HK 25: Heavy Ion Collision and QCD Phases VII

Zeit: Dienstag 16:30–18:00 Raum: S1/01 A4

Gruppenbericht HK 25.1 Di 16:30 S1/01 A4

A Bayesian approach to particle identification in ALICE — •Jeremy Wilkinson for the ALICE-Collaboration — Physikalisches Institut, Ruprecht-Karls-Universität Heidelberg

Particle identification (PID) is one of the major strengths of the ALICE detector at the LHC, and provides essential insight into quark-gluon plasma formation in heavy-ion collisions. PID is most effective when complementary identification techniques (such as specific energy loss in the Time Projection Chamber, or flight times measured by the Time Of Flight detector) are combined, however with standard PID techniques it can be difficult to combine these signals, especially when detectors with non-Gaussian responses are used.

Here, an alternative probabilistic PID approach based on Bayes' theorem will be presented. This method facilitates the combination of different detector technologies based on the combined probability of a particle type to produce the signals measured in various detectors. The Bayesian PID approach will be briefly outlined, and benchmark analyses will be presented for high-purity samples of pions, kaons, and protons, as well as for the two-pronged decay $D^0 \to K^-\pi^+$, comparing the performance of the standard PID approach with that of the Bayesian approach. Finally, prospects for measuring the Λ_c baryon in the three-pronged decay channel $\Lambda_c^+ \to pK^-\pi^+$ will be presented.

HK 25.2 Di 17:00 S1/01 A4

Performance of centrality determination in heavy-ion collisions with CBM experiment — •Viktor Klochkov and Ilya Selyuzhenkov for the CBM-Collaboration — GSI, Darmstadt

The goal of the CBM experiment at FAIR is to investigate the properties of compressed baryonic matter. The measurement of physics observables in heavy-ion collisions requires information about event geometry. A magnitude of the impact parameter, which is among the most important parameters to describe collision geometry, cannot be measured directly in experiment. One can estimate it by measuring produced particle's multiplicities or energy of the spectator fragments. Typically, the collisions are divided into centrality classes which corresponds to the ranges of impact parameter with e.g. centrality class 0-5% corresponds to most central events, and 95-100% to the most peripheral collisions. Sensitivity to the range of impact parameters with the Silicon Tracking System (STS) and Projectile Spectator Detector (PSD) to select centrality classes in the CBM experiment will be presented. The STS is measuring the multiplicity of the particles produced in the nuclei overlap zone and different areas of the PSD are sensitive to both spectator fragments and produced particles.

Supported by the GSI Helmholtzzentrum für Schwerionenforschung.

HK 25.3 Di 17:15 S1/01 A4

Flow harmonics in Au-Au collisions at 1.23 AGeV with HADES — •Behruz Kardan and Christoph Blume for the HADES-Collaboration — Goethe-Universiät, Frankfurt am Main

HADES provides a large acceptance combined with a high mass-resolution and therefore allows to study dielectron and hadron production in heavy-ion collisions with unprecedented precision. With the high statistics of seven billion Au-Au collisions at 1.23 AGeV recorded in 2012 the investigation of higher-order flow harmonics is possible for the first time at these energies.

Collective flow phenomena are a sensitive probe for the properties of extreme QCD matter. However, their interpretation relies on the understanding of the initial conditions, e.g. the eccentricity of the nuclear overlap region. Based on Glauber Monte Carlo calculations the primordial anisotropic configuration of the colliding nuclei is examined. Event-by-event flow observables and their fluctuations are deduced and compared with measured data. Besides the standard event-plane method, these analyses apply different methods such as Scalar Product, Lee-Yang Zeroes and Cumulants. Furthermore multi-particle azimuthal correlation technique can be utilized to disentangle the contributions from collective and from non-flow processes involved in the dynamical evolution of heavy-ion reactions.

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HK 25.4 Di 17:30 S1/01 A4

Physics performance studies with the CBM-TRD — •Julian Book for the CBM-Collaboration — Institut für Kernphysik, Goethe-Universität Frankfurt am Main

The CBM Experiment at SIS100 will provide unique capabilities to study strongly interacting matter at extreme densities. It might allow to locate the chiral and deconfinement phase transition in this energy regime.

The electron-setup of the CBM experiment is composed of a ring-imaging Cherenkov detetcor (RICH), followed by four layers of transition radiation detectors (TRD) and a time-of-flight detector (TOF). They will provide the necessary particle identification to study low-mass vector mesons and thermal radiation in the intermediate mass range (1-3 GeV/c^2) mediated via dielectron pairs at central rapdity ($|y| < 1.5$). In addition, the TRD contributes to the analysis of J/ψ decaying into two electrons by suppression of pions, which will allow to study J/ψ production near threshold. The unique capabilities to identify fragments via the dE/dx-measurement provided by the TRD allows the investigation of hyper-nuclei such as the $^{6}_{\Lambda\Lambda}$He.

After a brief description of the apparatus, the performance of the TRD in central Au+Au collisions at $\sqrt{s_{NN}} = 4.11$ GeV and p+Au collsions at $\sqrt{s_{NN}} = 7.62$ GeV will be shown.

HK 25.5 Di 17:45 S1/01 A4

Kalman filter based approach for reconstruction of short-lived particles — •Maksym Zyzak[1,2,3] and Ivan Kisel[1,2,3] for the CBM-Collaboration — [1]GSI Helmholtzzentrum für Schwerionenforschung GmbH — [2]Frankfurt Institute for Advanced Studies — [3]Goethe-Universität Frankfurt

Today the most interesting physics of the heavy-ion experiments is hidden in the properties of short-lived particles, that can be reconstructed only through their decay products — daughter particles. Short-lived particles that have a very small production probability or small branching ratio of the channel, which is suitable for registration, are usually of the particular interest.

In order to process accurately events of the experiment interest, the algorithms for particles reconstruction should be efficient, that requires precise mathematical estimations. The KF Particle package for the CBM experiment, which is based on the Kalman filter method, provides rich and mathematically correct functionality for reconstruction of decays. It allows to obtain physical parameters of the particle as well as their errors. Also, KF Particle contains the mass and topological constraints, which are of the particular importance for reconstruction of decay trees like multi-strange hyperons and resonances.