AKBP 6: Poster Session

Time: Wednesday 18:30–20:00 Location: P4

AKBP 6.1 Wed 18:30 P4

Laser and Electron Diagnostics at the LUX Beamline — •Christian Markus Werle[1], Niels Matthias Delbos[1], Paul Winkler[1,3], Vincent Leroux[1,2], Manuel Kirchen[1], Soeren Jalas[1], Phillip Messner[1,4], Spencer Jolly[1,2], Maximilian Trunk[1], Matthias Schnepp[1], and Andreas Richard Maier[1] — [1]Center for Free-Electron Laser Science and Department of Physics, University of Hamburg, 22761 Hamburg, Germany — [2]ELI Beamlines, Dolní Břežany, Czech Republic — [3]DESY, Hamburg, Germany — [4]International Max Planck Research School for Ultrafast Imaging and Structural Dynamics, Hamburg, Germany

Within the LAOLA Collaboration, the University of Hamburg and DESY work closely together to combine university research in the field of laser-plasma acceleration with the expertise of a large and well-established accelerator facility. Within this framework the LUX beamline, a dedicated beamline for generation of laser-plasma-driven undulator radiation, is being developed. After the initial commissioning has been successfully completed, we are currently preparing the future extensions of the beamline, with additional beam optics and further diagnostics. With the final goal, reliable day-to-day undulator operation, a central emphasis is on the development and adaptation of the laser and electron diagnostics, based on standard accelerator design principles, for this kind of machine. Here, we present calibration and resolution measurements for several of the LUX beamline diagnostics, including, amongst others, our parabola diagnostics, laser screen stations and the electron spectrometer.

AKBP 6.2 Wed 18:30 P4

The applicability of dielectric laser accelerators as an ultrashort microbeam radiation source for single-cell experiments — •Anna Mittelbach[1], Joshua McNeur[1], Martin Kozák[1], Johannes Illmer[1], Anna A. Friedl[2], Luitpold Distel[3], and Peter Hommelhoff[1] — [1]Department Physik, Friedrich-Alexander-Universität Erlangen-Nürnberg (FAU), Erlangen — [2]Department für Strahlentherapie, Ludwig-Maximilians-Universität München (LMU), München — [3]Department für Strahlentherapie, Friedrich-Alexander-Universität Erlangen-Nürnberg (FAU), Erlangen

Dielectric laser accelerators enable a variety of new applications [1]. Due to their miniaturized scale and potential as a pen-sized MeV electron source, one such application is as an intraoperative oncological irradiation device. Here we discuss the design of an experiment meant to test the feasibility of this application. A laser-triggered 50 keV Schottky-emitter is used as the electron source, due to its similarity to the anticipated DLA beam. We aim to monitor double strand breaks induced in the DNA of these cells after the irradiation process via γ-H2AX assay [2]. From these results, we investigate the influence of ultrashort pulsed microbeams on biological targets. The current status of the experiment will be reported.

[1] R. J. England et al., Dielectric laser accelerators. Rev. Mod. Phys. 86, 1337-1389 (2014)

[2] E.P. Rogakou et al., DNA Double-stranded Breaks Induce Histone H2AX Phosphorylation on Serine 139. J. Biol. Chem. 273, 5858 (1998)

AKBP 6.3 Wed 18:30 P4

Enhancing atomic physics modeling in PIConGPU — •Marco Garten — HZDR, Dresden, Deutschland — TU Dresden, Dresden, Deutschland

In laser-generated plasmas the free electron density is a crucial parameter for plasma dynamics. Therefore, to model its spatial and temporal evolution the adequate treatment of ionization is vital. This poster presents the work in progress on numerical field ionization methods implemented in the world's fastest 3D3V electromagnetic particle-in-cell code PIConGPU. Thus, computing a value for the systematic error via repeating simulations with varying ionization schemes is in reach. With high performance computing we can give a range of validity for predictions of pump-probe experiments with high power lasers and X-ray free electron lasers.

AKBP 6.4 Wed 18:30 P4

Magnesium photocathodes in superconducting RF photoelectron injectors — •Jochen Teichert[1], André Arnold[1], Pengnan Lu[1,2], Petr Murcek[1], Hannes Vennekate[1,2], and Rong Xiang[1] — [1]HZDR, Dresden, Germany — [2]TU Dresden, Dresden, Germany

To improve the quality of photocathodes is one of the critical issues in enhancing the stability and reliability of the photoinjector systems. Using metallic photocathodes for the ELBE superconducting RF photoelectron source (SRF Gun) is the primary choice to prevent contamination to the superconducting cavity.

