between client and server). Since its beginning, within Tango, this type of communication is implemented using a CORBA notification service implementation called omniNotify. This system is currently re-written using zeromq as transport layer. Reasons of the zeromq choice will be detailed. A first feedback of the new implementation will be given.

TUAAULT03 09:05 **BLED: A Top-down Approach to Accelerator Control System Design** – *J. Bobnar (Cosylab) K. Zagar (COBIK)*

In many existing controls projects the central database/inventory was introduced late in the project, usually to support installation or maintenance activities. Thus construction of this database was done in a bottom-up fashion by reverse engineering the installation. However, there are several benefits if the central database is introduced early in machine design, such as the ability to simulate the system as a whole without having all the IOCs in place, it can be used as an input to the installation/commissioning plan, or act as an enforcer of certain conventions and quality processes. Based on our experience with the control systems, we have designed a central database BLED (Best and Leanest Ever Database), which is used for storage of all machine configuration and parameters as well as control system configuration, inventory, and cabling. First implementation of BLED supports EPICS, meaning it is capable of storage and generation of EPICS templates and substitution files as well as archive, alarm and other configurations. With a goal in mind to provide functionality of several existing central databases (IRMIS, SNS db, DBSF etc.) a lot of effort has been made to design the database in a way to handle extremely large set-ups, consisting of millions of control system points. Furthermore, BLED also stores the lattice data, thus providing additional information (e.g. survey data) required by different engineering groups. The lattice import/export tools among others support MAD and TraceWin Tools formats which are widely used in the machine design community.

TUAAULT04
09:25

Web-based Execution of Graphical Workflows : a Modular Platform for Multi-functional Scientific Process Automation – *E. De Ley (iSencia Belgium), D. Jacobs (iSencia Belgium) M. Ounsy (SOLEIL)*
The Passerelle process automation suite offers a fundamentally modular solution platform, based on a layered integration of several best-of-breed technologies. It has been successfully applied by Synchrotron Soleil as the sequencer for data acquisition and control processes on its beamlines, integrated with TANGO as a control bus and GlobalScreen as the Scada package. Since last year it is being used as the graphical workflow component for the development of an eclipse-based Data Analysis Work Bench, at ESRF. The top layer of Passerelle exposes an actor-based development paradigm, based on the Ptolemy framework (UC Berkeley). Actors provide explicit reusability and strong decoupling, combined with an inherently concurrent execution model. Actor libraries exist for TANGO integration, web-services, database operations, flow control, rules-based analysis, mathematical calculations, launching external scripts etc. Passerelle's internal architecture is based on OSGi, the major Java framework for modular service-based applications. A large set of modules exist that can be recombined as desired to obtain different features and deployment models. Besides desktop versions of the Passerelle workflow workbench, there is also the Passerelle Manager. It is a secured web application including a graphical editor, for centralized design, execution, management and monitoring of process flows, integrating standard Java Enterprise services with OSGi. We will present the internal technical architecture, some interesting application cases and the lessons learnt.

TUAAUKP05
09:45

Trends in Programming Languages – *M. Voelter (itemis)*
Over the last couple of years, two major trends have occurred in programming languages. One is the demise of Java as the jack of all trades in programming languages. New languages are developed, driven by the need for better support for concurrency and multicore, functional programming and meta programming. Second, the feasibility for niche communities to build their own languages has increased by the advent of language workbenches, tools that support the rapid development of DSLs, languages customized for a given task or problem domain. In this talk, I provide a quick overview of these trends, as well as the relevant languages and tools.

11-Oct-11	10:45 – 12:30	Plenary Oral	Auditorium

TUBAU — Hardware

Chair: J. Serrano (CERN)

TUBAUST01 10:45

FPGA-based Hardware Instrumentation Development on MAST – *B.K. Huang (Durham University), R.M. Myers, R.M. Sharples (Durham University) G. Cunningham, G.A. Naylor (CCFE) R.G.L. Vann (York University)*

On MAST (the Mega Amp Spherical Tokamak) at Culham Centre for Fusion Energy some key control systems and diagnostics are being developed and upgraded with FPGA hardware. FPGAs provide many benefits including low latency and real-time digital signal processing. FPGAs blur the line between hardware and software. They are programmed (in VHDL/Verilog language) using software, but once configured act deterministically as hardware. The challenges in developing a system are keeping up-front and maintenance costs low, and prolonging the life of the device as much as possible. We accomplish lower costs by using industry standards such as the FMC (FPGA Mezzanine Card) Vita 57 standard and by using COTS (Commercial Off The Shelf) components which are significantly less costly than developing them in-house. We extend the device operational lifetime by using a flexible FPGA architecture and industry standard interfaces. We discuss the implementation of FPGA control on two specific systems on MAST. The Vertical Stabilisation system comprises of a 1U form factor box with 1 SP601 Spartan6 FPGA board, 10/100 Ethernet access, Microblaze processor, 24-bit sigma delta ADS1672 ADC and ATX power supply for remote power cycling. The Electron Bernstein Wave system comprises of a 4U form factor box with 2 ML605 Virtex6 FPGA boards, Gigabit Ethernet, Microblaze processor and 2 FMC108 ADC providing 16 Channels with 14-bit at 250MHz. AXI4 is used as the on chip bus between firmware components to allow very high data rates which has been tested at over 40Gbps streaming into a 2GB DDR3 SODIMM.

TUBAUST02 11:00

A Signal Processing Board with Isolated Analogue Inputs, Web Interface and Real-Time Output – *M.A.C. Jennison (CCFE), C.W. Appelbee, S.E. Dorling, R.M.A. Lucock (CCFE)*

The major JET enhancement project that replaces the first wall with an ITER-like material resulted in the need for many new data acquisition channels and real-time systems. We have recently added a real-time output to a 3U Eurocard digitiser that we developed. It has eight electrically isolated analogue voltage or current input channels each with software settable gain and offset. At the centre of the design is an FPGA which contains programmable digital filters and hosts a 32-bit soft-core processor. The FPGA drives the ADCs and contains a chain of decimating filters so that the sampling rate can be varied from 200kS/s down to 2S/s. An internal sequencer can be programmed to switch the sampling rate at defined times and all timing is locked to the JET trigger and reference clock. Communication with the module is via Ethernet and an HTTP server which runs on the soft-core processor in the FPGA. This provides a machine interface and a direct operator interface via HTML pages. The real-time output is a small UDP datagram containing a header, some status flags and the measured volts or amps as floating point numbers. The datagrams are sent at a rate of up to 1000S/s and the header ensures that the receiver can easily deal with datagrams from multiple boards. No HTTP communications are required during a pulse so the UDP datagrams are the only traffic and real-time latency and jitter are kept low. There are currently more than 1000 of these analogue channels being used on JET with over 200 being used in real-time systems.

TUBAULT03 11:15

The Upgrade Path from Legacy VME to VXS Dual Star Connectivity for Large Scale Data Acquisition and Trigger Systems – *C. Cuevas (JLAB), D. Abbott, F.J. Barbosa, H. Dong, W. Gu, E. Jastrzembski, S.R. Kaneta, B. Moffitt, N. Nganga, B.J. Raydo, A. Somov, W.M. Taylor, J. Wilson (JLAB)*

New instrumentation modules have been designed by Jefferson Lab and to take advantage of the higher performance and elegant backplane connectivity of the VITA 41 VXS standard. These new modules are required to meet the 200KHz trigger rates envisioned for the 12GeV experimental program. Upgrading legacy VME designs to the high speed gigabit serial extensions that VXS offers, comes with significant challenges, including electronic engineering design, plus firmware and software development issues. This paper will detail our system design approach including the critical system requirement stages, and explain the pipeline design techniques and selection criteria for the FPGA that require embedded Gigabit serial transceivers. The entire trigger system is synchronous and operates at 250MHz clock with synchronization signals, and the global trigger signals distributed to each front end readout crate via the second switch slot in the 21 slot, dual star VXS backplane. The readout of the buffered detector signals relies on 2eSST over the standard VME64x path at >200MB/s. We have achieved 20Gb/s transfer rate of trigger information within one VXS crate and will present results using production modules in a two crate test configuration with both VXS crates fully populated. The VXS trigger modules that reside in the front end crates, will be ready for production orders by the end of the 2011 fiscal year. VXS Global trigger modules are in the design stage now, and will be complete to meet the installation schedule for the 12GeV Physics program.

TUBAULT04 11:35

Open Hardware for CERN's Accelerator Control Systems – *E. Van der Bij (CERN), P. Alvarez, A. Boccardi, M. Cattin, C. Gil Soriano, S. Iglesias Gonsalvez, G. Penacoba Fernandez, J. Serrano, N. Voumard, T. Wlostowski (CERN)*

The accelerator control systems at CERN will be renovated and many electronics modules will be redesigned as the modules they will replace cannot be bought anymore or use obsolete components. The modules used in the control systems are diverse: analog and digital I/O, level converters and repeaters, serial links and timing modules. Overall around 120 modules are supported that are used in systems such as beam instrumentation, cryogenics and power converters. Only a small percentage of the currently used modules are commercially available, while most of them had been specifically designed at CERN. The new developments are based on VITA and PCI-SIG standards such as FMC (FPGA Mezzanine Card), PCI Express and VME64x using transition modules. As system-on-chip interconnect, the public domain Wishbone specification is used. For the renovation, it is considered imperative to have for each board access to the full hardware design and its firmware so that problems could quickly be resolved by CERN engineers or its collaborators. To attract other partners, that are not necessarily part of the existing networks of particle physics, the new projects are developed in a fully 'Open' fashion. This allows for strong collaborations that will result in better and reusable designs. Within this Open Hardware project new ways of working with industry are being tested with the aim to prove that there is no contradiction between commercial off-the-shelf products and openness and that industry can be involved at all stages, from design to production and support.

TUBAUIO05 11:55 **Challenges for Emerging New Electronics Standards for Physics** – *R.S. Larsen (SLAC)*
A unique effort is underway between industry and the international physics community to extend the Telecom industry's Advanced Telecommunications Computing Architecture (ATCA and MicroTCA) to meet future needs of the physics machine and detector community. New standard extensions for physics have now been designed to deliver unprecedented performance and high subsystem availability for accelerator controls, instrumentation and data acquisition. Key technical features include a unique out-of-band imbedded standard Intelligent Platform Management Interface (IPMI) system to manage hot-swap module replacement and hardware-software failover. However the acceptance of any new standard depends critically on the creation of strong collaborations among users and between user and industry communities. For the relatively small high performance physics market to attract strong industry support requires collaborations to converge on core infrastructure components including hardware, timing, software and firmware architectures; as well as to strive for a much higher degree of interoperability of both lab and industry designed hardware-software products than past generations of standards. The xTCA platform presents a unique opportunity for future progress. This presentation will describe status of the hardware-software extension plans; technology advantages for machine controls and data acquisition systems; and examples of current collaborative efforts to help develop an industry base of generic ATCA and MicroTCA products in an open-source environment.

11-Oct-11 13:30 – 18:00	Tutorial	Makalu

TUTMU — Tutorials Session

Process tuning and feedback systems

TUTMUKP01 13:30 **Control Theory and Application to Accelerators and Fusion Reactors** – *S. Simrock (ITER Organization)*
Feedback control plays an important role in the design and operation of modern accelerators and fusion devices. Feedback is required to stabilize inherently unstable system dynamics and processes and to improve machine performance. To better understand the theory of feedback control and be able to design feedback controllers this tutorial will consists of 3 parts: 1.Introduction to control theory (60 min) 2.Examples for control applications in accelerators and fusion devices (30 min) 3.Demonstration of control system analysis and design tools in the MATLAB / Simulink environment. (30 min) Control theory deals with the behaviour of dynamical systems. The desired output of a system is called the reference. When one or more output variables of a system need to follow a certain reference over time, a controller manipulates the inputs to a system to obtain the desired effect on the output of the system.

Software technology evolution

TUTMUKP02 16:00 **Implementing DSLs with Xtext and MPS** – *M. Voelter (itemis)*
This tutorial is an introduction to development of domain-specific languages, based on the 'Trends in Programming Languages' talk on Tuesday morning. I show a couple of example DSLs used in various technical domains. Then I provide details on two language workbenches: Eclipse Xtext and JetBrains MPS. Both are Java-based Open Source products that support the rapid development of DSLs, but they use radically different approaches: Xtext is parser-based, MPS is a projectional editor. The goal of the tutorial is to illustrate the usefulness of

DSLs, showcase the productivity of language workbenches for developing languages, and give participants a head start in using Xtext and MPS. The tutorial is mostly example-based: I will demonstrate the implementation of a small DSL in each of the tools.

11-Oct-11 14:00 – 15:30	Plenary Oral	Auditorium

TUCAU — Control System Upgrade

Chair: R. Tanaka (JASRI/SPring-8)

TUCAUST01 14:00

Upgrading the Fermilab Fire and Security Reporting System – *R. Neswold (Fermilab), CA. King (Fermilab)*

Fermilab's homegrown fire and security system (known as FIRUS) is highly reliable and has been used nearly thirty years. The system has gone through some minor upgrades, however, none of those changes made significant, visible changes. In this paper, we present a major overhaul to the system that is halfway complete. We discuss the use of Apple's OS X for the new GUI, upgrading the servers to use the Erlang programming language and allowing limited access for iOS and Android-based mobile devices.

TUCAUST02 14:15

SARAF Control System Rebuild – *E. Reinfeld (Soreq NRC), I. Eliyahu, I.G. Gertz, I. Mardor (Soreq NRC)*

The Soreq Applied Research Accelerator Facility (SARAF) is a proton/deuteron RF superconducting linear accelerator, which was commissioned at Soreq NRC. SARAF will be a multi-user facility, whose main activities will be neutron physics and applications, radio-pharmaceuticals development and production, and basic nuclear physics research. The SARAF Accelerator Control System (ACS) was delivered while still in development phase. Various issues limit our capability to use it as a basis for future phases of the accelerator operation and need to be addressed. Recently two projects have been launched in order to streamline the system and prepare it for the future development of the accelerator. This article will describe the plans and goals of these projects, the preparations undertaken by the SARAF team, the design principles on which the control methodology will be based and the architecture which is planned to be implemented. The rebuilding process will take place in two consecutive projects. The first will revamp the network architecture and the second will involve the actual rebuilding of the control system applications, features and procedures.

TUCAUST03 14:30

The Upgrade Program for the ESRF Accelerator Control System – *J.M. Meyer (ESRF), J.M. Chaize (ESRF)*

To reach the goals specified in the ESRF upgrade program [*], for the new experiments to be built, the storage ring needs to be modified. The optics must to be changed to allow up to seven meter long straight sections and canted undulator set-ups. Better beam stabilization and feedback systems are necessary for the nano-focus experiments planned. Also we are undergoing a renovation and modernization phase to increase the lifetime of the accelerator and its control system. This paper resumes the major upgrade projects, like the new BPM system, the fast orbit feedback or the ultra small vertical emittance, and their implications on the control system. Ongoing modernization projects such as the solid state radio frequency amplifier or the HOM damped cavities are described. Software upgrades of several sub-systems like vacuum and insertion devices, which are planned for this year or for the long shutdown period beginning of 2012 are covered as well. The final goal is to move to a Tango only control system.

TUCAUST04 14:45

Changing Horses Mid-stream: Upgrading the LCLS Control System During Production Operations – *S. L. Hoobler (SLAC), R.P. Chestnut, S. Chevtsov, T.M. Himel, K.D. Kotturi, K. Luchini, J.J. Olsen, S. Peng, J. Rock, R.C. Sass, T. Straumann, R. Traller, G.R. White, S. Zelazny (SLAC)*

The control system for the Linac Coherent Light Source (LCLS) began as a combination of new and legacy systems. When the LCLS began operating, the bulk of the facility was newly constructed, including a new control system using the Experimental Physics and Industrial Control System (EPICS) framework. The Linear Accelerator (LINAC) portion of the LCLS was repurposed for use by the LCLS and was controlled by the legacy system, which was built nearly 30 years ago. This system uses CAMAC, distributed 80386 microprocessors, and a central Alpha 6600 computer running the VMS operating system. This legacy control system has been successfully upgraded to EPICS during LCLS production operations while maintaining the 95% uptime required by the LCLS users. The successful transition was made possible by thorough testing in sections of the LINAC which were not in use by the LCLS. Additionally, a system was implemented to switch control of a LINAC section between new and legacy control systems in a few minutes. Using this rapid switching, testing could be performed during maintenance periods and accelerator development days. If any problems were encountered after a section had been switched to the new control system, it could be quickly switched back.

TUCAUST05 15:00

New Development of EPICS-based Data Acquisition System for Millimeter-wave Interferometer in KSTAR Tokamak – *T.G. Lee (NFRI), Y.U. Nam, M.K. Park (NFRI)*

After achievement of first plasma in 2008, Korea Superconducting Tokamak Advanced Research (KSTAR) is going to be performed in the 4nd campaign in 2011. During the campaigns, many diagnostic devices have been installed for measuring the various plasma properties in the KSTAR tokamak. From the first campaign, a data acquisition system of Millimeter-wave interferometer (MMWI) has been operated to measure the plasma electron density. The DAQ system at the beginning was developed for three different diagnostics having similar channel characteristics with a VME-form factor housing three digitizers in Linux OS platform; MMWI, H-alpha and ECE radiometer. However, this configuration made some limitations in operation although it had an advantage in hardware utilization. It caused unnecessarily increasing data acquired from the other diagnostics when one of them operated at higher frequency. Moreover, faults in a digitizer led to failure in data acquisition of the other diagnostics. In order to overcome these weak points, a new MMWI DAQ system is under development with a PXI-form factor in Linux OS platform and main control application is going to be developed based on EPICS framework like other control systems installed in KSTAR. It also includes MDSplus interface for the pulse-based archiving of experimental data. Main advantages of the new MMWI DAQ system besides solving the described problems are capabilities of calculating plasma electron density during plasma shot and display it in run-time. By this the data can be provided to users immediately after archiving in MDSplus DB.

TUCAUST06 15:15

Event-Synchronized Data Acquisition System of 5 Giga-bps Data Rate for User Experiment at the XFEL Facility, SACLA – *M. Yamaga (JASRI/SPring-8), A. Amselem, T. Hirono, Y. Joti, A. Kiyomichi, T. Ohata, T. Sugimoto, R. Tanaka (JASRI/SPring-8) T. Hatsui (RIKEN/SPring-8)*

A data acquisition (DAQ), control, and storage system has been developed for user experiments at the XFEL facility, SACLA, in the SPring-8 site. The anticipated experiments demand shot-by-shot DAQ in synchronization with the beam operation cycle in order to correlate the beam characteristics, and recorded data such as X-ray diffraction pattern. The experiments produce waveform or image data, of which the data size ranges from 8 up to 48 M byte for each x-ray pulse at 60 Hz. To meet these requirements, we have constructed a DAQ system that is operated in synchronization with the 60Hz of beam operation cycle. The system is designed to handle up to 5 Gbps data rate after compression, and consists of the trigger distributor/counters, the data-filling computers, the parallel-writing high-speed data storage, and the relational database. The data rate is reduced by on-the-fly data compression through front-end embedded systems. The self-described data structure enables to handle any type of data. The pipeline data-buffer at each computer node ensures integrity of the data transfer with the non-real-time operating systems, and reduces the development cost. All the data are transmitted via TCP/IP protocol over GbE and 10GbE Ethernet. To monitor the experimental status, the system incorporates with on-line visualization of waveform/images as well as prompt data mining by 10 PFlops scale supercomputer to check the data health. Partial system for the light source commissioning was released in March 2011. Full system will be released to public users in March 2012.

11-Oct-11	16:00 – 17:30	Plenary Oral	Auditorium

TUDAU — Status Reports 2

Chair: J.F. Maclean (ANL)

TUDAUST01 16:00

Inauguration of the XFEL Facility, SACLA, in SPring-8 – *R. Tanaka (JASRI/SPring-8), Y. Furukawa, T. Hirono, M. Ishii, M. Kago, A. Kiyomichi, T. Masuda, T. Matsumoto, T. Matsushita, T. Ohata, C. Saji, T. Sugimoto, M. Yamaga, A. Yamashita (JASRI/SPring-8) T. Fukui, T. Hatsui, N. Hosoda, H. Maesaka, T. Ohshima, T. Otake, Y. Otake, H. Takebe (RIKEN/SPring-8)*

The construction of the X-ray free electron laser facility (SACLA) in SPring-8 started in 2006. After 5 years of construction, the facility completed to accelerate electron beams in February 2011. The main component of the accelerator consists of 64 C-band RF units to accelerate beams up to 8GeV. The beam shape is compressed to a length of 30fs, and the beams are introduced into the 18 insertion devices to generate 0.1nm X-ray laser. The first SASE X-ray was observed after the beam commissioning. The beam tuning will continue to achieve X-ray laser saturation for frontier scientific experiments. The control system adopts the 3-tier standard model by using MADOCA framework developed in SPring-8. The upper control layer consists of Linux PCs for operator consoles, Sybase RDBMS for data logging and FC-based NAS for NFS. The lower consists of 100 Solaris-operated VME systems with newly developed boards for RF waveform processing, and the PLC is used for slow control. The Device-net is adopted for the frontend devices to reduce signal cables. The VME systems have a beam-synchronized data-taking link to meet 60Hz beam operation for the beam tuning diagnostics. The accelerator control has gateways to the facility utility system not only to monitor devices but also to control the tuning points of the cooling water. The data acquisition system for the experiments is challenging. The data rate coming from 2D multiport CCD is 3.4Gbps that produces 30TB image data in a day. A sampled data will be transferred to the 10PFlops supercomputer via 10Gbps Ethernet for data evaluation.

TUDAUST02
16:15

Status Report of the FERMI@Elettra Control System – *M. Lonza (ELETTRA), A. Abrami, F. Asnicar, L. Battistello, A.I. Bogani, R. Borghes, V. Chenda, S. Cleva, A. Curri, M. De Marco, M.F. Dos Santos, G. Gaio, F. Giacuzzo, G. Kourousias, G. Passos, R. Passuello, L. Pivetta, M. Prica, M. Pugliese, C. Scafuri, G. Scalamera, G. Strangolino, D. Vittor, L. Zambon (ELETTRA)*

FERMI@Elettra is a new 4th-generation light source based on a seeded Free Electron Laser (FEL) presently under commissioning in Trieste, Italy. It is the first seeded FEL in the world designed to produce fundamental output wavelength down to 4 nm with High Gain Harmonic Generation (HGHG). Unlike storage ring based synchrotron light sources that are well known machines, the commissioning of a new-concept FEL is a complex and time consuming process consisting in thorough testing, understanding and optimization, in which a reliable and powerful control system is mandatory. In particular, integrated shot-by-shot beam manipulation capabilities and easy to use high level applications are crucial to allow an effective and smooth machine commissioning. The paper reports the status of the control system and the experience gained in two years of alternating construction and commissioning phases.

TUDAUST03
16:30

Control System in SwissFEL Injector Test Facility – *M. Dach (PSI), D. Anicic, D.A. Armstrong, K. Bitterli, H. Brands, P. Chevtsov, F. Haemmerli, M. Heiniger, C.E. Higgs, W. Hugentobler, G. Janser, B. Kalantari, R. Kapeller, T. Korhonen, M.P. Laznovsky, T. Pal, D. Vermeulen (PSI) G. Jud, R.A. Krempaska, W. Portmann, E. Zimoch (PSI-LRF)*

The Free Electron Laser (SwissFEL) Test Facility is an important milestone for realization of a new SwissFEL facility. The first beam in the Test Facility was produced on the 24th of August 2010 which inaugurated the operation of the Injector. Since then, beam quality in various aspects has been greatly improved. This paper presents the current status of the Test Facility and is focused on the control system related issues which led to the successful commissioning. In addition, the technical challenges and opportunities in view of the future SwissFEL facility are discussed.

TUDAUST04
16:45

Status of the Control System for the European XFEL – *K. Rehlich (DESY)*

DESY is currently building a new 3.4 km-long X-ray free electron laser facility. Commissioning is planned in 2014. The facility will deliver ultra short light pulses with a peak power up to 100 GW and a wavelength down to 0.1 nm. About 200 distributed electronic crates will be used to control the facility. A major fraction of the controls will be installed inside the accelerator tunnel. MicroTCA was chosen as an adequate standard with state-of-the-art connectivity and performance including remote management. The FEL will produce up to 27000 bunches per second. Data acquisition and controls have to provide bunch-synchronous operation within the whole distributed system. Feedbacks implemented in FPGAs and on service tier processes will implement the required stability and automation of the FEL. This paper describes the progress in the development of the new hardware as well as the software architecture. Parts of the control system are currently implemented in the much smaller FLASH FEL facility.

TUDAUST05 17:00 **The Laser MegaJoule Facility: Control System Status Report** – *J.I. Nicoloso (CEA/DAM/DIF) J.P. Arnoul (CEA)*

The French Commissariat à l'Energie 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. LMJ technological choices were validated with the LIL, a scale 1 prototype of one LMJ bundle. The construction of the LMJ building itself is now achieved and the assembly of laser components is on-going. A Petawatt laser line is also being installed in the building. The presentation gives an overview of the general control system architecture, and focuses on the hardware platform being installed on the LMJ, in the aim of hosting the different software applications for system supervisory and sub-system controls. This platform is based on the use of virtualization techniques that were used to develop a high availability optimized hardware platform, with a high operating flexibility, including power consumption and cooling considerations. This platform is spread over 2 sites, the LMJ itself of course, but also on the software integration platform built outside LMJ, and intended to provide system integration of various software control system components of the LMJ.

TUDAUST06 17:15 **Status of the National Ignition Campaign and National Ignition Facility Integrated Computer Control System** – *L.J. Lagin (LLNL), G.K. Brunton, R.W. Carey, R. Demaret, J.M. Fisher, B.T. Fishler, A.P. Ludwigsen, C.D. Marshall, R.K. Reed, R.T. Shelton, S.L. Townsend (LLNL)*

The National Ignition Facility (NIF) at the Lawrence Livermore National Laboratory is a stadium-sized facility that will contains a 192-beam, 1.8-Megajoule, 500-Terawatt, ultraviolet laser system together with a 10-meter diameter target chamber with room for multiple experimental diagnostics. NIF is the world's largest and most energetic laser experimental system, providing a scientific center to study inertial confinement fusion (ICF) and matter at extreme energy densities and pressures. NIF's laser beams are designed to compress fusion targets to conditions required for thermonuclear burn. NIF is operated by the Integrated Computer Control System (ICCS) in an object-oriented, CORBA-based system distributed among over 1800 front-end processors, embedded controllers and supervisory servers. In the fall of 2010, a set of experiments began with deuterium and tritium filled targets as part of the National Ignition Campaign (NIC). At present, all 192 laser beams routinely fire to target chamber center to conduct fusion and high energy density experiments. During the past year, the control system was expanded to include automation of cryogenic target system and over 20 diagnostic systems to support fusion experiments were deployed and utilized in experiments in the past year. This talk discusses the current status of the NIC and the plan for controls and information systems to support these experiments on the path to ignition.

11-Oct-11	17:30 – 18:00	Reports from workshops	Auditorium

TURAU — Reports from the Workshops
Chair: J.M. Chaize (ESRF)

12-Oct-11 08:30 – 10:25	Plenary Oral	Auditorium

WEAAU — Software Technology

Chair: J. Klora (CELLS-ALBA Synchrotron)

WEAAUST01 08:30 **Sardana: The Software for Building SCADAS in Scientific Environments** – *T.M. Coutinho (CELLS-ALBA Synchrotron), G. Cuni, D.F.C. Fernandez-Carreiras, J. Klora, C. Pascual-Izarra, Z. Reszela, R. Suñé (CELLS-ALBA Synchrotron) A. Homs, E.T. Taurel (ESRF)*

Sardana is a software for supervision, control and data acquisition in large and small scientific installations. It delivers important cost and time reductions associated with the design, development and support of the control and data acquisition systems. It enhances Tango with the capabilities for building graphical interfaces without writing code, a powerful python-based macro environment for building sequences and complex macros, and a comprehensive access to the hardware. It scales well to small laboratories as well as to large scientific institutions. It has been commissioned for the control system of Accelerators and Beamlines at the Alba Synchrotron.

WEAAULT02 08:45 **Model Oriented Application Generation for Industrial Control Systems** – *B. Copy (CERN), R. Barillere, R.N. Fernandes, B. Fernandez Adiego, I. Prieto Barreiro (CERN)*

The CERN Unified Industrial Control Systems framework (UNICOS) is a software generation methodology that standardizes the design of slow process control applications [1]. A Software Factory, named the UNICOS Application Builder (UAB) [2], was introduced to provide a stable metamodel, a set of platform-independent models and platform-specific configurations against which code and configuration generation plugins can be written. Such plugins currently target PLC programming environments (Schneider UNITY and SIEMENS Step7 PLCs) as well as SIEMENS WinCC Open Architecture SCADA (previously known as ETM PVSS) but are being expanded to cover more and more aspects of process control systems. We present what constitutes the UAB metamodel and the models in use, how these models can be used to capture knowledge about industrial control systems and how this knowledge can be leveraged to generate both code and configuration for a variety of target usages.

WEAAULT03 09:05 **A Platform Independent Framework for Statecharts Code Generation** – *L. Andolfato (ESO), G. Chiozzi (ESO) N. Migliorini (ENDIF) C. Morales (UTFSM)*

Control systems for telescopes and their instruments are reactive systems very well suited to be modeled using Statecharts formalism. The World Wide Web Consortium is working on a new standard called SCXML that specifies an XML notation to describe Statecharts and provides a well defined operational semantic for run-time interpretation of the SCXML models. This paper presents a generic application framework for reactive non real-time systems based on interpreted Statecharts. The framework consists of a model to text transformation tool and an SCXML interpreter. The tool generates from UML state machine models the SCXML representation of the state machines and the application skeletons for the supported software platforms. An abstraction layer propagates the events from the middleware to the SCXML interpreter facilitating the support of different software platforms. This project benefits from the positive experience gained in several years of development of coordination and monitoring applications for the telescope control software domain using Model Driven Development technologies.

WEAAUKP04 09:25

The Power of Hybridization – *B.E. Eckel (Self Employment)*

Botanical hybridization combines the best characteristics of plants. Differential equations are often solved by transforming into a space where the solutions become trivial. Programming languages always do some things well but not others: Python punts when it comes to user interfaces, Java's artificial complexity prevents rapid development and produces tangles, and it will be a while before we see benefits from C++ concurrency work. The"weigh" of languages increases the cost of experimentation, impeding your ability to fail fast and iterate. If you must use a single language to solve your problem, you are binding yourself to the worldview limitations and the mistakes made by the creator of that language. Consider increasing your wiggle room, complementing a language that is powerful in one area with a different language powerful in another. This is not easy. You'll probably prefer pounding out a solution in your one chosen language – only discovering the impenetrable roadblock after you've built a mass of code, long after passing from a brief experiment into"the critical path on which all depend". Language hybridization can speed the experiment forward to quickly discover your real problems, giving you more time to fix them. After making a case for hybridizing your thinking in general, I will present a number of simple examples showing the hooks that are already built into languages (such as Python's ctypes) and tools created to aid hybridization (like XML-RPC). Along the way, I'll point out pitfalls, the most devious of which is"assumptions about performanc".

12-Oct-11 10:45 – 12:15	Parallel Oral	Auditorium

WEBHAU — Infrastructure Management

Chair: S.G. Azevedo (LLNL)

WEBHAUST01 10:45

LHCb Online Infrastructure Monitoring Tools – *L.G. Cardoso (CERN), N. Neufeld, F. Varela (CERN) D. Galli (INFN-Bologna)*

The Online System of the LHCb experiment at CERN is composed of a very large number of PCs: around 1500 in a CPU farm for performing the High Level Trigger; around 200 for the control system, running the SCADA system - PVSS; and several others for performing data monitoring, reconstruction, storage, and infrastructure tasks, like databases, etc. Some PCs run Linux, some run Windows but all of them need to be remotely controlled and monitored to make sure they are correctly running and to be able, for example, to reboot them whenever necessary. A set of tools was developed in order to centrally monitor the status of all PCs and PVSS Projects needed to run the experiment: a Farm Monitoring and Control (FMC) tool, which provides the lower level access to the PCs, and a System Overview Tool (developed within the Joint Controls Project – JCOP), which provides a centralized interface to the FMC tool and adds PVSS project monitoring and control. The implementation of these tools has provided a reliable and efficient way to manage the system, both during normal operations but also during shutdowns, upgrades or maintenance operations. This paper will present the particular implementation of this tool in the LHCb experiment and the benefits of its usage in a large scale heterogeneous system.

WEBHAUST02 11:00 **Optimizing Infrastructure for Software Testing and Deployment in Self-contained Environments Using Virtualization** – *O. Khalid (CERN), B. Copy, D.F. Rodrigues, A A. Shaikh (CERN)*

Virtualization technology and cloud computing have a brought a paradigm shift in the way we utilize, deploy and manage computer resources. They allow fast deployment of multiple operating system as containers on physical machines which can be either discarded after use or snapshot for later re-deployment. At CERN, we have been using virtualization/cloud computing to quickly setup virtual machines for our developers with pre-configured software to enable them test/deploy a new version of a software patch for a given application. We also have been using the infrastructure to do security analysis of control systems as virtualization provides a degree of isolation where control systems such as SCADA systems could be evaluated for simulated network attacks. This paper reports both on the techniques that have been used for security analysis involving network configuration/isolation to prevent interference of other systems on the network. This paper also provides an overview of the technologies used to deploy such an infrastructure based on VMWare and OpenNebula cloud management platform.

WEBHAUST03 11:15 **Large-bandwidth Data Acquisition Network for XFEL Facility, SACLA** – *T. Sugimoto (JASRI/SPring-8), Y. Joti, T. Ohata, R. Tanaka, M. Yamaga (JASRI/SPring-8) T. Hatsui (RIKEN/SPring-8)*

We have developed a large-bandwidth data acquisition (DAQ) network for user experiments at the SPring-8 Angstrom Compact Free Electron Laser (SACLA) facility. The network connects detectors, on-line visualization terminals and a high-speed storage of the control and DAQ system to transfer beam diagnostic data of each X-ray pulse as well as the experimental data. The development of DAQ network system (DAQ-LAN) was one of the critical elements in the system development because the data with transfer rate reaching 5 Gbps should be stored and visualized with high availability. DAQ-LAN is also used for instrument control. In order to guarantee the operation of both the high-speed data transfer and instrument control, we have implemented physical and logical network system. The DAQ-LAN currently consists of six 10-GbE capable network switches exclusively used for the data transfer, and ten 1-GbE capable network switches for instrument control and on-line visualization. High-availability was achieved by link aggregation (LAG) with typical convergence time of 500 ms, which is faster than RSTP (2 sec.). To prevent network trouble caused by broadcast, DAQ-LAN is logically separated into twelve network segments. Logical network segmentation are based on DAQ applications such as data transfer, on-line visualization, and instrument control. The DAQ-LAN will connect the control and DAQ system to the on-site high performance computing system, and to the next-generation super computers in Japan including K-computer for instant data mining during the beamtime, and post analysis.

WEBHAUST04 11:30 **A Virtualized Computing Platform For Fusion Control Systems** – *T.M. Frazier (LLNL), P. Adams, J.M. Fisher, A.J. Talbot (LLNL)*

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, UV laser system together with a 10-meter diameter target chamber with room for multiple experimental diagnostics. NIF is the world's largest and most energetic laser experimental system, providing a scientific center to study inertial confinement fusion (ICF) and matter at extreme energy densities and pressures. NIF's laser beams are designed to compress fusion targets to conditions required for thermonuclear burn, liberating more energy than required to initiate the fusion reactions. 2,500 servers, 400 network devices and 700 terabytes of networked attached storage provide the foundation for NIF's Integrated Computer Control System (ICCS) and Experimental Data Archive. This talk discusses the rationale & benefits for server virtualization in the context of an operational experimental facility, the requirements discovery process used by the NIF teams to establish evaluation criteria for virtualization alternatives, the processes and procedures defined to enable virtualization of servers in a timeframe that did not delay the execution of experimental campaigns and the lessons the NIF teams learned along the way. The virtualization architecture ultimately selected for ICCS is based on the Open Source Xen computing platform and 802.1Q open networking standards. The specific server and network configurations needed to ensure performance and high availability of the control system infrastructure will be discussed.

WEBHAUST05 11:45 **Distributed System and Network Performance Monitoring** – *R. Petkus (BNL)*
A robust and reliable network and system infrastructure is vital for successful operations at the NSLS-II (National Synchrotron Light Source). A key component is a monitoring solution that can provide system information in real-time for fault-detection and problem isolation. Furthermore, this information must be archived for historical trending and post-mortem analysis. With 200+ network switches and dozens of servers comprising our control system, what tools should be selected to monitor system vitals, visualize network utilization, and parse copious Syslog files? How can we track latency on a large network and decompose traffic flows to better optimize configuration? This work will examine both open-source and proprietary tools utilized in the controls group for distributed monitoring such as Splunk, Nagios, SNMP, sFlow, Brocade Network Advisor, and the perfSONAR Performance Toolkit. We will also describe how these elements are integrated into a cohesive platform.

WEBHAUST06 12:00 **Virtualized High Performance Computing Infrastructure of Novosibirsk Scientific Center** – *A. Zaytsev (BINP SB RAS), S. Belov, V.I. Kaplin, A. Sukharev (BINP SB RAS) A.S. Adakin, D. Chubarov, V. Nikultsev (ICT SB RAS) V. Kalyuzhny (NSU) N. Kuchin, S. Lomakin (ICM&MG SB RAS)*
Novosibirsk Scientific Center (NSC), also known worldwide as Akademgorodok, is one of the largest Russian scientific centers hosting Novosibirsk State University (NSU) and more than 35 research organizations of the Siberian Branch of Russian Academy of Sciences including Budker Institute of Nuclear Physics (BINP), Institute of Computational Technologies, and Institute of Computational Mathematics and Mathematical Geophysics (ICM&MG). Since each institute has specific requirements on the architecture of computing farms involved in its research field, currently we've got several computing facilities hosted by NSC institutes, each optimized for the particular set of tasks, of which the largest are the NSU Supercomputer Center, Siberian Supercomputer Center (ICM&MG), and a Grid Computing Facility of BINP. A dedicated optical network with the initial bandwidth of 10 Gbps connecting these three facilities was built in order to make it possible to share the computing resources among the research communities, thus increasing the efficiency of operating the existing computing facilities and offering a common platform for building the computing infrastructure for future scientific projects. Unification of the computing infrastructure is achieved by extensive use of virtualization technology based on XEN and KVM platforms. Our contribution gives a thorough review of the present status and future development prospects for the NSC virtualized computing infrastructure focusing on its applications for handling everyday data processing tasks of HEP experiments being carried out at BINP.

