BRAHMS Identified Particle $v_2(p_t,y)$ Analysis

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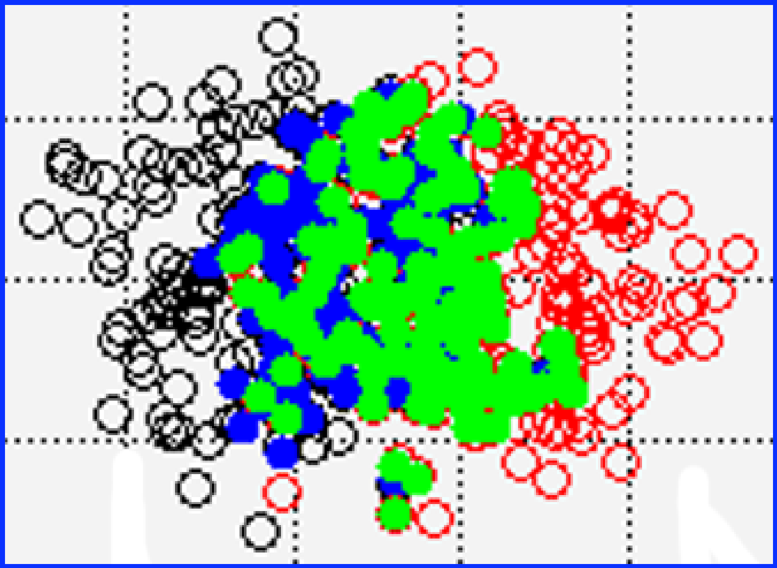
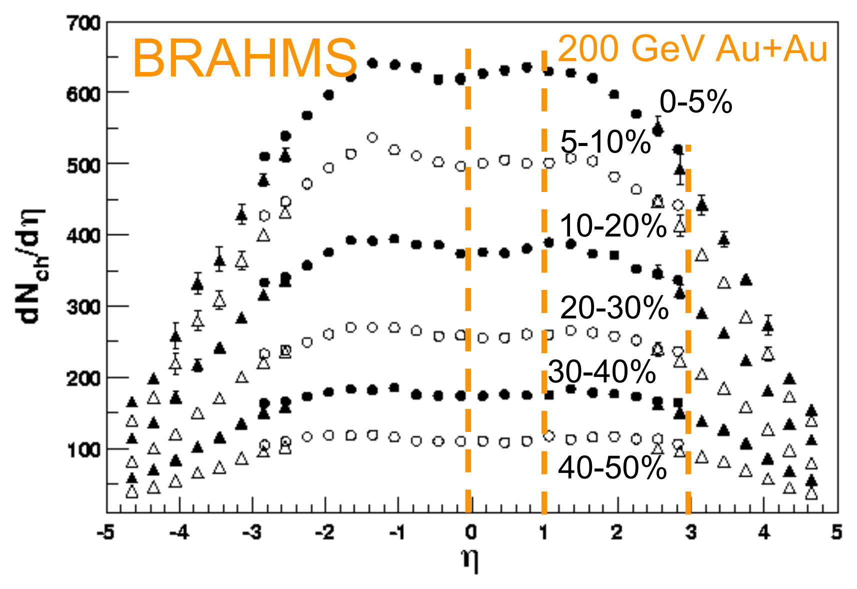
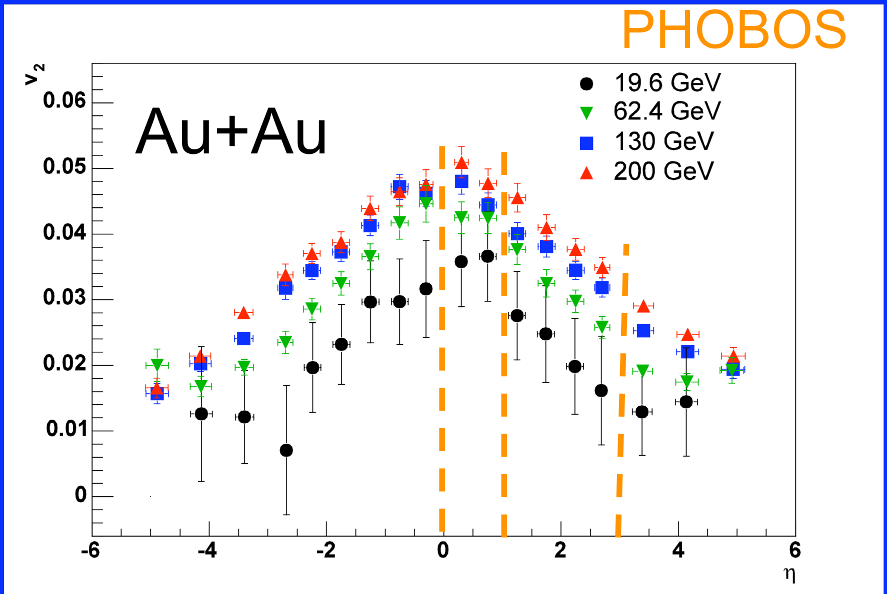


BRAHMS explores the longitudinal behavior of RHIC reactions. What changes going to forward rapidities?



