Forward-Rapidity Azimuthal and Radial Flow of Identified Particles for $\sqrt{s_{NN}}$ = 200 GeV Au+Au and Cu+Cu Collisions

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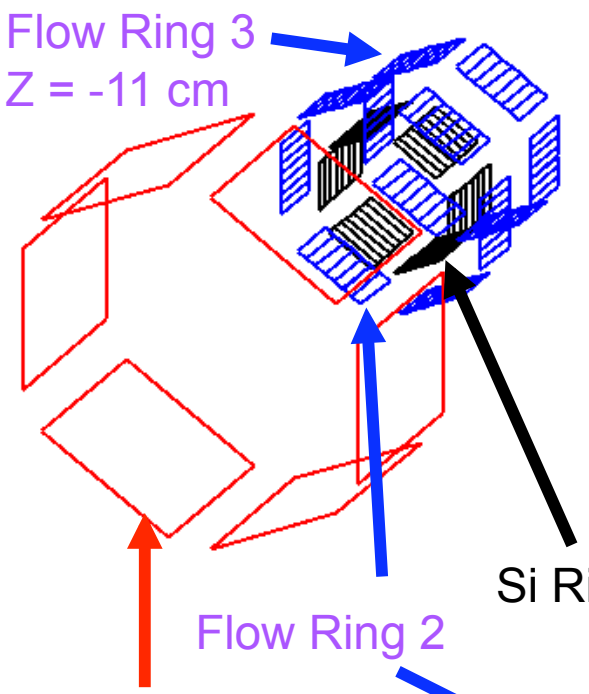
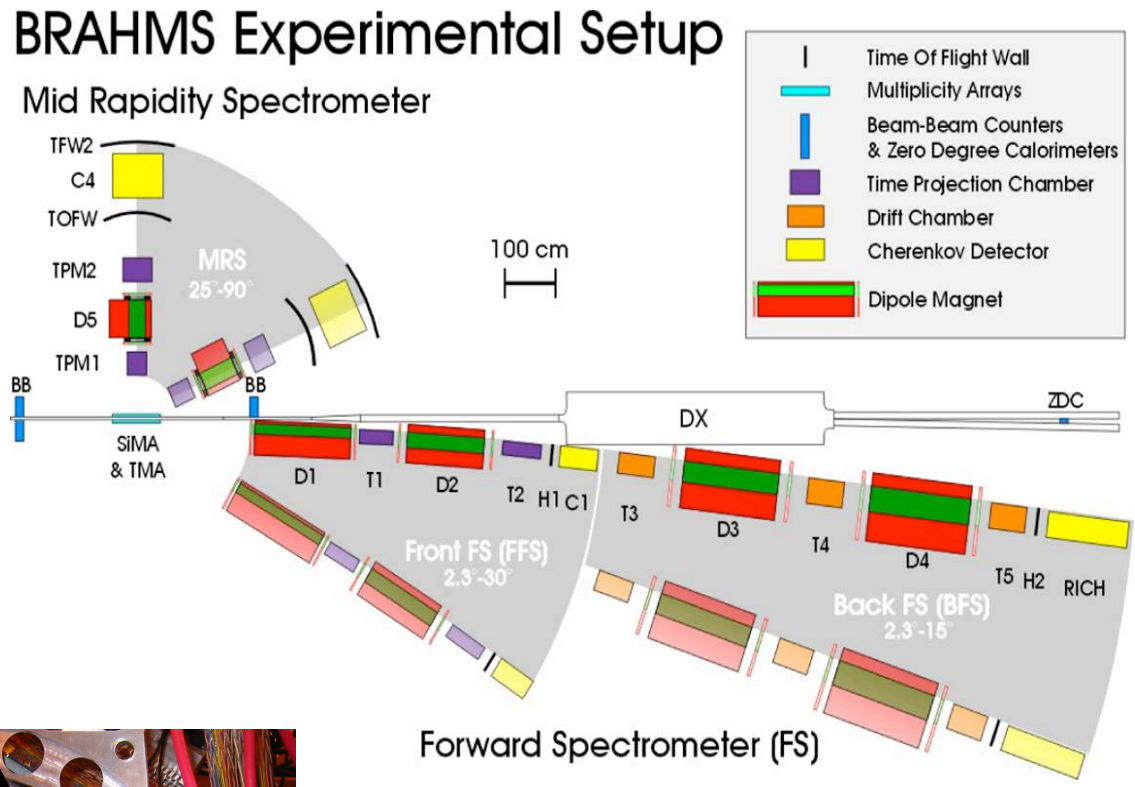
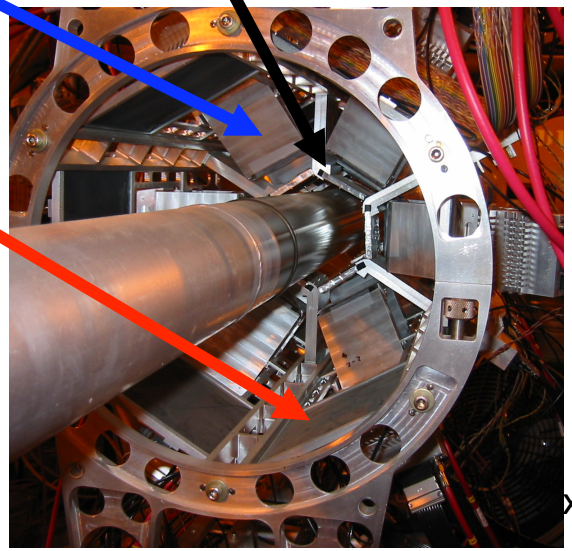
for the BRAHMS Collaboration

