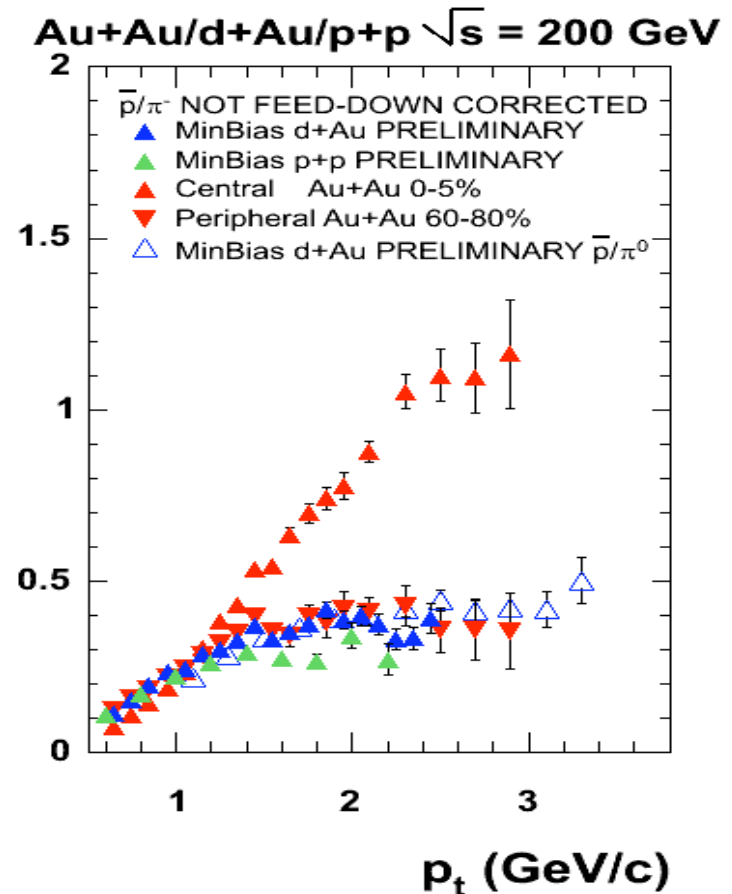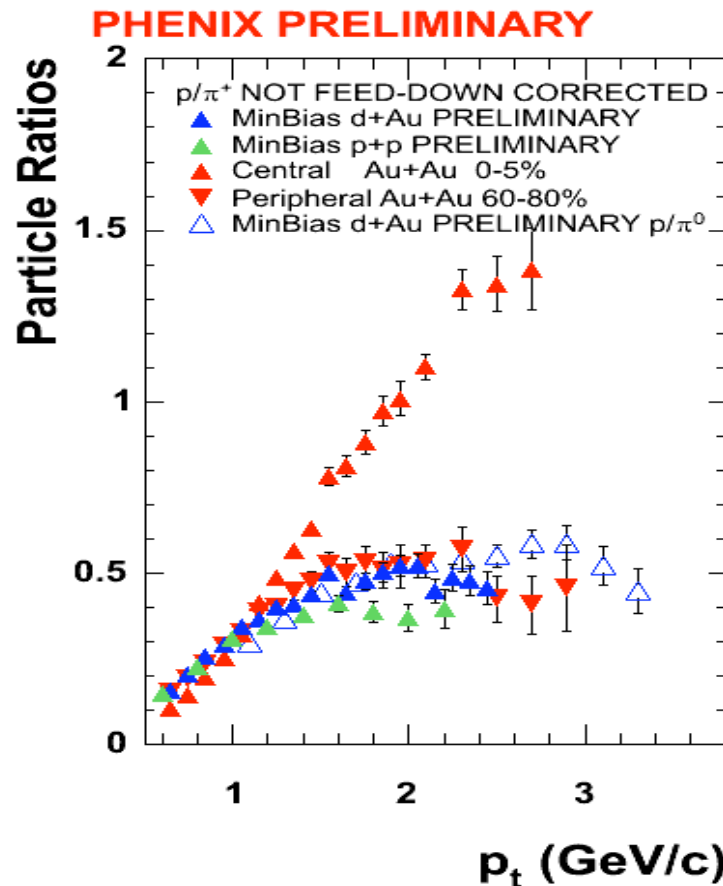# Jets with Identified Particles in AuAu and dAu at PHENIX

