HK 20: Heavy Ion Collisions and QCD Phases IV

Zeit: Dienstag 14:00–16:15 Raum: F 1

Gruppenbericht HK 20.1 Di 14:00 F 1

Femtoscopy in Pb-Pb collisions with ALICE — •Hans Beck for the ALICE-Collaboration — University of Heidelberg

Femtoscopy exploits quantum-statistical and final-state interaction induced correlations to probe the spatio-temporal extent of the particle emitting source. We review the most recent results in Pb-Pb collisions by ALICE; among them measurements involving strangeness-carrying baryons, where the aim is to determine the strong two-body interaction potentials as well as source dynamics through the investigation of the transverse mass dependence of source radii. The latter is also performed with identical kaon pair measurements, where new three-dimensional results highlight the importance of the inclusion of a hadronic phase in the modeling of heavy-ion collisions. New avenues are pursued with non-identical kaon pair measurements which inter alia might identify a tetra-quark particle. We conclude by showing source extent studies with respect to the event plane and will outline prospective analyses, e.g. photon-photon correlation measurements.

HK 20.2 Di 14:30 F 1

Measurement of Identified Hadron Production in Charged Jets from Proton-Lead Collisions with ALICE at the LHC — •Martin Schmidt for the ALICE-Collaboration — Physikalisches Institut, Universität Tübingen

The spectra of identified hadrons in jets offer possibilities to investigate the fragmentation of partons in detail. By comparing the results for proton-proton (pp) and proton-lead (p-Pb) collisions we can test hypotheses about cold nuclear matter effects.

The ALICE experiment at the LHC has excellent particle identification capabilities for tracks with transverse momentum ranging from 150 MeV/c to above 20 GeV/c. It therefore can measure identified hadrons in a way that is unique at the LHC.

In p-Pb collisions the underlying event, coming from soft interactions, cannot be neglected and spoils the jet measurements. We present methods to measure the individual contributions of π/K/p to the underlying event and discuss how to properly subtract it from the particle production inside the jet area. The study of the underlying event in p-Pb collisions also serves as a proof of principle to adapt the methods later on for lead-lead (Pb-Pb) collisions where the underlying event is huge.

We show the corrected jet constituent spectra from p-Pb collisions with systematic uncertainties as a function of $p_{\mathrm{T}}^{\mathrm{track,charged}}$ and $z = p_{\mathrm{T}}^{\mathrm{track,charged}}/p_{\mathrm{T}}^{\mathrm{jet,charged}}$.

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HK 20.3 Di 14:45 F 1

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

In the presence of Quark Gluon Plasma (QGP) created in ultra relativistic heavy ion collisions, jets probe the strongly-interacting medium. Jets are collimated sprays of particles produced from fragmenting hard scattered partons. When high energetic partons pass through the QGP, they interact with the medium and lose a part of their energy. This phenomenon, called jet quenching, has been observed as a suppression of high transverse momentum particles and disappearance of opposite side in di-jet production. A quantitative understanding of the mechanisms of parton energy loss and the parton-medium interaction is not yet established. Model calculations suggest the formation of Mach cones as a result of the interaction between partons and the QGP.

We present an analysis of azimuthal correlations of inclusive hadrons with respect to the axis of charged jets in Pb-Pb collisions at $\sqrt{s_{NN}}$ = 5.02TeV with the ALICE detector. Jet-hadron and jet-proton correlations allow to study the interaction between jets and the medium and allow to disentangle jet fragmentation and the medium response. The status of the analysis will be presented.

HK 20.4 Di 15:00 F 1

Recent measurements of jet substructure in Pb-Pb collisions at ALICE — •Leticia Cunqueiro for the ALICE-Collaboration — University of Muenster

We report recent measurements of jet substructure in Heavy Ion Collisions at ALICE. Those measurements are the jet mass, the ratio of 2-Subjettiness to 1-Subjettiness calculated with respect the two subjet axes given by kT in exclusive mode as well as the aperture angle between these axes. These observables probe different aspects of the jet evolution in the presence of a Quark Gluon Plasma: while the mass probes possible broadening/collimation of the jet shower, the Subjettiness measurements are used to investigate the role of coherence. Coherence effects relate to the ability of the medium to resolve a jet*s substructure, which has an impact on the energy loss magnitude and mechanism of the traversing jet. New techniques are used to subtract background, to suppress combinatorial jets and to unfold simultaneously the shape and the jet pT to provide fully corrected measurements in central Pb-Pb collisions at sqrtsNN =2.76 TeV

HK 20.5 Di 15:15 F 1

Beauty-jet reconstruction using the track counting method in pp collisions with ALICE at the LHC — •Linus Feldkamp for the ALICE-Collaboration — Institut für Kernphysik, Westfälische-Wilhelms-Universität Münster

