AKBP 7: Diagnostics, Control and Instrumentation

Time: Tuesday 14:30–16:00 Location: MOL 213

AKBP 7.1 Tue 14:30 MOL 213

Rogowski-based beam position monitors for storage rings — •Falastine Abusaif for the JEDI-Collaboration — Juelich Forschungszentrum (IKP-2)

The Electric Dipole Moment (EDM) of elementary particles has gained a big interest in particle physics for the fact that it violates Charge Parity (CP) symmetry. The standard model lacks additional CP violating phenomenons to explain the matter-antimatter asymmetry. The Jülich Electric Dipole moment Investigations (JEDI) collaboration is preparing for measuring the EDM of charged hadrons (protons and deuterons) using the Cooler Synchrotron (COSY) storage ring. The search for an EDM requires highly precise measurement conditions. This comes from theoretical predictions, the strength of the EDM signal is so tiny that it can be easily mimicked by other effects. For this, it is necessary to disentangle a real EDM signal from systematic ones. The beam orbit is one of the important things that needs to be well known and controlled. The beam position monitors (BPMs) are used to deliver the transverse beam positions. The Rogowski coil operation, which is based on magnetic induction is exploited in a compact and sensitive position monitor for storage rings. This poster will present the working principles and the latest achievements of the Rogowski-based beam position monitor used at COSY.

AKBP 7.2 Tue 14:45 MOL 213

Beam-based alignment at the Cooler Synchrotron (COSY) in Jülich — •Tim Wagner for the JEDI-Collaboration — Institut für Kernphysik, Forschungszentrum Jülich — III. Physikalisches Institut B, RWTH Aachen University

The JEDI collaboration intends to perform a direct measurement of the electric dipole moment (EDM) of protons and deuterons using a storage ring. In order to measure the EDM with a high precision a small orbit RMS is needed, since unknown magnetic fields, which are picked up when one is off of the optimal orbit, significantly add to the systematic error. In order to achieve a good orbit RMS in the accelerator one needs to know the size of the offsets between the beam position monitors (BPM) and the magnets, i.e. quadrupoles. A beam time to determine those offsets for the first time for all quadrupoles in the Cooler Synchrotron (COSY) has been performed in September/October 2019. During the beam time the so called beam-based alignment method was used to determine the location of the magnetic center for all the quadrupoles with respect to the electric center of the BPMs. With the known offsets between the BPMs and quadupoles one can recalibrate the BPMs to have the zero orbit go through the magnetic centers of the quadrupoles. In this talk the results of that beam time and other insight gained into the positions of the quadrupoles will be presented.

AKBP 7.3 Tue 15:00 MOL 213

Towards Automated Operation of the Super-FRS — •Jan-Paul Alexander Hucka[1,2], Stephane Pietri[2], and Joachim Enders[1] — [1]TU Darmstadt, Institut für Kernphysik — [2]GSI Helmholtzzentrum für Schwerionenforschung

For the upgrade of the GSI accelerators to the FAIR facility, a new control system is required to provide maximized parallelization and synchronicity of individual machines during operation.

Hence a framework from CERN, LSA [1], is being implemented and adapted to the needs of the GSI/FAIR facilities and its accelerators and beam transfers. The fragment separator FRS [2] and - at a later stage - also the superconducting fragment separator Super-FRS [3] at FAIR will be operated via LSA.

Current developments at the FRS towards an automated operation has shown to be successful as a proof of principle during the last engineering run. These developments encompass an automatic online setting generation by including energy-loss calculations for matter. It was shown that both primary beams of ^{40}Ar and ^{238}U as well as secondary fragment beams could be transported through the FRS without prior setting preparation.

Work supported by BMBF (05P19RDFN1) and through the TU Darmstadt-GSI cooperation contract.

[1] M. Lamont et al., LHC Project Note 368 (2005)
[2] H. Geissel et al., NIM B 70, 286 (1992)
[3] M. Winkler et al., NIM B 266, 4183 (2008)

AKBP 7.4 Tue 15:15 MOL 213

Energy Resolved Emittance Measurements of Laser-Wakefield Accelerated Beams — •Paul Winkler[1], Lars Hübner[1], Björn Hubert[2], Sören Jalas[2], Manuel Kirchen[2], Philipp Messner[2,3], Laurids Jeppe[2], Vincent Leroux[2], Timo Eichner[2], Thomas Hülsenbusch[2], Matthias Schnepp[2], Maximilian Trunk[2], Christian Werle[1], Bernhard Schmidt[1], and Andreas R. Maier[2] — [1]DESY — [2]Center for Free-Electron Laser Science and Department of Physics, Universität Hamburg — [3]Max Planck Institute for the Structure and Dynamics of Matter

Laser-wakefield accelerators enable the generation of electron beams with initially nm-small emittances and GeV-level beam energies within cm-scale. However, shot-to-shot fluctuations in beam quality can pose a limit to the transportability of plasma-generated beams, and, in particular, impede the measurement of the beam emittance using conventional methods.

Here, we present results from an emittance diagnostic implemented at the LUX laser-plasma accelerator. Results from a single-shot method are compared to results obtained from a quadrupole-scan for different energy-slices. After proving the applicability of the single-shot method at our setup for a narrow energy interval, we show an energy-resolved measurement of the electron phase-space. Slice-emittances as low as 0.8 mm mrad from ionization-injected beams as well as a complex modulation of the electron phase-space along the broad energy spectrum are observed.

AKBP 7.5 Tue 15:30 MOL 213

Optimization of RF Synchronization with the FLUTE Timing System — •Thiemo Schmelzer[1], Michael J. Nasse[2], Marcel Schuh[2], Nigel Smale[2], and Anke-Susanne Müller[1,2] — [1]LAS, KIT, Karlsruhe — [2]IBPT, KIT, Karlsruhe

FLUTE (Ferninfrarot Linac- Und Test-Experiment) is a new compact versatile linear accelerator at KIT. Its primary goal is to serve as a platform for a variety of accelerator studies as well as to generate strong ultra-short THz pulses for photon science. Trigger signals with several frequencies are needed at FLUTE for devices as well as for sampling or as synchronization references. The trigger generation was revised to optimize the power stability for the RF system, which will be presented in this contribution.

AKBP 7.6 Tue 15:45 MOL 213

Bayesian Optimization of Injection Efficiency at KARA using Gaussian Processes — •Chenran Xu[1], Tobias Boltz[1], Akira Mochihashi[2], and Anke-Susanne Müller[1,2] — [1]LAS, KIT, Karlsruhe — [2]IBPT, KIT, Karlsruhe

The injection at the KIT storage ring KARA is tuned by many parameters, such as the strength of various magnets and the RF frequency. The tuning process is currently performed manually by machine operators, which is time consuming and often gets stuck in local optima. This is exactly the domain for Bayesian optimization, a technique to optimize noisy black box functions. Using Gaussian processes (GPs) for regression, we obtain a probabilistic model which allows the integration of prior knowledge about the physical process. The model can be queried during the optimization procedure in order to efficiently explore the given parameter space, leading to comparably fast convergence. In this contribution, we demonstrate the implementation of Bayesian optimization to automate and optimize the injection process.