Working Group on Accelerator physics
Arbeitskreis Beschleunigerphysik (AKBP)

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Overview of Invited Talks and Sessions

(Lecture room MOL 213; Poster P4)

Sessions

AKBP 1.1–1.11	Mon	15:00–18:00	MOL 213	**New Accelerator Concepts I**
AKBP 2.1–2.12	Tue	9:30–12:45	MOL 213	**New Accelerator Concepts II**
AKBP 3.1–3.5	Tue	15:00–16:15	MOL 213	**Particle Sources**
AKBP 4.1–4.9	Wed	9:30–12:00	MOL 213	**Radiofrequency and Beam Dynamics**
AKBP 5.1–5.10	Wed	15:00–17:45	MOL 213	**Hadron and Electron Accelerators**
AKBP 6.1–6.15	Wed	18:30–20:00	P4	**Poster Session**
AKBP 7.1–7.12	Thu	9:30–12:45	MOL 213	**Synchrotron Radiation and FELs**
AKBP 8.1–8.10	Thu	15:00–17:45	MOL 213	**Diagnostics, Control, Instrumentation**

Annual Meeting of the Working Group on Accelerator Physics

Thu 18:00–19:00 MOL 213

- Bericht des Vorsitzenden
- Neue Beschleunigerpreise (Horst-Klein-Preis, DPG-Nachwuchspreis)
- Bericht aus dem Komitee für Beschleunigerphysik
- Bericht aus der DPG-Vorstandsratssitzung
- AKBP-Webseiten und weiteres Engagement
- Verschiedenes

AKBP 1: New Accelerator Concepts I

Time: Monday 15:00–18:00 Location: MOL 213

AKBP 1.1 Mon 15:00 MOL 213

LUX Beamline for Laser-Plasma Driven Undulator Radiation — •Andreas R. Maier[1], Niels Delbos[1], Irene Dornmair[1], Henning Groth[1], Sören Jalas[1], Spencer Jolly[1,2], Manuel Kirchen[1], Vincent Leroux[1,2], Philiip Messner[1], Kevin Peters[1], Matthias Schnepp[1], Maximilian Trunk[1], Christian Werle[1], and Paul Winkler[1] — [1]Center for Free-Electron Laser Science & Department of Physics, University of Hamburg, 22761 Hamburg, Germany — [2]ELI Beamlines, Dolní Břežany, Czech Republic

Plasma-based accelerators promise ultra-compact sources of highly relativistic electron beams, especially suited for driving novel x-ray light sources. Within the LAOLA Collaboration, the University of Hamburg and DESY work closely together, combining university research with the expertise of a large and well-established accelerator facility, to enhance the performance of plasma accelerators for applications. Here, we will discuss and show first results from the so-called LUX beamline for plasma-driven undulator radiation and provide an overview of our group activities.

AKBP 1.2 Mon 15:15 MOL 213

Control and propagation effects of the wavefront quality for a high-power laser system — •Vincent Leroux[1,2], Spencer W. Jolly[1,2], Matthias Schnepp[1], and Andreas R. Maier[1] — [1]Center for Free-Electron Laser Science & Department of Physics, University of Hamburg, 22761 Hamburg — [2]ELI Beamlines, Dolní Břežany, Czech Republic

Laser-Plasma Wakefield Accelerators showed promising results in the past few years, generating high-energy electron beam over cm-distances. Nevertheless, the quality and shot-to-shot stability of such beams have not yet reached the level of conventional accelerators. One of the crucial factors is the driver laser beam quality, which needs to be focused close to the diffraction limit. To achieve the highest electron beam quality, the laser wavefront has to be controlled via a closed loop including a deformable mirror and a wavefront sensor. The LUX beamline, built in collaboration between ELI-Beamlines, the University of Hamburg and DESY, aims to generate and study plasma-driven undulator radiation. It is driven by the 200 TW ANGUS laser system which includes such adaptive optics. In this talk, I will present results on the wavefront control of the high power laser beam, including effects of the wavefront propagation through the 35 meters long transport beamline and wavefront-based alignment of the focusing parabolic mirror. The quality of the focal spot is investigated as the final figure of merit.

AKBP 1.3 Mon 15:30 MOL 213

Pre-target characterization of the ANGUS laser at the LUX plasma accelerator and online diagnostics of the laser system — •Matthias Schnepp[1], Niels Matthias Delbos[1], Irene Dornmair[1], Sören Jalas[1], Spencer Windhorst Jolly[1,3], Manuel Kirchen[1], Vincent Leroux[1,3], Phillip Messner[1,4], Kevin Peters[1], Maximilian Trunk[1], Christian Markus Werle[1], Paul Winkler[1,2], and Andreas R. Maier[1] — [1]Center for Free-Electron Laser Science and Department of Physics,University of Hamburg, 22761 Hamburg, Germany — [2]DESY, Hamburg, Germany — [3]ELI Beamlines, Dolní Břežany, Czech Republic — [4]International Max Planck Research School for Ultrafast Imaging and Structural Dynamics, Hamburg, Germany

Laser-plasma based acceleration has matured into a technique providing high-energy electron beams able to drive undulator-based x-ray light sources. The LUX beamline, currently built up in a collaboration between University of Hamburg, DESY and ELI-Beamlines, is designed to be such a light source. The plasma acceleration stage is driven by the 5 Hz 200 TW laser system ANGUS. Recently first accelerated electrons have been shown. In this presentation the ANGUS laser system and its transport beamline will be briefly introduced. First measurements of pre-target diagnostic will be presented as well as the implementation of online diagnostics at the laser repetition rate.

AKBP 1.4 Mon 15:45 MOL 213

Research activities and capabilities at the DRACO laser system — Florian Brack[1,2], Lennart Gaus[1,2], Alexander Jahn[1,2], Thomas Kluge[1], Stephan Kraft[1], Florian Kroll[1,2], Josefine Metzkes[1], Lieselotte Obst[1,2], Martin Rehwald[1,2], •Hans-Peter Schlenvoigt[1], Karl Zeil[1], Tim Ziegler[1,2], and Ulrich Schramm[1,2] — [1]Helmholtz-Zentrum Dresden – Rossendorf, Institute of Radiation Physics, Bautzner Landstr. 400, 01328 Dresden, Germany — [2]Technische Universität Dresden, 01062 Dresden, Germany

Since 2014, the DRACO laser system of HZDR got back into operation with both its original 150 TW beam and the new 1 PW beam. Its main goal is to study novel, laser-driven, plasma-based acceleration concepts and their potential to medical applications. Highlight experiments for ion acceleration were using a cryogenic hydrogen jet as pure proton, near-critical-density target with high repetition rate capability (collaboration with SLAC and European XFEL), ultra-thin liquid-film targets in combination with a laser pulse contrast cleaning technique (collaboration with Ohio State University), the implementation of a pulsed-solenoid-based proton beamline for in-vivo cell irradiation experiments as well as the first shots with a full PW laser beam.

AKBP 1.5 Mon 16:00 MOL 213

Development and In Situ - Characterization of Ultra-Thin Laser Targets for the Acceleration of Protons and Ions at the DRACO Laser with Ultra-High Pulse Contrast — •Alexander Jahn[1,2], Joshua Gössel[1,2], Stephan Kraft[1], Lieselotte Obst[1,2], Hans-Peter Schlenvoigt[1], Karl Zeil[1], and Ulrich Schramm[1,2] — [1]HZDR, Dresden, Germany — [2]Technische Universität Dresden, Dresden, Germany

High-intensity laser-plasma ion generation is promising as a compact, low-cost proton source for applications like ion beam therapy. To reach the performance of conventional and already existing systems there is still a lot to optimize. One way to characterize the ion acceleration performance for given laser parameters can be performed using thickness scans and hence the determination of the optical target thickness. We present the development of an ultra-thin foil target system (range of 10–1000 nm) including reliable thickness measurement. These targets will be applied for measurements at 600 TW Draco laser at the HZDR with ultra-high contrast. The foils are made of formvar (aka polyvinyl formal) or polysterene powder which has to be solved and put on a water surface to generate a thin film structure. To measure the thickness of the produced targets a F20 reflectometry system by Filmetrics is established. The reflectometer calculates the thickness of the measured sample out of the reflection spectrum based on the phenomenon of thin-film interference. The main advantage of this technique is the possibility to characterize the target thickness directly before the high power laser shot at the interaction point in the vacuum chamber.

AKBP 1.6 Mon 16:15 MOL 213

Probing of ultra-high contrast laser-plasma interaction from condensed hydrogen jet — •Tim Ziegler[1,2], Karl Zeil[1], Lieselotte Obst[1,2], Martin Rehwald[1,2], Florian Brack[1,2], Josefine Metzkes[1], Stephan Kraft[1], Hans-Peter Schlenvoigt[1], Sebastian Goede[3], Maxence Gauthier[3], Christian Roedel[3], Chandra Curry[3], Siegfried Glenzer[3], and Ulrich Schramm[1,2] — [1]Helmholtz-Zentrum Dresden-Rossendorf, Dresden, Germany — [2]TU Dresden, Dresden, Germany — [3]SLAC National Accelerator Laboratory, Stanford, United States

To advance the development of laser proton accelerators for highly demanding applications like cancer treatment a stable source of energetic particles at high repetition rates is required. During our last experimental campaign at the Helmholtz-Zentrum Dresden-Rossendorf we therefore employed a pure condensed hydrogen jet as a renewable target for the 100TW Draco laser. Draco is a ultra-high power Ti:Sa laser system which delivers pulses of 30fs and 3J on target at 800nm with a repetition rate of 10Hz. A recollimating single plasma mirror results in an improved temporal contrast represented by an ASE level of 10^{-13}. The expanding jet was monitored on-shot with a separate phase locked diode-pumped ps-laser at a wavelength of 515 nm. By that over-exposure of the CCD resulting from strong plasma self-emission which had been observed in earlier experiments to be at the harmonics of the pump laser, could be avoided. The probe beam was split in two parts oriented perpendicular and parallel with respect to the pump laser axis in order to precisely determine the jet position and its density profile.

15 min. break

AKBP 1.7 Mon 16:45 MOL 213

Plasma targets for the Laser-plasma driven Undulator X-ray source LUX — •Philipp Messner[1,2], Niels Delbos[1], and Andreas R. Maier[1] — [1]Center for Free-Electron Laser Science & Department of Physics, University of Hamburg, 22761 Hamburg, Germany — [2]International Max Planck Research School for Ultrafast Imaging & Structural Dynamics, 22761 Hamburg, Germany

Laser-plasma accelerator are promising candidates to provide ultra-relativistic electron beams for compact light sources. However, the generation of stable, high quality electron beams which are necessary to drive such a compact light source is challenging. The main determining factors are thereby the plasma properties which are given by the structure of the cm-scaled plasma target itself.

Here, we present the design process of the LUX plasma targets. Based on computational fluid dynamic simulations, targets were produced allowing to control the plasma properties and to set stable, repeatable conditions. Raman spectroscopy measurements of the gas density in the target confirm these simulations. Furthermore, results from target machining in sapphire crystals using a femtosecond laser system with KHZ repetition rate are presented and compared to the machining with state of the art milling machines.

