

High p_T Spectra of Identified Particles Produced in Pb+Pb Collisions at 158 GeV/nucleon Beam Energy

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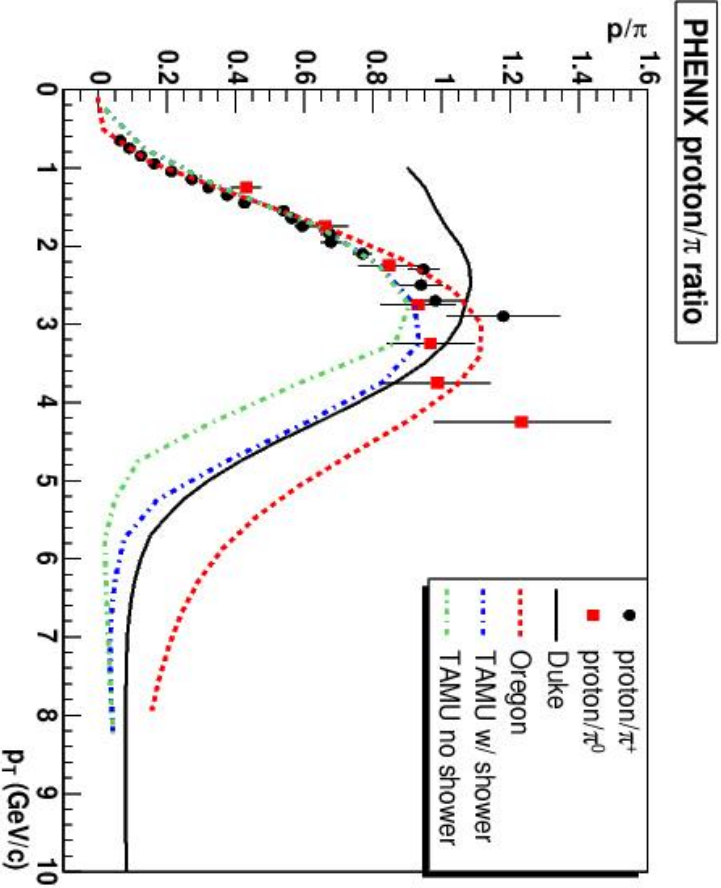
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Quark Matter 2005, Budapest, Hungary

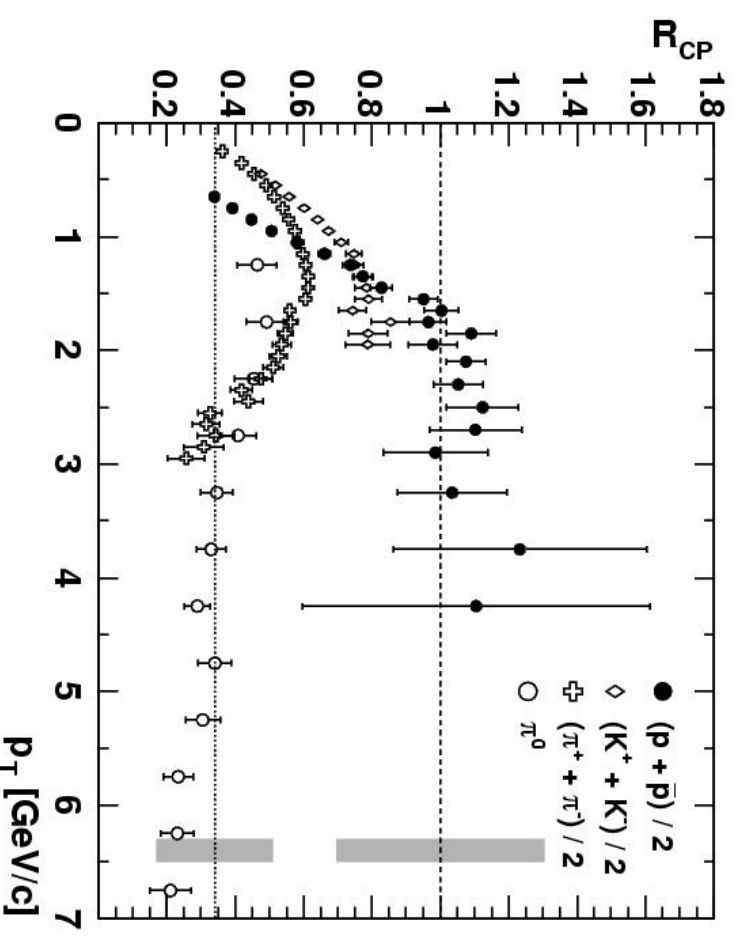
- ➔ Physics motivation: energy dependence.
- ➔ Data sets, centrality selection.
- ➔ Charged hadron analysis.
- ➔ K_s^0 and Λ identification.
- ➔ Hadron yield ratios.
- ➔ R_{CP} for identified charged hadrons.
- ➔ Summary.



Baryon/meson ratio at RHIC

Increasing with p_T , may bend down

Described by coalescence



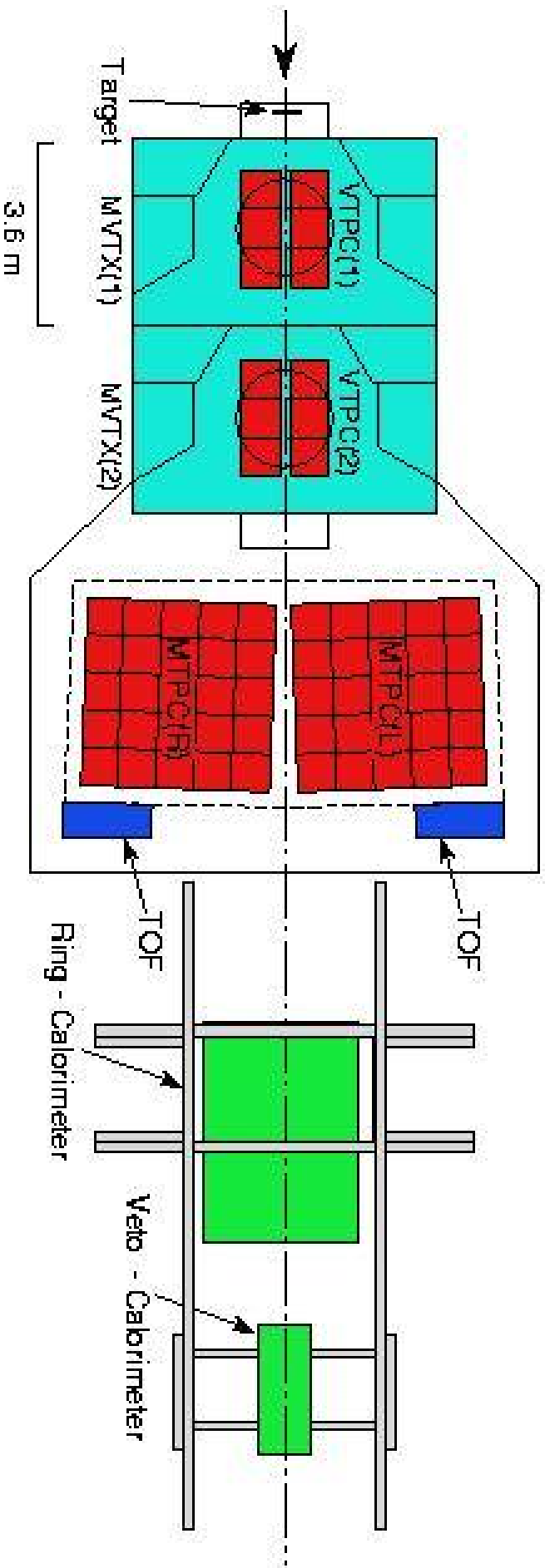
R_{CP} at RHIC

Suppression of high p_T particles

Described by jet-quenching

What is the energy dependence of these effects?

Pb+Pb @ 158 GeV/nucleon beam energy, CERN-NA49.



Data sets from 1996:

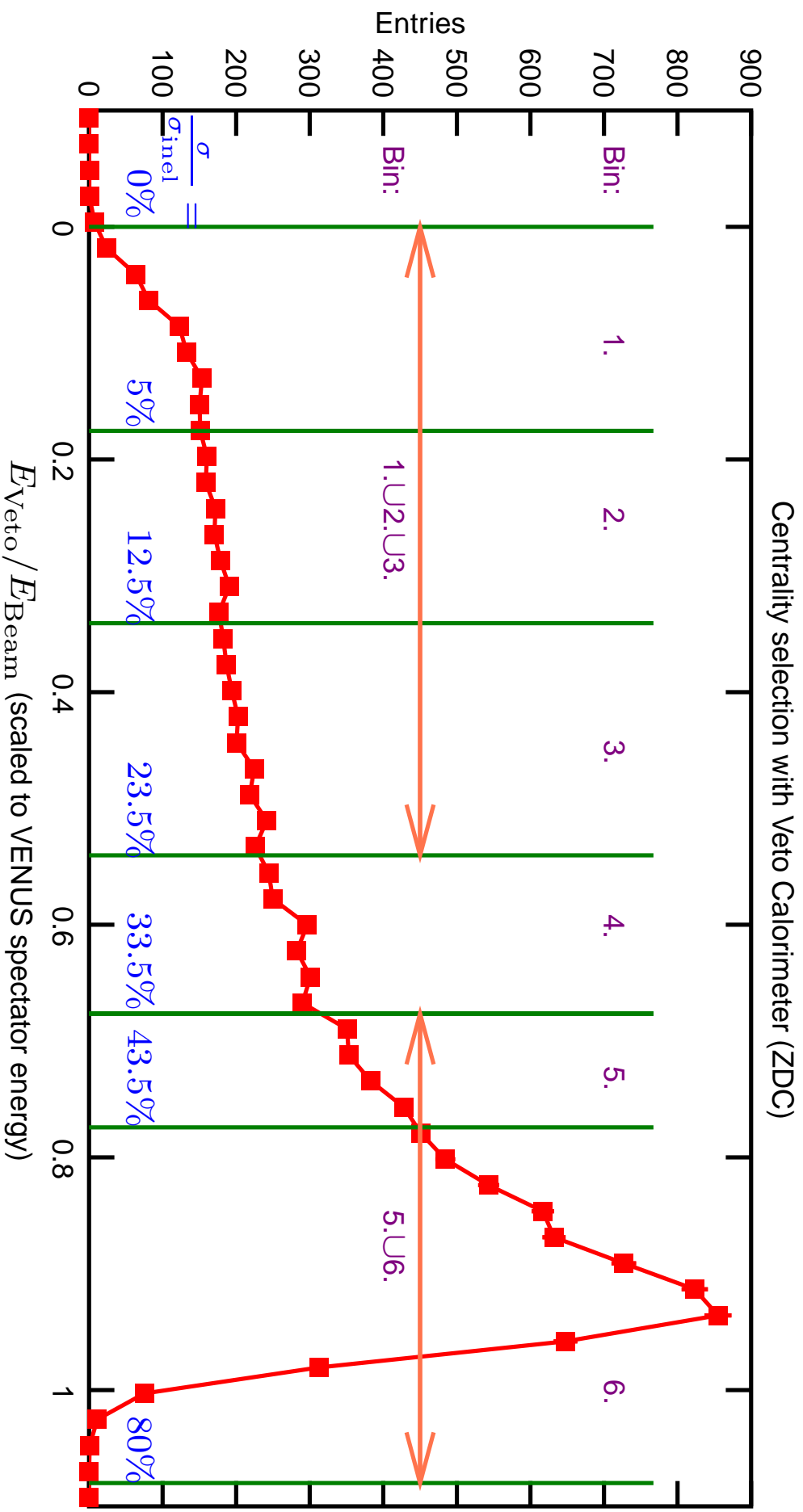
minimum-bias (406k)

