HK 68: Instrumentation

Zeit: Donnerstag 14:00–16:15 Raum: HSZ-405

HK 68.1 Do 14:00 HSZ-405

Offline Signal Tail-Correction for the ALICE TPC — •Mesut Arslandok for the ALICE-Collaboration — Institut für Kernphysik (IKF), Goethe Universität, Max-von-Laue-Str. 1 60438 Frankfurt am Main

The ALICE Time Projection Chamber (TPC) is the main tracking and particle identification (PID) detector of ALICE at the CERN-LHC. It was designed for multiplicities of up to 20,000 primary and secondary charged particles emerging from a single central Pb-Pb collision. The PID in the TPC is calculated from the specific energy loss measurement (dE/dx), which is derived from the pulse height distribution of charged particle tracks measured along 159 read-out planes. The signals from the Multi Wire Proportional Chambers (MWPC) show a characteristic long undershoot after the signal, which is due to the long ion drift times in the MWPC amplification region. Such an "ion tail" may lead to a loss of signal amplitude for the following signals on the same readout pad. Eventually, this results in a deterioration of the dE/dx resolution, in particular in the high multiplicity environment of Pb-Pb collisions. In this study, an offline correction method is presented which is expected to improve the dE/dx resolution and thus the PID quality of TPC. The method will be applied to the Pb-Pb collision data set taken in 2010 and 2011. Details of the correction procedure and first results will be presented.

HK 68.2 Do 14:15 HSZ-405

Extraction of Photomultiplier-Pulse Features — •Philipp Joerg, Tobias Baumann, Maximilian Büchele, Horst Fischer, Matthias Gorzellik, Tobias Grussenmeyer, Florian Herrmann, Paul Kremser, Tobias Kunz, Christoph Michalski, Sebastian Schopferer, and Tobias Szameitat — Physikalisches Institut der Universität Freiburg

Experiments in subatomic physics have to handle data rates at several MHz per readout channel to reach statistical significance for the measured quantities. Frequently such experiments have to deal with fast signals which may cover large dynamic ranges. For applications which require amplitude as well as time measurements with highest accuracy transient recorders with very high resolution and deep onboard memory are the first choice. We have built a 16-channel 12-or14 bit single unit VME64x/VXS sampling ADC module which may sample at rates up to 1GS/s. Fast algorithms have been developed and successfully implemented for the readout of the recoil-proton detector at the COMPASS-II Experiment at CERN. We report on the implementation of the feature extraction algorithms and the performance achieved during a pilot with the COMPASS-II Experiment.

Supported by BMBF and EU FP7 (Grant Agreement283286).

HK 68.3 Do 14:30 HSZ-405

PSA via Singular Value Decomposition — •Tobias Habermann[1], Joachim Maruhn[1], and Jürgen Gerl[2] — [1]Goethe Universität Frankfurt — [2]GSI, Darmstadt

Gamma ray tracking is a substantial feature of upcoming gamma ray detector arrays (e.g. AGATA, GRETA). The precision and efficiency of tracking algorithms heavily depends on the knowledge of the exact interaction position inside the detector volume. To determine the position inside a segment of the detector pulse shape analysis (PSA) is applied. Due to a complicated electric field in parts of the detector there is no simple method to determine the position for a given pulse. Instead a database of pulse shapes with corresponding positions is created either by scanning the detector or from electric field simulations. The problem of finding the exact position for a given pulse is reduced to finding the best fit to this signal from the database. Finding the best fit from the database can be substantially accelerated by applying a transformation to the signals in the database and to the recorded pulse shape of the event before comparing them. An optimal linear transformation is obtained by calculating a Singular Value Decomposition of all the signals in the database.

HK 68.4 Do 14:45 HSZ-405

Offline software for the luminosity detector at PANDA — •Anastasia Karavdina[1], Achim Denig[1,2], Florian Feldbauer[1,2], Miriam Fritsch[1,2], Prometeusz Jasinski[1,2], Heinrich Leithoff[1,2], Mathias Michel[1,2], Stefan Pflueger[1,2], and Tobias Weber[1,2] for the PANDA-Collaboration — [1]Institut für Kernphysik, Johannes Gutenberg-Universität Mainz — [2]Helmholtz-Institut Mainz

The precise determination of the luminosity is crucial for the PANDA experiment which will be built at the new antiproton accelerator HESR (FAIR, Darmstadt, Germany). For this measurement elastic antiproton-proton scattering can be used. In the range of very small momentum transfer this process can be calculated exactly from QED. Therefore we are going to perform measurements at very small momentum transfer (and thus very small scattering angle). The current design for the detector has four planes (10/20 cm in between). It is located outside the magnetic field, 11 m behind the interaction point. Our reconstruction software includes standard parts as hit reconstruction, track finding and track fitting and specific procedures for luminosity extraction and background treatment. Beside these algorithms we developed a software alignment procedure based on reconstructed tracks by using the Millipede algorithm.

In this talk an overview of the basic concept and Monte Carlo based performance studies will be presented.

HK 68.5 Do 15:00 HSZ-405

Time Based Detector Simulation for the PANDA Experiment — •Tobias Stockmanns[1] and Mohammad Al-Turany[2] for the PANDA-Collaboration — [1]Forschungszentrum Jülich GmbH, IKP-1, 52425 Jülich — [2]GSI Helmholtzzentrum für Schwerionenforschung GmbH, Planckstraße 1, 64291 Darmstadt

PANDA is one of the main experiments of the future Facility for Antiproton and Ion Research (FAIR) at Darmstadt. Its purpose is the examination of the strong force in the energy regime of charmonium.

