HK 38: Instrumentation X

Zeit: Mittwoch 14:00–16:00 Raum: S1/01 A2

Gruppenbericht HK 38.1 Mi 14:00 S1/01 A2

The CBM Time-of-Flight wall — •Ingo Deppner and Norbert Herrmann for the CBM-Collaboration — Physikalisches Institut der Universität Heidelberg

The Compressed Baryonic Matter spectrometer (CBM) is a future heavy ion experiment located at the Facility for Anti-proton and Ion Research (FAIR) in Darmstadt, Germany. The main interest of CBM is the investigation of the phase diagram of strongly interacting matter in the region of the highest baryon densities. In order to measure the necessary observables with unprecedented precision an excellent particle identification is required. The key element in CBM providing hadron identification at incident energies between 2 and 35 AGeV will be a 120 m^2 large Time-of-Flight (ToF) wall composed of Multi-gap Resistive Plate Chambers (MRPC) with a system time resolution better than 80 ps. The most demanding challenge, however, is the enormous incident particle fluxes between 100 Hz/cm^2 and 25 kHz/cm^2 generated at the highest interaction rates (10 MHz) that CBM is designed for. The current conceptual design of the ToF-wall will be presented. We will show various MRPC prototypes developed by the CBM-Tof group. In order to elaborate the final MRPC design of these counters heavy ion test beam times were performed at SPS/CERN. In this contribution we will present performance test results regarding time resolution, efficiency, cluster size and rate capability for several counter types. Work was supported partially by BMBF 05P12VHFC7 and by EU/FP7-HadronPhysics3/WP19.

HK 38.2 Mi 14:30 S1/01 A2

Untersuchungen zur Lebensdauer von neuen langlebigen Microchannel-Plate Photomultipliern — •Markus Pfaffinger, Merlin Böhm, Albert Lehmann und Fred Uhlig — Physikalisches Institut , Universität Erlangen-Nürnberg

Das PANDA-Experiment an der FAIR Beschleunigeranlage plant den Einsatz von 2 DIRC Detektoren zur Teilchenidentifikation. Aufgrund der hohen Magnetfelder von bis zu 2 Tesla müssen hier Microchannel-Plate Photomultiplier (MCP-PMTs) verbaut werden. Die MCP-PMTs sollen während des ganzen Experiments nicht getauscht werden, deshalb muss deren Lebensdauer bestimmt und optimiert werden. Die Quanteneffizienz (QE) eines Photomultipliers ist ein Maß für dessen Lebensdauer. Mit zunehmender Alterung geht die QE immer weiter zurück, bis der Sensor schließlich quasi "blind" ist. Diese Alterung kommt u.a. von positiven Ionen, die von den Photoelektronen an den Microchannelplates ausgelöst werden und von dort durch die Spannungsdifferenz auf die Photokathode beschleunigt werden. Diese wird beim Auftreffen der Ionen beschädigt. Die Beschädigung der Photokathode hängt also mit der vom Sensor gesehenen Gesamtladung zusammen. Im vorliegenden Aufbau werden neue MCP-PMTs bestrahlt und deren integrierte Anodenladung gemessen. Dabei werden in kurzen Intervallen Messungen der spektralen QE sowie QE-Scans über die gesamte Oberfläche der Sensoren durchgeführt, um den Verlauf der Alterung zu protokollieren. Im Rahmen des Vortrags werden der Messaufbau und die Ergebnisse der Lebensdauermessungen präsentiert.

HK 38.3 Mi 14:45 S1/01 A2

Untersuchung von 2x2 Zoll MCP-PMT Prototypen mit sehr feiner Anodenpixelierung — •Fred Uhlig, Merlin Böhm, Albert Lehmann und Markus Pfaffinger — Universität Erlangen-Nürnberg, physikalisches Institut

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. Um den Wechselwirkungspunkt wird ein Barrel-DIRC zum Einsatz kommen, in Vorwärtsrichtung wird dies durch einen Scheiben-DIRC erfolgen.

Zur Detektion der Cherenkov-Photonen sind Photosensoren notwendig, die eine sehr gute Zeitauflösung von $<$ 100 ps für einzelne Photonen in Magnetfeldern über 1 Tesla, eine niedrige Dunkelrate und eine hohe Ratenstabilität haben. Desweiteren wird zur Rekonstruktion des Cherenkov-Winkels am Scheiben-DIRC in einer Dimension eine Anodenbreite von maximal 0,5 mm benötigt. Eine gute Oberflächenuniformität bezüglich der Verstärkung und der Quanteneffizienz, sowie ein geringes Pixelübersprechen ist insbesondere bei der feinen Pixellierung notwendig.

