Cold nuclear matter effects in d+Au with high-p_{T} reconstructed jets at PHENIX

Dennis V. Perepelitsa
Columbia University
for the PHENIX Collaboration

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PHENIX

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Cold nuclear matter effects

- p+A collisions are needed to establish a baseline for A+A:

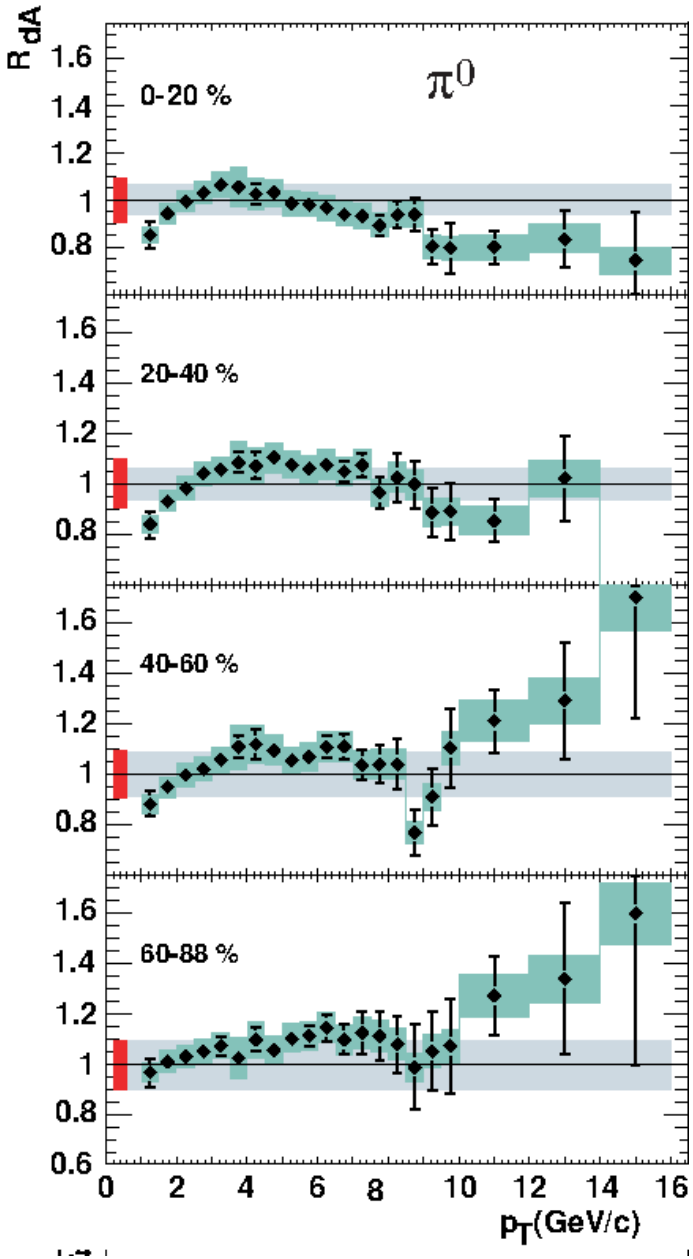
  $\Rightarrow$ confirm that suppression in A+A is a final state effect

  $\Rightarrow$ probes centrality dependence of nPDF's

  $\Rightarrow$ tests pQCD & factorization at high x

- At RHIC, we perform measurements in d+Au

CNM for pions in 2003



- π^0 measurement published by PHENIX:

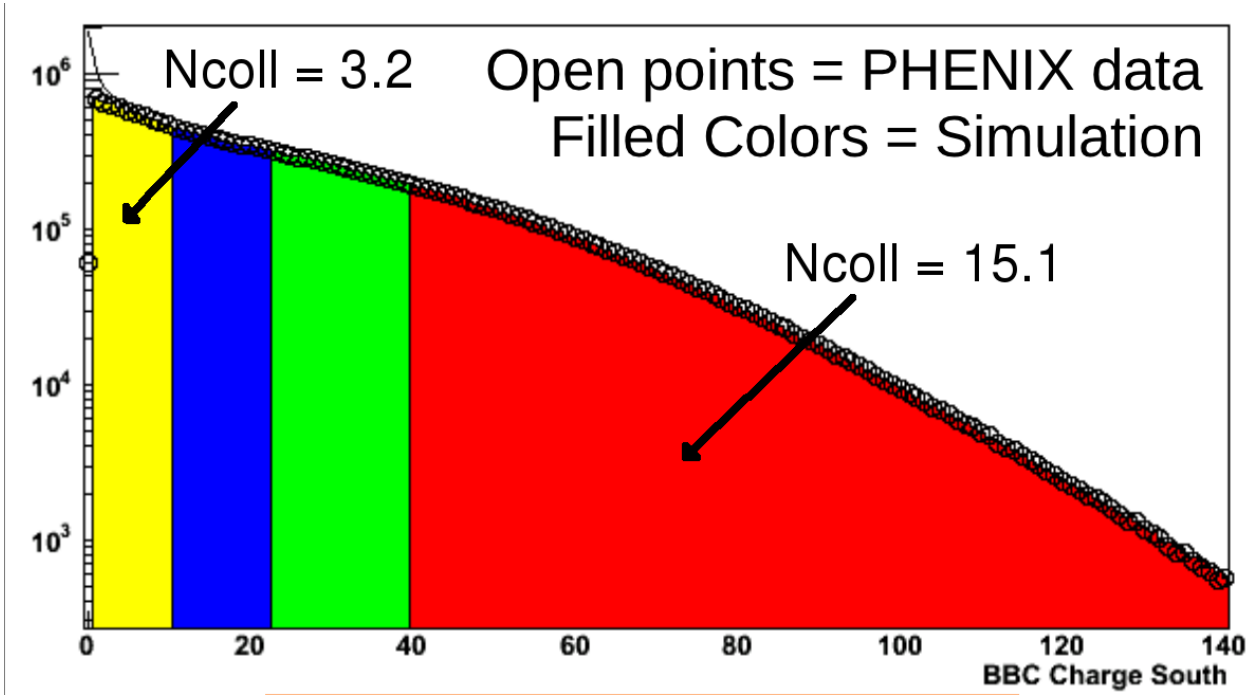
  $\Rightarrow$ Phys. Rev. Lett. **98**, 172302 (2007)

  $\Rightarrow$ data from RHIC 2003 run

  $\Rightarrow$ weak centrality dependence in R_{dA}

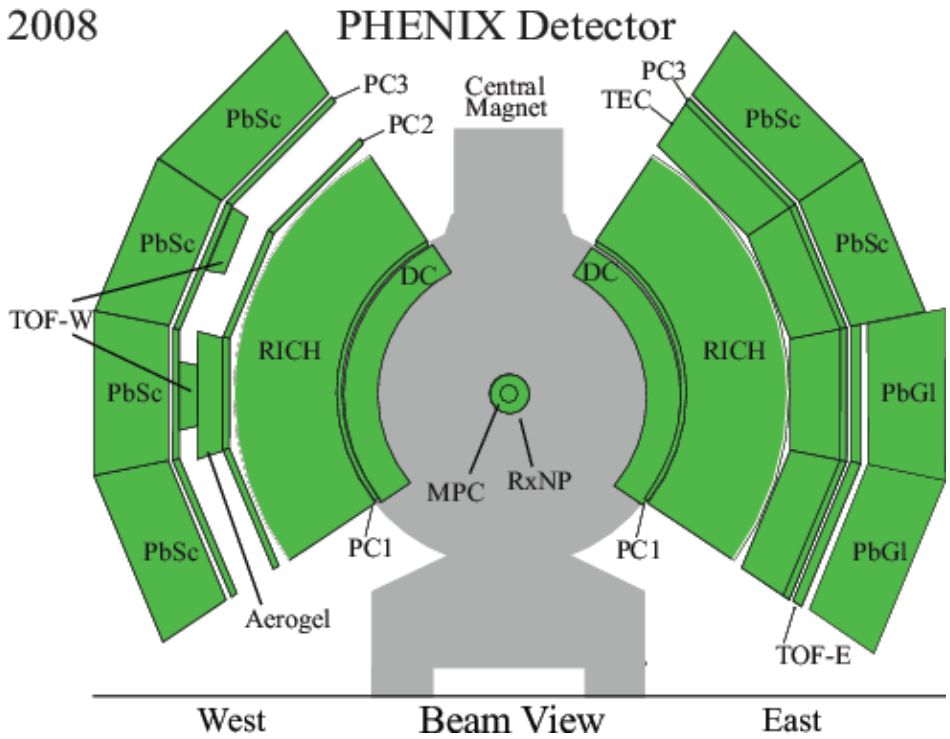
  $\Rightarrow$ low statistics at high-p_{T}

