Transverse Momentum Spectra and Yield Ratios of Identified Charged Hadrons in p-p Collisions at RHIC

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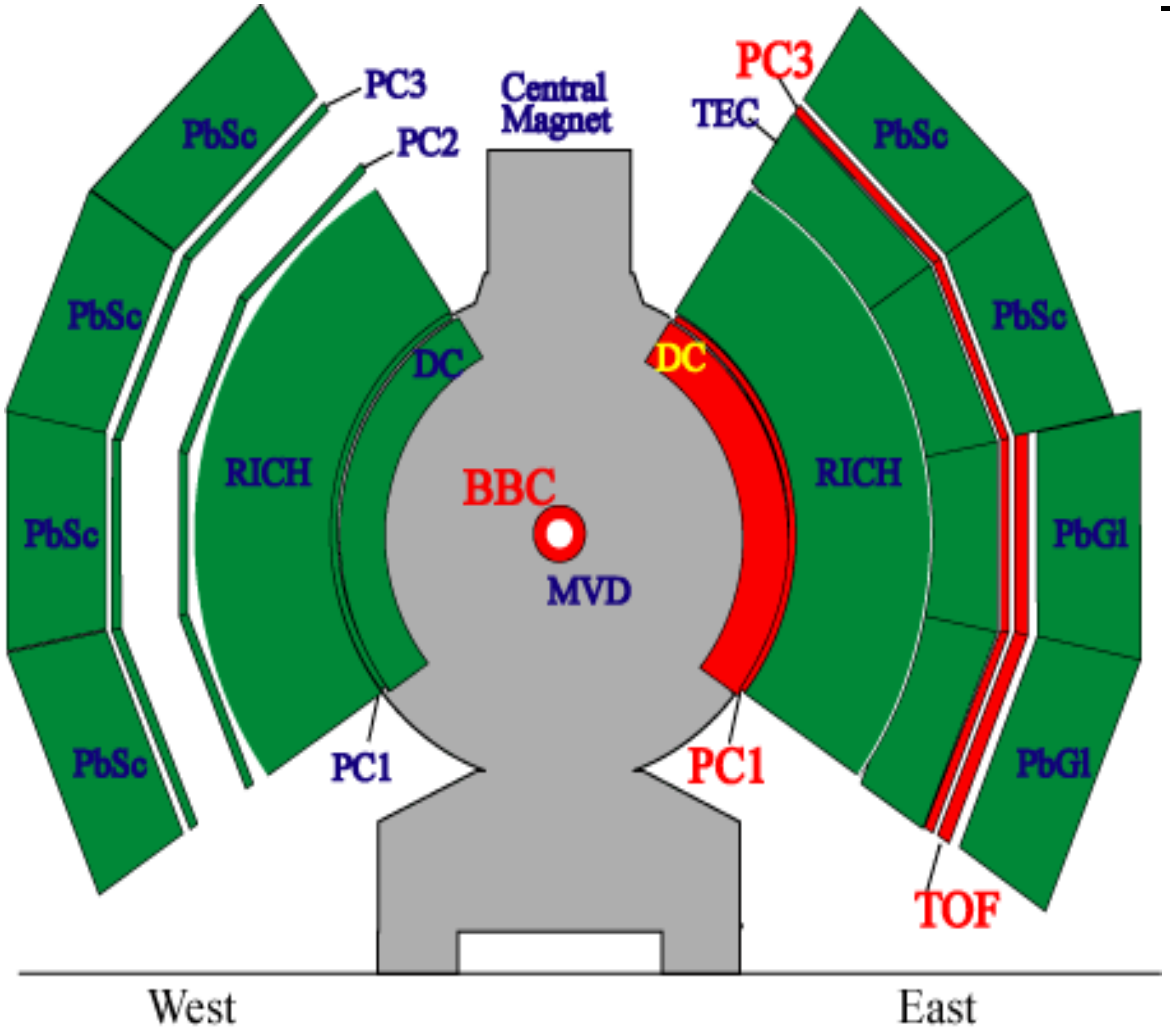
Physics Motivation

