AKBP 8: Poster session

Zeit: Mittwoch 18:00–19:30 Raum: NW-Bau - HS2

AKBP 8.1 Mi 18:00 NW-Bau - HS2

Beam Dynamics Simulations for the New Superconducting CW Heavy Ion LINAC at GSI — •Malte Schwarz[1], Markus Basten[1], Marco Busch[1], Holger Podlech[1], Manuel Heilmann[2], Stepan Yaramyshev[2], Winfried Barth[2,3], Viktor Gettmann[3], Thorsten Kuerzeder[3], Maksym Miski-Oglu[3], and Kurt Aulenbacher[3,4] — [1]IAP, Goethe University Frankfurt — [2]GSI Helmholtz Centre, Darmstadt — [3]HIM Helmholtz Institute, Mainz — [4]IKP, Johannes Gutenberg University Mainz

For future experiments with heavy ions near the coulomb barrier within the super-heavy element (SHE) research project a multi-stage R&D program of GSI, HIM and IAP is currently in progress. It aims at developing a superconducting (sc) continuous wave (CW) LINAC with multiple CH cavities as key components downstream the upgraded High Charge State Injector (HLI) at GSI. The LINAC design is challenging due to the requirement of intense beams in CW-mode up to a mass-to-charge ratio of 6 while covering a broad output energy range from 3.5 to 7.3 MeV/u with minimum energy spread. After successful tests with the first CH cavity in 2016 demonstrated a promising maximum accelerating gradient of 9.6 MV/m, the worldwide first and successful beam test with this superconducting multi-gap CH cavity in 2017 was a milestone in the R&D work of GSI, HIM and IAP. In the light of experience gained in this research so far, the Beam Dynamics layout for the full LINAC was recently updated and significantly optimized. The corresponding simulations will be presented within this contribution.

AKBP 8.2 Mi 18:00 NW-Bau - HS2

Manufacturing & Measurements of the 325 MHz Ladder RFQ — •Max Schuett, Marc Syha, and Ulrich Ratzinger — IAP, Goethe University Frankfurt

Based on the positive results of the unmodulated 325 MHz Ladder-RFQ prototype from 2013 to 2016, we developed and designed a modulated 3.3 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 200 μs.

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 creates difficulties for a 4-ROD type RFQ, 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 a suitable candidate for that frequency. The duty cycle is suitable up to 5%.

The basic design and tendering of the RFQ has been successfully completed in 2016. Manufacturing will be completed in early 2018. We will show the results of manufacturing as well as first low level RF measurements on field flatness and frequency spectra compared in comparison to simulations.

*Journal of Physics: Conf. Series 874 (2017) 012048

**Proceedings of LINAC2016, East Lansing, TUPLR053

Supported by BMBF 05P15RFRBA

AKBP 8.3 Mi 18:00 NW-Bau - HS2

Beam stability study for FCC-hh — •Daria Astapovych and Oliver Boine-Frankenheim — TU Darmstadt, Darmstadt, Germany

The future circular hadron collider FCC-hh is one of the options for the post-LHC era. Currently an accelerator with the circumference of 100 km and center of massenergy 100 TeV is considered. The main limitations for the FCC-hh beam intensity are resistive wall impedance and electron clouds. The electron clouds, appearingdue to the short relativistic bunches, are significant issue causing beam quality degradation, beam instabilities and emittance growth. The numerical and analytical results for the impedance and growth rates of transverse coupled-bunch instabilities will be shown. Estimations of the tune footprint due to electron cloud effect, and secondary electron yield threshold also will be presented.

AKBP 8.4 Mi 18:00 NW-Bau - HS2

Bunch Shape Measurement at the GSI CW-Linac Prototype — •Thomas Sieber[1], Peter Forck[1], Winfried Barth[1], Viktor Gettmann[1], Maxym Miski-Oglu[1], Stepan Yaramyshev[1], Florian Dziuba[1], Manuel Heilmann[1], Thorsten Kürzeder[1], Alexander Feschenko[2], and Sergei Gavrilov[2] — [1]GSI Darmstadt — [2]INR Moscow

