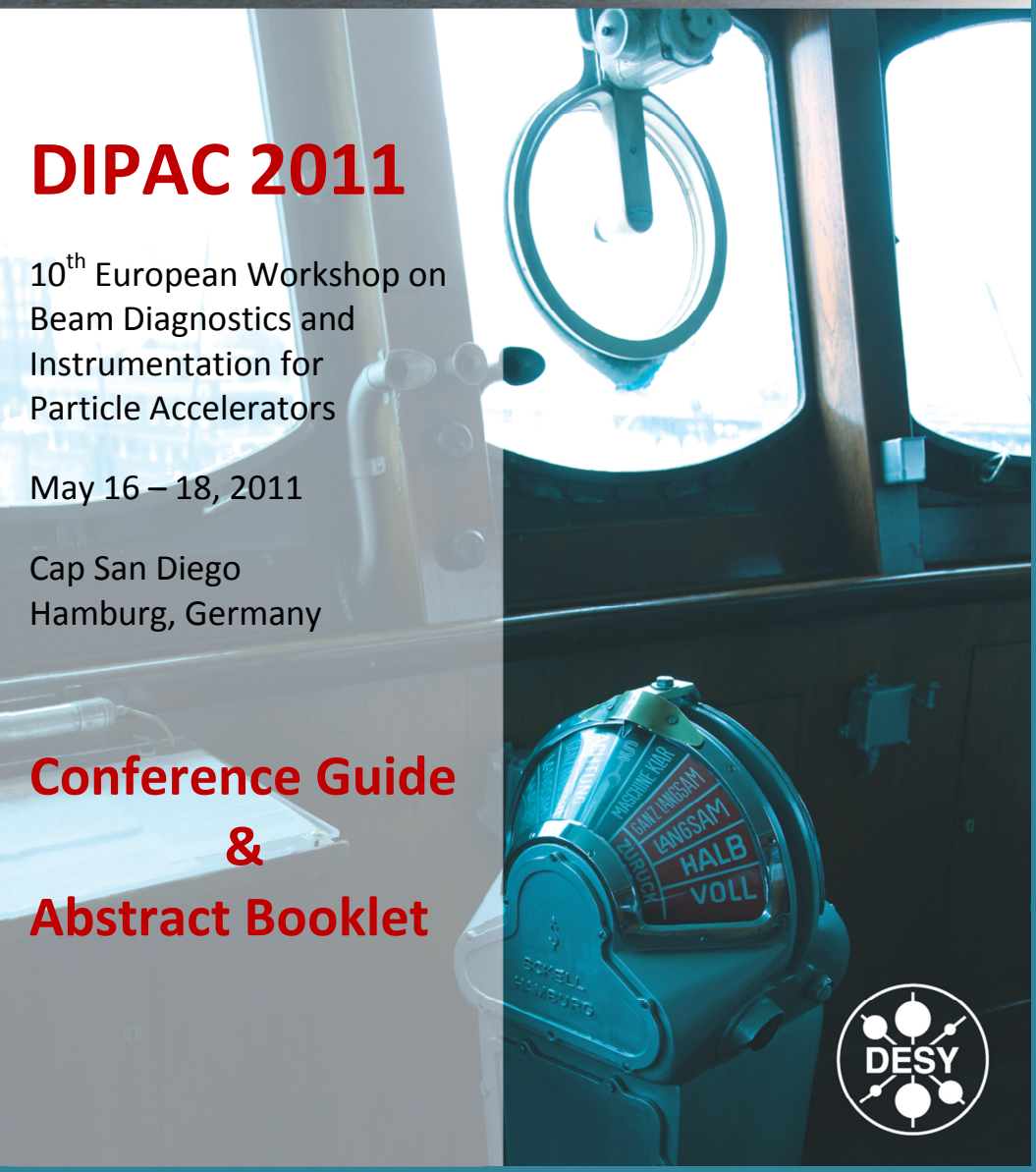
DIPAC 2011

10th European Workshop on Beam Diagnostics and Instrumentation for Particle Accelerators

May 16 – 18, 2011

Cap San Diego
Hamburg, Germany

Conference Guide & Abstract Booklet



http://dipac2011.desy.de

DIPAC 2011

Aboard the museum freighter Cap San Diego

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Conference Guide
&
Abstract Booklet

Hosted by
DESY, Hamburg, Germany

http://dipac2011.desy.de

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Foreword of the Chairman

Dear colleagues,

the research center DESY is pleased to be hosting the 10th biennial European Workshop on Beam Diagnostics and Instrumentation for Particle Accelerators, DIPAC'11, in Hamburg, Germany, on board the museum freighter Cap San Diego, from 16-18 May 2011.

DIPAC provides a unique forum for experts and novices to share their experience and to exchange information and ideas in the field of particle accelerator beam diagnostics. The workshop aims to provide an atmosphere that fosters lively discussions regarding latest developments and new concepts in instrumentation at particle accelerator facilities worldwide, ranging from low energy gun and injector test facilities to high energy, high intensity hadron accelerators and colliders. Diagnostics and instrumentation issues at synchrotron radiation user facilities, accelerator-based cancer therapy centers and next generation LINAC-based FELs also form an integral part of the Workshop.

The DIPAC Program Committee and organizers welcome you to Hamburg and we hope, that you will have a great time at DIPAC'11.

Yours sincerely,

Kay Wittenburg

Chairman, DIPAC'11 Program Committee

Conference Organization

Contacts

Chair:	Kay Wittenburg
Secretary:	Christel Oevermann & Helga Ahluwalia
Industrial Exhibition:	Gero Kube
Poster Sessions:	Norbert Wentowski & Dirk Noelle
Internet Café:	Gunnar Priebe & Klaus Knaack
Proceedings Office:	Michaela Marx
Speakers' Assistance:	Klaus Knaack & Carsten Kluth
DESY Tour:	Hans Christian Schröder

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Ian Martin (Diamond)
Raphael Müller (GSI)
Volker RW Schaa (GSI)
Cécile Vock (PSI)

Abstract Booklet: Michaela Marx (DESY) & Volker RW Schaa (GSI)

Conference Venue

The DIPAC 2011 Conference will be held on board the museum freighter Cap San Diego.

Address:
Cap San Diego
Überseebrücke
20459 Hamburg
Germany

Phone: +49-40-36 24 09

Web: www.capsandiego.de (in German)

Information about the freighter in English:
http://www.capsandiego.de/Summary/Information_in_English_Today.html

Transportation

From the airport or from the main station take the local city train S1 with direction “Hauptbahnhof” and “Blankenese” or “Wedel”. Leave the train at “Landungsbrücken”. Take the exit “Landungsbrücken”. Turn left and you will see the “Rickmer Rickmers” and behind the “Cap San Diego”. Walk 10 min along the pier to the “Überseebrücke”, enter the pontoon and the gangway. Welcome onboard!

Public transport in Hamburg:
http://www.hvv.de/en/index.php

X


St. Pauli Hafenstraße
Landungsbrücken
Rainer Abicht Elbreederei GmbH & Co
Pupasch
Hamburg City Tour, Stadt und Hafenrundfahrten in Hamburg
St. Pauli Nachtwächter
Stattreisen Hamburg eV Stadtführungen
Kuhberg
Eichholz
Hotel Hafentor
Zahnarzt-Klinik am Johannisbollwerk Dr. Ole Richter
Schwedische Gustav-Adolf-Kirche
Ditmar-Koel-Straße
Comptronic Computer und Elektronik Handelsgesellschaft
Bugsier
Johannisbollwerk
Rickmer Rickmers Stiftung des Vereines Windjammer für Hamburg
Restaurant Überseebrücke
Vorsetzen
Hotel Stella Maris Hamburg
Restaurante Porto
Meson Galicia
Restaurant Casa-Madeira
Panthera Rodizio Brasilianische Spezialitäten
Hanse Clipper Haus Hamburg City
Fischmarkt
Brauerknechtgraben
Tapasria con Carvalho
Rambachstraße
Karpfangerstraße
Casa Franco
guenstiger.de
Sagres
Wolfgangsweg
Galego
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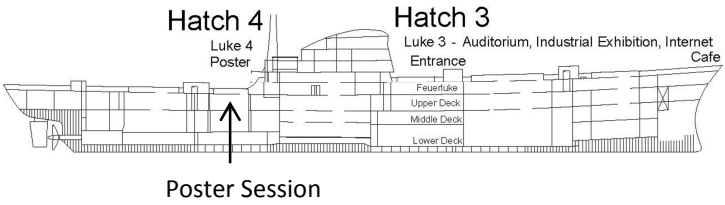
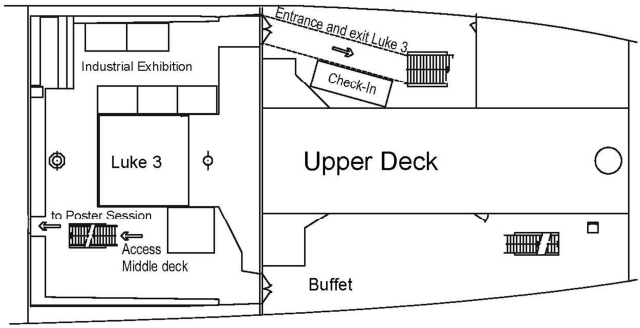
Neustädter Neuer Weg
Gruner Jahr
Schaarsteinweg
Pasmannstraße
MeridianSpa City
Madison Hotel Hamburg
HanseNautic
Ahlers & Vogel Rechtsanwälte
Zahnarztpraxis Dr. Nils & Jörn Mühlenbeck
Stubbenhuk
Am Baumwall
Baumwall
Überseebrücke
Niederhafen
Cap San Diego
Floating Home
©2011 Google - Map data ©2011 Tele Atlas

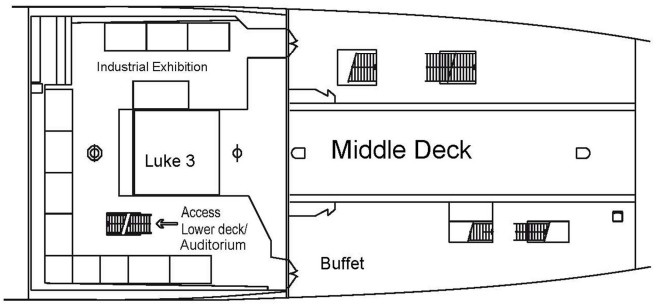
Cap San Diego – deck plans

The main entrance is near hatch 3 (Luke 3). Please enter here for the registration desk, the industrial exhibition, the Internet Café and the auditorium. Follow the signs.

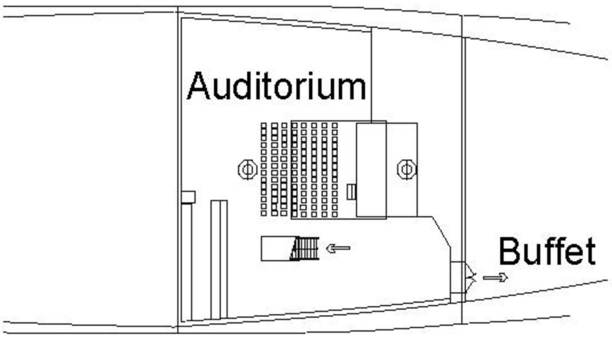




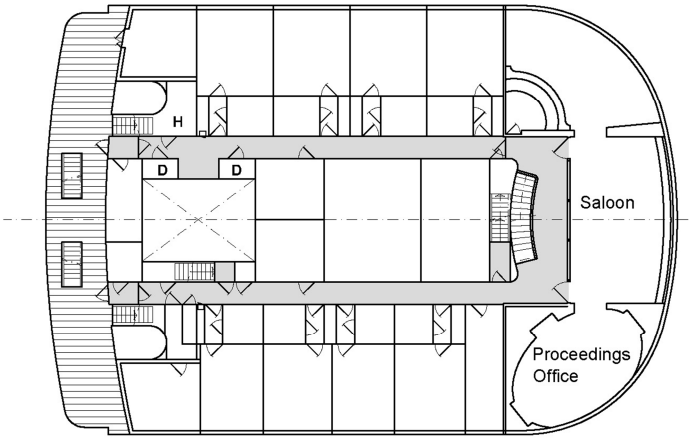
Industrial Exhibition: Upper and Middle Deck



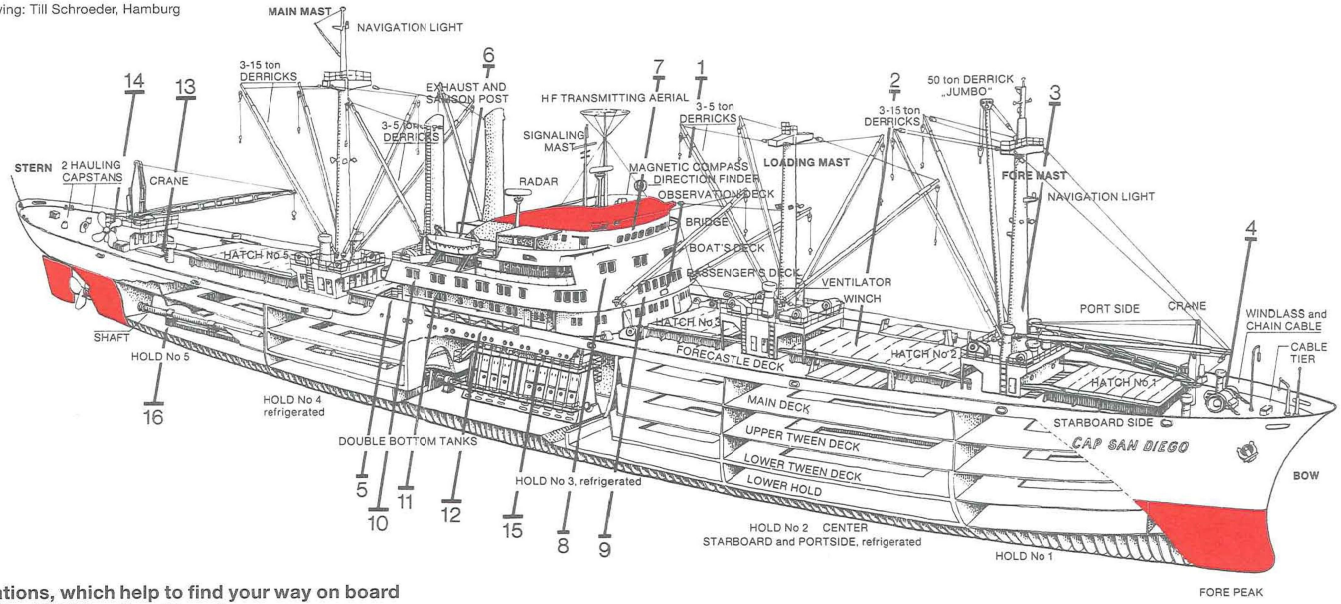
Lower Deck – Auditorium



Bridge Deck – The Proceedings Office (located in the saloon).



Drawing: Till Schroeder, Hamburg



Stations, which help to find your way on board of the MV "Cap San Diego":

Registration

The registration will take place from 16:00 – 19:00 h on Sunday, May 15 at the workshop venue and on Monday morning, May 16 starting at 8:00 h. Please follow the signs onboard the Cap San Diego.

You'll be supplied with a name badge. Please wear this name badge onboard throughout DIPAC 2011.

The workshop fee includes a workshop kit, the welcome reception, the workshop dinner, coffee breaks, lunch meals, an abstract booklet and a name badge.

Information Desk

The Information Desk opens throughout the workshop as follows:

Sunday	16:00 – 19:00 h
Monday	8:00 – 18:00 h
Tuesday	8:00 – 18:00 h
Wednesday	8:00 – 12:00 h

Welcome Reception & Workshop Dinner

On Sunday, May 15 a welcome reception will be held onboard the Cap San Diego from 17:30 – 19:30 h.

The workshop dinner will take place on Tuesday, May 17 at the Gröninger Privatbrauerei, a famous Hamburg brewery.
The address is: Willy-Brandt-Str. 47, 20457 Hamburg, located within a walking distance from the Cap San Diego.
http://www.groeninger-hamburg.de/

Proceedings Office

The Proceedings Office is located on the Bridge Deck in the Saloon.

Proceedings Office hours:

Monday	8:30 – 18:30
Tuesday	8:30 – 18:30
Wednesday	8:30 – 12:30

Authors are requested to check on the status of their submitted paper by first consulting the electronic dotting board located in the neighborhood of the internet café or by logging in to their JACoW DIPAC'11 SPMS account.

Editorial staff will be working in the saloon on the bridge deck. Author reception will be located outside the editorial office.

In case your paper status is yellow or red please proceed to the author reception desk.

Internet Café

The Internet Café is located in the Feuerluke at hatch 3 above the upper deck. Wireless internet will be available as well.

Opening hours:

Monday	8:00 – 18:00
Tuesday	8:00 – 18:00
Wednesday	8:00 – 18:00

Sponsors & Student Grants

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

Dimtel, Inc. for the Welcome Hors d'Oeuvres on Sunday afternoon.

FNT and **LONG-IT** for the Happy Hour on Monday afternoon.

Instrumentation Technologies for the Startup Cocktail at the conference dinner.

Reuter Technologie for the contribution to our Farewell Drink on Wednesday evening.

The student travel program is made possible by the funding support from DIPAC'11 and generous contributions from **BERGOZ** and **NTG**.

CERN Courier provided free advertisement for IBIC2012

The **Australian Synchrotron** and **BERGOZ** added some valuable amount to the printed proceedings.

Industrial Exhibition & Sponsors

The industrial exhibition will take place on the middle deck at Luke 3.

Exhibition hours:

Monday	9:00 – 18:00
Tuesday	9:00 – 17:00

List of Exhibitors

Bergoz Instrumentation

CIVIDEC

Dimtel, Inc.

ESSEX

FMB

FNT

INCAA Computers B.V.

Instrumentation Technologies

Long-IT

NTG Neue Technologien

MEN

Optronis

PHOTONIS | INDUSTRY | SCIENCE | MEDICAL

Reuter Technologie

SEMIC

Struck

Tektronix

Times Microwave Systems

VACOM

W-IE-NE-R, Plein & Baus GmbH

Further information from the exhibitors can be found in the conference bags.

Security & Insurance

Participants are asked not to leave their belongings unattended and to wear their conference badge all the time onboard the Cap San Diego and at all DIPAC'11 sponsored events.

The workshop organizers cannot accept liability for personal injuries sustained or for loss or damage to participants (or companions) personal property during the workshop.

Safety Instructions

You have to expect non-conform conditions onboard the Cap San Diego like steep and narrow stairs and gangways, high doorsteps and slippery and uneven floors – and only marginal signs and warnings! Please be aware of these risks, use adequate footwear and use the hand rail on gangways and stairs.
Please note: The use of dangerous or inflammable materials is forbidden.

During the conference we have two medical aidmen on board to provide professional first aid.

DESY Tour

The DESY tour will occur on Thursday, May 19.
The buses will leave the "Landungsbrücken" at 9:00
and return at 14:30.

There is the possibility to have lunch at the DESY canteen.

Please note: The buses return to the Landungsbrücken and additionally to the main train station and the airport.

Oral Presentations

Oral presentations will take place in the auditorium on the lower deck at hatchway 3 (Luke 3). The invited talks are 25 + 5 minutes (presentation + discussion), the contributed talks are 15 + 5 minutes (presentation + discussion)

In addition 10 minutes have been allocated for discussions at the end of each session.

A speaker preparation room is available in the Feuerluke at hatchway 3 (Luke 3). This is an area where speakers can preview and test their presentations.

All speakers must give their presentations from the laptop set up in the auditorium. Individual laptops cannot be accommodated.

Please note: Speakers MUST upload their talks to the SPMS,

https://oraweb.cern.ch/pls/dipac2011/profile.html

at least 24 hours in advance of their presentations.

Help is provided by Klaus Knaack and Gunnar Priebe from the DIPAC2011 crew.

Poster Sessions

The poster sessions will be located in the upper deck at hatchway 4 (Luke 4). They will take place on Monday and Tuesday afternoon. The poster rooms may be visited throughout the day.

Poster session hours:

Monday 16:00 – 19:00 h
Tuesday 15:10 – 17:30 h

Posters should be mounted latest during lunch time, but it is possible to mount it already during the morning – all necessary material for poster display (pins, etc.) will be provided by the conference organizers. The Poster has to be dismounted at the end of the session by the author/presenter.

Posters are grouped by their classifications. Each poster board is numbered with a Paper-ID whereby the first two letters correspond to the day of presentation.

Posters must be manned throughout the entire session.

Help is provided by Norbert Wentowski and Dirk Noelle from the DIPAC2011 crew.

Authors are reminded that no contributions are accepted for publication only. Any paper accepted for presentation, which is not presented at the conference, will be excluded from the Proceedings. Furthermore, the Program Committee reserves the right to refuse for publication work not properly presented in the poster session.

16-May-11 09:00 – 10:50
Auditorium

Monday Session A
Chair: K. Wittenburg (DESY)

01 Overview and Commissioning of Facilities

MOOA01 **Accelerator Projects at DESY** – *R. Brinkmann (DESY)*
DESY is one of the worldwide leading accelerator laboratories. At present we operate the synchrotron radiation storage rings DORIS and PETRA-III and the superconducting linac soft X-ray free electron laser facility FLASH. DESY is a major partner for the construction of the European XFEL project and coordinator of the international consortium which builds the accelerator complex. In this talk, after a brief general introduction to the laboratory, an overview of DESY's activities in the area of accelerator operation, construction and R&D will be given.

MOOA02 **Beam Instrumentation for X-FELs** – *H. Loos (SLAC)*
The performance of X-ray Free-electron lasers depends strongly on the achieved quality of the high brightness electron beam and its shot by shot stability. The requirements and challenges of the instrumentation needed to tune and optimize such electron beams will be discussed. Of particular interest are measurements of the beam orbit, emittance, energy, and bunch length and the different measurement techniques for these transverse and longitudinal beam parameters and their implementation for routine operation will be addressed in detail, particularly the necessary instrumentation to fulfill different user requirements in terms of beam energy and bunch length. Specific requirements for the initial commissioning, routine optimization and feedback applications will be presented as well.

09 Others

MOOA03 **Photon Diagnostics for X-ray FELs** – *M. Gensch (HZDR)*
SASE FEL's have now truly evolved into the long anticipated so called 4th generation of accelerator based X-ray light sources. A number of piloting experiments are proof that these novel X-ray sources provide radiation with the theoretically predicted unprecedented properties such as femtosecond pulse duration or Gigawatt peak power in a photon energy range extending from the soft X-ray into the hard X-ray regime. However, the success of these facilities depends strongly on the availability of suitable photon diagnostics. To be precise, due to the stochastic nature of the SASE process, properties such as pulse energy, wavelength, pulse duration and arrival time are varying from pulse to pulse and more complex experiments will crucially depend on the determination of these properties for every individual X-ray pulse. In this talk, the state of the art of currently available photon diagnostic is discussed and novel single shot techniques for the measurement of X-ray pulse duration and arrival time are presented.

16-May-11 11:20 – 13:00
Auditorium

Monday Session B
Chair: H. Schmickler (CERN)

02 BPMs

MOOB01 **An Aperture Backscatter X-ray Beam Position Monitor at Diamond** – *C. Bloomer (Diamond), G. Rehm, C.A. Thomas (Diamond)*
This paper presents the design and first results of a new XBPM developed at Diamond that images the backscatter from an aperture in the Front End to measure the beam centre of mass. This is of particular interest for monitoring the emission from elliptically polarizing undulators where the profile of the beam varies strongly with change of beam polarization. Traditional four-blade Front End XBPMs struggle to resolve a beam centre of mass for EPUs because of this. We have developed an XBPM that observes the backscattered photons from a copper aperture through a pinhole. This solution is capable of operating with the full white beam, and has been designed to fit into the same physical space as the standard front end XBPMs in use at Diamond. This offers the potential to easily replace traditional XBPMs where beneficial and required.

09 Others

MOOB02 **Emittance and Energy Spread Measurements of Laser-wakefield Accelerated Electron Beams** – *G.G. Manahan (USTRAT/SUPA), M.P. Anania, C. Aniculaesei, E. Brunetti, S. Cipiccia, B. Ersfeld, M.R. Islam, R.C. Issac, D.A. Jaroszynski, R.P. Shanks, G.H. Welsh, S.M. Wiggins (USTRAT/SUPA)*
The normalised transverse emittance characterises the quality of an electron beam generated from the laser-plasma wakefield accelerator (LWFA). Brightness, parallelism and focusability are all functions of the emittance. In this report, we present a high-resolution single shot method of measuring the transverse emittance of a 125 MeV electron beam generated from a LWFA using a pepper-pot mask. An average normalised emittance of around $\epsilon rms, x, y = 2.0 \pm 0.6\,\pi$-mm-mrad was measured, which is comparable to that of a conventional accelerator. The best measured emittance was $\epsilon rms, x = 1.1 \pm 0.1\,\pi$-mm-mrad, corresponding to the resolution limit of our system. We also obtained high energy monoenergetic electron beam with relative energy spread less than 0.8%. The low emittance and low energy spread indicate that our accelerator is suitable for compact free electron laser driver.

04 Beam Loss Detection

MOOB03 **Diamond-based Beam Halo Monitor Equipped with RF Fingers for SPring-8 XFEL** – *H. Aoyagi (JASRI/SPring-8), T. Aoki, T. Bizen, K. Fukami, N. Nariyama, S. Suzuki (JASRI/SPring-8) Y. Asano, T. Itoga, H. Kitamura, T. Tanaka (RIKEN/SPring-8)*
The diamond-based beam halo monitor has been developed for the X-ray free electron laser facility at SPring-8 (SPring-8 XFEL). This monitor is an interlock sensor to protect the undulator magnets against radiation

damage. Pulse-mode measurement is adopted to suppress the background noise efficiently. The diamond detectors are dipped into the beam duct in order that the intensity of the beam halo can be measured directly. However, it is important issue to avoid degradation in quality of electron beam for SPring-8 XFEL. We designed new RF fingers with aluminum windows in order to reduce the impedance to the beam. The RF fingers are made of beryllium copper, and having the aluminum windows, which is low-Z material, in front of active areas of the diamond detectors. Therefore, the influence of secondary electrons and bremsstrahlung from the finger material can be suppressed. To evaluate influence on the output signal of the diamond detector by changing the finger material, both the simulation study and the experimental measurement have been carried out. Feasibility tests of this monitor, which is equipped with the RF fingers, have also been demonstrated at the SCSS test accelerator.

03 Longitudinal Diagnostics and Synchronization

MOOB04 **Bunch Compression, RF Curvature Correction and Measurements of M55, T566 and U5666 Matrix Elements at JLab IR/UV Upgrade** – *P. Evtushenko (JLAB), S.V. Benson, D. Douglas (JLAB)*

The JLab IR/UV FEL Upgrade operates with the bunch length compressed down to 100–150 fs RMS. An indispensible part of the bunch compression scheme is the correction of the so-called LINAC RF curvature. Unlike other systems – where the RF curvature gets corrected using higher a harmonic LINAC – our system utilizes magnetic elements of the beam transport system to correct and adjust the second and third order correlation terms. These are expressed in terms of the transport matrix elements T566 and U5666. The linear correlation term described by M55 is adjusted using the magnetic system as well. The large energy spread induced on the beam by the FEL operation is compressed as a part of the energy recovery process. As in the case of bunch length compression, this energy compression is optimized by properly adjusting high order transport matrix elements. In this contribution we describe the system used for direct measurements of the transport matrix elements M55, T566 and U5666 and its impact on the operation and bunch compression. Results of the measurements are presented together with the bunch length measurements including the data showing resolution and accuracy of the system.

16-May-11 14:30 – 16:00
Auditorium

Monday Session C
Chair: P. Forck (GSI)

02 BPMs

MOOC01 **Overview of Recent Trends and Developments for BPM Systems** – *M. Wendt (Fermilab)*
Beam position monitoring (BPM) systems are the workhorse beam diagnostics for almost any kind of charged particle accelerator; linear, circular or transport-lines, operating with leptons, hadrons or heavy ions. The BPMs are essential for beam commissioning, accelerator fault analysis and trouble shooting, machine optics and lattice measurements, and finally for the accelerator optimization to achieve the ultimate beam quality. This presentation summarizes the efforts of the beam instrumentation community on recent developments and advances on BPM technologies, i.e. BPM pickup monitors and front-end electronics (analog and digital). Principles, examples, and state-of-the-art status on various BPM techniques are outlined, serving hadron and heavy ion machines, sync light synchrotron's, as well as electron linacs for FEL or HEP applications.

MOOC02 **Cavity BPM System for ATF2** – *A. Lyapin (JAI), R. Ainsworth, S.T. Boogert, F.J. Cullinan, N.Y. Joshi (JAI) A.S. Aryshev, Y. Honda, N. Terunuma, JU. Urakawa (KEK) J.C. Frisch, D.J. McCormick, J. Nelson, T.J. Smith, G.R. White (SLAC) A. Heo, E.-S. Kim, Y.I. Kim (KNU) M.C. Ross (Fermilab)*
In this paper we summarise our 2-year experience operating the Cavity Beam Position Monitor (CBPM) system at the Accelerator Test Facility (ATF) in KEK. The system currently consists of 41 C and S-band CBPMs and is the main diagnostic tool for the new ATF2 extraction beamline. We concentrate on issues related to the scale of the system and also consider long-term effects, most of which are undetectable or insignificant in smaller experimental prototype systems. We consistently show submicron BPM resolutions and week-to-week scale drifts of an order of 1%.

