Measurement of Two-Point Energy Correlators Within Jets in $p+p$ Collisions at $\sqrt{s} = 200$ GeV

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Abstract

Jet substructure is a powerful tool to probe the time evolution of a parton shower. However, many of the analysis methods used to extract splitting formation times from jet substructure, such as Soft Drop grooming and the Lund plane, focus on the hardest radiation of the jet. A complementary observable with growing theoretical and experimental interest, the 2-point Energy Correlator (EEC), re-contextualizes jet substructure study by using the distribution of angular distance of all combinations of two final state particles within a jet. This distribution is weighted by the product of the fractions of jet energy that each of the constituents carry, and thus is infrared-and-collinear safe. The EEC can cleanly reveal the separation between two distinct regimes: effects originating from free hadrons at small opening angles and from perturbative fragmentation of quarks and gluons at large opening angles.

In this talk, the first fully corrected measurement of the EEC at RHIC is presented, using the data taken at $\sqrt{s} = 200$ GeV $p+p$ collisions by STAR. The EEC will be shown for several full jet p_T selections and compared to predictions from the PYTHIA-6 STAR tune. This work will be useful as a baseline for comparisons to future studies in heavy-ion systems, which will provide information about how the quark-gluon plasma interacts with the jet across different angular scales.