HK 8: Instrumentation III

Time: Tuesday 14:00–16:00 Location: H1

Group Report HK 8.1 Tue 14:00 H1

The Silicon Tracking System of the CBM experiment: towards series production — •Adrian Rodriguez Rodriguez for the CBM-Collaboration — GSI Helmholtzzentrum für Schwerionenforschung, Darmstadt, Germany

The Silicon Tracking System (STS) is the central detector for charged-particle identification and momentum determination in the future CBM experiment at the new FAIR accelerator facility. It is designed to measure up to 1000 charged particles in nucleus-nucleus collision at interaction rates up to 10 MHz, achieve a momentum resolution better than 2% inside 1 Tm magnetic field, and identify complex particle decays topologies. The STS comprises eight tracking stations equipped with double-sided silicon microstrip sensors. Two million channels are read out with self-triggering electronics, matching the experiment's data streaming and online event analysis concept. The STS functional building block is the detector module. It consists of a sensor, micro-cables, and two front-end electronics boards, carrying the custom-developed readout ASIC. The test and characterization of the first detector modules, part of the pre-series production, have been performed in the laboratory and the beamline as part of the FAIR Phase 0 activities. This presentation shows an overview of the STS project and its focus towards the series production; special emphasis is drawn to the quality assurance and current status of the module components, readout chain, and system integration.

HK 8.2 Tue 14:30 H1

The Silicon Strip Detector setup for the MAGIX Experiment — •Jennifer Geimer for the MAGIX-Collaboration — Institute for Nuclear Physics, Mainz, Germany

The MAGIX-Experiment (Mainz Gas Injection Target Experiment) will be a high precision electron scattering experiment located at the MESA accelerator at the *Institute for Nuclear Physics* in Mainz. The experimental setup comprises a windowless gas jet target which allows direct interaction between beam electrons and target nuclei. It can be operated with different types of target gas and therefore allows investigation of a wide physical program. While the scattered electrons will be detected by two magnet spectrometers, the detection of nuclear fragments of the target will be done by using several recoil detectors. The centerpiece of the recoil detector design is a *Silicon Strip Detector* with size of 50 x 50 mm^2. To completely stop protons with an energy of $\mathcal{O}$(70 MeV), the silicon detector will be equipped with an additional plastic scintillator layer read out by silicon photomultipliers. The channels of the silicon detector as well as the silicon photomultipliers will be processed by the APV25 Chip, while the trigger signal is simultaneously produced using an additional frontend board.
This presentation gives a short overview of the MAGIX experiment and the resulting design parameters for the recoil detector. It focuses on the working principle and the current state of development of the *Silicon Strip Detector.*

HK 8.3 Tue 14:45 H1

Characterization of the MAGIX windowless gas jet target in high-intensity electron beams — •Maximilian Littich for the MAGIX-Collaboration — Institut für Kernphysik, Johannes Gutenberg-Universität Mainz, Deutschland

MAGIX is a fixed target electron scattering experiment at the upcoming MESA accelerator. It will be operated in the energy recovery linac mode of the accelerator which allows to reach beam currents of at least 1 mA. This operation mode requires a very thin target for which MAGIX will use an internal, windowless gas jet target. This cryogenic supersonic gas jet target will be able to run with different gases, e.g. hydrogen, deuterium, helium, oxygen, argon or xenon.

At the existing A1 multi-spectrometer facility at the electron accelerator MAMI detailed studies have been carried out using hydrogen as the target gas. This talk will show the results of these studies, the challenges of the operation and the performance of the target under real beam condition.

HK 8.4 Tue 15:00 H1

Development of a lithium target for $^{3}_{\Lambda}H$ observation — •Julian Geratz[1], Patrick Achenbach[1], Philipp Eckert[1], Philipp Herrmann[1], Pascal Klag[1], Josef Pochodzalla[1], and Marcell Steinen[2] for the A1-Collaboration — [1]Inst. für Kernphysik, JGU Mainz — [2]Helmholtz Institut Mainz

Studies of light hypernuclei offer insights into the strong nuclear force. For this purpose, the $^{4}_{\Lambda}H$ has been observed at the electron accelerator MAMI in Mainz through pionic decay. In this experiment, beryllium was used as target material. Observation of the hypertriton, the lightest hypernucleon, by this method would require an increase in luminosity by about a factor of 10. To study the $^{3}_{\Lambda}H$ a new target was designed and has been tested. This new target for hypertriton observation uses lithium as target material. As target material, lithium offers higher $^{3}_{\Lambda}H$ yield than beryllium, as it has fewer possible fragmentation channels. Furthermore, its low density enables a new target geometry, with a thick target along the beam and a small transverse dimension, thus limiting the energy loss variations of the decay pions.
The dimensions of the target are 1.5 × 50 × 50 mm^3, the electron beam will travel through 50 mm of lithium. As a material, lithium is difficult to handle due to its low melting point and high reactivity.
The challenges of using lithium as target material, their solutions and the advantages of lithium are the topic of this presentation.
Supported by DFG (PO 256/7-1) and by the European Union's Horizon 2020 programme, No 824093.