12-Oct-11	12:15 – 12:45	Reports from workshops	Auditorium

WERAU — Reports from the Workshops
Chair: J.M. Chaize (ESRF)

12-Oct-11	10:45 – 12:15	Parallel Oral	Makalu

WEBHMU — Hardware 2
Chair: K. Rehlich (DESY)

WEBHMUST01 10:45

The MicroTCA Common Acquisition and Processing Back-end System for FERMI@Elettra Diagnostics' Instrumentation – *A.O. Borga (ELETTRA), R. De Monte, M. Ferianis, G. Gaio, L. Pavlovic, M. Predonzani, F. Rossi (ELETTRA)*
Several diagnostics instruments for the FERMI@Elettra FEL require accurate readout, processing, and control electronics; together with a complete integration within the TANGO control system. A custom developed back-end system, compliant to the PICMG MicroTCA standard, provides a robust platform for accommodating such electronics; including reliable slow control and monitoring infrastructural features. Two types of digitizer AMCs have been developed, manufactured, tested and successfully commissioned in the FERMI facility. The first being a fast (160Msps) and high-resolution (16 bits) Analog to Digital and Digital to Analog (A|D|A) Convert Board, hosting 2 A-D and 2 D-A converters controlled by a large FPGA (Xilinx Virtex-5 SX50T) responsible also for the fast communication interface handling. The latter being an Analog to Digital Only (A|D|O), derived from A|D|A, with an analog front-side stage made of 4 A-D converters. A simple MicroTCA Timing Central Hub (MiTiCH) completes the set of modules necessary for operating the system. Several TANGO servers and panels have been developed and put in operation with the support of the controls group. The overall system's architectures, with different practical application examples, together with the specific AMCs' functionalities, are presented. Impressions on our experience on the field using the novel MicroTCA standard are also discussed.

WEBHMUST02 11:00

Solid State Direct Drive RF Linac: Control System – *T. Kluge (Siemens AG), M. Back, U. Hagen, O. Heid, M. Hergt, T.J.S. Hughes, R. Irsigler, J. Sirtl (Siemens AG) R. Fleck (Siemens AG, Corporate Technology, CT T DE HW 4) H. Schroeder (ASTRUM IT GmbH)*
Recently a Solid State Direct Drive^{TM} concept for RF linacs has been introduced*. This new approach integrates the RF source, comprised of Silicon Carbide transistors**, directly onto the cavity. Such an approach introduces new challenges for the control of such machines namely the non-linear behavior of the solid state devices and the direct coupling of the devices onto the cavity. In this paper we discuss further results of the experimental program*** **** to integrate and control 500 devices onto a lambda/4 cavity. The response of the combined system RF source plus cavity has been characterized and although it is non-linear it behaves reproducibly. This allowed looking at a feed forward strategy for the control system in a second stage of experiments. For this purpose a digital control board comprising of an Virtex 6 FPGA, high speed DACs/ ADCs and trigger I/O is developed and integrated into the experiment and used to control the system. The design of the board is consequently digital aiming at base band processing of the signals. Power control within the cavity is achieved by a mirrored phase vector control of two groups of the SiC transistors. This allows a full power control without coupled phase shifts and increasing power dissipation in the transistors.

WEBHMULT03 11:15 **EtherBone - A Network Layer for the Wishbone SoC Bus** – *M. Kreider (GSI), W.W. Terpstra (GSI) J.H. Lewis, J. Serrano, T. Wlostowski (CERN)*

Today, there are several System on a Chip (SoC) bus systems. Typically, these busses are confined on-chip and rely on higher level components to communicate with the outside world. Taking these systems a step further, we see the possibility of extending the reach of the SoC bus to remote FPGAs or processors. This leads to the idea of the EtherBone (EB) core, which connects a Wishbone (WB) Ver. 4 Bus via a Gigabit Ethernet based network link to remote peripheral devices. EB acts as a transparent interconnect module towards attached WB Bus devices. Address information and data from one or more WB bus cycles is preceded with a descriptive header and encapsulated in a UDP/IP packet. Because of this standard compliance, EB is able to traverse Wide Area Networks and is therefore not bound to a geographic location. Due to the low level nature of the WB bus, EB provides a sound basis for remote hardware tools like a JTAG debugger, In-System-Programmer (ISP), boundary scan interface or logic analyser module. EB was developed in the scope of the WhiteRabbit Timing Project (WR) at CERN and GSI/FAIR, which employs GigaBit Ethernet technology to communicate with memory mapped slave devices. WR will make use of EB as means to issue commands to its timing nodes and control connected accelerator hardware.

WEBHMULT04 11:35 **Sub-nanosecond Timing System Design and Development for LHAASO Project** – *Q. Du (TUB), J.M. Li (TUB) S. Chen, G.H. Gong, Y. Liu (Tsinghua University) H. He (IHEP Beijing)*

The Large High Altitude Air Shower Observatory (LHAASO) project is designed to trace galactic cosmic ray sources by different types of ground air shower detector arrays covering 1 square kilometer at 4300 m a.s.l in Tibet. Reconstruction of cosmic ray arrival directions requires sub-nanosecond time synchronization between approximately 10,000 detector nodes via hundreds of distributed data acquisition frontends. Here we describe a novel design of the LHAASO timing system by means of packet-based frequency distribution and time synchronization over Ethernet. The White Rabbit Protocol (WR) is applied as the infrastructure of the timing system, which implements a distributed adaptive phase tracking technology based on Synchronous Ethernet (layer 1) to lock all local ADC frequency and clock phase, and a real time delay calibration method based on the Precision Time Protocol (IEEE 1588-2008, layer 2) to keep all local time tag synchronized within a nanosecond. We also demonstrate the development and test status on prototype WR switches and nodes.

WEBHMUIO05 11:55 **Large-scale Distribution of Femtosecond Timing for Accelerators** – *J.M. Byrd (LBNL), L.R. Doolittle (LBNL)*

Distribution of timing signals with femtosecond relative stability has become a critical technology for linac-based free electron lasers (FELs) and linear collider accelerator complexes. The uses for this timing distribution include synchronization of diverse array of remote clients such as mode-locked laser oscillators, beam and x-ray diagnostics systems, and RF systems. I will describe recent progress in the technology of femtosecond timing distribution and locking to remote clients. I will also present concepts of how such systems are extended to multiple channels with an emphasis on applications to FELs.

12-Oct-11 13:30 – 14:00	Mini oral	Auditorium

WEMAU — Mini Orals C
Chair: J.M. Meyer (ESRF)

Distributed computing

WEMAU001 **A Remote Tracing Facility for Distributed Systems** – *F. Ehm (CERN), A. Dworak (CERN)*

Today the CERN's accelerator control system is built upon a large number of services mainly based on C++ and JAVA which produce log events. In such a largely distributed environment these log messages are essential for problem recognition and tracing. Tracing is therefore a vital part of operations, as understanding an issue in a subsystem means analyzing log events in an efficient and fast manner. At present 3150 device servers are deployed on 1600 diskless frontends and they send their log messages via the network to an in-house developed central server which, in turn, saves them to files. However, this solution is not able to provide several highly desired features and has performance limitations which led to the development of a new solution. The new distributed tracing facility fulfills these requirements by taking advantage of the Simple Text Orientated Message Protocol [STOMP] and ActiveMQ as the transport layer. The system not only allows to store critical log events centrally in files or in a database but also it allows other clients (e.g. graphical interfaces) to read the same events at the same time by using the provided JAVA API. This facility also ensures that each client receives only the log events of the desired level. Thanks to the ActiveMQ broker technology the system can easily be extended to clients implemented in other languages and it is highly scalable in terms of performance. Long running tests have shown that the system can handle up to 10.000messages/second.

WEMAU002 **Coordinating Simultaneous Instruments at the Advanced Technology Solar Telescope** – *S.B. Wampler (Advanced Technology Solar Telescope, National Solar Observatory), B.D. Goodrich, E.M. Johansson (Advanced Technology Solar Telescope, National Solar Observatory)*

A key component of the Advanced Technology Solar Telescope control system design is the efficient support of multiple instruments sharing the light path provided by the telescope. The set of active instruments varies with each experiment and possibly with each observation within an experiment. The flow of control for a typical experiment is traced through the control system to preset the main aspects of the design that facilitate this behavior. Special attention is paid to the role of ATST's Common Services Framework in assisting the coordination of instruments with each other and with the telescope.

WEMAU003 **The LabVIEW-RADE Framework Distributed Architecture** – *O.O. Andreassen (CERN), D. Kudryavtsev, A. Raimondo, A. Rijllart (CERN) S. Shaipov, R. Sorokoletov (JINR)*

For accelerator GUI applications there is a need for a rapid development environment to create expert tools or to prototype operator applications. Typically a variety of tools are being used, such as Matlab^{TM} or Excel^{TM}, but their scope is limited, either because of their low flexibility or limited integration into the accelerator infrastructure. In addition, having several tools obliges users to deal with different programming techniques and data structures. We have addressed these limitations by using LabVIEW^{TM}, extending it with interfaces to C++ and Java. In this way it fulfills requirements of ease of use, flexibility and connectivity. We present the RADE framework and four applications based on it. Recent application requirements could only be met by implementing a distributed architecture with multiple servers running multiple services. This brought us the additional advantage to implement redundant services, to increase the availability and to make transparent updates. We will present two applications requiring high availability. We also report on issues encountered with such a distributed architecture and how we have addressed them. The latest extension of the framework is to industrial equipment, with program templates and drivers for PLCs (Siemens and Schneider) and PXI with LabVIEW-Real Time.

Integrating industrial/commercial devices

WEMAU004 **Integrating EtherCAT Based Remote IO into EPICS at Diamond** – *R. Mercado (Diamond), I.J. Gillingham, J. Rowland, K.G. Wilkinson (Diamond)*

Diamond Light Source is actively investigating the use of EtherCAT-based Remote I/O modules for the next phase of photon beamline construction. Ethernet-based I/O in general is attractive, because of reduced equipment footprint, flexible configuration and reduced cabling. EtherCAT offers, in addition, the possibility of using inexpensive Ethernet hardware, off-the-shelf components with a throughput comparable to current VME based solutions. This paper presents the work to integrate EtherCAT-based I/O to the EPICS control system, listing platform decisions, requirement considerations and software design, and discussing the use of real-time pre-emptive Linux extensions to support high-rate devices that require deterministic sampling.

WEMAU005 **ATLAS Transition Radiation Tracker (TRT) Detector Control System** – *J. Olszowska (IFJ-PAN), E. Banas, Z. Hajduk (IFJ-PAN) M. Hance, D. Olivito, P. Wagner (University of Pennsylvania) T. Kowalski, B. Mindur (AGH University of Science and Technology) A. Romaniouk (MEPhI) K. Zhukov (LPI)*

TRT is one of the ATLAS experiment Inner Detector components providing precise tracking and electrons identification. It consists of 370 000 proportional counters (straws) which have to be filled with stable active gas mixture and high voltage biased. High voltage setting at distinct topological regions are periodicaly modified by closed-loop regulation mechanism to ensure constant gaseous gain independent of drifts of atmospheric pressure, local detector temperatures and gas mixture composition. Low voltage system powers front-end electronics. Special algorithms provide fine tuning procedures for detector-wide discrimination threshold equalization to guarantee uniform noise figure for whole detector. Detector, cooling system and electronics temperatures are continuosly monitored by ~ 3000 temperature sensors. The standard industrial and custom developed server applications and protocols are used for devices integration into unique system. All parameters originating in TRT devices and external infrastructure systems (important for Detector operation or safety) are monitored and used by alert and interlock mechanisms. System runs on 11 computers as PVSS (industrial SCADA) projects and is fully integrated with ATLAS Detector Control System. TRT DCS operational experience gained during commissioning and first year of operation during ATLAS data taking is described.

WEMAU006 **WinCC OA as Operating System for the MedAustron Accelerator Control System** – *M. Marchhart (EBG MedAustron), A.B. Brett, R. Moser, H. Pavetits, M. Thonke, C. Torcato de Matos (EBG MedAustron) J. Dedic (Cosylab) J. Gutleber, M. Janulis (CERN)*

MedAustron is an ion beam cancer therapy and research centre under construction in Wiener Neustadt, Austria. The heart of this centre is a synchrotron particle accelerator, designed for protons, carbon-ions and other light ions. As core operating system for controlling the particle accelerator, MedAustron chose the commercial SCADA tool SIMATIC WinCC OA. The tool has been designed following an open, distributed system architecture to accommodate traditional supervisory control and data acquisition tasks. It offers the possibility to extend the system for tasks that go beyond those traditional tasks. The accelerator control system follows a four tier architecture. In the lower two tiers the control system interfaces with many heterogeneous devices. The tool acts as the main communication bus, keeping at all times a consistent state of the entire system. Persistency features and redundancy capabilities of the tool will be useful in the future to be able to come to a robust accelerator control system core. To uniform the interfaces of all devices we apply an object-oriented, XML-based device modelling system to define interfaces for all devices and to wrap them in a standardized state machine. Quickly identifying misbehaving components within the plant is the key for maintaining a high level of safety and for keeping maintenance costs under control. For that reason we developed a WinCC Qt component for interactive 3D process visualization. To interface from C# natively to the WinCC OA process data, we developed a C# API based on the supplier provided API manager library.

WEMAU007 **Turn-key Applications for Accelerators with LabVIEW-RADE** – *O.O. Andreassen (CERN), P. Bestmann, C. Charrondiere, T. Feniet, J. Kuczerowski, M. Nybo, A. Rijllart (CERN)*

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. We present three examples of applications of different nature to show that the framework provides solutions at all three tiers of the control system, data access, process and supervision. The first example is a remotely controlled alignment system for the LHC collimators. The collimator alignment will need to be checked periodically. Due to limited access for personnel, the instruments are mounted on a small train. The system is composed of a PXI crate housing the instrument interfaces and a PLC for the motor control. We report on the design, development and commissioning of the system. The second application is the renovation of the PS beam spectrum analyser where both hardware and software were renewed. The control application was ported from Windows to LabVIEW-Real Time. We describe the technique used for a full integration into the PS console. The third example is a control and monitoring application of the CLIC two beam test stand. The application accesses CERN front-end equipment through the CERN middleware, CMW, and provides many different ways to view the data. We conclude with an evaluation of the framework based on the three examples and indicate new areas of improvement and extension.

Software technology evolution

WEMAU009 **Plant Information Modeling in Prototype Control Systems** – *E. Reiswich (University of Hamburg)*

The world of control systems can be roughly divided into mature, well established systems and one-of-a-kind, prototype control systems. Developing prototype control systems is a challenging task as there are no comparable systems that can serve as blueprints. As software engineers we've been working in the realm of prototype control systems for over 5 years. During this time we noticed various recurrent problems we had to solve over and over again. Looking out for help in science and industry we've found a gap between research activities in the Control Layer and in the Human Machine Interface layer. While the Control Layer seems to attract the majority of research interest, the HMI layer seems to be rather a side show. The majority of problems we've identified developing prototype control systems at the HMI Layer can be put down to a missing plant information model. The world of plant information modeling is currently dominated by versatile object-oriented methods as well as emerging techniques like CAEX and OPC UA. Approaching these concepts from the software engineering side raises however many questions on how to adapt these concepts to existing control systems and software tools. In this talk we give a brief overview of common problems we've identified developing prototype control systems, present the state of the art in plant information modeling and propose a service oriented, minimally invasive solution which we've been able to evaluate for over one year with our industry partner. Finally we point at challenges we haven't found solutions for yet.

WEMAU010 **Web-based Control Application using the WebSocket** – *Y. Furukawa (JASRI/SPring-8)*

The Websocket* brings asynchronous full-duplex communication between a web-based (i.e. java-script based) application and a web-server. The WebSocket started as a part of HTML5 standardization but has now been separated from the HTML5 and developed independently. Using the WebSocket, it becomes easy to develop platform independent presentation layer applications of accelerator and beamline control software. In addition, no application program has to be installed on client computers except for the web-browser. The WebSocket based applications communicate with the WebSocket server using simple text based messages, so the WebSocket can be applicable message based control system like MADOCA, which was developed for the SPring-8 control system. A simple WebSocket server for the MADOCA control system and a simple motor control application was successfully made as a first trial of the WebSocket control application. Using google-chrome (version 10.x) on Debian/Linux and Windows 7, opera (version 11.0 beta) on Debian/Linux and safari (version 5.0.3) on MacOSX as clients, the motors can be controlled using the WebSocket based web-application. The more complex applications are now under development for synchrotron radiation experiments combined with other HTML5 features.

WEMAU011 **LIMA: A Generic Library for High Throughput Image Acquisition** – *A. Homs (ESRF), L. Claustre, A. Kirov, E. Papillon, S. Petitdemange (ESRF)*
A significant number of 2D detectors are used in large scale facilities' control systems for quantitative data analysis. In these devices, a common set of control parameters and features can be identified, but most of manufacturers provide specific software control interfaces. A generic image acquisition library, called LIMA, has been developed at the ESRF for a better compatibility and easier integration of 2D detectors to existing control systems. The LIMA design is driven by three main goals: i) independence of any control system to be shared by a wide scientific community; ii) a rich common set of functionalities (e.g., if a feature is not supported by hardware, then the alternative software implementation is provided); and iii) intensive use of events and multi-threaded algorithms for an optimal exploit of multi-core hardware resources, needed when controlling high throughput detectors. LIMA currently supports the ESRF Frelon and Maxipix detectors as well as the Dectris Pilatus. Within a collaborative framework, the integration of the Basler GigE cameras is a contribution from SOLEIL. Although it is still under development, LIMA features so far fast data saving on different file formats and basic data processing / reduction, like software pixel binning / sub-image, background subtraction, beam centroid and sub-image statistics calculation, among others.

WEMAU012 **COMETE: A Multi Data Source Oriented Graphical Framework** – *G. Viguier (SOLEIL), Y. Huriez, M. Ounsy, K.S. Saintin (SOLEIL) R. Girardot (EXTIA)*
Modern beamlines at SOLEIL need to browse a large amount of scientific data through multiple sources that can be scientific measurement data files, databases or Tango[*] control systems. We created the COMETE[**] framework because we thought it was necessary for the end users to use the same collection of widgets for all the different data sources to be accessed. On the other side, for GUI application developers, the complexity of data source handling had to be hidden. These 2 requirements being now fulfilled, our development team is able to build high quality, modular and reusable scientific oriented GUI software, with consistent look and feel for end users. COMETE offers some key features to our developers: Smart refreshing service , easy-to-use and succinct API, Data Reduction functionality. This paper will present the work organization, the modern software architecture and design of the whole system. Then, the migration from our old GUI framework to COMETE will be detailed. The paper will conclude with an application example and a summary of the incoming features available in the framework.

12-Oct-11 13:30 – 14:00	Mini oral	Makalu

WEMMU — Mini Orals D

Chair: R. Wilcke (ESRF)

Hardware

WEMMU001 **Floating-point-based Hardware Accelerator of a Beam Phase-Magnitude Detector and Filter for a Beam Phase Control System in a Heavy-Ion Synchrotron Application** – *F.A. Samman (Technische Universität Darmstadt) M. Glesner, C. Spies, S. Surapong (TUD)*

A hardware implementation of an adaptive phase and magnitude detector and filter of a beam-phase control system in a heavy ion synchrotron application is presented in this paper. The main components of the hardware are adaptive LMS filters and a phase and magnitude detector. The phase detectors are implemented by using a CORDIC algorithm based on 32-bit binary floating-point arithmetic data formats. Therefore, a decimal to floating-point adapter is required to interface the data from an ADC to the phase and magnitude detector. The floating-point-based hardware is designed to improve the precision of the past hardware implementation that is based on fixed-point arithmetics. The hardware of the detector and the adaptive LMS filter have been implemented on a reconfigurable FPGA device for hardware acceleration purpose. The ideal Matlab/Simulink model of the hardware and the VHDL model of the adaptive LMS filter and the phase and magnitude detector are compared. The comparison result shows that the output signal of the floating-point based adaptive FIR filter as well as the phase and magnitude detector is simillar to the expected output signal of the ideal Matlab/Simulink model.

WEMMU002 **FPGA Communications Based on Gigabit Ethernet** – *L.R. Doolittle (LBNL), C. Serrano (LBNL)*

The use of Field Programmable Gate Arrays (FPGAs) in accelerators is widespread due to their flexibility, performance, and affordability. Whether they are used for fast feedback systems, data acquisition, fast communications using custom protocols, or any other application, there is a need for the end-user and the global control software to access FPGA features using a commodity computer. The choice of communication standards that can be used to interface to a FPGA board is wide, however there is one that stands out for its maturity, basis in standards, performance, and hardware support: Gigabit Ethernet. In the context of accelerators it is desirable to have highly reliable, portable, and flexible solutions. We have therefore developed a chip- and board-independent FPGA design which implements the Gigabit Ethernet standard. Our design has been configured for use with multiple projects, supports full line-rate traffic, and communicates with any other device implementing the same well-established protocol, easily supported by any modern workstation or controls computer.

WEMMU004 **SPI Boards Package, a New Set of Electronic Boards at Synchrotron SOLEIL** – *Y.-M. Abiven (SOLEIL), P. Betinelli, J. Bisou, F. Blache, A. Chattou, J. Coquet, N. Leclercq, P. Monteiro, G. Renaud, J.P. Ricaud (SOLEIL)*

SOLEIL is a third generation Synchrotron radiation source located in France near Paris. At the moment, the Storage Ring delivers photon beam to 23 beamlines. Since machine and beamlines improve their performance, new requirements are identified. On the machine side, new implementation for feedforward of electromagnetic undulators is required to improve beam stability. On the beamlines side, a solution is required to synchronize data acquisition with motor position during continuous scan. In order to provide a simple and modular solution for these applications requiring synchronization, the electronic group developed a set of electronic boards called"SPI board packag". In this package, the boards can be connected together in daisy chain and communicate to the controller through a SPI* Bus. Communication with control system is done via Ethernet. At the moment the following boards are developed: a controller board based on a Cortex M3 MCU, 16bits ADC board, 16bits DAC board and a board allowing to process motor encoder signals based on a FPGA Spartan III. This platform allows us to embed process close to the hardware with open tools. Thanks to this solution we reach the best performances of synchronization.

Infrastructure management and diagnostics

WEMMU005 **Fabric Management with Diskless Servers and Quattor in LHCb** – *L. Brarda (CERN), E. Bonaccorsi, G. Moine, P. Schweitzer (CERN)*

Large scientific experiments nowadays very often are using large computer farms to process the events acquired from the detectors. In LHCb a small sysadmin team manages 1400 servers of the LHCb Event Filter Farm, but also a wide variety of control servers for the detector electronics and infrastructure computers : file servers, gateways, DNS, DHCP and others. This variety of servers could not be handled without a solid fabric management system. We choose the Quattor toolkit for this task. We will present our use of this toolkit, with an emphasis on how we handle our diskless nodes (Event filter farm nodes and computers embedded in the acquisition electronic cards). We will show our current tests to replace the standard (RedHat/Scientific Linux) way of handling diskless nodes to fusion filesystems and how it improves fabric management.

WEMMU006 **Management Tools for Distributed Control System in KSTAR** – *S. Lee (NFRI), J.S. Park, M.K. Park, S.W. Yun (NFRI)*

The integrated control system of the Korea Superconducting Tokamak Advanced Research (KSTAR) is a real-time distributed control system based on EPICS framework, and has the essential roles of remote operation and supervising of tokamak device, and conducting of plasma experiments without any interruption. Therefore the availability of the control system directly affects the entire device performance. For the non-interrupted operation of the control system, we developed a tool named as Control System Monitoring (CSM) to monitor the resources of EPICS IOC servers (utilization of memory, cpu, disk, network, user-defined process and system-defined process), the soundness of storage systems (storage utilization, storage status), the status of network switches using Simple Network Management Protocol (SNMP), the network connection status of every local control sever using Internet Control Management Protocol (ICMP), and the operation environment of the main control room and the computer room (temperature, humidity, electricity) in real time and to raise alarms to operators. When abnormal conditions or faults are detected by the CSM, it alerts the operators. Among the faults, if the critical fault relating to data storage should happen the process failover module of the CSM is executed in the redundant server and minimizes the data loss. In addition to CSM, the channel archiver scheduler stops and runs the data storing process according to the user-defined policy.

Protection and safety systems

WEMMU007 **Reliability in a White Rabbit Network** – *M.M. Lipinski (CERN), J. Serrano, T. Wlostowski (CERN) C. Prados (GSI)*

White Rabbit (WR) is a time-deterministic, low-latency Ethernet-based network which enables transparent, sub-ns accuracy timing distribution. It is being developed to replace the General Machine Timing (GMT) system currently used at CERN and will become the foundation for the control system of the Facility for Antiproton and Ion Research (FAIR) at GSI. High reliability is an important issue in WR's design, since unavailability of the accelerator's control system will directly translate into expensive downtime of the machine. A typical WR network is required to lose not more than a single message per year. Due to WR's complexity, the translation of this real-world-requirement into a reliability-requirement constitutes an interesting issue on its own: a WR network is considered functional only if it provides all its services to all its clients at any time. This paper defines reliability in WR and describes how it was addressed by dividing it into sub-domains: deterministic packet delivery, data redundancy, topology redundancy and clock resilience. The studies show that the Mean Time Between Failure (MTBF) of the WR Network is the main factor affecting its reliability. Therefore, probability calculations for different topologies were performed using the"Fault Tree analysi" and analytic estimations. Results of the study show that the requirements of WR are demanding. Design changes might be needed and further in-depth studies required, e.g. Monte Carlo simulations. Therefore, a direction for further investigations is proposed.

WEMMU009 **Status of the CERN's RBAC Infrastructure and Lessons Learnt from its Deployment in LHC** – *I. Yastrebov (CERN), P. Charrue, W. Sliwinski (CERN)*

The distributed control system for the LHC accelerator poses many challenges due to its inherent heterogeneity and highly dynamic nature. One of the important aspects is to protect the machine against unauthorised access and unsafe operation of the control system, from the low-level front-end machines up to the high-level control applications running in the control room. In order to prevent an unauthorized access to the control system and accelerator equipment and to address the possible security issues, the Role Based Access Control (RBAC) project was designed and developed at CERN, with a major contribution from Fermilab laboratory. Furthermore, RBAC became an integral part of the CERN Controls Middleware (CMW) infrastructure and it was deployed and commissioned in the LHC operation in the summer 2008, well before the first beam in LHC. This paper presents the current status of the RBAC infrastructure, together with an outcome and gathered experience after a massive deployment in the LHC operation. Moreover, we outline how the project evolved over the last two years and give an overview of the major extensions introduced to improve integration, stability and its functionality. The paper also describes the plans of future project evolution and possible extensions, based on gathered users requirements and operational experience.

WEMMU010 **Dependable Design Flow for Protection Systems using Programmable Logic Devices** – *M. Kwiatkowski (CERN), B. Todd (CERN)*
Programmable Logic Devices (PLD) such as Field Programmable Gate Arrays (FPGA) are becoming more prevalent in protection and safety-related electronic systems. When employing such programmable logic devices, extra care and attention needs to be taken. It is important to be confident that the final synthesis result, used to generate the bit-stream to program the device, meets the design requirements. This paper will describe how to maximize confidence using techniques such as Formal Methods, exhaustive Hardware Description Language (HDL) code simulation and hardware testing. An example will be given for one of the critical function of the Safe Machine Parameters (SMP) system, one of the key systems for the protection of the Large Hadrons Collider (LHC) at CERN. The design flow will be presented where the implementation phase is just one small element of the whole process. Techniques and tools presented can be applied for any PLD based system implementation and verification.

WEMMU011 **Radiation Safety Interlock System for SACLA (XFEL/SPring-8)** – *M. Kago (JASRI/SPring-8), T. Matsushita, N. Nariyama, R. Tanaka, A. Yamashita (JASRI/SPring-8) Y. Asano, T. Hara, T. Itoga, Y. Otake, H. Takebe (RIKEN/SPring-8) H. Tanaka (RIKEN SPring-8 Center)*
The radiation safety interlock system for SACLA (XFEL/SPring-8) protects personnel from radiation hazards. The system controls access to the accelerator tunnel, monitors the status of safety equipment such as emergency stop buttons, and gives permission for accelerator operation. The special feature of the system is a fast beam termination when the system detects an unsafe state. A total beam termination time is required less than 16.6 ms (linac operation repetition cycle: 60 Hz). Especially important is the fast beam termination when the electron beams deviates from the proper transport route. Therefore, we developed optical modules in order to transmit a signal at a high speed for a long distance (an overall length of around 700 m). An exclusive system was installed for fast judgment of a proper beam route. It is independent from the main interlock system which manages access control and so on. The system achieved a response time of less than 7ms, which is sufficient for our demand. The construction of the system was completed in February 2011 and the system commenced operation in March 2011. We will report on the design of the system and its detailed performance.

12-Oct-11	13:30 – 15:00	Poster	Kilimanjaro Nord

WEPKN — Poster
Chair: R. Wilcke (ESRF)

Distributed computing

WEPKN001 **MDSplus Data Access in EPICS** – *A. Barbalace (Consorzio RFX, Associazione Euratom-ENEA sulla Fusione), A. Luchetta, G. Manduchi, C. Taliercio (Consorzio RFX, Associazione Euratom-ENEA sulla Fusione)*
The MDSplus package is used in many different Nuclear Fusion Experiments to handle experimental and configuration data and to supervise data acquisition. During the years, experiments adopting MDSplus have developed their own library to bridge MDSplus data access to different protocols used locally. EPICS is being adopted also in Nuclear Fusion Experiments and it relies on its Channel Access protocol that enables experiment supervision and control functions.

Control and supervision tasks are carried out in EPICS within Input Output Controllers (IOC). An IOC can include various databases which implement control algorithms that are made up of control blocks called records. The typical usage scenario is where EPICS IOCs are used to supervise the experiment and to provide control functions and MDSplus is used for the management and storage of both configuration data and experimental results. Several components have been developed, namely: -a set of IOC records for handling MDSplus data and events within EPICS IOCs; -a new Channel Archiver tool, which provides storage of archive data in MDSplus pulse files. -a new EPICS Channel Access Server. The Channel Access Server, described in this paper, provides seamless integration of MDSplus to store EPICS configuration data. Configuration data are exported via Channel Access and therefore are natively available to IOC records. For the same reason, EPICS configuration tools (such as Control System Studio tools) can be used at the same time to interact with the plant and to store the current configuration in the MDSplus database.

WEPKN002 **Tango Control System Management Tools** – *P.V. Verdier (ESRF)*

Tango is an object oriented control system toolkit based on CORBA initially developed at the ESRF. It is now also developed and used by Soleil, Elettra, Alba, Desy, MAX Lab, FRM II and some other labs. Tango concept is a full distributed control system. That means that several processes (called servers) are running on many different hosts. Each server manages one or several Tango classes. Each class could have one or several instances. This poster will show existing tools to configure, survey and manage a very large number of Tango components.

WEPKN003 **Distributed Fast Acquisitions System for Multi Detector Experiments** – *F. Langlois (SOLEIL), A. Buteau, X. Elattaoui, S. Le, K. Medjoubi, S. Poirier (SOLEIL) A. Noureddine (MEDIANE SYSTEM) C. rodriguez (ALTEN)*

An increasing number of SOLEIL beamlines need to use in parallel several detection techniques, which could involve 2D area detectors, 1D fluorescence analyzers, etc. For such experiments, we have implemented Distributed Fast Acquisition Systems for Multi Detectors. Data from each Detector are collected by independent software applications (in our case Tango Devices), assuming all acquisitions are triggered by a unique Master clock. Then, each detector software device streams its own data on a common disk space, known as the spool. Each detector data are stored in independent NeXus files, with the help of a dedicated high performance NeXus streaming C++ library (called NeXus4Tango). A dedicated asynchronous process, known as the DataMerger, monitors the spool, and gathers all these individual temporary NeXus files into the final experiment NeXus file stored in SOLEIL common Storage System. Metadata information describing context and environment are also added in the final file, thanks to another process (the DataRecorder device). This software architecture proved to be very modular in terms of number and type of detectors while making life of users easier, all data being stored in a unique file at the end of the acquisition. The status of deployment and operation of this"Distributed Fast Acquisitions system for multi detector experiment" will be presented, with the examples of QuickExafs acquisitions on the SAMBA beamline and QuickSRCD acquisitions on DISCO. In particular, the complex case of the future NANOSCOPIUM beamline will be developed.

WEPKN004 **PVManager Cookbook** – *G. Carcassi (BNL), L.R. Dalesio (BNL)*
When writing a client application for a control system, common elements always have to be implemented such as rate decoupling, queuing, caching, aggregation, notification on the correct thread. PVManager allows you to assemble your pipeline starting from commonly used elements, instead of re-implementing every time. In this talk we will present the underlying architecture and a series of examples that cover typical use cases for accessing EPICS systems.

WEPKN005 **Experiences in Messaging Middleware for High-Level Control Applications** – *N. Wang (Tech-X), J.L. Matykiewicz, S.G. Shasharina (Tech-X) N. Malitsky (BNL)*
Existing high-level applications in accelerator control and modeling systems leverage many different languages, tools and frameworks that do not interoperate with one another. As a result, the community has moved toward the proven Service-Oriented Architecture approach to address the interoperability challenges among heterogeneous high-level application modules. This paper presents our experiences in developing a demonstrative high-level application environment using emerging messaging middleware standards. In particular, we utilized new features such as pvData, in the EPICS v4 and other emerging standards such as Data Distribution Service (DDS) and Extensible Type Interface by the Object Management Group. Our work on developing the demonstrative environment focuses on documenting the procedures to develop high-level accelerator control applications using the aforementioned technologies. Examples of such applications include presentation panel clients based on Control System Studio (CSS), Model-Independent plug-in for CSS, and data producing middle-layer applications such as model/data servers. Finally, we will show how these technologies enable developers to package various control subsystems and activities into"service" with well-defined"interface" and make leveraging heterogeneous high-level applications via flexible composition possible.

WEPKN006 **Running a Reliable Messaging Infrastructure for CERN's Control System** – *F. Ehm (CERN)*
The current middleware for CERN's accelerator controls system is based on two implementations: corba-based Controls MiddleWare (CMW) and Java Messaging Service [JMS]. The JMS service is realized using the open source messaging product ActiveMQ and had became an increasing vital part of beam operations as data need to be transported reliably for various areas such as the beam protection system, post mortem analysis, beam commissioning or the alarm system. The current JMS service is made of 17 brokers running either in clusters or as single nodes. The main service is deployed as a two node cluster providing failover and load balancing capabilities for high availability. Non-critical applications running on virtual machines or desktop machines read data via a third broker to decouple the load from the operational main cluster. This scenario was introduced last year and the statistics showed an uptime of 99.998% and an average data serving rate of 1.6GB /min represented by around 150 messages/ sec. Deploying, running, maintaining and protecting such messaging infrastructure is not trivial and includes setting up of careful monitoring and failure pre-recognition. Naturally, lessons have been learnt and their outcome is very important for the current and future operation of such service.

WEPKN007 **A LEGO Paradigm for Virtual Accelerator Concept** – *S.N. Andrianov (St. Petersburg State University), A.N. Ivanov, E.A. Podzyvalov (St. Petersburg State University)*

The paper considers basic features of a Virtual Accelerator concept based on LEGO paradigm. This concept involves three types of components: different mathematical models for accelerator design problems, integrated beam simulation packages (i.e. COSY, MAD, OptiM and others), and a special class of virtual feedback instruments similar to real control systems (EPICS). All of these components should interoperate for more complete analysis of control systems and increased fault tolerance. The Virtual Accelerator is an information and computing environment which provides a framework for analysis based on these components that can be combined in different ways. Corresponding distributed computing services establish interaction between mathematical models and low level control system. The general idea of the software implementation is based on the Service-Oriented Architecture (SOA) that allows using cloud computing technology and enables remote access to the information and computing resources. The Virtual Accelerator allows a designer to combine powerful instruments for modeling beam dynamics in a friendly to use way including both self-developed and well-known packages. In the scope of this concept the following is also proposed: the control system identification, analysis and result verification, visualization as well as virtual feedback for beam line operation. The architecture of the Virtual Accelerator system itself and results of beam dynamics studies are presented.

WEPKN008 **Message-Driven Data Access Layer for Client Applications** – *A.D. Petrov (Fermilab), CA. King, R. Neswold (Fermilab)*

For a number of years, Fermilab Accelerator Control System has been using Java Remote Method Invocation (Java RMI) protocol as a principal means of communication between client applications and the data acquisition middleware. Our experience suggests that this may not be the most effective or easy way of connecting remote user applications with the central system. Recurring struggle with client-side network firewalls, the need in an extensive state synchronization, and the lack of portability to other platforms are just some of the problems. As the majority of data in the control system are relatively small packets delivered at a rate of up to 15 Hz via 350,000+ channels, we decided to move from an RPC-style communication to a messaging protocol. Instead of direct connections between client applications and server-side data providers, the nodes in the new system are loosely coupled, talking to each other through several central message brokers. By increasing the number of players in the system we, in fact, improved its reliability and security. This also simplified the implementation of both the clients and the servers. The new system uses AMQP messaging protocol and RabbitMQ data brokers. It is planned to port the server-side data providers from Java to Erlang.

WEPKN009 **ChannelFinder - A Directory Service for Control Systems** – *R. Lange (HZB) G. Carcassi, K. Shroff (BNL)*

The basic idea for a control system directory service was presented in a paper at the ICALEPCS2009 conference.* The implementation follows a design that uses a REST-style web service on top of a mySQL relational database for the service. Client libraries for Java and Python have been added, as well as an application within the Control System Studio framework. This paper describes the design and implementation of the ChannelFinder service, and discusses performance and first usage experiences.

Integrating industrial/commercial devices

WEPKN010 **European XFEL Phase Shifter: PC-based Control System** – *E. Molina Marinas (CIEMAT), J.M. Cela-Ruiz, A. Guirao, I. Moya, S. Sanz, C. Vazquez (CIEMAT)*
European XFEL at Desy has chosen Beckhoff as its control systems supplier. Beckhoff Twincat PLC is a PC-based control technology using EtherCAT, a real-time Ethernet fieldbus. The Accelerators Unit at Ciemat is in charge of the Spanish contribution to XFEL. One of the components of this contribution is the Phase Shifter (PS) for the SASE undulator system. This device is operated with a stepper motor and controlled by a Twincat-PLC program using the TcMC2 library, an implementation of the PLCopen Motion Control specification. The position is monitored with a digital encoder. Our team has developed a control system for the first and second prototype devices using off-the-shelf hardware and software while meeting stringent precision and repeatability requirements.

WEPKN011 **Development of XFEL Insertion Device Control System.** – *T. Otake (RIKEN/SPring-8), T. Fukui, T. Tanaka (RIKEN/SPring-8) T. Ohata (JASRI/SPring-8)*
We completed development of the insertion device control system for XFEL/SPring-8 (SACLA) in March 2011. SACLA consists of 18 undulator units. An overall positioning accuracy of these undulator gaps require within 1 micrometer. 6 linear encoders and 1 rotary encoder are installed to realize the requirement. Also we adopted a stepping motor driver with high-resolution absolute resolver, which has been developed for SACLA since 2009. These apparatus are connected with a programmable logic controller (PLC) via DeviceNet, which is one of the open networks used in the automation industry. PLC is a master node of DeviceNet and applies position compensation function with a newly developed feedback algorithm. The feedback parameter is calculated with magnetism, repulsion, mass of magnet array and others. One DeviceNet network controls two insertion devices and one VME is used to control together 9 PLCs connected via FL-net. FL-net is an Ethernet-based factory floor network. In this paper, development of the XFEL insertion device control system will be summarized.

