

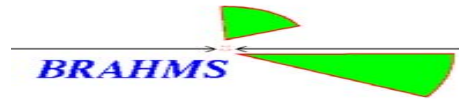
Results from the BRAHMS experiment at RHIC

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for the

BRAHMS collaboration



- Experimental setup
- Stopping
- Particle production
 - Charged particle pseudo-rapidity distribution
 - Rapidity spectra of identified particles

BRAHMS collaboration

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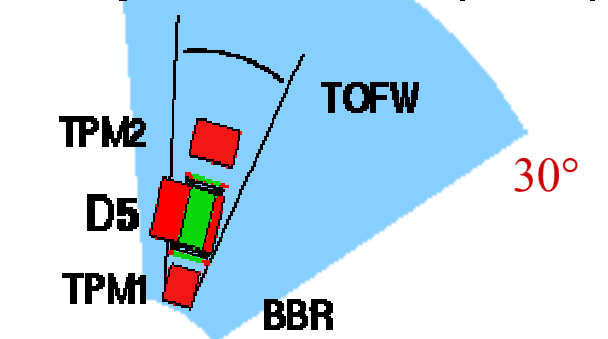
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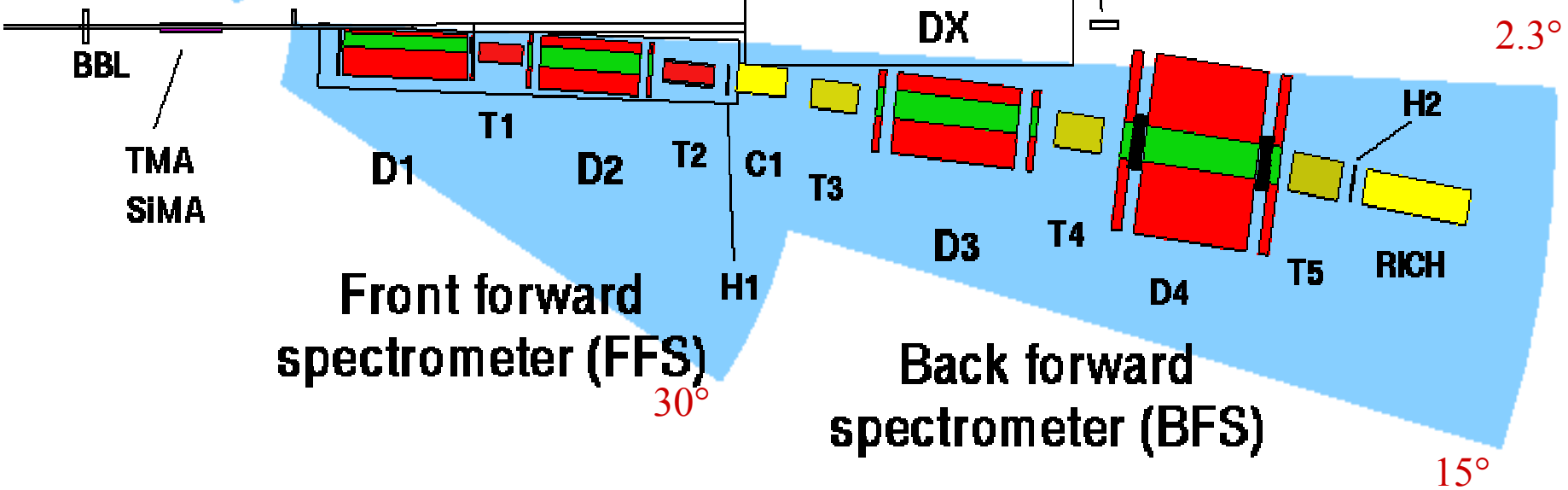
BRAHMS detector

- Broad Range Hadron Magnetic Spectrometer

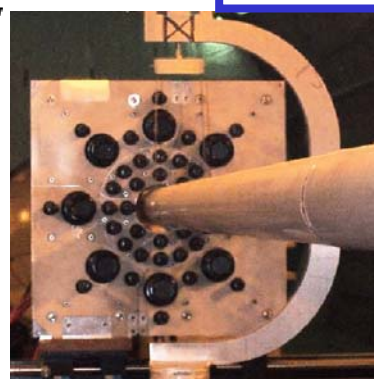
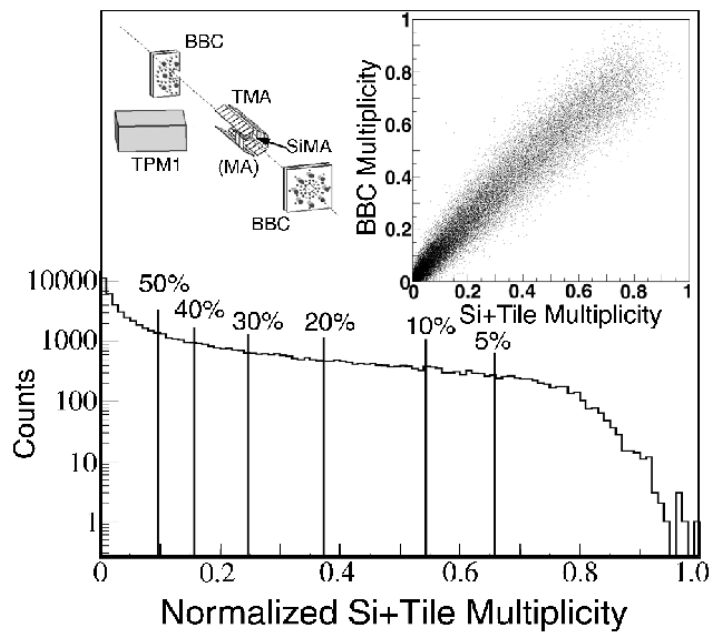
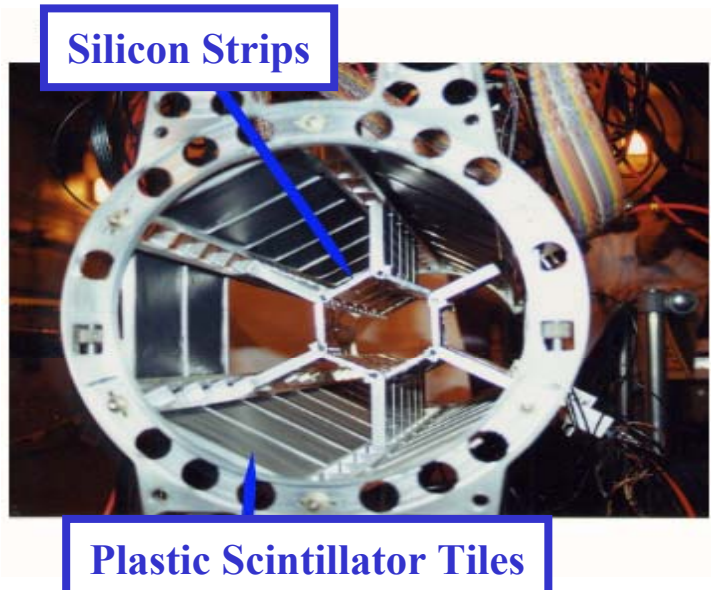
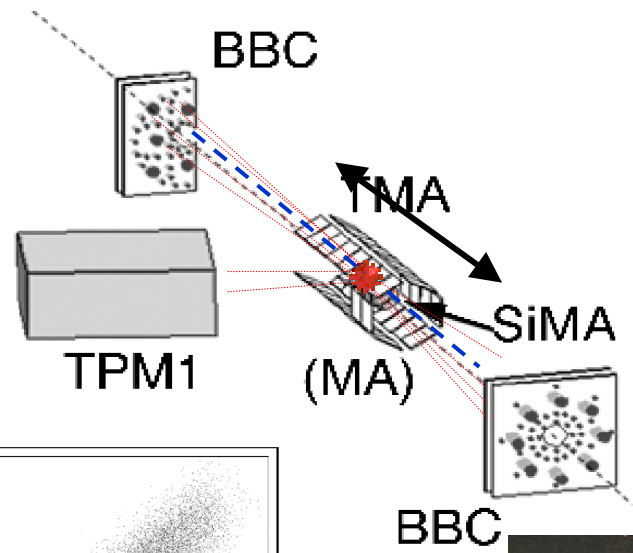
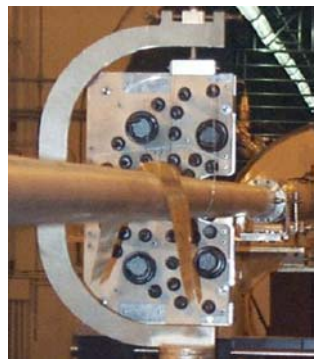
95° **Mid rapidity spectrometer (MRS)**



