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## Study of higher-order cumulants of net-charge, net-hadron, net-kaon and net-proton production in pp collisions at $\sqrt{s} = 13$ TeV using Pythia8 and Herwig

The study of higher-order cumulants of conserved quantities—such as net-charge, net-baryon, and net-strangeness distributions—is a valuable approach for determining freeze-out parameters and exploring phase transitions in heavy-ion collisions at LHC energies. Recent studies hint at the formation of Quark-Gluon Plasma (QGP) in smaller systems, such as proton-proton (pp) collisions, which further motivates this investigation.

In this contribution, the first Monte Carlo analysis of higher-order cumulants and their ratios for net-charge, net-hadron, net-kaon, net-baryon, and net-proton distributions in pp collisions at  $\sqrt{s} = 13$  TeV is studied by utilizing pQCD-based models such as Pythia8 and Herwig. This includes an examination of different particle production mechanisms and their influence on cumulant values. The results provide a foundational simulation baseline for upcoming LHC measurements, offering insights into the interplay between small system behavior and heavy-ion collisions.

## **Field of contribution**

Phenomenology

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