Arbeitskreis Beschleunigerphysik (AKBP)

(Working Group on Accelerator Physics)

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Übersicht der Hauptvorträge und Fachsitzungen

(HS 7 und 8; Poster Foyer Nordbau)

Hauptvorträge

AKBP 5.1	Di	11:00–11:30	HS 7	**New Developments in Cyclotrons and Gantries for Proton Therapy** — •Marco Schippers
AKBP 5.2	Di	11:30–12:00	HS 7	**Non-destructive Beam Diagnostics for high Current Proton LINACs** — •Peter Forck
AKBP 5.3	Di	12:00–12:30	HS 7	**The High Brillance Neutron Source (HBS) - Challenges of a Modern Proton Accelerator** — •Holger Podlech
AKBP 5.4	Di	12:30–13:00	HS 7	**The High Brilliance Neutron Source (HBS) Project** — •Thomas Brückel

Hauptvorträge des fachübergreifenden Symposiums SYPA

Das vollständige Programm dieses Symposiums ist unter SYPA aufgeführt.

SYPA 1.1	Mi	14:00–14:30	Plenarsaal	**Laser-driven ion acceleration in plasmas** — •Jörg Schreiber
SYPA 1.2	Mi	14:30–15:00	Plenarsaal	**Laser-driven electron acceleration in plasmas** — •Jeroen van Tilborg
SYPA 1.3	Mi	15:00–15:30	Plenarsaal	**Beam-driven electron acceleration in plasmas** — •Richard D'Arcy
SYPA 1.4	Mi	15:30–16:00	Plenarsaal	**Solar energetic electron events: Trying to understand the role of the shock** — •Nina Dresing
SYPA 2.1	Mi	16:30–17:00	Plenarsaal	**Plasma Wakefield Acceleration: Instabilities and Stabilization** — •Alexander Pukhov
SYPA 2.2	Mi	17:00–17:30	Plenarsaal	**LUX - A Laser-Plasma Driven Undulator Beamline** — •Andreas R. Maier
SYPA 2.3	Mi	17:30–18:00	Plenarsaal	**Magnetic reconnection as a particle accelerator** — •Michael Hesse
SYPA 2.4	Mi	18:00–18:30	Plenarsaal	**Experimental demonstration of proton bunch self-modulation and of electron acceleration in a 10m-long plasma** — •Patric Muggli

Fachsitzungen

AKBP 1.1–1.7	Mo	14:00–15:45	HS 8	**Particle Sources and Radiofrequency 1**
AKBP 2.1–2.7	Mo	14:00–15:45	HS 7	**Diagnostics, Control and Instrumentation**
AKBP 3.1–3.7	Mo	16:30–18:15	HS 8	**Beam Dynamics**
AKBP 4.1–4.5	Mo	16:30–17:45	HS 7	**Diagnostics, Control and Instrumentation**
AKBP 5.1–5.4	Di	11:00–13:00	HS 7	**Modern Proton Accelerators - Challenges and Perspektives**
AKBP 6.1–6.7	Di	14:00–15:45	HS 8	**Free-Electron Lasers**
AKBP 7.1–7.5	Di	14:00–15:15	HS 7	**Hadron Accelerators and Colliders**
AKBP 8.1–8.5	Di	16:30–17:45	HS 8	**New Accelerator Concepts**
AKBP 9.1–9.8	Di	16:30–18:30	HS 7	**Electron Accelerators**
AKBP 10.1–10.6	Mi	11:00–12:30	HS 8	**New Accelerator Concepts**
AKBP 11.1–11.6	Mi	11:00–12:30	HS 7	**Synchrotron Radiation**

AKBP 12	Do	11:00–13:00	HS 7	**Bestowal of Prizes**
AKBP 13.1–13.4	Do	14:00–15:00	HS 8	**Hadron Accelerators and Colliders**
AKBP 14.1–14.4	Do	14:00–15:00	HS 7	**Radiofrequency 2**
AKBP 15.1–15.25	Do	16:30–18:00	Foyer Nordbau	**Poster session**
AKBP 16	Do	19:00–21:30	HS 7	**General Assembly of the Working Group on Accelerator Physics**

Mitgliederversammlung Arbeitskreis Beschleunigerphysik

(General Assembly of the Working Group on Accelerator Physics)

Donnerstag 19:00–21:30 HS 7

- Bericht der Vorsitzende
- Beschleunigerpreise
- Verschiedenes

AKBP 1: Particle Sources and Radiofrequency 1

Zeit: Montag 14:00–15:45 Raum: HS 8

AKBP 1.1 Mo 14:00 HS 8

Setup for cooled GaAs cathodes with increased charge lifetime — •Tobias Eggert, Joachim Enders, Martin Espig, Yuliya Fritsche, Dominik Gappa, Neeraj Kurichiyanil, and Markus Wagner — Institut für Kernphysik, TU Darmstadt

For high-current applications with spin-polarized electrons emitted from GaAs-photocathodes it is necessary to maximize the charge lifetime of the cathode material to ensure reliable operation. By using a cryogenic subvolume it is expected to improve the local vacuum conditions around the GaAs cathode, with its sensitive negative-electron-affinity surface. Furthermore, the cooling of the cathode itself also allows a higher laser power to be deposited in the material, resulting in higher possible currents. To further increase the lifetime, an electrostatic bend is introduced leading to the reduction of ion-backbombardment. Such an electron source is presently being developed at the Photo-CATCH test facility in Darmstadt. The current status of the source as well as future plans will be presented. Work supported by DFG (GRK 2128) and BMBF (05H18RDRB1).

AKBP 1.2 Mo 14:15 HS 8

Spin manipulation with the waveguide RF Wien filter — •Jamal Slim for the JEDI-Collaboration — III. Physikalisches Institut B, RWTH Aachen University, Aachen, Germany

The JEDI Collaboration aims at the first measurement of the Electric Dipole Moment of charged particles at the COoler SYnchrotron in Jülich. For this purpose a waveguide-based RF Wien filter has been developed and commissioned. This device acts as a spin rotator without inducing any beam distortion, i.e., beam steering and oscillation. This talk presents the preliminary measurement results of the spin manipulation with the RF Wien filter.

AKBP 1.3 Mo 14:30 HS 8

Systematic Studies of a Second Sound System for Quench Detection — •Bosse Bein[2], Wolfgang Hillert[2], Carsten Müller[1], Detlef Reschke[1], Jörn Schaffran[1], Sven Sievers[1], Lea Steder[1], and Mateusz Wiencek[1] — [1]DESY, Hamburg, Germany — [2]University of Hamburg, Hamburg, Germany

Several tools for quench detection of supra conducting radio frequency (SRF) cavities are existing. One of these techniques uses the excitation of temperature waves in liquid Helium which are created by a quench on the cavity surface. Below the lambda point so called second sound waves occur. Special sensors, like Oscillating Superleak Transducers (OSTs) are able to detect the waves. With the help of the OSTs the transit times of the signals are determined.

Using a set of algorithms one can postulate a most probable spot for the quench location. Two such methods are used at DESY: Multilateration and Raytracing. Their precision, their constraints and limits are compared, and the hardware systematics are studied. For this purpose a tool for calibration via simulation of a quench generated wave is developed. The simulation is done by injection of short heat pulses at exact known time and space coordinates.

Measurements with the calibration tool and results of data analyses obtained with both algorithms will be presented.

AKBP 1.4 Mo 14:45 HS 8

Updates on the RF Design of the 750 MHz PIXE RFQ — •Hermann Winrich Pommerenke[1,2], Vittorio Bencini[1], Amy Bilton[1], Lorenzo Giuntini[3], Alexej Grudiev[1], Alessandra Lombardi[1], Serge Mathot[1], Francesco Taccetti[3], Marc Timmins[1], Eric Montesinos[1], Ursula van Rienen[2], and Maurizio Vretenar[1] — [1]CERN, Geneva, Switzerland — [2]University of Rostock, Germany — [3]INFN, Florence, Italy

Protons with an energy of few MeV are commonly used for Ion Beam Analysis (IBA) of materials, in particular with the Proton Induced X-ray Emission technique (PIXE). The technique covers the non-destructive, quantitative analysis of elements with very good efficiency and ppm range detection limits. It it is widely used in different fields, in particular for the diagnosis of cultural heritage artwork.

As transporting artworks to the IBA facilities is often unacceptable, the PIXE RFQ, a one-meter long radio frequency quadrupole operating at 750 MHz, has been developed as a transportable proton accelerator within the collaborative MACHINA project between CERN and INFN. The PIXE RFQ is constructed at CERN based on the experience from the high-frequency RFQ for medical applications. The construction will be completed in the first quarter of 2019 and first measurements on artwork are expected in 2020.

This talk gives an update on the RF design of the PIXE RFQ accelerator, including simulation results regarding cavity geometry, coupler, thermal behaviour, and beam dynamics studies.

AKBP 1.5 Mo 15:00 HS 8

Development of a 200 keV Inverted-Geometry Polarized Photo-Electron Gun for Photo-CATCH* — •Maximilian Herbert, Joachim Enders, Yuliya Fritzsche, and Vincent Wende — Institut für Kernphysik, Technische Universität Darmstadt, Schlossgartenstraße 9, 64289 Darmstadt

The institute for nuclear physics at TU Darmstadt houses a dedicated test stand for Photo-Cathode Activation, Test and Cleaning using atomic-Hydrogen (Photo-CATCH). Using GaAs photocathodes to provide pulsed and/or polarized electron beams and featuring a 60 keV inverted-insulator geometry photo-electron gun with adjacent diagnostics beamline as well as a system for photocathode activation and cleaning, it furnishes the Superconducting Darmstadt Linear Accelerator S-DALINAC with an ideal environment for photo-electron gun research and development. Currently, an upgrade of the existing inverted geometry to 200 keV is being developed for operational tests at Photo-CATCH and future use at the S-DALINAC. This contribution will present status, challenges and perspectives of the 200 keV gun design.

*Supported by DFG through GRK 2128 "AccelencE".

AKBP 1.6 Mo 15:15 HS 8

Plasma Photocathode for Wakefield Acceleration — •Michael Stumpf, Severin Montag, and Georg Pretzler — Institut für Laser- und Plasmaphysik, Heinrich-Heine-Universität Düsseldorf

We present a newly developed setup for a plasma photocathode inside a wakefield acceleration structure that can be used in a Trojan Horse Injection scheme. The fs-laser based optical scheme provides precisely defined and modifiable electron bunch charges and volumes. Adaption to parameters required by the acceleration field is possible by exact control of the laser focus in intensity, size and 3D-shape. The modular, all-optical setup can be used in plasma and laser wakefield acceleration experiments. The injected charge has been simulated using different ionization models and is compared to experimentally obtained values. The agreement of those values also confirms the ultra-small initial spread of the electron bunch in time and space and the ultra-low transverse and longitudinal momenta. According to the Trojan Horse Injection scheme*, the electron bunch should keep low emittance in the nm rad regime after direct acceleration within a wakefield potential.
*B. Hidding et al., Phys. Rev. Lett. 108, 034001 (2012)

AKBP 1.7 Mo 15:30 HS 8

Estimation of the Critical RF Fields on a SRF Cavity Flange Transition — •Jonas Christian Wolff[1,2], Jens Iversen[1], Daniel Klinke[1], Denis Kostin[1], Detlef Reschke[1], Sven Thorsten Sievers[1], Alexey Sulimov[1], Jan-Hendrik Thie[1], Ralf Wendel[2], and Mateusz Wiencek[1] — [1]DESY, Notkestraße 85, 22607 Hamburg, Germany — [2]Hochschule für Angewandte Wissenschaften Hamburg, Berliner Tor 7, 20099 Hamburg, Germany

To minimize the distance between the flange contact and the iris of a superconducting radio frequency (SRF) cavity, it is required to know the critical value for the RF fields. This allows us to prevent a potential early quench at its flange contact area (transition). To avoid changes on the SRF cavity used for the tests, all RF cryogenic experiments will be carried out by using a cylinder in the center of a 1-cell cavity drift tube to increase the field density at its flange contact. This cylinder was designed and optimized by CST Microwave Studio simulations for the use of a test cavity with a comparatively low gradient to avoid field restrictions by the cavity. The ongoing work investigates the distance limitation for commonly used flanges at 1.3 GHz TESLA-Shape SRF cavities, originally designed for low field areas. Due to the high losses at the non superconducting seal a relatively low value can be expected to be critical. For this reason approaches to increase the critical RF fields will be investigated during the further process.

AKBP 2: Diagnostics, Control and Instrumentation

Zeit: Montag 14:00–15:45 Raum: HS 7

AKBP 2.1 Mo 14:00 HS 7

First Comissioning Results of a Software Upgrade for the Slow Orbit Feedback at the Electron Storage Ring at DELT — •Stephan Kötter, Andreas Glassl, and Thomas Weis — TU Dortmund University (DELTA) Center for Synchrotron Radiation

A software upgrade for the slow orbit feedback at the electron storage ring at DELTA is in commissioning. The program is able to subject corrector currents and transverse orbit positions to equality and inequality constraints by using an interior-point method made for constrained, quadratic optimization. This feature is exploited to align the orbit with beamlines and to minimize currents of power sources for steerer magnets.

AKBP 2.2 Mo 14:15 HS 7

Vertical Beam-Size Diagnostics at BESSY II: A Comparative Study — •Marten Koopmans[1,2], Ji-Gwang Hwang[1], Peter Kuske[1], Markus Ries[1], and Gregor Schiwietz[1] — [1]Helmholtz-Zentrum Berlin — [2]Humboldt-Universität zu Berlin

With the VSR upgrade for the BESSY II electron storage ring [1] bunch resolved diagnostics are required for machine commissioning and to ensure the long-term quality and stability of operation. For transverse beam size measurements we are going to use an interferometric method, which will be combined with a fast intensified CCD camera at a subsequent stage. A double-slit interferometer method has already been verified successfully at BESSY II [2]. In addition the obstacle-bar method [3] is presently being tested as an alternative interferometric technique. It uses diffraction from a centered horizontal X-ray blocker for vertical beam-size determination. This technique will lead to enhanced photon statistics and possibly improve monitor resolution. We are using either π- or σ-polarized synchrotron radiation at the first of the new diagnostic beamlines for BESSY VSR. Measurements of the two interferometer schemes and X-ray pinhole as function of a vertical electron beam excitation are compared. The results will be presented and discussed at the conference.

[1] A. Jankowiak et al., eds., "BESSY VSR - Technical Design Study", HZB, Germany, June 2015. DOI: 10.5442/R0001

[2] M. Koopmans et al., in Proc. IPAC'17, pp. 149-152.

[3] J. Breunlin et. al., in Nucl. Instrum. Meth., vol. A803, pp. 55-64, 2015

AKBP 2.3 Mo 14:30 HS 7

Entwicklung zur Unterstützung von Strahlführung am S-DALINAC mit Methoden der künstlichen Intelligenz* — •J. Hanten, M. Arnold, T. Bahlo, J. Birkhan, C. Caliari, R. Grewe, N. Pietralla, T. Schösser und M. Steinhorst — Institut für Kernphysik, TU Darmstadt

Für das EPICS-basierte Kontrollsystem des supraleitenden Elektronenlinearbeschleunigers S-DALINAC werden derzeit KI basierte Erweiterungen entwickelt. Ein Teilbereich dieser Erweiterungen ist die Unterstützung der Strahljustierung und Kontrolle mit künstlichen neuronalen Netzten, welche verstärkendes Lernen nutzen. Ein Teilchenbeschleuniger hat einen sehr großen Parameterraum mit oftmals versteckten Verknüpfungen zwischen dessen Größen. Künstliche neuronale Netze sind somit ein geeignetes Mittel, das Verhalten des Strahls vorherzusagen. Unterschiedliche Netzstrukturen und Trainingsmethoden für das verstärkende Lernen werden derzeit anhand von Simulationen getestet. Eine weitere Aufgabe für die Kontrollsystemerweiterung ist die Entwicklung eines intelligenten Überwachungswerkzeugs um mögliche Fehlfunktionen des Heliumverflüssigers mit Hilfe von lernenden Algorithmen vorherzusagen und zu verhindern. In diesem Beitrag werden das Konzept der beiden geplanten Erweiterungen und erste Ergebnisse vorgestellt.