WEPKN012 **LabVIEW Control System of the Cryogenic Complex for the Kaon RF-Separator at IHEP** – *A. Lutchev (IHEP Protvino), A.I. Ageev, V. Alferov, A. Bakay, V. Fedorchenko, A. Kholkin, V. Krendelev, D. Vasiliev (IHEP Protvino)*
The superconducting RF separator is used for the separation of kaons at the OKA experimental setup at IHEP. The separator consists of two deflecting niobium cavities housed in the cryostats. Their cooling is provided by one large commercial helium refrigerator and two custom heat exchangers, located near cavities. The cryogenic complex for the separator provides liquid superfluid helium with the temperature of 1.8K as well as liquid nitrogen. The paper describes the architecture and the LabVIEW based software of the control system.

WEPKN013 **The Design and Development of an H^- Ion Source Control System at CSNS** – *G. Li (IHEP Beijing)*
The China Spallation Neutron Source (CSNS) is an accelerator based multidisciplinary user facility in China. As the origin of the linac accelerator, the H^- ion source plays a significant role for the reliable and stable operation of the CSNS. The control system of H^- ion source test stand is designed and constructed, based on the sequence Yokogawa PLC (program logic controller) and EPICS at the lab. To produce a 20 mA pulsed beam current with 500 μs time width, the commissioning of the source is in progress. To improve reliability and high availability of H^- ion source control system, the new control structure of CSNS

H^- ion source will be redesigned and installed in CSNS site, which is based on both embedded IOC PLC (F3RP61) and sequence PLC.

WEPKN014 **Filling Pattern Measurement at NSLS-II** – *Y. Hu (BNL), L.R. Dalesio, I. Pinayev (BNL)*
Multi-bunch injection will be deployed at NSLS-II. High bandwidth diagnostic monitors with high-speed digitizers are used to measure bunch-by-bunch charge variation. The requirements of filling pattern measurement and layout of beam monitors are described. The evaluation results of commercial fast digitizer Agilent Acqiris and high bandwidth detector Bergoz FCT are presented.

WEPKN015 **A New Helmholtz Coil Permanent Magnet Measurement System*** – *J.Z. Xu (ANL), I. Vasserman (ANL)*
A new Helmholtz Coil magnet measurement system has been developed at the Advanced Phone Source (APS) to characterize and sort the insertion device permanent magnets. The system uses the latest state-of-the-art field programmable gate array (FPGA) technology to compensate the speed variations of the magnet motion. Initial results demonstrate that the system achieves a measurement precision better than 0.001 ampere-meters squared (A·m2) in a permanent magnet moment measurement of 32 A·m2, probably the world's best precision of its kind.

WEPKN016 **WinCC OA as Operating System for the MedAustron Accelerator Control System** – *M. Marchhart (EBG MedAustron), A.B. Brett, R. Moser, H. Pavetits, M. Thonke, C. Torcato de Matos (EBG MedAustron) J. Dedic (Cosylab) J. Gutleber, M. Janulis (CERN)*
MedAustron is an ion beam cancer therapy and research centre under construction in Wiener Neustadt, Austria. The heart of this centre is a synchrotron particle accelerator, designed for protons, carbon-ions and other light ions. As core operating system for controlling the particle accelerator, MedAustron chose the commercial SCADA tool SIMATIC WinCC OA. The tool has been designed following an open, distributed system architecture to accommodate traditional supervisory control and data acquisition tasks. It offers the possibility to extend the system for tasks that go beyond those traditional tasks. The accelerator control system follows a four tier architecture. In the lower two tiers the control system interfaces with many heterogeneous devices. The tool acts as the main communication bus, keeping at all times a consistent state of the entire system. Persistency features and redundancy capabilities of the tool will be useful in the future to be able to come to a robust accelerator control system core. To uniform the interfaces of all devices we apply an object-oriented, XML-based device modelling system to define interfaces for all devices and to wrap them in a standardized state machine. Quickly identifying misbehaving components within the plant is the key for maintaining a high level of safety and for keeping maintenance costs under control. For that reason we developed a WinCC Qt component for interactive 3D process visualization. To interface from C# natively to the WinCC OA process data, we developed a C# API based on the supplier provided API manager library.

WEPKN017 **Wireless Based Control System for the18 GHz High Temperature Superconducting ECR Ion Source, PKDELIS, on a 100 kV High Voltage Platform** – *R.N. Dutt (IUAC), D. Kanjilal, A. Mandal, Y. Mathur, U.K. Rao, G. Rodrigues (IUAC)*

A wireless based control system has been designed based on MODBUS protocol and implemented for the control and operation of the 18GHz High Temperature Superconducting ECR Ion Source (HTS-ECRIS) PKDELIS on a 40kV/100 kV high voltage platform and the Low Energy Beam Transport Section. This system makes operation and control of the devices on the 40kV/100 kV high voltage platforms easy and is found to be robust in spark environments. For interlocking purposes and fail-safe operation at the hardware level, programmable logic controllers are used. The cost to performance ratio has been minimised when compared to the use of Field Point modules. The system has been in continuous operation for more than three years. The design and performance of this system will be presented in detail.

WEPKN018 **NSLS-II Vacuum Control for Chamber Acceptance** – *H. Xu (BNL), L.R. Dalesio, M.J. Ferreira, D. Zigrosser (BNL)*

The vacuum chamber bakeout and control system for NSLS-II storage ring is on the way. A necessary step prior to the chambers use in the storage ring tunnel will be to check the chambers for vacuum integrity, which includes a full bakeout of the vacuum chamber. The control system will control the temperature profile during the baking, Ti sublimation and ion pumps operation. Data that will be acquired by the system includes system temperature, vacuum pressure, residual gas analyzer scans, ion pump current, TSP operation and NEG activation. This data will be used as part of the acceptance process of the chamber for installation in the ring. This paper presents the design and implementation of the vacuum bakeout control, as well as some other related procedures' control.

WEPKN019 **A Programmable Logic Controller-Based System for the Recirculation of Liquid C6 F14 in the ALICE High Momentum Particle Identification Detector at the Large Hadron Collider.** – *I. Sgura (INFN-Bari), G. De Cataldo, A. Franco, C. Pastore (INFN-Bari) C. Dell'Olio (Università e Politecnico di Bari)*

We present the design and the implementation of the Control System (CS) for the recirculation of liquid C6 F14 (Perfluorohexane) in the High Momentum Particle Identification Detector (HMPID). The HMPID is a sub-detector of the ALICE experiment at the CERN Large Hadron Collider (LHC) and it uses liquid C6 F14 as Cherenkov radiator medium in 21 quartz trays for the measurement of the velocity of charged particles. The primary task of the Liquid Circulation System (LCS) is to ensure the highest transparency of C6F14 to ultraviolet light by re-circulating the liquid through a set of special filters. In order to provide safe long term operation a PLC-based CS has been implemented. The CS supports both automatic and manual operating modes, remotely or locally. The adopted Finite State Machine approach minimizes the possible operator errors and provides a hierarchical control structure allowing the operation and monitoring of a single radiator tray. The LCS is protected against anomalous working conditions by both active and passive systems. The active ones are ensured via the control software running in the PLC whereas the human interface and data archiving are provided via PVSS, the SCADA framework which integrates the full detector control. The LCS under CS control has been fully commissioned and proved to meet all requirements, thus enabling HMPID to successfully collect the data from the first LHC operation.

WEPKN020 **TANGO Integration of a SIMATIC WinCC Open Architecture SCADA System at ANKA** – *T. Spangenberg (Karlsruhe Institute of Technology (KIT)), K. Cerff, W. Mexner (Karlsruhe Institute of Technology (KIT)) V. Kaiser (Softwareschneiderei GmbH)*

The WinCC OA supervisory control and data acquisition (SCADA) system provides at the ANKA synchrotron facility a powerful and very scalable tool to manage the enormous variety of technical equipment relevant for house keeping and beamline operation. Crucial to the applicability of a SCADA system for the ANKA synchrotron are the provided options to integrate it into other control concepts even if they are working e.g. on different time scales, managing concepts, and control standards. Especially these latter aspects result into different approaches for controlling concepts for technical services, storage ring, and beamlines. The beamline control at ANKA is mainly based on TANGO and SPEC, which has been expanded by TANGO server capabilities. This approach implies the essential need to provide a stable and fast link, that does not increase the dead time of a measurement, to the slower WinCC OA SCADA system. The open architecture of WinCC OA offers a smooth integration in both directions and therefore gives options to combine potential advantages, e.g. native hardware drivers or convenient graphical skills. The implemented solution will be presented and discussed at selected examples.

WEPKN023 **Design of a Prototype Vacuum Control System Based on Embedded IOC for CSNS** – *Y.C. He (IHEP Beijing), C.H. Wang, J.C. Wang, X. Wu (IHEP Beijing)*

A prototype vacuum control system based on embedded Input/Output Controller (IOC) was designed for China Spallation Neutron Source (CSNS). Under the EPICS software framework, this prototype vacuum control system consists of three layers: the operator interface (OPI) layer, the IOC layer and the equipment control layer. Vacuum instrumentation (Gauges and Pump controllers) is interfaced through a Moxa embedded computer running embedded Linux system and EPICS IOCCore. Interlocking and protection of equipment is realized in a Yokogawa PLC, and an embedded Linux controller, F3RP61 (e-RT3 2.0), on the same base unit as the I/O modules is used to run EPICS IOCCore. This paper describes the hardware, software and stability of this prototype vacuum control system.

WEPKN024 **UNICOS CPC New Domains of Application: Vacuum and Cooling & Ventilation** – *D. Willeman (CERN), E. Blanco, B. Bradu, J.O. Ortola (CERN)*

The UNICOS (UNified Industrial Control System) framework, and concretely the CPC package, has been extensively used in the domain of continuous processes (e.g. cryogenics, gas flows,…) and also others specific to the LHC machine as the collimators environmental measurements interlock system. The application of the UNICOS-CPC to other kind of processes: vacuum and the cooling and ventilation cases are depicted here. One of the major challenges was to figure out whether the model and devices created so far were also adapted for other types of processes (e.g Vacuum). To illustrate this challenge two domain use cases will be shown: ISOLDE vacuum control system and the STP18 (cooling & ventilation) control system. Both scenarios will be illustrated emphasizing the adaptability of the UNICOS CPC package to create those applications and highlighting the discovered needed features to include in the future UNICOS CPC package. This paper will also introduce the mechanisms used to optimize the commissioning time, the so-called virtual commissioning. In most of the cases, either the process is not yet accessible or the process is critical and its availability is then reduced, therefore a model of the process is used to offline validate the designed control system.

WEPKN025 **Supervision Application for the New Power Supply of the CERN PS (POPS)** – *H. Milcent (CERN), X. Genillon, M. Gonzalez-Berges, A. Voitier (CERN)*

The power supply system for the magnets of the CERN PS has been recently upgraded to a new system called POPS (POwer for PS). The old mechanical machine has been replaced by a system based on capacitors. The equipment as well as the low level controls have been provided by an external company (CONVERTEAM). The supervision application has been developed at CERN reusing the technologies and tools used for the LHC Accelerator and Experiments (UNICOS and JCOP frameworks, PVSS SCADA tool). The paper describes the full architecture of the control application, and the challenges faced for the integration with an outsourced system. The benefits of reusing the CERN industrial control frameworks and the required adaptations will be discussed. Finally, the initial operational experience will be presented.

WEPKN026 **The ELBE Control System – 10 Years of Experience with Commercial Control, SCADA and Data Acquisition Systems.** – *M. Justus (HZDR), R. Jainsch, N. Kretzschmar, K.-W. Leege, P. Michel, A. Schamlott (HZDR)*

The 40 MeV c.w. electron LINAC facility ELBE is the central experimental site at the Helmholtz-Zentrum Dresden-Rossendorf, Germany. Experiments with Bremsstrahlung started in 2001 and since that, through a series of expansions and modifications, ELBE has evolved into a 24/7 machine running a total of seven secondary sources incl. two IR FELs. Selecting a certain control system is a fundamental and (once a facility is in user operation) immovable decision to be made. ELBE uses WinCC, a Windows based commercial SCADA system by Siemens, on top of a networked PLC architecture, using industrial field bus technology. For highly time resolved data acquisition, mainly real time or Windows based NI systems are in use, with LabVIEW application software. RF and synchronisation are based on in-house built digital and analogue hardware technologies. A brief overview of the evolution of this system is given in terms of system complexity, its degree of automation and technologies used, along with an experience report on the efforts necessary to keep track with ongoing IT, OS and security developments. Limits in application and new demands imposed by the forthcoming facility upgrade as a centre for high intensity beams (in conjunction with TW/PW femtosecond lasers) are discussed.

WEPKN027 **The Performance Test of F3RP61 and Its Applications in CSNS Experimental Control System** – *J. Zhuang (IHEP Beijing), Y.P. Chu, J. Jin, L. Li (IHEP Beijing)*

F3RP61 is an embedded PLC developed by Yokogawa, Japan. It is based on PowerPC 8347 platform. Linux and EPICS can run on it. We do some tests on this device, including CPU performance, network performance, CA access time and scan time stability of EPICS. We also compare E3RP61 with MVME5100, which is most used IOC in BEPCII. After the tests and comparison, the performance and ability of F3RP61 is clear. It can be used in Experiment Control System of CSNS (China Spallation Neutron Source) as communication nodes between front control layer and Epics layer. And in some cases, F3RP61 also has the ability to exert more functions such as control tasks.

12-Oct-11 13:30 – 15:00	Poster	Kilimanjaro Sud

WEPKS — Poster
Chair: R. Wilcke (ESRF)

Software technology evolution

WEPKS001 **Agile Development and Dependency Management for Industrial Control Systems** – *B. Copy (CERN), M. Mettaelae (CERN)*
The production and exploitation of industrial control systems differ substantially from traditional information systems; this is in part due to constraints on the availability and change life-cycle of production systems, as well as their reliance on proprietary protocols and software packages with little support for open development standards [1]. The application of agile software development methods therefore represents a challenge which requires the adoption of existing change and build management tools and approaches that can help bridging the gap and reap the benefits of managed development when dealing with industrial control systems. This paper will consider how agile development tools such as Apache Maven for build management, Hudson for continuous integration or Sonatype Nexus for the operation of"definite media librarie" were leveraged to manage the development life-cyle of the CERN UAB framework [2], as well as other crucial building blocks of the CERN accelerator infrastructure, such as the CERN Common Middleware or the FESA project.

WEPKS002 **Quick EXAFS Experiments Using a New GDA Based Eclipse RCP GUI with EPICS Hardware Control** – *R.J. Woolliscroft (Diamond), C. Coles, M. Gerring, M.R. Pearson (Diamond)*
The Generic Data Acquisition (GDA) framework is an open source, Java and Eclipse RCP based data acquisition software for synchrotron and neutron facilities. A new implementation of the GDA on the B18 beamline at the Diamond synchrotron will be discussed. This beamline performs XAS energy scanning experiments and includes a continuous-scan mode of the monochromator synchronised with various detectors for Quick EXAFS (QEXAFS) experiments. A new perspective for the GDA's Eclipse RCP GUI has been developed in which graphical editors are used to write xml files which hold experimental parameters. The same xml files are marshalled by the GDA server to create Java beans used by the Jython scripts run within the GDA server. The underlying motion control is provided by EPICS. The new Eclipse RCP GUI and the integration and synchronisation between the two software systems and the detectors shall be covered.

WEPKS003 **An Object Oriented Framework of EPICS for MicroTCA Based Control System** – *Z. Geng (SLAC)*
EPICS (Experimental Physics and Industrial Control System) is a distributed control system platform which has been widely used for large scientific devices control like particle accelerators and fusion plant. EPICS has introduced object oriented (C++) interfaces to most of the core services. But the major part of EPICS, the run-time database, only provides C interfaces, which is hard to involve the EPICS record concerned data and routines in the object oriented architecture of the software. This paper presents an object oriented framework which contains some abstract classes to encapsulate the EPICS record concerned data and routines in C++ classes so that full OOA (Objected Oriented Analysis) and OOD (Object Oriented Design) methodologies can be used for EPCIS IOC design. We also present a dynamic device management scheme for the hot-swap capability of the MicroTCA based control system.

WEPKS004 **ISAC EPICS on Linux : The March of the Penguins** – *J.E. Richards (TRIUMF, Canada's National Laboratory for Particle and Nuclear Physics), R.B. Nussbaumer, S.A. Rapaz, G. Waters (TRIUMF, Canada's National Laboratory for Particle and Nuclear Physics)*
By their DC nature, the linear accelerators of the ISAC radioactive beam facility at TRIUMF do not impose rigorous timing constraints on the control system. Therefore a non real-time operating system is suitable for device control. The ISAC Control System is completing a move to the use of the open source Linux operating system for hosting all EPICS IOCs. The IOC platforms include GE-Fanuc VME based CPUs for control of most optics and diagnostics, rack mounted servers for supervising PLCs, small desktop PCs for GPIB and serial"one-of-a-kin" instruments, as well as embedded ARM processors controlling CAN-bus devices that provide a suitcase sized control system. Linux is also the OS used for hosting most other EPICS applications (boot-servers, data loggers, display managers), operator consoles, developer environment, and relational database and web services. Virtualization technology is used to segregate services. This article focuses on the experience of creating a customized Linux distribution for front-end IOC deployment. Rationale, a roadmap of the process, and efficiency advantages in personnel training and system management realized by using a single OS will be discussed.

WEPKS005 **State Machine Framework and its Use for Driving LHC Operational States** – *M. Misiowiec (CERN), V. Baggiolini, M. Solfaroli Camillocci (CERN)*
The LHC follows a complex operational cycle with 12 major phases that include equipment tests, preparation, beam injection, ramping and squeezing, finally followed by the physics phase. This cycle is modeled and enforced with a state machine, whereby each operational phase is represented by a state. On each transition, before entering the next state, a series of conditions is verified to make sure the LHC is ready to move on. The State Machine framework was developed to cater for building independent or embedded state machines. They safely drive between the states executing tasks bound to transitions and broadcast related information to interested parties. The framework encourages users to program their own actions. Simple configuration management allows the operators to define and maintain complex models themselves. An emphasis was also put on easy interaction with the remote state machine instances through standard communication protocols. On top of its core functionality, the framework offers a transparent integration with other crucial tools used to operate LHC, such as the LHC Sequencer. LHC Operational States has been in produc-

tion for half a year and was seamlessly adopted by the operators. Further extensions to the framework and its application in operations are under way.

WEPKS006 **UNICOS Evolution: CPC Version 6** – *E. Blanco (CERN)*
The UNICOS (UNified Industrial Control System) framework was created back in 1998, since then a noticeable number of applications in different domains have used this framework to develop process control applications. Furthermore the UNICOS framework has been formalized and their supervision layer has been reused in other kinds of applications (e.g. monitoring or supervisory tasks) where a control layer is not necessarily UNICOS oriented. The process control package has been reformulated as the UNICOS CPC package (Continuous Process Control) and a reengineering process has been followed. These noticeable changes were motivated by many factors as (1) being able to upgrade to the new more performance IT technologies in the automatic code generation, (2) being flexible enough to create new additional device types to cope with other needs (e.g. Vacuum or Cooling and Ventilation applications) without major impact on the framework or the PLC code baselines and (3) enhance the framework with new functionalities (e.g. recipes). This publication addresses the motivation, changes, new functionalities and results obtained. It introduces in an overall view the technologies used and changes followed, emphasizing what has been gained for the developer and the final user. Finally some of the new domains where UNICOS CPC has been used will be illustrated.

WEPKS007 **(Hardware) Interface Independent Serial Communication** – *P. Kankiya (BNL), L.T. Hoff, J.P. Jamilkowski, S.A. Kennell, R.H. Olsen (BNL)*
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, RS485, GPIB, USB, Ethernet and CAN, to name a few. IISC is a client software library which can be used to initiate, communicate and terminate sessions with devices irrespective of type of connection in use. It acts as a layer of abstraction allowing a developer to establish communication with these devices eliminating detailed know-how of interface hardware and protocol involved. Details of implementation and a performance analysis will be presented.

WEPKS008 **Rules-based Analysis with JBoss Drools : Adding Intelligence to Automation** – *E. De Ley (iSencia Belgium), D. Jacobs (iSencia Belgium)*
Rules engines are less-known as software technology than the traditional procedural, object-oriented, scripting or dynamic development languages. This is a pity, as their usage may offer an important enrichment to a development toolbox. JBoss Drools is an open-source rules engine that can easily be embedded in any Java application. Through an integration in our Passerelle process automation suite, we have been able to provide advanced solutions for intelligent process automation, complex event processing, system monitoring and alarming, automated repair etc. This platform has been proven for many years as an automated diagnosis and repair engine for Belgium's largest telecom provider, and it is being piloted at Synchrotron Soleil for device monitoring and alarming. After an introduction to rules engines in general and JBoss Drools in particular, we will present some practical use cases and important caveats.

WEPKS009 **Integrating Gigabit Ethernet Cameras into EPICS at Diamond Light Source** – *T.M. Cobb (Diamond)*

At Diamond Light Source we have selected Gigabit Ethernet cameras supporting GigE Vision for our new photon beamlines. GigE Vision is an interface standard for high speed Ethernet cameras which encourages interoperability between manufacturers. This paper describes the challenges encountered while integrating GigE Vision cameras from a range of vendors into EPICS.

WEPKS010 **Architecture Design of the Application Software for the Low-Level RF Control System of the Free-Electron Laser at Hamburg** – *Z. Geng (SLAC) V. Ayvazyan (DESY) S. Simrock (ITER Organization)*

The superconducting linear accelerator of the Free-Electron Laser at Hamburg (FLASH) provides high performance electron beams to the lasing system to generate synchrotron radiation to various users. The Low-Level RF (LLRF) system is used to maintain the beam stabilities by stabilizing the RF field in the superconducting cavities with feedback and feed forward algorithms. The LLRF applications are sets of software to perform RF system model identification, control parameters optimization, exception detection and handling, so as to improve the precision, robustness and operability of the LLRF system. In order to implement the LLRF applications in the hardware with multiple distributed processors, an optimized architecture of the software is required for good understandability, maintainability and extendibility. This paper presents the design of the LLRF application software architecture based on the software engineering approach and the implementation at FLASH.

WEPKS011 **Exploitation of ITER CODAC Core System in SPIDER Ion Source Experiment** – *C. Taliercio (Consorzio RFX, Associazione Euratom-ENEA sulla Fusione), A. Barbalace, M. Breda, R. Capobianco, A. Luchetta, G. Manduchi, F. Molon, M. Moressa, P. Simionato (Consorzio RFX, Associazione Euratom-ENEA sulla Fusione)*

In February 2011 ITER released a new version (v2) of the CODAC Core System. In addition to the selected EPICS core, the new package includes also several tools from Control System Studio [1]. These tools are all integrated in Eclipse and offer an integrated environment for development and operation. The SPIDER Ion Source experiment is the first experiment planned in the ITER Neutral Beam Test Facility under construction at Consorzio RFX, Padova, Italy. As the final product of the Test Facility is the ITER Neutral Beam Injector, we decided to adhere since the beginning to the ITER CODAC guidelines. Therefore the EPICS system provided in the CODAC Core System will be used in SPIDER for plant control and supervision and, to some extent, for data acquisition. In this paper we report our experience in the usage of CODAC Core System v2 in the implementation of the control system of SPIDER and, in particular, we analyze the benefits and drawbacks of the Self Description Data (SDD) tools which, based on a XML description of the signals involved in the system, provide the automatic generation of the configuration files for the EPICS tools and PLC data exchange.

WEPKS012 **Intuitionistic Fuzzy (IF) Evaluations of Multidimensional Model** – *I.D. Valova (ICER)*

There are different logical methods for data structuring, but no one is perfect enough. Multidimensional model of data is presentation of data in a form of cube (referred as infocube or hypercube) with data or in form of"sta" type scheme (referred as multidimensional scheme), by use of F-structures (Facts) and set of D-structures (Dimensions), based on the notion of hierarchy of D-structures. The data, being subject of analysis in a specific multidimensional model is located in a Cartesian space, being restricted by D-structures. In fact, the data is either dispersed or"concentrate", therefore the data cells are not distributed evenly within the respective space. The moment of occurrence of any event is difficult to be predicted and the data is concentrated as per time periods, location of performed event, etc. To process such dispersed or concentrated data, various technical strategies are needed. The use of intuitionistic fuzzy evaluations- IFE provide us new possibilities for alternative presentation and processing of data, subject of analysis in any OLAP application. The use of IFE at the evaluation of multidimensional models will result in the following advantages: analysts will dispose with more complete information for processing and analysis of respective data; benefit for the managers is that the final decisions will be more effective ones; enabling design of more functional multidimensional schemes. The purpose of this work is to apply intuitionistic fuzzy evaluations of multidimensional model of data.

WEPKS013 **Graphical User Interfaces for the Imaging and Medical Beamline of the Australian Synchrotron.** – *A. Maksimenko (ASCo), A. Rhyder (ASCo)*

The Imaging and Medical Beamline of the Australian Synchrotron will be one of the most advanced instruments of this type in the world. It is designed to provide a wide variety of techniques including, but not limited to the computed tomography (CT), K-edge subtraction, inline and analyzed phase contrasts, microbeam radiation therapy, mammography and others. Thus, the beamline consists of and contains many different complex instruments. The instruments are integrated into the EPICS to provide homogeneous access. However, considering the target audience of the potential beamline users consisting mainly of professionals with a limited technical background (medical doctors, physiologists, paleontologists), the use of the standard to EPICS Motiff-based graphical user interface is expected to introduce a higher starting barrier for new users and may considerably limit the efficiency of the experimentalists. Addressing the issues we considered different possible frameworks and the decision was made in favor of the Qt library. The choice was determined by the combination of the following factors: availability of the EPICS-Qt interlayer developed in-house, cross-platform nature of the framework which mimics the native look-and-feel, modular design with a rich selection of components, bindings in several programming languages, open-source distribution model. This report presents some of the currently implemented and soon coming applications. They include general beamline control (slits, filters, shutters, mono), motion control, time and position scans, area detector, CT acquisition.

WEPKS014 **NOMAD – More Than a Simple Sequencer** – *P. Mutti (ILL), F. Cecillon, A. Elaazzouzi, Y. Le Goc, J. Locatelli, H. Ortiz, J. Ratel (ILL)*

NOMAD is the new instrument control software of the Institut Laue-Langevin. A highly sharable code among all the instruments' suite, a user oriented design for tailored functionality and the improvement of the instrument team's autonomy thanks to a uniform and ergonomic user interface are the essential elements guiding the software development. NOMAD implements a client/server approach. The server is the core business containing all the instrument methods and the hardware drivers, while the GUI provides all the necessary functionalities for the interaction between user and hardware. All instruments share the same executable while a set of XML configuration files adapts hardware needs and instrument methods to the specific experimental setup. Thanks to a complete graphical representation of experimental sequences, NOMAD provides an overview of past, present and future operations. Users have the freedom to build their own specific workflows using intuitive drag-and-drop technique. A complete drivers' database to connect and control all possible instrument components has been created, simplifying the inclusion of a new piece of equipment for an experiment. A web application makes available outside the ILL all the relevant information on the status of the experiment. A set of scientific methods facilitates the interaction between users and hardware giving access to instrument control and to complex operations within just one click on the interface. NOMAD is not only for scientists. Dedicated tools allow a daily use for setting-up and testing a variety of technical equipments.

WEPKS015 **Automatic Creation of LabVIEW Network Shared Variables** – *T. Kluge (Siemens AG) H. Schroeder (ASTRUM IT GmbH)*

We are in the process of preparing the LabVIEW controlled system components of our Solid State Direct Drive^{TM} experiments for the integration into a Supervisory Control And Data Acquisition (SCADA) or distributed control system. The predetermined route to this is the generation of LabVIEW network shared variables that can easily be exported by LabVIEW to the SCADA system using OLE for Process Control (OPC) or other means. Many repetitive tasks are associated with the creation of the shared variables and the required code. We are introducing an efficient and inexpensive procedure that automatically creates shared variable libraries and sets default values for the shared variables. Furthermore, LabVIEW controls are created that are used for managing the connection to the shared variable inside the LabVIEW code operating on the shared variables. The procedure takes as input an XML spreadsheet defining the required input. The procedure utilizes XSLT and LabVIEW scripting. In a later state of the project the code generation can be expanded to also create code and configuration files that will become necessary in order to access the shared variables from the SCADA system of choice.

WEPKS016 **Software for Virtual Accelerator Designing** – *N.V. Kulabukhova (St. Petersburg State University), A.N. Ivanov, V.V. Korhov, A. Lazarev (St. Petersburg State University)*

The article discusses appropriate technologies for software implementation of the Virtual Accelerator. The Virtual Accelerator is considered as a set of services and tools enabling transparent execution of computational software for modeling beam dynamics in accelerators on distributed computing resources. Distributed storage and information processing facilities utilized by the Virtual Accelerator make use of the Service-Oriented Architecture (SOA) according to a cloud computing paradigm. Control system toolkits (such as EPICS, TANGO), computing modules (including high-performance computing), realization of the GUI with existing frameworks and visualization of the data are discussed in the paper. The presented research consists of software analysis for realization of interaction between all levels of the Virtual Accelerator and some samples of middleware implementation. A set of the servers and clusters at St.-Petersburg State University form the infrastructure of the computing environment for Virtual Accelerator design. Usage of component-oriented technology for realization of Virtual Accelerator levels interaction is proposed. The article concludes with an overview and substantiation of a choice of technologies that will be used for design and implementation of the Virtual Accelerator.

WEPKS017 **Combining the Repository Architectural Pattern with Message-based Coordination** – *J.M. Nogiec (Fermilab)*

Software architecture describes the organization of the overall software system, and, therefore, has key influence over general properties and characteristics of the system. Over time, various architectural patterns have emerged, with the repository pattern used in many domains, including control and automation. This pattern presents a straightforward solution for sharing data between several independent agents or entities, while at the same time it does not address the problem of coordination between these entities. Since a single architectural pattern rarely addresses all the concerns, several patterns are often combined in a single design. The author proposes to combine the repository pattern with message-based coordination. This solution is characterized by loose coupling of collaborating entities, extensibility, and clear separation of concerns for data sharing and coordination. The architectures of two control and automation systems, both developed at Fermilab based on the proposed architectural blueprint, are used to discuss particular implementations for distributed and local systems, with both centralized and decentralized coordination mechanisms. Alternatives for repository implementations are presented, ranging from the use of a distributed memory-resident database to a centralized XML data repository. The benefits of the discussed architectural style, as well as experience gained and lessons learned from applying this style in the design of concrete systems are summarized.

WEPKS018 **MstApp, a Rich Client Control Applications Framework at DESY** – *W. Schütte (DESY), K. Hinsch (DESY)*

The control system for PETRA 3 [1] and its pre accelerators extensively use rich clients for the control room and the servers. Most of them are written with the help of a rich client Java framework: MstApp. They total to 10^6 different console and 158 individual server applications. MstApp takes care of many common control system application aspects beyond communication. MstApp provides a common look and feel: core menu items, a color scheme for standard states of hardware components and standardized screen sizes/locations. It interfaces our console application manager (CAM) and displays on demand our communication link diagnostics tools. MstApp supplies an accelerator context for each application; it handles printing, logging, resizing and unexpected application crashes. Due to our standardized deploy process MstApp applications know their individual developers and can even send them – on button press of the users - emails. Further a concept of different operation modes is implemented: view only, operating and expert use. Administration of the corresponding rights is done via web access of a database server. Initialization files on a web server are instantiated as JAVA objects with the help of the Java SE XMLEncoder. Data tables are read with the same mechanism. New MstApp applications can easily be created with in house wizards like the NewProjectWizard or the DeviceServerWizard. MstApp improves the operator experience, application developer productivity and delivered software quality.

WEPKS019 **Data Analysis Workbench** – *A. Gotz (ESRF), M.W. Gerring (ESRF)*

Data Analysis Workbench is a new software tool produced in collaboration by the ESRF, Soleil and Diamond. It provides data visualization and workflow algorithm design for data analysis in combination with data collection. The workbench uses Passerelle as the workflow engine and EDNA plugins for data analysis. Actors talking to Tango are used for sending limited commands to hardware and starting existing data collection algorithms. There are scripting interfaces to SPEC and Python. The current state at the ESRF is prototype.

WEPKS020 **Adding Flexible Subscription Options to EPICS** – *R. Lange (HZB) L.R. Dalesio (BNL) A.N. Johnson (ANL)*

The need for a mechanism to control and filter subscriptions to control system variables by the client was described in a paper at the ICALEPCS2009 conference.* The implementation follows a plug-in design that allows the insertion of plug-in instances into the event stream on the server side. The client can instantiate and configure these plug-ins when opening a subscription, by adding field modifiers to the channel name using JSON notation.** This paper describes the design and implementation of a modular server-side plug-in framework for Channel Access, and shows examples for plug-ins as well as their use within an EPICS control system.

WEPKS021 **A Novel Design of EPICS V4 in Python** – *G. Shen (BNL), M.A. Davidsaver, M.R. Kraimer (BNL)*

A novel design and implementation of EPICS version 4 is undergoing in Python. EPICS V4 defined an efficient way to describe a complex data structure, and data protocol. Current implementation in either C++ or Java has to invent a new wheel to present its data structure. However, it is more efficient in Python by mapping the data structure into a numpy array. This presentation shows the performance benchmarking, comparison in different language, and current status.

WEPKS022 **Mango: an Online GUI Development Tool for the Tango Control System (Strangolino)** – *G. Strangolino (ELETTRA), C. Scafuri (ELETTRA)*

Mango is an online tool based on QTango that allows easy development of graphical panels ready to run without need to be compiled. Developing with Mango is easy and fast because widgets are dragged from a widget catalogue and dropped into the Mango container. Widgets are then connected to the control system variables by choosing them from a Tango device list or by dragging them from any other running application built with the QTango library. Mango has also been successfully used during the FERMI@Elettra commissioning both by machine physicists and technicians.

WEPKS023 **Further Developments in Generating Type-Safe Messaging** – *R. Neswold (Fermilab), CA. King (Fermilab)*

At ICALEPCS '09, we introduced a source code generator that allows processes to communicate safely using native data types. In this paper, we discuss further development that has occurred since the conference in Kobe, Japan, including adding three more client languages, an optimization in network packet size and the addition of a new protocol data type.

WEPKS024 **CAFE, A Modern C++ Interface to the EPICS Channel Access Client Library** – *J.T.M. Chrin (PSI), M.C. Sloan (PSI)*

CAFE (Channel Access interFacE) is a C++ library that provides a modern, multifaceted interface to the EPICS-based control system. CAFE makes extensive use of templates and multi-index containers to enhance efficiency, flexibility and performance. Stability and robustness are accomplished by ensuring that connectivity to EPICS channels remains in a well defined state in every eventuality, and results of all synchronous and asynchronous operations are captured and reported with integrity. CAFE presents the user with a number of options for writing and retrieving data to and fro the control system. In addition to basic read/write operations, a further abstraction layer provides transparency to more intricate functionality involving logical sets of data; such object sequences are easily instantiated through an XML-based configuration mechanism. CAFE's suitability for use in a broad spectrum of applications is demonstrated. These range from script-like frameworks such as Matlab, to high performance Qt GUI control widgets, to event processing agents that propagate data through OMG's Data Distribution Service (DDS). The methodology for the modular use of CAFE serves to improve maintainability by enforcing a logical boundary between the channel access components and the specifics of the application framework at hand.

WEPKS025 **Evaluation of Software and Electronics Technologies for the Control of the E-ELT Instruments: a Case Study** – *P. Di Marcantonio (INAF-OAT), R. Cirami, I. Coretti (INAF-OAT) G. Chiozzi, M. Kiekebusch (ESO)*

In the scope of the evaluation of architecture and technologies for the control system of the E-ELT (European-Extremely Large Telescope) instruments, a collaboration has been set up between the Instrumentation and Control Group of the INAF-OATs and the ESO Directorate of Engineering. The first result of this collaboration is the design and implementation of a prototype of a small but representative control system for an E-ELT instrument that has been setup at the INAF-OATs premises. The electronics has been based on PLCs (Programmable Logical Controller) and Ethernet based fieldbuses from different vendors but using international standards like the IEC 61131-3 and PLCopen Motion Control. The baseline design for the control software follows the architecture of the VLT (Very Large Telescope) Instrumentation application framework but it has been implemented using the ACS (ALMA Common Software), an open source software framework developed for the ALMA project and based on CORBA middleware. The communication among the software components is based in two models: CORBA calls for command/reply and CORBA notification channel for distributing the devices status. The communication with the PLCs is based on OPC-UA, an international standard for the communication with industrial controllers. The results of this work will contribute to the definition of the architecture of the control system that will be provided to all consortia responsible for the actual implementation of the E-ELT instruments. This paper presents the prototype motivation, its architecture, design and implementation.

WEPKS026 **A C/C++ Build System Based on Maven for the LHC Controls System** – *J. Nguyen Xuan (CERN), B. Copy, M. Donszelmann (CERN)*

The CERN accelerator controls system, mainly written in Java and C/C++, consists nowadays of 50 projects and 150 active developers. The controls group has decided to unify the development process and standards (e.g. project layout) using Apache Maven and Sonatype Nexus. Maven is the de-facto build tool for Java, it deals with versioning and dependency management, whereas Nexus is a repository manager. C/C++ developers were struggling to keep their dependencies on other CERN projects, as no versioning was applied, the libraries have to be compiled and available for several platforms and architectures, and finally there was no dependency management mechanism. This results in very complex Makefiles which were difficult to maintain. Even if Maven is primarily designed for Java, a plugin (Maven NAR) adapts the build process for native programming languages for different operating systems and platforms. However C/C++ developers were not keen to abandon their current Makefiles. Hence our approach was to combine the best of the two worlds: NAR/Nexus and Makefiles. Maven NAR manages the dependencies, the versioning and creates a file with the linker and compiler options to include the dependencies. The Makefiles carry the build process to generate the binaries. Finally the resulting artifacts (binaries, header files, metadata) are versioned and stored in a central Nexus repository. Early experiments were conducted in the scope of the controls group's Testbed. Some existing projects have been successfully converted to this solution and some starting projects use this implementation.

WEPKS027 **Java Expert GUI Framework for CERN's Beam Instrumentation Systems** – *S. Bart Pedersen (CERN), S. Bozyigit, S. Jackson (CERN)*

The CERN Beam Instrumentation Group software section have recently performed a study of the tools used to produce Java expert applications. This paper will present the analysis that was made to understand the requirements for generic components and the resulting tools including a compilation of Java components that have been made available for a wider audience. The paper will also discuss the eventuality of using MAVEN as deployment tool with its implications for developers and users.

WEPKS028 **Exploring a New Paradigm for Accelerators and Large Experimental Apparatus Control Systems** – *L. Catani (INFN-Roma II), R. Ammendola, F. Zani (INFN-Roma II) C. Bisegni, S. Calabrò, P. Ciuffetti, G. Di Pirro, G. Mazzitelli, A. Stecchi (INFN/LNF)*

The integration of web technologies and web services has been, in the recent years, one of the major trends in upgrading and developing control systems for accelerators and large experimental apparatuses. Usually, web technologies have been introduced to complement the control systems with smart add-ons and user friendly services or, for instance, to safely allow access to the control system to users from remote sites. In spite of this still narrow spectrum of employment, some software technologies developed for high performance web services, although originally intended and optimized for these particular applications, deserve some features that would allow their deeper integration in a control system and, eventually, use them to develop some of the control system's core components. In this paper we present the conclusion of the preliminary investigations of a new paradigm for an accelerator control system and associated machine data acquisition system (DAQ), based on a synergic combination of network distributed cache memory and a non-relational key/value database. We investigated these technologies with particular interest on performances, namely speed of data storage and retrieve for the network memory, data throughput and queries execution time for the database and, especially, how much this performances can benefit from their inherent scalability. The work has been developed in a collaboration between INFN-LNF and INFN-Roma Tor Vergata.

