diamond

IBIC2013

International Beam Instrumentation Conference

The 2nd International Beam Instrumentation Conference

16-19 September 2013 Oxford, UK

Hosted by Diamond Light Source

Programme Committee:

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Mark Boland (Australian Synchrotron)
Glenn Decker (APS)
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Kay Wittenburg (DESY)

Ian Martin (Diamond) – Editor of Proceedings

Scope:

The second International Beam Instrumentation Conference (IBIC) will be held in the historic city of Oxford, UK, on Monday 16 – Thursday 19 September 2013. The programme of talks, tutorials and discussion groups will be designed to explore the physics and engineering developments and challenges of beam diagnostics and instrumentation for charged particle accelerators worldwide. Taking place at the University of Oxford's Saïd Business School, the IBIC 2013 conference will also include poster sessions and an industrial exhibition. The Saïd's central location will allow visitors to explore the historic University City as well as allowing convenient access to Diamond Light Source and ISIS, which delegates will be invited to tour during the conference.

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www.ibic2013.org

IBIC 12

IBIC2012

IBIC2012

Date 1-4 October 2012

Venue Tsukuba, Japan

Conference Guide & Abstract Booklet

1-4 October 2012 Tsukuba, Japan

http://ibic12.kek.jp

Hosted by High Energy Accelerator Research Organization, KEK

IBIC2012

Tsukuba International Congress Center “EPOCHAL”

Tsukuba, Japan
Oct 1 – 4, 2012

Conference Guide
&
Abstract Booklet

Hosted by
KEK, Tsukuba, Japan

http://ibic12.kek.jp/

Contents

Welcome from the Conference Chairman

Dear Colleagues,

I am pleased to welcome you to Tsukuba for the 1st International Beam Instrumentation Conference, IBIC2012, on behalf of the Program Committee. The conference is hosted by the High Energy Accelerator Research Organization (KEK) and supported by our sponsors and venders. In 2010, representatives from the Americas, Europe, and Asia agreed to merge the two regional workshops, BIW in North America and DIPAC in Europe, and combine with a newly-established Asian regional committee to create a new International Beam Instrumentation Conference, IBIC, from 2012. This is a great milestone for the world beam instrumentation community, and it reflects the maturity of international collaboration in the field of beam instrumentation for accelerators. IBIC will be dedicated to exploring the physics and engineering challenges of beam diagnostic and measurement techniques for charged particle accelerators worldwide.

The venue for IBIC2012 is the Tsukuba International Congress Center, a modern, dedicated conference facility, situated in the heart of the city. Tsukuba is located 60 km east of Tokyo, and is Japan's largest research city with more than 300 research institutes. Tsukuba is also one of world's key sites for basic research in science and technology.

The IBIC2012 program includes three tutorials on selected topics, 11 invited talks, 18 contributed talks, and poster sessions. There are 24 vendor exhibits from Monday through Wednesday. The conference Banquet will be held in the traditional Japanese Ryokan (Hotel) "Edoya," on Mt. Tsukuba. A tour of the accelerator facilities at KEK and J-PARC is scheduled for on Thursday afternoon. In addition, there is a special social event, a one day tour to Nikko on Friday. Nikko is a popular destination for Japanese and international tourists, with shrines and temples on the UNESCO World Heritage List.

The Program Committee would sincerely like to give thanks for the generous support of KEK, ACFA, the Tsukuba Tourist and Convention Association, Tsukuba EXPO'85 Memorial Foundation, Foundation for High Energy Accelerator Science, and JACoW. A special "Thank you" must also be expressed to the members of the Local Organizing Committee, whose enthusiastic and outstanding efforts made IBIC 2012 a reality

Sincerely,
Toshiyuki Mitsuhashi
Chair of IBIC 2012

Conference Organization

Program Committee

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Jianshe Cao (IHEP)
Kuo-Tung Hsu (NSRRC)
Kevin Jordan (Jeferson Lab.)
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N. Hayashi (JAEA)
N. Fukunishi (Riken)
T. Watanabe (Riken)

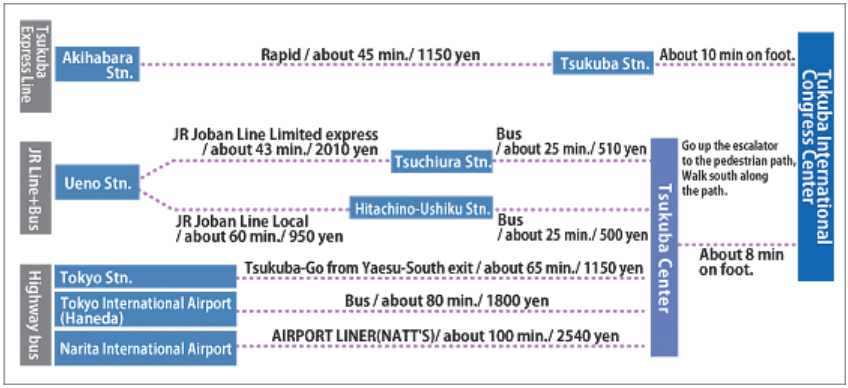
Contacts
ibic12-secretary@ml.post.kek.jp

Conference Venue

IBIC2012 will be held at Tsukuba International Congress Center, also known as “EPOCHAL TSUKUBA”. All plenary sessions will be held in Convention Hall, Room 300, on the 3rd floor of the building.

Address
2-20-3, Takezono, Tsukuba, Ibaraki 305-0032, Japan
Tel: +81-29（861）0001　Web:　http://www.epochal.or.jp/eng/

Transportation



Timetable of airport highway bus (between Narita and Tsukuba).

Airport Liner NATT'S			
Narita->Tsukuba (for Tsuchiura Station)		Tsukuba->Narita [Reservation obligatory]	
Narita Airport	Tsukuba Ctr.	Tsukuba Ctr.	Narita Airport
7:40	9:20	6:00	7:45
9:05	10:45	7:00	8:45
10:35	12:15	8:50	10:30
12:50	14:30	10:40	12:20
14:30	16:10	12:20	14:00
16:15	17:55	13:35	15:15
17:20	19:00	14:35	16:15
18:45	20:25	15:50	17:30
20:10	21:50	17:35	19:15
Reservation: 029-822-5345 (9:00-19:00)			
Fare: JPY2540. for one way			

Timetable of Tsukuba Express train (between Akihabara and Tsukuba).

Akihabara -> Tsukuba

Weekday (Mon-Fri)								Weekend (Sat/Sun/Holiday)							
5	30	45	57					5	30	45	57				
6	05	20	29	45	52			6	05	18	31	43	55		
7	00	11	24	37	46			7	00	12	24	35	48	55	
8	02	08	15	24	34	47	57	8	00	20	25	30	50	55	
9	09	17	22	30	45			9	00	19	25	30	45	55	
10	00	15	22	30	45	52		10	00	15	22	30	45	52	
11	00	15	22	30	45	52		11	00	15	22	30	45	52	
12	00	15	22	30	45	52		12	00	15	22	30	45	52	
13	00	15	22	30	45	52		13	00	15	22	30	45	52	
14	00	15	22	30	45	52		14	00	15	22	30	45	52	
15	00	15	22	30	45	52		15	00	15	22	30	45	52	
16	00	15	22	30	45	52		16	00	15	22	30	45	52	
17	00	17	22	30	40	50		17	00	12	24	36	48		
18	00	10	20	30	40	50		18	00	12	24	36	48		
19	00	10	20	30	40	50		19	00	12	24	36	48		
20	00	10	20	30	40	50		20	00	12	24	36	48		
21	00	12	23	36	48	55		21	00	12	24	36	48		
22	00	15	30	45	51			22	00	15	30	45			
23	00	15	30					23	00	15	30				

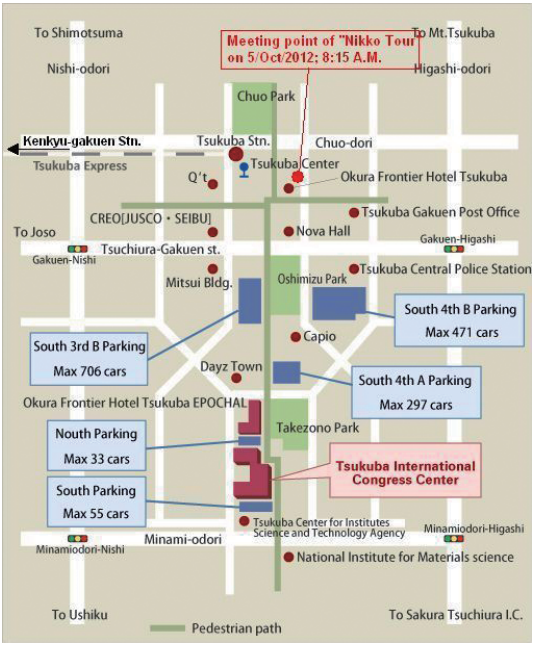
Tsukuba -> Akihabara

Weekday (Mon-Fri)								Weekend (Sat/Sun/Holiday)							
5	07	28	32	51				5	07	28	32	51			
6	12	32	41	56	57			6	13	33	45	57			
7	06	12	25	27	42	56	57	7	01	16	28	31	41	58	
8	12	26	31	47				8	02	15	28	32	47		
9	00	14	25	32	45	55		9	00	10	17	32	42	54	
10	02	15	25	30	44	55		10	02	12	25	30	44	55	
11	02	14	25	30	44	55		11	02	14	25	30	44	55	
12	00	14	25	30	44	55		12	00	14	25	30	44	55	
13	00	14	25	30	44	55		13	00	14	25	30	44	55	
14	00	14	25	30	44	55		14	00	14	25	30	44	55	
15	00	14	25	30	44	55		15	00	14	25	30	44	55	
16	00	14	25	30	43	51		16	00	14	25	30	44	55	
17	09	12	21	32	48	51		17	02	20	25	33	46	49	
18	02	19	21	31	38	49	51	18	02	20	25	38	49		
19	08	19	21	38	49	51		19	02	20	25	37	49		
20	09	19	24	39	51			20	01	20	25	37	51		
21	08	11	27	42	57			21	08	11	27	42	57		
22	14	27	40	57				22	14	27	40	57			
23	14							23	14						

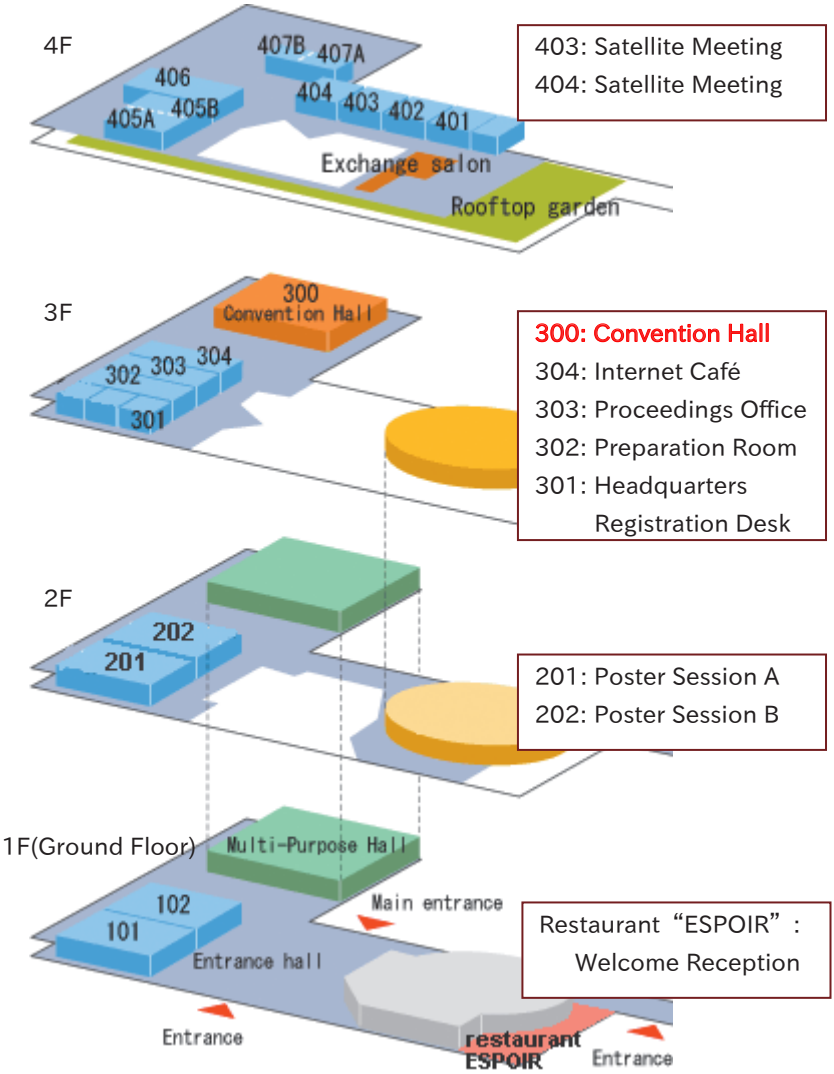
red	rapid	45 min
blue	semi-rapid	52 min
black	local	57 min

Fair : JPY 1,150 (Adult), JPY 580 (Child)
(This timetable is valid until 2012/Oct/15)

Maps of Tsukuba city and the city center.



Floor Guide


4F
407B
407A
406
405A
405B
404
403
402
401
Exchange salon
Rooftop garden
403: Satellite Meeting
404: Satellite Meeting
3F
300
Convention Hall
302
303
304
301
300: Convention Hall
304: Internet Café
303: Proceedings Office
302: Preparation Room
301: Headquarters
Registration Desk
2F
202
201
201: Poster Session A
202: Poster Session B
1F(Ground Floor)
Multi-Purpose Hall
102
101
Main entrance
Entrance hall
Entrance
restaurant
ESPOIR
Entrance
Restaurant “ESPOIR” :
Welcome Reception

Registration and Conference Desk

The registration desk will take place in the following schedule:
Sep. 30 (Sun) 17:00 – 20:00 at restaurant “ESPOIR”
Oct. 1 (Mon) 8:00 – 18:00 in front of Headquarters (301)
Oct. 2 (Tue) 8:00 – 18:00 in front of Headquarters (301)
Oct. 3 (Wed) 8:00 – 15:00 Headquarters (301)
Oct. 4 (Thu) 8:30 – 12:30 Headquarters (301)

Welcome Reception and Banquet

On Sunday Sep 30, a welcome reception will be held at restaurant “ESPOIR” in the conference venue from 18:00 – 20:00.

The conference dinner is scheduled for Oct. 3 (Thu) 18:30 - 21:00 at the beautiful, Japanese-style hotel "EDOYA," located on the hillside of Mt. Tsukuba. Traditional Japanese cuisine will be served. The bus will leave from in front of the conference venue at 18:00, and will return to Tsukuba station around 21:30.

Proceedings Office

The conference proceedings will be published on the JACoW website. The proceedings office is located in Room 303 of the conference venue. Authors are requested to check the status of their submitted paper on the "electronic dot-board" in front of the proceedings office. You can also check the status by logging in to your JACoW IBIC12 SPMS account.
In case your paper status is yellow or red, please visit the author reception desk in the proceedings office.

Internet Café and Wireless Connection

Internet Café is located in the room 304, at the 3rd floor of the conference venue.

Internet café hours:

Oct. 1 (Mon)	8:00 – 18:00
Oct. 2 (Tue)	8:00 – 18:00
Oct. 3 (Wed)	8:00 – 17:30
Oct. 4 (Thu)	8:00 – 12:30

A wireless internet connection is available as well.

ESSID : Password:

You can connect to the internet at lobby space of conference venue all the time. In the convention hall 300, the connection is turned off during sessions, and turned on during breaks.

Sponsors & Student Grants

We would like to acknowledge and thank the following for their sponsorship and support.

Student grants are supported by KEK, Tsukuba Tourist and Convention Association, Tsukuba EXPO'85 Memorial Foundation and Foundation for High Energy Accelerator Science.

CERN Courier provided free advertisement for IBIC2012

Sponsor Logo

KEK High Energy Accelerator Research Organization

Foundation for High Energy Accelerator Science

Tsukuba Tourist and Convention Association

Tsukuba EXPO'85 Memorial Foundation

Special Invited Talk

We are pleased to invite you to the Special Invited Talk in IBIC 2012 titled “Neutrino experiments in Japan”. This talk is scheduled on Monday, Oct 1, 19:00 – 20:00 at the Convention Hall 300. Speaker is Dr. Takashi Kobayashi, KEK/J-PARC. He is one of the leading scientists in neutrino physics in the world.

Laboratory Tour

We are planning to have an optional site tour on Oct. 4 afternoon (Thursday) on the choice between KEK (Tsukuba) and J-PARC (Tokai).

KEK (Tsukuba) Tour

At the Tsukuba campus of KEK, there are several particle accelerators such as the KEKB B-Factory (electron-positron colliding rings), the Photon Factory and PF-AR (synchrotron light sources), and a 600 m long injector linac. R&D for the International Linear Collider (ILC) is being performed at the experimental accelerators ATF and STF. An Energy Recovery Linac (ERL) has been studied as a future light source, and a test accelerator named "Compact ERL (cERL)" is now under construction. As KEKB is in a luminosity-upgrade shutdown, we can offer a rare chance to tour the accelerator tunnel of the colliding rings.

As the available time for the site tour is limited, we plan to have the following two courses in the KEK tour.

Course K1: KEKB, KEK Linac, PF-ring, and cERL
Course K2: cERL, ATF, STF, and KEKB

The schedule for the KEK tour is as follows,

14:00 Depart from conference venue (after lunch)
14:30 Arrive at KEK
14:30-17:00 Site Tour
17:00 Depart from KEK
17:30 Arrive at conference venue

J-PARC (Tokai) Tour

J-PARC is located on the Tokai site of JAEA, about one hour drive from Tsukuba, and its accelerator complex consists of an injector linac, a 3-GeV RCS (Rapid Cycling Synchrotron), and the 30-GeV MR (Main Ring). The J-PARC tour will cover the following course:

Course J1: J-PARC Linac, CCR, MR

The schedule for J-PARC (Tokai) Tour is as follows,

12:30 Depart from conference venue (lunch in the bus)
14:00 Arrive at Tokai
14:00-16:30 Site Tour
16:30 Depart from Tokai
18:00 Arrive at conference venue

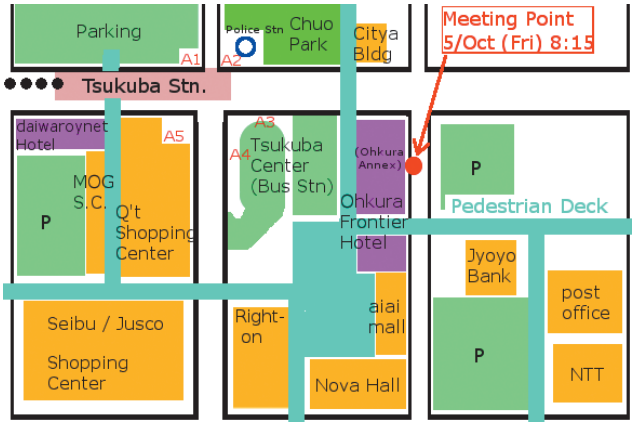
As J-PARC is located inside the JAEA site, a visitor with foreign citizenship is required to submit a Visit Proposal to JAEA. A foreign citizen is not allowed to enter the JAEA site without a visit proposal accepted in advance. The deadline for Visit Proposal submission is September 15, 2012. Please refer to the IBIC12 Web site for details.

Excursion

We are arranging a one-day excursion to Nikko on October 5th. Nikko is one of the most famous site-seeing locations in Japan, and is located 120 km north of Tsukuba, about 2 hours by tour bus. Nikko has many historical shrines and temples, and is a UNESCO World Heritage Site. Nikko also has beautiful natural treasures such as Kegon Waterfall and Lake Chuzenji.

Schedule:

8:15 Meet in front of “Okura Frontier Hotel” (see map on p.5)
Depart Tsukuba
Visit Nikko Toshogu Shrine and Rinnoji Temple (Guided walk)
12:30 Lunch
Visit Kegon Waterfall and Lake Chuzenji (Free stroll)
17:30 Arrive back at Tsukuba



Program Codes

Program Codes are the "unique identifiers" of contributions to the scientific program of the conference. They are used to identify contributions by type (oral, poster), and to place them in time (date of presentation), session (location) and sequence. They are used to identify the files of contributions to the proceedings.
Program codes are composed as follows:

- The first two letters are the code for the day: MO, TU, WE, TH ;
- The third letter pertains to the type of presentation:
  - I is for invited oral contributions ;
  - T is for tutorial contributions ;
  - C is for contributed oral sessions ;
  - P is for poster;
- The fourth letter, A, B etc., indicate the session for plenary session A , B etc. , for the poster session, the character A or B indicates the location for the poster session: A (Poster room 201) or B (Poster room 202);
- The number at the end is the numbers within the session, for both oral and poster sessions.

For example:
MOIA01 would be the first invited oral presentation, in the A plenary session on Monday in the Main Hall.

MOPA01 would be a poster presented during the poster session scheduled on Monday afternoon in the Poster room 201.

Industrial Exhibition and Sponsors

The industrial exhibition will take place on the 3rd floor of the conference venue. Exhibition hours are listed below:
Oct. 1 (Mon) 12:00 – 18:00
Oct. 2 (Tue) 9:00 – 18:00
Oct. 3 (Wed) 9:00 – 13:30
More information can be found at the end of this booklet.

List of exhibitors (alphabetical order)

ADVANTEST CORPORATION

Agilent Technologies

ARKUS Inc.

Bergoz Instrumentation

CIVIDEC Instrumentation GmbH

Dimtel, Inc.

HAMAMATSU PHOTONICS K.K.

Instrumentation Technologies, d.d.

KIYOHARA OPTICS Inc.

Komine Musen Denki Co., LTD.

Kyocera Corporation

Mitsubishi Cable Industries, LTD.

MTT Corporation

National Instruments Japan Co.

OKAZAKI MANUFACTURING Co.

ORIENT MICROWAVE Co.

Pascal Co., Ltd.

R&K Company Limited

RadiaBeam Technologies, LLC.

SEIKO EG&G

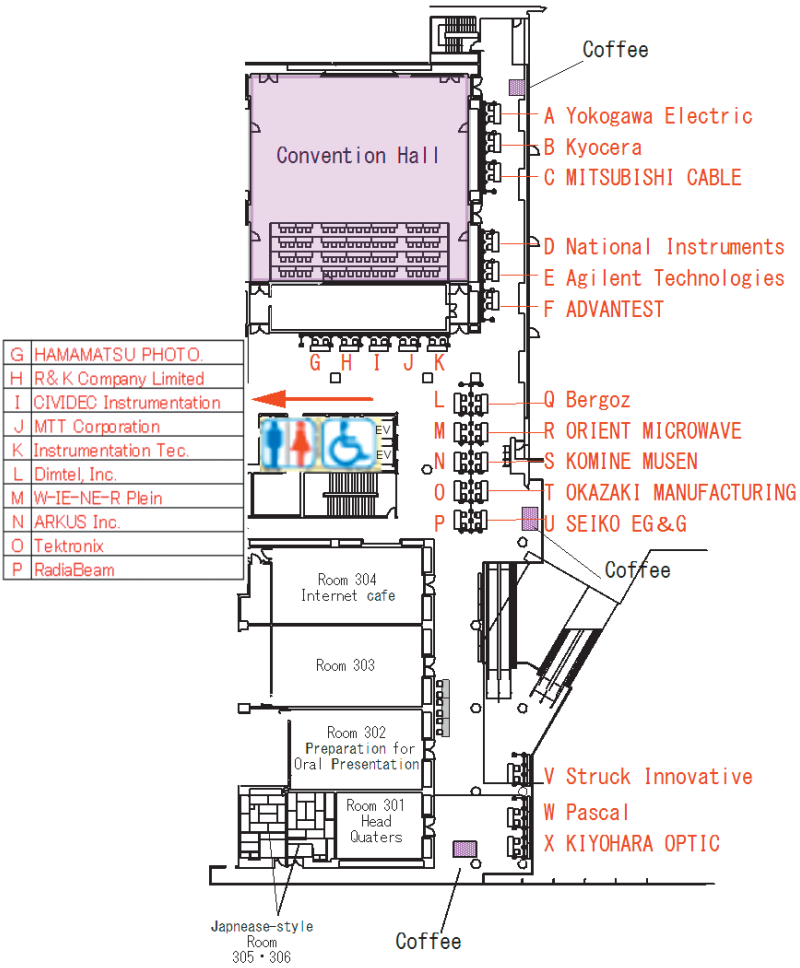
Struck Innovative Systeme GmbH

Tektronix

W-IE-NE-R Plein & Baus GmbH

Yokogawa Electric Corporation

Layout of Vendor Booth



3rd-floor Layout

Abstracts

Monday Session A, 8:30 – 10:00
Chair: Toshiyuki Mitsuhashi (KEK)

MO1A01 **Accelerator Projects at KEK** - *Katsunobu Oide (KEK, Ibaraki)*
This is a short talk to introduce accelerator projects at KEK including the Super B-Factory (SuperKEKB), Photon Factory (PD/PF-AR) and the high-intensity proton machine J-PARC. Some R&D efforts for future such as the International Linear Collider (ILC/STF/ATF) and the Energy Recovery Linac will be also overviewed. It may briefly mention on critical issues related to beam instrumentation for each project.

MO1A02 **Progress of Beam Instumentation in J-PARC Linac** - *Akihiko Miura (JAEA/J-PARC, Tokai-mura)*
J-PARC, one of the high intensity proton accelerators, achieved the output power of 300 kW at the downstream rapid cycling synchrotron with a beam energy of 181 MeV and a beam current of 15 mA. When an upgrade of an ion source which can provide 50 mA and the installation of the additional acceleration cavities for the energy upgrade up to 400 MeV are completed, output power can reach 1MW. To meet with the requirements of the high intensity beam diagnostics, we prepare several measures against high intensity proton related issues. The following subjects have been reported among many subjects: development of strip-line type beam position monitors, beam current monitors, phase monitors and transverse profile monitors. And the subjects of the beam diagnostic for the energy upgraded linac including the longitudinal beam profile monitor and the developing laser based profile monitor will be mentioned. A big earthquake occurred on May 11, 2011. We successfully recovered to have commercial operation, but a partial recovery is still undergoing. Influence of the quake on the J-PARC linac is also mentioned.

Monday Session B, 10:30 – 12:10
Chair: Kay Wittenburg (DESY)

MOCB01 **Beam Instrumentation of SuperKEKB Rings** - *Hitoshi Fukuma, Mitsuhiro Arinaga, John Walter Flanagan, Hitomi Ikeda, Hitoshi Ishii, Shiori Kanaeda, Kenji Mori, Masaki Tejima, Makoto Tobiyama (KEK, Ibaraki), Gary Varner (University of Hawaii, Honolulu, HI), Giovanni Bonvicini (Wayne State University,)*
The electron-positron collider KEKB B-factory is currently being

upgraded to SuperKEKB. The design luminosity of 8 x 10^35 /cm^2/s will be achieved using beams with low emittance of several nm and doubling beam currents to 2.6 A in the electron ring (HER) and 3.6 A in the positron ring (LER). A beam position monitor (BPM) system of HER and LER will be equipped with super-heterodyne detectors, turn by turn log ratio detectors with fast gates to measure optics parameters during collision operation and detectors of BPMs near the collision point (IP) for orbit feedback to maintain stable collision. New X-ray beam profile monitors based on the coded aperture method will be installed aiming at bunch by bunch measurement of the beam profile. A large angle beamstrahlung monitor detecting polarization of the synchrotron radiation generated by beam-beam interaction will be installed near IP to obtain information about the beam-beam geometry. The bunch by bunch feedback system will be upgraded using low noise frontend electronics and new 12 bits iGp digital filters. An overview of beam instrumentation of SuperKEKB rings will be given in this paper.

MOCB02 **A Generic BPM Electronics Platform for European XFEL, SwissFEL and SLS** - *Boris Keil, Raphael Baldinger, Robin Ditter, Waldemar Koprek, Reinhold Kramert, Goran Marinkovic, Markus Roggli, Markus Stadler, Daniel Marco Treyer (Paul Scherrer Institut, Villigen)*

PSI is currently developing the 2nd generation of a generic modular electronics platform for linac and storage ring BPMs and other beam diagnostics systems. The first platform, developed in 2004 and based on a generic digital back-end with Xilinx Virtex 2Pro FPGAs, is currently used at PSI for proton accelerator BPMs, resonant stripline BPMs at the SwissFEL test injector facility, and a number of other diagnostics and detector systems. The 2nd platform will be employed e.g. for European XFEL BPMs, a new SLS BPM system, and the SwissFEL BPM system. This paper gives an overview of the architecture, features and applications of the new platform, including interfaces to control, timing and feedback systems. Differences and synergies of the different BPM and non-BPM applications will be discussed.

MOCB03 **Modelling and Performance Evaluation of DCCTs in SSRF** - *Zhichu Chen, Yongbin Leng, Yun Xiong, Weimin Zhou (SSRF, Shanghai)*

Direct Current Current Transformer (DCCT) is the most

commonly used high precision current monitor in modern particle accelerators including Shanghai Synchrotron Radiation Facility (SSRF). Three types of noise have been observed in the output signal of the DCCT in the storage ring of SSRF: power line noise, beam current related narrow band noise and random square wave noise from nowhere. This article will discuss the noise removal algorithms in SSRF and the performance of the DCCTs afterwards.

MOCB04 **Vertical Emittance Measurements using a Vertical Undulator** - *Kent Peter Wootton, Roger Paul Rassool, Geoffrey Taylor (The University of Melbourne, Melbourne), Mark James Boland, Bruce Cowie, Rohan Dowd (ASCo, Clayton, Victoria), Yannis Papaphilippou (CERN, Geneva)*

With vertical dimensions of several microns, direct measurement of beam size is approaching diffraction limits of visible light and hard x-ray emittance diagnostics. We report on the development of a new vertical electron beam size measurement and monitoring technique which utilizes a vertical undulator. An APPLE-II type undulator was phased to produce a horizontal magnetic field, deflecting the electron beam in the vertical plane. The measured ratios of undulator spectral peak heights are evaluated by fitting to simulations of the apparatus. Vertical electron beam emittances of several picometres have been observed at the Australian Synchrotron storage ring. With this apparatus immediately available at most existing electron and positron storage rings, we find this to be an appropriate and novel vertical emittance diagnostic.

