Elliptic flow of electrons/positrons in 200 GeV Au+Au collisions at RHIC-PHENIX

Shingo Sakai

Univ. of Tsukuba

for the PHENIX Collaboration

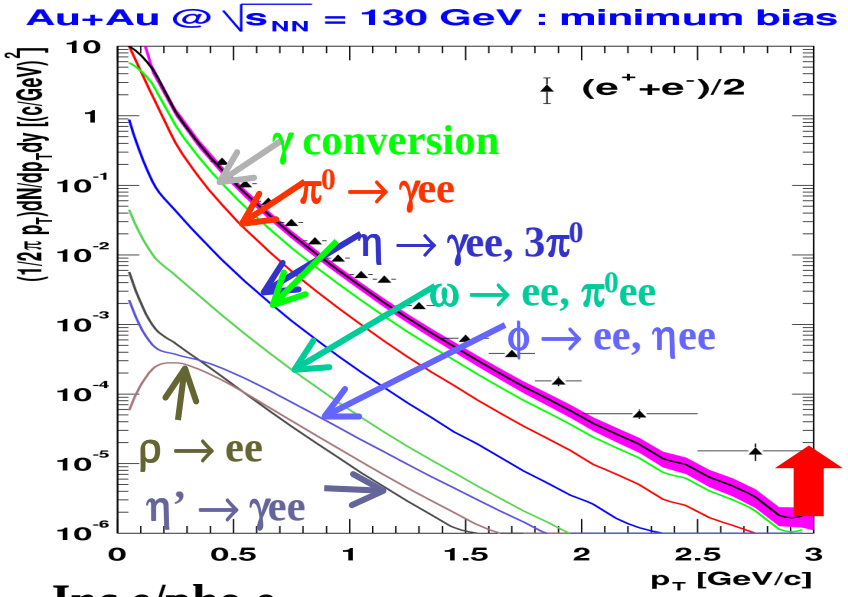
Motivation(1)

From Run1 result

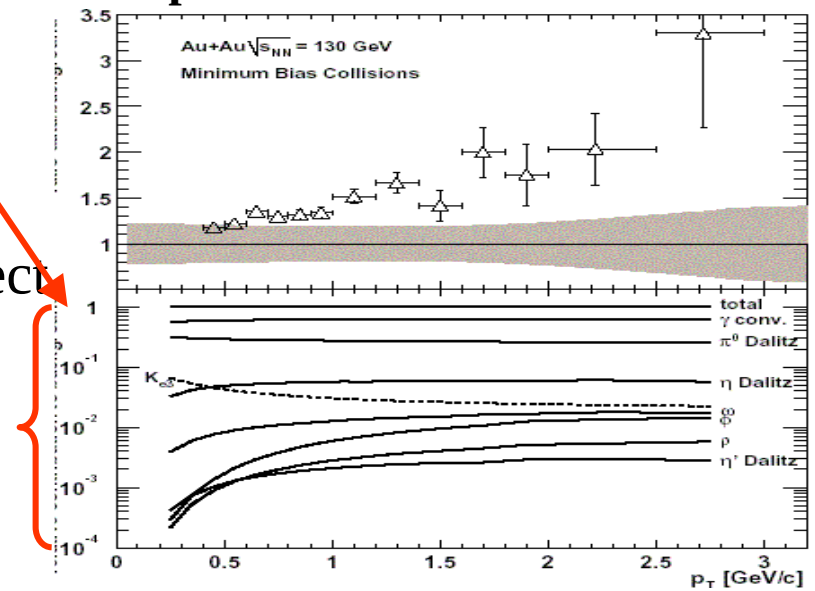
(PHENIX: PRL 88(2002)192303)

Electron source

- **Dalitz decays**
- **Di-electron decays**
- **Photon conversions**
- **Kaon decays**
- **Thermal dileptons**
- **charm decay**
- **beauty decay**