Magnesium has a low work function (3.6 eV) and is relatively chemically stable. The SRF Gun has successfully provided electron beams to ELBE users with Mg photocathodes. However, the present cleaning process with a high intensity laser (activation) is time consuming and produces an unwanted surface roughness.

Alternative surface cleaning methods, ion beam sputtering and thermal treatment will be investigated and the results will be compared with the laser cleaning. For this reason the existing vacuum setup has to be modified, the new cleaning procedures have to be tested and optimized, and the quantum efficiency of the photo cathode samples has to be measured. Furthermore Mg samples of different microstructure, composition, and from different suppliers will be treated and measured.

AKBP 6.5 Wed 18:30 P4

Development of a cryogenic GaAs DC photo-gun for high-current applications* — •Simon Weih, Joachim Enders, Martin Espig, Yuliya Fritzsche, Neeraj Kurichiyanil, and Markus Wagner — Institut für Kernphysik, TU Darmstadt, Schlossgartenstraße 9, 64289 Darmstadt, Germany

For high-current applications in polarized electron generation, that may be used in ERLs or for positron production at ILC, it is necessary to maximize the charge lifetime of the GaAs cathode material to ensure reasonable operation. By means of cryogenic cooling of the cathode, the local vacuum conditions around the source can be improved due to cryogenic adsorption of reactive rest gas molecules at the chamber walls. Furthermore, the cooling also allows a higher laser power deposited in the material, resulting in higher currents that can be extracted from the source. Ion-backbombardment of the cathode is expected to be reduced using electrostatic bending of the electrons behind the cathode. To measure the characteristics of such an electron source, a dedicated setup is being developed at the Photo-CATCH test facility at Darmstadt.

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AKBP 6.6 Wed 18:30 P4

Development of an SRF Cavity for the S-DALINAC Injector* — •Dmitry Bazyl, Wolfgang F.O. Müller, and Herbert De Gersem — Technische Universitat Darmstadt, Institut fur Theorie Elektromagnetischer Felder, Darmstadt, Germany

Using a superconducting cavity with $\beta = 1$ to accelerate the electron beam with the energy of 200 keV results in significant energy spread growth and affects the quality of the beam in general. Therefore, an optimization of the capture cavity of the S-DALINAC injector is required to obtain the necessary beam energy and quality. We propose different SRF structures to upgrade the capture section. To find an optimal solution, we carried out a series of electrodynamical and beam-dynamics computations.

*Supported by the DFG through GRK 2128

AKBP 6.7 Wed 18:30 P4

Status of the beam dynamics design of the new post-stripper DTL for GSI-FAIR — •Anna Rubin, Lars Groening, Sascha Mickat, Xiaonan Du, and Michael Kaiser — GSI, Planckstr. 1, 64291 Darmstatd

The GSI UNILAC has served as injector for all ion species since 40 years. Its 108 MHz Alvarez DTL providing acceleration from 1.4 MeV/u to 11.4 MeV/u has suffered from material fatigue and has to be replaced. The design of the new post-stripper DTL is developed in GSI. Five Alvarez tanks with four intertank sections provide 100% transmission and low emittance growth. The beam dynamics simulations for 6 different scenarios including the FAIR design case and low energy operation are presented.

AKBP 6.8 Wed 18:30 P4

Alvarez DTL Cavity Design for the UNLAC Upgrade —

•Xiaonan Du[1], Lars Groening[1], Sacha Micakt[1], and Anja Seibel[1,2] — [1]GSI, Darmstadt, Germany — [2]Frankfurt University of Applied Sciences, Frankfurt, Germany

The GSI UNILAC upgrade project includes the replacement of the existing post-stripper drift tube linac (DTL). In this project, our goal is to provide a complete design for the new Alvarez-type cavities to achieve the same acceleration within the same total rf-length as before. In order to improve the performance of the cavities, the tube shape is specifically designed to obtain a more homogeneous surface field w.r.t. the existing layout, thus lowering the peak surface field being equivalent to an increase of the shunt impedance. A tuning method was developed to stabilize the cavity with dedicated stem configurations. The beta profile design is performed with cell by cell simulation of 3D models, which provide accurate energy gain and other rf-parameters for every cell. The acceleration from 1.4 MeV/u to 11.4 MeV/u will be provided by five tanks with different tube shapes and average axial electric field. Details of the DTL design are reported in this paper.

