AKBP 18: Beam Dynamics II

Time: Thursday 17:30–18:45 Location: CHE/0184

AKBP 18.1 Thu 17:30 CHE/0184

beam dynamics simulation and optimization of an electron beam for magnetic bunch compressor commissioning at PITZ — •Ekkachai Kongmon, Prach Boonpornprasert, Xiangkun Li, Mikhail Krasilnikov, Frank Stephan, Namra Aftab, Dima Dmytriiev, Grygorii Vashchenko, Georgi Georgiev, Christopher Richard, Anne Oppelt, and Matthias Gross — Deutsches Elektronen-Synchrotron DESY, Platanenallee 6, 15738, Zeuthen, Germany

A THz free electron laser (FEL) prototype has been developed at the Photo Injector Test Facility at DESY in Zeuthen (PITZ) for obtaining high intensity radiation for THz-pump-X-ray-probe experiments at the European XFEL. In this development, a magnetic chicane was recently installed to enhance the THz FEL performance. The aim of this study was to investigate the beam dynamics in the chicane for finding the optimum machine parameters for an electron beam transportation in the experiment. The simulation was performed via ASTRA software using a 3-dimensional magnetic field of the chicane simulated with CST-EM Studio. Furthermore, the influences of the Coherent Synchrotron Radiation (CSR) on the electron beam were studied by using the OCELOT code. The simulated results indicate the possibility of obtaining on-axis trajectory and zero-momentum dispersion of the compressed beam. The commissioning results are also reported in this presentation.

AKBP 18.2 Thu 17:45 CHE/0184

Measurement of emittance and spatial coherence for low intensity electron beams — •Benat Alberdi-Esuain — Helmholtz-Zentrum Berlin, 12489 Berlin — Humboldt-Universität zu Berlin, 12489 Berlin

The SRF-Photoinjector is a superconducting linear electron accelerator currently being commissioned in Helmholtz-Zentrum Berlin. It is able to provide a very broad range of beam parameters, which enables applications of the injector that go beyond its original operation purpose as an ERL technology demonstrator. The ultra-short bunch length, high repetition rate and low achievable emittances make the SRF Photoinjector an ideal candidate for Ultrafast Electron Diffraction (UED) and direct imaging experiments with the aim of imaging biological molecules in gas or liquid solutions. The first stage of the development of UED capabilities in HZB consists of a static UED experiment to prove that the spatial resolution required for UED experiments can be achieved. To monitor the performance of the experiment the diagnostics of transverse beam parameters is necessary, which is challenging to do with traditional techniques given the small emittances and low bunch charges. In this work we present the results of the measurement of transverse normalized emittance and spatial coherence length with appropriate methods for UED experimental conditions. The experiments were carried out at the UED user facility in KAERI, in South Korea, with the goal of developing the capabilities for beam monitoring for when the SRF Photoinjector in HZB becomes operational.

AKBP 18.3 Thu 18:00 CHE/0184

Influence of the Complex Filling Patterns on the Results of the Transverse Beam Size Measurements with the Interferometric Technique — •Irma Shmidt, Ji-Gwang Hwang, Gregor Schiwietz, and Andreas Jankowiak — Helmholtz-Zentrum Berlin

The transverse size of the electron beam in a storage ring can be measured using the synchrotron radiation of a bending magnet. Due to the diffraction limit, many facilities exploit beam size monitors in the X-ray regime. On the other hand, the visible part of the emitted radiation delivers spatial information via an interference pattern after passing through a double slit. Assuming a Gaussian beam distribution the size of the beam can be easily obtained with an analytical formula. If this assumption is not fulfilled, the calculated beam shape will vary from the real distribution. This can appear for instance in case of exotic beam optics settings or complicated filling patterns, that are widely used in modern storage-ring-based light sources. Influence of the additional electron distribution with larger emittance on the measurement of the transverse size of the multi-bunch train with the usual interferometric method will be discussed in this presentation.

AKBP 18.4 Thu 18:15 CHE/0184

Investigations of TRIBs in BESSY III design lattices — •Michael Etienne Arlandoo — Helmholtz-Zentrum Berlin — Humboldt-Universität zu Berlin

At HZB's BESSY II and PTB's Metrology Light Source (MLS), resonances and islands in transverse phase space are exploited in a special operation mode usually referred to as Transverse Resonance Island Buckets (TRIBs). This mode provides a second stable orbit well separated from the main orbit and one of its applications in photon science is the ultra-fast switching of the helicity of circularly polarized light pulses. In the context of the conceptual design study of BESSY III, investigations have already started to study the feasibility of the implementation of this special optics mode in the MBA lattice candidates. Here, we present some studies, fundamental and applied, regarding the implementation of TRIBs in the context of BESSY III lattice design.

AKBP 18.5 Thu 18:30 CHE/0184

Turn-by-turn Measurements of the Energy Spread at Negative Momentum Compaction Factor at KARA — •Christian Goffing[1], Erik Bründermann[1], Michele Caselle[1], Stefan Funkner[1], Gudrun Niehues[1], Marvin-Dennis Noll[1], Meghana Patil[1], Patrick Schreiber[1], Johannes Steinmann[1], Anke-Susanne Müller[1], Giovanni Paternoster[2], Maurizio Boscardin[2], and Matteo Centis Vignali[2] — [1]KIT, Karlsruhe, Germany — [2]FBK, Trento, Italy

The Karlsruhe Research Accelerator, the storage ring KARA at KIT, allows short electron bunch operation with positive as well as negative momentum compaction factor. For both cases, the beam dynamics are studied. Using the KALYPSO (KArlsruhe Linear arraY detector for MHz rePetition rate SpectrOscopy) linear array, based on TI-LGAD, the horizontal intensity distribution of the emitted visible part of the synchrotron radiation is measured at a 5-degree port of a bending magnet on a turn-by-turn time scale. Because the measurement is located at a dispersive section, the dynamics of the energy spread can be studied by measuring the horizontal bunch profile. The acquisition rate at MHz-frequencies and the low-charge sensitivity of the line camera allow the investigation of the microbunching instability. This contribution presents the results of the bunch profile measurements performed at positive and negative momentum compaction factor.