Inc.e/pho.e

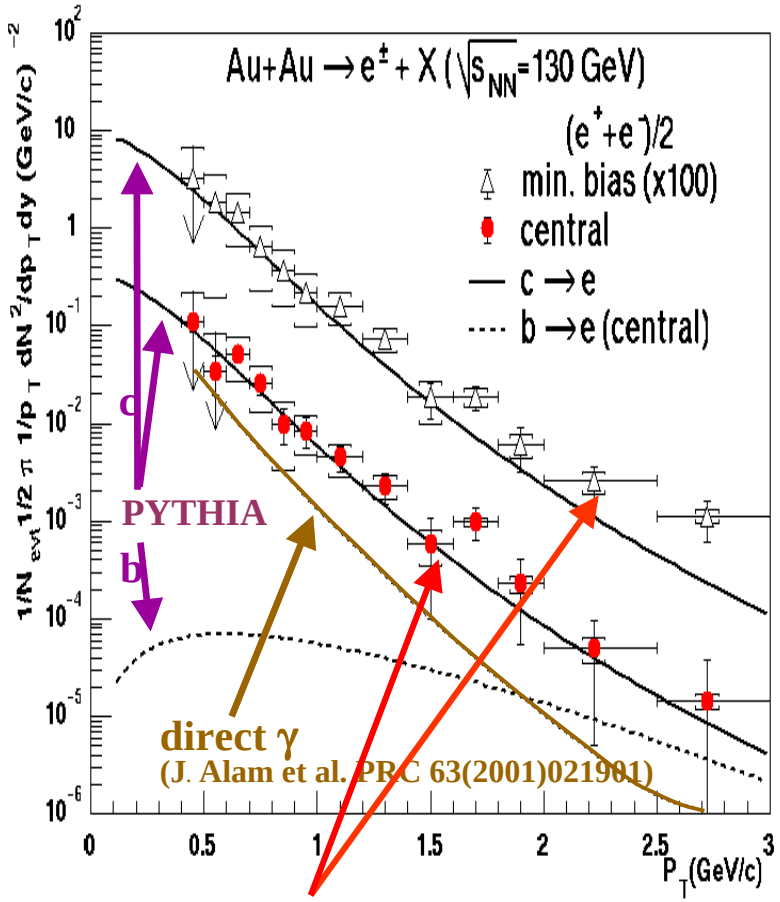


- Clear excess about 1 GeV/c with respect to photon conversion and light hadron decay.

Motivation(2)

- The photonic-subtracted electron single spectra consistent with charm decay (binary scaled).

"The high p_t electron v_2 can carry information about the anisotropy of the parent charmed mesons. "

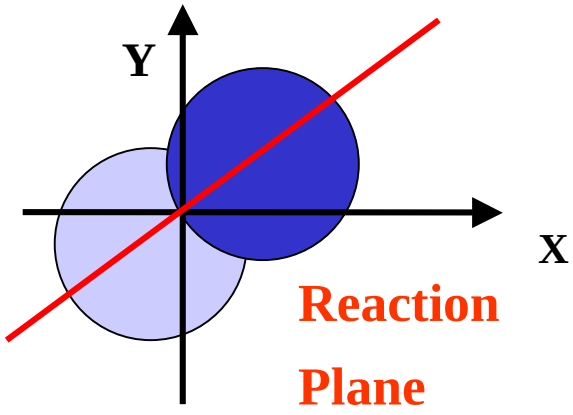


photonic-subtracted electron

Measurement of v_2^e

<<Reaction Plane Method>>

Measure azimuthal angle of each particle with respect to the reaction plane

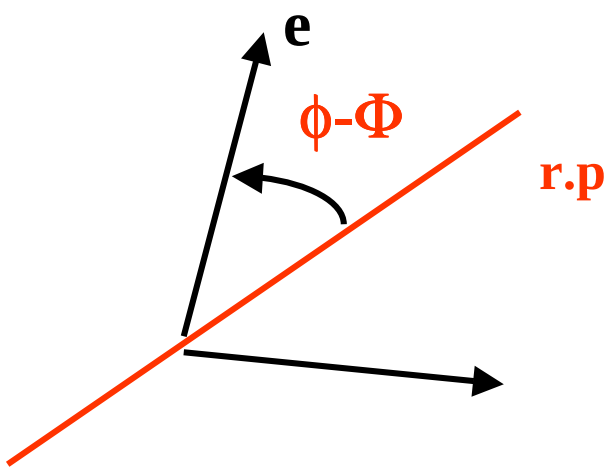


$$dN/d(\phi-\Phi) = N\,(1 + 2v_2^{obs}\cos(2(\phi-\Phi)))$$

Φ : azimuthal angle of reaction plane
ϕ : azimuthal angle of electrons
v_2^{obs}: strength of azimuthal anisotropy
(fitting of $dn/d(\phi-\Phi)$ or $v_2=\langle\cos2(\phi-\Phi)\rangle$)
$v_2 = v_2^{obs}/\ \sigma$

