HK 7: Instrumentierung I

Time: Monday 14:00–16:00 Location: HS1

HK 7.1 Mon 14:00 HS1

Beam test of a GEM-TPC prototype — •Sverre Dørheim for the GEM-TPC-Collaboration — sdorheim@e18.physik.tu-muenchen.de

A Time Projection Chamber (TPC) with a GEM-based read out is one option for the central tracker of PANDA at the Facility for Antiproton and Ion Research (FAIR) in Darmstadt. A TPC offers very good momentum resolution and the ability to do particle ID using precise energy-loss measurements. The suppression of ion backflow intrinsic to GEM-based amplification allows us to operate the TPC an ungated, continuous mode, as required by the quasi-continuous beam in the HESR.

To show the feasibility of such a detector a prototype with a drift length of 725 mm and an outer radius of 300 mm has been built. The pad plane of the detector has 10254 hexagonal read out pads which are read out using 42 front end cards based on the AFTER-T2K chip. A gas mixture of Ar/CO_2 (90/10) was used together with different drift fields ranging from 150 to 350 $\frac{V}{cm}$.

The GEM-TPC was installed and tested in the FOPI spectrometer at GSI (Darmstadt, Germany) with a 2 $\%X_0$ Al target beeing hit by heavy ion beams of Kr at 1.2 AGeV and Au at 1.0 AGeV, respectively.

A detailed overview of the detector hardware as well as first experimental data from the beam test will be presented.

This work is supported by the German BMBF, the EU 7th framework program, the DFG Cluster of Excellence "Universe", the Maier-Leibnitz Labor der LMU und TU Muenchen, and GSI.

HK 7.2 Mon 14:15 HS1

Energy loss measurement and particle identification with the use of PANDA-type Straw Tube Tracker — •Krzysztof Pysz[1,2], Susanna Costanza[3], Wilhelm Erven[1], Pawel Kulessa[1,2], Robert Nellen[1], Henner Ohm[1], Dieter Prashun[1], James Ritman[1], Valeriy Serdyuk[1,4], Peter Wintz[1], and Peter Wuestner[1] for the PANDA-Collaboration — [1]IKP Forschungszentrum Juelich, Germany — [2]Institute for Nuclear Physics PAN Krakow, Poland — [3]INFN Pavia, Italy — [4]JINR Dubna, Russia

The proposed Straw Tube Tracker (STT) for the PANDA Experiment at the FAIR facility consists of 4600 straws which fill a cylindrical volume with a length of 1200 mm and inner and outer diameter of 150 mm and 410 mm, respectively. The tubes have a length of 1200 mm and diameter of 10 mm and are filled with an Ar/CO2 gas mixture. In the middle part of detector some straw layers skewed by about 3° relative to the standard axial orientation will be used. In effect the 3-dimensional particle tracking with a resolution of 150 μm ($r-\phi$) and 2.9 mm in z-direction is expected. In addition, the energy loss measured via charges collected on the anode wires will be used for particle identification in the momentum range up to 1500 MeV/c. Various types of front end and data acquisition electronics are developed and tested. Performance tests for STT prototype are undertaken with proton beams at COSY Juelich. Experimental details, perspectives for the final equipment and results from measurements will be presented.

HK 7.3 Mon 14:30 HS1

Development of a time projection chamber for Crystal Ball at MAMI — •Oliver Steffen, Wolfgang Gradl, and Achim Denig for the A2-Collaboration — Institut für Kernphysik, Johannes Gutenberg-Universität Mainz, D-55099 Mainz

The Crystal Ball Collaboration at the electron accelerator MAMI in Mainz studies photo-induced reactions on nucleons and nuclei with energy tagged photons produced via bremsstrahlung. The Crystal Ball/TAPS calorimeters form a 4π detector optimized for the detection of neutral final states. The inner detector system includes a two-layer MWPC for the detection of charged particle tracks.

The increased rate of charged particles in current and future experiments exceeds the rate capabilities of these MWPCs. As a replacement option, a Time Projection Chamber (TPC) with triple GEM readout is being considered. Besides higher rate capabilities, such a detector allows real track reconstruction with better angular resolution and may contribute to particle identification.

A detector test stand was set up in Mainz, and a small TPC prototype with triple-GEM readout was put into operation. This allows basic studies of detector parameters and the future development of readout electronics. In this talk, we present design considerations for such a tracking device for Crystal Ball and report on first results of tests with cosmic particles.

HK 7.4 Mon 14:45 HS1

Status der Driftkammern für das BGO-OD-Experiment an ELSA *) — •Timothy Schwan für die BGO-OD-Kollaboration — Physikalisches Institut, Universität Bonn

Das BGO-OD-Experiment, das sich derzeit am Elektronenbeschleuniger ELSA des Physikalischen Instituts der Universität Bonn im Aufbau befindet, soll neben Kaonen vor allem gemischt geladene Vielteilchen-Endzuständen in der Meson-Photoproduktion am Nukleon nachweisen. Zur Impuls- und Ladungsbestimmung der in Vorwärtsrichtung ausgesendeten Teilchen dient ein Magnetspektrometer großer Apertur. Dabei sollen die Teilchenspuren hinter dem Magnetfeld mit Hilfe von acht ebene Driftkammern rekonstruiert werden.
In diesem Talk werden Ergebnisse von ersten Testmessungen mit Photonstrahl sowie der derzeitige Status des Driftkammer-Pakets vorgestellt.