*Gefördert durch DFG unter GRK 2128

AKBP 2.4 Mo 14:45 HS 7

Electrostatic deflector development — •Christian Käseberg[1,2], Andreas Lehrach[1,2], and Kirill Grigoryev[3] for the JEDI-Collaboration — [1]Institute for Nuclear Physics IV, FZ Jülich, Germany — [2]III. Physikalisches Institut B, RWTH Aachen University, Germany — [3]Institute for Nuclear Physics II, FZ Jülich, Germany

The direct measurement of the proton or deuteron Electric Dipole Moment (EDM) has never been performed before. These experiments can be done at electrostatic storage ring. As a starting point the magnetic storage ring COSY at Forschungszentrum Jülich can be used. It will require implementation of the electrostatic or electromagnetic beam-bending elements. For testing the electrodes' material, shape, surface treatment and high voltage, a real size large deflector is developed and will be checked in a magnetic field of a large-gap dipole magnet. The experimental setup and the laboratory test results will be presented.

AKBP 2.5 Mo 15:00 HS 7

Design und Aufbau eines OTR-Messplatzes zur Strahlqualitätsmessung am S-DALINAC* — •M. Fischer, M. Arnold, M. Dutine, L. Jürgensen, J. Pforr und N. Pietralla — Institut für Kernphysik, TU Darmstadt, Darmstadt

Der S-DALINAC [1] ist der supraleitende Elektronenlinearbeschleuniger am Institut für Kernphysik der Technischen Universität Darmstadt. Er ist für Strahlenergien von bis zu 130 MeV konzipiert, die unter anderem für Experimente in der kernphysikalischen Grundlagenforschung genutzt werden. Nach dem Einbau eines Scrapersystems in die Extraktionsstrahlführung wurde erstmals eine optische Vermessung der Strahlausdehnung in einer darauf folgenden dispersiven Sektion durchgeführt, um den Einfluss des Scrapersystems auf die Energieunschärfe des Elektronenstrahls zu überprüfen. Die erfolgreiche Durchführung bot Anlass, einen neuen Messplatz in dieser Sektion zu installieren. Mit diesem sollen das Strahlprofil sowie zeitliche Fluktuationen des Strahls durch Optical Transition Radiation (OTR) vermessen werden. Der neue Aufbau hat zum Ziel, die Unsicherheiten der vorangegangenen Messung deutlich zu reduzieren und die Energieunschärfe des Strahls ohne Zuhilfenahme eines Spektrometers in kurzer Zeit bestimmen zu können. In diesem Vortrag wird das Design und die Funktionsweise sowie der aktuelle Status des OTR-Messplatzes gezeigt.

*Gefördert durch die DFG im Rahmen des GRK 2128

[1] N. Pietralla, Nuclear Physics News, Vol. 28, No. 2, 4 (2018).

AKBP 2.6 Mo 15:15 HS 7

Turn-by-turn horizontal bunch size and energy spread studies at KARA — •Benjamin Kehrer[1], Meghana Patil[1], Miriam Brosi[1], Erik Bründermann[2], Stefan Funkner[1], Gudrun Niehues[1], Marcel Schuh[2], Johannes Steinmann[2], and Anke-Susanne Müller[1,2] — [1]LAS, KIT, Karlsruhe — [2]IBPT, KIT, Karlsruhe

The energy spread is an important beam dynamics parameter. It can be derived from measurements of the horizontal bunch size. At the KIT storage ring KARA (Karlsruhe Research Accelerator) at Karlsruhe Institute of Technology (KIT) a fast-gated camera is routinely used for horizontal bunch size measurements with a single-turn resolution for a limited time span. To overcome the limits of the current camera setup in respect to time and energy resolution and time span, a high-speed line array with up to 10 Mfps, the KALYPSO system, is foreseen as a successor. The KALYPSO versions range from 256-pixel to 1024-pixel and allow unlimited turn-by-turn imaging of a single bunch at KARA. We successfully tested such a system at our visible light diagnostics beamline. In this contribution, we give a status on the FGC studies and present first test results using KALYPSO.

AKBP 2.7 Mo 15:30 HS 7

Development of beam position monitors for storage rings — •Falastine Abusaif for the JEDI-Collaboration — Juelich Forschungszentrum IKP-2 — RWTH Aachen University, Physics Institute B, Germany

The Juelich Electric Dipole Moment (JEDI) Collaboration is presently preparing for a first direct measurement of the deuteron Electric Dipole Moment (EDM) in the COoler SYnchrotron (COSY). A non-vanishing EDM signal would provide a new source for CP violation which could answer the mystery behind the matter abundance in the universe. The EDM is expected to be very small that can be easily mimicked by fake signals.

In accelerator physics, understanding and controlling beam dynamics can be considered as important step towards an EDM measurement. Beam position monitors are needed for tracking beam transverse coordinates and to maintain overall stable orbit.

A new type of Beam Position Monitor (BPM) which is based on a Rogowski pickup coil was developed lately and installed at COSY. In this talk , results of different tests and calibrations that were performed in the lab will be presented. In addition to the first commissioning results for the installed BPM coil during the November/December 2018 beam time.

AKBP 3: Beam Dynamics

Zeit: Montag 16:30–18:15 Raum: HS 8

AKBP 3.1 Mo 16:30 HS 8

Beam-based alignment at the Cooler Syncrotron (COSY) — •Tim Wagner for the JEDI-Collaboration — Institut für Kernphysik, Forschungszentrum Jülich — III. Physikalisches Institut B, RWTH Aachen University

There is a matter-antimatter asymmetry observed in the universe that can not be explained by the Standard Model of particle physics. To resolve that problem additional CP violating phenomena are needed. A candidate for an additional CP violating phenomenon is a non-vanishing Electric Dipole Moment (EDM) of subatomic particles. Since permanent EDMs violate parity and time reversal symmetries, they also violate CP if the CPT-theorem holds.

The Jülich Electric Dipole moment Investigation (JEDI) Collaboration works on a direct measurement of the electric dipole moment (EDM) of protons and deuterons using a storage ring. The JEDI experiment requires a small beam orbit RMS in order to measure the EDM. Therefore an ongoing upgrade of the Cooler Syncrotron (COSY) is done in order to improve the precision of the beam position. One of part of this upgrade is to determine the magnetic center of the quadrupoles with respect to the beam position monitors. This can be done with the so called beam-based alignment method. In this talk the first results of the beam based alignment measurement performed in February 2019 will be presented.

AKBP 3.2 Mo 16:45 HS 8

Beam Dynamics Simulations for the ERL Mode at the S-DALINAC* — •F. Schliessmann, M. Arnold, J. Pforr, and N. Pietralla — Institut für Kernphysik, Darmstadt, Germany

The S-DALINAC [1] is a superconducting recirculating electron accelerator at TU Darmstadt. An additional recirculation beamline was installed in the years 2015-2016, so that the beam can pass the main accelerator up to four times in order to reach an energy gain of up to 130 MeV or to run the accelerator as a onefold or twofold Energy Recovery Linac (ERL) by shifting the path length of this recirculation beamline by 180°. Since the electrons' kinetic energy at injection and extraction in ERL mode is less than 8 MeV ($\gamma < 17$, $\beta < 0.9982$) and since eight 20-cell cavities designed for $\beta = 1$ are used in the main accelerator, the electrons suffer from the effect of phase slippage. In this contribution, the 6D beam dynamics simulations for ERL mode considering that phase slippage will be presented.

*Work supported by DFG through GRK 2128 and BMBF through grant No. 05H18RDRB2.

[1] N. Pietralla, Nuclear Physics News, Vol. 28, No. 2, 4 (2018).

AKBP 3.3 Mo 17:00 HS 8

Optimization of the injection beam line at COSY — •Benat Alberdi[1,2], Joerg Pretz[1,2], and Christian Weidemann[1] for the JEDI-Collaboration — [1]IKP FZ Juelich, Germany — [2]RWTH Aachen University, Germany

The Cooler Synchrotron (COSY) is a particle accelerator and storage ring operated by the Institute for Nuclear Physics (IKP) at Forschungszentrum Juelich. The facility provides polarized and unpolarized beam sources, a cyclotron, an injection beam line and the synchrotron itself, which besides many other features contains electron and stochastic cooling systems. The injection beam line of CoSy has been injecting 45 MeV proton and 75 MeV deuteron beams from the cyclotron into the ring since 1991. The optimization of the injection is done by hand and, therefore, the opportunity for improvement is substantial. Currently, a new approach is being developed in order to make this process of optimization automatic. The main objective is to rely on computational and machine learning methods to set the injection beam line parameters in order to achieve desirable results and match the synchrotron's properties such as its acceptance. We discuss the different necessary steps to reach this goal. The process includes a first analysis of the injection beam line lattice and the optimization of its sections using the Bmad software, the characterization of the beam in the injection beam line, the calculation of its main parameters and, finally, the identification and automatic optimization of the ones we are interested in.

AKBP 3.4 Mo 17:15 HS 8

Influence of the Longitudinal Damping Time on the Micro-bunching Instability — •Miriam Brosi, Julian Gethmann, Patrick Schreiber, Johannes Steinmann, Benjamin Kehrer, Alexander Papasch, Axel Bernhard, Erik Bründermann, and Anke-Susanne Müller — Karlsruhe Institute of Technology, Karlsruhe, Deutschland

At the KIT storage ring KARA (KArlsruhe Research Accelerator), the momentum compaction factor can be reduced leading to natural bunch lengths in the ps range. Due to the high degree of longitudinal compression, the micro-bunching instability arises. During this longitudinal instability, the bunches emit bursts of intense coherent synchrotron radiation in the THz frequency range caused by the complex longitudinal dynamics. The temporal pattern of the emitted bursts depends on given machine parameters, like momentum compaction factor, acceleration voltage, and damping time. In this talk, the influence of the damping time is studied by utilizing the CLIC damping wiggler prototype installed in KARA as well as by simulations using the Vlasov-Fokker-Planck solver Inovesa.

AKBP 3.5 Mo 17:30 HS 8

Transfer Line for ultra short bunches from FLUTE to cSTART — •Jens Schäfer[2], Bastian Härer[1], Alexander Papash[1], and Anke-Susanne Müller[1,2] — [1]IBPT, KIT, Karlsruhe, Germany — [2]LAS, KIT, Karlsruhe, Germany

The FLUTE test experiment at KIT produces 50 MeV electron bunches with ultra short bunch lengths of only a few femtoseconds to create coherent THz radiation. These bunches will be transferred to the high acceptance storage ring cSTART which will be installed right above FLUTE. The low energy loss due to synchrotron radiation at 50 MeV results in a damping time of 20 s which makes cSTART an excellent tool to investigate short bunches in a non-equilibrium regime. This presentation adresses the status of the transfer line from FLUTE to cSTART which should maintain the ultra short bunch length and provide additional compression if needed. The layout of FLUTE and cSTART requires deflection of the beam in both transversal planes with only limited space. At the insertion point, the beam parameters have to be matched to the optics of cSTART with a given flexibility, taking non-linear effects into account. In addition cSTART serves as a test area for a LWFA as full-energy injector, therefore the transfer line has to allow modifications of the energy spread for preliminary studies.

AKBP 3.6 Mo 17:45 HS 8

A CLIC damping wiggler at KIT—from beam dynamics simulations to short bunch experiments — •Julian Gethmann[1], Axel Bernhard[2], Miriam Brosi[1], Benjamin Kehrer[1], Alexander Papasch[2], and Anke-Susanne Müller[1,2] — [1]LAS, KIT, Karlsruhe — [2]IBPT, KIT, Karlsruhe

(As a part of the CLIC collaboration) A CLIC damping wiggler prototype has been installed at the KArlsruhe Research Accelerator synchrotron light source in order to validate the technical design of the 3 T superconducting conduction cooled wiggler and to carry out studies on beam dynamics, including collective effects. This talk will focus on the influence of this device on the beam dynamics and its capability of deliberately varying the damping time, which was used for the detailed study of THz radiation in KIT's storage ring KARA's (KArlsruhe Research Accelerator) short bunch mode operation.

AKBP 3.7 Mo 18:00 HS 8

Coherent synchrotron radiation at the very large acceptance compact storage ring cSTART — •Andreas Kaiser[1], Bastian Härer[2], Alexander Papash[2], Jens Schäfer[1], and Anke-Susanne Müller[1,2] — [1]LAS, KIT, Karlsruhe, Germany — [2]IBPT, KIT, Karl-

sruhe, Germany

The planned very large acceptance compact storage ring (cSTART) at KIT is designed to cope with ultra-short bunches from a laser wakefield accelerator (LWFA) as injector. Because of their high intensity at wavelength larger than the bunchlength, these bunches have excellent characteristics for the production of coherent synchrotron radiation (CSR). In this contribution the effect of the CSR self interaction with the beam in cSTART is studied by tracking simulations using elegant.

AKBP 4: Diagnostics, Control and Instrumentation

Zeit: Montag 16:30–17:45 Raum: HS 7

AKBP 4.1 Mo 16:30 HS 7

Continuous Bunch-by-Bunch Reconstruction of Short Detector Pulses — •Matthias Martin[1], Miriam Brosi[1], Erik Bründermann[1], Michele Caselle[2], Patrick Schreiber[1], Johannes Steinmann[3], and Anke-Susanne Müller[1,3] — [1]LAS, KIT, Karlsruhe — [2]IPE, KIT, Karlsruhe — [3]IBPT, KIT, Karlsruhe

The KAPTURE system (KArlsruhe Pulse Taking and Ultrafast Readout Electronics), developed at Karlsruhe Institute of Technology (KIT), was designed to digitize detector pulses during multi-bunch operation at the KIT storage ring KARA (Karlsruhe Research Accelerator). KAPTURE provides digitization for pulses at rates of 500 MHz using up to 4 sampling points per pulse to record each bunch and each turn for potentially unlimited time. The new KAPTURE-2 system now provides eight sampling points per pulse, including baseline sampling between pulses, which allows improved reconstruction of the pulse shape. The advanced reconstruction of the pulse shape is realized with a highly parallelised implementation on GPU. The system will be used for the investigation on longitudinal beam dynamics e.g. by measuring instability induced CSR fluctuations or arrival time oscillations. This contribution will report on first results of the KAPTURE-2 system at KARA.

AKBP 4.2 Mo 16:45 HS 7

FLUTE Profile Monitors - From Image to Information — •Thiemo Schmelzer[1], Wolfgang Mexner[2], Michael Nasse[2], Robert Ruprecht[2], Marcel Schuh[2], Nigel Smale[2], Minjie Yan[2], and Anke-Susanne Müller[1,2] — [1]LAS, KIT, Karlsruhe — [2]IBPT, KIT, Karlsruhe

FLUTE (Ferninfrarot Linac- Und Test-Experiment) is a compact versatile linear accelerator at Karlsruhe Institute for Technology (KIT). It serves as a platform for a variety of accelerator studies as well as a source of strong ultra-short THz pulses for photon science. For the characterization of electron bunches different diagnostic systems are needed. The profile and shape of an electron bunch is measured with profile monitors at FLUTE, using a scintillating screen and a camera to retrieve the transversal spot of the bunch. After the data acquisition, the image is processed to find the beam properties, e.g. spot size. This contribution is focused on the profile monitors at FLUTE, including the acquisition and analysis of the transversal beam image.

AKBP 4.3 Mo 17:00 HS 7

FPGA based real-time signal processing for particle-detectors at COSY — •Mathis Beyss for the JEDI-Collaboration — Forschungszentrum Jülich — Rheinisch-Westfälische Technische Hochschule Aachen

Field programmable gate arrays (FPGAs) allow fast signal processing due to high parallelisation while offering highly customizable circuit design; they are nowadays of high importance in many data processing applications.

At the COoler SYnchrotron (COSY) at the Forschungszentrum Jülich, hydrogen atom detectors (H0) consisting of two plastic scintillators are used to observe the electron-ion recombination rate during electron cooling of the proton beam. The recombination rate provides valuable information on the alignment of the electron and proton beam. Using FPGAs and a System-on-a-Chip approach a fast data acquisition and processing system of the detector signals will be set up and integrated into the Experimental Physics and Industrial Control System (EPICS).

