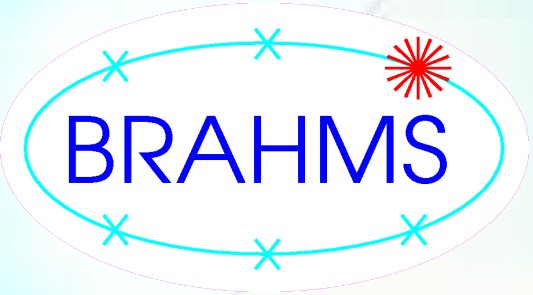
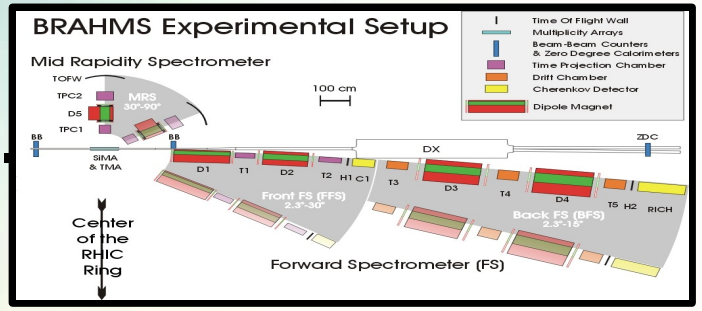


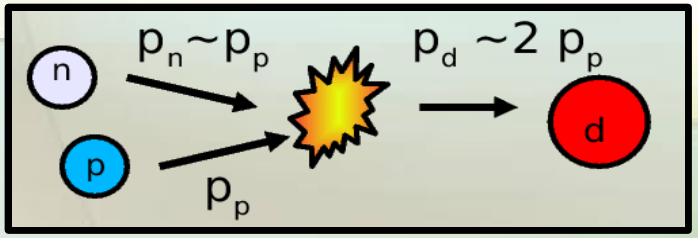
Rapidity Dependency of Coalescence in Au-Au Collisions at $\sqrt{s_{NN}}$ =200 GeV

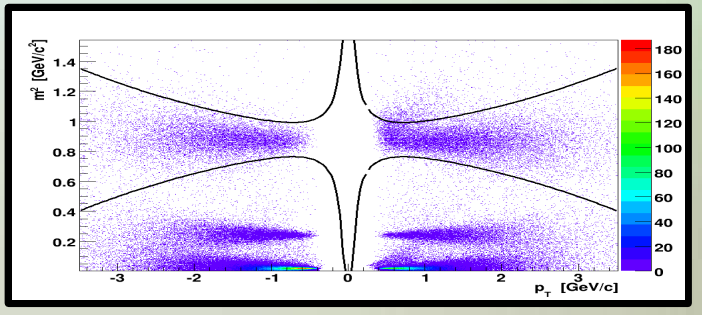
Casper Nygaard, Niels Bohr Institute
BRAHMS Collaboration

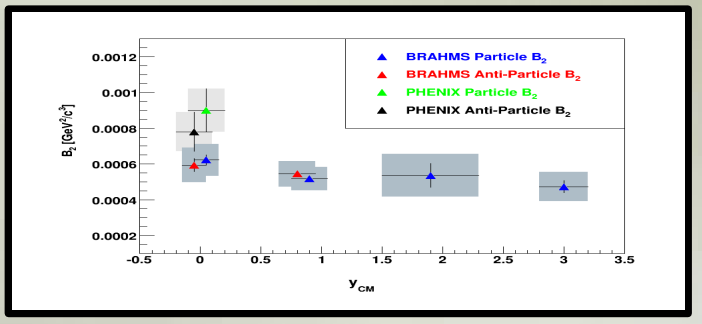
Outline

- The Brahms Experiment .....
- Coalescence.....
- Analysis .....
- Results.....

