Summary of High p_T Physics with PHOBOS

Gunther Roland/MIT
for the PHOBOS collaboration

PHOBOS Collaboration



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UNIVERSITY OF ILLINOIS AT CHICAGO
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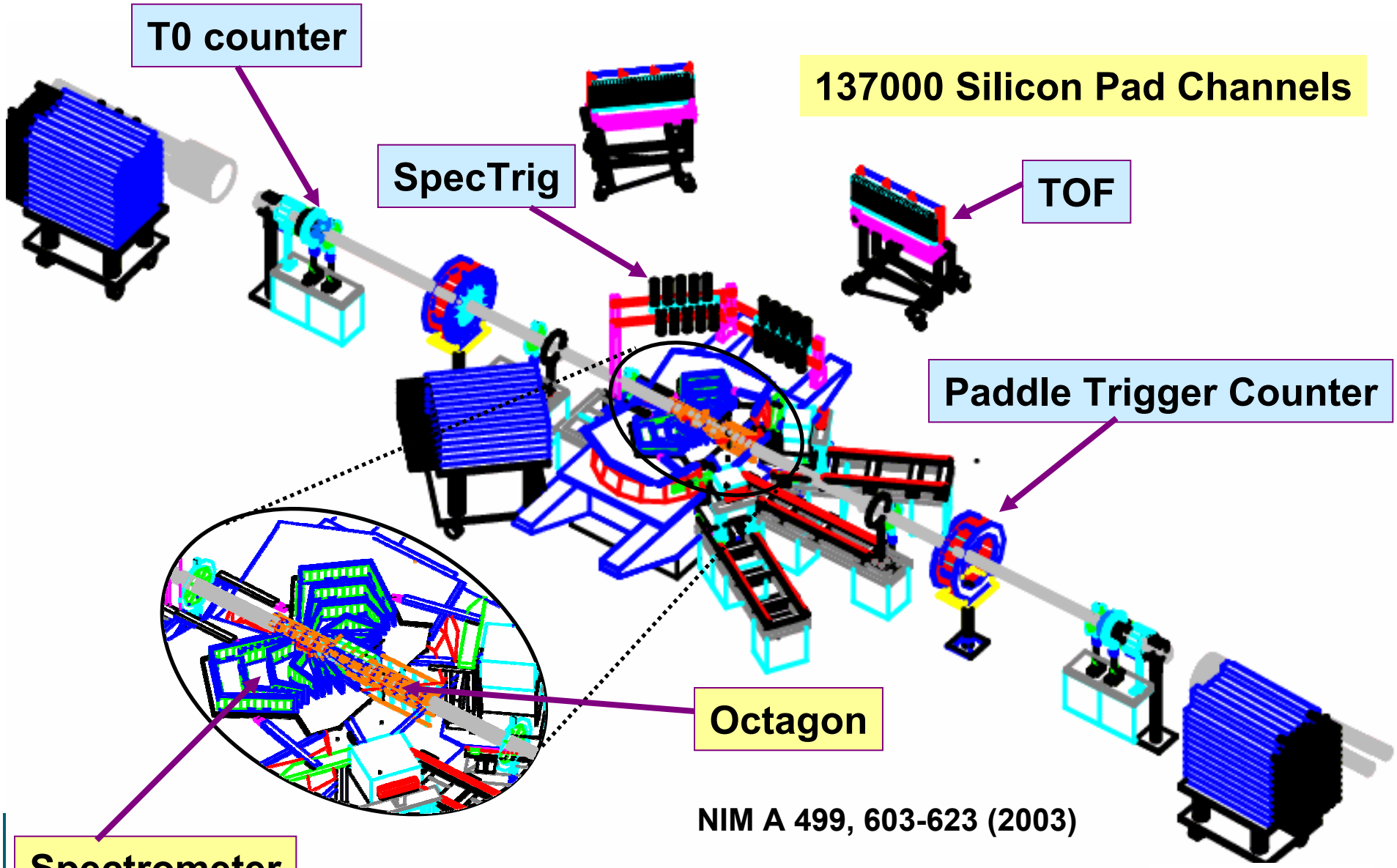
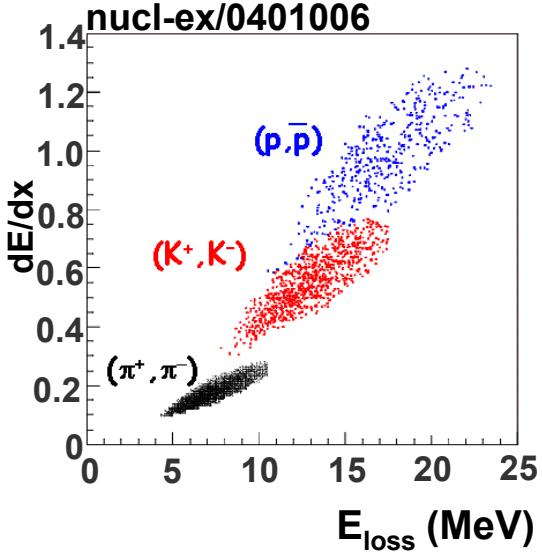
PHOBOS Detector

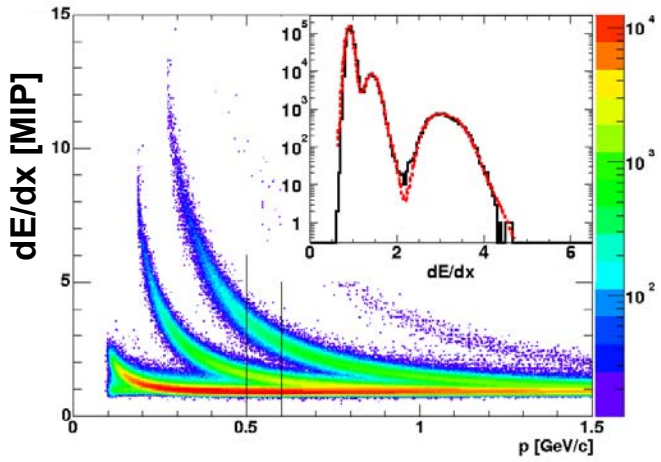


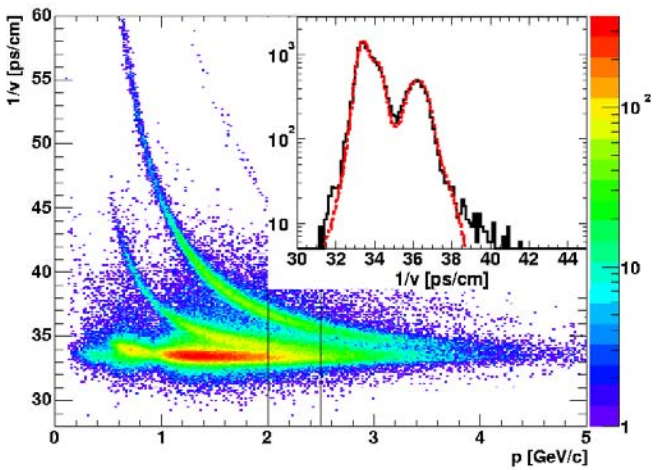
NIM A 499, 603-623 (2003)

