Charged Hadron Spectra in Cu+Cu Collisions from PHENIX

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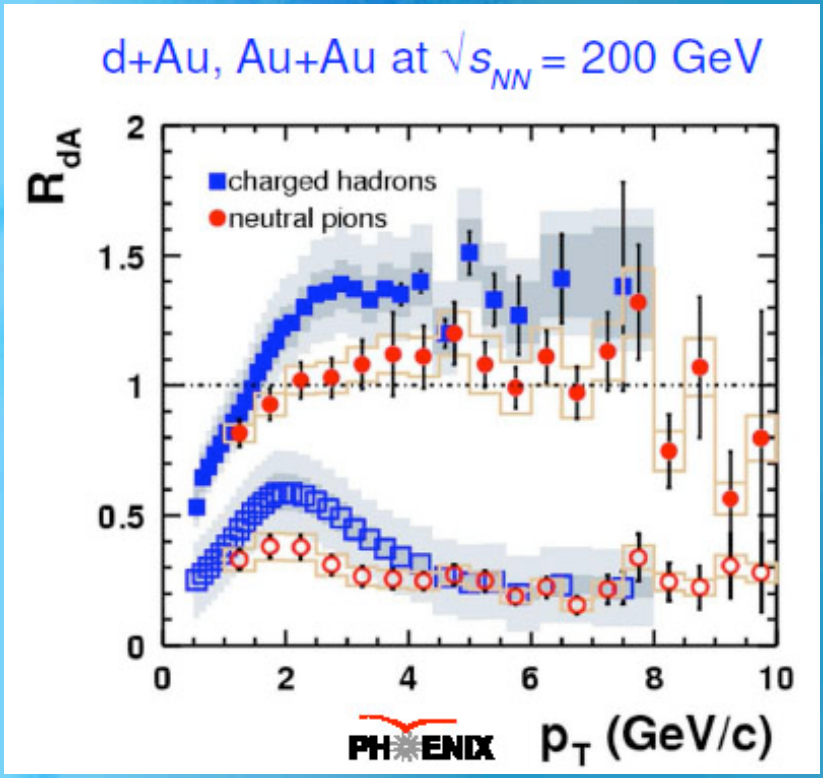
Motivation

In Au+Au collisions, the production of particles at large transverse momentum in central collisions is suppressed: "jet quenching"

$$R_{AA} = \frac{\text{Yield}_{AA} / \langle N_{\text{binary}} \rangle_{AA}}{\text{Yield}_{pp}}$$



In d+Au collisions this suppression is not observed

⇒ final state effects are the favored scenario, such as parton energy loss in the dense medium created in the collision.

⇒ understanding of the suppression mechanism(s) is far from complete

Why Cu+Cu Collisions?

- Varying the system size provides more information, which can be used to constrain theorical predictions:

  the medium created in central Cu+Cu collisions has a different density and overall dimensions than central Au+Au

  ⇒ the path length dependence of the suppression can be studied in more detail

- PHENIX collected several Cu+Cu data samples during Run 5:

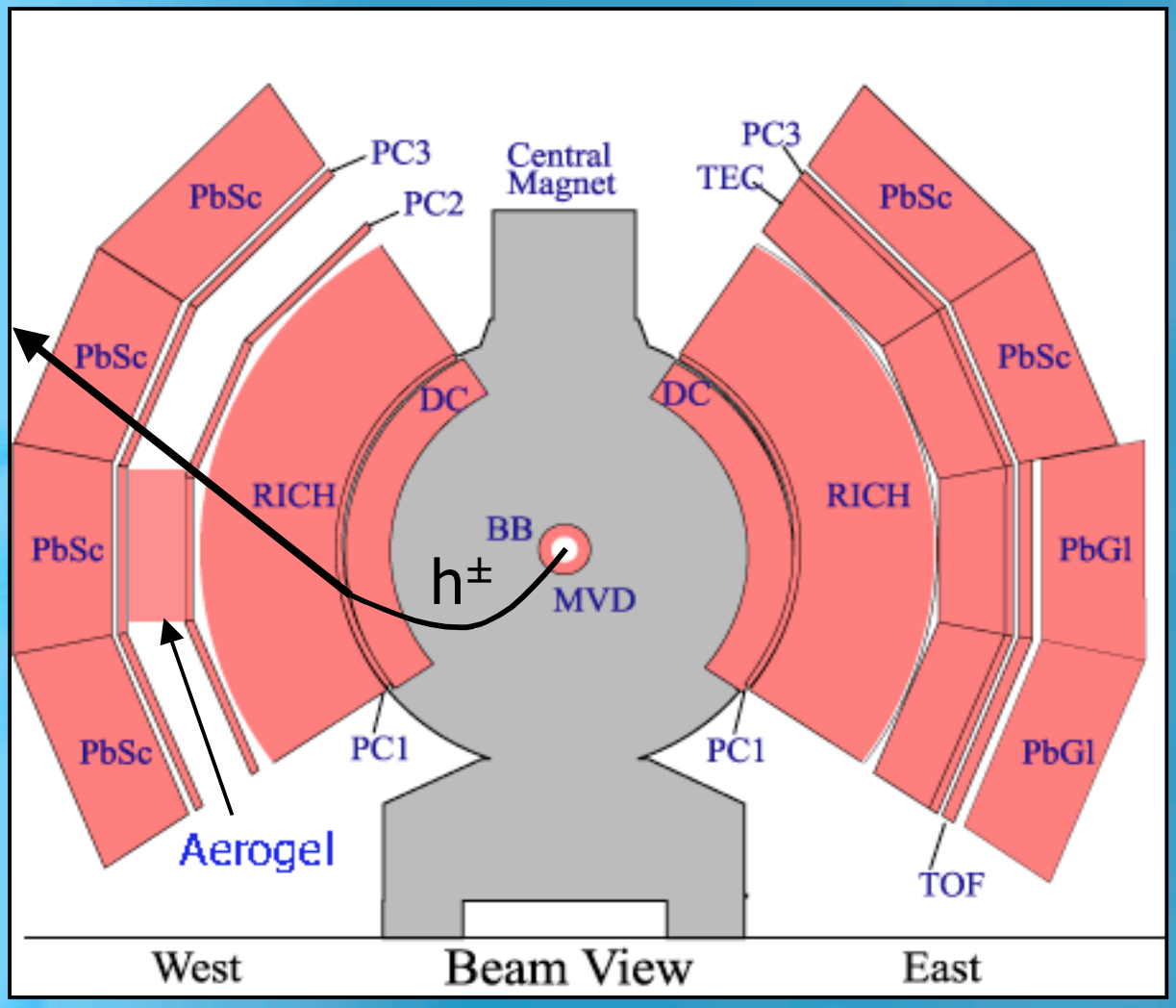
  ➡ at 200GeV: > 1B Minimum Bias Events + Triggered Events

