HK 8: Schwerionenkollisionen und QCD Phasen II

Time: Monday 16:30–19:00 Location: HS AP

Group Report HK 8.1 Mon 16:30 HS AP

Strange baryon production in heavy-ion collisions at SIS. — •Krzysztof Wisniewski for the FOPI-Collaboration — Physikalisches Institut, Universität Heidelberg, Philosophenweg 12, 69120 Heidelberg

Although it is not yet quite clear how kaons and antikaons change their properties in the nuclear medium, it has been recently speculated that the dense objects formed from antikaons and nucleons, so called dense kaonic clusters, can be produced, for example, in collisions of heavy ions at SIS energies. In order to understand this phenomena, not only production of strange mesons, e.g., kaons and antikaons, has to be studied in such collisions. Because dense kaonic clusters should predominantly decay into pairs of a hyperon and a nuclear fragment, production of strange baryons in heavy-ion collisions has attracted much interest in the recent years again.

In this group report, we present results of the analysis of correlations between Λ hyperons and other products of collisions of different systems, from light Al+Al up to heavy Pb+Pb, measured with the FOPI detector at SIS in GSI. In order to examine the possible production of kaonic clusters, correlations between the reconstructed Λ's and protons and deuterons are studied. The experimental procedure is verified by reconstructing $\Sigma^* \rightarrow \Lambda + \pi$ decays. In addition results on the production of hypertritons, decaying into ${}_{\Lambda}t \rightarrow {}^3He + \pi$ are shown.

Group Report HK 8.2 Mon 17:00 HS AP

Dielektronen Produktion in elemenatren und protoninduzierten Reaktionen — •Manuel Lorenz[1], Michael Weber[2] und Anar Rustamov[3] für die HADES-Kollaboration — [1]Institut für Kernphysik, Goethe-Universität, Frankfurt am Main — [2]Technische Universität München, Physikdept. E12, Garching — [3]GSI Helmholtzzentrum für Schwerionenphysik, Darmstadt

Die HADES Kollaboration hat ihr Physikprogramm von Schwerionenkollisionen und elementaren Reaktionen auf protoninduzierte Reaktionen ausgedehnt, um Mediumeffekte in kalter nuklearer Materie zu untersuchen. Dafür wurden Daten der Kollisionssysteme p+p und p+Nb bei einer Strahlenergie von 3.5 GeV aufgenommen. Ziel war es, eine mögliche Modifikationen in der Linienform des ω Mesons nachzuweisen. Mittlerweile haben wir unseren Fokus aufgrund der geringen Statistik im Bereich der Vektormesonen sowie experimenteller Befunde, die eine starke Modifikation der Linienform ausschließen, zu einer umfangreicheren Untersuchung von Dielektronen Emissionen in elementaren und protoninduzierten Reaktionen gerichtet. Aus den elementaren Daten lassen sich die bisher unbekannten inklusiven Wirkungsquerschnitte für die Produktion von π^0- sowie der η- und ω-Mesonen bestimmen. Ferner zeigen die Daten Sensitivität auf den elektromagnetischen Formfaktors der Δ-Resonanz. Um Effekte kalter nuklearer Materie zu quantifizieren, bilden wir das Verhältnis R_{pA} der beiden Datensätze in differentiellen Darstellungen. Abschließend konfrontieren wir die experimentellen Befunde mit theoretischen Erwartungen. Gefördert durch EMMI, HIC for FAIR, BMBF(06FY9100I+06MT9156) und GSI.

HK 8.3 Mon 17:30 HS AP

Femtoskopie mit HADES — •Christian Wendisch für die HADES-Kollaboration — Helmholtz-Zentrum Dresden-Rossendorf

Wir präsentieren Ergebnisse der Untersuchung von Proton-Proton, Pion-Pion sowie Lambda-Proton-Korrelationen bei kleinen Relativimpulsen mit dem Spektrometer HADES am SIS18/GSI. Grundlage dafür bilden Daten der Reaktionen Ar+KCl bei 1.76 AGeV und p+Nb bei 3.5 GeV Strahlenergie. Im Rahmen der femtoskopischen Analyse wurden die extrahierten Ausdehnungen der entsprechenden Quelldichteverteilungen auf Abhängigkeiten von verschiedenen Freiheitsgraden untersucht und mit Hilfe verschiedener Modelle interpretiert. Die Radien der entsprechenden Quellverteilungen werden miteinander sowie mit Radien aus Schwerionenstößen anderer Experimente an SIS, AGS, SPS und RHIC verglichen.

HK 8.4 Mon 17:45 HS AP

Analysis of charged Kaon Flow in Ni+Ni collisions at 1.91 AGeV with the FOPI detector — •Victoria Zinyuk for the FOPI-Collaboration — Ruprecht-Karls-Universität Heidelberg

As a consequence of chiral symmetry restoration in hot and dense environment theory suggests a change of the effective kaon mass in medium. The K^+ mass is believed to increase slightly and the K^- mass drops considerably with increasing baryon density.
These changes are implemented in transport models as an density dependent kaon-nucleon potential which influence the propagation of kaons through the medium after the collision. Therefor the measurement of charged kaon flow and comparison to the transport models provide information about the presence and magnitude of in-medium-effects on kaons.
In this presentation we show the rapidity, transverse momentum and centrality dependence of the fourier coefficients characterizing the direct (v_1) and elliptic (v_2) flow of charged kaons[1]. The kaons are produced in Ni+Ni collisions at sub-threshold energies and measured with the FOPI detector. The flow patterns are compared to the predictions of Hadron-String-Dynamics(HSD) and Isopin Quantum Molecular Dynamics(IQMD) transport approaches.