Monday Session C, 13:50 – 15:50
Chair: Hitoshi Tanaka (RIKEN/SPring-8)

MOCC01 **UV/X-ray Diff**
raction Radiation for Non-intercepting Micron-scale Beam Size Measurement - *Lorraine Marie Bobb (CERN, Geneva; JAI, Egham, Surrey), Nicolas Chritin, Thibaut Lefevre (CERN, Geneva), Michael Gerard Billing (CLASSE, Ithaca, New York), Pavel Karataev (JAI, Egham, Surrey)*

Diffraction Radiation (DR) is produced when a relativistic charged particle moves in the vicinity of a medium. The electric field of the charged particle polarizes the target atoms which then oscillate, emitting radiation with a very broad spectrum. The spatial-spectral properties of DR are sensitive to a range of

electron beam parameters. Furthermore, the energy loss due to DR is so small that the electron beam parameters are unchanged. Therefore DR can be used to develop non-invasive diagnostic tools. The aim of this project is to measure the transverse (vertical) beam size using incoherent DR. To achieve the micron-scale resolution required by CLIC, DR in the UV and X-ray spectral-range must be investigated. During the next few years, experimental validation of such a scheme will be conducted on the CesrTA at Cornell University, USA. Here we present the current status of the experiment preparation.

MOICO2 **Electron Beam Diagnostic System for the Japanese XFEL, SACLA** - *Hirokazu Maesaka, Hiroyasu Ego, Chikara Kondo, Takashi Ohshima, Yuji Otake, Hiromitsu Tomizawa (RIKEN SPring-8 Center, Sayo-cho, Sayo-gun, Hyogo), Shin-ichi Matsubara (JASRI/SPring-8, Hyogo), Takahiro Matsumoto, Kenichi Yanagida (JASRI/SPring-8, Hyogo-ken)*

An x-ray free-electron laser (XFEL) based on self-amplified spontaneous emission (SASE) requires a highly brilliant electron beam. The Japanese XFEL facility, SACLA, requires a normalized emittance less than 1 mm mrad and a peak current more than 3 kA. To achieve this high peak current, 1 A beam with 1 ns duration from a thermionic electron gun is compressed down to 30 fs by means of a multi-stage bunch compressor system. Therefore, the beam diagnostic system for SACLA was designed for the measurements of the emittance and bunch length at each compression stage. We developed a high-resolution transverse profile monitor and a temporal bunch structure measurement system with a C-band rf deflector cavity etc. In addition, precise overlapping between an electron beam and radiated x-rays in the undulator section is necessary to ensure the XFEL interaction. Therefore, we employed a C-band sub-micron resolution RF-BPM to fulfill the demanded accuracy of 4 um. The beam diagnostic system surely contributed to the first x-ray lasing at a wavelength of 1.2 Angstrom. We present a design strategy of the whole beam diagnostic system and the achieved performance for each monitor.

MOCCO3 **The First Observation of the Electron Bunch Measurement by Means of Organic EO Crystals DAST** - *Yuichi Okayasu, Tadashi Togashi (JASRI/SPring-8, Hyogo-ken), Makoto Aoyama (JAEA/Kansai, Kyoto), Shin-ichi Matsubara (JASRI/SPring-8, Hyogo), Takeshi Matsukawa (RIKEN ASI, Sendai, Miyagi), Hiroaki Minamide (RIKEN Advanced Science Insititute, Sendai, Miyagi),*

Kanade Ogawa, Takahiro Sato, Hiromitsu Tomizawa (RIKEN SPring-8 Center, Sayo-cho, Sayo-gun, Hyogo), Eiji Takahashi (RIKEN, Saitama), Atsushi Iwasaki, Shigeki Owada (The University of Tokyo, Tokyo)

Pilot user experiments via the seeded FEL have been demonstrated at the Prototype Test Accelerator (VUV-FEL), SPring-8 from July, 2012. A precise measurement of the electron bunch charge distribution (BCD) is crucial key to keep spatial and temporal overlaps between high-order harmonic (HH) laser pulses and electron bunches. R&D of the 3D-BCD monitor with a single-shot detection has been extensively promoted at SPring-8. The monitor adopts a spectral decoding based Electro-Optic (EO) sampling technique that is non-destructive and enables real-time reconstruction of the 3D-BCD with a temporal resolution of 30- to 40-fs (FWHM). So far, such EO sampling based BCD monitors have been developed by utilizing inorganic EO crystals such as ZnTe and their temporal resolutions are limited to ~130 fs (FWHM). As a part of this project, the first BCD measurement with an organic EO crystal DAST has been successfully demonstrated at the facility. Signal intensities, temporal resolutions and radiation related issues via both ZnTe and DAST are discussed.

MOCC04 Improvement of Screen Monitor with Suppression of Coherent-OTR for SACLA - *Shin-ichi Matsubara, Yuji Otake (RIKEN/SPring-8, Hyogo), Hirokazu Maesaka (RIKEN Spring-8 Harima, Hyogo), Shinobu Inoue (SES, Hyogo-pref.)*

The construction of SACLA (SPring-8 Angstrom Compact free electron LAser) was already completed and it is under operation. A screen monitor (SCM) system has been developed and was installed in order to obtain a direct image of a transverse beam profile with a spatial resolution of about 10 um, which is required to investigate electron-beam properties, such as a beam emittance. The SCM originally has a stainless steel target as a OTR radiator or a Ce:YAG crystal as a scintillation target. At the beginning of the SACLA operation, strong coherent OTR (COTR), which made an incorrect beam profile, was observed after bunch compressors. In order to suppress the COTR on the SCM, the stainless steel target was replaced to the Ce:YAG scintillation target. Since the COTR was still generated from the Ce:YAG target, a spatial mask was employed. The mask was mounted on the center of the optical line of the SCM, because the COTR light is emitted forward within ~$1/\gamma$ radian, while the scintillation light has not angular dependence. Clear beam

profiles with a diameter of a few tens of micro-meter are observed by means of the SCMs with this simple improvement.

Monday Poster Session, 16:20 – 17:50

MOPA01 **Final Design of the Striplines for the Extraction Kicker of the CLIC Damping Rings** - *Carolina Belver-Aguilar, Angeles Faus-Golfe (IFIC, Valencia), Michael John Barnes (CERN, Geneva), Ivan Podadera, Fernando Toral (CIEMAT, Madrid)*

Pre-Damping Rings (PDR) and Damping Rings (DR) are required to reduce beam emittance and, therefore, to achieve the luminosity requirements for the CLIC main linac. Kicker systems will be used to inject and extract the beam from the PDRs and DRs: the most challenging of these is the DR extraction kicker system. In this paper we present results from a comprehensive set of 3D analyses of the striplines for the DR extraction kicker, including studies of tapering of the electrodes, an estimate of the power loss in the coaxial feedthroughs and beam coupling impedance calculations for a tapered beam pipe. Furthermore the required mechanical tolerances for the stripline are also presented. Prototype striplines will be manufactured, to the specified tolerances, and will be available for tests from December 2012: it is planned to measure field stability, field homogeneity and beam coupling impedance. Measurements will be carried out in the laboratory and in both the ALBA and ATF2 facilities.

MOPA02 **270 degree Electron Beam Bending System using Two Sector Magnets for Therapy Application** - *Sanjay Daga Dhole, Shahzad Akhter, Vasnat Nagesh Bhoraskar, Bhushankumar Jagnnath Patil (University of Pune, Pune), Sharad Trayambak Chavan, Ramamoorthy Krishnan, Sanjay Neelkanth Pethe (SAMEER, Mumbai)*

The 270 degree doubly achromatic beam bending magnet system using two sector magnets has been designed mainly for treating cancer and skin diseases. The main requirements of the design of two magnet system is to focus an electron beam having a spot size less than 3 mm X 3 mm, energy spread within 3% and divergence angle <= 3 mrad at the target. To achieve these parameters the simulation was carried out using Lorentz-3EM software. The beam spot, divergence angle and energy spread were observed with respect to the variation in angles of sector magnets and drift distance. From the simulated

results, it has been optimized that the first and second magnet has an angle 195 degree and 75 degree and the drift distance 64 mm. It is also observed that at the 1396, 2878 and 4677 A-turn, the optimized design produces 3324, 6221 and 9317 Gauss of magnetic field at median plane require to bend 6, 12 and 18 MeV electron respectively. The output parameters of the optimized design are energy spread 3 %, divergence angle ~ 2.8 mrad and spot size 2.6 mm.

MOPA03 **Beam Diagnostics for PAL-XFEL** - *Changbum Kim, Hyojin Choi, Jae-Young Choi, Do Tae Kim, Eun Hee Lee, Byoung Ryul Park, Jong Chel Yoon (PAL, Pohang, Kyungbuk)*
Pohang Accelerator Laboratory started its XFEL program from 2011. The XFEL project in Pohang Accelerator Laboratory (PAL) requires low beam-emittance, ultra-short bunch length, high peak current, high stability of beam energy. Therefore, beam diagnostics for SASE XFEL should be, focused on attaining femto-second precision in the measurement of temporal beam parameters, and sub-micrometer precision in beam position measurement. Charge measurement and energy measurement and their feedback are important as well. In this work, technical concepts regarding the diagnostic monitors will be summarized and present status of them will be described.

MOPA04 **An Electron Beam Profile Monitor for the Race-track Microtron** - *Sanjay Daga Dhole, Vasnat Nagesh Bhoraskar, Bhushankumar Jagnnath Patil, Ninad S. Shinde (University of Pune, Pune)*
In electron irradiation experiments on materials such as semiconductors, solar cells etc., an uniformity and the charge distribution in the electron beam is very important. Therefore, an electron beam current monitor and its electronic system have been designed and built to measure the distribution of a beam current either in the horizontal or vertical direction along with the beam dimensions. To obtain X-Y beam profile, a special type of Faraday Cup was designed which mainly consists of charge collecting electrodes made up of thin copper strips. Each strip having dimensions 0.5 mm wide, 4 mm thick and 20 mm long were fixed parallel to each other and separation between them was ~ 0.5 mm. This multi electrode Faraday was mounted at the extraction port of the Race Track Microtron, where 1 MeV electron beam allowed to fall on it. The beam characterization in the form of current and uniformity were measured. The current from each strip were measured using an electronic circuit developed based on the multiplexing principle.

The uniformity of the beam can be measured with an accuracy of 10%. The minimum and maximum dimensions which can be measured are 3 mm and 15 mm respectively.

MOPA05 **X-ray Diagnostic of High-current Low-energy Electron Beam in Plasma** - *Sergiy Cherenshchykov, Valentin Kotsubanov (NSC/KIPT, Kharkov)*

Low-energy high-current electron beams are used in a novel technology for surface modification of metallic materials. Propagation high current electron beam in plasma give possibility for much current increasing. Direct diagnostic by a Faraday cup in plasma is incorrect. Therefore we used for beam diagnostic X-ray radiation from a metal target. The electron beam was creating by a cold-cathode magnetron injection gun. The gun voltage was nearly 20 kV. The target current was up to 20 kA. We observed X-ray radiation by its transformation in visible light. Plastic scintillators were used for high time resolution. A cross section of beam and time dependences was obtained too. For time dependence resolution was used digital oscillograph Tektronix. Photomultiplier tubes were used for light detection. Their signal was write together with target current by the Faraday cup and visible light emission. We observed in oscillograms X-ray radiation without target current and target current without X-ray radiation with duration up several microseconds. The diagnostic method will be use for next improvement cold-cathode magnetron injection gun as source of low-energy high-current electron beam.

MOPA06 **VIMOS, New Capabilities for a Dedicated Optical Safety System** - *Knud Thomsen (Paul Scherrer Institut, Villigen)*

VIMOS is a dedicated safety system developed at the Spallation Neutron Source SINQ at the Paul Scherrer Institut, PSI, in Switzerland. VIMOS very directly monitors the correct current density distribution of the proton beam on the target by sampling the light emitted from a glowing mesh heated by the passing protons. The design has been optimized for obtaining maximum sensitivity and timely detection of beam irregularities relying on standard well-proven components. Recently it has been demonstrated that technical boundary conditions like radiation level and signal strength should allow for upgrading the system to a sensitive diagnostic device delivering quantitative and image-resolved values for the proton current density distribution on the SINQ target. By determining the temperature of the glowing mesh from the signals in two

separate wavelength bands the temperature distribution over the mesh can be derived und subsequently the incident proton beam current density distribution. Work aimed at investigating the feasibility of adding these diagnostic abilities to VIMOS shows initial promising results. The status of the project and preliminary findings will be reported.

MOPA07 **Development of a Phase Probe for the Small Cyclotron HM-18 at NIRS** - *Satoru Hojo, Akira Goto, Toshihiro Honma, Ken Katagiri, Akinori Sugiura (NIRS, Chiba-shi), Yuichi Takahashi (AEC, Chiba)*
The small cyclotron HM-18 of the National Institute of Radiological Sciences (NIRS) has been operated for use in RI production since 1994. The HM-18 allows us to accelerate protons and deuterons at fixed energies of 18 and 9 MeV, respectively. It has four trim coils for generation of the isochronous fields. Until recently, currents of the four trim coils had been adjusted only by monitoring the output beam intensity. In order to exactly produce the isochronous fields, a new phase probe has been installed in the HM-18. The phase probe has a simple structure in which four copper electrode plates of 60 mm x70 mm in area are glued to a copper base plate with a polyimide insulator between them. The thicknesses of the copper plates and the polyimide are 0.1 mm. This structure has an advantage that it can be easily installed in the cyclotron; only one part of a pair of upper and lower electrodes, which is usually adopted, is simply attached on the surface of the (lower) sector pole. The development of the phase probe and some results of a preliminary beam test using it are reported.

MOPA08 **Various Usages of Wall Current Monitors for Commissioning of RF Systems in J-PARC Synchrotrons** - *Fumihiko Tamura, Masahiro Nomura, Alexander Schnase, Taihei Shimada, Masanobu Yamamoto (JAEA/J-PARC, Tokai-Mura, Naka-Gun, Ibaraki-Ken), Keigo Hara, Katsushi Hasegawa, Chihiro Ohmori, Makoto Toda, Masahito Yoshii (KEK, Tokai, Ibaraki)*
Wall current monitors (WCM) for rf system commissioning are installed in the J-PARC synchrotrons, the RCS and the MR. The WCM signals are used as the input of the beam loading compensation system, and also used diagnosis to adjust the rf system parameters. Since the rf and beam frequency is in the range of a few MHz, direct measurement of the WCM signals is possible. For the diagnosis, the WCM signals are taken by an oscilloscope with the revolution clock signal generated by the

LLRF control system, and slices of the WCM waveform with lengths of the revolution periods are generated. By stacking the slices, one can get a mountain plot, which shows motions of bunches and variations of the bunch shapes. Also, time variations of the bunching factor, which are important for acceleration of high intensity proton beams, are obtained. The harmonic analysis is performed on the WCM signal and the cavity voltage monitor signal. By using complex amplitudes of them, one can calculate the impedance seen by the beam. In this presentation, we show examples of the analyses described above. The rf parameters for high intensity beams have been successfully adjusted by using these analyses.

MOPA09 **Comparison of Three Different Concepts of High Dynamic Range and Dependability Optimised Current Measurement Digitisers for Beam Loss Systems** - *William Vigano, Bernd Dehning, Ewald Effinger, Giuseppe Guido Venturini, Christos Zamantzas (CERN, Geneva)*

The first concept is based on current to frequency conversion, enhanced with an ADC for extending the dynamic range and decreasing the response time. A summary of 3 years worth of operational experience with such a system for LHC beam loss monitoring will be given. The second principle is based on an adaptive current to frequency converter implemented in an ASIC. The basic parameters of the circuit are discussed and compared with measurements. Several measures are taken to harden both circuits against single event effects and to make them tolerant for operation in radioactive environments. The third circuit is based on a fully differential integrator for enhanced dynamic range, where laboratory and test installation measurements will be presented. All circuits are designed to avoid any dead time in the acquisition and have reliability and fail safe operational considerations taken into account.

MOPA10 **Diamond Detectors** - *Erich Griesmayer, (Vienna University of Technology, Austria), Bernd Dehning, (CERN, Geneva, Switzerland)*

Diamond is perhaps the most versatile, efficient and radiation-tolerant material available for use in beam detectors. Correspondingly, it has a wide range of applications in beam instrumentation. Numerous practical applications have demonstrated the exceptional sensitivity of diamond to charged particles, photons and neutrons. Some examples will be given including the latest measurements made with the Diamond

Beam Loss Monitors at the LHC and the impact of diamond detectors on the observation of the Higgs candidate at CERN.

MOPA11 **The Linearity Calibration of the PMT Using Synchrotron Light** - *Chang Liu, Yongbin Leng, Luyang Yu (SINAP, Shanghai)*
A fiber-based Cerenkov beam loss monitor has been widely used in the world for FEL facilities to monitor electron beam losses. As a key component, Photomultiplier (PMT) is employed to detect the Cerenkov light emitted by the secondary charge particles. The linearity of the PMT has to be calibrated precisely due to its strong impact to the position accuracy and sensitivity of the whole system. Synchrotron radiation is therefore a perfect calibration source with fine linearity and large intensity scale. The preliminary calibration result of PMT using synchrotron light at SSRF will be presented in this paper.

MOPA12 **Characterization of a Wide Dynamic-range, Radiation-tolerant Charge-digitizer ASIC for Monitoring of Beam Losses** - *Giuseppe Guido Venturini, Francis Anghinolfi, Bernd Dehning (CERN, Geneva), Maher Kayal (EPFL, Lausanne)*
An Application Specific Integrated Circuit (ASIC) has been designed and fabricated to provide a compact solution to digitize current signals from ionization chambers and diamond detectors, employed as beam loss monitors at CERN and several other high energy physics facilities. The circuit topology has been devised to accept positive and negative currents, to have a wide dynamic range (above 120 dB), withstand radiation levels over 100kGy and offer different modes of operation, covering a broad range of applications. Furthermore, an internal conversion reference is employed in the digitization, to provide an accurate absolute measurement. This paper discusses the detailed characterization of the first prototype: linearity, radiation tolerance and temperature dependence of the conversion, as well as implications and system-level considerations regarding its use for beam instrumentation applications in a high energy physics facility.

MOPA13 **Real-time Calculation of Scale Factors of X-ray Beam Position Monitors during User Operation** - *Christopher Bloomer, Guenther Rehm (Diamond, Oxfordshire)*
Photoemission based X-ray Beam Position Monitors (XBPMs) are widely used at 3rd generation light sources to both monitor and stabilise the photon beam to sub-micron precision. Traditionally, finding the geometric scale factors requires either

systematic stepper motor movements of the XBPM or well controlled electron beam displacements to measure the response of the XBPM. For each Insertion Device gap it is required to repeat this in order to build up a complete set of scale factors covering all possible operating conditions. Elliptically Polarising Undulators further complicate matters by having multiple operating modes which would require multi dimensional lookup tables. Presented in this paper is a method for retrieving the geometric scale factors of an XBPM in real time by making use of the intrinsic small random movements of the electron beam and finding the correlation in synchronous measurements from Electron BPMs and XBPMs at kHz sample rates.

MOPA14 **Development of the New Electronic Instrumentation for the LIPAc/IFMIF Beam Position Monitors** - *Angel Guirao, José Miguel Carmona, Luis Miguel Martinez, Ivan Podadera (CIEMAT, Madrid)*

Among all the LIPAc/IFMIF accelerator diagnostics instrumentation, the Beam Position Monitors are a key stone for its operation. A new approach for the LIPAc/IFMIF beam position monitors acquisition electronics is proposed for the twenty BPM stations distributed along the accelerator. The new system under development is a fully digital instrumentation which incorporates automatic calibration of the monitors' signals and allows monitoring of both fundamental and second signal harmonics. The current state of the development and first experimental results of the system on the test bench will be presented.

MOPA15 **New Electronics Design for the European XFEL Re-entrant Cavity Beam Position Monitor** - *Claire Simon (CEA/DSM/IRFU,), Raphael Baldinger, Boris Keil, Reinhold Kramert, Goran Marinkovic, Markus Roggli, Markus Stadler (Paul Scherrer Institut, Villigen)*

About one third of the beam position monitors (BPMs) in the European XFEL (E-XFEL) cryomodules will be re-entrant cavities. The BPM mechanics and Radio-Frequency front-end (RFFE) electronics are developed by CEA/Saclay. Two RFFEs and a digital back-end with two ADC mezzanines are integrated into a compact standalone unit called MBU (modular BPM unit) developed by PSI. The signal processing uses hybrids and a single stage downconversion to generate the signals sum and delta. Every RF/analog component of the re-entrant BPM

electronics has been simulated with a Mathcad model and tested independently on test benches. The very low Q of the cavity monopole mode allows the new electronics to filter this mode at the dipole mode frequency and an IQ demodulation for delta and sum channels allow the digital back-end to determine the sign of the beam position just by comparing the phases of the channels, independently of beam arrival time jitter and external reference clock phase. This paper describes the design and architecture of a new re-entrant BPM electronics, including results of beam tests at FLASH that were performed to validate the chosen design.

MOPA16 Design, Characterization and Beam Tests of a Stripline BPM for the CLIC Drive Beam - *Lars Soby (CERN, Geneva)*
A prototype of a strip line Beam Position Monitor (BPM) with its associated readout electronics has been developed in collaboration with SLAC, LAPP and IFIC and tested at CERN. The position resolution and accuracy parameters are expected to be below 2μm and 20μm respectively for a beam with a bunching frequency of 12GHz, and an average current of 101A. This paper will focus on the measured characteristics in the laboratory and with beam in the CERN CTF3 TBL line. Also 3D electromagnetic simulations and proposed improvements of the design will be presented.

MOPA17 Modular Logarithmic Amplifier Beam Position Monitor Read-Out - *Bryce Jacobson, John Madey (University of Hawaii, Honolulu, HI)*
High brightness electron beams for inverse Compton backscatter photon sources driven by thermionic microwave guns require real-time position measurements in order to achieve the spatial and temporal coincidence necessary to ensure statistically measurable signals. True logarithmic amplifiers are more adequately suited to signal comparison than are sigma-delta methods. A low-cost, modular and scalable readout and data acquisition system for strip-line beam position monitors utilizing the AD640 log-amp is being developed at University of Hawai'i MkV Linear Accelerator and Free Electron Laser Lab. Initial measurements and prototyping of the hardware is complete, production and deployment underway, and commissioning scheduled for July and August. We present the methodology and results of this project.

MOPA18 **A Prototype Cavity Beam Position Monitor for CLIC** - *Lars Soby (CERN, Geneva)*
The Compact Linear Collider (CLIC) places unprecedented demands on its diagnostics systems. A large number of cavity beam position monitors (BPMs) throughout the main linac and beam delivery system must routinely perform with 50 nm spatial resolution. Multiple position measurements within a single bunch train are also required. A prototype cavity beam position monitor (BPM) has been designed and built to be tested on the CLIC Test Facility (CTF3) probe beam. This paper presents the latest measurements of the prototype cavity BPM and the design and measurement of the radio frequency (RF) processing electronics with regards to the final performance. Installation of the BPM in the CTF3 probe beam line is also discussed.

MOPA20 **Octave Broadband EO-probe Laser Source for High Resolution 3D-EO Sampling** - *Kanade Ogawa, Hiromitsu Tomizawa (RIKEN SPring-8 Center, Sayo-cho, Sayo-gun, Hyogo), Shin-ichi Matsubara, Yuichi Okayasu (JASRI/SPring-8, Hyogo)*
We have been developing three dimensional bunch charge distribution (3D-BCD) monitor for FEL seeded with high-order harmonic (HH) pulse. 3D-BCD is based on EO-sampling technique with multiple EO crystal detectors in the manner of spectral decoding. Using this 3D-EO sampling technique, the positioning and timing of electron bunch is obtained in real-time with non-destructive measurement. For obtaining the high temporal resolution, an octave broadband probe laser with linear chirp rate of 1 fs/nm is required. We are developing an EO-probe laser pulse with ~10 μJ pulse energy and the bandwidth over 300 nm (FWHM). For meet these bandwidth and pulse energy, this EO-probe pulse is using a supercontinuum generated by photonic crystal fiber (PCF) and amplified with optical parametric amplification (OPA). Especially, for amplification with maintaining octave bandwidth, non-collinear OPA (NOPA) using BBO crystal and a pump source with a wavelength of 450 nm are adopted. The EO-probe pulse energy of 10 μJ provides for high S/N ratio to each detector and the bandwidth of 300 nm with 300 fs pulse duration allows the measurement for the 30 fs electron bunch duration (FWHM).

MOPA21 **Improvement of Storage Ring BPM System for SIAM Photon Source** - *Supat Klinkhieo, Supan Boonsuya, Prapong Klysubun, Siriwan Krainara, Porntip Sudmuang, Natthawut Suradet, Sitthichoke Tesprasitte (SLRI, Nakhon Ratchasima), Prayoon*

Songsiriritthigul (SLRI, Nakhon Ratchasima; Suranaree University of Technology, Nakhon Ratchasima)
This report describes the improvement of the Beam Position Monitoring (BPM) systems for the 1.2 GeV storage ring of the Siam Photon Source (SPS). The systematic studies and investigations for improving the machine performance, and storage ring BPM system has been carried out in the last few years. Some major technical problems have been found and solved. The inefficiency and unreliability of the original BPM system were also identified. They are mainly caused due to the use of low quality signal and improper installation of cables. Detailed descriptions of the replacement with the higher quality (lower loss and better interference shielding) BPM cables and implementation of a separated cable trays for the BPM cables, as well as the work on BPM electronic board calibration will be described. The measurement results before and after the improvement of the BPM system will also be presented.

MOPA22 **Beam Position Measurement System in the Injector of HLS II** - *Junying Zou, Jia Fang, Wubin Li, Ping Lu, Tianji Ma, Bao-gen Sun, Yongliang Yang, Ze Ran Zhou (USTC/NSRL, Hefei, Anhui)*
A beam position monitor(BPM) system is being installed to improve the beam position measurement of the injector at the upgrade project of Hefei Light Source (HLS II). The new BPM system is consists of 19 stripline BPMs and 19 Libera Brilliance Single Pass modules. The parameters and placement of the stripline BPMs were carefully designed. A clock distribution system was built. An EPICS-based control and display system has been developed, including a new record type to calculate the beam position by log-ratio method. The performance of the electronic system is presented based on the laboratory tests as well as real beam test at HLS linac using existing BPMs.

MOPA23 **Measurement of X-Y Coupling at J-PARC MR** - *Kazuhito Ohmi (KEK, Ibaraki), Shuichiro Hatakeyama (JAEA/J-PARC, Tokai-mura)*
In high intensity proton ring, nonlinear accelerator elements and space charge force in the presence of x-y coupling induces skew resonances. Degradation of the beam performance, beam loss enlargement, is caused by the resonances. x-y coupling has been measured in whole ring of J-PARC MR. We discuss the measurement and the effect of x-y coupling in the beam performance.

MOPA24 **Photon Beam Position Monitor at SIAM Photon Source** - *Porntip Sudmuang, Supan Boonsuya, Sarunyu Chaichuay, Prapong Klysubun, Siriwan Krainara, Hideki Nakajima, Supagorn Rugmai, Nattaphol Sumano, Natthawut Suradet (SLRI, Nakhon Ratchasima)*

Photon beam position monitors (PBPM) have been designed and installed in the beamline front-ends at Siam Photon Source (SPS). Up till now, these blade-type PBPMs have been successfully installed at three bending magnet and an insertion device (planar undulator) beamlines. Its performance has been tested and compared with that of the electron beam position monitor. The achieved resolution is found to be better than 3 μm. The obtained PBPM data proved to be extremely invaluable in the investigation of the sources of the observed beam positional fluctuation, and for compensation of the orbit perturbation caused by undulator gap change. In this paper, the details of the calibration procedure will be presented. Various factors affecting reading of the signal such as back scattering effect, choice of bias voltage, and temperature variation have been investigated and the results will be discussed herewith.

MOPA25 **New Progress of DBPM Processor Development at SINAP** - *Yongbin Leng (SSRF, Shanghai), Longwei Lai, Xudong Sun, Bao Peng Wang, Yingbing Yan, Xing Yi (SINAP, Shanghai)*

A high speed ADC and FPGA based beam signal processing platform with modular structure has been developed to meet the various requirements of synchrotron light source and FEL facilities at SINAP. Equipped with 500MHz band-pass RF front end this instrument demonstrated very good performance in SSRF ring as a standard DBPM processor. Equipped with GHz front end this instrument can be a cavity BPM processor serving FEL facilities. New beam test results of this prototype will be presented in this paper.

MOPA26 **Performance and Upgrade of BPMs at the J-PARC MR** - *Takeshi Toyama, Yoshinori Hashimoto (J-PARC, KEK & JAEA, Ibaraki-ken), Shuichiro Hatakeyama (JAEA/J-PARC, Tokai-mura), Masashi Okada, Masaki Tejima (KEK, Ibaraki), Kotoku Hanamura (MELCO SC, Tsukuba)*

Since recovery from the great earthquake 2011.3.11, proton beam, more than 10^14 ppp, is accelerated up to 30 GeV at the J-PARC MR. The BPMs were originally designed with the external capacitors. The aim was to improve the position response in wider frequencies and to get an adequate output

voltage at the design intensity, 4x10^13 ppb. It was modified, however, not to have the capacitors. Therefore we have sufficient signal intensity from low intensity beams of the initial beam commissioning, but too large from the design intensity beam. The processing circuits (BPMC) have to accommodate those output signals from high intensity beams. We are adding the attenuator-LPFs just before the BPMC. This paper will describe these additional attenuator-LPFs. In connection with the MR collimator upgrade, some BPMs are re-allocated. This process is also reported.

MOPA27 **The Progress in BPM Electronic System of CSNS RCS** - *Wei Lu, Xiaolei Guan, Huayi Sheng, Xingcheng Tian, Yubin Zhao (IHEP, Bejing)*

The Beam Position Monitor (BPM) system is designed for the Rapid Cycling Synchrotron (RCS) in China Spallation Neutron Source (CSNS) to acquire beam position. This article introduces the design and implementation of the BPM electronic system. In the BPM system, signal is generated by diagonally cut electrode with dynamic range of 75dB (5.8mv~32V) and frequency range of 1MHz to 2.4MHz. Signals from the four electrodes of one test point are processed and digitalized individually, and the position is calculated using Δ/Σ method in FPGA. It is the key point of our design to receive signal with large dynamic range while keeping low noise figure. Analog circuit with much consideration is described, and the primary test result of the system is provided in the end of this article.

