AKBP 3: Instrumentation and Beam Diagnostics I

Time: Monday 15:00–16:45 Location: E 020

AKBP 3.1 Mon 15:00 E 020

Analyse eines Protonenstrahls mittels Kamerasystem — •Alina Dittwald, Andrea Denker, Jürgen Bundesmann, Georgios Kourkafas und Timo Fanselow — Helmholtz-Zentrum Berlin, Berlin, Deutschland

Seit mehr als 25 Jahren werden am HZB-Zyklotron in Kollaboration mit der Charité - Universitätsmedizin Berlin Protonen zur Behandlung von Augentumoren eingesetzt. Zudem gibt es ein Forschungs- und Entwicklungsprogramm für verschiedene Bereiche wie die Strahlendosimetrie, Medizinphysik, Strahlenhärtetests und PIXE. Für jede dieser Anwendungen ist eine Visualisierung der Strahlform, der Strahlposition und der Intensitätsverteilung des Strahls erforderlich. Hierfür wurde ein sehr leichtes und kompaktes Kamerasystem entwickelt, das zur Visualisierung und Auswertung des Protonenstrahls dient. Diese Eigenschaften und die Datenauswertung der Bilder werden vorgestellt.

AKBP 3.2 Mon 15:15 E 020

Commissioning and Experiments with a Compact Transverse Deflecting System at FLUTE — •Matthias Nabinger[1], Michael J. Nasse[1], Jens Schäfer[1], Erik Bründermann[1], Anton Malygin[1], Katharina Mayer[1], Robert Ruprecht[1], Thiemo Schmelzer[1], Nigel Smale[1], Anke-Susanne Müller[1], Micha Dehler[2], Rasmus Ischebeck[2], Matthias Moser[2], Volker Schlott[2], Thomas Feurer[3], Mozghan Hayati[3], Zoltan Ollmann[3], Sergei Glukhov[4], and Oliver Boine-Frankenheim[4] — [1]KIT, Karlsruhe, Deutschland — [2]PSI, Villigen, Schweiz — [3]Universität Bern, Bern, Schweiz — [4]TU Darmstadt, Darmstadt, Deutschland

A Compact Transverse Deflecting System (Compact-TDS) designed for longitudinal electron bunch diagnostics in the femtosecond regime is presently undergoing commissioning at the Karlsruhe Institute of Technology (KIT). This technique, based on THz streaking with a Split-Ring Resonator (SRR), demands a high level of electron beam controllability and stability at the micrometer scale. To meet these requirements, the Ferninfrarot Linac- Und Test-Experiment (FLUTE) has undergone an upgrade in 2023, incorporating a new RF system equipped with a state-of-the-art modulator, RF photoinjector and solenoid magnet.

In this contribution, we present first experiments conducted with the Compact-TDS at FLUTE, utilizing the enhanced RF setup.

AKBP 3.3 Mon 15:30 E 020

Development of a 6 GHz Cavity BPM for the Multi-Turn ERL Operation at the S-DALINAC* — •Manuel Dutine, Michaela Arnold, Ruben Grewe, Lars Jürgensen, Norbert Pietralla, Felix Schliessmann, and Manuel Steinhorst — Institut für Kernphysik, TU Darmstadt

The S-DALINAC is a thrice-recirculating electron accelerator operating in cw-mode at a frequency of 3 GHz. Due to the implementation of a path-length adjustment system capable of a 360° phase shift, it is possible to operate the accelerator as an Energy-Recovery LINAC. The multi-turn ERL operation has been demonstrated in 2021. While operating the accelerator in this mode, there are two sets of bunches, the still-to-be accelerated and the already decelerated beam, with a longitudinal phase difference close to 180 degrees and significantly deviant transversal coordinates in the same beamline. A 6 GHz resonant cavity Beam Position Monitor (cBPM) has been developed in order to measure the beam position of both, the accelerated and the decelerated beam simultaneously in the same beamline. First measurement results will be shown.

