HK 21: Instrumentation VIII

Zeit: Dienstag 14:00–15:30 Raum: HZO 90

Gruppenbericht HK 21.1 Di 14:00 HZO 90

Status of the Barrel and Disc DIRC detectors at PANDA — •Markus Pfaffinger for the PANDA-Collaboration — Physikalisches Institut , Universität Erlangen-Nürnberg

The PANDA experiment at the new FAIR facility at GSI in Darmstadt will investigate open questions of hadron physics in the momentum region of $1.5 - 15\,\mathrm{GeV/c}$ with $\bar{\mathrm{p}}\mathrm{p}$ annihilations. The excellent particle identification (PID) needed will be achieved by two DIRC detectors. The Barrel DIRC will surround the interaction point and perform a π/K separation for momenta of $0.5 - 3.5\,\mathrm{GeV/c}$ at polar angles from 22° to 140°. Its design is based on the successful BaBar DIRC with several improvements to make it more compact and to achieve a separation power larger than $3\,\sigma$ for the expected momentum region of the π/K. In the forward region of the detector the Endcap Disc DIRC will be located to cover an angular region from 5° to 22° and clearly separate π/K up to $4\,\mathrm{GeV/c}$ with a separation power of about $3\,\sigma$. For the detection of the Cherenkov photons lifetime-enhanced MCP-PMTs will be used in combination with fast readout electronics. The radiators will be made of precisely polished fused silica to guarantee a low photon loss ratio and conserve the Cherenkov angle during their propagation through the optical components using internal total reflection. To evaluate the designs Geant4 simulations and tests of different prototypes have been performed at various beam facilities. This talk will present both detector concepts and the achieved results.

HK 21.2 Di 14:30 HZO 90

Setup and first results of quality assurance measurements with MCP-PMTs — •Merlin Böhm, Rafael Frytz, Albert Lehmann, Daniel Miehling, Markus Pfaffinger, and Samuel Stelter for the PANDA-Collaboration — Physikalisches Institut, Universität Erlangen-Nürnberg

For the planned DIRC detectors (detection of internally reflected Cherenkov light) of the PANDA experiment several hundred microchannel-plate photomultipliers (MCP-PMTs) are required. The PMTs must have a good time resolution and a homogeneous gain and quantum efficiency across the active surface. To measure, among others, the position dependent time resolution, gain and dark count rate (DCR), we have built a semi-automatic quality control measurement setup in a light tight box consisting of a 3D-stepper and a picosecond laser pulser. Number of hits, timing and pulse height data for each anode channel are parallelly read out with the PADIWA-AMP2/TRB3 DAQ system from GSI. In first test measurements the laser was scanned across the surface of different MCP-PMTs. With these measurements, besides the mentioned properties, we could also easily study background sources like DCR, afterpulsing probability and recoil ion TOF distributions, crosstalk among the anode channels like charge sharing and electronics effects, and the distributions of electrons recoiling at the first MCP layer.

- Gefördert durch BMBF und GSI -

HK 21.3 Di 14:45 HZO 90

Lifetime performance of recently developed Microchannel-Plate Photomultipliers — •Daniel Miehling, Merlin Böhm, Steffen Krauss, Albert Lehmann, Markus Pfaffinger, Nico Schwarm, and Samuel Stelter for the PANDA-Collaboration — Physikalisches Institut , Universität Erlangen-Nürnberg

The PANDA experiment at the new FAIR facility will use two DIRC detectors for hadron identification. The focal plane of both DIRC detectors will be located inside a magnetic field of $\sim$1 T. In the PANDA environment the only sensor option for the detection of the Cherenkov photons are Microchannel-Plate Photomultipliers (MCP-PMTs). The most limiting parameter until a few years ago was the lifetime of the MCP-PMTs. The quantum efficiency (QE) correlated to the integrated anode charge (IAC) being measured in the sensor is an indicator for the lifetime. The QE will decrease with increasing IAC because of aging processes taking place at the photo cathode (PC) until the sensor is "blind". One of these processes is the interaction of feedback ions from the residual gas which may damage the PC on impact. The Erlangen lifetime setup is capable of illuminating various MCP-PMTs simultaneously and monitoring their IAC. The spectral QE of the sensors is measured every few weeks and full surface scans are made every few months. This talk will present the current setup and the latest obtained results. The focus will be on recent 2-inch MCP-PMTs from Photonis and Hamamatsu. IACs of $\gg 5\,\mathrm{C/cm^2}$ were obtained with no or only minor QE loss which is sufficient for both PANDA DIRCs.

- Funded by BMBF and GSI -

HK 21.4 Di 15:00 HZO 90

Time resolution of the DiRICH MAPMT readout with and without WLS coverage * — •Adrian Amatus Weber for the CBM-Collaboration — Justus-Liebig-Universität Gießen

The HADES experiment during FAIR phase 0 and later the CBM experiment will employ RICH detectors for high quality electron identification. Photon detection is performed by H12700 Hamamatsu MAPMTs. A new FPGA-TDC based readout scheme has been developed with the 32 channel DiRICH readout module as its core component. Signal discrimination, time- and time-over-thershold measurement, as well as digital data handling, are all implemented on a central Lattice ECP5 FPGA. Good timing resolution requires a careful timing calibration taking into account nonlinearities in the TDC-FPGA design itself, temperature and voltage variations, as well as channel-to-channel delays has to be performed. We developed an FPGA based linear calibration of the TDCs that could successfully be tested on a TrbSc board. Timing precision in the range of 20-30 ps is achieved. A proximity focusing CBM RICH prototype has been tested at COSY using the full FPGA-TDC readout for 12 MAPMTs, partially covered with WLS coatings in order to enhance the UV sensitivity. Timing precision of the MAPMTs and readout electronics in-beam with and without WLS coating has been measured. The timing precision is on the order of 500 ps. Adding the WLS layer one measures an additional fast (2.4 ns) fluorescence decay component.

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HK 21.5 Di 15:15 HZO 90

Optimierung einer Diskriminatorschwelle der DIRICH MAPMT Auslesekette* — •Jörg Förtsch für die CBM-Kollaboration — Bergische Universität Wuppertal

In diesem Vortrag stellen wir die DIRICH-Auslesekette des CBM- und HADES-Experiments am FAIR Beschleunigerzentrum vor. Die Frontend Elektronik verzichtet auf ADCs und verwendet lediglich TDCs, die in einem Lattice ECP5 FPGA integriert sind. Die Optimierung der Diskriminatorschwelle ist hierbei entscheidend für eine hohe Nachweiswahrscheinlichkeit sowie präzise Messung der Ankunftszeit der Photonen bei gutem Signal- zu Rausch-Verhältnis. Da jegliche Amplitudeninformation fehlt, ist das Bestimmen der Diskriminatorschwelle aus einem Amplitudenspektrum nicht möglich. In diesem Vortrag soll eine Methode beschrieben werden, die über die Signalrate als Funktion der eingestellten Schwelle (Ratenscan) und deren Differenzierung ein sogenanntes statistisches Pulshöhenspektrum generiert und damit die Schwellenfindung ermöglicht. Das Verfahren wurde mit einzelnen Photonen und einem H12700 MAPMT (Hamamatsu) getestet.

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