Strangeness production in $\sqrt{s_{NN}} = 200\,GeV$ Au+Au collisions at RHIC

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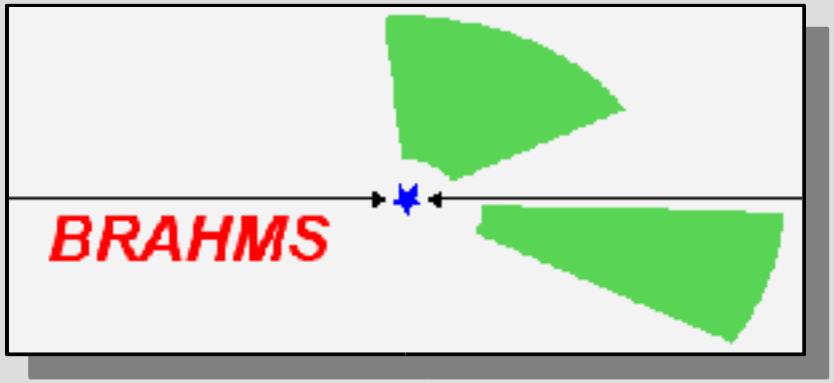
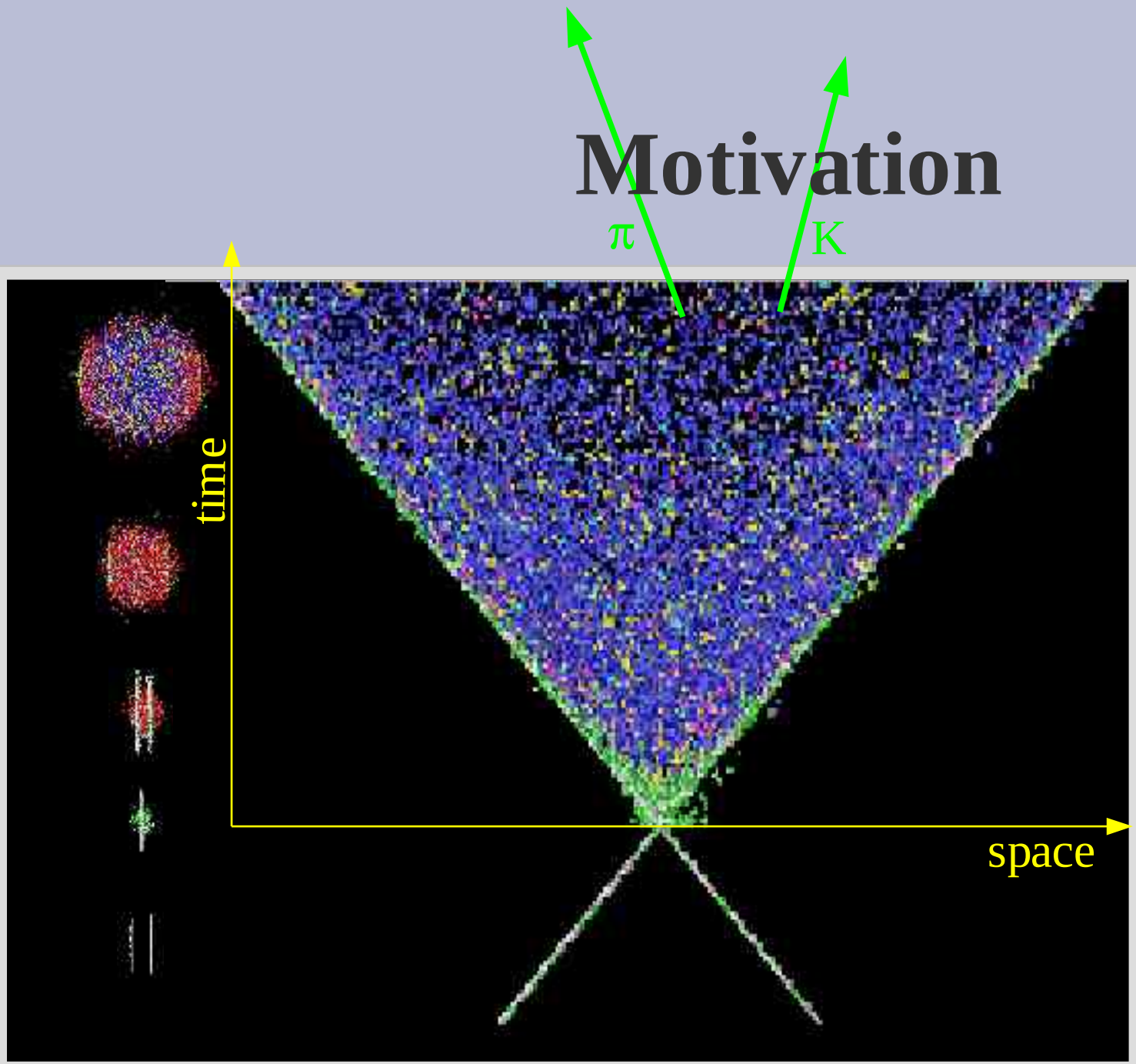


Brief outline

- Motivations
- Experimental setup
- m_T spectra
- Kinematics: $\langle p_T \rangle$
- Yields and ratios
- Dependence on experimental parameters
- Comparison to other experiments and models

