AKBP 11: Beam Dynamics 2

Time: Wednesday 16:00–17:45 Location: AKBP-H13

AKBP 11.1 Wed 16:00 AKBP-H13

Investigation of the spin coherence time for measuring the electric dipole moment of protons in the COSY cooler synchrotron — •Daoning Gu[1,2,3], Maximilian Vitz[1,2], and Andreas Lehrach[1,2] for the JEDI-Collaboration — [1]Institute for Nuclear Physics IV , FZ Jülich, Germany — [2]III. Physikalisches Institut B, RWTH Aachen University, Germany — [3]GSI Helmholtzzentrum für Schwerionenforschung GmbH, Darmstadt, Germany

The Electric Dipole Moment (EDM) of a subatomic particle is predicted by the Standard Model (SM) and provides simultaneous violation of parity (P) and time reversal (T). Assuming CPT-theorem holds, an EDM is also a source of CP violation, which is needed to explain the matter-antimatter asymmetry. Measuring an EDM at a higher value than the SM prediction would therefore provide additional CP violation and would be a strong indication for physics beyond the SM.

Optimization of the Spin Coherence Time (SCT) plays a central role in storage ring EDM experiments, since a large SCT is required to achieve the statistical sensitivity for an EDM measurement. After a sufficient long SCT was achieved for deuteron beams, the JEDI-Collaboration in Jülich is preparing a similar measurement for the SCT for protons at the storage ring COSY. Many parameters indicate that for proton beams, the optimization procedure to realize long SCT is more difficult than for deuteron beams. Therefore, spin tracking simulations were performed with the software library BMAD to investigate the sextupole contributions. This talk will concentrate on the recent tracking results to optimize the SCT for a proton beam at COSY.

AKBP 11.2 Wed 16:15 AKBP-H13

Beam dynamics studies by long-term observation of coherently emitted THz pulses at DELTA — •Carsten Mai, Benedikt Büsing, Arne Held, and Shaukat Khan — Center for Synchrotron Radiation (DELTA), TU Dortmund University, Dortmund, Germany

At DELTA, a 1.5-GeV electron storage ring operated as a synchrotron light source by the TU Dortmund University, experiments with THz radiation are carried out at a dedicated beamline. An interaction of short laser pulses with electron bunches is used to generate broadband as well as tunable narrowband radiation up to 6 THz. Coherent emission of (sub-)THz pulses is typically observed during several storage ring revolutions after the initial laser-electron interaction. However, a coherent emission is observed at half-integer multiples of the synchrotron oscillation period after the interaction because the density in the longitudinal phase space is similar to the initial situation. Experimental results and simulations of the longitudinal phase space are presented.

AKBP 11.3 Wed 16:30 AKBP-H13

Detailed analysis of transverse emittance of the FLUTE electron bunch — •Thiemo Schmelzer, Erik Bründermann, Igor Kriznar, Matthias Nabinger, Michael Nasse, Robert Ruprecht, Jens Schäfer, Marcel Schuh, Nigel Smale, Pawel Wesolowski, and Anke-Susanne Müller — KIT, Karlsruhe

The new compact and versatile linear accelerator-based test facility FLUTE (Ferninfrarot Linac- Und Test-Experiment) is operated at KIT. Its primary goal is to serve as a platform for a variety of accelerator R&D studies like the generation of strong ultra-short terahertz pulses. The amplitude of the generated coherent THz pulses is proportional to the square number of particles in the bunch. With the transverse emittance, a measure for the transverse particle density can be determined. It is therefore a vital parameter in the optimization of the operation. In a systematic study, the transverse emittance of the electron beam was measured in the FLUTE injector. A detailed analysis considers different influences such as the bunch charge and compares this with particle tracking simulations carried out with ASTRA. In this contribution, the key findings of this analysis are discussed. Thiemo Schmelzer acknowledges the support by the Doctoral School "Karlsruhe School of Elementary and Astroparticle Physics: Science and Technology".

AKBP 11.4 Wed 16:45 AKBP-H13

Development of a transfer line for LPA-generated electron bunches to a compact storage ring — •Bastian Härer[1], Erik Bründermann[1], Alexander Papash[1], Robert Ruprecht[1], Jens Schäfer[1], Christina Widmann[1], Anke-Susanne Müller[1], Laurids Jeppe[2], Philipp Messner[2], Andreas R. Maier[2], Jens Osterhoff[2], and Eva Panofski[2] — [1]Karlsruhe Institute of Technology (KIT) — [2]Deutsches Elektronen-Synchrotron (DESY)

The injection of LPA-generated beams into a storage ring is considered to be one of the most prominent applications of laser plasma accelerators (LPAs). In a combined endeavour between Karlsruhe Institute of Technology (KIT) and Deutsches Elektronen-Synchrotron (DESY) the key challenges will be addressed with the aim to successfully demonstrate injection of LPA-generated beams into a compact storage ring with large energy acceptance and dynamic aperture. Such a storage ring and the corresponding transfer line are currently being designed within the cSTART project at KIT and will be ideally suited to accept bunches from a 50 MeV LPA prototype developed at DESY.

