AKBP 4: Diagnostics, Control and Instrumentation

Zeit: Dienstag 16:30–18:30 Raum: NW-Bau - HS4

AKBP 4.1 Di 16:30 NW-Bau - HS4

Characterization of a compact and calibratable von-Hamos X-Ray Spectrometer based on full-cylindrical HAPG mosaic crystals — •Malte Wansleben, Yves Kayser, Ina Holfelder, and Burkhard Beckhoff — Physikalisch-Technische Bundesanstalt

The further development of more complex nano-materials and thin film applications with distinct properties need an analysis independent from any reference material. A method of choice could be X-ray emission spectroscopy (XES). A reliable quantitative and moreover reference-free XES approach, however, requires calibrated instrumentation.

We would like to present a high-resolution wavelength-dispersive spectrometer for XES in the energy range of 2.3 keV to 20.0 keV. Making use of two full-cylindrical Highly Annealed Pyrolytic Graphite (HAPG) crystals as dispersive elements in a modified von-Hamos geometry a large solid angle of detection and hence high efficiency is realized. HAPG is a synthetic type of carbon which forms mosaic crystals. Although the peak reflectivity is smaller than in perfect crystals, the diffraction profile of this mosaic crystal is much wider leading to an increased integrated reflectivity. This work shows the characterization of the spectrometer including mosaicity and integrated reflectivity measurements on the HAPG optics, achievable energy resolution and relative efficiency of the device. Furthermore, the chemical speciation capability of the device is demonstrated with different binary titanium and iron compounds.

AKBP 4.2 Di 16:45 NW-Bau - HS4

Cavity Beam Position Monitor development at CLEAR(CERN) — •Johannes Nadenau for the JEDI-Collaboration — Institut für Kernphysik, Forschungszentrum Jülich — III. Physikalisches Institut B, RWTH Aachden University

At the CERN Linear Electron Accelerator for Research (CLEAR) facility component studies for existing and future machines are performed. Part of these studies are cavity Beam Position Monitor (BPM) developments. Cavity BPMs provide high accuracy position measurements. CLEAR is equiped with three BPMs which allows to measure positions on two devices and check the predicted position in the third one. In the talk the principle of measurement and first results will be discussed.

AKBP 4.3 Di 17:00 NW-Bau - HS4

Development of a Rogowski Coil Beam Position Monitor — •Kirill Grigoryev for the JEDI-Collaboration — Institut für Kernphysik, Forschungszentrum Jülich, Germany

Electric Dipole Moments (EDMs) violate parity and time reversal symmetries. Assuming the CPT-theorem, this leads to CP violation, which is needed to explain the matter over antimatter dominance in the Universe. Thus, a non-zero EDM is a hint to new physics beyond the Standard Model. The JEDI collaboration (Jülich Electric Dipole moment Investigations) has started investigations of a direct measurement of EDMs of protons and deuterons at a storage ring COSY (COoler SYnchrotron). To measure the tiny EDM signal with high precision, systematic effects and the beam orbit have to be controlled to the same level. Therefore, a new Beam Position Monitor (BPM) based on magnetic pick-up coils has been developed. The main advantage of the coil design compared to electric pick-up BPMs is the high response to bunched beam frequency signal and the coil compactness. The Rogowski BPM measures the beam position in horizontal and vertical directions. Tests in laboratory as well as measurements at the COSY accelerator will be presented.

AKBP 4.4 Di 17:15 NW-Bau - HS4

Characterization of a dispersion free bending magnet of the S-DALINAC Polarized-electron Injector* — •René Heber, Maximilian Herbert, Joachim Enders, Yuliya Fritzsche, and Vincent Wende — Institut für Kernphysik, Technische Universität Darmstadt, Schlossgartenstraße 9, 64289 Darmstadt

The S-DALINAC Polarized-electron Injector SPIn creates polarized electron beams of 100 keV. An upgrade is planned to increase the electron energy to 200 keV. A dispersion-free bending magnet, a so-called alpha-magnet, is currently used to transfer the electron beam from the vertical to the horizontal beamline. Subject of this contribution are measurements to determine if the magnet can be used to transfer 200 keV electron beams. Therefore the magnetic field of the alpha-magnet, the temperature of the magnet coil, and the trajectory of the electron beam are observed and simulated [1].

*Work supported in part by the Deutsche Forschungsgemeinschaft through SFB 1245 and GRK 2128 'AccelencE'

[1] Y. Poltoratska et al., J. Phys.: Conf. Series 298, 012002 (2011).

AKBP 4.5 Di 17:30 NW-Bau - HS4

Entwicklung und Test einer Messung der Strahlqualität am S-DALINAC* — •Manuel Dutine, Michaela Arnold, Thore Bahlo, Jonny Birkhan, Uwe Bonnes, Antonio D'Alessio, Michaela Hilcker, Lars Jürgensen, Norbert Pietralla, Philipp Ries, Adrian Rost, Maxim Singer und Gerhard Steinhilber — Institut für Kernphysik, Darmstadt, Deutschland

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 Verbesserung der Strahlqualität am Ort des Experiments wurde ein Hochenergie-Scrapersystem installiert.