*Work supported by DFG (GRK 2128), BMBF (05H21RDRB1), the State of Hesse within the Research Cluster ELEMENTS (Project ID 500/10.006) and the LOEWE Research Group Nuclear Photonics.

AKBP 3.4 Mon 15:45 E 020

Distributed Image Analysis from Digital Cameras at ELSA using the RabbitMQ Message Broker — •Michael Switka, Klaus Desch, Thomas Gereons, Dennis Proft, and Axel Spreitzer — Physikalisches Institut, Universität Bonn

For digital camera based imaging and image analysis a distributed data processing approach was implemented at the ELSA facility. We utilize the RabbitMQ message broker to share the high data throughput from image acquisition, processing, analysis, display and storage between different work stations to achieve an optimum efficiency of the involved hardware. Calibration of beam profile monitors using OpenCV machine vision algorithms allow us to perform qualitative beam photometry measurements. We describe the features and experience gained with the imaging system and present the architecture and applications, such as the programming and web interfaces for machine operators and developers.

AKBP 3.5 Mon 16:00 E 020

Investigation of Ion Trapping and Beam-Induced Fluorescence at the Electron Cooler Test-Bench at HIM. — •Thomas Beiser — Helmholtz-Institut Mainz, Germany

Beam-current dependent and wavelength-resolved studies of the beam-induced fluorescence at the electron cooler test-bench recorded with a low-noise, cooled sCMOS-camera, will be presented. A high-voltage switch was utilized for beam interruptions, counteracting ion trapping.

AKBP 3.6 Mon 16:15 E 020

Investigation Of Plasma Stability Of The Prototype Plasma Lens For Optical Matching At The ILC e+ Source — •Niclas Hamann[1,2], Manuel Formela[1,2], Gregor Loisch[2], Gudrid Moortgat-Pick[1,2], Kai Ludwig[2], and Jens Osterhoff[2] — [1]Uni Hamburg — [2]DESY Hamburg

The quest for novel technologies in the ever-evolving landscape of scientific exploration has led to the investigation of plasma lensing as a potential solution for optical matching devices at the International Linear Collider (ILC) positron source. This research becomes increasingly significant as the need for higher data output demands innovative concepts to increase positron yield and therefore luminosity. Our initial experiments revealed instabilities within the plasma. This talk will delve into these instabilities, explore their potential causes and the challenges they would pose. We'll discuss strategies for stabilizing the plasma to enhance the development of an efficient optical matching device. Overcoming these challenges is pivotal for a future application of plasma lenses as an integral part of a high performance ILC positron source.

AKBP 3.7 Mon 16:30 E 020

Reinforcement Learning Techniques for Injection Control at the Cooler Synchrotron COSY — •Awal Awal[1,2], Jan Hetzel[2], and Jörg Pretz[1,3] — [1]RWTH Aachen University — [2]GSI Helmholtzzentrum für Schwerionenforschung — [3]Forschungszentrum Jülich

Machine learning, particularly Reinforcement Learning (RL), holds significant promise in enhancing operations and optimisation within particle accelerator facilities. This study explores the application of RL for optimising particle accelerators, with a focus on the injection process at the COSY facility in Jülich, Germany. We propose a general formulation for RL problem and utilise it to optimise the injection into the synchrotron by manipulating four quadrupoles and seven steerers in the last section of the Injection Beam Line IBL.

Our methodology employs a soft actor-critic agent with dense neural networks, adapted for continuous action spaces, and training it with domain randomization to handle a variety of complex environmental dynamics. This results in a robust policy capable of generalizing to new, unseen environments. The integration of modernized viewer and control systems enabled direct analysis and automated adjustments of the beam cross section based on the RL agent's decisions. We extend this study with an in-depth analysis of the different components of the proposed RL framework and their significance. The successful implementation of this technique demonstrates a proof of concept in automating and optimizing accelerator operations, presenting a leap towards more efficient and consistent particle accelerator performance.