Contribution ID: **130** Type: **Parallel Talk**

Probing heavy ion collisions using quark and gluon jet substructure with machine learning

Wednesday 16 May 2018 12:10 (20 minutes)

We introduce a novel jet quenching study approach by the classification of quark-initiated jets and gluon-initiated jets in proton-proton and heavy ion collisions using modern machine learning techniques. We train a deep convolutional neutral network on jet images. The classification performance is compared with the multivariate analysis of several physically-constructed jet observables including the jet mass, the p_T^D, the multiplicity and the radial moments. We also compare with the systematic N-subjet expansion in the recently developed telescoping jet deconstruction framework to exploit the information carried by the subjets. The quark and gluon jet samples generated from the JEWEL simulation are used as an example to demonstrate this general method. We find that the classification performance goes down in the JEWEL-simulated heavy ion collisions. The information carried by the subleading subjets can be washed out by the possible subjet thermalization or randomization due to the soft event activities. Our method provides a systematically improvable framework for analyzing and comparing jet simulations and measurements in heavy ion collisions.

Content type

Theory

Collaboration

Centralised submission by Collaboration

Presenter name already specified

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Session Classification: Jet modifications and high-pT hadrons

Track Classification: Jet modifications and high-pT hadrons