MOPA28 **Turn-by-turn BPM System using Coaxial Switches and ARM Microcontroller at UVSOR** - *Tomonori Toyoda (IMS, Okazaki), Kenji Hayashi, Masahiro Katoh (UVSOR, Okazaki)*

A major upgrade of the electron storage ring at UVSOR (Institute for Molecular Science, Japan) started from April 2012. To assist the commissioning procedure, we have developed a turn-by-turn Beam Position Monitor (BPM) system which consists of a signal switching circuit, a digital oscilloscope and software. The storage ring has 24 BPMs, each of which consists of four electrodes. By using the signal switching circuit, we can select one BPM from eight BPM's. The four signals from the BPM are sent to a digital oscilloscope and are recorded. In the switching circuit, coaxial switches of SPDT (Single Pole Dual Throw) and SP4T type are used. To control coaxial switches, we adopted 'mbed', the ARM microcontroller development kit. The 'mbed' stores the control applications configured in the HTML

file and JavaScript library which can handle multiple I/O ports. It responds as a HTTP server and the control application runs on a Web browser. By clicking buttons with a mouse, we can control the I/O ports of 'mbed' through JavaScript library and accordingly can control coaxial switches. In the presentation, we will report the detail of the developed BPM system and its performance.

MOPA29 **Development of a microTCA Stripline BPM System for LCLS II at SLAC** - *Daniel Van Winkle, Jeff Olsen, Chengcheng Xu (SLAC, Menlo Park, California)*
A new stripline BPM system has been developed in the microTCA .4 (mTCA) platform for the upcoming LCLS II machine at SLAC. The new systems is based upon a mix of commercial off the shelf (COTS) digitizers and custom signal conditioning rear transitions modules (RTM). A shelf of mTCA BPMs can contain up to 8 BPMs which reduces the complexity of the cable plant and overhead required for the current 2u rack mounted chassis solution. The new system has increased sensitivity requirements as well as the potential to work with proposed multi-bunch operation of LCLS II. We will provide details of the system architecture, implementation and provide actual beam results.

MOPA30 **Application of EMMA BPMs to the ALICE Energy Recovery Linac** - *Alexander Kalinin, Deepa Angal-Kalinin, Frank Jackson, James Jones (STFC/DL/ASTeC, Daresbury, Warrington, Cheshire)*
The ALICE Energy Recovery Linac arc button pickups have been recently equipped with EMMA BPM electronics*. These bunch-by-bunch EPICS VME BPMs give information about charge and position, and its jitter, allowing estimates of the beam energy jitter in ALICE in different modes of operation. A Mathematica program is designed to monitor statistically individual bunches (spacing 61.54ns) as well the train as a whole (up to 1625 bunches), allowing the study of jitter and position stability of the beam through the arc. The ALICE arc has been designed to be isochronous, with the bunch compression achieved through a separate dedicated bunch compressor chicane. The arc incorporates two sextupoles for correcting non-linear longitudinal matrix terms and experimental evidence suggests that the off-centred beam in the sextupoles breaks the linear isochronicity. We present some beam measurement results collected in 2012 using these BPMs.

MOPA31 **Design and Fabrication of the Stripline BPM at ESSB** - *Seadat Varnasseri, Daniel Belver, Pedro J. Gonzalez (ESS Bilbao, LEIOA), Iñigo Arredondo, F. Javier Bermejo, Jorge Feuchtwanger, Nagore Garmendia, Leire Muguira (ESS Bilbao, Bilbao), Victor Etxebarria, Josu Jugo, Joaquin Portilla (University of the Basque Country, Bilbao)*

A Stripline type BPM is designed and fabricated at ESSB. In order to compare, in the future, the functionality and response of the previous BPM capacitive pick-ups design with stripline, a design for stripline BPM is proposed. The design is based on travelling wave electrodes principles to detect the transverse position of the beam in the vacuum chamber. In the design of stripline setup, it has been considered to keep the comparison conditions with pick-ups as similar as possible. The length of strip electrodes is 200 mm and the coverage angle is 0.952 rad. The structure is rotationally pi/2 symmetric and the alignment of electrodes are pi/4, 3pi/, 5pi/4 and 7pi/4. The design is optimized for a frequency of 352 MHz, however it can function on a wide range of frequencies out coming from the measurement results. Striplines in general have well defined behavior even for low beta and low intensity beams as well as functionality at low and high frequencies. A report on the design and characteristics measurement of Stripline will be presented. The characteristics like frequency range, electrodes insulation, electrode response, sensitivities to beam power and position will be presented.

MOPA33 **Image Profile Diagnostics Solution for the Taiwan Photon Source** - *Chih-Yu Liao, Yung-Sen Cheng, Pei-Chen Chiu, Kuo-Tung Hsu, Kuo Hwa Hu, Changhor Kuo, Demi Lee, Chunyi Wu (NSRRC, Hsinchu)*

TPS (Taiwan Photo Source), a third generation 3 GeV synchrotron light facility, featuring ultra-high photon brightness with extremely low emittance which will be a state-of-the-art synchrotron radiation facility and is being in construction at National Synchrotron Radiation Research Center (NSRRC) campus. For optimize machine operation and diagnostics applications, beam image profile and its analysis play an important role in beam diagnostics of a particle accelerator system. However, due to the CCD image collection devices are distributed around the linac, booster, and storage ring, a distributed EPICS based image profile diagnostics solution was proposed, which are based on Gigabit PoE embedded vision system with PoE camera. This solution provides an effective way

to simplify wiring, and increased performance, load independence and reliability. The system is implemented and tested and the results will be summarized in this report.

MOPA34 **Improvement of Hardware and Software Setup for the Acquisition and Processing of SIAM Photon Source BPM Signal** - *Natthawut Suradet, Supan Boonsuya, Supat Klinkhieo, Prapong Klysubun, Siriwan Krainara, Chaiyut Preecha, Porntip Sudmuang (SLRI, Nakhon Ratchasima)*

Data acquisition and processing system has been developed for the Siam Photon Source storage ring BPM system in order to improve monitoring and logging performances. BPM readout, i.e. scanning of BPM electrode voltage outputs and subsequently converting to X-Y position values, is now performed by an upgraded Programmable Logic Controller (PLC) with higher bit resolution (16-bit) digital-to-analog converter (DAC). Moving averaging is then performed on the obtained BPM data utilizing a LabVIEW code to reduce background noise during on-line measurement. All data is then stored on a dedicated computer serving as a central data logging system, which can be remotely accessed via a network communication link. In this report, details of the new setup will be presented, and comparison will be made between the performance of the new and previous setups, together with suggestions on further improvements.

MOPA35 **Design Status of the European X-FEL Tranverse Intra Bunch Train Feedback** - *Boris Keil, Raphael Baldinger, Carl David Beard, Micha Markus Dehler, Waldemar Koprek, Goran Marinkovic, Markus Roggli, Martin Rohrer, Markus Stadler, Daniel Marco Treyer (Paul Scherrer Institut, Villigen), Vladimir Balandin, Winfried Decking, Nina Golubeva (DESY, Hamburg)*

The European X-Ray Free Electron Laser (E-XFEL) will have a fast transverse intra-bunch train feedback (IBFB) system to stabilize the beam position in the SASE undulators. E-XFEL bunch trains consist of up to 2700 bunches with a minimum bunch spacing of 222ns and typ. 10Hz train repetition rate. The IBFB will measure the positions of each bunch in the bunch train, and apply intra-train feedback corrections with fast kickers, in addition to a feed-forward correction for reproducible trajectory perturbations. By achieving a feedback loop latency in the order of one microsecond, the IBFB will allow the beam position to converge quickly to the nominal orbit as required for stable SASE operation. The latest conceptual design of the IBFB and the status of IBFB

components will be presented.

MOPA36 **Development of Bunch Current and Oscillation Recorder for SuperKEKB Accelerator** - *Makoto Tobiyama, John Walter Flanagan (KEK, Ibaraki)*

A High-speed digital signal memory has been developed for the bunch current and oscillation recorder for SuperKEKB. The memory consists of an 8-bit ADC and a FPGA daughter card with Spartan6 and DDR2 memories commercially available on a double width VME card. The block-RAM on the FPGA is used to transfer bunch current data with low latency for prompt bunch current measurements, and the large DDR2 memory is used for long-duration position recording, such as post-mortem bunch oscillation recording. The performance of the board, including data transfer rate, will be presented.

MOPA37 **Reliable Beam-Intensity Control Technique at the HIMAC Synchrotron** - *Kota Mizushima, Takuji Furukawa, Yousuke Hara, Yoshiyuki Iwata, Ken Katagiri, Koji Noda, Shinji Sato, Toshiyuki Shirai (NIRS, Chiba-shi)*

The carbon-ion beam is slowly extracted from the Heavy Ion Medical Accelerator in Chiba (HIMAC) synchrotron using the third-order resonance with the RF-knockout method for scanned carbon-ion therapy. However, an overshoot of the beam spill at the start of extraction is often induced by a slight variation of the beam emittance in operation cycles. It brings dose hot spot inside the target volume, because the tolerable beam-intensity in scanning irradiation is low. We have added short extraction, called preliminary extraction, before irradiation in order to remove the uncontrollable spilled particles. During preliminary extraction, it is necessary to prevent the beam delivering to the patient. Therefore, a fast beam shutter on which an ionization chamber is mounted was developed, and it was installed in the extraction line. The fast shutter enables us to switch from preliminary extraction to irradiation within 100 ms, and the reliability of the beam-intensity control system was drastically improved by the preliminary extraction technique.

MOPA38 **Development of the System for Longitudinal Coupled Bunch Modes Measurement at Indus-2** - *Surendra Yadav, Anil Holikatti, Chandrashekhar Purushottam Navathe, Tushar A. Puntambekar, Yetendra Tyagi (RRCAT, Indore (M.P.)), Avanish Ojha (RRCAT, Indore (MP))*

In a circular accelerator, beam instabilities are

intensity-dependent collective effects that arise because of the electromagnetic wake fields generated by the beam as it interacts with its environment. These instabilities limit the high current operation in the accelerator and degrade the performance of synchrotron radiation beam. Indus-2 is a synchrotron radiation source at RRCAT, Indore having design beam current of 300 mA and 2.5 GeV beam energy. Beam intensity signal obtained from wall current monitor (WCM) is used to measure the longitudinal coupled bunch modes (CBM). To study the beam instabilities, an automated software has been developed which acquires the beam intensity spectrum for measurement of coupled bunch modes. The software has option of complete CBM scan, scanning near the significant RF cavity higher order modes (HOM) and scanning of user-selected modes. The scanning time for complete 291 modes is ˜5 minutes. In this paper, we describe the measurement system, features of the developed software and some measurement results on Indus-2 machine.

MOPA39 **Introduction of Photon BPMs in SOLEIL Global Orbit Feedback Systems** - *Nicolas Hubert, Lodovico Cassinari, Jean-Claude Denard, Laurent Stanislas Nadolski (SOLEIL, Gif-sur-Yvette)*
SOLEIL global orbit feedback systems (slow and fast), based on 122 Electron Beam Position Monitor (eBPM) readings, are in operation since 2008 and give very satisfying performances (0.1Hz-500Hz vertical noise < 300 nm, long term (8h) drifts < 1μm RMS). Nevertheless, in SOLEIL layout, magnetic elements (quadrupoles and sextupoles) are located between dipoles and their closest eBPMs. For that reason, Photon Beam Position Monitors (XBPMs) in the dipole beamline frontend give additional information that is useful to stabilize better the source point in the dipole. XBPMs provide also a better angular measurement resolution as they are located at 4 meters from the source point. Results presented in this papers show that vertical stability on bending magnet beamlines can be improved by including their XBPM measurements in global orbit feedback systems. In a first time XBPMs have been introduced in the Slow Orbit Feedback system (SOFB) that corrects the orbit with a repetition rate of 0.1Hz. In a second time XBPMs will be introduced in the Fast Orbit Feedback system (FOFB) running at a repetition rate of 10 kHz.

MOPA40 **High Frequency Response of Accelerator Vacuum Chambers and Implications for Orbit Feedback Systems** - *Boris Podobedov (BNL, Upton, Long Island, New York)*

Understanding the response of conducting accelerator vacuum chambers to external AC magnetic field is important for many accelerator applications, where the particle beam is dynamically driven with magnets external to the chamber. For instance, efficient orbit feedback system design requires detailed knowledge of the chamber transfer function at the locations of corrector magnets, which in general depends on the chamber material, cross-sectional shape and thickness. In practically interesting cases, the chamber response is influenced by both eddy currents and the skin effect, which are often accounted for rather crudely when modeling the system. This paper presents new analytical results for transfer functions through arbitrary shaped vacuum chambers; compares them with the measurements for the present NSLS rings and discusses the implications for the future NSLS-II orbit feedback systems.

MOPA42 **Measurements of Martin-Puplett Interferometer Limitations using Blackbody Source** - *Pavel Evtushenko, J. Michael Klopf (JLAB, Newport News, Virginia)*

Frequency domain measurements with Martin-Puplett interferometer is one of a few techniques capable of bunch length measurements at the level of ~ 100 fs. As the bunch length becomes shorter, it is important to know and be able to measure the limitations of the instrument in terms of shortest measurable bunch length. In this paper we describe experiment of using blackbody source with the modified Matrin-Puplett interferometer that is routinely used for bunch length measurements at the JLab FEL, as a way to estimate the shortest, measurable with the device, bunch. The limitation comes from high frequency cut-off of the presently used wire-grid polarizer and is estimated to be 50 fs RMS. The measurements are made with the same Golay cell detector that is used for beam measurements. We demonstrate that, even though the blackbody source is many orders of magnitude less bright than the coherent transition or synchrotron radiation, it can be used for the measurements and gives a very good signal to noise ratio in a combination with lock-in detection. We also compare the measurements made in air and in vacuum to show the very strong effect of the atmospheric absorption.

MOPA43 **RF Front-end for High Bandwidth Bunch Arrival-time Monitors in Free-Electron Lasers at DESY** - *Andreas Penirschke, Aleksandar Angelovski, Matthias Hansli, Rolf Jakoby (TU Darmstadt, Darmstadt), Marie Kristin Bock, Michael Bousonville, Holger Schlarb, Cezary Sydlo (DESY, Hamburg), Sascha Schnepp (IFH, Zurich), Thomas Weiland (TEMF, TU Darmstadt, Darmstadt), Alexander Kuhl (Uni HH, Hamburg)*

The Free-Electron Laser in Hamburg FLASH is equipped with Bunch Arrival-time Monitors (BAMs) that use an electro-optical detection scheme to modulate the intensity of the femtosecond laser pulse train with the pickup signals (*). The achieved resolution of the existing BAMs are less than 10 fs for bunch charges higher than 500 pC. For lower bunch charges the time resolution drops significantly. Increased demands for low bunch charge operation modes of 20 pC and less at FLASH II and the European X-ray Free-Electron Laser XFEL require an upgrade of the existing beam diagnostic equipment. High bandwidth BAMs with newly developed cone-shaped pickups (**) promise sub-10 fs time resolution for both, the high and low bunch charge operation mode. This paper addresses the RF signal path of the high bandwidth BAMs for FLASH II and XFEL. It comprises radiation resistant coaxial cables, combiners and limiters up to a frequency of 40 GHz from the pickup electrodes to the Electro-optical Mach-Zehnder type modulator (EOM). Detailed investigations of the signal path using measurements and simulations with AWR Microwave Office allows for a good prediction of the signal quality and shape at the EOM.

MOPA44 **Coherent Optical Transition Radiation at the SwissFEL Injector Test Facility** - *Bennie Smit, Masamitsu Aiba, Simona Bettoni, Bolko Beutner, Rasmus Ischebeck, Gian Luca Orlandi, Eduard Prat, Leonid Rivkin, Thomas Schietinger, Volker Schlott (Paul Scherrer Institut, Villigen)*

SwissFEL uses magnetic dispersive sections for bunch compression, which may cause micro-bunching within the electron bunch. Studies of Coherent Optical Transition Radiation (COTR) allow us to see whether or not such bunching is present. We present pilot results of COTR experiments carried out at the SwissFEL Injector Test Facility. Optical transition radiation is generated at an aluminium-coated silicon wafer that can be inserted into the beam. This can either be imaged to a CCD camera, or focused into a spectrometer with a spectral range from 200 nm to 925 nm. The compression of the electron bunches was varied, and data was recorded at different bunch

lengths. Spectral data shows a clear gain of the signal and a shift towards the infrared for a stronger compression of the bunches. Results indicate that the spectrum fluctuates at maximum compression. This is consistent with fluctuations observed in COTR images.

MOPA45 **Study of Beam Length Measurement based on TM010 Mode** - *Renxian Yuan, Yongbin Leng, Luyang Yu, Weimin Zhou (SINAP, Shanghai)*
Beam length measurement in frequency domain is a familiar method, and the resolution is seriously limited by the system signal-noise-ratio (SNR) and the beam length measured. Usually this method can only obtain the resolution about ~10ps with beam length ~30ps when using signal from button or stripline BPM. But in FEL case, the beam length is the ps or sub-ps order. The paper discusses the probability of beam length measurement based on the TM010 mode in FEL case. When adopting High Order Mode(HOM) reject and system gain control, the system SNR can arrive at 110dB and the resolution can achieve 30fs with beam length ps or sub-ps.

MOPA46 **Realization and Measurements of Cone-shaped Pickups for Bunch Arrival-time Monitors for FLASH and XFEL** - *Aleksandar Angelovski, Matthias Hansli, Rolf Jakoby, Andreas Penirschke (TU Darmstadt, Darmstadt), Marie Kristin Bock, Michael Bousonville, Holger Schlarb, Cezary Sydlo (DESY, Hamburg), Sascha Schnepp (IFH, Zurich), Thomas Weiland (TEMF, TU Darmstadt, Darmstadt), Alexander Kuhl (Uni HH, Hamburg)*
At the Free Electron Laser FLASH at DESY, the installed Bunch Arrival-time Monitors (BAMs) use an electro-optical detection scheme for arrival-time measurements. The achieved time resolution is in the sub-10 fs range for bunch charges higher than 500 pC. The extension of FLASH II and the European X-ray Free Electron Laser Project (XFEL) foresees a low charge operation mode with bunch charge of 20 pC or less. The time resolution of the BAMs significantly drops as the bunch charge reduces (*). By expanding the bandwidth of the pickups one can increase the time resolution at low charges. In this paper, we present the characterization results of the manufactured cone-shaped pickups introduced in (**) with a bandwidth up to 40 GHz. The pickups mounted in a vacuum body exhibit four-fold rotational symmetry with respect to the beam pipe. Due to different beam pipe apertures for FLASH and XFEL, two bodies are manufactured. The rf properties of the mounted

pickups in case of open and sealed body as well as the pickups separately are measured and compared to the simulation results obtained by CST STUDIO SUITE®.

MOPA47 **Planar Transmission Line BPM for Magnetic Bunch Compressor Chicane for XFEL** - *Aleksandar Angelovski, Rolf Jakoby, Andreas Penirschke (TU Darmstadt, Darmstadt), Christopher Gerth, Uros Mavric, Holger Schlarb, Cezary Sydlo (DESY, Hamburg)*
In order to obtain ultra-short bunches in the Free Electron Laser FLASH at DESY, the electron beam is compressed in magnetic chicanes. Precise knowledge of the beam position in the chicane is of great significance for the longitudinal dynamics control. In the current implementation cylindrical pickup-striplines mounted perpendicularly to the beam are used as a Beam Position Monitor (BPM)(*). One can determine the horizontal beam position by measuring the phase difference of the beam induced signal at opposite ends of a pickup. Due to the different electrical and mechanical requirements for the European XFEL a new BPM has to be developed. In this paper, we present the design and analysis of a planar transmission line structure which is planned to be used as a BPM in the European XFEL. The planar design of the pickups can provide for proper impedance match to the subsequent electronics as well as sufficient mechanical stability along the aperture when using alumina substrates. A scaled non-hermetic prototype of the BPM is built and characterized by scattering parameters. The measurement results are compared to simulations obtained by CST STUDIO SUITE®.

MOPA48 **Measurement of Temporal Resolution and Detection Efficiency of X-ray Streak Camera by Single Photon Images** - *Akira Mochihashi, Mitsuhiro Masaki, Haruo Ohkuma, Shiro Takano, Kazuhiro Tamura (JASRI/SPring-8, Hyogo-ken)*
In the third generation and the next generation synchrotron radiation light sources, the electron beam bunch length of ps ~ sub-ps is expected to be achieved. An X-ray streak camera (X-SC) can directly measure the temporal width of X-ray synchrotron radiation pulse. The temporal resolution of X-SC depends on the initial velocity distribution of the photoelectrons from a photocathode which converts the X-ray photons to the photoelectrons. To measure the temporal resolution of the X-SC, we have observed 'single photon' streak camera images and measured the temporal spread of the images. By this 'single photon' experiment, we have evaluated

the dependence of the temporal resolution and the detection efficiency on the photon energy. We have also tried to evaluate the dependence of the temporal resolution and the detection efficiency on the thickness of the photocathode. For this purpose, we have developed a multi-array type CsI photocathode with 3 different thickness of the photocathode. The experimental setups, and the results of the measurements of the temporal spread and the detection efficiency of the single photon events will be presented.

MOPA49 **EO-sampling-based Temporal Overlap Control System for a Seeded FEL** - *Shin-ichi Matsubara (RIKEN/SPring-8, Hyogo), Makoto Aoyama (JAEA/Kansai, Kyoto), Yuichi Okayasu, Tadashi Togashi, Takahiro Watanabe (JASRI/SPring-8, Hyogo-ken), Kanade Ogawa, Takahiro Sato, Hiromitsu Tomizawa (RIKEN SPring-8 Center, Sayo-cho, Sayo-gun, Hyogo), Atsushi Iwasaki, Shigeki Owada (The University of Tokyo, Tokyo)*

FELs have greatly interested for the short-wavelength region. However, their temporal profile and frequency spectra have shot-to-shot fluctuation by a SASE process. One of the promising approached for the problems is a seeded FEL scheme by using a full-coherent light source. The seeded FEL has been demonstrated in the EUV region by employ the high-order harmonics (HH) generation from an external laser source at the SCSS test-accelerator in the SPring-8. It is important for the HH-seeded FEL scheme to synchronize and overlap between the seeding laser pulse and the electron bunch. Their timing difference and laser spatial pointing is drifting. Therefore, a timing feedback and non-destructive monitor are necessary to operate seeded FEL continuously. We have constructed the timing monitor based on Electro-Optic (EO) sampling which is measure the timing difference the seeded laser pulse and the electron bunch simultaneously with the seeded FEL process. The probe laser pulse for the EO-sampling system is optically split from the common external HH laser driver for the seeded FEL. The EO-sampling system is able to use timing feedback for continual operation of the HH-seededFEL.

MOPB50 **Design and Operation of the LHC's High Intensity Luminosity Monitor** - *Howard S. Matis, Samuel Carter Hedges, Massimo Placidi, Alessandro Ratti, William Charles Turner (LBNL, Berkeley, California), Enrico Bravin (CERN, Geneva), Ryoichi Miyamoto (ESS, Lund)*

We have built a high-pressure ionization chamber (BRAN) for

the IP1 (ATLAS) and IP5 (CMS) regions of the LHC. This chamber is designed to measure the relative bunch-by-bunch collision rate of the LHC from 1028 cm-2s-1 during beam commissioning all the way up to the expected full luminosity of 1034 cm-2s-1 at 7.0 TeV. These high-pressure ionization chambers measure the intensity of hadronic/electromagnetic showers produced by the forward neutral particles of LHC collisions. They are designed to withstand the high radiation produced by these forward collisions and are currently used in LHC operations. This paper covers the detector's design and performance in measuring both pp and PbPb collisions during LHC operation, including a comparison with the ATLAS and CMS luminosity measurements. The work also includes modeling of the detectors and the ability to predict how the detector will respond to the higher energy and intensity operation of the LHC with different operating modes involving both ions and protons.

MOPB51 **Beam Monitors of NIRS Fast Scanning System for Particle Therapy** - *Takuji Furukawa, Taku Inaniwa, Ken Katagiri, Kota Mizushima, Koji Noda, Shinji Sato, Toshiyuki Shirai, Eri Takeshita (NIRS, Chiba-shi)*

At National Institute of Radiological Sciences, more than 6500 patients have been successfully treated by carbon beams since 1994. The successful results of treatments have led us to construct a new treatment facility equipped with three-dimensional pencil beam scanning irradiation system. The commissioning of NIRS fast scanning system installed into the new facility was started in September 2010, and the treatment with scanned ion beam was started in May 2011. In the scanning delivery system, beam monitors are some of the most important components. In order to measure and control the dose of each spot, the main and the sub ionization chambers are placed separately as flux monitors. For monitoring of the scanned beam position, a beam position monitor, which is multi-wire proportional chamber, is installed just downstream from the flux monitors. This monitor can output not only the beam position but also the 2D fluence distribution using dynamic fast convolution algorithm. In this paper, the design and the commissioning of these monitors are described.

MOPB52 **Status and Activities of the SPring-8 Diagnostics Beamlines** - *Shiro Takano, Mitsuhiro Masaki, Akira Mochihashi, Haruo Ohkuma, Masazumi Shoji, Kazuhiro Tamura (JASRI/SPring-8,*

Hyogo-ken), Hiroshi Sumitomo, Masamichi Yoshioka (SES, Hyogo-pref.)
At SPring-8 synchrotron radiation (SR) in both the X-ray and the visible bands is exploited in the two diagnostics beamlines. The diagnostics I beamline has a dipole magnet source. The beam size is measured by imaging with the zoneplate X-ray optics. Recently, the transfer line of the visible light has been upgraded. The in-vacuum mirror was replaced to increase the acceptance of the visible photons. A new dark room was built and dedicated to the gated photon counting system for bunch purity monitoring. To improve the performance, the input optics of the visible streak camera was replaced by a reflective optics. Study of the power fluctuation of visible SR pulse is in progress to develop a diagnostic method of short bunch length. The diagnostics II has an insertion device (ID). To monitor stabilities of the ID photon beam, a position monitor for the white X-ray beam based on a CVD diamond screen was installed. A turn-by-turn diagnostics system using the monochromatic X-ray beam was developed to observe fast phenomena such as beam oscillation at injection for top-up and beam blowups caused by instabilities. Study of temporal resolution of the X-ray streak camera is also in progress.

MOPB53 **Hartmann Screen and Wavefront Sensor System for Extracting Mirror at SSRF** - *Jie Chen, Yongbin Leng, Kairong Ye (SINAP, Shanghai)*
A Be mirror was used to extract visible synchrotron radiation light from bending magnet at SSRF. The surface of mirror was deformed because of X-ray heat. A set of Hartmann Screen Test was used to measure the surface of the mirror. Another equipment named The Shack-Hartmann wavefront sensor system was introduced to get more precision data. The result of two kind of test match each other well.

MOPB54 **Development of the New Type MLIC with PMMA Plates and Graphite Electrodes** - *Souma Iwata, Chihiro Kobayashi, Naoki Shinozaki, Atsushi Takubo (AEC, Chiba), Tatuaki Kanai (Gunma University, Maebashi-Gunma), Shigekazu Fukuda (NIRS, Chiba-shi)*
The MLIC (Multi-Layer Ionization Chamber) that has a lot of ionization chambers stacked in the depth direction is useful a detector for measuring the depth dose distribution. By using the MLIC, the measurement time and the amount of beam for dosimetry are drastically decreased. In HIMAC (Heavy-Ion

Medical Accelerator in Chiba), the MLIC has been effectively used for QA (Quality Assurance) measurement of heavy-ion therapeutic beam since 2002. We are developing a new type MLIC that has electrodes made of graphite on the surface of the polymethyl-methacrylate (PMMA) plates for particle therapy. The purpose is to obtain the equivalent measurement results of depth dose distribution in water. We will report on the progress of development.

MOPB55 **Electron Cloud Measurements using Shielded Pickups at CesrTA** - *John Sikora, James Arthur Crittenden, David Rubin (CLASSE, Ithaca, New York)*

The Cornell storage ring was originally a positron/electron collider with beam energies ranging from 2 to 5 GeV. In 2008 it was reconfigured as the Cornell Electron Storage Ring Test Accelerator (CesrTA). An important part of the research at CesrTA is the study of the growth, decay and mitigation of electron clouds. Electron Cloud (EC) densities can be measured with a Shielded Pickup (SPU), where cloud electrons pass into the detector through an array of small holes in the wall of the beam-pipe. The signals produced by SPU have proved to be very useful in measuring the mitigating effect of different vacuum chamber surfaces - including differences in quantum efficiency as well as secondary and elastic yield. This has been accomplished through the careful comparison of observed signals with the output of the EC simulation code ECLOUD. We present example comparisons of data and simulation that show the effect of different surfaces as well as beam conditioning effects. In addition, some data has been acquired using a solenoid to produce a longitudinal magnetic field at the SPU. We will present our current understanding of the effect of a longitudinal magnetic field on SPU signals.

MOPB56 **Electron Cloud Measurements Using a Time Resolved Retarding Field Analyzer at CesrTA** - *John Sikora, Michael Gerard Billing, Joseph Vincent Conway, Yulin Li, Xianghong Liu, David Rubin, Charles Ralph Strohman (CLASSE, Ithaca, New York), Mark Alan Palmer (Fermilab, Batavia), Ken-ichi Kanazawa (KEK, Ibaraki)*

The Cornell Electron Storage Ring has been reconfigured as a test accelerator (CesrTA) with positron or electron beam energies ranging from 2 GeV to 5 GeV. An area of research at CesrTA is the study of the growth, decay and mitigation of electron clouds in the storage ring. With a Retarding Field Analyzer (RFA), cloud electrons pass into the detector through

an array of small holes in the wall of the beam-pipe. The electrons are captured by several collectors, so that the electron flux can be measured vs. horizontal position. Up to now, we have integrated the collector currents to provide DC measurements. We have recently constructed a new Time Resolved RFA, where the collector currents can be observed on the time scale of the bunch train in the storage ring. We present a summary of the design, construction and commissioning of this device, as well as initial beam measurements at CesrTA.

MOPB57 **Overview of Beam Instrumentation and Beam Tuning Methods of RIKEN RI Beam Factory** - *Nobuhisa Fukunishi, Masaki Fujimaki, Naruhiko Sakamoto, Tamaki Watanabe, Kazunari Yamada (RIKEN Nishina Center, Wako), Ryo Koyama (SHI Accelerator Service Ltd., Tokyo)*

RIKEN RI Beam Factory (RIBF) was constructed as the first of the next-generation radioactive-beam facilities aiming at investigating vast unknown fields of unstable nuclei. In order to obtain the world-most intense heavy-ion beams, we have employed, taking into account cost effectiveness, a multistage acceleration scheme including 4 ring cyclotrons. We have already obtained 1 pμA, 0.42 pμA, and 22 pnA beams for 18O, 48Ca and 124Xe ions, respectively. The present performance has been obtained by using very conventional beam instruments such as Faraday cups, wire scanners and so on. Beam instruments used in RIBF are briefly summarized putting emphasis on beam tuning methods using them. In addition, limitations of these conventional devices and possible upgrade of beam instruments are discussed for further intensity upgrades and more stable operations of RIBF.