- Centrality detectors
 - Tiles
 - Silicon strips
 - Beam-Beam counters
 - Zero-degree calorimeters
 - Two movable spectrometers
 - Midrapidity spectrometer
 - Forward Spectrometer
- 100 cm

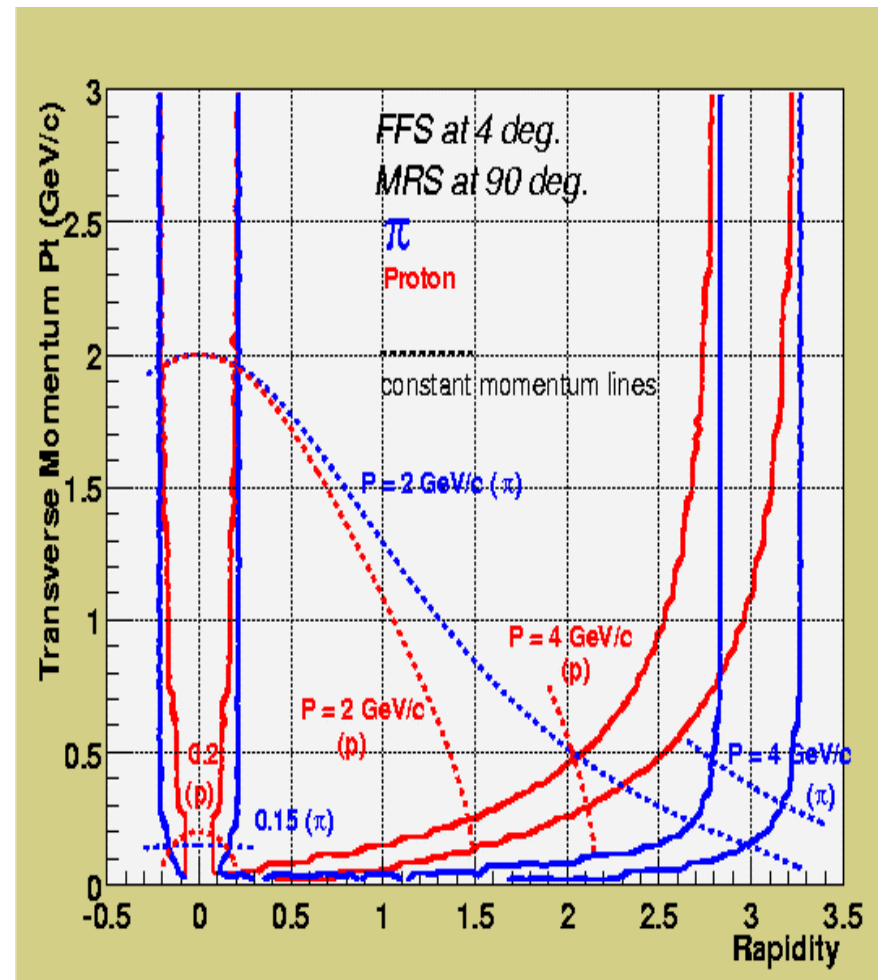
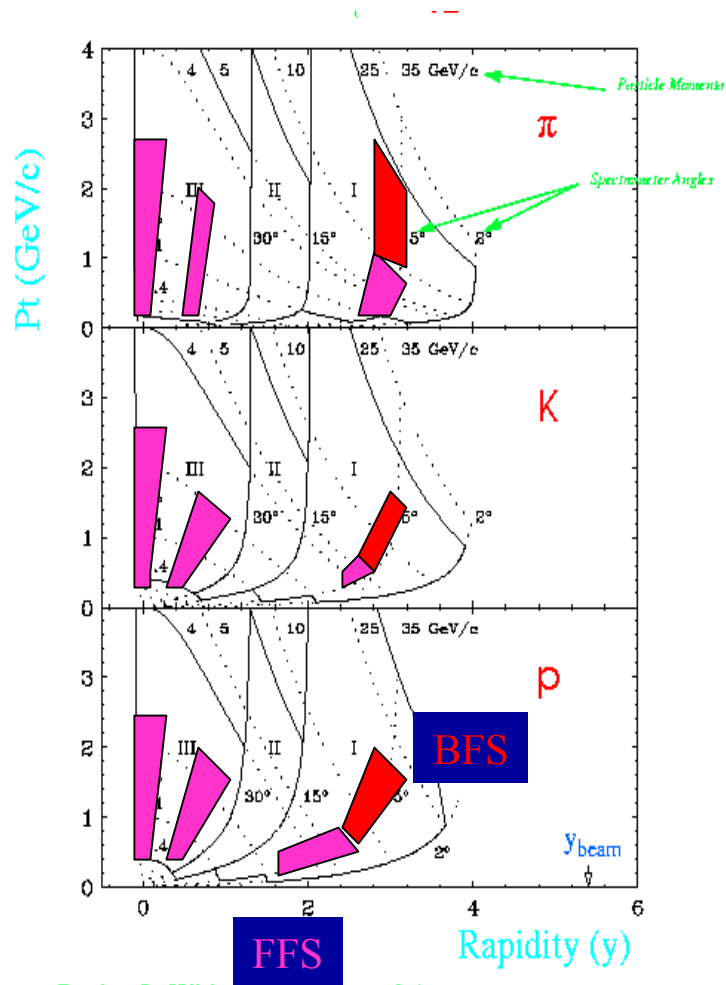


