PHENIX Highlights

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What's New at PHENIX and RHIC

New era of heavy flavor physics

- VTX (2011) and FVTX (2012) are installed

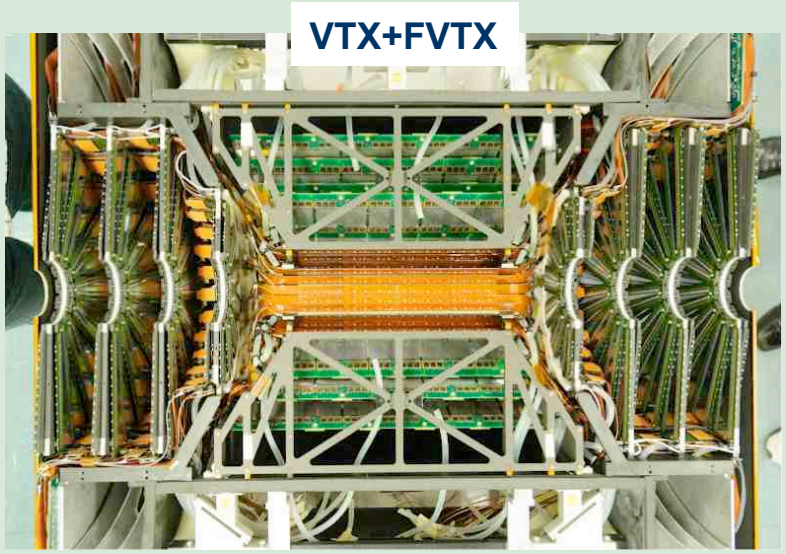
New Collision species and high luminosity (2012)

- U+U 193GeV
  - 3 weeks, 90/ub
- Cu+Au 200GeV
  - 5.5 weeks, 2.5/nb

→ geometry control

PHENIX took data with high efficiency

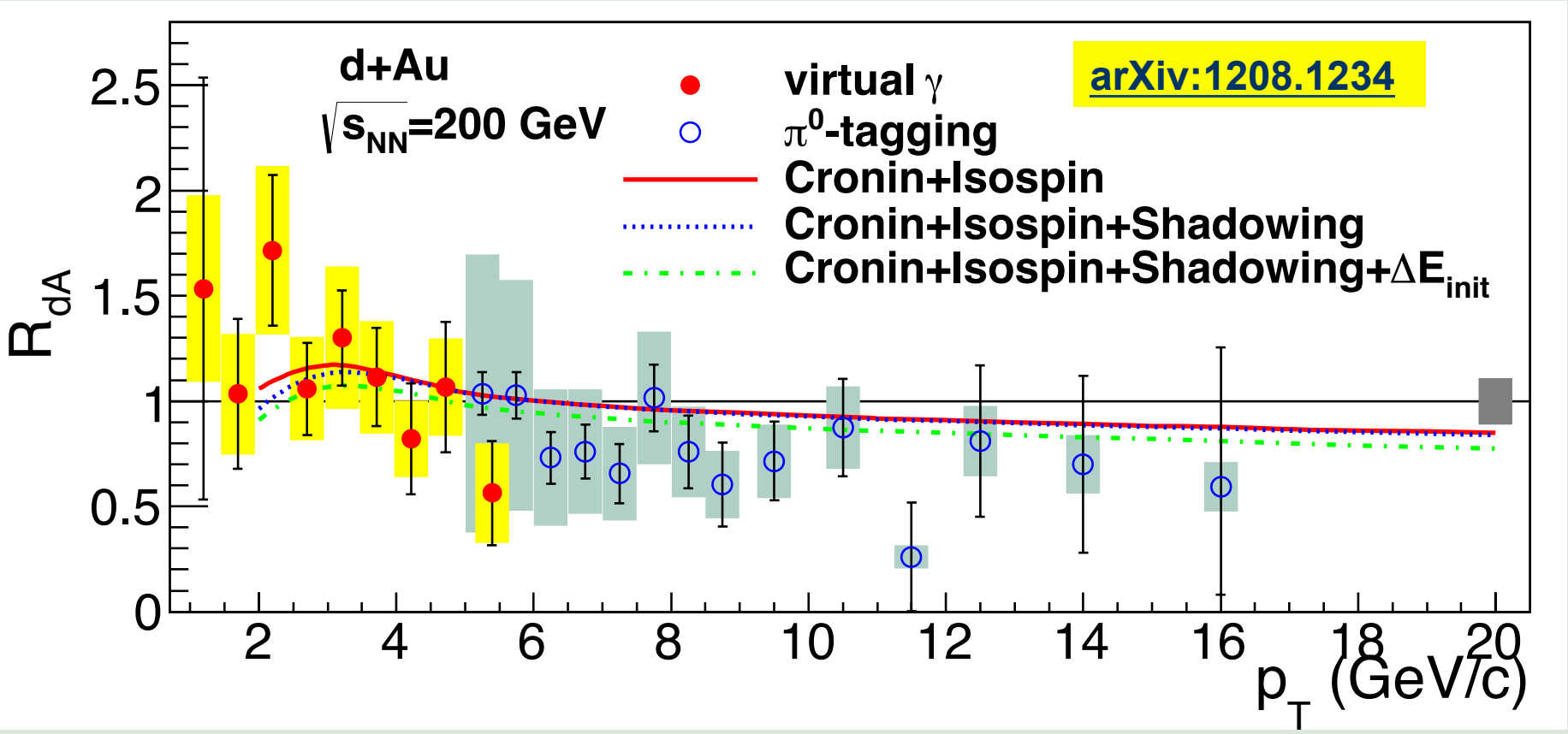
Energy scans (2010-2012): 7.7, 19.6, 27, 39, 62, 200GeV



Probing initial state with high precision d+Au data

Direct photon

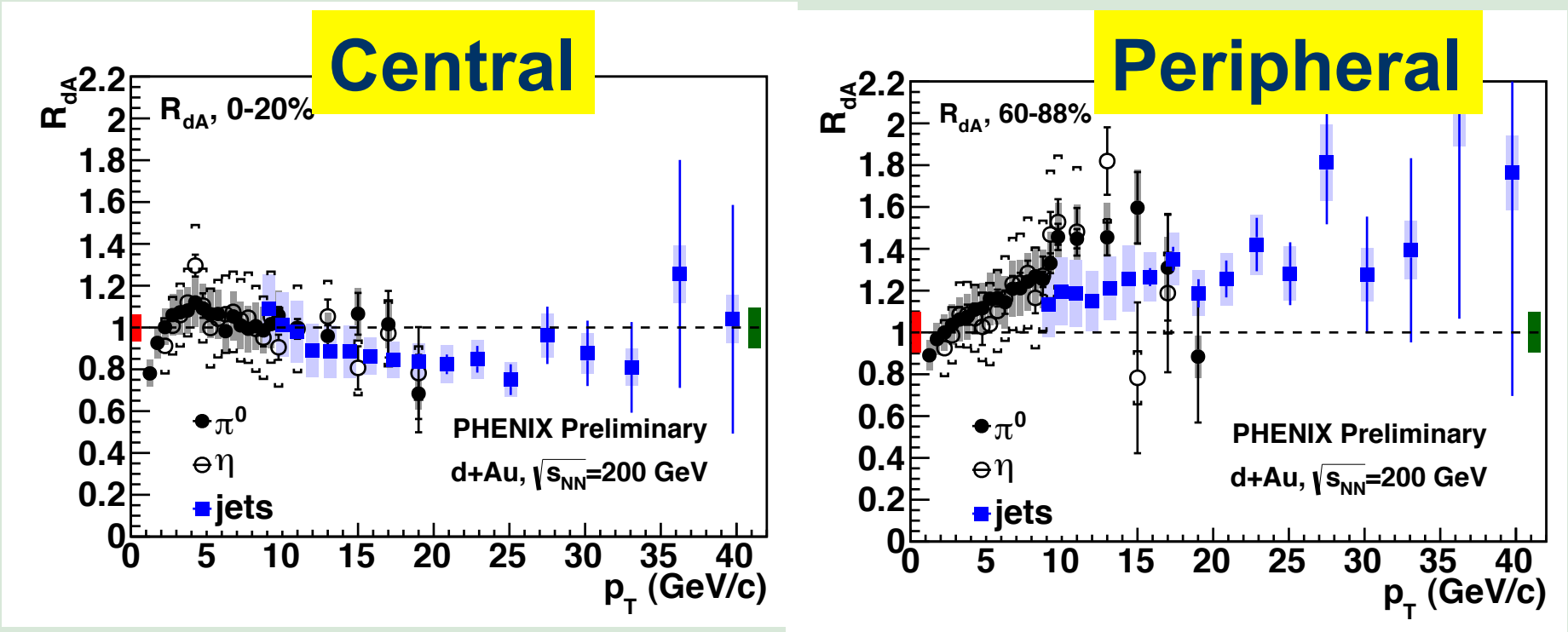
- No modification in initial hard scattering and PDF compared to p+p at mid-rapidity



See I. Tserruya (Thu) talk

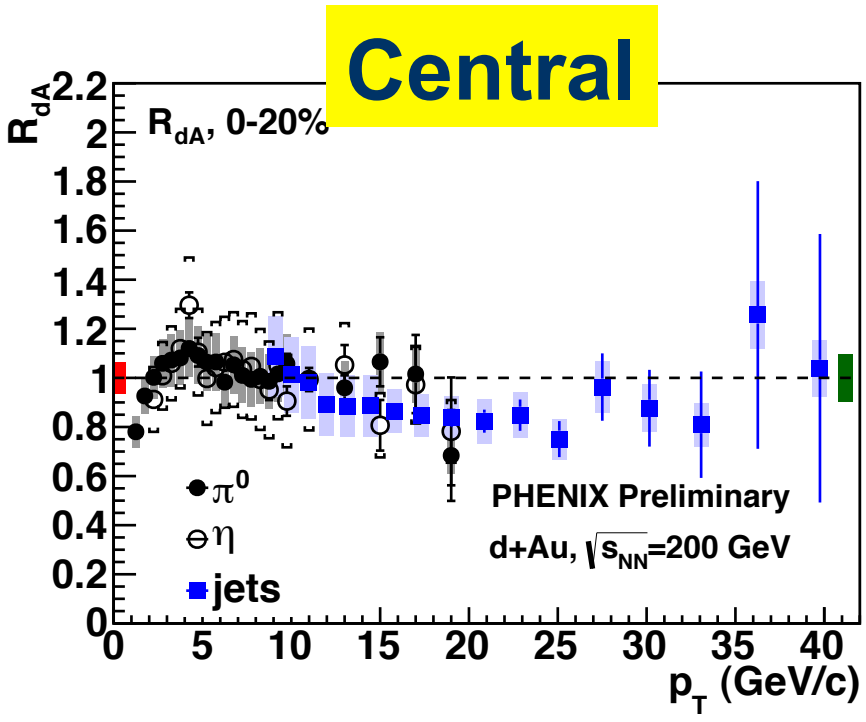
Initial state - Jet probes -

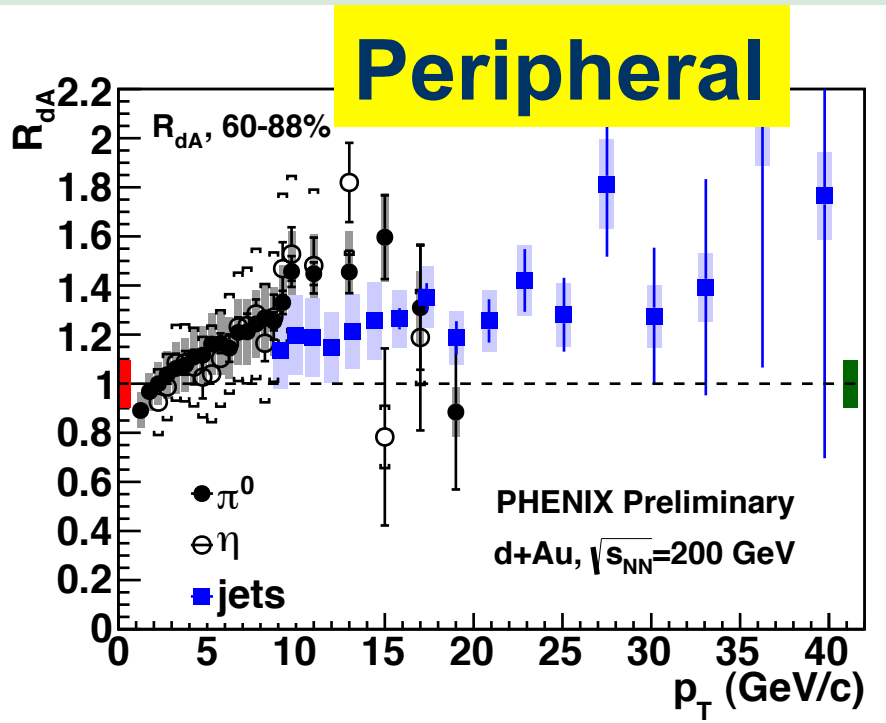
- Jets are reconstructed in d+Au up to 40 GeV/c



Initial state - Jet probes -

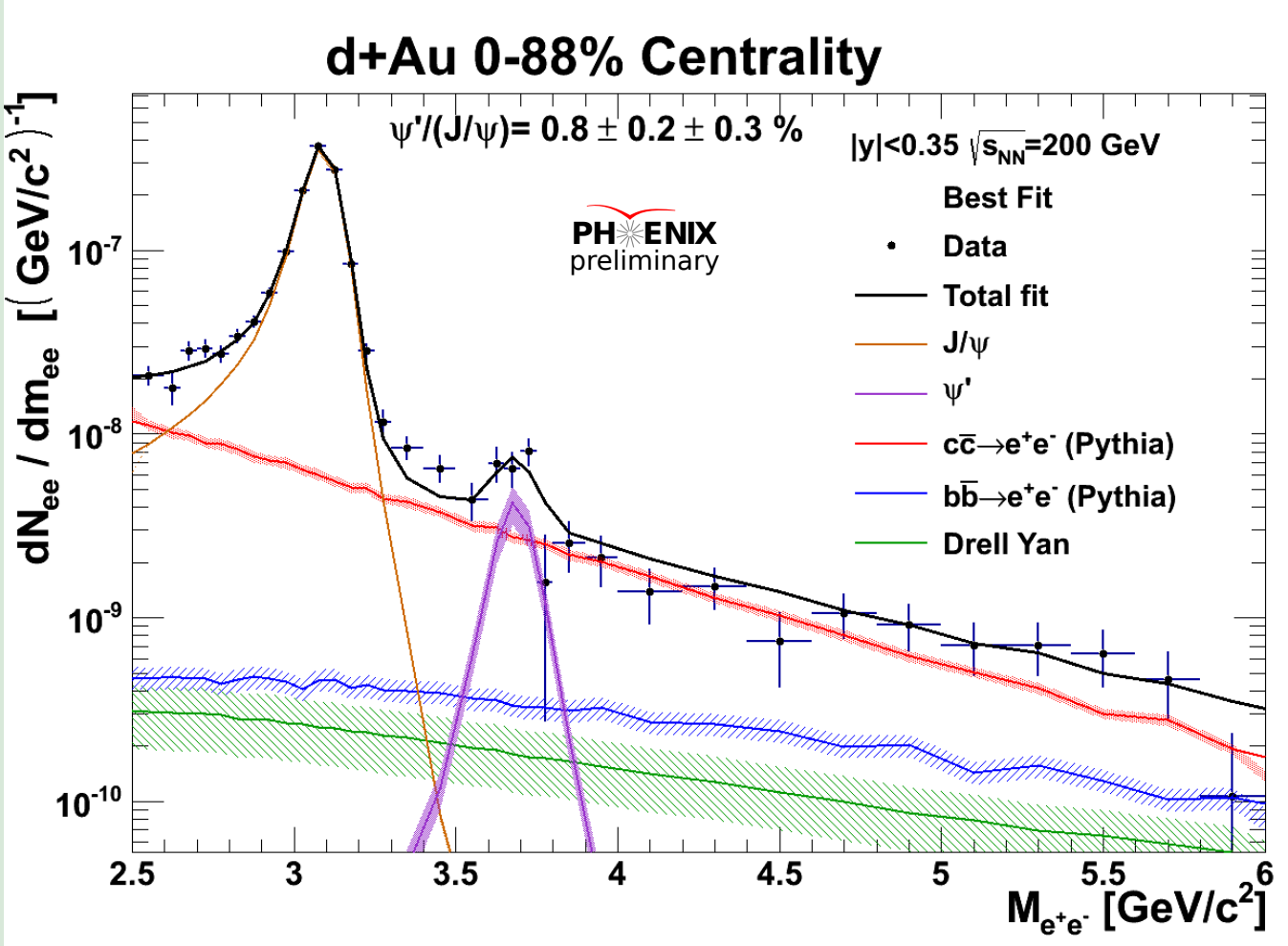
- Jets are reconstructed at mid-rapidity in d+Au up to 40 GeV/c
- R_{dA} increases for more peripheral collisions at high p_T





