HK 13: Physik mit schweren Ionen

Zeit: Montag 16:30–19:00 Raum: 2E

Gruppenbericht HK 13.1 Mo 16:30 2E

High-p_T Particle Spectra at PHENIX – A Way to Study Parton Energy Loss — •Baldo Sahlmüller for the PHENIX-Collaboration — Institut für Kernphysik, Universität Münster

The PHENIX experiment has measured the spectra of hadrons such as the π^0 up to transverse momenta of $p_T = 20$ GeV/c. By measuring these particle spectra and by calculating the corresponding suppression patterns at different energies, in different collision systems, and - in non-central heavy ion events - at different angles w.r.t. the reaction plane, the data can be used to characterize parton energy loss by its energy, collision system and path length dependence. The high statistics acquired in the 2004 Au+Au run leads to reduced statistical (and systematic) uncertainties and can thus be used to constrain theoretical parameters in parton energy loss models, such as the initial gluon density dN^g/dy and the transport coefficient $\hat{q}$.
In this talk, we will present the latest results on the suppression of high-p_T π^0's and η's in Au+Au at $\sqrt{s_{NN}} = 200$ GeV as well as at 62.4 GeV, and in Cu+Cu at 22.4, 62.4, and 200 GeV. To examine the path length dependence, we also measure the suppression as a function of the angle w.r.t. the reaction plane in non-central Au+Au collisions. Finally, the results will be confronted with expectations from partonic energy loss models.

HK 13.2 Mo 17:00 2E

Open charm measurements in the CBM experiment — •Selim Seddiki[1,2], Christina Dritsa[2], Michael Deveaux[3], and Iouri Vassiliev[1] for the CBM-Collaboration — [1]GSI, Darmstadt, Germany — [2]IPHC, Strasbourg, France — [3]Goethe University, Frankfurt, Germany

The CBM experiment at the FAIR-SIS300 will study the properties of nuclear matter at extreme densities by colliding heavy ions at beam energies from 8 to 45 AGeV. One of the key observables for CBM is the production of open charm, considered as a probe which is sensitive to the early, high-density stage of the collision. The challenge of this measurement lies in the extremely low multiplicity, open charm being close to its production threshold at FAIR energies, within an environment of several hundreds of prompt charged particles. The displaced vertex topology of the open charm decay into charged hadrons has to be exploited in order to suppress the background of primary particles sufficiently. This task requires an excellent vertexing performance to be provided from the CBM micro-vertex detector (MVD). We will present feasibility studies for open charm measurements in CBM based on semi-realistic detector response simulation and full event reconstruction. Our results show that the measurements of the main reaction channels (D^0, $D^{\pm}$, D^*, D_s) appears feasible provided the targeted detector performances can be reached.

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HK 13.3 Mo 17:15 2E

Neutral and charged K meson reconstruction in central Pb+Au collisions at 158 A GeV in CERES experiment — •Matus Kalisky — GSI, Darmstadt, Deutschland

Over the last 20 years strangeness became one of the main probes in the relativistic heavy ion collisions [1]. The enhancement of the strange particle production and, particularly, the strongly nonmonotonic dependence of the K^+/π^+ ratio on the collision energy [2] attracted a lot of attention. In this talk we present results of a measurement of charged and neutral K meson production in central Pb+Au collisions at E_{lab} = 158 AGeV by the CERES collaboration. Kaons were reconstructed via their decays into charged pions: $K^0_S \to \pi^+\pi^-$, $K^+ \to \pi^+\pi^+\pi^-$, $K^- \to \pi^+\pi^-\pi^-$. While the K^0 analysis in the charged pion decay channel is an established technique it is for the first time in collisions of heavy nuclei (with the exception of the pioneering work of NA35 [3]) that it is being applied for charged kaons. The beam energy dependence of kaon production is a much discussed issue especially at SPS energies and an independent measurement with completely different systematics is therefore important. The charged and neutral kaon yields are compared to each other, to other experiments, and to theoretical predictions.