  ➡ The preliminary results shown here include ~ 80M reconstructed MB events

  ➡ at 62.4 GeV: ~425M Minimum Bias Events

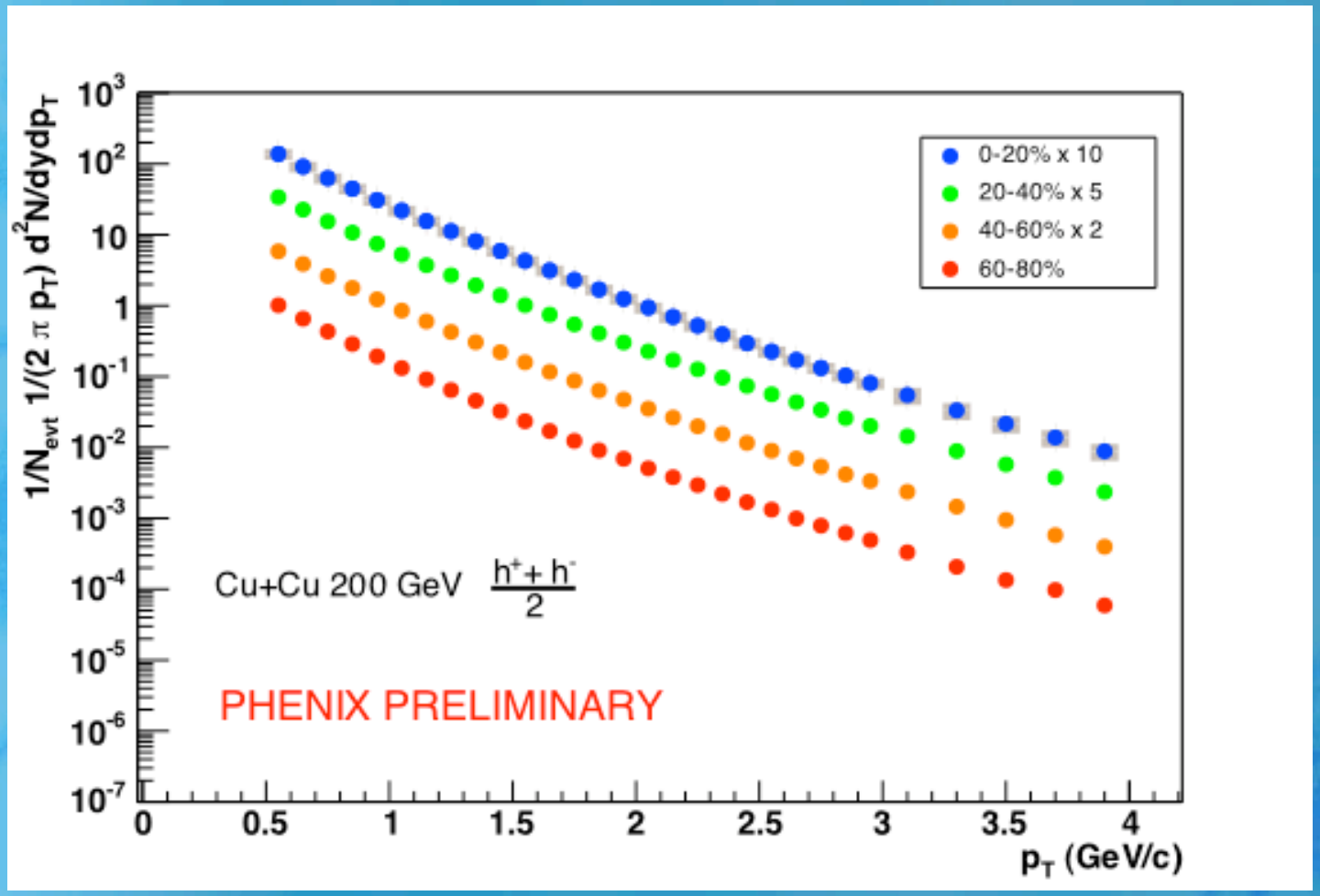
  ➡ at 22.5 GeV: 9.3 M Events

PHENIX Central Arm in Run5



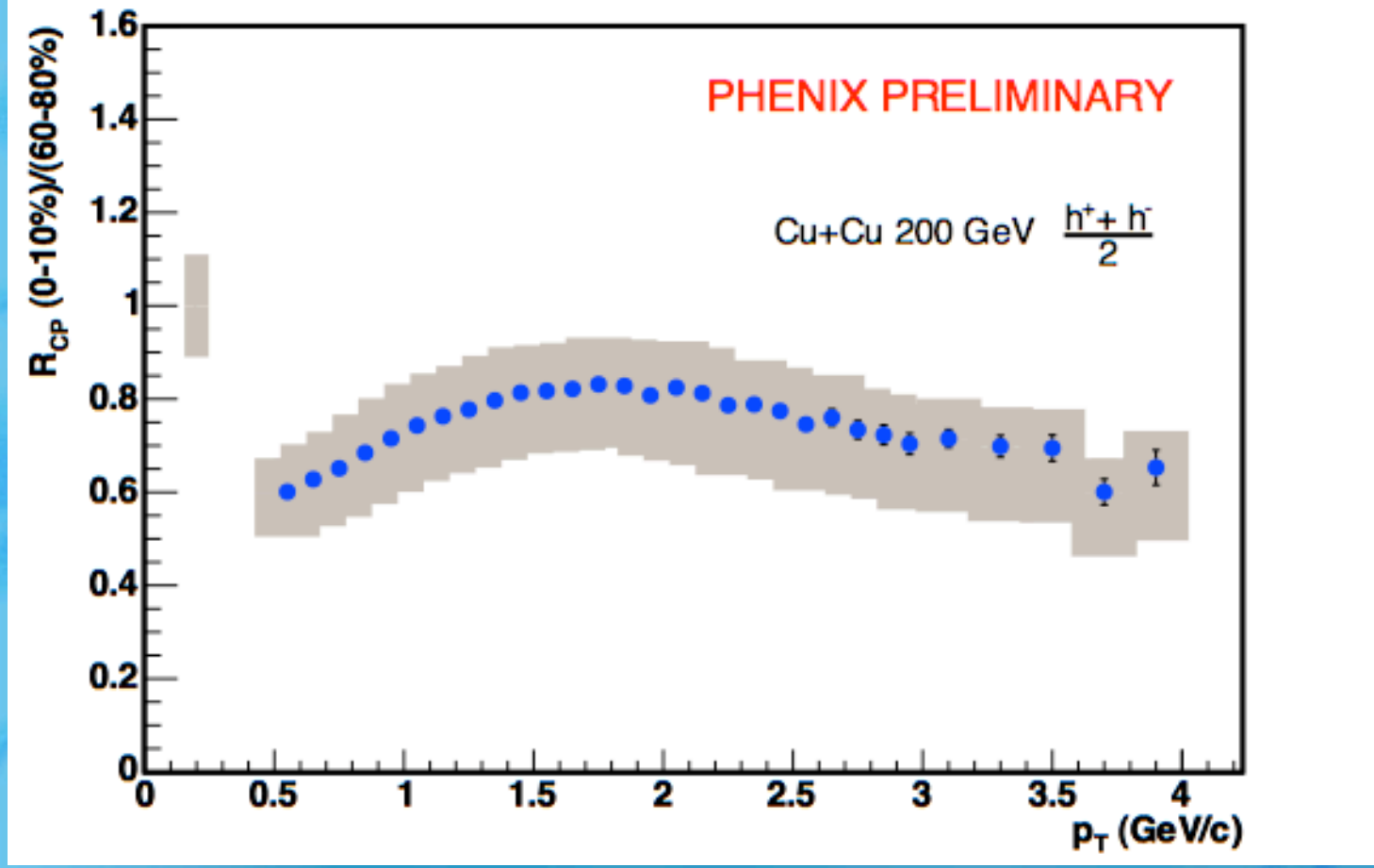
Charged hadron tracking and momentum measurements use Pad Chambers (PC1 - PC3), Drift Chamber (DC)

