High p_T Spectra of Protons and Charged Pions in Au+Au and d+Au Collisions at $\sqrt{s_{NN}}$=200 GeV

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for the BRAHMS Collaboration

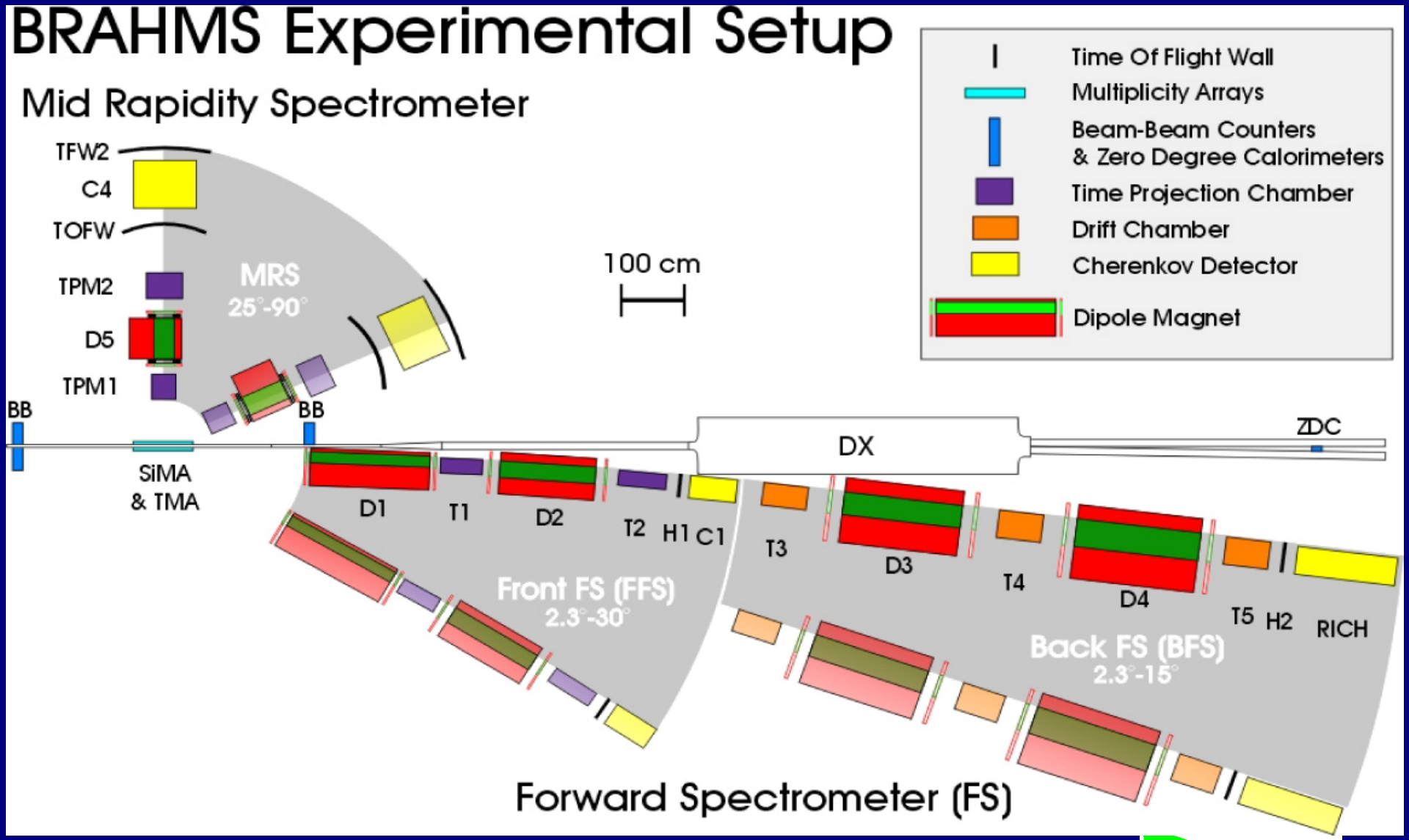
Outline

- High p_T spectra
- High p_T particle composition in Au+Au and d+Au collisions at both mid- and forward rapidity
- Nuclear medium effects:
  - High p_T suppression in Au+Au collisions
  - Cronin effects at mid-rapidity in d+Au collisions
  - Color Glass Condensate (CGC) effects at forward rapidity in d+Au collisions?

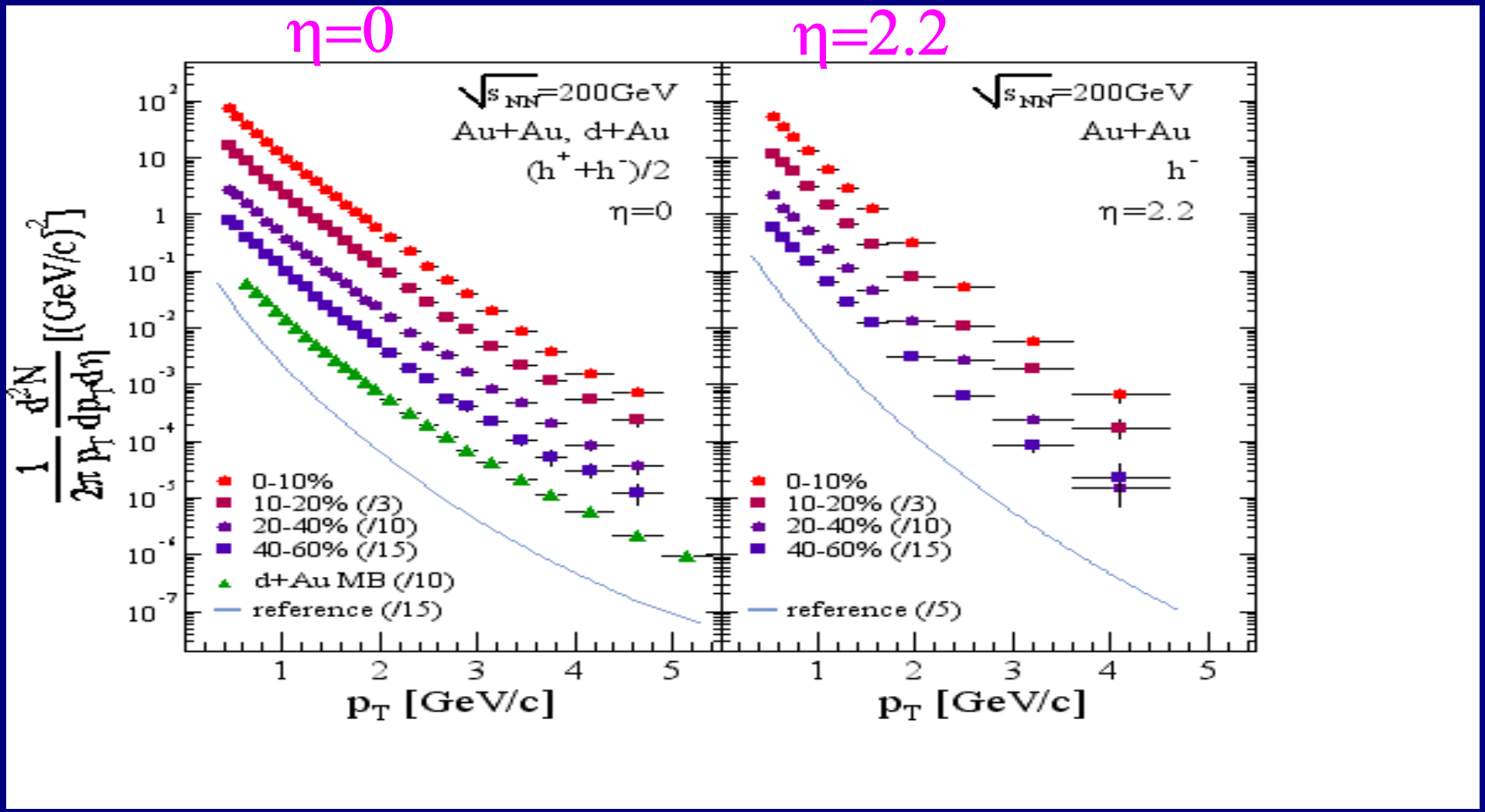
Nuclear Modification Factor:

$$R_{Au} = \frac{d^2N/dp_T d\eta\ (Au+Au)}{N_{Coll} d^2N/dp_T d\eta\ (p+p)}$$

The BRAHMS Experiment



Invariant Spectra of Charged Hadrons



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Reference spectrum : UA1 scaled to our acceptance