To be able to handle different physics questions PANDA abstains from the use of a first level hardware trigger. The complete detector data is read out to the control room where a software based event selection is done with the full PANDA data set.

This readout concept sets huge requirements on the readout system of PANDA as well as the used data selection algorithms. To be able to develop and test those it is necessary to do a chronologically ordered data simulation which differs strongly from the usual event based Monte-Carlo simulation of detectors.

The existing simulation software *pandaRoot* was extended to give both possibilities: event and time based simulation. The concept and simulation results will be shown in the presentation.

HK 68.6 Do 15:15 HSZ-405

Time-based simulation of the PANDA EMC — •Jifeng Hu, Martin Johannes Galuska, Wolfgang Kühn, Jens Sören Lange, Yutie Liang, and Björn Spruck for the PANDA-Collaboration — II.Physikalisches Institut, JUSTUS-LIEBIG University Giessen, 35392, Germany

The PANDA detector is a general-purpose detector for antiproton physics that will be operating at FAIR. The detector will be running at interaction rates of up to 30 MHz, leading to significant pile-up of events. As an important component of the detector, the electromagnetic calorimeter (EMC) will be exposed to this high rate environment. To understand the implications such as potential loss of efficiency or resolution, a framework for time-based simulation has been implemented within the PandaRoot software package. In this presentation, the concept of this simulation will be explained and the photon detection efficiency as a function of energy, polar angle, and event rate will be discussed.

This work was supported in part by the LOEWE Center HICforFAIR and BMBF under contract number 05P12RGFPF.

HK 68.7 Do 15:30 HSZ-405

FLUKA Rechnungen für das CBM Experiment an FAIR* — •ANNA SENGER für die CBM-Kollaboration — GSI Helmholtzzentrum für Schwerionenforschung GmbH, Darmstadt, Deutschland

Die Mission des Compressed Baryonic Matter (CBM) Experiments an FAIR ist die Erforschung der Eigenschaften von Kernmaterie bei extrem hohen Dichten, wie sie im Innern von Neutronensternen auftreten. Die an FAIR zur Verfügung stehenden Schwerionenstrahlen sind besonders dafür geeignet, solche Bedingungen im Labor zu erzeugen. Neue Erkenntnisse erwartet man von der Untersuchung von Teilchen die in der dichten Phase des Stoßes entstehen: seltsame und charmante Hadronen, sowie Mesonen die in Leptonenpaare zerfallen. Diese Messungen erfordern Reaktionsraten von bis zu 107 Au+Au Stößen pro sec. Die damit verbundenen Dosisbelastungen der Detektoren, die Aktivierung von Materialien und die benötigten Abschirmungen wurden durch realistische Simulationen unter Verwendung des FLUKA-Programmpakets untersucht. Diese Rechnungen gingen ein in die Auslegung der Detektoren und bildeten die Grundlage für die Auslegung der Experimentierhalle. Einige Ergebnisse werden vorgestellt.

*gefördet durch EU-FP7 HadronPhysics3

HK 68.8 Do 15:45 HSZ-405

Particle Identification with a large GEM-TPC — •Felix Valentin Böhmer for the GEM-TPC-Collaboration — Technische Universität München

A Time Projection Chamber (TPC) with its low material budget constitutes an almost ideal device for 3-dimensional tracking of charged particles.

The employment of Gas Electron Multiplier (GEM) foils for gas amplification promises to remedy the former limitation of TPCs to low-rate experiments: The intrinsic ion backflow suppression features of GEMs make traditional gating structures dispensable and thus open the possibility of a continuous operation of TPCs even in high-rate environments.

A large prototype (75 cm length, 15 cm radius) of such a GEM-TPC with $\sim$ 10000 readout channels has been built and successfully used in a physics campaign (π-beam on different targets) at the FOPI experiment at GSI, Darmstadt. From the recorded data, charged particle tracks entering the GEM-TPC are reconstructed using a fully 3-dimensional clustering algorithm and then matched with the surrounding FOPI tracking detectors.

In this talk we present a first analysis of the specific energy loss (dE/dx) of Pions, Kaons and Protons as a function of the particle momentum. Energy loss resolutions as well as separation power for particle identification are discussed.

This work has been supported by the BMBF and the DFG Cluster of Excellence "Universe" (Exc153)

HK 68.9 Do 16:00 HSZ-405

Particle Identification with a Disc DIRC Detector — •Julian Rieke, Michael Düren, Avetik Hayrapetyan, Klaus Föhl, Oliver Merle, Benno Kröck, and Daniel Mühlheim — Justus Liebig Universität, Gießen, Germany

The PANDA experiment at the future FAIR facility needs excellent particle identification to do precision studies of antiproton-proton reactions in the 1.5-15 GeV/c momentum range. To fulfill this need, two Cherenkov detectors will be installed in the PANDA Target Spectrometer, both based on the DIRC concept that uses internally reflected Cherenkov light to perform particle identification, with a focus on the separation of pions and kaons. While the Barrel-DIRC covers central angles, the Disc-DIRC is designed to cap the forward region of theta angles between 5 and 22 degrees. It will be the first time that a Disc-DIRC is used for PID in a real physics experiment beyond prototyping.

A prototyping Disc-DIRC apparatus has been developed at the JLU Giessen featuring a quarter segment of the total disc. It was equipped with 30 multi-anode-phototubes with a total of 480 photo sensor pixels. The performance of the DIRC was tested using 3 GeV electrons provided by DESY Hamburg and a mixed hadron beam provided by CERN. A first analysis of the recorded data will be shown as well as results from a Monte Carlo simulation.