HK 2: Heavy Ion Collisions and QCD Phases I

Zeit: Montag 16:45–19:00 Raum: F 1

Gruppenbericht HK 2.1 Mo 16:45 F 1

Transverse momentum distributions of charged particles in pp and Pb–Pb collisions with ALICE at the LHC — •Julius Gronefeld for the ALICE-Collaboration — GSI Helmholtzzentrum für Schwerionenforschung, Darmstadt — Institut für Kernphysik, Technische Universität Darmstadt

ALICE is an experiment dedicated to the study of heavy-ion collisions at the LHC, with the aim of understanding the physics of the hot and dense deconfined medium produced such in collisions. Since the start of its second phase of running the LHC is delivering collision of protons and lead ions at the top energy of $\sqrt{s} = 13\,\mathrm{TeV}$ for pp and $\sqrt{s_{\mathrm{NN}}} = 5.02\,\mathrm{TeV}$ for Pb–Pb collisions.

The study of inclusive charged particle spectra sheds light on parton energy loss in the medium leading to a suppression of hadron production at high transverse momentum (p_{T}). A common way to investigate this effect is the determination of the nuclear modification factor (R_{AA}) given by the ratio between a given p_{T} spectrum and a reference spectrum in pp collisions scaled by the number of binary collisions.

In this talk achievements in the analysis of transverse momentum distributions with ALICE are presented. A significant reduction of systematic uncertainties was achieved and furthermore newly developed techniques were applied to the analysis of data at $\sqrt{s_{\mathrm{NN}}} = 2.76\,\mathrm{TeV}$ taken in 2010. Spectra and R_{AA} will be shown in dependence of centrality. In addition the results will be compared to current models.

HK 2.2 Mo 17:15 F 1

Comparison of hydrodnamical and transport theoretical calculations for p+A and A+A collisions — •Kai Gallmeister, Harri Niemi, Carsten Greiner, and Dirk Rischke — Institut für Theoretische Physik, Goethe Universität Frankfurt am Main

The good agreement of calculations on the basis of dissipative hydrodynamics with experimental data for p+Pb collisions hints to a strong collective behavior and a fast equilibration. But already for heavy ion collisions large dissipative corrections are necessary within the calculations. By comparing hydrodynamical calculations with microscopical calculations with the transport theoretical Boltzmann solver BAMPS we explore the range of applicability of hydrodynamics to small systems.

HK 2.3 Mo 17:30 F 1

Performance of charged pions, kaons, protons and their anti-particles identification in the CBM experiment — •Viktor Klochkov[1,2] and Ilya Selyuzhenkov[1] for the CBM-Collaboration — [1]GSI Helmholtzzentrum für Schwerionenforschung — [2]Goethe University Frankfurt

The goal of the CBM experiment at FAIR is to investigate the properties of the dense baryonic matter. Among the key observables which are used to characterize the particle production in heavy-ion collisions are the charged particle spectra, anisotropic flow, and angular correlations. The particle mass ordering and flavor dependence provide an important information on the evolution of the created matter. A procedure for particle identification in centrality classes is developed for CBM. It is based on a Bayesian approach which allows for high-purity selection of charged pions, kaons, and protons using the correlation between the signal in the CBM time-of-flight (TOF) detector and the reconstructed particle momentum. The CBM performance for charged hadron identification is studied for Au-Au collisions simulated at different SIS-100 energies. The developed procedure can be further used to unfold the contribution to physics observables from individual identified hadrons in case of low purity.

Supported by Helmholtz Graduate School for Hadron and Ion Research (HGS-HIRe) and GSI Helmholtzzentrum für Schwerionenforschung.

HK 2.4 Mo 17:45 F 1

What do pions tell us about dynamics of heavy-ion collisions at SIS18 energies ? — •Malgorzata Gumberidze for the HADES-Collaboration — TU Darmsatdt, Germany

Pion production is the dominating inelastic process in nucleus-nucleus collisions. The production of pions in the SIS18 energy range (1-2 GeV per nucleon) proceeds primarily through the excitation and decay of baryonic resonances. In a baryon rich environment, therefore, pions serve as important messengers of the reaction dynamics.

In this contribution we present results of a study of charged pion production at SIS18 energies using the HADES spectrometer at GSI. The main focus will be on 40% most central Au(1.23 GeV per nucleon)+Au collisions. Our results contribute with an unprecedented statistics to systematic studies of pion production in heavy-ion collisions.

We have preformed a measurement of the transverse momentum distributions of $\pi^{\pm}$ mesons covering a fairly large rapidity interval. The yields, transverse mass, angular distributions and azimuthal emission patterns are compared with transport model calculations as well as wtih existing data from other experiments.

This work has been supported by VH-NG-823, Helmholtz Alliance HA216/EMMI, GSI.

