HK 39: Instrumentation VIII

Zeit: Mittwoch 14:00–15:45 Raum: HS 11

Gruppenbericht HK 39.1 Mi 14:00 HS 11

The PANDA DIRC Detectors — •Ilknur Koseoglu for the PANDA-Collaboration — JLU Giessen, Giessen, Germany — GSI, Darmstadt, Germany

The PANDA experiment at the new Facility for Antiproton and Ion Research (FAIR) near Darmstadt/Germany is planned to investigate fundamental questions of hadron physics. The PANDA detector is designed as a fixed-target experiment by using antiproton beam with a momentum range of 1.5 to 15 GeV/c colliding on a hydrogen or nuclear target. In order to achieve excellent particle identification (PID), two DIRC detectors have been developed. The Barrel DIRC will cover the polar angles from 22°-140° and perform π/K separation with 3 σ or more for momenta from 0.5 to 3.5 GeV/c. The design of the Barrel DIRC is based on the successful BaBar DIRC and the SuperB FDIRC R&D with several improvements to optimize the performance for PANDA. The novel Endcap Disc DIRC (EDD) will cover the polar angle range from 5° to 22° and will provide π/K separation up to 4 GeV/c with a separation power of about 3 σ. Both PANDA DIRC use synthetic fused silica bars or plates as radiators and lightguides and lifetime-enhance Microchannel Plate PMTs (MCP-PMTs) as sensors. The Cherenkov radiator for the EDD is a 2 cm thin plate of synthetic fused silica, divided into 4 identical quadrants. In order to conserve the Cherenkov angle during propagation, the surfaces of the 4 quadrants are polished with high precision. The technical design of the two DIRC detectors and the results of beam tests at CERN for two prototypes will be presented.

HK 39.2 Mi 14:30 HS 11

Prototype test for the PANDA Barrel DIRC — Ahmed Ali[1,2], Anastasios Belias[1], •Roman Dzhygadlo[1], Andreas Gerhardt[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

The Barrel DIRC (Detection of Internally Reflected Cherenkov light) detector will be an essential part of the hadronic PID system of the PANDA experiment at GSI, Darmstadt. Covering the polar angle range of 22-140 degrees, it will provide pion-kaon separation power of at least 3 standard deviations for a charge particle momenta between 0.5 GeV/c and 3.5 GeV/c.

The design of the Barrel DIRC features the narrow bar radiator made from synthetic fused silica, a complex multi-layer spherical lens focusing system, a prism-shaped fused silica expansion volume, and MCP-PMTs (MicroChannel-Plate PhotoMultiplier Tubes) to detect the location and arrival time of the Cherenkov photons. All components were tested and successfully validated with a sophisticated prototype in a mixed hadron particle beam at CERN during 2015-2017. Additional test was conducted at CERN in 2018 with a purpose to optimize the number of used MCP-PMTs. Result of the optimization with the analysis and a comparison to the Geant4 simulation will be presented.

HK 39.3 Mi 14:45 HS 11

Performance of most advanced 2-inch MCP-PMT tubes from PHOTONIS and Hamamatsu — •Markus Pfaffinger, Merlin Böhm, Steffen Krauss, Albert Lehmann, Daniel Miehling, Márton Németh-Csóka, Nico Schwarm, and Samuel Stelter — Physikalisches Institut , Universität Erlangen-Nürnberg

The $\bar{P}$ANDA experiment at the new FAIR facility will use two DIRC detectors for particle identification. The focal plane of both detectors will be located inside a magnetic field of >1 Tesla. Microchannel-Plate Photomultipliers (MCP-PMTs) are the favored sensors for the detection of the Cherenkov photons.

Coating the MCPs with an atomic layer deposition (ALD) technique has increased the lifetime of MCP-PMTs more than a factor of 50 making them durable enough to be used in high luminosity experiments like $\bar{P}$ANDA. The performance of the most recent lifetime-enhanced tubes from PHOTONIS (XP85112/A1-Q-HA 9002108) and Hamamatsu (R13266-07-M64M YH0250) have been tested in Erlangen. The results concerning QE, gain, time resolution, rate capability, darkcount rate, afterpulsing and crosstalk will be discussed in this talk.