- Invariant cross section in p-p collisions is fundamentally important
  - Disentangling underlying nuclear effects
    - Careful examination of Nuclear Modification Factors; e.g., R_{dAu} and R_{AuAu}
  - Detailed study of p_T-broadening
- At intermediate energies (root s ~ 30 GeV)
    - Enhancement of the production cross section in p +A collisions compared to p-p collisions
    - Interpretation; 'initial state partonic scatterings'

PHENIX Detector



Identified Charged Hadron Analysis Detection Elements:

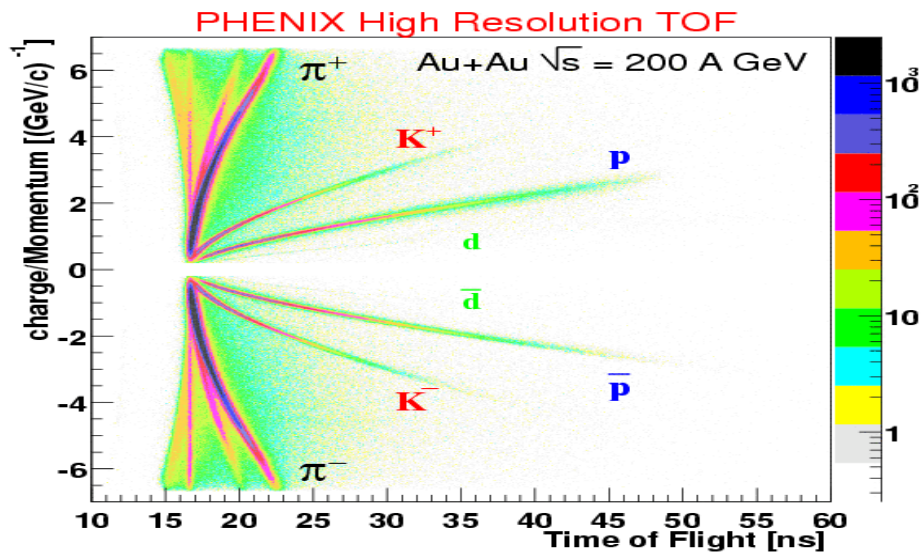
- Beam-Beam Counter (BBC)
  - Trigger, timing, and collision information
- Drift Chamber (DC)
  - Charge particle tracking and momentum information
- Pad Chambers (PC1-PC3; in analysis, use only PC1)
  - 3D space-point information on charged particles
- Time-Of-Flight (TOF) Detector
  - Timing information and charged hadron identification

Particle Detection and Measurement

High Resolution Time-of-Flight (TOF) detector

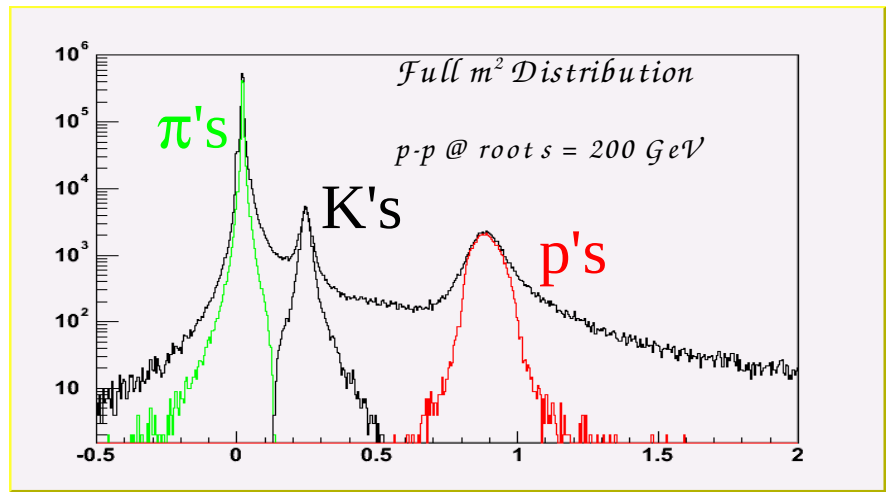
TOF time resolution: 120 ps, relative to 2 σ cut in m^2; K/pi separation up to 2 GeV/c; P/K separation extends up to p_T = 4 GeV/c - (Au-Au)