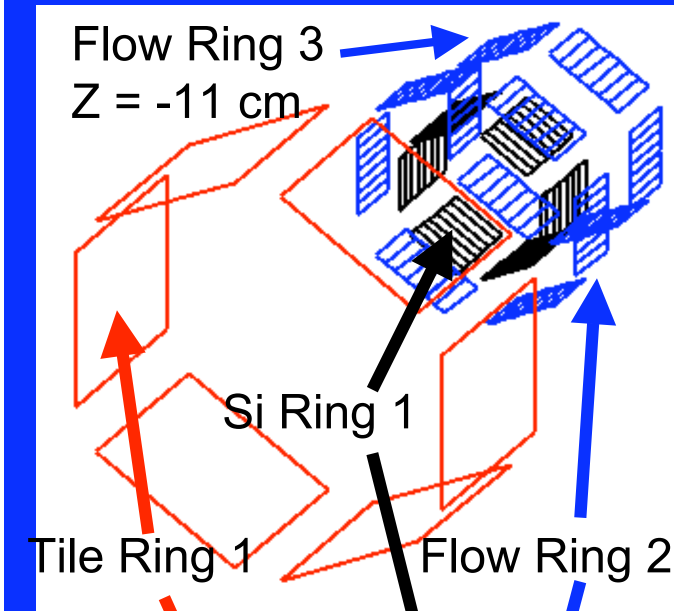


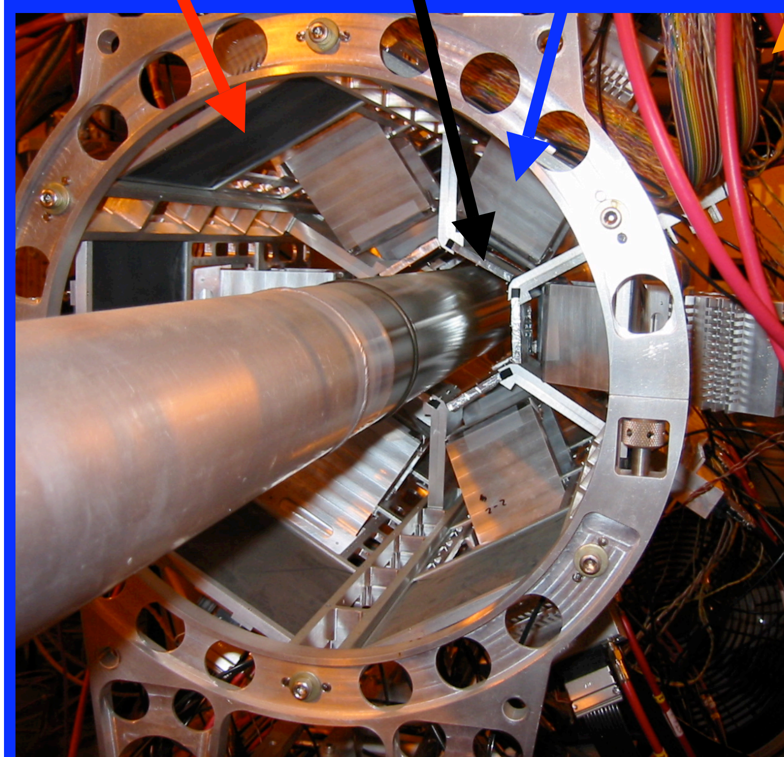
From η~0 to η~3, $dN_{ch}/d\eta$ drops about 25%…

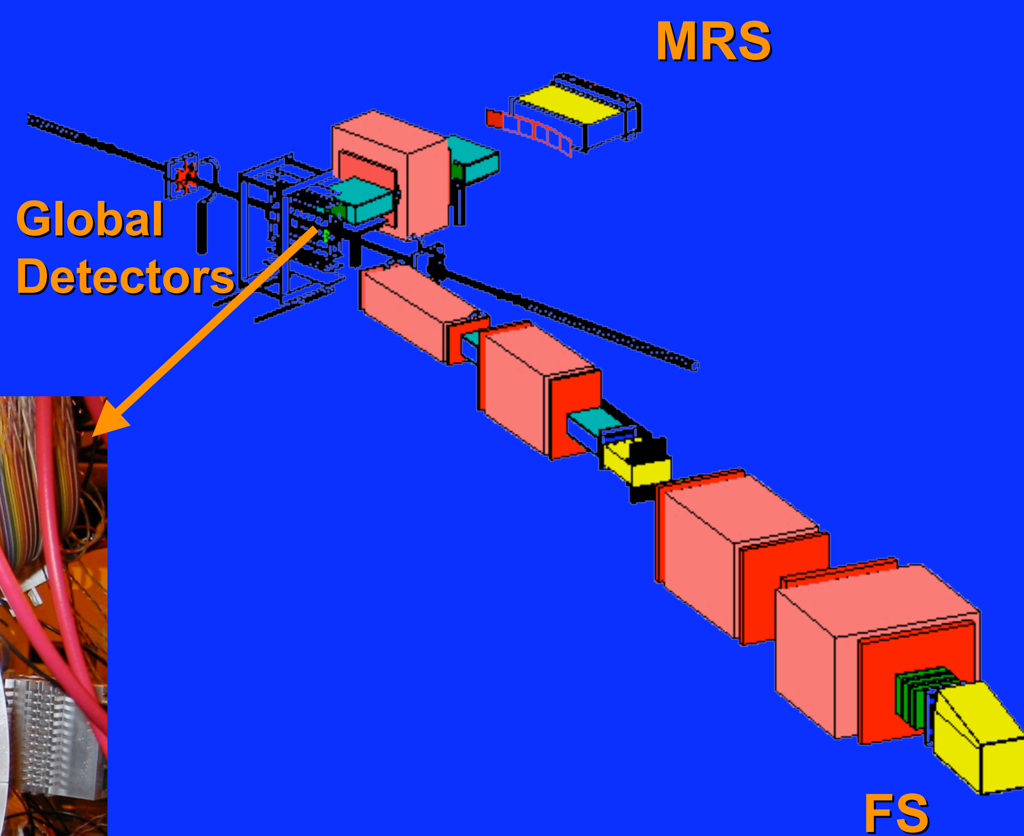
…and v_2 is reduced about 40%.

How does identified particle $v_2(p_T)$ change in going to forward angles?

BRAHMS Experimental Arrangement







Spectrometer arms measure identified particle v_2, while global detectors determine reaction plane.

Determining Reaction Plane with Multiple Detector Subsystems

$$\frac{d^3N}{2\pi p_T dp_T dy d(\phi - \Psi_R)} = \frac{d^2N}{2\pi p_T dy}\left(1 + \sum_n 2v_n \cos\left[n(\phi - \Psi_R)\right]\right)$$

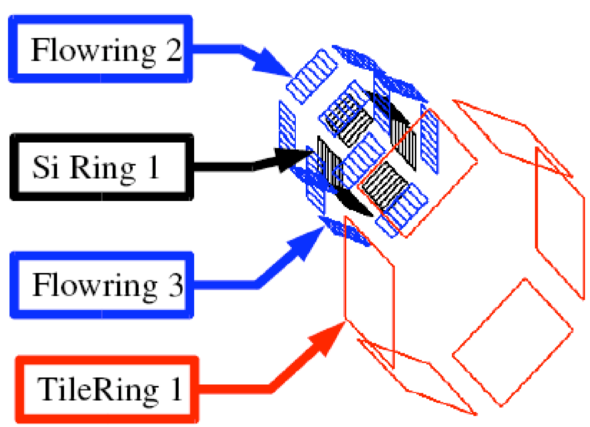


Figure 1Detector geometry of the four azimuthally symmetry rings used in the integrated flow analysis.