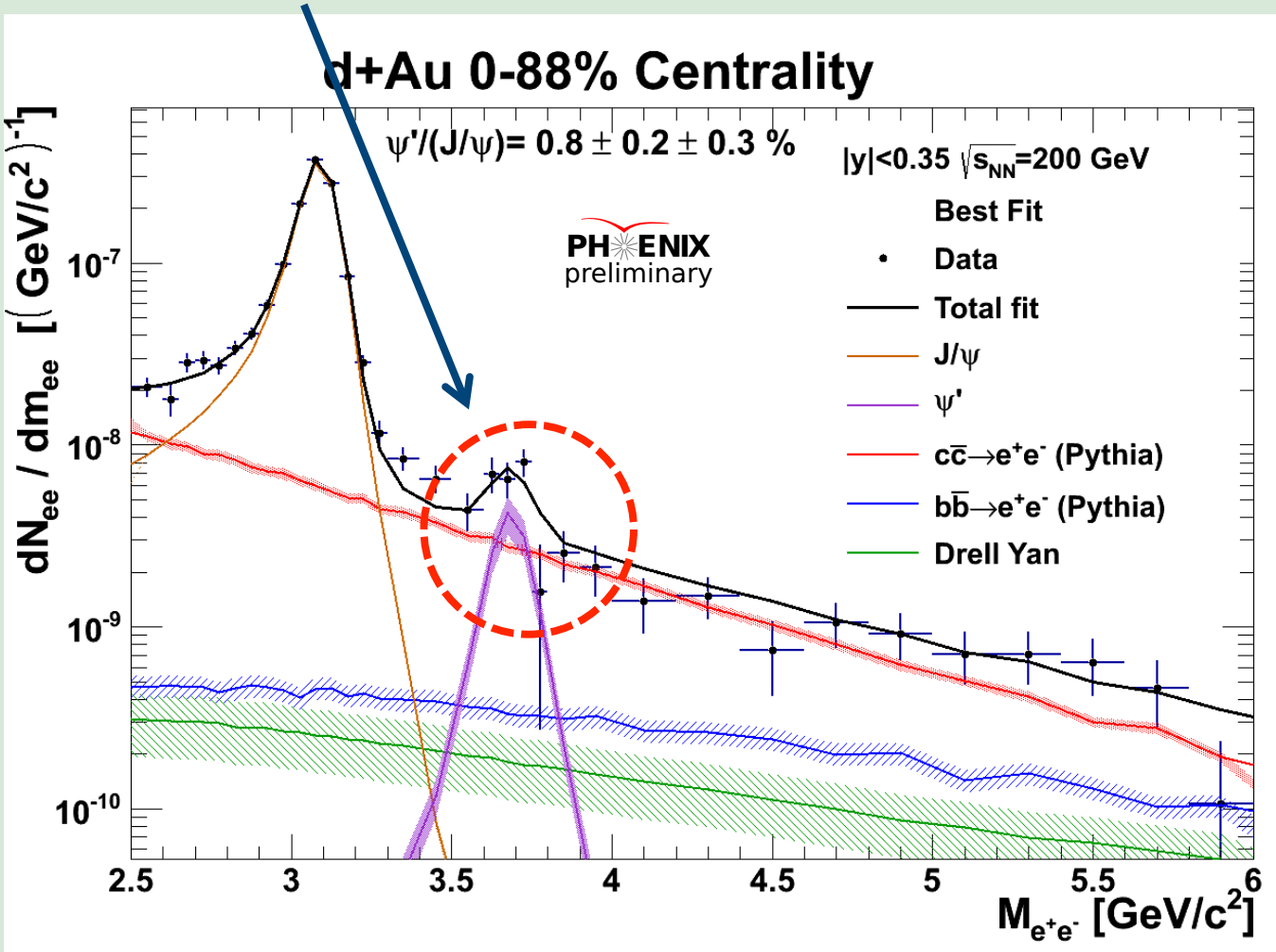
See M. Wysocki (Mon) and B. Sahlmueller (Wed) talk

First measurement of ψ' in d+Au (y=0)



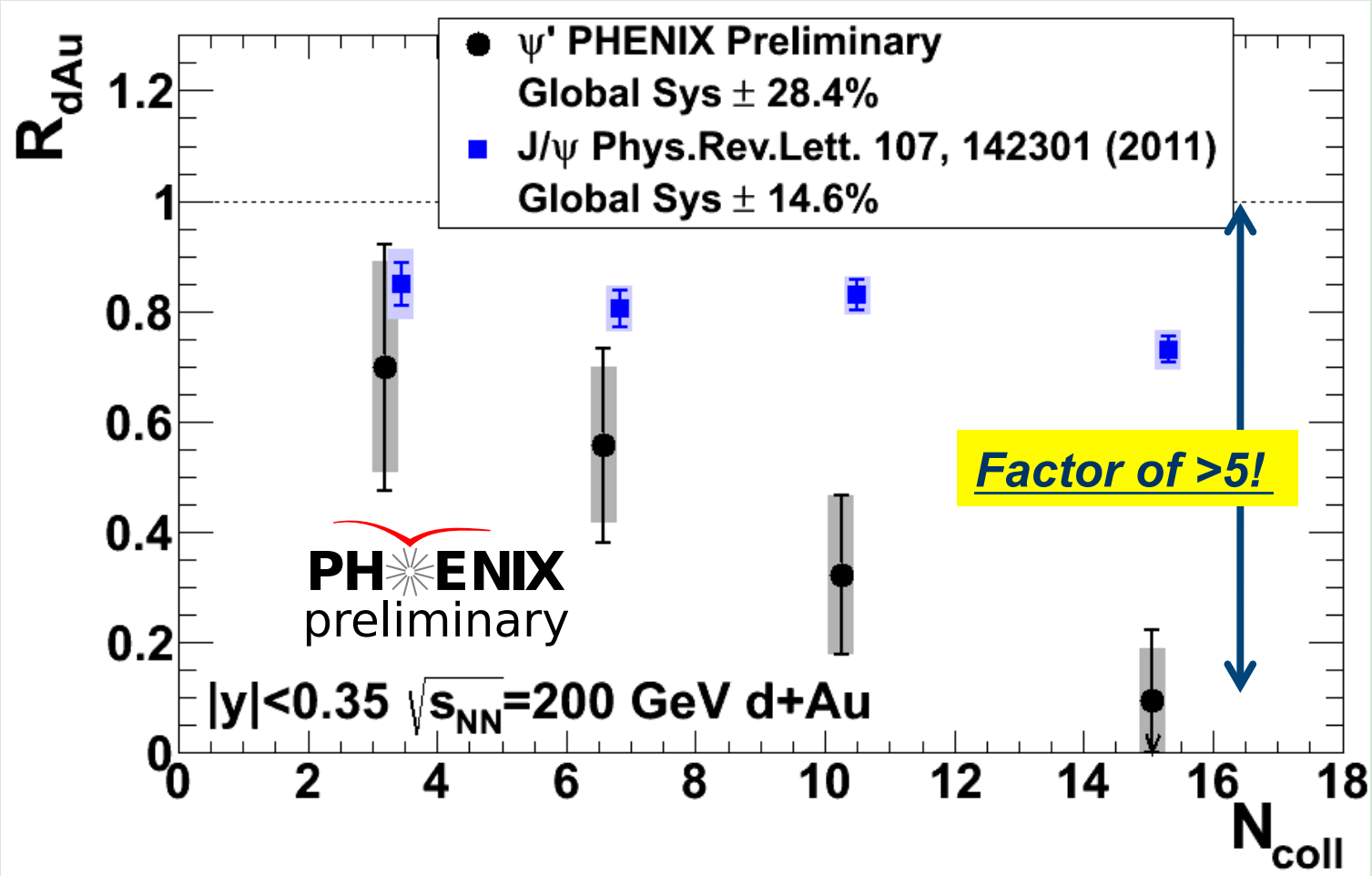
First measurement of ψ' in d+Au (y=0)

- ψ'/(J/ψ) = 2% in p+p, 0.8% in d+Au



ψ' is strongly suppressed in dAu

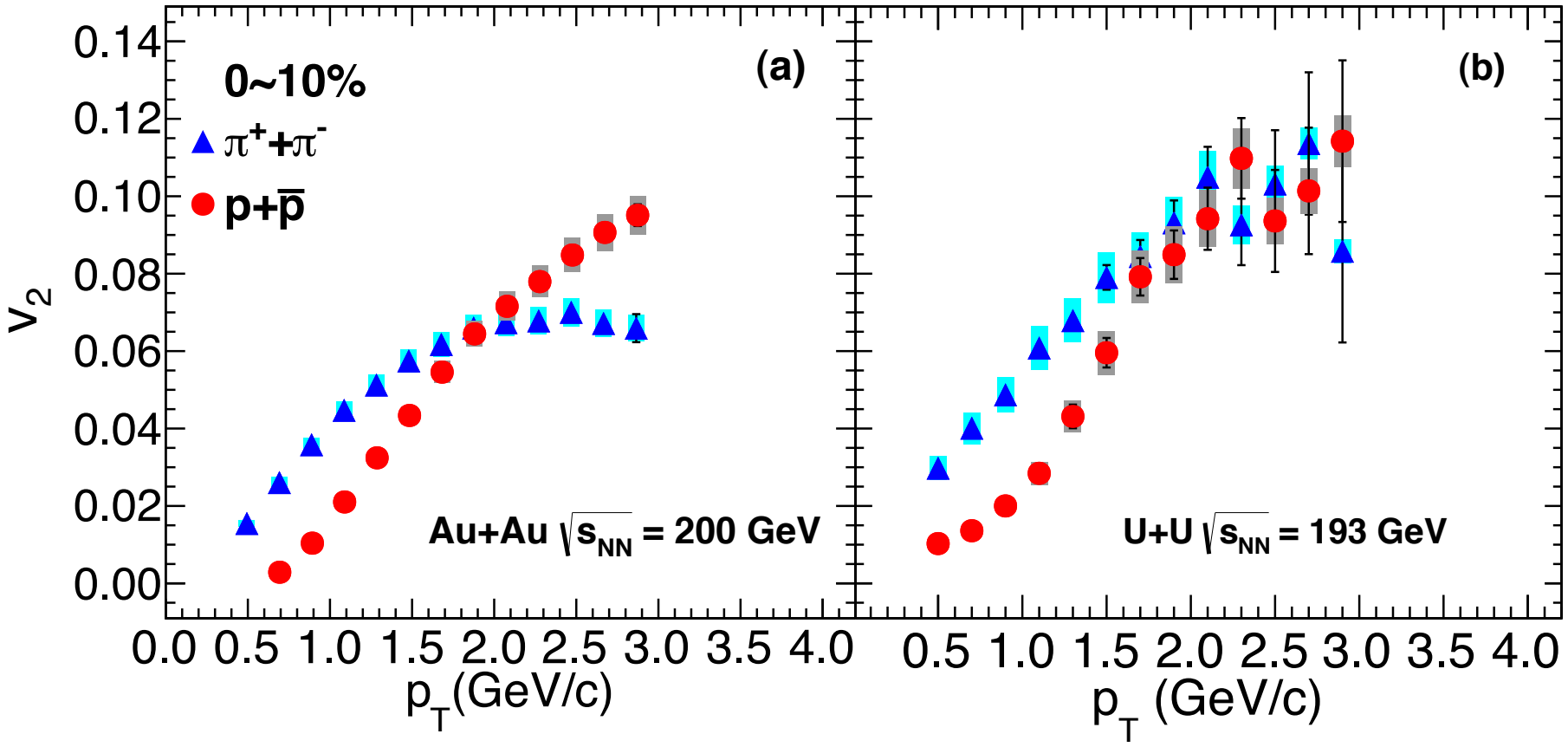
- Very challenging for models!



See M. Wysocki (Mon) and D. McGlinchey (Tue) talk

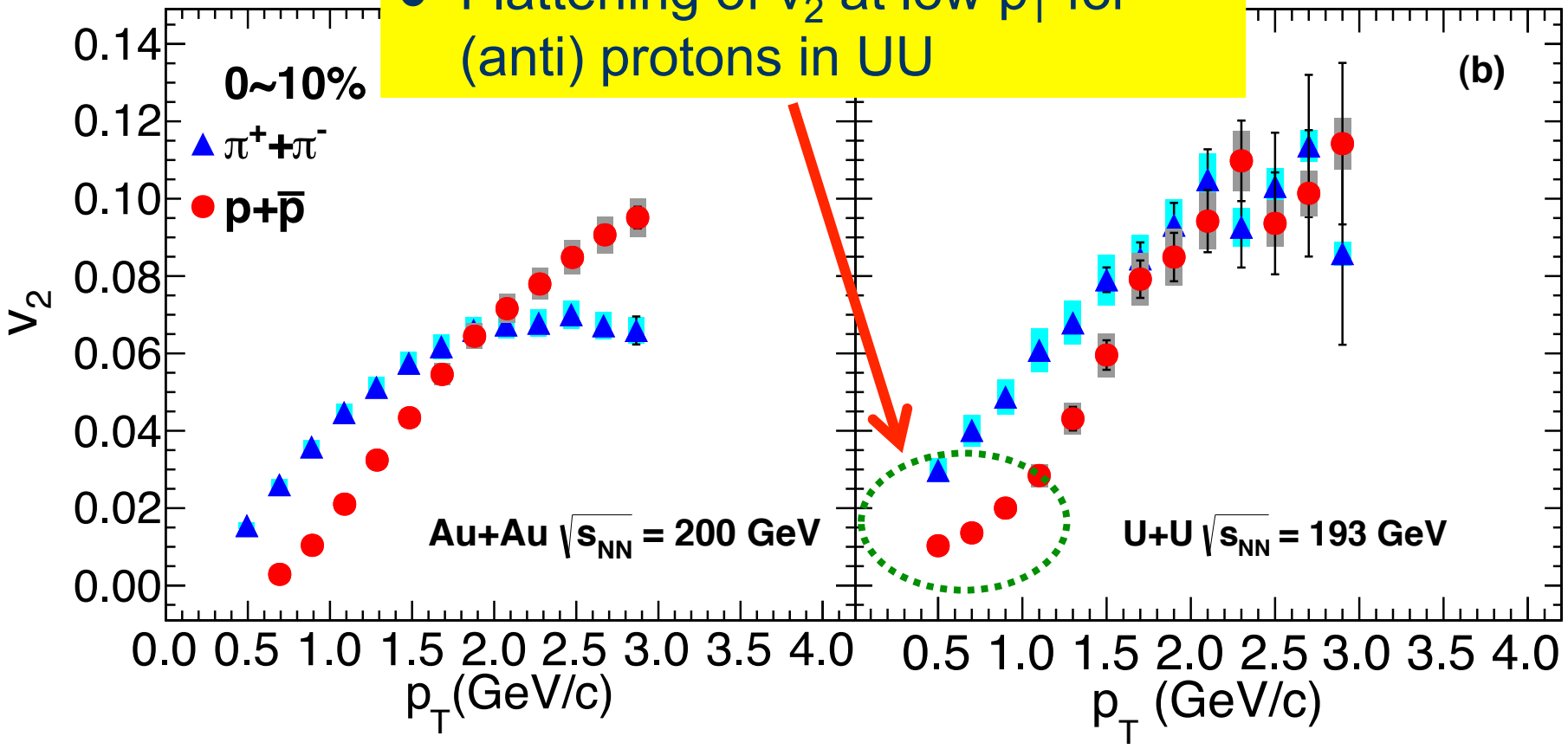
Probing Hot dense matter with collision geometry control