Charm and beauty quarks, produced in the early stage of heavy-ion collisions, are ideal probes to study the characteristics of the hot and dense deconfined medium (Quark-Gluon Plasma) formed in these collisions. The radiative energy loss of high energy partons interacting with the medium is expected to be larger for gluons than for quarks, and to depend on the quark mass, with beauty quarks losing less energy than charm quarks, light quarks and gluons. Therefore, a comparison of the modification in the momentum distribution or possibly in the jet shape of beauty-jets with that of light flavour or c-jets in Pb-Pb collisions relative to pp collisions allows to investigate the mass dependence of the energy loss. It also allows to study the redistribution of the lost energy and possible modifications to b-quark fragmentation in the medium. The track counting method exploits the large rϕ-impact parameters, $d_0 = |\vec{d_0}|$, of B-meson decay products to identify beauty-jets. The signed rϕ-impact parameter, $d_0 = sign(\vec{d_0} \cdot \vec{p}_{\mathrm{jet}})d_0$, is calculated for each track in the jet cone, where $\vec{d_0}$ is pointing away from the primary vertex. The distribution of the n-th largest signed impact parameter in a jet is sensitive to the flavour of the hadronizing parton and allows to select jets coming form beauty on a statistical basis. In this contribution, we give an overview of the beauty jet measurement using the track counting method with ALICE in pp collisions at $\sqrt{s} = 7$ TeV.

HK 20.6 Di 15:30 F 1

Shear viscosity and entropy of a hadron gas — •Jean-Bernard Rose[1,2], Dmytro Oliinychenko[1,2], Juan Torres-Rincon[1], and Hannah Petersen[1,2,3] — [1]Frankfurt Institute for Advanced studies, Frankfurt am Main, Deutschland — [2]Goethe Universität, Frankfurt am Main, Deutschland — [3]GSI Helmholzzentrum für Schwerionenforschung, Darmstadt, Deutschland

Microscopic non-equilibrium dynamics are used to calculate the transport coefficients of dense hadronic matter. Specifically, the shear viscosity to entropy density ratio is investigated, its temperature dependence between 75 MeV and 175 MeV is explored, and the effects of non-zero baryon and strange chemical potentials are probed. This is important to constrain the value of shear viscosity over entropy density used in hydrodynamic calculations of heavy ion reactions at RHIC and the LHC. Calculations are initialized using particle densities computed from a thermal model in a hadronic box simulating infinite matter. After an equilibration delay, the shear viscosity is computed using the Green-Kubo formalism. We use the Gibbs formulato get the entropy density and spectral fitting to obtain the equilibrated temperatures and chemical potentials of the system. The results for the entropy and shear viscosity of a massive and massless pion gas are compared to analytic estimates. The shear viscosity to entropy density ratio is found to be significantly lower than found in previous similar calculations, but in qualitative agreement with other calculations using other methods. This will be the starting point for the calculation of more transport coefficients as functions of temperature and chemical potential.

HK 20.7 Di 15:45 F 1

A generalized quasiparticle model for hot QCD matter — •Thorsten Steinert and Wolfgang Cassing — Institut für Theoretische Physik, JLU Giessen, 35392 Giessen, Germany

The QCD equation of state as predicted by lattice QCD calculations (lQCD) is well reproduced in terms of effective quasiparticle models. These models so far fail to describe the susceptibilties and underestimate the pressure at finite densities. We present a generalised quasiparticle model where the partonic propagators explicitly depend on the three-momentum with respect to the medium. Within this extended model we reproduce simultaneously the equation of state and the susceptibilties as provided by lQCD. We calculate the shear and bulk viscosity as well as the electric conductivity and compared them to default quasiparticle models. We find a good agreement between our model and available lattice data for all transport coefficients. We use thermodynamic consistency to extend the model to finite chemical potential.

HK 20.8 Di 16:00 F 1

Baryon-baryon femtoscopy in pp collisions at 7 TeV with ALICE at the LHC — •Oliver Arnold for the ALICE-Collaboration — Physik Department, Technische Universität München, Garching, Germany — Excellence Cluster "Universe", Garching, Germany

Two-particle correlation functions at low relative momenta are sensitive to the size of the emission zone of the particles. By knowing the interaction of the emitted particle pair very precisely it is possible to make a detailed study of the source size of the system, which has an extension on the fermi scale. This is usually done with particle pairs, where the interaction is precisely known. However, if the size of the emission zone is constrained one can use the femtoscopy technique to investigate the interaction between pairs of particles where not much is known about the interaction.

We use the femtoscopy technique to measure the correlation functions of proton-proton, proton-Lambda and Lambda-Lambda pairs, which were produced in pp collisions at 7 TeV at the Large Hadron Collider and measured with the ALICE experiment. This is the first femtoscopy measurement with baryon pairs at such a large energy and small system. We show that a simultaneous fit of the proton-proton and proton-Lambda correlation functions is sensitive to scattering parameters of the proton-Lambda pair. This opens the possibility to investigate the interaction of proton-Lambda pairs complementary to scattering experiments. This work is supported by HIC for FAIR, HGS-HIRe and BMBF FSB 202.