Joint CATHIE / TECHQM Workshop

December 14-18, 2009

Recent d+Au results from PHENIX

Ondřej Chvála (UC Riverside)
for the PHENIX collaboration

PHENIX Run8 d+Au

- Run8: 30x higher total integrated luminosity of d+Au events compared to Run3

	min bias	triggered
p + p	529 M	1170 M
d + Au	1649 M	3680 M

- Outline
  - Di-hadron jet correlations, underlying event yields
  - Single particle measurements
  - Forward/central correlations

Di-hadron correlations in d+Au

Jiangyong Jia (for PHENIX)
arXiv:0906.3776v1 [nucl-ex]

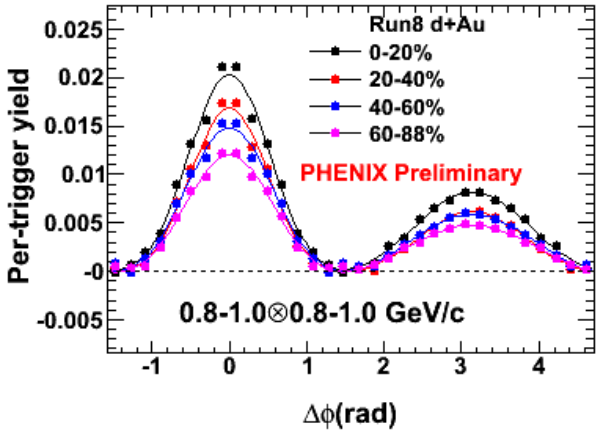
Jet modification in d+Au

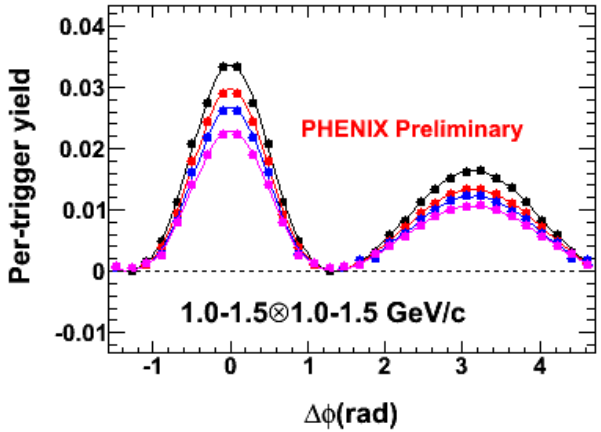
→ yields per trigger

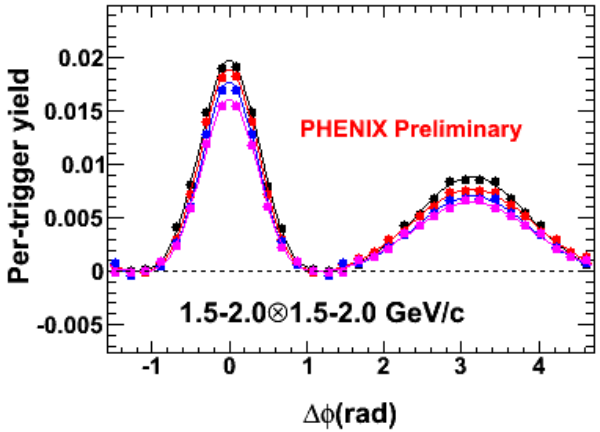
Enhancement at low p_T with centrality, vanishes for $p_T a + p_T b > 4$ GeV/c

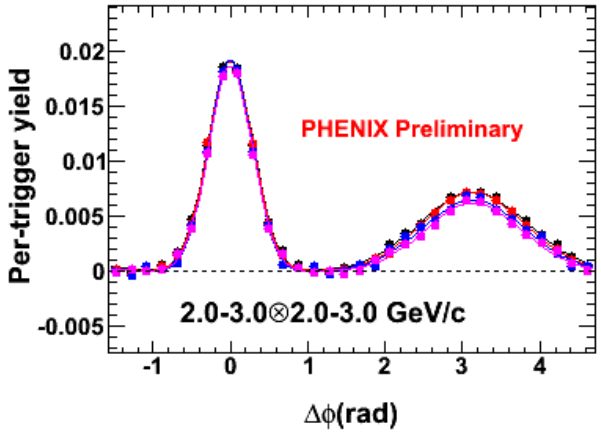
→ jet shape

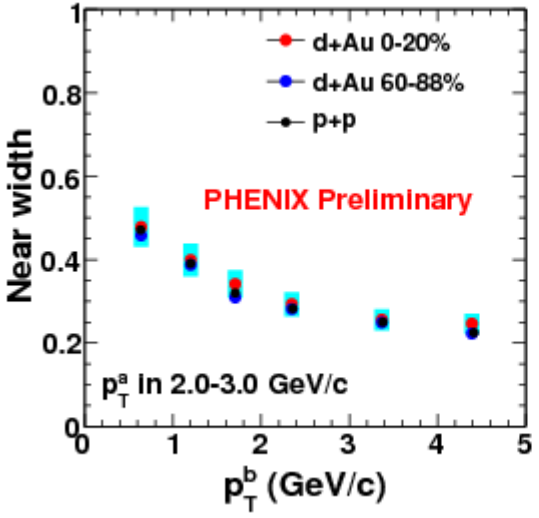
Width consistent with p+p
Broadening on away side (within syst. errors)

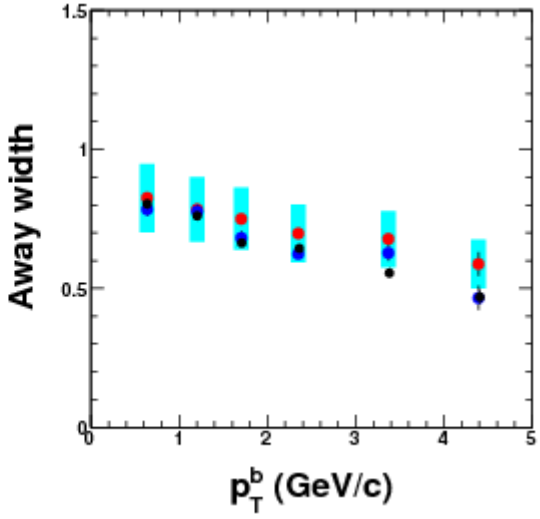










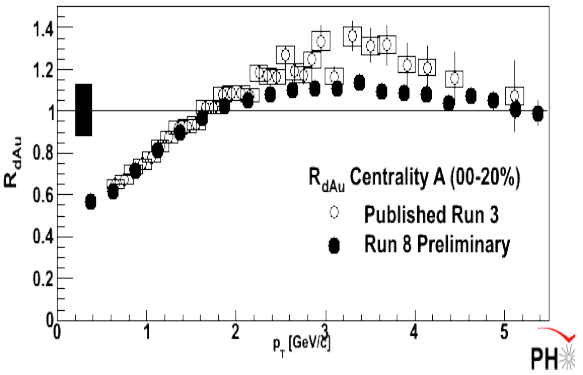


Di-hadron correlations in d+Au: J_{dAu}

Modification of pair yield: $$J_{dAu}(p_T^a, p_T^b) = \frac{\mathrm{PairYield_{dAu}}}{\mathrm{N_{coll}} \times \mathrm{PairYield_{pp}}}$$

