# HK 2: Heavy-Ion Collisions and QCD Phases I

Time: Monday 14:00–15:30 Location: HK-H1

**Group Report** HK 2.1 Mon 14:00 HK-H1

**Measurement of neutral mesons in pp, p–Pb and Pb–Pb collisions with ALICE** — •Marvin Hemmer for the ALICE-Collaboration — Institut für Kernphysik, Goethe-Universität Frankfurt

Multiplicity-dependent measurements of the neutral meson production in pp, p–Pb, and Pb–Pb collisions can be utilised to study different aspects of the hadronisation such as multi-parton interactions and collective effects. Furthermore, a better understanding of the neutral meson production can help to better constrain theoretical models of the production processes and can serve as crucial input for cocktail calculations needed for direct photon and dielectron analyses.

In ALICE, neutral mesons can be measured using different reconstruction methods. For the $\pi^0$ and $\eta$ mesons these methods are based on the detection of decay photons with calorimeters or by reconstructing $e^+e^-$ pairs from conversions in the detector material with the central tracking system. The $\omega$ meson is reconstructed using the measured $\pi^0$ mesons together with an additional photon ($\omega \to \pi^0\gamma$) or opposite charged pion tracks ($\omega \to \pi^+\pi^-\pi^0$).

In this talk, an overview of the $\pi^0$, $\eta$ and $\omega$ measurements with ALICE is presented. In particular, we will focus on a multiplicity dependent measurement of $\pi^0$ and $\eta$ in pp collisions at $\sqrt{s}$ = 13 TeV.

Supported by BMBF and the Helmholtz Association.

HK 2.2 Mon 14:30 HK-H1

**Reconstruction of neutral mesons via photon conversion method in Ag-Ag collisions at 1.58A GeV with HADES*** — •Tetiana Povar for the HADES-Collaboration — University of Wuppertal

A main goal of the HADES (High Acceptance DiElectron Spectrometer) experiment is to investigate properties of strongly interacting matter at moderate temperatures and large baryo-chemical potential. One tool is the study of virtual photons and their decays into electron pairs $\left(e^- + e^+\right)$ in hadron and heavy-ion collisions. Due to their large mean free path in the final state, electrons and positrons are particularly ideal probes to study the pair production also in the dense nuclear medium. Dalitz-decays of the light neutral mesons $\pi^0, \eta$ constitute a major contribution to the observed dielectron spectrum at low invariant masses (below the vector-meson pole mass). A precise determination of their abundance is crucial for proper control of the composition of the whole spectrum.

In HADES, these mesons can be reconstructed via their dominant $\gamma\,\gamma$ decays (BR $\sim$ 99%) utilizing double photon detection in the electromagnetic calorimeter (ECAL) or via double external pair conversion $\gamma_{\text{material}} \to e^+ + e^-$ in target or detector material with subsequent electron/positron identification.

We will present preliminary results of $\pi^0$ and $\eta$ production yields in Ag-Ag collisions at 1.58A GeV incident beam energy applying the double photon conversion method (PCM).

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HK 2.3 Mon 14:45 HK-H1

**Production of $\omega$-meson in pp collisions at 13 TeV** — •Jens Robert Lühder for the ALICE-Collaboration — Institut für Kernphysik, Wilhelm-Klemm-Str. 9, 48149 Münster

Measurements of neutral mesons in small collision systems can serve as a baseline to understand modifications in heavy-ion collisions, where a QGP is formed. These measurements can also be used to test pQCD predictions and to constrain fragmentation functions as well as parton distribution functions. Furthermore, a good understanding of particle production enables the measurement of direct photons yields, where a large background of decay photons is present and needs to be accounted for.

In this talk the invariant cross section of the $\omega$-meson production in pp collisions at a center of mass energy of $\sqrt{s}$ = 13 TeV, as measured by ALICE via its dominant decay channel $\omega \to \pi^+\pi^-\pi^0$, will be presented. While charged pions can directly be measured by the ALICE central barrel trackers, neutral pions are reconstructed using their decay channel into two photons. This reconstruction is realized with several complementary methods making use of various calorimeters and the ALICE central barrel trackers. The combined result covers an unprecedented $p_T$ range with small statistical and systematic uncertainties.

HK 2.4 Mon 15:00 HK-H1

**Measurement of $\omega$ mesons in pp and p–Pb collisions at $\sqrt{s_{\text{NN}}}$=5.02 TeV with ALICE** — •Nicolas Strangmann for the ALICE-Collaboration — Institut für Kernphysik, Goethe-Universität Frankfurt

The ALICE experiment at the LHC investigates the properties of hot and dense nuclear matter in heavy-ion collisions. By comparing the particle production in pp and p–Pb collisions, possible initial state effects can be isolated, which arise from the partons being bound within nuclei. Measurements of the $\omega$ meson spectra in pp and p–Pb collisions not only allow for a determination of the nuclear modification factor $R_{\text{pA}}$, but also provide vital input for direct photon cocktail simulations.

In the analysis presented in this talk, $\omega$ mesons are reconstructed via their primary decay channel into three pions ($\pi^+\pi^-\pi^0$). While the two charged pions can be identified with the tracking detectors (TPC, ITS), the $\pi^0$ has to be reconstructed from its two decay photons, that are detected in the electromagnetic calorimeter (EMCal).

In this talk, the measurement of the $\omega$ meson production in pp and p–Pb collisions at $\sqrt{s_{\text{NN}}}$=5.02 TeV will be presented. This includes the signal extraction and various corrections of the $\omega$ meson yields as well as the derivation of the $R_{\text{pA}}$.

Supported by BMBF and the Helmholtz Association.

HK 2.5 Mon 15:15 HK-H1

**Neutral pion identification from merged clusters with machine learning methods in ALICE** — •Jan Honermann for the ALICE-Collaboration — Institut für Kernphysik, Münster, Deutschland

The ALICE detector at CERN LHC is designed for the study of hot nuclear matter. Historically, one of the first probes to confirm the presence of such hot nuclear matter in heavy-ion collisions were neutral pions. The production of neutral pions was found to be significantly suppressed in heavy-ion collisions compared to pp or deuteron-gold collisions. Most traditional identification methods for neutral pions in these studies rely on an invariant mass analysis of the decay products. When the energy of the neutral pion becomes too large, these methods stop working though, since hits of decay products can not be resolved individually any longer. In this talk, initial efforts to distinguish between these merged clusters from neutral pions and coincidental hits from background processes with the help of neural networks in 13TeV pp-collisions will be presented.

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