An Investigation of Flavor Dependence of Jet Shape Modifications in Au+Au Collisions at $\sqrt{s_{NN}} = 200$ GeV

Diptanil Roy
For the STAR Collaboration
Mentor: Dr. Sevil Salur

June 23, 2022

1 Abstract

Partons (quarks/gluons) in heavy-ion collisions interact strongly with the Quark-Gluon Plasma (QGP), and hence have their energy and shower structure modified compared to those in vacuum, e.g., those produced in proton-proton collisions. Theoretical calculations predict that radiative energy loss, which is the dominant mode of energy loss for gluons and light quarks in the QGP, is suppressed for heavy quarks (such as charm and bottom) at low transverse momenta (p_{T}). A measurement of the $D^0(c\bar{u})$ meson radial profile in jets from the CMS experiment at the LHC hints at its modification at low D^0 p_{T} in heavy-ion collisions, which is qualitatively different from that of the inclusive hadrons. The excellent secondary vertex resolution provided by the Heavy Flavor Tracker in the STAR experiment at RHIC enables reconstruction of D^0 mesons at low with high significance, making STAR ideal for similar measurements.

Previously, we presented the D^0 meson tagged jet p_{T} spectra, D^0 meson radial profile, and the nuclear modification factor R_{CP} for higher p_{T} (> 5 GeV/c) D^0 mesons in Au+Au collisions at $\sqrt{s_{\mathrm{NN}}} = 200$ GeV at RHIC. While the R_{CP} for jet p_{T} spectra showed an interesting p_{T} dependence, the ratio of radial distribution of D^0 mesons in central and peripheral collision systems was found to be consistent with unity. We extend these observables to lower p_{T} (> 1 GeV/c) D^0 mesons where the charm mass is expected to play a more significant role in the interaction of the tagged jets with the medium. Such measurements are expected to shed light on parton flavor and mass dependencies of jet quenching, and constrain theoretical models.