I. Experimental Method

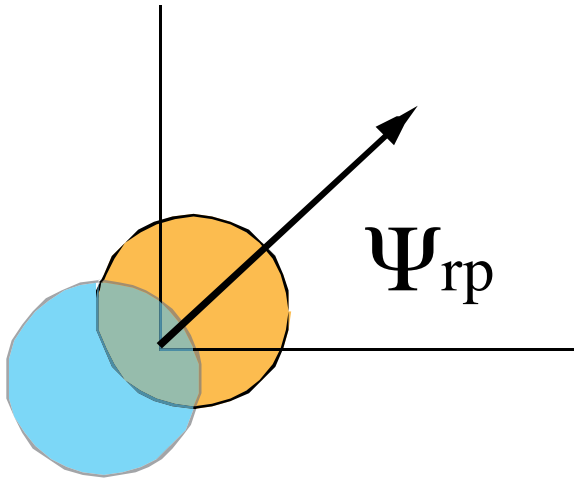






Determine v_2 by reaction plane method

$$\frac{dN}{d\phi} \propto 1 + 2v_2 \cos\left[2(\phi - \Psi_{rp}^{true}\right]$$



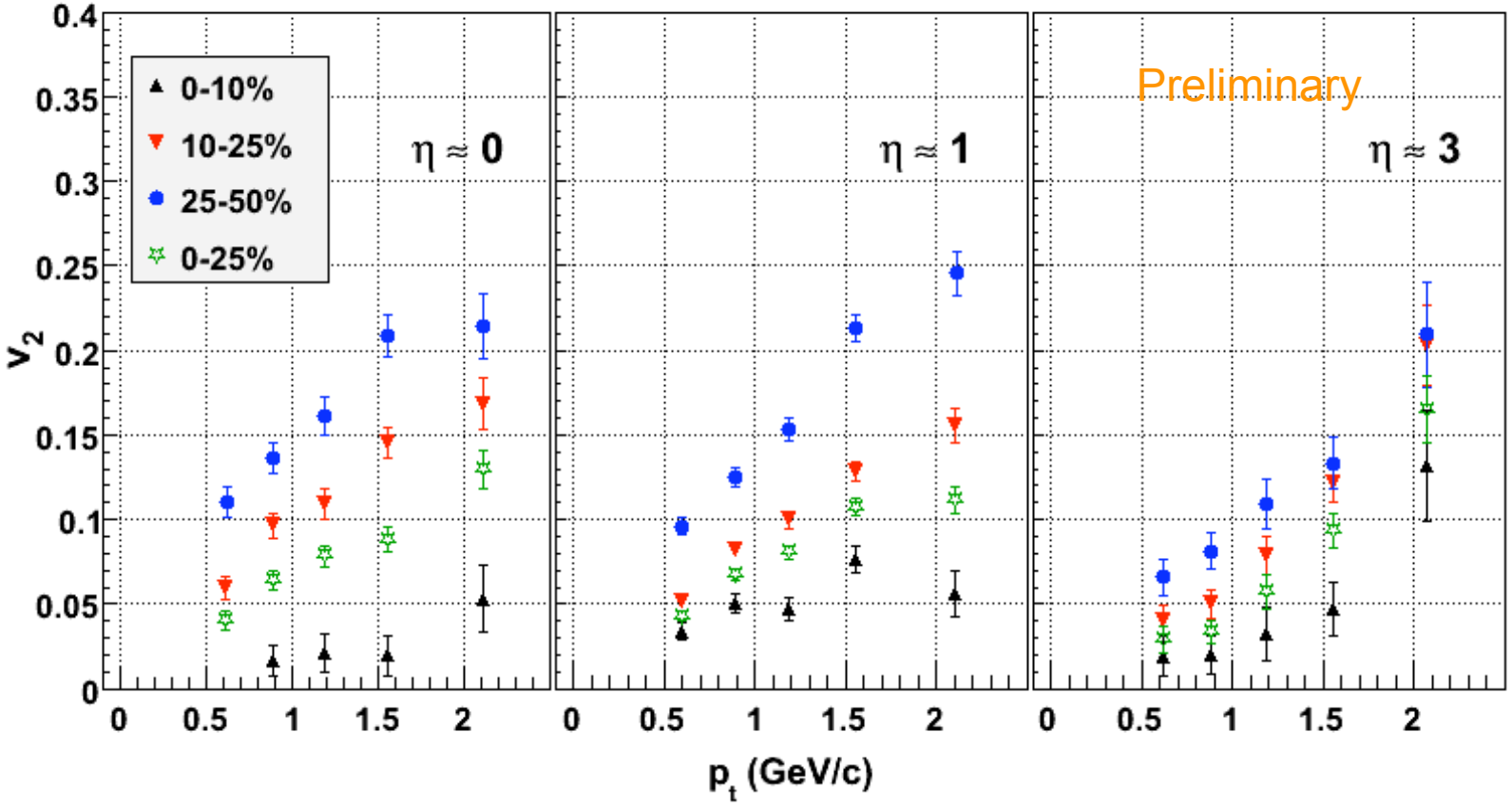
$$\Psi_{rp} = \frac{1}{2}\tan^{-1}\left(\frac{\sum w_i \sin\left(2\phi_i\right)}{\sum w_i \cos\left(2\phi_i\right)}\right)$$

Since Ψ_{rp}^{true} is not measured

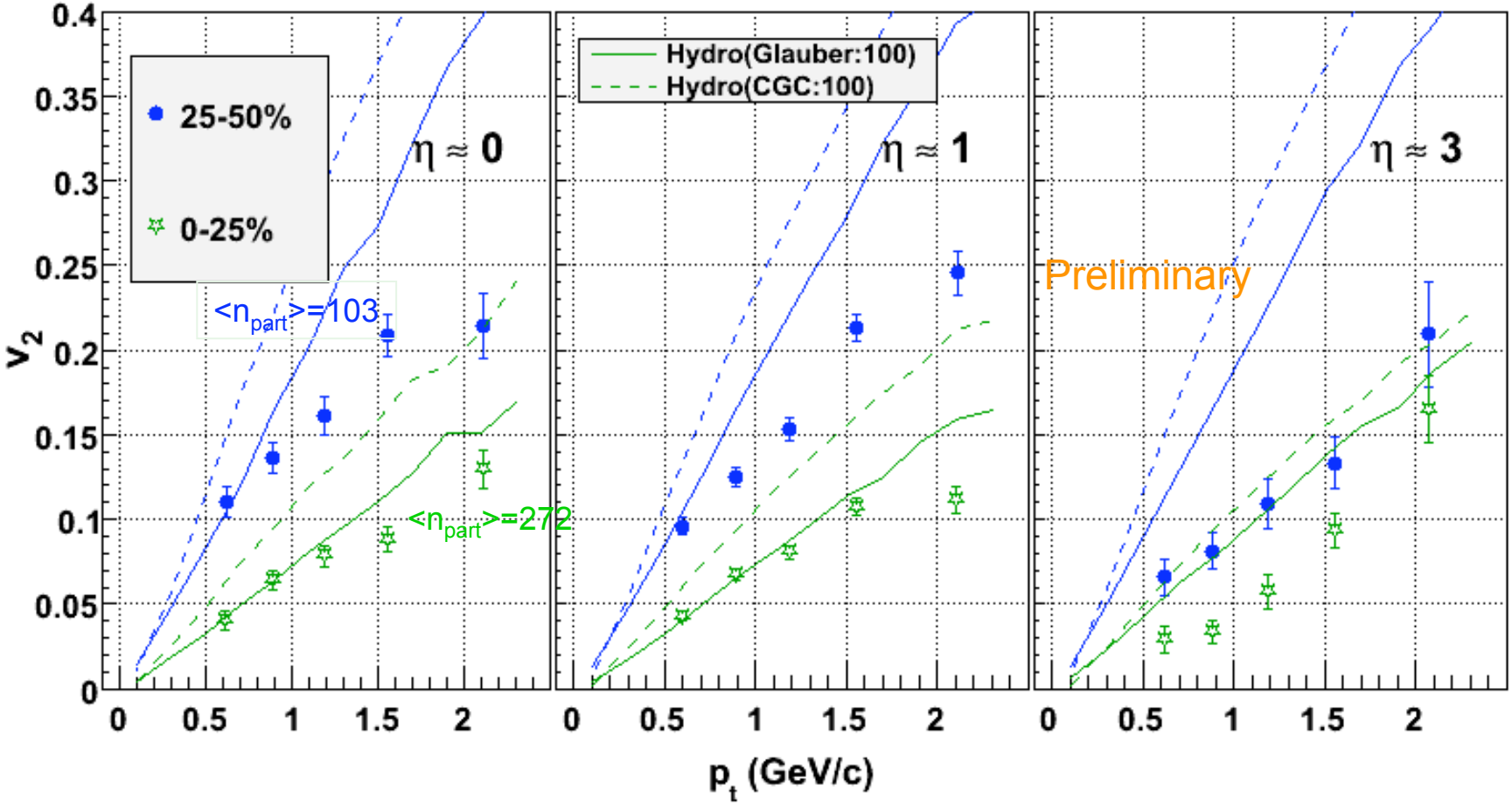
$$v_2 = (resolution\ correction)v_2^{obs}$$

The BRAHMS spectrometers identify particles at ϕ =0° (MRS) and 180° (FS) with the corresponding reaction plane angles Ψ_{rp} determined by the global detector systems.