PID'ed v2 in Au+Au and U+U



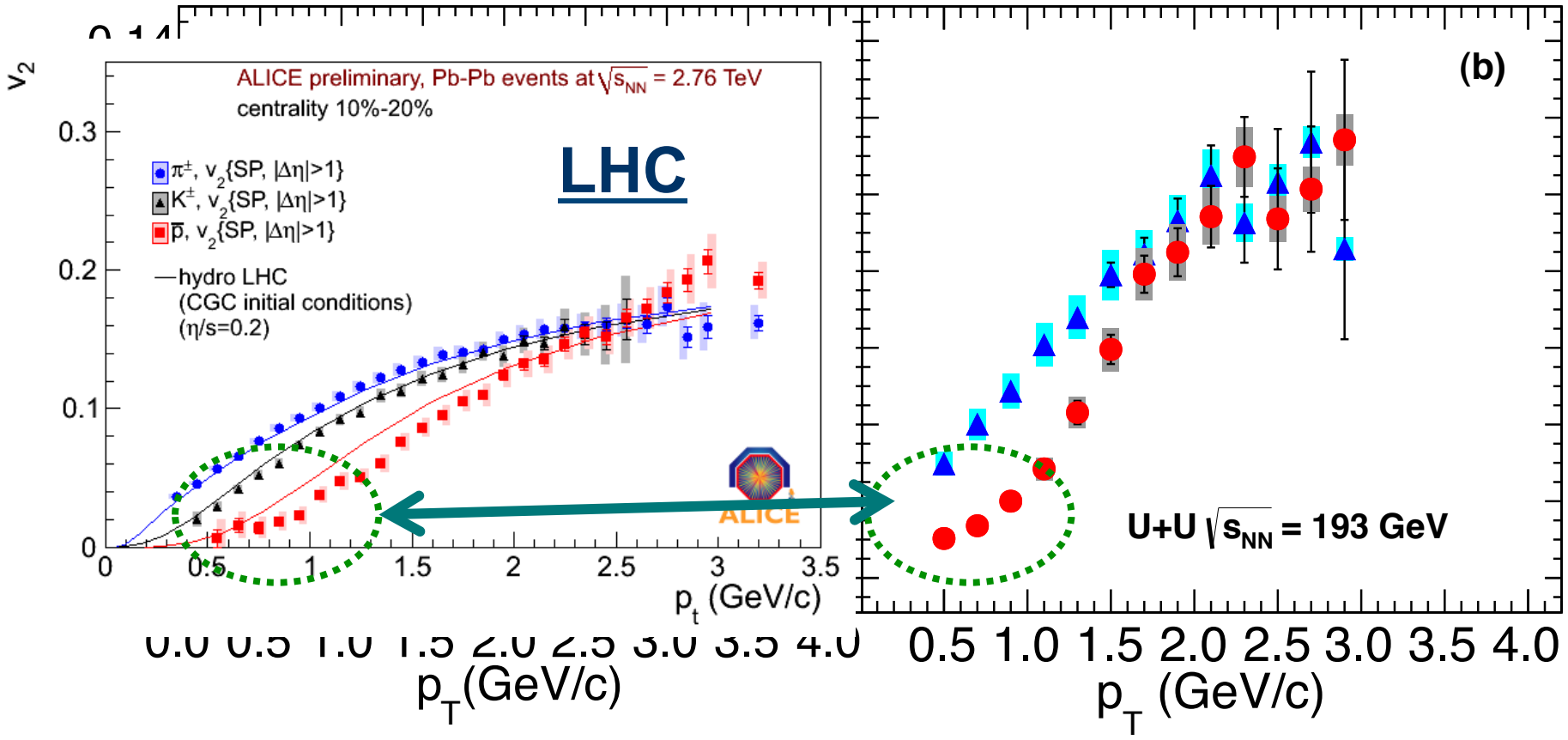
PID'ed v2 in Au+Au and U+U

- Flattening of v_2 at low p_T for (anti) protons in UU

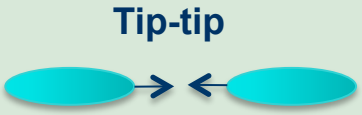


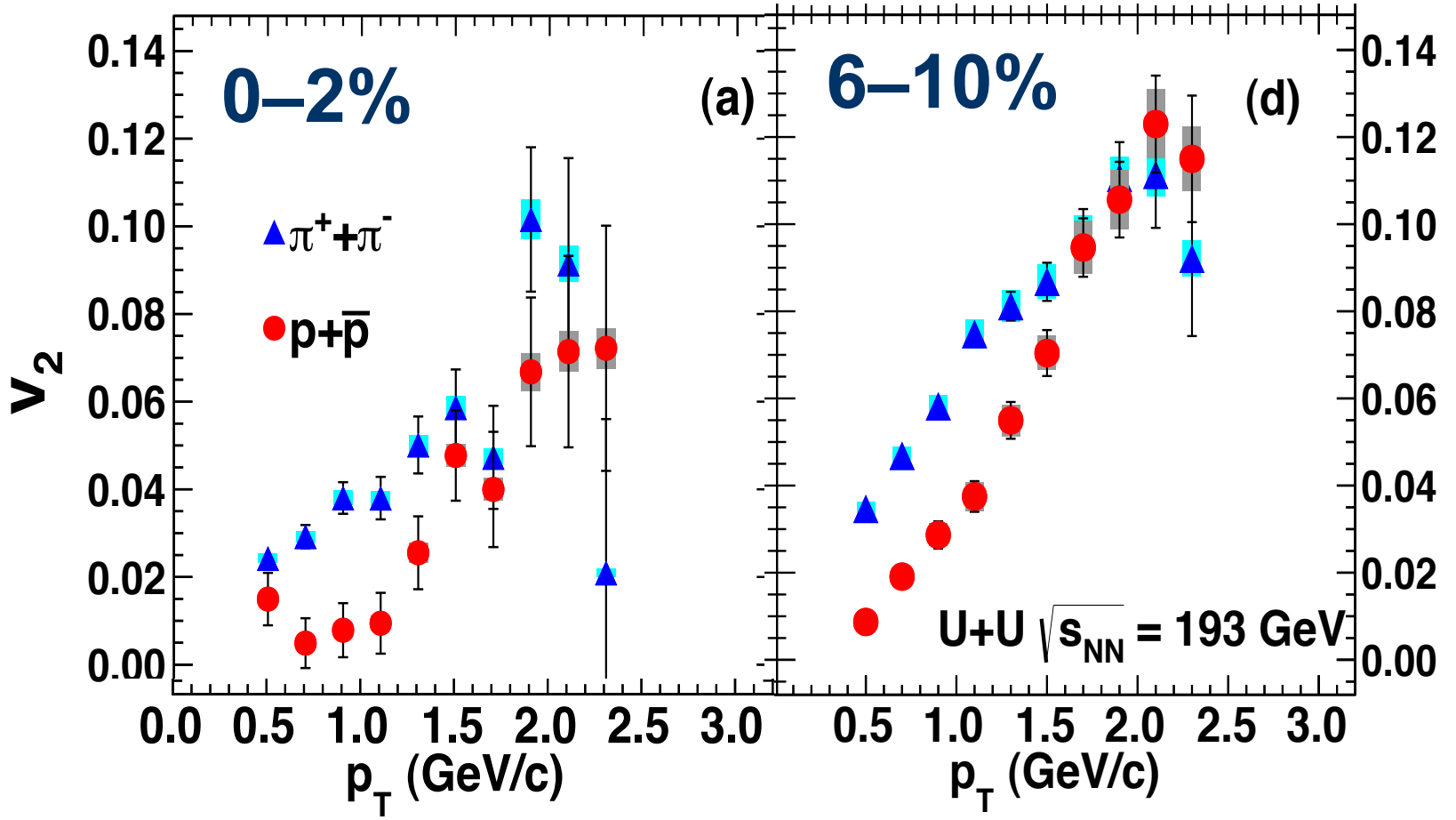
PID'ed v2 in Au+Au and U+U

- Similar radial flow at RHIC and LHC

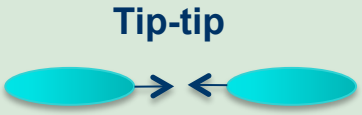


Strong radial flow in Tip-Tip enriched events



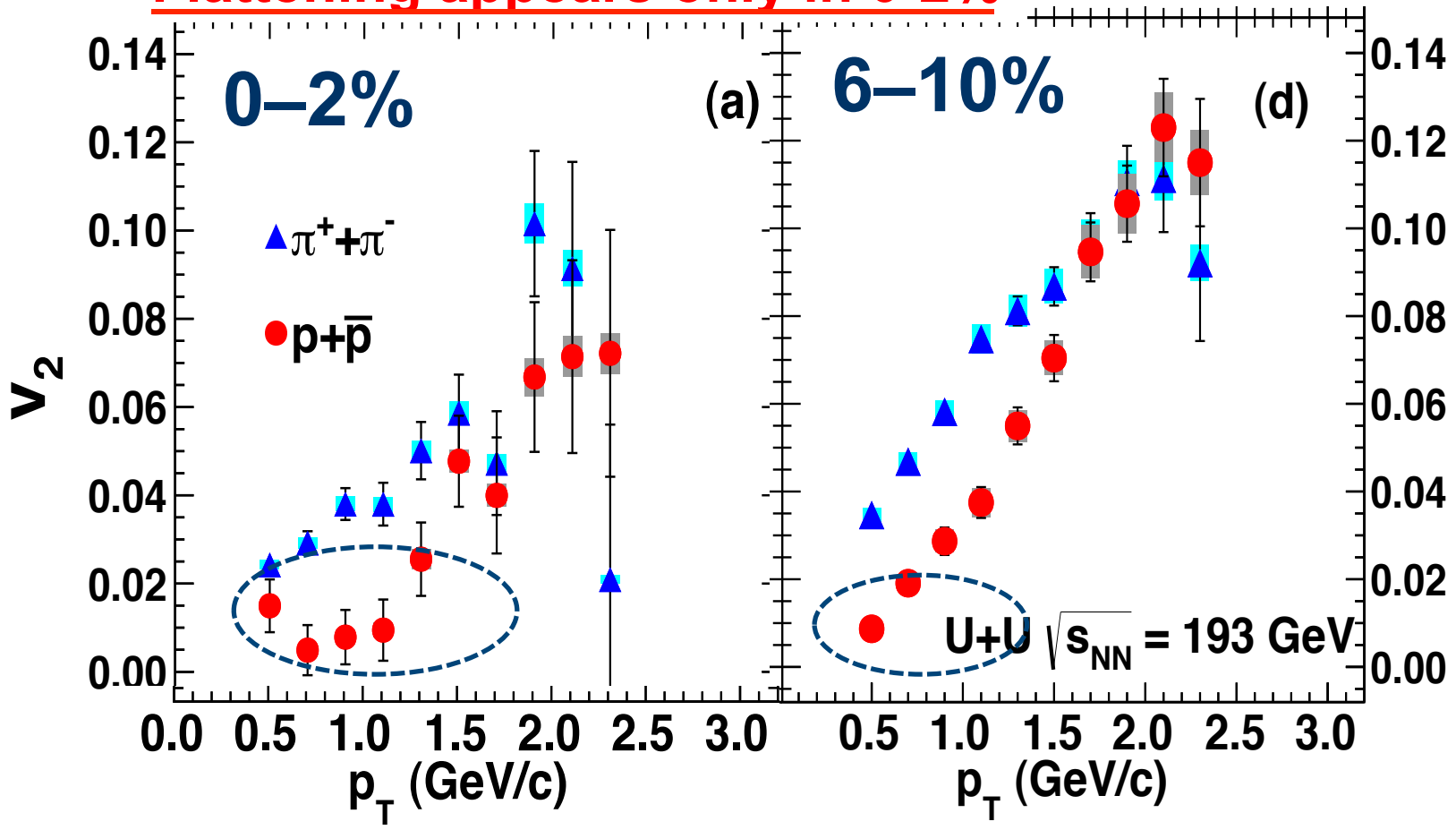


Strong radial flow in Tip-Tip



- Strong radial flow due to geometry or higher energy density?