Motivation



T. Chujo, PHENIX collaboration, QM02

Chemical freeze out

↑

Expansion

↑

Mixed

↑

QGP

↑

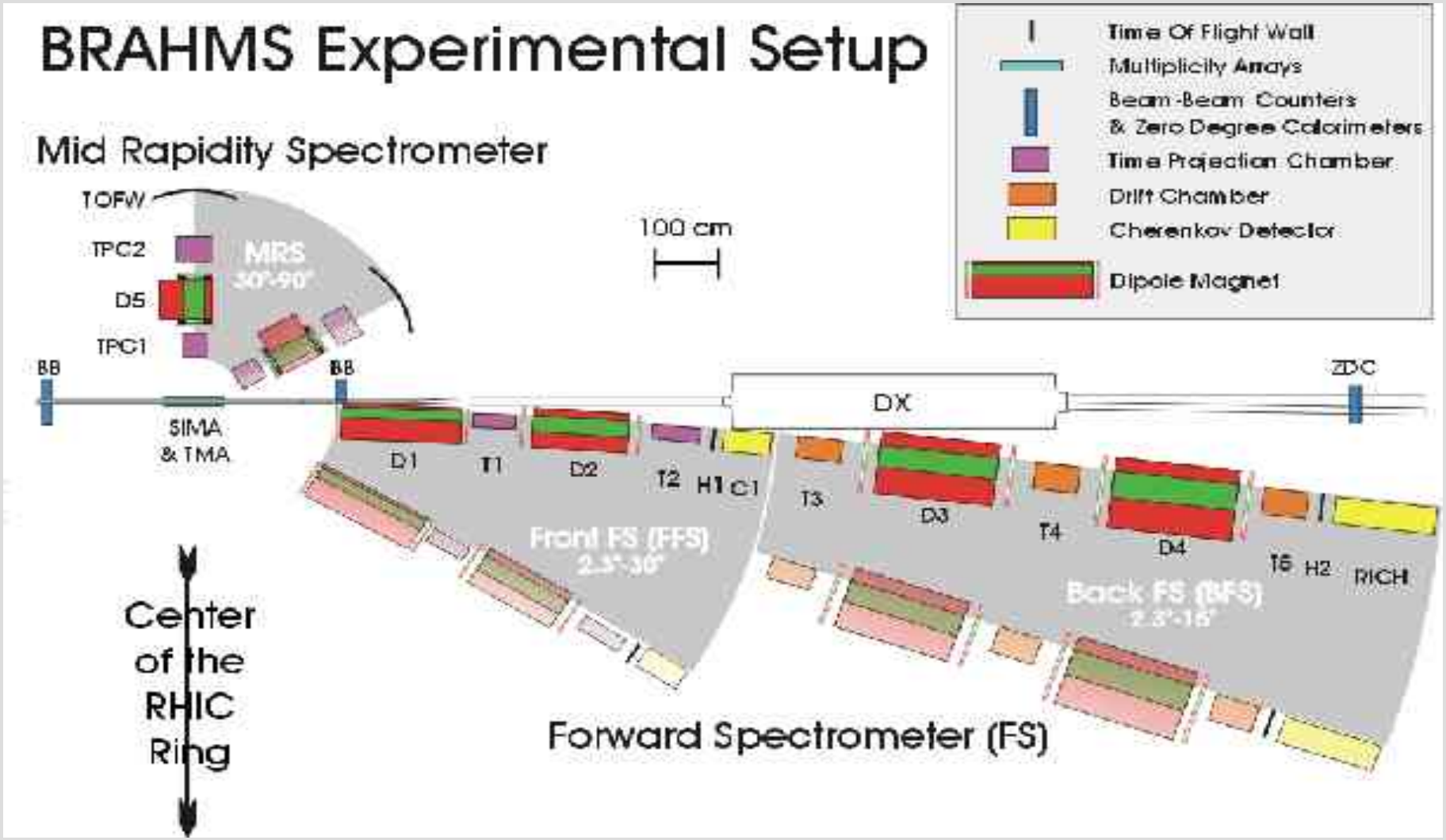
Thermalization

↑

Pre equilibrium

- Probe the chemical bulk properties
- Possible probe for the state of nuclear matter phase

The BRAHMS experiment



K and π spectra

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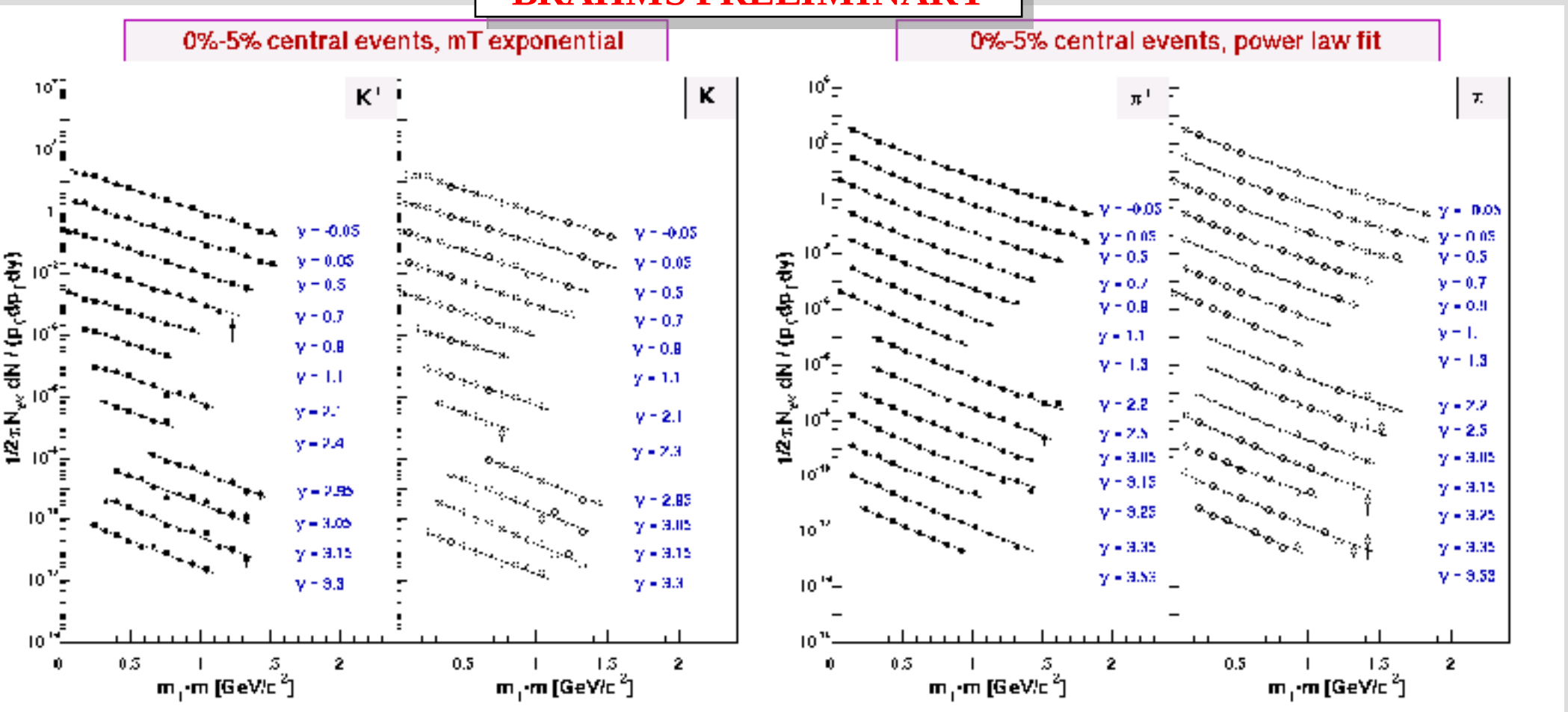
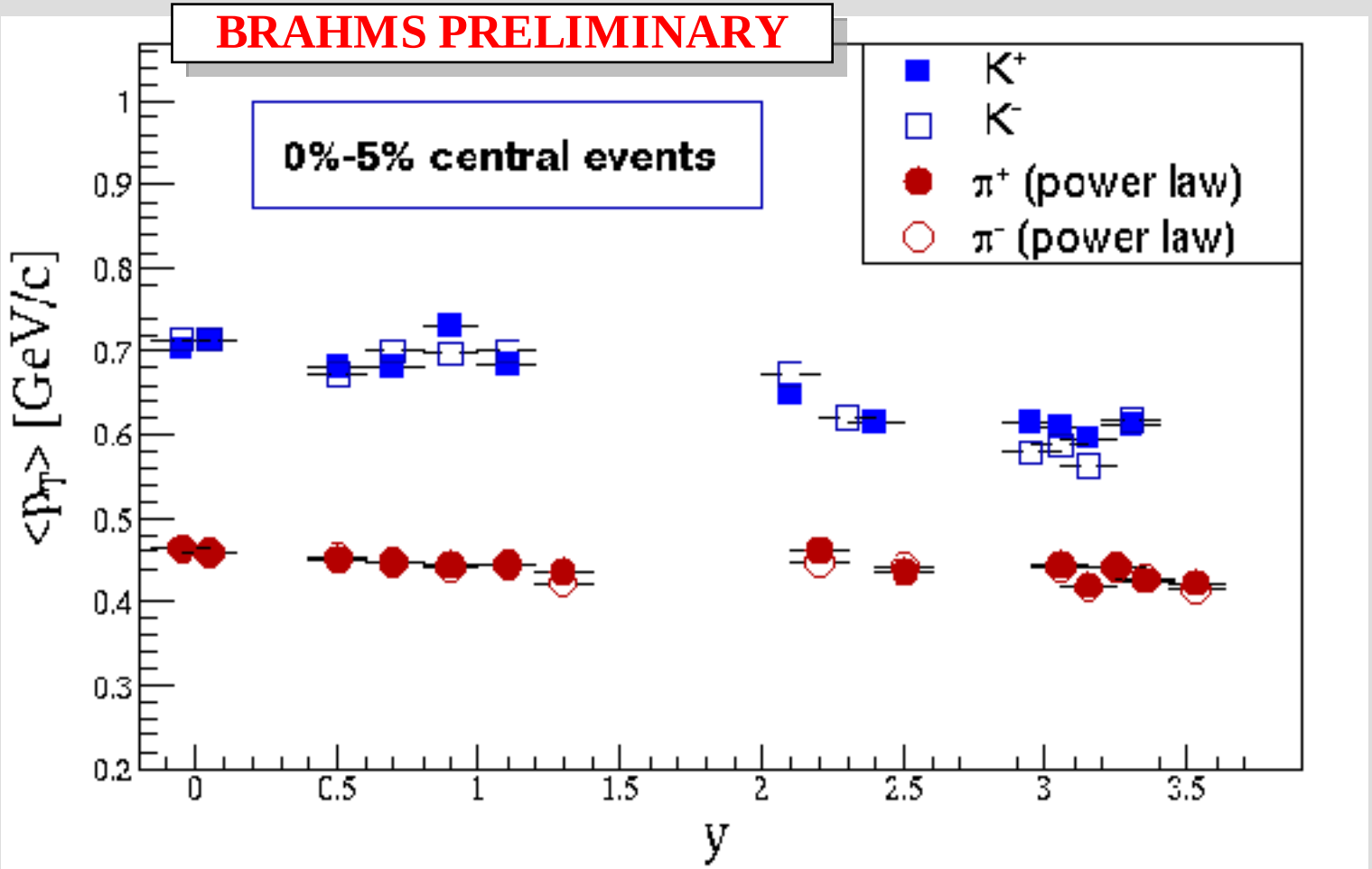