II. Pseudorapidity dependence of charged-hadron elliptic flow



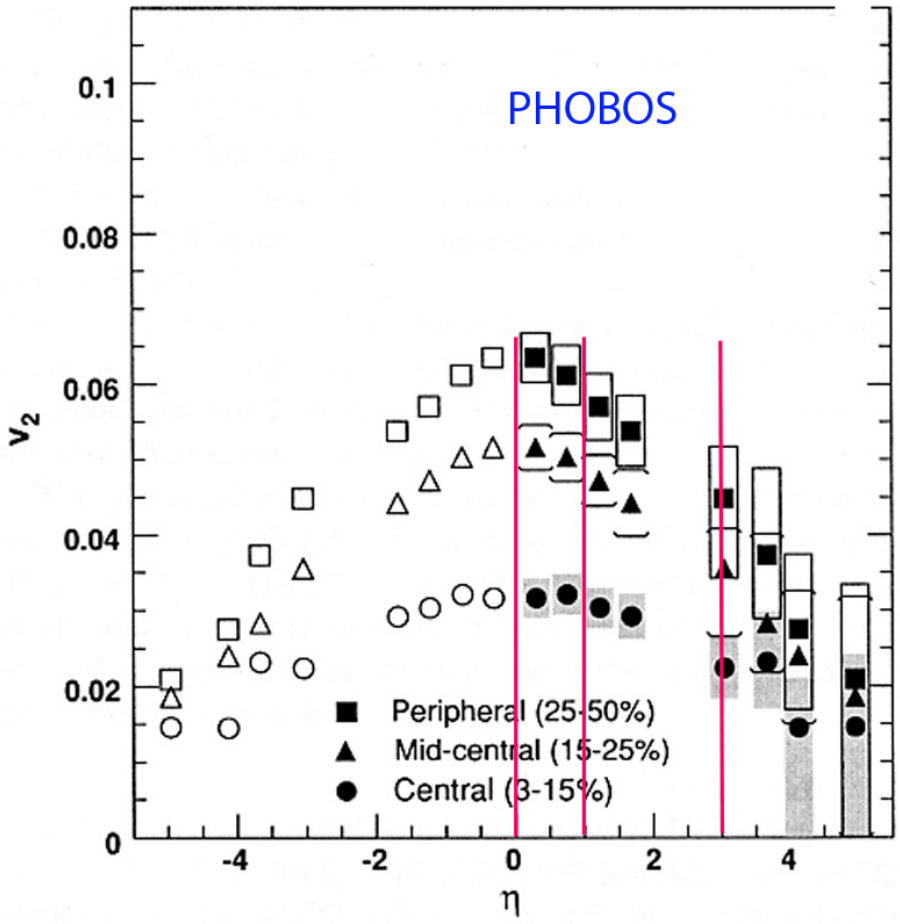
…there is a reduction in the v_2 values at forward rapidities that is most pronounced for the more peripheral events.



T.Hirano and Y.Nara, Nucl.Phys.A743(2004)305

…3D Hydro with Glauber IC has good agreement with experiment at mid-rapidity but predicts larger values than observed at forward rapidity.

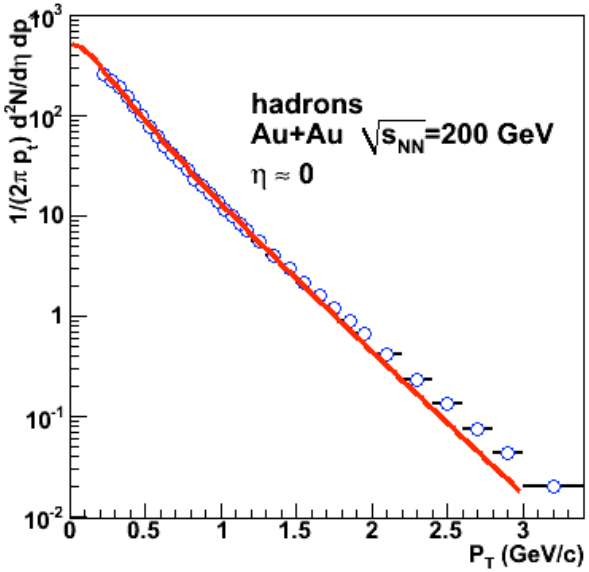
PHYSICAL REVIEW C 72, 051901(R) (2005)

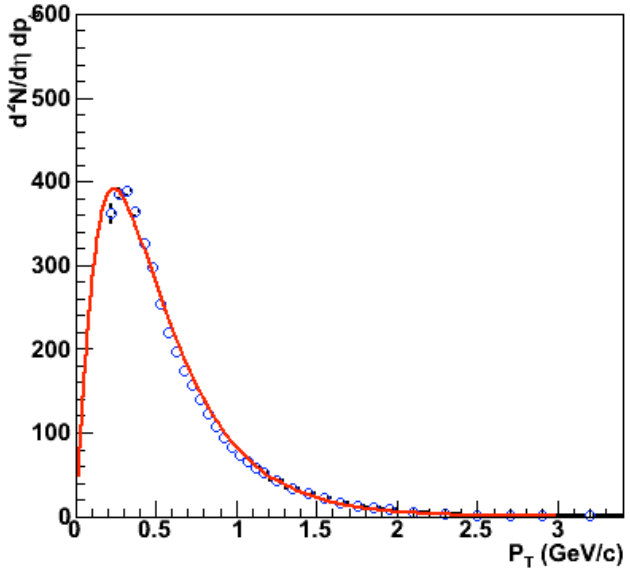


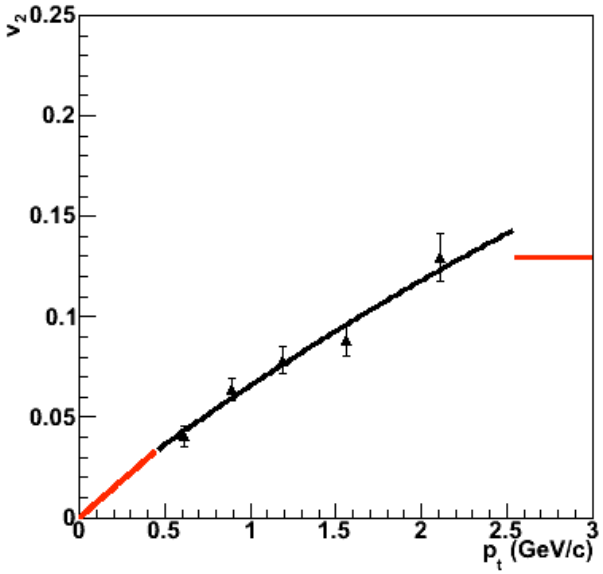
PHOBOS has shown that the integral v_2 values for 200-GeV AuAu fall considerably going to forward rapidity. Is this consistent with the BRAHMS results?

