Identified and high p_T charged particle elliptic flow with respect to the reaction plane at PHENIX

Hiroshi Masui for the PHENIX Collaboration

PHENIX

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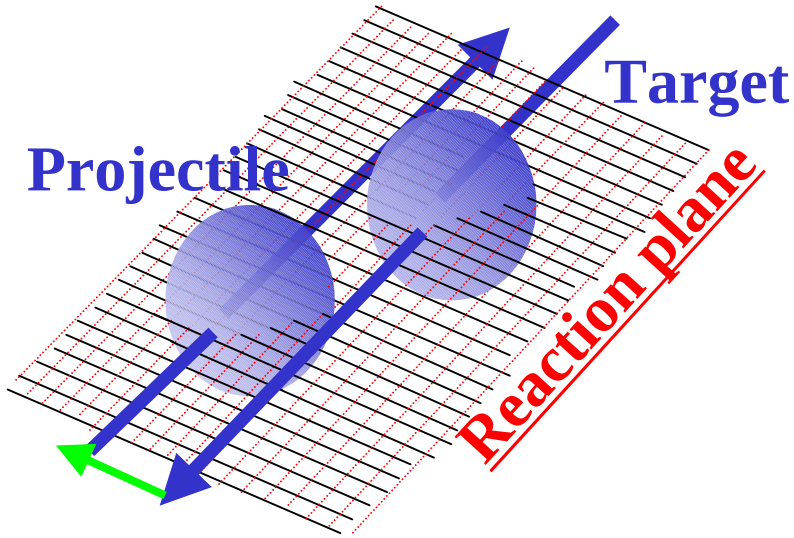
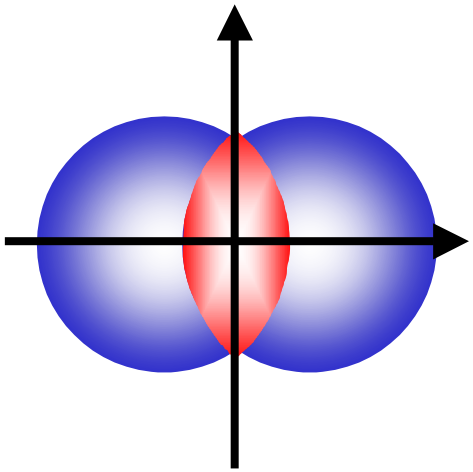
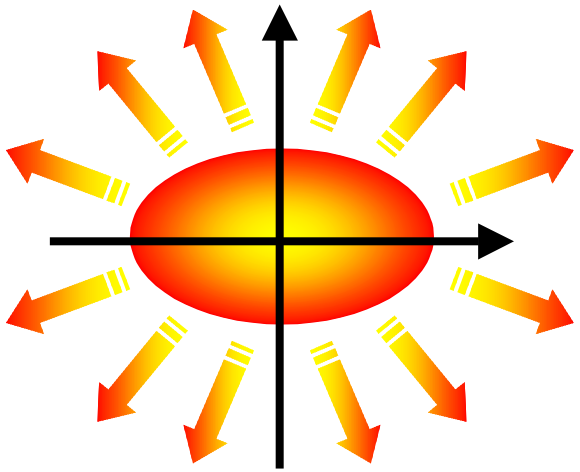
Introduction



b:impact parameter

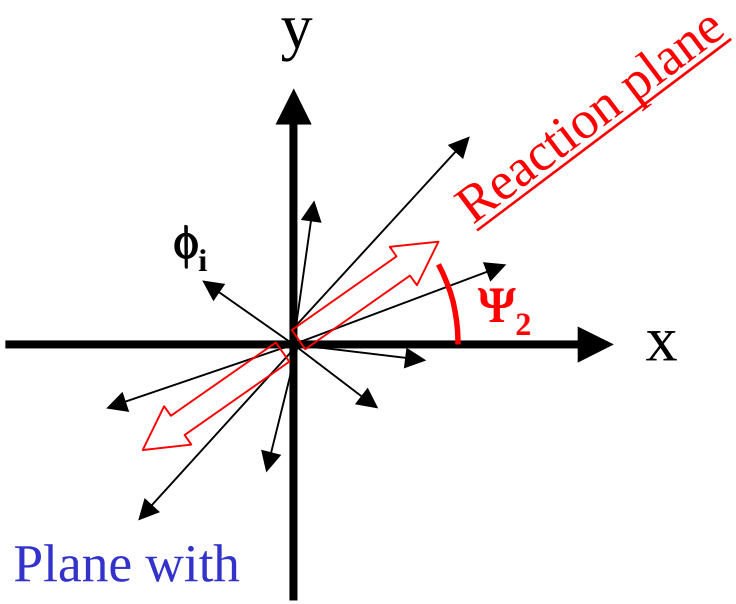


initial geometry



final momentum anisotropy

Method



Plane with
the elliptic moment

$$\tan(2\Psi_2) = \frac{\Sigma\, w_i * \sin(2\phi_i)}{\Sigma\, w_i * \cos(2\phi_i)}$$