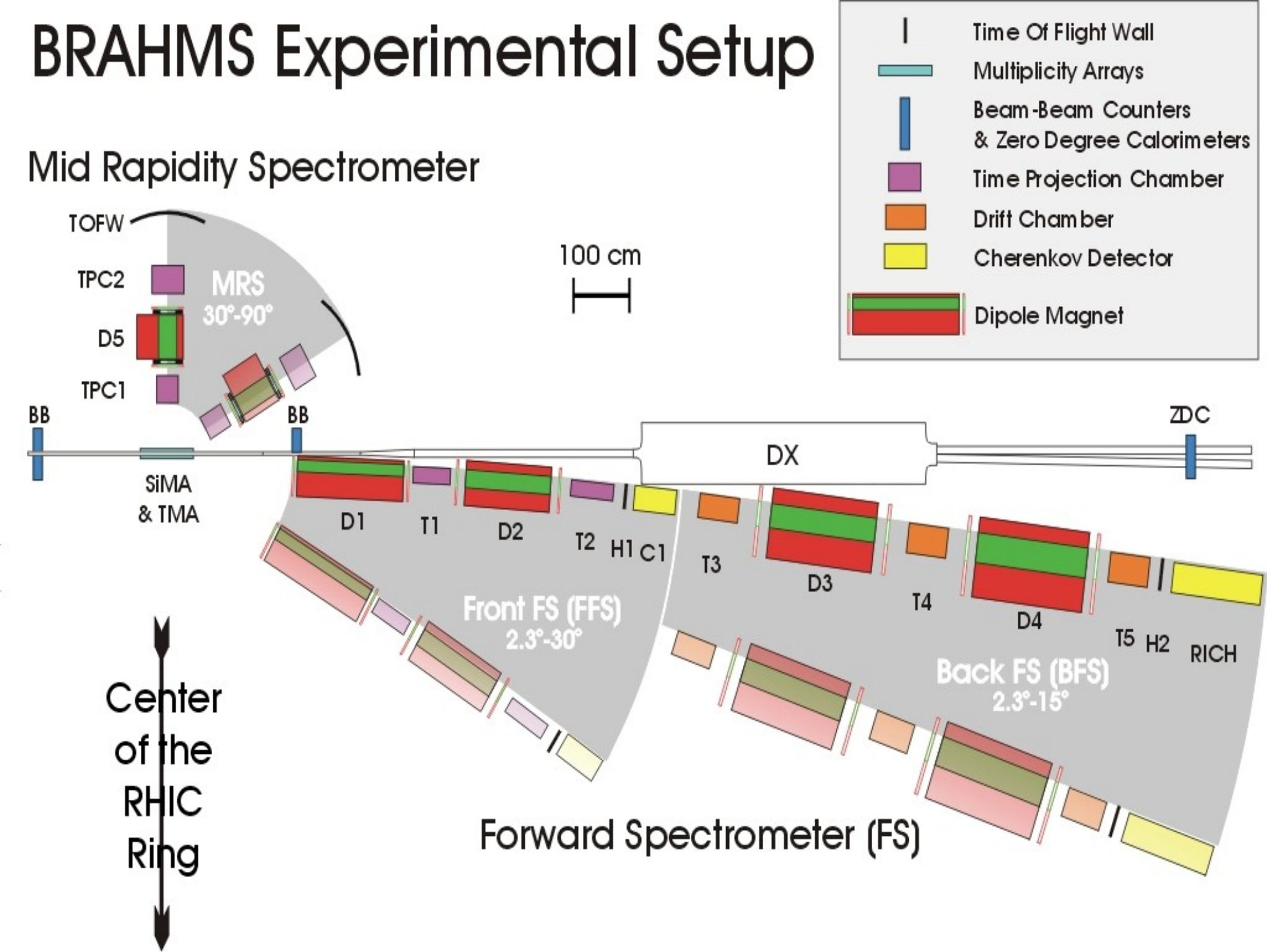






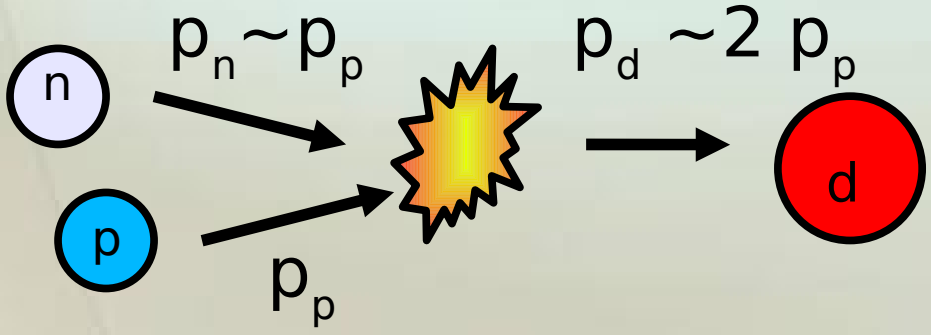


BRAHMS Experimental Setup



Coalescence

- Coalescence is the creation of a deuteron, from a proton and a neutron.
- Due to the very low binding energy of the deuteron (2.22 MeV) , Coalescence probes the collision at the timescale of the freeze-out.
- Coalescence parameter given by:

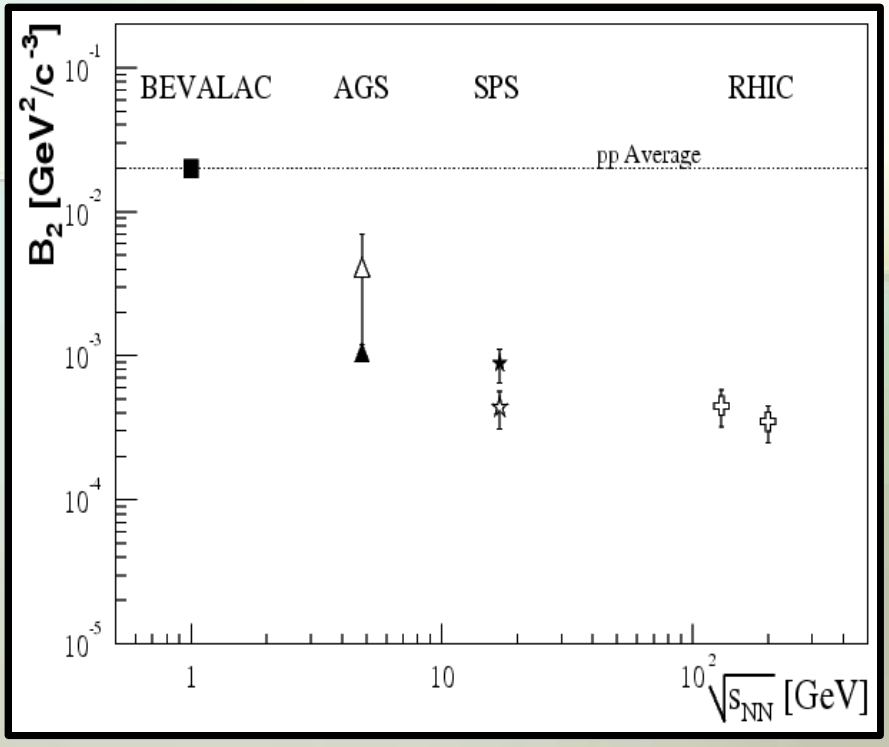


$$B_2 = \frac{E_d \cdot \left(\frac{d^3 N_d}{dp_d^3} \right)}{\left(\frac{E_p \cdot d^3 N_p}{dp_p^3} \right)_2}$$