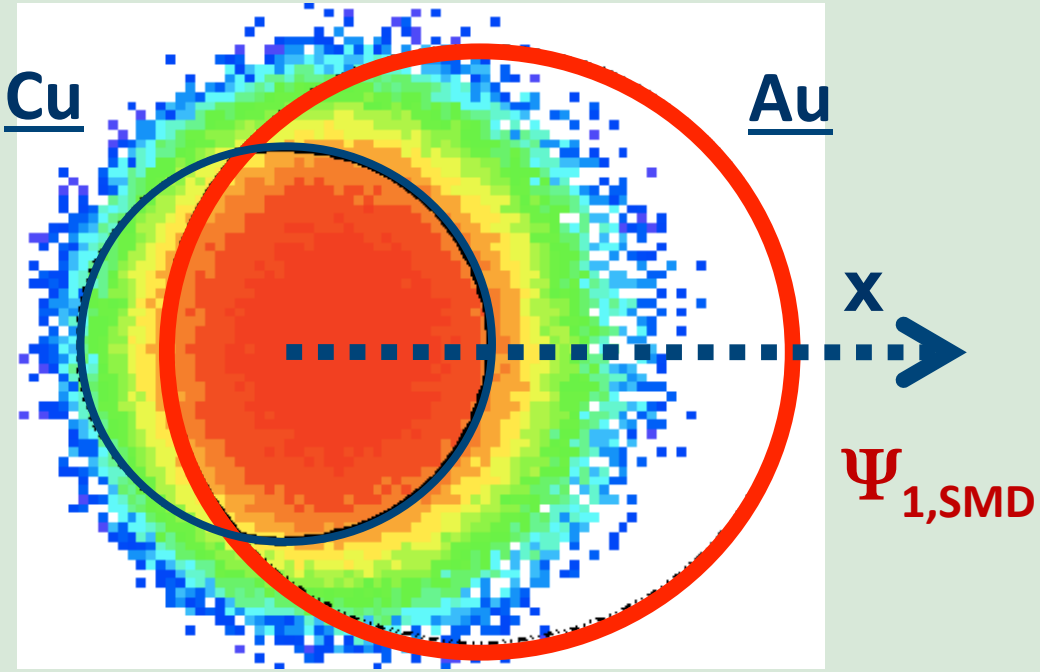
Flattening appears only in 0-2%

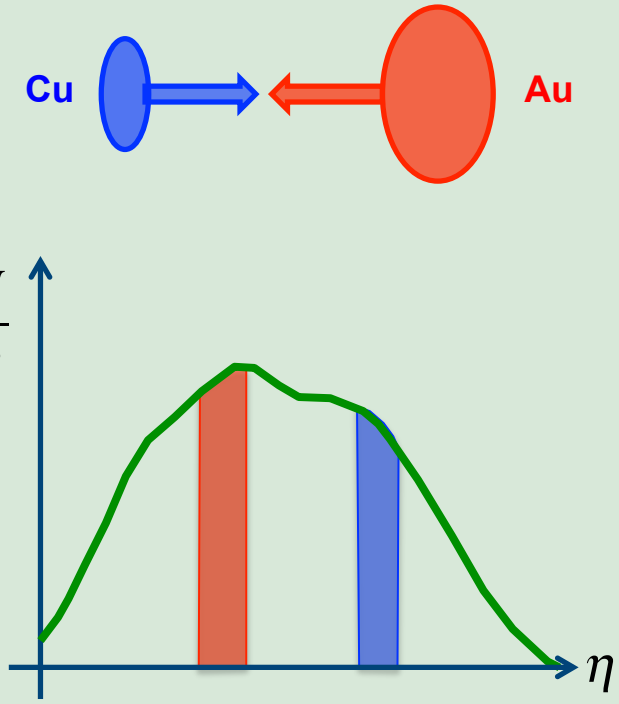


See S. Huang (Thu) talk

Asymmetric Cu+Au collisions

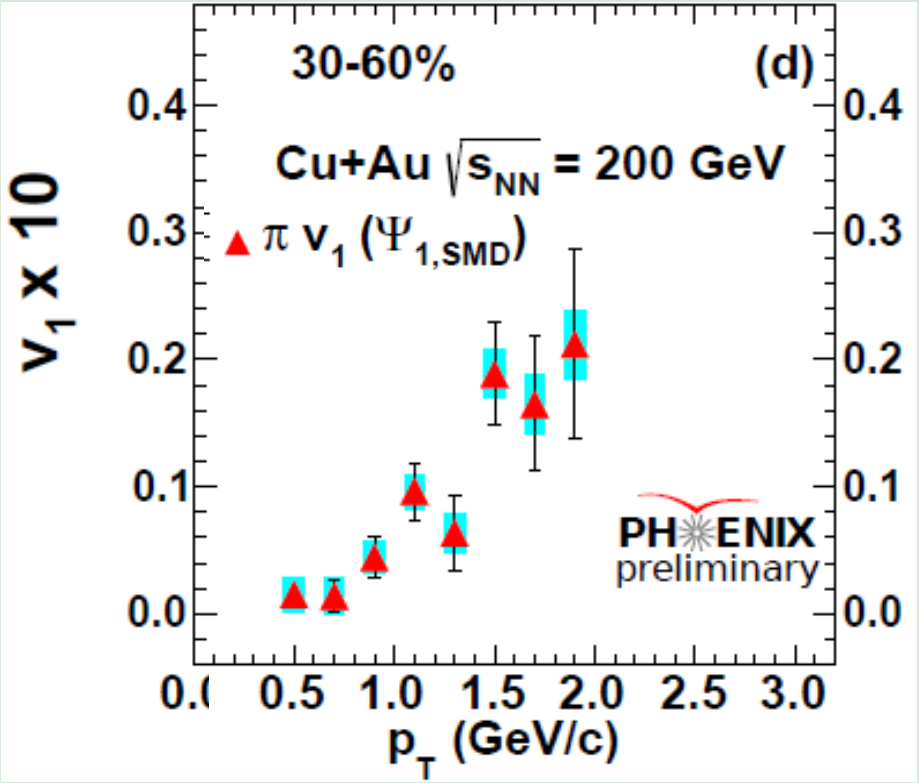
- Asymmetric coordinate space leads to asymmetric density profile and pressure gradient
- Shower Max Detector (SMD) sees Au-spectator and defines Ψ_1

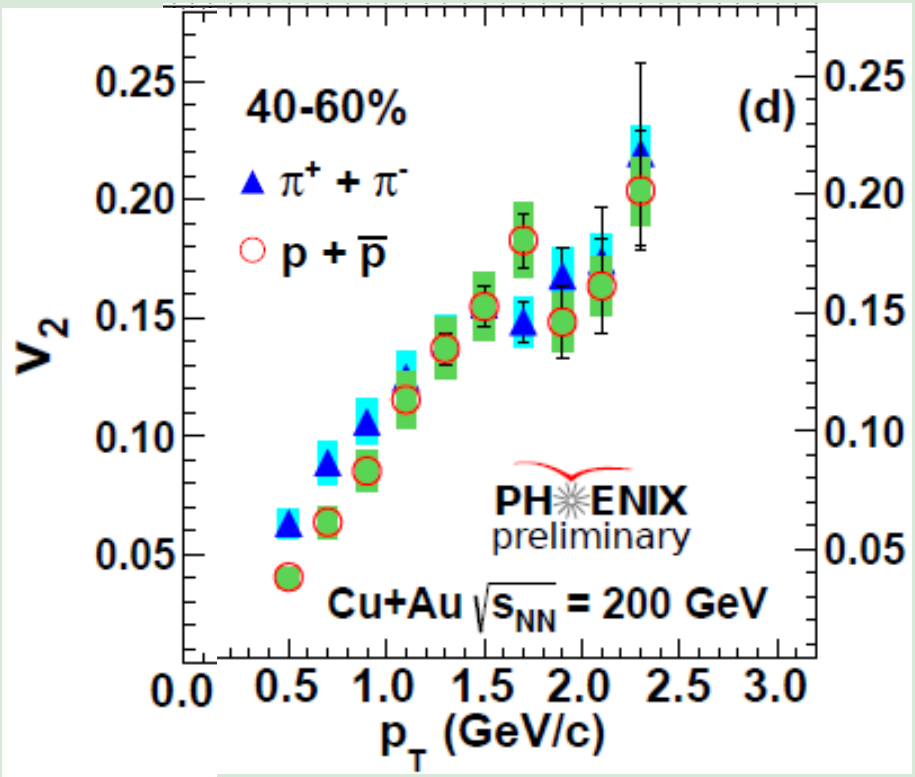




v_1 and v_2 in Cu+Au collisions

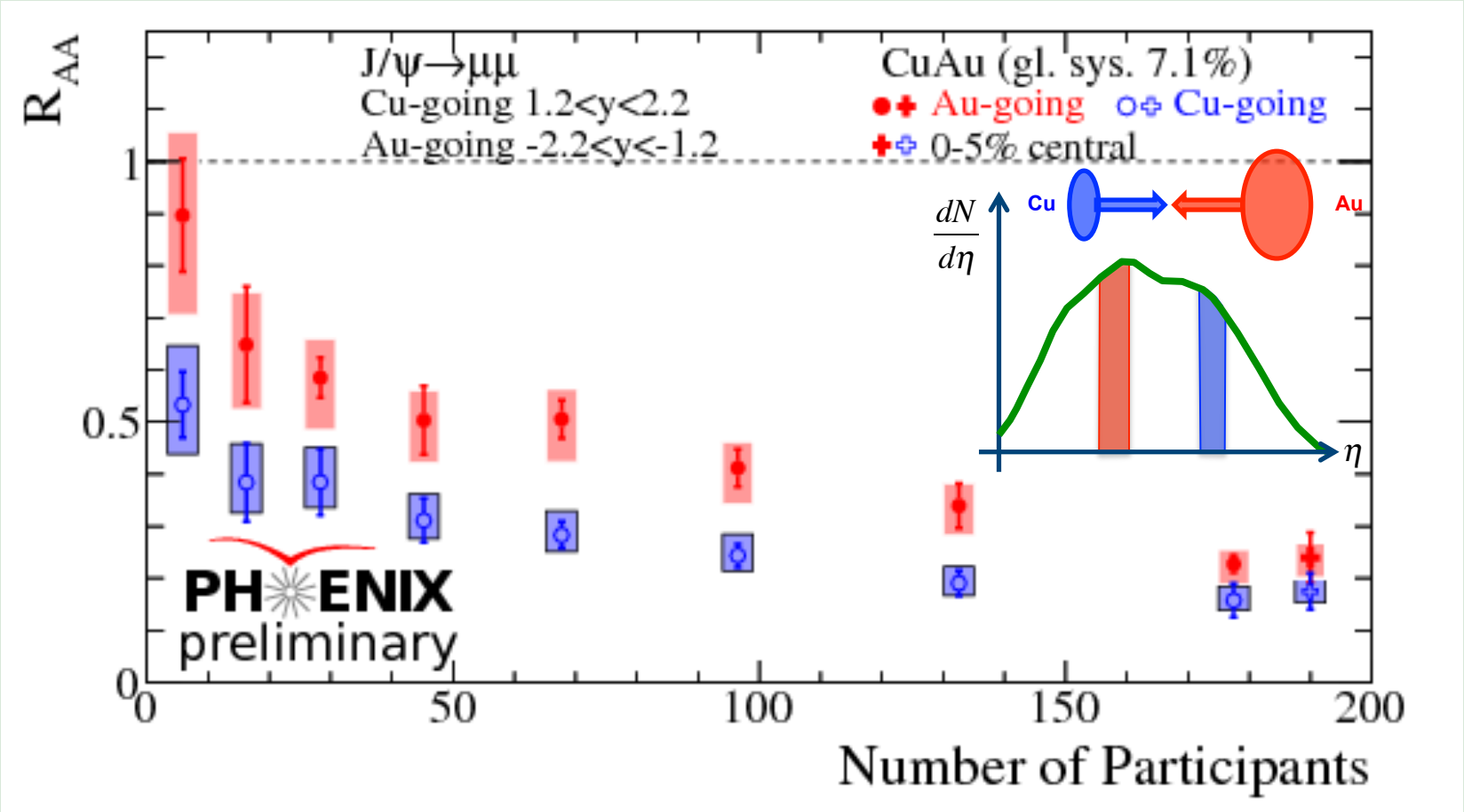
- SMD sees Au-spectator and defines Ψ_1
- Sizable v_1 is seen (direction opposite to AMPT)





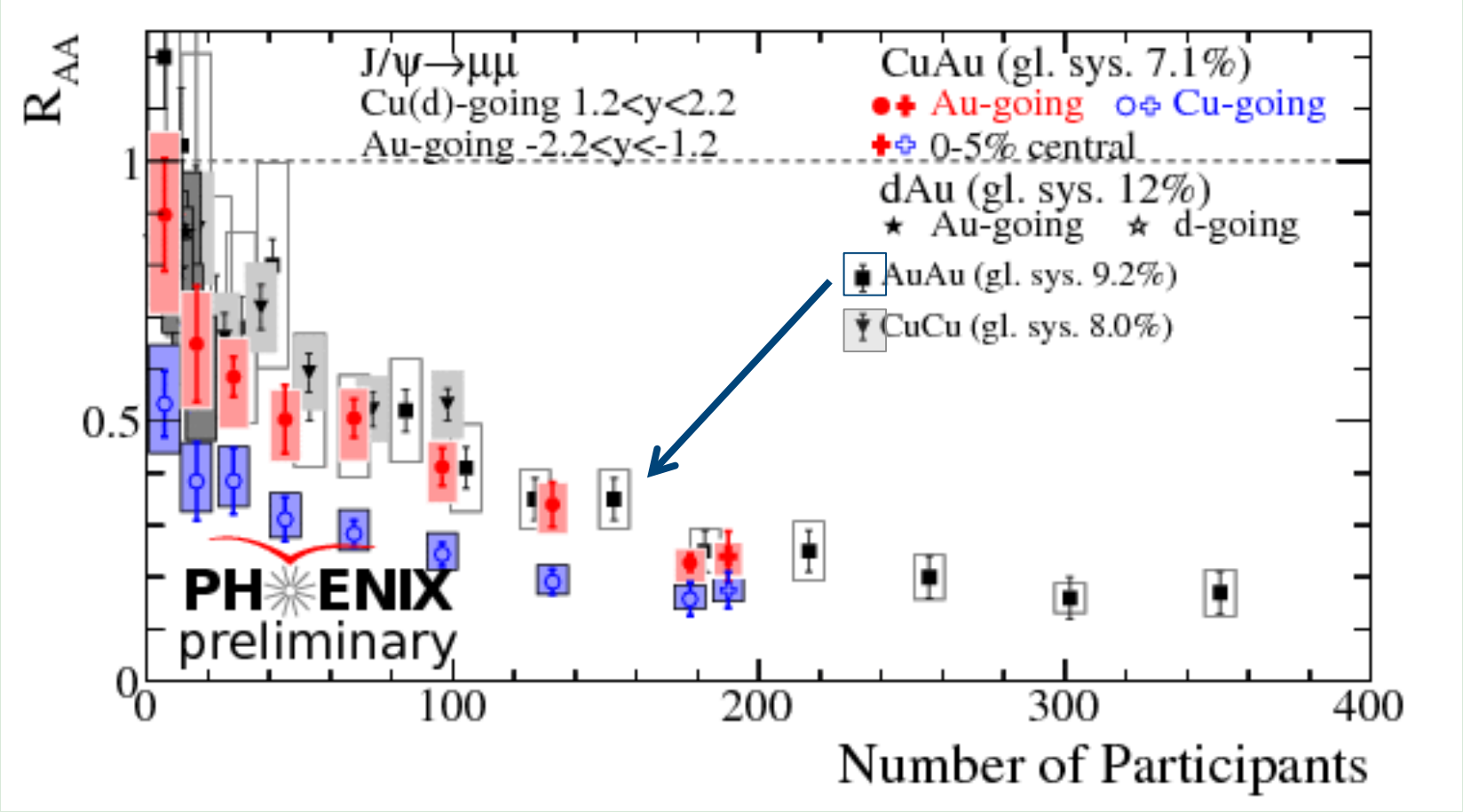
J/ψ in Cu+Au

- J/ψ is more suppressed in Cu going direction compared to Au going direction (CNM and final state?)



J/ψ in Cu+Au, Au+Au

- J/ψ suppression in Au-going direction is same as Au+Au
- Cu-going direction stronger suppression than in Au+Au



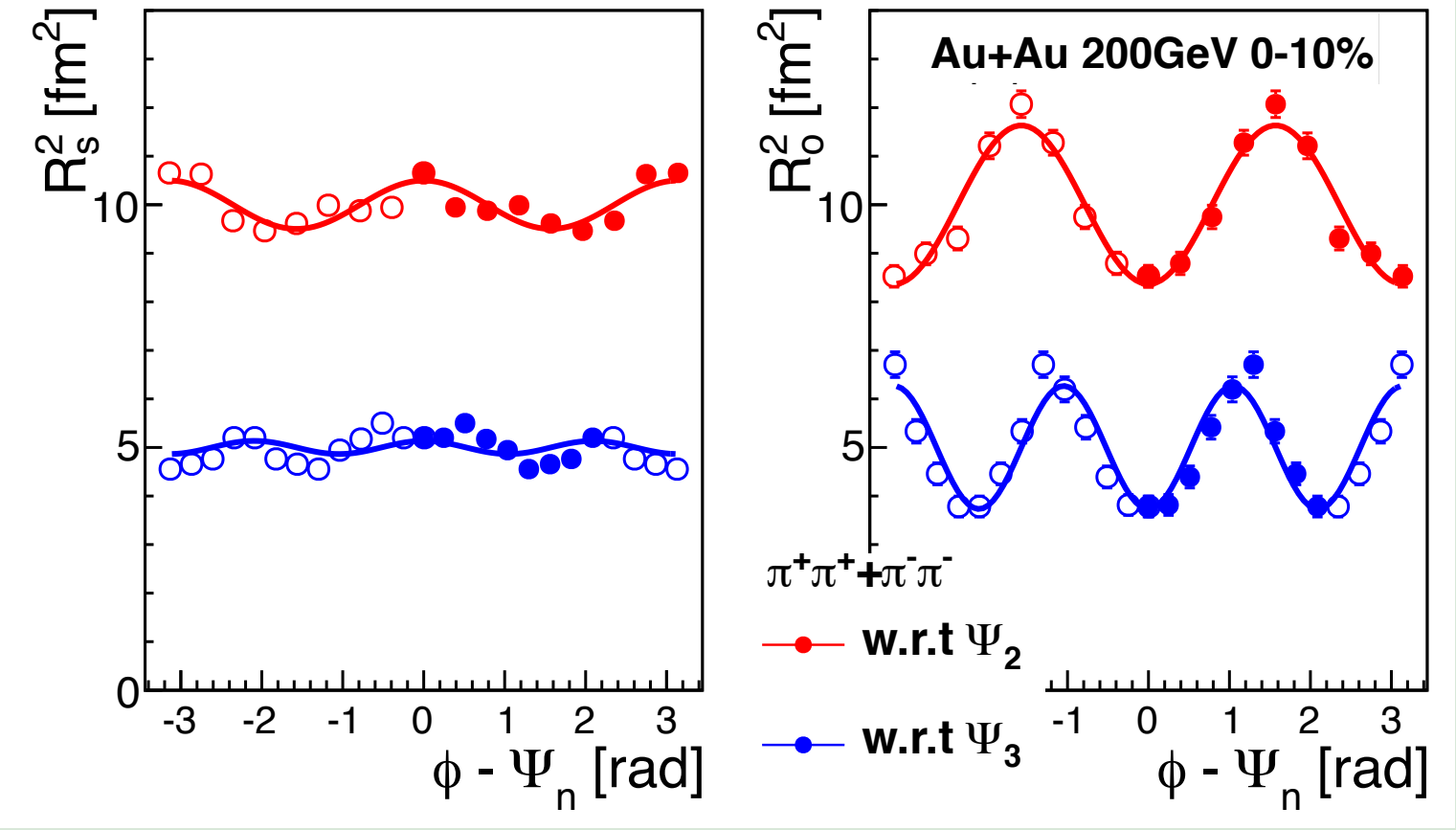
See M. Rosati (Tue) and R. Hollis (Fri) talk