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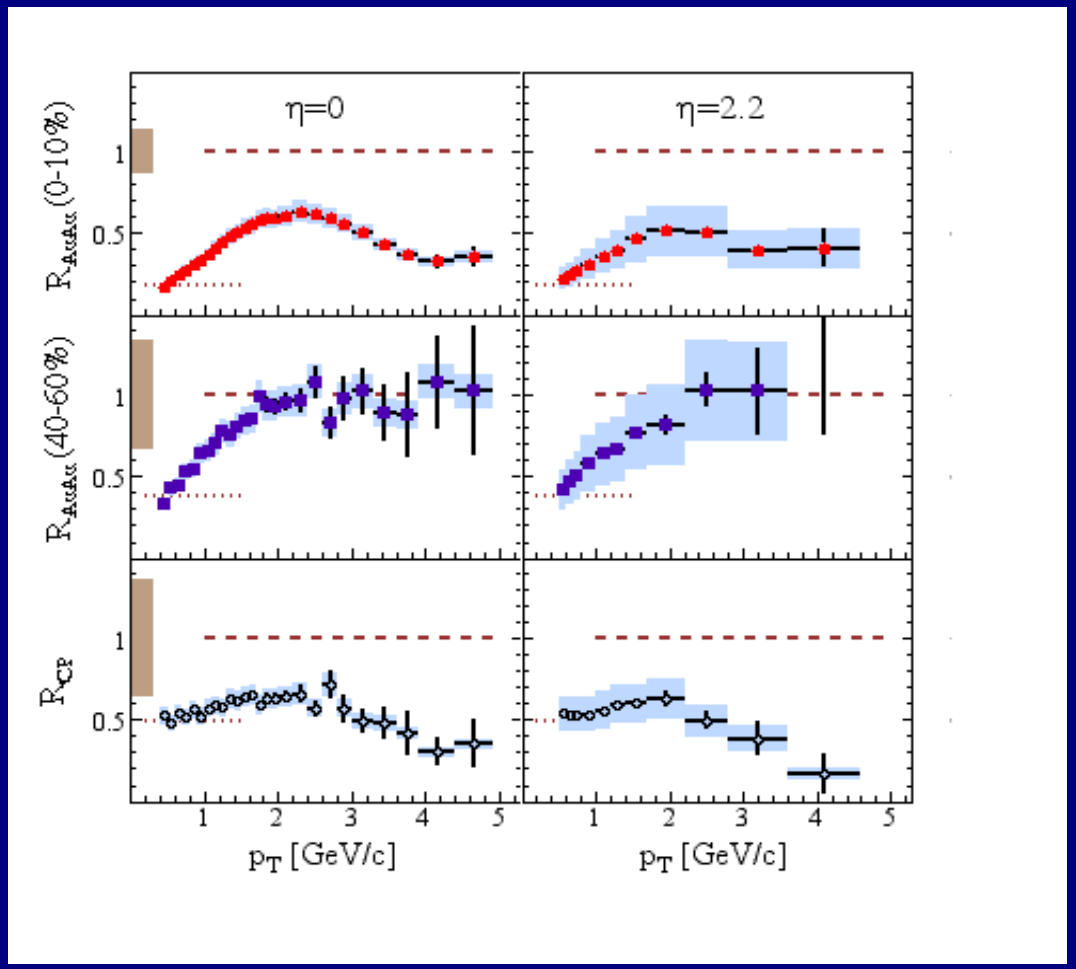
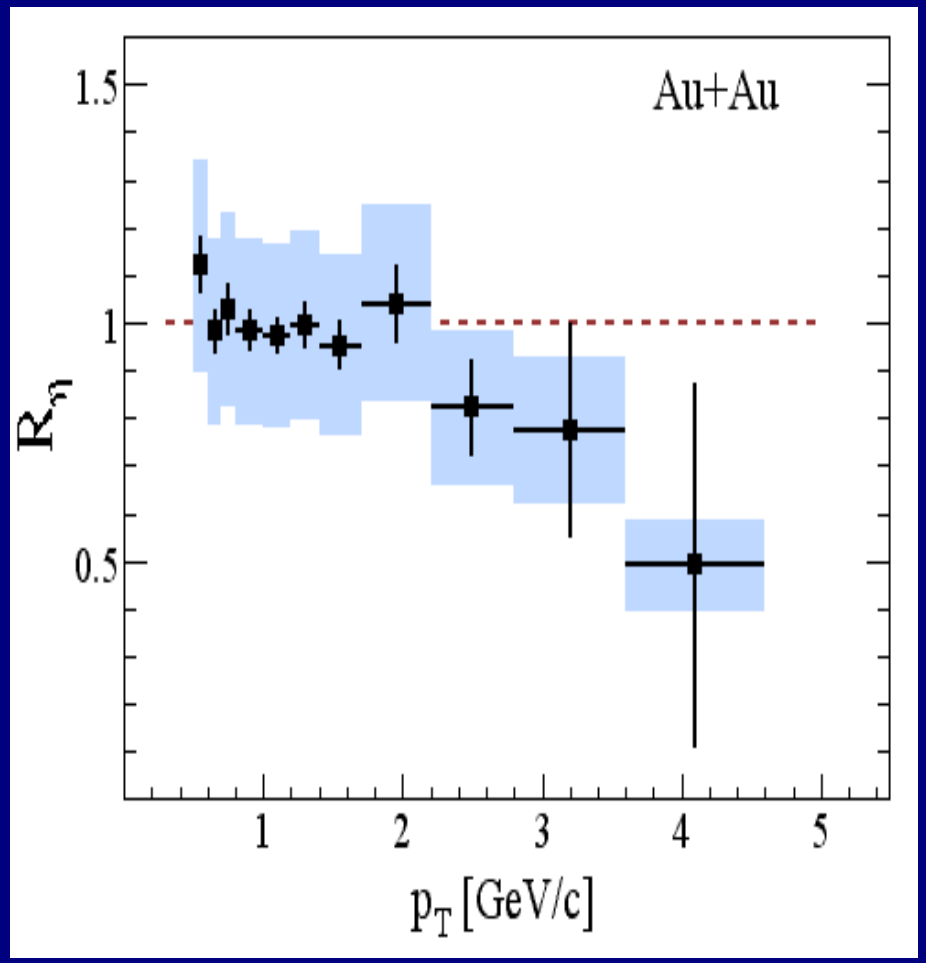
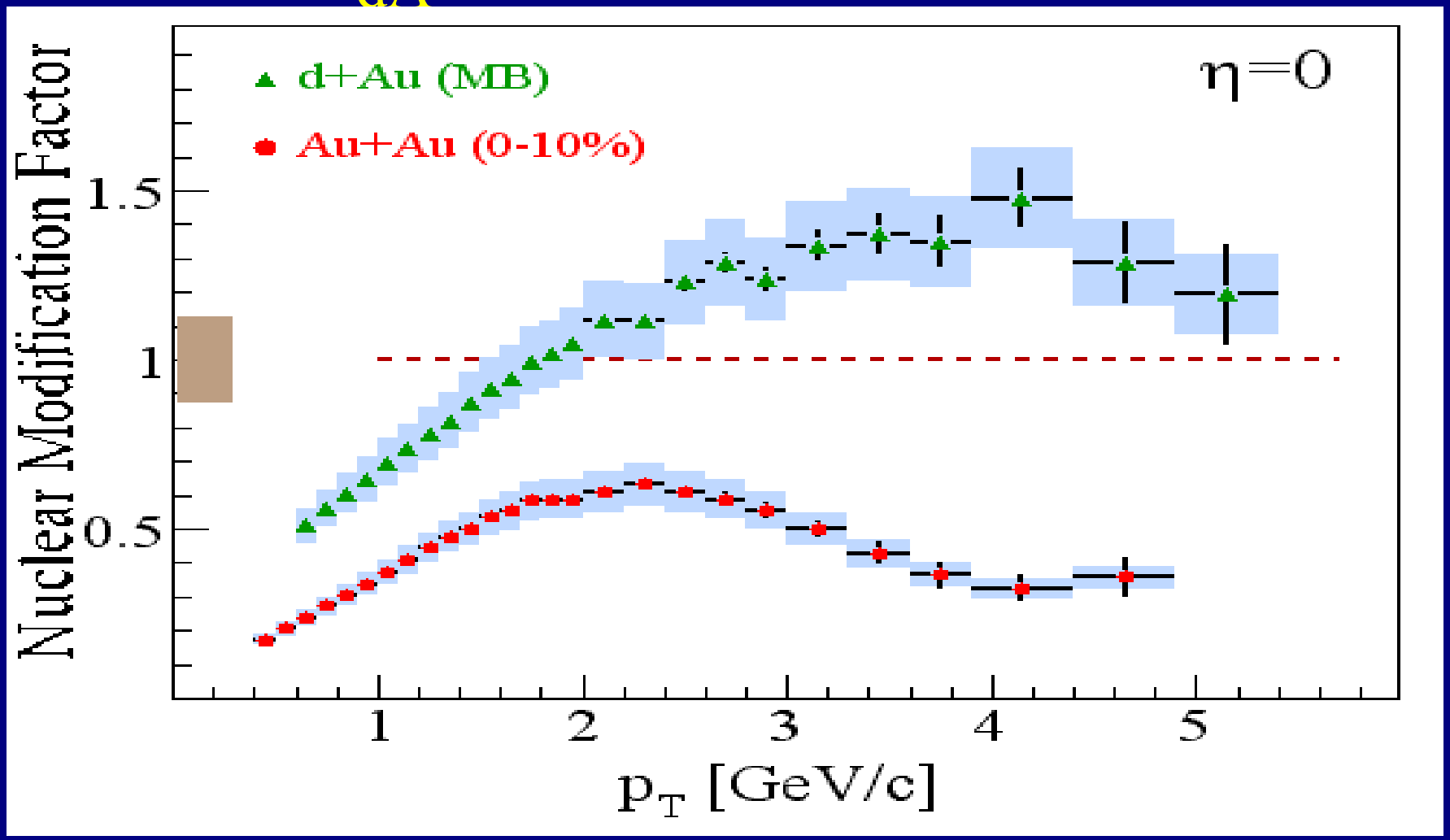
Nuclear Modification Factors





