Elliptic Flow Analysis at BRAHMS

Charged-particle anisotropy over pseudorapidity and transverse momentum ranges of $0<\eta<3$ and $0<pt<3$ in AuAu Collisions at $\sqrt{s}_{NN} = 200$ GeV

Current status of BRAHMS elliptic flow analysis

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BRAHMS Collaboration

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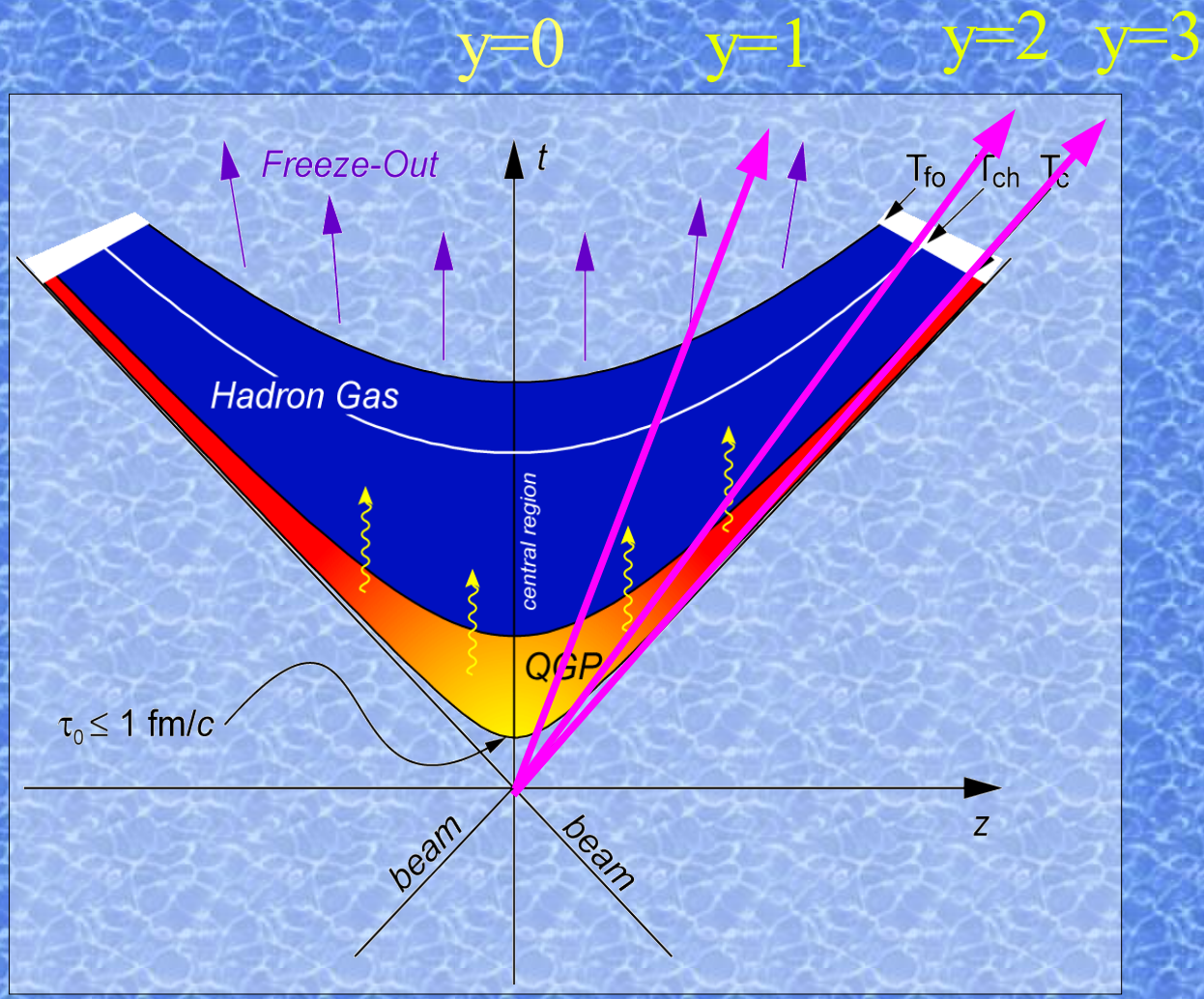
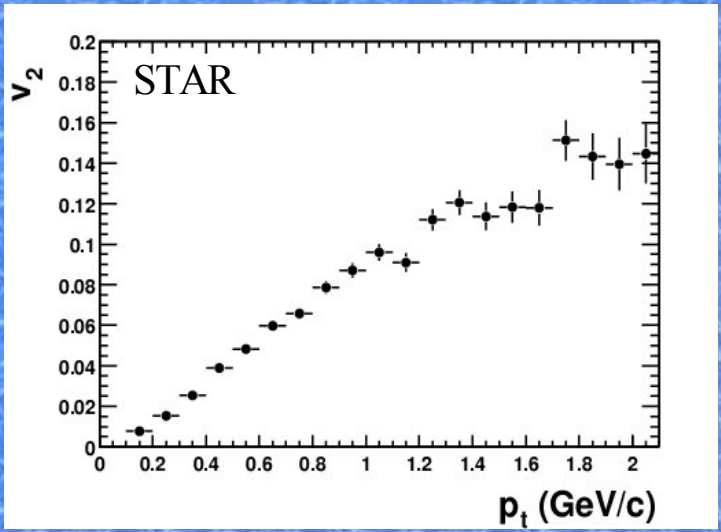
Size of created medium?