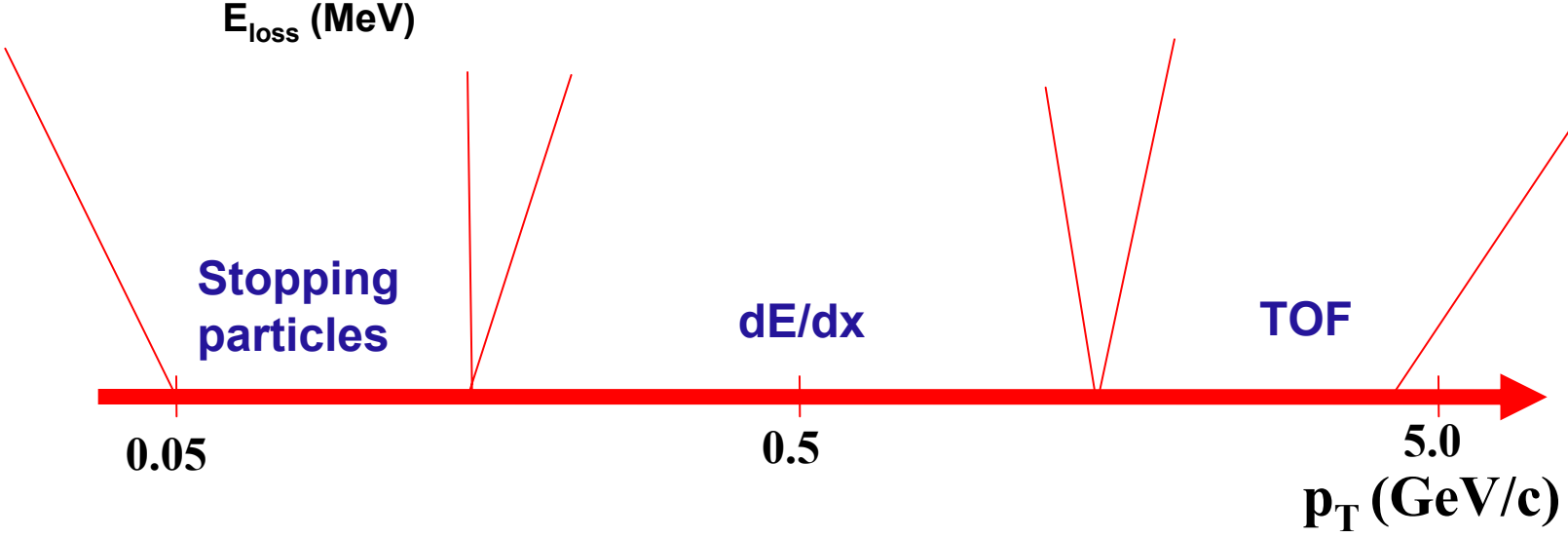
PHOBOS PID Capabilities

PRC in press
nucl-ex/0401006





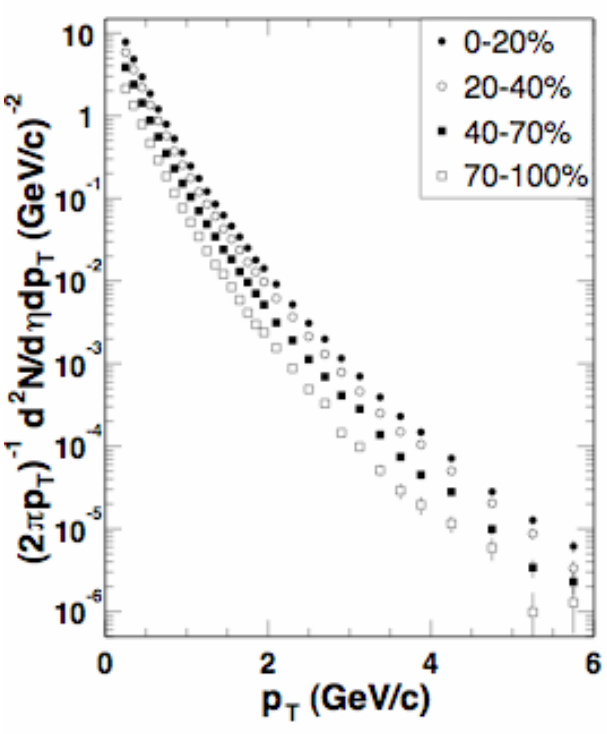




PHOBOS Data Sets

PLB 578297, 2004

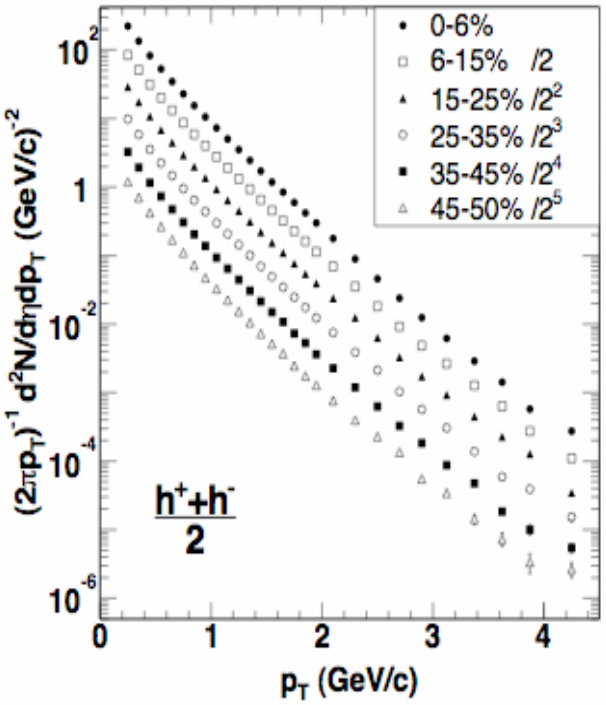
200 GeV d+Au



Run 3

nucl-ex/0405003

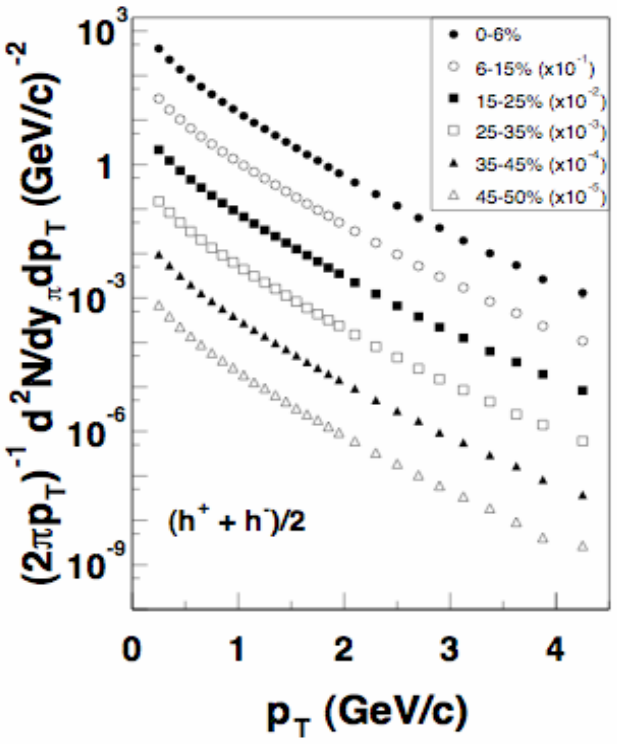
62.4 GeV Au+Au



Run 4

PLB 578297, 2004

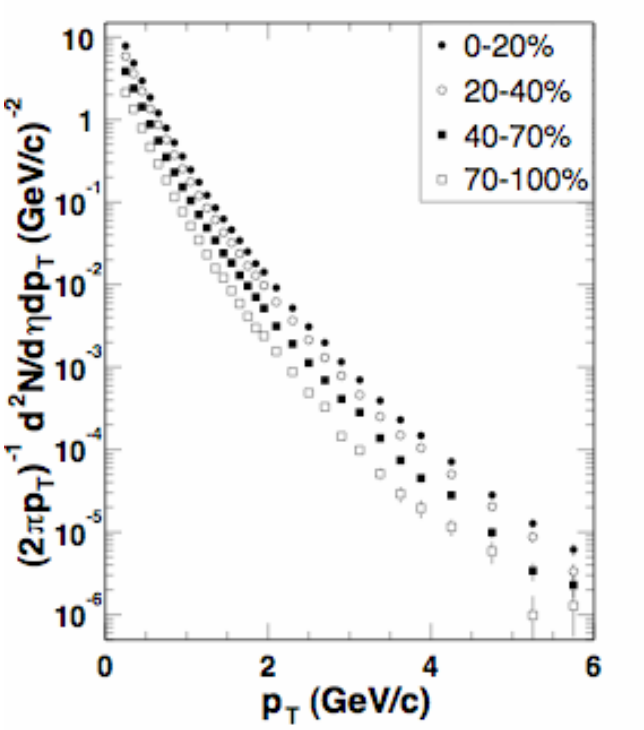
200 GeV Au+Au



Run 2

Results for d+Au

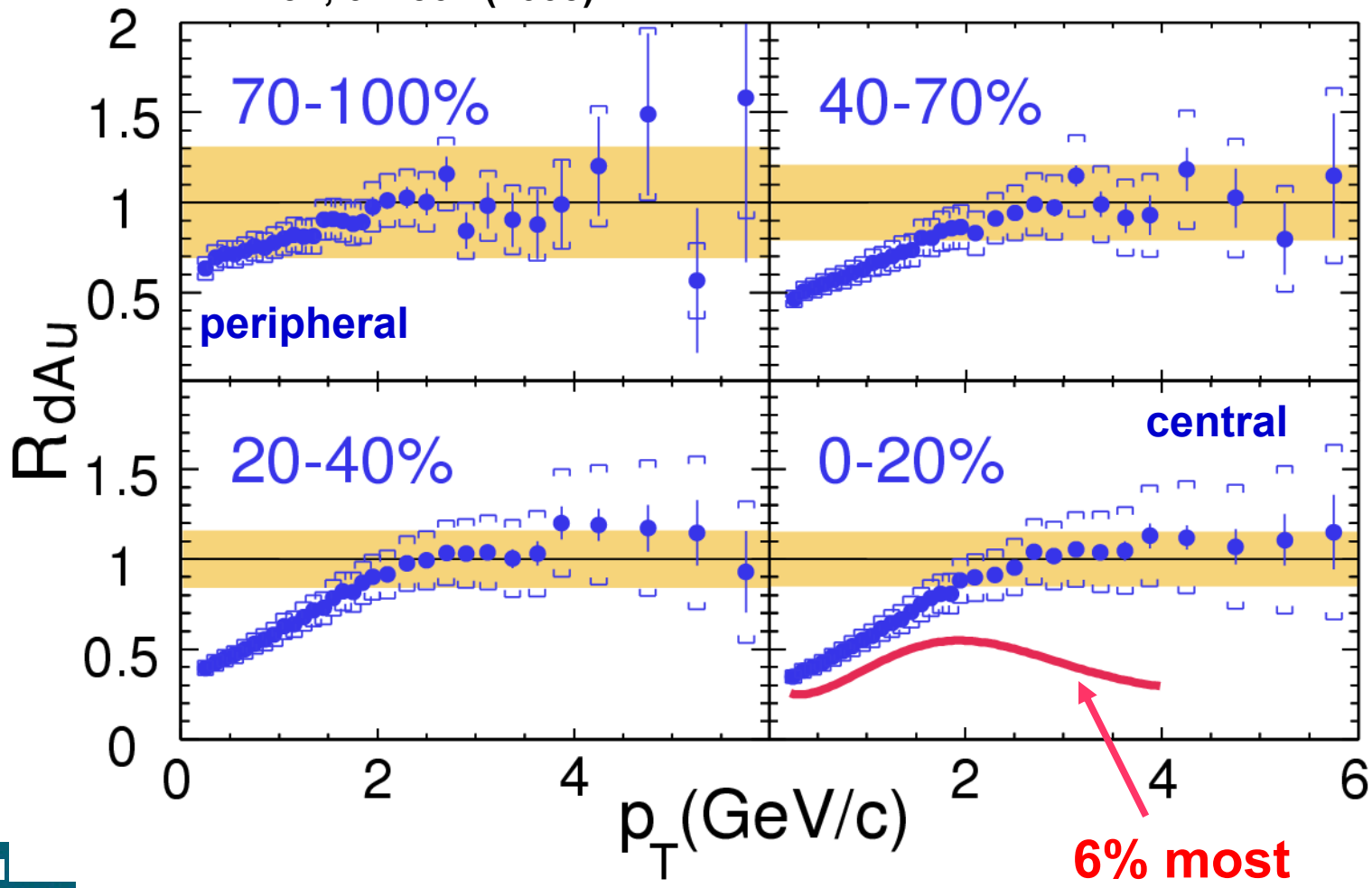
200 GeV d+Au



R_{dAu} vs. Centrality

$$R_{dAu} = \frac{\sigma_{p\bar{p}}^{inel}}{\langle N_{coll} \rangle} \frac{d^2 N_{dAu}/dp_T d\eta}{d^2\sigma(\mathrm{UA1})_{p\bar{p}}/dp_T d\eta}$$

PRL 91, 072302 (2003)

