HK 62: Instrumentation XIII

Zeit: Freitag 14:00–16:00 Raum: F 102

HK 62.1 Fr 14:00 F 102

Electron Identification with the ALICE TRD using the TMVA Toolkit — •Martin Kroesen for the ALICE-Collaboration — Physikalisches Institut, Universität Heidelberg

The ALICE Transition Radiation Detector (TRD) provides excellent electron identification via the measurement of specific energy loss and transition radiation (TR). The ALICE TRD is uniquely designed to record the time evolution of the signal, where at large drift times the TR contribution is measured. This allows a better electron/pion discrimination compared to measurements of the total integrated charge. The TMVA framework (Toolkit for Multivariate Analysis) in ROOT provides different non-linear statistical modeling tools. Neural Networks and other methods from TMVA are studied to maximize the separation power between electrons and pions taking into account the temporal evolution of the signal. These methods also consider the time-dependent correlations of the signal, which provides better electron/pion discrimination compared to standard simplified likelihood methods.

HK 62.2 Fr 14:15 F 102

Charakterisierung von GEM-Detektoren im Elektronenstrahl für das MAGIX-Experiment an MESA — •Mirco Christmann für die MAGIX-Kollaboration — Institut für Kernphysik der Universität Mainz

Am Institut für Kernphysik der Johannes Gutenberg-Universität Mainz wird in den kommenden Jahren der neue Teilchenbeschleuniger MESA in Betrieb gehen. Im energierückgewinnenden Modus (5 bis 105 MeV | 1 mA) wird das MAGIX-Experiment installiert. Dort werden Präzisions-Streuexperimente mit Hilfe eines fensterlosen Gas-Jet-Targets durchgeführt. Die Winkel und Impulse der gestreuten Elektronen können über zwei schwenkbare Magnetspektrometer bestimmt werden. In der Fokalebene der Magnete wird ein präzises Detektorsystem mit einer aktiven Fläche von $1,20\ \mathrm{m} \times 0,30\ \mathrm{m}$ und einer Ortsauflösung besser als 50 μm benötigt. Geplant sind auf GEMs basierende Detektoren.

In diesem Beitrag wird zunächst die Konstruktion eines Prototyp-Detektors mit 100 cm^2 aktiver Fläche vorgestellt. Die GEM-Folien wurden thermisch gespannt und gerahmt. Die Auslese erfolgte über 512 gekreuzte Kupferstreifen mit einem SRS, wobei die Wellenform jedes Streifens aufgenommen wurde. Zur Charakterisierung des GEM-Detektors wurden Messungen im Labor und im Elektronenstrahl von MAMI durchgeführt. Mit kosmischen Myonen wurde die Homogenität des Detektors vermessen. Im Elektronenstrahl konnten die ortsabhängigen Effizienzen bei unterschiedlich hohen Elektronenraten bestimmt werden.

HK 62.3 Fr 14:30 F 102

Characterization of Ceramic GEM for The International Large Detector — •Serhat Atay, Ulrich Wertenbach, and Ivor Fleck — University of Siegen

The International Large Detector (ILD) will become one of the detectors of The International Linear Collider (ILC). A Time Projection Chamber (TPC), instrumented with Gas Electron Multipliers (GEM), will be constructed inside the ILD as the central tracking chamber. Different GEM prototypes are proposed. This talk will present result from characterization of ceramic GEMs, especially for gas gain and long term stability. They have been produced with a thickness of 120 um and a hole diameter 200 um. Gains of up to 100 have been measured in an Ar:CO2 mixture.

HK 62.4 Fr 14:45 F 102

Detector performance tests for the CBM TRD — •Martin Kohn for the CBM-Collaboration — Institut für Kernphysik, WWU Münster

The Compressed Baryonic Matter (CBM) experiment is a fixed target heavy-ion experiment at the future FAIR accelerator facility. The CBM Transition Radiation Detector (TRD) is one of the key detectors to provide electron identification and charged particle tracking. For the detection of the Transition Radiation a Multi-Wire Proportional Chamber (MWPC) with a 5 mm drift region is used. With the construction phase of the detector nearing, we will present results of the detector obtained with the final detector prototypes. The outer dimensions of this chambers are $95\times95\ \mathrm{cm}^2$. These results were achieved from data recorded at in-beam tests at CERN PS and SPS. The PS delivered a mixed pion/electron beam from 0.5 up to 3 GeV. From the SPS a Pb beam in the range from 13 *A*GeV to 150 *A*GeV was hit on a Pb target to archive environments with high interaction rate of charged particles. Particular focus was put on comparing the different prototypes from Frankfurt/Münster with rectangular readout pads on the one hand and the prototypes from Bucharest with triangular pads on the other hand. The TRD has different pad sizes for the MWPCs to handle different interaction rates depending on distance from the beam line. The large size prototypes has the largest pad size of $155\times7.2\ \mathrm{mm}^2$. The Bucharest prototype has a pad-size of $7.5\times25\ \mathrm{mm}^2$, which are split along the diagonal. For all measurements the same DAQ chain with SPADIC v1.0/1.1 front end electronic was used.

