Understanding Uncertainties and Biases in Jet Quenching in High-Energy Nucleus-Nucleus Collisions

LLNL-ABS-738296 [1]

Matthias Heinz, Ron Soltz, and Aaron Angerami

Abstract

Jets are the collimated streams of particles resulting from hard scattering in the initial state of high-energy collisions. In heavy-ion collisions, jets interact with the quark-gluon plasma (QGP) before freezeout, providing a probe into the internal structure and properties of the QGP. In order to study jets, background must be subtracted from the measured event, potentially introducing a bias. We aim to understand and quantify this subtraction bias. PYTHIA, a library to simulate pure jet events, is used to simulate a model for a signature with one pure jet (a photon) and one quenched jet, where all quenched particle momenta are reduced by a user-defined constant fraction. Background for the event is simulated using multiplicity values generated by the TRENTO initial state model of heavy-ion collisions fed into a thermal model consisting of a 3-dimensional Boltzmann distribution for particle types and momenta. Data from the simulated events is used to train a statistical model, which computes a posterior distribution of the quench factor for a data set. The model was tested first on pure jet events and then on full events including the background. This model will allow for a quantitative determination of biases induced by various methods of background subtraction.

[1]This work was performed under the auspices of the U.S. Department of Energy by Lawrence Livermore National Laboratory under Contract DE-AC52-07NA27344.