Data selection



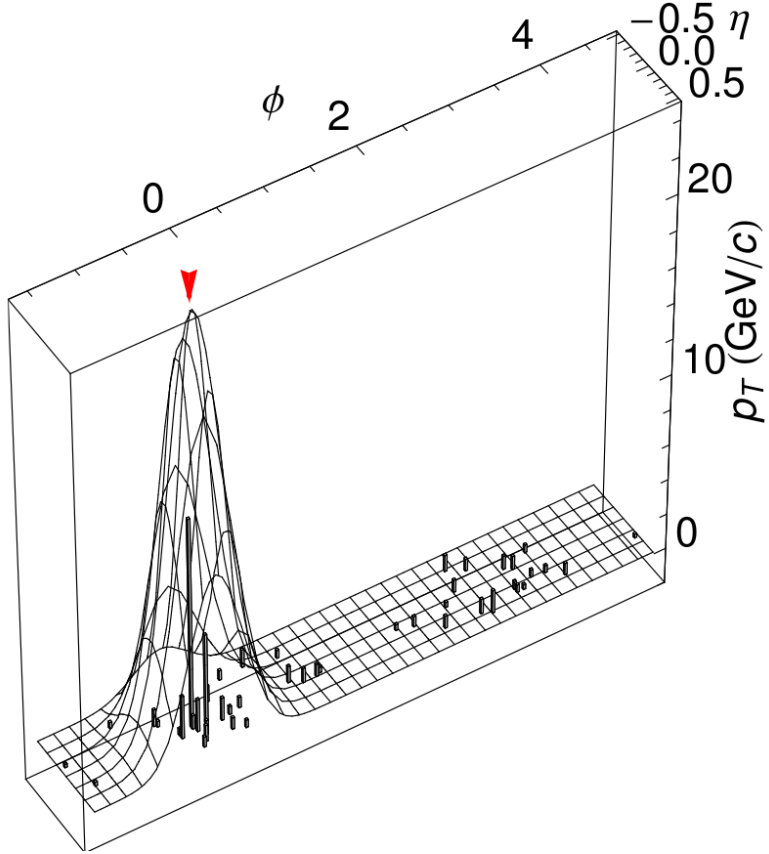
- RHIC 2008 run, d+Au and p+p at $\sqrt{s_{NN}} = 200$ GeV:
  - $\Rightarrow$ 30x increase in statistics!
  - $\Rightarrow$ Au-going beam-beam counter (BBC) used for centrality determination
  - $\Rightarrow$ Glauber simulation used to calculate $\langle N_{\rm coll} \rangle$