Determination of Collision Vertex and Centrality



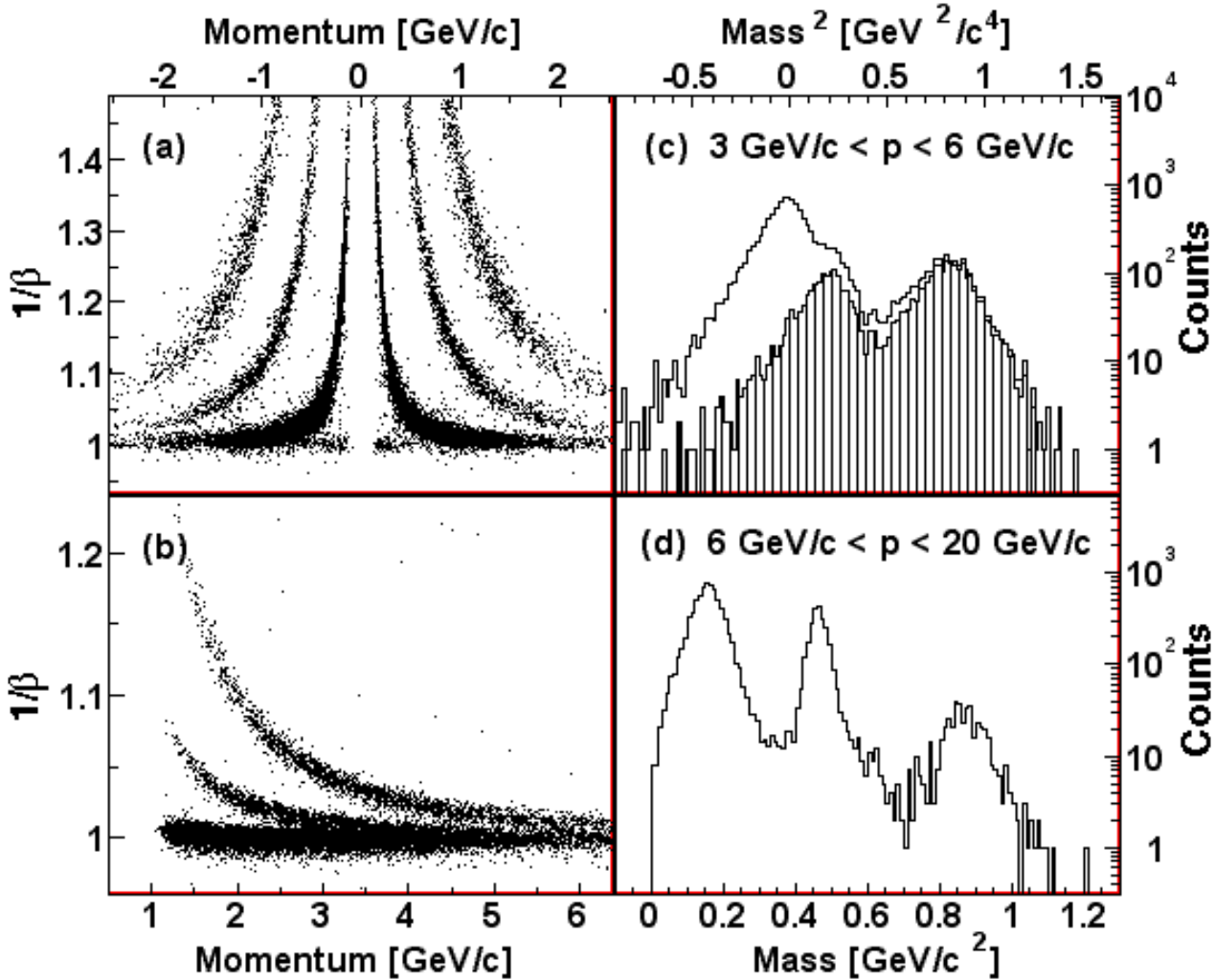
Spectrometer acceptance

August 2000 & 2001



Hadron identification

MRS
TOF

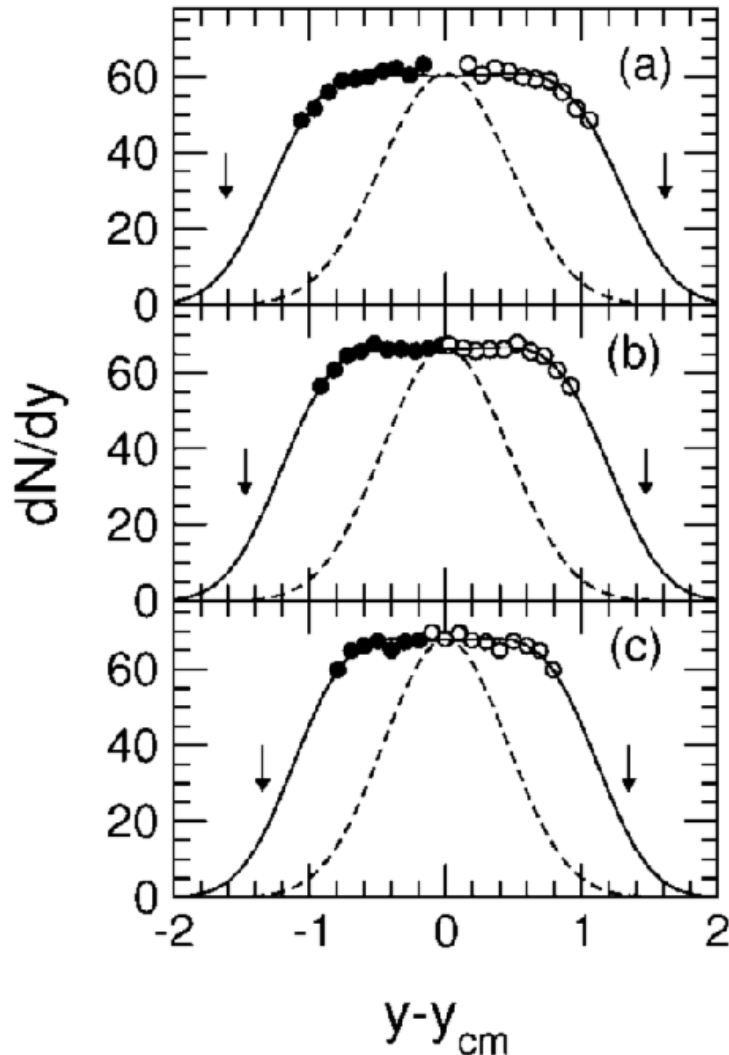


FS
TOF
+C1

FS
TOF

RICH

Proton rapidity distribution

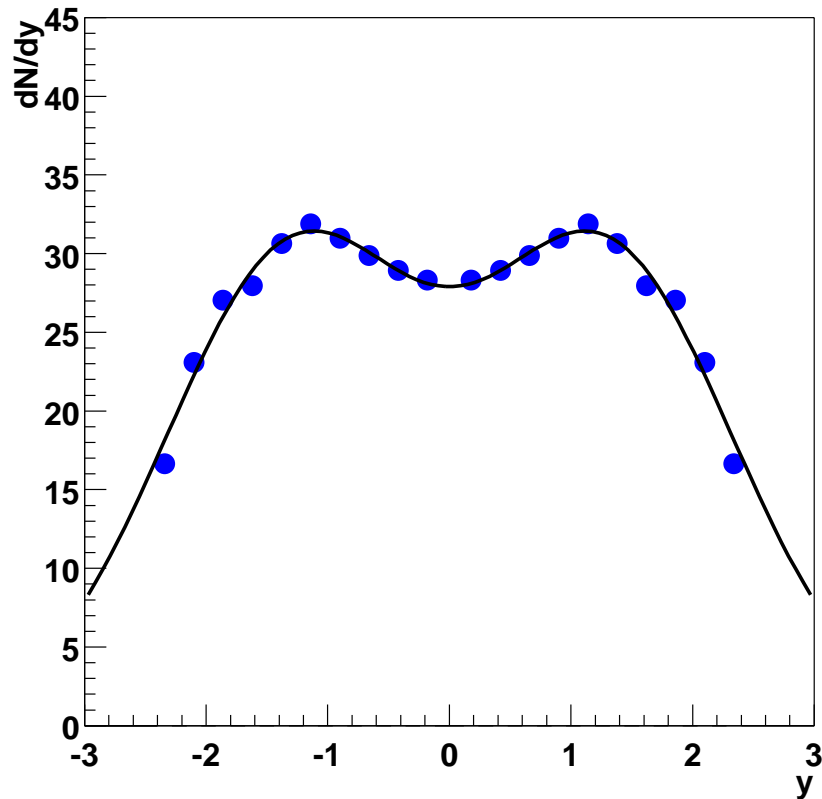


- AGS energies
 - Central collisions
 - Energy dependence

B. Back et al., E917 Collaboration,
