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Revealing the source of the radial flow patterns in proton–proton collisions using hard probes

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In this work, we propose a tool to reveal the origin of the collective-like phenomena observed in proton–proton collisions. We exploit the fundamental difference between the underlying mechanisms, color reconnection and hydrodynamics, which produce radial flow patterns in Pythia 8 and Epos 3, respectively. Specifically, we proceed by examining the strength of the coupling between the soft and hard components which, by construction, is larger in Pythia 8 than in Epos 3. We study the transverse momentum (p_{T}) distributions of charged pions, kaons and (anti) protons in inelastic pp collisions at $\sqrt{s} = 7$ TeV produced at mid-rapidity. Specific selections are made on an event-by-event basis as a function of the charged particle multiplicity and the transverse momentum of the leading jet ($p_{\mathrm{T}}^{\mathrm{jet}}$) reconstructed using the FastJet algorithm at mid-pseudorapidity ($|\eta|1$). From our studies, quantitative and qualitative differences between Pythia 8 and Epos 3 are found in the p_{T} spectra when (for a given multiplicity class) the leading jet p_{T} is increased. In addition, we show that for low-multiplicity events the presence of jets can produce radial flow-like behavior. Motivated by our findings, we propose to perform a similar analysis using experimental data from RHIC and LHC.

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