AKBP 15: Poster session

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

AKBP 15.1 Do 16:30 Foyer Nordbau

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

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

AKBP 15.2 Do 16:30 Foyer Nordbau

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

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

AKBP 15.3 Do 16:30 Foyer Nordbau

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

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

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

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

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

AKBP 15.4 Do 16:30 Foyer Nordbau

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

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

AKBP 15.5 Do 16:30 Foyer Nordbau

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

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

AKBP 15.6 Do 16:30 Foyer Nordbau

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

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

AKBP 15.7 Do 16:30 Foyer Nordbau

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

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

small medical irradiation devices to small footprint free electron lasers.

AKBP 15.8 Do 16:30 Foyer Nordbau

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

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

AKBP 15.9 Do 16:30 Foyer Nordbau

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

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

AKBP 15.10 Do 16:30 Foyer Nordbau

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

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

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

AKBP 15.11 Do 16:30 Foyer Nordbau

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

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

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

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

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

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

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

AKBP 15.12 Do 16:30 Foyer Nordbau

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

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

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

AKBP 15.13 Do 16:30 Foyer Nordbau

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

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

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

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

AKBP 15.14 Do 16:30 Foyer Nordbau

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

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

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

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

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

AKBP 15.15 Do 16:30 Foyer Nordbau

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

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

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

AKBP 15.16 Do 16:30 Foyer Nordbau

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

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

AKBP 15.17 Do 16:30 Foyer Nordbau

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

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

AKBP 15.18 Do 16:30 Foyer Nordbau

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

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

AKBP 15.19 Do 16:30 Foyer Nordbau

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

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

AKBP 15.20 Do 16:30 Foyer Nordbau

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

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

AKBP 15.21 Do 16:30 Foyer Nordbau

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

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

AKBP 15.22 Do 16:30 Foyer Nordbau

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

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

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

AKBP 15.23 Do 16:30 Foyer Nordbau

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

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

*Gefördert durch die DFG im Rahmen des GRK 2128.

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

AKBP 15.24 Do 16:30 Foyer Nordbau

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

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

AKBP 15.25 Do 16:30 Foyer Nordbau

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

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

*Supported by the DFG through GRK 2128.

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