[1] L. Sandor, *J.Phys*, **G32**, (2006) 127-134
[2] S. Afanasiev and others *Phys. Rev.*, **C66**, (2002) 054902
[3] T. Alber et al., NA35 Collaboration, *Z. Phys.* **C64**, (1994), 195-207

HK 13.4 Mo 17:30 2E

Direct Photons and Neutral-Pions from p+C-, p+Pb- and Pb+Pb-Collisions at $\sqrt{s_{NN}}$ = 17.3 GeV — •Markus Rammler, Christoph Baumann und Klaus Reygers für die WA98-Kollaboration — Institut für Kernphysik, 48149 Münster

The WA98 experiment has measured the production of direct photons and neutral-pions in central Pb+Pb collisions at $\sqrt{s_{NN}} = 17.3$ GeV [1][2]. In order to interpret the Pb+Pb data p+A reference spectra measured at the same energy are useful.
From the Pb+Pb photon data the initial temperature could be constrained to values between 200 and 400 MeV. The spread of these temperatures is due to the uncertainty of the relative amount by which photons from hard scattering processes and thermally produced photons contribute to the photon excess. The status of the analysis of direct photon production in p+Pb collisions at $\sqrt{s_{NN}} = 17.3$ GeV measured with the WA98 experiment will be presented and implications for the different production mechanisms in Pb+Pb collisions are discussed.
Moreover, the neutral-pion supression measured in Pb+Pb by using the p+C and p+Pb spectra as references will be presented as a function of the centrality of the collision.
[1] WA98 Collaboration, Phys.Rev.Lett 85, 3595, 2000
[2] WA98 Collaboration, Eur.Phys.J.C 23, 225-236, 2002

HK 13.5 Mo 17:45 2E

Two-particle correlations in Pb+Au collisions at CERN SPS energies — •Simone Schuchmann, Dariusz Antończyk, Harald Appelshäuser, Stefan Kniege, and Mateusz Płoskoń for the CERES-Collaboration — Institut für Kernphysik, Max-von-Laue-Str.1, 60438 Frankfurt am Main

The investigation of momentum correlations of identical bosons yields information about the spatial and temporal evolution of the particle emitting source in heavy-ion collisions. A well-established technique to study space-time dimensions in such reactions is Hanbury-Brown Twiss (HBT) interferometry. Measurements of HBT parameters have been reported by several experimental collaborations from AGS to RHIC, spanning two orders of magnitude in $\sqrt{s_{NN}}$. The energy dependence may be interpreted in terms of a universal freeze-out scenario [1,2]. However, in the SPS regime systematic uncertainties do not yet allow to derive final conclusions from the measured excitation function of the HBT parameters [3,4]. Hence, a reanalysis of the data sets for 40, 80 and 158 AGeV collected in 1999 and 2000, employing an improved calibration scheme of the CERES TPC, is being performed.

Recent results of the HBT analysis at 40, 80 and 158 AGeV as well as a comparison to previous results will be presented and discussed in the context of different freeze-out scenarios.

This work is supported by BMBF and GSI.
[1] D.Adamová et al., PRL 90(2003) 022301; [2] Q.Li, M.Bleicher and H.Stöcker, nucl-th/0706.2091v2; [3] D.Adamová et al. Nucl.Phys. A 714 (2003) 124; [4] C.Alt et al., nucl-ex/0709.4507v2

HK 13.6 Mo 18:00 2E

Centrality dependence of proton and antiproton yields in Pb+Pb collisions at $\sqrt{s_{NN}}$ = 17.3 GeV — Hans Beck[1], Julian Book[1], Christoph Blume[1], Peter Dinkelaker[1], Volker Friese[2], Marek Gazdzicki[1], Claudia Höhne[2], Dmytro Kresan[2], Benjamin Lungwitz[1], Michael Mitrovski[1], Rainer Renfordt[1], Tim Schuster[1], Reinhard Stock[1], Claudia Strabel[1], Herbert Ströbele[1,2], •Milica Utvic[1], and Alexander Wetzler[1] for the NA49-Collaboration — [1]Fachbereich Physik der Universität Frankfurt — [2]Gesellschaft für Schwerionenforschung (GSI), Darmstadt

The centrality dependence of proton and antiproton spectra in high energy nuclear collisions is used to study the evolution of baryon stopping and transverse flow with the volume of interacting matter. The (anti−) proton yields in Pb+Pb minimum bias collisions at $\sqrt{s_{NN}} = 17.3$ GeV were measured by the NA49 Collaboration. They were identified in the c.m. rapidity interval -0.4 < y < 1.0 (corresponding to the laboratory momentum range 5-40 GeV/c) via their specific energy loss in the TPC detector gas. The resulting raw yields were corrected for geometrical acceptance, reconstruction efficiency and feeddown from weak decays. Rapidity distributions, transverse mass spectra and inverse slope pa-

rameters were studied as a function of collision centrality and compared to published data. It is found that the ratio of antiprotons to protons at midrapidity increases approximately by a factor of 2 from peripheral to the most central collisons.

