AKBP 11: Diagnostics, Syn. radiation and FELs

Time: Wednesday 9:30–11:00 Location: MOL 213

AKBP 11.1 Wed 9:30 MOL 213

2D Analysis of Excited-Bunch Dynamics at BESSY II — •Marten Koopmans, Ji-Gwang Hwang, Andreas Jankowiak, Markus Ries, and Gregor Schiwietz — Helmholtz-Zentrum Berlin

With the VSR upgrade for the BESSY II electron-storage ring bunch resolved diagnostics are required for machine commissioning and to ensure the long-term quality and stability of operation. For bunch-length measurements a dedicated beamline equipped with a fast streak camera was set up and successfully commissioned. The beamline is also capable of direct beam-profile imaging and interferometry of the vertical beam size using the X-ray blocker bar. While optimizations are still ongoing, 2D bunch-resolved measurements with an additional transverse dimension are already possible with the streak camera.

Using this potential, we present a new method to study the properties of the "pulse picking by resonant excitation" (PPRE) bunch. Applying a statistical analysis to single shot (of a single turn) images, enables to distinguish between horizontal orbit motion and the broadening of the bunch due to the excitation. The results are compared with data from the beam position monitor system.

AKBP 11.2 Wed 9:45 MOL 213

Synchrotron radiation-based beam size measurements at KARA — •Carl Sax[1], Benjamin Kehrer[2], Marcel Schuh[2], and Anke-Susanne Müller[1,2] — [1]LAS, KIT, Karlsruhe — [2]IBPT, KIT, Karlsruhe

At synchrotron light sources it is crucial to know the size of the electron beam both for accelerator physics and applications of the synchrotron radiation. One way is to use the radiated synchrotron light to infer to the electron beam size. This contribution presents such a beam diagnostic system implemented at the Karlsruhe Research Accelerator (KARA). A python interface for epics (pyDevSup) allows to analyze and calculate the image information inside an epics IOC and transfer it via epics PV to the KARA control system. Additionally it is possible to use a double slit to provide information about the vertical beam size. This setup has been included into the KARA control system and first measurements will be presented.

AKBP 11.3 Wed 10:00 MOL 213

Eddy Current Sensor to detect the superconducting transition of the SC magnetic shielding inside the bERLinPro Photoinjector — •Jens Völker — Helmholtz Zentrum Berlin, Berlin, Deutschland

Inside the Photoinjector module for bERLinPro a superconducting (SC) magnetic shield will be installed between SRF gun cavity and SC solenoid to reduce the magnetic flux next to the cavity shielding during solenoid operation. A test setup was build up to measure the magnetic shield and the cooling efficiency of our new shield design. One element of this setup is a system to detect the superconducting transition of the Niobium plate based on an Eddy-Current Sensor (ECS). The sensor and the read out were designed and tested to observe the thermal induced changes of the ohmic resistance of copper and aluminum plates and also superconducting transition of Niobium. In this talk the ECS system will be introduced and measurement results will be shown.

AKBP 11.4 Wed 10:15 MOL 213

Developing a coherent radiation direct detection scheme for the SSMB PoP experiment — •Arnold Kruschinski[1,2], Arne Hoehl[3], Roman Klein[3], Markus Ries[1], and Jörg Feikes[1] — [1]Helmholtz-Zentrum Berlin — [2]Humboldt-Universität zu Berlin — [3]Physikalisch-Technische Bundesanstalt

The method of Steady-State Microbunching (SSMB) as proposed by Alex Chao and Daniel Ratner in 2010 can be used to generate intense coherent synchrotron radiation at a storage ring. The scheme would allow synchrotron light with brilliance similar to an FEL while enabling high repetition rates typical for a storage ring.

A proof-of-principle experiment is conducted at the MLS storage ring in Berlin, demonstrating stability of a microbunch structure over one turn in the storage ring. So far it has only been possible to detect the coherent synchrotron light at the second harmonic of the laser wavelength. This is because the laser pulse used to imprint a microbunch structure onto the electron beam saturates the detectors, blinding them for the detection of the coherent pulse. A Master's project now aims to also enable a first harmonic detection scheme where Pockels cells are to be used for temporal isolation of the coherent signal appearing 160 ns after the laser pulse.

AKBP 11.5 Wed 10:30 MOL 213

Numerical simulation of a superradiant THz source at the PITZ facility — •Natthawut Chaisueb[1,2], Sakhorn Rimjaem[1], and Mikhail Krasilnikov[3] — [1]Plasma and Beam Physics Research Facility (PBP), Department of Physics and Materials Science, Faculty of Science, Chiang Mai University, Chiang Mai, Thailand — [2]Doctor of Philosophy Program in Physics (International Program), Department of Physics and Materials Science, Faculty of Science, Chiang Mai University, Chiang Mai, Thailand — [3]DESY, Zeuthen, Germany

An accelerator-based THz source is under development at the Photo Injector Test Facility at DESY in Zeuthen (PITZ). The PITZ accelerator consists of a photocathode RF electron gun enclosed by solenoid magnets, a booster cavity (cut disk structure, CDS) for further acceleration, and several precise instruments for electron beam diagnostics. The facility can produce high brightness electron beams with small emittance and currently plans to develop a tunable high-power THz SASE FEL source for supporting THz-pump, X-ray probe experiments at the European XFEL. An LCLS-I undulator, a magnetic chicane bunch compressor, and THz pulse diagnostics will be installed downstream the current setup of the PITZ beamline. Additionally to the SASE FEL, a possibility to generate THz undulator radiation from short electron bunches is under investigations. Numerical simulations of the superradiant THz radiation by using sub-picosecond electron bunches from the PITZ accelerator are presented and discussed in this contribution.

AKBP 11.6 Wed 10:45 MOL 213

Studies on seeding of THz SASE FEL by photocathode laser pulse modulation for PITZ — •Georgi Georgiev[1], Mikhail Krasilnikov[1], and Wolfgang Hillert[2] — [1]Deutsches Elektronen-Synchrotron DESY, 15738 Zeuthen, Germany — [2]University of Hamburg, 22761 Hamburg, Germany

A THz SASE FEL is investigated at the Photo Injector Test Facility at DESY in Zeuthen (PITZ) as a THz radiation source, that is proposed for pump-probe experiments at the EXFEL. Proof-of-principle experiments are considered with LCLS-I undulators, to be installed in the tunnel annex. Start to end simulations point to FEL saturation from shot noise being reached at about the lenght of the undulator with approximately 0.5 mJ THz pulse energy at 100 μm center wavelenght. To further improve the pulse energy, saturation lenght and stability of SASE, several seeding methods are considered. A temporal intensity modulation of the photocathode laser pulse is planned as one of these methods. Beam dynamics simulations carried on ASTRA have been performed to study the longitudinal modulation of the electron beam from the PITZ photo injector and results will be presented.