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Unraveling fragmentation using jet substructure at LHCb

Jet substructure measurements at the LHC produce precision tests of jet formation and fragmentation in vacuum as well as at the high temperatures and densities formed in heavy-ion collisions. Jets containing a heavy-flavor hadron drive these QCD measurements into a regime where parton mass and colour factors are critical, pushing the limits of theoretical calculations both in-vacuum and in-medium. Mapping out individual emissions in the Lund jet plane for heavy-flavour jets and comparing to light-quark-enriched jets tagged by a Z boson reveals significant mass-dependence to jet fragmentation, offering a decisive channel to decipher in-medium modification to jet fragmentation across different kinematics. At the same time, measuring heavy-flavour jet mass with a theoretically-safe flavour tagging algorithm for the first time tests perturbative QCD at unprecedented theoretical precision and probes the gluon splitting contribution to heavy-flavour production, a yet-unobserved probe of how the medium resolves quark entanglement. The LHCb collaboration presents recent jet substructure results at forward rapidity in pp collisions at centre-of-mass energy $\sqrt{s} = 13$ TeV. These measurements are compared to theoretical predictions, providing new insight on QCD fragmentation at forward rapidity and at low and moderate values of jet transverse momentum. These results provide a baseline for future measurements of jet quenching in PbPb collisions.

Category

Experiment

Collaboration (if applicable)

LHCb

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