Reaction plane based analysis

$$\frac{dN}{d(\phi - \Psi_n)} = N_0\left(1 + \sum_{n=1}^{\infty} 2v_n^{obs}\cos(n(\phi - \Psi_n))\right)$$

$$v_n = \frac{v_n^{obs}}{resolution}$$

ϕ : azimuthal angle for charged particle
Ψ_n : reaction plane angle
v_n^{obs} : measured anisotropy parameter
v_n : corrected anisotropy parameter

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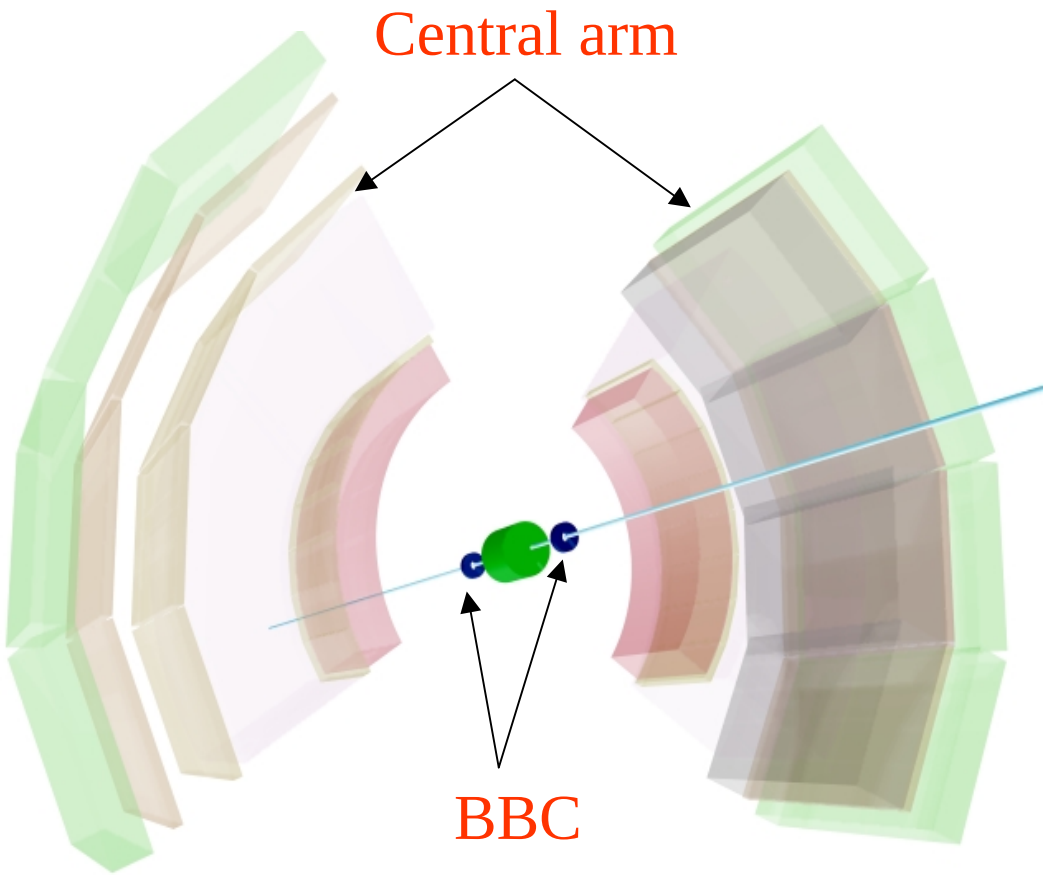
Hiroshi Masui

