HK 21: Heavy Ion Collisions and QCD Phases V

Zeit: Dienstag 14:00–16:15 Raum: F 3

Gruppenbericht HK 21.1 Di 14:00 F 3

Neutral meson measurements with ALICE — •Annika Passfeld for the ALICE-Collaboration — WWU Münster

With the ALICE experiment, neutral mesons (π^0, η) can be measured via their two photon decay channel. Therefore, several analysis methods including the electromagnetic calorimeters PHOS and EMCal and the reconstruction of converted photons with the tracking detectors ITS and TPC can be used.

In this group report the different detection techniques will be presented. The results for pp, p-Pb and Pb-Pb collisions will be compared and discussed in the context of initial state modifications, final state interactions, and collective effects.

This work has been supported by BMBF (FSP201-ALICE).

HK 21.2 Di 14:30 F 3

Neutral Meson Production in pp and p-Pb Collisions Measured with ALICE Calorimeters — •Fabian Pliquett for the ALICE-Collaboration — Institut für Kernphysik, Goethe-Universität Frankfurt

The properties of the quark-gluon plasma, a hot and dense state of matter created in high-energy nucleus-nucleus collisions, are investigated by ALICE, the dedicated heavy-ion experiment at the LHC, by means of particle production measurements. At high transverse momentum they provide information on the energy-loss mechanism of partons in the plasma. The measurement of neutral meson production complements other measurements of identified particles in the experiment. pp and p-Pb collisions function as control experiments to facilitate a better understanding of particle production in heavy-ion collisions. In ALICE, the reconstruction of neutral mesons is conducted by measuring the energy and position of the decay photons from the two-photon decay channel.

In this talk, the status of the neutral-meson measurements in pp and p-Pb collisions with two of the ALICE calorimeters, PHOS and EMCal, will be presented.

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HK 21.3 Di 14:45 F 3

Reconstruction of neutral pions at CBM-RICH detector via conversion* — •Ievgenii Kres, Karl-Heinz Kampert, and Christian Pauly for the CBM-Collaboration — Wuppertal University

The Compressed Baryonic Matter (CBM) experiment at the future FAIR complex will investigate the phase diagram of strongly interacting matter at high baryon density and moderate temperatures in A+A collisions from 2-11 AGeV (SIS100). A central component of the proposed detector setup is a Ring Imaging Cherenkov Detector (RICH) using CO_2 as radiator gas, a focussing optics with a large spherical mirror, and, as a result of recent CBM RICH geometry optimizations, a cylindrically shaped photon detection surface. As leptons are not affected by hadronic final state interactions, the dilepton spectrum, in particular dileptonic decays of light vector mesons like ρ or ω, offers the possibility to look into the dense fireball. At the low mass region, this spectrum is dominated by physical background from π^0 and η mesons, mainly decaying into photons suffering subsequent conversion processes. The presented analysis aims at reconstructing π^0 and η mesons via double conversion $\left(\pi^0 \to \gamma\left(e^+e^-\right) + \gamma\left(e^+e^-\right)\right)$ inside the target or first detector layers in order to scale these background channels accurately in the integral e^+e^- invariant mass spectrum. Proper counting of the pions requires an exact description of the combinatorical background below the pion invariant mass peak, which is achieved using the event mixing technique. First results of this conversion analysis are presented.

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HK 21.4 Di 15:00 F 3

Measurement of neutral mesons in Pb-Pb collisions at $\sqrt{s_{\mathrm{NN}}} = 5.02$ TeV with PCM in ALICE — •Meike Danisch for the ALICE-Collaboration — Physikalisches Institut Heidelberg

Neutral mesons can provide important information on the energy loss of partons traversing the hot and dense matter, which is created in high energy heavy-ion collisions. Furthermore, they constitute the largest background contribution for direct photons, which are among the most important tools to study the properties of the Quark Gluon Plasma. In the ALICE experiment, neutral mesons can be measured via their decay to two photons. Apart from the two calorimeters EMCal and PHOS, photons can be reconstructed also via the Photon Conversion Method (PCM). The latter exploits the fact that a photon can convert to an electron-positron pair. These charged particles can be detected via their tracks in the Time Projection Chamber (TPC) and the Inner Tracking System (ITS). The PCM allows the measurement of both photons and neutral mesons, carrying low transverse momenta ($p_{\mathrm{T}} \gtrsim 1$ GeV), with very good energy resolution. Apart from presenting the performance of the photon conversion method, first results on the π^0 and η meson production in Pb-Pb collisions with a center-of-mass collision energy per nucleon of $\sqrt{s_{NN}} = 5.02$ TeV will be shown.

