



Contribution ID: 84

Type: Poster

Target jet substructure and correlation

We introduce the “target jet” in the forward region of the ion in deep inelastic scattering (DIS) events with a jet radius which depends on the DIS kinematics in order to separate the current and target regions in the laboratory frame. We show that target jet substructure and its correlation with the substructure of the leading jet is sensitive to the internal structure of nucleon and ion, thereby motivating the design of forward detectors to fulfill target jet substructure phenomenology at the future Electron Ion Collider. Combining target jet charge and leading jet charge significantly improves the identification of the hard scattering flavor structure in electron-proton collisions. Furthermore, forward neutron tagging allows an isolation of an almost pure up-quark jet sample, which could be used to enhance sensitivities to flavor-dependent effects such as Sivers asymmetry. We demonstrate the connections between target jet energy flow observables and parton distributions, as well as the mapping between forward nuclei tagging and details of nuclear breakup process such as the location of the DIS nucleon.

Category

Theory

Collaboration (if applicable)

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Session Classification: Poster session 1

Track Classification: Initial state of hadronic and electron-ion collisions & nuclear structure