These sensors have meanwhile also been included in the Erlangen lifetime setup where their quantum efficiency (QE) is monitored in correlation with the integrated anode charge (IAC). The lifetime performance of both new devices will be compared to other lifetime-enhanced MCP-PMTs measured with the same setup.

- Funded by BMBF and GSI -

HK 39.4 Mi 15:00 HS 11

Evaluation und Qualifikation optischer Filter für den PANDA Endcap Disc DIRC — •Lisa Brück, Michael Düren, Erik Etzelmüller, Klaus Föhl, Avetik Hayrapetyan, Ilknur Köseoğlu, Mustafa Schmidt, Marc Strickert, Simon Bodenschatz, Jan Niclas Hofmann, Sophie Kegel und Jhonathan Pereira de Lira für die PANDA-Kollaboration — Justus Liebig-Universität Gießen, II.Physikalisches Institut, Gießen

Der Endcap Disc DIRC Detektor für das PANDA Experiment nutzt den Cherenkov-Effekt zur Identifikation von geladenen Teilchen. Zur Verbesserung der Auflösung des Detektors, welche maßgeblich durch chromatische Dispersion beeinflusst wird, sollen im finalen Detektor optische Filter, die bestimmte Wellenlängen der Cherenkov Photonen herausfiltern, eingesetzt werden. Die Filter müssen dabei hohe Anforderungen an den Transmissionsgrad der Photonen und die Strahlungshärte erfüllen. In diesem Zusammenhang wurden diverse Filter getestet und qualifiziert.

HK 39.5 Mi 15:15 HS 11

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, Darmstadt — [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. Two reconstruction algorithms were developed to optimize the hadronic PID performance. Benchmark physics channels of cleanly identified exclusive events will be used for DIRC performance studies. The DIRC counter will be installed into the GlueX experiment during the winter 2018/2019 shutdown and commissioned with beam in February 2019. We will discuss the status of the GlueX DIRC detector and first impressions from the commissioning run.

HK 39.6 Mi 15:30 HS 11

Ein Cosmic-Teststand für die Entwicklung des Endcap Disc DIRC Detektors — •Jhonatan Pereira de Lira, Simon Bodenschatz, Lisa Brück, Michael Düren, Erik Etzelmüller, Klaus Föhl, Avetik Hayrapetyan, Jan Niclas Hofmann, Sophie Kegel, Ilknur Köseoğlu, Mustafa Schmidt und Marc Strickert für die PANDA-Kollaboration — "Justus-Liebig-Universität Gießen, II.Physikalisches Institut, Gießen"

Der Endcap Disc DIRC (EDD) ist ein Cherenkov-Detektor, der derzeit in Gießen von der AG Düren entwickelt wird. Dieser Detektor wird zukünftig in Darmstadt im PANDA-Experiment eingesetzt und wurde dafür entworfen, Pionen und Kaonen die diesen Detektor mit Impulsen von bis zu 4 GeV/c in einem Polarwinkelbereich von 5° und 22° durchqueren, mit einer Separation-Power von drei Standardabweichungen zu identfizieren. Mit Hilfe von Monte-Carlo-Simulationen wurden verschiedene Konfigurationen und Materialien für den EDD untersucht und deren Ergebnisse mit Tests an Prototypen im CERN und im DESY bestätigt. Um Tests des EDDs flexibler und nicht nur an externen Beschleunigeranlagen durchführen zu können, wird zurzeit ein Teststand aufgebaut, der die myonische Komponente der sekundären kosmischen Strahlung zunutze macht. Dieser Vortrag umfasst einerseits den Aufbau des Cosmic-Teststandes und andereseits die aktuellen Ergebnisse die mit Monte-Carlo-Simulationen erhalten wurden.