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Probing the Dead Cone using the Lund Jet Plane

In high-energy particle collisions, high-momentum quarks and gluons (collectively called partons) are emitted from the colliding particles. As these partons move away from the collision point, they transfer their energy to multiple lower energy particles in a cascading process known as a parton shower. Eventually, the low-energy partons combine to form hadrons, which are collected into a jet. To study the evolution of such jets, we exploit a jet substructure observable known as the Lund Jet Plane (LJP), which maps the momentum and angular separation of emissions originating from a jet-initiating quark. This approach is useful for probing the Dead Cone phenomenon, a predicted suppression of soft-gluon radiation around the forward axis of a radiating massive quark. We present results from an analysis of the emission density within the LJP of bottom-tagged jets generated in PYTHIA8 simulations. Furthermore, we discuss opportunities for extensions to heavy-ion collisions where medium-induced radiation is expected to fill the Dead Cone region, providing a tool to isolate and characterize the high temperature phase of the Quark-Gluon Plasma.

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