$$v_n = \left\langle \cos\left(n\left[\phi - \Psi_R\right]\right)\right\rangle$$

$$\Psi_n = \frac{1}{n}\sum_i \frac{w_i \sin(n\phi_i)}{w_i \cos(n\phi_i)}$$

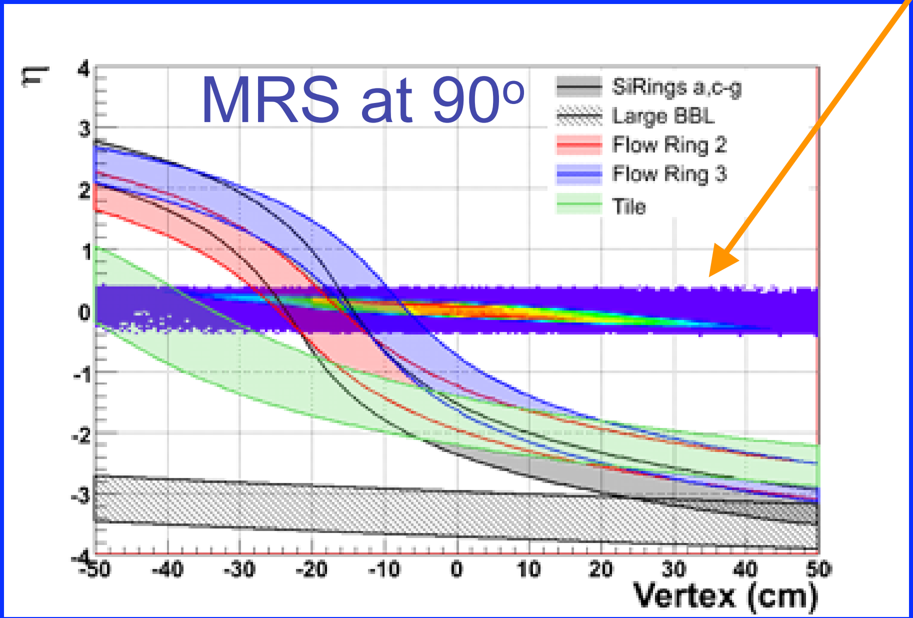
$$v_n^{'} = \frac{\left\langle \cos\left(n\left[\phi - \Psi_2\right]\right)\right\rangle}{\text{ResCor}}$$

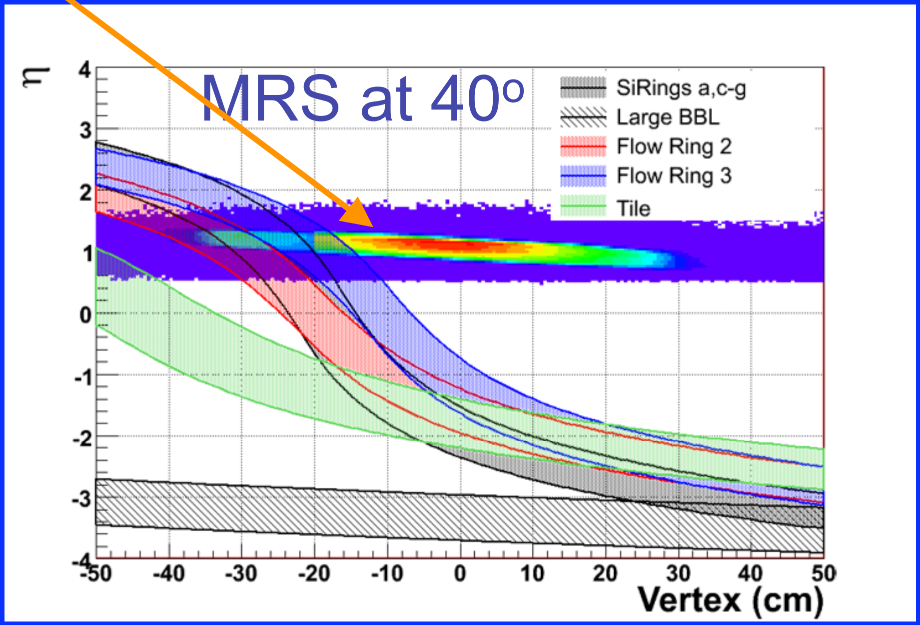
$$\text{ResCor(Detector A)} = \sqrt{\frac{\left\langle \cos\left(2\left[\Psi_2^A - \Psi_2^B\right]\right)\right\rangle\left\langle \cos\left(2\left[\Psi_2^A - \Psi_2^C\right]\right)\right\rangle}{\left\langle \cos\left(2\left[\Psi_2^B - \Psi_2^C\right]\right)\right\rangle}}$$

Experimental correction factors found in good agreement with Monte Carlo simulations.

