Higher flow coefficients with STAR energy

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1. Introduction:

The higher flow coefficients are important to understand the nuclear matter at very high energy and density in the heavy ion collision. Therefore it is necessary to understand the nature of the higher flow coefficient and its fluctuations.

In this presentation we use dynamic simulation transport models A Multi Phase Transport model (AMPT)[1].

AMPT model uses HIJING [2] to generate the initial conditions, ZPC [3] for treating partonic scatterings, quark coalescence model for hadronization, and ART [4] model for treating hadronic scatterings.

In this abstract we are presenting for one energy at STAR [5], i.e. in 200GeV for Au+Au system for higher harmonics of flow coefficient. The analysis was carried out for centrality, pseudorapidity & transverse momentum dependence.

2. Method of analysis:

We adopted Fourier series method [6] to measure flow coefficient measurement, which is given by the formula

$$E\frac{d^3N}{d^3p} = \frac{1}{2\pi}\frac{d^2N}{p_t dp_t dy}\left(1 + \sum_{n=1}^{n=\infty} 2v_n \cos[n(\varphi - \psi_r)]\right)$$

Where E is the energy, p is the momentum, p_t is the transverse momentum, y is the rapidity, φ is azimuthal angle & ψ_r is the reaction plane angle, n is then is the order of harmonics.

v_n is referred as flow coefficient & given by the formula

$$v_n = \langle \cos[n(\varphi - \psi_r)] \rangle$$

<..> this symbol is the average over all particles in all events.

We have used participant plane method [7] to calculate ψ_r which is given by the formula

$$\psi_{pp} = \frac{atan2(\langle r^2 \sin(n\varphi_{part})\rangle, \langle r^2 \cos(n\varphi_{part})\rangle) + \pi}{n}$$

With this formalism we have used AMPT string melting scenario for carrying out this work. After a cutoff time when hadronic interaction ceases, the observables were analyzed using 100k events.

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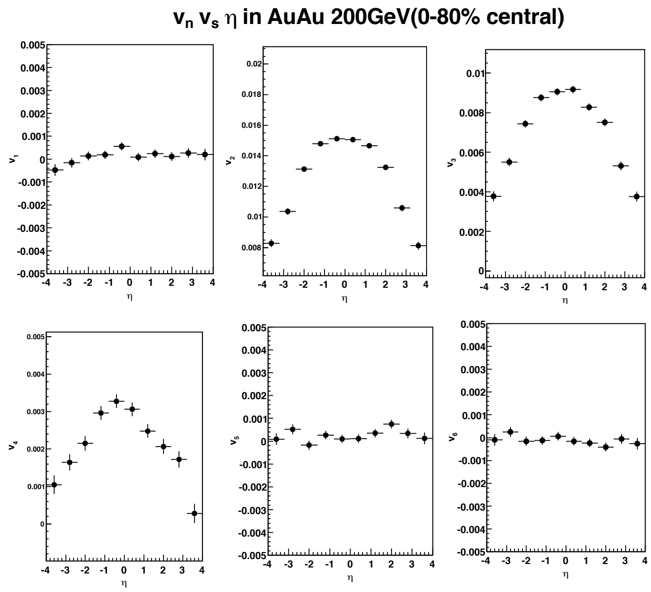
3. Results:

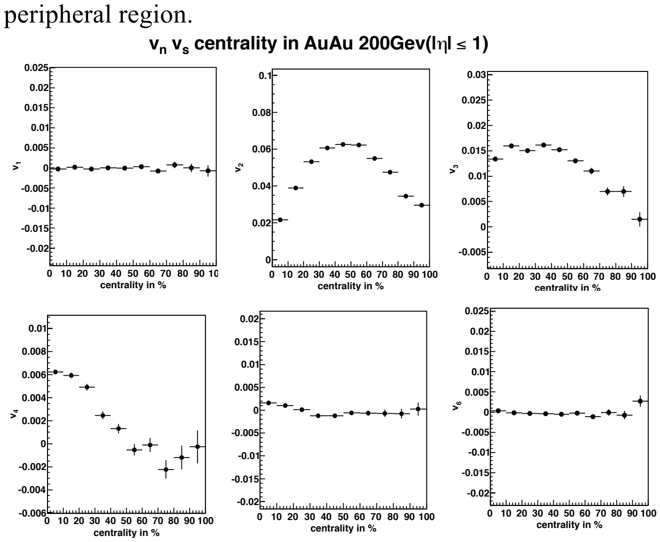
In figure-1 flow coefficients plotted against pseudo rapidity. Directed flow (v1), pentagonal flow (v5) & hexagonal flow (v6) is found to be zero. Rest is maximum at mid rapidity (|eta|<1) and decreases on both sides on increase of eta.



(**Fig.1**: flow coefficient versus pseudo-rapidity)

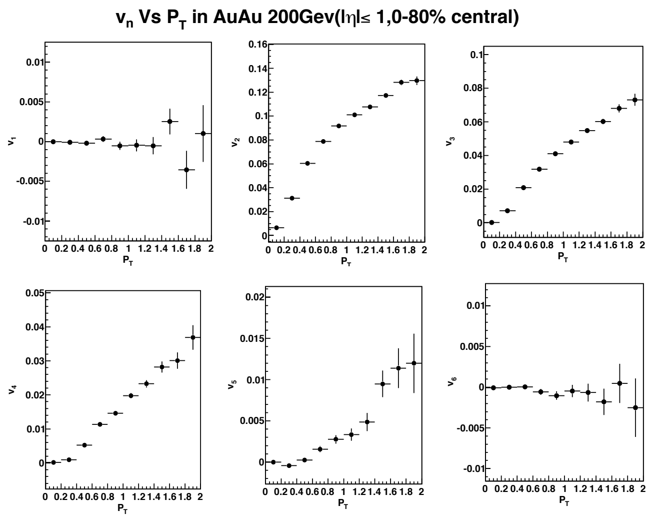
In figure-2 flow coefficients plotted against centrality (we have taken impact parameter as definition of centrality). Directed flow & hexagonal flow found to be zero

We found that directed flow (v1), pentagonal flow (v5) & hexagonal flow (v6) are zero. Elliptic flow is maximum at mid central region and decreases on both central & peripheral region. However triangular flow & quadra-gonal flow w are found to be maximum in central region and becomes zero at peripheral region.



(**Fig-2**: flow coefficients versus centrality)

In figure-3 flow coefficients plotted against transverse momentum in mid rapidity (eta<1) & mini-bias centrality (0-80%). We found that increasing of flow coefficients with increase of transverse momentum (up to 2 GeV) except directed flow (v1) & hexagonal flow (v6), which are found to be zero.



[**Fig-3**: flow coefficients versus transverse momentum]

4. Conclusion:

Using AMPT model for first time we are calculating higher harmonics of flow (v1 to v6).

Looking at the plot we conclude that higher than 6th harmonic, flow coefficient is basically zero. And magnitude of flow found to decrease with increase of flow harmonics onwards elliptic flow and zero at hexagonal flow.

During presentations we will include other energies of STAR experiment.

Reference:

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