The existing GSI accelerator will become the injector for FAIR. To preserve and enhance the current experimental program at UNILAC, a dedicated new Linac is under development, which shall run in parallel to the FAIR injector, providing cw-beams of ions at energies from 3.5 MeV/u to 7.3 MeV/u. For this cw-Linac a superconducting prototype cavity has been developed and was first operated with beam in summer 2017. The resonator is a Cross-bar H-structure (CH) of 0.7 m length, with a resonant frequency of 216.8 MHz. It has been installed behind the GSI High Charge State Injector (HLI), which provided 108 MHz bunches of 1.4 MeV/u Ar6+, Ar9+ and Ar11+ ions at a duty cycle of 25 %. Due to the frequency jump and small longitudinal acceptance of the CH, proper matching of the HLI beam to the prototype was required. The bunch properties of the injected beam as well as the effect of different phase- and amplitude-settings of the cavity were measured in detail with a bunch shape monitor (BSM) fabricated at INR, Moscow, while the mean energy was analyzed by time of flight method. In this contribution, the bunch shape measurements are described and the capabilities of the used BSM measurement principle are discussed.

AKBP 8.5 Mi 18:00 NW-Bau - HS2

RF Simulations of the Injector Part from CH8 to CH15 for MYRRHA — •Patrick Müller, Dominik Mäder, Klaus Kümpel, Holger Podlech, Marco Busch, Nils Petry, and Malte Schwarz — IAP, Goethe-University Frankfurt, Germany

MYRRHA (Multi-purpose hYbrid Research Reactor for High-tech Applications) is the first prototype of an accelerator driven nuclear reactor dealing with the transmutation of long-living nuclear waste. Beam quality and reliability are crucial for the reactor. The injector design is done by IAP, Goethe-University, and has been adapted to the final magnet design and voltage distributions. The energy section from 5.87*MeV up to 16.6 MeV has been changed to normal conducting CH cavities as in the lower energy part of the injector. For beam adjustment a 5-gap CH cavity rebuncher at 5.87 MeV as well as two doublet magnets forming the new MEBT-2 section between CH7 and CH8 have been added. Starting parameters for the RF simulations have been given by beam dynamics results calculated with LORASR. RF simulations of these structures consisting of flatness and tuning optimizations will be presented within this contribution.

AKBP 8.6 Mi 18:00 NW-Bau - HS2

Optics design and space charge effects in Injection arc of MESA* — •Aamna Khan[1], Oliver Boine-Frankenheim[1], and Christian Stoll[2] — [1]Institut für Theorie Elektromagnetischer Felder, TU Darmstadt, Darmstadt-64289, Germany — [2]Institut für Kernphysik, Johannes Gutenberg-Universitat, D-55099 Mainz, Germany.

For intense electron bunches traversing through bends, as for example the recirculation arcs of an ERL, space charge (SC) may result in beam phase space deterioration. SC modifies the electron transverse dynamics in dispersive regions along the beam line and causes emittance growth for mismatched beams or for specific phase advances. The study focuses on the optics design, including SC, of a 180° low energy (5 MeV) injection arc which is matched to the injector with first cryomodule for energy recovery operation in the Mainz Energy-recovering Superconducting Accelerator (MESA). MESA should deliver a CW beam at 105 MeV for physics experiments with an internal target.

AKBP 8.7 Mi 18:00 NW-Bau - HS2

The spatial process model of the GSI-SIS18 synchrotron for the closed orbit feedback system — •Sajjad Hussain Mirza[1,2], Peter Forck[1], Rahul Singh[1], and Harald Klingbeil[1,2] — [1]GSI Darmstadt, Planckstraße 1, 64291 Darmstadt,Germany — [2]TEMF, Schlossgartenstraße 8, 64289 Darmstadt, Germany

A closed orbit feedback system is under development at the GSI SIS18 synchrotron for orbit correction during the whole acceleration ramp. Spatial process model of the system has been investigated and a re-

placement of the singular value decomposition (SVD) technique with a new faster Discrete Fourier Transform (DFT) based inversion of orbit response matrix (ORM) has been proposed, exploiting the Circulant symmetry of the synchrotron. A clear relation between SVD modes and singular values to DFT modes and coefficients has also been described. The DFT based decomposition gives hints on physical interpretation of SVD and DFT modes of the perturbed closed orbit. The use of DFT modes to provide robustness against BPM failures has been demonstrated with the help of MADX simulations.

