Arbeitskreis Beschleunigerphysik (AKBP)

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Übersicht der Plenarvorträge, Hauptvorträge, Symposien, Fachsitzungen und Poster

(Hörsäle S1/05-23, S1/05-24 und S1/05-122; Poster S1/05-22, S1/05-23 und S1/05-24)

Plenarvorträge mit direktem Bezug zur Beschleunigerphysik

Das vollständige Programm aller Plenarvorträge ist unter PV aufgeführt.

PV V	Do	9:45–10:30	S1/01 A1	**From COSY to HESR and EDM-at-COSY** — •Mei Bai

Hauptvorträge des FV Hadronen- und Kernphysik mit direktem Bezug zur Beschleunigerphysik

Das vollständige Programm ist unter HK aufgeführt.

HK 62.4	Fr	12:30–13:00	S1/01 A1	**Upgrade of the GSI-Unilac as a FAIR High Current Injector** — •Hendrik Hähnel

Plenarvorträge des Symposiums From QCD to Nuclei

SYNU 1.1	Di	9:00– 9:45	S1/01 A1	**Few Nucleon Systems from Lattice QCD** — •Martin Savage
SYNU 1.2	Di	9:45–10:30	S1/01 A1	**Uncertainty quantification and nuclear forces** — •Richard Furnstahl
SYNU 2.1	Di	11:20–12:05	S1/01 A1	**Recent Results in Nuclear Lattice Effective Field Theory** — •Dean Lee
SYNU 2.2	Di	12:05–12:50	S1/01 A1	**Atomic nuclei from effective field theories** — •Thomas Papenbrock

Hauptvorträge des Symposiums Energy Recovery Linacs

SYER 1.1	Mi	9:00– 9:45	S1/05 122	**What Is An Energy Recovery Linac, and Why There Might Be One In Your Future*** — •Geoffrey Krafft
SYER 1.2	Mi	9:45–10:30	S1/05 122	**An FFAG-ERL at Cornell University for eRHIC Prototyping and Bright-Beam Applications** — •Georg Hoffstaetter
SYER 2.1	Mi	11:00–11:30	S1/05 122	**Physics opportunities at ERLs** — •Jan Bernauer
SYER 2.2	Mi	11:30–12:00	S1/05 122	**MESA - an ERL project for particle physics experiments*** — •Florian Hug
SYER 2.3	Mi	12:00–12:30	S1/05 122	**Development of a high brightness, high current SRF photo-electron source for ERL applications** — •Axel Neumann

Fachsitzungen

AKBP 1.1–1.7	Mo	14:00–15:45	S1/05 23	**Injectors, Lasers I**
AKBP 2.1–2.7	Mo	14:00–15:45	S1/05 24	**RF, Resonators and Applications I**
AKBP 3.1–3.8	Mo	16:30–18:30	S1/05 23	**Injectors, Laser II**
AKBP 4.1–4.7	Mo	16:30–18:15	S1/05 24	**RF, Resonators and Applications II**
AKBP 5.1–5.8	Di	14:00–16:00	S1/05 23	**Beam and Accelerator Control I**
AKBP 6.1–6.8	Di	14:00–16:00	S1/05 24	**Beam Dynamics / Simulation I**

AKBP 7.1–7.8	Di	16:30–18:30	S1/05 23	**Beam and Accelerator Control II**
AKBP 8.1–8.8	Di	16:30–18:30	S1/05 24	**Polarized Beams**
AKBP 9.1–9.7	Mi	14:00–16:00	S1/05 122	**Seeding, Thomson and Compton Scattering**
AKBP 10.1–10.8	Mi	16:30–18:30	S1/05 122	**Beam Dynamics / Simulation II**
AKBP 11.1–11.27	Mi	18:30–20:30	S1/05 22-24	**Poster**
AKBP 12.1–12.8	Do	14:00–16:00	S1/05 23	**Beam Diagnostics I**
AKBP 13.1–13.8	Do	14:00–16:00	S1/05 24	**PWA, DLA, Thomson and Compton Scattering**
AKBP 14.1–14.8	Do	16:30–18:30	S1/05 23	**Beam Diagnostics II**
AKBP 15.1–15.8	Do	16:30–18:30	S1/05 24	**PWA and self modulation**

Mitgliederversammlung Arbeitskreis Beschleunigerphysik

Mi 20:00–21:00 Raum S1/05-122

- Neuigkeiten vom AKBP
- Bericht von den DPG Vorstandsratssitzungen
- Neuigkeiten vom Komitee für Beschleunigerphysik (KfB)
- Einrichtung eines Beschleunigerpreises
- Verschiedenes

AKBP 1: Injectors, Lasers I

Zeit: Montag 14:00–15:45 Raum: S1/05 23

AKBP 1.1 Mo 14:00 S1/05 23

Optimierung der thermionischen Elektronenquelle des S-DALINAC — •Mirco Gros, Uwe Bonnes, Thore Bahlo, Thorsten Kürzeder und Norbert Pietralla — Institut für Kernphysik, TU Darmstadt, Darmstadt, Germany

Der S-DALINAC ist ein supraleitender Elektronenlinearbeschleuniger an der TU-Darmstadt. Zur Erzeugung der Elektronen können eine thermionische Quelle oder alternativ eine Quelle für spinpolarisierte Elektronen genutzt werden. Im Anschluss daran erfolgt die Vorbereitung des Elektronenstrahls in einer Chopper/Prebuncher-Sektion für die Beschleunigung in den 3 GHz supraleitenden Beschleunigungsstrukturen des S-DALINAC. An die thermionische Elektronenquelle schließt sich eine elektrostatische Beschleunigungskaskade an, die einen Energiegewinn von 250 keV sicherstellen soll. Spannungsschwankungen, verursacht durch Durchschläge und Kriechströme, lassen die Elektronen diese Energie nicht zuverlässig erreichen, was zu Flugzeiteffekten auf dem Weg zum Injektor führt. Um die Ursachen der Spannungsschwankungen bestimmen zu können, wurde eine umfangreiche Fehlersuche betrieben. Mit Hilfe von Tests und Simulationen wurden verschiedene Maßnahmen, wie zum Beispiel das Entfernen eines Feldführungsrings, durchgeführt, um Durchschläge zu vermeiden. Des Weiteren wurde mittels einer Strombilanz der beteiligten Verbraucher eine Überwachung der Strahlstromstärke entwickelt. In diesem Beitrag wird über die Ansätze zur Spannungsstabilisierung der thermonischen Quelle berichtet und das System zur Überwachung der Strahlstromstärke wird vorgestellt.

AKBP 1.2 Mo 14:15 S1/05 23

Spectral response measurements on photocathodes for bERLinPro — •Hans Kirschner, Martin Schmeisser, Julius Kühn, Thorsten Kamps, and Andreas Jankowiak — Helmholtz-Zentrum Berlin

Photocathodes of the alkali antimonide group are promising candidates for the generation of electron beams with high brightness and high average current for Energy Recovery Linacs such as bERLinpro. The spectral response (spectrally resolved quantum efficiency) is an important figure of merit and depends strongly on the surface composition and crystal phases present in the sample. We present an optical setup that will allow in-situ measurements of photocathode samples in our preparation system.

AKBP 1.3 Mo 14:30 S1/05 23

Photocathode R&D for bERLinPro — •Martin Schmeisser, Hans Kirschner, Julius Kühn, Thorsten Kamps, and Andreas Jankowiak — Helmholtz-Zentrum Berlin

In order to generate high brightness and high-current electron beams for bERLinPro, an SRF photoinjector is being developed at HZB. Normal conducting CsK_2Sb cathodes will be used due to their high quantum efficiency (QE) at visible wavelengths and fast response time. We report on the preparation and characterization of photocathode samples and the development of an UHV transport system for gun operation.

AKBP 1.4 Mo 14:45 S1/05 23

Zeitaufgelöste Messungen der Pulsantwort von Photokathoden bei verschiedenen Laserwellenlängen — •Monika Dehn und Kurt Aulenbacher — JGU Mainz

An der Johannes Gutenberg-Universität Mainz können wir die longitudinale Pulsantwort von Photokathoden bei der Photoemission mit unterschiedlichen Anregungswellenlängen messen. Bereits erreicht ist eine Zeitauflösung $<$ 2ps. Darüber hinaus ermöglicht uns ein hoher dynamischer Bereich in der Datenerfassung langsame, intensitätsschwache Anteile (longitudinaler Halo) der Impulsantwort zu untersuchen.

AKBP 1.5 Mo 15:00 S1/05 23

Explosive electron emission from flat Ge crystals — Vitali Porshyn, •Stephan Mingels, Dirk Lützenkirchen-Hecht, and Günter Müller — University of Wuppertal

During the search for photo-induced field emission from flat semiconductors, which might provide high brightness electron beams, we have found with our new ultra-high vacuum measurement system [1] explosive electron emission (EEE) from n-doped Ge crystals resulting in high current pulses of ∼100 A and ∼4 ns duration. This effect reproducibly appears in a narrow photon energy range of 3.2-3.6 eV with a quantum efficiency of up to 20%. Moreover, the EEE current does not depend on the surface field but on the extraction voltage (500-3000 V). EEE is a well known plasma-induced effect for locally heated metals resulting in a crater-like destruction of the surface [2]. For Ge, however, it appears at a factor of 20 lower power density (0.3 MW/cm^2) of the pulsed laser, and each current pulse forms a new crater of ∼10 μm size. The measured EEE spectra show a similar FWHM ($<$ 1 eV) as photo emitted electrons. Potential applications, e.g. in microwave tubes or gyrotrons, will be discussed.

[1] S. Mingels et al., Rev. Sci. Instr. **86**, 043307 (2015).

[2] G.A. Mesyats, Plasma Phys. Control. Fusion **47**, A109-A151 (2005).

Funded by the German Federal Ministry of Education and Research under project number 05K13PX2.

AKBP 1.6 Mo 15:15 S1/05 23

Einsatz Hochfrequenz-modulierter Diodenlaser zur Erzeugung gepulster Elektronenstrahlen aus GaAs-Photokathoden mit variabler Repetitionsrate und unterdrücktem Untergrund — •Martin Espig, Joachim Enders, Yuliya Fritzsche, Andreas Kaiser, Neeraj Kurichiyanil und Markus Wagner — TU Darmstadt, Institut für Kernphysik, Darmstadt, Deutschland

Die Quellen spinpolarisierter Elektronen am supraleitenden Darmstädter Elektronen-Linearbeschleuniger S-DALINAC basieren auf der Photoemission aus GaAs-Photokathoden. Durch geeignete Wahl der Laserparameter können die Eigenschaften des erzeugten Elektronenstrahls in puncto Strom, Polarisationsgrad, Emittanz und Zeitstruktur direkt beeinflusst werden.
Es wird ein Hochfrequenz-moduliertes Diodenlasersystem vorgestellt, welches Laserpulse mit Halbwertsbreiten $<$50 ps bei unterdrücktem Untergrund zur Erzeugung von Elektronenbunchen, sowie variablen Repetitionsraten von 1 MHz bis 3 GHz für Polarisations-, Hochstrom- und Laufzeitexperimente zur Verfügung stellt.
Gefördert durch die DFG (SFB 634; Graduiertenkolleg 2128) und durch das Land Hessen (LOEWE-Zentrum HIC for FAIR).

AKBP 1.7 Mo 15:30 S1/05 23

Developement of a LabVIEW-based surface with innovative controls for the control system of the spin-polarized electron test source Photo-CATCH. — •Heidi Ayse Rösch, Joachim Enders, Martin Espig, Yuliya Fritzsche, and Markus Wagner — TU Darmstadt, Institut für Kernphysik

Operations of the spin-polarized electron source of the S-DALINAC will be supported by a photo-cathode activation, test and cleaning system, Photo-CATCH. Besides cathode-performance studies, this teststand produces spin-polarized electron bunches from a GaAs photocathode that are then transported, manipulated, and characterized by devices in a low-energy beam line. To set and monitor the various components of the beamline, a control system was developed, based on the EPICS framework. As interfaces, LabVIEW was used in combination with a gamepad as a controlling device.

Supported in part by DFG (SFB 634) and by the state of Hessen (LOEWE center HIC for FAIR).

AKBP 2: RF, Resonators and Applications I

Zeit: Montag 14:00–15:45 Raum: S1/05 24

AKBP 2.1 Mo 14:00 S1/05 24

Aufbau und Test des MESA-Choppers — •Ben Ledroit — Institut für Kernphysik Uni Mainz

Der Chopperkollimator dient als Teil des Chopper-Buncher-Systems der longitudinalen Strahlanpassung an den Injektorlinac von MESA. Hierzu wird ein an MAMI erfolgreich eingesetztes Konzept verwendet. Dabei muss höheren Anforderungen in Bezug auf Strahlintensität und -qualität an den Beschleuniger Rechnung getragen werden. Im Folgenden sollen die wichtigen Aspekte und Lösungen bei der Entwicklung des MESA-Chopperkollimators diskutiert werden.

AKBP 2.2 Mo 14:15 S1/05 24

Longitudinale Emittanzanpassung durch Geschwindigkeitsmodulation im Injektionssystem von MESA — •Philipp Heil — Inst.f. Kernphysik, JGU Mainz, 55128 Mainz, D

Am Institut für Kernphysik an der Johannes Gutenberg-Universität Mainz wird der neue Elektronenbeschleuniger MESA (Mainz Energy-recovering Superconducting Accelerator) errichtet. MESA dient Experimenten der Teilchenphysik, wie z.B. der Vermessung des Weinbergwinkels. Um Elektronen mit falscher Phasenlage in den Beschleunigungssektionen frühzeitig abzutrennen wird direkt nach der Quelle und vor dem Vorbeschleuniger ein von MAMI Chopper/Buncher abgeleitetes System verwendet. Der kontinuierliche Elektronenstrahl aus der Quelle wird hierbei vom Chopper in Bunche einer Länge von ca. 100 Grad zerhackt und im darauf folgenden Bunchersystem im longitudinalen Phasenraum auf weniger als 2 Grad der Hochfrequenzperiode T (f=1/T=1300MHz) fokussiert. Es wird die Entwicklung der zwei Buncherkavitäten vorgestellt. Dabei wurden Prototypen auf ihre Kenngrößen hin optimiert und vermessen. Aus den hier gewonnen Erfahrungen wurden schließlich ausheizbare hochleistungskavitäten aus OFHC-Cu hergestellt. Es ist geplant das Chopper/Buncher System 2016 als Teil eines LEBT Testaufbaues im Strahlbetrieb zu testen.

AKBP 2.3 Mo 14:30 S1/05 24

Überlegungen zum Betrieb des Elektronenbeschleunigers ELSA mit zwei Resonatortypen — •Jens Derksen und Wolfgang Hillert — Elektronen-Strecher-Anlage ELSA, Physikalisches Institut, Universität Bonn

Im Zuge der Intensitätserhöhung des internen Strahlstroms der Elektronen-Strecher-Anlage ELSA von 20 mA auf 200 mA wird die vorhandene HF-Anlage durch eine zweite HF-Station mit zwei zusätzlichen Beschleunigungsresonatoren erweitert.

Dadurch, dass zukünftig zwei unterschiedliche Resonatortypen verwendet werden, müssen die beiden Hochfrequenzstationen mit unterschiedlichen Leistungen betrieben werden, um den Elektronenstrahl möglichst effizient zu beschleunigen.

Es wurden Simulationen und Störkörpermessungen durchgeführt, um das Modenspektrum der neuen siebenzelligen PETRA Resonatoren zu verstehen und die Effekte abschätzen zu können, welche Strahlschwingungen anregen.

Im Vortrag wird der aktuelle Stand des Umbaus zusammen mit den Ergebnissen der vorgenommenen Studien dargestellt.

AKBP 2.4 Mo 14:45 S1/05 24

New Design of the HSI RFQ for UNILAC Upgrade — •Chuan Zhang[1], Lars Groening[1], Sascha Mickat[1], Hartmut Vormann[1], Markus Baschke[2], Holger Podlech[2], Ulrich Ratzinger[2], and Rudolf Tiede[2] — [1]GSI Helmholtz Center for Heavy Ion Research, Planckstr. 1, Darmstadt, Germany — [2]Institute for Applied Physics, Goethe-University, Frankfurt a.M., Germany

As the main injector to the future FAIR facility, the UNILAC accelerator is required to deliver ion beams with high intensities as well as good beam quality. The electrodes of the current HSI RFQ are exhausted and the current RFQ itself is assigned to be one bottle-neck for improving the brilliance performance of the whole linac. Based on the so-called NFSP (New Four-Section Procedure) method, a new RFQ electrode design has been developed and optimized for 20emA, U4+ beams at the RFQ-eintrance. Since just the electrodes will be replaced, the RFQ length has been kept unchanged. Even with a lowered intervane voltage, the new RFQ design has achieved higher transmission efficiency and much better brilliance, compared to previous designs.

AKBP 2.5 Mo 15:00 S1/05 24

Eigenmode Computation for Single and Multicell Cavities Using Perturbative Methods — •Korinna Brackebusch and Ursula van Rienen — Institute of General Electrical Engineering, University of Rostock

The design of accelerator cavities is a challenging task since it implies the manipulation of various shape parameters regarding different optimization goals, resulting in extensive geometric parameter studies. Computing the electromagnetic characteristics of only a single design may already involve high expenses, forcing an enormous total computational effort for studies. In most cases, this limits the observed frequency range and the number of computation passes. For the same reason, the effects of geometric imperfections are usually excluded from optimization processes, even though they may be of particular importance for the final design. Perturbative methods (PMs) offer an efficient approach to tackle this issue. They allow the computation of the eigenmodes and the derived cavity characteristics of a multitude of varied cavity designs based on one initial design. So, PMs are highly suited for carrying out parameter studies.

In this contribution, we present the application of PMs to real life examples of single and multicell cavities by investigating the achievable accuracy and required computational effort depending on the observed mode order, nature and extent of the applied perturbation and complexity of the investigated structure. Work supported by Federal Ministry for Research and Education BMBF under contracts 05K13HR1 and 05H15HRRBA.

AKBP 2.6 Mo 15:15 S1/05 24

YACS - Progression Towards Isoparametric 2.5D Finite Elements — •Benjamin Dirk Isbarn, Bernard Riemann, Malte Sommer, and Thomas Weis — TU Dortmund University (DELTA), Center for Synchrotron Radiation, Maria-Goeppert-Mayer-Str. 2, 44221 Dortmund

YACS is a 2.5D finite element method solver capable of solving for the full 3D eigenfrequency spectra of resonant axisymmetric structures while reducing the computational problem to a 2D rotation plane. Prior studies and benchmarks comparing YACS to well known commercial 3D and 2D applications already demonstrated its feasibility of performing fast optimizations of geometries due to its minimal computational overhead. However, because of the first order approximation of the basis functions and reference triangle, this solving speed advantage vastly diminishes when targeting higher accuracies. In order to circumvent these issues we chose to upgrade YACS to support arbitrary order basis functions and curved quadrilateral meshes leading to, but not limited to, isoparametric finite elements. We will present first performance benchmarks on a reduced 2D problem along with comparisons to commercial applications.

AKBP 2.7 Mo 15:30 S1/05 24

A new MTCA.4 based digital LLRF system for the GSI UNILAC — •Jens Zappai, Bernhard Schlitt, Alexander Schnase, and Gerald Schreiber — GSI Helmholtzzentrum für Schwerionenforschung, Darmstadt

The heavy ion linear accelerator UNILAC served for over 40 years as workhorse for nuclear physics experiments at GSI and as injector to the SIS18 synchrotron. Within the scope of the FAIR project it will also act as injector with increased requirements in beam current and beam quality. To meet these requirements and to ensure reliability for the future, a new digital low level RF system is under development. The spectrum of accelerated ions from hydrogen to uranium results in a huge dynamic range in amplitude, duty cycle and beamloading, especially in respect of the 50 Hz mixed mode. To account for the individual demands of the accelerator and to combine these with the advantages of a commercial-off-the-shelf system like longterm availability and state-of-the-art technology, the new LLRF system will be based on the modular MicroTCA.4 standard. Design and current status of development will be presented.

AKBP 3: Injectors, Laser II

Zeit: Montag 16:30–18:30 Raum: S1/05 23

AKBP 3.1 Mo 16:30 S1/05 23

Beam Transport and Stabilization System for the FLUTE Gun Laser — •Sophie Walther[1], Erik Bründermann[3], Stefan Funkner[1], Anke-Susanne Müller[2], Michael Nasse[1], and Gudrun Niehues[1] — [1]LAS, KIT, Karlsruhe — [2]ANKA, IPS, LAS, KIT, Karlsruhe — [3]IPS, KIT, Karlsruhe

The linear accelerator of FLUTE (Ferninfrarot Linac- Und Test-Experiment) is currently under commissioning at the Karlsruhe Institute of Technology. It is planned to use strong femtosecond to picosecond UV pulses for the photoinjection of electrons from the cathode into the linear accelerator structure. For this purpose a femtosecond laser system is located in a distance of more than 30 meters in a clean room environment. This study investigates the performance of optical setups to reach a stable optical layout for transport of the femtosecond to picosecond laser pulses to the cathode. To compensate drifts and movements of the laser beam over the more than 30 meters a stabilization system is evaluated and tested. The results of these measurements are presented in this contribution.