- B_2 is inversely proportional to the collision volume according to a thermal model. [Pearson]

Coalescence

- Previous Experiments show that B_2 decreases with collision energy.
- B_2 vs. p_T yields information on the transverse flow of the collision.
- B_2 at various rapidities will give an idea if the source size is changing when moving forward in rapidity.



Analysis

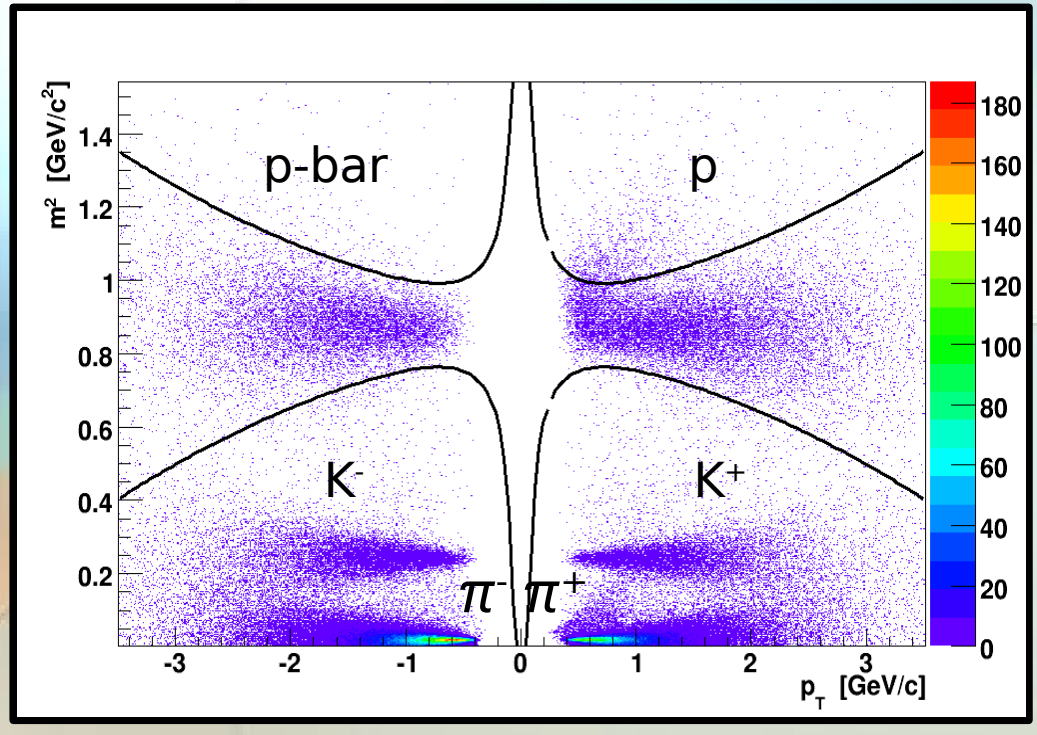
Collision Energy: 200 GeV
Collision Species: Au + Au
Centrality: 0-20% central

Rapidity Slices :

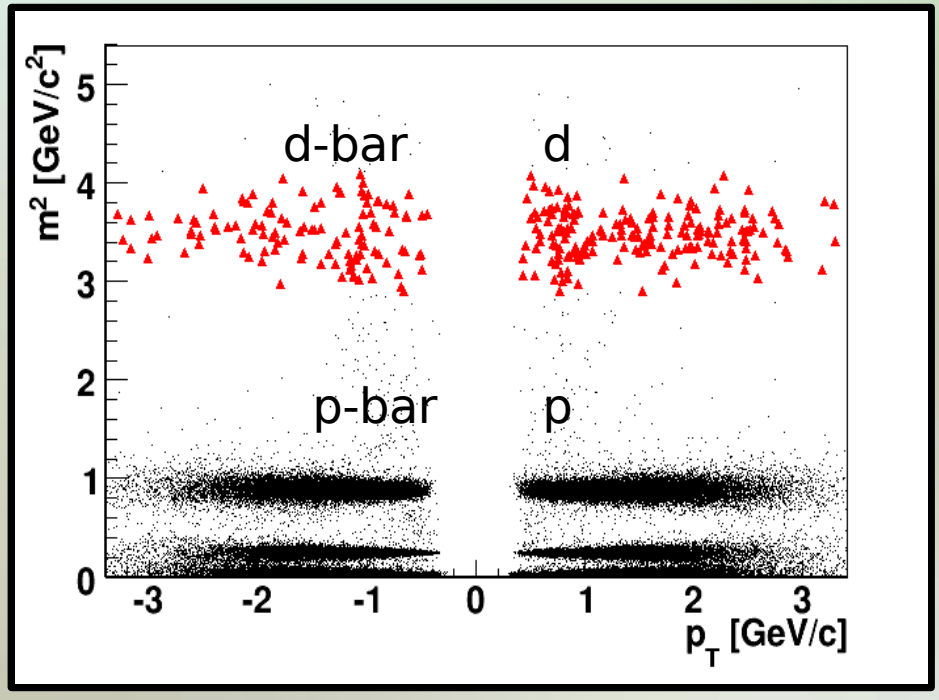
y = [-0.1;0.1] ($\theta \sim 90^{o}$)
y = [0.7;1.0] ($\theta \sim 40^{o}$)
y = [1.5;2.4] ($\theta \sim 8\text{-}10^{o}$)
y = [2.8,3.2] ($\theta \sim 2.3\text{-}4^{o}$)

