Working Group on Accelerator Physics
Arbeitskreis Beschleunigerphysik (AKBP)

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Overview of Invited Talks and Sessions

(Lecture hall E 020; Poster A)

Sessions

AKBP 1.1–1.3	Mon	9:30–11:00	E 020	**Facility Reports**
AKBP 2.1–2.7	Mon	11:30–13:30	E 020	**Electron Sources and Cathodes**
AKBP 3.1–3.7	Mon	15:00–16:45	E 020	**Instrumentation and Beam Diagnostics I**
AKBP 4.1–4.7	Mon	17:00–18:45	E 020	**Beam Dynamics I**
AKBP 5.1–5.2	Tue	9:30–10:30	E 020	**New Accelerator Concepts - Experimental Results**
AKBP 6.1–6.8	Tue	11:00–13:00	E 020	**New Accelerator Concepts - Models and Experiments**
AKBP 7.1–7.6	Wed	9:30–11:00	E 020	**Applied Physics with Accelerators**
AKBP 8.1–8.8	Wed	11:30–13:30	E 020	**Beam Dynamics II**
AKBP 9.1–9.6	Wed	15:00–16:30	E 020	**SRF-Cavities -Materials and Methods**
AKBP 10.1–10.7	Wed	17:00–19:00	E 020	**Instrumentation and Beam Diagnostics II**
AKBP 11.1–11.6	Thu	9:30–11:00	PC 203	**Accelerators for Medical Applications (joint session ST/AKBP)**
AKBP 12.1–12.16	Thu	11:00–14:00	Poster A	**AKBP Poster Session**
AKBP 13	Thu	15:00–16:00	E 020	**AKBP Young Scientist Prize Award Ceremony**
AKBP 14.1–14.7	Thu	16:15–18:00	E 020	**Light Sources and FEL's**
AKBP 15	Thu	18:30–19:30	E 020	**Members' Assembly**
AKBP 16.1–16.6	Fri	9:30–11:00	E 020	**Spin Polarized Beams**
AKBP 17.1–17.4	Fri	11:15–12:15	E 020	**Future Extensions of Existing Machines**

Members' Assembly of the Working Group on Accelerator Physics

Donnerstag 18:30–19:30 E 020

- Bericht der AKBP Aktivitäten
- Wahl des/der Vorsitzenden
- Bericht aus dem KFB
- Verschiedenes

AKBP 1: Facility Reports

Time: Monday 9:30–11:00 Location: E 020

Group Report AKBP 1.1 Mon 9:30 E 020
KIT accelerators and research highlights - an overview — Bastian Haerer, •Erik Bründermann, Matthias Fuchs, Akira Mochihashi, Markus Schwarz, Julian Gethmann, Johannes L. Steinmann, and Marcel Schuh — Karlsruhe Institute of Technology, Karlsruhe, Germany

The Institute for Beam Physics and Technology (IBPT) at the Karlsruhe Institute of Technology (KIT) operates the Karlsruhe Research Accelerator (KARA) and the short-bunch linear accelerator, Ferninfrarot Linac- und Test-Experiment (FLUTE). In addition, a new compact storage ring will be realised in the context of the cSTART project and a new laser plasma accelerator laboratory will be the stepping stone for R&D based on novel acceleration techniques. This contribution gives an overview of current and future facilities and highlight respective accelerator physics research activities.

Group Report AKBP 1.2 Mon 10:00 E 020
Status of the PITZ facility: photoinjector R&D and applications — •Anne Oppelt — DESY, Platanenallee 6, 15738 Zeuthen

The Photo Injector Test facility at DESY in Zeuthen (PITZ) focuses on the development of high brightness electron sources for Free Electron Lasers (FELs) as well as on the applications of high brightness electron beams. In this talk, we will introduce the PITZ facility with its wide spectrum of beam parameters and its advanced diagnostics capabilities. The latest results of all three research directions will be presented: the development of new L-band normal conducting photocathode RF guns, the worldwide first high-power tunable narrow-band THz SASE FEL, and the new R&D platform FLASHlab@PITZ which offers unique research capabilities for tumor radiotherapy and radiation biology.

Group Report AKBP 1.3 Mon 10:30 E 020
Recent Developments at S-DALINAC* — •Michaela Arnold, Adrian Brauch, Manuel Dutine, Joachim Enders, Ruben Grewe, Lars Jürgensen, Maximilian Meier, Fatemeh Sadat Moujani Ghomi, Norbert Pietralla, Felix Schliessmann, Dominic Schneider, and Alexander Smushkin — Institut für Kernphysik, Technische Universität Darmstadt, Darmstadt, Germany

The superconducting Darmstadt linear accelerator S-DALINAC is a thrice-recirculating accelerator for electrons. Besides the conventional acceleration scheme with corresponding nuclear physics experiments, the accelerator can also be operated as an energy recovery linac (ERL) [1]. Since its establishment in 1991, the S-DALINAC was mainly developed and operated by students. The latest achievement was the successful operation as a superconducting multi-turn ERL [2]. Dedicated diagnostics to measure both beams in the same beamline simultaneously are under commissioning. A streak camera will be used to optimize the bunch length. The operation is supported by machine learning techniques. A laser Compton backscattering setup is close to its commissioning. Other projects are working on further improvements of the machine. This contribution will give a complete overview.

[1] M. Arnold et al., Phys. Rev. Accel. Beams 23, 020101 (2020).
[2] F. Schliessmann et al., Nat. Phys. 19, 597-602 (2023).

*Work supported by DFG (GRK 2128, IRTG 2891), BMBF (05H21RDRB1), State of Hesse (Research Cluster ELEMENTS (Project ID 500/10.006), LOEWE Research Group Nuclear Photonics).

AKBP 2: Electron Sources and Cathodes

The session deals with new developmetns for electron sources

Time: Monday 11:30–13:30 Location: E 020

Group Report AKBP 2.1 Mon 11:30 E 020
Photo-electron Source Research at Photo-CATCH* — •Maximilian Herbert, Joachim Enders, Markus Engart, Maximilian Meier, Julian Schulze, Vincent Wende, and Victor Winter — Institut für Kernphysik, Fachbereich Physik, Technische Universität Darmstadt, Darmstadt, Germany

The institute for nuclear physics at TU Darmstadt houses the test stand for Photo-Cathode Activation, Testing and Cleaning using atomic-Hydrogen Photo-CATCH. It enables dedicated research on GaAs photocathodes as well as DC photo-gun design for future use at the in-house Superconducting Darmstadt Linear Accelerator S-DALINAC. This contribution will give an overview of recent, ongoing and planned projects at Photo-CATCH.

*Work supported by DFG (GRK 2128 „AccelencE “, project number 264883531)

AKBP 2.2 Mon 12:00 E 020
Exploring the untapped potential of the next-generation SRF gun cavity — •Gowrishankar Thalagavadi Hallilingaiah and André Arnold — Helmholtz-Zentrum Rossendorf-Dresden, Dresden, Germany

A high beam brightness is a fundamental requirement for an electron linear accelerator, with the injector setting the lower limit for the achievable brightness. Over the past fifteen years at the ELBE accelerator in Dresden, the superconducting radio-frequency photoelectron injector (SRF gun) has been consistently delivering a high-brightness continuous wave electron beam, supporting the FEL, THz, and neutron experiments. Throughout this period, the gun cavity was operated below its design gradient due to the field emission from intricate cleaning and assembly processes, as well as contamination during cathode handling. A lower accelerating gradient reduces particle energy gain per cell and adversely affects beam quality by deviating from theoretical optima.

To overcome these limitations, a new cavity design is being explored, aiming to restrict the peak surface electric field to practically achievable levels. Additionally, the investigation includes the utilization of secondary TM and TE modes for improving the beam quality. Simultaneously, enhancements to the choke cell, cathode shape, and the transition from cell to beam pipe are being implemented to maximize the beam brightness and improve cavity cleaning. This contribution will discuss the initial findings obtained from the electromagnetic and beam dynamics simulations conducted on the new gun cavity.

AKBP 2.3 Mon 12:15 E 020
Development of a Hybrid Thermionic and Photoemission Electron Gun and Dedicated Test Stand for ELSA — •Samuel Kronenberg, Klaus Desch, Dennis Proft, and Philipp Hänisch — Physikalisches Institut der Universität Bonn

A new electron gun is currently being designed for the S-band Linac injector for ELSA. The objective of this development is to realise a new single bunch injection mode in addition to the standard long pulse (multi bunch) mode along with an improvement of the current beam parameters (e.g. emission current & transverse emittance) achieved by the existing gun. A dual mode design is being developed that utilises a caesium dispenser cathode both as a thermionic and a photo-cathode using thermally assisted photoemission. In addition to the novel electron gun, a dedicated test stand is currently being designed to allow detailed characterisation of both operating modes. The refined design of the gun and the current status of the test stand including beam parameter simulations are presented.

AKBP 2.4 Mon 12:30 E 020
Quantum efficiency scan setup for the activation chamber of Photo-CATCH* — •Julian Schulze, Joachim Enders, Markus Engart, Maximilian Herbert, Maximilian Meier, and Victor Winter — Institut für Kernphysik, Fachbereich Physik, Technische Universität Darmstadt, Darmstadt, Germany

GaAs photocathodes are used to generate spin-polarized electron

beams for a variety of applications. The quantum efficiency (QE) of a photocathode is defined as the ratio of extracted electrons to incident photons. GaAs cathodes are activated to negative electron affinity (NEA) by applying a thin layer of an alkali metal (esp. Cs) and an oxidant (eg. O_2). The activation layer may be inhomogeneous and/or deteriorate during operation due to interaction with residual-gas atoms or ion back-bombardment. The QE thus is position-dependent. A map of the QE can be measured by raster scanning the cathode surface with a laser to find the region with maximum QE which is best suited for beam extraction. A QE scan setup based on a piezoelectric mirror mount and a position sensitive feedback detector has been designed and installed. This contribution presents the design and characterization of the QE scan setup as well as results of the first performed QE scans at the activation chamber of Photo-CATCH.

*Work supported by DFG (GRK 2128 „AccelencE“, project number 264883531)

AKBP 2.5 Mon 12:45 E 020

High quantum efficiency magnesium photocathode for photoinjectors — •Rong Xiang, Jana Schaber, Jochen Teichert, Andre Arnold, Petr Murcek, Raffael Niemczyk, and Anton Ryzhov — Helmholtz Zentrum Dresden Rossendorf

To improve the quality of photocathodes is one of the critical issues in enhancing the stability and reliability of photo-injector systems. Magnesium has a low work function (3.6 eV) and shows high quantum efficiency (QE) after proper surface cleaning. This paper presents the investigation of alternative surface cleaning procedures, such as ps-laser cleaning, thermal cleaning and ion beam cleaning. The QE is able to be improved two magnitudes after the treatment.

AKBP 2.6 Mon 13:00 E 020

Na-K-Sb photocathodes for high brilliant electron beams — •Chen Wang[1,2], Sonal Mistry[1], Julius Kühn[1], and Thorsten Kamps[1,3] — [1]HZB, Berlin, Germany — [2]University of Siegen, Siegen, Germany — [3]Humboldt University of Berlin, Berlin, Germany

My PhD project aims to develop Na-K-Sb photocathodes for the Superconducting RF Electron Accelerator LABorotory (Sealab/bERLinPro) at HZB. The photocathode requires high quantum efficiency (QE) and long operational and dark lifetimes. To achieve these requirements, the QE as well as the thermal/ chemical stability of Na-K-Sb photocathode is being studied in the photocathode lab at HZB with spectral response and X-ray Photoelectron Spectroscopy (XPS). In this contribution, we will present the initial correlation between the chemical composition of Na-K-Sb and its QE and stability, as well as its failure mechanism during thermal degradation and oxidation.

AKBP 2.7 Mon 13:15 E 020

Development of a metal photocathode for the DESY SRF gun — •Chirag Banjare[1], Dmitry Bazyl[1], Klaus Floettmann[1], and Wolfgang Hillert[2] — [1]Deutsches Elektronen-Synchrotron DESY, Notkestraße 85, 22607 Hamburg, Germany — [2]Universität Hamburg, Hamburg, Germany

DESY and its collaborators are working on future continuous wave (CW) operations of a superconducting radio-frequency (SRF) photoinjector for the European X-ray-free electron laser (EuXFEL). CW-mode operation in a photoinjector requires a sufficiently high quantum efficiency (QE) photocathode. Currently, semiconductor photocathodes are operated in pulsed mode for the Eu-XFEL. However, installing a semiconductor photocathode in the SRF gun cavity can increase the risk of contamination of the SRF cavity. Therefore, metal photocathodes such as copper, gold, or niobium, which are durable, air-stable, and have a lesser risk of contamination in the cavity, are preferable to semiconductor photocathodes. However, metallic photocathodes have a lower QE (10^{-5}) than semiconductor photocathodes. Thus, the engineering of metallic photocathode design from the backside and front side illumination for light absorption is studied. A subwavelength-sized rectangular nanohole array on the gold surface is modeled to excite surface plasmons. Using CST Studio and FDTD software, the attenuated total reflection (ATR) phenomenon in a thin metal prism and several other techniques are simulated to perfectly absorb the light in the ultraviolet to green spectrums. This phenomenon contributes to obtaining the high QE of metal photocathodes.

AKBP 3: Instrumentation and Beam Diagnostics I

Time: Monday 15:00–16:45 Location: E 020

AKBP 3.1 Mon 15:00 E 020

Analyse eines Protonenstrahls mittels Kamerasystem — •Alina Dittwald, Andrea Denker, Jürgen Bundesmann, Georgios Kourkafas und Timo Fanselow — Helmholtz-Zentrum Berlin, Berlin, Deutschland

Seit mehr als 25 Jahren werden am HZB-Zyklotron in Kollaboration mit der Charité - Universitätsmedizin Berlin Protonen zur Behandlung von Augentumoren eingesetzt. Zudem gibt es ein Forschungs- und Entwicklungsprogramm für verschiedene Bereiche wie die Strahlendosimetrie, Medizinphysik, Strahlenhärtetests und PIXE. Für jede dieser Anwendungen ist eine Visualisierung der Strahlform, der Strahlposition und der Intensitätsverteilung des Strahls erforderlich. Hierfür wurde ein sehr leichtes und kompaktes Kamerasystem entwickelt, das zur Visualisierung und Auswertung des Protonenstrahls dient. Diese Eigenschaften und die Datenauswertung der Bilder werden vorgestellt.

AKBP 3.2 Mon 15:15 E 020

Commissioning and Experiments with a Compact Transverse Deflecting System at FLUTE — •Matthias Nabinger[1], Michael J. Nasse[1], Jens Schäfer[1], Erik Bründermann[1], Anton Malygin[1], Katharina Mayer[1], Robert Ruprecht[1], Thiemo Schmelzer[1], Nigel Smale[1], Anke-Susanne Müller[1], Micha Dehler[2], Rasmus Ischebeck[2], Matthias Moser[2], Volker Schlott[2], Thomas Feurer[3], Mozghan Hayati[3], Zoltan Ollmann[3], Sergei Glukhov[4], and Oliver Boine-Frankenheim[4] — [1]KIT, Karlsruhe, Deutschland — [2]PSI, Villigen, Schweiz — [3]Universität Bern, Bern, Schweiz — [4]TU Darmstadt, Darmstadt, Deutschland

A Compact Transverse Deflecting System (Compact-TDS) designed for longitudinal electron bunch diagnostics in the femtosecond regime is presently undergoing commissioning at the Karlsruhe Institute of Technology (KIT). This technique, based on THz streaking with a Split-Ring Resonator (SRR), demands a high level of electron beam controllability and stability at the micrometer scale. To meet these requirements, the Ferninfrarot Linac- Und Test-Experiment (FLUTE) has undergone an upgrade in 2023, incorporating a new RF system equipped with a state-of-the-art modulator, RF photoinjector and solenoid magnet.

In this contribution, we present first experiments conducted with the Compact-TDS at FLUTE, utilizing the enhanced RF setup.

