HK 28: Instrumentation X

Zeit: Dienstag 16:30–18:15 Raum: HZO 90

HK 28.1 Di 16:30 HZO 90

DIRC-based PID for the EIC Central Detector — •Roman Dzhygadlo[1], Klaus Peters[1,2], Carsten Schwarz[1], and Jochen Schwiening[1] for the DIRC-at-EIC-Collaboration — [1]GSI Helmholtzzentrum für Schwerionenforschung GmbH, Darmstadt — [2]Goethe-Universität Frankfurt

The physics program for the Electron-Ion Collider (EIC) detector requires charged Particle Identification (PID) (e/π, π/K, K/p) over a wide momentum range. It is expected that the PID system will need to include one or more Cherenkov counters to achieve this goal. A radially compact DIRC (Detector of Internally Reflected Cherenkov light) counter is an attractive option in barrel region.

The ongoing R&D investigates ways to extend the momentum coverage of a DIRC counter for the EIC detector beyond the current state-of-the-art with clean π/K separation up to at least 6 GeV/c. Possible design improvements include a complex imaging system, comprising multi-component spherical lenses, a compact fused silica expansion volume, and multi-anode sensors with smaller pixels, providing fast single-photon timing in high magnetic fields, a time-based PID algorithm, and chromatic dispersion mitigation.

We will discuss the current status of the design studies with Geant simulations, improvements to the time-based imaging reconstruction, and the results of prototype tests with particle beams at CERN.

This work was supported in part by BNL under eRD4 and eRD14.

HK 28.2 Di 16:45 HZO 90

Prototype test for the PANDA Barrel DIRC — Ahmed Ali[1,2], Anastasios Belias[1], •Roman Dzhygadlo[1], Andreas Gerhardt[1], Marvin Krebs[1], Dorothe Lehmann[1], Klaus Peters[1,2], Georg Schepers[1], Carsten Schwarz[1], and Jochen Schwiening[1] for the PANDA-Collaboration — [1]GSI Helmholtzzentrum für Schwerionenforschung GmbH, Darmstadt — [2]Goethe-Universität Frankfurt

Excellent hadronic particle identification (PID) in the barrel region of the PANDA experiment at the new Facility for Antiproton and Ion Research in Europe (FAIR) at GSI, Darmstadt, will be provided by a DIRC (Detection of Internally Reflected Cherenkov light) counter. It will cover the polar angle range of 22-140 degrees and separate charged pions from kaons for momenta between 0.5 GeV/c and 3.5 GeV/c with a separation power of at least 3 standard deviations.

A sophisticated prototype was constructed and tested in a hadronic particle beam at CERN during the fall of 2017 to test the PID performance of the final design. The prototype comprised a narrow bar made from synthetic fused silica, a complex multi-layer spherical lens system, and a prism-shaped fused silica expansion volume. An array of microchannel-plate photomultiplier tubes was used to measure the location and arrival time of the Cherenkov photons. Data were collected for different optics configurations at different beam angles and momenta. Results of the analysis and a comparison to the Geant4 simulation will be presented.

HK 28.3 Di 17:00 HZO 90

High Precision Measurements for the PANDA Barrel DIRC Radiators — •Marvin Krebs[1,2], Klaus Peters[1], Georg Schepers[1], Carsten Schwarz[1], and Jochen Schwiening[1] for the PANDA-Collaboration — [1]GSI Helmholtzzentrum für Schwerionenforschung GmbH, Darmstadt — [2]Goethe-Universität, Frankfurt

The PANDA experiment at FAIR (Facility for Antiproton and Ion Research in Europe) at GSI, Darmstadt, will study fundamental questions of hadron physics and QCD. A compact, fast focusing Ring Imaging Cherenkov counter using the DIRC (Detection of Internally Reflected Cherenkov light) technology, will provide charged particle identification (PID) in the barrel region of the PANDA experiment. To meet the PANDA PID requirements, the Barrel DIRC has to provide precise measurements of the Cherenkov angle, which is conserved for Cherenkov photons propagating through the radiator by total internal reflection. The radiators, rectangular bars made from synthetic fused silica, have to fulfill strict optical and mechanical requirements. This includes squareness and parallelism of the bar sides, sharp corners, and smoothly polished surfaces in the order of 10 Å, ensuring very little angular distortions and high transport efficiency. An optical setup, consisting of a computer-controlled positioning and multi-wavelength laser system, is used to evaluate the bars to obtain critical values like transmittance and reflectivity. Prototypes from various manufacturers using different production techniques have been tested to qualify vendors for the Barrel DIRC bar production. Setup, measuring procedure and measurement results will be presented in this contribution.

