# AKBP 8: Diagnostics, Control, Instrumentation

Time: Thursday 15:00–17:45 Location: MOL 213

AKBP 8.1 Thu 15:00 MOL 213

**Electrostatic deflector development for JEDI** — •Kirill Grigoryev — on behalf of the JEDI collaboration — III. Physikalisches Institut B, RWTH Aachen

The direct measurement of the proton or deuteron Electric Dipole Moment (EDM) has never been performed before. These experiments can be done at storage rings. As a starting point for a first measurement, the pure magnetic storage ring COSY at Forschungszentrum Jülich can be used. A dedicated storage ring will require pure electric or combined electric and magnetic deflection elements.

For testing the electrode material, shape, surface treatment and high voltage tests, a new laboratory was set up at RWTH Aachen. The experimental setup and results of the tests will be presented.

AKBP 8.2 Thu 15:15 MOL 213

**Model of statistical errors in the search for the deuteron EDM in the storage ring** — •Aleksandr Aksentev — Forschugszentrum Jülich, Jülich, Germany

In this work we investigate the standard error of the spin precession frequency estimate in an experiment for the search for the electric dipole moment (EDM) of the deuteron using the polarimeter. The basic principle of polarimetry is the scattering of a polarized beam on a carbon target. Since the number of particles in one fill is limited, we must maximize the utility of the beam. This raises the question of sampling efficiency, as the signal, being an oscillating function, varies in informational content. To address it, we define a numerical measurement model, and compare two sampling strategies (uniform and frequency-modulated) in terms of beam-use efficiency. The upshot is the formulation of the conditions necessary for the effective use of the modulated sampling strategy, and the evaluation of its advantage over the uniform strategy. The simulation results are also used to compare two competing analytical models for the standard error of the frequency estimate.

AKBP 8.3 Thu 15:30 MOL 213

**An Active Spin Tune Feedback System for the Cooler Synchrotron (COSY)** — •Nils Hempelmann — Institut für Kernphysik, Forschungszentrum Jülich

The Jülich Electric Dipole Moment Investigation (JEDI) Collaboration works on a measurement of the electric dipole moment (EDM) of charged hadrons using a storage ring. Such a dipole moment would violate CP symmetry, providing a test for physics beyond the Standard Model. To measure the EDM in a magnetic storage ring, the precession of the spin in the ring has to be kept in phase with an RF Wien Filter that manipulates the spin.

In fall 2015 an active feedback system that meets this requirement was successfully tested at COSY. The system works by adjusting the accelerator frequency, which changes the beam velocity and therefore the rate of spin precession. Data from the polarimeter EDDA are analyzed over a period of about one second to determine the relative phase between the spin precession and the external frequency, which is used to calculate the necessary correction.

In absence of a Wien filter an RF solenoid coil was used as a spin manipluator in the tests.

The test of the feedback system proofs that the method is suitable for a proof of principle experiment for EDM measurements at COSY.

AKBP 8.4 Thu 15:45 MOL 213

**Acoustic diagnostic of the RF-gun at PITZ** — •Andrea Heilrath, Igor Isaev, Mikhail Krasilnikov, Mario Pohl, and Frank Stephan — Deutsches Elektronen Synchrotron DESY, Platanenallee 6, 15738 Zeuthen, Germany

The Photo Injector Test facility at DESY in Zeuthen (PITZ) develops and optimizes high brightness RF photoinjectors for modern Free Electron Lasers. An L-band 1,6-cell normal conducting RF-gun is operated at high peak (up to 7 MW) and average (up to ˜50 kW) power levels. This causes a significant pulse heating of the copper gun cavity. Effective RF conditioning of such cavities is one of the important tasks of the photoinjector optimization. An interlock (IL) system serves to prevent severe damages during gun conditioning and operation. Recently several piezo sensors were installed around the RF-gun system (fixed at the waveguides and at some distance) additionally to the existing IL sensors. The signals from these sensors including their spectra were analyzed and correlated with different parameters of the standard gun operation as well as with various IL events. First results of the analysis will be presented, further improvements in the proposed diagnostics will be discussed.