AKBP 3.3 Mon 15:30 E 020

Development of a 6 GHz Cavity BPM for the Multi-Turn ERL Operation at the S-DALINAC* — •Manuel Dutine, Michaela Arnold, Ruben Grewe, Lars Jürgensen, Norbert Pietralla, Felix Schliessmann, and Manuel Steinhorst — Institut für Kernphysik, TU Darmstadt

The S-DALINAC is a thrice-recirculating 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 as an Energy-Recovery LINAC. The multi-turn ERL operation has been demonstrated in 2021. While operating the accelerator in this mode, there are two sets of bunches, the still-to-be accelerated and the already decelerated beam, with a longitudinal phase difference close to 180 degrees and significantly deviant transversal coordinates in the same beamline. A 6 GHz resonant cavity Beam Position Monitor (cBPM) has been developed in order to measure the beam position of both, the accelerated and the decelerated beam simultaneously in the same beamline. First measurement results will be shown.

*Work supported by DFG (GRK 2128), BMBF (05H21RDRB1), the State of Hesse within the Research Cluster ELEMENTS (Project ID 500/10.006) and the LOEWE Research Group Nuclear Photonics.

AKBP 3.4 Mon 15:45 E 020

Distributed Image Analysis from Digital Cameras at ELSA using the RabbitMQ Message Broker — •Michael Switka, Klaus Desch, Thomas Gereons, Dennis Proft, and Axel Spreitzer — Physikalisches Institut, Universität Bonn

For digital camera based imaging and image analysis a distributed data processing approach was implemented at the ELSA facility. We utilize the RabbitMQ message broker to share the high data throughput from image acquisition, processing, analysis, display and storage between different work stations to achieve an optimum efficiency of the involved hardware. Calibration of beam profile monitors using OpenCV machine vision algorithms allow us to perform qualitative beam photometry measurements. We describe the features and experience gained with the imaging system and present the architecture and applications, such as the programming and web interfaces for machine operators and developers.

AKBP 3.5 Mon 16:00 E 020

Investigation of Ion Trapping and Beam-Induced Fluorescence at the Electron Cooler Test-Bench at HIM. — •Thomas Beiser — Helmholtz-Institut Mainz, Germany

Beam-current dependent and wavelength-resolved studies of the beam-induced fluorescence at the electron cooler test-bench recorded with a low-noise, cooled sCMOS-camera, will be presented. A high-voltage switch was utilized for beam interruptions, counteracting ion trapping.

AKBP 3.6 Mon 16:15 E 020

Investigation Of Plasma Stability Of The Prototype Plasma Lens For Optical Matching At The ILC e+ Source — •Niclas Hamann[1,2], Manuel Formela[1,2], Gregor Loisch[2], Gudrid Moortgat-Pick[1,2], Kai Ludwig[2], and Jens Osterhoff[2] — [1]Uni Hamburg — [2]DESY Hamburg

The quest for novel technologies in the ever-evolving landscape of scientific exploration has led to the investigation of plasma lensing as a potential solution for optical matching devices at the International Linear Collider (ILC) positron source. This research becomes increasingly significant as the need for higher data output demands innovative concepts to increase positron yield and therefore luminosity. Our initial experiments revealed instabilities within the plasma. This talk will delve into these instabilities, explore their potential causes and the challenges they would pose. We'll discuss strategies for stabilizing the plasma to enhance the development of an efficient optical matching device. Overcoming these challenges is pivotal for a future application of plasma lenses as an integral part of a high performance ILC positron source.

AKBP 3.7 Mon 16:30 E 020

Reinforcement Learning Techniques for Injection Control at the Cooler Synchrotron COSY — •Awal Awal[1,2], Jan Hetzel[2], and Jörg Pretz[1,3] — [1]RWTH Aachen University — [2]GSI Helmholtzzentrum für Schwerionenforschung — [3]Forschungszentrum Jülich

Machine learning, particularly Reinforcement Learning (RL), holds significant promise in enhancing operations and optimisation within particle accelerator facilities. This study explores the application of RL for optimising particle accelerators, with a focus on the injection process at the COSY facility in Jülich, Germany. We propose a general formulation for RL problem and utilise it to optimise the injection into the synchrotron by manipulating four quadrupoles and seven steerers in the last section of the Injection Beam Line IBL.

Our methodology employs a soft actor-critic agent with dense neural networks, adapted for continuous action spaces, and training it with domain randomization to handle a variety of complex environmental dynamics. This results in a robust policy capable of generalizing to new, unseen environments. The integration of modernized viewer and control systems enabled direct analysis and automated adjustments of the beam cross section based on the RL agent's decisions. We extend this study with an in-depth analysis of the different components of the proposed RL framework and their significance. The successful implementation of this technique demonstrates a proof of concept in automating and optimizing accelerator operations, presenting a leap towards more efficient and consistent particle accelerator performance.

AKBP 4: Beam Dynamics I

Time: Monday 17:00–18:45 Location: E 020

AKBP 4.1 Mon 17:00 E 020

A 6-Dimensional Analytical Model for the SEALab SRF Gun and Solenoid — •Emily Jayne Brookes — HZB, Berlin, Germany

SEALab is home to an R&D superconducting radio-frequency photoinjector setup which aims to produce pulses of electrons at high brightness and low emittance to develop the technology for future high-brilliance electron beam purposes. Commissioning of the photoinjector will determine the characteristics of the achievable particle beam through the initial accelerating and magnetic components. In order to aid the commissioning of the setup, an analytical model of the machine is desired to provide fast insights into the beam dynamics for a simplified beamline. This will aid decision-making for commissioning and operation of the machine. For this purpose, a 6-dimensional, first-order, linear model of the photoinjector has been developed. This paper demonstrates the applicability of this toy-model for use in initial commissioning and its comparison to the corresponding ASTRA simulation.

AKBP 4.2 Mon 17:15 E 020

Phase space density tomography constrained by the Vlasov-Fokker-Planck equation — •Felipe Donoso, Stefan Funker, Erik Bründermann, Martin Frank, and Anke-Susanne Müller — KIT, Karlsruhe, Germany

Understanding the evolution of complex systems with numerous interacting particles requires advanced analytical tools capable of capturing the intricate dynamics of phase space. This study introduces a novel approach to phase space density tomography, leveraging constraints imposed by the Vlasov-Fokker-Planck equation. The Vlasov-Fokker-Planck equation offers a comprehensive description of the evolution of distribution functions in phase space, accounting for both deterministic and stochastic processes. The method proposed is designed to address the specific challenges associated with electron beam dynamics, providing enhanced accuracy in reconstructing phase space distributions.

In this work, we present a tomographic framework for reconstructing the phase space density of an electron bunch in the KARA synchrotron using simulated data and the Vlasov-Fokker-Planck equation.

AKBP 4.3 Mon 17:30 E 020

A Simulation of Ultrafast Electron Scattering Applications — •Simon Barg — Helmholtz-Zentrum Berlin für Materialen und Energie, Berlin, Germany

The superconducting radio-frequency (SRF) photoinjector is a photoelectron driven linear accelerator located at the SEALab facility at Helmholtz-Zentrum Berlin. With the injector, very flexible beam parameters can be achieved enabling many scientific applications like performing ultrafast electron scattering with diffraction and imaging modalities, which is this work's focus. Complex structures such as biological molecules, which are not suitable for conventional crystallographic methods, could be imaged and studied with this technique.

To assess the feasibility of ultrafast imaging, procedures and code libraries from electron microscopy (EM) are used and extended with the overall goal to provide a full numerical simulation for proposed liquid state experiments incorporating every step of the electrons' path: the emission from the gun, the deflection due to the interaction with a perpendicular stream of molecules and the aberrations created by the magnetic lens system.

A Python toolkit is build, which simplifies applying the simulation and thereby helps answering some of the experiment's key design questions: It allows the comparison of different modalities like dark and bright field imaging. It can also be used for optimizing the lens setup, or beam parameters. Additionally, it supports coherency studies and stroboscopic imaging to extensively and precisely explore different options for the future experiments at SEALab.

AKBP 4.4 Mon 17:45 E 020

Analytic formulation of the zero-crossing slope for a non-axial symmetric generalized Gaussian bunch. — •Stefano

Mattiello, Bernhard Erich Jürgen Scheible, and Andreas Penirschke — Technische Hochschule Mittelhessen, Friedberg, Hessen

For future experiments with ultra-short X-ray free-electron lasers (XFEL) shots, fs precision is required for the synchronisation systems even with 1 pC bunches using one or more button-like pickups in the Bunch Arrival Time Monitors (BAM). The sensitivity of the BAM depends in particular on the slope of the bipolar signal at the zero crossing and thus also on the bunch charge. Consequently, a precise theoretical prediction of the slope is a challenging and fundamental task. Nevertheless, previous investigations assume a perfectly axial-symmetric gaussian bunch. In this contribution the theoretical foundations of the pickup signal are presented in a systematic way including a non-axial symmetric generalized Gaussian bunch a point-symmetric distorsion of the standard Gaussian charge distribution. We focus on a button-like pickup and present an exact estimation of the zero-crossing slope as well as systematic comparison to results for the axial symmetric gaussian bunch in order to to achieve a deeper understanding of the effects of the asymmetric contribution.

AKBP 4.5 Mon 18:00 E 020

Determining quadrupole magnetic length shortening in COSY using a Bmad model — •Michael Margos — Institut für Kernphysik, FZ Jülich, Germany — III. Physikalisches Institut B, RWTH Aachen University, Germany — GSI Helmholtzzentrum für Schwerionenforschung GmbH, Darmstadt, Germany

Precision experiments, like the search for electric dipole moments (EDMs) in storage rings require very stable beam conditions and a very good understanding of the accelerator. The JEDI-Collaboration (Jülich Electric Dipole moment Investigations) in Jülich has modelled the storage ring COSY (COoler SYnchrotron) in the simulation software Bmad. A discrepancy between betatron tune measurements and computed betatron tune was found.

The primary suspect for this discrepancy is an inadequate description of quadrupole magnets, especially magnetic length shortening due to surrounding ferromagnetic material. Tune measurements with different quadrupole settings were measured and are compared to model tunes to determine actual quadrupole strength.

AKBP 4.6 Mon 18:15 E 020

Modelling of longitudinal phase space parameters of space charge dominated electron beams at PITZ — •Zarmina Shah[1,2], Namra Aftab[2], and Mohsen Kelisani[2] — [1]Brandenburgische Technische Universität-Cottbus — [2]Deutsches Elektronen-Synchrotron DESY, Platanenallee 6, 15738 Zeuthen, Germany

The Photo Injector Test facility at DESY in Zeuthen (PITZ) was established as a test stand of electron sources for the European X-ray Free Electron Laser (XFEL) and Free electron LASer in Hamburg (FLASH). PITZ utilizes tomography technique to reconstruct the LPS after the gun, which is based on an analytical model of the LPS parameters. This model does not include space charge forces and hence underestimates the energy spread for high charge beams, e.g., 250pC case, which is the working point for XFEL. The scope of this work was to include space charge forces into the analytical model. Astra simulations were carried out for electron beam including space charge forces and the calculated momentum and the momentum spread were compared to the results of the 6 dimensional envelope-based equations. The evaluation was done for different number of particles as well as under different energy chirp manipulation.

AKBP 4.7 Mon 18:30 E 020

Strategy towards deterministic lattice design — •Bettina Kuske and Paul Goslawski — HZB, Berlin, Germany

HZB is in the process of developing the lattice for BESSY III, the successor of the 1.7 GeV electron storage ring running in Berlin-Adlershof since 1998. Resource-intense generic optimization is often used to develop new lattices or modify existing lattices for new needs. Exploiting the intrinsic structure of modern MBA lattices, we elaborate on the benefits and limits of a deterministic approach that builds on principle considerations and short parameter scans.

AKBP 5: New Accelerator Concepts - Experimental Results

Time: Tuesday 9:30–10:30 Location: E 020

Group Report AKBP 5.1 Tue 9:30 E 020

Status and progress of the PWFA experiment FLASHForward — •Stephan Wesch[1], Judita Beinortait[1,2], Jonas Björklund Svensson[1], Lewis Boulton[1], Gregory Boyle[3], James Chappell[4], James Cowley[4], Severin Diederichs[1], Brian Foster[1,4], Matthew Garland[1], Pau González Caminal[1], Harry Jones[1], Advait Kanekar[1,6], Carl Lindstrøm[5], Gregor Loisch[1], Mathis Mewes[1], Jens Osterhoff[1,6], Felipe Peña[1,6], Angel Ferran Pousa[1], Siegfried Schreiber[1], Sarah Schröder[1], Rob Shalloo[1], Maxence Thévenet[1], Matthew Wing[1,2], Jonathan Wood[1], and Richard D'Arcy[1,4] — [1]Deutsches Elektronen-Synchrotro DESY, Hamburg, Germany — [2]University College London, United Kingdom — [3]James Cook University, Australia — [4]University of Oxford, United Kingdom — [5]University of Oslo, Norway — [6]Universität Hamburg, Germany

Experimental results in the last decades of beam-driven plasma-wakefield accelerators (PWFA) have demonstrated the feasibility of high-gradient acceleration and promise reduction of costs and sizes of future high-energy facilities. The requirements of current users of accelerators for luminosity and brightness cannot yet be met in terms of beam quality, high overall energy-transfer efficiency and operation at high-average-power. These are major research pillars which the PWFA experiment FLASHForward at DESY aims to combine in a single stage at acceleration gradients >1 GV/m with significant energy gain. Here, we present the status of the experiment and show latest results.

Group Report AKBP 5.2 Tue 10:00 E 020

Extended coherent nanophotonic electron acceleration — •Stefanie Kraus[1], Tomás Chlouba[1], Roy Shiloh[2], Leon Brückner[1], Julian Litzel[1], Zhexin Zhao[1], Manuel Konrad[1], and Peter Hommelhoff[1] — [1]Friedrich-Alexander-Universität (FAU), Erlangen, Germany — [2]Hebrew University, Jerusalem, Israel

Today's classical particle accelerators use radio-frequency metal cavities to accelerate and confine particles by synchronizing a microwave travelling wave with the particle propagation. We have shown the same principle, but in the optical domain and with dielectric materials. We demonstrate acceleration of electrons from 28.4 to 40.7 keV in a 0.5 mm long structure. Not only do we accelerate the electrons, but we also confine them with the help of the optical fields transversely utilising the alternating phase focussing scheme. This way, we can accelerate the electrons inside of a 250 nm narrow channel [1]. This could lead to a new type of accelerator that fits on a chip for applications in science, medicine, and industry.

[1] T. Chlouba*, R. Shiloh*, S. Kraus*, L. Brückner*, J. Litzel, P. Hommelhoff, Nature, 622, 476-480 (2023)

AKBP 6: New Accelerator Concepts - Models and Experiments

Time: Tuesday 11:00–13:00 Location: E 020

AKBP 6.1 Tue 11:00 E 020

Absolute lanex screen calibration for laser accelerated proton bunch detection — •Joshua Dietrich Schilz[1], Elisabeth Bodenstein[1,2], Florian-Emanuel Brack[1], Martin Rehwald[1], Florian Kroll[1], Jörg Pawelke[1,2], Felix Horst[1,2], Ulrich Schramm[1,3], Karl Zeil[1], and Josefine Metzkes-Ng[1] — [1]Helmholtz-Zentrum Dresden-Rossendorf, Dresden, Germany — [2]OncoRay, Dresden, Germany — [3]TUD Dresden, Dresden, Germany

Plasma-based accelerators leverage the robust electromagnetic fields sustained by plasmas for propelling charged particles to elevated energy levels. The creation of accelerating field structures within plasma is achieved through the application of intense laser pulses or charged particle beams. Laser-plasma accelerated (LPA) proton bunches are now applied for research fields ranging from ultra-high dose rate radiobiology to material science. For a long time, multi channel plates (MCP) have been used to characterize these proton bunches in e.g. Thomson parabolas (TPS). It is difficult to asses an absolute proton number calibration from these MCPs due to their nonlinear response. Scintillating lanex screens emerge as a promising and already implemented alternative in LPA facilities for the detection of ions and electrons. This study introduces an absolute proton number calibration for one of the most sensitive screens, the DRZ High (Mitsubishi Chemical Corporation, Duesseldorf, Germany), with the added benefit of seamless transferability to other facilities. Additionally, we delve into the quenching properties of the lanex screen, further enhancing our understanding of its capabilities.