Probing the geometry evolution with HBT

Triangularity from HBT in Au+Au

Rside

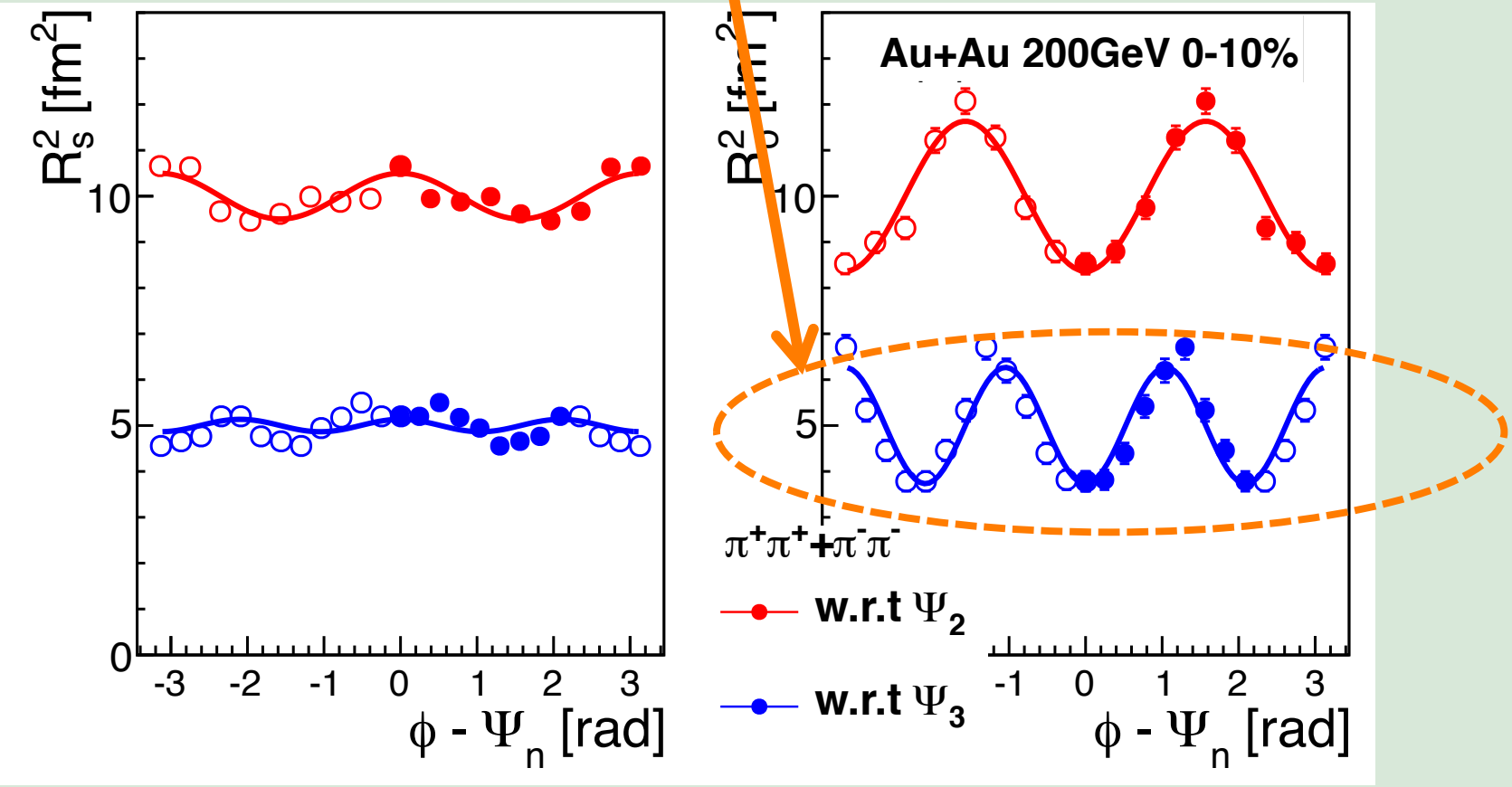
Rout



See T. Niida (Tue) talk

Triangularity from HBT in Au+Au

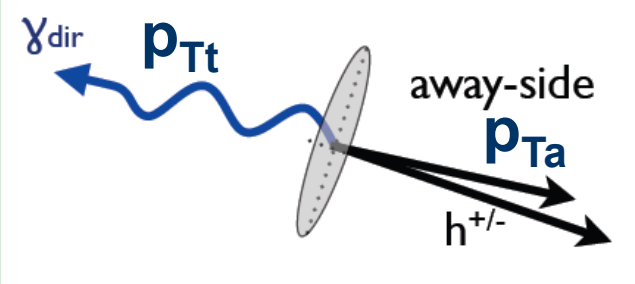
- Large modulation of HBT radii (R_O) with respect to ψ_3 is seen for the first time



See T. Niida (Tue) talk

Probing hot dense matter with hard probes

γ-h correlation in Au+Au



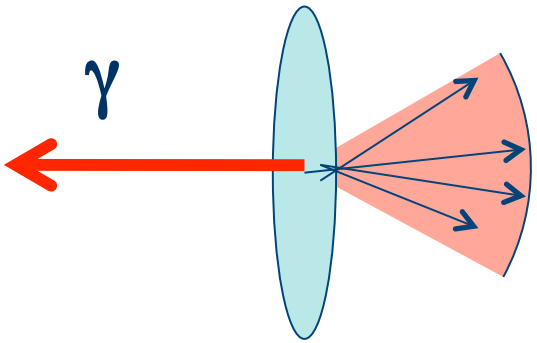
$z_T = p_{Ta}/p_{Tt}$

$\xi = \ln(1/z_T)$

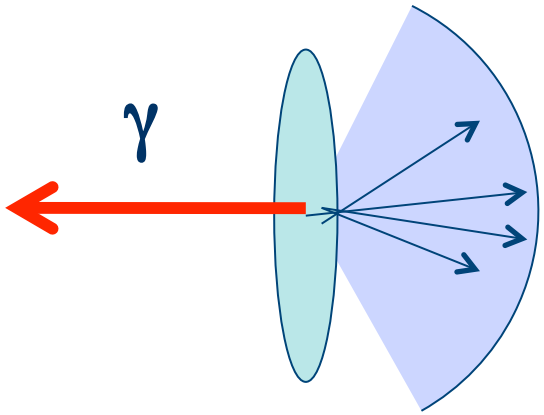
$$I_{AA} \equiv \frac{(1/N_{trig}dN/d\xi)_{AA}}{(1/N_{trig}dN/d\xi)_{pp}}$$

- Associated particles in three angle ranges are integrated

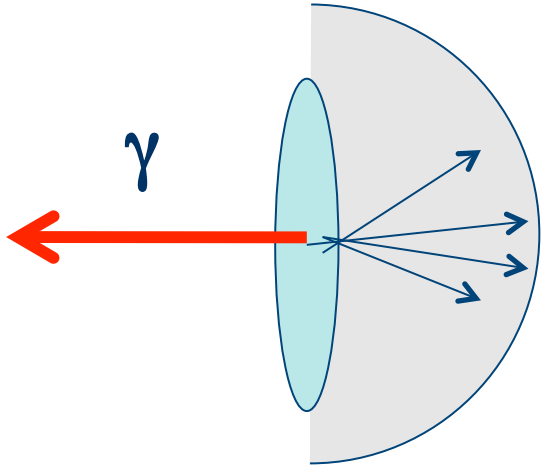
$|\Delta\phi|>5\pi/6$



$|\Delta\phi|>2\pi/3$



$|\Delta\phi|>\pi/2$

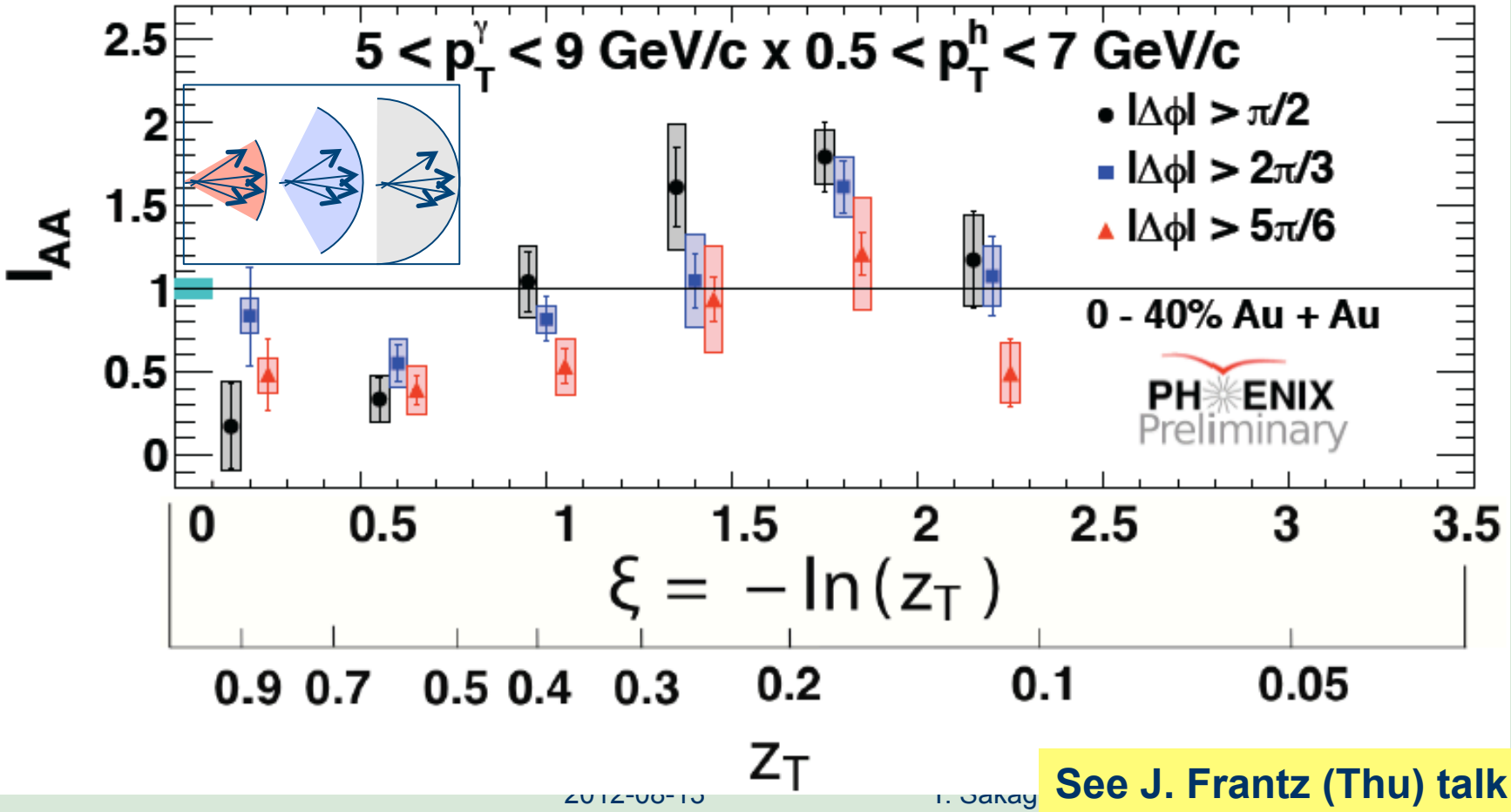


See J. Frantz (Thu) talk

γ-h correlation in Au+Au

$$I_{AA} \equiv \frac{(1/N_{trig} dN/d\xi)_{AA}}{(1/N_{trig} dN/d\xi)_{pp}}$$

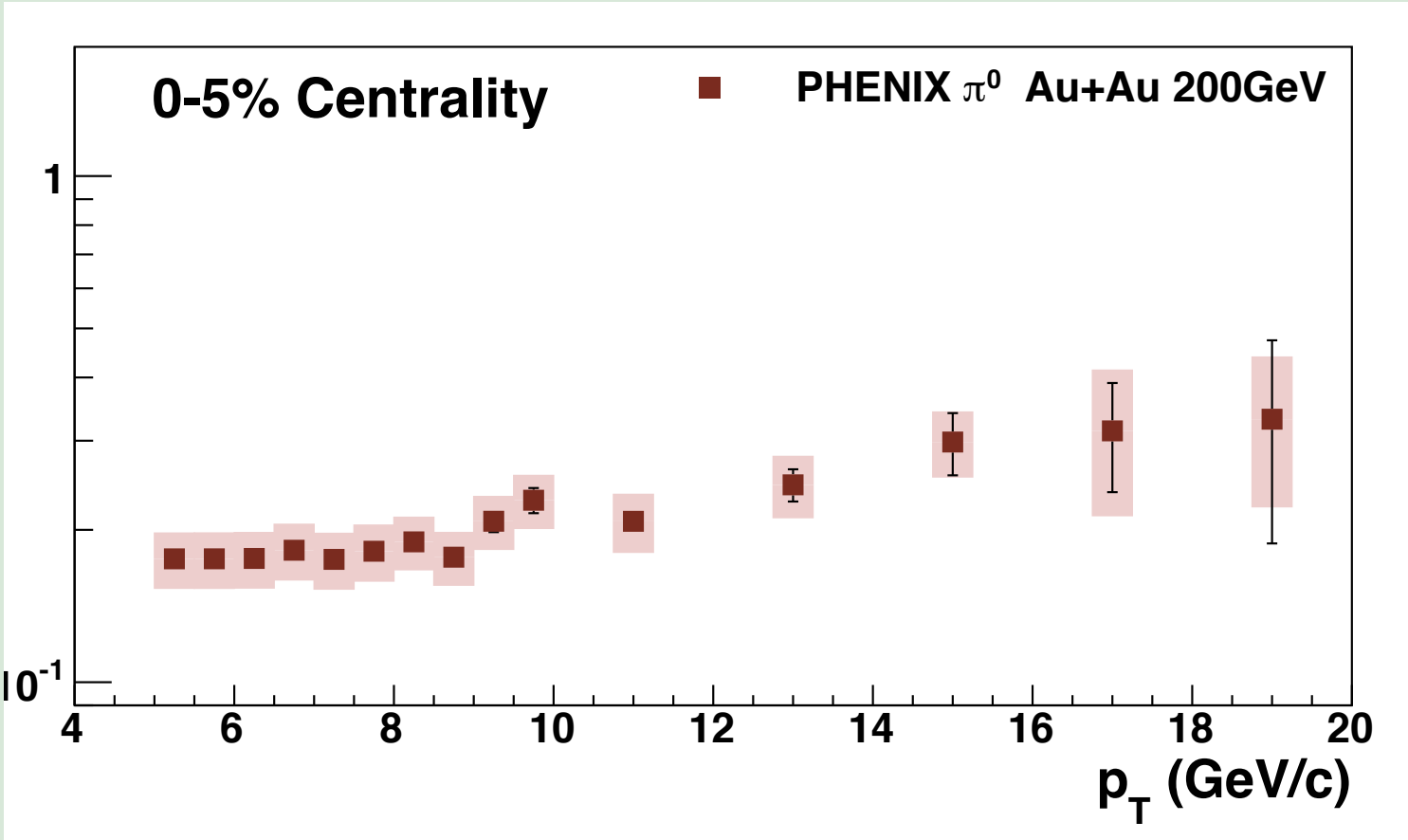
Low z_T away side particles distributed over wider angle



