

HK 56: Heavy-Ion Collisions and QCD Phases XII

Time: Friday 11:00–13:00

Location: J-HS F

Group Report

HK 56.1 Fri 11:00 J-HS F

Measurement of light neutral mesons and direct photons in Pb-Pb collisions with ALICE at the LHC — ●MEIKE DANISCH for the ALICE-Collaboration — Physikalisches Institut Heidelberg

The ALICE experiment is dedicated to the study of the quark-gluon plasma (QGP) formed in heavy-ion collisions. Direct photons are excellent probes to investigate the space-time evolution and temperature of the QGP. Neutral mesons like π^0 and η can provide important information on the energy loss mechanisms of partons in the medium. Furthermore, they constitute the largest background contribution for direct photons. In the ALICE experiment, neutral mesons can be measured via their decay to two photons. Apart from the two calorimeters EMCal and PHOS, photons can also be reconstructed via the Photon Conversion Method (PCM). The latter exploits the fact that a photon can convert to an electron-positron pair in the detector material. These charged particles can then be detected via their tracks in the Time Projection Chamber (TPC) and the Inner Tracking System (ITS). In this talk an overview of neutral meson and direct photon production in Pb-Pb collisions as measured by ALICE will be presented.

HK 56.2 Fri 11:30 J-HS F

Photon and neutral meson measurements with the conversion method in ALICE: Reducing the material budget uncertainty — ●STEPHAN STIEFELMAIER for the ALICE-Collaboration — Physikalisches Institut Heidelberg

One method to measure neutral mesons and direct photons in ALICE is to reconstruct electron-positron pairs from the conversion of photons in the detector material. This approach currently suffers from a 4% systematic uncertainty related to the knowledge of the material budget. A reduction of this uncertainty is key for establishing a signal of thermal direct photons at low pT ($1 < pT < 3$ GeV/c) and for discriminating between models describing direct-photon production in heavy-ion collisions. We have explored whether the material budget uncertainty can be reduced by calibrating the rest of the detector material using the TPC gas as a well understood reference.

HK 56.3 Fri 11:45 J-HS F

Measurement of Neutral Mesons in pp Collisions at the LHC with ALICE — ●JENS LÜHDER — Institut für Kernphysik, Münster

In ALICE, the measurement of photons is performed in two different ways: First, via the tracking of e^+e^- pairs and secondly, via their energy deposits in electromagnetic calorimeters. The first method is called PCM (Photon Conversion Method) as photons may convert to e^+e^- pairs when interacting with the detector material. For the second method, different calorimeters are used, whereas this talk will focus on the PHOS (PHOTON Spectrometer). By using the measured photons to reconstruct the amount of neutral mesons, the fraction of decay photons out of all measured photons can be acquired. The talk will cover the measurement principles of the PCM, the calorimeters and the hybrid method, which combines these two methods in order to benefit from both detection principles. First results of the analysis of neutral mesons in the data of LHC Run 2 with a center of mass energy $\sqrt{s} = 13$ TeV will be given.

HK 56.4 Fri 12:00 J-HS F

Measurement of neutral mesons in pp collisions at $\sqrt{s} = 13$ TeV with ALICE — ●JOSHUA KÖNIG for the ALICE-Collaboration — Institut für Kernphysik, Goethe-Universität Frankfurt

ALICE, the dedicated heavy-ion experiment at the LHC, investigates the properties of the quark-gluon plasma (QGP) that is believed to be produced in central AA collisions at high center-of-mass energies. Collective effects that were interpreted as an indication of the QGP in AA collisions have now also been observed in high multiplicity pp collisions. Measurements of the neutral meson (π^0 , η) production in pp collisions as a function of multiplicity and sphericity at the highest available energies can reveal detailed insights into these effects. Additionally, those measurements are the baseline for direct-photon analyses.

The reconstruction of neutral mesons via their two-photon-decay channel can be realized in ALICE with several complementary methods, including the calorimeters and the TPC. In this talk the status of the π^0 and η analysis in pp collisions at $\sqrt{s} = 13$ TeV with ALICE

will be presented.