Suppression at η = 2.2 is similar to or stronger than that at η = 0.

R_{dA} in d+Au Collisions



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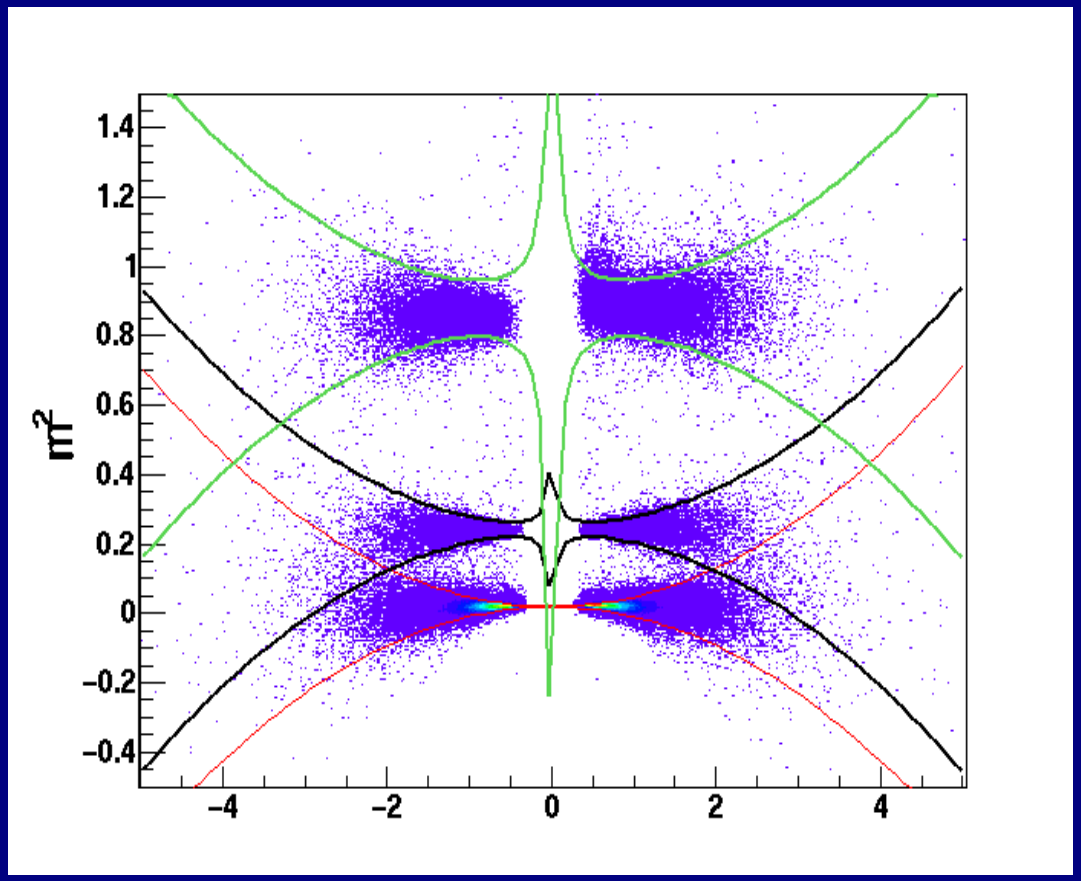
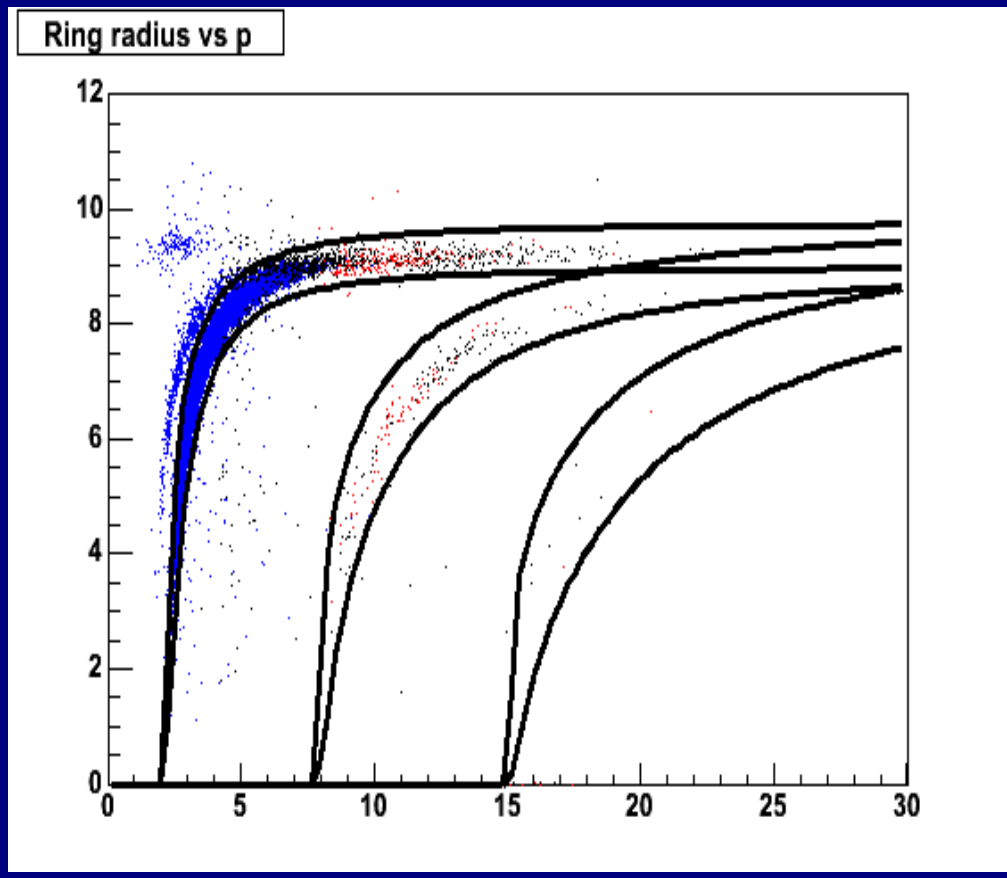
High p_T yield of charged hadrons is enhanced in d+Au collisions

