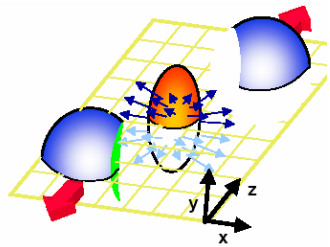
Reaction Plane/Elliptic Flow Measurements in BRAHMS: Why and How



v2 at RHIC is getting more interesting!

- high *v2* observed (viscosity, density),
- pt dependence: Hydro+pQCD,
- PID dependent: at pt>2 GeV/c

  v2(p,pbar)>*v2*(π^+,π^-)? (Hydro: *v2*(p,pbar)<*v2* (π^+,π^-))
- Pseudo-rapidity dependent: *v2* drops too fast?

  -Hydro (3d) cannot reproduce.

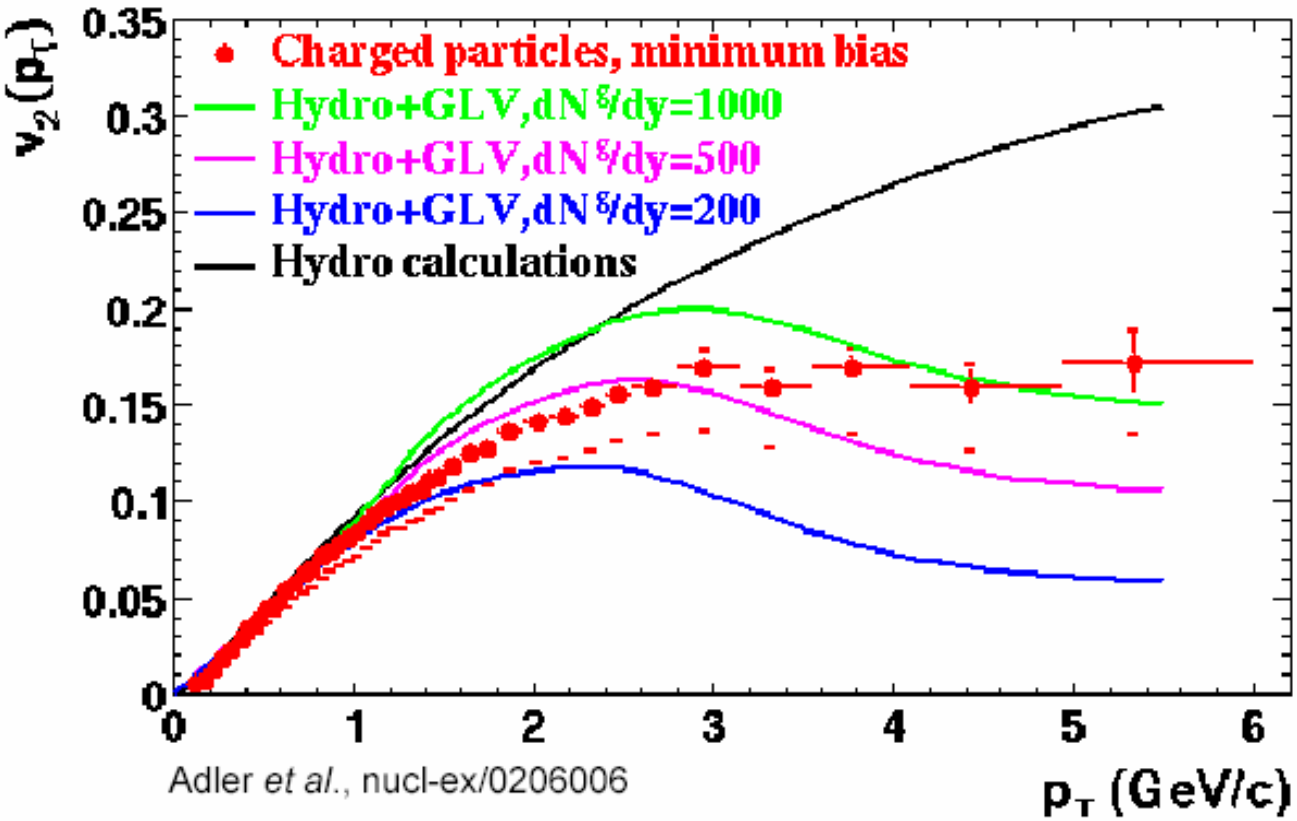
  -Need more understanding of physics or measurement?
- **Need measurements of *v2*(PID,rapidity,pt,centrality)!**
- **BRAHMS is the only experiment can measure that!**