AKBP 8.8 Mi 18:00 NW-Bau - HS2

Development of compact heavy ion linear accelerators — •Hendrik Hähnel, Ulrich Ratzinger, Rudolf Tiede, Jan Kaiser, and Christian Wirth — Institut für Angewandte Physik, Goethe Universität Frankfurt

Recent developments of heavy ion accelerators at IAP Frankfurt will be discussed. Using H-mode cavities, compact and efficient linear accelerators can be designed. One example is the development of a replacement for the GSI UNILAC poststripper linac. A replacement based on IH-type cavities would essentially cut the linac length in half while providing the same beam energy and similar beam quality. Additionally, the development of linac structures towards higher energies will be discussed.

AKBP 8.9 Mi 18:00 NW-Bau - HS2

design study on a 800 MHz RF cavity and HOM couplers for the higgs mode of operation of FCC-ee — •shahnam gorgi zadeh[1], rama calaga[2], frank gerigk[2], and ursula van rienen[1] — [1]University of Rostock — [2]CERN

After the discovery of the Higgs particle, CERN launched the study of the Future Circular Collider to act as a potential successor to the LHC. The FCC study includes a high luminosity lepton collider (FCC-ee) aiming to conduct precise measurements on the Z, W and H bosons and top quark. The FCC-ee will include different operating modes with beam energies of 45.6, 80, 120 and 182.5 GeV. The SRF requirements for each case necessitate different cavity designs. Nevertheless, no more than one or two designs should be found that could serve for all four scenarios. In this poster, we present the design of an accelerating cavity at 800 MHz including higher order mode couplers, considering mainly the requirements of the H mode of operation.

AKBP 8.10 Mi 18:00 NW-Bau - HS2

Control system and data acquisition of the laser-plasma accelerator LUX — •Soeren Jalas[1], Manuel Kirchen[1], Niels Delbos[1], Timo Eichner[1], Bjoern Hubert[1], Lars Huebner[1], Spencer W. Jolly[1,2], Vincent Leroux[1,2], Sebastian Mahncke[1], Philipp Messner[1], Matthias Schnepp[1], Max Trunk[1], Christian Werle[1], Paul Winkler[1,3], and Andreas R. Maier[1] — [1]Center for Free-Electron Laser Science & Department of Physics, University of Hamburg, Luruper Chaussee 149, 22761 Hamburg, Germany — [2]Institute of Physics of the ASCR, ELI-Beamlines project, Na Slovance 2, 18221 Prague, Czech Republic — [3]Deutsches Elektronen-Synchrotron DESY, Notkestr. 85, 22607 Hamburg, Germany

LUX is a dedicated laser-plasma accelerator built within a close collaboration of the University of Hamburg and DESY. Driven by the ANGUS laser system the accelerator provides electrons with GeV-scale energies at up to 5 Hz repetition rate. Here, we present the integration of the laser system and the plasma accelerator into an online control system for continious and non-invasive monitoring and control of the machine. Using an event based data acquisition service we record data from more than 100 diagnostics and operation-critical devices synchronized to each individual laser shot. Active feedback loops allow us to stabilize the accelerator in real time, which is key to enable reliable and reproducible long-term operation of a laser-plasma accelerator.

AKBP 8.11 Mi 18:00 NW-Bau - HS2

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

Plasma accelerators are compact high-energy particle sources. Excited by an ultra-short laser or particle beam driver, the strong electric fields inside a plasma allow to accelerate electron bunches to GeV energy levels on mm length scales. Modelling the complex acceleration process requires computationally demanding Particle-In-Cell codes that self-consistently solve the electromagnetic particle interaction inside the plasma. Here, we present FBPIC - a highly parallel Particle-In-Cell code featuring a spectral electromagnetic solver that eliminates numerical instabilities common to traditional field solvers, a quasi-3D geometry that greatly reduces the computational costs and the Lorentz-boosted frame technique that scales down the required simulation time by orders of magnitude. The code is written in pure Python using Just-In-Time compilation to generate machine code supporting CPU multi-threading and multi-GPU execution.

AKBP 8.12 Mi 18:00 NW-Bau - HS2

Beam Dynamics for the FAIR-p-Linac-RFQ — •Marc Syha, Maximilian Schütt, and Ulrich Ratzinger — Institut für Angewandte Physik, Goethe-Universität Frankfurt, Deutschland

After the successful measurements with a 0.8 m prototype a 3.3 m Ladder-RFQ is under construction at IAP, Goethe University Frankfurt. It 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 modulation parameter, aperture and synchronous phase all course linear, which differentiates this design approach from other designs developed at IAP. The ratio of transversal vane curvature radius to mid-cell radial aperture as well as the vane radius itself are constant, which favors 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 Los Alamos RFQGen-code was used for the RFQ design and the beam dynamics simulations.