10% most central (930k)

Data sets from 2000:

minimum-bias (340k)

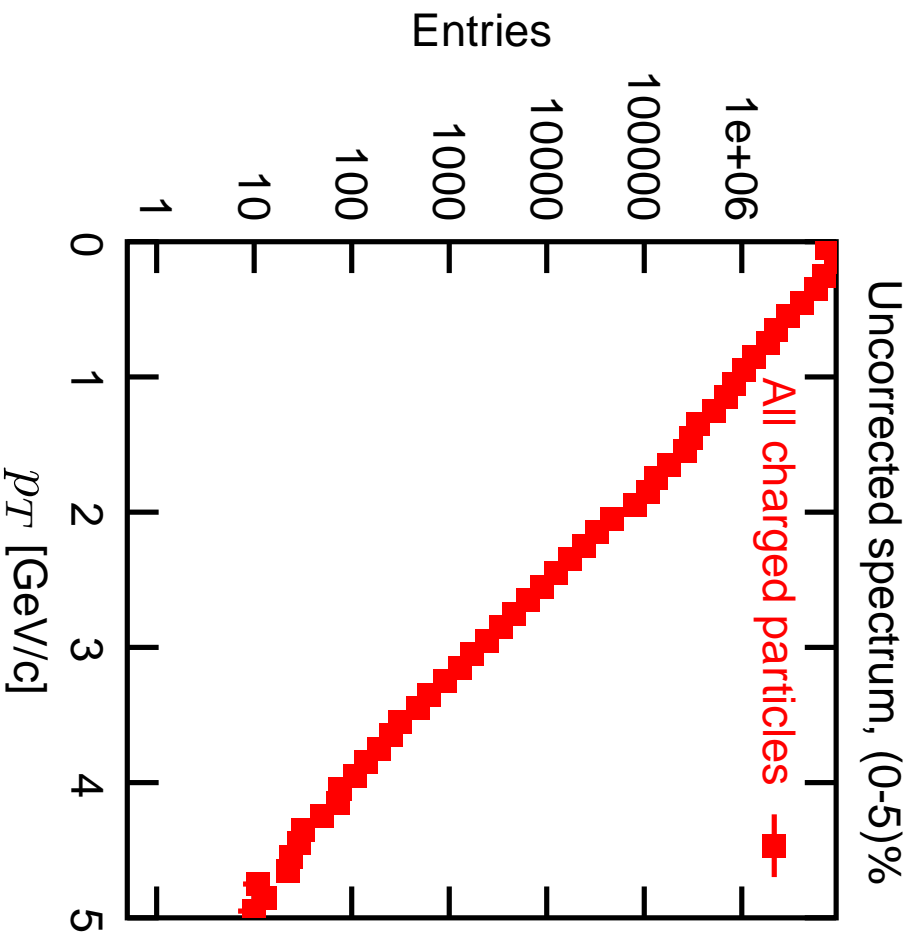
24% most central (3M)



Charged particle analysis: in (0-5)%, (12.5-23.5)%, (33.5-80)% centrality bins.

Neutral strange particle analysis: in (0-23.5)% centrality bin.

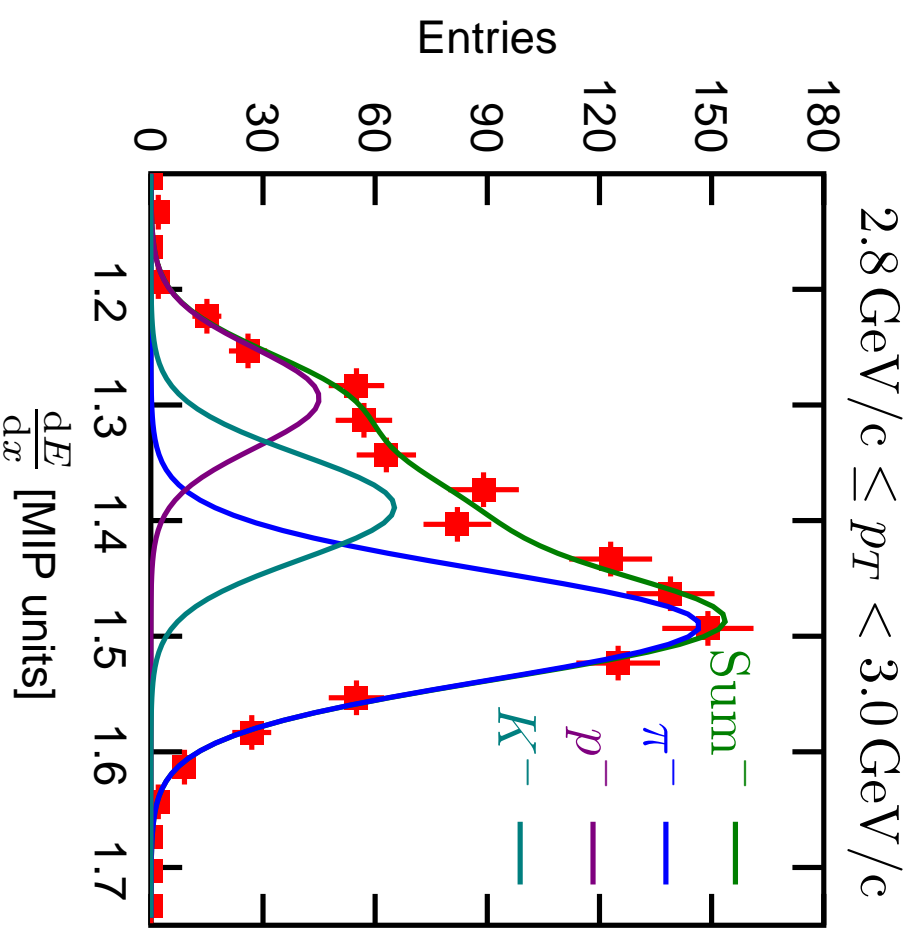
Rapidity domain: $[-0.3, 0.7]$.



Good statistics. Tracking efficiency $> 95\%$.

Efficient fake track rejection.

Typ. mom. resolution: $\frac{\sigma(p)}{p^2} \approx 10^{-4} \frac{1}{\text{GeV}/c}$



Good $\frac{dE}{dx}$ resolution.

Typ. $\frac{dE}{dx}$ resolution: $3 - 6\%$

Preliminary high p_T results

Corrected for:

- geometrical acceptance,
- tracking efficiency.

Not corrected for:

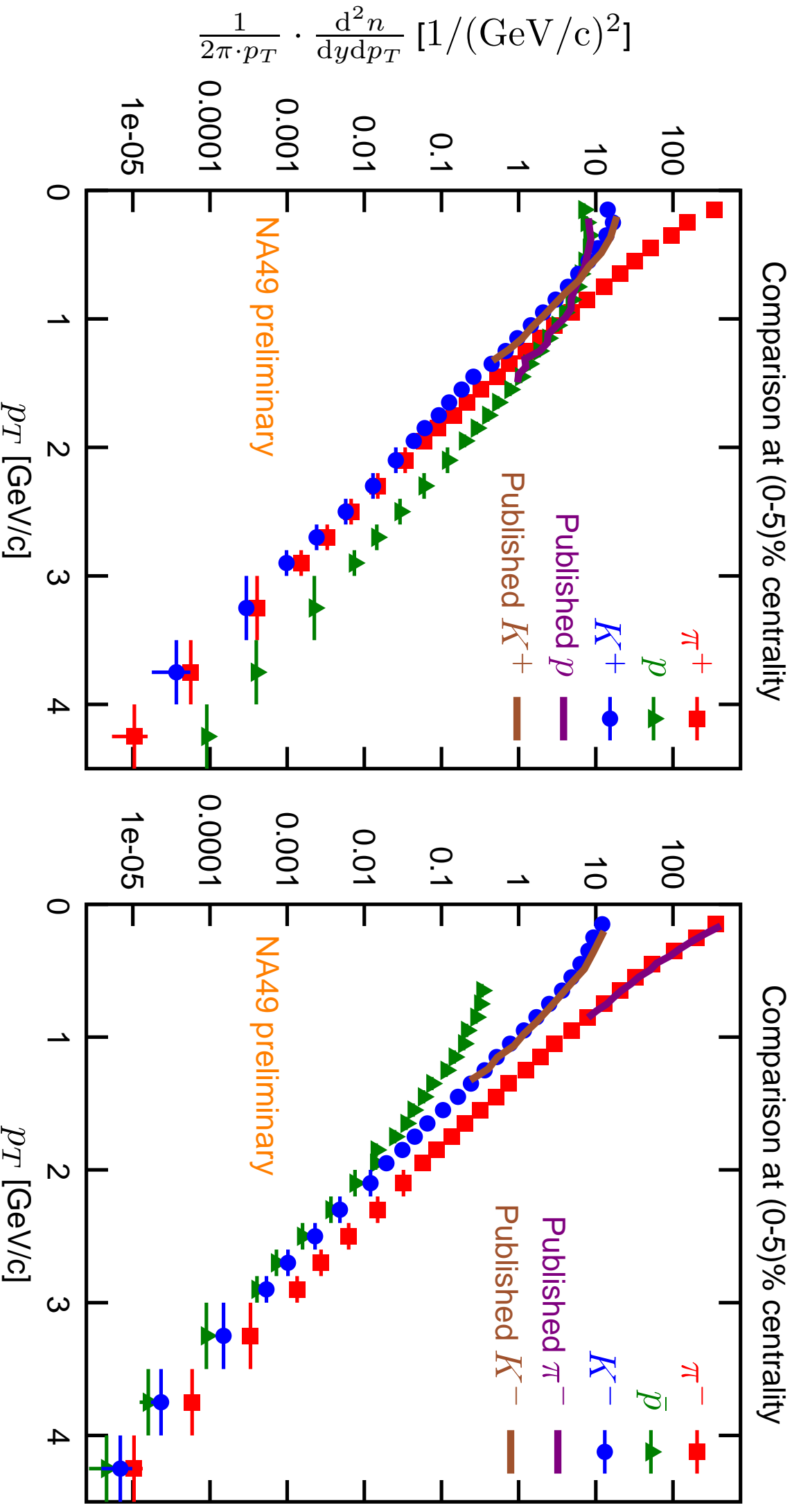
- K^\pm and π^\pm decay,
- feeddown.

