HK 7: Instrumentierung

Zeit: Montag 14:00–16:00 Raum: HZ 9

HK 7.1 Mo 14:00 HZ 9

Technical design of the PANDA Disc DIRC Detector — •Erik Etzelmüller, Klim Biguenko, Michael Düren, Klaus Föhl, Avetik Hayrapetyan, Benno Kröck, Oliver Merle, and Julian Rieke for the PANDA-Collaboration — Jusust-Liebig-Universität, Gießen

The physics program of the PANDA detector at the future FAIR facility at GSI requires excellent particle identification. In the forward angular region between 5 and 22 degrees, this will be achieved by a DISC DIRC detector that detects internally reflected Cherenkov light in order to separate pions, kaons and other hadrons. It will be the first time that a Disc-DIRC is used in a high performance 4π detector. Technical challenges such as radiation hardness of used materials and sensors, the presence of a strong magnetic field and limited space for mechanics which arise from constraints of the PANDA environment, had to be overcome in the detector design. The actual detector design and solutions to the formerly mentioned challenges will be presented and discussed.

HK 7.2 Mo 14:15 HZ 9

A new prototype for the PANDA Disc DIRC Detector — •Julian Rieke, Michael Düren, Avetik Hayrapetyan, Klaus Föhl, Benno Kröck, Oliver Merle, Erik Etzelmüller, and Klim Biguenko for the PANDA-Collaboration — Justus Liebig Universität, Gießen, Germany

The PANDA experiment at the future FAIR facility needs excellent particle identification to do precision studies of antiproton-proton reactions in the 1.5-15 GeV/c momentum range. To fulfill this need, two Cherenkov detectors will be installed in the PANDA target spectrometer, both based on the DIRC concept that uses internally reflected Cherenkov light to perform particle identification, with a focus on the separation of pions and kaons. The Disc-DIRC is designed to cap the forward region of theta angles between 5 and 22 degrees. It will be the first time that a 3D-Disc-DIRC is used for PID in a real physics experiment beyond prototyping.

A new prototyping Disc-DIRC apparatus has been constructed at the JLU Giessen. Unlike previous prototypes, this one features a radiator as well as focusing elements made out of fused silica. The Cherenkov light is detected with 22 multi-anode-phototubes and 4 MCP-PMTs, totalling 608 individual pixels. Timing information for each of the latter is generated using the novel TRB3 system developed at GSI. The entire prototype was tested with an electron beam of several GeV/c provided by DESY in Hamburg. The components, their setup and a first analysis of the recorded data will be presented.

HK 7.3 Mo 14:30 HZ 9

Untersuchung eines Flugzeitspektrometers auf Basis von MCP-PMTs — •Fred Uhlig, Alexander Britting, Wolfgang Eyrich und Albert Lehmann — Physikalisches Institut, Universität Erlangen-Nürnberg

Microchannel-Plate Photomultiplier (MCP-PMTs) zeichnen sich unter anderem durch eine sehr gute Zeitauflösung von kleiner als 50ps für einzelne Photonen aus. Da sich die Zeitauflösung für Messungen mit mehreren Photonen entsprechend $\sigma_N = \frac{\sigma_0}{\sqrt{N}}$ verbessert, sollte es möglich sein mit passender Elektronik Zeitauflösungen im Bereich einiger 10ps zu erreichen.

In einem Radiator (z.B. Plexiglas) lassen sich mit Hilfe eines geladenen Teilchenstrahls mehrere Cherenkov-Photonen erzeugen. Durch die Kombination zweier Systeme aus jeweils einem Radiator und einem MCP-PMT kann man die Flugzeit von Teilchen, und damit deren Identität bestimmen. Zusätzlich kann mit Multianoden MCP-PMTs Teilchenspurrekonstruktion (Tracking) betrieben werden.

Zur Untersuchung dieser sogenannten MCP-TOF Methode wurden an Teststrahlzeiten am CERN und FZ Jülich im Rahmen von Detektortests für die DIRC-Detektoren (Detection of Internally Reflected Cherenkov Light) am PANDA-Experminent Messungen durchgeführt. Die Ergebnisse hieraus werden vorgestellt.

- Gefördert durch BMBF und GSI -

HK 7.4 Mo 14:45 HZ 9

Measurements of recent microchannel-plate photomultipliers with significantly increased lifetime — •Alexander Britting, Wolfgang Eyrich, Albert Lehmann, and Fred Uhlig for the PANDA-Collaboration — Physikalisches Institut, Universität Erlangen-Nürnberg

Due to their usability in high magnetic fields of up to 2 Tesla and a time resolution of better than $\sigma = 50$ ps microchannel-plate photomultipliers (MCP-PMT) are the favored sensors for the DIRC detectors (Detection of Internally Reflected Cherenkov light) of the PANDA experiment. The anticipated average luminosity of $2 \cdot 10^{32}\ \ cm^{-2}s^{-1}$ in the detector requires a rate capability high enough to withstand a detected photon rate of about 200 $kHz\ cm^{-2}$ at the MCP-PMTs surface. This rate accumulates to an integrated anode charge for the MCP-PMTs of $\approx 5\ C/cm^2$ for the Barrel DIRC and even more for the Endcap Disc DIRC after a 10 years operation time of PANDA.

The major drawback up to now was the limited lifetime of MCP-PMTs, which seems to be solved for the most recent MCP prototype devices. The main aging parameter is the quantum efficiency as a function of the integrated anode charge. We performed lifetime measurements for several MCP-PMTs, which correspond to different stages of lifetime enhancement. Results of these measurements will be presented. The achieved lifetimes now match the PANDA requirements for the Barrel-DIRC.

