Contribution ID : **17** Type : **not specified**

Study of direct photon production in Pb-Pb collisions at $\sqrt{s_{NN}}$ = 5.02 TeV with ALICE experiment's Photon Spectrometer(PHOS) at Large Hadron Collider

Thursday, 23 January 2025 09:15 (60)

The Quark-Gluon Plasma (QGP), a state of deconfined quarks and gluons, is believed to have existed in the early Universe shortly after the Big Bang. As the QGP cools, it transitions into the hadronic matter we observe today. In laboratory settings, small-scale "Big Bangs" are created through high-energy heavy-ion collisions, which heat the hadronic matter above the transition temperature, approximately 150 MeV, resulting in the formation of the QGP. Direct photons serve as unique probes in high-energy proton-proton and nucleus-nucleus collisions due to their weak interaction with the dense and hot quark-gluon medium. These photons escape the medium unaltered, providing undistorted information about the collision's evolution.
In the ALICE experiment at the Large Hadron Collider (LHC), photons from lead-lead collisions are measured using techniques such as the Photon Conversion Method and Electromagnetic Calorimeter. The Photon Spectrometer (PHOS), offering high-precision photon detection, was used for our analysis (with Run 2 data in Pb-Pb collisions at $\sqrt{s_{NN}}$ = 5.02 TeV) to measure inclusive photons and simulate decay photons, aiding in the derivation of direct photon spectra. By disentangling the contributions of decay, prompt and thermal photons emitted during these collisions, we can estimate the effects of cold and hot nuclear matter and gain insights into the temperature, correlations, and collective phenomena within the QGP.

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