HK 39: Heavy Ion Collisions and QCD Phases VIII

Zeit: Donnerstag 14:00–16:15 Raum: F 1

Gruppenbericht HK 39.1 Do 14:00 F 1

Recent ALICE measurements on open heavy-flavour hadron production in pp, p–Pb, and Pb–Pb collisions at the LHC — •Andrea Dubla for the ALICE-Collaboration — GSI Helmholtzzentrum für Schwerionenforschung, Darmstadt, Germany — Physikalisches Institut, University of Heidelberg, Heidelberg, Germany

In heavy-ion collisions at ultra-relativistic energies a de-confined state of quarks and gluons, the Quark-Gluon Plasma (QGP), is expected to be formed. Produced in hard-scattering processes in the initial stage of the collision, heavy quarks are a powerful tool to probe the partonic interactions ongoing in the medium. The analysis of the transverse momentum spectra and of the azimuthal anisotropy of heavy-flavour particles in Pb–Pb collisions provides crucial information on the mechanisms of parton energy loss, hadronisation and thermalization in the hot and dense state of matter. Heavy-flavour measurements in pp collisions provide a baseline for the results from Pb–Pb data, and an important test of perturbative QCD. In heavy-ion collisions, the nuclear nature of the incoming projectiles also give rise to cold nuclear matter effects such as modification of parton densities in nuclei, momentum broadening and shadowing. These effects have to be disentangled from those due to the hot QGP phase. This can be studied with p–Pb collisions. The most recent results obtained in Pb–Pb collisions at $\sqrt{s_{\rm NN}}$ = 2.76 TeV and 5.02 TeV will be discussed, together with the results measured in smaller collision systems.

HK 39.2 Do 14:30 F 1

Charm quark diffusion coefficients in the quark-gluon plasma — •Johannes Misch, Moritz Greif, Hendrik van Hees, and Carsten Greiner — Institut fuer Theoretische Physik/ITP, Johann Wolfgang Goethe-Universitaet, Frankfurt am Main

The diffusion of heavy quarks, e.g., charm quarks in a thermal medium can be described by the Fokker-Planck equation. Heavy quarks are important probes of the quark-gluon plasma, and the understanding of their diffusion properties is necessary to explain experimental data. We use the BAMPS (Boltzmann Approach to Multi-Parton Scatterings) simulation framework to determine the drag and diffusion constants. BAMPS uses pQCD matrix elements for binary and inelastic scattering. We study the dependence of the charm quark diffusion on multiple scales of the system, such as charm mass, temperature and ingoing charm momentum.

HK 39.3 Do 14:45 F 1

Measurement of the production cross-section of electrons from heavy-flavour hadron decays in pp collisions at $\sqrt{s}$ = 2.76 TeV with ALICE — •Sebastian Hornung for the ALICE-Collaboration — GSI, Darmstadt, Germany — Heidelberg University, Germany

Measurements of heavy-flavour hadrons produced in proton-proton collisions are important to test perturbative Quantum ChromoDynamics and as a reference for measurements in heavy-ion collisions. Electrons from semileptonic decay of heavy-flavour hadrons are obtained subtracting the background from non-heavy-flavour sources from the inclusive electron spectra. Traditionally, this is done with the so-called cocktail-subtraction method based on a Monte Carlo simulation of electrons from various sources. This approach is affected by large systematic uncertainties, especially at low transverse momenta, where the main source of background are photon conversions and Dalitz decays of light neutral mesons. A data-driven method to subtract these electrons was developed in the last years, which turned out to be less affected by systematic uncertainties. Background electrons are reconstructed by pairing electrons (positrons) with tracks identified as positron (electron). The electron candidates belonging to low mass pairs are subtracted from the inclusive electron yield. The production cross-section of electrons from heavy-flavour hadron decays was measured in pp collisions at $\sqrt{s}$ = 2.76 TeV applying the pair-finding method. With the resulting cross-section the precision of the measurement of the nuclear modification factor at low transverse momenta was improved.

HK 39.4 Do 15:00 F 1

NLO + Parton Shower Calculation of Heavy Flavour Electrons with Nuclear PDFs — •Florian Herrmann — Westfälische Wilhelms-Universität, Münster, Germany

Heavy flavour (beauty and charm) quarks are of special interest for the study of the Quark-Gluon Plasma as they are predominantly produced in the initial hard-scattering process and participate in the entire evolution of the system created in heavy-ion collisions. Thus, heavy flavours are an excellent probe to study in-medium energy loss (mechanisms) in nuclear collisions by calculating the nuclear modification factor R_{AA} or the azimuthal anisotropy and especially the elliptic flow v_2 of heavy-flavour particles. Experimentally, heavy flavours are often investigated using measurements of electrons from heavy-flavour hadron decays. These electrons can be separated statistically from the background originating from light flavours and gluons and provide insight into the colour charge and mass dependence of parton energy loss. We present the relative contribution of electrons from beauty hadron decays to the yield of electrons from heavy-flavour hadron decays estimated with Monte Carlo simulations based on POWHEG. The calculations are performed for p–p and Pb–Pb collisions at $\sqrt{s_{NN}}$ = 2.76 TeV. Nuclear effects are taken into account using the nuclear parton distribution functions EPS09 and nCTEQ15. These calculations serve as an essential ingredient to separate the contributions of charm and beauty quarks in the measurements of the p_T-differential invariant cross section and elliptic flow of electrons from heavy-flavour hadron decays. – Supported by DFG GRK2149

