HK 26: Instrumentation und Anwendungen II

Zeit: Dienstag 11:00–13:30 Raum: 2D

Gruppenbericht HK 26.1 Di 11:00 2D

The Transition Radiation Detector for ALICE at LHC — •Ken Oyama for the ALICE-TRD-Collaboration — Physikalisches Institut, Heidelberg

The Transition Radiation Detector (TRD) for the ALICE experiment at the Large Hadron Collider consists of 540 Xe gas-filled drift chambers with transition radiators arranged in 18 supermodules in barrel geometry in the central part of the ALICE detector. The large active area of roughly 750m^2 is covered by almost 1.2 million readout channels. The TRD performs online tracking and electron identification in the challenging heavy-ion collisions environment within 6μs after the interaction and thus requires excellent position resolution and pion rejection capability.

Two of the 18 TRD supermodules are installed in the ALICE central barrel. A third one was exposed in its final configuration to a beam of tagged electrons and pions at the CERN Proton Synchrotron at beam momenta from 1 to 6 GeV/c and will be installed in November 2007. Also, data from cosmic events with the ALICE detector will be taken in December 2007. We give an overview of the commissioning of the detector. We will present latest results from the detector performance. Finally, we report on the preparation for the first collisions in ALICE with the startup of LHC mid of 2008.

HK 26.2 Di 11:30 2D

Performance of High-Rate TRD Prototypes for the CBM Experiment in Test Beam and Simulation — •Melanie Klein-Bösing for the CBM-Collaboration — Institut für Kernphysik, Münster

The goal of the future Compressed Baryonic Matter (CBM) experiment is to explore the QCD phase diagram in the region of high baryon densities not covered by other experiments. Among other detectors, it will employ a Transition Radiation Detector (TRD) for tracking of charged particles and electron identification.

To meet the demands for tracking and for electron identification at large particle densities and very high interaction rates, high efficiency TRD prototypes have been developed. These prototypes with double-sided pad plane electrodes based on Multiwire Proportional Chambers (MWPC) have been tested at GSI and implemented in the simulation framework of CBM.

Results of the performance in a test beam and in simulations will be shown. In addition, we will present a study of the performance of CBM for electron identification and dilepton reconstruction with this new detector layout.

HK 26.3 Di 11:45 2D

Calibration of the Alice Transition Radiation Detector — •Raphaelle Bailhache — Gesellschaft fuer Schwerionenforschung, Darmstadt, Deutschland

The Alice Transition Radiation Detector (TRD), is composed of drift chambers filled with Xe/CO_2 (85/15%). In the nominal conditions of pressure and temperature the drift field of 700 V/ cm corresponds to a drift velocity of the electrons of 1.5 cm/μs resulting in a signal extension of about 2 μs. The nominal gas gain is about 5000 for an anode voltage of 1.55 kV. It is important for the particle identification and the tracking capability of the detector to do an absolute and relative calibration of the drift velocity, the gas gain, the time offset and the width of the pad response function of the 540 chambers of the TRD. Physics events will be used, taking into account the fact that the produced particles are mostly pions and to first order uniformly distributed over the rapidity range $|\eta|<0.9$ covered by the detector. To account for the variation of the gas composition, the electric field, the pressure and the temperature, the calibration constants will be obtained every 10 minutes for each of the 18 TRD supermodules, and every run (about 3 hours) per detector. Once per year (10^9 pp events) every pad (total number of pads: 1181952) is calibrated against static local non-uniformities of the detector. A first calibration is performed online and can be then improved offline.

HK 26.4 Di 12:00 2D

Systematic studies on the rate capability of MWPC operated in Xe/CO_2 — •Diego Gonzalez-Diaz and Florian Uhlig for the CBM-Collaboration — GSI, Darmstadt, Germany

Operation of TRD chambers at particle rates up to 200 kHz/cm^2 is required for identification of daughter electrons from charmonia (J/Ψ and Ψ'), within the future Compressed Baryonic Matter (CBM) experiment at FAIR. With this motivation, we have scrutinized the possibility of adopting as the TRD active element the well established MWPC technology, operated in Xenon for maximizing the absorption of TR X-rays. In order to provide a low aging figure, CO_2 was used as UV-quencher, while the chamber gap was kept at 3 mm to shorten the ions drift time.