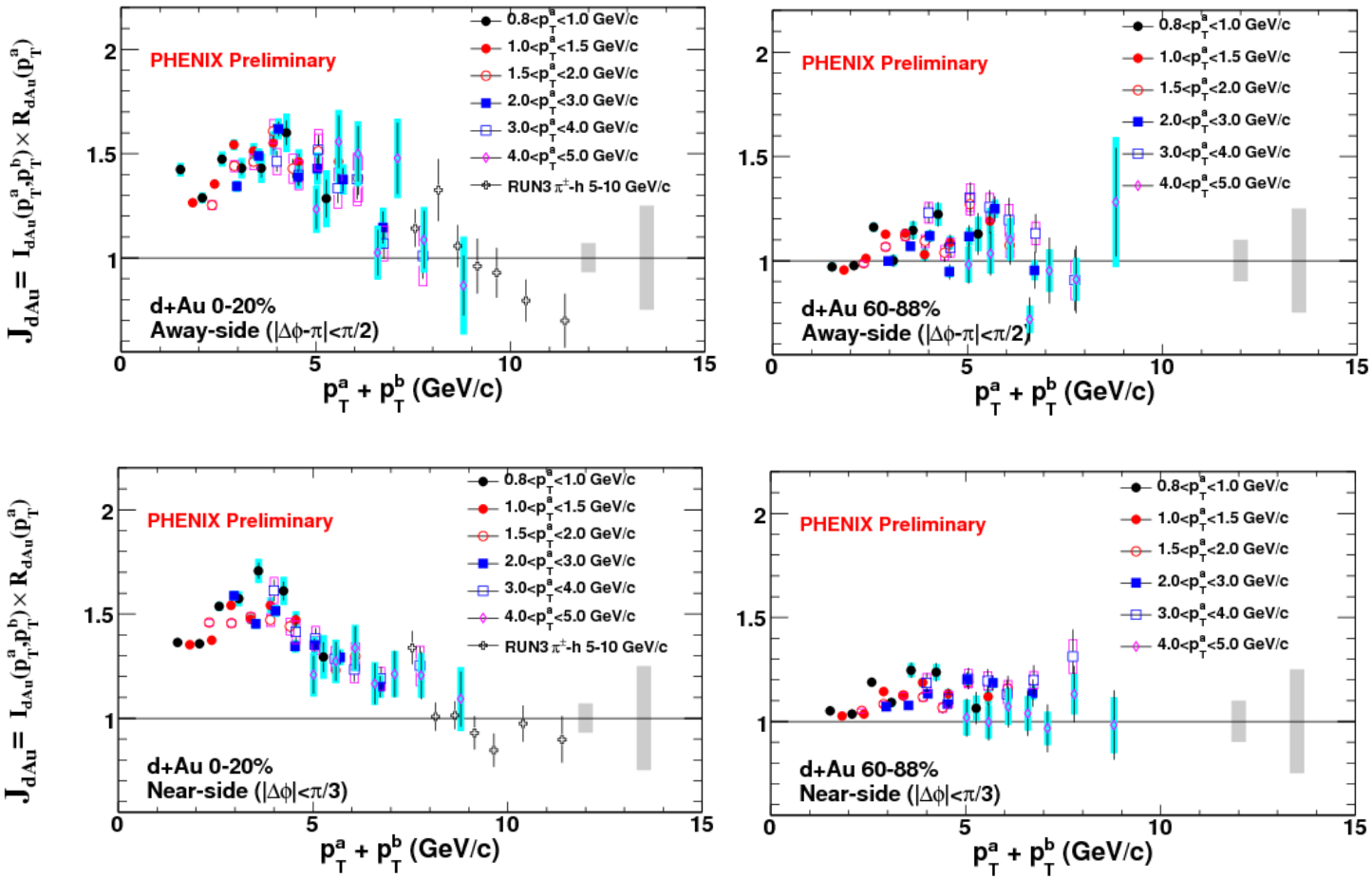
Scaling with sum of p_Ts

Cronin-like peak in central events, lack of low p_T suppression



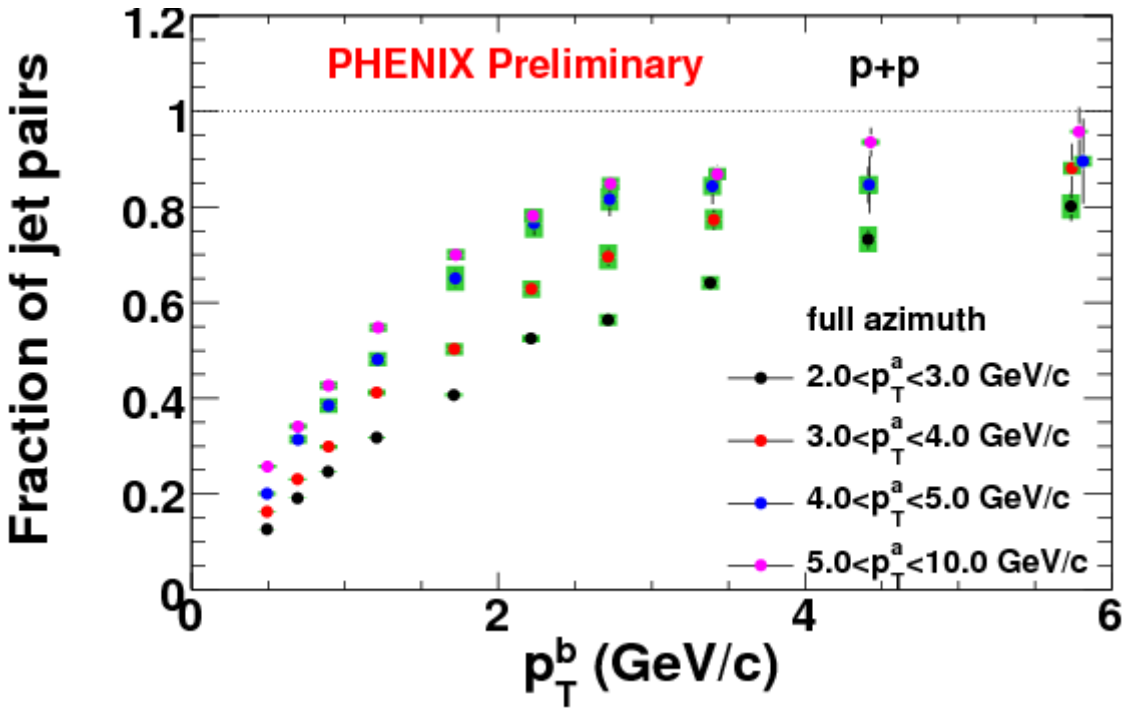
Little modification for peripheral events.

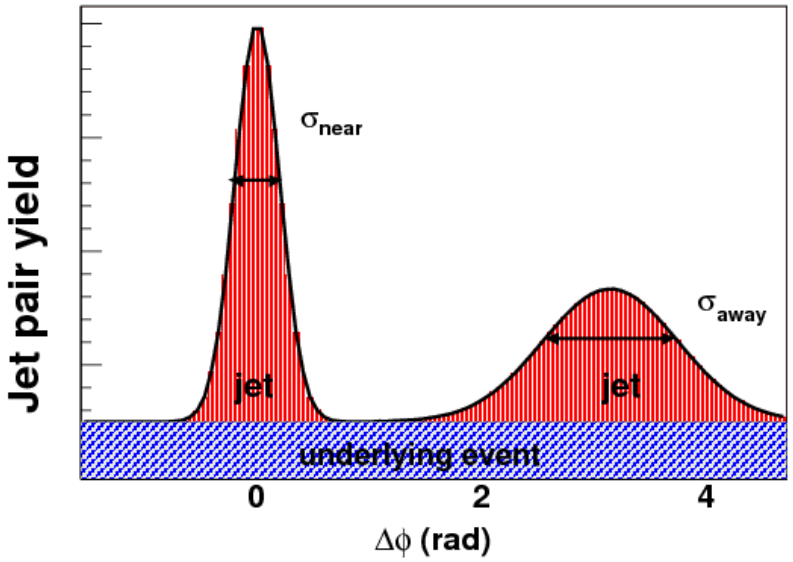
Central (0-20%) | **Peripheral (60-88%)**



Underlying event (UE) “pedestal” in p+p

What is relative contribution from the jet and from UE?





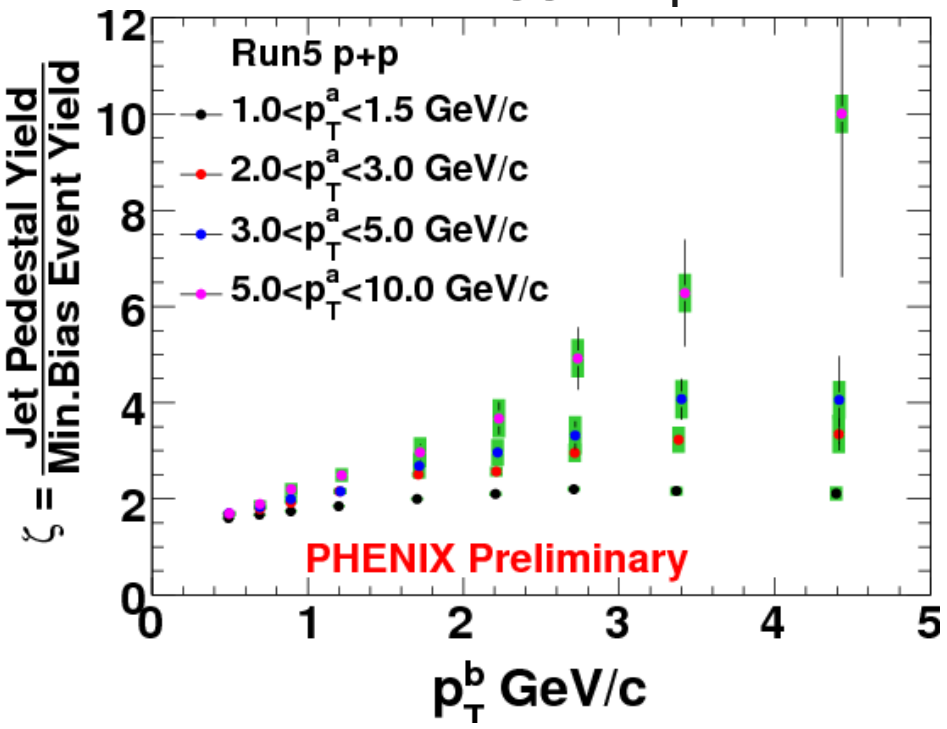
Jiangyong Jia (for PHENIX)
arXiv:0906.3776v1 [nucl-ex]

Jet fraction increases with increasing trigger (p_Ta) and associate (p_Tb) transverse momenta

UE yield in p+p and d+Au

ζ = (associated UE yield per trigger) / (min bias yield per event)

p+p, four trigger p_T bins

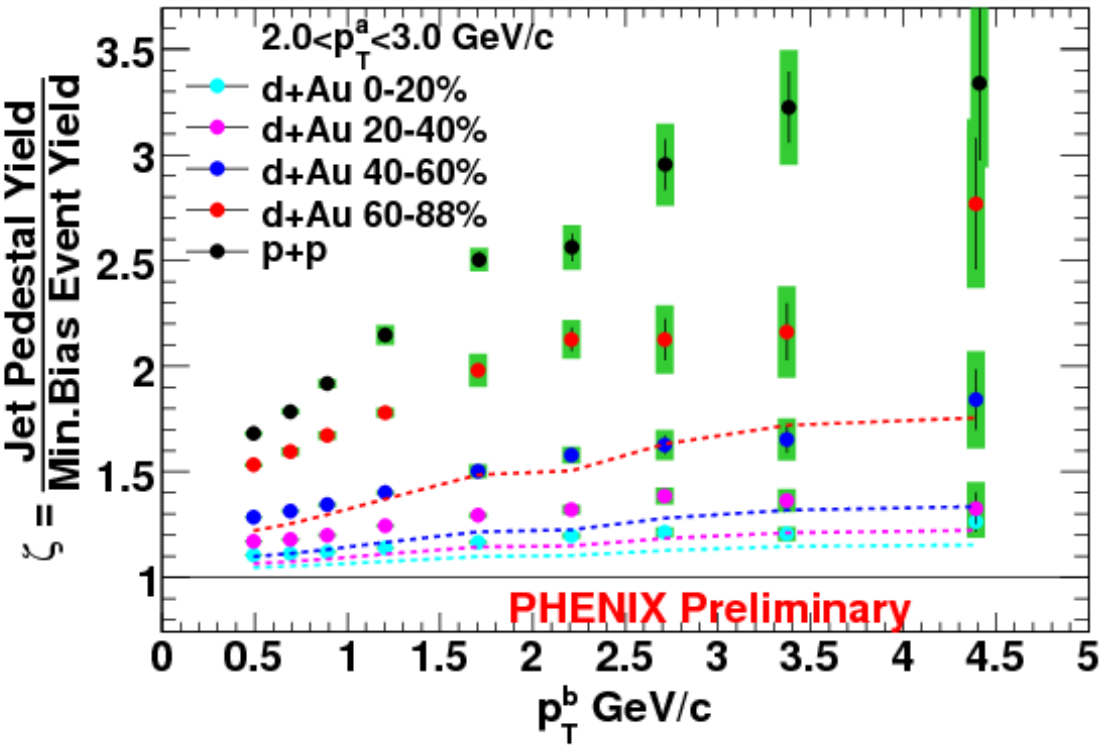


ζ > 1

p+p centrality bias due to trigger?