PHENIX detector



Reaction plane determination
at 3 units of rapidity away
from the mid-rapidity,

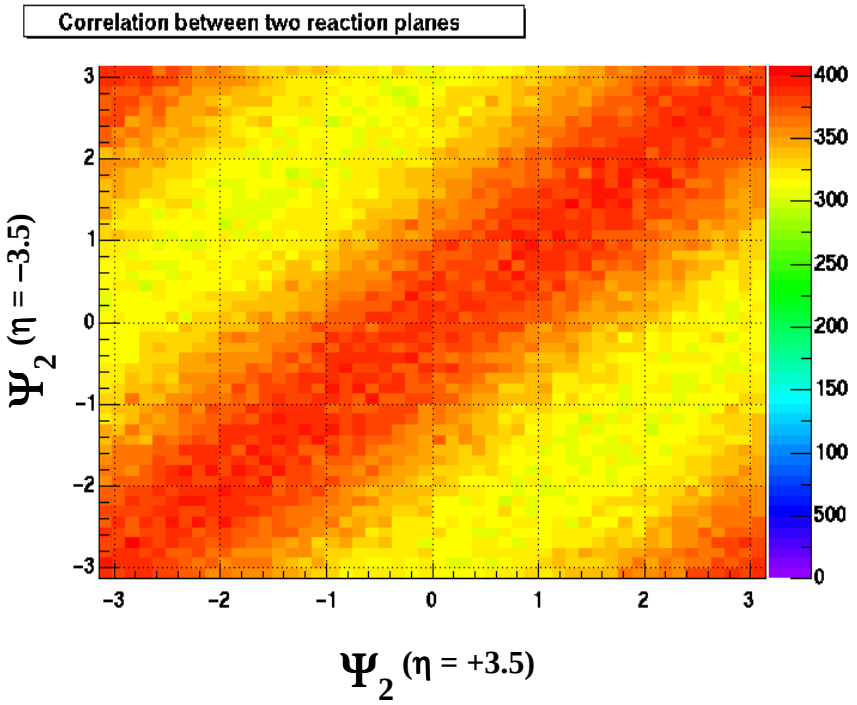
⇩

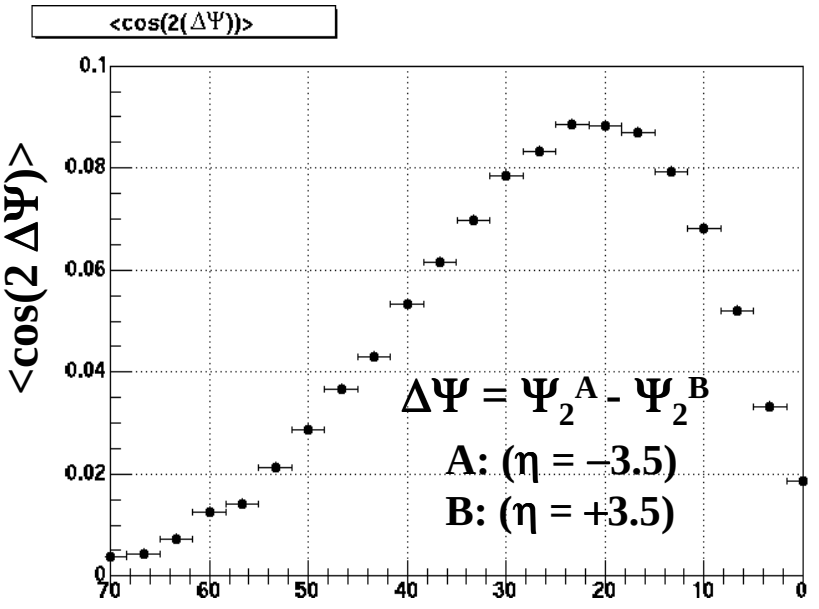
Less non-flow contributions.
- HBT
- decay
- momentum conservation
- jet
etc ….

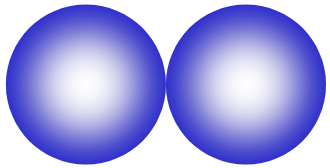
Central arm $|\eta|<0.35$
BBC $|\eta| \sim 3.5$

Correlation of reaction plane

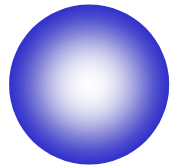
$\eta = -3.5$ vs $\eta = +3.5$
(elliptic : n=2)