AKBP 3.2 Mo 16:45 S1/05 23

First On-table Results of Quasi Ellipsoidal Photocathode Laser Pulses at PITZ — •James Good[1], Alexey Andrianov[2], Ekaterina Gacheva[2], Efim Khazanov[2], Martin Khojoyan[4], Mikhail Krasilnikov[1], Sergey Mironov[2], Anatoly Poteomkin[2], Tino Rublack[1], Frank Stephan[1], Eugeniy Syresin[3], and Viktor Zelenogorsky[2] — [1]DESY, Zeuthen, Germany — [2]IAP/RAS, Nizhny Novgorod, Russia — [3]JINR, Dubna, Moscow Region, Russia — [4]SOLEIL, Paris, France

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

The pulse shaping was realized by utilizing spatial light modulators, and is characterized by both auto- and cross-correlation measurements in the infrared and ultraviolet. In this contribution the overall setup and layout, basic operating principles, stability measurements, and the first results at PITZ will be presented.

These results include preliminary calibration data, and comparative measurements in both optical regimes of applied guassian, supergaussian, and elliptical temporal masks.

AKBP 3.3 Mo 17:00 S1/05 23

Generation of a ring-focus by the use of a deformable mirror — •Tim Ziegler[1,2], Karl Zeil[1], and Ulrich Schramm[1,2] — [1]Helmholtz-Zentrum Dresden-Rossendorf (HZDR), Bautzner Landstr. 400, 01328 Dresden, Germany — [2]Technische Universität Dresden, 01062 Dresden, Germany

The target-normal-sheath-acceleration (TNSA) is a very promising way to accelerate protons by relativistic laser-plasma interaction. A central issue is still to increase the energy of the accelerated protons and to reduce their divergence. Therefore one approach is to vary the intensity distribution of the incoming laser-beam and by that the electron sheath on the rear-side which accelerates the protons. A ring-shaped intensity distribution promises an improvement for both features, so a deeper understanding how to generate and control such a distribution is required. The use of a deformable mirror is one method to shape the focal intensity distribution of an intense laser-beam in such a way. In order to get the desired intensity distribution in the focal plane it is necessary to do numerical simulations to get the appropriated shape of the deformable mirror. The mirror itself comes up with some constraints which must be taken into account as well and require a special adjustment.

The results of the simulations and whether the theoretical results are technically feasible will be presented. The experimental investigations using a copropagating alignment beam and a closed loop adaptive optics were performed at the Draco Laser facility of the Helmholtz-Zentrum Dresden-Rossendorf.

AKBP 3.4 Mo 17:15 S1/05 23

Evaluation of the Photocathode Laser Transverse Distribution — Chaipattana Saisa-ard[1,2], Mikhail Krasilnikov[1], and •Grygorii Vashchenko[1] — [1]DESY, Zeuthen, Germany — [2]Chiang Mai University, Chiang Mai, Thailand

Many years experience of electron source developments at the photo injector test facility at DESY in Zeuthen (PITZ) show that the photocathode laser is the one of major tools to produce high brightness electron beams. The transverse distribution of the laser on the photocathode plays a significant role in the high brightness photo injector optimization. However, the imperfections in the laser beam profile according to the deviation from a radially homogeneous profile directly result in transversely distorted charged particle distributions. This includes inhomogeneous core as well as transverse halo which is due to not sharp edges around the core. The laser transverse distribution is measured at PITZ using a virtual cathode :this is a CCD camera located at the position which is optically equivalent to the photocathode position (so called virtual cathode). An algorithm is developed for the evaluation of the experimentally obtained transverse profiles. It fits a flat-top or an inhomogeneous rotational symmetric core with exponentially decaying tails to an experimental distribution. The MATLAB script with implemented algorithm is applied to a set of measured transverse laser distributions. Results of the analysis will be presented.

AKBP 3.5 Mo 17:30 S1/05 23

First Characterizations of a 4 nC Electron Beam for THz Options at PITZ — •Prach Boonpornprasert[1], Galina Asova[1,2], Mahmoud Bakr[1,3], Matthias Gross[1], James Good[1], Carlos Hernandez-Garcia[1,4], Holger Huck[1], Igor Isaev[1], Davit Kalantaryan[1], Mikhail Krasilnikov[1], Osip Lishilin[1], Gregor Loisch[1], Dmitriy Malyutin[1], David Melkumyan[1], Anne Oppelt[1], Marek Otevrel[1], Gaurav Pathak[1], Yves Renier[1], Tino Rublack[1], Ivan Rybakov[1,5], Frank Stephan[1], Grygorii Vashchenko[1], and Quantang Zhao[1] — [1]DESY, Zeuthen, Germany — [2]INRNE, Sofia, Bulgaria — [3]Assiut University, Assiut, Egypt — [4]Jlab, Newport News, USA — [5]INR of the RAS, Moscow, Russia

The Photo Injector Test facility at DESY, Zeuthen site (PITZ) develops high brightness electron sources for modern linac-based Free Electron Lasers (FELs). The PITZ accelerator can also be considered as the proper machine for the development of an IR/THz source prototype for pump and probe experiments at the European XFEL. One of interesting options for the IR/THz generation at PITZ is to generate the radiation by means of a SASE FEL. Previous calculations have shown that by using an electron bunch with a bunch charge of 4 nC and a helical undulator with a period length of 40 mm, a saturation pulse energy of about 1 mJ is achievable within a saturation length of 3 m for a radiation wavelength of 100 μm. In this contribution, the experimental demonstration of generating electron beams with 4 nC bunch charge by the PITZ accelerator together with the results of the electron beam characterization are presented and discussed.

AKBP 3.6 Mo 17:45 S1/05 23

Efficient Acceleration Using Single-cycle THz pulses — •Arya Fallahi[1], Moein Fakhari[1], Alireza Yahaghi[1], and Franz Kärtner[1,2,3,4] — [1]Center for Free-Electron Laser Science, DESY, Notkestrasse 85, 22607 Hamburg, Germany — [2]Department of Physics, University of Hamburg, Jungiusstrasse 9, 20355 Hamburg, Germany — [3]The Hamburg Center for Ultrafast Imaging, Luruper Chaussee 149, 22761 Hamburg, Germany — [4]Department of Electrical Engineering and Computer Science and Research Laboratory of Electronics, Massachusetts Institute of Technology, 77 Massachusetts Avenue, Cambridge, Massachusetts 02139, USA

Novel structures for electron acceleration are introduced which operate with single-cycle pulses. Due to the considered excitation, the new types of guns are named as single-cycle ultrafast guns. The operating frequencies considered here are at THz wavelengths inspired by the recent progress in the optical generation of intense single-cycle THz pulses. Two distinct regimes, namely low energy and high energy THz pulses are considered. It is theoretically demonstrated that the proposed electron guns have potentials to provide 30 fs electron bunches at 30 keV energies and 100 fs bunches at 2MeV energies. More importantly, it is shown that the already achieved THz pulse energies of 20

uJ are enough to realize relativistic acceleration gradients. These structures will underpin future devices for fabricating miniaturized electron guns and linear accelerators.

AKBP 3.7 Mo 18:00 S1/05 23

Simulating THz generation for powering compact x-ray sources — •Anthony Hartin, Ravi Kostuban, Franz Kaertner, Xiaojun Wu, and Chun Zhou — DESY, CFEL, Notkestrasse 85, Hamburg 22607

Compact x-ray sources can be made compact by using THz electromagnetic waves to power scaled down accelerating structures. An efficient method of generating the THz is via optical rectification using tilted pulse fronts in a nonlinear optical crystal such as Lithium Niobate.

A phenomenological simulation code for the THz generation by an optical pump pulse impinging on a lithium niobate crystal is presented. linear and nonlinear optical parameters serving as inputs are obtained from the literature. A realistic optical system delivering the pump pulse to the crystal is modelled, and optical rectification is achieved in a 2D model.

The simulation model is validated by comparison with an experiment consisting of a 4.2 mJ, 1030 micron, 650 fs pump pulse incident on a 5.6% MgO doped $LiNO_3$ crystal. There is reasonable agreement between simulation and experiment. At a pump fluence of 500 J/m^2, THz is extracted with 0.6% efficiency at 300 K and 1.2% efficiency at 100 K. Optimisation of the extracted efficiency using the simulation is explored.

AKBP 3.8 Mo 18:15 S1/05 23

The ELSA Laser Beamline for Electron Polarization Measurements via Compton Backscattering — •Michael Switka, Florian Hinterkeuser, Rebecca Koop, and Wolfgang Hillert — Electron Stretcher Facility ELSA, Physics Institute of Bonn University

The Electron Stretcher Facility ELSA provides a spin polarized electron beam with energies of 0.5 - 3.2 GeV for double polarization hadron physics experiments. As of 2015, the laser beamline of the polarimeter based on Compton backscattering restarted operation. It consists of a cw disk laser with design total beam power of 40 W and features two polarized 515 nm photon beams colliding head-on with the stored electron beam in ELSA. The polarization measurement is based on the vertical profile asymmetry of the back-scattered photons, which is dependent on the polarization degree of the stored electron beam. After recent laser repairs, beamline and detector modifications, the properties of the beamline have been determined and first measurements of the electron polarization degree were conducted. The beamline performance and first measurements are presented.

AKBP 4: RF, Resonators and Applications II

Zeit: Montag 16:30–18:15 Raum: S1/05 24

AKBP 4.1 Mo 16:30 S1/05 24

Recommissioning of the High-Temperature UHV-Furnace at the S-DALINAC for Research on Future RF Cavitiy Materials* — •Ruben Grewe[1], Jens Conrad[1], Thorsten Kürzeder[1], Norbert Pietralla[1], Lambert Alff[2], Marton Major[2], and Florian Hug[3] — [1]Institut für Kernphysik, TU Darmstadt, Darmstadt, Germany — [2]Materialwissenschaft, TU Darmstadt, Darmstadt, Germany — [3]Institut für Kernphysik, JGU Mainz, Mainz, Germany

Current research shows an up to four times higher Q-factor for nitrogen doped superconducting niobium cavities. Those cavities are usually heat processed in an uhv-furnace with temperatures around 800°C and a short time exposed to a nitrogen atmosphere. The uhv-furnace at the S-DALINAC is able to reach temperatures of up to 1800°C, which offers the possibility of making N-doped niobium samples at temperatures between 1300°C and 1700°C. At these temperatures the so-called δ-phase of NbN forms, which is highly interesting for superconducting accelerator usage. In order to produce such samples for research on δ-phase NbN, the uhv-furnace needs technical upgrades. These include enhanced vacuum systems, temperature monitoring and residual gas analysis as well as a new, smaller niobium hot-pot for heat processing of niobium samples. In this talk first results of the furnace recommissioning will be presented. An outlook on future activities will be given.

*Work supported by BMBF through 05H15RDRBA.

AKBP 4.2 Mo 16:45 S1/05 24

Suppression of field emission from Nb and Mo surfaces by insulating oxides — •Stefan Lagotzky and Günter Müller — University of Wuppertal, D-42097 Wuppertal, Germany

Parasitic field emission (FE) from particulates and surface defects is one of the main field limitations of superconducting Nb cavities and leads to dark current (DC) from the Mo substrates of semiconducting photocathodes. The activation field E_{act} of typical emitters and the emitter number density N is strongly influenced by the surface oxide thickness d_{ox}. Reduction of these oxides, e.g. by heat treatments (HT), leads to activation of new emitting sites [1-2] with $N \sim exp(-d_{ox})$. Since the achievable surface quality, however, is not yet sufficient for future ILC accelerating structures [3] and actual photoinjectors, thicker oxides are promising to reduce FE and DC, respectively. FE measurements of thermally oxidized and dry ice cleaned single crystal Nb samples ($d_{ox} \sim$ 100 nm) revealed a reduction of N by a factor 20 at 70 MV/m, i.e. the intended electric peak field of future ILC cavities. The remaining FE was caused by surface defects and partially molton features with onset fields E_{on} above 90 MV/m. Furthermore, oxygen exposure of a Mo sample partially weakened or deactivated emission sites, which were previously activated by HT at 400-600°C with E_{on} = 20 MV/m.

[1] A. Navitski et al., Phys. Rev. ST-AB 16, 112001 (2013).
[2] S. Lagotzky et al., Eur. Phys. J. Appl. Phys. 70, 21301 (2015).
[3] S. Lagotzky u. G. Müller, Nucl. Instrum. Meth. A 806, 193 (2016).
This work was funded by BMBF projects 05H12PX6 and 05K13PX2.

AKBP 4.3 Mo 17:00 S1/05 24

Influence of Eletron Beam Welding on the Surface Resistance of Bulk Niobium — •Marian Lückhof[1,2], Sarah Aull[3], Jens Knobloch[1,2], and Walter Venturini Delsolaro[3] — [1]Universität Siegen, Siegen, Deutschland — [2]Helmholtz Zentrum Berlin, Berlin, Deutschland — [3]CERN, Geneva, Switzerland

Along the production processes of SRF cavities, electron beam welding (EBW) is a production step that is predominantly used nowadays in cavity assembling. EBW changes the material properties and hence might influence the surface resistance of bulk niobium significantly.

The talk presents results from RF measurements performed on a niobium sample with an EBW on the surface as a function of temperature. The measurements were performed with CERN's Quadrupole Resonator, allowing to extract the surface resistance with high precision as a function of temperature and the applied RF fields.

AKBP 4.4 Mo 17:15 S1/05 24

Messung des Oberflächenwiderstands von supraleitenden Proben mit dem HZB Quadrupolresonator — •Sebastian Keckert, Raphael Kleindienst, Jens Knobloch und Oliver Kugeler — Helmholtz-Zentrum für Materialen und Energie GmbH, Albert-Einstein-Str. 15, 12489 Berlin

Supraleitende Beschleunigerkavitäten zeichnen sich durch ihren Oberflächenwiderstand im nOhm-Bereich aus und eröffnen dadurch Anwendungen bei hohem Beschleunigungsgradienten im cw-Betrieb. Für ein umfassendes Verständnis der Beiträge zum Oberflächenwiderstand und der Vergleich mit verschiedenen Theorien sind präzise Messungen notwendig. Der Quadrupolresonator bietet dafür ein ideales System, um flache Proben in einem großen Temperaturbereich und bei typischen Betriebsfrequenzen von 430, 860 und 1300 MHz zu charakterisieren. Mit HF-Magnetfeldstärken von bis zu 120 mT werden die Bedingungen von heutigen Beschleunigungsgradienten erreicht. Die Messung der HF-Verluste erfolgt kalorimetrisch und ermöglicht dadurch eine Auflösung von unter 1 nOhm. Nach der Inbetriebnahme des Resonators im letzten Jahr werden Messungen an Niob-Proben mit unterschiedlichen Korngrößen sowie die Entwicklung einer teilbaren Kalorimetriekammer mit dünner Probe vorgestellt.

AKBP 4.5 Mo 17:30 S1/05 24

Studies of HOMs in Chains of SRF Cavities using State-Space Concatenation Scheme — •Tomasz Galek, Johann Heller, Thomas Flisgen, Korinna Brackebusch, and Ursula van Rienen — Institut für Allgemeine Elektrotechnik, Universität Rostock

The design of modern superconducting radio frequency cavities for acceleration of charged particle bunches requires intensive numerical simulations, as they typically arise as modules of several multi-cell cavities. A wide variety of parameters vital to the proper operation of accelerating cavities must be optimized and studied. One of the most important issues concerning the SRF cavities is the influence of the higher order modes on the beam quality, in this contribution. For TESLA-like structures with 1.3 GHz accelerating mode, higher order modes are calculated up to 4 GHz, the external quality factor and the shunt/geometrical impedance spectra are analyzed. To compute properties of complete RF modules the state-space concatenation scheme is used. The aspects of the concatenation scheme and its application to the bERLinPro's chain of cavities is discussed. Work supported by Federal Ministry for Research and Education BMBF under contracts 05K13HR1 and 05H15HRRBA.

AKBP 4.6 Mo 17:45 S1/05 24

Numerical Investigation of External Losses for Superconducting Radio-Frequency Resonators — •Johann Heller, Thomas Flisgen, Tomasz Galek, and Ursula van Rienen — Institute for General Electrical Engineering, Rostock

For the thorough design of particle accelerators, the electromagnetic behavior of the accelerating resonators has to be investigated. Of special interest are the losses inside the resonators which have to be optimized such that the operation costs stay as moderate as possible and the quality of the particle beam is not diminished. In superconducting radio-frequency (SRF) cavities, the losses are dominated by energy leaving the structure through the open waveguide ports. Generally, the numerical discretization of such problems lead to large scale, non-linear, complex eigenvalue problems which are extremely hard to solve. Therefore, a standard approach is to introduce some simplifications (e.g. linearization), that allow for the fast computation of such losses. In this talk, we present an algorithm, that allows for the solution of the full non-linear eigenvalue problem by applying some model-order reduction. The usability of the approach for large-scale, real-life applications is shown on parts of the Third-Harmonic Module of the FLASH accelerator in Hamburg.

AKBP 4.7 Mo 18:00 S1/05 24

Multi-Objekt-Optimierung für Strahldynamikstudien an einem SRF Photoinjektor — •Eva Panofski, Andreas Jankowiak, Thorsten Kamps und Jens Völker — Helmholtz-Zentrum Berlin für Materialien und Energie

Viele zukünftige Anwendungen von Teilchenbeschleunigern, wie FELs oder ERLs, erfordern hochbrilliante Elektronenstrahlen. Entscheidender Bestandteil des Beschleunigers ist hierbei die Elektronenquelle, die neben einer sehr kleinen Strahlemittanz ($<$ 1 mm mrad) zeitgleich auch einen hohen mittleren Strahlstrom zur Verfügung stellen muss. Ein Photoinjektor mit supraleitender Beschleunigungskavität hat das Potential, Elektronenstrahlen hoher Strahlbrillianz zu erzeugen. Für Design und Betrieb einer solchen Elektronenquelle stellt die Wahl geeigneter Parameter bzgl. Photoemissionslaser, Kavität und Solenoid eine Herausforderung dar. Die große Anzahl relevanter Parameter und Randbedingungen sowie die Nichtlinearität der Raumladungseffekte schließen eine exakte, rein analytische Betrachtung aus. Bei der Verwendung einer Multi-Objekt-Optimierung mit evolutionären Algorithmen kann ein optimaler Parametersatz aus Pareto-optimalen Lösungen extrahiert werden.

Es werden die Entwicklung eines Multi- Objekt Optimierungsalgorithmus sowie erste Ergebnisse eines Optimierungsproblems im Bereich der Strahldynamik für GunLab, einem SRF Photoinjektor Teststand am Helmholtz-Zentrum Berlin, präsentiert.

AKBP 5: Beam and Accelerator Control I

Zeit: Dienstag 14:00–16:00 Raum: S1/05 23

AKBP 5.1 Di 14:00 S1/05 23

Laser cooling of relativistic highly charged ions — •Danyal Winters[1], Tobias Beck[2], Gerhard Birkl[2], Oliver Boine-Frankenheim[1,2], Christina Dimopoulou[1], Lewin Eidam[1,2], Volker Hannen[3], Daniel Kiefer[2], Thomas Kühl[1,4,5], Matthias Lochmann[1,4], Markus Löser[6,7], Xinwen Ma[8], Fritz Nolden[1], Wilfried Nörtershäuser[1,2,4], Benjamin Rein[2], Rodolfo Sanchez[1], Ulrich Schramm[6,7], Mathias Siebold[6], Peter Spiller[1], Markus Steck[1], Thomas Stöhlker[1,5,9], Johannes Ullmann[2,5], Thomas Walther[2], Weiqiang Wen[6,8], Jie Yang[8], Dacheng Zhang[8], and Michael Bussmann[6] — [1]GSI Helmholtzzentrum Darmstadt — [2]Technische Universität Darmstadt — [3]Universität Münster — [4]Universität Mainz — [5]Helmholtz Institut Jena — [6]Helmholtz-Zentrum Dresden-Rossendorf — [7]Technische Universität Dresden — [8]Institute of Modern Physics, Lanzhou, China — [9]Universität Jena

An overview of recent laser cooling activities with relativistic heavy ion beams at the ESR (GSI, Darmstadt, Germany) and the CSRe (IMP, Lanzhou, China) storage rings will be presented. Some of the latest results will be shown and new developments concerning xuv-detector systems and cw and pulsed laser systems will be addressed. Finally, plans for laser cooling at the future facility FAIR in Darmstadt will be described.

AKBP 5.2 Di 14:15 S1/05 23

Laser Cooling of Intense Ultra-Relativistic Ion Beams — •Lewin Eidam[1] and Oliver Boine-Frankenheim[1,2] — [1]TEMF, TU-Darmstadt, Germany — [2]gsi helmholtzzentrum für schwerionenforschung, Germany

The principle of Doppler laser cooling was verified in low energy storage rings. Within the FAIR project laser cooling should be applied to ultra-relativistic heavy ion beams. The cooling process leads to a compression of the longitudinal phase space and to non-Gaussian beam profiles. In order to ensure stable operation and optimize the cooling process, the interplay of the cooling force and intensity effects has to be studied numerically. The modeling of the laser particle interaction is discussed. The different cooling schemes with cw and pulsed laser system are described and intensity limiting processes are explained.

AKBP 5.3 Di 14:30 S1/05 23

Fully automated adjustment of the electron beam line of the 2 MeV Electron Cooler at the Cooler Synchrotron @ FZ-Jülich — •Arthur Halama and Vsevolod Kamerdzhiev — Forschungszentrum Jülich, IKP-4

The 2 MeV electron cooler has maximal design parameters, such as 2 MeV electron kinetic energy and 3 A current. Its entire transport line guides the electron beam using a longitudinal magnetic field. Up to now the beam line is setup mostly manually. As this is time consuming and particular beam properties are linearly coupled, the design parameters could not be reached yet. A control software is being developed to adjust the beam line for a cool and low-offset beam transport and a high collector efficiency. The software uses field maps of all given magnets to simulate all known influences onto the electron's trajectory using particle tracing. Thus there is not only a model to describe the trajectory, but also to obtain responses to any number of changes within the system. Linear optimization calculations of the responses will yield the wanted magnetic beam line setting to get closer to the design parameters.