→ enhancement of multi-parton interactions

centrality dep. at one p_T bin

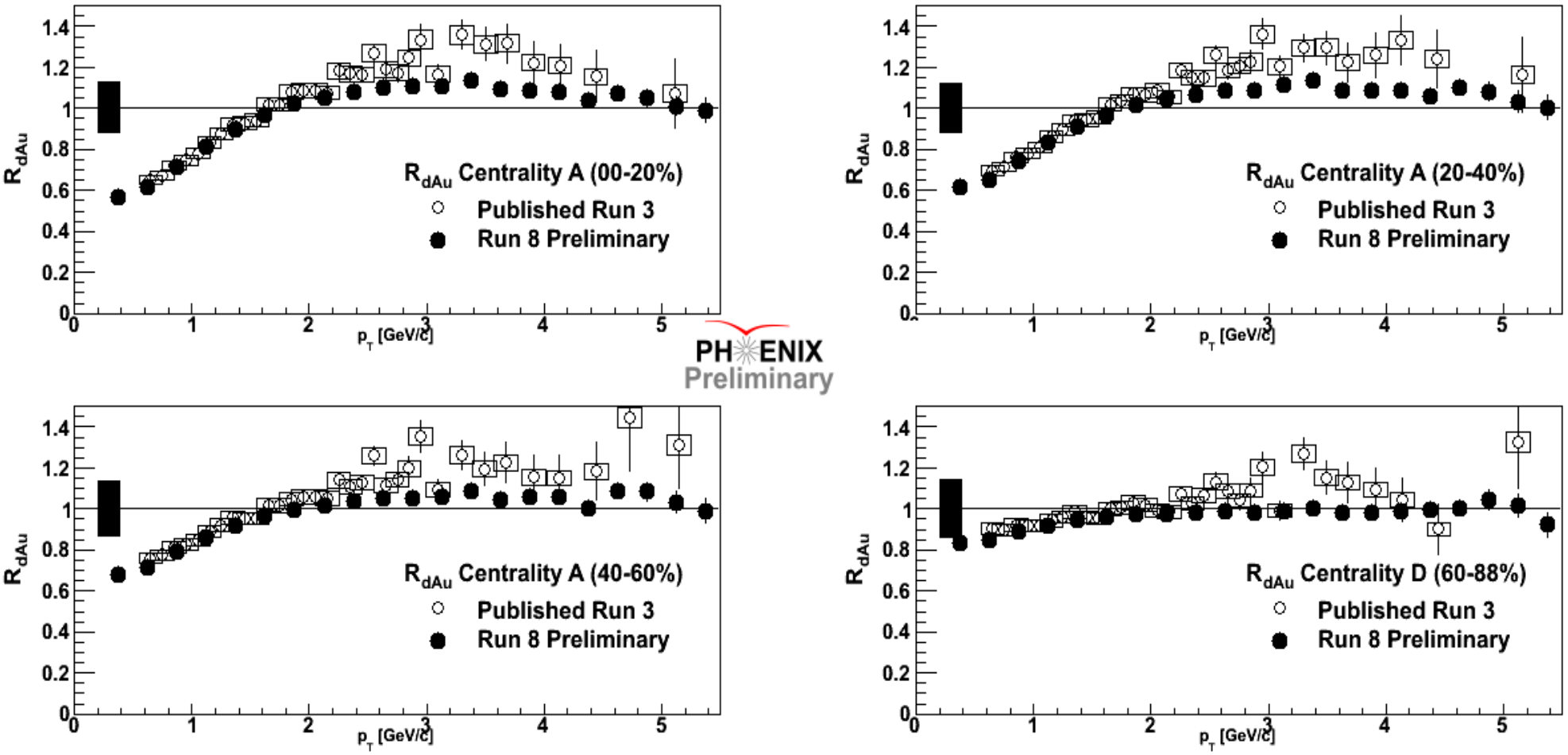


- Much smaller centrality bias in d+Au due to trigger requirement?
- UE in d+Au (containing trigger) ≠ UE in p+p (with trigger) +
  + (Ncoll-1) UE p+p (min bias)

… soft physics, work in progress

Inclusive charged R_{dAu} at midrapidity

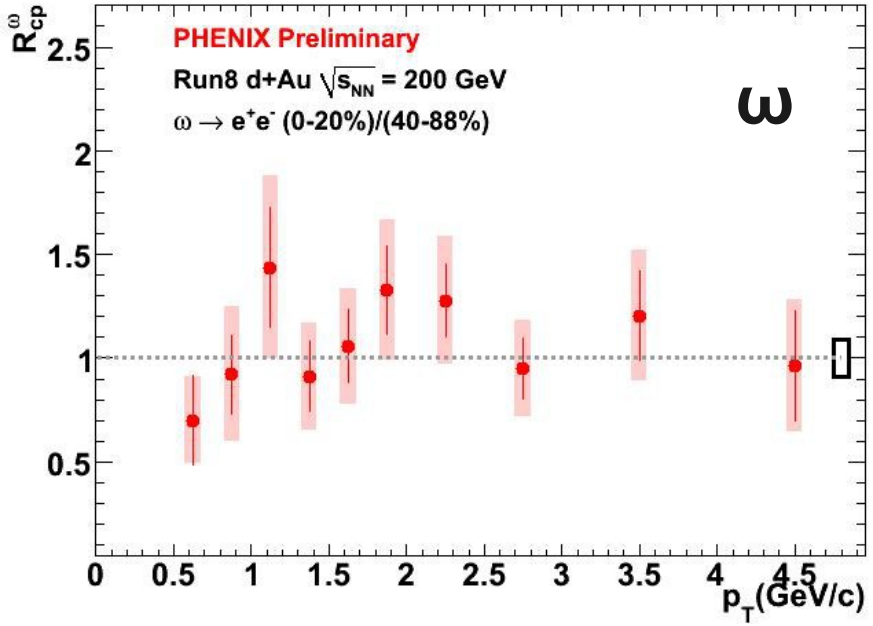
Zvi Citron (for PHENIX), arXiv:0907.4796v3 [nucl-ex]

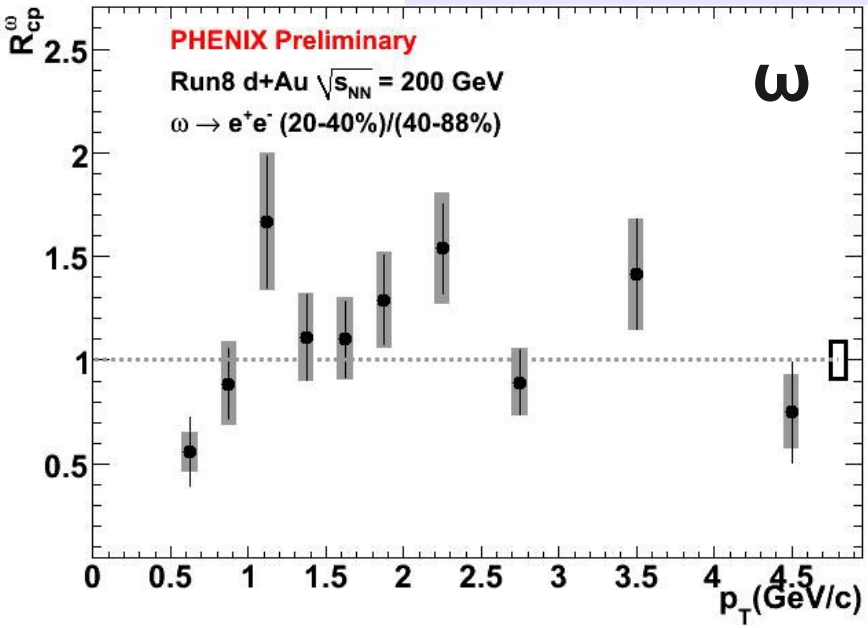


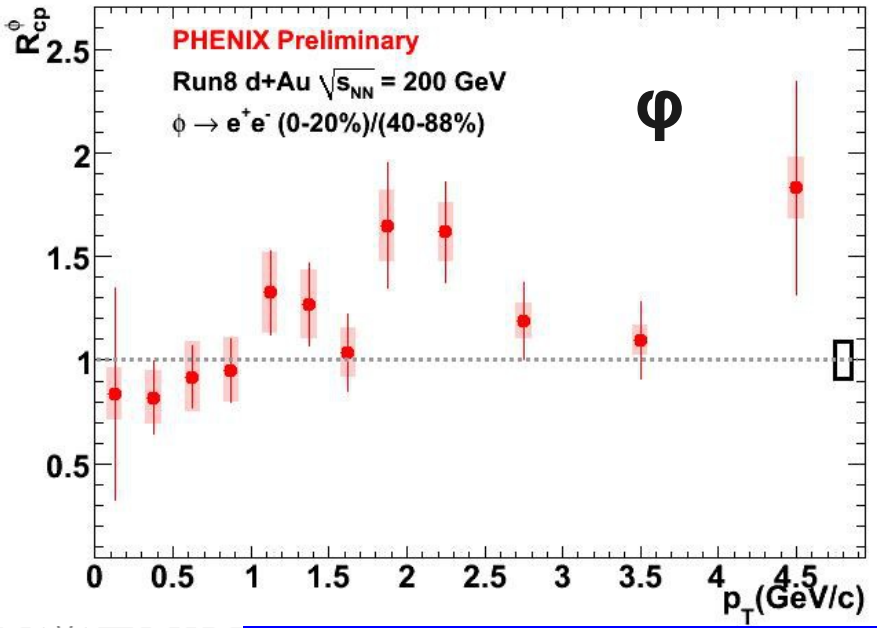
New preliminary data overlap with year 2003 π^0 measurement

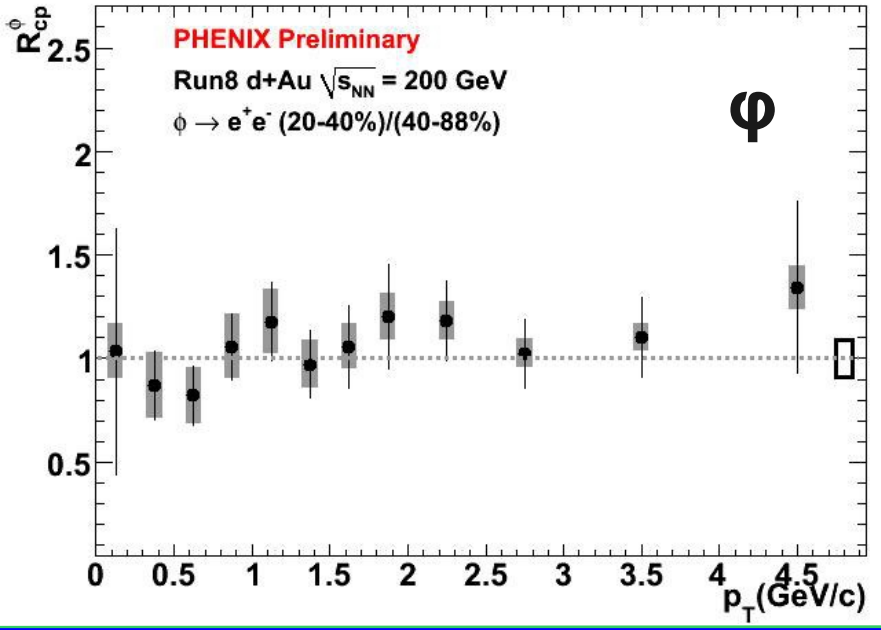
Light vector meson R_{CP} at midrapidity

Deepali Sharma et al.



