HK 24: Beschleunigerphysik V (Strahldiagnose I)

Zeit: Montag 16:45–19:00 Raum: WIL-C205

HK 24.1 Mo 16:45 WIL-C205

The impact of linear space charge on the tomographic reconstruction at PITZ — •Georgios Kourkafas[1], Mikhail Krasilnikov[1], Dmitriy Malyutin[1], Barbara Marchetti[1], Frank Stephan[1], and Galina Asova[2] — [1]DESY, 15738 Zeuthen, Germany — [2]INRNE-BAS, 1784 Sofia, Bulgaria

The Photo Injector Test facility at DESY, Zeuthen site (PITZ) focuses on testing, characterizing and optimizing high brightness electron sources for free electron lasers. Among various diagnostic tools installed at PITZ, the tomography module is used to reconstruct the transverse phase space distribution of the electron beam by capturing its projections while rotating in the phase space. This diagnostic technique can resolve the two transverse planes simultaneously with an improved resolution for pulses of low charge or in the future even for individual bunches within a bunch train.

The low emittance, high charge density and moderate energy of the electron beam at PITZ contribute to significant space-charge forces. The conducted study aims to investigate how the phase space rotations and thus the reconstruction result are affected when considering the linear space-charge effect along the tomography lattice. The beam dynamics simulations were done using the V-Code tool.

HK 24.2 Mo 17:00 WIL-C205

HEDA2 resolution limitation for the longitudinal phase space measurements at PITZ — •Dmitriy Malyutin, Mikhail Krasilnikov, and Frank Stephan — DESY, Zeuthen, Germany

The second High Energy Dispersive Arm (HEDA2) was installed in the PITZ beamline in the year 2011 and the first commissioning was done in the summer 2012. The main goals of this dispersive section are the high resolution momentum measurements up to 40 MeV/c, the longitudinal phase space measurements and the transverse slice emittance measurements. The limits of the momentum and time resolutions of the section are estimated and discussed in the talk. Simulations of the momentum measurement are presented.

HK 24.3 Mo 17:15 WIL-C205

Studies for the determination of the beam energy with Compton backscattered photons — •Cheng Chang, Vitali Judin, Erhard Huttel, Marcel Schuh, Max Streichert, Alexander Papash, Michael J. Nasse, Edmund Hertle, and Anke-Susanne Müller — Karlsruhe Institute of Technology

The method of resonant depolarization which is now used for determination of beam energy (~2.5GeV) at ANKA becomes cumbersome for lower beam energies. As an alternative method, a compact Compton backscattering setup with a storage cavity of laser and appropriate detection system is proposed. In the presentation, the preliminary design of the setup and simulation results are present.

HK 24.4 Mo 17:30 WIL-C205

Design of planar pick-ups for beam position monitor in the bunch compressor at FLASH and XFEL — •Aleksandar Angelovski[1], Andreas Penirschke[1], Cezary Sydlo[2], Uros Mavric[2], Christopher Gerth[2], and Rolf Jakoby[1] — [1]Institut für Mikrowellentechnik und Photonik, TU Darmstadt, Germany — [2]DESY, Hamburg, Germany

For obtaining ultra short electron bunches at the Free Electron Laser at DESY (FLASH) the beam is compressed in magnetic chicanes. During the compression process the precise knowledge of the energy of the bunches is essential for the longitudinal dynamics control. The measurement of the beam position in the chicane allows for non-destructive measurements of the energy. For that purpose, two stripline pick-ups perpendicular to the beam direction are installed in the chicane at FLASH as a part of the Beam Position Monitor. The recent upgrade in the electronics as well as the increased aperture and length of the beam pipe (for the European XFEL) requires the design of new pick-ups which will fulfill the new demands. Namely, the pick-ups should have maximum signal at 3 GHz with minimum reflections. In this talk, we will present the design of planar transmission line pick-ups for FLASH and XFEL. The planar design of the pick-ups can provide for a proper impedance matching to the subsequent electronics as well as sufficient mechanical stability along the aperture when using alumina substrate. A prototype of the pick-ups was build and installed in a non-hermetic body. The measured S parameters are compared to the simulation.

HK 24.5 Mo 17:45 WIL-C205

Test of a Bunch Shape Monitor for high current LINACs at GSI — •Benjamin Zwicker[1], Peter Forck[1], Oliver Kester[1,2], and Piotr Kowina[1] — [1]GSI Helmholtzzentrum für Schwerionenforschung, Darmstadt, Germany — [2]Institut für Angewandte Physik, Goethe Universität Frankfurt, Germany

Due to the efficient acceleration foreseen at the Proton-LINAC for FAIR, the longitudinal beam dynamics plays a key role for the optimization of the beam parameters. To achieve the highest current operation foreseen for the FAIR facility, a dedicated instrument for bunch shape measurement is required.