Anne Sickles
SUNY Stony Brook

for the

PHENIX Collaboration
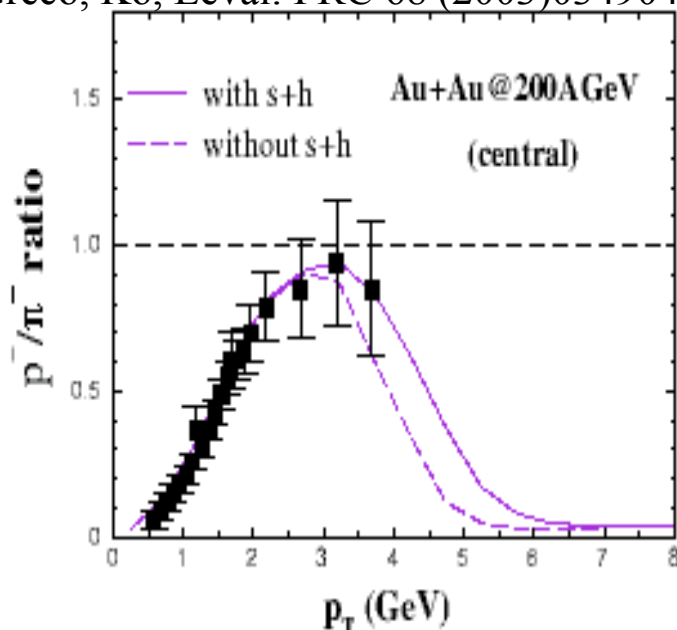
Physics Motivation

- Proton to pion ratio in central AuAu collisions is about 1 at intermediate p_T, much higher than in other collision systems (dAu and pp)
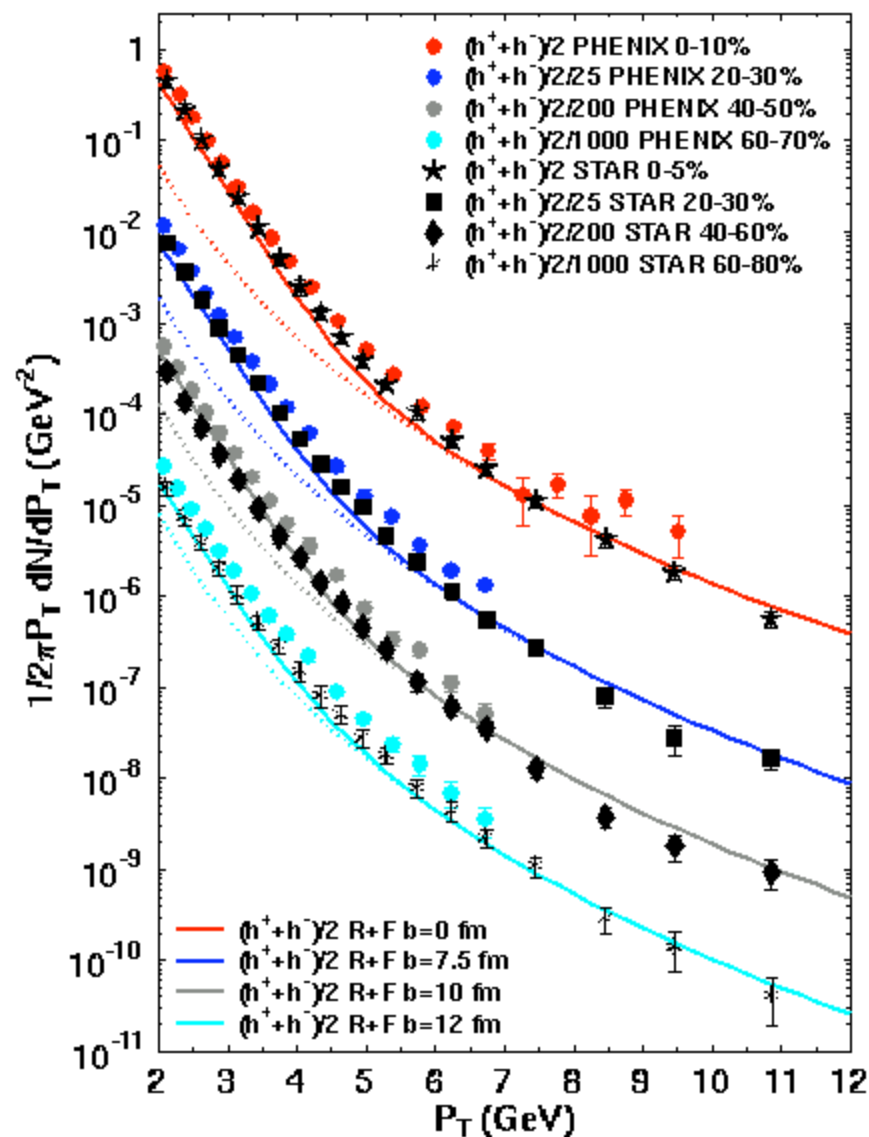
Coalescence Predictions

Greco, Ko, Levai: PRC 68 (2003)034904
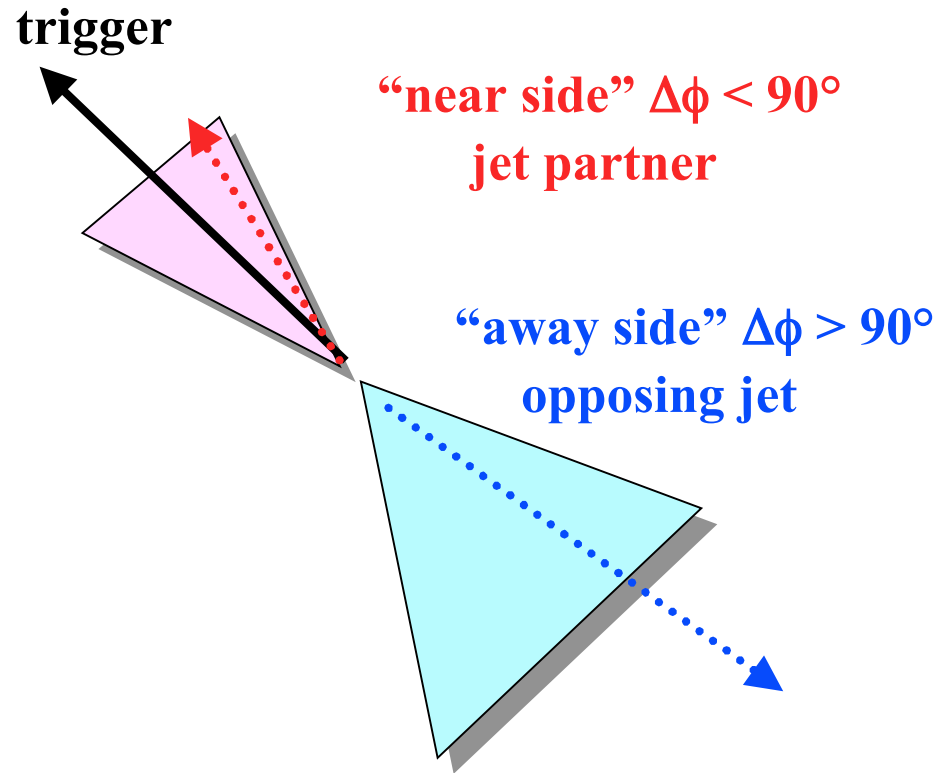
Fries et al: Phys.Rev. C68 (2003) 044902

- Able to predict particle ratios and spectra

- If intermediate p_T hadrons come from coalescence of flowing partons they should not have jet like associated particles

Jet physics in PHENIX

trigger

"near side" $\Delta\phi < 90°$
jet partner

"away side" $\Delta\phi > 90°$
opposing jet

Use PHENIX PID to identify trigger or associated particle

Trigger:
hadron with $p_T > 2.5$ GeV/c

Count associated particles
for each trigger at lower p_T
(> 1 GeV/c)
$\rightarrow$ "conditional yield"

Near side yield: number of
jet associated particles from
same jet in specified p_T bin

Away side yield: jet
fragments from opposing jet

Jets in PHENIX

- **Large event multiplicity**

  --solution: find jets in a statistical manner using
    angular correlations of particles
    mixed events give combinatorial background

- **2 x 90 degree acceptance in phi and $|\eta|<0.35$**

  --solution: correct for azimuthal acceptance,
    but not for η acceptance

- **Elliptic flow correlations**

  --solutions:
  use published v_2 values;
  fit correlation functions;
  integrate over 90°
  (integrates all even
  harmonics to zero)

