AKBP 6: Beam Dynamics / Simulation I

Zeit: Dienstag 14:00–16:00 Raum: S1/05 24

AKBP 6.1 Di 14:00 S1/05 24

Ein realistisches Magnetoptik-Modell für ELSA — •Jens-Peter Thiry und Wolfgang Hillert — Elektronen-Stretcher-Anlage ELSA, Physikalisches Institut, Universität Bonn

An der Elektronen-Stretcher-Anlage ELSA werden polarisierte Elektronen auf eine Energie von bis zu 3.2 GeV beschleunigt und anschließend mittels Resonanzextraktion verschiedenen Experimenten zugeführt. Ein realistisches Modell der Magnetoptik ist dabei eine Grundvoraussetzung um den Beschleuniger stabil betreiben zu können.

Bei ELSA wird das Programm elegant für die Simulation des Beschleuniger-Modells verwendet. Um das Modell an die tatsächliche Magnetoptik anzupassen wird dazu die von elegant berechnete Orbit-Response-Matrix an die gemessene Matrix angeglichen.

Da bei ELSA die horizontale Orbitkorrektur durch die Korrekturwindungen der Ablenkdipole realisiert wird muss bei der Berechnung der Matrix die räumliche Ausdehnung der Magnete besonders berücksichtigt werden. Als Eingabeparameter für die Berechnung dienen beispielsweise Gradienten- und Aufstellungsfehler der Magnete. In Abhängigkeit der Eingabeparameter wird dann mittels des Levenberg-Marquardt-Algorithmus die berechnete Matrix angeglichen.

In diesem Vortrag werden die konkrete Implementierung und erste Ergebnisse vorgestellt.

AKBP 6.2 Di 14:15 S1/05 24

Linear Optics Survey of the BESSY II Booster Synchrotron — •Paul Volz, Andreas Jankowiak, and Markus Ries — Helmholtz-Zentrum Berlin, Berlin

The proposed VSR upgrade for the BESSY II storage ring features photon pulses as short as 1.7 ps. The current injection system (linac, booster synchrotron, and transfer line) cannot provide electron bunches short enough to meet the required injection efficiency for TopUp operation. This contribution investigates if the momentum compaction factor of the booster synchrotron can be decreased just by changing the quadrupole strengths in the existing booster synchrotron lattice. It was found that by splitting the two quadrupole families into four the momentum compaction factor can be reduced.

AKBP 6.3 Di 14:30 S1/05 24

FCC-ee: Overview and Status of the Lattice Design — •Bastian Haerer[1,2], Sandra Aumon[2], Anton Bogomyagkov[3], Andreas Doblhammer[2], Bernhard Holzer[2], Katsunobu Oide[4], and Frank Zimmermann[2] — [1]LAS, KIT, Karlsruhe — [2]CERN, Geneva — [3]BINP, Novosibirsk — [4]KEK, Tsukuba

FCC-ee is an 100 km e^+/e^- collider being designed within the international Future Circular Collider Study. It will house at least two mini-beta insertions optimised for precision studies and rare decay observations in the range of 90 to 350 GeV center of mass energy with luminosities in the order of $10^{35}\,cm^{-2}s^{-1}$. To achieve this goal the beam needs to be squeezed by the final doublet quadrupoles to beta-functions of 1 m/2 mm, which drives the chromaticity to more than -2000 units. As a consequence a state of the art multi-family sextupole scheme has to be combined with a local chromaticity correction.

This presentation will provide an overview about the project mainly focusing on the status of lattice design and higher order chromaticity correction.

AKBP 6.4 Di 14:45 S1/05 24

Simulations of the effects of a superconducting damping wiggler on a short bunched electron beam at ANKA — •Julian Gethmann[1], Axel Bernhard[1], Edmund Blomley[1], Steffen Hillenbrand[1], Anke-Susanne Müller[1], Konstantin Zolotarev[2], and Nigel Smale[1] — [1]Karlsruher Institut für Technologie (KIT) — [2]Budker Institute of Nuclear Physics

(As a part of the CLIC collaboration) A CLIC damping wiggler prototype has been installed at the ANKA synchrotron light source in order to validate the technical design of the 3 T superconducting conduction cooled wiggler and its cryostat and to cary out studies on beam dynamical aspects including collective effects. The latter one will be the main focus in this talk. Collective effects that will occur in damping rings are an issue in ANKA's short bunch operation as well. To simulate these effects the accelerator's model including its insertion device has to be very accurate. Such a model of the ANKA storage ring in short bunch operation mode has been developed in elegant. Simulations with the damping wiggler switched on and off have been performed in order to investigate effects of the wiggler on different machine parameters. These new results will be discussed with regard to the question if on the one hand the wiggler could be used for diagnostic purposes and if on the other hand the wiggler's impact on the beam dynamics is changed by the collective effects.

