AKBP 3: Diagnostics, Control and Instrumentation 1

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

AKBP 3.1 Mon 16:00 AKBP-H13

Simulation of the effect of corrugated structures on the longitudinal beam dynamics at KARA — •Sebastian Maier[1], Miriam Brosi[2], Akira Mochihashi[2], Michael J. Nasse[2], Markus Schwarz[2], and Anke-Susanne Müller[1,2] — [1]LAS, KIT, Karlsruhe — [2]IBPT, KIT, Karlsruhe

Two parallel corrugated plates will be installed at the KIT storage ring KARA (KArlsruhe Research Accelerator). This impedance manipulation structure will be used to study and eventually control the beam dynamics and the emitted coherent synchrotron radiation (CSR). In this contribution, we present the influence of the parameters of the structure on its impedance and simulation results obtained with the Vlasov-Fokker-Planck solver Inovesa showing the impedance impact of different corrugated structures on the CSR power. This work is supported by the DFG project 431704792 in the ANR-DFG collaboration project ULTRASYNC. Sebastian Maier acknowledges the support by the DFG-funded Doctoral School "Karlsruhe School of Elementary and Astroparticle Physics: Science and Technology"

AKBP 3.2 Mon 16:15 AKBP-H13

Implementing electro-optical detection methods for far-field THz detection at DELTA — •Vivek Vijayan, Arne Held, Shaukat Khan, Carsten Mai, and Boris Sawadski — Center for Synchrotron Radiation (DELTA), TU Dortmund, Dortmund, Germany

At the DELTA storage ring at TU Dortmund University, ultrashort THz pulses are coherently emitted by the interaction of a single electron bunch with an ultrashort laser pulse. This THz radiation can be used as a diagnostics tool for the laser-electron interaction as well as for studies of general storage ring parameters and electron beam dynamics. Currently, different thermal and photoconductive THz detectors are used at DELTA, which are sensitive to the intensity of the radiation. Detection schemes using the electro-optic effect enable a quantitative detection of the THz pulse shape with sub-picosecond resolution and are sensitive to both amplitude and phase information of the signal. An experimental setup based on electro-optical detection is currently being implemented at DELTA and its progress is discussed.

AKBP 3.3 Mon 16:30 AKBP-H13

Picosecond time-resolved solvated electron evolution triggered within laser-accelerated proton tracks in liquid water — •Alexander Prasselsperger[1], Mark Coughlan[2], Nicole Breslin[2], Mark Yeung[2], Christine Arthur[2], Hannah Donnelly[2], Steven White[2], Masoud Afshari[1], Martin Speicher[1], Rong Yang[1], Balder Villagomez-Bernabe[3], Frederick J. Currell[3], Jörg Schreiber[1], and Brendan Dromey[2] — [1]Fakultät für Physik, Ludwig-Maximilians-Universität München — [2]School of Mathematics and Physics, Queens University Belfast — [3]School of Chemistry, The University of Manchester

The processes initiating ion track formation in matter are fundamental to radiation science. Gauduel et al. (2010) proposed the dissipation time within these tracks to scale with the local energy density. This especially applies to state-of-the-art laser-based accelerators where peak currents of $> 10^6 A$ have been reached. Utilising a laser-ion-accelerator, we were able to demonstrate these delaying mechanisms for the first time (PRL 2021). By picking a synchronized chirped probe from the main driving laser pulse of a TNSA scheme, we implemented a single-shot $1.12ps$ time-resolved transmission imaging setup. Probing the interactions of accelerated proton bunches in H_2O with this setting revealed the temporal evolution of the solvated electron density over $1ns$ covering both, the x-ray and the ion bunch interactions emitted during the TNSA process. The absolute timing reference provided by the x-rays enabled the measurement of a $> 20ps$ delay in solvation time when compared to models presuming lower local energy density.