HK 21.5 Di 15:15 F 3

Photon and neutral meson measurements with the conversion method in ALICE: Reducing the material budget uncertainty — •Stephan Stiefelmaier for the ALICE-Collaboration — Physikalisches Institut Heidelberg

One method to measure neutral mesons and direct photons in ALICE is to reconstruct electron-positron pairs from the conversion of photons in the detector material. This approach currently suffers from a 4% systematic uncertainty related to the knowledge of the material budget. A reduction of this uncertainty is key for establishing a signal of thermal direct photons at low p_T ($1 < p_T < 3$ GeV/c) and for discriminating between models describing direct-photon production in heavy-ion collisions. We have explored whether the material budget uncertainty can be reduced by calibrating the rest of the detector material using the TPC gas as a well understood reference.

HK 21.6 Di 15:30 F 3

ϕ meson production in p(3.5 GeV) + Nb reactions. — •Christian Wendisch for the HADES-Collaboration — GSI Helmholtzzentrum Darmstadt

For understanding the behavior of strange particles inside nuclear matter besides the study of complex heavy ion collisions, in particular studies of nucleon-core collisions are well suited. In this contribution we focus on the production of the ϕ meson, carrying hidden strangeness, reconstructed via it's hadronic decay into two charged kaons. The investigated data sample comprises $4 \cdot 10^9$ p(3.5 GeV) + Nb Reactions measured by HADES. We discuss the observed ϕ/ω ratio with respect to the suppression by the OZI rule and to the statistical particle production. In addition the preliminary experimental results are compared to transport model calculations.

HK 21.7 Di 15:45 F 3

Preliminary results on the direct photon excess ratio for the HADES experiment — •Christina Deveaux for the HADES-Collaboration — Justus Liebig Universität, Giessen

Measurements of direct photons from PHENIX and ALICE experiments at high energies show an unexpectedly high yield combined with a large elliptic flow. Both observations cannot be reconciled with current models describing the evolution of the fireball. In order to provide additional empirical data to this discussion, we analyze data on Au+Au collisions at 1.23 AGeV taken by the HADES experiment at GSI Helmholtzzentrum, Darmstadt. We present first results on the direct photon excess ratio as a function of transverse momentum and an estimate of the corresponding systematic uncertainties. Supported by BMBF and HIC for FAIR.

HK 21.8 Di 16:00 F 3

Coherent hypernucleus production in antiproton-nucleus collisions and κ meson — •Alexei Larionov[1], Horst Lenske[2], and Marcus Bleicher[3,4] — [1]National Research Center "Kurchatov Institute", 123182 Moscow, Russia — [2]Institut für Theoretische Physik, Universität Giessen, D-35392 Giessen, Germany — [3]Frankfurt Institute for Advanced Studies (FIAS), D-60438 Frankfurt am Main, Germany — [4]Institut für Theoretische Physik, J.W. Goethe-Universität, D-60438 Frankfurt am Main, Germany

Coherent reactions, when the hypernucleus is produced in a given quantum state, are especially sensitive to the reaction mechanism and to the properties of the Λ-nucleus interaction. In this talk we discuss the exclusive reaction $A(\bar{p}, \bar{\Lambda})_\Lambda A$ at $p_{\mathrm{lab}} = 1.5 \div 20$ GeV/c. The am-

plitude of the underlying $\bar{p}p \to \bar{\Lambda}\Lambda$ process with bound proton and Λ includes t-channel exchanges by the pseudoscalar K, vector K^*, and the yet to be confirmed scalar κ (i.e. $K_0^*(800)$) $S = \pm 1$ mesons. The relativistic wave functions of the bound proton and Λ are calculated from the static Dirac equation with scalar and vector potentials fitted to describe the binding energy and r.m.s. nucleon radii of the initial nucleus and the phenomenological energy levels of the final hypernucleus. The initial and final state interactions of the antibaryons in the nucleus are described in the eikonal approximation. We show that inclusion of the κ meson strongly influences the beam momentum dependence of the hypernucleus production cross sections in various quantum states. This can be regarded as the first clear signal of the correlated πK 0^+ exchange in $\bar{p}A$ collisions.