AKBP 5.4 Di 14:45 S1/05 23

Upgrade des UNILAC-Frontend der GSI-Darmstadt — •Hartmut Vormann, Aleksey Adonin, Lars Groening, Ralph Hollinger, Sascha Mickat und Chen Xiao — GSI Darmstadt

Am UNILAC (Universal Linear Accelerator) der GSI Darmstadt sind mehrere Upgrade-Maßnahmen geplant. Um die Anforderungen der neuen Beschleunigeranlage FAIR (Facility for Antiproton and Ion Research) erfüllen zu können, soll der HSI (Hochstrominjektor) modernisiert werden, und ein neuer eigener Ionenquellen-Zweig für Uran-Strahlbetrieb soll aufgebaut werden (Compact-LEBT). Dabei soll der HSI mit verbesserter RFQ-Teilchendynamik und mit einer neu-

en Matching-Sektion zum IH-DTL ausgerüstet werden, der Stripper-Bereich zwischen HSI und Poststripper-DTL soll für gepulsten Gas-Einlaß modifiziert werden. Mögliche Alternativen für den Poststripper-Beschleuniger sind bis dato mit einzelnen Modell-Untersuchungen behandelt worden.

Der vorliegende Beitrag gibt einen groben Überblick über die Upgrade-Maßnahmen, und stellt das Compact-LEBT-Projekt detaillierter vor.

AKBP 5.5 Di 15:00 S1/05 23

Gepulster Gas-Stripper für das Elektronen-Stripping von 1,4 MeV/u Hochstrom-Schwerionenstrahlen am GSI UNILAC — •Paul Scharrer[1,2,3], Winfried Barth[1,2], Mario Bevcic[2], Christoph E. Düllmann[1,2,3], Lars Groening[2], Klaus-Peter Horn[2], Egon Jäger[2], Jadambaa Khuyagbaatar[1,2], Jörg Krier[2] und Alexander Yakushev[1,2] — [1]Helmholtz Institut Mainz — [2]GSI Helmholtzzentrum für Schwerionenforschung, Darmstadt — [3]Johannes Gutenberg-Universität Mainz

Der GSI UNILAC wird künftig als Teil eines Injektor-Systems für die im Bau befindliche FAIR Beschleunigeranlage dienen. Dafür werden Schwerionen-Strahlen mit hoher Intensität und hoher Strahlqualität benötigt. Aktuell wird der 1,4 MeV/u Gas-Stripper weiterentwickelt, mit dem Ziel, die Ausbeute der zu beschleunigenden Ionen nach dem Stripper zu verbessern und damit die Strahlintensität zu erhöhen. Der neue Aufbau des Strippers verwendet einen gepulsten Gaseinlass, welcher mit den Strahlpulsen synchronisiert wird. Dies erlaubt eine höhere effektive Gasdichte für das Stripping bei gleichzeitig reduzierter Gasmenge. So wurden systematische Messungen der Ladungsverteilungen, des Energieverlustes sowie der Strahl-Emittanz für verschiedene Ionenstrahlen (u.a. 209Bi und 238U) und verschiedene Gase (u.a. H2 und He) durchgeführt. Mit H2 wurde eine Erhöhung des mittleren Ladungszustands sowie der maximalen Ausbeute im dominanten Ladungszustand erreicht. Zusammen mit Verbesserungen an der Ionenquelle sowie dem Hochstrominjektor wurde ein neuer Uran-Intensitätsrekord hinter dem Gas-Stripper aufgestellt.

AKBP 5.6 Di 15:15 S1/05 23

Aufbau einer Online-Magnetfeldmessung am S-DALINAC* — •Maximilian Herbert, Michaela Arnold, Christoph Burandt, Thorsten Kürzeder und Norbert Pietralla — TU Darmstadt, Darmstadt, Germany

Im Rahmen des Einbaus einer dritten Rezirkulation am S-DALINAC wird ein System von Magnetometern an 25 Dipol-Magneten des Beschleunigers eingebaut. Die Magnetfeldstärke wird dabei über die in einer rotierenden Messspule induzierte Spannung gemessen. Die Vorteile solcher Magnetometer sind die geringe Empfindlichkeit gegenüber Strahlung und niedrigere Kosten gegenüber strahlungsresistenten Hall-Sonden. Die Magnetometer werden in das auf EPICS basierende Kontrollsystem integriert und sollen die Bestimmung der Strahlenergie an verschiedenen Stellen des Beschleunigers ermöglichen. Die Stabilität der Magnetfeldstärken soll im Betrieb dauerhaft überwacht werden. Das neue System ersetzt und erweitert den bisherigen Aufbau aus kommerziellen Sonden, welcher die direkte Überwachung der Magnetfeldstärken an sechs Dipolmagneten ermöglichte. In diesem Vortrag wird die Infrastruktur des Messsystems sowie erste Ergebnisse von Messungen an Dipol-Magneten vorgestellt.

*Gefördert durch die DFG im Rahmen des SFB 634

AKBP 5.7 Di 15:30 S1/05 23

Solenoid-Fokussierungsmagnete für den niederenergetischen Strahltransport an MESA — •Christian Stoll — Institut für Kernphysik

Für den niederenergetischen Strahltransport an MESA werden Solenoidmagnete zur Fokussierung benötigt. Eine besondere Herausforderung stellt das Solenoidpaar am Chopperkollimator dar, das im thermischen Kontakt mit dem ausheizbaren Strahlrohr steht und der Ausheiztemperatur von 250°C gegenüber resistent sein muss. Im Folgenden sollen Planung und Umsetzung des Solenoidpaares dargestellt werden.

AKBP 5.8 Di 15:45 S1/05 23

Der Laborbeschleuniger LAB - ein Beschleuniger als Praktikumsversuch — •Jan Schmidt, Philipp Hänisch und Wolfgang Hillert — Elektronen-Stretcher-Anlage ELSA, Physikalisches Institut, Universität Bonn

Der Laborbeschleuniger LAB soll Physikstudenten in Bonn die Möglichkeit geben eigenständig einen Beschleuniger zu bedienen und die beschleunigerphysikalische Ausbildung um eine praktische Komponente erweitern. LAB besteht aus einer eigens dafür entwickelten thermischen Elektronenquelle und einer etwa 3 m langen modular aufgebauten Strahlführung. Der kontinuierliche Elektronenstrahl wird auf bis zu 50 keV beschleunigt und kann dann mittels Quadrupol- und Korrektormagneten manipuliert und auf Leuchtschirmen beobachtet werden.

Die Studenten sollen das Einstellen einer Strahlführung erlernen und Strahlenoptik anwenden um beispielsweise die Emittanz zu messen. Alle Komponenten von LAB können über einen PC ferngesteuert werden. Durch die Verwendung des ELSA Kontrollsystems unterscheidet sich die Steuerung von LAB kaum von großen Beschleunigeranlagen.

AKBP 6: Beam Dynamics / Simulation I

Zeit: Dienstag 14:00–16:00 Raum: S1/05 24

AKBP 6.1 Di 14:00 S1/05 24

Ein realistisches Magnetoptik-Modell für ELSA — •Jens-Peter Thiry und Wolfgang Hillert — Elektronen-Stretcher-Anlage ELSA, Physikalisches Institut, Universität Bonn

An der Elektronen-Stretcher-Anlage ELSA werden polarisierte Elektronen auf eine Energie von bis zu 3.2 GeV beschleunigt und anschließend mittels Resonanzextraktion verschiedenen Experimenten zugeführt. Ein realistisches Modell der Magnetoptik ist dabei eine Grundvoraussetzung um den Beschleuniger stabil betreiben zu können.

Bei ELSA wird das Programm elegant für die Simulation des Beschleuniger-Modells verwendet. Um das Modell an die tatsächliche Magnetoptik anzupassen wird dazu die von elegant berechnete Orbit-Response-Matrix an die gemessene Matrix angeglichen.

Da bei ELSA die horizontale Orbitkorrektur durch die Korrekturwindungen der Ablenkdipole realisiert wird muss bei der Berechnung der Matrix die räumliche Ausdehnung der Magnete besonders berücksichtigt werden. Als Eingabeparameter für die Berechnung dienen beispielsweise Gradienten- und Aufstellungsfehler der Magnete. In Abhängigkeit der Eingabeparameter wird dann mittels des Levenberg-Marquardt-Algorithmus die berechnete Matrix angeglichen.

In diesem Vortrag werden die konkrete Implementierung und erste Ergebnisse vorgestellt.

AKBP 6.2 Di 14:15 S1/05 24

Linear Optics Survey of the BESSY II Booster Synchrotron — •Paul Volz, Andreas Jankowiak, and Markus Ries — Helmholtz-Zentrum Berlin, Berlin

The proposed VSR upgrade for the BESSY II storage ring features photon pulses as short as 1.7 ps. The current injection system (linac, booster synchrotron, and transfer line) cannot provide electron bunches short enough to meet the required injection efficiency for TopUp operation. This contribution investigates if the momentum compaction factor of the booster synchrotron can be decreased just by changing the quadrupole strengths in the existing booster synchrotron lattice. It was found that by splitting the two quadrupole families into four the momentum compaction factor can be reduced.

AKBP 6.3 Di 14:30 S1/05 24

FCC-ee: Overview and Status of the Lattice Design — •Bastian Haerer[1,2], Sandra Aumon[2], Anton Bogomyagkov[3], Andreas Doblhammer[2], Bernhard Holzer[2], Katsunobu Oide[4], and Frank Zimmermann[2] — [1]LAS, KIT, Karlsruhe — [2]CERN, Geneva — [3]BINP, Novosibirsk — [4]KEK, Tsukuba

FCC-ee is an 100 km e^+/e^- collider being designed within the international Future Circular Collider Study. It will house at least two mini-beta insertions optimised for precision studies and rare decay observations in the range of 90 to 350 GeV center of mass energy with luminosities in the order of $10^{35}\,cm^{-2}s^{-1}$. To achieve this goal the beam needs to be squeezed by the final doublet quadrupoles to beta-functions of 1 m/2 mm, which drives the chromaticity to more than

-2000 units. As a consequence a state of the art multi-family sextupole scheme has to be combined with a local chromaticity correction.

This presentation will provide an overview about the project mainly focusing on the status of lattice design and higher order chromaticity correction.

AKBP 6.4 Di 14:45 S1/05 24

Simulations of the effects of a superconducting damping wiggler on a short bunched electron beam at ANKA — •Julian Gethmann[1], Axel Bernhard[1], Edmund Blomley[1], Steffen Hillenbrand[1], Anke-Susanne Müller[1], Konstantin Zolotarev[2], and Nigel Smale[1] — [1]Karlsruher Institut für Technologie (KIT) — [2]Budker Institute of Nuclear Physics

(As a part of the CLIC collaboration) A CLIC damping wiggler prototype has been installed at the ANKA synchrotron light source in order to validate the technical design of the 3 T superconducting conduction cooled wiggler and its cryostat and to cary out studies on beam dynamical aspects including collective effects. The latter one will be the main focus in this talk. Collective effects that will occur in damping rings are an issue in ANKA's short bunch operation as well. To simulate these effects the accelerator's model including its insertion device has to be very accurate. Such a model of the ANKA storage ring in short bunch operation mode has been developed in elegant. Simulations with the damping wiggler switched on and off have been performed in order to investigate effects of the wiggler on different machine parameters. These new results will be discussed with regard to the question if on the one hand the wiggler could be used for diagnostic purposes and if on the other hand the wiggler's impact on the beam dynamics is changed by the collective effects.

AKBP 6.5 Di 15:00 S1/05 24

Beam Dynamics Simulations on transversal beam break-up for the S-DALINAC* — •Jonas Pforr, Michaela Arnold, Florian Hug, Lars Jürgensen, Thorsten Kürzeder und Norbert Pietralla — Institut für Kernphysik, TU Darmstadt, Darmstadt, Germany

Der S-DALINAC ist ein supraleitender, rezirkulierender Linearbeschleuniger. Generell ist in supraleitenden Linacs der Strahlstrom durch transversales beam break-up (BBU) begrenzt. Dieser Effekt wird durch Moden höherer Ordnung (HOMs) in den Kavitäten hervorgerufen, die den Strahl ablenken. In einem rezirkulierenden Beschleuniger wird dieser Effekt dadurch verschärft, dass der abgelenkte Strahl mit einem transversalen Versatz wieder in die Kavitäten eintritt und dadurch die HOMs verstärken kann. Zur Unterdrückung von BBU sollen am S-DALINAC zwei Strategien getestet werden. Diese bestehen aus einer Vertauschung der transversalen Phasenräume durch Rotations-Quadrupole bzw. aus einer Erhöhung der Chromatizität durch den Einsatz von Sextupolmagneten. In diesem Vortrag werden die Ergebnisse von Strahldynamiksimulationen vorgestellt, die den Einsatz dieser neu eingebauten Magnete beinhalten.

*Gefördert durch das BMBF unter 05K13RDA

AKBP 6.6 Di 15:15 S1/05 24

BESSY VSR - Supplying Short X-Ray Pulses with an Electron Storage Ring — Andreas Jankowiak, Jens Knobloch, Wolfgang Anders, Andrew Burrill, Hartmut Ehmler, Alexander Föhlisch, Paul Goslawski, Karsten Holldack, Peter Kuske, Dmitriy Malyutin, Aleksandr Matveenko, Roland Müller, Axel Neumann, Klaus Ott, •Markus Ries, Martin Ruprecht, Andreas Schälicke, Adolfo Velez, and Godehard Wüstefeld — Helmholtz-Zentrum Berlin, Berlin, Deutschland

The HZB has started the innovative project "BESSY VSR" to upgrade the 1.7 GeV synchrotron radiation source BESSY II. The project aims for simultaneous production of 1.7 ps and 15 ps long, intense X-ray pulses. These pulses are generated by an enhanced longitudinal focusing applying superconducting 5-cell cavities of 1.8 °K and are available at all photon beam ports. By properly chosen RF-frequencies of 1.5 GHz and 1.75 GHz a beating focusing scheme generates alternating long and short bunches. The project status as well as current fields of research will be presented.

AKBP 6.7 Di 15:30 S1/05 24

Transverse beam emittance optimization for the injection into BESSY II — •Felix Kramer — Helmholtz Zentrum Berlin, Institut Beschleunigerphysik — Humboldt-Universität zu Berlin, Institut für Physik

For top up injection into the storage ring BESSY II an average injection efficiency of at least 90% is required. In low alpha mode the injection efficiency does not meet the requirements. Future BESSY II features will include shorter bunches in the storage ring (VSR) and user transparent injection with a non linear kicker. These will raise the demands on the quality of the injected beam even further. This work investigates the development of transverse emittance over the acceleration cycle in the synchrotron and the possibility of transverse emittance exchange by a sequence of skew quadrupoles in the transfer line. Results of emittance measurements and emittance exchange simulations will be given.

AKBP 6.8 Di 15:45 S1/05 24

Proton beam transport experiments with pulsed high-field magnets at the Dresden Laser Acceleration Source Draco — •Florian Kroll[1,2], Stephan Kraft[1], Josefine Metzkes[1], Hans-Peter Schlenvoigt[1], Karl Zeil[1], and Ulrich Schramm[1,2] — [1]Helmholtz-Zentrum Dresden - Rossendorf, Dresden, Germany — [2]Technische Universität Dresden, Dresden, Germany

Compact laser-driven ion accelerators are a potential alternative to large and expensive conventional accelerators. High-power short-pulse lasers, impinging on e.g. thin metal foils, enable multi-MeV ion acceleration on μm length and fs to ps time scale. The generated ion bunches (typically protons) show unique beam properties, like ultra-high pulse dose. Nevertheless, laser accelerators still require substantial development in reliable beam generation and transport.

Recently developed pulsed magnets meet the demands of laser acceleration and open up new research opportunities: We present a pulsed solenoid for effective collection and focusing of laser-accelerated protons that acts as link between fundamental research and application.

The solenoid is powered by a capacitor-based pulse generator and can reach a maximum magnetic field of 20 T. It was installed in the target chamber of the Draco laser at HZDR. The transported beam was detected by means of radiochromic film, scintillator and Thomson parabola spectrometer. We present the characterization of the solenoid with regard to future application in radiobiological irradiation studies. Furthermore, a detailed comparison to previous experiments with a similar magnet at the PHELIX laser at GSI, Darmstadt is provided.

AKBP 7: Beam and Accelerator Control II

Zeit: Dienstag 16:30–18:30 Raum: S1/05 23

AKBP 7.1 Di 16:30 S1/05 23

Implementierung einer automatisierten on-line Strahldynamik-Simulation am S-DALINAC — •Manuel Steinhorst, Christoph Burandt, Jonny Birkhan, Thomas Schösser, Thorsten Kürzeder und Norbert Pietralla — Institut für Kernphysik, TU Darmstadt, Darmstadt, Deutschland

Der S-DALINAC, ein supraleitender rezirkulierender Elektronen-Linearbeschleuniger, stellt das zentrale Forschungsgroßgerät des Instituts für Kernphysik der TU Darmstadt dar. Zur Steuerung wird ein EPICS-basiertes Kontrollsystem eingesetzt. Es erlaubt insbesondere die Ansteuerung aller Strahlführungselemente und der Hochfrequenz-Beschleunigungskavitäten. Die Strahleinstellung wird derzeit auf Basis vorab ausgeführter Strahldynamik-Simulationen manuell durchgeführt. Dabei wird die Einstellung jeder einzelnen magnetischen Komponente iterativ optimiert, bis die gewünschte Strahlqualität erreicht ist. Um dieses Vorgehen zu beschleunigen, soll eine Visualisierung der verschiedenen Strahlparameter durch eine Echtzeit-Strahldynamik-Simulation ermöglicht werden. Dafür soll der Simulationscode „elegant" in das Kontrollsystem integriert werden. Somit können in Zukunft zum einen simulierte Einstellungen direkt an das Kontrollsystem übergeben werden und zum anderen während der Strahloptimierung eine Echtzeit-Strahldynamik-Simulation durchgeführt werden.

Der Vortrag stellt das entwickelte Konzept vor und zeigt den derzeitigen Stand der Umsetzung.

AKBP 7.2 Di 16:45 S1/05 23

Stand der Implementierung einer automatisierten Strahloptimierung am S-DALINAC — •Thomas Schösser, Christoph Burandt, Jonny Birkhan, Manuel Steinhorst, Thorsten Kürzeder, Uwe Bonnes und Norbert Pietralla — Institut für Kernphysik, TU Darmstadt, Darmstadt

Der S-DALINAC ist ein supreleitender rezirkulierender Elektronenlinearbeschleuniger und das zentrale Großforschungsgerät am Institut für Kernphysik der TU Darmstadt. Im Rahmen der Migration des Kontrollsystems auf ein EPICS-basiertes System werden die verschiedenen Kontrollsystem-Komponenten, die für eine automatisierte Strahloptimierung notwendig sind, schrittweise in das Kontrollsystem integriert. Für die automatisierte Auswertung von Videobildern zur Strahldiagnose werden Berilliumoxid-Targets verwendet, die mittels Pressluftkolben in den Strahlweg gefahren werden. Das Kamerasignal dieser Targets wird über einen analogen Videomultiplexer an einen Digitalisierer übertragen. Die funktionellen Neuerungen sind dabei die Digitalisierung der Videobilder und deren Bereitstellung in der EPICS-Umgebung. Die Konfiguration aller benötigten Software-Komponenten erfolgt aus einer relationalen Datenbank. Dieser Vortrag stellt die verwendeten technischen Geräte, das beschreibende Konzept für die Einbindung in das EPICS-basierte Kontrollsystem, sowie den aktuellen Stand der Umsetzung vor.

AKBP 7.3 Di 17:00 S1/05 23

Finales Design und Status der dritten Rezirkulation für den S-DALINAC * — •Michaela Arnold[1], Florian Hug[2], Thorsten Kürzeder[1] und Norbert Pietralla[1] — [1]Institut für Kernphysik, Technische Universität Darmstadt, Darmstadt, Deutschland — [2]Institut für Kernphysik, Johannes Gutenberg-Universität Mainz, Mainz, Deutschland

Seit 1991 wird der zweifach rezirkulierende supraleitende Darmstädter Elektronenlinearbeschleuniger S-DALINAC betrieben. Er konnte allerdings seine Design-Endenergie von 130 MeV im cw-Betrieb bisher nicht erreichen, da die Güten der supraleitenden Kavitäten hinter den Erwartungen zurückblieben.

Reduziert man die benötigten Beschleunigungsgradienten und nutzt den Hauptbeschleuniger ein weiteres Mal, kann die maximal mögliche Strahlenergie erhöht werden. Für diese zusätzliche Durchquerung des Hauptbeschleunigers wird eine weitere Rezirkulationsstrahlführung benötigt. Der Umbau des S-DALINAC setzt sich aus diversen Aspekten zusammen: Neben dem Aufbau der neuen Strahlführung müssen bestehende Strahlführungssektionen an die neuen Randbedingungen angepasst werden. Diese neuen Randbedingungen ergeben sich größtenteils aus diversen Strahldynamiksimulationen und aus dem Design des neuen Separationsdipols, der die einzelnen Strahlen energieabhängig in die verschiedenen Rezirkulationen ablenken soll.

Der Vortrag beschäftigt sich mit der Vorstellung des umgesetzten Designs und wird den aktuellen Stand des Projekts thematisieren.