AKBP 3.4 Mon 16:45 AKBP-H13

Slow control loop to stabilize the RF power of the FLUTE electron gun — •Marvin Noll, Nigel Smale, Andreas Böhm, Igor Kriznar, Marcel Schuh, Robert Ruprecht, John Jelonnek, and Anke-Susanne Müller — Karlsruher Institut für Technologie (KIT), Karlsruhe, Germany

The linear accelerator FLUTE (Far Infrared Linac and Test Experiment) at KIT serves as a test facility for accelerator research and for the generation of ultra-intense coherent THz radiation.

To achieve stable THz photon energy and optimal beam trajectory, the energy of the electrons emitted from the RF photo-injector must be stable. The accelerating voltage of the RF cavity has been shown to be a significant influencing factor. Here, we report on the development of a slow closed-loop feedback system to stabilize the RF power and thus the accelerating voltage in the RF photo-injector cavity. With this closed-loop feedback system the relative standard deviation of the RF power in the cavity can be improved by 8.5 %.

AKBP 3.5 Mon 17:00 AKBP-H13

A streak camera for measuring the temporal correlation of two pulses in the few-fs range — •Marc Osenberg, Michael Stumpf, and Georg Pretzler — Institut für Laser- und Plasmaphysik, Heinrich-Heine-Universität Düsseldorf

For experiments with fs-scale XFEL or electron pulses together with laser pulses, the mutual timing is crucial. In this talk we present a novel all-optical method for obtaining such timing results with fs resolution. We developed a setup based on a Kerr gate which was elongated into a 1D structure along which single-shot temporal resolution is created within a tunable time window in the ps-range like in a streak camera. The setup requires an ultrashort laser pulse as the gate and an arbitrary light pulse as the signal. In the talk, we will present the setup and its characteristics and will discuss different ways to use it for various signal types, like OTR in the case of an electron pulse, for example.

AKBP 3.6 Mon 17:15 AKBP-H13

Laser alignment of internal components of the linear accelerator FLUTE — •Jens Schäfer, Bastian Härer, Matthias Nabinger, Michael J. Nasse, Robert Ruprecht, Nigel J. Smale, and Anke-Susanne Müller — KIT, Karlsruhe, Deutschland

The linac-based test facility FLUTE (Ferninfrarot Linac- Und Test Experiment) at KIT will be used to study novel accelerator technology and provide intense THz pulses. The latest experiments involving a Split Ring Resonator for longitudinal bunch profile measurements pushed the requirements on alignment precision of several hardware components down to the sub-milimeter level. In order to achieve the required precision, the low energy section of FLUTE was opened and an alignment laser was installed to mark mechanical axis of the machine. This presentation addresses details and challenges of this laser-based alignment process. Jens Schäfer acknowledges the support by the Doctoral School KSETA (Karlsruhe School of Elementary and Astroparticle Physics: Science and Technology).

AKBP 3.7 Mon 17:30 AKBP-H13

Development of an electro-optical longitudinal bunch profile monitor at KARA towards a beam diagnostics tool for FCC-ee — •Micha Reissig[1], Erik Bründermann[1], Stefan Funkner[1], Bastian Härer[1], Gudrun Niehues[1], Meghana M. Patil[2], Christina Widmann[2], and Anke-Susanne Müller[1,2] — [1]IBPT, KIT, Karlsruhe — [2]LAS, KIT, Karlsruhe

The Karlsruhe Research Accelerator (KARA) at KIT features an electro-optical (EO) near-field diagnostics setup to conduct turn-by-turn longitudinal bunch profile measurements in the storage ring using electro-optical spectral decoding (EOSD). Within the Future Circular Collider Innovation Study (FCCIS) an EO monitor using the same technique is being conceived to measure the longitudinal profile and center-of-charge of the bunches in the future electron-positron collider FCC-ee. This contribution provides an overview of the EO near-field diagnostics at KARA and discusses the development and its challenges towards an effective beam diagnostics concept for the FCC-ee.

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