HK 39.5 Do 15:15 F 1

Prospects for extended heavy flavour investigations in ALICE using new vertexing methods — •Lukas Layer for the ALICE-Collaboration — University Heidelberg — GSI Darmstadt

A Large Ion Collider Experiment (ALICE) is a dedicated heavy-ion experiment at the LHC that focuses on the study of the hot and dense strongly interacting medium created in Pb-Pb collisions, the so-called Quark-Gluon Plasma (QGP). Heavy quarks (charm and beauty), that are only produced in the initial hard scattering processes, constitute an important way to probe features of the QGP. Due to the typically short decay length for charmed hadrons ($c_\tau \approx 150\mu m$) and beauty hadrons ($c_\tau \approx 500\mu m$) powerful vertexing algorithms are needed in order to reach the precision required to measure these decays and to distinguish the contributions from charm and beauty. For this a new vertexing package "KFParticle", that is based on Kalman Filter mathematics, is tested and the prospects for new heavy flavour measurements are investigated.

HK 39.6 Do 15:30 F 1

J/ψ measurements pp collisions at 13 TeV using EMCal-triggered events with ALICE at LHC — •Cristiane Jahnke for the ALICE-Collaboration — Excellence Cluster *Universe*, Garching, Germany

The study of the J/ψ production in pp collisions provides important information on perturbative and non-perturbative quantum chromodynamics. The production of the heavy-quark pairs can be described perturbatively while its hadronisation into quarkonium state is a non-perturbative process. These processes are not fully understood and additional experimental data are necessary to further constraints the theoretical production models. In this work we report studies of J/ψ production in pp collisions at a centre-of-mass energy of $\sqrt{s}$ = 13 TeV with ALICE. The J/ψ were reconstructed via their dielectron decay channel in events where at least one of the decay electrons was triggered on by the Electromagnetic Calorimeter (EMCal). The availability of a high-$p_{\rm T}$ electron trigger enhanced the sampled luminosity significantly relative to the available minimum bias triggered data set and extended the $p_{\rm T}$ reach for the J/ψ measurement. Additionally, the usage of EMCal for particle identification in high $p_{\rm T}$ ranges provides a very good electron/hadron separation. Using this data, the J/ψ was measured in the transverse momentum interval of $5 < p_{\rm T} < 20$ GeV/c.

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HK 39.7 Do 15:45 F 1

Charmonium production in heavy-ion collisions at LHC energies with the statistical hadronisation model — Anton Andronic[1], Peter Braun-Munzinger[1], •Markus K. Köhler[2], and Johanna Stachel[2] — [1]Research Division and ExtreMe Matter Institute EMMI, GSI Helmholtzzentrum für Schwerionenforschung, Darmstadt, Germany — [2]Physikalisches Institut, Ruprecht-Karls-

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Charmonia are an important tool to investigate the fundamental properties of the early phases of a heavy-ion collision (HIC). Due to their high mass, charm quarks are not produced thermally, but only in initial hard scatterings. Matsui and Satz [1] showed, if a deconfined medium is formed, a Debye-like colour screening prevents the formation of J/ψ and a suppression with respect to the expectation from binary collision scaling should be observed. It was predicted within the statistical hadronisation model [2] that, since the charm cross section increases significantly as a function of collision energy, an enhanced charmonium production is expected for LHC energies in comparison to lower energies.
In this contribution, we compare the production of J/ψ calculated within the statistical hadronisation model with available J/ψ yields measured at the LHC. The centrality as well as the rapidity dependence will be investigated.
[1] T. Matsui and H. Satz, Phys. Lett. B 178 (1986) 178
[2] P. Braun-Munzinger and J. Stachel, Phys. Lett. B 490 (2000) 196

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Measurement of the J/ψ elliptic flow at mid-rapidity in Pb−Pb collisions at $\sqrt{s_{\mathrm{NN}}}$ = 5.02 TeV. — •Pascal Dillenseger for the ALICE-Collaboration — Goethe Universität

J/ψ measurements at $\sqrt{s_{\mathrm{NN}}}$ = 2.76 TeV Pb−Pb collisions clearly show a smaller suppression than the one expected from color screening, when compared to binary-scaled pp collisions. An answer to this behavior is presented by models containing a regeneration component. In these models a possible (re)combination of (un)correlated c$\bar{\mathrm{c}}$-quarks enhances the J/ψ production. Since those c$\bar{\mathrm{c}}$-quarks interact with the bulk medium before forming a J/ψ, they should be coupled to the medium flow. Hence the measurement of the elliptic flow (v_2) for J/ψ imposes strong constraints on the J/ψ production models in high energy Pb−Pb collisions.
The ALICE experiment at the Large Hadron Collider (LHC) is a unique tool to study J/ψ. It is able to measure the J/$\psi \rightarrow \mathrm{e}^+\mathrm{e}^-$ decay channel at mid-rapidity ($|y| < 0.9$) and down to $p_{\mathrm{T}} = 0$. New preliminary results on the v_2 of J/ψ measured in the $\mathrm{e}^+\mathrm{e}^-$ decay channel with ALICE in Pb−Pb collisions at $\sqrt{s_{\mathrm{NN}}}$ = 5.02 TeV will be presented.