Measuring path-length dependence of jet quenching at STAR

Isaac Mooney, Tristan Protzman,
Rosi Reed, Nihar Sahoo, Subhash Singha,
for the STAR Collaboration

May 1, 2023

Abstract

The modification of jets in heavy-ion (A+A) collisions compared to proton-proton (p+p) collisions ("jet quenching") offers insight into the nature of the medium's interactions with colored probes. The degree of jet quenching is expected to be highly dependent on the jet's path length in the medium, which in turn is dependent on the geometry of the collision. To control the geometry and thereby the path length, semi-central collisions can be used. These collisions create a medium which is tilted along the longitudinal axis and has an approximately elliptical overlap region in the transverse plane. Measuring the Fourier harmonics for jets in A+A collisions can quantify the modification of isotropically-produced hard scatterings within an anisotropic medium.

In this talk, we present the first measurements of the jet v_1 and v_2 (the first two Fourier harmonics) at RHIC using STAR's high-statistics isobaric Zr+Zr and Ru+Ru collision data. In addition, new results for jet v_1 will be shown for a larger system of Au+Au collisions as well as progress toward the jet v_2 measurement in a smaller system of O+O collisions. To achieve even better control over the path length, we also present new results using event shape engineering, by which we select on the eccentricity of an event, which can vary widely even within a given centrality selection, and compare the in- and out-of-plane spectra of charged hadrons. Together, these results allow for detailed study of the nature of parton-medium interaction.