AKBP 8.5 Thu 16:00 MOL 213

**Entwicklung eines Faraday-Cup für den European XFEL** — •Felix Riemer[1,2] und Martin Sachwitz[1] — [1]Deutsches Elektronen-Synchrotron DESY — [2]Humboldt-Universität zu Berlin

Ein Faraday-Cup ist ein Messgerät, was die Ladung eines Teilchenstrahls messen kann. Das Prinzip besteht darin, alle Ladungsträger und geladenen Sekundärteilchen vollständig im Faraday-Cup abzubremsen und den abfallenden Strom zu messen. Im Injektor des European XFEL in Hamburg sind momentan mehrere, provisorische Faraday-Cups aus Kupfer im Einsatz. Mit der Monte-Carlo Simulation FLUKA wurde berechnet, dass nur ca. 85% der Teilchen vom Messgerät detektiert werden; ein Großteil wird an der Oberfläche reflektiert. Ein mehrschichtiger Aufbau aus verschiedenen Materialien soll die Präzision deutlich erhöhen. Zugleich soll aber auf eine Optimierung der Baugröße geachtet werden, weil im Beschleuniger nicht viel Bauraum zur Verfügung steht. Das neu entwickelte Konzept weißt nach Simulation mit FLUKA eine deutlich höhere Genauigkeit auf, mehr als 99,9% der einfallenden Ladung wird vom Faraday-Cup detektiert.

AKBP 8.6 Thu 16:15 MOL 213

**Model driven SAXS reconstruction** — •Malte Zacharias — HZDR, Dresden, Deutschland — TU Dresden, Dresden, Deutschland

Laser-generated solid density plasmas can be used to produce highly energetic electrons and ions. Diagnosing properties within those plasmas at nm length scales and down to fs time scales plays a crucial role in understanding the involved processes. This has only recently become feasible through the advent of X-Ray Free Electron Lasers (XFELs). XFELs now make experimental techniques like Small Angle X-Ray Scattering (SAXS) applicable to solid density plasmas. As a straight-forward inverse Fourier transform of the SAXS signal is impossible due to lack of phase information, other approaches have to be used. Reconstruction methods like iterative phase retrieval algorithms are an option but in our case do a poor job without strong real space constraints. Our approach is to use parameterized models of the charge density distribution and to adjust their parameters to best fit the resulting simulated SAXS signal to the experimental data. Thus we obtain model information about experimental data in form of the fit parameters. Combining a model with an iterative reconstruction algorithm can be used to automatize the fitting. We present results where this model approach has been applied to a SAXS experiment with structured metal targets that had a well known periodic grating on the surface.

**15 min. break**

AKBP 8.7 Thu 16:45 MOL 213

**Double Slit Interferometer for Transverse Beam Size Measurements at BESSY II** — •Marten Koopmans, Paul Goslawski, Ji-Gwang Hwang, Markus Ries, Martin Ruprecht, and Andreas Schälicke — Helmholtz-Zentrum Berlin, Berlin

The VSR upgrade for the BESSY II storage ring demands additional beam diagnostics for machine commissioning and development. Currently, transverse beam size measurements are done with pinhole monitor systems. However, this system cannot provide bunch resolved measurements. Alternative methods to measure the transverse beam size using synchrotron radiation in the visible spectrum are interferometric techniques, which could also be upgraded to bunch resolved systems. For that purpose a double slit interferometer has been designed and constructed. Commissioning of the system has started and experimental results are discussed and compared with the existing pinhole system.