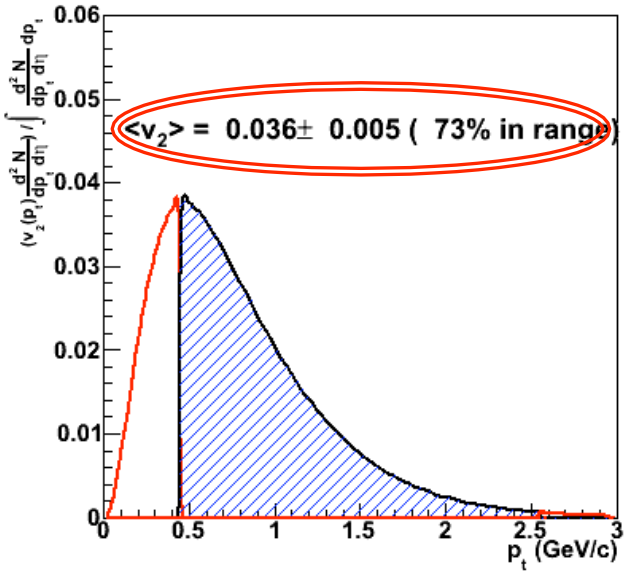
η=0

Calculating the integral v_2 from the differential…



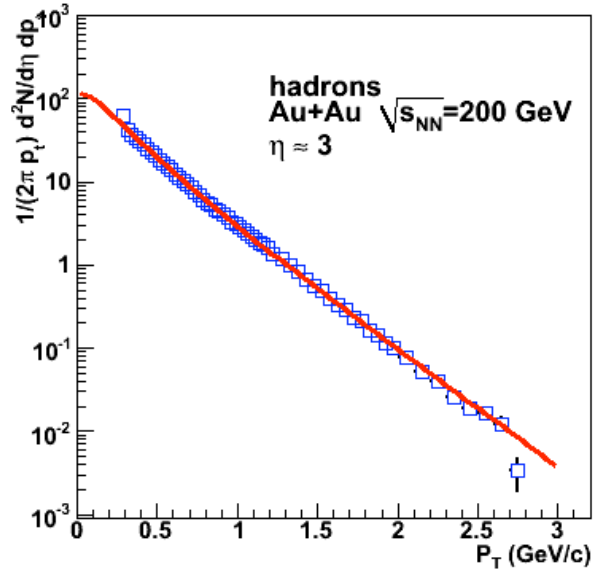


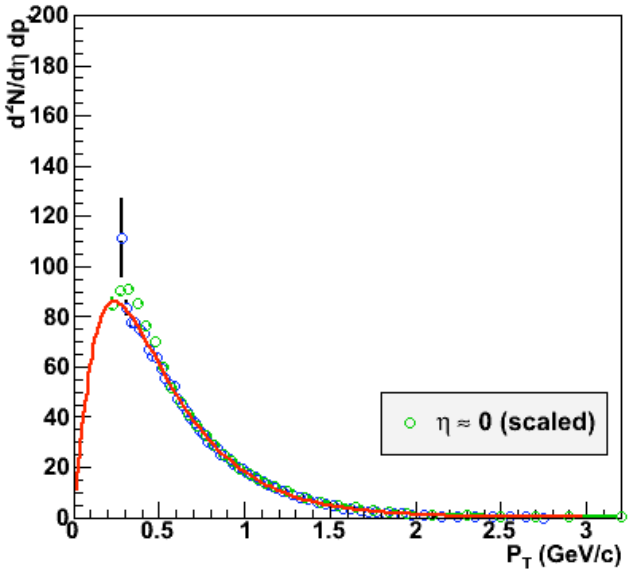


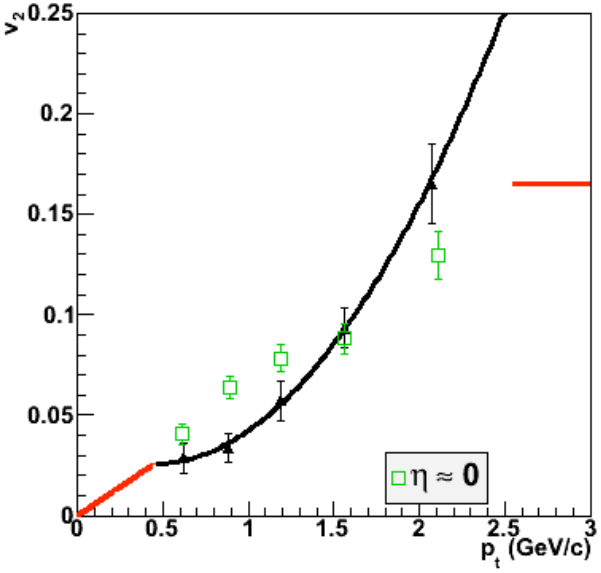


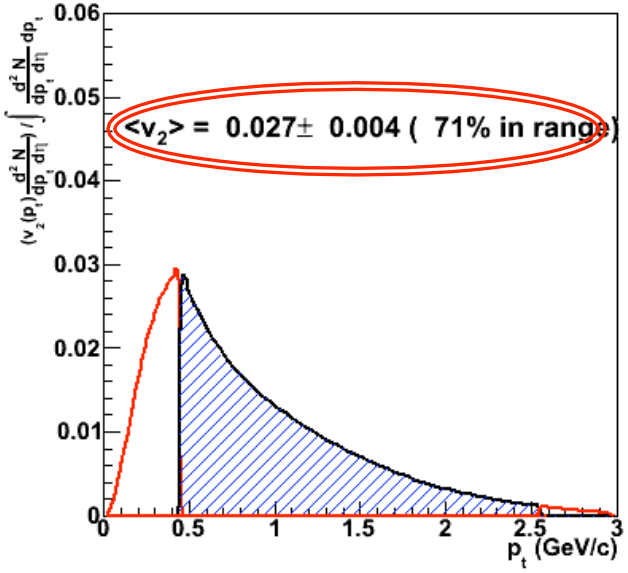
η~3

The integral v_2 values decrease at forward rapidity BOTH because of a reduction of the differential $v_2(p_T)$ values AND a smaller $<p_T>$.

