HK 27: Instrumentierung VI

Time: Tuesday 16:30–18:45 Location: HS1

HK 27.1 Tue 16:30 HS1

Entwicklung eines Disc DIRC Detektors für PANDA — •Oliver Merle, Michael Düren, Avetik Hayrapetyan, Klaus Föhl, Benno Kröck, Peter Koch, Kristof Kreutzfeldt, Marko Zühlsdorf, Michael Sporleder und Ann-Kathrin Rink — Justus-Liebig-Universität, Giessen

Zur Identifikation von geladenen Teilchen im $\overline{\text{P}}$ANDA@FAIR Experiment wird ein neuartiger DIRC Cherenkov Detektor entwickelt. Dabei handelt es sich um ein kompaktes Design von nur wenigen Zentimetern Dicke. Das in BaBar erfolgreich umgesetzte DIRC Prinzip wird damit erstmals auf einen scheibenförmigen Radiator angewandt. Geant4-Simulationen und deren Analyse mittels eigens entwickelter Rekonstruktionsmethoden erlauben es, potentielle Designschwächen schon vor den ersten Prototypen zu identifizieren und Lösungen zu erarbeiten. Aktuelle Ergebnisse dieser Studien zeigen, dass eine Pion/Kaon Trennung von $> 4\sigma$ bis zu Impulsen von 4.0 GeV/c sowohl bei einer einzelnen als auch bei zwei koinzidenten Teilchenspuren möglich ist. Über den aktuellen Stand der Entwicklung wird in diesem Vortrag berichtet.

HK 27.2 Tue 16:45 HS1

Optical Properties of Radiators for the PANDA Barrel DIRC — Roland Hohler[1,2], •Grzegorz Kalicy[1,2], Klaus Peters[1,2], Georg Schepers[1], Carsten Schwarz[1], and Jochen Schwiening[1] for the PANDA-Collaboration — [1]GSI Hemholtzzentrum für Schwerionenforschung, Darmstadt — [2]JWG Universität Frankfurt

The physics program of the PANDA experiment at the future FAIR facility includes hadron spectroscopy which requires efficient particle identification (PID) over a large angular and momentum range. The main system responsible for hadronic PID in the barrel region of the detector uses the DIRC (Detection of Internally Reflected Cherenkov light) principle with long, rectangular bars made from synthetical fused silica as radiators and light guides.

The performance of the Barrel DIRC strongly depends on the optical properties of radiators such as surface roughness. A motion controlled setup was designed for measurements of the bulk attenuation and reflection coefficient to qualify the production and polishing processes of the different bar manufacturers. This talk will present the results for several prototype bars from measurements using lasers with different wavelengths.

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HK 27.3 Tue 17:00 HS1

Test of prototypes of the PANDA Disc DIRC — •Peter Koch, Michael Düren, Klaus Föhl, Avetik Hayrapetian, Kristof Kreutzfeldt, Benno Kröck, Oliver Merle, Michael Sporleder, and Marko Zühlsdorf — II. Physikalisches Institut, Universität Giessen, Germany

The Panda Disc DIRC is a detector for particle identification in the forward direction of the PANDA experiment at FAIR. It uses internally reflected Cherenkov light that is emitted by a charged particle crossing a transparent disc. During 2010, several test beam experiments at DESY, CERN and Jülich have been done using glass and acrylic glass radiators and focusing elements to map the Cherenkov cone onto position sensitive photon detectors. Several fast avalanche photo diodes (APDs), multichannel plate photomultipliers (MCP-PMTs) and the new digital silicon photomultipliers (dSiPMs) from Philips have been tested. First results will be presented.