WEPKS029 **Integrating a Workflow Engine within a Commercial SCADA to Build End User Applications in a Scientific Environment** – *M. Ounsy (SOLEIL), G. Abeille, S. Pierre-Joseph Zephir, K.S. Saintin (SOLEIL) E. De Ley (iSencia Belgium)*

To build integrated high-level applications, SOLEIL is using an original component-oriented approach based on GlobalSCREEN, an industrial Java SCADA [1]. The aim of this integrated development environment is to give SOLEIL's scientific and technical staff a way to develop GUI applications for beamlines external users . These GUI applications must address the 2 following needs : monitoring and supervision of a control system and development and execution of automated processes (like beamline alignment, data collections, and on-line data analysis). The first need is now completely answered through a rich set of Java graphical components based on the COMETE [2] library and providing a high level of service for data logging, scanning and so on. To reach the same quality of service for process automation, a big effort has been made to integrate more smoothly PASSERELLE [3], a workflow engine, with dedicated user-friendly interfaces for end users, packaged as JavaBeans in GlobalSCREEN components library. Starting with brief descriptions of software architecture of the PASSERELLE and GlobalSCREEN environments, we will then present the overall system integration design as well as the current status of deployment on SOLEIL beamlines.

WEPKS030 **A General Device driver Simulator to Help Compare Real Time Control Systems** – *M.S. Mohan (EGO)*

Supervisory Control And Data Acquisition systems (SCADA) such as Epics, Tango and Tine usually provide small device driver programs for testing or to help users get started, however they differ between systems making it hard to compare the SCADA. To address this I have created a small simulator driver which emulates signals and errors similar to those received from a hardware device. Currently the simulator driver can return from one to four signals: a small ramp signal, a large ramp signal, an error signal and a timeout. The different signals or errors can be selected by calling an associated software register number. The simulator driver performs similar functions to Epics clockApp, Tango's TangoTest and the Tine sinegenerator but the signals are independent of the SCADA. A command line application, an Epics server (ioc), a Tango device server, and a Tine server (fec) were created and linked with the simulator driver. In each case the software register numbers were equated to a dummy device. Using the servers it was possible to compare how each SCADA behaved against the same repeatable signals. In addition to comparing and testing the SCADA the finished servers proved useful as templates for real hardware device drivers.

WEPKS031 **TSPP, An Event Driven Communication Protocol: Performance and Redundant Implementation** – *J.O. Ortola (CERN), M. Boccioli (CERN)*

The CERN Unified Industrial Control Systems framework (UNICOS) is the CERN solution for control systems generation that standardizes the design and implementation of industrial process control applications. Its middleware is based on the Time Stamp Push Protocol (TSPP) which provides a high performance communication between the front end and back end layers of a UNICOS application by establishing an event driven communication mechanism. The TSPP protocol is currently reaching its maturity by the recent implementation of redundant capabilities. In this presentation, a summary of the test scenarios and performance tests evaluation is provided as well as the redundancy design, architecture and implementation.

WEPKS032 **A UML Profile for Code Generation of Component Based Distributed Systems** – *G. Chiozzi (ESO), L. Andolfato, R. Karban (ESO) A. Tejeda (UCM)*

A consistent and unambiguous implementation of code generation (model to text transformation) from UML must rely on a well defined UML profile, customizing UML for a particular application domain. Such a profile must have a solid foundation in a formally correct ontology, formalizing the concepts and their relations in the specific domain, in order to avoid a maze or set of wildly created stereotypes. The paper describes a generic profile for the code generation of component based distributed systems for control applications, the process to distill the ontology and define the profile, and the strategy followed to implement the code generator. The main steps that take place iteratively include: defining the terms and relations with an ontology, mapping the ontology to the appropriate UML metaclasses, testing the profile by creating modelling examples, and generating the code.

WEPKS033 **UNICOS CPC6: Automated Code Generation for Process Control Applications** – *B. Fernandez Adiego (CERN), E. Blanco, I. Prieto Barreiro (CERN)*

The Continuous Process Control package (CPC) is one of the components of the CERN Unified Industrial Control System framework (UNICOS). As a part of this framework, UNICOS-CPC provides a well defined library of device types, a methodology and a set of tools to design and implement industrial control applications. The new CPC version uses the software factory UNICOS Application Builder (UAB) to develop the CPC applications. The CPC component is composed of several platform oriented plug-ins (PLCs and SCADA) describing the structure and the format of the generated code. It uses a resource package where both, the library of device types and the generated file syntax are defined. The UAB core is the generic part of this software, it discovers and calls dynamically the different plug-ins and provides the required common services. In this paper the UNICOS CPC6 package is presented. It is composed of several plug-ins: the Instance generator and the Logic generator for both, Siemens and Schneider PLCs, the SCADA generator (based on PVSS) and the CPC wizard as a dedicated Plug-in created to provide the user a friendly GUI. A management tool called UAB bootstrap will administer the different CPC component versions and all the dependencies between the CPC resource packages and the components. This tool guides the control system developer to install and launch the different CPC component versions.

12-Oct-11 13:30 – 15:00	Poster	Mont Blanc Nord

WEPMN — Poster
Chair: J.M. Meyer (ESRF)

Embedded + realtime software

WEPMN001 **Experience in Using Linux Based Embedded Controllers with EPICS Environment for the Beam Transport in SPES Off–Line Target Prototype** – *M. Montis (INFN/LNL), M.G. Giacchini (INFN/LNL)*
EPICS was chosen as general framework to develop the control system of SPES facility under construction at LNL. We report some experience in using some commercial devices based on Debian Linux to control the electrostatic deflectors installed on the beam line at the output of target chamber. We discuss this solution and compare it to other IOC implementations in use in the Target control system.

WEPMN002 **The CERN Accelerator Front-End Software Architecture (FESA)** – *M. Arruat (CERN), L. Fernandez, J.P. Palluel, D.G. Saavedra (CERN)*
At CERN, all equipment software running in the Front-end is hosted by a unique real-time C++ Framework (FESA). FESA defines a high level modeling language to design any type of equipment software and provides a unique architecture. FESA has become an extreme success in the standardization of the front-end software development for the LHC and its injectors. Recently, a brand new version of FESA was developed through a CERN-GSI collaboration. This brand new product brings exportability and specialization per laboratories, as well as many other improvements: an integrated development environment, based on a dedicated Eclipse plug-in, that guides the developer through all the stages of the software development life cycle; a complete abstraction of the accelerator timing system; a support of relationships (association, composition, inheritance) making the equipment software reusable. The new version of FESA is a breakthrough for the development of the front-end software for the LHC and injectors at CERN. Nowadays, FESA is not only a success at CERN but is also becoming the future of the controls systems for FAIR at GSI. This paper will present all the new features, focusing in the programming paradigms, like Metaprogramming, Event-driven, Parallel-processing, Data-driven, Abstraction, Polymorphism, that FESA brings at the level of equipment software.

WEPMN003 **Implementing Hard Real-time in Distributed Control Systems** – *J.C. Bau (CERN), J. Serrano (CERN)*

The CERN accelerator control system is mainly based on a distributed architecture where real-time tasks are executed in front-end computers running the Linux operating system. Upon arrival of real-time timing messages, these tasks are triggered and access hardware modules (function generators, fieldbus masters, ...) to change settings and collect acquisition data. The main issue with this design model is the execution time which is not predictable due to many uncontrollable factors like the operating system and the interaction among real-time tasks sharing the same processor. To solve this problem, we propose to transfer the critical tasks currently executed in the host towards the hardware modules, and also to connect them to the timing system. This solution has the advantage of shielding the real-time processing from host software crashes. The proposed hardware support is based on generic carrier cards in several form factors and VITA 57 FPGA Mezzanine Cards (FMC). Critical software will be downloadable via the host and executed by an embedded processor in a single-task single-user environment. This approach for real-time processing results in improved reliability and opens the way to new control strategies.

WEPMN005 **Spiral2 Control Command: a Standardized Interface between High Level Applications and EPICS IOCs** – *C.H. Haquin (GANIL)*

The SPIRAL2 linear accelerator will produce entirely new particle beams enabling exploration of the boundaries of matter. Coupled with the existing GANIL machine this new facility will produce light and heavy exotic nuclei at extremely high intensities. The field deployment of the Control System relies on Linux PCs and servers, VME VxWorks crates and Siemens PLCs; equipment will be addressed either directly or using a Modbus/TCP field bus network. Several laboratories are involved in the software development of the control system. In order to improve efficiency of the collaboration, special care is taken of the software organization. During the development phase, in a context of tough budget and time constraints, this really makes sense, but also for the exploitation of the new machine, it helps us to design a control system that will require as little effort as possible for maintenance and evolution. The major concepts of this organization are the choice of EPICS, the definition of an EPICS directory tree specific to SPIRAL2, called"topSP": this is our reference work area for development, integration and exploitation, and the use of version control system (SVN) to store and share our developments independently of the multi-site dimension of the project. The next concept is the definition of a"standardized interfac" between high level applications programmed in Java and EPICS databases running in IOCs. This paper relates the rationale and objectives of this interface and also its development cycle from specification using UML diagrams to testing on the actual equipment.

WEPMN006 **Commercial FPGA Based Multipurpose Controller: Implementation Perspective** – *I. Arredondo (ESS-Bilbao), D. Belver, P. Echevarria, M. Eguiraun, H. Hassanzadegan, M. del Campo (ESS-Bilbao) V. Etxebarria, J. Jugo (University of the Basque Country, Faculty of Science and Technology) N. Garmendia, L. Muguira (ESS Bilbao)*

This work presents a fast acquisition multipurpose controller, focussing on its EPICS integration and on its XML based configuration. This controller is based on a Lyrtech VHS-ADC board which encloses an FPGA, connected to a Host PC. This Host acts as local controller and implements an IOC integrating the device in an EPICS network. These tasks have been performed using Java as the main tool to program the PC to make the device fit the desired application. All the process includes the use of different technologies: JNA to handle C functions i.e. FPGA API, JavaIOC to integrate EPICS and XML w3c DOM classes to easily configure the particular application. In order to manage the functions, Java specific tools have been developed: Methods to manage the FPGA (read/write registers, acquire data,…), methods to create and use the EPICS server (put, get, monitor,…), mathematical methods to process the data (numeric format conversions,…) and methods to create/initialize the application structure by means of an XML file (parse elements, build the DOM and the specific application structure). This XML file has some common nodes and tags for all the applications: FPGA registers specifications definition and EPICS variables. This means that the user only has to include a node for the specific application and use the mentioned tools. It is the developed main class which is in charge of managing the FPGA and EPICS server according to this XML file. This multipurpose controller has been successfully used to implement a BPM and an LLRF application for the ESS-Bilbao facility.

Operational tools and operators' view

WEPMN007 **An Operational Event Announcer for the LHC Control Centre Using Speech Synthesis** – *S.T. Page (CERN), R. Alemany-Fernandez (CERN)*

The LHC island of the CERN Control Centre is a busy working environment with many status displays and running software applications. An audible event announcer was developed in order to provide a simple and efficient method to notify the operations team of events occurring within the many subsystems of the accelerator. The LHC Announcer uses speech synthesis to report messages based upon data received from multiple sources. General accelerator information such as injections, beam energies and beam dumps are derived from data received from the LHC Timing System. Additionally, a software interface is provided that allows other surveillance processes to send messages to the Announcer using the standard control system middleware. Events are divided into categories which the user can enable or disable depending upon their interest. Use of the LHC Announcer is not limited to the Control Centre and is intended to be available to a wide audience, both inside and outside CERN. To accommodate this, it was designed to require no special software beyond a standard web browser. This paper describes the design of the LHC Announcer and how it is integrated into the LHC operational environment.

Embedded + realtime software

WEPMN008 **Function Generation and Regulation Libraries and their Application to the Control of the New Main Power Converter (POPS) at the CERN CPS** – *Q. King (CERN), S.T. Page, H. Thiesen (CERN) M. Veenstra (EBG MedAustron)*

Power converter control for the LHC is based on an embedded control computer called a Function Generator/Controller (FGC). Every converter includes an FGC with responsibility for the generation of the reference current as a function of time and the regulation of the circuit current, as well as control of the converter state. With many new converter controls software classes in development it was decided to generalise several key components of the FGC software in the form of C libraries: function generation in libfg, regulation, limits and simulation in libreg and DCCT, ADC and DAC calibration in libcal. These libraries were first used in the software class dedicated to controlling the new 60MW main power converter (POPS) at the CERN CPS where regulation of both magnetic field and circuit current is supported. This paper reports on the functionality provided by each library and in particular libfg and libreg. The libraries are already being used by software classes in development for the next generation FGC for Linac4 converters, as well as the CERN SPS converter controls (MUGEF) and MedAustron converter regulation board (CRB).

WEPMN009 **Simplified Instrument/Application Development and System Integration Using Libera Base Building Blocks** – *M. Kenda (I-Tech), T. Beltram, T. Juretic, B. Repic, S. Skvarc, C. Valentincic (I-Tech)*

Development of many appliances used in scientific environment forces us to face similar challenges, often executed repeatedly. One has to design or integrate hardware components. Support for network and other communications standards needs to be established. Data and signals are processed and dispatched. Interfaces are required to monitor and control the behaviour of the appliances. At Instrumentation Technologies we identified and addressed these issues by creating a generic framework which is composed of several reusable building blocks. They simplify some of the tedious tasks and leave more time to concentrate on real issues of the application. Further more, the end product quality benefits from larger common base of this middle-ware. We will present the benefits on concrete example of instrument implemented on MTCA platform accessible over graphical user interface.

WEPMN010 **Programmable Signal Generator for a Solid Target Electroplating** – *M.G. Hur (KAERI), I.J. Kim, E.J. Lee, J.H. Park, S.D. Yang (KAERI)*

Solid target with cyclotron can be used to produce many useful metal radioisotopes, such as Tl-201, Ga-67, In-111, Pd-10^3 and so on. In order to produce designated radionuclides effectively and efficiently, the electroplated solid targets should satisfy not only physicochemical quality requirements on metal layers but also a set of demands on the plating technology, such as plating mechanics and signal waveform. Particularly, several waveforms are known as optimum choices for the specific radionuclides. For instances, chopped bipolar sawtooth and chopped cathodic sine signals are practically optimum selections, respectively, for the high quality Tl-201 and Ga-67 targets. In this research, electroplating signal generation methodology is considered. Particularly, program based signal generation module is designed and developed as an embedded system. The main components of the embedded system are microcontroller and digital-to-analog converter. The flash-based microcontroller is featured as RISC CPU with simple 35 instructions, low power consumption, and various peripherals characteristics. The developed signal generator provides flexibility in the choice of signal type. In other words, the signal generation module can generate completely different electroplating signals by downloading the designated program without any kind of variation in hardware.

WEPMN011 **Controlling the EXCALIBUR Detector** – *J.A. Thompson (Diamond), I. Horswell, J. Marchal, U.K. Pedersen (Diamond) S.R. Burge, J.D. Lipp, T.C. Nicholls (STFC/RAL)*
EXCALIBUR is an advanced photon counting detector being designed and built by a collaboration of Diamond Light Source and the Science and Technology Facilities Council. It is based around 48 CERN Medipix III silicon detectors arranged as an 8x6 array. The main problem addressed by the design of the hardware and software is the uninterrupted collection and safe storage of image data at rates up to one hundred (2048x1536) frames per second. This is achieved by splitting the image into six 'stripes' and providing parallel data paths for them all the way from the detectors to the storage. This architecture requires the software to control the configuration of the stripes in a consistent manner and to keep track of the data so that the stripes can be subsequently stitched together into frames.

WEPMN012 **PC/10^4 Asyn Drivers at Jefferson Lab** – *J. Yan (JLAB), S.D. Witherspoon (JLAB)*
PC/10^4 embedded IOCs that run RTEMS and EPICS have been applied in many new projects at Jefferson Lab. Different commercial PC/10^4 I/O modules on the market such as digital I/O, data acquisition, and communication modules are integrated in our control system. AsynDriver, which is a general facility for interfacing device specific code to low level drivers, was applied for PC/10^4 serial communication I/O cards. We choose the ines GPIB-PC/10^4-XL as the GPIB interface module and developed the low lever device driver that is compatible with the asynDriver. The ines GPIB-PC/10^4-XL has iGPIB 72110 chip, which is register compatible with NEC uPD7210 in GPIB Talker/Listener applications. Instrument device support was created to provide access to the operating parameters of GPIB devices. Low level device driver for the serial communication board Model 10^4-COM-8SM was also developed to run under asynDriver. This serial interface board contains eight independent ports and provides effective RS-485, RS-422 and RS-232 multipoint communication. StreamDevice protocols were applied for the serial communications. The asynDriver in PC/10^4 IOC application provides standard interface between the high level device support and hardwire level device drivers. This makes it easy to develop the GPIB and serial communication applications in PC/10^4 IOCs.

WEPMN013 **Recent Developments in Synchronised Motion Control at Diamond Light Source** – *B.J. Nutter (Diamond), T.M. Cobb, M.R. Pearson, N.P. Rees, F. Yuan (Diamond)*
At Diamond Light Source the EPICS control system is used with a variety of motion controllers. The use of EPICS ensures a common interface over a range of motorised applications. We have developed a system to enable the use of the same interface for synchronised motion over multiple axes using the Delta Tau PMAC controller. Details of this work will be presented, along with examples and possible future developments.

WEPMN014 **The Software and Hardware Architectural Design of the Vessel Thermal Map Real-Time System in JET** – *D. Alves (IPFN), A. Neto, D.F. Valcárcel (IPFN) P. Card, R.C. Felton, A. Goodyear, P.J. Lomas, P. McCullen, A.V. Stephen, K-D. Zastrow (CCFE) S. Jachmich (RMA)*

The installation of ITER-relevant materials for the plasma facing components (PFCs) in the Joint European Torus (JET) is expected to have a strong impact on the operation and protection of the experiment. In particular, the use of all-beryllium tiles, which deteriorate at a substantially lower temperature than the formerly installed CFC tiles, imposes strict thermal restrictions on the PFCs during operation. Prompt and precise responses are therefore required whenever anomalous temperatures are detected. The new Vessel Thermal Map (VTM) real-time application collects the temperature measurements provided by dedicated pyrometers and Infra-Red (IR) cameras, groups them according to spatial location and probable offending heat source and raises alarms that will trigger appropriate protective responses. In the context of JET's global scheme for the protection of the new wall, the system is required to run on a 10 millisecond cycle communicating with other systems through the Real-Time Data Network (RTDN). In order to meet these requirements a Commercial Off-The-Shelf (COTS) solution has been adopted based on standard x86 multi-core technology, Linux and the Multi-threaded Application Real-Time executor (MARTe) software framework. This paper presents an overview of the system with particular technical focus on the configuration of its real-time capability and the benefits of the modular development approach and advanced tools provided by the MARTe framework.

WEPMN015 **Timing-system Solution for MedAustron; Real-time Event and Data Distribution Network** – *R. Stefanic (Cosylab), J. Dedic, R. Tavcar (Cosylab) J. Gutleber (CERN) R. Moser (EBG MedAustron)*

MedAustron is an ion beam cancer therapy and research centre currently under construction in Wiener Neustadt, Austria. This facility features a synchrotron particle accelerator for light ions. A timing system is being developed for that class of accelerators targeted at clinical use as a product of close collaboration between MedAustron and Cosylab. We redesignedμResearch Finland transport layer's FPGA firmware, extending its capabilities to address specific requirements of the machine to come to a generic real-time broadcast network for coordinating actions of a compact, pulse-to-pulse modulation based particle accelerator. One such requirement is the need to support for configurable responses to timing events on the receiver side. The system comes with National Instruments LabView based software support, ready to be integrated into the PXI based front-end controllers. This paper explains the design process from initial requirements refinement to technology choice, architectural design and implementation. It elaborates the main characteristics of the accelerator that the timing system has to address, such as support for concurrently operating partitions, real-time and non real-time data transport needs and flexible configuration schemes for real-time response to timing event reception. Finally, the architectural overview is given, with the main components explained in due detail.

WEPMN016 **Synchronously Driven Power Converter Controller Solution for MedAustron** – *L. Sepetavc (Cosylab), J. Dedic, R. Tavcar (Cosylab) J. Gutleber (CERN) R. Moser (EBG MedAustron)*

MedAustron is an ion beam cancer therapy and research centre currently under construction in Wiener Neustadt, Austria. This facility features a synchrotron particle accelerator for light ions. Cosylab is closely working together with MedAustron on the development of a power converter controller (PCC) for the 260 deployed converters. The majority are voltage sources that are regulated in real-time via digital signal processor (DSP) boards. The in-house developed PCC operates the DSP boards remotely, via real-time fiber optic links. A single PCC will control up to 30 power converters that deliver power to magnets used for focusing and steering particle beams. Outputs of all PCCs must be synchronized within a time frame of at most 1 microsecond, which is achieved by integration with the timing system. This pulse-to-pulse modulation machine requires different waveforms for each beam generation cycle. Dead times between cycles must be kept low, therefore the PCC is reconfigured during beam generation. The system is based on a PXI platform from National Instruments running LabVIEW Real-Time. An in-house developed generic real-time optical link connects the PCCs to custom developed front-end devices. These FPGA-based hardware components facilitate integration with different types of power converters. All PCCs are integrated within the SIMATIC WinCC OA SCADA system which coordinates and supervises their operation. This paper describes the overall system architecture, its main components, challenges we faced and the technical solutions.

WEPMN017 **PCI Hardware Support in LIA-2 Control System** – *D. Bolkhovityanov (BINP SB RAS), P.B. Cheblakov (BINP SB RAS)*

LIA-2 control system* is built on cPCI crates with x86-compatible processor boards running Linux. Slow electronics is connected via CAN-bus, while fast electronics (4MHz and 200MHz fast ADCs and 200MHz timers) are implemented as cPCI/PMC modules. Several ways to drive PCI control electronics in Linux were examined. Finally a userspace drivers approach was chosen. These drivers communicate with hardware via a small kernel module, which provides access to PCI BARs and to interrupt handling. This module was named USPCI (User-Space PCI access). This approach dramatically simplifies creation of drivers, as opposed to kernel drivers, and provides high reliability (because only a tiny and thoroughly-debugged piece of code runs in kernel). LIA-2 accelerator was successfully commissioned, and the solution chosen has proven adequate and very easy to use. Besides, USPCI turned out to be a handy tool for examination and debugging of PCI devices direct from command-line. In this paper available approaches to work with PCI control hardware in Linux are considered, and USPCI architecture is described.

WEPMN018 **Performance Tests of the Standard FAIR Equipment Controller Prototype** – *S. Rauch (GSI), R. Baer, W. Panschow, M. Thieme (GSI)*
For the control system of the new FAIR accelerator facility a standard equipment controller, the Scalable Control Unit (SCU), is presently under development. First prototypes have already been tested in real applications. The controller combines an x86 ComExpress Board and an Altera Arria II FPGA. Over a parallel bus interface called the SCU bus, up to 12 slave boards can be controlled. Communication between CPU and FPGA is done by a PCIe link. We discuss the real time behaviour between the Linux OS and the FPGA Hardware. For the test, a Front-End Software Architecture (FESA) class, running under Linux, communicates with the PCIe bridge in the FPGA. Although we are using PCIe only for single 32 bit wide accesses to the FPGA address space, the performance still seems sufficient. The tests showed an average response time to IRQs of 50 microseconds with a 1.6 GHz Intel Atom CPU. This includes the context change to the FESA userspace application and the reply back to the FPGA. Further topics are the bandwidth of the PCIe link for single/burst transfers and the performance of the SCU bus communication.

WEPMN019 **A User Configurable Digital Signal Processing Platform for High-rate, High Channel Count Data Acquisition Systems** – *A.N. Salim (University of Strathclyde), L. Crockett (University of Strathclyde) J.W. McLean, P.G. Milne (D-TACQ Solutions)*
A real-time digital signal processing platform has been developed for control and data acquisition applications in high energy physics. The D-TACQ Reconfigurable User In-line DSP (DRUID) system allows users to customize and assemble Digital Signal Processing (DSP) systems for high speed, high channel count applications. This paper will demonstrate how the DRUID system can be used to carry out signal processing tasks in hardware accelerators implemented in a Field Programmable Gate Array (FPGA), using an embedded microprocessor to control the flow of data. Users can choose signal processing units from a hardware library already implemented in the FPGA and configure programmable parameters using a conventional software high level language. This saves the users the time, cost and complexity of designing hardware systems, allows system upgrades as required, and enables the same hardware to be used for multiple applications, simply by changing the software routine. A matrix multiply DSP unit has been developed for plasma control applications and is shown to compute a 32x32 square matrix multiplication with a 32x1 channel vector in less than 1 μs. The size and dimensions of the matrices are programmable by the user with up to 96 input channels. The architecture of this unit is described to demonstrate how it allows matrix coefficients to be updated in real time. The DRUID platform has been implemented on a field upgrade to existing D-TACQ digitizers that provides high speed data streaming links on PCIe, optical fiber and Gigabit Ethernet.

WEPMN020 **New Developments on Tore Supra Data Acquisition Units** – *F. Leroux (Association EURATOM-CEA), G. Caulier, L. Ducobu (Association EURATOM-CEA)*
Tore Supra data acquisition system (DAS) was designed in the early 1980s and has considerably evolved since then. Three generations of data acquisition units still coexist: Multibus, VME, and PCI bus system. The second generation, VME bus system, running LynxOS real-time operating system (OS) is diskless. The third generation, PCI bus system, allows to perform extensive data acquisition for infrared and visible video cameras that produce large amounts of data to handle. Nevertheless, this third generation was up to now provided with an hard

drive and a non real-time operating system Microsoft Windows. Diskless system is a better solution for reliability and maintainability as they share common resources like kernel and file system. Moreover, open source real-time OS is now available which provide free and convenient solutions for DAS. As a result, it was decided to explore an alternative solution based on an open source OS with a diskless system for the fourth generation. In 2010, Linux distributions for VME bus and PCI bus systems have been evaluated and compared to LynxOS. Currently, Linux OS is fairly mature to be used on DAS with pre-emptive and real time features on Motorola PowerPC, x86 and x86 multi-core architecture. The results allowed to choose a Linux version for VME and PC platform for DAS on Tore Supra. In 2011, the Tore Supra DAS dedicated software was ported on a Linux diskless PCI platform. The new generation was successfully tested during real plasma experiment on one diagnostic. The new diagnostics for Tore Supra will be developed with this new set up.

WEPMN022 **LIA-2 Power Supply Control System** – *A. Panov (BINP SB RAS), P.A. Bak, D. Bolkhovityanov (BINP SB RAS)*
LIA-2 is an electron Linear Induction Accelerator designed and built by BINP for flash radiography. Inductors get power from 48 modulators, grouped by 6 in 8 racks. Each modulator includes 3 control devices, connected via internal CAN bus to an embedded modulator controller, which runs Keil RTX real-time OS. Each rack includes a cPCI crate equipped with x86-compatible processor board running Linux*. Modulator controllers are connected to cPCI crate via external CAN bus. Additionally, brief modulator status is displayed on front indicator. Integration of control electronics into devices with high level of electromagnetic interferences is discussed, use of real-time OSes in such devices and interaction between them is described.

WEPMN023 **The ATLAS Tile Calorimeter Detector Control System** – *G. Arabidze (MSU)*
The main task of the ATLAS Tile calorimeter Detector Control System (DCS) is to enable the coherent and safe operation of the calorimeter. All actions initiated by the operator, as well as all errors, warnings and alarms concerning the hardware of the detector are handled by DCS. The Tile calorimeter DCS controls and monitors mainly the low voltage and high voltage power supply systems, but it is also interfaced with the infrastructure (cooling system and racks), the calibration systems, the data acquisition system, configuration and conditions databases and the detector safety system. The system has been operational since the beginning of LHC operation and has been extensively used in the operation of the detector. In the last months effort was directed to the implementation of automatic recovery of power supplies after trips. Current status, results and latest developments will be presented.

WEPMN024 **NSLS-II Beam Position Monitor Embedded Processor and Control System*** – *K. Ha (BNL)*

NSLS-II Digital Beam Position Monitor (DBPM) system electronics and embedded software processor has been successfully tested in the ALS storage ring and BNL Lab. Digital Front End (DFE) board main device which is Virtex-5 for DFE-1 and Virtex-6 for DFE-2, it provides Gigabit hardware TEMAC core and Microblaze soft CPU for system on a chip embedded applications. Digital signal processing parts implemented by System Generator and Matlab Simulink tools and embedded processor were designed Xilinx EDK kernel based multi thread applications. DBPM Control System is based on the EPICS IOC for DBPM signal control and monitoring, IOC and DBPM communication used robust simple protocol it directly accesses 1 GByte DDR-3 memory space. EPICS IOC uses Industrial PC and Linux Operation System and supports waveform monitoring which is ADC raw waveform (117 MHz), Turn by Turn (TBT, 378 kHz) waveform, Fast waveform (FA, 10 kHz) and Slow data (SA, 10 Hz). ADC raw, TBT and FA data is operated on demand and support large 1 million samples history buffer data (~ 32 Mbytes) transmitter to host computers (EPICS IOC, Matlab stand alone client computer). EPICS IOC application program is based on Asyn driver for custom TCP/IP communication it provides very stable communication with NSLS-II DBPM.

WEPMN025 **A Triggerless Acquisition System For Large Detector Arrays** – *P. Mutti (ILL), M. Jentschel, J. Ratel, F. Rey, E. Ruiz-Martinez, W. Urban (ILL)*

Presently a common characteristic trend in low and medium energy nuclear physics is to develop more complex detector systems to form multi-detector arrays. The main objective of such an elaborated set-up is to obtain comprehensive information about the products of all reactions. State-of-art γ-ray spectroscopy requires nowadays the use of large arrays of HPGe detectors often coupled with anti-Compton active shielding to reduce the ambient background. In view of this complexity, the front-end electronics must provide precise information about energy, time and possibly pulse shape. The large multiplicity of the detection system requires the capability to process the multitude of signals from many detectors, fast processing and very high throughput of more that 10^6 data words/sec. The possibility to handle such a complex system using traditional analogue electronics has shown rapidly its limitation due, first of all, to the non negligible cost per channel and, moreover, to the signal degradation associated to complex analogue path. Nowadays, digital pulse processing systems are available, with performances, in terms of timing and energy resolution, equal when not better than the corresponding analogue ones for a fraction of the cost per channel. The presented system uses a combination of a 15-bit 10^0 MS/s digitizer with a PowerPC-based VME single board computer. Real-time processing algorithms have been developed to handle total event rates of more than 1 MHz, providing on-line display for single and coincidence events.

WEPMN026 **Evolution of the CERN Power Converter Function Generator/Controller for Operation in Fast Cycling Accelerators** – *D.O. Calcoen (CERN), Q. King, P.F. Semanaz (CERN)*

Power converters in the LHC are controlled by the second generation of an embedded computer known as a Function Generator/Controller (FGC2). Following the success of this control system, new power converter installations at CERN will be based around an evolution of the design - a third generation called FGC3. The FGC3 will initially be used in the PS Booster and Linac4. This paper compares the hardware of the two generations of FGC and details the decisions made during the design of the FGC3.

WEPMN027 **Fast Scalar Data Buffering Interface in Linux 2.6 Kernel** – *A. Homs (ESRF)*
Key instrumentation devices like counter/timers, analog-to-digital converter and encoders provide scalar data input. Many of them allow fast acquisitions, but do not provide hardware triggering or buffering mechanisms. A Linux 2.4 kernel driver called Hook was developed at the ESRF as a generic software-triggered buffering interface. This work presents the portage of the ESRF Hook interface to the Linux 2.6 kernel. The interface distinguishes two independent functional groups: trigger event generators and data channels. Devices in the first group create software events, like hardware interrupts generated by timers or external signals. On each event, one or more device channels on the second group are read and stored in kernel buffers. The event generators and data channels to be read are fully configurable before each sequence. Designed for fast acquisitions, the Hook implementation is well adapted to multi-CPU systems, where the interrupt latency is notably reduced. On heavily loaded dual-core PCs running standard (non real time) Linux, data can be taken at 1 KHz without losing events. Additional features include full integration into the sysfs (/sys) virtual filesystem and hotplug devices support.

WEPMN028 **Development of Image Data Acquisition System for Large Scale X-ray 2D Detector Experiments at SACLA (SPring-8 XFEL)** – *A. Kiyomichi (JASRI/SPring-8), A. Amselem, T. Hirono, T. Ohata, R. Tanaka, M. Yamaga (JASRI/SPring-8) T. Hatsui (RIKEN/SPring-8)*
The x-ray free electron laser facility SACLA (SPring-8 Angstrom Compact free electron LAser) was constructed and started beam commissioning from March 2011. For the requirements of proposed experiments at SACLA, x-ray multi-readout ports CCD detectors (MPCCD) have been developed to realize a system with the total amount of 4 Mega-pixels area and 16bit wide dynamic range at a frame rate of 60Hz shot rate. We have developed the image data-handling scheme using the event-synchronized data-acquisition system. The front-end system used the CameraLink interface that excels in abilities of real-time triggering and high-speed data transfer. For the total data rate up to 4Gbps, the image data are collected by dividing the CCD detector into eight segments, which handles 0.5M pixels each, and then sent to high-speed data storage in parallel. We prepared two types of Cameralink imaging system for the VME and PC base. The Image Distribution board is made up of logic-reconfigurable VME board with CameraLink mezzanine card. The front-end system of MPCCD detector consists of eight sets of Image Distribution boards. We plan to introduce the online lossless compression using FPGA with arithmetic coding algorithm. For wide adaptability of user requirements, we also prepared the PC based imaging system, which consists of Linux server and commercial CameraLink PCI interface. It does not contain compression function, but supports various type of CCD camera, for example, high-definition (1920x1080) single CCD camera.

WEPMN029 **Event-based Timing Control System at SuperKEKB Injection** – *K. Furukawa (KEK), T.T. Nakamura, M. Satoh, T. Suwada (KEK) T. Kudou, S. Kusano (MELCO SC)*

The event-based timing control system has been proved to be very effective for the simultaneous/alternative beam injections to three storage rings at 50-Hz. It performed successfully as another faster control layer beside the EPICS control layer. In the SuperKEKB project, a damping ring will be constructed at the middle of the linac in order to achieve a positron beam with lower emittance, which is required by the beam optics design at the interaction region. The injection and extraction scheme at the damping and main rings was designed satisfying several criteria, which include the RF frequencies at the linac and the rings synchronized with large integers of 49 and 275, dual beam bunches in a linac pulse, and rising and falling times of the kickers. The harmonic number of the damping ring was chosen to allow wider range of buckets to be filled in the main ring. In order to enable the full bucket selection, a pulse-to-pulse LLRF adjustment system will be installed at the latter half of the linac, based on the cascaded event timing system. Pulse-to-pulse injection switching between SuperKEKB, PF-AR with positron and Photon Factory with electron is also discussed.

WEPMN030 **Power Supply Control Interface for the Taiwan Photon Source** – *C.Y. Wu (NSRRC), J. Chen, Y.-S. Cheng, P.C. Chiu, K.T. Hsu, K.H. Hu, C.H. Kuo, K.-B. Liu (NSRRC)*

The Taiwan Photon Source (TPS) is a latest generation synchrotron light source. Stringent power supply specifications should be met to achieve design goals of the TPS. High precision power supply equipped with 20, 18, and 16 bits DAC for the storage ring dipole, quadrupole, and sextupole are equipped with Ethernet interfaces. Control interface include basic functionality and some advanced features which are useful for performance monitoring and post-mortem diagnostics. Power supply of these categories can be accessed by EPICS IOCs. The corrector power supplies' control interface is a specially designed embedded interface module which will be mounted on the corrector power supply cages to achieve required performance. The setting reference of the corrector power supply is generated by 20 bits DAC and readback is done by 24 bits ADC. The interface module has embedded EPICS IOC for slow control. Fast setting ports are also supported by the internal FPGA for orbit feedback supports.

WEPMN031 **A Prototype of CSNS Power Supply Control Based on Embedded IOC** – *X. Wu (IHEP Beijing), Y.C. He, C.H. Wang, J.C. Wang (IHEP Beijing)*

In the concept phase, there are 5 kinds of power supply of the China Spallation Neutron Source (CSNS) rapid cycling synchrotron (RCS). The control of the main magnet family using White Circuits and resonance excite at 25Hz. The internal control of RCS power supply is designed to use the Digital Power Supply Control Module (DPSCM), which can regulate the current and voltage circuit. As there is only serial port available on the board, so we use the MOXA DA682 embedded controller to interface with DPSCM. Linux operation system and EPICS IOC run on the DA682, which takes the responsibility of controlling power supply and data acquisition. In the test, embedded IOC can communicate well with DPSCM by RS232 protocol. This prototype is stable and reliable.

WEPMN032 **Development of Pattern Awareness Unit (PAU) for the LCLS Beam Based Fast Feedback System** – *K.H. Kim (SLAC), S. Allison, D. Fairley, T.M. Himel, P. Krejcik, D. Rogind, E. Williams (SLAC)*

LCLS is now successfully operating at its design beam repetition rate of 120 Hz, but in order to ensure stable beam operation at this high rate we have developed a new timing pattern aware EPICS controller for beam line actuators. Actuators that are capable of responding at 120 Hz are controlled by the new Pattern Aware Unit (PAU) as part of the beam-based feedback system. The beam at the LCLS is synchronized to the 60 Hz AC power line phase and is subject to electrical noise which differs according to which of the six possible AC phases is chosen from the 3-phase site power line. Beam operation at 120 Hz interleaves two of these 60 Hz phases and the feedback must be able to apply independent corrections to the beam pulse according to which of the 60 Hz timing patterns the pulse is synchronized to. The PAU works together with the LCLS Event Timing system which broadcasts a timing pattern that uniquely identifies each pulse when it is measured and allows the feedback correction to be applied to subsequent pulses belonging to the same timing pattern, or time slot, as it is referred to at SLAC. At 120 Hz operation this effectively provides us with two independent, but interleaved feedback loops. Other beam programs at the SLAC facility such as LCLS-II and FACET will be pulsed on other time slots and the PAUs in those systems will respond to their appropriate timing patterns. This paper describes the details of the PAU development: real-time requirements and achievement, scalability, and consistency. The operational results will also be described.

WEPMN033 **Application of EPICS on F3RP61 to LLRF Control System for SuperKEKB** – *J.-I. Odagiri (KEK)*

For the SuperKEKB accelerator project, a prototype Low Level RF control system was designed and implemented to upgrade existing one, which is based on Experimental Physics and Industrial Control System. The new LLRF control system adopted F3RP61, a PLC's CPU that runs Linux as its operating system. The CPU works as an IOC together with a normal sequence CPU and I/O modules of the FA-M3 PLC. The PLC-based IOC replaced a VME-based IOC, CAMAC interface modules and part of NIM modules being used in the existing LLRF control system. The consolidation of the frontend control components into a single PLC made the system much simpler and increased flexibility in the modification of the control logic. This paper describes the implementation of the PLC-based embedded IOC of the new LLRF control system.