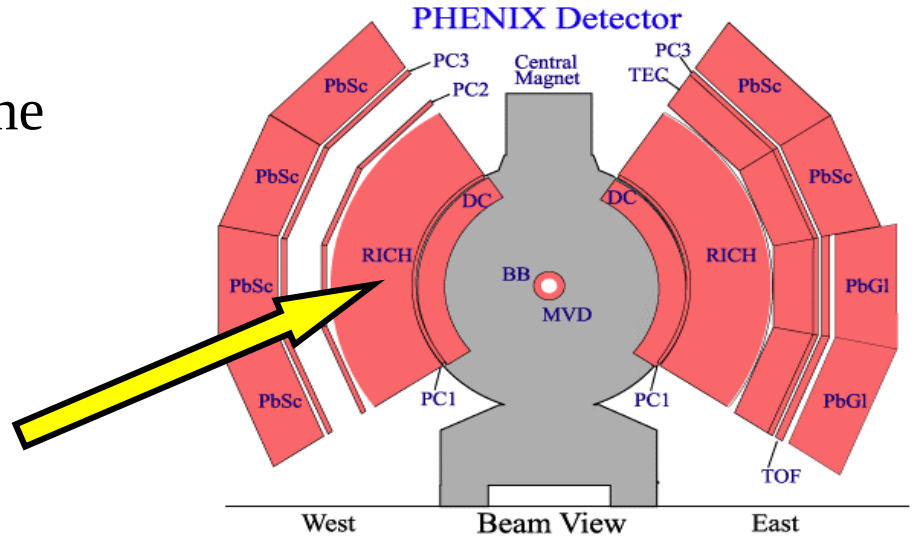
$$\tan 2\Phi_{rp} = \frac{\Sigma\, w_i * \sin(2\phi_i)}{\Sigma\, w_i * \cos(2\phi_i)}$$

$$\sigma = \langle\cos(2(\Psi_m-\Psi_{real}))\rangle$$
$$= \{\langle\cos(2(\Psi_A-\Psi_B))\rangle\}^{1/2}$$



Electron measurement at PHENIX

The PHENIX experiment has the unique capability to measure electrons at RHIC



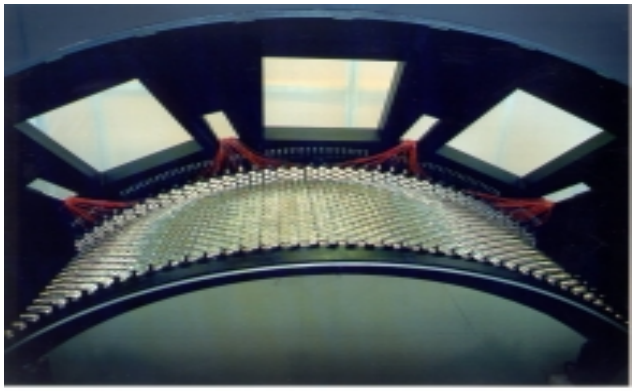
Electron identification :