Jets in PHENIX detector



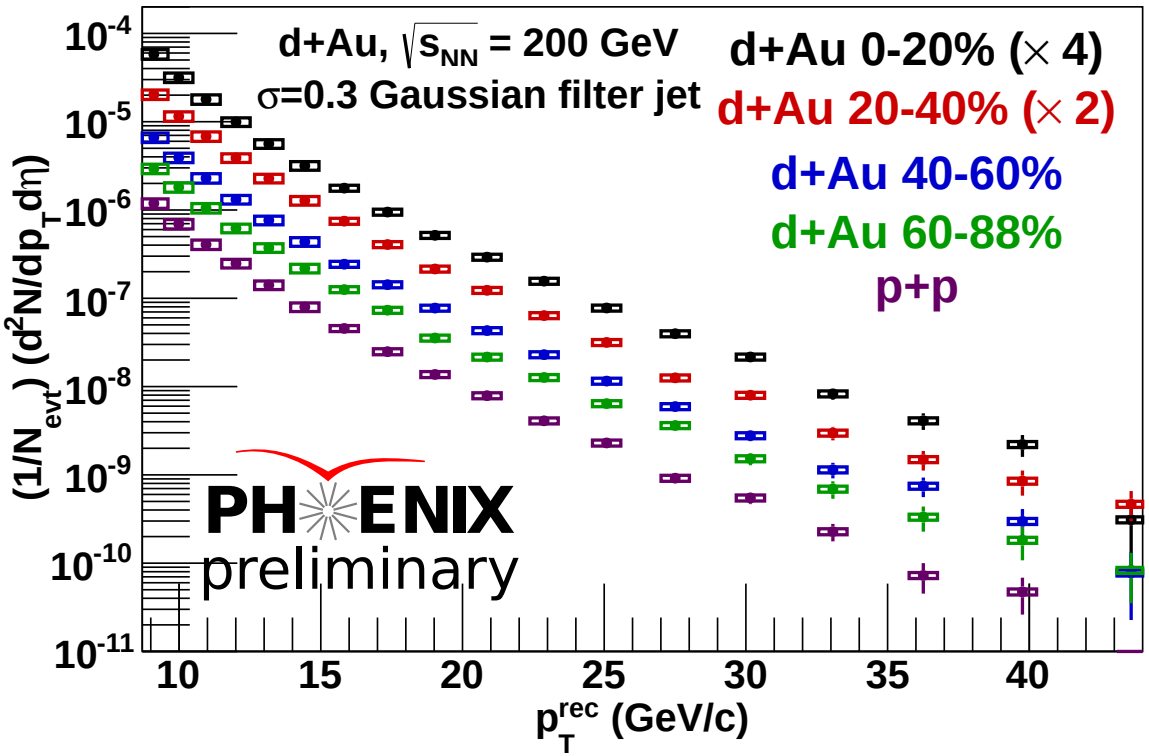
- Central arms, $|\eta| < 0.35$, $\Delta\phi = \pi$:
  - $\Rightarrow$ charged tracks $p_{\mathrm{T}}^{rec} > 400$ MeV/c in the Drift Chamber (DC), Pad Chambers (PC)
  - $\Rightarrow$ neutral clusters $p_{\mathrm{T}}^{rec} > 400$ MeV/c in the EMCal (EMC)

