Suppression of High p_T Hadron Production in Nuclear Collisions at RHIC

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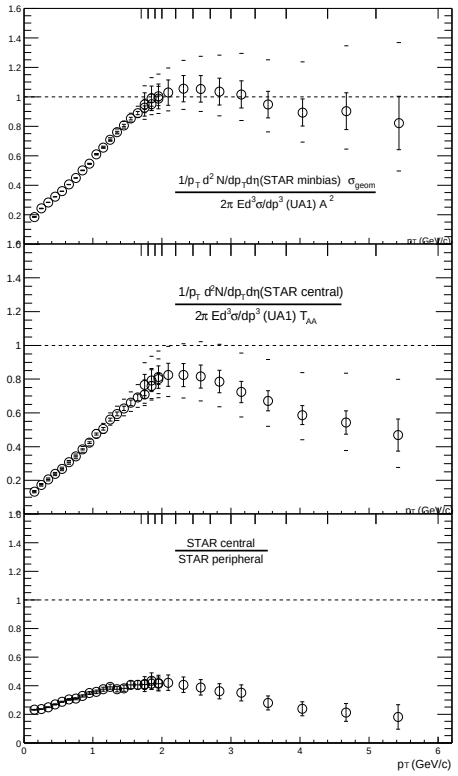
The energy loss of fast partons in matter is predicted to be much larger in a deconfined medium than in cold hadronic matter [1]. This phenomenon, known as "jet quenching", may be a sensitive probe of the state of matter created in high energy heavy ion collisions. Energy loss will generate an apparent softening of the fragmentation of jets, leading to the suppression in the observed yield of high p_T hadrons[2].

At RHIC, for the first time in the laboratory study of nuclear collisions, jets are copiously produced and serve as a robust, high statistics probe of the medium generated in the collision. STAR has previously reported the measurement of charged hadrons up to p_T=6 GeV/c in central Au+Au collisions at $\sqrt{s_{NN}} = 130$ GeV[3]. Comparison to hadron yields in nucleon-nucleon collisions (UA1 data), scaled to account for geometrical effects, revealed a suppression for central collisions of about a factor 2 at 6 GeV/c. The PHENIX collaboration has reported similar results [4].

This analysis has been extended to all centralities. The upper panel of the figure shows the ratio of the charged hadron p_T distribution from minimum bias Au+Au collisions to the nucleon-nucleon reference scaled by A^2, the geometric scaling expected if there are no nuclear effects. The middle panel shows the ratio of STAR central (0-5%) to the reference, showing the previously established suppression at high p_T. The lower panel shows the ratio of STAR central over peripheral data (60-80%), normalized by the mean number of binary collisions in the two event samples. Significant suppression at high p_T is also evident in this case.

While these results are consistent with theoretical predictions of jet quenching, further study is needed (especially of proton-nucleus collisions) to measure competing nuclear effects such as initial state multiple scattering, in order to firmly establish the magnitude of jet quenching at RHIC.



References

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