Um den Einfluss verschiedener Einstellungen des Scrapersystems auf die Strahlqualität zu überprüfen, wurden Messungen der Energieschärfe und der Strahlausdehnung in der Streukammer des 169°-Spektrometers durchgeführt. Für die vorhandene Geometrie der Streukammer wurde eine neue Targetleiter mit einer Drahtscannermessung und einem Target zur Messung der optischen Übergangsstrahlung entwickelt. Im Vortrag wird das Hochenergie-Scrapersystem kurz vorgestellt und der Aufbau sowie die Ergebnisse der Strahlqualitätsmessung gezeigt.

*Gefördert durch die DFG im Rahmen des GRK 2128.

AKBP 4.6 Di 17:45 NW-Bau - HS4

Progress towards slice emittance measurements at PITZ — •Raffael Niemczyk[1], Prach Boonpornprasert[1], Ye Chen[1], James Good[1], Matthias Gross[1], Holger Huck[1], Igor Isaev[1], Davit Kalantaryan[1], Christian Koschitzki[1], Mikhail Krasilnikov[1], Xin Li[1], Osip Lishilin[1], Gregor Loisch[1], David Melkumyan[1], Anne Oppelt[1], Houjun Qian[1], Yves Renier[1], Chaipattana Saisa-ard[1,4], Frank Stephan[1], Zohrab Amirkhanyan[2], Anushavan Azatyan[2], Armen Grigoryan[2], Vahe Sahakyan[2], Artsrun Sargsyan[2], Ashot Vardanyan[2], Arsham Yeremyan[2], Marek Otevrel[3], Sakhorn Rimjaem[4], Galina Asova[5], Quantang Zhao[6], and Ingo Will[7] — [1]DESY, Zeuthen, Germany — [2]CANDLE, Yerevan, Armenia — [3]CEITEC, Brno, Czech Republic — [4]CMU, Chiang Mai, Thailand — [5]INRNE, Sofia, Bulgaria — [6]IMP, Lanzhou, China — [7]MBI, Berlin, Germany

Transverse emittance is one of the most important properties for high-brightness electron beams used for X-Ray free-electron lasers. The photo injector test facility at DESY in Zeuthen (PITZ) focuses on the development of high-brightness electron sources. The two main methods to measure the emittance are the quadrupole scan and the slit scan. Combining either of these methods with a transverse deflecting cavity allows the measurement of the slice emittance. At PITZ, space-charge effects at the low beam momentum of 24 MeV/c complicate in particular the quadrupole scan. This has to be considered in the emittance measurements. First slit-scan based slice emittance results will be shown next to studies on the beam transport for quadrupole scans.

AKBP 4.7 Di 18:00 NW-Bau - HS4

Evaluation of a Cone-Program Based Approach to Orbit Correction at the Electron Storage Ring Delta — •Stephan Kötter, Bernard Riemann, Benjamin Dirk Isbarn, Malte Sommer, and Thomas Weis — TU Dortmund University (DELTA) Center for Synchrotron Radiation

A new program for orbit correction is currently being developed at the electron storage ring Delta. The optimization problem of finding a set of dipole-field-strength variations which minimize the deviation of the orbit from a reference orbit can be parameterized as cone program. This parametrization allows for arbitrary, linear constraints. Robust and fast solvers for this type of problem exist.

This presentation focuses on a comparison of correction results of the aforementioned program for three algorithms. These algorithms are singular value decomposition (SVD), the limited-memory Broyden-

Fletcher-Goldfarb-Shanno algorithm with box constraints (L-BFGS-B) and a solver for cone programs (from cvxopt python package). After a short introduction to cone programming, measurements are shown along with numerical convergence studies.

AKBP 4.8 Di 18:15 NW-Bau - HS4

Systematic effects in the beam energy measurements by undulator radiation at MAMI — •Pascal Klag[1], Patrick Achenbach[1], Toshiyuki Gogami[2], Philipp Herrmann[1], Masashi Kaneta[2], Yoshihiro Konishi[2], Werner Lauth[1], Sho Nagao[2], Satoshi Nakamura[2], Josef Pochodzalla[1], Yuichi Toyama[2], and Shoko Tomita[2] — [1]Johannes Gutenberg-Universität Mainz — [2]Tohoku University Sendai

The Mainz microtron is an electron accelerator, which delivers electron energies up to 1.6 GeV, with a small spread of the energy $\sigma_{beam} < 13$keV. The uncertainty for the absolute energy for all available beam energies was limited to 160 keV. A novel method is used to improve the uncertainty for the energy of a 195 MeV beam. The method is based on interferometry with two spatially separated light sources (undulators) driven by relativistic electrons. A high resolving monochromator was used to analyse the spectrum of the light. In 2016 a preliminary pilot beamtime proved the principle, but it could also be shown that systematic effects have to be considered. These effects had to be understood and minimized. Recent developments are dedicated to these systematics. In the talk the results and reached accuracy goal will be presented.