AKBP 7.4 Di 17:15 S1/05 23

Investigation of the RF phase modulation at DELTA — •Marcel Bursy[1], Jonathan Fürsch[2], Peter Hartmann[1], Benjamin Isbarn[1], Malte Sommer[1], and Thomas Weis[1] — [1]Center for Synchrotron Radiation (DELTA) TU Dortmund University, 44227 Dortmund, Germany — [2]Affiliation changed meanwhile

At DELTA, a third generation 1.5 GeV synchrotron radiation facility, we utilize an RF phase modulation of the master-RF frequency at two times the synchrotron frequency. This provides additional damping capabilities for longitudinal coupled bunch mode instabilities and a significant increase in beam lifetime, due to bunch lengthening and reduced Touschek effect. This leads to an enhanced beam lifetime of approximately 20%. Despite the apparent influence on beam lifetime and longitudinal beam stability, the actual impact of the RF phase modulation on the time dependent acceleration gradient of the normal conducting cavity and its influence on the longitudinal phase space dynamics has not been studied sufficiently yet. We present an overview of the existing modulation system as well as studies of its effect on the longitudinal beam dynamics and the small bandwidth accelerating cavity.

AKBP 7.5 Di 17:30 S1/05 23

Interaction of RF Phase Modulation and Coupled Bunch Instabilities at the DELTA Storage Ring* — •Malte Sommer, Benjamin Isbarn, Bernard Riemann, and Thomas Weis — TU Dortmund University (DELTA) Center for Synchrotron Radiation Maria-Goeppert-Mayer-Str. 2 D - 44221 Dortmund

In 2011, a bunch-by-bunch feedback system has been installed at the DELTA storage ring and is mainly used for diagnostic purposes. In standard user operation, longitudinal coupled bunch instabilities are suppressed by RF phase modulation, which also increases the beam lifetime. The additional stabilisation is induced by a nonlinear spread of the synchrotron frequency due to Landau damping. To analyze the influence of RF phase modulation on coupled bunch instabilities, the bunch-by-bunch feedback system is used to achieve a deeper understanding of the interaction between both effects. The stabilisation has been investigated in more detail by elaborated excite-damp techniques. This talk will present recent results obtained at the DELTA storage ring.

*Work supported by the BMBF under contract no. 05K13PEB.

AKBP 7.6 Di 17:45 S1/05 23

Progress towards an arbitrary filling pattern at DELTA — •Yvonne Bernau[1], Peter Hartmann[1], John Kettler[2], Tim Hanke[1], Benjamin Isbarn[1], and Thomas Weis[1] — [1]Center for Synchrotron Radiation (DELTA), TU Dortmund University, 44227 Dortmund, Germany — [2]Affiliation changed meanwhile

DELTA is a 1.5 GeV synchrotron radiation facility operating at a typical 3/4 filling pattern for user operation. Meantime a single bunch mode for short pulse applications utilizing CHG is used. The current injection scheme for user operation features a simple sweep through the bunch train and thus is severely affected by unstable injection efficiencies, leading to inflexible and hardly predictable filling patterns. However, at present two self-contained timing systems are being used for injection and filling pattern readout. We present the first attempts of synchronizing those two independent timing systems to supply arbitrary filling patterns and combine different user requirements using a single filling pattern, e.g. hybrid mode for standard user and CHG operation. Based on these synchronised timing systems, a new software to supply arbitrary filling patterns is introduced.

AKBP 7.7 Di 18:00 S1/05 23

Beam studies with a new longitudinal feedback system at the ANKA Storage Ring — •Edmund Blomley, Miriam Brosi, Erik Bründermann, Nicole Hiller, Benjamin Kehrer, Anke-Susanne Müller, Manuel Schedler, and Nigel Smale — Karlsruher Institut für Technologie

With the now fully commissioned longitudinal feedback system at the ANKA Storage Ring - in addition to the already operational transverse feedback system - the stability throughout the injection and ramping process was increased considerably. This opened up the possibility to investigate beam dynamics and limitations such as the dynamic aperture and the tune space during injection more systematically. This talk presents the first results of these studies.

AKBP 7.8 Di 18:15 S1/05 23

Entwicklung der Strahlstabilisierung bei MESA für das P2-Experiment — •Ruth Herbertz für die P2-Kollaboration — Institut für Kernphysik, JGU Mainz

Am Elektronenbeschleuniger MESA, der zur Zeit in Mainz errichtet wird, soll ein Experiment zur präzisen Bestimmung des Weinbergwinkels (P2-Experiment) durchgeführt werden. Hierzu wird ein Elektronenstrahl mit extrem genau fixierten Strahlparametern im Energiebereich zwischen 100 und 200 MeV benötigt. Die Entwicklung der dazu notwendigen Strahlstabilisierung findet in einer Strahlführung am existierenden MAMI-Beschleuniger bei 180 MeV statt, wofür Hochfrequenzmonitore und schnelle Korrekturmagnete als Stellelemente eingebaut wurden. Die Regelungselektronik beruht auf dem Einsatz von FPGAs und schnellen ADCs und wird auf Rauscharmut hin optimiert. Der Strahl konnte bereits in der Lage stabilisiert werden. Im Vortrag wird auf die Untersuchung der zu beeinflussenden Regelstrecke und die elektronische Realisierung eingegangen.

AKBP 8: Polarized Beams

Zeit: Dienstag 16:30–18:30 Raum: S1/05 24

AKBP 8.1 Di 16:30 S1/05 24

Development status of a test stand for semiconductor photocathodes with 60 keV spin-polarized beamline — •Neeraj Kurichiyanil, Joachim Enders, Martin Espig, Yuliya Fritzsche, Domenic Heichelt, Andreas Kaiser, Heidi Rösch, and Markus Wagner — Institut für Kernphysik, TU Darmstadt

A test facility for Photo-Cathode Activation, Test and Cleaning using atomic-Hydrogen (Photo-CATCH) is being constructed at TU Darmstadt's Institute for Nuclear Physics (IKP) which houses the Superconducting Darmstadt Linear Accelerator (S-DALINAC). In order to improve the performance of the SDALINAC's photoelectron source based on GaAs, systematic studies in terms of quantum efficiency (QE), cathode rejuvenation, lifetimes and polarization (P) have to be conducted on different photocathode types. These factors strongly depend on handling of the cathode, the vacuum condition in the chambers, cathode surface cleaning as well as preservation of stoichiometry, negative electron affinity (NEA) activation of the cathode and the type and structure of the semiconductor material. With Photo-CATCH, experiments such as atomic-hydrogen cleaning, multi-alkali and oxidant NEA activation of the cathode and tests of QE, P and lifetimes can be performed in an improved vacuum. Additionally, experiments with polarized-electron beams of up to 60 keV are foreseen.

Work supported in part by DFG through SFB 634 and by the state of Hesse through HIC for FAIR.

AKBP 8.2 Di 16:45 S1/05 24

Spinmanipulation und Analyse an der neuen Testquelle spinpolarisierter Elektronen Photo-CATCH — •Dominic Heichelt, Joachim Enders, Martin Espig, Yulyia Fritzsche, Neeraj Kurichiyanil und Markus Wagner — Technische Universität Darmstadt, Institut für Kernphysik, Darmstadt, Deutschland

Die neue Testquelle spinpolarisierter Elektronen Photo-CATCH (Photo-Cathode Activation, Test and Cleaning with Atomic Hydrogen) des supraleitenden Darmstädter Linearbeschleunigers S-DALINAC ist seit Anfang 2016 im Betrieb. Zur Bestimmung des Polarisationsgrades kommt ein neues Doppel-Mott-Polarimeter zum Einsatz. Durch dieses kann die Asymmetrie unabhängig von der Dicke der eingesetzten Streutargets bestimmt und die Sherman-Funktion berechnet werden. Als Detektoren dienen vier kreuzförmig angeordnete Silizium-HL-Detektoren, die zudem rotierbar sind, um den gesamten Raumwinkel abzutasten. Notwendiges Kriterium für die Doppel-Mott-Polarimetrie ist eine transversale Ausrichtung des Elektronenspins. Da die Elektronenquelle von Photo-CATCH longitudinalen Spin liefert, kommt ein Wien-Filter und ein nachfolgender Solenoid zum Einsatz. Damit lässt sich der Spin in jede Raumrichtung einstellen. Teilweise gefördert durch die DFG (SFB63, GK2128) und euch das Land Hessen (LOEWE-Zentrum HIC for FAIR).

AKBP 8.3 Di 17:00 S1/05 24

Entwicklung einer invertierten kryogenen spinpolarisierte Elektronenquelle — •Markus Wagner, Joachim Enders, Martin Espig, Yuliya Fritzsche und Neeraj Kurichijanil — TU Darmstadt, Institut für Kernphysik, Darmstadt, Deutschland

Künftige Experimente mit polarisierten Elektronenstrahlen bedürfen immer größerer Elektronenströme. Herausforderungen sind z.B. die Erzeugung polarisierter Strahlen für Energy-recovery Linacs oder für die Produktion polarisierter Positronen durch direkte Konversion aus polarisierten Elektronen. Die Quanteneffizienz heutiger GaAs-Kathoden limitiert diese Ströme zwar noch nicht, allerdings ist die thermische Belastung der Kathoden und auch deren Ladungslebensdauer eine dauerhaftes Problem. Letzteres hängt sehr diffiziel von den Vakuumbedingungen innerhalb der Kathodenkammer ab. Eine Verbesserung durch Hinzufügen weiterer Pumpen ist sehr kostenintensiv und kaum zielführend. Aus diesem Grund präsentieren wir ein neues Kammerdesign, welches einen Kryokopf nutzt, um sowohl die thermische Belastung als auch den erreichbaren Enddruck um einen Faktor 1000 zu reduzieren. Wir berichten von den aktuellen Planungen und zeigen erste Kammerdesigns.

Gefördert durch das BMBF (05HI5RDRB1), das Land Hessen (LOEWE-Zentrum HIC for FAIR) und die DFG (Graduiertenkolleg 2128).

AKBP 8.4 Di 17:15 S1/05 24

Systematic studies of spin dynamics in preparation for the EDM searches at COSY. — •Artem Saleev for the JEDI-Collaboration — Wilhelm-Johnen-Straße 52428 Jülich

Searches of the electric dipole moment (EDM) at a pure magnetic ring, like COSY, encounter strong background coming from magnetic dipole moment (MDM). The most troubling issue is the MDM spin rotation in the so-called imperfection, radial and longitudinal, B-fields. To study the systematic effects of the imperfection fields at COSY we proposed the original method which makes use of the two static solenoids acting as artificial imperfections. Perturbation of the spin tune caused by the spin kicks in the solenoids probes the systematic effect of cumulative spin rotation in the imperfection fields all over the ring. The spin tune is one of the most precise quantities measured presently at COSY at 10^{-10} level. The method has been successfully tested in September 2014 run at COSY, unravelling strength of spin kicks in the ring's imperfection fields at the level of $10^{-3} rad$.

AKBP 8.5 Di 17:30 S1/05 24

Spin simulations for the final EDM storage ring — •Alexander Albert Skawran and Andreas Lehrach for the JEDI-Collaboration — Institut für Kernphysik, Forschungszentrum Jülich

A hint for physics beyond the Standard Model would be a non-vanishing electric dipole moment (EDM) of subatomic particles. The JEDI (Jülich Electric Dipole moment Investigations) collaboration has the goal to investigate the existence of a permanent EDM of deuterons with a precision up to 10^{-29} ecm level. This experiment requires the construction of a dedicated storage ring. A permanent EDM would lead to a torque of the spin motion in the vertical direction which leads to a vertical polarization build-up.

The program COSY Infinity is used for spin tracking simulations investigating options for a final EDM storage ring lattice design. Furthermore the impact of gradient fields on the spin motion in an EDM storage ring has to be taken into account. In this talk first results of spin tracking simulations and estimates for the effect of gradient fields are presented.

AKBP 8.6 Di 17:45 S1/05 24

Ein Detektorsystem für Compton-Polarimetrie an ELSA — •Rebecca Koop, Michael Switka und Wolfgang Hillert — Elektronen-Stretcher-Anlage ELSA, Physikalisches Institut Universität Bonn

Für die Messung der transversalen Elektronenpolarisation im 3,2 GeV Elektronen-Stretcherring ELSA befindet sich ein Compton-Polarimeter im Aufbau. Als polarisierte Photonenquelle für die frontale Kollision mit dem Elektronenstrahl dient ein 515 nm Dauerstrich Laser. Aus der ortsaufgelösten Vermessung des Photonen-Rückstreuprofils mit Hilfe eines Silizium-Streifendetektors kann die Polarisation des Elektronenstrahls bestimmt werden. Das Detektorsystem, das Messverfahren und erste Messungen mit polarisiertem Elektronenstrahl werden vorgestellt.

AKBP 8.7 Di 18:00 S1/05 24

Challenges in designing a very compact 130 MeV Møller Polarimeter for the S-DALINAC* — •Thore Bahlo, Joachim Enders, Thorsten Kürzeder, Norbert Pietralla, and Jan Wissmann — Institut für Kernphysik, TU Darmstadt, Darmstadt, Germany

The Superconducting Darmstadt Linear Accelerator is capable of accelerating polarized electron beams produced by the S-DALINAC Polarized Injector (SPIN). For electron energies of up to 14 MeV it is possible to measure the absolute polarization of the electrons with two Mott polarimeters that are already mounted in the injector beamline. Until now it is not possible to measure the absolute electron beam polarization after the passage of the main accelerator. Therefore a Møller polarimeter for energies between 50 MeV and 130 MeV is currently being developed. The rather low incident beam energy, the variability of the incident beam energy, and spatial restrictions necessitate a compact set-up with large acceptance. The very restrictive boundary conditions introduce technical and geometrical challenges. We will present the design of the target chamber, of the separation dipole mag-

net as well as the beam dump. *Supported by the DFG under grant No. SFB 634

AKBP 8.8 Di 18:15 S1/05 24

Aperture Studies and Detector Geometry Optimization for the S-DALINAC Møller Polarimeter using GEANT4* — •Jan Wissmann, Thore Bahlo, Joachim Enders, Thorsten Kürzeder, and Norbert Pietralla — Institut für Kernphysik, Technische Universität Darmstadt, Darmstadt, Germany

The S-DALINAC is equipped with a source for spin polarized electrons. To determine the beam polarization at extraction, a Møller polarimeter for energies between 50 MeV and 130 MeV is to be installed between the main accelerator and the experimental setups.

Due to the limited available space, the shielding of the detectors of the Møller electron pairs from beam-induced background is challenging. In particular production of bremsstrahlung close to the detectors is to be avoided. To minimize the amount of scattered electrons close to the detector position. The spatial beam distribution needs to be constrained by an aperture while maintaining full coverage of the detectors. Different aperture designs are simulated using the GEANT4 toolkit to find the best geometric parameters. Further background reduction can be achieved by optimizing the detector geometry and introducing suitable shielding materials. We will present different aperture layouts and the detector geometry.

*Work supported by DFG through SFB 634

AKBP 9: Seeding, Thomson and Compton Scattering

Zeit: Mittwoch 14:00–16:00 Raum: S1/05 122

Gruppenbericht AKBP 9.1 Mi 14:00 S1/05 122

(Group Report) Status of the Short-Pulse Facility at DELTA — •Fabian Götz, Fin Hendrik Bahnsen, Max Bolsinger, Svenja Hilbrich, Markus Höner, Marc André Jebramcik, Shaukat Khan, Nils Lockmann, Carsten Mai, Arne Meyer auf der Heide, Robert Molo, Rafael Niemczyk, Gholamreza Shayeganrad, Peter Ungelenk, and Dennis Zimmermann — Center for Synchrotron Radiation (DELTA), TU Dortmund University, Dortmund, Germany

At the 1.5-GeV synchrotron light source DELTA operated by the TU Dortmund University, femtosecond laser pulses interact with electrons in order to generate coherent ultrashort radiation pulses in the VUV regime (coherent harmonic generation, CHG). The electric field of the laser pulses modulates the electron energy. By passing a magnetic chicane, this energy modulation is converted into a density modulation, which gives rise to coherent radiation at harmonics of the laser wavelength. In this contribution, a general overview of the DELTA short-pulse facility and methods to characterize the CHG radiation are presented. To control the shape and the spectra of the CHG pulses, studies using a scanning monochromator with an APD as a detector and a single-shot spectrometer based on a gated CCD camera were carried out. The CHG radiation spectra change under variation of the laser pulse properties and chicance strengths. Finally, spectral measurements are compared with simulations of the microbunching process and the CHG radiation.

AKBP 9.2 Mi 14:30 S1/05 122

Influence of RF Phase Modulation on Laser-Induced Coherent Synchrotron Radiation — •Marc Andre Jebramcik, Fin Hendrik Bahnsen, Max Bolsinger, Svenja Hilbrich, Shaukat Khan, Carsten Mai, Arne Meyer auf der Heide, Robert Molo, Gholamreza Shayeganrad, and Peter Ungelenk — Center for Synchrotron Radiation (DELTA), TU Dortmund University, Dortmund, Germany

In circular accelerators, RF phase modulation is routinely used to prolong the beam lifetime and to damp multi-bunch instabilities. At the 1.5-GeV synchrotron light source DELTA operated by the TU Dortmund University, synchronized RF phase modulation has also been used to increase the intensity of the ultrashort coherent pulses in the VUV and THz regime generated by the coherent harmonic generation (CHG) technique since 2014. The quality of the laser-electron interaction is heavily influenced by the energy spread and density of the electron bunches. Hence, RF phase modulation can be used to modulate these parameters in order to achieve an increased intensity of the laser-induced radiation. An analysis regarding the relationship between synchronized RF phase modulation and the laser-induced radiation is presented.

AKBP 9.3 Mi 14:45 S1/05 122

Design of Vacuum Components for a EEHG-Based Short-Pulse Facility at DELTA — •Fin Hendrik Bahnsen, Max Bolsinger, Svenja Hilbrich, Marc Andre Jebramcik, Shaukat Khan, Nils Lockmann, Carsten Mai, Arne Meyer auf der Heide, Robert Molo, Gholamreza Shayeganrad, Peter Ungelenk, and Dennis Zimmermann — Center for Synchrotron Radiation (DELTA), TU Dortmund University, Dortmund, Germany

Since 2011, a short-pulse facility is in operation at the 1.5-GeV synchrotron light source DELTA. Coherent VUV radiation pulses with femtosecond duration are routinely generated using the coherent harmonic generation (CHG) technique which is based on the interaction of electrons with ultrashort laser pulses. In order to generate even shorter wavelengths, an upgrade employing the echo-enabled harmonic generation (EEHG) and femtoslicing schemes is planned for 2017. A new vacuum system for the modified section of the storage ring considering the boundary conditions given by the changed magnetic layout and the existing vacuum setup was designed. The results including simulations of the vacuum profile along the storage ring and wake fields in new chamber parts will be presented.

AKBP 9.4 Mi 15:00 S1/05 122

Recent Progress Towards the EEHG-Based Short-Pulse Facility at DELTA — •Nils Lockmann, Fin Hendrik Bahnsen, Max Bolsinger, Fabian Götz, Svenja Hilbrich, Marc Jebramcik, Shaukat Khan, Carsten Mai, Arne Meyer auf der Heide, Robert Molo, Raffael Niemczyk, Helge Rast, Gholamreza Shayeganrad, Peter Ungelenk, and Dennis Zimmermann — Center for Synchrotron Radiation (DELTA), TU Dortmund University, Dortmund, Germany

In the field of photon science, the demand for brilliant radiation at short wavelengths with shortest pulse durations keeps growing. At the synchrotron radiation source DELTA operated by the TU Dortmund University, this is achieved by an interaction of a short laser pulse with highly relativistic electrons. The currently used coherent harmonic generation (CHG) technique leads to femtosecond synchrotron radiation pulses in the VUV regime. However, the so-called echo-enabled harmonic generation (EEHG) scheme promises to reach much shorter wavelengths. Therefore, the short-pulse facility will be modified in order to implement EEHG as well as the femtoslicing technique, another method providing short pulses with short wavelengths using the laser-electron-interaction.

In this contribution the status of the upgrade will be presented, including the magnetic layout of the storage ring, the laser system and hardware components.

AKBP 9.5 Mi 15:15 S1/05 122

Design Study of a Traveling-Wave Thomson-Scattering Experiment for the Realization of Optical Free Electron Lasers — •Klaus Steiniger[1,2], Daniel Albach[1], Alexander Debus[1], Markus Loeser[1,2], Richard Pausch[1,2], Fabian Roeser[1], Ulrich Schramm[1,2], Matthias Siebold[1], and Michael Bussmann[1] — [1]Helmholtz-Zentrum Dresden-Rossendorf — [2]Technische Universität Dresden

We present an experimental setup strategy for the realization of an optical free-electron laser (OFEL) in the Traveling-Wave Thomson-Scattering geometry (TWTS). In TWTS, the electric field of petawatt class, pulse-front tilted laser pulses is used to provide an optical undulator field. This is passed by a relativistic electron bunch so that electron direction of motion and laser propagation direction enclose an interaction angle. The combination of side scattering and pulse-front tilt provides continuous overlap of electrons and laser pulse over meter scale distances which are achieved with centimeter wide laser pulses. An experimental challenge lies in shaping of these wide laser pulses in terms of laser dispersion compensation along the electron trajectory

and focusing. In the talk we show how diffraction gratings in combination with mirrors are used to introduce and control dispersion of the laser in order to provide a plane wave laser field along the electron trajectory. Furthermore we give tolerance limits on alignment errors to operate the OFEL. Example setups illustrate functioning and demonstrate feasibility of the scheme.

