

# **Industry meets Academia: Beam Monitoring Instrumentation and Quality Assurance**



## **Report of Contributions**

Contribution ID: **18**

Type: **not specified**

## **Address of Welcome**

*Thursday, 10 November 2011 12:15 (15 minutes)*

**Primary author:** Dr EICKHOFF, Hartmut (GSI Helmholtzzentrum für Schwerionenforschung GmbH)

**Presenter:** Dr EICKHOFF, Hartmut (GSI Helmholtzzentrum für Schwerionenforschung GmbH)

**Session Classification:** Particle Beam Monitoring & Therapy

Contribution ID: 19

Type: **not specified**

## Particle therapy beam diagnostics. Risks and rewards for industry.

*Thursday, 10 November 2011 12:30 (30 minutes)*

The talk will present an overview of the particle therapy commercial marketplace (players, technology trends etc) as well as of the particle therapy beam delivery options (accelerator types, scattering and scanning). Diagnostic devices (multiwire and multistrip chambers, scintillators, Faraday cups); Some discussion of commercial electrometer design options for multichannel low-current measurement; Some discussion of alternative electronics architectures, including redundancy requirements for beam scanning and dosimetry; Recent work at Pyramid on ultra-low scattering ionization chambers for particle therapy beam scattering; Recent work at Pyramid on high-channel count readout electronics.

**Primary author:** Dr GORDON, John (Pyramid)

**Presenter:** Dr GORDON, John (Pyramid)

**Session Classification:** Particle Beam Monitoring & Therapy

Contribution ID: 21

Type: **not specified**

## Beam Diagnostics makes FAIR play

*Friday, 11 November 2011 09:00 (30 minutes)*

Presently the FAIR (Facility for Antiproton and Ion Research) project at GSI Darmstadt enters into the realization phase. Because of the intricate requirements, like e.g. operation at high beam intensities near the space charge limit, as well as transport of low particle numbers of rare isotope beams, the FAIR facility demands in many cases for enhanced and/or novel types of beam diagnostic instrumentation. This presentation gives an overview of the present developments of GSI Beam Diagnostics department.

**Primary author:** Dr SCHWICKERT, Marcus (GSI Darmstadt)

**Presenter:** Dr SCHWICKERT, Marcus (GSI Darmstadt)

**Session Classification:** Beam Monitoring in Accelerator Facilities

Contribution ID: 23

Type: **not specified**

## Monitoring a very low current and wide beam at KATRIN

*Friday, 11 November 2011 12:30 (30 minutes)*

The Karlsruhe Tritium Neutrino Experiment uses a Windowless Gaseous Tritium source to measure the neutrino mass. This source provides a flux of electrons with an average energy of 4 keV towards retarding spectrometers of  $10E11$  electrons per second. The flux, which is guided adiabatically by magnetic fields, is uniformly spread over cross sections larger than  $40\text{ cm}^2$ . We outline the cases, why it is desired to measure the intensity of this low energy beam as precise as possible without interference of the beam.

**Primary author:** Dr RENSCHLER, Pascal (KIT)

**Presenter:** Dr RENSCHLER, Pascal (KIT)

**Session Classification:** Neutrons & Neutrinos

Contribution ID: 24

Type: **not specified**

## **Beam monitoring in an industrial particle therapy system**

*Thursday, 10 November 2011 14:00 (30 minutes)*

Industrial particle therapy solutions include a wide variety of beam monitoring devices. Detectors used in the IBA system may be sorted in two categories: those used for monitoring the cyclotron accelerator and the beamline, and the external devices used for calibration, validation and quality assurance purposes. Driven by robustness, maintainability and cost, IBA has selected simple designs and proven technologies. The presentation will review the different types of beam monitors and dosimetric tools that are used for the commissioning and daily operations of an IBA proton therapy centre.

**Primary author:** Dr BERTRAND, Damien (IBA)

**Presenter:** Dr BERTRAND, Damien (IBA)

**Session Classification:** Particle Beam Monitoring & Therapy

Contribution ID: 25

Type: **not specified**

## Photon Diagnostics at the Free Electron Laser FLASH

*Friday, 11 November 2011 10:00 (30 minutes)*

We present an overview of the different photon diagnostic methods used at FLASH. After a short introduction to the free electron laser and the properties of the produced radiation, the requirements and difficulties of photon diagnostics in the spectral region of FLASH are discussed. The special properties of the radiation require unique diagnostic methods that are not commercially available. The individual methods for measuring the pulse energy (Gas Monitor Detector), beam position (GMD split electrodes), intensity profile/wavefront (wavefront sensor) and spectral distribution (Photoelectron spectrometer) are introduced. We will conclude with an outlook about future perspectives and developments in the field of photon diagnostics for free electron lasers.