Phys. Rev. Lett. **86** (2001) 1970

Net proton rapidity distribution

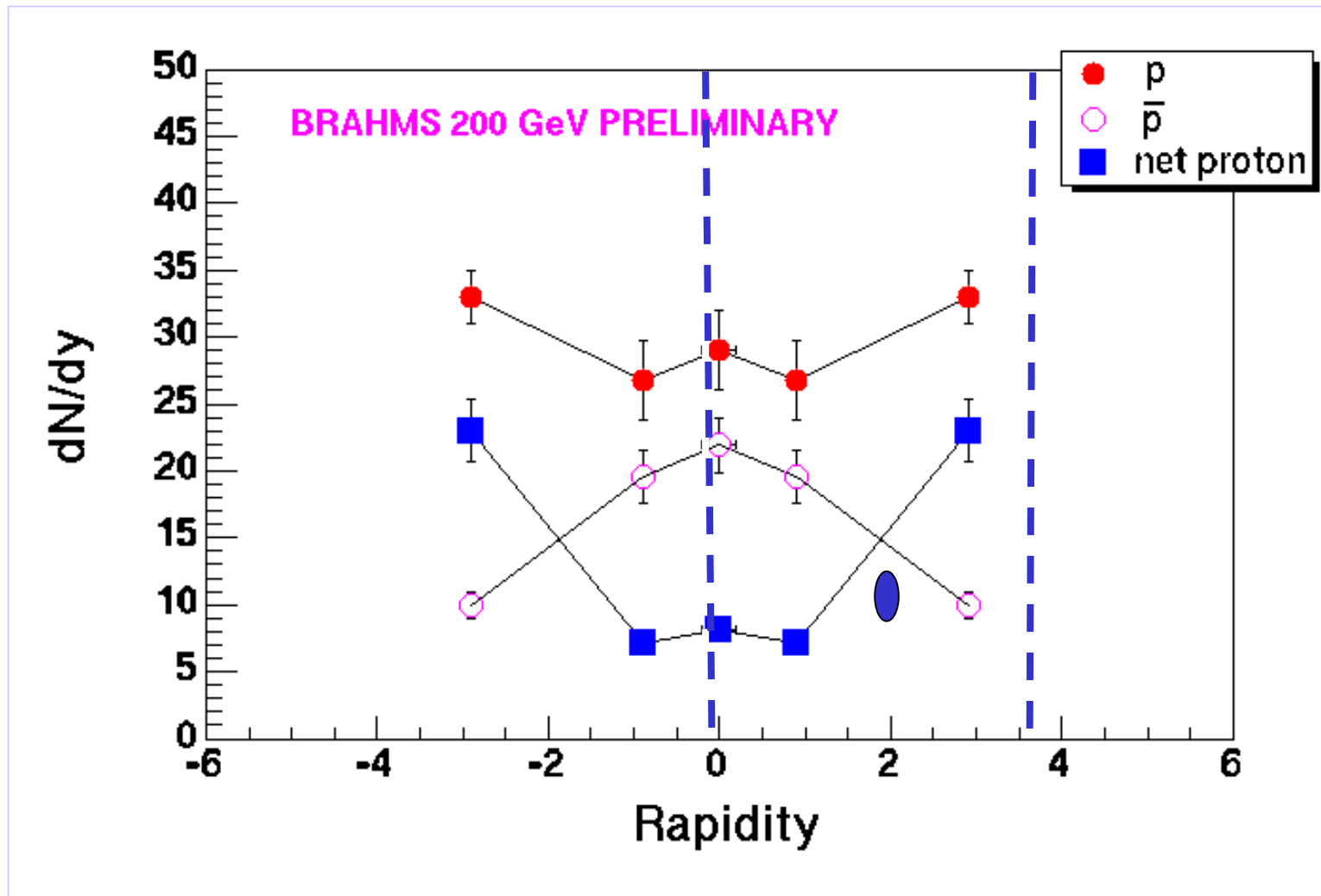
Net proton rapidity distribution, SPS



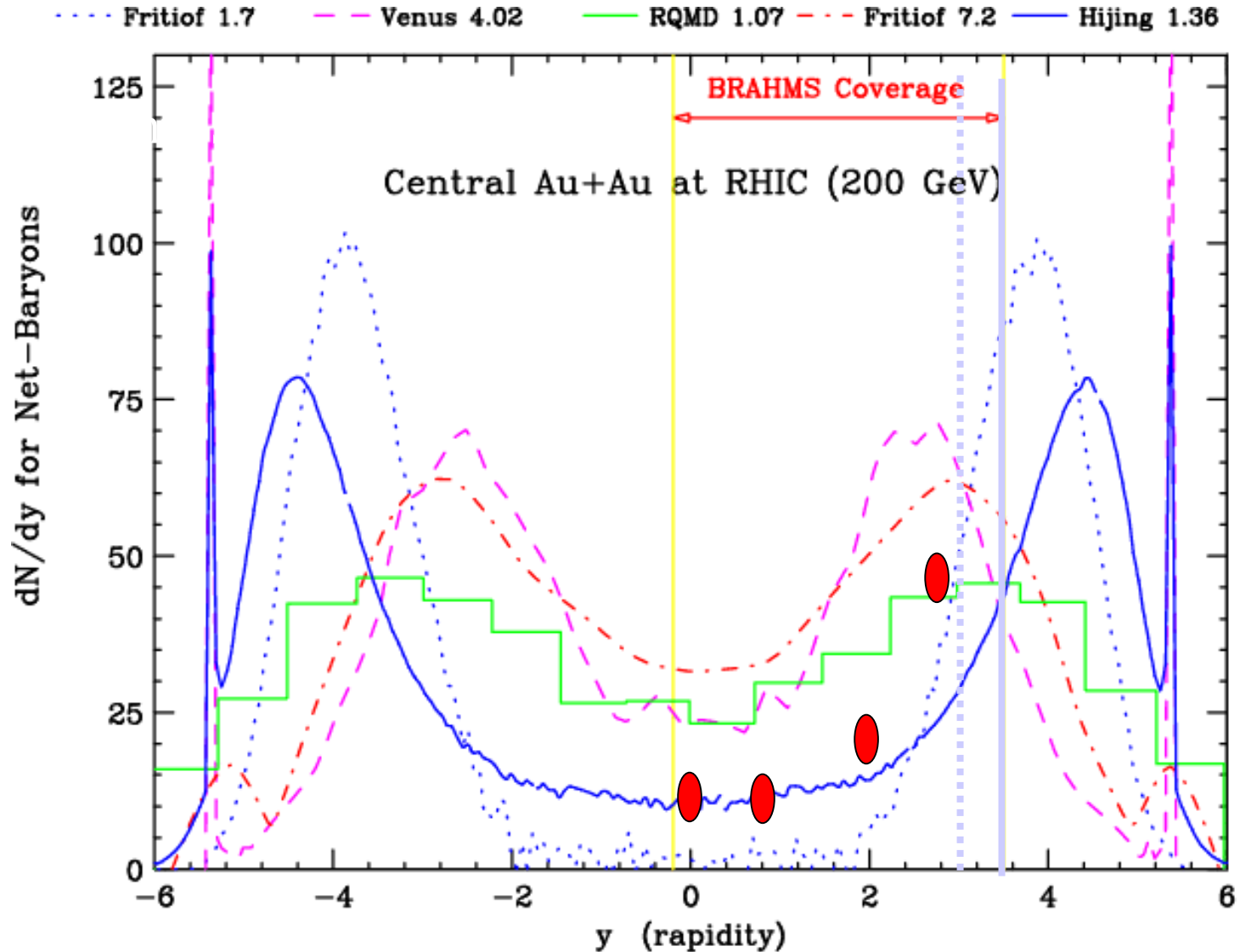
- SPS
 - central (6%) Pb+Pb, 158 GeV/nucleon.
 - NA49

G. Cooper et al. (NA49 Collaboration),
Nucl. Phys. **A661** (1999) 362c-365c

Net protons vs Rapidity

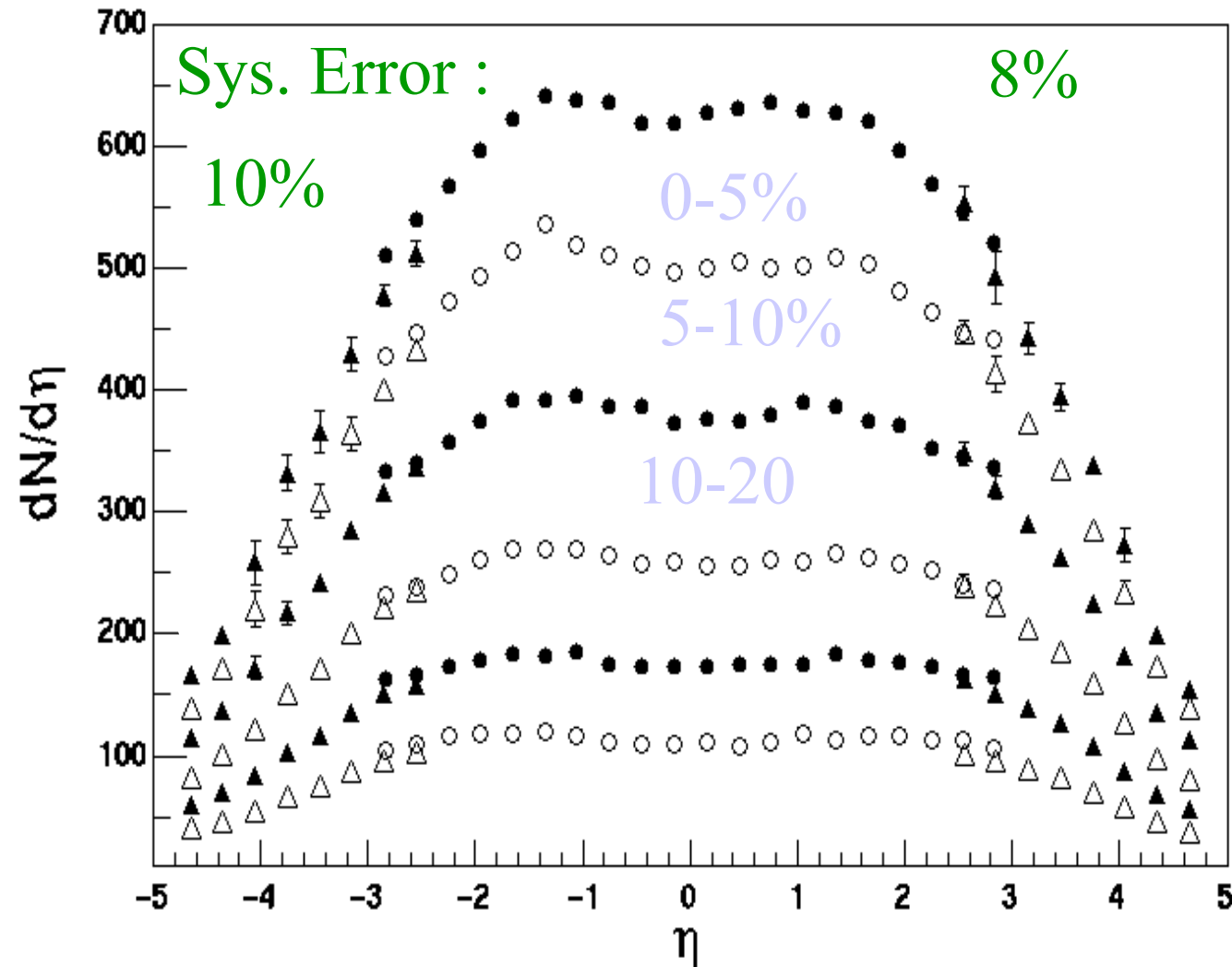


Can we kill models?



