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Exploring medium properties and evolution with ALICE using correlated, groomed, and reclustered jet substructure

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The study of jet substructure in heavy-ion collisions provides multiple tools for incisive exploration of jet-medium interactions and the mechanisms underlying jet quenching. Some results, however, remain disjoint: the jet mass and jet angularities, including girth and thrust, are strongly-correlated observables that have given seemingly conflicted answers on the angular quenching of jets traversing the QGP. ALICE has carried out new systematic measurements of these and other perturbatively-calculable angularities using consistent definitions for the first time, resolving the long-standing girth-mass problem, and revealing quenching effects at broad angles. Concurrently, applying soft drop grooming isolates the narrowing in the core of quenched jets. Grooming can also be employed to resolve medium scattering centers, with varying methods to focus on regions of the splitting phase space.

We present the first application of dynamical grooming in heavy-ion collisions to search for excess $k_{\mathrm{T,g}}$ emissions as a signature of point-like scatters, providing new constraints on searches for in-medium Molière scattering. We also present a new approach for studying jet-medium opacity, based on a time-like rather than angular perspective. By employing a new time reclustering strategy, we potentially enable a time-dependent study of jet substructure observables. We compare all results to assorted jet quenching models, providing new critical information on medium evolution as a function of angular, momentum, and time structure.

Category

Experiment

Collaboration (if applicable)

ALICE

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