Particle Identification

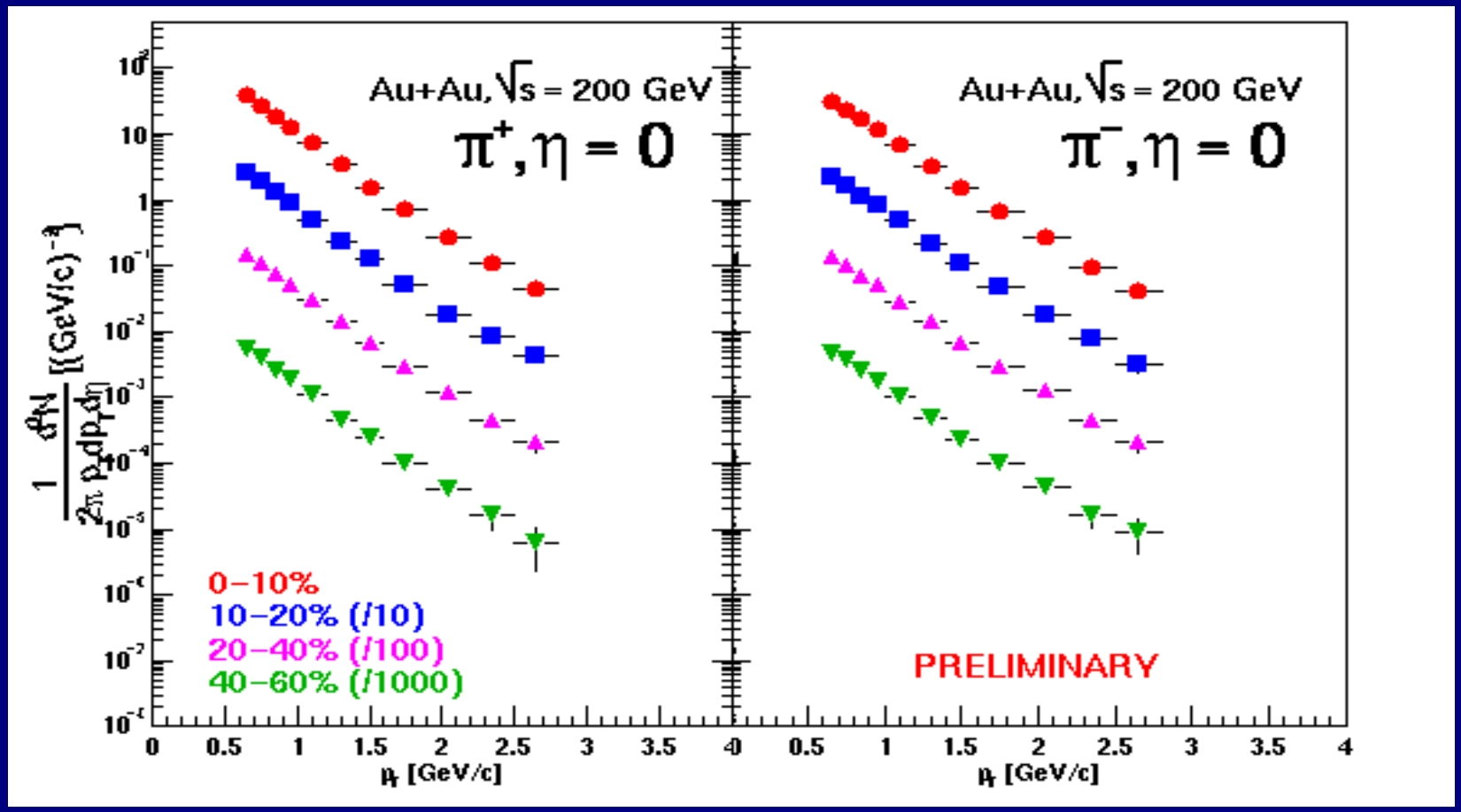




- TOFW at mid-rapidity
- 2 sigma cuts
- K/π separation up to 2 GeV/c
- p/K separation up to 3.3 GeV/c

- RICH, H1 and H2 at forward rapidity
- RICH: 3 sigma cuts
  K/π separation up to 18 GeV/c

Spectra for Charged Pions in Au+Au



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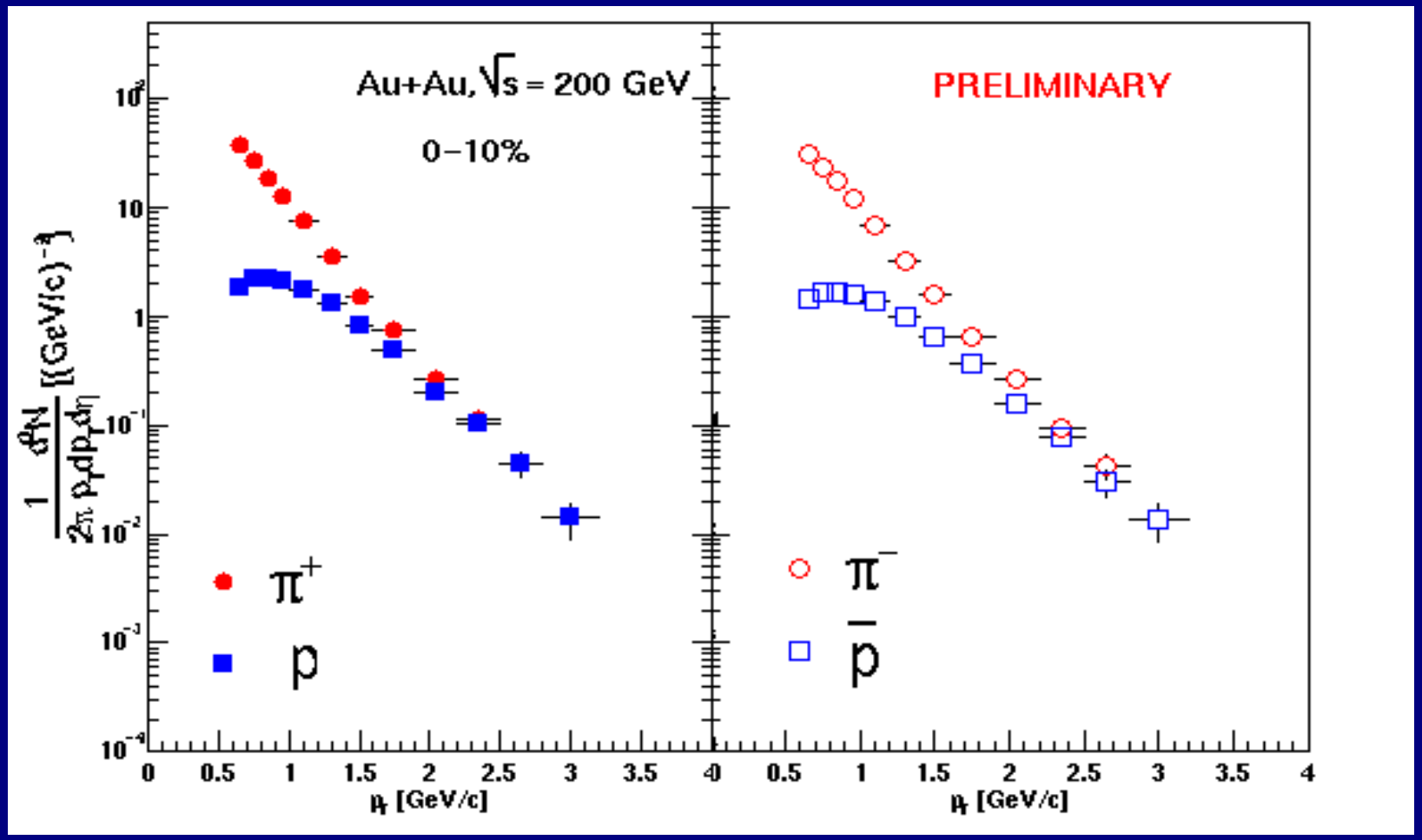
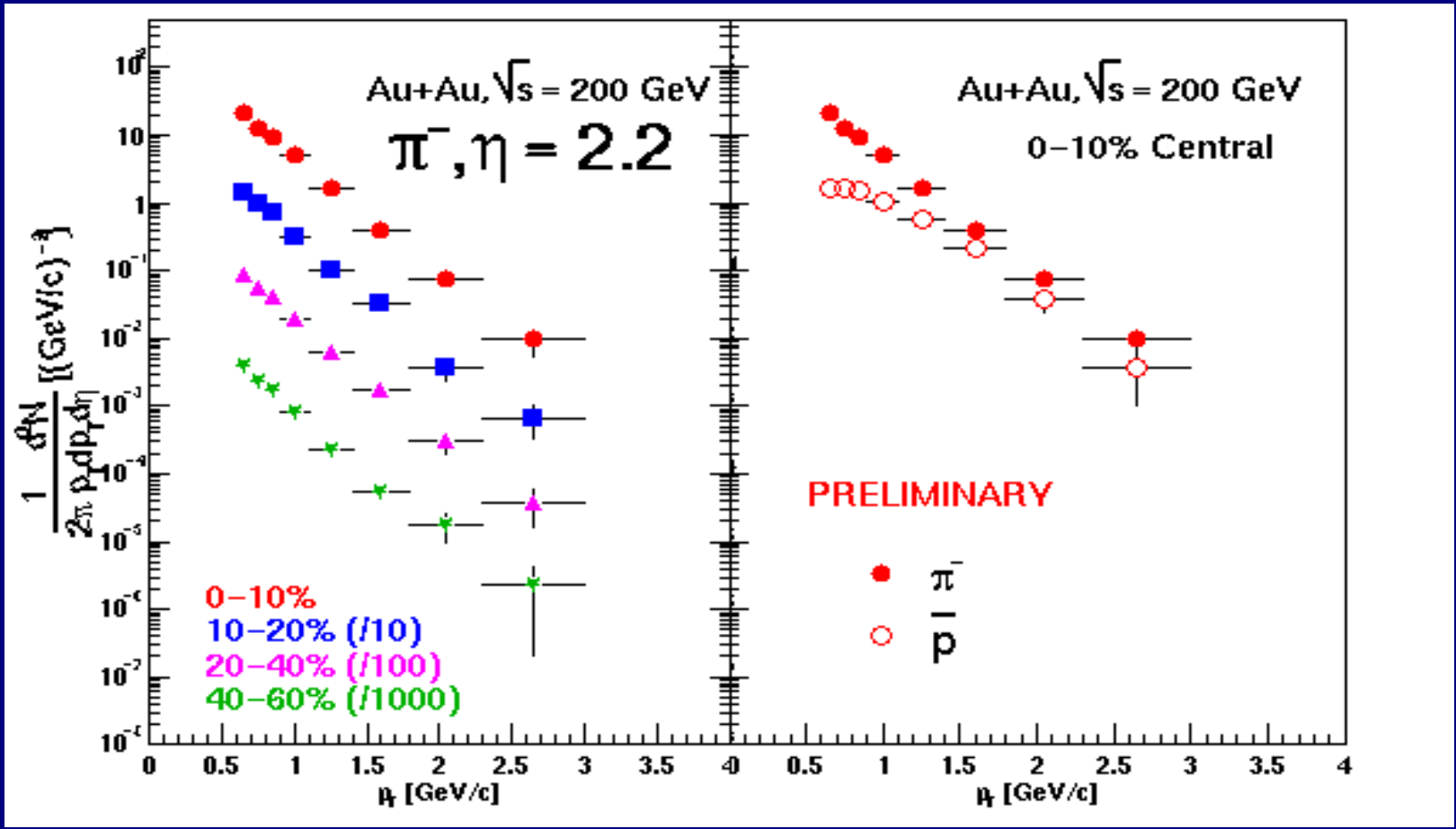
Pions and Protons at Mid-Rapidity in Au+Au Collisions



