Exploring correlations among jet substructure observables with MultiFold in $\sqrt{s} = 200$ GeV pp collisions at STAR

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Jets are collimated sprays of final-state particles produced from initial high-momentum-transfer partonic (quark/gluon) scatterings in hadron collisions. Measurements of jet substructure observables can reveal details of the parton shower and hadronization processes that create a jet. Using MultiFold, a novel machine-learning based method to correct for detector effects (unfold), we measure six jet observables simultaneously. A commonly used method for unfolding, Iterative Bayesian Unfolding, requires binning to be determined beforehand and is limited to unfolding in up to three dimensions. In contrast, MultiFold is able to unfold in higher dimensions in an unbinned manner, through iterative reweighting on an event-by-event basis with the help of neural networks. This flexibility allows us to explore the multi-dimensional correlation among the jet substructure observables, including the SoftDrop groomed jet radius and momentum imbalance, and the CollinearDrop groomed jet mass. These correlation measurements provide insights into the interplay between different stages of the parton shower to which the various observables are sensitive.

In this talk, we present a brief overview of the mechanism of MultiFold, and results from our multi-differential correlation measurements, with jets reconstructed from $\sqrt{s} = 200$ GeV pp collisions at STAR.