Avoiding Auto Correlations…

MRS Events

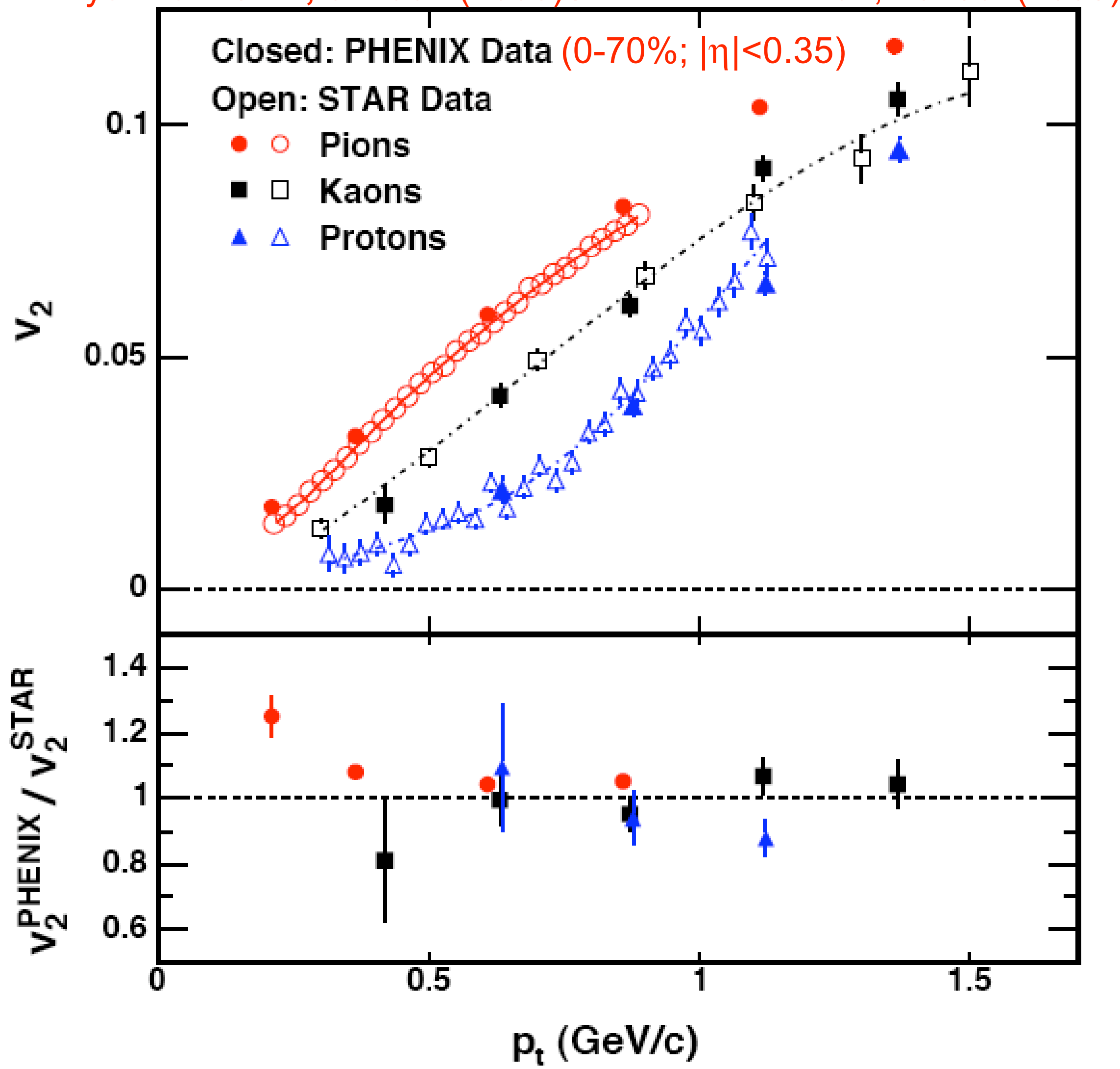




A restricted vertex range is used in the analysis to avoid auto correlations: z>-5 cm @ 90° and z>-20 cm @ 40° an 4°.

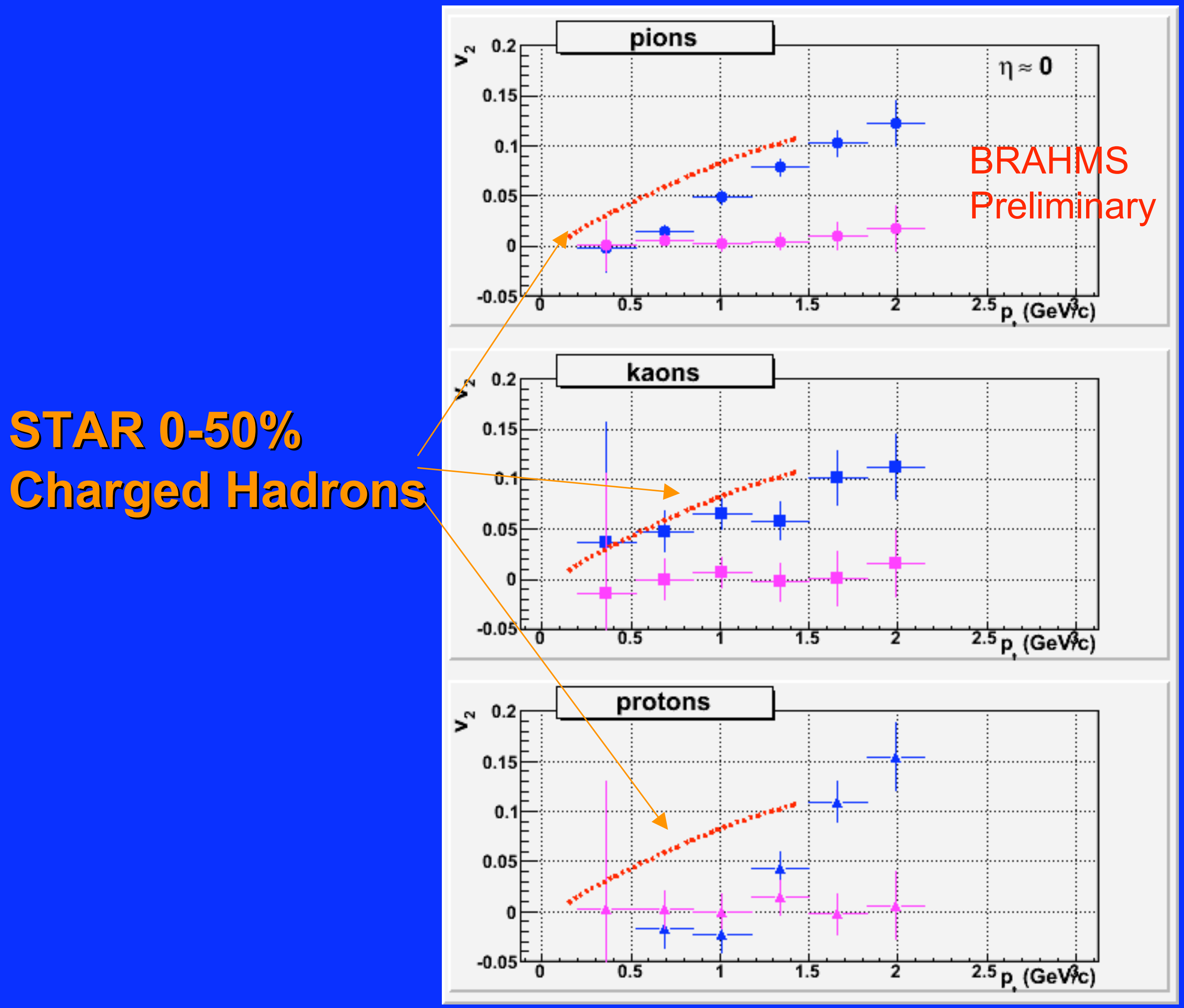
Precision measurements at mid-rapidity (not BRAHMS)

STAR: Phys. Rev. C **72,** 014904 (2005) / PHENIX: PRL 91, 182301(2003)