Furthermore, the effects of and the compensation for the longitudinal on-axis fringe-fields at the gap between the grounded entrance flange and the electrode entrance plane are discussed*.

*M. Schütt, Design and Development of a 325 MHz Ladder RFQ, Dissertation, IAP Goethe-Universität Frankfurt, 2017.

AKBP 8.13 Mi 18:00 NW-Bau - HS2

Intensity limits of DLA grating structures at relativistic energies — •Thilo Egenolf[1], Uwe Niedermayer[1], and Oliver Boine-Frankenheim[1,2] — [1]TEMF, TU Darmstadt, Schloßgartenstraße 8, 64289 Darmstadt, Germany — [2]GSI, Planckstraße 1, 64291 Darmstadt, Germany

Dielectric Laser Acceleration (DLA) is an advanced electron accelerator concept reaching gradients significantly larger than conventional RF cavities. Recent experiments using dielectric nanostructures have demonstrated acceleration gradients of about 690 MeV/m. Due to the extremely small apertures, intensity effects caused by space charge and wakefields are critical limitations. To estimate the intensity limits at relativistic energies, we present simulations of the longitudinal wakefield for different DLA grating geometries and bunch properties. Based on these simulations, we calculate the beam loading intensity limit, where the energy loss equals the external energy gain. Additionally, we simulate the transverse wakefield for beam stability analysis. Furthermore, we outline the integration of a wake kick in our simplified 6D particle tracking code to study the beam dynamics in DLA gratings. The required single particle wake function is obtained by fitting analytical solutions of similar metallic geometries. For verification, we compare the tracking results to Particle-In-Cell simulations with commercial software.

AKBP 8.14 Mi 18:00 NW-Bau - HS2

Setup for cooled GaAs cathodes with increased charge lifetime — •Tobias Eggert, Markus Wagner, Yuliya Fritzsche, Neeraj Kurichiyanil, and Joachim Enders — Institute for Nuclear Physics, TU Darmstadt

For high-current applications of GaAs photocathodes it is necessary to maximize the charge lifetime of the cathode material to ensure reliable operation. By means of cryogenic cooling of the electrode, the local vacuum conditions around the GaAs cathode, with its sensitive negative-electron-affinity surface, are expected to improve due to cryogenic adsorption of reactive residual gas molecules at the surrounding walls. Furthermore, the cooling also allows a higher laser power deposited in the material, resulting in higher currents that can be extracted from the cathode. Ion-backbombardment is expected to be reduced using an electrostatic bend after the electrons leave the cathode. To measure the characteristics of such an electron source, a dedicated set-up is being developed at the Photo-CATCH test facility (Proc. 7th DAE-BRNS Indian particle accelerator conference, Mumbai 2015) in

Darmstadt, Germany. We will present the current status of the source, including electrostatic and vaccum simulations and future plans.

The project is funded by DFG (GRK 2128) and BMBF (05H15RDRB1).

AKBP 8.15 Mi 18:00 NW-Bau - HS2

On evaluation of transient BPM signals — •Rahul Singh, Peter Forck, Andreas Reiter, Piotr Kowina, Kevin Lang, Wolfgang Kaufmann, Piotr Miedzik, and Oleksandr Chorniy — GSI Darmstadt, Planckstrasse 1, Germany

Capacitive beam position monitors are non-interceptive devices providing signals from injection till extraction of beam from a synchrotron. Their typical usage is for the orbit or turn-by-turn position measurements of a bunched beam. In this contribution, we will discuss their utility in the *other beam states* such as during injection, debunching, unbunched state, during rf gymnastics and potentially while beam is being extraction. The influence of BPM signal processing on utilizing BPM signals in aforementioned cases will be highlighted.

AKBP 8.16 Mi 18:00 NW-Bau - HS2

Reconstructing Space-Charge Distorted IPM Profiles with Machine Learning Algorithms — •Dominik Vilsmeier, Mariusz Sapinski, and Rahul Singh — GSI Helmholtzzentrum für Schwerionenforschung, Darmstadt, Deutschland

Measurements of undistorted transverse profiles via Ionization Profile Monitors (IPMs) may pose a great challenge for high brightness or high energy beams due to interaction of ionized electrons or ions with the electromagnetic field of the beam. This contribution presents application of various machine learning algorithms to the problem of reconstructing the actual beam profile from measured profiles that are distorted by beam space-charge interaction. (Generalized) linear regression, artificial neural network and support vector machine algorithms are trained with simulation data, obtained from the VirtualIPM simulation tool, in order to learn the relation between distorted profiles and original beam dimension. The performance of different algorithms is assessed and the obtained results are very promising for testing with simulation data.