MOOC03 **The Fermi@Elettra Cavity BPM System: Description and Commissioning Results** – *M. Ferianis (ELETTRA), A.O. Borga, P. Craievich, R. De Monte, G. Gaio, M. Predonzani (ELETTRA) M. Dal Forno (DEEI)*
The Fermi@elettra cavity BPM (C-BPM) system is based on an original implementation of the C-BPM scheme as the pick-up, operating at 6.5 GHz, is coupled to a dedicated, self-calibrating electronics based on a novel concept. The system has been developed in-house; both the E-M and the mechanical design of the pick-up have been carried out, including an original frequency tuning scheme. The detector electronics directly obtains the envelope of the sum and difference signals by means of an RF 180^{o} hybrid; no mixer for the RF signal down conversion is used. The detector is based on 3 blocks: an RF front-end, a baseband

analogue transmission module and a digital back-end unit, based on a micro-TCA platform. The digital back-end is equipped with a powerful Virtex 5 FPGA and several real-time tasks have been implemented on it, including intra-pulse calibration. Ten C-BPM stations have been installed so far, fully integrated in the FERMI control System, enabling a real-time control of this key FEL diagnostics. Results on performances with beam are also presented; the scale factor of C-BPMs is obtained with beam, as two-axis micrometer translation stages have been installed.

16-May-11 16:30 – 18:00
Luke 4

Monday Poster Session

01 Overview and Commissioning of Facilities

MOPD01 **Beam Diagnostics for the NSLS-II Booster** – *V.V. Smaluk (BINP) E.A. Bekhtenev, V.P. Cherepanov, G.V. Karpov, V. Kuzminykh, O.I. Meshkov (BINP SB RAS) I. Pinayev, O. Singh, K. Vetter (BNL)*
For successful commissioning and effective operation of the projected NSLS-II Booster, a set of beam diagnostic instruments has been designed. Fluorescent screens are used for the Booster commissioning and troubleshooting. Closed orbit is measured using electrostatic BPMs with turn-by-turn capability. The circulating current and beam lifetime are measured using a DC current transformer. The fill pattern is monitored by a fast current transformer. Visible synchrotron radiation is registered for observation of the beam image. Betatron tunes are measured using two pairs of striplines, the first pair is for beam excitation and the second one – for beam response measurement. Design and performance of the Booster beam instrumentation are described.

MOPD02 **The CNAO Qualification Monitor** – *C. Viviani (CNAO Foundation), J. Bosser, H. Caracciolo, M.A. Garella, A. Parravicini (CNAO Foundation)*
The CNAO (Centro Nazionale di Adroterapia Oncologica) Foundation is the first Italian center for deep hadrontherapy. It will treat patients using Protons and Carbon ions in the next coming months. Patient safety is the first priority and many diagnostics devices have been developed to guarantee it. This work presents the so-called Qualification Monitor (QM). It is mounted in the common part of the four extraction lines, in front of the Chopper Dump, and it aims to qualify the extracted beam profile and intensity, before sending it to the treatment rooms. It is made of two different detectors: the first one, called Qualification Profile Monitor (QPM), is made by two dimensional harp of scintillating fibers to measure horizontal and vertical profiles. The second one, named Qualification Intensity Monitor (QIM) is a scintillating plate for intensity measurement. At the beginning of each extracted spill the beam is dumped on the Chopper Dump and it hit the QM. Only a positive result from beam qualification allows to switch on Chopper magnets and to send the beam to the patient. The QM is working with beam from some months, first results and future upgrades are presented.

MOPD03 **The Beam Safety System of the PSI UCN Source** – *D. Reggiani (PSI), B. Blarer, P.-A. Duperrex, G. Dzieglewski, F. Heinrich, A.C. Mezger, U. Rohrer, K. Thomsen, M. Wohlmuther (PSI)*
At PSI, a new and very intensive Ultra-Cold Neutron (UCN) source based on the spallation principle was commissioned in December 2010 and will start production in 2011. From then on, two neutron spallation sources, the continuous wave SINQ and the macro-pulsed UCN source, both furnished with a solid state target, will be operating concurrently at PSI. The 590 MeV, 1.3 MW proton beam will be switched towards the new spallation target for about 8 s every 800 s. Safe operation of the UCN source is guaranteed by two independent interlock systems. In fact, beside the well established accelerator protection system, a new fast interlock system has been designed following the experience gathered with the MEGAPIE (Megawatt Pilot Target Experiment) project. The goal of this additional system is to preserve the UCN target and the complete beam line installation by ensuring correct beam settings and, at the same time, to avoid any accidental release of radioactive material. After a brief introduction of the PSI UCN source, this paper will focus on the motivations as well as the principle of operation of the UCN beam safety system.

MOPD04 **RHIC Electron Lens Test Bench Diagnostics** – *D.M. Gassner (BNL), E.N. Beebe, W. Fischer, K. Hamdi, J. Hock, C. Liu, T.A. Miller, A.I. Pikin, P. Thieberger (BNL)*
An Electron Lens system will be installed in RHIC to increase luminosity by counteracting the head-on beam-beam interaction. The proton beam collisions at the two experimental locations will introduce a tune spread due to a difference of tune shifts between small and large amplitude particles. A low energy electron beam will be used to improve luminosity and lifetime of the colliding beams by reducing the betatron tune shift and spread. In preparation for the Electron Lens installation next year, a test bench facility will be used to gain experience with all sub-systems. This paper will discuss the diagnostics related to measuring the electron beam parameters.

MOPD05 **Beam Diagnostic Layout for SIS100 at FAIR** – *M. Schwickert (GSI), T. Hoffmann, P. Kowina, H. Reeg (GSI)*
The SIS100 heavy ion synchrotron will be the central machine of the FAIR (Facility for Antiprotons and Ions Research) project currently designed at GSI. The unique features of SIS100, like e.g. the acceleration of high intensity beams of $2.5{\cdot}10^{13}$ protons and $5{\cdot}10^{11}$ Uranium ions near the space charge limit, the anticipated large tune spread, extreme UHV conditions of the cryogenic system for superconducting magnets and fast ramp rates of 4 T/s, make challenging demands on the beam diagnostic components. This contribution describes the conceptual design for SIS100 beam diagnostics and reports on the present status of prototype studies. Exemplarily the progress concerning beam position monitors, beam current transformers and beam-loss monitors is presented.

MOPD06 **Capabilities and Performance of the LHC Schottky Monitors** – *M. Favier (CERN), T.B. Bogey, F. Caspers, O.R. Jones (CERN) J. Cai, E.S.M. McCrory, R.J. Pasquinelli (Fermilab) A. Jansson (ESS)*
The LHC Schottky system has been under commissioning since summer 2010. This non destructive observation relies on a slotted waveguide structure resonating at 4.8 GHz. Four monitors, one for each plane of the two counter-rotating LHC beams, are used to measure the transverse Schottky sidebands Electronic gating allows selective bunch-by-bunch measurements, while a triple down-mixing scheme combined with heavy filtering gives an instantaneous dynamic range of over 100 dB within a 20 kHz bandwidth. Observations of both proton and lead ion Schottky spectra will be discussed along with a comparison of predicted and measured performance.

MOPD07 **Implementation of New Beam Diagnostics at the Australian Synchrotron** – *E.D. van Garderen (ASCo)*
The Australian Synchrotron is aiming at implementing Top-Up operations by the end of 2011. To reduce costs only one of the two klystrons in the linac will be used. The energy of the electron beam at the end of the linac will be reduced from 100 MeV to about 60 MeV which will require the injection system to be recommissioned. To this purpose the beam position monitors in the booster have been upgraded and YAG screens have been added in the booster-to-storage ring (BTS) transfer line. The injection efficiency will also require optimization and monitoring. A Fast Current Transformer has thus been included at the end of the BTS.

MOPD08 **Design and Fabrication of Beam Monitors in the Energy Upgraded J-PARC Linac** – *A. Miura (JAEA/J-PARC) K. Hasegawa (JAEA) Z. Igarashi, M. Ikegami, T. Miyao, T. Toyama (KEK)*
J-PARC had developed the beam diagnostic devices for the current J-PARC linac and has used them since the operation start. J-PARC linac began the energy upgrade project since 2009 and 21 ACS cavities will be installed. In this project, many cavities and related devices are newly installed in the ACS section and its downstream part. Because the beam parameters are updated, new beam diagnostic devices are fabricated and current diagnostic devices are developed. Beam position monitors (BPM) are newly designed and fabricated, based on the computer simulation and bench test. Because the gas proportional BLMs as the current BLM are sensitive to background noise of X-ray emitted from RF cavities, it is difficult to recognize real beam loss. We need to subtract an X-ray noise from the signal from BLM, another candidate BLMs have been tried to measure the beam loss. In addition, the bunch shape monitor for the longitudinal tuning has been developed in the corroboration with the institute for nuclear research, Russia. In this paper, we describe the new developed devices and their development process, especially for beam loss monitor and the developing bunch shape monitor.

MOPD09 **Electron Beam Diagnostics for FLASH II** – *N. Baboi (DESY), D. Nölle (DESY)*
Up to now, the FLASH linac serves one SASE (Self-Amplified Spontaneous Emission) undulator. The radiation produced can be guided to one of 5 beamlines in the experimental hall. In order to increase the availability of the machine, an extension, FLASH II, will be built in the next few years. A second undulator section will be built to generate SASE light. A HHG (High Harmonic Generation) laser will alternatively be used to produce seeded radiation in the undulators. The electron beam diagnostics in FLASH II has to enable the precise control of the beam position, size, timing, as well as the overlap of the electron beam with the HHG laser. The losses have to be kept under control, and the beam has to terminate safely in the beam dump. In comparison to FLASH, which was designed to run with rather high charge, the dynamic range of the diagnostics has to be between 0.1 to 1 nC, similar to the European XFEL. This paper gives an overview of the diagnostics for FLASH II.

02 BPMs

MOPD10 **A Calibration Method for the RF Front-end Asymmetry of the DBPM Processor** – *X. Yi (SSRF), L.W. Lai, Y.B. Leng, Y.B. Yan, N. Zhang (SSRF)*
Digital Beam Position Monitor (DBPM) processor, designed to measure beam positions of LINAC, booster and storage ring, has been used in many synchrotron radiation facilities. Channels asymmetry, deteriorates the performance of the DBPM, is inevitable since the RF front-end needs four exactly same blocks. Quasi-crossbar is a technique adopted by Libera to reject the channels asymmetry, but it decreases resolution of the wideband beam position due to the switching noise. Recently, a RF Front-end board for DBPM was completed with calibration circuit which clears the switching noise. The calibration method will be described in detail, including an overview of the RF board. The beam current dependence, which is sensitive to channels asymmetry, decreases from 160 μm to 25 μm after calibration in the lab test.

MOPD11 **High Resolution BPM Upgrade for the ATF Damping Ring at KEK** – *N. Eddy (Fermilab)*
A beam position monitor (BPM) upgrade at the KEK Accelerator Test Facility (ATF) damping ring has been accomplished, carried out by a KEK/FNAL/SLAC collaboration under the umbrella of the global ILC R&D effort. The upgrade consists of a high resolution, high reproducibility read-out system, based on analog and digital down-conversion techniques, digital signal processing, and also implements a new automatic gain error correction schema. The technical concept and realization as well as results of beam studies are presented.

MOPD12 **Expressing Properties of BPM Measurement System in Terms of Error Emittance and Error Twiss Parameters** – *V. Balandin (DESY), W. Decking, N. Golubeva (DESY)*
The determination of variations in the beam position and in the beam energy using BPM readings is one of the standard problems of accelerator physics. If the optical model of the beam line and BPM resolutions are known, the typical choice is to let jitter parameters be a solution of

the weighted linear least squares problem. For transversely uncoupled motion this least squares problem can be solved analytically, but the direct usage of the obtained solution as a tool for designing a BPM measurement system is not straightforward. A better understanding of the nature of the problem is needed. In this paper we show that properties of the BPM measurement system can be described in terms of the usual accelerator physics concepts of emittance, energy spread, dispersions and betatron functions. In this way one can compare two BPM systems comparing their so-called error emittances and error energy spreads, or, for a given measurement system, one can achieve a balance between coordinate and momentum reconstruction errors by matching the error betatron functions in the point of interest to the desired values.

MOPD13 **Mode-Selective Waveguide BPM** – *A. Lyapin (JAI)*
I propose a mode-selective waveguide Beam Position Monitor (BPM). It uses waveguide couplers arranged at the beampipe to create boundary conditions similar to those in slot-coupled cavity BPMs. This structure allows to couple to the differential waveguide mode co-propagating with the beam, and reject the usually much stronger monopole component of the field. As the full dynamic range of the processing electronics can be used for position measurements, and a waveguide is a native high-pass filter, such a BPM is expected to outperform stripline and button BPMs in terms of both spacial and time resolution. In this paper I give some details on the basic principle and the first simulation results and discuss possible ways of signal processing.

MOPD14 **Calibration of the Electrostatic Beam Position Monitors for VEPP-2000** – *Yu. A. Rogovsky (BINP SB RAS)*
The basic requirement for the VEPP-2000 Beam Position Monitor (BPM) is the measurement of the beam orbit with 0.1 mm precision. To improve the measurement accuracy, the response of the electrostatic BPMs (pickups) were mapped in the laboratory before they were installed in the VEPP-2000 ring. The wire method for the sensitivity calibration and position-to-signal mapping is used. The test stand consists of high frequency coaxial switches to select each pickup electrode, movable antenna to simulate the beam, signal source, spectrum analyzer to measure the pickup signals, and analysis software. This calibration showed possibility of required accuracy. During calibration the electrical center of the different BPMs was measured with respect to the mechanical center. Conversion between the BPM signal and the actual beam position is done by using polynomial expansions fit to the mapping data within ±6 mm square. Results for these portions of the calibration are presented.

MOPD15 **Electromagnetic Simulations of an Embedded BPM in Collimator Jaws** – *A.A. Nosych (CERN), C.B. Boccard, M. Gasior (CERN)*
Next generation of the LHC collimators will be equipped with button beam position monitors (BPMs) embedded into the collimator jaws. Such a solution will improve the accuracy of the jaw alignment with respect to the beam and reduce the beam time necessary for the collimator setup. This paper describes results of electromagnetic simulations of the jaw BPMs performed with the CST Particle Studio suite, aimed at

characterisation of the BPMs as well as the simulation software itself. The results are compared to the measurements obtained with beam on a prototype system installed in the CERN SPS.

MOPD16 **Advanced Digital Signal Processing for Effective Beam Position Monitoring** – *D.A. Liakin (ITEP) P. Forck, K. Lang, R. Singh (GSI)*
A latest experience in digital signal processing of BPM data obtained in synchrotrons of ITEP and GSI is discussed. The data in ITEP was collected by BPM processor prototype while the SIS18 at GSI uses a renovated digital system. Due to different concept of BPM architectures on those facilities it is possible to compare algorithms oriented to certain hardware. Several algorithms of position detection are compared to each other. Performances of 'collective' and partly distributed algorithms are estimated. Data reduction methods and visualization solutions are considered. Finally low- and wideband data evaluation for longitudinal phase space is presented.

MOPD17 **Beam-based HOM Study in Third Harmonic SC Cavities for Beam Alignment at FLASH** – *P. Zhang (UMAN), R.M. Jones, I.R.R. Shinton (UMAN) N. Baboi, B. Lorbeer, P. Zhang H. Ecklebe, T. Flisgen, H.-W. Glock (Rostock University, Faculty of Computer Science and Electrical Engineering)*
An electron beam entering an accelerator cavity excites higher order modes (HOM). These are radiated to HOM couplers, subsequently damped, and can also be used to facilitate beam monitoring. The modes which deflect the beam transversely are the focus of this study and are used to monitor the beam position. Results are presented on the first analysis of beam alignment based on HOM signals from the third harmonic cavities at FLASH. The electrical center of each mode is ascertained by moving the beam to minimize the HOM signal detected. A single electron bunch per RF pulse is used.

MOPD18 **Embedded Collimator Beam Position Monitors** – *C.B. Boccard (CERN), A. Bertarelli, A. Dallocchio, M. Gasior, L. Gentini, A.A. Nosych (CERN)*
The LHC collimation system is crucial for safe and reliable operation of proton beams with 350 MJ stored energy. Currently the collimator set-up is performed by observing beam losses when approaching the collimator jaws to the beam. For all 100 LHC movable collimators the procedure may take several hours and since it has to be repeated whenever the beam configuration changes significantly, the collimator setup has an important impact on the overall machine operation efficiency. To reduce the collimator setup time by two orders of magnitude the next generation of the LHC collimators will be equipped with button beam position monitors (BPMs) embedded into the collimator jaws. This paper describes the BPM design and presents prototype results obtained with beam in the CERN-SPS.

MOPD19 **Button BPM Development for the European XFEL** – *D. Lipka (DESY), D. Nölle, M. Siemens, S. Vilcins (DESY)*
Button beam position monitors will be the main BPM type used to measure the electron beam position at the European XFEL. Two different

kinds of buttons are necessary: one type will be installed in the acceleration modules of the cold linac and the other in the warm environment. The electro-magnetic design of the feedthrough for both types of buttons will be discussed. A comparison of the designed and measured RF properties will be presented. In addition to the usual RF properties, also the properties at cryogenic level will play a role. HOM power must not heat up the BPM feedthroughs, in order to keep the cryo load of an overall accelerator module low, and also to prevent damage due to large temperature gradients over the ceramics of the feedthrough. First measurements with beam at FLASH show good agreement of the measured signals with the expectation.

MOPD20 **Applicability of the AM-PM-Method for Beam Position Monitoring of S-Band Accelerated Electron Beams** – *M. Ruf (U. Erlangen-Nurnberg LHFT), P. Quednau, L. Schmidt (U. Erlangen-Nurnberg LHFT) S. Setzer (Siemens Med)*
In this paper, the applicability of the amplitude-to-phase-conversion (AM-PM) method to beam position monitoring (BPM) purposes in S-Band frequency range is investigated. The proof-of-principle experiment is done by AM-PM-processing of capacitive pickup signals generated by a 6 MeV S-Band electron beam. It is demonstrated that the AM-PM-output pulsed DC signal is proportional to transverse beam offsets. Furthermore, design considerations and selection criteria of appropriate RF devices are described. Additionally, results of cold measurements of a planar 2-channel AM-PM-receiver module are presented indicating that the applicability will also be given for even higher frequency ranges.

MOPD21 **Overview of the BPM System of the ESS-Bilbao** – *D. Belver (ESS-Bilbao), I. Arredondo, P. Echevarria, J. Feuchtwanger, H. Hassanzadegan, M. del Campo (ESS-Bilbao) F.J. Bermejo (Bilbao, Faculty of Science and Technology) V. Etxebarria, J. Jugo, J. Portilla (University of the Basque Country, Faculty of Science and Technology) N. Garmendia, L. Muguira (ESS Bilbao)*
The BPM system from ESS-Bilbao is presented, including test bench, electronics and test results. Our test bench implements 4 capacitive buttons welded to the beam pipe. The position of the internal tube simulating the beam can be changed with respect to the outer tube within a range of 20 mm, with a resolution less than 10 μm. It is connected to an Analog Front-End (AFE) where signals are conditioned and converted to baseband and a Digital Unit (DU) to sample them and calculate the position and phase. The AFE is based on logarithmic amplifiers and IQ demodulators. Signals are converted from differential to single-ended and conditioned to meet the DU requirements (FPGA and ADC). DU includes offset compensation, gain adjustment, CORDIC, delta over sigma algorithm and linearization blocks. To manage the FPGA a Java interface has been developed including also the EPICS integration by means of JavaIOC and a MySQL interface. The resolution and accuracy results are promising (less than 10 μm and 1^o for the position and phase) provided that the effect of several errors such as temperature variations and non-linearities are minimized through temperature regulation and system calibration.

MOPD22 **Beam Based Gain Calibration of Beam Position Monitors in J-PARC MR** – *M. Tejima (KEK), T. Toyama (KEK) S. Hatakeyama (JAEA/J-PARC)*
The output data from a beam position monitor (BPM) system usually was calibrated on the test bench and so on. The gain of the output data may drift due to unpredictable imbalance among output signals from the pickup electrodes, because they must travel through separate paths,cables, connectors, attenuators, switches, and then are measured by detectors. The gain calibration has been tried to apply for the BPM system in J-PARC Main Ring. This paper reports the result of beam based gain callibration to estimate the imbalance, which was performed measuring the response from four output data of a BPM head.

MOPD23 **Photon BPM Electronics Development at TLS** – *P.C. Chiu (NSRRC), J. Chen, K.T. Hsu, K.H. Hu, C.H. Kuo (NSRRC)*
Photon BPMs are very useful for photon beam position and stability observation. There are several kinds of photon BPMs and electronics with different design installed at beamline front-ends at the Taiwan Light Source. To provide a better integration and efficient usage of the photon BPM, a commercial BPM electronics - Libera Photon was chosen for an integral solution and has showed at least one micron performance for several months of testing. In this report, the installation process and testing results of the photon BPM will be presented.

MOPD24 **A High-resolution Diode-based Orbit Measurement System – Prototype Results from the LHC** – *M. Gasior (CERN), R.J. Steinhagen (CERN)*
The prototype of a high resolution beam position monitor (BPM) electronics based on diode peak detectors was tested with LHC beams. In this technique developed at CERN the short beam pulses from each BPM electrode are converted into slowly varying signals by compensated diode peak detectors. The slow signals can be digitised with a laboratory voltmeter or high resolution ADC. As presented in the paper, this technique allows resolutions in the order of 1 ppm of the BPM aperture to be achieved with

MOPD25 **Diode Down-mixing of HOM Coupler Signals for Beam Position Determination in 1.3-GHz- and 3.9-GHz-Cavities at FLASH** – *H.-W. Glock (Rostock University, Faculty of Computer Science and Electrical Engineering), H. Ecklebe, T. Flisgen (Rostock University, Faculty of Computer Science and Electrical Engineering) N. Baboi, P. Zhang (DESY)*
Beam excited signals available at the HOM coupler ports of superconducting accelerating cavities cover a wide frequency range and carry information about (amongst others) transverse beam position. Down-mixing these signals using detector diodes is a mean to measure with standard and non-specific oscilloscope technology the time dependency of the power leaving the HOM coupler. Experiments undertaken at the accelerator modules ACC1 and ACC39 at FLASH demonstrated the possibility to extract beam position data out of low-frequency signals sampled with such a setup. These experiments as part of an ongoing study are described together with mathematical details of the evaluation scheme.

MOPD26 **Testing of New Hadron Beam Phase and Position Monitor at CIEMAT Laboratory** – *M. Znidarcic (I-Tech), B.B. Baricevic, R. Hrovatin (I-Tech) J.M. Carmona, A. Ibarra, I. Podadera Aliseda (CIEMAT)*
The Libera Single Pass H is the new instrumentation intended for phase, position and charge monitoring in hadron and heavy ion LINACs and transfer lines. Initial measurements and verification of the instrumentation performance were conducted in the laboratory at Instrumentation Technologies. Characterization measurements of the same electronics were later carried out at CIEMAT laboratory. The measurements were performed on a CIEMAT wire test bench with the 175 MHz pulsed signal connected to the wire. Different measurements were performed on the test bench; First, by moving the wire over larger displacements and checking the position and, later, by changing the signal phase and performing the phase shift measurement. This article discusses the new Libera Single Pass H electronics, the tests carried out in the test bench and the performance obtained.

03 Longitudinal Diagnostics and Synchronization

MOPD27 **A Sensitive Resonant Schottky Pick-Up for the ESR Storage Ring at GSI** – *F. Nolden (GSI), P. Hülsmann, P. Moritz, C. Peschke, P. Petri, M. Steck, H. Weick (GSI) Yu.A. Litvinov (MPI-K) M.S. Sanjari (IKF) J.X. Wu, Y.D. Zang, S.H. Zhang, T.C. Zhao (IMP)*
A cavity-like Schottky detector for the heavy ion storage ring ESR at GSI is presented. It works at resonant frequencies around 245 MHz, its loaded Q value is 511, and its loaded R/Q value is roughly 55 Ω. It features both a very good sensitivity even for beams with single circulating ions and the possibility to take valuable spectra in short time. A few experiments with the new device are presented which show clearly that the device offers new experimental opportunities, both for accelerator diagnostics and nuclear physics experiments. A similar device will be built into the CSRe storage ring at IMP.

MOPD28 **Loss Factor Measurement using Time Correlated Single Photon Counting of Synchrotron Radiation** – *G. Rehm (Diamond), C. Bloomer, C.A. Thomas (Diamond)*
A method to derive the total loss factor from the variation of SR photon arrival times with bunch charge has been developed. A time correlated single photon counting system is used operationally for fill pattern and bunch purity measurements. By fitting the individual peaks in the photon arrival time histogram, their relative timing can be retrieved with ps resolution and reproducibility. For a measurement of the loss factor, a fill pattern comprising a range of different bunch charges is stored and then their timing relative to the RF buckets is charted against charge. Examples of measurements illustrate the variation of loss factor with RF voltage and change in Insertion Device gap.

MOPD29 **Single-Shot Electrooptical Sampling using Dispersive Fourier-Transform for a Proton-Driven Plasma Wakefield Accelerator** – *O. Reimann (MPI-P), A. Caldwell (MPI-P)*
The concept of proton-driven plasma wakefield acceleration has recently been proposed as a means of accelerating a bunch of electrons to high energies with very high gradients, and a demonstration experiment at CERN is now under consideration. For this a clear understanding of the temporal and spatial behavior of the proton driver bunches and the longitudinal field gradients in the plasma is essential. A single-shot electrooptical sampling system using dispersive Fourier-transform is proposed here to measure the bunch and field properties in the frequency domain. Frequencies up to the terahertz region with a resolution of less than 10 GHz should be measurable. The system with a closed optical fiber path is based on a semiconductor laser source to achieve easy handling and robustness. The principle idea, estimations of the needed sensitivity, and simulation results of a typical configuration are presented. First experiments are ongoing.

MOPD30 **Bunch Length Measurement for PETRA III Light Source Storage Ring** – *H.-Ch. Schröder (DESY), A. Affeldt, H.P. Gausepohl, G. Kube, G. Priebe (DESY)*
To fulfill the demand for a very high brilliance synchrotron light source, it is required, that the individual particle bunches, used to create the synchrotron light in special undulator sections, do not exceed certain limits in linear dimension and divergence during the storage time. The bunch length measurement in the visible region of the spectrum is the sole system to measure the longitudinal beam parameter needed for a complete description of the behavior of the PETRAIII positron beam. A detailed description of the dipole magnet visible synchrotron light extraction, the light transport and the analysis by means of a Streak Camera System (SCS) in the context of the PETRAIII storage ring is given. The influence of the custom designed apochromatic refractive optics transport line on the time resolution of the bunch length measurement is discussed and values are given. The final time resolution of the whole system transport optics and Streak camera is shown to be not bigger than 4 ps. Several measurements from PETRAIII runs are presented and results of the bunch length measurements are shown. The typical bunch length measured is about 40 ps.

MOPD31 **Future Timing and Synchronization Scheme at ELBE** – *M. Kuntzsch (HZDR), A. Buechner, U. Lehnert, F. Roeser (HZDR)*
The Radiation Source ELBE at Helmholtz-Zentrum Dresden-Rossendorf is currently extended to offer capacity for new experiments. The reconstruction includes the setup of a THz-beamline with a dedicated user laboratory and a beamline for electron-beam - high-power laser experiments. The current synchronization scheme offers stability to the picoseconds level. The new experiments require a femtosecond synchronization in order to get field-strength resolved THz-probes and to have a stable overlap between the electron-bunches with the laser pulses. In the future there will be a MIT/Desy-like System with a pulsed fiber laser as

an optical reference oscillator. The laser pulses will be distributed over stabilized fiber links to the remote stations. Later on it is planned to install EOM-based beam arrival time monitors (BAMs) in order to monitor the bunch jitter and to establish a feedback system to reduce the jitter. Besides that, the timing system has to be revised to trigger experiments with low repetition rate, two guns (thermionic DC, superconducting RF) and lasers. The Poster will show the Layout of the possible future Timing and Synchronization System at ELBE.

MOPD32 **Bunch Length Measurement from Power Fluctuation at Diamond** – *C.A. Thomas (Diamond), G. Rehm (Diamond) I.P.S. Martin (JAI)*
Bunch length can be measured using the visible light power fluctuation statistics of an individual bunch . This method developed at ALS has been implemented at Diamond with further improvement on the detection method and the speed of the measurement. In this paper, we firstly report on the development and implementation of the method. We will show the performance of several detector diodes used and the limits of the method. Validation of the method will be demonstrated against streak camera measurement with picosecond long bunches. Before concluding, we will discuss about the strengths and weaknesses of the method.

MOPD33 **Pickup Design for a High Resolution Bunch Arrival Time Monitor for FLASH and XFEL** – *A. Angelovski (TU Darmstadt), R. Jakoby, A. Kuhl, A. Penirschke, S. Schnepp (TU Darmstadt) M.K. Bock, M. Bousonville, P. Gessler, H. Schlarb (DESY) J. Rönsch-Schulenburg, J. Roßsbach (Uni HH) T. Weiland (TEMF, TU Darmstadt)*
The Free Electron Laser in Hamburg (FLASH) is currently equipped with four Bunch Arrival time Monitors (BAM's) which are part of the optical synchronization system. FLASH usually works with bunch charges of 0.2 to 1 nC, but for a variety of future experiments, the system needs to operate with bunch charges in the range of 10 to 20 pC. Below 0.2 nC the sensitivity of such a BAM scales approximately linearly with the bunch charge and therefore the system no longer fulfills the time resolution requirements for these low charges. For the low bunch charge regime operation, the bandwidth has to be increased substantially. This paper shows a new design of a high frequency button pickup that can operate in a frequency band from DC up to 40 GHz. The design criterias of the pickup are the voltage slope steepness at the zero-crossing, the maximum amplitude and the ringing of the picked-up voltage. The performance of the designed model is analyzed for fabrication tolerances and orbit variations. Some manufacturing and practical issues are discussed and solutions are offered for improving the results. A full wave simulation with CST PARTICLE STUDIO is performed in order to prove the concept.