AKBP 8.8 Thu 17:00 MOL 213

**Die digitale Hochfrequenzregelung des S-DALINAC - Herausforderungen des ERL-Betriebs*** — •Manuel Steinhorst[1], Christoph Burandt[1], Michaela Arnold[1], Sebastian Orth[2],

Uwe Bonnes[1], Thorsten Kürzeder[1] und Norbert Pietralla[1] — [1]IKP, TU Darmstadt, Deutschland — [2]TEMF, TU Darmstadt, Deutschland

Der supraleitende rezirkulierende Elektronen-Linearbeschleuniger S-DALINAC stellt das zentrale Forschungsgroßgerät des Instituts für Kernphysik der TU Darmstadt dar. In den Jahren 2015/2016 wurde eine dritte Rezirkulation eingebaut. Die neue Strahlführung bietet neben einer gesteigerten Maximalenergie die Möglichkeit den S-DALINAC als Energy Recovery Linac (ERL) zu betreiben. Dies stellt neue Anforderungen an die bestehende Hochfrequenzregelung. Für den Normalbetrieb der supraleitenden Beschleunigungsstrukturen wird hierfür seit 2010 erfolgreich ein digitales System eingesetzt. Dieses war jedoch nicht für einen ERL Betrieb konzipiert und optimiert worden. Dieser Vortrag stellt die digitale Hochfrequenzregelung des S-DALINAC vor und diskutiert die erwarteten Herausforderungen des ERL-Betriebs. *Gefördert durch die DFG im Rahmen von GRK 2128.

AKBP 8.9 Thu 17:15 MOL 213

**Research and Development of Diamond Based Beam Monitoring and Diagnostics Systems at the S-DALINAC*** — •Adrian Rost[1], Tetyana Galatyuk[1,2], and Jerzy Pietraszko[2] — [1]Institut für Kernphysik, Technische Universität Darmstadt, Germany — [2]GSI Helmholtzzentrum für Schwerinonenforschung, Darmstadt, Germany

For future experiments with the HADES and CBM detectors at FAIR in Darmstadt, a radiation hard and fast beam detector is required. The beam detector has to perform precise T0 measurements ($\sigma_{T0} < 50\,\mathrm{ps}$) and should also offer beam monitoring capabilities. These tasks can be fulfilled by utilizing single-crystal Chemical Vapor Deposition (scCVD) diamond based detectors. For research and development of such detectors, a test set-up will be installed at the Superconducting Darmstadt Electron Linear Accelerator (S-DALINAC) of TU Darmstadt.

A read-out system for a beam monitoring and diagnostics system is currently under development. It is based on the already well established TRB3 platform, which can provide FPGA based signal discriminators and high precision FPGA-TDCs with on-line monitoring capabilities. In this contribution the concept and the performance of a prototype beam monitoring system will be discussed. Furthermore the preparatory work, with particular focus on the beam-line simulations, for a multipurpose beam detector test set-up at the S-DALINAC will be addressed.

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AKBP 8.10 Thu 17:30 MOL 213

**Konzeption einer Messung der Strahlausdehnung mit Hilfe eines Drahtscanners am S-DALINAC*** — •Manuel Dutine, Lars Jürgensen, Jonas Pforr, Thorsten Kürzeder und Norbert Pietralla — IKP, TU Darmstadt

Der supraleitende Elektronen-Linearbeschleuniger S-DALINAC am Institut für Kernphysik der TU Darmstadt ermöglicht Elektronenstrahlen von bis zu 130 MeV im CW-Betrieb. Diese werden an diversen Experimentierplätzen unter anderem für hochauflösende Elektronenstreuexperimente genutzt. Zur Steigerung der Energieschärfe und Verbesserung der Strahlfokussierbarkeit wurde ein Hochenergie-Scrapersystem installiert. Dieses System wirkt ebenfalls als Energiefilter kombiniert mit drei Halo-Scrapern. Um den Einfluss des Scrapersystems auf die Strahlqualität am Ort des Experiments zu überprüfen, sind Messungen der Strahlausdehnung bei verschiedenen Einstellungen der Scraper geplant. Für die vorhandene Geometrie der Streukammer wurde eine Drahtscanner-Messung entwickelt und die zu erwartenden Zählraten mittels einer GEANT4-Simulation abgeschätzt. Im Vortrag wird das Hochenergie-Scrapersystem kurz Vorgestellt und der Aufbau zur Messung der Strahlausdehnung gezeigt.

*Gefördert durch die DFG im Rahmen des GRK 2128.