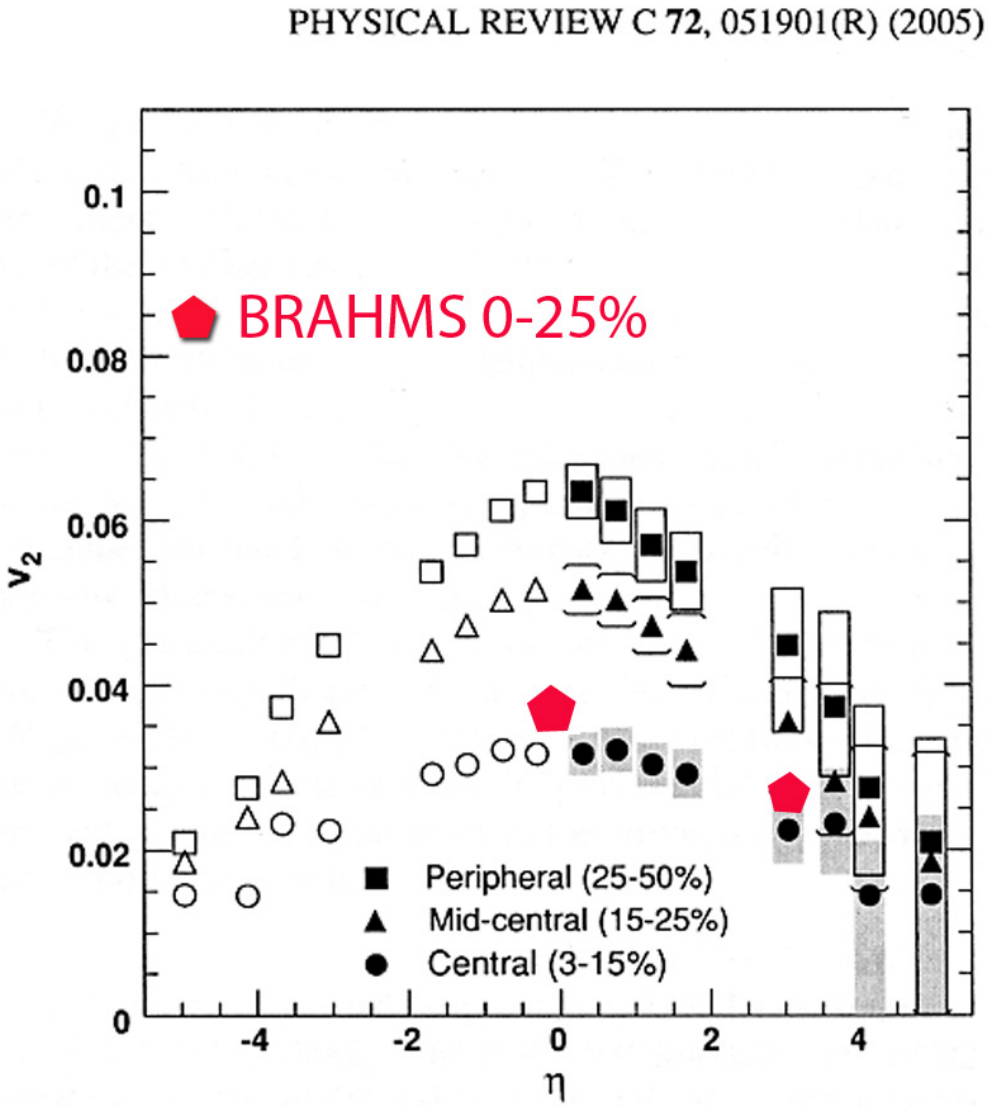




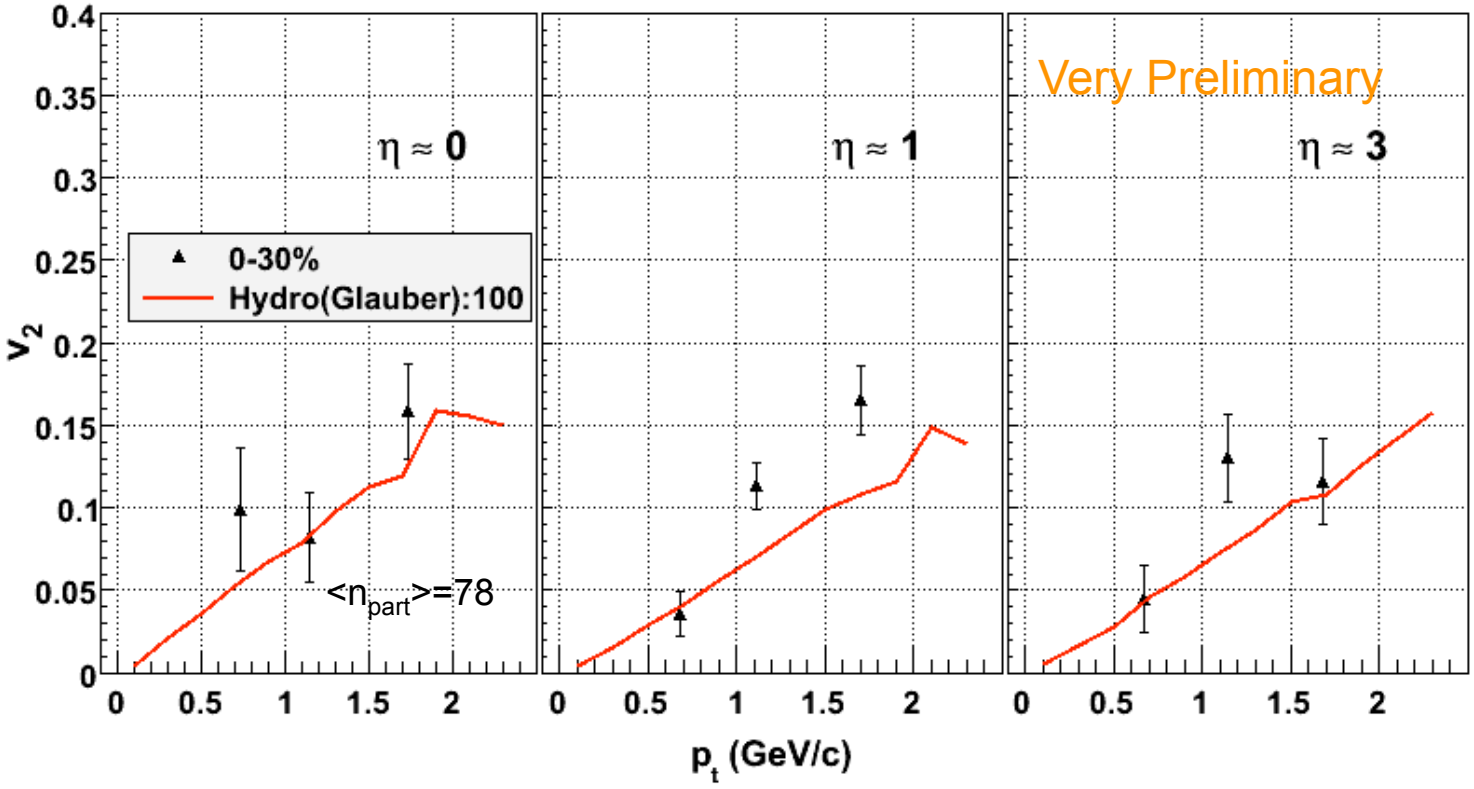




There is general agreement of the BRAHMS integral v2 calculated from the pt distributions to the PHOBOS results…