Jet Reconstruction: I



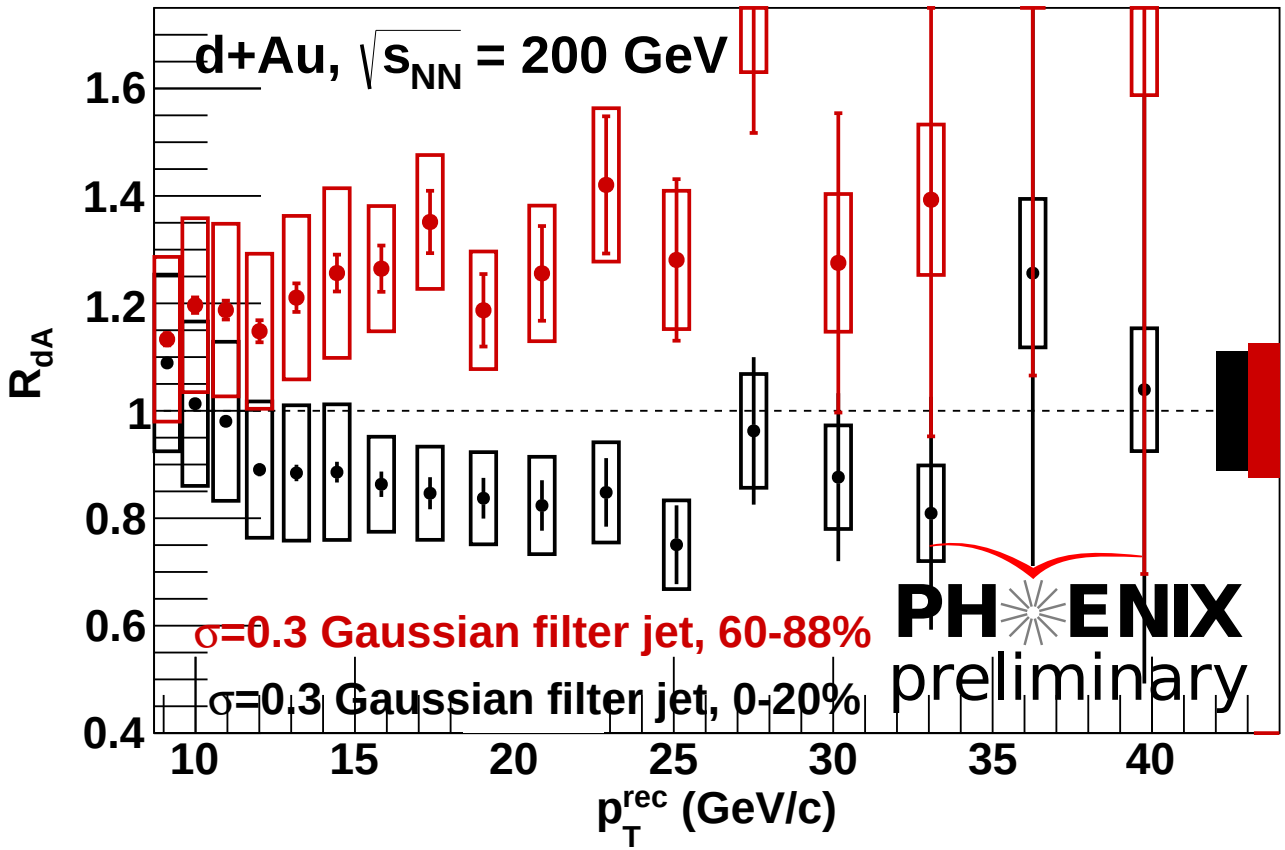
- Gaussian filter algorithm ($\sigma = 0.3$):
  - $\Rightarrow$ continuous angular weighting, stable in HI background
  - $\Rightarrow$ used successfully in p+p and Cu+Cu at PHENIX
  - $\Rightarrow$ cross-checked with anti-k_{T} algorithm