Flow Measurements in BRAHMS: How

- Determine reaction plane (r.p.) using charged particle azimuthal distribution – Look at identified particles in the spectrometers as a function of a reaction plane
- strongest signal at y=0 but non flow contribution (jets, resonances) is expected to be highest

v_2 for High p_t Particles

See also, M. Gyulassy, I. Vitev and X.N. Wang, nucl-th/00012092

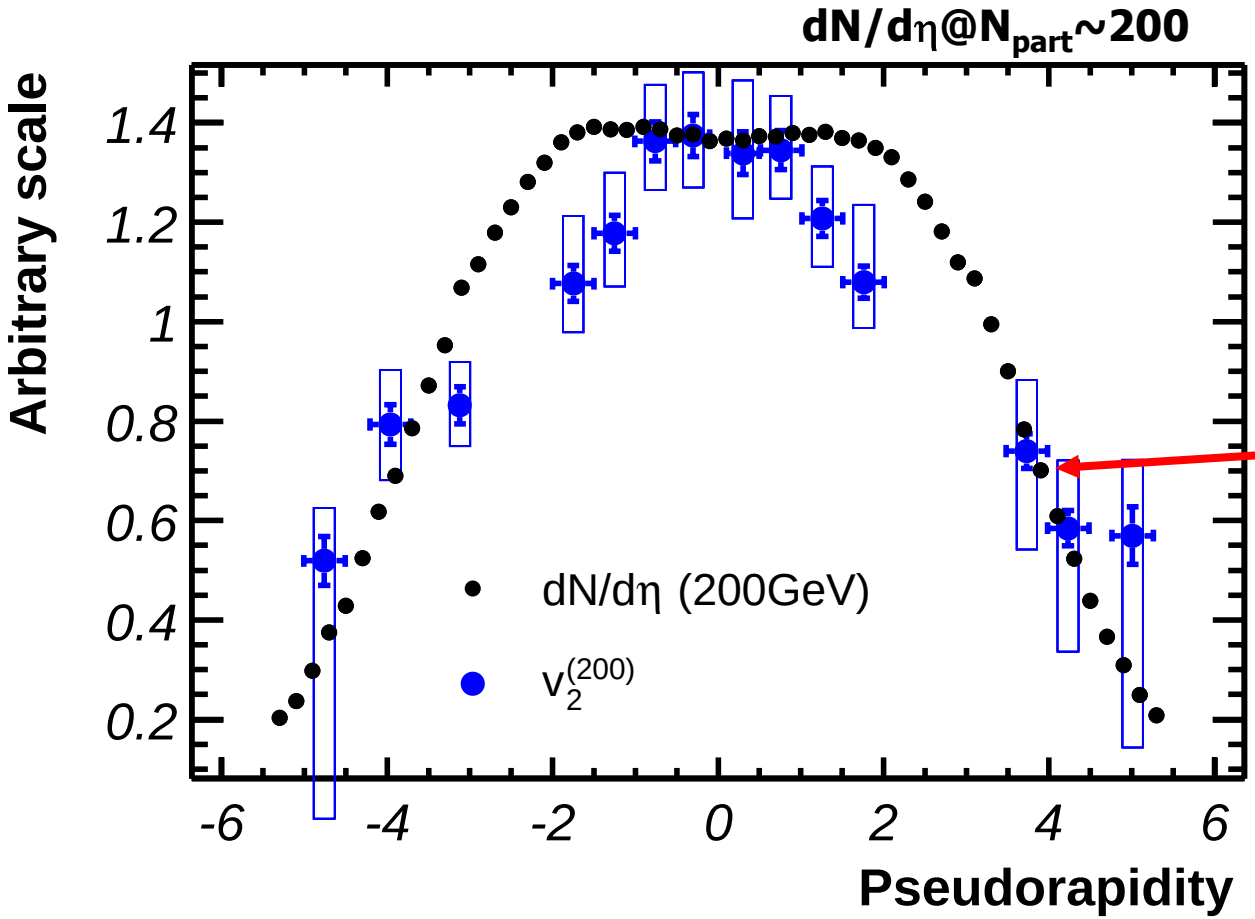


Adler *et al.*, nucl-ex/0206006

v_2 is large … but at p_t > 2 GeV/c the data starts to deviate from hydrodynamics