HK 8.5 Tue 15:15 H1

Measurements of the accelerator beam quality and lifetime at COSY with the $\overline{\text{P}}$ANDA Cluster-Jet Target — •Hanna Eick, Philipp Brand, Benjamin Hetz, Daniel Klostermann, Christian Mannweiler, Sophia Vestrick, and Alfons Khoukaz for the PANDA-Collaboration — Institut für Kernphysik, Westfälische Wilhelms-Universität Münster, 48149 Münster, Germany

The internal, windowless $\overline{\text{P}}$ANDA Cluster-Jet Target developed at WWU Münster will be the Day-1 target of the antiproton storage ring facility HESR, which is currently under construction at the future GSI/FAIR facility. With a target thickness of more than 2×10^{15} atoms/cm^2 without temporal substructures and a distance from the target nozzle of more than 2 m to the interaction point, it is suitable for 4π experiments with a high luminosity. Of particular interest during the test beam time at COSY are the studies of the beam-target interaction. In August 2019, special attention was paid to the measurements of the accelerator beam quality and lifetime in conjunction with the $\overline{\text{P}}$ANDA target and the elements of the stochastic cooling of the HESR also installed at COSY. An overview of the $\overline{\text{P}}$ANDA Cluster-Jet Target and measurements performed at COSY in August 2019 will be presented in this talk.

This project has received funding from BMBF (05P19PMFP1) and the European Union's Horizon 2020 programme (824093).

HK 8.6 Tue 15:30 H1

Angular error correction by analysing the Fresnel diffraction in an undulator interferometer — •Pascal Klag[1], Patrick Achenbach[1], Philipp Eckert[1], Toshiyuki Gogami[2], Philipp Herrmann[1], Masashi Kaneta[3], Sho Nagao[3], Satoshi Nakamura[3], Josef Pochodzalla[1], and Yuichi Toyama[3] for the A1-Collaboration — [1]Johannes Gutenberg-Universität Mainz — [2]Kyoto University, Kyoto — [3]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 $\sigma_{beam} < 13keV$. 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 energies of 180 and 195 MeV. The method is based on interferometry with two spatially separated light sources (undulators) driven by relativistic electrons. The improved resolution of the setup revealed the modification of the undulator interference by Fresnel diffraction. A detailed analysis allowed to compensate for this structure and led to an enhanced accuracy of the measurement. The determination of the angle of observation strongly benefited from the diffraction. High precision beam stabilization has been used to fix the electron beam at optimal conditions. Supported by DFG (PO 256/7-1) Supported by the European Union's Horizon 2020 programme, No 824093.

HK 8.7 Tue 15:45 H1

Studies and Developments for the $\overline{\text{P}}$ANDA Cluster-Jet

Target — •Philipp Brand, Daniel Bonaventura, Hanna Eick, Clara Fischer, Jost Froning, Benjamin Hetz, Niklas Humberg, Christian Mannweiler, Jeremy Runge, Sophia Vestrick, Michael Weide, and Alfons Khoukaz for the PANDA-Collaboration — Institut für Kernphysik, Westfälische Wilhelms-Universität Münster, 48149 Münster, Germany

The $\overline{\text{P}}$ANDA cluster-jet target will be the Day-1 target for the $\overline{\text{P}}$ANDA experiment at HESR at FAIR. With this device a target thickness of more than 10^{15} atoms/cm^2 is achieved at the interaction point more than 2 m below the nozzle. The cluster-jet is then pumped away using a beam dump which is again more than 2 m below the interaction point. The long and narrow jet pipe in between makes a precise adjustment of the complete target system and the use of various monitor systems at different positions necessary. Therefore, a new beam dump is developed which allows the integration of monitor systems. Additionally, due to the large distances between the vacuum pumps of this 4π detector, it is crucial to understand the complete vacuum system including the source of residual gas. For this purpose, extensive studies and calculations are ongoing. Furthermore, studies on the production of new Laval nozzles and the process of cluster formation are performed. Within this talk, the current and future developments at the $\overline{\text{P}}$ANDA cluster-jet target will be discussed. This project has received funding from BMBF (05P19PMFP1), GSI FuE (MSKHOU1720 and MSKHOU2023) and the EU's Horizon 2020 programme (824093).