HIAT2012

12th Heavy Ion Accelerator Technology Conference

Chicago, Illinois USA
June 18-21, 2012

Hosted by
Argonne National Laboratory
9700 South Cass Avenue
Argonne, IL 60439

Argonne NATIONAL LABORATORY

UChicago ▶ Argonne LLC

Office of Science U.S. DEPARTMENT OF ENERGY

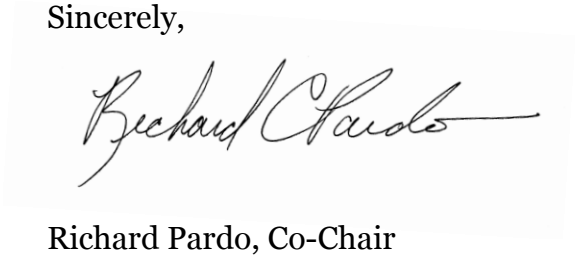
WELCOME

Dear Attendee,

On behalf of the Local Organizing Committee, we would like to welcome you to Chicago for the 12th Heavy Ion Accelerator Technology Conference (HIAT2012) hosted by Argonne National Laboratory, June 18-21, 2012. We hope many of you will be able to participate in the ATLAS tour and/or High-Mass RIB Workshop on June 22nd at Argonne.

HIAT is an international conference dedicated to the design, construction, development and operation of heavy-ion accelerators and their components. It focuses on the operational experience of existing facilities, achievements in heavy-ion accelerator physics and technology, progress on the implementation of new projects and infrastructure upgrades, and trends in the proposal and design of heavy ion accelerators as well as their main systems and components.

Sincerely,



Richard Pardo, Co-Chair

Richard Vondrasek, Co-Chair

SPECIAL THANKS TO OUR SPONSORS

Mike Schmidt, DREEBIT GmbH
Zur Wetterwarte 50, Haus 301, 01109, Dresden, Germany
Fax: +49 (0351)-2127001 80 E-Mail: mike.schmidt@dreebit.com
Website: http://www.dreebit.com/

Vacuum equipment and components

Brian Richter, GMW Associates
955 Industrial Road, San Carlos, CA 94070
Phone: 650-802-8292 E-Mail: brian@gmw.com
Website: www.gmw.com

Sensors, transducers, instruments, and systems based on magnetics

Gregory Norton, National Electrostatics Corp.
7540 Graber Road, P.O. Box 620310, Middleton, WI 53562-0310 USA
Phone: (608) 831-7600 E-Mail: nec@pelletron.com
Website: http://www.pelletron.com/index.html

Electrostatic ion beam accelerator systems

Antonio Villari, Pantechnik
13 Rue de la Resistance, 14 400 Bayeux, France
Phone: 33-231-512760 E-mail: contact@pantechnik.com
Website:www.pantechnik.fr

Unique and patented products to be used with particle accelerators

Don Andersen, Swagelok/Chicago Fluid System Technologies, Inc.
360 Windy Point Drive
Glendale Heights, IL 60139
Phone: 630-545-0003 E-Mail: info@chicago.swagelok.com
Website: http://www.swagelok.com/Chicago

Filters, fittings, hoses, flexible tubing, regulators, valves, measuring devices

Steve Hopkins, TDK-Lambda
405 Essex Road
Neptune, NJ 07753 USA
Phone: 732-922-9300 E-Mail: steve.hopkins@us.tdk-lambda.com
Website: http://www.tdk-lambda.com/

AC-DC power supplies, DC-DC converters, DC-AC Inverters and noise filters

Scott Dix, Vacuum One
3717 North Ravenswood, Suite 240
Chicago, IL 60613
Phone: 773.244.3102 E-Mail: info@vacuumone.com
Website:http://www.vacuumone.com

Vacuum pumps

GENERAL INFORMATION

HOTEL LINCOLN CHICAGO – BREAKFAST

A complimentary breakfast buffet will be served in the Clark Room (second floor). This is the same space used for the welcome reception on Sunday evening. The buffet will be served June 18th through the 23rd. For those who arrive early, they will receive vouchers for the lobby coffee shop.

The breakfast schedule is as follows:

Monday	7:00 AM to 8:45 AM	(Conference starts 9:00 AM)
Tues. – Thurs.	6:45 AM to 8:30 AM	(Conference starts 8:45 AM)
Friday	6:00 AM to 8:00 AM	(Buses leave for Argonne at 7:30 AM)
Saturday	7:00 AM to 8:45 AM	

HIAT2012 CONFERENCE OFFICE

The registration desk will be open from 6:00-8:00 pm on Sunday, June 17th at the Hotel Lincoln Chicago. Registration will continue Monday morning at the hotel.

The Conference Office, for both administrative and proceedings assistance, is located in the Robinson Gallery of the Chicago History Museum. The hours are:

Monday	9:00 – 17:30
Tuesday	8:30 – 17:30
Wednesday	8:30 – 17:30
Thursday	8:30 – 12:30

MESSAGES

Messages for conference attendees can be e-mailed to HIAT2012@anl.gov or left with the Conference Secretary at 630-252-4085 during office hours. There is also a message board for attendees located in the Robinson Gallery.

COMPUTERS AND PRINTERS

Several computers and a printer are available in the conference computer area, located in the Chicago Room South during the hours noted above. These computers will be configured with the same versions of software as the presentation computer (Office 2010 and Acrobat Reader).

Wireless access will be available at the Chicago History Museum and at the Hotel Lincoln Chicago.

INFORMATION FOR SPEAKERS

Presentations need to be in PowerPoint or PDF format and can be submitted through JACoW. If the presentation file has not been submitted ahead of time or if there are changes, it must be brought to the Session Chair at least 15 minutes prior to the session. There will be no overhead or slide projector available.

Oral Sessions

All oral sessions will take place in the Chicago Room North. Oral presentations will be made electronically using the audio-video equipment provided by the Conference Center.

Invited Oral: 25 minutes plus 5 minutes discussion
Contributed Oral: 17 minutes plus 3 minutes discussion

Speakers are requested to upload their presentation, in exactly the same way as their contributions to the Proceedings.

NOTE: Presentations must be uploaded the day before their scheduled presentation time in order to allow verification and transfer to the Conference Center's system. All talks should be submitted to the JACoW website:

https://appora.fnal.gov/pls/hiat12/profile.html

In addition to the presentation we require a PDF file of the presentation for inclusion in the conference proceedings.

Poster Session

The poster session will take place Monday and Tuesday, 16:30-18:00 in the Chicago Room South. Poster boards will be available along with push pins. The usable poster board size is 45" x 91" (114 x 231 cm). You may put your poster up any time before the poster session. Your poster must be on display by 16:00. It should remain posted until the end of the poster session on Tuesday. Your assigned poster number is the same number on your abstract. The assignments will also be on display at the poster area. Please mount your poster on the board labeled with that number.

Presenters are asked to be available at their poster location for the first hour of each day's poster session.

Proceedings

All presentations are expected to also have a paper submitted for publication. Publication will be done through JACoW and follow the standard guidelines for JACoW. We are asking that papers be limited to 7 pages. Details for the preparation of your paper may be found at http://www.phy.anl.gov/hiat12/Paper_Preparation.html.

Please see Maria Power, Proceedings Editor, if you encounter any difficulties. She is available in the Conference Office during the posted office hours.

LIST OF PARTICIPANTS

A complete list of HIAT2012 attendees and their contact information will be provided to each participant at the conference in paper form. This information will also be posted on the HIAT2012 website following the conference.

NO-SMOKING POLICY

Illinois has a no-smoking policy that restricts smoking in all public and work places; smoking is only permitted outside (15 feet beyond building entrances).

VENDOR EXHIBITS

Vendor Exhibits will be in the Chicago Room South on Tuesday and Wednesday.

SECURITY

Participants are responsible for their laptops and all other valuables that they bring to the conference sessions.

COMPANION'S PROGRAM

Chicago is a large city with many world class tourist attractions. We will not offer a formal companion program, but we will provide information links to some of the most interesting sites in Chicago. In addition, our Thursday excursions are available for all and will be highlighting some of the most interesting aspects of Chicago world-renowned architecture. Please check the HIAT website for links to museums and entertainment venues that may be of interest.

WELCOME RECEPTION: Sunday, June 17

You are invited to join us at a Welcome Reception on Sunday held from 18:00 to 20:00 in the Clark Room of the Hotel Lincoln Chicago. While there you can check-in, receive your conference materials, and enjoy food and refreshments.

BANQUET: Wednesday, June 20

The conference dinner is scheduled for Wednesday evening, June 20th, at 19:00 at Salvatore's Restaurant. The restaurant is within easy walking distance of the hotel.

Salvatore's Restaurant
525 W. Arlington Place
Chicago, IL 60614
(773) 528-1200

EXCURSION: Thursday, June 21

On Thursday afternoon, June 21st, there are 2 concurrent excursions. Participants and companions have selected between an architecturally focused guided walking tour of Chicago's historic south loop highlighting early skyscraper design, or a guided bicycle tour of the city's north side neighborhoods and beaches with views of the magnificent skyline. The walking tour is still available for signup at the conference desk.

After a short rest at the hotel, an evening social event is planned at Chicago's Adler Planetarium. Guests will be able to view exhibits, tour the Midwest's largest telescope accessible to the public, and gaze upon the city skyline lit up at night. Bus transportation will be provided between the Hotel Lincoln and the Adler Planetarium. If you did not sign up for one of the afternoon excursions, you are not registered for the Adler visit. If you would like to visit the Adler, see the conference secretary about obtaining a ticket to the Planetarium.

ATLAS TOUR: Friday, June 22

At 07:30 Friday morning we will depart for Argonne National Laboratory to tour the ATLAS facility, and the Accelerator Development Facilities, including the resonator processing facilities and offline beamline test facility. For the attendees not staying for the High-Mass RIB Workshop, a bus will be provided to take you back to the hotel.

Note: If you would like limo reservations from Argonne to an airport, please see Janet Bergman, Conference Secretary.

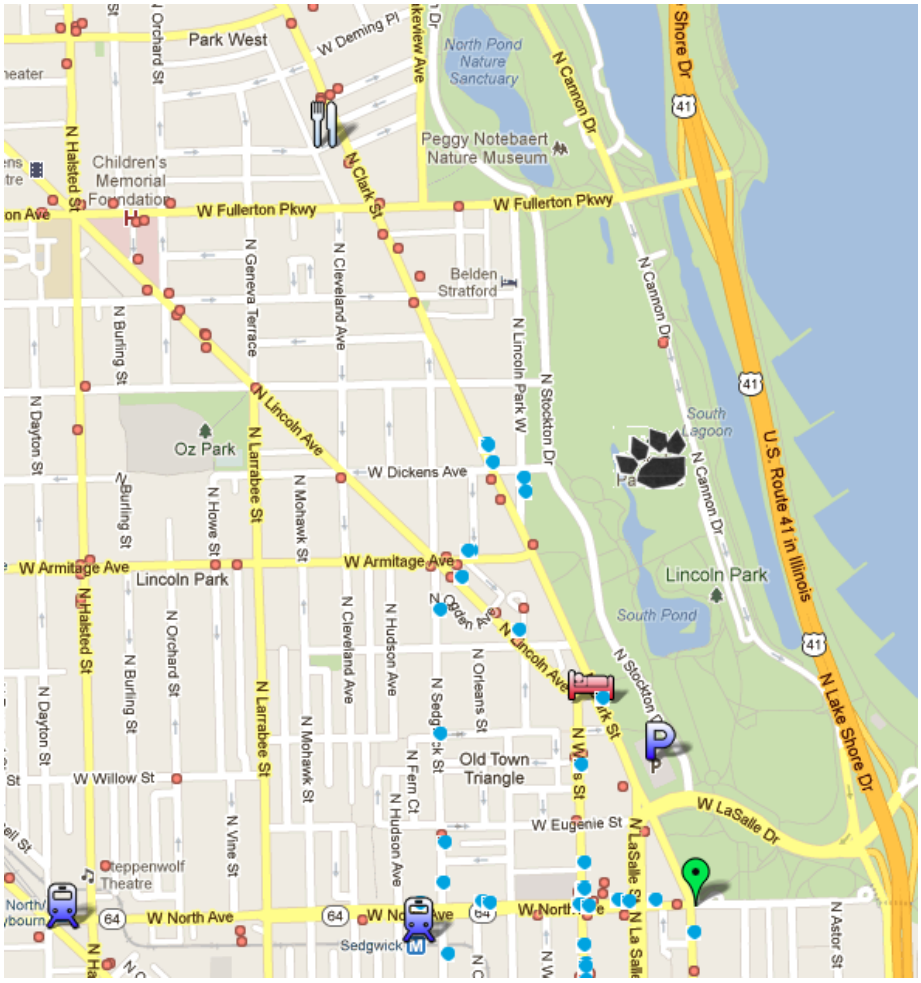
HIGH-MASS RIB WORKSHOP: Friday, June 22

An add-on workshop following HIAT2012, focused on the status and techniques for production of high mass radioactive ion beams, will be held on Friday afternoon, June 22, at Argonne following the ATLAS tour. This workshop will be a follow-up to the workshop hosted by TRIUMF in November 2011. Transportation to and from Argonne will be provided at no additional fee.