Charged Hadron Yields

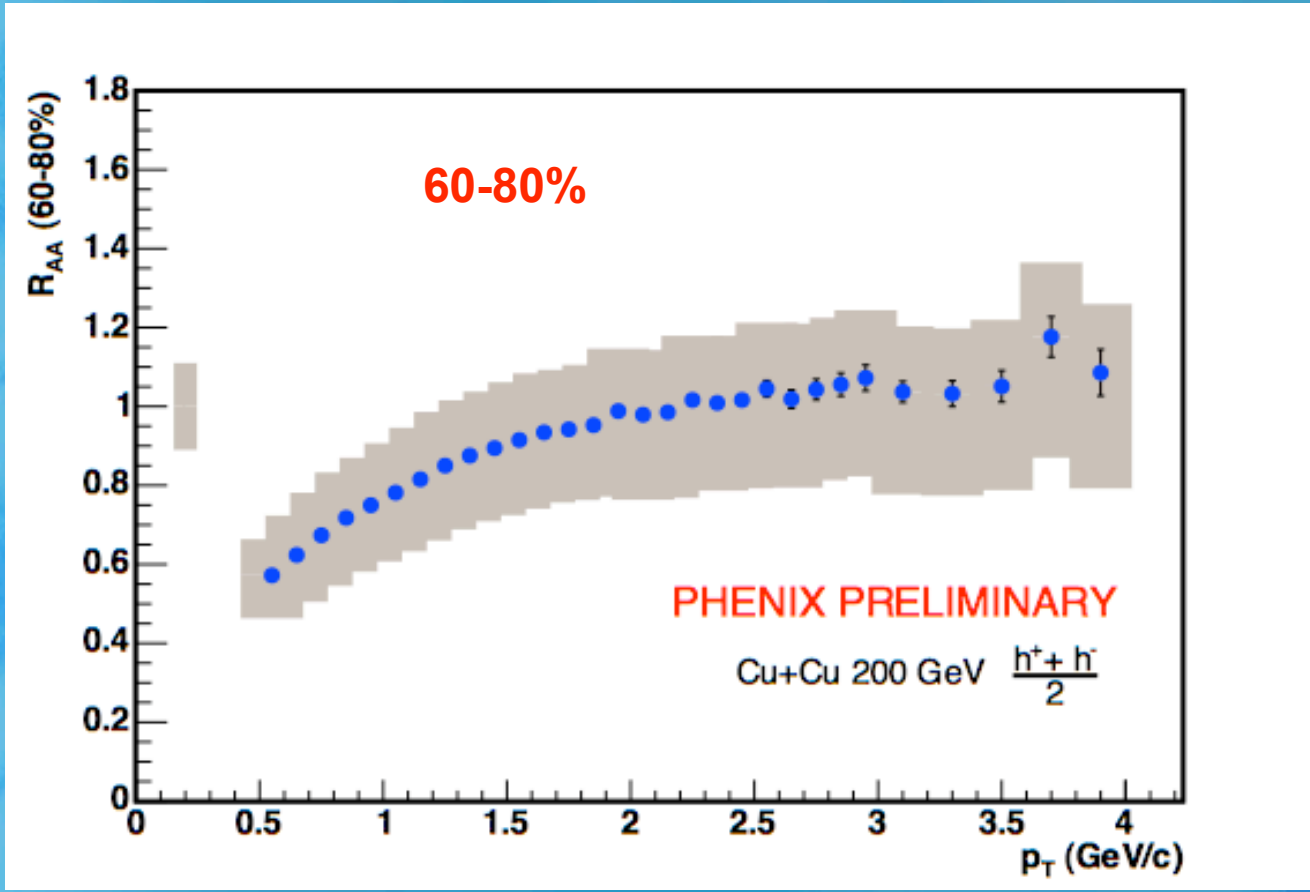


R_{CP}

$$R_{CP} = \frac{\text{Yield}_{\text{Central}} / \langle N_{\text{binary}} \rangle_{\text{Central}}}{\text{Yield}_{\text{Peripheral}} / \langle N_{\text{binary}} \rangle_{\text{Peripheral}}}$$



Centrality Dependence of R_{AA}



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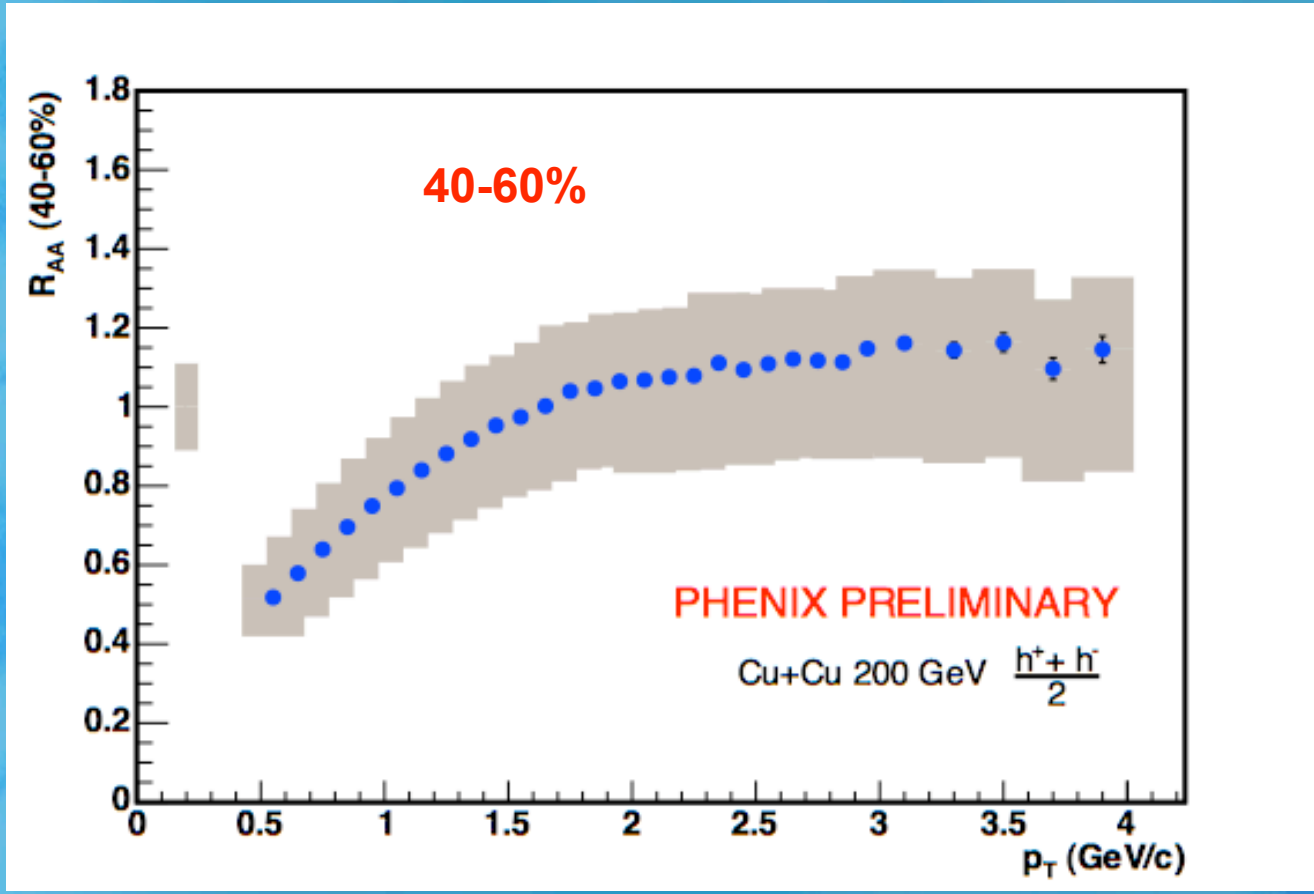

