AKBP 14: Instrumentation II

Time: Thursday 15:30–17:15 Location: CHE/0183

AKBP 14.1 Thu 15:30 CHE/0183

System for Bunch Length Measurements behind the Injector of S-DALINAC* — •A. Brauch, M. Arnold, J. Enders, L. Jürgensen, and N. Pietralla — Technische Universität Darmstadt, Department of Physics, Institut für Kernphysik, Darmstadt, Deutschland

The estimation of the bunch length in accelerators is vital for monitoring and preserving the quality of the beam. At the S-DALINAC accelerating cavities are used for measuring this parameter at higher energies. However, values obtained by this method only serve as an upper estimate for the bunch length. A new setup involving a streak camera will be used to provide accurate evaluations of the small bunch lengths of < 2 ps at the S-DALINAC. An integrative measurement with a comparable resolution to the bunch length at different positions behind the injector is planned. This contribution will present the layout of this system, its current status and design considerations.

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AKBP 14.2 Thu 15:45 CHE/0183

Simulationen zur Optimierung von Vakuumsystemen für Beschleunigerstrahlführungen* — •Alexander Smushkin, Ruben Grewe, Michaela Arnold, Manuel Dutine, Marco Fischer, Lars Jürgensen, Felix Schliessmann und Norbert Pietralla — Institut für Kernphysik, TU Darmstadt, Darmstadt, Germany

Der S-DALINAC ist ein supraleitender, rezirkulierender Linearbeschleuniger. Im Rahmen der fortschreitenden Optimierungen der Systeme am S-DALINAC wurden Segmente der Strahlführung bezüglich ihrer Vakuumeigenschaften untersucht. Hierbei wurde der Einfluss verschiedener Geometrien und Pumpenkonfigurationen auf das Vakuum mit der Simulationssoftware Molflow untersucht, um eine Grundlage für weitere Entwicklungen zu schaffen. Insbesondere werden Verbindungen zwischen Bereichen mit unterschiedlichen Vakuumanforderungen untersucht, wie z.B. beim Übergang zu den Kryostatmodulen oder Experimentierplätzen mit hohen Vakuumanforderungen. In diesem Vortrag werden diese Simulationsergebnisse vorgestellt.

*Gefördert durch die DFG (GRK 2128 AccelencE)

AKBP 14.3 Thu 16:00 CHE/0183

An all-optical streak camera to measure the jitter between two beams in the single-digit femtosecond regime — •Marc Osenberg[1], Ahmad Fahim Habib[2], Lina Wübbena[1], Michael Stumpf[1], and Georg Pretzler[1] — [1]Institute of Laser- and Plasmaphysics, University Düsseldorf — [2]University of Strathclyde, Glasgow

We present a novel All-Optical Streak Camera (AOSC) based on the Kerr-effect which measures the relative temporal position of a laser pulse and a second short pulse of arbitrary constituents (e.g., electrons, protons, light, or x-rays) in a single shot. Many modern accelerator concepts rely on the coupling of an electron beam with a laser beam, which must overlap with ultra-high temporal precision down to the low fs-regime which will be shown quantitatively by simulation results. Our new device comes in at this point, measuring the temporal position of the electron pulse relative to the laser pulse for single shots, which will also show jitter or temporal drifts. We show proof-of principle experiments of this new device with an ultrashort laser pulse (6 fs FWHM) demonstrating resolution in the 10-fs regime.

AKBP 14.4 Thu 16:15 CHE/0183

controlling the transverse beam shape of the photoinjector laser via a spatial light modulator — •Stephan-Robert Kötter, Erik Bründermann, Matthias Nabinger, Michael Nasse, Andrea Santamaria Garcia, Chenran Xu, and Anke-Susanne Müller — KIT, Karlsruhe, Germany

In order to achieve unprecedented control over the phase space of electron beams in linear accelerators, the laser pulse of the photoinjector can be shaped by spatial light modulators (SLMs). Here, we use a convolutional neural network (CNN) from a proof-of-principle test with a visible diode laser on the TiSa-800-nm photoinjector laser system of the Ferinfrarot Linac- und Test-Experiment (FLUTE) at KIT to compensate the effects of compression and the non-linear process of third harmonic generation on the transverse laser profile.

AKBP 14.5 Thu 16:30 CHE/0183

First two-bunch measurements using the electro-optical near-field monitor at KARA — •Micha Reissig[1], Erik Bründermann[1], Bastian Härer[1], Akira Mochihashi[1], Gudrun Niehues[1], Meghana M. Patil[2], Robert Ruprecht[1], and Anke-Susanne Müller[1,2] — [1]IBPT, KIT, Karlsruhe — [2]LAS, KIT, Karlsruhe

The Karlsruhe research accelerator KARA is an electron storage ring, which features an electro-optical near-field monitor as a tool for longitudinal bunch profile measurements. The device performs well in single-shot turn-by-turn measurements during single-bunch operation and over the years, the design has been optimized to be prepared for measurements in multi-bunch operation. The ability to work with multiple bunches and short bunch spacing is an important step to make the device suitable for more application purposes, such as a diagnostics tool for the future electron-positron collider FCC-ee. This contribution provides first tests of the monitor during two-bunch operation with minimum 2 ns bunch spacing. Challenges like crystal heating due to an increased beam current are discussed and strategies for mitigation are presented.

AKBP 14.6 Thu 16:45 CHE/0183

Analytic formulation of the zero-crossing slope for a circular button-like pickup — •Stefano Mattiello, Bernhard Erich Jürgen Scheible, and Andreas Penirschke — Technische Hochschule Mittelhessen, Friedberg, Hessen

With the emerging demand of the experimenters for future experiments with ultra-short X-ray free-electron lasers (XFEL) shots, fs precision is required for the synchronization systems even with 1pC bunches using one or more button-like pickups in the Bunch Arrival Time Monitors (BAM). Because the sensitivity of the BAM depends in particular on the slope of the bipolar signal at the zero crossing and thus, also on the bunch charge, a precise theoretical prediction of the slope is a challenging and fundamental task. In this contribution the theoretical foundations of the pickup signal are presented in a systematic way, and we focus on a button-like pickup with circular active surface, that is the standard choice in the past. We present an exact general estimation of the zero-crossing slope and then discuss the results for ultra-short bunches. The comparison to the long-bunch case allows to achieve a deeper understanding of the features of these limiting cases as well as of the intermediate region.

AKBP 14.7 Thu 17:00 CHE/0183

Evaluation of a terahertz camera system for imaging, tomographic and diagnostic measurements at KARA — •André Schmidt[1], Stefan Funkner[1], Gudrun Niehues[1], Erik Bründermann[1], and Anke-Susanne Müller[1,2] — [1]IBPT, KIT, Karlsruhe — [2]LAS, KIT, Karlsruhe

With a short bunch operation mode, the KIT electron storage ring KARA (Karlsruhe Research Accelerator) features the creation of the so-called microbunching instability, which emits bright bursts of THz radiation.

The creation of an instability provides the opportunity to study complex beams dynamics by the investigation of properties from the emitted radiation. Furthermore, the emission of bright THz radiation bears the potential for many research applications in photon science.

In this contribution, we present an evaluation of a microbolometer-based THz-camera system, which is able to operate at 50 frames/s. In this regard, first results from tomographic measurements with a standalone THz illumination source and results from diagnostic beam measurements during the short bunch operation mode at KARA are shown.