AKBP 6.2 Tue 11:15 E 020

Coulomb-correlated few-electron states from a laser-driven field emitter — •Armin Feist[1,2], Rudolf Haindl[1,2], Till Domröse[1,2], Marcel Möller[1,2], John H. Gaida[1,2], Sergey V. Yalunin[1,2], and Claus Ropers[1,2] — [1]Max Planck Institute for Multidisciplinary Sciences, Göttingen, DE — [2]4th Physical Institute, University of Göttingen, DE

Coulomb repulsion in charged particle beams and pulses is usually considered detrimental due to a stochastic emittance increase. An extreme limit for high-brightness few-electron pulses is the spatially confined femtosecond photoemission from field emitters [1,2] employed in ultrafast electron microscopes [3]. However, ensemble-averaged detection usually prevents studying correlations in free-electron beams.

Here, we use event-based electron microscopy to characterize laser-triggered few-electron pulses generated at a Schottky field emitter [4]. We find strong Coulomb-correlations and field-controllable antibunching in electron pair, triple, and quadruple states, with a characteristic energy scale of 2 eV. State-sorted beam caustics show a discrete increase in virtual source size and longitudinal source shift.

Inducing such few-electron Coulomb correlations facilitates non-Poissonian electron pulse statistics and single-electron heralding, and promises applications in free-electron quantum optics.

[1] P. Hommelhoff *et al.*, Phys. Rev. Lett. **96**, 077401 (2006).
[2] C. Ropers *et al.*, Phys. Rev. Lett. **98**, 043907 (2007).
[3] A. Feist *et al.*, Ultramicroscopy **176**, 63-73 (2017).
[4] R. Haindl *et al.*, Nature Physics **19**, 1410-1417 (2023).

AKBP 6.3 Tue 11:30 E 020

Enhancing the Efficiency of Laser-Based Heavy Ion Acceleration by Radiative Target Heating — •Veronika Kratzer, Laura D. Geulig, Erin G. Fitzpatrick, Runjia Guo, Ming-Yang Hsu, Vitus Magin, Maximilian J. Weiser, and Peter G. Thirolf — Ludwig-Maximilians-Universität München, Munich, Germany

The efficient acceleration of heavy ions to kinetic energies above ca. 7 MeV/u is crucial to investigate the properties of heavy, neutron-rich nuclei in the novel fission-fusion nuclear reaction scheme [1]. This necessitates the acceleration of heavy ions with an intense laser pulse yielding bunches of multiple ion species of several charge states and with a continuous energy spectrum up to a characteristic cutoff-energy. Previously, it was found that the acceleration of (in our case) Au ions from thin foil targets can significantly be enhanced by evaporating surface contaminants and thus suppressing the acceleration of namely protons and C ions [2,3]. At the Centre for Advanced Laser Applications, we successfully accelerate highly charged Au ions from targets which are radiatively heated. Additionally, we record the thermal spectrum of the target and determine the surface temperature by fitting Plancks radiation law which allows a quantitative analysis [4]. The heating behavior of gold foils in vacuum and air is compared. Further, targets of different manufacturing processes and with different foil thicknesses are studied. [1] D. Habs et al., Appl. Phys. B 103, 471-484 (2011) [2] F. H. Lindner et al., Phys. Plasm. Contr. Fusion 61, 055002 (2019) [3] F. H. Lindner et al., Sci Rep 12, 4784 (2022) [4] M. J. Weiser, Master Thesis, LMU Munich, 2021

AKBP 6.4 Tue 11:45 E 020

Influence of laser intensity ramps on proton acceleration of solid density targets in PIC simulations — •Franziska Paschke-Bruehl, Thomas Kluge, and Ilja Göthel — HZDR (Helmholtz-Zenrum Dresden-Rossendorf), Dresden, Germany

We present a study that investigates the influence of an exponential laser intensity ramp (pre main pulse) on the proton acceleration from an ultra-thin Hydrogen target at plastic-density in 1D PIC (particle in cell) simulations. We find that laser ramp constellations with long scale lengths, i.e. shallow slope for energy deposition, and less energy in the ramp, about 2-8 % of total energy in pulse, are optimal for high proton energies due to a shock appearing in the expanding plasma on the rear side of the target. Protons of the pre plasma experience reflection from the shock and additional acceleration when traveling down the density gradient, these particles gain significant velocity and overtake the expanding TNSA protons.

By varying parameters such as a0, target thickness and density, we tested the robustness of the mentioned dynamics and found the same trends for a number of setups.

AKBP 6.5 Tue 12:00 E 020

Predicting Atomic States in Laser Plasma Accelerators — •Brian Edward Marré[1], Axel Huebl[2], Sergei Bastrakov[1], Michael Bussman[1,3], René Widera[1], Thomas Cowan[1], Ulrich Schramm[1], and Thomas Kluge[1] — [1]Helmholtz-Zentrum Dresden-Rossendorf — [2]Berkley National Lab — [3]CASUS-Center for Advanced System Understanding

Standard atomic physics models in Particle-in-Cell(PIC) simulations either neglect excited states, predict atomic state population in post processing only, or assume quasi-thermal plasma conditions.

This is not sufficient for high-intensity short-pulse laser generated plasmas, due to their non-equilibrium, transient and non-thermal plasma conditions, which are now becoming accessible in XFEL experiments at HIBEF (EuropeanXFEL), SACLA (Japan) or at MEC (LCLS/SLAC).

To remedy this we have developed FLYonPIC, an extension of the PIC code PIConGPU, modelling excited atomic states population dynamics in transient plasmas and without assuming a specific spectrum or temperature for electrons. This extension is based on an atomic state super configuration model, solved explicitly in time and with feedback to PIC, enabling full self consistency.

We will present an efficient implementation and discuss statistical analysis for validation of our model.

AKBP 6.6 Tue 12:15 E 020

Searching for non-thermal acoustic pulses emitted from laser-produced plasmas in water — •Timo Pohle, Anna-Katharina Schmidt, Julia Liese, and Jörg Schreiber — Fakultät für Physik, Ludwig-Maximilians-Universität München, Am Coulombwall 1, 85748 Garching

Laser acceleration in plasmas can yield short, very dense bunches of protons and heavier ions, which complicates diagnosing them. We use water as a detector medium where the ions deposit their energy when slowing down without the risk of destroying the detector. The rapid change in energy density results in an acoustic wave that provides a way of characterizing each ion bunch individually. Modeling the process commonly relies on the thermoacoustic approach, that is water thermally expands due to local heating. Surprisingly, heating by ions creates an additional, non-thermoacoustic, signal component which becomes observable close to the temperature where water has its highest density. In contrast, heating due to linear absorption of light behaves thermally [1]. We are now measuring the acoustic signal created by a laser produced plasma and by ions depositing their energy using wa-

ter of around $4°C$. This suppresses the thermoacoustic contribution and enables us to investigate the origin of the non-thermal signal. In my talk I will present first experimental results of the plasma-acoustic experiments.

[1] R. Lahmann et al. Astropart. Phys. 65, 69 (2015).

AKBP 6.7 Tue 12:30 E 020

Transverse Plasma Density Redistribution in Discharge Capillaries — •Advait Kanekar, Judita Beinortaite, Jonas Björklund Svensson, Lewis Boulton, Matthew James Garland, Harry Jones, Gregor Loisch, Mathis Mewis, Felipe Peña, Sarah Schröder, Maxence Thévenet, Stephan Wesch, Matthew Wing, and Richard D'Arcy — Deutsches Elektronen-Synchrotron (DESY), Hamburg, Germany

Plasma-wakefield accelerators provide acceleration gradients several orders of magnitude higher than radio-frequency accelerators and therefore represent a promising technology for reducing the footprint of future particle accelerators. Detailed knowledge of plasma dynamics, both spatially and temporally, is crucial to be able to mature the technology for application to linear colliders and free-electron lasers. FLASHForward is a beam-driven plasma-wakefield accelerator experiment at DESY. Using discharge capillaries as its plasma source, FLASHForward acts as a test bench to develop technologies to accelerate electron beams with high quality and high average power. In this contribution we present investigations into the temporal evolution of transverse plasma-density distributions at FLASHForward. Beam-based measurements are compared to hydrodynamic simulations for the first time.

AKBP 6.8 Tue 12:45 E 020

Visualizing Plasmons and Ultrafast Kinetic Instabilities in Laser-Driven Solids using X-ray Scattering — •Paweł Ordyna[1,2], Ulrich Schramm[1,2], Thomas Cowan[1,2], and Thomas Kluge[1] — [1]Helmholtz-Zentrum Dresden-Rossendorf — [2]Technical University Dresden

Ultra-intense lasers that ionize and accelerate electrons in solids to near the speed of light can lead to kinetic instabilities that alter the laser absorption and subsequent electron transport, isochoric heating, and ion acceleration. These instabilities can be difficult to characterize, but a novel approach using X-ray scattering at keV photon energies allows for their visualization with femtosecond temporal resolution on the few nanometer mesoscale.

The scattering signal can be predicted from Particle-in-cell simulations. We present here combined experimental and synthetic results from laser-driven flat silicon membranes that show development of periodic structures in the plasma electron density. Our Particle-in-cell simulations confirm that the observed signals are due to an oblique two-stream filamentation instability.

These findings provide new insight into ultra-fast instability and heating processes in solids under extreme conditions at the nanometer level with possible implications for laser particle acceleration, inertial confinement fusion, and laboratory astrophysics.

AKBP 7: Applied Physics with Accelerators

Time: Wednesday 9:30–11:00 Location: E 020

AKBP 7.1 Wed 9:30 E 020

The solid state Physics programme at ISOLDE-CERN: an important update — •Juliana Schell[1,2], Hans Hofsaess[3], Peter Schaaf[4], Lukas Eng[5], Sergiy Divinski[6], Anna Krawczuk[3], and Doru Lupascu[2] — [1]European Organization for Nuclear Research (CERN), Switzerland — [2]University of Duisburg-Essen, Germany — [3]Georg-August-Universität Göttingen, Germany — [4]TU Ilmenau, Germany — [5]Technische Universität Dresden, Germany — [6]University of Münster, Germany

ISOLDE-CERN is the worldwide reference facility for the production and delivery of radioactive ion beams of high purity. Since the late 70s the laboratory is pioneer in the use of nuclear techniques for studying local properties of materials using high-technology equipment. For instance, the brand-new ultra-high-vacuum implantation chamber called ASPIC Ion Implantation chamber (ASCII) decelerates the radioactive ion beam allowing to perform ultra-low energy ion implantations, and local measurements on the surface and interface of materials. The new MULTIPAC setup for Perturbed Angular Correlation Experiments in Multiferroic (and Magnetic) Materials simultaneously allows to measure local magnetic and ferroelectric properties of materials in magnetic fields up to 8.5 T. Last, but not least, the eMIL-Setup is an advanced emission Mössbauer spectrometer for measurements in versatile conditions of several classes of materials, thanks to the emission Magnetic Mössbauer Analyzer (eMMA) extension. This presentation introduces the new setups and discuss the possibilities of investigations on the frontiers of solid-state physics research.

AKBP 7.2 Wed 9:45 E 020

Proton Beam Based Production of a Positron Emitter by Exploiting the ^{27}Al(p,x)^{22}Na Reaction — •Lisa-Marie Krug[1], Leon Chryssos[1], Jürgen Bundesmann[2], Alina Dittwald[2], Georgios Kourkafas[2], Andrea Denker[2], and Christoph Hugenschmidt[1] — [1]Heinz Maier-Leibnitz Zentrum (MLZ), Technische Universität München, Lichtenbergstr. 1, 85748 Garching, Germany — [2]Helmholtz-Zentrum Berlin für Materialien und Energie, Protonen für die Therapie, Hahn-Meitner-Platz 1, 14109 Berlin, Germany

Compact setups for defect spectroscopy based on positron annihilation conventionally comprise a β^+ emitter as positron source. We produced ^{22}Na sources by irradiating aluminum targets with a 68 MeV proton beam available at the cyclotron at the Helmholtz-Zentrum Berlin (HZB). The design of the target allowed the production of multiple positron sources at once as well as the analysis of the depth dependent activity of ^{22}Na, which was found to be in agreement with the simulated depth profile. In total a ^{22}Na activity of 140(23) kBq was produced, which is spread over 50 individual Al discs whereby the highest activity achieved amounts to 4.62(23) kBq. Using the activated Al discs as positron emitters intrinsically avoids wet chemical processes. The production of stronger sources is desired for positron annihilation spectroscopy experiments can easily be achieved by irradiating the target for a longer period of time. Other radionuclides among ^{7}Be, ^{48}Sc, ^{54}Mn and ^{56}Co were produced with a total activity of 70(5) kBq, but can be avoided aside from ^{7}Be by using aluminum of a higher purity.

AKBP 7.3 Wed 10:00 E 020

First thoughts on electron beam treatment at the high average power SRF photoinjector SEALab — •Tasha Spohr — Helmholtz-Zentrum Berlin, Berlin, Germany

SEALab at the Helmholtz-Zentrum Berlin (HZB) is a high average power linear accelerator designed for ERL and UED experiments.

The electron beam from the SEALab photoinjector has potential properties which could be used for electron beam irradiation of wastewater, removing PFAS and other forever chemicals.

With Access@SEALab, we want to study the cleaning process and the required beam properties. In addition, we want to design an in-air beamline to study specific questions of wastewater removal by electron beam treatment.

The process of research and simulations will be presented in this talk.

AKBP 7.4 Wed 10:15 E 020

Installation of the Future Neutron Irradiation Site at the Bonn Isochronous Cyclotron — •Maximilian Loepke, Reinhard Beck, Dieter Eversheim, and Dennis Sauerland — Helmholtz-Institut für Strahlen- und Kernphysik Bonn

The Bonn Isochronous Cyclotron provides a beam of protons, deuterons, α-particles with a kinetic energy ranging from 7 to 14 MeV per nucleon. Since 2019, a proton beam is utilized for irradiation of e.g. silicon pixel detectors for radiation hardness studies.

It is planned to extend the facility's irradiation and experimentation capabilities by providing a neutron beam in the near future. The neutrons are produced by splitting-up deuterons into protons and neutrons in a thick carbon converter. Protons are stopped in the converter whereas the neutrons' flux and angular energy distribution is optimized by a subsequent copper/tungsten collimator. After collimation, the neutron beam can be utilized for irradiation.

For the installation of the site, a CAD model of the experimental

area was photogrammetrically created using the tools Meshroom and Meshlab. The collimator will be precisely aligned onto the beam axis. Beam axis determination and collimator alignment will be facilitated using a laser tracker. The beam diagnostics at the site will consist of a Secondary Electron Monitor (SEM) for non-destructive monitoring of beam current and position, a Faraday-Cup for SEM calibration and a scintillation screen for visual adjustment of the beam profile and the optics of the transfer beamline. This talk gives a detailed overview on the next steps of the installation of this irradiation site.

AKBP 7.5 Wed 10:30 E 020

Hochleistungs-Röntgenquelle für die Krebstherapie mit Mikrostrahlen — •Anton Dimroth[1], Stefan Bartzsch[2], Johanna Winter[2], Christian Petrich[2], Thomas Beiser[3], Ghaleb Natour[1] und Kurt Aulenbacher[3] — [1]ZEA-1, Forschungszentrum Jülich — [2]Klinikum rechts der Isar, TU München — [3]Institut für Kernphysik, Universität Mainz

Mikrostrahltherapie (MST) ist eine Entwicklung der Radioonkologie, die Röntgenstrahlung alternierend als Peaks hoher Dosis und Bereiche niedriger Dosis moduliert. Präklinisch zeigte die Therapie eine wesentlich bessere Verträglichkeit bei gleicher Tumorkontrolle im Vergleich zur konventionellen Strahlentherapie. Aufgrund der Abhängigkeit von Synchrotronstrahlung, gelang bislang keine klinische Anwendung.