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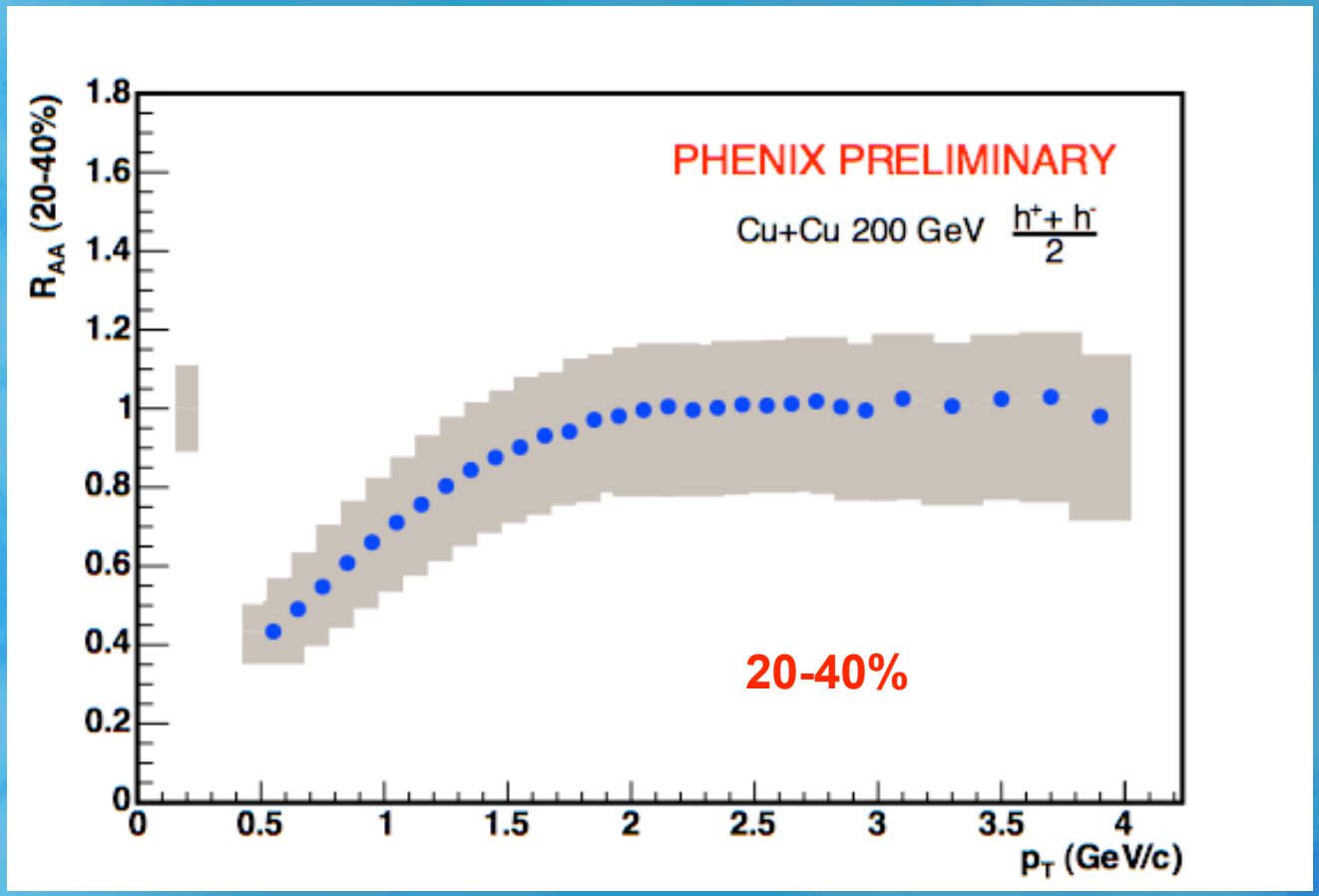