HK 27.4 Tue 17:15 HS1

PANDA DIRC simulation and reconstruction — Carsten Schwarz[1], Dipanwita Dutta[1,2], Klaus Goetzen[1], •Maria Patsyuk[1], Klaus Peters[1], and Jochen Schwiening[1] — [1]GSI Helmholtzzentrum für Schwerionenforschung GmbH — [2]Present address: Nuclear Physics Division, Bhabha Atomic Research Centre, Mumbai 400085, India

The PANDA experiment at the future facility for anti-proton and ion research (FAIR) at GSI, Darmstadt, aims at studying the strong interaction by precision spectroscopy. A detector system with excellent particle identification properties over a large range of solid angle and momentum is therefore mandatory. Charged hadron identification in the barrel region will be performed by a compact ring imaging Cherenkov detector based on the DIRC (Detection of Internally Reflected Cherenkov light) principle. The current design of the PANDA barrel DIRC is based on the BABAR DIRC with several important improvements, such as focusing optics and fast photon timing. We present details of the simulation of the Barrel DIRC in Geant and a study of the detector performance using a fast reconstruction algorithm to determine the single photon Cherenkov angle resolution and photon yield for several design options.

HK 27.5 Tue 17:30 HS1

Single photon detection properties of H8500 MAPMTs for the CBM RICH detector * — •Christian Pauly for the CBM-Collaboration — Bergische Universität Wuppertal

The Compressed Baryonic Matter (CBM) experiment, being build at the Facility for Antiproton and Ion Research (FAIR) at Darmstadt, is being designed to investigate heavy-ion collisions in fixed target mode at energies ranging from 10-45 GeV/nucleon. A key component for particle identification in the proposed setup is a gaseous RICH detector using CO_2 as radiator gas. For the photon detector it is foreseen to use Hamamatsu H8500 Multianode PMTs, which provide a good tradeoff in terms of single-photon detection, geometric coverage and price per instrumented area.

We have studied the single photon detection properties of these tubes, in particular in presence of a magnetic field since the CBM RICH detector will be placed in direct vicinity to a superconducting dipole magnet. The possible use of wavelength-shifting coatings to enhance the quantum efficiency in the UV range will be discussed.

For autumn 2011 we plan a fullscale prototype test using 16 MAPMTs in a realistic gas radiator setup. We will report on the ongoing preparations for this test.

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HK 27.6 Tue 17:45 HS1

Quantum efficiency of multianode photomultiplier tubes and beam test results for the development of a CBM RICH detector* — •Jan Kopfer for the CBM-Collaboration — Bergische Universität Wuppertal, Germany

The Compressed Baryonic Matter (CBM) experiment at the future Facility for Antiproton and Ion Research (FAIR) is dedicated to explore the intermediate range of the QCD phase diagram using nucleus-nucleus collisions from 8-45 GeV/nucleon beam energy.

A gaseous RICH detector is developed for clean and efficient electron identification. Its photodetector is planned to be based on H8500 Hamamatsu multianode photomultiplier tubes (MAPMTs) whose characteristics are important for the detector performance.

On the way towards a scalable CBM RICH prototype an array of four MAPMTs with self triggered readout electronics has successfully been tested at the Cern PS/T10 beamline in a proximity focussing test beam setup. We present the conceptual design of the CBM RICH detector, discuss results of quantum efficiency measurements of H8500 MAPMTs with bialkali and superbialkali cathodes as well as borosilicate and UV glass windows, and report on the beam test results.

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HK 27.7 Tue 18:00 HS1

Untersuchung von Microchannel-Plate Photomultipliern für den PANDA Barrel-DIRC — •Fred Uhlig, Alexander Britting, Wolfgang Eyrich und Albert Lehmann für die PANDA-Kollaboration — Universität Erlangen-Nürnberg, Physkalisches Institut IV

Für das PANDA-Experiment am HESR/FAIR-Komplex der GSI in Darmstadt ist der Einsatz von zwei DIRC (Detection of Internally Reflected Cherenkov Light) Detektoren zur Teilchenidentifikation geplant. Dazu werden die Öffnungswinkel des beim Durchlauf eines relativistischen Teilchens durch einen Radiator emittierten Cherenkov-Kegels bestimmt. In Vorwärtsrichtung wird dies durch einen Scheiben-DIRC erfolgen, um den Wechselwirkungspunkt wird ein Barrel-DIRC zum Einsatz kommen.