Beam-Beam Counter (BBC) provides start clock trigger

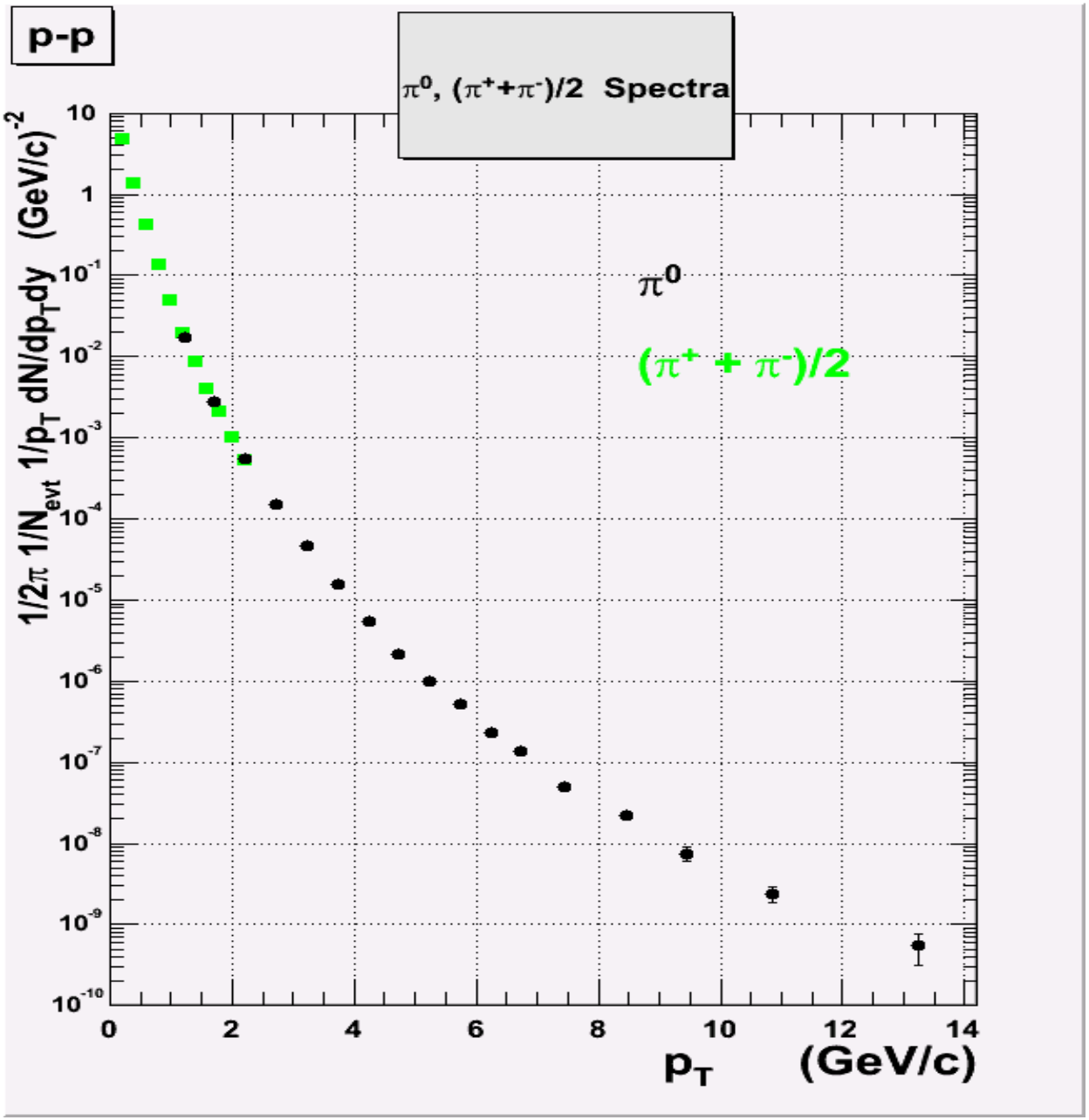


TOF

BBC



In p-p, certainly have clean pion and kaon separation out to |p| ~ 1.6 GeV/c



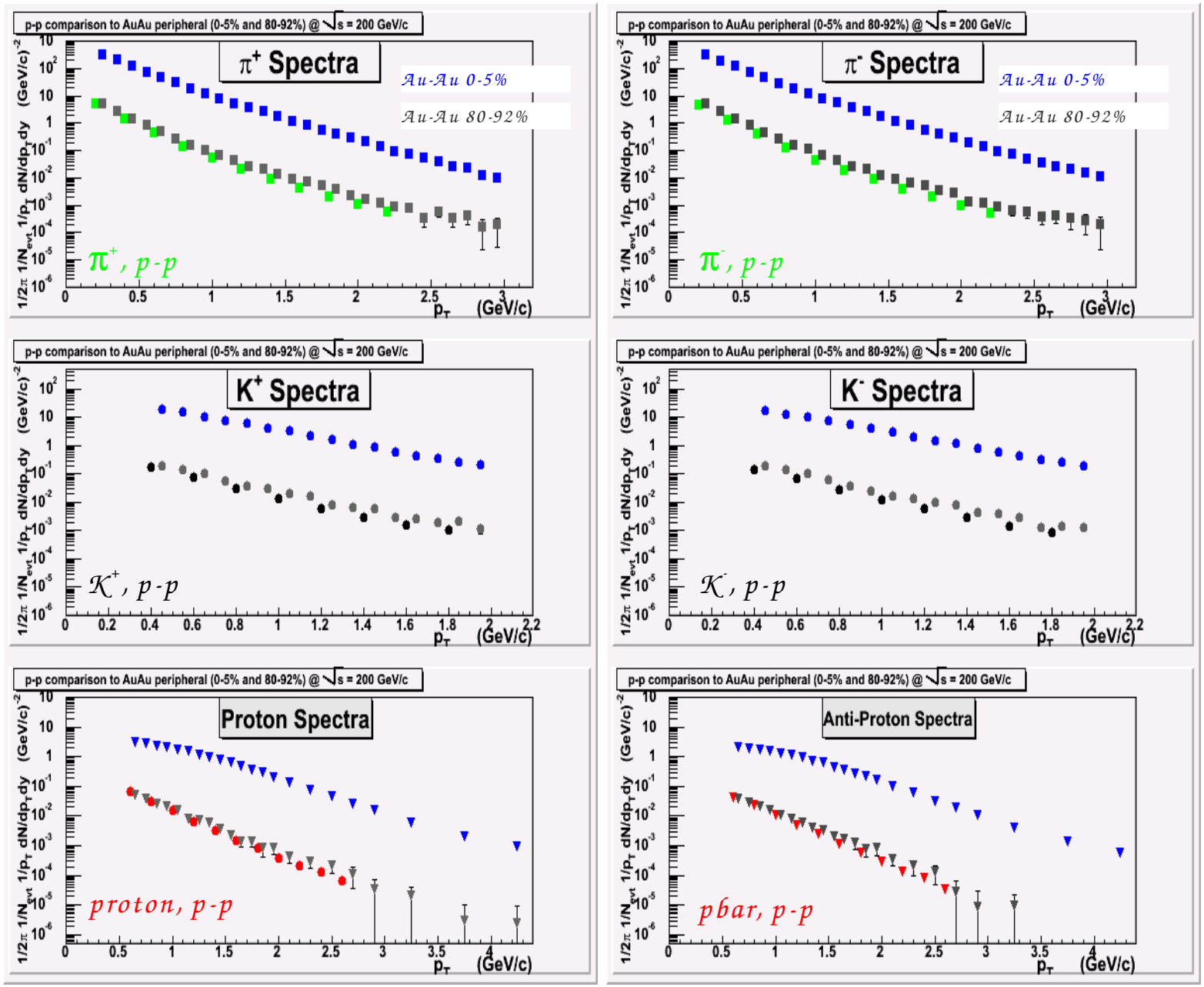
