HK 41: Heavy-Ion Collisions and QCD Phases VIII

Zeit: Mittwoch 16:30–18:30 Raum: HS 15

Gruppenbericht HK 41.1 Mi 16:30 HS 15

Two-Pion Intensity Interferometry in Collisions of Au+Au @ 1.23AGeV — •Robert Greifenhagen[1,2] and Roland Kotte[1] for the HADES-Collaboration — [1]Helmholtz-Zentrum Dresden-Rossendorf — [2]Technische Universität Dresden

The HADES apparatus 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, the investigation of collective effects and particle correlations is possible with so far unrivalled accuracy.

We present results on identical pion intensity interferometry (HBT) with substantial charge sign difference. Our data allow access to the dependence of the pion emitting source on both the pair transverse momentum and the collision centrality. Comparing our femtoscopic results at $\sqrt{s_{\mathrm{NN}}}$ = 2.4 GeV to similar results achieved for heavy-ion collisions in a wide range of beam energies we see a very smooth evolution of the source parameters, contrary to the preexisting picture.

Furthermore, the high statistics measurements of flow coefficients for protons, deuterons and tritons are presented here. In addition to the directed (v1) and elliptic (v2) flow components also the higher coefficients v3 and v4 are investigated for the first time in this energy regime.

Together with the transverse momentum spectra of identified particles a consistent picture emerges which provides strong evidence for a substantial collective expansion already at these low beam energies.

HK 41.2 Mi 17:00 HS 15

Collective flow and correlation measurements with HADES in Au+Au collisions at 1.23 AGeV — •Behruz Kardan — Goethe-Universität, 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. The high statistics measurements of flow coefficients for protons, deuterons and tritons in Au+Au collisions at 1.23 AGeV (performed with the HADES experiment at SIS18/GSI) are presented here. In addition to the directed (v1) and elliptic (v2) flow components also the higher coefficients v3 and v4 are investigated for the first time in this energy regime. All flow coefficients are studied multi-differential, i.e. as a function of transverse momentum pt and rapidity over a large region of phase space and for several intervals of reaction centrality. This provides the possibility to characterize the particle production in heavy-ion collisions as a full 3D-picture in momentum space and puts strong constraints on the determination of the properties of dense matter, such as its viscosity and equation-of-state (EOS). Information on radial flow can be obtained from the analysis of pion HBT-correlations and transverse momentum spectra of identified particles. We will present new results on these observables extracted from the HADES data and discuss their correlations. From these a consistent picture emerges which provides strong evidence for a substantial radial expansion already at these low beam energies.

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HK 41.3 Mi 17:15 HS 15

Probing initial state fluctuations by the directed flow of spectators with ALICE at the LHC — •Lukas Kreis for the ALICE-Collaboration — GSI Helmholtzzentrum für Schwerionenforschung — Physikalisches Institut, Ruprecht-Karls-Universität Heidelberg

Particles produced in relativistic heavy-ion collisions show azimuthally anisotropic transverse momentum distributions. They result from the initial spatial distributions of participant and spectator nucleons, which fluctuate from event to event, combined with a rapid transverse expansion. The interplay between the initial momentum transfer to spectator nucleons and the spatial profile of the energy density in the nuclei overlap region is reflected in the relation between anisotropies present in the spectator and participant region.
Previous measurements by ALICE at the LHC revealed a non-zero rapidity-even and odd directed flow and a weak correlation between participant and spectator symmetry planes. In this talk, the correlation of flow magnitude of the spectators and produced particles in Pb-Pb collisions recorded by ALICE is studied using the event-shape-engineering method.

HK 41.4 Mi 17:30 HS 15

Identified particle correlations at high p_T — •Lucia Anna Husova for the ALICE-Collaboration — Westfälische Wilhelms Universität, Münster, Germany

Due to high particle multiplicities produced in Pb-Pb collisions, it is difficult to reconstruct the low-energy jets in such a collision system. Instead the method of two-particle correlations can be used to study jet properties. This work reports results coming from two-particle correlations in pp collisions at 13 TeV collected at ALICE experiment at LHC, which can be used as basis for the same analysis by Pb-Pb collisions. Two-particle correlations were done with identified and unidentified trigger particles at high p_T up to 15 GeV/c. Strange V^0 particles K^0_S,Λ and $\bar{\Lambda}$ were chosen, because of their good reconstruction also at high p_T. The per trigger yield at near and away side was studied as a function of p_T trigger particle and the collision multiplicity. The dependace of the yield on the trigger particle at the near side will be discussed.