Supported by BMBF and the Helmholtz Association

HK 56.5 Fri 12:15 J-HS F

Measurement of neutral mesons in p-Pb collisions at $\sqrt{s_{NN}} = 5.02$ TeV with ALICE — ●ANDREA HORNING for the ALICE-Collaboration — Institut für Kernphysik, Goethe-Universität Frankfurt

ALICE, the dedicated heavy-ion experiment at the LHC, investigates the properties of the quark-gluon plasma (QGP). In collisions of high-energetic nuclei, energy loss effects have been observed in the production of hadrons at high transverse momenta. To disentangle effects on the particle production caused by the QGP and concurrent initial-state effects, in addition to collisions of heavy nuclei, collisions of protons and nuclei are studied. The measurement of neutral mesons, e.g. π^0 and η mesons, provides insight into these effects. Furthermore, a precise measurement of neutral mesons is mandatory for the measurement of direct photons. In ALICE, π^0 and η mesons can be measured via their two-photon decay channel using the ALICE calorimeters PHOS and EMCal or the photon conversion method.

With the new LHC RUN2 data, ALICE has collected eight times more statistics in p-Pb collisions at $\sqrt{s_{NN}} = 5.02$ TeV compared to the LHC RUN1 data. In this talk, the status of the analysis of π^0 and η mesons in the combined data set using the different available detection methods is presented.

Supported by BMBF and the Helmholtz Association.

HK 56.6 Fri 12:30 J-HS F

Feasibility study for the measurement of direct photon elliptic flow in central Pb-Pb collisions at $\sqrt{s_{NN}} = 17.3$ GeV with WA98 — ●TIM ROGOSCHINSKI¹, HENNER BÜSCHING¹, and KLAUS REYGERS² — ¹Institut für Kernphysik, Goethe-Universität Frankfurt — ²Physikalisches Institut, University of Heidelberg

The collaborations ALICE at LHC and PHENIX at RHIC have reported on the invariant yield and elliptic flow v_2 of direct photons in heavy-ion collisions. The PHENIX collaboration discovered a large excess of direct photons compared to the reference in p+p collisions as well as a large v_2 of direct photons. The magnitude of direct photon v_2 measured with ALICE is similar to the v_2 observed by PHENIX. For theoretical models the simultaneous description of the large yield and the large v_2 remains a challenge and is commonly referred to as the direct photon puzzle. A joint measurement of the direct photon yield and v_2 at SPS energy could provide additional input for theoretical models. The WA98 collaboration at SPS earlier has reported on the direct photon invariant yield [1]. In this talk, a reanalysis of the WA98 dataset from 1996 with a focus on the v_2 of direct photons produced in central Pb-Pb collisions at $\sqrt{s_{NN}} = 17.3$ GeV utilizing the Plastic-Ball and the LEDA detector will be presented.

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[1] Phys.Rev.Lett. 85 (2000) 3595-3599

HK 56.7 Fri 12:45 J-HS F

Probing the evolution of heavy-ion collisions using direct photon interferometry — ●NICOLE LÖHER — Physikalisches Institut, Universität Heidelberg

A measurement of Hanbury-Brown Twiss (HBT) correlations of direct photons in nucleus-nucleus collisions offers an experimental tool to discriminate between different sources of photon enhancement. Unfortunately the statistics recorded so far at the ALICE experiment at the LHC was not sufficient for such a measurement, but the expected statistics in the upcoming high-luminosity LHC runs could lead to a significant signal. In order to demonstrate this, a feasibility study has been carried out in which two different photon sources in addition to the yields from standard hydrodynamical simulations are investigated. First a photon enhancement near the pseudo-critical temperature $T_c \approx 155$ MeV using a phenomenological ansatz and second additional photons, which are produced from the early pre-equilibrium stage, are discussed. For both scenarios the correlators for relative momenta q_{out} , q_{side} and q_{long} for different transverse pair momenta K_T are determined. Among the three directions the longitudinal correlation is the most sensitive to different photon sources. The performed study led to the conclusion that, considering only statistical uncertain-

ties, the detection of 10^{10} heavy ion events could lead to a measurement of the HBT correlations for $K_T < 1$ GeV which is statistically significant.