AKBP 12: Beam Diagnostics I

Zeit: Donnerstag 14:00–16:00 Raum: S1/05 23

AKBP 12.1 Do 14:00 S1/05 23

Messung einer 3D-Resonanzkarte an ELSA — •Dennis Proft, Jan Schmidt, Jens-Peter Thiry und Wolfgang Hillert — Elektronen-Stretcher-Anlage ELSA, Physikalisches Institut, Universität Bonn

An der Elektronen Stretcher Anlage ELSA werden Elektronen mit einer schnellen Energierampe mit 6 GeV/s beschleunigt. Währenddessen kommt es zu dynamischen Effekten, die einen starken Einfluss auf den Arbeitspunkt haben. Zur Vermeidung von Strahlverlust ist die Wahl eines geeigneten Arbeitspunkts fernab von optischen Resonanzen essentiell.

Daher wurde ein Messverfahren zur Bestimmung aller auftretenden Resonanzen im Bereich des Standardarbeitspunktes entwickelt. Dabei werden die 3D-Arbeitspunkte präzise durch Luftquadrupole und ein LLRF System eingestellt, sowie mit hoher Genauigkeit in der Größenordnung von 10^{-5} gemessen. Die Stärke der Resonanzen wird durch ein Strahlverlust-Monitoringsystem mit Halbleiterdetektoren festgestellt.

In diesem Vortrag wird das Messverfahren sowie exemplarische Resultate vorgestellt.

AKBP 12.2 Do 14:15 S1/05 23

Characterization of BPM pickup designs for the HESR @ FAIR using simulations and numerical calculations — •Arthur Halama, Vsevolod Kamerdzhiev, Christian Böhme, and Sudharsan Srinivasan — Forschungszentrum Jülich, IKP-4

The institute of Nuclear Physics 4(IKP-4) of the Research Center Jülich (FZJ) is in charge of building and commissioning the High Energy Storage Ring (HESR) within the international Facility for Antiproton and Ion Research (FAIR) at Darmstadt. Simulations and numerical calculations were performed to characterize the initial beam position pickup design. Capacitive couplings of the electrodes and the behavior of the electrical equivalent circuit were investigated. This made room for changes to the design and performance increase. A prototype of the BPM pickup was constructed and tested on a dedicated test bench. Preliminary results will be presented. In order to gain higher signal levels and higher sensitivity, another suggested design was characterized as well and put into comparison.

AKBP 12.3 Do 14:30 S1/05 23

Design and Construction of the HESR BPM prototype wire test bench at COSY, Forschungzentrum Jülich — •Sudharsan Srinivasan, Vsevolod Kamerdzhiev, and Christian Böhme — Forschunzentrum Jülich GmbH

The Institute of Nuclear Physics 4(IKP-4), of the Research Center Jülich (FZJ), is in charge of building and commissioning the High Energy Storage Ring (HESR) within the international facility, Facility for Antiproton and Ion Research (FAIR) at Darmstadt. Beam Position Monitors (BPMs) are an essential instrument for any accelerator allowing operators to accurately monitor and control the accelerated beam. The demand for a BPM test bench will be showcased which will help to assess the design's ability to meet the system requirements. The weight is on the factors considered for the development of the initial test bench, its functional components, the metrology tests for ensuring positional measurement accuracy, and the design modifications from metrology investigations leading to the conceptual development of a new test bench.

AKBP 12.4 Do 14:45 S1/05 23

High-accuracy electron beam energy measurement at the Mainz Microtron — •Philipp Herrmann — Institut für Kernphysik, Johannes Gutenberg-Universität, Mainz

The Mainz Microtron MAMI delivers an electron beam of up to 1.6 GeV. The absolute energy is measured inside the third stage of the accelerator with an accuracy of $\delta E_{beam} = 160\,\mathrm{keV}$ independent of the beam energy, with an energy spread $\sigma_{beam} < 13\,\mathrm{keV}$ and long-term drifts of less than 1 keV when stabilized. To obtain an absolute energy measurement within $\delta E_{beam} \sim 20\,\mathrm{keV}$ uncertainty, a 42°-dipole of the beam-line leading to the spectrometer facility is used as a high-accuracy beam spectrometer. A high-precision field mapping device was developed and a dedicated beam detection system of RF cavity position monitors and YAG:Ce screens was implemented. The goal is to achieve $10\,\mu\mathrm{T}$ and $10\,\mu\mathrm{m}$ uncertainties in the field map. The electron beam deflection is expected to be measured with $\delta\theta/\theta < 10^{-5}$. The overlay of the magnetic field map and the actual beam position during calibration is achieved by a collinear laser system. With the calibrated beam the absolute momentum calibration of the three high-resolution spectrometers at MAMI can be improved. Key factors will be the setup and automation of the field mapping with the desired precision, combined with the global positions of beam and field.