This work was supported by BMBF 06HD9121I.

[1] S. Voloshin and Y. Zhang, Z. Phys. C70, 665 (1996)

HK 8.5 Mon 18:00 HS AP

A Kinematic Refit for the analysis of the reaction $pp \rightarrow pK^+\Lambda$ at 3.1 GeV with FOPI — •Dominik Pleiner for the FOPI-Collaboration — Excellence Cluster Universe, TU München, Boltzmannstr. 8, D-85748 Garching

In order to study the existence of the ppK^- kaonic bound state, the FOPI experiment at GSI took data with a 3.1 GeV/c proton beam hitting a LH_2 target in August 2009. The ppK^-, which might decay into a lambda and a proton, is searched for, applying the missing mass and invariant mass technique. The reaction of interest will be $pp \rightarrow pK^+\Lambda$, where the lambda further decays into a proton and a pion. In order to improve the mass resolution of the reconstructed lambda, a kinematic refit was developed. The refit imposes the knowledge of several physical processes on the track-fitting by introducing certain constraints on the reconstructed tracks of the final reaction $pp \rightarrow pK^+p\pi^-$. In addition to several non-vertex constraints (e.g. energy/momentum conservation), also a secondary-vertex constraint is applied.
The basic functioning as well as preliminary results of the kinematic refit will be presented.

HK 8.6 Mon 18:15 HS AP

Search for hyper-triton in Ni+Ni at 1.91A GeV — •Yapeng Zhang and Norbert Herrmann for the FOPI-Collaboration — Physikalisches Institut, Uni Heidelberg

Investigating the production of hypernuclei in Heavy-ion collision is a unique way to study the interaction between strange baryons and normal nuclear matter. In this presentation, we present preliminary results of reconstructing hypertritons in Ni+Ni reactions at an incident energy of 1.91A GeV in the experiment performed with FOPI detector at SIS18 in GSI. By evaluating the invariant mass of $\pi^- - {}^3He$ pairs, we find a pronounced excess near the nominal mass of the hyper-triton under certain selection criteria. The reconstruction efficiency and the background are analysed by means of the MC simulations of the detector response.

* This work was supported by BMBF 06HD9121I.

HK 8.7 Mon 18:30 HS AP

Low-mass di-electron reconstruction in the CBM experiment at FAIR — •Elena Lebedeva[1], Tatyana Galatyuk[1], Claudia Höhne[2], and Joachim Stroth[1] for the CBM-Collaboration — [1]Goethe-Universität, Frankfurt, Germany — [2]Justus-Liebig Universität, Giessen, Germany

The Compressed Baryonic Matter (CBM) experiment at the future FAIR facility will measure lepton pairs emitted out of the hot and dense stage of relativistic heavy-ion collisions from 8-45 GeV/u beam energies. One of the experimental goals of the CBM experiment is the reconstruction of low-mass vector mesons (ρ_0, ω and ϕ) by means of their electromagnetic decay.

The challenge is to effectively reduce the combinatorial background with the currently foreseen experimental setup, which does not provide

electron identification in front of the magnetic field. The strategy of electron identification and background suppression will be discussed in particular with respect to systematic studies of the detector performance. Signal reconstruction efficiencies and signal-to-background ratios as function of collision energy will be presented.

HK 8.8 Mon 18:45 HS AP

On-line Hyperons reconstruction in Au+Au collisions at 10 and 25 AGeV with the CBM detector — •Vassiliev Iouri[1,2], Kisel Ivan[2], Kulakov Igor[2,3], Zyzak Maksym[2,3], and Akishina Valentina[4] for the CBM-Collaboration — [1]Goethe-Universität, Institut für Kernphysik, Frankfurt am Main, Germany; — [2]GSI, Darmstadt, Germany — [3]National Taras Shevchenko University of Kyiv, Ukraine — [4]Moscow State University, Russia

The main goal of the CBM experiment is to study the properies of compressed barionic matter as created in high energy heavy ion collisions. One of the most promising probes of the dence phase of the collision are (multi-) strange particles. Hyperons like Λ, Ξ^- and Ω^- will be measured in CBM via their decay into charged hadrons which are detected in the Silicon Tracking System (STS). To study the feasibility of on-line reconstruction of hyperons in the CBM experiment, a set of 10^4 central Au+Au events at 10 and 25 AGeV, generated with UrQMD, were simulated. The standard geometry with eight STS stations of double-sided segmented strip detectors is used for tracking. No kaon or proton identification with the time-of-flight detector is applied. The cellular automaton based track finder was used for on-line track reconstruction. Primary vertex finding and the reconstruction of the decayed particles from their daughter particles were done with SIMD instructions. The strategy for signals selection and background suppression will be discussed.

Supported by GSI, HIC for FAIR, EU FP7 Hadronphysics2