Pions and Protons at η = 2.2 in Au+Au Collisions



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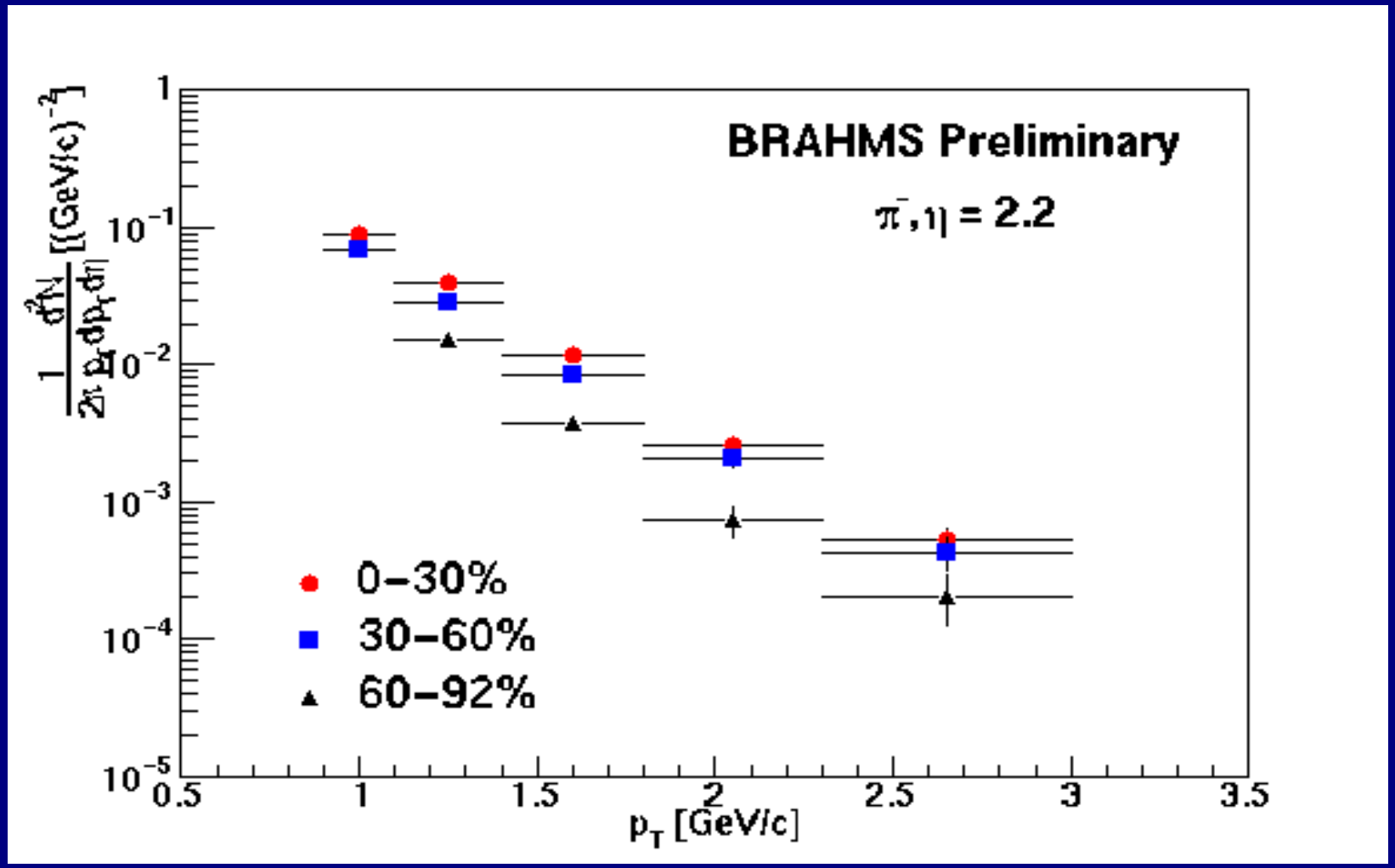
Pion Spectra at η = 2.2 from d+Au