Wir entwickeln eine Linienfokus-Röntgenröhre, die MST in klinische Studien bringen soll. Dazu müssen Dosisraten von über 100 Gy/s erreicht werden. Die größte Herausforderung ist die niedrige Effizienz von Röntgenröhren und die resultierende hohe Wärmelast auf dem Target. Konventionell bestehen rotierende Röntgentargets aus Wolfram-Molybdän-Verbindungen. Die für unsere Anwendung notwendigen hohen Rotationsgeschwindigkeiten und enormen Temperaturen erfordern allerdings andere Materialkombinationen. Wir konstruieren daher ein Röntgentarget aus Titan, das lediglich eine dünne Mantelschicht aus Molybdänlegierung und Wolfram aufweist. Die niedrigere Dichte von Titan bei hoher Hitzebeständigkeit reduziert mechanischen Spannungen. Durch Ausnutzung des Wärmekapazitätslimit verbleibt die Temperatur im Brennfleck unterhalb der Schmelztemperatur von Wolfram.

AKBP 7.6 Wed 10:45 E 020

Multiscale material characterization of palm-leaf manuscripts using SAXS and WAXS — •Laura Gallardo[1,2], Giovanni Ciotti[2,3], Mark Busch[1], Richard Kohns[1], Agnieszka Helman-Wazny[2], Sylvio Haas[2,4], and Patrick Huber[1,4,5] — [1]Institute for Materials and X-Ray Physics, Hamburg University of Technology — [2]Centre for the Study of Manuscript Cultures (CSMC), Hamburg University — [3]Department of History and Cultures, University of Bologna — [4]Deutsches Elektronen-Synchrotron DESY — [5]Institute of Surface Science, Helmholtz-Zentrum Hereon

Palm-leaf has been a very important material for the production of manuscripts in South, Central and South East Asia. In spite of the large collections preserved throughout the world, a classification of these manuscripts is only possible according to their language or their content, where the origin of the manuscripts is rarely known. This tradition has almost disappeared with the exception of a few monasteries and workshops for tourist handicrafts, where they still produce this writing support. Recent efforts have been made to document the manufacture process of the palm-leaves, finding crucial differences between the different monasteries that may help to identify the origin of the palm-leaf manuscripts (PLM) inherited from the past. In this study, we use Small and Wide Angle X-ray Scattering (SAXS and WAXS) to analyze the structural differences and similarities of palm-leaves in different stages of preparation and PLM. We aim to understand the physical changes of the leaves during the preparation process and to identify the similarities with unclassified PLM.

AKBP 8: Beam Dynamics II

Time: Wednesday 11:30–13:30 Location: E 020

AKBP 8.1 Wed 11:30 E 020

Hydrodynamic Simulations of an Argon-filled Tapered Plasma Lens for Optical Matching at the ILC e^+ Source — •Manuel Formela[1], Niclas Hamann[1], Gudrid Moortgat-Pick[1,2], Gregor Loisch[2], Mathis Mewes[2], Maxence Thévenet[2], Jens Osterhoff[2], and Greg Boyle[3] — [1]II. Institute of Theoretical Physics, University of Hamburg, Luruper Chaussee 149, 22761 Hamburg, Germany — [2]Deutsches Elektronen-Synchrotron DESY, Hamburg, Germany — [3]James Cook University, Townsville, Australia

The positron beam produced in the target of the ILC positron source is highly divergent and therefore requires immediate optical matching conventionally performed by some kind of solenoid arrangement. More recently, the usage of a plasma lens is considered as an alternative with the expectation of enhanced performance. Previous simulations have indicated that a plasma lens design with linear tapering is optimal for the ILC positron source.

The latest hydrodynamic simulations are meant to investigate argon as a plasma medium for the aforementioned linear design. Argon*s various reaction paths are systematically studied to understand their impact on the discharge process. The obtained results are then compared with hydrogen.

AKBP 8.2 Wed 11:45 E 020

Beam dynamic investigations for heavy ion beams with high duty cycle — •Pascal Häckel[2,3], Winfried Barth[1,2,3], and Simon Lauber[1,2] — [1]GSI, Damstadt, Germany — [2]HIM, Mainz, Germany — [3]JGU, Mainz, Germany

Research on Super Heavy Elements (SHE) is a fundamental component of scientific inquiry. The GSI Helmholtz Centre for Heavy Ion Research is an institution engaged in the discovery of new elements. It has successfully identified elements 108 to 112, made possible through the utilization of the UNILAC (Universal Linear Accelerator), which delivers 11.4 MeV/u heavy ion beams. For further synthesis of new elements, HELIAC (Helmholtz Linear ACcelerator) is currently constructed at GSI. In addition a new transfer channel from HELIAC to UNILAC for integration of HELIAC into existing beamlines, using bending- and focusing magnets, is being designed, transferring particles from HELIAC into experimental halls or further accelerators. To build this channel, the beamline is investigated using beam dynamics simulations for applicability for several energies and collimation. Through a parameter study, the optimal magnetic strengths of the magnets are determined. The HELIAC will provide variable energies between 3.5 and 7.3 MeV/u. Therefore, it is crucial to use the simulation to identify the parameters for various energies. The parameter study cannot be carried out for each energy individually. Accordingly, relationships between the parameters and energy are investigated. This allows the magnets to be adjusted for each energy, ensuring high transmission and beam quality for delivered heavy ion beams.

AKBP 8.3 Wed 12:00 E 020

Beam Dynamics Investigations for the HELIAC advanced demonstrator — •Simon Lauber[1], Robin Kalleicher[1,2,3], Maksym Miski-Oglu[1], Stepan Yaramyshev[1], and Winfried Barth[1,2,3] — [1]GSI, Darmstadt, Deutschland — [2]HIM, Mainz, Deutschland — [3]JGU, Mainz, Deutschland

The Helmholtz Linear Accelerator (HELIAC) is under construction at GSI Helmholtz Center for Heavy Ion Research. The superconducting linac will provide for continuous wave heavy ion beams to conduct super heavy element research, as well as material science. A special feature of this machine is the variable output energy of 3.5 to 7.3 MeV/u within an energy spread of ±3 keV/u. Following the beam test of the crossbar H-Mode cavity, in fall 2023 the first cryomodule, consisting of three cavities and two solenoids, is foreseen to be operated with beam. Preparations and measurements for the commissioning of the mentioned first of four cryomodules are presented.

AKBP 8.4 Wed 12:15 E 020

Coping non-linear dynamics in the BESSY III MBA lattice — •Paul Goslawski, Michael Abo-Bakr, Michael Arlandoo, Johan Bengtsson, Bettina Kuske, and Malte Titze — Helmholtz-Zentrum Berlin für Materialien und Energie

The main strategy to cope with non-linear beam dynamics at BESSY III is avoiding it. The main drivers of non-linear dynamics in the transverse and longitudinal plane and techniques to control and suppress it will be discussed.

AKBP 8.5 Wed 12:30 E 020

Modes Investigation for a Coupled Cross-bar H-type Cavity — •Ali Almomani[1] and Ulrich Ratzinger[2] — [1]Physics Department, Faculty of Science, Yarmouk University, 211-63 Irbid, Jordan — [2]Institute for Applied Physics, University of Frankfurt, Max-von-Laue Str. 1, 60438 Frankfurt am Main, Germany

The development of Cross-bar H-type cavities (CH-DTL) lasts since more than 20 years at IAP - Frankfurt and GSI - Darmstadt. In comparison with the conventional DTL, the H-type cavities show advantages with respect to the effective field gradient and to the shunt impedance at an energy range up to 100 A MeV. Efficient H - mode DTL's can be designed when applying the KONUS beam dynamics. Up to around 35 MeV, it is attractive to integrate one triplet lens into each cavity, as one KONUS section is relatively short and would not exploit the full RF power of 3 MW klystrons. Such a cavity is denoted as Coupled CH - cavity CCH. It can be seen as a coupled resonator connecting of two accelerating drift tube sections and one coupling cell containing of the triplet housing drift tube. In a second step, the second accelerator section of the CCH - cavity is rotated by 90°. In a third step, the coupling cell in the original CCH - cavity is rotated by 90°. In a fourth step, the coupling cell in the original CCH - cavity is exchanged by an ordinary accelerating drift tube section. As a result, it is shown that the RF behaviour for the first three modes is nearly identical. This means, that the tuning behaviour of the CCH - cavity can be simply deduced from the ordinary CH - cavity by replacing the coupling cell by an ordinary drift tube structure.

AKBP 8.6 Wed 12:45 E 020

Towards experimental-tailored laser wakefield acceleration aided by Bayesian methods — •Franziska Marie Herrmann[1,2], Tobias Hänel[1,2], Susanne Schöbel[1,2], Amin Ghaith[1], Maxwell Laberge[1], Yen-Yu Chang[1], Patrick Ufer[1,2], Paula Twellenkamp[1,2], Teresa D'Orsi Barreto[1,2], Jeffrey Kelling[1], Arie Irman[1], and Ulrich Schramm[1,2] — [1]Institut für Strahlenphysik, Helmholtz-Zentrum Dresden-Rossendorf, Deutschland — [2]Technische Universität Dresden, Deutschland

In recent years, the demand for relativistic electrons is increasing emerging from various applications in material science, particle physics and medicine. This fuels the development of compact electron accelerators. One promising approach is laser wakefield acceleration, which harnesses the capability of plasma to sustain very high electric fields. As laser wakefield acceleration is driven by high-intensity lasers, it relies on a complex, non-linear interplay between drive lasers and plasma parameters, resulting in a broad parameter space for an optimum acceleration for the generation of high quality electron beams. For tailoring the electron beam to match the requirements of each application case, independent control of all the interconnected parameters is imperative. Because optimization relying solely on experimental data is expensive in both time and resources, we utilize Bayesian methods to optimise the acceleration process parameters and determine the Pareto front for each experiment, ensuring reproducible conditions on each operation day. This project will be a crucial step toward a stable laser-plasma accelerator with experiment-adapted electron beam properties.

AKBP 8.7 Wed 13:00 E 020

HELIAC Beam Dynamics Simulations — •Robin Kalleicher[2,3], Winfried Barth[1,2,3], and Simon Lauber[1,2] — [1]GSI, Darmstadt, Germany — [2]HIM, Mainz, Germany — [3]JGU, Mainz, Germany

The synthesis of **S**uper **H**eavy **E**lements (**SHE**) is an active field in nuclear physics. Thereby, research in accelerator technology, contributing to synthesis of SHEs, is strongly motivated. At **GSI** Helmholtz Centre for Heavy Ion Research, where the elements 107 to 112 were discovered, the new **HE**lmholtz **LI**near **AC**celerator (**HELIAC**) is currently under construction. As a state-of-the-art continuous-wave (**CW**) superconducting accelerator for stable heavy ion beams, the HELIAC offers output energies in between 3.5 MeV/u and 7.3 MeV/u with outstanding precision for the SHE research community.

Still, for superconducting accelerators, cost substantially increases with the size of their cryo cooling system, limiting space for beam diagnotics elements. In this contribution a real-time, live simulation tool - the **Advanced Demonstrator Simulator** -, which was operated in parallel to beam tests in Q4 2023, will be presented. The main goal of this Advanced Demonstrator Simulator is the precise modelling and prediction of heavy ion beams inside the first HELIAC cryomodule conducting multi-particle simulations by implementing a digital twin of the actual machine. Beneficially, operators obtain massive gains in information, potentially resulting in faster tuning of the accelerator with increased precision. Furthermore, the interactive design of the tool enables calibration processes to be practised and post-processing of data in a well-organized manner.

AKBP 8.8 Wed 13:15 E 020

Chaotic Dynamics of Near-Critical Density Plasmas for Laser-Ion Acceleration — •Thomas Miethlinger[1], Sergei Bastrakov[1], Michael Bussmann[1], Alexander Debus[1], Marco Garten[3], Ilja Göthel[1,2], Axel Huebl[3], Brian Marre[1,2], Richard Pausch[1], Martin Rehwald[1,2], Klaus Steininger[1], Rene Widera[1], Karl Zeil[1], Thomas Cowan[1,2], Ulrich Schramm[1,2], and Thomas Kluge[1] — [1]Helmholtz-Zentrum Dresden-Rossendorf — [2]Technische Universität Dresden — [3]Lawrence Berkeley National Laboratory

We investigate the emergence and consequences of chaotic dynamics in the interaction of near-critical density plasmas with ultra-intense laser pulses, leading to highly sensitive dependencies on initial conditions even for important macroscopic quantities such as the absorbed laser energy and the spectrum of ions accelerated in the process. The interplay of laser- and induced fields continuously accelerates electrons in both forward and backward directions, leading to the formation of spiral-like vortex structures in phase space that exhibit varying degrees of mixedness. We identify a stretching and folding process in the electron dynamics, which is a prerequisite for deterministic chaos and also responsible for the creation of additional electron streams. Based on the results of particle-in-cell simulations, we present the intimate connection between the degree of mixing and chaotic dynamics, and we show a pathway to enhance the stability of the laser-plasma dynamics and thus secondary particle generation and acceleration.

AKBP 9: SRF-Cavities -Materials and Methods

Time: Wednesday 15:00–16:30 Location: E 020

AKBP 9.1 Wed 15:00 E 020

Superconducting Thin Films on Higher Order Mode Antennas for increase the CW Performance of SRF Cavities at MESA(*)(**) — •Paul Plattner, Florian Hug, and Timo Stengler — Institut für Kernphysik, Mainz, Deutschland

The Mainz Energy-Recovering Superconducting Accelerator (MESA), an energy-recovering (ER) LINAC, is currently under construction at the Institute for Nuclear physics at the Johannes Gutenberg-Universität Mainz, Germany. In the ER mode continues wave (CW) beam is accelerated from 5 MeV up to 105 MeV. The energy gain of the beam is provided through 2 enhanced ELBE-type cryomodules containing two 1.3 GHz 9-cell TESLA cavities each. By pushing the limits of the beam current up to 10 mA, a quench can occur at the HOM Antennas. The quench is caused through the increased power deposition induced by the electron beam in ER mode. Calculation shown that an upgrade from 1 mA to 10 mA is increasing the deposited power in the HOMs from 30.8 mW up to 3080 mW. 30% of this power will be out coupled with the HOM couplers and can be used as a thermal input. Simulations show a power limit of 95 mW which includes the power for 1 mA but is exceeded at 10 mA. A solution to increase the power limit are superconducting thin films which provides higher critical fields, temperature and currents. As candidates are Nb_3Sn and NbTiN are chosen. First simulations of the power limit for coated HOM antennas are shown. (*)The authors acknowledge the transfer of one cryomodule to Mainz by the STFC Daresbury. (**)The work received funding by BMBF through 05H21UMRB1.

AKBP 9.2 Wed 15:15 E 020

Magnetic Characterization of PEALD Coated Thin Films for SRF Cavity Research — •Lea Preece[1], Isabel Gonzalez Diaz-Palacio[1], Getnet Deyu[1], Robert Blick[1], Robert Zierold[1], Daniel Turner[2], Alick Macpherson[2], Marc Wenskat[1], and Wolfgang Hillert[1] — [1]Universität Hamburg, Hamburg, Germany — [2]CERN, Geneva, Switzerland

Superconducting radio frequency (SRF) bulk niobium cavities approach their performance limit. Therefore, current research explores novel approaches, such as coating the inner cavity walls with superconductor-insulator-superconductor (SIS) multilayers. Herein, we report on the unprecedented in-depth magnetic characterization of SIS samples deposited by plasma-enhanced atomic layer deposition (PEALD). The aim of this study is to assess the quality of PEALD-based SIS films and foresee potential improvements in cavity performance. The research involves several steps. First, the critical temperature (T_C) and the lower critical magnetic field (H_{C1}) of SIS-coated Nb and Si samples are measured via electrical transport and vibrating sample magnetometry. Then, the magnetic flux expulsion of SIS-coated Nb samples is being investigated in cooperation with CERN. Moreover, the London penetration depth (λ_L) of a coated Nb sample is derived. Finally, the lower critical magnetic field H_{C1} of SIS-coated Nb samples with various thicknesses of the superconducting top layer is determined by performing third-harmonic voltage measurements with local magnetometry. All these results will be tested against theoretical predictions for SIS multilayer films.