BRAHMS

You may wonder anyway…



Arbitrary fit

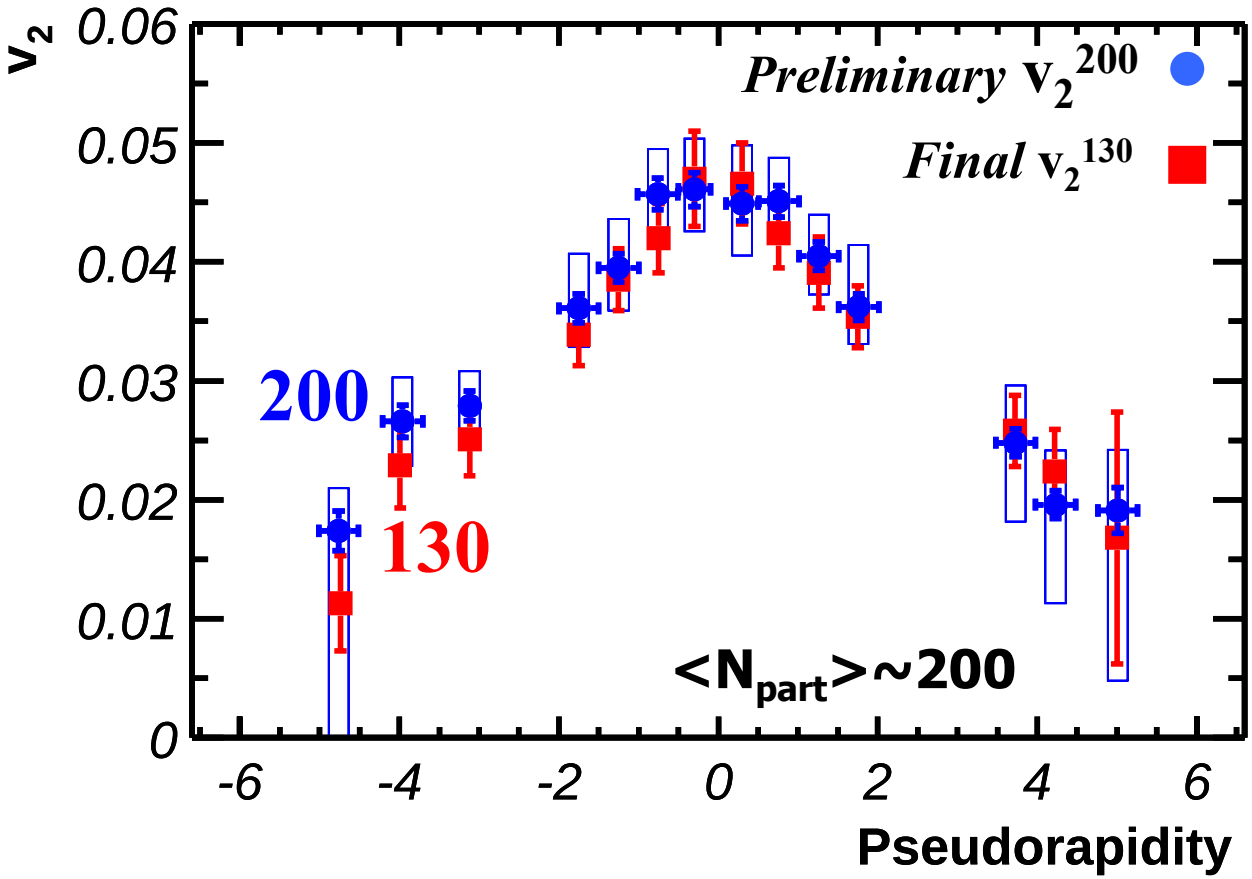
Fit high η

dN/dη is broader than v_2

$v_2 \propto P_T$ → Missing measurement $\langle P_T \rangle(\eta)$

How about η dependence?