This contribution presents the foreseen layout of the transfer line from the LPA to the injection point of the storage ring and discusses the status of beams optics calculations.

AKBP 11.5 Wed 17:00 AKBP-H13

Beam Pulsing at the S-DALINAC: Superposition of the 3 GHz Beam Structure with a 1 MHz Macrostructure* — •Lennart Stobbe, Michaela Arnold, Jonny Birkhan, Uwe Bonnes, Lars Jürgensen, and Norbert Pietralla — Institut für Kernphysik, TU Darmstadt, Germany

The superconducting electron-linear-accelerator S-DALINAC provides a cw-beam with a 3 GHz time structure for different experiments. This mode is fixed and does not allow to deliver a (macro-) pulsed beam to the experimental setups. As time of flight measurements should become feasible at the so-called QCLAM magnetic spectrometer an additional pulsing device has been built and studied. The 3 GHz beam structure was superimposed with a 1 MHz macrostructure. The superposition was archived with a plate capacitor setup in the S-DALINAC's injector-beamline. The plate capacitor deflected the beam across an aperture with a repetition rate of 1 MHz. The current state of the capacitor setup as well as the first test measurement of the macrostructure with a plastic scintillator will be presented.
*Work supported by DFG (GRK 2128) and the State of Hesse within the Research Cluster ELEMENTS (Project ID 500/10.006).

AKBP 11.6 Wed 17:15 AKBP-H13

Proton Irradiation Site for Si-Detectors at the Bonn Isochronous Cyclotron — •Dennis Sauerland[1], Paul-Dieter Eversheim[1], Reinhard Beck[1], Pascal Wolf[2], and Jochen Dingfelder[2] — [1]Helmholtz-Institut für Strahlen und Kernphysik, Universität Bonn — [2]SiLab, Physikalisches Institut, Universität Bonn

With the Bonn Isochronous Cyclotron either protons, deuterons or ions up to $^{12}C^{4+}$ are accelerated to a kinetic energy ranging from 7 to 14 MeV per nucleon. The extracted beam is guided to one of five experimental sites.

At a new proton irradiation site, a 1 μA proton beam with a diameter of $\leq$ 6 mm is utilized to irradiate a target in air, e.g. cooled Si semiconductor detectors for radiation hardness tests. For homogeneous irradiation, the targets are scanned through the beam in a row-wise pattern with constant velocity and a row spacing much smaller than the beam diameter. During the irradiation procedure, the beam current and position is continuously measured non-destructively using a calibrated, secondary electron emission-based beam monitor, positioned at the exit window of the beamline. An on-the-fly beam monitor calibration can be obtained using a movable Faraday Cup. The diagnostics and the irradiation procedure ensure a homogeneous irradiation of the target with a fluence error of $\leq$ 2 %.

In this talk, an overview of the accelerator facility will be given, the irradiation site with its beam diagnostics will be presented in detail, along with an outlook on planned future developments at the facility.

AKBP 11.7 Wed 17:30 AKBP-H13

Progress of the SSMB Proof-of-Principle experiment at the Metrology Light Source — •Arnold Kruschinski[1], Arne Hoehl[2], Roman Klein[2], Ji Li[1], Jana Puls[2], Markus Ries[1], and Jörg Feikes[1] — [1]Helmholtz-Zentrum Berlin, Berlin, Germany — [2]Physikalisch-Technische Bundesanstalt, Berlin, Germany

The method of Steady-State Microbunching (SSMB) as proposed by Alex Chao and Daniel Ratner in 2010 is envisioned to generate intense coherent synchrotron radiation at a storage ring. The scheme would allow synchrotron light with brilliance similar to an FEL while enabling high repetition rates typical for a storage ring.

A proof-of-principle (PoP) experiment is conducted at the MLS storage ring in Berlin and has successfully demonstrated the viability of the general mechanism behind SSMB by showing stability of a microbunch structure over one turn in the storage ring. This talk will briefly introduce the idea behind SSMB and give an overview of the PoP experiment, its current status and outlook.