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Novel jet substructure observables and techniques with ALICE

Jet substructure observables are incisive probes of quantum chromodynamics (QCD), providing insight into perturbative and non-perturbative processes, and probing the structure and dynamics of the quark-gluon plasma (QGP). The jet shower is sensitive to multiple scales during its evolution, encoding the physics into correlated angular and momentum space phenomena which cannot be fully characterized by a single observable. This multidimensional complexity requires both new approaches via new observables and detailed studies of existing measurement techniques to fully disentangle and understand the encoded information. In this talk, we report several recent ALICE jet substructure measurements in pp and Pb-Pb collisions at $\sqrt{s_{NN}} = 5.02$ TeV, both with and without grooming. We present a new measurement of the energy-energy correlators (EEC) in pp collisions at $\sqrt{s} = 5.02$ TeV. The EEC is a momentum-weighted angular correlation of jet constituents which probes intra-jet energy flow, with clear separation between perturbative and non-perturbative regimes. We also report new studies of the soft drop and dynamical grooming algorithms, benchmarking their performance using the groomed relative transverse momentum, $k_{T,g}$. These new measurements include the first application of dynamical grooming in heavy-ion collisions, and enable a search for excess $k_{T,g}$ emissions arising from point-like scatters in the QGP, providing new constraints on its quasi-particle nature.

Primary author: Dr EHLERS, Raymond (Lawrence Berkeley National Lab/UC Berkeley)

Presenter: Dr EHLERS, Raymond (Lawrence Berkeley National Lab/UC Berkeley)