MOPB58 **Beam Quality Ensuring Instruments at the Gunma University Heavy-ion Medical Center** - *Eri Takeshita, Tatuaki Kanai, Motohiro Kawashima, Yoshiki Kubota, Akihiko Matsumura, Hirofumi Shimada, Mutsumi Tashiro, Kota Torikai, Satoru Yamada, Ken Yusa (Gunma University, Maebashi-Gunma)*

Since the carbon beam based cancer therapy started at the Gunma University Heavy-ion Medical Center in the year 2010, the total number of treated patients increased to 306 by the end of fiscal 2011. This year, already 82 patients have been treated. In order to control the medical beam qualities, i.e., position, size and intensity of the beam, monitoring devices were mounted on the high-energy beam transport line. The beam position and size can be measured and tuned with a

screen monitor, which consists of a fluorescent screen and a CCD camera. Just before starting the treatment, the operators check for a proper beam position by strip-line monitor measurements placed close to the iso center. The irradiation dose is controlled using two secondary electron emission monitors placed before the wobbling magnets. This dose monitor is helpful for high fluence of the beam because it's less affected by the recombination effect. In the conference, we would like to report on details of each monitoring device.

MOPB59 **ADS Injector II Beam Diagnostics** - *Junxia Wu (IMP, Lanzhou)*
A 10 mA/50 MeV superconducting proton linac as the demo of the Accelerator-Driven System (ADS) driver is designing and constructing in China. One of the 10 MeV lines, called injector II, is fabricating at the Institute of Modern Physics, Chinese Academy of Sciences. It consists of ECR source, LEBT, 2.5 MeV RFQ, MEBT and superconducting structure from 2.5 MeV to 10 MeV. In this paper the diagnostics after the RFQ and to the end of the 10 MeV will be introduced. Some of the measurements in the lab will be described also.

MOPB60 **Beam Diagnostics for AREAL RF Photogun Linac** - *Koryun Manukyan, Gayane A. Amatuni, Bagrat Grigoryan, Vahe Sahakyan, Artsrun Sargsyan, Gevorg Suren Zanyan (CANDLE, Yerevan)*
Advanced Research Electron Accelerator Laboratory (AREAL) based on photocathode RF gun is under construction at CANDLE. The basic approach to the new facility is the photocathode S-band RF electron gun followed by two 1 m long S-band travelling wave accelerating sections. Linac will operate in single and multibunch modes with final beam energy up to 20 MeV and the bunch charge 10 - 200 pC. In this paper the main approaches and characteristics of transverse and longitudinal beam diagnostics are presented. The diagnostics included beam momentum, charge, transverse emittance and bunch length measurements for two operation modes.

MOPB61 **The Status of Turkish Accelerator and Radiation Laboratory in Ankara (TARLA)*** - *Caglar Kaya, Avni Aksoy (Ankara University, Golbasi / Ankara), Suat Ozkorucuklu (SDU, Isparta)*
Turkish Accelerator and Radiation Laboratory in Ankara (TARLA) project has been supported by State Planning Organization (SPO) of Turkey since 2006 as a first step of the national Turkish Accelerator Center (TAC) project. TARLA facility, which is

essentially proposed to generate oscillator mode FEL in 2-250 microns wavelengths range, will consist of totally normal conducting injector system with 250 keV beam energy, two superconducting RF accelerating modules in order to accelerate the beam between 15-40 MeV energies, and two different optical cavity systems with different undulator magnets with the periods of 25 mm and 90 mm. However continuous wave (CW) electron beam provided by TARLA accelerator is convenient for many other applications. Therefore additional Bremsstrahlung laboratory is also proposed at TARLA. In this study we present the current status of TARLA, time scale for commissioning process in addition to the operation process of thermionic gun.

MOPB63 **Emittance Measurement using X-ray Profile Monitor at KEK-ATF** - *Takashi Naito (KEK, Ibaraki)*

The X-ray profile monitor consists of two Fresnel zone plates and X-ray CCD camera. The synchrotron radiation from the bending magnet is monochromatized by a crystal monochromator. The design resolution of the selected wavelength 3.8nm is sufficiently small for the emittance measurement of the KEK-ATF. However, the measurement result at the early stage was affected to the mechanical vibration. This paper describes the improvement of the resolution and the measurement results.

MOPB64 **Emittance Measurement for BEPCII Linac** - *Yan-feng Sui, Jianshe Cao (IHEP, Beijing)*

BEPCII is an upgrading project of the Beijing Electron-Positron Collider. Recent efforts have been focussed on improving beam transmission between linac and storage ring. Emittance measurements using four wire scanners. The result of measurement and some discussion will be presented.

MOPB65 **Measurement of Sub-picosecond Bunch Length with the Interferometry from Double Diffraction Radiation Target** - *Gennady Naumenko, Alexander Potylitsyn, Dmitry Shkitov (TPU, Tomsk), Haixiao Deng, Shanliang Lu, Tiemin Yu, Jianbing Zhang (SINAP, Shanghai), Mikhail Victorovich Shevelev (Tomsk Polytechnic University, Tomsk)*

Reliable and precise methods for non-invasive diagnostics of sub-picosecond electron bunches are required for new accelerator facilities (FEL, LWFA, et al.). Measurements of spectral characteristics of coherent radiation generated by such

bunches using interferometer allow to determine a bunch length [1]. The interference pattern obtained by two diffraction radiation (DR) beams from two shifted plates (double DR target) may be used instead an interferometer [2]. Recently the coherent DR interferometry scheme at the SINAP accelerator facility was established [3]. Here we report the results of comparing the first measurement from such a technique with the measurement from Michelson interferometer. The parameters of fs linac are described in [4]. The DR target was consisted of two plates made from aluminum foil. The pyroelectric detector SPI-D-62 was used. The analysis of results from two techniques gives the same estimated bunch length about 660 fs (0.2 mm), which confirms the ability of the proposed technique for non-invasive bunch length measurements in the sub-picosecond range without a complicated scheme like Michelson interferometer or similar.

MOPB66 **Optimization of the Interferometry Beam Size Monitor in PLS-II** - *Ji-Gwang Hwang (Kyungpook National University, Daegu), HyangKyu Park (CHEP, Daegu), Eun-San Kim (KNU, Deagu), Jung Yun Huang, Changbum Kim, Gyeong Hwa Kim, Heung-Soo Lee, Seunghwan Shin (PAL, Pohang, Kyungbuk)*

Pohang Light Source-II (PLS-II) is recently upgraded to 3 GeV and the circumference, beam current, emittance of PLS-II storage ring are 281.82 m, 100 mA and 5.7 nm-rad, respectively. The storage ring includes an interferometry beam size monitor system in 2B beam line. It consists of the quadrature slit, lens, 650 nm wave-length filter and CCD camera. We will present the measurement results and the issues to optimize the beam size monitor system in the beam line.

MOPB67 **Development of Offner Relay Optical System for OTR Monitor at 3-50 Beam Transport Line of J-PARC** - *Masaki Tejima, Toshiyuki Mitsuhashi (KEK, Ibaraki), Yoshinori Hashimoto, Takeshi Toyama (J-PARC, KEK & JAEA, Ibaraki-ken), Satoru Otsu (MELCO SC, Tsukuba)*

An extremely wide aperture relay optical system based on Offner system has been designed and constracted for OTR monitor at 3-50 beam transport line of J-PARC. Diagnostics for beam profile and halo are very important to optimize injection beam from RCS to MR in J-PARC. For this purpose, an OTR monitor is planed to install for an observation of image of the beam and halo after the beam collimators. Since opening of OTR is very wide due to small Gamma; 3.2, extremely wide

aperture (500mrad) optics will necessary to extract OTR from file target. We designed Offner type relay optics for the effective extraction of OTR having F=0.83. The clear aperture will cover 100 x 100mm aria on the target screen. Results of optical testing and design of OTR monitor will present in this paper.

MOPB68 Development of Profile Monitor System for High Intense Spallation Neutron Source - *Shin-ichiro Meigo (JAEA/J-PARC, Tokai-Mura, Naka-Gun, Ibaraki-Ken)*

At the JSNS in J-PARC, a mercury target is employed as the neutron production target. It is well known that the damage on the mercury target is promotional to the 4th power of the peak current density of the primary proton beam on the target. For the high intense neutron source, the profile on the target is important to drive the neutron source with the continuously observation of the profile. We have developed to Multi Wire Profile Monitor System (MWPM). During beam operation, when the abnormally of the beam is found, the beam is cut out by the Machine Protection System (MPS). For the measurement of the two dimension observation on the target, we have developed the system based on the residual radiation measurement by using an imaging plate (IP), It is found that the both result by the MWPM and IP shows good agreement.

MOPB69 Development of Four Mirror Pulsed Laser Wire System for ATF-KEK Damping Ring - *Alexander S. Aryshev, Yosuke Honda, Hirotaka Shimizu (KEK, Ibaraki), Arpit Ashok Rawankar (Sokendai, Ibaraki), Nobuhiro Terunuma, Junji Urakawa (Sokendai, Ibaraki; KEK, Ibaraki), Yan You (TUB, Beijing)*

Production and handling of a low emittance beam is one of the key technologies for linear colliders. The Accelerator Test Facility (ATF) was constructed at KEK to study low emittance beam physics and to develop the technologies associated with it. In ATF damping ring, the vertical beam size is less than 10 μm. To measure it precisely, a thin and intense laser beam is required. We utilize a pulsed four mirror optical cavity based on IR laser oscillator to fulfill this requirement. With pulsed green laser oscillator, the beam waist will reduce by factor of 2. Therefore, with green laser oscillator, effective electron-photon collision can be observed. Minimum beam waist is obtained in sagittal plane. Special type of mirror alignment scheme is used to make a compact four mirror optical cavity. With Pulsed laser oscillator the electron beam scanning is very fast as compare to CW Laser wire system. Profile of electron beam can be

measured in vertical, horizontal and longitudinal direction within a few second. We report the design studies of such compact resonator and scheme to obtain laser beam size less than 6 μm in rms.

MOPB70 **The Synchrotron Radiation Diagnostic Beam line of SSRF** - *Jie Chen, Zhichu Chen, Guoqing Huang, Yongbin Leng, Kairong Ye (SINAP, Shanghai)*

The synchrotron radiation photon beam line has been operated since 2009 at Shanghai Synchrotron Radiation Facility. There are two diagnostic beam lines of the storage ring behind bending magnet, which is employed conventional X-ray and visible imaging techniques. A synchrotron radiation (SR) interferometer using visible light region in order to measure the small transverse electron beam size (about 22 μm); low emittance and a low coupling. A small off-axis mirror is set for the convenience of the observation. Wave front testing is used for interferometer to calibrate the deformation effect of optical components. An X-ray pin-hole camera is also employed in the diagnostics beamline of the ring to characterize beam. Typically the point spread function of the X-ray pinhole camera is calculated via analytical or numerical method. Those two methods check each other. As a result, the measurement with SR system has quite enough resolution of itself even though the absolute beam size acquired. The existed system suffers with dynamic problem for beam physics studies. It has been measured 2.8nm.rad in small emittance mode at SSRF.

MOPB72 **First Measurements with Coded Aperture X-ray Monitor at the ATF2 Extraction Line** - *John Walter Flanagan, Hitoshi Fukuma, Hitomi Ikeda, Toshiyuki Mitsuhashi (KEK, Ibaraki)*

The ATF2 extraction line is used as a test-bed for technologies needed for the ILC final-focus region. An x-ray extraction beam line has been constructed at the final upstream bend before the extraction line straight section, for development and testing of optics and readout systems for a coded aperture-based imaging system. The x-ray monitor is expected to eventually be able to measure single-shot vertical bunch sizes down to a few microns in size at its source location in the ATF2 extraction line. Preliminary scanned measurements have been made with beams in the ~15 micron range, and it is planned to make more measurements with further-tuned beam, and with fast read-out electronics. The details of the layout, expected performance, and preliminary measurement results will be presented.

MOPB73 **Beam Size and Intensity Diagnostics for a SRF Photoelectron Injector** - *Roman Barday, Wolfgang Anders, Falk Hoffmann, Andreas Jankowiak, Thorsten Kamps, Jens Knobloch, Oliver Kugeler, Peter Kuske, Alexander N. Matveenko, Axel Neumann, Torsten Quast, Jeniffa Rudolph, Mario Schenk, Susanne Gundula Schubert, Jens Voelker (HZB, Berlin), Frank Siewert (BESSY GmbH, Berlin), John Smedley (BNL, Upton, Long Island, New York), Jacek Sekutowicz (DESY, Hamburg), Jochen Teichert (HZDR, Dresden)*

A high brightness photoelectron injector must be developed as a part of the BERLinPro program. The injector is designed to produce an electron beam with 100 mA average current and a normalized emittance of 1 mm*mrad. The project will be realized in two stages. First with a Pb cathode in a SRF gun, work ongoing, followed by a normal conducting CsK2Sb cathode capable of generating high current beams. In the first stage we have measured the fundamental beam parameters bunch charge, beam energy and energy spread with a special focus on the measurement of the transverse beam profiles. We also discuss our plans for the beam characterization at high currents.

MOPB74 **Beam Measurement with Synchrotron Radiation for BEPCII Storage Ring** - *Li Wang, Jianshe Cao, Zheng Zhao (IHEP, Beijing)*

The detail of Synchrotron Light Monitor for BEPCII storage ring is introduced. The Synchrotron Light Monitor measures both transverse beam profiles and longitudinal bunch length. Transverse profiles are measured by visible light imaging and spatial interferometer, and longitudinal bunch length is measured by streak cemera and intensity interferometer.

MOPB75 **Real-time Beam Profile Measurement System using Fluorescent Screens** - *Takahiro Yuyama, Ikuo Ishibori, Tomohisa Ishizaka, Susumu Okumura, Yosuke Yuri (JAEA/TARRI, Gunma-ken)*

In the TIARA AVF cyclotron facility of JAEA, we are developing an irradiation technique of a large-area uniform ion beam formed by nonlinear focusing using multipole magnets. It is indispensable to perform beam tuning and evaluation of the beam quality at the same time for efficient operation. Therefore, we developed a real-time beam profile measurement system composed of two CCD cameras, fluorescent screens, and an image analysis program based on LabVIEW. In order to measure the transverse intensity distribution of the beam through the luminance map converted from a camera image, the

characteristics of fluorescent screens, DRZ (Gd2O2S:Tb) and AF995R (Al2O3:Cr), were investigated using several species of ion beams. It was found that the light yield from the DRZ-HIGH screen irradiated with 10 MeV H+ beam was increased linearly with the particle fluence rate from 5×10^7 to 5×10^8 [cm-2・s-1] and that the relative transverse intensity distribution could be obtained from the fluorescence in real time. It was also confirmed that the intensity distribution measured in this system agreed well with the relative intensity distribution obtained with a Gafchromic radiochromic film.

MOPB76 **Evaluation of a Fluorescent Screen with a CCD System for Quality Assurance in Heavy-Ion Beam Scanning Irradiation System** - *Yousuke Hara, Takuji Furukawa [on leave], Taku Inaniwa [on leave], Kota Mizushima [on leave], Koji Noda [on leave], Shinji Sato [on leave], Toshiyuki Shirai [on leave], Eri Takeshita [on leave] (NIRS, Chiba-shi)*

The precise heavy-ion therapy such as the scanning irradiation system necessitates the precise quality assurance (QA) procedures to verify the performance of therapeutic scanned ion beams. To evaluate the uniformity of the 2D field, radiographic film is used due to its high spatial resolution and suit for the measurements of the integral dose. However, this technique is time consuming. Thus, we developed the QA tool with high spatial resolution to verify accuracy of the lateral size, position and uniformity of scanned ion beams in clinical application at the HIMAC, which we called the QA-SCN. The QA-SCN consists of a fluorescent screen, a CCD camera, a mirror, camera controllers and a dark box to protect against surrounding light. In this paper, to evaluate the performance of the QA-SCN, we compared the results obtained by using it with the measurements by radiographic film performed in the same experimental conditions. Also, we verified several types of corrections about errors, e.g. background, vignetting, to distort the measurement results. As a result, we confirmed that the QA-SCN can be used as the system for QA procedures of therapeutic scanned ion beams.

MOPB77 **Adjustable Optics for a Non-destructive Beam Profile Monitor based on Scintillation of Residual Gas** - *Vsevolod Kamerdzhiev, Karl Reimers (FZJ, Jülich), Alexander Pernizki (INP, Juelich)*

The scintillation profile monitor (SPM) is being developed at COSY in addition to the existing ionisation profile monitor (IPM). Contrary to the IPM it does not require in-vacuum components,

making it a robust and inexpensive instrument. The SPM is suitable for high intensity operation rather than operation with low intensity polarised beams. A multichannel PMT is used to detect scintillation light. The rate of detectable scintillation events is about three orders of magnitude lower compared to the rate of ionisation events. To boost the photon yield, small amounts of nitrogen are injected into the SPM vacuum chamber. An adjustable light focusing system is being built to optimise the SPM performance for different machine operation modes. The new system allows using a variety of optical components ranging from single lenses to high-grade camera objectives. Cylindrical lenses are considered to further boost the sensitivity by better fitting the beam image to the detector geometry. The latest experimental results and the new design of the optical system are presented.

MOPB78 **Beam Spot Measurement using a Phosphor Screen for Carbon-Ion Therapy at NIRS** - *Kota Mizushima, Takuji Furukawa, Yousuke Hara, Ken Katagiri, Koji Noda, Toshiyuki Shirai, Eri Takeshita (NIRS, Chiba-shi)*

A two-dimensional beam imaging system with a terbium-doped gadolinium oxysulfide (Gd2O2S:Tb) phosphor screen and high-speed charge coupled device (CCD) camera has been used to measure the beam spot for scanned carbon-ion therapy at National Institute of Radiological Sciences (NIRS). The system enables us to obtain one image of the beam spot every 20 milliseconds. The fluctuation of the unscanned-beam spot size and position was observed in the isocenter to verify the time stability of the delivered beam for scanning irradiation. The beam imaging system also functions as a beam alignment adjustment system by setting a steel sphere at the isocenter. For quality assurance, the beam alignment is routinely checked by observing a shadow of the steel sphere on the beam spot image, and it is confirmed that the misalignment of the beam is smaller than the tolerance of 0.5 mm.

MOPB79 **Design of a High-precision Fast Wire Scanner for the SPS at CERN** - *Raymond Veness, Nicolas Chritin, Bernd Dehning, Jonathan Emery, Juan Herranz Alvarez, Mohamed Koujili, Jose Luis Sirvent Blasco (CERN, Geneva)*

Studies are going on of a new wire scanner concept. All moving parts are inside the beam vacuum and it is specified for use in all the machines across the CERN accelerator complex. Key components have been developed and tested. Work is now

focussing on the installation of a prototype for test in the Super Proton Synchrotron (SPS) accelerator. This article presents the specification of the device and constraints on the design for integration in the different accelerators at CERN. The design issues of the mechanical components are discussed and optimisation work shown. Finally, the prototype design, integrating the several components into the vacuum tank is presented.

MOPB80 High Dynamic Range Beam Imaging with Two Simultaneously Sampling CCDs - *Pavel Evtushenko (JLAB, Newport News, Virginia)*

Transverse beam profile measurement with sufficiently high dynamic range (HDR) is a key diagnostic to measure the beam halo, understand its sources and evolution. In this contribution we describe our initial experience with the HDR imaging of the electron beam at the JLab FEL. On contrary to HDR measurements made with wire scanners in counting mode, which provide only two or three 1D projections of transverse beam distribution, imaging allows to measure the distribution itself. That is especially important for non-equilibrium beams in the LINACs. The measurements were made by means of simultaneous imaging with two CCD sensors with different exposure time. Two images are combined then numerically in to one HDR image. The system works as an online tool providing HDR images at 4 Hz. An optically polished YAG:Ce crystal with the thickness of 100 um was used for the measurements. When tested with a laser beam images with the DR of about 1E+5 were obtained. With the electron beam the DR was somewhat smaller due to the limitations in the time structure of the tune-up beam macro pulse.

MOPB81 Residual Gas Ionization Profile Monitors in J-PARC Slow-extraction Beam Line - *Yoshinori Sato, Keizo Agari, Erina Hirose, Masaharu Ieiri, Yohji Katoh, Michifumi Minakawa, Megumi Naruki, Shinya Sawada, Yoshihisa Shirakabe, Yoshihiro Suzuki, Hitoshi Takahashi, Akihisa Toyoda, Hiroaki Watanabe, Yutaka Yamanoi (KEK, Tsukuba), Ryotaro Muto, Minoru Takasaki, Kazuhiro Tanaka (KEK, Ibaraki), Hiroyuki Noumi (RCNP, Osaka)*

Residual gas ionization profile monitors (RGIPMs) working in 1 Pa pressure have been developed for high-intensity proton beam (maximum: 50GeV-15uA) at J-PARC slow-extraction beam line. The transverse beam profiles are measured by collecting electrons produced by ionization of 1 Pa residual gas. The

electrons are guided to the segmented electrode with a uniform electrostatic field applied in the gap. A uniform magnetic field is applied parallel to the electric field to reduce diffusion of electrons travelling to the electrodes. Typical spatial resolution of the RGIPMs with a 10 cm gap, a 10 V/cm electrostatic field, and a 400 gauss magnetic field at center is 0.5 mm. The collected charge is integrated during every extraction period (typically 2 second in 6 second accelerator cycle). Subtracting background distributions measured during off-beam period, profile distributions are measured clearly. The 14 RGIPMs installed in the slow-extraction beam line are working stably for the 30 GeV-0.46 uA proton beam at current maximum. In this contribution, detailed specifications and performance of the present RGIPMs will be reported.

MOPB82 **Bunch-Compressor Transverse Profile Monitors of the SwissFEL Injector Test Facility** - *Gian Luca Orlandi, Rasmus Ischebeck, Volker Schlott, Vincent Thominet (Paul Scherrer Institut, Villigen), Christopher Gerth (DESY, Hamburg)*

The 250 MeV SwissFEL Injector Test Facility (SITF) is the test bed of the future 5.7 GeV SwissFEL linac that will drive a coherent FEL light source in the wavelength range 7-0.7 and 0.7-0.1 nm. Aim of the SITF is to demonstrate the technical feasibility of producing and measuring 10 or 200pC electron bunches with normalized emittance down to 0.25 μm. A further goal is to demonstrate that the electron beam quality is preserved in the acceleration process, in the X-Band linearizer and the magnetic compression from about 10 ps down to 200 fs. The SITF movable magnetic bunch-compressor is equipped with several CCD/CMOS cameras for monitoring the beam transverse profile and determining the beam energy spread: a Ce:YAG screen and an OTR screen camera at the mid-point of the bunch compressor and a SR camera imaging in the visible the Synchrotron Radiation emitted by the electron beam crossing the third dipole. Results on the commissioning of such instrumentations, in particular in the low charge limit, and measurements of the beam energy spread vs. the compression factor will be presented.

MOPB83 **Turn-by-turn Observation of the Injected Beam Profile at the Australian Synchrotron Storage Ring** - *Mark James Boland (ASCo, Clayton, Victoria), Toshiyuki Mitsuhashi (KEK, Ibaraki), Kent Peter Wootton (The University of Melbourne, Melbourne)*

A fast gated intensified CCD camera was used to observe the

beam profile turn-by-turn in the visible light region. Using the visible light from the optical diagnostic beamline on the storage ring at the Australian Synchrotron an optical telescope was constructed to focus an image on the ICCD. The event driven timing system was then used to synchronise the camera with the injected beam. To overcome the problem of dynamic range between the amount of charge in an injected bunch and the stored beam, the beam was dumped by slowly phase flipping the RF by 180 degrees between each one 1 Hz injection cycle. The injection process was verified to be stable enough so that measurements of the different turns could be captured on successive injections and did not need to be captured in single shot. The beam was seen to come in relatively cleanly in a tight beam but would then rapidly decohere due to the strong non-linear fields needed to run the storage ring at high chromaticity. It would take thousands of turns for the beam to damp down again and recohere into a tight beam spot again. This measurement technique will be used to tune the storage ring injection process.

MOPB85 **Latest Results from the 4.8GHz LHC Schottky System** - *Mathilde Favier, Owain Rhodri Jones (CERN, Geneva)*
This paper will present the latest results from the LHC 4.8GHz travelling wave Schottky system, summarising measurements performed during the 2011 and 2012 LHC runs. It will also describe attempts to improve the system architecture in order to make it more immune to the strong coherent lines observed with proton bunches even at these very high frequencies.

MOPB86 **Betatron Tune Measurement and Automatic Correction Systems at NewSUBARU Storage Ring** - *Satoshi Hashimoto, Yousuke Hamada, Shuji Miyamoto (LASTI, Hyogo)*
At the 1.5GeV electron storage ring NewSUBARU, the two different kinds of systems for measuring betatron tunes have been developed: the high precision tune monitor and that for automatic correction. The vertical and horizontal tunes can be observed during the user time, because a stripe-line kicker to enlarge the beam lifetime vertically shakes electron beams. The high-precision tune monitor has the resolution of 0.0002 and uses frequency analysis methods such as SRSA, zoom FFT, STFT, in addition to usual FFT. Tune shifts due to a slight difference of filling patterns during top-up operations can be observed with this monitor. The another tune monitoring and automatic-correcting system has been developed to

compensate tune shifts caused by the decrease of the stored current, the difference of filling patterns during top-up operations, and the energy ramp from 1.0 to 1.5 GeV. This system estimates betatron tunes every 0.5 sec and can keep tunes to the optimal values. The system also has a tune survey function that can automatically measure the beam lifetime in a tune diagram.

MOPB87 Development and First Tests of a High Sensitivity Charge Monitor for SwissFEL - *Sebastien Artinian, Julien Bergoz, Frank Stulle (BERGOZ Instrumentation, Saint Genis Pouilly), Patrick Pollet, Volker Schlott (PSI, Villigen)*

The compact X-ray free electron laser SwissFEL, which is presently under development at the Paul Scherrer Institut (PSI) in Villigen, Switzerland, will operate at comparably low charges, allowing the compression of the electron bunches to a few femto-seconds (nominal 200 pC mode) and even towards the atto-second range (short bunch 10 pC mode). A high precision charge measurement turns out to be a challenge, especially in the presence of dark currents, which may occur from high gradient RF gun and accelerating structure operation. In response to this challenge, a higher sensitivity charge transformer and new beam charge monitor electronics were developed in collaboration between Bergoz Instrumentation and PSI. The Turbo-ICT captures sub-pC bunch charge thanks to a new magnetic alloy exhibiting very low core loss. Transmission over a carrier using narrow-band cable television technique preserves the signal integrity from the Turbo-ICT to the BCM-RF. Electro-magnetic and RF interferences are strongly attenuated; the dark current signal is suppressed. First beam test results, which have been performed at the SwissFEL Test Injector Facility (STIF), are presented in this contribution.

Monday Session F, Special Invited Talk 18:00 – 19:00
Chair: Takeshi Toyama (KEK)

M01F01 **Neutrino experiments in Japan** – *Takashi Kobayashi (KEK, J-Parc)*
Neutrino experiments in Japan starting from Kamiokande have been playing leading role in neutrino physics. Escpecially, accelerator based long baseline neutrino experiment is pioneered by K2K experiment in Japan. Current its successor, T2K experiment with much higher beam intensity is leading second generation long baseline experiments for high sensitivity and precision measurements of oscillations. In this talk, recent experiments in Japan such as Super-Kamiokande, T2K and KamLAND and their latest results are reviewed.

Tuesday Session A, 8:30 – 10:05
Chair: Jianshe Cao (IHEP)

TUCA01 **Beam Instrumentation Global NETwork [BIGNet]: A Common Web Portal for Beam Instrumentalists** - *Jean-Jacques Gras (CERN, Geneva)*

This document will present an initiative launched during the International Particle Accelerator Conference (IPAC11) to define and produce a common web portal for Beam Instrumentation, with the aim of allowing any beam instrumentalist to easily and efficiently: - find the laboratories with machines using beams of similar characteristics (particle type, total beam intensity, bunch intensity, frequency, energy) - find the person who is working there on the beam observable concerned (i.e. beam position, loss, intensity, transverse or longitudinal profile, tune) and how to contact him/her. - create discussion forums with the right audience on hot beam instrumentation topics or issues - advertise topical events and workshop - provide links towards documents describing system designs and performance assessments. - and possibly more This document will cover the status and prospects of the project with the aim to invite and welcome new laboratories to join the adventure.

TUTA02 **BPM Electrode and High Power Feedthrough - Special Topics in Wideband Feedthrough** - *Makoto Tobiyama (KEK, Ibaraki)*

Since most of the beam in accelerator runs in the vacuum chamber made of metal, it is needed to have 'feedthrough' to get or to put the RF signal from or to beam. For example, we can get the beam signal by using button-type electrode which have electrical isolation material to seal the vacuum. Now, many types of vacuum feedthrough with coaxial structure are available commercially. Nevertheless, it is meaningful to understand the design principle of the feedthough needed for the beam instrumentation, especially for short bunch length, high beam current machine. I will show the design method of the feedthrough such as BPM electrodes or high power feedthroughs using 3D EM-codes such as HFSS or GdfidL based on several examples developed for SuperKEKB accelerators.

Tuesday Session B, 10:30 – 12:20
Chair: Kevin Jordan (JLab)

TUIB01 **Bigger, Brighter and more Powerful** - *Hermann Schmickler (CERN, Geneva)*
The community of high energy physics has several proposals for more powerful accelerator projects. This presentation reviews all current projects with center of mass energies above 10 GeV in the field of hadron accelerators, lepton colliders and lepton-hadron colliders. Special emphasis is given on the new needs for beam instrumentation.

TUIB02 **Femtosecond Resolution Bunch Profile Diagnostics** - *Bernhard Schmidt (DESY, Hamburg)*
The generation of ultrashort x-ray pulses in the femtosecond (fs) regime in FELs requires electron bunches with lengths significantly below 1 ps with a strong tendency to aim for the 1 fs scale. This greatly challenges the present beam diagnostic methods. In this paper, we will present an overview of the existing and proposed techniques of bunch profile diagnostics including transverse deflecting cavities, electro optic methods, frequency domain techniques as well as more complex approaches like "optical replica synthesizers" (ORS).