AKBP 9.6 Mi 15:30 S1/05 122

Compact x-ray sources - simulating the electron/strong laser interaction — •Anthony Hartin — DESY, CFEL, Notkestrasse 85, Hamburg 22607

The collision of an intense laser with an electron bunch can be used to produce x-rays via the inverse Compton scattering (ICS) mechanism. The ICS can be simulated via either a classical theory in which electrons and photons are treated in terms of classical electromagnetic waves - or a quantum theory in which charged particles interact with strong electromagnetic fields.

The laser intensity used in a practical ICS collision is likely to be at such a level that quantum effects may be significant and the use of quantum theory may become a necessity. A simulation study is presented here comparing the classical and quantum approaches to the ICS.

A custom particle-in-cell (PIC) software code, with photon generation by monte carlo of the exact quantum transition probability is used to simulate the quantum treatment. Peak resonant energies and the angular distribution of the x-rays are obtained and compared with those predicted by the classical theory. The conditions under which significant differences between the two theories emerges is obtained.

AKBP 9.7 Mi 15:45 S1/05 122

Detection of Inverse Compton Scattering in Plasma Wakefield Experiments — •Simon Bohlen[1], Darragh Corvan[2], Jens Osterhoff[1], Bernhard Schmidt[1], Jan-Patrick Schwinkendorf[1], and Matthew Streeter[1] — [1]Deutsches Elektronen-Synchrotron, Notkestrasse 85, 22607 Hamburg, Germany — [2]School of Mathematics and Physics, The Queen's University of Belfast, BT71NN Belfast, United Kingdom

Inverse Compton Scattering (ICS) of a laser pulse off an electron bunch can produce highly energetic photons. In combination with plasma wakefield acceleration, ICS offers a compact way to provide a source of directed gamma radiation. Besides industrial and medical applications, ICS may be utilized as a diagnostic for the electron bunch used in the interaction. By measuring properties of the gamma beam, electron beam information such as energy and divergence as well as its longitudinal properties can be determined.

Typical electron energies in plasma wakefield experiments lead to gamma-rays with energies on the order of about 1-100 MeV rendering the detection of the ICS photons challenging. Furthermore, the femtosecond duration of the produced gamma beams prevents the use of standard measurement techniques, which rely on diagnosing single photon events. Here, we present a discussion of novel detector techniques and their use to create functional diagnostics for plasma based ICS beams.

AKBP 10: Beam Dynamics / Simulation II

Zeit: Mittwoch 16:30–18:30 Raum: S1/05 122

AKBP 10.1 Mi 16:30 S1/05 122

Improvements in the Beam Dynamics Simulations for the HESR — •Jan Henry Hetzel, Andreas Lehrach, Ulf Bechstedt, Jürgen Böker, Bernd Lorentz, and Raimund Tölle — FZ Jülich, Jülich, Deutschland

The High-Energy Storage Ring HESR is a part of the emerging accelerator complex FAIR (Facility for Antiproton and Ion Research) at the GSI in Darmstadt. The HESR will accelerate and store antiprotons with a momentum range from 1.5 to 15 GeV/c. It will also be suitable for heavy ions with an approximate momentum range from 0.6 GeV/c to 5.8 GeV/c.

In this talk beam-dynamics simulations for the HESR will be presented. The first focusing magnets and the first bending magnets have been delivered and the magnetic field measured recently. These measurements include the estimation of the mulipole components. From these measurement the average harmonic content and its standard deviation throughout the series is estimated. In beam tracking studies for the HESR the multipole errors are diced accordingly. The results of these tracking studies are then used to estimate the dynamic aperture.

AKBP 10.2 Mi 16:45 S1/05 122

Simulation Studies on Measures to Mitigate Ion Clouds — Prasanth Babu Ganta[1], Ahmed Masood[1], Dennis Sauerland[2], Wolfgang Hillert[2], Atoosa Meseck[3], and •Ursula van Rienen[1] — [1]Universität Rostock, Institut für Allgemeine Elektrotechnik, Albert-Einstein-Str. 2, 18059 Rostock — [2]Physikalisches Institut der Universität Bonn, ELSA, Nussallee 12, 53115 Bonn — [3]HZB, Institut Beschleunigerphysik, Albert-Einstein-Str. 15, 12489 Berlin

For future Energy Recovery Linacs (ERL), parasitic ions, which are generated by collisions of the beam and the rest gas in the vacuum chamber, present a limiting factor for the high current-low emittance electron beams. Clearing gaps, clearing electrodes and appropriate filling patterns are a remedy to keep the ion density in the accelerator at a level that allows for a minimum stability of the beam parameters. The MOEVE PIC Tracking code, which employs a 2D wake matrix, enables tracking simulations of the ion distribution over a relatively long period of up to thousands of interactions with the passing bunches. It enables to develop a deeper understanding of the ion-cloud behavior in order to design appropriate measures for their mitigation. For certain cases, it is sufficient to study the problem in 2D. Therefore, an additional 2D solver shall be implemented into MOEVE PIC Tracking in order to reduce the computation times. Numerical studies of ion cloud dynamics in beam guiding magnets and drift sections of electron machines will be shown and compared with experimental results obtained at the ELSA facility. Work supported by Federal Ministry for Research and Education BMBF under contract 05K13HRC.

AKBP 10.3 Mi 17:00 S1/05 122

Experimentelle Studien zur Ionendynamik in Kreisbeschleunigern* — •Dennis Sauerland[1], Wolfgang Hillert[1], Ursula van Rienen[2] und Atoosa Meseck[3] — [1]Elektronen-Stretcher-Anlage, Physikal. Institut, Universität Bonn — [2]Institut für Allgemeine Elektrotechnik, Universität Rostock — [3]Helmholtz-Zentrum Berlin

Im ELSA Stretcherring der Universität Bonn werden Elektronen auf eine Energie von bis zu 3,2 GeV beschleunigt. Hierbei akkumulieren Ionen, welche durch Stoßionisation kontinuierlich produziert werden, im Strahlpotential und sind Ursache für inkohärente Arbeitspunktverschiebungen und Strahlinstabilitäten. Da die Arbeitspunktverschiebung linear mit der Neutralisation anwächst, bietet sie einen Zugang um angewendete Ionensäuberungsmaßnahmen zu evaluieren:
Durch eine breitbandige Anregung des Strahls um seinen transversalen Arbeitspunkt mittels eines Stripline-Kickers ist es möglich, die Transferfunktion des Strahls zu bestimmen. Die Verschiebung und Verbreiterung des Arbeitspunktes kann durch eine Größe parametrisiert werden, welche mit der inkohärenten Arbeitspunktverschiebung korreliert. Der Einfluss von inkohärenten Effekten auf das kohärente Antwortverhalten des Elektronenstrahls bei dieser Methode ist zur Zeit noch nicht ausreichend untersucht worden, wodurch aus der gemessene Größe nicht direkt eine Neutralisation extrahiert werden kann. Deshalb werden in diesem Vortrag neue numerische Berechnungen und experimentelle Nachweise vorgestellt, die die Ergebnisse der vorangegangenen Messung untermauern.
*Gefördert vom BMBF unter Fördernummer 05K13PDA

AKBP 10.4 Mi 17:15 S1/05 122

UFOs in the LHC — •Laura Grob — CERN, Geneva, Switzerland — Technische Universität Darmstadt

In the Large Hadron Collider (LHC) localized and recurring beam losses have been observed, which usually persist for several hundred microseconds. With increasing beam energy these losses were found to pose a serious risk to the machine availability, as some of these events can cause quenches in the superconducting magnets. The current un-

derstanding is that these losses are caused by falling microparticles that interact with the proton beam. To describe these so-called UFOs (unidentified falling objects) and their dynamics, a model was developed starting from the approach that only gravitational and electrostatic forces act on a neutrally charged particle. However, the model's results cannot reproduce the actual data from the LHC's beam loss monitors (BLMs), which indicates a more complex UFO dynamic. Experimental studies and further analysis of the BLM data are planned to investigate the UFO dynamics in greater detail and to understand origins and release mechanisms for microparticles in the LHC beam pipe.

AKBP 10.5 Mi 17:30 S1/05 122

Zeitersparnis durch den "Multi-Energie-Betrieb" — •Mohammad Hossein Ravasani, Christian Schömers und Andreas Peters — Heidelberger Ionenstrahl-Therapiezentrum

Das Heidelberger Ionenstrahl Therapiezentrum (HIT) wurde im Jahr 2009 eröffnet.Die Tumorbestrahlung erfolgt mit dem Rasterscan-Verfahren.Ein Ionenstrahl, der auf die zur Eindringtiefe passenden Energien beschleunigt wurde, wird über die Iso Energie Schichten(IES)im Tumor geführt. In einem Synchrotron werden die Teilchen auf das vorgegebene Energieniveau beschleunigt. Die benötigten Teilchen werden anschließend in einem RF-K.O Extraktionsprozess vom Strahl getrennt und weitergeleitet. Die restlichen Teilchen,werden an einem Scraper gezielt gestoppt. In diesem Bestrahlungsmodus muss für jedes Energieniveau ein neuer Synchrotronzyklus gestartet werden. Dadurch erhöht sich die Behandlungsdauer. Um dem entgegen zu wirken, soll am HIT ein multipler Energiebetrieb (MEB) eingeführt werden. Dieser soll es ermöglichen, mit einer Synchrotronfüllung mehrere Zyklen zu durchlaufen,um so eine Zeitersparnis zu erreichen. Im Rahmen einer Bachelor-Arbeit werden die Bestrahlungspläne aller am HIT behandelten Patienten analysiert. In einer Simulation des MEB wird abgeschätzt wie viel Zeit eingespart werden kann. Dazu werden mit einem Pythonprogramm, Energieniveaus,und die mittlere Zeitdauer der IES, aus den Bestrahlungsplänen extrahiert. Das Modell wird dann um Annahmen in Bezug auf die Strahldynamik erweitert, die eine Vorhersage der Bestrahlungsdauer im MEB-Modus ermöglichen. Das signifikante Zeitersparnis wird hier präsentiert.

AKBP 10.6 Mi 17:45 S1/05 122

Simulation studies of gas and plasma-based charge strippers — •Oliver Sebastian Haas[1] and Oliver Boine-Frankenheim[1,2] — [1]Institut für Theorie Elektromagnetischer Felder, Darmstadt, Germany — [2]GSI Helmholtz Centre for Heavy Ion Research, Darmstadt, Germany

Charge stripping of heavy ion beams at high intensities is a major challenge in current and future facilities with high intensity heavy ion beams. Conventional stripping techniques are limited in their applicability, e.g. solid carbon foils suffer from short lifetimes at high intensities and gas strippers usually achieve only low charge states. One possible alternative is the use of a plasma as a stripping medium. The presented work focuses on theoretical studies of the interaction of an heavy ion beam with a plasma and accompanying effects in possible charge strippers.

The main interest in the presented studies is the final charge state distribution of the ion beam. Different models for solving the corresponding rate equations were developed, taking into account ionization, recombination, energy loss and straggling processes. Sophisticated models, e.g. for ionization cross sections, as well as limits and applicability of simplified models are discussed. Quantitative results are presented in form an overview of the charge state distributions of different - conventional and novel - charge stripping media. Furthermore comparisons are done with charge state distributions of available experimental data. Typical practically relevant target conditions are discussed as well as deterioration of beam quality.

AKBP 10.7 Mi 18:00 S1/05 122

Realistic ion optical transfer maps for Super-FRS magnets from numerical field data — •Erika Kazantseva and Oliver Boine-Frankenheim — Schlossgartenstr.8, Technische Universität Darmstadt

In large aperture accelerators such as Super-FRS, the non-linearity of the magnetic field in bending elements leads to the non-linear beam dynamics, which cannot be described by means of linear ion optics. Existing non-linear approach is based on the Fourier harmonics formalism and is not working if horizontal aperture is bigger as vertical or vice versa. In Super-FRS dipole the horizontal aperture is much bigger than the vertical. Hence, it is necessary to find a way to create the higher order transfer map for this dipole to accurately predict the particle dynamics in the realistic magnetic fields in the whole aperture.

The aim of this work is to generate an accurate high order transfer map of magnetic elements from measured or simulated 3D magnetic field data. Using differential algebraic formalism allows generating transfer maps automatically via numerical integration of ODEs of motion in beam physics coordinates along the reference path. To make the transfer map accurate for all particles in the beam, the magnetic field along the integration path should be represented by analytical function, matching with the real field distribution in the volume of interest. Within this work the steps of high order realistic transfer map production starting from the field values on closed box, covering the volume of interest, will be analyzed in detail.

AKBP 10.8 Mi 18:15 S1/05 122

Transverse decoherence with space charge — •Ivan Karpov[1], Vladimir Kornilov[2], and Oliver Boine-Frankenheim[1,2] — [1]TEMF, TU Darmstadt, Schloßgartenstraße 8, 64289 Darmstadt, Germany — [2]GSI, Planckstr. 1, 64291 Darmstadt, Germany

After a transverse offset the amplitude of beam centroid oscillations decays due to the spread of individual particle frequencies. Decoherence of low intensity coasting beams can be described as the pulse response. However in heavy ion and proton beams, like in SIS100 synchrotron of the FAIR project, transverse space charge strongly modify this process. We present a model that explains the first stage of decoherence process in high intensity bunched beams. It uses the modified beam transfer function with space charge and image charges to calculate the pulse response. The model agrees with particle tracking simulations and measurements at the SIS18 synchrotron at GSI Darmstadt. The applicability region of the model was obtained.

AKBP 11: Poster

Zeit: Mittwoch 18:30–20:30 Raum: S1/05 22-24

AKBP 11.1 Mi 18:30 S1/05 22-24

Upgrade of the UNiversal Linear ACcelerator UNILAC for FAIR — •Lars Groening[1], Sascha Mickat[1], Alexsey Adonin[1], Winfried Barth[1], Markus Baschke[2], Xiaonan Du[1], Christoph Emanuel Düllmann[3], Hendrik Hähnel[2], Ralph Hollinger[1], Egon Jäger[1], Holger Podlech[2], Ulrich Ratzinger[2], Anna Rubin[1], Paul Scharrer[3], Bernhard Schlitt[1], Gerald Schreiber[1], Anja Seibel[2], Rudolf Tiede[2], Hartmut Vormann[1], Chen Xiao[1], Alexander Yakushev[1], and Chuan Zhang[1] — [1]GSI Helmholtzzentrum für Schwerionenforschung, 64291 Darmstadt / Germany — [2]Goethe University Frankfurt, D-60438 Frankfurt / Germany — [3]Helmholtz-Institut Mainz, D-55099 Mainz / Germany

In order to meet the requirements on beam parameters for the upcoming FAIR facility at GSI, the injector linac UNILAC will be upgraded. The activities comprise development of the sources for stable provision of intense uranium beams at a repetition rate of 2.7 Hz, a revision of the beam dynamics layout of the 120 keV/u RFQ, the replacement of the matching section to the 1.4 MeV/u pre-stripper DTL, and enhancement of the gaseous stripping section efficiency. This section shall also include a round-to-flat emittance adaptor to prepare the beam for injection into the synchrotron SIS18 which has a flat transverse injection acceptance. Finally, the upgrade includes the complete replacement of the 40 year old 11.4 MeV/u Alvarez-type post-stripper DTL with a new DTL, preferably using Alvarez-type cavities with improved beam focusing features, as well as its rf-power alimentations.

AKBP 11.2 Mi 18:30 S1/05 22-24

Status of the EPICS-based Accelerator Control System of the S-DALINAC* — •Christoph Burandt, Jonny Birkhan, Joachim Enders, Thorsten Kürzeder, Norbert Pietralla,

Thomas Schösser, and Manuel Steinhorst — Institut für Kernphysik, TU Darmstadt, Darmstadt, Germany

The Superconducting Darmstadt Electron Linear Accelerator (S-DALINAC) is the primary research instrument of the Institut für Kernphysik at TU Darmstadt providing beams mainly for experiments on nuclear structure physics. Its control system has been migrated to an EPICS-based system throughout the last years.

The development during this phase focused on the hardware frontend layer in order to allow for basic beam operation. However, some higher-level services like archiving and save/restore have already been installed, but still need to be reworked by some degree and complemented with additional services like an alarm handling system.

This contribution will show the architecture of the S-DALINAC's accelerator control system and will summarize the ongoing development of the higher-level service layer.

*Supported by the DFG under grant Nos. SFB 634 and GRK 2128.

AKBP 11.3 Mi 18:30 S1/05 22-24

Beam Emittance Measurements with Heavy Ion Beams at the GSI UNILAC — •Peter Gerhard, Lars Groening, Michael Maier, and Günther Riehl — GSI Helmholtzzentrum für Schwerionenforschung GmbH, Darmstadt, Germany

Beam emittance is the key parameter for any beam dynamics simulation or design of new accelerators or components. Profound knowledge of the transverse emittance is indispensable in the quest for high brilliance heavy ion beams. In the last years, high quality transverse beam emittance measurements have been established as a standard tool for accelerator investigations at the UNILAC. Recently, a special device was commissioned to enable transverse emittance measurements beyond two dimensions. Here we present the tools used at the UNILAC, along with an overview of studies carried out in the last years.

AKBP 11.4 Mi 18:30 S1/05 22-24

Advances in beam position monitoring methods at GSI synchrotrons — •Rahul Singh, Andreas Reiter, Peter Forck, Piotr Kowina, Kevin Lang, and Piotr Miedzik — GSI, Darmstadt

At the GSI synchrotron facilities, capacitive beam pick-up signals for position evaluation are immediately digitized within the acquisition electronics due to availability of reliable, fast and high resolution ADCs. The signal processing aspects are therefore fully dealt with in the digital domain. Novel digital techniques for asynchronous and synchronous (bunch-by-bunch) beam position estimation have been developed at GSI SIS-18 and CRYRING as part of FAIR development program. This contribution will highlight the advancements and its impact on the operational ease and high availability of the BPM systems.

AKBP 11.5 Mi 18:30 S1/05 22-24

A Heterogeneous CPU+GPU Poisson Solver for Space Charge Calculations in Beam Dynamics Studies — •Dawei Zheng and Ursula van Rienen — University of Rostock, Institute of General Electrical Engineering, Rostock, 18059, Germany

In beam dynamics studies in accelerator physics, space charge plays a central role in the low energy regime of an accelerator. Numerical space charge calculations are required, both, in the design phase and in the operation of the machines as well. Due to its efficiency, mostly the Particle-In-Cell (PIC) method is chosen for the space charge calculation. Then, the solution of Poisson's equation for the charge distribution in the rest frame is the most prominent part within the solution process. The Poisson solver directly affects the accuracy of the self-field applied on the charged particles when the equation of motion is solved in the laboratory frame. As the Poisson solver consumes the major part of the computing time in most simulations it has to be as fast as possible since it has to be carried out once per time step. In this work, we demonstrate a novel heterogeneous CPU+GPU routine for the Poisson solver. The novel solver also benefits from our new research results on the utilization of a discrete cosine transform within the classical Hockney and Eastwood's convolution routine.

The work of Dawei Zheng was supported by the China Scholarship Council under Grant 2011618041.

AKBP 11.6 Mi 18:30 S1/05 22-24

Studies on a Modified Cathode Tip for the ELBE SRF Gun — Eden Tafa Tulu[1], Prasanth Babu Ganta[1], André Arnold[2], and •Ursula van Rienen[1] — [1]Universität Rostock, Institut für Allgemeine Elektrotechnik, Albert-Einstein-Str. 2, 18059 Rostock — [2]HZDR, Strahlungsquelle ELBE, Bautzner Landstraße 400, 01328 Dresden

Future light sources such as synchrotron radiation sources driven by an Energy Recovery Linac (ERL), Free Electron Laser (FEL) or THz radiation sources have in common that they require injectors, which provide high-brilliance, high-current electron beams in almost continuous operation. Thus, the development of appropriate highly brilliant electron sources is a central factor. A promising approach for this key component is provided by superconducting radiofrequency photoinjectors (SRF guns). Since 2007, the free-electron laser FELBE at HZDR successfully operates such a SRF gun under real conditions and equipped with all components. Nevertheless, there are limitations caused by multipacting which should be overcome in order to further improve the gun. One aspect in order to reach this aim lies in studying various modifications of the cathode tip. This contribution will present results of a systematic multi-objective optimization with respect to multipacting of differently formed grooves. Work supported by Federal Ministry for Research and Education BMBF under contract 05K13HRB.

AKBP 11.7 Mi 18:30 S1/05 22-24

The Optimized Advanced Demonstrator for the SC CW Heavy Ion Linac at GSI — •Malte Schwarz[1], Markus Basten[1], Marco Busch[1], Florian Dziuba[1], Holger Podlech[1], Ulrich Ratzinger[1], Rudolf Tiede[1], Viktor Gettmann[2], Manuel Heilmann[2], Winfried Barth[2,3], Sascha Mickat[2,3], Maksym Miski-Oglu[3], and Kurt Aulenbacher[4] — [1]Institut für Angewandte Physik, Goethe-Universität Frankfurt am Main — [2]GSI Helmholtzzentrum, Darmstadt — [3]HIM, Helmholtzinstitut, Mainz — [4]KPH, Johannes Gutenberg Universität, Mainz

For future experiments with heavy ions at the coulomb barrier within the SHE research project a multi-stage R&D program of GSI, HIM and IAP is currently under progress. It aims at developing a superconducting (sc) continuous wave (cw) LINAC with multiple CH-cavities as key components. As intermediate step towards the whole LINAC, the Optimized Advanced Demonstrator is proposed. Consisting of short CH-cavities and cryostats, it could provide several advantages regarding velocity acceptance, higher tolerance with respect to frequency and field deviation, easier mounting, handling and maintenance as well as a more robust longitudinal beam dynamic. The beam dynamics concept is based on EQUUS (Equidistant Multigap Structure) constant-beta cavities. The corresponding simulations for the proposed next extension stage - the Optimized Advanced Demonstrator - will be presented.

