HK 56: Instrumentation XV

Time: Thursday 14:00–15:30 Location: SCH/A.101

Group Report HK 56.1 Thu 14:00 SCH/A.101

Performance of the upgraded HADES RICH in heavy ion collisions* — •Jörg Förtsch for the HADES-Collaboration — Bergische Universität Wuppertal

The 1.58A GeV Ag+Ag beamtime of the High Acceptance DiElectron Spectrometer (HADES) at GSI Darmstadt, Germany, in March 2019 marked the first use of the upgraded HADES RICH. At triggered event rates of up to 18 kHz the HADES RICH detector is the key component for efficient identification of electrons and positrons in hadronically dominated collision products.

The HADES RICH detector is a gaseous ring imaging Cherenkov detector with C_4H_{10} (isobutane) being used as radiator hence making the detector hadron blind for momenta up to approximately 2 GeV/c. A spherical mirror reflects Cherenkov photons on a staggered photon detection plane comprised of 428 MultiAnode Photo electron Multipliers (MAPMTs) of type Hamamatsu H12700. All 27392 different MAPMT channels are read out by the DIRICH readout electronic scheme measuring leading edge and time over threshold of each pulse down to sub-nanosecond precision.

In this talk we will present key features of our upgrade and lay out quantitatively how well the RICH performed throughout the full measurement campaign.

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HK 56.2 Thu 14:30 SCH/A.101

Design of a luminosity monitor for the P2 parity violating experiment at MESA — Sebastian Baunack[1], Boris Gläser[1], Rahima Krini[1], Frank Maas[1,2,3], •Tobias Rimke[1], David Rodriguez Pineiro[2], and Malte Wilfert[1] — [1]Institut für Kernphysik, Johannes Gutenberg-Universität Mainz — [2]Helmholtz-Institut Mainz, Johannes Gutenberg-Universität Mainz — [3]PRISMA+ Cluster of Excellence, Johannes Gutenberg-Universität Mainz

The P2 experiment at the future MESA accelerator in Mainz plans to measure the weak mixing angle $\sin^2(\theta_W)$ in parity violating elastic electron-proton scattering. The aim of the experiment is a very precise measurement of the weak mixing angle with an accuracy of 0.15% at a low four-momentum transfer of $Q^2 = 4.5 \cdot 10^{-3}$ GeV^2. In order to achieve this accuracy, it is necessary to monitor the stability of the electron beam and the liquid hydrogen target. Any helicity correlated fluctuation of the target density leads to false asymmetries.

Therefore, it is planned to install a luminosity monitor in forward direction close to the beam axis. The motivation and challenges for designing an air Cherenkov luminosity monitor will be discussed in this talk. Furthermore, I show promising results from prototype tests with the electron beam of the MAMI accelerator.

HK 56.3 Thu 14:45 SCH/A.101

Performance of the first mass production MCP-PMTs for the PANDA Barrel DIRC and lifetime of the latest MCP-PMTs — •Katja Gumbert, Merlin Böhm, Steffen Krauss, Albert Lehmann, and Daniel Miehling for the PANDA-Collaboration — Physikalisches Institut, Universität Erlangen-Nürnberg

In the PANDA detector at FAIR two DIRC detectors will be used for particle identification using Cherenkov light. Since the focal planes of both DIRCs are located inside magnetic fields of $\gtrsim 1$ Tesla, Microcannel-Plate Photomultipliers (MCP-PMTs) will be used to detect the few Cherenkov photons. The Barrel DIRC, which will surround the beam line and the interaction point, will be equipped with 128 MCP-PMTs of the type XP85112-S-BA by PHOTONIS with an active area of 2x2 inch^2, 8x8 anode pixels and a pore diameter of 10 μm of the MCPs. As part of the quality controll process Erlangen will measure performance parameters like the efficiency, both quantum and collection efficiency, the gain distribution, the time resolution, the afterpulse probability and the rate capability of these sensors.

The quantum efficiency of former MCP-PMTs dropped after only a few hundred mC/cm^2 integrated anode charge due to feedback ions produced in the residual gas. These ions are accelerated back to the photo cathode and may damage it. This aging problem was significantly reduced by applying an ALD coating (atomic-layer deposition) to the MCP pores. Both the lifetime performance of the latest tubes and the performance of the first Barrel DIRC MCP-PMTs will be shown in this talk. - Funded by BMBF and GSI -

HK 56.4 Thu 15:00 SCH/A.101

New "escalation" effect observed in recent MCP-PMTs — •Steffen Krauss, Merlin Boehm, Katja Gumbert, Albert Lehmann, and Daniel Miehling — Physikalisches Institut, Universität Erlangen-Nürnberg

Two DIRC-type Cherenkov detectors will be employed in the PANDA experiment at FAIR for pion/kaon separation. Since the focal planes of both DIRC detectors are located in a $\gtrsim 1$ Tesla magnetic field, Microchannel-Plate Photomultipliers (MCP-PMTs) are the only viable option to detect the few generated Cherenkov photons. To distinguish these single photons safely from the thermally emitted photo electrons a low darkcount rate is required in combination with a high gain of $> 10^6$. In some of the latest MCP-PMTs a new and completely unexpected effect was observed recently. At high gains and sometimes in combination with high illumination levels the MCP-resistance drops significantly, the gain drops, and a high amount of photons are created inside the tube, which causes a drastic increase of count rate. Inside a magnetic field this behavior seems to be significantly suppressed.

To study this effect in more detail several measurements of current, gain, and count rate were performed and compared for different MCP-PMTs. The rate of the produced photons were measured in an oppositely placed additional MCP-PMT. The results of these measurements are presented in this talk for older and the most recent MCP-PMT generations of different manufacturers.

- Funded by BMBF and GSI -

HK 56.5 Thu 15:15 SCH/A.101

Prototype studies towards the CBM RICH air cooling system* — •Gianluca Boccarella, Christian Pauly, Dennis Pfeifer, and Karl-Heinz Kampert for the CBM-Collaboration — Bergische Universität Wuppertal, Gaußstraße 20, 42119 Wuppertal

The Compressed Baryonic Matter (CBM) RICH detector is a CO_2 based gaseous Ring Imaging Cherenkov detector using MultiAnode PhotoMultipliers (MAPMT) for Cherenkov photon detection. It is placed beam downstream directly behind the CBM superconducting magnet and serves the precise electron identification and pion suppression. The photon detector is split into two separate cameras each including 30k channels DIRICH frontend readout electronics. Both cameras are enclosed by an iron shielding box in order to protect the MAPMT sensors from the magnetic stray field of the nearby CBM magnet. This shielding enclosure poses a major challenge for the cooling of the electronics dissipating approximately 3 kW heat inside each camera module. In order to achieve reliable cooling of all $\sim$1000 readout modules per camera we plan to use a closed-cycle enforced air cooling system.

In the talk, we present the cooling concept of the CBM RICH detector together with first measurements obtained using a full scale prototype of one of the camera modules.

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