Tuesday Session C, 13:50 – 15:50
Chair: Mark Boland (ASLS)

TUCC01 **Electron Storage Ring as a Single Shot Linac Beam Monitor** - *Yoshihiko Shoji, Koji Takeda (LASTI, Hyogo), Takao Asaka, Yasuyuki Minagawa, Shinsuke Suzuki, Yasuhiro Takemura (JASRI/SPring-8, Hyogo-ken)*
The SPring-8 linac has been operated as an injector to the electron storage ring, NewSUBARU. Because of the small acceptance of the ring, fine parameter tuning is required for the stable top-up injection. In that process, some single shot linac beam measurements were necessary to understand the shot-by-shot fluctuation of the injection efficiency. We used the electron ring itself as a linac beam monitor. The time-resolving visible light monitor in the ring records the profiles of the injected linac beam for many revolutions. The pulse width for the single rf bucket (500MHz) of the ring is normally 1 ns, which contains 3 linac bunches (2856MHz). The time profile in the ring gives the energy profile at after 1/4 of the synchrotron

oscillation period. The spatial profile of several revolutions, recorded by a double-sweep streak camera or ICCD gated camera, gives a beam emittance of a single-shot. The streak camera enables the bunch by bunch measurement. The effective resolution depends on the beta function of the ring, which can easily be changed. For the vertical emittance, our spatial resolution of 0.3 mm FWHM at βy = 17 m was good enough to identify the quadrupole mismatch.

TUIC02 Direct Observation of the Dust-trapping Phenomenon - *Yasunori Tanimoto (KEK, Ibaraki)*

Dust trapping has long been an unwelcome and mysterious phenomenon in electron storage rings. As it leads to a sudden decrease in beam lifetime, dust trapping has been a perpetual nuisance at the Photon Factory Advanced Ring (PF-AR) since its beginning in the 1980s. However, during recent research on dust trapping at the PF-AR, video cameras serendipitously captured the culprit behind this phenomenon; the cameras recorded a luminous micro-particle trapped in the electron beam, just as if a shooting star were traveling in the beam tube. In the successive research, supersensitive cameras repeatedly observed trapped dust particles, and revealed that they behaved differently under different conditions. My presentation will summarize these experimental results, as well as long-term statistics supporting present dust-trapping theories.

TUCC03 Design and Expected Performance of the New SLS Emittance Monitor - *Natalia Milas, Volker Schlott, Andreas Streun (PSI, Villigen), Åke Andersson, Jonas Breunlin (MAX-lab, Lund), Martin Rohrer, Angela Saa Hernandez (Paul Scherrer Institut, Villigen)*

The vertical emittance minimization campaign at SLS, realized in the context of the TIARA WP6, has already achieved the world's smallest vertical emittance of 0.9 pm in a synchrotron light source. The minimum value reached for the vertical emittance is only five times bigger than the quantum limit of 0.2 pm. However, the resolution limit of the present SLS emittance monitor has also been reached thus, to further continue the emittance minimization program the construction of an improved second monitor is necessary. In this paper we present the design and studies on the performance of this new monitor based on the image formation method using vertically polarized synchrotron radiation in the vis-UV spectral regimes. This monitor includes a new feature, providing the possibility of

performing full interferometric measurement by the use of a set of vertical obstacles that can be driven on the light path. Simulations results are used to investigate the possible source of errors and their effects on imaging and the determination of the beam height. We also present the expected performance, in term of emittance accuracy and precision, and discuss possible design limitations.

TUCC04 Measurement of Nanometer Electron Beam Sizes with Laser Interference using IPBSM - *Jacqueline Yan (University of Tokyo, Tokyo)*

At ATF2, the Local Chromaticity Correction focusing scheme is to be verified through realizing its design vertical e- beam size (σy) of 37 nm. The 'IPBSM', installed at ATF2's virtual IP, is the only existing beam size monitor capable of measuring σy < 100 nm, making it indispensable for ATF's goals and R&D at future LCs. This owes to a novel technique of colliding e- beam against laser interference fringes. σy is derived from the modulation depth of resulting Compton photons, which is large for small σy. The measurable range from O(10) nm ~ a few μm, is controlled by switching between laser crossing angles θ = 174°, 30°, and 2° - 8°. In early 2011, measuring σy < 300 nm was hindered by an immense earthquake and heavy signal jitters. The ensuing recovery and upgrades stabilized the laser system and improved resolution to 5%. In spring 2012, we commissioned advanced crossing angle modes by consistently measuring σy $\geq$ 150 nm. Our goals for the autumn 2012 run is to stably measure σy < 50 nm. Major hardware upgrades during the summer aim at more reliable alignment and optimization of specialized functions to suppress bias factors.

Tuesday Poster Session 16:20 – 17:50

TUPA01 Diagnostics Update for the Taiwan Photon Source - *Changhor Kuo, Jenny Chen, Yung-Sen Cheng, Pei-Chen Chiu, Kuo-Tung Hsu, San-Yuang Hsu, Kuo Hwa Hu, Chih-Yu Liao, Chunyi Wu (NSRRC, Hsinchu)*

Taiwan Photon Source (TPS) is a 3 GeV synchrotron light source which is being construction at campus of NSRRC. Various diagnostics are in implementation and will deploy in the future to satisfy stringent requirements of TPS for commissioning, top-up injection, and operation. These designs include beam intensity observation, trajectory and beam positions

measurement, destructive profile measurement, synchrotron radiation monitors, beam loss monitors, orbit and bunch-by-bunch feedbacks, filling pattern and etc. are in final design phase. Progress of construction of the planned beam instrumentation system for the TPS will be summarized in this report.

TUPA02 **Upgrade of the Injection System Diagnostic in the Taiwan Light Source** - *Changhor Kuo, Jenny Chen, Yung-Sen Cheng, Pei-Chen Chiu, Kuo-Tung Hsu, San-Yuang Hsu, Kuo Hwa Hu, Chih-Yu Liao, Chunyi Wu (NSRRC, Hsinchu)*
Taiwan Light Source is an 1.5 GeV synchrotron based light source which dedicated almost 20 year ago. During several major and minor upgrades, the TLS operate in top-up mode. To provide a better operation of the injector for the TLS, several minor upgrade in diagnostics are proceed recently. Efforts of these upgrades and modifications will summary in this report.

TUPA03 **The Development of EPICS Driver for High Voltage Supplies System** - *Jiaoni Bai, Fang Li, Wei Pan, jianmin Tian, Lei Zeng (IHEP, Beijing)*
The Iseg-VHQ 204L with option M-h is chosen as high voltage supplies for sensors of BLM of CSNS project. EPICS driver for it has been developed. And High voltage supplies system suppsatisfies request after examination. In the future, it will be used in the machine running.In this paper EPICS driver and Control Interface for VHQ 204L will be presented.

TUPA04 **Wire-scanner Readout for the CSNS Front-end** - *Fang Li, Peng Li, Xia Cai Zhang (IHEP, Beijing)*
The linac wire scanner system (WS) for the China Spallation Neutron Source (CSNS) calls for 4 units in the medium energy beam transport (MEBT), which will be used in beam profile measurements. In this paper we designed a readout system based on EPICS of WS, including the readout of wire position information and the beam profile information through ADC, and the selection of different Electronics range through DO signal.

TUPA05 **The Calibration Factor Determined and Analysis for HLS Bunch Current Measurement System** - *Yongliang Yang (USTC/NSRL, Hefei, Anhui)*
For bunch current measurement, the calibration factor is a key parameter. Usually, button electrode or stripline electrode can be selected as signal pickup, and peak value or integral of

bunch signal from pickup can be used to calculate the related bunch current value. To obtain the absolute value of bunch current, the calibration factor should be determined with the help of DCCT. At HLS, the Stretch effect of bunch length was observed when bunch current decay over time and this will affect the performance of bunch current detection for different pickup type and calculate method. Theoretical analysis and experimental validation results are performed to find out an ideal solution for bunch current measurement at HLS. The results show that, bunch current measurement system can obtain the best performance by stripline and its integral signal.

TUPA06 **Pulsed Electron Beam Current and Flux Monitor for the Race-Track Microtron** - *Sanjay Daga Dhole, Shahzad Akhter, Vasnat Nagesh Bhoraskar, Bhushankumar Jagnnath Patil, Ninad S. Shinde (University of Pune, Pune)*

In electron irradiation experiments on the materials, a true current of the electron beam is to be known to calculate the electron fluence received by the sample. Therefore, a pulsed electron beam current and flux monitor alongwith electronic system for an electron accelerator called Race-Track Microtron has been designed and developed. The sensing device used was a ferrite core having suitable number of turns of copper wire wound around it, through which the electron beam was passed without loss in the intensity. With an appropriate developed electronic circuit, the instantaneous value of the induced voltage was measured which in turn provides value of the electron beam pulsed current. The total charge passed through the ferrite core per unit time was therefore recorded and an integrated value of the total charge in a given period could be derived. This system can be used to measure the electron flux in the range from 10^8 electron/cm^2 to 10^16 electron/cm^2. Moreover, this system has been used successfully in a few electron irradiation experiments where the knowledge of the electron fluence received by the sample is required.

TUPA07 **BPM Selection for Beam Current Monitoring in SSRF** - *Zhichu Chen, Yongbin Leng, Yingbing Yan (SSRF, Shanghai)*

Although Direct Current Current Transformer (DCCT) is the general solution of beam current monitor, Beam Position Monitor (BPM) sum signals may still surpass it in some aspects such as the faster data rate and higher resolution in low current situations. Nevertheless, an additional monitor should be

harmless. Meanwhile, the DCCTs in the storage ring of Shanghai Synchrotron Radiation Facility (SSRF) have been suffering from various noise and the signals from the BPMs could be an aid to provide the beam current more accurately. There're 140 BPMs in the storage ring in SSRF but not all of them are suitable for this particular usage. This article focuses on the methods used here to dynamicly choose the BPMs that meet the criteria.

TUPA08 **Application of Single Crystal Diamonds (sCVD) as Beam Conditions Monitors at LHC** - *Maria Elena Castro Carballo (DESY Zeuthen, Zeuthen)*

The properties of the single-crystal diamond (scCVD): radiation hardness, low leakage current and fast signal, make it suitable for use as a particle detector in areas of high radiation dose. The Beam Conditions and Radiation Monitoring system (BRM) of the CMS experiment has a monitor (BCM1F) consisting of 4 modules located 1.8 m away from the interaction point, on both sides. Each module contains a sensor, radiation hard FEE and optical transmission of the signal. It counts single particles of beam halo, beam-gas, machine induced background, and collision products. The BRM protects CMS from high beam losses and provides feedback to the LHC and CMS on the beam conditions. The BCM1F sub-detector is very helpful as it is able to provide different background information together with luminosity correlations. Additional scCVD sensors are being installed in the LHC ring to be used as BLMs. The new BLM system (BCM1F4LHC) will be composed of 8 diamonds in points likely to suffer from beam losses. Nowadays, four sensors deliver information of hit rates that are correlated to the existing BLMs. A characterization of both BCM1F systems is presented.

TUPA09 **Architecture of the System for Beam Loss Monitoring and Measurements under Development for the Injector Complex at CERN** - *Christos Zamantzas, Marcel Alsdorf, Bernd Dehning, Stephen Jackson, Maciej Kwiatkowski, William Vigano (CERN, Geneva)*

The strategy for beam setup and machine protection of the accelerators at the European Organisation for Nuclear Research (CERN) is mainly based on its Beam Loss Monitoring (BLM) systems. For their upgrade to higher beam energies and intensities, a new BLM system is under development with the aim of providing faster measurement updates with higher dynamic range and the ability to accept more types of detectors as input compared to its predecessors. In this paper, the

architecture of the complete system is explored giving an insight to the design choices made to provide a highly reconfigurable system that is able to fulfil the different requirements of each accelerator using reprogrammable devices.

TUPA10 **Development of Optical Fiber Beam Loss Monitor System for the KEK Photon Factory** - *Takashi Obina, Yoshiharu Yano (KEK, Ibaraki)*
Beam loss monitor system using optical fibers has been developed to determine the loss point of the injected beam at the KEK Photon Factory (PF) electron storage ring. Large-core optical fiber was installed along the vacuum chamber of the storage ring, of which circumference is about 187m. In order to cover the whole location, total 10 optical fibers with the length of 30 m is used. Both ends of the fiber has been fed out of the radiation shield of the ring. The Cherenkov light produced by the electron which is not captured in the ring, is detected by a photomultiplier tube (PMT) attached on the upstream side of the fiber. Rise-time of the PMT of 5 ns is fast enough to determine the location of the beam loss point. In the KEK-PF, two kinds of injection system, kicker magnets and a pulsed sextupole magnet (PSM), has been used for the routine operation. In this paper, details of the loss monitor system are reported and the difference of the two injection system will be discussed.

TUPA11 **SSRF BPM System Optimization and Upgrade** - *Yingbing Yan, Yongbin Leng (SSRF, Shanghai)*
The beam position monitor (BPM) system at SSRF was fully equipped with Libera Electrons. It have operated steadily for nearly five years. During the summer shutdown of 2012 more than 50 Libera Electrons were upgraded to Libera Brilliance which are used mainly for fast obit feedback system. The software of whole system is upgraded from 1.42 to 2.07. Some other hardware and software optimizations are carried out. After this upgrade, the stability and performance have been improved significantly. This paper introduces the details of the optimization and upgrade.

TUPA12 **An On-line FPGA based Calibration Method on DBPM** - *Xudong Sun, Yongbin Leng (SINAP, Shanghai)*
An calibration method on the four channels of DBPM is discussed . Using interpolation, the method is implemented on FPGA , which can handle the data on-line. The calibration

algorithm is mono-channel dependent and is intended to solve the beam current dependence problem and increase resolution. Orientations of the method is presented. Basic design diagrams of the pipelined FPGA modules are listed and comparisons are made before and after the calibration both using PC and on-line FPGA. Experiments data at SSRF indicate this method works well.

TUPA13 Design Status of Beam Position Monitors for ADS Injector II Proton LINAC - *Yong Zhang, Xincai Kang, Min Li, Junxia Wu, Jingzhe Zhang (IMP, Lanzhou)*

Beam Position Monitors (BPM) based on capacitive pick-ups are designed for Accelerator-Driven System (ADS) Injector II proton LINAC. This LINAC is aiming to produce a maximum design current of 15 mA at the 10 MeV energy with an operating frequency of 162.5 MHz. Non-interceptive BPM will be installed to measure the transverse beam position and beam phase in the vacuum chamber. Depending on the location, the response of the BPMs must be optimized for a beam with an energy range from 2.1 up to 10 MeV and an average current between 0.01 and 15 mA. Apart from the broadening of the electromagnetic field due to the low-beta beam, specific issues are affecting some of the BPMs: tiny space in the transport line between the RFQ and the cryomodule and the cryogenic temperature inside the cryomodule. For this reason two types of BPMs are being designed for each location (MEBT and cryomoudle). In this contribution, the present status of the design of each BPM will be presented, focusing on the electromagnetic response for low-beta beams.

TUPA14 Development of a Cavity-type Beam Position Monitors with High Resolution for ATF2 - *Si-Won Jang, Ae-young Heo, Eun-San Kim (KNU, Deagu), Yosuke Honda, Toshiaki Tauchi, Nobuhiro Terunuma (KEK, Ibaraki), Ji-Gwang Hwang (Kyungpook National University, Daegu)*

We have developed a high resolution beam position monitors for ATF2 at KEK, which is an accelerator test facility for International Linear Collider(ILC). The main goals of ATF2 are achievement of 37nm beam size and 2nm beam position resolution for beam stabilization. For these goals, low-Q IP-BPM(Interaction Point Beam Position Monitor) with latency of 20 ns are being developed. In this paper, we will describe about design of Low-Q IP-BPM, the basics test results as RF test and BPM sensitivity test. An electronics for Low-Q IP-BPM will be

also described.

TUPA15 **Beam Postion Monitor for Energy Recovery Linac** - *Igor Pinayev (BNL, Upton, Long Island, New York)*
The energy recovery linacs have co-propagating beams in the same vacuum vessel. These beams can have different trajectories, which should be distinguished by beam position monitors (BPM). In this paper we present a concept of BPM utilizing the phase information for calculation individual position of each of the two beams (accelerating and decelerating). The practical realizations are presented and achievable accuracy is estimated.

TUPA16 **HOM Choice Study with Test Electronics for use as Beam Position Diagnostics in 3.9 GHz Accelerating Cavities in FLASH** - *Nicoleta Baboi, Bastian Lorbeer (DESY, Hamburg), Pei Zhang (DESY, Hamburg; UMAN, Manchester), Nathan Eddy, Brian Fellenz, Manfred Wendt (Fermilab, Batavia)*
Higher Order Modes (HOM) excited by the beam in the 3.9 GHz accelerating cavities in FLASH can be used for beam position diagnostics, as in a cavity beam position monitor. Previous studies of the modal choices within the complicated spectrum have revealed several options*: cavity modes with high coupling to the beam, and therefore with the potential for better position resolution, but which are propagating within all 4 cavities, and modes localized in the cavities or the beam pipes, which can give localized position information, but which provide worse resolution. For a better characterization of these options, test electronics has been built, which can down convert various frequencies between about 4 and 9 GHz to 70 MHz. The performance of various 20 MHz bands has been estimated. The best resolution of 20 μm was found for some propagating modes. Based on this study one band at ca. 5 GHz was chosen for high resolution position monitoring and a band at ca. 9 GHz for localized monitoring.

TUPA17 **The BPM Electronics Performance Measurement and Statistics for TPS** - *Pei-Chen Chiu, Kuo-Tung Hsu, Kuo Hwa Hu, Changhor Kuo (NSRRC, Hsinchu)*
The new BPM electronics Libera Brilliance Plus are developed for Taiwan Photon Source (TPS) which is a 3 GeV synchrotron light source constructed at NSRRC. This new BPM electronics can accommodate four BPM modules with integrated FPGA-based hardware. The preliminary test for the first arrival

unit had been performed in the TLS (Taiwan Light Source) and had shown nearly equal performance compared with Libera Brilliance. The extra 75 sets had been delivered in 2011 and 2012. Performance of each unit are individually tested and measured.

TUPA18 Development of Beam Position Monitors for the SPIRAL2 Linac - *Mohammed Ben Abdillah (IPN, Orsay)*

The SPIRAL 2 facility will be able to deliver stable heavy ion beams and deuteron beams at very high intensity, producing and accelerating light and heavy rare ion beams. The driver will accelerate between 0.15mA and 5 mA deuteron beam up to 20 MeV/u and also q/A=1/3 heavy ions up to 14.5 MeV/u. The accurate tuning of the LINAC is essential for the operation of SPIRAL2 and requires from the Beam Position Monitor (BPM) system the measurements of the beam transverse position, the phase of the beam with respect to the radiofrequency voltage and the beam energy. Twenty three BPM were realized for SPIRAL2. This paper addresses all aspects of the design, realization, and calibration of these BPM, while emphasizing the determination of the beam position and shape. The measurements on the BPM are carried out on a test bench in the laboratory: the position mapping with a resolution of 50 μm is performed and the sensitivity to the beam displacement is about 1.36dB/mm at the centre of the BPM. The characterization of the beam shape is performed by means of a special test bench configuration. An overview of the electronics under realization for the BPM of the SPIRAL2 Linac is given.

TUPA19 First Tests of a Low Charge uTCA-based Electronics for Button and Stripline BPM at FLASH - *Bastian Lorbeer, Nicoleta Baboi, Frank Schmidt-Foehre (DESY, Hamburg)*

Current FEL based light sources foresee operation with very short electron bunches. These can be obtained with charges of 100pC and lower. The specified charge range for FLASH, DESY, Hamburg goes from 100pC up to 1nC. The electronics currently installed at button and stripline BPMs of FLASH have been designed for best performance at higher charges and have reached their limits. Currently a new type of electronics is being developed at DESY to overcome these limitations. These electronics is/are conforming with the uTCA for physics standard(ref). This paper describes the next generation of FLASH BPM electronics suitable for button and stripline BPM. Furthermore the first measurement results taken with beam at

FLASH, DESY are presented here.

TUPA20 **Prototype Development of a Beam Position Monitor for Hadrontherapy Facilities and First Beam Test in the PS** - *Juan Jose Garcia-Garrigos, Carolina Belver-Aguilar, Cesar Blanch Gutierrez, Angeles Faus-Golfe (IFIC, Valencia), Maurice Haguenauer, Patrick Poilleux (LLR, Palaiseau)*
Beam Position Monitors (BPM) are crucial to control the beam in Hadrontherapy accelerators, especially in the secondary transport lines towards the patient room where the beam position must be determined with high precision. In this paper we describe the design and construction of a first prototype based on four scintillating fibers coupled to one photodiode each, to detect the light produced by the fibers when intercepting the beam tails. The results of the first beam test using a 6GeV proton beam from the PS accelerator at CERN are also presented. This beam test, jointly with a previous calibration test done with a radioactive source, has been served to evaluate the different design options of the prototype and its read-out electronic setup in order to define the best processing method to get the beam position.

TUPA21 **Optimization of Blade X-ray Beam Position Monitors for NSLS-II** - *Petr Ilinski (BNL, Upton, Long Island, New York)*
Blade X-ray Beam Position Monitors (XBPM) are used as a standard photon beam monitors for most third generation synchrotron radiation storage rings. Blade XBPMs characterized by good spacial resolution, but have some systematic drawbacks. Optimization of XBPMs blade material, geometry and operation principle was analyzed to improve blade XBPMs performance. Optimization is based on calculation of the XBPM signal spatial distribution.

TUPA22 **RF Front End for Cavity Beam Position Monitor based on ICs** - *Bao Peng Wang, Yongbin Leng, Luyang Yu, Renxian Yuan, Weimin Zhou (SINAP, Shanghai)*
RF front end has the significant impact on the performance of cavity beam position monitor (CBPM) which is indispensable beam instrumentation component in free electron laser(FEL) or linear collider facility. With many new advances in data converter and radio technology, complex RF front end design has been greatly simplified. Now based on digital intermediate frequency (IF) receiver architecture, a new RF front end for (CBPM) has been designed and fabricated using surface mount

component on print circuit board (PCB). The front end contains analog-digital converter used to digitize the IF signals. The whole system would be integrated to a digital board developed by our lab to produce the dedicated signal processor for CBPM. There is an Xilinx Vertex-5 FPGA device on the digital board and relevant signal processing algorithm has been implemented on it using VHDL. The details about design and test results would be introduced blow.

TUPA23 **Performance of a Downconverter Test-electronics with μTCA-based Digitizers for Beam Position Monitoring in 3.9GHz Accelerating Cavities** - *Thomas Wamsat (DESY, Hamburg)*
Beam excited higher order modes (HOM) in 3.9GHz accelerating cavities at the European XFEL are planned to be used for beam position monitoring. The selected HOMs are located around 5440MHz and 9060MHz and are filtered in a bandwidth of 100MHz. A downconverter test electronics converts the HOMs to an intermediate frequency of 70MHz. The μTCA (Micro Telecommunications Computing Architecture) standard will be used for the XFEL. Thus it is important to have a performance study of the downconverter test electronics using the μTCA digitizer card SIS8300. In the digitizer IF frequency of 70MHz is undersampled with a clock frequency of 108MS/s. The paper will present the performance of the digitizer together with the test-electronics. A comparison with a 216MS/s VME (Versa Module Eurocard) digitizer will be made.

TUPA24 **Design of Cavity BPMs for SwissFEL** - *Fabio Marcellini, Boris Keil, Martin Rohrer, Markus Stadler, Jerome Stettler, Daniel Marco Treyer (Paul Scherrer Institut, Villigen), Dirk Lipka, Dirk Noelle, Maike Pelzer, Silke Vilcins (DESY, Hamburg)*
SwissFEL is a 0.1nm hard X-ray Free Electron Laser being built at PSI. A photocathode gun, S-band injector and C-band linac provide 2 bunches at 28ns spacing, 10-200pC charge, and 5.8GeV maximum energy. A fast distribution kicker will provide one bunch each to one hard X-ray and one soft X-ray undulator line. For linac and undulators, first prototypes of dual-resonator cavity BPM pickups have been designed and fabricated. The pickups were optimized for low charge and short bunch spacing in the linac. Design considerations, simulation and first test results will be reported.

TUPA25 **Signal Transmission Characteristics in Stripline-Type Beam Position Monitor** - *Tsuyoshi Suwada (KEK, Ibaraki)*
New stripline-type beam position monitor (BPM) system is under development at the KEKB injector linac in order to measure transverse beam positions with a high precision less than 10 micron meters towards the Super KEKB-factory (SKEKB) at KEK. During the KEKB operation, conventional stripline-type BPMs with a position resolution of 0.1 mm have been working well. However, the high-precision BPM system is strongly required for the SKEKB operation to stably accelerate single-bunch electron and positron beams with high bunch charges of ˜5 nC/bunch, and also to keep the beam stability with higher brightness. The new stripline-type BPMs with large aperture compared with previously designed BPMs, which will be installed just after the positron production and capture section, have been designed. In this report, the basic design for fabricating the prototype stripline-type BPM, and, especially, theoretical analysis and experimental investigations on the signal propagation characteristics and performance along the stripling electrodes are described in detail on the base of a coupled-mode analysis of uniform coupled transmission lines.

TUPA26 **Development of New BPM Electronics for The Swiss Light Source** - *Waldemar Koprek, Raphael Baldinger, Robin Ditter, Boris Keil, Goran Marinkovic, Markus Roggli, Markus Stadler, Daniel Marco Treyer (Paul Scherrer Institut, Villigen)*
PSI is currently developing new BPM electronics for the Swiss Light Source (SLS). Although the present "DBPM1" system that was designed 12 years ago still allows to achieve excellent beam stability and uptime, the development of a new system is motivated by long-term maintenance, improved performance in line with increasing user requirements, and new features and functionality provided by latest electronics technology. The new electronics is based on a generic modular BPM electronics platform developed by PSI that will also be used for linac based FELs like European XFEL and SwissFEL. The hardware and firmware architecture of the present prototypes as well as first test results will be presented.

TUPA27 **Beam Test Results of Undulator Cavity BPM Electronics For The European XFEL** - *Markus Stadler, Raphael Baldinger, Robin Ditter, Boris Keil, Waldemar Koprek, Reinhold Kramert, Goran Marinkovic, Markus Roggli, Daniel Marco Treyer (Paul Scherrer Institut, Villigen), Dirk Lipka, Dirk Noelle, Maike Pelzer, Silke*

Vilcins (DESY, Hamburg)
The European X-ray Free Electron Laser (E-XFEL) will use dual-resonator cavity BPMs (CBPMs) in the SASE undulators to measure and stabilize the beam trajectory. The BPM electronics is developed by PSI, while the pickup mechanics is developed by DESY. First beam tests with three adjacent pickups have been performed. The system architecture and algorithms, achieved performance and noise correlation measurements of the present electronics prototypes will be presented.

TUPA28 **Ultra-fast Data Acquisition System for Coherent Synchrotron THz Radiation based on YBCO Film Detectors** - *Michele Caselle (KIT, Eggenstein-Leopoldshafen), Suren A. Chilingarian (FZ Karlsruhe, Karlsruhe)*
The ANKA synchrotron radiation source located at the Karlsruhe Institute of Technology in Germany operates in the energy range between 0.5-2.5GeV and provides coherent synchrotron radiation. To resolve the ultra-short terahertz pulses emitted by a single bunch, thin YBCO superconducting film detectors have been developed. A response time of 45ps was determined as the FWHM of the voltage transient at the output of the analog amplifier. A novel and high accuracy data acquisition architecture for sampling of the individual ultra-short terahertz pulses for coherent synchrotron radiation is presented.The high bandwidth acquisition chain consists of wide bandwidth low noise amplifier connected to a high-speed digitizer board. The digitizer board is a made-in-house board designed for sampling of the fast pulse signals with pulse width between few tens of picosecond until 100ps.A prototype setup with terahertz detectors,digitizer boards and the highthroughput FPGA framework has been successfully developed and tested at ANKA. The overview of the experimental setup including the YBCO detector technology and the preliminary results with single and multibunch filling pattern will be discussed.

TUPA29 **Implementation of an FPGA Based System Survey and Diagnostic Reader with the Aim to Increase the System Dependability** - *Marcel Alsdorf, Bernd Dehning, Maciej Kwiatkowski, William Vigano, Christos Zamantzas (CERN, Geneva)*
The operation and machine protection of accelerators practically rely on their underlying instrumentation systems and a failure of any of those systems could pose a significant impact on the overall reliability and availability. In order to improve the detection and in some cases the prevention of failures, a survey

mechanism could be integrated to the system that collects crucial information about the current system status through a number of acquisition modules. The implementation and integration of such a method is presented with the aim to standardize the implementation, where the acquisition modules share a common build and are connected through a standardized interface to a survey reader. The reader collects regularly data and controls the readout intervals. The information collected from these modules is used locally in the FPGA device to identify critical system failures and results in an immediate failsafe reaction with the data also transmitted and stored in external databases for offline analysis.

TUPA30 **Development of a Beam Loss Measurement System with Gigabit Ethernet Readout at CERN** - *Maciej Kwiatkowski, Marcel Alsdorf, Emmanouil Angelogiannopoulos, Bernd Dehning, Stephen Jackson, William Vigano, Christos Zamantzas (CERN, Geneva)*
The aim of the BLM Dual Polarity card under development at the European Organisation for Nuclear Research (CERN) is to measure and digitise with high precision the current produced by several types of beam loss detectors. In its default configuration, it is expected to provide data to the processing electronics through two point-to-point connections with bidirectional multi-gigabit optical links. For the development phases as well as later serving as a stand-alone measurement system, its reconfigurable FPGA device is exploited to provide a soft-core CPU with a custom made server. This server, running on the CPU, will expose through the Gigabit Ethernet connection and the TCP/IP protocol different types of data in the network. In this paper the development of the system and of the communication protocol is explored as well as the accompanying client application that is realised with the purpose of commanding, collecting storing and viewing the different types of data.

TUPA31 **A Real-Time FPGA Based Algorithm for the Combination of Beam Loss Acquisition Methods used for Measurement Dynamic Range Expansion** - *Christos Zamantzas, Marcel Alsdorf, Bernd Dehning, Maciej Kwiatkowski, William Vigano (CERN, Geneva)*
The aim of the Beam Loss Monitoring Dual Polarity (BLEDP) module under development at the European Organisation for Nuclear Research (CERN) is to measure and digitise with high precision the current produced by several types of beam loss detectors. The BLEDP card consists of eight analogue channels

each with a fully differential integrator and an accompanying 16 bit ADC at the output of each analogue integrator. The on-board FPGA device controls the integral periods, instructs the ADC devices to perform measurements at the end of each period and collects the measurements. In the next stage it combines the number of charge and discharge cycles accounted in the last interval together with the cycle fractions observed using the ADC samples to produce a digitized high precision value of the charges collected. This paper describes briefly the principle of the fully differential integrator and focuses on the algorithm employed to process the digital data.