HK 28.4 Di 17:15 HZO 90

Concept and design of an alignment monitoring system for the CBM RICH mirrors* — •Jordan Bendarouach for the CBM-Collaboration — II. physikalisches Institut, Gießen

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 2-15 AGeV (SIS100).

One of the key detectors of CBM to explore this physics program is the RICH (Ring Imaging CHerenkov) detector, which is developed for efficient and clean electron identification and pion suppression. About 80 trapezoidal glass mirror tiles equally distributed in two half-spheres will serve as focusing elements with spectral reflectivity down to the UV range.

An important aspect to guarantee a stable operation of the RICH detector is the mirror alignment. To determine and quantify mirror misalignments, a method inspired from the HERA-B experiment is employed. The misalignment information is used in a correction cycle to allow a proper operation of the detector under these conditions.

A global correction cycle will be presented. Results from an automated correction routine and the impact of the corrections on the matching efficiency of the detector will be shown.

(*Supported by BMBF grants 05P15RGFCA, HIC for FAIR and HGS-HIRe)

HK 28.5 Di 17:30 HZO 90

Bau einer Cosmics-Teststation für Teilchendetektoren — •Simon Bodenschatz, Michael Düren, Erik Etzelmüller, Klaus Föhl, Avetik Hayrapetyan, Kristof Kreutzfeldt, Julian Rieke, Mustafa Schmidt und Marc Strickert — II. Physikalisches Institut, Justus-Liebig-Universität Gießen, Germany

Der hier entworfene Teststand nutzt kosmische Myonen zum Test von Detektoren der Teilchenphysik. Er besteht aus zwei Szintillatorplatten von 50x50 cm^2, die als Trigger fungieren und mit PMTs an allen vier Ecken ausgelesen werden. Zur Spurrekonstruktion der Myonen gibt es 2x2 Ebenen aus jeweils 48 überlappenden, 1,5 cm breiten Szintillatorstreifen in x- und y-Richtung, die eine Ortsauflösung von $\sigma = 4,5$ mm erlauben. Die Winkelauflösung durch diese beiden Doppelebenen im Abstand von bis zu 1,7 m beträgt bis zu 3 mrad für den Polar- und bis zu 20 mrad für den Azimuthalwinkel. Die Streifen werden durch SiPMs mit Hilfe von TOFPET-ASICs ausgelesen. Ein Bleiabsorber von ca. 45 cm Dicke zwischen den Spurdetektoren und dem unteren Trigger-Detektor erlaubt es Myonen mit einer Energie E > 750 MeV zu selektieren. Der Teststand wurde speziell zum Test des PANDA DIRC Cherenkov Detektors entwickelt.

HK 28.6 Di 17:45 HZO 90

DIRC detector upgrade for the GlueX experiment — •Ahmed Ali[1,2], Roman Dzhygadlo[1], Klaus Peters[1,2], Jochen Schwiening[1], and Carsten Schwarz[1] for the GlueX-Collaboration — [1]GSI Helmholtzzentrum für Schwerionenforschung GmbH, Darmstad — [2]Goethe-Universität Frankfurt

The upgrade of the GlueX experiment at Jefferson Lab with a DIRC (Detection of Internally Reflected Cherenkov light) counter will significantly improve the particle identification (PID) capabilities in the forward region of the detector by providing clean π/K separation for momenta up to 4 GeV/c.

The GlueX DIRC combines four bar boxes from the decommissioned BaBar DIRC detector with new compact photon cameras based on the SuperB FDIRC concept.

Geant4 simulations were used to design the focusing photon camera. Two reconstruction algorithms were developed to optimize the hadronic PID performance. We will discuss the status of the DIRC detector and the latest achievements in the reconstruction.

HK 28.7 Di 18:00 HZO 90

Di-Electron identification with the upgraded RICH detector

at HADES — •Jan-Hendrik Otto for the HADES-Collaboration — Justus Liebig Universität Gießen

The HADES (High Acceptance DiElectron Spectrometer) detector, located at GSI, Darmstadt, has been built to study dense baryonic matter and hadronic properties such as form-factors using in particular electromagnetic probes. Currently several upgrades are done in order to improve the HADES performance at SIS18 during FAIR phase 0 experiments. The photon detector of the RICH detector is replaced by H12700 MAPMTs. In this contribution the expected performance of the RICH detector and studies of e^+e^- pair identification in heavy ion collisions are presented: Simulated UrQMD events of semi-central (44 %) Ag+Ag collisions at 1.65 AGeV beam energy enriched with an additionally embedded PLUTO signal of vector-meson decays have been used for these studies. The high efficient ring finding of the upgraded RICH detector allows for so far unreached background suppression and enables the extraction of an invariant mass spectrum of di-electrons from 50 MeV/c^2 up to masses beyond the phi meson pole.