**Primary author:** Dr MAHNS, Ilka (DESY)

**Presenter:** Dr MAHNS, Ilka (DESY)

**Session Classification:** Beam Monitoring in Accelerator Facilities

Contribution ID: 26

Type: **not specified**

## Performance of diamond detectors used for timing applications in HADES

*Friday, 11 November 2011 11:45 (15 minutes)*

The report will give an overview of the results obtained in HADES heavy ion experiments with the diamond based detectors. These detectors have been used to measure the reaction time ( $T_0$ ) thus have to cope with very high particle flux, above  $10^6$  Au ions/sec/mm<sup>2</sup>. The  $T_0$  measurement is crucial for the particle identification in the HADES spectrometer and intrinsic time resolution better than 50ps (sigma) is required. The recent results from five days of such experiment will be presented.

To take full advantage of the properties of the diamond material very fast analog and digital electronics is essential. The available solutions for the fast timing applications based on NINO and HPTDC chips with intrinsic time resolution below 20ps will be discussed and a new TDC concept based on Field Programmable Arrays (FPGA) will be mentioned as well.

**Primary author:** Dr PIETRASZKO, Jerzy (GSI)

**Presenter:** Dr PIETRASZKO, Jerzy (GSI)

**Session Classification:** Diamond Detectors in Beam Monitoring



Contribution ID: 27

Type: **not specified**

## Diamond Detectors in Beam Monitoring

*Friday, 11 November 2011 11:00 (30 minutes)*

At the LHC at CERN diamond detectors are used at the 4 LHC experiments for the condition monitoring of the beams inside the detectors. At the accelerator they are located at different places to monitor losses which synchronised with the beam injection process, the extraction of the beams from the rings and the revolution period. For the event driven monitors the signals are recorded on the nanosecond scale for a duration of some milliseconds. Another acquisition modus counts single particle loss events and measures its arrival time in respect to the revolution period. This acquisition mode allows to monitor the bunch patterns and possible inter bunch intensity accumulations. These diamond based detectors operate at room temperature while for their application in the superconducting LHC magnets at 2 Kelvin test measurements are started. The actual statuses of the employments the detectors will be given.

**Primary author:** Dr DEHNING, Bernd (CERN)

**Presenter:** Dr DEHNING, Bernd (CERN)

**Session Classification:** Diamond Detectors in Beam Monitoring

Contribution ID: 28

Type: **not specified**

## Detectors for Regular Beam Tuning and Daily Quality Assurance at the HIT Facility

*Thursday, 10 November 2011 13:00 (30 minutes)*

HIT uses MWPC/IC-combinations and scintillating screens designed, manufactured and tested at GSI. These detectors are necessary for the daily operation of the HIT accelerator to ensure the quality of the beam. A daily QA check with a substantial random sample of beam parameters at different locations in the High Energy Beam Transport Line area secures a reliable basis for the irradiation of patients at HIT, which started two years ago now. The talk will give an overview on the detectors, their parameters and their usage in daily procedures

**Primary author:** Dr PETERS, Andreas (HIT)

**Presenter:** Dr PETERS, Andreas (HIT)

**Session Classification:** Particle Beam Monitoring & Therapy

Contribution ID: 29

Type: **not specified**

## Beam Profilometry with Crystalline Silicon Detectors

*Thursday, 10 November 2011 16:00 (30 minutes)*

Particle and nuclear physics experiments have been pushing the development of position sensitive semiconductor detectors, notably based on Silicon and with a pixelized layout.

Available systems and dedicated detectors resulting from the same background knowledge have been recently commissioned for beam profilometry in a broad sense, ranging from a modern, digital equivalent of the alumina scintillator screens to devices capable of providing quantitative information on the beam parameters. The review will essentially address results based on 3 extremely complementary approaches and technologies:

- a hybrid pixel detector based on the MEDIPIX counting chip
- a hybrid pixel detector based on the LHCb vertex detector technology
- a dedicated monolithic active pixel detector with moderate granularity, high dynamic range and high frame rate.

**Primary author:** Prof. CACCIA, Massimo (INFN)

**Presenter:** Prof. CACCIA, Massimo (INFN)

**Session Classification:** Laser-Accelerated Particle Beams, Pixel Detectors, Transmission Chambers

Contribution ID: 30

Type: **not specified**

## NTG-Beam Diagnostics and Special Topics

*Friday, 11 November 2011 09:30 (30 minutes)*

From January 1st 2011 NTG has taken over well known company PET-Darmstadt owned by P. Strehl and H. Kraus. The implementation of PET's products and components into the NTG product range results in a considerable extension of the product range, especially in the field of accelerator physics and beam diagnostics. This presentation first gives an overview about NTG's competence and product range in this fields. In the second part of the presentation some special topics concerning design and signal calculation of beam diagnostic components are discussed, shortly.

