Study of azimuthal anisotropy of charged particles in Au + Au collisions at $\sqrt{s_{NN}}$ = 200 GeV at RHIC-PHENIX

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It has been established that the high temperature and high dense matter, quark gluon plasma (QGP), was produced in the gold-gold collision by the relativistic heavy ion collider (RHIC) at the Brookhaven National Laboratory (BNL) in the United States. QGP is a form of matter in which quarks and gluons strongly interact with each other. It was found that it is a "perfect fluid" having almost no viscosity. The quantitative research on the QGP properties is progressing. One of the discoveries that was made at the RHIC is a strong elliptical flow, in which the particles generated by nuclear collision come out with anisotropy, not uniformly with respect to the reaction plane. In this report, we describe the analysis of the azimuthal anisotropy parameter (v_2), which represents the difference in yield between the in and out of planes, in order to investigate the properties of the energy loss mechanism resulting from the different interacting lengths with QGP when high transverse momentum particles are emitted.[1,2)]

The parameter v_2 is calculated from the azimuthal angle Φ of the reaction plane using the south and north of the Beam-Beam Counter (BBC) and the azimuthal angle Ψ of the emitted particles. This is called the "reaction plane method."[3)] In this method, v_2 is quantified by the Fourier coefficient in the following equation:

$$dN/d(\Phi - \Psi) \propto 1 + 2v_2\cos[2(\Phi - \Psi)] \quad (1)$$

The angle Φ is determined from the density of the azimuthal angle of the particles detected in the forward and backward BBC for each event. In addition, since the value of $v_2^{measured}$ observed in the experiment is influenced by the detector, we can obtain v_2^{true} from the following formula with the correction factor C_{reso}.

$$v_2^{true} = v_2^{measured}/C_{reso} \quad (2)$$

The detectors used for the measurement of the plane in this analysis are the south and north of the BBC and Central Arm Detectors (CNT). The resolution of the reaction plane C_{reso} is obtained using the three sub method, which uses these three detectors. The result of the resolution of the reaction plane measured in step of 5% is shown in Fig. 1, which shows that the resolution is at most 20–25%. When the resolution is large, it is possible to measure the reaction plane with good performance. On the other hand, for low centrality (0∼10%), the resolution is small, because the eccentricity of the reaction region is small. For high centrality (30%∼), the resolution decreases due to the reduction in the number of particles.

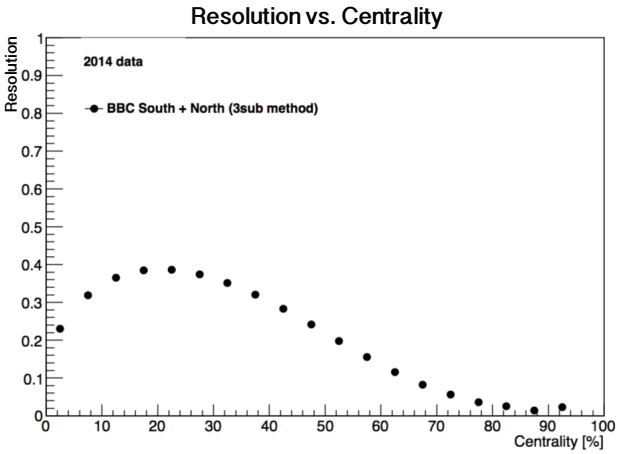

Fig. 1. Resolution of the reaction plane to centrality.[4)]

The following event selections are required for this analysis.

- Collision vertex is within ±10 cm from the origin in the beam axis direction,
- One or more hits in both BBC South and BBC North. In addition, the following track selections are required,
- 5 or 6 hits with Drift Chamber (DC) and Pad Chamber 1,
- Transverse momentum $p_T > 0.5$ GeV/c
- The hit position in the beam axis direction at DC is ±75 cm,
- χ square cut on the tracking
- Position matching cut ($< 3\sigma$)
- E/p cut ($0.2 < \mathrm{E/p} < 0.8$)

I will remove the background even more by turning the above cuts with a detailed study, especially about the E/p cut.

References

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