HK 35 Instrumentation und Anwendungen

Zeit: Dienstag 16:30–19:00 Raum: TU MA144

Gruppenbericht HK 35.1 Di 16:30 TU MA144

The ALICE TPC - An Innovative Device for Heavy-Ion Collisions at LHC — •H.R. Schmidt[1], P. Braun-Munzinger[1], U. Frankenfeld[1], C. Garabatos[1], P. Glässel[2], H. Öschler[3], R. Renfordt[4], J. Stachel[2], H. Stelzer[1], H.K. Soltveit[2], D. Vranic[1], J. Wiechula[1] und B. Windelband [2] — [1]Gesellschaft für Schwerionenforschung, Darmstadt — [2]Universität Heidelberg — [3]Technische Universität Darmstadt — [4]Universität Frankfurt

In 2007, the Large Hadron Collider (LHC) at CERN is scheduled to commence operations. ALICE is the only experiment at the LHC dedicated to the investigation of Pb-Pb collisions at 1248 TeV center-of-mass energy. Large secondary particle multiplicities and high rates set new demands on the design of the ALICE sub-detectors. In this contribution, we will focus on the design strategy of the ALICE Time Projection Chamber (TPC) and its innovative features: i) a high precision field cage consisting of two double-shelled containment vessels with CO_2 insulation gap built of composite materials of very low radiation length; ii) a "cold", low-Z drift gas ($NeCO_2$) with N_2 admixture to improve its stability; iii) a cooling and temperature regulation system, which stabilizes the overall the temperature to $\Delta T \leq 0.1$°C; iv) highly granular readout chambers operated at very high gas gain with 557,568 readout pads; v) highly integrated front-end readout electronics with adaptive baseline restoration. The construction of the TPC components is close to completion. We will present the roadmap of the TPC installation and its commissioning until the LHC startup.

Gruppenbericht HK 35.2 Di 17:00 TU MA144

ALICE TRD - Report on the first beam test with a real size, 6-layer, series production detector stack — •David Emschermann for the ALICE TRD collaboration — Physikalisches Institut, Universität Heidelberg, Germany

The ALICE Transition Radiation Detector (TRD) consists of 540 individual detector chambers offering close to 1.2 million channels on a total area of roughly 750 m^2. It is arranged in a six layer barrel geometry in the central part of the ALICE detector. Apart from providing charged particle tracking and electron identification, the TRD will give fast electron trigger decisions within 6 μs after the heavy ion collisions.

Series production of TRD chambers has started end of 2003. We report on measurements using a stack of the first six series production chambers partly equipped with final readout electronics. End of October 2004 this stack was installed at CERN for a beam test with particle momenta up to 10 GeV/c. The objectives of this beam test included measurements of : electron identification performance, position resolution with tilted pad geometry and dependence of detector response on variation of incident particle angles and momenta. An overview on the preparation and on results of the beam test will be presented.

HK 35.3 Di 17:30 TU MA144

Transition Radiation Spectroscopy with Prototypes of the ALICE TRD — •Christian Lippmann for the ALICE TRD collaboration — Gesellschaft für Schwerionenforschung mbH, Darmstadt, Germany

The ALICE Transition Radiation Detector (TRD) consists of 540 large-area drift chambers with charge sensitive cathode pad read out. The TRD trigger performs online tracking and electron identification and thus requires excellent position resolution and pion rejection. As signatures to discriminate electrons from pions the different ionization energy loss and the emission of X-ray transition radiation photons by electrons are used.

To optimize the electron identification the knowledge of the spectral distributions of ionization energy loss and of detected transition radiation (TR) in the momentum region of interest are crucial. We carried out extensive measurements of TR spectra produced in our irregular foam/fiber radiators, in regular foil radiators, in pure fiber and in pure foam radiators at 1 to 10 GeV/c. To estimate additional contributions we also replaced the radiators by a dummy with similar radiation length. In all measurements the TR was separated from the beam by a strong magnetic field. The measurements were carried out at a secondary beam at the CERN PS in autumn 2004. To complete the picture, the data are compared to simulations.

HK 35.4 Di 17:45 TU MA144

X-Ray Interferences with Transition Radiation from a Micro-Focused 600 MeV Electron Beam of MAMI — •M. El Ghazaly, H. Backe, N. Clawiter, F. Hagenbuck, W. Lauth, A. Rueda, and T. Weber — Institut für Kernphysik der Universität, D-55099 Mainz

Transition Radiation in the X-ray region has been produced with a 600 MeV electron beam of the Mainz Microtron MAMI in a stack of thin polyimide foils. From the small beam spot of size $\sigma_h = 1.9$ μm (rms) and $\sigma_v = 1.6$ μm (rms) transverse coherent 6 keV X-rays are emitted in a cone with an apex angle of about 2 mrad. The radiation was monochromized by a (111) silicon single crystal in a distance of 7.34 m from the target. Tungsten and polymer wires of various thickness in the region between 10 μm and 200 μm were imaged with both, X-ray films and an open CCD chip. Interference fringes up to the 13^{th} order were observed and quantitatively analyzed. The possibility will be discussed to get information on the structure of objects by this kind of Gabor in-line holograms in the X-ray region.