See J. Frantz (Thu) talk

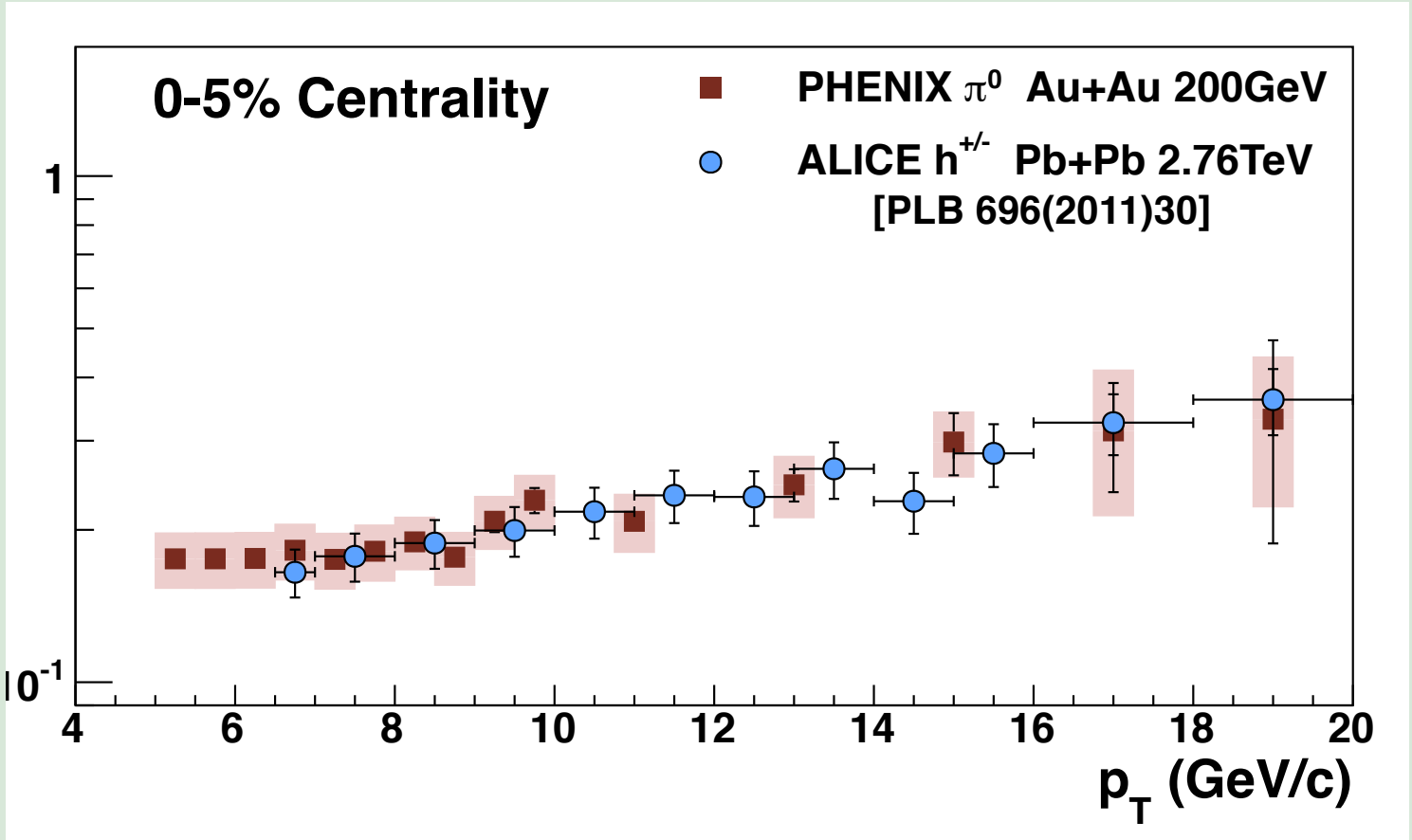
Single hadron R_{AA} RHIC energy

- π^0 in Au+Au 200GeV 0-5%
- Rising slope in R_{AA}: $(1.06\ ^{+0.34}_{-0.29})\times10^{-2}$ (GeV/c)$^{-1}$



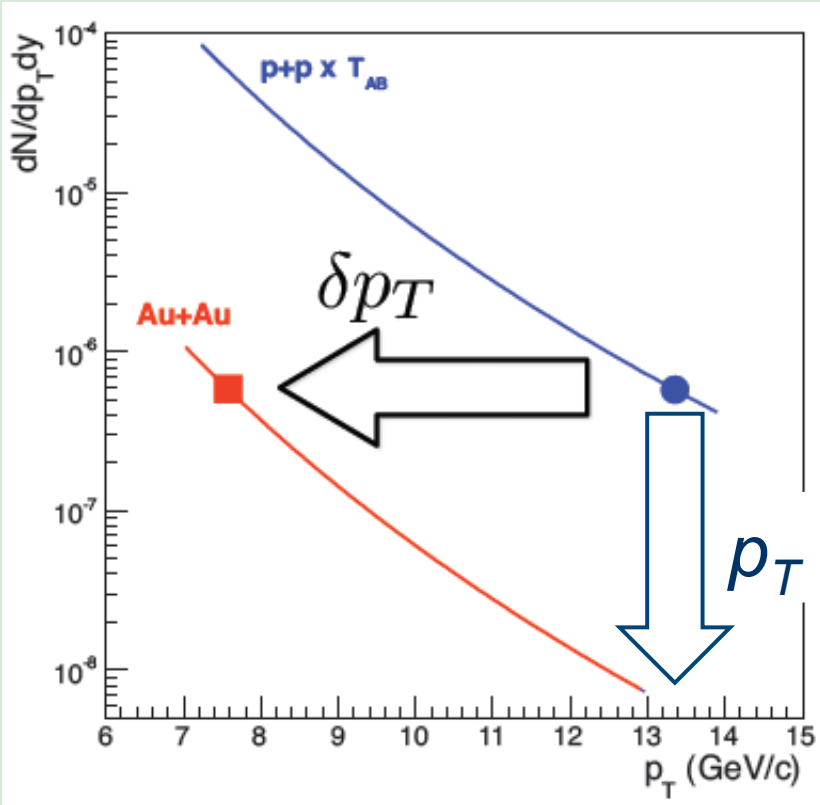
Single hadron R_{AA} RHIC vs LHC

- Charged hadrons in Pb+Pb 2.76TeV 0-5%
- R_{AA} for both systems look very similar

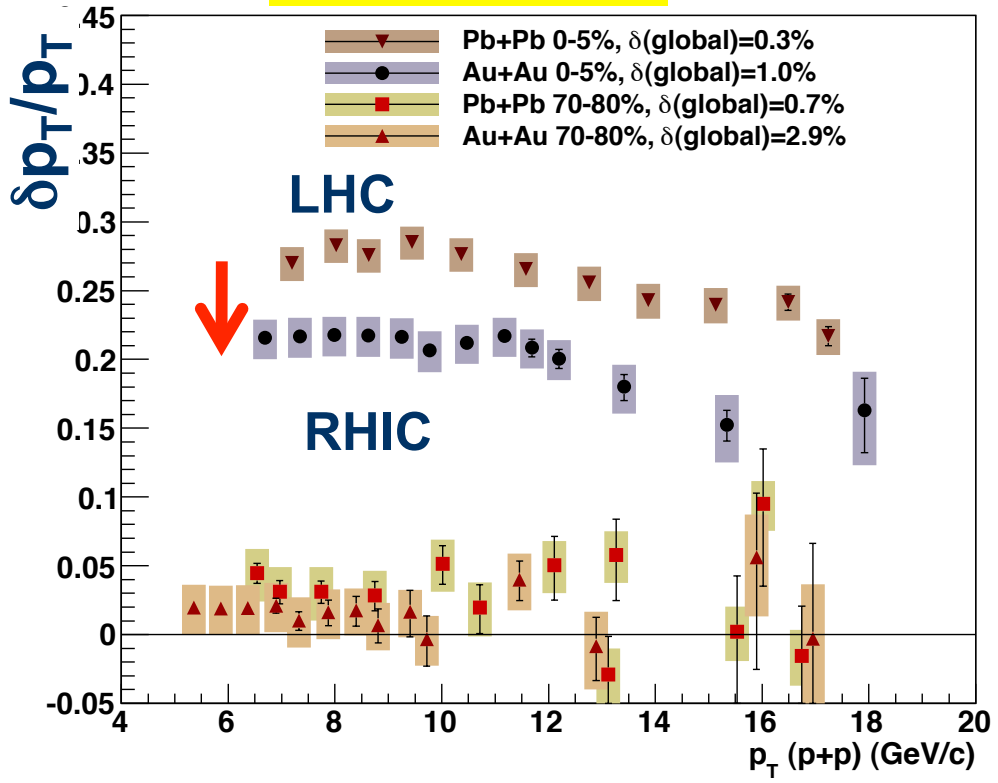


Fractional momentum loss

- Measure fractional mom. loss ($\delta p_T/p_T$) instead of R_{AA}
- Different $\delta p_T/p_T$ for same R_{AA}