In this work the processing chain from signal discrimination up to coincidence counting of the detected particles and the implementation based on the FPGA development board will be presented.

AKBP 4.4 Mo 17:15 HS 7

Revealing experimental instabilities and improvements in the optics for Undulator interferometry — •Pascal Klag[1], Patrick Achenbach[1], Toshiyuki Gogami[2], Philipp Herrmann[1], Masashi Kaneta[2], Yoshihiro Konishi[2], Werner Lauth[1], Sho Nagao[2], Satoshi Nakamura[2], Josef Pochodzalla[1], and Yuichi Toyama[2] — [1]Johannes Gutenberg-Universität Mainz — [2]Tohoku University Sendai

The Mainz microtron is an electron accelerator, which delivers electron energies up to 1.6 GeV, with a small spread of the energy σbeam<13keV. The uncertainty for the absolute energy for all available beam energies was limited to 160 keV. A novel method is used to improve the uncertainty for the energy of a 195 MeV beam. The method is based on interferometry with two spatially separated light sources (undulators) driven by relativistic electrons. A beamtime has been performed, that was dedicated to systematic effects of the energy measurement by undulator interferometry. The analysis of the data revealed that a combination of the moving stage, optics, the magnetic field and the stabilization of the electron beam acted as sources for deviations from a distortion free signal. The uncertainty for the measurement shall be quantified on a maximal rigid system. The presentation will cover how the optics gave a systematic error, but on the other hand, how they beneficially contributed to the alignment.

AKBP 4.5 Mo 17:30 HS 7

Characterization of the FLUTE compressor Magnets — •Yimin Tong — Nancystr.22, Karlsruhe, Deutschland

FLUTE (Ferninfrarot Linac- Und Test-Experiment) is a compact versatile linear accelerator at Karlsruhe Institute for Technology (KIT). Its primary goal is to serve as a platform for a variety of accelerator studies as well as to generate strong ultra-short THz pulses for photon science. In order to achieve optimal bunch compression, the magnet field of the FLUTE quadrupole and and compressor dipole magnets need to meet tight tolerances. The compressor dipoles are currently characterized at the KIT magnet test bench LASMagLab. In this contribution we report on the first results of this magnet characterization.

AKBP 5: Modern Proton Accelerators - Challenges and Perspektives

Zeit: Dienstag 11:00–13:00 Raum: HS 7

Hauptvortrag AKBP 5.1 Di 11:00 HS 7

New Developments in Cyclotrons and Gantries for Proton Therapy — •Marco Schippers — Paul Scherrer Institut, Villigen, Switzerland

After an introduction to proton therapy and the basic characteristics of cyclotrons for this application, the special role of the cyclotron in proton therapy will be discussed. It will be shown how modern technology like e.g. superconductivity is applied to make the cyclotron more compact and cheaper after its initial simplification from an accelerator for physics research into a medical device. However, it will also be shown how several of these developments could be a limitation in currently available successful treatment techniques.

To irradiate the tumor from different directions a gantry is used. This is a beam transport system mounted on a mechanical structure that can rotate around the patient. Due to the masses and sizes of the magnets for the beam transport, such a gantry has a typical diameter of 10-12 m and a mass of 100-200 tons. To reduce the associated costs of such gantries several groups are working on various new designs.

The development of smaller and/or less heavy gantries requires the application of special techniques in the transport of charged particle beams.

In addition to a possible cost reduction, new technologies also enable possibilities to apply new irradiation techniques to achieve an often beneficially much faster irradiation treatment of a patient. Recent developments in this field will be discussed.

Hauptvortrag AKBP 5.2 Di 11:30 HS 7

Non-destructive Beam Diagnostics for high Current Proton LINACs — •Peter Forck — GSI

To achieve an efficient acceleration, high current hadron LINACs are operated close to their technical limits and in many cases a non-standard beam dynamics is chosen. Beam parameters have to be well controlled calling for a precise beam measurement. Non-invasive beam instrumentation is preferred to enable the simultaneous observation along the entire LINAC and to prevent for the destruction of any intersecting material.

For pulsed LINACs the beam current and transmission measurements with current transformers is standard, but an extended principle suited for cw-LINACs had recently been established. Non-invasive profile measurements are based on the detection of residual gas ionization products by an Ionization Profile Monitor or the detection of beam induced fluorescence photons. Such systems were recently developed. For H^--beams photo-detachment by a scanning laser beam can be applied for profile and emittance determination. The capability of methods for bunch shape determination will be addressed. Examples from different accelerators illustrate the applicability. Perspectives for the instrumentation will be discussed in this overview talk.

Hauptvortrag AKBP 5.3 Di 12:00 HS 7

The High Brillance Neutron Source (HBS) - Challenges of a Modern Proton Accelerator — •Holger Podlech[1], Martin Droba[1], Klaus Kümpel[1], Sarah Lamprecht[1], Oliver Meusel[1], Nils Petry[1], Philipp Schneider[1], Malte Schwarz[1], Chao Li[2], Chuan Zhang[3], Johannes Baggemann[2], Thomas Brückel[2], Tobias Cronert[2], Paul Doege[2], Thomas Gutberlet[2], Eric Mauerhofer[2], Ulrich Rücker[2], Paul Zakalek[2], and Sarah Böhm[4] — [1]Goethe Universität Frankfurt (IAP) — [2]Forschungszentrum Jülich GmbH — [3]GSI Helmholtzzentrum — [4]RWTH Aachen

Due to the decommissioning of several research reactors there will be a severe drop in available neutrons for research in Europe in the next decade despite the commissioning of the European Spallation Source (ESS). The High Brilliance Neutron Source (HBS) currently under development at Forschungszentrum Jülich is scalable in terms of beam energy and power due to its modular design. The driver Linac for HBS at will accelerate a 100 mA proton beam to 70 MeV. The Linac is operated with a beam duty cycle of up to 6% (11% RF duty cycle) and can simultaneously deliver three proton pulse lengths (384 Hz at 52 μ s, 96 Hz at 208 μ s and 24 Hz at 832 μ s) for three neutron production targets. The front end of the HBS Linac consists of an ECR source, LEBT and a 2.5 MeV RFQ followed by a CH-DTL with 35 room temperature CH-cavities. The presentation describes the conceptual design and the challenges of such a modern high power proton accelerator with high reliability and availability.

Hauptvortrag AKBP 5.4 Di 12:30 HS 7

The High Brilliance Neutron Source (HBS) Project — Thomas Gutberlet[1], Ulrich Rücker[1], Paul Zakalek[1], Eric Mauerhofer[1], Tobias Cronert[1], Johannes Baggemann[1], Paul Doege[1], Marius Rimmler[1], Sarah Böhm[2], Jinjing Li[1], Olaf Felden[1], Ralf Gebel[1], Holger Podlech[3], Oliver Meusel[3], and •Thomas Brückel[1] — [1]Forschungszentrum Jülich GmbH — [2]RWTH Aachen University — [3]Goethe University Frankfurt

Neutron scattering has proven to be one of the most powerful methods for studying structure and dynamics of condensed matter on atomic length and time scales. It is essential to understand processes, phenomena and functionalities in a wide range of materials. Accelerator driven neutron sources with high brilliance neutron provision are an attractive option as older research reactors are fading out. The Juelich Centre for Neutron Science is developing a compact accelerator driven high-brilliance neutron source to offer access for science and industry to neutrons in form of a medium-flux, but high-brilliance neutron facility. The High-Brilliance Neutron Source (HBS) will consist of a high current proton accelerator, compact neutron production and moderator system and optimized neutron extraction and transport for thermal and cold neutrons. The project will allow construction of a scalable neutron source ranging from a university-based neutron laboratory to a full-fledged user facility with open access and service. We will describe the currents status of the project, the requirements for the accelerator, the next steps, milestones and the vision for the future use of neutrons at universities and research institutes.

AKBP 6: Free-Electron Lasers

Zeit: Dienstag 14:00–15:45 Raum: HS 8

AKBP 6.1 Di 14:00 HS 8

High-temperature superconducting undulators for compact Free Electron Lasers — •Sebastian Richter[1,3], Axel Bernhard[1], Julian Gethmann[1], Kantaphon Damminsek[1], Daniel Schoerling[3], and Anke-Susanne Müller[1,2] — [1]LAS, KIT, Karlsruhe — [2]IBPT, KIT, Karlsruhe — [3]CERN, Genva, Switzerland

Future compact Free Electron Lasers driven by X-band LINACs or laser plasma accelerators might strongly benefit from the application of short-period superconducting undulators wound from high-temperature superconducting (HTS) tape. We present parameters studies exploring the potential of the HTS undulator technology for future compact FELs.

AKBP 6.2 Di 14:15 HS 8

Cryogenic Undulator for a Laser-Plasma Driven FEL Demonstrator — •Maximilian Trunk[1], Johannes Bahrdt[2], and Andreas R. Maier[1] — [1]Center for Free-Electron Laser Science & Department of Physics, University of Hamburg, 22761 Hamburg, Germany — [2]Helmholtz-Zentrum Berlin für Materialien und Energie GmbH Hahn-Meitner-Platz 1, 14109 Berlin

Laser-plasma accelerators are promising candidates to drive a next-generation FEL. The LUX accelerator, developed and operated by the LUX research group at the University of Hamburg, recently demonstrated spontaneous undulator radiation from laser-plasma generated electron beams. A future upgrade of the beamline will use the cryogenic undulator FROSTY to demonstrate first FEL gain from laser-plasma electron beams following the decomression scheme developed in our group. This contribution will report on the commissioning of the FROSTY undulator towards a first FEL experiment.

AKBP 6.3 Di 14:30 HS 8

Impact of electron beam chirp on seeded Free-Electron Lasers — •Georgia Paraskaki[1], Bart Faatz[1], Vanessa Grattoni[1], Wolfgang Hillert[2], Christoph Lechner[1], and Johann Zemella[1] — [1]Deutsches Elektronen-Synchrotron (DESY), Hamburg — [2]Universität Hamburg, Hamburg

Free-electron lasers (FELs) deliver transversely coherent light pulses of high brightness. However, the radiation produced in FELs with self-amplified spontaneous emission (SASE) has poor temporal coherence. In seeded FELs, this is enhanced by initiating the FEL amplification process using an external, coherent light pulse. One parameter affecting the properties of the generated radiation is the chirp of the electron beam driving the seeded FEL. In this contribution, the impact of this electron beam property will be discussed.

AKBP 6.4 Di 14:45 HS 8

Simulation studies for a EEHG seeded FEL in the XUV — •Vanessa Grattoni[1], Christoph Lechner[1], Wolfgang Hillert[2], Georgia Paraskaki[1], and Ralph Assmann[1] — [1]DESY, Hamburg, Deutschland — [2]Universität Hamburg, Hamburg, Deutschland

Echo enabled harmonic generation (EEHG) is a promising technique for seeded free electron lasers not only to go down to wavelengths of 1 nm, but also to simplify the schemes that are currently used to achieve a similar wavelength range (double-cascaded HGHG). Thus a study op-

timizing the EEHG performance in the wavelength range from 60 to 4 nm is performed, assuming a linear accelerator operated at electron beam energies of 750 MeV and 1.35 GeV. These two working points are analyzed in detail for two different seed laser frequencies: visible and UV.

AKBP 6.5 Di 15:00 HS 8

Resonant small angle x-ray scattering probing ultrashort pulse high-intensity laser-solid interactions — •L. Gaus[1], M. Bussmann[1], A. L. Garcia[1], S. Glenzer[2], C. Gutt[3], B. Nagler[2], A. Pelka[1], M. Rödel[1], H.-P. Schlenvoigt[1], T. Cowan[1], U. Schramm[1], and T. Kluge[1] — [1]HZDR — [2]SLAC — [3]Uni. Siegen

The development of second-generation short-pulse laser-driven radiation sources requires a mature understanding of the relativistic laser-plasma processes as e.g. plasma oscillations, heating and transport of relativistic electrons as well as the development of plasma instabilities. These dynamic effects occurring on femtosecond and nanometer scales are very difficult to access experimentally.

In a first experiment in 2014 at the Matter of Extreme Conditions facility at LCLS we demonstrated that Small Angle X-ray Scattering (SAXS) of femtosecond x-ray free electron laser pulses is able to make these fundamental processes accessible on the relevant time and length scales in direct in-situ pump-probe experiments [Kluge et al., Phys. Rev. X 8, 031068 (2018)]. Here we report on a recent follow-up experiment with significantly higher pump intensity reaching the relativistic intensity domain, improved targetry, XFEL shaping and particle diagnostics. We give an overview of the new capabilities in combining a full suite of particle and radiation diagnostics and SAXS scattering. Especially probing at resonant x-ray energies can give new insight into the ultra-fast ionization processes, plasma opacity and equation-of-state in non-equilibrium plasmas.

AKBP 6.6 Di 15:15 HS 8

Current status of the EEHG upgrade plan at the DELTA short-pulse source — •Benedikt Büsing, Shaukat Khan, Daniel Krieg, Carsten Mai, Arne Meyer auf der Heide, Maximilian Schmutzler, and Frederik Teutenberg — Center for Synchrotron Radiation (DELTA), TU Dortmund University, Dortmund, Germany

To generate short pulses at short wavelengths in storage rings, seeding schemes from free-electron lasers can be adopted. Energy modulation induced by laser-electron interaction leads to micro-bunching and coherent emission of radiation.

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. An upgrade torwards echo-enabled harmonic generation (EEHG) is planed to reach even shorter wavelengths. The current status and simulation results including optics studies for the future lattice will be presented.

This project is supported by the accelerator initiative (ARD) of the Helmholtz Association and by the BMBF under contract 05K16PEA.

AKBP 6.7 Di 15:30 HS 8

Off-Angle Harmonic Seeding at the Short-Pulse Source at DELTA — •Arne Meyer auf der Heide, Benedikt Büsing, Shaukat Khan, Daniel Krieg, Carsten Mai, and Frederik Teutenberg — Zentrum für Synchrotronstrahlung (DELTA), TU Dortmund, Deutschland

At the 1.5-GeV synchrotron light source DELTA operated by the TU Dortmund University, coherent harmonic generation (CHG) is employed to provide ultrashort pulses in the vacuum ultraviolet and terahertz regime. Here, a modulation of the electron energy induced by an interaction of an ultrashort laser pulse with an electron bunch within an undulator (modulator) tuned to the laser wavelength is transformed into a density modulation by a magnetic chicane. This results in the emission at harmonics of the laser wavelength as well as pulses in the THz regime. Recently, seeding experiments were performed with the laser wavelength being a harmonic of the undulator wavelength. The energy modulation tends to follow the angular distribution of spontaneous radiation at the respective undulator harmonic, e.g., an off-axis maximum for the second harmonic when seeding with 400-nm pulses while tuning the modulator to 800 nm. Measurements and simulation results will be shown and possible applications will be discussed. Funded by BMBF under contract 05K16PEA and by the Land Berlin

AKBP 7: Hadron Accelerators and Colliders

Zeit: Dienstag 14:00–15:15 Raum: HS 7

AKBP 7.1 Di 14:00 HS 7

Target Concept for a Compact Laboratory Scale Accelerator Driven High Brilliance Neutron Source — •Paul-Emmanuel Doege[1], Johannes Baggemann[1], Tobias Cronert[1], Thomas Gutberlet[1], Eric Mauerhofer[1], Ulrich Rücker[1], Jörg Voigt[1], Yannick Bessler[2], Jörg Wolters[2], Sarah Böhm[3], Jingnig Li[3], Ghaleb Natour[2], and Thomas Brückel[1] — [1]JCNS, Forschungszentrum Jülich, Germany — [2]ZEA-1, Forschungszentrum Jülich, Germany — [3]NET, RWTH-Aachen, Germany

In the framework of the High Brilliance Neutron Source Project - HBS, novel accelerator driven neutron sources are in development. They are intended to be employed in a variety of fields, such as neutron scattering, imaging and activation analysis. Due to the scalable, modular approach, sources replacing todays medium flux reactor facilities, as well as laboratory sources for universities or industry will be possible to realize. The neutron production of these sources is based on nuclear reactions, which are taking place when ions of hydrogen isotopes with an energy well below the spallation threshold energy are impinging on a suitable target material. The target assembly and the cooling circuit need to be adapted to the projectile energy and the beam current. A target assembly for 10 MeV protons and an average beam power of 400 W, which was conceived for a laboratory scale facility, will be presented here.

