NOVEL JET SUBSTRUCTURE MEASUREMENTS IN pp COLLISIONS AT $\sqrt{s} = 200$ GEV BY THE STAR EXPERIMENT

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Jets are collimated sprays of final-state particles produced from initial high-momentum-transfer partonic scatterings in particle collisions. Since jets are multi-scale objects that connect asymptotically free partons to confined hadrons, jet substructure measurements in vacuum can provide access to both regimes. Such measurements will also serve as baselines for future measurements of the same observables in heavy-ion collisions.

In this talk, we present a suite of new jet substructure measurements in pp collisions at 200 GeV by the STAR experiment which probe the physics of parton shower, hadronization, and the transition between the two. Specifically, we show the measurements of CollinearDrop-groomed (CD) jet mass and its correlation with SoftDrop-groomed (SD) observables, the charge correlator ratio (r_c), and the energy energy correlators (EECs). The CD jet mass, sensitive to the soft radiation, and the CD-SD jet correlations are corrected for detector effects with MultiFold, a novel machine learning method that preserves multi-dimensional correlations among jet observables. Such CD-SD correlation measurements probe the interplay between different stages of parton shower. The measurement of the EEC, on the other hand, cleanly separates jet evolution stages via the angular separation between all possible combinations of charged particles within a jet, with the perturbative parton shower at large opening angles and non-perturbative hadronization at small opening angles. Lastly, the measurement of r_c, which distinguishes the charge signs of leading and subleading charged particles within a jet, can be used to test hadronization models, such as the Lund string model.

Date: April 26, 2023.