Cherenkov light in RICH

- $|\eta| \leq 0.35$
- p_t 0.2~4.9 GeV/c

• Number of hit PMT

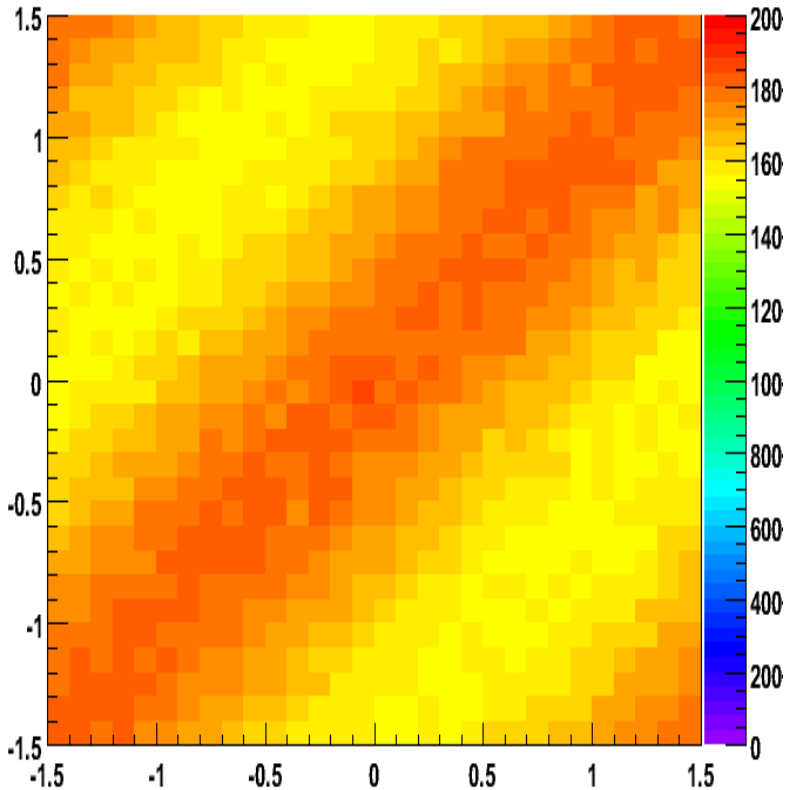
• Ring shape

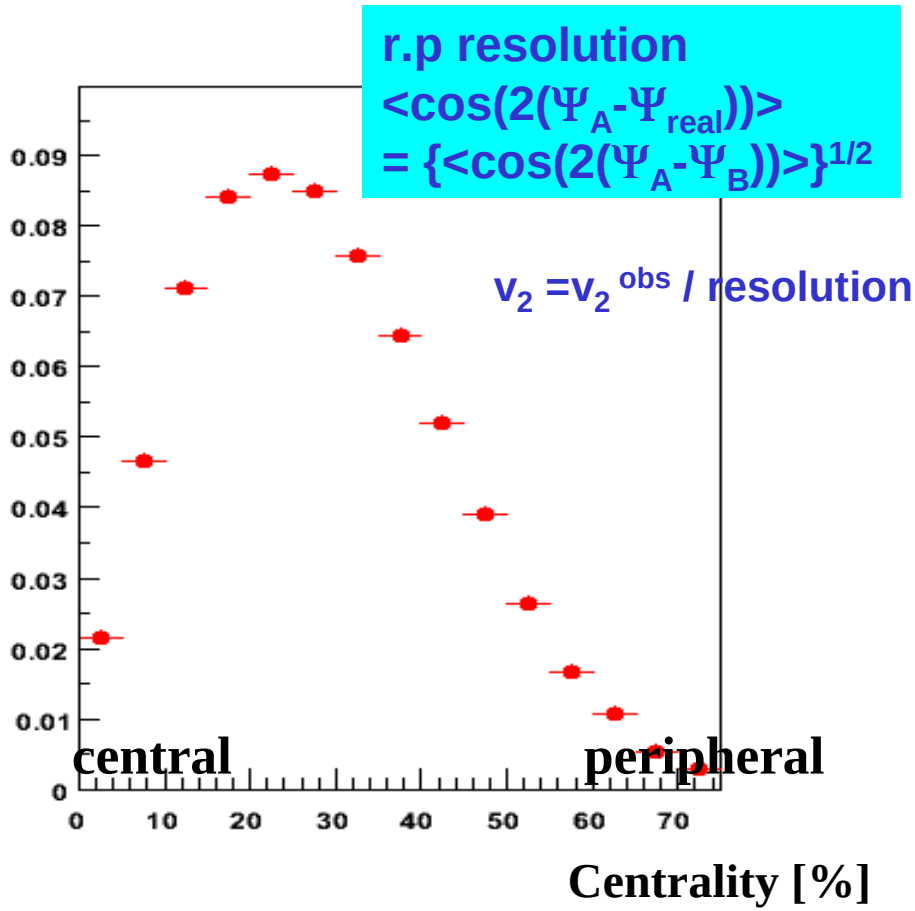


Reaction plane

Determine r.p using BBC north and south