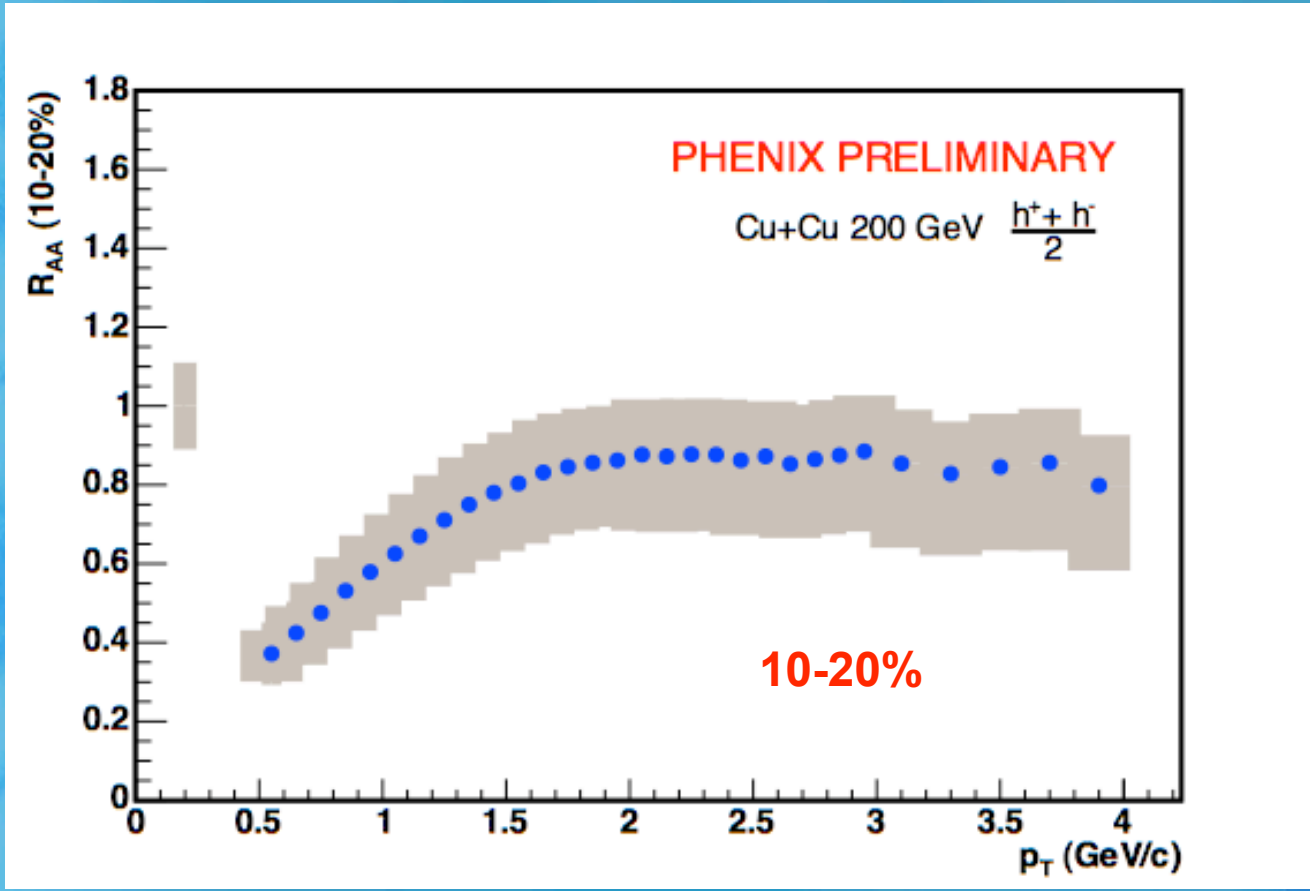
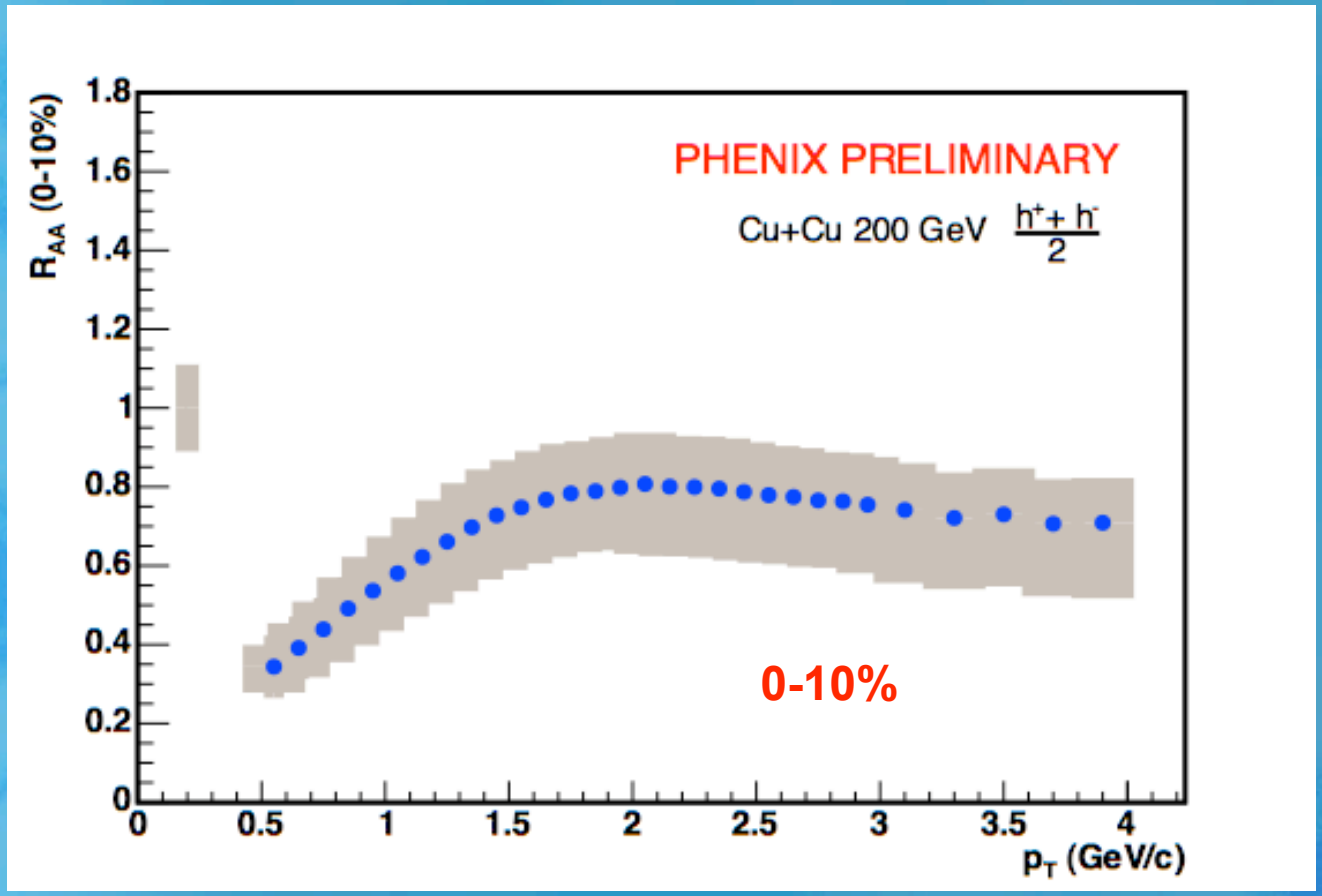