PHENIX

p-p charged results are Work in Progress

Shape of Charged pion average result in agreement with pi zero result -- As viewed from two independent analyses

p-p pi zero Results

Preprint hep-ex/0304038



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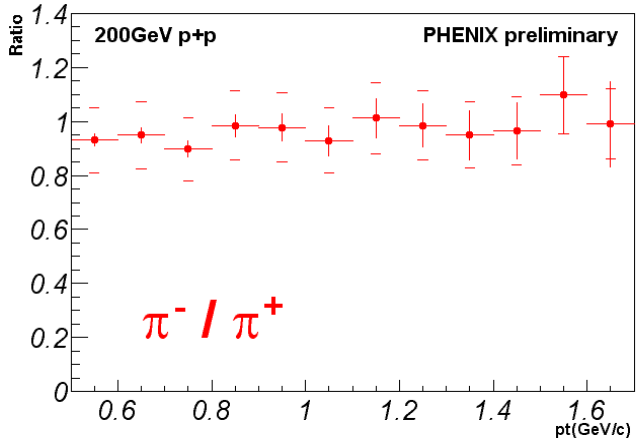
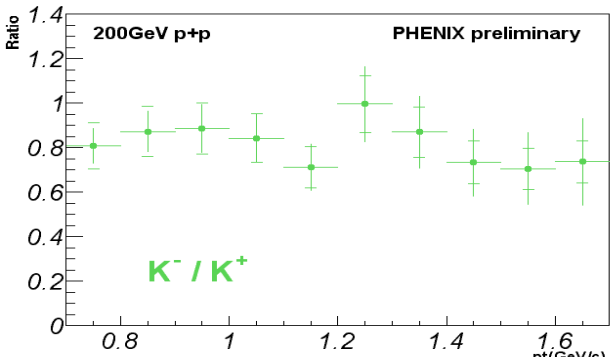
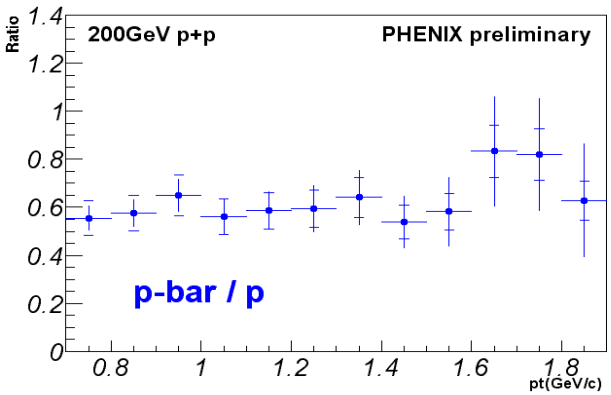
p-p charged Spectra are Work in Progress