Work supported by Deutsche Forschungsgemeinschaft DFG under contract BA 1336/1-3

HK 35.5 Di 18:00 TU MA144

Electron/Pion Identification with ALICE TRD Prototypes using a Neural Network Algorithm — •Alexander Wilk for the ALICE TRD collaboration — Institut für Kernphysik, Wilhelm-Klemm-Straße 9, 48149 Münster

The identification of electrons with a momentum p > 1 GeV/c is one of the most important features of the ALICE Transition Radiation Detector (TRD). We present the e/π identification performance using a neural network algorithm (NN).

The likelihood methods, the usual approach based on the integrated energy deposit, use only part of the information measured with the ALICE TRD. In addition, the amplitude measurement of each time bin can be exploited provided the correlations among the amplitudes of a given event are properly taken into account. The usage of a neural network algorithm is the natural choice for the analysis of such data. We present the latest results for pion rejection using a NN, which increases the pion rejection up to about 500 for a momentum of 2 GeV/c, a significant advantage compared to the standard methods where the pion rejection factor is of the order of 100. We investigate different NN topologies and their effect on the e/π identification. The momentum dependence of the pion rejection is studied in the range 2-6 GeV/c.

This work is supported by BMBF.

Gruppenbericht HK 35.6 Di 18:15 TU MA144

First on-line mass measurements at SHIPTRAP — •M. Block for the SHIPTRAP collaboration — GSI, Planckstrasse 1, D-64291 Darmstadt, Germany

The ion trap facility SHIPTRAP at GSI Darmstadt was set up to enable various experiments on heavy elements produced in fusion evaporation reactions at SHIP. In the first stage SHIPTRAP focuses on precision mass measurements of nuclei not available at ISOL or fragmentation facilities with a Penning trap mass spectrometer. The speciality of SHIPTRAP is the access to the region of the heaviest elements where the majority of masses is only known from extrapolations with a few hundred keV precision. In addition most of the masses in this region are linked to only a few α-decay chains. Hence direct mass measurements from which nuclear binding energies can be deduced are required. The commissioning of SHIPTRAP included extensive off-line tests in order to characterize and optimize all individual components. In on-line experiments the efficiency of the stopping cell was measured with radioactive ions to be 5-8 %. This limits at the moment the overall efficiency of SHIPTRAP. However, mass measurements of radioactive ions with moderate production rates are already feasible. In a beam time in July 2004 radionuclides around ^{147}Ho were produced in the reaction ^{92}Mo(^{58}Ni,xpxn) with a primary beam energy of 4.35 MeV/u. In this run the first mass measurements with the Penning traps were performed. The masses of ^{147}Ho, ^{147}Er and ^{148}Er were measured, the latter ones for the first time.

HK 35.7 Di 18:45 TU MA144

Time-of-flight mass spectrometry at SHIPTRAP and at the FRS-Ion-Catcher — •Wolfgang R. Plass[1], Zhenyu Di[1,2], Timo Dickel[1], Alexander F. Dodonov[3], Sergey A. Eliseev[1,2], Hans Geissel[1,2], Viatcheslav I. Kozlovski[3], Gottfried Münzenberg[2], Martin Petrick[1], Christoph Scheidenberger[1,2], and Zheng Wang[1,2] for the SHIPTRAP collaboration and the FRS-Ion-Catcher collaboration — [1]II. Physikalisches Institut, Justus-Liebig-Universität Gießen — [2]GSI, Darmstadt — [3]BINEPCP, Russian Academy of Sciences, Chernogalovka, Russia

The current status of a time-of-flight mass spectrometer system for the SHIPTRAP and FRS-Ion-Catcher facilities at GSI is described. At these facilities, fusion-reaction products and projectile / fission fragments, respectively, are decelerated and thermalized in gas-filled stopping cells and made available to precision experiments performed at energies in the eV range.

The time-of-flight mass spectrometer can be used to obtain broadband, high-resolution mass spectra with cycle times of less than 1 ms. Thus it is ideally suited for the characterization and optimization of the stopping cells as key parts of these facilities, as well as for direct mass measurements on very short-lived exotic nuclei, and for atomic and chemical studies. Recent results from experiments performed at SHIPTRAP and the FRS-Ion-Catcher and developments for chemical studies and ion mobility measurements of transuranium elements will be presented.