PHENIX PRL 91 (2003) 182301
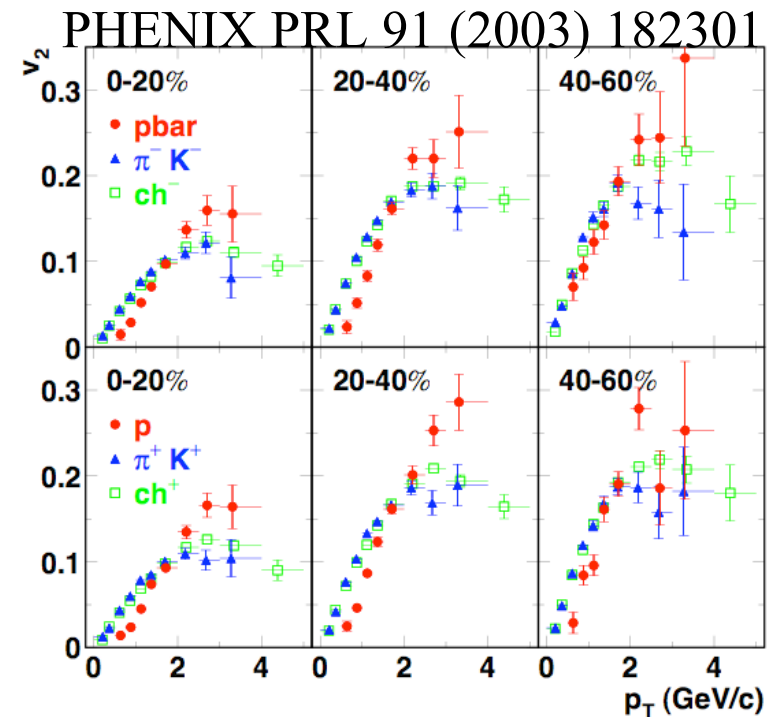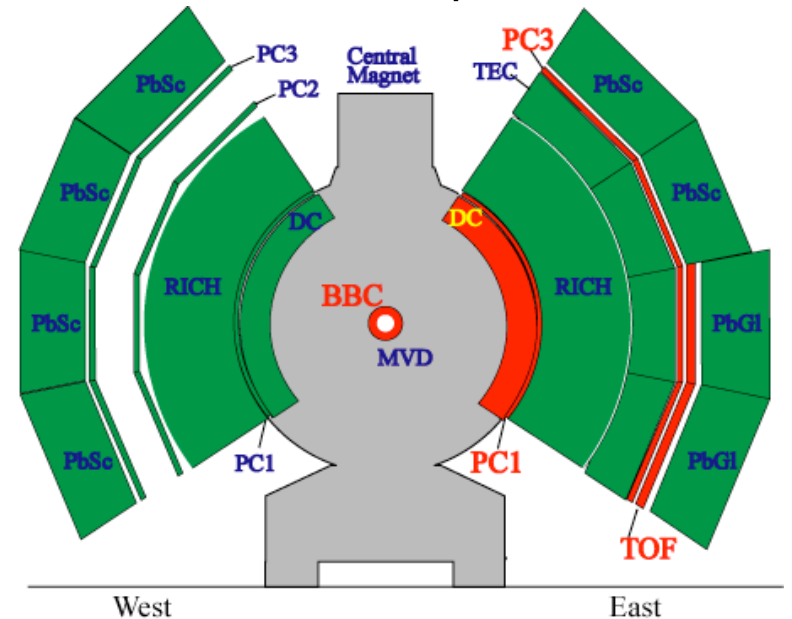
PID in PHENIX

Identified Triggers:
PHENIX TOF provides
meson/baryon separation
out to 4GeV/c
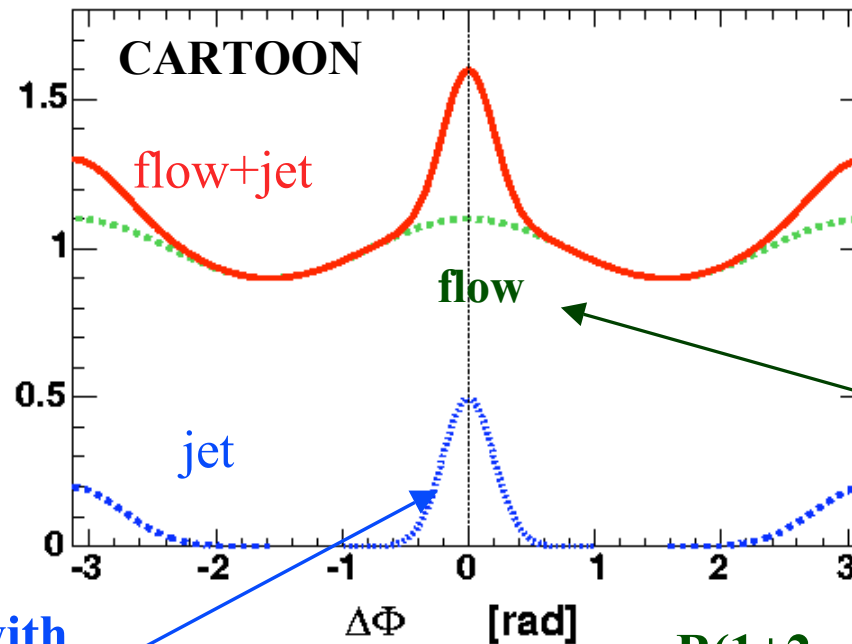