WEPMN034 **YAMS: a Stepper Motor Controller for the FERMI@Elettra Free Electron Laser** – *A. Abrami (ELETTRA), M. De Marco, M. Lonza, D. Vittor (ELETTRA)*

New projects, like FERMI@Elettra, demand for standardization of the systems in order to cut development and maintenance costs. The various motion control applications foreseen in this project required a specific controller able to flexibly adapt to any need while maintaining a common interface to the control system to minimize software development efforts. These reasons led us to design and build"Yet Another Motor Subrac", YAMS, a 3U chassis containing a commercial stepper motor controller, up to eight motor drivers and all the necessary auxiliary systems. The motors can be controlled locally by means of an operator panel or remotely through an Ethernet interface and a dedicated Tango device server. The paper describes the details of the project and the deployment issues.

WEPMN035 **Symmetric Multi Processor (SMP) Supports for EPICS** – *K.H. Kim (SLAC), E. Williams (SLAC)*

The Symmetric Multi Processor (SMP) technology has been utilized in embedded real-time software. However, EPICS, developed for multi-processing, multi-threading, has not yet achieved the real advantage of SMP. We are considering two major achievements with the SMP. The first one is the isolation between critical tasks and non-critical tasks in load balancing. EPICS has multiple critical tasks which are deeply involved in the real-time performance. EPICS also has non-critical tasks which are not involved in the real-time performance directly, but are performing communication, logging and some other functions. We want to make a partition between both, and if non-critical tasks got overloaded, we want to isolate it from overloading the critical tasks. Then, we can protect the real-time performance. We can implement it with CPU affinity in SMP. We are also considering the other major achievement: improving real-time performance with multi-threads on the multiple cores in SMP. EPICS contains callback tasks at the heart of real-time processing, and can create hot spots for CPU usage. We can make multiple, identical tasks for the callbacks and those tasks should share a callback request queue. Then, multiple callback requests can proceed in multiple tasks on multiple cores concurrently. It can bring a significant real-time performance improvement. But, it can create other issues with the concurrent processing. In this paper, we discuss the detailed issues, our performance testing results, and (*) our implementation details in the Operating System Independent (OSI) layer in EPICS.

WEPMN036 **Qualitative Comparison of EPICS IOC and MARTe for the Development of a Hard Real-Time Control Application** – *A. Barbalace (Consorzio RFX, Associazione Euratom-ENEA sulla Fusione), G. Manduchi (Consorzio RFX, Associazione Euratom-ENEA sulla Fusione)*

EPICS is used worldwide to setup distributed control systems for scientific experiments. The EPICS software suite is based around its Channel Access (CA) network protocol that allows the communication of different EPICS' clients and servers in a distributed architecture. Servers are called Input/Output Controllers (IOCs) and perform real-world I/O or local control tasks. EPICS IOCs were designed on VxWorks to meet the demanding/real-time requirements of control algorithms and lately ported to several operating systems. The MARTe framework has been recently adopted to develop an increasing number of hard real-time systems in different fusion experiments. MARTe is a software library that allows the rapid and modular development of stand-alone hard real-time control applications on various operating systems. Different MARTe application can federate other distributed networks (like EPICS and MDSplus). MARTe was born to be portable and during the last years it was continually upgraded to support the multicore architectures. In this paper we review several implementation differences between EPICS IOC and MARTe. We dissect their internal data structures and synchronization mechanisms to understand what happens behind the scenes. Differences in the component based approach and in the concurrent model of computation of an EPICS IOC and a MARTe application is shown. Such differences lead to distinct time models in the computational blocks (records and GAMs) of the two softwares that a developer must be aware of. The article ends analyzing the debugging and introspection tools.

WEPMN037 **DEBROS: Design and Use of a Linux-like RTOS on an Inexpensive 8-bit Single Board Computer** – *M.A. Davis (NSCL)*

As the power, complexity, and capabilities of embedded processors continues to grow, it is easy to forget just how much can be done with inexpensive single board computers based on 8-bit processors. When the proprietary, non-standard tools from the vendor for one such embedded computer became a major roadblock, I embarked on a project to expand my own knowledge and provide a more flexible, standards based alternative. Inspired by operating systems such as Unix, Linux, and Minix, I wrote DEBROS (the Davis Embedded Baby Real-time Operating System), which is a fully pre-emptive, priority-based OS with soft real-time capabilities that provides a subset of standard Linux/Unix compatible system calls such as stdio, BSD sockets, pipes, semaphores, etc. The end result was a much more flexible, standards-based development environment which allowed me to simplify my programming model, expand diagnostic capabilities, and reduce the time spent monitoring and applying updates to the hundreds of devices in the lab currently using this hardware.

WEPMN038 **A Combined On-line Acoustic Flowmeter and Fluorocarbon Coolant Mixture Analyzer for the ATLAS Silicon Tracker** – *A. Bitadze (University of Glasgow), R.L. Bates (University of Glasgow) M. Battistin, S. Berry, P. Bonneau, J. Botelho-Direito, B. Di Girolamo, J. Godlewski, E. Perez-Rodriguez, L. Zwalinski (CERN) N. Bousson, G.D. Hallewell, M. Mathieu, A. Rozanov (CNRS/CPT) R. Boyd (University of Oklahoma) M. Doubek, V. Vacek, M. Vitek (Czech Technical University in Prague, Faculty of Mechanical Engineering) K. Egorov (Indiana University) S. Katunin (PNPI) S. McMahon (STFC/RAL/ASTeC) K. Nagai (University of Tsukuba, Graduate School of Pure and Applied Sciences,)*

An upgrade to the ATLAS silicon tracker cooling control system requires a change from C3F8 (molecular weight 188) coolant to a blend with 10-30% C2F6 (mw 138) to reduce the evaporation temperature and better protect the silicon from cumulative radiation damage at LHC. Central to this upgrade an acoustic instrument for measurement of C3F8/C2F6 mixture and flow has been developed. Sound velocity in a binary gas mixture at known temperature and pressure depends on the component concentrations. 50kHz sound bursts are simultaneously sent via ultrasonic transceivers parallel and anti-parallel to the gas flow. A 20MHz transit clock is started synchronous with burst transmission and stopped by over-threshold received sound pulses. Transit times in both directions, together with temperature and pressure, enter a FIFO memory 100 times/second. Gas mixture is continuously analyzed using PVSS-II, by comparison of average sound velocity in both directions with stored velocity-mixture look-up tables. Flow is calculated from the difference in sound velocity in the two directions. In future versions these calculations may be made in a micro-controller. The instrument has demonstrated a resolution of <0.3% for C3F8/C2F6 mixtures with ~20%C2F6, with simultaneous flow resolution of ~0.1% of F.S. Higher precision is possible: a sensitivity of ~0.005% to leaks of C3F8 into the ATLAS pixel detector nitrogen envelope (mw difference 156) has been seen. The instrument has many applications, including analysis of hydrocarbons, mixtures for semi-conductor manufacture and anesthesia.

12-Oct-11 13:30 – 15:00	Poster	Mont Blanc Sud

WEPMS — Poster
Chair: J.M. Meyer (ESRF)

Quality assurance

WEPMS001 **Interconnection Test Framework for the CMS Level-1 Trigger System** – *J. Hammer (CERN) M. Magrans de Abril (UW-Madison/PD) C.-E. Wulz (HEPHY)*
The Level-1 Trigger Control and Monitoring System is a software package designed to configure, monitor and test the Level-1 Trigger System of the Compact Muon Solenoid (CMS) experiment at CERN's Large Hadron Collider. It is a large and distributed system that runs over 50 PCs and controls about 200 hardware units. The Interconnection Test Framework (ITF), a generic and highly flexible framework for creating and executing hardware tests within the Level-1 Trigger environment is presented. The framework is designed to automate testing of the 13 major subsystems interconnected with more than 1000 links. Features include a web interface to create and execute tests, modeling using finite state machines, dependency management, automatic configuration, and loops. Furthermore, the ITF will replace the existing heterogeneous testing procedures and help reducing maintenance and complexity of operation tasks. Finally, an example of operational use of the Interconnection Test Framework is presented. This case study proves the concept and describes the customization process and its performance characteristics.

WEPMS002 **The Commissioning Software of HIRFL-CSR** – *P. Li (IMP), J.C. Yang, Y.J. Yuan (IMP)*
HIRFL-CSR is a new ion cooler-storage-ring system in China's IMP (Institute of Modern Physics; it consists of a main ring (CSRm) and an experimental ring (CSRe). In this paper, the architecture and algorithm of the commissioning software of HIRFL-CSR is introduced firstly. Secondly, in order to enhance the facility reliability, the commissioning software of HIRFL-CSR was upgraded in several aspects which contain the change of the machine cycle to avoid the hysteresis effect of magnets and a slow feedback to keep stability of the magnetic field. All of them are described in this paper.

WEPMS003 **Testbed for Validating the LHC Controls System Core Before Deployment** – *J. Nguyen Xuan (CERN), V. Baggiolini (CERN)*
Since the start-up of the LHC, it is crucial to carefully test core controls components before deploying them operationally. The Testbed of the CERN accelerator controls group was developed for this purpose. It contains different hardware (PPC, i386) running different operating systems (Linux and LynxOS) and core software components running on front-ends, communication middleware and client libraries. The Testbed first executes integration tests to verify that the components delivered by individual teams interoperate, and then system tests, which verify high-level, end-user functionality. It also verifies that different versions of components are compatible, which is vital, because not all parts of the operational LHC control system can be upgraded simultaneously. In addition, the Testbed can be used for performance and stress tests. Internally, the Testbed is driven by Bamboo, a Continuous Integration server, which builds and deploys automatically new software versions into the Testbed environment and executes the tests continuously to prevent from software regression. Whenever a test fails, an e-mail is sent to the appropriate persons. The Testbed is part of the official controls development process wherein new releases of the controls

system have to be validated before being deployed operationally. Integration and system tests are an important complement to the unit tests previously executed in the teams. The Testbed has already caught several bugs that were not discovered by the unit tests of the individual components.

WEPMS005 **Automated Coverage Tester for the Oracle Archiver of PVSS** – *A. Voitier (CERN), P. Golonka, M. Gonzalez-Berges (CERN)*
In a control system archived data have the important usage of providing feedback to the operators and experts about how the machine is behaving. Every year at CERN a large amount of these data are stored. The consistency of the archived data has to be ensured from writing to reading as well as across updates of the archiving system. The multiplicity of archived data types and other software contexts such as operating system, environment variables or version of the different software components involved is also a factor impacting the quality of service offered by the archiving system. An automatic tester has been implemented to execute test scripts in parallel. These scripts are generated based on templates and can cover a wide range of software contexts. The tester has been fully written in the same software environment as the targeted SCADA system. The current implementation is able to test over 300 use cases, both for normal events and alarms. It allowed to report issues to the commercial provider of the control system. The template mechanism allows sufficient flexibility to adapt the suite of tests to future needs. This tester can also be used during developments related to a part of the archiving system to broadly evaluate the functional impact of a modification. Parallel testing focusing on other components of the control system than archiving could as well reuse this software.

WEPMS006 **Automated testing of OPC Servers** – *B. Farnham (CERN)*
CERN relies on OPC Server implementations from 3rd party device vendors to provide a software interface to their respective hardware. Each time a vendor releases a new OPC Server version it is regression tested internally to verify that existing functionality has not been inadvertently broken during the process of adding new features. In addition bugs and problems must be communicated to the vendors in a reliable and portable way. This presentation covers the automated test approach used at CERN to cover both cases: Scripts are written in a domain specific language specifically created for describing OPC tests and executed by a custom software engine driving the OPC Server implementation.

WEPMS007 **Backward Compatibility as a Key Measure for Smooth Upgrades to the LHC Control System** – *V. Baggiolini (CERN), M. Arruat, R. Gorbonosov, W. Sliwinski, P. Tarasenko, Z. Zaharieva (CERN)*

Now that the LHC is operational, a big challenge is to upgrade the control system smoothly, with minimal downtime and interruptions. Backward compatibility (BC) is a key measure to achieve this: a subsystem with a stable API can be upgraded smoothly. As part of a broader Quality Assurance effort, the CERN Accelerator Controls group explored methods and tools supporting BC. We investigated two aspects in particular: (1)"API Usag", to know which part of an API is really used and (2) BC validation, to check that a modification is really backward compatible. We used this approach for Java APIs and for FESA devices (which expose an API in the form of device/property sets). For Java APIs, we gather usage information by regularly running byte-code analysis on all the 1000 Jar files that belong to the control system and find relevant dependencies (methods calls and inheritance). An Eclipse plug-in we developed shows this usage information to the owner of a Java API. If an API method is used by many clients, it has to remain backward compatible. On the other hand, if a method is not used, it can be freely modified. To validate BC, we explored the official Eclipse tools (PDE-API tools), but finally selected one that checks BC without need for invasive technology such as OSGi. For FESA devices, we instrumented key components of our controls system to know which devices and properties are in use. This"API usag" information is collected in the Controls Database and is used (amongst others) by the FESA design tools in order to prevent the FESA class developer from breaking BC.

WEPMS008 **Software Tools for Electrical Quality Assurance in the LHC** – *M. Bednarek (CERN) J. Ludwin (IFJ-PAN)*

There are over 1600 superconducting magnet circuits in the LHC machine. Many of them consist of a large number of components electrically connected in series. This enhances the sensitivity of the whole circuits to electrical faults of individual components. Furthermore, circuits are equipped with a large number of instrumentation wires, which are exposed to accidental damage or swapping. In order to ensure safe operation, an Electrical Quality Assurance (ELQA) campaign is needed after each thermal cycle. Due to the complexity of the circuits, as well as their distant geographical distribution (tunnel of 27km circumference divided in 8 sectors), suitable software and hardware platforms had to be developed. The software combines an Oracle database, LabView data acquisition applications and PHP-based web follow-up tools. This paper describes the software used for the ELQA of the LHC.

Hardware

WEPMS009 **MicroTCA.4: a New Hardware Standard for Accelerators and Experiments** – *K. Rehlich (DESY)*

Several accelerator labs developed an extension for the MicroTCA standard together with industrial partners within the PICMG organization. This new MTCA.4 standard adds the required IO, clock and trigger capabilities to the telco dominated basic specifications. This paper describes the unique technology for high resolution and high performance front-end data acquisition and control. MTCA.4 provides comfortable sized Rear Transition Modules, high speed serial communication, precision clock distribution and full management. This make it an ideal choice for high precision analog IO in large installations. The European XFEL project is based on this new standard and several other labs are in a prototyping or evaluation phase.

WEPMS011 **The Timing Master for the FAIR Accelerator Facility** – *R. Baer (GSI), T. Fleck, M. Kreider, S. Mauro (GSI)*

One central design feature of the FAIR accelerator complex is a high level of parallel beam operation, imposing ambitious demands on the timing and management of accelerator cycles. Several linear accelerators, synchrotrons, storage rings and beam lines have to be controlled and re-configured for each beam production chain on a pulse-to-pulse basis, with cycle lengths ranging from 20 ms to several hours. This implies initialization, synchronization of equipment on the time scale down to the ns level, interdependencies, multiple paths and contingency actions like emergency beam dump scenarios. The FAIR timing system will be based on White Rabbit* network technology, implementing a central Timing Master (TM) unit to orchestrate all machines. The TM is subdivided into separate functional blocks: the Clock Master, which deals with time and clock sources and their distribution over WR, the Management Master, which administrates all WR timing receivers, and the Data Master, which schedules and coordinates machine instructions and broadcasts them over the WR network. The TM triggers equipment actions based on the transmitted execution time. Since latencies in the low μs range are required, this paper investigates the possibilities of parallelisation in programmable hardware and discusses the benefits to either a distributed or monolithic timing master architecture. The proposed FPGA based TM will meet said timing requirements while providing fast reaction to interlocks and internal events and offers parallel processing of multiple signals and state machines.

WEPMS012 **Comparative Evaluation of IEEE-1588 Precision Time Protocol for the Synchronized Operation of Tokamak Device** – *M.K. Park (NFRI), S. Lee, T.G. Lee, W.R. Lee, S.W. Yun (NFRI)*

Recently the International Thermonuclear Experimental Reactor (ITER), which is the largest project in scale to construct a fusion reactor for the research of fusion energy source jointly with seven participants, has chosen IEEE-1588 precision time protocol (PTP) as a timing system standard for precisely synchronizing tokamak operation and plasma experiments. The IEEE-1588 PTP was designed as a standard for precision clock synchronization protocol for network measurements and control systems, and guarantees higher accuracy (less than sub-microsecond) than using NTP and more economical implementation than using GPS. Besides the original purpose, the uses are expanding to the provision of event timing and synchronization capabilities for large experimental facilities like ITER. On the other hands, many working tokamaks have operated with own timing systems having non-standard protocols. The Korea Superconducting Tokamak Advanced Research (KSTAR) has successfully operated the homemade timing system with the following features; PMC foam-factor with PCI/ PCI-X interface, using EPICS 3.14.12 framework, board driver in VxWork5.5.1 and Linux2.6.x platforms, a master clock of 200MHz, timing accuracy less than 50ns, 8 output ports for trigger or clock signals, 8 configurable multi-triggering sections and provision of accurate time referenced to GPS time. This paper describes the result of evaluating IEEE-1588 PTP for tokamak and its detail implementation, and also the comparative analysis with KSTAR timing system after operating them in KSTAR during the 4th campaign in 2011.

WEPMS013 **Timing System of the Taiwan Photon Source** – *C.Y. Wu (NSRRC), Y.-T. Chang, J. Chen, Y.-S. Cheng, P.C. Chiu, K.T. Hsu, K.H. Hu, C.H. Kuo, C.-Y. Liao (NSRRC)*
The timing system of the Taiwan Photon Source provides synchronization for electron gun, modulators of linac, pulse magnet power supplies, booster power supply ramp, bucket addressing of storage ring, diagnostic equipments, beamline gating signal for top-up injection. The system is based on an event distribution system that broadcasts the timing events over a 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 10 μsec response time. The hardware of the event system is a new design that is based on 6U CompactPCI form factor. This paper describes the technical solution, the functionality of the system and some applications that are based on the timing system.

WEPMS014 **New System Architecture for the LLRF System for LCLSII usingμTCA** – *A. Young (SLAC), R. Akre, J.E. Dusatko, R.S. Larsen, J.J. Olsen (SLAC) F. Ludwig, K. Rehlich (DESY)*
The next generation of light sources requires the LLRF to have the smallest amplitude (0.1 %) and phase (0.5 degrees at x-band) resolution and will require high availability. Due to these stringent requirements, a new architecture for the LLRF system is highly desirable in developing a state of the art system. This new architecture system allows for modular designs with highly integrated backplane interfaces. The interfaces have been specified by international physics community to extend the Telecom industry's Advanced Telecommunications Computing Architecture (TCA). This interface will allow for low jitter clock distribution, interlock distribution, integrated monitoring of the status of the each device using Intelligent Platform Management Interface (IPMI) system. This paper will discuss the designs of key components that proposed for SLAC for the LLRF upgrade for LCLSII and DESY LLRF for the XFEL such as; custom RTMs, high speed ADCs, and interlock module.

WEPMS015 **NSLS-II Booster Timing System** – *S.E. Karnaev (BINP SB RAS), P.B. Cheblakov (BINP SB RAS) J.H. DeLong (BNL)*
The NSLS-II light source includes the main storage ring with beam lines and injection part consisting of 200 MeV linac, 3 GeV booster synchrotron and two transport lines. The booster timing system is a part of NSLS-II timing system which is based on Event Generator (EVG) and Event Receivers (EVRs) fromμResearch Finland. The booster timing is based on the external events coming from NSLS-II EVG:"Pre-Injectio","Injectio","Pre-Extractio","Extractio". These events are referenced to the specified bunch of the Storage Ring and correspond to the first bunch of the booster. EVRs provide two scales for triggering both of the injection and the extraction pulse devices. The first scale provides triggering of the pulsed septums and the bump magnets in the range of milliseconds and uses TTL outputs of EVR, the second scale provides triggering of the kickers in the range of microseconds and uses CML outputs. EVRs also provide the timing of a booster cycle operation and events for cycle-to-cycle updates of pulsed and ramping parameters, and the booster beam instrumentation synchronization. This paper describes the final design of the booster timing system. The timing system functional and block diagrams are presented.

WEPMS016 **Network on Chip Master Control Board for Neutron Acquisition** – *E. Ruiz-Martinez (ILL), M. Mary, P. Mutti, J. Ratel, F. Rey (ILL)*

In the neutron scattering instruments at the Institute Laue-Langevin, one of the main challenges for the acquisition control is to generate the suitable signalling for the different modes of neutron acquisition. An inappropriate management could cause loss of information during the course of the experiments and in the subsequent data analysis. It is necessary to define a central element to provide synchronization to the rest of the units. The backbone of the proposed acquisition control system is the denominated master acquisition board. This main board is designed to gather together the modes of neutron acquisition used in the facility, and make it common for all the instruments in a simple, modular and open way, giving the possibility of adding new performances. The complete system also includes a display board and n histogramming modules connected to the neutrons detectors. The master board consists of a VME64X configurable high density I/O connection carrier board based on latest Xilinx Virtex-6T FPGA. The internal architecture of the FPGA is designed as a Network on Chip (NoC) approach. It represents a switch able to communicate efficiently the several resources available in the board (PCI Express, VME64x Master/Slave, DDR3 controllers and user's area). The core of the global signal synchronization is fully implemented in the FPGA, the board has a completely user configurable IO front-end to collect external signals, to process them and to distribute the synchronization control via the bus VME to the others modules involved in the acquisition.

WEPMS017 **The Global Trigger Processor: A VXS Switch Module for Triggering Large Scale Data Acquisition Systems** – *S.R. Kaneta (JLAB), C. Cuevas, H. Dong, W. Gu, E. Jastrzembski, N. Nganga, B.J. Raydo, J. Wilson (JLAB)*

The 12 GeV upgrade for Jefferson Lab's Continuous Electron Beam Accelerator Facility requires the development of a new data acquisition system to accommodate the proposed 200 kHz Level 1 trigger rates expected for fixed target experiments at 12 GeV. As part of a suite of trigger electronics comprised of VXS switch and payload modules, the Global Trigger Processor (GTP) will handle up to 32,768 channels of preprocessed trigger information data from the multiple detector systems that surround the beam target at a system clock rate of 250 MHz. The GTP is configured with user programmable Physics trigger equations and when trigger conditions are satisfied, the GTP will activate the storage of data for subsequent analysis. The GTP features an Altera Stratix IV GX FPGA allowing interface to 16 Sub-System Processor modules via 32 5-Gbps links, DDR2 and flash memory devices, two gigabit Ethernet interfaces using Nios II embedded processors, fiber optic transceivers, and trigger output signals. The GTP's high-bandwidth interconnect with the payload modules in the VXS crate, the Ethernet interface for parameter control, status monitoring, and remote update, and the inherent nature of its FPGA give it the flexibility to be used large variety of tasks and adapt to future needs. This paper details the responsibilities of the GTP, the hardware's role in meeting those requirements, and elements of the VXS architecture that facilitated the design of the trigger system. Also presented will be the current status of development including significant milestones and challenges.

WEPMS018 **SiPM Readout System of ECAL in the PEBS and Testing Result with the System** – *L. Li (TUB) G.H. Gong, M. Zeng (Tsinghua University)*

Silicon photomultiplier (SiPM) shows its advantages in many fields. Compared with PMT, the advantages of SiPM are high gain, excellent time resolution, not sensitive to magnetic fields and low operating voltage. So, the Positron Electron Balloon Spectrometer (PEBS) experiment selects SiPM detector produced by Hamamatsu Corporation (Hamamatsu) as the Electromagnetic calorimeter (ECAL) and Tracker's detectors. The PEBS experiment is to study the dark matter, which is the newest cosmology in the astrophysics field. So, the ECAL and Tracker detector need a system to read out the SiPM and control the timing signal. The system contains a kind of DAQ board and many kinds of Front-end board. This paper will introduce the design of the system of ECAL and Track, and the testing result included.

WEPMS019 **Measuring Angle with Pico Radian Resolution** – *P. Mutti (ILL), M. Jentschel, M. Mary, F. Rey (ILL) G. Mana, E. Massa (INRIM)*

The kilogram is the only remaining fundamental unit within the SI system that is defined in terms of a material artefact (a PtIr cylinder kept in Paris). Therefore, one of the major tasks of modern metrology is the redefinition of the kilogram on the basis of a natural quantity or of a fundamental constant. However, any kilogram redefinition must approach a 10^{-8} relative accuracy in its practical realization. A joint research project amongst the major metrology institutes in Europe has proposed the redefinition of the kilogram based on the mass of the 12C atom. The goal can be achieved by counting in a first step the number of atoms in a macroscopic weighable object and, in a second step, by weighing the atom by means of measuring its Compton frequency vC. It is in the second step of the procedure, where the ILL is playing a fundamental role with GAMS, the high-resolution γ-ray spectrometer. Energies of the γ-rays emitted in the decay of the capture state to the ground state of a daughter nucleus after a neutron capture reaction can be measured with high precision. In order to match the high demand in angle measurement accuracy, a new optical interferometer with 10 picorad resolution and linearity over a total measurement range of 15^{o} and high stability of about 0.1 nrad/hour has been developed. To drive the interferometer, a new FPGA based electronics for the heterodyne frequency generation and for real time phase measurement and axis control has been realized. The basic concepts of the FPGA implementation will be revised.

WEPMS020 **The NSLS-II Booster Power Supplies Control** – *P.B. Cheblakov (BINP SB RAS), S.E. Karnaev (BINP SB RAS) W. Louie, Y. Tian (BNL)*

The NSLS-II booster Power Supplies (PSs)* are divided into two groups: ramping PSs providing passage of the beam during the beam ramp in the booster from 200 MeV up to 3 GeV at 300 ms time interval, and pulsed PSs providing beam injection from the linac and extraction to the Storage Ring. A special set of devices was developed at BNL for the NSLS-II magnetic system PSs control: Power Supply Controller (PSC) and Power Supply Interface (PSI). The PSI has one or two precision 18-bit DACs, nine channels of ADC for each DAC and digital input/outputs. It is capable of detecting the status change sequence of digital inputs with 10 ns resolution. The PSI is placed close to current regulators and is connected to the PSC via fiber-optic 50 Mbps data link. The PSC communicates with EPICS IOC through a 100 Mbps Ethernet port. The main function of IOC includes ramp curve upload, ADC waveform data download, and various process variable control. The 256 Mb DDR2 memory on PSC provides large storage for up to 16 ramping tables for the both DACs, and 20 second waveform recorder for all the ADC channels. The 100 Mbps Ethernet port enables real time display for 4 ADC waveforms. This paper describes a project of the NSLS-II booster PSs control. Characteristic features of the ramping magnets control and pulsed magnets control in a double-injection mode of operation are considered in the paper. First results of the control at PS testing stands are presented.

WEPMS022 **The Controller Design for Kicker Magnet Adjustment Mechanism in SSRF** – *R. Wang (SINAP), R. Chen, M. Gu (SINAP)*
The kicker magnet adjustment mechanism controller in SSRF is to improve the efficiency of injection by changing the magnet real-time, especially in the top-up mode. The controller mainly consists of Programmable Logic Controller (PLC), stepper motor, reducer, worm and mechanism. PLC controls the stepper motors for adjusting the azimuth of the magnet, monitors and regulates the magnet with inclinometer sensor. It also monitors the interlock. In addition, the controller is provided with local and remote working mode. This paper mainly introduces related hardware and software designs for this device.

WEPMS023 **ALBA Timing System. A Known Architecture with Fast Interlock System Upgrade** – *O. Matilla (CELLS-ALBA Synchrotron), D.B. Beltran, D.F.C. Fernandez-Carreiras, J.J. Jamroz, J. Klora, J. Moldes, R. Suñé (CELLS-ALBA Synchrotron)*
Like most of the newest synchrotron facilities the ALBA Timing System works on event based architecture. Its main particularity is that integrated with the Timing system a Fast Interlock System has been implemented which allows for an automated and synchronous reaction time from any-to-any point of the machine faster than 5μs. The list of benefits of combining both systems is large: very high flexibility, reuse of the timing actuators, direct synchronous output in different points of the machine reacting to an interlock, implementation of the Fast Interlock with very low cost increase as the timing optic fiber network is reused or the possibility of combined diagnostic tools implementation for triggers and interlocks. To enhance this last point a global timestamp of 8ns accuracy that could be used both for triggers and interlocks has been implemented. The system has been designed, installed and extensively used during the Storage Ring commissioning with very good results.

WEPMS024 **ALBA High Voltage Splitter - power distribution to ION pumps.** – *J.J. Jamroz (CELLS-ALBA Synchrotron), E. Al-dmour, D.B. Beltran, J. Klora, R. Martin, O. Matilla, S. Rubio-Manrique (CELLS-ALBA Synchrotron)*
The High Voltage Splitter is an equipment designed in Alba that allows a distribution of high voltage (up to +7kV) from one Ion Pump Controller up to eight Ion Pumps. Using it the total number of high voltage power supplies needed in a vacuum installation has decreased significantly. The current drawn by each channel is measured independently inside a range from 10nA up to 10mA with 5% accuracy which allows for the estimation of the vacuum pressure. As the relationship between current vs pressure depends on the Ion Pump type, different tools providing the full calibration flexibility have been implemented. The equipment integrates a 10/100 Base-T Ethernet port from which the device can be fully configured and all the data is available. It also allows for it to be controlled manually. The device supports also additional functions as high voltage cable interlock management, pressure interlock output available for the equipment protection system (EPS), programmable pressure warnings/alarms, and an automatic calibration process based on an external current reference. This paper will describe the project, functionality, installation, and troubleshooting found during operation of the vacuum system at Alba.

WEPMS025 **Low Current Measurements at ALBA** – *J. Lidon-Simon (CELLS-ALBA Synchrotron), D.F.C. Fernandez-Carreiras, J.V. Gigante, J.J. Jamroz, J. Klora, O. Matilla (CELLS-ALBA Synchrotron)*
High accuracy low current readout is an extensively demanded technique in 3rd generation synchrotrons. Whether reading from scintillation excited large-area photodiodes for beam position measurement or out of gold meshes or metallic coated surfaces in drain-current based intensity monitors, low current measurement devices are an ubiquitous need both for diagnostics and data acquisition in today's photon labs. In order to tackle the problem of measuring from various sources of different nature and magnitude synchronously, while remaining flexible at the same time, ALBA has developed a 4 independent channel electrometer. It is based on transimpedance amplifiers and integrates high resolution ADC converters and an 10/100 Base-T Ethernet communication port. Each channel has independently configurable range, offset and low pass filter cut-off frequency settings and the main unit has external I/O to synchronize the data acquisition with the rest of the control system.

WEPMS026 **The TimBel Synchronization Board for Time Resolved Experiments at Synchrotron SOLEIL** – *J.P. Ricaud (SOLEIL), P. Betinelli, J. Bisou, X. Elattaoui, C. Laulhe, P. Monteiro, L.S. Nadolski, S. Ravy, G. Renaud, M.G. Silly, F. Sirotti (SOLEIL)*
Time resolved experiments are one of the major services that synchrotrons can provide to the scientists. The very short and regular flashes of synchrotron light are a fantastic tool to study the evolution of phenomena over the time. To run time resolved experiments, Beamlines need to synchronize their devices with those flashes of light with a jitter better than 10 ps. To do that, Synchrotron SOLEIL has developed the TimBeL board which is fully integrated in TANGO framework. This paper is a presentation of our requirements for time resolved experiments and how we achieved our goals with the TimBeL board.

WEPMS027 **The RF Control System of the SSRF 150MeV Linac** – *S.M. Hu (SINAP), J.G. Ding, G.-Y. Jiang, L.R. Shen, S.P. Zhong (SINAP)*
Shanghai Synchrotron Radiation Facility (SSRF) use a 150 MeV linear electron accelerator as injector, its RF system consists of many discrete devices. The control system is mainly composed of a VME controller and a home-made signal conditioner with DC power supplies. The uniform signal conditioner serves as a hardware interface between the controller and the RF components. The DC power supplies are used for driving the mechanical phase shifters. The control software is based on EPICS toolkit. Device drivers and related runtime database for the VME modules were developed. The operator interface was implemented by EDM.

WEPMS028 **Online Evaluation of New DBPM Processors at SINAP** – *Y.B. Leng (SSRF), G.Q. Huang, L.W. Lai, Y.B. Yan, X. Yi (SSRF)*
In this paper, we report our online evaluation results for new digital BPM signal processors, which are developed for the SSRF and the new Shanghai SXFEL facility. Two major prototypes have been evaluated. The first algorithm evaluation prototype is built using commercial development toolkits modules in order to test various digital processing blocks. The second prototype is designed and fabricated from chips level in order to evaluate the hardware performances of different functional modules and assembled processor.

WEPMS030 **Low Phase Noise Local Oscillator Generation for Cavity Field Detection** – *M. Zukocinski (Warsaw University of Technology, Institute of Electronic Systems), P. Barmuta, K. Czuba, L. Zembala (Warsaw University of Technology, Institute of Electronic Systems) M. Hoffmann, F. Ludwig (DESY) U. Mavric (I-Tech)*

When designing Low-Level RF (LLRF) system for the new generation of Free-Electron Laser (FEL) machines, there are many aspects the designer has to consider. The design for exceptional performance is focused on ultra low phase noise signal generation, distribution, processing and packaging, which influence the cavity field stability and finally the performance of the laser light generated by FELs. One of the crucial subsystems of the LLRF is the Local Oscillator (LO) generation. The cavity probe signal is mixed with the LO signal and down-converted to an intermediate frequency (IF), which carries the cavity amplitude and phase information. In this paper different LO generation schemes have been presented and discussed. The main design parameters the paper focuses on are performance and small form factor for PCB integration. Phase-locked loop (PLL) and mixing techniques were investigated. During the study, technological limitations of such as VCO and filter size were reached. The two devices under test methodology have been used to measure residual phase noise of different LO generation circuits. A residual integrated RMS phase jitter of the LO subsystem on a femtosecond scale has been achieved and presented in this paper.

12-Oct-11 13:30 – 15:00	Poster	Makalu

WEPMU — Poster

Chair: J.M. Meyer (ESRF)

Protection and safety systems

WEPMU001 **The Temperature Measurement System of Novosibirsk Free Electron Laser** – *S.S. Serednyakov (BINP SB RAS), B.A. Gudkov, V.R. Kozak, E.A. Kuper, S.V. Tararyshkin (BINP SB RAS)*

This paper describes the temperature-monitoring system of Novosibirsk FEL. The main task of this system is to prevent the FEL from being overheated and its individual components from being damaged. The system accumulates information from a large number of temperature sensors installed on different parts of the FEL facility, which allows measuring the temperature of the vacuum chamber, cooling water, and magnetic elements windings. Since the architecture of this system allows processing information not only from temperature sensors, it is also used to measure, for instance, vacuum parameters and some parameters of the cooling water. The software part of this system is integrated into the FEL control system, so readings taken from all sensors are recorded to the database every 30 seconds.

WEPMU002 **Testing Digital Electronic Protection Systems** – *A. Garcia (CERN), S. Gabourin (CERN)*

The Safe Machine Parameters Controller (SMPC) ensures the correct configuration of the LHC machine protection system, and that safe injection conditions are maintained throughout the filling of the LHC machine. The SMPC receives information in real-time from measurement electronics installed throughout the LHC and SPS accelerators, determines the state of the machine, and informs the SPS and LHC machine protection systems of these conditions. This paper outlines the core concepts and realization of the SMPC test-bench, based on a VME crate and LabVIEW program. Its main goal is to ensure the correct function of the SMPC for the protection of the CERN accelerator complex. To achieve this, the tester has been built to replicate the machine environment and operation, in order to ensure that the chassis under test is completely exercised. The complexity of the task increases with the number of input combinations which are, in the case of the SMPC, in excess of $2^3$64. This paper also outlines the benefits and weaknesses of developing a test suite independently of the hardware being tested, using the"" approach.

WEPMU003 **The Diamond Machine Protection System** – *M.T. Heron (Diamond), Y.S. Chernousko, P. Hamadyk, S.C. Lay, N. Rotolo (Diamond)*

The Diamond Light Source Machine Protection System manages the hazards from high power photon beams and other hazards to ensure equipment protection on the booster synchrotron and storage ring. The system has a shutdown requirement, on a beam mis-steer, of under 1msec and has to manage in excess of a thousand interlocks. This is realised using a combination of bespoke hardware and programmable logic controllers. The structure of the Machine Protection System will be described, together with operational experience and developments to provide post-mortem functionality.

WEPMU004 **Semantic Approaches in Accident Prevention** – *L. Aprin (Bergische Universität Wuppertal)*

The appearance of the World Wide Web (WWW) has enriched societies' interactions with the resource of knowledge by opening up a multitude of possibilities. Hypertext, applied in a variety of ways, can now be found in nearly every area of life. In recent times certain technological developments of the WWW called"semantic we" have increasingly become the focus of research and industry. While the practice of knowledge management still remains primarily at the level of indexing and linking documents, the approaches of semantic technology aim to operationalize the knowledge at the level of the data itself. One advantage being that there is an increase in the potential for automatization of the knowledge processes. Such a paradigm shift regarding the resource of knowledge also creates new perspectives for the area of accident prevention. In the context of the project, the attempt will be made to develop a model for prevention management based on semantic approaches. The goal of this model will be to estimate the risk potential of a situation and connect this with prevention measures in a software-oriented manner. For that reason a formal and logic-based ontology is developed to describe the initial activities within the standardly performed risk-analysis. By means of this ontological knowledge base the formal representations of the initial activities will be conceptually expanded and compared to past accident scenarios. In this manner the semi-automatic anticipation of accident scenarios for pending activities (including the selection of prevention measures) becomes feasible.

WEPMU005 **Personnel Protection, Equipment Protection and Fast Interlock systems. The Alba Control System Integrates Three Different Technologies to Provide Protection at Three Different Levels.** – *D.F.C. Fernandez-Carreiras (CELLS-ALBA Synchrotron), J. Klora, O. Matilla, J. Moldes, R. Montano, M. Niegowski, R. Ranz, A. Rubio (CELLS-ALBA Synchrotron)*
The Personnel Safety System is based on PILZ PLCs, SIL3 compatible following the norm IEC 61508. It is independent from other subsystems and relies on a dedicated certification by PILZ first and then by TÜV. The Equipment Protection System uses B&R hardware and comprises more than 50 PLCs and more than 100 distributed I/0 modules installed inside the tunnel. The CPUs of the PLCs are interconnected by a deterministic network, supervising more than 7000 signals. Each Beamline has an independent system. The fast interlocks use the bidirectional fibers of the MRF timing system for distributing the interlocks in the microsecond range. Events are distributed by fiber optics for synchronizing more than 280 elements.

WEPMU006 **Architecture for Interlock Systems: Reliability Analysis with Regard to Safety and Availability** – *S. Wagner (CERN), R. Schmidt, B. Todd, A. Vergara-Fernández, M. Zerlauth (CERN)*
For accelerators (e.g. LHC) and other large experimental physics facilities (e.g. ITER), the machine protection relies on complex interlock systems. In the design of interlock loops, the choice of the hardware architecture impacts on machine safety and availability. While high machine safety is an inherent requirement, the constraints in terms of availability may differ from one facility to another. For the interlock loops protecting the LHC superconducting magnet circuits, reduced machine availability can be tolerated since shutdowns do not affect the longevity of the equipment. In ITER's case on the other hand, high availability is required since fast shutdowns cause significant magnet aging. A reliability analysis of various interlock loop architectures has been performed. The analysis based on an analytical model compares a 1oo3 (one-out-of-three) and a 2oo3 architecture with a single loop. It yields the probabilities for four scenarios: (1)- completed mission (e.g., a physics fill in LHC or a pulse in ITER without shutdown triggered), (2)- shutdown because of a failure in the interlock loop, (3)- emergency shutdown (e.g., after a quench of a magnet) and (4)- missed emergency shutdown (shutdown required but interlock loop fails, possibly leading to severe damage of the facility). Scenario 4 relates to machine safety and together with scenarios 2 and 3 defines the machine availability reflected by scenario 1. This paper presents the results of the analysis on the properties of the different architectures with regard to machine safety and availability.