**Primary author:** Dr STREHL, Peter (NTG)

**Co-author:** Dr BECHTHOLD, Alexander (NTG)

**Presenters:** Dr BECHTHOLD, Alexander (NTG); Dr STREHL, Peter (NTG)

**Session Classification:** Beam Monitoring in Accelerator Facilities

Contribution ID: 31

Type: **not specified**

## Achieving valorization success

*Thursday, 10 November 2011 18:00 (30 minutes)*

Prof. Dr. Peter Heydebreck will outline the opportunities and challenges of commercializing the research potentials and results from public research. More specifically, he will address the adequacy of different incentive mechanisms for the engaged researchers, research institutions and valorization professionals. Peter will highlight the unique opportunities which partnerships between leading public research institutions and private commercialization partners offer.

**Primary author:** Prof. HEYDEBRECK, Peter (Engage AG)

**Presenter:** Prof. HEYDEBRECK, Peter (Engage AG)

**Session Classification:** Beam Monitoring and Technology Transfer

Contribution ID: 32

Type: **not specified**

## Introducing PTW-Freiburg

*Thursday, 10 November 2011 16:30 (30 minutes)*

PTW-Freiburg is an internationally operating company, manufacturing and marketing specialized dosimetry and quality control equipment for the medical radiology and health physics market. The talk will provide an introduction to the PTW product family, focusing on electrometers, single chambers and monitor chambers.

**Primary author:** Dr WÜRFEL, Jan (PTW)

**Presenter:** Dr WÜRFEL, Jan (PTW)

**Session Classification:** Laser-Accelerated Particle Beams, Pixel Detectors, Transmission Chambers

Contribution ID: 33

Type: **not specified**

## The low energy neutron beam as a tool for QA-QC of particle detectors

*Friday, 11 November 2011 13:30 (30 minutes)*

Neutron quasi-monoenergetic beam irradiations are presented delivered by proton- or deuteron induced reactions by CW-beam of protons or deuterons of the 5.5 MV-TN11 Tandem Van der Graaff particle accelerator of the NCSR “Demokritos”. Emphasis is given to the comprehension of all the interactive mechanisms resulting from the presence of the high background radiation, with respect to the neutron energy and the materials, as a QA\_QC tool for the detectors.

A simulation model, based on the Geant4 program, was used to describe the experimental setup and the neutron impact. The simulation results were found to be in good agreement with the experimental results.

**Primary author:** Prof. GAZIS, Evangelos (Athens / CERN)

**Presenter:** Prof. GAZIS, Evangelos (Athens / CERN)

**Session Classification:** Neutrons & Neutrinos

Contribution ID: 34

Type: **not specified**

## **CDT: 10Boron based neutron detectors as technological alternative to 3He based neutron detectors that suffer the severe crisis in supply of 3He**

*Friday, 11 November 2011 13:00 (30 minutes)*

CDT is a university spin-off founded in 2006 dedicated to detector technology, especially neutron detectors. Therefore it develops and provides complete solutions for customized needs starting from particle detector front-end systems over highly integrated readout electronics and software. For neutron detection thin coatings of 10Boron are used as technological alternative to 3He based neutron detectors that suffer the severe crisis in supply of 3He. Highly integrated ASIC-technology is used to realize hundreds of individual detection channels at non-proportional cost. All detectors use an ASIC electronic front-end paired with an adaptable integrated FPGA data processing unit to provide high rate capacity.

**Primary author:** Dr KLEIN, Martin (CDT GmbH)

**Presenter:** Dr KLEIN, Martin (CDT GmbH)

**Session Classification:** Neutrons & Neutrinos



Contribution ID: 35

Type: **not specified**

## Proposal for a common web portal for beam instrumentation

*Thursday, 10 November 2011 17:30 (30 minutes)*

This talk will present an initiative launched during the recent International Particle Accelerator Conference (IPAC11) to define and produce a common web portal for Beam Instrumentation, with the aim of allowing any beam instrumentalist to:

- Easily find the laboratories with machines using beams of similar characteristics (particle type, total beam intensity, bunch intensity, frequency, energy...)
- Easily find the person who is working there on the beam observable concerned (i.e. beam position, loss, intensity, transverse or longitudinal profile, tune...) and how to contact him/her.
- Provide links towards documents describing system designs and performance assessments.
- And possibly more ...