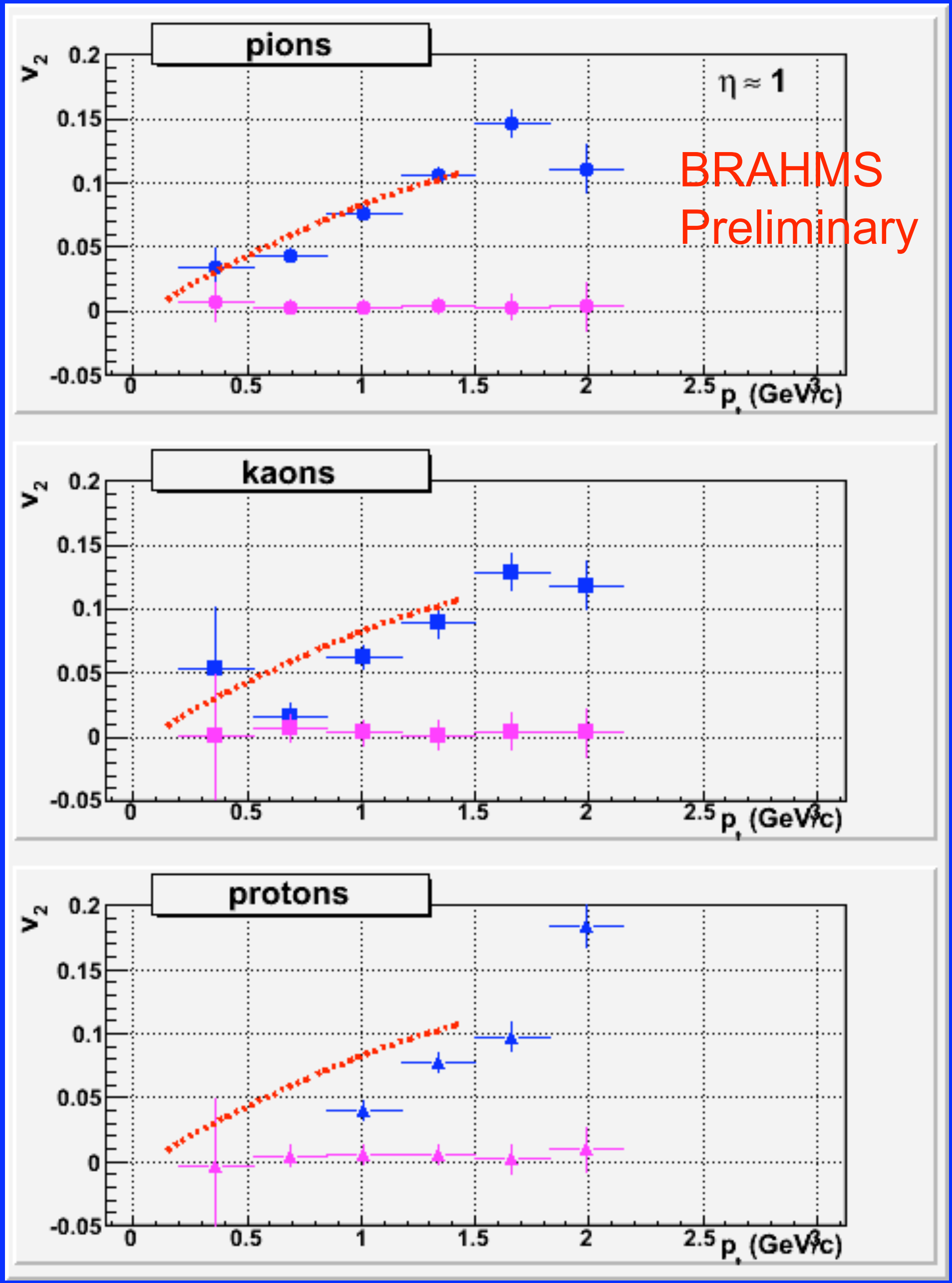
Protons and kaons show delayed onset of v_2 rise (consistent with hydrodynamic models)

