

Momentum and charge correlations within jets : a new observable to probe nonperturbative aspects of jet evolution

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The planned future Electron Ion Collider (EIC) will provide a unique laboratory for precise studies of both perturbative and non-perturbative QCD through examining the time evolution of jets and their constituents from short to long distances scales. Correlations among identified particle species within jets can reveal tremendous information of this evolution. Utilizing the particle identification (PID) capabilities of the EIC detectors, one can study hadronization within jets in a wide kinematic regime by characterizing the x and Q^2 scales of the process.

We propose a new class of jet substructure observables constructed with identified leading and first subleading particles within jets (for example, pion-pion). Comparing numbers of events where the electric charges of the two leading particles are of the same sign (N_{CC}) or opposite sign ($N_{C\bar{C}}$), we define a ratio observable $r_c = (N_{CC} - N_{C\bar{C}}) / (N_{CC} + N_{C\bar{C}})$ which can be a function of any jet observables. Specifically, the formation time extracted from the two leading particle kinematics gives information on the space-time evolution of jets. Sub-jet kinematics obtained from the C/A reclustering tree also provides a complementary method to formulate r_c . We will demonstrate the correlations for identified particles at the proposed top collision energy at the EIC using PYTHIA and Herwig event generators. One specific example of connecting strange flavor tagging to string or cluster hadronization through such correlations will be presented.

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