Jet Reconstruction: II



- Jets out to 40 GeV/c are reconstructed at the detector energy scale:
  - $\Rightarrow$ bin-by-bin unfolding to correct for p_{T} increase from mild d+Au UE
  - $\Rightarrow$ small residual fake rate ($< 5\%$) above > 9 GeV/c

Jet R_{dA}

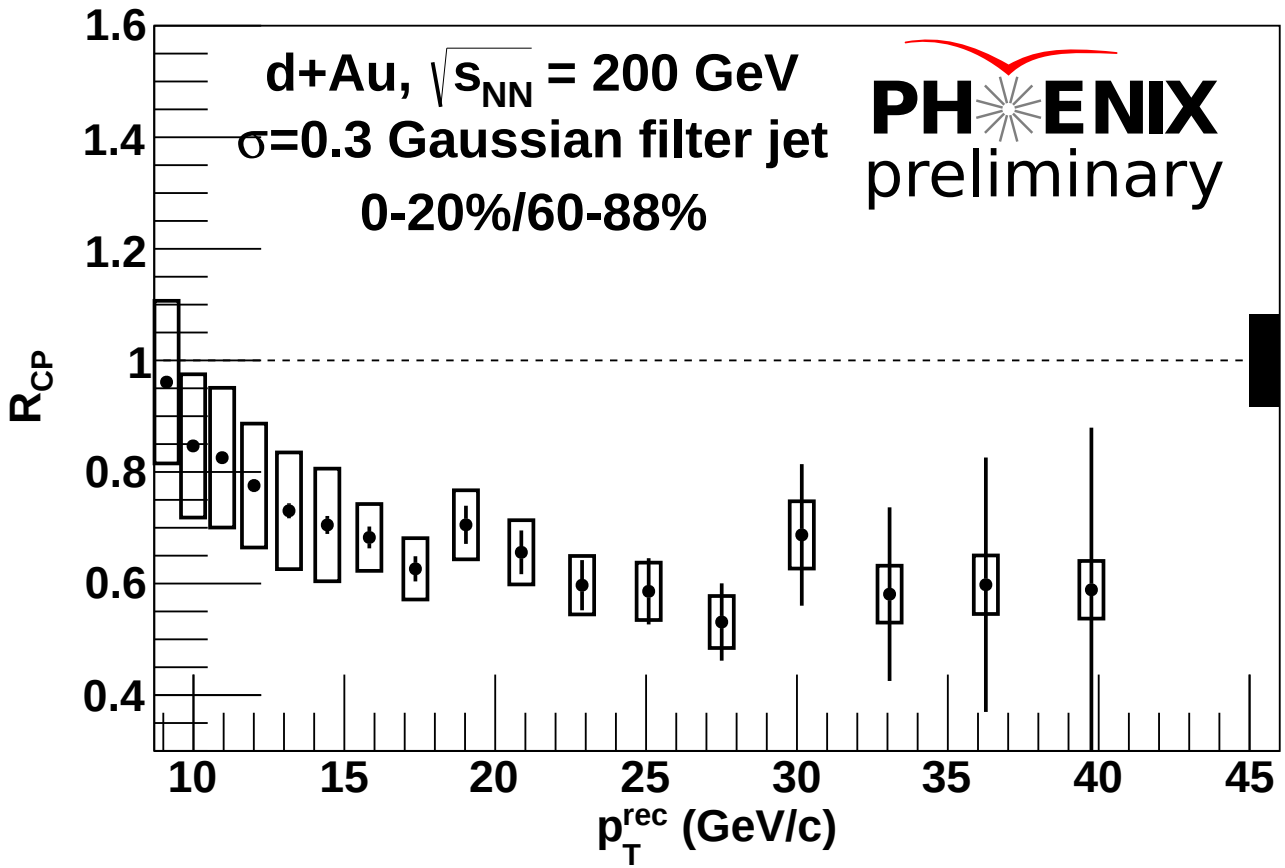


- Mild suppression in **central events** at high-p_{T}
- Moderate enhancement in **peripheral events** at high-p_{T}

  $\Rightarrow$ unexpected result!

Jet R_{CP}

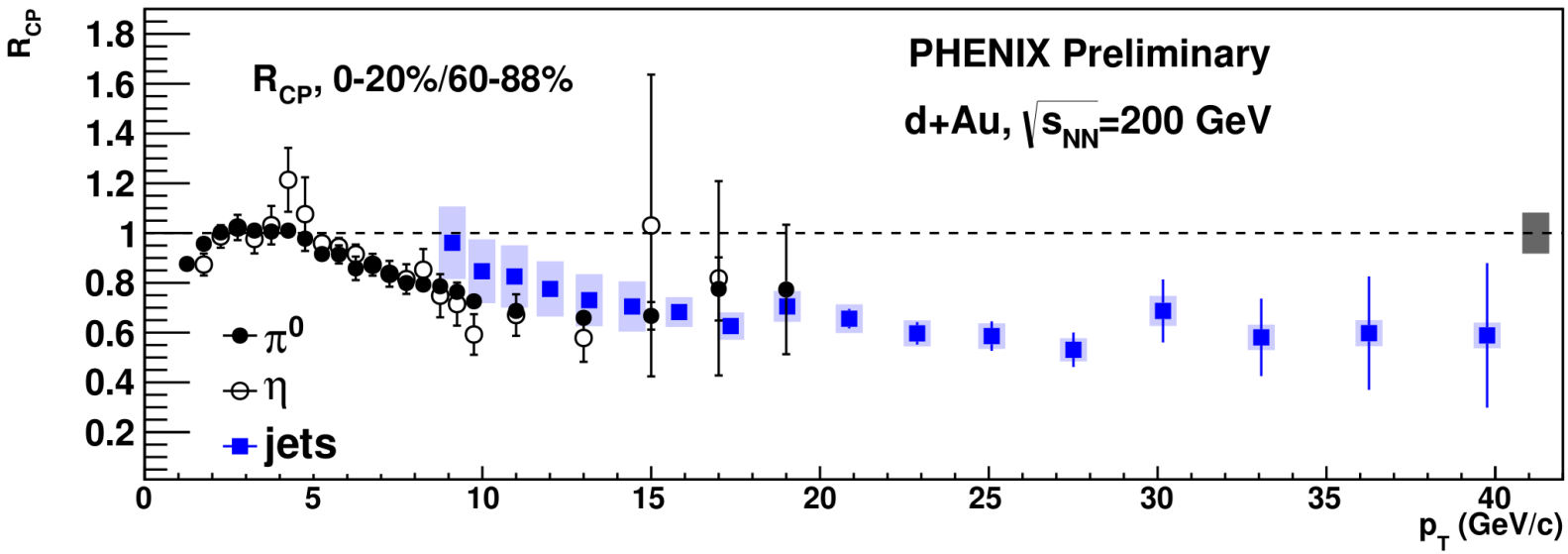
- Another way to look at the central/peripheral difference!