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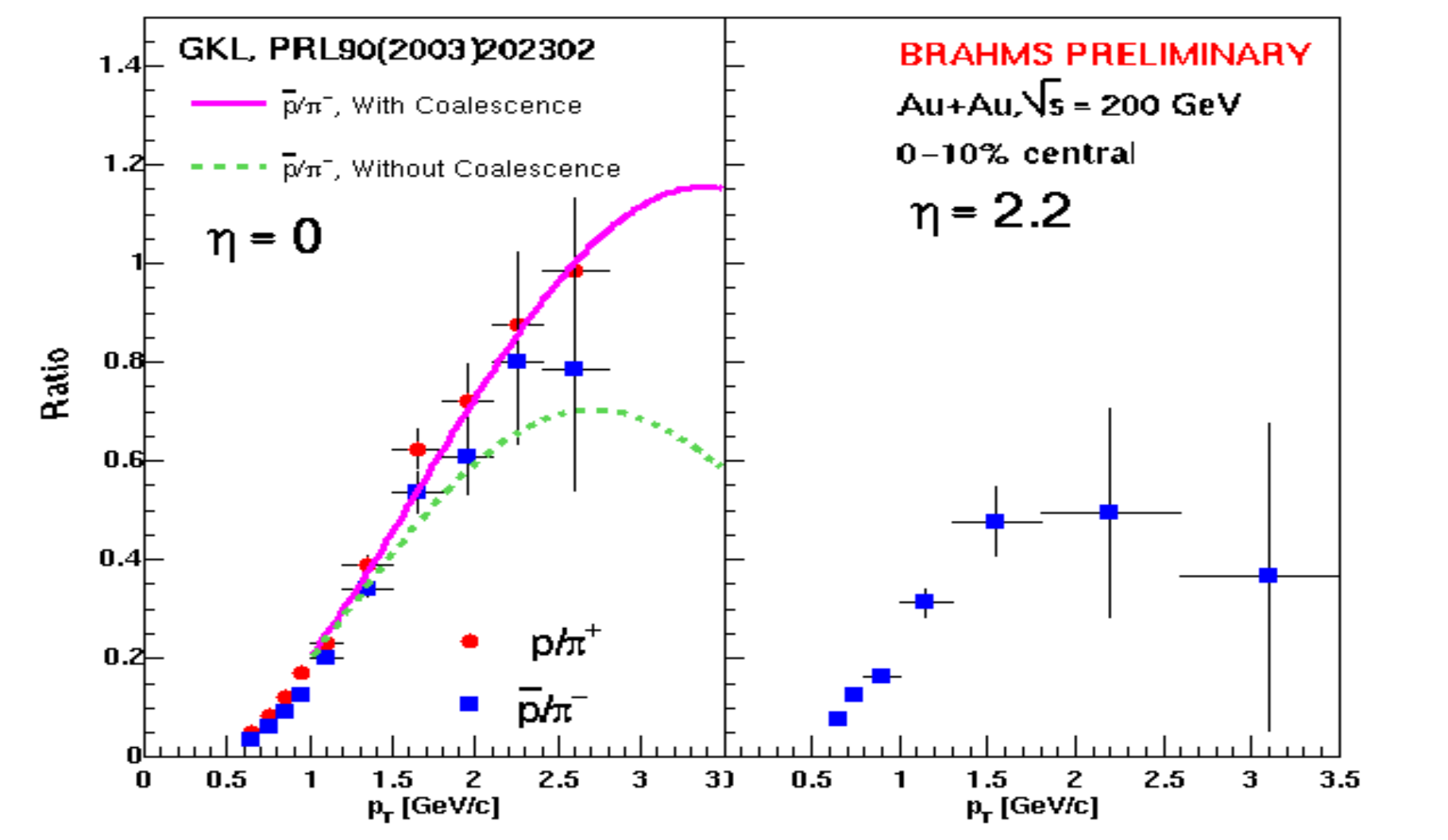
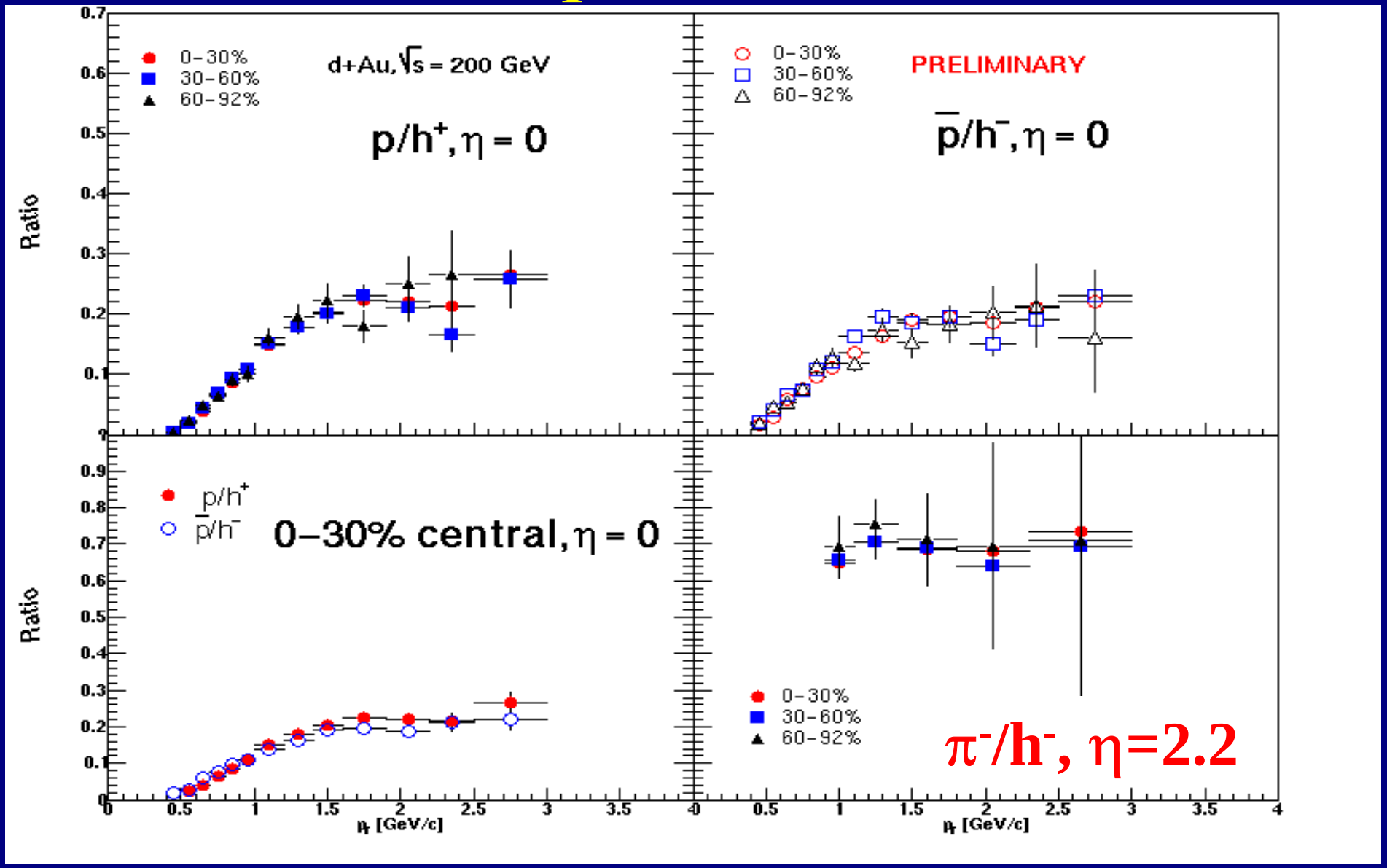
Ratios: (Anti-) Protons to Pions



Particle Composition from d+Au



There is no centrality dependence.

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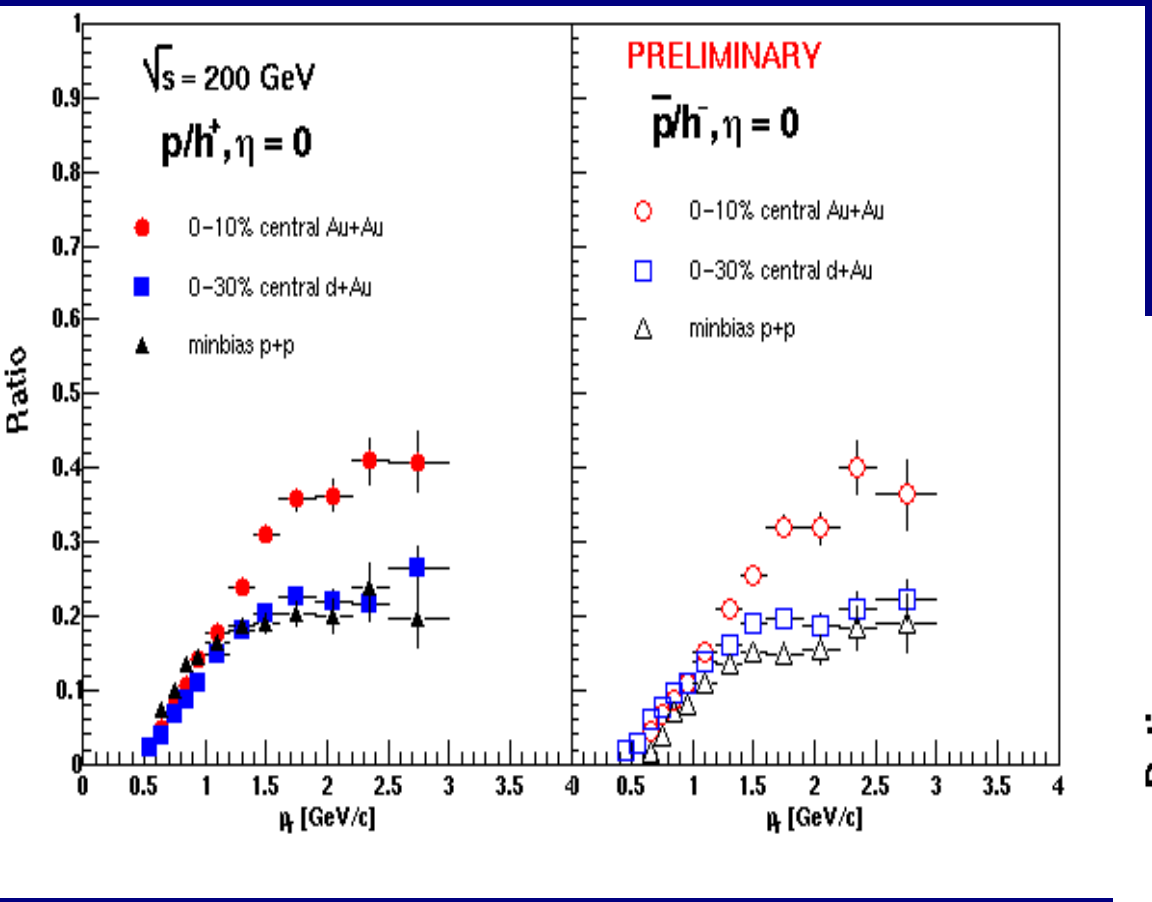
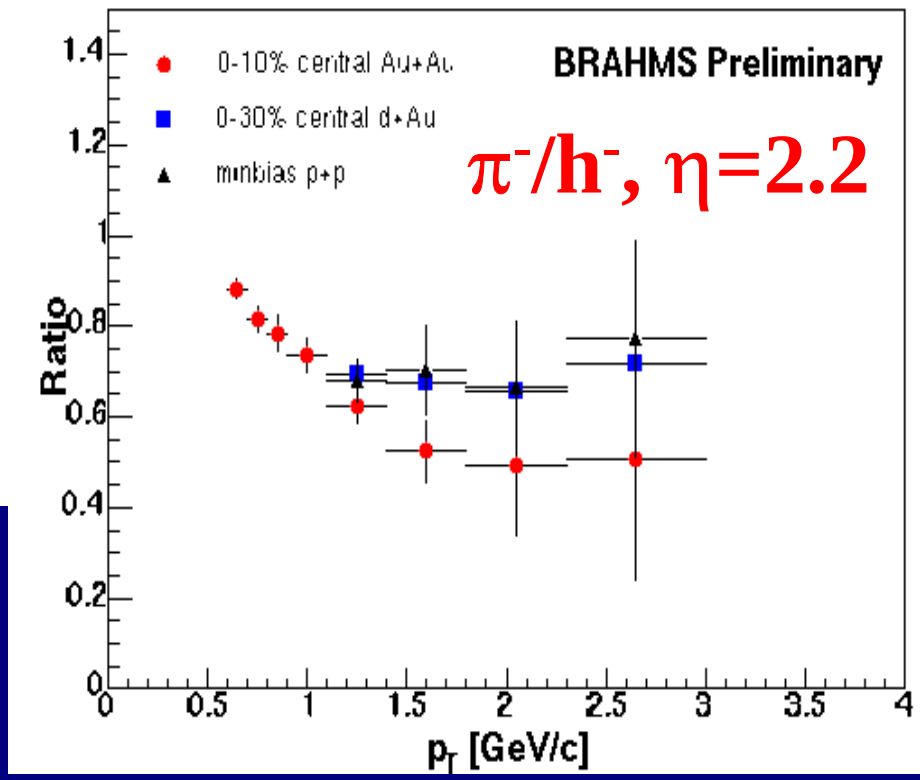
Systematics