Ph.D thesis by D.Ouerdane, NBI

Mean p_T

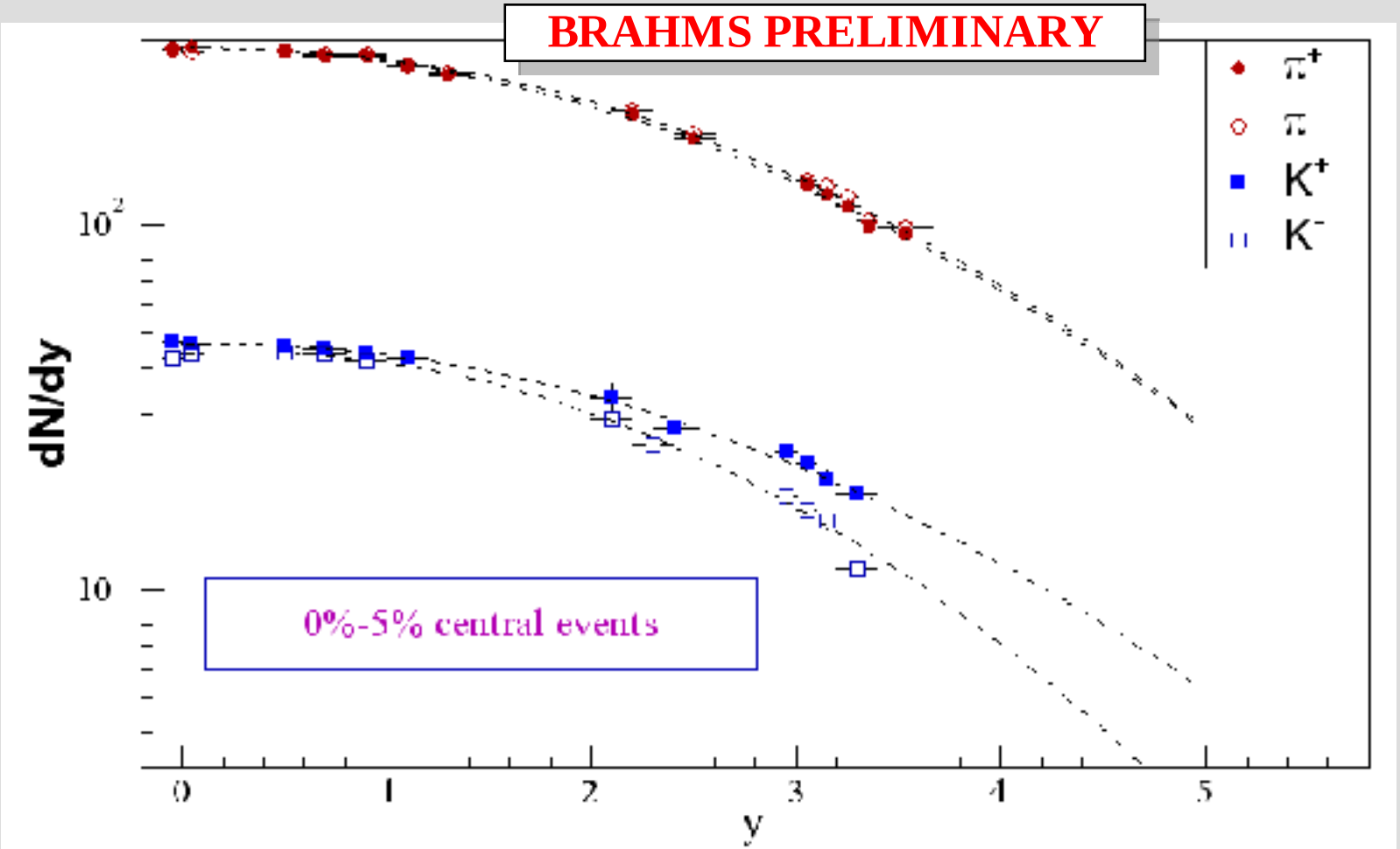


Overall slighty less transverse expansion at y=3 than at y=0

STAR / PHENIX: saturation of $\langle p_T \rangle$ at y~0 with increasing centrality: 15-20% increase in $\langle p_T \rangle$ for kaons and 20-25% for pions

- $\langle p_T \rangle$ estimated from fit functions
- Slow decrease in $\langle p_T \rangle$ for kaons and pions
- possibly a slightly steeper gradient for kaons

Yields



- Plateau at y ~ 0? No conclusive answer.
- $\sigma(\pi^+) = 2.28 \pm 0.02$
- $\sigma(\pi^-) = 2.33 \pm 0.02$
- $\sigma(K^+) = 2.42 \pm 0.06$
- $\sigma(K^-) = 2.12 \pm 0.04$

Single Gaussian preliminary fits:

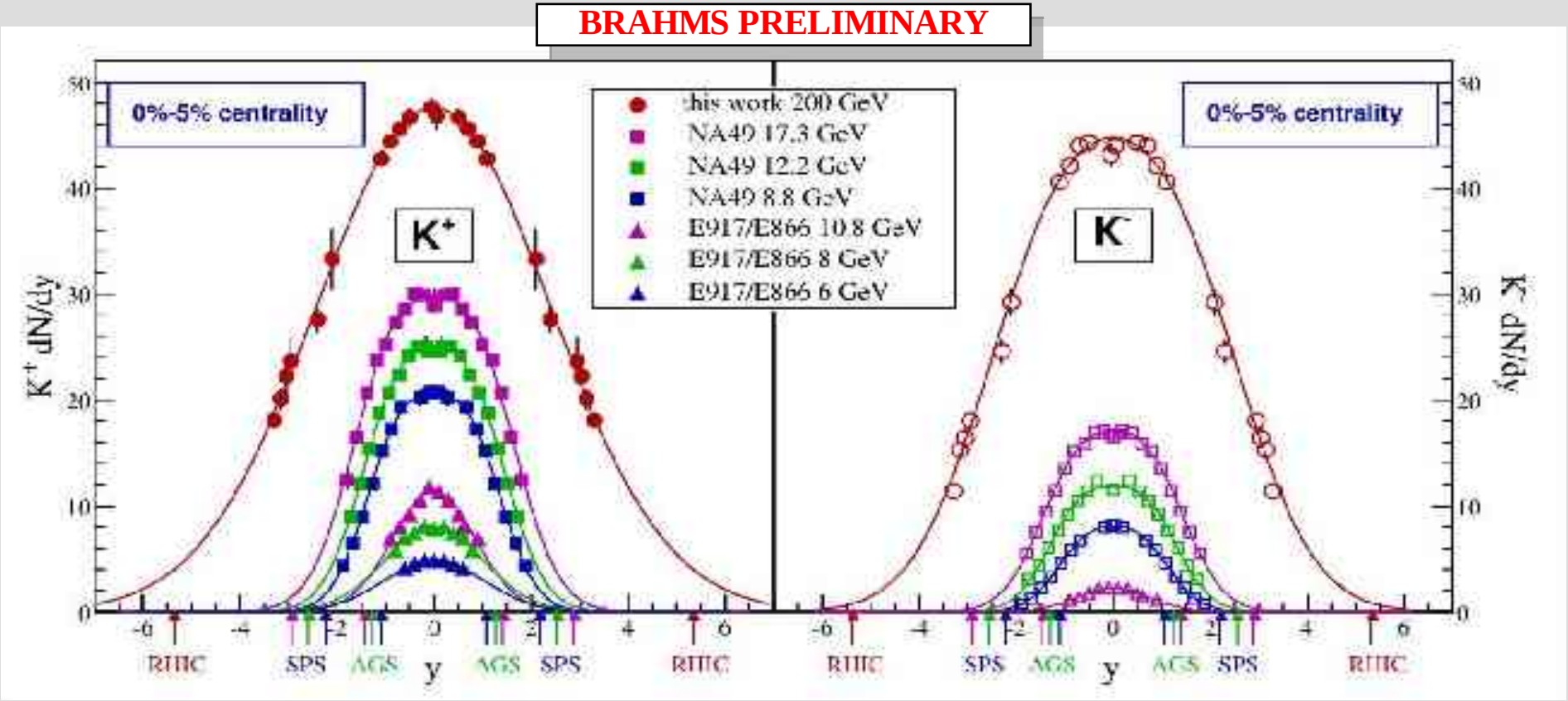
$N_{\pi^+} \approx 1755 \pm 11$

$N_{\pi^-} \approx 1796 \pm 12$

$N_{K^+} \approx 286 \pm 4$

$N_{K^-} \approx 243 \pm 2$

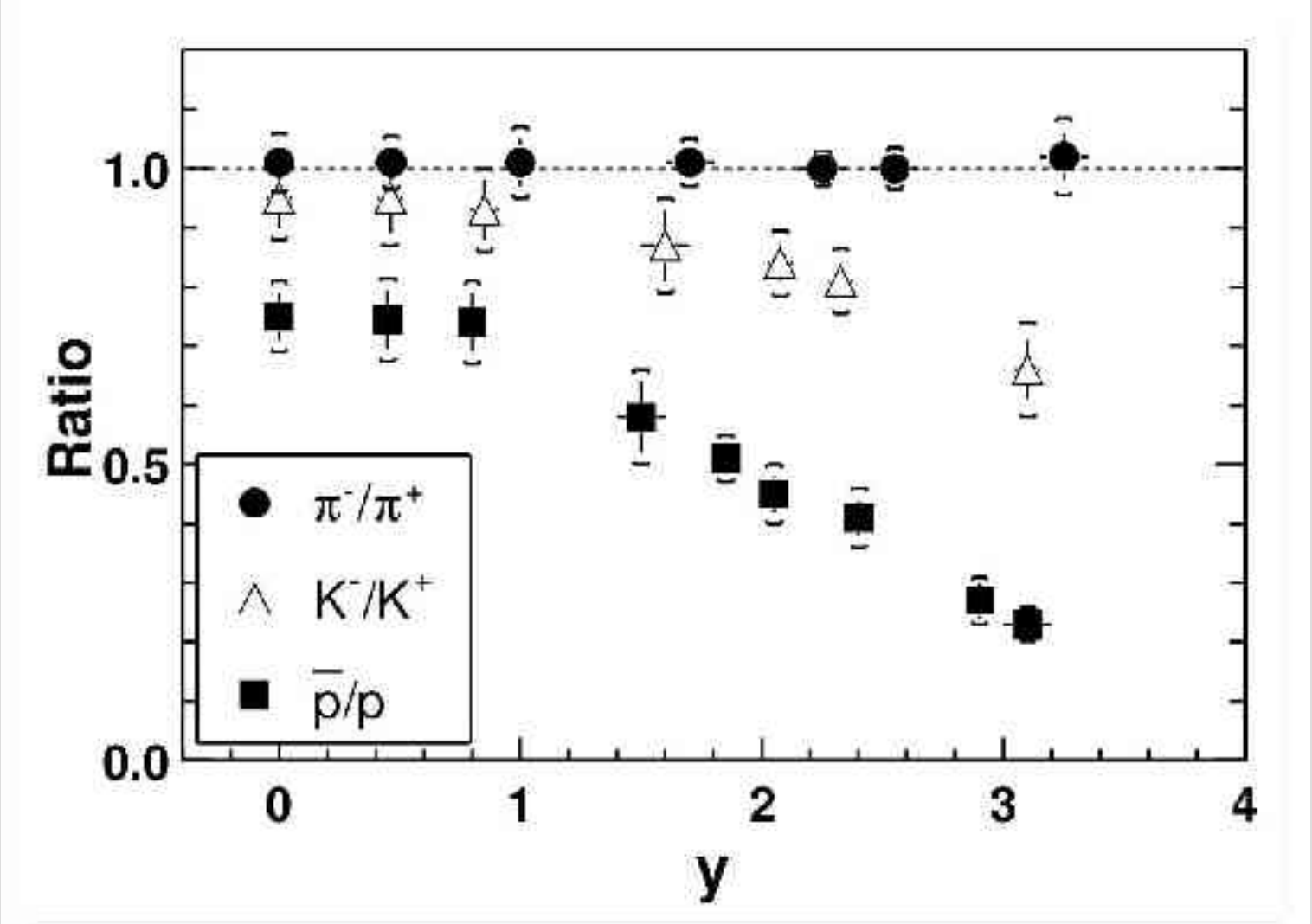
Kaon dN/dy vs lower energies



The shape of the K^+ distribution still wider than of K^-. However they approach each other.

