Centrality dependence of pion and kaon production in Pb+Pb collisions at SPS energies.

Outline

Motivation and claim

Data and analysis

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Interpretation

Motivation and claim

- K^+ mesons are a good gauge for the strangeness content. Total strangeness ~ 2 x (K^+ +K^0 + $\overline{Y}$).
- K to π ratios (K/π) are a good measure for the strangeness enhancement.
- The double ratio K/π in A+A and K/π in p+p ($K/\pi_{AA}/K/\pi_{pp}$) is a good measure for the **relative** strangeness enhancement.

- The well established strangeness enhancement saturates in **central** collisions of heavy systems already at SIS18 energies.

- **The saturation of the strangeness enhancement depends on centrality. It is realized for mid-central collisions at the highest SPS energies and already in peripheral collisions (40 participants) at the highest RHIC energies.**

Data and analysis

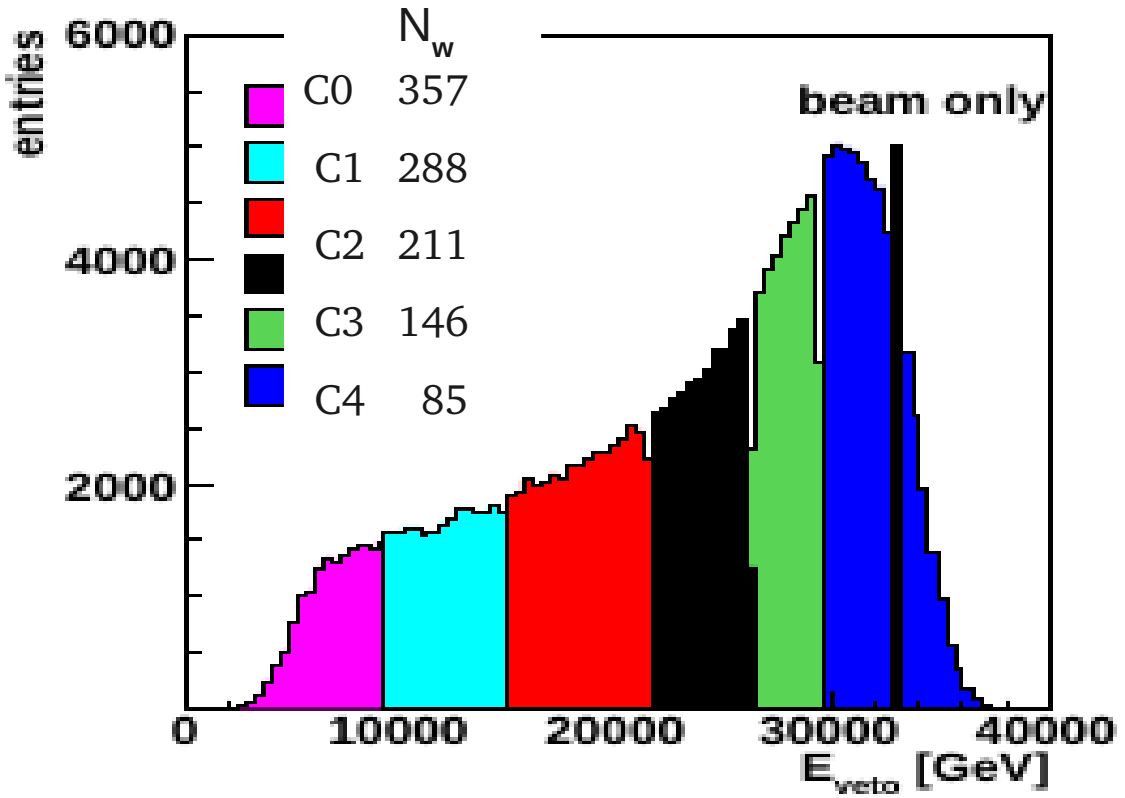
Experiment NA49 at the CERN SPS has taken and analyzed kaons and pions in minimum bias Pb+Pb collisions at 40A and 158A GeV (forward hemisphere) with a large acceptance TPC/TOF based detector.
Kaon identification was achieved by energy loss (dE/dx) and time-of-flight (TOF) measurements. The yield of π^- was obtained from the yield of all negatively charged particles by subtracting K^- and $\bar{p}$. The yield of π^+ was determined by a combined analysis of dE/dx and TOF measurements near mid-rapidity assuming that the shapes of p_T and rapidity distributions of π^+ are the same as of π^-**.**

We compare to data on C+C and Si+Si at 40A and 158A GeV which were taken earlier and analyzed in the same way.