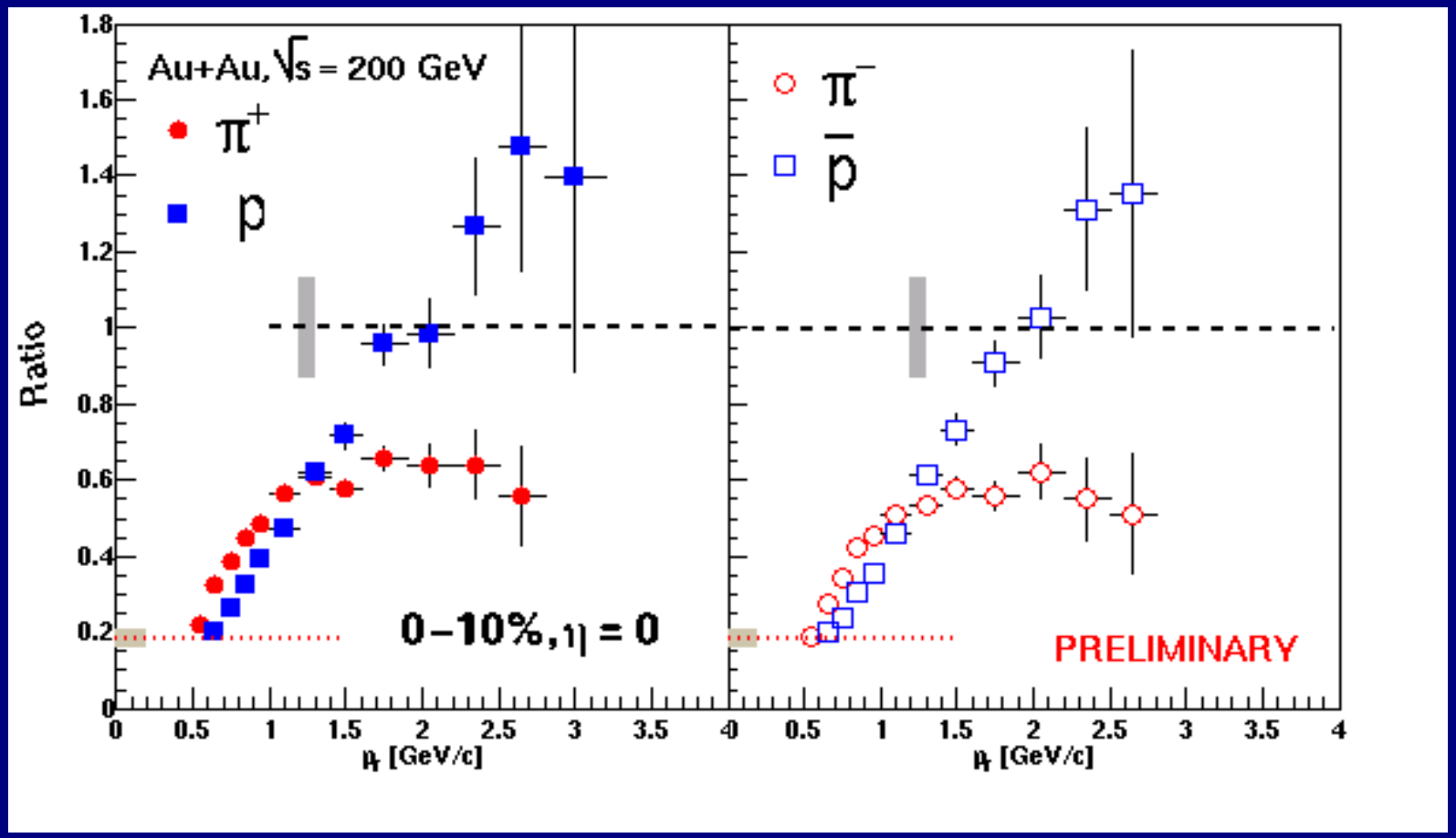


p/h$^+$ and pbar/h$^-$ at mid-rapidity



Ratios of negatively charged pions and hadrons at forward rapidity

Nuclear Modification Factor for Pions and Protons



Neutral pion spectrum for p+p collisions measured by PHENIX is scaled to our rapidity range (-0.05 – 0.05) as reference spectrum for pions. Preliminary (anti-) proton spectrum for p+p collisions measured by STAR is used as reference spectrum for (anti-) protons.