TUPA32 **Signal Equalizer for SPS Ecloud/TMCI Instability Feedback Control System** - *Kristin Pollock, John Dusatko, John Fox, Daniel Van Winkle (SLAC, Menlo Park, California), Raffaello Secondo (CERN, Geneva)*

The 4GS/sec electron cloud and transverse mode coupled instability (TMCI) control system in development for the CERN Super Proton Synchrotron (SPS) requires 1.5GHz of processing bandwidth for the beam pickups and signal digitizer. An exponentially tapered stripline pickup has sufficient bandwidth, but has a phase response that distorts the beam signal in the time domain. We report on results from the design and implementation of an equalizer for the front end signal processing with correction for the pickup and cable responses. Using a model of the transfer functions for the pickups and the cabling, we determine a desired frequency response for the equalizer. Design for the circuitry, component value fitting is discussed as well as board construction and reduction of parasitic impedances. Finally, we show results from the measurement of an assembled equalizer, compare them with simulations and show beam signals from use at the SPS.

TUPA33 **Fast Orbit Feedback Calculation Implementation for TPS** - *Peter Leban, Ales Bardorfer, Rok Hrovatin (I-Tech, Solkan), Kuo-Tung Hsu, Changhor Kuo (NSRRC, Hsinchu)*

Fast orbit feedback (FOFB) application is planned for the Taiwan Photon Source (TPS) at storage ring commissioning. Part of the application is transferred to the beam position electronics which implements global orbit position data concentration, its processing and optical outputs to the magnet power supply controllers with new setpoints. The beam position electronics (Libera Brilliance+) includes gigabit data exchange (GDX) modules with Virtex6 field programmable gate array. The

feedback calculation algorithm is based on the SVD - the PI controller will be applied in the modal space for individual eigenmodes. The calculation will be distributed to all GDX modules to reduce overall latency. Each GDX module will calculate either 4 vertical or 4 horizontal directions. This article presents details about the FOFB topology and implementation in the GDX module.

TUPA34 Inverse Response Matrix Computation for the Storage Ring Slow Orbit Feedback Control: Synthesized Topological Inversion Computation - *Jay Min Lee, Jung Yun Huang, Changbum Kim (PAL, Pohang, Kyungbuk)*

Using the derivative response matrix between BPM-data and MPS-setting, we described the inverse computation methodology for the storage ring orbit feedback control. Practically useful for SOFB with assistance of FOFB, the inverse of SVD manipulation is less efficient because a type of consecutive instability noise irreversibly accumulates in the beam trajectory deviation. In contrast, a novel numerical recipe based on topological math can lead to a self-consistent solution, dramatically suppressing ill-posed instability problems. This approach, known as a singularity regularization method, makes it feasible to compute a system-matched de-noising filter. The response matrix in H/V dimensions reflects a global beam dynamics along the storage ring lattices. Matrix refinement manipulatcan can be made to filter out the uncertainty of measurement errors escaping from beam dynamics constraints. Then we believe that algorithm filter can be effective as a software part of FOFB control. Our math STIC (Synthesized Topological Inversion Computation*) appears to be the most reliable inverse computation methodology. Our PLS-2 response matrix will be presented to explain our ORBIT-STIC test.

TUPA35 Digital Longitudinal Bunch-by-bunch Feedback System for the HLS II* - *Wubin Li, Ping Lu, Bao-gen Sun, Fangfang Wu, Wei Xu, Yongliang Yang, Ze Ran Zhou, Junying Zou (USTC/NSRL, Hefei, Anhui)*

In order to suppress the longitudinal coupled bunch instabilities, a digital longitudinal bunch-by-bunch feedback system will be developed in the upgrade project of Hefei Light Source (HLS II). The longitudinal feedback system consists of a pickup BPM, a front-end signal processor unit to detect the phase errors of all electron bunches, an iGp signal processor to calculate correction signals of those bunches, an RF power amplifier, and

a longitudinal kicker to supply proper correction energy kicks to individual bunches. A new waveguide overloaded cavity longitudinal feedback kicker has been designed with broadband and high shunt impedance. In this paper, we describe an overview of the new longitudinal feedback system.

TUPA36 **A 4 GSa/s Bunch Slice Feedback Processor Demonstrator for the SPS** - *John Dusatko, John Fox, Claudio Hector Rivetta, Ozhan Turgut (SLAC, Menlo Park, California)*

Intra-bunch instabilities driven by the presence of electron cloud and transverse mode coupled instabilities (TMCI) at the CERN Super Proton Synchrotron (SPS) have been observed with LHC beam, and are an area of concern. To date, efforts to understand and mitigate this effect have included numerical simulations of the instabilities and models of possible feedback control methods. An experimental program in 2011 used a 4 GSa/s excitation system to successfully drive head-tail modes within a single SPS proton bunch. The next step to control intra-bunch instabilities is the development of a 4 GSa/s DSP system to investigate closed loop control on a small number of bunches in the SPS. We present a system architecture and implementation outline for this transverse feedback channel. This processor uses a commercial FPGA board with custom-designed ADC and DAC daughterboards for the wideband input pickup/receiver and kicker signal output stages. The system is reconfigurable to allow evaluation of possible feedback control filter algorithms (FIR, IIR, etc.). This paper describes the design of this system, with a focus on the development of the signal processing hardware.

TUPA37 **FPGA Based Fast Orbit Feedback System for the Australian Synchrotron** - *Yaw-Ren Eugene Tan, Terry Cornall, Stephen A. Griffiths, Sean Murphy, Emmanuel Vettoor (ASCo, Clayton, Victoria)*

An initial design for a Fast Global Orbit Feedback System based on FPGAs has been proposed for the Australian Synchrotron Light Source (ASLS). The design uses a central processor (Xilinx Virtex 6) for all the computations and fast optical connections to distribute the computed data to corrector magnet power supplies. The network topology consists of two fibre optic rings. The first ring is used by the Libera Electron's to aggregate the beam position data at 10 kHz using Instrumentation Technologies' Grouping algorithm. The second ring is used to transmit the computed data. The cycle frequency of the

feedback is 10 kHz with a targeted total latency of under 350 us. We shall give an overview of the design goals and discuss the merits of the current implementation. We shall also present the measured bandwidth of the stainless steel vacuum chamber and test results from initial prototyping work.

TUPA38 **Current Status and Development Plan for RF Distribution and Control System of SPS Linac** - *Roengrut Rujanakraikarn (SLRI, Nakhon Ratchasima)*

The Siam Photon Source (SPS) is a dedicated synchrotron radiation facility in Nakorn Ratchasima, Thailand. SPS routinely serves various users with beam energy of 1.2 GeV. Its 40 MeV linac has been operated for beam injection since the first light in December 2001. With an increasing user demand, the improved stability and efficiency of the SPS linac is absolutely necessary. In this report the RF distribution and phasing system of SPS linac is described, which includes the system design and current operation status. We also present a plan to upgrade the hardware of the waveguide power attenuator and phase shifter, to develop the phase and amplitude detection unit for each acceleration unit, and to implement the phase and amplitude control system of the linac.

TUPA39 **Bunch Length Measurements of High Brightness Electron Beams in the Single-shot Mode** - *Gerard Andonian (UCLA, Los Angeles, California), Jayakar Charles Tobin Thangaraj (Fermilab, Batavia), Alex Murokh, Marcos Ruelas (RadiaBeam, Santa Monica)*

The determination of bunch length in the single-shot mode is critical for many advanced accelerator and light source facilities as ultra-short beams become more ubiquitous. These short beams (sub-ps) typically emit coherent radiation via transition radiation (or synchrotron or edge radiation) in the terahertz (THz) frequency range. The Real-Time interferometer (RTI) is a solid-state, spatial interferometer that incorporates terahertz optics and a novel linear, pyroelectric detector array that generates single-shot interferograms that are directly correlated to the beam bunch length. The device has been tested for coherent sources in the IR, and recently demonstrated at the Fermilab A0 test facility [1]. In this paper, we review the physical concepts, recent results, and potential future applications at both the Brookhaven National Laboratory Accelerator Test Facility and the SLAC National Laboratory FACET facility.

TUPA40 High Resolution Bunch Profile Determination with an X-band Deflecting Cavity - *Gerard Andonian (UCLA, Los Angeles, California), Ronald Agustsson, Luigi Faillace, Alex Murokh, Marcos Ruelas (RadiaBeam, Santa Monica)*

The determination of the longitudinal profile of high-brightness beams on the ˜fs scale is important for many present-day applications that employ ultra-short beams. A direct method to measure the beam profile in the temporal domain utilizes a transverse cavity operating in the zero-crossing mode. Here we present the development and commissioning results of an x-band deflecting cavity that is currently installed at the Brookhaven National Laboratory Accelerator Test Facility. Initial studies and simulations show that a temporal resolution of <10fs is achievable. In addition, we propose a method to enhance this resolution to the sub-fs scale with the addition of a laser-modulator (a high-power laser and an undulator) to impose an angular modulation on the beam. This modulation, in tandem with the transverse cavity, is resolvable on a distant screen; simulations show that temporal resolutions on the sub-fs scale are achievable.

TUPA41 Ultra-short Electron Bunch and X-ray Temporal Diagnostics with an X-band Transverse Deflecting Cavity - *Patrick Krejcik, Yuantao Ding, Josef Frisch, Zhirong Huang, Henrik Loos, Juwen W. Wang, Min-Huey Wang (SLAC, Menlo Park, California), Christopher Behrens (DESY, Hamburg), Paul J. Emma (LBNL, Berkeley, California)*

The technique of streaking an electron bunch with a RF deflecting cavity to measure its bunch length is being applied in a new way at the Linac Coherent Light Source with the goal of measuring the femtosecond temporal profile of the FEL photon beam. A powerful X-band deflecting cavity is being installed downstream of the FEL undulator and the streaked electron beam will be observed at an energy spectrometer screen at the beam dump. The single-shot measurements will reveal which time slices of the streaked beam have contributed to the FEL process by virtue of their greater energy loss and energy spread relative to the non-lasing portions of the electron bunch. Since the diagnostic is located downstream of the undulator it can be operated continuously without interrupting the beam to the users. The resolution of the new X-band system will be compared to the existing S-band RF deflecting diagnostic systems at SLAC and consideration is given to the required RF phase stability tolerances required for acceptable beam jitter on

the monitor. Simulation studies show that about 1 fs (rms) time resolution is achievable in the LCLS over a wide range of FEL wavelengths and pulse lengths.

TUPA42 **Beamline Optimisation and Image Processing for sub-ps Streak Camera Bunch Length Measurement** - *Cyrille Thomas, Guenther Rehm (Diamond, Oxfordshire), Ian Martin (JAI, Oxford)*
Low alpha beam lattice at Diamond can generate bunch length as small as 0.6ps. In order to be able to measure reliably such a short bunch, we have been optimising the optical design of the visible Diagnostics beamline, and we have implemented image processing, taking into account the point spread function of the streak camera. The beamline optical design has removed a large chirp of 15ps/150nm bandwidth to 2ps /200nmbandwidth. It has also permit the transport of almost all the available power, increasing the power by a factor 20, yet maintaining the possibility to focus the beam down to less than 20um into the streak camera for the best static streak camera point spread function. The deconvolution technique implemented extends the performance of the streak camera to bunch length measurement much smaller than the 1ps PSF of the streak camera. In this paper we present these two essential features required to measure sub-ps bunched with a streak camera.

TUPA43 **First Operation of the Electro optical Sampling Diagnostics of the FERMI@Elettra FEL** - *Marco Veronese, Alessandro Abrami, Maurizio Bossi, Miltcho B. Danailov, Mario Ferianis, Sandi Grulja, Mauro Predonzani, Fabio Rossi (ELETTRA, Basovizza)*
The FERMI @Elettra seeded FEL has demanding synchronization requirements and therefore an accurate knowledge of longitudinal beam properties is of high importance, both for the time profile and time jitter of the electron beam at the entrance of the undulator chain. To fulfill this requirement, an electro optical sampling (EOS) station based on the spatial encoding scheme has been designed and installed in the FEL1 chain of FERMI. The paper describes the design criteria of this system, its specific features and the first operational measurement results obtained. This diagnostics allows for temporal coarse alignment of the seed laser with the electron beam. This feature is described and results are discussed. Finally, the paper provides also the guidelines for future developments foreseen for this system.

TUPA44 **Status of the LCLS Experiment Timing System** - *Josef Frisch, Justin May, Stephen Smith (SLAC, Menlo Park, California)*
X-ray / optical laser pump - probe experiments are used for a significant fraction of the scientific work performed at LCLS. The experimental laser systems are locked to the timing of the electron beam through a combination of RF and optical fiber based systems. The remaining ~100 femtosecond RMS jitter of the X-rays relative to the optical laser is measured shot-to-shot by both a RF timing detector, and by direct X-ray to optical cross-correlation, and the result is used to correct the experiment timing to 10s of femtoseconds. We present the present status of the system and plans for future upgrades.

TUPA45 **Intense Broadband Terahertz Radiation from LCLS and FACET at SLAC** - *Alan Stephen Fisher, Matthias Fuchs, John Joseph Goodfellow, Jerry LaRue, Ziran Wu (SLAC, Menlo Park, California), Dan Daranciang (Stanford University, Stanford, California), Aaron Lindenberg (Stanford University, Stanford, California; SLAC, Menlo Park, California)*
At SLAC both LCLS and FACET produce highly compressed electron bunches well suited to producing. At the LCLS x-ray free-electron laser, 13-GeV bunches of up to 0.35 nC, compressed to 20 fs RMS, generate intense broadband terahertz radiation by coherent transition radiation when passing through a 10-micron-thick beryllium foil 30 m downstream of the undulator. FACET, a user facility for advanced acceleration experiments, runs with 20-GeV, 3-nC bunches compressed to 80 fs. THz is again generated by CTR when the beam passes through a 1-micron titanium foil 10 m upstream of the experimental table. We will report on these sources and on spectral measurements used to find the longitudinal profiles. We are beginning studies of electro-optic and ferro-electric materials using THz and a fs Ti:sapphire laser, and of THz-driven catalysis. A 40-m-long transport line is planned to bring THz from the FACET tunnel to a user hutch. This may be followed by a 100-m line to transport THz to LCLS users in the experimental hall.

TUPA46 **Streak Camera Measurements at ALBA: Bunch Length and Energy Matching** - *Ubaldo Iriso, Ferran Fernandez (CELLS-ALBA Synchrotron, Cerdanyola del Vallès)*
This report describes the electron beam longitudinal studies performed at ALBA Storage Ring using the streak camera. We first show the usual studies involving precise bunch length

measurements and related beam parameters like energy spread or momentum compaction factor. Next, the studies to match the injected beam in energy and phase are reported and compared with simulations.

TUPA47 **Middle-Infrared Prism Spectrometer for Single-Shot Bunch Length Diagnostics at the LCLS** - *Timothy John Maxwell, Yuantao Ding, Alan Stephen Fisher, Josef Frisch, Sasha Gilevich, Henrik Loos (SLAC, Menlo Park, California), Christopher Behrens [on leave] (DESY, Hamburg)*

Modern high-brightness accelerators such as laser plasma wakefield and free-electron lasers continue the drive to ever-shorter bunches. At low-charge (< 20 pC), bunches as short as 10 fs are reported at the Linac Coherent Light Source (LCLS). Advanced time-resolved diagnostics approaching the fs-level have been proposed requiring the support of rf-deflectors, modern laser systems, or other complex systems. Though suffering from a loss of phase information, spectral diagnostics remain appealing by comparison as compact, low-cost systems suitable for deployment in beam dynamics studies and operations instrumentation. Progress in mid-IR imaging and detection of the corresponding micrometer-range power spectrum has led to the continuing development of a single-shot, 1.2 - 40 micrometer prism spectrometer for ultra-short bunch length monitoring. In this paper we report further analysis and experimental progress on the spectrometer installation at LCLS.

TUPB48 **Beam Instrumentation for COSY Electron Cooler** - *Vsevolod Kamerdzhiev, Lijun Mao, Karl Reimers (FZJ, Jülich), Evgeniy Bekhtenev, Valentin Bocharov, Maxim Igorevich Bryzgunov, Alexander Bubley, Gennady Karpov, Vladimir Panasiuk, Vasily Parkhomchuk, Vladimir Borisovich Reva (BINP SB RAS, Novosibirsk), Juergen Dietrich (HIM, Mainz)*

The report deals with beam instrumentation of the electron cooler for COSY storage ring. The electron cooler is an electrostatic accelerator designed for beam energy up to 2 MeV and electron current up to 3 A with recuperation. The electron beam is immersed in longitudinal magnetic field so the electron motion is strongly magnetized. The near-cathode electrode in the electron gun is composed of four electrically isolated sectors. Applying AC voltage to one sector allows tracing of motion of that particular part of the beam. The electron beam shape is registered with the combination of 4-sector electron

gun and the BPMs. This method allows observing both dipole and quadruple (galloping) modes of electron beam oscillation. Compass probe for measuring and tuning the direction of magnetic field in the cooling section is described. A profile monitor based on few small faraday caps for measuring distribution of the electron beam is presented.

TUPB49 **Electron Cloud Density Measurements Using Resonant TE Waves at CesrTA** - *John Sikora, Michael Gerard Billing, Danielle Oleda Duggins, David Rubin, Robert Schwartz, Kiran G. Sonnad (CLASSE, Ithaca, New York), Stefano De Santis (LBNL, Berkeley, California)*

The Cornell Electron Storage Ring has been reconfigured as a test accelerator (CesrTA) with beam energies ranging from 2 GeV to 5 GeV of either positrons or electrons. Research at CesrTA includes the study of the growth, decay and mitigation of electron clouds in the storage ring. Electron Cloud (EC) densities can be measured by resonantly exciting the beam-pipe with microwaves. The EC density will change beam-pipe's resonant frequency by an amount that is proportional to the local electric field squared of the standing waves. When the EC density is not uniform, it is especially important to know the standing wave pattern in order to obtain an absolute EC density measurement. We will present our current understanding of this technique in the context of new test sections of beam-pipe installed in August 2012. This will include bench measurements of standing waves in the beam-pipe, simulations of this geometry and recent EC density measurements with beam.

TUPB50 **Development of the GSI Beam Instrumentation for FAIR Facility** - *Piotr Kowina, Christiane Andre, Christoph Dorn, Peter Forck, Kai Guetlich, Wolfgang Kaufmann, Marcus Schwickert, Beata Walasek-Hoehne (GSI, Darmstadt), Rahul Singh (GSI, Darmstadt; TEMF, TU Darmstadt, Darmstadt), Benjamin Zwicker (TU Darmstadt, Darmstadt; GSI, Darmstadt)*

Most challenging for beam instrumentation at FAIR facility is the required high flexibility due to the parallel operation with the beams of different ion species and extremely different beam intensities. This contribution gives an overview of the selected beam diagnostics methods that are under development at GSI in the perspective of FAIR: i) The optimization of the beam injection chain consisting of two linacs is focused on the monitoring of the longitudinal bunch shape and the

measurements of the momentum spread by analysis of the incoherent components of the bunch signals. ii) Determination of transversal profiles of the high current ion beams at linear accelerators and transfer lines requires minimal intercepting method. The methods based on OTR fulfilling these requirements were successfully applied in the recent tests. iii) The development of the synchrotron beam diagnostics is focused on design validation of the cryogenic BPM. In addition measurements and interpretation of the transversal beam motions for intense beams were performed. This allowed the precise determination of the coherent and incoherent tune shift and other relevant beam and machine parameters.

TUPB51 **Gatling Gun Test Stand Instrumentation** - *David Mark Gassner, Ilan Ben-Zvi, Cliff Brutus, Alexander I. Pikin, John Skaritka, Michelle Wilinski (BNL, Upton, Long Island, New York)*
In order to reach the design eRHIC luminosity 50mA of polarized electron current is needed. This is far beyond what the present state-of-the-art polarized electron cathode can deliver. A high average polarized current injector based on the Gatling Gun principle is being designed. This technique will employ multiple cathodes and combine their multiple bunched beams along the same axis. A proof-of-principle test bench will be constructed that includes a 220 keV Gatling Gun, beam combiner, diagnostics station, and collector. The challenges for the instrumentation systems and the beam diagnostics that will measure current, profile, position, and halo will be described.

TUPB52 **Optical Diagnostic System for the Photon Factory Storage Ring** - *Ryota Takai, Takashi Obina, Mikito Tadano (KEK, Ibaraki)*
Visible synchrotron radiations emitted from two different bending magnets have been used for the optical beam diagnostics at the Photon Factory storage ring. One of these radiations is relayed to an optical hutch where the focusing system and double-slit interferometers are installed, and utilized for the constant monitoring of the transverse beam profile and beam size. The other radiation is transferred to another hutch equipped with the fast-gated camera and streak camera in order to measure the turn-by-turn beam profile, injected beam oscillation, bunch length, and so on. An overview of these optical diagnostic systems as well as some recent results obtained with them will be given in this paper.

TUPB53 **Abort Diagnostics and Analysis during KEKB Operation** - *Hitomi Ikeda, John Walter Flanagan, Takaaki Furuya, Makoto Tobiyama (KEK, Ibaraki), Manabu Tanaka (MELCO SC, Tsukuba)*

KEKB has stopped since June 2010 for upgrading the luminosity 40 times, i.e. SuperKEKB. During the operation of 11 years, a pair of controlled beam abort systems worked more than 10000 times to protect the hardware components of KEKB accelerator and the detector against the high intensity beams of LER and HER. Optimization of the abort trigger was necessary to balance efficient operation with the safety of the hardware. Therefore, we analyzed one-by-one all of the aborts, and continually adjusted the abort system. The diagnostic system was based on a high-sampling-rate data logger that recorded beam currents, RF signals and beam loss monitor signals. The beam oscillation signals, vacuum pressure and detector dose rate were also examined. This paper describes the typical abort causes, optimizations of abort levels, and abort statistics over approximately eight years after having arrived at high beam current operation.

TUPB54 **The Radioactive Beam Diagnostics at LNS - INFN** - *Luigi Cosentino (INFN/LNS, Catania)*

At LNS - INFN Catania, two complementary facilities for Radioactive Ion Beams have been developed in recent years. They exploit the two techniques known as Isotope Separation On Line (ISOL) and In Flight Fragmentation, with a primary beam accelerated by means of the LNS Superconducting Cyclotron. EXCYT makes use of the ISOL technique to produce the radioactive beams, with an energy up to 7 AMeV. FRIBs uses the In-Flight technique, with an energy up to 60 AMeV. The intensity is well below to the levels of the standard stable beams, being tipically below 10^6 pps. The standard beam diagnostics cannot be used, because of the low signal to noise ratio. An efficient beam diagnostics has been therefore developed and installed, well suited for our low intensity radioactive beams. It permits an accurate check in real time of the beam, such as the profiles, the intensity and the isotope identification along the beam lines, thus allowing the optimization of the transmission until to the experimental halls. The devices are based on nuclear particle detectors, in particular on position sensitive silicon detectors (PSSD), germanium detectors, scintillators and scintillating optical fibres.

TUPB55 **S-band Timing Diagnostic at the LCLS** - *Dorian Keith Bohler (SLAC, Menlo Park, California)*
Timing and synchronization at the LCLS is a multiple tiered process with various hardware and software systems, which are functionally independent. This autonomy has resulted in timing errors observed by LCLS users. Coherent laser timing jumps have occurred during cycles of unlocking-locking the Femtolock box. The software does not monitor the state of the Femtolock and these jumps occur when the laser SPAC (on 476 MHz) rotates the reference phase larger than 350ps (one cycle of 2856 MHz). A diagnostic was developed to accurately measure the time difference between the timing fiducials and the beam-induced signal from the toroids in the LCLS injector. This diagnostic has a timing has 40ps and detects these timing jumps as they occur.

TUPB56 **MicroTCA.4: a New Standard for Diagnostics and Controls** - *Kay Rehlich (DESY, Hamburg)*
MTCA.4 was released in Oct 2011 as a new standard based on MicroTCA with extensions for rear IO and precision timing. The MTCA.4 standard was driven by several accelerator labs together with industrial partners within the PICMG. It provides a higher degree of modularization compared to other crate systems. Complex designs with FPGA interfaces to PCIe on the front side of a crate can be interfaced by application specific signal conditioning or processing on the rear side. Even high performance RF front-ends could be implemented on a rear module. And the new standard defines precision clock and trigger distribution within a shelf. Furthermore, full remote management on the crate and slot level is available. Diagnostic electronics require a clean environment for sensitive signal processing and high speed data transfers to cope with increasing ADC sampling rates and fast feedbacks. High quality and high performance of analog signal processing was recently demonstrated. The highlights of the new MTCA.4 standard as well as experience and results with the first systems in the field will be described.

TUPB57 **Extreme Light Infrastructure - Research and Technology on New Short Pulse Intense Laser driven X-ray Sources** - *Lukas Pribyl (Czech Republic Academy of Sciences, Prague), Stephane Sebban (LOA, Palaiseau)*
We will be giving an overview on the development of the 'ELI-Beamline facility', which will be a high-energy,

repetition-rate laser pillar of the ELI (Extreme Light Infrastructure) project. It will be an international facility for both academic and applied research, slated to provide user capability since the beginning of 2016. The main purpose of the facility is the generation and applications of laser driven high-brightness X-ray sources and accelerated particles (electrons, protons and ions). The laser system will be delivering pulses with length ranging between 10 and 150 fs and will provide high-energy Petawatt and 10-PW peak powers. We will concentrate on the development of short photon wavelength (20 eV-100 keV) laser driven sources and their practical implementation. The sources are either based on direct interaction of the laser beam with a gaseous or solid target or will first accelerate electrons which then will interact with laser produced wigglers or directly injected into undulators. The main planned short pulse laser driven x-ray sources and their parameters will be presented together with requirements on the relevant beam detectors.

TUPB58 **Design Status of the Diagnostic System for the RISP Driver Linac** - *Hyung Jin Kim, JaeEun Han, Dong-O Jeon (IBS, Daejeon)*

Rare Isotope Science Project (RISP) has been proposed as a multi-purpose accelerator facility for providing beams of exotic rare isotopes of various energies. The RISP driver linac which is used to accelerate the beam, for an example, Uranium ions from 0.3 MeV/u to 200 MeV/u consists of superconducting RF cavities and warm quadrupole magnets for focusing heavy ion beams. Requirement of diagnostic system is especially high for the RISP commissioning and operation. Design of diagnostic devices such as beam profile monitors, beam current monitors (BCM), Faraday cups, emittance scanners, bunch shape monitors (BSM) are under way. In this paper, we summarize in detail current status of the RISP beam instrumentation.

TUPB59 **Beam Diagnostics of Injector Test Facility for PAL XFEL** - *Sung-Ju Park, Hyojin Choi, Jae-Young Choi, Jang Hui Han, Juho Hong, Heung-Sik Kang, Changbum Kim, In Soo Ko (PAL, Pohang, Kyungbuk), MoonSik Chae (POSTECH, Pohang, Kyungbuk), Alex Murokh (RadiaBeam, Santa Monica)*

We are constructing an injector test facility (ITF) for the PAL XFEL. The target of the facility is to demonstrate an emittance of < 0.5 mm mrad (projected, normalized rms) at the beam charge of 200 pC with small energy spread and high stablities. By collaborating with the RADIABEAM Technologies*, we have

developed beam diagnostics with enough precision and reliability to provide beam information including beam energy, energy spread, charge, profile, position, and bunch length. Resolutions of the beam-size and position measurements will be 17.5 um (rms, for OTR screens) and < 10 um (rms) respectively. A S-band transverse deflecting cavity will be used for measuring the bunch length with resolution down to 10 fs. In this article we report on current status of the PAL-XFEL injector test facility with emphases on its beam diagnostics.

TUPB60 **Beam Diagnostics of Central Japan Synchrotron Radiation Research Facility Accelerator Complex** - *Masahito Hosaka, Kiyoshi Takami, Yoshifumi Takashima, Naoto Yamamoto (Nagoya University, Nagoya), Masahiro Katoh (UVSOR, Okazaki)*
A new synchrotron radiation facility, Central Japan Synchrotron Radiation Research Facility is built in Aichi area. The light source accelerator complex consists of a 1.2 GeV compact electron storage ring and a full energy injector for top-up operation. The key equipments of the accelerator are four 5 T superconductive bending magnets. Although the acceleration energy of the storage ring is relatively low, synchrotron radiation from the superconductive bending magnet reaches hard X-ray region and can be provided for more than 10 beamlines. Construction of the facility started in 2010 and finished in Apr. 2012. Commissioning of the accelerator complex started in Mar. 2012. We adapted a turn-by-turn beam position monitoring system based on a digital oscilloscope developed at the UVSOR. In the presentation, we report on details of beam diagnostics conducted during the commissioning.

TUPB61 **First Experience with the LHC Beam Gas Ionisation Monitor** - *Mariusz Sapinski, William Andreazza, Vincent Baglin, Francois Bellorini, Didier Calegari, Bernd Dehning, Ana Guerrero, Marcin Patecki, Reine Versteegen (CERN, Geneva)*
The Beam Gas Ionisation Monitors (BGI) are used to continuously measure the beam size at the LHC. This paper describes the detectors and their operation and discusses the issues encountered during the commissioning. It also discusses the various calibration procedures used to correct for non-uniformity of Multi-Channel plates and to correct the beam size for effects affecting the electron trajectory after ionisation.

TUPB62 **Transverse Emittance Measurement using Slit-Grid** - *Min Li, Peng Li, Ruishi Mao, Junxia Wu, Jingzhe Zhang, Yong Zhang, Tiecheng Zhao (IMP, Lanzhou)*

There are several ways to measure the beam transverse emittance. In this paper, the slit-grid emittance measurement device was proposed. The slit-grid is a one dimensional emittance measurement device. During the measurement, the slit, driven by the stepper motor is moved stepwise across the beam, and then the signal induced on the grid will be stored in the computer for further analysis. Because slit-grid is one dimensional device, two sets of this device are needed for transverse measurement. In this paper, we introduce the design, parameters, data acquisition and analysis for this measurement. Especially the software integration is given in this paper. The software development for emittance front-end control and data analysis is based on the labview language. The slit-grid device was tested at the 320kV high voltage platform in Lanzhou. The tested results were also presented in this paper.

TUPB63 **Development of Turn-by-turn Beam Diagnostic System using Undulator Radiation** - *Mitsuhiro Masaki, Akira Mochihashi, Haruo Ohkuma, Shiro Takano, Kazuhiro Tamura (JASRI/SPring-8, Hyogo-ken)*

At the diagnostic beamline II (BL05SS) of the SPring-8 storage ring, a turn-by-turn beam diagnostic system using undulator radiation has been developed to observe fast phenomena such as stored beam oscillations during the top-up injections, blowups of beam size and energy spread coming from the instabilities of a high current single bunch and so on. The fast diagnostic system observes a spatial profile of the undulator radiation on a selected harmonic number. Especially, the higher harmonic radiations than the 10th-order are sensitive to the energy spread. A fluorescence screen (YAG:Ce) with afterglow of several tens of nano-second converts the radiation profile into visible light image. The imaging optics makes the horizontal and vertical profiles as two line images by one-dimensional focusing using cylindrical lenses. A fast-gated CCD camera with image intensifier simultaneously captures the two line images. The kinetics readout mode of the fast CCD camera is used to register the spatial profiles of several tens of turns in one flame. The principle and experimental setup of the turn-by-turn diagnostic system, and examples of beam observations will be presented.