- significantly reduced systematics
- cleaner measurement of relative centrality dependence

Jet and new π^0 $R_{\rm CP}$

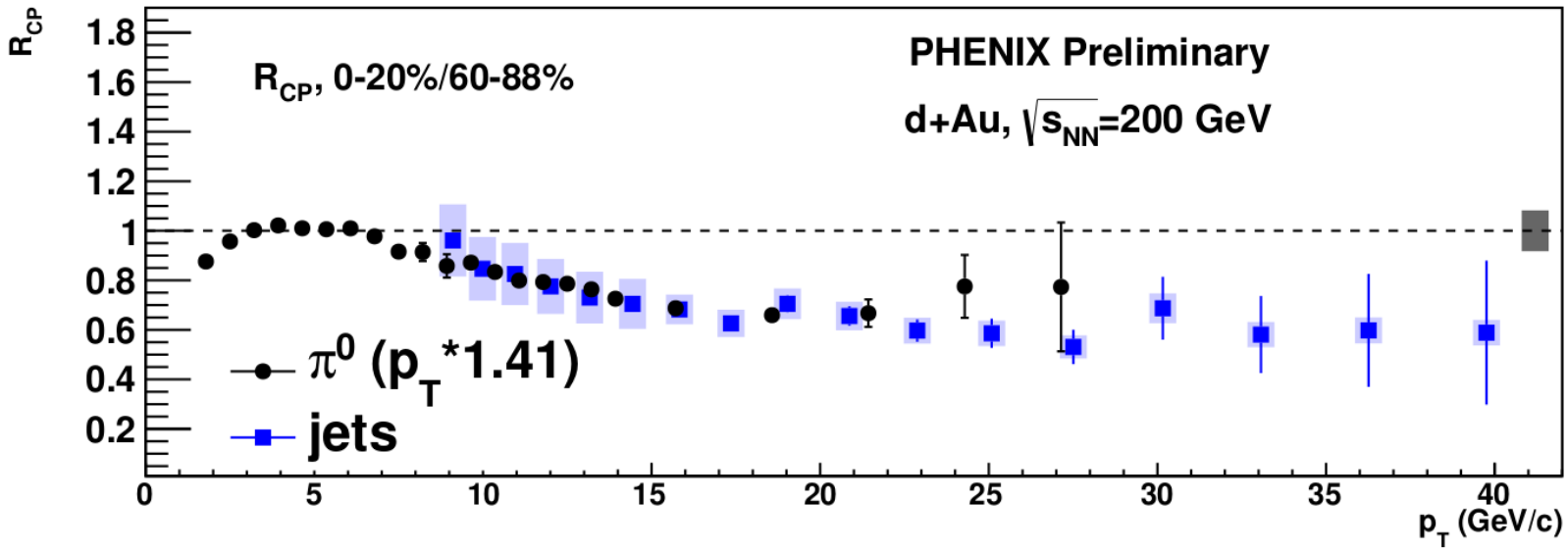
- Preliminary π^0/η measurement with 2008 data



- . . . but **hadrons** & **reconstructed jets** have different $p_{\rm T}$-scale. . .

Jet and new π^0 $R_{\rm CP}$: Rescaled

- Scale single hadron $p_{\rm T}$ by $1/\langle z \rangle$ using empirical $\langle z \rangle = 0.7$:



- Excellent agreement in shape between **jets** and **hadrons**
  - $\Rightarrow$ very different systematics
  - $\Rightarrow$ large difference in behavior between central vs. peripheral collisions **not** an artifact of jet reconstruction

Conclusion

- Gaussian filter reco jets in RHIC 2008 d+Au and p+p
- We observe a large centrality dependence in R_{dA} at high-p_{T}
  - $\Rightarrow$ small suppression in **central**
  - $\Rightarrow$ moderate enhancement in **peripheral**
- Challenging to simultaneously explain both!