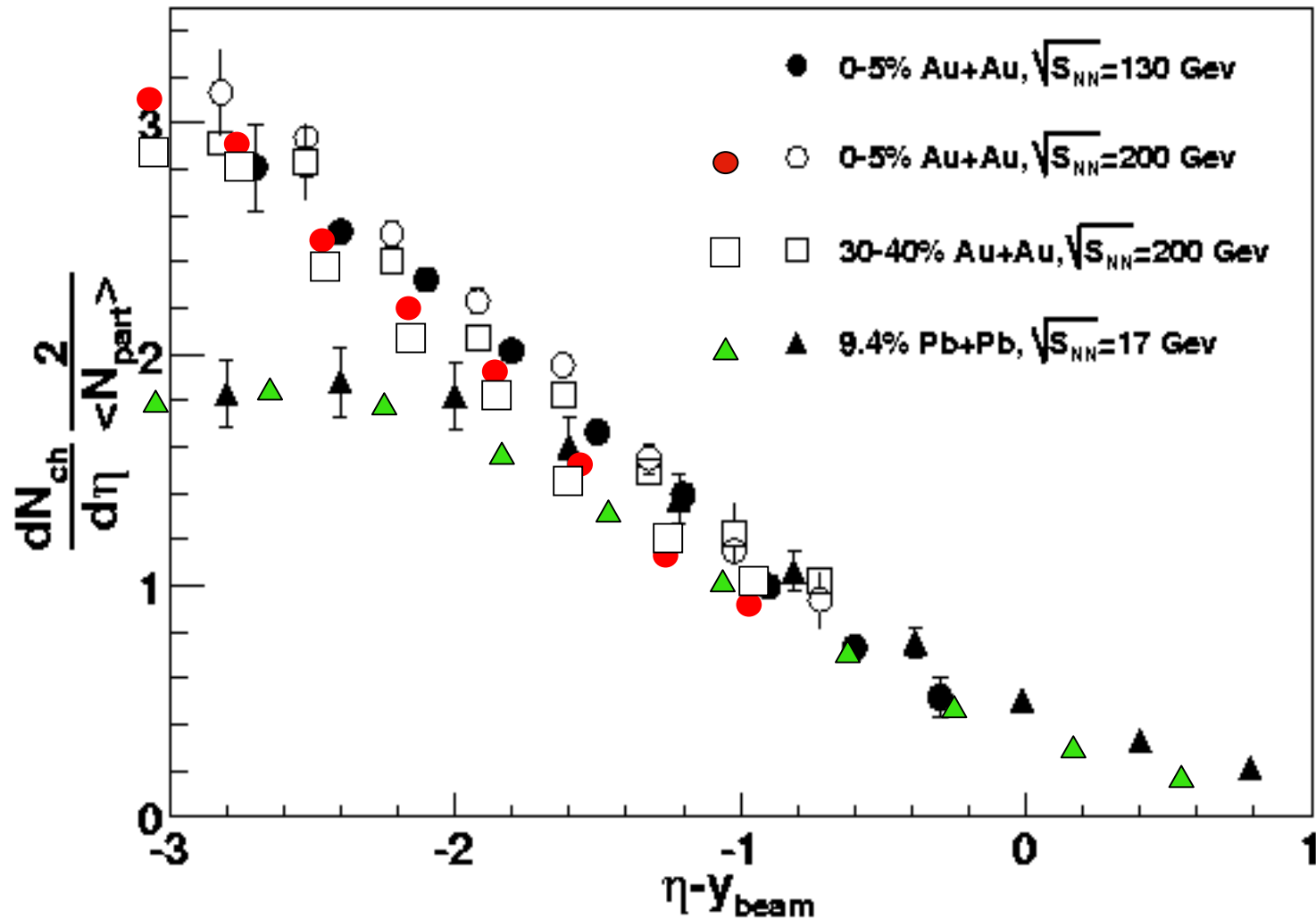
Particle production

$dN^{\text{ch}}/d\eta @ \sqrt{s_{\text{mn}}} = 200 \text{ GeV}$

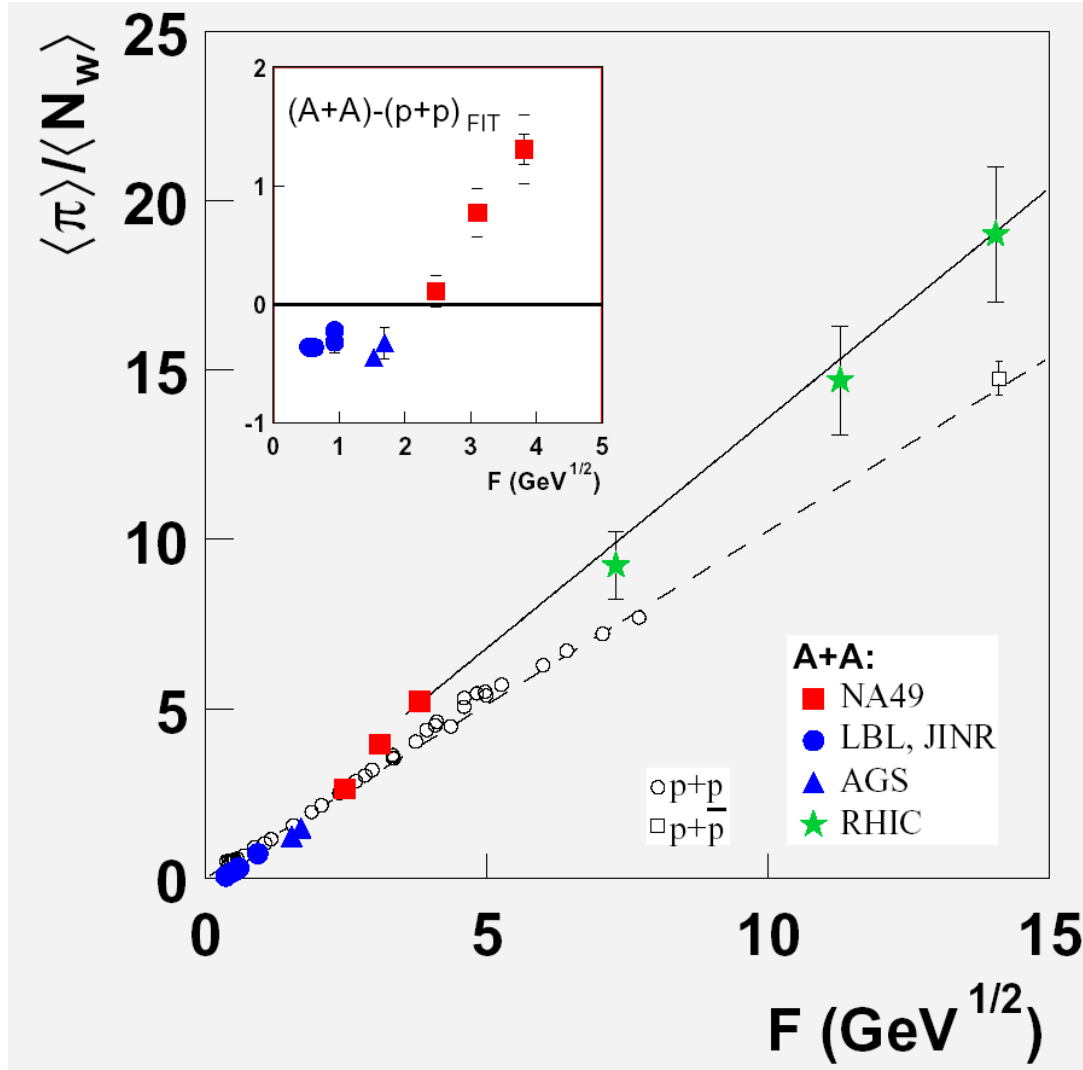


- 100A GeV+100
A GeV:
- $\int N(\text{ch})d\eta =$
4630
 - Central 0-5%
 $dN(\text{ch})/d\eta (\eta=0)$
=632
 - FWHM of
distribution
 $\Delta\eta = 7.5 \pm 0.5$