TUPB64 **Methods to Reduce the System Error for High Power MSSW Emittance** - *Shi Xiang Peng, Jia Chen, Zhiyu Guo, Pengnan Lu [on leave], Haitao Ren, Yuan Xu, Zhong Xi Yuan, Jie Zhao (PKU/IHIP, Beijing)*

Recently a new Multi-Slit Single-Wire (MSSW) type high power beam emittance meter named as HIBEMU-5 has developed in Peking University (PKU). Compared to previous MSSW devices, HIBEMU-5 greatly reduced the system error from 16.4% to 3.7% by specific designs to solve the incomplete short-slit sampling and fixed slit-wire distance. The problems of previous PKU devices are analyzed in part one. In part two, we describe the specific updating methods to solve its short-slit disadvantage by re-designing a longer-slit board with sufficient cooling, detail the mechanical scheme of changing the slit-wire distance for different beam divergence. The commissioning results given at part three prove that this new long slits design is successful to complete the beam sampling without being distorted by high power H+ beam. And the movable wire cup is able to locate the best measurement position for different beam focusing

TUPB65 **Transverse-acceptance Measurement System for the JAEA AVF Cyclotron** - *Hirotsugu Kashiwagi, Satoshi Kurashima, Nobumasa Miyawaki, Okumura Susumu (JAEA/TARRI, Gunma-ken)*

We are developing an acceptance measurement system to evaluate transverse phase-space matching of the emittance of an injection beam to the acceptance of the AVF cyclotron. The system is composed of a phase-space collimator in the low energy section and a beam intensity monitor in the high energy section. The phase-space collimator, which consists of two pairs of slits, allows very small-emittance beams to be injected into the cyclotron by limiting position and divergence angle of the beam from an ion source. The beam intensity monitor is used to obtain the ratio of beam intensity at the collimator to that at the monitor. In acceptance measurement, the small-emittance beams at various positions in a transverse phase-plane are injected to determine the distribution of relative transmission in the phase plane. In preliminary tests, only a part of acceptance was able to be measured because the injection-beam emittance from ion sources does not cover the whole acceptance. To expand the measurement area, a steering magnet has been added in the system. The magnet scans the injection beam in phase planes in synchronization with the acceptance measurement to simulate the large emittance.

TUPB66 **A Beam Tail Monitoring System of a High Intensity Beam to the Main Ring of J-PARC** - *Kenichirou Satou (J-PARC, KEK & JAEA, Ibaraki-ken)*

We have established a real-time beam-tail monitoring system using long air ionization chambers (AICs) and collimators of the beam transport line to the main ring of J-PARC. The collimators remove the beam tail components outside the emittance of 54pi mm mrad for horizontal and 60pi mm mrad for vertical, and the AICs identify the beam loss power at the collimators. The intentional beam losses have been used to calibrate the AICs. The output response showed good linearity up to the intensity of 8.4E11/batch, which amounts to 1% of the designed beam intensity of 8E13/batch, and the estimated error was ±7% which includes a dependence of beam loss points on the collimators and the shot-by-shot beam fluctuations. The calibration procedures and the performances of the system will be described.

TUPB67 **Test Measurements of Beam Profile Monitor at HIRFL-RIBLL2** - *Tiecheng Zhao, Yongchun Feng, Xincai Kang, He Li, Min Li, Peng Li, weinian ma, Ruishi Mao, Qianshun She, Hong Su, Jia Wen Xia, Guo Qing Xiao, zhiguo xu, Youjin Yuan (IMP, Lanzhou)*

The beam intensity supplied by HIRF-CSR has a wide range, high-intensity primary beams and low intensity fragment-beams in connection with the slow extraction and the fast beam-extraction from the synchrotron CSRm. The detector (CG) has been developed for the beam profile monitoring at radioactive beam line HIRFL-CSR. The front-end electronics are based on CPLD controlled sample-and-hold circuits and multiplexer. Remote control is used to tune the detector sensitivity by setting the gas pressure in the detector's cell, the bias voltage of the anode and the integration time. The test measurements results are presented in this paper. Keywords: beam profile monitor; current grids; multiplexer; HIRFL CSR;

TUPB68 **A new Multi-strip Ionization Chamber used as On-line Beam Profile Monitor at HIRFL-CSR** - *Zhiguo Xu, Zhengguo Hu, He Li, Min Li, Ruishi Mao, Qianshun She, Hong Su, Junxia Wu, Jia Wen Xia, Hushan Xu, Youjin Yuan, Tiecheng Zhao (IMP, Lanzhou)*

The beam extracted from CSRm is mainly used for heavy-ion tumor therapy and physics experiments with stable and radioactive ions. A position sensitive detector is usually implemented to monitor the primary beam online in the nuclear experiments. Meanwhile, the detector should be thin enough to

reduce the influence of energy spread and beam purity. This paper describes the developing and building a new detector with position resolution better than 0.5mm (FWHM) and using metallic-membrane plating technology for sharp reducing electrode's thickness of detector. The sensitive area of the detector is (100×100)mm2, with 1mm strip pitch. The anodes, cathode and the sealed windows are all made by 2 μm thick Mylar layer on which a 0.1 μm thick film of aluminum has been plated. Total thickness of the detector is about 12 μm.

TUPB69 **Numerical Analysis on the Gain-reduction Characteristics of Multi-wire Proportional Chambers** - *Ken Katagiri, Takuji Furukawa, Koji Noda (NIRS, Chiba-shi)*

Several MWPC (Multi-Wire Proportional Chamber) monitors are installed to diagnosis the beam profiles in the high-energy beam transport at HIMAC (Heavy Ion Medical Accelerator in Chiba) synchrotrons. When the intensity of the incident beams are much high, the gain reduction of the output signal from the MWPC monitor occurs due to the space charge effect of positive ions around the anode wires. The gain reduction is expected to be improved by changing geometric parameters, such as anode radius and distance between electrodes. In order to investigate the gain-reduction characteristics for different geometric parameters, we performed numerical simulation using a numerical code. The numerical code was developed using a two-dimensional drift-diffusion model to evaluate the gas gain including the reduction effect caused by the space charge effect of the moving positive ions. We investigate the gain-reduction rate for several parameters of the anode distance when changing the beam intensity. From these results, we discuss desirable distances between the anode wires to improve the gain reduction.

TUPB70 **The ATF2 Multi-OTR System: Studies and Design Improvements** - *Javier Alabau-Gonzalvo, Cesar Blanch Gutierrez, Angeles Faus-Golfe, Juan Jose Garcia-Garrigos, Javier Resta-López (IFIC, Valencia), Juan Cruz, Douglas McCormick, Glen White, Mark Woodley (SLAC, Menlo Park, California)*

A multi-Optical Transition Radiation system made of four stations has been installed in the extraction line of ATF2 and has been fully operational since September 2011. The system is being used routinely for beam size and emittance measurements as well as for coupling correction and energy spread measurements. In this paper we present the beam sizes

and emittance measurements performed during 2012 runs as well as a detailed study of the experimental single-shot automated coupling correction and the comparison with the simulations. Wakefields problems experimented with the simultaneous measurement has been studied and will be solved by new target holders that will be installed in the next Fall 2012 run.

TUPB71 **A New Low Intensity Beam-profile Monitor for SPIRAL2** - *Jean-Luc Vignet, Eloise Gueroult, Julien Pancin, Nicolas Renoux (GANIL, Caen)*

In order to obtain profiles of SPIRAL 2 ion beams, several beam-profile monitors are presently being developed at GANIL. One of them is a low-intensity beam-profile monitor that works as a secondary electron detector. This Emission-Foil Monitor (EFM) will be used in the radioactive beam lines of SPIRAL2 and in the experimental rooms of this new facility. The ions produce secondary electrons when they are stopped in an aluminium emissive foil. The electrons are then guided in an electric field placed parallel to a magnetic field in a double-stage microchannel plate (MCP). A 2D pixelated pad plane placed below the MCP is then used to collect the signals. The magnetic field created by permanent magnets in a closed magnetic circuit configuration permits the beam-profile reconstruction to be achieved with good resolution. The EFM can visualize beam-profile intensities between only a few pps to as much as 10 9 pps and with energies as low as several keV. This profiler has been studied since 2011 and will be manufactured in 2013. For the signal acquisition, a new dedicated electronics system will be employed. Recent results of this monitor and the electronics will be presented here.

TUPB72 **Injected Beam Profile Measurement during Top-Up Operation** - *Mark James Boland (ASCo, Clayton, Victoria), Toshiyuki Mitsuhashi (KEK, Ibaraki), Kent Peter Wootton (The University of Melbourne, Melbourne)*

A coronagraph-like apparatus was constructed on the optical diagnostic beamline on the storage ring to observe the injected beam during top-up operations. An image was created on an intensified CCD that can be gated on a single bunch or on a bunch train for a stronger signal. The bright central stored beam was obscured so the comparatively faint injected beam could be observed. The injected beam comes in at a large enough offset so that it was clearly visible above any diffraction or beam

halo signals. The beam profile measured was in good agreement with the observations made of the injected beam only using a telescope apparatus. The measurements were made during user beam in top-up operation mode and can be used to optimise the injection process.

TUPB73 **Development of a Beam Profile Monitor using Nitrogen-Molecular Jet for Intense Beams** - *Yoshinori Hashimoto, Takeshi Toyama (J-PARC, KEK & JAEA, Ibaraki-ken), Yoichiro Hori, Suguru Muto, Koji Yoshimura (KEK, Ibaraki), Daisuke Ohsawa (Kyoto University, Kyoto-shi), Teruhisa Morimoto (Morimoto Engineering, Iruma, Saitama), Takashi Fujisawa, Takeshi Murakami, Koji Noda (NIRS, Chiba-shi)*

A non-destructive beam profile monitor using a sheeted jet beam of nitrogen molecular as a target has been developed for intense ion beams. The pressure of the sheeted molecular beam was 5 x 10-4 Pa at the beam collision point. A light emitted from excited nitrogen by an ion beam collision is measured by a high sensitive camera with a radiation resistant image intensifier. Verification of such a principle was already demonstrated with low-energy ion beams[1]. In this paper, some actual designs for intense beams of the J-PARC MR will be discussed mainly as bellow, intensity upgrade of the jet beam production, configuration of the detection chamber and its apparatus placed beam collision point, and the optical system for the light detection.

TUPB74 **Diamond Mirrors for the SuperKEKB Synchtron Radiation Monitor** - *John Walter Flanagan, Mitsuhiro Arinaga, Hitoshi Fukuma, Hitomi Ikeda (KEK, Ibaraki)*

The SuperKEKB accelerator, a 40x luminosity upgrade to the KEKB accelerator, will be a high-current, low-emittance double ring collider. The beryllium primary extraction mirrors used for the synchrotron radiation monitors at KEKB suffered from heat distortion due to incident synchrotron radiation, leading to systematic changes in magnification with beam current and necessitating continuous monitoring and compensation of such distortions in order to correctly measure the beam sizes. The heat loads on the extraction mirrors will be higher at SuperKEKB, with heat-induced magnification changes up to 40% expected if the same mirrors were used as at KEKB. We are working on a design based on mirrors made of quasi-monocrystalline diamond, which has much higher heat conductance and a lower thermal expansion coefficient than beryllium. With such mirrors

it is targeted to reduce the beam current-dependent magnification effects to the level of a few percent at SuperKEKB. Measurements of heat-induced deformations on fabricated prototype mirrors will be presented, along with comparisons with the results of numerical simulations.

TUPB75 **Design and Construction of SEM for Continues 200keV Electrostatic Accelerator** - *Mehdi Shafiee, Ehsan Ebrahimibasabi, Amir Hossein Feghhi (sbu, Tehran), Morteza Jafarzadeh (ILSF, Tehran)*

Beam profile and position monitoring at continues beams aren't possible by electromagnetic based instruments such as Pick Up, by this regard, design and construction of SEM has done for 200 keV electrostatic machines which can be classified into mechanic and electronic sections. At mechanical section the vacuum chamber with 3 feed-through which each one has 32 pins was constructed then grids with 16 copper wire with length of 10 cm and 80 μm diameter at each vertical and horizontal direction considered. The produced signals amplified and then digitized by ADC and transferred by ATMEGA32 ports to PC which set by GUI (MATLAB) as data analyzer. Induced profile at quartz glass which is placed at the end of beam tube was considered as bench mark source. The electrical results were compared with the result of quartz as practical method and CST as simulation. high accuracy and precision deduced which is presented at this article.

TUPB76 **Infra Undulator Screen Diagnostics for FERMI@Elettra FEL** - *Marco Veronese, Thomas Borden, Maurizio Bossi, Andrea Bucconi, Marco De Marco, Mario Ferianis, Sandi Grulja (ELETTRA, Basovizza), Filippo Cianciosi (ESRF, Grenoble)*

The FERMI @Elettra seeded FEL has demanding requirements in terms of intra-undulator diagnostics. An advanced multi-purpose screen system has been developed and installed on the FEL1 and FEL2 intra-undulator sections. These diagnostics have been designed also to allow both electron beam transverse size measurement and FEL radiation spatial distribution measurements. A series of important constrains in the design such as COTR suppression, seed laser suppression, FEL wavelength range and minimization of ionizing radiations has led to new design concepts. The paper describes the design, the features and the performances obtained with the FERMI intra-undulator screen system.

TUPB77 **Measurement of the Frequency Spectrum on the Beam Profile Controlled by RF Kicker** - *Yasukazu Yamamoto (Ritsumeikan University, Kusatsu-City, Shiga)*

The frequency spectrum on the beam profile was measured at the compact superconducting storage ring of Ritsumeikan University. The radiation detector was used an avalanche photodiode module with a high frequency response of 1 GHz for the visible ray. Signals from the detector were transferred to a spectrum analyzer. The beam profile was magnified strongly by a conventional profile monitor system. We scanned the beam profile in vertical direction by shifting the detector. The distribution of peak intensity as a function of the position on beam profile was obtained.

TUPB78 **Flying Wire Beam Profile Monitors at the J-PARC MR** - *Susumu Igarashi, Dai Arakawa, Yoshinori Hashimoto, Masaki Tejima, Takeshi Toyama (KEK, Ibaraki), Kotoku Hanamura (MELCO SC, Tsukuba)*

Transverse beam profiles have been measured using flying wire monitors at the main ring of the Japan Proton Accelerator Research Complex. The wire target should be thin and the wire scan has to be fast for the precise profile measurement. Otherwise the beam distribution would be disturbed and the measured profile would not be accurate. We use carbon fibers of 7 μm in diameter and the scan speed of 10 m/s. The wire is attached with an aluminum flame of 140 mm of the rotation radius and rotated with a DC servomotor. A potentiometer is attached to the wire flame and the angle readout is used for the feedback of the servomotor and the wire position measurement. The secondary particles from the beam-wire scattering are measured with a scintillation counter. Beam profiles are reconstructed by making the scatter plot of the scintillator signal and wire position. Both horizontal and vertical flying wire monitors have been used for the beam commissioning. We have successfully measured the beam profile of up to 1.2×10^13 protons per bunch.

TUPB79 **Use of Gafchromic Films to Measure the Transverse Intensity Distribution of a Large-Area Ion Beam** - *Yosuke Yuri, Ikuo Ishibori, Tomohisa Ishizaka, Akane Kitamura, Susumu Okumura, Takahiro Yuyama (JAEA/TARRI, Gunma-ken), Shin-ichi Sawada, Tetsuya Yamaki (JAEA/QuBS, Takasaki)*

In the TIARA AVF cyclotron facility of JAEA, it is necessary to evaluate the cross-sectional area and uniformity of a large-area

uniform ion beam formed by multipole magnets both precisely and handily. A technique has, therefore, been developed to measure the two-dimensional transverse intensity distribution of the ion beam using Gafchromic radiochromic films (Ashland Inc.). In order to show available fluence ranges of the film, the coloring response of the Gafchromic films irradiated with several species of ion beams is investigated as a change in the optical density of the film. It has been found that the optical density increases linearly with the fluence, whose range is practical for materials and biological research. Thus, the relative transverse intensity distribution of ion beams can be measured using the film. Furthermore, the intensity distribution determined by the Gafchromic film is compared with the area-density distribution of track-etched pores in a polymer film from a microscopic viewpoint. It has been demonstrated that the beam uniformity obtained from the Gafchromic film is equivalent to the relative standard deviation of the microscopic pore distribution.

TUPB80 **Transverse Profile Monitor for SwissFEL** - *Rasmus Ischebeck, Bolko Beutner, Eduard Prat, Volker Schlott, Vincent Thominet (Paul Scherrer Institut, Villigen)*

In future free electron lasers, electron and photon beam sizes range between 10 um and a few millimeters. For an initial set up of the accelerator, to confirm target parameters for optics and emittance, and to optimize the FEL for different user requests, the transverse profile of these beams has to be determined. A monitor based on a scintillating crystal as well as optical transition radiation (for the electron beam) has been designed for the SwissFEL project. It features a projected pixel size of 7 micrometers, a good resolution over a field of view of 6 mm x 15 mm, a good sensitivity (as required for the low-charge mode of SwissFEL) and a 100 Hz image readout. To test the monitor, it has been installed at the SwissFEL Injector Test Facility, where electron bunches between 10 and 200 pC can be generated. In conjunction with a transverse deflecting cavity, the profile monitor has been used to measure the time-resolved slice emittance of these bunches.

TUPB81 **Design of the Beam Profile Monitors for the SXFEL Facility** - *Luyang Yu, Jie Chen, Yongbin Leng, Kairong Ye, Weimin Zhou (SINAP, Shanghai)*

The Shanghai X-ray Free Electron Laser Facility will begin construction at next year. The linac electron beam energy is

0.84 GeV. Over 50 beam profile monitors with OTR and YaG screen will be installed along the linac and undulators. The profile monitor system design is a challenging task, since the system has to measure transverse electron beam sizes from millimeter down to 40 μm scale with a 20 μm resolution and 50 μm repeat positioning accuracy. This paper describes the design of the mechanical detector , the integrated step-servo motor controlling system, the beam imaging system, as well as the software system.

TUPB82 Development of Laser Wire System in the Electron Beam Transport Line of BEPC II - *Cong Zhang (IHEP,), Jianshe Cao, Qingyong Deng, Yan-feng Sui (IHEP, Beijing)*

A Laser Wire system is under development in the electron beam transport line of BEPC II (Beijing Electron Positron Collider II). The whole system will be installed in the tunnel of beam transport line in this summer shutdown of the BEPCII. We present recent work on subsystems of Laser Wire in this paper, such as improvement of laser system and construction of gamma detector. Some measurement and test results are also showed. The electron beam profile measurement experiment with Laser Wire will start in the next accelerator run.

TUPB83 Beam Size and Emittance Measurements in the ALBA Booster - *Ubaldo Iriso, Gabriele Benedetti (CELLS-ALBA Synchrotron, Cerdanyola del Vallès)*

The synchrotron radiation monitor in the ALBA Booster provides a measurement of the transverse beam size, which is then used to evaluate the emittance evolution along the energy ramp. We find that the beam size measurement is significantly influenced by the Booster closed orbit deviations. This report describes the experimental measurements, and compares them with theoretical expectations.

TUPB84 Storage Ring Tune Measurements using High-Speed Optical Photodiodes - *Sophie Dawson, David J. Peake, Roger Paul Rassool (The University of Melbourne, Melbourne), Mark James Boland (ASCo, Clayton, Victoria), Ralph Jeffrey Steinhagen (CERN, Geneva)*

Knowledge of the betatron tunes within a storage ring is important to prevent the creation of instabilities and maximise the lifetime of the stored current within the ring. Typical tune measurements excite the beam and measure the resulting motion over time using electromagnetic pickups. The novel

measurement technique presented utilises high-speed MSM photodiodes in a balanced detector set-up to measure the vertical and horizontal betatron tunes. Radiation from a bending magnet consists of both visible light and X-rays. The visible light is separated from the X-rays with an optical chicane and focussed onto a pair of length-matched optical fibers each coupled to an MSM photodiode. The specialised biasing circuit for the photodiodes is constructed in a balanced detector configuration to emphasise any motion in the beam. Signal resulting from beam motion is amplified and digitised for analysis. Using this set-up the tunes for the storage ring at the Australian Synchrotron have been measured and verified with comparison to existing tune measurement technologies. The results from the new optical tune measurement system will be presented and discussed.

TUPB85 **Spectrum of Bunch-by-Bunch Position Model and Parameter Acquisition Algorithm** - *Yong Yang, Yongbin Leng (SSRF, Shanghai), Bao Peng Wang (SINAP, Shanghai)*

Based on the spectrum of turn-by-turn model for the storage ring, spectrum of bunch-by-bunch position model was derived through some assumptions. Spectrum of excited electron beam position was analyzed in Shanghai Synchrotron Radiation Facility(SSRF) and Genetic Algorithm was used to obtain the model parameters when fitting multi-curve data. Results show that, after 100 times iteration, all the correlation of fitted data and original data can be up to 95%, and the model can accurate estimate a bimodal split of the spectrum curve.

TUPB86 **An Upgrade for the Bunch Current Measurement System of BEPC II** – *Qingyong Deng, Jianshe Cao, Lin Wang, Qiang Ye, Junhui Yue (IHEP, Beijing)*

Recently, the BCM (Bunch Current Measurement) system is being developed at BEPC II (Beijing Electron-Positron Collider II). In order to solve the instability problems which frequently happen in the existing system, we have upgraded the DAQ system with new ADC card and new DSP arithmetic in FPGA. In addition, some discussion for the upgrade such as the generality of the arithmetic, easy to change operation mode, noise reduction measurements, and so on, are also presented in this paper.

Wednesday Session A, 8:30 – 10:05
Chair: Sung-Ju Park (Postech)

WECA01 **Theoretical and Experimental Investigation on Resolution of Optical Transition Radiation Transverse Beam Profile Monitor** - *Alexander S. Aryshev, Nobuhiro Terunuma, Junji Urakawa (KEK, Ibaraki), Benoit Bolzon, Enrico Bravin, Thibaut Lefevre (CERN, Geneva), Laurence James Nevay (Oxford University, Oxford, Oxon), Stewart Takashi Boogert, Pavel Karataev (Royal Holloway, University of London, Surrey)*

Optical Transition Radiation (OTR) appearing when a charged particle crosses an interface between two media with different dielectric constants has widely been used as a tool for transverse profile measurements of charged particle beams in numerous facilities worldwide. The basic tuning methods and operation of conventional OTR monitors are well established for transverse beam sizes not smaller than 3-5 um. Since the Point Spread Function (PSF) dimension defines the resolution of the conventional monitors, for small electron beam dimensions the PSF form significantly depends on a presence of OTR tails diffraction and aberrations in the optical system. In our experiment we have managed to squeeze the electron beam such that we can practically measure PSF distribution in one direction. The revealed PSF structure is such that the visibility depends on the transverse beam size on micron scale. We developed an empirical calibration technique and successfully overcame the resolution limit of the common OTR monitor reaching sub-micron level. Here we represent the recent developments and upgrades in both setup and data analysis of a sub-micrometer electron beam profile monitor.

WETA02 **Learning from Beams - Beam Instrumentation, Signal Processing, and (mis) Applications of Linear Time Invariant System Formalisms** - *John Fox (SLAC, Menlo Park, California)*

Almost all particle accelerators measure and control beam properties. This talk looks at the signals from bunched beams using time domain and frequency domain formalisms. The signatures of bunch charge and bunch structure, motion in the longitudinal and transverse planes are reviewed and illustrated with examples from various types of beam pickups and monitors. Common control room diagnostics, instruments and measurement techniques are highlighted via techniques in use at selected accelerators and light sources. This tutorial is intended to help engineers and accelerator physicists interpret

signals in the control room, and specify and understand the fundamental and technological limits of beam measurements. Examples are presented for position monitor techniques, pickups and the signal processing required for tune measurements, multi-bunch and intra-bunch instability control systems. The significance of technical implementation choices, and important lessons in understanding the impact of non-linear effects (such as in amplifiers) are presented.

Wednesday Session B, 10:30 – 12:20
Chair: Thomas Shea (ESS Lund)

WE1B01 Overview of ESS Beam Diagnostics - *Andreas Jansson, Christian Boehme, Benjamin Cheymol, Hooman Hassanzadegan, Thomas Shea, Lali Tchelidze (ESS, Lund)*

The European Spallation Source (ESS) will use a 2.5GeV superconducting proton linac with a 5MW average beam power to produce the worlds most powerful neutron source. The project, sited in the south of Sweden, is approaching the end of the pre-construction phase, and is expected to enter the construction phase in 2013. This paper gives an overview of the ESS accelerator and the planned beam diagnostics systems, as well as the associated challenges.

WE1B02 Review of Reliability Concepts Applied to Beam Loss Monitoring Systems - *Bernd Dehning (CERN, Geneva)*

Beam loss measurement systems are often used for the protection of equipment against the damage caused by impacting particles creating secondary showers and their energy dissipation in the matter. Depending on the acceptable consequences and the frequency of particle impact events on equipment reliability requirements are scaling accordingly. Increasing reliability often leads to more complex systems. The downside of complexity is a reduction of availability, therefore an optimum has to be found for these conflicting requirements. A detailed review of selected concepts and solutions from real-life examples will be given to show approaches used in various parts of the system from the sensors, signal processing, and software implementations up to the requirements for operation and documentation.

Wednesday Session C, 13:50 – 15:50
Chair: Yongbin Leng (SINAP)

WECC01 **IFMIF-LIPAc Diagnostics and its Challenges** - *Jacques Marroncle, Philippe Abbon, Jean Francois Denis, Jan Egberts, Jean-François Gournay, Fabien Jeanneau, Anthony Marchix, Jean-Phillippe Mols, Thomas Papaevangelou (CEA/IRFU, Gif-sur-Yvette), Michal Pomorski (CEA/DRT/LIST, Gif-sur-Yvette Cedex), Julio Calvo, José Miguel Carmona, Angel Guirao, Daniel Iglesias, Concepcion Oliver, Ivan Podadera (CIEMAT, Madrid), Marco Poggi (INFN/LNL, Legnaro (PD))*

The International Fusion Materials Irradiation Facility (IFMIF) aims at providing a very intense neutron source (10**17 neutron/s) to test the structure materials for the future fusion reactors, beyond ITER (International Thermonuclear Experimental Reactor). Such a source will be driven using 2 deuteron accelerators 125 mA cw up to 40 MeV impinging into a lithium liquid curtain, thus producing very high neutron flux with a similar spectrum as those expected in fusion reactors. A validation phase was decided for this 10 MW facility consisting partly in the design of the prototype accelerator LIPAc (Linear IFMIF Prototype Accelerator). LIPAc, which is in design phase, will accelerate a 125 mA cw beam deuteron up to the first superconductive linac module (4 for IFMIF). The 9 MeV beam will be driven through a HEBT to beam dump. This facility is currently under construction at Rokkasho (Japan). We propose to describe the beam diagnostics foreseen for this 1.125 MW accelerator emphasizing the challenges encountered and the overcome solutions, if any.

WEIC02 **Recent Progresses in SR Interferometer** - *Toshiyuki Mitsuhashi (KEK, Ibaraki)*

Beam size measurement in accelerator is very important to evaluate beam emittance. SR interferometer has been used as one of powerful tools for measurement of small beam size through special coherence of visible SR. Recent progresses in this technique improve measurable range for smaller beam size less than 10μm. An application of reflective optics to eliminate chromatic aberration in focus system of SR interferometer makes it possible to measure the beam size down to 5μm range. The unbalanced input technique is developed in recent few years, and this technique magnifies beam size 2-3 times, and observation range is improved down to 2-3μm range. These

progresses on SR interferometer will introduce in this talk.

WECC03 **Intensity Imbalance Optical Interferometer Beam Size Monitor** - *Mark James Boland (ASCo, Clayton, Victoria), Toshiyuki Mitsuhashi, Takashi Naito (KEK, Ibaraki), Kent Peter Wootton (The University of Melbourne, Melbourne)*

The technique of measuring the beam size in a particle accelerator with an optical interferometer with the Mitsuhashi apparatus is well established and one of the only direct measurement techniques available. However, one of the limitations of the technique is the dynamic range and noise level of CCD cameras when measuring ultra low emittance beams and hence visibilities close to unity. A new design has been successfully tested to overcome these limitations by introducing a know intensity imbalance in one of the light paths of the interferometer. This modification reduces the visibility in a controlled way and lifts the measured interference pattern out of the noise level of the CCD, thus increasing the dynamic range of the apparatus. Results are presented from tests at the ATF2 at KEK and on the optical diagnostic beamline at the Australian Synchrotron storage ring.

WECC04 **Analysis of the Electro-Optical Frontend for the New 40 GHz Bunch Arrival Time Monitor System** - *Alexander Kuhl, Juliane Roensch-Schulenburg, Jörg Rossbach (Uni HH, Hamburg), Marie Kristin Bock, Michael Bousonville, Holger Schlarb, Cezary Sydlo (DESY, Hamburg), Sascha Schnepp (IFH, Zurich), Thomas Weiland (TEMF, TU Darmstadt, Darmstadt), Aleksandar Angelovski, Rolf Jakoby, Andreas Penirschke (TU Darmstadt, Darmstadt)*

The Free electron LASer in Hamburg (FLASH) is currently equipped with four Bunch Arrival time Monitors (BAMs) which achieve a time resolution of less than 10 fs for bunch charges higher than 500 pC (1). In order to achieve single spike FEL pulses at FLASH, electron bunch charges down to 20 pC are of interest. With the current BAMs the required time resolution is not reachable for bunch charges below 500 pC. Therefore new pickups with a bandwidth of up to 40 GHz (2) are designed and manufactured. The signal evaluation takes place with a time-stabilized reference laser pulse train which is modulated with an Electro-Optical intensity Modulator (EOM). The new pickup system also requires a new electro-optical frontend with a 40 GHz EOM. The theoretical limits of the time resolution depending on the RF signal at different bunch charges and on

the jitter of the reference laser pulses where analyzed for the new EOM.