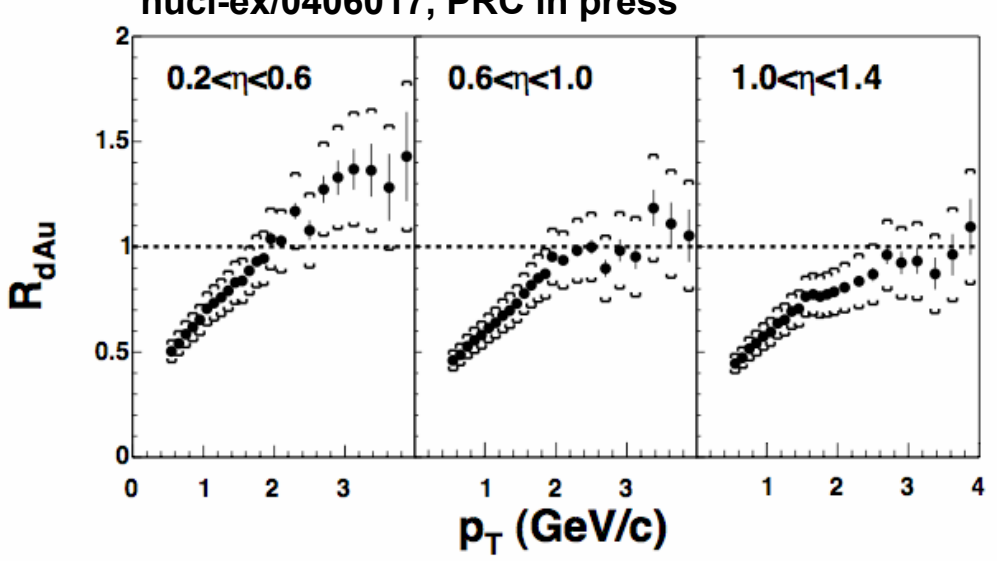


η ~ 1

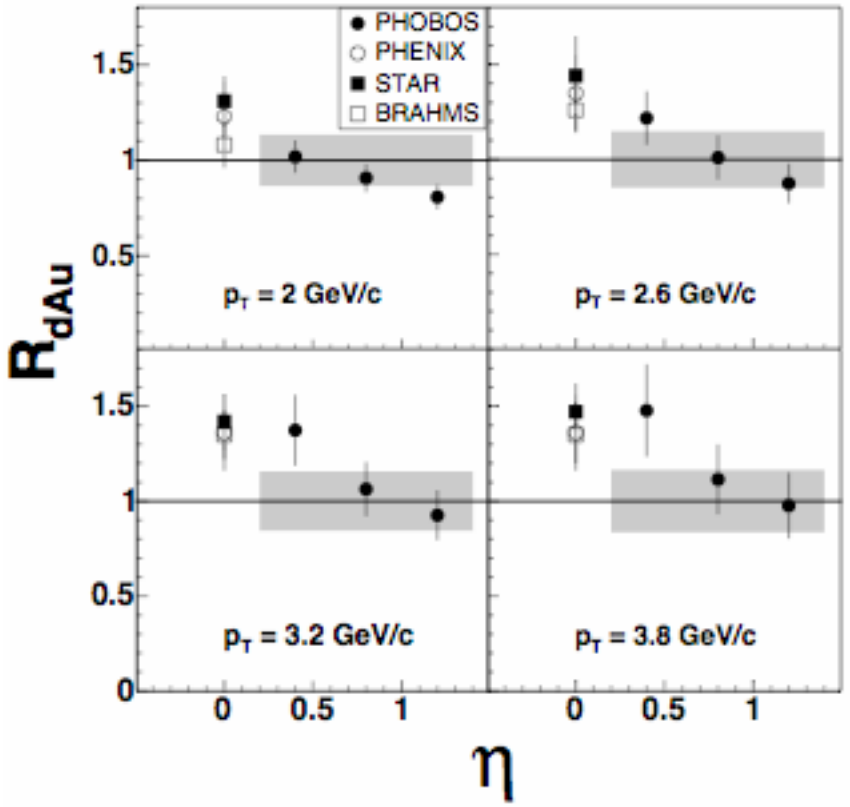
6% most central Au+Au

R_{dAu} as a Function of η

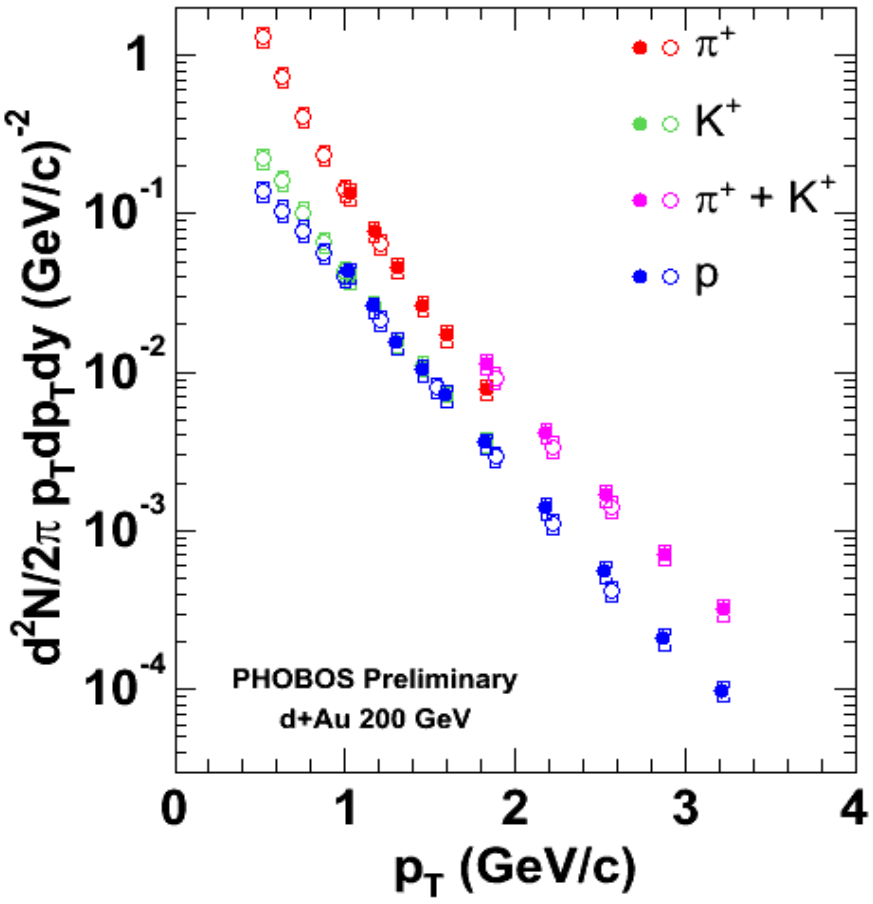
nucl-ex/0406017, PRC in press

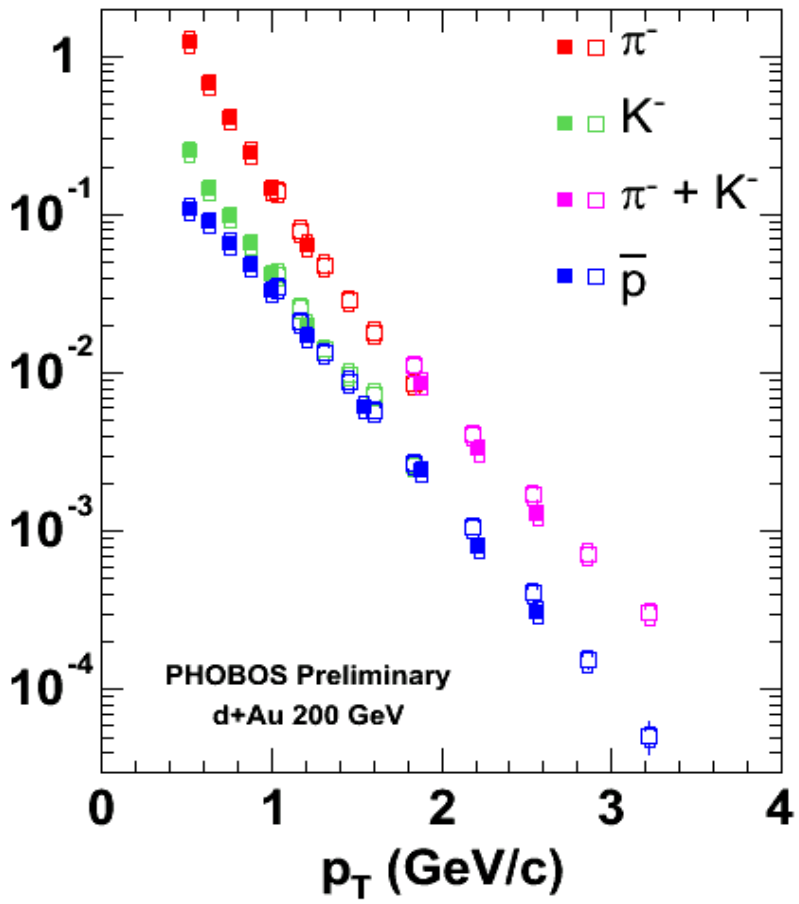


nucl-ex/0406017, PRC in press



Identified p_T -spectra in d+Au

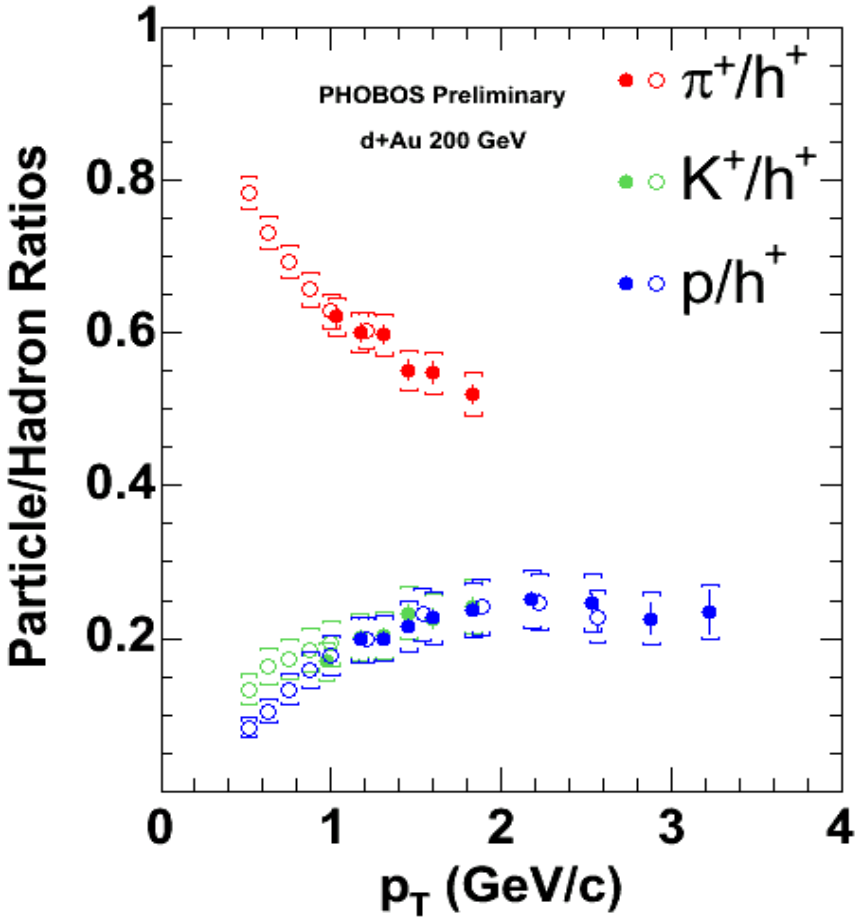


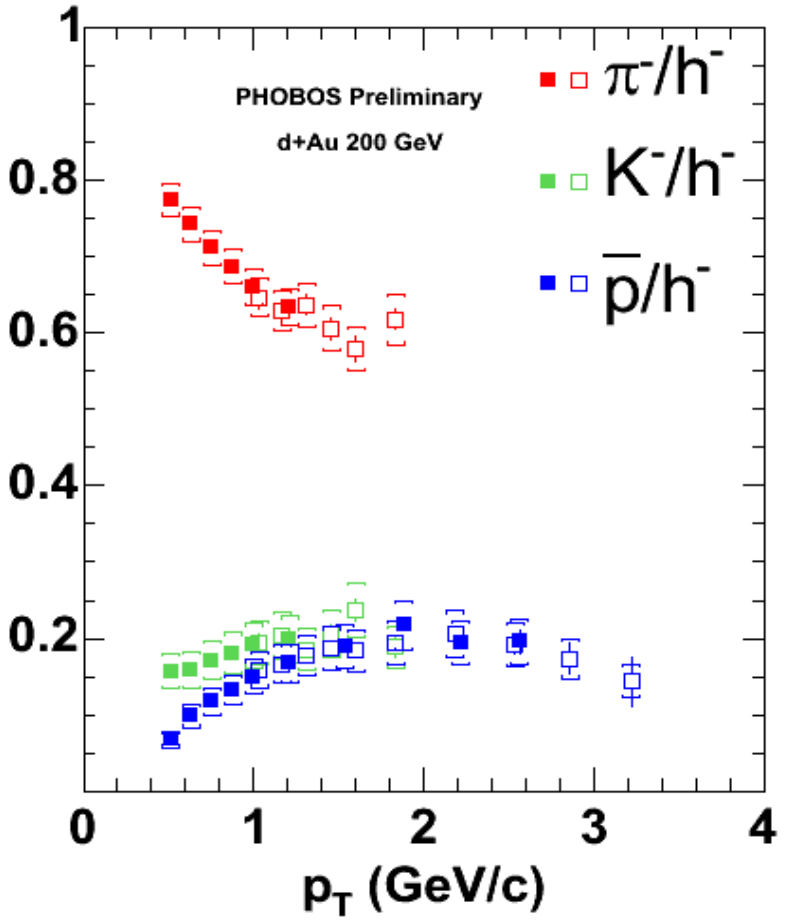


Scale uncertainty: 15%

Not feed-down corrected

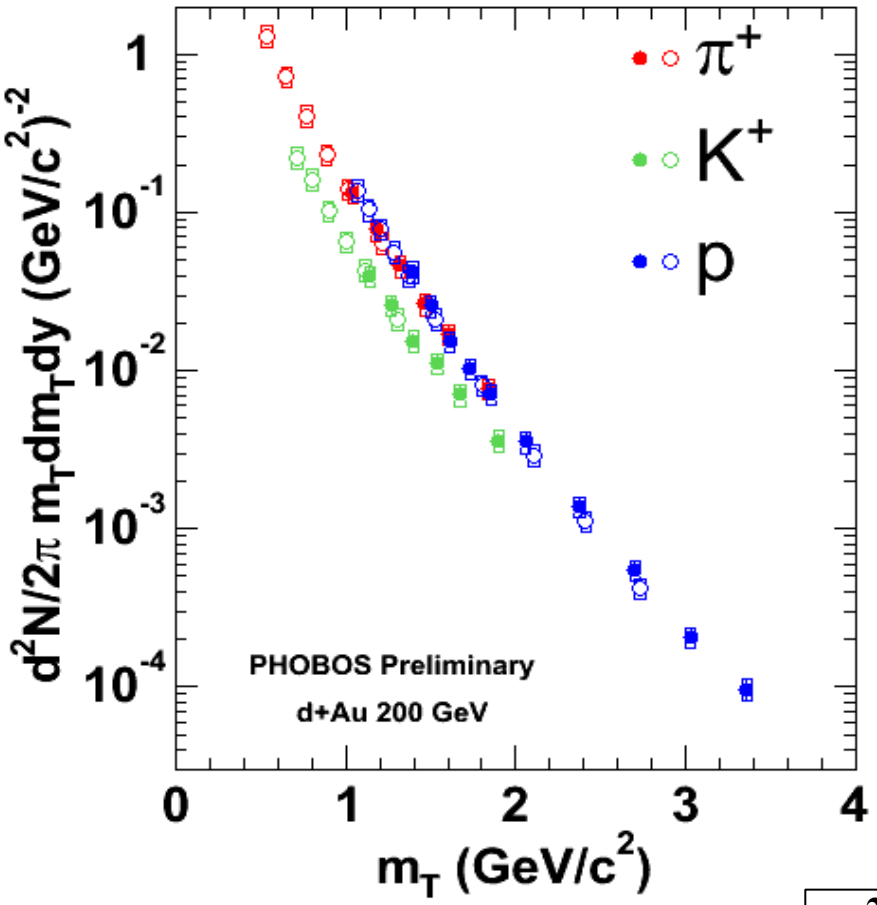
Particle Composition in d+Au

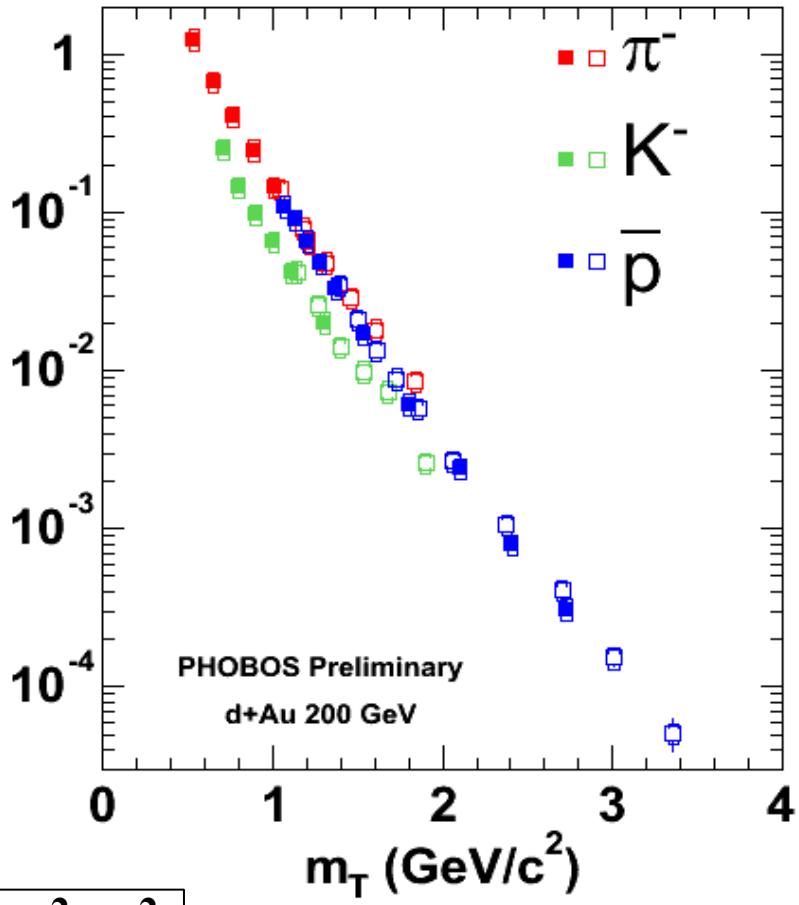




Not feed-down corrected

m_T-spectra in d+Au





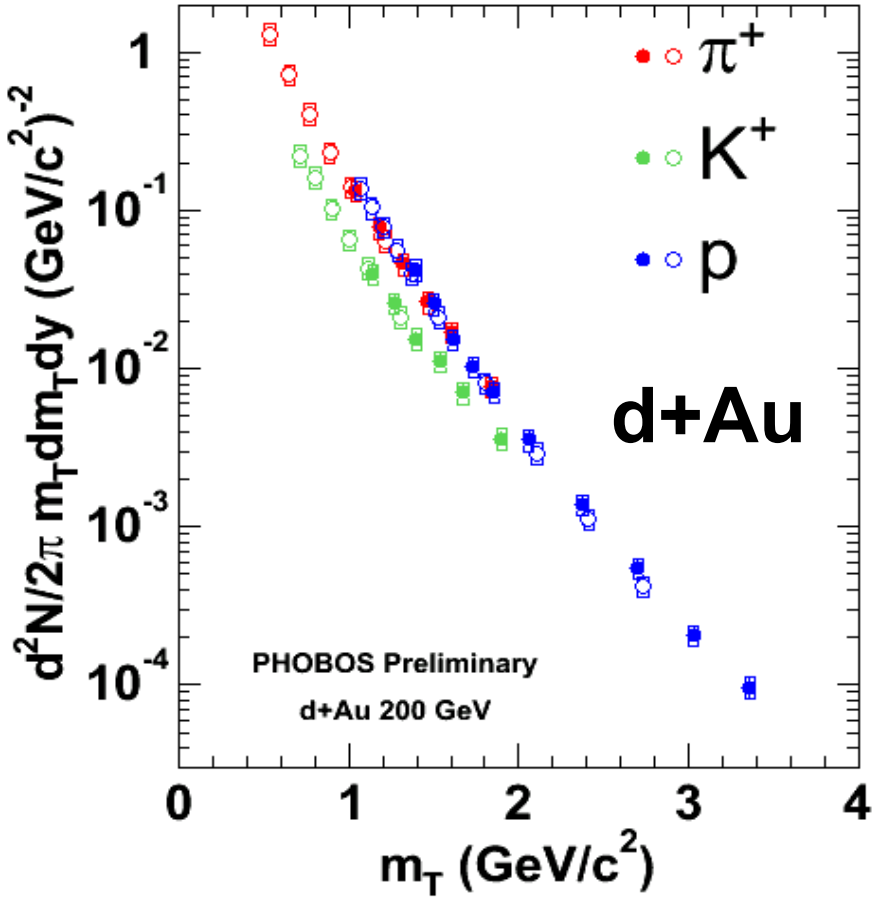
