

Differentiating Energy-Energy Correlators with Charged Particle Multiplicities within a Jet

Sunday, 26 October 2025 15:25 (20 minutes)

Recent CMS results reveal that jets with extremely high multiplicity exhibit novel substructure patterns not seen in ordinary jets, including long-range correlations. However, standard Monte Carlo tools struggle to access this regime due to its rarity and complexity. In this work, we develop a theoretical framework to study high-multiplicity jets, incorporating both multiplicity evolution and Energy-Energy Correlators (EEC) as key probes of jet substructure. Using the normalized multiplicity ratio $m=n/\langle n \rangle$, we investigate how jet properties evolve across multiplicity classes and compare our findings with Pythia8 simulations. This provides new insights into perturbative QCD dynamics in extreme jet events.

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Session Classification: Parallel I

Track Classification: 喷注物理 (jet physics)