Vast majority of data as well as models about elliptic flow concentrates on describing phenomena at midrapidity.

That is great, but how about longitudinal information?

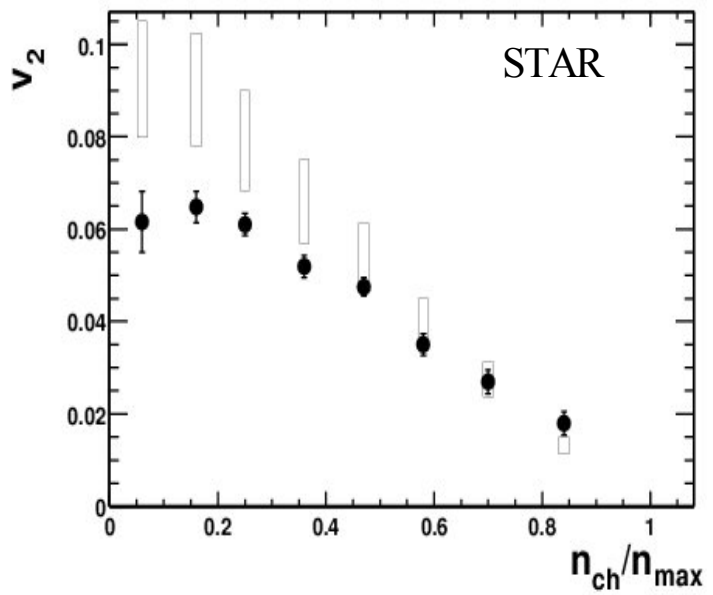


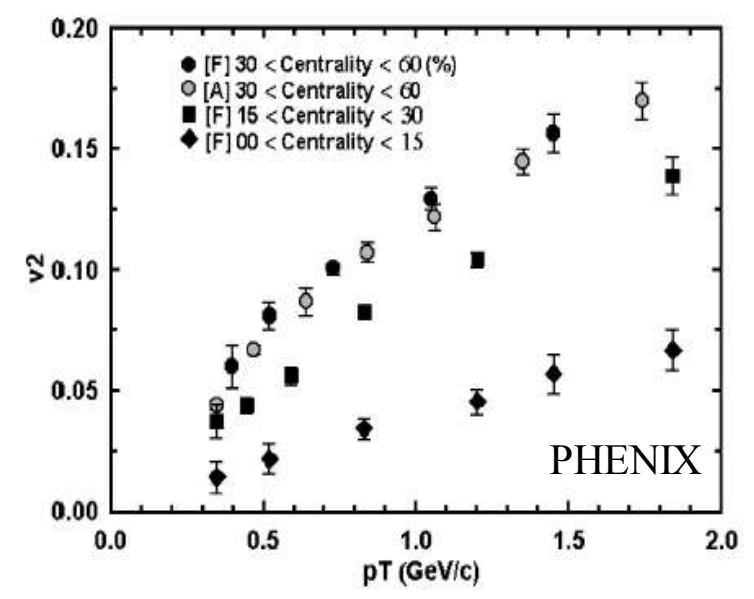
Elliptic flow at Midrapidity



At midrapidity, several measurements of elliptic flow have been reported at RHIC.