Correlation r.p $_{BBC_north}$ & r.p $_{BBC_south}$



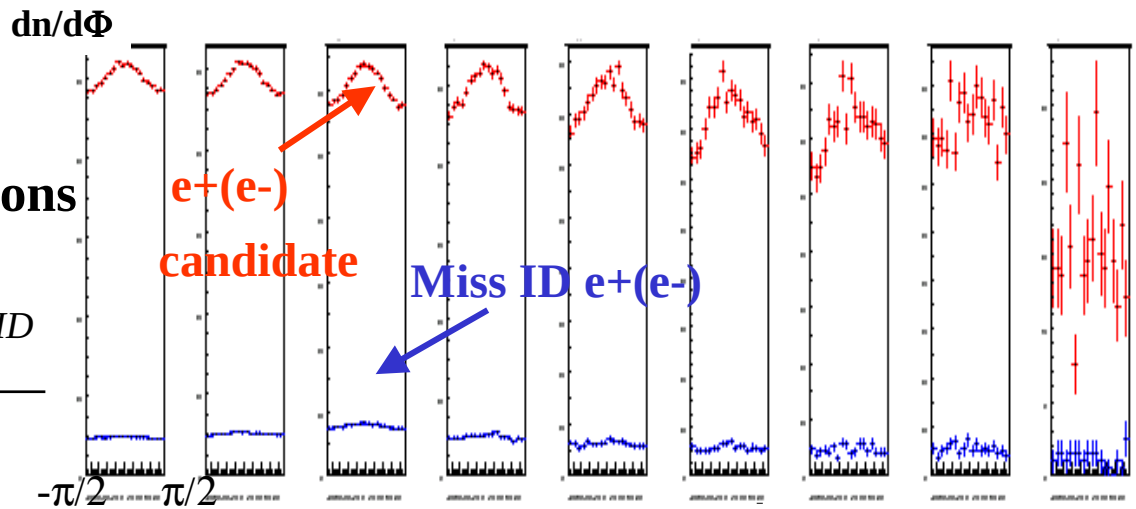


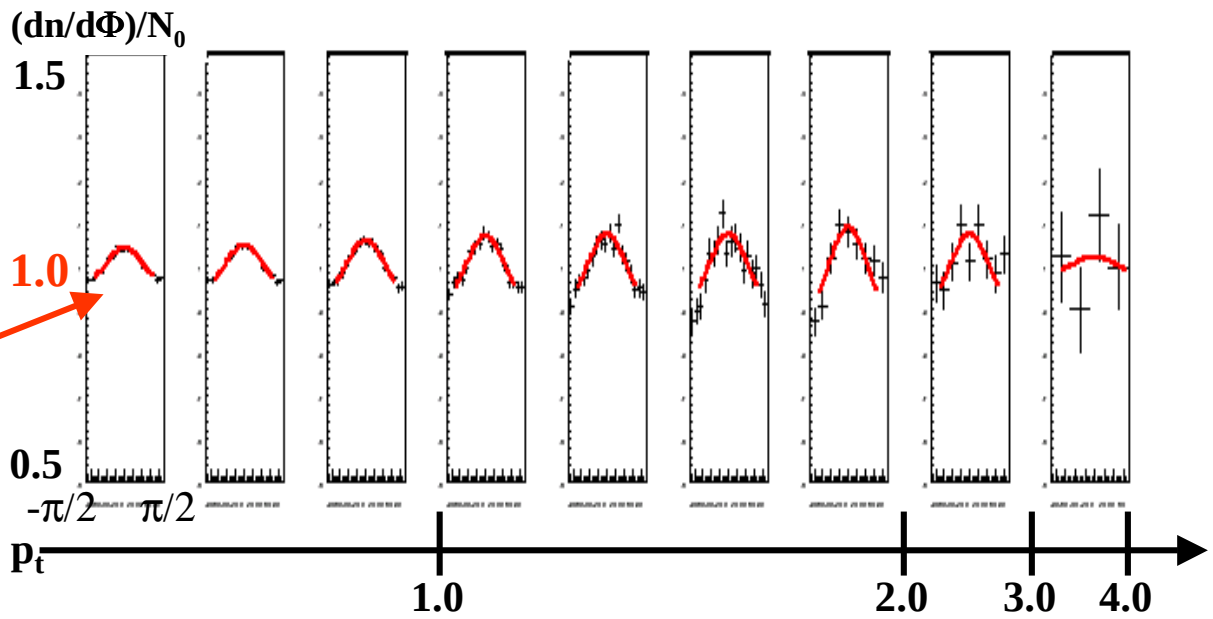
dn/dΦ distribution

v_2^e is corrected by subtracting miss ID of electrons

$$\frac{dN^{corr}}{d\phi} = \frac{dN^{cand}}{d\phi} - \frac{dN^{missID}}{d\phi}$$