CHICAGO HISTORY MUSEUM

TRANSPORTATION

Within Chicago, transportation is usually by taxi cab or through the Chicago Transit Authority (CTA) bus and rail systems. Transit Cards can be purchased and value can be added to Transit Cards at vending machines located at all CTA rail stations. Vending machines accept $1, $5, $10, and $20 USD bills, and all coins except pennies and half dollars. Credit cards cannot be used to purchase transit cards at the station.



Chicago History Museum

Hotel Lincoln

CTA Sedgwick Station - Brown/Purple Line
CTA North/Clybourn Station – Red Line

Salvatore's Restaurant

Restaurants

ATMs

CONTACTS

Conference Co-Chairs
Richard Pardo, pardo@phy.anl.gov
Richard Vondrasek, vondrasek@anl.gov

Janet Bergman, Conference Secretary
HIAT2012@anl.gov

Maria Power, Proceedings Editor
mpower@anl.gov

Argonne National Laboratory
9700 South Cass Avenue
Argonne, IL 60439

Phone: (630) 252-4085
Fax: (630) 252-9647

International Advisory Committee

Giovanni Bisoffi, INFN-LNL, Legnaro, Italy
Osamu Kamigaito, RIKEN, Japan
Oliver Kester, GSI, Germany
Bernard Laune, Orsay, France
Robert Laxdal, TRIUMF, Canada
Daniela Leitner, MSU, USA
Nikolai Lobanov, Australian National Univ., Australia
Francis Osswald, IPHC and SPIRAL2, France
Richard Pardo, ANL, USA
Zhaohua Peng, China Institute of Atomic Energy, China
Roland Repnhow, Max-Planck-Inst., Germany
Danilo Rifuggiato, INFN, Catania, Italy
Amit Roy, Inter-University Accelerator Centre, India
Kimikazu Sasa, University of Tsukuba, Japan

Local Organizing Committee

Richard Pardo, Co-Chairman
Richard Vondrasek, Co-Chairman
Judy Benigno
Janet Bergman
Jacque LeBreck
Tala Palchan-Hazan
Kim Miller
Maria Power
Robert Scott

SCHEDULE

	Sunday - June 17	Monday - June 18	Tuesday - June 19	Wednesday - June 20	Thursday - June 21	Friday - June 22
8:00		Registration desk open at Hotel Lincoln				
8:30						Trip to ANL
9:00		Opening & Welcome Remarks	Electrostatic D. Kanjilal - TUA01 Heavy-ion Accel Dev @IUAC P. Bhagwat - TUA02	Applications & Optics L. Falbo - WEA01 Advanced Hadron Therapy O. Meusel - WEA02 Plasma Lens Focusing	Linacs P. Ostroumov - THA01 Heavy Ion SC Linacs D. Jeon - THA02	Lab Tour
9:30		RIBs P. Bricault - MOA01 RIB Frontier Technologies	X. Guan - TUA03		Y. He - THA03	
10:00		Coffee Break	Coffee Break	Coffee Break	Coffee Break	Coffee Break
10:30		RIB Facilities J. Wei - MOB01 FRIB Overview	S. Ito - TUB01	Ion Sources E. Beebe - WEB01 EBIS Performance	Linacs H. Okuno - THB01 RIKEN He Gas Stripper	High Mass RIB Workshop
11:00		J. Kim - MOB02	D. Ghita - TUB02	S. Kondrashev - WEB02	B. Mustapha - THB02	
11:30		J. Nolen - MOB03	N. Lobanov - TUB03	M. Schmidt - WEB03	E. Kim - THB03	
12:00		S. Manikonda - MOB04	Silvia Vitulli - TUB04	C. Dickerson - WEB04	L. Dahl - THB04	
12:30		RIB Facilities O. Kamigaito - MOB05 RIBs in ASIA		L. Celona - WEB05 ECRIS Latest Developments	F. Herfurth - THB05 HITRAP Decelerator	
13:00		Lunch	Lunch	Lunch	Lunch	Lunch At ANL Cafeteria
13:30						
14:00		RIB Facilities M. Marchetto - MOC01 High Mass RIBs @TRIUMF	Circular M. Comunian - TUC01 SPES Design & Status	Cavities/LINAC ops M. Kelly - WEC01		High Mass RIB Workshop
14:30		E. Petit - MOC02 Status of SPIRAL2	K. Takayama - TUC02	M. Fraser - WEC02	Excursion Bicycle or Walking Tour	
15:00		C. Morton - MOC03	T. Palchan - TUC03	S. Mickat - WEC03		
15:30		R. Vondrasek - MOC04 CARIBU Commissioning	S. Baker - TUC04	S. Ghosh - WEC04 B. Schlitt - WEC05		
16:00		Coffee Break	Coffee Break	Coffee Break		
16:30		Poster Session A	Poster Session B	International Advisory Committee Meeting		
17:00						
17:30						
18:00	Welcome Reception Hotel Lincoln 6-8 pm				Adler After Dark Excursion 6-10 pm	
18:30						
19:00				Banquet Salvatores Restaurant 7-11 pm		
19:30						

Monday 18-June-2012

9:00 – 9:30 MOT – Opening and Welcome Remarks

9:30 – 10:00 MOA – RIBs
Session Chair: Richard Claude Pardo ANL

MOA01 Frontier Technologies and Future Directions in High Intensity ISOL RIB Production
Pierre Gerard Bricault - TRIUMF Canada's National Laboratory for Particle and Nuclear Physics

10:30 – 12:30 MOB – RIB Facilities
Session Chair: Giovanni Bisoffi (INFN/LNL)

MOB01 The FRIB Project – Accelerator Challenges and Progress
Jie Wei - Facility for Rare Isotope Beams

MOB02 Design Study of In-flight Fragment Separator for Rare Isotope Science Project in Korea
Jong-Won Kim - National Cancer Center, Korea Center for Proton Therapy

MOB03 Design and Status of the Super Separator Spectrometer for the GANIL SPIRAL2 Project
Jerry Nolen - Argonne National Laboratory

MOB04 Argonne In-flight Radioactive Ion Separator
Shashikant L. Manikonda - Argonne National Laboratory

MOB05 RIB Facilities in Asia: Current Status and Future Development
Osamu Kamigaito - RIKEN Nishina Center

14:00 – 16:00 MOC – RIB Facilities
Session Chair: Michael Kelly (ANL)

MOC01 Progress and Plans for High Mass Beam Delivery at TRIUMF
Marco Marchetto - TRIUMF Canada's National Laboratory for Particle and Nuclear Physics

MOC02 Progress of the SPIRAL2 Project
Eric Petit - Grand Accélérateur Nat. d'Ions Lourds

MOC03 Operational Considerations for Future Multi-user RIB Facilities
Colin Morton - TRIUMF Canada's National Laboratory for Particle and Nuclear Physics

MOC04 Commissioning Experience with CARIBU
Richard Vondrasek - Argonne National Laboratory

16:30 – 18:00 PO – Poster Session

PO01 SPIRAL2 PHASE1 Project - Integration of the Accelerator Processes and Building Construction
Pascal Anger - Grand Accélérateur Nat. d'Ions Lourds

PO02 GANIL Operation Status and Upgrade of SPIRAL1
Frédéric Chautard - Grand Accélérateur Nat. d'Ions Lourds

PO03 The RIB Dynamics of the SPIRAL 2 Transfer Line
Francis René Osswald - Institut Pluridisciplinaire Hubert Curien

PO04 The Darmstadt Multi-Frequency Digital Low Level RF System in Pulsed Application
Ralf Eichhorn - Technische Universitaet Darmstadt Institut fuer Kernphysik Fachbereich 05

PO05 Control and Information System for BARC – TIFR Superconducting LINAC Booster
Sudheer Singh - Bhabha Atomic Research Centre Nuclear Physics Division

PO06 Extension of Superconducting LINAC Operation to Lighter Beams
Rudrajyoti Palit - Tata Institute of Fundamental Research BARC-TIFR Pelletron Accelerator Facility Department of Nuclear and Atomic Physics (DNAP)

PO07 A Cost-Effective Energy Upgrade of the ALPI Linac at INFN-Legnaro
Giovanni Bisoffi - Istituto Nazionale di Fisica Nucleare Laboratori Nazionali di Legnaro

PO09 Study of the RFQ Beam Cooler for SPES Project
Mario Maggiore - Istituto Nazionale di Fisica Nucleare Laboratori Nazionali di Legnaro

PO10 On Line Performance of ALPI New Medium Beta Resonators
Anna Maria Porcellato - Istituto Nazionale di Fisica Nucleare Laboratori Nazionali di Legnaro

PO12 Damage Situation of the 12UD Pelletron Tandem Accelerator at the University of Tsukuba by the Great East Japan Earthquake
Kimikazu Sasa - University of Tsukuba Tandem Accelerator Complex

PO13 Longitudinal Beam Motion in the KEK Digital Accelerator: Tracking Simulation and Experimental Results
Xingguang Liu - Department of Energy Sciences Tokyo Institute of Technology

PO14 Feedback of Slow Extraction in CSRm
Jian Shi - Chinese Academy of Sciences Institute of Modern Physics

PO15 Study of the Heavy Ion Bunch Compression in CSRm
Da Yu Yin - Chinese Academy of Sciences Institute of Modern Physics

PO16 Multiphysics and Pressure Code Analysis of the FRIB Accelerating Cavities
Samuel John Miller - Facility for Rare Isotope Beams Michigan State University Cyclotron Laboratory

PO17 Simulation of Electron and Ion Dynamics in an EBIS
Jin-Soo Kim - Far-Tech, Inc.