This contribution is based on **Phys. Rev. C 86, 054903 (2012)**

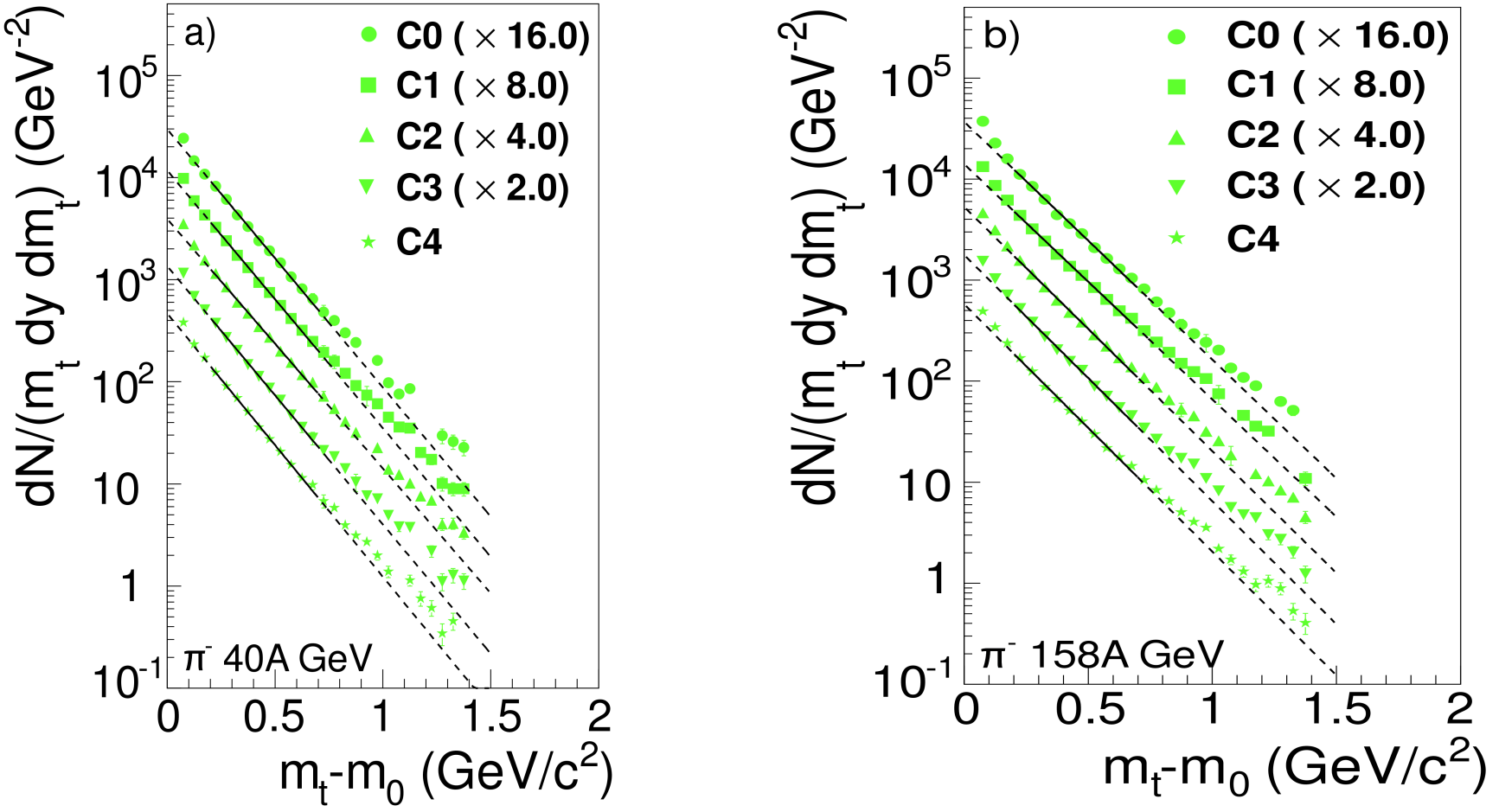
Analysis

Centrality is determined by the measurement of the forward going (mainly spectator) energy (E_{veto}) quantified by the number of “wounded” nucleons (N_w).



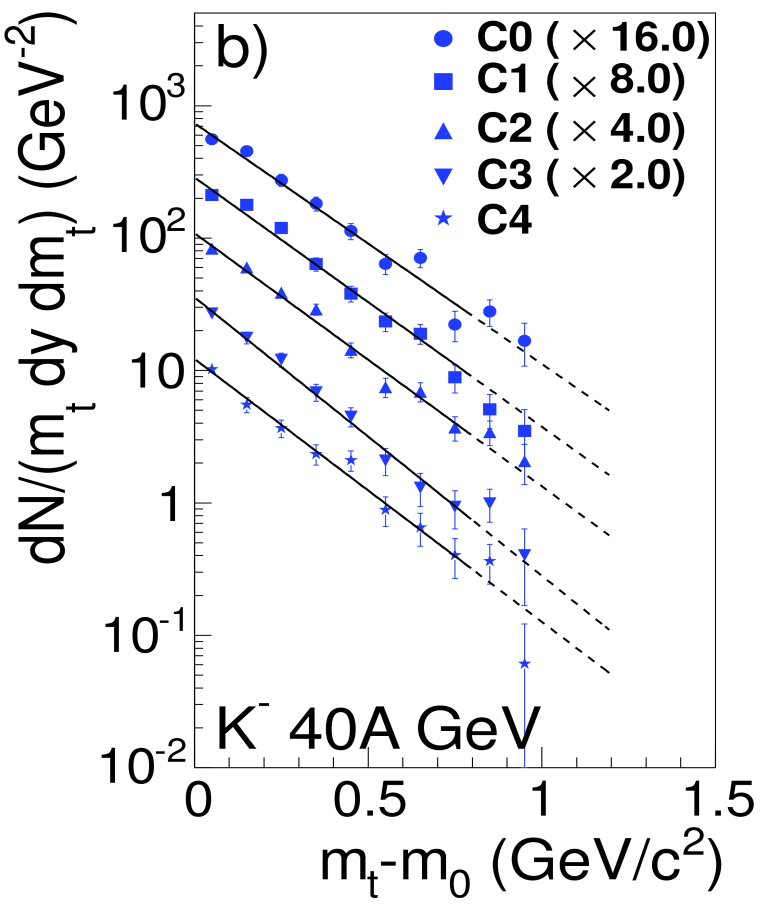
Results (1)

