HK 5: Schwerionenkollisionen und QCD Phasen

Zeit: Montag 14:00–16:00 Raum: HZ 7

HK 5.1 Mo 14:00 HZ 7

A Bayesian approach to PID in ALICE, as studied in the channel D0 -> Kπ — •Jeremy Wilkinson — Physikalisches Institut, University of Heidelberg, Im Neuenheimer Feld 226

The standard particle identification (PID) method in ALICE uses a frequentist, or nσ, approach. In this method, particles are accepted via a selection on the number of standard deviations by which a signal differs from the expected detector response. This works well for most particle species, but in some cases, such as the non-resonant decay of Λc -> pKπ, the combinatorial background is too high to make a significant measurement. The usage of an alternative Bayesian approach, based on a combination of the measured dE/dx and time-of-flight of the daughter tracks, will be presented here. The Bayesian method bases its response on prior probabilities of a given particle species being produced with a given momentum, allowing a calculation of the probability for a daughter particle to belong to each species (π, K, p, etc.) based on the detector response seen. In order to check the validity of this method, various decay channels were tested and compared to the nσ method. Among these was the channel D0 -> Kπ, which provides a valuable cross-check of both the kaon and pion responses in this approach. In addition to considering the differences in signal-to-background ratio and significance obtained when applying the various methods, a comparison will be shown between the yield obtained without PID and those found when using Bayesian and nσ approaches after being corrected for their respective PID efficiencies.

HK 5.2 Mo 14:15 HZ 7

The Parallel Cellular Automaton track finder for the CBM experiment — •Valentina Akishina[1,2,4] and Ivan Kisel[1,2,3] for the CBM-Collaboration — [1]Goethe-Universität Frankfurt am Main, Frankfurt am Main, Germany — [2]GSI Helmholtzzentrum für Schwerionenforschung GmbH, Darmstadt, Germany — [3]Frankfurt Institute for Advanced Studies, Frankfurt am Main, Germany — [4]JINR Joint Institute for Nuclear Research, Dubna, Russia

The CBM experiment at FAIR is being designed to study heavy-ion collisions at extremely high interaction rates. The event selection has to be done online and requires full event topology reconstruction, therefore fast and efficient reconstruction algorithms are needed.

The Cellular Automaton track finder is fast and robust and thereby will be used for the online and offline track reconstruction. In order to fully utilise the processing power provided by modern computer architectures, parallelism is to be implemented for the reconstruction.

The CA track finder was fully parallelised inside the event. Since the CBM beam will have no bunch structure, but continuous, the reconstruction of time slices rather than events is needed. Thus, the parallel version of the algorithm was optimised for reconstruction of groups of minimum bias events packed in slices.

The parallel version of the algorithm shows the same efficiency as a single core one and achieves a speed up of about 10 while parallelising between 10 Intel Xeon physical cores with a hyper-threading.

Supported by FIAS, HICforFAIR and HGS-HIRe for FAIR and Hessischen Ministerium für Wissenschaft und Kunst.

HK 5.3 Mo 14:30 HZ 7

Stability of the CBM CA based Track Finder with Respect to Number of Stations — Ivan Kisel[1,2,3] and •Igor Kulakov[1,2,3] for the CBM-Collaboration — [1]Goethe-Universitat Frankfurt am Main — [2]Frankfurt Institute for Advanced Studies — [3]GSI Helmholtzzentrum fur Schwerionenforschung GmbH

The main tracking detector in the CBM experiment (FAIR, Darmstadt, Germany) is the Silicon Tracking System (STS). A number of conditions complicates the track reconstruction in STS: up to 1000 tracks per event, up to 10^7 events per second, non-homogeneous magnetic field, up to 85% fake combinatorial space points in double-sided strip detectors.

The cellular automaton (CA) based track reconstruction performs with efficiency of 98% and time of 12 ms with standard STS setup, consisting of 8 stations. The detector is placed in a dipole magnet and the space available for STS is limited. Therefore geometries with different number of stations required to be considered additionally.

Tests of the CA based reconstruction have been performed with data simulated in 7 different STS setups, changing number of STS stations from 4 to 8. The track reconstruction efficiencies for majority of the signal tracks stays on the level of 90-100% for all setups for minimum bias events. Momentum resolution stays on the same level of 1.3% for all STS setups, which has at least 70 cm length.

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HK 5.4 Mo 14:45 HZ 7

Full kinematic reconstruction of B^+ mesons with the upgraded ALICE inner tracker — •Johannes Stiller for the ALICE-Collaboration — Physikalisches Insitut, Heidelberg

During the second long shutdown of the LHC in 2018, the ALICE experiment will undergo major detector upgrades, including the installation of a new high-granularity silicon pixel inner tracker in the central barrel. A single-hit resolution of 4 μm close to the interaction point and a readout rate capability of up to 50 kHz in Pb-Pb collisions will allow new and unique measurements in the heavy-quark sector. In this talk we focus on the performance of full kinematic reconstruction down to lowest p_T in the channel $B^+ \to \overline{D}^0\pi^+$ and $\overline{D}^0 \to K^+\pi^-$ with branching ratios of 0.5 % and 3.9 % respectively, using detailed Monte Carlo simulations of high-multiplicity Pb–Pb collisions. Topologic and kinematic criteria are used to select the rare signal. Furthermore, the track rotation method is used to improve the background statistics estimate in order to give a first outlook on the expected signal-to-background ratio and statistical significance.