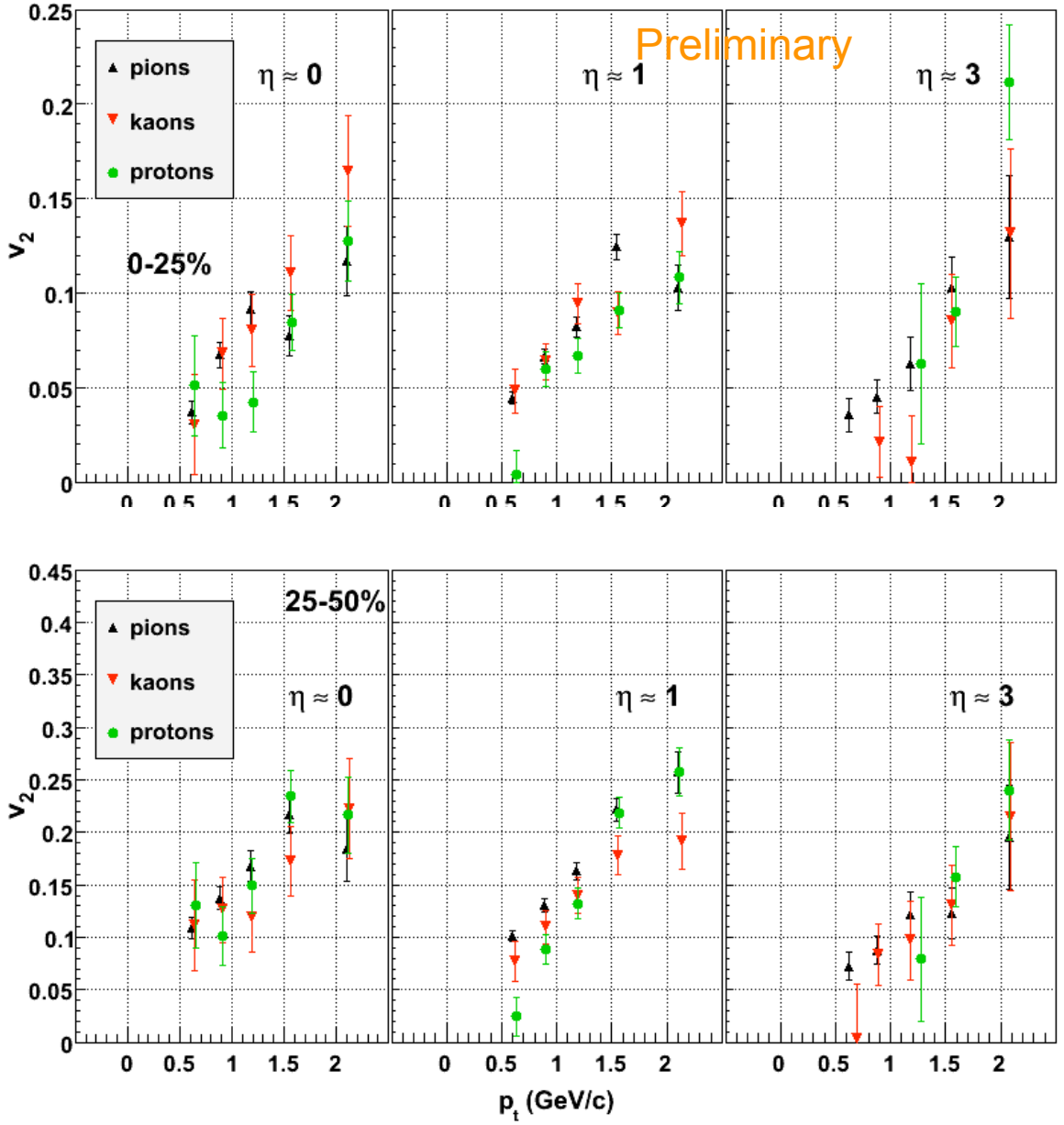
200-GeV CuCu



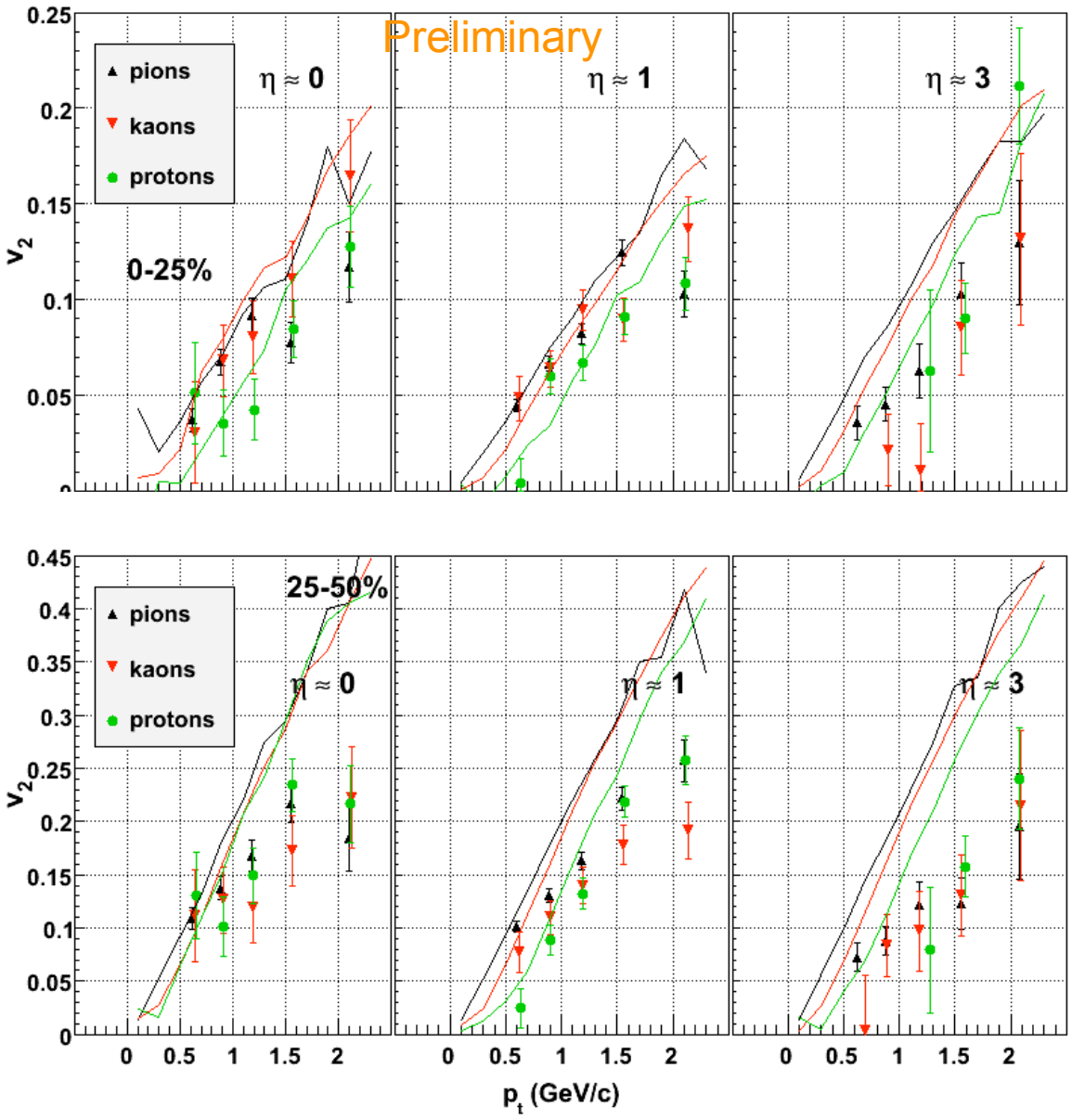
…3D Hydro with Glauber IC does good job in describing data.