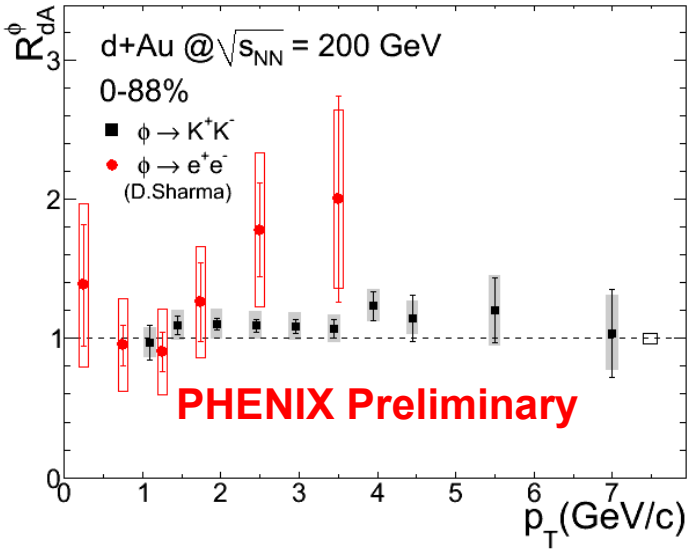


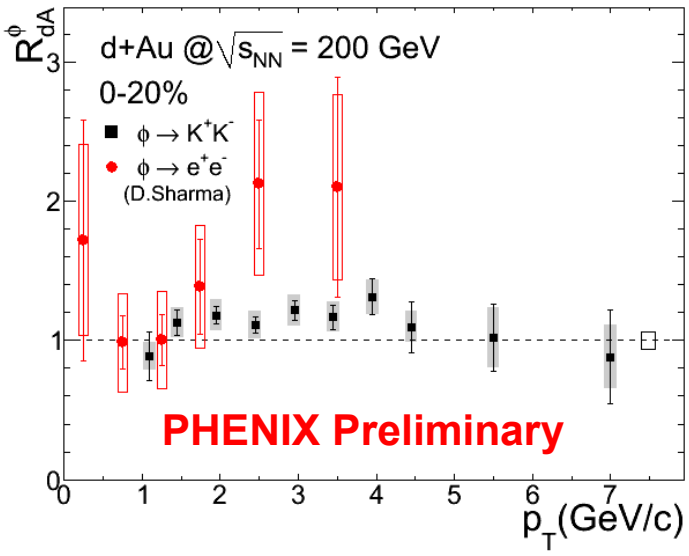


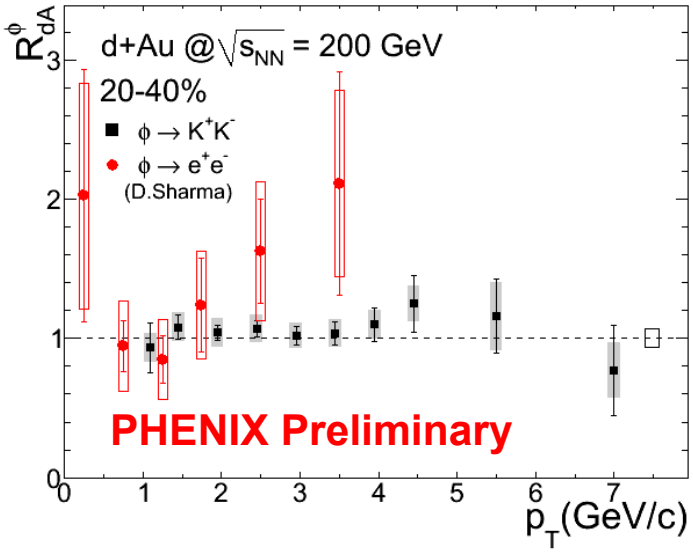


R_{dAu} of φ meson production at midrapidity

e+e- channel: Deepali Sharma et al.
K+K- channel: Dmitry Kotov et al.







Red/Black points are for e^+e^-/K^+K^- points

φ production is consistent in e+e- and K+K- channels
No mass shift observed in d+Au

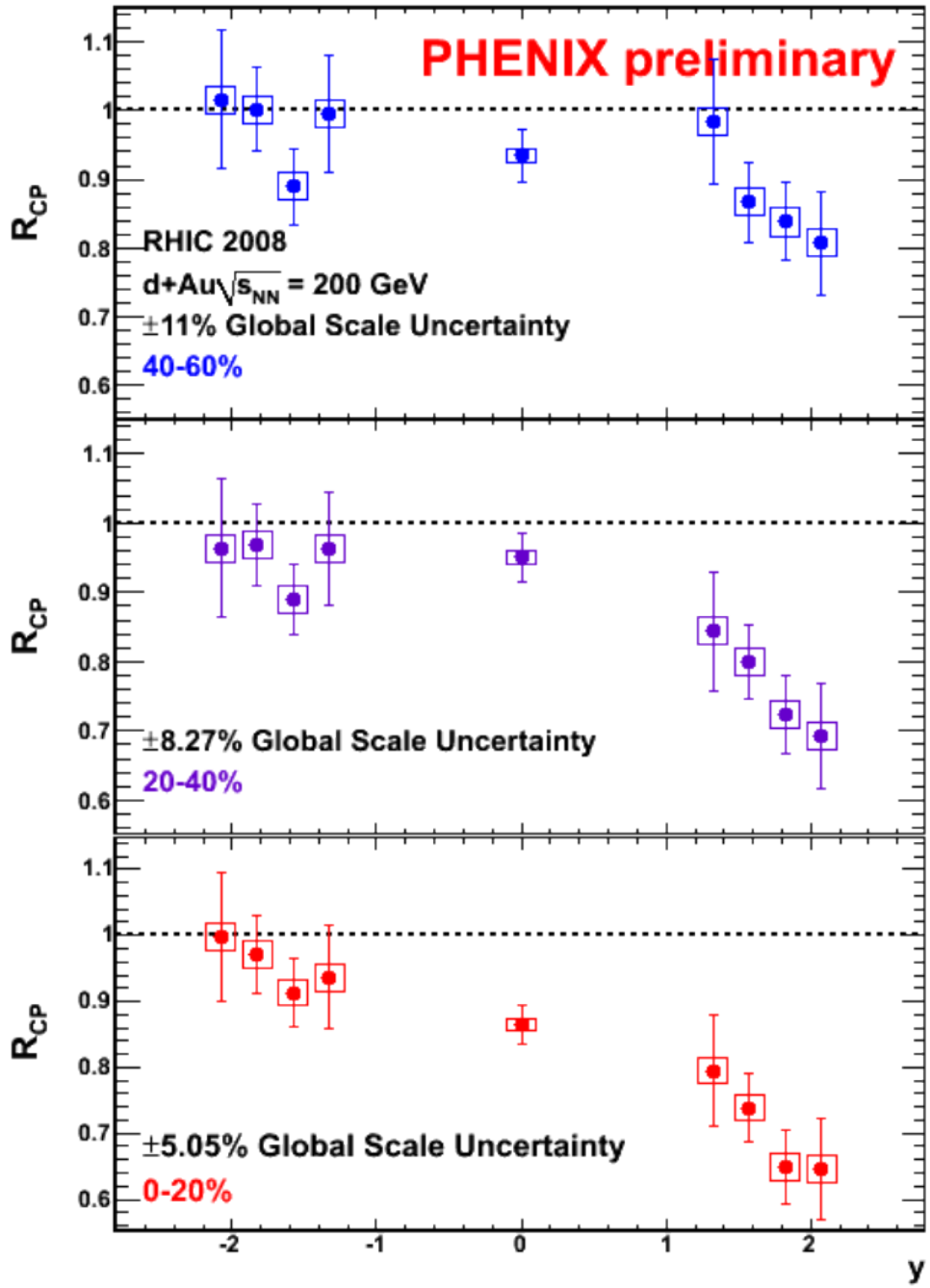
J/ψ R_{CP} as a function of rapidity

J/ψ suppression in forward (d) direction is progressively suppressed.

No suppression in backward (Au) direction.

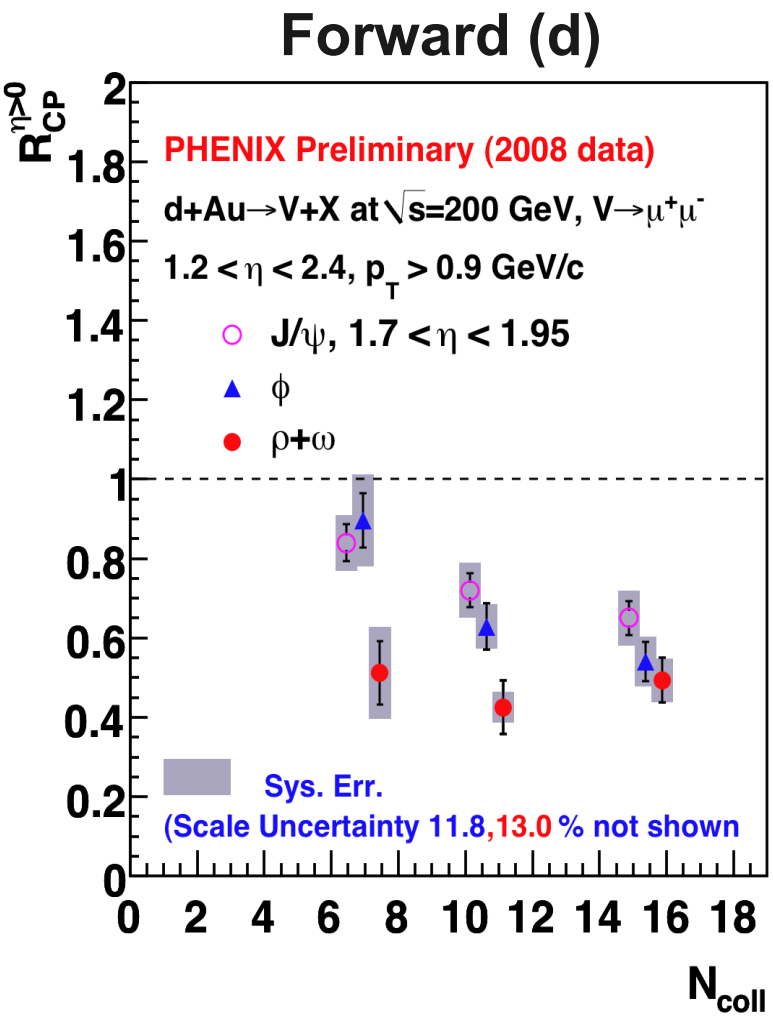
Preliminary shown at QM2009, publication in progress.