PHENIX High Resolution TOF
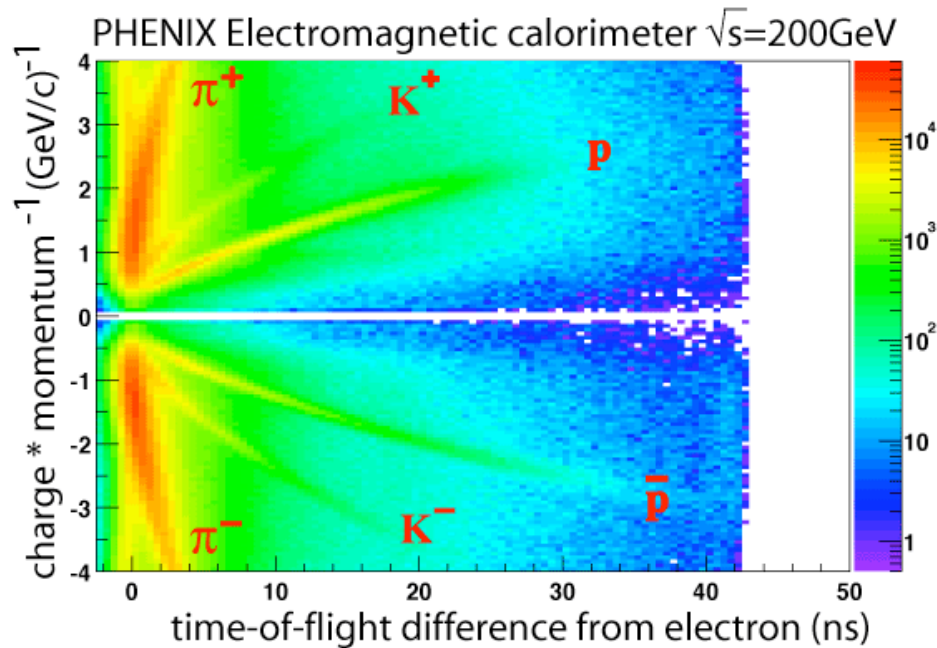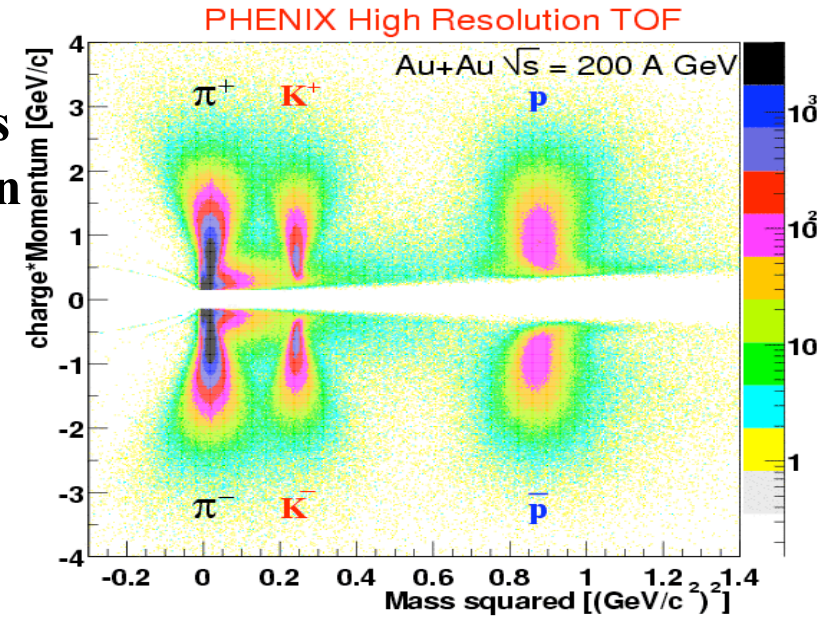
Identified Associated Particles:
PHENIX EMC provides
meson/baryon separation
out to 2.5GeV/c

Do Trigger Particles Have Associated Particles?

includes ALL triggers
(even those with no
associated particles in
the event)

$$\frac{1}{N_{trig}} \frac{dN}{d\Delta\phi}$$

CARTOON

flow+jet

flow

jet

$\Delta\Phi$ [rad]

associated particles with
non-flow angular
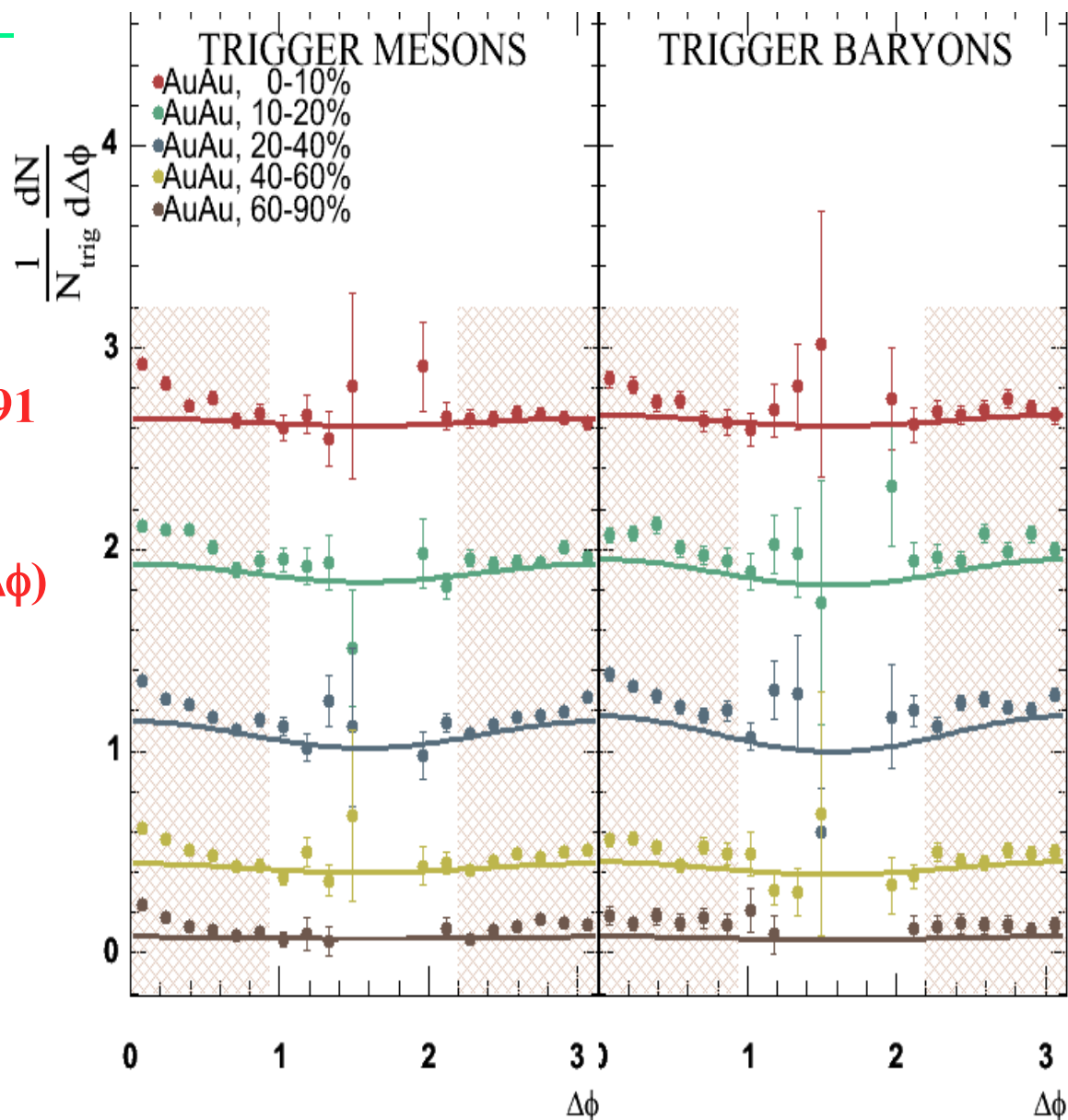correlations -> jets!