WEPMU007 **Securing a Control System: Experiences from ISO 27001 Implementation** – *V. Vuppala (NSCL), J. Kusler, J.J. Vincent (NSCL)*
Recent incidents have emphasized the importance of security and operational continuity for achieving the quality objectives of an organization, and the safety of its personnel and machines. However, security and disaster recovery are either completely ignored or given a low priority during the design and development of an accelerator control system, the underlying technologies, and the overlaid applications. This leads to an operational facility that is easy to breach, and difficult to recover. Retrofitting security into the control system becomes much more difficult during operations. In this paper we describe our experiences in achieving ISO 27001 compliance for NSCL's control system. We illustrate problems faced with securing low-level controls, infrastructure, and applications. We also provide guidelines to address the security and disaster recovery issues upfront during the development phase.

WEPMU008 **Access Safety Systems – New Concepts from the LHC Experience** – *T. Ladzinski (CERN), Ch. Delamare, S. Di Luca, T. Hakulinen, L. Hammouti, F. Havart, J.-F. Juget, P. Ninin, R. Nunes, T.R. Riesco, E. Sanchez-Corral Mena, F. Valentini (CERN)*

The LHC Access Safety System has introduced a number of new concepts into the domain of personnel protection at CERN. These can be grouped into several categories: organisational, architectural and concerning the end-user experience. By anchoring the project on the solid foundations of the IEC 61508/ 61511 methodology, the CERN team and its contractors managed to design, develop, test and commission on time a SIL3 safety system. The system uses a successful combination of the latest Siemens redundant safety programmable logic controllers with a traditional relay logic hardwired loop. The external envelope barriers used in the LHC include personnel and material access devices, which are interlocked door-booths introducing increased automation of individual access control, thus removing the strain from the operators. These devices ensure the inviolability of the controlled zones by users not holding the required credentials. To this end they are equipped with personnel presence detectors and the access control includes a state of the art biometry check. Building on the LHC experience, new projects targeting the refurbishment of the existing access safety infrastructure in the injector chain have started. This paper summarises the new concepts introduced in the LHC access control and safety systems, discusses the return of experience and outlines the main guiding principles for the renewal stage of the personnel protection systems in the LHC injector chain in a homogeneous manner.

WEPMU009 **The Laser MégaJoule Facility: Personnel Security and Safety Interlocks** – *J.-C. Chapuis (CEA), J.P. Arnoul, A. Hurst, M.G. Manson (CEA)*

The French CEA (Commissariat à l'Énergie Atomique) is currently building the LMJ (Laser MégaJoule), at the CEA Laboratory CESTA near Bordeaux. The LMJ is designed to deliver about 1.4 MJ of 0.35 μm light to targets for high energy density physics experiments. Such an installation entails specific risks related to the presence of intense laser beams, and high voltage power laser amplifiers. Furthermore, the thermonuclear fusion reactions induced by the experiment also produce different radiations and neutrons burst and also activate some materials in the chamber environment. Both risks could be lethal. This presentation (paper) discusses the SSP (system for the personnel safety) that was designed to prevent accidents and protect personnel working in the LMJ. To achieve the security level imposed on us by labor law and by the French Safety Authority, the system consists of two independent safety barriers based on different technologies, whose combined effect can reduce to insignificant level the occurrence probability of all accidental scenarios identified during the risk analysis.

WEPMU010 **Automatic Analysis at the Commissioning of the LHC Superconducting Electrical Circuits** – *H. Reymond (CERN), O.O. Andreassen, C. Charrondiere, A. Rijllart, M. Zerlauth (CERN)*

Since the beginning of 2010 the LHC has been operating in a routinely manner, starting with a commissioning phase and then an operation for physics phase. The commissioning of the superconducting electrical circuits requires rigorous test procedures before entering into operation. To maximize the beam operation time of the LHC these tests should be done as fast as procedures allow. A full commissioning needs 12000 tests and is required after circuits have been warmed above liquid nitrogen temperature. Below this temperature, after an end of year break of two months, commissioning needs about 6000 tests. Because the manual analysis of the tests takes a major part of the commissioning time, we proceeded to the automation of the existing analysis tools. We present the way in which these LabVIEW^{TM} applications were automated. We evaluate the gain in commissioning time and reduction of experts on night shift observed during the LHC hardware commissioning campaign of 2011 compared to 2010. We end with an outlook at what can be further optimized.

WEPMU011 **Automatic Injection Quality Checks for the LHC** – *L.N. Drosdal (CERN), B. Goddard, R. Gorbonosov, S. Jackson, D. Jacquet, V. Kain, D. Khasbulatov, M. Misiowiec, J. Wenninger, C. Zamantzas (CERN)*

Twelve injections per beam are required to fill the LHC with the nominal filling scheme. The injected beam needs to fulfill a number of requirements to provide useful physics for the experiments when they take data at collisions later on in the LHC cycle. These requirements are checked by a dedicated software system, called the LHC injection quality check. At each injection, this system receives data about beam characteristics from key equipment in the LHC and analyzes it online to determine the quality of the injected beam after each injection. If the quality is insufficient, the automatic injection process is stopped, and the operator has to take corrective measures. This paper will describe the software architecture of the LHC injection quality check and the interplay with other systems. A set of tools for self-monitoring of the injection quality checks to achieve optimum performance will be discussed as well. Results obtained during the LHC commissioning year 2010 and the LHC run 2011 will finally be presented.

WEPMU012 **First Experiences of Beam Presence Detection Based on Dedicated Beam Position Monitors** – *A. Jalal (CERN), M. Gasior (CERN)*

A high intensity particle beam injection in the LHC is only to be made when a low intensity circulating beam is already present in the LHC in order to avoid damage to the machine. In the 2010 LHC run, the detection of the low intensity particle beam was done using the Beam Current Transformer (BCT) system which was designed for operational purposes but not for protection. To increase redundancy of this important protection feature a dedicated Beam Presence Flag (BPF) system, based on Beam Position Monitors (BPM), was designed, built and tested. This paper reviews the new implementation, outlining the principle changes from the BCT to the BPM systems. It briefly describes the testing method, focuses on the results obtained from the tests executed during the end of 2010 LHC run and shows the first observations made during early 2011 operations. It concludes with a description of the improvements which could be implemented to improve the performance of the system.

WEPMU013 **Development of a Machine Protection System for the Superconducting Beam Test Facility at FERMILAB** – *L.r. Carmichael (Fermilab), R. Neswold, A. Warner, J. You (Fermilab)*

Fermilab's Superconducting Radiofrequency Beam Test Facility currently under construction will produce electron beams capable of damaging the acceleration structures and the beam line vacuum chambers in the event of an aberrant accelerator pulse. The accelerator is being designed with the capability to operate with up to 3000 bunches per macro-pulse, 5Hz repetition rate and 1.5 GeV beam energy. It will be able to sustain an average beam power of 72 KW at the bunch charge of 3.2 nC. Operation at full intensity will deposit enough energy in niobium material to approach the melting point of 2500^{o}C. A robust Machine Protection System (MPS) is being designed to mitigate effects due to such a large damage potential. This report will provide an overview of the MPS and specifically describe the FPGA-based permit system component of the MPS.

WEPMU014 **Architecture of VEPP-4M Collider's Interlock System** – *O.A. Plotnikova (BINP SB RAS)*

To measure the beam energy with high precision is necessary to consider the change in temperature of the magnets and the environment. In addition, it is necessary to power off timely the magnets in case of overheating. In recent years The Total Temperature Measurements and Interlock System at the VEPP-4M Collider has been built. The system measures the temperature into nearly 500 points every 5 seconds, performs warning and interlocking function. This article describes the method of collecting and processing temperature data, role of database for the system.

WEPMU015 **The Machine Protection System for the R&D Energy Recovery LINAC** – *Z. Altinbas (BNL), J.P. Jamilkowski, D. Kayran, R.C. Lee, B. Oerter (BNL)*

The Machine Protection System (MPS) is a device-safety system that is designed to prevent damage to hardware by generating interlocks, based upon the state of input signals generated by selected sub-systems. It protects all the key machinery in the R&D Project called the Energy Recovery LINAC (ERL) against the high beam current. The MPS is capable of responding to a fault with an interlock signal within several microseconds. The ERL MPS is based on a National Instruments CompactRIO platform, and is programmed by utilizing National Instruments' development environment for a visual programming language. The system also transfers data (interlock status, time of fault, etc.) to the main server. Transferred data is integrated into the pre-existing software architecture which is accessible by the operators. This paper will provide an overview of the hardware used, its configuration and operation, as well as the software written both on the device and the server side.

WEPMU016 **Pre-Operation, During Operation and Post-Operational Verification of Protection Systems** – *I. Romera (CERN), M. Audrain (CERN)*

This paper will provide an overview of the software checks performed on the Beam Interlock System ensuring that the system is functioning to specification. Critical protection functions are implemented in hardware, at the same time software tools play an important role in guaranteeing the correct configuration and operation of the system during all phases of operation. This paper will describe tests carried out pre-, during- and post- operation, if protection system integrity is not sure, subsequent injections of beam into the LHC will be inhibited.

WEPMU017 **Safety Control System for the Off-Line Front-End of the SPES Project at the LNL** – *J.A. Vasquez (INFN/LNL), A. Andrighetto, G. Bassato, L. Costa, M.G. Giacchini (INFN/LNL)*

The SPES off-line front-end apparatus involves a number of subsystems and procedures that are potentially dangerous both for human operators and for the equipment. Four systems have been selected as the most potentially dangerous: the high voltage power supply, the ion source complex power supplies, the target chamber handling systems and the laser device. In this way, in order to prevent injury to the operators and damages to the equipment, a safety control system has been developed. It is based on Schneider Electrics Preventa family safety modules that control the power supply of critical subsystems in conjunction with safety detectors that monitor critical variables. Moreover, a Programmable Logic Controller (PLC), model BMXP342020 from the Schneider Electrics Modicon M340 family, is used to monitor the status of the system as well as to control the sequence of some operations; the Human Machine Interface (HMI) have been developed using a touch screen, model XBTGT5330 from the Schneider Electrics Magelis family, and communicates with the PLC using MODBUS over Ethernet communication. The PLC software was written using the Unity Pro S development software, while Vijeo Designer was used to develop the graphical interface on the HMI.

WEPMU018 **Real-time Protection of the"ITER-like Wall at JE"** – *M.B. Jouve (Association EURATOM-CEA), C. Balorin (Association EURATOM-CEA) G. Arnoux, S. Devaux, D. Kinna, P.D. Thomas, K-D. Zastrow (CCFE) P.J. Carvalho (IPFN) J. Veyret (Sundance France)*

During the last JET tokamak shutdown a new ITER-Like Wall was installed using Tungsten and Beryllium materials. To ensure plasma facing component (PFC) integrity, the real-time protection of the wall has been upgraded through the project"Protection for the ITER-like Wal" (PIW). The choice has been made to work with 13 CCD robust analog cameras viewing the main areas of plasma wall interaction and to use regions of interest (ROI) for monitoring in real time the surface temperature of the PFCs. For each camera, ROIs will be set up prepulse and, during plasma operation, surface temperatures from these ROIs will be sent to the real time processing system for monitoring and eventually preventing damages on PFCs by modifying the plasma parameters. The video and the associated control system developed for this project is presented in this paper. The video is captured using PLEORA frame grabber and it is sent on GigE network to the real time processing system (RTPS) divided into a 'Real time processing unit' (RTPU), for surface temperature calculation, and the 'RTPU Host', for connection between RTPU and other systems. The RTPU design is based on commercial Xilinx Virtex5 FPGA boards with one board per camera and 2 boards per host. Programmed under Simulink using System generator blockset, the field programmable gate array (FPGA) can manage simultaneously up to 96 ROI defined pixel by pixel.

WEPMU019 **First Operational Experience with the LHC Beam Dump Trigger Synchronisation Unit** – *A. Antoine (CERN), C. Boucly, P. Juteau, N. Magnin, N. Voumard (CERN)*

Two LHC Beam Dumping Systems (LBDS) remove the counter-rotating beams safely from the collider during setting up of the accelerator, at the end of a physics run and in case of emergencies. Dump requests can come from 3 different sources: the machine protection system in emergency cases, the machine timing system for scheduled dumps or the LBDS itself in case of internal failures. These dump requests are synchronised with the 3 μs beam abort gap in a fail-safe redundant Trigger Synchronisation Unit (TSU) based on Digital Phase Lock Loops (DPLL), locked onto the LHC beam revolution frequency with a maximum phase error of 40 ns. The synchronised trigger pulses coming out of the TSU are then distributed to the high voltage generators of the beam dump kickers through a redundant fault-tolerant trigger distribution system. This paper describes the operational experience gained with the TSU since their commissioning with beam in 2009, and highlights the improvements which have been implemented for a safer operation. This includes an increase of the diagnosis and monitoring functionalities, a more automated validation of the hardware and embedded firmware before deployment, or the execution of a post-operational analysis of the TSU performance after each dump action. In the light of this first experience the outcome of the external review performed in 2010 is presented. The lessons learnt on the project life-cycle for the design of mission critical electronic modules are discussed.

WEPMU020 **LHC Collimator Controls for a Safe LHC Operation** – *S. Redaelli (CERN), R.W. Assmann, R. Losito, A. Masi (CERN)*

The beam stored energy at the Large Hadron Collider (LHC) will be up to 360 MJ, to be compared with the quench limit of super-conducting magnets of a few mJ per cm^3 and with the damage limit of metal of a few hundreds kJ. The LHC collimation system is designed to protect the machine against beam losses and consists of 10^8 collimators, 10^0 of which are movable, located along the 27 km long ring and in the transfer lines. Each collimator has two jaws controlled by four stepping motors to precisely adjust collimator position and angle with respect to the beam. Stepping motors have been used to ensure high position reproducibility. LVDT and resolvers have been installed to monitor in real-time at 10^0 Hz the jaw positions and the collimator gaps. The cleaning performance and machine protection role of the system depend critically on the accurate jaw positioning. A fully redundant survey system has been developed to ensure that the collimators dynamically follow optimum settings in all phases of the LHC operational cycle. Jaw positions and collimator gaps are interlocked against dump limits defined redundantly as functions of the time, of the beam energy and of the beta* functions that describes the focusing property of the beams. In this paper, the architectural choices that guarantee a safe LHC operation are presented. Hardware and software implementations that ensure the required reliability are described. The operational experience accumulated so far is reviewed and a detailed failure analysis that show the fulfillment of the machine protection specifications is presented.

WEPMU022 **Quality-Safety Management and Protective Systems for SPES** – *S. Canella (INFN/LNL), D. Benini (INFN/LNL)*

SPES (Selective Production of Exotic Species) is an INFN project to produce Radioactive Ion Beams (RIB) at Laboratori Nazionali di Legnaro (LNL). The RIB will be produced using the proton induced fission on a Direct Target of UCx. In SPES the proton driver will be a Cyclotron with variable energy (15-70 MeV) and a maximum current of 0.750 mA on two exit ports. The SPES Access Control System and the Dose Monitoring will be integrated in the facility Protective System to achieve the necessary high degree of safety and reliability and to prevent dangerous situations for people, environment and the facility itself. A Quality and Safety Management System for SPES (QSMS) will be realized at LNL for managing all the phases of the project (from design to decommissioning), including therefore the commissioning and operation of the Cyclotron machine too. The Protective System, its documents, data and procedures will be one of the first items that will be considered for the implementation of the QSMS of SPES. Here a general overview of SPES Radiation Protection System, its planned architecture, data and procedures, together with their integration in the QSMS are presented.

WEPMU023 **External Post-Operational Checks for the LHC Beam Dumping System** – *N. Magnin (CERN), V. Baggiolini, E. Carlier, B. Goddard, R. Gorbonosov, D. Khasbulatov, J.A. Uythoven, M. Zerlauth (CERN)*
The LHC Beam Dumping System is a critical part of the LHC machine protection system. After every LHC beam dump action the various signals and transient data recordings of the beam dumping control systems and beam instrumentation measurements are automatically analysed by the eXternal Post-Operational Checks (XPOC) system to verify the correct execution of the dump action and the integrity of the related equipment. This software system complements the LHC machine protection hardware, and has to ascertain that the beam dumping system is 'as good as new' before the start of the next operational cycle. This is the only way by which the stringent reliability requirements can be met. The XPOC system has been developed within the framework of LHC Post-Mortem system, allowing for highly dependable data acquisition, data archiving, live analysis of acquired data and replay of previously recorded events. It is composed of various analysis modules, each one dedicated to the analysis of measurements coming from a specific equipment. This paper describes the global architecture of the XPOC system and gives examples of the analyses performed by some of the most important analysis modules. It explains the integration of the XPOC into the LHC control infrastructure along with its integration into the decision chain to allow proceeding with beam operation. Finally, it discusses the operational experience with the XPOC system acquired during the first years of LHC operation, and illustrates examples of internal system faults or abnormal beam dump executions which it has detected.

WEPMU024 **The Radiation Monitoring System for the LHCb Inner Tracker** – *O. Okhrimenko (NASU/INR), V. Iakovenko, V.M. Pugatch (NASU/INR) F. Alessio, G. Corti (CERN)*
The performance of the LHCb Radiation Monitoring System (RMS)*, designed to monitor radiation load on the Inner Tracker** silicon micro-strip detectors, is presented. The RMS comprises Metal Foil Detectors (MFD) read-out by sensitive Charge Integrators***. MFD is a radiation hard detector operating at high charged particle fluxes. RMS is used to monitor radiation load as well as relative luminosity of the LHCb experiment. The results obtained by the RMS during LHC operation in 2010-2011 are compared to the Monte-Carlo simulation.

WEPMU025 **Equipment and Machine Protection Systems for the FERMI@Elettra FEL facility** – *F. Giacuzzo (ELETTRA), L. Battistello, L. Froehlich, G. Gaio, M. Lonza, G. Scalamera, G. Strangolino, D. Vittor (ELETTRA)*
FERMI@Elettra is a Free Electron Laser (FEL) based on a 1.5 GeV linac presently under commissioning in Trieste, Italy. Three PLC-based systems communicating to each other assure the protection of machine devices and equipment. The first is the interlock system for the linac radiofrequency plants; the second is dedicated to the protection of vacuum devices and magnets; the third is in charge of protecting various machine components from radiation damage. They all make use of a distributed architecture based on fieldbus technology and communicate with the control system via Ethernet interfaces and dedicated Tango device servers. A complete set of tools including graphical panels, logging and archiving systems are used to monitor the systems from the control room.

WEPMU026 **Protecting Detectors in ALICE** – *M. Lechman (CERN), A. Augustinus, P.Ch. Chochula, A. Di Mauro, L.S. Jirden, A.N. Kurepin, P. Rosinsky (CERN) G. De Cataldo (INFN-Bari) A. Moreno (Universidad Politécnica de Madrid, E.T.S.I Industriales) O. Pinazza (INFN-Bologna)*
ALICE is one of the big LHC experiments at CERN in Geneva. It is composed of many sophisticated and complex detectors mounted very compactly around the beam pipe. Each detector is a unique masterpiece of design, engineering and construction and any damage to it could stop the experiment for months or even for years. It is therefore essential that the detectors are protected from any danger and this is one very important role of the Detector Control System (DCS). One of the main dangers for the detectors is the particle beam itself. Since the detectors are designed to be extremely sensitive to particles they are also vulnerable to any excess of beam conditions provided by the LHC accelerator. The beam protection consists of a combination of hardware interlocks and control software and this paper will describe how this is implemented and handled in ALICE. Tools have also been developed to support operators and shift leaders in the decision making related to beam safety. The gained experiences and conclusions from the individual safety projects are also presented.

WEPMU027 **CSNS Machine Protection System** – *M.T. Kang (IHEP Beijing)*
The CSNS Machine Protection System (MPS) must protect beam apertures and inserted devices from damage, minimize radiation produced by the beam for hands on maintenance, and shut down the beam when beam-on-target parameters drift outside specifications.

WEPMU028 **Development Status of Personnel Protection System for IFMIF/EVEDA Accelerator Prototype** – *T. Kojima (Japan Atomic Energy Agency (JAEA), International Fusion Energy Research Center (IFERC)), T. Narita, K. Nishiyama, H. Sakaki, H. Takahashi, K. Tsutsumi (Japan Atomic Energy Agency (JAEA), International Fusion Energy Research Center (IFERC))*
The Control System for IFMIF/EVEDA* accelerator prototype consists of six subsystems; Central Control System (CCS), Local Area Network (LAN), Personnel Protection System (PPS), Machine Protection System (MPS), Timing System (TS) and Local Control System (LCS). The IFMIF/EVEDA accelerator prototype provides deuteron beam with power greater than 1 MW, which is the same as that of J-PARC and SNS. The PPS is required to protect technical and engineering staff against unnecessary exposure, electrical shock hazard and the other danger phenomena. The PPS has two functions of building management and accelerator management. For both managements, Programmable Logic Controllers (PLCs), monitoring cameras and limit switches and etc. are used for interlock system, and a sequence is programmed for entering and leaving of controlled area. This article presents the PPS design and the interface against each accelerator subsystems in details.

WEPMU029 **Industrial Devices Robustness Assessment and Testing against Cyber Security Attacks** – *F.M. Tilaro (CERN), B. Copy (CERN)*
CERN (European Organization for Nuclear Research),like any organization, needs to achieve the conflicting objectives of connecting its operational network to Internet while at the same time keeping its industrial control systems secure from external and internal cyber attacks. With this in mind, the ISA-99* international cyber security standard has been adopted at CERN as a reference model to define a set of guidelines and security robustness criteria applicable to any network device. Devices robustness represents a key link in the defense-in-depth concept as some attacks will inevitably penetrate security boundaries

and thus require further protection measures. When assessing the cyber security robustness of devices we have singled out control system-relevant attack patterns derived from the well-known CAPEC** classification. Once a vulnerability is identified, it needs to be documented, prioritized and reproduced at will in a dedicated test environment for debugging purposes. CERN - in collaboration with SIEMENS – has designed and implemented a dedicated working environment, the Test-bench for Robustness of Industrial Equipments***("TRoIE"). Such tests attempt to detect possible anomalies by exploiting corrupt communication channels and manipulating the normal behavior of the communication protocols, in the same way as a cyber attacker would proceed. This document provides an inventory of security guidelines**** relevant to the CERN industrial environment and describes how we have automated the collection and classification of identified vulnerabilities into a test-bench.

Infrastructure management and diagnostics

WEPMU030 **CERN Safety System Monitoring - SSM** – *T. Hakulinen (CERN), P. Ninin (CERN)*
CERN SSM (Safety System Monitoring) is a system for monitoring state-of-health of the various access and safety systems of the CERN site and accelerator infrastructure. The emphasis of SSM is on the needs of maintenance and system operation with the aim of providing an independent and reliable verification path of the basic operational parameters of each system. Included are all network-connected devices, such as PLCs, servers, panel displays, operator posts, etc. The basic monitoring engine of SSM is a freely available system monitoring framework Zabbix, on top of which a simplified traffic-light-type web-interface has been built. The web-interface of SSM is designed to be ultra-light to facilitate access from handheld devices over slow connections. The underlying Zabbix system offers history and notification mechanisms typical advanced monitoring systems.

WEPMU031 **Virtualization in Control System Environment** – *L.R. Shen (SINAP) G.Y. Jiang (SSRF)*
In a large scale distribute control system, there are lots of common services composing an environment of the entire control system, such as the server system for the common software base library, application server, archive server and so on. This paper gives a description of a virtualization realization for a control system environment, including the virtualization for server, storage, network system and application for the control system. With a virtualization instance of the epics based control system environment built by the VMware vSphere v4, we tested the whole functionality of this virtualization environment in the SSRF control system, including the common server of the NFS, NIS, NTP, Boot and EPICS base and extension library tools, we also carried out virtualization of the application server such as the Archive, Alarm, EPICS gateway and all of the network based IOC. Specially, we tested the high availability (HA) and VMotion for EPICS asynchronous IOC successfully under the different VLAN configuration of the current SSRF control system network.

WEPMU032 **Management of the FERMI@Elettra Control System Infrastructure** – *L. Pivetta (ELETTRA), A.I. Bogani, M. De Marco, M.F. Dos Santos, R. Passuello (ELETTRA)*
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.

WEPMU033 **Monitoring of Controls Applications at CERN** – *F. Varela (CERN), F.B. Bernard, L.B. Petrova (CERN)*
The Industrial Controls and Engineering (EN-ICE) group of the Engineering Department at CERN has produced, and is responsible for the operation of around 60 applications, which control critical processes in the domains of cryogenics, quench protections systems, power interlocks for the Large Hadron Collider and other sub-systems of the accelerator complex. These applications require 24/7 operation and a quick reaction to problems. For this reason the EN-ICE is presently developing the monitoring tool to detect, anticipate and inform of possible anomalies in the integrity of the applications. The tool builds on top of Simatic WinCC Open Architecture (formerly PVSS) SCADA and makes usage of the Joint COntrols Project (JCOP) and UNICOS Frameworks developed at CERN. The tool provides centralized monitoring of the different elements integrating the controls systems like Windows and Linux servers, PLCs, applications, etc. Although the primary aim of the tool is to assist the members of the EN-ICE Standby Service, the tool may present different levels of details of the systems depending on the user, which enables experts to diagnose and troubleshoot problems. In this paper, the scope, functionality and architecture of the tool are presented and some initial results on its performance are summarized.

WEPMU034 **Infrastructure of Taiwan Photon Source Control Network** – *Y.-T. Chang (NSRRC), J. Chen, Y.-S. Cheng, K.T. Hsu, S.Y. Hsu, K.H. Hu, C.H. Kuo, C.Y. Wu (NSRRC)*
A reliable, flexible and secure network is essential for the Taiwan Photon Source (TPS) control system which is based upon the EPICS toolkit framework. Subsystem subnets will connect to control system via EPICS based CA gateways for forwarding data and reducing network traffic. Combining cyber security technologies such as firewall, NAT and VLAN, control network is isolated to protect IOCs and accelerator components. Network management tools are used to improve network performance. Remote access mechanism will be constructed for maintenance and troubleshooting. The Ethernet is also used as fieldbus for instruments such as power supplies. This paper will describe the system architecture for the TPS control network. Cabling topology, redundancy and maintainability are also discussed.

WEPMU035 **Distributed Monitoring System Based on ICINGA** – *C. Haen (CERN), E. Bonaccorsi, N. Neufeld (CERN)*
The basic services of the large IT infrastructure of the LHCb experiment are monitored with ICINGA, a fork of the industry standard monitoring software NAGIOS. The infrastructure includes thousands of servers and computers, storage devices, more than 200 network devices and many VLANS, databases, hundreds diskless nodes and many more. The amount of configuration files needed

to control the whole installation is big, and there is a lot of duplication, when the monitoring infrastructure is distributed over several servers. In order to ease the manipulation of the configuration files, we designed a monitoring schema particularly adapted to our network and taking advantage of its specificities, and developed a tool to centralize its configuration in a database. Thanks to this tool, we could also parse all our previous configuration files, and thus fill in our Oracle database, that comes as a replacement of the previous Active Directory based solution. A web frontend allows non-expert users to easily add new entities to monitor. We present the schema of our monitoring infrastructure and the tool used to manage and automatically generate the configuration for ICINGA.

WEPMU036 **Efficient Network Monitoring for Large Data Acquisition Systems** – *D.O. Savu (CERN), B. Martin (CERN) A. Al-Shabibi (Heidelberg University) S.M. Batraneanu, S.N. Stancu (UCI)*

Though constantly evolving and improving, the available network monitoring solutions have limitations when applied to the infrastructure of a high speed real-time data acquisition (DAQ) system. DAQ networks are particular computer networks where experts have to pay attention to both individual subsections as well as system wide traffic flows while monitoring the network. The ATLAS Network at the Large Hadron Collider (LHC) has more than 200 switches interconnecting 3500 hosts and totaling 8500 high speed links. The use of heterogeneous tools for monitoring various infrastructure parameters, in order to assure optimal DAQ system performance, proved to be a tedious and time consuming task for experts. To alleviate this problem we used our networking and DAQ expertise to build a flexible and scalable monitoring system providing an intuitive user interface with the same look and feel irrespective of the data provider that is used. Our system uses custom developed components for critical performance monitoring and seamlessly integrates complementary data from auxiliary tools, such as NAGIOS, information services or custom databases. A number of techniques (e.g. normalization, aggregation and data caching) were used in order to improve the user interface response time. The end result is a unified monitoring interface, for fast and uniform access to system statistics, which significantly reduced the time spent by experts for ad-hoc and post-mortem analysis.

WEPMU037 **Virtualization for the LHCb Experiment** – *E. Bonaccorsi (CERN), L. Brarda, M. Chebbi, N. Neufeld (CERN)*

The LHCb Experiment, one of the four large particle physics detectors at CERN, counts in its Online System more than 2000 servers and embedded systems. As a result of ever-increasing CPU performance in modern servers, many of the applications in the controls system are excellent candidates for virtualization technologies. We see virtualization as an approach to cut down cost, optimize resource usage and manage the complexity of the IT infrastructure of LHCb. Recently we have added a Kernel Virtual Machine (KVM) cluster based on Red Hat Enterprise Virtualization for Servers (RHEV) complementary to the existing Hyper-V cluster devoted only to the virtualization of the windows guests. This paper describes the architecture of our solution based on KVM and RHEV as along with its integration with the existing Hyper-V infrastructure and the Quattor cluster management tools and in particular how we use to run controls applications on a virtualized infrastructure. We present performance results of both the KVM and Hyper-V solutions, problems encountered and a description of the management tools developed for the integration with the Online cluster and LHCb SCADA control system based on PVSS.

WEPMU038 **Network Security System and Method for RIBF Control System** – *A. Uchiyama (SHI Accelerator Service ltd.) M. Fujimaki, N. Fukunishi, M. Komiyama, R. Koyama (RIKEN Nishina Center)*
In RIKEN RI beam factory (RIBF), the local area network for accelerator control system (control system network) consists of commercially produced Ethernet switches, optical fibers and metal cables. On the other hand, E-mail and Internet access for unrelated task to accelerator operation are usually used in RIKEN virtual LAN (VLAN) as office network. From the viewpoint of information security, we decided to separate the control system network from the Internet and operate it independently from VLAN. However, it was inconvenient for users for the following reason; it was unable to monitor the information and status of accelerator operation from the user's office in a real time fashion. To improve this situation, we have constructed a secure system which allows the users to get the accelerator information from VLAN to control system network, while preventing outsiders from having access to the information. To allow access to inside control system network over the network from VLAN, we constructed reverse proxy server and firewall. In addition, we implement a system to send E-mail as security alert from control system network to VLAN. In our contribution, we report this system and the present status in detail.

WEPMU039 **Virtual IO Controllers at J-PARC MR using Xen** – *N. Kamikubota (J-PARC, KEK & JAEA), N. Yamamoto (J-PARC, KEK & JAEA) T. Iitsuka, S. Motohashi, M. Takagi, S.Y. Yoshida (Kanto Information Service (KIS), Accelerator Group) H. Nemoto (ACMOS INC.) S. Yamada (KEK)*
The control system for J-PARC accelerator complex has been developed based on the EPICS toolkit. About 100 traditional "rea") VME-bus computers are used as EPICS IOCs in the control system for J-PARC MR (Main Ring). Recently, we have introduced"virtua" IOCs using Xen, an open-source virtual machine monitor. Scientific Linux with an EPICS iocCore runs on a Xen virtual machine. EPICS databases for network devices and EPICS soft records can be configured. Multiple virtual IOCs run on a high performance blade-type server, running Scientific Linux as native OS. A few number of virtual IOCs have been demonstrated in MR operation since October, 2010. Experience and future perspective will be discussed.

WEPMU040 **Packaging of Control System Software** – *K. Zagar (Cosylab), M. Kobal, N. Saje, A. Zagar (Cosylab) F. Di Maio, D. Stepanov (ITER Organization) R. Sabjan (COBIK)*

Control system software consists of several parts – the core of the control system, drivers for integration of devices, configuration for user interfaces, alarm system, etc. Once the software is developed and configured, it must be installed to computers where it runs. Usually, it is installed on an operating system whose services it needs, and also in some cases dynamically links with the libraries it provides. Operating system can be quite complex itself – for example, a typical Linux distribution consists of several thousand packages. To manage this complexity, we have decided to rely on Red Hat Package Management system (RPM) to package control system software, and also ensure it is properly installed (i.e., that dependencies are also installed, and that scripts are run after installation if any additional actions need to be performed). As dozens of RPM packages need to be prepared, we are reducing the amount of effort and improving consistency between packages through a Maven-based infrastructure that assists in packaging (e.g., automated generation of RPM SPEC files, including automated identification of dependencies). So far, we have used it to package EPICS, Control System Studio (CSS) and several device drivers. We perform extensive testing on Red Hat Enterprise Linux 5.5, but we have also verified that packaging works on CentOS and Scientific Linux. In this article, we describe in greater detail the systematic system of packaging we are using, and its particular application for the ITER CODAC Core System.

13-Oct-11 08:30 – 10:15	Plenary Oral	Auditorium

THAAU — Integration of Industrial Devices
Chair: Stephane Perez (CEA)

THAAUST01 08:30 **Tailoring the Hardware to Your Control System** – *E. Bjorklund (LANL), S.A. Baily (LANL)*

In the very early days of computerized accelerator control systems the entire control system, from the operator interface to the front-end data acquisition hardware, was custom designed and built for that one machine. This was expensive, but the resulting product was a control system seamlessly integrated (mostly) with the machine it was to control. Later, the advent of standardized bus systems such as CAMAC, VME, and CANBUS, made it practical and attractive to purchase commercially available data acquisition and control hardware. This greatly simplified the design but required that the control system be tailored to accommodate the features and eccentricities of the available hardware. Today we have standardized control systems (Tango, EPICS, DOOCS) using commercial hardware on standardized busses. With the advent of FPGA technology and programmable automation controllers (PACs & PLCs) it now becomes possible to tailor commercial hardware to the needs of a standardized control system and the target machine. In this paper, we will discuss our experiences with tailoring a commercial industrial I/O system to meet the needs of the EPICS control system and the LANSCE accelerator. We took the National Instruments Compact RIO platform, embedded an EPICS IOC in its processor, and used its FPGA backplane to create a"standardize" industrial I/O system (analog in/out, binary in/out, counters, and stepper motors) that meets the specific needs of the LANSCE accelerator.

THAAUST02 08:45 **Suitability Assessment of OPC UA as the Backbone of Ground-based Observatory Control Systems** – *W. Pessemier (KU Leuven), G. Deconinck, G. Raskin, H. Van Winckel (KU Leuven) P. Saey (Katholieke Hogeschool Sint-Lieven)*

A common requirement of modern observatory control systems is to allow interaction between various heterogeneous subsystems in a transparent way. However, the integration of COTS industrial products - such as PLCs and SCADA software - has long been hampered by the lack of an adequate, standardized interfacing method. With the advent of the Unified Architecture version of OPC (Object Linking and Embedding for Process Control), the limitations of the original industry-accepted interface are now lifted, and in addition much more functionality has been defined. In this paper the most important features of OPC UA are matched against the requirements of ground-based observatory control systems in general and in particular of the 1.2m Mercator Telescope. We investigate the opportunities of the"information modellin" idea behind OPC UA, which could allow an extensive standardization in the field of astronomical instrumentation, similar to the standardization efforts emerging in several industry domains. Because OPC UA is designed for both vertical and horizontal integration of heterogeneous subsystems and subnetworks, we explore its capabilities to serve as the backbone of a dependable and scalable observatory control system, treating"industrial component" like PLCs no differently than custom software components. In order to quantitatively assess the performance and scalability of OPC UA, stress tests are described and their results are presented. Finally, we consider practical issues such as the availability of COTS OPC UA stacks, software development kits, servers and clients.

THAAUIO03
09:00

How Many Marriages Last 10 Years? A tale of Industrial Relations for Accelerator and Experiment Controls at CERN – *R.J. Jones (CERN)*

The CERN environment is highly reliant on industrial control systems such as control actuators, remote profibus Input/Output modules, PLCs and SCADA systems. The LHC accelerator and experiments are examples of large-scale industrial plants and, as such, are of great interest to commercial companies. CERN and the LHC collaborations work closely with ETM, the provider of the SCADA system, and Siemens for PLCs and other devices within the context of the CERN openlab project. For nearly 10 years the CERN openlab project has been bringing together leading companies to evaluate and integrate cutting-edge technologies and services. The CERN openlab project is a highly visible example of a successful public-private partnership. Through close collaboration with these companies, CERN acquires early access to technology that is not yet commercialised. In return, CERN offers expertise and a highly demanding environment for pushing new technologies to their limits and provides a neutral ground for carrying out advanced R&D. This presentation will explain why the CERN openlab project came into existence and how it has evolved over the last decade. Examples of the technical achievements from the control domain will be highlighted. The motivations and expectations of CERN as a research organisation and the industrial partners as commercial companies will be explored as well as the experiences gained and lessons learnt. Through this presentation, the audience will gather insights into how research organisations could build their own win-win model for industrial relations.

THAAUKP04
09:30

Customized COTS Technologies Through Industry – Research Facility Partnership – *J.T. Truchard (National Instruments)*

The current economic climate has put even more focus on keeping projects under budget and on time while using the latest technology to meet the needs of measurement, diagnostic, and control systems. Commercial off-the - shelf (COTS) systems take advantage of innovations in the computer industry and the hundreds of millions of dollars devoted to R&D – domain experts can now benefit from FPGAs as wells as multicore CPUs and GPUs without being specialists on these technologies. Through collaborations between industry and research facilities, engineers can customize these technologies while keeping costs low to achieve faster computing and loop rates. With every project lasting 15 to 20 years, obsolescence management is yet another key benefit of industry - research collaborations. At this session, examine the technological and business benefits of this type of partnership.

13-Oct-11 10:45 – 12:30	Parallel Oral	Auditorium

THBHAU — Operation Tools

Chair: E. Bjorklund (LANL)

THBHAUST01
10:45

SNS Online Display Technologies for EPICS – *K.-U. Kasemir (ORNL), X.H. Chen, E. Danilova, J.D. Purcell (ORNL)*

The ubiquitousness of web clients from personal computers to cell phones results in a growing demand for web-based access to control system data. At the Oak Ridge National Laboratory Spallation Neutron Source (SNS) we have investigated different technical approaches to provide read access to data in the Experimental Physics and Industrial Control System (EPICS) for a wide variety of web client devices. We compare them in terms of requirements, performance and ease of maintenance.