AKBP 9.3 Wed 15:30 E 020

Atomlagenabscheidung von Tantaloxid - einem neuen Material für die Beschichtung von Cavities — •Marco Voige, Getnet Kacha Deyu, Robert Zierold, Robert Blick, Marc Wenskat und Wolfgang Hillert — Universität Hamburg, Hamburg, Deutschland

Vielversprechende Ansätze zur weiteren Erhöhung der Beschleunigungsfelder in supraleitenden Cavities bestehen z.B. in der Passivierung der verlustbehafteten nativen Oxid-Oberfläche oder der Aufbringung von Mehrschichtstrukturen. Die Atomlagenabscheidung (ALD) erweist sich hierfür als ideal geeignete Methode, um die innere Oberfläche von Cavities homogen und mit sub-nm Präzision mit verschiedenen Materialien ohne Abschattungseffekte zu beschichten. Aufgrund des selbstlimitierenden Prozesses müssen jedoch die optimalen Parameter experimentell gefunden werden. Optimierungen führten zu einer reproduzierbaren und erfolgreichen Beschichtung mehrere Cavities mit Al2O3, was durch kryogene RF Tests belegt wird. Studien zu Ta2O5 zeigen interessante Materialeigenschaften und legen nahe, die bisher nur mit Al2O3-Beschichtungen durchgeführten Studien entsprechend zu erweitern. Dazu muss die Prozessoptimierung für Ta2O5 erneut durchgeführt werden, wobei das Augenmerk auf der Minimierung der thermischen Belastung der Cavity liegt, um parasitäres Diffundieren interstitieller Atome zu verhindern. Dazu werden Proben an verschiedenen Positionen in einer Cavity platziert und ex-situ mittels Oberflächenanalysen, auch nach Nachbehandlungen, charakterisiert. Abschließend ist ein kryogener RF Tests einer beschichteten Cavity geplant.

AKBP 9.4 Wed 15:45 E 020

Physical properties of Nb_3Sn films grown on copper by low-temperature co-sputtering for SRF cavity application — Nils Schäfer[1], Carl Jung[1], Matthias Mahr[1], Christian Dietz[1], Sebastian Bruns[1], Michaela Arnold[2], •Márton Major[1], and Lambert Alff[1] — [1]Institute of Materials Science, Technical University of Darmstadt, Darmstadt, Germany — [2]Institute of Nuclear Physics, Technical University of Darmstadt, Darmstadt, Germany

In this contribution we present the application relevant physical properties of Nb_3Sn thin-film coatings deposited onto copper substrates by a recently developed low-temperature co-sputtering process. We show by X-ray photoelectron spectroscopy that copper diffusion during low-temperature growth is limited to an interface region of about 100 nm. Furthermore, we show that the deposition time has a critical influence on phase formation. The deposited Nb_3Sn films have low surface roughness, high scratch resistance and they show excellent adhesion before and after thermal cycling. Nb_3Sn thin films grown at as low as 480 °C substrate temperature achieve a T_c of 16.8 K.

This work was supported by the German Federal Ministry of Education and Research (BMBF) through grant 05H21RDRB1 and the German Research Foundation (DFG) via AccelencE research training Group (GRK2128).

AKBP 9.5 Wed 16:00 E 020

Industrielle SRF Kryomodule für FEL Anwendungen — •Daniel Trompetter und Alexander Navitski — RI Research Instrument GmbH, Bergisch Gladbach, Germany

Seit ca. 20 Jahren entwickelt und baut die RI Research Instruments GmbH (vormals Accel Instruments GmbH) supraleitende 1,3 GHz Beschleuniger-Kryomodule für Forschungsanlagen an Universitäten und Forschungsinstituten wie 4 GLS (ALICE), TARLA, MESA und POLFEL. Die Kryomodule basieren auf einer Konstruktion der Anlage ELBE am Helmholtz-Zentrum Dresden-Rossendorf (HZDR, vormals FZ Rossendorf), wurden aber für die verschiedenen Projekte teilweise oder in Gänze angepasst. Neben Optimierungen der Fertigungsvorgänge wurden neue Rezepte zur Oberflächenpräparation der SRF Kavitäten, verbesserte Tunermechanismen und einstellbare Hochleistungskoppler in der Konstruktion berücksichtigt. Für das Projekt POLFEL wurde zudem das thermische Schild von einer statischen Kühlung mit flüssigem Stickstoff auf das Durchströmen mit gasförmigem Helium umgestellt. Das polnische Institut NCBJ bereitet aktuell die Tests der Kryomodule vor, die Ergebnisse dürften ab Mitte 2025 verfügbar sein. Mit der Anlage POLFEL wird das NCBJ zunächst einen THz FEL sowie ein Experiment zum ultraschnellen Elektronen Diffraktion betreiben.

AKBP 9.6 Wed 16:15 E 020

Particle-free cathode transfer system for SRF photoinjector — •Rong Xiang, Stefan Gatzmaga, Petr Murcek, Reinhard Steinbrueck, Jochen Teichert, Andre Arnold, and Adrian Hoffmann — Helmholtz Zentrum Dresden Rossendorf, Dresden, Germany

Superconducting radio frequency (SRF) photoinjectors offer advantages for continuous wave (CW) operation and high brightness, high current beam generation. One of the critical components for successful operation of SRF photoinjectors is the photocathode system. HZDR is building a sophisticated cathode exchange system to ensure accurate, particle-free and warm cathode exchange. A novel alignment process aligns the cathode to the gun axis without touching the cathode plug itself. Less than 10 particles as small as 0.3 micrometer are detected during the cathode load-lock tests.

AKBP 10: Instrumentation and Beam Diagnostics II

Time: Wednesday 17:00–19:00 Location: E 020

Group Report AKBP 10.1 Wed 17:00 E 020

Overview of the accelerator magnet systems developments at the Karlsruhe Institute of Technology — •Julian Gethmann[2], Falastine Abusaif[2], Axel Bernhard[2], Samira Fatehi[1], Andreas Grau[2], Bennet Krasch[2], David Saez de Jauregui[2], Erik Bründermann[2], and Anke-Susanne Müller[1,2] — [1]LAS, KIT, Karlsruhe — [2]IBPT, KIT, Karlsruhe

A key strategic approach to making accelerator-driven light sources more energy efficient and sustainable is to employ superconductivity.

At Karlsruhe Institute of Technology (KIT) there is a successful experience in developing and enhancing superconducting magnet systems for accelerators.

That includes the design and fabrication of low and high-temperature superconducting technologies, high-field undulators with long/short periodic lengths as well as novel miniature high-strength magnets.

This contribution gives an overview of the previous achievements and ongoing projects at KIT related to superconducting undulators and magnets.

AKBP 10.2 Wed 17:30 E 020

Gobau-Line Measurements for In-Vacuum Undulators — •Paul Volz — Helmholtz-Zentrum Berlin, Berlin — Johannes Gutenberg-Universität, Mainz

The in-vacuum elliptical undulator, IVUE32, is being developed at Helmholtz-Zentrum Berlin. The 2.5 m long device with a period length of 32 mm and a minimum gap of about 7 mm is to be installed in the BESSY II storage ring. The proximity of the undulator structure to the electron beam makes the device susceptible to wakefield effects which can influence beam stability. A complete understanding of its impedance characteristics is required prior to installation and operation. To understand and measure the IVU's impedance characteristics a Goubau-Line test stand is being designed. A Goubau-line is a single wire transmission line for high frequency surface waves with a transverse electric field resembling that of a charged particle beam out to a certain radial distance. Time domain reflectometry measurements of IVUE32 taper components will be presented. Together with a capability analysis of the Goubau-Line test stand.

AKBP 10.3 Wed 17:45 E 020

Development of an Active Beam Stabilization System for Electrofission Experiments at the S-DALINAC — •Dominic Schneider, Michaela Arnold, Uwe Bonnes, Adrian Brauch, Manuel Dutine, Ruben Grewe, Lars Jürgensen, Norbert Pietralla, Felix Schliessmann, and Gerhart Steinhilber — Technische Universität Darmstadt, Institute for Nuclear Physics, Darmstadt, Germany

The r-process fission cycle terminates the synthesis of heavy elements in binary neutron-star mergers. Fission processes of transuranium nuclides will be studied in electrofission reactions at the S-DALINAC. Due to the minuscule fissile target, the experimental setup requires an active electron-beam-stabilization system with high accuracy and a beam position resolution in the submillimeter range. Requirements and concepts for this system regarding beam diagnostics elements, feedback control and readout electronics will be presented. The usage of a cavity beam position monitor and optical transition radiation screens to monitor the required beam parameters will be discussed in detail. Additionally, various measurements performed at the S-DALINAC to assess requirements and limits for the beam-stabilization system will be presented. Finally, the option to use advanced machine learning methods, such as neural networks and agent-based reinforcement learning, will be discussed.

Work supported by DFG (GRK 2128), BMBF (05H21RDRB1), the State of Hesse within the Research Cluster ELEMENTS (Project ID 500/10.006) and the LOEWE Research Group Nuclear Photonics.

AKBP 10.4 Wed 18:00 E 020

Status and Perspectives of the Laser-Compton Backscattering Source at the S-DALINAC* — •Alexander Smushkin[1], Michaela Arnold[1], Vincent Bagnoud[2,3], Joachim Enders[1], Maximilian Meier[1], and Norbert Pietralla[1] — [1]Institut für Kernphysik, TU Darmstadt, Germany — [2]Institut für Angewandte Physik, TU Darmstadt, Germany — [3]GSI, Darmstadt, Germany

Quasi-monochromatic highly polarized MeV-ranged photon beams can be provided for a variety of applications by Compton scattering of a laser beam off ultra-relativistic electrons through a restricted aperture. The energy of the scattered photons is highest for backscattering, i.e. a scattering angle of 180°. In order to provide a high-flux Laser-Compton backscattering (LCB) light source with narrow energy bandwidth, a high-power laser with high stability and high repetition rate needs to be precisely synchronized with an ultra-relativistic electron beam. Such a source has been designed and constructed at the Superconducting Darmstadt Linear Accelerator S-DALINAC. The LCB source will be capable to provide photons with high brilliance and energies around 0.1 MeV. It is envisaged to be used as diagnostics tool for on-line beam-energy and energy-spread measurements, as well as a future experimental setup in the three-turn Energy Recovery Linac (ERL) mode of the S-DALINAC. This contribution will present the current status and perspectives of the LCB source.

*Work supported by DFG (GRK 2128 „AccelencE“, GRK 2891 and Inst163/308-1 FUGG) and HMWK (cluster project ELEMENTS, ID 500/10.006, and LOEWE research cluster „Nuclear Photonics“)

AKBP 10.5 Wed 18:15 E 020

Bunch-Length Measurement System Downstream the Injector of the S-DALINAC* — •A. Brauch, M. Arnold, M. Dutine, J. Enders, R. Grewe, L. Jürgensen, N. Pietralla, F. Schliessmann, and D. Schneider — Technische Universität Darmstadt, Department of Physics, Institute for Nuclear Physics, Schlossgartenstr. 9, 64289 Darmstadt, Germany

The S-DALINAC is a thrice-recirculating electron accelerator with a continuous-wave beam at a frequency of 2.9972 GHz that can be operated [1] as a twice-recirculating energy-recovery linac. Optimization of the bunch length downstream the injector is necessary to improve beam quality in regular operation as well as in energy-recovery mode. Currently, measurements of this beam parameter are accomplished by using the radio-frequency zero-crossing method. Since this method is time consuming and inaccurate, a new setup for these measurements using a streak camera is developed. Optical transition radiation from an aluminum-coated Kapton target is used to map the bunch length information to a light pulse which enables a precise measurement compared to a scintillating screen. The light pulse can then be evaluated with the streak camera. The device will be prepared for being useable at two different measurement setups downstream the injector. This contribution will present the design and the current status of the measurement setup as well as its properties.

[1] F. Schliessmann et al., Nat. Phys. 19, 597-602 (2023).

*Work supported by the State of Hesse (Cluster Project ELEMENTS, Project ID 500/10.006) and by DFG (GRK 2128 AccelencE).

AKBP 10.6 Wed 18:30 E 020

Characterizing Optical Synchrotron Radiation in the Geometric Optical Phase Space and Optimizing the Energy Transport to a Photo Detector — •Marvin-Dennis Noll, Johannes Leonard Steinmann, Dima El Khechen, Erhard Huttel, Erik Bründermann, and Anke-Susanne Müller — IBPT, KIT, Karlsruhe

At the Karlsruhe Research Accelerator (KARA) facility, an electron beam is generated by a thermionic electron gun, pre-accelerated to 53 MeV by a microtron and then ramped up to 500 MeV in a booster synchrotron before being injected into the storage ring, where a final electron energy of 2.5 GeV is reached.

With a circumference of 26 m the booster synchrotron has similar size and revolution frequency as the proposed large momentum acceptance storage ring of the cSTART project at KIT. Both synchrotrons do not reach equilibrium conditions which emphasizes the need for fast bunch-by-buch resolved diagnostics.

Compared to a 2D camera, when using 1D photodetectors for synchrotron light based diagnostics, either directly or after a fiber optics segment, the optic design goal is to maximize the optical intensity at the photo detector, rather than to keep spacial coherence. In this field of non-imaging optics the emitter, optical setup and sink can be modelled in the optical phase space, with the etendue being the conserved quantity and position and angle the independent variables. In this

contribution we describe the measurement setup and compare with measurments.

AKBP 10.7 Wed 18:45 E 020

Experiments on Single Electrons at the DELTA Storage Ring — •Zohair Usfoor[1], Shaukat Khan[1], Carsten Mai[1], Arjun Radha Krishnan[1], Wa'el Salah[1,2], and Vivek Vijayan[1] — [1]Center for Synchrotron Radiation (DELTA), TU Dortmund University, Dortmund, Germany — [2]The Hashemite University, Zarqa, Jordan

The ability to generate a beam consisting of a single electron or a few electrons introduces novel experimental possibilities when contrasted with conventional accelerator physics. At DELTA, a 1.5-GeV synchrotron radiation source at TU Dortmund University, scraping the electron beam reduces the number of electrons in the storage ring while simultaneously counting the synchrotron radiation photons. Typically, synchrotron radiation is explained as an electromagnetic wave within the context of classical electrodynamics. However, the emission of photons by an individual electron exposes the quantum characteristics inherent in synchrotron light. The statistical attributes of these photons provide extra information that can be applied for purposes of beam diagnostics. Our experimental setup and first results are presented.

AKBP 11: Accelerators for Medical Applications (joint session ST/AKBP)

Time: Thursday 9:30–11:00 Location: PC 203

AKBP 11.1 Thu 9:30 PC 203

Investigation of the track structure of therapeutic carbon ion radiation at HIT using the PTB ion counting nanodosimeter. — •Miriam Schwarze, Hans Rabus, and Gerhard Hilgers — Physikalisch-Technische Bundesanstalt, Germany

Nanodosimetry characterizes charged particle track structure and its biological effectiveness by the frequency distribution of ionizations in a given target, the ionization cluster size distribution (ICSD). First measurements of ICSDs were performed with the PTB Ion Counter nanodosimeter with therapeutic 12C ions at HIT.

The nanodosimeter was operated behind a PMMA collimator and PMMA absorbers of different thickness. Ionizations in the target were recorded in coincidence with the signals from two silicon strip detectors to determine the dependence of ICSDs on the impact parameter of the ions to the target.

Measurements with different absorber thickness and beam energy, combined such as to give an energy of 1 GeV in the target, produced mean ICSD values (M1) varying by almost 50 % over the investigated beam energy range for all impact parameters. Experiments with fixed beam energy and varying absorber thickness showed significantly higher M1 values than expected from previously measured data at lower energies [1].

A simulation of the measurement setup by the simulation software Geant4 was used to determine whether these deviations are caused by secondary particles.