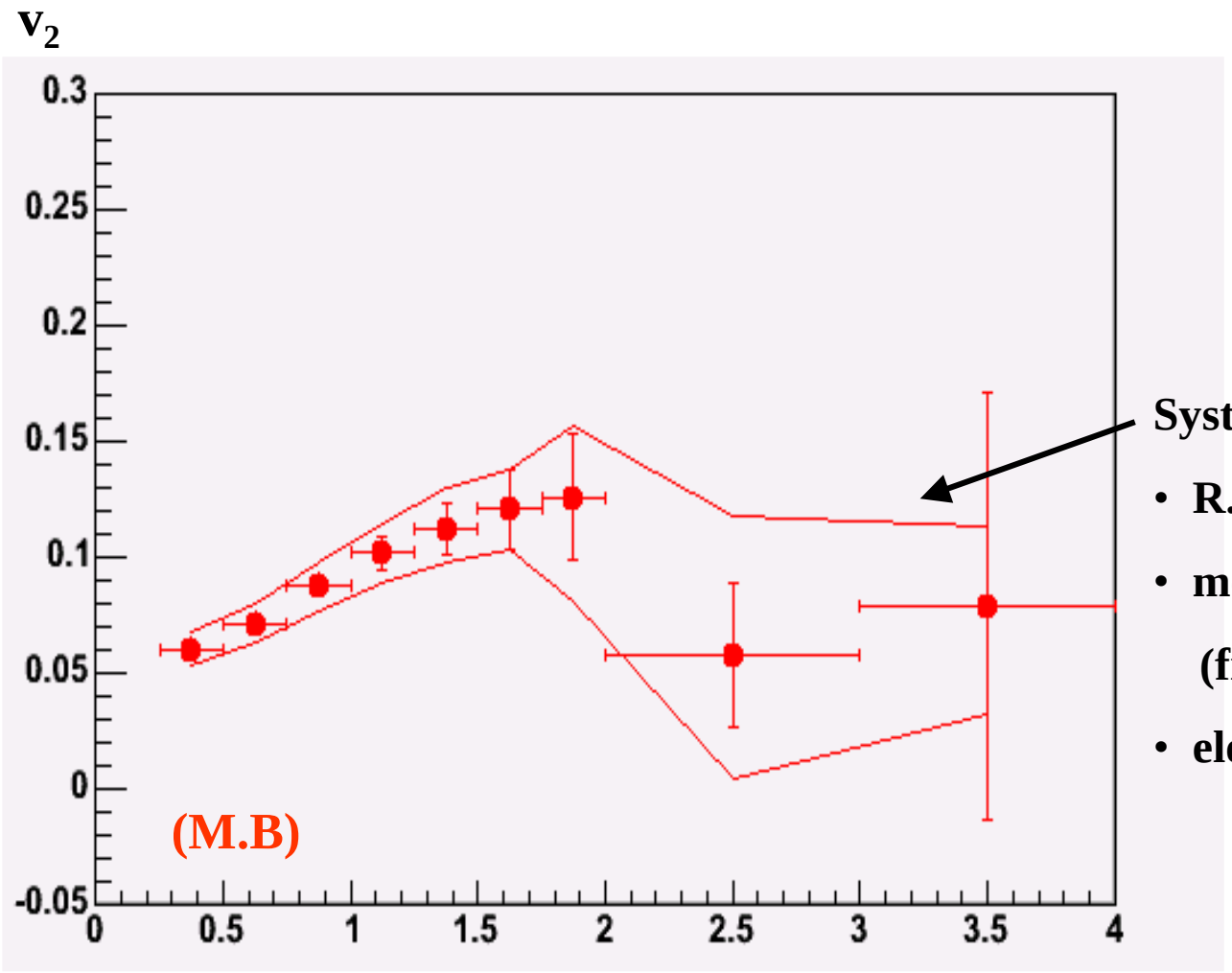
cand --- dn/dphi of candidate (detected RICH) e+(e-)
miss ID --- dn/dphi of miss ID e+(e-)





dn/dΦ of after subtract Miss ID e+(e-)