MOPD34 **Analysis of New Pickup Designs for the FLASH and XFEL Bunch Arrival Time Monitor System** – *A. Kuhl (TU Darmstadt), A. Angelovski, R. Jakoby, A. Penirschke, S. Schnepp (TU Darmstadt) M.K. Bock, M. Bousonville, P. Gessler, H. Schlarb (DESY) J. Rönsch-Schulenburg, J. Roßbach (Uni HH) T. Weiland (TEMF, TU Darmstadt)*
The Free Electron Laser in Hamburg (FLASH) is equipped with Bunch Arrival time Monitors (BAM), which provide for a time resolution of less than 10 fs for bunch charges higher than 0.2 nC. Future experiments, however, will aim at generating FEL light pulses from bunch charges of 10^{-20} pC. The sensitivity of the measurement system is defined by the slope of the pickup signal at the zero crossing and scales close to linear with the bunch charge. The requirements on the time resolution will no longer be fulfilled when operating at decreased bunch charges. Several designs have been developed in CST PARTICLE STUDIO®, each having an increased bandwidth larger than 40 GHz for meeting the requirements when operating at low bunch charges. Furthermore, new post-processing functions for the automatic evaluation of the signal slope and the ringing in the detected voltage signal have been developed and implemented within the CST software for defining optimization goals of the built-in optimizer for determining free design parameters. Results of the new designs are presented and compared with the current BAM pickup.

MOPD35 **Improved Signal Treatment for Capacitive Linac Pick-Ups** – *A. Reiter (GSI), C.M. Kleffner (GSI)*
Phase probes are a crucial diagnostic tool for pulsed particle beams of linear accelerators. In this contribution we present a simple, but very effective analysis procedure which has been established in various applications during commissioning campaigns of injector linacs for medical facilities. These injectors consist of a 400 keV/u radio-frequency quadrupole followed by a 7 MeV/u inter-digital drift tube linac, both operating at 216.8 MHz. At GSI, the new analysis was recently applied at the HITRAP decelerator, also with promising results. The data analysis exploits the periodic nature of sampling process and bunch signal improving the detector sensitivity and achieving an effective resolution of < 10 ps. If the macro-pulse is sufficiently long, the quality of the data can be improved further by a statistical average of subsequent data blocks acquired within one single macro-pulse. The latter is important for experiments with low beam intensity and low repetition rate like HITRAP where averaging over many macro-pulses is cumbersome.

MOPD36 **Development of a Silicon Detector Monitor for the Superconducting Upgrade of the REX-ISOLDE Heavy-Ion Linac at CERN** – *F. Zocca (IEM) E. Bravin, M.A. Fraser, D. Voulot, F.J.C. Wenander, F. Zocca M. Pasini (Instituut voor Kern- en Stralingsfysica, K. U. Leuven)*
A silicon detector monitor has been developed and tested in the frame of the beam diagnostics development program for the HIE-ISOLDE superconducting upgrade of the REX-ISOLDE heavy-ion linac at CERN. The monitor is intended for beam energy and timing measurements as well as for phase scanning of the superconducting cavities. Tests have been

performed with a stable ion beam, composed of carbon, oxygen and neon ions accelerated to energies from 300 keV/u to 2.85 MeV/u. The silicon detector was placed directly in the beam line and tested with a beam which was strongly attenuated to simulate the single particle detection regime for which the monitor is intended to finally function. The energy measurements performed allowed for beam spectroscopy and ion identification with a resolution of 3%. The principle of cavity phase scanning was also demonstrated with the REX 7-gap resonator thanks to the accurate peak energy identification. The time structure of the beam, characterized by a bunch period of 9.87 ns, was measured with a resolution better than 200 ps. This paper describes the results from all these tests as well as providing details of the detector.

MOPD37 **Bunch Length Monitor Diagnostics for the FERMI@ELETTRA FEL Project** – *R. Appio (ELETTRA), P. Craievich, M. Ferianis, M. Veronese (ELETTRA)*
Non destructive bunch length diagnostic after the magnetic compression is performed via the so-called Bunch Length Monitor (BLM). It includes a system based on the diffraction radiation from a ceramic gap, captured by three millimeter-waves band diodes, and the edge radiation from the last bending magnet of the bunch compressors, captured by a pyrodetecor. In this paper we report on the study of the coherent radiation from a gap which we performed both applying the analytical theory and by means of simulations of the radiated electromagnetic field (CST Particle Studio). The study started from a simple gap in the vacuum chamber, and time and frequency domain result have been investigated and compared with theoretical studies. In order to study the effect of the dielectric and metallic holed shield used to assure the electric continuity, the model has been further enhanced, and results are also presented.

MOPD38 **1-MHz Line Detector for Intra-bunch Multichannel Feedback** – *L. Kotynia (TUL-DMCS), D.R. Makowski, A. Mielczarek, A. Napieralski (TUL-DMCS) C. Gerth, T. Jezynski, H. Schlarb, B. Schmidt, B. Steffen (DESY)*
The measurement and control of the electron bunch length is one of the key diagnostics in linac-based free-electron lasers to reach the required peak current in the electron bunches. In order to use the multi-channel signals from longitudinal bunch shape measurements for intra train feedback for the European XFEL, line readout rates in the MHz range and low latencies are required, which is far more than commercial multichannel radiation detectors (line cameras) can provide. The paper presents a 256 channel detector that allows analyzing optical or infrared radiation with 1 MHz rate and a few microseconds latency using photodiode arrays, as needed for synchrotron light monitors, electro-optical bunch length measurements, or other laser based diagnostics. The proposed architecture aims at high frequency readout with low latency by using a multichannel electronic front-end designed for HEP, combined with Si or InGaAs detector arrays with very fast response time, and a low-latency data acquisition system. Currently the device is at the conceptual design stage.

04 Beam Loss Detection

MOPD39 **NSLS-II Beam Loss Monitor System** – *S.L. Kramer (BNL)*
NSLS-II storage ring is shielded to provide protection for the full injected beam loss in two periods of the ring, but the remainder of the ring is shielded for losses of <10% top-off injection beam current. To insure that beam losses don't exceed these design levels, a beam Loss Control and Monitoring system (LCM) has been designed. The LCM will control and monitor beam losses in the injection region and monitor injection losses outside that region. In order to measure quantitative charge losses, development of new beam loss monitors using Cerenkov light produces by the electron component of the shower induced by beam particles penetrating the vacuum chamber. These Cerenkov beam loss monitors (CBLM) measure the light from electrons passing through ultra-pure fused silica rod placed close to the inner edge of the VC. These rods should give sufficient light signal to monitor beam losses from several particle lost per turn to major fraction of the 500 mA beam in one to a few turns, about a 9 decade dynamic range of signal. Special photodiode modules are being developed to measure this high dynamic range signal. Design and measurements of the prototype CBLM system will be presented.

MOPD40 **Beam Measurements with Visible Synchrotron Light on VEPP-2000 Collider** – *Yu. A. Rogovsky (BINP SB RAS)*
This paper describes beam diagnostics at VEPP-2000 collider, based on visible synchrotron light analysis. These beam instruments include: SR beamline and optics; acquisition tools and high resolution CCD cameras distributed around the storage ring to measure the transverse beam profile and its position in vacuum chamber; photomultiplier tubes (PMT) which enables beam current measurements. Some applications of these measurement systems and their measurement results are presented.

MOPD41 **A Fast CVD Diamond Beam Loss Monitor for LHC** – *E. Griesmayer (CERN), B. Dehning, D. Dobos, E. Effinger, H. Pernegger (CERN)*
Chemical Vapour Deposition (CVD) diamond detectors were installed in the collimation area of the CERN LHC to study their feasibility as Fast Beam Loss Monitors in a high-radiation environment. The detectors were configured with a fast, radiation-hard pre-amplifier with a bandwidth of 2 GHz. The readout was via an oscilloscope with a bandwidth of 1 GHz and a sampling rate of 5 GSPS. Despite the 250 m cable run from the detectors to the oscilloscope, single MIPs were resolved with a 2 ns rise time, a pulse width of 10 ns and a time resolution of less than 1 ns. Two modes of operation were applied. For the analysis of unexpected beam aborts, the loss profile was recorded in a 1 ms buffer and, for nominal operation, the histogram of the time structure of the losses was recorded in synchronism with the LHC period of 89.2 μs. Measurements during the LHC start-up (February to December 2010) are presented. The Diamond Monitors gave an unprecedented insight into the time structure of the beam losses resolving the 400 MHz RF frequency as well as the nominal bunch separation of 25 ns. In future, these detectors will be used to study ghost bunches and particles in the 3 μs abort gap.

MOPD42 **μ-loss Detectors for IFMIF-EVEDA** – *J. Marroncle (CEA/DSM/IRFU), P. Abbon, J. Egberts (CEA/DSM/IRFU) M. Pomorski (CEA/DRT/LIST)*
For the IFMIF-EVEDA project, a prototype accelerator is being built in Europe and installed at Rokkasho (Japan). It is designed to accelerate 125 mA CW Deuteron to 9 MeV. The very high space charge and high power (1.125 MW) of the beam make this accelerator very challenging. For hands-on maintenance requirements, losses must be well less than 1 W/m, i.e. 10^{-6} of the beam. That is why, in the 5–9 MeV superconducting Linac, beam dynamics physicists search to tune the beam by minimizing the very external part of the halo. The need is thus to be able to measure very tiny beam losses, called μ-losses, at all the focusing magnets. Only neutrons and γ exit from the beam pipe due to the low deuteron beam energy. Thus such beam loss detectors have to be sensitive to neutrons, but rather insensitive for X-rays and γ to decrease their contributions coming from super-conducting cavity emission. They must be radiation hardness qualified, and capable to work at cryogenic temperature. Single CVD diamonds ($4\times4\times0.5\,mm^3$) are studied for these purposes and first results seem to fulfill the requirements up to now.

MOPD43 **Beam Loss Detected by Scintillation Monitor** – *A. Miura (JAEA/J-PARC), T. Maruta (JAEA/J-PARC) K. Hasegawa, N. Ouchi, H. Sako (JAEA) Z. Igarashi, M. Ikegami, T. Miyao (KEK)*
Ar gas proportional BLMs have measured the beam loss through operations, but they are also sensitive to background noise of X-ray emitted from RF cavities. We have tried to measure the beam loss using scintillation monitors which would bring more accurate beam loss measurements with suppression of X-ray noise. We measured beam loss using scintillation beam loss monitors. Because this scintillation BLM is sensitive for low energy gamma-rays and fast neutrons, small signals from X-rays would be also detected. As the measurement results, a good signal to noise ratio is observed for the scintillation monitor with quite low sensitivity to the background X-ray. And many single events are observed in the intermediate pulse bunch with about 600 ns as pulse width. After all signals passed through the filter circuit and integrated circuit, total amount of X-ray noise can become smaller. We obtained the good performances of scintillation BLM with small effect of X-ray noise. This monitor can be used for beam loss measurement and a knob for tuning. Furthermore, because the detail structure can be detected, this monitor could be employed for another diagnostic device.

MOPD44 **Self Testing Functionality of the LHC BLM System** – *J. Emery (CERN), B. Dehning, E. Effinger, C. Zamantzas (CERN)*
Reliability concerns have driven the design of the LHC BLM system throughout its development, from the early conceptual stage right through the commissioning phase and up to the latest development of diagnostic tools. To protect the system against non-conformities, new ways of automatic checking have been developed and implemented. These checks are regularly and systematically executed by the LHC operation team to insure that the system status after each test is "as good as new". This checks the electrical part of the detectors (ionisation chamber

or secondary emission monitor), their cable connections to the front-end electronics, the connections to the back-end electronics and their ability to request a beam abort. During the installation and in the early commissioning phase, these checks proved invaluable in finding non-conformities caused by unexpected failures. This paper will describe these checks in detail, commenting on the latest performance and the typical non-conformities detected. A statistical analysis of the LHC BLM system will also be presented to show the evolution of the various system parameters.

05 Transverse Profiles

MOPD45 **Single-Shot Beam Characterization Device Based on Pepper-Pot Principle** – *S.X. Peng (PKU/IHIP), J.E. Chen, Z.Y. Guo, P.N. Lu, Z.X. Yuan, J. Zhao (PKU/IHIP) H.T. Ren (Graduate University, Chinese Academy of Sciences)*

For the characterization of an ampere-scale microsecond single-pulse ion beam, a pepper-pot based beam profile measurement device was developed in Peking University (PKU). It is a combination of Faraday cup technique with pepper-pot measurement facility. The direct Faraday cup is used to observe the total beam current and an array of pepper-pot diamond holes at the bottom of the Faraday cup is served to separate a large beam into several beamlets for beam distribution measurement. A Faraday array that locates 3.8 mm away from the pepper-pot screen is used to measure the transverse size of the beam. Two sets of permanent magnet poles that locate at the entrance of the Faraday cup and just before the Faraday array respectively are used to suppressing the second electrons produced by the interaction of the beam with target. In this paper we emphasize details of the experimental setup, the results of the measurements and we give an outlook on further developments on pepper-pot devices.

MOPD46 **Developments in High Power Target and Beam Dump Instrumentation at the SNS** – *T.J. Shea (ORNL), T. Ally, K.C. Goetz, E. Iverson, M. Lance, L.C. Maxey, T.J. McManamy, S.M. McTeer, B.W. Riemer (ORNL) S. Sampath (SBU)*

As the Spallation Neutron Source (SNS) ramped up to become a megawatt class facility, increasing attention has been paid to instrumentation at the target and the high power injection dump. Through a collaborative development effort, a target imaging system system was designed and deployed in time for replacement of the first Mercury target. This system has also spawned some related technical developments and applications. Radiation-tolerant luminescent coatings are an enabling technology and coating development is an ongoing activity. Characterization of the system's performance required measurement of emission spectra from both the coating on the target and the gas in the core vessel. Hyper-spectral imaging and luminescent lifetime imaging were both utilized to isolate the desired signal. During dedicated beam study periods, neutron production efficiencies and mechanical vibration intensities were measured and correlated with beam properties at the

target. Finally, a concept has been developed for an imaging system that could monitor waste beam at the SNS ring injection dump.

MOPD47 **Goals and Status of MICE, the International Muon Ionisation Cooling Experiment** – *V.C. Palladino (INFN-Napoli)*
Muon ionization cooling provides the only practical solution to prepare high brilliance beams necessary for a neutrino factory or muon colliders. The muon ionization cooling experiment (MICE) is thus a strategic R&D project for neutrino physics. MICE is under development at the Rutherford Appleton Laboratory (UK). It comprises a dedicated beam line to generate a range of input emittance and momentum, with time-of-flight and Cherenkov detectors to ensure a pure muon beam. A first measurement of emittance is performed in the upstream magnetic spectrometer with a sci-fiber tracker. A cooling cell will then follow, alternating energy loss in Li-H absorbers and RF acceleration. A second spectrometer identical to the first and a second muon identification system provide a measurement of the outgoing emittance. In the 2010 run, completed in August, the beam and most detectors have been fully commissioned. Data analysis should be completed by the time of the Conference. The time of the first measurement of input beam emittance is closely approaching. The plan of steps of measurements, of emittance and emittance reduction (cooling), that will follow in 2011 and later, will be reported.

MOPD48 **Electron Beam Diagnostics in Electron Cooling Devices** – *T. Weilbach (HIM) K. Aulenbacher (IKP) J. Dietrich (FZJ)*
New magnetized high energy coolers like the one proposed for the High Energy Storage Ring (HESR) at the Facility for Antiproton and Ion Research (FAIR) have specifific demands on the diagnostic of the electron beam. Due to high voltage breakdowns they only allow a very small beam loss so non-invasive beam diagnostic methods are necessary. For beam profifile measurement a system based on beam induced fluorescence (BIF) was designed fiand installed at the 100 keV polarized test setup at the Mainzer Mikrotron (MAMI). For the diagnostic of other observables of the cooling beam, like the electron beam energy or the electron temperature, a Thomson scattering experiment is planned at the HESR cooler test bench. Experimental results from the BIF measurement are presented and the challenges of the Thomson scattering method are discussed.

MOPD49 **Beam Parameters Measurements by Ionization Cross Section Monitor on Proton LINAC of INR RAS** – *P.I. Reinhardt-Nickoulin (RAS/INR), S. Bragin, A. Feschenko, S.A. Gavrilov, I.V. Vasilyev, O. Volodkevich (RAS/INR)*
The ionization beam cross section monitor (BCSM) is developed and used on proton linac of INR RAS to provide non-intercepting measurements of beam parameters. Operation of the monitor is based on utilization of residual gas ionization. The BCSM configuration design and image processing system are described and estimations of influence of the linac radiation background are discussed. The monitor enables to observe beam cross section and extract from it beam profiles and position

as well as their evolution in time within a wide range of beam intensities and energies. The available experimental results of beam spot, profiles and emittances measurements at the linac output are presented.

MOPD50 **Thermal Characteristics of Vibrating Wire Monitor with Separated Wires** – *G.S. Harutyunyan (YSU) S.G. Arutunian, A.E. Avetisyan, M.M. Davtyan, I.E. Vasiniuk (YerPhI)*
There was developed a new modification of Vibrating Wire Monitor with Large Aperture (VWM_LA) based on two separated, strained and mechanically coupled wires, one of which is vibrating and the second is sensitive and interact with the beam with large transversal sizes. Sensitive wire heating leads to vibrating wire tension change, which is registered by it's natural oscillation frequency measurement. In this work the VWM_LA thermal characteristics including response times are investigated in air and vacuum. Sensitive wire temperature changes was modeled by direct current. Analytical estimations of dependence of VWM_LA frequency from it's component's temperature were done. Thermocycling of VWM_LA in vacuum and air provides dependence on ambient temperature and sensor drift parameters.

MOPD51 **Progress with the Scintillation Profile Monitor at COSY** – *V. Kamerdzhiev (FZJ), J. Dietrich, F. Klehr, K. Reimers (FZJ) C. Böhme (UniDo/IBS)*
After successful demonstration measurements with the Scintillation Profile Monitor at COSY, a dedicated vacuum chamber with two vacuum windows and supporting vacuum ports was installed in the COSY synchrotron. The chamber is blackened inside to suppress light reflection. Since residual gas pressure is too low to support reliable profile measurements based on beam induced scintillation, a piezo-electric dosing valve was installed allowing fast injections of defined amount of nitrogen. A 32-channel photomultiplier is used to detect light. Beam profile measurements and first operational experience are reported.

MOPD52 **First Results from Beam Measurements at the 3 MeV Test Stand for CERN Linac4** – *B. Cheymol (CERN), U. Raich, F. Roncarolo (CERN)*
The H^- source and the low energy beam line will determine to a large extend the performance of Linac-4, the new machine foreseen as injector into the PS Booster. For this reason a test stand will be set up consisting of the source, Low Energy Beam Transport (LEBT), RFQ and chopper line. Up to now only the source and LEBT are installed. First measurements have been performed using a Faraday Cup to measure the total source intensity, a slit-&-grid emittance meter for transverse emittance measurements and a spectrometer for energy spread measurements. This paper discusses the results from measurements on H^- beams at 35 kV extraction voltage as well as protons at 45 kV, showing the emittance dependence on source RF power as well as the influence of a solenoid in splitting the beam into its various constituents: protons, H0, H^{2+} and H^{3+}. Energy spread measurements are also presented.

MOPD53 **Scintillation Screen Investigations for High Energy Heavy Ion Beams at GSI** – *P. Forck (GSI), C.A. Andre, F. Becker, R. Haseitl, B. Walasek-Höhne*

(GSI) W. Ensinger, R. Krishnakumar (TU Darmstadt)
Various scintillation screens were irradiated with high energy ion beams as extracted from the GSI synchrotron SIS18. Their imaging properties were studied with the goal to achieve a precise transverse profile determination. Scintillation images were characterized with respect to the light yield and statistical moments of the light distribution i.e. imaged beam width and shape. To study the scintillation properties over a wide range of intensities a 300 MeV/u Uranium ion beam with 10^4 to 10^9 particles per pulse was applied. Sensitive scintillators, namely CsI:Tl, YAG:Ce, P43 and Ce-doped glass were investigated for lower beam currents. Ceramics like Al_2O_3, Al_2O_3:Cr, ZrO_2:Y and ZrO_2:Mg as well as Herasil-glass were studied up to the maximum beam currents. For the various screens remarkable differences have been observed, e.g. the recorded profile width varies by nearly a factor of two. The obtained results serve as a basis for an appropriate choice of scintillator materials, which have to cope with the diversity of ion species and intensities at FAIR.

MOPD54 **Commissioning Results of the Photon-Electron Diagnostic Unit at sFLASH** – *J. Bödewadt (Uni HH), E. Hass, J. Roßbach (Uni HH)*
Recently a seeded free-electron laser operating in the extreme ultraviolet (XUV) spectral range was installed and commissioned at the free-electron laser FLASH. The seed beam is generated by higher harmonics of near infrared laser pulses. A dedicated transport system guides the radiation into the electron accelerator environment. Within the seed undulator section compact diagnostic units were installed to control the transverse overlap of the photon and the electron beam. These units contain a BPM, horizontal and vertical wire scanners and an OTR screen for the electron diagnostic. A Ce:YAG screen and a MCP readout for the wire scanner are used to measure the photon beam position. This paper presents the commissioning results and the performance of the diagnostic units.

MOPD55 **SEM-GRID Prototype Electronics using Current-Frequency-Converters** – *M. Witthaus (GSI), J. Adamczewski-Musch, H. Flemming, J. Frühauf, S. Löchner, H. Reeg, P. Skott (GSI)*
A prototype system using an ASIC equipped with 8 channels of Charge to Frequency Converters (CFC) was developed in collaboration between the Beam Diagnostics and Experiment Electronics Department at GSI. The maximum sensitivity is 250 fC per output pulse. It will serve as an economic alternative for the readout electronics of Secondary Electron Monitor (SEM)-profile grids. The goal of this contribution is to perform a detailed performance test under real beam conditions at GSI. A 32-channel electronics chain is connected to different beam profile SEM-Grids at a LINAC beam line and tested with various beam conditions. Transversal beam profiles with a time resolution down to the microsecond range have been recorded successfully. Beam profiles recorded with the CFC-board and the standard trans-impedance amplifiers agreed well. It is planned to test the CFC-board for further diagnostic devices like Multi-Wire Proportional Chamber (MWPC) in the near future.

MOPD56 **4-D Emittance Reconstruction using Multiple 2-D Beam Profiles** – *C. Gabor (STFC/RAL/ASTeC) S. Jolly, S. Kneip, S. P. D. Mangles (Imperial College of Science and Technology, Department of Physics) A.P. Letchford (STFC/RAL/ISIS) J.K. Pozimski (STFC/RAL)*
A number of techniques already exist for making high resolution emittance measurements. However, techniques for making single-shot emittance measurements that are correlated in X and Y, such as the pepperpot, significantly degrade the measurement resolution in order to make such a measurement. High resolution correlated single-shot emittance measurements are required for any beam that is not highly repeatable, such as those produced by plasma wakefield acceleration: the broad output energy spectrum and non-reproducability of plasma wakefield beams makes emittance measurements particularly challenging. We present a technique to reconstruct 4-D correlated emittances using multiple 2-D X-Y profiles. Previous techniques have used many 1-D intensity profiles to reconstruct emittances in each plane independently. This method is extended to make use of the significant increase in resolution provided by 2-D profile images to reconstruct the emittance in both transverse planes. Results are presented using this technique to measure the emittance of the ISIS Front End Test Stand 65 keV H-minus beam and compared to direct emittance measurements using the existing pepperpot system.

MOPD57 **Quantitative Scintillation Screen Studies at GSI-LINAC and Related Model Calculations** – *E. Gütlich (GSI), P. Forck, B. Walasek-Höhne (GSI) W. Ensinger (TU Darmstadt)*
Scintillating screens are commonly used at accelerator facilities, however their imaging quality are not well understood, especially for high current ion beam operation. Several types of inorganic scintillators were investigated for various ion species and energies between 4.8 and 11.4 MeV/u. To validate the imaging quality of the scintillators a scraper scan method was established. For Al_2O_3 with a Ca beam of 4.8 and 11.4 MeV/u and a constant beam flux (ions/cm^2/s), these methods are compared. For 4.8 MeV/u the results are in good agreement, while for 11.4 MeV/u the screen image does not reflect the beam distribution. A microscopic model is under development taking the properties of the fast electrons generated by the primary interaction into account. For Al_2O_3 this model can describe the observed saturation effect. Spectroscopic investigations were performed, to determine the influence of the ion beam intensity on the luminescence spectra emitted by the materials. No significant dependence on the spectrum with respect to the beam intensity was found for most of the scintillators.

MOPD58 **The Calibration for Small Beam Size Measurement at SSRF** – *K.R. Ye (SINAP), J. Chen, G.Q. Huang, Y.B. Leng, W.M. Zhou (SINAP)*
The beam size in SSRF storage ring was measured using the SR-double-slit interferometer and X-ray pinhole camera. Front wave error caused by the deformation of extraction mirrors be measured is very important. It will be introduced, a calibration method for interferometer by a Shack-Hartmann wave front sensor equipment developed. Another way, beam shift at the SR source point and observe the resulting shifts in the phase

of the interference fringes. The calibrations of the SRM were checked by comparing the measured vertical beam sizes with this beam shift calculated. It can perform an absolute calibration of the SRM system, including the effects of mirror distortion for interferometer. Compared measuring results by X-ray pinhole camera and interferometer will be described also.

MOPD59 **A New Fast Profile Monitor for the LHC and the SPS** – *S. Burger (CERN), A. Boccardi, E. Bravin (CERN) A.S. Fisher (SLAC)*
The beam profile is an important parameter for the tuning of particle accelerators. These profiles are often obtained by imaging optical transition radiation from a radiator on a CCD camera. This technique works well for slow acquisitions, but in some cases it is necessary to acquire profiles with higher rates where such standard cameras are no longer suitable. In our case the aim is to sample the profiles on a turn-by-turn basis which, for the CERN-SPS, corresponds to ~44 kHz. For this reason we have developed a fast detector based on a recent Hamamatsu linear CCD and an optical system using cylindrical lenses. The readout electronics is based on CERN developed, radiation tolerant components and the digital data is transmitted to an acquisition board outside of the tunnel by mean of optical fibres. This contribution describes the system and shows the performance obtained on a test bench.

MOPD60 **Beam Induced Fluorescence (BIF) Monitors as a Standard Operating Tool** – *C.A. Andre (GSI), F. Becker, H. Bräuning, P. Forck, R. Haseitl, B. Walasek-Höhne (GSI)*
For high current operation at the GSI Heavy Ion UNILAC non intercepting methods for transverse beam profile determination are required. The Beam Induced Fluorescence (BIF) Monitor, an optical measurement device based on the observation of fluorescent light emitted by excited gas molecules was brought to routine operation. Detailed investigations were conducted for various beam parameters to improve the electronics and the optical setup. Up to now, four BIF monitor stations (for detection of both, horizontal and vertical beam profiles) were installed at UNILAC and two additional setups are planned. This contribution reports on first upgrades of the BIF monitors with a Siemens PLC for FESA-based slow controls and hardware protection procedures. The versatile control and display software ProfileView is presented as an easy-to-use and stable beam diagnostic tool for the GSI operating team.

MOPD61 **Vertical Emittance Measurement at the ESRF** – *F. Ewald (ESRF), P. Elleaume, L. Farvacque, F. Franchi, D. Robinson, K.B. Scheidt, A. Snigirev, I. Snigireva (ESRF)*
In the short term the ESRF aims to reach emittances of less than 2 pm. We review the existing emittance diagnostics – X-ray projection monitors and pinhole cameras – and evaluate their ability to resolve such ultra-small vertical emittances. Even though these devices are reliable and show good agreement between measurements and theoretical predictions down to vertical emittance values of less than 10 pm, they will reach their limit of resolution for emittances decreasing below a few picometers. In addition to the existing emittance diagnostics, a new

device which is imaging bending magnet radiation using compound refractive lenses has been installed. Two lens materials (Al and Be) have been tested as well as different photon energies. We can conclude that this new system will be most suitable for reaching the performances necessary to resolve ultra-small vertical emittances.

MOPD62 **Storage Ring Injector Diagnostics using Synchrotron Radiation** – *A.F.D. Morgan (Diamond), C.A. Thomas (Diamond) R. Bartolini (JAI)*
The state of the Diamond injector can be passively monitored using beam profile measurements of synchrotron radiation from bending magnets. This provides us with information on the characteristics of the beam injected into the storage ring. Using a numerical fit we are able to retrieve key parameters like beam position, size and tilt angle from every shot. This enables us to gather longer term trends to monitor for any changes during top-up operation in order to better understand any variability of the injector. We present here the study and the analysis performed with this diagnostic with the results from several months of operation.

MOPD63 **Finding the Limits of a Pepperpot Emittance System at 5 MeV** – *C.H. Gough (PSI), S. Ivkovic, M. Paraliev (PSI)*
For the initial SwissFEL project development, a novel combined DC-RF electron gun was tested at PSI. This paper presents some practical results from the pepperpot emittance measurement system for this gun, up to a maximum energy of 5 MeV. Beam charges were up to 100 pC and emittance values were typically 0.4–1.0 μrad-m. Pepperpots with different materials, thicknesses, rasters and hole sizes were tested, software for measuring and improving image resolution was developed, variations of emittance values with focusing and the ultimate resolution of the pepperpot system was found.