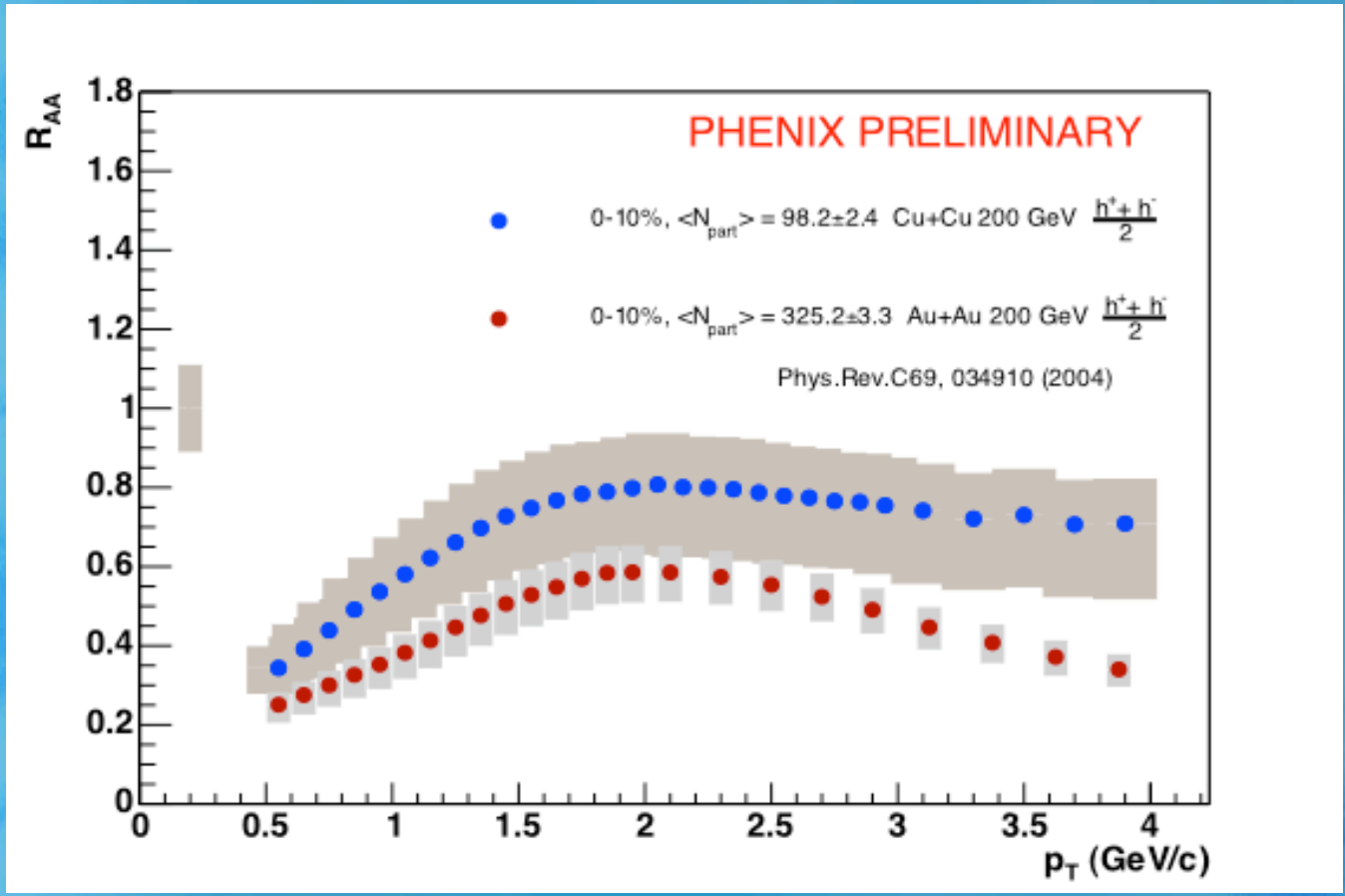
Centrality Dependence of R_{AA}



Centrality Dependence of R_{AA}

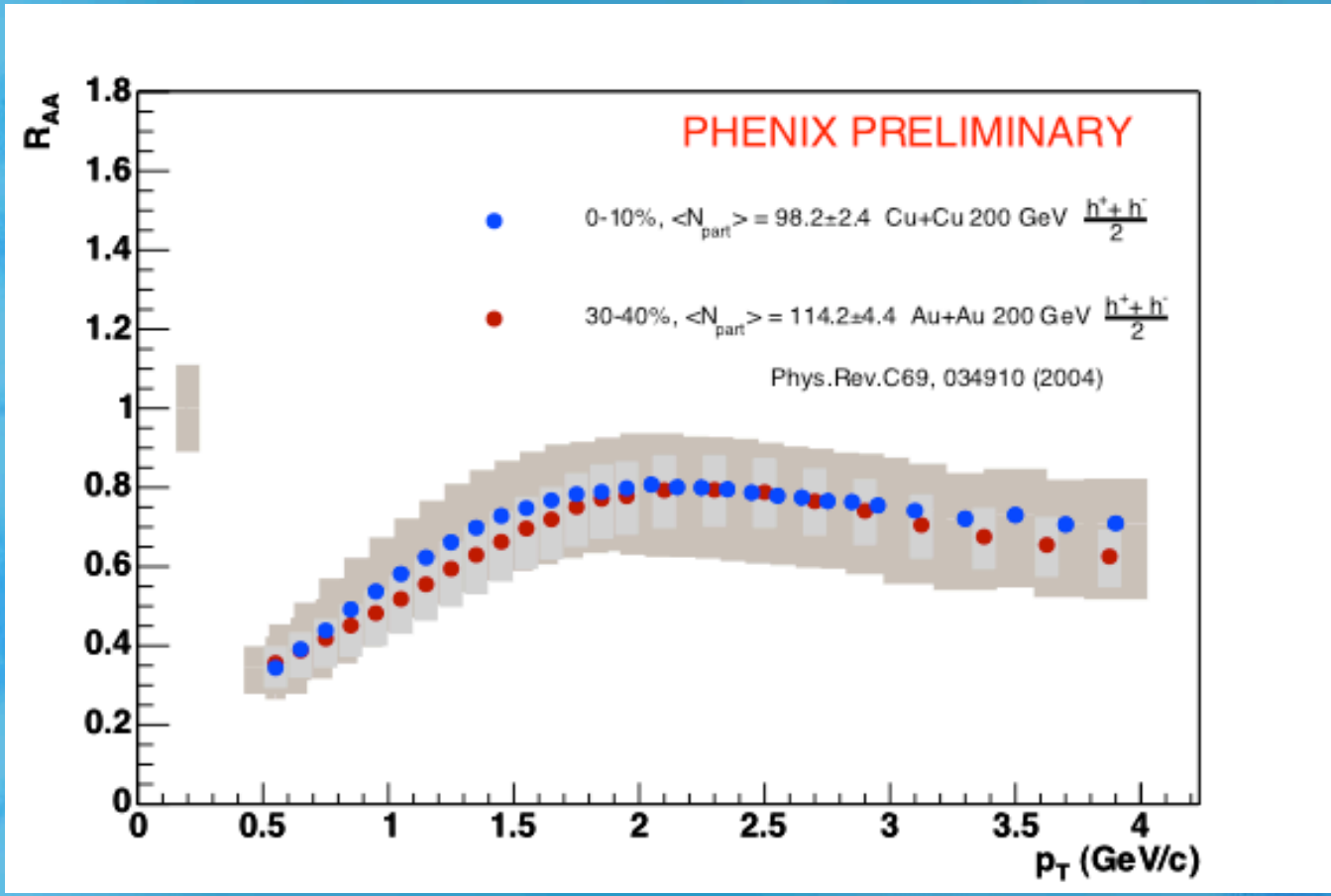


Comparing to Au+Au I



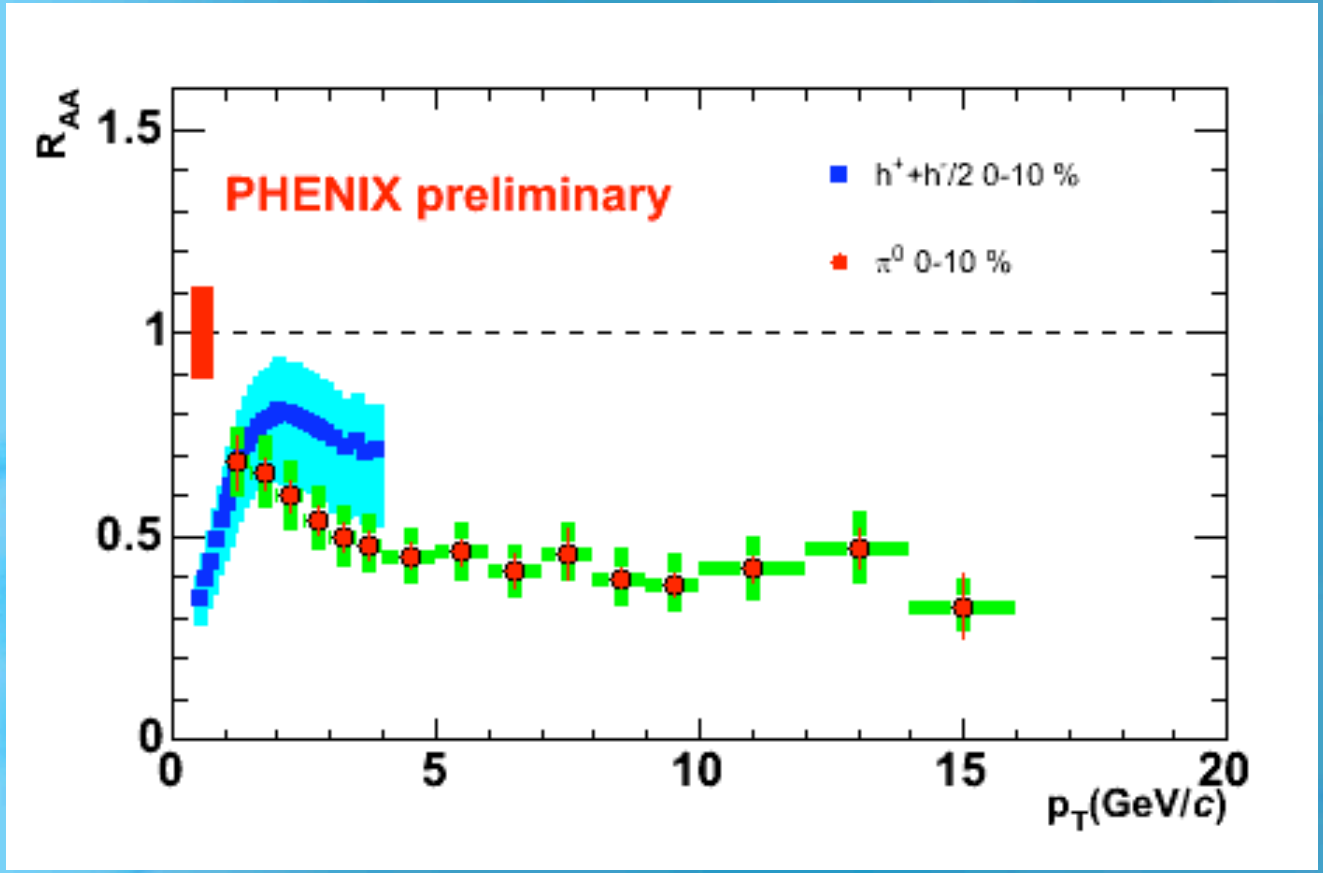
Suppression for central Au+Au collisions is stronger …

Comparing to Au+Au II



… but mid-central Au+Au very similar to central Cu+Cu. (bins have approximately the same $\langle N_{part} \rangle$)