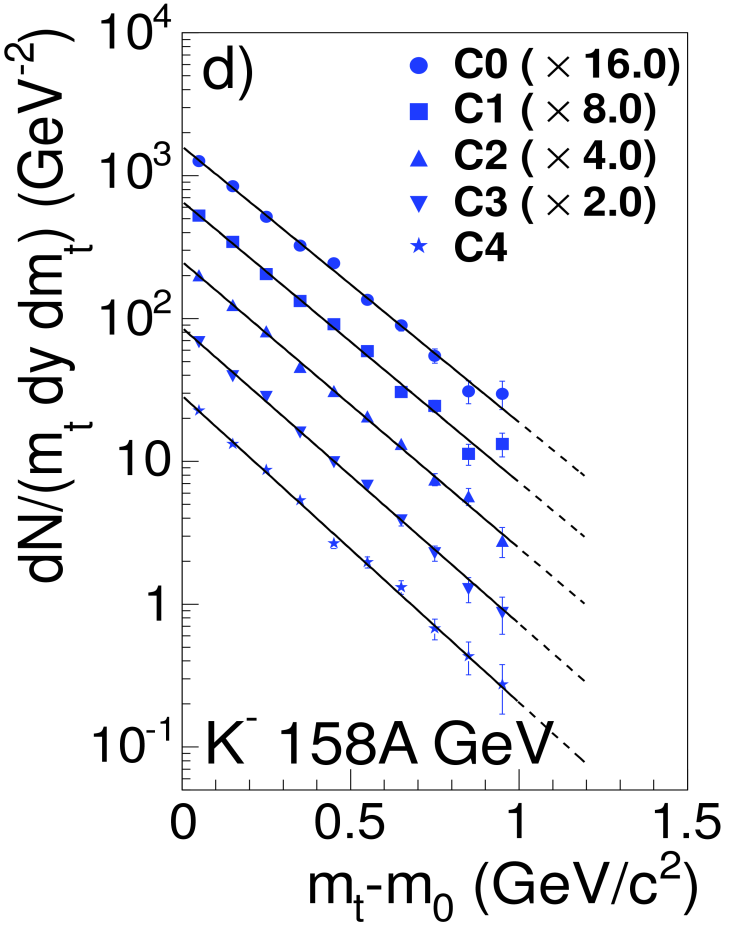
Transverse mass spectra (y=0) of π^- at 40A and 158A GeV



Results (2)

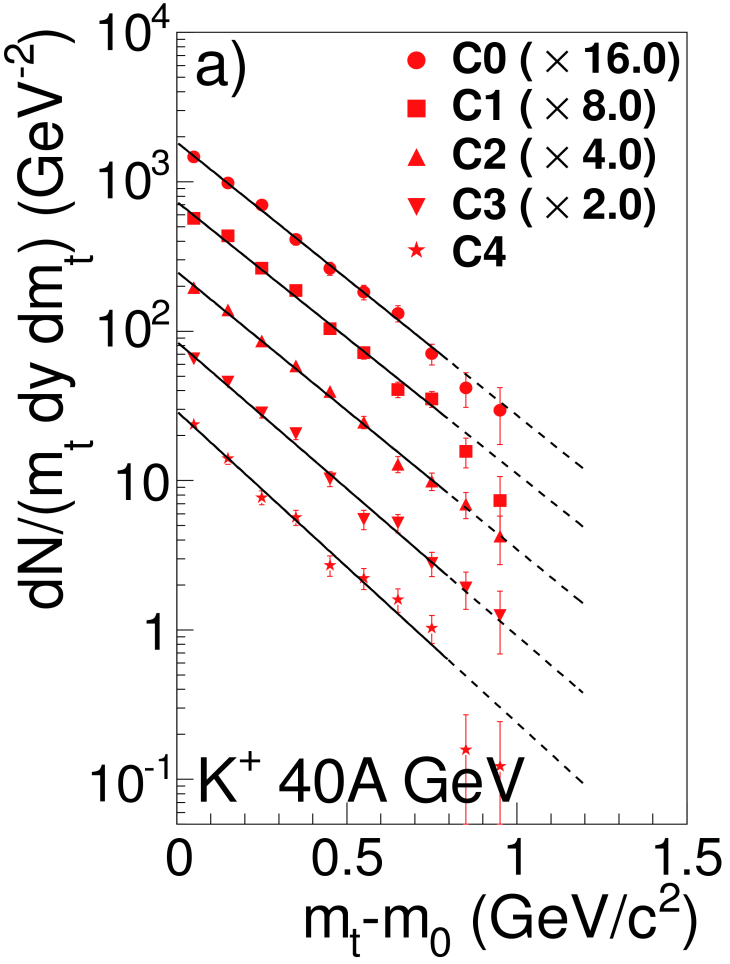
Transverse mass spectra (y=0) of K^- at 40A and 158A GeV