→ systematic biases $\leq 10\%$

Comparison with published spectra at low and medium p_T :

- A. Afanasiev *et al* (the NA49 collaboration): Phys. Rev., C66, 054902, 2002
- T. Anticic *et al* (the NA49 collaboration): Phys. Rev., C69, 024902, 2004

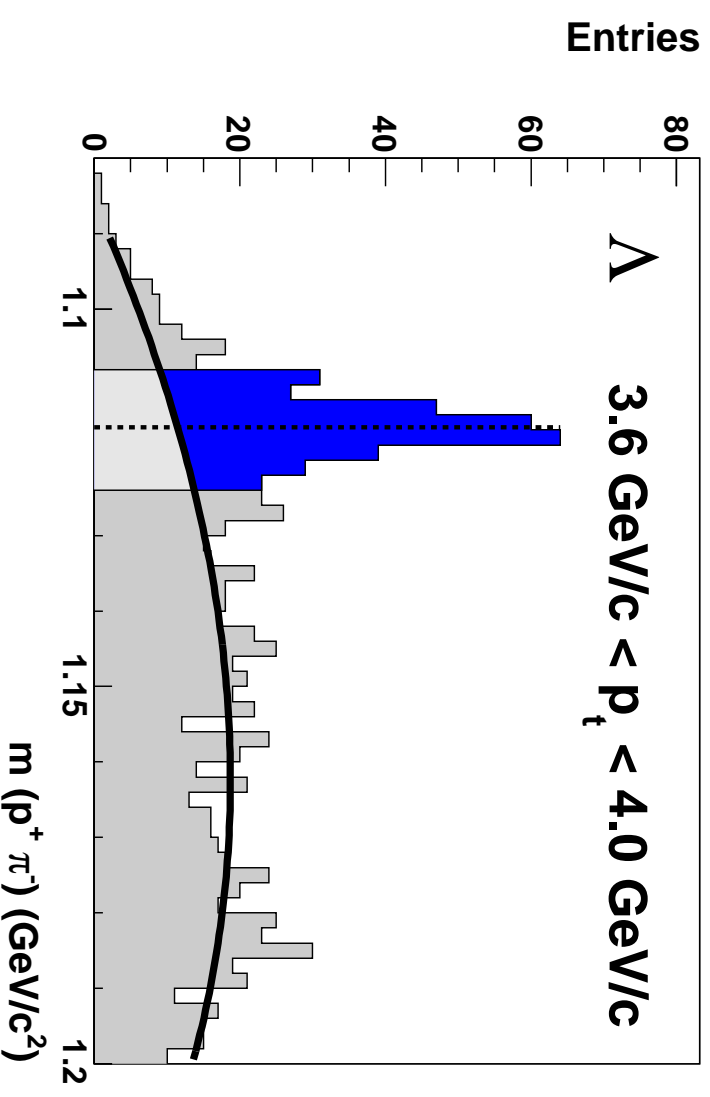
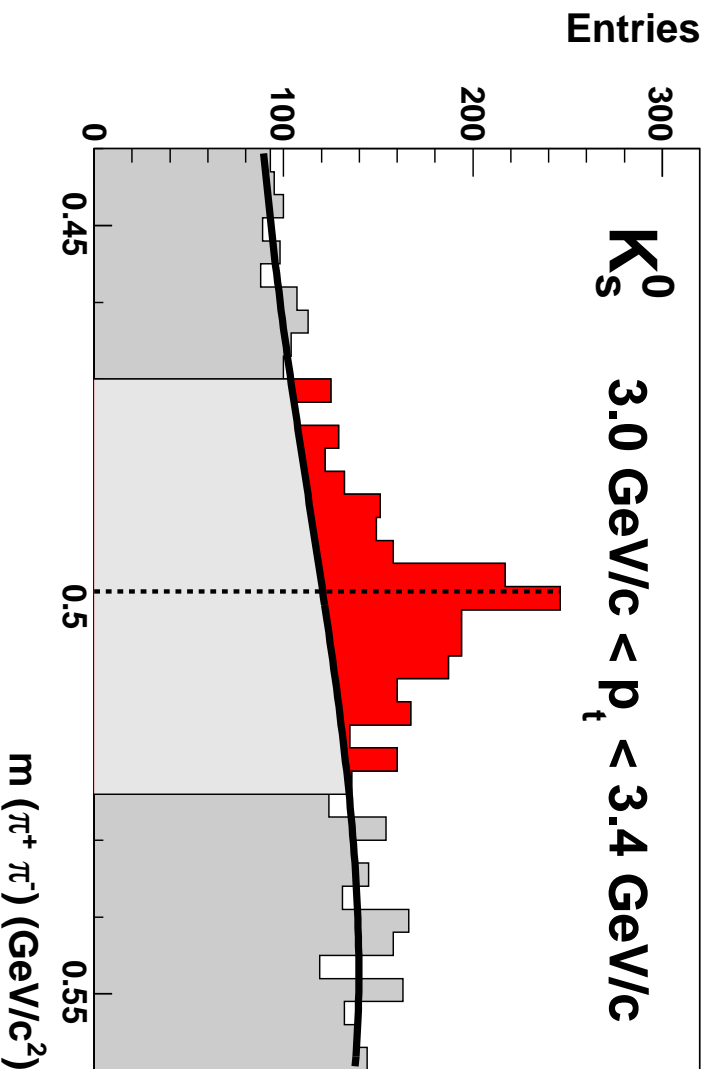
Preliminary spectra (symbols) vs published spectra (solid lines).



Neutral strange particles: identification via decay topology.

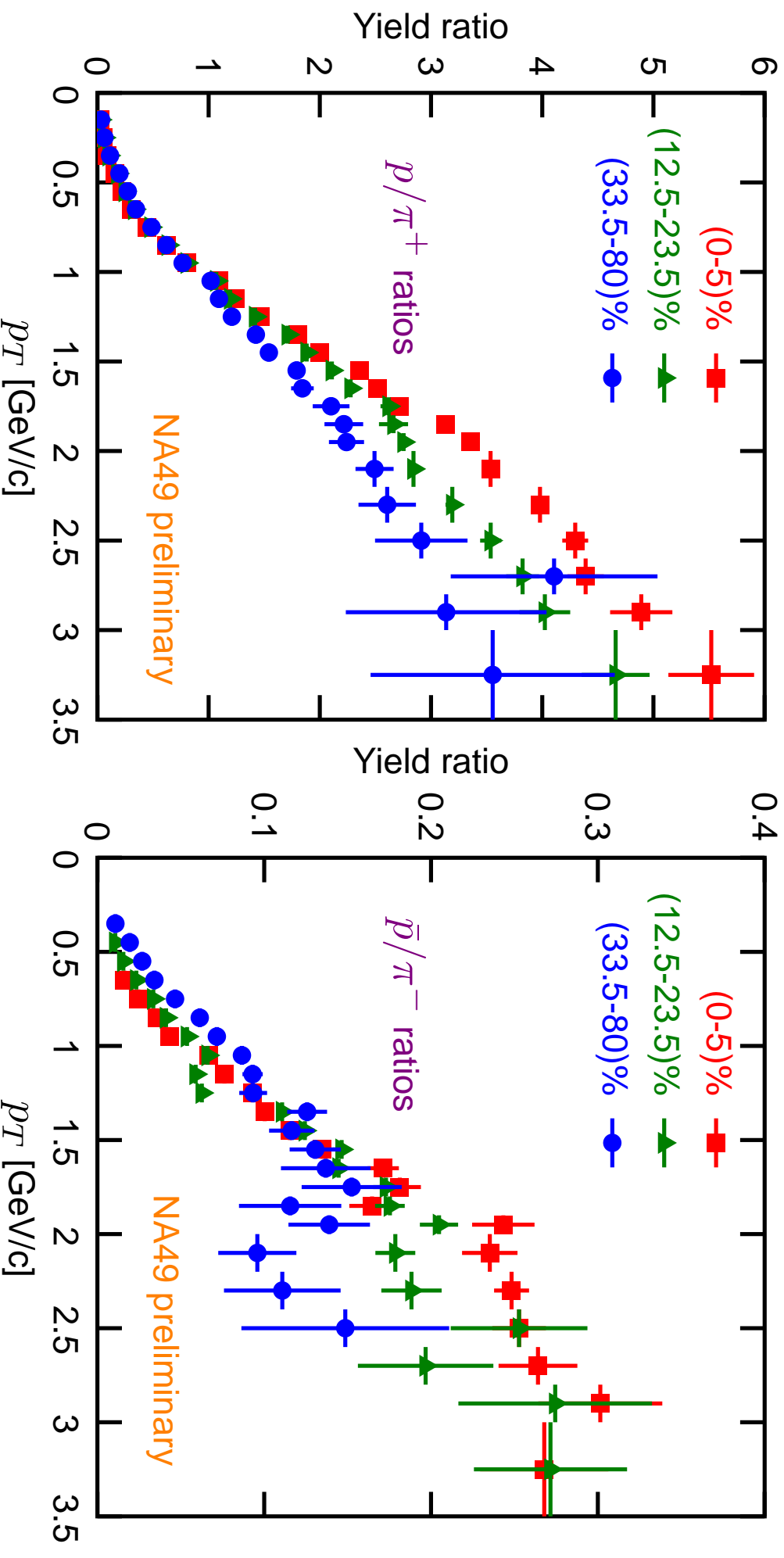
(Reconstruction of decay vertex, and invariant mass calculation.)

