HK 66: Heavy-Ion Collisions and QCD Phases XIV

Time: Thursday 16:00–17:15 Location: HK-H2

HK 66.1 Thu 16:00 HK-H2

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

In relativistic heavy-ion collisions, a deconfined medium with high energy density is created, the quark-gluon plasma. Amongst other observables, jets – originating from primordial hard scatterings – act as useful probes for the properties of this medium. As the initial partons traverse the quark-gluon plasma, they lose energy by interacting with the constituents of the medium. The study of this so called "jet quenching" yields insight into the properties of the medium.

By analyzing the angular correlations of jets with charged hadrons, one obtains information about the energy loss of jets in the medium. The study of these correlation functions for different orientations of the jet to the event plane allows for a measurement of the energy loss which is sensitive to the in-medium path-length of the jet. In this talk, first studies of event plane dependent jet-hadron correlations for data collected by the ALICE experiment in PbPb collisions at $\sqrt{s_{\mathrm{NN}}} = 5.02$ TeV are presented.

HK 66.2 Thu 16:15 HK-H2

Deuteron production in and out of jets measured with ALICE at the LHC — •Chiara Pinto for the ALICE-Collaboration — Technische Universität München, Garching bei München, Germany

The production mechanism of (anti)nuclei in ultrarelativistic hadronic collisions is under intense debate in the scientific community. The description of the experimental measurements is currently based on two competing phenomenological models: the statistical hadronisation model and the coalescence approach. For the first time, the deuteron production in pp collisions at $\sqrt{s} = 13$ TeV is measured both in jets and in the underlying event. Due to the collimated emission of nucleons in a jet, the nuclear production by coalescence is expected to be enhanced. In this contribution, the results for the coalescence parameter B_2 in and out of the jet are presented in comparison with predictions from the coalescence model and a recently developed reaction-based production mechanism implemented in PYTHIA 8.3.

HK 66.3 Thu 16:30 HK-H2

Multi-particle correlation in proton-proton collisions from a toy hydrodynamic model — •Seyed Farid Taghavi — E62, Physics department, Technical university of Munich, Garching, Germany

Over the past years, there have been ongoing debates on the origin of the long-range correlations observed in proton-proton collisions at RHIC and LHC. In this talk, a toy model based on Gubser flow is introduced to shed light on the applicability of hydrodynamics in proton-proton collisions. The model, initial state fluctuation + Gubser solution + Cooper-Frye freeze-out, is validated by comparing its results with MC-Glauber + VISH2+1. A rather model-independent approach for the initial state is followed where the RMS radius and ellipticity event-by-event fluctuations are modeled instead of modeling the initial entropy density of individual events. This approach helps us to find out which initial state fluctuating properties would lead to a correct final multiparticle correlation. The toy model describes the multiplicity and transverse momentum dependence of two-point and four-point correlation functions in an accurate agreement with proton-proton collision experimental measurements. In particular, the sign of the four-point correlation function is the same as the observation. We find that neither AMPT nor T$_{\mathrm{R}}$ENTo with nucleonic substructure initial state models can produce the predicted fluctuation for the RMS radius and ellipticity.
Based on:
S. F. Taghavi, Phys.Rev.C 104 (2021) 5, 054906

HK 66.4 Thu 16:45 HK-H2

Differential studies of multi-harmonic flow correlations in ALICE — •Anton Riedel for the ALICE-Collaboration — TU Muenchen, Garching b. M., Deutschland

Symmetric cumulants are a reliable tool for estimating the multi-harmonic correlations between different flow harmonics and have been used in ALICE to constrain the details of η/s temperature dependence of the matter produced in heavy-ion collisions.

In this poster, we present a further differential study of multi-harmonic correlations obtained with symmetric cumulants, SC(k, l) and SC(k, l, m). We present the first results for symmetric cumulants as functions of pseudorapidity η and transverse momentum p_{T} utilizing Pb–Pb collision at LHC and show how granular the correlations can be extracted using the available statistics. These differential studies provide new and independent constraints both on initial conditions and on the properties of produced nuclear matter.

HK 66.5 Thu 17:00 HK-H2

Impact of hadronic interactions and conservation laws on cumulants of conserved charges in a dynamical model — •Jan Hammelmann[1] and Hannah Elfner[2,1] — [1]Frankfurt Institute for Advanced Studies (FIAS) — [2]GSI Helmholtzzentrum für Schwerionenforschung

Understanding the phase diagram of QCD by measuring fluctuations of conserved charges in heavy-ion collision is one of the main goals of the beam energy scan program at RHIC. Within this work, we calculate the role of hadronic interactions and momentum cuts on cumulants of conserved charges up to fourth order in a system in equilibrium within a hadronic transport approach (SMASH). In our model the net-baryon, net-charge and net-strangeness is perfectly conserved on an event-by-event basis and the cumulants are calculated as a function of subvolume sizes and compared to analytic expectations. We find a modification of the kurtosis due to charge annihilation processes in systems with simplified degrees of freedom. Furthermore the result of the full SMASH hadron gas for the net-baryon and net-proton number fluctuations is presented for systems with zero and finite values of baryochemical potential. Additionally we find that due to dynamical correlations the cumulants of the net-baryon number cannot be recovered from the net-protons. Finally the influence of deuteron cluster formation on the net-proton and net-baryon fluctuations in simplified system is shown. This analysis is important to better understand the relation between measurements of fluctuations in heavy-ion collisions and theoretical calculation which are often performed in a grand canonical ensemble.