HK 13.7 Mo 18:15 2E

Two- and three particle correlations of high-p_t charged particles in heavy ion collisions at CERN SPS energy* — Stefan Kniege, •Dariusz Antonczyk, Harald Appelshäuser, and Simone Schuchmann for the CERES-Collaboration — Institut für Kernphysik Frankfurt, Max-von-Laue-Str. 1, 60438 Frankfurt a.M.

The analysis of azimuthal correlations of hadrons with high transverse momenta provide a unique tool to study the interactions of partons with the medium in an early stage of heavy ion collisions. A detailed analysis of two particle correlations in Pb-Au collisions from the CERES experiment at top SPS energy will be presented. The key observation is a non-Gaussian shape on the "away-side"of the two particle correlation function in central collisions indicating significant interactions of partons traversing the medium even at SPS energy. A study of the correlations for different charge combinations of trigger and associate particles reveals charge ordering in the fragmentation process and sensitivity to the charges of the interacting partons. Hence the analysis may reveal properties of the initial as well as the final state of the collision. To further investigate the pattern of the two particle correlation function an analysis based on three particle correlations is presented. Different scenarios like elastic scattering of the initial partons or the evolution of a mach cone can lead to the same observable shape of the two particle correlation function. The three particle analysis presented gives strong indications for a cone like emission of hadrons emerging from hard parton-parton interactions in the collisions.

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HK 13.8 Mo 18:30 2E

Semiclassical expansion of quantum characteristics for many-body potential scattering problem — •Mikhail Krivoruchenko, Christian Fuchs, Amand Faessler, and Boris Martemyanov — Institut für Theoretische Physik, Tübingen Universität, Baden-Württemberg

Quantum characteristics, which appear in the Heisenberg picture as the Weyl's symbols of operators of canonical coordinates and momenta, solve the evolution equations for symbols of other operators acting in the Hilbert space. To any fixed order in the Planck's constant, many-body potential scattering problem simplifies to a statistical-mechanical problem of computing an ensemble of quantum characteristics and their derivatives with respect to the initial canonical coordinates and momenta. The reduction to a system of ordinary differential equations pertains rigorously at any fixed order in the Planck's constant. We present semiclassical expansion of quantum characteristics and provide tools for calculation of average values of time-dependent physical observables and cross sections. The method of quantum characteristics admits the consistent incorporation of specific quantum effects, such as non-locality and coherence in propagation of particles, into the semiclassical transport models.

[1] M. I. Krivoruchenko, C. Fuchs, Amand Faessler, Annalen Phys. 16, 587 (2007).

[2] M. I. Krivoruchenko, Amand Faessler, J. Math. Phys. 48, 052107 (2007).

[3] M. I. Krivoruchenko et al., Phys. Rev. C 76, 059801 (2007).

HK 13.9 Mo 18:45 2E

Systematic Study of the Optimization Potential for Di-Lepton Measurements in the CBM Experiment — •Konstantin Antipin[1], Harald Appelshäuser[1], and Claudia Höhne[2] for the CBM-Collaboration — [1]Institut für Kernphysik, Universität Frankfurt, Frankfurt — [2]Gesellschaft für Schwerionenforschung, Darmstadt

Currently the design of the CBM experiment at the future FAIR complex at GSI is being optimized for precision measurements of lepton pairs. They are considered to be a central observable for the understanding and characterization of the high density baryonic matter created in heavy-ion collisions. Since leptons leave the fireball without interaction, their study can provide information on in-medium properties of vector mesons or on a possible restoration of the chiral symmetry.

In this presentation we will focus on the electron decay channel of the vector mesons. The main challenge in this process is to effectively reduce the combinatorial background. Potential contributions to the background as Dalitz-decays or gamma conversion have to be studied in detail and strategies have to be developed to increase the signal-to-background ratio.

A systematic study on the development of an optimized detector setup for a high precision di-electron measurement will be presented. This includes modifications of the proposed setup of the CBM detector, the introduction of new detector components, establishing of necessary purity levels and particle identification strategies.

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