HK 41.5 Mi 17:45 HS 15

Jet-hadron correlations in Pb–Pb collisions at $\sqrt{s_{\mathrm{NN}}}$ = 5.02 TeV — •Jiyoung Kim for the ALICE-Collaboration — Physikalisches Institut, Heidelberg University

The Quark-Gluon Plasma, a state of matter in which quarks and gluons are deconfined from nuclei, is produced in the early stages of our universe and also in ultra-relativistic heavy ion collisions. A Large Ion Collider Experiment (ALICE) aims to investigate properties of this strongly-interacting medium under extreme experimental conditions. Hard-scattered partons, which fragment into clusters of hadrons known as 'jets', are created in the initial stages of the collision, and then propagate through the medium. The interaction between partons and the medium leads to a modification of the jet properties, such as broadening, energy loss, and an additional medium response triggered by jets. By investigating the angular correlation between hadrons and jets, we explore the interaction between partons and the medium and quantitatively study the medium response around jets.

We present an analysis of angular correlations of inclusive hadrons and identified protons with respect to the axis of charged jets in Pb–Pb collisions at $\sqrt{s_{\mathrm{NN}}}$ = 5.02 TeV with the ALICE detector. The correlation functions are fully corrected for detector acceptance and tracking efficiency. Although both the jet-hadron and the jet-proton correlations contain the medium response, since the proton abundance in the medium is relatively higher than in jet fragmentation, we expect to see an amplified medium signal in the jet-proton correlations.

This work is supported by BMBF and HGS-HIRe.

HK 41.6 Mi 18:00 HS 15

Azimuthal particle correlations as a probe of collectivity in deep inelastic electron-proton collisions at HERA — •Dhevan Gangadharan for the ZEUS-Collaboration — Univeristat Heidelberg

Recent observations at RHIC and the LHC of two- and multi-particle correlations in high multiplicity relativistic proton-proton and proton-ion collisions and similarity of the results to those observed in central heavy-ion collisions are often interpreted as an evidence for collective particle production in small collision systems. These results motivate a study in even smaller systems, such as produced in relativistic electron-proton collisions.

A measurement is presented of two-particle correlations in collisions of electron beams at 27.5 GeV with beams of protons at 920 GeV, which corresponds to 318 GeV centre-of-mass energy. A sample of events equivalent to the integrated luminosity of 430 inverse pb was recorded with the ZEUS experiment in 2003-2007. The correlations are measured for charged hadrons as a function of event multiplicity for the lab pseudorapidity range -1.5$<\eta$lab$<$2. To probe the possible contribution due to collective effects, the correlations are studied as a function of the particle's pair separation in pseudorapidity and the pair mean transverse momentum. The observed correlations are compared to available Monte Carlo models of deep inelastic electron-proton scattering. Observations based on the analysis of the ZEUS data put a limit on the possible collective effects in high multiplicity electron-proton collisions.

HK 41.7 Mi 18:15 HS 15

Feasibility study for the measurement of a photon HBT signal — •Nicole Löher[1], Jürgen Berges[2], Oscar Garcia[2], Aleksas Mazeliauskas[2], and Klaus Reygers[1] — [1]Physikalisches Institut, Universität Heidelberg — [2]Institut für Theoretische Physik, Universität Heidelberg

A theoretical study on a possible measurement of Hanbury-Brown Twiss (HBT) correlations of direct photons in nucleus-nucleus collisions is presented. The spatial-temporal evolution of the Quark Gluon Plasma (QGP) at LHC energies ($\sqrt{s_{NN}} = 2.74\,\mathrm{TeV}$) is simulated using the hydrodynamic code iEBE-VISHNU. Photon invariant yields are then calculated based on the photon rates from P. Arnold, G. Moore and L. Yaffe for the QGP phase and parameterizations by M. Heffernan, P. Hohler and R. Rapp for the hadron gas phase. The HBT signal for thermal photons is determined. In addition, two extra sources for photons are investigated. An early source based on nonequilibrium Yang-Mills dynamics and a photon enhancement near the critical temperature T_c are discussed. The photon HBT signal is calculated for all three scenarios and the results are compared. Based on these calculations an estimate for the required statistics for a possible measurable signal in the ALICE detector system is given.