Data taken by BRAHMS at the RHIC in Run4 in 2004

TOF PID



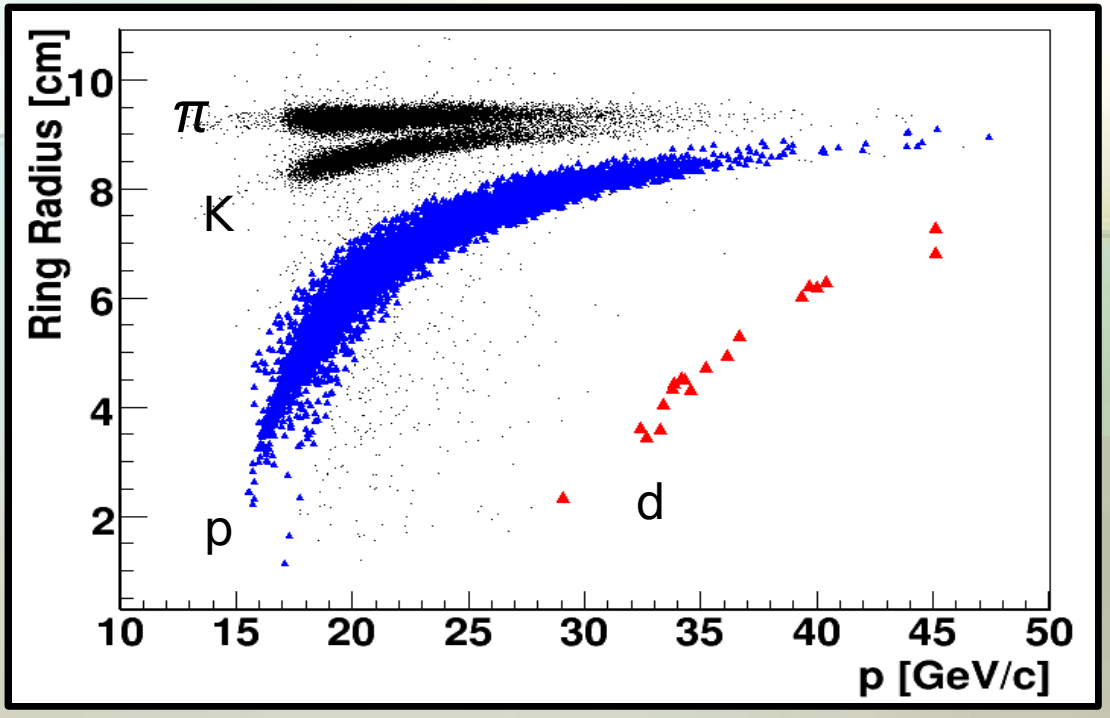
- Proton PID done by fitting the m^2 vs. p_T distribution.
- Deuteron PID done by a gaussian fit in the m^2 distribution.



- TOF PID used in the MRS and in combination with the RICH at y~2.

