Studying path-length dependent energy loss using jet v_1 and event shape engineered high momentum probes in heavy-ion collisions at $\sqrt{s_{NN}} = 200$ GeV by STAR

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Studying its path-length dependence is crucial for understanding the mechanisms of parton energy loss in the Quark-Gluon Plasma (QGP) [1]. A path-length asymmetry along impact parameter direction (x) exists for hard probes in heavy-ion collisions at finite rapidity, as the QGP bulk is tilted in reaction plane, while the hard scattering profile is not [2]. Previous measurements of v_1 ($= \langle p_x/p_T \rangle$) of D^0-mesons have demonstrated sensitivity of hard produced partons to this path-length asymmetry [2, 3]. Measurements of jet v_1 will provide access to path-length dependent energy loss of partons in the QGP. The jet v_1 measurements do not get contributions from event-by-event geometry fluctuations, unlike measurements relative to the second order event plane. Measurements therefore of in- and out-of-plane yield ratios of hard probes in events with different second-order eccentricities offer complementary information on this effect in the QGP.

In this talk we present the first measurement of inclusive charged jet and high-p_T charged hadron v_1 in Au+Au and Ru+Ru, Zr+Zr (isobar) collisions at $\sqrt{s_{\rm NN}} = 200$ GeV by STAR. Jet $p_{\rm T}$ and radius dependence of jet v_1 will be shown. We will also present an evaluation of the initial path-length asymmetry from the tilted bulk, utilizing models describing the measured pseudorapidity dependence of particle production in asymmetric collisions and discuss future opportunities with event shape engineering (ESE) for the first order anisotropy. In addition, measurements of ratios of in-and out-of-plane yields of high momentum probes in events selected to have different second order eccentricities, using ESE, in Au + Au collisions at $\sqrt{s_{\rm NN}} = 200$ GeV will be shown.

References

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