THBHAUST02 11:00

The Wonderland of Operating the ALICE Experiment – *A. Augustinus (CERN), P.Ch. Chochula, G. De Cataldo, L.S. Jirden, A.N. Kurepin, M. Lechman, O. Pinazza, P. Rosinsky (CERN) A. Moreno (Universidad Politécnica de Madrid, E.T.S.I Industriales)*

ALICE is one of the experiments at the Large Hadron Collider (LHC), CERN (Geneva, Switzerland). Composed of 18 sub-detectors each with numerous subsystems that need to be controlled and operated in a safe and efficient way. The Detector Control System (DCS) is the key for this and has been used by detector experts with success during the commissioning of the individual detectors. With the transition from commissioning to operation more and more tasks were transferred from detector experts to central operators. By the end of the 2010 datataking campaign the ALICE experiment was run by a small crew of central operators, with only a single controls operator. The transition from expert to non-expert operation constituted a real challenge in terms of tools, documentation and training. In addition a relatively high turnover and diversity in the operator crew that is specific to the HEP experiment environment (as opposed to the more stable operation crews for accelerators) made this challenge even bigger. This paper describes the original architectural choices that were made and the key components that allowed to come to a homogeneous control system that would allow for efficient centralized operation. Challenges and specific constraints that apply to the operation of a large complex experiment are described. Emphasis will be put on the tools and procedures that were implemented to allow the transition from local detector expert operation during commissioning and early operation, to efficient centralized operation by a small operator crew not necessarily consisting of experts.

THBHAUST03 11:15

Purpose and Benefit of Control System Training for Operators – *E. Zimoch (PSI-LRF), A. Luedeke (PSI-LRF)*

The complexity of accelerators is ever increasing and today it is typical that a large number of feedback loops are implemented, based on sophisticated models which describe the underlying physics. Despite this increased complexity the machine operators must still effectively monitor and supervise the desired behaviour of the accelerator. This is not alone sufficient; additionally, the correct operation of the control system must also be verified. This is not always easy since the structure, design, and performance of the control system is usually not visualized and is often hidden to the operator. To better deal with this situation operators need some knowledge of the control system in order to react properly in the case of problems. In this paper we will present the approach of the Paul Scherrer Institute for operator control system training and discuss its benefits.

THBHAUST04 11:30

jddd, a State-of-the-art Solution for Control Panel Development – *E. Sombrowski (DESY), A. Petrosyan, K. Rehlich, W. Schütte (DESY)*

Software for graphical user interfaces to control systems may be developed as a rich or thin client. The thin client approach has the advantage that anyone can create and modify control system panels without specific skills in software programming. The Java DOOCS Data Display, jddd, is based on the thin client interaction model. It provides"Includ" components and address inheritance for the creation of generic displays. Wildcard operations and regular expression filters are used to customize the graphics content at runtime, e.g. in a"DynamicLis" component the parameters have to be painted only once in edit mode and then are automatically displayed multiple times for all available instances in run mode. This paper will describe the benefits of using jddd for control panel design as an alternative to rich client development.

THBHAUST05 11:45 **First Operation of the Wide-area Remote Experiment System** – *Y. Furukawa (JASRI/SPring-8), K. Hasegawa (JASRI/SPring-8) G. Ueno (RIKEN Spring-8 Harima)*

The Wide-area Remote Experiment System (WRES) at the SPring-8 has been successfully developed*. The system communicates with the remote user's based on the SSL/TLS with the bi-directional authentication to avoid the interference from non-authorized access to the system. The system has message filtering system to allow remote user access only to the corresponding beamline equipment and safety interlock system to protect persons aside the experimental station from accidental motion of heavy equipment. The system also has a video streaming system to monitor samples or experimental equipment. We have tested the system from the point of view of safety, stability, reliability etc. and successfully made first experiment from remote site of RIKEN Wako site 480km away from SPring-8 in the end of October 2010.

THBHAUIO06 12:00 **Ergonomics of Operational Tools** – *A. Luedeke (PSI-LRF)*

Control systems became continuously more powerful over the past decades. The ability for high data throughput and sophisticated graphical interactions opened a variety of new possibilities. But did this help to provide intuitive, easy to use applications to simplify the operation of modern large scale accelerator facilities? We will discuss what makes an application useful to operation and what is necessary to make a tool easy to use. Special attention will be given to the different needs of the different users. We will show that even the implementation of a small number of simple design rules for applications can help to ease the operation of a facility.

13-Oct-11	10:45 – 12:30	Parallel Oral	Makalu

THBHMU — Quality Assurance

Chair: K. Larsson (MAX-lab)

THBHMUST01 10:45 **Multi-platform SCADA GUI Regression Testing at CERN.** – *P.C. Burkimsher (CERN), M. Gonzalez-Berges, S. Klikovits (CERN)*

The JCOP Framework is a toolkit used widely at CERN for the development of industrial control systems in several domains (i.e. experiments, accelerators and technical infrastructure). The software development started 10 years ago and there is now a large base of production systems running it. For the success of the project, it was essential to formalize and automate the quality assurance process. The paper will present the overall testing strategy and will describe in detail mechanisms used for GUI testing. The choice of a commercial tool (Squish) and the architectural features making it appropriate for our multi-platform environment will be described. Practical difficulties encountered when using the tool in the CERN context are discussed as well as how these were addressed. In the light of initial experience, the test code itself has been recently reworked in OO style to facilitate future maintenance and extension. The paper concludes with a description of our initial steps towards incorporation of full-blown Continuous Integration (CI) support.

THBHMUST02 11:00 **Assessing Software Quality at Each Step of its Lifecycle to Enhance Reliability of Control Systems** – *V.H. Hardion (SOLEIL), A. Buteau, S. Le, N. Leclercq (SOLEIL)*

A distributed software control system aims to enhance the evolutivity and reliability by sharing responsibility between several components. Disadvantage is that detection of problems is harder on a significant number of modules. In the Kaizen spirit, we choose to continuously invest in automatism to obtain a complete overview of software quality despite the growth of legacy code. The development process was already mastered by staging each lifecycle step thanks to a continuous integration server based on JENKINS and MAVEN. We enhanced this process focusing on 3 objectives : Automatic Test, Static Code Analysis and Post-Mortem Supervision. Now the build process automatically includes the test part to detect regression, wrong behavior and integration incompatibility. The in-house TANGOUNIT project satisfies the difficulties of testing the distributed components that Tango Devices are. Next step, the programming code has to pass a complete code quality check-up. SONAR quality server was integrated to the process, to collect each static code analysis and display the hot topics on synthetic web pages. Finally, the integration of Google BREAKPAD in every TANGO Devices gives us an essential statistic from crash reports and allows to replay the crash scenarii at any time. The gain already gives us more visibility on current developments. Some concrete results will be presented like reliability enhancement, better management of subcontracted software development, quicker adoption of coding standard by new developers and understanding of impacts when moving to a new technology.

THBHMUST03 11:15 **System Design towards Higher Availability for Large Distributed Control Systems** – *S.M. Hartman (ORNL)*

Large distributed control systems for particle accelerators present a complex system engineering challenge. The system, with its significant quantity of components and their complex interactions, must be able to support reliable accelerator operations while providing the flexibility to accommodate changing requirements. System design and architecture focused on required data flow are key to ensuring high control system availability. Using examples from the operational experience of the Spallation Neutron Source at Oak Ridge National Laboratory, recommendations will be presented for leveraging current technologies to design systems for high availability in future large scale projects.

THBHMUST04 11:30 **The Software Improvement Process – Tools and Rules to Encourage Quality** – *K. Sigerud (CERN), V. Baggiolini (CERN)*

The Applications section of the CERN accelerator controls group has decided to apply a systematic approach to quality assurance (QA), the"Software Improvement Proces", SIP. This process focuses on three areas: the development process itself, suitable QA tools, and how to practically encourage developers to do QA. For each stage of the development process we have agreed on the recommended activities and deliverables, and identified tools to automate and support the task. For example we do more code reviews. As peer reviews are resource-intensive, we only do them for complex parts of a product. As a complement, we are using static code checking tools, like FindBugs and Checkstyle. We also encourage unit testing and have agreed on a minimum level of test coverage recommended for all products, measured using Clover. Each of these tools is well integrated with our IDE (Eclipse) and give instant feedback to the developer about the quality of their code. The major challenges of SIP have been to 1) agree on common standards and configurations, for example common code formatting and Javadoc documentation guidelines, and 2) how to encourage the developers to do QA. To address the second point, we have successfully implemented 'SIP days', i.e. one day dedicated to QA work to which the whole group of developers participates, and 'Top/Flop' lists, clearly indicating the best and worst products with regards to SIP guidelines and standards, for example test coverage. This paper presents the SIP initiative in more detail, summarizing our experience since two years and our future plans.

THBHMUKP05 11:45 **Distributed Software Infrastructure for Scientific Applications** – *M. Livny (University of Wisconsin-Madison)*

For more than two decades we have been involved in developing and implementing distributed software tools that have been adopted by a broad spectrum of commercial and scientific infrastructures. Ranging from state of the art rendering farms to distributed high throughput computing facilities for the LHC community our Condor software tools effectively and reliably manage large distributed infrastructures. These open source tools are distributed and supported by commercial entities in support of enterprise wide infrastructures and commercial applications. We believe that the design principals, the software development procedures and the software lifecycle practices we use are applicable to the Accelerator and LEPCS communities. Over the years we have learned the importance of information flow and policy decision points as well as an appreciation for the challenges of logging and error propagation in dynamic environments. We have adopted continuous integration methodologies that are supported by a dedicated build and test facility using multiple packaging tools and devoted effort toward installation and configuration tools. A key element of our software methodology is that we use the tools we develop. We use them to manage a campus wide computing infrastructure of more than 10K cores as well as to manage the more than 250 cores in our build and test facility that supports more than 20 software projects. We also make our infrastructure available for other communities. We work closely with our users and maintain ties with application developers that depend on our tools.

13-Oct-11 14:00 – 15:30	Parallel Oral	Auditorium

THCHAU — Data Management
Chair: A. Buteau (SOLEIL)

THCHAUST01 14:00 **PaN-data, the Photon and Neutron Open Data Infrastructure Project** – *R.D. Dimper (ESRF)*

The PaN-data collaboration brings together some of the major multidisciplinary research infrastructures in Europe to construct and operate a sustainable data infrastructure for the European Neutron and Photon laboratories. Such a unique infrastructure will enhance all research done in this community, by making data accessible, preserving the data, allowing experiments to be carried out jointly in several laboratories and by providing powerful tools for scientists to remotely interact with the data. The presentation will introduce the PaN-data FP7 project, highlight its potential benefits and then focus on the challenges which will be addressed in the months and years to come, like the management of large data rates and data sets, standardized annotation of the data, transparent and secure remote access to data, and long-term data preservation.

THCHAUST02
14:15

Large Scale Data Facility for Data Intensive Synchrotron Beamlines – *R. Stotzka (New Affiliation Request Pending) A. Garcia, V. Hartmann, T. Jejkal, H. Pasic, A. Streit, J. van Wezel (KIT) D. Haas, W. Mexner, T. dos Santos Rolo (Karlsruhe Institute of Technology (KIT))*

ANKA is a large scale facility of the Helmholtz Association of National Research Centers in Germany located at the Karlsruhe Institute of Technology. As the synchrotron light source it is providing light from hard X-rays to the far-infrared for research and technology. It is serving as a user facility for the national and international scientific community currently producing 100 TB of data per year. Within the next two years a couple of additional data intensive beamlines will be operational producing up to 1.6 PB per year. These amounts of data have to be stored and provided on demand to the users. The Large Scale Data Facility LSDF is located on the same campus as ANKA. It is a data service facility dedicated for data intensive scientific experiments. Currently storage of 4 PB for unstructured and structured data and a HADOOP cluster as a computing resource for data intensive applications are available. Within the campus experiments and the main large data producing facilities are connected via 10 GE network links. An additional 10 GE link exists to the internet. Tools for an easy and transparent access allow scientists to use the LSDF without bothering with the internal structures and technologies. Open interfaces and APIs support a variety of access methods to the highly available services for high throughput data applications. In close cooperation with ANKA the LSDF provides assistance to efficiently organize data and meta data structures, and develops and deploys community specific software running on the directly connected computing infrastructure.

THCHAUST03
14:30

"CommonDataModel". A Unified Layer to Access Data from Data Analysis Applications Point of View – *N. Hauser (ANSTO), T.K. Lam, N. Xiong (ANSTO) A. Buteau, M. Ounsy, S. Poirier, G. Viguier (SOLEIL) C. rodriguez (ALTEN)*

For almost 20 years, the scientific community of neutrons and synchrotron facilities has been dreaming of using a common data format to be able to exchange experimental results and applications to analyse them. If using HDF5 as a physical container for data quickly raised a large consensus, the big issue is the standardisation of data organisation. By introducing a new level of indirection for data access, the CommonDataModel (CDM) framework offers a solution and allows to split development efforts and responsibilities between institutes. The CDM is made of a core API that accesses data through a data format plugins mechanism and scientific applications definitions (i.e. sets of logically organized keywords defined by scientists for each experimental technique). Using a innovative"mappin" system between applications definitions and physical data organizations, the CDM allows to develop data reduction applications regardless of data files formats AND organisations. Then each institute has to develop data access plugins for its own files formats along with the mapping between application definitions and its own data files organisation. Thus, data reduction applications can be developed from a strictly scientific point of view and are natively able to process data coming from several institutes. A concrete example on a SAXS data reduction application, accessing NeXus and EDF (ESRF Data Format) file will be commented.

THCHAUST04 14:45

Management of Experiments and Data at the National Ignition Facility – *S.G. Azevedo (LLNL), R.G. Beeler, R.C. Bettenhausen, E.J. Bond, A.D. Casey, H.C. Chandrasekaran, C.B. Foxworthy, M.S. Hutton, J.E. Krammen, J.A. Liebman, A.A. Marsh, T. M. Pannell, J.J. Rhodes, J.D. Tappero, A.L. Warrick (LLNL)*

Experiments, or"shot", conducted at the National Ignition Facility (NIF) are discrete events that occur over a very short time frame (tens of ns) separated by hours. Each shot is part of a larger campaign of shots to advance scientific understanding in high-energy-density physics. In one campaign, energy from the 192-beam, 1.8-Megajoule pulsed laser in NIF will be used to implode a hydrogen-filled target to demonstrate controlled fusion. Each shot generates gigabytes of data from over 30 diagnostics that measure optical, x-ray, and nuclear phenomena from the imploding target. Because of the low duty cycle of shots, and the thousands of adjustments for each shot (target type, composition, shape; laser beams used, their power profiles, pointing; diagnostic systems used, their configuration, calibration, settings) it is imperative that we accurately define all equipment prior to the shot. Following the shot, and the data acquisition by the automatic control system, it is equally imperative that we archive, analyze and visualize the results within the required 30 minutes post-shot. Results must be securely stored, approved, web-visible and downloadable in order to facilitate subsequent publication. To-date NIF has successfully fired over 2,500 system shots, and thousands of test firings and dry-runs. We will present an overview of the highly-flexible and scalable campaign setup and management systems that control all aspects of the experimental NIF shot-cycle, from configuration of drive lasers all the way through presentation of analyzed results.

THCHAUST05 15:00

LHCb Online Log Analysis and Maintenance System – *F. Nikolaidis (CERN), L. Brarda, J.C. Garnier, N. Neufeld (CERN)*

History has shown, many times computer logs are the only information an administrator may have for an incident, which could be caused either by a malfunction or an attack. Due to huge amount of logs that are produced from large-scale IT infrastructures, such as LHCb Online, critical information may overlooked or simply be drowned in a sea of other messages . This clearly demonstrates the need for an automatic system for long-term maintenance and real time analysis of the logs. We have constructed a low cost, fault tolerant centralized logging system which is able to do in-depth analysis and cross-correlation of every log. This system is capable of handling O(10000) different log sources and numerous formats, while trying to keep the overhead as low as possible. It provides log gathering and management, offline analysis and online analysis. We call offline analysis the procedure of analyzing old logs for critical information, while Online analysis refer to the procedure of early alerting and reacting. The system is extensible and cooperates well with other applications such as Intrusion Detection / Prevention Systems. This paper presents the LHCb Online topology, problems we had to overcome and our solutions. Special emphasis is given to log analysis and how we use it for monitoring and how we can have uninterrupted access to the logs. We provide performance plots, code modification in well known log tools and our experience from trying various storage strategies.

THCHAUST06 15:15

Instrumentation of the CERN Accelerator Logging Service: Ensuring Performance, Scalability, Maintenance and Diagnostics – *C. Roderick (CERN), R. Billen, D.D. Teixeira (CERN)*

The CERN accelerator Logging Service currently holds more than 90 terabytes of data online, and processes approximately 450 gigabytes per day, via hundreds of data loading processes and data extraction requests. This service is mission-critical for day-to-day operations, especially with respect to the tracking of live data from the LHC beam and equipment. In order to effectively manage any service, the service provider's goals should include knowing how the underlying systems are being used, in terms of:"Who is doing what, from where, using which applications and methods, and how long each action take". Armed with such information, it is then possible to: analyze and tune system performance over time; plan for scalability ahead of time; assess the impact of maintenance operations and infrastructure upgrades; diagnose past, on-going, or re-occurring problems. The Logging Service is based on Oracle DBMS and Application Servers, and Java technology, and is comprised of several layered and multi-tiered systems. These systems have all been heavily instrumented to capture data about system usage, using technologies such as JMX. The success of the Logging Service and its proven ability to cope with ever growing demands can be directly linked to the instrumentation in place. This paper describes the instrumentation that has been developed, and demonstrates how the instrumentation data is used to achieve the goals outlined above.

13-Oct-11 14:00 – 15:30	Parallel Oral	Makalu

THCHMU — Embedded+Real Time 1

Chair: L.T. Hoff (BNL)

THCHMUST01 14:00

Control System for Cryogenic THD Layering at the National Ignition Facility – *M.A. Fedorov (LLNL), C.J. Blubaugh, O.D. Edwards, J. Mauvais, R.J. Sanchez, B.A. Wilson (LLNL)*

The National Ignition Facility (NIF) is the world largest and most energetic laser system for Inertial Confinement Fusion (ICF). In 2010, NIF began ignition experiments using cryogenically cooled targets containing layers of the tritium-hydrogen-deuterium (THD) fuel. The 75 μm thick layer is formed inside of the 2 mm target capsule at temperatures of approximately 18 K. The ICF target designs require sub-micron smoothness of the THD ice layers. Formation of such layers is still an active research area, requiring a flexible control system capable of executing the evolving layering protocols. This task is performed by the Cryogenic Target Subsystem (CTS) of the NIF Integrated Computer Control System (ICCS). The CTS provides cryogenic temperature control with the 1 mK resolution required for beta layering and for the thermal gradient fill of the capsule. The CTS also includes a 3-axis x-ray radiography engine for phase contrast imaging of the ice layers inside of the plastic and beryllium capsules. In addition to automatic control engines, CTS is integrated with the Matlab interactive programming environment to allow flexibility in experimental layering protocols. The CTS Layering Matlab Toolbox provides the tools for layer image analysis, system characterization and cryogenic control. The CTS Layering Report tool generates qualification metrics of the layers, such as concentricity of the layer and roughness of the growth boundary grooves. The CTS activities are automatically coordinated with other NIF controls in the carefully orchestrated NIF Shot Sequence.

THCHMUST02 14:15 **Control and Test Software for IRAM Widex Correlator** – *S. Blanchet (IRAM), P. Chavatte, F. Morel, A. Perrigouard, M. Torres (IRAM)*
IRAM is an international research institute for radio astronomy. It has designed a new correlator called WideX for the Plateau de Bure interferometer (an array of six 15-meter telescopes) in the French Alps. The device started its official service in February 2010. This correlator must be driven in real-time at 32 Hz for sending parameters and for data acquisition. With 3.67 million channels, distributed over 1792 dedicated chips, that produce a 1.87 Gbits/sec data output rate, the data acquisition and processing and also the automatic hardware-failure detection are big challenges for the software. This article presents the software that has been developed to drive and test the correlator. In particular it presents an innovative usage of a high-speed optical link, initially developed for the CERN ALICE experiment, associated with real-time Linux (RTAI) to achieve our goals.

THCHMUST03 14:30 **A New Fast Data Logger and Viewer at Diamond: the FA Archiver** – *M.G. Abbott (Diamond), G. Rehm, I. Uzun (Diamond)*
At the Diamond Light Source position data from 168 Electron Beam Position Monitors (BPMs) and some X-Ray BPMs is distributed over the Fast Acquisition communications network at an update rate of 10kHz; the total aggregate data rate is around 15MB/s. The data logger described here (the FA Archiver) captures this entire data stream to disk in real time, re-broadcasts selected subsets of the live stream to interested clients, and allows rapid access to any part of the saved data. The archive is saved into a rolling buffer allowing retrieval of detailed beam position data from any time in the last four days. A simple socket-based interface to the FA Archiver allows easy access to both the stored and live data from a variety of clients. Clients include a graphical viewer for visualising the motion or spectrum of a single BPM in real time, a command line tool for retrieving any part of the stored data by time of day, and Matlab scripts for exploring the dataset, helped by the storage of decimated minimum, maximum, and mean data.

THCHMUST04 14:45 **Free and Open Source Software at CERN: Integration of Drivers in the Linux Kernel** – *J.D. González Cobas (CERN), E.G. Cota, S. Iglesias Gonsalvez, J.H. Lewis, J. Serrano, M. Vanga (CERN) A. Rubini (GNUDD)*
We describe the experience acquired during the integration of the tsi148 driver into the main Linux kernel tree. The benefits (and some of the drawbacks) for long-term software maintenance are analysed, the most immediate one being the support and quality review added by an enormous community of skilled developers. Indirect consequences are also analysed, and these are no less important: a serious impact in the style of the development process, the use of cutting edge tools and technologies supporting development, the adoption of the very strict standards enforced by the Linux kernel community, etc. These elements were also exported to the hardware development process in our section and we will explain how they were used with a particular example in mind: the development of the FMC family of boards following the Open Hardware philosophy, and how its architecture must fit the Linux model. This delicate interplay of hardware and software architectures is a perfect showcase of the benefits we get from the strategic decision of having our drivers integrated in the kernel. Finally, the case for a whole family of CERN-developed drivers for data acquisition models, the prospects for its integration in the kernel, and the adoption of a model parallel to Comedi, is also taken as an example of how this model will perform in the future.

THCHMUST05 15:00 **The Case for Soft-CPUs in Accelerator Control Systems** – *W.W. Terpstra (GSI)*
The steady improvements in Field Programmable Gate Array (FPGA) performance, size, and cost have driven their ever increasing use in science and industry. As FPGA sizes continue to increase, more and more devices and logic are moved from external chips to FPGAs. For simple hardware devices, the savings in board area and ASIC manufacturing setup are compelling. For more dynamic logic, the trade-off is not always as clear. Traditionally, this has been the domain of CPUs and software programming languages. In hardware designs already including an FPGA, it is tempting to remove the CPU and implement all logic in the FPGA, saving component costs and increasing performance. However, that logic must then be implemented in the more constraining hardware description languages, cannot be as easily debugged or traced, and typically requires significant FPGA area. For performance-critical tasks this trade-off can make sense. However, for the myriad slower and dynamic tasks, software programming languages remain the better choice. One great benefit of a CPU is that it can perform many tasks. Thus, by including a small"Soft-CP" inside the FPGA, all of the slower tasks can be aggregated into a single component. These tasks may then re-use existing software libraries, debugging techniques, and device drivers, while retaining ready access to the FPGA's internals. This paper discusses requirements for using Soft-CPUs in this niche, especially for the FAIR project. Several open-source alternatives will be compared and recommendations made for the best way to leverage a hybrid design.

THCHMUST06 15:15 **The FAIR Timing Master: A Discussion of Performance Requirements and Architectures for a High-precision Timing System** – *M. Kreider (GSI) M. Kreider*
Production chains in a particle accelerator are complex structures with many interdependencies and multiple paths to consider. This ranges from system initialisation and synchronisation of numerous machines to interlock handling and appropriate contingency measures like beam dump scenarios. The FAIR facility will employ WhiteRabbit, a time based system which delivers an instruction and a corresponding execution time to a machine. In order to meet the deadlines in any given production chain, instructions need to be sent out ahead of time. For this purpose, code execution and message delivery times need to be known in advance. The FAIR Timing Master needs to be reliably capable of satisfying these timing requirements as well as being fault tolerant. Event sequences of recorded production chains indicate that low reaction times to internal and external events and fast, parallel execution are required. This suggests a slim architecture, especially devised for this purpose. Using the thread model of an OS or other high level programs on a generic CPU would be counterproductive when trying to achieve deterministic processing times. This paper deals with the analysis of said requirements as well as a comparison of known processor and virtual machine architectures and the possibilities of parallelisation in programmable hardware. In addition, existing proposals at GSI will be checked against these findings. The final goal will be to determine the best instruction set for modelling any given production chain and devising a suitable architecture to execute these models.

13-Oct-11 16:00 – 17:40	Plenary Oral	Auditorium

THDAU — Embedded+Real Time 2
Chair: K. Furukawa (KEK)

THDAULT01 16:00 **Modern System Architectures in Embedded Systems** – *T. Korhonen (PSI), M. Dach (PSI)*
Several new technologies are making their way also in embedded systems. In addition to FPGA technology which has become commonplace, multicore CPUs and I/O virtualization (among others) are being introduced to the embedded systems. In our paper we present our ideas and studies about how to take advantage of these features in control systems. Some application examples involving things like CPU partitioning, virtualized I/O and so an are discussed, along with some benchmarks.

THDAUST02 16:15 **An Erlang-Based Front End Framework for Accelerator Controls** – *D.J. Nicklaus (Fermilab), C.I. Briegel, J.D. Firebaugh, CA. King, R. Neswold, R. Rechenmacher, J. You (Fermilab)*
We have developed a new front-end framework for the ACNET control system in Erlang. Erlang is a functional programming language developed for real-time telecommunications applications. The primary task of the front-end software is to connect the control system with drivers collecting data from individual field bus devices. Erlang's concurrency and message passing support have proven well-suited for managing large numbers of independent ACNET client requests for front-end data. Other Erlang features which make it particularly well-suited for a front-end framework include fault-tolerance with process monitoring and restarting, real-time response,and the ability to change code in running systems. Erlang's interactive shell and dynamic typing make writing and running unit tests an easy part of the development process. Erlang includes mechanisms for distributing applications which we will use for deploying our framework to multiple front-ends, along with a configured set of device drivers. We've developed Erlang code to use Fermilab's TCLK event distribution clock and Erlang's interface to C/C++ allows hardware-specific driver access.

THDAUST03 16:30 **The FERMI@Elettra Distributed Real-time Framework** – *L. Pivetta (ELETTRA), G. Gaio, R. Passuello, G. Scalamera (ELETTRA)*
FERMI@Elettra is a Free Electron Laser (FEL) based on a 1.5 GeV linac. The pulsed operation of the accelerator and the necessity to characterize and control each electron bunch requires synchronous acquisition of the beam diagnostics together with the ability to drive actuators in real-time at the linac repetition rate. The Adeos/Xenomai real-time extensions have been adopted in order to add real-time capabilities to the Linux based control system computers running the Tango software. A software communication protocol based on gigabit Ethernet and known as Network Reflective Memory (NRM) has been developed to implement a shared memory across the whole control system, allowing computers to communicate in real-time. The NRM architecture, the real-time performance and the integration in the control system are described.

THDAULT04
16:45

Embedded Linux on FPGA Instruments for Control Interface and Remote Management – *B.K. Huang (Durham University), R.M. Myers, R.M. Sharples (Durham University) G. Cunningham, G.A. Naylor (CCFE) O. Goudard (ESRF) R.G.L. Vann (York University)*

FPGAs are now large enough that they can easily accommodate an embedded 32-bit processor which can be used to great advantage. Running embedded Linux gives the user many more options for interfacing to their FPGA-based instrument, and in some cases this enables removal of the middle-person PC. It is now possible to manage the instrument directly by widely used control systems such EPICS or TANGO. As an example, on MAST (the Mega Amp Spherical Tokamak) at Culham Centre for Fusion Energy, a new vertical feedback system is under development in which waveform coefficients can be changed between plasma discharges to define the plasma position behaviour. Additionally it is possible to use the embedded processor to facilitate remote updating of firmware which, in combination with a watchdog and network booting ensures that full remote management over Ethernet is possible. We also discuss UDP data streaming using embedded Linux and a web based control interface running on the embedded processor to interface to the FPGA board.

THDAULT05
17:05

Embedded LLRF Controller with Channel Access on MicroTCA Backplane Interconnect – *K. Furukawa (KEK), K. Akai, S. Michizono, T. Miura, J.-I. Odagiri (KEK) H. Deguchi, K. Hayashi, M. Ryoshi (Mitsubishi Electric TOKKI Systems)*

A low-level RF controller has been developed for the accelerator controls for SuperKEKB, Super-conducting RF Test facility (STF) and Compact-ERL (cERL) at KEK. The feedback mechanism will be performed on Vertex-V FPGA with 16-bit ADCs and DACs. The card was designed as an advanced mezzanine card (AMC) for a MicroTCA shelf. An embedded EPICS IOC on the PowerPC core in FPGA will provide the global controls through channel access (CA) protocol on the backplane interconnect of the shelf. No other mechanisms are required for the external linkages. CA is exclusively employed in order to communicate with central controls and with an embedded IOC on a Linux-based PLC for slow controls.

THDAULT06
17:25

MARTe Framework: a Middleware for Real-time Applications Development – *A. Neto (IPFN), D. Alves, B. Carvalho, P.J. Carvalho, H. Fernandes, D.F. Valcárcel (IPFN) A. Barbalace, G. Manduchi (Consorzio RFX, Associazione Euratom-ENEA sulla Fusione) L. Boncagni (ENEA C.R. Frascati) G. De Tommasi (CREATE) P. McCullen, A.V. Stephen (CCFE) F. Sartori (F4E) R. Vitelli (Università di Roma II Tor Vergata) L. Zabeo (ITER Organization)*

The Multi-threaded Application Real-Time executor (MARTe) is a C++ framework that provides a development environment for the design and deployment of real-time applications, e.g. control systems. The kernel of MARTe comprises a set of data-driven independent blocks, connected using a shared bus. This modular design enforces a clear boundary between algorithms, hardware interaction and system configuration. The architecture, being multi-platform, facilitates the test and commissioning of new systems, enabling the execution of plant models in offline environments and with the hardware-in-the-loop, whilst also providing a set of non-intrusive introspection and logging facilities. Furthermore, applications can be developed in non real-time environments and deployed in a real-time operating system, using exactly the same code and configuration data. The framework is already being used in several fusion experiments, with control cycles ranging from 50 microseconds to 10 milliseconds exhibiting jitters of less than 2%, using VxWorks, RTAI or Linux. Codes can also be developed and executed in Microsoft Windows, Solaris and Mac OS X. This paper discusses the main design concepts of MARTe, in particular the architectural choices which enabled the combination of real-time accuracy, performance and robustness with complex and modular data driven applications.

13-Oct-11	16:00 – 16:30	Tutorial	Makalu

THTMU — Data and information management

Chair: N. Hauser (ANSTO)

THTMUKP01
16:00

NetApp Innovation Strategy – *J.F. Marie (NetApp, France)*

Innovation has a special meaning at NetApp. Our founders built innovation into the culture of the company, and for 20 years now we've continued to push the boundaries of what's possible, with a single goal in mind: customer success. For us, those two concepts, innovation and customer success, go hand in hand. Derived from our Product Operations Analyst Day presentations, this presentation establishes our main value claims, discusses where and how we've succeeded to date, and where and how we'll continue to deliver value in shared infrastructure and Big Data.

14-Oct-11	08:30 – 10:15	Plenary Oral	Auditorium

FRAAU — Protection and Safety Systems

Chair: B. Todd (CERN)

FRAAUST01 08:30 **Development of the Machine Protection System for LCLS-I** – *J.E. Dusatko (SLAC)*

Machine Protection System (MPS) requirements for the Linac Coherent Light Source I demand that fault detection and mitigation occur within one machine pulse (1/120th of a second at full beam rate). The MPS must handle inputs from a variety of sources including loss monitors as well as standard state-type inputs. These sensors exist at various places across the full 2.2km length of the machine. A new MPS has been developed based on a distributed star network where custom-designed local hardware nodes handle sensor inputs and mitigation outputs for localized regions of the LCLS accelerator complex. These Link-Nodes report status information and receive action commands from a centralized processor running the MPS algorithm over a private network. The individual Link-Node is a 3u chassis with configurable hardware components that can be setup with digital and analog inputs and outputs, depending upon the sensor and actuator requirements. Features include a custom MPS digital input/output subsystem, a private Ethernet interface, an embedded processor, a custom MPS engine implemented in an FPGA and an Industry Pack (IP) bus interface, allowing COTS and custom analog/digital I/O modules to be utilized for MPS functions. These features, while capable of handing standard MPS state-type inputs and outputs, allow other systems like beam loss monitors to be completely integrated within them. To date, four different types of Link-Nodes are in use in LCLS-I. This paper describes the design, construction and implementation of the LCLS MPS with a focus in the Link-Node.

FRAAULT02 08:45 **STUXNET and the Impact on Accelerator Control Systems** – *S. Lueders (CERN)*

2010 has seen a wide news coverage of a new kind of computer attack, named"Stuxne", targeting control systems. Due to its level of sophistication, it is widely acknowledged that this attack marks the very first case of a cyber-war of one country against the industrial infrastructure of another, although there is still is much speculation about the details. Worse yet, experts recognize that Stuxnet might just be the beginning and that similar attacks, eventually with much less sophistication, but with much more collateral damage, can be expected in the years to come. Stuxnet was targeting a special model of the Siemens 400 PLC series. Similar modules are also deployed for accelerator controls like the LHC cryogenics or vacuum systems or the detector control systems in LHC experiments. Therefore, the aim of this presentation is to give an insight into what this new attack does and why it is deemed to be special. In particular, the potential impact on accelerator and experiment control systems will be discussed, and means will be presented how to properly protect against similar attacks.

FRAAULT03 09:05 **Diamond Light Source PSS – Progress with EN 61508 Conformance** – *M.C. Wilson (Diamond), A.G. Price (Diamond)*

Diamond Light Source is constructing a third phase (Phase III) of photon beamlines and experiment stations. Experience gained in the design, realization and operation of the Personnel Safety Systems (PSS) on the first two phases of beamlines is being used to improve the design process for this development. Information on the safety functionality of Phase I and Phase II photon beamlines is maintained in a hazard database. From this reports are used to assist in the design, verification and validation of the new PSSs. The data is used to make comparisons between beamlines, validate safety functions and to record documentation for each beamline. This forms part of documentations process demonstrating conformance to EN 61508.

FRAAULT04 09:25 **Centralised Coordinated Control to Protect the JET ITER-like Wall.** – *A.V. Stephen (CCFE), G. Arnoux, T. Budd, P. Card, R.C. Felton, A. Goodyear, J. Harling, D. Kinna, P.J. Lomas, P. McCullen, P.D. Thomas, I.D. Young, K-D. Zastrow (CCFE) D. Alves, D.F. Valcárcel (IST) S. Devaux (MPI/IPP) S. Jachmich (RMA) A. Neto (IPFN)*

The JET ITER-like wall project replaces the first wall carbon fibre composite tiles with beryllium and tungsten tiles which should have improved fuel retention characteristics but are less thermally robust. An enhanced protection system using new control and diagnostic systems has been designed which can modify the pre-planned experimental control to protect the new wall. Key design challenges were to extend the Level-1 supervisory control system to allow configurable responses to thermal problems to be defined without introducing excessive complexity, and to integrate the new functionality with existing control and protection systems efficiently and reliably. Alarms are generated by the vessel thermal map (VTM) system if infra-red camera measurements of tile temperatures are too high and by the plasma wall load system (WALLS) if component power limits are exceeded. The design introduces two new concepts: local protection, which inhibits individual heating components but allows the discharge to proceed, and stop responses, which allow highly configurable early termination of the pulse in the safest way for the plasma conditions and type of alarm. These are implemented via the new real-time protection system (RTPS), a centralised controller which responds to the VTM and WALLS alarms by providing override commands to the plasma shape, current, density and heating controllers. This paper describes the design and implementation of the RTPS system which is built with the Multithreaded Application Real-Time executor (MARTe) and will present results from initial operations.

FRAAUIO05 09:45 **High-Integrity Software, Computation and the Scientific Method** – *L. Hatton (Kingston University)*

Given the overwhelming use of computation in modern science and the continuing difficulties in quantifying the results of complex computations, it is of increasing importance to understand its role in the essentially Popperian scientific method. There is a growing debate but this has some distance to run as yet with journals still divided on what even constitutes repeatability. Computation rightly occupies a central role in modern science. Datasets are enormous and the processing implications of some algorithms are equally staggering. In this paper, some of the problems with computation, for example with respect to specification, implementation, the use of programming languages and the long-term unquantifiable presence of undiscovered defect will be explored with numerous examples. One of the aims of the paper is to understand the implications of trying to produce high-integrity software and the limitations which still exist. Unfortunately Computer Science itself suffers from an inability to be suitably critical of its practices and has operated in a largely measurement-free vacuum since its earliest days. Within CS itself, this has not been so damaging in that it simply leads to unconstrained creativity and a rapid turnover of new technologies. In the applied sciences however which have to depend on computational results, such unquantifiability significantly undermines trust. It is time this particular demon was put to rest.

14-Oct-11 10:45 – 12:15	Parallel Oral	Auditorium

FRBHAU — Process Tuning and Feedback Systems 2

Chair: H.D. Pujara (Institute for Plasma Research)

FRBHAULT01 10:45

Feed-forward in the LHC – *M. Pereira (CERN), K. Fuchsberger, M. Lamont, G.J. Müller, R.J. Steinhagen, J. Wenninger (CERN)*
The LHC operational cycle is comprised of several phases such as the ramp, the squeeze and stable beams. During the ramp and squeeze in particular, it has been observed that the behaviour of key LHC beam parameters such as tune, orbit and chromaticity are highly reproducible from fill to fill. To reduced the reliance on the crucial feedback systems, it was decided to perform fill-to-fill feed-forward corrections. The LHC feed-forward application was developed to ease the introduction of corrections to the operational settings. It retrieves the feedback system's corrections from the logging database and applies appropriate corrections to the ramp and squeeze settings. The LHC Feed-Forward software has been used during LHC commissioning and tune and orbit corrections during ramp have been successfully applied. As a result, the required real-time corrections for the above parameters have been reduced to a minimum.

FRBHAULT02 11:05

ATLAS Online Determination and Feedback of LHC Beam Parameters – *J.G. Cogan (SLAC), R. Bartoldus, D.W. Miller, E. Strauss (SLAC)*
The High Level Trigger of the ATLAS experiment relies on the precise knowledge of the position, size and orientation of the luminous region produced by the LHC. Moreover, these parameters change significantly even during a single data taking run. We present the challenges, solutions and results for the online luminous region (beam spot) determination, and its monitoring and feedback system in ATLAS. The massively parallel calculation is performed on the trigger farm, where individual processors execute a dedicated algorithm that reconstructs event vertices from the proton-proton collision tracks seen in the silicon trackers. Monitoring histograms from all the cores are sampled and aggregated across the farm every 60 seconds. We describe the process by which a standalone application fetches and fits these distributions, extracting the parameters in real time. When the difference between the nominal and measured beam spot values satisfies threshold conditions, the parameters are published to close the feedback loop. To achieve sharp time boundaries across the event stream that is triggered at rates of several kHz, a special datagram is injected into the event path via the Central Trigger Processor that signals the pending update to the trigger nodes. Finally, we describe the efficient near-simultaneous database access through a proxy fan-out tree, which allows thousands of nodes to fetch the same set of values in a fraction of a second.