PO18 Tandem EBIS
Alexander I. Pikin - Brookhaven National Laboratory Collider-Accelerator Department

Tuesday 19-June-2012

8:45 – 10:00 TUA – Electrostatic
Session Chair: Nikolai R. Lobanov (Research School of Physics and Engineering, Australian National University)

TUA01 Heavy Ion Accelerator Development at IUAC Delhi
Dinakar Kanjilal - Inter University Accelerator Centre

TUA02 ECR Based Heavy Ion Accelerator Program at BARC-TIFR Pelletron Accelerator Facility
Pramod Vasant Bhagwat - Bhabha Atomic Research Centre Nuclear Physics Division

TUA03 The Compact Pulsed Hadron Source Status*
Xialing Guan - Tsinghua University in Beijing Accelerator Laboratory Department of Engineering Physics

10:30 – 12:30 TUB – Electrostatic
Session Chair: Roland Repnow (Max-Planck-Institut für Kernphysik (MPI-K))

TUB01 Development of NRA System for a 1.7MV Tandem Accelerator-Human Resource Development Program for Nuclear Engineering, The University of Tokyo
Seiji Ito - The University of Tokyo School of Engineering

TUB02 New Developments at the Tandem Accelerators Laboratory at IFIN-HH
Dan Gabriel Ghita - National Institute for Physics and Nuclear Engineering Nuclear Physics-Tandem

TUB03 Terminal Voltage Stabilization of Pelletron Tandem Accelerator
Nikolai R. Lobanov - Research School of Physics and Engineering Australian National University Nuclear Physics

TUB04 LINAC Experience In The First Two Years Of Operation @ CNAO (Centro Nazionale Adroterapia Oncologica)
Silvia Vitulli - Centro Nazionale di Adroterapia Oncologica

14:00 – 16:00 TUC – Circular
Session Chair: Danilo Rifuggiato (INFN/LNS)

TUC01 Physical Design of the SPES Facility
Michele Comunian - Istituto Nazionale di Fisica Nucleare Laboratori Nazionali di Legnaro

TUC02 KEK Digital Accelerator and Recent Beam Commissioning Result
Ken Takayama - High Energy Accelerator Research Organization Accelerator Laboratory

TUC03 Laser Ablation of Solids into an Electron Cyclotron Resonance Ion Sources for Accelerator Mass Spectroscopy
Tala Palchan - Argonne National Laboratory

TUC04 Experiences and Lessons Learned at CARIBU with an Open 252Cf Source
Samuel I. Baker - Argonne National Laboratory Physics Division

16:30 – 18:00 Poster Session

Wednesday 20-June-2012

8:45 – 10:00 WEA – Applications & Optics
Session Chair: Pierre Gerard Bricault (TRIUMF)

WEA01 Advanced Accelerator Technology Aspects for Hadron Therapy
Luciano Falbo - Centro Nazionale di Adroterapia Oncologica

WEA02 Focusing of Intense Heavy Ion Beams with Plasma Lenses
Oliver Meusel - Goethe Universität Frankfurt Institut für Angewandte Physik

10:30 – 12:30 WEB – Ion Sources
Session Chair: Alexander I. Pikin (BNL)

WEB01 Review of EBIS Ion Source Performance
Edward Beebe - Brookhaven National Laboratory Collider-Accelerator Department

WEB02 Commissioning of CARIBU EBIS Charge Breeder Sub-systems
Sergei A. Kondrashev - Argonne National Laboratory

WEB03 DREEBIT EBIS/T for Applications in Accelerator Physics
Mike Schmidt - DREEBIT GmbH

WEB04 Electron and Ion Beam Dynamics in the CARIBU EBIS Charge Breeder
Clayton Dickerson - Argonne National Laboratory

WEB05 ECRIS Latest Developments
Luigi Celona - Istituto Nazionale di Fisica Nucleare Laboratori Nazionali del Sud

14:00 – 16:00 WEC – Cavities/LINAC Operations
Session Chair: Anna Maria Porcellato (INFN/LNL)

WEC01 Production 72 MHz Beta=0.077 Superconducting Quarter-wave Cavities for ATLAS
Michael Kelly - Argonne National Laboratory

WEC02 Status of the HIE-ISOLDE Project at CERN
Matthew Alexander Fraser - European Organization for Nuclear Research Beams Department (BE)

WEC03 The SC CW LINAC Demonstrator – 1st Test of an SC CH-cavity with Heavy Ions
Sascha Mickat - GSI Helmholtzzentrum für Schwerionenforschung GmbH

WEC04 Operation of Superconducting Linac and Commissioning of the Last Linac Module at IUAC Delhi
Subhendu Ghosh - Inter University Accelerator Centre

WEC05 Design Studies for a New Heavy Ion Injector Linac for FAIR
Bernhard Schlitt - GSI Helmholtzzentrum für Schwerionenforschung GmbH

Thursday 21-June-2012

8:45 – 10:00 THA – LINACs
Session Chair: Robert Edward Laxdal (TRIUMF)

THA01 Heavy Ion Superconducting Linacs: Status and Upgrade Projects
Peter Ostroumov - Argonne National Laboratory Physics Division

THA02 Overview of the RISP Superconducting Linac
Dong-O Jeon - Institute for Basic Science

THA03 Status and Upgrade Project of HIRFL
Yuan He - Chinese Academy of Sciences Institute of Modern Physics

10:30 – 12:30 THB – LINACs
Session Chair: Jerry Nolen (ANL)

THB01 New Developments in Low-Z Gas Stripper Sstem at RIKEN Radioactive Isotope Beam Factory (RIBF)
Hiroki Okuno - RIKEN Nishina Center

THB02 New Design for the SARAF Phase II Linac
Brahim Mustapha - Argonne National Laboratory Physics Division

THB03 Design Sudy for Front-End System at Rare Isotope Science Project (RISP)
Eun-San Kim - Kyungpook National University

THB04 Development of the Intensity and Quality of the Heavy Ion Beams at GSI
Ludwig A. Dahl - GSI Helmholtzzentrum für Schwerionenforschung GmbH

THB05 HITRAP Decelerator and According Beam Instrumentation
Frank Herfurth - GSI Helmholtzzentrum für Schwerionenforschung GmbH

ABSTRACTS

MOA01 ***Frontier Technologies and Future Directions in High Intensity ISOL RIB Production***

Pierre Gerard Bricault (TRIUMF, Vancouver)

The future frontier of the ISOL technique is to increase the intensity of the RIB beams. In the ISOL technique there are several ways to increase substantially the production of rare isotope beam. The most expedient one is to increase the incident beam on target. Increasing the overall release efficiency and ionization efficiency are the other two easiest ways to increase the overall RIB intensity. Now with the TRIUMF/ISAC facility the ISOL RIB facility can operate routinely up to 50 kW, this is 100 µA on target. But, the driver beam intensity cannot increase without considering the radiation damage issues and the challenge to the ion source itself where ionization efficiency are dramatically affected by target out-gazing. The other technology challenge for the ISOL technique is the target material itself. The main concern is the capability of the target material to sustain high power density deposited by the driver beam. Refractory metals foil target are suitable but nevertheless very limited in the available species we can produce with those targets. Composite targets, either for carbide and oxide target material were developed at ISAC that can sustain very high power density.

Funding: TRIUMF is funded by a contribution from the federal government through the National Research Council of Canada

Notes:

MOB01 ***The FRIB Project – Accelerator Challenges and Progress***

Jie Wei, Edward Charles Bernard, Nathan Bultman, Fabio Casagrande, Shailendra Chouhan, Chris Compton, Kelly Douglas Davidson, Paul Gibson, Thomas Glasmacher, Lee Harle, Kent Holland, Matthew John Johnson, Shelly Jones, Daniela Leitner, Matthaeus Leitner, Guillaume Machicoane, Felix Marti, Dan Morris, Joseph Paul Ozelis, Sheng Peng, John Popielarski, Laura Popielarski, Eduard Pozdeyev, Thomas Russo, Kenji Saito, Robert C. Webber, John Weisend, Michael Williams, Yoshishige Yamazaki, Al Zeller, Yan Zhang, Qiang Zhao (FRIB, East Lansing), Jerry Nolen (ANL, Argonne; FRIB, East Lansing), Alberto Facco (FRIB, East Lansing; INFN/LNL, Legnaro (PD)), Dana Arenius, Venkatarao Ganni (JLAB, Newport News, Virginia)

The Facility for Rare Isotope Beams, a new national user facility funded by the U.S. Department of Energy Office of Science to be constructed and operated by MSU, is currently being designed to provide intense beams of rare isotopes to better understand the physics of nuclei, nuclear astrophysics, fundamental interactions, and applications for society. The FRIB driver linac can accelerate all stable isotopes to energies beyond 200 MeV/u at beam powers up to 400 kW. Key technical R&D programs include low-beta cw SRF cryomodules and highly efficient charge stripping using a liquid lithium film or helium gas. Physical challenges include acceleration of multiple charge states of beams to meet beam-on-target requirements, efficient production and acceleration of intense heavy-ion beams from low to intermediate energies, accommodation of multiple charge stripping scenarios and ion species, designs for both baseline in-flight fragmentation and ISOL upgrade options, and design considerations of machine availability, tunability, reliability, maintainability, and upgradability. We report on the FRIB accelerator design and developments with emphasis on technical challenges and progress.

Funding: This material is based upon work supported by the U.S. Department of Energy Office of Science under Cooperative Agreement DE-SC0000661

Notes:

MOB02 ***Design Study of In-flight Fragment Separator for Rare Isotope Science Project in Korea***

Jong-Won Kim (NCC, Korea, Kyonggi), Do Gyun Kim, Mijung Kim, Sun Kee Kim, Jeong-Seog Song, Chong Cheoul Yun (IBS, Daejeon), Weishi Wan (LBNL, Berkeley, California)

A heavy-ion accelerator complex is being designed for rare isotope beam production utilizing both in-flight fragmentation and ISOL methods in Korea. The project had been planned with conceptual design efforts, and officially launched in January this year with full funding promised. The driver accelerator is a superconducting linac with a beam power of 400 kW. The uranium beam, which is a primary beam for projectile fragmentation, is to be accelerated to 200 MeV/u. The in-flight fragment separator can be divided into pre and main separators. The target system and beam dump to handle the full beam power are located in the front part of the pre-separator, and are being studied using various codes such as PHITS and ANSYS considering issues especially related to radiation damage and shielding. Beam optics design was performed in the previous conceptual study, and further optimization is under way. The separator will be composed of large aperture superconducting quadrupole magnets and conventional dipole magnets, and prototyping of the superconducting magnet is planned. The status of the design efforts will be presented.

Notes:

MOB03 ***Design and Status of the Super Separator Spectrometer for the GANIL SPIRAL2 Project***

Jerry Nolen, Shashikant L. Manikonda (ANL, Argonne), Martial Authier, Antoine Drouart, Jacques Payet (CEA/DSM/IRFU,), Olivier Delferriere (CEA/IRFU, Gif-sur-Yvette), Franck Lutton, Hervé Savajols, Mehdi Souli, Marc-Hervé Stodel (GANIL, Caen), Bernard Laune (IPN, Orsay)

The Super Separator Spectrometer (S3) is a device designed for experiments with the very high intensity stable heavy ion beams of the superconducting linear accelerator of the SPIRAL2 Project at GANIL. S3 is designed to combine high acceptance, a high degree of primary beam rejection, and high mass resolving power to enable new opportunities in several physics domains, e.g. super-heavy and very-heavy nuclei, spectroscopy at and beyond the drip-line, isomers and ground state properties, multi-nucleon transfer and deep-inelastic reactions. The spectrometer comprises 8 large aperture multipole triplets (7 superconducting and 1 open-sided room temperature), 3 magnetic dipoles, and 1 electrostatic dipole arranged as a momentum achromat followed by a mass separator. A summary of the beam-optical simulations and the status of the main spectrometer components will be presented with special emphasis on the design of the superconducting multipole triplets.

Funding: This work is partially supported by the U.S. Department of Energy, Office of Nuclear Physics, under Contract No. DE-AC02-06CH11357.