*) gefördert von der DFG im Rahmen des SFB/TR 16

HK 7.5 Mon 15:00 HS1

Performance of TRD Prototypes for the CBM Experiment — •Cyrano Bergmann for the CBM-Collaboration — Institut für Kernphysik, WWU Münster

CBM is a fixed target experiment at the future FAIR facility. The CBM Transition Radiation Detector (TRD) is geometrically arranged in three stations composed of four layers each. It consists of 1200 individual detector chambers with about 1.3 million readout channels covering a total area of roughly 1110 m^2. Apart from providing charged particle tracking it is the key detector to provide electron identification through suppression of pions. Based on the ALICE TRD two small prototype modules have been designed in Münster, which can be scaled up to the final size of TRD module. In November 2010 the two prototypes were tested in a common CBM beam test at the CERN Proton Synchroton with particle momenta up to 6 GeV/c. In addition, for the first time a time sampling Self-triggered Pulse Amplification and Digitization asIC (SPADIC) was used to readout the TRD modules. The objectives of the beam test included measurements of: electron identification performance, position resolution and dependence of detector response on variation of incident particle angle, gas mixtures, drift and anode voltage settings and particle momenta. first results from this beam test will be presented. Work supported by BMBF and the HadronPhysics2 project financed by EU-FP7.

HK 7.6 Mon 15:15 HS1

Results from first tests of TRD prototypes for CBM — •Pascal Dillenseger for the CBM-Collaboration — Institut für Kernphysik Frankfurt am Main

The CBM experiment at FAIR will explore the QCD phase-diagram with heavy ion collisions from 10 to 45 AGeV. The precise measurement of leptonic decay channels of charmonia is one of the key observables of the CBM physics program. In CBM the electrons will be identified by serveral layers of Transition Radiation Detectors (TRD) and a RICH detector, providing a pion rejection factor of 10^3. The expected high signal rates demand a fast detector response. We present the approach to facilitate thin MultiWire Proportional Chambers (MWPC) to fulfill this requirement. Several prototypes with different wire pitch and gas gap have been built and tested with a Fe^{55} and a Cd^{109} source. In addition first results from beam tests with a mixed electron pion beam from the CERN PS will be discussed.

HK 7.7 Mon 15:30 HS1

Ein Gaszähler zur Protonen/Elektronen-Detektion für das Neutronen-Lebensdauerexperiment PENeLOPE — •Thorsten Schäfer für die PENeLOPE-Kollaboration — Technische Universität München, Physik Department

Ein Gaszähler zur Protonen/Elektronen-Detektion für das Neutronen-Lebensdauerexperiment PENeLOPE

An der Technischen Universität München soll mit dem Magnetspeicherexperiment PENeLOPE die Genauigkeit des derzeit bekannten Zahlenwertes für die Neutronenlebensdauer um eine Größenordnung

auf 0,1 s verbessert werden. Dafür sollen zusätzlich zur Detektion der Neutronen auch die Neutronen-Zerfallsprodukte Proton und Elektron zeitaufgelöst nachgewiesen werden.

In diesem Vortrag wird die Möglichkeit erörtert, dazu einen gasgefüllten Detektor zu verwenden. Es wird auf die Problematik der Gaspermeation durch dünne Folien und der Signalerzeugung in Gasdetektoren bei tiefen Temperaturen (ca. 77 K) eingegangen. Ferner werden erste Tests zur Charakterisierung eines Prototyps vorgestellt, der aus einer Anordnung von mehreren Parallel Grid Avalanche Countern besteht. Ausserdem wird die Herstellung von dünnen Polyimidfolien erläutert, wobei die Polyimidfolien mit einer Konversionsschicht zur Produktion von Sekundärelektronen aus den Zerfallsprotonen versehen sind.

Das Projekt wird gefördert vom Maier-Leibnitz-Laboratorium Garching sowie der Deutschen Forschungsgemeinschaft und dem Exzellenzcluster “Origin and Structure of the Universe”.

HK 7.8 Mon 15:45 HS1

Online Drift Velocity Calibration with the Laser System of the ALICE-TPC — •Mesut Arslandok for the ALICE-Collaboration — Johann-Wolfgang Goethe University Max-von-Laue-Str. 1 60438 Frankfurt am Main

The ALICE Time Projection Chamber (TPC) is the main tracking detector of ALICE which was designed to perform well at multiplicities of up to 20000 charged primary and secondary tracks emerging from Pb-Pb collisions. For a precise reconstruction of particle tracks in the TPC, the calibration of the drift velocity, which provides time information and thus the z position of the traversing particles, is essential. In this presentation an online method for the calibration of the drift velocity is presented, using the TPC laser system. The resulting time dependent drift velocity correction parameters are entered into a database and provide start values for the offline reconstruction process of ALICE. Even though no tracking information is used, the online drift velocity calibration is in agreement with the full offline calibration including tracking on the level of 2×10^{-4}.