AKBP 1.8 Mon 17:00 MOL 213

LUX Electron Optic — •Paul Winkler[1,2], Christian Werle[2], Niels Delbos[2], Max Trunk[2], Philipp Messner[2,4], Manuel Kirchen[2], Sören Jalas[2], Spencer Jolly[2,3], Vincent Leroux[2,3], Matthias Schnepp[2], Dariusz Kocoń[3], Alexander Molodozhentsev[3], Přibyl Lukáš[3], and Andreas R. Maier[2] — [1]DESY, Hamburg, Germany — [2]Center for Free-Electron Laser Science & Department of Physics, University of Hamburg, 22761 Hamburg, Germany — [3]ELI Beamlines, Dolní Břežany, Czech Republic — [4]International Max Planck Research School for Ultrafast Imaging & Structural Dynamics, 22761 Hamburg, Germany

The LUX experiment, built and operated by the LUX Junior Research Group of the University of Hamburg in close cooperation with DESY, produces laser-plasma electron bunches with 5 Hz repetition and is currently upgraded towards the generation of undulator radiation. In this talk we present a beam optic for electron energies of 100-400 MeV with a modified, compact electro quadrupole doublet. The magnets feature a gap size as small as 12 mm, resulting in field gradients of up to 150 T/m, which allows capturing the beam 10cm behind the target and focusing it into a 5mm period undulator or an electron spectrometer, respectively. Special care was taken in the beam pipe design to ensure clip-free laser transport to the post target diagnostics.

AKBP 1.9 Mon 17:15 MOL 213

Studying a new LWFA scheme that produces electron bunches of several hundred picocoulombs using PIConGPU — •Richard Pausch[1,2], Alexander Debus[1], Klaus Steiniger[1,2], Marco Garten[1,2], Jurjen Couperus[1,2], Alexander Köhler[1,2], Heiko Burau[1,2], Axel Huebl[1,2], Arie Irman[1], Ulrich Schramm[1,2], and Michael Bussmann[1] — [1]Helmholtz-Zentrum Dresden - Rossendorf — [2]Technische Universität Dresden

We present recent simulation studies of laser wakefield acceleration that match experiments performed at HZDR which produce quasi mono-energetic electron bunches of several hundred picocoulombs charge. The talk focuses on the dynamics of this new acceleration scheme and required code improvements to study it using the 3D3V particle-in-cell code PIConGPU. We discuss in detail the influence of various ionization mechanisms and laser implementations on the plasma dynamics. Furthermore, we present computation constrains and implementation challenges that these new methods entail. On top of discussing the acceleration scheme, we predict experimental observables using PIConGPU's in-situ synthetic radiation diagnostics. It allows predicting spectra from infrared to x-rays and provides the capability to determine the temporal and spatial origin of the radiation. These radiation simulations give valuable spectral signatures that allow conclusions on the micrometer femtosecond electron dynamics occurring in experiments. As an example of such a signature, simulated betatron spectra will be compared to experimentally measured spectra in order to determine the spatial extent of the electron bunch.

AKBP 1.10 Mon 17:30 MOL 213

Studying laser ion acceleration with overdense hydrogen ribbon targets by PIC code simulation — •João Branco[1,2], Karl Zeil[1], Lieselotte Obst[1,2], Ulrich Schramm[1,2], Thomas Kluge[1], and Michael Bussmann[1] — [1]Helmholtz-Zentrum Dresden - Rossendorf, Dresden, Deutschland — [2]Technische Universität Dresden, Dresden, Deutschland

We present simulation results on laser ion acceleration using hydrogen ribbon targets irradiated by ultra-intense, ultra-short laser pulses. These targets promise to produce pure proton beams applicable for cancer therapy at high repetition rates. We address critical issues concerning the acceleration process that potentially hinders the application of these beams in a clinical scenario.

For achieving proton energies suitable for the treatment of deep seated tumors it is important to increase the laser intensity. At high laser intensities, plasma instabilities both at the target surfaces and target bulk can create electron filaments which result in non-uniform proton beams, detrimental for delivering uniform dose distributions.

By varying the laser contrast it is possible to change the preplasma scale length to influence the formation of instabilities. Other means of controlling proton beams are either changing target geometry (e.g. going from planar ribbon targets to spherical droplet targets) or the polarization. We present results of 2D3V particle-in-cell simulations at realistic densities that show the influence on the plasma dynamics and final beam properties and discuss their relevance regarding applications of solid hydrogen targets for laser-driven proton tumor therapy.

AKBP 1.11 Mon 17:45 MOL 213

Optimization of the lateral and depth dose profile in the course of a small animal irradiation with laser-accelerated protons — •L. Gaus[1,3], E. Beyreuther[1], F.-E. Brack[1,3], L. Karsch[2], S. Kraft[1], F. Kroll[1,3], J. Metzkes[1], J. Pawelke[1,2], H.-P. Schlenvoigt[1], M. Schürer[2], K. Zeil[1], and U. Schramm[1,3] — [1]Helmholtz-Zentrum Dresden-Rossendorf — [2]Oncoray, National Center for Radiation Research in Oncology, Dresden — [3]Technische Universität Dresden

Laser-driven ion acceleration has been considered a potential alternative for conventional accelerators and thus could provide a more compact and cost-efficient particle therapy solution. The beam properties of laser accelerated beams strongly differ from quasi-continuous beams. They exhibit fs to ps bunch length, carry up to 10^13 particles with broad energy spectrum and are highly divergent.

The current driving question is whether pulsed proton beams obtain an equivalent biological efficacy compared to quasi-continuous beams in the case that a living organism is irradiated. Therefore, a small animal irradiation will be undertaken. That requires a homogeneous lateral and depth dose distribution, proton energies in the range of 25 MeV and dose rates in the order of Gy/min with a high degree of reproducibility. The experiment will be performed with the 600 TW beam of the Dresden laser acceleration source Draco.

This talk focuses on the characterization and optimization of the depth dose distribution as well as on the optimization of the target alignment procedure to provide the necessary dose rate.

AKBP 2: New Accelerator Concepts II

Time: Tuesday 9:30–12:45 Location: MOL 213

AKBP 2.1 Tue 9:30 MOL 213

Construction and characterization of a short-period undulator for a laser-plasma driven light source — •Maximilian Trunk, Irene Dornmair, Christian Werle, Florian Holy, and Andreas R. Maier — Center for Free-Electron Laser Science & Department of Physics, University of Hamburg, 22761 Hamburg, Germany

Laser-plasma accelerators provide high accelerating gradients and are therefore promising candidates as drivers for next generation brilliant light sources. The LUX experiment, developed and operated by the LUX junior research group at the University of Hamburg and situated at DESY, aims at producing spontaneous undulator radiation from laser-plasma generated electron beams. The BEAST II undulator is based on permanent magnets and is designed and built for in-vacuum operation in the lux beamline. It features an extremely short period length of 5 mm, a gap of 2 mm and consists of 100 periods. Already for an electron beam with a kinetic energy of 400 MeV, the produced X-ray radiation is expected to reach the water window with a wavelength of 4 nm. The contribution will cover the design, construction and manufacturing of the BEAST II undulator.

AKBP 2.2 Tue 9:45 MOL 213

Intrinsic elimination of the numerical Cherenkov instability in Lorentz-boosted frame simulations of plasma accelerators — •Manuel Kirchen, Irene Dornmair, Sören Jalas, Kevin Peters, and Andreas R. Maier — Center for Free-Electron Laser Science & Department of Physics, University of Hamburg, 22761 Hamburg, Germany

We present a novel Particle-In-Cell algorithm that is intrinsically free of the numerical Cherenkov instability for relativistic plasmas flowing at a uniform velocity. The new method is independent of the geometry and - unlike previous suppression strategies - we completely avoid artificial modifications of the electromagnetic fields. Application is shown at the example of Lorentz-boosted frame simulations of plasma accelerators, achieving excellent accuracy and high speed-ups using our spectral, quasi-3D GPU code FBPIC.

AKBP 2.3 Tue 10:00 MOL 213

Detailed Analysis of a Linear Beam Transport Line from a Laser Wakefield Accelerator to a Transverse-Gradient Undulator — •Andreas Will[1], Axel Bernhard[2], Christina Widmann[1], and Anke-Susanne Müller[1,2] — [1]LAS, KIT, Karlsruhe — [2]IBPT, KIT, Karlsruhe

A linear beam transport system, experimentally tested at the Laser Wakefield Accelerator in Jena, Germany, has been carefully analyzed in order to gain a deeper understanding of the experimental results and to develop experimental strategies for the future. This analysis encompassed a detailed characterization of the focusing magnets and an investigation of the effects of source parameters as well as magnet and alignment errors on the observables accessible in the experiment. A dedicated tracking tool was developed for these investigations. In this contribution we review the main results of these studies.

AKBP 2.4 Tue 10:15 MOL 213

Staged acceleration, microbunching, and focusing in a dielectric laser accelerator — •Joshua McNeur, Martin Kozak, Norbert Schönenberger, Ang Li, Peyman Yousefi, Anna Mittelbach, and Peter Hommelhoff — Department Physik, Friedrich-Alexander-Universität Erlangen-Nürnberg (FAU), Erlangen

Dielectric laser accelerators (DLAs) form a class of novel accelerators that enables a variety of exciting applications, ranging from MeV handheld electron sources to table-top coherent x-ray sources[1]. They operate via the synchronous interaction of electrons traversing the laser-induced near-fields at dielectric nanostructures. Recently, DLAs have demonstrated acceleration gradients approaching and exceeding 1 GeV/m with a variety of dielectric materials, laser wavelengths, and nanostructure geometries [2,3,4]. Realizing the above applications, however, requires extending the interaction length between electrons and the laser induced fields via phase-controlled staging. Furthermore, the restrictive longitudinal and transverse acceptance of the nanostructures necessitates microbunching and focusing the electron beam, preferably on a similarly-miniaturized scale. Here, we report on experimental demonstration of DLA-based staging and focusing [5] and on efforts to realize a DLA-based microbunching scheme. roaches for addressing these challenges are discussed.

1. England, R. J.et al., Rev.Mod. Phys. 86, 1337 (2014).
2. Leedle, K. J. et al., Opt. Lett.40, 4344-4347 (2015).
3. McNeur, J et al.,arXiv:1604.07684 [accelerator physics] (2016).

AKBP 2.5 Tue 10:30 MOL 213

Simulations of DLA structures based on FEM in the frequency domain — •Thilo Egenolf[1], Uwe Niedermayer[1], and Oliver Boine-Frankenheim[1,2] — [1]TEMF, TU Darmstadt, Schloßgartenstraße 8, 64289 Darmstadt, Germany — [2]GSI, Planckstraße 1, 64291 Darmstadt, Germany

Grating structures of a dielectric laser accelerator (DLA) driven by ultrashort laser pulses can reach orders of magnitude larger acceleration gradients than conventional RF electron accelerators. The ratio of energy gain to laser peak amplitude defines the structure constant.

To calculate it, a new field solver based on the finite element method in the frequency domain was implemented. The maximization of the structure constant is presented as a parameter study. Based on the optimized single cell the entire design of a beta-matched grating is completed in an iterative process. The period length increment depends on the velocity of the electron, which increases, when a subrelativistic beam is accelerated. The determination of the optimal period length thus requires the knowledge of the energy gain within all periods passed before.

Furthermore, we outline estimations of the beam loading intensity limit by reversing the solver for the calculation of the beam coupling impedance at optical frequencies.

