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

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Hard-scattered partons ejected from high-energy collisions undergo fragmentation and hadronization, resulting in collimated sprays of particles that are clustered into jets. The Energy-Energy correlator (EEC) is a jet substructure observable used to study the time evolution of the parton shower. This observable re-contextualizes jet substructure study by using the distribution of angular distance of all combinations of two final state particles within a jet weighted by the product of the fractions of jet energy carried by each constituent. With this definition, the perturbative and non-perturbative QCD effects can be separated without the need for re-clustering or rejection of soft constituents. The EEC distribution cleanly reveals the separation between these two regimes: i) from the free hadrons phase at small opening angles, and ii) from the perturbative fragmentation of quarks and gluons at large opening angles.

In this poster, the first measurement of the corrected EEC distribution at RHIC is presented using pp collision data at $\sqrt{s} = 200$ GeV collected by the STAR experiment. The EEC is shown differentially in jet transverse momentum and compared to predictions from the Monte-Carlo event generator PYTHIA-8 and next-to-leading-logarithmic pQCD calculation. Furthermore, this work will serve as the baseline for future measurements of the EEC in heavy-ion systems which will provide information about how the quark-gluon plasma interacts with jets across different angular and time scales.

Category

Experiment

Collaboration (if applicable)

STAR

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