Rapidity domain: $[-0.5, 0.5]$.



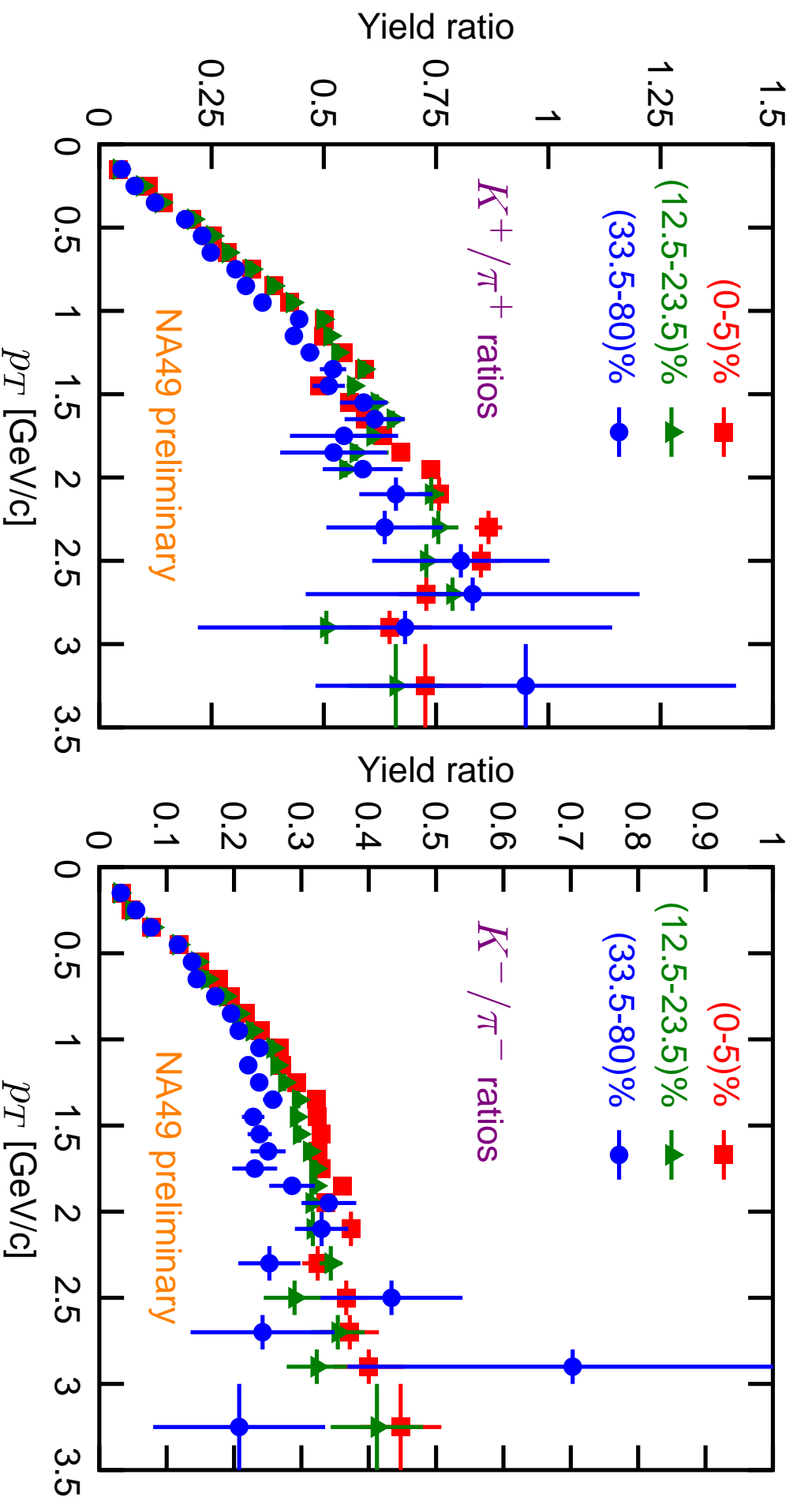
Centrality: (0-23.5)%.

p/π ratios.



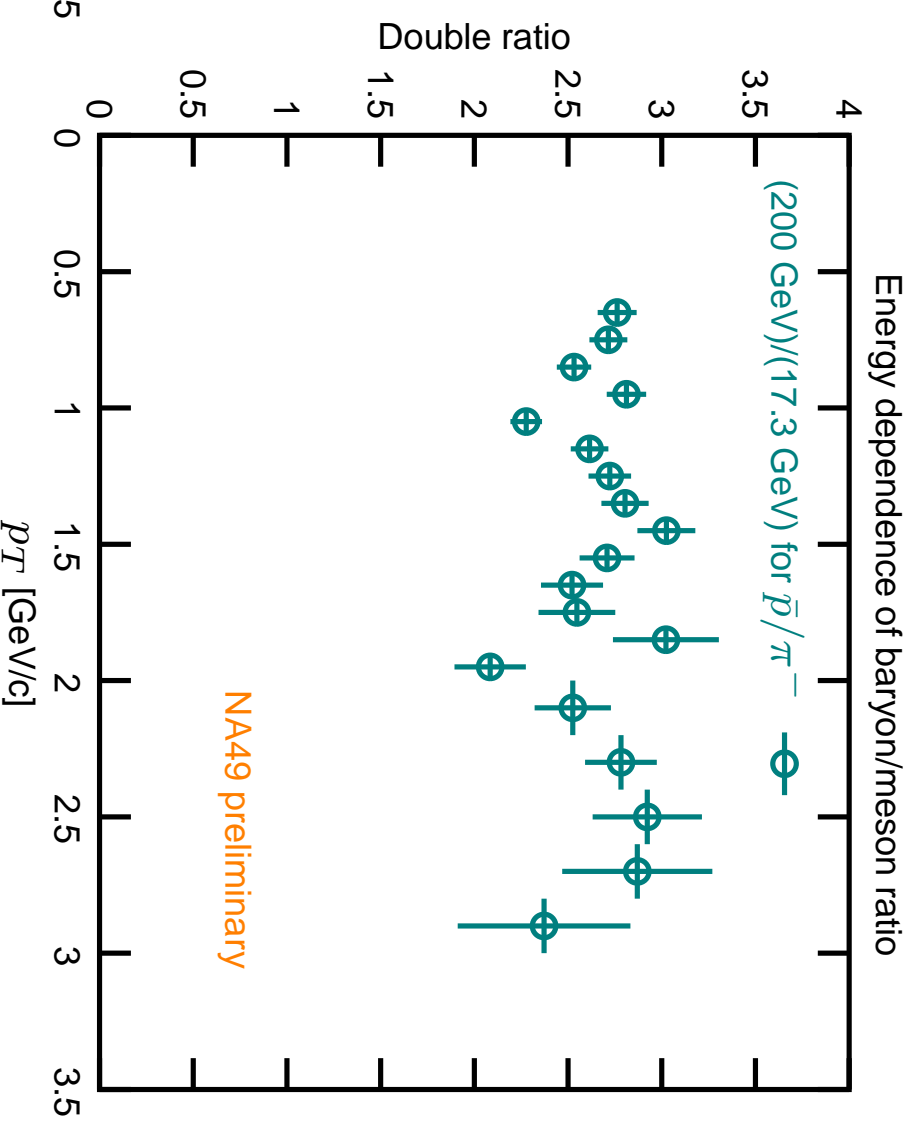
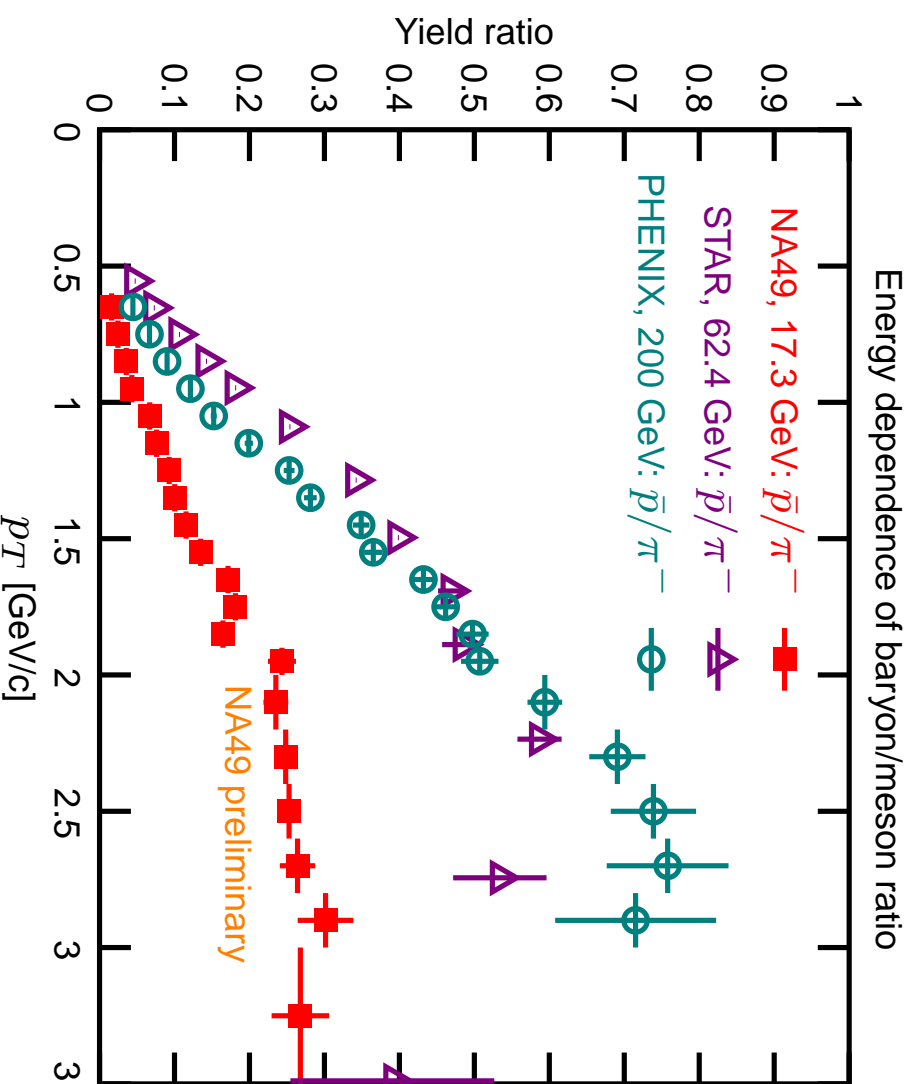
Monotonic increase with p_T and centrality at high p_T .