Notes:

MOB04 ***Argonne In-flight Radioactive Ion Separator***

Shashikant L. Manikonda, Martin Alcorta, Birger Back, Jerry Nolen, Richard Claude Pardo, Ernst Rehm, Guy Savard, Dariusz Seweryniak (ANL, Argonne), Bela Erdelyi (ANL, Argonne; Northern Illinois University, DeKalb, Illinois)

The Argonne In-flight Radioactive Ion Separator (AIRIS) is a new large recoil separator that is being designed as a part of proposed future upgrade of the ATLAS facility to provide at least 10 times more collection efficiency than the existing system. In combination with other proposed upgrades it will provide a 2 orders of magnitude gain in the intensity for the in-flight produced secondary beams compared to the existing facility. The resulting unprecedented intensities for the recoil beam open new opportunities in several physics domains, e.g. gamma ray spectroscopy after secondary reactions, reactions for rp-, νp-, αp- processes and CNO cycle. The proposed design for the AIRIS device is based on four multipole magnets and four dipole magnets arranged in a so called broadband spectrometer configuration. This arrangement will be followed by two RF cavities to provide further selection based on velocity differences between the primary beam tail and the recoiling RIB. The advantages of such a design and key parameters will be discussed. We will demonstrate the performance of the device for few representative reaction cases that can be studied using AIRIS.

Funding: This work was supported by the U.S. Department of Energy, Office of Nuclear Physics, under Contract No. DE-AC02-06CH11357

Notes:

MOB05 ***RIB Facilities in Asia: Current Status and Future Development***

Osamu Kamigaito (RIKEN Nishina Center, Wako)

Growing activities in the RIB facilities in Asian countries will be reviewed. Current status and future development will be discussed.

Notes:

MOC01 ***Progress and Plans for High Mass Beam Delivery at TRIUMF***

Marco Marchetto (TRIUMF, Vancouver)

ISAC is a TRIUMF facility for production and post-acceleration of radioactive ion beams (RIB). The RIBs are produced in two targets using a 500 MeV proton of up to 0.1 mA. The produced radioactive species are then ionized, extracted up to 60 kV, mass selected and transported to either the low energy experimental area or to the post-accelerators. The first stage of acceleration is accomplished via an RFQ followed by a DTL; at this medium stage the energy ranges between 0.15 MeV/u and 1.8 MeV/u for $3 \leq A/q \leq 7$. The second stage of the acceleration uses a 40 MV superconducting linac for a final energy up to 18 MeV/u. High mass (>30) beams need multiple charges to be accepted by the RFQ. The single charge ions out of the target source are charge bred using an ECR charge state booster. The breeding process generates a significant amount of background contamination that masks the desired ions inside a mixed ”cocktail” beam. Such a cocktail needs to be cleaned of contaminants. An unprecedented effort is going on at TRIUMF trying to clean the high mass cocktail beams using the accelerator chain as filter. The progress and future plans of the project will be presented in this paper.

Notes:

MOC02 ***Progress of the SPIRAL2 Project***

Eric Petit (GANIL, Caen)

The SPIRAL2 facility will extend the possibilities offered at GANIL to heavier radioactive beams, with much higher intensities : it will provide intense beams of neutron-rich exotic nuclei created by the ISOL production method. The extracted exotic beam will be used either in a new low energy experimental area called DESIR, or accelerated by the existing SPIRAL 1 cyclotron (CIME. The intense primary stable beams (deuterons, protons, light and heavy ions) will also be used at various energies for nuclear physics, as well as for neutron-based research and multi-disciplinary research, in dedicated caves called S3 and NFS. During year 2008, the decision has been taken to build the SPIRAL2 machine in two phases: - first phase including the driver accelerator and its associated new experimental areas (S3 and NFS caves), - second phase including the RIB production part, with the low energy RIB experimental hall called DESIR, and the connection to the GANIL existing facility for post-acceleration by the existing CIME cyclotron. The SPIRAL2 facility is now in its construction phase, with the objective of obtaining the first beams for physics during year 2014 with the first phase.

Notes:

MOC03 ***Operational Considerations for Future Multi-user RIB Facilities***

Colin Morton (TRIUMF, Vancouver)

TRIUMF's ISAC is an ISOL-type RIB facility. RIB are produced in direct reactions of 480—500 MeV protons from TRIUMF's main cyclotron on thick targets in one of two production target stations. Like other such facilities, ISAC is only capable of serving a single RIB user at any given time, though simultaneous delivery of stable and radioactive beams to different experimental areas is possible. With the construction of ARIEL, the Advanced Rare-IsotopE Laboratory, ISAC will gain a second production front end. RIB will be produced by photofission on actinide targets using electrons from a new superconducting electron linac. This will give ISAC the ability to serve two RIB experiments concurrently with beams produced by different reaction mechanisms in separate target areas (with delivery of a third, stable, beam still possible). The shift from single-user to multi-user RIB operation will introduce significant new complexity to beam delivery, requiring new tools and techniques for beam time to be used efficiently. A first look at the potential operational requirements of a multi-user RIB facility will be discussed.

Notes:

MOC04 ***Commissioning Experience with CARIBU***

Richard Vondrasek, Samuel I. Baker, Shane Caldwell, Jason Clark, Cary Davids, Daniel Lascar, Anthony Levand, Richard Claude Pardo, Don Peterson, Donald Robert Phillips, Guy Savard, Jon Van Schelt, Matthew Sternberg, Tao Sun, Bruce Zabransky (ANL, Argonne)

The Californium Rare Ion Breeder Upgrade (CARIBU) of the ATLAS superconducting linac facility aims at providing low-energy and reaccelerated neutron-rich radioactive beams to address key nuclear physics and astrophysics questions. These beams are obtained from fission fragments of a Cf-252 source, thermalized and collected into a low-energy particle beam by a helium gas catcher, mass analyzed by an isobar separator, and charge bred with an ECR ion source to higher charge states for acceleration in ATLAS. Low-energy mass separated radioactive beams have been extracted, charge bred with a 10% efficiency, reaccelerated to 6 MeV/u, and delivered to GAMMASPHERE for beta decay studies. In addition, the Canadian Penning Trap (CPT) mass spectrometer has been relocated to the CARIBU low-energy beam line. Mass measurements on over 42 neutron rich nuclei have already been performed and additional measurements are underway. In addition, a new tape station for beta decay studies has just been commissioned. In this talk I will describe the current status of the overall CARIBU system and the plans for bringing the system into full operation and use in research with accelerated beams.

Notes:

PO01 ***SPIRAL2 PHASE1 Project - Integration of the Accelerator Processes and Building Construction***

Pascal Anger, Philippe Bisson, Olivier Danna, Xavier Hulin, Jean-Michel Lagniel, Eric Petit, Lorenzo Roupsard (GANIL, Caen)

The SPIRAL 2 construction at GANIL is divided in two phases : • Phase 1 dedicated to the construction of a ion superconducting CW LINAC (up to 5 mA - 40 MeV deuteron beams and up to 1 mA - 14.5 MeV/u heavy ion beams) with 2 experimental areas called S3 (“Super Separator Spectrometer”) and NfS (“Neutron for Science”), • Phase 2 dedicated to the construction of the PRODUCTION and DESIR buildings in order to allow a high-rate ISOL production of RIB. These RIBS can be post-accelerated by the existing Ganil cyclotron CIME. The Phase 1 building studies as well as the accelerator and experimental equipment integration started in 2009. The ground breaking started at the end of 2010. The integration task of the different equipments into the buildings is managed by a trade-oriented integration unit gathering the accelerator integration team, the building prime contractor and a dedicated contracting assistant. All work packages are synthesized at the same time using 3D models. 3D tools are used to carry out integration, synthesis, process connections and the preparation of the future assembly. This contribution will describe these tools and the status of the building construction.

Notes:

PO02 ***GANIL Operation Status and Upgrade of SPIRAL1***

Frédéric Chautard, Olivier Bajeat, Pierre Delahaye, Mickael Dubois, Pascal Jardin, Omar Kamalou, Laurent Maunoury, Gilles Senecal (GANIL, Caen)

The GANIL facility (Caen, France) is dedicated to the acceleration of heavy ion beams for nuclear physics, atomic physics, radiobiology and material irradiation. The production of stable and radioactive ion beams for nuclear physics studies represents the main part of the activity. The exotic beams are produced by the Isotope Separation On-Line method (ISOL, the SPIRAL1 facility) with SPIRAL1 facility. It is running since 2001, producing and post-accelerating radioactive ion beams. The review of the operation from 2001 to 2011 is presented. Because of the physicist demands, the facility is about to be improved with the project Upgrade SPIRAL1. The goal of the project is to extend the range of post-accelerated exotic beams avalaible.

Notes:

PO03 ***The RIB Dynamics of the SPIRAL 2 Transfer Line***

David Boutin, Francis René Osswald (IPHC, Strasbourg Cedex 2), Christophe Peaucelle (IN2P3 IPNL, Villeurbanne), Nikolay Kazarinov (JINR, Dubna, Moscow Region), Thomas Thuillier (LPSC, Grenoble)

The design of the SPIRAL 2 RIB extraction and mass analysis results of previous experiences at Ganil (SIRa) and SPIRAL* and concerns the ISOL process. The layout presents different beam sections of optical interest starting with a conventional Einzel lens, a 1 T solenoid, a triplet of magnetic quadrupoles and a magnetic dipole for the mass analysis. The down-stream 1+ ions transfer line to the users is designed following a conservative solution composed of emittance limitation, homothetic betatron matching, passive and symmetrical optical lattices (point to point and unitary transport) as well as beam instrumentation enabling the control of the losses (pepperpots, slits, beam profilers, FC, etc.). The presentation will mainly focus on the description of the beam line, its characteristics and on some side effects which have to be taken into account in order to match the beam properly during the operations.

* On Line Isotopic Separator Test Benches at GANIL, R. Anne et al., PAC proceed. ed. IEEE, 1993

Notes:

PO04 ***The Darmstadt Multi-Frequency Digital Low Level RF System in Pulsed Application***

Ralf Eichhorn, Uwe Bonnes, Christoph Burandt, Martin Konrad, Patrick Nonn (TU Darmstadt, Darmstadt), Gerald Schreiber, Wolfgang Vinzenz (GSI, Darmstadt)

Triggered by the need to control the superconducting cavities of the S-DALINAC, the development of a digital low level RF control system was started several years ago. The chosen design proved to be very flexible since other frequencies than the original 3 GHz may be adapted easily: The system converts the RF signal coming from the cavity (e. g. 3 GHz) down to the base band using a hardware I/Q demodulator. The base band signals are digitized by ADCs and fed into a FPGA where the control algorithm is implemented. The resulting signals are I/Q modulated before they are sent back to the cavity. Meanwhile, this system has been successfully operated on 3 GHz, 6 GHz and 325 MHz cavities, on normal and superconducting cavities as well as in cw or pulsed mode. This contribution will focus on the 325 MHz version built to control a pulsed prototype test stand for the p-LINAC at FAIR and possible extensions to even lower frequencies. We will present the architecture of the RF control system as well as results obtained during operation.

Funding: Work supported by DFG through CRC 634 and by the BMBF under 06 DA 9024 I

Notes:

PO05 ***Control and Information System for BARC – TIFR Superconducting LINAC Booster***

Sudheer Singh (BARC, Mumbai), Pitamber Singh (LEHIPA Project, Physics Group, Mumbai), Jitendra N Karande, Vandana Nanal, R. G. Pillay (TIFR, Mumbai)

Superconducting LINAC booster is modular machine which consists of 7 cryomodules each consisting four quarter wave resonators and one superbuncher module.The control system is a mixed distributed control system. Geometrical distributed system architecture has been followed for RF control. RF control has four local nodes(RF LCS) each nodes catering to two cryostat. Two additional nodes are made for beam line system and cryogenics distribution system, making it a systematic distribution system. The system is developed on Linux operating system but the software is portable on Linux and Microsoft windows. The software is developed in two layers namely scanner and operator interface. Scanners interacts with the interface hardware.All scanners are developed in JAVA , which is very challenging job looking towards the feature of JAVA. Various issues regarding this were closely investigated and solved to overcome the deficiency of JAVA .A micro-controller based board has been developed for cryogenics line distribution system. Different subsystems of the control system has been developed independently. A complete integration of the system will be completed before Dec 2012.