Hydrodynamic models describe the data well up to ~ 2GeV/c

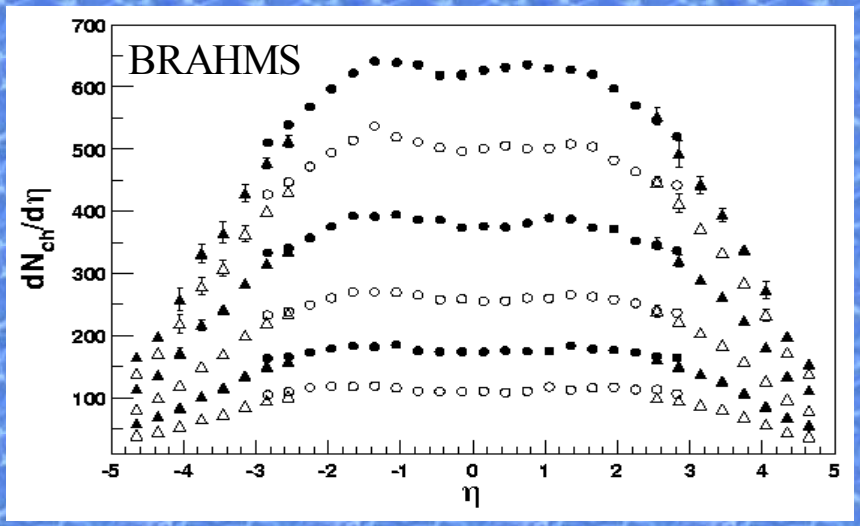




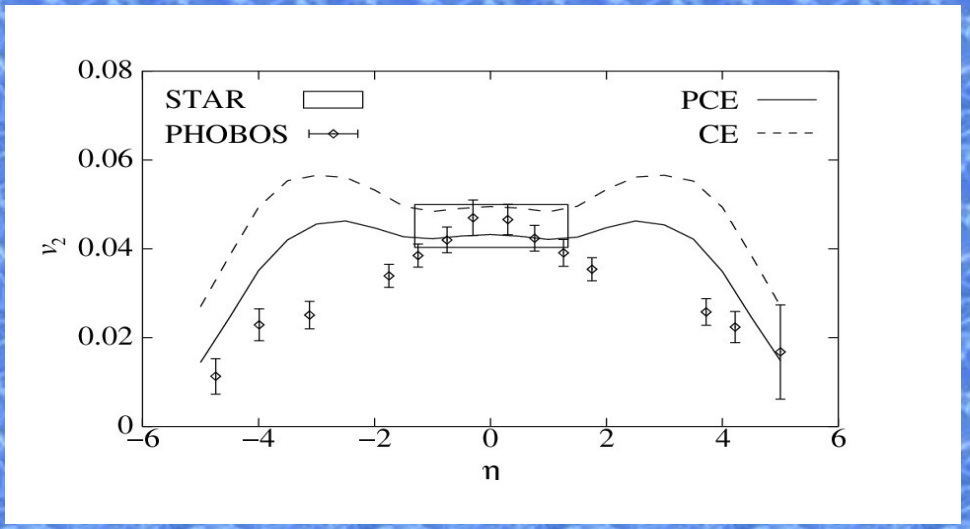
Phys. Rev. Lett. 86 (2001) 402

Phys. Rev. Lett. 89 (2002) 212301-1

Not at midrapidity



Phys. Rev. Lett. 88 202301 (2002)