RICH PID

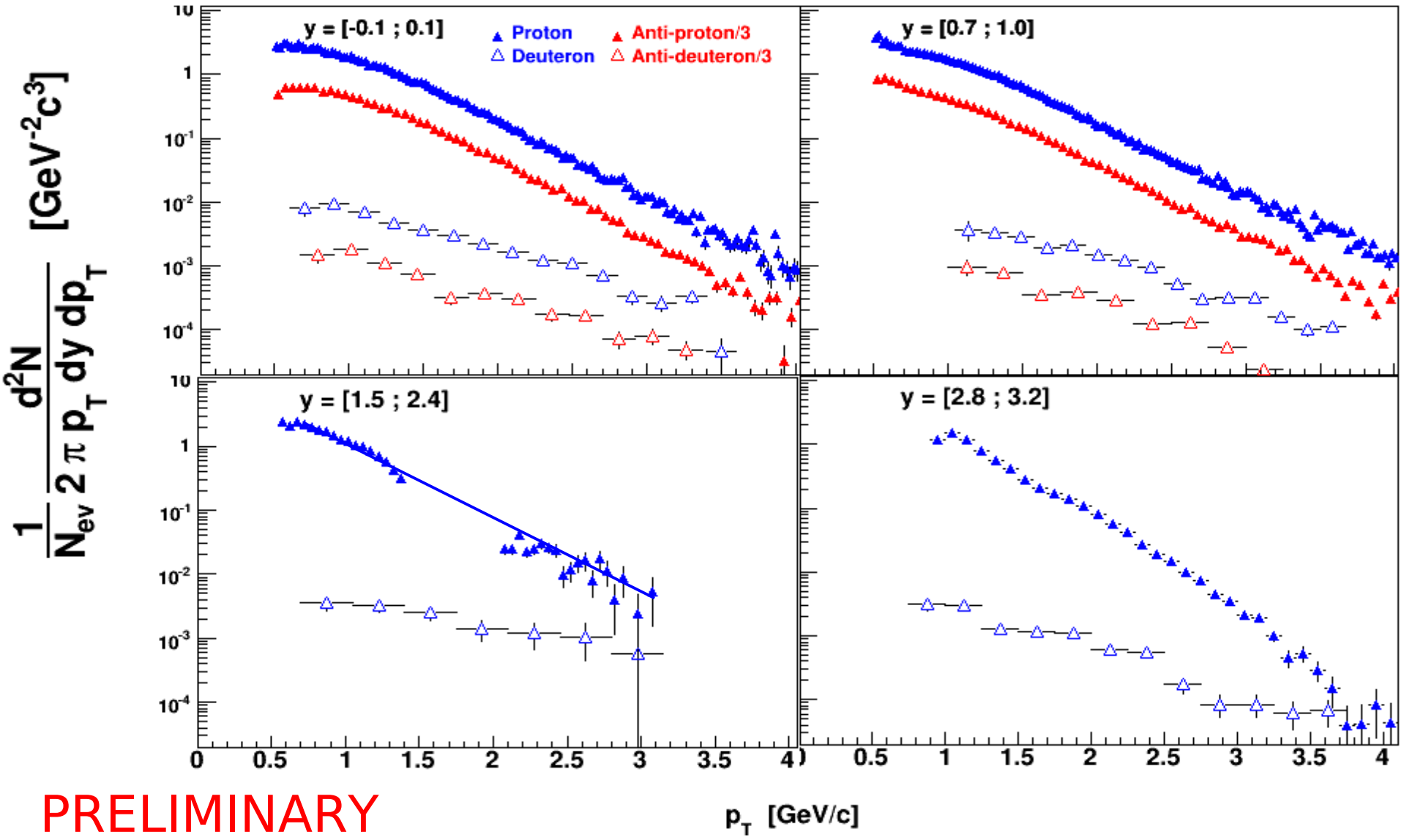
- Proton PID
  - Direct: From p~17 GeV/c, the Cherenkov ring radius is used
  - Indirect: 12>p>17 GeV/c
- Deuteron PID
  - Direct: From p~30 GeV/c
  - Indirect: 17>p>24 GeV/c
- Used for PID at y~3 and in combination with the TOFs at y~2.



Spectra

- The invariant spectra have been corrected for:
  - Acceptance
  - Tracking efficiency
  - Multiple scattering, absorption and weak decay for protons

