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 regard-

ing 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.

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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 col-

liding 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. 1, 91058 Erlangen

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.

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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.

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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.