Für letzteren sind Multipixel-Sensoren notwendig, die eine sehr gu-

te Zeitauflösung von <100 ps für einzelne Photonen in Magnetfeldern über 1 Tesla erreichen. Außerdem werden niedrige Dunkelzählraten, eine hohe Ratenstabilität, wenig Übersprechen und eine lange Lebensdauer verlangt.

Bisher gibt es keinen idealen Photosensor, der diese Anforderungen vollständig erfüllt. Als vielversprechende Kandidaten werden zur Zeit u.a. Microchannel-Plate Photomultiplier (MCP-PMTs) von Photonis (XP85112, XP85012) mit verbessertem inneren Aufbau untersucht. Unsere neuesten Ergebnisse werden vorgestellt.

- Gefördert durch BMBF und GSI-

HK 27.8 Tue 18:15 HS1

SiPM's for particle detection — •Gamal AHMED[1,2], Paul BUEHLER[1], Johann MARTON[1], and Ken SUZUKI[1] — [1]Stefan Meyer Institute of the Austrian Academy of Sciences, Boltzmanngasse 3, 1090 Vienna, Austria. — [2]Al-Azhar University, Faculty of Science,Physics Department, 11884, Cairo, Egypt.

Particle identification (PID) for hadrons and leptons over a large range of solid angle and momenta is an essential requirement for physics objectives of the PANDA detector. The solenoid in the target spectrometer produces a magnetic field of B $\approx$ 2T necessary for momentum resolution of the tracking detectors. PID in the barrel section of the target, spectrometer has to work in this strong magnetic field within the solenoid, since it is surrounded by an electromagnetic calorimeter, it cannot take too much radial space. Readout of promptly emitted Cherenkov light with SiPM is a promising combination, with advantages like compactness, magnetic field resistance; simple operation and fast timing make SiPM an excellent candidate. The detection of momenta up to several GeV/c can be performed by the Detection of Internally Reflected Cherenkov (DIRC) light. The PANDA detector will feature two DIRC detectors, a DIRC in barrel geometry surrounding the target region, and a disc DIRC in the forward region. SiPM's with a sensitive area of 3mmx3mm are on the market. We discuss here SiPM's timing performance characteristics and dependence of the operation conditions measurements performed at Stefan Meyer Institute. The single photoelectron time resolution results are also presented.

HK 27.9 Tue 18:30 HS1

Lifetime of microchannel-plate photomultipliers for the PANDA-DIRC — •Alexander Britting, Wolfgang Eyrich, Albert Lehmann, and Fred Uhlig for the PANDA-Collaboration — Physikalisches Institut IV, Universität Erlangen-Nürnberg

At the PANDA experiment the particle identification will be accomplished by using DIRC detectors (Detection of Internally Reflected Cherenkov Light). By total reflection inside the radiator the Cherenkov photons are guided to the photo sensors.

With the planned optics at the barrel DIRC a spatial resolution of about 5 mm at the focal plane will be necessary for the reconstruction of the Cherenkov angles. Because of their advantageous properties especially inside a magnetic field multi-anode microchannel plate photo multipliers (MCP-PMT) are the favoured sensor types.

With the anticipated average luminosity of $2 \cdot 10^{32}\ cm^{-2}s^{-1}$ this implies a rate of detected photons of about 200 $kHz\ cm^{-2}$ at the MCP-PMTs surface. However, a major drawback of MCP-PMTs is still their lifetime. At these photon rates an integrated charge of about 1 $C\ cm^{-2}\ a^{-1}$ will be collected at the MCP anode which is well beyond the amount currently available devices can stand. In Erlangen we have investigated a few types of multi-anode MCP-PMTs, especially lifetime enhanced tubes not commercially available yet. The results of these lifetime measurements will be presented.

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