AKBP 2.6 Tue 10:45 MOL 213

Towards higher intensities and proton imaging with the laser-driven LIGHT beamline — •Diana Jahn[1], Dennis Schumacher[2], Christian Brabetz[2], Johannes Ding[1], Simon Weih[1], Abel Blazevic[2,3], Vincent Bagnoud[2,3], Florian Kroll[4,5], Florian-Emanuel Brack[4,5], Tom Cowan[4,5], Ulrich Schramm[4,5], and Markus Roth[1] — [1]Technische Universität Darmstadt, Darmstadt, Deutschland — [2]GSI Helmholtzzentrum für Schwerionenforschung, Darmstadt, Deutschland — [3]Helmholtzinstitut Jena, Jena, Deutschland — [4]Das Helmholtz-Zentrum Dresden-Rossendorf, Dresden, Deutschland — [5]Technische Universität Dresden, Deutschland

Within the Laser Ion Generation, Handling and Transport (LIGHT) research project at GSI, laser-driven ion acceleration and beam shaping are explored, combining a target normal sheath acceleration (TNSA) proton source with conventional accelerator technology. For this investigation, an ion test beamline was built and protons were accelerated via the TNSA mechanism. Out of broad energy spectrum, protons with an energy of 8 MeV are selected using chromatic focusing of a pulsed solenoid and injected into an rf cavity. Through phase focusing, temporally compressed proton bunches below 0.5 ns (FWHM) were generated with up to 5x108 particles in a single bunch at a distance of 6 m from the source and focused with a second solenoid. These bunches were successfully used for proton imaging.

15 min. break

AKBP 2.7 Tue 11:15 MOL 213

PIC Simulations of PWFA at PITZ using a high order Discontinuous Galerkin Method — Stefan Frank[1], Erion Gjonaj[2], Andreas Jankowiak[3], Gregor Loisch[1], Alberto Martinez de la Ossa[4], Atoosa Meseck[3], Anne Oppelt[1], Jens Osterhoff[4], and •Valentin Wohlfarth[1] — [1]DESY Zeuthen, 15738 Zeuthen, Deutschland — [2]TEMF TU Darmstadt, 64289 Darmstadt, Deutschland — [3]Helmholtz-Zentrum Berlin, 14109 Berlin, Deutschland — [4]DESY Hamburg, 22607 Hamburg, Deutschland

Several experiments investigating beam-driven Plasma Wakefield Acceleration (PWFA) are currently conducted at the Photo Injector Test Facility at DESY in Zeuthen (PITZ). So far, Particle-in-Cell (PIC) simulations for the preparation and theoretical evaluation of these experiments have been conducted with HiPACE, a code which is based on Poisson solvers to compute the electromagnetic fields. In this work, a

code solving the fields with a high order Discontinuous Galerkin (DG) method [1] is used to reproduce simulations done with HiPACE and the resulting fields and particle beam distributions are compared.

[1] E. Gjonaj and T. Weiland, "Particle Based PWFA Simulations using a Discontinuous Galerkin Approach," in Proc. of ICEAA, 2010, pp. 604-607.

AKBP 2.8 Tue 11:30 MOL 213

Next generation plasma cell for PWFA experiments at PITZ — •Osip Lishilin[1], Reinhard Brinkmann[2], Johannes Engel[1], Florian Gruener[3,4], Matthias Gross[1], Gerald Koss[1], Gregor Loisch[1], Sebastian Phillip[1], Dieter Richter[5], Carl Schroeder[6], Rico Schuetze[1], and Frank Stephan[1] — [1]DESY, Zeuthen, Germany — [2]DESY, Hamburg, Germany — [3]Universität Hamburg, Hamburg, Germany — [4]CFEL, Hamburg, Germany — [5]HZB, Berlin, Germany — [6]LBNL, Berkeley, USA

The PWFA experiment at the Photo Injector Test facility at DESY, Zeuthen site (PITZ) was launched to experimentally demonstrate and study a promising phenomenon for future plasma-based accelerators and one of the major aspects of the upcoming AWAKE experiment - the self-modulation of long particle beams in plasma. Key points for the experiment are the plasma cell of novel design, the flexible photocathode laser system and well-developed diagnostics at PITZ. The plasma cell is a cross-shaped lithium heat pipe oven with inert gas buffer zones at input/output ports. An ArF ionization laser is coupled through side ports for the plasma generation. The next generation of plasma cell includes such improvements as an altered chamber geometry and a new heat pipe design. The ionization laser transport is improved in comparison to the previous setup. This contribution presents an overview of the current experimental setup, measurements of plasma density and homogeneity as well as highlights of the first experimental results.

AKBP 2.9 Tue 11:45 MOL 213

Gas discharge plasma cells for low density plasma wakefield acceleration — •Gregor Loisch[1], Johannes Engel[1], Matthias Gross[1], Martin Hochberg[2], Gerald Koss[1], Osip Lishilin[1], Anne Oppelt[1], Sebastian Philipp[1], Dieter Richter[3], Martin Sack[2] und Frank Stephan[1] — [1]DESY Zeuthen, 15738 Zeuthen, Deutschland — [2]Karlsruhe Institute of Technology, 76131 Karlsruhe, Deutschland — [3]Helmholtzzentrum Berlin, 14109 Berlin, Deutschland

Am Photoinjektor-Teststand bei DESY in Zeuthen (PITZ) werden derzeit Experimente zur teilchenstrahlgetriebenen Plasmabeschleunigung (PWFA) durchgeführt. Fokus der Experimente liegt auf der Selbstmodulation eines langen Elektronen-Paketes und der Untersuchung von PWFA bei hohen Transformationsverhältnissen (Verhältnis von Beschleunigungsfeldstärke zu abbremsender Feldstärke im Treiberpaket größer als 2). Dabei kommt unter anderem eine Gasentladungsplasmazelle zum Einsatz, die die Erzeugung von Plasmen mit Dichten bis 5x10^16 cm^-3 ermöglicht. Die Eignung der Zelle für diese und weitere Experimente wird anhand von spektroskopischen Messungen und Messungen mit Elektronenstrahl diskutiert, auch im Hinblick auf die Verwendung langer Gasentladungszellen als Beschleunigungsmedium für PWFA mit selbstmodulierten Protonenstrahlen.

AKBP 2.10 Tue 12:00 MOL 213

Continuous-Flow Operation of LWFA Targets — •Niels Delbos[1], Christian Werle[1], Irene Dornmair[1], Spencer Jolly[1,2], Manuel Kirchen[1], Vincent Leroux[1,2], Philipp Messner[1], Maximilian Trunk[1], Paul Winkler[1,3], Matthias Schnepp[1], and Andreas R. Maier[1] — [1]Center for Free-Electron Laser Science & Department of Physics, University of Hamburg, 22761 Hamburg, Germany — [2]ELI Beamlines, Dolní Břežany, Czech Republic — [3]Deutsches Elektronen Synchrotron (DESY)

The ability to operate plasma targets with high repetition rate is a key element for reproducible LWFA performance and experiments with good statistics. Here, we show the design and commissioning results for a target setup using a capillary-type plasma target and a differential pumping scheme, implemented at the LUX Beamline for plasma-driven undulator radiation. We show continuous flow operation with target pressures of up to 400mbar and 5Hz electron generation. With this system, the electron repetition rate is only limited by the repetition rate of the laser.

AKBP 2.11 Tue 12:15 MOL 213

Laser Plasma Module in the Space Charge Tracking Code ASTRA — •Irene Dornmair[1], Klaus Floettmann[2], and Andreas R. Maier[1] — [1]Center for Free-Electron Laser Science & Department of Physics, University of Hamburg, 22761 Hamburg — [2]Deutsches Elektronen-Synchrotron (DESY), Notkestraße 85, 22607 Hamburg

Due to their high accelerating gradients, laser-plasma accelerators (LPA) have experienced a surge of popularity over the last few years. On the quest for improved beam quality as well as for stability, also the external injection of electron beams from conventional, RF-based accelerators into LPA stages has been pursued. In the hereby typically employed linear wakefield regime the wakefield can easily be described by analytical models. We present the integration of a plasma module using the linear wakefield model into the well-known space charge tracking code ASTRA. This allows for efficient and fast estimations of the beam dynamics in an LPA stage, as well as for parameter scans and for jitter studies.

AKBP 2.12 Tue 12:30 MOL 213

Simulation of a laser-plasma-driven Thomson source for medical X-ray fluorescence imaging — •Theresa Brümmer and Florian Grüner — Institut für Experimentalphysik, Universität Hamburg, Deutschland

The topic of this talk is the development of an X-ray source for the detection of gold nanoparticles in the human body through X-ray fluorescence. These nanoparticles can act as a tracer for cancer cells or damaged neurons. On the basis of laser-plasma acceleration, an all-laser driven and thus compact X-ray source can be realised with the help of Thomson scattering (optical undulator). The medical application dictates the characteristics of the source which are a quasi-monochromatic photon spectrum at 150 keV, the maximum possible photon yield and a small opening angle to achieve a high spatial resolution. For this, electron bunch and laser pulse parameters are optimised with the help of simulations. These include the simulation of the electron trajectories. Their radiation per energy and solid angle is then calculated numerically. In this talk, first simulative results of the optimisation process are presented.

AKBP 3: Particle Sources

Time: Tuesday 15:00–16:15 Location: MOL 213

AKBP 3.1 Tue 15:00 MOL 213

Hochfrequenz Aufzug für gepulste Positronenstrahlen — •Marcel Dickmann[1], Johannes Mitteneder[2], Gottfried Kögel[2], Ulrich Ackermann[2], Günther Dollinger[2], Werner Egger[2], Niklas Grill[1], Christian Piochacz[1], Peter Sperr[2], Samantha Zimnik[1] und Christoph Hugenschmidt[1] — [1]Heinz Maier-Leibnitz Zentrum (MLZ) and Physik-Department E21, Technische Universität München, Lichtenbergstraße 1, D-85748 Garching — [2]Universität der Bundeswehr München, Institut für Angewandte Physik und Messtechnik, Werner-Heisenberg-Weg 39, D-85577 Neubiberg

Die intensive Positronenquelle NEPOMUC am Forschungsreaktor FRM II erzeugt mono-energetische Positronen variabler Energie für Wissenschaft und Forschung. Die Brillanz des NEPOMUC-Strahls wird durch Remoderation in einem Wolfram-Einkristall erhöht. Bei jeder Remoderations-Stufe gehen dabei mehrere keV an kinetischer Strahlenergie verloren. Um die potentielle Strahlenergie zu erhöhen, wurde ein neuartiges Beschleunigerkonzept entwickelt, der sogenannte Positronen-Aufzug. Zwei Aufzüge sind bereits an NEPOMUC im Einsatz. Das Konzept ermöglicht die Erhöhung der potentiellen Energie für beliebige geladene Teilchen. Strahlparameter, wie Brillanz oder kinetische Energie, bleiben dabei unverändert. Mit Hilfe des Aufzuges können Beschleunigungsstrecken realisiert werden, bei denen Quelle und Target auf dem gleichen Potential liegen. Im Vortag wird das Konzept des Positronen-Aufzuges vorgestellt, erste Messergebnisse und Anwendungsmöglichkeiten werden gezeigt.

AKBP 3.2 Tue 15:15 MOL 213

Status and Perspectives of the S-DALINAC Polarized-electron Injector* — •Maximilian Herbert, Joachim Enders, Martin Espig, Yuliya Fritzsche, Neeraj Kurichiyanil, and Markus Wagner — Institut für Kernphysik, Technische Universität Darmstadt, Schlossgartenstraße 9, 64289 Darmstadt

The S-DALINAC Polarized Injector (SPIn) uses GaAs photocathodes to provide pulsed and/or polarized electron beams for nuclear-structure investigations. Recently, a test facility for Photo-Cathode Activation, Test and Cleaning using atomic-Hydrogen (Photo-CATCH) has been developed. This setup uses an inverted insulator geometry. Currently, tests and optimizations are conducted at Photo-CATCH in order to implement the inverted design at SPIn. This talk will present the current status of Photo-CATCH, the planned upgrade of SPIn (aimed at an operational voltage of 200 kV) and future measurements.