Limiting fragmentation



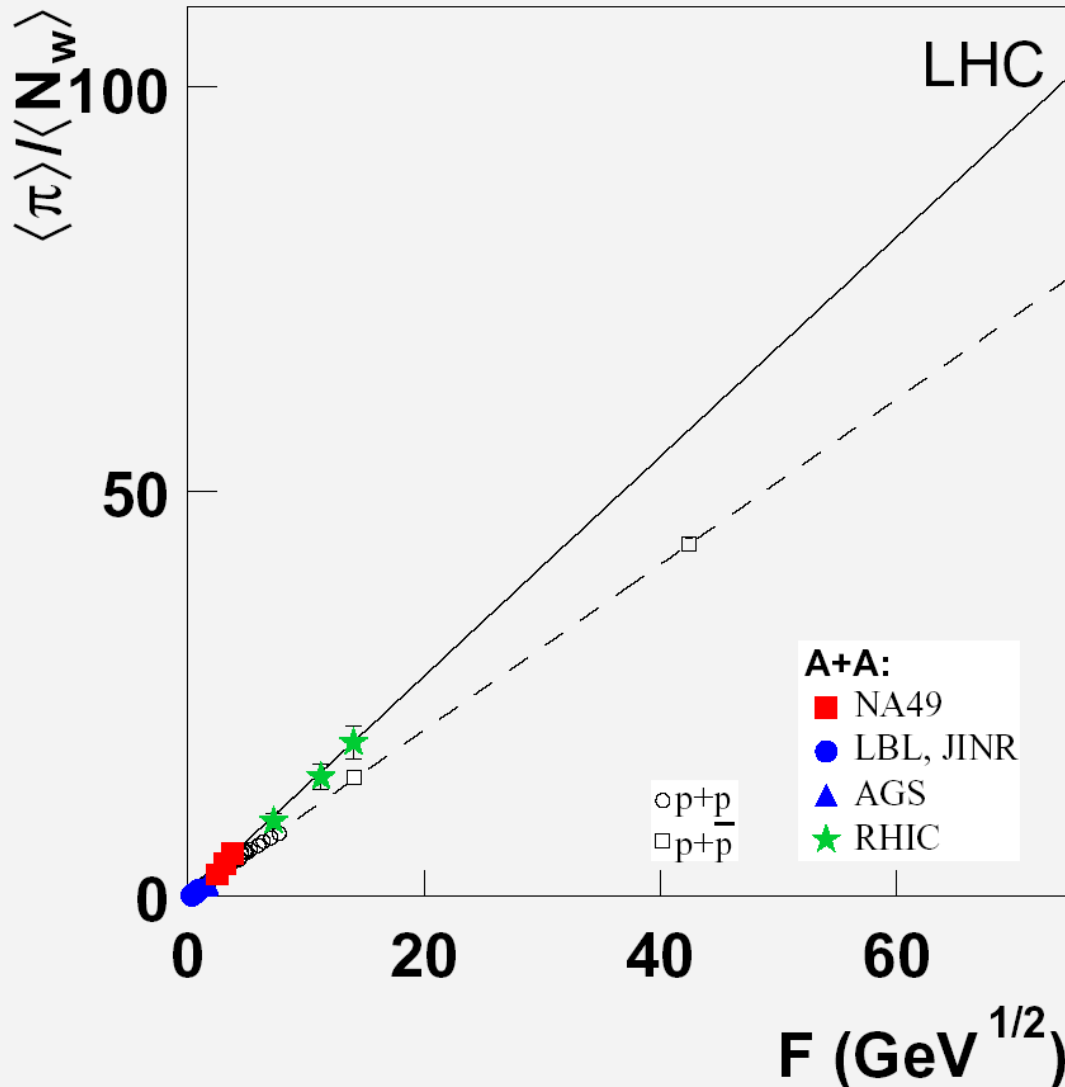
Energy dependence of pion production (1)



Change from pion suppression in AA compared to pp at low energy to enhancement at high energy

$$F \stackrel{\text{def}}{=} (\sqrt{s} - 2m_N)^{3/4} / \sqrt{s}^{1/4}$$

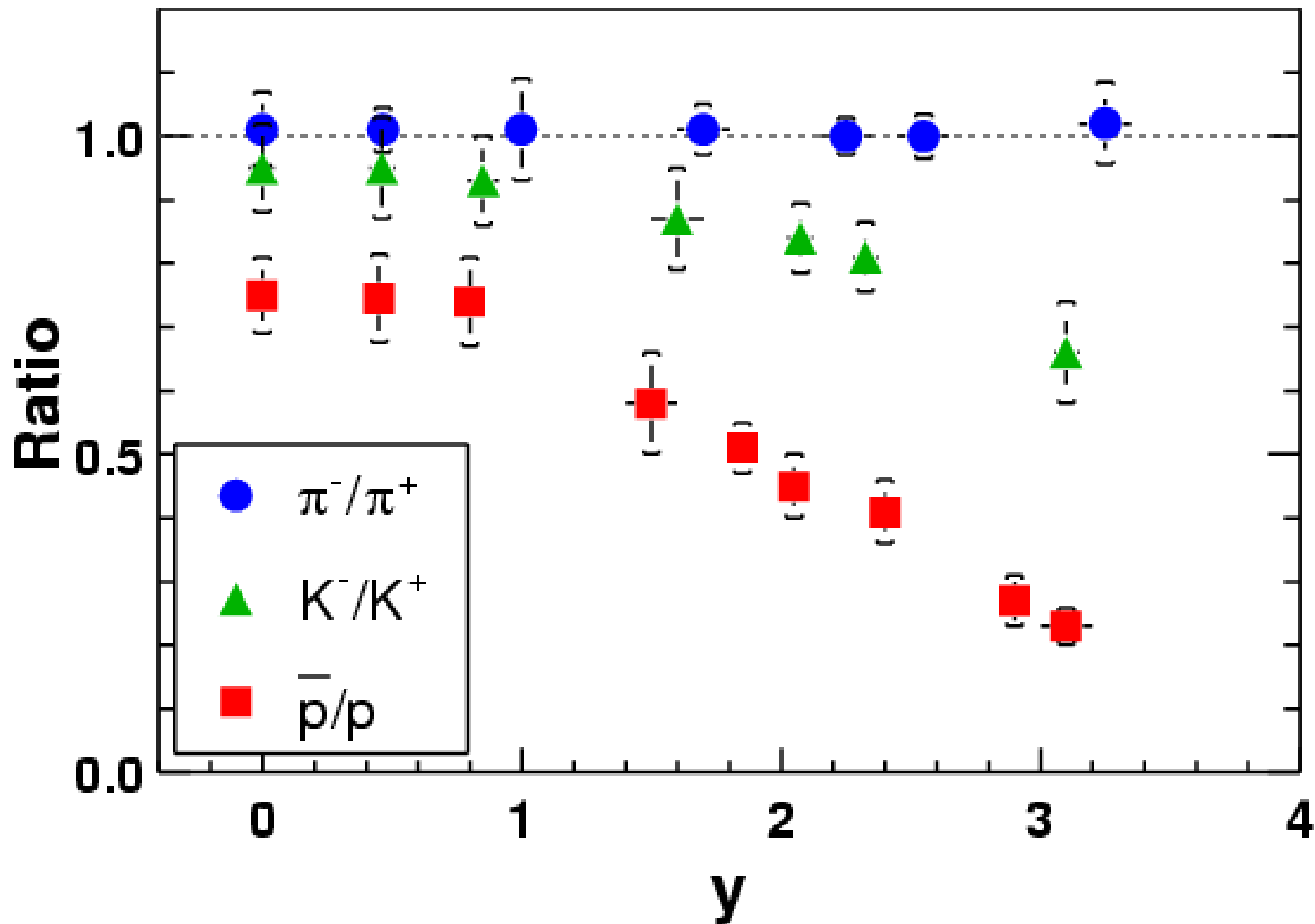
Energy dependence of pion production (2)