AKBP 8.17 Mi 18:00 NW-Bau - HS2

Experimente zur Beschleunigerphysik für junge Menschen - Schwerpunkt Beschleuniger-Entwicklung — •Stefan Bechstein, Achim Stahl und Josef Riese — RWTH Aachen University (Germany)

Mit der Entwicklung und dem Bau eines Lehr-Zyklotrons, eines Lehr-Linearbeschleunigers und zwei Funktionsmodellen werden erstmals Experimentiergelegenheiten zur modernen Beschleunigerphysik für Schulen, Universitäten und Ausbildungsbetriebe geschaffen. Die gesellschaftliche Relevanz zeigt sich vor allem in den wachsenden Anwendung im Bereich der Medizin/Krebs-Therapie und dem FEL. In der Lehre werden die physikalischen Zusammenhänge bis dato lediglich mithilfe von bildlichen Darstellungen oder Computersimulationen vermittelt, einige Parameter bleiben dabei allerdings außen vor.

Die Kooperationsstruktur, bestehend aus dem Institut für experimentelle Teilchen- und Astroteilchenphysik der RWTH Aachen University und dem Institut für Didaktik der Physik und Technik an der RWTH, sowie der enge Austausch mir dem Head of Educational Outreach and Physics Education Research des CERN/Genf, ermöglicht Forschungen sowohl beim Quellen-Design, der Vakuum- und Beschleunigungstechnik oder den Analyse-Möglichkeiten, als auch bei Konstruktion von Lerngelegenheiten.

Auf dem Poster werden die geplante Modellserie, erste bauliche Lösungen, aber auch Fragestellungen zur Umsetzung aus der laufenden Entwicklungsphase zu sehen sein. Daneben werden Aspekte zur Bedeutung der Teilchenphysik für eine breite Öffentlichkeit skizziert.

AKBP 8.18 Mi 18:00 NW-Bau - HS2

Slow Extraction Spill Characterization from Micro to Milli-Second Scale — •Peter Forck, Plamen Boutachkov, Rahul Singh, Stefan Sorge, and Horst Welker — GSI, Darmstadt

This contribution deals with the topic of slow extraction spill quality characterization based on the measurements performed at GSI SIS-18. As a first step, external ripples were introduced into the dipole and quadrupole power supplies to estimate the source and magnitude of coherent peaks seen in a spill spectrum. Spill characterization techniques in the time and frequency domain are discussed exemplified by typically measured spills and their differences from an ideal or "dc" spill. Standard characterization methods of the slow extraction spill is interesting due to two reasons, firstly; there is a big variety in experimental requirements with each having different tolerances to deviations from a "dc" beam occurring primarily due to beam response to imperfections like power supplier ripples. Secondly, different slow extraction methods lead to characteristic temporal variations of spill quality even during one extraction cycle; some examples are discussed. An appropriate spill characterization aims to provide a suitable abstraction for communication about the spill quality requirements between accelerator operations and users.

AKBP 8.19 Mi 18:00 NW-Bau - HS2

3D space charge tracking using fast multipole methods* — •Steffen Schmid, Erion Gjonaj, and Herbert De Gersem — Institut für Theorie Elektromagnetischer Felder, TU Darmstadt, GER

In high brilliance photoinjectors, such as the PITZ gun used at the EXFEL, the particle bunch properties are strongly influenced by space charge effects [1]. Computer simulations allow to investigate systematically how these effects influence the beam dynamics of the bunch. This knowledge is needed for the optimization of a photoinjector.

Currently, most of the simulation codes are based on particle-particle (PP) or particle-mesh (PM) algorithms. PP-codes are very flexible, but computationally expensive. PM-algorithms are more efficient, but less flexible and conceptually more complicated.

The fast multipole method [2] (FMM) combines some of the advantages of both of the aforementioned approaches. We present a code which uses "ExaFMM" [3] to provide the space charge interaction forces to an in-house developed particle tracker.