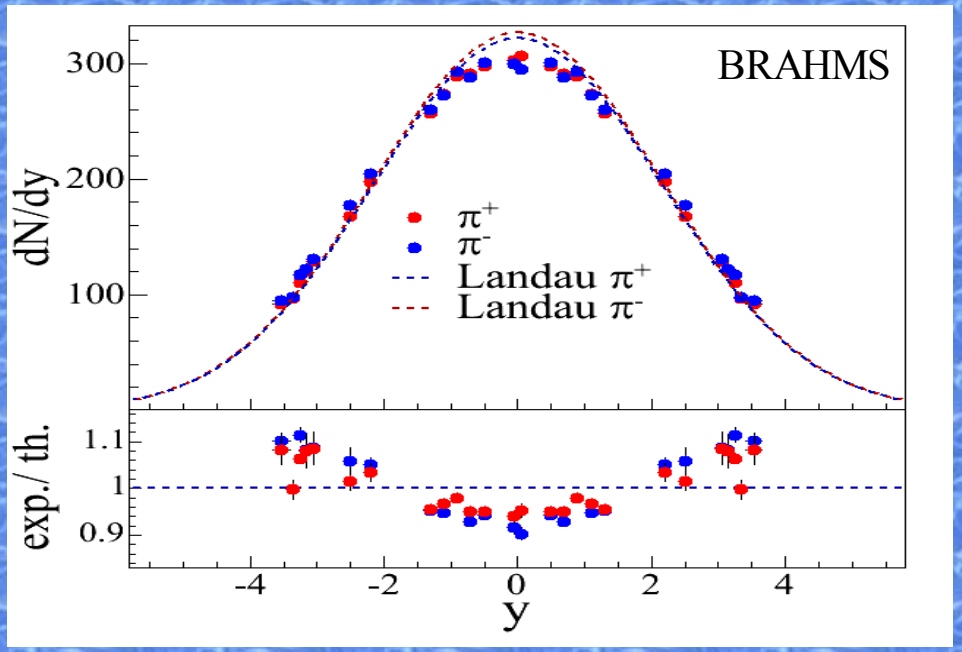


PRC 65 (2002) 011901

At forward and backward rapidities, understanding of v2 is not quite sufficient.

The model seems to follow the pseudorapidity distribution.

The data exhibits sharp triangular shape.



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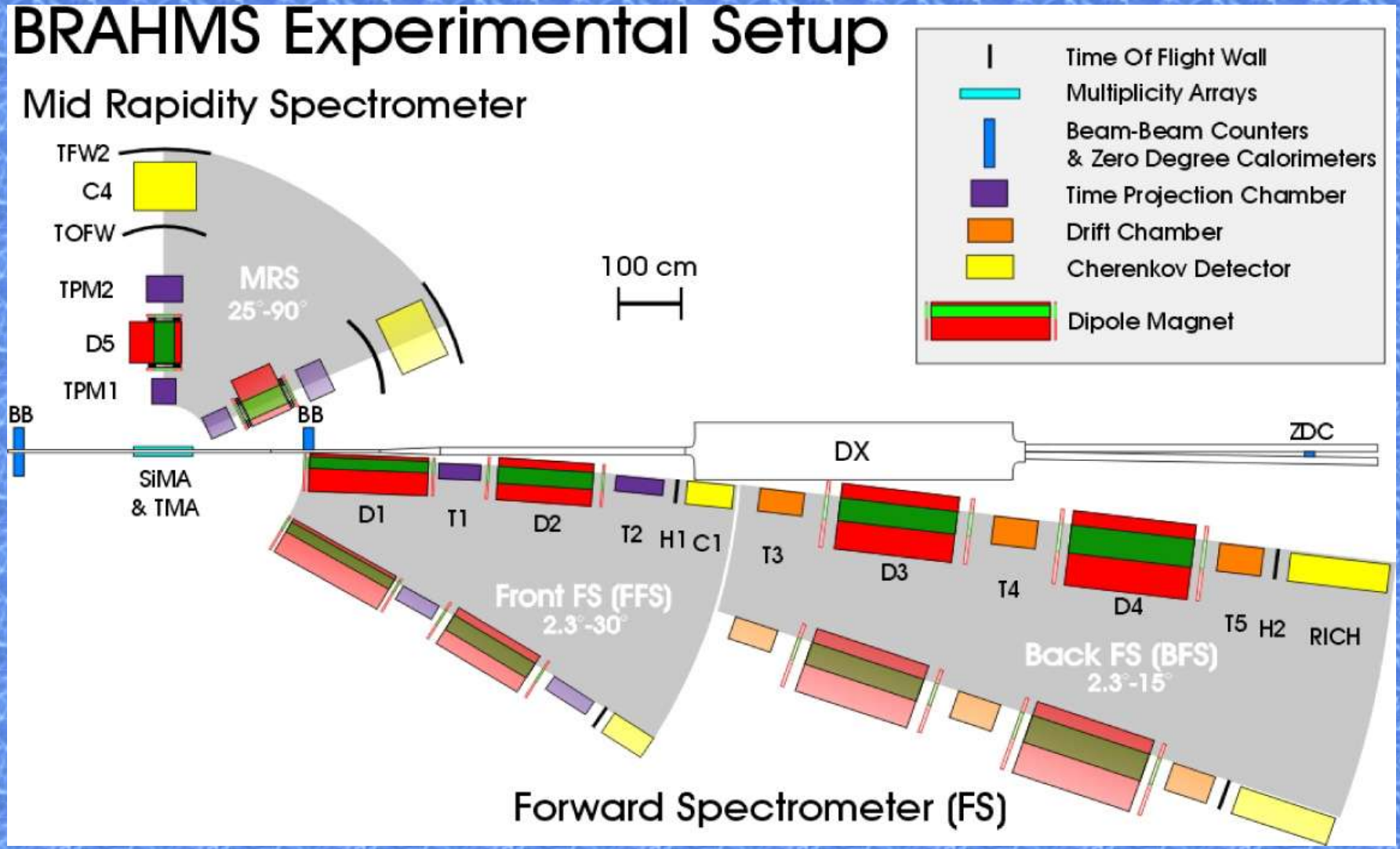
BRAHMS Detector System