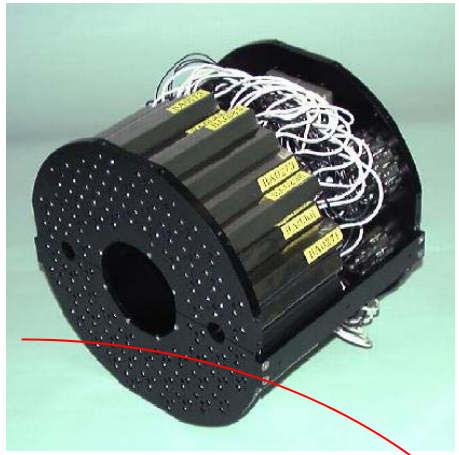
Naïve expectation → Boost invariance

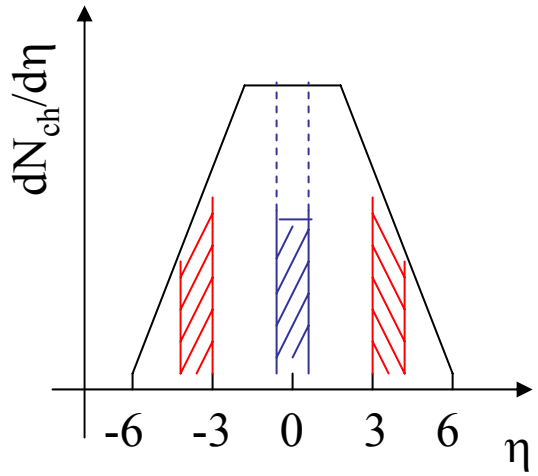


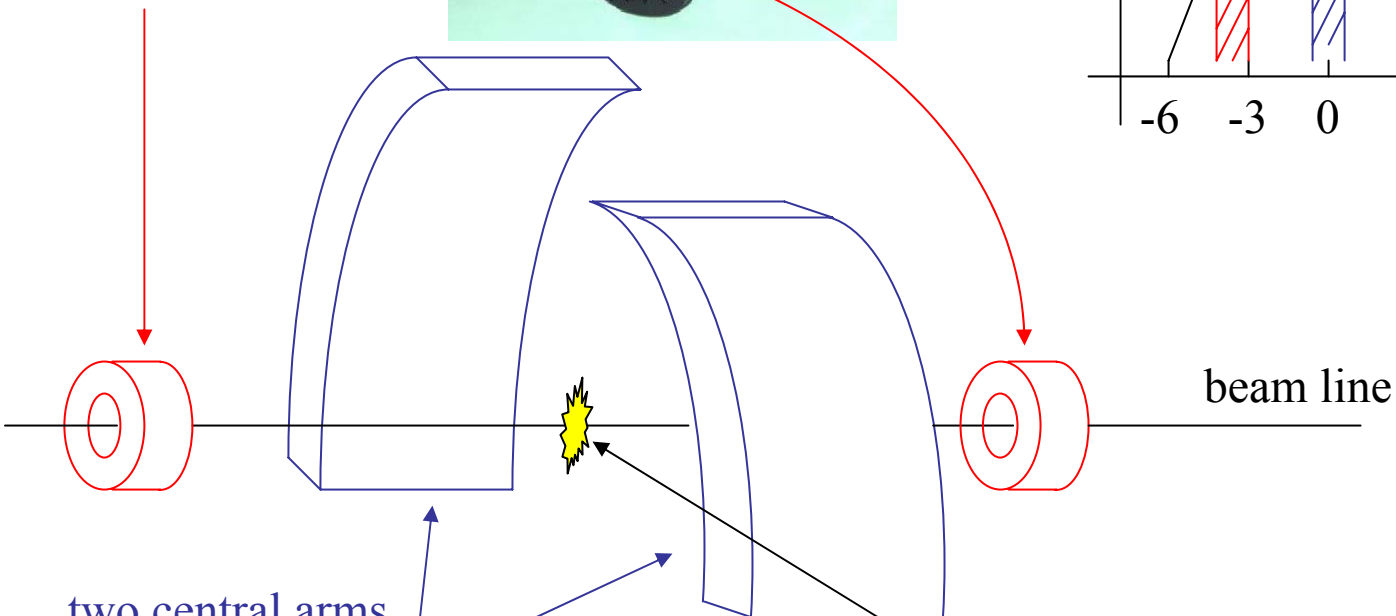
BRAHMS

PHENIX

Beam-beam counter
(BBC) $|\eta|$=**3~4**
64pmts in each BBC
charged particles







