Azimuthal anisotropy of high p_T charged hadrons at RHIC

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High $p_T$hadrons produced in ultra-relativistic heavy-ion collisions probe nuclear matter at extreme conditions of high energy density. Recent experimental measurements in Au+Au collisions at RHIC establish the existence of strong medium effects on hadron production well into the perturbative regime. Inclusive charged hadron distributions measured in Au+Au collisions at $\sqrt{s_{NN}}$=130, 200 GeV [1, 2] show a suppression of hadron yields at high p_T in central collisions relative to peripheral collisions and scaled nucleon-nucleon interactions, consistent with the picture of partonic energy loss in a dense system [3]. Back-to-back jet production is also shown to be strongly suppressed in the most central Au+Au collisions [4].

The initial spatial almond-shaped geometry of the reaction zone in non-central nuclear collisions can be used to study the propagation of partons and their fragmentation products through the azimuthally asymmetric system. The azimuthal anisotropy of final state hadrons in non-central collisions is quantified by the coefficients of the Fourier decomposition of the azimuthal particle distributions, with the second harmonic coefficient v_2 referred to as elliptic flow [5]. v_2 is inferred from the azimuthal particle distribution with respect to the estimated reaction plane orientation, corrected for the reaction plane resolution. The previous measurements of azimuthal anisotropy of charged hadrons at $\sqrt{s_{NN}}$=130 GeV [7] showed that elliptic flow rises almost linearly with transverse momentum up to 2 GeV/c, behavior that is well described by hydrodynamic calculation. Above $p_T \sim 2$ GeV/c, $v_2(p_T)$ deviates from a linear rise and saturates for $3 < p_T < 6$ GeV/c. The new STAR data on the azimuthal anisotropy parameter v_2 for Au+Au collisions at $\sqrt{s_{NN}}$=200 GeV extend the measurements up to $p_T = 12$ GeV/c and provide important constraints on the underlying mechanisms of high p_T hadron production in nuclear collisions.

Fig. 1 shows v_2 of charged hadrons as a function of p_t for different collision centralities at $\sqrt{s_{NN}}$=200 GeV. v_2 remains finite for non-central collisions, exhibiting a decrease from the saturation level at the highest measured p_T for the more central events. It is expected that the azimuthal anisotropy will vanish in the limit of very high p_T. In the saturation region at $3 < p_T < 6$ GeV/c, the magnitude of the azimuthal anisotropy measured at $\sqrt{s_{NN}}$=200 GeV is the same to within 5% as that measured at $\sqrt{s_{NN}}$=130 GeV, in contrast to the growth of the inclusive cross section with increasing $\sqrt{s_{NN}}$ [2]. This is an indication of the geometrical origin of the large anisotropies observed in the hard scattering region. v_2 values measured at high p_T for a restricted centrality range, corrected for contribution from non-flow effects, are consistent with the maximum expected v_2 from surface emission [8].

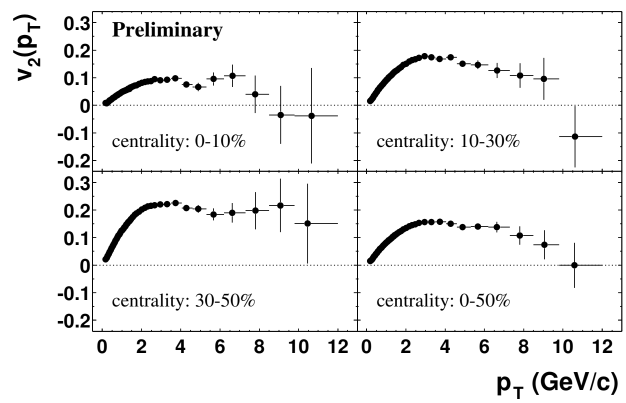

FIG. 1: v_2 of charged hadrons as a function of p_t for different collision centralities at $\sqrt{s_{NN}}$=200 GeV.

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