90°

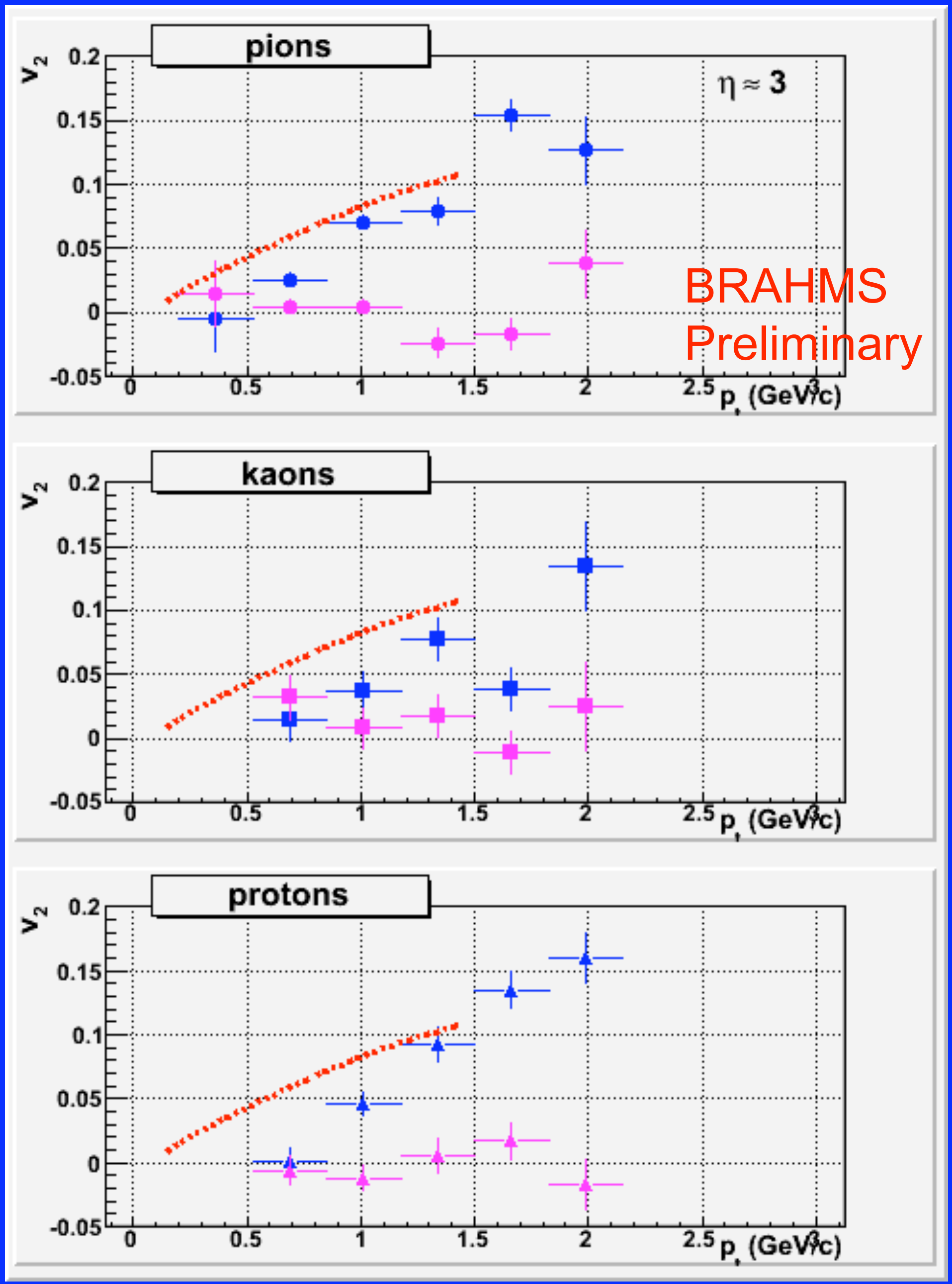


pions
kaons
protons
v_2
$\eta \approx 0$
BRAHMS
Preliminary
p_t (GeV/c)
STAR 0-50%
Charged Hadrons

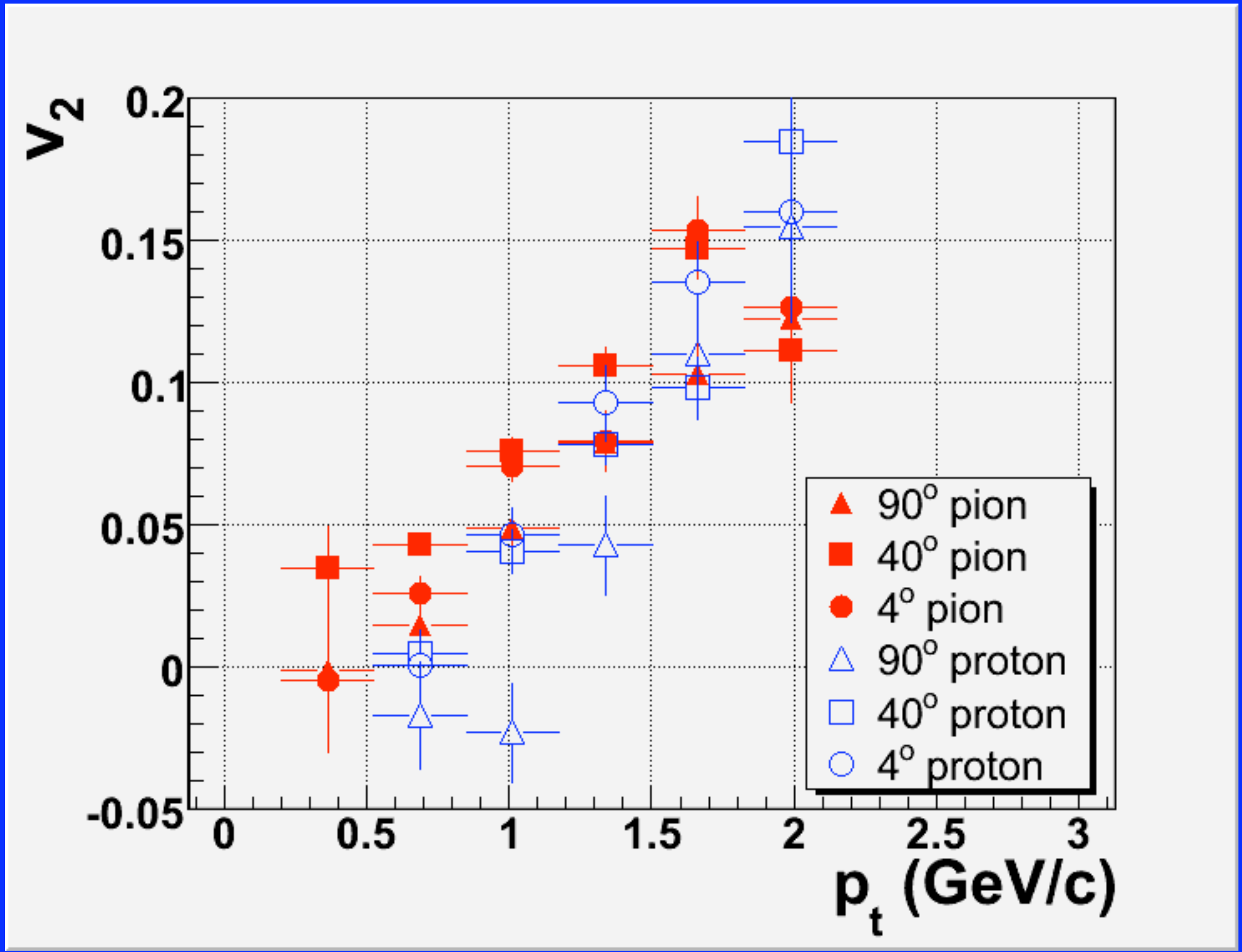
40°


pions
$\eta \approx 1$
BRAHMS
Preliminary
v_2
p_t (GeV/c)
kaons
v_2
p_t (GeV/c)
protons
v_2
p_t (GeV/c)