HK 2.5 Mo 18:00 F 1

Transverse momentum distributions of charged-particles in pp collisions with ALICE at the LHC — •Edgar Perez Lezama for the ALICE-Collaboration — Institut für Kernphysik, Goethe-Universität Frankfurt, Max-von-Laue-Str. 1, 60438 Frankfurt am Main — Research Division and ExtreMe Matter Institute, GSI Helmholtzzentrum für Schwerionenforschung, Planckstr. 1, 64291 Darmstadt

The charged-particle transverse momentum spectrum is an important observable for testing pQCD (perturbative QCD) calculations and serves as a reference for Pb-Pb collisions to study QGP bulk properties. The measurement of inclusive production of charged-particles in high-energy proton-proton collisions and its evolution with the event multiplicity is also a key observable to test models of particle production. In 2015, pp collisions at $\sqrt{s} = 13\,\mathrm{TeV}$ and $\sqrt{s} = 5.02\,\mathrm{TeV}$ were recorded using the ALICE detector at the LHC. With the increase in collision energy, the role of hard processes (parton scatterings with large momentum transfer) increases and offers the possibility to understand the interplay between soft and hard processes of particle production. The measurement of the charged-particle spectrum at 5.02 TeV is used in the construction of the nuclear modification factor (R_{AA}). In this talk, the transverse momentum distributions measured with ALICE at a collision energy of $\sqrt{s} = 13\,\mathrm{TeV}$, $\sqrt{s} = 5.02\,\mathrm{TeV}$ in pp collisions and the reanalysis of the data at $\sqrt{s} = 2.76\,\mathrm{TeV}$ will be presented as well as comparisons to models and previous ALICE measurements.

HK 2.6 Mo 18:15 F 1

Performance studies for electron measurement with the CBM-TRD — •Etienne Bechtel — IKF,Frankfurt,Germany

A crucial performance aspect of the CBM-TRD is to achieve a sufficient pion suppression while maintaining a high electron efficency. This requires an adequate identification method and the likelihood method offers a comparable performance to the artifical neural network while at the same time allowing for a maximum of control and robustness. To employ this method one has to get very pure input information about the energy deposition of the particles inside the TRD. For electrons, this is done via careful topology cuts on photon conversions. We will present a simulation study of electron efficiencies, pion suppression and reconstruction efficiencies. Special attention is placed onto the study of intermediate mass di-leptons ($1.5\ \mathrm{GeV}/c^2 < m_{inv} < 3.0\ \mathrm{GeV}/c^2$), which deliver an important physics case for the CBM-TRD, since they potentially provide access to the study of thermal medium radiation. A prerequisite for these studies is a good electron identification at high momenta which is provided by the CBM-TRD.

HK 2.7 Mo 18:30 F 1

Studies of Isolated Photon Production in pp Collisions with ALICE — •Rene Schach — Institut für Kernphysik, Goethe Universität Frankfurt

Isolated photons at high transverse momenta are produced in hard-scattering processes in high-energy pp and heavy-ion collisions. Photon production in heavy-ion collisions is thought to scale by the underlying number of binary collisions times photo-production in pp collisions. Therefore the comparison of results from pp collisions to results from p-Pb and heavy-ion collisions functions as a test for these scaling properties and helps to interpret the isolated-photon spectra in p-Pb and heavy-ion collisions at the LHC.

Since isolated photons originate directly in parton-parton interac-

tions, their measurement may also give insights to possible modifications of nuclear PDFs.

After a description of the analysis technique, the status of the isolated-photon measurement in pp collisions with the ALICE EMCAL will be presented. The cross sections of isolated photons for different collision energies and necessary corrections will be discussed.

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HK 2.8 Mo 18:45 F 1

Feasibility Studies on a Nuclei Trigger using the ALICE-TRD — •Benjamin Brudnyj — Institut für Kernphysik, Goethe-Universität Frankfurt, Frankfurt am Main

At the Large Hadron Collider (LHC) at CERN significant production rates of light (anti-)(hyper-)nuclei have been measured in Pb–Pb collisions. The production of such nuclei has recently become a topic of high interest. For instance the measured lifetime of the lightest hypernucleus, the hypertriton (a bound state of a proton, a neutron and a Λ hyperon), is significantly below the expectation of state-of-the-art theory calculations which expect the lifetime to be very close to the Λ lifetime. Therefore, it is important to also measure these rare nuclei in p–p collisions.

Due to their short lifetime, only its decay products can be measured, e.g. the charged two body decay channel ${}^{3}_{\Lambda}\mathrm{H} \rightarrow {}^{3}\mathrm{He} + \pi^{-}$. In order to be able to measure these rare (anti-)fragments also in p–p and p–Pb collisions, it is essential to increase the statistics by employing a trigger on nuclei. Using the data on Pb–Pb collisions at $\sqrt{s_{NN}} = 2.76$ TeV it turned out that particles with $Z > 1$ in the TRD show a behavior that can be used to implement such a nuclei trigger.

In this talk the physics case of a nuclei trigger will be elaborated as well as the exctracted efficiencies and purities for the different light nuclei, i.e. (anti-)d, (anti-)t, (anti-)^{3}He and (anti-)^{4}He.