Notes:

PO06 ***Extension of Superconducting LINAC Operation to Lighter Beams***

Vandana Nanal, Ravindra Dinkar Deshpande, Prajakta Dhumal, Jitendra N Karande, Rudrajyoti Palit, R. G. Pillay, Mahesh Shivram Pose, Sandeep M Powale, Catarina Rozario, S. K. Sarkar, Mandar Sawant, Avinash A Shinde, S Sinha, Ajay N Takke (TIFR, Mumbai), Sudheer Singh (LEHIPA Project, Physics Group, Mumbai)

The superconducting LINAC booster at Pelletron Linac Facility(Mumbai), has been fully operational since July 2007. The Liquid Helium Refrigeration plant for the LINAC has been upgraded to enhance the refrigeration capacity to ~450 Watts at 4.5K without LN2 pre-cool, from the earlier capacity of ~300 Watts. All beam lines in new user halls have been commissioned and new experimental setups have been added. Several experiments have been carried out using beams of 12C, 16O, 19F, 28Si, 31P. The QWR cavity is designed for beta=0.1 and hence it is difficult to accelerate lighter beams. Due to growing interest in studying Li induced reactions on fissile targets at energies higher than 55 MeV, we have recently accelerated Li beam using four cryostat modules. Starting with 40 MeV Li beam from the pelletron, 56 MeV beam was successfully delivered at target station for a test experiment.

Notes:

PO07 ***A Cost-Effective Energy Upgrade of the ALPI Linac at INFN-Legnaro***

Giovanni Bisoffi, Michele Comunian, Alberto Facco, Alessio Galatà, Paolo Modanese, M. Francesca Moisio, Andrea Pisent, Anna Maria Porcellato, Sergey Stark (INFN/LNL, Legnaro (PD)), Boris Borisovich Chalykh (ITEP, Moscow)

The ALPI SC linac at INFN-LNL is being constantly upgraded in terms of maximum beam energy (Ef) and current, made available for experiments. Presently, a liquid-N cooling scheme is being applied to the RF power couplers of the 16 full Nb resonators, to keep them locked at 5 MV/m, vs. present 3 MV/m. A further upgrade of the 44 "medium beta section" cavities, changing the cavity Cu substrates, was prototyped and is reported at this conference: however it is not fully funded yet and is extremely time-consuming. A cost-effective Ef upgrade is proposed here: to move 2 SC buncher cryostats, which house a single working SC QWR but were designed for 4, at the end of ALPI, equipping them with 4 Nb/Cu QWRs each (new bunchers would either be NC QWRs or a single SC cavity cryostat). The contribution of these cryostats to Ef would be extremely effective: e.g. a Ef~10 MeV/A (Ibeam≥ 1 pnA) Pb beam, a very attractive tool for the Nuclear Physics community, is achievable. A being performed upgrade of ALPI cryoplant, expected to increase the refrigeration capability by ~25%, makes this change possible today. Details of this solutions, as well as its limits, will be presented and discussed

Notes:

PO09 ***Study of the RFQ Beam Cooler for SPES Project***

Mario Maggiore, Anna Maria Porcellato, Sergey Stark (INFN/LNL, Legnaro (PD))

The SPES project is the new Radioactive Ion Beam facility under construction at Laboratori Nazionali of Legnaro, Italy. In this framework in order to improve the beam quality in terms of emittance and energy spread, a study of a new RFQ beam cooler device is accomplishing. The electromagnetic design of the RFQ section and the electrostatic layout of the injection and extraction regions have been done. The study about the beam dynamic is going on by means of dedicated codes which allow to take into account the interaction of the ions with the buffer gas needed to cool the beams. The preliminary results for vacuum system done by MOLFLOW code will be also presented. The status of the project will be shown in this report.

Notes:

PO10 ***On Line Performance of ALPI New Medium Beta Resonators***

Anna Maria Porcellato, Francesca Chiurlotto, Sergey Stark (INFN/LNL, Legnaro (PD))

All the Nb sputtered medium beta cavities installed up to the last year in ALPI were produced by upgrading of old previously Pb plated substrates. For the first time this year we had the opportunity to test on line four 160 MHz, beta=0.11 QWRs which were designed and built in order to be Nb sputtered. These resonators were sputtered in between 2007 and 2008 and they were tested at low fields (up to 3 MV/m) just after their production when they showed Q-zero values exceeding 1xE9. They were then stored for about three years in plastic bags and installed in ALPI only this year. The on line tests that we performed after installation showed Q-zero values reduced of about a factor five with respect to the ones measured in laboratory. It is the first time we could pick out a Q deterioration caused by storage in air. So far we have not recognized any Q–degradation both when the sputtered cavities were maintained in vacuum for many years and also when they were open to air for a few weeks for cryostat maintenance. In such a case, as it happened in the maintenance of cryostat CR19 housing high beta resonators, we could instead find some improvements in the Q-curves.

Notes:

PO12 ***Damage Situation of the 12UD Pelletron Tandem Accelerator at the University of Tsukuba by the Great East Japan Earthquake***

Kimikazu Sasa (UTTAC, Tsukuba, Ibaraki)

The 12UD Pelletron tandem accelerator at the University of Tsukuba suffered serious damage from the Great East Japan Earthquake on 11 March 2011. On the day, the 12UD Pelletron tandem accelerator was in operation at 8 MV. A main tank of the 12 UD Pelletron tandem accelerator located from downstairs 4th floor to 7th floor was strongly shaken by the shock of the earthquake. All high voltage accelerating columns fell down in the accelerator tank. The situation of damage and a post-quake reconstruction project of the Tandem Accelerator Facility at the University of Tsukuba will be reported.

Notes:

PO13 ***Longitudinal Beam Motion in the KEK Digital Accelerator: Tracking Simulation and Experimental Results***

Xingguang Liu (Department of Energy Sciences, Yokohama), Taiki Iwashita (KEK, Ibaraki), Toshikazu Adachi (KEK, Ibaraki; Sokendai, Ibaraki), Ken Takayama (KEK, Ibaraki; Sokendai, Ibaraki; TIT, Yokohama), Takashi Yoshimoto (TIT, Yokohama), Shinya Harada (Tokyo City University, Tokyo)

Beam commissioning in the KEK Digital Accelerator*, which is a small scale induction synchrotron (IS), has been conducted since the middle of 2011. Longitudinal beam motion in the induction synchrotron, which utilizes induction cells (IC) for acceleration and confinement, is characterized as barrier bucket acceleration. . These ICs are driven by the switching power supply (SPS). Pulse voltage is fully managed by the gate control for solid-state switching elements in the SPS, where FPGAs and DSPs take a key role**. A tracking code has been developed to understand the longitudinal motion affected by longitudinal space charge forces, under programmed settings of confinement and acceleration voltage. This code, where the trigger control scenario is fully implemented, calculates temporal evolution of momentum and phase of macro-particles. The simulation result has well reproduced beam commissioning results, such as bunch squeezing experiment and barrier bucket acceleration. In addition, the code is going to be applied to explain the rapid growth of micro-bunch structure in the injected ion bunch.

* T. Iwashita et al., "KEK Digital Accelerator" , Phys. Rev. ST-AB 14, 071301 (2011). And K.Takayama et al., in this conference. ** S.Harada, Ms. Thesis (TCU) (2011).

Notes:

PO14 ***Feedback of Slow Extraction in CSRm***

Jian Shi, Weiping Chai, Jie Li, Jia Wen Xia, Jiancheng Yang, Youjin Yuan (IMP, Lanzhou)

The transverse tune of the beam in the synchrotron will fluctuate due to the quadrupole current ripple, which lead the spill ripple through the variation of the separatrices area. In order to reduce the ripple of the spill, a pair of fast response quadrupole (FQ) is adopted to compensate the tune ripple caused by other quadrupoles. After using the FQ feedback, the amplitude of the spill ripple within 800Hz has been reduced to 1/10 times from the normal mode. This method will be used in the HITFiL (Heavy Ion Therapy Facility in Lanzhou).

Notes:

PO15 ***Study of the Heavy Ion Bunch Compression in CSRm***

Da Yu Yin (IMP, Lanzhou)

The feasibility of attaining short pulse duration heavy ion beam with a scale of nanosecond pulse length is studied in the main ring of the Heavy Ion Research Facility in Lanzhou (HIRFL). Such heavy ion beam can be produced by non-adiabatic compression, and it is implemented by a fast rotation in the longitudinal phase space. In this paper, the possible beam parameters during longitudinal bunch compression are studied with the envelope model and PIC simulation, and the results are compared. The result shows that the shortest heavy ion bunch 238U28+ of 50ns with the energy of 200MeV/u can be obtained which can satisfy the research of high energy density physics.

Notes:

PO16 ***Multiphysics and Pressure Code Analysis of the FRIB Accelerating Cavities***

Samuel John Miller, Joseph Binkowski, Alberto Facco, Matthew John Johnson, Ying Xu (FRIB, East Lansing, Michigan)

Four low-beta resonator types have been designed at the Facility for Rare Isotope Beams (FRIB) at Michigan State University (MSU) for use in a heavy ion linac. Two 80.5 MHz quarter wave resonators (QWR) and two 322 MHz half wave resonators (HWR) have been developed. Integrated RF eigenvalue simulations and structural simulations were performed using ANSYS FEM software to simulate cool-down temperature effects and RF frequency tuning. Pressure vessel engineering principles were applied to the niobium cavity and CP grade 2 titanium helium vessel for operational as well as failure scenarios of the 2 K liquid helium system. Simulations were used to structurally reinforce the cavities to reduce RF resonance detuning due to external helium pressure fluctuations and Lorentz force detuning.

Funding: U.S. Department of Energy Office of Science under Cooperative Agreement DE-SC0000661

Notes:

PO17 ***Simulation of Electron and Ion Dynamics in an EBIS***

Liangji Zhao, Evstatiev Evstati, Jin-Soo Kim (Far-Tech, Inc., San Diego, California)

To model the dynamics of the ions in an Electron Beam Ion Source (EBIS), a time-dependent, self-consist particle-in-cell Monte Carlo code (EBIS-PIC) has been developed by FAR-TECH, Inc. The energetic background electron beam is modeled by PBGUNS (http://www.far-tech.com/pbguns/index.html) by dividing the long beam path into several segments to resolve the big length-to-radius spatial scaling problem. The injected primary ions and ionized neutral gas ions are tracked using Monte Carlo method which includes the ionization, charge-exchange and Coulomb collisions with the electron beam and the neutral gas in the potential well, which is calculated by solving the Poisson equation each time step. EBIS-PIC has been able to predict the spatial and velocity space distributions and the evolution of the charge state distribution (CSD) of trapped ions in EBIS devices operating in fast or slow trapping mode. The physical model of EBIS-PIC code and the simulations of the trapping and charge-breeding of injected Cs+1 ions on the Test EBIS* at BNL will be presented. The simulation results have shown good consistency with the experiments.

* S. Kondrashev, J.G. Alessi, E.N.Beebe, C. Dickerson, P.N.Ostroumov, A. Pikin, G. Savard, NIMPR. A, 642 (2011), 18-24.

Funding: Grant supported by DOE office of Nuclear Physics

Notes:

PO18 ***Tandem EBIS***

Alexander I. Pikin, James Alessi, Edward Beebe, Masahiro Okamura, Deepak Raparia, John Ritter, Louis Snydstrup (BNL, Upton, Long Island, New York)

A method to increase the ion beam intensity of RHIC EBIS by extending its ion trap into magnetic field of an additional superconducting solenoid is described. The strong axial support of the cold masses in these solenoids is required to place them on a common axis close to each other. Such configuration of solenoids allows to produce a long EBIS with a single electron gun, electron collector and injection system. Preliminary calculations of magnetic forces, magnetic field and potential distributions are presented along with proposed structure of the ion traps.

Funding: Work supported under the auspices of the US Department of Energy and the National Aeronautics and Space Administration.