AKBP 7.2 Di 14:15 HS 7

Electron Cooling Experiments with 2.4 GeV/c proton beam at COSY — •Philipp Niedermayer, Vsevolod Kamerdzhiev, Arthur Halama, Christian Böhme, Ilja Bekman, Karl Reimers, Nikolay Shurkhno, and Rolf Stassen — IKP-4, Forschungszentrum Jülich, 52428 Jülich

Experimental results from the recent cooling beam time are presented. Studies of transverse and longitudinal magnetized electron cooling were carried out. Thereby the e-cooling was accompanied by stochastic cooling, barrier bucket and operation of an internal cluster jet target. To further investigate the cooling process, shifts in the electron orbit were performed while monitoring the momentum of the cooled proton beam. From the measurements the effective energy distribution within the electron beam was deduced. Comparing the results to theoretical predictions yields better understanding of the cooling dynamics in order to further improve the cooling process. By combining electron and stochastic cooling, best results in terms of cooling speed and equilibrium emittance were achieved.

AKBP 7.3 Di 14:30 HS 7

Search for Electric Dipole Moments at COSY in Jülich - Spin Tracking Simulations using Bmad — •Vera Poncza[1,2] and Andreas Lehrach[1,2] for the JEDI-Collaboration — [1]Institute for Nuclear Physics IV , FZ Jülich, Germany — [2]III. Physikalisches Institut B, RWTH Aachen University, Germany

The observed matter-antimatter asymmetry in the universe cannot be explained by the Standard Model (SM) of particle physics. In order to resolve the matter dominance an additional $\mathcal{CP}$ violating phenomenon is needed. A candidate for physics beyond the SM is a non-vanishing Electric Dipole Moment (EDM) of subatomic particles. Since permanent EDMs violate parity and time reversal symmetries, they are also $\mathcal{CP}$ violating if the $\mathcal{CPT}$-theorem is assumed.

The JEDI (Jülich Electric Dipole moment Investigations) collaboration in Jülich is preparing a direct EDM measurement of protons and deuterons first at the storage ring COSY (COoler SYnchrotron) and later at a dedicated storage ring.

In order to analyse the data and to disentangle the EDM signal from systematic effects spin tracking simulations are needed. Therefore a model of COSY was implemented using the software library Bmad. It includes the measured magnet misalignments of the latest survey

and a simplified description of the RF-Wien Filter device that is used for the EDM measurement. Simulation results regarding the invariant spin axis as well as closed orbit simulations will be presented.

AKBP 7.4 Di 14:45 HS 7

Simulation for a Prototype Proton EDM Storage Ring — •Saad Siddique[1,2] and Andreas Lehrach[1,2] for the JEDI-Collaboration — [1]1 Institute for Nuclear Physics IV , FZ Jülich, Germany — [2]2 III. Physikalisches Institut B, RWTH Aachen University, Germany

Matter-antimatter asymmetry can be understood by investigating Electric Dipole Moments (EDM) of Elementary charged particles. Permanent EDMs of subatomic particles violate both time reversal (T) and Parity (P) invariance and also CP-violation via CPT-theorem. Finding an EDMs of charged particles with ultimate precision would be a strong sign for physics beyond the Standard Model (SM). Up to now, EDMs of neutral systems (neutrons, atoms and molecules) have been investigated. However, direct search of proton and deuteron EDMs bear the potential to reach the sensitivities beyond 10^{-29}ecm. This goal can be pursued either with an all-electric proton storage ring, or by an approach using a combined electric-magnetic lattice which shall allow access to the EDMs of proton, deuteron, and ^{3}He in one-and-the-same machine. The purpose of this Prototype Proton EDM Storage Ring is to demonstrate the satisfactory beam lifetime and spin coherence time in the electrostatic ring, clockwise and counter-clockwise beam operation, beam spin control, beam-based element alignment, and methods for reducing systematic errors in the EDM measurements and deals with simulation of lattice and beam lifetime of Prototype pEDM Ring.

AKBP 7.5 Di 15:00 HS 7

Characterisation of the Radiation Hardness of Cryogenic Bypass Diodes for the HL-LHC Inner Triplet Circuit — •Andreas Will[1,2], Axel Bernhard[1], Giorgio D'Angelo[2], Reiner Denz[2], Dietrich Hagedorn[2], Arnaud Monteuuis[2], Anke-Susanne Mueller[1], Felix Rodriguez Mateos[2], Krzysztof Stachon[2], and Daniel Wollmann[2] — [1]KIT, Karlsruhe, Germany — [2]CERN, Geneva, Switzerland

One option for the powering layout of the new HL-LHC Nb3Sn triplet circuits is the use of cryogenic bypass diodes, where the diodes are located inside an extension to the magnet cryostat, operated in superfluid helium and exposed to radiation. Therefore, the radiation hardness of different type of bypass diodes has been tested at low temperatures in CERN*s CHARM irradiation facility during the operational year 2018. The forward bias characteristics, the turn on voltage, the reverse blocking voltage and the capacitance of each diode were measured weekly at 4.2 K and 77 K, respectively, as a function of the accumulated radiation dose. The diodes were submitted to a dose close to 12 kGy and a 1 MeV equivalent neutron fluence of $2.2 \cdot 10^{14}$ n/cm^2. After the end of the irradiation campaign the annealing behaviour of the diodes was tested by increasing the temperature slowly to 300 K. This contribution describes the experimental setup, the measurement procedure and discusses the results of the measurements.

AKBP 8: New Accelerator Concepts

Zeit: Dienstag 16:30–17:45 Raum: HS 8

AKBP 8.1 Di 16:30 HS 8

TWEAC - Laser-plasma acceleration beyond the dephasing and depletion limits — •Alexander Debus[1], Richard Pausch[1,2], Axel Huebl[1,2], Klaus Steiniger[1], Rene Widera[1], Tom Cowan[1,2], Ulrich Schramm[1,2], and Michael Bussmann[1] — [1]Helmholtz-Zentrum Dresden - Rossendorf, Bautzner Landstr. 400, Dresden, Germany — [2]Technische Universität Dresden, 01062 Dresden

We present Traveling-Wave Electron Acceleration (TWEAC), a novel compact electron accelerator scheme based on laser-plasma acceleration. While laser-plasma accelerators provide multi-GeV electron beams today, the acceleration to higher energies is limited. The subluminal group-velocity of plasma waves let electrons outrun the accelerating field.

In order to control the speed of the accelerating plasma cavity, TWEAC utilizes two pulse-front tilted laser pulses whose propagation directions enclose an acute angle. The accelerating cavity is created along their overlap region in the plasma and can move at the vacuum speed of light. Thus, TWEAC provides constant acceleration which opens the way for electron energies beyond 10 GeV, possibly towards TeV class electron beams, without the need for multiple laser-accelerator stages.

AKBP 8.2 Di 16:45 HS 8

Pulse-front tilt in laser-plasma accelerators with short focal lengths — •Klaus Steiniger[1], Michael Bussmann[1], Thomas Kluge[1], Richard Pausch[1,2], Karl Zeil[1], and Alexander Debus[1] — [1]Helmholtz-Zentrum Dresden - Rossendorf, Bautzner Landstr. 400, 01328 Dresden, Germany — [2]Technische Universität Dresden, 01062 Dresden

Laser ion accelerators utilize high-power laser pulses in tight-focusing geometries to provide pulsed, high-intensity ion beams. Efficient capturing, transport and application of these beams is an ongoing effort which depends on precise knowledge of the accelerated ion distribution's properties and how to control these. For example, it is known that the propagation direction of the accelerated ions can be controlled by tilting the driving laser pulse-front. Since laser pulse-front tilts can be present accidentally, for example by a small misalignment of the compressor gratings in a chirped-pulse amplification system, knowledge of the scaling of the pulse-front tilt at a target position is desired. The talk gives relations for pulse-front orientation dependent on setup parameters and identifies regimes were pulse-front tilt has a sizable impact.

AKBP 8.3 Di 17:00 HS 8

Single Shot Emittance Measurements at LUX — •Lars Hübner[1], Björn Hubert[1], Timo Eichner[1], Sören Jalas[1], Manuel Kirchen[1], Vincent Leroux[1,2], Matthias Schnepp[1], Philipp Messner[1,3], Maximilian Trunk[1], Christian M. Werle[1], Paul Winkler[1,2], and Andreas R. Maier[1] — [1]Center for Free-Electron Laser Science & Department of Physics, University of Hamburg, Hamburg, Germany — [2]Deutsches Elektronen-Synchrotron DESY, Hamburg, Germany — [3]Max Planck Institute for the Structure and Dynamics of Matter, Hamburg, Germany

The LUX beamline is a novel laser-plasma accelerator, built in close collaboration of the University of Hamburg and DESY, and dedicated for the generation of laser-plasma driven undulator radiation. For beam transport design, the beam properties after the plasma target are crucial. Here, we discuss the characterization of the electron beam optics at LUX and report on emittance reconstruction from single shots using measured beam profiles and electron spectra.

AKBP 8.4 Di 17:15 HS 8

Gas jet targets and their application in laser-driven ion acceleration — •Alexander Schulze-Makuch[1,2], Stefan Assenbaum[2,3], Constantin Bernert[2,3], Florian-Emanuel Brack[2,3], Lennart Gaus[2,3], Stephan Kraft[2], Florian Kroll[2], Josefine Metzkes-Ng[2], Lieselotte Obst-Hübl[2,3], Martin Rehwald[2,3], Marvin Reimold[2,3], Hans-Peter Schlenvoigt[2], Karl Zeil[2], Tim Ziegler[2,3], and Ulrich Schramm[2,3] — [1]Albert-Ludwigs Universität Freiburg, Freiburg, Germany — [2]Helmholtz-Zentrum Dresden-Rossendorf, Dresden, Germany — [3]Technische Universität Dresden, Zellescher Weg 19, 01069 Dresden, Germany

Currently, the acceleration gradients of conventional linear accelerators are limited to 10 MeV/m. However, the acceleration gradients of laser-driven particle accelerators can be in the order of 1 TV/m. This can lead to the development of compact accelerators including their use in medical applications, e.g. hadron therapy. Conventional targets for ion acceleration are operationally limited because of relatively low repetition rate and contamination of optics from debris. Therefore, alternative target schemes need to be investigated. One possible way forward are high-density gas jets which, in contrast to gas jets for electron acceleration, are near the critical density and thus offer a variety of physical mechanisms to accelerate protons or even heavier particles.

Here we present our recent developments in establishing a high-density gas jet at the DRACO laser in the Helmholtz-Zentrum Dresden-Rossendorf and highlight its properties and feasibility for

laser-ion acceleration.

AKBP 8.5 Di 17:30 HS 8

Optimization of ionization injection in laser wakefield acceleration — •Philipp Messner[1,2], Lars Hübner[3], Sören Jalas[1], Manuel Kirchen[1], Vincent Leroux[3], Matthias Schnepp[1], Paul Winkler[3], and Andreas R. Maier[1] — [1]Center for Free-Electron Laser Science & Department of Physics, Hamburg University, Hamburg, Germany — [2]International Max Planck Research School for Ultrafast Imaging and Structural Dynamics, Hamburg, Germany — [3]Deutsches Elektronen-Synchrotron DESY, Hamburg, Germany

Laser-plasma accelerators are capable to produce GeV beam energies over only a few centimeter, making them interesting as driver for compact light sources. However, electron beam parameters have to be matched to the beam optics. Online tunability of energy, energy spread and charge are therefore mandatory for efficient electron beam transport. Controlling the injection mechanism of the electrons into the wakefield is one promising way to optimize these parameters. Here, we present the influence of the dopant concentration on electron beams generated with ionization injection. Using the 200 TW peak power laser system ANGUS at the LUX facility in Hamburg, we accelerated electron beams up to a few hundred MeVs in a gas mixture of nitrogen and hydrogen. We precisely scanned the nitrogen concentration online between 0.1 and 5% while keeping the background plasma density forming the wakefield constant. Changes in beam properties can therefore directly be related to the injection mechanism. We found that the amount of trapped charge is increased significantly for larger nitrogen concentrations, while energy gain is reduced.

AKBP 9: Electron Accelerators

Zeit: Dienstag 16:30–18:30 Raum: HS 7

AKBP 9.1 Di 16:30 HS 7

Status and recent highlights of KARA and FLUTE — •Bastian Härer[1], Axel Bernhard[1], Edmund Blomley[2], Tobias Boltz[2], Miriam Brosi[1], Andi Chai[2], Erik Bründermann[1], Sara Casalbuoni[1], Kantaphon Damminsek[2], Stefan Funkner[1], Julian Gethmann[2], Andreas Grau[1], Erhard Huttel[1], Andreas Kaiser[2], Benjamin Kehrer[2], Anton Malygin[1], Matthias Martin[2], Sebastian Marsching[2], Yves-Laurent Mathis[1], Wolfgang Mexner[1], Akira Mochihashi[1], Michael J. Nasse[1], Gudrun Niehues[2], Meghana Patil[2], Alexander Papash[1], Robert Ruprecht[1], David Saez de Jauregui[1], Jens Schäfer[2], Thiemo Schmelzer[2], Patrick Schreiber[2], Marcel Schuh[1], Nigel J. Smale[1], Johannes L. Steinmann[1], Yimin Tong[2], Pawel Wesolowski[1], Minjie Yan[1], and Anke-Susanne Müller[1,2] — [1]IBPT, KIT, Karlsruhe, Germany — [2]LAS, KIT, Karlsruhe, Germany

The Institute for Beam Physics and Technology (IBPT) at the Karlsruhe Institute of Technology (KIT) operates the Karlsruhe Reaseach Accelerator (KARA) and the Ferninfrarot Linac and Test Experiment (FLUTE) which is presently under construction. An overview of these facilities and the accelerator physics research activies will be given.

AKBP 9.2 Di 16:45 HS 7

Commissioning of the Third Recirculation Beam Line of the S-DALINAC* — •M. Arnold, T. Bahlo, R. Grewe, L. Jürgensen, N. Pietralla, M. Steinhorst, and S. Weih — IKP, TU Darmstadt

The S-DALINAC was set into full operation in 1991 as a twice-recirculating SC-RF linac for electrons with a maximum design energy of 130 MeV. The maximum energy reached so far in cw operation was 85 MeV. This limit was set by the maximum cooling power of the cryoplant and the SRF cavities with a lower than expected quality factor. Therefore, the accelerating gradients must be limited to match the dissipated power to the available cooling power. A fourth passage of the beam through the accelerator increases its energy reach. To that end a third recirculation beam line was installed in 2015/2016. The energy gain of the main accelerator can be kept constant while keeping the accelerating gradients, and thus the dissipated power, low at the same time. It was necessary to modify major parts of the lattice. The new beam line features a path-length adjustment system capable of a change of the beam phase of up to 360°. The S-DALINAC can now be operated in single pass, once- or thrice-recirculating and once- or twice recirculating ERL mode. Single pass, once- and thrice recirculating mode as well as the once-recirculating ERL mode have been successfully demonstrated, already. First data on the twice-recirculating ERL mode have recently been taken, too. This contribution will give an overview on the commissioning of the modified S-DALINAC.

*Work supported by DFG through GRK 2128.

AKBP 9.3 Di 17:00 HS 7

Synchrotron Radiation Background in the FCC-ee Interaction Region — •Marian Lückhof — CERN, Meyrin, Schweiz — Universität Hamburg, Gruppe Beschleunigerphysik Hamburg, Deutschland

FCC-ee is one of the future circular collider options with 80 km to 100 km circumference, a precision machine for e^+-e^- collisions and currently studied at CERN.

It aims for collision energies ranging from 90 to 365 GeV. A significant level of synchrotron radiation can be expected, emitted by electron and positron beams at this very high energies. For FCC-ee, synchrotron radiation induces limits on machine performance and is one of the main drivers for the design of the interaction region.