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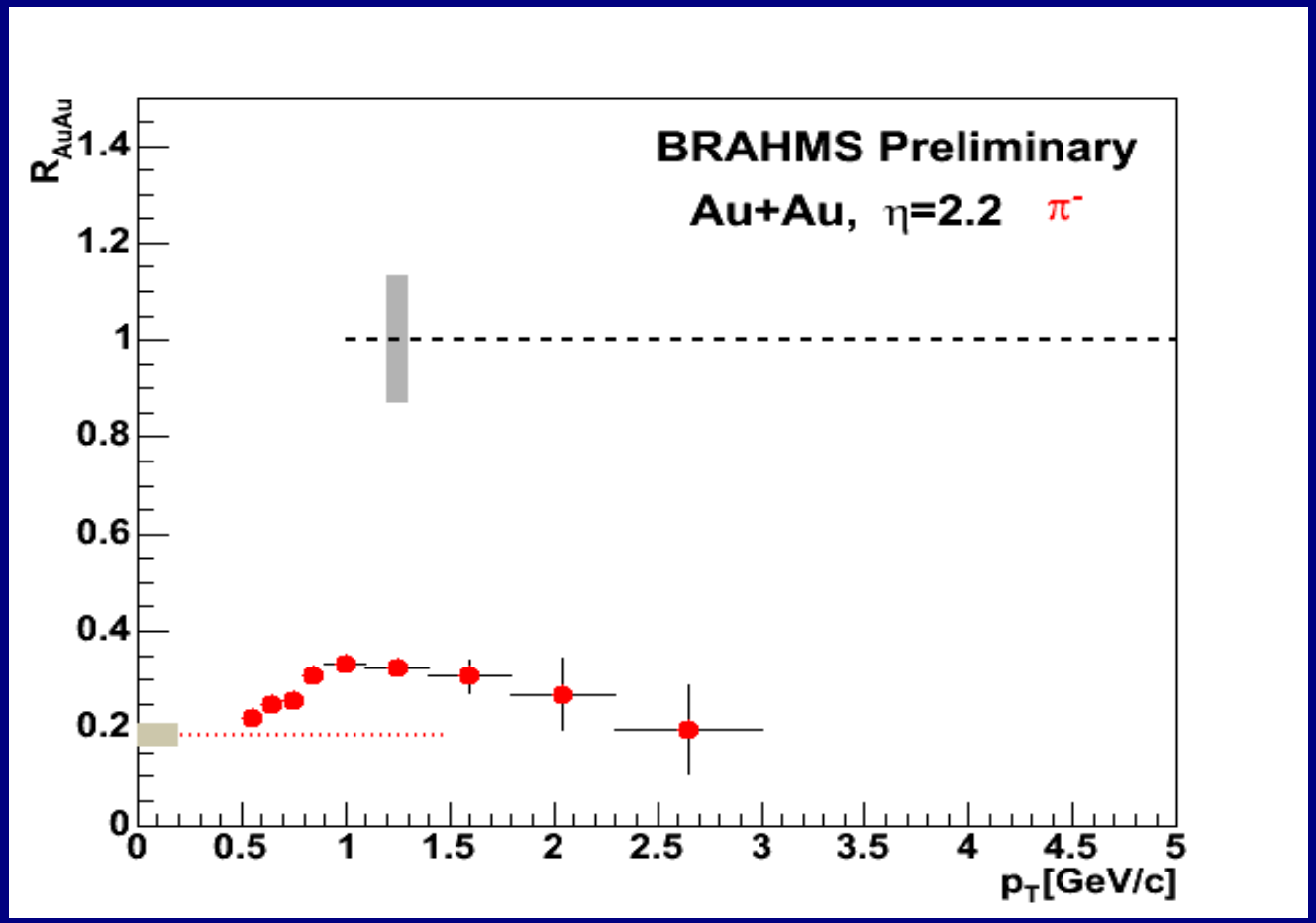
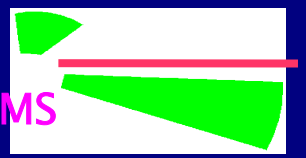
Nuclear Modification Factor at Forward Rapidity

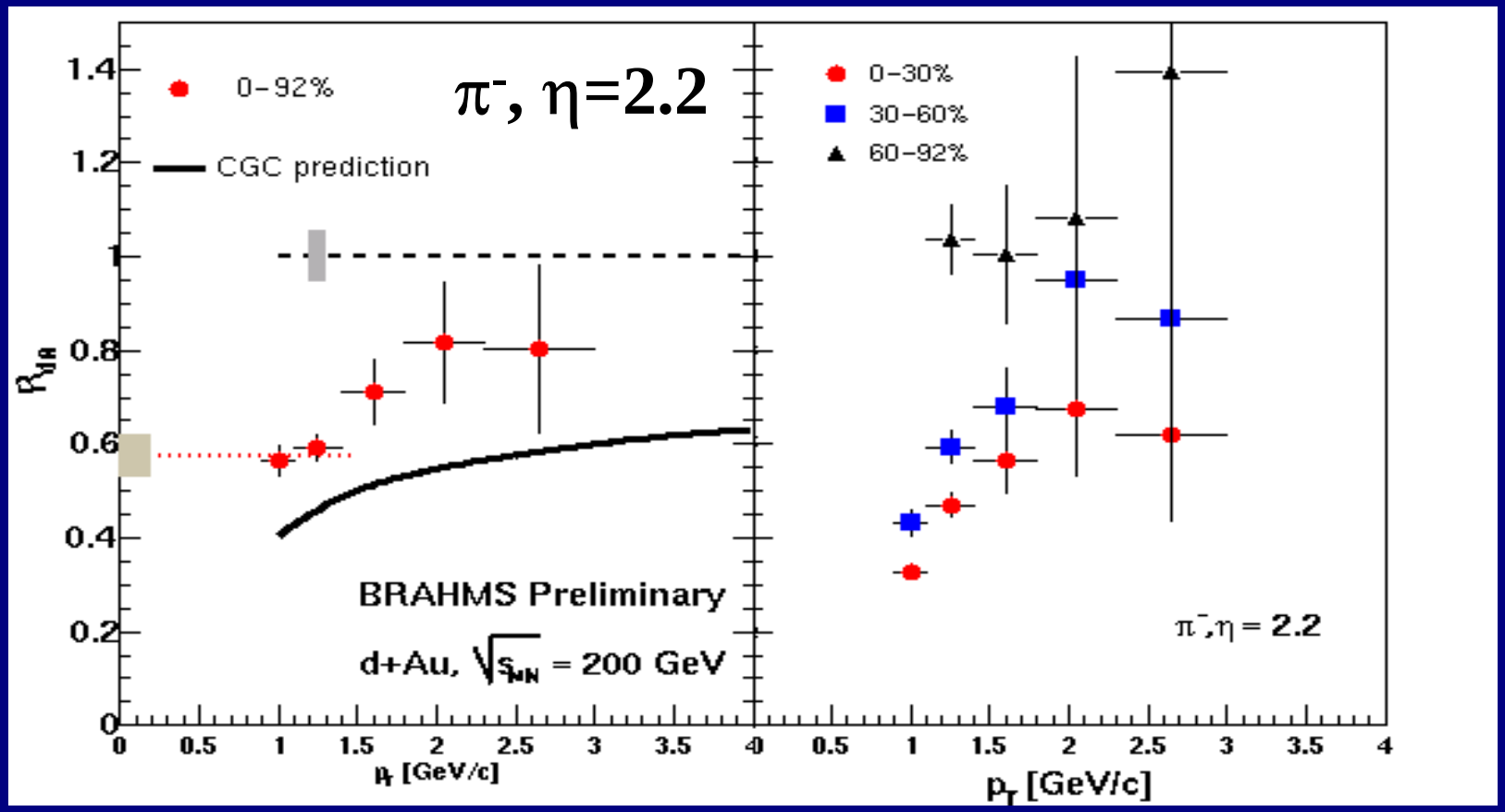


- Pythia + PHENIX neutral pion measurement for pp collisions at midrapidity
- Strong suppression at forward rapidity



Nuclear Modification Factor in d+Au Collisions

Prediction from the talk by D. Kharzeev at the RIKEN-BNL Workshop on high p_T physics at RHIC, 12/2-6/2003.



High p_T yields of pions are suppressed at forward rapidity in central d+Au collisions.

Summary

- Suppression of high p_T yields of charged hadrons and identified pions has been observed in Au+Au collisions at both mid-rapidity and forward rapidity. The suppression appears stronger at forward rapidity.
- Ratios of (anti-) proton to pion show an enhancement of (anti-) proton production in Au+Au collisions compared to p+p and d+Au collisions.
- High p_T yields of pions are also suppressed in central d+Au collisions at forward rapidity. The more central the collisions, the stronger the suppression.

The BRAHMS Collaboration

I. Arsene[10], I. G. Bearden[7], D. Beavis[1], C. Besliu[10], B. Budick[6], H. Bøggild[7], C. Chasman[1], C. H. Christensen[7], P. Christiansen[7], J. Cibor[4], R. Debbe[1], E. Enger[12], J. J. Gaardhøje[7], M. Germinario[7], K. Hagel[8], O. Hansen[7], H. Ito[1, 11], A. Jipa[10], F. Jundt[2], J. I. Jørdre[9], C. E. Jørgensen[7], R. Karabowicz[3], E. J. Kim[5], T. Kozik[3], T. M. Larsen[12], J. H. Lee[1], Y. K. Lee[5], S. Lindal[12], R. Lystad[9], G. Løvhøiden[2], Z. Majka[3], A. Makeev[8], B. McBreen[1], M. Mikelsen[12], M. Murray[8, 11], J. Natowitz[8], B. Neumann[11], B. S. Nielsen[7], J. S. Norris[11], D. Ouerdane[7], R. Planeta[4], F. Rami[2], C. Ristea[10], O. Ristea[10], D. Röhrich[9], B. H. Samset[12], D. Sandberg[7], S. J. Sanders[11], R. A. Scheetz[1], P. Staszel[7], T. S. Tveter[12], F. Videbæk[1], R. Wada[8], Z. Yin[9], I. S. Zgura[10]

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