*Work supported by DFG through GRK 2128 and SFB 1245

AKBP 3.3 Tue 15:30 MOL 213

Study on transverse emittance in the case of an SRF Photoinjector — •H. Vennekate[1,2], A. Arnold[1], P. Lu[1,2], J. Teichert[1], R. Xiang[1], and G. Ciovati[3,4] — [1]HZDR — [2]TU Dresden — [3]TJNAF — [4]Old Dominion University, Norfolk, VA

When it comes to high duty cycles in combination with large bunch charges, superconducting RF injectors offer certain advantages over normal conducting ones. This topic is studied at the HZDR within the framework of the ELBE SRF Gun. Here, Gun I was the worldwide first SRF injector to supply an accelerator. The currently installed Gun II is an upgrade of this injector, featuring a new superconducting solenoid for enhanced beam handling and emittance compensation, while Gun III is a further upgrade planned for the coming year. The presentation will summarize the experiences in the field of transverse emittance compensation made with Gun II, including the results of a novel study of a transverse electrical mode in a 3 1/2-cell gun cavity.

AKBP 3.4 Tue 15:45 MOL 213

Untersuchungen der Zeitantwort von GaAs und K2CsSb Photokathoden — •Victor Bechthold — Institut für Kernphysik, JGU Mainz, 55128 Mainz, D

Multialkali-Antimonid Verbindungen wie K2CsSb gelten als Kandidaten für zukünftige Beschleuniger Anwendungen wie FEL und ERLs. Neben wichtigen Eigenschaften wie einer hohen Quanteneffizienz, langer Lebensdauer, kleiner thermische Emittanz zeichnen sich diese Positive Elektronen Affinität (PEA) Photokathoden durch eine schnelle Antwortzeit aus. Am Institut für Kernphysik der Johannes Gutenberg Universität Mainz ist es möglich K2CsSb Photokathoden zu synthetisieren und ihre Zeitantworten zu untersuchen. Die nach dem Prinzip der HF-Streak Methode durchgeführten Messungen erreichen eine Zeitauflösung von bis zu 1 Pikosekunde. Desweiteren erlaubt der experimentelle Aufbau die Vermessung eines zeitlich langreichweitigen Anteils der Impulsantwort, des sog. "longitudinalen Halos", auf einem relativen Niveau von <1*10-3 der maximalen Intensität nach der Anregung. Es werden Ergebnisse der Zeitantwort Messungen von K2CsSb bei 400 nm präsentiert und mit Messungen an GaAs bei Wellenlängen von 800 nm und 400 nm verglichen.

AKBP 3.5 Tue 16:00 MOL 213

NEA activation and cleaning studies on GaAs photocathodes — •Neeraj Kurichiyanil, Joachim Enders, Martin Espig, Yuliya Fritzsche, and Markus Wagner — Institut für Kernphysik, Technische Universität Darmstadt, Germany.

A test facility for photocathode activation, test and cleaning using atomic-hydrogen (Photo-CATCH) has been constructed at the Institute für Kernphysik (IKP) of TU Darmstadt. Systematic studies of cathode preparation have been conducted using bulk GaAs cathode samples. Different negative electron affinity (NEA) activation methods are investigated and compared and rejuvenation of photocathodes through atomic-hydrogen cleaning has been verified.

Work supported in part by DFG through GRK 2128 and by the BMBF contract 05H15RDRB1.

AKBP 4: Radiofrequency and Beam Dynamics

Time: Wednesday 9:30–12:00 Location: MOL 213

AKBP 4.1 Wed 9:30 MOL 213

Nitrogen-doped niobium for superconducting RF cavities* — •Márton Major[1], Ruben Grewe[1], Jens Conrad[1], Thorsten Kürzeder[1], Florian Hug[2], Norbert Pietralla[1], and Lambert Alff[1] — [1]Technische Universität Darmstadt, Darmstadt, Germany — [2]Johannes Gutenberg Universität Mainz, Mainz, Germany

Niobium is the standard material for superconducting RF (SRF) cavities. Superconducting materials with higher critical temperature or higher critical magnetic field allow cavities to work at higher operating temperatures or higher accelerating fields, respectively. Enhancing the surface properties of the superconducting material in the range of the penetration depth is also beneficial. One direction of search for new materials with better properties is the modification of bulk niobium by nitrogen doping. In the Nb-N phase diagram the cubic δ-phase of NbN has the highest critical temperature (16 K). Already slight nitrogen doping of the α-Nb phase results in higher quality factors.**

In this contribution the status of the refurbished UHV-furnace, located at the Institute of Nuclear Physics in Darmstadt, and the results of the N-doping experiments will be presented. Nb-sheets will be used to optimize the recipe to obtain the lowest RF resistance. The structural and superconducting properties of the samples will be investigated at the department of Materials Research.

*Work supported by BMBF through 05H15RDRBA

**Grassellino *et al.*, Proc. SRF2015, MOBA06, pp. 48–54.

AKBP 4.2 Wed 9:45 MOL 213

Nitrogen doping of the niobium (100) single-crystal surface — •Guilherme Dalla Lana Semione[1,2], Arti Dangwal Pandey[1], Vedran Vonk[1], and Andreas Stierle[1,2] — [1]Deutsches Elektronen-Synchrotron DESY, Notkestraße 85, 22603 Hamburg, Germany — [2]Fachbereich Physik Universität Hamburg, Jungiusstraße 9, 20355, Hamburg, Germany

Modern particle accelerators rely on niobium RF (Radio-Frequency) cavities for their operation and there is a big drive for performance improvement of such devices. Achieving a higher quality factor (Q0), will lead to higher luminosity while reducing the dynamic heat load, resulting in potential cost savings. Nitrogen doping is known to increase the performance of niobium cavities [1], however, the physical and chemical processes and phenomena involved are far from being understood [1,2]. In this work, niobium (100) single-crystals were subjected to a recently proposed nitrogen doping preparation, called "nitrogen infusion" [3]. The changes in the surface layers were monitored by in-situ X-Ray Reflectivity (XRR) measurements, and also investigated by ex-situ Grazing Incidence X-Ray Diffraction (GIXRD), X-Ray Photoemission Spectroscopy (XPS) and Scanning Electron Microscopy (SEM). The results show a decrease in the thickness of the native niobium oxide upon high-temperature annealing and the formation of an approximately 15nm thick niobium oxynitride layer during the nitrogen-infusion. [1] A. Grassellino et al, Supercond. Sci. Technol. 26 102001 (2013). [2] P. Dhakal et al, IEEE Tran. on App. Superc. 25 3500104 (2015). [3] Solyak N. et al, ECFA linear collider workshop (2016).

AKBP 4.3 Wed 10:00 MOL 213

Eigenfrequenzregelung supraleitender Beschleunigungsstrukturen mit piezoelektrischen Aktuatoren bei 2 K* — •Christoph Burandt[1], Uwe Bonnes[1], Joachim Enders[1], Florian Hug[2], Thorsten Kürzeder[1], Norbert Pietralla[1] und Sven Sievers[3] — [1]Institut für Kernphysik, Technische Universität Darmstadt — [2]Institut für Kernphysik, Johannes Gutenberg-Universität Mainz — [3]Marburger Ionenstrahl-Therapie Centrum (MIT)

Am supraleitenden Darmstädter Elektronenbeschleuniger S-DALINAC werden die vielzelligen Hochfrequenzresonatoren in einer selbsterregten Schleife betrieben. Dabei werden elektromagnetische Schwingungen immer bei der Resonanzfrequenz angeregt. Eine effektive Teilchenbeschleunigung erfordert in diesem Modus, dass die Resonanzfrequenzen aller Beschleunigungsstrukturen miteinander übereinstimmen. Hierzu stimmt eine Eigenfrequenzregelung die Resonatoren kontinuierlich nach. Die Frequenzeinstellung ist durch mechanische Verformungen der Resonatoren möglich. Diese wurden

am S-DALINAC bisher durch magnetostriktive Aktuatoren hervorgerufen. Die für die Magnetostriktion erforderlichen Magnetfelder können jedoch die Hochfrequenz-Restwiderstände der supraleitenden Resonatoren negativ beeinträchtigen. Daher wurde am S-DALINAC inzwischen eine Umrüstung auf piezoelektrische Aktuatoren begonnen. Dieser Beitrag beschreibt die Erfahrungen mit piezoelektrischen Aktuatoren, welche in suprafluidem Helium betrieben werden, und deren Integration in das digitale Hochfrequenzregelungssystem.

*Gefördert durch die DFG im Rahmen des GRK2128.

AKBP 4.4 Wed 10:15 MOL 213

Beam dynamical behaviour of the MESA SRF-structures under recirculating operation — •Christian Stoll and Daniel Simon — Institut für Kernphysik, Johannes Gutenberg Universität, Mainz

Beam break up simulations for the MESA Accelerator*

MESA is a recirculating superconducting accelerator under construction at Johannes Gutenberg-Universität Mainz. It will be operated in two different modes: the first is the external beam (EB) mode, where the beam is dumped after being used at the experiment. The required beam current in EB mode is 150 μA with polarized electrons at 155 MeV. In the second operation mode MESA will be run as an energy recovery linac (ERL) with an unpolarized beam of 1 mA at 105 MeV. In a later construction stage of MESA the achievable beam current in ERL-mode shall be upgraded to 10 mA. To understand the behaviour of the superconducting cavities under recirculating operation with high beam currents, simulations of beam breakup have to be performed. The status of the analytical approximations and numerical simulations is presented.

*Supported by DFG through GRK 2128

AKBP 4.5 Wed 10:30 MOL 213

Untersuchungen des longitudinalen Phasenraums der Elektronenstrahlen am S-DALINAC* — •Felix Schliessmann[1], Michaela Arnold[1], Thore Bahlo[1], Jonny Birkhan[1], Florian Hug[2], Thorsten Kürzeder[1], Norbert Pietralla[1] und Thomas Schösser[1] — [1]Institut für Kernphysik, TU Darmstadt, Darmstadt — [2]Institut für Kernphysik, JGU Mainz, Mainz

Der supraleitende Elektronenlinearbeschleuniger S-DALINAC des Instituts für Kernphysik der TU Darmstadt wurde im vergangenen Jahr um eine weitere Rezirkulationsstrecke erweitert. Somit kann der Hauptbeschleuniger nun viermal anstatt wie bisher nur dreimal zur Beschleunigung eines jeden Elektronenpakets genutzt werden. Auch im neuen, dreifach-rezirkulierenden Betrieb sollen die Beschleunigungsstrukturen off-crest und die Rezirkulationen nicht-isochron betrieben werden, denn durch eine geeignete Wahl der Synchrotronphase und der longitudinalen Dispersionen führt die Vielzahl an Scherungen im longitudinalen Phasenraum zu einer signifikanten Verringerung der Impulsunschärfe. Die zur geringsten Impulsunschärfe führende Kombination aus Synchrotronphase und den longitudinalen Dispersionen wurde mithilfe der kommerziellen Software *MATLAB* ermittelt und anschließend mit der am Argonne National Laboratory entwickelten Software *elegant* verifiziert.

Im Vortrag wird das nicht-isochrone Rezirkulationsschema am S-DALINAC zusammen mit den Ergebnissen der Simulationsrechnungen vorgestellt.

*Gefördert durch die DFG im Rahmen des GRK 2128.