K/π ratios.



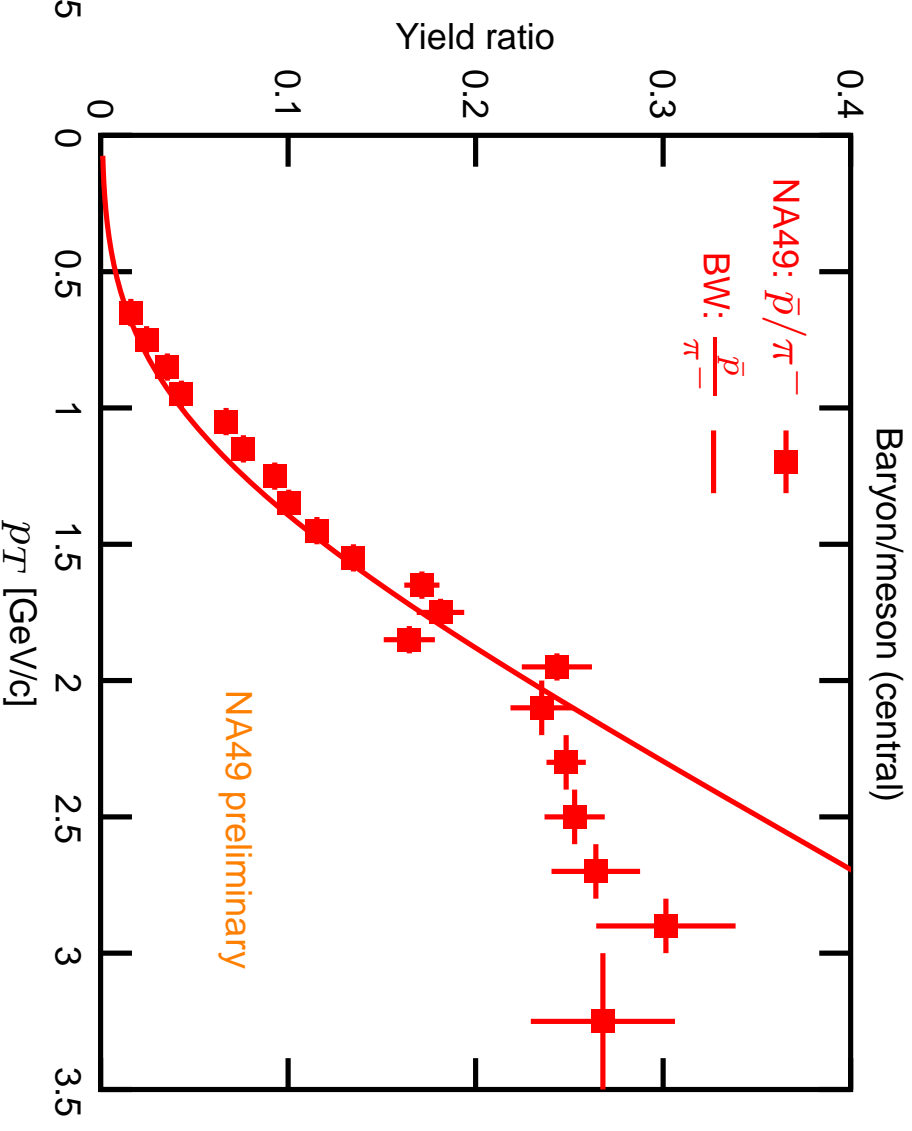
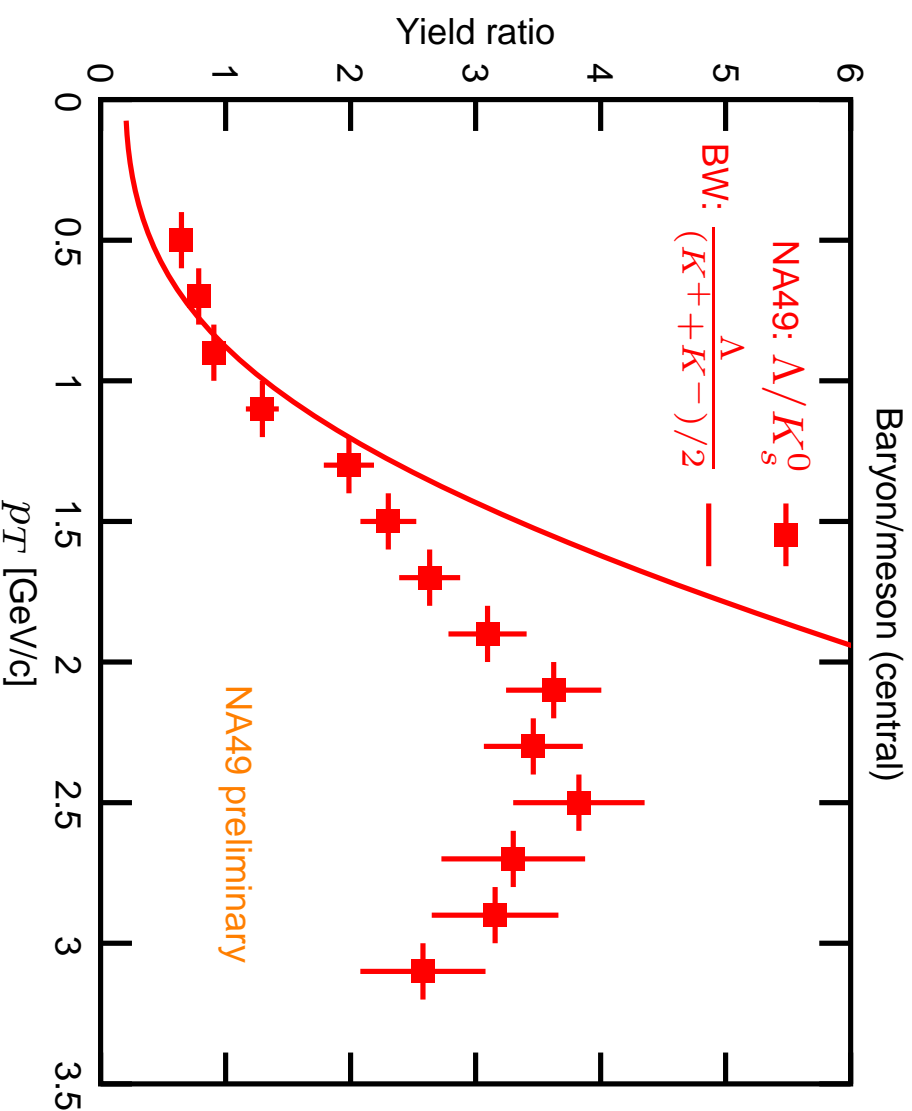
Monotonic increase with p_T and centrality at high p_T . Saturation at high p_T ?

Energy dependence of baryon/meson ratios.



Approximately energy independent shape.

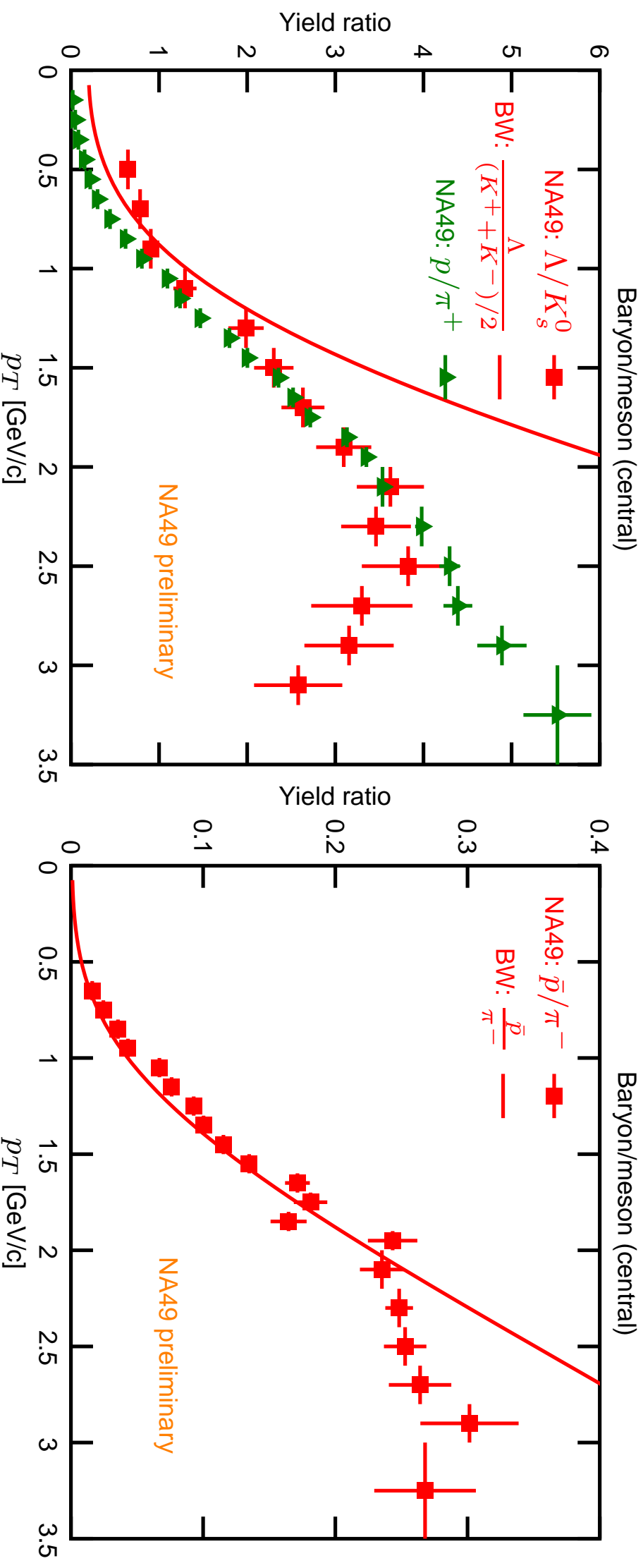
Blast-wave model.