$$m_T^2 = m^2 + p_T^2$$

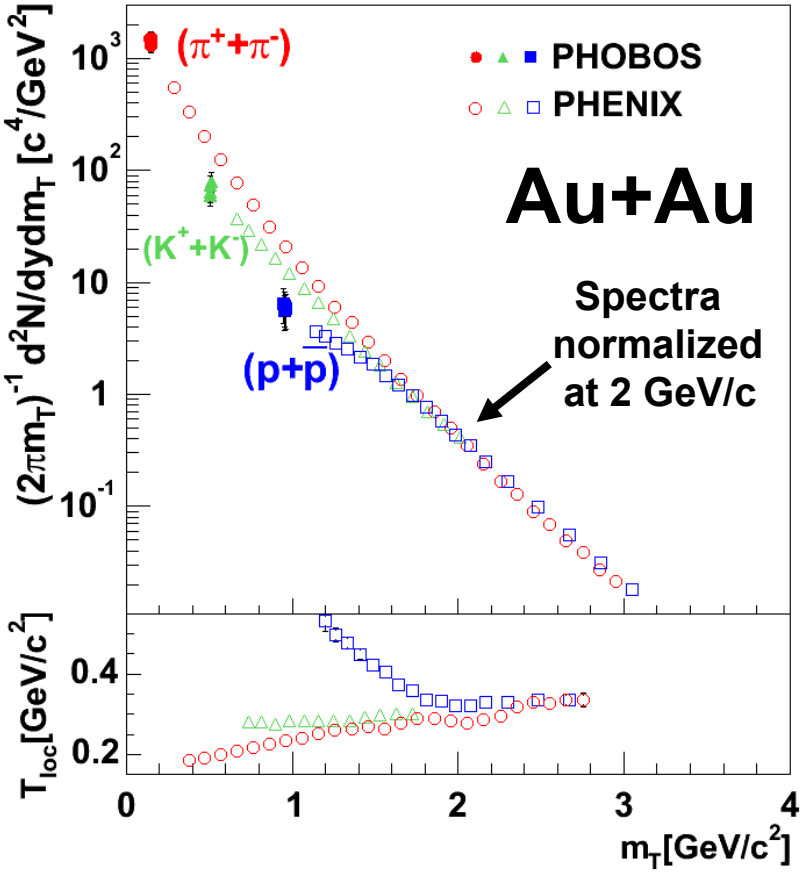
Scale uncertainty: 15%

Not feed-down corrected

m_T Scaling in d+Au vs Au+Au

PRC in press
nucl-ex/0401006



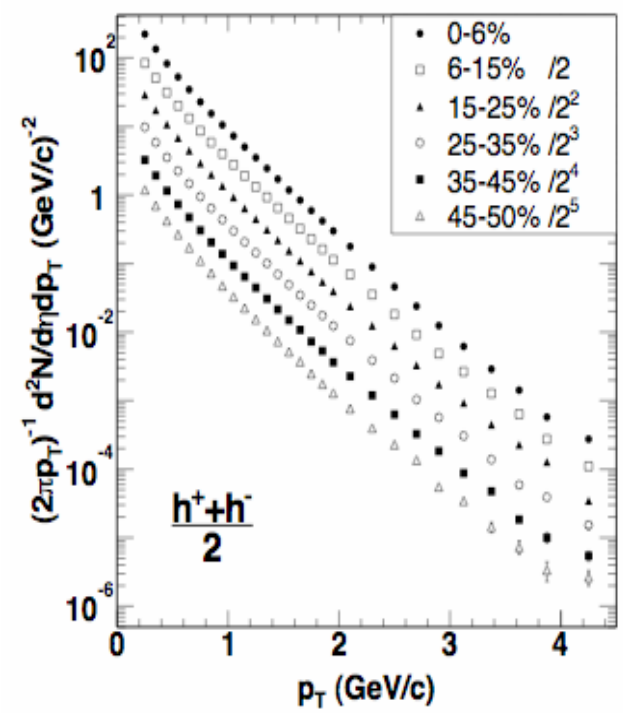


Scale uncertainty: 15%

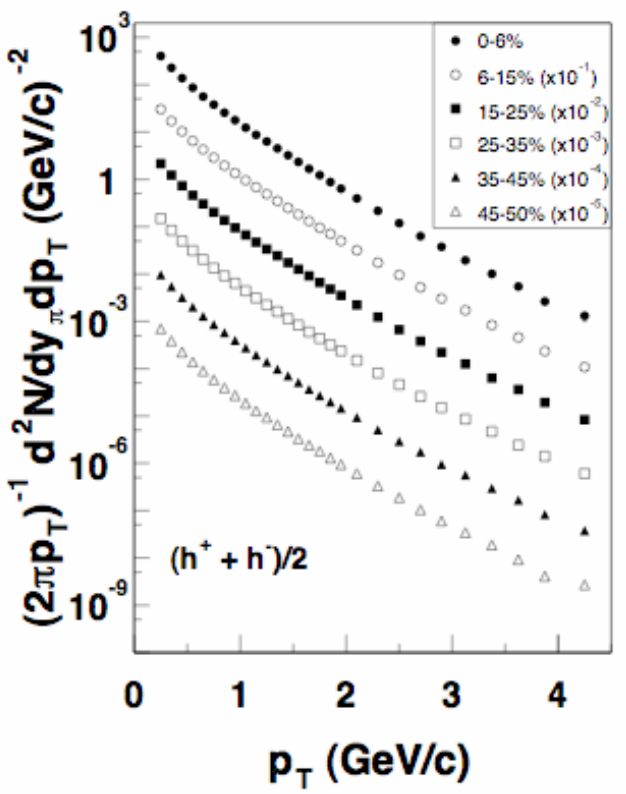
Not feed-down corrected

Results for Au+Au

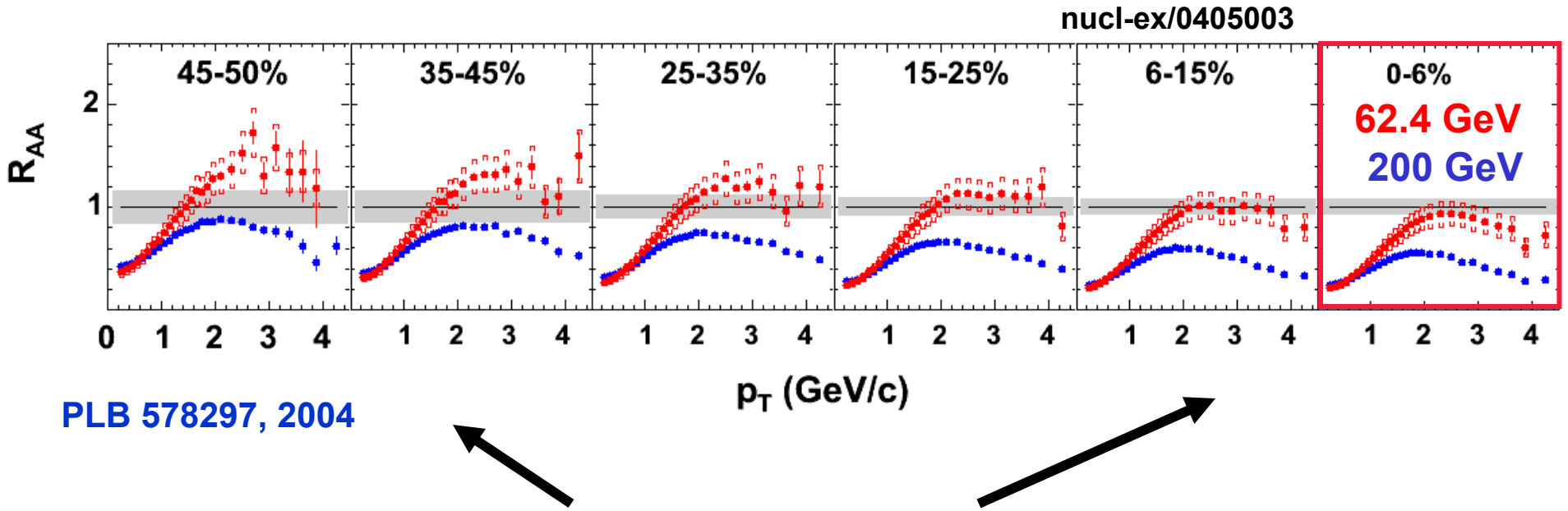
62.4 GeV Au+Au



200 GeV Au+Au



Energy Dependence of R_{AA}



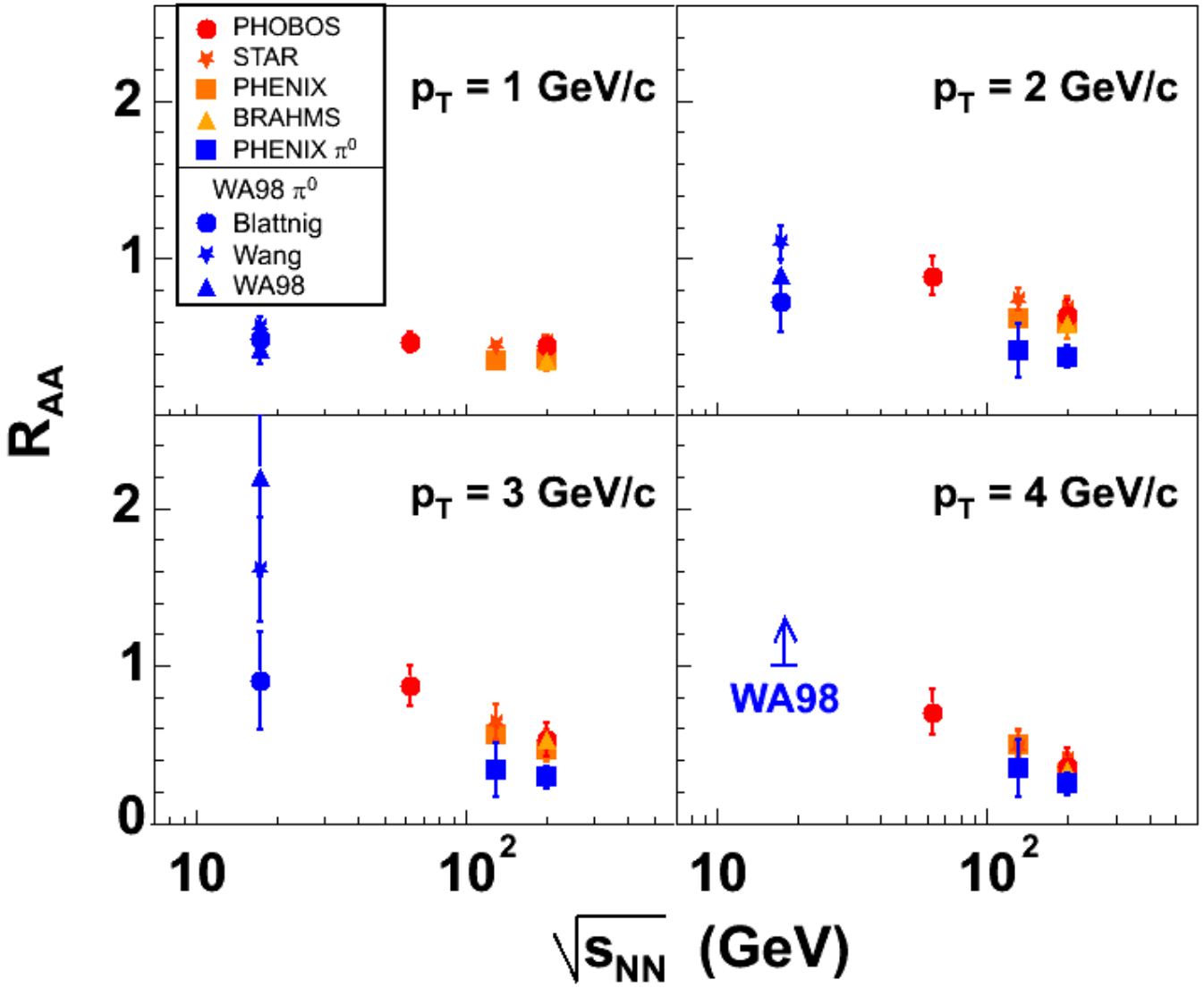
PLB 578297, 2004

At 62.4 GeV, significantly higher R_{AA} than at 200 GeV

$$R_{AA} = \frac{\sigma_{pp}^{inel}}{\langle N_{coll} \rangle} \frac{d^2 N_{AA}/dp_T d\eta}{d^2 \sigma_{pp}/dp_T d\eta}$$