Spectra

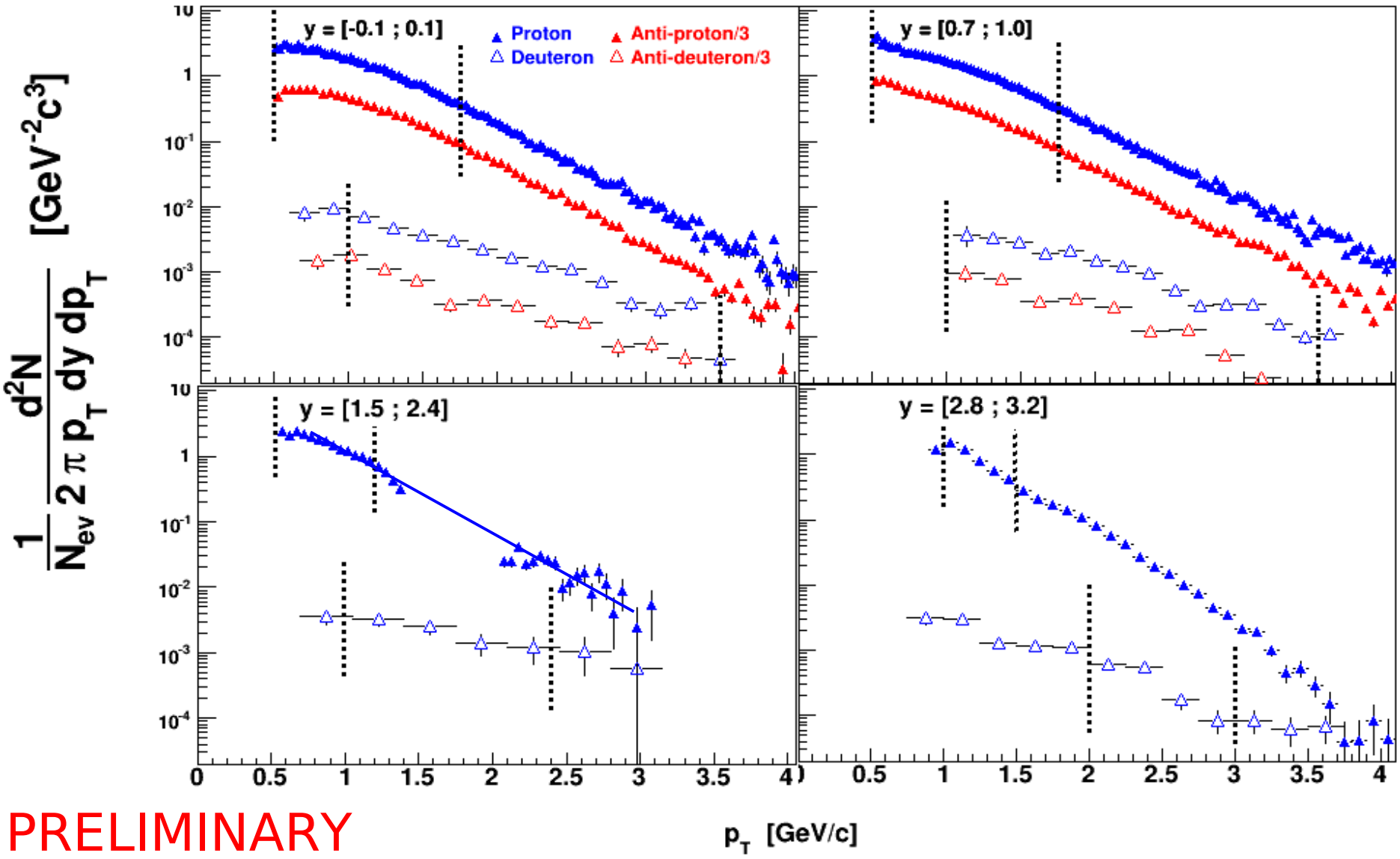


PRELIMINARY

Missing corrections

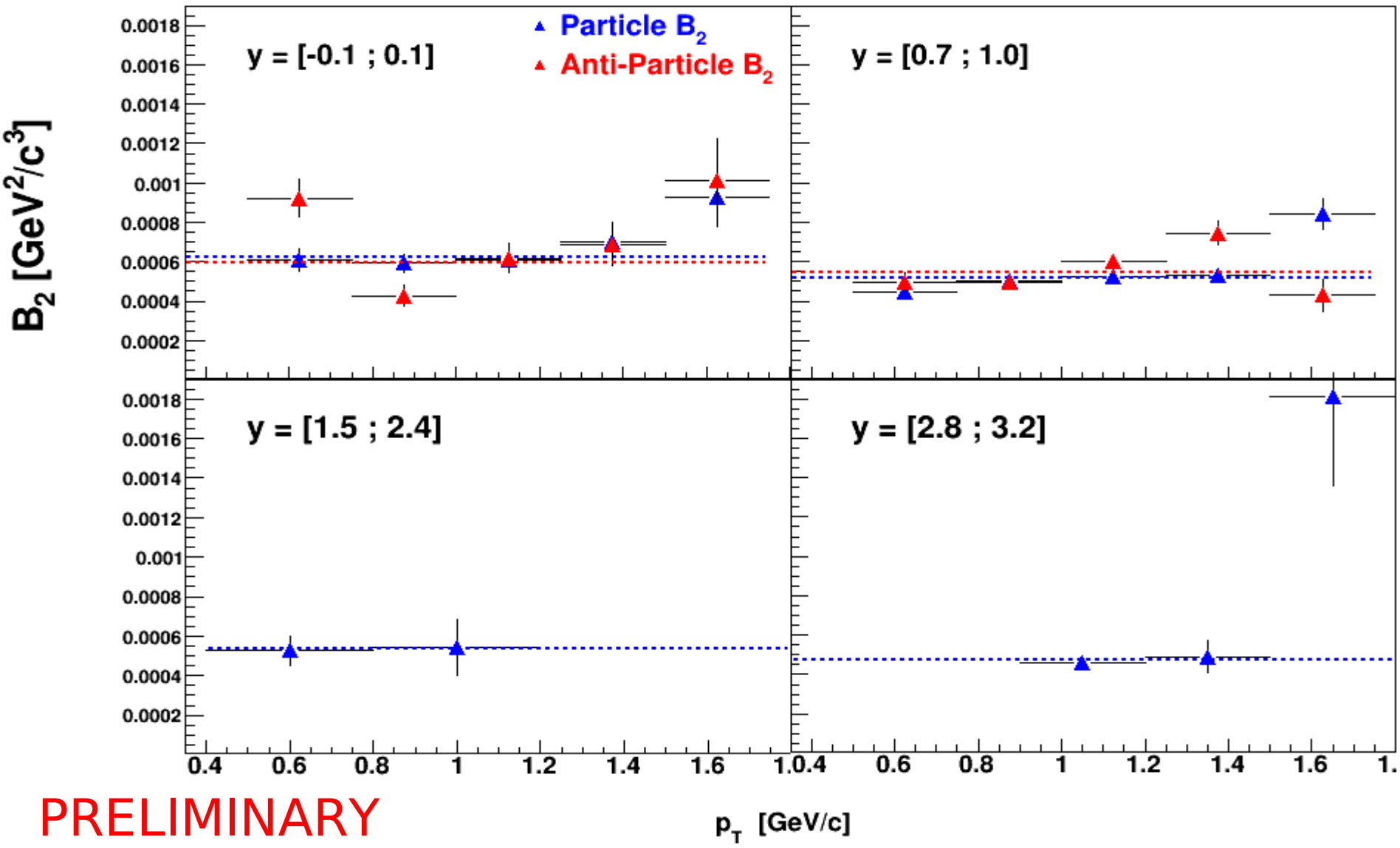
- Multiple Scattering, Absorbtion, weak decay for deuterons not yet implemented
- Correction for RICH inefficiency not yet implemented for proton and deuteron spectra.

