Event anisotropy measurement in 200GeV Au+Au collisions at RHIC-PHENIX experiment

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Event anisotropy such as directed and elliptic flow might have more sensitivity to the early stage of ultra-relativistic heavy-ion collisions at RHIC, where one might expect the quark gluon plasma (QGP), compared to other hadronic variables which could be more affected by the final stage of hadronic interaction. This is an anisotropy in momentum space of produced particles, which exhibits a initial geometry of the overlapped 2 beam nuclei. A possible formation of QGP might affect how this anisotropy of the initial geometry (space coordinate) is transfered into the momentum space at the final state. The pressure of QGP inside the interaction region will accelerate or decelerate the space-time evolution of the matter which has an almond shape in the beginning. Therefore the the event anisotropy is a one of the direct probe to study the degree of freedom at the initial stage of collision and the dynamic evolution of the interaction region.

The PHENIX experiment has measured v1 and v2 at the mid-rapidity for charged hadrons and identified hadron for 130 and 200GeV Au+Au collisions at RHIC. The elliptic flow parameter v2 increases with the beam energy from AGS/SPS to RHIC, however the hadronic cascade models do often under-estimate the data, while the hydro-dynamic models tend to over-estimate. The high p_T hadrons were found to be suppressed with respect to the binary collision scaling at RHIC energy, one explanation is the jet quenching in QGP. The high p_T behavior of the event anisotropy is expected to give us more information on investigating the jet quenching, since it has an additional information which can come from the different thickness of the almond shape, that is to measure it as a function of azimuthal angle relative to the measured reaction plane, in addition to the absolute yield which one can get from the inclusive analysis of single particle transverse momentum spectra.

There is a standard way of flow analysis with respect to the reaction plane, on the other hand, the PHENIX experiment has been using the two or multi-particle azimuthal correlation to extract the flow variable. We have adopted the standard reaction plane determination technique with the beam-beam counter at forward rapidities and with the central arm at mid-rapidity in order us directly to compare the results. The difference of the results we can get from those two methods could possibly help us to distinguish the different effects which are contained in v2 and in the higher harmonics of the Fourier coefficients, such as mini-jets productions.

In this presentation, we discuss the event anisotropy of high p_T charged particles and identified hadrons measured in the central arm detectors ($\eta < 0.35$) with respect to the event reaction plane determined by the beam-beam counter ($\eta = 3 \sim 4$) and a comparison to the different technique to extract anisotropy variables such as pair-wise and multi-particle azimuthal correlations methods.