06 Beam Charge and Current Monitors

MOPD64 **High Quality Measurements of Beam Lifetime, Instant-Partial-Beam Losses and Charge-Accumulation with the New ESRF BPM System** – *K.B. Scheidt (ESRF), F. Ewald, B. Joly (ESRF)*
The BPM system of the ESRF Storage Ring, that was entirely replaced by 224 units of the Libera-Brilliance system in 2009, is now also being used for precise and fast measurements of the Beam Lifetime and so-called Instant-Partial-BeamLosses. This is possible by the use of the Sum signal of the four BPM buttons on each of the 224 BPM stations in the Ring. This paper will describe the strong advantages in terms of response time, but also the precautions and the limitations of this particular use. Results will show the ultimate attainable performances and a detailed comparison with that of three independent DC current transformers also installed in the Ring. The same Sum signal is also usable for precise measurement of Accumulated Charge during the injection process and results of this will also be presented.

MOPD65 **Sensitivity Optimization of the Standard Beam Current Monitors for XFEL and FLASH II** – *M. Werner (DESY), J. Lund-Nielsen, Re. Neumann, N. Wentowski (DESY)*
There is a tendency to operate 4th generation SASE driven light sources at

very low charge in order to further shorten the pulse length. Therefore the operation range of XFEL and FLASH II was extended to a charge range of 20 pC to 1 nC. For a reliable charge measurement down to 20 pC, a low noise design of the signal chain from the monitor head to the digitizing ADC is necessary. This paper describes the steps taken in order to increase the sensitivity and dynamic range of the monitors currently used in the FLASH accelerator, and the basic theoretical background will be explained. Finally, first results are presented.

MOPD66 **Upgrade of the CERN PSB/CPS Fast Intensity Measurements** – *A. Monera Martinez (CERN), M. Andersen, D. B. Belohrad, L.K. Jensen, G. Kasprowicz, L. Soby (CERN)*
The CERN PSB and CPS complex fast beam intensity measurement is undergoing a major upgrade. The old analogue electronics does not provide enough accuracy, resolution and versatility to perform the accurate measurements needed for the LHC and high intensity neutrino production beams. Reliability is also becoming an issue due to the ageing of equipment. A new measurement system - a Transformer Integrator Card (TRIC) – has therefore been developed to replace the obsolete acquisition systems. TRIC is a generic platform used to independently measure the intensity in the different transfer lines at CERN. It contains two 200 MHz ADCs and a calibration system that allows measurement and calibration of extraction. Five TRICs were installed in the PSB during the 2010 run allowing statistical evaluation of their performance. The aim of this article is to present the technical aspects of the new system and available measurement scenarios. It also discusses possible sources of the measurement errors and presents the statistical data acquired during the 2010 run.

MOPD67 **Non-Intercepting Detection of Low-Intensity Ion Beams** – *F. Kurian (GSI), P. Hülsmann, P. Kowina, H. Reeg, M. Schwickert (GSI) R. Geithner (HIJ) R. Neubert, W. Vodel (FSU Jena)*
For slow extraction from the SIS100 synchrotron, the high energy beam transfer lines of FAIR accelerators demand for diagnostic devices for non-intercepting measurement of beam currents down to nA range. A Cryogenic Current Comparator (CCC) offers the required absolute and non-intercepting current measurement. The current resolution of the CCC is limited by the system noise, mainly originating from external magnetic fields and mechanical vibrations. A meander-shaped superconducting shielding efficiently suppresses non-azimuthal field components from the ferromagnetic pick-up coil. The attenuation of external magnetic field components is studied for various geometrical and material parameters by means of FEM simulations. The calculations are compared with measurement results obtained during re-commissioning of a CCC prototype installation.

07 Tune, Chromaticity and General Storage Ring Diagnostics

MOPD68 **Pickup Beam Measurement System at the Vepp-2000 Collider** – *Yu. A. Rogovsky (BINP SB RAS)*
This paper reviews the present state of electromagnetic beam position monitors (pickups) at VEPP-2000 collider. It includes descriptions of position monitors, typical interfaces for these monitors and their system characteristics (resolution, stability, bandwidth and problems or limitations) are discussed. The paper also reviews several types of diagnostic measurements using beam position monitors which are useful in improving accelerator operations.

MOPD69 **Tune Measurements with High Intensity Beams at SIS-18** – *R. Singh (GSI), P. Forck, P. Kowina, P. Moritz (GSI) T. Weiland (TEMF, TU Darmstadt)*
To achieve high current operation close to the space charge limit in a synchrotron, a precise tune measurement during a full accelerating cycle is required. A tune measurement system that was recently commissioned at GSI synchrotron SIS-18 allows for online evaluation of the actual tune. This system consists of three distinct parts; an exciter which provides power to excite coherent betatron oscillations of the beam. The BPM signals thus induced are digitized by fast ADCs at 125 MSa/s and then the post processing electronics integrates the data bunch by bunch to obtain one position value per bunch. Subsequently base band tune is determined by Fourier transformation of the position data. The tune variation during acceleration for various beam conditions was measured using this system and is discussed. A detailed investigation of the incoherent tune shift was conducted with Uranium ion beams at the injection energy of 11.6 MeV/u. The results show the influence of beam current on the tune spectrum. In addition, the effects of the measurement method on the beam emittance and beam losses are discussed.

MOPD71 **Using the Transverse Digital Damper as a Real-time Tune Monitor for the Booster Synchrotron at Fermilab** – *N. Eddy (Fermilab)*
The Fermilab Booster is a fast ramping (15 Hz) synchrotron which accelerates protons from 400 MeV to 8 GeV. During commissioning of a transverse digital damper system, it was shown that the damper could provide measure the machine tune throughout the cycle by exciting just 1 of the 84 bunches with minimal impact on the machine operation. The algorithms used to make the measurement have been incorporated into the damper FPGA firmware allowing for real-time tune monitoring of all Booster cycles.

08 Feedbacks and Beam Stability

MOPD72 **Beam Energy Measurements after Installation of a 3rd Harmonic Module at FLASH using a Synchrotron Radiation Monitor and Bunch Arrival Monitors** – *C. Gerth (DESY), M. Hoffmann, F. Ludwig, H. Schlarb, Ch. Schmidt (DESY)*
The high beam energy stability required for stable operation of linac-driven free-electron lasers demands for precise cavity RF field regulation. This is in particular true for the accelerator modules at low beam

energies which are used to induce an energy correlation on the electron beam for longitudinal bunch compression in magnetic chicanes. At FLASH, a major upgrade of the injector has taken place in the shutdown 2009/2010 including the installation of a 3rd harmonic accelerating module, exchange of modulators and re-cabling and temperature stabilization of the low-level RF electronics. Several beam-based techniques have been developed recently which can be used to monitor the beam energy with high precision or as fast feedbacks for the RF regulation. In this paper, we report on bunch-resolved energy measurements recorded independently with a synchrotron radiation monitor and bunch arrival monitors. Good agreement between the monitors was found, and the rms energy jitter was determined to be 6×10^{-5}. The measurement data is compared with the results from RF detection.

MOPD73 **Study of Beam Size Blowup due to Transverse Bunch Feedback Noise on e^+e^- Collider** – *M. Tobiyama (KEK), K. Ohmi (KEK)*
Vertical beam size blowup with the gain of the transverse bunch feedback systems has been observed in KEKB B-factory rings. With the numerical simulation, large beam-beam effect enhances small oscillation induced by the broadband noise of the bunch feedback kick. To examine the simulation, beam response, effective beam size and the luminosity change with artificial external noise injected in the transverse feedback system have beem measuredn in KEKB LER ring during collision. The result has been compaired with the simulation including beam-beam effect and showed good agreement.

MOPD74 **The New Fast Orbit Correction System of the ESRF Storage Ring** – *E. Plouviez (ESRF), F. Epaud, J.M. Koch, K.B. Scheidt (ESRF)*
The ESRF is upgrading the orbit correction system of its storage ring. The goal of this upgrade is to damp the effect on the orbit stability of the insertion devices during the changes of their settings, as well as the effect of the environmental vibrations and AC main power spurious fields; in order to achieve this goal we aim at a correction bandwith of 200 Hz. The final system will use the data of 224 BPMs already equipped with Libera brilliance electronics. The correction will be applied by a set of 96 correctors implemented in the auxillary legs of the sextupolar magnets, driven by newly designed fast power supplies . The power supplies are controlled using a set of 8 FPGA boards connected to the power supplies inputs with serial links; these FPGA will also compute the correctors currents using the BPMs data. All the correctors and BPMs are now installed and interconnected and we have already performed orbit correction tests over 2 of the 32 cells of our storage ring using one single FPGA board controlling 6 correctors. These tests have allowed us to evaluate the final performance of the system. This paper presents this new system and the results of these tests.

MOPD75 **Reconfigurable FPGA Based Beam Current Safety System for UCN** – *P.-A. Duperrex (PSI)*
At PSI, a new and very intensive Ultra-Cold Neutron (UCN) source based on the spallation principle was commissioned in December 2010 and will start production in 2011. The 590 MeV, 1.3 MW proton beam will be switched towards the new spallation target for about 8 s every 800 s. A beam current monitoring system has been developed as part of a safety system for the UCN source operation. This monitoring system is based on a reconfigurable FPGA system from National Instrument. This paper will present the advantages of such a system compared to analog electronics, its flexibility to future new performance requests and the integration details in the safety control system.

MOPD76 **The Petra III Fast Orbit Feedback System** – *H.T. Duhme (DESY), K. Balewski, J. Klute, H. Tiessen, F. Wierzcholek (DESY)*
Orbit stability is a crucial and import issue of 3rd generation light sources. Ambient mechanical and electrical noise cause rather large orbit distortions which have to be counteracted by an orbit feedback. Extensive studies of the orbit distortions in PETRA III have shown that the frequencies of the ambient noise lie within a frequency range from about 0.01 Hz to 100 Hz. In this paper we describe the main components, their properties and the layout of PETRA III's orbit feedback. Furthermore experimental results on short and long term stability will be presented. It will be shown that the required orbit stability of $\pm 0.5\,\mu$m in the vertical plane can be maintained over 50 h.

MOPD77 **Broadband Digital Feedback System for the VEPP-4M Electron-Positron Collider** – *V.V. Oreshonok (BINP SB RAS), V.V. Smaluk (BINP SB RAS) V.P. Cherepanov, V.V. Oreshonok, D.P. Sukhanov (NSU)*
To suppress the transverse instability, which is the main reason of beam current limitation at the VEPP-4M electron-positron collider, a digital bunch-by-bunch feedback system has been developed, installed and commissioned. The real-time data processing is performed by a special code running in an FPGA module. This provides high efficiency and flexibility of the system. During the system commissioning, a 3-times increase of the beam current injected into VEPP-4M was reached. The system design and data processing algorithms are described, the commissioning results are presented.

MOPD78 **Synchronous Measurement of Stability of Electron Beam, X-ray Beam, Ground and Cavity Voltage** – *G. Rehm (Diamond), M.G. Abbott, C. Bloomer, I. Uzun (Diamond)*
We have developed hardware and software that allows continuous and synchronous recording of electron and X-Ray beam position as well as cavity voltage and ground vibrations at a rate of about 10 kS/s for periods of many days. To this end, additional nodes have been added to our existing fast network that feeds the Fast Orbit Feedback System, namely tungsten vane type front end XBPMs, RF cavity pickups and accelerometers. The synchronous nature of these measurements shows the correlation between electron beam motion through an insertion device and observed X-ray beam motion in the frontend or orbit distortions

caused by fluctuations of the RF cavity voltage. While the additional channels currently are only observed, the potential of including these in the fast orbit feedback will be discussed.

MOPD79 **An FPGA-based Turn-by-Turn Beam Position Monitoring System for Studying Multiple Bunch Beams in the ATF Damping Ring** – *G.B. Christian (JAI), D.R. Bett, B. Constance, M.R. Davis, J. Resta-López (JAI) R. Apsimon, P. Burrows, C. Perry (Oxford University, Physics Department) A. Gerbershagen (CERN)*
Instabilities associated with beam-size blow-up have previously been observed with multi-bunch beam in the damping ring (DR) of the KEK Accelerator Test Facility (ATF). A system has been developed to monitor such instabilities, utilising an ATF stripline beam position monitor (BPM) in the DR, and BPM processor hardware designed for the FONT upstream feedback system in the ATF extraction line. The system is designed to record the horizontal and/or vertical positions of up to three bunches in the DR in single-bunch multi-train mode or the head bunch of up to three trains in multi-bunch mode, with a bunch spacing of 5.6 ns. The FPGA firmware and data acquisition software were modified to record turn-by-turn data for up to six channels and 1–3 bunches in the DR. The maximum memory configuration on the FPGA allows 131071 bunch-turn-channels of data to be recorded from a particular machine pulse, and the system has the capability to select only certain turns at a regular interval in which to record data, in order to zoom out and cover the entire period of the damping cycle at the ATF. An overview of the system and initial results will be presented.

MOPD80 **An FPGA-based Bunch-by-Bunch Position and Angle Feedback System at ATF2** – *G.B. Christian (JAI), R. Apsimon, D.R. Bett, B. Constance, M.R. Davis, J. Resta-López (JAI) P. Burrows, C. Perry (Oxford University, Physics Department) A. Gerbershagen (CERN)*
The FONT5 intra-train feedback system serves as a prototype for an interaction point beam-based feedback system for future electron-positron colliders, such as the International Linear Collider. The system has been tested on the KEK Accelerator Test Facility (ATF) and is deployed to stabilise the beam orbit at the ATF2. The goal of this system is to correct both position and angle jitter in the vertical plane, providing stability of ~1 micron at the entrance to the ATF2 final-focus system. The system comprises three stripline beam position monitors (BPMs) and two stripline kickers, custom low-latency analogue front-end BPM processors, a custom FPGA-based digital processing board with fast ADCs, and custom kicker-drive amplifiers. An overview of the hardware, and the latest results from beam tests at ATF2, will be presented. The total latency of the system with coupled position and angle feedback loops operating simultaneously was measured to be approximately 140 ns. The greatest degree of correction observed was down to a jitter of 0.4 microns at one of the feedback BPMs, a factor of six compared to the uncorrected beam jitter, for a very high degree of bunch-to-bunch correlation.

MOPD81 **Engineering Layout of the Synchrotron Radiation Monitor for Beam Energy Measurements at the European XFEL** – *J. Nagler (DESY Zeuthen), M. Sachwitz (DESY Zeuthen) C. Gerth, N. Mildner (DESY)*
A beam-energy monitor located in the bunch compressor chicanes of the European XFEL takes advantage of the synchrotron radiation created by the dipole magnets in the dispersive section. The energy of the electron beam can be derived from a position measurement by imaging the synchrotron light emitted by the electron bunch. The out-coupling of the synchrotron radiation for a large range of possible trajectories of the electron bunch in the 400 mm wide vacuum chambers requires the construction of long, guided bellow components. We present the engineering layout of the synchrotron radiation monitor and laser alignment system for absolute beam position measurements.

09 Others

MOPD82 **Installation for Measurements of Secondary Emission Yield and Electron Cloud Lifetime** – *A.A. Krasnov (BINP SB RAS), V.V. Anashin, V.V. Smaluk, D.P. Sukhanov (BINP SB RAS)*
An experimental setup for investigations of electron-surface interaction and electron cloud behavior is under commissioning at BINP. The proposed method provides direct measurements of secondary emission yield and electron clouds lifetime in the presence of strong magnetic field. In principle, the experiments can be performed at cryogenic temperatures. The experimental data will help to figure out the process of reflection of low energy electrons from a metal surface and can be useful for improvement of computer codes developed for simulation of electron clouds behavior in a cold beam pipe of particle accelerators. The structure and performance capabilities of the setup are described, first experimental results are presented.

MOPD83 **Performance of the Fast Beam Conditions Monitor BCM1F using Diamond Sensors at the LHC** – *M.E. Castro Carballo (DESY Zeuthen)*
In the CMS detector a series of beam condition monitors were installed and are in operation for measuring radiation doses and preventing possible damages to the detector in case of beam losses. The Fast Beam Condition Monitor, BCM1F, is installed inside the pixel volume close to the beam pipe and it consists of two planes of 4 modules each located 1.8 m away from the IP, on both sides. It uses single-crystal CVD diamond sensors and radiation hard front-end electronics, along with an optical transmission of the signal. It was designed for fast flux monitoring, measuring beam halo and collision products on a bunch by bunch basis. Early in November 2009 the LHC restarted running with beams and since then BCM1F has been recording data from beam halo, beam studies, proton-proton and lead-lead collisions. It is an invaluable tool in everyday CMS operation and, due to the high sensitivity to beam conditions, is providing the so called Background (BKGD) 1 to LHC operators. A characterization of the system on the basis of data collected during LHC operation will be presented.

MOPD84 **Hollow Photocathode Prototype for e-Gun** – *M.A. Nozdrin (JINR), N. Balalykin, A.A. Feshchenko, V. Minashkin, G. Shirkov, G.V. Trubnikov (JINR) S. Gazi, J. Huran (Slovak Academy of Sciences, Institute of Electrical Engineering)*
Photocathodes are important devices for contemporary electron accelerators. Significant photocathode parameters are: fast response time, quantum efficiency, long lifetime, low emittance and minimal effect on RF properties of the accelerating system. In this paper development of the hollow photocathode conception is presented and prototype is described. Such cathode geometry allows quantum efficiency rising due to surface photoelectric effect which is concerned with normal to material surface wave electric field multiplier. Experimental results of hollow photocathode using efficiency are given (266 nm wavelength, 15 ns pulse time with 1 Hz repetition rate and 80 ps pulse time with 5 Hz repetition rate for the same wavelength). Backside irradiation radically simplifies laser beam targeting on emitting surface, accelerator equipment adjustment and allows photocathode working surface laser cleaning.

MOPD85 **Beam Emittance Studies at the Heavy Ion Linac UNILAC** – *P. Gerhard (GSI), W.A. Barth, G. Clemente, L.A. Dahl, L. Groening, S. Mickat, H. Vormann (GSI)*
New accelerating structures for the UNILAC at GSI were commissioned in the last two years, and major machine upgrades in order to meet the requirements for FAIR are in preparation. Beam emittance is one of the key beam parameters that are essential for any beam dynamics calculation, for the design of new accelerators as well as verification or investigation of existing machines. Its measurement is intricate and often time consuming. Extensive emittance measurements went along with the commissionings and were conducted to provide a reliable basis for beam dynamics simulations. In addition to the 10 permanent transverse emittance measurement devices installed all over the UNILAC, two "mobile" devices had been built and mounted at four different sites in the UNILAC. This work shows the standard slid-grid device used for transverse beam emittance measurements and gives an overview of the activities and results. The following topics will be presented with respect to design studies and simulations: Emittance growth of high current ion beams along the UNILAC, stripping, and resonance effects.

MOPD86 **Development of FESA-based Data Acquisition and Control for FAIR** – *R. Haseitl (GSI), H. Bräuning, T. Hoffmann, K. Lang, R. Singh (GSI)*
GSI has selected the CERN Front End Software Architecture (FESA) to operate future beam diagnostic devices for the upcoming FAIR facility. The FESA framework is installed and operational at the GSI site, giving equipment specialists the possibility to develop FESA classes for device control and data acquisition. This contribution outlines first developments of FESA-based systems for various applications. Prototype DAQ systems based on FESA are the BPM system of the synchrotron SIS18 with data rates up to 7 GBit/s and a large scaler setup for particle counters called LASSIE. FESA classes that address gigabit Ethernet cameras are used for video imaging tasks like scintillator screen obser-

vation. Control oriented FESA classes access industrial Programmable Logic Controllers (PLCs) for the slow control of beam diagnostic devices. To monitor temperatures and set fan speeds of VME crates, a class communicating over the CAN bus has been developed.

MOPD87 **The LHC Beam Presence Flag System** – *M. Gasior (CERN), T.B. Bogey (CERN)*
Before injecting any high intensity bunches into the LHC a circulating low intensity pilot bunch must be present to confirm the correct settings of the main machine parameters. For the 2010 LHC run the detection of this pilot beam was done with the beam current transformer system. To increase redundancy of this important safety function a dedicated beam presence flag system was designed, built and tested with beam to be used operationally in the 2011 run. In this system signals from four electrodes of a beam position monitor (BPM) are processed with separate channels, resulting in a quadruple system redundancy for either beam. Each system channel consists of an analogue front-end converting the BPM signals into two logic states, which are then transmitted optically to the machine protection and interlock systems. For safety reasons the system does not have any remote control or adjustable elements and its only inputs are the beam signals. This paper describes the new LHC beam presence flag system, in particular the analogue front-end based on diode peak detectors.

MOPD88 **Electron Beam Ion Sources, Ion Optical Elements and Beam Diagnostics for Particle Accelerators** – *F. Ullmann (DREEBIT GmbH), V.P. Ovsyannikov, M. Schmidt (DREEBIT GmbH) G. Zschornack (Technische Universität Dresden, Institut für Angewandte Physik)*
Electron Beam Ion Sources (EBISs) provide highly charged ions (HCIs) for a variety of investigations and applications, amongst others as injection source for particle accelerators. EBISs feature a lot of advantages which qualify them for accelerator injection, and which partly compensate their comparatively low number of particles. DREEBIT GmbH provides a family of compact EBISs based on permanent magnets. A more sophisticated version is based on cryogen-free superconducting magnets providing a higher ion output. Its compact design makes them transportable, low in operational costs, and guarantee easy handling. We present latest improvements and measurements proving the feasibility of producing beams of HCIs with convenient beam properties such as low transversal and longitudinal emittance. In addition we present a variety of ion optical elements and ion beam diagnostics. The DREEBIT Wien filter allows for the charge mass separation. The DREEBIT Pepperpot Emittance Meter allows for emittance measurements of beams of a wide range of particle intensity. Other beam diagnostics are provided, such as Beam Imaging System, Retarding Field Analyzer and different kinds of Faraday cups.

MOPD89 **Signal Transfer via UHV Compatible Fiber Optics Feedthroughs** – *T. Rausmann (VACOM GmbH), I. Pongrac, M. Veldkamp (VACOM GmbH)*
In recent years, fiber optics have been growing in importance for use in

vacuum technology, transporting light from ambient to vacuum environments. A particular challenge is UHV compatibility of the feedthroughs, dismissing the extensive use of glues. Furthermore, additional requirements like stability, leak rate and bake out temperature have to be considered. To improve out gassing behavior and to avoid ventilation cycles caused by damages of the optical fiber, we have developed an improved UHV-compatible connector and coupling system for fiber optics. The new coupling has a vented design, low insertion loss and is fully weldable. We will present the design and core technical features of the fiber optics feedthrough solution as well as field applications.

MOPD90 **Cause Identification of Beam Losses in PETRA III by Time Correlation of Alarms** – *T. Lensch (DESY), M. Werner (DESY)*
PETRA III is a high brilliant synchrotron light-source operating at 6 GeV at the DESY site in Hamburg. The Machine Protection System (MPS) of PETRA III is under operation since the beginning of the commissioning of PETRA III in April 2009. Under certain alarm conditions the MPS generates a dump command and protects the machine against damage. As a functional extension the MPS hardware examines the time correlation of alarm sequences after a beam loss. The alarm sequences are evaluated in a software based system so that the cause of a beam loss can be displayed in the control room immediately. This paper describes the hardware implementation as well as the software rules.

MOPD91 **Pulse-By-Pulse X-ray Beam Monitor Equipped with Microstripline Structure** – *H. Aoyagi (JASRI/SPring-8), S. Takahashi (JASRI/SPring-8) H. Kitamura (RIKEN/SPring-8)*
Pulse-by-pulse measurement of X-ray beam is import issue for the 3rd generation light sources in order not only to stabilize X-ray beam in an experimental hutch but also to diagnose electron beam in a storage ring. A new pulse-by-pulse X-ray beam monitor equipped with microstripline structure has been developed. The detector head has the microstripline structure, which is composed of a metal line photocathode, an AlN dielectric plate and a Cu cooling base. The impedance of the detector head is matched to 50 Ω. Thermodynamics of the detector head is also well considered against severe heat load. The advantage of this monitor is that output signal is short and unipolar pulse, so front-end electronics can be simplified. The feasibility tests have been demonstrated at the X-ray beamline of SPring-8 in the term of (1) pulse intensity monitor, (2) pulse-by-pulse X-ray beam position monitor, and (3) the pulse-timing monitor. The pulse length of the output signal was about 200 psec FWHM. The pulse height was about 100 mV for the single bunch of $3{\cdot}10^{10}$ electrons, typically.

MOPD92 **Review of Recent Upgrades & Modernizations on Diagnostics in the ESRF Storage Ring and Injector** – *B. Joly (ESRF), P. Arnoux, F. Ewald, D. Robinson, K.B. Scheidt (ESRF)*
Over the last two years a number of upgrades and modernizations have been implemented on diagnostics in both the Injector system and the Storage Ring. Also some new diagnostics have been added. In the Injector, a new TransferLine current monitor has been installed, as well as four

new quarter-wave Striplines equipped with Single-Pass Libera electronics. Results will be presented on the strongly improved sensitivity and resolution of Injector Beam Charge measurements. In the Storage Ring, a new Visible Light Mirror (VLM) system has replaced the original system that had been in place for more than 15 years. The acquisition for the 3 DDCT systems has been upgraded with new hardware. New calibration methods for the Beam Loss Detectors (BLD) have been developed and first data acquisition tests to allow Turn-by-Turn time-resolved studies on these BLDs have been carried out using specific Libera electronics. This paper also presents the results that show marked improvements in terms of performance and functionality of the above mentioned systems.

MOPD93 **Investigation of Diagnostic Techniques on a Nonneutral Plasma** – *K. Schulte (IAP), M. Droba, O. Meusel, U. Ratzinger (IAP)*
Space charge lenses use a confined electron cloud for the focusing of ion beams. The focusing strength is given by the electron density whereas the density distribution influences the mapping quality of the space charge lens and is related to the confinement. The plasma parameters, loss as well as production mechanisms have a strong impact on plasma beam interactions. A scaled up space charge lens was constructed to investigate the properties of a nonneutral plasmas in detail. New non-interceptive diagnostic has been developed to characterize the collective behaviour of the confined nonneutral plasma in terms of an optimized lens design and parameters. Experimental results will be presented in comparison with numerical simulations.

MOPD94 **Radiation Field Characterisation of Free Electron Laser in Hamburg (FLASH)** – *B. Mukherjee (Westdeutsches Protonentherapiezentrum) E. Negodin (DESY) J. Rönsch-Schulenburg, J. Roßbach, R. Tarkeshian (Uni HH)*
The Free Electron Laser in Hamburg (FLASH) is driven by a 1.2 GeV superconducting electron linear accelerator (linac). Accelerated dark current electrons produced in the electron gun as well as accelerated field emission electrons from the superconducting modules made of ultra pure Niobium interact with the accelerator beam lines, thereby producing intense fields of bremsstrahlung gamma rays and photoneutrons. These radiation fields are detrimental to microelectronic devices located in the FLASH tunnel. We have explicitly measured the neutron and gamma doses along the modules of FLASH using passive radiation detectors like, radiochromic films, thermoluminescence dosimeter (TLD) and superheated emulsion (bubble) detectors at different accelerator operating conditions. Using the gamma radiation dose estimated with the TLDs we also have estimated the cryogenic loss induced by field emission electrons in the superconducting modules. This report will highlight the results of the comprehensive dosimetry experiments.

MOPD95 **Radiation Shielding Design for Microelectronic Devices Operating in the Environment of Free Electron Laser in Hamburg (FLASH)** – *B. Mukherjee (Westdeutsches Protonentherapiezentrum), J. Lambert (Westdeutsches Protonentherapiezentrum) O. Kroeplin, E. Negodin, J. Roßbach, S. Ruzin (DESY) J. Rönsch-Schulenburg, R. Tarkeshian (Uni HH)*
To reduce the public radiation exposure High-Energy linacs are housed in well-shielded tunnels. The radiation levels inside the linac-tunnel are many orders of magnitude higher than that of outside the shielding. In some cases sophisticated electronic instruments, susceptible to detrimental radiation effects have to be installed inside the tunnel, hence, the implementation of suitable radiation shielding becomes imperative. Due to space limitations in the tunnel, complex exposure geometry and large variation of the linac operation conditions, shielding calculations based on Monte-Carlo simulations are unable to produce reliable results. Therefore, we have developed an analytical shielding calculation method based on experimentally estimated attenuation properties of selected shielding materials at FLASH driven by a 1.2 GeV superconducting electron linac. Shielding design of a container housing a Streak Camera with femtosecond resolution consisting of delicate micro- and optoelectronics will be presented. The validation of the shielding efficacy using TL-dosimeters and failure probabilities of common microelectronic devices located inside the container will be highlighted.

MOPD96 **The Mirror Mounting of a Fast Switching Mirror Unit at FLASH** – *F. Perlick (DESY Zeuthen), A. Donat, R. Heller, M. Sachwitz, L.V. Vu (DESY Zeuthen) F. Siewert (BESSY GmbH)*
To provide different beam lines with laser light from one source, a fast switching mirror unit that allows permanent switching with a frequency of up to 2.5 Hz was developed. One part of the study deals with the mirror and the design of its mounting in the chamber. The challenge lies in achieving a firm mounting of the mirror without significant mirror deformation, since the users demand only very few divergence of the laser beam at the test sites. The newest design of the mounting brought considerable improvement with regard to the pitching and the torsion of the mirror, which have an important impact on the beam divergence.