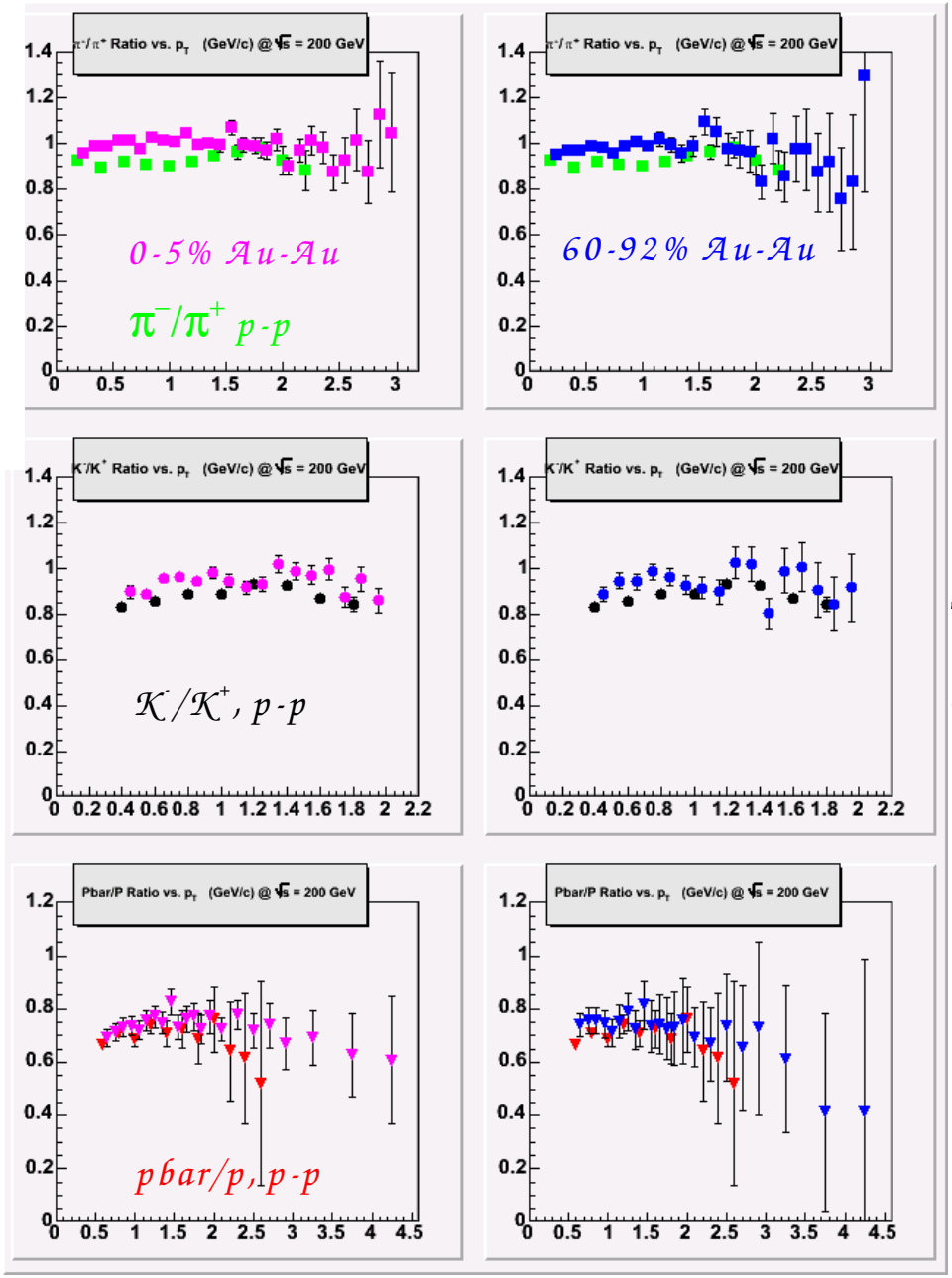
- **Pion spectra,** *Characterized by power law shape; concave shape*
- **Kaon spectra, Fall-off exponentially in p_T**
- **Proton spectra,** *'Characterized by Boltzman shape' shoulder-arm shape steeper fall off peripheral and p-p data*