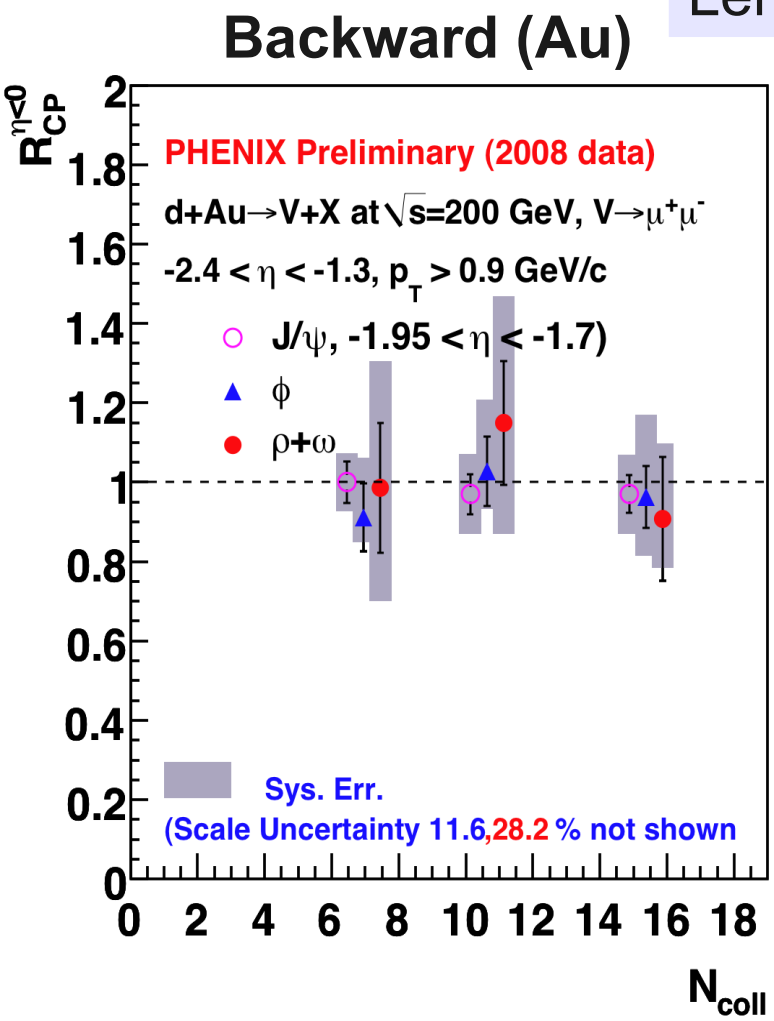
L. A. Linden Levy et al.



Low mass vector mesons from muon arms

Lei Guo et al.

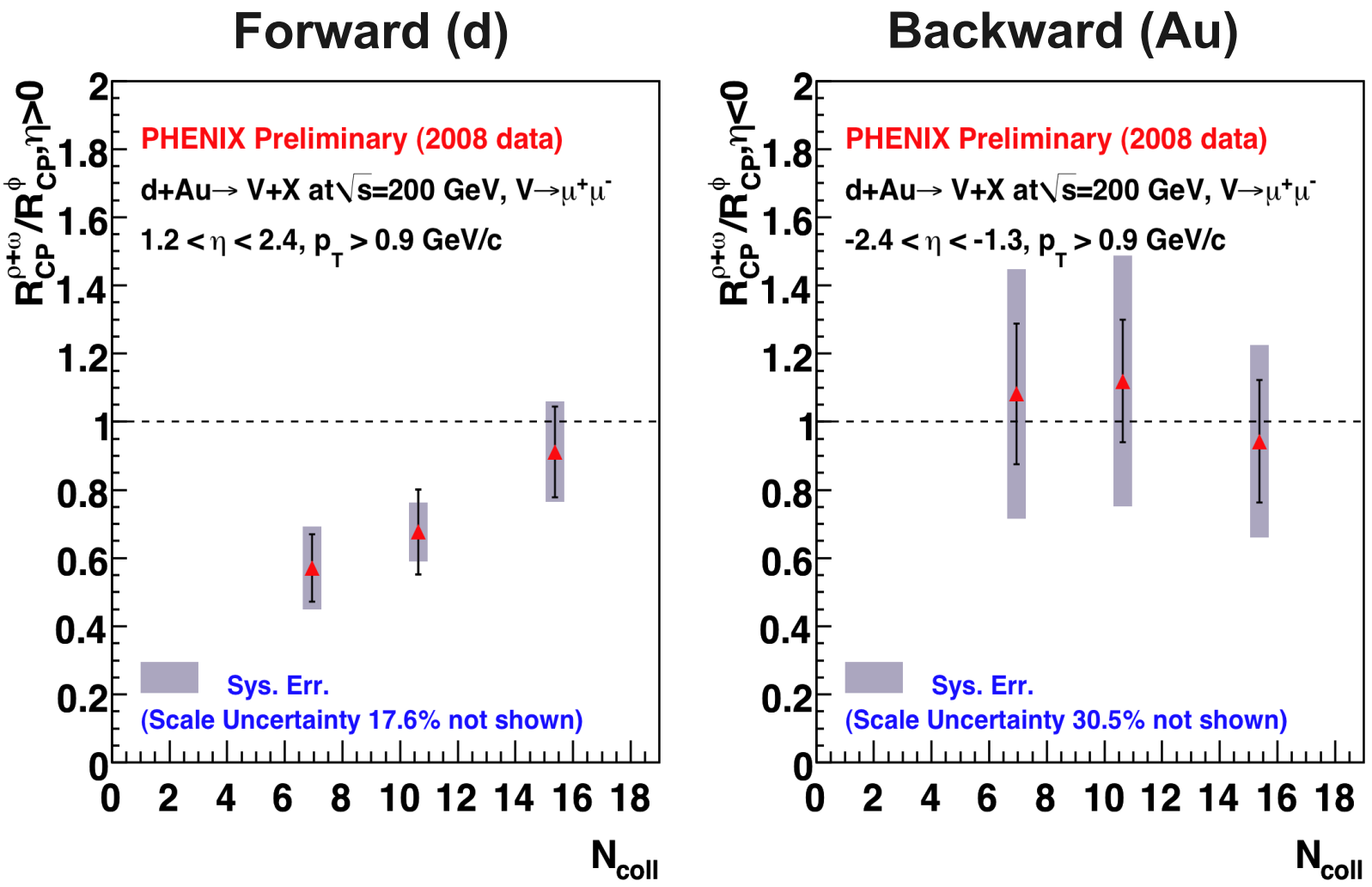




Suppression in forward direction similar for φ and J/ψ

No suppression in backward direction

Ratio of R_{CP} results of ρ+ω to φ



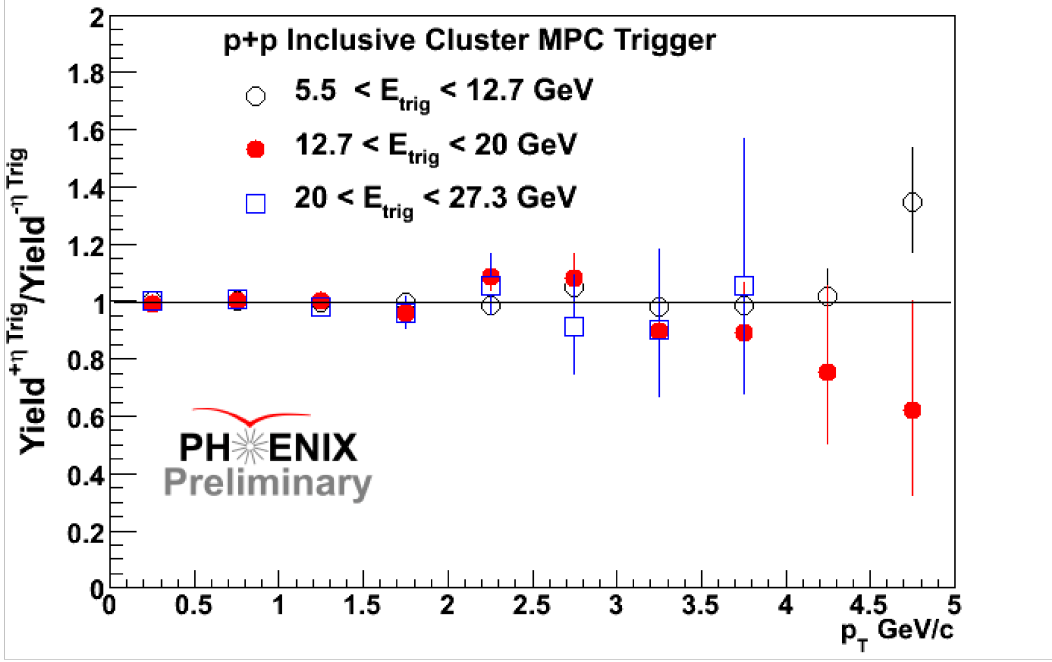
Results suggestive of faster suppression in forward rapidity for vector mesons composed of lighter quarks

MPC + central arms correlation

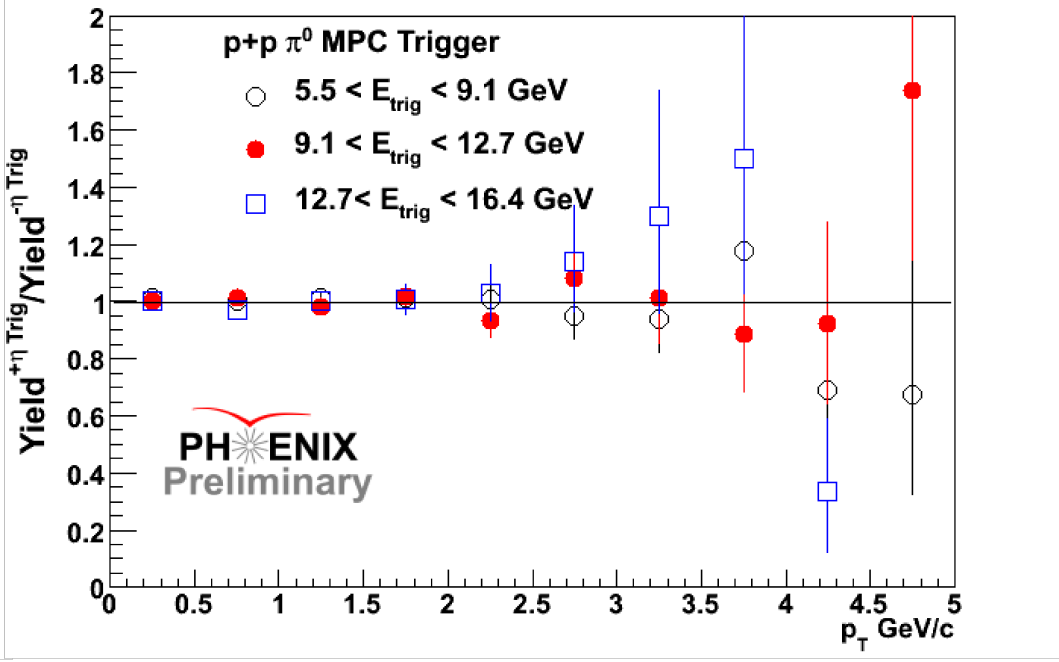
South and North Muon Piston Calorimeters (MPC) cover region -3.1 to -3.7, and 3.1 to 3.9 in η

MPC yields can be correlated with mid-rapidity triggers, or vice-versa, to probe the low-x region in Au.