AKBP 11.8 Mi 18:30 S1/05 22-24

Wakefield dechirping with a dielectrically lined waveguide at ELBE — •Franziska Reimann[1], Ursula van Rienen[1], Peter Michel[2], and Ulf Lehnert[2] — [1]Universität Rostock, Institut für Allgemeine Elektrotechnik; Rostock, Germany — [2]Helmholtz-Zentrum Dresden-Rossendorf; Dresden-Rossendorf, Germany

Dielectrically lined waveguides are planned to be used as a passive wakefield dechirper[1] for the electron beam at the ELBE facility of the Helmholtz-Zentrum Dresden Rossendorf.

In this work we introduce the design of such a passive wakefield dechirper based on the analysis of dielectrically lined rectangular waveguides with a semi-analytical model developed at the University of Rostock. The generality of this model allows for a quick calculation of the wakefields of numerous different beam types via the Green's function method.

In this work, we present the dechirped phase-spaces of a variety of beam distributions, as well as the theoretically possible dechirping for the ELBE beam. Furthermore, we present an experimental structure planned at the ELBE facility to verify the calculated dechirping effect.

The author would like to thank the BMBF under contract number 05K13HR2 for funding.

[1] Antipov et al. in: Proceedings of IPAC2012, New Orleans, USA, 2012

AKBP 11.9 Mi 18:30 S1/05 22-24

Field stabilization for UNILAC Alvarez DTL — •Xiaonan Du[1], Lars Groening[1], Sascha Mickat[1], and Anja Seibel[1,2] — [1]GSI, D-64291 Darmstadt, Germany — [2]University of Frankfurt, D-60438 Frankfurt, Germany

The field flatness along an accelerating cavity admits variations with respect to the design value that must not exceed a few percent. In order to get reliable and safe maintenance of the upgraded UNILAC

Alvarez-type cavities, a non-uniform stem configuration was developed as a new method to achieve field stabilization. To obtain the strategy for stem configuration optimization an analytical tool is needed that models the impact of the applied stem configuration on the field tilt sensitivity. In this contribution a three conductor transmission line equivalent circuit for the DTL with uniform stem configuration is presented and dispersion curves are analyzed for some particular cases. The study is supported by simulation of a uniform cavity based on UNILAC 108 MHz Alvarez DTL design. This new tuning method performed well in 3D model simulation and it can be applied to the cavity design of new Alvarez-DTL for UNILAC upgrade in GSI.

AKBP 11.10 Mi 18:30 S1/05 22-24

Die neue Strahlführung für Detektortests an ELSA — •Nikolas Heurich, Philipp Hänisch, Frank Frommberger und Wolfgang Hillert — Elektronen-Stretcher-Anlage ELSA, Physikalisches Institut, Universität Bonn

Am Elektronenbeschleuniger ELSA wurde eine neue externe Strahlführung aufgebaut, deren Aufgabe es ist, einen primären Elektronenstrahl für Detektortests zur Verfügung zu stellen. Damit wird die Beschleunigeranlage zukünftig nicht nur für Experimente der Hadronenphysik zur Verfügung stehen, sondern auch eine Plattform für das „Forschungs- und Technologiezentrum Detektorphysik“ zur Entwicklung von Detektoren für die Teilchen- und Astroteilchenphysik bieten.

Strahlparameter wie Strahlstrom und -breite sollen über einen großen Bereich variiert werden können. Durch die an ELSA genutzte langsame Resonanzextraktion ist es möglich, dem Testplatz einen quasi-kontinuierlichen externen Strahlstrom von 100 pA bis zu kleiner 1 fA bei einer Energie von maximal 3,2 GeV anzubieten. Die Strahlbreite kann in beiden transversalen Richtungen kontinuierlich von 1 mm bis zu 8 mm verändert werden.

Zur Vernichtung und gleichzeitigen Strommessung des Elektronenstrahls hinter den Detektorkomponenten wird ein Faraday-Cup eingesetzt. Strahlung, die den Cup verlässt, wird in einer Betonummantelung absorbiert. Das Strahlenschutzkonzept für den Bereich der neuen Strahlführung wurde mit Hilfe des Monte-Carlo-Programms *Fluka* entworfen. Dabei wurden auch Mauern berücksichtigt, durch die ein gefahrloses Arbeiten im so geschaffenen Nebenraum ermöglicht wird.

AKBP 11.11 Mi 18:30 S1/05 22-24

Transverse Emittance Reduction for an SRF Photoinjector — •Hannes Vennekate[1,2], André Arnold[1], Dietmar Janssen[1], Peter Kneisel[3], Pengnan Lu[1,2], Petr Murcek[1], Jochen Teichert[1], and Rong Xiang[1] — [1]Helmholtz-Zentrum Dresden-Rossendorf — [2]Technical University Dresden — [3]Thomas Jefferson National Accelerator Facility

In May 2014 the first SRF photo injector at HZDR has been replaced by a new version, the ELBE SRF Gun II, featuring a new resonator and cryostat. The intention for this upgrade has been to reach for higher beam energies, bunch charges and therefore an increased average beam current, which is to be injected into the superconducting, CW ELBE accelerator, where it can be used for multiple purposes, such as THz generation or Compton back-scattering. Because of the increased bunch charge of this injector compared to its predecessor, it demands upgrades of the existing and/or novel approaches to alleviate the transverse emittance growth. One of these methods is the integration of a superconducting solenoid into the cryostat. Another method, the so called RF focusing, is realized by displacing the photo cathode's tip and retracting it from the last cell of the resonator. In this case, part of the accelerating field is sacrificed for a better focus of the electron bunch right at the start of its generation. Besides particle tracking simulations, a recent study, investigating on the exact position of the cathode tip with respect to the cell's back plane after tuning and cool down, has been performed.

AKBP 11.12 Mi 18:30 S1/05 22-24

Optimization of an SRF Gun for High Bunch Charge Applications at ELBE — •Pengnan Lu[1,2], Andre Arnold[1], Jochen Teichert[1], Hannes Vennekate[1,2], and Rong Xiang[1] — [1]HZDR, Dresden,Germany — [2]TUD, Dresden, Germany

The performance of the ELBE SRF Gun II, to be operated in a high bunch charge mode, is investigated by simulations. The beam dynamics in the SRF injector itself are simulated by ASTRA, while the further beam transport is computed using the code of elegant. Firstly discussed is how to apply these two codes to the specific setting of the ELBE accelerator. Then the optimization of the SRF gun is explained, as well as the beam transport strategy for applications of THz radiation and Compton Backscattering experiments. Within the beam transport strategy, two important methods are presented: One is to utilize the space charge force to manipulate the longitudinal phase space; the other is to over-compress the bunch in a chicane to compensate the non-linear chirp from the RF cavities. As a result, for the THz experiments which require a high longitudinal charge density, the present setup of the ELBE accelerator with the SRF gun is able to provide 350 pC bunches with individual bunch length of 0.21 ps, or 500 pC bunches with a bunch length of 0.46 ps. For the Compton Backscattering experiments, where the bunch charge and the beam size are more critical, the maximum transportable bunch charge is around 500 pC, which can be focused down to an rms size of 0.36 mm.

AKBP 11.13 Mi 18:30 S1/05 22-24

Status des Injektors für polarisierte Elektronen am S-DALINAC — •Yuliya Fritzsche, Michaela Arnold, Joachim Enders, Martin Espig, Neeraj Kurichiyanil, Christian Schwebler und Markus Wagner — Technische Universität Darmstadt, Institut für Kernphysik

Wir berichten über den aktuellen Status des Injektors für spinpolarisierte Elektronen am Darmstädter Linearbeschleuniger S-DALINAC. Die Strahlführung des Injektors umfasst ein Wien-Filter zur Spinmanipulation, ein 100 keV Mott-Polarimeter zur Messung der Polarisation, Strahldiagnose, einen Chopper sowie eine zweistufige Prebuncher-Sektion. Um die Lebensdauer der GaAs-Photokathoden zu verlängern wurden verschiedene Aktivierungsmethoden untersucht. Darüber hinaus werden Pläne zum Umbau der Kathodenkammer auf ein invertiertes Design auf Hinblick der Erhöhung der Elektronenenergie vorgestellt.

*Gefördert durch die DFG (SFB 634; GraduirtenkollegK 2128) und durch das Land Hessen (LOEWE-Zentrum HIC for FAIR).

AKBP 11.14 Mi 18:30 S1/05 22-24

Superconducting cavity design for future circular collider — •Shahnam Gorgi Zadeh[1], Rama Calaga[2], Frank Gerigk[2], and Ursula van Rienen[1] — [1]Rostock University, Rostock, Germany — [2]CERN, Geneva, Switzerland

The future circular collider (FCC) study covers three machines for colliding different particles: proton-proton (hh), electron-positron (e+e-) and lepton-hadron (he) collider. FCC-hh aims at colliding protons with the center of mass energy of the order of 100 TeV. The SRF system of the FCC will accelerate proton beams to 50TeV and lepton beams up to 175GeV. In addition to the high energy, the RF system has to cope with beam currents exceeding 1 A for some modes of operation. This paper will address some design aspects of superconducting RF cavities covering primarily the requirements of the FCC-ee with high accelerating gradient and high current in the same machine.

The work is done within a collaboration with the FCC study at CERN.

AKBP 11.15 Mi 18:30 S1/05 22-24

Development of a 325 MHz Ladder-RFQ of the 4-Rod-Type — •Maximilian Schütt[1], Ulrich Ratzinger[1], and Chuan Zhang[2] — [1]Institut für Angewandte Physik, Goethe-Universität, Frankfurt am Main, Germany — [2]GSI, Darmstadt, Germany

In order to have an inexpensive alternative to 4-Vane RFQs above 200 MHz, we study the possibilities of a Ladder-RFQ. The 325 MHz RFQ is designed to accelerate protons from 95 keV to 3.0 MeV according to the design parameters of the research program with cooled antiprotons at FAIR. This particular high frequency for an RFQ creates difficulties, which are challenging in developing a cavity. In order to define a satisfactory geometrical configuration for this resonator, both from the RF and the mechanical point of view, different designs have been examined and compared. Very promising results have been reached with a ladder type RFQ, which has been investigated since 2013. Due to its geometric size the manufacturing as well as maintenance is not too complex compared with welded accelerators. The manufacturing, coppering and assembling of a 0.8 m prototype RFQ is finished. We present recent measurements of the rf-field, frequency-tuning, field flatness and the mode spectrum.

AKBP 11.16 Mi 18:30 S1/05 22-24

Dielectric Laser Accelerators as Accelerator Beamline Component and Ultrafast Diagnostic Elements — •Joshua McNeur, Martin Kozak, Norbert Schönenberger, Alexander Tafel, Ang Li, and Peter Hommelhoff — Department Physik, Friedrich-Alexander-Universität Erlangen-Nürnberg (FAU), Staudtstr.

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By combining the strong fields of ultrashort laser pulses and the large damage thresholds of dielectrics, dielectric laser accelerators (DLAs) have the potential to reduce the size and cost of extant accelerators dramatically. Acceleration and deflection have already been demonstrated in several proof of principle experiments in a single stage [1,2]. Here we discuss technical details of the extension of these experiments towards multiple-stage operation and ultrafast diagnostics [3,4]. Transverse deflection, focusing, and ultrafast gating via the DLA-electron interaction is presented.

[1] J. Breuer and P. Hommelhoff, Phys. Rev. Lett. 111, 134803 (2013).
[2] E. A. Peralta et al. Nature 503, 91-94 (2013).
[3] M. Kozak, J. McNeur et al., submitted
[4] J, McNeur, M. Kozak et al., submitted

AKBP 11.17 Mi 18:30 S1/05 22-24

Dipole Compensation of the 176 MHz MYRRHA RFQ — •Klaus Kümpel[1], Holger Podlech[1], Alexander Bechtold[3], Chuan Zhang[2], Christoph Lenz[1], and Nils Petry[1] — [1]IAP University of Frankfurt, 60438 Frankfurt am Main, Germany — [2]GSI Helmholzzentrum, 64291 Darmstadt, Germany — [3]NTG Neue Technologien GmbH und Co KG, 63571 Gelnhausen, Germany

The MYRRHA (Multi-purpose hYbrid Research Reactor for High-tech Applications) Project is planned as an accelerator driven system (ADS) for the transmutation of long-living radioactive waste. For this project a cw 4-rod-RFQ with 176 MHz and a total length of about 4 m is required. It is supposed to accelerate protons from 30 keV up to 1.5 MeV*. One of the main tasks during the development of the RFQ is the very high reliability of the accelerator to limit the thermal stress inside the reactor. Another challenge was to compensate the dipole component of the MYRRHA-RFQ which is due to the design principle of 4-rod-RFQs. This dipole component is responsible for shifting the ideal beam axis from the geometrical center of the quadrupole downwards. Design studies with CST MICROWAVE STUDIO have shown that the dipole component can be almost completely compensated by widening the stems alternately so that the current paths of the lower electrodes are increased.

AKBP 11.18 Mi 18:30 S1/05 22-24

Position map calculations of BPMs by CST Particle Studio for non-relativistic energies — •Peter Forck[1,2], Mohammed Almalki[1,2], Jun He[3], Wolfgang Kaufmann[1], Oliver Kester[1,2], Thomas Sieber[1], and Rahul Singh[1] — [1]GSI, Darmstadt, Germany — [2]Goethe Universität Frankfurt, Germany — [3]Institute of High Energy Physics, CAS Beijing, China

Beam positon monitors BPM at LINACs serve as the basic instrument for non-destructive position determination as yield from the difference-over-sum of signal of opposite electrodes. The time evolution of the signals, and consequently their Fourier-transformations, depend on the particle velocity and the distance from the electrodes. Position maps, i.e. electrodes difference-over-sum signal versus beam offset, were calculated using the wake-field solver CST Particle Studio in the velocity range from 0.05c to 0.5c for two BPM types. For the planned proton LINAC at FAIR, four separated button BPM electrodes are foreseen. The BPMs installed in the GSI UNILAC are made of a ceramic ring with four metallized sectors installed in a special housing. For the latter type resonances and capacitive coupling between the sectors modify the position map. The general findings and peculiarities of both types are presented.

AKBP 11.19 Mi 18:30 S1/05 22-24

Investigation of the Imaging Properties of Inorganic Scintillation Screens using High Energetic Ion Beams — Alice Lieberwirth[2,3], Peter Forck[1], Wolfgang Ensinger[2], Oliver Kester[3], Stephan Lederer[2], and •Thomas Sieber[1] — [1]GSI Darmstadt, Germany — [2]TU Darmstadt, Germany — [3]JWG Universität Frankfurt/Main, Germany

Inorganic scintillation screens are a common diagnostics tool in heavy ion accelerators. In order to investigate the imaging properties of various screen materials, four different material compositions were irradiated at GSI, using protons up to Uranium ions as projectiles. Beams were extracted from SIS18 with high energy (300 MeV/u) in slow and fast extraction mode. During irradiation the scintillation response of the screens was simultaniously recorded by two different optical setups to investigate light output, profile characteristics and emission spectra. It was observed, that fast extracted beams induce in general lower light output than slow extracted beams, while the light output per deposited energy decreases with atomic number. The analysis of the spectral emission as well as investigations with classical optical methods showed no significant defect-building in all materials, not even under irradiation with increasing beam intensity or over long time periods. The investigated scintillation screens can be considered as stable under irradiation with high energetic heavy ion pulses and are appropriate for beam diagnostics applications in future accelerator facilities like FAIR. Characteristic properties and application areas of the screens are presented in the poster.

AKBP 11.20 Mi 18:30 S1/05 22-24

Open-loop Magneto-resistance Sensor-Based DC Current Transformer for FAIR — Eman Soliman[1], Klaus Hofmann[1], Hansjörg Reeg[2], and •Marcus Schwickert[2] — [1]Technical University Darmstadt, Germany — [2]GSI Helmholtzzentrum für Schwerionenforschung, Darmstadt, Germany

A Novel DC Current Transformer (N-DCCT) is currently under development for FAIR. The N-DCCT is going to be installed inside the SIS100 synchrotron. The proposed system is no longer based on magnetic modulation principle of the conventional DCCT. Instead, a Magneto-resistance sensor is utilized to detect the magnetic field of the ion-beam. For a first prototype the N-DCCT is realized as an open-loop system. It consists of a high permeability slotted ring core and up to two MR sensors. The maximum ion-beam current magnetic field is concentrated inside the ring core air gaps. MR sensors are placed inside the core air gaps. The sensor output voltage is directly proportional to the ion-beam current. The system is implemented using commercial Tunneling MR sensors. Measurements using one single sensor, as well as the application of two sensors are presented in this work. The sensitivity of the proposed N-DCCT is 0.566 [V/A] for one single MR sensor and 1.56 [V/A] when two sensors are implemented.

AKBP 11.21 Mi 18:30 S1/05 22-24

Structural analysis of nitrogen doped niobium single crystals* — •Marton Major[1], Lambert Alff[1], Jens Conrad[2], Ruben Grewe[2], Florian Hug[3], Thorsten Kürzeder[2], and Norbert Pietralla[2] — [1]Materialwissenschaft, Technische Universität Darmstadt, Darmstadt, Germany — [2]Institut für Kernphysik, Technische Universität Darmstadt, Darmstadt, Germany — [3]Institut für Kernphysik, Johannes Gutenberg Universität Mainz, Mainz, Germany

Nitrogen doped niobium superconducting cavities show enhanced Q-factors. The cubic δ-phase of NbN has the highest T_c amongst the niobium nitride phases. Niobium cavities with NbN surface coating offer a way to improve the superconductive characteristics of accelerator cavities.

The high temperature UHV-furnace installed at S-DALINAC gives the opportunity to prepare samples of NbN via nitrogen doping of Nb. In parallel to this research, single crystals of Nb with different surface orientations will be annealed in nitrogen atmosphere to gain a basic understanding of the nitridation process. Those pilot experiments will take place at the Institute of Materials Research of the Technische Universität Darmstadt. The samples will be characterized by x-ray diffraction, atomic force microscopy and high resolution scanning electron microscopy. The collected experience will help in the analysis of N doped Nb samples of the UHV-furnace and pave the route to the N-doping of complete cavities. In this contribution the first results will be presented.

*Work supported by BMBF through 05H15RDRBA

AKBP 11.22 Mi 18:30 S1/05 22-24

Non-Intercepting Beam Intensity Measurements towards pico-Ampere: Cryogenic Current Comparators for FAIR — •Febin Kurian[1,2,3], Marcus Schwickert[1], Thomas Sieber[1], Piotr Kowina[1], Hansjoerg Reeg[1], Rene Geithner[4], Ralf Neubert[4], Thomas Stoehlker[1,3,4], Paul Seidel[4], and Jessica Golm[4] — [1]GSI Helmholtzzentrum für Schwerionenforschung — [2]Goethe University, Frankfurt am Main, Germany — [3]Helmholtz Institute Jena, Germany — [4]Friedrich-Schiller- Universität Jena, Germany

To satisfy the requirement of non-interceptive measurement of beam intensity down to nA range foreseen in the upcoming FAIR accelerator facility, several Cryogenic Current Comparator (CCC) systems are planned to be installed in its beam transfer lines and storage rings. As a test bench for the development of advanced CCC systems for these installations, the existing CCC system at GSI has been recommissioned and upgraded with advanced sensor components. Successful

beam intensity measurements using this upgraded CCC system will be reported in this contribution. Apart from the beam measurements, several operational aspects of the CCC system were investigated, such as the baseline drifts and various noise influences. Combining the operational experiences and boundary conditions given at various installation locations in the FAIR facility, an advanced CCC system is currently under development and is planned to be installed at the Cryring facility at GSI for test measurements. Details on the development of this advanced CCC system will also be presented in this contribution.

AKBP 11.23 Mi 18:30 S1/05 22-24

PSpice Modeling of Broadband RF Cavities for Transient and Frequency Domain Simulations — •Jens Harzheim — Institut für Theorie Elektromagnetischer Felder, Fachgebiet Beschleunigertechnik, TU Darmstadt

In the future accelerator facility FAIR, Barrier-Bucket Systems will play an important role for different longitudinal beam manipulations. As the function of this type of system is to provide single sine gap voltages, the components of the system have to operate in a broad frequency range. To investigate the different effects and to design the different system components, the whole Barrier-Bucket System is to be modeled in PSpice. While for low power signals, the system shows linear behavior, nonlinear effects arise at higher amplitudes. Therefore, simulations in both, frequency and time domain are needed. The highly frequency dependent magnetic alloy ring cores of the future Barrier-Bucket cavity have been modeled in a first step and based on these models, the whole cavity was analyzed in PSpice. The simulation results show good agreement with former measurements.

AKBP 11.24 Mi 18:30 S1/05 22-24

Experiment setup for a deterministic Bunch-to-Bucket transfer for FAIR — •Thibault Ferrand — TEMF, TU Darmstadt — GSI, Helmholzzentrum für Schwerionenforschung

The FAIR accelerator facility is expected to be one of the largest ion research center worldwide. In the frame of this project, the SIS18 will serve as an injector for the SIS100, currently under construction. The development of a deterministic Bunch-to-Bucket synchronization procedure is one of the key features of the beam transfer system between SIS18 and SIS100.

The Bunch-to-Bucket transfer for FAIR must be scalable to any type of ion, which are accelerated in the SIS18. Two extreme cycles are taken into concern in the frame of this research: proton beam up to an energy of 4 GeV and uranium ions U^{28+} up to an energy of 196 MeV/u at transfer flattop in the SIS18. An experimental setup aiming at validating the LLRF topology for the phase advance acquisition and the phase advance control procedures has been assembled.