This talk aims to give an overview over the FCC-ee machine detector interface and MDISim, a simulation toolkit to do detailed studies of synchrotron radiation backgrounds in the interaction region.The principle is shown, together with first results on synchrotron radiation background at top energy (182.5 GeV per beam). Also an outlook on improvements and further studies will be given.

AKBP 9.4 Di 17:15 HS 7

Status of the new capture section for the S-DALINAC injector* — •Simon Weih[1], Michaela Arnold[1], Dmitry Bazyl[2], Joachim Enders[1], Herbert De Gersem[2], Wolfgang Müller[2], and Norbert Pietralla[1] — [1]Institut für Kernphysik, TU Darmstadt, Darmstadt, Germany — [2]Institut für Theorie Elektromagnetischer Felder, TU Darmstadt, Darmstadt, Germany

The first cavity of the superconducting section of the S-DALINAC [1] injector will be replaced by a new beta-adapted 6-cell structure in order to improve the electron bunch capture at an energy of 250 keV. To adapt the existing cryomodule to the new capture cavity, the tuner frame and other surrounding parts were modified. Beam dynamics simulations show that the beam quality downstream the injector strongly depends on the input bunch parameters. Therefore, a diagnostics setup at the end of the normal-conducting section of the injector is currently being planned. This setup will be used to characterize the beam in front of the capture section, supporting the future commissioning of the upgraded injector. This contribution will present the status of the foreseen improvements.

[1] N. Pietralla, Nuclear Physics News, Vol. 28, No. 2, 4 (2018).
*Work supported by DFG through GRK 2128

AKBP 9.5 Di 17:30 HS 7

Status of Operation With Negative Momentum Compaction at KARA — •Patrick Schreiber, Alexander Papash, Akira Mochihashi, Bastian Härer, Marcel Schuh, Miriam Brosi, and Tobias Boltz — Karlsruher Institut für Technologie (KIT)

For future synchrotron light source development novel operation modes are under investigation. At the Karlsruhe Research Accelerator (KARA) an optics with negative momentum compaction has been proposed, which is currently under commissioning. In this context, the collective effects expected in this regime are studied with an initial focus on the head-tail instability and the micro-bunching instability resulting from CSR self-interaction. In this contribution, we will present the status of implementation for operation in the negative momentum compaction regime as well as a preliminary discussion of expected collective effects.

AKBP 9.6 Di 17:45 HS 7

Focussing Schemes for an Electron ource for Ultrafast Electron Diffraction at DELTA — •Daniel Krieg[1], Shaukat Khan[1], Klaus Sokolowski-Tinten[2], and Thies Johannes Albert[2] — [1]Zentrum für Synchrotronstrahlung, TU Dort-

mund, Dortmund,Deutschland — [2]Universität Duisburg-Essen, Duisburg, Deutschland

Ultrafast electron diffraction (UED) is a pump-probe technique to explore the structural dynamics of matter, combining sub-angstrom De-Broglie wavelength of electrons with femtosecond time resolution. UED experiments require ultrashort laser pulses to pump a sample, electron bunches with small emittance and ultrashort length to analyze the state of the sample and excellent control of the delay between them. Electrons accelerated to a few MeV in photocathode gun offer significant advantages compared to keV electrons from electrostatic electron sources, regarding emittance, bunch length and bunch charge. Furthermore, the longer mean free path of MeV electrons allows for a wider range of possible materials. In this talk, longitudinal and transverse focussing schemes, which minimize space charge effects and nonlinearities, are presented for a university-based UED facility with ultrashort and low-emittance MeV electron bunches are presented. The requirements for the laser system and the radiofrequency incoupling will be discussed.

AKBP 9.7 Di 18:00 HS 7

Investigation on the Ion-Clearing Performance of Multi-Purpose Electrodes planned for bERLinPro — Gisela Pöplau[1], •Atoosa Meseck[2], Fjodor Falkenstern[2], and Michael Markert[2] — [1]Universität zu Lübeck, Lübeck, Germany — [2]Helmholtz-Zentrum Berlin, Berlin, Germany

High-brightness electron beams provided by modern accelerators require several measures to preserve their high quality and to avoid instabilities. The mitigation of the impact of residual ions is one of these measures. It is particularly important if high bunch charges in combination with high repetition rates are aimed for. This is because ions can be trapped in the strong negative electrical potential of the electron beam causing emittance blow-up, increased beam halo and longitudinal and transverse instabilities.

One ion-clearing strategy is the installation of clearing electrodes. Of particular interest in this context is the performance of multi-purpose electrodes, which are designed such that they allow for a simultaneous ion-clearing and beam-position monitoring. Such electrodes will be installed in the bERLinPro facility.

In this contribution, we present numerical studies of the performance of multi-purpose clearing-electrodes planned for bERLinPro, i.e. we investigate the behavior of ions generated by electron bunches while passing through the field of the electrodes. Hereby, several ion species and configurations of electrodes are considered.

AKBP 9.8 Di 18:15 HS 7

Analytical Calculations for Thomson-Backscattering Based-Light Sources — •Paul Volz and Atoosa Meseck — Helmholtz-Zentrum Berlin

There is a rising interest in Thomson-backscattering based-light sources, as scattering intense laser radiation on MeV electrons produces high energy photons that would require GeV or even TeV electron beams when using conventional undulators or dipoles. Particularly, medium energy high brightness beams delivered by LINACs or Energy Recovery LINACs, such as bERLinPro being built at Helmholtz-Zentrum Berlin, seem suitable for these sources. In order to study the merit of Thomson-backscattering-based light sources, we have developed an analytical code to simulate the characteristics of the Thomson scattered radiation. The code calculates the distribution of scattered radiation depending on the incident angle and polarization of the laser radiation. Also the impact of the incident laser profile and the full 6D bunch profile, including microbunching, are incorporated. The features of the code and some simulation results will be presented.

AKBP 10: New Accelerator Concepts

Zeit: Mittwoch 11:00–12:30 Raum: HS 8

AKBP 10.1 Mi 11:00 HS 8

Stability analysis of Laser-Plasma accelerators using quasi-cylindrical PIC simulations — •Sören Jalas, Jannis Neuhaus-Steinmetz, Manuel Kirchen, and Andreas R. Maier — Center for Free-Electron Laser Science (CFEL) and Hamburg University

Particle-in-Cell (PIC) codes have proven to be a vital tool in the developement of plasma based accelerators. For example, the process of electron injection due to wave breaking and with that the beam charge and phase space is currently not quantitively described by analytical theories. Therefore, studies on the impact of fluctuating experimental parameters in this case lean on numerical simulations. For reliable quantitive results numerical convergence of these simulations is paramount. However, the computational demand of full 3D PIC simulations hinders extensive convergence and stability studies for many problems. The use of quasi-cylindrical PIC codes can greatly improve this by reducing the computational cost to that of a few 2D simulations. Here we present the results of extensive convergence and physical parameter studies of laser plasma accelerators using the quasi-cylindrical PIC code FBPIC. With the ultimate goal of using PIC codes for plasma accelerators just like tracking tools are used for conventional accelerators, we study the feasibility of wide range, high statistics parameter studies in terms of computational cost, when also quantitive precision is a key factor.

AKBP 10.2 Mi 11:15 HS 8

FBPIC - A spectral, quasi-3D, multi-GPU Particle-In-Cell code for plasma accelerators — •Manuel Kirchen, Soeren Jalas, Jannis Neuhaus-Steinmetz, and Andreas R. Maier — Center for Free-Electron Laser Science & Department of Physics, University of Hamburg, Luruper Chaussee 149, 22761 Hamburg, Germany

Plasma accelerators are compact high-energy particle sources allowing to accelerate charged particles to relativistic energy levels on mm length scales. Modelling the complex acceleration process requires computationally demanding Particle-In-Cell codes. These codes self-consistently solve the electromagnetic particle interaction inside the plasma. We present the latest features of FBPIC - a highly parallel Particle-In-Cell code featuring a spectral electromagnetic solver that eliminates numerical instabilities common to traditional field solvers, a quasi-3D geometry that greatly reduces the computational costs and the Lorentz-boosted frame technique that scales down the required simulation time by orders of magnitude.

AKBP 10.3 Mi 11:30 HS 8

Approaching predictive capabilities for LWFA experiments with PIConGPU — •Richard Pausch[1,2], Jurjen Couperus Cabadağ[1], Marco Garten[1,2], Axel Huebl[1,2], Alexander Köhler[1,2], Thomas Kurz[1,2], Susanne Schöbel[1,2], Ulrich Schramm[1,2], Klaus Steiniger[1], René Widera[1], Omid Zarini[1,2], Arie Irman[1], Michael Bussmann[1], and Alexander Debus[1] — [1]HZDR — [2]TU Dresden

State-of-the-art particle-in-cell simulations are becoming faster in terms of time to solution by utilizing modern hardware accelerators like GPUs and more accurate by improving the underlying algorithms. However, in order to model experiments, methods to include realistic laser pulses and gas distributions as well as efficient techniques to predict experimental observables, so-called synthetic diagnostics, need to be included in these simulations.

In this talk, we present extensions to the particle-in-cell code PIConGPU that were essential to accurately model LWFA experiments based on self-truncated ionization injection performed at HZDR. We discuss the significant impact of the implementation of higher order laser modes on the plasma dynamics and the resulting acceleration process. Furthermore, we discuss in detail the advantage of efficient in situ data analysis on the example of studying electron phase space evolution and of predicting spectrally and directionally radiation emission by all particles.

These improvements set the stage for quantitatively predicting the results of experiments in the near future.

AKBP 10.4 Mi 11:45 HS 8

Stand-alone laser system for off-harmonic optical probing of high intensity laser interaction with cryogenic hydrogen jet targets — •Constantin Bernert[1,2], Markus Loeser[1], Lieselotte Obst-Hübel[1,2], Martin Rehwald[1,2], Mathias Siebold[1], Karl Zeil[1], Tim Ziegler[1,2], and Ulrich Schramm[1,2] — [1]Helmholtz-Zentrum Dresden - Rossendorf, Bautzner Landstraße 400, 01328 Dresden, Germany — [2]TU Dresden, Zellescher

Weg 19, 01069 Dresden, Germany

The availability of high-intensity short-pulse lasers in the Peta-Watt regime drives the development of new and compact accelerator schemes like for example the generation of multiple 10 MeV proton beams from high-density targets. Particularly cryogenic hydrogen jet-targets offer the benefit of being debris-free and capable of high-repetition rate applications. Together with spatially and temporally resolved optical probing techniques this target is most suitable for a comparison to numerical particle-in-cell simulations. However, the strong plasma self-emission often masks the laser-target interaction point and thus complicates the data analysis.

Here we show the performance of a probe-laser-system operating at a central wavelength of 1030nm far off the fundamental wavelength of the drive laser at 800nm. The application in an experimental campaign dedicated to laser-proton acceleration together with cryogenic hydrogen jet-targets showed a significant improvement of imaging quality for the laser-target interaction concerning the plasmas self-emission.

AKBP 10.5 Mi 12:00 HS 8

High-power laser grating deformation and resulting spatio-temporal couplings — •Vincent Leroux[1,2], Manuel Kirchen[1], Sören Jalas[1], Philipp Messner[1,3], Paul Winkler[1,2], Matthias Schnepp[1], Timo Eichner[1], Christian Werle[1], and Andreas R. Maier[1] — [1]Center for Free-Electron Laser Science, Hamburg, Germany — [2]DESY, Hamburg, Germany — [3]Max-Planck Institute for the Structure and Dynamics of Matter, Hamburg, Germany

Laser-plasma accelerators are driven by hundreds terawatt or up to petawatt laser systems, at a few Hz repetition rates. Furthermore, as the laser technology pushes forward the average power limit, the absorbed heat into the gold-coated in-vacuum compressor gratings increases. This heat leads to deformations of the grating surface which changes the spatial and temporal properties of the laser beam during high-power operation, which can in turn drastically decrease the peak intensity on target, as well as degrade the quality of the accelerated electron beams.

We previously investigated the impact of the grating deformation on the compressed laser wavefront, and we now report on the simulation of the spatio-temporal couplings stemming from the same causes. We then draw conclusions on the overall decrease of the peak intensity in the focal plane due to both the increase in pulse duration and beam size.

AKBP 10.6 Mi 12:15 HS 8

Probing the transient fields of the plasma accelerators with an ultrashort electron beam — •Pardis Niknejadi[1], Kristjan Poder[1], Richard D'Arcy[1], Lucas Schaper[1], Alexander Knetsch[1], Simon Bohlen[2], Martin Meisel[2], and Jens Osterhoff[1] — [1]Deutsches Elektronen-Synchrotron DESY, Notkestraße 85, 22607 Hamburg, Germany — [2]Universität Hamburg, Luruper Chaussee 149, 22761 Hamburg, Germany

FLASHForward, the exploratory FLASH beamline for Future-ORiented Wakefield Accelerator Research and Development, is a European pilot test bed facility for plasma-wakefield acceleration (PWFA) experiments. The goals of these experiments are to produce, in a few centimeters of ionized gas, beams of GeV energy with high quality, develop diagnostics for such beams, and evaluate their application in the fields of high energy physics and future compact light sources. Several conventional and novel diagnostics tools, capable of characterizing ultra-short plasma-wakefield accelerator beams, are under development in the FLASHForward diagnostic test laboratory. Notably, the Femtosecond innovative RelativistiC Electron (FiRCE) is a probe designed for investigation of plasma interaction region. Therefore, the FiRCE probe will aid in the understanding of the processes of electron trapping and acceleration in PWFA through the mapping of transient electric fields. In this contribution, a summary of the research and development related to the FiRCE probe, such as the parameter regime and set up requirements, is discussed.

AKBP 11: Synchrotron Radiation

Zeit: Mittwoch 11:00–12:30 Raum: HS 7

AKBP 11.1 Mi 11:00 HS 7

Feedback Design for Control of the Micro-Bunching Instability based on Reinforcement Learning — •Tobias Boltz, Miriam Brosi, Erik Bründermann, Bastian Härer, Patrick Schreiber, Minjie Yan, and Anke-Susanne Müller — KIT, Karlsruhe, Deutschland

The operation of ring-based synchrotron light sources with short electron bunches increases the emission of coherent synchrotron radiation in the THz frequency range. However, the micro-bunching instability resulting from self-interaction of the bunch with its own radiation field limits stable operation with constant intensity of CSR emission to a particular threshold current. Above this threshold, the longitudinal charge distribution and thus the emitted radiation vary rapidly and continuously. Therefore, a fast and adaptive feedback system is the appropriate approach to stabilize the dynamics and to overcome the limitations given by the instability. In this contribution, we discuss first efforts towards a longitudinal feedback design that acts on the RF system of the KIT storage ring KARA (Karlsruhe Research Accelerator) and aims for stabilization of the emitted THz radiation. Our approach is based on methods of adaptive control that were developed in the field of reinforcement learning and have seen great success in other fields of research over the past decade. We motivate this particular approach and comment on different aspects of its implementation.

AKBP 11.2 Mi 11:15 HS 7

Developing Beam Optics for the Future of BESSY II — •Felix Andreas[1,2] and Paul Goslawski[2] — [1]Humboldt University of Berlin — [2]Helmholtz-Zentrum Berlin

BESSY II is a third generation synchrotron light source located in Berlin. In operation for 20 years it provides extremely brilliant synchrotron light pulses in the range from Terahertz radiation to hard X-rays. First discussions about a successor have been started. However, at BESSY II due to the continuously increasing interest in short pulse operation, a major upgrade of the ring will enable simultaneous storage of long and short bunch. This Variable pulse-length Storage Ring (VSR) will be achieved by the installation of additional superconducting high gradient cavities. The cavities will be assembled into one cryomodule in one straight of the storage ring. As this module needs more space then initially assumed, one possible solution is to remove two quadrupoles to gain available installation length. We switched off the quadrupoles and optimized the linear beam optics in simulations. The different theoretical optics obtained were transferred to the storage ring. Storage of high current with reasonable injection efficiency and lifetime was possible with the best solution found. The proposed optics has to be further optimized in regards to nonlinear beam dynamics, but has shown that an the available installation length can be increased. The developed beam optics code will be further extended to study first lattice ideas for a BESSY II successor.