Notes:

TUA01 ***Heavy Ion Accelerator Development at IUAC Delhi***

Dinakar Kanjilal (IUAC, New Delhi)

Inter University Accelerator Centre has been involved in the development of heavy ion accelerators, ion sources, beam lines and experimental facilities for providing various heavy ion beams in a wide energy range varying from a few tens of keV to hundreds of MeV for experiments by more than four hundred research groups from all over India and abroad. A large vertical Pelletron electrostatic tandem accelerator capable of achieving terminal voltage up to 16MV has been in operational for more than a couple of decades. Superconducting niobium linac booster accelerating modules having eight niobium quarter wave resonators each have been developed and used. A high temperature superconducting electron cyclotron resonance ion source (HTS-ECRIS) was designed, fabricated and installed. It is in regular operation for production of highly charged ion beams for alternate high current injector (HCI) system consisting of radio frequency quadrupole and drift tube Linacs. Details of developments of various heavy ion beam facilities and experimental systems at IUAC will be presented.

Notes:

TUA02 ***ECR Based Heavy Ion Accelerator Program at BARC-TIFR Pelletron Accelerator Facility***

Pramod Vasant Bhagwat, Jaydeep Ashok Gore, Anit Kumar Gupta, Nitin Mehrotra (BARC, Mumbai), S. Kailas (Bhabha Atomic Research Centre, Mumbai)

The 14 UD Pelletron Accelerator at Mumbai has recently completed twenty four years of successful operation. The accelerator is used for basic research in the fields of nuclear, atomic, condensed matter and material science. The superconducting LINAC booster provides additional acceleration to the ions from Pelletron injector up to A~60 region with E~5 MeV/A. Further, an alternate injector system to the Superconducting LINAC booster is planned as an augmentation programme, comprising of a superconducting ECR ion source, room temperature RFQ and superconducting low-beta cavity resonators. The RFQ operating at 75 MHz will accelerate ions up to 575 keV/u for q/m of 1/7. The realization of an ECR based alternate injector will significantly enhance the utilization capability of LINAC by covering heavier mass range up to Uranium. An 18 GHz ECR ion source known as Pk-ISIS has been commissioned on 9th March 2012 at Van-de-graaff Lab, BARC. During site acceptance test, 238U+34 ion beam was accelerated with 4.5 eμA at 800 W (available RF power ~1.7 KW). This paper will describe in detail the ongoing developmental programmes at this facility.

Notes:

TUA03 ***The Compact Pulsed Hadron Source Status****

Xialing Guan (TUB, Beijing)

Abstract The Compact Pulsed Hadron Source (CPHS) at the Tsinghua University in Beijing, China has been reported in this paper. CPHS consists of a proton linac, a neutron target station, and a small-angle neutron scattering instrument, a neutron imaging/radiology station, and a proton irradiation station. The proton linac accelerator part is composed of a ECR ion source. LEBT section, a RFQ accelerator, a DTL linac and a HEBT. A 3 meters long of RFQ machine can accelerate the proton to 3MeV. No MEBT will be requirement in this project. The Drift Tube Linac with permanent magnets focusing lens will accept the proton beam direct from RFQ. A 4.3 meters length of DTL will accelerate the beam up to 13MeV. The HEBT section will transport the proton beam from output of DTL to the center of MTR. Up to now, the IS/LEBT and the RFQ heve ready. The first phase of the CPHS construction is scheduled to complete 3MeV proton beam on the target in the middle of 2012.

*Work supported by the "985 Project" of the Ministry of Education of China,
**guanxialing7911@vip.sina.com

Notes:

TUB01 ***Development of NRA System for a 1.7MV Tandem Accelerator-Human Resource Development Program for Nuclear Engineering, The University of Tokyo***

Seiji Ito, Hiroyuki Matsuzaki, Akira Morita (The University of Tokyo, Tokyo)

The 1.7MV tandem accelerator (RAPID) at the University of Tokyo has been used for various research projects and educational studies since its installation in 1994. Recently RAPID has contributed to educational program for study by utilizing high sensitive ion beam analysis methods of the accelerator. In the fall of 2011, we newly developed a NRA (Nuclear Reaction Analysis) system with BGO scintillator. Detecting the resonant reaction 19F (p, αγ) 16O, a special student experimental class was successfully performed as a "Human resource development program for nuclear engineering". The feature of this experiment is very few in advanced case study, which has performed with combine multiple ion beam correspond to a purpose for experiment. In this program students make their own samples for NRA analysis by ion implantation. Later in the year, RAPID will be relocated to the University of Tokyo (HIT facility) in Ibaraki prefecture to replace the 1MV tandem accelerator which was damaged by the Great East Japan Earthquake on March of 2011.

Notes:

TUB02 ***New Developments at the Tandem Accelerators Laboratory at IFIN-HH***

Dan Gabriel Ghita (IFIN, Magurele- Bucuresti)

The upgrade of the 9 MV Tandem accelerator at IFIN-HH started in 2007. Remarkable improvements were done in the last 5 years that can be seen in the improved performance and reliability of the machine. Using original preparation techniques, some new beam species were tested for the first time in our laboratory. This opened the door to new experiments. A major improvement for the laboratory is the installation of 1 MV Tandetron accelerator dedicated to ultra-sensitive AMS measurements of C-14, Be-10, Al-26 and I-129, and 3 MV Tandetron accelerator dedicated to ion beam analysis. The main directions of the research activity in the laboratory will be shortly presented.

Notes:

TUB03 ***Terminal Voltage Stabilization of Pelletron Tandem Accelerator***

Nikolai R. Lobanov, Michael Blacksell, Peter Linardakis, Dimitrios Tsifakis (Research School of Physics and Engineering, Canberra)

A conventional corona control terminal voltage stabiliser has been investigated on the ANU 14UD tandem accelerator. The fluctuations in the charge transport of electrostatic pelletron generator and their correlation with mechanical oscillations of the chains and terminal voltage ripple have been analysed. Emphasis is placed on the performance of the two-loop feedback system and on the tuning of this system to production of high energy-resolution beams. The transfer function for the corona regulation loop has been determined and examined. The system produces the beam position at the image slit of the 90 energy-analysing magnet with long-term stability equivalent to a few hundred volts rms fluctuation of the terminal voltage. The concept of novel fast control loop utilizing the high-frequency component from the image slits to control the voltage of the last gap of high-energy acceleration tube is discussed.

Funding: Heavy Ion Accelerators Education Investment Fund (EIF)

Notes:

TUB04 ***LINAC Experience In The First Two Years Of Operation @ CNAO (Centro Nazionale Adroterapia Oncologica)***

Silvia Vitulli, Enrico Vacchieri (CNAO Foundation, Milan)

CNAO is the first medical accelerator facility for deep hadrontherapy with C6+ and H3+ in Italy. The LINAC device at CNAO include a RFQ structure accelerating up to 400 keV/u and an IH structure works up to 7 MeV/u. Such LINAC works as injector in a 78 m circumference synchrotron where the beam reaches up to 400 MeV/u. The LINAC commissioning was performed during 2009 and from beginning of 2011, it entered into routine and continuous operation. First patient was treated in September 2011. The principal LINAC parameters are daily monitored, like output energy (by means of online not destructive ToF measurements), cavities voltage, cavities RF forward power, beam current transmission. No major faults were observed in the first two years of operation. LINAC beam is stable within an error of ±0.02 MeV/u. The relation between LINAC extraction and synchrotron injection is under investigation. This paper summarizes the monitoring issues (i.e. reproducibility of settings and beam parameters as well as long term stability measures) on the CNAO LINAC during daily patient treatments and outlines the measurements performed in the initial commissioning compared within actual status.

Notes:

TUC01 ***Physical Design of the SPES Facility***

Michele Comunian (INFN/LNL, Legnaro (PD))

SPES (Selective Production of Exotic Species) is the Italian project for a radioactive ion beam (RIB) facility based on a cyclotron as primary accelerator and on the existing superconducting linac ALPI as post accelerator. The cyclotron, energy up to 70 MeV and total current of 0.75 mA, shared on two exits, is in construction in the industry. The production of neutron-rich radioactive nuclei, with ISOL technique, employs the proton induced fission on a direct target of UCx; the fission rate expected with a proton beam of 40 MeV and 0.2 mA, is 10^13 fissions/s. The main goal of physical design of the SPES facility is to provide an accelerator system to perform forefront research in nuclear physics by studying nuclei far from stability, in particular neutron-rich radioactive nuclei with masses in the range of 80–160. The final RIB energy on the experimental target will be up to 11 MeV/A for A = 130, with an intensity in the range of 10^7–10^9 pps.

Notes:

TUC02 ***KEK Digital Accelerator and Recent Beam Commissioning Result***

Ken Takayama, Toshikazu Adachi, Teruo Arai, Dai Arakara, Taiki Iwashita, Eiichi Kadokura, Tadamichi Kawakubo, Tomio Kubo, Hiroshi Nakanishi, Katsuya Okamura, Hirohiko Someya, Masayoshi Wake (KEK, Ibaraki), Hiroyuki Asao, Yoshihito Okada (NETS, Fuchu-shi), Kohji Okazaki (Nippon Advanced Technology Co. Ltd., Ibaraki-prefecture), Kwee Wah Leo (Sokendai, Ibaraki), Xingguang Liu, Takashi Yoshimoto (TIT, Yokohama), Shinya Harada (Tokyo City University, Tokyo)

The digital accelerator (DA), which is a small-scale induction synchrotron "*" requiring no high-energy injector and capable of providing various ions, was constructed at KEK"**". Beam commissioning has been carried out. The KEK-DA consists of a 200 kV high voltage terminal, in which a permanent mag. x-band ECRIS is embedded, 15 m long LEBT, ES injection kicker, and a 10 Hz rapid cycle synchrotron equipped with the induction acceleration system. An ion pulse chopped in 5 micro-sec by the newly developed Marx generator driven Einzel lens chopper"***" was guided through the LEBT and injected by the kicker in one turn. 3 micro-sec ion pulse was successfully captured with a pair of barrier voltage-pulses of 2 kV and accelerated up to 12 MeV with another flat induction-acceleration voltage-pulse through an acceleration period of 50 msec. Beam commissioning started with a He1+ ion beam of 100 microA. Details of fully digital-controlled barrier bucket trapping and induction acceleration are described, although the acceleration/extraction is still at a preliminary stage. Some of unique applications, such as laboratory space science using virtual cosmic rays, will be introduced.

* K.Takayama and R.J.Briggs (Eds), “Induction Accelerators”, (Springer, 2010). ** T. Iwashita et al., Phys. Rev. ST-AB 14, 071301 (2011). *** T.Adachi et al., Rev. Inst. Meth. 82, 083305 (2011).

Notes:

TUC03 ***Laser Ablation of Solids into an Electron Cyclotron Resonance Ion Sources for Accelerator Mass Spectroscopy***

Tala Palchan, Filip G. Kondev, Sergei A. Kondrashev, Chithra Nair, Richard Claude Pardo, Robert Scott, Richard Vondrasek (ANL, Argonne), Jeffrey Berg, Thomas Maddock, Giuseppe Palmotti, Gilles Youinou (INL, Idaho Falls, Idaho), Massimo Salvatores (INL, Idaho Falls, Idaho; CEA Cadarache, Saint Paul Lez Durance), George Imel (ISU, Pocatello, Idaho), Michael Paul (The Hebrew University of Jerusalem, Jerusalem), William Bauder, Philippe Collon (University of Notre Dame, Indiana)

A project using accelerator mass spectrometry (AMS) is underway at the ATLAS facility to measure the atom densities of transmutation products present in samples irradiated in the Advanced Test Reactor at INL. These atom densities will be used to infer effective actinide neutron capture cross-sections ranging from Thorium to Californium isotopes in different neutron spectra relevant to advanced fuel cycles. This project will require the measurement of many samples with high precision and accuracy. The AMS technique at ATLAS is based on production of highly-charged positive ions in an ECRIS followed by injection into a linear accelerator. We use a picosecond laser to ablate the actinide material into the ion source. We expect that the laser ablation technique will have higher efficiency and lower chamber contamination than sputtering or oven evaporation thus reducing 'cross talk' between samples. In addition a multi-sample holder/changer is part of the project to allow for a quick change between multiple samples. The results of off-line ablation tests and first results of a beam generated by the laser coupled to the ECR will be discussed as well as the overall project schedule.