AKBP 6.9 Wed 18:30 P4

Numerical Investigation of Multi-Cavity Superconducting Radio-Frequency Resonators — •Johann Heller, Thomas Flisgen, Tomasz Galek, and Ursula van Rienen — Institut für Allgemeine Elektrotechnik, Rostock, Deutschland

For the thorough design of particle accelerators, the electromagnetic behavior of the accelerating resonators has to be investigated. These fields are computed numerically by solving the curl-curl equation, derived from Maxwells equations. The field patterns in large and complex structures can not be computed on standard workstation computers in reasonable time due to the huge number of degrees of freedom which arises from the discretization of the problem. For such type of problems, sophisticated parallel codes are employed on high-performance computers (HPC). Being very expensive, HPC platforms are rather rare so that it is difficult to access these computing infrastructures. Therefore, we recently proposed a concatenation scheme, denoted as State-Space Concatenations (SSC), which is able to compute complex RF structures on standard workstations. In this contribution large-scale multi-cavity applications of SSC are being compared to measurements related to FLASH.

AKBP 6.10 Wed 18:30 P4

Cavity design study for the Higgs operation mode of the FCC-ee — •shahnam gorgi zadeh[1], rama calaga[2], frank gerigk[2], and ursula van rienen[1] — [1]University of Rostock, Albert Einstein Str.2, 18059 Rostock, Germany — [2]CERN, Geneva, Switzerland

In the design study of future circular collider (FCC) a lepton collider (FCC-ee) is foreseen as a potential intermediate step toward building a 100 TeV pp-collider (FCC-hh). The lepton collider shall operate at four different energies in order to study the properties of Z, W, H and top quark with unprecedented precision. Based on the preliminary studies, a single cavity design that can serve all four setups is not feasible. The H and $t\bar{t}$ are two demanding cases that require an RF system that can provide high accelerating voltage of up to 10 GV. In this poster we will present a cavity design considering the requirements of the H and $t\bar{t}$ operation modes.

AKBP 6.11 Wed 18:30 P4

Unidentified Falling Objects (UFOs) in the LHC to be identified — •Laura Grob — CERN, Geneva, Switzerland — Technische Universität Darmstadt, Germany

Macroparticles entering the beam and hence causing accidental beam losses have shown to be a limitation to beam availability in the LHC. This macroparticle-beam-interaction first observed in the LHC seems to affect also other positive beam facilities such as SuperKEKb. A more detailed knowledge about the involved particles is needed to understand their origin and the mechanism how they enter the positively charged beam. Another objective of the on-going research is to find suitable mitigation methods. In an experimental intervention on a dipole which is taken out from the LHC during the winter shutdown 2016/2017, dust samples will be extracted from this magnet. These samples will then be analyzed for their sizes and chemical composition to help explain the so-called UFOs (unidentified falling objects) in the LHC.

AKBP 6.12 Wed 18:30 P4

Overview over the experimental progress of the dechirper planned at ELBE — •Franziska Reimann[1], Ursula van Rienen[1], Peter Michel[2], and Ulf Lehnert[2] — [1]Universität Rostock, Institut für Allgemeine Elektrotechnik; Rostock, Germany — [2]Helmholtz-Zentrum Dresden-Rossendorf; Dresden-Rossendorf, Germany

Dielectrically lined rectangular waveguides provide the possibility to passively reduce the energy spread of particle beams via the interaction of the beam and its own wakefield ([*],[**]). Such a device is commonly referred to as a dechirper, and is currently used as a prototype for perspective studies at the Helmholtz-Zentrum Dresden-Rossendorf. During the beam time in the second half of the year 2016, an 80 cm long structure was inserted into the beam line and tested regarding its dechirping effect on the beam. In this work, we present the geometry of the dechirper and report on the status of the prototype and the first measurements made with it.

This work is supported by the Federal Ministry for Research and Education BMBF under contract 05K13HR1.

[*]F. Reimann, U. van Rienen, P. Michel, U. Lehnert: A dielectrically lined rectangular waveguide as a wakefield dechirper for ELBE, Proceedings of the Internat. Conf. on Electromagn. in Adv. Appl. 2015, Torino, Italy, 2015.

