AKBP 9: Electron Accelerators

Zeit: Dienstag 16:30–18:30 Raum: HS 7

AKBP 9.1 Di 16:30 HS 7

Status and recent highlights of KARA and FLUTE — •Bastian Härer[1], Axel Bernhard[1], Edmund Blomley[2], Tobias Boltz[2], Miriam Brosi[1], Andi Chai[2], Erik Bründermann[1], Sara Casalbuoni[1], Kantaphon Damminsek[2], Stefan Funkner[1], Julian Gethmann[2], Andreas Grau[1], Erhard Huttel[1], Andreas Kaiser[2], Benjamin Kehrer[2], Anton Malygin[1], Matthias Martin[2], Sebastian Marsching[2], Yves-Laurent Mathis[1], Wolfgang Mexner[1], Akira Mochihashi[1], Michael J. Nasse[1], Gudrun Niehues[2], Meghana Patil[2], Alexander Papash[1], Robert Ruprecht[1], David Saez de Jauregui[1], Jens Schäfer[2], Thiemo Schmelzer[2], Patrick Schreiber[2], Marcel Schuh[1], Nigel J. Smale[1], Johannes L. Steinmann[1], Yimin Tong[2], Pawel Wesolowski[1], Minjie Yan[1], and Anke-Susanne Müller[1,2] — [1]IBPT, KIT, Karlsruhe, Germany — [2]LAS, KIT, Karlsruhe, Germany

The Institute for Beam Physics and Technology (IBPT) at the Karlsruhe Institute of Technology (KIT) operates the Karlsruhe Reaseach Accelerator (KARA) and the Ferninfrarot Linac and Test Experiment (FLUTE) which is presently under construction. An overview of these facilities and the accelerator physics research activies will be given.

AKBP 9.2 Di 16:45 HS 7

Commissioning of the Third Recirculation Beam Line of the S-DALINAC* — •M. Arnold, T. Bahlo, R. Grewe, L. Jürgensen, N. Pietralla, M. Steinhorst, and S. Weih — IKP, TU Darmstadt

The S-DALINAC was set into full operation in 1991 as a twice-recirculating SC-RF linac for electrons with a maximum design energy of 130 MeV. The maximum energy reached so far in cw operation was 85 MeV. This limit was set by the maximum cooling power of the cryoplant and the SRF cavities with a lower than expected quality factor. Therefore, the accelerating gradients must be limited to match the dissipated power to the available cooling power. A fourth passage of the beam through the accelerator increases its energy reach. To that end a third recirculation beam line was installed in 2015/2016. The energy gain of the main accelerator can be kept constant while keeping the accelerating gradients, and thus the dissipated power, low at the same time. It was necessary to modify major parts of the lattice. The new beam line features a path-length adjustment system capable of a change of the beam phase of up to 360°. The S-DALINAC can now be operated in single pass, once- or thrice-recirculating and once- or twice recirculating ERL mode. Single pass, once- and thrice recirculating mode as well as the once-recirculating ERL mode have been successfully demonstrated, already. First data on the twice-recirculating ERL mode have recently been taken, too. This contribution will give an overview on the commissioning of the modified S-DALINAC.

*Work supported by DFG through GRK 2128.

AKBP 9.3 Di 17:00 HS 7

Synchrotron Radiation Background in the FCC-ee Interaction Region — •Marian Lückhof — CERN, Meyrin, Schweiz — Universität Hamburg, Gruppe Beschleunigerphysik Hamburg, Deutschland

FCC-ee is one of the future circular collider options with 80 km to 100 km circumference, a precision machine for e^+-e^- collisions and currently studied at CERN.

It aims for collision energies ranging from 90 to 365 GeV. A significant level of synchrotron radiation can be expected, emitted by electron and positron beams at this very high energies. For FCC-ee, synchrotron radiation induces limits on machine performance and is one of the main drivers for the design of the interaction region.

This talk aims to give an overview over the FCC-ee machine detector interface and MDISim, a simulation toolkit to do detailed studies of synchrotron radiation backgrounds in the interaction region.The principle is shown, together with first results on synchrotron radiation background at top energy (182.5 GeV per beam). Also an outlook on improvements and further studies will be given.

AKBP 9.4 Di 17:15 HS 7

Status of the new capture section for the S-DALINAC injector* — •Simon Weih[1], Michaela Arnold[1], Dmitry Bazyl[2], Joachim Enders[1], Herbert De Gersem[2], Wolfgang Müller[2], and Norbert Pietralla[1] — [1]Institut für Kernphysik, TU Darmstadt, Darmstadt, Germany — [2]Institut für Theorie Elektromagnetischer Felder, TU Darmstadt, Darmstadt, Germany

The first cavity of the superconducting section of the S-DALINAC [1] injector will be replaced by a new beta-adapted 6-cell structure in order to improve the electron bunch capture at an energy of 250 keV. To adapt the existing cryomodule to the new capture cavity, the tuner frame and other surrounding parts were modified. Beam dynamics simulations show that the beam quality downstream the injector strongly depends on the input bunch parameters. Therefore, a diagnostics setup at the end of the normal-conducting section of the injector is currently being planned. This setup will be used to characterize the beam in front of the capture section, supporting the future commissioning of the upgraded injector. This contribution will present the status of the foreseen improvements.