In this contribution, a numerical analysis of the approximation errors and the speedup gained by using the FMM-code is shown. Furthermore, FMM and PP beam dynamics simulations for the PITZ photoinjector are compared. The results suggest to use the FMM-code as a basis for the implementation of more advanced interaction models.

[1] Y. Chen et al., IPAC, Richmond, VA, USA, MOPWA029 (2015)
[2] L. Greengard et al., J COMPUT PHYS, **73**, CP975706 (1997)
[3] R. Yokota et al., "ExaFMM", https://github.com/exafmm/exafmm

* This work is supported by the DFG in the framework of GRK 2128

AKBP 8.20 Mi 18:00 NW-Bau - HS2

Numerical studies for optimized ionization injection — •Sebastian Mahncke[1], Niels Delbos[1], Irene Dornmair[1], Timo Eichner[1], Björn Hubert[1], Lars Hübner[1], Sören Jalas[1], Spencer W. Jolly[1,2], Manuel Kirchen[1], Vincent Leroux[1,2], Philipp Messner[1], Matthias Schnepp[1], Maximilian Trunk[1], Christian Werle[1], Paul A. Walker[3], Paul Winkler[1,3], and Andreas R. Maier[1] — [1]Center for Free-Electron Laser Science & Department of Physics, University of Hamburg, Luruper Chaussee 149, 22761 Hamburg, German — [2]Institute of Physics of the ASCR, ELI-Beamlines project, Na Slovance 2, 18221 Prague, Czech Republic — [3]Deutsches Elektronen-Synchrotron DESY, Notkestr. 85, 22607 Hamburg, Germany

The LUX beamline is a novel laser-plasma accelerator, built in close collaboration of the University of Hamburg and DESY, and dedicated for the generation of laser-plasma driven undulator radiation. Separating the injection of electrons from the acceleration in the plasma is crucial for improved control over the electron beam phase space. Here, we present numerical studies on ionization injection with a focus on the separation of the injection and acceleration sections, while optimizing experimentally accessible parameters for improved electron beam quality.

AKBP 8.21 Mi 18:00 NW-Bau - HS2

Beam intensity measurement with nA precision - the Cryogenic Current Comparator (CCC) — •David Haider[1], Thomas Sieber[1], Febin Kurian[1], Peter Forck[1], Marcus Schwickert[1], Frank Schmidl[2], Peter Seidel[2], Ralf Neubert[2], Jessica Golm[2,3], Volker Tympel[3], Nicolas Marsic[4], Herbert De Gersem[4], Matthias Schmelz[5], Ronny Stolz[5], Viatcheslav Zakosarenko[6], and Thomas Stöhlker[1,2,3] — [1]GSI Helmholz Centre for Heavy Ion Research, Darmstadt, Germany — [2]Friedrich-Schiller-University Jena, Germany — [3]Helmholtz-Institute Jena, Germany — [4]TU Darmstadt, Germany — [5]Leibniz Institute of Photonic Technology, Jena, Germany — [6]Supracon AG, Jena, Germany

The storage of low current beams and the slow extraction of ion beams at FAIR bring new demands for a non-destructive beam intensity monitoring of nA currents. To address this requirement, the concept of a Cryogenic Current Comparator (CCC) using a low temperature

SQUID sensor has been adapted to form an extremely sensitive beam current transformer. Such CCCs were installed successfully in the extraction line of GSI SIS18 (2014) and - as the first stand-alone device - in the CERN Antiproton Decelerator (2017). Currently, the next generation of CCCs is being designed as a routine diagnostic system for FAIR and will be tested in CRYRING at GSI. The challenge of the ongoing research is to improve the robustness against external interference, based on electro-mechanical studies, and to optimize the design of each component accordingly. In this contribution, recent results and future developments of the FAIR-CCC are discussed.

AKBP 8.22 Mi 18:00 NW-Bau - HS2

Recent developments in beam diagnostics and control systems at COSY — •Philipp Niedermayer, Ilja Bekman, Christian Böhme, Arthur Halama, Vsevolod Kamerdzhiev, Karl Reimers, Michael Simon, and Michael Thelen — IKP-4, Forschungszentrum Jülich, 52425 Jülich, Germany

The Cooler Synchrotron (COSY) is currently operated mainly for accelerator and detector related preparations for the future accelerator facility FAIR as well as the Electric Dipole Moment (EDM) investigations. In order to reach the goals of current and future experiments, fast and reliable real-time diagnostic of beam parameters is crucial. Therefore many present subsystems are being upgraded and new systems are added. Integration of these systems into the Experimental Physics and Industrial Control System (EPICS) enabling online monitoring and archiving is one of the core activities. These include, but are not limited to, Beam Position Monitors (BPM), Beam Loss Monitors (BLM), Profile Grids and Multi-Wire Proportional Chambers, Spill Detector. Latest activities and achievements are presented.

