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Testing the QCD formation time with reconstructed parton splittings

Heavy ion collisions provide a unique opportunity to access the space-time ordering of parton branching processes, since parton showers interact with a spatially-extended dense medium. However, the challenges of robustly isolating the formation time of a splitting phenomenologically has prevented formation time-dependent modification effects from being accessed experimentally. We address these challenges using heavy flavour, which offers an additional handle on tracing the propagation of individual quarks through the medium. We demonstrate how modified and groomed versions of the Cambridge/Aachen or FlavourCone jet finding algorithms applied on $g \rightarrow c\bar{c}$ splittings can be used to reconstruct the kinematics of such splittings with high fidelity using either final state partons or hadrons. We construct the parton formation time distribution, which has characteristic distortions arising from medium effects. This effect can be used to construct ratios of τ_f -distributions in which the sensitivity of parton branching to the QCD formation time becomes experimentally accessible.

Category

Theory

Collaboration (if applicable)

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