AKBP 4.6 Wed 10:45 MOL 213

Experimente zu transversalem Beam Break-Up am S-DALINAC* — •Jonas Pforr[1], Michaela Arnold[1], Florian Hug[2], Lars Jürgensen[1], Thorsten Kürzeder[1] und Norbert Pietralla[1] — [1]Institut für Kernphysik, TU Darmstadt — [2]Institut für Kernphysik, JGU Mainz

Transversales Beam Break-Up (BBU) ist eine Instabilität, die vor allem an supraleitenden, rezirkulierenden Linearbeschleunigern auftreten kann. Diese wird durch Moden höherer Ordnung in den Kavitäten verursacht und begrenzt den möglichen Strahlstrom. Am zweifach rezirkulierenden S-DALINAC wurde BBU bereits bei Strömen von nur wenigen μA beobachtet. Für die üblichen kernphysikalischen Experimente stellt das keine Limitierung dar, es ermöglicht allerdings eine experimentelle Untersuchung dieses Phänomens, ohne dass Strahlverluste eine große Gefahr darstellen. Am S-DALINAC wurden Experimente durchgeführt, um die Abhängigkeit des Grenzstroms von verschiedenen Größen zu untersuchen. Dabei ist von besonderem Interesse, wie BBU durch Änderungen der Strahloptik vemieden werden kann. In diesem Vortrag sollen die bisher am S-DALINAC durchgeführten Experimente zu BBU vorgestellt werden.

*Gefördert durch die DFG im Rahmen des GRK 2128.

15 min. break

AKBP 4.7 Wed 11:15 MOL 213

Beam dynamics and collimation following MAGIX at MESA* — •Ben Ledroit and Stephan Aulenbacher — Institut für Kernphysik JGU Mainz

The Mainz Energy-recovering Superconducting Accelerator (MESA) will be an electron accelerator allowing operation in energy-recovery linac (ERL) mode. After the beam hits the target at the MESA Internal Gas Target Experiment (MAGIX), the beam is phase shifted and fed back into the linac sections. These will transfer the kinetic beam energy back to the RF-field by deceleration of the beam and allow for high beam power with low RF-power input. Since most of the beam does not interact with the target, the beam will mostly just pass the target untouched. However, a fraction of the scattered electrons may be in the range outside the accelerator acceptance and therefore cause malicious beam dynamical behavior in the linac sections or even damage to the machine. The goal of this work is to determine the beam behavior upon target passage by simulation and experiment and to protect the machine with a suitable collimation system. A short introduction and present status of the work will be given.

*Supported by the DFG through GRK 2128

AKBP 4.8 Wed 11:30 MOL 213

Verwendung des MAMI 3,5 MeV Strahls für Bestrahlungsexperimente mit hoher Leistungsdichte — Kurt Aulenbacher[1], •Thomas Beiser[1], Philipp Heil[1], Alexandr Ignatenko[2], Gudrid Moortgat-Pick[2], Sabine Riemann[2], Valery Tioukine[1] und Andriy Ushakov[2] — [1]Institut für Kernphysik, Johannes-Gutenberg-Universität Mainz, GER — [2]Deutsches Elektronen-Synchrotron DESY, GER

Um die Belastbarkeit von potentiellen Materialien für die ILC-Positronentargets zu untersuchen wurden diese an MAMI mit 3,5 MeV Elektronen bestrahlt.

Ziel war es eine möglichst hohe Brillanz des Strahl zu gewährleisten, was durch ein Fokussierungssystem aus Quadrupolen erreicht wurde.

Zur Kontrolle der erzielten Strahlfleckgröße wurde erstmals an MAMI optische Übergangsstrahlung (OTR) benutzt; diese wurde auch zur Emittanzmessung verwendet.

AKBP 4.9 Wed 11:45 MOL 213

Analysis of Closed-Orbit Deviations for a first direct Deuteron Electric Dipole Moment Measurement at the Cooler Synchrotron COSY — •Vera Schmidt[1,2] and Andreas Lehrach[1,2] — [1]Forschungszentrum Jülich, IKP 4, Jülich, Deutschland — [2]RWTH Aachen University, 3. Physikalisches Institut, Aachen, Deutschland

This presentation investigates closed orbit influencing effects focusing on transverse orbit deviations. Using a model of the Cooler Synchrotron COSY at the Forschungszentrum Jülich implemented in the Methodical Accelerator Design (MAD-X) program, several magnet misalignments are simulated and analyzed. A distinction is made between magnet displacements along the axes and rotations around them. Results are always analyzed for the uncorrected as well as for the orbit after the application of an orbit correction. Furthermore, the effect of displaced beam position monitors is simulated and a constraint resolution of their readout is considered. Besides magnet misalignments also field variations resulting from residual power supply oscillations are quantified for all types of magnets.

AKBP 5: Hadron and Electron Accelerators

Time: Wednesday 15:00–17:45 Location: MOL 213

AKBP 5.1 Wed 15:00 MOL 213

Beam Evolution during the 2016 Proton-Lead Run of the LHC — •Marc Jebramcik[1,2], John Jowett[1], Tom Mertens[1], and Michaela Schaumann[1] — [1]CERN, Geneva, Switzerland — [2]Goethe University Frankfurt, Frankfurt, Germany

At the end of 2016, the second proton-lead run took place in the LHC. Enabling data taking in no less than 5 experiments resulted in demanding operational conditions due to the different requests of the experiments. These requests included a multiple change of beam directions, switches of the beam energies between 4 Z TeV and 6.5 Z TeV and different demands for luminosity and pile-up. In one month of heavy ion operation, the achieved integrated luminosity came close to the demanded and the measured peak luminosity exceeded several times the unofficial design value.

The different machine settings caused different evolutions of the beam properties, e.g., the beam lifetime and bunch size evolution, which had to be observed cautiously during operation. Simulations as well as first interpretations of the measured data are given.

AKBP 5.2 Wed 15:15 MOL 213

High-Temperature Superconductor Coating for the FCC Beam Screen — •Patrick Krkotić[1], Uwe Niedermayer[1], and Oliver Boine-Frankenheim[1,2] — [1]TU Darmstadt - TEMF — [2]GSI Helmholtzzentrum für Schwerionenforschung Darmstadt

The international Future Circular Collider (FCC-hh) study develops a conceptual design for a post LHC particle accelerator with collision energies up to 100 TeV. To mitigate beam instabilities the coupling impedance of the beam screen has to be sufficiently low. So far, copper coatings are intended, but the resulting impedance might not be low enough to run without an active feedback. Therefore, High-Temperature Superconductors (HTS) in the operating beam screen temperature of 40K to 60K are studied to reduce the coupling impedance.

The main idea is to display HTS and copper in several selected positions in the beam screen in form of alternating stripes. This is combined with a very thin surface layer of amorphous carbon coating to reduce the electron cloud effect. The behaviour of HTS and change in impedance under the given temperatures, frequencies, magnetic fields and synchrotron radiation is examined. The results of coupling impedance simulations using the two-dimensional finite element solver BeamImpedance2D [1] are given.

[1] U. Niedermayer, O. Boine-Frankenheim, and H. De Gersem, Phys. Rev. Special Topics * Accelerators and Beams 18, 032001, (2015)

AKBP 5.3 Wed 15:30 MOL 213

Spin tune mapping as a novel tool to probe magnetic imperfections of a storage ring — •Artem Saleev — Institut für kernphysik Forschungszentrum Jülich, Jülich, Deutschland

In precision searches for electric dipole moments of charged particles using storage rings, one needs to quantify background signals that stem from false rotations of the magnetic dipole moments in the radial and longitudinal magnetic fields of the storage ring. Mapping the spin tune response of a machine with artifically applied longitudinal magnetic fields allows one to probe the magnetic imperfection field content of the ring. The novel technique, called *spin tune mapping*, emerges as an extremely powerful probe of the spin dynamics in storage rings. The technique was experimentally tested by JEDI at COSY, and for the first time, the angular orientation of the stable spin axis at two different locations in the ring has been determined to an unprecedented accuracy of $\approx 10^{-6}\mu$rad.

Based on the obtained results, a roadmap toward further perfectioning of the technique is formulated, which fits the extensive program of upgrading COSY for a first direct measurement of the electric dipole moments of protons and deuterons using an RF Wien filter.

AKBP 5.4 Wed 15:45 MOL 213

Recent laser cooling and laser spectroscopy experiments at the ESR — •Michael Bussmann[1], Oliver Boine-Frankenheim[2,3], Axel Buss[4], Lewin Eidam[2,3], Volker Hannen[4], Zhongkui Huang[5], Daniel Kiefer[3], Sebastian Klammes[3], Thomas Kühl[2], Markus Löser[1,6], Xinwen Ma[5], Fritz Nolden[2], Wilfried Nörtershäuser[3], Rodolfo Marcelo Sanchez Alarcon[2], Ulrich Schramm[1,6], Mathias Siebold[1], Markus Steck[2], Thomas Stöhlker[2,7,8], Johannes Ullmann[3], Thomas Walther[3], Hanbing Wang[5], Weiqiang Wen[5], Christian Weinheimer[4], Danyal Winters[2], and Daniel Winzen[4] — [1]Helmholtz-Zentrum Dresden - Rossendorf — [2]GSI Darmstadt — [3]TU Darmstadt — [4]Uni Münster — [5]IMP Lanzhou — [6]TU Dresden — [7]HI Jena — [8]Uni Jena

Laser cooling is one of the most promising techniques for ion beam cooling at high energies. The fluorescence emitted during the cooling process can be used for both optical beam diagnostics and precision spectroscopy. We present results on experiments with 12C3+ beams (122 MeV/u) stored in the experimental storage ring (ESR) in Darmstadt, Germany. For the excitation of the cooling transition, a pulsed laser system with a high repetition rate and a wide-scanning cw laser system have been used simultaeneously. For the fluorescence detection a novel XUV detector system installed inside the vacuum of the ESR. We will discuss the experimental setup and preliminary data on the interaction of the lasers with the beam and discuss them in the light of applications at future high energy storage rings at FAIR and HIAF.

AKBP 5.5 Wed 16:00 MOL 213

Aufbau und Status des dreifach rezirkulierenden S-DALINAC* — •Michaela Arnold[1], Cornelia Eschelbach[2], Ruben Grewe[1], Florian Hug[3], Thorsten Kürzeder[1], Michael Lösler[2], Jonas Pforr[1] und Norbert Pietralla[1] — [1]IKP, TU Darmstadt, Darmstadt, Germany — [2]LIM, Frankfurt UAS, Frankfurt, Germany — [3]KPH, JGU Mainz, Mainz, Germany

Von 1991 bis 2015 konnte der Elektronenlinearbeschleuniger S-DALINAC mit zwei Rezirkulationen betrieben werden. Da die Güten der supraleitenden Kavitäten nicht ihre angestrebten Werte erreichten, blieb die maximale Strahlenergie im cw-Betrieb deutlich unterhalb der ursprünglich geplanten 130 MeV. Aus diesem Grund wurde in 2015/2016 eine weitere Rezirkulation installiert, wodurch es in Zukunft möglich sein wird, den Hauptbeschleuniger viermal anstatt dreimal zu nutzen. Somit können die Beschleunigungsstrukturen bei reduzierten Feldgradienten betrieben werden, womit nun die ursprünglich geplanten Strahlenergien von bis zu 130 MeV erreicht werden. Die Erweiterung um eine zusätzliche Rezirkulation resultierte in einem erneuten Aufbau von weiten Teilen der bestehenden Strahlführung sowie einem erstmaligen Aufbau der neuen Sektion. Des Weiteren mussten alle Magnete hinsichtlich ihrer Position und Orientierung geodätisch erfasst und justiert werden. Der Vortrag beschäftigt sich mit dem Aufbau und wird die verwendeten Methoden zur Justage vorstellen. Des Weiteren wird der aktuelle Status der Inbetriebnahme thematisiert.

*Gefördert durch die DFG im Rahmen des GRK 2128 und SFB 634.