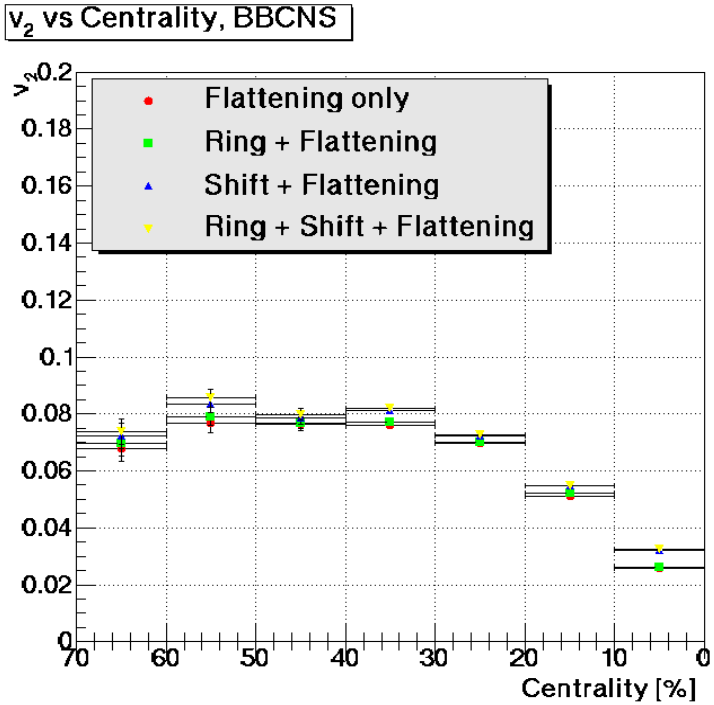


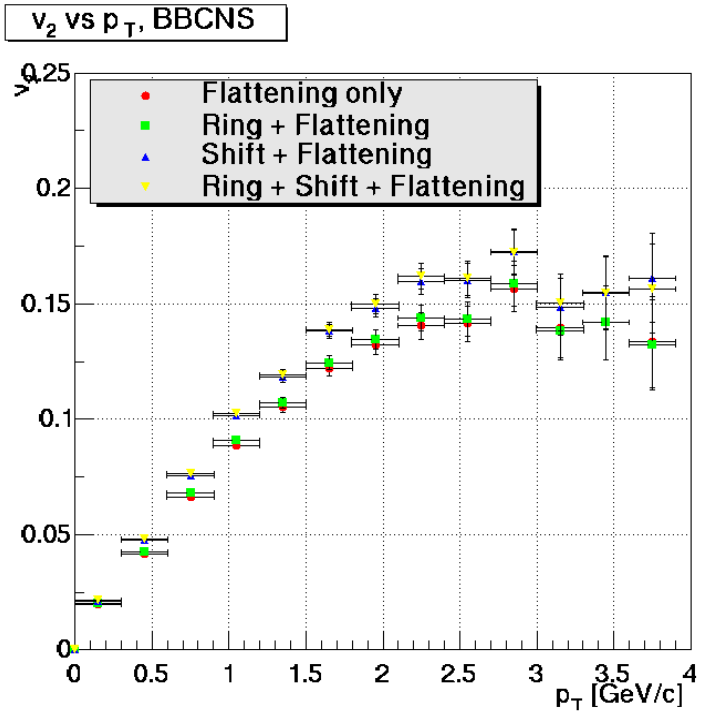
100%



0%

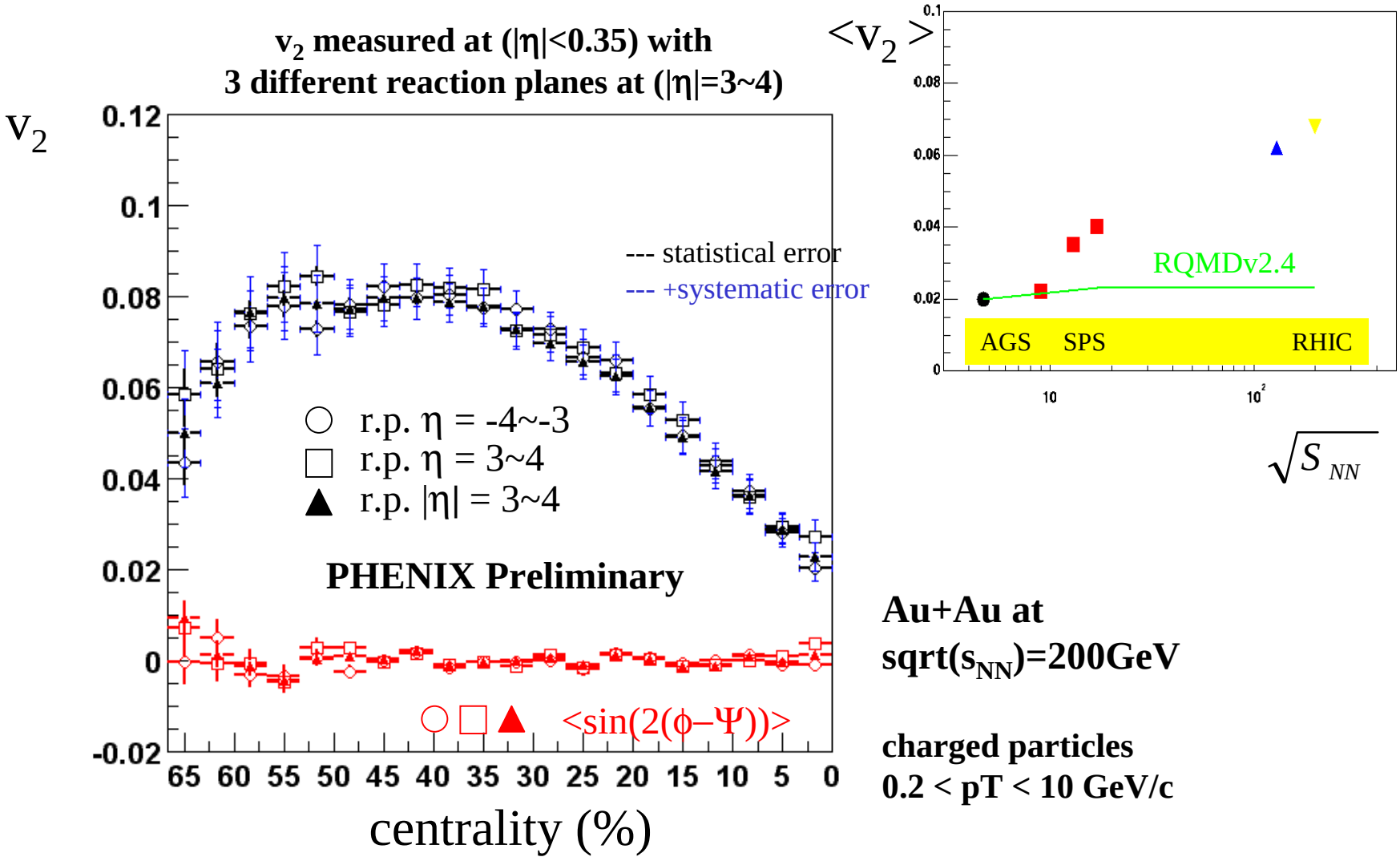
Systematic error





Systematic error is estimated by different methods.