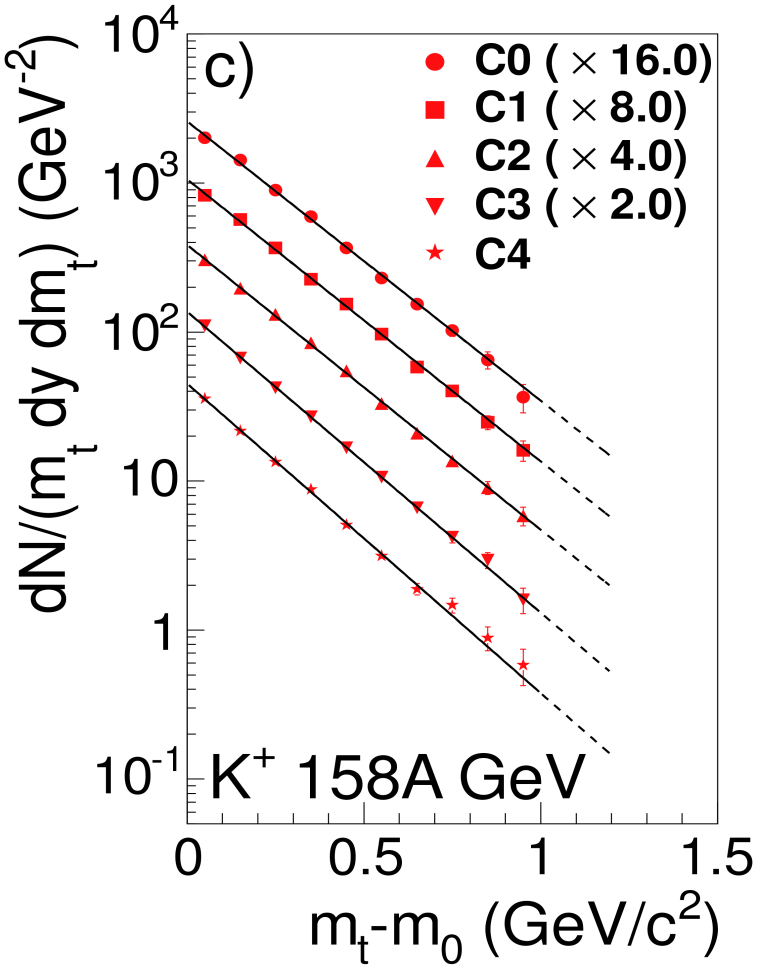




Results (3)

Transverse mass spectra (y=0) of K^- at 40A and 158A GeV



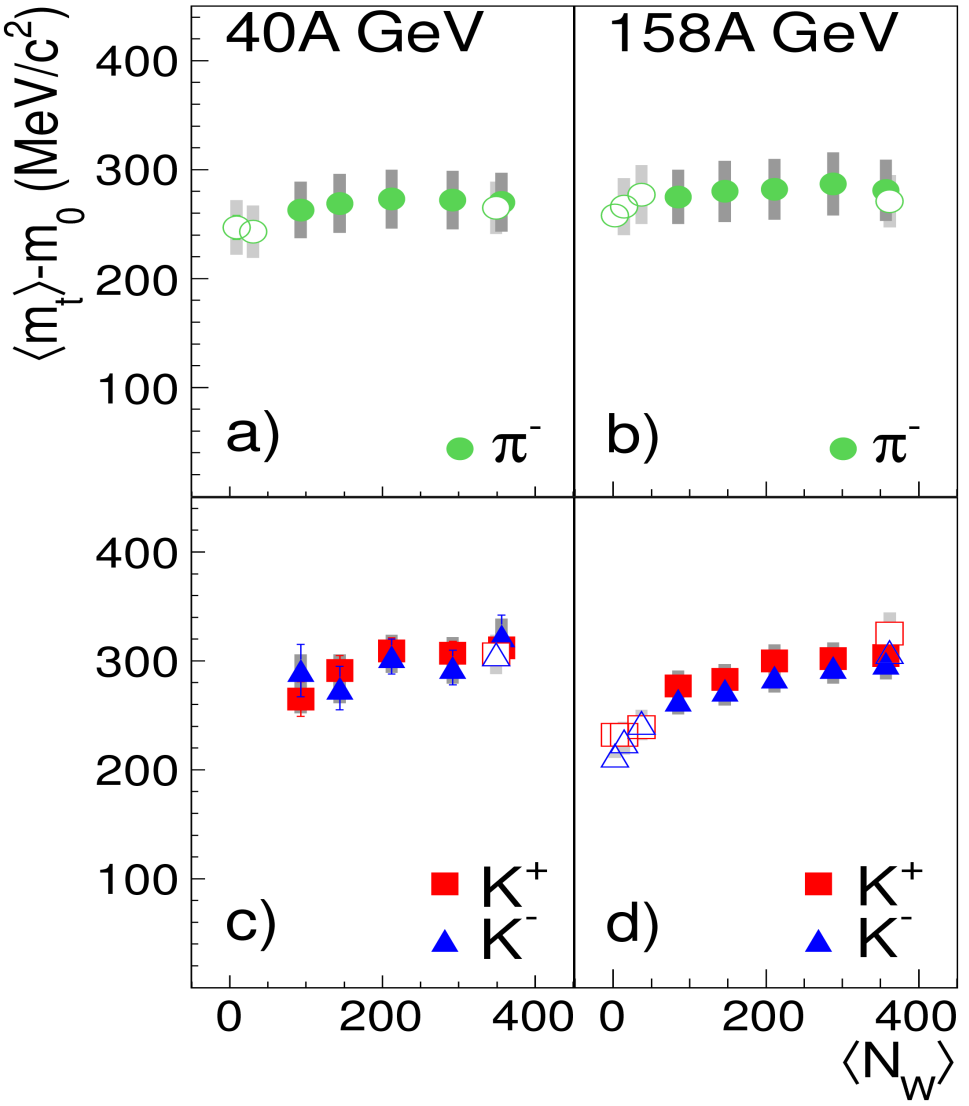


Results (4)

Centrality dependence of the mean transverse mass (y=0) of π^- and K^- at 40A and 158A GeV.