III. Identified Particle Results

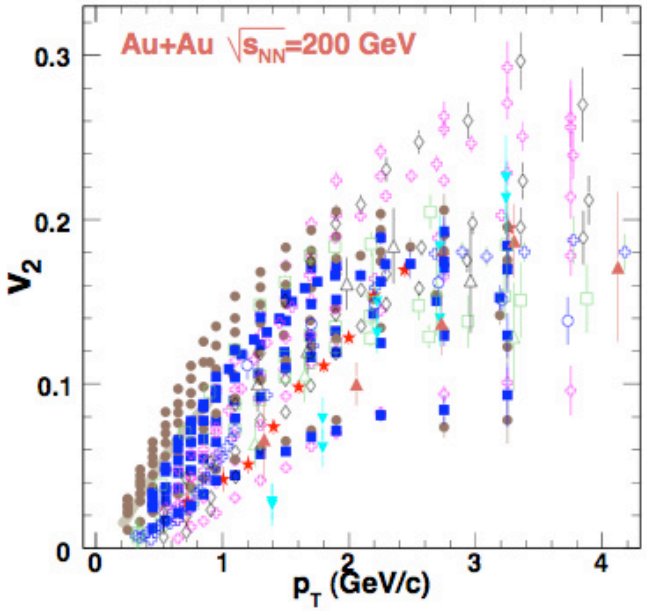
200-GeV AuAu



…again, 3D Hydro does good job describing more central, mid-rapidity results, including the mass ordering.



Constituent quark scaling has been found to highlight a common behavior for 200-GeV AuAu v_2 results for many particle species…

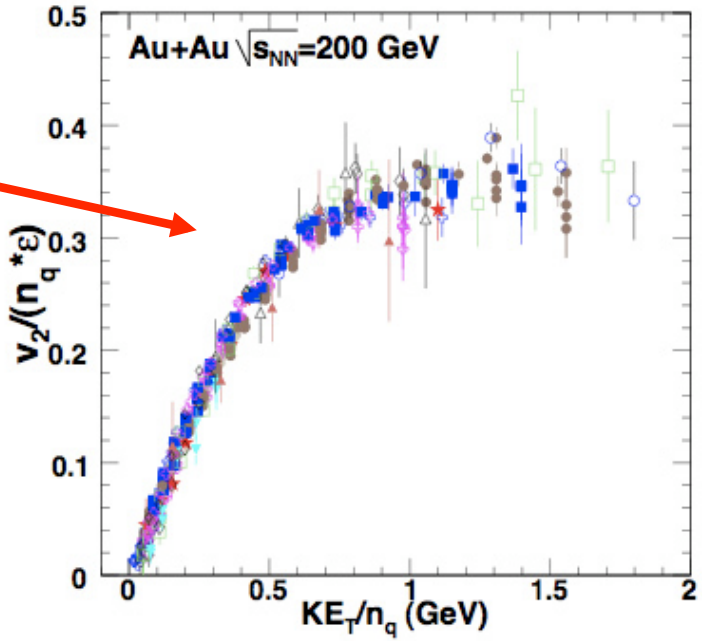


PHENIX (Phys.Rev.Lett.91, Preliminary: QM05, GRC 06)
- $\pi^+ + \pi^-$: min.bias,0-10%,10-20%,20-30%,30-40%,40-50%,20-60%
- π^0 : min.bias
- $K^+ + K^-$: min.bias, 0-10%,10-20%,20-30%,30-40%,40-50%,20-60%
- $p + \bar{p}$: min.bias, 0-10%,10-20%,20-30%,30-40%,40-50%,20-60%
- d : min.bias, 10-50%
- ϕ : 20-60%

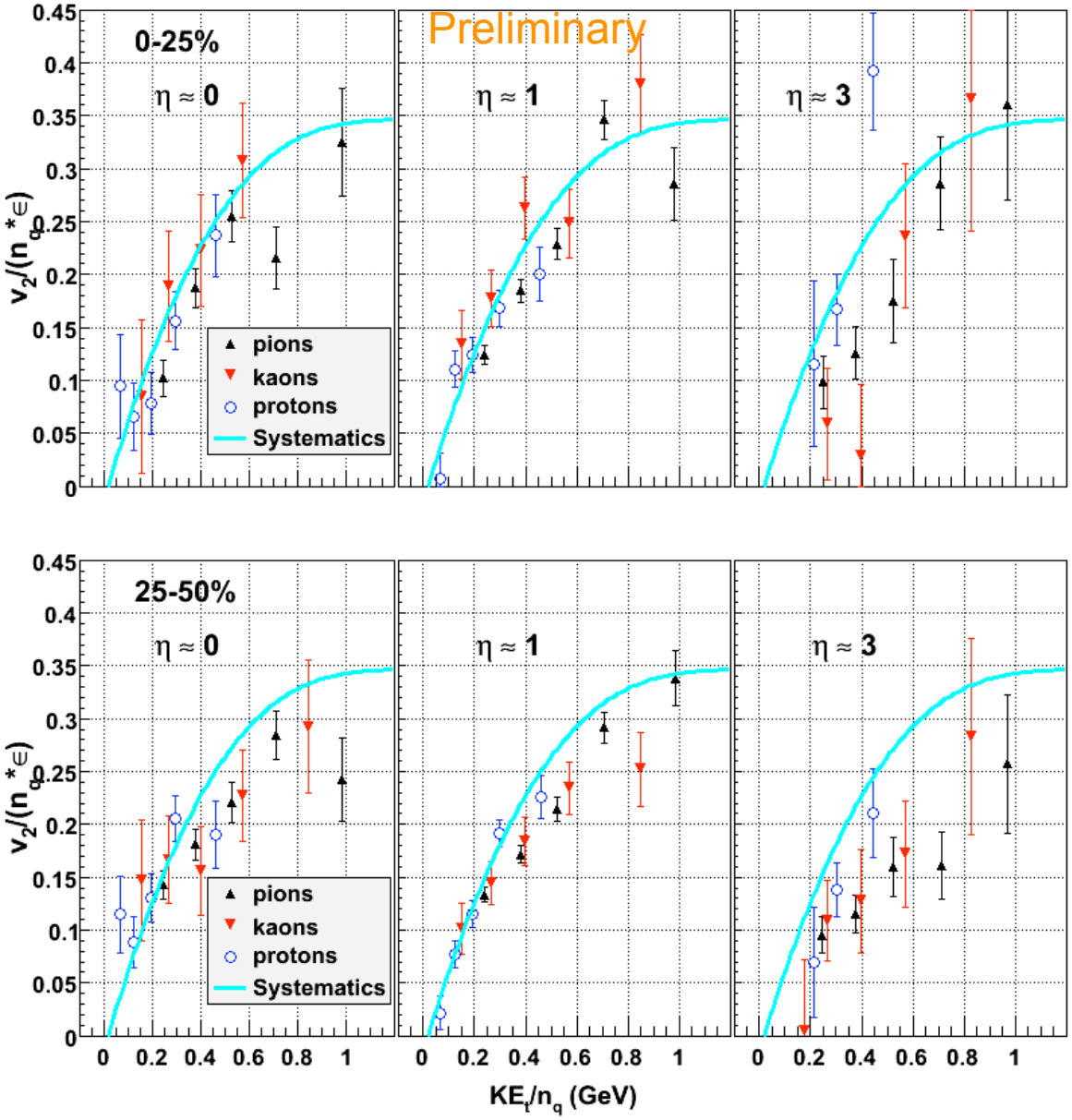
STAR (Phys.Rev.Lett. 92, Phys.Rev.C72(2005), Preliminary QM05,SQM06)
- $\pi^+ + \pi^-$: min.bias
- K^0_S : min.bias, 5-30%,30-70%
- $p + \bar{p}$: min.bias
- $\Lambda + \bar{\Lambda}$: min.bias, 5-30%,30-70%
- $\Xi + \bar{\Xi}$: min.bias
- $\Omega + \bar{\Omega}$: min.bias