AKBP 5.6 Wed 16:15 MOL 213

Absolute charge calibration and degeration studies of various scintillation screens used in laser Wakefield acceleration — •Thomas Kurz[1,2], Jurjen Couperus[2,7], Jakob Krämer[2,7], Hao Ding[1,6], Stephan Kuschel[3,4], Dominik Hollatz[3,4], Alexander Köhler[2,7], Omid Zarini[2,7], Richard D'arcy[5], David Schinkel[3,4], Jan-Patrick Schwinkendorf[5,8], Matt Zepf[3,9], Jens Osterhoff[5,8], Arie Irman[2], Ulrich Schramm[2,7], and Stefan Karsch[1,6] — [1]Ludwig-Maximilians-Universität, München — [2]Helmholtz-Zentrum Dresden-Rossendorf, Dresden — [3]Helmholtz Institut, Jena — [4]Friedrich-Schiller-Universität Jena, Jena — [5]Deutsches Elektronen-Synchrotron, Hamburg — [6]Max-Planck-Institut für Quantenoptik, Garching — [7]Technische Universität Dresden, Dresden — [8]Universität Hamburg, Hamburg — [9]Queen's University, Belfast

Scintillation screens are generally used as the electron beam diagnostics in Laser Wakefield Accelerators. We present an absolute charge calibration of the electron detector i.e. a scintillating screen with a layer of powdered rare earth phosphor (Gd_2O_2S:TB). The calibration was designed to investigate the absolute light/charge–ratio and saturation effects of various screens used in current laser–electron accelerators. The scintillation screens show a linear photon response to the applied charge up to an upper boundary caused by saturation effects. We also report about degeneration studies of some of these screens which were excited with a similar condition compared to Wakefield experiments.

15 min. break

AKBP 5.7 Wed 16:45 MOL 213

KIT-IBPT accelerator test facilities status report — •Marcel Schuh[1], Axel Bernhard[2], Edmund Blomley[2], Tobias Boltz[1], Miriam Brosi[1], Erik Bründermann[2], Sara Casalbuoni[2], Stefan Funkner[1], Julian Gethmann[1], Andreas Grau[2], Erhard Huttel[2], Benjamin Kehrer[1], Sebastian Marsching[1], Yves-Laurent Mathis[2], Wolfgang Mexner[2], Michael J. Nasse[2], Gudrun Niehues[1], Alexander Papash[2], Florian Rähmisch[1], Robert Ruprecht[2], David Saez de Jauregui[2], Manuel Schedler[1], Thiemo Schmelzer[1], Patrik Schönfeldt[2], Markus Schwarz[1], Nigel J. Smale[2], Johannes L. Steinmann[1], Bettina Stöhr[1], Pawel Wesolowski[2], Minjie Yan[2], and Anke-Susanne Müller[1,2] — [1]LAS, KIT, Karlsruhe, Germany — [2]IBPT, KIT, Karlsruhe, Germany

The Institute for Beam Physics and Technology (IBPT) at the KIT operates the accelerator test facility and synchrotron light source ANKA and the Ferninfrarot Linac and Test Experiment (FLUTE) which is presently under construction. An overview over the accelerator physics research performed at these two facilities will be given.

AKBP 5.8 Wed 17:00 MOL 213

Characterisation of the photo-injector laser and laser transport for the production of short electron bunches at FLUTE — •Thiemo Schmelzer[1], Stefan Funkner[1], Minji Yan[2], Michael Nasse[2], Marcel Schuh[1], Erik Bründermann[2], and Anke-Susanne Müller[1,2] — [1]LAS, KIT, Karlsruhe, Germany — [2]IBPT, KIT, Karlsruhe, Germany

At the Ferninfrarot Linac and Test Experiment (FLUTE), which is currently under construction at KIT, a photo-injector gun system is used to generate electron bunches with different charges. The pulses from the gun laser have to be transported over a distance of around 35 m from the laser lab to the electron gun via image relay. For an optimized laser transport the transversal and longitudinal size of the laser pulses are important. In this contribution we present the characteristics of the photo injector laser and the planned laser transport.

AKBP 5.9 Wed 17:15 MOL 213

Experimental Optimization of Electron Beams for Generating THz Coherent Transition and Diffraction Radiations with PITZ — •Prach Boonpornprasert[1], Galina Asova[1,2], Ye Chen[1], James Good[1], Holger Huck[1], Igor Isaev[1], Davit Kalantaryan[1], Mikhail Krasilnikov[1], Xin Li[1], Osip Lishilin[1], Gregor Loisch[1], David Melkumyan[1], Anne Oppelt[1], Houjun Qian[1], Yves Renier[1], Tino Rublack[1], Chaipattana Saisard[1,3], Frank Stephan[1], and Quantang Zhao[1,4] — [1]DESY, Zeuthen, Germany — [2]INRNE, Sofia, Bulgaria — [3]CMU, Chiangmai, Thailand — [4]IMP/CAS, Lanzhou, China

The Photo Injector Test facility at DESY, Zeuthen site (PITZ), develops high brightness electron sources for modern linac-based Free Electron Lasers (FELs). The PITZ accelerator can also be considered as a suitable machine for the development of an IR/THz source prototype for pump-probe experiments at the European XFEL. Interesting options for the IR/THz generation with PITZ are to generate the radiation by means of a Coherent Transition Radiation (CTR) and a Coherent Diffraction Radiation (CDR). Experimental optimizations of electron beams for such means were done with two types of longitudinal profiles; short Gaussian and comb-like profiles. In this contribution, results of the optimizations are presented and discussed together with corresponding calculations of the CTR and CDR. Progress on the design and installation of a CTR/CDR station is also reported.

AKBP 5.10 Wed 17:30 MOL 213

Preliminary On-table and Photoelectron Results from the PITZ Quasi Ellipsoidal Photocathode Laser — •James Good[1], Alex Andrianov[2], Ekaterina Gacheva[2], Efim Khazanov[2], Mikhail Krasilnikov[1], Sergey Mironov[2], Anatoly Poteomkin[2], Tino Rublack[1], Frank Stephan[1], Eugeniy Syresin[2], and Viktor Zelenogorsky[2] — [1]DESY, Zeuthen — [2]IAP RAS, Nizhny Novgorod, Russia

The optimization of photoinjectors is crucial for the successful operation of linac-based free electron lasers, and beam dynamics simulations have shown that ellipsoidal photocathode laser pulses result in significantly lower electron beam emittance than that of conventional cylindrical pulses. Therefore, in collaboration with the Institute of Applied Physics (Nizhny Novgorod, Russia) and the Joint Institute of Nuclear Research (Dubna, Russia), a Laser system capable of generating quasi 3-D ellipsoidal laser pulses has been developed and installed at the Photo Injector Test facility at DESY, Zeuthen (PITZ).

The pulse shaping has been realized using the spatial light modulator technique, characterized by cross-correlation and spectrographic measurements, and is demonstrated with electron beam measurements. In this contribution the overall setup, operating principles, and initial results of the new photocathode laser system at PITZ will be reported.

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.

*supported by DFG (GRK 2128) and BMBF (05H15RDRB1)

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.

AKBP 7: Synchrotron Radiation and FELs

Time: Thursday 9:30–12:45 Location: MOL 213

AKBP 7.1 Thu 9:30 MOL 213

Numerical Simulations on the Effect of Broadband Microbunching on the Radiation Spectra of Short Undulators — •Paul Volz and Atoosa Meseck — HZB, Berlin

It is known that microbunched beams emit coherently in spectral ranges shorter than the bunch length when traversing insertion devices. However, the impact of a broadband microbunching on the spectrum of a short undulator has not yet been investigated. The presented work tests these effects numerically using WAVE. The spectra of smooth, Gaussian bunches are compared to bunches with microstructure in energy spread, longitudinal and transversal distribution. Coherent amplification can be observed in the microbunched case.

AKBP 7.2 Thu 9:45 MOL 213

Transverse resonant island buckets and their implementation at BESSY II as a bunch seperation scheme — •Felix Kramer, Paul Goslawski, Andreas Jankowiak, and Markus Ries — Helmholtz-Zentrum Berlin, Berlin, Germany

Electron storage ring operation close to a resonance can be used to generate a second stable island orbit winding around the standard orbit. These orbits can be well separated allowing users to choose their radiation source point from one or the other orbit and provide the possibility to fulfill conflicting user demands simultaneously. At BESSY II resonant island operation at sufficient life time and stability for top up mode has been realized and tested under user operation conditions. Theoretical investigations on transverse resonant island buckets in general and the latest results of the implementation of a resonant island operation mode at BESSY II will be presented.

AKBP 7.3 Thu 10:00 MOL 213

Time-resolved energy spread studies at the ANKA storage ring — •Benjamin Kehrer[1], Edmund Blomley[2], Miriam Brosi[1], Erik Bründermann[2], Nicole Hiller[4], Michael J. Nasse[2], Manuel Schedler[1], Patrik Schönfeldt[2], Marcel Schuh[1], Paul Schütze[3], Markus Schwarz[1], Nigel J. Smale[2], Johannes L. Steinmann[1], and Anke-Susanne Müller[1,2] — [1]LAS, KIT, Karlsruhe, Germany — [2]IBPT, KIT, Karlsruhe, Germany — [3]DESY, Hamburg, Germany — [4]PSI, Villinge, Switzerland

Recently, a new setup for measuring the beam energy spread has been commissioned at the ANKA storage ring at the Karlsruhe Institute of Technology. This setup is based on a fast-gated intensified camera and detects the horizontal profiles of individual bunches in a multi-bunch environment on a single-turn base. As the radiation source point is located in a dispersive section of the storage ring, this allows time-resolved studies of the energy spread. These studies are of particular interest in the framework of short-bunch beam dynamics and the characterization of instabilities. The system is fully synchronized to other beam diagnostics devices allocated in various places along the storage ring, such as the single-shot electro-optical spectral decoding setup or the turn-by-turn terahertz detection systems. Here we discuss the results of the synchronous measurements with the various systems with special emphasis on the energy spread studies.

This work has been supported by the Initiative and Networking Fund of the Helmholtz Association under contract number VH-NG-320 and by the BMBF under contract numbers 05K13VKA and 05K16VKA.

AKBP 7.4 Thu 10:15 MOL 213

Ultrashort VUV Synchrotron Radiation Pulses at DELTA — •M. Suski[1], F.H. Bahnsen[1], M. Bolsinger[1], B. Büsing[1], S. Cramm[2], S. Döring[2,3], M. Gehlmann[2,3], F. Götz[1], S. Hilbrich[1], S. Khan[1], M. Jebramcik[1], N.M. Lockman[1], C. Mai[1], A. Meyer auf der Heide[1], R. Niemczyk[1], M. Plötzing[2,3], L. Plucinski[2], B. Riemann[1], G. Shayeganrad[1], P. Ungelenk[1], S. Xiao[3], U. Bovensiepen[3], and C.M. Schneider[2,3] — [1]Center for Synchrotron Radiation (DELTA), TU Dortmund University, Dortmund, Germany — [2]Peter Grünberg Institute, PGI-6, FZ-Jülich GmbH, Jülich, Germany — [3]Experimental Physics, University of Duisburg-Essen, Duisburg, Germany

The 1.5-GeV synchrotron light source DELTA, operated by the TU Dortmund University, provides femtosecond pulses in the VUV regime using the coherent harmonic generation (CHG) technique. A laser-induced energy modulation of electrons in a thin slice of the electron bunch is converted into a density modulation corresponding to the laser wavelength, which gives rise to coherent radiation at harmonics of the laser wavelength. Measurements with a single-shot spectrometer based on a gated image-intensified CCD camera were carried out in order to better understand and optimize the CHG radiation. Furthermore, a proof-of-principle pump-probe experiment employing the CHG radiation has been performed.