HK 62.5 Fr 15:00 F 102

Construction of large full-size MWPC prototypes for the CBM-TRD — •Susanne Gläessel and Florian Roether for the CBM-Collaboration — Institut für Kernphysik

The Compressed Baryonic Matter (CBM) experiment at the future Facility for Antiproton and Ion Research (FAIR) will be dedicated to the exploration of the QCD phase-diagram in the region of high net-baryon densities. The Transition-Radiation Detector (TRD) has to provide efficient electron pion separation at high momenta and contribute to the identification of charged hadrons, in particular fragments, at high event rates of up to 10 MHz. Each layer of the TRD is composed of several Multi-Wire Proportional Chambers (MWPC).

The key challenge for the MWPC detector design is to deliver a fast detector response, i.e. short signal collection times, without significantly compromising on the TR-absorption capabilities. The best performance is achieved by adding a small drift region of only 5 mm thickness to the xenon gas volume.

For the first time, four large full-size prototypes for the outer detector area with dimensions of $95\times95\times4.95\ \mathrm{cm}^3$ have been built in a combined effort in Frankfurt and Münster and allow for an advanced evaluation of the detector performance including its tracking capabilities. The chamber construction and the implementation of the specific requirements of the experiment into the detector design and its mounting structure will be presented and discussed.

Supported by the German BMBF-grant 05P15RFFC1.

HK 62.6 Fr 15:15 F 102

Development of a Gas System Prototype for the CBM-TRD — •Felix Fidorra for the CBM-Collaboration — Institut für Kernphysik, WWU Münster, Deutschland

The Compressed Baryonic Matter (CBM) experiment is a fixed target heavy-ion experiment at the future FAIR accelerator facility. The CBM Transition Radiation Detector (TRD) is one of the key detectors to provide electron identification and charged particle tracking. For the detection of the Transition Radiation, a Multi-Wire Proportional Chamber (MWPC) with a 5 mm drift region is used. As these detectors are very sensitive to the operating conditions, a high quality gas supply system has been designed and built in order to supply the detectors with a gas mixture of constant composition and flow. The operation of the full detector system requires accurate monitoring and regulation. The design goal of the gas supply to the TRD chamber is a constant flow of 3 l $\mathrm{Ar/CO_2}$ mixture in the ratio of 80/20 %. Of particular importance is to secure the maximum overpressure of 1 mbar to protect the sensitive Kapton entrance window of the chambers. In this talk the author will report on the requirements to the system and discuss the process of its development. Work supported by the German BMBF.

HK 62.7 Fr 15:30 F 102

An instrumented analysis and supply gas system prototype for the CBM TRD — •Philipp Munkes for the CBM-Collaboration — Institut für Kernphysik, WWU Münster, Deutschland

The Compressed Baryonic Matter (CBM) experiment is a fixed target heavy-ion experiment at the future FAIR accelerator facility. The CBM Transition Radiation Detector (TRD) is one of the key detectors to provide electron identification and charged particle tracking. For the detection of the Transition Radiation a Multi-Wire Proportional

Chamber (MWPC) with a 5 mm drift region is used. As these detectors are very sensitive to the operating conditions a high quality gas supply system had to be designed and built to supply the detectors with a gas mixture of constant composition and flow. The operation of the system has to accompanied by close monitoring to fulfill the design goals. The design goal of the gas supply to the TRD chamber is a constant flow of about 3l Ar/CO_2 mixture in the ratio of 80/20%. The most important task is to secure the maximum overpressure of 1mbar to the sensitive Kapton windows of the chambers. In this talk the author will provide an overview over the architecture of the monitoring system, as well as the first analysis of all environmental data collected from the gas system for the CBM TRD during a recent in-beam test at CERN SPS. This work has been supported by BMBF.

HK 62.8 Fr 15:45 F 102

Spectra and Position Reconstruction on CBM-TRD Data from CERN-SPS Testbeam 2016 — •Philipp Kähler for the CBM-Collaboration — Institut für Kernphysik, WWU Münster, Deutschland

Real-size prototypes of the 95×95 cm^2 Transition Radiation Detector (TRD) chambers for the upcoming Compressed Baryonic Matter (CBM) experiment have been subjected to a testbeam campaign at CERN-SPS in the last quarter of 2016. Several datasets have been recorded to confirm the detector performance as well as to investigate the self-triggered, free-streaming SPADIC v1.1 DAQ chain in fixed-target Pb–Pb collisions with beam energies of 13, 30 and 150 AGeV. First results on the analysis of the testbeam data will be shown. Offline-event reconstruction enables the understanding of charge distribution on the cathode pad-plane and is resulting in an inclusive energy loss spectrum of charged particles. Different approaches for the spectrum calculation are compared. For the first time, this spectrum can be calibrated using ^{55}Fe measurements performed at SPS. DAQ-specific possibilities of event reconstruction in high-rate and high-multiplicity environments are discussed. Furthermore, steps towards 2-dimensional position reconstruction and particle tracking in the CBM-TRD setup will be shown. Work supported by BMBF.