Centrality dependence

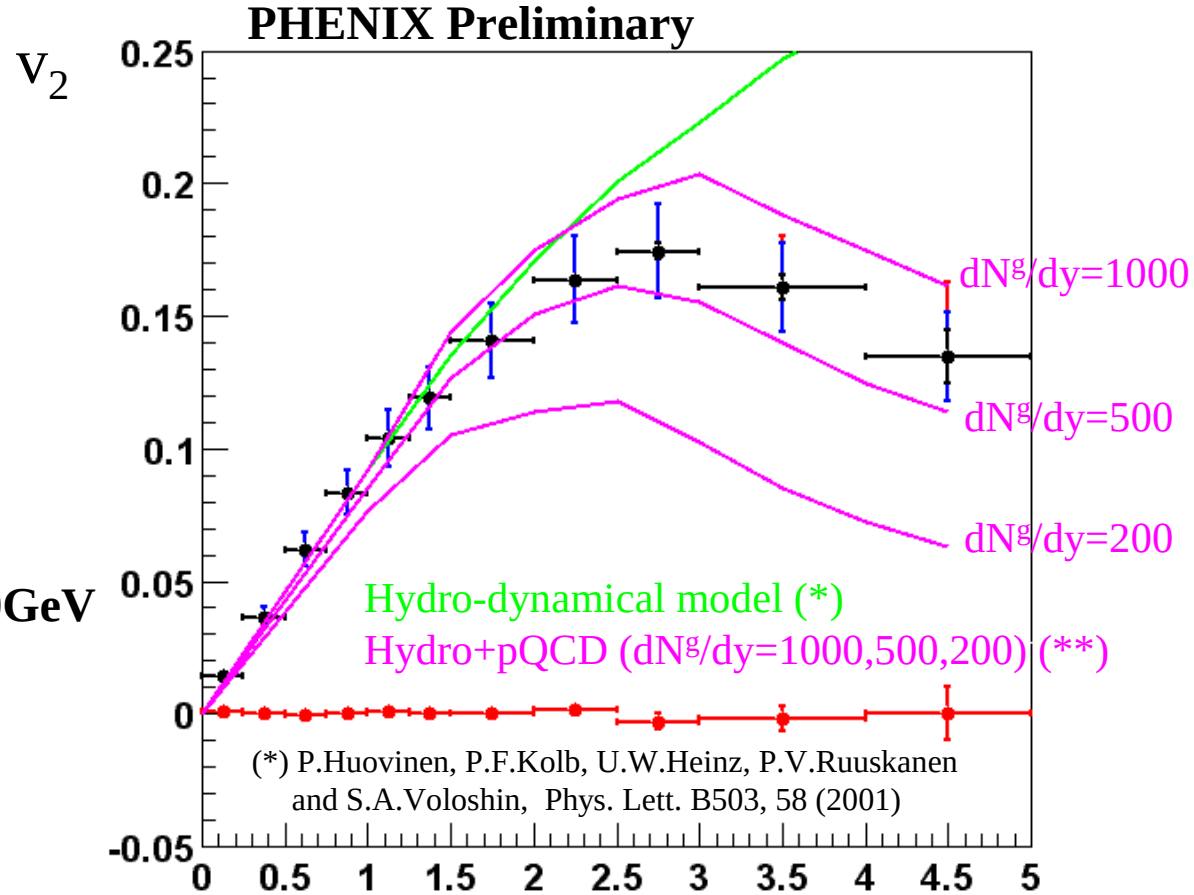


Au+Au at
sqrt(s_{NN})=200GeV

charged particles
0.2 < pT < 10 GeV/c

p_T dependence

- **reaction plane based analysis (r.p. |η|=3~4)**