R.A. Lacey and A. Taranenko, nucl-ex/0610029

Scaled yields consistent with ideal hydrodynamics..

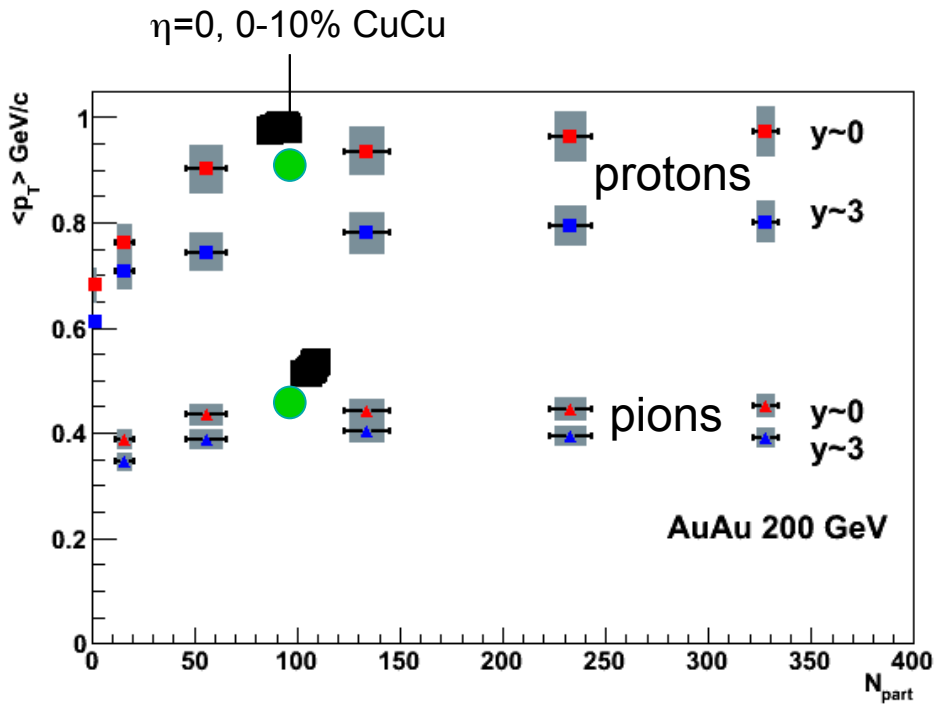


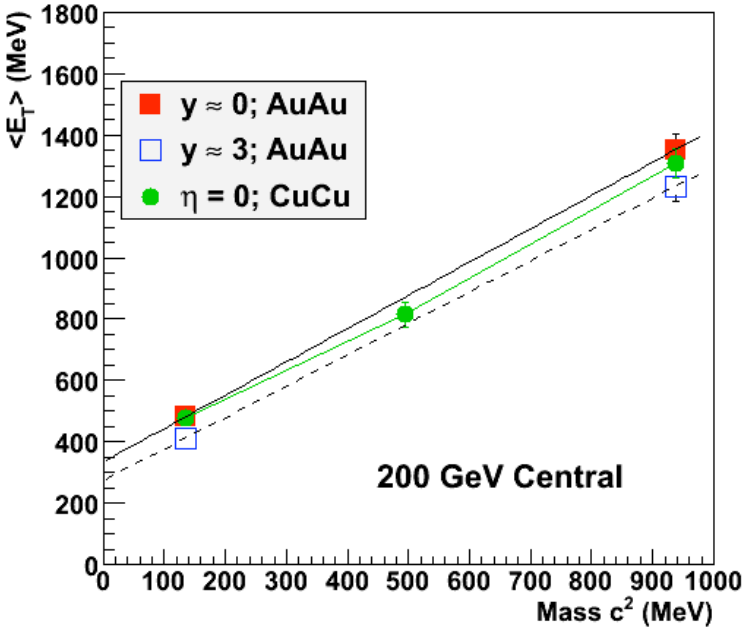
Constituent quark scaling of BRAHMS data..



The curve is based on the previously observed behavior near mid-rapidity…

The reduction in azimuthal flow at forward coincides with an apparent reduction in radial flow, as evidenced by $\langle E_T \rangle$ values…





IV. Summary

•BRAHMS has measured identified-particle $v_2(p_T)$ at η=0,1, and 3 for the Au+Au and Cu+Cu systems at $\sqrt{s_{NN}}$ =200 GeV. The differential elliptic flow decreases at forward rapidity.

•Corresponding measurements of the particle spectra indicate a decrease in $\langle E_T \rangle$ at forward rapidity, suggesting a reduction in radial flow.

•The significant decrease in the integral v_2 values going to forward rapidity is found to arise from BOTH the reduction in differential elliptic flow and a reduction in radial flow.

•3D Hydro does a good job reproducing the mid-rapidity results for both charged hadrons and identified particles, but predicts too large v_2 values at forward rapidity.

The BRAHMS Collaboration

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