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Scaling properties of jets in high-energy pp collisions

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Measurements of jet profiles in high-energy collisions are sensitive probes of QCD parton splitting and showering. Precise understanding of the jet structures are essential for setting the baseline not only for nuclear modification of jets in heavy-ion collisions, but also for possible cold QCD effects that may modify jets in high-multiplicity proton-proton collisions. In this talk we demonstrate that the radial jet profiles in proton-proton collisions exhibit scaling properties with charged-hadron event multiplicity over a broad transverse-momentum range. Based on this we propose that the scaling behavior stems from fundamental statistical properties of jet fragmentation. We also study the multiplicity distributions of events with hard jets and show that the charged-hadron multiplicity distributions scale with jet momentum. This suggests that the Koba–Nielsen–Olesen (KNO) scaling holds within a jet. The in-jet scaling is fulfilled without multiple-parton interactions (MPI), but breaks down in case MPI is present without color reconnection. Our findings imply that KNO scaling is violated by parton shower or multiple-parton interactions in higher-energy collisions.

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