AKBP 11.25 Mi 18:30 S1/05 22-24

Phase calibration strategies for synchrotron RF signals — •Aleksandr Andreev[1], Harald Klingbeil[1,2], and Dieter Lens[2] — [1]TEMF, Technische Universität Darmstadt, Germany — [2]GSI Helmholtzzentrum für Schwerionenforschung GmbH, Darmstadt, Germany

For the FAIR facility that is currently under construction, the beam quality requirements impose several demands on the low-level RF (LLRF) systems. For example the phase error of the gap voltage of a specific RF cavity must be less than 1°. The RF reference signals for the FAIR synchrotron RF cavity systems are generated by direct digital synthesis modules (DDS) mounted in one crate called Group-DDS. In order to allow performing various multi-harmonic operations, each DDS unit operates at a certain mode defined by the harmonic number that can be changed during the operation. Since the DDS modules generate reference RF signals for different LLRF systems, the precise calibration of units to compensate the different phase response is of importance. The currently used calibration procedure is done with a fixed harmonic number for each module and uses the DDS module configured to the highest harmonic number as a reference. If the harmonic number of the DDS module is changed, one then has to repeat the calibration for the new values. Therefore, a new calibration method with respect to the absolute phases of DDS modules is under development and will be presented.

AKBP 11.26 Mi 18:30 S1/05 22-24

Setup and programming of a one-wire temperature grid — •Janna Vischer — Georg-August-Universität, Göttingen, Germany

This project aims at building a field of ten by ten temperature Sensors as a prototype of a more precise temperature measurement in an inner detector layer. So it is possible to get a better resolution of the temperature near the sensitive pixel detectors there. A prominent example of such a detector is ATLAS at CERN. It is desirable to use as few wires as possible. This can be achieved with the One-wire technology where all sensors are connected in a row. They can be approached individually by unique addresses. With the help of an Arduino microcontroller the data can be read out, saved and displayed as a visual temperature map. This project was executed during the Netzwerk Teilchenwelt Projektwochen at CERN.

AKBP 11.27 Mi 18:30 S1/05 22-24

Experimental Investigations of Beam Induced Fluorescence Profile Monitor for FAIR — •Serban Udrea[1], Peter Forck[1,2], Dieter H. H. Hoffmann[3], Oliver Kester[1,2], Yulia Shutko[2,3], Thomas Sieber[2], and Beata Walasek-Höhne[2] — [1]Goethe Universität Frankfurt am Main — [2]GSI Helmholtzzentrum für Schwerionenforschung — [3]Technische Universität Darmstadt

Minimal invasive beam diagnostics techniques are highly relevant for the future FAIR accelerator facilities to be built at the GSI Helmholtzzentrum für Schwerionenforschung GmbH. Beam induced fluorescence (BIF) is one physical effect which can be exploited for the determination of the transverse beam profile. BIF based monitors are already in operation at GSI's linear accelerator UNILAC since some years. Further investigations and development necessary for BIF based monitors of high energy beams, like those to be delivered by FAIR's SIS-100 synchrotron, have been performed at GSI. These include beam profile and spectroscopic investigations with Nitrogen and Argon at pressures from 10^{-3} to 2 mbar with heavy ion beams having energies from 100 to 900 MeV/u. Moreover, since along the high energy beam transport line high radiation levels are expected, an optical relay has been designed and a prototype is under construction with the goal of improving the signal to noise ratio of the BIF monitor.

AKBP 12: Beam Diagnostics I

Zeit: Donnerstag 14:00–16:00 Raum: S1/05 23

AKBP 12.1 Do 14:00 S1/05 23

Messung einer 3D-Resonanzkarte an ELSA — •Dennis Proft, Jan Schmidt, Jens-Peter Thiry und Wolfgang Hillert — Elektronen-Stretcher-Anlage ELSA, Physikalisches Institut, Universität Bonn

An der Elektronen Stretcher Anlage ELSA werden Elektronen mit einer schnellen Energierampe mit 6 GeV/s beschleunigt. Währenddessen kommt es zu dynamischen Effekten, die einen starken Einfluss auf den Arbeitspunkt haben. Zur Vermeidung von Strahlverlust ist die Wahl eines geeigneten Arbeitspunkts fernab von optischen Resonanzen essentiell.

Daher wurde ein Messverfahren zur Bestimmung aller auftretenden Resonanzen im Bereich des Standardarbeitspunktes entwickelt. Dabei werden die 3D-Arbeitspunkte präzise durch Luftquadrupole und ein LLRF System eingestellt, sowie mit hoher Genauigkeit in der Größenordnung von 10^{-5} gemessen. Die Stärke der Resonanzen wird durch ein Strahlverlust-Monitoringsystem mit Halbleiterdetektoren festgestellt.

In diesem Vortrag wird das Messverfahren sowie exemplarische Resultate vorgestellt.

AKBP 12.2 Do 14:15 S1/05 23

Characterization of BPM pickup designs for the HESR @ FAIR using simulations and numerical calculations — •Arthur Halama, Vsevolod Kamerdzhiev, Christian Böhme, and Sudharsan Srinivasan — Forschungszentrum Jülich, IKP-4

The institute of Nuclear Physics 4(IKP-4) of the Research Center Jülich (FZJ) is in charge of building and commissioning the High Energy Storage Ring (HESR) within the international Facility for An-

tiproton and Ion Research (FAIR) at Darmstadt. Simulations and numerical calculations were performed to characterize the initial beam position pickup design. Capacitive couplings of the electrodes and the behavior of the electrical equivalent circuit were investigated. This made room for changes to the design and performance increase. A prototype of the BPM pickup was constructed and tested on a dedicated test bench. Preliminary results will be presented. In order to gain higher signal levels and higher sensitivity, another suggested design was characterized as well and put into comparison.

AKBP 12.3 Do 14:30 S1/05 23

Design and Construction of the HESR BPM prototype wire test bench at COSY, Forschungzentrum Jülich — •Sudharsan Srinivasan, Vsevolod Kamerdzhiev, and Christian Böhme — Forschunzentrum Jülich GmbH

The Institute of Nuclear Physics 4(IKP-4), of the Research Center Jülich (FZJ), is in charge of building and commissioning the High Energy Storage Ring (HESR) within the international facility, Facility for Antiproton and Ion Research (FAIR) at Darmstadt. Beam Position Monitors (BPMs) are an essential instrument for any accelerator allowing operators to accurately monitor and control the accelerated beam. The demand for a BPM test bench will be showcased which will help to assess the design's ability to meet the system requirements. The weight is on the factors considered for the development of the initial test bench, its functional components, the metrology tests for ensuring positional measurement accuracy, and the design modifications from metrology investigations leading to the conceptual development of a new test bench.

AKBP 12.4 Do 14:45 S1/05 23

High-accuracy electron beam energy measurement at the Mainz Microtron — •Philipp Herrmann — Institut für Kernphysik, Johannes Gutenberg-Universität, Mainz

The Mainz Microtron MAMI delivers an electron beam of up to 1.6 GeV. The absolute energy is measured inside the third stage of the accelerator with an accuracy of $\delta E_{beam} = 160\,\mathrm{keV}$ independent of the beam energy, with an energy spread $\sigma_{beam} < 13\,\mathrm{keV}$ and long-term drifts of less than 1 keV when stabilized. To obtain an absolute energy measurement within $\delta E_{beam} \sim 20\,\mathrm{keV}$ uncertainty, a 42°-dipole of the beam-line leading to the spectrometer facility is used as a high-accuracy beam spectrometer. A high-precision field mapping device was developed and a dedicated beam detection system of RF cavity position monitors and YAG:Ce screens was implemented. The goal is to achieve $10\,\mu$T and $10\,\mu$m uncertainties in the field map. The electron beam deflection is expected to be measured with $\delta\theta/\theta < 10^{-5}$. The overlay of the magnetic field map and the actual beam position during calibration is achieved by a collinear laser system. With the calibrated beam the absolute momentum calibration of the three high-resolution spectrometers at MAMI can be improved. Key factors will be the setup and automation of the field mapping with the desired precision, combined with the global positions of beam and field.

AKBP 12.5 Do 15:00 S1/05 23

The Transverse Deflecting Cavity for Beam Diagnostics at bERLinPro — •Georgios Kourkafas[1], Hans-Walter Glock[1], Andreas Jankowiak[1], Thorsten Kamps[1], Dmitriy Malyutin[1], Axel Neumann[1], Jens Völker[1], Alessandro Ferrarotto[2], and Thomas Weis[2] — [1]Helmholtz-Zentrum Berlin für Materialien und Energie GmbH, 12489 Berlin, Germany — [2]Technische Universität Dortmund, 44227 Dortmund, Germany

The bERLinPro facility at Helmholtz-Zentrum in Berlin (HZB) aims to develop an Energy-Recovery Linac capable of providing the demanding beam requirements of future light sources. A crucial part of the machine's overall performance is determined already at the beam source, namely a superconducting RF photoinjector operated in continuous-wave mode. Therefore, considerable effort is given in the development, optimization and characterization of such an advanced system by the GunLab group at HZB.

As part of the proposed beam diagnostics, a transverse deflecting cavity operating in both transverse polarizations of the TM110 mode is foreseen for the measurement of the longitudinal phase space and the transverse slice emittance. An improved cavity design is presented and its effect on the beam dynamics and measurements is simulated.

AKBP 12.6 Do 15:15 S1/05 23

Development of a diamond detector for temporal profile measurements of intense, short ion bunches within the LIGHT project — Diana Jahn[1], •Michael Träger[2], and Mladen Kis[2] for the LIGHT-Collaboration — [1]Technische Universität Darmstadt — [2]GSI Helmholtzzentrum für Schwerionenforschung

In the context of the Laser Ion Generation, Handling and Transport (LIGHT) research project at GSI, laser-driven ion acceleration and beam shaping are explored, combining a target normal sheath acceleration (TNSA) proton source with conventional accelerator technology. In the LIGHT experimental campaign in 2015, protons were accelerated via the TNSA mechanism, an energy of 7.8 MeV was selected and collimated with a pulsed solenoid and injected into a rf cavity. Through phase focusing, temporally compressed proton bunches were generated to a pulse length of <240 ps (FWHM) with up to 5×10^8 particles in a single bunch at a distance of 6 m from the source. An ultrafast diamond detector has been specially developed to measure the temporal profile of these bunches and will be presented.

AKBP 12.7 Do 15:30 S1/05 23

Simultaneous detection of longitudinal and transverse bunch signals at ANKA — •Benjamin Kehrer[1], Edmund Blomley[1], Miriam Brosi[1], Erik Bründermann[1], Nicole Hiller[1], Anke-Susanne Müller[1], Paul Schütze[2], Johannes Steinmann[1], Manuel Schedler[1], Marcel Schuh[1], Patrik Schönfeldt[1], and Nigel Smale[1] — [1]Karlsruhe Institute of Technology, Kaiserstraße 12, 76131 Karlsruhe — [2]Deutsches Elektronen-Synchrotron DESY Notkestraße 85, 22607 Hamburg

The ANKA storage ring offers different operation modes including the short-bunch mode with bunch lengths tuned down to a few picoseconds. This can lead to the occurrence of microwave instabilities coupled to the emission of coherent synchrotron radiation (CSR) in the so-called 'bursts'. To study this CSR instability we use several turn-by-turn enabled detector systems to synchronously measure both the THz signal as well as bunch profiles. The different detectors are placed at different locations around the storage ring. Here we discuss the experimental setup and calibration of the various systems' synchronisation.

AKBP 12.8 Do 15:45 S1/05 23

Rose, a rotating System for 4D Emittance measurements — •Michael Maier, Lars Groening, Chen Xiao, Sascha Mickat, Xiaonan Du, Gerhard Peter, and Vormann Hartmut — GSI Helmholtzzentrum für Schwerionenforschung GmbH

A ROtating System for Emittance measurements ROSE, to measure the full 4 dimensional transverse beam matrix of a heavy ion beam has been developed and commissioned. Different heavy ion beams behind the HLI at GSI have been used in two commissioning beam times. All technical aspects of Rose have been tested, Rose has been benchmarked against existing emittance scanners for horizontal and vertical projections and the method, hard- and software to measure the 4D beam matrix has been upgraded, refined and successfully commissioned. The inter plane correlations of the HLI beam have been measured, yet as no significant initial correlations were found to be present, controlled coupling of the beam by using a skew triplet has been applied and confirmed with Rose. The next step is to use ROSE to measure and remove the known inter plane correlations of a Uranium beam before SIS18 injection.

AKBP 13: PWA, DLA, Thomson and Compton Scattering

Zeit: Donnerstag 14:00–16:00 Raum: S1/05 24

AKBP 13.1 Do 14:00 S1/05 24

Synthetic radiation diagnostics in PIConGPU - integrating spectral detectors into particle-in-cell codes — •Richard Pausch[1,2], Alexander Debus[1], Heiko Burau[1,2], Axel Huebl[1,2], Klaus Steiniger[1,2], René Widera[1], and Michael Bussmann[1] — [1]Helmholtz-Zentrum Dresden - Rossendorf — [2]Technische Universität Dresden

We present the in-situ far field radiation diagnostics in the particle-in-cell code PIConGPU. It was developed to close the gap between simulated plasma dynamics and radiation observed in laser plasma experiments. Its predictive capabilities, both qualitative and quantitative, have been tested against analytical models. Now, we apply this synthetic spectral diagnostics to investigate plasma dynamics in laser wakefield acceleration, laser foil irradiation and plasma instabilities.

Our method is based on the far field approximation of the Liénard-Wiechert potential and allows predicting both coherent and incoherent radiation spectrally from infrared to x-rays. Its capability to resolve the radiation polarization and to determine the temporal and spatial origin of the radiation enables us to correlate specific spectral signatures with characteristic dynamics in the plasma. Furthermore, its direct integration into the highly-scalable GPU framework of PIConGPU allows computing radiation spectra for thousands of frequencies, hundreds of detector positions and billions of particles efficiently.

In this talk we will demonstrate these capabilities on resent simulations of laser wakefield acceleration (LWFA) and high harmonics generation during target normal sheath acceleration (TNSA).

AKBP 13.2 Do 14:15 S1/05 24

Modeling Traveling-wave Thomson scattering using PIConGPU — •Alexander Debus[1], Klaus Steiniger[1,2], Richard Pausch[1,2], Axel Huebl[1,2], Ulrich Schramm[1], Thomas Cowan[1], and Michael Bussmann[1] — [1]Helmholtz-Zentrum Dresden-Rossendorf, 01328 Dresden — [2]Technische Universität Dresden, 01062 Dresden

Traveling-wave Thomson scattering (TWTS) laser pulses are pulse-front tilted and dispersion corrected beams that enable all-optical free-electron lasers (OFELs) up to the hard X-ray range. Electrons in such a side-scattering geometry experience the TWTS laser field as a continuous plane wave over centimeter to meter interaction lengths.

After briefly discussing which OFEL scenarios are currently numerically accessible, we detail implementation and tests of TWTS beams within PIConGPU (3D-PIC code) and show how numerical dispersion and boundary effects are kept under control.

AKBP 13.3 Do 14:30 S1/05 24

Towards the Realization of a Dielectric Laser Accelerator Beamline: Staging and Transverse Dynamics — •Joshua McNeur, Martin Kozak, Norbert Schönenberger, Ang Li, Alex Tafel, and Peter Hommelhoff — Department Physik, Friedrich-Alexander-Universität Erlangen-Nürnberg (FAU), Staudtstr. 1, 91058 Erlangen

Dielectric laser accelerators (DLAs) belong to a novel regime of accelerators that aim to reduce both the cost and footprint of state-of-art Microwave Linacs. Their orders-of-magnitude smaller footprints and larger acceleration gradients potentially enable University-lab scale (and smaller) high energy electron sources with a wide range of applications, ranging from tumor irradiation to x-ray generation. However, to progress from the proof of principle DLA experiments [1,2] to a DLA-based accelerator beamline, many challenges need to be addressed. Here, we discuss experimental confirmation of DLA-based staging, deflection and focusing, crucial steps towards the realization of a DLA-beamline [3].

1.Peralta, E. A. et al. Demonstration of electron acceleration in a laser-driven dielectric microstructure Nature 503, 91-94 (2013).

2.Breuer, J. & Hommelhoff, P. Laser-Based Acceleration of Nonrelativistic Electrons at a Dielectric Structure. Phys. Rev. Lett. 111, 134803 (2013).

3.McNeur, J., Kozak, M. et al., submitted

AKBP 13.4 Do 14:45 S1/05 24

Application of dielectric laser acceleration technique for temporal and spatial characterization of charged particle beams — •Martin Kozák, Joshua McNeur, Norbert Schönenberger, Alex Tafel, Ang Li, and Peter Hommelhoff — Department of Physics, Friedrich-Alexander-Universität Erlangen-Nürnberg (FAU), Staudtstrasse 1, 91058 Erlangen, Germany, EU

In this contribution we show the use of dielectric laser acceleration for sub-optical cycle temporal gating and transverse streaking of free electrons at sub-relativistic energies (25-30 keV). Utilizing the inverse Smith-Purcell effect [1,2], the energy and/or transverse momentum of electrons are modulated by the interaction with near-fields of a dielectric nanostructure. The sub-cycle temporal structure of the femtosecond laser pulse is transferred to the electron beam. Combined with high-pass energy filtering of accelerated electrons, this allows us to achieve temporal resolution of 1.3 fs. This technique can have direct applications in ultrafast diffraction and microscopy or as a tool for temporal characterization of attosecond particle bunches, potentially offering 10 as temporal resolution. Moreover, the sub-wavelength spatial decay of optical near-fields at the nanostructure can be used for beam position monitoring applications with spatial resolution better than 500 nm.

[1] J. Breuer, and P. Hommelhoff, Phys. Rev. Lett. 111, 134803 (2013). [2] E. A. Peralta, et al. Nature 503, 91-94 (2013).

AKBP 13.5 Do 15:00 S1/05 24

Commissioning of the LUX Beamline for Laser-Plasma Driven Undulator Radiation — •A. R. Maier — Center for Free-Electron Laser Science & Department of Physics University of Hamburg, Luruper Chaussee 149, 22761 Hamburg, Germany

Plasma-based accelerators promise ultra-compact sources of highly relativistic electron beams, especially suited for driving novel x-ray light sources. Within the LAOLA Collaboration, the University of Hamburg and DESY work closely together, combining university research with the expertise of a large and well-established accelerator facility, to enhancing the performance of plasma accelerators for applications. Here, we discuss and show first results from the commisssioning of the so-called LUX beamline for plasma-driven undulator radiation. We cover laser operations using an accelerator controlls system, laser transport and diagnostics, as well as target area design. As an outlook, we will discuss the experimental strategies in Hamburg towards a first proof-of-principle FEL experiment using plasma-driven electron beams available today.

AKBP 13.6 Do 15:15 S1/05 24

Tailoring Laser Wakefield Accelerated electron beams; an experimental study on the influence of experimental conditions on electron beam parameters — •Jurjen P. Couperus[1,2], Alexander Koehler[1,2], Omid Zarini[1,2], Axel Jochmann[1], Axel Huebl[1,2], Alexander Debus[1], Arie Irman[1], and Ulrich Schramm[1,2] — [1]Institute of Radiation Physics, Helmholtz-Zentrum Dresden - Rossendorf, Germany — [2]Technische Universität Dresden, Germany

Laser wakefield acceleration (LWFA) has emerged as a promising concept for the next generation of high energy electron accelerators. In LFWA a high intensity ultrashort laser pulse drives plasma density waves, inducing a high accelerating field gradient in the order of GV/m.

To create stable reproducible electron beams, tailoring of experimental parameters like gas density, laser energy and laser pulse duration is required. In this talk we present an overview of our experimental studies with the DRACO (3J on target, 30 fs) laser on ultrasonic gas-jet targets (He & He-N_2 mixtures). We discuss the influence of experimental parameters on beam parameters like beam charge, shot-to-shot stability and energy distribution, both in the self-injecting bubble regime as well as in the ionisation injection regime.

AKBP 13.7 Do 15:30 S1/05 24

Measuring of ultrashort electron bunch durations from Laser-wakefield accelerators via a broadband, single-shot spectrometer. — •Omid Zarini[1,2], Jurjen Couperus[1,2], Alexander Köhler[1,2], Axel Jochmann[1], Alexander Debus[1], Arie Irman[1], and Ulrich Schramm[1,2] — [1]Helmholtz-Zentrum Dresden-Rossendorf — [2]Technische Universität Dresden

Laser-wakefield accelerators (LWFA) feature electron bunch durations ranging from several fs to tens of fs. Due to the nonlinear nature of the

injection and acceleration process in such accelerators, small changes in experimental conditions lead to the electron bunch properties which are often subject to large shot-to-shot variations. Single-shot measurement of a broadband coherent and incoherent transition radiation produced by the LWFA electron bunches is a promising way to deduce the longitudinal structure of such bunches. In this talk we present results from our recent measurement campaign by analyzing transition radiation spectra produced as LWFA electron bunches pass a metal foil. We investigate electron bunch longitudinal structure generating from different acceleration regimes, i.e., ionization-injection and self-injection. Knowledge and control of the electron bunch duration is essential for the design of future table-top and x-ray light-sources.