arXiv:1208.2254

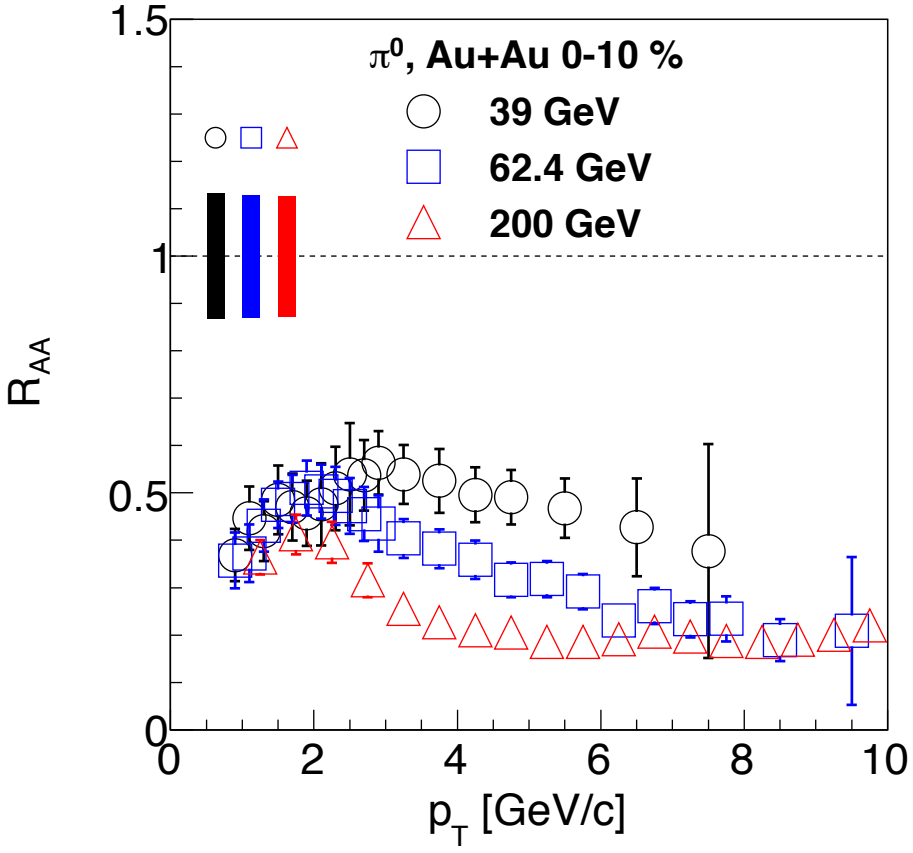


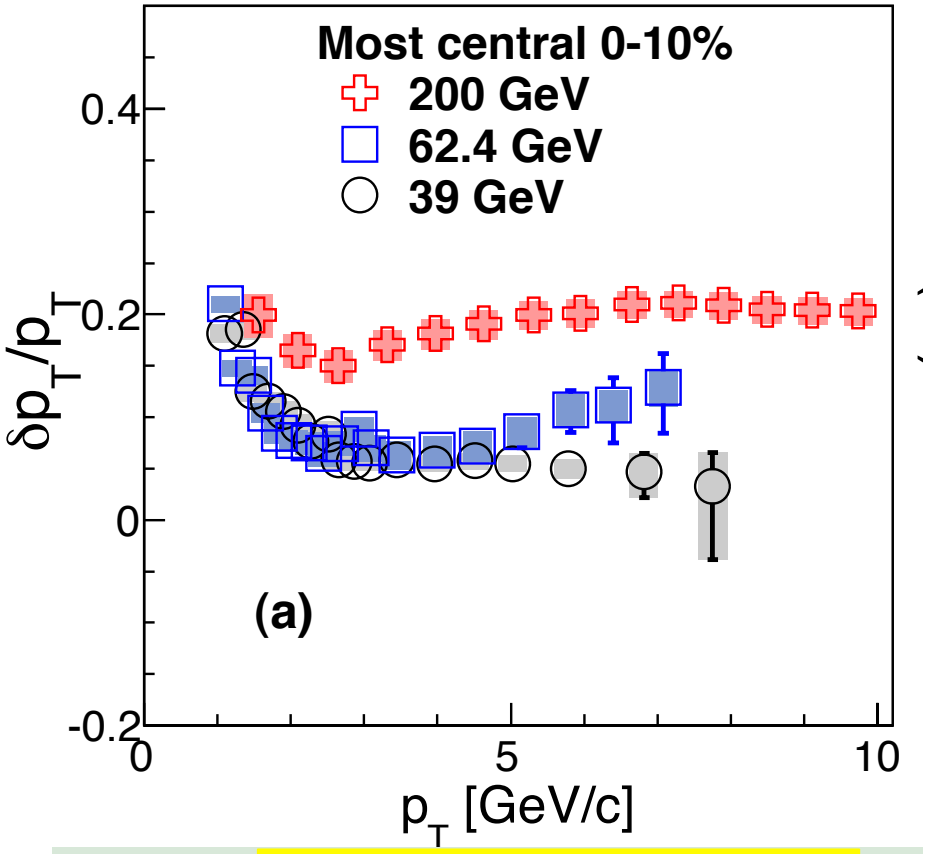
See M. McCumber (Tue) talk

Energy dependence of $\delta p_T/p_T$

- $\delta p_T/p_T$ decreases significantly going from 200GeV to 62, 39GeV

arXiv:1204.1526



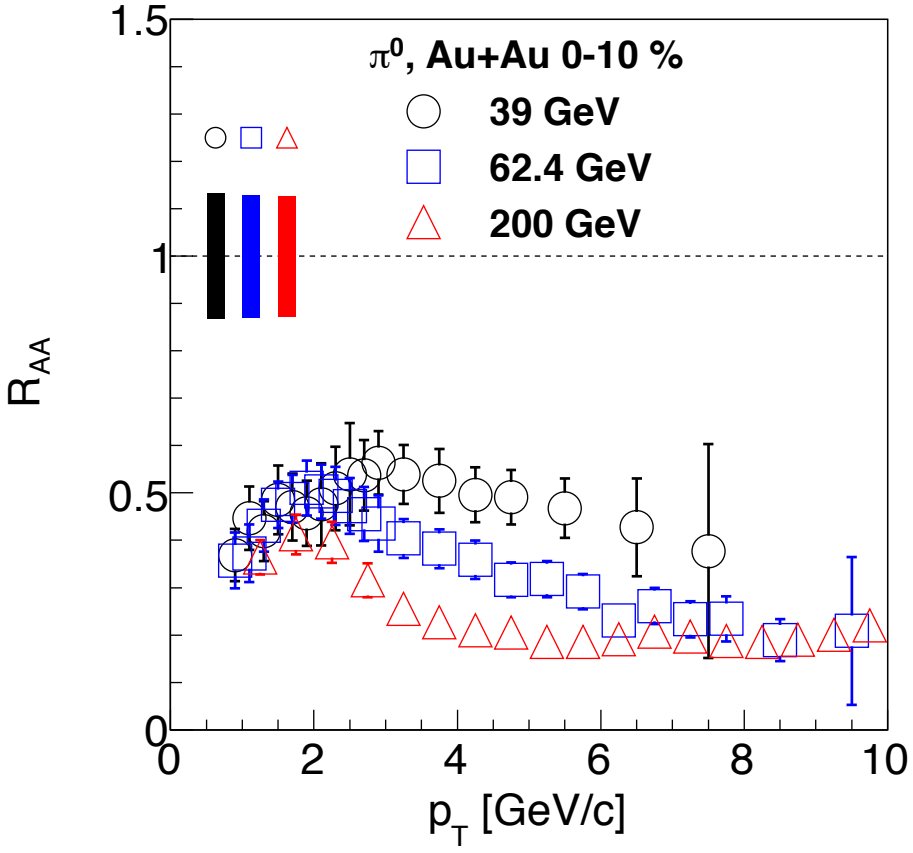


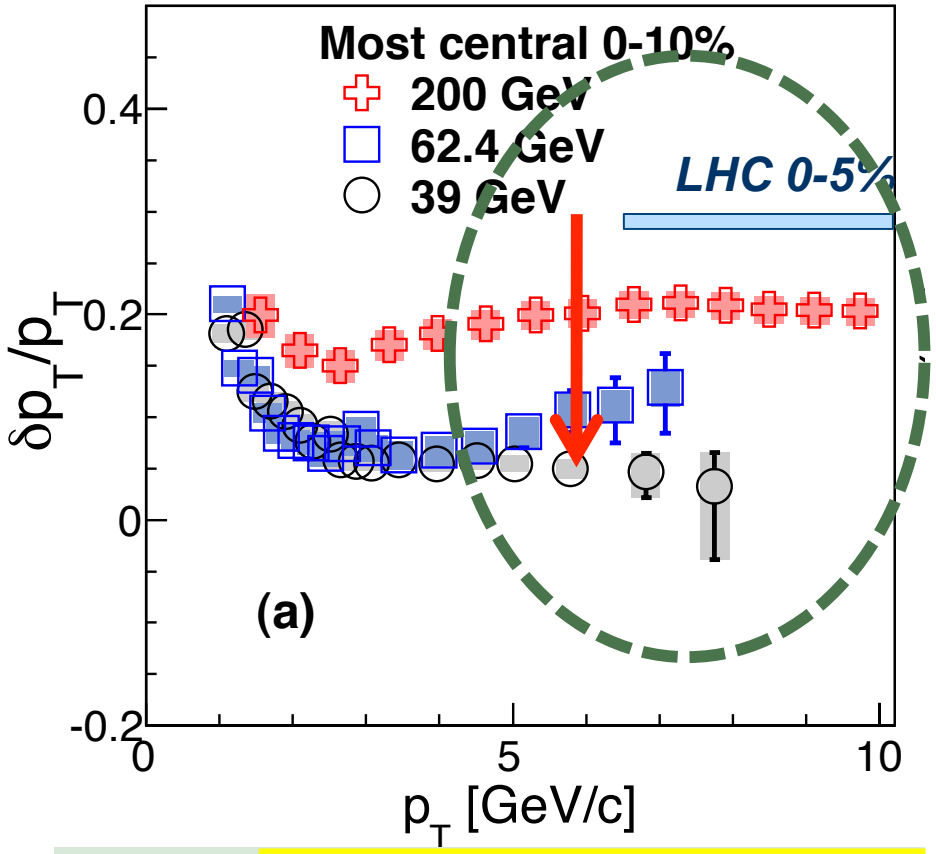
See E. O'Brien (Fri) talk

Energy dependence of $\delta p_T/p_T$

- $\delta p_T/p_T$ from 39GeV to 2.76TeV!

arXiv:1204.1526



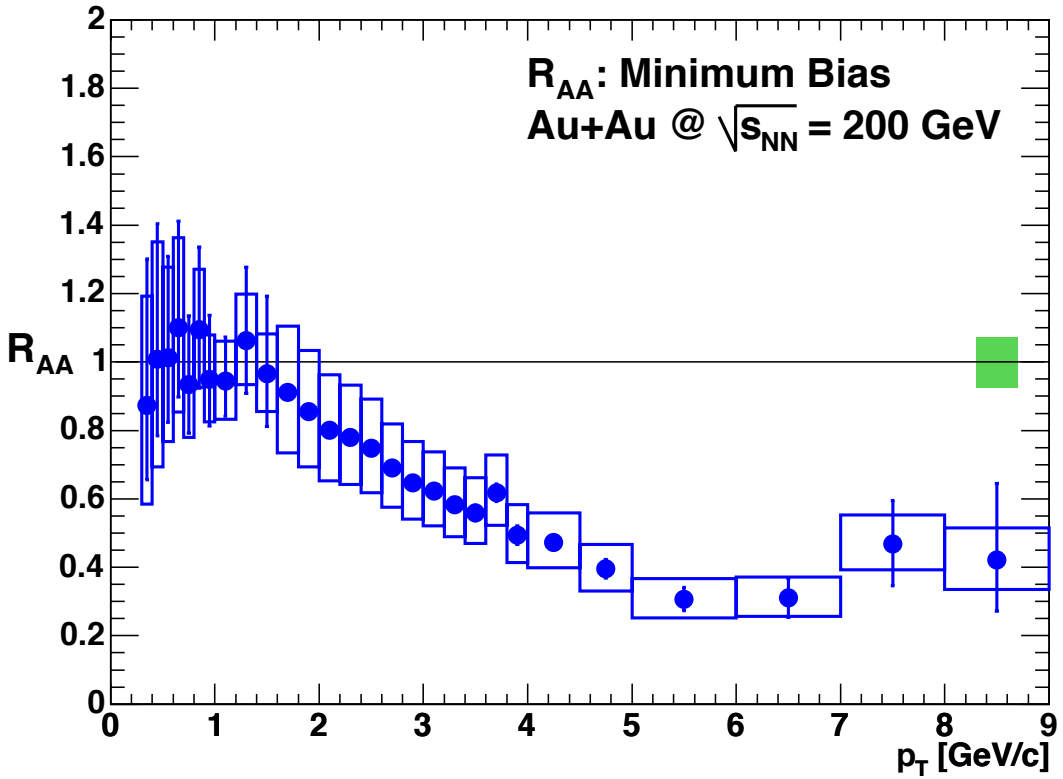


See E. O'Brien (Fri) talk

Single electrons

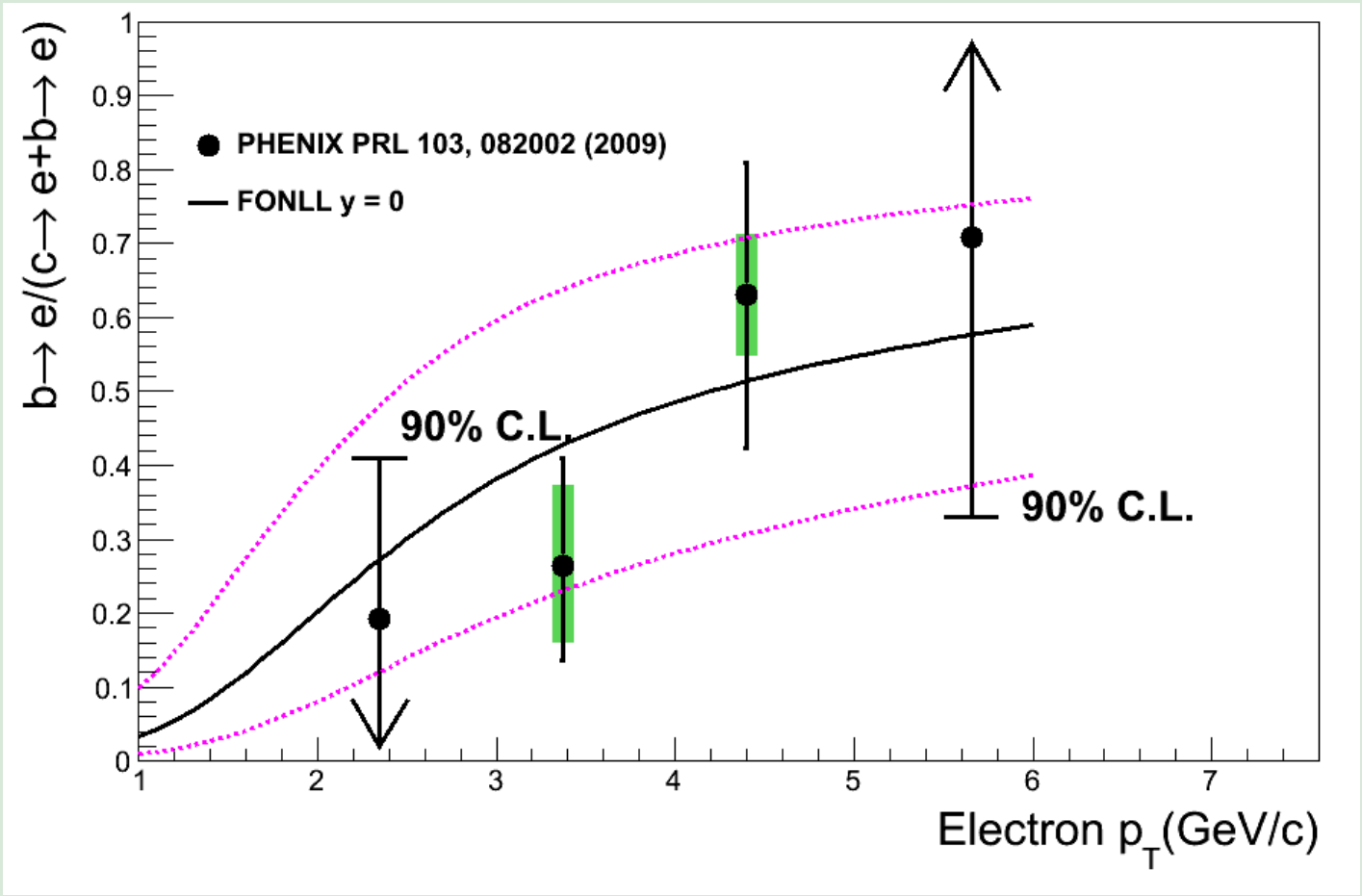
- Heavy flavor electron R_{AA} is a mixture of charm and bottom contributions
- We really want R_{AA} for charm and bottom

PRC. 84, 044905 (2007)



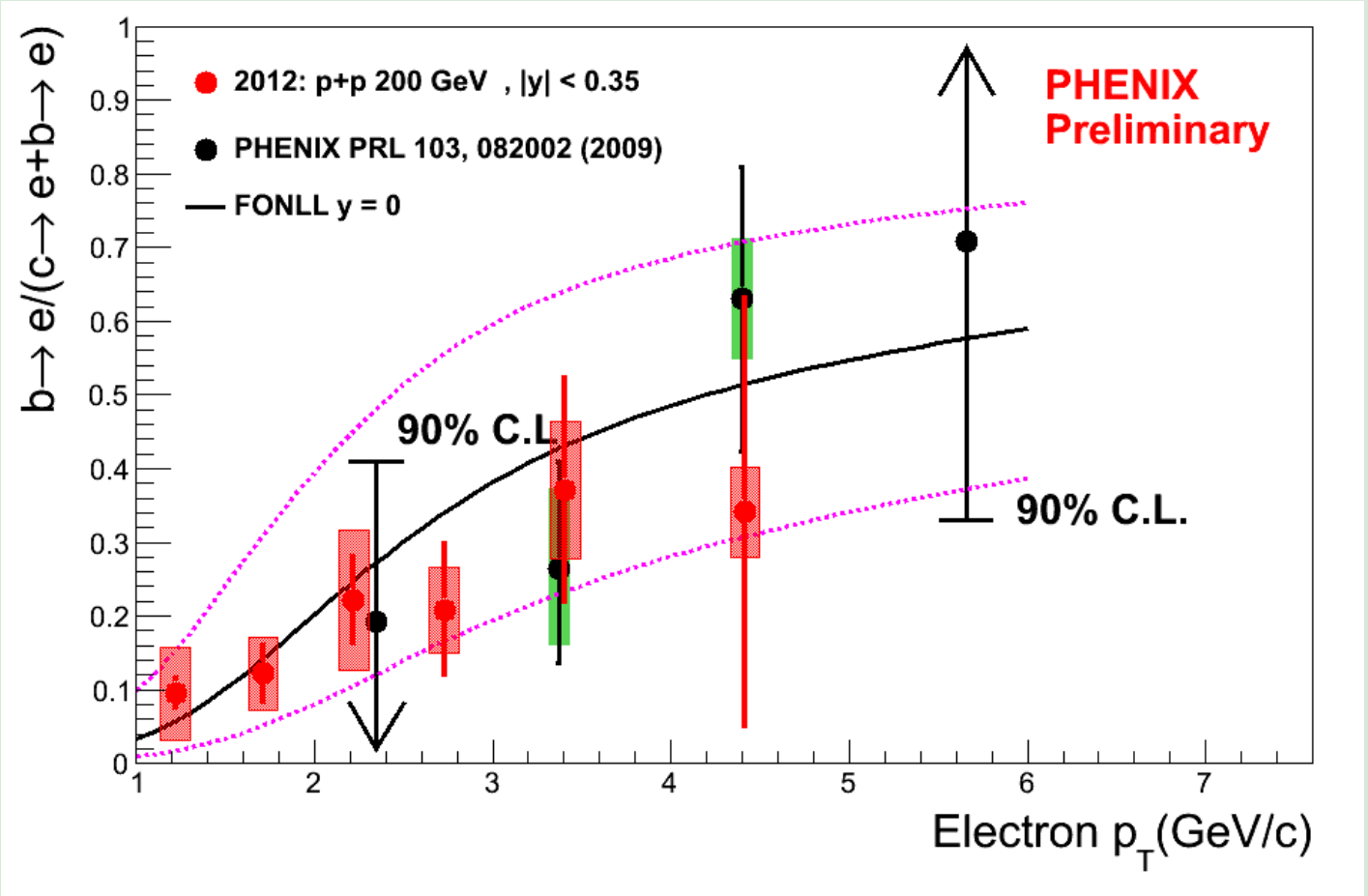
Charm and bottom decomposition

- (b->e)/(b->e + c->e) ratio for p+p collisions from partial reconstruction of $D \rightarrow e^{+/-}K^{-/+}X$



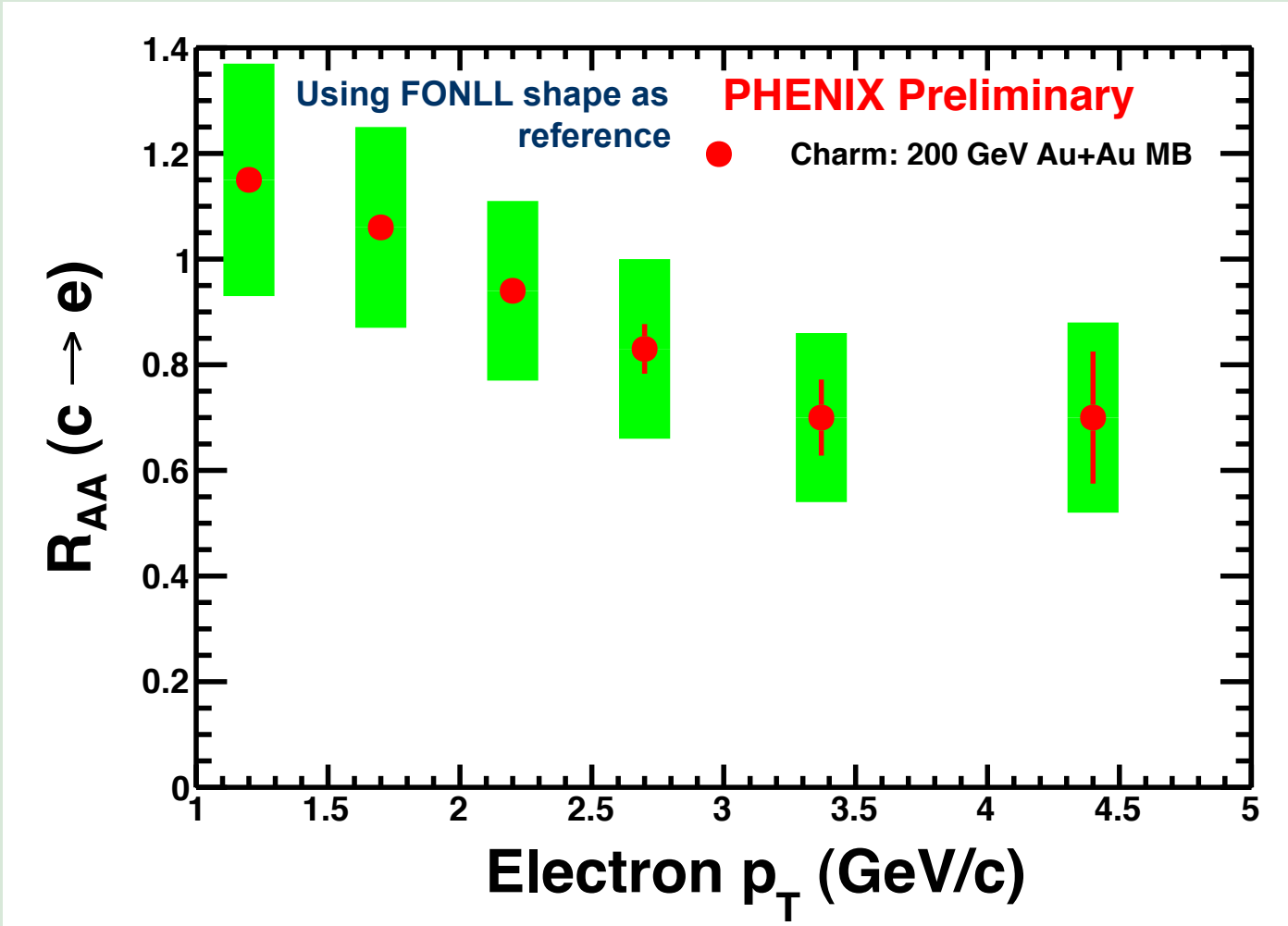
First direct c/b decomposition with new VTX detector