17-May-11 09:00 – 10:50
Auditorium

Tuesday Session A
Chair: T.M. Mitsuhashi (KEK)

01 Overview and Commissioning of Facilities

TUOA01 **Beam Instrumentation in J-PARC** – *T. Toyama (J-PARC, KEK & JAEA)*
The talk will summarize the beam instrumentation at J-PARC with a focus on MW class proton beams. The measurements of beam intensities, positions, losses, profiles, and halos at each stage of accelerator, 181 MeV LINAC (to be upgraded to 400 MeV), 3 GeV RCS and 50 (30 as phase I) GeV MR will be reported. Present status, including modification and improvement of instrumentations to meet with LINAC energy upgrade and a future plan will be reported with emphasis on high beam power related issues such as radiation hardness (mechanically and electrically), beam coupling impedance, etc..

TUOA02 **Diagnostics during the ALBA Storage Ring Commissioning** – *U. Iriso (CELLS-ALBA Synchrotron), M. Alvarez, F.F.B. Fernandez, A. Olmos, F. Perez (CELLS-ALBA Synchrotron)*
The ALBA Storage Ring is a 3 GeV 3rd Generation Synchrotron Light Source whose 1st phase commissioning took place in Spring 2011. The machine is equipped with 123 BPMs, striplines, several fluorescent screens, FCT and DCCT, 128 BLMs, and two front ends strictly used for electron beam diagnostics (pinhole and streak camera). This paper presents an overview of the Diagnostics elements installed in the machine and our experience during the commissioning.

TUOA03 **The Fermilab HINS Test Facility and Beam Measurements of the Ion Source and 325 MHz RFQ** – *V.E. Scarpine (Fermilab), S. Chaurize, B.M. Hanna, S. Hays, J. Steimel, R.C. Webber, D. Wildman (Fermilab)*
The Fermilab High Intensity Neutrino Source (HINS) project is intended to test new concepts for low-energy, high-intensity superconducting linacs. HINS initial design consists of a 50 keV ion source, a 2.5 MeV Radiofrequency Quadrupole (RFQ) followed by room temperature and superconducting spoke resonator acceleration sections. At present, a proton ion source and the 325 MHz RFQ, followed by a beam diagnostics section, have been operated with beam. This paper will present the beam measurement results for the proton ion source and for the 325 MHz RFQ module. In addition, this paper will discuss the role of HINS as a test facility for the development of beam diagnostic instrumentation required for future high-intensity linacs.

04 Beam Loss Detection

TUOA04 **Instrumentation for Machine Protection at FERMI@Elettra** – *L. Froehlich (ELETTRA), A.I. Bogani, K. Casarin, G. Cautero, G. Gaio, D. Giuressi, A. Gubertini, R.H. Menk, E. Quai, G. Scalamera, A. Vascotto (ELETTRA) L. Catani, D. Di Giovenale (INFN-Roma II)*
FERMI@Elettra is a linac-driven free-electron laser currently under commissioning at Sincrotrone Trieste, Italy. In order to protect the facility's permanent undulator magnets from radiation-induced demagnetization,beam losses and radiation doses are monitored closely by an active machine protection system. The talk focuses on the design and performance of its main diagnostic subsystems: Beam loss position monitors based on the detection of Cherenkov light in quartz fibers with multi-pixel photon counters, conventional ionization chambers with a new frontend electronics package, and solid-state RadFET dosimeters providing an online measurement of the absorbed dose in the undulator magnets.

17-May-11 11:20 – 13:00
Auditorium

Tuesday Session B
Chair: A. Peters (HIT)

09 Others

TUOB01 **Options for Next Generation Digital Acquisition Systems** – *A. Boccardi (CERN)*
Digital acquisition system designers have an always increasing number of options in terms of bus standards and digital signal processing hardware among which to choose. This allows for a high flexibility but also open the door to a proliferation of different architectures, potentially limiting the reusability and the design synergies among the various instrumentation groups. This contribution illustrates the design trends in some of the major institutes around the world with design examples including VME, PCI and μTCA based modular systems using AMC and/or FMC mezzanines. Some examples of FPGA design practices aimed to increase reusability of code will be mentioned together with some of the tools already available to designers to improve the information exchange and the collaboration, like the Open Hardware Repository project.

TUOB02 **Designing Electronics for Use in Radiation Environments** – *C. Zamantzas (CERN)*
In this talk, an overview will be provided on the necessary steps a new project will need to take to ensure the requirements in terms of resilience to the dose accumulated and single event effects. Information will be given on the different design options and the available tools designers can employ to augment the tolerance of the system as well as the techniques developed to mitigate the problems that can arise in radiation environments. It will be also shown how the knowledge of the expected fluence and flux, together with the given specifications will dictate the

conceptual design, the component choices limited to use, and the required validation and quality assurance through irradiation testing that will be necessary to be undertaken.

TUOB03 **Next Generation Electronics based on μTCA for Beam-Diagnostics at FLASH and XFEL** – *P. Gessler (DESY), M.K. Bock, M. Bousonville, M. Felber, M. Hoffmann, T. Jezynski, T. Lamb, F. Ludwig, G. Petrosyan, L.M. Petrosyan, K. Rehlich, S. Schulz, P. Vetrov, M. Zimmer (DESY) C. Bohm, A. Hidvegi (Stockholm University) K. Czuba (Warsaw University of Technology, Institute of Electronic Systems) D.R. Makowski (TUL-DMCS)*
Almost all accelerator-related diagnostic and steering systems require front-end electronic hardware and software for digitizing, synchronization, processing, controlling, and providing access to the control system. Increasingly high demands on resolution, bandwidth, stability, redundancy, low latency, real-time processing and distribution create the need for new technologies in order to fulfill those demands. For this reason, at the European XFEL and FLASH, the new, μTCA industry standard will be deployed. Over the last few years, significant achievements have been made in μTCA developments in collaboration with other research institutes and industry. In this paper, we give an overview of the required components of a typical μTCA system for diagnostics applications. The FLASH bunch arrival-time monitor will be used as an example.

17-May-11 14:30 – 15:00
Auditorium

Tuesday Session C
Chair: V. Schlott (PSI)

09 Others

TUOC01 **Highlights from the 2010 Beam Instrumentation Workshop** – *J.D. Gilpatrick (LANL)*
The 14th Beam Instrumentation Workshop (BIW10) was hosted by the Los Alamos National Laboratory and was held in the La Fonda Hotel in downtown Santa Fe, NM, USA from May 3–6, 2010. At BIW10, there were a record amount of participants including 177 registered attendees, 92 poster presentations, and 22 companies represented. The oral presentations included 3 tutorials, 8 invited, 10 contributed, a Faraday Cup Award, 2 Vendor Technical, and 1 Special. This oral presentation provides an overview of beam instrumentation areas of interest, which were discussed during the workshop. From a selection of the BIW10 presented papers, a number of technical highlights will also be described. Finally, this oral presentation will briefly discuss the BIW10 Thursday afternoon tour that took place at the Los Alamos Neutron Science Center.

17-May-11 16:30 – 18:00
Luke 4

Tuesday Poster Session

01 Overview and Commissioning of Facilities

TUPD01 **Beam Diagnostics for the SPIRAL2 Linear Accelerator** – *P. Ausset (IPN) C. Jamet, J.L. Vignet (GANIL)*
The future SPIRAL2 facility is now well into the construction phase at CAEN (France). A partnership of several French and foreign laboratories are building the facility according to two phases: the first one includes the construction of the Linear Accelerator and the second one the erection of a dedicated building covering the production process of radioactive beams. The accelerator is a multi-beam driver designed to deliver 5 mA/40 MeV deuterons and 5 mA /14.5 MeV/u heavy ion beams. The accelerator is made up of two ECR sources, a Radio Frequency Quadrupole and a superconducting Linac. This paper describes the driver diagnostics and gives information on the general layout of the beam instrumentation and the current status of some diagnostics which have been already tested.

TUPD02 **Beam Diagnostics for the ESS** – *A. Jansson (ESS), L. Tchelidze (ESS)*
The European Spallation Source (ESS) is a based on a 2.5 GeV superconducting linac, producing a 5 MW beam. Since it is optimized for cold neutrons, there is no accumulator ring, and hence no need for change exchange injection. Therefore, unlike most other proposed MW-class linacs, the ESS linac will accelerate protons rather than H^- ions. This poses a particular challenge for beam size mesurements in the superconducting section. This paper discusses the ESS beam diagnostics requirements, along with some possible instrument design options.

TUPD03 **Beam Diagnostics during Top-up Injection with a Pulsed Sextupole Magnet** – *R. Takai (KEK), K. Harada, T. Honda, Y. Kobayashi, S. Nagahashi, T. Obina, A. Ueda (KEK) N. Nakamura, H. Takaki (ISSP/SRL)*
A beam injection method using a pulsed multipole magnet is suitable for the top-up injection because a perturbation on the stored beam is much less than that of conventional method using several kicker magnets. At the Photon Factory storage ring, the beam injection with a pulsed sextupole magnet (PSM) has been used for user operation since January 2011. To ascertain the effectiveness of the PSM injection, we observed the dynamics of the injected and stored beams by using a synchrotron radiation monitor. The result was in a good agreement with that of a multi-particle simulation, and it was demonstrated that the PSM injection had a much better performance than the conventional method.

TUPD04 **Diagnostics for the 150 MeV Linac of Taiwan Photon Source** – *C.-Y. Liao (NSRRC), Y.-T. Chang, J. Chen, Y.-S. Cheng, K.T. Hsu, S.Y. Hsu, K.H. Hu, C.H. Kuo, D. Lee, K.-K. Lin, K.L. Tsai, C.Y. Wu (NSRRC)*
The TPS 150 MeV linac is in installation and commissioning phase at the test site for acceptance test. The linac will move to the final installation site after the building complete which is expected in 2012. The linac and

a short transport line for mean parameters measurement equips with several types of diagnostic devices include screen monitors, fact current transformers, integrated current transformer, wall current monitors, and Faraday cup. These devices are arranged to measure the specification parameters such as charge in bunch train, pulse purity, energy, energy spread, and emittance. Implementation details and preliminary test results will summary in this report.

TUPD05 **Diagnostic Scheme for the HITRAP Decelerator** – *G. Vorobjev (GSI), C.A. Andre, W.A. Barth, E. Berdermann, M.I. Ciobanu, G. Clemente, L.A. Dahl, P. Forck, P. Gerhard, R. Haseitl, F. Herfurth, M. Kaiser, W. Kaufmann, H.J. Kluge, N. Kotovski, C. Kozhuharov, M.T. Maier, W. Quint, A. Reiter, A. Sokolov, T. Stöhlker (GSI) O.K. Kester, J. Pfister, U. Ratzinger, A. Schempp (IAP)*
The HITRAP linear decelerator currently being set up at GSI will provide slow, few keV/u highly charged ions for atomic physics experiments. The expected beam intensity is up to 10^5 ions per shot. To optimize phase and amplitude of the RF systems intensity, bunch length and kinetic energy of the particles need to be monitored. The bunch length that we need to fit is about 2 ns, which is typically measured by capacitive pickups. However, they do not work for the low beam intensities that we face. We investigated the bunch length with a fast CVD diamond detector working in single particle counting mode. Averaging over 8 shots yields a clear, regular picture of the bunched beam. Energy measurements by capacitive pickups are limited by the presence of intense primary and partially decelerated beam and hence make tuning of the IH-structure impossible. The energy of the decelerated fraction of the beam behind the first deceleration cavity was determined to about 10 % accuracy with a permanent dipole magnet combined with a MCP. Better detector calibration should help reaching the required 1 %. Design of the detectors as well as the results of the measurements will be presented.

TUPD06 **Beam Diagnostic Overview of the SPIRAL2 RNB Section** – *C. Jamet (GANIL), T.A. Andre, E. Gueroult, B. Jacquot, A. Savalle, T. Signoret, F. Varenne, J.L. Vignet (GANIL) J.-M. Fontbonne (LPC)*
A RNB section of the SPIRAL2 facility is under development to produce intense radioactive beams in next years at GANIL. The SPIRAL2 project will be realized in two phases, the first phase consists in building a driver capable of accelerating 5 mA deuteron up to 40 MeV and 1 mA heavy ions up to 14.5 MeV/u, and the second phase will be composed by a production module and a RNB section. Primary beams will be used for the production of intense RIB by several reaction mechanisms (fusion, fission, transfer, etc.) and technical methods (ISOL, IGISOL..).The radioactive ion beam production will be based on fission of uranium target induced by neutrons. Exotic beams will be driven in a new DESIR hall or will be accelerated by the existing cyclotron CIME before to be send in the GANIL experimental areas. The Phase1 building construction is started since the beginning of 2011 and first stable beams are expected in 2013 for the commissioning. This overview gives a description of the different low energy lines, the foreseen diagnostics which

will allow to tune and control stable and radioactive beams used in the SPIRAL2 phase 2.

TUPD07 **Instrumentation Needs and Solutions for the Development of an SRF Photoelectron Injector at the Energy-Recovery Linac BERLinPro** – *T. Kamps (HZB), R. Barday, J. Rudolph (HZB) A. Ferrarotto, T. Weis (DELTA)*
BERLinPro is an energy-recovery linac for an electron beam with 1 mm mrad normalized emittance and 100 mA average current. The initial beam parameters are determined by the performance of the electron source, an SRF photo-electron injector. Development of this source is a major part of the BERLinPro programme. The instrumentation for the first stage of the programme serves the purpose to have robust and reliable monitors for fundamental beam parameters like emittance, bunch charge, energy and energy spread. The critical issue of the second stage is the generation of an electron beam with 100 mA average current and a normalized emittance of 1 mm·mrad. Therefore we plan to setup a dedicated instrumentation beamline with a compact DC gun to measure thermal emittance, current and current lifetime. In parallel an SRF gun with dedicated diagnostics will be build focused on ERL specific aspects like emittance compensation with low-energy beams and reliability of high current operation. This paper collects requirements for each development stage and discusses solutions to specific measurement problems.

TUPD08 **Electron Beam Diagnostics for the New THz and Laser Interaction Beamlines at ELBE** – *R. Schurig (FZD), W. Seidel (FZD) M. Gensch, U. Lehnert, P. Michel (HZDR)*
The 40 MeV, 1 mA electron beam of the superconducting ELBE accelerator in the Helmholtz-Zentrum Dresden-Rossendorf (HZDR) is used to drive two IR FELs, a Bremsstahlung facility, a photoneutron- and a positron source. Work is currently ongoing to add several THz sources and a chamber for interaction experiments with TW and PW class laser. There will be several broadband THz sources e.g. CSR from the last magnet of a bunch compressor chicane as well as CTR and CDR from insertable screens. This will be followed by an electromagnetic undulator as a tunable (0.3–10 mm) narrow band source. The aim of the paper is to present and discuss the proposed electron beam diagnostics on this new facility. Beside the basic diagnostics such as BPM, BLM, DCM, viewers, we foresee bunch compression monitors with phase feedback, a moveable BPM in the chicane for energy stabilization and beam arrival time monitors for synchronization purposes.

TUPD09 **Beam Diagnostics at the MAX IV Storage Rings** – *Å. Andersson (MAX-lab), A. Hansson, D. Kumbaro, S.C. Leemann, P. Lilja, L. Malmgren, R. Nilsson, M. Sjöström, P.F. Tavares (MAX-lab)*
The construction of the MAX IV facility has started. User operation should commence in 2015. The facility is comprised of two storage rings optimized for different wavelength ranges, a linac-based short-pulse facility and a free-electron laser for the production of coherent radiation. The two storage rings will operate at 3 GeV and 1.5 Gev, with horizontal emittances below 0.33 nmrad and 6.0 nmrad respectively. An overview of the beam diagnostics in the rings is presented.

TUPD10 **Monitoring and Control System for Beam Diagnostics Facility of K-500 Superconducting Cyclotron at Kolkata** – *N. Chaddha (DAE/VECC), R.K. Bhandari, R.B. Bhole, C. Mallik, G.P. Pal, S. Pal, D. Sarkar (DAE/VECC)*
The K-500 Superconducting Cyclotron at VEC Centre, Kolkata is at an advanced stage of commissioning. It has been designed to accelerate ion beams up to 80 MeV/A energy for fully stripped light heavy ions and 10 MeV/A for heavy ions. An internal beam of Ne^{3+} with 5 MeV/A has been successfully accelerated up to the extraction radius. All the four beam segments of this cyclotron employ various indigenously developed beam diagnostics components. Ion beam is diagnosed in the injection and external beam lines with Faraday cups, slits and beam viewers. The acceleration and extraction regions, being the most critical zones, are equipped with 3-fingure probe, differential probe, 1-finger probe, viewer probe, magnetic channels and M-9 slit to analyse the size, shape, magnitude and axial distribution of the ion beam. A distributed control system (DCS), designed in a 3-layer architecture, monitors and controls these components. This paper describes the design philosophy of the control system for the beam diagnostics and instrumentation, the challenges, modifications and the future steps planned to operate these components.

02 BPMs

TUPD11 **Developments for IFMIF/EVEDA Beam Position Monitors: The Sensors at the MEBT and the Wire Test Bench** – *I. Podadera Aliseda (CIEMAT), J.M. Carmona, A. Ibarra, L.M. Martinez Fresno, E. Mirones, R. Unamuno, J.G.S. de la Gama (CIEMAT)*
The IFMIF-EVEDA accelerator will be a 9 MeV, 125 mA CW deuteron accelerator which aims to validate the technology that will be used in the future IFMIF accelerator. In the Medium Energy Beam Transport line (MEBT) connecting the RFQ and the MEBT, non-interceptive Beam Position Monitors pickups (MBPM's) will measure the transverse position and phase in order to maximize the transport efficiency of the beamline. The response of the MBPM's must be optimized for a beam current for 5 MeV, and a peak beam current of 125 mA. Due to the lack of space in the MEBT, the MBPM's will be located inside the magnets. The MBPM's will have to fit inside the magnets without perturbing the magnetic field. In this contribution, the electromagnetic and mechanical design of the MBPM will be presented. In addition, in order to validate and characterize all the BPM's type of IFMIF/EVEDA once they are manufactured, a wire test bench has been constructed and verified at CIEMAT. The design and validation results of the test bench will be discussed.

TUPD12 **The LHC Beam Position System: Performance during 2010 and Outlook for 2011** – *E. Calvo Giraldo (CERN), B. Araujo Meleiro, J.L. Gonzalez, L.K. Jensen, O.R. Jones, T. Lefevre, J.-J. Savioz, R.J. Steinhagen, J. Wenninger (CERN)*
This paper will present the performance of the LHC Beam Position System during 2010. The system proved to meet most specifications, was highly reliable and continuously provided 25 Hz real-time orbit data

with micron level resolution to the automatic global orbit feedback system. Several issues were however observed and will be discussed in detail, such as the dependence on bunch intensity and the effect of surface rack temperature variations on the measured position.

TUPD13 **CLIC Drive Beam Position Monitor** – *S.R. Smith (CERN), D. Gudkov, L. Soby (CERN) S.R. Smith*
CLIC, an electron-positron linear collider proposed to probe the TeV energy scale, is based on a two-beam scheme where RF power to accelerate a high energy luminosity beam is extracted from a high current drive beam. The drive beam is efficiently generated in a long train at modest frequency and current then compressed in length and multiplied in frequency via bunch interleaving. The drive beam decelerator requires >40000 quadrupoles, each holding a beam position monitor (BPM). Though resolution requirements are modest (2 microns) these BPMs face several challenges. They must be compact and inexpensive. They must operate below waveguide cutoff to insure locality of position signals, ruling out processing at the natural 12 GHz bunch spacing frequency. Wakefields must be kept low. We find compact conventional stripline BPM with signals processed below 40 MHz can meet requirements. Choices of mechanical design, operating frequency, bandwidth, calibration, and processing algorithm are presented. Calculations of wakes and trapped modes and damping are discussed.

TUPD14 **Commissioning of the Cavity BPMs for the FERMI@Elettra FEL Project** – *P. Craievich (ELETTRA), T. Borden, A.O. Borga, R. De Monte, M. Predonzani (ELETTRA) M. Dal Forno, R. Vescovo (DIEIT)*
The cavity Beam Position Monitor (BPM) is a fundamental beam diagnostic device that allows the measurements of the electron beam trajectory in a non-destructively way and with sub-micron resolution. Ten cavity BPM systems have been installed along the undulators chain in the FERMI@Elettra FEL1 project. In this paper we discuss the installation, commissioning and performance of these cavity BPM systems. We have carried out preliminary operations during a pre-beam period, such as the alignment and fine tuning of the RF cavities under vacuum. During the commissioning each BPM has been calibrated by mechanically moving the support on which the BPM is mounted. We have estimated the single shot resolution in presence of beam jitter by reading the beam position synchronously over many electron bunches from three or more BPMs. The algorithms have been subsequently improved, and the results are described.

TUPD15 **Technology Selection for the Beam Position Tuning System in Hadrontherapy Facilities** – *C. Belver-Aguilar (IFIC), C. Blanch Gutierrez, A. Faus-Golfe, J.J. Garcia-Garrigos (IFIC) M. Haguenauer, P. Poilleux (LLR)*
The Beam Delivery System of some hadrontherapy facilities is characterized by having scanning magnets, which move the beam in order to irradiate all the tumor volume. To control the beam position, a Beam Position Monitor (BPM) is needed. The BPM described in this paper is a new type of BPM based on four scintillating fibers coupled to four

photodiodes to detect the light produced by the fibers when intercepting the beam. We present here the study of the possible photodiodes able to read the light emitted by the scintillating fiber, and the tests performed in order to find the most suitable photodiode to measure the beam position from the variations in the beam current. The setup used for the tests comprises a Sr-90 source, which emits electrons, a scintillating fiber, converting these electrons into photons, and a photodiode, which detects the photons leaving the fiber. The photodiodes studied have been of two types: Avalanche Photodiode (APD) and Multi Pixel Photon Counter (MPPC). In this paper both photodiodes are compared and the results are presented.

TUPD16 **High Frequency Measurements of the Beam Position Monitors for the TBL Line of the CTF3 at CERN** – *J.J. Garcia-Garrigos (IFIC), C. Blanch Gutierrez, J.V. Civera-Navarrete, A. Faus-Golfe (IFIC)*
A series of Inductive Pick-Ups (IPU) for Beam Position Monitoring (BPM) with its associated electronics were designed, constructed and tested at IFIC. A full set of 16 BPMs, so called BPS units, were successfully installed in the Test Beam Line (TBL) of the 3rd CLIC Test Facility (CTF3) at CERN. Two different characterization tests, at low and high frequencies, were carried out on the BPS units: The low frequency test, in the beam pulse time scale (until 10 ns/100 MHz), determined the BPSs parameters directly related to the beam position monitoring and the high frequency test, reaching the microwave X-Ku bands around the beam bunching time scale (83 ps/12 GHz). In this paper we describe the results and methods used to obtain the longitudinal impedance in the frequency range of interest. This test is based on the S-parameters measurements of the propagating TEM mode in a matched coaxial waveguide, specifically designed for the BPS, which is able to emulate an ultra-relativistic electron beam.

TUPD17 **Spatial Resolution Test of a BPMS for DESIREE Beam Line Diagnostics** – *S. Das (MSL), A. Källberg (MSL) J. Harasimowicz (The University of Liverpool)*
Spatial resolution of a beam profile monitoring system (BPMS) was tested. It will be a part of the DESIREE diagnostics to monitor and cover the wide range of beam intensities and energies. The BPMS consists of an aluminum (Al) plate, a grid placed in front of Al, a microchannel plate (MCP), a fluorescent screen (F.S.), a PC, and a CCD camera. A beam collimator containing a set of circular holes of different diameter and separation between them was built to check the spatial resolution of the system. Two holes of diameter 1 mm, separated by 2 mm, in the collimator were used for this purpose. A proton beam was used for the measurements. It was observed that these holes create two beams of approximately same intensity of areas each of 1 mm in diameter with 2 mm separation between the beam centers on the screen, suggesting a resolution of 2 mm of the system. The resolution was tested for different beam energy (0.5–40 keV), and voltages applied on the Al and MCP plates. The experimental results will be compared with the simulations.

TUPD18 **Beam Position Monitors for the ACS Section of the J-PARC Linac** – *T. Miyao (KEK), Z. Igarashi, T. Toyama (KEK) A. Miura (JAEA/J-PARC)*
The J-PARC is consisted of Linac, 3 GeV-RCS, and 50 GeV-MR. We are aiming at the energy upgrade of J-PARC linac from 181 MeV to 400 MeV. We employed the ACS(Annular Coupled Structure) as the acceleration cavities. To have the energy upgrade, we need to develop beam instruments including beam position monitors (BPMs). Then, we designed them to be able to measure a horizontal and vertical beam position and employed a stripline-type as their electrodes. The BPMs are required to be calibrated to the accuracy of beam orbit within 100 μm. To achieve the requirement, we did some calibrations. First, we decided a width of stripuline, whose characteristic impedance can be calibrated to 50 Ω with electric field simulations. Second, we also measured characteristic impedance of 4 different striplines per a BPM corresponding with BPM simulations. Last, we measured an electrical center position of BPMs with a simulated beam signal at 324 MHz, 6 dBm. A BPM will be installed at each quadrupole magnet in the ACS section to be used for a beam commissioning. Systematic calibration of developed BPMs is described in this paper. In addition, a phase measurement using these BPMs will be considered.

TUPD19 **Initial Tests of New Electron and Photon Beam Position Monitor Electronics at the Advanced Photon Source** – *P. Leban (I-Tech) G. Decker (ANL)*
Measurements were done at the Advanced Photon Source (APS) with Libera Brilliance+, connected to the small-aperture insertion device vacuum chamber pickup electrodes near the beamline 35-ID source point. A photoemission-based photon beam position monitor located 16.35 m downstream of the center of the ID straight section was also monitored using Libera Photon electronics in horizontal/vertical configuration. Top-up injection transients were recorded simultaneously on both units, providing details about the electron and photon beam motions before, during, and after injection in the storage ring and beamline front end. FFT spectra from the APS-developed BSP-100 broadband BPM data acquisition electronics were compared with the Libera instruments. This article discusses the calibration procedure for electron and photon beam position monitors along with results of these measurements.

TUPD20 **Pre-amplifier Impedance Matching for Cryogenic BPMs** – *P. Kowina (GSI), M. Freimuth, K. Gütlich, W. Kaufmann, J. Wießmann (GSI)*
Beam Position Monitors (BPMs) for the FAIR fast-ramped super conducting synchrotron SIS-100 will be installed inside the cryostats of quadrupole magnets. This contribution focuses on the coupling path between BPM electrodes and low noise amplifiers installed outside the cryostat. Matching transformers (MT) meet well the requirements of reflection free signal transfer through the relative long lines without loading the capacitive BPM by 50 Ω. Different transformers based on toroidal cores made out of Vitroperm-500F nanocrystalline were tested. The form of windings and circuit geometry were optimized to improve linearity allow for resonance-free transmission over a required frequency

range from 0.1 MHz to 80 MHz. The MTs have to be balanced pair wise within 0.1 dB and the geometry of windings has to be mechanically stabilized using e.g. epoxy resin. A choice of different epoxy types and their suitability for cryogenic operation was tested in liquid Nitrogen and liquid Helium.

TUPD21 **Frontend Measurements and Optimizations at Libera Brilliance BPM Electronics during Commissioning of the Petra III Synchrotron Light Source** – *F. Schmidt-Föhre (DESY), G. Kube, K. Wittenburg (DESY)*
New 3rd generation synchrotron light sources like Petra III utilize high-accuracy beam position measurement (BPM) systems to achieve the desired precision for beam position measurement and control, as needed for electron/positron beam stability and brilliance of the delivered photon beam. To reach the design goals, specifically adapted and parameterized commercial-of-the-shelf (COTS) Libera Brilliance BPM processor electronics are used within the Petra III BPM system. Quality of the acquired position measurement and orbit control data is highly dependent on the properties and setup of the analog and digital frontend of such BPM electronics. This paper shows influences and optimizations at the BPM system frontend of the Petra III light-source in reference to corresponding measurements done during the accelerator commissioning phase.

TUPD22 **EMMA FFAG BPM Employment for High Rate Intra-Train Measurements on the ERL IR FEL at Daresbury Laboratory** – *A. Kalinin (STFC/DL/ASTeC), P.A. McIntosh, R.J. Smith (STFC/DL/ASTeC) G. Cox (STFC/DL) I. Kirkman (Cockcroft Institute)*
A turn-by-turn BPM is developed at Daresbury Laboratory for the 'EMMA' Non Scaling FFAG Facility as a beam-clocked time-domain-multiplexing BPM where for each of two channels, the ADC sequentially measures two pickup signals on each turn. BPM control and memory readout utilise a VME interface and EPICS. For the 'ALICE' ERL IR FEL bunch rate set to 1/5 of 81.25 MHz, it becomes possible to apply these BPMs for bunch-by-bunch measurements. We discuss the ERL BPM set-up and present first measurement results of transverse jitter and intensity variation along the train. We also discuss an 'on-line' BPM resolution measurement, which is based on a 'quadrupole' combination of the beam signals.

TUPD23 **BPM System for the Taiwan Photon Source** – *C.H. Kuo (NSRRC), J. Chen, P.C. Chiu, K.T. Hsu, K.H. Hu, D. Lee (NSRRC)*
Taiwan Photon Source (TPS) is a 3 GeV synchrotron light source which being in construction at NSRRC. New BPM electronics with updated and integrated FPGA based hardware with enhance functionality of current generation was adopted in the TPS. The preliminary electronic testing and relative property will be reported in this report.