[1] G. Hilgers et al., Phys. Med. Biol. 62 (2017) 7569-97

AKBP 11.2 Thu 9:45 PC 203

Dosimetry at low and ultra-high dose rates at FLASHlab@PITZ — •Felix Riemer, Namra Aftab, Zohrab Amirkhanyan, Prach Boonpornprasert, Dmytro Dmytriiev, Anna Grebinyk, Matthias Gross, Andreas Hoffmann, Mikhail Krasilnikov, Xiangkun Li, Frieder Mueller, Anne Oppelt, Chris Richard, Frank Stephan, Grygorii Vashchenko, Daniel Villani, and Steven Worm — Deutsches Elektronen-Synchrotron DESY, Platanenallee 6, 15738 Zeuthen, Germany

A new R&D facility for radiation therapy studies, called FLASHlab@PITZ, is being setup at the Photo Injector Test facility at DESY in Zeuthen (PITZ). It can provide worldwide unique beam parameters regarding delivered dose and dose rate. With an average dose rate within one RF pulse of up to 10^9 Gy/s and peak dose rates up to 4×10^{13} Gy/s, PITZ is fully capable of ultra-high dose rate experiments, for example the investigation of the FLASH effect. Nevertheless, dosimetry is a major challenge. Traditional detectors suffer from saturation and cannot provide reliable measurements up to such high dose rates. The goal is to test and benchmark detectors (also from external users) that cover the whole range of dose rates available at PITZ. Results of experiments using Gafchromic films in air and water will be presented. Dose depth profiles for four completely different beam configurations were measured with films and compared to Monte-Carlo simulations using FLUKA. The commercially available ionization chamber PPC05 (IBA Dosimetry) was benchmarked and comparisons with film measurements will be shown.

AKBP 11.3 Thu 10:00 PC 203

Dosimetry based on Cherenkov radiation: a method proposed to be studied for a wide range of dose rates at FLASHlab@PITZ — •Daniel Villani, Namra Aftab, Zohrab Amirkhanyan, Prach Boonpornprasert, Dmytro Dmytriiev, Anna Grebinyk, Matthias Gross, Andreas Hoffmann, Mikhail Krasilnikov, Xiangkun Li, Frieder Mueller, Anne Oppelt, Chris Richard, Felix Riemer, Frank Stephan, Grygorii Vashchenko, and Steven Worm — Deutsches Elektronen-Synchrotron DESY, Platanenallee 6, 15738 Zeuthen, Germany

The Photo Injector Test facility at DESY in Zeuthen (PITZ) is preparing an R&D platform for electron FLASH radiation therapy and radiation biology (FLASHlab@PITZ). This platform is based on the unique beam parameters available at PITZ: ps scale electron bunches of up to 22 MeV with up to 5 nC bunch charge at 4.5 MHz bunch repetition rate in bunch trains of up to 1 ms in length repeating at 1 to 10 Hz. These parameters can result average dose rates within one RF pulse of up to 10^9 Gy/s and peak dose rates up to 4×10^{13} Gy/s. At such beam conditions, dosimetry is a challenge. Studies have established that light emitted by the Cherenkov effect may be used for several radiation therapy dosimetry applications, since there is a correlation between the light captured using a UV-sensitive CCD camera and expected absorbed dose under certain conditions. This work aims to present a proposal for using Cherenkov light as a dosimetry method to be used at both low and high dose rates available at FLASHlab@PITZ.

AKBP 11.4 Thu 10:15 PC 203

Investigation of Measurement Techniques to Determine the Applied Dose of Ultra-High Energy Electron Beams in Cell Samples for FLASH Therapy at ELSA — •Leonardo Thome[1], Manuela Denz[2], Klaus Desch[1], Stephan Garbe[2], Frank Giordano[3], Kelly Grunwald[1], Carsten Herskind[3], Miriam Lösgen[1], Dennis Proft[1], and Susanne Spaeth[2] — [1]Physikalisches Institut der Universität Bonn — [2]Klinik für Strahlenthearpie und Radioonkologie der Universitätsklinik Bonn — [3]Klinik für Strahlentherapie und Radioonkologie der Universitätsklinik Mannheim

Ultra-high energy electrons (UHEE) are used to investigate their effect on tumor cells and healthy tissue in short pulses of microseconds at the electron accelerator facility ELSA. This may enable highly efficient treatment of deep-seated tumors due to the FLASH effect. In a preliminary setting the booster synchrotron is used to deliver electrons of 1.2 GeV energy to irradiate cell samples placed in a water phantom. Irradiation occurs with dose rates of up to 10 MGy/s due to the short pulse lengths of 250 ns. A precise dose determination is necessary to monitor the efficacy of the biological effect. Measurement techniques based on the usage of different detector types, such as radiochromic films, luminous screens, ionisation chambers and a diamond based detector, are evaluated.

AKBP 11.5 Thu 10:30 PC 203

Medical irradiation studies at IBPT accelerators — •Katharina Mayer, Markus Schwarz, Alfredo Ferrari, Michael J. Nasse, Martin Börner, Angelica Cecilia, Erik Bründermann, and Anke-Susanne Müller — KIT, Karlsruhe

Radiation therapy is an important oncological treatment method in which the tumor is irradiated with ionizing radiation. In recent years, the study of the beneficial effects of short intense radiation pulses (FLASH effect) or spatially fractionated radiation (MicroBeam/MiniBeam) have become an important research field. Systematic studies of this type often require non-medical accelerators that are capable of generating the desired short intense pulses and, in general, possess a large and flexible parameter space for investigating a

wide variety of irradiation methods.

At KIT, the accelerators of IBPT (Institute for Beam Physics and Technology) give access to complementary high-energy and time-resolved radiation sources. While the linear electron accelerator FLUTE (Ferninfrarot Linac- und Testexperiment) can generate ultra-short electron bunches, the electron storage ring KARA (Karlsruhe Research Accelerator) provides a source of pulsed X-rays.

In this contribution, first dose measurements and simulations for FLUTE and KARA using the Monte Carlo simulation program FLUKA are presented.

AKBP 11.6 Thu 10:45 PC 203

Hochleistungs-Röntgenquelle für die Krebstherapie mit Mikrostrahlen — •Stefan Bartzsch[1], Anton Dimroth[2], Johanna Winter[1], Christian Petrich[1], Thomas Beiser[3], Ghaleb Natour[2] und Kurt Aulenbacher[3] — [1]ZEA-1, Forschungszentrum Jülich — [2]Klinikum rechts der Isar, TU München — [3]Institut für Kernphysik, Universität Mainz

Zahlreiche präklinische Studien konnten zeigen, dass die Mikrostrahltherapie mit nicht homogenen Strahlenfeldern erhebliche Vorteile bringt: Bereiche niedriger Dosis ermöglichen die rasche Regeneration gesunden Gewebes, hohe Dosen in den mikrometerbreiten Peaks schädigen das Tumorgefäßsystem und lösen Immunreaktionen aus.

Um Strahlen mit 50 um Breite zu erzeugen, bedarf es einer Röntgenquelle im Orthovoltbereich, die hohe Dosisraten von einem mikrometerbreiten Brennfleck liefert. Wir entwickeln eine Linienfokusröntgenröhre, die 100 Gy/s, 600 kVp Röntgenstrahlung liefert und demnächst für erste Patientenbehandlungen eingesetzt werden soll.

Um derart hohe Dosisraten zu erzeugen, entwickeln wir einen Elektronenbeschleuniger mit über 1 A Strahlstrom. Die Elektronen werden auf einen Brennfleck von 50 um Breite und 20 mm Länge fokussiert. Durch die hohe Rotationsgeschwindigkeit des Röntgentargets wird das Wärmekapazitätslimit erreicht und damit die Temperatur im Brennfleck unterhalb des Schmelzpunktes von Wolfram gehalten. Die großen Herausforderungen bei der Beschleunigerentwicklung betreffen eine niedrige Emittanz, trotz hohem Strahlstrom und erheblicher Raumladungseffekte.

AKBP 12: AKBP Poster Session

Time: Thursday 11:00–14:00 Location: Poster A

AKBP 12.1 Thu 11:00 Poster A

Design of Dual-Core Cryogenic Current Comparators for Beamlines — •Volker Tympel[1,2], Frank Machalett[1,2,3], Thomas Stöhlker[1,2,3], Lorenzo Crescimbeni[2,3], David Haider[2], Thomas Sieber[2], Marcus Schwickert[2], Frank Schmidl[3], Paul Seidel[3], Matthias Schmelz[4], Ronny Stolz[4], and Vyacheslav Zakosarenko[4,5] — [1]Helmholtz Institut Jena, Jena — [2]Fröbelstieg 3 — [3]Friedrich-Schiller-University Jena — [4]Leibniz Institute of Photonic Technology, Jena — [5]Supracon AG, Jena

Bunched (AC) and un-bunched (DC) beam of charged particle leads to a magnetic field, like an electrical current in a wire. Cryogenic Current Comparators (CCC) for beamlines are able to measure that AC or DC beam current non-destructive, highly sensitive, and absolute in the nA range. Niobium based single core CCCs are running at CERN-Antiproton Decelerator (100 mm beamline diameter, BLD) and tested at GSI-CRYRING@ESR for the new Facility for Antiproton and Ion Research (FAIR) in Darmstadt with 150 mm BLD. In this work, smaller CCCs (BLD 63 mm) were created to investigate the limits of this measuring principle. For this purpose, dual-core CCCs (DCCCs) with total inductances of 200 uH or 300 uH @4.2 K were developed and measured. The fluctuation dissipation theorem (FDT) proved to be an effective tool for making a prediction about the expected current noise right at the beginning of the CCC creation. For the first time a white noise below 1 pArms/sqrt(Hz) could be achieved. Finely, it was possible to measure current impulses below 1 nApp in the laboratory. First results were presented at the EUCAS 2023 in Bologna.

AKBP 12.2 Thu 11:00 Poster A

PID-based beam current stabilisation system for Photo-CATCH* — •Victor Winter, Joachim Enders, Markus Engart, Maximilian Herbert, Maximilian Meier, and Julian Schulze — Institut für Kernphysik, Fachbereich Physik, Technische Universität Darmstadt, Darmstadt, Germany

Photo-CATCH is a test stand for research on GaAs photocathodes that can be used to generate spin-polarized electrons. It features a -60 kV DC photo-electron source with adjacent beamline. A stable current is required for operation of a particle accelerator. For a photo-electron source, this can be provided by altering the incident laser power on the photocathode surface. A PID controller can be used for this purpose, controlling a $\lambda/2$-plate to regulate the power of the laser beam and hence the emitted beam current. This contribution will present development and testing of a PID controller for beam current stabilisation at Photo-CATCH.

*Work supported by DFG (GRK 2128 „AccelencE“, project number 264883531)

AKBP 12.3 Thu 11:00 Poster A

Adaptive automated GaAs photocathode activation procedure for Photo-CATCH* — •Markus Engart, Joachim Enders, Maximilian Herbert, Maximilian Meier, Julian Schulze, and Victor Winter — Institut für Kernphysik, Fachbereich Physik, Technische Universität Darmstadt, Darmstadt, Germany

Photocathodes based on GaAs are a common source of spin-polarized electrons for particle accelerators. To achieve a sufficient yield of electrons with a GaAs semiconductor, the cathodes are activated to negative electron affinity by applying a thin layer of cesium and an oxidant, in our case O_2.The activation process is generally done manually, following an established scheme such as Co-Deposition (Co-De), i.e., the simultaneous application of Cs and O_2. This Contribution presents the development of an adaptive algorithm for the automation of Co-De activations and its implementation at the Photo-CATCH test stand.

*Work supported by DFG (GRK 2128 „AccelencE“, project number 264883531)

AKBP 12.4 Thu 11:00 Poster A

Investigation of annealed NbTiN thin films with field emisson scanning microscopy — •Frederic Braun[1], Isabel Díaz-Palacio[2], Florian Brockner[1], Robert Zierold[2], Wolfgang Hillert[2], and Dirk Lützenkirchen-Hecht[1] — [1]Bergische Universtiät Wuppertal — [2]Universität Hamburg

Superconducting radio-frequency (SRF) cavities, primarily constructed from Niobium, are currently operating at or near their theoretical limits, leaving little room for significant improvements. Consequently, the exploration of alternative materials becomes imperative to push the boundaries of SRF cavity performance. A promising approach for achieving enhanced performance involves the deposition of superconducting thin films, such as NbTiN or Nb*Sn on the inner walls of the cavities. This study focuses on the analysis of NbTiN-coated samples using a Field Emission Scanning Microscope (FESM) to get critical insights into the field emission properties within an accelerating field. The measurement of current-voltage curves on the surface allows for the determination of the onset-field, where a sufficiently large current of, e.g., 1 nA is measured. Surface mapping reveals variations in onset-fields, attributed to film properties like surface roughness, impurities, and contamination from small particles and adsorbates. Moreover, conducting constant current measurements over an extended period provides valuable information regarding the long-term stability of the thin film surface. These analyses assess NbTiN-coated surfaces in SRF cavities, aiming to enhance efficiency in superconducting applications.

AKBP 12.5 Thu 11:00 Poster A

Investigation of laser macro- and micropolishing on fine-grained niobium for use in Superconducting radio frequency cavities — •Florian Brockner[1], Laura Kreinest[2], Patrick Schwoche[1], and Dirk Lützenkirchen-Hecht[1] — [1]Bergische Universität Wuppertal — [2]Fraunhofer-Institut für Lasertechnik ILT

We carried out a feasibility study on laser macro and micro polishing of polycrystalline fine-grained planar niobium sheets, which fulfil the specification for a use in SRF cavities. Due to the high initial roughness of the untreated, non-polished sheets, macropolishing was first

carried out under an inert Ar-gas atmosphere using a diode-pumped fiber laser, and the laser polishing parameters (laser power, feed rate, beam diameter, number of cycles) were systematically varied. The optimal parameters are adjusted and selected after analysing the surface using white light interferometry. The test areas prepared in this way (approx. (5x5)mm^2) were then subjected to micropolishing by varying the average laser power and pulse duration of the ns laser used. The prepared surfaces were characterised using optical profilometry, electron microscopy, energy dispersive X-ray spectroscopy and measurements of the parasitic field emission.

AKBP 12.6 Thu 11:00 Poster A

Beam dynamics simulation of the high bunch charge in the second injection beamline of MESA — •Anatolii Kalamaiko[1], Kurt Aulenbacher[1,2,3], Monika Dehn[1], and Simon Friederich[1] — [1]Institute of Nuclear Physics, Mainz, Germany — [2]Helmholtz Institute Mainz, Germany — [3]GSI Helmholtzzentrum fur Schwerionenforschung, Darmstadt, Germany

MESA (Mainz Energy-recovering Superconducting Accelerator) is an electron accelerator with the beam energy up to 155 MeV, which is under construction at the Johannes Gutenberg University in Mainz. The accelerator has two laser-driven 100 KeV electron sources (polarized and unpolarized). The unpolarized electron source MIST (MESA Injector Source Two) allows producing highly charged electron bunches (up to 7.7 pC in a bunch). This electron source will be arranged above the main injector beamline of MESA. A special parallel shifting beamline was developed for transporting and compress with a buncher of electron beam from the electron source MIST to the main MESA beamline. This report presents the last results of the beam dynamics simulation and status of the second separation beamline of MESA.

AKBP 12.7 Thu 11:00 Poster A

Co-sputtering of Nb_3Sn thin films for prospective SRF applications — •Amir Farhood, Nils Schäfer, Alexey Arzumanov, Márton Major, and Lambert Alff — Institute of Materials Science, TU Darmstadt, 64287 Darmstadt, Germany

Nb_3Sn thin films are excellent candidates for superconducting radio frequency (SRF) applications due to their low surface resistivity and high superheating field in comparison to pure bulk Nb. Magnetron co-sputtering is shown to grow Nb_3Sn thin films with excellent homogeneity and microstructure at low temperature. In this work, the deposition of Nb_3Sn thin films using the mentioned magnetron co-sputtering process with substrate temperature of 400 °C to 600 °C on fused silica substrates was done. Based on earlier works, the presence of phase pure Nb_3Sn was shown by X-ray diffraction (XRD) scans. The stoichiometry of the thin films was verified by energy dispersive spectroscopy (EDS) measurements. Finally, critical temperature up to 16.5 K were measured for the applied thin films.

This work was supported by the German Federal Ministry for Education and Research (BMBF) through grant 05H21RDRB1 and the German Research Foundation (DFG) via AccelencE research training Group (GRK2128).