Funding: This work is supported by the U.S. Department of Energy, Office of Nuclear Physics, under contract No. DE-AC02-06CH11357.

Notes:

TUC04 ***Experiences and Lessons Learned at CARIBU with an Open 252Cf Source***

Samuel I. Baker, John Philip Greene, Anthony Levand, Richard Claude Pardo, Guy Savard, Richard Vondrasek, Loren Weber (ANL, Argonne)

The CARIBU (the CAlifornium Rare Ion Breeder Upgrade) project at ATLAS is based on the creation of beams of neutron-rich nuclei produced as fission fragments from the 3% fission branch that occurs naturally in the decay of Cf-252. These fission fragments are thermalized in ultrapure helium gas and turned into a charged beam for use by the ATLAS accelerator or 'stopped' beam experiments. This requires a very thin source, electroplated on a stainless steel or platinum backing so that the fission fragments escape into the helium gas and are efficiently thermalized and collected into an ion beam. The information learned from the successive use of two sources with strengths of 2 mCi and 100 mCi has now prepared us for the installation in mid-summer of a 500 mCi source recently produced by Oak Ridge National Laboratory. This paper will describe the radiological monitoring system and our experience with the two weak "open" sources which have exercised and tested our radiological controls, emissions monitors, and procedures for the CARIBU facility and the source transfer area.

Funding: This work is supported by the U.S. Department of Energy, Office of Nuclear Physics, under contract No. DE-AC02-06CH11357.

Notes:

WEA01 ***Advanced Accelerator Technology Aspects for Hadron Therapy***

Luciano Falbo (CNAO Foundation, Milan)

Nowadays cancer can be considered as one of the wide spread diseases all around the world. Radiotherapy is the clinical technique used in 40% of cancer treatments: nowadays about 40% of the 18000 particle accelerators running in the world are devoted to radiotherapy. Classical radiotherapy employs photons and electrons that damage not only the diseased cells but also the healthy ones. Hadrontherapy is a high-precision radiotherapy exploiting the depth-dose deposition characteristics of the hadron particles. The realization of machines for hadrontherapy is more challenging than for standard radiotherapy: while most of hospitals have a device for classical radiotherapy, the hadrontherapy needs a dedicated building with the needed technology for the hadron acceleration. The first hadrontherapy treatments have been performed in particle physics research centers clinically adapted; nowadays there are dedicated facilities designed and built as hadrontherapy centers. This paper will give an overview on the existing hadrontherapy centers presenting the technologic background that is at the basis of the hadrontherapy world.

Notes:

WEA02 ***Focusing of Intense Heavy Ion Beams with Plasma Lenses***

Oliver Meusel, Martin Droba, Ulrich Ratzinger, Kathrin Schulte (IAP, Frankfurt am Main)

Gabor lenses are a special type of plasma lens using a stable confined electron cloud for beam focusing. The electrons provide space charge neutralization of the beam traveling through the lens volume. At the same time a radial symmetric electrostatic self field focuses the beam mass independently. It is possible to control the density and distribution of the confined electrons providing variable focusing strength and moderate emittance growth of the beam. The knowledge of the behavior of the electron column inside this lens type is essential to understand the impact on beam transport. Therefore several diagnostic tools were developed to measure the electron cloud properties with and without ion beam propagation through Gabor lenses. Based on experimental results a new Gabor plasma lens has been designed for focusing heavy ion beams. A comparison of this lens type and a superconducting solenoid is planned at the low energy transport section of the GSI - High Current Test Injector (HOSTI).

Notes:

WEB01 ***Review of EBIS Ion Source Performance***

Edward Beebe (BNL, Upton, Long Island, New York)

Notes:

WEB02 ***Commissioning of CARIBU EBIS Charge Breeder Sub-systems***

Sergei A. Kondrashev, Clayton Dickerson, Anthony Levand, Peter Ostroumov, Richard Vondrasek (ANL, Argonne), Marina Batazova, Genadiy Kuznetsov (BINP SB RAS, Novosibirsk), Alexander I. Pikin (BNL, Upton, Long Island, New York)

A high-efficiency charge breeder based on an Electron Beam Ion Source (EBIS) to increase the intensity and improve the purity of accelerated neutron-rich radioactive ion beams is being developed by the ANL Physics Division. The design of the EBIS charge breeder is complete and manufacturing of the components and sub-systems is in progress. A 6-Tesla superconducting solenoid and a high-perveance electron gun were recently delivered and successfully commissioned. The current status of the ANL EBIS development and commissioning results of different EBIS sub-systems will be presented.

Funding: This work was supported by the U.S. Department of Energy, Office of Nuclear Physics, under contract number DE-AC02-06CH11357.

Notes:

WEB03 ***DREEBIT EBIS/T for Applications in Accelerator Physics***

Mike Schmidt, Alexandra Thorn (DREEBIT GmbH, Dresden), Günter Zschornack (Technische Universität Dresden, Dresden)

Electron Beam Ion Sources and Traps provide light up to heavy ions of low up to high charge states for various applications in accelerator physics such as medical particle therapy and charge breeding. Beside the well-known but quiet costly superconducting EBIS/T type systems compact and permanent magnet-operated EBIS/T from the DREEBIT Company are available, favorable for low-budget projects. Moreover, the "flagship" of the DREEBIT ion source family, the superconducting EBIS-SC features operating parameters comparable to the complex and expensive systems in the EBIS/T community.

Funding: Supported by the European Regional Development Fund (ERDF) and the German Federal Ministry of Economics and Technology

Notes:

WEB04 ***Electron and Ion Beam Dynamics in the CARIBU EBIS Charge Breeder***

Clayton Dickerson, Sergei A. Kondrashev, Brahim Mustapha, Peter Ostroumov (ANL, Argonne), Alexander I. Pikin (BNL, Upton, Long Island, New York)

An Electron Beam Ion Source (EBIS) is being built to charge breed ion beams from the Californium Rare Isotope Breeder Upgrade (CARIBU) for acceleration in the Argonne Tandem Linear Accelerator System (ATLAS) at Argonne National Laboratory (ANL). The overall efficiency of the source and charge breeder system is important since CARIBU will produce many low intensity radioactive ion species. Simulations of the electron and ion beam dynamics have been used to determine the system's expected performance. The details of these simulations and results will be presented.

Funding: This work is supported by the U.S. Department of Energy, Office of Nuclear Physics, under contract number DE-AC02-06CH11357.

Notes:

WEB05 ***ECRIS Latest Developments***

Luigi Celona, Giuseppe Castro, Santo Gammino, David Mascali (INFN/LNS, Catania)

The production of intense beams of highly charged ions (HCI) is one of the most relevant challenge for the future accelerator facilities. Electron Cyclotron Resonance Ion Sources (ECRIS) are nowadays the most powerful devices able to feed accelerators with HCI in a reliable and efficient way. The reliability of frontier solutions for magnets and the increased costs for microwave generators make scaling to larger frequency not viable. Any further improvement of ECRIS output currents and average charge state requires a deep understanding of electron and ion dynamics in the plasma. In the past 20 years different teams have been working in the forefront of ion source developments with both experimental and theoretical activities, proposing different solutions to improve the production rate. The paper will discuss the most recent technological developments in the field, worldwide, together with the modeling issues of non-classical evidences like sensitivity of Electron Energy Distribution Function to the magnetic field detuning, influence of plasma turbulences on electron heating and ion confinement, coupling between electron and ion dynamics and relative impact on the formed ion beam.

Notes:

WEC01 ***Production 72 MHz Beta=0.077 Superconducting Quarter-wave Cavities for ATLAS***

Michael Kelly, Zachary Alan Conway, Scott Gerbick, Mark Kedzie, Ryan Murphy, Brahim Mustapha, Peter Ostroumov, Thomas Reid (ANL, Argonne)

A total of eight 72 MHz beta=0.077 superconducting quarter-wave cavities have recently been completed at Argonne National Laboratory. Seven of these will installed into the ATLAS superconducting heavy-ion linac as part of a beam intensity upgrade, with one remaining for the purposes of continuing to push the performance limits in these structures. Cavities were fabricated using techniques adapted the worldwide effort push niobium cavities close to the material limits. Key developments include the use of electropolishing on the complete helium-jacketed cavity. Wire EDM has been used instead of traditional niobium machining in order to minimize performance limiting defects near the weld seams. Hydrogen degassing at 600C after electropolishing has also been performed. Initial test results show practical acceleration at 4 Kelvin with cavity voltages, Vacc>3 MV/cavity and at 2 Kelvin with Bpeak>120 mT and Vacc>5 MV/cavity.

Notes:

WEC02 ***Status of the HIE-ISOLDE Project at CERN***

Yacine Kadi, Yorick Blumenfeld, Enrico Bravin, Sergio Calatroni, Matthew Alexander Fraser, Brennan Goddard, Walter Venturini Delsolaro, Didier Voulot, Lloyd Williams (CERN, Geneva)

The HIE-ISOLDE project represents a major upgrade of the ISOLDE facility with a mandate to significantly improve the quality and increase the intensity and energy of radioactive nuclear beams produced at CERN. The project will expand the experimental nuclear physics programme at ISOLDE and the focus of the upgrade is a 40 MV superconducting linac to increase the beam energy from 3 MeV/u to over 10 MeV/u, which is based on thirty-two niobium sputter-coated quarter-wave resonators. The existing REX linac will be upgraded in stages to first deliver beam energies of 5.5 MeV/u, with two high-β cryomodules placed downstream, before the energy variable section of REX is replaced with two low-β cryomodules and two additional high-β cryomodules are installed to attain 10 MeV/u. A status report of the different linac R&D activities will be presented, including the progress of the thin-film sputtering development and RF testing of the prototype QWRs, development of the compact diagnostics box and steerers for the inter-cryomodule region, active optical alignment system, LEBT (providing the option of 100 ns bunch spacing) and HEBT.

Notes:

WEC03 ***The SC CW LINAC Demonstrator – 1st Test of an SC CH-cavity with Heavy Ions***

Sascha Mickat, Winfried A. Barth (GSI, Darmstadt; HIM, Mainz), Ludwig A. Dahl (GSI, Darmstadt), Michael Amberg, Viktor Gettmann (HIM, Mainz), Kurt Aulenbacher (HIM, Mainz; IKP, Mainz), Daniel Bänsch, Florian Dirk Dziuba, Dominik Mäder, Holger Podlech, Ulrich Ratzinger (IAP, Frankfurt am Main)

The superconducting (sc) continuous wave (cw) LINAC Demonstrator is a collaboration project between GSI, the Helmholtz Institute Mainz (HIM), and the Institute for Applied Physics (IAP) at the Goethe University Frankfurt. The aim is a full performance test of a 217 MHz sc Crossbar H-mode (CH) cavity, which provides gradients of 5.1 MV/m at a total length of 0.69 m. In addition the Demonstrator comprises two 9.3 Tesla sc solenoids. The configuration of a CH-cavity embedded by two sc solenoids is taken from a conceptual layout of a new sc cw LINACwith nine CH-cavities and seven solenoids. Such an accelerator is highly desired by a broad community of users requesting heavy ion beam energies in the Coulomb barrier range. A successful test of such an sc multigap structure are an important milestone towards the proposed cw-LINAC.