Au-Au Results Preprint nucl-ex/0307022









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p-p results are Work in Progress

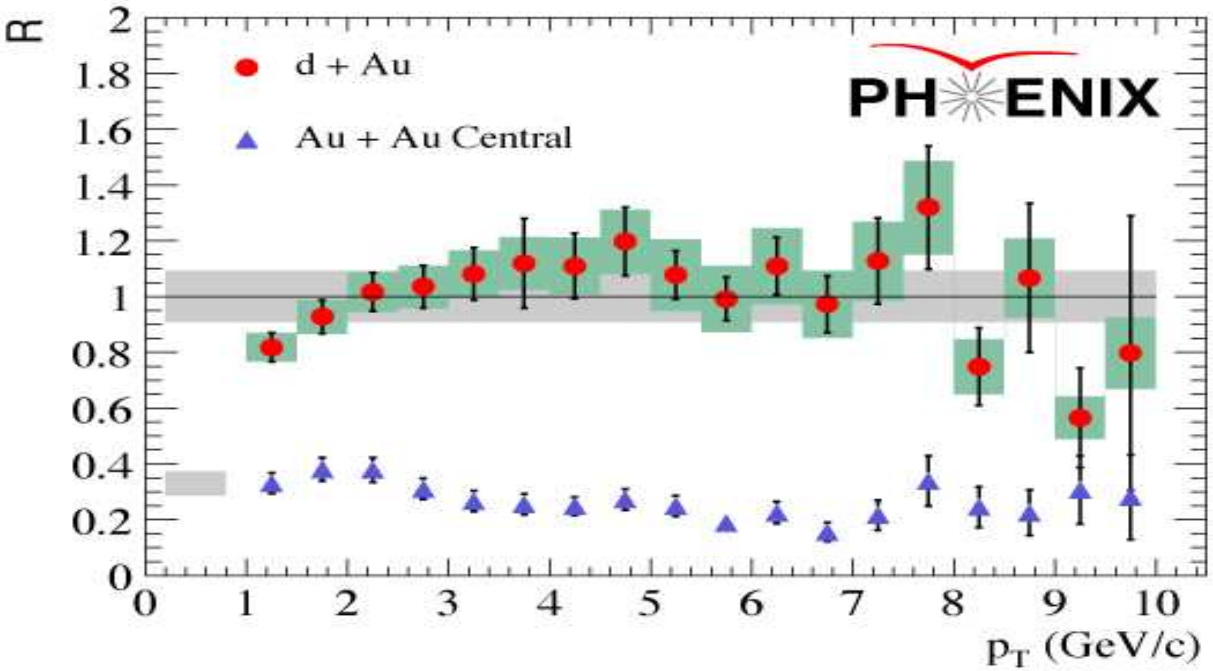
- **Pion ratios,**
  - *flat dependence in p_T*
  - *no centrality dependence*
- ***K ratios for p-p data analyses are consistent with Au-Au***
- **Proton ratios,**
  - ***'central: flat dependence in p_T'***
  - ***'possibly decreasing for peripheral > 3GeV' Au-Au; ~ 2.6 GeV/c in p-p (WP)?***
- ***Flat p_T dependence in this work consistent with Au-Au result and preliminary p-p result***

Summary

- The identified charged hadron p-p Spectra (work in progress) are in agreement with:
  - Au-Au peripheral Spectra shape
  - pi zero Spectra shape

  (i.e., comparable to charged pion average)

- Ratios of p-p data agree very well with peripheral Au-Au published results
- On the menu; R_{dAu} and R_{AuAu} from p-p charged hadron data
  - cross checks, systematics and otherwise



$R_{dAu} \sim 1$;
implication:
partonic momenta not
significantly decreased
in traversing hot medium

R_{AuAu} considerably less than 1;
implication:
jet quenching due to
hard scattered partons

How does it look for charged pions, Kaons and Protons? (IN PHENIX, of course)