associated particles
from underlying event

$$B(1+2v_2(p_T^{trig})v_2(p_T^{assoc})\cos(2\Delta\phi))$$
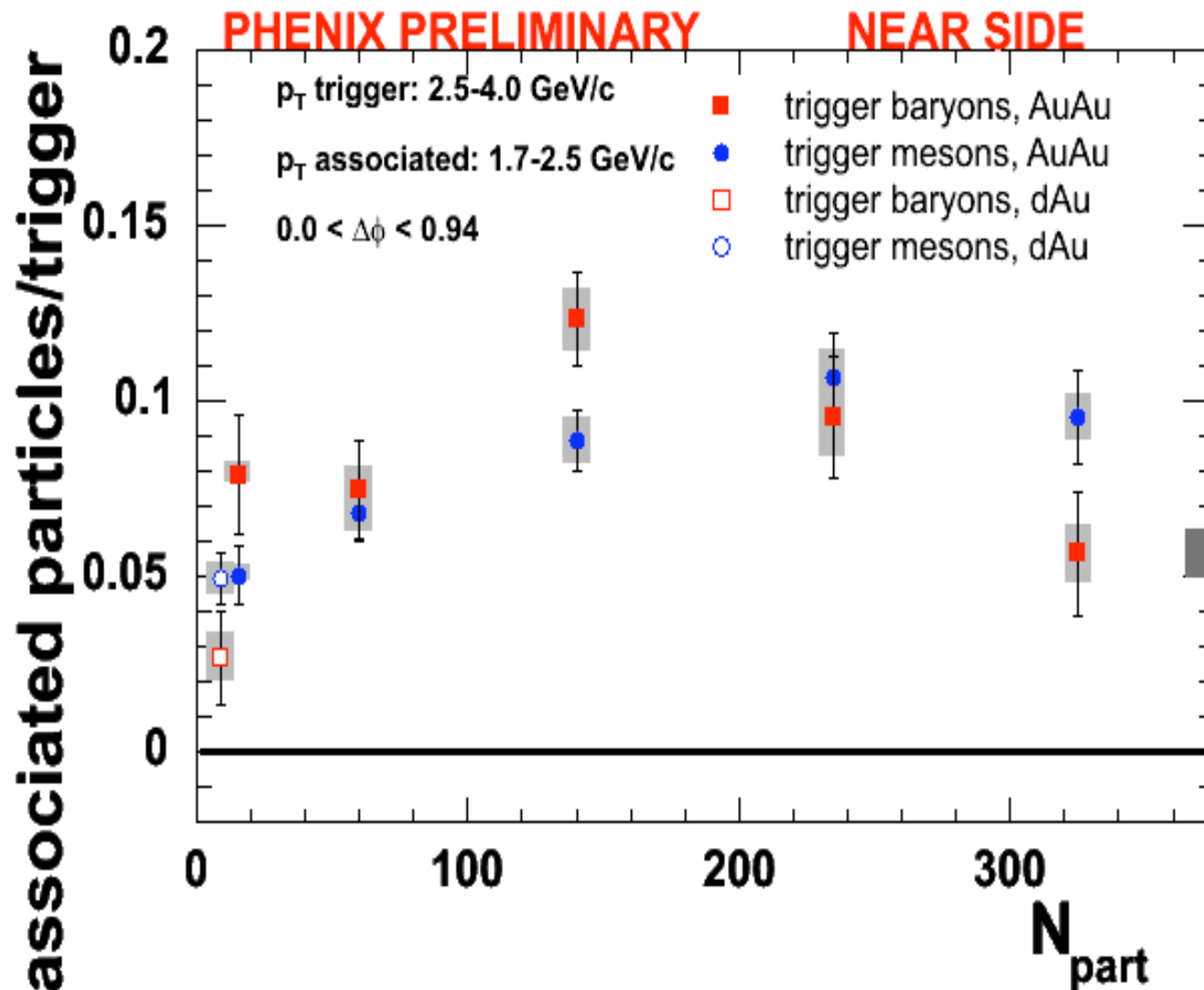
Analysis Method I --Conditional Yields

- **Combinatoric background level determined by convolution of trigger and associated particle rate**

- **v2 values taken from PRL 91 (2003) 182301 modulates combinatoric level by $1+2v_2(p_T^{trig})v_2(p_T^{assoc})\cos(2\Delta\phi)$ (solid lines in plot)**

