Charm Mesons and Charm Meson Tagged Jets at STAR

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1 Abstract

Heavy flavor partons like charm (c) and bottom (b), produced in the early stages of the collisions, serve as excellent probes of the properties of the Quark-Gluon Plasma. The nuclear modification factors related to the production cross-section of heavy-flavor hadrons can quantify the flavor dependence of the medium induced parton energy loss. Jets tagged with heavy flavor hadrons can additionally shed light on their fragmentation, parton shower, and propagation in the medium.

The jet fragmentation function is related to the transverse momentum fraction of the jet carried by hadrons along the jet axis ($z = p_{T,hadron}/p_{T,jet}$) and connects the production of quarks and gluons in the perturbative regime with the hadronized final state particles in the non-perturbative regime. In the QGP medium, modifications to the fragmentation function compared to that in the vacuum can provide insights to the underlying mechanism of jet quenching. Such modifications have been observed at the LHC for inclusive jets. In this talk, we report measurements of $D^0(c\bar{u})$ meson tagged jets in Au+Au collisions at $\sqrt{s_{NN}} = 200$ GeV, collected by the STAR experiment at RHIC. We show the transverse momentum dependent invariant yields of the D^0 jets and the first measurement of the transverse momentum fraction of D^0 mesons in the jets. We also measure the nuclear modification factors as functions of the transverse momentum and the transverse momentum fraction. Additionally, we measure the radial profile of the D^0 mesons in these tagged jets.

We also report the first measurements of the D^0 meson production at mid-rapidity ($|y| < 1$) in isobar collisions (^{96}Ru + ^{96}Ru and ^{96}Zr + ^{96}Zr) at $\sqrt{s_{NN}} = 200$ GeV, at the STAR experiment at RHIC. We report the transverse momentum dependent invariant yields of the D^0 meson, along with the centrality-dependent nuclear modification factors, and compare them to the published results from Au+Au collisions at $\sqrt{s_{NN}} = 200$ GeV. Such measurements can constrain theoretical calculations of parton flavor and mass dependencies of medium modifications across systems of different sizes.