AKBP 3: Beam Dynamics

Zeit: Montag 16:00–18:00 Raum: NW-Bau - HS5

AKBP 3.1 Mo 16:00 NW-Bau - HS5

Vergleich zweier Verfahren zur Optimierung eines SRF Photoinjektors mit Booster für hochbrilliante Elektronenstrahlen — •Simon Koch, Andreas Jankowiak, Thorsten Kamps und Eva Panofski — Helmholtz-Zentrum Berlin für Materialien und Energie, Berlin, Deutschland

Am Helmholtz-Zentrum Berlin (HZB) sollen hochbrilliante Elektronenstrahlen erzeugt werden, um zeitaufgelöste Beugungsexperimente mit ultra-kurzen Elektronenpulsen zu ermöglichen. Ein SRF Photoinjektor und ein Booster Vorbeschleuniger dienen dabei als Elektronenquelle. Um eine hohe Strahlbrillianz zu erreichen, müssen Emittanz und Länge der Elektronenpakete minimiert werden. Die dafür benötigten optimalen Parametereinstellungen werden mit zwei unterschiedlichen Optimierungsverfahren gesucht - einerseits mithilfe einer numerischen auf einem Multi-Objective Genetic Algorithmus (MOGA) basierenden Methode und andererseits mithilfe einer analytischen Optimierung der longitudinalen Strahldynamik. Es werden erste Ergebnisse der Analyse vorgestellt.

AKBP 3.2 Mo 16:15 NW-Bau - HS5

Beam Dynamics Simulations for the first ERL Operation of the S-DALINAC* — •Jonas Pforr, Michaela Arnold, and Norbert Pietralla — Institut für Kernphysik, Darmstadt, Germany

The S-DALINAC is a superconducting recirculating electron accelerator which has been operated since 1991 at TU Darmstadt. In 2015/16 an additional recirculation beamline was implemented in order to allow for an additional linac pass and thus an increased maximum energy and improved stability. The new recirculation includes a pathlength adjustment system that enables a 360° phase shift. With this device, switching between accelerating and ERL operation is possible. In the design phase the accelerator lattice was optimized for acceleration, not for ERL operation. This contribution presents beam dynamics simulations of the S-DALINAC in ERL mode.

*Work supported by the DFG through GRK 2128

AKBP 3.3 Mo 16:30 NW-Bau - HS5

Autonome Optimierung des Strahltransports am S-DALINAC — Michaela Arnold, •Jonny Birkhan, Timon Dörnfeld, Norbert Pietralla, Alexander Schmidt und Thomas Schösser — Insitut für Kernphysik, Technische Universität Darmstadt

Teilchenbeschleuniger sind die Basisinfrastrukturen physikalischer Grundlagenforschung auf den Gebieten der Teilchen- und Kernphysik. Die technische Komplexität der Anlagen hat in den vergangenen Dekaden infolge der gestiegenen Anforderungen an Strahlenergie und -qualität um ein Vielfaches zugenommen. Die großen Betriebsparameterräume solcher Anlagen machen den Einsatz von strukturbildenden und automatisierenden Algorithmen zur effizienten Einstellung der Parameter erforderlich. Am Darmstädter supraleitenden Elektronenlinearbeschleuniger S-DALINAC wurden zunächst klassische Optimierungsalgorithmen zur autonomen Einstellung des Strahltransports durch verschiedene Strahlführungsabschnitte entwickelt und getestet. Darauf aufbauend ist damit begonnen worden, neuronale Netze zu entwerfen, die solche Optimierungsaufgaben effizienter lösen können. Erste Ergebnisse und Erfahrungen dazu sollen vorgestellt werden.

AKBP 3.4 Mo 16:45 NW-Bau - HS5

Search for Electric Dipole Moments at COSY in Jülich - Closed-Orbit and Spin Tracking Simulations — •Vera Schmidt[1,2] and Andreas Lehrach[1,2] for the JEDI-Collaboration — [1]Forschungszentrum Jülich, IKP-4, Jülich, Deutschland — [2]III. Physikalisches Institut B, RWTH Aachen University, Aachen, Deutschland

The observed matter-antimatter asymmetry in the universe cannot be explained by the Standard Model (SM) of particle physics. In order to resolve the matter dominance an additional $\mathcal{CP}$ violating phenomenon is needed. A candiate for physics beyond the SM is a non-vanishing Electric Dipole Moment (EDM) of subatomic particles. Since permanent EDMs violate parity and time reversal symmetries, they are also $\mathcal{CP}$ violating if the $\mathcal{CPT}$-theorem is assumed.