AKBP 7.5 Thu 10:30 MOL 213

Self-consistently modeling Traveling-Wave Thomson-Scattering Optical Free-Electron Lasers — •Alexander Debus[1], Richard Pausch[1,2], Klaus Steiniger[1,2], Daniel Albach[1], Markus Loeser[1], Ulrich Schramm[1,2], Mathias Siebold[1], and Michael Bussmann[1] — [1]Helmholtz-Zentrum Dresden - Rossendorf — [2]Technische Universität Dresden

Traveling-Wave Thomson-Scattering (TWTS) provides optical undulators with hundreds to thousands of undulator periods from high-power, pulse-front tilted lasers pulses. These allow to realize optical free-electron lasers (OFELs) with state-of-the-art technology in electron accelerators and laser systems.

TWTS employs a side-scattering geometry where laser and electron propagation direction of motion enclose the interaction angle. Tilting the laser pulse front with respect to the wave front by half the interaction angle ensures continuous overlap over the whole laser pulse width while the electrons cross the laser beam path.

Scaling laws and analytical models allow identifying experimentally promising FEL regimes in feasible setup geometries. However, self-consistently including all non-ideal effects in 3D FEL simulations is desirable for predicting TWTS-OFEL designs with quantitative performance and tolerance characteristics suitable for engineering an optimal proof-of-principle experiment. In this talk we outline the challenges of existing FEL codes that cannot cope with the non-collinear geometry of TWTS-OFELs, show how we solve these using the particle-in-cell code PIConGPU as 3D-FEL code and present first results.

AKBP 7.6 Thu 10:45 MOL 213

Design of Optical Setups for High-Yield Optical Undulators in the Traveling-Wave Thomson-Scattering geometry — •Klaus Steiniger[1,2], Daniel Albach[1], Alexander Debus[1], Markus Loeser[1], Richard Pausch[1,2], Fabian Roeser[1], Ulrich Schramm[1,2], Matthias Siebold[1], and Michael Bussmann[1] — [1]Helmholtz-Zentrum Dresden-Rosendorf, Bautzner Landstraße 400, 01328 Dresden — [2]Technische Universität Dresden, 01062 Dresden

Traveling-Wave Thomson-Scattering (TWTS) can realize ultra-compact, inherently synchronized and highly brilliant light sources from the ultraviolet to the hard X-ray range. In TWTS ultrashort laser pulses and relativistic electron bunches are utilized in a side-scattering geometry where their directions of motion enclose an interaction angle. By tilting the laser pulse-front TWTS ensures continuous overlap of laser and electrons while these traverse the laser cross-sectional area. This enables interaction over hundreds to thousands of optical undulator periods, enough to allow for optical free-electron laser (OFEL) operation. After shortly introducing the TWTS geometry, the design of optical setups to form laser pulses for TWTS is presented in the talk. This setup strategy provides laser dispersion compensation during interaction, required due to angular dispersion of the laser pulse, which is especially relevant when building compact, high-yield hard X-ray TWTS sources in large interaction angle setups. Determining parameters of TWTS setups is illustrated in examples of an ultraviolet TWTS OFEL and a hard X-ray TWTS sources.

15 min. break

AKBP 7.7 Thu 11:15 MOL 213

Diagnostics of laser-induced THz radiation at DELTA — •Carsten Mai[1], Fin Hendrik Bahnsen[1], Max Bolsinger[1], Benedikt Büsing[1], Fabian Götz[1], Svenja Hilbrich[1], Shaukat Khan[1], Marc Andre Jebramcik[1,2], Nils Maris Lockmann[1], Arne Meyer auf der Heide[1], Raffael Niemczyk[1], Bernard Riemann[1], Gholamreza Shayeganrad[1], Mateusz Suski[1], Peter Ungelenk[1], and Dennis Zimmermann[1] — [1]Center for Synchrotron Radiation (DELTA), TU Dortmund University, Dortmund, Germany — [2]now at: CERN, Geneva, Switzerland

Coherent ultrashort THz pulses induced by a laser-electron interaction are routinely produced and observed at DELTA, a 1.5-GeV synchrotron light source operated by the TU Dortmund University. In the past, spectral measurements of the radiation were limited to the frequency range above 1 THz. Recently, first spectra were measured using a newly built polarizing Fourier-transform spectrometer which also covers the sub-THz regime. Studies of the temporal evolution of the spectrum during several revolutions of the energy-modulated electrons are presented. Furthermore, a setup currently being commissioned for electro-optical measurements of the THz field is discussed.

This project was funded by the BMBF under contract 05K16PEB.

AKBP 7.8 Thu 11:30 MOL 213

Studies of the micro-bunching instability in multi-bunch operation at the ANKA storage ring — •Miriam Brosi[1], Edmund Blomley[2], Erik Bründermann[2], Michele Caselle[3], Benjamin Kehrer[1], Andreas Kopmann[3], Florian Rämisch[1], Lorenzo Rota[3], Manuel Schedler[2], Patrik Schönfeldt[2], Marcel Schuh[1], Markus Schwarz[1], Johannes L. Steinmann[1], Marc Weber[3], and Anke-Susanne Müller[1,2] — [1]LAS, KIT, Karlsruhe — [2]IBPT, KIT, Karlsruhe — [3]IPE, KIT, Karlsruhe

The test facility and synchrotron light source ANKA at the Karlsruhe Institute of Technology (KIT) operates in the energy range from 0.5 to 2.5 GeV and can generate brilliant coherent synchrotron radiation in the THz range employing a dedicated bunch length-reducing optic at 1.3 GeV beam energy. The high degree of spatial compression leads to complex longitudinal dynamics and to time evolving sub-structures in the longitudinal phase space of the electron bunches. The results of the micro-bunching instability are time-dependent fluctuations and strong bursts in the radiated THz power. To study these fluctuations in the emitted THz radiation simultaneously for each individual bunch in a multi-bunch environment, fast THz detectors are combined with KAPTURE, the dedicated Karlsruhe Pulstaking and Ultrafast Readout Electronics system, developed at KIT. In this contribution we present measurements conducted to study possible multi-bunch effects on the characteristic bursting behavior of the micro-bunch instability.

Supported by BMBF (05K13VKA, 05K16VKA), the HGF (VH-NG-320) and the HIRST.

AKBP 7.9 Thu 11:45 MOL 213

Comprehensive Analysis of Micro-Structure Dynamics in Longitudinal Profiles — •Tobias Boltz, Miriam Brosi, Erik Bründermann, Florian Rämisch, Patrik Schönfeldt, Markus Schwarz, Minjie Yan, and Anke-Susanne Müller — KIT, Karlsruhe, Germany

Operating with short electron bunches at Synchrotron Light Sources can induce micro-structures inside the bunches, which intensify the emission of Coherent Synchrotron Radiation (CSR) in the wavelength range comparable to the size of the micro-structures. Dynamic variations of these micro-structures, however, lead to fluctuations in the intensity of the emitted CSR. Such phenomena have been observed at various facilities including ANKA, KIT. Using the in-house developed simulation code, Inovesa, the dynamics of the micro-structures in the longitudinal profiles have been investigated with the help of machine learning techniques. In this contribution we present possible categorization of these micro-structures and their correlations to the CSR intensity.

AKBP 7.10 Thu 12:00 MOL 213

Progress of the EEHG upgrade at the DELTA short-pulse source — •Benedikt Büsing[1], Fin Hendrik Bahnsen[1], Max Bolsinger[1], Fabian Götz[1], Svenja Hilbrich[1], Shaukat Khan[1], Marc Jebramcik[1,2], Nils Lockman[1], Carsten Mai[1], Arne Meyer auf der Heide[1], Raffael Niemczyk[1], Bernard Riemann[1], Eric Schneider[1], Gholamreza Shayeganrad[1], Mateusz Suski[1], Peter Ungelenk[1], and Dennis Zimmermann[1] — [1]Center for Synchrotron Radiation (DELTA), TU Dortmund University, Dortmund, Germany — [2]now at: CERN, Geneva, Switzerland

At DELTA, a 1.5-GeV synchrotron light source operated by the TU Dortmund University, a short-pulse source based on coherent harmonic generation (CHG) is used to generate sub-picosecond synchrotron radiation pulses in the VUV regime, which result from micro-bunching at the center of an electron bunch due to laser-electron interaction. Shorter wavelengths are achievable with the so-called echo-enabled harmonic generation (EEHG) technique by adding a second laser-electron interaction. The current short-pulse source will be modified to include the EEHG scheme. The status of the upgrade project will be presented.

This project was supported by the accelerator initiative (ARD) of the Helmholtz society and by the BMBF under contract 05K13PE3 and 05K16PEA.

AKBP 7.11 Thu 12:15 MOL 213

Investigation of the laser-plasma interaction with the method of small- angle x-ray scattering (SAXS) at an XFEL — •Melanie Rödel[1], Alexander Pelka[1], Thomas Kluge[1], Alejandro Laso Garcia[1], Emma McBride[2], Christian Rödel[2], Irene Prencipe[1], Nicholas Hartley[1], Dominik Kraus[1], Christian Gutt[3], Ulrich Schramm[1], and Thomas Cowan[1] — [1]Helmholtz-Zentrum Dresden-Rossendorf, Dresden, Germany — [2]SLAC National Laboratory, Stanford, USA — [3]Universität Siegen, Siegen, Germany

The combination of ultra-intense lasers with x-ray free-electron lasers (XFELs) opens up a variety of applications in plasma and shock physics. Many phenomena during the laser-target interaction happen on short time scales in the range from femto- to picoseconds and length scales of tens of nanometers to a few micrometers. Unlike the ultra-short, highly coherent x-ray pulse, optical methods or conventional continuous x-ray sources cannot probe the dynamics of the bulk material with sufficient temporal and spatial resolution. Here we will show the potential of SAXS in combination with short-pulse laser experiments. With this method it is possible to draw conclusions about the electron density distribution in the target by analyzing the XFEL diffraction pattern in the vicinity of the direct beam. A setup to perform such SAXS experiments was developed and optimized during a beamtime at the Matter in Extreme Conditions instrument (MEC) at the Linear Coherent Light Source (LCLS) in Stanford. We will discuss the setup and present a preliminary analysis of the data obtained during this experiment.

AKBP 7.12 Thu 12:30 MOL 213

Predicting SAXS images beyond single scattering — •Marco Garten — HZDR, Dresden, Deutschland — TU Dresden, Dresden, Deutschland

Laser-generated solid density plasmas can be used to produce highly energetic electrons and ions. Diagnosing properties within those plasmas at nm length scales and down to fs time scales plays a crucial role in understanding the involved processes. This has only recently become feasible through the advent of X-Ray Free Electron Lasers (XFELs). XFELs now make experimental techniques like Small Angle X-Ray Scattering (SAXS) applicable to solid density plasmas.

We present a scalable GPU-based software framework for simulating photon scattering processes of X-ray beams in matter using Monte-Carlo methods. These simulations enable us to produce synthetic SAXS signals from the interaction of a modeled X-ray pulse with an arbitrarily complex, 3D electron density distribution obtained e.g. from detailed particle-in-cell simulations. Our new framework allows for single and multiple scattering and is extendable to include complex physics processes like ionization, atomic excitation and de-excitation to further enhance its predictive capability.