AKBP 11.3 Mi 11:30 HS 7

Spectrotemporal shaping of laser-induced THz pulses at the DELTA storage ring — •Carsten Mai, Benedikt Büsing, Shaukat Khan, Daniel Krieg, and Arne Meyer auf der Heide — Center for Synchrotron Radiation (DELTA), TU Dortmund University, Dortmund, Germany

At the 1.5-GeV electron storage ring DELTA, operated by the TU Dortmund University, a broadband source for coherently emitted (sub-)THz radiation was commissioned in 2011. The generation of both broadband and narrowband radiation is based on an interaction of short laser pulses with electron bunches in the storage ring. To enhance a narrowband spectral content, a periodic intensity modulation is applied to the laser pulses employing the chirped-pulse beating technique. The use of a spatial light modulator promises to allow a more flexible control of the laser pulse shape and the spectrotemporal properties of the resulting THz pulse.

Funded by BMBF 05K16PEB and by the Land NRW.

AKBP 11.4 Mi 11:45 HS 7

Alternative methods for Landau damping of transverse instabilities in synchrotrons. — •Vadim Gubaidulin[1], Oliver Boine-Frankenheim[1,2], and Vladimir Kornilov[2] — [1]TEMF, TU Darm-

stadt, Darmstadt, Germany — [2]GSI, Darmstadt, Germany

Octupoles are now the standard method of providing incoherent tune spread for Landau damping. This method scales poorly for higher intensity beams and coherent beam instabilities become harder to damp, requiring more and more octupole magnets. Alternative methods (such as electron lens or radio frequency quadrupole) can, in theory, be more effective for damping and less destructive for single particle stability. Beam stability in space charge dominated beams must account for effects of space charge induced tune spread and tune shift on Landau damping. We shall compare how alternative Landau damping methods compete with conventional Landau octupoles for different applications.

AKBP 11.5 Mi 12:00 HS 7

Two Orbit Operation at Bessy II - During a User Test Week — •Paul Goslawski, Felix Armborst, Felix Andreas, and Markus Ries — Helmholtz-Zentrum Berlin, BESSY II

Operating a storage ring close to a horizontal resonance and manipulating the non-linear dynamics by non-linear magnets could generate Transverse Resonance Island Buckets (TRIBs), which provide a 2nd stable orbit in the machine. Both orbits can be populated with different electron bunch fill pattern and provide to some extent two different radiation sources to the user community. At BESSY II, the aim is to establish a real operation mode and provide a multi-bunch train on the standard orbit for average brightness and a single or a few bunch fill on the island orbit for the timing user community. A first 'Two Orbit User Test Week' has been conducted in February 2018 and results and user feedback will be discussed in this contribution.

AKBP 11.6 Mi 12:15 HS 7

Measurement and Optimization of TRIBs Optics at BESSY II — •Felix Armborst[1,2], Paul Goslawski[1], Andreas Jankowiak[1,2], Peter Kuske[1], Marten Koopmans[1,2], Andreas Schälicke[1], and Markus Ries[1] — [1]Helmholtz-Zentrum Berlin für Materialien und Energie — [2]Humboldt-Universität zu Berlin

Transverse Resonant Island Buckets (TRIBs) correspond to a second stable orbit, longitudinally winding around the core orbit in the transverse x-x'-phasespace. The exploitation possibilities for stable TRIBs are under investigation at the third generation light source BESSY II in Berlin. The applicability for bunch separation is a main subject of these studies. Stable operation of TRIBs optics with a single or few bunches on the second orbit and a multibunch train on the main orbit has been shown. Photons emitted on the second orbit are well separated from those of the main orbit at all beamlines. This provides the possibility of bunch separation by beamline adjustment for the timing community without significant impact on the average brightness for other users. Simulations based on linear optics from closed orbits (LOCO) and on nonlinear optics derived from the measured chromaticity and tune shift with action (TSWA) predict this separation well. Friendly user experiments in 2018 confirmed these results. The scheduled upgrade BESSY VSR features simultaneously stored long and short bunches. Then TRIBs optics would in principle enable the separation of the different bunches at every beamline offering unique possibilities to our users. Simulations and measurements of further optimizations of the TRIBs optics are presented.

AKBP 12: Bestowal of Prizes

Zeit: Donnerstag 11:00–13:00 Raum: HS 7

Bestowal of Prizes

AKBP 13: Hadron Accelerators and Colliders

Zeit: Donnerstag 14:00–15:00 Raum: HS 8

AKBP 13.1 Do 14:00 HS 8

Proton beam multiplexing and pulse distribution concepts for the High Brilliance neutron Source HBS — •Marius Rimmler[1], Johannes Baggemann[2], Olaf Felden[1], Ralf Gebel[1], Thomas Gutberlet[2], Ulrich Rücker[2], Paul Zakalek[2], and Thomas Brückel[2] — [1]Institut für Kernphysik, Jülich, Germany — [2]Jülich Centre for Neutron Science, Jülich, Germany

The High Brilliance Source (HBS) project aims to develop a scalable Compact Accelerator-driven Neutron Source (CANS) using nuclear reactions of protons in the low MeV energy range with a suitable solid target. Optimization of the accelerator as well as the target-, moderator- and shielding assembly allows to obtain neutron fluxes at the instruments comparable to today's research reactors. The HBS project features efficient simultaneous operation of different neutron instruments. This will be realized by distributing appropriate 50 - 800 μs long pulse sequences in a multiplexed 70 MeV energy proton beam to different target stations operated at different repetition rate but identical average power. The different timing schemes can be used to obtain the optimal balance between wavelength bandwidth and resolution of the time-resolved neutron spectrum extracted from the thermal or cold neutron moderator according to the requirement of the experiment.

This contribution presents current developments of a proton pulse distribution device. Synchronisation to a pulser in the LEBT beam line of the accelerator requires fast kicker magnets that enable pulsed beam deflection. We discuss challenges in the design of such magnets and outline plans of prototype developments.

AKBP 13.2 Do 14:15 HS 8

Laser cooling of stored relativistic heavy-ion beams at the SIS100 — •Danyal Winters[1], Daniel Albach[3,5], Gerhard Birkl[2], Michael Bussmann[3], Volker Hannen[4], Max Horst[1,2], Daniel Kiefer[2], Sebastian Klammes[1,2], Thomas Kühl[1], Markus Löser[3,5], Ulrich Schramm[3,5], Mathias Siebold[3,5], Thomas Stöhlker[1,6,7], Johannes Ullmann[1,4], Thomas Walther[2], Daniel Winzen[4], and Peter Spiller[1] — [1]GSI Darmstadt — [2]TU Darmstadt — [3]HZDR Dresden — [4]Uni Münster — [5]TU Dresden — [6]HI Jena — [7]Uni Jena

At relativistic velocities, laser cooling is an efficient technique to minimize the momentum spread of stored heavy-ion beams in storage rings. For the future facility FAIR in Darmstadt, this cooling method will also uniquely be applied to the heavy-ion synchrotron SIS100. As part of this project, we are currently designing a dedicated laser beamline, which will run from the laser lab (maintenance tunnel) to the ion beampipe (accelerator tunnel). The laser beamline will be about 25 m long and pumped down to reach a vacuum of $\sim 10^{-6}$ mbar. To analyze and prepare for unwanted effects during laser cooling, such as optical pumping, changes in the polarization of the transported laser light are being studied using a scaled-down version of the laser beamline and the real optics. We will present the status of the construction of the SIS100 (building site), give an overview of our project and show some of our test results.

AKBP 13.3 Do 14:30 HS 8

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

At heavy-ion storage rings, almost all experiments strongly benefit from *cooled* ion beams, *i.e.* beams which have a small relative momentum spread and a small emittance. Although electron cooling and stochastic cooling are most frequently used, laser cooling has proven to be a powerful technique with a large potential. Laser cooling is based

on resonant absorption (of momentum & energy) in the longitudinal direction and subsequent spontaneous random emission (fluorescence) of photons by ions. Because of its efficiency at high energies, laser cooling will *e.g.* be the only cooling method at the heavy-ion synchrotron SIS100. We will report on results from recent laser cooling experiments performed at the ESR (GSI) and the CSRe (IMP, Lanzhou, China) storage rings, using C^{3+} and O^{5+} ion beams, respectively. Finally, we will present our plans for laser cooling experiments at FAIR.

AKBP 13.4 Do 14:45 HS 8

Beam Impact Experiment of 440GeV/p Protons on Superconducting Wires and Tapes in a Cryogenic Environment — •Andreas Will[1,2], Axel Bernhard[1], Marco Bonura[3], Matthias Mentink[2], Anke-Susanne Mueller[1], Andreas Oslandsbotn[2], Carmine Senatore[3], and Daniel Wollmann[2] — [1]KIT, Karlsruhe, Germany — [2]CERN, Geneva, Switzerland — [3]University de Geneve, Geneva, Switzerland

The superconducting magnets used in high energy particle accelerators such as CERN's LHC can be impacted by the circulating beam in case of specific failure cases. This leads to interaction of the beam particles with the magnet components, like the superconducting coils, directly or via secondary particle showers. The interaction leads to energy deposition in the timescale of microseconds and induces large thermal gradients within the superconductors in the order of 100 K/mm. To investigate the effect on the superconductors, an experiment at CERN's HiRadMat facility was designed and executed, exposing short samples of Nb-Ti and Nb3Sn strands as well as YBCO tape in a cryogenic environment to microsecond 440 GeV/p proton beams. The irradiated samples were extracted and analyzed for their superconducting properties, such as the critical transport current. This paper describes the experimental setup as well as the results of the analysis.

AKBP 14: Radiofrequency 2

Zeit: Donnerstag 14:00–15:00 Raum: HS 7

AKBP 14.1 Do 14:00 HS 7

Longitudinale Ensemble-Rekonstruktion für den SC CW HELIAC — •Simon Lauber[1,2], Kurt Aulenbacher[1,2,3], Winfried Bart[1,2], Christoph Burandt[1,2], Viktor Gettmann[1,2], Manuel Heilmann[2], Thorsten Kürzeder[1,2], Julian List[1,2], Maksym Miski-Oglu[1,2], Stepan Yaramyshev[2] und Florian Dziuba[1,2,3] — [1]HIM Helmholtz-Institut Mainz, 55128 Mainz — [2]GSI Helmholtzzentrum für Schwerionenforschung GmbH, 64291 Darmstadt — [3]Johannes Gutenberg-Universität Mainz, 55099 Mainz

Ein Schwerionenbeschleuniger, der Helmholtz Linear Accelerator (HELIAC), befindet sich in der Entwicklung. Es ist der erste Beschleuniger, der mit supraleitenden (SC) Multigap Crossbar H-Mode (CH) Kavitäten am GSI Helmholtzzentrum für Schwerionenforschung (GSI) in Darmstadt arbeitet. Der bereits existierende Hochladungsinjektor (HLI) liefert hierfür mittlere und schwere Ionenstrahlen. Die Parameter des injizierten Strahls müssen für einen Hochleistungsbetrieb genau bekannt sein. Daher wird ein Verfahren zur Rekonstruktion der Dichte in der longitudinalen Phasenebene verwendet, um mit einem Strahlform-Monitor (BSM) erhobene Daten zu verarbeiten. Die so erhaltenen longitudinalen Informationen vervollständigen die 6D-Analyse des Eingangsstrahls. Der aktuelle Stand des Rekonstruktionsprozesses wird präsentiert.

AKBP 14.2 Do 14:15 HS 7

Entwicklung von Hochfrequenz-Leistungskopplern für supraleitende CH-Kavitäten — •Julian List[1,2], Kurt Aulenbacher[4], Winfried Barth[1,2], Marco Busch[3], Florian Dziuba[1,2,4], Viktor Gettmann[1,2], Manuel Heilmann[2], Thorsten Kuerzeder[1,2], Simon Lauber[1,2], Maksym Miski-Oglu[1,2], Holger Podlech[3], Julian Salvatore[2], Alexander Schnase[2], Malte Schwarz[3] und Stepan Yaramyshev[2] — [1]Helmholtz-Institut Mainz (HIM), 55128 Mainz, Germany — [2]GSI Helmholtzzentrum, 64291 Darmstadt, Germany — [3]IAP Goethe-Universität Frankfurt, 60438 Frankfurt, Germany — [4]Johannes Gutenberg-Universität Mainz, 55099 Mainz, Germany

Der UNIversal Linear ACcelerator (UNILAC) der GSI wird in Zukunft zum Injektor für das geplante FAIR-Projekt (Facility for Antiproton and Ion Research) umgebaut. Um die Superschwere Element-Synthese an der GSI weiterhin betreiben zu können, wird ein neuer dedizierter Beschleuniger benötigt und der HELmholtz LInear ACcelerator (HELIAC), ein supraleitender, im Dauerstrich betriebener Linearbeschleuniger für Schwerionen entwickelt. Die Beschleunigung erfolgt mit Hilfe von zwölf 217 MHz Crossbar-H-mode (CH) Kavitäten. Für die Versorgung mit Hochfrequenzleistung werden geeignete Leistungskoppler benötigt. Kopplertests und zwei Strahltests haben gezeigt, dass das bestehende Design weiter verbessert werden muss. Neben hochfrequenztechnischen und thermischen Optimierungen wird der Koppler ein modulares Design erhalten. Dies würde den Reinigungs- und Installationsprozess der Koppler erheblich vereinfachen. Dieser Beitrag stellt den aktuellen Stand der Kopplerentwicklung für den HELIAC vor.

AKBP 14.3 Do 14:30 HS 7

Nitrogen Infusion R&D for continuous wave operation at DESY — •Christopher Bate[1,2], Arti Dangwal Pandey[1], Wolfgang Hillert[2], Detlef Reschke[1], Jörn Schaffran[1], Guilherme Della Lana Semione[1], Sven Sievers[1], Lea Steder[1], Andreas Stierle[1], Hans Weise[1], and Marc Wenskat[1] — [1]DESY, Hamburg, Deutschland — [2]Universität Hamburg, Deutschland

The European XFEL continuous wave upgrade requires cavities with reduced surface resistance (high Q-values) for high duty cycle while maintaining high accelerating gradient for short-pulse operation. A possible way to meet the requirements is the so-called nitrogen infusion procedure. However, a fundamental understanding and a theoretical model of this method are still missing. The approach presented here is based on sample R&D, with the goal to identify all key parameters of the process and establish a stable, reproducible recipe. To understand the underlying processes of the surface evolution, which yield in improved cavity performance, advanced surface analysis techniques (e.g. SEM/EDX, TEM, XPS, TOF-SIMS) are utilized and several kinds of samples - such as in-situ model samples, cavity cut-outs, and samples treated together with cavities, are analyzed. Results of these analyses, their implications for the cavity R&D and next steps are presented.

AKBP 14.4 Do 14:45 HS 7

Nitrogen-doped niobium for SRF cavities — •Márton Major[1], Matthias Mahr[1], Stefan Flege[1], Lambert Alff[1], Jens Conrad[1], Ruben Grewe[1], Michaela Arnold[1], Norbert Pietralla[1], and Florian Hug[2] — [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. 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).

Niobium samples were N-doped at the refurbished UHV furnace at IKP Darmstadt. In parallel, reference samples were annealed in 1 bar nitrogen atmosphere at different temperatures in a tube furnace. In this contribution we focus on the structural investigations (x-ray diffraction and pole figure, secondary ion mass spectroscopy, scanning electron microscopy) of the doped samples.

Work supported by the German Federal Ministry for Education and Research (BMBF) through grants 05H15RDRBA and 05H18RDRB2.

AKBP 15: Poster session

Zeit: Donnerstag 16:30–18:00 Raum: Foyer Nordbau

AKBP 15.1 Do 16:30 Foyer Nordbau

Online Diagnostics and Stabilisation of the ANGUS 200 TW Laser — •Cora Braun[1], Timo Eichner[1], Vincent Leroux[1,2], Matthias Schnepp[1], and Andreas R. Maier[1] — [1]Center for Free-Electron Laser Science, Hamburg, Germany — [2]DESY, Hamburg, Germany

Laser-Plasma-Accelerators are prominent candidates to drive a next generation of high-brightness x-ray sources. The LUX laser-plasma-accelerator, driven by the ANGUS 200 TW laser, has recently demonstrated the generation of few-nm-plasma-driven undulator radiation. Long-term operation of the plasma accelerator with reproducible electron beams requires a highly stable drive laser. To reach this goal, we have integrated the ANGUS laser in an accelerator-grade control system. We will report on the day-long operation of the laser, enabled by our implementation of active feedback systems, and lessons learned from correlating laser control parameters.