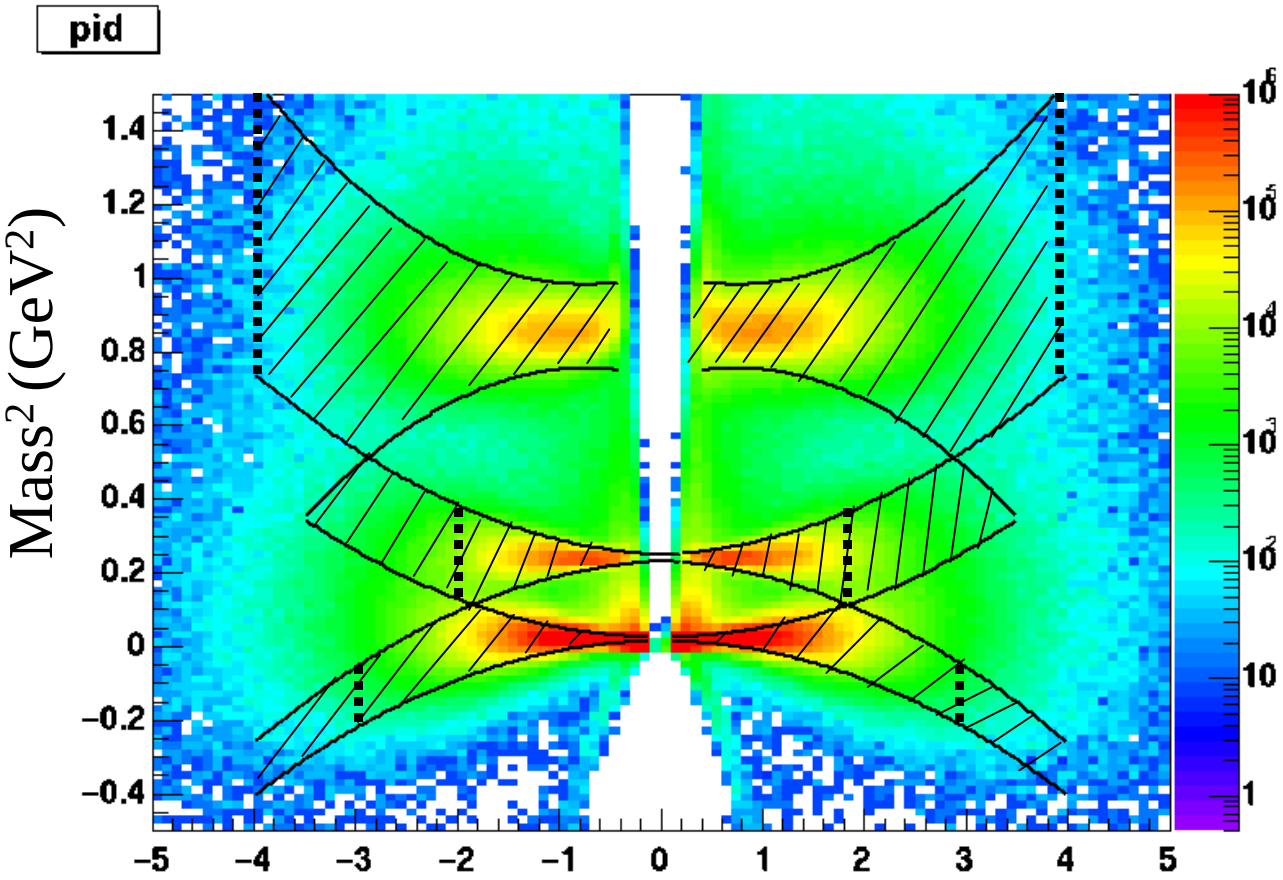


Au+Au at sqrt(s_{NN})=200GeV

min. bias

(**) M.Gyulassy, I.Vitev and X.N.Wang, Phys. Rev. Lett. 86, 2537, (2001)