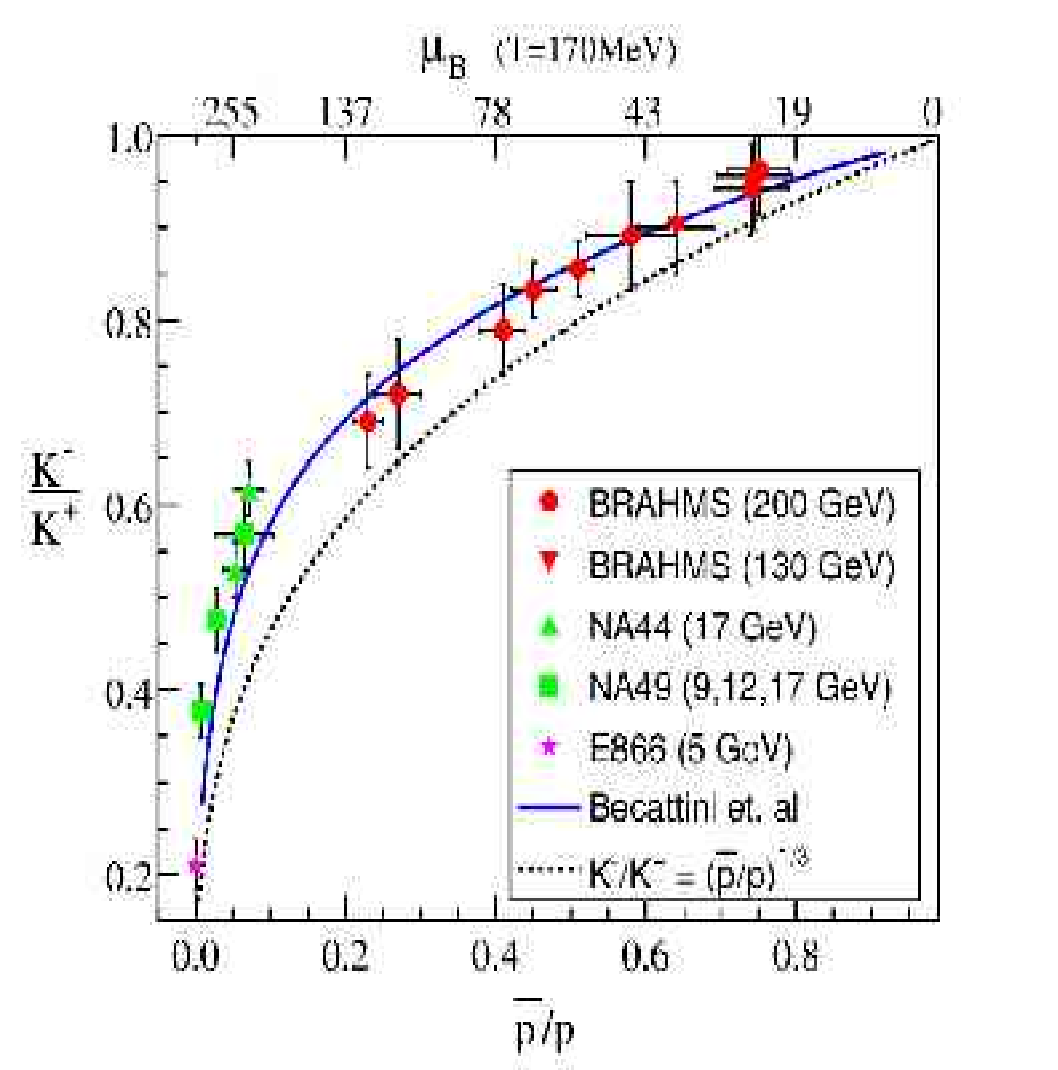
S.V.Afanasiev *et al.*, NA49 collaboration
[Phys. Rev. C **66,** 054902 (2002)]
L.Ahle *et al.*, E866/E917 collaboration
[nucl-ex/9910008]
[Phys. Lett. B **490**, 53 (2002)]
[Phys. Rev. C **60**, 044904 (1999)]

Like particle ratios



I.G.Bearden *et al.*, BRAHMS collaboration [Phys. Rev. Lett. **90**, 102301 (2002)]