TUPD24 **Design Status of Beam Position Monitors for the FAIR Proton Linac** – *C.S. Simon (CEA/DSM/IRFU), F. Senee (CEA/DSM/IRFU) G. Clemente, P. Forck, W. Kaufmann, P. Kowina (GSI)*
Beam Position Monitors (BPM) based on capacitive buttons are designed for the FAIR Proton-LINAC, constructed as an extension of the existing GSI facility. This LINAC is aiming to produce a maximum design current of 70 mA at the 70 MeV energy with an accelerating frequency of 325 MHz. At 14 locations, the BPMs will measure the transverse beam position, the relative beam current and the mean beam energy by time-of-flight method. Depending of the location, the BPM design has to be optimized, taking into account an energy range from 3 MeV to 70 MeV, a short insertion and a beam pipe aperture changes from 30 mm to 50 mm. Some of BPMs will be mounted very close to the CH cavities and special care must be taken to suppress the pickup of the strong rf-field from that cavities. In this contribution, the status of the BPM design will be presented.

TUPD25 **Design of Magnetic BPM and Error Corrections** – *M. Shafiee (Shahid Beheshti University), E. Ebrahimi, S.A.H. Feghhi (Shahid Beheshti University)*
For beam position monitoring (BPM) purposes, two prominent approaches as a physical effect have been applied including electrostatic and magnetic. In electrostatic types, secondary emission from the electrodes can be a problem when strong beam loss occurs, in such a situation, a magnetic BPM may be chosen. For this purpose we made a magnetic BPM including a square shape of ferromagnetic core with winding on each side. In this case study we used it for detecting the position of wire which is including a pulsed current (as an electron bunch) produced by a PROTEK G305 pulse generator. A Tektronix 2235A oscilloscope was calibrated and used to measure the induced voltage of magnetic BPM. Measurement results have been compared with simulation using CST software and performed error corrections which are presented, with this regard we could measure the wire position with high resolution furthermore we deduced the wire position hasn't linear relation with induced voltage and needs more physical and mathematical analyzing. This way propose us that we can use magnetic BPMs in this approach and calibrate them before installing on accelerators.

TUPD26 **Cavity-based Beam Diagnostics at ELSA** – *T.R. Pusch (ELSA), F. Frommberger, W. Hillert, B. Neff (ELSA)*
Online monitoring of the intensity and position of an electron beam of a few hundred pA in the experiment beamlines at the ELSA facility is enabled by a system of resonant cavities. The position signal extracted from the resonators amounts to about 10^{-19} W for 0.1 mm displacement at a beam current of 400 pA. It is separated from noise by phase-sensitive detection in a lock-in amplifier. Thus the beam's position is obtained with a precision of one tenth of a millimeter, the signal strength being normalized by a beam current measurement with an uncertainty of a few pA. Via frequency mixing, the cavity signal of 1.5 GHz is converted down to the operating range of 100 kHz of the amplifier, thus requiring a local oscillator stabilized by a feedback loop to 10^{-6} precision. Measurements

detailing the system are presented.

TUPD27 **EPICS IOC of Oscilloscope for Beam Diagnostics System** – *N. Zhang (SSRF)*
In SSRF, an embedded data acquisition (DAQ)system based on high-performance digital oscilloscope for BPM data acquisition is developed, which can be used for acquiring beam parameters such as beam current and beam position in storage ring. In order to acquire the raw data of waveform signals from the BPM electrodes, the four input channels (CH1-CH4) of the WindowsXP-based oscilloscope is connected with the four output ends of the button BPM electrodes Correspondingly, and data acquisition software has been initially developed by C/C++ and VISA protocol, which is designed to base on EPICS so that the oscilloscope can work as an EPICS IOC . For calculating the beam parameters, a new EPICS database type and its record support are also developed. This DAQ system is hoped to achieve real time bunch by bunch beam measurement, and we hope it would be great helpful for machine research in the future, for example, the beam instability research. The DAQ system can be upgraded by software Optimization and the replacement by a better oscilloscope. In this paper, we will describe the BPM DAQ software based on EPICS and the results of its performance evaluation in detail.

03 Longitudinal Diagnostics and Synchronization

TUPD28 **Benchmarking the Performance of the Present Bunch Arrival Time Monitors at FLASH** – *M.K. Bock (DESY), M. Bousonville, M. Felber, P. Gessler, T. Lamb, S. Ruzin, H. Schlarb, B. Schmidt, S. Schulz (DESY)*
Presently, at FLASH four bunch arrival time monitors (BAM) are installed and in permanent operation. Moreover, they are incorporated in a longitudinal intra-bunch train feedback. In this paper, we present a review of the performance and the limitations of the current BAM design, based on the most recent machine studies. The detection principle of the monitor implements the electro-optical modulation of synchronised laser pulses. The RF and electro-optical front-ends are designed to be operated in a frequency band from DC up to 10 GHz. This allows for measuring the arrival time of each individual electron bunch at femtosecond resolution. The current design of the BAMs has been tested under the influence of disturbances on the arrival time measurement, such as variation of the bunch charge as well as deviation from the reference transverse bunch position. Those results will be incorporated in an upcoming design revision to upgrade the application and robustness of the BAMs.

TUPD29 **Commissioning of the Longitudinal Profile Measurement at the FERMI@ELETTRA Photo-Injector** – *L. Badano (ELETTRA), F. Cianciosi, M.B. Danailov, A.A. Demidovich, M. Ferianis, L. Rumiz, C. Spezzani, C. Svetina, M. Trovo (ELETTRA) P. Evtushenko (JLAB)*
Low energy high brilliance beam characterization plays a crucial role in the optimization of the FERMI@ELETTRA FEL process. For the first time the photo-injector electron beam longitudinal profile versus the electron

beam charge and the photo-injector laser time profile has been measured using a Cherenkov radiator coupled to an ultra fast streak camera with a temporal resolution of 200 fs. Following a brief description of the design and specifications of the longitudinal measurement system, including the optical transport line, the paper focuses on the measurements results and the achieved system performances.

TUPD30 **Bunch Length Measurement using Coherent Cherenkov Radiation** – *K. Kan (ISIR), T. Kondoh, T. Kozawa, K. Norizawa, A. Ogata, J. Yang, Y. Yoshida (ISIR)*
Ultra-short electron bunches on the order of 100 fs or less can be used in the study of ultrafast reactions and phenomena in time-resolved pump-probe experiments involving the application of techniques such as pulse radiolysis. Such electron bunches are also useful for electro-magnetic (EM) radiation production, where the frequency of EM radiation depends on the electron bunch length. In this presentation, Coherent Cherenkov Radiation (CCR), which is a method of THz radiation emitted from relativistic electron bunches, was studied for a diagnostic of electron bunch length. A picosecond electron bunch generated by a photocahode radio frequency (RF) gun was used. CCR can emit narrow-band THz wave with a dielectric-lined waveguide structure. The intensity and frequency of CCR were measured by a Michelson interferometer and a 4.2 K liquid-He cooled bolometer.

TUPD31 **Measurement of the Slice Energy Spread Induced by a Transverse Deflecting Structure at FLASH** – *C. Gerth (DESY), C. Behrens (DESY)*
Operation of a high-gain free-electron laser requires a high-brightness electron beam with high peak current and small slice energy spread. The slice energy spread can be measured with high longitudinal resolution by using a transverse deflecting structure in combination with viewing screen in a dispersive section. However, off-axis accelerating fields induce a correlated energy spread that depends inversely proportional on the longitudinal resolution. As a consequence, short bunches, which intrinsically require a high longitudinal resolution in order to be diagnosed, suffer from a large induced energy spread which limits the energy resolution. To be able to measure the impact of the transverse deflecting structure on the slice energy spread without distortions by space charge or coherent synchrotron radiation effects, we tailored short electron bunches with low peak currents by clipping low energy electrons in the collimator of the first bunch compressor at FLASH. In this paper, we present first systematic measurements of the correlated energy spread induced by a transverse deflecting structure. The results are compared with analytical calculations.

TUPD32 **THz Radiation Diagnostics for Monitoring the Bunch Compression at the SwissFEL Injector Test Facility** – *C. Gerth (DESY), E. Prat, B. Schmidt, S. Wesch (DESY) R. Ischebeck, G.L. Orlandi, P. Peier, V. Schlott (PSI)*
At the SwissFEL Injector Test Facility, installation of a magnetic chicane for longitudinal bunch compression is foreseen for the first half of 2011. Bunch compression will be accomplished by operating two S-band accelerating structures on-crest and two S-band structures at off-crest RF

phases. An X-band structure for the linearization of the longitudinal phase space will be installed at a later stage. The detection of coherent synchrotron radiation or coherent diffraction radiation in the THz range can be used to monitor the bunch compression process and stabilize the RF phases by a beam-based feedback. In this paper, we study the source characteristics of the edge radiation emitted at the 4th dipole of the bunch compressor as well as the diffraction radiation generated by a metallic foil with a hole. Particle tracking simulations were used to model the bunch compression process for different operation modes. The performance of a bunch compression monitor consisting of focusing mirrors and band pass filters has been evaluated by simulating the THz radiation transport of the optical components.

TUPD33 **Coherent Resonant Diffraction Radiation from Inclined Grating as a Tool for Bunch Length Diagnostics** – *L.G. Sukhikh (DESY), G. Kube (DESY) A. Potylitsyn (Tomsk Polytechnic University) V. Schlott (PSI)*
There exists considerable interest in studying new types of non-invasive bunch length diagnostics for sub-picosecond bunches. In this context coherent Smith-Purcell radiation (CSPR) is a good candidate because the use of grating causes wavelength dispersive radiation emission, i.e. a CSPR based monitor does not require any additional spectrometer. In contrast to existing CSPR monitors a new scheme is proposed with two detectors placed at fixed positions, and a wavelength scan is performed by scanning the tilt angle between grating surface and beam axis. In this scheme the information of both detectors, positioned opposite to each other and perpendicular to the beam axis, can be combined by taking the intensity ratio of the signals from both detectors. The advantage of such diagnostics scheme is that one has not to rely on absolute values of the radiation yield, avoiding the need to know the sensitivity of each detector with high accuracy. In contrast to CSPR which is emitted from a grating oriented parallel to the beam, the effect is termed coherent resonant diffraction radiation when the grating is tilted. In the report we present simulation results and detailed experimental plan.

TUPD34 **The New Coherent THz Facility at ELBE: Opportunities for Single Shot Electron Bunch Diagnostics** – *M. Gensch (HZDR), U. Lehnert, P. Michel, R. Schurig (HZDR) G. Geloni (European XFEL GmbH) M. Helm, H. Schneider, W. Seidel (FZD) N. Stojanovic, F. Tavella (DESY)*
At the ELBE accelerator a new electron beamline, providing for femtosecond electron bunches with nC bunch charges and repetition rates in the 10–200 kHz regime is currently constructed. The 40 MeV electrons will be used in photon-electron interaction experiments with TW and PW class laser and for the generation of broad band and narrow bandwidth coherent THz pulses. In this paper we outline ideas to utilize these THz pulses for novel online diagnostics of the electron bunch properties (e.g. arrival time and bunch form).

TUPD35 **Development of a Photodiode-based Detection Principle for the Optical Synchronization Systems at FLASH and XFEL** – *T. Lamb (DESY), M.K. Bock, M. Bousonville, M. Felber, P. Gessler, F. Ludwig, S. Ruzin, H. Schlarb, B. Schmidt, S. Schulz (DESY)*
The distribution of the timing information in the optical synchronization system at FLASH and the upcoming European XFEL is based on optical fibers. These fibers have to be continuously monitored and their drifts in terms of time are actively compensated in order to provide a phase stable pulse train at the end of the optical fiber. At present, detectors based on optical cross-correlation are used to detect these drifts. Further technologies for the stabilization of the optical fiber links are under research to overcome some of the disadvantages of the current detection principle. These efforts recently led to promising results from the development of an alternative, photodiode-based detection principle at DESY. The long-term stability of the prototype for this detector over 33 h was demonstrated to be below 5 fs (peak-to-peak) with a timing jitter of about 0.86 fs. The detection principle itself is highly robust, practically drift free and needs only about a tenth of the optical power, compared to conventional detectors.

TUPD36 **Progress and Status of the Laser-based Synchronization System at FLASH** – *S. Schulz (DESY), M.K. Bock, M. Bousonville, M. Felber, P. Gessler, T. Lamb, F. Ludwig, S. Ruzin, H. Schlarb, B. Schmidt (DESY)*
The free-electron lasers FLASH and European XFEL demand a high timing accuracy between the electron bunches and external laser systems for both exploitation of the short VUV and X-ray pulses in time-resolved pump-probe experiments and seeded operation modes. The required precision can only be achieved with laser-based synchronization schemes. The prototype system installed at FLASH is continuously evolving and subject to improvements. In this paper, we give an overview on the present status, report on the latest developments and extensions, and discuss future challenges. Particularly, the recent move to a new type of master laser oscillator led to a significant enhancement of the robustness and reliability. Consequently, research can focus on the implementation of the electron bunch arrival time feedback, new technologies for timing distribution and integration of Ti:sapphire lasers into the optical synchronization system.

TUPD37 **Investigations of the Longitudinal Single Bunch Instability by Means of Coherent Synchrotron Radiation** – *P. Kuske (HZB)*
As long as a bunch of electrons is longitudinally stable the coherently emitted power of synchrotron radiation remains constant and as time independent as the form of the bunch of electrons itself. At the onset of longitudinal instability the form of the bunch becomes time-dependent and also the CSR-power will no longer be constant. According to the well accepted description of the instability threshold at least one longitudinal azimuthal mode becomes unstable. This mode creates small density modulations which in case of the 1.7 GeV storage ring BESSY can be observed as time varying THz-power levels. CSR can be observed because the size of these density modulations is significantly smaller

than the bunch length. The CSR was used to investigate the onset of the instability as a function of the bunch length and the current dependent features of the instability with the transition from regular to random changes of the bunch form. The interpretation of the experimental results is based on the numerical solutions of the Vlasov-Fokker-Planck equation with a description of the interaction between the bunch and the vacuum chamber in terms of simple impedance models.

TUPD38 **Design of a Single-shot Prism Spectrometer in the Near- and Mid-infrared Wavelength Range for Ultra-Short Bunch Length Diagnostics** – *C. Behrens (DESY) J.C. Frisch, A. Gilevich, H. Loos, J. Loos (SLAC)*
The successful operation of high-gain free-electron lasers (FEL) relies on the understanding, manipulation, and control of the parameters of the driving electron bunch. Present and future FEL facilities have the tendency to push the parameters for even shorter bunches with lengths below 10 fs and charges well below 100 pC. This is also the order of magnitude at laser-driven plasma-based electron accelerators. Devices to diagnose such ultra-short bunches even need longitudinal resolutions smaller than the bunch lengths, i.e. in the range of a few femtoseconds. This resolution is currently out of reach with time-domain diagnostics like RF-based deflectors, and approaches in the frequency-domain have to be considered to overcome this limitation. Our approach is to extract the information on the longitudinal bunch profile by means of infrared spectroscopy using a prism as dispersive element. In this paper, we present the design considerations on a broadband single-shot spectrometer in the near- and mid-infrared wavelength range (0.8–39.0 μm).

TUPD39 **A Low-Cost Microwave Detector for Observations of Synchrotron Radiation at ANKA** – *V. Judin (KIT), N. Hiller, A. Hofmann, E. Huttel, B. Kehrer, M. Klein, S. Marsching, A.-S. Müller, N.J. Smale (KIT) F. Caspers (CERN)*
Generally Coherent Synchrotron Radiation (CSR) is emitted for wavelengths longer than or equal the bunch length, so for CSR in the THz-range short bunches are required. There are two types of detectors in this range of the spectrum: slow detectors like a golay cell or pyrometric detectors (used for e.g. imaging, spectroscopy) and fast detectors like superconducting bolometer detector systems and Schottky Barrier diodes (used for e.g. the investigation of dynamic processes in accelerator physics). The hot electron bolometer (HEB) detector system is a member of second group. It is very fast and has broad spectral characteristics, but unfortunately very expensive and have to be cooled using liquid helium. If the broad spectral response is not important, it will be suitably to use a Schottky Barrier diode instead. These detectors are massively cheaper but also slower. As an alternative to a Schottky diode a LNB (Low Noise Block) can be also used. It is usually used in standard TV-SAT-receivers. Due to mass production LNBs became very cheap, moreover they are optimized to detect very low intensity "noise-like" signals. In this paper we present our experience with a LNB at ANKA.

04 Beam Loss Detection

TUPD40 **Post-mortem Diagnostics for the TLS** – *K.H. Hu (NSRRC), Y.-T. Chang, J. Chen, P.C. Chiu, K.T. Hsu, C.H. Kuo, Y.R. Pan (NSRRC)*
Analyzing the reasons of various trip events are basis to improve reliability of a accelerator system. Understand the mechanisms caused trip of the machine will be very helpful to decide what the adequate measures to improve availability. To identify the causes of trips at Taiwan Light Source (TLS), various diagnostics tool were employed. These diagnostic tools can capture beam trips, interlock signals of superconducting RF system, quench and interlock signals of the superconducting insertion device, waveform of the injection kickers, and instability signals of the stored beam for post-mortem analysis. Various functionalities of trip diagnostic are supported. Available tools and experiences will be summarized in this report.

TUPD41 **The Beam Halo Monitor for FLASH** – *A. Ignatenko (DESY), N. Baboi, O. Hensler, M. Schmitz, K. Wittenburg (DESY) H.M. Henschel, W. Lange, W. Lohmann (DESY Zeuthen) S. Schuwalow (University of Hamburg)*
The Beam Halo Monitor (BHM) for FLASH based on pCVD diamond and monocrystalline sapphire sensors has been successfully commissioned and is in operation. It is a part of the beam dump diagnostics system that ensures safe beam dumping. The description of the BHM and experience gained during its operation are given in this paper.

TUPD42 **Design and Experiences with the Beam Condition Monitor as Protection System in the CMS Experiment of the LHC** – *M. Guthoff (CERN)*
The Beam Condition Monitor (BCM) is used as protection system. In order to prevent damage to the pixel and tracker detectors it can trigger a beam dump when extremely high beam losses occur. The system consists of BCM1L with 4 diamonds per side at 1.8 m away from the interaction point and BCM2 with 4 inner and 8 outer diamonds per side at 14.4 m away from the interaction point. As detector material polycrystalline CVD diamonds are used. The readout electronics is identical to the Beam Loss Monitor (BLM) system of the LHC. With cross calibration measurements a direct comparison between the BLM and the BCM systems is possible. The BCM system is therefore a transparent extension of the BLM system into the CMS cavern. The BCM2 system has been active in the beam abort system since the beginning of collisions at the LHC. Design and performance of the system during the run of the LHC so far will be presented.

TUPD43 **XFEL Beam Loss Monitor System** – *A. Kaukher (DESY), D. Nölle, H. Tiessen (DESY)*
European XFEL will have a sophisticated Machine Protection System, part of which - Beam Loss Monitors(BLM). The monitors will detect losses of electron beam, in order to protect the components of the XFEL from damage and excessive activation. For protection of undulators, BLMs with a scintillator bar will be used. BLMs at places with high radiation load will be equipped with fused silica rods. Beam dumps of the XFEL will be instrumented with glass-fiber BLMs. The BLMs were tested with an electron test-beam at DESY, as well as at FLASH. Due to

large amount of light produced by scintillator and high gain of the used photomultiplier, no optical grease is needed in front of the photomultiplier' window, while typical cathode voltage is only 500–600 volt. The prototype with quartz glass was typically operated at higher cathode voltage. Good operation of all three types of BLMs prototypes was obtained. It is planned to use same monitors also for the FLASH2 project. Current status of the XFEL BLM system development will be presented.

TUPD44 **Test Procedures for FPGA Functionality** – *C. Zamantzas (CERN), B. Dehning, E. Effinger, J. Emery, E. Fadakis, C.F. Hajdu (CERN)*
Code and functionality verification methods will be discussed, taking as an example the threshold comparator card of the LHC BLM system. The first verification method consists of hard and software based test set-ups. An optical signal pulse generator is used to simulate signals supplied to the card by the front-end digitalisation circuit. This reproduces both sampled signals from actual measurements and extreme condition signals, to allow evaluation of the card behaviour under arbitrary input conditions. Another testing strategy is based on sampling the functionality of the FPGA by changing all possible settings of the system. This lengthy procedure was used on the installed system to verify its basic functionality. A completely different approach is based on creating test benches and running simulations for several code components of the FPGA firmware. The test benches were written in VHDL and simulated using ModelSim software. This paper will describe all of these methods and present the gain in confidence obtained from the statistical analysis of the results.

05 Transverse Profiles

TUPD46 **Beam Species Fraction Measurement using Doppler Shift Method with FUJIKURA Fiberscope for IFMIF-EVEDA Injector** – *F. Senee (CEA/DSM/IRFU)*
To characterize high intensity ion beam in low energy beam transport line, diagnostics based on residual gas molecule excitation are commonly used. An example is CCD sensors for beam intensity, beam position and beam profile measurements. At CEA/Saclay with the SILHI injector, beam images transport from viewport to sensor have been performed with a fiberscope. Such technique will be used to transport the beam images outside the irradiated zone of the IFMIF-EVEDA tunnel which requires using hardened radiation devices. Indeed, the (D,d) reaction, due to interaction of 140 mA–100 keV deuteron beam with vacuum pipes, leads to high neutron flux, gamma ray and activation. As a consequence, in addition to CID cameras for online beam positioning and shape measurements, a 20 m long Fujikura fiberscope has been selected to analyze species fraction using the Doppler shift method. Preliminary measurements have been performed with the SILHI beam to characterize the fiberscope. Its spatial resolution and transmission as well as a CCD sensor and fiberscope comparison are presented. Beam species fractions with and without the use of fiberscope will be also reported.

TUPD48 **Transition Radiation from a Cylindrical Target and Transverse Beam Size Diagnostics** – *A. Potylitsyn (TPU) L.G. Sukhikh (DESY)*
For modern X-ray FELs like LCLS in SLAC, FLASH in DESY and constructed ones like European X-FEL the transverse beam profile diagnostics using well-known optical Transition Radiation (TR) is not a trivial task because of a short bunch length and instabilities. Due to these reasons a bunch emits any kind of radiation coherently that makes it impossible to determine transverse profile of such bunch. One may use radiation with wavelengths shorter than bunch length (e.g. EUV) to avoid the problem of radiation coherence. Because of a high quality of mirrors in that region needed to construct proper optical line we propose to use a cylindrical target instead of flat one. TR generated by the cylindrical target is wider than the one from the flat target. But in this case the radiation generated by particles with different impact-parameters relative to a cylinder axes depends on the point of interaction. Proper choice of cylinder parameters allows to obtain beam profile image without any additional optics. In this report we present the simulation results and show how the radiation from the cylindrical target may be used for the bunch transverse profile diagnostics with good space resolution.

TUPD49 **Performance of Parabolic and Diffusive OTR Screens at the CLIC Test Facility 3** – *M. Olvegaard (CERN), B. Bolzon, E. Bravin, S. Burger, A.E. Dabrowski, T. Lefevre (CERN) C.P. Welsch (The University of Liverpool)*
At the CLIC Test Facility 3, OTR screens are commonly used in beam imaging systems for energy and energy spread characterization in dedicated spectrometer lines. In these lines the horizontal beam size is typically of the order of one centimeter. Already in 2005 a limitation was observed resulting from a strong dependence of the intensity of the light captured by the camera, on the position on the screen (vignetting). The severity of this effect increases with the electron energy, as the aperture of the optical system is finite and the OTR photons are emitted in a small cone of $1/\gamma$ angle. To mitigate this effect, different shapes and surface polishing of the screens were investigated. Parabolic and diffusive OTR radiators were tested in several spectrometer lines all along the CTF3 complex. The results are presented in this paper.

TUPD50 **Slice-Emittance Measurements at ELBE / SRF-Injector** – *J. Rudolph (HZB), M. Abo-Bakr, T. Kamps (HZB) J. Teichert (HZDR)*
The linear accelerator ELBE delivers high-brightness electron bunches to multiple user stations, including an IR-FEL. The current thermionic injector is being replaced by a superconducting rf photoinjector (SRF-injector) which promises higher beam quality. Using a transfer chicane, beam from the SRF-injector can be injected into the ELBE linac. Detailed characterization of the electron beam is achieved by measuring the vertical slice emittance of the beam. To perform this measurement a combination of rf zero-phasing, spectrometer dipole and quadrupole scan is used. The electron beam is accelerated by the first cavity of the ELBE accelerator module and send through a second cavity which is operated at zero-crossing of the rf. In doing so a linear energy-time correlation is induced to the beam. The chirped beam is send through a

spectrometer dipole and the longitudinal distribution can be made visible on a scintillator screen. Performing a quadrupole scan allows the determination of the emittance for different slices. This paper explains the working principle of the method and the experimental setup and shows results of performed simulations as well as first measurement results.

TUPD51 **Ionization Profile Monitors - IPM @ GSI** – *T. Giacomini (GSI), P. Forck (GSI) J. Dietrich (FZJ) D.A. Liakin (ITEP)*
The Ionization Profile Monitor in the SIS18 is frequently used for machine development. The permanent availability and the elaborated software user interface make it easy and comfortable to use. Additional to the beam profile data the device records the data of synchrotron dc current, dipole ramp and accelerating rf properties. The trend curves of these data are shown correlated to the beam profile evolution for a full synchrotron cycle from injection to extraction with 100 profiles/s. The reliable function is based on the optimized in-vacuum hardware design, like the stable high voltage connections, the electric field box with very uniform field distribution and the uv-light based calibration system. The permanent availability is based on the convenient software interface using the Qt library. A new IPM generation was recently commissioned in the experimental storage ring ESR at GSI and one in the COSY ring at FZ-Jülich. These monitors are enhancements of the SIS18 multiwire IPM but equipped with an especially developed large area 50×100 mm^2 optical particle detector of rectangular shape that is readout by a digital camera through a viewport.

TUPD52 **First Measurements with the Test Stand for Optical Beam Tomography** – *C. Wagner (IAP), O. Meusel, U. Ratzinger, H. Reichau (IAP)*
A test stand for optical beam tomography was developed. As a new non destructive beam-diagnostic system for high current ion beams, the test stand will be installed behind the chopping system in the Frankfurt Neutron Source (FRANZ) low energy beam transport section. This test stand consists of a rotatable vacuum chamber with a mounted CCD camera. The maximum rotation angle amounts to 270°. In a first phase the optical beam profile measurement and 3D density reconstruction is tested at a time independent 20 keV He beam. The measurements and performance of data processing algorithms are compared with the beam transport simulations. In a later phase the performance with time dependent beams has to be evaluated. In compression mode FRANZ will deliver a 200 mA proton beam at 120 keV with a repetition rate of 250 kHz and a duty cycle of 2.5%. An overview of the first phase results is shown.

TUPD53 **A Low-Power Laser Wire with Fiber Optic Distribution** – *R.B. Wilcox (LBNL), J.M. Byrd (LBNL) V.E. Scarpine (Fermilab)*
Laser-based position diagnostics for hydrogen ion (H-) beams typically use high power optical pulses that must be transported via free space to the diagnostic point. It is difficult to maintain stable alignment through such systems, especially when multiple channels are required. We describe a method for distributing low power, amplitude modulated pulse

trains via fiber optic, and detecting interaction with the H^- beam by synchronous detection of the stripped electrons. Trains of 10 ps, 1064 nm pulses at 400 MHz repetition rate are modulated by a 1 MHz signal that is the reference for a lockin amplifier. The average beam power is below one Watt. Synchronous detection at RF frequencies allows for efficient noise rejection when using optical powers below the nonlinear (Raman scattering) threshold of an optical fiber. The laser is synchronized with the bunch repetition rate, so the diagnostic can be used for bunch length measurements as well. We present results of tests of the optical system with 100 m, single-mode fiber and realistic detected signal levels, demonstrating detection of the modulation signal with high signal-to-noise ratio and low nonlinearity.

TUPD54 **Comparison of Different Radiators used to Measure the Transverse Characteristics of Low Energy Electron Beams at PITZ** – *S. Rimjaem (DESY Zeuthen), G. Asova, J.W. Bähr, H.-J. Grabosch, M. Gross, L. Hakobyan, I.I.V. Isaev, Ye. Ivanisenko, M.A. Khojoyan, G. Klemz, M. Krasilnikov, M. Mahgoub, D.A. Malyutin, A. Oppelt, M. Otevrel, B. Petrosyan, F. Stephan, G. Vashchenko, S. Weidinger (DESY Zeuthen) D. Richter (HZB)*
The photoinjector test facility at DESY, Zeuthen site (PITZ), has been established for developing and optimizing electron sources for linac based Free Electron Lasers (FELs). Characterizations of electron beams with maximum energies of about 25 MeV are carried out at PITZ. In order to study properties of electron beams, several diagnostic systems are applied. One of the important investigations is the study of transverse beam profiles at different beam conditions. Three screen types -YAG powder coated, optical transition radiation (OTR), and CVD-diamond screen- are used as beam profile monitors and are installed in screen stations at different locations along the beam transport line. In addition, wire scanner systems are available in the beamline for the same purpose. In this contribution a comparison of measurement results from all three screen types and the wire scanner used to characterize long pulse trains will be presented and discussed.