FRBHAULT03 11:25

Beam-based Feedback for the Linac Coherent Light Source – *D. Fairley (SLAC), K.H. Kim, P. Krejcik, L. Piccoli (SLAC)*
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 feedback loops, a 6x6 longitudinal feedback loop, 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. In order to run the feedback loops at beam rate, the feedback loops were implemented in EPICS IOCs with a dedicated ethernet multicast network. This paper will discuss the design, configuration and commissioning of the beam-based Fast Feedback System for LCLS. Topics include algorithms for 120Hz feedback, multicast network performance,

actuator and sensor performance for single-pulse control and sensor readback, and feedback configuration and runtime control.

FRBHAULT04 11:45 **Commissioning of the FERMI@Elettra Fast Trajectory Feedback** – *G. Gaio (ELETTRA), M. Lonza, R. Passuello, L. Pivetta, G. Strangolino (ELETTRA)*
FERMI@Elettra is a new 4th-generation light source based on a single pass Free Electron Laser (FEL). In order to ensure the feasibility of the free electron lasing and the quality of the produced photon beam, a high degree of stability is required for the main parameters of the electron beam. For this reason a flexible real-time feedback framework integrated in the control system has been developed. The first implemented bunch-by-bunch feedback loop controls the beam trajectory. The measurements of the beam position and the corrector magnet settings are synchronized to the 50 Hz linac repetition rate by means of the real-time framework. The feedback system implementation, the control algorithms and preliminary close loop results are presented.

14-Oct-11 10:45 – 12:30	Parallel Oral	Makalu

FRBHMU — Distributed Computing

Chair: G. Chiozzi (ESO)

FRBHMUST01 10:45 **The Design of the Alba Control System. A Cost-Effective Distributed Hardware and Software Architecture has been Validated.** – *D.F.C. Fernandez-Carreiras (CELLS-ALBA Synchrotron), T.M. Coutinho, J. Klora (CELLS-ALBA Synchrotron)*
The control system of Alba is highly distributed from both hardware and software points of view. The hardware infrastructure for the control system includes in the order of 350 racks, 20000 cables and 6200 equipments. More than 150 diskless industrial computers, distributed in the service area and 30 multicore servers in the data center, manage several thousands of process variables. The software is, of course, as distributed as the hardware. It is also a success story of the Tango Collaboration where a complete software infrastructure is available"off the shel". In addition Tango has been productively complemented with the powerful Sardana framework, a great effort in terms of development, which nowadays, several institutes benefit from. The whole installation has been coordinated from the beginning with a complete cabling and equipment database, where all the equipment, cables, connectors are described and inventoried. The so called"cabling databas" is core of the installation. The equipments and cables are defined there. The basic configurations of the hardware like MAC and IP addresses, DNS names, etc. are also gathered in this database, allowing the network communication files and declaration of variables in the PLCs to be created automatically. This paper explains the design and the architecture of the control system, describes the tools and justifies the choices made. Furthermore, it presents and analyzes the figures regarding cost and performances.

FRBHMUST02 11:00 **Towards High Performance Processing in Modern Java Based Control Systems** – *M. Misiowiec (CERN), W. Buczak, M. Buttner (CERN)*
CERN controls software is often developed on Java foundation. Some systems carry out a combination of data, network and processor intensive tasks within strict time limits. Hence, there is a demand for high performing, quasi real time solutions. Extensive prototyping of the new CERN monitoring and alarm software required us to address such expectations. The system must handle dozens of thousands of data samples every second, along its three tiers, applying complex computations throughout. To accomplish the goal, a deep understanding of multithreading, memory management and interprocess communication was required. There are unexpected traps hidden behind an excessive use of 64 bit memory or severe impact on the processing flow of modern garbage collectors, including the state of the art Oracle GarbageFirst. Tuning JVM configuration significantly affects the execution of the code. Even more important is the amount of threads and the data structures used between them. Accurately dividing work into independent tasks might boost system performance. Thorough profiling with dedicated tools helped understand the bottlenecks and choose algorithmically optimal solutions. Different virtual machines were tested, in a variety of setups and garbage collection options. The overall work provided for discovering actual hard limits of the whole setup. We present this process of architecting a challenging system in view of the characteristics and limitations of the contemporary Java runtime environment.

FRBHMUST03 11:15 **Thirty Meter Telescope Observatory Software Architecture** – *K.K. Gillies (TMT), C. Boyer (TMT)*
The Thirty Meter Telescope (TMT) will be a ground-based, 30-m optical-IR telescope with a highly segmented primary mirror located on the summit of Mauna Kea in Hawaii. The TMT Observatory Software (OSW) system will deliver the software applications and infrastructure necessary to integrate all TMT software into a single system and implement a minimal end-to-end science operations system. At the telescope, OSW is focused on the task of integrating and efficiently controlling and coordinating the telescope, adaptive optics, science instruments, and their subsystems during observation execution. From the software architecture viewpoint, the software system is viewed as a set of software components distributed across many machines that are integrated using a shared software base and a set of services that provide communications and other needed functionality. This paper describes the current state of the TMT Observatory Software focusing on its unique requirements, architecture, and the use of middleware technologies and solutions that enable the OSW design.

FRBHMULT04 11:30 **Towards a State Based Control Architecture for Large Telescopes: Laying a Foundation at the VLT** – *R. Karban (ESO), N. Kornweibel (ESO) D.L. Dvorak, M.D. Ingham, D.A. Wagner (JPL)*
Large telescopes are characterized by a high level of distribution of control-related tasks and will feature diverse data flow patterns and large ranges of sampling frequencies; there will often be no single, fixed server-client relationship between the control tasks. The architecture is also challenged by the task of integrating heterogeneous subsystems which will be delivered by multiple different contractors. Due to the high number of distributed components, the control system needs to effectively detect errors and faults, impede their propagation, and accurately mitigate them in the shortest time possible, enabling the service to be restored. The presented Data-Driven Architecture is based on a decentralized approach with an end-to-end integration of disparate independently-

developed software components, using a high-performance standards-based communication middle-ware infrastructure, based on the Data Distribution Service. A set of rules and principles, based on JPL's State Analysis method and architecture, are established to avoid undisciplined component-to-component interactions, where the Control System and System Under Control are clearly separated. State Analysis provides a model-based process for capturing system and software requirements and design, helping reduce the gap between the requirements on software specified by systems engineers and the implementation by software engineers. The method and architecture has been field tested at the Very Large Telescope, where it has been integrated into an operational system with minimal downtime.

FRBHMULT05 11:50 **Middleware Trends and Market Leaders 2011** – *A. Dworak (CERN), P. Charrue, F. Ehm, W. Sliwinski, M. Sobczak (CERN)*

The Controls Middleware (CMW) project was launched over ten years ago. Its main goal was to unify middleware solutions used to operate CERN accelerators. An important part of the project, the equipment access library RDA, was based on CORBA, an unquestionable standard at the time. RDA became an operational and critical part of the infrastructure, yet the demanding run-time environment revealed some shortcomings of the system. Accumulation of fixes and workarounds led to unnecessary complexity. RDA became difficult to maintain and to extend. CORBA proved to be rather a cumbersome product than a panacea. Fortunately, many new transport frameworks appeared since then. They boasted a better design, and supported concepts that made them easy to use. Willing to profit from the new libraries, the CMW team updated user requirements, and in their terms investigated eventual CORBA substitutes. The process consisted of several phases: a review of middleware solutions belonging to different categories (e.g. data-centric, object-, and message-oriented) and their applicability to a communication model in RDA; evaluation of several market recognized products and promising start-ups; prototyping of typical communication scenarios; testing the libraries against exceptional situations and errors; verifying that mandatory performance constraints were met. Thanks to the performed investigation the team have selected a few libraries that suit their needs better than CORBA. Further prototyping will select the best candidate.

FRBHMULT06 12:10 **EPICS V4 Expands Support to Physics Application, Data Acsuisition, and Data Analysis** – *L.R. Dalesio (BNL), G. Carcassi, M.A. Davidsaver, M.R. Kraimer, R. Lange, N. Malitsky, G. Shen (BNL) J. Rowland (Diamond) M. Sekoranja (Cosylab) G.R. White (SLAC)*

EPICS version 4 extends the functionality of version 3 by providing the ability to define, transport, and introspect composite data types. Version 3 provided a set of process variables and a data protocol that adequately defined scalar data along with an atomic set of attributes. While remaining backward compatible, Version 4 is able to easily expand this set with a data protocol capable of exchanging complex data types and parameterized data requests. Additionally, a group of engineers defined reference types for some applications in this environment. The goal of this work is to define a narrow interface with the minimal set of data types needed to support a distributed architecture for physics applications, data acquisition, and data analysis.

14-Oct-11 13:30 – 14:45	Plenary Oral	Auditorium

FRCAU — Towards the Future

Chair: M. Mouat (TRIUMF, Canada's National Laboratory for Particle and Nuclear Physics)

FRCAUST01 13:30

The Control System for the FAIR facility – Project Status and Design Overview – *R. Baer (GSI)*

In the next few years the international accelerator complex FAIR (Facility for Anti-protons and Ion Research) will be erected at GSI, substantially extending the present GSI accelerators then being used as injectors. FAIR will provide anti-proton, ion, and rare isotope beams with unprecedented intensity and quality. For FAIR, a new accelerator control system is presently under development that addresses all aspects of the functionality to operate the GSI/FAIR machines and moreover integrates the present GSI control system infrastructure. One prominent challenge is the complex operation scheme with the handling and management of massive parallel beam operation which imposes ambitious demands on the timing and cycle management system. This presentation shortly summarizes the general status of the FAIR project and major challenges following from being an international project. We focus on the progress of the general control system design, system architecture, technology validation and choices, and integration of complete controls building blocks developed or adapted in the framework of collaborations. The presentation is supplemented by reporting our activities of retrofitting the present GSI control system stack to allow integration into the new FAIR controls environment.

FRCAUST02 13:45

Status of the CSNS Controls System – *C.H. Wang (IHEP Beijing)*

The China Spallation Neutron Source (CSNS) is planning to start construction in 2011 in China. The CSNS controls system will use EPICS as development platform. The scope of the controls system covers thousands of devices located in Linac, RCS and two transfer lines. The interface from the control system to the equipment will be through VME Power PC processors and embedded PLC as well as embedded IPC. The high level applications will choose XAL core and Eclipse platform. Oracle database is used to save historical data. This paper introduces controls preliminary design and progress. Some key technologies, prototypes,schedule and personnel plan are also discussed.

FRCAUST03 14:00

Status of the ESS Control System – *G. Trahern (ESS)*

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. It is designed to include the ability to upgrade the LINAC to a higher power of 7.5 MW at a fixed energy of 2500 MeV. The Accelerator Design Update (ADU) collaboration of mainly European institutions will deliver a Technical Design Report at the end of 2012. First protons are expected in 2018, and first neutrons in 2019. The ESS will be constructed by a number of geographically dispersed institutions which means that a considerable part of control system integration will potentially be performed off-site. To mitigate this organizational risk, significant effort will be put into standardization of hardware, software, and development procedures early in the project. We have named the main result of this standardization the Control Box concept. The ESS will use EPICS, and will build on the positive distributed development experiences of SNS and ITER. Current state of control system design and key decisions are presented in the paper as well as immediate challenges and proposed solutions.

FRCAUST04 14:15 **Status of the ASKAP Monitoring and Control System** – *J.C. Guzman (CSIRO ATNF) H. Shoaee (SLAC)*

The Australian Square Kilometre Array Pathfinder, or ASKAP, is CSIRO's new radio telescope currently under construction at the Murchison Radio astronomy Observatory (MRO) in Mid West region of Western Australia. As well as being a world-leading telescope in its own right, ASKAP will be an important testbed for the Square Kilometre Array, a future international radio telescope that will be the world's largest and most sensitive. This paper gives a status update of the ASKAP project and provides a detailed look at the initial deployment of the monitoring and control system as well as major issues to be addressed in future software releases before the start of system commissioning later this year.

FRCAUST05 14:30 **Status of the LCLS** – *H. Shoaee (SLAC)*

The successful commissioning and initial series of experiments at SLAC's Linac Coherent Light Source (LCLS) have been the culmination of a significant effort to integrate new, state-of-the-art controls with legacy controls of the SLAC linac. The controls architecture consists of a distributed system of EPICS IOCs and Linux servers operating in conjunction with an older system consisting of centralized VMS facility, CAMAC fieldbus and Intel industrial front-end processors. A rich and burgeoning suite of high level Java and MATLAB applications provide data acquisition and analysis tools for diagnosing, tuning and optimizing the machine. A relational database unites the configuration control, online modeling and reference beam data. The AIDA middleware provides transparent access to data from either controls systems and has allowed engineers to migrate to new platforms without requiring changes to applications software. A recent upgrade of the legacy Linac controls includes a data bridge from the CAMAC system to VME IOCs which results in uniform EPICS channel access interface to entire LCLS controls data. One of the many design challenges has been to provide such data synchronously with the timing system on a pulse-by-pulse basis at 120 Hz to support beam-based feedback and other applications.

14-Oct-11	14:45 – 15:30	Plenary Oral	Auditorium

FRDAU — Closing Session

Chair: A. Gotz (ESRF)

FRDAUIO01 14:45 **ICALEPCS 2011 highlights** – *J.M. Chaize (ESRF)*
wrap up of the ICALEPCS 2011. Main strams, keywords, highlights

FRDAUIO02 15:05 **ICALEPCS 2013** – *C.D. Marshall (LLNL)*
Presentation of the ICALEPCS 2013 organisation and venue

FRDAUIO03 15:15 **ICALEPCS 2015** – *L. Corvetti (ASCo)*
Abstract: The Australian Synchrotron (AS) wishes to contribute to the ICALEPCS series by hosting it in Melbourne, Australia in 2015. The AS will be supported by Australia's highly respected science and technology organisations, ANSTO, CSIRO and ANU with a desire to participate in the continuing success of ICALEPCS. The AS, a 3GeV third generation Synchrotron light source has been in operation since 2007 with expansion plans for new beamlines and further capability. Melbourne, a multicultural, safe and friendly city is an ideal location to host the ICALEPCS in 2015.

FRDAUKP04 15:25 **ICALEPCS 2011 Official Closing Ceremony** – *A. Gotz (ESRF)*
ICALEPCS2011 official closing ceremony

Boldface papercodes indicate primary authors

— A —

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Abbott, D.	TUBAULT03
Abbott, M.G.	MOPKS027, **MOPMU032, THCHMUST03**
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Appelbee, C.W.	TUBAUST02
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Arroyo Garcia, J.A.R.	**MOPMN020**
Arruat, M.	**WEPMN002, WEPMS007**
Artoos, K.	MOMMU005
Asano, Y.	WEMMU011
Asnicar, F.	MOPMN013, TUDAUST02
Assmann, R.W.	WEPMU020
Audrain, M.	WEPMU016
Auge, G.	MOMAU005
Augustinus, A.	MOPKN015, MOPKN018, MOPMS031, WEPMU026, **THBHAUST02**
Auria, S.X.	MOPKN019
Ayvazyan, V.	WEPKS010
Azevedo, S.G.	**THCHAUST04**

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Back, M.	WEBHMUST02
Badillo, I.	**MOMMU002**
Bär, R.	WEPMN018, **WEPMS011, FRCAUST01**
Baggiolini, V.	MOPMN027, WEPKS005, WEPMS003, **WEPMS007,** WEPMU023, THBHMUST04
Baily, S.A.	THAAUST01
Bak, P.A.	MOPMU030, WEPMN022
Bakay, A.	WEPKN012
Balasubramanyan, A.	MOPMU014
Balorin, C.	WEPMU018
Banas, E.	MOBAUST02, WEMAU005
Bandyopadhyay, S.	MOMMU006, MOPKS009
Bao, X.	MOPKS006, MOPMS004
Barabin, S.V.	**MOPKS007**
Barbalace, A.	**WEPKN001, WEPKS011, WEPMN036, THDAULT06**
Barbosa, F.J.	TUBAULT03
Baribeau, L.	MOPMU036
Barillari, T.	MOBAUST02
Barillere, R.	MOPMS025, WEAAULT02
Barmuta, P.	WEPMS030
Baros, D.	MOPMS010
Bart Pedersen, S.	**WEPKS027**
Bartoldus, R.	FRBHAULT02
Bassato, G.	MOPKN012, MOPKS007, **MOPMS035, WEPMU017**
Bates, R.L.	WEPMN038

Batrakov, A.M.	MOPMU030
Batraneanu, S.M.	WEPMU036
Battistello, L.	TUDAUST02, WEPMU025
Battistin, M.	WEPMN038
Bau, J.C.	**WEPMN003**
Baudrenghien, P.	MOPKS024
Beauregard, D.	MOPMU013
Becheri, F.	MOMMU001
Bednarek, M.	**WEPMS008**
Beeler, R.G.	THCHAUST04
Behera, B.	MOPMU026
Bellorini, F.	MOPMS001
Belov, S.	WEBHAUST06
Beltram, T.	WEPMN009
Beltran, D.B.	MOPMN003, MOPMU023, WEPMS023, WEPMS024
Belver, D.	WEPMN006
Benedikt, M.	MOBAUST03
Benini, D.	WEPMU022
Berg, R.	MOPMU013
Berkaev, D.E.	MOPKN004, **MOPMU028**
Berkovits, D.	MOPMS006, MOPMS008
Bernard, F.B.	MOPMS001, WEPMU033
Berry, S.	WEPMN038
Berthe, C.	MOPMN016
Bertin, J.	MOMAU005
Besser, B.	**MOPMN017**
Bestmann, P.	WEMAU007
Betinelli, P.	MOCAUIO04, MOPMU040, WEMMU004, WEPMS026
Bettenhausen, R.C.	THCHAUST04
Beutner, B.	MOPMN021
Bhattacharjee, T.	**MOPKS009**
Bhole, R.B.	MOPKS009
Billen, R.	MOPKN009, MOPKN010, MOPKN024, THCHAUST06
Bindi, M.	MOBAUST02, MOPMN014
Binello, S.	MOBAUST04
Bisegni, C.	WEPKS028
Bisou, J.	WEMMU004, WEPMS026
Bitadze, A.	**WEPMN038**
Bitenc, U.X.	MOPKN019
Bitterli, K.	TUDAUST03
Björklund, E.	**THAAUST01**
Blache, F.	MOPMU040, WEMMU004
Black, G.	MOPMU013
Blanchard, S.	**MOPMS001, MOPMS016**
Blanchet, S.	**THCHMUST02**
Blanco, E.	MOPMS001, WEPKN024, **WEPKS006, WEPKS033**
Bloch, P.	MOPKN007
Blubaugh, C.J.	THCHMUST01

Bobnar, J.	**TUAAULT03**
Boccardi, A.	TUBAULT04
Boccioli, M.	MOPMS016, WEPKS031
Boeckmann, T.	MOPMS017
Bogani, A.I.	TUDAUST02, WEPMU032
Bolkhovityanov, D.	**MOPMU010, WEPMN017, WEPMN022**
Bonaccorsi, E.	WEMMU005, WEPMU035, **WEPMU037**
Boncagni, L.	THDAULT06
Bond, E.J.	THCHAUST04
Bonneau, P.	WEPMN038
Bonnes, U.	MOMMU012
Boots, M.J.	MOPMU013
Bordanovski, Y.V.	MOPMU004
Borga, A.O.	**WEBHMUST01**
Borghes, R.	**MOPMU015, TUDAUST02**
Boriskin, V.N.	MOPMU016, MOPMU022
Botelho-Direito, J.	WEPMN038
Boterenbrood, H.	MOBAUST02
Boucly, C.	WEPMU019
Bourguignon, G.	MOMAU005
Bousson, N.	WEPMN038
Boyd, R.	WEPMN038
Boyer, C.	**MODAULT01, FRBHMUST03**
Bozyigit, S.	WEPKS027
Bradu, B.	WEPKN024
Bräger, M.	MOPMS037
Bräuning, H.	MOPMN008
Brands, H.	TUDAUST03
Brarda, L.	**WEMMU005, WEPMU037, THCHAUST05**
Braun, H.	MOBAUST02
Breda, M.	WEPKS011
Brenner, R.	MOBAUST02
Bressler, S.	MOPMN014
Brett, A.B.	MOBAUST03, MOPKN023, MOPMN005, WEPKN016
Briegel, C.I.	**MOPMU039, THDAUST02**
Brightwell, M.	**MOPMS037**
Brown, K.A.	**MOBAUST04**
Browne, S.	MODAULT01
Brunton, G.K.	TUDAUST06
Buczak, W.	FRBHMUST02
Budd, T.	FRAAULT04
Buffat, X.	MOPMN018
Burandt, C.	MOMMU012
Burandt, N.	MOPMU012
Burge, S.R.	WEPMN011
Burkimsher, P.C.	**THBHMUST01**
Buteau, A.	MOPKN016, WEPKN003, THBHMUST02, THCHAUST03
Butterworth, A.C.	MOPKS024

Buttner, M.	MOPKN011, FRBHMUST02
Byrd, J.M.	**WEBHMUIO05**

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Caforio, D.	MOBAUST02
Calabrò, S.	WEPKS028
Calcoen, D.O.	**WEPMN026**
Callot, O.	MOBAUST06
Calvo, J.C.	**MOPMS009**
Campbell, I.G.	MOBAUST04
Canella, S.	**MOPMN012, WEPMU022**
Capobianco, R.	WEPKS011
Carcassi, G.	MOPMN015, **WEPKN004, WEPKN009, FRBHMULT06**
Card, P.	WEPMN014, FRAAULT04
Cardoso, L.G.	MOBAUST06, **MOPMN028, WEBHAUST01**
Carey, R.W.	MOMAU009, TUDAUST06
Carletto, O.	MOPMN012
Carlier, E.	WEPMU023
Carmichael, L.r.	**WEPMU013**
Carvalho, B.	THDAULT06
Carvalho, I.S.	MOPMU035
Carvalho, P.J.	WEPMU018, THDAULT06
Casalegno, L.	MOPKN023
Casey, A.D.	THCHAUST04
Catani, L.	**WEPKS028**
Cattin, M.	TUBAULT04
Caulier, G.	WEPMN020
Cavinato, M.	MODAUIO02
Cazala, J.	MOPMU031
Cecillon, F.	WEPKS014
Cela-Ruiz, J.M.	WEPKN010
Cerff, K.	WEPKN020
Chai, J.-S.	MOPKS017
Chaize, J.M.	MOOAUKP01, TUCAUST03, **FRDAUIO01**
Chakraborty, P.S.	MOPKS009
Chanan, G.A.	MOPKS023
Chandrasekaran, H.C.	THCHAUST04
Chang, Y.-T.	MOPMU002, WEPMS013, **WEPMU034**
Chapuis, J.-C.	**WEPMU009**
Charrondiere, C.	MOPKN007, **MOPMS002, WEMAU007, WEPMU010**
Charrue, P.	WEMMU009, FRBHMULT05
Chattopadhyay, S.	MOPKS009
Chattou, A.	WEMMU004
Chavatte, P.	THCHMUST02
Chebbi, M.	WEPMU037
Cheblakov, P.B.	MOPMU010, WEPMN017, WEPMS015, **WEPMS020**

Chekulaev, S. MOBAUST02
Chen, J. MOPKN013, MOPMN023, **MOPMU002, WEPMN030,** WEPMS013, WEPMU034
Chen, R. WEPMS022
Chen, S. WEBHMULT04
Chen, X.H. MOPMS018, THBHAUST01
Chen, Y.K. MOPMU002
Chenda, V. MOPMU015, TUDAUST02
Cheng, Y.-S. MOPKN013, **MOPMN023, MOPMU002, WEPMN030,** WEPMS013, WEPMU034
Chernousko, Y.S. WEPMU003
Chestnut, R.P. TUCAUST04
Chevtsov, P. TUDAUST03, **MOPKS019**
Chevtsov, S. TUCAUST04
Chiozzi, G. WEAAULT03, WEPKS025, **WEPKS032**
Chiu, P.C. MOPKS022, MOPMN023, MOPMU002, WEPMN030, WEPMS013
Chochula, P.Ch. MOPKN015, **MOPKN018, MOPMS031, WEPMU026,** THBHAUST02
Chrin, J.T.M. **WEPKS024**
Christou, C. MOPKS001
Chu, Y.P. MOPMU011, WEPKN027
Chubarov, D. WEBHAUST06
Cirami, R. WEPKS025
Citterio, M. MOPMS021
Ciuffetti, P. WEPKS028
Clausen, M.R. MOPMS017
Claustre, L. WEMAU011
Cleva, S. TUDAUST02
Cobb, T.M. MOPMU032, **WEPKS009, WEPMN013**
Cogan, J.G. **FRBHAULT02**
Colavita, M.M. MOPKS023
Coles, C. WEPKS002
Collette, C.G.R.L. MOMMU005
Colocho, W.S. MOMAU008
Conforto, N. MOPMS035
Copy, B. **WEAAULT02, WEBHAUST02, WEPKS001, WEPKS026,** WEPMU029
Coquet, J. MOPMU040, WEMMU004
Coretti, I. WEPKS025
Corruble, D. **MOPMU040**
Corti, G. WEPMU024
Corvetti, L. **FRDAUIO03**
Costa, I. MOPMN003
Costa, L. WEPMU017
Costanzo, M.R. MOBAUST04
Cota, E.G. THCHMUST04
Coutinho, T.M. **WEAAUST01, FRBHMUST01**

Crockett, L.	WEPMN019
Crombie, M.A.	MOPMS013
Cuevas, C.	**TUBAULT03, WEPMS017**
Cuní, G.	WEAAUST01
Cunningham, G.	TUBAUST01, THDAULT04
Curri, A.	MOPMU015, TUDAUST02
Curry, D.	**MOPMS018**
Czuba, K.	WEPMS030

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Dach, M.	MOPKS002, **TUDAUST03, THDAULT01**
Dalesio, L.R.	MOPKS004, MOPKS015, WEPKN004, WEPKN014, WEPKN018, WEPKS020, **FRBHMULT06**
Danilova, E.	MOPKN025, THBHAUST01
Darcourt, G.	MOMAU005
Das, M.	MOMMU006
Datta, C.	MOPMU014
Datta, K.	**MOPMU014**
D’Auria, S.	MOBAUST02
Davidsaver, M.A.	WEPKS021, FRBHMULT06
Davis, M.A.	**WEPMN037**
De Cataldo, G.	THBHAUST02, MOPKN015, WEPKN019, WEPMU026
De Ley, E.	**TUAAULT04, WEPKS008, WEPKS029**
De Marco, M.	TUDAUST02, WEPMN034, WEPMU032
De Monte, R.	WEBHMUST01
De Tommasi, G.	MODAUIO02, MOPMU035, THDAULT06
Decker, G.	MOPKS025
Deconinck, G.	THAAUST02
DeContreras, G.	MOMAU008
Dedič, J.	MOBAUST03, MOPMN005, MOPMS018, WEPKN016, WEPMN015, WEPMN016
Deguchi, H.	THDAULT05
del Campo, M.	MOPKN012, MOPMU007, WEPMN006
Delamare, Ch.	WEPMU008
Deliyergiyev, M.	MOBAUST02
Dell’Olio, C.	WEPKN019
DeLong, J.H.	WEPMS015
Demaret, R.	MOMAU009, TUDAUST06
Dementyev, E.N.	MOPMU001
Denis, J.F.	MOPMU005, MOPMU025
Devaux, S.	WEPMU018, FRAAULT04
Di Calafiori, D.R.S.	MOPMS003
Di Giacomo, M.	MOPMN016
Di Girolamo, B.	WEPMN038
Di Luca, S.	WEPMU008
Di Maio, F.	**MOPKS029, WEPMU040**

Di Marcantonio, P. **WEPKS025**
Di Mauro, A. WEPMU026
Di Monte, N.P. **MOPKS026**
Di Pirro, G. WEPKS028
DiCastro, M. MOPMS015
Dickson, R. MOPMS018
Dimper, R.D. **THCHAUST01**
Ding, J.G. WEPMS027
Dissertori, G. MOPMS003
Dolton, W. MOPMU013
Dong, H. TUBAULT03, WEPMS017
Donszelmann, M. WEPKS026
Doolittle, L.R. WEBHMUIO05, **WEMMU002**
Dorling, S.E. TUBAUST02
Dos Santos, M.F. WEPMU032, TUDAUST02
dos Santos Rolo, T. THCHAUST02
D'Ottavio, T. MOBAUST04, **MOMAU002**
Doubek, M. WEPMN038
Dovzhenko, B.A. MOPMU021
Drochner, M. MOPMU020
Drosdal, L.N. **WEPMU011**
Du, Q. **WEBHMULT04**
Ducobu, L. WEPMN020
Duncan, S. MOPKS001
Duru, P. MOCAULT03
Dusatko, J.E. WEPMS014, **FRAAUST01**
Dutt, R.N. **WEPKN017**
Dutta, D.P. MOPMU014
Duval, P. MOPMS033
Dvorak, D.L. FRBHMULT04
Dworak, A. WEMAU001, **FRBHMULT05**

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Echevarria, P. WEPMN006
Eckel, B.E. **WEAAUKP04**
Edwards, O.D. MOMAU009, THCHMUST01
Egorov, K. WEPMN038
Eguiraun, M. MOMMU002, **MOPMU007, WEPMN006**
Ehm, F. **WEMAU001, WEPKN006, FRBHMULT05**
Eichhorn, R. MOMMU012, MOPMN002
Eisele, W. MOBAUST04
Elaazzouzi, A. WEPKS014
Elattaoui, X. WEPKN003, WEPMS026
Eliyahu, I. MOPMN007, MOPMS006, **MOPMS008, TUCAUST02**
Ellerbroek, B.L. MODAULT01
Ellis, C. MOPMS013

Engel, D.B. **MOPKN027**
Epaud, F. MOPKS010, **MOPKS014**
Ertel, E. MOBAUST02
Esposito, M. MOMMU005
Etxebarria, V. WEPMN006
Ezawa, K. MOPMU017

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Fabich, A. MOBAUST03
Fairley, D. WEPMN032, **FRBHAULT03**
Farnham, B. **MOPMS025, WEPMS006**
Farnsworth, R.I. MOPKS025
Fatkin, G.A. **MOPMU030**
Fedorchenko, V. WEPKN012
Fedorov, M.A. **THCHMUST01**
Fehling-Kaschek, M.L. MOPKN019
Felton, R.C. WEPMN014, FRAAULT04, MOPMU035
Feniet, T. WEMAU007
Ferianis, M. WEBHMUST01
Fernandes, H. THDAULT06
Fernandes, R.N. WEAAULT02
Fernandez, L. WEPMN002
Fernandez Adiego, B. WEAAULT02, **WEPKS033**
Fernandez Carmona, P. MOMMU005
Fernandez-Carreiras, D.F.C. MOMMU001, MOPMN003, **MOPMU006, MOPMU023,** WEAAUST01, WEPMS023, WEPMS025, **WEPMU005, FRBHMUST01**
Fernando, A. MOBAUST04
Ferreira, M.J. WEPKN018
Feuchtwanger, J. MOPMU007
Fiedler, S. MOPMS015
Filimonov, V. MOBAUST02
Firebaugh, J.D. THDAUST02
Fisher, J.M. TUDAUST06, WEBHAUST04
Fishler, B.T. TUDAUST06
Fleck, R. WEBHMUST02
Fleck, T. WEPMS011
Fleischhauer-Fuss, L. MOPMU020
Flemming, M. MOMAU003
Fortescue-Beck, E. **MOPKN024**
Foxworthy, C.B. THCHAUST04
Frak, B. MOBAUST04, MOMAU002
Franco, A. WEPKN019
Franek, B. MOBAUST06
Frank, M. MOBAUST06
Franke, S. **MOPMN002**

Franz, S. MOBAUST02
Frazier, T.M. **WEBHAUST04**
Fröhlich, G. MOPMS014, MOPMS030
Fröhlich, L. WEPMU025
Fu, W. MOBAUST04, **MOPKN021**
Fuchsberger, K. MOMMU003, MOPMN018, FRBHAULT01
Fujihara, R. MOPMN025
Fujimaki, M. WEPMU038
Fukui, T. MOPMN025, TUDAUST01, WEPKN011
Fukunishi, N. MOPKN005, WEPMU038
Fukutani, S. MOPMN010
Fullerton, J. **MOPMS034**
Furukawa, K. **MOBAUST05, MOPKN008, MOPMS029, WEPMN029, THDAULT05**
Furukawa, Y. TUDAUST01, **WEMAU010, THBHAUST05**

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Gabourin, S. WEPMU002
Gaio, G. MOPMU015, WEBHMUST01, WEPMU025, THDAUST03, **FRBHAULT04, TUDAUST02**
Gajewski, K.J. **MOPMN001**
Galli, D. WEBHAUST01
Galt, A.A. MOPMU021
Garcia, A. **WEPMU002, THCHAUST02**
Garmendia, N. WEPMN006
Garnier, J.C. MOBAUST06, THCHAUST05
Gasior, M. WEPMU012
Gaspar, C. **MOBAUST06, MOPMN019, MOPMN028**
Gassner, D.M. MOPMU027
Gayadeen, S. **MOPKS001**
Geng, Z. **WEPKS003, WEPKS010**
Genillon, X. WEPKN025
Gerring, M. WEPKS002
Gerring, M.W. WEPKS019
Gertz, I.G. **MOPMN007, MOPMS006, MOPMS008, TUCAUST02**
Giacchini, M.G. **MOPKN012, MOPMS035, WEPMN001, WEPMU017**
Giacuzzo, F. **WEPMU025, TUDAUST02**
Gibbons, P. **TUAAUST01**
Gigante, J.V. MOPMN003, WEPMS025
Gil Soriano, C. TUBAULT04
Gilles, L. MODAULT01
Gillette, P. MOPMN016, **MOPMN029, MOPMU005, MOPMU025**
Gillies, K.K. **FRBHMUST03**
Gillingham, I.J. WEMAU004
Giovannini, L.G. MOPKN012
Giovannozzi, M. MOPMN018

Girardot, G. MOPMS016
Girardot, R. WEMAU012
Glesner, M. WEMMU001
Goddard, B. WEPMU011, WEPMU023
Godlewski, J. WEPMN038
Golonka, P. MOPMN020, WEPMS005
Gomes, P. MOPKN024, MOPMS001, **MOPMS016**
Gong, G.H. WEBHMULT04, WEPMS018
Gonzalez-Berges, M. MOPMN020, WEPKN025, WEPMS005, THBHMUST01
González Cobas, J.D. **THCHMUST04**
Goodrich, B.D. WEMAU002
Goodyear, A. WEPMN014, FRAAULT04
Gorbachev, E.V. **MOPMS036**
Gorbonosov, R. MOPMN027, WEPMS007, WEPMU011, WEPMU023
Goryl, P.P. **MOPMU008**
Gotz, A. **MOOAUKP01, MOCAULT03, WEPKS019, FRDAUKP04**
Goudard, O. THDAULT04
Gougnaud, F. MOPMU005, **MOPMU025**
Gourber-Pace, M. MOPKN009
Gournay, J.-F. MOPMU005, MOPMU025, MOCAUIO04
Graehling, P.G. MOPMU005
Grassi, V. MOBAUST02
Grin, A. MOPMS006
Gu, M. WEPMS022
Gu, W. TUBAULT03, WEPMS017
Gudkov, B.A. WEPMU001
Guinchard, M. MOMMU005
Guirao, A. WEPKN010
Gurd, D.P. **MOCAULT02**
Gutleber, J. **MOBAUST03, MOPKN023, MOPMN005, WEPKN016,** WEPMN015, WEPMN016
Gutzwiller, O. MOBAUST02
Guyot, J. MOPKN016
Guzman, J.C. **FRCAUST04**

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Ha, K. **WEPMN024**
Haas, D. THCHAUST02
Haberer, Th. MOMMU009, MOPMS030
Habring, J. MOBAUST02
Haemmerli, F. TUDAUST03
Haen, C. **WEPMU035**
Hagen, U. WEBHMUST02
Hahn, S.H. MOPKS021
Hajduk, Z. MOBAUST02, WEMAU005
Hakulinen, T. WEPMU008, **WEPMU030**

Halfon, S. MOPMS008
Hallewell, G.D. WEPMN038
Hamadyk, P. WEPMU003
Hammer, J. **WEPMS001**
Hammouti, L. WEPMU008
Hance, M. WEMAU005
Hanke, S. MOMMU009
Haquin, C.H. MOPMU005, MOPMU025, **WEPMN005**
Hara, T. WEMMU011
Hardion, V.H. **THBHMUST02**
Harling, J. FRAAULT04
Harper, G. MOPMU007
Hart, R.G.K. MOBAUST02, MOPMN014
Hartert, J. MOBAUST02
Hartman, S.M. **THBHMUST03**
Hartmann, V. THCHAUST02
Hasegawa, K. THBHAUST05
Haseitl, R. MOPMN008
Hassanzadegan, H. WEPMN006
Hatsui, T. TUCAUST06, TUDAUST01, WEBHAUST03, WEPMN028
Hatton, L. **FRAAUIO05**
Hauser, N. **THCHAUST03**
Hauviller, C. MOMMU005
Havart, F. WEPMU008
Hayashi, K. THDAULT05
Hazenshprung, N. MOPMS008
He, H. WEBHMULT04
He, Y.C. **WEPKN023, WEPMN031**
Heid, O. WEBHMUST02
Heiniger, M. TUDAUST03
Hergt, M. WEBHMUST02
Heron, M.T. MOCAUIO04, MOPKN006, MOPKS001, MOPKS027, **MOPMU009, TUAAUST01, WEPMU003**
Higgs, C.E. TUDAUST03
Himel, T.M. TUCAUST04, WEPMN032
Hinsch, K. WEPKS018
Hirai, Y. MOPMN010
Hirono, T. TUCAUST06, TUDAUST01, WEPMN028
Hirschbuehl, D. MOBAUST02
Ho, C. MOBAUST04
Höppner, K. MOMMU009, **MOPMS030**
Hoff, L.T. MOBAUST04, MOPMU027, WEPKS007
Hoffmann, D. MOBAUST02, MOPKN019
Hoffmann, M. WEPMS030
Hoffmann, T. **MOPMN008**
Hogan, M.E. MOPMS013
Hoibian, N. MOPKN009
Holme, O. MOPMN020, **MOPMS003**

Homs, A. WEAAUST01, **WEMAU011, WEPMN027**
Hong, S.S. MOPKS008
Hoobler, S. L. **TUCAUST04**
Horswell, I. WEPMN011
Hosoda, N. MOPMN025, TUDAUST01
Hosselet, J.H. MOPMU005, MOPMU025
Hostandie, Ph. MOPMU031
Hovey, G.J. MODAULT01
Hsu, K.T. MOPKN013, MOPKS022, MOPMN023, MOPMU002, WEPMN030, WEPMS013, WEPMU034
Hsu, S.Y. MOPMU002, WEPMU034
Hu, C. MOPKN022
Hu, K.H. MOPKN013, MOPKS022, MOPMU002, WEPMN030, WEPMS013, WEPMU034
Hu, L. MOPMU011
Hu, S. MOPMU036
Hu, S.M. **WEPMS027**
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