At the heavy ion LINAC at GSI, a novel scheme of non-invasive Bunch Shape Monitor has been tested. Caused by the beam impact on the residual gas, secondary electrons are liberated. These electrons are accelerated by an electrostatic field, transported through a sophisticated electrostatic energy analyzer and an rf-deflector, acting as a time-to-space converter. Finally a MCP detects the electron distribution. This Bunch Shape Monitor is able to obtain longitudinal profiles down to 400 ps with a resolution of 50 ps, corresponding to 2° of the acceleration frequency, and is able to recognize bunch distortion up to 1300 ps. Systematic parameter studies for the device were performed to demonstrate the applicability and to determine the achievable resolution.

HK 24.6 Mo 18:00 WIL-C205

System Design for the FAIR Proton LINAC BPMs — •Peter Forck[1], Mohammed Almalki[1], Gianluigi Clemente[1], Lars Groening[1], Wolfgang Kaufmann[1], Piotr Kowina[1], Claire Simon[2], and Wolfgang Ackermann[3] — [1]GSI — [2]CEA/ Saclay, IRFU — [3]TU Darmstadt, TEMF

The planned Proton LINAC at the FAIR facility will provide a beam current of 70 mA accelerated to 70 MeV by novel CH-type DTLs. Four-fold button Beam Position Monitor (BPM) will be installed at 14 locations along the LINAC. The specification for position measurement is 0.1 mm spatial resolution and for time-of-flight beam velocity determination the accuracy must be 8.5 ps corresponding to 1 degree with respect to the 325 MHz acceleration frequency. Finite element and finite integration technique calculations by CST Particle Studio for non-relativistic velocities were performed to determine the signal characteristic in time- and frequency domain. Most of these BPMs are mounted only about 40 mm upstream of the CH cavities and the BPM signal strength caused by the cavity residual rf-power was estimated. The technical layout of the BPM system is discussed.

HK 24.7 Mo 18:15 WIL-C205

Beam loss studies at the ANKA storage ring — •Edmund Hertle, Nigel Smale, Tobias Götsch, Anke-Susanne Müller, Frans Wegh, and Kai Worms — Karlsruher Institut für Technologie

The real time study and the post mortem analysis of beam loss are powerful tools for the optimization of a storage ring's performance. It allows, for example, a fast identification of failing hardware components or can be used to improve the beam lifetime by a reduction of the losses. This needs a sophisticated beam loss monitor system with appropriate spatial and temporal resolution. This presentation gives an overview of the loss monitor system under study at the ANKA synchrotron radiation facility of the Karlsruhe Institute of Technology.

HK 24.8 Mo 18:30 WIL-C205

Beam Studies with a LNB Detector System — •Joachim Schwarzkopf, Vitali Judin, and Anke-Susanne Müller — Karlsruhe Institut für Technologie

At ANKA, the synchrotron of the KIT (Karlsruhe Institue of Technology), beam studies with a detector system better known for its use in the entertainment industry have been carried out. The system basically consists of a LNB (Low Noise Block), usually part of a satellite TV receiver. One possible application in accelerator physics is the monitoring of the bunch length. This presentation reports on beam experiments with this inexpensive detector.

HK 24.9 Mo 18:45 WIL-C205

Transversal diagnostics of low-charge electron bunches at REGAE — •Shima Bayesteh — Uni Hamburg

A small Linac is operational as an electron source for the ultra-fast relativistic electron diffraction experiment, REGAE (Relativistic Electron Gun for Atomic Exploration), at DESY. Electron bunches, few fs-short, will be used to study structural dynamics of a sample in a time scale comparable to the electron pulse length. In order to confine electrons in a small volume and avoid the space-charge effect, relativistic electrons of 2-5 MeV energy are generated via a photo-injector RF-gun. Furthermore low-charge electron bunches of sub-pico Coulomb are required to keep the beam emittance small. Apart from all these preparations the atomic evolution should be monitored in a shot-to-shot basis. Sophisticated single-shot diagnostics are essential to generate and maintain such electron-bunches. Diagnostics include charge, energy, energy spread and transversal profile measurements. A LYSO scintillator coupled to a detector forms the transversal diagnostics. High-light emission of LYSO crystal in addition to efficient collection of the scintillated light, make the transversal diagnostics very sensitive to the low-charge detection. For this reason the first coupling optics component is located as close as possible to the scintillator. A stand-alone CCD as well as a home-made ICCD can be used as detector. The flexibility of switching between two different detectors provides a wide dynamic range of sensitivity to light. In ICCD mode the detectability of charge goes down to a few electrons per pixel with a significant single-shot S/N ratio. Aside from a breakthrough in low-charge detection in transversal diagnostics, this fulfills the requirements of electron bunch diagnostics at REGAE.