Notes:

WEC04 ***Operation of Superconducting Linac and Commissioning of the Last Linac Module at IUAC Delhi***

Subhendu Ghosh, Rajiv Ahuja, Joby Antony, Suresh Babu, Jacob Chacko, Anup Choudhury, Gajanan Kaluram Chowdhury, Tripti Sekhar Datta, Rajendra Nath Dutt, Rajan Joshi, Dinakar Kanjilal, Soumen Kar, Joydeep Karmakar, Manoj Kumar, Devendra Singh Mathuria, Kishore Kumar Mistri, Ashutosh Pandey, Padmanava Patra, P. Prakash, Abhishek Rai, Amit Roy, J. Sacharias, Bhuban Kumar Sahu, Abhijit Sarkar, Soma Sundara Sonti (IUAC, New Delhi)

The major part of the superconducting linac at IUAC has been operational for the past few years and the last accelerating module is in the final stage of completion. The full linac system consists of five cryostats, housing a total of twenty seven niobium quarter wave resonators. At present, the Superbuncher, the first two linac accelerating modules and the Rebuncher are operational and ion beams in the mass range 12C to 107Ag from Pelletron accelerator have been further accelerated and delivered to conduct experiments. A method of random phase focusing to select the accelerating phase of the resonators between 70□ and 110□ has been successfully tried to reduce the final time width of the beam bunch. Presently, to improve the accelerating fields of the linac resonators in phase locked condition, efforts are dedicated towards improvement of the cooling efficiency of the drive coupler, enhancement of the microphonics damping efficiency with mixtures of SS-balls and testing of an alternate tuning mechanism based by Piezo Crystal. The beam acceleration through the complete linac is to be performed by end of the summer of 2012.

Notes:

WEC05 ***Design Studies for a New Heavy Ion Injector Linac for FAIR***

Bernhard Schlitt, Winfried A. Barth, Gianluigi Clemente, Wolfgang Vinzenz (GSI, Darmstadt)

As the GSI UNILAC started operation in 1975, it will be more than 40 years old when the commissioning of the future Facility for Antiproton and Ion Research (FAIR) at GSI will start. To assure reliable operation for FAIR and to provide beams for a variety of experiments, three separate linacs are proposed: 1.) A new superconducting cw heavy-ion linac behind the upgraded high charge state injector HLI shall provide ion beams with high duty cycle and adjustable energy in the MeV/u region for the super-heavy element program as well as for further UNILAC experiments. 2.) A dedicated 70 MeV proton linac will serve as injector for the FAIR pbar physics program. 3.) To deliver high-intensity heavy-ion beams for FAIR, the existing post-stripper linac should be replaced by a new high energy linac with short beam pulses, low pulse repetition rate, and fixed end energy. Conceptual design studies for the latter machine using 108 MHz IH-type drift tube structures will be presented, including a proposal to increase the ion charge states for synchrotron injection as well as a linac beam energy upgrade using 325 MHz CH structures.

Notes:

THA01 ***Heavy Ion Superconducting Linacs: Status and Upgrade Projects***

Peter Ostroumov (ANL, Argonne)

We observe that there is an increase in the demand, by the scientific community, for accelerated CW ion beams which can be efficiently provided by SC ion linacs. This demand can be categorized into two areas: existing and new facilities. Existing facilities are being refurbished and upgraded for higher energies and beam intensities. Several new projects are under development or construction worldwide. Recently, development of new SC ion linacs has started in China, Korea and Spain. In this talk I will briefly review both the upgrade and new SC ion linac projects with a primary focus on the advances in heavy-ion linac technologies achieved at ANL in connection with the efficiency and intensity upgrade of ATLAS.

Funding: This work was supported by the U.S. Department of Energy, Office of Nuclear Physics, under contract number DE-AC02-06CH11357.

Notes:

THA02 ***Overview of the RISP Superconducting Linac***

Dong-O Jeon, Yeonsei Chung, Hyung Jin Kim, Sun Kee Kim (IBS, Daejeon), Yong Yung Lee (BNL, Upton, Long Island, New York), Eun-San Kim (KNU, Deagu), Jong-Won Kim (NCC, Korea, Kyonggi)

The Rare Isotope Science Project (RISP) got launched December 2011 which consists of In-Flight Fragmentation Facility and ISOL facility, providing uniques research opportunities in broad range of sciences. The superonducting driver linac can accelerate up to 200 MeV/u for uranium beam and up to 600 MeV for proton beam. The ISOL post linac which is also a superconducting linac. Design parameters and choices are presented.

Notes:

THA03 ***Status and Upgrade Project of HIRFL***

Yuan He, Xiaonan Du, Huan Jia, Chao Li, Xiaoni Li, Zhijun Wang, Jia Wen Xia, Jiancheng Yang, Yaqing Yang, Youjin Yuan, Hongwei Zhao (IMP, Lanzhou), Yuanrong Lu (PKU/IHIP, Beijing)

Heavy Ion Research Facility at Lanzhou is a heavy ion accelerator complex for nuclear, atomic, and biology application research activities. It is the biggest heavy ion accelerator facility in China, consisting two cyclotrons in series as injector and two cooling storage rings (CSRm and CSRe) as main synclotron and experimental spectrum separately. The species from P to U were accelerated in the machine, And the maximum energy is 1 GeV/u for C. The experimetal teminals are on meterial, biology, canser therapy, SHE, RIB, mass measurement, inner target, and so on. To improve beam intensity and available beam time, a linear injectors SSC-LINAC were proposed in 2009. It consists a 4-rod RFQ and 4 IH-DTL tanks. The RFQ, IH-DTL, and 60 kW solid state amplifier for SSC-LINAC are tested priliminaryly. The operation status and progress of upgrade projects of HIRFL are presented in the paper.

Notes:

THB01 ***New Developments in Low-Z Gas Stripper Sstem at RIKEN Radioactive Isotope Beam Factory (RIBF)***

Hiroki Okuno, Nobuhisa Fukunishi, Hiroo Hasebe, Hiroshi Imao, Osamu Kamigaito, Masayuki Kase, Hironori Kuboki (RIKEN Nishina Center, Wako)

Electron stripping process from heavy ion in material is a useful tool in accelerator complex to give higher charge state of the ion, allowing its effective acceleration. This process is competed with electron capture process and reach to the equilibrium charge state. Carbon foils is convenient for charge stripper but have short lifetime due to thermal stress and sputtering in the case of high power beam of heavy ion such as uranium. Gas is basically free from lifetime but gives lower charge state due to absent of density effect. Therefore, charge stripper especially for uranium beams at 10-20 MeV/u could be a bottle-neck problem in high power heavy ion facility such as RIBF, FRIB and FAIR. A charge stripper using low-Z gas (He or H2) is an important candidate to solve the problem because the high equilibrium mean charge states for the low-Z gas stripper are expected due to the suppression of the electron capture process. This presenation will describe the results for the develeopments and tests of He gas stripper for uranium beams at 11 MeV/u.

Notes:

THB02 ***New Design for the SARAF Phase II Linac***

Brahim Mustapha, Zachary Alan Conway, Michael Kelly, Andrei Kolomiets, Sergey V Kutsaev, Peter Ostroumov (ANL, Argonne), Jacob Rodnizki (Soreq NRC, Yavne)

We have developed a new design for the 40 MeV/u - 5 mA proton/deuteron SARAF Phase-II Linac. It includes a RFQ, room-temperature bunchers and two types of SC cavities. The new design is based on highly optimized ring-shaped HWR structures operating at 176 MHz, the same frequency as the current SARAF Phase-I linac. We will first present the optimized design of all the components from the RFQ to the SC cavities, then the proposed linac layout, and finally the results of end-to-end beam dynamics simulations including machine errors, realistic corrections and beam loss analysis.

Funding: This work was supported by the ANL WFO No. 85Y47.

Notes:

THB03 ***Design Sudy for Front-End System at Rare Isotope Science Project (RISP)***

Eun-San Kim (KNU, Deagu), Bong Huk Choi, Dong-O Jeon, Byung Cheol Kim, HaeJin Kim, Sun Kee Kim (IBS, Daejeon), JungBae Bahng, Ji-Gwang Hwang, Si-Won Jang (Kyungpook National University, Daegu)

Heavy ion beams of 400 kW and 70 kW are generated at the RISP by in-flight and ISOL methods, respectively. Front-End system in the RISP consists of 28 GHz superconducting ECR-IS with 10 keV/u, LEBT with two-bends and a multi-harmonic buncher, a RFQ with 81.25 MHz and 300 keV/u, and MEBT with two re-bunchers. The design studies have been performed to optimize the beam and accelerator parameters to meet the required design goals. It is shown that the front-end simulations results can provide the two-charge state beams up to uranium to upstream linac with the required beam emittances. In this paper, we present the design results for the front-end system and on the beam dynamics.

Notes:

THB04 ***Development of the Intensity and Quality of the Heavy Ion Beams at GSI***

Ludwig A. Dahl, Winfried A. Barth, Maria Cristina Bellachioma, Lars Groening, Oliver Karl Kester, Markus Kirk, David Ondreka, Niels Pyka, Peter J. Spiller, Jens Stadlmann, Hartmut Vormann (GSI, Darmstadt), Lars Bozyk, Youssef El-Hayek (FIAS, Frankfurt am Main), Chen Xiao (IAP, Frankfurt am Main)

For injection into the future FAIR SIS100 synchrotron the GSI linear accelerator UNILAC and synchrotron SIS18 have to provide 1.5·1011 p/spill for the reference U28+ beam. The MeVVa ion source extracts 37 emA of U4+ beam. For improved transmission the RFQ vanes were revised and exchanged. A new ion source terminal with straightforward beam injection into the RFQ is calculated and partly realized for loss free beam transport to the RFQ. To improve the quality of the space charge dominated beam in the DFFD periodic focussing Alvarez section a transverse 4th order resonance was investigated by simulations and experimentally. The multi turn beam injection into the SIS18 requires emittances below βγεx/βγεy=0.8/2.5 [μm]. This suggests introducing a new concept for emittance transfer by solenoidal stripping. A set-up for experimental proof of principle will be installed at the foil stripper. The SIS18 has been equipped with NEG-coated chambers for all magnets and the injection septum. Newly installed ion catchers improve especially the dynamic vacuum pressure. The effect on progress in beam quality development and intensity will be reported.

Notes:

THB05 ***HITRAP Decelerator and According Beam Instrumentation***

Frank Herfurth, Winfried A. Barth, Gianluigi Clemente, Ludwig A. Dahl, Peter Gerhard, Michael Kaiser, Oliver Karl Kester, Hans-Jürgen Kluge, Christophor Kozhuharov, Michael Tobias Maier, Dennis Neidherr, Andreas Reiter, Thomas Stoehlker, Gleb Vorobjev, Stepan Yaramyshev (GSI, Darmstadt), Ulrich Ratzinger, Alwin Schempp (IAP, Frankfurt am Main)

A linear decelerator is being commissioned for heavy, highly-charged ions (HCI) at GSI in Darmstadt/Germany. HCI with only one or few electrons are interesting systems for many different experiments as for instance precision tests of the theory of quantum electrodynamics (QED). In order to transform heavy HCI produced at 400 MeV/u to stored and cooled HCI at low energy the linear decelerator facility HITRAP has been setup behind the experimental storage ring (ESR). The ions are decelerated in the ESR from 400 to 4 MeV/u, cooled and extracted. The ions are then matched to an IH-structure using a double drift buncher, decelerated from 4 to 0.5 MeV/u in the IH, and then down to 6 keV/u in a 4-rod RFQ. To detect and analyze the weak and sparse ion bunches a new type of energy analyzing detector has been developed along with improvements to other "standard" beam instrumentation. One million highly charged ions have been decelerated with the IH from 400 MeV/u to about 0.5 MeV/u per cycle. The RFQ has shown in off-line tests to decelerate ions, however, the measured acceptance does not fit the ion beam from the IH. This requires a refined design, which is underway.

Notes:

Author Index

Author Index