Contribution ID: **280** Type: **Poster**

Shedding Light on the Baryon Production via Angular Correlation Studies with ALICE

One of the most effective techniques for investigating the mechanism of baryon production is the study of angular correlations between two particles. Angular correlations represent a convolution of various physical processes, such as mini-jets, Bose-Einstein quantum statistics, conservation of momentum, resonances, and other phenomena that contribute to the unique behavior observed for different particle species.

Experimental results from proton-proton collisions at 7 TeV have revealed a pronounced anticorrelation —a phenomenon that has not been replicated by Monte Carlo models. This discovery triggered a series of studies that led to the formulation of what is now referred to as the “baryon correlation puzzle”.

In this work, we present ALICE measurements of angular correlation functions for identified particles—including $\pi\pm$, K±, p–$\bar{p}$, Λ–$\bar{\Lambda}$, and notably p–Φ pairs—in pp, p–Pb, and Pb–Pb collisions at LHC energies from both Run 2 and Run 3 data. The inclusion of p–Φ correlations provides a crucial test case for evaluating the role of particle mass in the manifestation of anticorrelations. These results, studied across various multiplicity and centrality classes, offer new perspectives on the underlying dynamics and deliver a key piece to approaching the solution of the baryon correlation puzzle.

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Session Classification: Poster session

Track Classification: Heavy Ion Collisions and QCD Phases