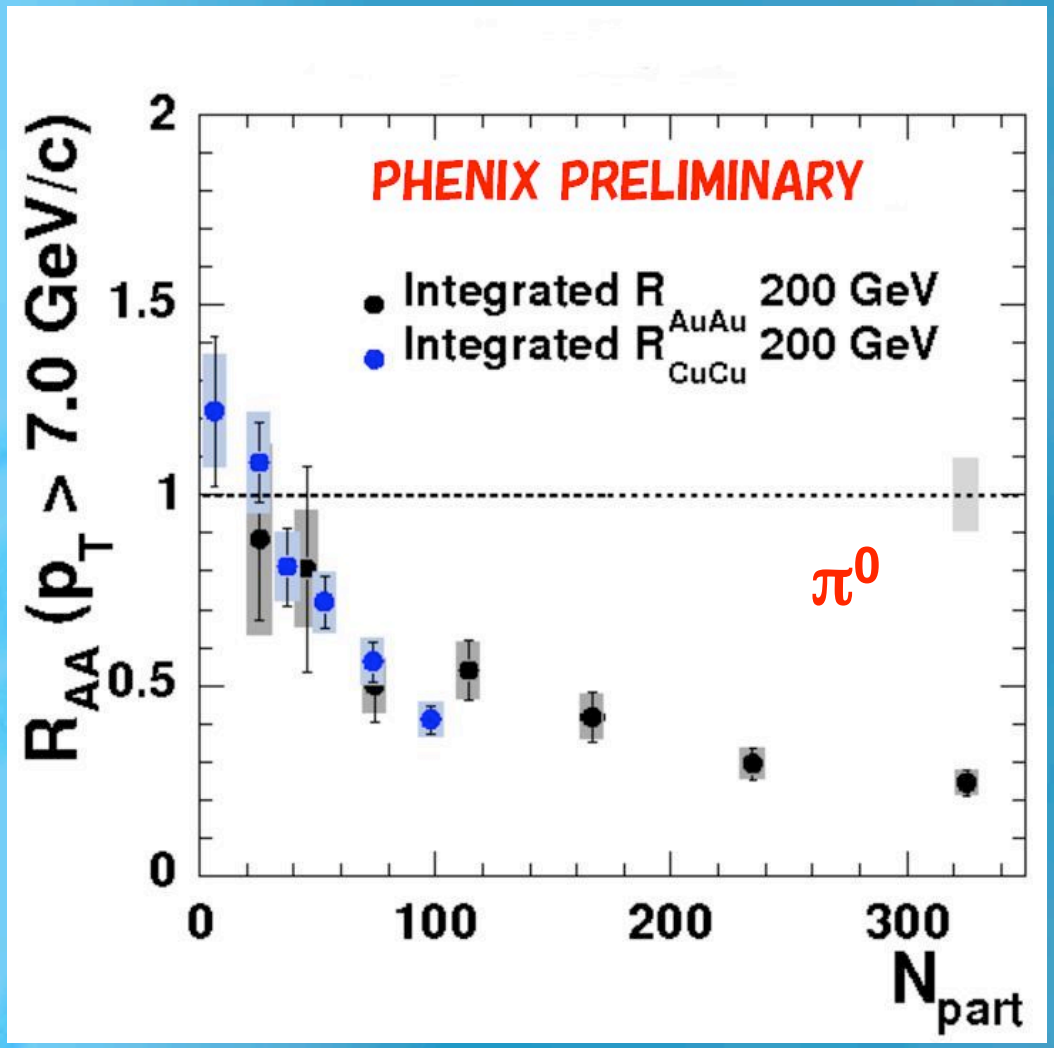
Charged vs. π^0 R_{AA}



Suppression is flat at high p_T, as observed in Au+Au

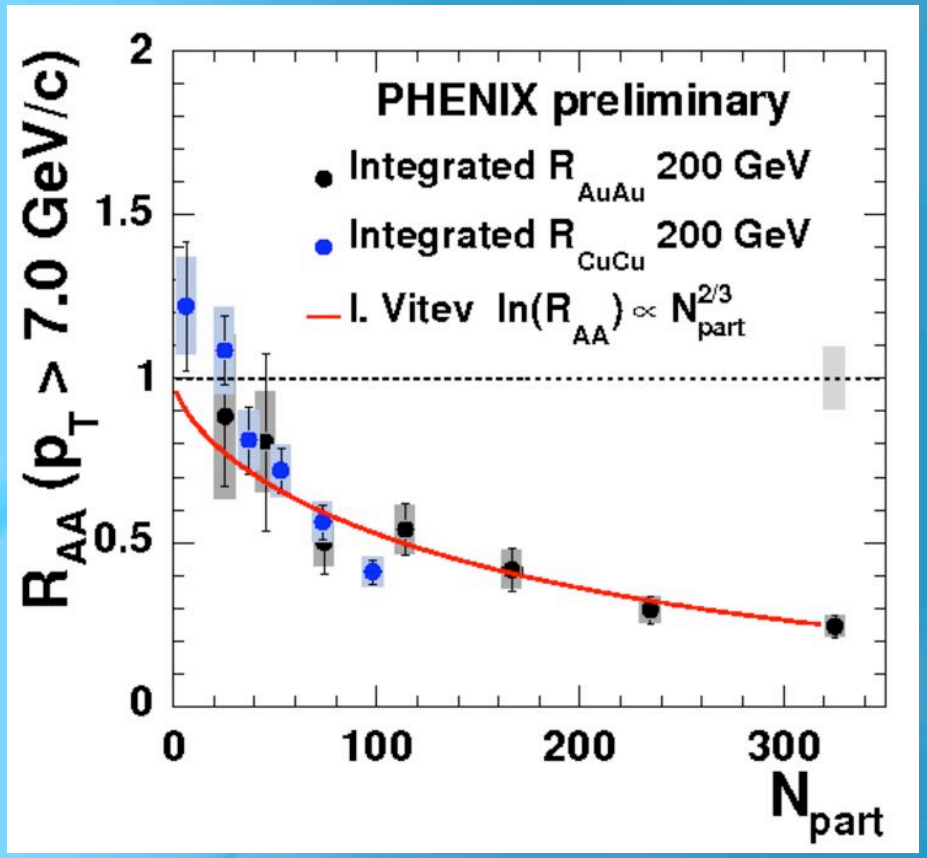
For more on Cu+Cu π^0 results, see CC2 - Stefan Bathe, Tue 2:30pm

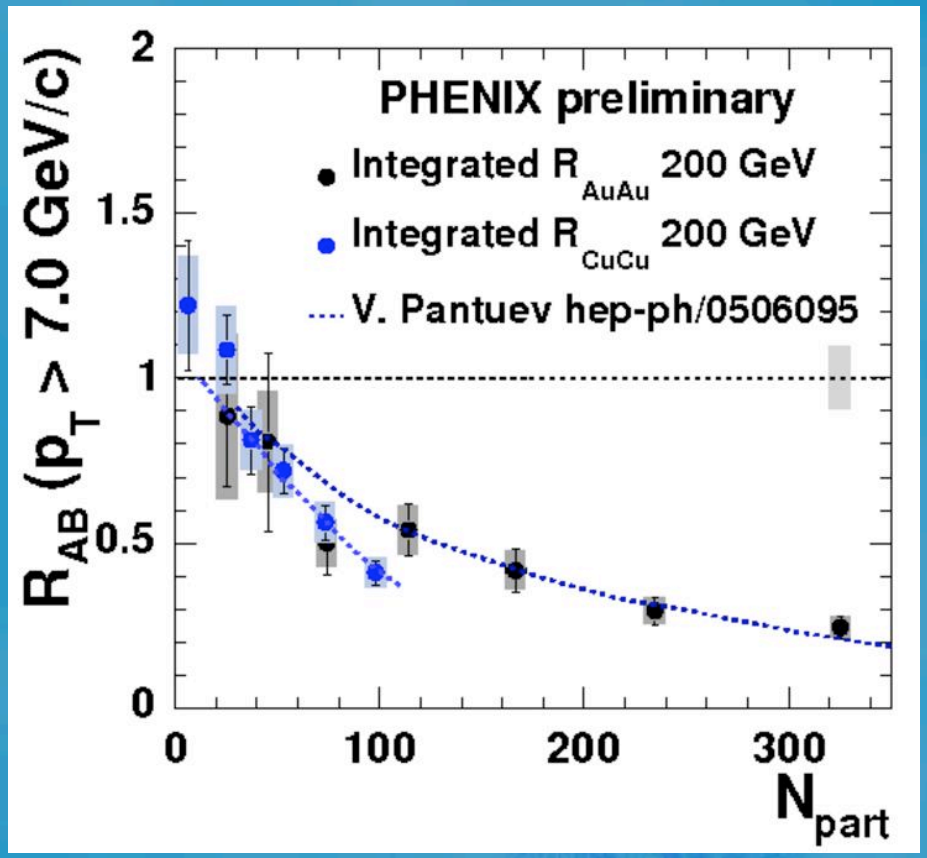
N_{part} Dependence



Cu+Cu results fit well within the N_{part} dependence of R_{AA} seen for Au+Au; Central collisions in Cu+Cu have N_{part}~100 ⇒ more precise measurement in that range

Model Comparisons





Left: N_{part} alone defines energy loss regardless of system

Right: Detailed geometry (i.e., surface vs volume differences) still important

Summary & Outlook

- High p_T suppression observed in Cu+Cu collisions for charged hadrons and π^0
- R_{AA} for Cu+Cu is equivalent to that of Au+Au for collisions with the same average number of participants
- Flat R_{AA} at high p_T up to 15 GeV (measured for π^0)
- The large available Cu+Cu data sample will soon provide many more results, which will contribute to the clarification of the jet quenching landscape.