Two rotatable spectrometers: MRS and FS
Small solid angles

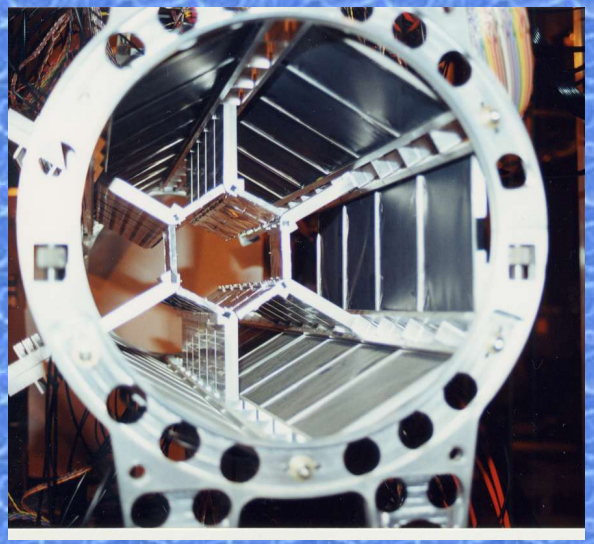


Modification to the SMA detector

Up to RUN03, BRAHMS had not been able to measure event planes.

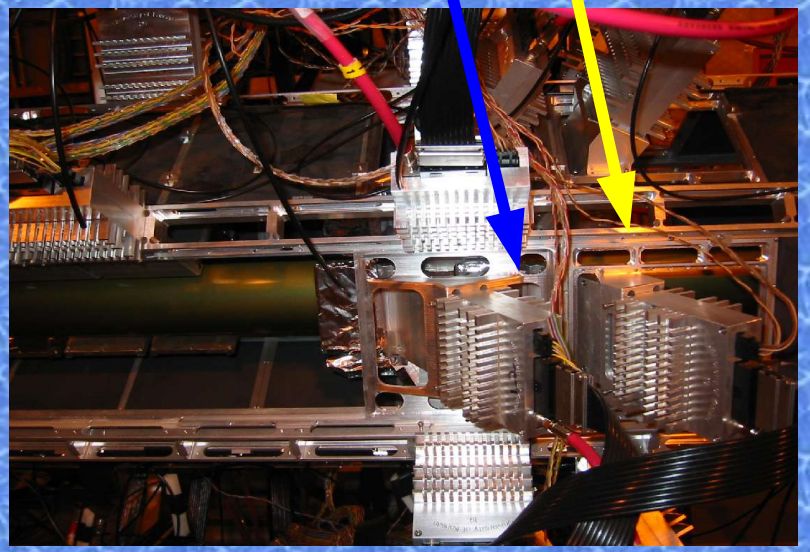
SMA is rotated 90 deg normal to the beam axis.