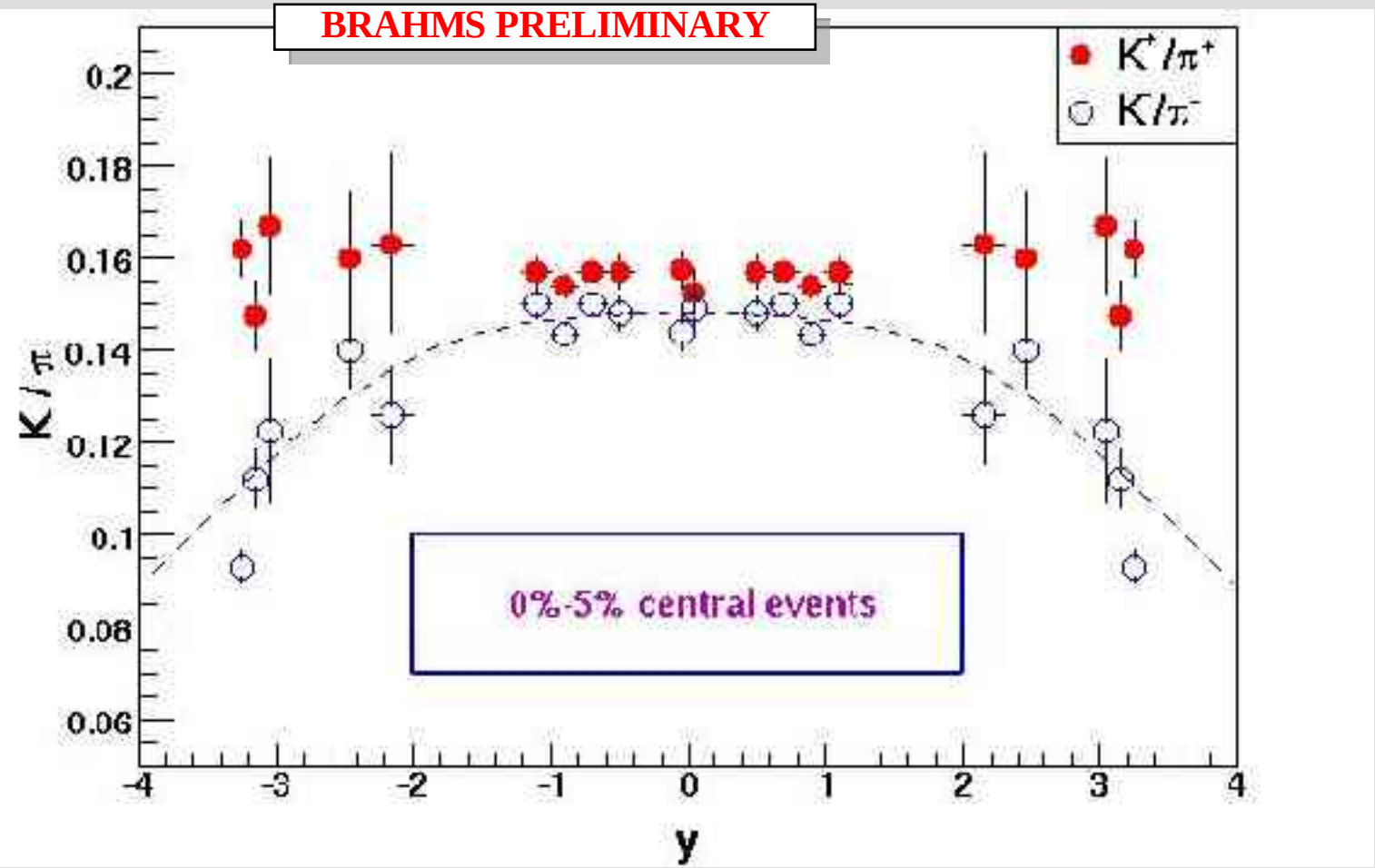
Comparison to thermal model



I. G. Bearden *et al.*, BRAHMS collaboration
[Phys. Rev. Lett. **90**, 102301 (2002)]
F. Becattini *et al.*,
[Phys. Rev. C **64**, 024901 (2001)]

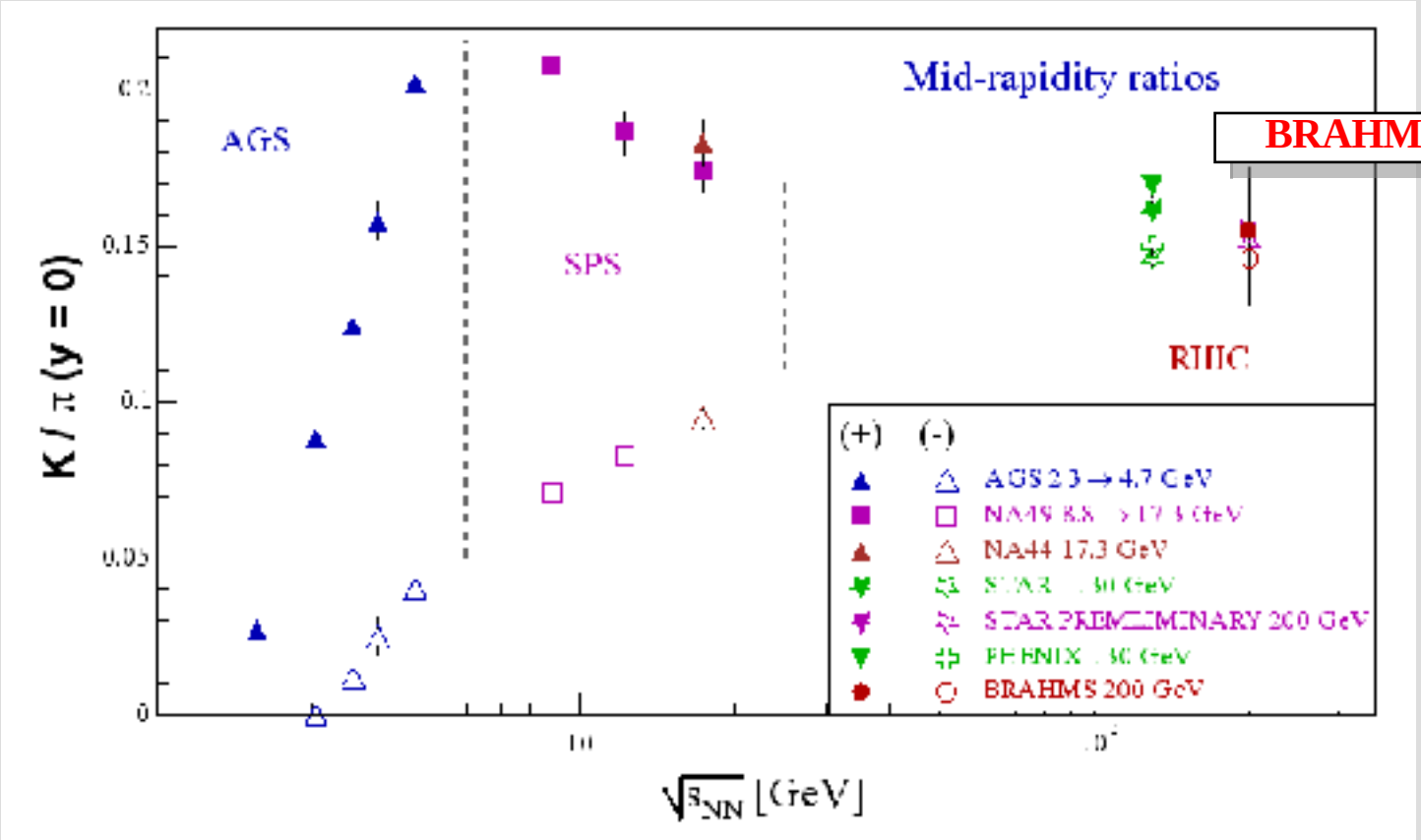
RHIC, SPS and AGS data well described by thermal model.

K/π(y)



K^+/π^+ constant throughout BRAHMS' acceptance
K^-/π^- decreases with increasing y