Solid curve: Blast-Wave (BW) parameterization of the combined data on m_T spectra and HBT, fitted simultaneously at low p_T . At high p_T : does not describe data.

BW: F. Retiere, M. A. Lisa: Phys. Rev., C70, 044907, 2004.

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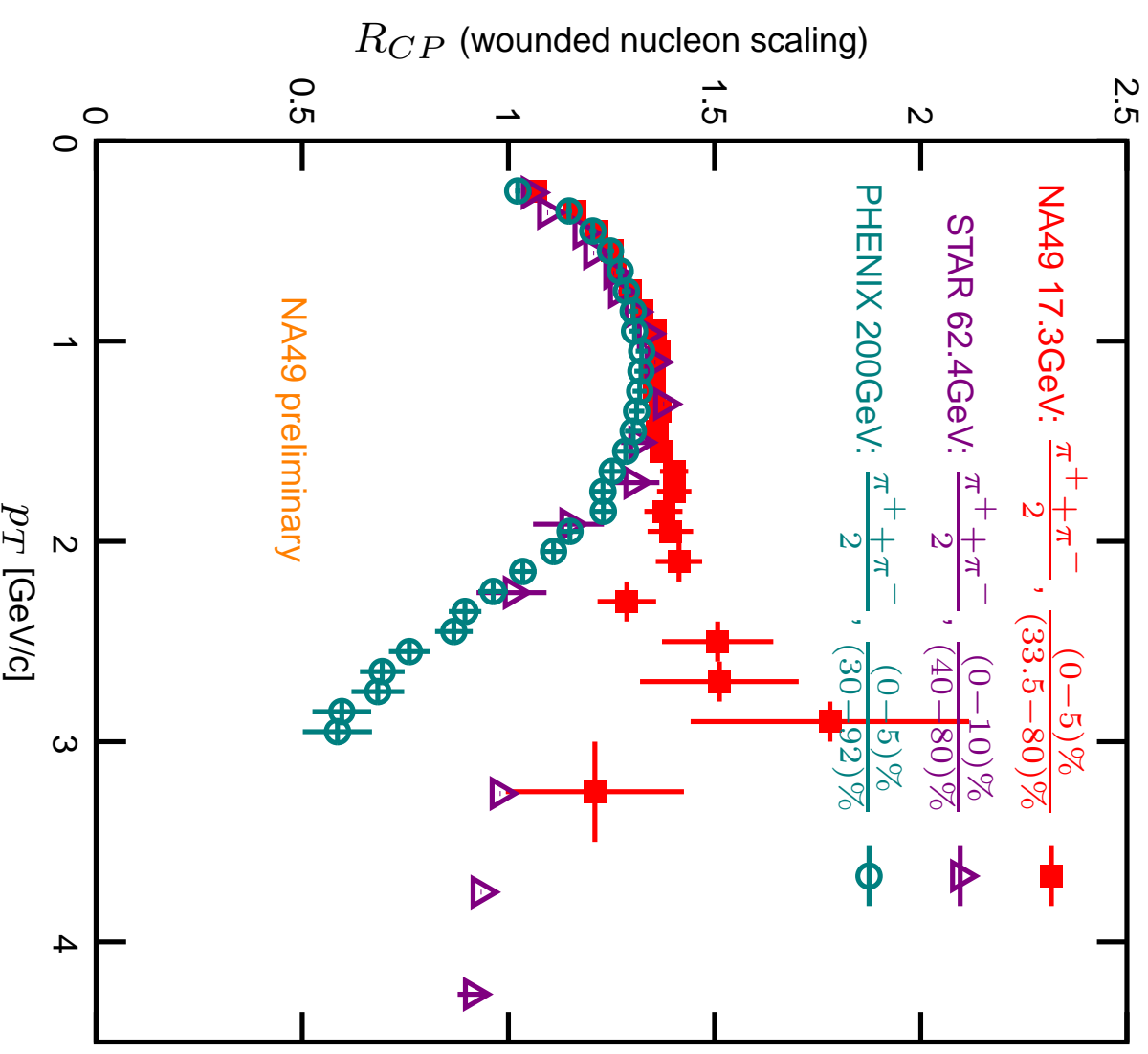
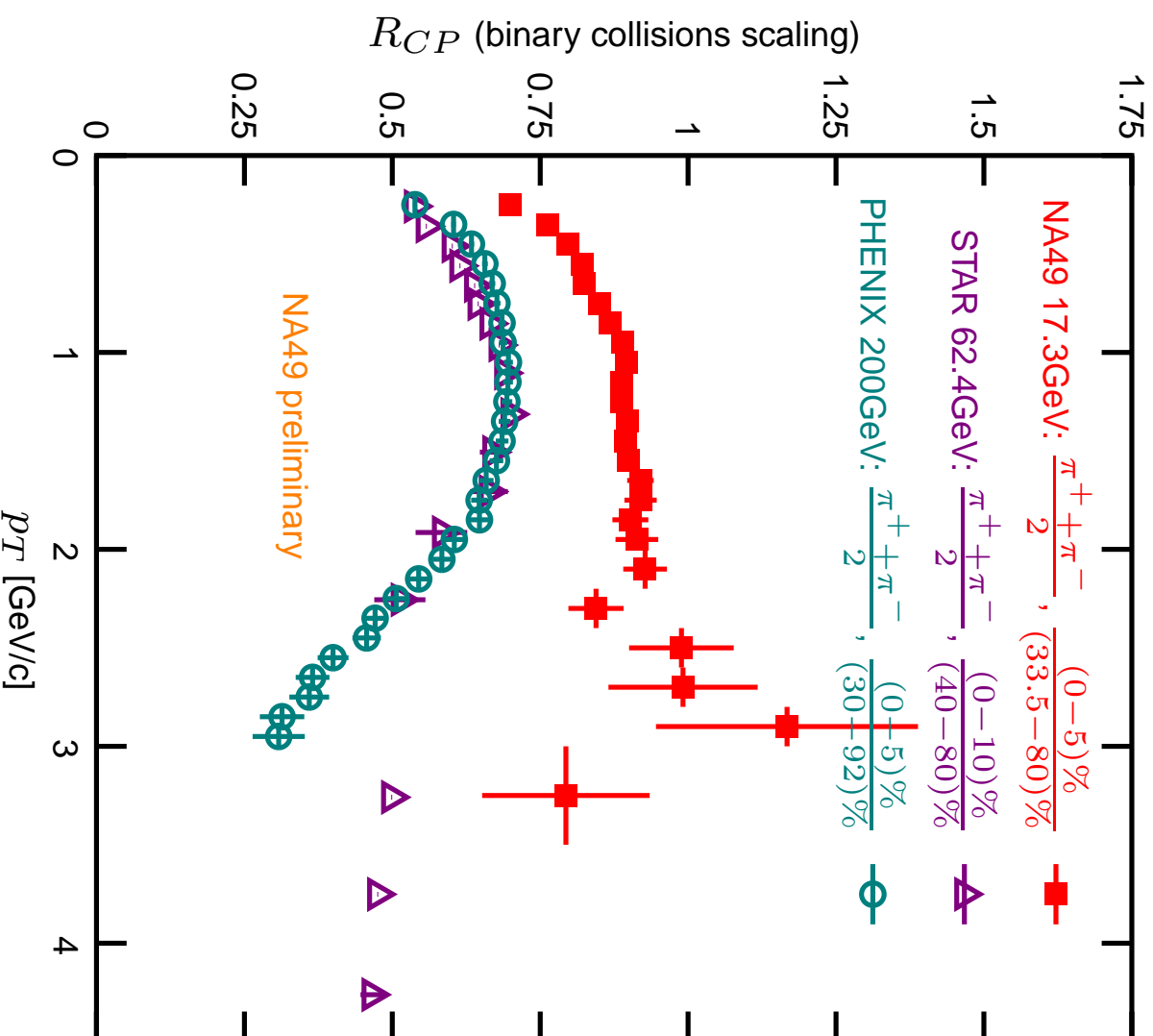
Nuclear modification factor (*R_{CP}*).

Defined by:

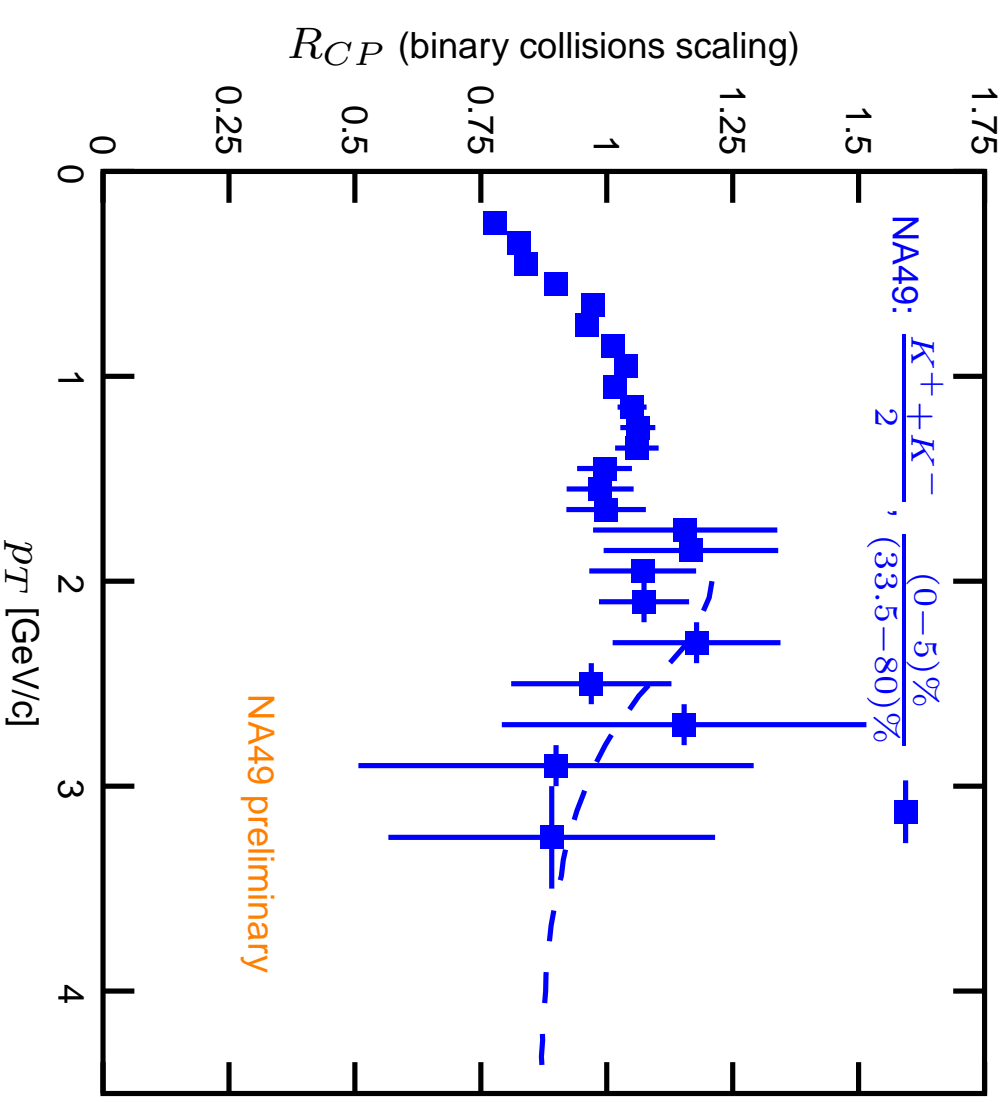
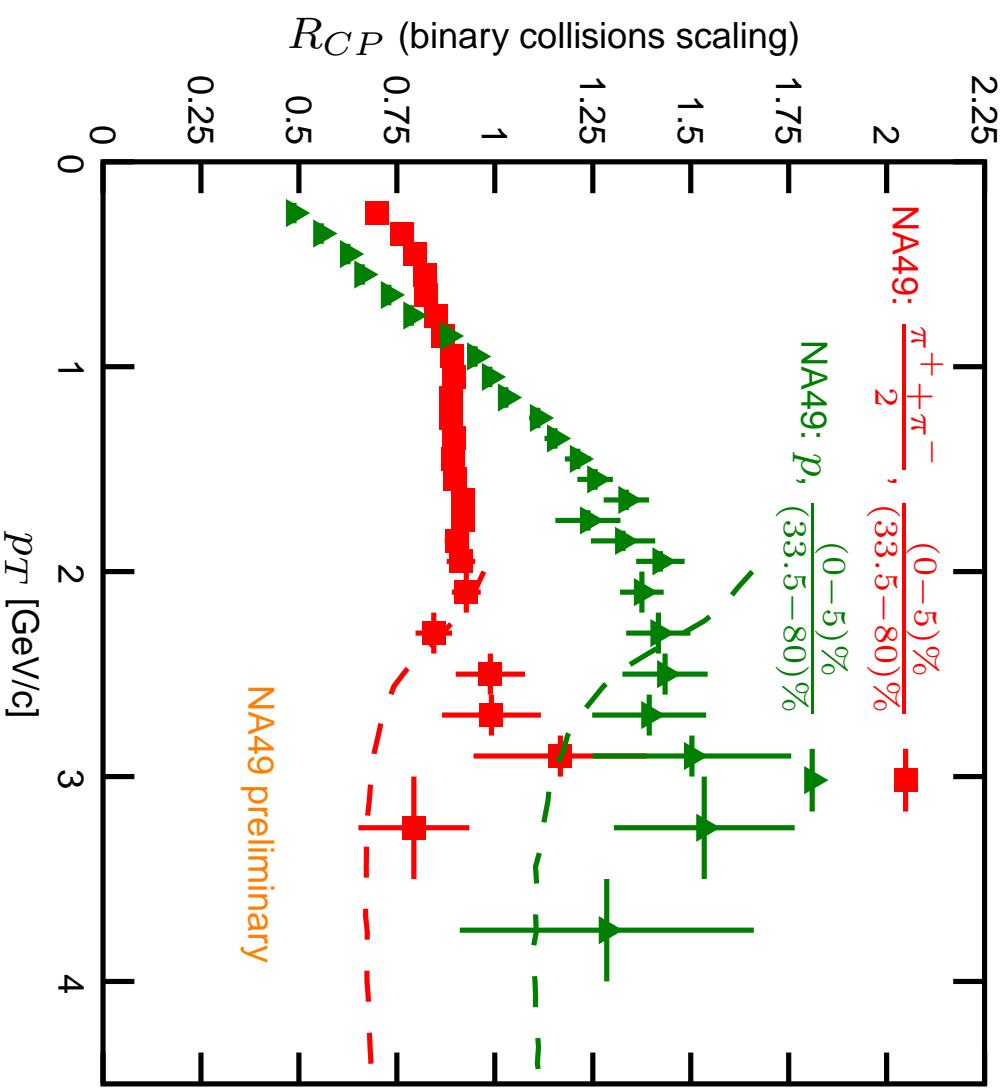
$$R_{CP} := \frac{N(\text{Peripheral})}{N(\text{Central})} \cdot \frac{\text{Yield}(\text{Central})}{\text{Yield}(\text{Peripheral})}.$$

Here *N* can be either the calculated value of the number of binary collisions, or the calculated value of the number of wounded nucleons, in the given centrality range.

Energy dependence of R_{CP} .

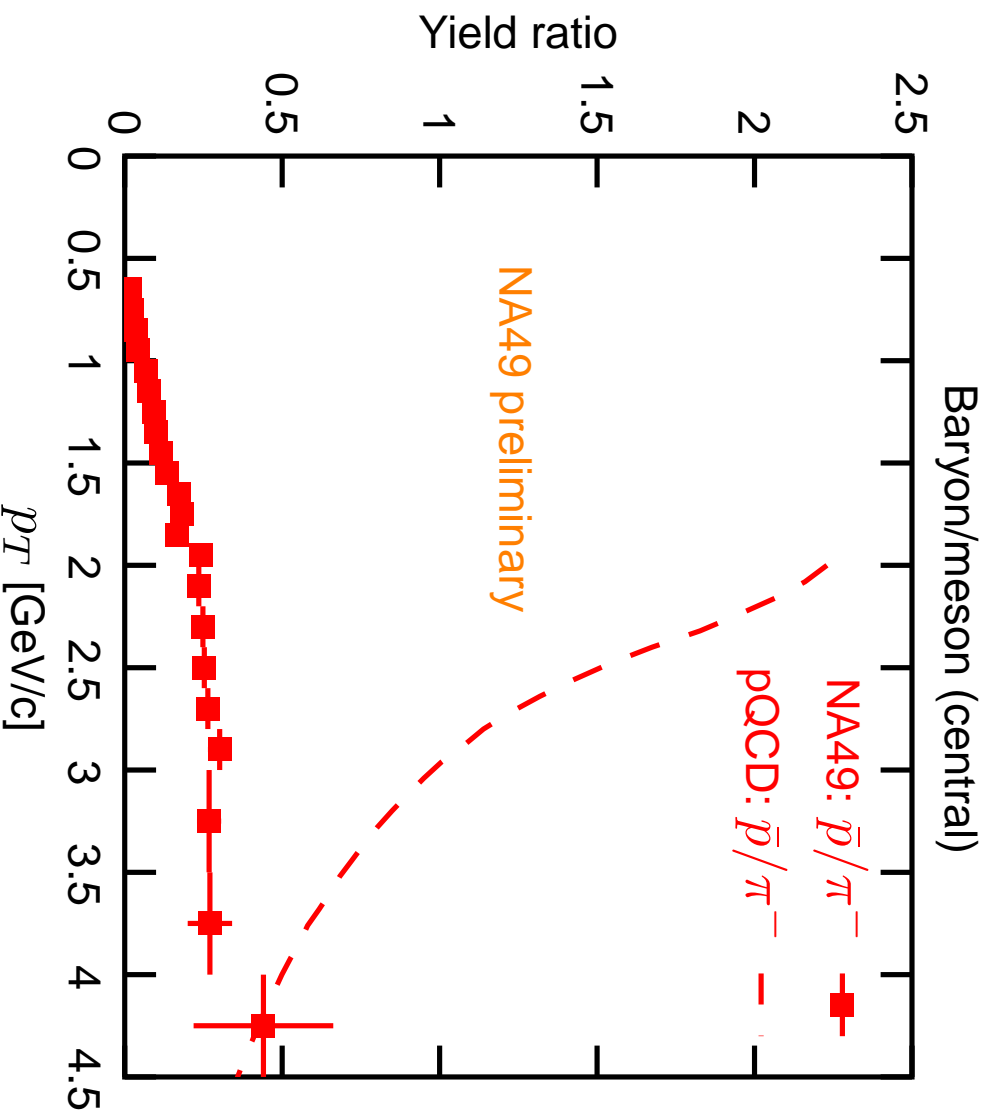


pQCD model.