Trigger p_T: 2.5-4.0GeV/c

Associated p_T: 1.7-2.5GeV/c

TRIGGER MESONS

TRIGGER BARYONS

- AuAu, 0-10%
- AuAu, 10-20%
- AuAu, 20-40%
- AuAu, 40-60%
- AuAu, 60-90%

$\frac{1}{N_{trig}}\frac{dN}{d\Delta\phi}$
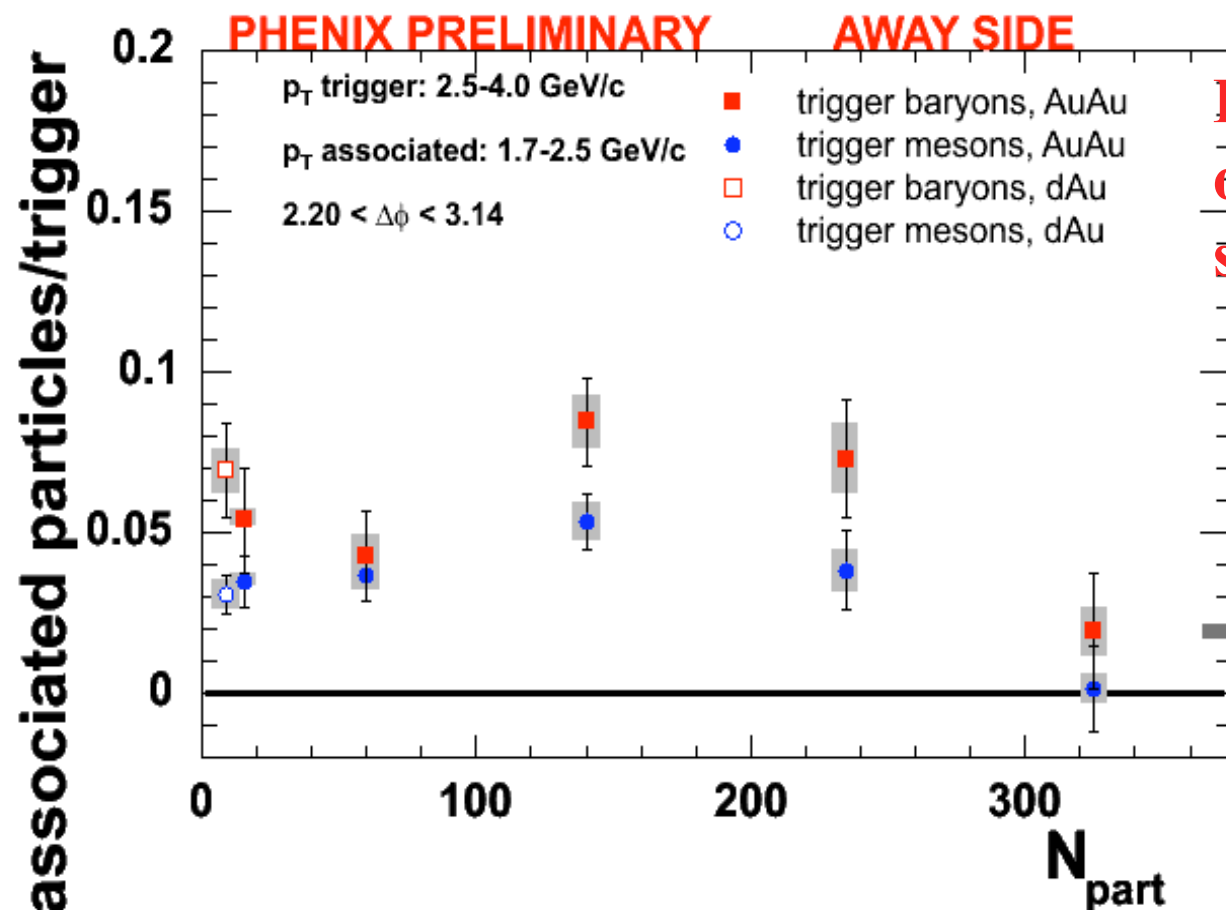
$\Delta\phi$

Identify Trigger: Source of intermediate p_T baryons?

• jet partner equally likely for trigger baryons & mesons
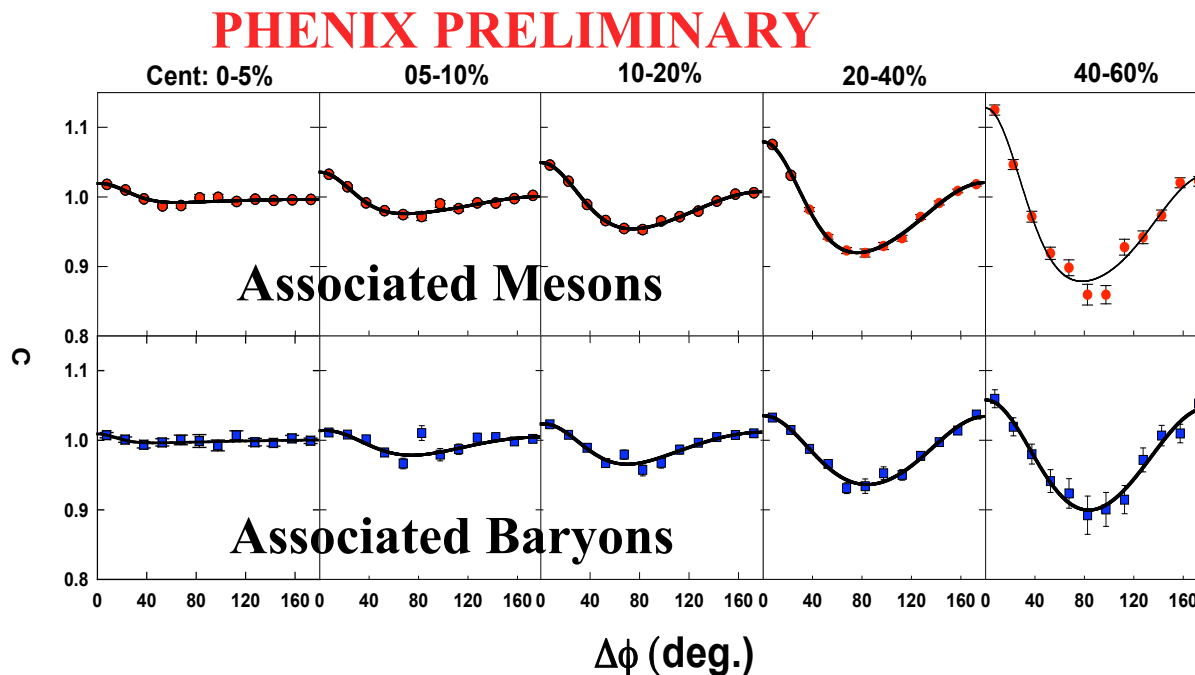
• no significant decrease with centrality!

Identify Triggers: Away Side Yields

In agreement with other measurements of suppression/broadening

Baryon trigger: more associated particles on far side?

Analysis Method II --Correlation Functions

PHENIX PRELIMINARY

Associated Mesons

Associated Baryons

Correlation functions:

$$\frac{dN/d\Delta\phi_{real}}{dN/d\Delta\phi_{mixed}}$$
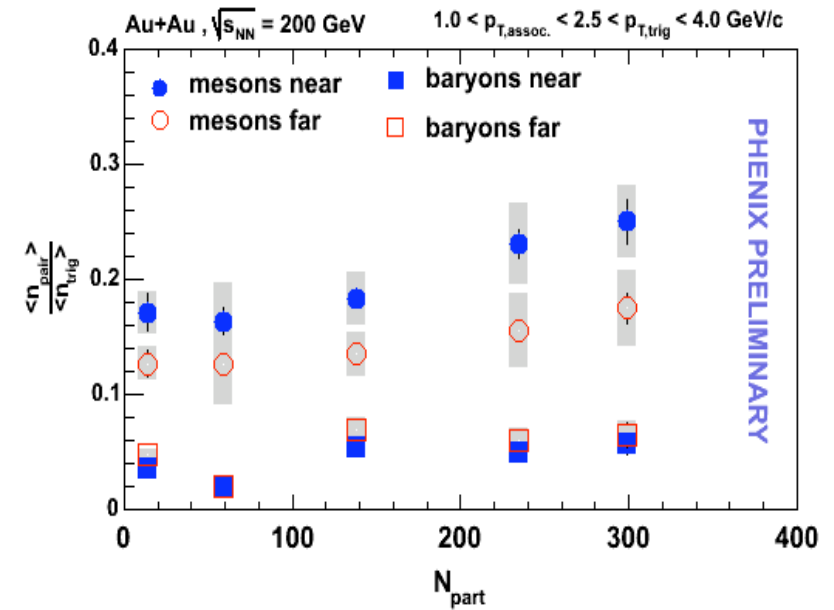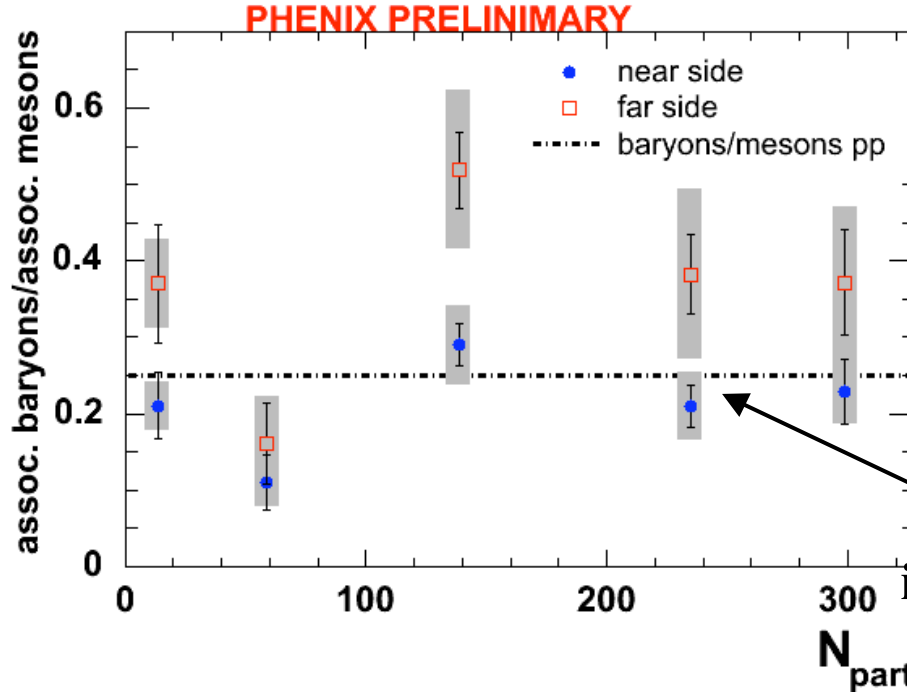
Trigger p_T:
2.5-4.0GeV/c

Associated p_T:
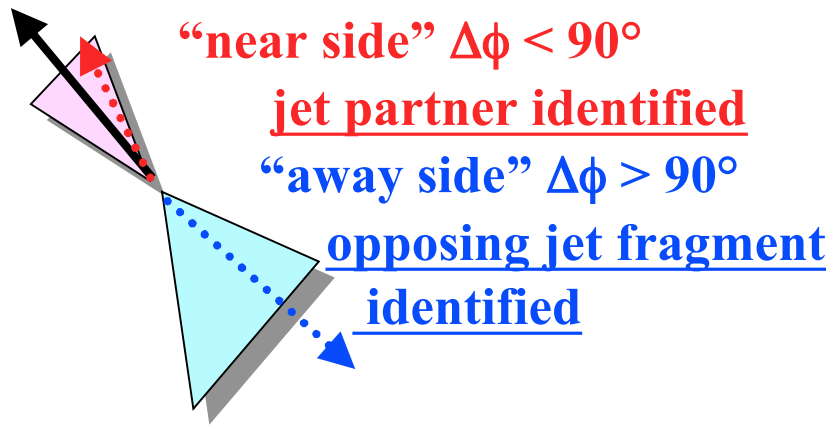**1.0-2.5GeV/c**

- same shape as "conditional yields": one factor → absolute yields

- use different trigger orientations with respect to reaction plane (Bielcikova, et al nucl-ex/0311007)

- for v_2: assume near side jet yield & shape independent of trigger orientation with respect to reaction plane (...surface emission)

- in agreement with method I

See Poster of N. Ajitanand

Identified Associated Particles--AuAu
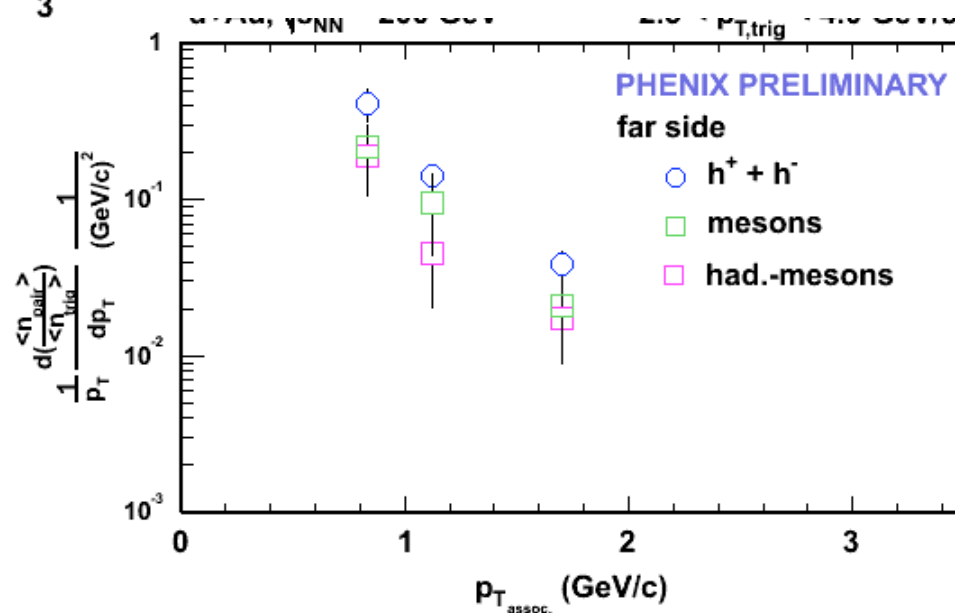
Trigger (not identified)

"near side" Δφ < 90°
jet partner identified
"away side" Δφ > 90°
opposing jet fragment
identified

Au+Au , $\sqrt{s_{NN}}$ = 200 GeV   1.0 < $p_{T,assoc.}$ < 2.5 < $p_{T,trig}$ < 4.0 GeV/c