AKBP 13.8 Do 15:45 S1/05 24

Plasma-based ultrashort electron bunch diagnostic — •Irene Dornmair[1], Carl B. Schroeder[2], Klaus Floettmann[3], Barbara Marchetti[3], and Andreas R. Maier[1] — [1]Center for Free-Electron Laser Science & Department of Physics, University of Hamburg, Luruper Chaussee 149, 22761 Hamburg — [2]Lawrence Berkeley National Laboratory, California 94720, USA — [3]Deutsches Elektronen-Synchrotron DESY, Notkestr. 85, 22607 Hamburg

Ultrashort electron bunches of few femtoseconds length are highly desirable for a large number of applications, such as ultrafast electron diffraction, free-electron lasers or for external injection into plasma wakefields. A precise knowledge of the longitudinal phase space is crucial for these applications and in order to optimize bunch compression. However, measuring the bunch length or even the current profile becomes increasingly challenging for ever shorter bunches. We will present a new method to diagnose ultrashort bunches using laser-driven plasma wakefields and explore its limitations in terms of resolution in time and energy spread.

AKBP 14: Beam Diagnostics II

Zeit: Donnerstag 16:30–18:30 Raum: S1/05 23

AKBP 14.1 Do 16:30 S1/05 23

THz-Based Longitudinal Beam Diagnostics at DELTA — •Raffael Niemczyk, Fin Hendrik Bahnsen, Max Bolsinger, Fabian Götz, Svenja Hilbrich, Markus Höner, Marc Andre Jebramcik, Shaukat Khan, Nils Lockmann, Carsten Mai, Arne Meyer auf der Heide, Robert Molo, Gholamreza Shayeganrad, Peter Ungelenk, and Dennis Zimermann — Center for Synchrotron Radiation (DELTA), TU Dortmund University, Dortmund, Germany

At the 1.5-GeV electron storage ring DELTA operated by the TU Dortmund University, THz radiation is induced by a laser-electron interaction in an undulator. A dip in the longitudinal charge distribution forms after the electron bunch passes dispersive magnet structures leading to the emission of coherent THz radiation. Next to turn-by-turn-resolved studies of the THz intensity, a set-up for electro-optical measurements of the THz field is being commissioned. This method will allow to analyze the charge distribution on a sub-ps scale.

AKBP 14.2 Do 16:45 S1/05 23

Multi-turn Spectral Observation of Coherent THz Pulses at DELTA — •Carsten Mai, Fin Hendrik Bahnsen, Max Bolsinger, Fabian Götz, Svenja Hilbrich, Markus Höner, Marc Andre Jebramcik, Shaukat Khan, Nils Lockmann, Arne Meyer auf der Heide, Robert Molo, Raffael Niemczyk, Gholamreza Shayeganrad, Peter Ungelenk, and Dennis Zimmermann — Center for Synchrotron Radiation (DELTA), TU Dortmund University, Dortmund, Germany

Coherent ultrashort THz pulses induced by a laser-electron interaction are routinely produced and observed at DELTA, a 1.5-GeV synchrotron light source operated by the TU Dortmund University. The radiation spectrum is known to shift to the sub-THz regime after the initial laser-electron interaction. At a dedicated THz beamline, measurements using a polarizing Fourier-transform spectrometer have been performed in conjunction with an ultra-fast Schottky-diode detector. Studies showing the spectral evolution after several revolutions and further measurements are presented.

AKBP 14.3 Do 17:00 S1/05 23

THz Spectrometer Calibration at FELIX — •Toke Kövener, Steffen Wunderlich, Peter Peier, Eugen Hass, and Bernhard Schmidt — Deutsches Elektronen-Synchrotron, Notkestrasse 85, 22607 Hamburg, Germany

Coherent radiation spectroscopy is a suitable method for longitudinal electron bunch diagnostics at femtosecond bunch lengths. The absolute value of the longitudinal form factor, that is connected to the longitudinal profile, can be retrieved by measuring the intensity spectrum of a coherent transition radiation source at FLASH. The response function of the used spectrometer has to be well known in absolute values in order to perform accurate measurements. Until now, the response was predicted by calculations.

As the free-electron lasers at the FELIX facility in Nijmegen (NL) provide quasi-monochromatic beams that can be tuned in a wide spectral range at micrometer wavelengths, a calibration campaign for two THz spectrometers was performed at this facility with the goal to deduce their response function. Here we present the setup at FELIX that was used for the calibration scans, the achieved scan ranges and the collected data. Furthermore, the analysis of the measured data is discussed. The results are then compared to the previous calculations of the response functions.

AKBP 14.4 Do 17:15 S1/05 23

Status of Near-Field EO Measurements at ANKA — •Patrik Schönfeldt, Michele Caselle, Nicole Hiller, Anke-Susanne Müller, Michael Nasse, Gudrun Niehues, Lorenzo Rota, and Sophie Walther — KIT, Karlsruhe, Germany

ANKA is the first storage ring in the world that has a near-field electro-optical (EO) bunch profile monitor installed inside its vacuum chamber. Using the method of electro-optical spectral decoding, the setup made it possible to study longitudinal beam dynamics (e.g. microbunching) occurring during ANKA's low-alpha-operation with sub-ps resolution (granularity).

Installed in 2013, the initial setup is currently being upgraded. The commercial spectrometer is replaced by a custom development that offers repetition rates in the MHz range. The in-vacuum geometry has been redesigned to reduce the effect of wakefields, aiming for measurements in multi-bunch operation. This talk presents the current status of the upgrade and of near-field EO measurements at ANKA in general.

AKBP 14.5 Do 17:30 S1/05 23

Snapshot Measurements Used for Systematic Studies of the Bursting Threshold at ANKA — •Miriam Brosi, Edmund Blomley, Erik Bründermann, Michele Caselle, Nicole Hiller, Benjamin Kehrer, Anke-Susanne Müller, Patrik Schönfeldt, Marcel Schuh, and Johannes L. Steinmann — KIT, Karlsruhe, Germany

The ANKA storage ring at the Karlsruhe Institute of Technology (KIT) can generate brilliant coherent synchrotron radiation in the THz range by using a dedicated electron bunch length reducing optic. One challenge in the production of coherent THz radiation at synchrotrons is the high degree of spatial compression in this so-called low-alpha optics. The resulting complex longitudinal dynamics of the electron bunches, called micro-bunching instability, leads to time dependent fluctuations and strong bursts in the radiated THz intensity.

This contribution will present a quasi instantaneous method to measure the bursting characteristics by evaluating the information of all bunches in a multi-bunch fill. The reduction of the measurement time from hours down to seconds, allows the measurement of bursting characteristics for various accelerator settings within one fill.

AKBP 14.6 Do 17:45 S1/05 23

Influence of filling pattern structure on synchrotron radiation and beam spectrum at ANKA — •Johannes Steinmann, Miriam Brosi, Erik Bründermann, Michele Caselle, Edmund Blomley, Nicole Hiller, Benjamin Kehrer, Anke-Susanne Müller, Patrik Schönfeldt, Marcel Schuh, Markus Schwarz, and Michael Siegel — Karlsruher Institut für Technologie, Kaiserstr. 12, 76131 Karlsruhe

We present the effects of the filling pattern structure in multi-bunch mode on the beam spectrum. This effects can be seen by all detectors whose resolution is better than the RF frequency, ranging from stripline and Schottky measurements to high resolution synchrotron radiation measurements. Our heterodyne measurements of the emitted coherent synchrotron radiation at 270 GHz reveal the discrete frequency harmonics around the 100'000 revolution harmonic of ANKA, the synchrotron radiation facility in Karlsruhe, Germany. Significant effects of bunch spacing, gaps between bunch trains and variations in individual bunch currents on the emitted CSR spectrum are described by theory and supported by observations.

AKBP 14.7 Do 18:00 S1/05 23

Proposal of low-cost COTS Safety MCU for radiation tolerant controls in CBM detectors — •Jose Antonio Lucio Martinez and Udo Kebschull for the CBM-Collaboration — Infrastructure and Computer Systems in Data Processing, Goethe University Frankfurt, Germany

Amid general necessity of a robust slow control system for detectors, a DCS board with a cheap COTS MCU conceived for safety critical applications, and that supports conventional RTEMS+EPICS, is being designed for hostile environments. E.g. To operate inside detectors. For this purpose such MCU, which has redundancy features like lockstep run and ECC-SECDED error correction on flash and SRAM internal memories, was tested under radiation condition at the SPS beamtime parasitically to a detector test in CERN. In this preliminary beam-test, RTEMS+EPICS simplifies controls management and in this case supported data acquisition by monitoring the fault registers of the MCU and transmitting them with the ethernet interface, as a backup method the JTAG was used to inspect such registers to confirm the register reads. The results suggest that this is a reliable MCU for hostile conditions.

AKBP 14.8 Do 18:15 S1/05 23

Ein Hochenergie-Scrapersystem für die Extraktionsstrahlführung des S-DALINAC - Design und Aufbau* — •Lars Jürgensen[1], Thore Bahlo[1], Christoph Burandt[1], Florian Hug[2], Thorsten Kürzeder[1], Norbert Pietralla[1], Simon Weih[1] und Jan Wissmann[1] — [1]Institut für Kernphysik, TU Darmstadt, Darmstadt, Germany — [2]Institut für Kernphysik, Johannes Gutenberg Universität, Mainz, Germany

Der S-DALINAC ist der supraleitende Elektronenlinearbeschleuniger des Institut für Kernphysik der Technischen Universität Darmstadt. Der 30 MeV Hauptbeschleuniger kann mit Hilfe der drei Rezirkulationen bis zu viermal genutzt werden. Die gesamte Anlage ist ausgelegt für eine Endenergie von 130 MeV im Dauerstrich-Betrieb. Zur Verbesserung der Energieschärfe und zur Stabilisierung der Elektronenergie wurde ein neues Scrapersystem entwickelt und aufgebaut. Dazu wird die Extraktionsstrahlführung durch eine dispersionsfreie Schikane aus vier Dipolmagneten und drei Scraperkammern ergänzt. Das System soll x- und y-Haloscraping sowie die Verbesserung und Stabilisierung der Energieschärfe durch einen weiteren Scraper in einer dispersiven Strecke ermöglichen. In diesem Vortrag wird die Auslegung des Systems vorgestellt und wir berichten über den Einbau in die Strahlführung.

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AKBP 15: PWA and self modulation

Zeit: Donnerstag 16:30–18:30 Raum: S1/05 24

AKBP 15.1 Do 16:30 S1/05 24

Gasentladungszelle für Plasmabeschleunigungsexperimente am Photoinjektor-Teststand Zeuthen — •Gregor Loisch[1], Johannes Engel[1], Matthias Gross[1], Martin Hochberg[2], Gerald Koss[1], Mikhail Krasilnikov[1], Osip Lishilin[1], Anne Oppelt[1], Gaurav Pathak[1], Sebastian Philipp[1], Dieter Richter[3], Martin Sack[2] und Frank Stephan[1] — [1]Deutsches Elektronen-Synchrotron DESY, Platanenallee 6, 15738 Zeuthen — [2]Karlsruher Institut für Technologie KIT, Kaiserstraße 12, 76131 Karlsruhe — [3]Helmholtz-Zentrum Berlin HZB, Albert-Einstein-Straße 15, 12489 Berlin

Am Photoinjektor-Teststand PITZ in Zeuthen, DESYs Standort bei Berlin, sind Experimente in Vorbereitung, mit Hilfe derer theoretische Modelle der Plasmabeschleunigung experimentell untersucht werden sollen: zum einen die Selbstmodulation eines Teilchenstrahls in einer Plasmawelle, zum anderen die Beschleunigung von Teilchen bei hohem Transformationsverhältnis (Verhältnis von abgegebener Energie des Treibers zu aufgenommener Energie der beschleunigten Teilchen). Zusätzlich zum bereits realisierten Ansatz der Plasmaerzeugung in einem Metalldampfofen, wird hierfür eine Gasentladungszelle geplant, aufgebaut und vermessen. Diese bietet gegenüber den sehr komplexen Metalldampföfen einen vereinfachten Aufbau und einfache Handhabung, hat sich allerdings bisher noch nicht experimentell bewährt. Nach der Konstruktion und Inbetriebnahme sollen erste Diagnostikexperimente zeigen, ob die kapazitive Entladung in Argon bei niedrigem Druck die Anforderungen von 5% longitudinaler Homogenität bei einer Dichte von 10^{15} Elektronen pro Kubikzentimeter erfüllen kann.

AKBP 15.2 Do 16:45 S1/05 24

Electron windows studies for Self-Modulation Experiments at PITZ — •Osip Lishilin[1], Reinhard Brinkmann[2], Johannes Engel[1], Florian Gruener[3,4], Matthias Gross[1], Gerald Koss[1], Gregor Loisch[1], Sebastian Philipp[1], Gaurav Pathak[1], Dieter Richter[5], Carl Schroeder[6], Rico Schuetze[1], and Frank Stephan[1] — [1]DESY, Zeuthen, Germany — [2]DESY, Hamburg, Germany — [3]Universität Hamburg, Hamburg, Germany — [4]CFEL, Hamburg, Germany — [5]HZB, Berlin, Germany — [6]LBNL, Berkeley, USA

The self-modulation instability of long particle beams was proposed as a new mechanism to produce driver beams for proton driven plasma wakefield acceleration (PWFA). The PWFA experiment at the Photo Injector Test facility at DESY, Zeuthen site (PITZ) was launched to experimentally demonstrate and study the self-modulation of long electron beams in plasma. Key aspects for the experiment are the plasma cell of novel design, the flexible photocathode laser system and well-developed diagnostics at PITZ. The plasma cell is a cross-shaped lithium heat pipe oven with inert gas buffer zones at input/output ports. An ArF ionization laser is coupled through side ports for the plasma generation. Thin foils are mounted at the ends of the plasma cell to isolate plasma and buffer gas from the vacuum beamline, while the electron beam has to pass them with minimal distortion. This contribution presents an overview of the experimental setup and preparatory studies for the most suitable parameters of the electron windows as well as proposed improvements for the technical design of the setup.

AKBP 15.3 Do 17:00 S1/05 24

Gas Density Measurement for Self-Modulation Experiment at PITZ — •Gaurav Pathak[1], Matthias Gross[2], Osip Lishilin[1], Gregor Loisch[2], Johannes Engel[2], Sebastian Phiipp[2], and Frank Stephan[2] — [1]Universität Hamburg, Luruper Chaussee 149, D-22761, Germany — [2]Deutsches Elektronen-Synchrotron, Platanenallee 6, D-15738, Zeuthen, Germany

Since the time self-modulation (SM) of long charged particle beams has been proposed as an instrument for plasma wakefield acceleration it gained large attention to the physics community all around the world. Instrumental for this scheme is the SM of a long charged particle beam to generate bunchlets for resonant plasma wave excitation and efficient acceleration. The Photo-Injector Test Facility at DESY, Zeuthen site (PITZ) has set up an independent experiment for the proof of principle and detailed characterization of the effect.

In the experiment a plasma oven is placed in the PITZ beamline to study the SM. Plasma generated through single photon ionization relies on the Lithium (Li) gas density. This contribution presents the results of the Li gas density measurement for the PITZ plasma oven. The hook method, direct laser absorption and white light absorption method have been applied for the Li gas density measurement. The results show that with increase of buffer gas and of the Lithium amount independently, the Li gas density increases. The maximum Li gas density that has been achieved so far is which is 2 orders of magnitude less than the desired value.

AKBP 15.4 Do 17:15 S1/05 24

Theoretical and Experimental Studies of Plasma Channel Generation for Beam Driven Plasma Wakefield Accelerators — •Gabriele Tauscher[1], Alexander Aschikhin[1,2],

John Dale[2], Jan-Hendrik Erbe[1,2], Lars Goldberg[1,2], Timon Mehrling[1], Lucas Schaper[2], Jan-Patrick Schwinkendorf[1,2], Matthew Streeter[2], Bernhard Schmidt[2], and Jens Osterhoff[2] — [1]University of Hamburg, Germany — [2]Deutsches Elektronen-Synchrotron DESY, Hamburg, Germany

Plasma-based wakefield acceleration is a promising approach in shrinking the size and cost of future particle accelerators and free-electron lasers. In the FLASHForward project a wakefield accelerator will be driven by an electron bunch from the FLASH accelerator while a multi-TW short pulse laser will pre-ionise a hydrogen gas target to form a plasma. Disentangling the processes of ionisation and wakefield driving enables improved control over the plasma density profiles and therefore over the structure of the wakefields crucially effecting the quality of the accelerated beams. To work out the electron density distribution in the target, we compute the ionisation rates of hydrogen molecules in strong laser fields. To be able to benchmark the predicted behaviour experimentally we also take into account the temporal and spatial laser-intensity profile evolution. The here developed understanding of the underlying processes of plasma generation ultimately allows for tailoring of the focusing geometry and laser-power-profile evolution to achieve desired plasma properties. As a proof of concept, we aim to realise plasmas with tailored shapes experimentally early 2016.

AKBP 15.5 Do 17:30 S1/05 24

Emittance conservation through tailored plasma ramps in PWFA scenarios — •Alexander Aschikhin, Alberto Martinez de la Ossa, Timon Mehrling, and Jens Osterhoff — Deutsches Elektronen-Synchrotron, Notkestraße 85, 22607 Hamburg, Germany

The FLASHForward facility will offer unique capabilities or plasma-wakefield acceleration experiments. It uses high-quality beams from the FLASH accelerator to excite plasma wakefields for the exploration and improvement of novel and existing injection mechanisms.

The unique nature of the plasma environment creates several challenges with regard to the conservation of the beam quality, partially due to the strong focusing fields present in the blowout region following a driver beam in the highly nonlinear regime. The beta function of a beam needs to be matched into the wakefield in order to avoid severe growth of the beam emittance - a crucial quality parameter for beam transport, staging and applications.

Since the matched beta function is usually at least an order of magnitude lower than easily accessible for conventional accelerator optics, multiple schemes have been proposed to mitigate severe emittance growth by tailoring the plasma profile to adiabatically reduce the beta function to match the plasma wakefield.

We will focus on an introduction of these techniques, before presenting initial results from numerical and theoretical analyses for the typical FLASH beam parameter space.

AKBP 15.6 Do 17:45 S1/05 24

Single-shot betatron source size measurement from a laser-wakefield accelerator — •Alexander Köhler[1,2], Jurjen Couperus[1,2], Omid Zarini[1,2], Axel Jochmann[1], Arie Irman[1], and Ulrich Schramm[1,2] — [1]Helmholtz-Zentrum Dresden - Rossendorf, Bautzner Landstr. 400, 01328 Dresden — [2]Technische Universität Dresden, 01062 Dresden

Betatron radiation emitted by accelerated electrons in laser-wakefield accelerators can be used as a diagnostic tool to investigate electron dynamics during the acceleration process. We analyse the spectral characteristics of the emitted betatron pattern utilizing a 2D x-ray imaging spectroscopy technique. Together with simultaneously recorded electron spectra and x-ray images, the betatron source size, thus the electron beam radius, can be deduced at every shot.

AKBP 15.7 Do 18:00 S1/05 24

Reaching for highest ion beam intensities through laser ion acceleration and beam compression — •Dennis Schumacher[1], Diana Jahn[2], Johannes Ding[2], Christian Brabetz[1], Abel Blazevic[1], Vincent Bagnoud[1], Florian Kroll[3], Ulrich Schramm[3], Tom Cowan[3], Simon Weih[1], and Markus Roth[2] for the LIGHT-Collaboration — [1]GSI Helmholtzzentrum für Schwerionenforschung — [2]TU Darmstadt — [3]Helmholtzzentrum Dresden Rossendorf

Laser ion acceleration provides access to ion sources with unique properties. To use these capabilities the LIGHT collaboration (Laser Ion Generation Handling and Transport) was founded. The aim of this collaboration is the beam transport and manipulation of laser accelerated ions with conventional accelerator structures. Therefor a dedicated beam line has been build up at GSI Helmholtzzentrum für Schwerionenforschung. With this beam line the manipulation of the transversal and also the longitudinal beam parameters has been achieved. It has been shown that laser generated ion beams can be transported over more than 6 meters and pulses shorter than 300 ps can be generated at this distance. This Talk will give an overview over the recent developments and plans of the LIGHT collaboration.

AKBP 15.8 Do 18:15 S1/05 24

High-repetition-rate laser-proton acceleration from a condensed hydrogen jet — •Lieselotte Obst[1], Karl Zeil[1], Sebastian Göde[2], Josefine Metzkes[1], Hans-Peter Schlenvoigt[1], Maxence Gauthier[2], Martin Rehwald[1], Christian Rödel[2], Philipp Sommer[1], Michael MacDonald[2], Florian Brack[1], William Schumaker[2], Ulrich Schramm[1], and Siegfried Glenzer[2] — [1]Helmholtz-Zentrum Dresden-Rossendorf (HZDR), Dresden, Germany — [2]SLAC National Accelerator Laboratory, Stanford, USA

Applications of laser-accelerated protons demand a stable source of energetic particles at high repetition rates. We present the results of our experimental campaign in cooperation with MEC/SLAC at the 10Hz Ti:Sa laser Draco of Helmholtz-Zentrum Dresden-Rossendorf (HZDR), employing a pure condensed hydrogen jet as a renewable target. Draco delivers pulses of 30 fs and 5 J at 800 nm, focused to a 3 μm spot by an F/2.5 off-axis parabolic mirror. The jet's nominal electron density is approximately 30 times the critical density and its thickness is 2 μm, 5 μm or 10 μm, depending on the applied aperture on the source. Ion diagnostics reveal mono-species proton acceleration in a solid angle of at least +/-45° with respect to the incoming laser beam, with maximum energies of around 5 MeV. The expanding jet could be monitored on-shot with a temporally synchronized probe beam perpendicular to the pump laser axis. Recorded probe images resemble those of z-pinch experiments with metal wires and indicate an m=0 instability in the plasma.