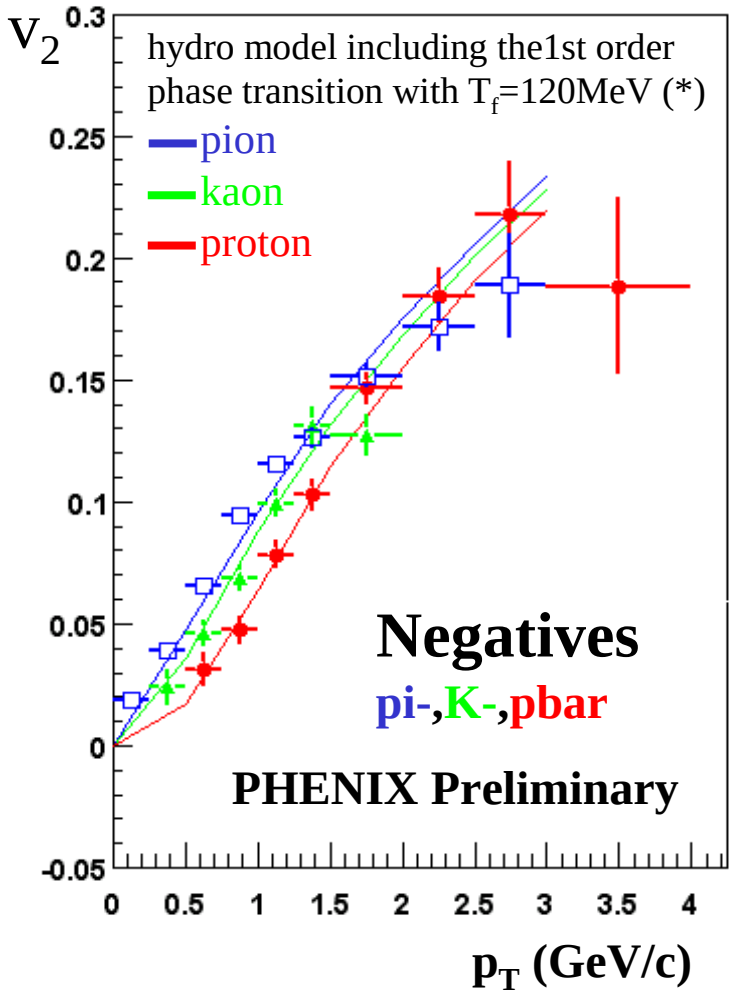
Mass square distribution

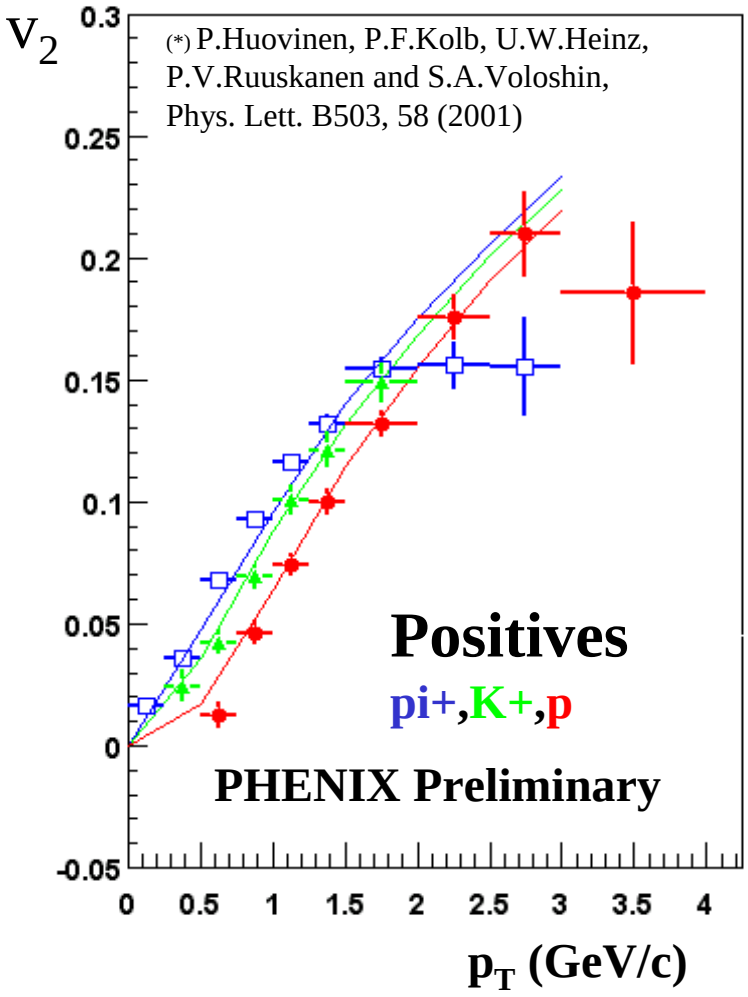


π < 3 GeV/c
K < 2 GeV/c
p < 4 GeV/c

v_2 of identified hadrons

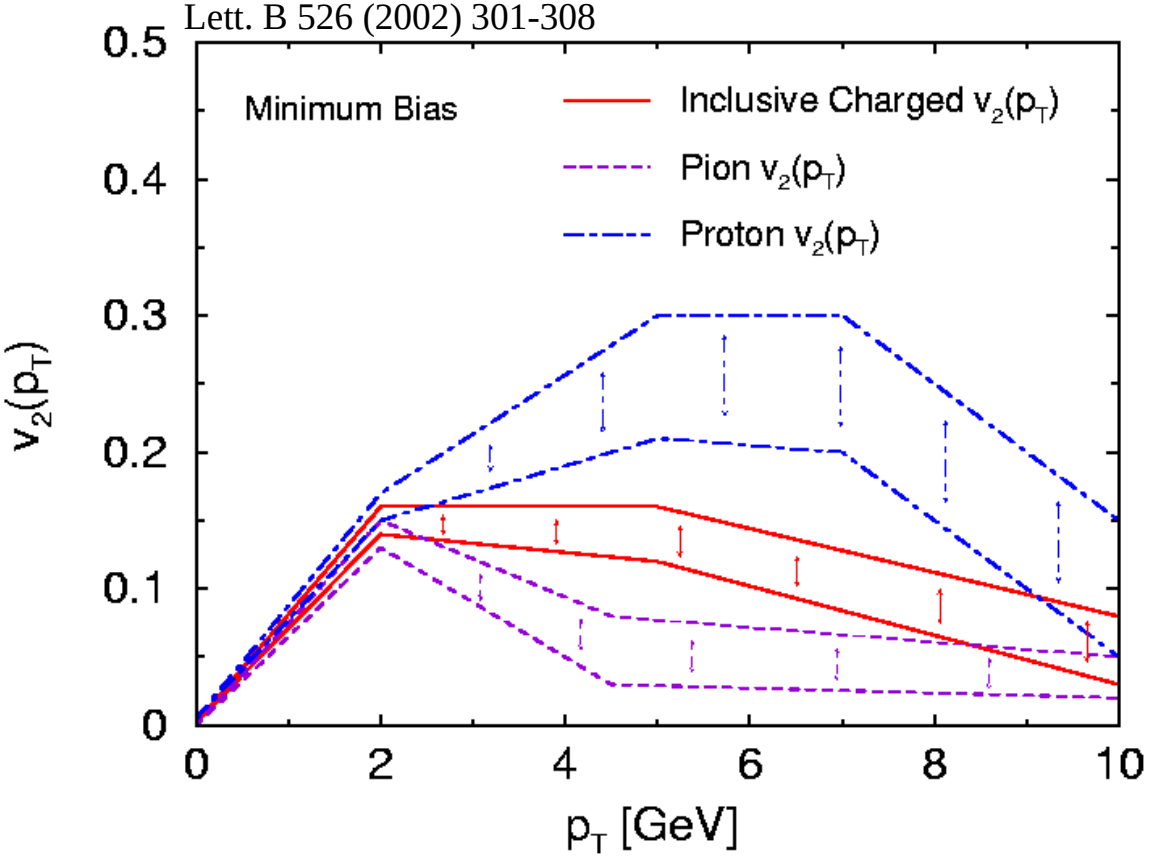
Au+Au at sqrt(s_{NN})=200GeV
min. bias r.p. |η|=3~4





$v_2(p_t)$ proposed scenario

M. Gyulassy, I. Vitev, X.N. Wang and P. Huovinen, Phys. Lett. B 526 (2002) 301-308



Summary

- The analysis of event anisotropy with respect to the reaction plane has started at PHENIX.
- Different reaction planes to extract anisotropy are compared and the results are consistent.
- v2 parameter of charged particle is saturated over 2 GeV/c.
- v2 parameters of identified particles ($\pi^{+/-}$,$K^{+/-}$,p,pbar) are measured and the behavior of v2 above 2 GeV/c are different from the prediction by hydro-dynamical model.