4º

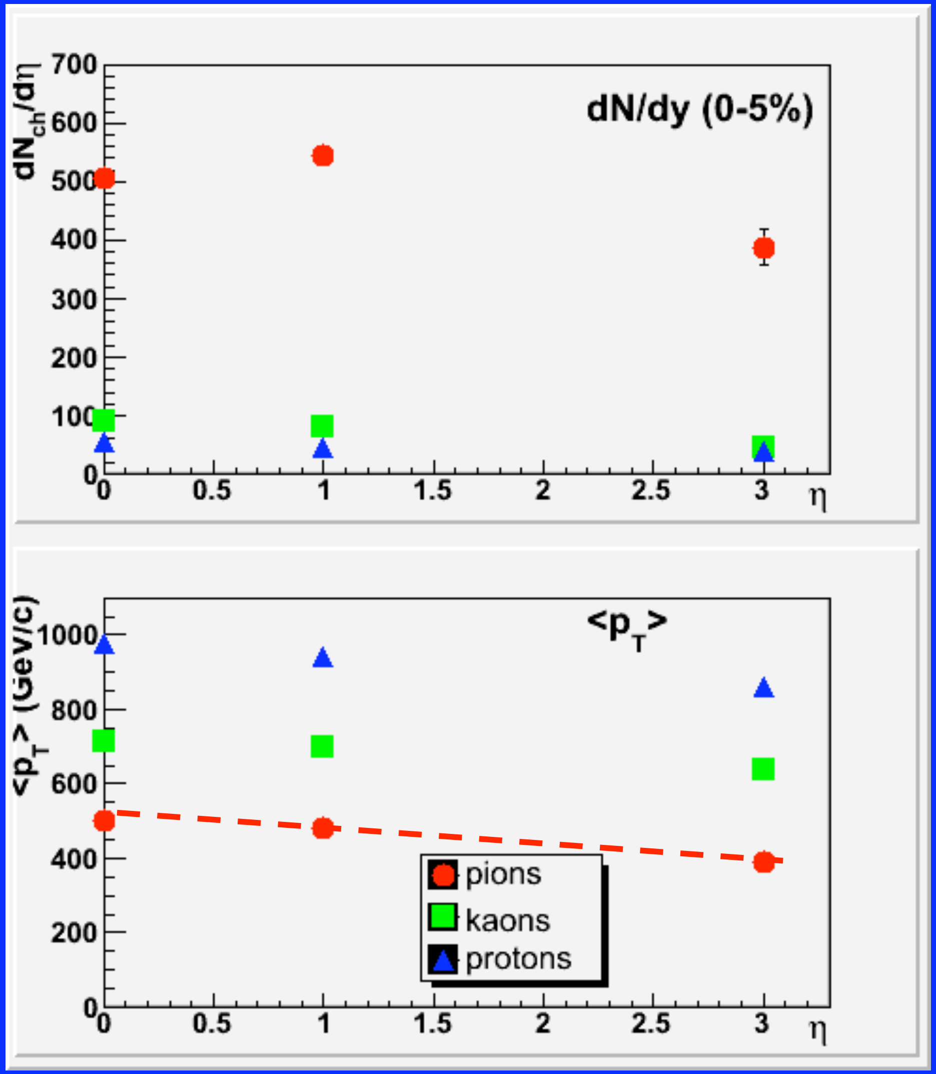


Comparison of 4°, 40° and 90° settings.

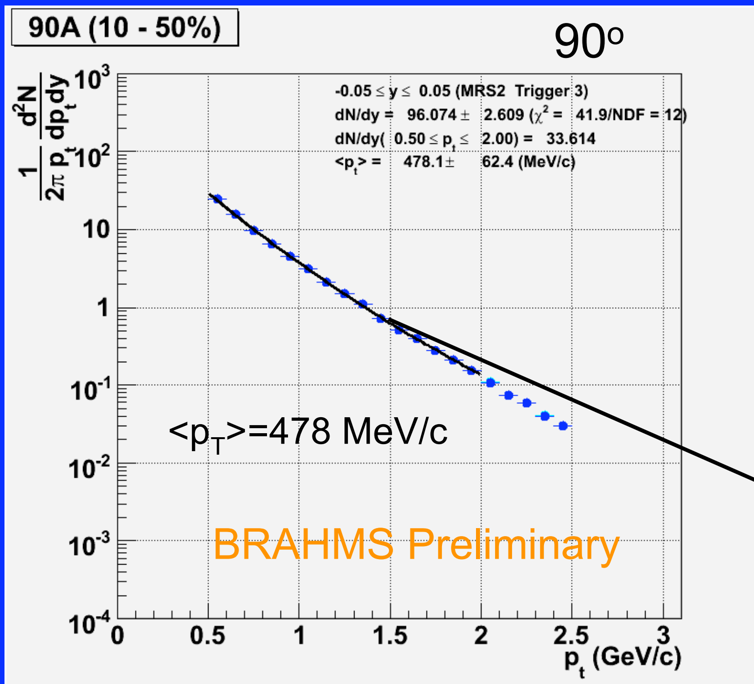


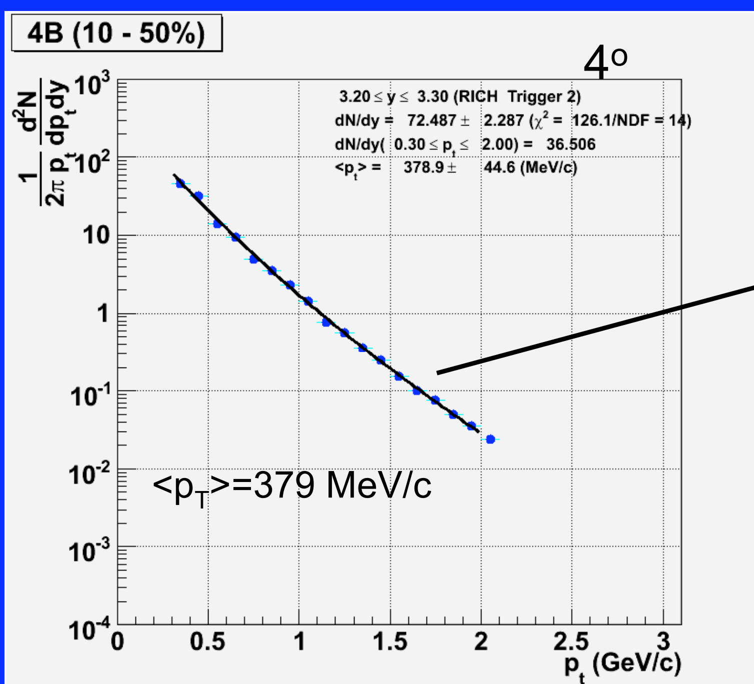
No appreciable change observed above 1 GeV/c.

How do we understand the integral v_2 behavior? What else changes in going to forward rapidities?