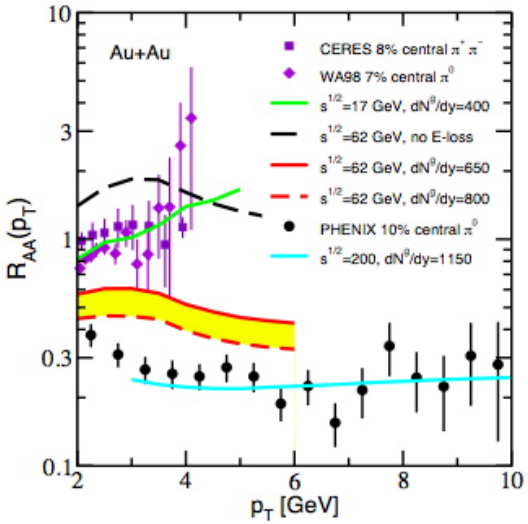
Energy Dependence of R_{AA}

nucl-ex/0405003

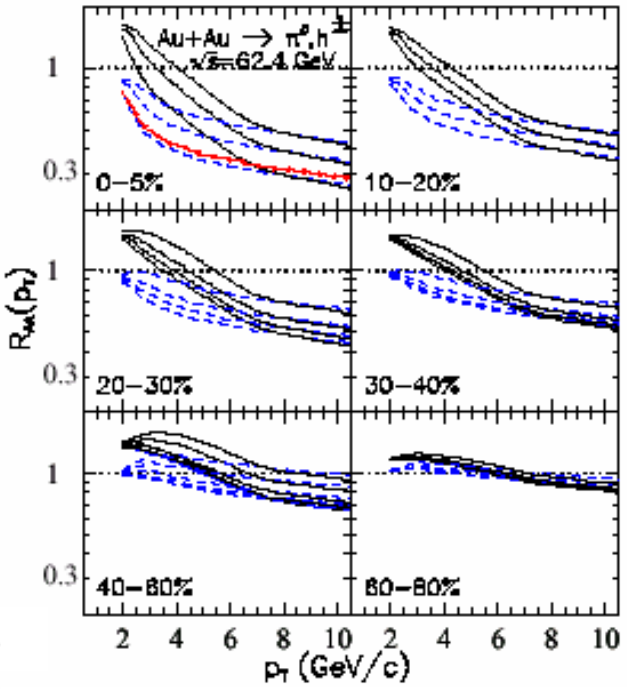


R_{AA} at 62.4 GeV from Theory

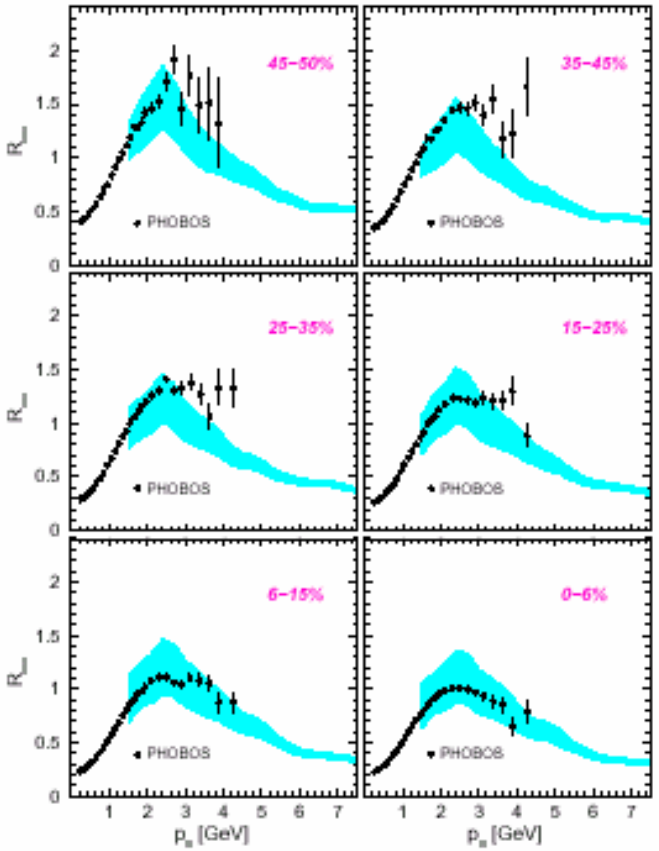
Vitev: nucl-th/0404052



XN Wang: nucl-th/0405029



Gallmeister, Cassing: hep-ph/0408223



Adil, Gyulassy: nucl-th/0405036

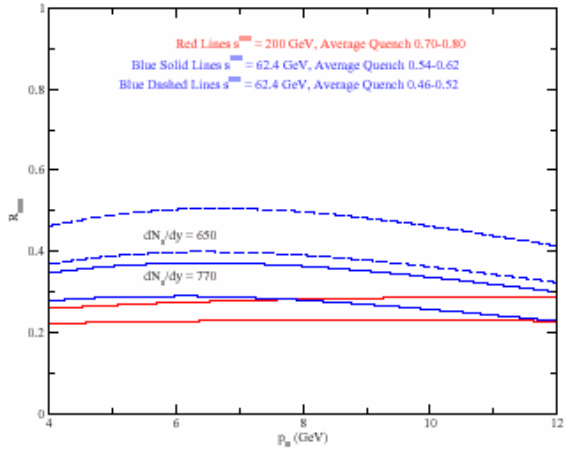
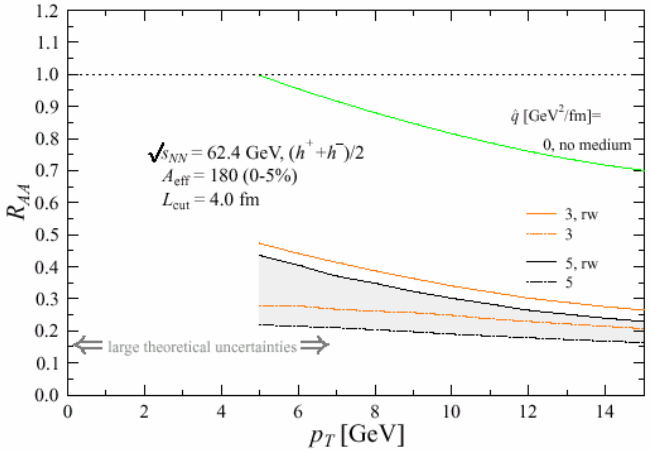
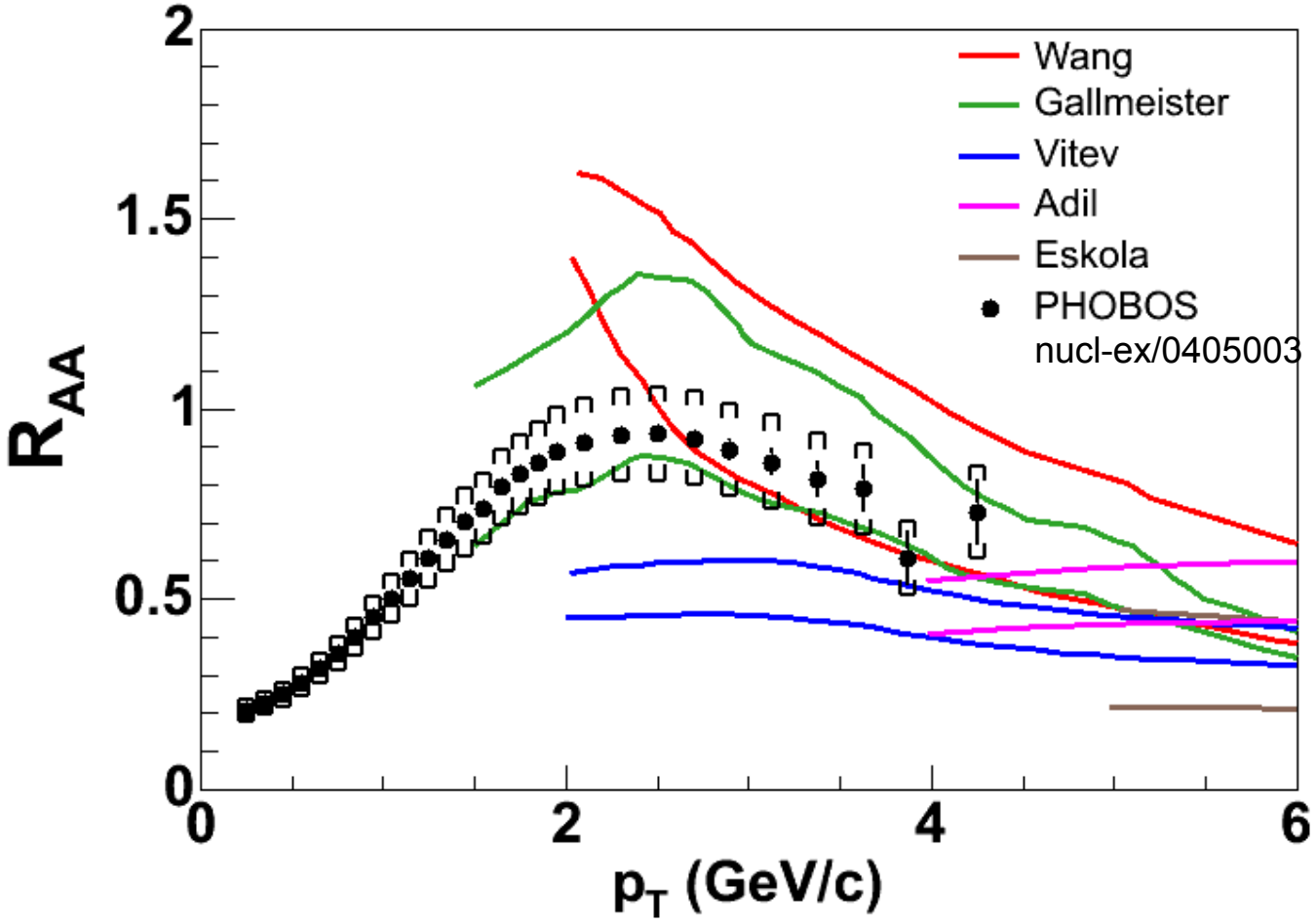


FIG. 5: R_{AA} at $\sqrt{s} = 62.4, 200$ GeV calculated using the uniform distribution.