P_t dependence of $v_{2(e)}$

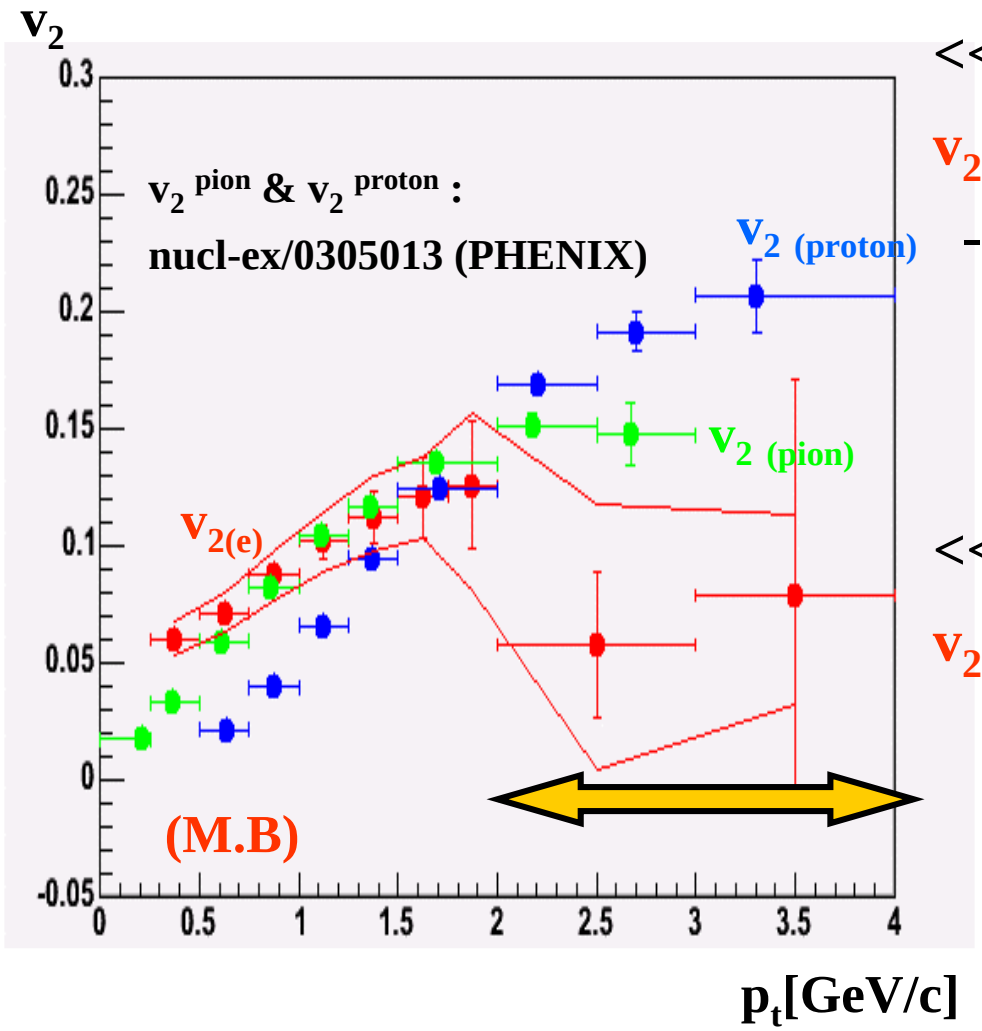


Systematic error

- **R.P**
- **method**

  (fitting / <cos2(Φ)>)
- **electron ID**

Comparison with v_2 of hadrons



<<Low p_t (p_t<1.0GeV/c)>>

$v_{2(e)}$ is larger than $v_{2(pion)}$& v_2 (proton)

-> dominant pi0 decay

- small decay angle
- decay from higher p_t

<<High p_t (p_t>2.0GeV/c)>>

$v_{2(e)}$ seems like smaller than v_2 (pion)

particular interest because of the contributions from heavy-quark (c/b) decays !(but the data include another sources now)

What is needed to estimate charmed electron v_2 ?

$$\frac{dN^e}{d\phi} = \frac{dN^p}{d\phi} + \frac{dN^c}{d\phi} \Rightarrow v_{2(c)} = \frac{v_{2(e)} - r v_{2(p)}}{1-r}$$

- Relative charm yield to the inclusive electron yield at Run2 (r= $\mathbf{N_p/N_e}$)
- electrons v_2 originating photonic source
- Study $v_2^{D\text{->}eX}$ (due to large Q value)

Summary

- Azumithal anisotropy of inclusive electrons/positrons are measured with respect to the reaction plane in 200 GeV Au+Au collision at RHIC-PHENIX.
- $v_{2(e)}$ is larger than $v_{2\ (pion)}$ & $v_{2\ (proton)}$ at low $p_{t.}$
- $v_{2(e)}$ seems like smaller than $v_{2\ (pion)}$ at high p_t
- Next Run (Au+Au) will start soon.

  much more statistics (error bars will be much smaller)