Als Kandidaten wurden hierzu neue MCP-PMT Prototypen von Hamamatsu mit einer Fläche von 2x2 Zoll und einer Anodenpixelierung von 8x8 und 6x128 Pixeln untersucht.

- Gefördert durch BMBF und GSI -

HK 38.4 Mi 15:00 S1/01 A2

Concept and design of an alignment monitoring system for the CBM RICH mirrors* — •Jordan Bendarouach for the CBM-Collaboration — Justus Liebig University, Germany

The Compressed Baryonic Matter (CBM) experiment at the future FAIR (Facility for Antiproton and Ion Research) complex will investigate the phase diagram of strongly interacting matter at high baryon density and moderate temperatures in A+A collisions from 2-11 AGeV (SIS100) beam energy. One of the key detector components required for this CBM physics program is the RICH (Ring Imaging CHerenkov) detector, developed for efficient and clean electron identification and pion suppression. The detector consists of about 80 spherical glass mirror tiles, distributed over two sphere parts.

An important aspect to guarantee a stable operation of the RICH detector is the alignment of the mirrors. A method originally developed and inspired by the HERA-B experiment uses recorded data to assess mirror alignment of the RICH mirror system. Measurements of Cherenkov distances and angles on the PMT plane may reveal potential misalignments of the considered tile. If mirror misalignment is revealed, it can be subsequently included and rectified by correction routines, which should mostly increase ring reconstruction as well as ring-track matching efficiencies. Results of this alignment method based on simulated events, reproducing potential mirror misalignments, its limits and first correction routines will be presented.

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HK 38.5 Mi 15:15 S1/01 A2

High Resolution Time-of-Flight (TOF) Detector for Particle Identification — •Merlin Böhm, Albert Lehmann, Markus Pfaffinger, and Fred Uhlig for the PANDA-Collaboration — Physikalisches Institut, Universität Erlangen-Nürnberg

Several prototype tests were performed with the PANDA DIRC detectors at the CERN T9 beam line. A mixed hadron beam with pions, kaons and protons was used at momenta from 2 to 10 GeV/c. For these tests a good particle identification was mandatory.

We report about a high resolution TOF detector built especially for this purpose. It consists of two stations each consisting of a Cherenkov radiator read out by a Microchannel-Plate Photomultiplier (MCP-PMT) and a Scintillating Tile (SciTil) counter read out by silicon photomulipliers (SiPMs). With a flight path of 29 m a pion/kaon separation up to 5 GeV/c and a pion/proton separation up to 10 GeV/c was obtained. From the TOF resolutions of different counter combinations the time resolution (sigma) of the individual MCP-PMTs and SciTils was determined. The best counter reached a time resolution of 50 ps.

- Gefördert durch BMBF und GSI -

HK 38.6 Mi 15:30 S1/01 A2

Testbeam results of the PANDA Endcap Disc Dirc — •Erik Etzelmüller, Klim Biguenko, Michael Düren, Avetik Hayrapetyan, Julian Rieke, and Mustafa Schmidt for the PANDA-Collaboration — II. Physikalisches Institut, Justus-Liebig-Universität, Gießen, Deutschland

The physics program of the PANDA detector at the future FAIR facility at GSI requires excellent particle identification. For the PANDA forward endcap region a novel detector type called "Disc DIRC" has been designed. It covers the angular range between 5 and 22 degrees and uses internally reflected Cherenkov light in order to separate pions, kaons and protons up to a momentum of 4 GeV/c.

A new prototype was tested at the PS East Area at CERN in May 2015. For the first time all optical components consisted of fused silica and different MCP-PMT sensors were used for the photon detection. A summary of the analysis will be presented along with results from in-house tests for the individual components.

HK 38.7 Mi 15:45 S1/01 A2

The Crystal Zero Degree Detector for ISR tagging at BES III

— Achim Denig[1], •Leonard Koch[2], Wolfgang Kühn[2], Sören Lange[2], Yutie Liang[2], Christoph Redmer[1], and Milan Wagner[2] for the BESIII-Collaboration — [1]Johannes Gutenberg Universität Mainz — [2]Justus-Liebig-Universität Gießen

The BES III experiment at the BEPCII electron positron collider in Beijing is collecting data in the charm-τ mass region. Being strongly peaked towards small polar angles, photons from initial state radiation (ISR) are detected with limited efficiency.

In order to increase the detection efficiency of these photons, we propose a small detector comprised of two arrays of scintillating crystals separated by a small gap to be placed in the very forward and backward region. The crystals will be read out by SiPMs and the signal will be digitized by a feature extracting flash ADC. This data stream is correlated with the BESIII trigger in realtime on FPGA based hardware.

The detectors response has been simulated using GEANT4 and the energy resolution has been obtained. A beam test of a prototype has demonstrated the stably running of the DAQ

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