$K/\pi(\sqrt{s_{NN}})$



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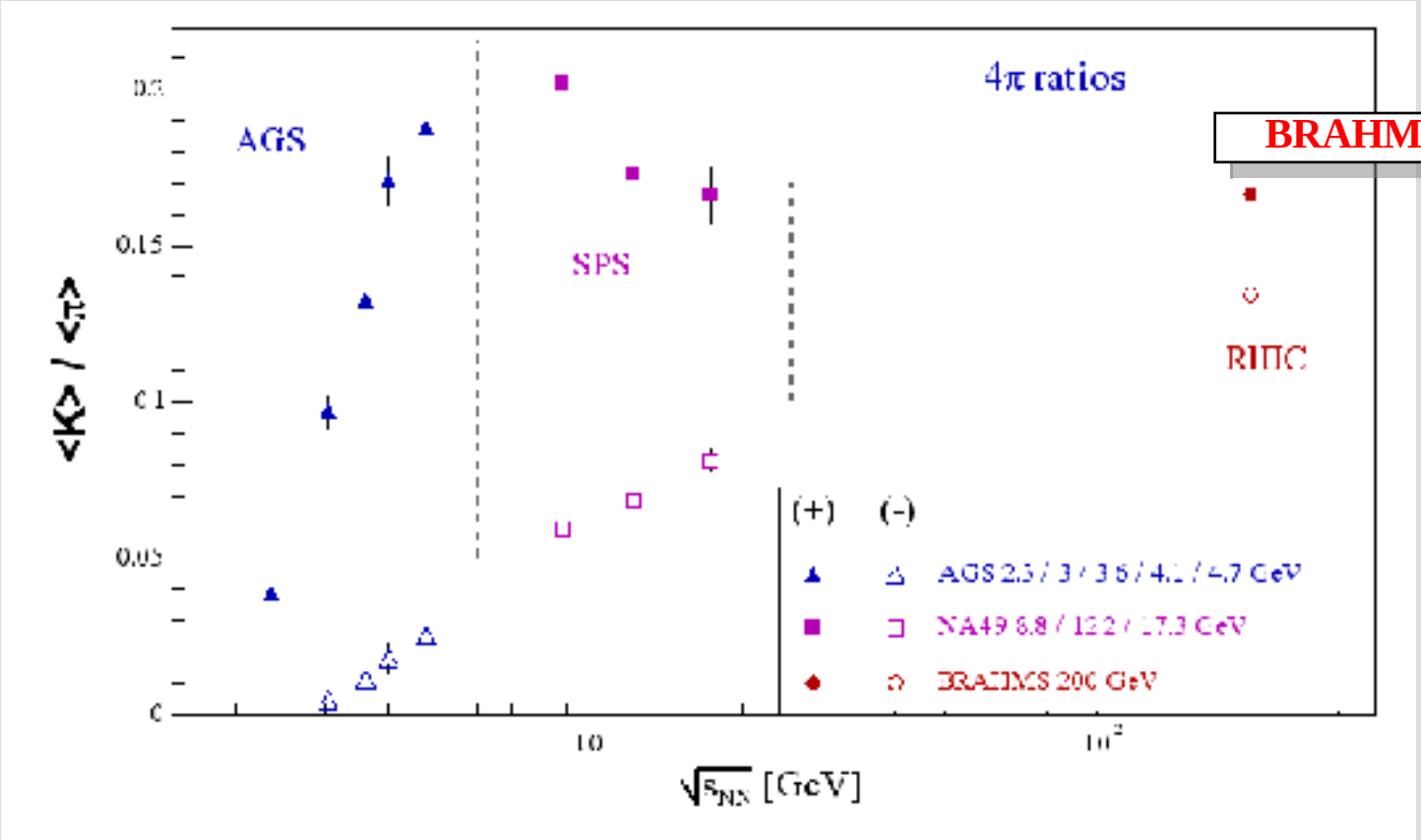
J.L.Klay *et al.* (E895 collaboration) [nucl-ex/0306033]
L.Ahle *et al.* (E866/E917 collaboration) [Phys. Rev. C **60,** 044904 (1999)] [Phys. Lett. B **490,** 53 (2000)]
S.V.Afanasiev *et al.* (NA49 collaboration) [Phys. Rev. C **66,** 054902 (2002)]
I.G.Bearden *et al.* (NA44 collaboration) [Phys. Lett. B **471,** 6 (1999)]
C.Adler *et al.* (STAR collaboration) [nucl-ex/0206008]
O.Barannikova, F.Wang (STARcollaboration) [Talk at QM02]
K.Adcox *et al.* (PHENIX collaboration) [Phys. Rev. Lett. **88,** 242301 (2002)]

$K/\pi(\sqrt{s_{NN}})$



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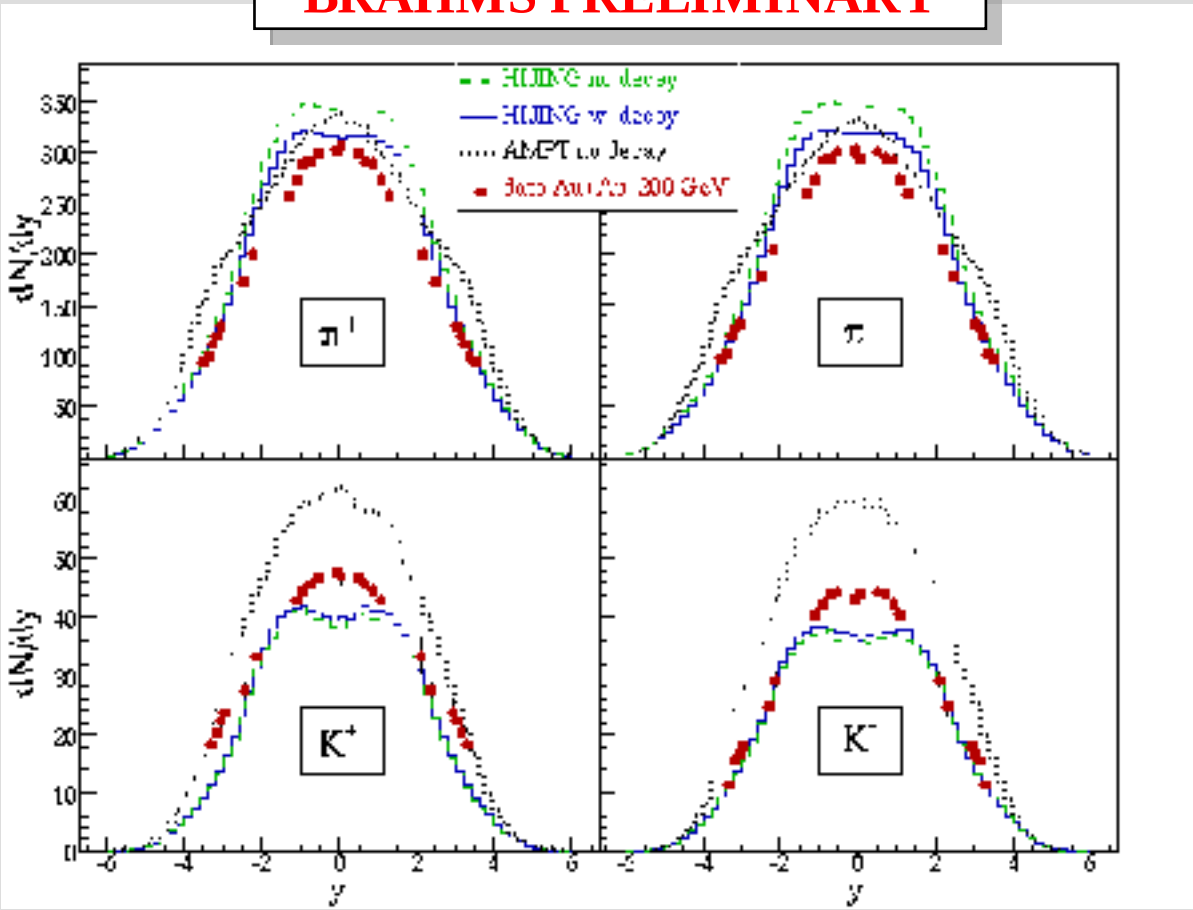
Comparison to more models