Ratio of forward/backward triggered mid-rapidity charged hadron yields from 2008 p+p data to confirm symmetry



MPC inclusive cluster trigger

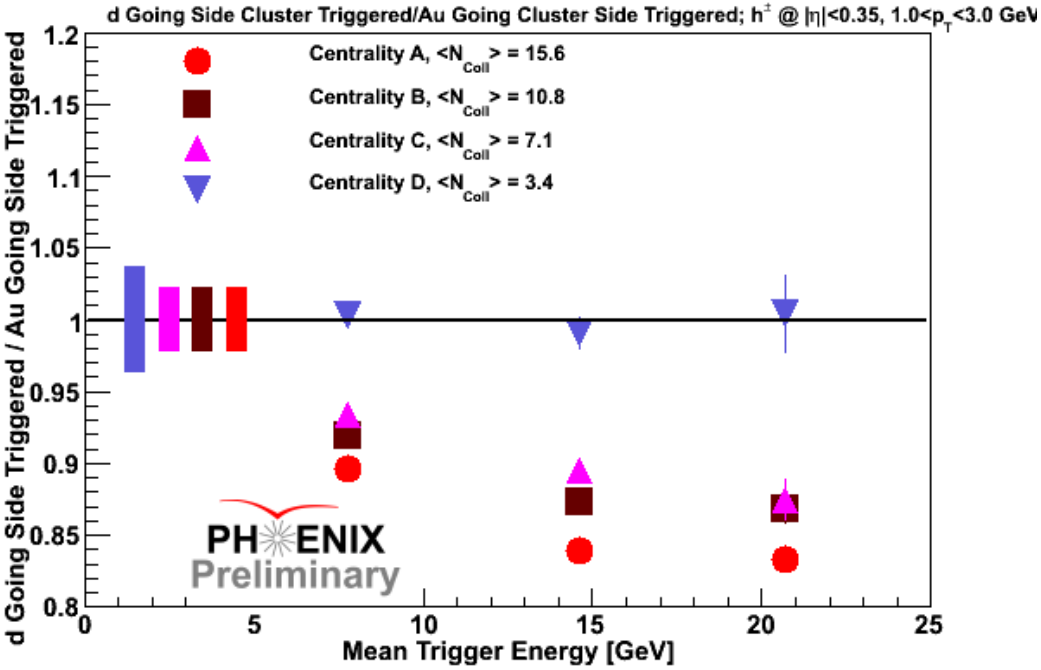


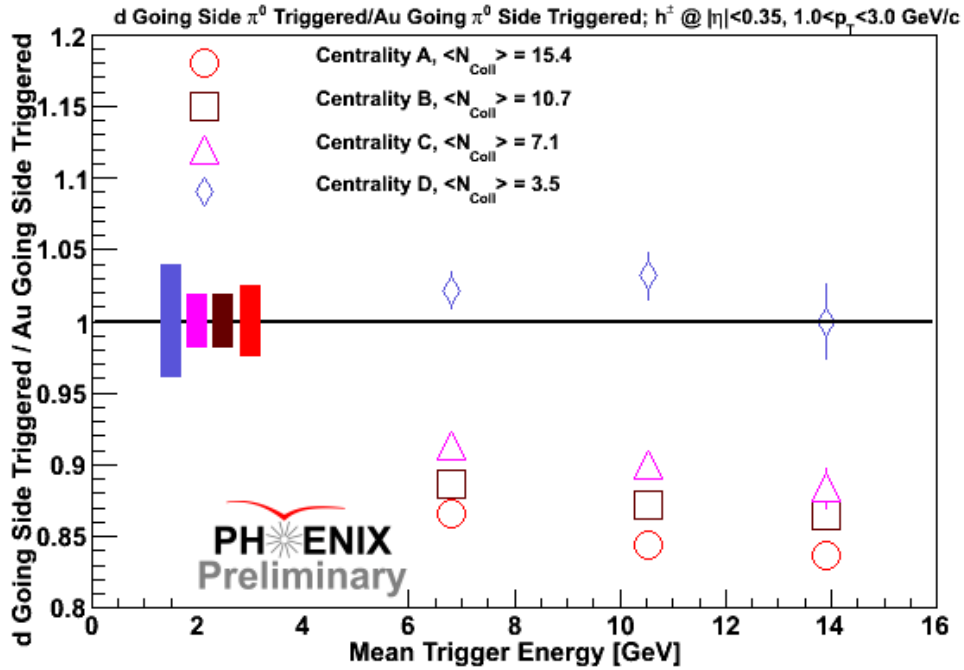
MPC reconstructed π^0 trigger

Zvi Citron (for PHENIX), arXiv:0907.4796v3 [nucl-ex]

Ratio of mid-rapidity yields using MPC trigger

Mid-rapidity charged particle yields $h^{\pm}$ are off-line "triggered" by MPC cluster or π^0
Ratio of forward (d) / backward (Au) triggered yields is shown:



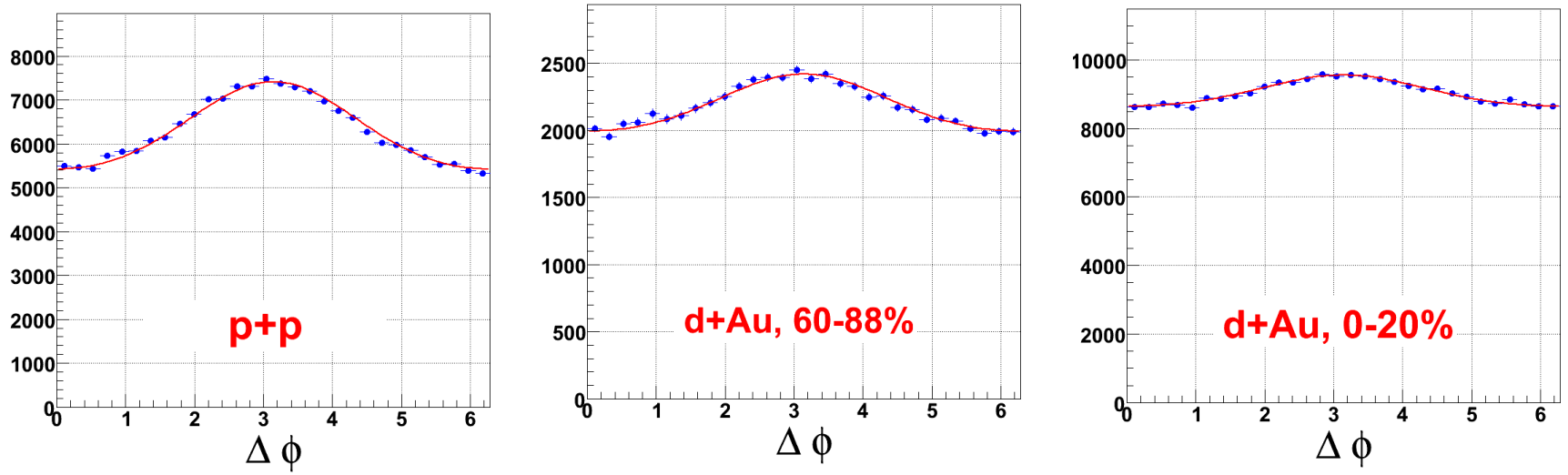


Suppression increases with Ncoll and trigger energy

Zvi Citron (for PHENIX), arXiv:0907.4796v3 [nucl-ex]

MPC yields correlated to a mid-rapidity trigger

Example of Δφ correlation function.
Trigger pi0 at midrapidity, associate pi0 in MPC, for 3 centralities:



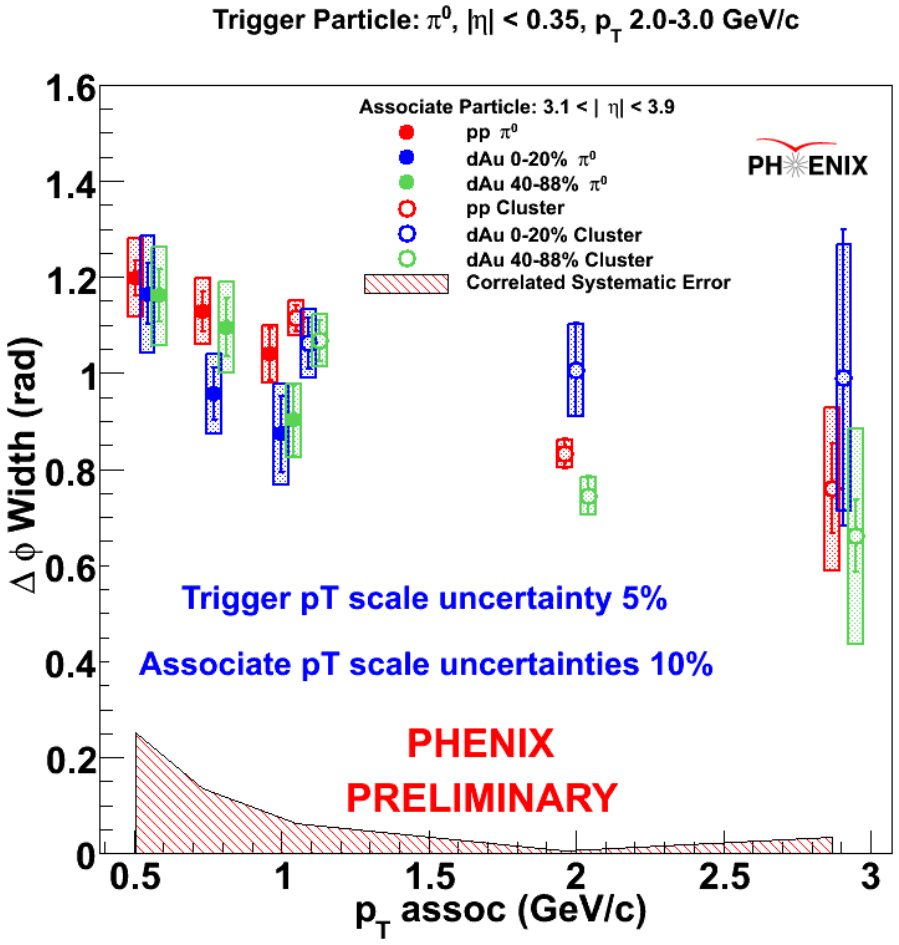
Conditional yield (CY) is the integral of the peak minus the combinatorial background, normalized per trigger