The JEDI (Jülich Electric Dipole moment Investigations) collaboration in Jülich is preparing a direct EDM measurement of protons and deuterons first at the storage ring COSY (COoler SYnchrotron) and later at a dedicated storage ring.

Ensuring a precise measurement, various beam and spin manipulating effects have to be considered and investigated. Therefore closed orbit and spin tracking simulations are performed in order to quantify the effect of systematics on the EDM measurement and to predict the accuracy of the experiment. The EDM measurement method, as well as simulation results will be presented.

AKBP 3.5 Mo 17:00 NW-Bau - HS5

Injection arc design for ERL operation at MESA* — •Christian Stoll[1] and Aamna Khan[2] — [1]Institut für Kernphysik JGU Mainz — [2]Institut für Theorie Elektromagnetischer Felder, TU Darmstadt

MESA is a recirculating superconducting accelerator under construction at Johannes Gutenberg-Universität Mainz. It will be operated in two different modes: the first is the external beam (EB) mode, where the beam is dumped after being used at the experiment. The required beam current in EB mode is 150 μA with polarized electrons at 155 MeV. In the second operation mode MESA will be run as an energy recovery linac (ERL) with an unpolarized beam of 1 mA at 105 MeV. In a later construction stage of MESA the achievable beam current in ERL-mode shall be upgraded to 10 mA. The careful design of the 5 MeV injection arc of MESA and the control of the optical parameters is crucial to allow for the energy recovery mode to reach the desired performance. Optimization of the arc optics with MadX and the implementation of a cavity model in elegant are presented. The required parameters for the final arc optics were determined via backtracking through the first Cryomodule.

*Supported by DFG through GRK 2128

AKBP 3.6 Mo 17:15 NW-Bau - HS5

Beam Dynamics and Collimation Following MAGIX at MESA* — •Ben Ledroit and Kurt Aulenbacher — Institut für Kernphysik, Johannes Gutenberg-Universität Mainz

The Mainz Energy-recovering Superconducting Accelerator (MESA) will be an electron accelerator allowing operation in energy-recovery linac (ERL) mode. After the beam hits the target at the MESA Internal Gas Target Experiment (MAGIX), the beam is phase shifted and fed back into the linac sections. These will transfer the kinetic beam energy back to the RF-field by deceleration of the beam and allow for high beam power with low RF-power input. Since most of the beam does not interact with the target, the beam will mostly just pass the target untouched. However, a fraction of the scattered electrons may be in the range outside the accelerator acceptance and therefore cause malicious beam dynamical behavior in the linac sections or even damage to the machine. The goal of this work is to determine the beam behavior upon target passage by simulation and experiment and to protect the machine with a suitable collimation system. The present status of the investigations is presented.

*Supported by the DFG through GRK 2128

AKBP 3.7 Mo 17:30 NW-Bau - HS5

Improvement of the Current DELTA Lattice Model Based on Measured Response Matrices — •Andreas Glassl, Stephan Kötter, Thomas Weis, and Bernard Riemann — TU Dortmund University (DELTA) Center for Synchrotron Radiation

An improved lattice model for the electron storage ring DELTA at TU Dortmund is being investigated using MAD-X. For this purpose, an already existing lattice model is updated by introducing fringe fields and data related to new measurements of magnet positions e.g. The linear predictions of this model is compared to optical functions and tunes computed by the COBEA-algorithm (AKBP 66) using measured response matrices of the storage ring as input. To improve the lattice model further the consideration of nonlinear field moments created by sextupoles and modified quadrupoles is presently under progress. Recent results will be presented together with first suggestions for a lattice model aiming at reduced momentum compaction factors while keeping magnet positions and minimizing variations to magnet strengths.

AKBP 3.8 Mo 17:45 NW-Bau - HS5

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

The Jülich Electric Dipole moment Investigation (JEDI) Collaboration works on a measurement of the electric dipole moment (EDM) of charged hadrons using a storage ring. Such a dipole moment would violate CP symmetry, providing a test for physics beyond the Standard Model. The JEDI experiment requires a small beam orbit RMS in order to measure the EDM.

Therefore an ongoing upgrade of the Cooler Syncrotron (COSY) is done in order to improve the precision of the beam position. In this talk the first results of the beam based alignment method that was tested with one quadrupole will be presented. The measurements were done during a beam time in November 2017.