HK 26: Heavy-Ion Collisions and QCD Phases V

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

Gruppenbericht HK 26.1 Di 16:30 HS 15

Results of low-mass dielectron measurements in pp, p–Pb and Pb–Pb collisions with ALICE at the LHC — •Torsten Dahms for the ALICE-Collaboration — Excellence Cluster Universe - TUM, Garching, Germany

Low-mass e^+e^- pairs (dielectrons) are a particularly useful probe to study the hot and dense medium created in ultra-relativistic heavy-ion collisions. Such pairs are produced during all stages of the collision and carry information about the whole space-time evolution of the system, unperturbed by strong final-state interactions.

The invariant-mass continuum of dielectrons is extremely rich in physics sources: on top of ordinary in-vacuum decays of light and heavy-flavour hadrons, the contributions from thermal radiation and a modified ρ meson due to the predicted restoration of chiral symmetry in heavy-ion collisions are of great interest. However, it is first necessary to understand the very large background of correlated dielectron pairs from semi-leptonic charm and beauty hadron decays. Dielectron measurements in pp and p–Pb collisions serve as crucial vacuum and cold nuclear matter references needed for the heavy-ion studies. Here, the intermediate-mass region provides insight into heavy-flavour production complementary to single heavy-flavour hadron measurements.

We present an overview of the latest results on low-mass dielectron production from the ALICE Collaboration in pp, p–Pb and central Pb–Pb collisions at various energies. The implications for heavy-flavour and (thermal) direct photon production will be discussed. Finally, perspectives for the LHC Run-3 will be shortly mentioned.

HK 26.2 Di 17:00 HS 15

Considering the Effects of Radial Flow in Decay Photon Calculations in Ultrarelativistic Nucleus-Nucleus Collisions — •Ilya Fokin — Physikalisches Institut, Heidelberg, Germany

For decay-photon calculations, it is crucial to accurately describe the spectra of particles that decay into photons. These include particle species for which there are either no measurements available or only measurements with large uncertainties such as the η, ω and η'. Since collective radial flow is expected in heavy-ion collisions, it must be taken into account when predicting particle spectra. A cocktail from transverse mass scaling, which does not include radial flow, serves as a baseline. In a two-component model, the momentum distributions are split into one component that incorporates all radial flow using a blast-wave description and one component for hard scatterings without radial flow. The parameters for extrapolating to other particles are obtained in a simultaneous fit with $\pi^{\pm}$ and $K^{\pm}$ data from ALICE. The model predicts an enhancement in the η, ω and η' to π^0 ratios at intermediate transverse momenta which results in a 5% increase in decay-photons in this range. Because the direct photon signal is already small compared to the background of decay photons, this relatively small increase can have a significant effect on the double ratio R_γ which determines the direct photon yield.

HK 26.3 Di 17:15 HS 15

Azimuthal Anisotropy of Virtual Photons — •Dominique Dittert for the HADES-Collaboration — TU Darmstadt

Virtual photons, that decay into dileptons, are penetrating probes which directly access the entire space-time-evolution of the fireball and escape from the collision zone without further interactions. Thus they provide unique information about the various stages of the collision. Collective observables like flow are used to describe the macroscopic properties of nuclear matter. Since the effective temperature extracted from the m_T spectra of dileptons results from the superposition of all fireball stages with decreasing temperature T but increasing radial flow over time, it is difficult to disentangle early and late emission sources. In comparison, the elliptic flow does not show this implicit time dependence and the combined dependence of elliptic flow of dileptons on their transverse momentum and their invariant mass provides a rich landscape of structures, which allows to set the observational window on specific stages of the fireball evolution. In this contribution the preliminary results on azimuthal anisotropy of e^+e^- excess radiation measured in Au+Au collisions at $\sqrt{s_{NN}} = 2.4\,GeV$ with HADES will be presented.

HK 26.4 Di 17:30 HS 15

Low-mass dielectron measurements in high-multiplicity pp collisions with ALICE at the LHC — •Ivan Vorobyev for the ALICE-Collaboration — Technische Universität München

Electron-positron pairs produced in ultra-relativistic heavy-ion collisions at the LHC carry important information about the system space-time evolution unperturbed by strong final-state interactions. Measurements of the dielectron continuum in inelastic proton-proton collisions serve as an important vacuum reference for the heavy-ion studies. However, proton-proton collisions with high charged-particle multiplicities recently have been found to exhibit interesting phenomena, such as the longitudinal structure in the two-dimensional angular correlation and the enhanced production of strange and heavy-flavour hadrons. Measurements of low-mass dielectrons could provide additional information regarding the underlying physics processes in high-multiplicity pp collisions.

In this talk, we present the latest results of the dielectron analysis with ALICE in pp collisions at $\sqrt{s} = 13$ TeV. A particular focus of the discussion is put on the modification of dielectron spectrum in pp collisions collected with a trigger on high charged-particle multiplicities with respect to the inelastic events. The relative increase of dielectron production in high-multiplicity events is compared to the expectations from already measured multiplicity-dependent production of light and heavy hadrons. The production of direct photons in inelastic and high-multiplicity collisions is also discussed.

HK 26.5 Di 17:45 HS 15

Performance simulation of the Transition Radiation Detector of the CBM experiment — •Etienne Bechtel for the CBM-Collaboration — IKF , Frankfurt , Germany

The Compressed Baryonic Matter (CBM) experiment will access a wide range of physics observables for heavy-ion collisions in the region of high- est net-baryon densities. One of the core physics program is the study of rare dilepton channels, which was not precisely measured before with other experiments in this energy range. For this purpose a powerful electron iden- ti*cation, respectively a good pion suppression, is absolutely crucial. In ad- dition to the RICH detector the Transition Radiation Detector (TRD), will contribute to the electron identi*cation in the complete momentum range and is supposed to deliver the main identi*cation power for momenta above 6 GeV/c. The dE/dx measurement, in combination with the mass of the Time-Of-Flight (TOF) detector, also makes possible the separation of charge states of light nuclei, which is necessary for the CBM hypernuclei program. This talk will cover the newest results in the simulation of di*erent dielectron channels, including the measurement of the thermal radiation of the *reball itself, as well as the essential improvements on the whole TRD detector sim- ulation and reconstruction procedures, which allow to obtain a much more realistic description of test beam data with simulations. This work is supported by BMBF.

HK 26.6 Di 18:00 HS 15

Electrons from semi-leptonic decays of heavy-flavour hadron at mid-rapidity in pp collisions at $\sqrt{s} = 5.02$ TeV with ALICE — •Michael Ciupek — University, Heidelberg, Germany

Hadrons containing charm or beauty quarks are a unique probe to study the properties of the Quark-Gluon Plasma (QGP) created in heavy-ion collisions. Because of their large masses they are produced via initial hard partonic scattering processes and therefore witness the full evolution of the hot and dense QGP medium.

Measurements of heavy-flavour hadrons produced in proton-proton collisions provide a reference for the measurements in heavy-ion collisions and are also an important test for perturbative Quantum Chromo Dynamics calculations.

The measurement of electrons from semi-leptonic decays of heavy-flavour hadrons require a precise knowledge of electrons coming from non heavy-flavour sources.Therefore the main contribution of the background is removed by tagging electrons from Dalitz decays of neutral mesons and from photon conversions.

In this talk the production cross section of electrons from heavy-flavour hadron decays at mid-rapidity in proton-proton collisions at $\sqrt{s} = 5.02$ TeV with ALICE at the LHC will be shown.