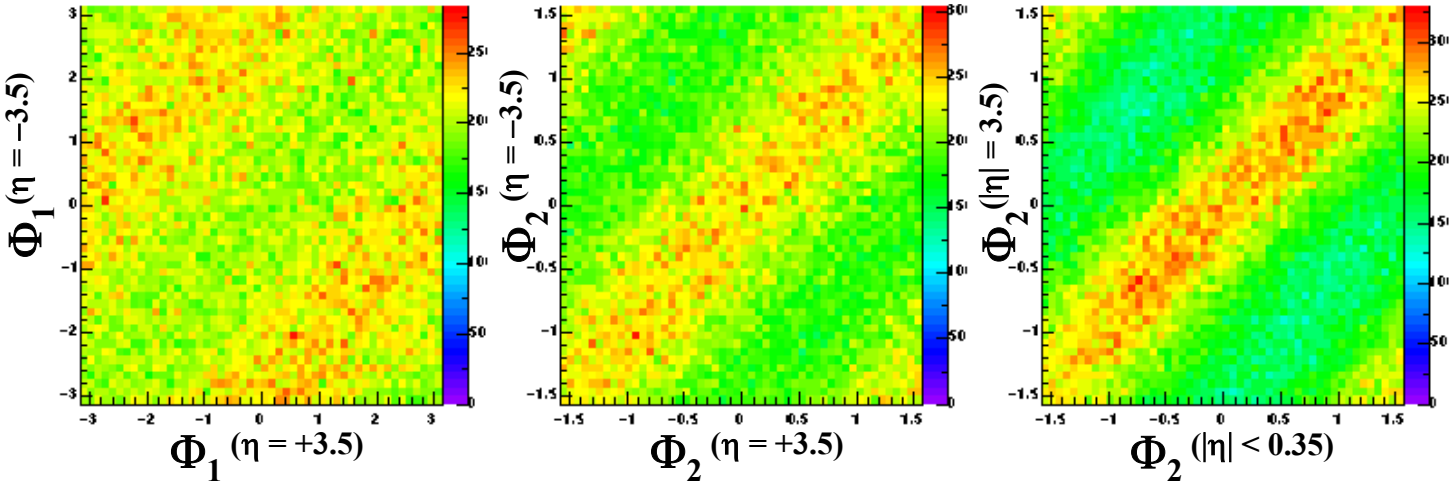
two central arms
(CNT) $|\eta|$**<0.35**
Dch,PCs,TOF,EMCAL
tracking, momentum, PID

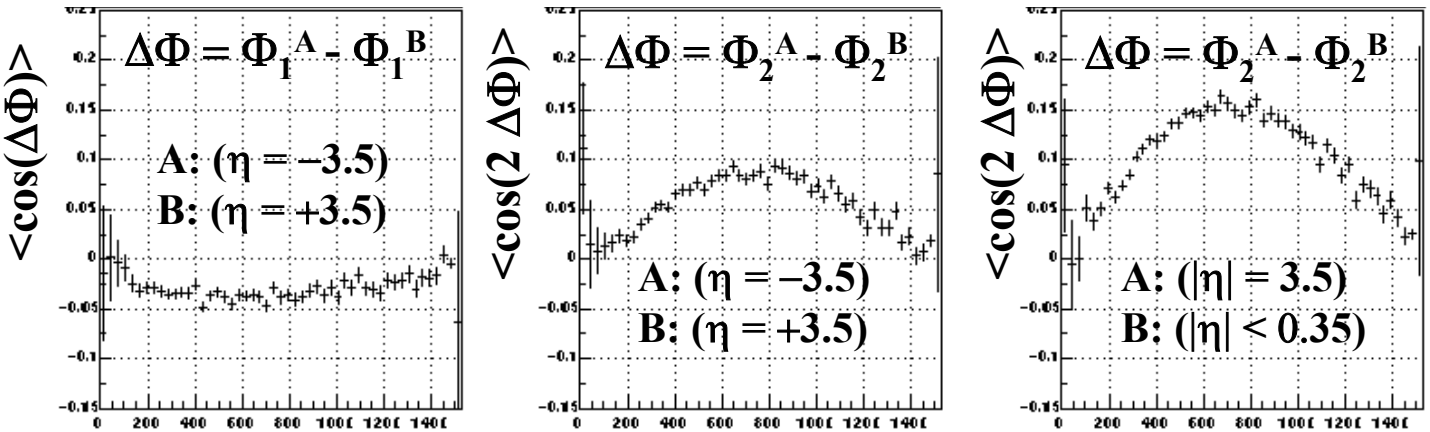
BRAHMS

$\eta = -3.5$ vs $\eta = +3.5$
(directed : n=1)

$\eta = -3.5$ vs $\eta = +3.5$
(elliptic : n=2)