BRAHMS PRELIMINARY

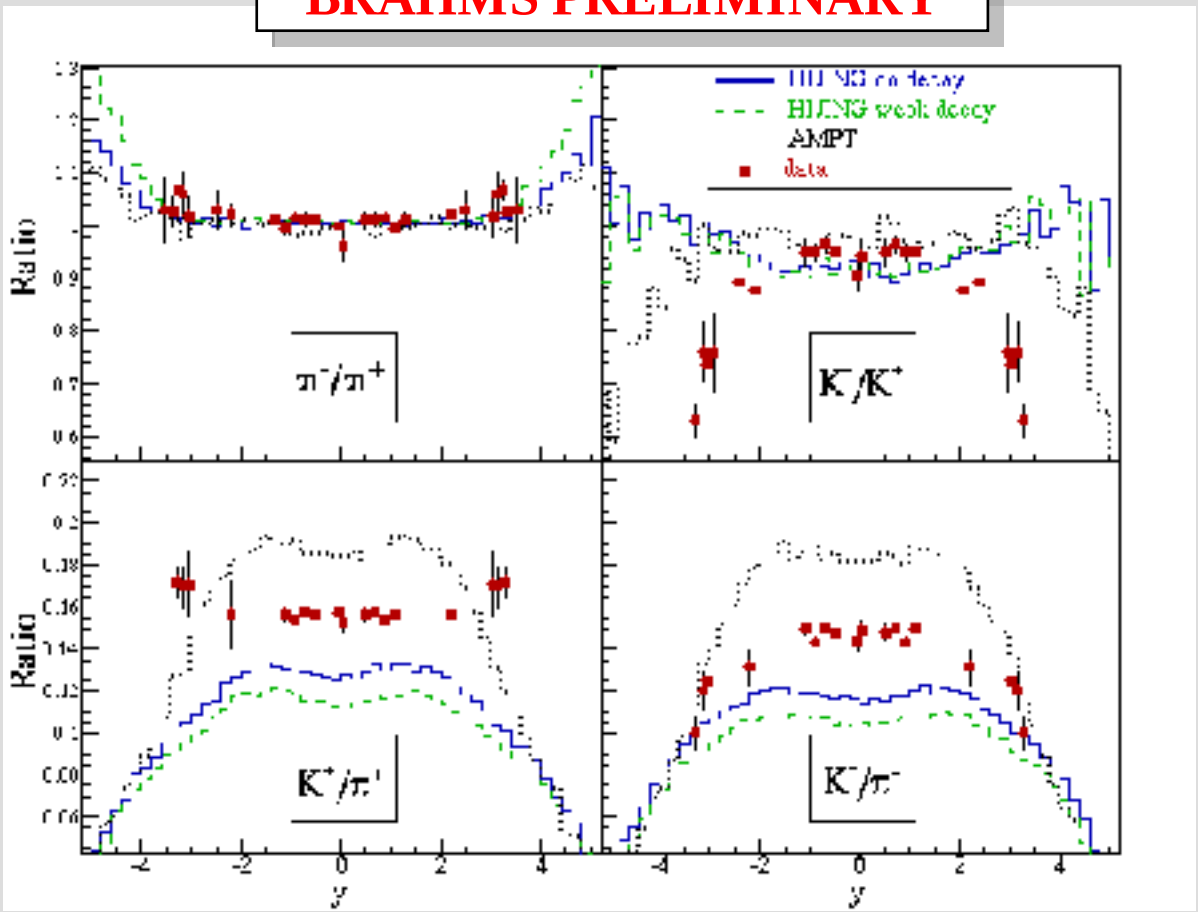


Description of pions not too far off, especially at high rapidity.

Kaon description off by about ¼ at midrapidity.

Comparison to more models

BRAHMS PRELIMINARY



Description of pions not too far off, especially at high rapidity.

Kaon description off by about ¼ at midrapidity.

Thus also K/π.

Summary

The BRAHMS experiment shows interesting results on strangeness in a wide rapidity window, $|y| < 3.5$:

- Slow decrease of $\langle p_T \rangle$ with increasing y, possibly stronger decrease for kaons than for pions
- dN/dy (y) described well by Gaussian, with comparable σ for π and K
- K/π ratios vs $\sqrt{s_{NN}}$: K^+/π^+ saturated while K^-/π^- still rising
- Thermal model describes K^+/K^- vs $\bar{p}p$ nicely
- The Hijing and AMPT models fail in particular in describing kaons rapidity distribution

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. Grotowski[4], 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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[6]New York University, USA
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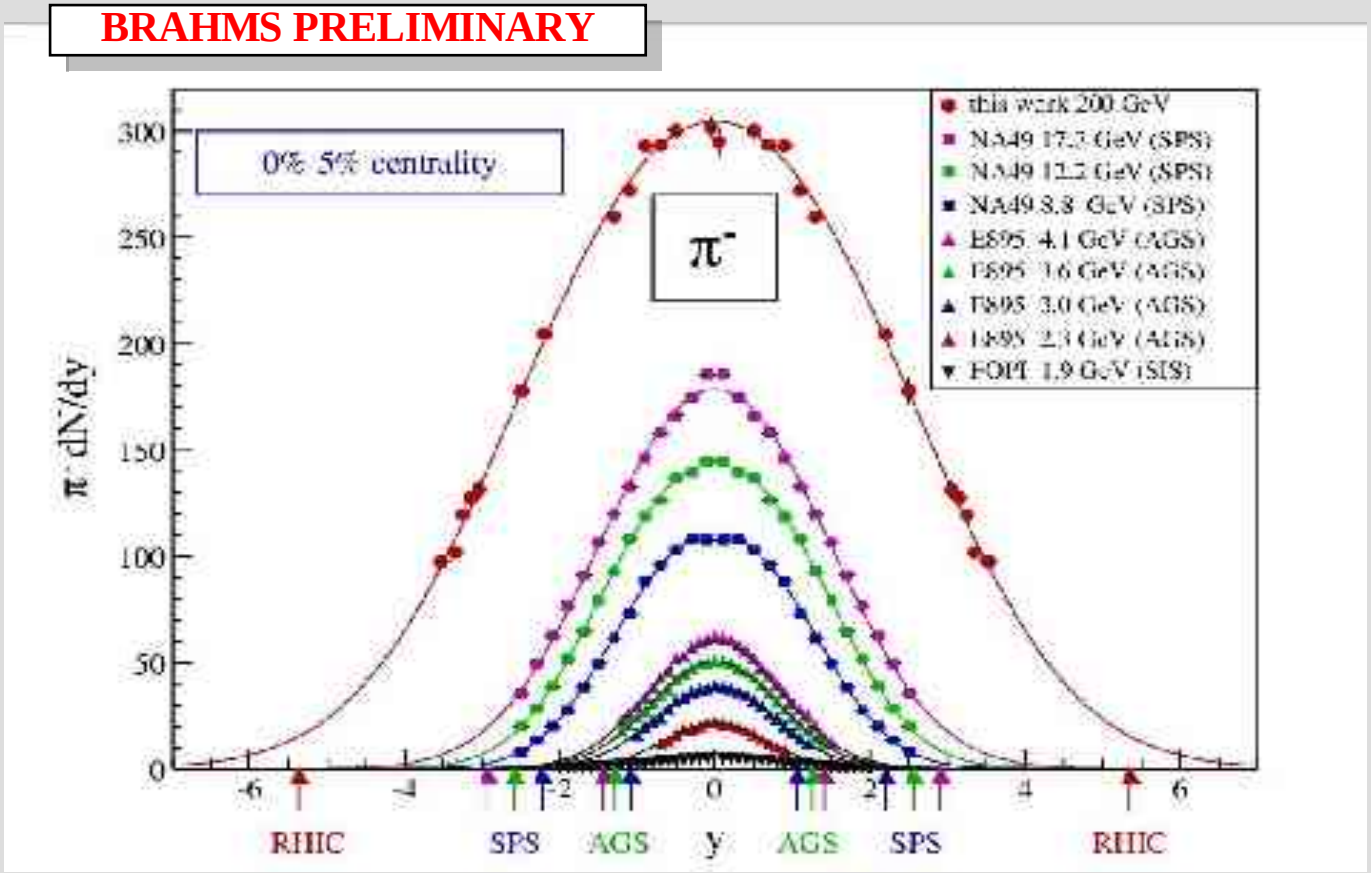
[9]University of Bergen, Norway
[10]University of Bucharest, Romania,
[11]University of Kansas, Lawrence,USA
[12] University of Oslo, Norway

Pion dN/dy compared to lower energies



Comparable shape of pions distributions