[**]S. Antipov: Passive Momentum Spread Compensation by a "Wakefield Silencer", Proceedings of the Internat. Part. Accel. Conf. 2012, New Orleans, USA, 2012.

AKBP 6.13 Wed 18:30 P4

Solid State Physics at ISOLDE — •Juliana Schell[1,2] and Doru C. Lupascu[2] — [1]European Organization for Nuclear Research (CERN), CH-1211 Geneva, Switzerland — [2]Institute for Materials Science and Center for Nanointegration Duisburg-Essen (CENIDE), University of Duisburg-Essen, 45141 Essen, Germany

The idea that new-is-small reflects a paradigm moving industries and research. New materials, new applications, new technologies, - but what do we need to make the new, understandable, applicable and reliable? Clearly, as things go smaller and smaller, it is more difficult to probe at the appropriate scale without influencing the subject of interest. Using radioactive probe atoms it is possible to use exotic techniques to carry out experiments dictated by half-life of the probe, from days to minutes and obtain tinny physics in materials. We explore the use of photoluminescence, Moessbauer spectroscopy, perturbed angular correlations, deep level transient spectroscopy, diffusion and emission channelling at ISOLDE-CERN.

AKBP 6.14 Wed 18:30 P4

Untersuchungen zur langsamen Extraktion am Marburger Ionenstrahl-Therapiezentrum — •Claude Krantz[1], Benno Kröck[1], Sven Sievers[1], Uwe Scheeler[1], Andreas Peters[2] und Thomas Haberer[1,2] — [1]Marburger Ionenstrahl-Therapiezentrum, 35043 Marburg — [2]Heidelberger Ionenstrahl-Therapiezentrum, 69120 Heidelberg

Das Marburger Ionenstrahl-Therapiezentrum (MIT) ist seit Oktober 2015 im klinischen Betrieb. Am MIT werden Protonen- (bis 220 MeV) und $^{12}C^{6+}$-Strahlen (bis 430 MeV/u) zur Tumorbehandlung eingesetzt. Als Haupt-Beschleunigungsstufe dient ein Ionensynchrotron, aus welchem der Therapiestrahl durch langsame Resonanzextraktion in Spills von ca. 1 bis maximal 8 Sekunden Dauer entnommen wird.

Durch aktives Regeln der Leistung der transversalen Strahlanregung kann die Intensität des extrahierten Strahls während des Spills über mehrere Dekaden gezielt variiert werden. Um ein schnelles Regelverhalten und einen guten Dynamikbereich zu erhalten, ist eine sorgfältige Abstimmung zwischen Anregungsspektrum und Maschinentune notwendig.

Gegenwärtig werden Möglichkeiten untersucht, das Regelverhalten sowie die Stetigkeit der Strahlanregung, und damit die Qualität des extrahierten Strahls, durch (Millisekunden-) schnelle Tunevariation weiter zu verbessern. Die Ergebnisse der bereits vorgenommenen Optimierungen werden präsentiert.

AKBP 6.15 Wed 18:30 P4

A compact and calibrateable von-Hamos X-Ray Spectrometer based on full-cylindrical HAPG mosaic crystals — •Malte Wansleben, Ina Holfelder, Jan Weser, and Burkhard Beckhoff — PTB, Berlin, Germany

The further development of more complex nano-materials and thin film applications with distinct properties needs an analysis independent from any reference material such as X-ray fluorescence analysis

(XRF). A reliable quantitative XRF requires calibrated instrumentation.

This work presents a high-resolution wavelength-dispersive spectrometer for XRF in the energy range of 2.3-19.0 keV. By using two full-cylindrical HAPG crystals as dispersive elements in modified von-Hamos geometry a large solid angle of detection and hence high efficiency is realized. This enables shortened measuring times while still having a compact design.

Highly Annealed Pyrolytic Graphite (HAPG) is a synthetic type of carbon which forms mosaic crystals. Although the peak reflectivity is smaller than in perfect crystals, the diffraction profile of this mosaic crystal is much wider leading to an increased integrated reflectivity. A maximum peak reflectivity of more than 60 % was found for the used HAPG films of 40 μm thickness on a cylindrical Zerodur substrate with a radius of 50 mm.

The calibration of the spectrometer involves detailed characterization of the optics, a precise setup for determining a traceable energy axis, the efficiency and response function of the spectrometer as well as a detailed budget of respective uncertainties.