AKBP 8.23 Mi 18:00 NW-Bau - HS2

Long-term performance of the Marburg Ion-Beam Therapy Centre Accelerator — •Adrian Weber[1], Claude Krantz[1], Benno Kröck[1], Uwe Scheeler[1], Rainer Cee[2], Michael Galonska[2], Andreas Peters[2], Stefan Scheloske[2], Christian Schoemers[2], and Thomas Haberer[1,2] — [1]Marburger Ionenstrahl-Therapiezentrum, 35043 Marburg — [2]Heidelberger Ionenstrahl-Therapiezentrum, 69120 Heidelberg

The Marburg Ion-Beam Therapy Centre (MIT) has been in clinical operation since October 2015. The raster scanning technique provides a precise and accurate radiation dose application employing beams of either protons or carbon nuclei. The accelerator, developed by Siemens/Danfysik, consists of an RF linear accelerator and a 65 m synchrotron. During treatment, the position, shape and intensity of the ion beam is monitored online at the beam outlet by the Therapy Control System. In addition, the quality of the beam along the accelerator is monitored by online measurements of beam properties using non-invasive beam diagnostics as well as by dedicated daily performance checks involving also destructive measurements. We present our experience on the machine stability from the first two years of operation of MIT as well as ongoing work to improve analysis tools for long-term monitoring of beam properties. A possible extension of the daily quality assurance tests based on the experience gathered so far is under investigation.

AKBP 8.24 Mi 18:00 NW-Bau - HS2

Performance of the ESR Barrier Bucket LLRF System — •Jens Harzheim[1], Dilyana Domont-Yankulova[1], Michael Frey[2], Kerstin Gross[1], Harald Klingbeil[1,2], and Dieter Lens[2] — [1]TU Darmstadt, Darmstadt, Germany — [2]GSI Helmholtzzentrum für Schwerionenforschung GmbH, Darmstadt, Germany

A barrier bucket (BB) RF system is currently being installed in the Experimental Storage Ring (ESR) at GSI, Darmstadt, Germany. This system will be able to provide pulsed gap voltages, enabling highly sophisticated longitudinal beam manipulations like longitudinal capture, compression and decompression or stacking of the beam.

To fulfill the high requirements on the BB gap signal, the input signal has to be predistorted. This task has to be fulfilled by the LLRF system which includes an identification of the required RF system parameters. Additionally, adiabatic amplitude ramps and phase shifts are required for the intended beam manipulations and need to be performed by the LLRF system. The ramps will be provided by the FAIR Central Control System (CCS).

In this contribution, the topology of the ESR BB LLRF System is presented together with measured performance results for the different functionalities requested of the system.

AKBP 8.25 Mi 18:00 NW-Bau - HS2

A Fluorescence Based Profile Monitor for Electron Lenses — •Serban Udrea[1], Peter Forck[1], Elena Barrios Diaz[2], Nicolas Chritin[2], Tom Marriott-Dodington[2], Rhodri Jones[2], Paolo Magagnin[2], Gerhard Schneider[2], Raymond Veness[2], Vasilis Tzoganis[3,4], Carsten Welsch[3], and Hao Zhang[3] — [1]GSI Helmholtzzentrum für Schwerionenforschung, Darmstadt, Germany — [2]CERN, Geneva, Switzerland — [3]Cockcroft Institute, Warrington, United Kingdom — [4]Oak Ridge National Laboratory, Oak Ridge, USA

A hollow electron lens is presently under study as a possible addition to the collimation system for the high luminosity upgrade of the LHC (HL-LHC) at CERN, while an electron lens system is proposed for space charge compensation in the SIS-18 synchrotron at GSI to allow for higher beam intensities at the future FAIR facility. For effective operation of these devices, a precise alignment is necessary between the high energy hadron beam and the low energy electron beam. In order to achieve this, a beam diagnostics setup based on an intersecting gas sheet and the observation of beam induced fluorescence is under development. In this contribution we give an account of recent studies, including the design and performance of the optical system and results of experiments performed using a laboratory gas curtain setup.