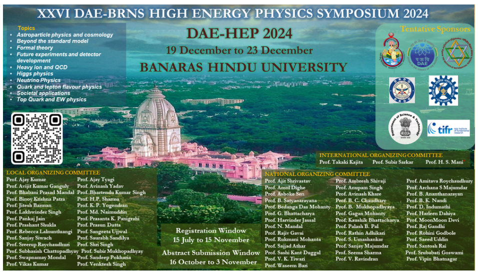

Contribution ID: **451**   Type: **Postar**

An Investigation of Jet Mass Distributions with Grooming in Pythia

The Large Hadron Collider (LHC) at CERN operates at a center-of-mass energy of 13.6 TeV, well above the electroweak scale. This energy enables the production of particles such as W and Z bosons, the Higgs boson, top quarks, and any new particles with masses near the electroweak scale. The high energy results in large boosts, causing their hadronic decays to become collimated and allowing them to be reconstructed as single large-radius jets. Jet substructure techniques play a crucial role in identifying boosted jets at the LHC, and their importance is expected to grow in future runs and at higher-energy colliders. These techniques enhance our understanding of jet radiation patterns, enabling the development of algorithms to separate signal jets from the QCD background. Jet grooming techniques, such as trimming, pruning, and soft drop, reduce noise by removing soft, wide-angle radiation, thereby enhancing the hard substructure of jets for both Standard Model studies and new physics searches. Currently, pileup (PU) events contribute significantly to the noise in jet measurements at LHC experiments, with an average of up to 60 PU events occurring alongside the primary interaction. In this contribution, we present a phenomenological study of the invariant mass distribution of hadronic jets in proton-proton collisions, employing grooming algorithms such as trimming, pruning, and soft drop with varying parameters to assess their effectiveness in preserving jet structure by reducing PU under high-pileup conditions. Large-radius jets are reconstructed using the anti-kT algorithm with a cone radius of 0.8 in various Monte Carlo simulated event samples, including hard QCD, Z+jet, and W+jet events, at center-of-mass energies of 13.6 and 14 TeV, using the Pythia 8 event generator and the FastJet package.

Field of contribution

Phenomenology

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Track Classification: Heavy ion and QCD