AKBP 6.5 Di 15:00 S1/05 24

Beam Dynamics Simulations on transversal beam break-up for the S-DALINAC* — •Jonas Pforr, Michaela Arnold, Florian Hug, Lars Jürgensen, Thorsten Kürzeder und Norbert Pietralla — Institut für Kernphysik, TU Darmstadt, Darmstadt, Germany

Der S-DALINAC ist ein supraleitender, rezirkulierender Linearbeschleuniger. Generell ist in supraleitenden Linacs der Strahlstrom durch transversales beam break-up (BBU) begrenzt. Dieser Effekt wird durch Moden höherer Ordnung (HOMs) in den Kavitäten hervorgerufen, die den Strahl ablenken. In einem rezirkulierenden Beschleuniger wird dieser Effekt dadurch verschärft, dass der abgelenkte Strahl mit einem transversalen Versatz wieder in die Kavitäten eintritt und dadurch die HOMs verstärken kann. Zur Unterdrückung von BBU sollen am S-DALINAC zwei Strategien getestet werden. Diese bestehen aus einer Vertauschung der transversalen Phasenräume durch Rotations-Quadrupole bzw. aus einer Erhöhung der Chromatizität durch den Einsatz von Sextupolmagneten. In diesem Vortrag werden die Ergebnisse von Strahldynamiksimulationen vorgestellt, die den Einsatz dieser neu eingebauten Magnete beinhalten.

*Gefördert durch das BMBF unter 05K13RDA

AKBP 6.6 Di 15:15 S1/05 24

BESSY VSR - Supplying Short X-Ray Pulses with an Electron Storage Ring — Andreas Jankowiak, Jens Knobloch, Wolfgang Anders, Andrew Burrill, Hartmut Ehmler, Alexander Föhlisch, Paul Goslawski, Karsten Holldack, Peter Kuske, Dmitriy Malyutin, Aleksandr Matveenko, Roland Müller, Axel Neumann, Klaus Ott, •Markus Ries, Martin Ruprecht, Andreas Schälicke, Adolfo Velez, and Godehard Wüstefeld — Helmholtz-Zentrum Berlin, Berlin, Deutschland

The HZB has started the innovative project "BESSY VSR" to upgrade the 1.7 GeV synchrotron radiation source BESSY II. The project aims for simultaneous production of 1.7 ps and 15 ps long, intense X-ray pulses. These pulses are generated by an enhanced longitudinal focusing applying superconducting 5-cell cavities of 1.8 °K and are available at all photon beam ports. By properly chosen RF-frequencies of 1.5 GHz and 1.75 GHz a beating focusing scheme generates alternating long and short bunches. The project status as well as current fields of research will be presented.

AKBP 6.7 Di 15:30 S1/05 24

Transverse beam emittance optimization for the injection into BESSY II — •Felix Kramer — Helmholtz Zentrum Berlin, Institut Beschleunigerphysik — Humboldt-Universität zu Berlin, Institut für Physik

For top up injection into the storage ring BESSY II an average injection efficiency of at least 90% is required. In low alpha mode the injection efficiency does not meet the requirements. Future BESSY II features will include shorter bunches in the storage ring (VSR) and user transparent injection with a non linear kicker. These will raise the demands on the quality of the injected beam even further. This work investigates the development of transverse emittance over the acceleration cycle in the synchrotron and the possibility of transverse emittance exchange by a sequence of skew quadrupoles in the transfer line. Results of emittance measurements and emittance exchange simulations will be given.

AKBP 6.8 Di 15:45 S1/05 24

Proton beam transport experiments with pulsed high-field magnets at the Dresden Laser Acceleration Source Draco — •Florian Kroll[1,2], Stephan Kraft[1], Josefine Metzkes[1], Hans-Peter Schlenvoigt[1], Karl Zeil[1], and Ulrich Schramm[1,2] — [1]Helmholtz-Zentrum Dresden - Rossendorf, Dresden, Germany —

[2]Technische Universität Dresden, Dresden, Germany

Compact laser-driven ion accelerators are a potential alternative to large and expensive conventional accelerators. High-power short-pulse lasers, impinging on e.g. thin metal foils, enable multi-MeV ion acceleration on μm length and fs to ps time scale. The generated ion bunches (typically protons) show unique beam properties, like ultra-high pulse dose. Nevertheless, laser accelerators still require substantial development in reliable beam generation and transport.

Recently developed pulsed magnets meet the demands of laser acceleration and open up new research opportunities: We present a pulsed solenoid for effective collection and focusing of laser-accelerated protons that acts as link between fundamental research and application.

The solenoid is powered by a capacitor-based pulse generator and can reach a maximum magnetic field of 20 T. It was installed in the target chamber of the Draco laser at HZDR. The transported beam was detected by means of radiochromic film, scintillator and Thomson parabola spectrometer. We present the characterization of the solenoid with regard to future application in radiobiological irradiation studies. Furthermore, a detailed comparison to previous experiments with a similar magnet at the PHELIX laser at GSI, Darmstadt is provided.