HK 59: Instrumentation XVI

Zeit: Donnerstag 16:30–18:15 Raum: S1/01 A3

Gruppenbericht HK 59.1 Do 16:30 S1/01 A3
The Barrel and Disc DIRC Counters for the PANDA Experiment at FAIR — •Mustafa Schmidt for the PANDA-Collaboration — II. Physikalisches Institut, Universität Gießen

The PANDA spectrometer for the future FAIR facility at GSI will be used to address open questions in hadronic physics by investigating antiproton collisions with a fixed target in the momentum range between 1.5 GeV/c and 15 GeV/c. In order to achieve a particle identification with a high precission, two different DIRC detector concepts have been developed by PANDA, which allow a compact detector design together with an excellent performance to cleanly separate pions, kaons, and protons. The Barrel DIRC in the target spectrometer of PANDA is based on the successful BaBar DIRC with several key improvements. It is designed for polar angles between $\theta = 22^\circ$ and $\theta = 140^\circ$ and momenta up to 3.5 GeV/c. The Disc DIRC is part of the endcap region of the spectrometer and covers the angular range from $\theta = 5^\circ/10^\circ$ to $\theta = 22^\circ$ in the forward direction of PANDA. It will provide a π/K separation with a 4-σ seperation power up to a momentum of 4 GeV/c. Both Cherenkov detectors will use MCP-PMTs for the photon detection in combination with fast readout electronics. The radiators are synthetic fused silica plates with precision polished surfaces that guarantee to have very little photon losses by total reflection and conserve the Cherenkov angle during propagation through the optical system. Simulations with Geant4 and tests with several prototypes at various test beam facilities have been used to evaluate the designs and validate the expected PID performance of the DIRC counters.

HK 59.2 Do 17:00 S1/01 A3
Deriving the effective focal plane for the CBM-RICH detector* — •Ievgenii Kres for the CBM-Collaboration — Wuppertal University

The Compressed Baryonic Matter (CBM) experiment at the future FAIR complex will investigate the phase diagram of strongly interacting matter at high baryon density and moderate temperatures in A+A collisions from 2-11 AGeV (SIS100). A central component of the proposed detector setup is a ring imaging Cherenkov detector (RICH) using CO2 as radiator gas, and a focussing optic with a large spherical mirror. In the present design, the optimal focal plane is approximated using four individual, flat detection surfaces. However, the exact shape and position of the ideal focal plane is subject to further optimization due to effects from tilting the focussing mirror and from momentum dependant deflection of the electron tracks in the magnetic stray field. In this talk, we present a new approach to derive the effective 3-dimensional shape of the focal plane based on a set of Monte Carlo simulations, comparing the ring sharpness at each point of a preliminary focal plane as function of z-position.

*gefördert durch BMBF 05P15PXFCA, und GSI.

HK 59.3 Do 17:15 S1/01 A3
Measurements of the mirror surface homogeneity in the CBM-RICH — •Elena Lebedeva and Claudia Hoehne for the CBM-Collaboration — II. Physikalisches Institut JLU Giessen

The Compressed Baryonic Matter (CBM) experiment at the future FAIR (Facility for Antiproton and Ion Research) complex will investigate the phase diagram of strongly interacting matter at high baryon densities and moderate temperatures in A+A collisions from 2-11 AGeV (SIS100) beam energy.

One of the key detector components required for the CBM physics program is the RICH (Ring Imaging CHerenkov) detector, which is developed for efficient and clean electron identification and pion suppression.

The CBM-RICH detector is being planned with gaseous radiator and in a standard projective geometry with focusing mirror elements and photon detector planes. One of the important criteria for the selection of appropriate mirrors is their optical surface quality (surface homogeneity). It defines the imaging quality of projected Cherenkov rings, and directly effects the ring finding and fitting performance. The global homogeneity has been tested with the D0 measurement. Local deformations e.g. by the mirror holding structure can be investigated with the Ronchi test and Shack-Hartmann method from which first results are discussed in this contribution.