- supported by BMBF and GSI -

HK 7.5 Mo 15:00 HZ 9

Simulation and Construction of MWPCs without drift region for the CBM-TRD — •Florian Roether for the CBM-Collaboration — Institut für Kernphysik, Goethe-Universität Frankfurt

The Compressed Baryonic Matter (CBM) experiment at the future Facility for Antiproton and Ion Research (FAIR) will explore the QCD phase-diagram in the region of high net-baryon densities. The Transition Radiation Detector (TRD) with its multi-layer-design will provide electron identification and contribute to particle tracking.

Each TRD module consists of a radiator and a Read Out Chamber (ROC). The Frankfurt prototypes are narrow Multiwire Proportional Chambers (MWPC) without a drift region and have therefore a short signal collection time, in order to handle the high event rates of up to 10 MHz in the experiment. The loss of transistion radiation is minimized by using an entrance window made of a thin foil. As a deformation of the entrance window could influence the performance of the detector, different methods to minimize this effect have been studied. In this talk the construction of an alternative prototype wire-geometry and simulations of gain variations are presented and different approches to stabilize the gas gain are discussed.

This work is supported by BMBF and the Helmholtz Association.

HK 7.6 Mo 15:15 HZ 9

Vergleich verschiedener Photosensoren anhand der CBM-RICH Strahlzeit 2012* — •Sascha Reinecke für die CBM-Kollaboration — Bergische Universität Wuppertal

In Darmstadt an der GSI wird derzeit die Facility for Antiproton and Ion Research (FAIR) gebaut. Eines der dort geplanten Projekte ist das Schwerionenexperiment Compressed Baryonic Matter (CBM). Ziel ist die Vermessung des QCD-Phasendiagramms bei hohen Netto-Baryonendichten und moderaten Temperaturen sowie die Charakterisierung des Phasenübergangs hadronischer Materie zum Quark-Gluon Plasma. Eine wesentliche Komponente des CBM-Detektors ist ein Ring-abbildender Cherenkov-Detektor (RICH), in welchem das Cherenkov-Licht schneller Teilchen ($v > c_n = c/n$) über sphärische Spiegel ringförmig auf den Photodetektor abgebildet wird.

Im Rahmen einer im Oktober 2012 durchgeführten Teststrahlzeit am CERN-PS Beschleuniger konnten wichtige Informationen u.a. für den Aufbau des Photodetektors des RICH gewonnen werden. Ein Ziel der Strahlzeit war die Charakterisierung von neuen Hamamatsu Multi-Anoden PMTs des Typs R11265 sowie von Micro-Channel-Plates (MCP) des Typs XP85012 der Firma Photonis sowie der jeweilige Vergleich mit den Hamamatsu H8500 MAPMTs. Eine wichtige Eigenschaft ist die Anzahl an detektierten Photonen pro Cherenkov-Ring, bei der Crosstalk eine erhebliche Rolle spielt. Wir berichten über fortgeschrittene Methoden zur Crosstalk-Bestimmung sowie weitere Resultate aus den bei dieser Strahlzeit gewonnenen Daten.

*gefördert durch BMBF 05P12PXFCE, und GSI

HK 7.7 Mo 15:30 HZ 9

Commissioning of the new Photon Tagger of the BGO-OD Experiment at ELSA — •Andreas Bella for the BGO-OD-Collaboration — Physikalisches Institut, Bonn, Deutschland

The BGO-OD Experiment, currently under construction at ELSA at the University of Bonn, is setup to investigate the photoproduction of mesons. Therefore, an electron beam provided by ELSA is used to produce Bremsstrahlung on a thin radiator. To determine the energy of the Bremsstrahlung, the electrons momenta are analysed through a dipole magnet which bends them into a hodoscope. It consists of 120 coincidence channels which cover an energy range from 10% to 90% of the incoming electron beam energy E_0. Due to geometrical constraints, the expected energy width of two overlapping scintillators varies from 0.4% to 1.7% of E_0. The optimum positions of the scintillators and the expected energy resolution were determined via Virtual Monte Carlo/Geant4.

The commissioning of the tagger hodoscope was finished with a final energy calibration, the results of which agree perfectly with simulations.

*Supported by DFG (SFB/TR-16)

HK 7.8 Mo 15:45 HZ 9

NeuLAND prototype: response to fast neutrons — •Simon Jährling[1], Thomas Aumann[1,2], Konstanze Boretzky[2], Igor Gasparic[1,3], Michael Heil[2], Dmytro Kresan[2], Heiko Scheit[1], and Haik Simon[2] for the R3B-Collaboration — [1]Technische Universität Darmstadt, Germany — [2]GSI Helmholtzzentrum für Schwerionenforschung GmbH, Darmstadt, Germany — [3]Rudjer Boskovic Institute, Zagreb, Croatia

Within the R3B collaboration (Reactions with Relativistic Radioactive Beams), a new neutron detector NeuLAND (New Large Area Neutron Detector) is being developed. It will be a fully active scintillation detector consisting of 3000 scintillator bars, arranged in 30 double layers. Within a double layer 50 bars are horizontal and 50 vertical orientated. The whole detector measures $2.5 \times 2.5 \times 3$ m^3. A prototype with 150 NeuLAND bars was tested at GSI using quasi-mono-energetic neutrons with different energies from 200 to 1500 MeV stemming from quasi-free deuteron breakup reactions on a CH_2 target. The experimental setup will be described and preliminary results for the time resolution and efficiency of the NeuLAND prototype detector will be presented.

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