Study of identified particle harmonics azimuthal anisotropy in 200GeV Au+Au collisions at RHIC-PHENIX experiment
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Introduction
Azimuthal anisotropy and particle species dependence of transverse momentum distribution have been studied actively because they reveal information about the QGP generated in high energy heavy ion collisions. From the study of elliptic event anisotropy $v_2$, we have understood that azimuthal anisotropy is generated by initial participant geometry, with a role for the QGP property $\eta/s$ (the ratio of shear viscosity to entropy density). In recent years, higher harmonics azimuthal anisotropies $v_{n>2}$ are analyzed so hard to improve study of QGP, because they are expected to be more sensitive to initial participant geometry and $\eta/s$ than will be $v_2$.

identified particle collective flow
It is known that elliptic anisotropy $v_2$ and transverse momentum distribution have particle dependence, and recent year it is studied higher harmonic anisotropies $v_2$, $v_3$, and $v_4(W_n)$ have also particle dependence. Specially, they have mass dependence in low $p_T$ range.

Result
Blast Wave model
It is known that hydrodynamic model can describe in less than KE=1.0[GeV] for spectra and $v_2$. In this poster, simple hydrodynamic model called Blast Wave is used for comparison with the data, this model can describe the final state from the information at freeze-out such as temperature$T_f$, average velocity$p_{\langle \rangle}$, anisotropic velocity$p_\alpha$ and spatially anisotropic$p_\gamma$. Spectra is calculated by temperature and average velocity, and $v_2$ is described by temperature, average velocity, anisotropic velocity and spatially anisotropic. Fitting for not only spectra and $v_2$, but also $v_{3,4}$, the informations at freeze-out are extracted.

Conclusion
The experimental results (spectra and azimuthal anisotropies) and BW model are compared. Similar behaviors of parameters are obtained regardless harmonics. These results indicate $v_2$, $v_3$ and $v_4(W_n)$ are generated due to the effect of initial fluctuation and hydrodynamic expansion of QGP.

The anisotropic velocity $p_\alpha$ at freeze-out seems to have similar centrality dependence to the measured higher harmonic anisotropies themselves, which show large centrality dependence for $p_{\langle \rangle}$ like $v_2$, while the higher moment $p_{\langle \rangle}$ and $p_\alpha$ do have flatter/weak dependences like $v_2$ and $v_3$.

In terms of spatial or density anisotropies $s_{\gamma}$ at freeze-out would call $e_{\gamma}$, the final eccentricity $e_{\gamma}$ does still show sizable magnitude (which can also be taken as consistent observation of $W_2$ dependence of HBT radius), however the final triangularity $e_{\Gamma 2}$ or rectangularity $e_{\kappa 2}$ are both small especially in the central collisions. This tells us that the initial higher harmonic spatial anisotropies $e_{\gamma}$ are mostly converted to the velocity anisotropy at freeze-out with rather small final higher harmonic spatial anisotropies $e_{\gamma}$, while it is still finite $e_{\gamma}$, which is consistent with the large initial eccentricity $e_{\gamma}$.

From comparison spatially anisotropy between initial and final, that gets weak but doesn’t disappear. This is similar to HBT results.