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 $\eta \sim 0$ to $\eta \sim 3$, $dN_{\text{ch}}/d\eta$ drops about 25%...

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

...and $v_2$ is reduced about 40%.
Spectrometer arms measure identified particle \( v_2 \), while global detectors determine reaction plane.
Determining Reaction Plane with Multiple Detector Subsystems

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

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

\[
\Psi_n = \frac{1}{n} \sum_i \frac{w_i \sin(n\phi_i)}{w_j \cos(n\phi_i)}
\]

\[
v'_n = \frac{\langle \cos(n(\phi - \Psi_2)) \rangle}{\text{ResCor}}
\]

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

Experimental correction factors found in good agreement with Monte Carlo simulations.
A restricted vertex range is used in the analysis to avoid auto correlations: $z>-5 \text{ cm } @ \ 90^\circ$ and $z>-20 \text{ cm } @ \ 40^\circ$ an $4^\circ$. 

**MRS Events**

**MRS at 90°**

**MRS at 40°**
Precision measurements at mid-rapidity
(not BRAHMS)

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

STAR 0-50% Charged Hadrons

BRAHMS Preliminary
40°

BRAHMS Preliminary
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 $\pi^+$
- No $y$ dependence of $v_2(p_T)$

Integral $v_2(90^\circ) = 0.040$
Integral $v_2(4^\circ) = 0.032$
20% decrease
Few models results available for particle identified $v_2$, but...

AMPT provides reasonable description with “string melting” near mid rapidity ($\mid \eta \mid < 3$)

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 $<p_T>$.