TUPD55 **Performance of the Time Resolved Spectrometer for the 5 MeV Photo-Injector PHIN** – *D. Egger (EPFL) A.E. Dabrowski, M. Divall Csatari, S. Döbert, D. Egger, T. Lefevre, O. Mete, M. Olvegaard, M. Petrarca (CERN)*
The PHIN photo-injector test facility is being commissioned at CERN in order to fulfill the beam parameter requirements for the 3rd CLIC Test Facility (CTF3), which includes the production of a 3.5 A stable beam, bunched at 1.5 GHz with a relative energy spread of less than 1%. A 90º spectrometer is instrumented with an OTR screen coupled to a gated intensified camera, followed by a segmented beam dump for time resolved energy measurements. The following paper describes the transverse and temporal resolution of the instrumentation with an outlook towards single-bunch energy measurements.

TUPD56 **High Resolution SR Profile Monitor at ATF Extraction Line** – *T. Naito (KEK), T.M. Mitsuhashi (KEK)*
The profile monitor using visible light of the SR at ATF2 extraction line has been developed. KEK-ATF is a facility to produce extremely low emittance beam for the linear collider. The emittance in the damping ring is e_x=1×10^{-9} m and e_y=1×10^{-11} m, respectively. The ATF2 extraction line is a transport line to study the Final focus system for the linear collider. The designed beam size at the profile monitor is 230 μm in horizontal and 13 μm in vertical. We used a wide aperture optical system to reduce the Rayleigh limit of the optical system. The performance of the monitor is reported.

TUPD57 **European XFEL Wire Scanners Design and Prototyping** – *V. Gharibyan (DESY), A. Brenger, I. Krouptchenkov, J. Kruse, D. Nölle, H. Tiessen, S. Vicins, M. Werner, K. Wittenburg (DESY)*
About 12 profiler stations with horizontal and vertical wire scanner units will be installed at the E-XFEL to measure width, emittance and optics parameters of the beam at energies ranging from few hundred MeV to above 10 GeV. Precise linear motors are explored to drive the wire in and out of the beam in a triggered way with um accuracy. Dedicated detectors to register the wire-beam interaction products will be synchronized with the wire movement on a bunch and pulse (train) level. A fast, up to 1 m/s and slow scans are foreseen depending on the bunch pattern. The wire-scanner as a moving device inside the superconducting machine vacuum requires special safety precautions. A prototype setup has been designed to probe the mechanics and movements safety and performance. Preliminary results from the prototype tests will be reported.

TUPD58 **Non-interceptive Profile Measurements using an Optical-based Tomography Technique** – *C.M. Mateo (CEA/IRFU), G. Adroit, G. Ferrand, A. France, R. Gobin, S. Nyckees, Y. Sauce, F. Senee, O. Tuske (CEA/IRFU)*
Most of the charged particle beam shapes do not possess symmetry. In such cases, diagnostic measurement obtained in one direction is not enough to reconstruct the spatial distribution of the beam. The use of intense beams which demands for non-interceptive diagnostic devices posed another challenge in measuring the beam's spatial distribution. At CEA Saclay and within the DITANET framework, the use of tomography combined with optical diagnostics to develop a non-interceptive transverse profile monitor is foreseen. This profile monitor will be first tested on the BETSI test bench. In this contribution, a tomography algorithm suited for beam profile measurements is presented. This algorithm is based on the formulation of iterative Algebraic Reconstruction Technique (ART) problem and the Maximum-Likelihood Expectation Maximization (MLEM) for the iteration step. The algorithm is optimized within the limit of using 6 projections only. Several beam shapes are generated and then reconstructed computationally. Actual measurements in the BETSI test bench will also be done to verify the tomographic reconstruction process.

TUPD59 **Suppression of Coherent Optical Transition Radiation in Transverse Beam Diagnostics by Utilising a Scintillation Screen in Combination with a Fast Gated CCD Camera** – *M. Yan (Uni HH) C. Behrens, C. Gerth, G. Kube, B. Schmidt, S. Wesch (DESY)*
Micro-bunching instabilities in high-brightness beams of linac-driven FELs can lead to coherence effects in the emission of optical transition radiation (OTR) used for standard transverse profile diagnostics, thus rendering it impossible to observe a direct image of the particle beam. By using a scintillation screen in combination with a fast gated CCD camera, coherence effects can be suppressed as OTR is created in an instantaneous process while scintillation light has a certain decay time. In addition, the emission of the scintillation light is a statistical process from many atoms which is completely insensitive to the longitudinal bunch structure and does not produce coherence effects. Gating the camera during the passage of the electron bunch should eliminate any influence of the coherent OTR (COTR). First experiments using this method have been performed successfully at FLASH as a proof-of-principle. In this paper, we study the applicability of scintillation screens for high-energy electron beams under operation conditions for which COTR is emitted. Experimental results together with simulations are presented and discussed in view of COTR suppression and spatial resolution.

TUPD60 **Optical Beam Diagnostics for Frankfurt Neutron Source** – *H. Reichau (IAP), O. Meusel, U. Ratzinger, C. Wagner (IAP)*
A non-interceptive optical diagnostic system on the basis of beam tomography, was developed for the planned Frankfurt Neutron Source (FRANZ). The proton driver linac of FRANZ will provide energies up to 2.0 MeV. The measurement device will non-interceptively derive required beam parameters at the end of the LEBT at beam energies of 120 keV and a current of 200 mA. On a narrow space of 351.2 mm length a rotatable tomography tank will perform a multi-turn tomography with a high and stable vacuum pressure. The tank allows to plug different measurement equipment additionally to the CCD Camera installed, to perform optical beam tomography. A collection of developed algorithms provides information about the density distribution, shape, size, location and emittance on the basis of CCD images. Simulated, as well as measured data have been applied to the evaluation algorithms to test the reliability of the beam. The actual contribution gives an overview on the current diagnostic possibilities of this diagnostic system.

TUPD61 **Multi Optical Transition Radiation System for ATF2** – *C. Blanch Gutierrez (IFIC), J. Alabau-Gonzalvo, A. Faus-Golfe, J.J. Garcia-Garrigos (IFIC) J. Cruz, D.J. McCormick, G.R. White, M. Woodley (SLAC)*
In this paper we describe the calibration tests, software development and first measurements of a Multi Optical Transition Radiation System in the beam diagnostic section of the Extraction (EXT) line of ATF2, close to the multi wire scanner system. First 2D emittance measurements have been made with success and the system is being used normally for coupling correction. 4D emittance reconstruction algorithm is under improvement and implementation before a systematic measurement campaign

and comparison with wire scanners is done. This will be a definitive test of the OTR as a beam emittance diagnostic device, which will give the ability to measure the beam emittance with high statistics, giving a low error and a good understanding of emittance jitter.

TUPD62 **Implementing of a New Laser System for the RAL Beam Profile Monitor** – *C. Gabor (STFC/RAL/ASTeC) G.E. Boorman, A. Bosco (Royal Holloway, University of London) A.P. Letchford (STFC/RAL/ISIS) J.K. Pozimski, P. Savage (Imperial College of Science and Technology, Department of Physics)*
Within the Front End Test Stand FETS project at Rutherford Appleton Laboratory are also efforts towards a beam profile monitor based on photo detachment with the final aim of applying tomographic methods measuring the beam very close to the ion source extraction system. So far, the results to demonstrate photo detachment at the front end were not fully convincing. Reasons might be not sufficient laser power and no optimal detector design. But it is on the other hand not only a difficult environment to carry out profile measurements at those beam parameters and such a low energy but also important to have diagnostics in order to find best transport settings to match the beam into the RFQ acceptance. The profile monitor will be equipped with a new, pulsed laser system and the paper concentrates on integration and first measurements with this fibre laser in the already existing set-up. It is also planned to extend the existing reconstruction code based on maximum entropy (used for emittance reconstruction) to spatial tomography and discuss long-term plans.

TUPD63 **Gas Electron Multiplier for the Antiproton Decelerator** – *S.C. Duarte Pinto (CERN), O.R. Jones, L. Ropelewski, J. Spanggaard, G. Tranquille (CERN)*
The new beam profile measurement for the Antiproton Decelerator (AD) at CERN is based on a single Gas Electron Multiplier (GEM) with a 2D readout structure. This detector is very light (~0.25 X0), and measures horizontal and vertical profiles directly in one plane. This overcomes the problems previously encountered with multi-wire proportional chambers (MWPCs) for the same purpose, where beam interactions with the detector severely affect the obtained profiles. A prototype was installed and successfully tested in late 2010, with another 3 detectors now installed in the ASACUSA beam line. This paper will provide a detailed description of the detector and discuss the initial results obtained.

TUPD64 **Test Measurements of a 20 ms^{-1} Carbon Wire Beam Scanner** – *M. Koujili (CERN), J. De Freitas, B. Dehning, J.F. Herranz Alvarez, D. Ramos, M. Sapinski (CERN)*
The scanning of a high intensity particle beam imposes challenging requirements on wire scanner systems, implying a design with extremely low vibration, vacuum compatibility, radiation, and temperature tolerance. The adopted solution consists of a rotary brush-less synchronous motor with a permanent magnet rotor installed inside of the vacuum chamber and a stator located on the outside. Two angular position sensors are mounted on the same axis as the fork and rotor and have to resist a bake-out temperature of 200 °C and ionizing radiation up to tens of kGy per year. A digital feedback controller allows maximum

flexibility for the loop parameters and feeds the 3 phase input for the linear power driver. This paper will present the results of laboratory test measurements using the final components, with discussion on the critical parameters such as maximum acceleration, maximum speed and the position measurement accuracy of the optical angular sensor.

TUPD65 **Four-Dimensional Transverse Emittance Measurement Device at Peking University** – *S.X. Peng (PKU/IHIP), J.E. Chen, Z.Y. Guo, P.N. Lu, Y.R. Lu, Z.X. Yuan, J. Zhao (PKU/IHIP) H.T. Ren (Graduate University, Chinese Academy of Sciences)*
An X-Y coplaner High Intensity Beam Emittance Measurement Unit named as HIBEMU-4 has been developed recently to measure the emmitance of 2 MeV/40 mA D^+ beam at the RFQ exit of PeKing University Neutron Imaging FaciliTY (PKUNIFTY). HIBEMU-4 is based on the slit-wire method, and has two groups of slits in the orthogonal directions. Equipped with user-oriented software, it is able to provide results as root-mean-square(rms) emittance, boundary emittance, Twiss-parameters and phase diagram. In this paper we will mainly discuss the strengths and limitations of HIBEMU-4 at the aspects of mechanical designing and data processing method. In addition the testing of HIBEMU-4 on 1 MeV O^+ beam as well as 2 MeV/40 mA D^+ is closely presented, which shows HIBEMU-4 is competent in high intensity beam (HIB) emmitance measurements.

06 Beam Charge and Current Monitors

TUPD66 **Sensor Optimizations for a Cryogenic Current Comparator** – *R. Geithner (HIJ), W. Vodel (HIJ) R. Geithner, R. Neubert, P. Seidel (FSU Jena) P. Kowina, F. Kurian, M. Schwickert (GSI) R. von Hahn (MPI-K)*
We present a non-destructive superconducting monitoring system for charged particles beams. The system uses the Cryogenic Current Comparator (CCC) principle with a low temperature DC-SQUID. The Cryogenic Current Comparator has shown its capability in the Horizontal Bi-Cavity Test Facility at the Helmholtz-Zentrum Berlin under noisy conditions. In this test facility for superconducting cavities the CCC setup was able to detect dark currents in the nA range. The suitability of the Cryogenic Current Comparator as a beam monitor for the Facility of Antiproton and Ion Research at GSI Darmstadt as well as for the Cryogenic Storage Ring at MPI Heidelberg will be pointed out and discussed. Special attention will be given to the ferromagnetic core materials embedded in the pickup coil.

TUPD67 **Injection Efficiency Diagnostic at TLS Storage Ring** – *P.C. Chiu (NSRRC), K.T. Hsu, K.H. Hu, C.H. Kuo, C.Y. Wu (NSRRC)*
TLS is now running at 360 mA top-up mode. In the normal situation, it takes few minutes for injection from zero current to 360 mA. When the working point is drifted too much at machine start, however, injection efficiency become worsen and it is necessary to adjust some machine parameters such as quadrupole strength, transport line correctors or booster dipole to improve efficiency. The current reading at 10 Hz time resolution which is the same with injection cycle seems too rough to

estimate efficiency therefore a new diagnostic tool based on BPM sum reading is developed to provide 10 kHz waveform display every second. Operators could utilize it to estimate efficiency more precise, quickly and easier.

TUPD68 **Feasibility Study for a 3D Bunch Charge Distribution Monitor with a Radial Polarized Probe Laser at SPring-8 Photoinjector** – *Y. Okayasu (JASRI/SPring-8), H. Dewa, H. Hanaki, S. Matsubara, A. Mizuno, S. Suzuki, T. Taniuchi, H. Tomizawa, K. Yanagida (JASRI/SPring-8) T. Ishikawa (RIKEN Spring-8 Harima) M. Uesaka (The University of Tokyo, Nuclear Professional School)*

It is essential for precise characterizations of light sources to monitor ever-changing charge distribution of electron bunch by single-shot measurement with high resolutions. Therefore, a single-shot and non-destructive 3D bunch charge distribution (BCD) monitor was developed to characterize longitudinal and transverse BCDs simultaneously. It is based on Electro-Optical (EO) multiple sampling with a manner of spectral decoding. For the transverse detection, eight EO-crystals surround the beam axis azimuthally, and a linear-chirped probe laser pulse with a hollow shape and spirally temporal shift, passes through the EO-crystals. A principle verification experiment has been successfully carried out with two EO-crystals in our facility. In addition, we are promoting a numerical calculation of the ultra-short and radial polarized laser transportation for our own system assuming eight EO-crystals usage in order to confirm observation feasibility. We report the principle and the first experimental results of the novel 3D-BCD monitor and introduce the feasibility demonstration with a calculation about a propagation of transverse polarization distributions along probe laser optics.

TUPD69 **Operational Experience and Improvements of the LHC Beam Current Transformers** – *OP. Odier (CERN), D. B. Belohrad, JJ.G. Gras, M. Ludwig (CERN)*

During the 2010 run the LHC continuously improved its performance. In particular the bunch charge and number of bunches were significantly increased, which revealed certain limitations of the LHC beam current transformers. The DC current transformers (DCCT), used to measure the circulating beam current, exhibited saturation related to bunch intensity, the number of batches in the machine and their spacing. Two major issues were also discovered on the fast beam current transformers (FBCT) used to measure the individual bunch charges: discrepancies in the measured intensities when compared to the DCCTs measurements and a bunch length dependence on the measured intensity. Further analysis showed that both problems are linked to the beam position dependence of the signal acquired from the toroids used in the FBCTs. This paper presents the observed issues, discusses possible solutions and reports on the results from modification made for the 2011 run.

07 Tune, Chromaticity and General Storage Ring Diagnostics

TUPD70 **Conceptual Design of a High Sensitive Versatile Schottky Sensor for the Collector Ring at FAIR** – *M. Hansli (TU Darmstadt), R. Jakoby, A. Penirschke (TU Darmstadt) W. Ackermann, T. Weiland (TEMF, TU Darmstadt) W. Kaufmann (GSI)*
The FAIR (Facility for Antiproton and Ion Research) accelerator complex includes the Collector Ring CR, i.e. a dedicated storage ring for secondary particles, rare isotopes and antiprotons. The CR features three different modes of operation: pre-cooling of antiprotons at 3 GeV, pre-cooling of rare isotope beams at 740 MeV/u and an isochronous mode for mass measurements. For beam optimizations in all three modes a sensitive Schottky setup is required to monitor very low beam intensities down to single particles. In this paper the conceptual design of a longitudinal Schottky sensor based on a pillbox cavity with adjustable coupling and frequency tuning is presented. The basic measurement principles are depicted and a possible realization is discussed with emphasize on the special requirements of the CR operational modes. Full-wave simulations of the proposed sensor cavity allow for further optimizations.

TUPD71 **Combined Approach using Closed-Orbit and Multiturn Data for Model-Independent and Fast Beam Optics Determination in Storage Rings** – *B. Riemann (DELTA), P. Grete, H. Huck, A. Nowaczyk, T. Weis (DELTA)*
Multiturn-capable BPMs have been used successfully for characterization of storage ring beam optics. While their use eases determination of optical parameters (e.g. beta function and phase) by observation of non ring-periodic beam centroid oscillation, the installation of multiturn electronics in all storage ring BPMs causes a high monetary effort. The presented method aims at combining multiturn and closed-orbit measurement methods in a cost-effective way. This is done using a single drift section in the ring, being equipped with two multiturn BPMs at its ends. Measuring the centroid motion in the full transverse phase space, one can completely determine all local beam optics parameters inside the drift space. Then, four additional dipole correctors inside this drift are used to create closed-orbit perturbations along the ring. Because of the known drift optics, it is then possible to extract all data that would be available if all storage ring BPMs were multiturn-capable, by using only closed-orbit BPM data of the mentioned four perturbations (incl. betatron coupling). This fast and model-independent approach may be increased in accuracy by a coupled bunch feedback system.

TUPD72 **Advancements in the Base-Band-Tune and Chromaticity Instrumentation and Diagnostics Systems during LHC's First Year of Operation** – *R.J. Steinhagen (CERN), M. Gasior, S. Jackson (CERN)*
The Base-Band-Tune (BBQ) system is an integral part of day-to-day LHC operation, used for tune and chromaticity diagnostics and feedback and giving unprecedented precision with good reliability. This contribution summarises the system's overall performance and documents the various improvements of the analogue front-end circuitry, digital post-processing and integration that were necessary in response to issues

arising during high-intensity physics operation. The result of beam studies undertaken are presented, which have established a better understanding of the detection principle since its first introduction in 2005.

08 Feedbacks and Beam Stability

TUPD73 **Fast Orbit Stabilization System for Tandem APPLE-II Undulators at the KEK-PF** – *T. Obina (KEK), K. Harada, R. Takai (KEK)*
A rapid-polarization switching source has been developed in the KEK-PF 2.5 GeV electron storage ring. The source consists of two tandem APPLE-II type elliptically polarizing undulators (EPU) and five fast kicker magnets. The kicker magnets produce a local bump orbit at the frequency up to 100 Hz. Amplitude and phase of these magnets must be tuned precisely in order to minimize the leakage of residual orbit outside of the kicker bump. A fast orbit stabilization system which consists of ADC/FPGA/DAC are also developed to reduce the remaining orbit fluctuations in vertical and horizontal planes. In this paper, design and the preliminary result of the fast orbit compensation system is presented.

TUPD74 **The Bunch by Bunch Feedback System in J-PARC Main Ring** – *Y. Kurimoto (KEK), Y.H. Chin, T. Obina, M. Tobiyama, T. Toyama (KEK) Y. Shobuda (JAEA/J-PARC)*
We report the current status of the bunch by bunch feedback system for the J-PARC Main Ring. The J-PARC Main Ring is the synchrotron accelerating protons from 3 GeV to 30 GeV. It is normally operating at the intensity of 135 kW. The bunch by bunch feedback system have been developed and used for the normal operation of J-PARC Main Ring. The system aims to reduce the coherent transverse oscillation due to the instabilities or injection errors. It consists of a beam position monitor, a stripline kicker and a signal processing electronics. We've observed the injection error leading to the head-tail oscillation and succeed in damping such kind of oscillations and reducing the beam loss significantly.

TUPD76 **Vibration and Beam Motion Diagnostics in TLS** – *Y.K. Chen (NSRRC), J. Chen, P.C. Chiu, K.T. Hsu, K.H. Hu, C.H. Kuo (NSRRC)*
Beam stability is crucial in a modern synchrotron light source. Beam motion caused by various factors should be remedy by various approaches to achieve high beam stability. Vibration will deteriorate beam stability and need consider as part for beam diagnostic. Due to the inconsistency sampling rates of different kind of devices, synchronize different kinds of the data acquisition system include BPM system, vibration monitoring system are need to correlate the relationship between event and data. An integrated environment for beam orbit and vibration monitoring system was sat up for various studies. Implementation details and some beam observation will present in this report.

TUPD78 **SOLEIL Beam Orbit Stability Improvements** – *N. Hubert (SOLEIL), L. Cassinari, J.-C. Denard, P. Lebasque, L.S. Nadolski, D. Pedeau (SOLEIL)*
SOLEIL beam orbit stability is being significantly improved. A first effort was set on long term stability for specific beamlines (new 160 m long Nanoscopium and Hard X-rays beamlines). BPM and XBPM steel supports will be replaced for reducing their sensitiveness to temperature

drift. Thermal expansion of INVAR and fused Silica stands has been measured. INVAR has been selected for the new BPM supports. A second effort aimed at improving the orbit stability of beamlines based on bending magnets. We plan to use their first XBPM in the global orbit feedback loops (slow and fast). For that purpose new XBPM electronics called Libera photons will be used. Soleil, having contributed to the development, tested extensively the first series. A third effort focused on noise source location. An application developed in-house has identified localized orbit perturbation sources introducing spurious spectrum lines at 46, 50 and 54 Hz on the orbit. They originate from fans rotating close to ceramics chambers of kickers, FCT and shaker. Their suppression decreases the vertical integrated noise down to 300 nm in the DC–500 Hz frequency range.

TUPD79 **Preliminary Tune Feedback Study in the Taiwan Light Source** – *C.H. Kuo (NSRRC), P.C. Chiu, K.T. Hsu, K.H. Hu, C.-Y. Liao, C.Y. Wu (NSRRC)*
There are many difference type insertion devices are disturbed in the storage ring of TLS. The traditional feed-forward control to correct orbit change and tune shift that isn't enough when difference type insertion devices are operated with various condition. There is global orbit feedback to solve global orbit problem. In the tune shift, the tune feedback will be proposed to make up it for various insertion devices operation. The stable tune measurement and compensation will be discussed in this report.

TUPD81 **The Petra III Multibunch Feedback System** – *J. Klute (DESY), K. Balewski, H.T. Duhme, Ru. Neumann (DESY)*
In order to fulfill the demands of a high brilliance synchrotron light source like PETRA III different feedback systems are required. The high brilliance is accomplished by high beam current of 100 mA and very small transverse emittances. The current in PETRA is limited by coupled bunch instabilities to rather low values and powerful longitudinal and transverse feedback systems are necessary to achieve the design current. A careful design of the feedback is required in order to avoid any kind of beam quality degradation such as beam blow up due to noise. Additional requirements on signal processing are: very high dynamic range, adaptive signal adjustment, very high sensitivity to beam oscillations, high resolution and very high bandwidth. This contribution will describe the most important components and their properties. Results of the feedback operation will be presented and discussed. The design current of 100 mA has been achieved without the indication of emittance growth and the feedback has been operated reliably during the fast user period.

09 Others

TUPD82 **First Results of the LHC Collision Rate Monitors** – *E. Bravin (CERN), S. Bart Pedersen, A. Boccardi, S. Burger, C. Dutriat (CERN) L.R. Doolittle, H.S. Matis, M. Placidi, A. Ratti (LBNL) R. Miyamoto (BNL)*
The aim of CERN's large hadron collider (LHC) is to collide protons and heavy ions with centre of mass energies up to 14 zTeV. In order to monitor

and optimize the collision rates special detectors have been developed and installed around the four luminous interaction regions. Due to the different conditions at the high luminosity experiments, ATLAS and CMS, and the low luminosity experiments, ALICE and LHC-b, two very different types of monitors are used, a fast ionisation chamber (BRAN-A) and a Cd-Te solid state detector (BRAN-B) respectively. Moreover in order to cope with the low collision rates foreseen for the initial run a third type of monitor, based on a simple scintillating pad, was installed in parallel with the BRAN-A. This contribution illustrates the results obtained during the 2010 run with an outlook for 2011 and beyond.

TUPD83 **Photodiode Calibration using an Electrical Substitution Radiometer in the Hard X-ray Region** – *N.I. Bolibruch (CLS), R. Igarashi, J.M. Vogt (CLS)*
An electrical substitution radiometer under development at the Canadian Light Source (CLS) has been used to calibrate a photodiode (AXUV100) from International Radiation Detectors Inc. within an energy range of 8 keV to 30 keV. These measurements were made using monochromatic X-rays on the Biomedical Imaging and Therapy bend magnet beam line and the Hard X-Ray Microanalysis beam line at the CLS. The results were then compared with silicon absorption calculations using data from the NIST mass absorption coefficient tables. Good agreement has been found between the diode calibration obtained from the radiometer and the theoretical calculation of the diode response.

TUPD84 **Application of EPICS Embedded Image Processing System to Beam Diagnostics** – *R. Takai (KEK), K. Furukawa, T. Obina, J.-I. Odagiri (KEK)*
A compact image processing system based on a Programmable Logic Controller (PLC) has been tested at the Photon Factory storage ring. The core of the system is a frame grabber module controlled by an EPICS-embedded CPU module. In a test experiment using an analog CCD camera, we confirmed its basic performances such as data acquisition synchronized with an external trigger, background subtraction and non-linear fitting for the projection data. This system can be applied easily to various beam diagnostics based on the image data.

TUPD85 **Photoinjector Based MeV Electron Microscopy** – *J. Yang (ISIR), K. Kan, Y. Murooka, N. Naruse, K. Tanimura, Y. Yoshida (ISIR) JU. Urakawa (KEK)*
A time-resolved MeV electron microscopy based on a photocathode rf electron gun is being developed in Osaka University to reveal the hidden dynamics of intricate molecular and atomic processes in materials. A new structure rf gun has been developed to generates a high-brightness femtosecond-bunch electron beam. The microscopy has been used successfully for the single-shot MeV electron diffraction measurement and the time-resolved measurement. The transverse emittance, bunch length and energy spread were diagnosed as the functions of the laser injection phase, the laser pulse width and the bunch charge. The growths of the emittance, bunch length and energy spread due to the rf and the space charge effects in the rf gun were investigated.

TUPD86 **RF Reference Distribution and Timing System for the Taiwan Photon Source** – *C.Y. Wu (NSRRC), Y.-T. Chang, J. Chen, K.T. Hsu, K.H. Hu, C.H. Kuo, C.-Y. Liao (NSRRC)*
Taiwan Photon Source (TPS) is a low-emittance 3 GeV synchrotron light source with circumference of 518.4 m (24 straight sections for installation of insertion devices), radio-frequency cavities and electron beam from the 150 MeV linac system which being in construction at National Synchrotron Radiation Research Center (NSRRC) campus. A high stability of the novel fiber based 500 MHz RF reference distribution is required and planned to use. Timing system for the TPS will be an event based system. It is based on 6U CompactPCI form factor from Micro-Research Finland Oy. Prototyping of the RF distribution and event system are on progress in this direction. The preliminary test results and implementation details will summary in this report.

TUPD87 **Fuzzy Logic Controls of a Particle Accelerator** – *O.F. Toader (NERS-UM)*
The ion beams produced in a particle accelerator have to be characterized and monitored using parameters specific to the instruments involved and information from practical (hands-on) operation of those instruments and of the accelerator as a whole. The control is critical considering the multitude of equipment and tasks involved. It is a nonlinear, non-standard process difficult to model. This paper will presents the progress that is currently being made in the attempt to implement fuzzy logic theory in controlling parts of the 1.7 MV Tandem particle accelerator at the Michigan Ion Beam Laboratory.

TUPD88 **A Micro-Channel Plate Based RFA Electron Cloud Monitor for the ISIS Proton Synchrotron** – *A. Pertica (STFC/RAL/ISIS), S.J. Payne (STFC/RAL/ISIS)*
Electron clouds produced inside a particle accelerator vacuum chamber by the passage of the beam can compromise the operation of the accelerator. The build up of electron clouds can produce strong transverse and longitudinal beam instabilities which in turn can lead to high levels of beam loss often requiring the accelerator to be run below its design specification. To study the phenomena of electron clouds at the ISIS Proton Synchrotron, a Micro-Channel Plate (MCP) based electron cloud detector has been developed. The detector is based on the Retarding Field Analyser (RFA) design and consists of a retarding grid, which provides energy analysis of the electron signal, and a MCP assembly placed in front of the collector plate. The MCP assembly provides a current gain over the range 300 to 25 K, thereby increasing the signal to noise ratio and dynamic range of the measurements. In this paper, we describe the lab based experiment used to test our detector using a low energy electron gun. Results from our MCP based detector installed in the ISIS accelerator ring are discussed and compared to a RFA detector, installed at the same location, which has no MCP fitted.

TUPD89 **Polarimetry of 0.1 – 130 MeV Electron Beams at the S-DALINAC** – *C. Eckardt (TU Darmstadt), P. Bangert, U. Bonnes, R. Eichhorn, J. Enders, C. Ingenhaag, Y. Poltoratska, M. Wagner (TU Darmstadt) R. Barday (HZB)*
A source of polarized electrons has been installed at the superconducting 130 MeV Darmstadt electron linear accelerator S-DALINAC, augmenting the experimental program for nuclear structure studies and fundamental experiments. Polarized electrons from a strained-superlattice GaAs cathode are electrostatically accelerated to 100 keV. In the low-energy beam line the beam parameters are measured using diagnostic elements like wire scanners and RF-monitors, a Wien filter for spin manipulation and a 100 keV Mott polarimeter for polarization measurement. Following a superconducting accelerator section, electron beams with 5–10 MeV energy are used for bremsstrahlung experiments. Here, the absolute degree of polarization will be measured using a Mott polarimeter, while monitoring the beam polarization during the experiment with a Compton transmission polarimeter. Alternatively, the electron beam can be further accelerated in the recirculating superconducting main linac. For beam energies of 50–130 MeV a Moeller polarimeter as well as two Compton transmission polarimeter are foreseen. We report on the performance of the polarized source and the polarimeter design and installation.