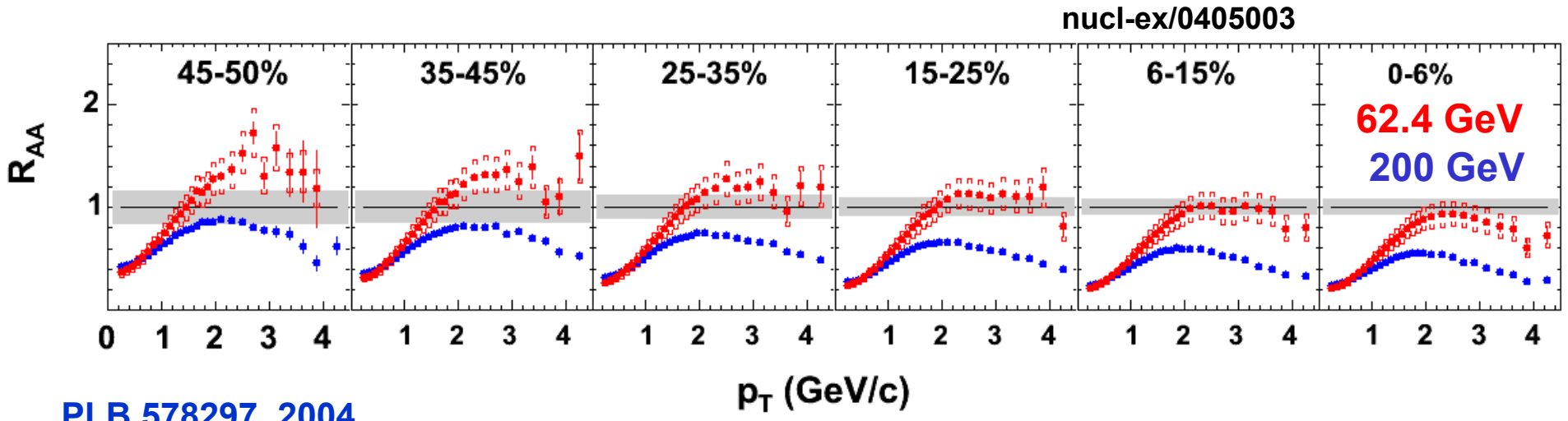


Eskola, Honkanen, Salgado, Wiedemann: hep-ph/0406319

R_{AA} at 62.4 GeV vs Theory



Centrality Dependence of R_{AA}

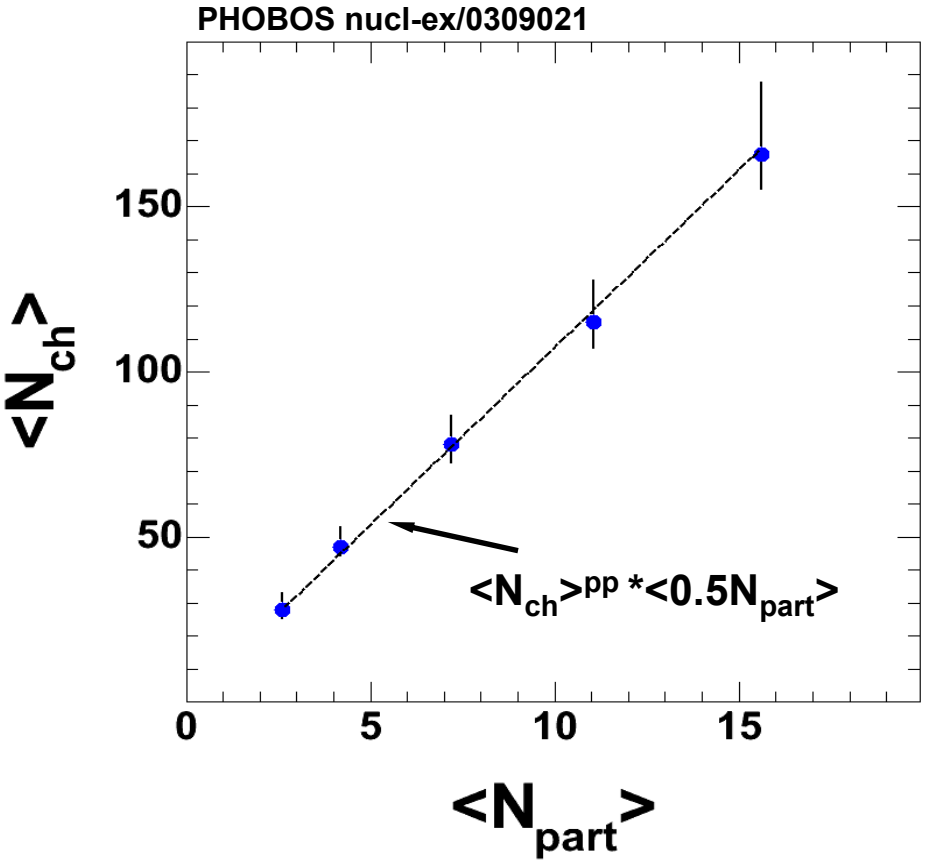


PLB 578297, 2004

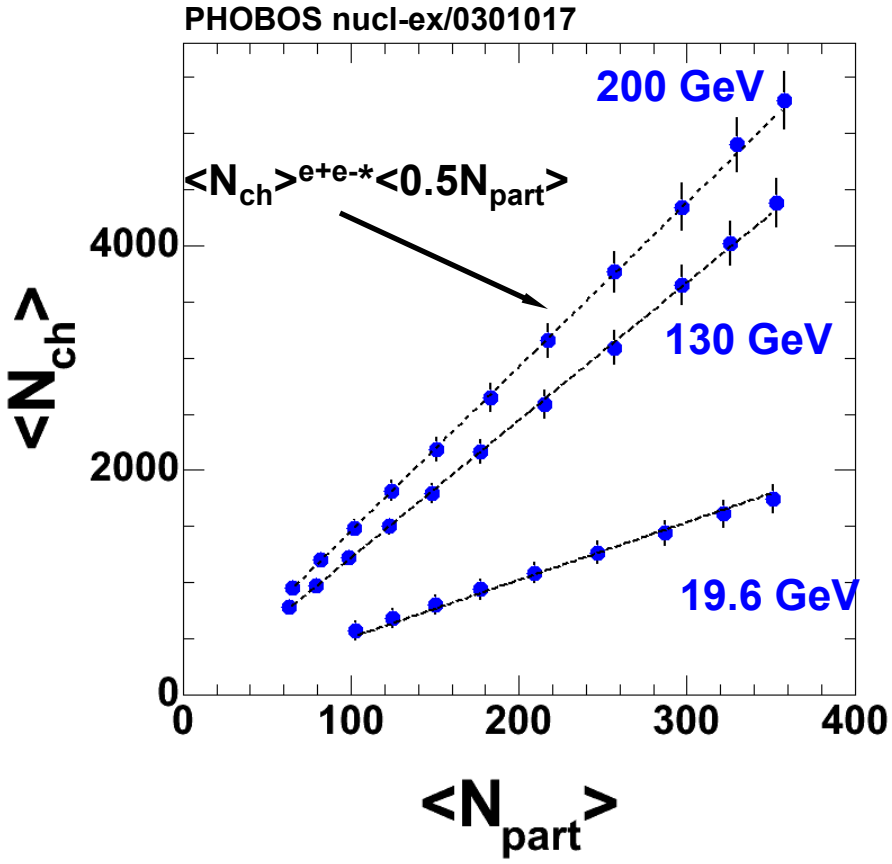
Features of centrality dependence?

Participant Scaling

d+Au



Au+Au

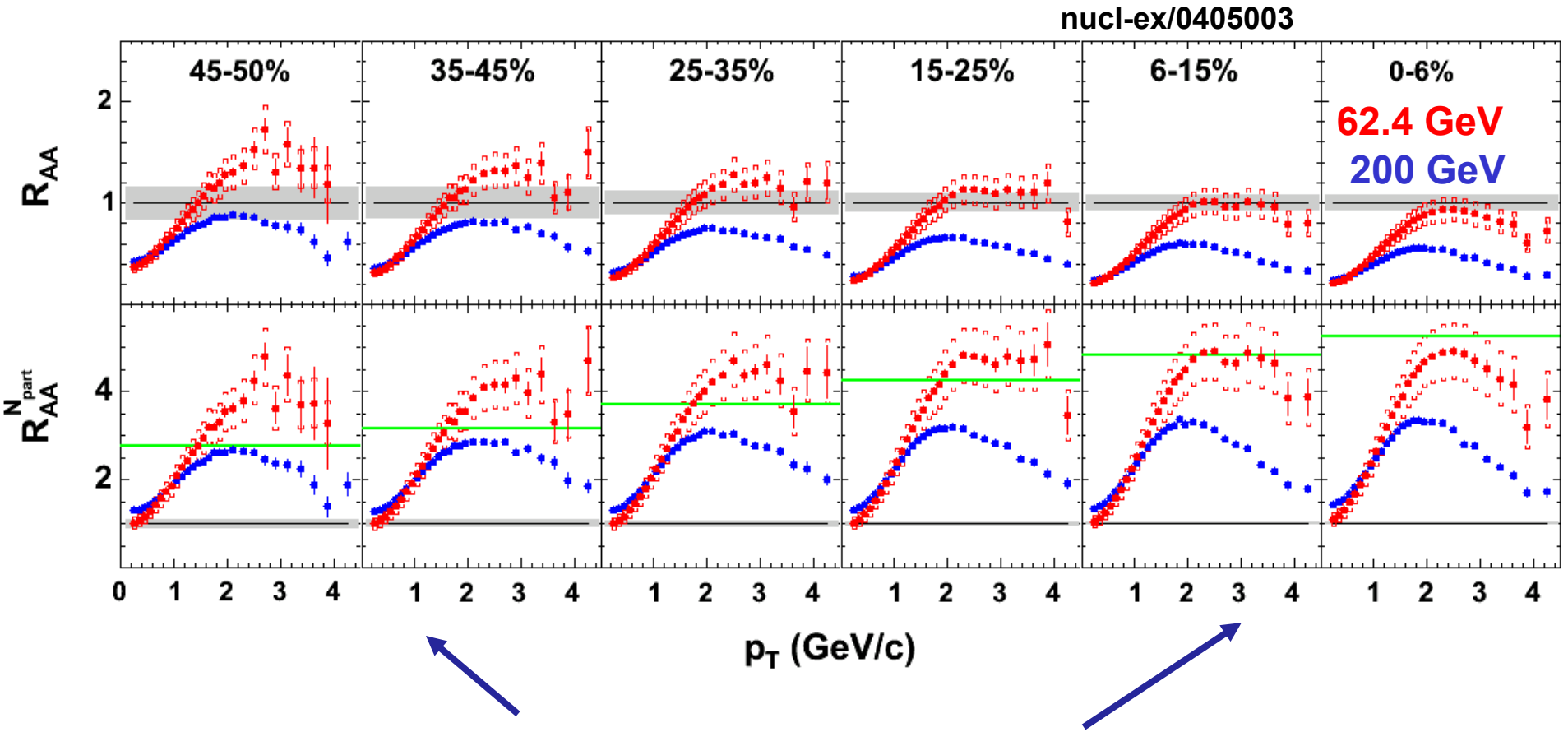


Centrality Evolution in Au+Au

$$R_{PC}^{N_{part}} = \frac{\langle N_{part}^{0-6\%} \rangle}{\langle N_{part} \rangle} \frac{d^2 N_{AA}/dp_T d\eta}{d^2 N_{AA}^{0-6\%}/dp_T d\eta}$$

- Use ***central*** A+A as denominator
- Scale with $1/\langle N_{part} \rangle$

$R_{AA}^{N_{part}}$ at 200 and 62.4 GeV (Au+Au)

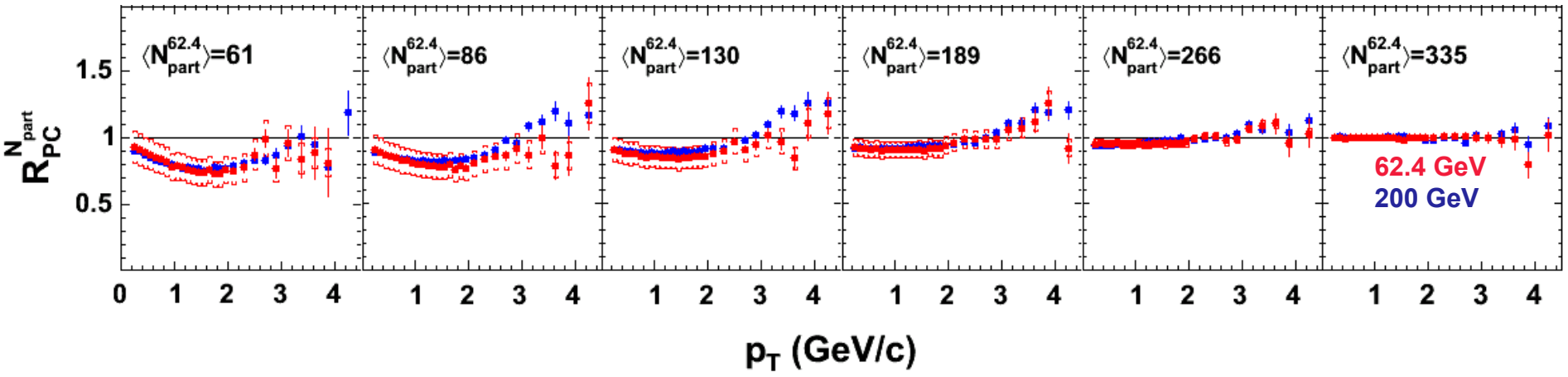


Yields normalized by N_{part} less centrality-dependent

Factorization of Energy/Centrality Dependence

$$R_{PC}^{N_{part}} = \frac{\langle N_{part}^{0-6\%} \rangle}{\langle N_{part} \rangle} \frac{d^2 N_{AA}/dp_T d\eta}{d^2 N_{AA}^{0-6\%}/dp_T d\eta}$$