- New direct measurement of bottom fraction agrees with FONLL



See M. Rosati (Tue) and R. Nouicer (Fri) talk

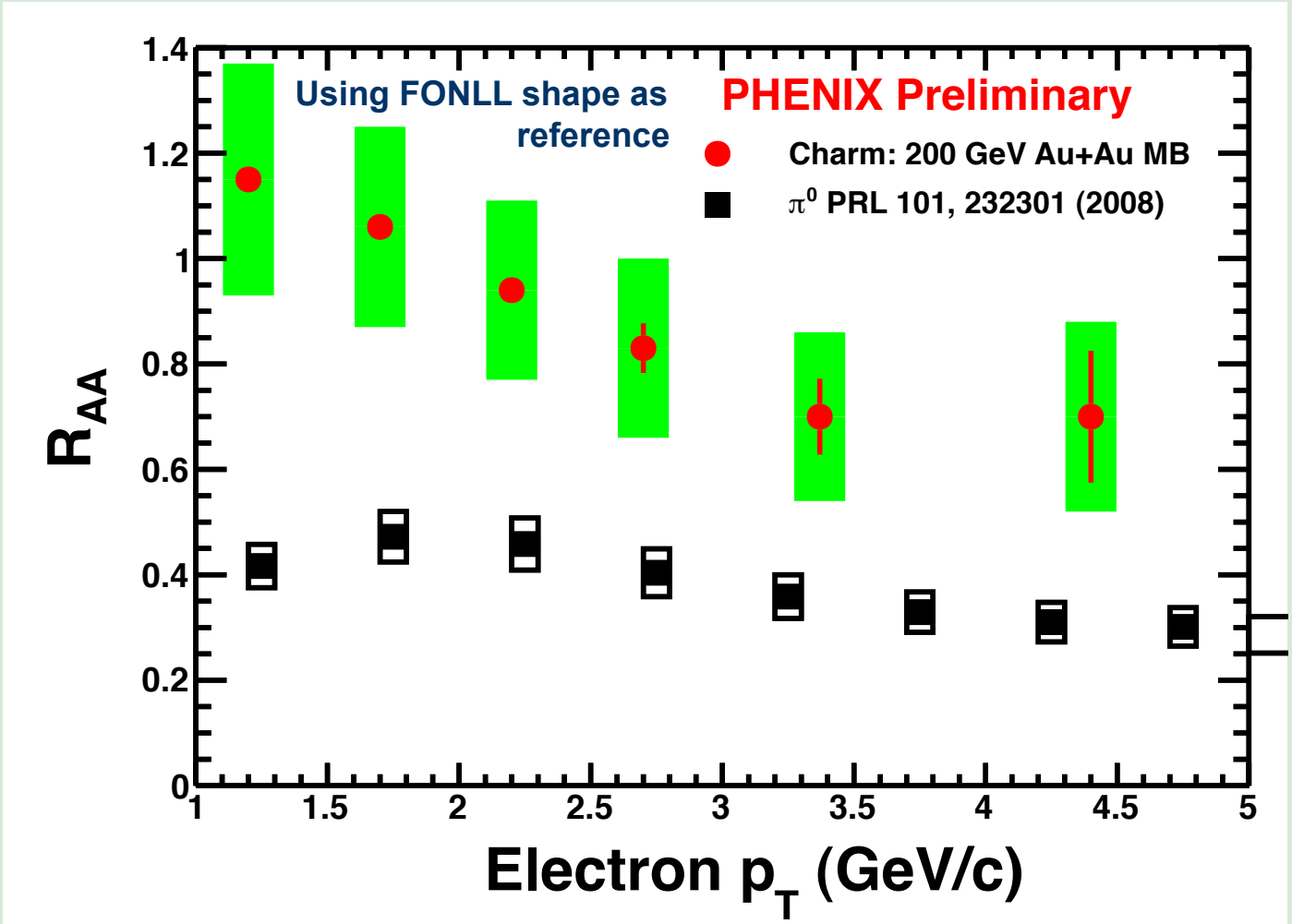
R_{AA} for c→e



See M. Rosati (Tue) and R. Nouicer (Fri) talk

R_{AA} for c→e and π^0

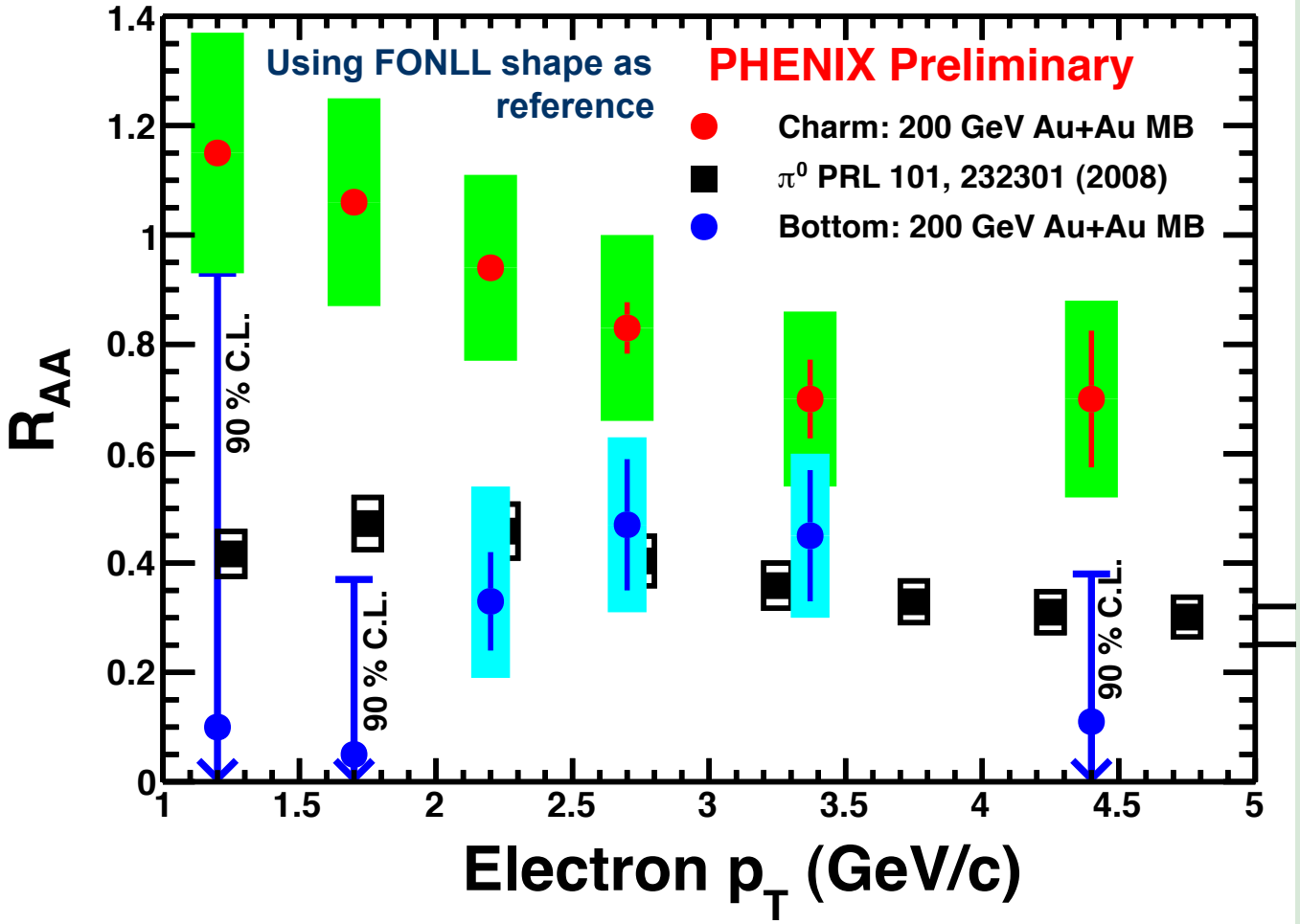
- Charm contribution is less suppressed



See M. Rosati (Tue) and R. Nouicer (Fri) talk

R_{AA} for c→e, b→e and π^0

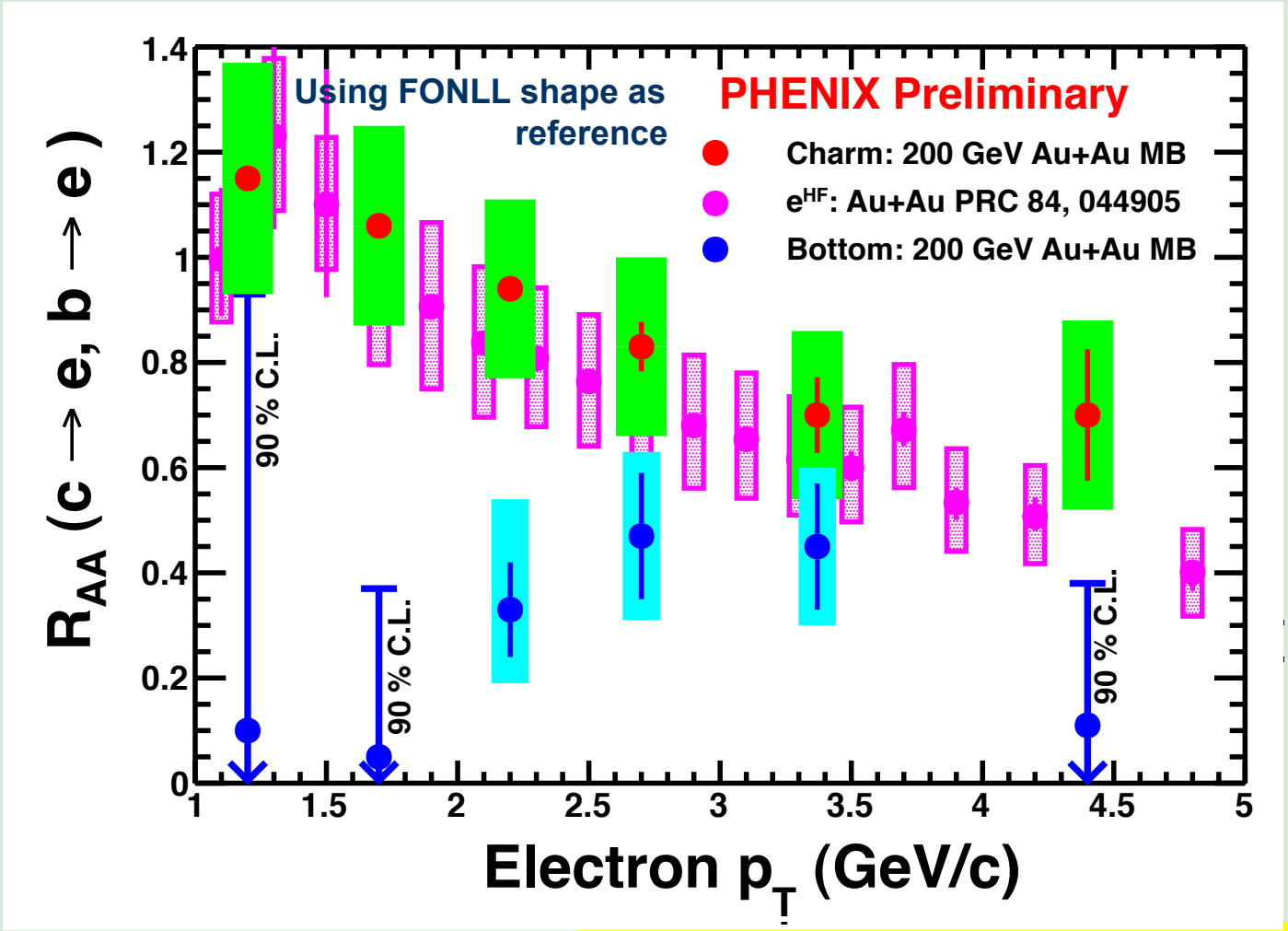
- Bottom contribution is heavily suppressed!



See M. Rosati (Tue) and R. Nouicer (Fri) talk

R_{AA} for c→e, b→e and HF e

- R_{AA} for c→e is consistent with R_{AA} for HF electrons



See M. Rosati (Tue) and R. Nouicer (Fri) talk

PHENIX talks

- Plenary talks
  - M. Wysocki (Mon, *Initial state, Global & Collective Dymanics*)
  - M. McCumber (Tue, *Jets*)
  - M. Rosati (Tue, *Heavy Flavor*)
  - I. Tserruya (Thu, *Quarkonia, Real & Virtual Photons*)
  - E. O'Brien (Fri, *Exploring the QCD Phase Diagram*)
- Parallel talks (Tue)
  - T. Niida (*Correlations & Fluctuations, Parallel #3*)
  - Y. Gu (*Global & Collective Dynamics, Parallel #1*)
  - J. Frantz (*Jets, Parallel #2*)
  - D. McGlinchey (*Heavy Flavor & Quarkonia, Parallel #4*)
- Parallel talks (Wed)
  - E. Atomssa (*Electro-Weak Probes, Parallel #7*)
  - M. Kurosawa (*Global & Collective Dynamics Parallel #5*)
  - B. Sahlmueller (*Pre-Equilibrium & Initial State, Parallel #8*)
  - S. Huang (*Global & Collective Dynamics Parallel #5*)
- Parallel talks (Thu)
  - P. Shukula (*High pT and Jets, Parallel #11*)
- Parallel talks (Fri)
  - J. Haggerty (*New Experimental Developments, Parallel #15*)
  - R. Nouicer (*Heavy Flavor & Quarkonia, Parallel #13*)
  - J. Seele (*New Experimental Developments, Parallel #15*)
  - T. Todoroki (*Correlations & Fluctuations,,Parallel #16*)
  - R. Hollis (*Correlations & Fluctuations,,Parallel #16*)
  - J. Mitchell (*Exploring the QCD Phase Diagram, Parallel #14*)

And, Many posters

Summary

- Understanding the baseline –d+Au-
  - Direct photons – no modification
  - Jets and high p_T π^0/η – Little modification
  - ψ' is very heavily suppressed
- Varying the geometry
  - U+U - Strong radial flow
  - positive v_1 in Cu+Au
  - J/ψ suppressed in Cu-going direction more than Au+Au at same N_{part}
- Varying the energy
  - $\delta p_T/p_T$ for hadrons increases by a factor of 6 from 39GeV to 2.76TeV
- Know your hard probes
  - γ-h – Detail jet tomography, hints of jet broadening
- Separating heavy flavor electrons into charm and bottom
  - Strong suppression of b in Au+Au for p_T<5GeV/c

Backup

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