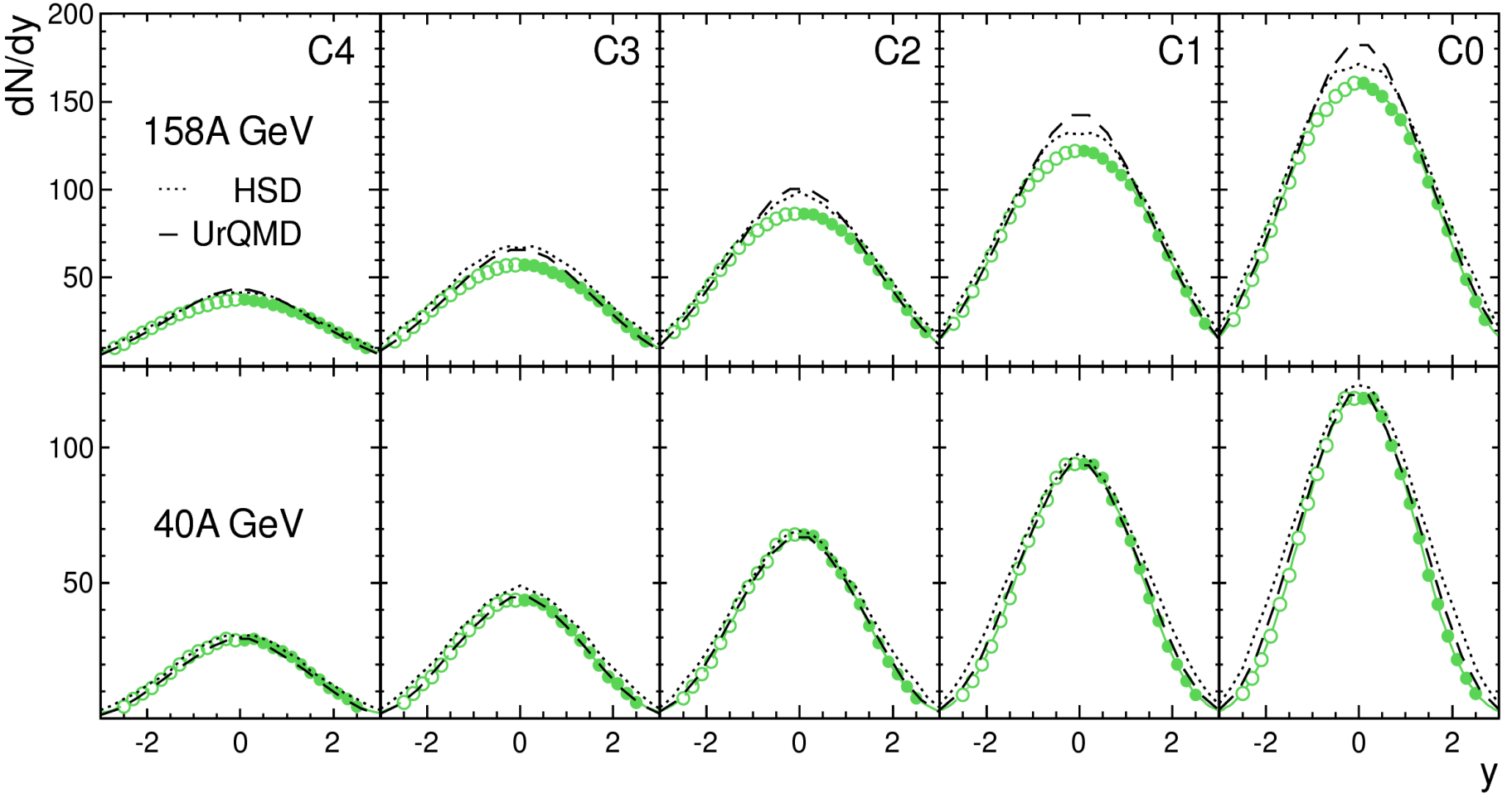
Also shown are data from p+p, C+C, and Si+Si when available.

Is the increase with centrality due to temperature or flow?



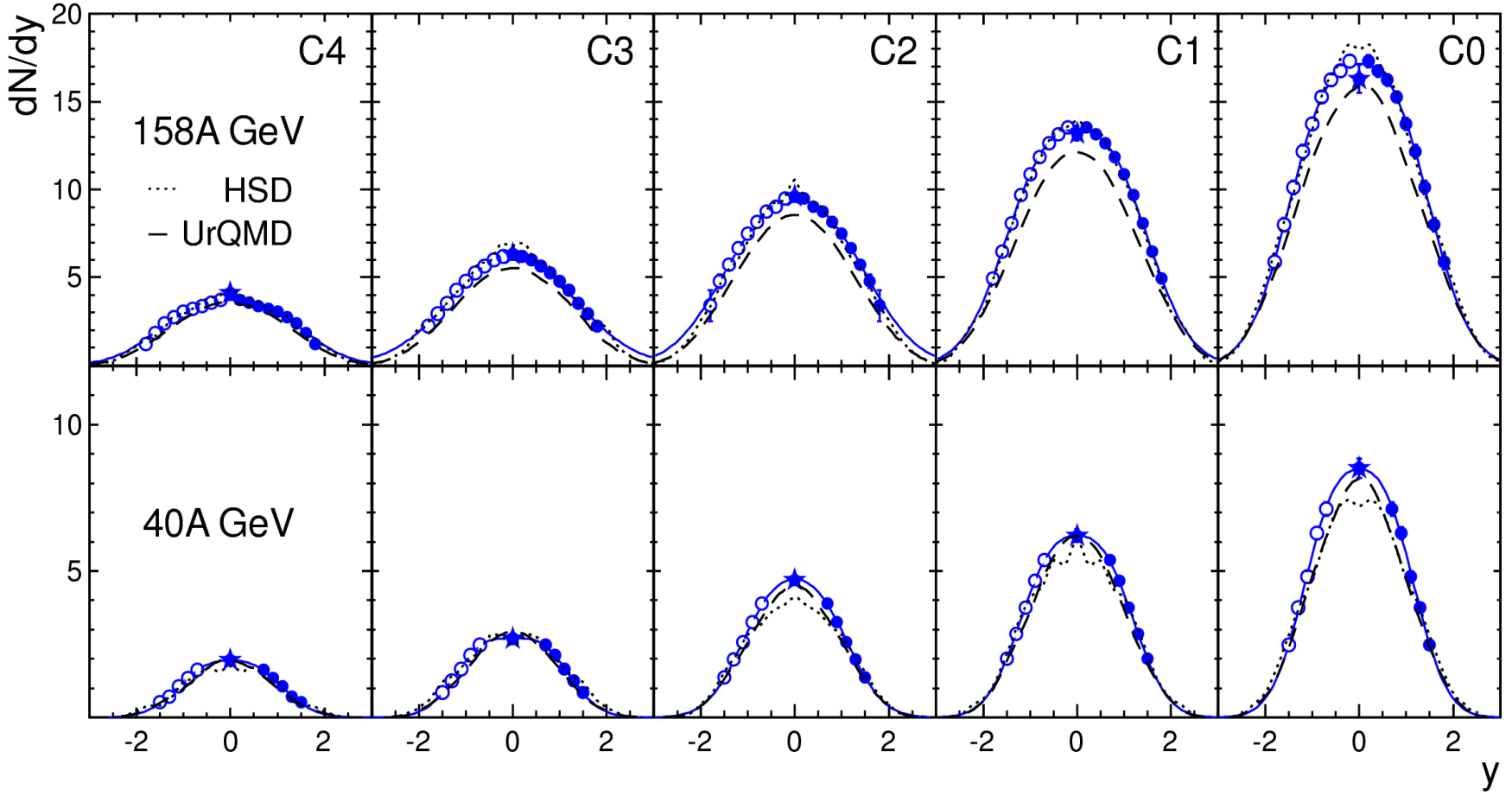
Results (5)