AKBP 8: Diagnostics, Control, Instrumentation

Time: Thursday 15:00–17:45 Location: MOL 213

AKBP 8.1 Thu 15:00 MOL 213

Electrostatic deflector development for JEDI — •Kirill Grigoryev — on behalf of the JEDI collaboration — III. Physikalisches Institut B, RWTH Aachen

The direct measurement of the proton or deuteron Electric Dipole Moment (EDM) has never been performed before. These experiments can be done at storage rings. As a starting point for a first measurement, the pure magnetic storage ring COSY at Forschungszentrum Jülich can be used. A dedicated storage ring will require pure electric or combined electric and magnetic deflection elements.

For testing the electrode material, shape, surface treatment and high voltage tests, a new laboratory was set up at RWTH Aachen. The experimental setup and results of the tests will be presented.

AKBP 8.2 Thu 15:15 MOL 213

Model of statistical errors in the search for the deuteron EDM in the storage ring — •Aleksandr Aksentev — Forschugszentrum Jülich, Jülich, Germany

In this work we investigate the standard error of the spin precession frequency estimate in an experiment for the search for the electric dipole moment (EDM) of the deuteron using the polarimeter. The basic principle of polarimetry is the scattering of a polarized beam on a carbon target. Since the number of particles in one fill is limited, we must maximize the utility of the beam. This raises the question of sampling efficiency, as the signal, being an oscillating function, varies in informational content. To address it, we define a numerical measurement model, and compare two sampling strategies (uniform and frequency-modulated) in terms of beam-use efficiency. The upshot is the formulation of the conditions necessary for the effective use of the modulated sampling strategy, and the evaluation of its advantage over the uniform strategy. The simulation results are also used to compare two competing analytical models for the standard error of the frequency estimate.

AKBP 8.3 Thu 15:30 MOL 213

An Active Spin Tune Feedback System for the Cooler Synchrotron (COSY) — •Nils Hempelmann — Institut für Kernphysik, Forschungszentrum Jülich

The Jülich Electric Dipole Moment Investigation (JEDI) Collaboration works on a measurement of the electric dipole moment (EDM) of charged hadrons using a storage ring. Such a dipole moment would violate CP symmetry, providing a test for physics beyond the Standard Model. To measure the EDM in a magnetic storage ring, the precession of the spin in the ring has to be kept in phase with an RF Wien Filter that manipulates the spin.

In fall 2015 an active feedback system that meets this requirement was successfully tested at COSY. The system works by adjusting the accelerator frequency, which changes the beam velocity and therefore the rate of spin precession. Data from the polarimeter EDDA are analyzed over a period of about one second to determine the relative phase between the spin precession and the external frequency, which is used to calculate the necessary correction.

In absence of a Wien filter an RF solenoid coil was used as a spin manipluator in the tests.

The test of the feedback system proofs that the method is suitable for a proof of principle experiment for EDM measurements at COSY.

AKBP 8.4 Thu 15:45 MOL 213

Acoustic diagnostic of the RF-gun at PITZ — •Andrea Heilrath, Igor Isaev, Mikhail Krasilnikov, Mario Pohl, and Frank Stephan — Deutsches Elektronen Synchrotron DESY, Platanenallee 6, 15738 Zeuthen, Germany

The Photo Injector Test facility at DESY in Zeuthen (PITZ) develops and optimizes high brightness RF photoinjectors for modern Free Electron Lasers. An L-band 1,6-cell normal conducting RF-gun is operated at high peak (up to 7 MW) and average (up to ˜50 kW) power levels. This causes a significant pulse heating of the copper gun cavity. Effective RF conditioning of such cavities is one of the important tasks of the photoinjector optimization. An interlock (IL) system serves to prevent severe damages during gun conditioning and operation. Recently several piezo sensors were installed around the RF-gun system (fixed at the waveguides and at some distance) additionally to the existing IL sensors. The signals from these sensors including their spectra were analyzed and correlated with different parameters of the standard gun operation as well as with various IL events. First results of the analysis will be presented, further improvements in the proposed diagnostics will be discussed.

AKBP 8.5 Thu 16:00 MOL 213

Entwicklung eines Faraday-Cup für den European XFEL — •Felix Riemer[1,2] und Martin Sachwitz[1] — [1]Deutsches Elektronen-Synchrotron DESY — [2]Humboldt-Universität zu Berlin

Ein Faraday-Cup ist ein Messgerät, was die Ladung eines Teilchenstrahls messen kann. Das Prinzip besteht darin, alle Ladungsträger und geladenen Sekundärteilchen vollständig im Faraday-Cup abzubremsen und den abfallenden Strom zu messen. Im Injektor des European XFEL in Hamburg sind momentan mehrere, provisorische Faraday-Cups aus Kupfer im Einsatz. Mit der Monte-Carlo Simulation FLUKA wurde berechnet, dass nur ca. 85% der Teilchen vom Messgerät detektiert werden; ein Großteil wird an der Oberfläche reflektiert. Ein mehrschichtiger Aufbau aus verschiedenen Materialien soll die Präzision deutlich erhöhen. Zugleich soll aber auf eine Optimierung der Baugröße geachtet werden, weil im Beschleuniger nicht viel Bauraum zur Verfügung steht. Das neu entwickelte Konzept weißt nach Simulation mit FLUKA eine deutlich höhere Genauigkeit auf, mehr als 99,9% der einfallenden Ladung wird vom Faraday-Cup detektiert.

AKBP 8.6 Thu 16:15 MOL 213

Model driven SAXS reconstruction — •Malte Zacharias — HZDR, Dresden, Deutschland — TU Dresden, Dresden, Deutschland

Laser-generated solid density plasmas can be used to produce highly energetic electrons and ions. Diagnosing properties within those plasmas at nm length scales and down to fs time scales plays a crucial role in understanding the involved processes. This has only recently become feasible through the advent of X-Ray Free Electron Lasers (XFELs). XFELs now make experimental techniques like Small Angle X-Ray Scattering (SAXS) applicable to solid density plasmas. As a straight-forward inverse Fourier transform of the SAXS signal is impossible due to lack of phase information, other approaches have to be used. Reconstruction methods like iterative phase retrieval algorithms are an option but in our case do a poor job without strong real space constraints. Our approach is to use parameterized models of the charge density distribution and to adjust their parameters to best fit the resulting simulated SAXS signal to the experimental data. Thus we obtain model information about experimental data in form of the fit parameters. Combining a model with an iterative reconstruction algorithm can be used to automatize the fitting. We present results where this model approach has been applied to a SAXS experiment with structured metal targets that had a well known periodic grating on the surface.

15 min. break

AKBP 8.7 Thu 16:45 MOL 213

Double Slit Interferometer for Transverse Beam Size Measurements at BESSY II — •Marten Koopmans, Paul Goslawski, Ji-Gwang Hwang, Markus Ries, Martin Ruprecht, and Andreas Schälicke — Helmholtz-Zentrum Berlin, Berlin

The VSR upgrade for the BESSY II storage ring demands additional beam diagnostics for machine commissioning and development. Currently, transverse beam size measurements are done with pinhole monitor systems. However, this system cannot provide bunch resolved measurements. Alternative methods to measure the transverse beam size using synchrotron radiation in the visible spectrum are interferometric techniques, which could also be upgraded to bunch resolved systems. For that purpose a double slit interferometer has been designed and constructed. Commissioning of the system has started and experimental results are discussed and compared with the existing pinhole system.

AKBP 8.8 Thu 17:00 MOL 213

Die digitale Hochfrequenzregelung des S-DALINAC - Herausforderungen des ERL-Betriebs* — •Manuel Steinhorst[1], Christoph Burandt[1], Michaela Arnold[1], Sebastian Orth[2], Uwe Bonnes[1], Thorsten Kürzeder[1] und Norbert Pietralla[1] — [1]IKP, TU Darmstadt, Deutschland — [2]TEMF, TU Darmstadt, Deutschland

Der supraleitende rezirkulierende Elektronen-Linearbeschleuniger S-DALINAC stellt das zentrale Forschungsgroßgerät des Instituts für Kernphysik der TU Darmstadt dar. In den Jahren 2015/2016 wurde eine dritte Rezirkulation eingebaut. Die neue Strahlführung bietet neben einer gesteigerten Maximalenergie die Möglichkeit den S-DALINAC als Energy Recovery Linac (ERL) zu betreiben. Dies stellt neue Anforderungen an die bestehende Hochfrequenzregelung. Für den Normalbetrieb der supraleitenden Beschleunigungsstrukturen wird hierfür seit 2010 erfolgreich ein digitales System eingesetzt. Dieses war jedoch nicht für einen ERL Betrieb konzipiert und optimiert worden. Dieser Vortrag stellt die digitale Hochfrequenzregelung des S-DALINAC vor und diskutiert die erwarteten Herausforderungen des ERL-Betriebs. *Gefördert durch die DFG im Rahmen von GRK 2128.

AKBP 8.9 Thu 17:15 MOL 213

Research and Development of Diamond Based Beam Monitoring and Diagnostics Systems at the S-DALINAC* — •Adrian Rost[1], Tetyana Galatyuk[1,2], and Jerzy Pietraszko[2] — [1]Institut für Kernphysik, Technische Universität Darmstadt, Germany — [2]GSI Helmholtzzentrum für Schwerinonenforschung, Darmstadt, Germany

For future experiments with the HADES and CBM detectors at FAIR in Darmstadt, a radiation hard and fast beam detector is required. The beam detector has to perform precise T0 measurements ($\sigma_{T0} < 50\,\mathrm{ps}$) and should also offer beam monitoring capabilities. These tasks can be fulfilled by utilizing single-crystal Chemical Vapor Deposition (scCVD) diamond based detectors. For research and development of such detectors, a test set-up will be installed at the Superconducting Darmstadt Electron Linear Accelerator (S-DALINAC) of TU Darmstadt.

A read-out system for a beam monitoring and diagnostics system is currently under development. It is based on the already well established TRB3 platform, which can provide FPGA based signal discriminators and high precision FPGA-TDCs with on-line monitoring capabilities. In this contribution the concept and the performance of a prototype beam monitoring system will be discussed. Furthermore the preparatory work, with particular focus on the beam-line simulations, for a multipurpose beam detector test set-up at the S-DALINAC will be addressed.

**This work has been supported by the DFG through GRK 2128 and VH-NG-823.*

AKBP 8.10 Thu 17:30 MOL 213

Konzeption einer Messung der Strahlausdehnung mit Hilfe eines Drahtscanners am S-DALINAC* — •Manuel Dutine, Lars Jürgensen, Jonas Pforr, Thorsten Kürzeder und Norbert Pietralla — IKP, TU Darmstadt

Der supraleitende Elektronen-Linearbeschleuniger S-DALINAC am Institut für Kernphysik der TU Darmstadt ermöglicht Elektronenstrahlen von bis zu 130 MeV im CW-Betrieb. Diese werden an diversen Experimentierplätzen unter anderem für hochauflösende Elektronenstreu-

experimente genutzt. Zur Steigerung der Energieschärfe und Verbesserung der Strahlfokussierbarkeit wurde ein Hochenergie-Scrapersystem installiert. Dieses System wirkt ebenfalls als Energiefilter kombiniert mit drei Halo-Scrapern. Um den Einfluss des Scrapersystems auf die Strahlqualität am Ort des Experiments zu überprüfen, sind Messungen der Strahlausdehnung bei verschiedenen Einstellungen der Scraper geplant. Für die vorhandene Geometrie der Streukammer wurde eine Drahtscanner-Messung entwickelt und die zu erwartenden Zählraten mittels einer GEANT4-Simulation abgeschätzt. Im Vortrag wird das Hochenergie-Scrapersystem kurz Vorgestellt und der Aufbau zur Messung der Strahlausdehnung gezeigt.

*Gefördert durch die DFG im Rahmen des GRK 2128.