AKBP 12.8 Thu 11:00 Poster A

Multi-physics simulation of Quadrupole Resonators under geometric uncertainties — •Piotr Putek[1], Gowrishankar T. Hallilingaiah[2], Marc Wenskat[3], Simon B. Adrian[1], and Ursula van Rienen[1] — [1]Universität Rostock, Rostock, Germany — [2]HZDR, Dresden, Germany — [3]Universität Hamburg, Hamburg, Germany

Exploring the fundamental properties of materials, including niobium, NbTiN, multilayers or Nb3Sn, in high-precision surface resistance measurements is highly relevant to superconducting radio-frequency (RF) technology. Typically, the calorimetric measurement is carried out with a quadrupole resonator (QPR) to precisely characterize the RF properties of superconducting samples. Still, one of the main challenges in the QPR design and operations is to mitigate the influence of microphonics and Lorentz force (LF) detuning, on the one hand, and the RF losses on the adapter flange with the fabrication tolerances, on the other hand, into QPR functioning. For this reason, a multi-physics problem with random input parameters is addressed to study a significant measurement bias of the surface resistance, observed mainly for the third operating mode of the given QPR. Finally, the preliminary optimization results and their implication for the operational conditions of the QPR are discussed.

AKBP 12.9 Thu 11:00 Poster A

Studies on a Three-Turn Energy-Recovery Mode at the S-DALINAC — •Felix Schliessmann, Michaela Arnold, Adrian Brauch, Manuel Dutine, Marco Fischer, Ruben Grewe, Lars Juergensen, Maximilian Meier, Norbert Pietralla, and Dominic Schneider — Institut für Kernphysik, Technische Universität Darmstadt, Schloßgartenstraße 9, 64289 Darmstadt, Darmstadt, Germany

The electron accelerator S-DALINAC at Technische Universität Darmstadt was successfully operated in one-turn and two-turn energy-recovery mode. Due to its existing third recirculation beamline, the S-DALINAC has the potential to be operated in three-turn energy-recovery mode. In this mode, an accelerated and a decelerated beam are superimposed in both the first and the second recirculation beamline. Due to this shared beam-transport, this mode is particularly challenging since the number of degrees of freedom is reduced compared to an individual beam-transport. Therefore, beam-dynamics simulations are necessary to determine a suitable setup in advance. In this contribution, results of these beam-dynamics simulations will be presented.

AKBP 12.10 Thu 11:00 Poster A

Assembly and test of the first cryo-module for the HELIAC-project at GSI — •Thorsten Kürzeder[1,2], Winfried Barth[1,2,3], Christoph Burandt[1], Florian Dziuba[1,2], Viktor Gettmann[1,2], Robin Kalleicher[2,3], Szymon Kowina[1], Simon Lauber[1], Julian List[1,3], Maksym Miski-Oglu[1,2], and Stepan Yaramyshev[1] — [1]GSI, Darmstadt, Germany — [2]HIM, Mainz, Germany — [3]JGU, Mainz, Germany

The Helmholtz Linear Accelerator HELIAC is a superconducting (sc) continuous wave linear accelerator for heavy ions currently in development at GSI, the Helmholtz Centre for Heavy Ion Research in Darmstadt. The HELIAC offers variable output energies in between 3.5 MeV/u and 7.3 MeV/u and its main acceleration will be done in three cryo-modules. The assembly of the first cryo-module has just been finished in June 2023. The module houses three sc multi gap Cross bar H-mode (CH) acceleration cavities and a sc rebuncher cavity, as well as two sc solenoid lenses. The cavities are operated at 4 K at an accelerating gradient of up to 7 MV/m. The cold-string assembly took place in an ISO-class 4 cleanroom, which was finished in March, subsequently it was integrated into the cryo-module in a dedicated area in front of the cleanroom. Afterwards the module with a total weight of about 7 tons and a length of 5.5 m was shipped to GSI where it was integrated in a test area with connection to a 700 W cryo-plant and a beamline for tests with heavy ion beams. We will report on the assembly and the setup at GSI. First results of the tests, which started in November 2023, will be presented.

AKBP 12.11 Thu 11:00 Poster A

Implementation of a Transmission Diagnostic for High-Power Laser Plasma Interactions during Laser Ion Acceleration — •Runjia Guo, Maximilian J. Weiser, Erin G. Fitzpatrick, Laura D. Geulig, Ming-Yang Hsu, Veronika Kratzer, Vitus Magin, and Peter G. Thirolf — Ludwig-Maximilians-Universität München, Munich, Germany

Laser-driven acceleration of heavy ions is actively studied due to its ability to deliver ion bunches with high densities and ultra-short duration. These are needed for the novel fission-fusion nuclear reaction mechanism to investigate nuclear properties related to the rapid neutron capture process [1]. The process of ion acceleration begins when the focused laser pulse interacts with the plasma it generates from thin foil targets. To put ion beams into applications, diagnostics of the laser-plasma interaction quality is significant. For this, in High Field (HF) experiments of the Centre for Advanced Laser Applications (CALA), we are currently developing a diagnostic method to measure the amount of transmitted light through the targets, which is a key indicator of the efficiency of the conversion of laser pulse to ion energy [2]. A sandblasted glass screen is placed at 33 cm downstream of the laser focus. Two cameras with varied filters image the laser pulse profile transmitted through targets, measuring empty and target shot brightness, respectively, to quantitatively assess laser-light transmission and its dependency on target thickness. [1] D. Habs et al., Appl. Phys. B 103, 471-484 (2011) [2] Nicholas P.Dover., et al. Light Sci Appl 12, 71 (2023).

AKBP 12.12 Thu 11:00 Poster A

Realizing the cSTART Compact Storage Ring at KIT — •Jakob Krämer[1], Guido Blokesch[1], Erik Bründermann[2], Kai Dunkel[1], Verena Kümper[1], Anke-Susanne Müller[2], Christoph

Quitmann[1], Robert Ruprecht[2], and Markus Schwarz[2] — [1]RI Research Instruments GmbH, Bergisch Gladbach, Germany — [2]Karlsruhe Institute of Technology, Karlsruhe, Germany

Karlsruhe Institute of Technology has designed a compact STorage ring for Accelerator Research and Technology (cSTART). This storage ring will operate with ultra-short electron bunches and wide momentum spread from either the FLUTE injector or a Laser Plasma Accelerator. RI Research Instruments (RI) won the contract in a competitive tendering process and is currently working on the Technical Design Report (TDR) together with subcontractors. In this contribution, we present the status of the design and its main challenges. Due to the pre-existing building the circumference of cSTART is limited to 44 m and will be installed at about 5 m height, above the existing FLUTE injector. Together with strict tolerances on the relative alignment of the magnets, this requires an innovative support structure and alignment concept. On-axis injection is mandatory to study the non-equilibrium beam dynamics of the stored bunches. The short revolution period of 144 ps sets the boundary conditions for the pulsed kickers and septa. The compact design also leads to tight packing of magnets that are designed to minimize cross-talk. Upon successful completion of the TDR, RI will also realize cSTART, targeting a start of operation in 2027.

AKBP 12.13 Thu 11:00 Poster A

Data-driven Simulation of Target Normal Sheath Acceleration by Fourier Neural Operator — •Jeyhun Rustamov, Thomas Miethlinger, Thomas Kluge, Nico Hoffmann, Michael Bussmann, and Jeffrey Kelling — Helmholtz-Zentrum Dresden Rossendorf, Dresden, Germany

Particle-in-Cell simulations are a ubiquitous tool for linking theory and experimental data in plasma physics, rendering the comprehension of non-linear processes such as Laser-Plasma Acceleration (LPA) feasible. These numerical codes can be considered as state-of-the-art approach for studying the underlying physical processes in high temporal and spatial resolution. The analysis of experiments is performed by optimizing simulation parameters so that the simulated system is able to explain experimental results. However, a high spatio-temporal resolution comes at the cost of elevated simulation times which makes the inversion nearly impossible. We tackle this challenge by introducing and studying a reduced order model based on a Fourier neural operator that is evolving the ion density function of Laser-driven ion acceleration via 1D Target Normal Sheath acceleration (TNSA). The ion density function can be dynamically generated over time with respect to the thickness of the target. We demonstrate that, for achieving physical fidelity, our method requires a large number of Fourier modes, on top of a logarithmically scaled real-space density. Finally, this approach yields a significant speed-up compared to numerical code Smilei while retaining physical properties to a certain degree promising applicability for inversion of experimental data by simulation-based inference.

AKBP 12.14 Thu 11:00 Poster A

Resonator design optimization for a compact transverse-deflecting system — •Sergei Glukhov[1], Oliver Boine-Frankenheim[1], Uwe Niedermayer[1], Matthias Nabinger[2], Jens Schäfer[2], Michael J. Nasse[2], Erik Bründermann[2], and Anke-Susanne Müller[2] — [1]Institute for Accelerator Science and Electromagnetic Fields (TEMF), Darmstadt, Germany — [2]Karlsruhe Institute of Technology (KIT), Karlsruhe, Germany

Various design options have been studied and simulated using CST MICROWAVE STUDIO for a compact transverse-deflecting system proposed for diagnostics of extremely short electron bunches. The idea of the method is to use terahertz radiation, produced from optical rectification of the facility's electron gun laser pulse. The proposed system is to be checked experimentally at the test facility FLUTE (Ferninfrarot Linac- und Test-Experiment) at Karlsruhe Institute of Technology (KIT).

The present paper is focused on the simulations of the resonator providing interaction between the electron bunch and the terahertz pulse. Two types of resonators and their arrays have been studied for this purpose: inverse split-ring resonator and tilted slit resonator. Different types of terahertz pulse structure have been studied, including plane wave and transversally focused (Gaussian) beam. Useful analytical models have been proposed to systematize the results of the simulations.

AKBP 12.15 Thu 11:00 Poster A

Coupled S-parameter modelling of the beam impedance of elliptical undulators — •Alistair Muir[1], Paul Volz[3], Frederik Quetscher[2], Atoosa Meseck[3], Erion Gjonaj[2], and Ursula van Rienen[1] — [1]Universität Rostock, Rostock, Germany — [2]TU Darmstadt, Darmstadt, Germany — [3]Helmholtz-Zentrum Berlin, Berlin, Germany

Undulators are long and complex structures used in electron accelerators to generate X-rays. They are central components of a free electron laser. Such structures can generate strong wakefields that affect the beam impedance and create heat loads. Current software cannot efficiently model the beam impedance for long, complex structures on modest computing resources. We use the CSC_Beam method, based on Coupled S-Parameter Calculation (CSC), to model the beam impedance of arbitrarily long structures efficiently. It involves dividing the beam path into sections, forming a matrix containing the S-parameters and the direct beam impedance for each section, and concatenating the matrices of all the sections using CSC. We apply this method to model the beam impedance through the entrance section of an elliptical undulator. We compare with direct simulation results and evaluate the relative computational efficiency of the method.

AKBP 12.16 Thu 11:00 Poster A

Algorithmic Quantification of Laser-Plasma Accelerated Electron Bunches for Campaign Bayesian Steering — Tobias Hänel[1], Franziska Herrmann[1], Susanne Schöbel[1], Anna Willmann[1], Richard Pausch[1], Amin Ghaith[2,1], Maxwell Laberge[1,3], Ye-Yu Chang[1], Patrick Ufer[1,4], Paula Twellenkamp[1], Teresa D'Orsi Barreto[1], Michael Bussmann[5,1], Ulrich Schramm[1,4], Arie Irman[1], and •Jeffrey Kelling[1,6] — [1]Helmholtz-Zentrum Dresden - Rossendorf, Dresden, Germany — [2]Synchrotron SOLEIL, Saint-Aubin, France — [3]The University of Texas at Austin, Austin, TX, USA — [4]Technische Universität Dresden, Dresden, Germany — [5]CASUS, Görlitz, Germany — [6]Institut für Physik, TU Chemnitz, Chemnitz, Germany

Laser-plasma accelerators (LPA) are much smaller than conventional systems and can generate electron bunches with uniquely high current and small length, making them ideally suited to seed free electron lasers (FEL). UV lasing in such a setup has recently been demonstrated at the COXINEL experiment. Characteristics of the emitted radiation are sensitive to the shape of the seeding electron bunches, which in turn is determined by the pulse-properties of the driving laser. In order to enable the use of multi-objective Bayesian optimization to efficiently find pareto-optimal laser parameters given electron-bunch energies and spreads, we require a consistent and automatic way of extracting these properties measured energy spectra. Here, we present our approach, based on classical computer-vision methodology and evaluate the efficacy for Bayesian optimization runs.

AKBP 13: AKBP Young Scientist Prize Award Ceremony

Time: Thursday 15:00–16:00 Location: E 020

The AKBP young scientist award winner will give his talk and receive the AKBP prize.

AKBP 14: Light Sources and FEL's

Time: Thursday 16:15–18:00 Location: E 020

AKBP 14.1 Thu 16:15 E 020

Analytical And Numerical Studies On Experimental HGHG Data At FLASH — •Hendrik Wenzel[1], Sven Ackermann[2], Margarit Asatrian[1], Eugenio Ferrari[2], Samuel Hartwell[2], Wolfgang Hillert[1], Mehdi Kazemi[2], Tino Lang[2], Velizar Miltchev[1], Pardis Niknejadi[2], Fabian Pannek[3], Georgia Paraskaki[2], Dmitrii Samoilenko[1], Lucas Schaper[2], and Johann Zemella[2] — [1]Universität Hamburg, Hamburg, Germany — [2]Deutsches Elektronen-Synchrotron (DESY), Hamburg, Germany — [3]European XFEL, Hamburg, Germany

Free-**E**lectron **L**asers (FELs) generate ultrashort, transversely coherent laser pulses through **S**elf-**A**mplified **S**pontaneous **E**mission (SASE). Since SASE starts from the shot noise naturally present in the electron beam, it exhibits poor longitudinal coherence and shot-to-shot fluctuations both in spectrum and intensity. These limitations can be overcome by starting the FEL process deterministically, e.g., by using external seeding. Due to the lack of suitable seed laser sources at short wavelengths, seeding setups employing harmonic conversion are crucial to achieving full coherence in the XUV – X-Ray range. One such scheme is **H**igh-**G**ain **H**armonic **G**eneration – HGHG. There, a seed laser induces a coherent modulation of the phase space of the electron beam. Since the modulation contains components at higher harmonics of the seed laser wavelength, it is possible to generate powerful coherent radiation at the short wavelengths. We present analytical and numerical studies based on experimental results obtained at Xseed, the seeding experiment at the FLASH FEL at DESY, Hamburg.

AKBP 14.2 Thu 16:30 E 020

Power Buildup in a Strongly-Tapered FEL Oscillator — •Margarit Asatrian[1], Eugenio Ferrari[2], Andrew Fisher[3], Georgia Paraskaki[2], Pietro Musumeci[3], and Wolfgang Hillert[1] — [1]University of Hamburg, Hamburg, Germany — [2]Deutsches Elektronen-Synchrotron DESY, Hamburg, Germany — [3]University of California at Los Angeles, Los Angeles, California, USA

Free-Electron Lasers (FELs) can deliver high-energy pulses at MHz repetition rates and wavelengths down to XUV – X-Ray regime by extracting a fraction of energy of ultrarelativistic electron bunches. This fraction, corresponding to the FEL efficiency, depends on the FEL setup and typically lies below 0.1%.

A promising scheme for its improvement – Tapering Enhanced Stimulated Superradiant Amplification (TESSA), proposes using a high-power seed laser pulse in combination with strongly-tapered undulators for extracting a significantly larger fraction of the energy from a pre-bunched beam. Since there is a lack of sufficiently powerful seed laser sources at shorter wavelengths, one can consider implementing the TESSA scheme in an FEL oscillator, so that the seed is generated and stored within the cavity.

We present a simulation study addressing the challenges of power buildup in such a strongly-tapered FEL oscillator. In particular, we look into the possibility of using fast control on the beam energy and the undulator phase shifters for accelerating the buildup process.