Rapidity distribution of π^- at 40A and 158A GeV



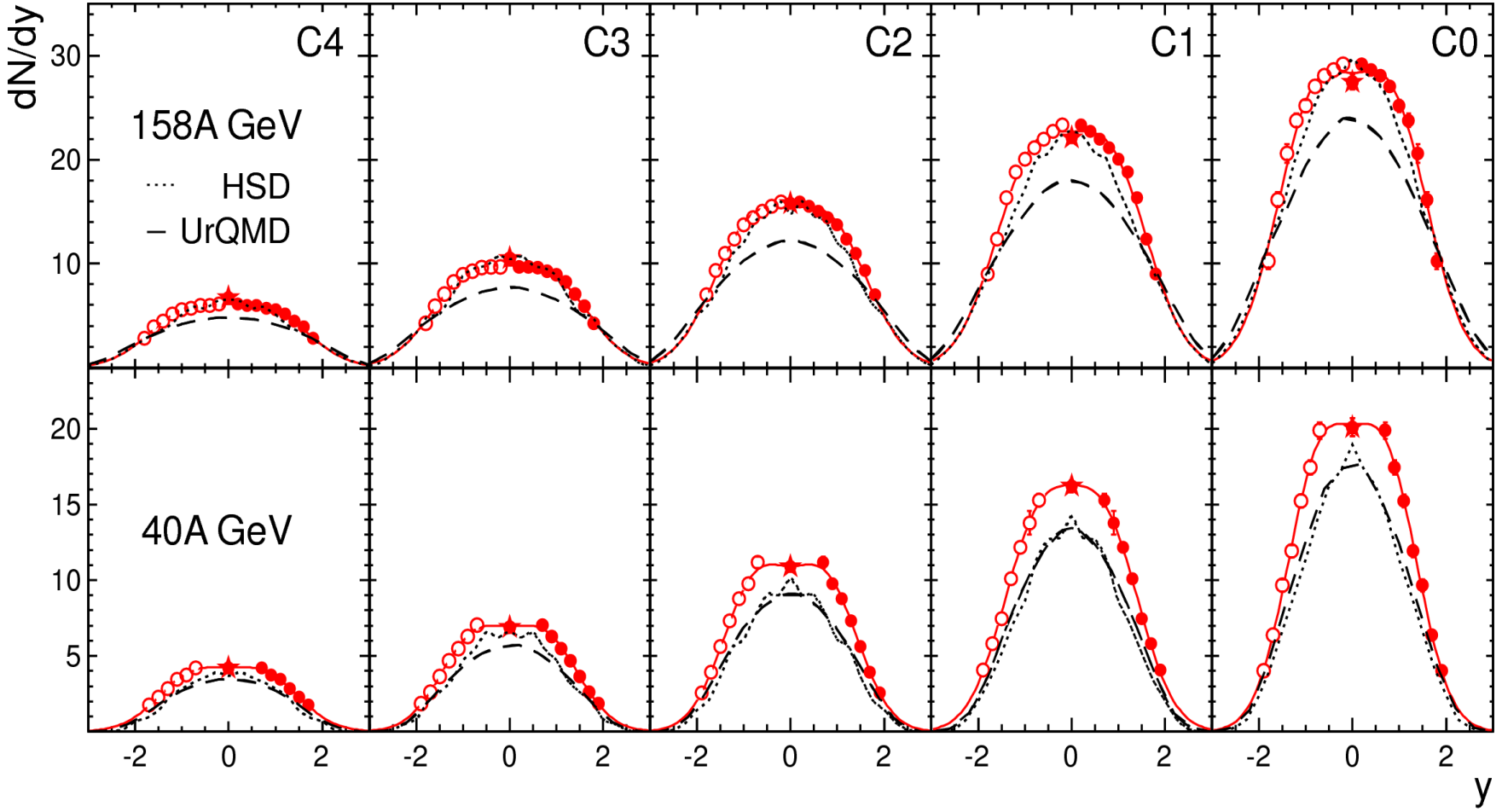
Results (6)

Rapidity distribution of K^- at 40A and 158A GeV



Results (7)