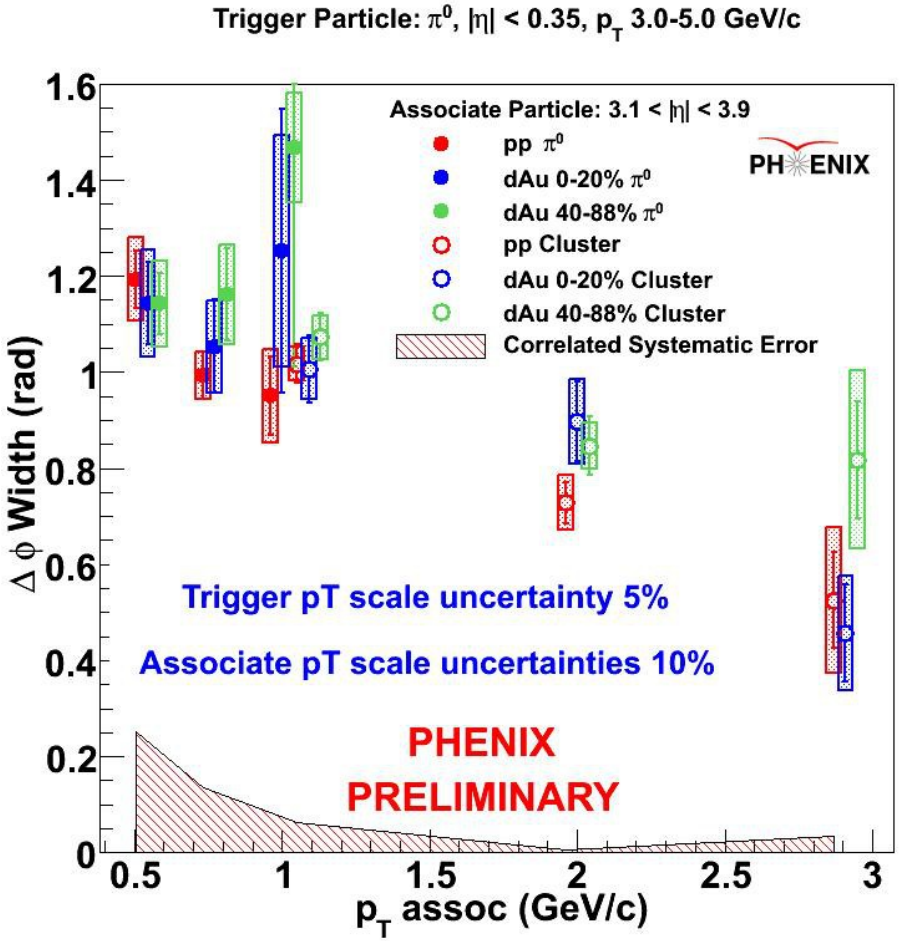
$$CY = \frac{\int_0^{2\pi} d(\Delta\phi)(CF(\Delta\phi) - bg(\Delta\phi))}{N_{trig} \times \epsilon}$$

Nuclear modification factor $I_{dA} = \frac{CY_{dA}}{CY_{pp}}$

Beau Meredith (for PHENIX), arXiv:0907.4832v2 [nucl-ex]

Correlation widths



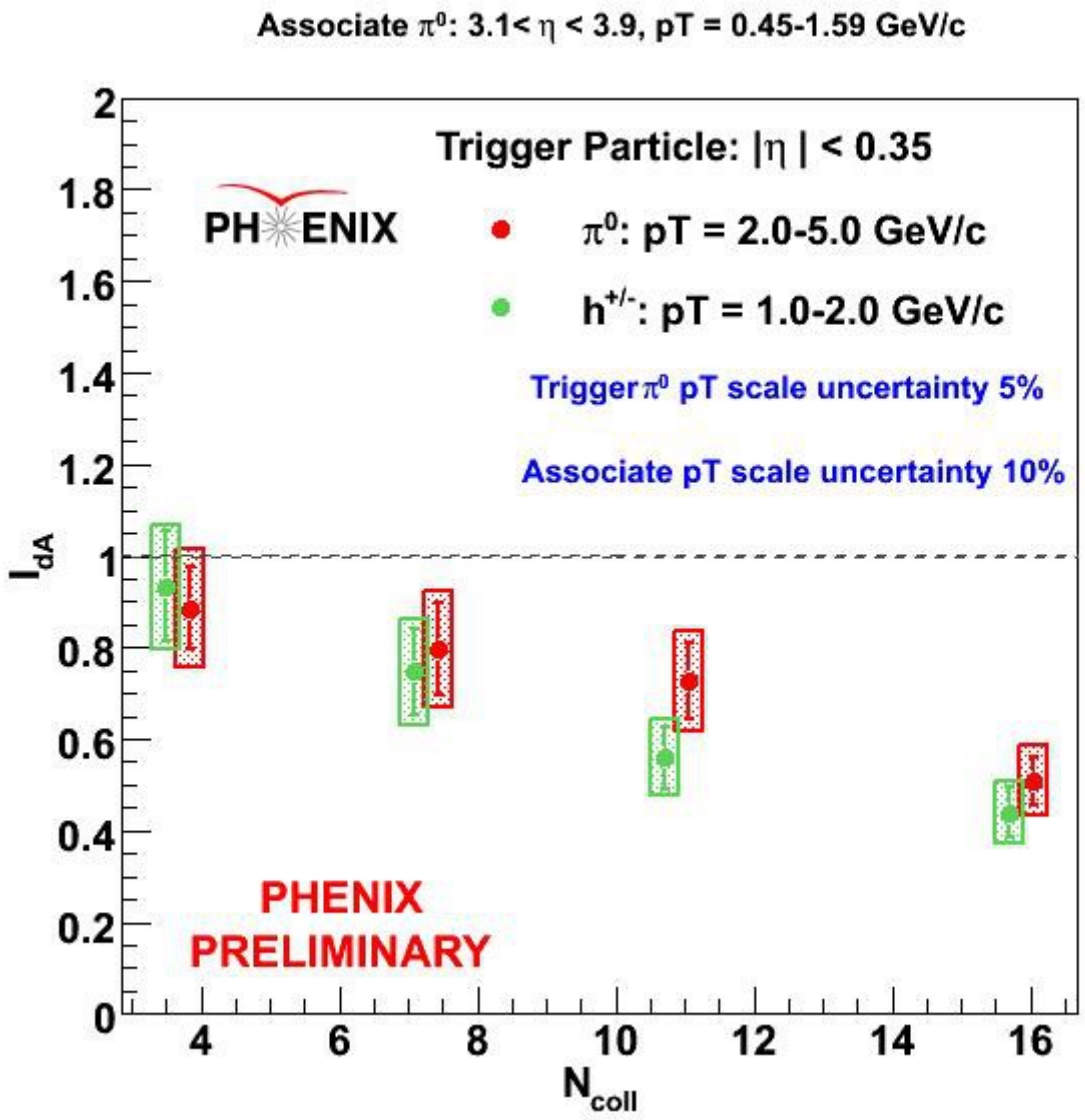


The widths decrease with increasing p_T as expected from vacuum jet fragmentation. Within the precision there is no significant difference apparent between p+p and d+Au

Beau Meredith (for PHENIX), arXiv:0907.4832v2 [nucl-ex]

MPC yields correlated to a mid-rapidity trigger

Significant decrease of I_{dAu} with increasing Ncoll for both $h^{\pm}$ and π^0 mid-rapidity triggers



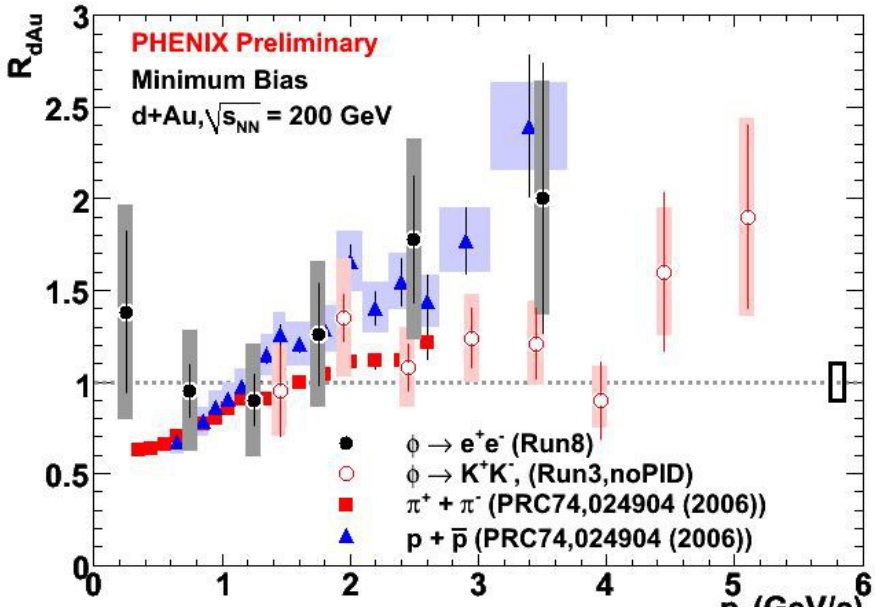
Beau Meredith (for PHENIX), arXiv:0907.4832v2 [nucl-ex]

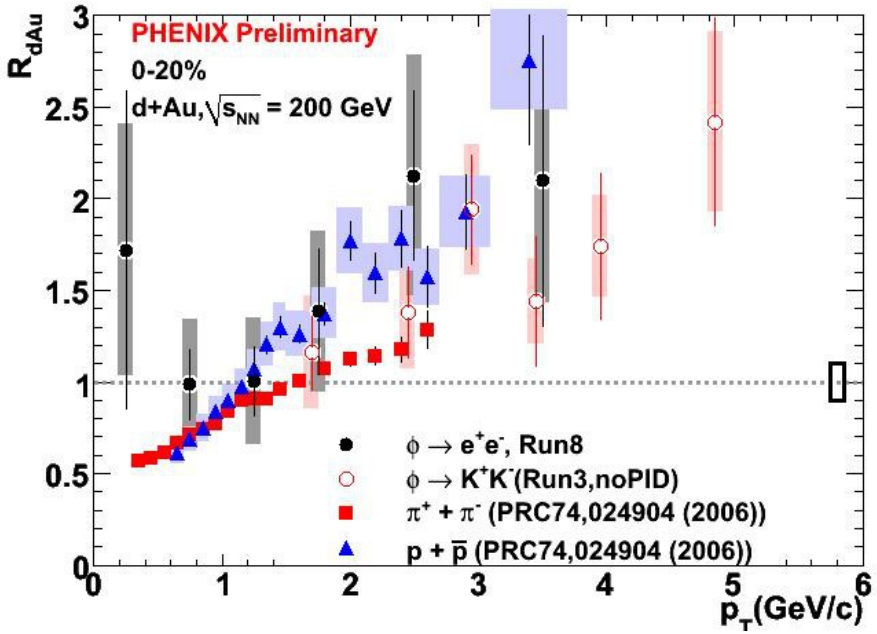
Summary and Conclusion

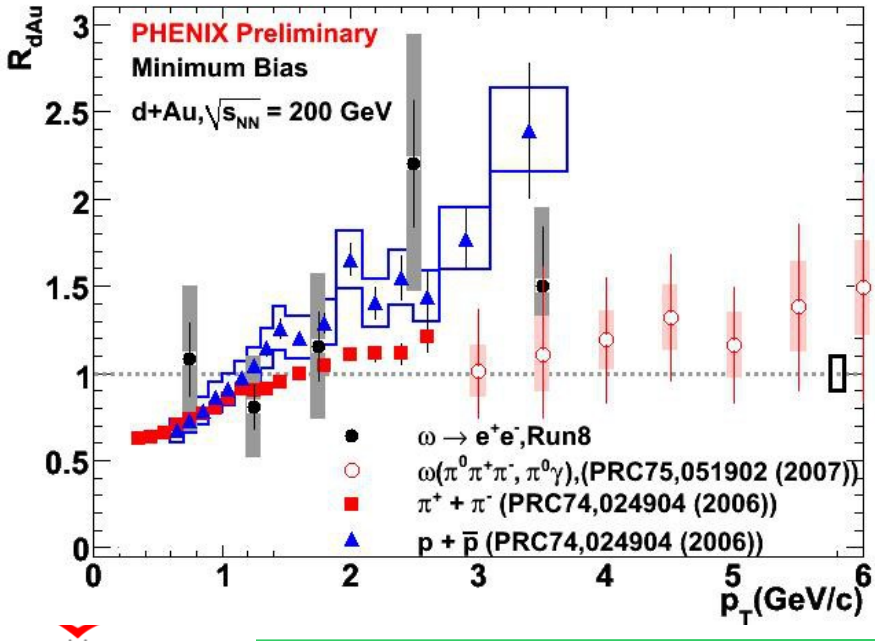
- The new high statistics d+Au run8 measurement
  - significantly improves precision and reach of single particle studies,
  - enables detailed correlation measurement over large rapidity regions, including di-jet correlations (proof of principle full jet reconstruction by Nathan Grau et al.),
  - which allow studying effects over a varying ranges of x, in particular the low-x region in nuclei.
- Suppression in forward direction similar for φ and J/ψ
- φ production is consistent in e+e- and K+K- channels
  - No mass shift observed in d+Au
- Work in progress