Silicon has two rings



Before

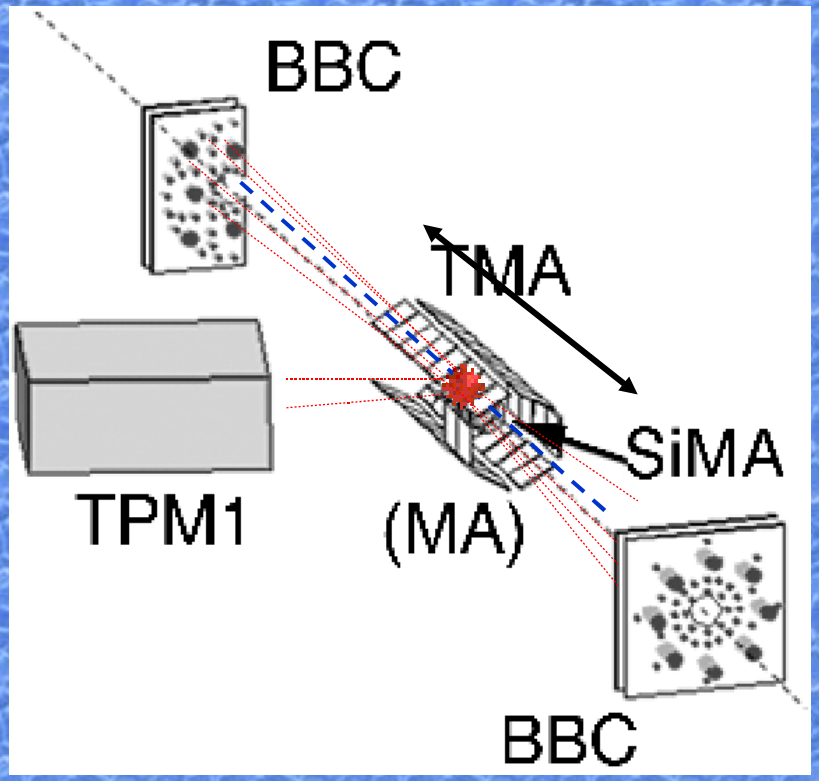
After



6 segments per 2π

42 segments per 2π

Idea to measure event plane and flow



Measure event plane by global detectors: SMA and BBC

Look at the correlation between the angle between observed event angle and particle angle measured in the tracking detectors (MRS and FS).

Complication?
They are small solid angle spectrometers.
--- require large number of events.
--- may require corrections due to the missing solid angles.

Equations

$$E\frac{d^3N}{d^3p}=\frac{1}{2\pi}\frac{d^2N}{p_t dp_t dy}\left(1+\sum_{n=1}^{\infty}2v_n\cos\left(n(\phi-\Psi_r)\right)\right)$$

Methods describe by
A. M. Poskanzer and S. A. Voloshin
Phys. Rev. C58 (1998) 1671

Reaction plane angle:

$$X_n=\sum_{i=1}^{N}w_i n_i^{ch}\cos(n\phi_i)$$

$$Y_n=\sum_{i=1}^{N}w_i n_i^{ch}\sin(n\phi_i)$$

$$\Psi_n=\frac{1}{n}\arctan\left(\frac{\sum_{i=1}^{N}w_i n_i^{ch}\sin(n\phi_i)}{\sum_{i=1}^{N}w_i n_i^{ch}\cos(n\phi_i)}\right)$$

$$v_n^{observed}=\left\langle\cos\left(n(\phi-\Psi_n)\right)\right\rangle$$

$$v_n^{real}=\frac{v_n^{observed}}{\left\langle\cos\left(n(\Psi_n-\Psi_r)\right)\right\rangle}$$

Currently, the preliminary data suggests the event plane resolutions of ~ 27 deg with n = 2.

Conclusion

We can not show any results of elliptic flow at this time.

Can we measure v2 at η=0, 1, 2 and 3?

Do we have enough events? Yes (Hopefully)

Can we measure event plane? Yes.

Recently, it was pointed out that it is not necessary for flow measurement to know event planes.