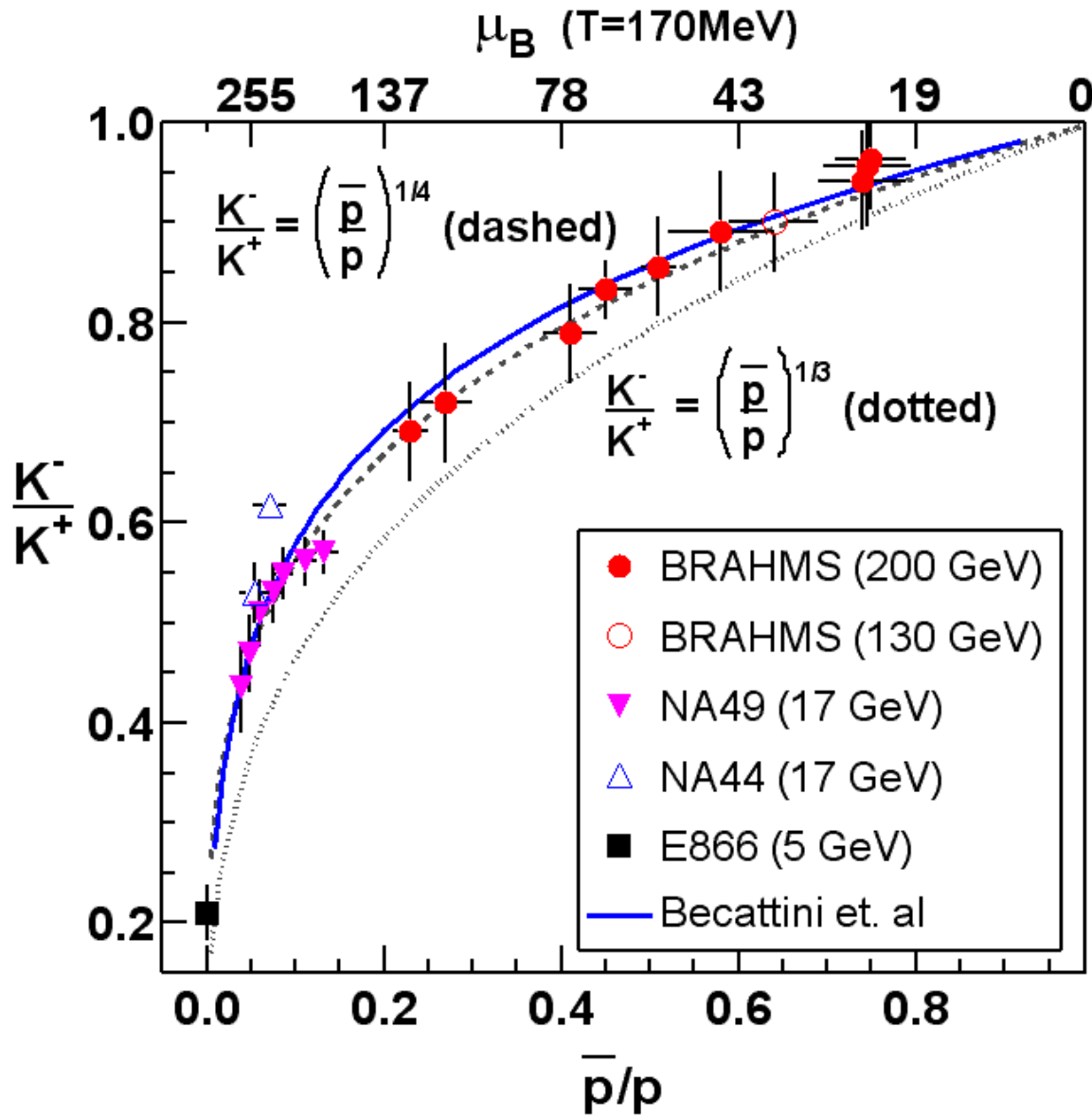
Prediction for LHC

$$F \stackrel{\text{def}}{=} (\sqrt{s} - 2m_N)^{3/4} / \sqrt{s}^{1/4}$$

Antiparticle/particle ratio – rapidity dependence



Thermal models at RHIC

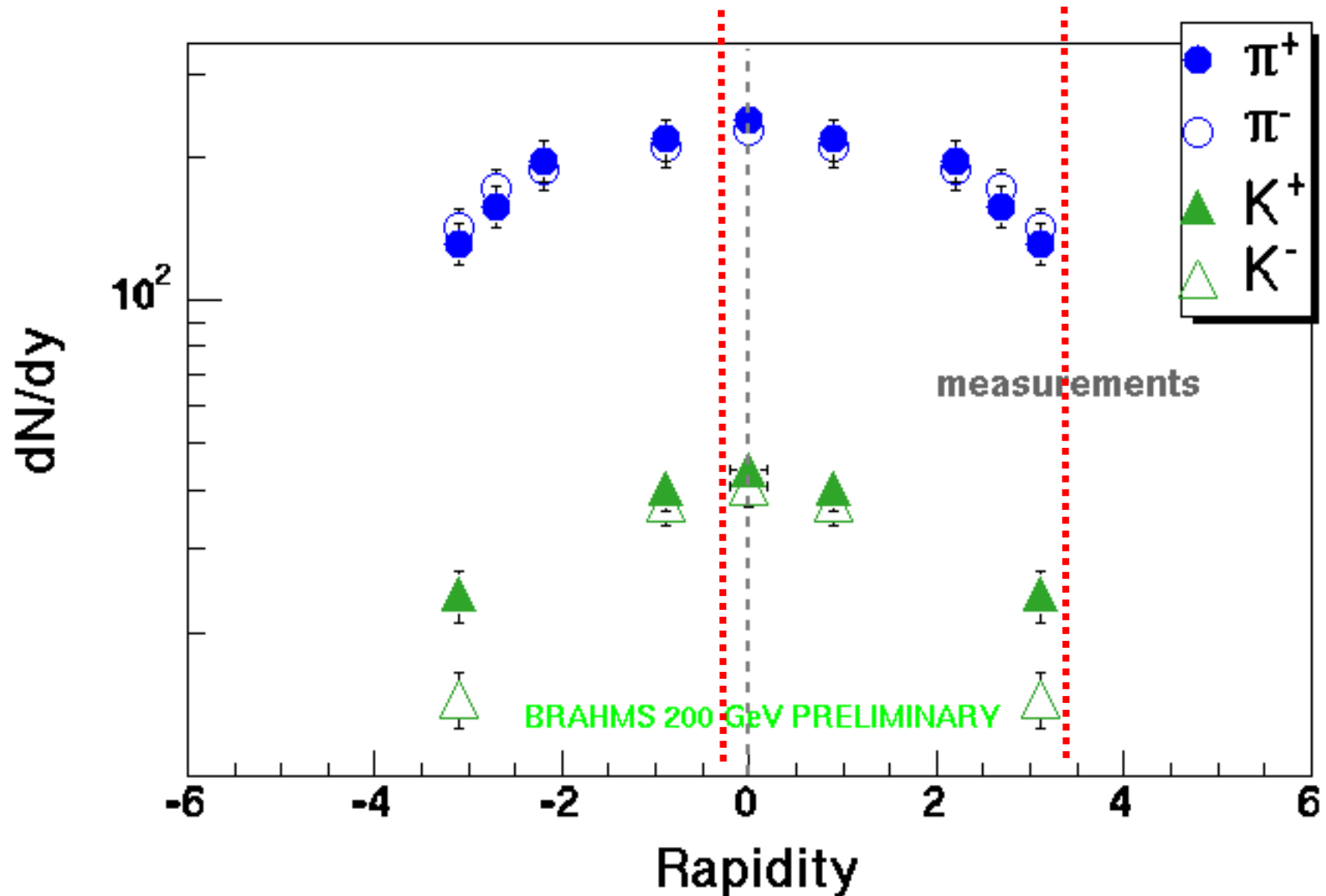


F. Becattini, J. Cleymans, A. Keranen, E. Suhonen, K. Redlich, Phys.Rev. **C64** (2001) 024901:

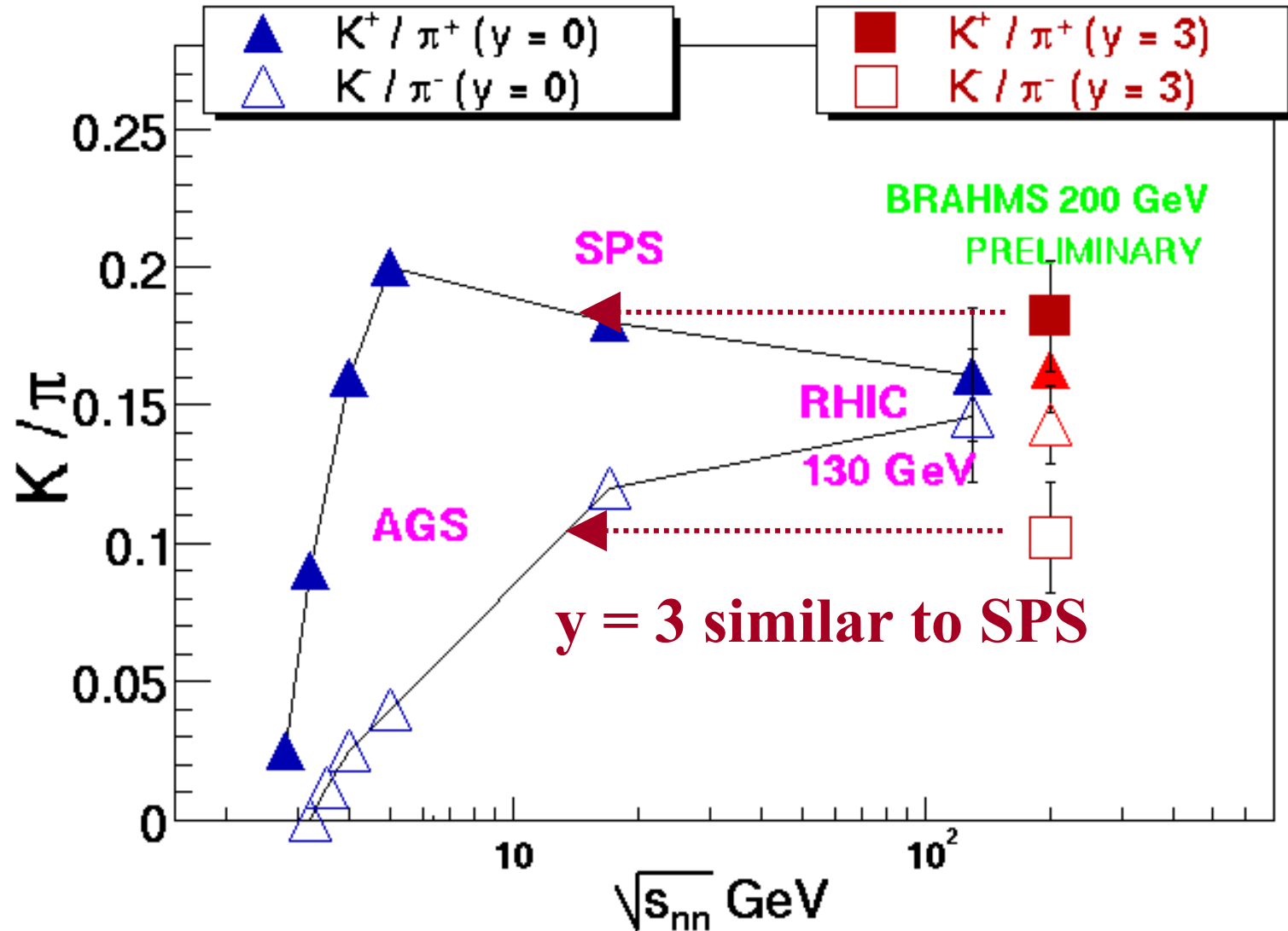
$$T=170, g_s=1$$

PBM (Phys.Lett. B518 (2000)41) predicts $y=0$ ratios almost exactly

Rapidity distributions



Strangeness : K/π systematics

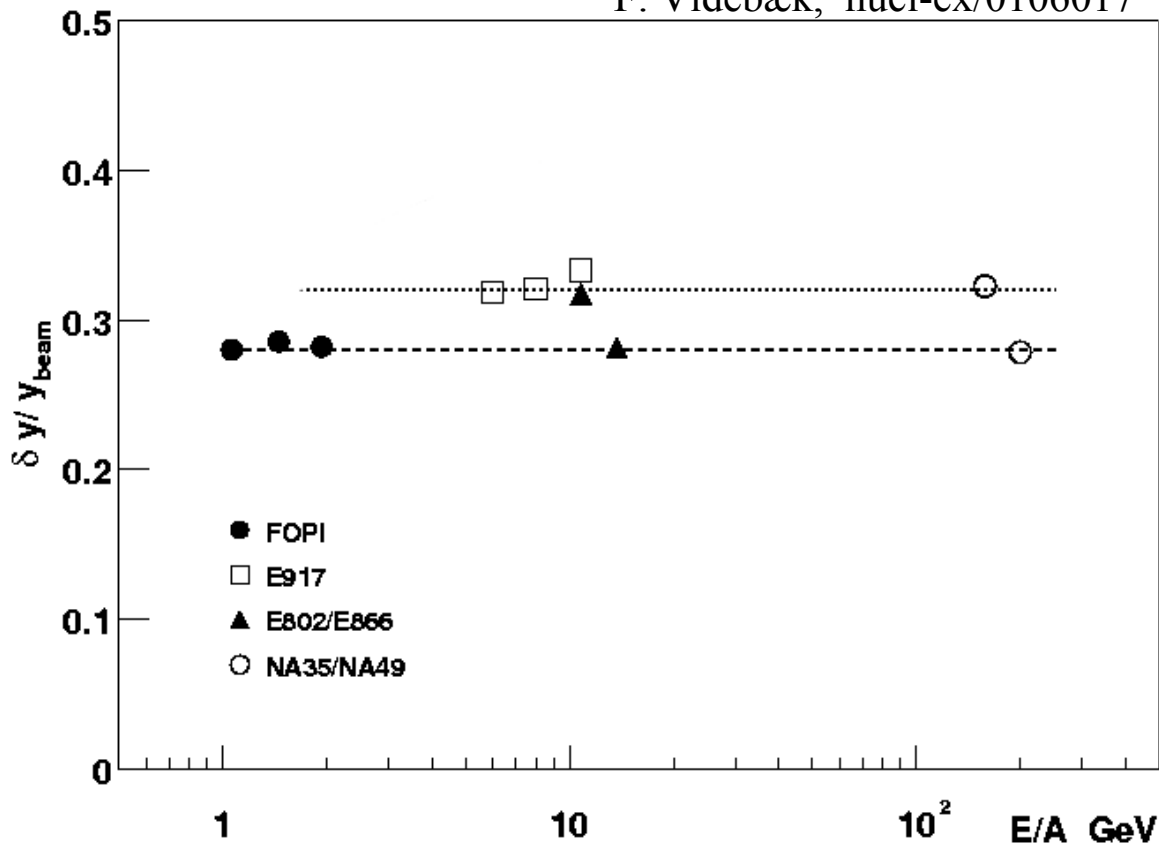


Summary

- **K^-/K^+ , $pbar/p$ ratios fall off with rapidity**
 - **Universal correlation between K^-/K^+ and $pbar/p$**
 - **K^-/π^- decreases from 0.15 ($y=0$) to 0.1 ($y=3$)**
 - **Measured dN/dy over 3 units of rapidity.**