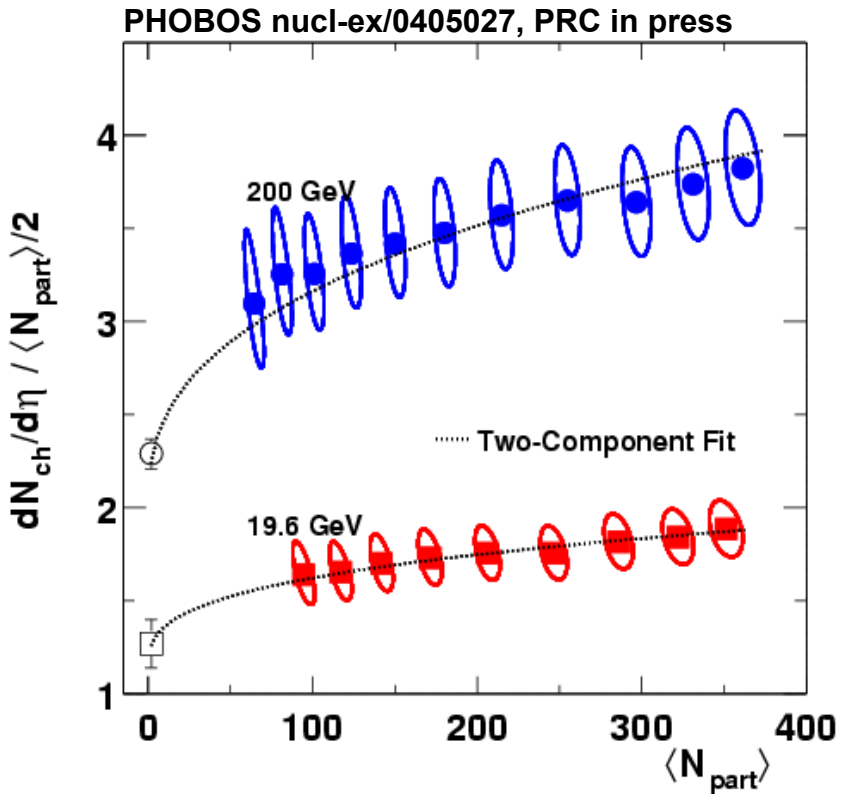
nucl-ex/0405003



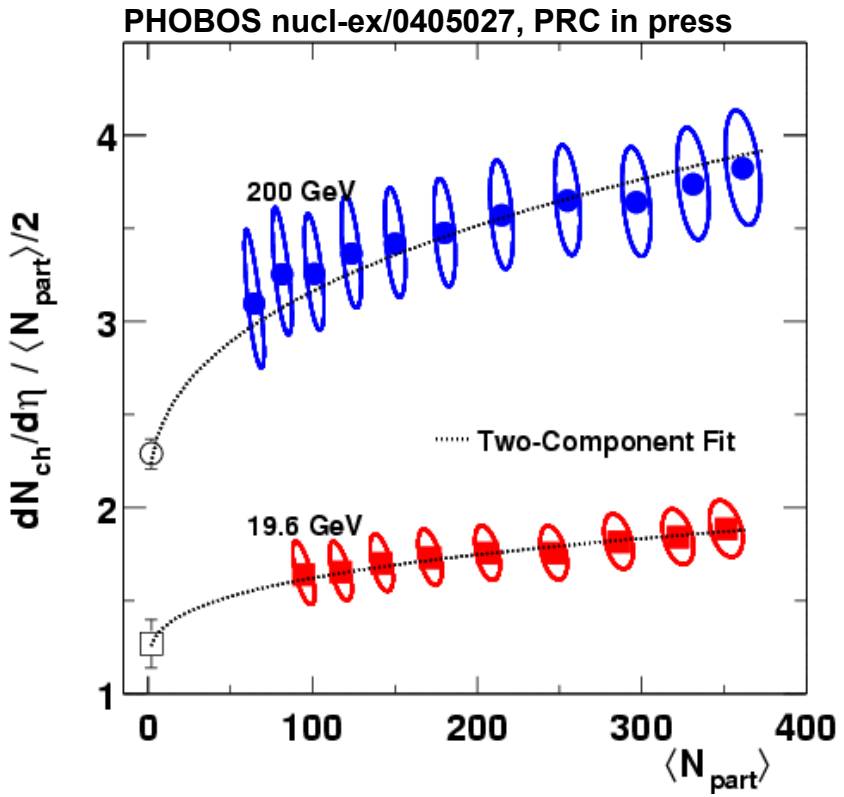
- Yield/participant changes by less than 25% for all p_T
- Factorization of energy and centrality dependence

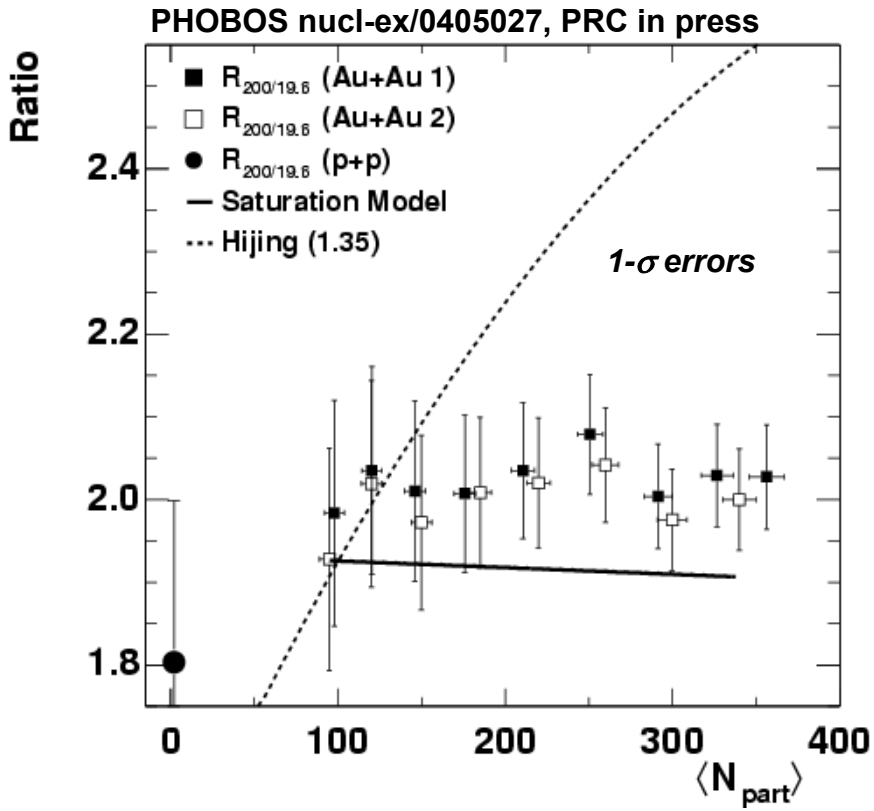
Factorization of Energy/Centrality Dependence

PHOBOS nucl-ex/0405027, PRC in press



Factorization of Energy/Centrality Dependence



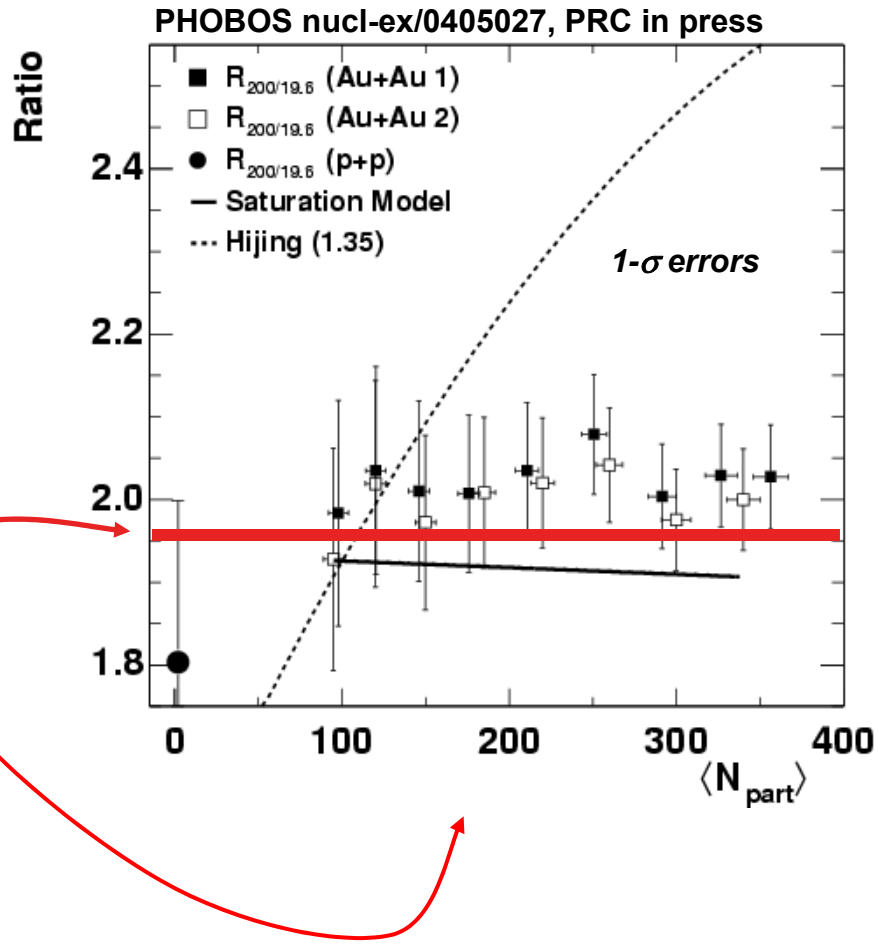


- dN/dη / <N_{part}/2> changes with sqrt(s), <N_{part}>
- Energy and Centrality Dependence Factorize

Factorization of Energy/Centrality Dependence

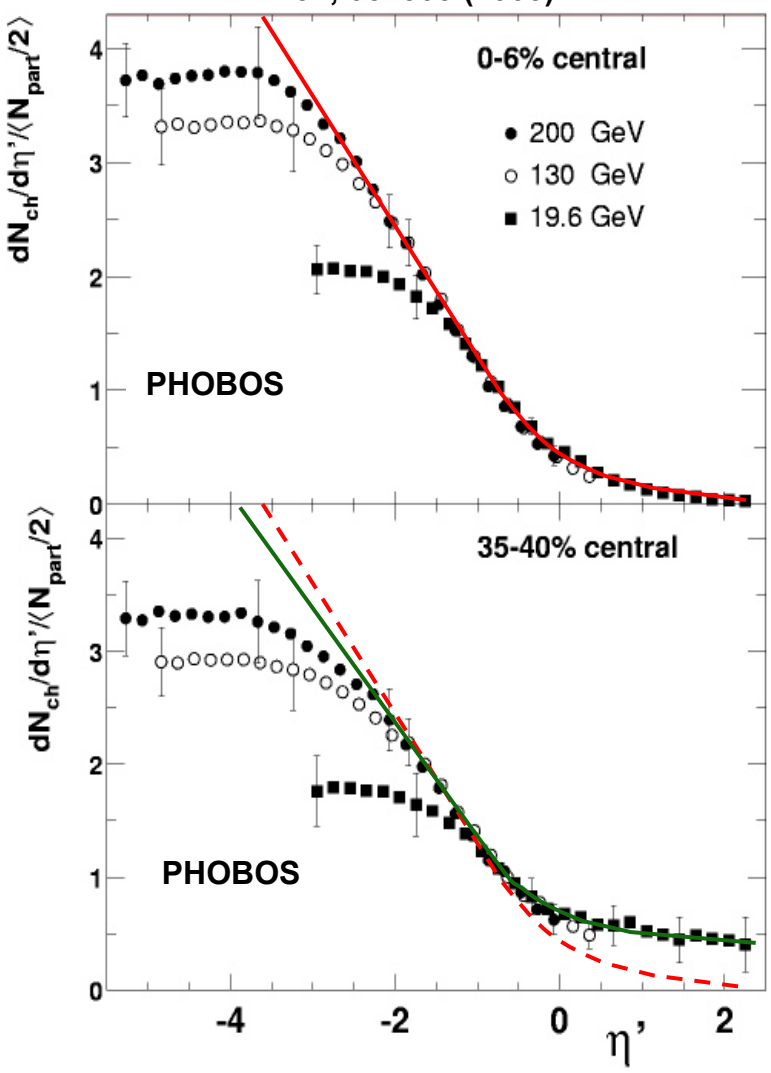
Armesto, Salgado, Wiedemann hep-ph/0407018

$$\left.\frac{1}{N_{\rm part}}\frac{dN^{AA}}{d\eta}\right|_{\eta\sim 0} = N_0\sqrt{s}^{\lambda}N_{\rm part}^{\frac{1-\delta}{3\delta}}$$



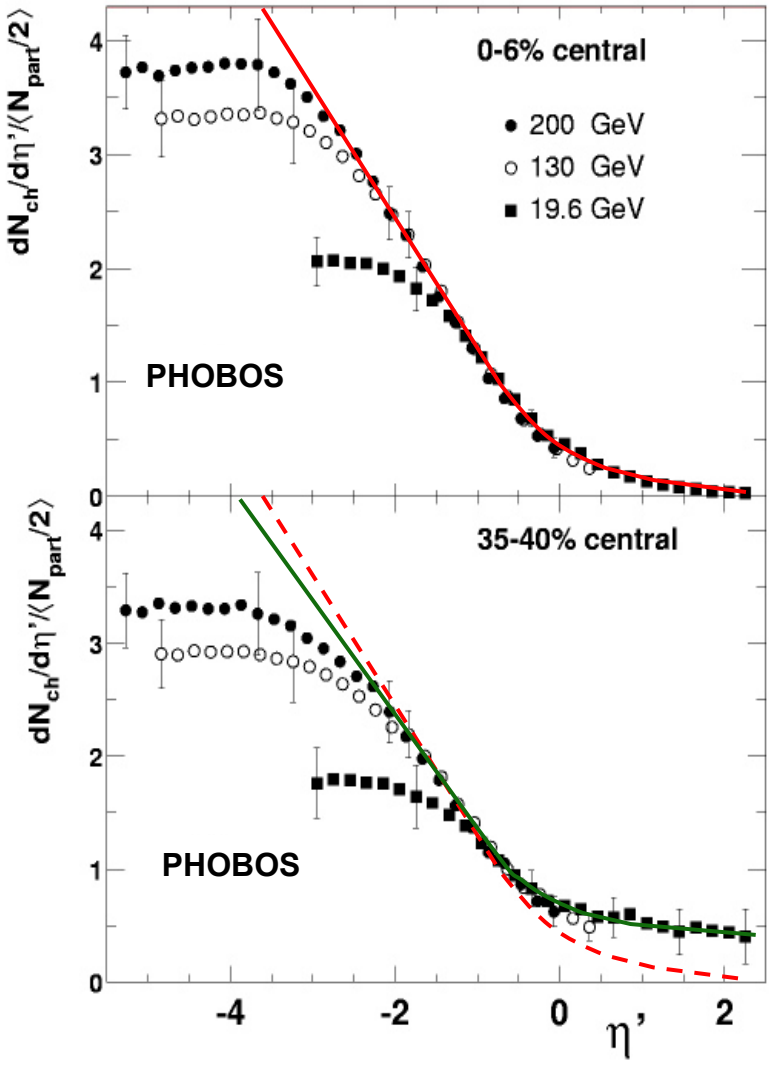
Factorization of Longitudinal Dynamics

PRL 91, 052303 (2003).