Spectra



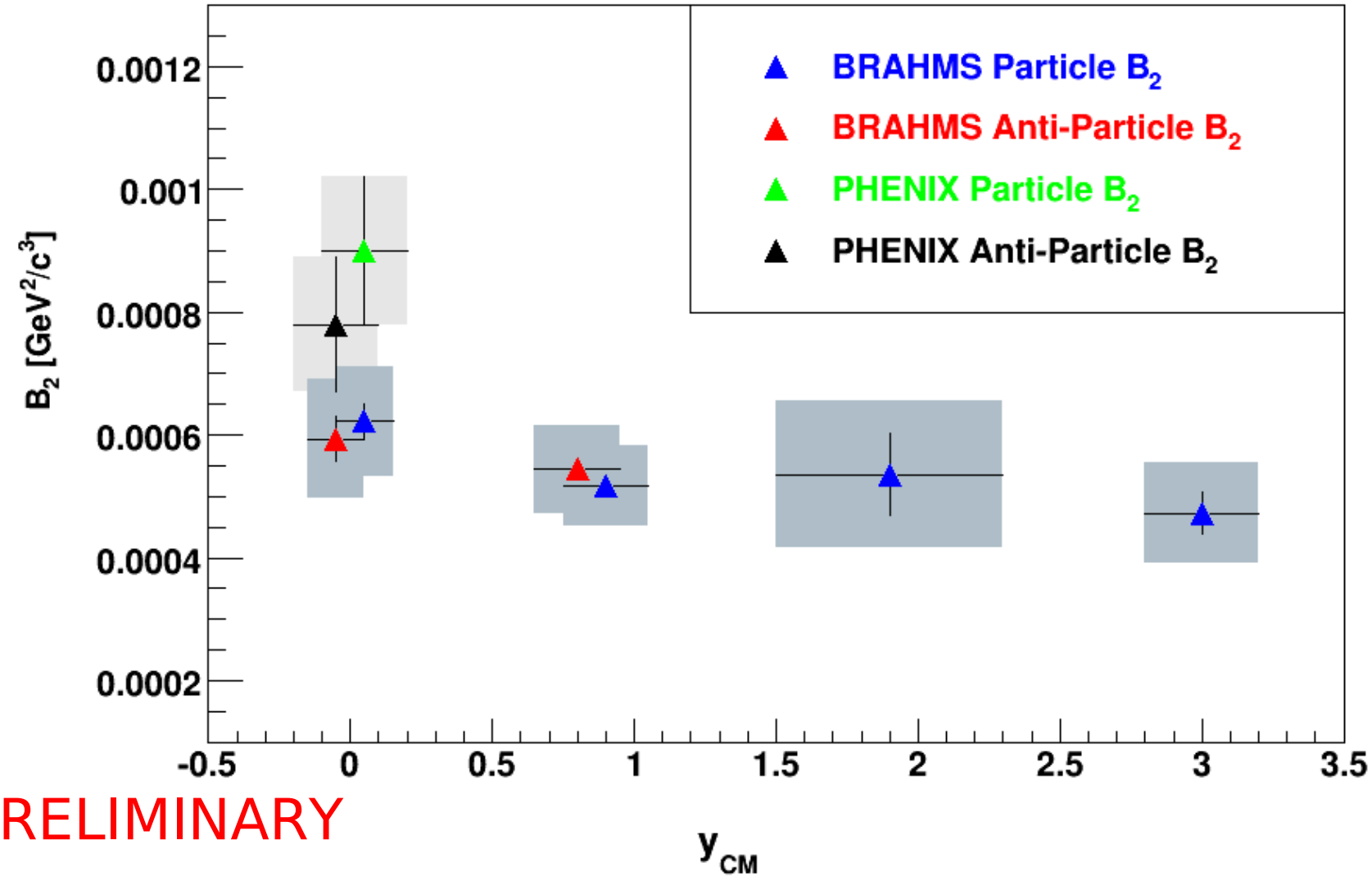
PRELIMINARY

B_2 vs. p_T



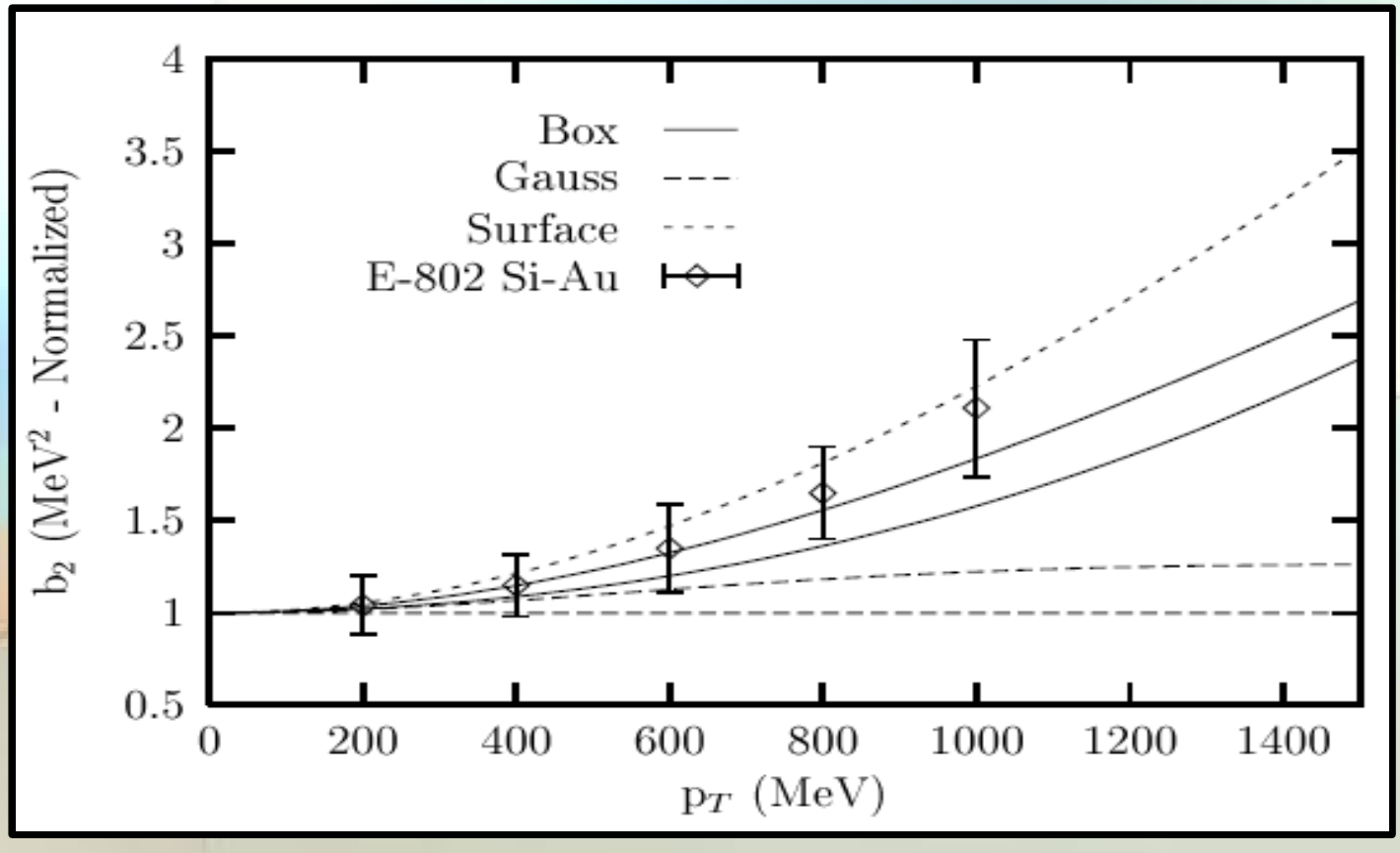
PRELIMINARY

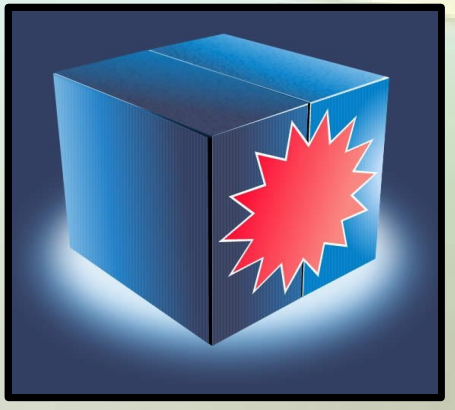
B_2 vs. y



PRELIMINARY

Density Profile





Simulation for different density and flow profiles [Polleri]

Summary

- B_2 increases as a function of p_T at y~0 and y~1.
- B_2 is constant within errors in the rapidity range y~[0; 3] , indicating that source sizes are comparable at these rapidities.

Outlook

- Further studies trying to single out which density profile best describes the data.
- Study of B_2 vs. y, for various centralities and systems (e.g. Cu+Cu and p+p).

BRAHMS Collaboration

I. C. Arsene[12], I. G. Bearden[7], D. Beavis[1], S. Bekele[12], C. Besliu[10], B. Budick[6], H. Bøgild[7], C. Chasman[1], C. H. Christensen[7], P. Christiansen[7], H.H.Dalsgaard[7], R. Debbe[1], J. J. Gaardhøje[7], K. Hagel[8], H. Ito[1], A. Jipa[10], E.B.Johnson[11,] J. I. Jørdre[9], C. E. Jørgensen[7], R. Karabowicz[5], N. Katrynska[5] ,E. J. Kim[11], T. M. Larsen[7], J. H. Lee[1], Y. K. Lee