TUPD90 **POMPOMs: Cost-Efficient Polarity Sensors for the MICE Muon Beamline** – *J. Nebrensky (Brunel University) P.M. Hanlet (IIT)*
The cooling effect in MICE (Muon Ionisation Cooling Experiment) will be studied with both positive and negative muons, reversing the electrical input to the magnets by physically swapping over the power leads. Ensuring the actual operating polarity of the beamline is correctly recorded is a manual step and at risk of error or omission. We have deployed a simple system for monitoring the operating polarity of the two bending magnets by placing in each dipole bore a Honeywell LOHET-II Hall-effect sensor that operates past saturation at nominal field strengths, and thus return one of two well-defined voltages corresponding to the two possible polarities of the magnet. The environment in the experimental hall is monitored by an AKCP securityProbe 5E system integrated into our EPICS-based controls and monitoring system. We read out the beamline polarity sensors using a voltmeter module, and translate the output voltage into a polarity (or alarm) state within EPICS whence it can be accessed by the operators and stored in the output datastream. Initial test of the LOHET-II sensors indicates they will still be able to indicate beamline polarity after radiation doses of 600 Gy (^{60}Co).

TUPD91 **Comparative Studies of Reconstruction Methods to Achieve Multi-Dimensional Phase Space Information** – *C. Gabor (STFC/RAL/ASTeC) A.P. Letchford (STFC/RAL/ISIS) D. Reggiani, M. Seidel (PSI)*
High Intensity Proton Accelerators like SNS, PSI or future machines like ESS or Isis upgrade cannot tolerate high losses due to activation. Standard beam diagnostics may not provide enough information about potential loss sources like beam filamentation or halo. Moreover, the application of interceptive methods like slits or pepperpot can be seriously

discouraged by either high power deposition or explicit requirements for non-destructive methods like on-line diagnostics near superconducting cavities. Reconstruction of the beam distribution with a tomography method based on Maximum Entropy could help to overcome those problems and is easily to integrate in already existing facilities because the algorithm does not depend on the experimental profile measurement technique. Furthermore beam tomography can be employed on both spatial and phase-space reconstruction. The paper compares results from two different software packages from PSI (Maximum Entropy Tomography MENT) with the code used at RAL (MemSys 5).

TUPD92 **SPIRAL2 Beam Energy Measurement** – *W. Le Coz (GANIL), C. Doutressoulles, C. Jamet (GANIL)*
In order to produce high intensity exotic beams in the existing experimental rooms of the GANIL facility, the SPIRAL2 project is under development and under construction at GANIL. The first phase of the SPIRAL2 project consists to build a new accelerator composed of two sources, an ion source and a proton/neutron source, a RFQ and a superconducting Linac. The linac is designed to accelerate 5 mA deuterons up to 40 MeV and 1 mA heavy ions up to 14.5 MeV/u. A new electronic device has been developed at GANIL to measure phase and amplitude of pick-up signals and calculate the beam energy. The principle consists of directly digitizing the pick-up pulses by under-sampling. The Phase and amplitude of different harmonics are then calculated with a FPGA by an I/Q method before the beam energy calculation. This paper gives results of the peak-up tests in laboratory and the comparisons with simulations. The tests in laboratory and on the GANIL accelerator of an electronic prototype are shown and presented.

TUPD93 **Diagnostics of RF Breakdowns in High-Gradient Accelerating Structures** – *A. Palaia (Uppsala University)*
Within the framework of the research on high-gradient accelerating structures for future linear colliders, diagnostics of radio-frequency (RF) breakdowns is of great importance to support the understanding of the vacuum breakdown process. Measurements of RF and electron and ion currents emitted during and after a breakdown can be used to calculate the properties of any objects responsible for such power reflection and charge emission. Possible breakdown models, breakdown localization and a time-scale of the process are here discussed and compared to dedicated measurements. First results are presented.

TUPD94 **Monitoring of GeV Deuteron Beam Parameters in ADS Experiments at the Nuclotron (JINR, Dubna)** – *A.A. Safronava (JIPNR-Sosny NASB)*
The quality of beam instrumentation is very important in the experiments on accelerator driven systems (ADS) aiming to investigate spatial and energy distribution of neutrons inside and outside the subcritical setups comprising spallation neutron sources irradiated by relativistic beams. An important source of systematic uncertainties of the experimental data is the inaccuracy of determination of the beam parameters such as total intensity of the extracted beam, beam position at the target,

fraction of the beam hitting the target and beam shape. This paper reviews the experimental techniques and measurement tools for deuteron beam monitoring used within the "Energy plus Transmutation" collaboration in the ADS experiments at the accelerator complex of Nuclotron (JINR, Russia): - solid nuclear track detectors method and activation technique using Al monitors for measurement of the total intensity of the extracted beam; - solid nuclear track detectors method and activation technique using segmented activation Cu foils for determination of beam profile and position at the target.

TUPD96 **Planned Machine Protection System for the Facility for Rare Isotope Beams at Michigan State University** – *G. Kiupel (FRIB), S. Assadi, T.D. Brown, J.L. Crisp (FRIB) M.W. Stettler (LANL)*
The Facility for Rare Isotope Beams (FRIB) at Michigan State University will use a 400 kW, heavy-ion cw linac to produce rare isotopes in support of a rich program of fundamental research. In the event of operating failures the Machine Protection System (MPS) shuts off the beam within microseconds to control beam losses that may damage the accelerator components. The operational mode is distributed via a finite state machine to all critical devices that have multiple hardware checkpoints and comparators. MPS will coordinate the validation of experimental request at start-up of every run. A prototype system consisting of an MPS master, five MPS nodes, a user interface and simulated devices for diagnostics (inputs) and mitigation (outputs) will be built to develop and test hardware, firmware and application software. A relational database supporting the MPS is being designed, that will provide the framework for the development of MPS software applications. These database-driven tools will provide MPS device configuration, machine snapshot and restore, and other MPS requirements. In this paper, we present FRIB MPS architecture, plans and implementation.

TUPD97 **Diagnostics System of TAC IR FEL Facility** – *Z. Nergiz (N.U) A. Aksoy (Ankara University, Faculty of Engineering) S. Ceylan, S. Ozkorucuklu (SDU) C. Kaya (HZDR)*
The TAC (Turkish Accelerator Center) IR FEL facility which is named as Turkish Accelerator and Radiation Laboratory at Ankara, TARLA will be based on a 15–40 MeV electron linac accompanying two different undulators with 2.5 cm and 9 cm periods in order to obtain IR FEL ranging between 2–250 μm. The electron linac will consist of two sequenced modules, each housing two 9-cell superconducting TESLA cavities for cw operation. It is planned that the TARLA facility will be completed in 2013 at Golbasi campus of Ankara University. This facility will give an opportunity to the scientists and industry to use FEL in research and development in Turkey and our region. In this study, the main structure of the facility and planned electron beam diagnostics system is given in detail.

18-May-11 09:00 – 10:50
Auditorium

Wednesday Session A
Chair: P. Krejcik (SLAC)

05 Transverse Profiles

WEOA01 **Summary of COTR Effects** – *S. Wesch (DESY), B. Schmidt (DESY)*
Coherent transition radiation in the visible regime (COTR) has become a serious issue in FEL - Linacs disturbing the measurement of beam profiles by OTR screens up to a level, where this diagnostics becomes totally impossible. The talk will summarize the measured COTR effects from LCLS, FLASH and other machines and the investigations done so far into the dependence of the effect on beam and machine parameters. The status of the theoretical background and understanding of its origin will be discussed as well as proposals and experiences with possible remedies.

WEOA02 **Experimental Investigations of Backward Transition Radiation from Flat Target in Extreme Ultraviolet Region** – *L.G. Sukhikh (DESY), G. Kube (DESY) D. Krambrich, W. Lauth (IKP) Yu.A. Popov, A. Potylitsyn (Tomsk Polytechnic University)*
Forward transition radiation in X-ray range and backward transition radiation (BTR) in optical spectral region are investigated in details due to their use for purposes of particle and beam diagnostics. In order to improve diagnostics tools we proposed to use BTR in extreme ultraviolet (EUV) region, where theoretical models are existing only. We performed experimental investigations of BTR characteristics in EUV spectral region generated by a molybdenum target at 855 MeV electron beam of the MAMI-B (Mainz, Germany). Angular patterns and intensities of BTR both in optical and EUV regions for different observation angles were investigated. The measured intensity of optical BTR agrees with a theory with reasonable accuracy but one in EUV region is more intense than theoretically predicted. Our experimental estimation of the experimental BTR yield in EUV region is $(2.4/3.6)\cdot10^{-4}$ photons/electron and this is more than 4 / 6 times higher than the theoretical value.

WEOA03 **Detailed Experimental Characterization of an Ionization Profile Monitor** – *J. Egberts (CEA), P. Abbon, F. Jeanneau, J.-Ph. Mols, T. Papaevangelou (CEA) F. Becker, P. Forck, B. Walasek-Höhne (GSI) J. Marroncle (CEA/DSM/IRFU)*
In the frame of the International Fusion Material Irradiation Facility (IFMIF), a prototype for a non-interceptive transverse beam profile monitor based on residual gas ionization (IPM) has been built and characterized in detail. We present results of test measurements performed at CEA Saclay with 80 keV protons in a cw beam of up to 10 mA and at GSI Darmstadt with pulsed Ca^{10+}, Xe^{21+} and U^{28+} beams of up to 1.6 mA at 5 MeV/u. The effects of N2, and different rare gases in the pressure range from $4\cdot10^{-7}$ mbar to $5\cdot10^{-4}$ mbar have been investigated. The signal was read by different electronic cards, based on linear and logarithmic

amplifiers as well as on charge integration. Furthermore the extraction voltage of the IPM-field-box was varied between 0.5 and 5 kV. Beam profiles were investigated with respect to signal intensity and profile shape and were compared to a SEM-grid and a Beam Induced Fluorescence monitor. Profiles of all monitors match nicely for the residual gases with differences in beam width well below 5%. Additional tests on the characteristics of the IPM have been performed and will be presented as well.

WE0A04 **Synchrotron Radiation Measurements at the CERN LHC** – *F. Roncarolo (CERN), S. Bart Pedersen, A. Boccardi, E. Bravin, A. Guerrero, A. Jeff, T. Lefevre, A. Rabiller (CERN) A.S. Fisher (SLAC)*
The CERN LHC is equipped with two systems (one for each beam) designed to image the synchrotron radiation emitted by protons and heavy ions. After their commissioning in 2009, the detectors were extensively used and studied during the 2010 run. This allowed preliminary limits in terms of sensitivity, accuracy and resolution to be established. The upgrade to an intensified video camera capable of gating down to 25 ns permitted the acquisition of single bunch profiles even with an LHC proton pilot bunch ($\sim 5 \cdot 10^9$ protons) at 450 GeV or a single lead ion bunch ($\sim 10^8$ ions) from about 2 TeV. Plans for the optimization and upgrade of the system will also be discussed.

18-May-11 11:20 – 13:00
Auditorium

Wednesday Session B
Chair: B. Dehning (CERN)

01 Overview and Commissioning of Facilities

WE0B01 **A Review of Screen Monitors** – *B. Walasek-Höhne (GSI) G. Kube (DESY)*
Scintillation screens are widely used for transverse beam profile diagnostics at particle accelerators. The monitor principle relies on the fact that a charged particle crossing the screen material will deposit a part of its energy which is converted to visible light. The resulting light spot is a direct image of the two-dimensional beam distribution and can be measured with standard optical techniques. Scintillating screen monitors were mainly deployed in hadron and low energy electron machines where the intensity of optical transition radiation (OTR) is rather low. The experience from modern linac based light sources showed that OTR diagnostics might fail even for high energetic electron beams, thus making the use of scintillators again very attractive. This contribution summarizes results and trends from "Scintillating Screen Applications in Beam Diagnostics" workshop recently held in Darmstadt. In the first part an introduction to the scintillation mechanism will be given, including demands and limitations as e.g. the dynamic range and saturation. Thereafter a brief overview on actual screen monitor applications at electron and hadron accelerators will be presented.

05 Transverse Profiles

WEOB02 **Experimental Comparison of Performance of Various Fluorescent Screens Applied for Relativistic Electron/Positron Beam Imaging** – *O.I. Meshkov (BINP SB RAS), V.A. Kiselev, A.N. Zhuravlev (BINP SB RAS) V.V. Smaluk (BINP)*

Fluorescent screens are widely used for single-pass measurements of transverse beam profile at most of accelerator facilities. Great number of materials is now used for manufacture of fluorescent screens. The linearity, sensitivity and spatial resolution of the diagnostics depend on the choice of screen substance. We made an attempt to compare a linearity and relative light yield for few types of the fluorescent materials applied for screen manufacturing. A CCD-camera and photomultiplier tube record the light flux and 2D profile of the electron/positron beam image on the screen. Experiments were carried out with the electron/positron beam energy of 350 MeV and the beam charge of 0.1–100 pC.

WEOB03 **Single-shot Resolution of X-ray Monitor using Coded Aperture Imaging** – *J.W. Flanagan (KEK), H. Fukuma, H. Ikeda, T.M. Mitsuhashi (KEK) J.P. Alexander, M.A. Palmer, D.P. Peterson (CLASSE) G.S. Varner (UH)*

We report on tests of an x-ray beam size monitor based on coded aperture imaging. This technique uses a mask pattern to modulate incoming light, with the resulting image being deconvolved through the mask and detector responses, including the effects of diffraction and attenuation materials in the path, over the spectral and angular distribution of the synchrotron radiation generated by the beam. We have tested mask patterns called URA masks, which have relatively flat spatial frequency response, and an open aperture of 50% for high-flux throughput, enabling single-shot (bunch-by-bunch, turn-by-turn) measurements without the need for heat-sensitive mirrors. Bunch size measurements of ~10 micron bunches with single-shot (statistics-dominated) resolutions of ~2.5 microns have been demonstrated at CesrTA, and single-shot measurements with similar or better resolution of beams in the ~5 micron range are being aimed for at the ATF2. A beam-size monitor based on these principles is also being designed for the SuperKEKB low-emittance rings. We will present estimated single-shot resolutions, along with a comparison to single-shot resolution measurements made at CesrTA.

18-May-11 14:30 – 16:00
Auditorium

Wednesday Session C
Chair: K. Jordan (JLAB)

06 Beam Charge and Current Monitors

WEOC01 **Beam Charge Measurements** – *D. B. Belohrad (CERN)*
The measurement of beam charge is fundamental to all particle accelerators. There exist many methods to achieve this, which can broadly be classified into two categories: intercepting measurements, which are destructive for the beam and result in absorption of a significant amount of energy; non-intercepting measurements using electric or magnetic field coupling. In both categories one can find instruments that process the beam signals with high dynamic range, both in amplitude and time. The aim of this article is to present the current state of beam charge measurement technology. Various measurement methods will be described with their uses, advantages, and achievable resolution and accuracy discussed. The technological problems related to their fabrication will also be addressed.

WEOC02 **Overview on Cryogenic Current Comparators for Beam Diagnostics** – *W. Vodel (FSU Jena) K.K. Knaack, K. Wittenburg (DESY) A. Peters (HIT) H. Reeg, M. Schwickert (GSI)*
An absolute and exact measurement of the intensity of charged particle beams - extracted from an accelerator or circulating in a Storage Ring - is one of the major problems of beam diagnostics. Also the measurement of so-called dark currents, generated by superconductive RF accelerator cavities at high voltage gradients to characterize the quality of these components becomes more and more important for the commissioning of new accelerators (XFEL). The Cryogenic Current Comparator (CCC) based on high precision LTS SQUIDs is an excellent tool to solve these problems. This contribution gives an overview on the development of SQUID-based CCC for nuclear physics from the first successful demonstration of the performance at GSI Darmstadt through the recently tested CCC for the XFEL at DESY to the latest improved version for FAIR.

WEOC03 **Dark Current Monitor for the European XFEL** – *D. Lipka (DESY), W. Kleen, J. Lund-Nielsen, D. Nölle, S. Vilcins, V. Vogel (DESY)*
Dark current is produced due from field emission in the accelerator. This generates a radiation background in the tunnel which damages the electronics and activates components. To decrease the dark current different methods like kickers and collimators are used. To control the dark current level and measure and optimize the efficiency of dark current reduction dark current monitors are required. To measure the dark current a cavity was designed and built with the operation frequency of the accelerator. Here the small charge of the dark current present in every RF bucket induces and superimposes a field up to a measurable level. The cavity is proven at the PITZ facility. In addition to dark current levels down to 50 nA, the monitor allows for charge measurements resolution

below pC, better than the Faraday cup. In addition the ratio of amplitudes from higher order monopole modes is a function of the bunch length. Measurements show the same trend of bunch length compared with a destructive streak camera method with comparable resolution. Therefore this monitor is able to measure bunch charge, dark current and bunch length in a non-destructive manner.

18-May-11 16:30 – 18:00
Auditorium

Wednesday Session D
Chair: G. Rehm (Diamond)

05 Transverse Profiles

WEOD01 **Beam Induced Fluorescence Monitors** – *F. Becker (GSI)*
Non-intersecting diagnostic devices in hadron accelerators offer continuous online monitoring capability. They also avoid the problem of potential thermal damage in high-current applications. Taking advantage of the residual gas as active material, the Beam Induced Fluorescence (BIF) monitor exploits gas fluorescence in the visible range for transversal profile measurements. Depending on beam parameters and vacuum-constraints, BIF monitors can be operated at base-pressure or in dedicated local pressure bumps up to the mbar range. Nowadays, BIF monitors are investigated in many accelerator laboratories for hadron energies from about 100 keV up to several 100 GeV. This talk gives an introduction to the measurement principle and typical operating conditions. It summarises recent investigations, e.g. on different working gases, and it compares various technical realisations.

01 Overview and Commissioning of Facilities

WEOD02 **LHC Beam Diagnostics - the User's View** – *J. Wenninger (CERN)*
The LHC started up with beam in November 2009, and within less then on year its luminosity reached $2{\cdot}10^{32}$ $cm^{-2}s^{-1}$ at 3.5 TeV in October 2010. A few weeks later, in November 2010, lead ion collisions were established within little over 2 days. The fast progress and successes of the LHC commissioning and early operation would not have been possible without the excellent performance of its beam instrumentation. All essential instruments worked from the first day or were commissioned in a very short time, providing rapid diagnostics for the beam parameters. Tune and orbit feedbacks that rely on high quality measurements were used early on to achieve smooth operation with minimal beam losses. This presentation will address the performance of the LHC beam instrumentation, in particular the very large beam position and beam loss monitoring systems, both composed of many thousand channels. Present limitations and future improvements will also be discussed.

Boldface papercodes indicate primary authors

— A —

— B —

— C —

— E —

— F —

— L —

— S —

DIPAC2011 Agenda - Monday, 16 May 2011

Monday Session A, Auditorium, 09:00 – 10:50
Chair: Kay Wittenburg - DESY
09:00 Accelerator Projects at DESY, Reinhard Brinkmann, DESY
09:30 Beam Instrumentation for X-FELs, Henrik Loos, SLAC
10:00 Photon Diagnostics for X-ray FELs, Michael Gensch, Helmholtz-Zentrum Dresden-Rossendorf

10:50 – 11:20 Coffee Break

Monday Session B, Auditorium, 11:20 – 13:00
Chair: Hermann Schmickler - CERN
11:20 An Aperture Backscatter X-ray Beam Position Monitor at Diamond, Christopher Bloomer, Diamond Light Source
11:40 Emittance and Energy Spread Measurements of Laser-wakefield Accelerated Electron Beams, Grace Gloria Manahan, University of Strathclyde, Scottish Universities Physics Alliance
12:00 Diamond-based Beam Halo Monitor Equipped with RF Fingers for SPring-8 XFEL, Hideki Aoyagi, SPring-8
12:20 Bunch Compression, RF Curvature Correction and Measurements of M55, T566 and U5666 Matrix Elements at JLab IR/UV Upgrade, Pavel Evtushenko, JLab

13:00 – 14:30 Lunch Break

Monday Session C, Auditorium, 14:30 - 16:00
Chair: Peter Forck – GSI
14:30 Overview of Recent Trends and Developments for BPM Systems, Manfred Wendt, Fermilab
15:00 Cavity BPM System for ATF2, Alexey Lyapin, JAI
15:20 The Fermi@Elettra Cavity BPM System: Description and Commissioning Results, Raffaele De Monte, ELETTRA

16:00 – 16:30 Coffee Break

16:30 – 18:00 Monday Poster Session, Luke 4

DIPAC2011 Agenda - Tuesday, 17 May 2011

Tuesday Session A, Auditorium, 09:00 – 10:50
Chair: Toshiyuki Mitsuhashi - KEK
09:00 Beam Instrumentation in J-PARC, Takeshi Toyama, J-PARC
09:30 Diagnostics during the ALBA Storage Ring Commissioning, Ubaldo Iriso, CELLS-ALBA Synchrotron
09:50 The Fermilab HINS Test Facility and Beam Measurements of the Ion Source and 325 MHz RFQ, Victor Scarpine, Fermilab
10:10 Instrumentation for Machine Protection at FERMI@Elettra, Lars Froehlich, ELETTRA

10:50 – 11:20 Coffee Break

Tuesday Session B, Auditorium, 11:20 – 13:00
Chair: Andreas Peters - HIT
11:20 Options for Next Generation Digital Acquisition Systems, Andrea Boccardi, CERN
11:50 Designing Electronics for Use in Radiation Environments Christos Zamantzas, CERN
12:20 Next Generation Electronics based on µTCA for Beam-Diagnostics at FLASH and XFEL, Patrick Gessler, DESY

13:00 – 14:30 Lunch Break

Tuesday Session C, Auditorium, 14:30 – 15:00
Chair: Volker Schlott - PSI
14:30 Highlights from the 2010 Beam Instrumentation Workshop J. Douglas Gilpatrick, LANL
15:00 Presentation of grants to students by sponsors

16:00 – 16:30 Coffee Break

15:10 – 17:30 Tuesday Poster Session, Luke 4

DIPAC2011 Agenda - Wednesday, 18 May 2011

Wednesday Session A, Auditorium, 09:00 – 10:50
Chair: Patrick Krejcik - SLAC
09:00 Summary of COTR Effects, Stephan Wesch, DESY
09:30 Experimental Investigations of Backward Transition Radiation from Flat Target in Extreme Ultraviolet Region, Leonid Sukhikh, DESY
09:50 Detailed Experimental Characterization of an Ionization Profile Monitor, Jan Egberts, CEA
10:10 Synchrotron Radiation Measurements at the CERN LHC, Federico Roncarolo, CERN

10:50 – 11:20 Coffee Break

Wednesday Session B, Auditorium, 11:20 – 13:00
Chair: Bernd Dehning – CERN
11:20 A Review of Screen Monitors, Beata Walasek-Hoehne, GSI
11:50 Experimental Comparison of Performance of Various Fluorescent Screens Applied for Relativistic Electron/Positron Beam Imaging, Oleg Meshkov, BINP
12:10 Single-shot Resolution of X-ray Monitor using Coded Aperture Imaging, John Walter Flanagan, KEK

13:00 – 14:30 Lunch Break

Wednesday Session C, Auditorium, 14:30 – 16:00
Chair: Kevin Jordan - Jlab
14:30 Beam Charge Measurements, David Belohrad, CERN
15:00 Overview on Cryogenic Current Comparators for Beam Diagnostics, Wolfgang Vodel, FSU Jena
15:20 Dark Current Monitor for the European XFEL, Dirk Lipka, DESY

16:00 – 16:30 Coffee Break

Wednesday Session D, Auditorium, 16:30 – 18:00
Chair: Guenther Rehm - Diamond Light Source
16:30 Beam Induced Fluorescence Monitors, Frank Becker, GSI
17:00 LHC Beam Diagnostics - the User´s View, Jorg Wenninger, CERN

Time	Sunday 5/15/2011	Monday 5/16/2011	Tuesday 5/17/2011	Wednesday 5/18/2011	Thursday 5/19/2011	Time
08:00		**Conference Desk (08:00 - 18:00)**	**Conference Desk (08:00 - 17:30)**	**Conference Desk (08:00 - 18:00)**		08:00
08:30						08:30
09:00		**Welcome by chair**	*Beam instrumentation in J-PARC* Takashi Toyama -KEK-	*Summary of COTR effects* Stephan Wesch -DESY-		09:00
09:10		*Accelerator Projects at DESY* R. Brinkmann -DESY-				09:10
09:20					**Busses to DESY**	09:20
09:30			*Diagnostics during the ALBA Storage Ring Commissioning* Ubaldo Iriso -CELLS-ALBA-	*Exp. Invest. of Backward TR from Flat Target in Extreme UV Region* Leonid G. Sukhikh -DESY-		09:30
09:40		*Electron beam diagnostics for X-ray FELs* Henrik Loos –SLAC-				09:40
09:50			*FNAL HINS Test Facility and Beam Meas. of the Ion Source and 325 MHz RFQ* by Victor Scarpine -Fermilab-	*Detailed Experimental Characterization of an IPM* Jan Egberts -CEA-		09:50
10:00						10:00
10:10		*Photon diagnostics for X-Ray FELs* M. Gensch -HZDR-	*Instrumentation for Machine Protection at FERMI@Elettra* Lars Froehlich -ELETTRA-	*Synchrotron Radiation Measurements at the CERN LHC* Federico Roncarolo -CERN-	**Visit of DESY Accelerators**	10:10
10:20						10:20
10:30			Time allocated for Discussions & Questions	Time allocated for Discussions & Questions		10:30
10:40		Discussions & Questions				10:40
10:50						10:50
11:00		**Coffee Break**	**Coffee Break**	**Coffee Break**		11:00
11:10						11:10
11:20		*An Aperture Backscatter X-ray BPM at Diamond* Christopher Bloomer -Diamond-	*Options for next generation digital acquisition systems* A. Boccardi -CERN-	*A review of screen monitors* Beata Walasek-Höhne –GSI-		11:20
11:30						11:30
11:40		*Emittance and Energy Spread Meas. of Laser-wakefield*		Special topical block 2 screens		11:40
11:50		*Accel. Electron Beams* by Grace G. Manahan -USTRAT/SUPA-	*Designing Electronics for use in Radiation Environments.* C. Zamantzas –CERN-			11:50
12:00		*Diamond-based Beam Halo Monitor Equipped with RF*		*Exp. Comp. of Performance of Var. Fluorescent Screens Applied for*		12:00
12:10		*Fingers for SPring-8 XFEL by* Hideki Aoyagi -JASRI/SPring-8-		*Relativistic e-/e+ Beam Imaging* by Oleg I. Meshkov -BINP-		12:10
12:20		*Bunch Comp., RF Curvature Corr. and Meas. of ...*	*Next Gen. Electronics based on uTCA for Beam-Diag. at FLASH & XFEL*	*Single-shot Resolution of X-ray Monitor using Coded Aperture Imaging*		12:20
12:30		Pavel Evtushenko -JLAB-	Patrick Gessler -DESY-	John W. Flanagan -KEK-		12:30
12:40		Time allocated for Discussions & Questions	Time allocated for Discussions & Questions	Time allocated for Discussions & Questions		12:40
12:50						12:50
13:00						13:00
13:10						13:10
13:20		**Lunch Break**	**Lunch Break**	**Lunch Break**	**Lunch Break**	13:20
13:30						13:30
13:40						13:40
13:50						13:50
14:00						14:00
14:10						14:10
14:20						14:20
14:30		*Overview of Recent Trends and Developments for BPM Systems* *Manfred Wendt -FNAL-*	*Highlights from BIW 2010* Doug Gilpatrick –LANL-	*Beam Charge Measurements* David Belohrad -CERN- Topical block 3 "Charge"	**Busses back to City and Airport**	14:30
14:40						14:40
14:50						14:50
15:00		*Cavity BPM System for ATF2* Alexey Lyapin -JAI-	Presentation of Grants to students by sponsors	*Overview on Cryogenic Current Comparators for Beam Diagnostics* by Wolfgang Vodel -FSU Jena-		15:00
15:10						15:10
15:20		*The Fermi@Elettra Cavity BPM System:* Raffaele De Monte -ELETTRA-	**Poster Session 2**	*Dark Current Monitor for the European XFEL* Dirk Lipka -DESY-		15:20
15:30						15:30
15:40		Time allocated for Discussions & Questions		Time allocated for Discussions & Questions		15:40
15:50						15:50
16:00						16:00
16:10		**Coffee Break**	**Coffee Break**	**Coffee Break**		16:10
16:20						16:20
16:30				*Beam Induced Fluorescence Monitors* Frank Becker –GSI-		16:30
16:40						16:40
16:50	**Registration and Reception**					16:50
17:00		**Poster Session 1**	**Poster Session 2**	*LHC beam diagnostics - the user´s view* Jörg Wenninger –CERN-		17:00
17:10						17:10
17:20						17:20
17:30				BIW12 and "IBIC'12" announcements and Closing Remarks		17:30
17:40	**incl. Welcome drink**					17:40
17:50						17:50
18:00	**Hors d'Oevre sponsored by DIMTEL**		**Removing booths and poster boards winch**		Start remove	18:00
18:10						18:10
18:20		**Happy hour sponsored by FNT and LONG-IT**		**Farewell cocktail** (not yet sponsored)		18:20
18:30						18:30
19:00			**Welcome Cocktail sponsored by Instrumentation Technologies**	**Removing equipment winch**		19:00
19:30						19:30
20:00			**Conference Dinner**			20:00
20:30						20:30
21:00						21:00
21:30						21:30
22:00						22:00
22:30						22:30
23:00						23:00

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