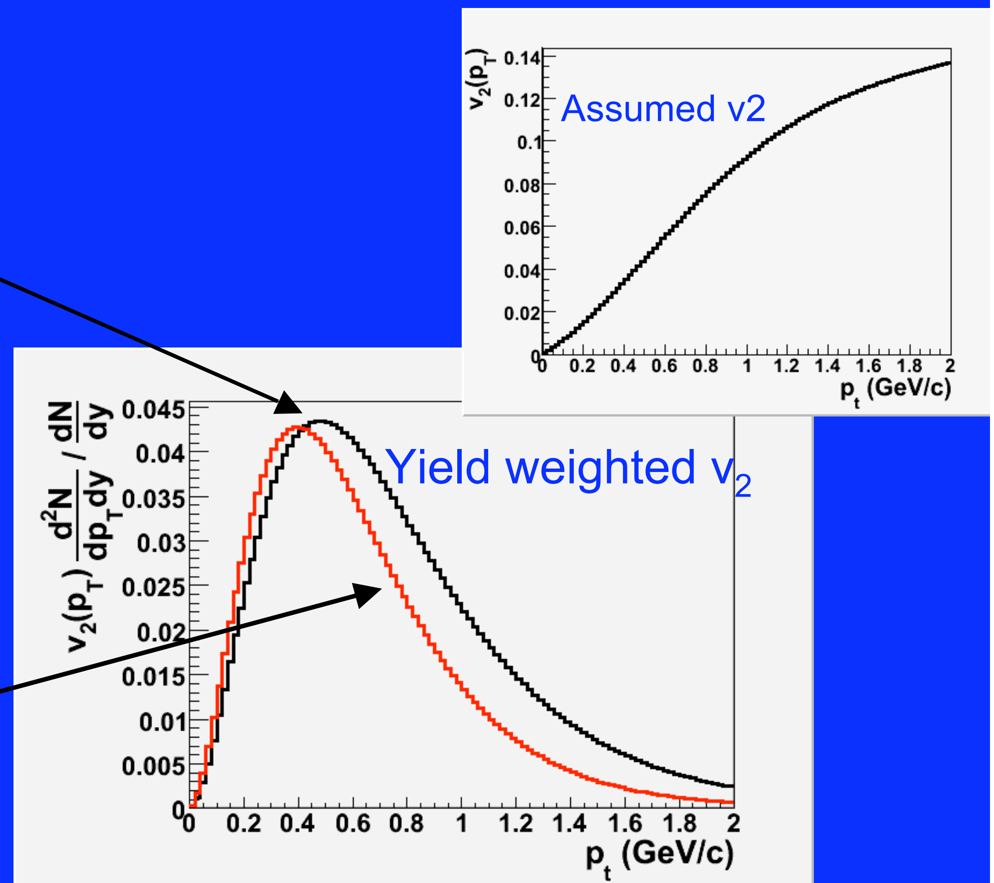
Pions must drive the behavior.





Toy model:

- All π+
- No y dependence of $v_2(p_T)$



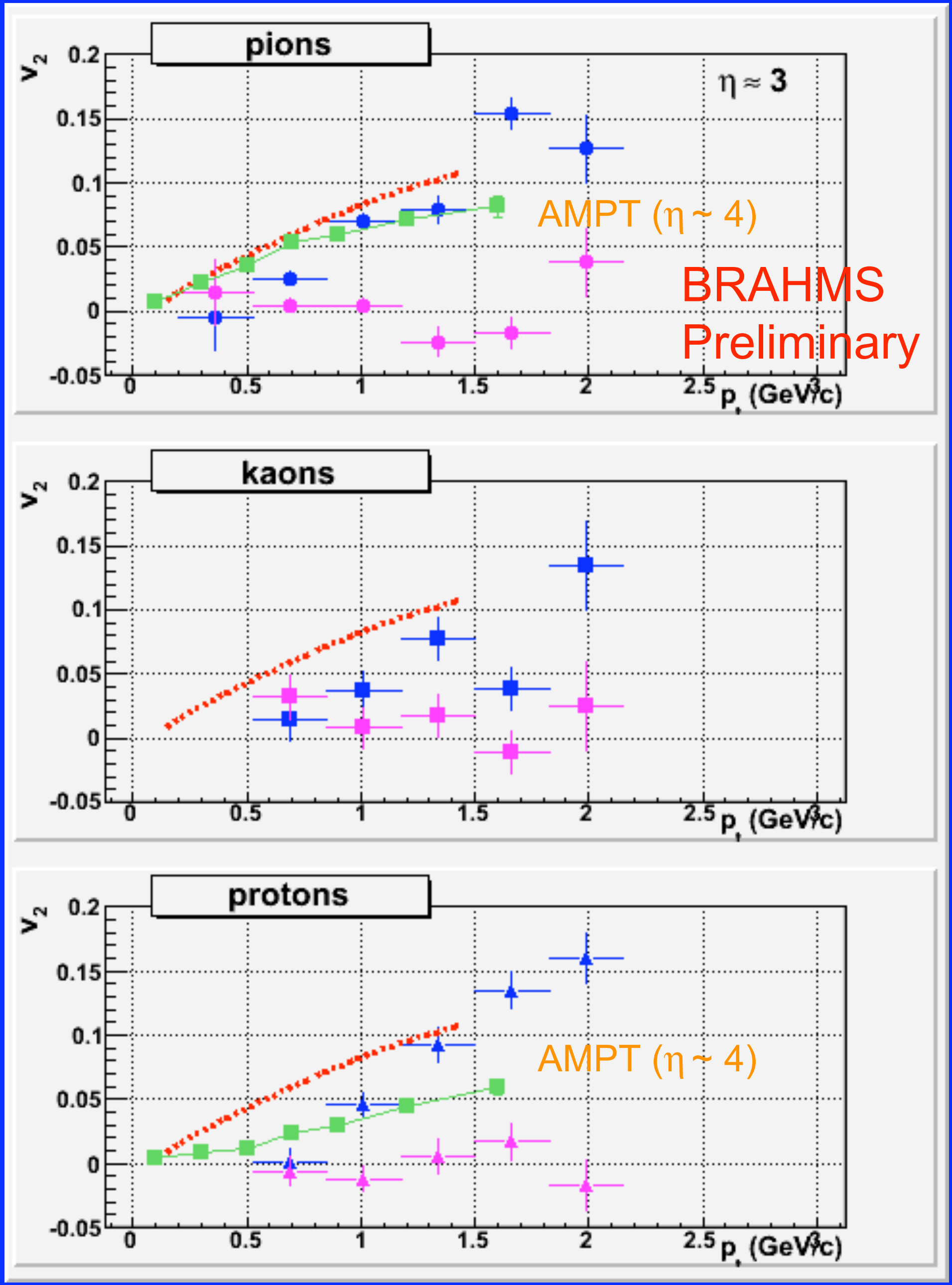
Integral $v_2(90^o)$ = 0.040

Integral $v_2(4^o)$ = 0.032

20% decrease

Few models results available for particle identified v2, but…

4º



AMPT provides reasonable description with "string melting" near mid rapidity (|η|<3)

Lie-Wen Chen, Vincenzo Greco, Che Ming Ko, Peter F. Kolb Phys. Lett. B, 605(2005); private communication.

Conclusions

- $v_2(p_T>1)$ for identified pions, kaons and protons remains relatively constant from y=0 to y=3.
- A significant fraction of the falloff observed for the integral v_2 can be attributed to the y-dependence of $<p_T>$.