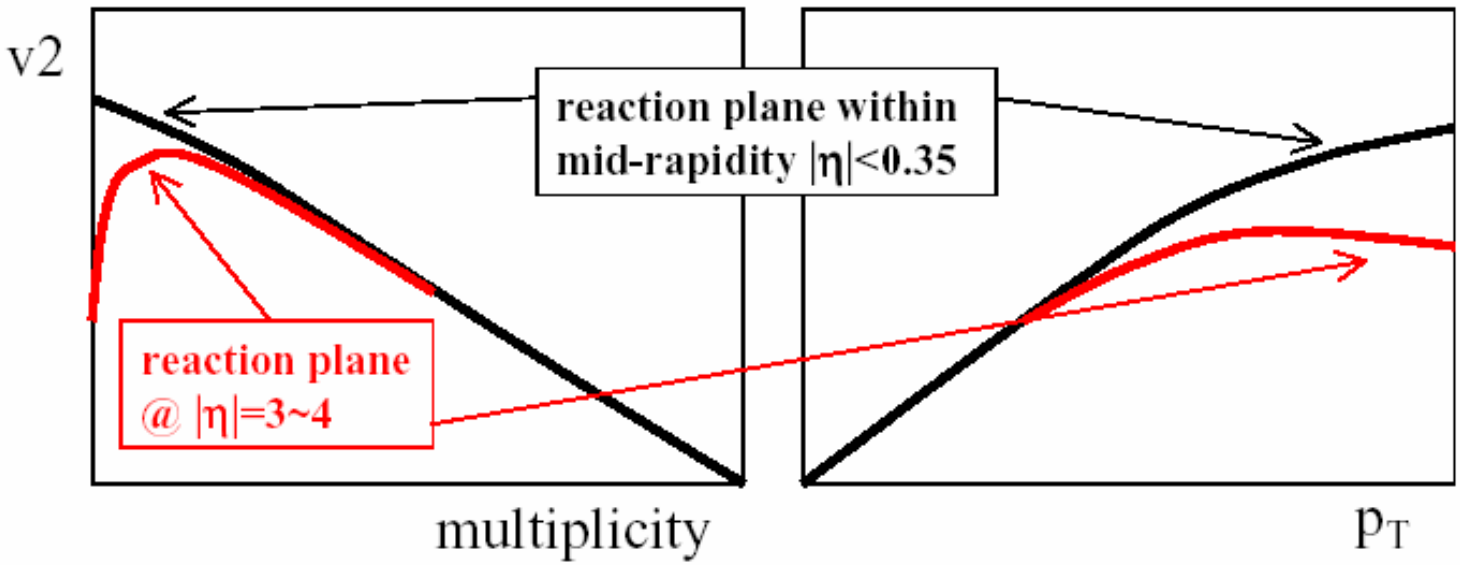
$|\eta|=3.5$ vs $|\eta| < 0.35$
(elliptic : n=2)





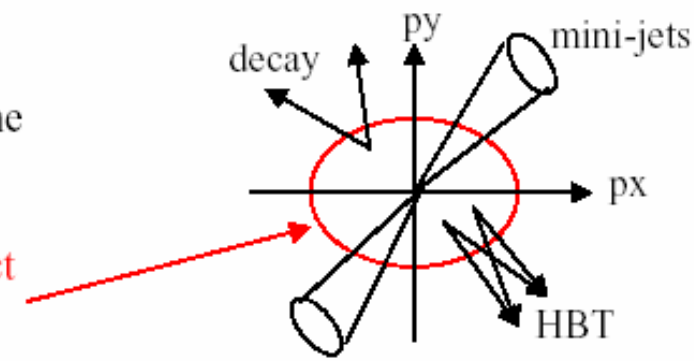
charged multiplicity ⟶

mid-rapidity v2



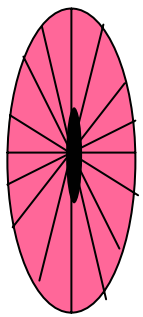
elliptic event anisotropy around the mid-rapidity → Jet?! (non-flow)

"normal" elliptic flow with respect to the true reaction plane



We need detectors

- Need to measure *v2* in Run4
- Not much time to make new
- Reconfiguring Si
- Modified BB?
- (Damaged Silicon, Multiplicity/Centrality Issues,
- Background in Spectrometers)
- New detector at MRS? Any Ideas
- Adding pizza shape scintillator detectors with fibers?



- 16-24 segmentations
- Cover ~1-1.5 unit of h at ~3-4
  (dN/dh~200 for 20-30% at y~3.5 ~10/slice)
- 2 sides preferred
- Tile worked. Light design.
- Shouldn't be much problem for BB
- Problem for FS? (lighter than trigger counter)
- Need simulations
- Can serve as extra centrality detector