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Clocking the particle production and tracking quantum numbers balance and radial flow effects across pp and Pb–Pb collisions at top LHC energies with ALICE

Balance functions have been used extensively to elucidate the time evolution of quark production in heavy-ion collisions. Early models predicted two stages of quark production: one for light quarks and another for the heavier strange quark, separated by a period of isentropic expansion. This led to the notion of clocking particle production and tracking radial flow effects that drive the expansion of the system.

In this talk, the balance functions of identified particles in different multiplicity classes of pp and Pb–Pb collisions at $\sqrt{s} = 13.6$ TeV and $\sqrt{s_{NN}} = 5.36$ TeV, respectively, are reported, as recorded by ALICE in Run 3. The results are compared with different models, as well as with previously published results on pp and Pb–Pb collisions at various energies. The results track the balancing of electric charge, baryon number, and strangeness by measuring how the widths and integrals of the charge, baryon number, and strangeness balance functions evolve across multiplicity classes. Results from pp collisions provide a reference for the Pb–Pb results, while the evolution with multiplicity allows us to glimpse the behavior toward high multiplicity scenarios in small systems. Comparisons with models constrain particle production mechanisms as well as the dynamics of system evolution.

Category

Experiment

Collaboration (if applicable)

ALICE

Authors: COLLABORATION, ALICE; GONZALEZ, Victor (Wayne State University (US))

Presenter: GONZALEZ, Victor (Wayne State University (US))

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