Rapidity distribution of K^+ at 40A and 158A GeV

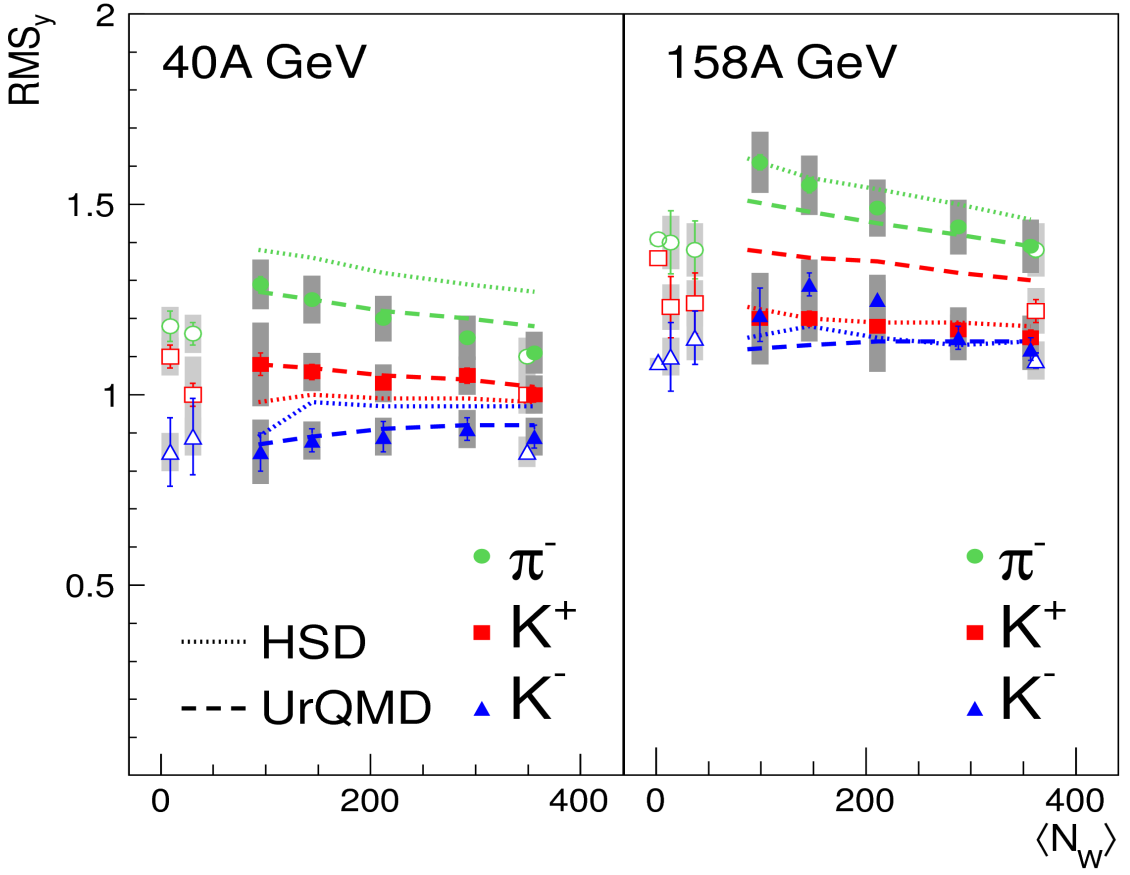


Results (8)

Centrality dependence of the widths of the rapidity distributions at 40A and 158A GeV

Little variation with system size except for pions.

=> Production and/or rescattering in spectator matter. Also seen in the models.