- mesons near   ■ baryons near
- mesons far   □ baryons far

PHENIX PRELIMINARY

$\frac{\langle n_{pair} \rangle}{\langle n_{trig} \rangle}$

N_{part}

PHENIX PRELINIMARY

assoc. baryons/assoc. mesons

- near side
- far side
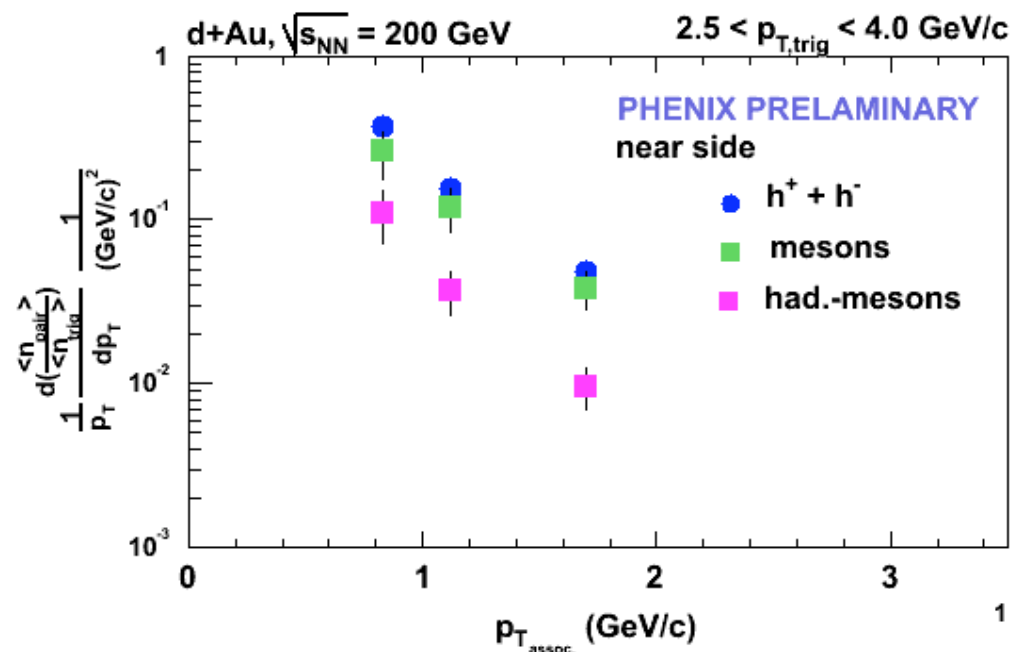- --- baryons/mesons pp

N_{part}

PHENIX's limited η acceptance or a medium effect?

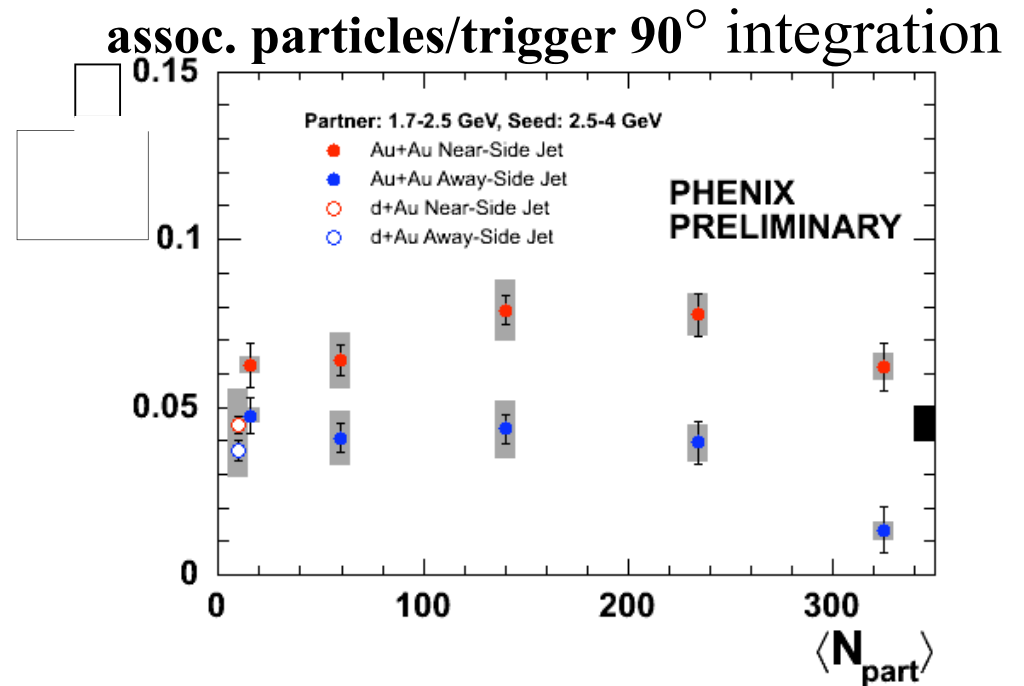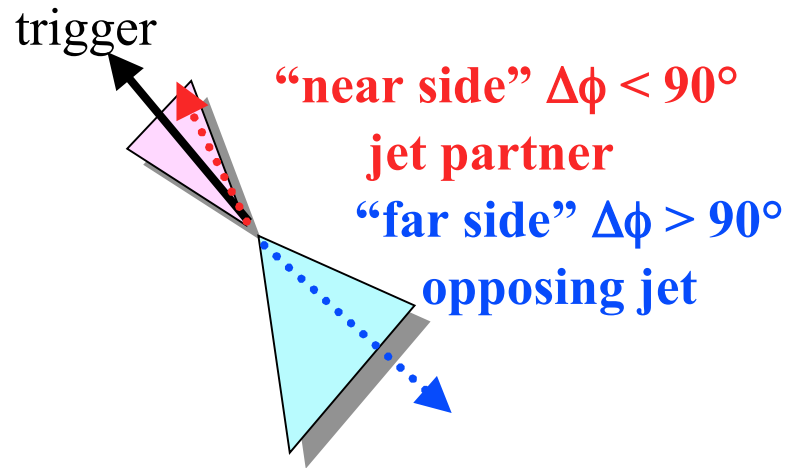**inclusive baryon over meson in pp**

Conclusions

- **Same side identified trigger particle yields approximately constant with centrality and greater than or equal to the dAu values--more statistics needed**

- **Baryons and mesons at 2.5GeV/c must include at least some partons from jets**

- **Near side yields for triggered baryons and mesons are the same**

- **Higher baryon to meson ratio in away side jet than near side and pp**

Identified Associated Particles--dAu

Away-side jet in Au+Au

trigger

"near side" Δφ < 90°
jet partner
"far side" Δφ > 90°
opposing jet

assoc. particles/trigger 90° integration

Partner: 1.7-2.5 GeV, Seed: 2.5-4 GeV
- Au+Au Near-Side Jet
- Au+Au Away-Side Jet
- d+Au Near-Side Jet
- d+Au Away-Side Jet

PHENIX
PRELIMINARY

see talk by J. Rak