Stony Brook University
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Doctoral Defense Announcement

Abstract

Direct Photon Tagged Jets in 200 GeV Au+Au Collisions at PHENIX

By

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A hot dense medium called the quark gluon plasma (QGP) has been created and observed at the Relativistic Heavy Ion Collider (RHIC). Quarks and gluons are deconfined in the QGP state but many of its properties are still under investigation. Jet tomography seeks to understand how the QGP affects high momentum partons which result from hard scatterings in the initial collision. While various energy loss models try to explain the measurements observed, a detailed understanding of the physics involved has still not been achieved and requires more sophisticated and quantitative observables.

Since full jet reconstruction is complicated by the high multiplicity background produced in heavy-ion collisions, high p_T two particle correlations are used instead. Although di-hadron correlations are useful for observing jet quenching and some modifications, the triggers, which are fragments of a modified jet themselves, are biased to be near the medium's surface and the jet energy is unknown. Since photons do not interact via the strong force, they are unmodified by the medium and provide an unbiased trigger. Direct photons result directly from the hard scattering. They balance the energy of the opposing parton and provide knowledge of the opposing jet momentum. Therefore, by measuring the hadron yield on the away-side, opposite the direct photon trigger, the jet fragmentation function can be measured.

By comparing the spectra in Au+Au collisions to that in p+p collisions, the effective modifications to the fragmentation function can be quantified. Although this measurement is known as a "golden channel," it is complicated by a large background of photons resulting from meson decays which need to be removed from the inclusive sample of photons. A statistical subtraction procedure was developed which subtracts decay photon-hadron correlations from inclusive photon-hadron correlations to extract the direct photon-hadron correlations. Additional techniques which remove decay photons from the inclusive sample have been investigated to improve the signal to background ratio for the subtraction and thereby reduce the uncertainties in the measurement. Using the data collected by PHENIX during the 2007 RHIC Run, the modified fragmentation function has been measured via direct photon-hadron correlations for a wider kinematic range.

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