MEASUREMENT OF SPLITTINGS ALONG A JET SHOWER IN $\sqrt{s} = 200$ GEV pp COLLISIONS AT STAR
ABSTRACT FOR BOOST 2021

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Jets are algorithmic proxies of hard scattered partons, i.e. quarks/gluons, in collisions of high energy particles. Jets derived from clustering algorithms contain additional information regarding the jet shower, which can be accessed via the SoftDrop algorithm and the Cambridge/Aachen de-clustering. The STAR collaboration has recently measured jet sub-structure observables in pp collisions at $\sqrt{s} = 200$ GeV including the jet mass (M), SoftDrop groomed jet mass (M_g), groomed jet radius (R_g) and shared momentum fraction (z_g) for jets with varying jet radius and momentum. To further explore the jet sub-structure, we present the first measurements of the jet shower at the first, second and third splits determined via the iterative SoftDrop procedure in 200 GeV pp collisions. For each of these splits, we measure the fully corrected z_g and R_g distributions and showcase a gradual variation in both the angular and momentum scales in data which can theoretically be related to virtuality evolution. These recursive measurements of the jet shower allow us to test the self-similarity of the splitting kinematics across different splits. We also measure the formation time defined as $\tau_f \equiv \frac{1}{2Ez(1-z)(1-\cos\theta_{1,2})}$ where E is the parent's energy, z the momentum fraction and $\theta_{1,2}$ is the opening angle. We compare the formation times for SoftDrop splits τ_f^{split} with varied parameters to the formation time calculated via the two highest-p_T charged constituents within the jet to study the onset of non-perturbative region of the jet shower. We compare our measurements to current state-of-the-art Monte Carlo models, providing stringent constraints on model parameters related to the parton shower and non-perturbative effects such as hadronization, that become increasingly significant as we travel further along the jet shower.

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