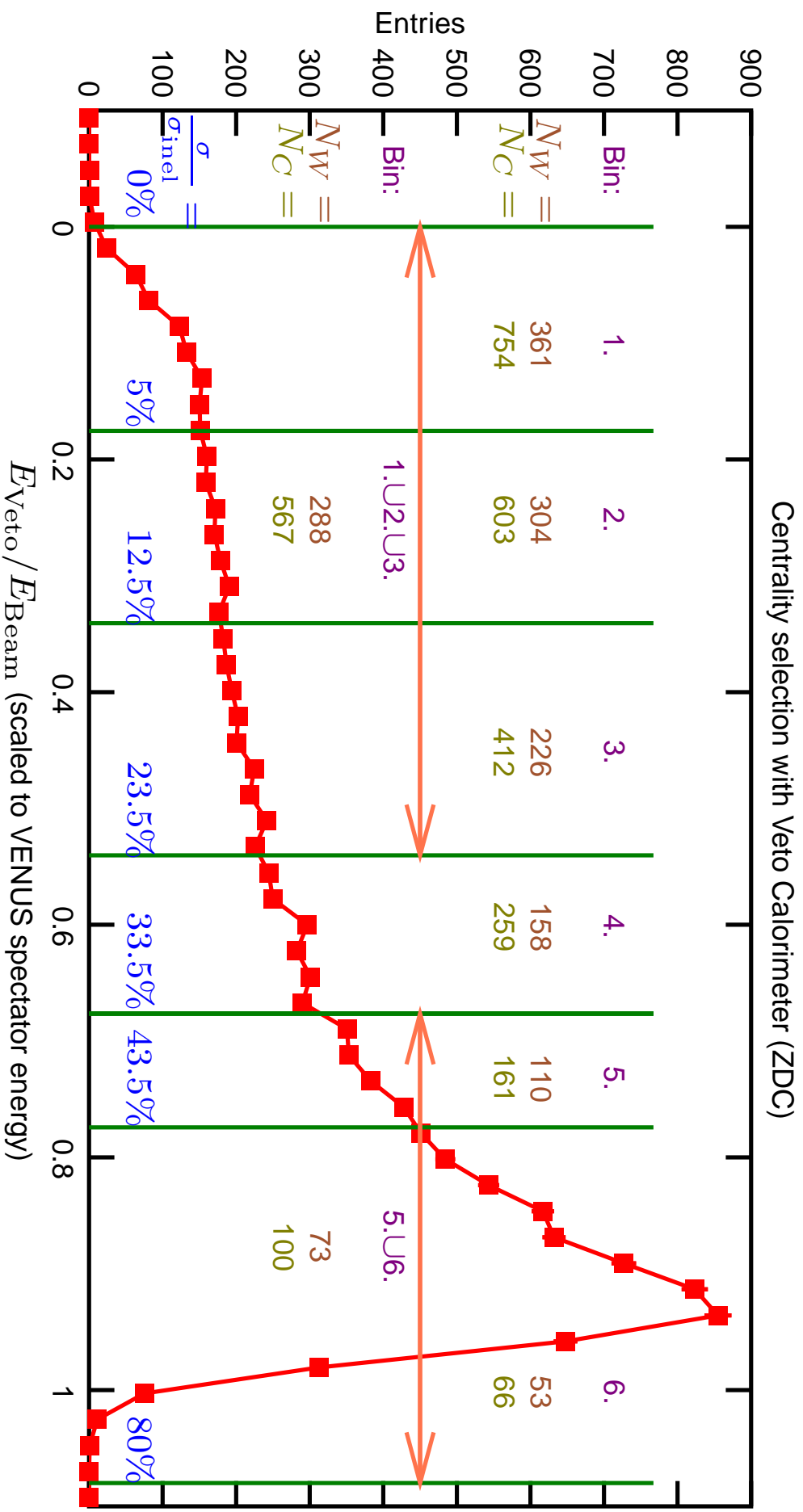
Dashed line: pQCD calculation. X.-N. Wang: Phys. Lett., B595, 165-170, 2004.

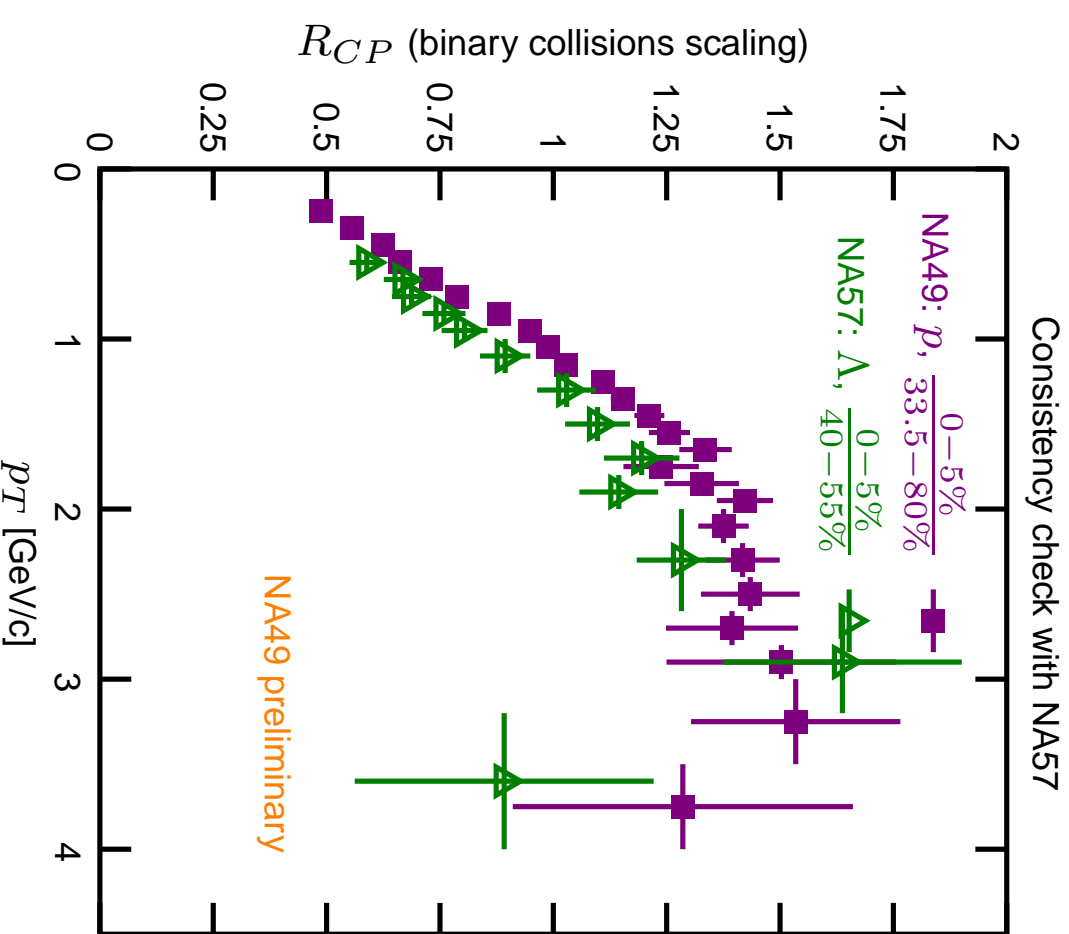
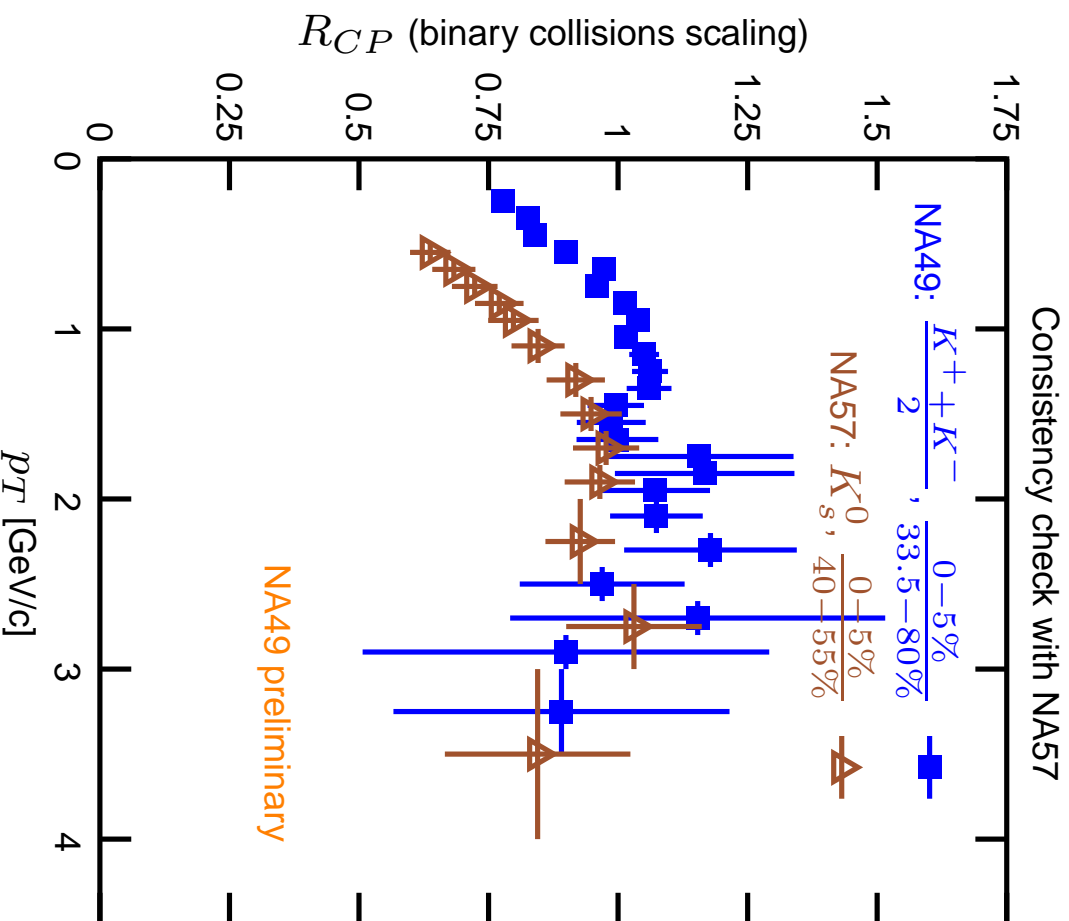
Seems to describe the experimental R_{CP} curves well.



The pQCD prediction does not approach the experimental baryon/meson ratio below 4 GeV/c transverse momentum.

- First NA49 results on yields at $2\text{GeV}/c \leq p_T < 4.5\text{GeV}/c$, around midrapidity.
- Monotonic increase of baryon/meson and Kaon/pion ratios with centrality and p_T .
- The p_T shape of baryon/meson ratio is approximately energy independent.
- The blast-wave model seems not to describe baryon/meson ratios at high p_T .
- In the R_{CP} curves, no Cronin enhancement observed for mesons, with binary collisions scaling.
- Strong energy dependence at high p_T , both with binary collisions and wounded nucleon scaling.
- The R_{CP} factors, using wounded nucleon scaling, show no remarkable energy dependence at low p_T . This was also pointed out in Phys. Rev. Lett., 94, 082304, 2005 by PHOBOS collaboration, for unidentified particles.
- The pQCD model do describe the R_{CP} -s correctly, however the baryon/meson prediction is far from experiment below $4\text{GeV}/c$ transverse momentum.





Empty symbols: NA57 preliminary.