Jet substructure measurements elucidating partonic evolution in $p+p$ collisions at RHIC

Monika Robotkova
(for the STAR Collaboration)

Nuclear Physics Institute,
Czech Academy of Sciences

Jets are multi-scale objects that connect partons to hadrons, making jet substructure measurements crucial for probing both perturbative and non-perturbative processes in QCD. At STAR, a variety of jet substructure observables, such as SoftDrop groomed splittings and N-Point Energy Correlators (ENC), provide insights into parton evolution and hadronization mechanisms. SoftDrop-groomed observables and ENCs both connect measurement to fundamental QCD at the parton level, allowing for comparisons to first principles theoretical calculations. Additionally, by including also charge information, as in the charge-weighted ENC, details about the hadronization mechanism can be obtained.

In this talk, we present measurements of SoftDrop correlations, including shared momentum fraction (z_{g}), splitting scale (k_{T}), and jet charge (Q), across different jet momenta and radii in $p+p$ collisions at $\sqrt{s} = 200$ GeV using STAR data. Detector corrections are handled using traditional and machine learning-based techniques like MultiFold, ensuring the preservation of correlations. Additionally, splitting observables at multiple stages of the jet shower are analyzed.

Furthermore, the first measurement of the three-point energy correlator (E3C) and its ratio to the two-point correlator (EEC) are presented. RHIC's quark-rich environment, with its lower jet momentum, offers a unique opportunity to observe charge-odd non-perturbative effects at more resolvable angular scales than at the LHC.