[4],S. Lindahl[12], G. Løvhøiden[12], Z. Majka[5], M. J. Murray[11],J. Natowitz[8], C.Nygaard[7] B. S. Nielsen[8], D. Ouerdane[8], D.Pal[12], F. Rami[3], C. Ristea[8], O. Ristea[11], D. Röhrich[9], B. H. Samset[12], S. J. Sanders[11], R. A. Scheetz[1], P. Staszel[5], T. S. Tveter[12], F. Videbæk[1], R. Wada[8], H. Yang[9], Z. Yin[9], I. S. Zgura[2]

1. Brookhaven National Laboratory, Upton, New York, USA
2. Institute of Space Science, Bucharest - Magurele, Romania
3. Institut Pluridisciplinaire Hubert Curien et Université Louis Pasteur, Strasbourg, France
4. Johns Hopkins University, Baltimore, USA
5. M. Smoluchkowski Institute of Physics, Jagiellonian University, Krakow, Poland
6. New York University, New York, USA
7. Niels Bohr Institute, University of Copenhagen, Copenhagen, Denmark
8. Texas A&M University, College Station, Texas, USA
9. University of Bergen, Department of Physics and Technology, Bergen, Norway
10. University of Bucharest, Romania
11. University of Kansas, Lawrence, Kansas, USA
12. University of Oslo, Department of Physics, Oslo, Norway