Wednesday Session D, 16:20 – 17:15
Chair: Prapong Klysubun (SLRI)

WECD01 **Operation of a Single Pass, Bunch-by-bunch x-ray Beam Size Monitor for the CESR Test Accelerator Research Program** - *Nate Rider, Michael Gerard Billing, Michael Paul Ehrlichman, Brian Heltsley, Mark Alan Palmer, Daniel P. Peterson, David Rubin, James P. Shanks, Kiran G. Sonnad (CLASSE, Ithaca, New York), John Walter Flanagan (KEK, Ibaraki)*

The CESR Test Accelerator (CESRTA) program targets the study of beam physics issues relevant to linear collider damping rings and other low emittance storage rings. This endeavor requires new instrumentation to study the beam dynamics along trains of ultra low emittance bunches. A key element of the program has been the design, commissioning and operation of an x-ray beam size monitor capable, on a turn by turn basis, of collecting single pass measurements of each individual bunch in a train over many thousands of turns. This new instrument utilizes custom, high bandwidth amplifiers and digitization hardware and firmware to collect signals from a linear InGaAs diode array. The instrument has been optimized to allow measurements with 3x109 to 1x1011 particles per bunch. This paper reports on the operational capabilities of this instrument, improvements for its performance, and the methods utilized in data analysis. Examples of key measurements which illustrate the instrument¿s performance are presented. This device demonstrates measurement capabilities applicable to future high energy physics accelerators and light sources.

WEID02 **BIW 2012 Highlights** - *Kevin Jordan (JLAB, Newport News, Virginia)*

The final Beam Instrumentation Workshop, hosted by Jefferson Lab, was held in Newport News Virginia, April 15 - 19, 2012. The series of 15 meetings, spanning 23 years began at Brookhaven National Lab, adopted the Faraday Cup Award to recognize excellence in particle beam diagnostics instruments, and culminated in a transition to a 3 year cycle with DIPAC & a new Asian meeting; the IBIC. This presentation gives highlights of the spring meeting and a bit of nostalgia of the past events.

Thursday Session A, 9:00 – 10:10
Chair: Takeshi Toyama (KEK/J-PARC)

THTA01 **Beam Position Monitors for Circular Accelerators** - *Shigenori Hiramatsu (KEK, Ibaraki)*
The electrostatic induction type beam position monitors (BPMs) for circular accelerators such as proton synchrotrons and electron accumulation rings will be discussed. Discussions on the beam induced charge on the BPM pick-up electrodes, signal detection systems, and techniques of beam based alignment and beam based calibration will be given. For high beam current machines, the evaluation of the beam coupling impedance of BPM is an important issue to avoid the beam current limit by beam instabilities caused by BPM impedances. Another serious problem is the movement of BPMs by the thermal distortion of the beam pipe by high power synchrotron radiation. These problems will be also mentioned briefly.

Thursday Session B, 10:40 – 12:00
Chair: Seadat Varnasseri (ESSB)

THCB01 **E-Lens Test Stand Instrumentation Progress** - *Toby Allen Miller, David Mark Gassner (BNL, Upton, Long Island, New York)*
In preparation for installation of an Electron Lens (E-Lens) into RHIC, planned for the Fall of 2012, a working test bench is in use testing performance of the gun, collector, instrumentation and controls. This paper will present the progress and pitfalls encountered while testing & operating the instrumentation on this test bench. Results are presented from issues including ground loop signals generated by the DCCTs, static magnetic field interference, competing YAG screen illumination techniques, YAG crystal damage during beam operation, pinhole scan data correction for skew angle and scaling, rendering of pinhole data into an image file, performance of the four quadrant beam scraper electrodes, and challenges in measuring beam current in the power circuit. Working knowledge and insight into each of these systems has been gained by both success and difficulties leading to success. These insights will be presented with supporting data and images.

THCB02 **Twisting Wire-Scanner** - *Vahagn Gharibyan (DESY, Hamburg)*
A new type of 'two-in-one' wire scanner is proposed. Recent advances in the linear motors' technology make it possible to combine translational and rotational movements. This will allow to scan the beam in two perpendicular directions using a single driving motor and a special fork attached to it. Vertical or horizontal mounting will help to escape problems associated with the 45 deg scanners.

Author Index

List of exhibitors (alphabetical order)

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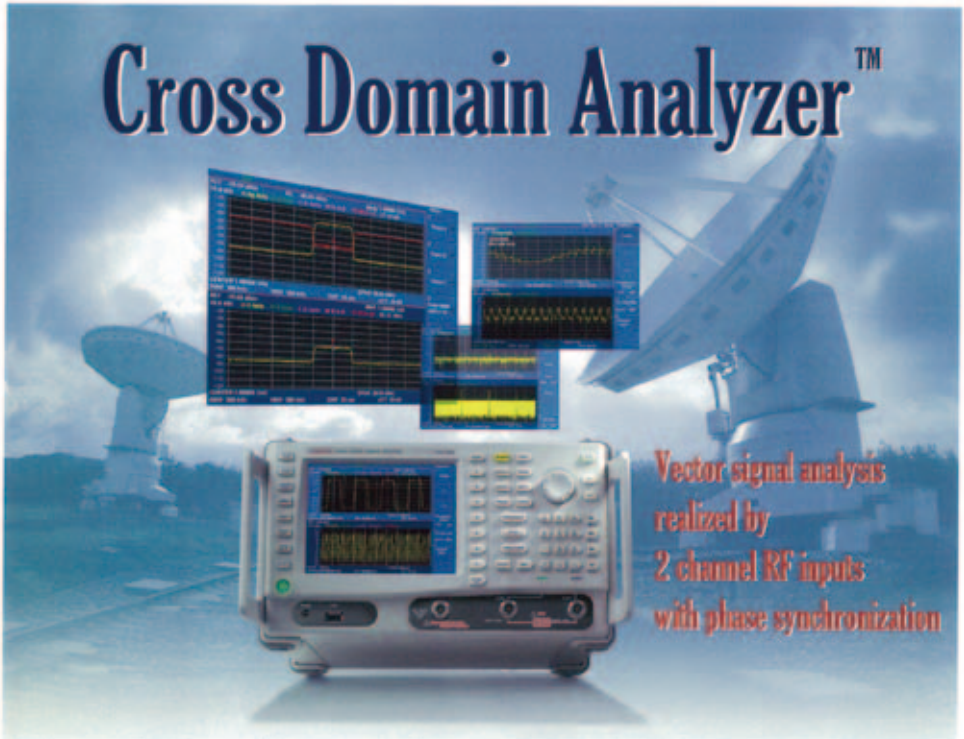

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装置への組み込みも容易な、PCを必要としないコンパクト設計のデジタルビデオレコーダで、装置のワーク部の異常監視（ビデオ保存）から、装置自体または装置を取り巻く環境の監視など様々なニーズに応えます。

- NTSCカメラ入力×4
- リアルタイムで画像圧縮、保存
- タイムスタンプ付きJPEG画像をSATA HDDに保存
- イーサネット経由で接続されたPCでのストリーミング表示、HDDへの保存も可能

開発事例2. Serial Rapid IOカード

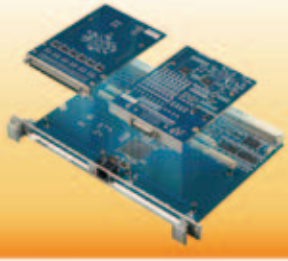
組み込みプロセッサとIO間の接続、バックプレーンを通じてのボード間の接続、装置間の高速接続など、アプリケーション内で幅広く適用できるオープンスタンダードなSerial Rapid IO（sRIO）をコンパクトなカードに凝縮しました。ホストとしてもIOとしても使用可能で、sRIO-GbEのゲートウェイカードとしても使用可能です。

- Freescale社PowerQUICC III MPC8548E搭載
- 2.5Gbps sRIO高速データリンク×4レーン
- ギガビットイーサネット
- PCIおよびPCI Expressインタフェース

開発事例3. リアルタイム汎用ロジックボード

ベースボード上のFPGAにお客様の処理ロジックを組み込み、各種IOドーターカードを搭載することで、リアルタイム処理をワンボードで実現します。例えば、カメラ入力カードから画像を取り込みながら重心計算をして、補正値をアナログ出力カードからモータに出力し位置補正するフィードバック処理をワンボードで行うことが可能です。

- ドーターカード：アナログIOカード、デジタルIOカード、カメラリンクカード、レジスタカードなど
- ロスレス画像圧縮機能オプション



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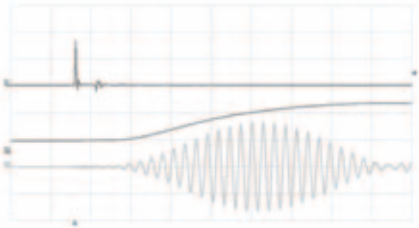

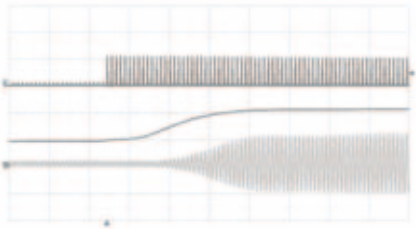

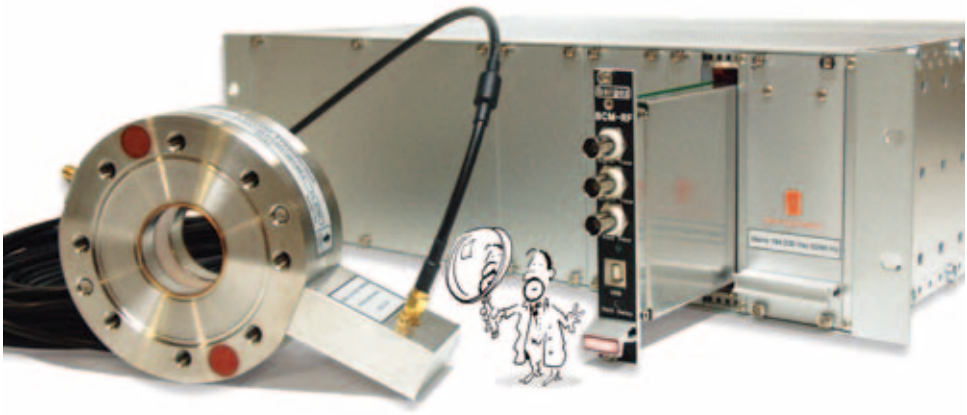

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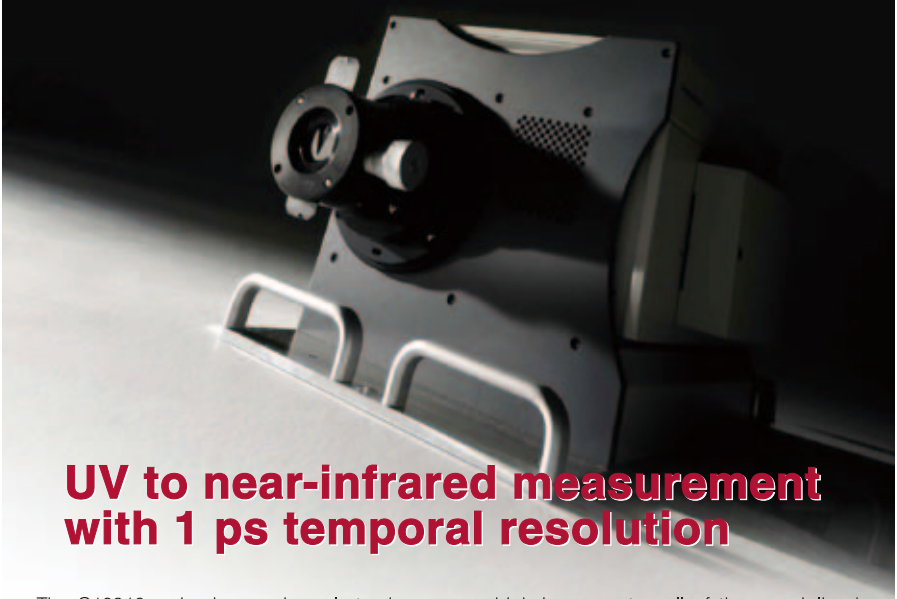

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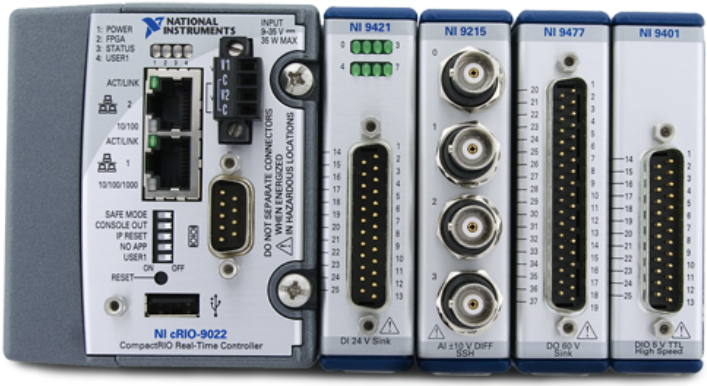

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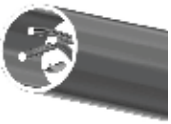

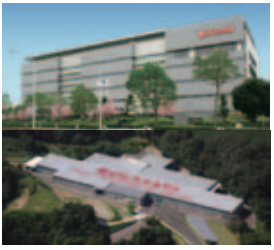

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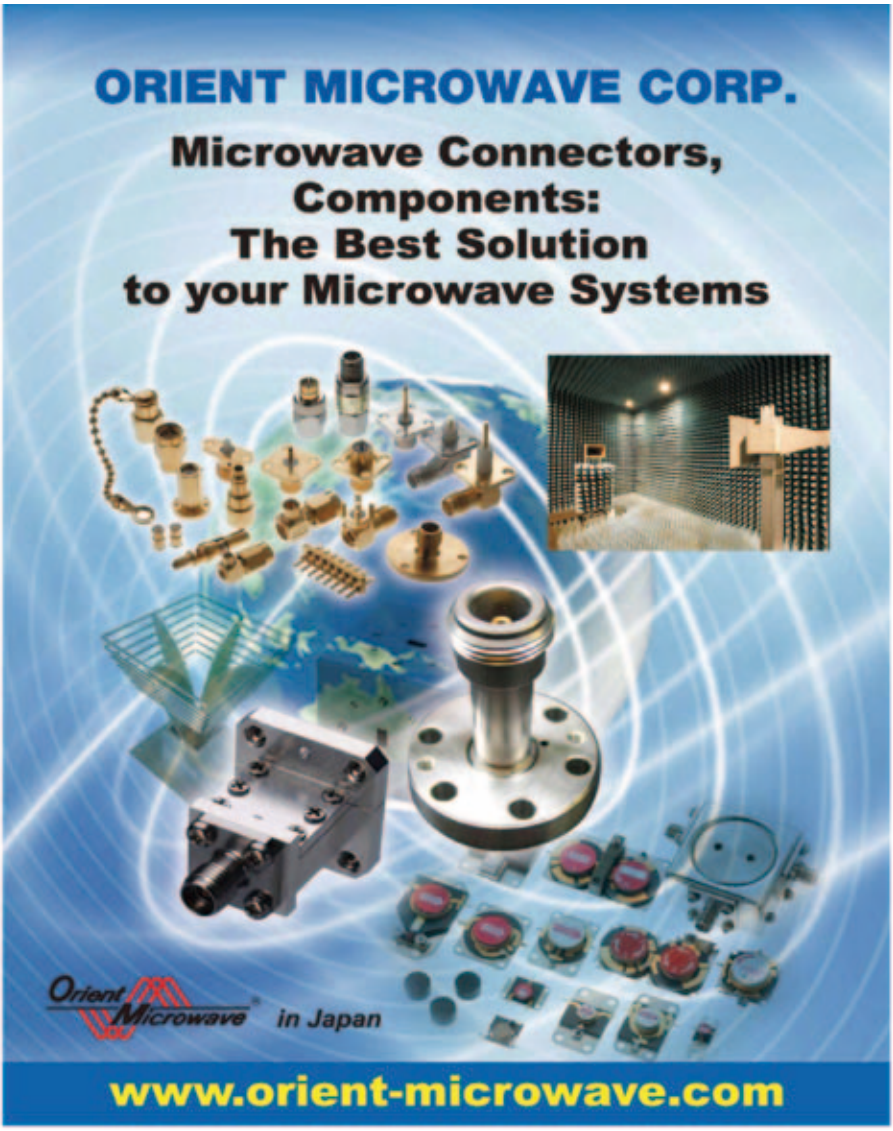

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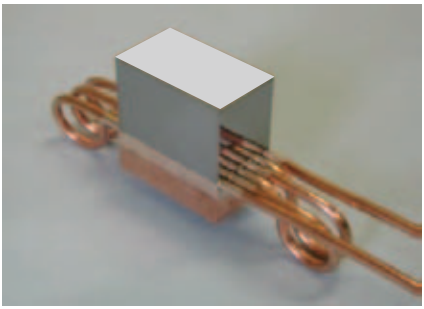
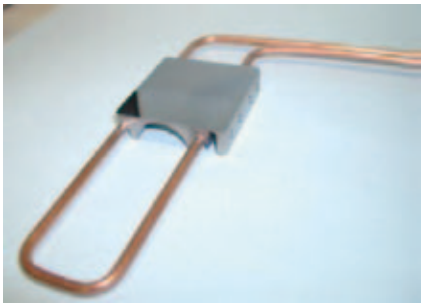
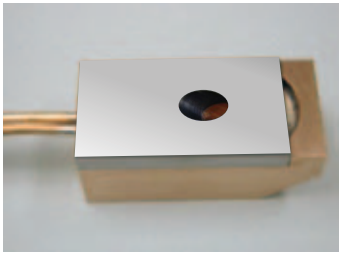
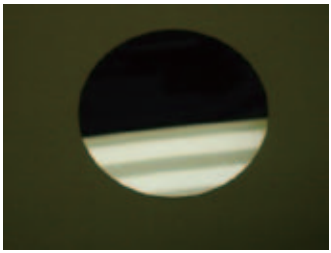


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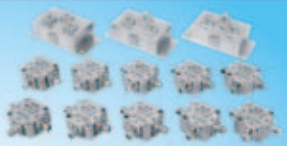
- RF Power Detectors



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Data Acquisition for Beam Instrumentation

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VME Digitizer
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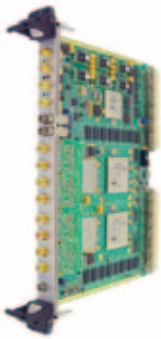
250 MSPS 14-bit or
125 MSPS 16-bit



SIS3305 VME Digitizer
two channels 5 GSPS 10-bit with
8 channels 1.25 GSPS operation

SIS8300
MTCA.4 Digitizer
10 channels
125 MSPS 16-bit

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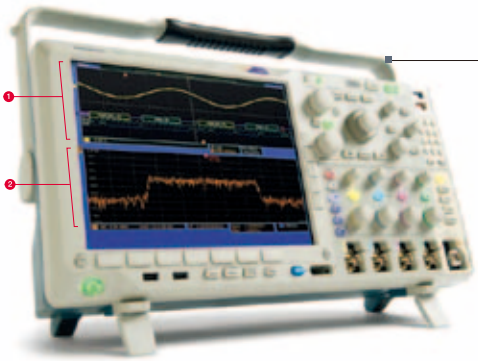
「アナログ／デジタル／RF信号を一台で同時観測」

MDO4000シリーズ・ミックスド・ドメイン・オシロスコープ



MDO4000シリーズ基本性能

- ❶時間ドメイン ❷周波数ドメイン
- アナログ4チャンネル
  - 周波数帯域500MHzまたは1GHz
- デジタル16チャンネル
- RF1チャンネル
  - 周波数レンジ 50kHz～3GHzまたは50kHz～6GHz
  - 最大3GHzの超広帯域リアルタイム取込み
  - 独自のRF解析ツール：自動マーカ、スペクトログラム表示、RF対時間トレース、アドバンスドRFトリガ
- パラレル・バスのトリガ／解析（標準）
- シリアル・バスのトリガ／解析（オプション）
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IBIC2012 Program Timetable

Sunday, 30 Sep 2012

17:00 Registration

18:00 Reception (Restaurant ESPOIR)

Monday, 1 Oct 2012

08:00 Conference Desk (08:00 – 18:00)

Monday Session A, 8:30 – 10:00

Chair: Toshiyuki Mitsuhashi (KEK)

08:30 Welcome by Chair

08:45 Accelerator Projects at KEK, K. Oide, KEK

09:05 Progress of Beam Instrumentation in J-PARC Linac
A. Miura, JAEA/J-PARC

9:50 – 10:20 Coffee Break

Monday Session B, 10:20 – 12:00

Chair: Kay Wittemburg (DESY)

10:30 Beam Instrumentation of SuperKEKB Rings, H. Fukuma, KEK

10:55 A Generic BPM Electronics Platform for European XFEL, SwissFEL and SLS, B. Keil, PSI

11:20 Modeling and Performance Evaluation of DCCTs in SSRF, Z. Chen, SSRF

11:45 Vertical emittance measurements using a vertical undulator, K. Wootton, Uni Melbourne

12:00 – 12:20 Student Grant Award

12:20 – 13:50 Lunch Break

Monday Session C, 13:50 – 15:50

Chair: Hitoshi Tanaka (RIKEN/SPring-8)

13:50 UV/X-ray Diffraction Radiation for Non-intercepting Micron-scale Beam Size Measurement, L. M. Bobb, CERN

14:15 Electron Beam Diagnostic System for the Japanese XFEL, SACLA, H. Maesaka, RIKEN/SPring-8

15:00 The first observation of the electron bunch measurement by means of organic EO crystals DAST,
Y. Okayasu, JASRI/SPring-8

15:25 Improvement of Screen Monitor with Suppression of Coherent-OTR for SACLA, S. Matsubara, RIKEN/SPring-8

15:50 – 16:20 Coffee Break

Monday Poster Session, 16:20 – 17:50

Special Invited Talk, 18:00 – 19:00

Chair : Takeshi Toyama (KEK)

T. Kobayashi (KEK/J-Parc)

Tuesday, 2 Oct 2012

08:00 Conference Desk (08:00 – 18:00)

Tuesday Session A, 8:30 – 10:05

Chair: Jianshe Cao (IHEP)

08:30 Beam Instrumentation Global NETwork [BIGNet]: A Common Web Portal for Beam Instrumentalists, J. J. Grass, CERN

08:55 Tutorial#1; BPM Electrode and High Power Feedthrough - Special Topics in Wideband Feedthrough, M. Tobiyama, KEK

10:05 – 10:35 Coffee Break

Tuesday Session B, 10:30 – 12:20

Chair: Kevin Jordan (J-Lab)

10:35 Bigger, Brighter and more Powerful, H. Schmickler, CERN

11:20 Femtosecond Resolution Bunch Profile Diagnostics, B. Schmidt, DESY

12:05 Student Grant Award

12:20 – 13:50 Lunch Break

Tuesday Session C, 13:50 – 15:50

Chair: Mark Boland (ASLS)

13:50 Electron Storage Ring as a Single Shot Linac Beam Monitor, Y. Shoji, LASTI

14:15 Direct Observation of the Dust-trapping Phenomenon, Y. Tanimoto, KEK

15:00 Design and expected performance of the new SLS emittance monitor, V. Schlott, PSI

15:25 Measurement of Nanometer Electron Beam Sizes with Laser Interference using IPBSM, J. Yan, U-Tokyo

15:50 – 16:20 Coffee Break

Tuesday Poster Session, 16:20 – 17:50

Wednesday, 3 Oct 2012

08:00 Conference Desk (08:00 – 15:00)

Wednesday Session A, 8:30 – 10:05

Chair: Sung-Ju Park (Postech)

08:30 Theoretical and Experimental Investigation on Resolution of Optical Transition Radiation Transverse Beam Profile Monitor, A. S. Aryshev, KEK

08:55 Tutorial#2; Learning from Beams - Beam Instrumentation, signal processing, and (mis) applications of Linear Time Invariant System formalisms, J. Fox, SLAC

10:05 – 10:35 Coffee Break

Wednesday Session B, 10:30 – 12:20

Chair: Thomas Shea (ESS Lund)

10:35 Overview of ESS Beam Diagnostics, A. Jansson, ESS Lund

11:20 Review of Reliability Concepts Applied to Beam Loss Monitoring Systems, B. Dehning, CERN

12:05 – 13:50 Lunch Break

Wednesday Session C, 13:50 – 15:50

Chair: Yongbin Leng (SINAP)

13:50 IFMIF-LIPAc diagnostics and its challenges, J. Marroncle, CEA/IRFU

14:15 Recent Progresses in SR Interferometer, T. Mitsuhashi, KEK

15:00 Intensity Imbalance Optical Interferometer Beam Size Monitor, M. Boland, ASCo

15:25 Analysis of the Electro-Optical Frontend for the New 40 GHz Bunch Arrival Time Monitor System, A. Kuhl, Uni HH

15:50 – 16:20 Coffee Break

Wednesday Session D, 16:20 – 17:15
Chair: Prapong Klysubun (SLRI)
16:20 Operation of a Single Pass, Bunch-by-bunch x-ray Beam Size Monitor for the CESR Test Accelerator Research Program, N. Rider, CLASSE
16:45 BIW 2012 Highlights, K. Jordan, JLab

Conference Dinner 18:30 – 23:00

Thursday, 4 Oct 2012

08:00 Conference Desk (08:00 – 12:30)

Thursday Session A, 09:00 – 10:10
Chair: Takeshi Toyama (KEK)
09:00 Tutorial#3; Beam Position Monitors for Circular Accelerators, H. Hiramatsu, KEK

10:10 – 10:40 Coffee Break

Thursday Session B, 10:40 – 12:00
Chair: Seadat Varnasseri (ESSB)
10:40 E-Lens Test Stand Instrumentation Progress, T. A. Miller, BNL
11:05 Twisting Wire-Scanner, V. Gharibyan DESY
11:30 Closing Remarks

12:00 – 13:30 Lunch Break
13:30 – 17:00 Laboratory Tour (KEK or J-PARC)

Friday, 5 Oct 2012

08:30 – 17:30 Excursion to Nikko

Program Timetable

	Sunday September 30	Monday October 1		Tuesday October 2	
0830		Wecome by Chair	15	Beam Instrumentation Global NETwork [BIGNet]: A Common Web Portal for Beam Instrumentalists - J. J. Gras CERN	20+5
		Accelerator Projects at KEK K. Oide	15+5		
0900			35+10	Tutorial #1 BPM Electrode and High Power Feedthrough - Special Topics in Wideband Feedthrough M.Tobiyama KEK	60+10
0930		Progress of Beam Instrumentation in J-PARC Linac A.Miura JAEA/J-Parc			
		Coffee Break 9:50 - 10:20	30	Coffee Break 10:05 - 10:35	30
1000					
		Beam Instrumentation of SuperKEKB Rings H.Fukuma KEK	20+5		
1030				Bigger, Brighter and more Powerful H. Schmickler	35+10
		A Generic BPM Electronics Platform for European XFEL, SwissFEL and SLS B.Keil PSI	20+5		
1100		Modeling and Performance Evaluation of DCCTs in SSRF Z. Chen SSRF	20+5		
1130				Femtosecond Resolution Bunch Profile Diagnostics B. Schmidt DESY	35+10
		Vertical emittance measurements using a vertical undulator K. Wootton Uni Melbourne	20+5		
1200		Student Grant Award	20	Group Photo	15
		Lunch 12:20 - 13:50	90	Lunch 12:20 - 13:50	90
1230					
1300					
1330					
		UV/X-ray Diffraction Radiation for Non-intercepting Micron-scale Beam Size Measurement - L.M.Bobb CERN	20+5	Electron Storage Ring as a Single Shot Linac Beam Monitor Y. Shoji LASTI	20+5
1400					
		Electron Beam Diagnostic System for the Japanese XFEL, SACLA H. Maesaka RIKEN/SPring-8	35+10	Direct Observation of the Dust-trapping Phenomenon Y. Tanimoto KEK	35+10
1430					
1500		The first observation of the electron bunch measurement by means of organic EO crystals DAST - Y. Okayasu JASLI/SPring8	20+5	Design and expected performance of the new SLS emittance monitor V. Schlott PSI	20+5
		Improvement of Screen Monitor with Suppression of Coherent-OTR for SACLA S. Matsubara Riken/SPring8	20+5	Measurement of Nanometer Electron Beam Sizes with Laser Interference using IPBSM Y. Yan U-Tokyo	20+5
1530					
		coffee break 15:50 - 16:20	30	coffee break 15:50 - 16:20	30
1600					
1630			90		90
1700	Registration	Poster Session 1 16:20 - 17:50		Poster Session 2 16:20 - 17:50	
1730					
1800	Reception (until 20:00)	Special Invited Talk Neutrino experiments in Japan T. Kobayashi 18:00 - 19:00	60		
1830					

Vendor Exhibition

	Wednesday October 3		Thursday October 4		Friday October 5
0830	Theoretical and Experimental Investigation on Resolution of OTR Transverse Beam Profile Monitor - A.S. Aryshev KEK	20+5			Excursion Nikko
0900	Tutorial #2 Learning from Beams - Beam Instrumentation, signal processing, and (mis) applications of Linear Time Invariant System formalisms J. Fox SLAC	60+10	Tutorial #3 Beam Position Monitors for Circular Accelerators S. Hiramatsu KEK	60+10	
0930					
1000	Coffee Break 10:05 - 10:35	30	Coffee Break 10:10 - 10:40	30	
1030	Overview of ESS Beam Diagnostics A. Jansson	35+10	E-Lens Test Stand Instrumentation Progress T.A. Miller BNL	20+5	
1100			Twisting Wire-Scanner V.Gharibyan DESY	20+5	
1130	Review of Reliability Concepts Applied to Beam Loss Monitoring Systems B. Dehning	35+10	IBIC13 Announcement Closing Remarks	30	
1200	Lunch 12:05 - 13:50	105	Lunch 12:00 - 13:30	90	
1230					
1300					
1330			Tour KEK or J-Parc		
1400	IFMIF-LIPAc diagnostics and its challenges J.Marroncle CEA/IRFU	20+5			
1430	Recent Progresses in SR Interferometer T. Mitsuhashi KEK	35+10			
1500	Intensity Imbalance Optical Interferometer Beam Size Monitor M. Boland ASCo	20+5			
1530	Analysis of the Electro-Optical Frontend for the New 40 GHz Bunch Arrival Time Monitor System - A.Kuhl Uni HH	20+5			
1600	coffee break 15:50 - 16:20	30			
1630	Operation of a Single Pass, Bunch-by-bunch x-ray Beam Size Monitor for the CESR-TA Research Program - N. Rider CLASSE	20+5			
1700	BIW 2012 Highlights K.Jordan JLab	25+5			
1730					
1800					
1830	Conference Dinner 18:30-21:00				

Vendor Exhibition

IBIC2012

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