[1] N. Pietralla, Nuclear Physics News, Vol. 28, No. 2, 4 (2018). *Work supported by DFG through GRK 2128

AKBP 9.5 Di 17:30 HS 7

Status of Operation With Negative Momentum Compaction at KARA — •Patrick Schreiber, Alexander Papash, Akira Mochihashi, Bastian Härer, Marcel Schuh, Miriam Brosi, and Tobias Boltz — Karlsruher Institut für Technologie (KIT)

For future synchrotron light source development novel operation modes are under investigation. At the Karlsruhe Research Accelerator (KARA) an optics with negative momentum compaction has been proposed, which is currently under commissioning. In this context, the collective effects expected in this regime are studied with an initial focus on the head-tail instability and the micro-bunching instability resulting from CSR self-interaction. In this contribution, we will present the status of implementation for operation in the negative momentum compaction regime as well as a preliminary discussion of expected collective effects.

AKBP 9.6 Di 17:45 HS 7

Focussing Schemes for an Electron ource for Ultrafast Electron Diffraction at DELTA — •Daniel Krieg[1], Shaukat Khan[1], Klaus Sokolowski-Tinten[2], and Thies Johannes Albert[2] — [1]Zentrum für Synchrotronstrahlung, TU Dortmund, Dortmund,Deutschland — [2]Universität Duisburg-Essen, Duisburg, Deutschland

Ultrafast electron diffraction (UED) is a pump-probe technique to explore the structural dynamics of matter, combining sub-angstrom De-Broglie wavelength of electrons with femtosecond time resolution. UED experiments require ultrashort laser pulses to pump a sample, electron bunches with small emittance and ultrashort length to analyze the state of the sample and excellent control of the delay between them. Electrons accelerated to a few MeV in photocathode gun offer significant advantages compared to keV electrons from electrostatic electron sources, regarding emittance, bunch length and bunch charge. Furthermore, the longer mean free path of MeV electrons allows for a wider range of possible materials. In this talk, longitudinal and transverse focussing schemes, which minimize space charge effects and nonlinearities, are presented for a university-based UED facility with ultrashort and low-emittance MeV electron bunches are presented. The requirements for the laser system and the radiofrequency incoupling will be discussed.

AKBP 9.7 Di 18:00 HS 7

Investigation on the Ion-Clearing Performance of Multi-Purpose Electrodes planned for bERLinPro — Gisela Pöplau[1], •Atoosa Meseck[2], Fjodor Falkenstern[2], and Michael Markert[2] — [1]Universität zu Lübeck, Lübeck, Germany — [2]Helmholtz-Zentrum Berlin, Berlin, Germany

High-brightness electron beams provided by modern accelerators require several measures to preserve their high quality and to avoid instabilities. The mitigation of the impact of residual ions is one of these measures. It is particularly important if high bunch charges in combination with high repetition rates are aimed for. This is because ions can be trapped in the strong negative electrical potential of the electron beam causing emittance blow-up, increased beam halo and longitudinal and transverse instabilities.

One ion-clearing strategy is the installation of clearing electrodes. Of particular interest in this context is the performance of multi-purpose electrodes, which are designed such that they allow for a simultaneous ion-clearing and beam-position monitoring. Such electrodes will be installed in the bERLinPro facility.

In this contribution, we present numerical studies of the performance of multi-purpose clearing-electrodes planned for bERLinPro, i.e. we investigate the behavior of ions generated by electron bunches while passing through the field of the electrodes. Hereby, several ion species and configurations of electrodes are considered.

AKBP 9.8 Di 18:15 HS 7

Analytical Calculations for Thomson-Backscattering Based-Light Sources — •Paul Volz and Atoosa Meseck — Helmholtz-Zentrum Berlin

There is a rising interest in Thomson-backscattering based-light sources, as scattering intense laser radiation on MeV electrons produces high energy photons that would require GeV or even TeV electron beams when using conventional undulators or dipoles. Particularly, medium energy high brightness beams delivered by LINACs or Energy Recovery LINACs, such as bERLinPro being built at Helmholtz-Zentrum Berlin, seem suitable for these sources. In order to study the merit of Thomson-backscattering-based light sources, we have developed an analytical code to simulate the characteristics of the Thomson scattered radiation. The code calculates the distribution of scattered radiation depending on the incident angle and polarization of the laser radiation. Also the impact of the incident laser profile and the full 6D bunch profile, including microbunching, are incorporated. The features of the code and some simulation results will be presented.