



Contribution ID: 540

Type: Poster

b-jet tagging at sPHENIX

Tuesday 5 September 2023 17:30 (2h 10m)

Beauty quarks are produced in hard-parton scatterings in the early stages of the partonic collisions. They are the ideal probe to investigate the properties of Quark-Gluon Plasma (QGP) produced in ultra-relativistic heavy-ion collisions as they experience the whole QGP evolution. Due to their large mass, their production can be calculated using perturbative Quantum Chromodynamics (pQCD), thus they can be used to test pQCD based models. Moreover, measurements in p+p collisions provide the necessary reference for the interpretation of heavy-ion collision results. Experimentally, tagging a jet by its flavor content gives direct access to the initial parton kinematics and can provide information on how the energy is dissipated in the QGP medium. The possible studies include the flavor and mass dependence of jet quenching, the collisional energy loss, the dead-cone effect, and the modification of the fragmentation and jet structure in the medium.

The sPHENIX detector will begin commissioning with Au + Au collisions in Spring 2023. It provides an excellent vertex resolution using 3 layers of Monolithic Active Pixel Sensors (MAPS) and Intermediate Silicon Tracker (INTT) detectors. The expected spatial resolution is $<6\mu\text{m}$ and the track vertex distance of closest approach (DCA) $<30\mu\text{m}$ for $p_T > 1\text{ GeV}/c$. In addition, a full azimuthal coverage of electromagnetic and hadronic calorimeters provides an excellent tool to study jet physics. In this poster, we will focus on the prospects of beauty-jet-tagging of full jets at sPHENIX. Several methods are studied in simulation, including tagging via the large DCA track and secondary vertex mass.

Category

Experiment

Collaboration (if applicable)

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Session Classification: Poster Session

Track Classification: Heavy Flavor