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Energy and momentum-dependent studies of $R_2(\Delta\eta, \Delta\varphi)$ and $P_2(\Delta\eta, \Delta\varphi)$ correlation functions in p−p collisions using color reconnection and rope hadronization models

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Color-reconnection (CR) mechanism used in PYTHIA8 has been reported to describe collective-like effects in small systems, such as mass-dependent growth in $\langle p_{\mathrm{T}} \rangle$ as a function of multiplicity, enhanced baryon production over meson at intermediate p_{T}, etc., similar to those observed in heavy-ion collisions. Color-reconnection (CR) and rope-hadronization (RH) development in PYTHIA8 have aided in a better understanding of the small system. We measure charge-independent (CI) and charge-dependent (CD) two-particle differential number correlation functions, $R_2(\eta, \varphi)$, and transverse momentum correlation functions, $P_2(\eta, \varphi)$, of charged particles produced in pp collisions at the LHC centre-of-mass energies $\sqrt{s}$ = 2.76 TeV, 7 TeV and 13 TeV with the PYTHIA8 model. For inclusive charged hadrons ($h^{\pm}$) in three distinct transverse momentum (p_{T}) ranges, PYTHIA8 predictions for R_2 and P_2 correlation functions with full azimuthal coverage in the pseudorapidity range $|\eta| < 1.0$ are shown. The strengths and shapes of R_2 and P_2 correlation functions are reported for various combinations of CR and RH to study particle production mechanisms in small systems. Additionally, for a better understanding of angular ordering and jet properties implemented in the PYTHIA8 model, $\Delta\eta$ and $\Delta\varphi$ dependence of R_2 and P_2 are compared. The evolution of near-side width of these correlation functions for different transverse momentum and energies is shown.

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