This presentation will cover the status and prospects of the project towards a first operational prototype and will also propose possible future extensions

**Primary author:** Mr GRAS, Jean-Jacques (CERN)

**Presenter:** Mr GRAS, Jean-Jacques (CERN)

**Session Classification:** Beam Monitoring and Technology Transfer

Contribution ID: 36

Type: **not specified**

## **Pixel detectors for laser accelerated proton beams**

*Thursday, 10 November 2011 15:40 (20 minutes)*

**Primary author:** Ms REINHARDT, Sabine (LMU)

**Presenter:** Ms REINHARDT, Sabine (LMU)

**Session Classification:** Laser-Accelerated Particle Beams, Pixel Detectors, Transmission Chambers

Contribution ID: 38

Type: **not specified**

## Detection of Laser-accelerated ions at the DRACO laser

*Thursday, 10 November 2011 15:00 (20 minutes)*

In the last years, the detection schemes for laser-accelerated ion beams had to be developed much further. In the beginning, experiments were mainly performed on laser facilities with a few shots a day and online diagnostics such as film stacks were sufficient in order to characterize the ion beam. Nowadays many experiments are carried out at high power lasers with repetition rates on the order of 10 Hz and thus the need of on line detectors has grown significantly.

In this talk, the ion accelerator at the 100 TW laser DRACO in Dresden are described. Already implemented detectors such as MCPs and scintillators as well as desirable devices for future measurements are described.

**Primary author:** Dr KRAFT, Stephan (HZDR)

**Presenter:** Dr KRAFT, Stephan (HZDR)

**Session Classification:** Laser-Accelerated Particle Beams, Pixel Detectors, Transmission Chambers

Contribution ID: 39

Type: **not specified**

## Dosimetry of laser-accelerated particle beams used for cell irradiation experiments

*Thursday, 10 November 2011 15:20 (20 minutes)*

The development of laser particle accelerators for radiotherapy application is the goal of comprehensive long-term research, established in close cooperation between the National Center of Radiation Research in Oncology (OncoRay) at Dresden University and the Helmholtz-Zentrum Dresden-Rossendorf (HZDR).

In a first step of the necessary translational chain from basic research to clinical application extensive radiobiological cell irradiation experiments have been performed. In order to determine the biological effectiveness of laser driven beams dose response curves have been measured. However, the mandatory precise dosimetric characterization is challenged by the specific properties of laser driven beams, namely the delivery of ultra-short pulses with very high pulse intensity.

In the presentation the more than four years experimental experience with both, laser accelerated electron and proton beams, will be overviewed. After introducing the dosimetric requirements the advantages and drawbacks of the different detectors and dosimeters in use like radiochromic film, Faraday cup, transmission ionization chamber, solid state detector etc. will be discussed. Furthermore, results of the cell irradiation experiments will be presented demonstrating that precise absolute and real time dosimetry is achieved by combining several detectors and dosimeters in an integrated irradiation and dosimetry system. Finally, the present developments toward clinical radiotherapy application will follow.

**Primary author:** Dr PAWELKE, Jörg (OncoRay / HZDR)

**Presenter:** Dr PAWELKE, Jörg (OncoRay / HZDR)

**Session Classification:** Laser-Accelerated Particle Beams, Pixel Detectors, Transmission Chambers

Contribution ID: 40

Type: **not specified**

## CVD-Diamond for accelerator beam diagnosis applications

*Friday, 11 November 2011 11:30 (15 minutes)*

CVD diamond is a wide band gap material combining the distinct thermal, optical, and electronic properties required for particle and photon detection in extreme conditions. Diamond detectors reveal extreme radiation tolerance and speed while operating at room temperature and visible light. They are capable of single-particle monitoring of primary ion beams in a wide beam intensity range from a few Hz to  $10E9$  ions/s. They provide single-shot sub-nanosecond time resolution, a position resolution in micrometer scale as well as excellent energy resolution approaching silicon resolution. Some possible beam diagnostics applications developed at GSI for polycrystalline and for single-crystal CVD diamond will be presented.

**Primary author:** Mrs BERDERMANN, Eleni (GSI)

**Presenter:** Mrs BERDERMANN, Eleni (GSI)

**Session Classification:** Diamond Detectors in Beam Monitoring

Contribution ID: 41

Type: **not specified**

## **Gaseous detectors for the Siemens IONTRIS medical application**

*Thursday, 10 November 2011 13:30 (30 minutes)*

The Siemens IONTRIS system for Particle Therapy (\*) comprises the raster scanning method for beam application. Due to the concept of reducing material in the beam path as much as possible, gaseous detectors are used to control beam application. The detectors are embedded into a detector system, comprising HV-generation, slow control, amplifier electronics, ADC's and reconstruction. Detector systems built by Siemens are in clinical use at the HIT facility in Heidelberg. Aspects of manufacturing, medical safety, documentation and quality control are discussed. The influence of the detector systems on the performance of the beam application system is outlined.

- Siemens Particle Therapy products and solutions are works-in-progress and require country specific regulatory approval prior to clinical use.

**Primary author:** Dr BRÄUER, Martin (Siemens)

**Presenter:** Dr BRÄUER, Martin (Siemens)

**Session Classification:** Particle Beam Monitoring & Therapy