AKBP 15.2 Do 16:30 Foyer Nordbau

Wakefield Tracking in Dielectric Laser Acceleration Grating Structures — •Thilo Egenolf[1], Uwe Niedermayer[1], and Oliver Boine-Frankenheim[1,2] — [1]Institut für Teilchenbeschleunigung und elektromagnetische Felder, TU Darmstadt, Schloßgartenstraße 8, 64289 Darmstadt, Germany — [2]GSI Helmholtzzentrum für Schwerionenforschung GmbH, Planckstrasse 1, 64291 Darmstadt, Germany

Dielectric laser accelerators contain nanostructures, where electrons are accelerated in the near field of a laser. The features of such grating structures are in the submicrometer range in order to fulfill the constraints given by the optical wavelength of the drive laser. This limits also the feasible bunch length and aperture size leading to critical intensity effects caused by wakefields. To investigate these effects on relativistic electron bunches, we present tracking results of our simplified particle tracking code DLAtrack6D with recently added nonlinear wakefield kicks. Longitudinal effects associated with energy loss as well as transverse effects are analyzed and quantitative intensity limits given by beam loading or transverse beam breakup are calculated. These tracking results of three-dimensional bunch distributions are compared to analytical estimations of a centered linecharge. Furthermore, we verify the underlying wakefield simulation results by scaled experimental data of SwissFEL at the Paul Scherrer Institute.

AKBP 15.3 Do 16:30 Foyer Nordbau

impedance characterization of a section of SPS using SSC method — •Shahnam Gorgi Zadeh[1], Rishab Dev[1], Christine Vollinger[2], and Ursula van Rienen[1] — [1]University of Rostock, Albert Einstein Str.2, 18059 Rostock, Germany — [2]CERN, Geneva, Switzerland

The High-Luminosity LHC (HL-LHC) project demands the upgrade of the LHC injector chain in order to produce beams with higher intensities [1]. As a part of the injector chain upgrade, the beam coupling impedance of the Super Proton Synchrotron (SPS) has to be determined and optimized to avoid beam instability issues. In that context, components with high contribution to the impedance of SPS have to be recognized and minimized. The common approach is to study the impedance contribution of each element in the ring separately. However, it is not an accurate approach as the neighbouring elements may couple to each other and form multi-component modes. We are employing the State Space Concatenation method (SSC) [2], which is a numerical approach for simulating a long structure by decomposing it into its individual components. In this poster, the SSC method will be used to calculate the eigenmodes of a long section of SPS and modes with high impedance will be identified.

This research is funded by the Bundesministerium für Bildung und Forschung (BMBF) under Grant No. 05H18HRRB1.

[1] LHC Injector Upgrade, Technical Design Report - Volume 1: Protons, CERN-ACC-2014-0337 -15 December 2014

[2] T. Flisgen, PhD thesis, University of Rostock, 2015

AKBP 15.4 Do 16:30 Foyer Nordbau

Emittance measurements and analysis in SRF gun II at ELBE and simulation — •Shuai Ma, Jochen Teichert, and Rong Xiang — Helmholtz-Zentrum Dresden Rossendorf, Bautzner Landstraße 400, 01328 Dresden

Emittance is a very important parameter to accelerators. So it is valuable to measure this parameter correctly. We measured the emittance using quadrupole scan in different places in drift space in SRF gun II at ELBE and found some differences among them. But in principle, they should be the same. We have analyzed it from theory and then made some simulations to proof that is right using ASTRA and ELEGANT.

AKBP 15.5 Do 16:30 Foyer Nordbau

Development of compact in vacuum high-voltage power supplies towards tabletop dielectric laser accelerators — •Stefanie Kraus, Johannes Illmer, Norbert Schönenberger, Roy Shiloh, and Peter Hommelhoff — Department Physik, Friedrich-Alexander-Universität Erlangen-Nürnberg (FAU), Staudtstraße 1,91058 Erlangen

High voltage sources are used in a variety of applications in environmental condition including X-ray tubes, electron microscopes and particle accelerators. One of the most common methods of high voltage generation is the Half-Wave Cockcroft-Walton voltage multiplier (HWCW), where each stage consists of two capacitors and two diodes. The aim of this work is to introduce a circuit design that provides a low power, high voltage (60keV) with low ripple (<1V) and a small footprint, while being fully UHV compatible. By placing this HWCM inside the vacuum one can avoid the large-size HV feedthrough and the isolation requirements. Such a unit could be used to operate an electron gun to provide a small sized self-contained electron source, which will be utilized for future dielectric laser accelerator experiments. Recent experimental results and simulations are presented.

AKBP 15.6 Do 16:30 Foyer Nordbau

First Operational Experience and Magnetic Characterization of a Superconducting Transverse Gradient Undulator for a Compact Laser Wakefield Acceleration-Driven FELs — •Kantaphon Damminsek, Axel Bernhard, Sebastian Richter, Maisui Ning, and Anke-Susanne Müller — Karlsruhe Institute of Technology, Karlsruhe, Germany

The application of Laser Wakefield Acceleration (LWFA) is a potential key for realizing extremely compact Free electron Lasers (FELs) due to an unprecedented high longitudinal electric field inside the laser-driven plasma wave. LWFA-generated electron beams exhibit challenging initial conditions in terms of beam divergence and energy spread. The transverse gradient undulator (TGU) scheme is a viable option to compensate the challenging properties of the LWFA electron beam to enable FELs amplification. At Karlsruhe Institute of Technology (KIT, Germany), a 40-period superconducting TGU has been designed and built. In this contribution, we report on the first test operation of this superconducting TGU in its own conduction-based cryostat, the quench tests performed in this configuration and first results of the two-dimensional Hall probe mapping of the TGU field.

AKBP 15.7 Do 16:30 Foyer Nordbau

Development of a miniaturized dielectric laser accelerator — •Johannes Illmer, Norbert Schönenberger, Anna Mittelbach, Roy Shiloh, Ang Li, Alexander Tafel, Peyman Yousefi, and Peter Hommelhoff — Department Physik, Friedrich-Alexander-Universität Erlangen-Nürnberg (FAU), 91058 Erlangen

In recent years, dielectric laser acceleration (DLA) experiments have moved on from basic proof of principle to more applicable accelerator concepts. Utilizing the high strength optical near fields generated by illuminating transparent nanostructures with femtosecond laser pulses electrons can be accelerated. Acceleration gradients of up to 850 MeV/m have been demonstrated. The transverse size of these accelerating structures is typically in the single micron regime, while longitudinally the structure can be scaled to reach the desired beam energy. Novel photonic-structure concepts allow for a high phase space control and acceleration of the electron beam, making final beam energies of >1 MeV feasible. We present an experimental setup capable of holding and driving photonic nanostructures combined with a dedicated electron source and an electron spectrometer for detection purposes. The size of the setup conveniently fits in the volume of a shoebox. The compact and light weight design is the first step towards the usage of DLA technology in a variety of applications, ranging from

small medical irradiation devices to small footprint free electron lasers.

AKBP 15.8 Do 16:30 Foyer Nordbau

Frequency Tuning of the 325 MHz Ladder-RFQ — •Huifang Wang, Maximilian Schütt, and Ulrich Ratzinger — IAP, Goethe University Frankfurt

A Ladder-Type- RFQ has been built for the FAIR Proton-Linac operating at 325.224 MHz. The 3.4 m Ladder-RFQ will accelerate up to 100 mA protons from 95 keV to 3 MeV at a duty factor of 0.08%. To tune the frequency a total of 12 tuners are planned, which two of them are movable and ten static plungers. By simulations with Microwave Studio (CST MWS) the exact positions, the shape of the frequency tuners as well as the combination of the two movable tuners have been determined. Furthermore the mode-crossing of the tuner eigenmode and cavity mode has been studied. In addition, the longitudinal field distribution (Flatness) in the unmodulated RFQ was measured using the bead-pulling measurement with various beads, which are suitable for modulated electrode.

AKBP 15.9 Do 16:30 Foyer Nordbau

Beam Dynamics of the FAIR p-Linac Ladder RFQ — •Marc Syha, Hendrik Hähnel, Ulrich Ratzinger, and Maximilian Schütt — IAP, Goethe University Frankfurt, Germany

The construction of a 3.3 m Ladder-RFQ at IAP, Goethe University Frankfurt, has been finished successfully last summer. This RFQ is designed to accelerate protons from 95 keV to 3.0 MeV according to the design parameters of the p-Linac at FAIR. Along the acceleration section the parameters modulation, aperture and synchronous phase are varied linearly with cell number, which differs from former designs from IAP Frankfurt. The ratio of transversal vane curvature radius to midcell radial aperture and the vane radius itself are constant to support a flat voltage distribution along the RFQ. This was verified by implantation of the modulated vane geometry into MWS-CST RF field simulations. The development of adequate beam dynamics was done in close collaboration with the IAP resonator design team. The RFQGen-code was used for beam dynamics simulations. Among those were also error studies, that were performed to test the beam dynamic's stability against input Twiss parameter deviations to a degree indicated by the LEBT measurements performed in Q1/2018 at CEA Saclay with participation of GSI's Ion Source Group. As a next step the RFQ beam dynamics could be successfully reproduced with the TOUTATIS routine of CEAs TraceWin code. This was followed by a thorough investigation of the influence of mechanical errors such as displacements and misalignments on the beam dynamics in form of further TOUTATIS simulations.

AKBP 15.10 Do 16:30 Foyer Nordbau

RF Measurements and Tuning of the 325 MHz Ladder-RFQ — •Maximilian Schütt, Marc Syha, and Ulrich Ratzinger — IAP, Goethe University Frankfurt, Germany

Based on the positive results of the unmodulated 325 MHz Ladder-RFQ prototype from 2013 to 2016, we developed and designed a modulated 3.4 m Ladder-RFQ*. The unmodulated Ladder-RFQ features a very constant voltage along the axis. It accepted 3 times the operating power of which is needed in operation**. That level corresponds to a Kilpatrick factor of 3.1 with a pulse length of 0.2 ms. The 325 MHz RFQ is designed to accelerate protons from 95 keV to 3.0 MeV according to the design parameters of the proton linac within the FAIR project. This particular high frequency for a 4-ROD-RFQ creates difficulties, which triggered the development of a Ladder-RFQ with its high symmetry. The results of the unmodulated prototype have shown, that the Ladder-RFQ is very well suited for that frequency. The duty cycle is up to 5% for the applied cooling concept. Manufacturing has been completed in September 2018. We will show the finalization of assembly after manufacturing as well as low level RF measurements. The final machining step for the flatness & frequency tuning is envisaged in spring 2019.

*Journal of Physics: Conf. Series 874 (2017) 012048 **Proceedings of LINAC2016, East Lansing, TUPLR053 Funded by BMBF 05P15RFRBA

AKBP 15.11 Do 16:30 Foyer Nordbau

The attempt of using (Cs:O)GaAs and (Cs)GaN as photocathodes in SRF photoinjectors — •Jana Schaber, Rong Xiang, and Jochen Teichert — Helmholtz-Zentrum Dresden-Rossendorf, Dresden, Germany

The photocathodes determine the beam quality in linear accelerators and represent a key component for many accelerator projects.

High quantum efficiency, a long lifetime and good vacuum stability, fast response time and low thermal emittance are desirable parameters for photocathodes used in accelerators. Semiconductors such as GaN and GaAs as novel materials are showing an enormous potential for an application as photocathodes.

GaAs is a well-known material for photocathodes. After activation with caesium and oxygen, it has a high QE for visible light. An advantage of GaAs is the opportunity of the layers to emit spin-polarized electrons.

GaN is a semi-conductive material and well known for its high QE when lighted with UV light. For improving the QE only caesium for activation is required. It is very new for application in SRF Guns. It seems to be more robust and achieves higher QE than other photocathodes [1].

Crystallinity and surface parameters define the photoemission properties. For identification impurities, dislocations and characterization of the crystallinity but also finding the perfect cleaning process and caesium rating modern analytical methods are used.

[1] Uchiyama, Shoichi et al. 2011. 103511(2005):1-4.

AKBP 15.12 Do 16:30 Foyer Nordbau

Überlagerung der 3 GHz Pulzstruktur am S-DALINAC mit einer 20 MHz Makrostruktur — •Lennart Stobbe, Michaela Arnold, Jonny Birkhan, Lars Jürgensen und Norbert Pietralla — Institut für Kernphysik, TU Darmstadt, Germany

Der supraleitende Elektronen-Linear-Beschleuniger S-DALINAC ist ein rezirkulierender Beschleuniger, der einen cw-Strahl mit einer Pulsstruktur von 3 GHz für Elektronenstreuexperimente bereitstellt [1]. In diesem Betriebsmodus sind keine Flugzeitmessungen zur Teilchenseparation für Koinzidenzmessungen am dafür vorgesehenen Magnetspektrometer Q-CLAM möglich . Mit Flugzeitmessungen ließe sich der Untergrund in den Energiespektren, der durch sekundär gestreute Elektronen verursacht wird, signifikant verringern. In der Vergangenheit war es möglich, den Beschleuniger mit einer Makrostruktur des Strahls von 10 MHz zu betreiben und damit Flugzeitmessungen durchzuführen [2]. Im Rahmen der kürzlich modernisierten Datenaufnahme des Spektrometers und der Inbetriebnahme des S-DALINAC als ERL soll ein Konzept für eine neue Pulsung des Strahls mit einer Zeitstruktur von ca. 20 MHz erarbeitet und umgesetzt werden. Erste Ergebnisse der Konzeptanalyse werden vorgestellt.

[1] N. Pietralla, Nuclear Physics News, Vol. 28, No. 2, 4 (2018)
[2] Friedrich Neumeyer, Untersuchung magnetischer Kernanregungen in ^{48}Ca und ^{90}Zr mit hochauflösender Elektronenstreuung unter 180° am S-DALINAC, Dissertation, TU-Darmstadt, 1997

AKBP 15.13 Do 16:30 Foyer Nordbau

Laser systems for nuclear photonics at the S-DALINAC* — •Maximilian Meier[1], Vincent Bagnoud[2], Joachim Enders[1], Norbert Pietralla[1], and Markus Roth[1] — [1]TU Darmstadt, Darmstadt, Deutschland — [2]GSI Helmholtzzentrum für Schwerionenforschung, Darmstadt, Deutschland

The superconducting Darmstadt electron linac S-DALINAC is a thrice-recirculating linear accelerator [1] providing electron beams with energies up to 130 MeV and beam currents up to 20 μA for a variety of nuclear physics experiments [2]. It has been operated as Germany*s first energy-recovery linac in the past year [3]. The electron beam is produced either in a thermionic gun or a DC photo-gun using GaAs as cathode material [4]. A new project foresees to use the S-DALINAC for laser Compton backscattering to produce a brilliant monochromatic high-energy photon beam for nuclear photonics applications in photonuclear reactions and for beam diagnostics. An overview over the laser systems at the S-DALINAC will be given, and simulations for the layout of the Compton-backscattering light source will be presented.

[1] M. Arnold, Dissertation, TU Darmstadt (2017)
[2] N. Pietralla, Nucl. Phys. News 28(2), 4 (2018)
[3] K. Sonnabend, Physik Journal 10 (2017), 7
[4] Y. Poltoratska et al., J. Phys.: Conf. Series 298, 012002 (2011)

*Supported in part through the state of Hesse (LOEWE research cluster Nuclear Photonics), the German BMBF (05H18RDRB1), and DFG through GRK 2128 *AccelencE*.