AKBP 12.5 Do 15:00 S1/05 23

The Transverse Deflecting Cavity for Beam Diagnostics at bERLinPro — •Georgios Kourkafas[1], Hans-Walter Glock[1], Andreas Jankowiak[1], Thorsten Kamps[1], Dmitriy Malyutin[1], Axel Neumann[1], Jens Völker[1], Alessandro Ferrarotto[2], and Thomas Weis[2] — [1]Helmholtz-Zentrum Berlin für Materialien und Energie GmbH, 12489 Berlin, Germany — [2]Technische Universität Dortmund, 44227 Dortmund, Germany

The bERLinPro facility at Helmholtz-Zentrum in Berlin (HZB) aims to develop an Energy-Recovery Linac capable of providing the demanding beam requirements of future light sources. A crucial part of the machine's overall performance is determined already at the beam source, namely a superconducting RF photoinjector operated in continuous-wave mode. Therefore, considerable effort is given in the development, optimization and characterization of such an advanced system by the GunLab group at HZB.

As part of the proposed beam diagnostics, a transverse deflecting cavity operating in both transverse polarizations of the TM110 mode is foreseen for the measurement of the longitudinal phase space and the transverse slice emittance. An improved cavity design is presented and its effect on the beam dynamics and measurements is simulated.

AKBP 12.6 Do 15:15 S1/05 23

Development of a diamond detector for temporal profile measurements of intense, short ion bunches within the LIGHT project — Diana Jahn[1], •Michael Träger[2], and Mladen Kis[2] for the LIGHT-Collaboration — [1]Technische Universität Darmstadt — [2]GSI Helmholtzzentrum für Schwerionenforschung

In the context of the Laser Ion Generation, Handling and Transport (LIGHT) research project at GSI, laser-driven ion acceleration and beam shaping are explored, combining a target normal sheath acceleration (TNSA) proton source with conventional accelerator technology. In the LIGHT experimental campaign in 2015, protons were accelerated via the TNSA mechanism, an energy of 7.8 MeV was selected and collimated with a pulsed solenoid and injected into a rf cavity. Through phase focusing, temporally compressed proton bunches were generated to a pulse length of <240 ps (FWHM) with up to 5×10^8 particles in a single bunch at a distance of 6 m from the source. An ultrafast diamond detector has been specially developed to measure the temporal profile of these bunches and will be presented.

AKBP 12.7 Do 15:30 S1/05 23

Simultaneous detection of longitudinal and transverse bunch signals at ANKA — •Benjamin Kehrer[1], Edmund Blomley[1], Miriam Brosi[1], Erik Bründermann[1], Nicole Hiller[1], Anke-Susanne Müller[1], Paul Schütze[2], Johannes Steinmann[1], Manuel Schedler[1], Marcel Schuh[1], Patrik Schönfeldt[1], and Nigel Smale[1] — [1]Karlsruhe Institute of Technology, Kaiserstraße 12, 76131 Karlsruhe — [2]Deutsches Elektronen-Synchrotron DESY Notkestraße 85, 22607 Hamburg

The ANKA storage ring offers different operation modes including the short-bunch mode with bunch lengths tuned down to a few picoseconds. This can lead to the occurrence of microwave instabilities coupled to the emission of coherent synchrotron radiation (CSR) in the so-called 'bursts'. To study this CSR instability we use several turn-by-turn enabled detector systems to synchronously measure both the THz signal as well as bunch profiles. The different detectors are placed at different locations around the storage ring. Here we discuss the experimental setup and calibration of the various systems' synchronisation.

AKBP 12.8 Do 15:45 S1/05 23

Rose, a rotating System for 4D Emittance measurements — •Michael Maier, Lars Groening, Chen Xiao, Sascha Mickat, Xiaonan Du, Gerhard Peter, and Vormann Hartmut — GSI

Helmholtzzentrum für Schwerionenforschung GmbH

A ROtating System for Emittance measurements ROSE, to measure the full 4 dimensional transverse beam matrix of a heavy ion beam has been developed and commissioned. Different heavy ion beams behind the HLI at GSI have been used in two commissioning beam times. All technical aspects of Rose have been tested, Rose has been benchmarked against existing emittance scanners for horizontal and vertical projections and the method, hard- and software to measure the 4D beam matrix has been upgraded, refined and successfully commissioned. The inter plane correlations of the HLI beam have been measured, yet as no significant initial correlations were found to be present, controlled coupling of the beam by using a skew triplet has been applied and confirmed with Rose. The next step is to use ROSE to measure and remove the known inter plane correlations of a Uranium beam before SIS18 injection.