A systematic study of thin MWPC with various concentrations of CO_2 in Xe, Ar and Ne under different pitch configurations (2-4 mm) will be presented. The data is described in the framework of the Mathieson theory, that allows to extract the ion mobilities under different hypothesis for the drifting ion, shedding light on the ultimate possibilities of usage of MWPC in high rate environments.

HK 26.5 Di 12:15 2D

Ein Gas-Monitor-System für den Übergangsstrahlungsdetektor (TRD) im ALICE Experiment am LHC — •Dominik Wegerle für die ALICE-TRD-Kollaboration — Institut für Kernphysik J. W. Goethe - Universität, Max-von-Laue-Str. 1 60438 Frankfurt am Main

Der Übergangsstrahlungsdetektor (TRD) des ALICE Experiments am CERN-LHC besteht aus 540 gasgefüllten Auslesekammern mit einem Gesamtvolumen von 27,2 m^3. Während des laufenden Betriebs muss kontinuierlich die Gasreinheit des Xe(85%)-CO_2(15%)-Gemisches überwacht werden. Dazu soll ein *Gas prOportional cOunter For driftIng Electrons* (Goofie) zum Einsatz kommen, wie er bereits in anderen Experimenten (NA49, STAR, ALICE-TPC) erfolgreich eingesetzt wurde. Gemessen wird die Driftzeit von Elektronen im Driftfeld des Goofie-Detektors mit bis zu 700V/cm. Diese werden durch Ionisation mittels zweier α - Quellen (^{241}Am) im Detektorgas erzeugt. Diese Erzeugung wird durch je einen Start Zähler detektiert und die Elektronen am Ende der Driftstrecke nachgewiesen. Aus dem Abstand der Quellen und den Driftzeiten lässt sich die Driftgeschwindigkeit berechnen. In Kombination mit einer Messung der Gasverstärkung kann darüber hinaus der Anteil von N_2 im Zählgas überwacht werden, welcher sich im Lauf des Betriebs verändert. Dies soll anhand von Magboltz-Simulationen demonstriert werden. In Frankfurt wurden ein Goofie Gas-Monitor realisiert und Testreihen durchgeführt. Die Ergebnisse dieser Messungen werden vorgestellt und die Vorbereitungen des Systems zum Einsatz im ALICE-Aufbau erläutert.

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HK 26.6 Di 12:30 2D

Bestimmung von Detektoreigenschaften in Abhängigkeit von Gasmischungen für Resitive Plate Chambers — •Ingo Deppner für die FOPI-Kollaboration — Physikalisches Institut Uni Heidelberg

Die Teilchenidentifikation mittels Flugzeitmessung (ToF) wird heutzutage in zuhnehmenden Maße mit Resistive Plate Chambers (RPC's) realisiert. Dabei können solche ToF-Detektorsysteme Ausmaße von mehreren hundert Quadratmetern erreichen. Gleichzeitig müssen hohe Anforderungen erüllt werden, wie z.B. eine Zeitauflösung von unter 50 ps bei Effizienzen von über 98%. Um diese hohen Anforderungen zu erfüllen, ist ein präzises Verständnis der verschiedenen Einflussgrössen auf den RPC notwendig. Insbesondere die Abhängigkeit der Zählereigenschaften von der verwendeten Gasmischung ist im Detail nicht bekannt.

Wir haben einen Testaufbau entwickelt, mit dem man Zählereigenschaften quantitativ bestimmen kann. Unter Verwendung eines FOPI RPC-Prototyps wurde die Abhängigkeit der Auflösung und der Effizienz von der Gasmischung ($C_2H_2F_4/SF_6/C_4H_{10}$) untersucht. Die Ergebnisse werden auch im Hinblick auf die Umweltverträglichkeit der verwendeten Gase diskutiert.