AKBP 15.14 Do 16:30 Foyer Nordbau

Inverted-geometry photo-electron gun research and development at TU Darmstadt — •Vincent Wende[1], Joachim Enders[1], Yuliya Fritzsche[1], Maximilian Herbert[1], and Neeraj

Kurichiyanil[2] — [1]Institut für Kernphysik, Technische Universität Darmstadt, 64289 Darmstadt — [2]Department of Medical Physics, Ludwig-Maximilians-Universität München, 85748 Garching

The Superconducting Darmstadt Linear Accelerator S-DALINAC provides electron beams for a variety of experiments in nuclear structure physics [1]. A photo-electron gun [2] using GaAs photocathodes provides pulsed and/or polarized electron beams. In order to optimize cathode performance for this source, a test facility for Photo-Cathode Activation, Test and Cleaning using atomic-Hydrogen (Photo-CATCH) has been constructed [3]. This setup consists of vacuum chambers for photocathode cleaning, activation and testing and a 60 keV beamline [4]. Currently, an upgraded inverted-insulator geometry is under investigation for Photo-CATCH that is supposed to be later implemented at the S-DALINAC, as well. This poster will present the current status of Photo-CATCH as well as ongoing developments and planned measurements.

Work supported by the Deutsche Forschungsgemeinschaft through GRK 2128 "AccelencE"

[1]: N.Pietralla, Nuclear Physics News 28(2), 4 (2018)
[2]: Y. Poltoratska et al., J. Phys.: Conf. Series 298, 012002 (2011)
[3] M. Espig, Dissertation, TU Darmstadt (2016)
[4] N. Kurichiyanil, Dissertation, TU Darmstadt (2016)

AKBP 15.15 Do 16:30 Foyer Nordbau

Development and Investigations of Coupling-Antenna Geometries at the S-DALINAC* — •C. Brückmann, M. Arnold, T. Bahlo, R. Grewe, N. Pietralla, and M. Steinhorst — Institute for Nuclear Physics, TU Darmstadt, Germany

The thrice-recirculating superconducting linear accelerator S-DALINAC [1] is the central research instrument of the Institute for Nuclear Phyics at TU Darmstadt. It is operated in cw-mode at a frequency of 3 GHz using superconducting niobium structures for acceleration. After the first commissioning in 1989 the rf couplers have been redesigned and replaced. The current operational setup uses a specific antenna geometry to couple to the rf field of the cavity. Investigations on other geometries of the input coupler antennas regarding their coupling behaviour and electric field profile for a possible upgrade of the antennas are ongoing. The results of these investigations will be presented.

*Supported by the DFG through GRK 2128
[1] N. Pietralla, Nuclear Physics News, Vol. 28, No. 2, 4 (2018).

AKBP 15.16 Do 16:30 Foyer Nordbau

Towards FPGA-based High Speed Data Acquisition and Online Analysis at MHz repetition rates — •Mohammed Bawatna[1], Sergey Kovalev[1], Michele Caselle[2], Bertram Green[1], and Michael Gensch[1] — [1]IRP-HZDR,Dresden,Germany — [2]IPE-KIT, Karlsruhe, Germany

Accelerator-based light sources, in particular, those based on linear accelerators, are intrinsically less stable than lasers or other more conventional light sources because of their large scale. In order to achieve optimal data quality, the properties of each light pulse need to be detected and implemented in the analysis of each respective experiment. Such schemes are of particular advantage in 4th generation light sources based on superconducting radiofrequency (SRF) technology, since here the combination of pulse-resolved detection schemes with high-repetition-rate is particularly fruitful [1,2,3]. In this contribution, we will outline how the pulse-resolved data acquisition scheme of the TELBE user facility shall be upgraded based on FPGA technology so that it allows operation at MHz repetition rates, subfemtosecond timing precision, online analysis of the measured data at MHz repetition rate, and will decrease the amount of data throughput and the required disk capacity for storing the data by orders of magnitude. Implementation of several novel purpose-built CMOS line array detector [4] will enable to perform arrival-time measurements at MHz repetition rates. [1] S. Kovalev et al., Struct. Dyn. 4, 024301 (2017). [2] B. Green et al., Sci. Rep. 6, 22256 (2016). [3] H. Hafez et al., Nature 561, 507 (2018). [4] L. Rota et al., Proceedings of IBIC2016, WEPG46 (2016).

AKBP 15.17 Do 16:30 Foyer Nordbau

Cavity Designs for the Superconducting Heavy Ion Accelerator HELIAC — •Thorsten Conrad[1], Kurt Aulenbacher[2,3], Winfried Barth[2,4], Markus Basten[1], Marco Busch[1], Malte Schwarz[1], Florian Dziuba[2], Viktor Gettmann[2], Manuel Heilmann[4], Thorsten Kürzeder[2], Maksym Miski-Oglu[2], Holger Podlech[1], Anna Rubin[4], Alexander Schnase[4], and Stephan Yaramyshev[4] — [1]IAP, Goethe University, Frankfurt am Main, Germany — [2]HIM, Mainz, Germany — [3]Johannes Gutenberg University, Mainz, Germany — [4]GSI Helmholtzzentrum, Darmstadt, Germany

In collaboration of GSI, HIM and Goethe University Frankfurt new designs for the CH-GTL cavities of the proposed Helmholtz Linear Accelerator (HELIAC) are developed. The cw-mode operated linac is intended for various experiments, especially with heavy ions at energies near the coulomb barrier for super-heavy element research. Currently eleven cavities are considered which will be split into four different cryostats. Each cavity will be equipped with dynamic bellow tuners. More detailed designs the cavities CH 3 and CH 4 more are given and compared to the specifications of the given beam dynamics. A closer look of the strain of the bellow tuners under mechanical stress is done, the behaviour of multipacting is investigated and the geometry of the cavities is so optimized that the peakfields are minimized.

AKBP 15.18 Do 16:30 Foyer Nordbau

A review of Nb3Sn thin film processing for Nb SRF cavities — •Nils Schäfer, Márton Major, and Lambert Alff — Institute of Material Science, Technische Universität Darmstadt, 64287 Darmstadt, Germany

Nowadays Nb is commonly used for superconducting radio frequency (SRF) cavities. Surface treatment can improve properties in the range of the penetration depth. Nb3Sn is a promising thin film material for SRF cavities as it can empower the cavity to operate at higher acceleration fields and higher temperatures. This is also achievable by a higher quality factor since the surface resistivity (RS) is lower with respect to Nb-only cavities at radiofrequency. Several approaches could be used for deposition of Nb3Sn thin film (e.g. sputtering, evaporation, and CVD; [Tan, TUPB055], [Pudasaini, TUPB067], [Pan, THPB057] and [Porter, WEXA03], Proc. SRF 2017). The applicability to successfully coat cavities was demonstrated for several processes with their respective disadvantages. Nb3Sn is either synthesized by a deposition of Sn on the Nb cavity or a stoichiometric deposition of Nb and Sn. Annealing forms the Nb3Sn thin film helps to further increase grain size and improve characteristics. Film Thickness, and especially stoichiometry are essential to make the most of the Nb3Sn material properties while under stoichiometric layers are still improve properties. A new modification to the sputtering process is made in the Advanced Thin Film Technology group to improve the stoichiometry of the layer. Work supported by the German Federal Ministry for Education and Research (BMBF) through grant 05H18RDRB2.

AKBP 15.19 Do 16:30 Foyer Nordbau

Geometry optimization of a 3.5-cell superconducting radio frequency cavity — •Kui Zhou, Jochen Teichert, Rong Xiang, and Andre Arnold — Bautzner Landstr. 400, 01328 Dresden -Germany

A new superconducting radio-frequency (SRF) cavity is developed at ELBE for its photocathode injector. This paper presents the preliminary geometry optimization of a 3.5-cell SRF cavity based on beam dynamics. The simulation results show that the higher electric field in the first half cell, the better beam parameters can be obtained, which, however, will also lead to some increment of Emax/Eacc and Bmax/Eacc.

AKBP 15.20 Do 16:30 Foyer Nordbau

Dispersion matching with space charge in energy recovery linacs — •Aamna Khan[1], Oliver Boine-Frankenheim[1], and Christian Stoll[2] — [1]TEMF, Technische Universität Darmstadt, Schlossgartenstr. 8, 64289 Darmstadt, Germany — [2]KPH, Johannes Gutenberg-Universität Mainz, Becher-Weg 45, 55128 Mainz, Germany

Dispersion matching of space charge (SC) dominated beams is a concern for high-intensity electron bunches traversing through bends, as for in the recirculation arc of an energy recovery linac (ERL) to a linac. For proper matching in presence of dispersion and SC, it's important to consider both centroid momentum and momentum spread of the bunch to prevent any emittance growth and phase space degradation. Also, it's necessary to couple transverse-longitudinal plane, as SC modified momentum compaction R_{56} can affect the efficiency of energy recovery process by varying the time of flight of electrons. We present a simple 3D coupled transverse-longitudinal envelope approach for dispersion matching with SC, benchmarked against particle tracking simulations with ELEGANT, for a 5MeV low energy, 180° injection arc matching with first cryomodule of multi-turn Mainz Energy-recovering Superconducting Accelerator (MESA).

AKBP 15.21 Do 16:30 Foyer Nordbau

Studies of Spill Ripple Compensation at Ion-Beam Therapy Synchrotrons — •Claude Krantz[1], Tobias Blumenstein[1], Uwe Scheeler[1], Max Rothenburger[1], Adrian Weber[1], Matthias Witt[1], Tobias Zinser[1], Rainer Cee[2], Fiona Faber[2], Eike Feldmeier[2], Michael Galonska[2], Stefan Scheloske[2], Christian Schömers[2], Andreas Peters[2], and Thomas Haberer[2] — [1]Marburger Ionenstrahl-Therapiezentrum, 35043 Marburg — [2]Heidelberger Ionenstrahl-Therapiezentrum, 69120 Heidelberg

Slow extraction is a key technique in operation of ion synchrotrons for radiation therapy, where stable properties of the extracted beams on time scales of seconds to sub-milliseconds are of prime importance for successful application of the raster scanning method. Residual ripple of synchrotron magnet power supplies is a well-known source of fluctuations in the extracted particle rate. One way of mitigation is active stabilisation of the horizontal synchrotron tune using fast quadrupole magnets. A prototype of a fast air-core quadrupole lens, suited for all beam rigidities relevant for proton and carbon-ion beam therapy, has been set up at the Marburg (MIT) and Heidelberg (HIT) Ion-Beam Therapy Centres. Initial tests of the device at MIT and HIT have shown that power-grid related ripple in the spill intensity of both synchrotrons can be significantly reduced when active stabilisation of the horizontal betatron frequency is applied. We present results from these initial studies and discuss possible future clinical applications of the technique.

AKBP 15.22 Do 16:30 Foyer Nordbau

Concept of a Beam Diagnostics System for the Multi-Turn ERL Operation at the S-DALINAC* — •M. Dutine, M. Arnold, T. Bahlo, R. Grewe, L. Jürgensen, N. Pietralla, F. Schliessmann, and M. Steinhorst — Institut für Kernphysik, TU Darmstadt

The S-DALINAC is a thrice-recirculating linear electron accelerator operating in cw-mode at a frequency of 3 GHz. Due to the implementation of a path-length adjustment system capable of a 360° phase shift, it is possible to operate the accelerator in ERL mode. For the multi-turn ERL operation the beam will be accelerated twice and subsequently decelerated twice again. For this mode, a non-destructive beam diagnostics system is necessary in order to measure the beam position and phase of both, the accelerated and the decelerated beam simultaneously in the same beam line. A particular challenge will be the operation at low beam currents of 100 nA, which corresponds to bunch charges of about 30 aC. The conceptional study of a 6 GHz resonant cavity beam position monitor will be presented together with alternative solutions.

*Work supported by DFG through GRK 2128 and BMBF through grant No. 05H18RDRB2.

AKBP 15.23 Do 16:30 Foyer Nordbau

Inbetriebnahme und Funktionstests eines Systems zur HF-Leistungsmessung am S-DALINAC* — •D. Schneider, M. Arnold, U. Bonnes, N. Pietralla und M. Steinhorst — Institut für Kernphysik, TU Darmstadt, Darmstadt

Der S-DALINAC ist ein supraleitender rezirkulierender Elektronenlinearbeschleuniger, der seit 1991 an der TU Darmstadt betrieben wird [1]. Die Leistung, die vom HF-Beschleunigungsfeld innerhalb der Hohlraumresonatoren auf den Strahl abgegeben wird, stellt eine wichtige Diagnose für den Strahlbetrieb dar. Diese Strahlleistung lässt sich durch Messen der Vor- und Rücklaufleistungen des HF-Feldes ermitteln. Die zuvor verwendete Infrastruktur zur Messung der HF-Leistungen war nicht auf eine langfristige und umfangreiche Leistungsdetektion ausgelegt. Aus diesem Grund wurde ein HF-Leistungsmesssystem aufgebaut, welches eine Strahlleistungsbestimmung im laufenden Betrieb ermöglicht. In diesem Beitrag wird das Leistungsmesssystem und die damit verbundenen Inbetriebnahmemaßnahmen vorgestellt. Neben der Fertigstellung und Kalibration des Systems wird auf eine umfangreiche Testreihe eingegangen.

*Gefördert durch die DFG im Rahmen des GRK 2128.

[1] N. Pietralla, Nuclear Physics News, Vol. 28, No. 2, 4 (2018)

AKBP 15.24 Do 16:30 Foyer Nordbau

Advanced Beam Dynamics Design for the Superconducting Heavy Ion Accelerator HELIAC — •Malte Schwarz[1], Markus Basten[1], Marco Busch[1], Thorsten Conrad[1], Holger Podlech[1], Manuel Heilmann[2], Anna Rubin[2], Stepan Yaramyshev[2], Florian Dziuba[3], Viktor Gettmann[3], Thorsten Kürzeder[3], Maksym Miski-Oglu[3], Winfried Barth[2,3], Christoph Burandt[2,3], Kurt Aulenbacher[3,4], Simon Lauber[2,3,4], and Julian List[2,3,4] — [1]Institut Für Angewandte Physik, Goethe-Universität Frankfurt — [2]GSI Darmstadt — [3]HIM Mainz — [4]IKP Mainz

Research and development in preparation of the proposed HElmholtz LInear ACcelerator (HELIAC) is performed by a collaboration of GSI, HIM and Goethe University Frankfurt. It is intended for various future experiments with special focus on heavy ion energies near the coulomb barrier for super-heavy element research. The linac will be operated in cw-mode and with a mass-to-charge-ratio up to 6. With a required minimum energy spread over a wide output energy range from 3.5 to 7.3 MeV/u the beam dynamics design is challenging. It is based on EQUUS (equidistant multi-gap structure) using highly efficient superconducting (sc) CH-DTL cavities with an accelerating gradient up to E_a = 7.1 MV/m. The worldwide first beam test with a sc multi-gap CH-DTL cavity in 2017 was a milestone in the R&D work of GSI, HIM and IAP. The layout for the entire linac has recently been updated and optimized and an advanced beam dynamics design for the HELIAC was developed.

AKBP 15.25 Do 16:30 Foyer Nordbau

Auto-Tuning of PI-Controllers for the RF Control at the S-DALINAC* — •M. Steinhorst, M. Arnold, and N. Pietralla — Institut für Kernphysik, TU Darmstadt, Darmstadt

The recirculating superconducting Darmstadt linear accelerator S-DALINAC [1] is one of the main research instruments at the institute for nuclear physics at the TU Darmstadt. It is operating in cw-mode at beam currents of up to 60 uA and energies of up to 130 MeV. In 2010 the current digital low-level rf control system was set into operation. The system is using PI-controllers to tune amplitude and phase of the rf accelerating field. For PI-controllers an important part is the proper tuning of the controller gains to minimize residual errors. These controller gains are normally not time invariant. Currently the tuning of the controller gains is done manually. It is planned to implement a scheme in the future future to automatically tune the controller gains to reach local minima of the residual errors in terms of phase and amplitude. This contribution is presenting a possible scheme and first results.

*Supported by the DFG through GRK 2128.

[1] N. Pietralla, Nucl. Phys. News 28 No. 2, 4 (2018).

AKBP 16: General Assembly of the Working Group on Accelerator Physics

Zeit: Donnerstag 19:00–21:30 Raum: HS 7

General Assembly of the Working Group on Accelerator Physics