AKBP 14.3 Thu 16:45 E 020

External Seeding via Echo-Enabled Harmonic Generation at FLASH — •Andreas Thiel[1], Sven Ackermann[2], Margarit Asatrian[1], Eugenio Ferrari[2], Samuel Hartwell[2], Wolfgang Hillert[1], Mehdi Kazemi[2], Tino Lang[2], Pardis Niknejadi[2], Fabian Pannek[3], Georgia Paraskaki[2], Dmitrii Samoilenko[1], Lucas Schaper[2], Hendrik Wenzel[1], and Johann Zemella[2] — [1]Universität Hamburg, Hamburg, Germany — [2]Deutsches Elektronen-Synchrotron (DESY), Hamburg, Germany — [3]European XFEL, Hamburg, Germany

Free-Electron Lasers (FELs) operating in Self-Amplified Spontaneous Emission (SASE) mode deliver high-power, transversely coherent and ultrashort pulses at wavelengths from THz down into the X-Ray regime. The limited longitudinal coherence and low spectral and pulse energy stability can be improved by various seeding schemes. In one of these, Echo-Enabled Harmonic Generation (EEHG), the electron beam is energy-modulated by two separate laser pulses in two modulators, each followed by a dispersive section. This results in a distinctive phase space profile containing density spikes, which allows the generation of fully coherent FEL radiation with narrow bandwidth at short wavelengths. At the FEL facility FLASH (DESY, Hamburg) possibilities for external seeding are explored within the Xseed environment, paving the path towards high repetition rate seeded FEL user operation, which is planned within the upgrade project FLASH2020+. In this contribution, the first experimental results of EEHG at FLASH are discussed along with the setup and hardware infrastructure.

AKBP 14.4 Thu 17:00 E 020

Optimization of the seeded THz-FEL at PITZ: study of shot noise and initial bunching factor impact for experimental beam conditions — •Xiaoyang Zhang, Xiangkun Li, Prach Boonpornprasert, and Mikhail Krasilnikov — Deutsches Elektronen- Synchrotron DESY, Zeuthen, Germany

The first operational high peak and average power THz SASE FEL at the Photo Injector Test Facility at DESY in Zeuthen (PITZ) has demonstrated up to 100 uJ single pulse energy at a center frequency of 3THz from electron bunches of 2-3 nC. The measured shot-to-shot radiation pulse energy has a fluctuation of ~10%. In previous studies, several seeding methods have been proposed in order to enhance the performance of the THz source, particularly in terms of shot-to-shot stability and temporal coherence. THz-FEL simulations with ideal electron beam parameters (temporal flattop with a peak current of 200A) have shown that a bunching factor of 10e-2 to 10e-3 is required for efficient seeding. In this talk, the seeding conditions for the PITZ experimental beam parameters (temporal Gaussian profile with a peak current of ~100 A) will be investigated, in particular the impact of the short noise and the initial bunching factor on the radiation pulse energy, stability and other properties of THz pulses.

AKBP 14.5 Thu 17:15 E 020

Advanced applicatons of the FLASH laser heater for short-pulse generation — •Carsten Mai[1], Philipp Amstutz[1], Shaukat Khan[1], and Christopher Gerth[2] — [1]Center for Synchrotron Radiation (DELTA), TU Dortmund University, Dortmund, Germany — [2]Deutsches Elektronen Synchrotron DESY, Hamburg, Germany

Laser heaters at FEL facilites are used to increase the electron energy spread and suppress the microbunching instability. A laser-heater has been installed as part of the FLASH2020+ upgrade program upstream of the first bunch compressor chicane at FLASH. As an extension of the standard laser heater operation, the FLASH Laser-Assisted Reshaping of Electron bunches (FLARE) project aims at the generation of short pulses by using the laser heater in an advanced configuration. Two different methods for the variation of the pulse duration using the laser heater and first measurements are presented.

AKBP 14.6 Thu 17:30 E 020

Seeding experiments using the echo-enabled harmonic generation scheme at DELTA — •Arjun Radha Krishnan[1], Benedikt Büsing[1], Shaukat Khan[1], Carsten Mai[1], Wa'el Salah[2], and Vivek Vijayan[1] — [1]Center for Synchrotron Radiation (DELTA), TU Dortmund University, Dortmund, Germany — [2]The Hashemite University, Zarqa, Jordan

Free-electron lasers use the echo-enabled harmonic generation (EEHG) scheme as a seeding method. However, the technique can be employed at storage rings for the generation of ultrashort radiation pulses, as well. At DELTA, a 1.5-GeV synchrotron light source operated by TU Dortmund University, recently an EEHG setup was implemented. Here, two-fold laser-electron interaction in two undulators, each followed by a magnetic chicane, is used to generate a density pattern with high harmonic content, leading to coherent radiation emission at harmonics of the laser wavelength. The implementation at DELTA is the world-wide first of its kind at a storage ring. The experimental setup and the present status of the project are presented.

AKBP 14.7 Thu 17:45 E 020

Methods for high-repetition THz production at XFEL — •Karel Peetermans[1], Wolfgang Hillert[2], and Francois Lemery[1] — [1]DESY — [2]Universität Hamburg

In order to exploit the full scientific potential of high-energy XFELs (electron energy > 10 GeV), it is necessary to provide adequate pump sources to enable pump-probe science. Users of the European XFEL have requested a THz pump source matching the machine repetition

rate (10 Hz burst mode with up to 2700 bunches per burst). In addition, they have demanded a spectral range spanning 0.1-30 THz with a tunable bandwidth to investigate broad and narrow resonances in matter. The EuXFEL R&D project, STERN, is exploring beam-based radiation generation methods using Cherenkov waveguides and diffraction radiation to satisfy these user requirements. This presentation will provide an overview of radiation generation from Cherenkov waveguides and diffraction sources, including theory, simulation and previous experimental results. We will cover a technical overview of our experimental area including the lattice and vacuum design. We furthermore discuss the collection and transport of the generated THz radiation. Finally, we will mention plans for THz diagnostics to characterize the generated radiation.

AKBP 15: Members' Assembly

Time: Thursday 18:30–19:30 Location: E 020

All members of the Working Group on Accelerator Physics are invited to participate.

AKBP 16: Spin Polarized Beams

Time: Friday 9:30–11:00 Location: E 020

AKBP 16.1 Fri 9:30 E 020

High-Precision Measurements of Asymmetry and Quantum Efficiency in Photocathodes for Polarised Electron Beam Experiments — •Jennifer Trieb, Valery Tioukine, and Kurt Aulenbacher — Johannes-Gutenberg Universität, Insitut für Kernphysik, Mainz, Deutschland

At the new, energy-recovering superconducting accelerator MESA in Mainz, spin-polarised electrons are required in the P2 experiment. Here the requirements increase considerably compared to the experiments at the microtron MAMI in Mainz. A very sensitive part of the photocathodes lies in the specially prepared surface, characterised by its negative electron affinity. This surface is highly sensitive to residual gases in vacuum and subjected to ion back bombardment. Traditionally, this negative electron affinity is achieved through a preparation involving caesium and oxygen. High current losses induce a degradation of quantum efficiency and the asymmetry, i.e the spin polarisation undergoes significant change. The exploration of the intricate relationship between asymmetry and quantum efficiency bears considerable importance, especially for the P2 experiment. Our aim is to clarify this connection and its implications, offering insights into managing spin polarisation and quantum efficiency in photocathodes.

AKBP 16.2 Fri 9:45 E 020

Determination of the Invariant Spin Axis in a COSY model using Bmad — •Maximilian Vitz — Forschungszentrum Jülich, Jülich, Germany — RWTH Aachen, Aachen, Germany

The matter-antimatter asymmetry might be understood by investigating the EDM (Electric Dipole Moment) of elementary charged particles. A permanent EDM of a subatomic particle violates time reversal and parity symmetry at the same time. A finite EDM, if detected with the experimental accuracy currently achievable, would be an indication of a CP violation beyond that established in the Standard Model.

The JEDI-Collaboration (Jülich Electric Dipole moment Investigations) in Jülich has performed a direct EDM measurement for deuterons with the so-called precurser experiments at the storage ring COSY (COoler SYnchrotron) in Forschungszentrum Jülich by measuring the invariant spin axis.

In order to interpret the measured data and to disentangle a potential EDM signal from systematic effects in the radial part of the invariant spin axis, spin tracking simulations in an accurate simulation model of COSY are needed. Therefore, a model of COSY has been implemented using the software library Bmad. Systematic effects were considered by including element misalignments, effective dipole shortening, longitudinal fields and steerer kicks. These effects rotate the invariant spin axis in addition to the EDM and have to be analyzed and understood. The most recent spin tracking results as well as the methods to find the invariant spin axis will be presented.

AKBP 16.3 Fri 10:00 E 020

Optimization of spin-coherence time for electric dipole moment measurements in a storage ring — •Rahul Shankar[1,2], Anna Piccoli[1], Paolo Lenisa[1,2], and Andreas Lehrach[3,4] — [1]Università degli studi di Ferrara, Ferrara, Italy — [2]Instituto Nazionale di Fisica Nucleare, Ferrara, Italy — [3]Forschungszentrum Jülich, 52425 Jülich, Germany — [4]RWTH Aachen University and JARA-FAME, 52056 Aachen, Germany

Electric dipole moments are very sensitive probes of physics beyond the Standard Model. The JEDI collaboration is dedicated to the search for the electric dipole moment (EDM) of charged particles making use of polarized beams in a storage ring. In order to reach the highest possible sensitivity, a fundamental parameter to be optimized is the Spin Coherence Time (SCT), i.e., the time interval within which the particles of the stored beam maintain a net polarization greater than 1/e. To identify the working conditions that maximize SCT, accurate spin-dynamics simulations have been performed using BMAD. In this study, lattices of a "prototype" storage ring, which uses combined electric and magnetic fields for bending, and a "hybrid" storage ring using only electric bending fields with magnets for focusing, are investigated. This talk presents a model of spin behaviour in frozen-spin lattices that has been verified in both situations, as well as a technique to optimize the second-order beam optics for maximum SCT at any given working point.

AKBP 16.4 Fri 10:15 E 020

Overview of Inverse Compton Scattering feasibility studies for MESA — •Christoph Lorey — Buchenweg 28, 65812, Bad Soden

At the Johnnes von Gutenberg University Mainz (JGU), the Institute of Nuclear Physics (KPH) is building the Main Energy Recovering Linear Accelarator (ERL) named MESA. As an ERL, MESA features a high brightness electron beam of up to 155 MeV. Different use cases of this beam for Inverse Compton Scattering (ICS) or Thomson Backscattering have been explored and their impact studied with a new quasi-analytical simulation code "COMPARSE". This presentation will give an overview of the mathematical foundation and results of our feasibility studies.

AKBP 16.5 Fri 10:30 E 020

Simulations of Beam-target Interaction for Prototype Electric Dipole Moment Storage Ring — •Saad Siddique — GSI GmbH Darmstadt Germany — RWTH Aachen University Germany — JEDI and CPEDM Collaborations

The matter-antimatter asymmetry observed in the universe may be explained through CP-violation by observing a permanent electric dipole moment (EDM) of subatomic particles. An advanced approach to measure the EDM of charged particles is to apply a Frozen spin method on a polarized beam in a storage ring. To increase the experimental precision step by step and to study systematic effects, the EDM experiment will be performed within three stages: the magnetic ring COSY Forschungzentrum Jülich Germany, a prototype EDM ring, and finally an all-electric EDM ring. The intermediate prototype EDM storage ring (PTR) will be a mock-up of the final ring, which will be used to study a variety of systematic effects and to implement the basic principle of the final ring. Beam storage and beam polarization measurement are challenging due to low beam energy and small size of ring. The preliminary results suggest that the PTR lattice with maximum vertical betatron function $<$ 100m could be acceptable to store beam for more than 1000s. However, these results need detailed studies of beam-target interaction which plays an important role in beam losses as well as in beam polarization measurements. The beam-tracking simulations are being performed with various sizes of external pellet targets and also with different positions to minimize beam losses as

well as to increase the efficiency of beam polarization measurements.

AKBP 16.6 Fri 10:45 E 020

Status of the 5 MeV Mott polarimeter at MESA — •Rakshya Thapa — Institut für Kernphysik, Mainz, Germany

P2 experiment at Mainz Energy-Recovering Superconducting Accelerator (MESA) desires to achieve Weinberg angle with an uncertainty of 0.15 %. This imposes that the uncertainty of the beam polarisation measurement has to be less than 1 %. A polarimetry chain with polarimeters operating at different energy and principles is planned to achieve this.

A Mott polarimeter operating at 5 MeV will be installed in this chain. The polarimeter has been designed. A study of the feasibility of several constituents of composite geometry is being carried out via computer simulation, which will be reported during this talk.

AKBP 17: Future Extensions of Existing Machines

Time: Friday 11:15–12:15 Location: E 020

AKBP 17.1 Fri 11:15 E 020

Arc design and simulations for the ERL-facility concept DICE — •Fatemeh Sadat Moujani Ghomi, Michaela Arnold, Lars Jürgensen, Norbert Pietralla, and Felix Schliessmann — Institut für Kernphysik, Technische Universität Darmstadt, Darmstadt, Germany

This contribution focuses on the design of an arc section for the ERL-concept study Darmstadt Individually recirculating Compact Energy recovery linac (DICE). The arc section consists of two vertical dog-legs and a total horizontal bend of 180°. Correspondingly, dispersion terms of both transverse planes must be controlled and, additionally, values for the longitudinal dispersion must be set depending on the operating mode. Here, the tracking software ELEGANT and its implemented optimization algorithms are used to find a suitable arc design and a proper behavior for the dispersion terms and beam envelopes. The overall goal is a compact design that can ideally be adapted for all arcs of DICE. We will discuss the parameters for a variable design of the arc sections of DICE and their justifications.

Work supported by BMBF under grant No. 05H21RDRB1 and by the DFG under grant GRK 2128 AccelencE, project-ID 264883531.

AKBP 17.2 Fri 11:30 E 020

Recent developments of the cSTART project — Markus Schwarz, •Erik Bründerman, Robert Ruprecht, Axel Bernhard, Bastian Härer, Dima El Khechen, Anton Malygin, Michael Johannes Nasse, Gudrun Niehues, Alexander Papash, Jens Schäfer, Marcel Schuh, Nigel Smale, Pawel Wesolowski, Christina Widmann, Anke-Susanne Müller, and Matthias Fuchs — KIT, Karlsruhe, Germany

The combination of a compact storage ring and a laser-plasma accelerator (LPA) can serve as the basis for future compact light sources. One challenge is the large momentum spread (˜ 2%) of the electron beams delivered by the LPA. To overcome this challenge, a very large acceptance compact storage ring (VLA-cSR) was designed as part of the compact STorage ring for Accelerator Research and Technology (cSTART) project. The project will be realized at the Karlsruhe Institute of Technology (KIT, Germany). Initially, the Ferninfrarot Linac-Und Test-Experiment (FLUTE), a source of ultra-short bunches, will serve as an injector for the VLA-cSR to benchmark and emulate LPA-like beams. In a second stage, a laser-plasma accelerator will be used as an injector, which is being developed as part of the ATHENA project in collaboration with DESY and the Helmholtz Institute Jena (HIJ). The small facility footprint, the large-momentum spread bunches with charges from 1 pC up to 1 nC and lengths from few fs to few ps pose challenges for the lattice design, RF system and beam diagnostics. The Technical Design Report is currently being developed in cooperation with Research Instruments and subcontractors.

AKBP 17.3 Fri 11:45 E 020

Results of target tests for the ILC — •Tim Lengler[1], Dieter Lott[2], and Gudrid Moortgat-Pick[1,3] — [1]Helmholtz-Zentrum Hereon, Geesthacht, Deutschland — [2]Universität Hamburg, Hamburg, Deutschland — [3]DESY, Hamburg, Deutschland

For the planned ILC (International Linear Collider) new target tests were carried out at the Mainzer Microtron in 2023, where titanium samples and additional materials were irradiated with an intense electron beam. For these samples the material was studied with high-energy x-ray diffraction. As comparative study an experiment was carried out where the heating effect was isolated and studied in the same way. Changes in the microstructure were analyzed qualitatively and quantitatively.

AKBP 17.4 Fri 12:00 E 020

Transverse Resonance Island Buckets in Advanced Light Sources — •Michael Arlandoo — Helmholtz-Zentrum Berlin

Transverse Resonance Island Buckets (TRIBs) is a special optics mode where the storage ring is tuned close to a resonance so that a second stable orbit can be operated together with the main one. The two orbits can be filled independently with bunches to some extent and this opens new possibilities for different timing mode experiments. TRIBs is successfully operated at BESSY II and in this talk, we discuss the possibility of implementing it in the upgrade project BESSY III. A first-principles approach based on nonlinear dynamics is presented where the mechanisms that generate TRIBs at different resonances are made transparent.