 - **Dramatic increase in net protons at $y=3$**
- \Rightarrow Low to high chemical potential from $y=0$ to $y=3$**
- \Rightarrow Net baryon central plateau ($y=0$ to almost $y=2$)**

Stopping

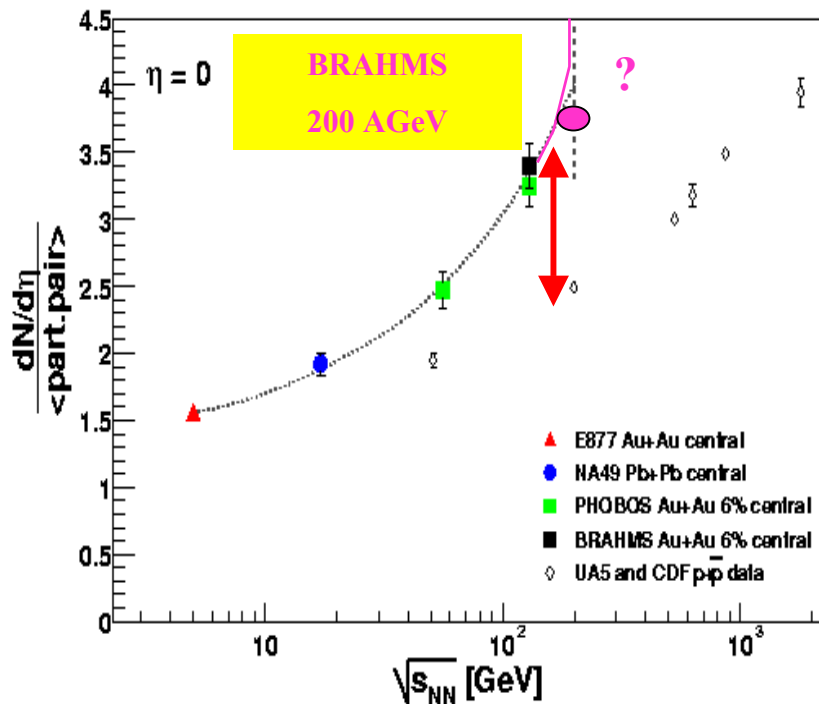
F. Videbæk, nucl-ex/0106017



- Rapidity loss
 - energy dependence

$$\delta y_p = \frac{\int dy dN/dy (y_p - y)}{\int dy dN/dy}$$

$dN_{ch}/d\eta$ vs. participant nucleon pairs - energy dependence



• 130 AGeV

- 3900 charged part. observed
- $N_{ch} \approx 23.5$ pr. part. pair
- cf. $N_{ch} \approx 17$ in p+p at $\sqrt{s}=130\text{GeV}$
- 35-40% increase over p+p

• 200 AGeV

- 4900 charged part. observed
- $N_{ch} \approx 30$ pr. part. pair
- cf. $N_{ch} \approx 20$ in p+p at $\sqrt{s}=200\text{GeV}$
- 50% increase over p+p