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Probing heavy ion collisions using quark and gluon jet substructure

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Uncovering the inner working of the quark-gluon plasma requires comprehensive jet substructure information. I will discuss the study of jet quenching utilizing quark and gluon jet substructures as independent probes of heavy ion collisions. Jet and subjet features are exploited to highlight differences between quark and gluon jets in vacuum and in a medium. I will first discuss a physics-motivated, multivariate analysis of jet substructure observables including the jet mass, the radial moments, the p_T^D and the pixel multiplicity. In comparison, I will use state-of-the-art image-recognition techniques by training a deep convolutional neutral network on jet images. To systematically extract jet substructure information, I will introduce the telescoping deconstruction framework exploiting subjet kinematics at multiple angular scales. I will draw connections to the soft-drop splitting function and illuminate medium-induced jet modifications using Lund diagrams. The quark gluon discrimination performance worsens in heavy ion jets simulated in JEWEL due to significant soft event activities affecting the soft jet substructure. This work suggests a systematically improvable framework for studying modifications to quark and gluon jet substructures and facilitating direct comparisons between theoretical calculations, simulations and measurements in heavy ion collisions.

Summary

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