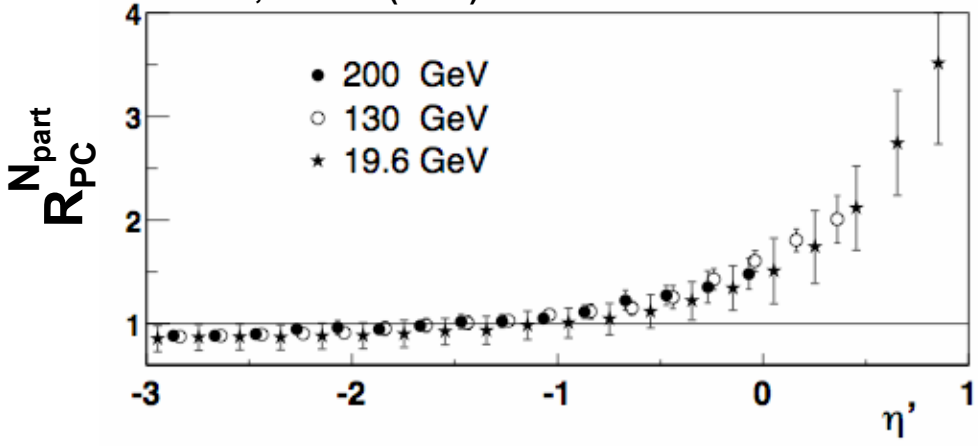


Factorization of Longitudinal Dynamics

PRL 91, 052303 (2003).



PRL 91, 052303 (2003).



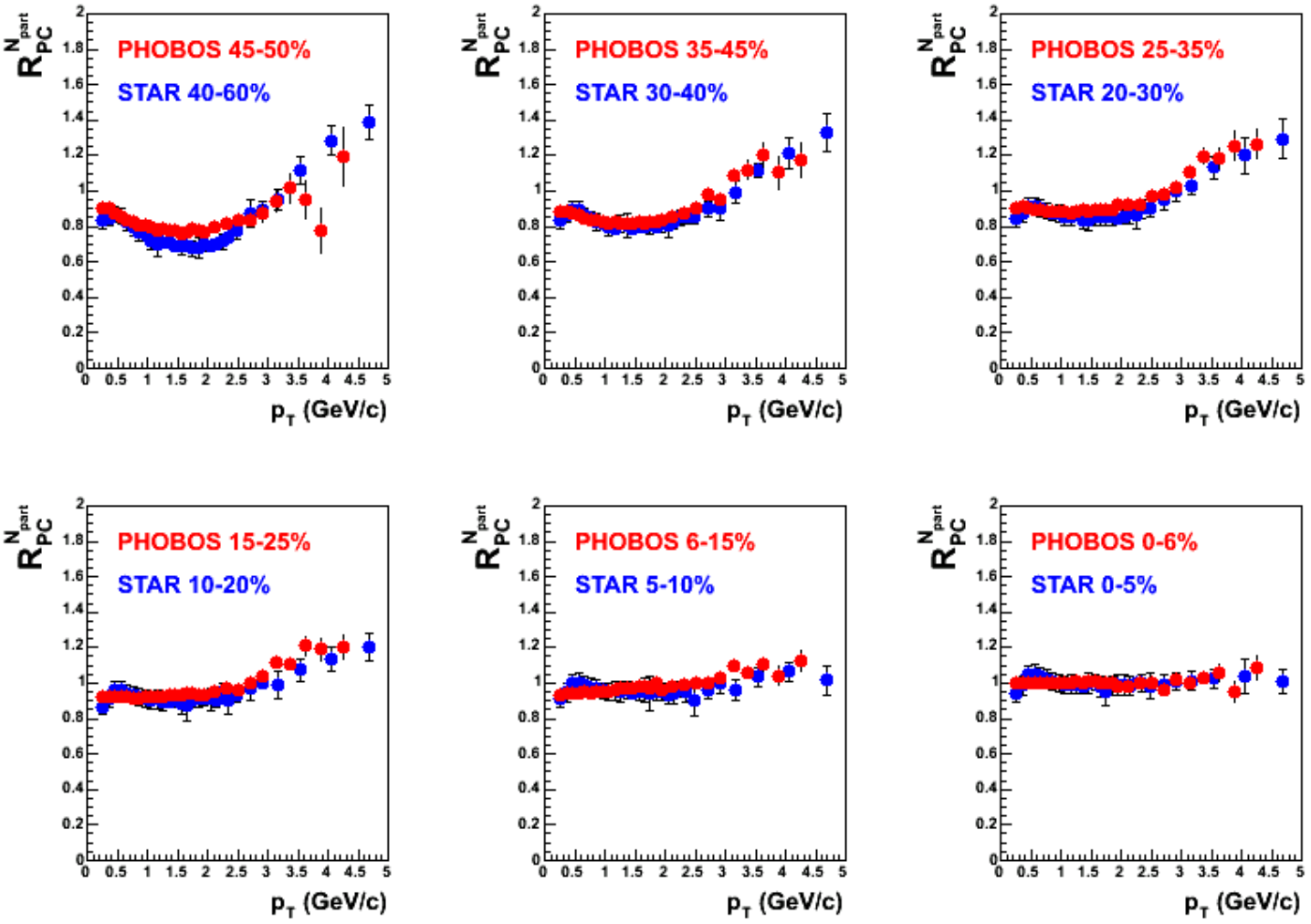
$$R_{PC}^{N_{part}} = \frac{\langle N_{part}^{0-6\%} \rangle}{\langle N_{part} \rangle} \frac{dN_{AA}/d\eta}{dN_{AA}^{0-6\%}/d\eta}$$

Again: Factorization of energy/centrality dependence

Summary

- Study of energy and system-size dependence
- Opaque medium created in A+A
  - Magnitude and energy dependence of suppression calculable
- Soft scaling at intermediate p_T?
  - m_T-Scaling in d+Au
  - Factorization of energy and centrality dependence
- More information from
  - PID spectra
  - high statistics 200 GeV Au+Au data
  - Cu+Cu run

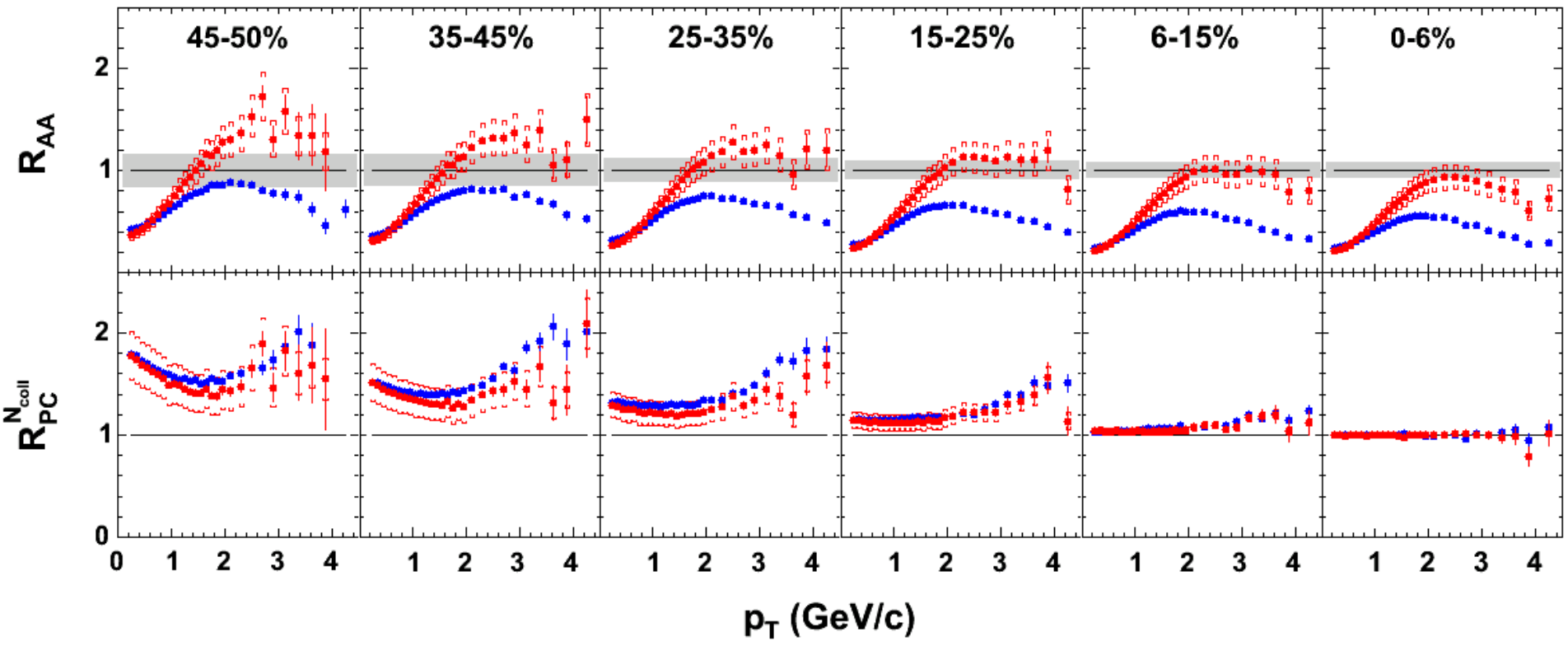
$R_{PC}^{N_{part}}$ vs. p_T, PHOBOS and STAR, 200 GeV



PLB 578297, 2004

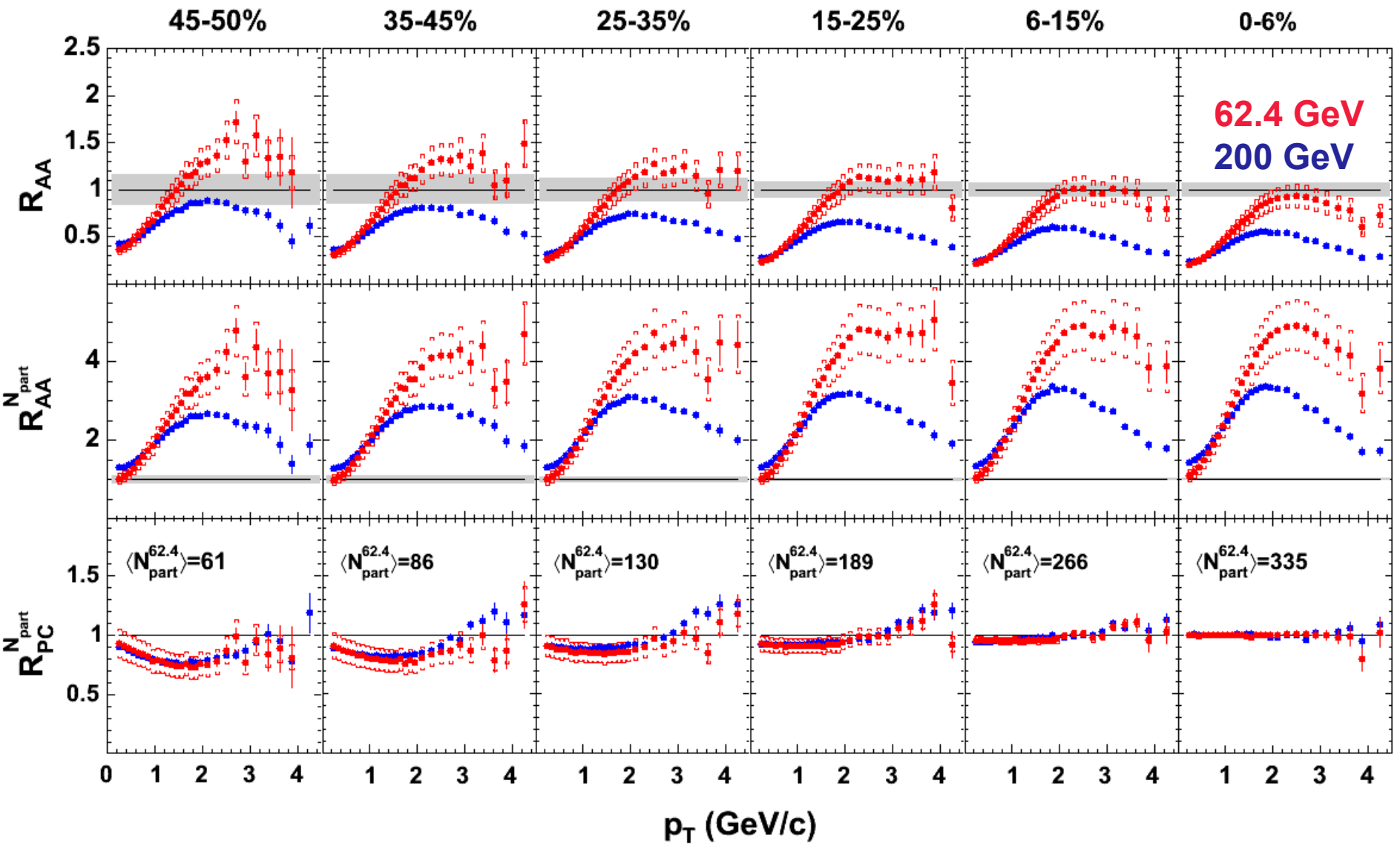
PRL 91, 172302, 2003

Collision Scaling vs Centrality



$$R_{PC}^{N_{coll}} = \frac{\langle N_{coll}^{0-6\%} \rangle}{\langle N_{coll} \rangle} \frac{d^2 N_{AA}/dp_T d\eta}{d^2 N_{AA}^{0-6\%}/dp_T d\eta}$$

Factorization of Energy/Centrality Dependence



N_{part} scaling relative to p+p

$$R_{AA}^{N_{part}} = \frac{\sigma_{pp}^{inel}}{\langle N_{part}/2 \rangle} \frac{d^2 N_{AA}/dp_T d\eta}{d^2 \sigma_{pp}/dp_T d\eta}$$

- Keep p+p as denominator
- Scale with $\langle N_{part} \rangle$ instead of $\langle N_{coll} \rangle$