HK 59.4 Do 17:30 S1/01 A3
CBM RICH geometry optimization* — •Tariq Mahmoud and Claudia Höhne for the CBM-Collaboration — II. Physikalisches Institut, Gießen; Deutschland

The Compressed Baryonic Matter (CBM) experiment at the future FAIR complex will investigate the phase diagram of strongly interacting matter at high baryon density and moderate temperatures in A+A collisions from 2-11 AGeV (SIS100) beam energy. The main electron identification detector in the CBM experiment will be a RICH detector with a CO_2 gaseous-radiator, focusing spherical glass mirrors, and MAPMT photo-detectors being placed on a PMT-plane. The RICH detector is located directly behind the CBM dipole magnet. As the final magnet geometry is now available, some changes in the RICH geometry become necessary. In order to guarantee a magnetic field of 1 mT at maximum in the PMT plane for effective operation of the MAPMTs, two measures have to be taken: The PMT plane is moved outwards of the stray field by tilting the mirrors by 10 degrees and shielding boxes have been designed. In this contribution the results of the geometry optimization procedure will be presented.

(*Gefördert durch das LOEWE Zentrum HIC for FAIR und BMBF 05P15 RGFCA)

HK 59.5 Do 17:45 S1/01 A3
Prototype Test for the PANDA Barrel DIRC — •Dzhygadlo Roman[1], Gerhardt Andreas[1], Kalicy Grzegorz[1], Krebs Marvin[1], Lehmann Dorothe[1], Peters Klaus[1,2], Schwarz Carsten[1], Schwiening Jochen[1], Belias Anastasios[1], and Traxler Michael[1] for the PANDA-Collaboration — [1]GSI Helmholtzzentrum fur Schwerionenforschung GmbH, Darmstadt — [2]Goethe-Universität Frankfurt

The Barrel DIRC (Detector of Internally Reflected Cherenkov light) is designed to provide particle identification (PID) for the PANDA experiment at the new Facility for Antiproton and Ion Research in Europe (FAIR) at GSI, Darmstadt. It is based on the successful BABAR DIRC detector with several key improvements, such as focusing optics, fast timing, and a compact expansion volume.

A large prototype was constructed and tested in a hadronic particle beam at CERN during the summer of 2015 to test the PID performance of different design options. The prototype included a fused silica radiator (either a narrow bar or a wide plate), an optional focusing lens, and a prism-shaped fused silica expansion volume. An array of microchannel-plate photomultiplier tubes measured the location and arrival time of the Cherenkov photons on 960 pixels. Data were collected for two radiator geometries and several types of focusing lenses at different beam momenta and polar angles. Results of the analysis as well as a comparison to the Geant4 simulation will be presented.

Work supported by BMBF 05E12CD2, EU FP7 227431, HGS-HIRe.

HK 59.6 Do 18:00 S1/01 A3
High precision timing in a FLASH — •Matthias Hoek, Matteo Cardinali, Michael Dickescheid, Sören Schlimme, Concettina Sfienti, Björn Spruck, and Michaela Thiel — Institut für Kernphysik, Johannes Gutenberg-Universität Mainz

A segmented highly precise start counter (FLASH) was designed and constructed at the Institute for Nuclear Physics in Mainz. Besides determining a precise reference time, a Time-of-Flight measurement can be performed with two identical FLASH units. Thus, particle identification can be provided for mixed hadron beam environments.

The detector design is based on the detection of Cherenkov light produced in fused silica radiator bars with fast multi-anode MCP-PMTs. The segmentation of the radiator improves the timing resolution while allowing a coarse position resolution along one direction. Both, the arrival time and the Time-over-Threshold are determined by the readout electronics, which enables walk correction of the arrival time.

The performance of two FLASH units was investigated in test experiments at the Mainz Microton (MAMI) using an electron beam with an energy of 855 MeV and at CERN's PS T9 beam line with a mixed hadron beam with momenta between 3-8 GeV/c. Effective Time-walk correction methods based on Time-over-Threshold were developed for the data analysis. The achieved Time-Of-Flight resolution after applying all corrections was found to be ~70ps. Furthermore, the PID and position resolution capabilities will be discussed in this contribution.