HK 5.5 Mo 15:00 HZ 7

Feasibility study on χ_c identification with ALICE at the LHC — •Steffen Weber for the ALICE-Collaboration — Research Division and ExtreMe Matter Institute, GSI Helmholtzzentrum für Schwerionenforschung, Planckstr. 1, 64291 Darmstadt — Institut für Kernphysik, Technische Universität Darmstadt, Schlossgrabenstr. 9, 64289 Darmstadt

At the high energies of the LHC, $c\bar{c}$ pairs are abundantly produced. As they are produced in initial hard collisions, they probe the deconfined medium in Pb-Pb collisions over its entire lifetime.

Charmonium, a bound state of c and $\bar{c}$ quarks, is a special probe of deconfinement and also a subject of research in elementary hadronic collisions.

Excited states of charmonium, like the $\psi(2S)$ and χ_c, are observables which could help to distinguish between regeneration and statistical hadronization models, which currently describe successfully the J/ψ data measured at the LHC. We present a study on the feasibility of identifying the χ_c charmonium state in ALICE, in pp, p-Pb and Pb-Pb collisions.

HK 5.6 Mo 15:15 HZ 7

Reconstruction of π^0 mesons via conversion method in Au+Au at 1.23AGeV with HADES — •Claudia Behnke for the HADES-Collaboration — Institut für Kernphysik, Goethe Universität Frankfurt

Lepton pairs emerging from decays of virtual photons are one of the most promising probes of compressed hadronic matter. The HADES experiment at GSI Helmholtzzentrum für Schwerionenforschung in Darmstadt studies di-electron radiation as well as strangeness production in various reactions, i.e. pion, proton, deuteron and heavy-ion induced reactions. The understanding of the corresponding experimental results calls for supporting studies from various model calculations. For a model-independent understanding of the dilepton cocktail the production cross sections of particles decaying during the freeze-out is crucial. In this contribution the capability of HADES to detect e^+e^- pairs from conversion of real photons will be demonstrated. We will present results from a two-photon analysis of Au+Au collisions at 1.23 GeV/u providing information on π^0 and η mesons. Supported by BMBF (05P12RFGHJ), Helmholtz Alliance EMMI, HIC for FAIR, HGS-HIRe

HK 5.7 Mo 15:30 HZ 7

Lepton identification performance in Au+Au at 1.23 GeV/u in HADES — •Szymon Harabasz for the HADES-Collaboration — TU Darmstadt

The High Acceptance Di-Electron Spectrometer, installed at GSI

Helmholtzzentrum für Schwerionenforschung in Darmstadt, has measured rare penetrating probes and strange particles production in elementary as well as in heavy ion collisions. The heaviest system, Au+Au at a maximum available at SIS18 beam kinetic energy of 1.23 GeV/u has been measured by HADES in April - May 2012. In such collisions, extracting a sample of very rare di-electrons radiated from a dense fireball plays a crucial role. Therefore, a pure electron identification is necessary. This is achieved by exploring information from the Ring Imaging Cherenkov detector in combination with the time-of- flight measurement and with an evidence of an electromagnetic shower formation. A sequence of one- or two-dimensional cuts does not meet requirements. Therefore lepton identification has to be done using a multi-dimensional condition calculated by an artificial neural network. In this contribution I will present results on efficiency and purity of electron identification obtained using multi-variate analysis method.

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HK 5.8 Mo 15:45 HZ 7

Charged Pion Production and V0 Reconstruction in Au+Au-Collisions at 1.23 AGeV with HADES — •Timo Scheib for the HADES-Collaboration — Goethe-Universität Frankfurt

In heavy ion collisions at beam energies of 1-2 AGeV, strange particles are produced below their elementary production threshold which results in a steep excitation function.

In April and May 2012, 7.3 billion Au(1.23 GeV per nucleon)+Au collisions have been recorded by the HADES detector, installed at the Helmholtzzentrum fuer Schwerionenforschung (GSI) in Darmstadt, Germany. In this collision system the weakly decaying strange hadrons K_s^0 and Λ were measured and reconstructed. In order to draw conclusions on strangeness production mechanisms in heavy ion collisions the yields can be compared to non-strange particle production, i.e. charged pions.

In this contribution preliminary particle spectra of charged pions, Λ hyperons and K_s^0 mesons measured in these collisions will be presented.
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