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HK 26.7 Di 12:45 2D

Nano composite materials for timing RPC — Frank Dohrmann[1], Roland Kotte[1], Lothar Naumann[1], Daniel Stach[1,2], Christian Wendisch[1,3], and •Jörn Wüstenfeld[1] — [1]Forschungszentrum Dresden - Rossendorf, Postfach 510119, 01314 Dresden — [2]Hochschule für Technik und Wirtschaft Dresden,

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The Compressed Baryonic Matter (CBM) experiment will be set up at the Facility for Antiproton and Ion Research(FAIR) near Darmstadt. CBM focuses on the investigation of baryonic matter at high densities and medium temperatures. This will be done by using dileptons as penetrating probes, which requires event rates of $\approx$ 10MHz. To measure the time of flight of all charged particles a wall of Resistive Plate Chamber (RPC) detectors will be used. Typically, those detectors are made of standard float glass, which has a volume resistivity between 10^{12} and 10^{13} Ωcm. This gives a good efficency up to rates of 2 kHz/cm^2 in variance with the CBM requirements of $20kHz/cm^2$. One promising approach to achieve a higher rate capability while keeping the very good timing performance of this detectors is to reduce the volume resistivity by a few orders of magnitude. In this talk, we report on measurements done at the Electron Linac of high Briliance and low Emitance (ELBE) at the Forschungszentrum Dresden - Rossendorf. Efficiencies of RPC's made of nano composite materials are presented and the suitability of using these materials as electrodes for RPC detectors will be discussed.

HK 26.8 Di 13:00 2D

Electron/Pion Separation in the ALICE TRD — Alexander Wilk[1] and •Alexandru Bercuci[2] — [1]Institut für Kernphysik, Münster — [2]Gesellschaft für Schwerionenforschung, Darmstadt

The identification of electrons with momenta > 1 GeV/c is one of the most important features of the ALICE Transition Radiation Detector (TRD). In 2007 a complete TRD supermodule was used for the first time for measurements in a beam of pions and electrons at the CERN PS.

A major goal of these measurements was to obtain runs with very high statistics (some 100k events) and a good independent electron/pion discrimination. These runs are used to extract reference data to be used for the electron/hadron identification procedures for physics data in ALICE, such as the 2-d likelihood method or an approach using artificial neural networks. In this talk we present the results of the pion suppression for momenta from 1 to 6 GeV/c as well as a comparison to results from simulations.

This work is supported by BMBF.

HK 26.9 Di 13:15 2D

System performances of the HADES-tRPC wall — •Diego Gonzalez-Diaz for the HADES-Collaboration — GSI, Darmstadt, Germany

The HADES-tRPC is a Time-of-Flight wall in an end-cap configuration, designed for reaching a global time resolution of the order of 100 ps(σ) and an efficiency close to 100% over 8 m^2, with an average 180 tracks load, at a particle flux of several hundreds of Hz/cm^2. The design of the HADES experiment emphasizes a ToF wall that makes a cost-effective use of the electronic channels (2400 channels, 1ch/35 cm^2) in order to keep the average channel occupancy below 10%, without further requirements on space resolution (kept in the current design at modest levels of 40-80 mm^2). Based on that, phenomena like charge sharing, and of course cross-talk or electric coupling in between channels cannot be tolerated and are therefore suppressed to a large extent, through the careful electrical shielding of each individual tRPC cell.

We will present in-beam measurements (October 2007) at nominal flux loads, from a fully equipped sextant (1.3 m^2), focusing on the time resolution and efficiency for different primary ionizations, together with performance studies at high local track density (that we refer as multi-hit capability). The preliminary achieved global time resolution of 85 ps(σ), efficiency above 98% with a comfortable plateau, self-calibration capability, stability and low cross-talk (below 1%) together with capability for double-hit recovery and compact FEE electronics with Q-ToT conversion on-board and high dynamic range are the main features of this new ToF wall.