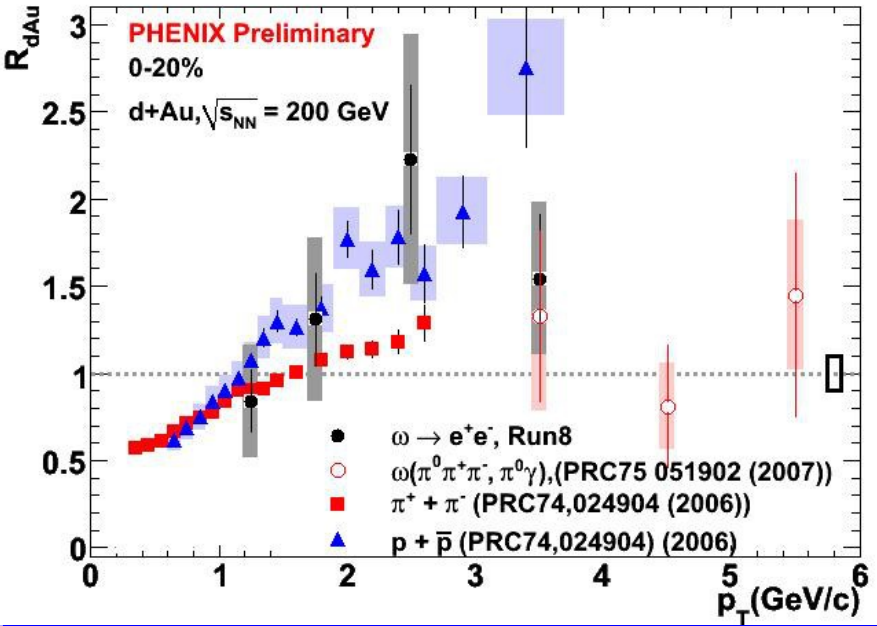
Backup slides

RdAu for omega and phi

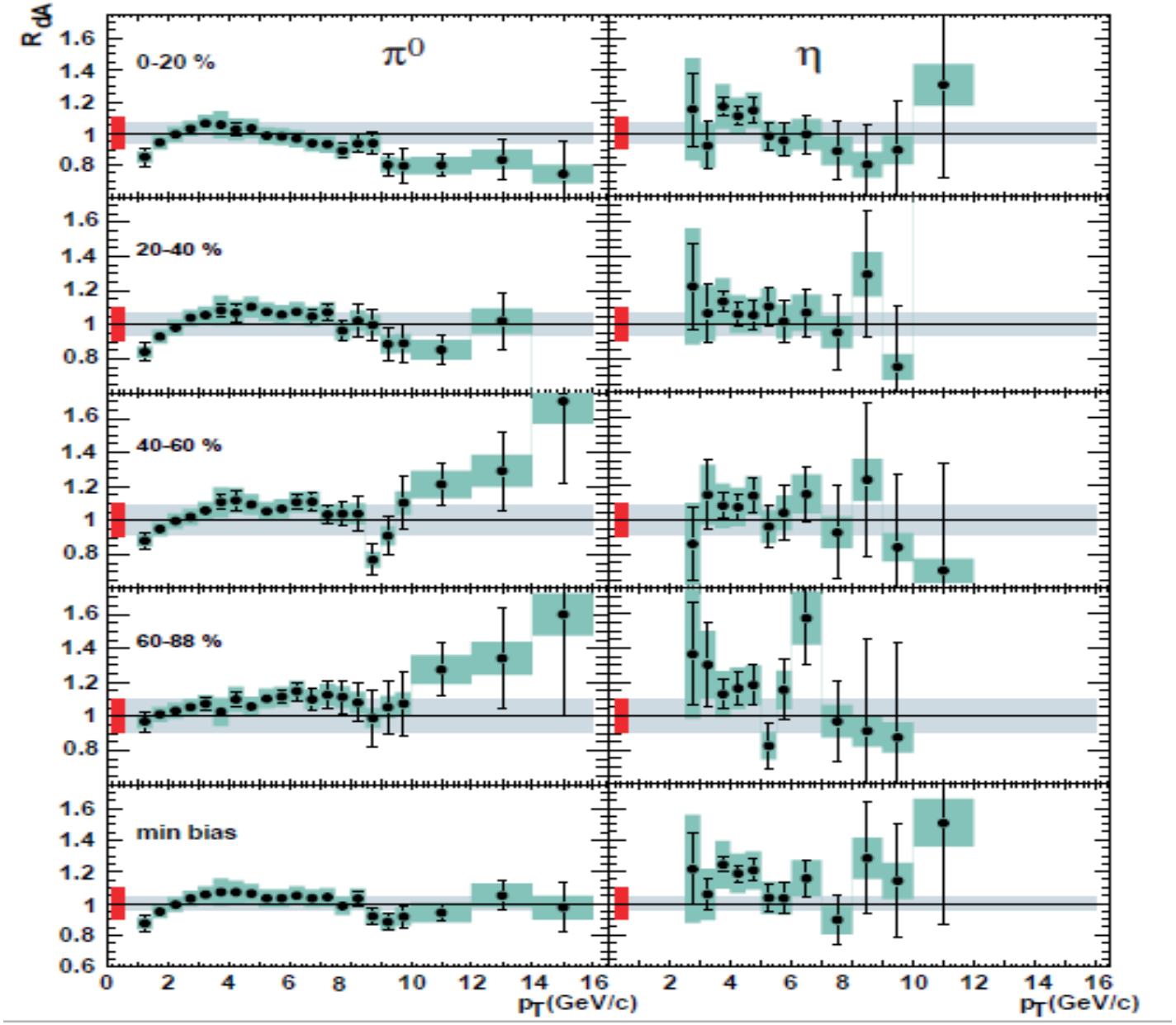


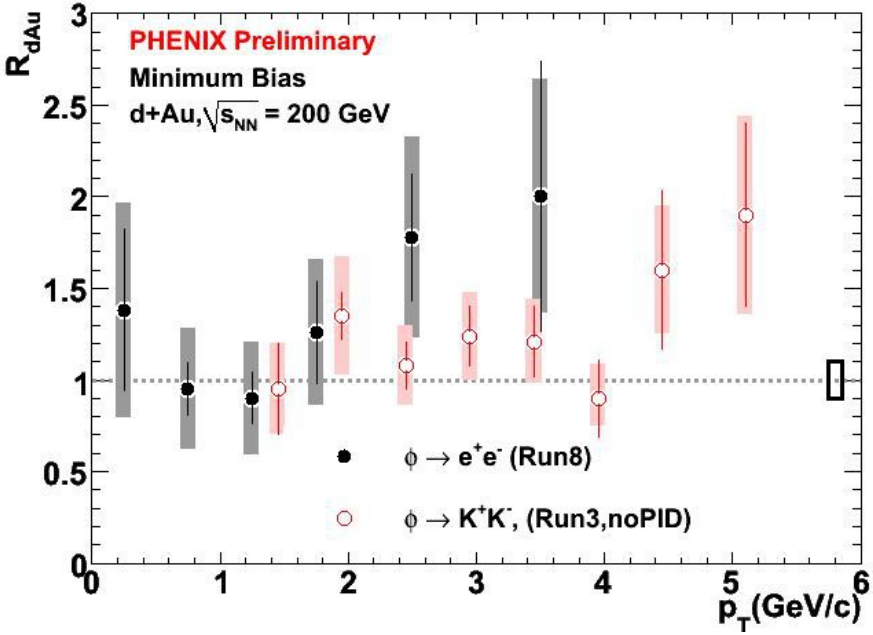


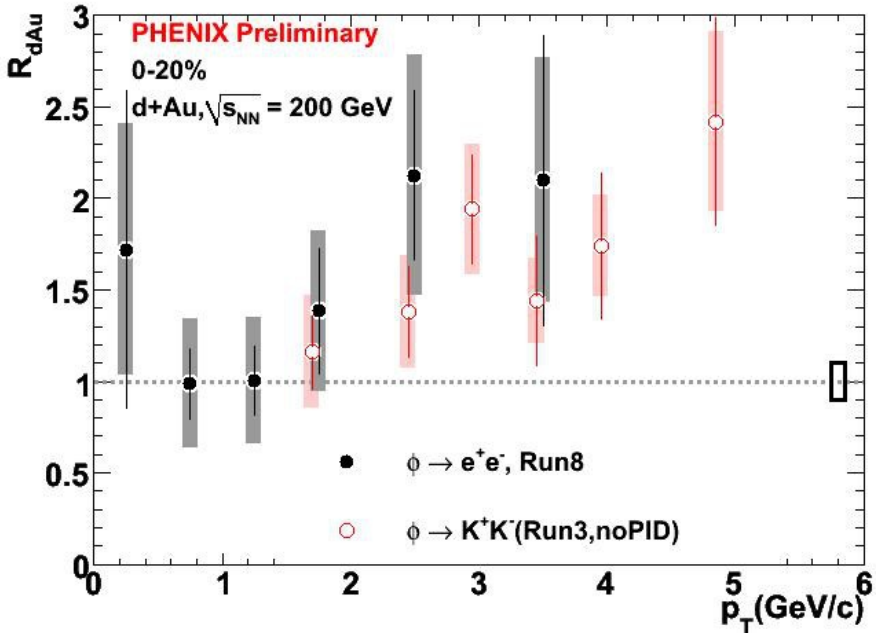




R_{dA} for π^0




PHENIX Preliminary
Minimum Bias
d+Au,√s_NN = 200 GeV
R_dAu
p_T(GeV/c)
φ → e+e- (Run8)
φ → K+K-, (Run3,noPID)


PHENIX Preliminary
0-20%
d+Au,√s_NN = 200 GeV
R_dAu
p_T(GeV/c)
φ → e+e-, Run8
φ → K+K-(Run3,noPID)