HK 12: Heavy-Ion Collisions and QCD Phases III

Time: Monday 16:00–17:30 Location: HK-H1

Group Report HK 12.1 Mon 16:00 HK-H1

Measurements of Heavy-flavour Baryon Production with ALICE at the LHC — •Jeremy Wilkinson for the ALICE-Collaboration — GSI Helmholtzzentrum für Schwerionenforschung GmbH, Darmstadt

The measurement of charmed baryons in hadronic collision systems at the LHC has recently shown an enhancement of the charmed baryon-to-meson ratios (Λ_c^+/D^0 and Ξ_c/D^0) with respect to previous measurements in e^+e^- and e^-p collisions, challenging previous assumptions about the universality of charm hadronisation processes between different collision systems. This in turn has a significant effect on the measured total charm cross section, where previously the relative contributions of charmed baryons had to be assumed based on results from leptonic collision experiments.

This talk will present the latest measurements performed by the ALICE Collaboration for charmed baryon production at mid-rapidity in pp and p–Pb collisions at the LHC. In particular, we highlight recent developments in analysis techniques using the XGBoost algorithm for machine learning selections, and the KFParticle package, which uses a Kalman filter to re-fit the decay tracks from baryon candidates and provide constraints to improve the mass resolution. These methods provide unprecedented experimental access to the low-p_T region for Λ_c^+ to serve as a constraint on the charm fragmentation fractions. In addition, they can be used to give indirect access to the beauty sector through non-prompt Λ_c^+, as well as previously inaccessible decays such as $\Omega_c^0 \to \Omega^-\pi^+$ and $\Xi_c^+ \to \Xi^-\pi^+\pi^+$.

HK 12.2 Mon 16:30 HK-H1

Reconstruction of $\Xi_c^+ \to \Xi^-\pi^+\pi^+$ in proton-proton collisions at $\sqrt{s} = 13$ TeV with the ALICE detector — •Carolina Reetz — Physikalisches Institut, Universität Heidelberg — GSI Helmholtzzentrum für Schwerionenforschung, Darmstadt

Recent measurements of charmed-baryon production at midrapidity in pp and p-Pb collisions show a baryon-to-meson ratio significantly higher than the one in e^+e^- collisions, suggesting that the fragmentation of charm quarks into hadrons is not universal across different collision systems.
The reconstruction of the Ξ_c^+ baryon decaying to $\Xi^-\pi^+\pi^+$ with the ALICE detector is the subject of the studies presented in this contribution. The reconstruction of the complex decay topology is performed with the help of the KF Particle Package. It supports the reconstruction of full particle decay chains, exploiting the use of invariant mass and topological constrained fits and including the complete treatment of tracking and vertexing uncertainties. These features are of crucial importance in the selection of reconstructed candidates which is performed by applying machine learning techniques in the form of Boosted Decision Tree (BDT) models using XGBoost.
The application of these advantageous techniques is of utmost importance in the search for rare signals and allows to extract signal even in low p_T-intervals where the signal-to-background ratio is rapidly decreasing. The cross section measurement together with the full treatment of the systematic uncertainties and the comparison to model calculations is reported.

HK 12.3 Mon 16:45 HK-H1

Reconstruction of beauty jets in proton-proton collisions at $\sqrt{s} = 13$ TeV with ALICE — •Katharina Demmich — Westfälische Wilhelms-Universität Münster, Germany

In this contribution, the performance of a beauty-jet tagging algorithm based on transverse impact-parameter threshold cuts will be discussed for data collected by the ALICE experiment in proton-proton collisions at $\sqrt{s} = 13$ TeV. Owing to the relatively large lifetimes and the cascade of weak decays of beauty hadrons, the measurement of the impact parameter of tracks within jets can be utilised to select beauty jets.

Measuring the beauty-jet production cross section in proton-proton collisions is a fundamental step towards a thorough testing of QCD calculations for the production and fragmentation of heavy flavours in nucleon-nucleon collisions. Thereby, the ALICE experiment offers excellent capabilities to assess theory predictions down to low $p_{T,Jet}$ due to its unique tracking performance.
In addition, the investigation of beauty-jet observables in proton-proton collisions is a reference for respective analyses on heavy-ion collisions. As such, it opens the possibility to study the mass dependence of particle interactions with the Quark-Gluon Plasma (QGP).

HK 12.4 Mon 17:00 HK-H1

Measurement of charm production cross-section via electron-muon coincidence — •Victor Feuillard for the ALICE-Collaboration — Physikalische Institut, Heidelberg, Germany

The measurement of the production of heavy-flavor hadrons, meaning hadrons with charm or beauty quarks, in proton-proton collisions provides a test of quantum chromodynamics (QCD), the theory of the strong interaction. Indeed, in hadronic collisions, heavy quarks are almost exclusively produced through initial hard partonic scattering processes because of their large masses.

One available method to investigate heavy-flavor production is the measurement of the contribution of semi-leptonic decays of heavy-flavor hadrons to the dilpeton spectra. In particular, it is possible to measure the production of heavy mesons in the electron-muon spectrum.

In this talk, we will present the measurement of the charm production cross section in pp collisions at $\sqrt{s} = 13$ TeV in ALICE using electron-muon coincidence.

HK 12.5 Mon 17:15 HK-H1

Hydrodynamic approach to heavy-quark diffusion in the quark-gluon plasma — •Federica Capellino[1,2], Andrea Beraudo[3], Andrea Dubla[2], Stefan Floerchinger[4], Silvia Masciocchi[1,2], Jan M. Pawlowski[4], and Ilya Selyuzhenkov[2] — [1]Physikalisches Institut Heidelberg, Heidelberg, Germany — [2]GSI Helmholtzzentrum für Schwerionenforschung, Darmstadt, Germany — [3]INFN Sezione di Torino, Torino, Italy — [4]Institut für Theoretische Physik, Heidelberg, Germany

In this work, a new hydrodynamic approach to the transport of heavy quarks in the quark-gluon plasma (QGP) is presented. We exploit the conservation of the number of heavy quark-antiquark pairs within the evolution of the QGP to construct causal second-order hydrodynamic equations of motion. The hydrodynamic transport coefficients associated with the heavy-quark diffusion current are then compared with the momentum-diffusion coefficients obtained in transport theory (Fokker-Planck equation). By investigating the relation between the two approaches, we provide new insights concerning the level of local thermalization of charm and bottom quarks inside the expanding QGP. Our results show that a fluid dynamic description of diffusion is feasible for charm quarks. In particular, in Bjorken flow the hydrodynamization time of charm quarks is in general short compared to the typical expansion time of the QGP, justifying a fluid description of charm diffusion. This work is funded via the DFG ISOQUANT Collaborative Research Center (SFB 1225).