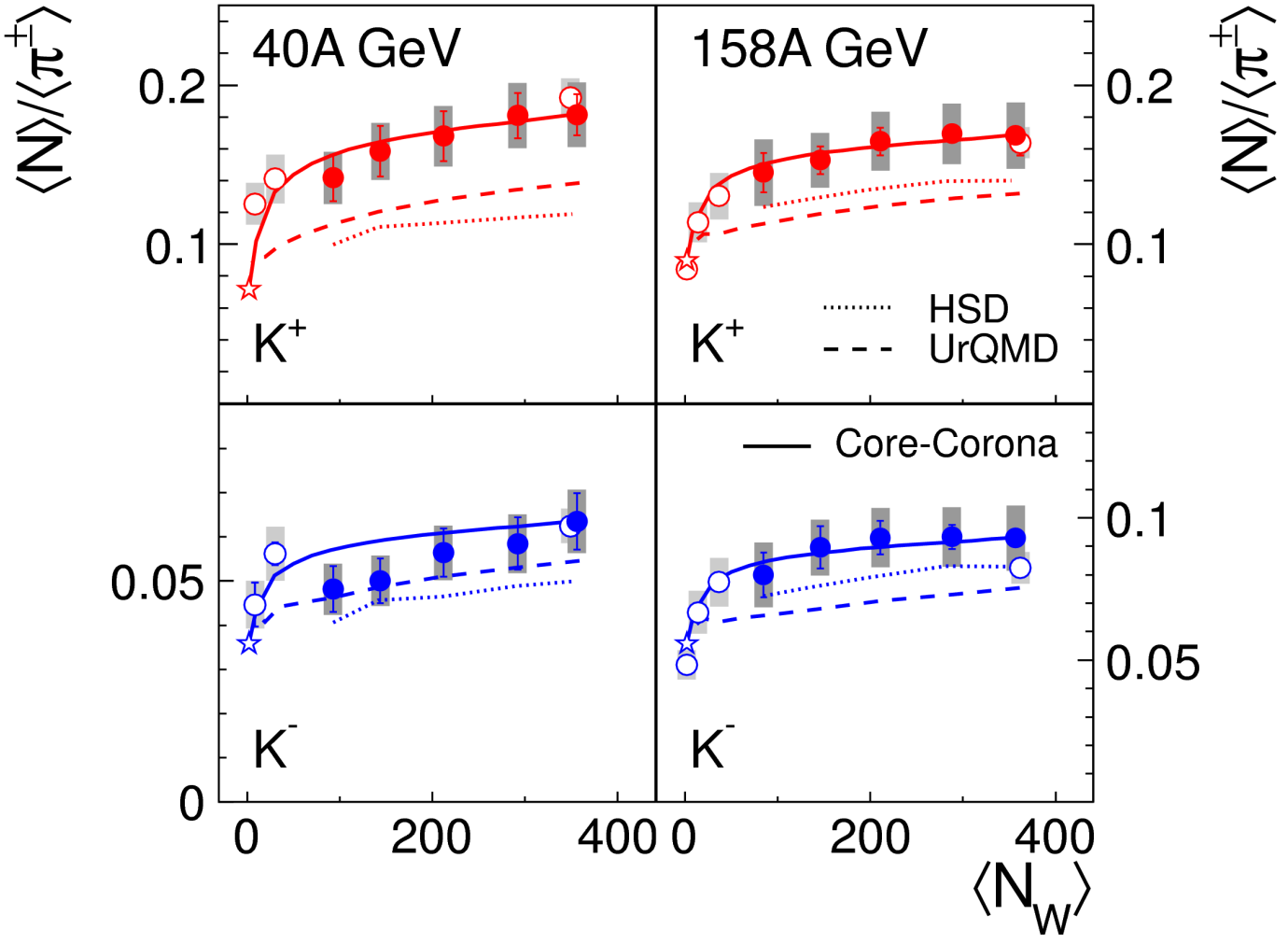


Results (9)

K/π yield ratios at 40A and 158A GeV

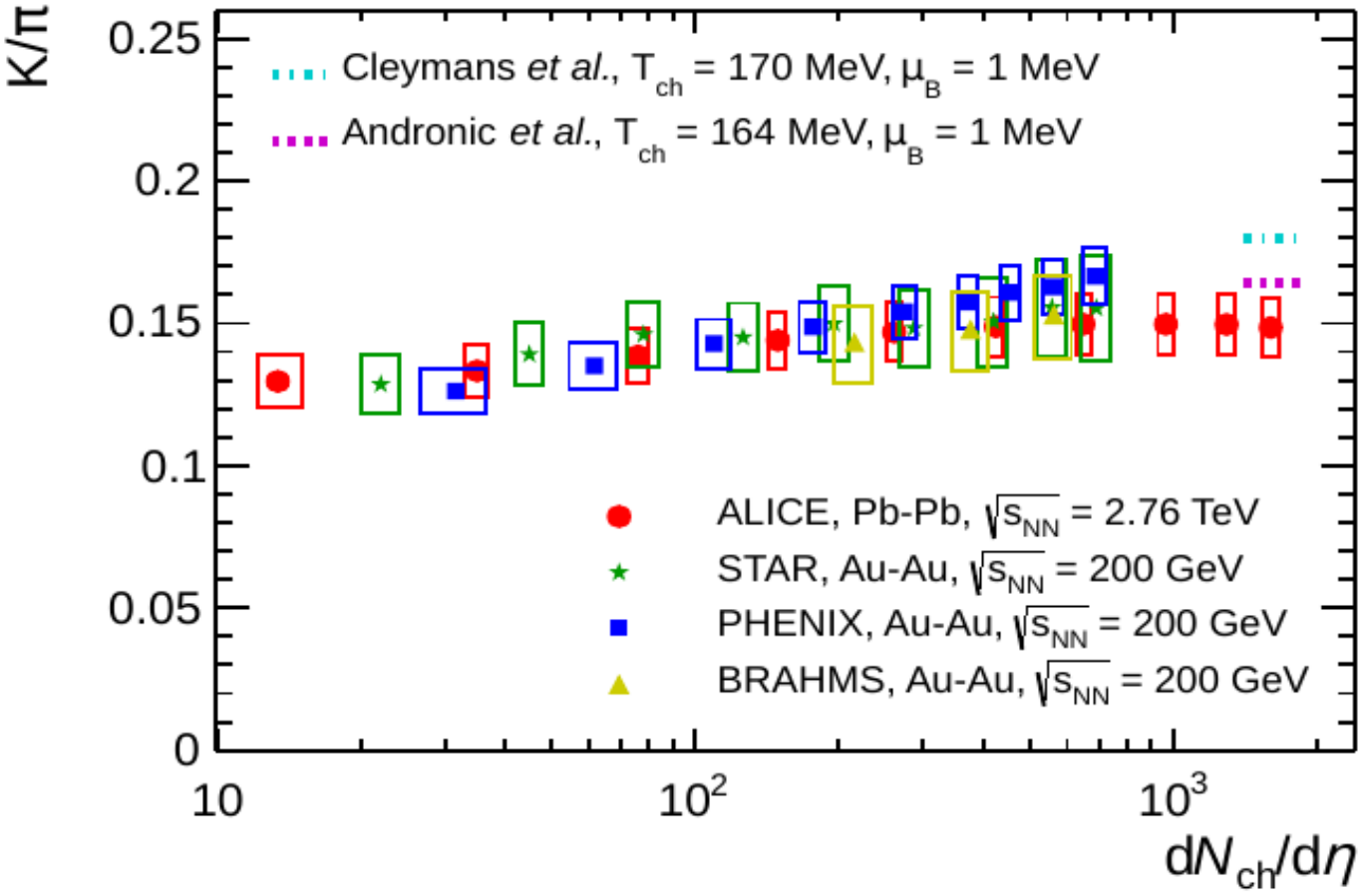
The models underpredict the strangeness enhancement at all centralities. The core corona approach works well.

K^- absorption most pronounced in peripheral collisions at 40A GeV.



ALICE and RHIC results

ALICE collaboration arXiv:1303.0737



Caveat:
-Midrapidity values at LHC.
-logarithmic scale.
-$\langle K^+ \rangle = \langle K^- \rangle$ at LHC.
-$(\langle K^+ \rangle/\pi + \langle K^- \rangle/\pi)/2 \approx 0.14$ at SPS (4π)..

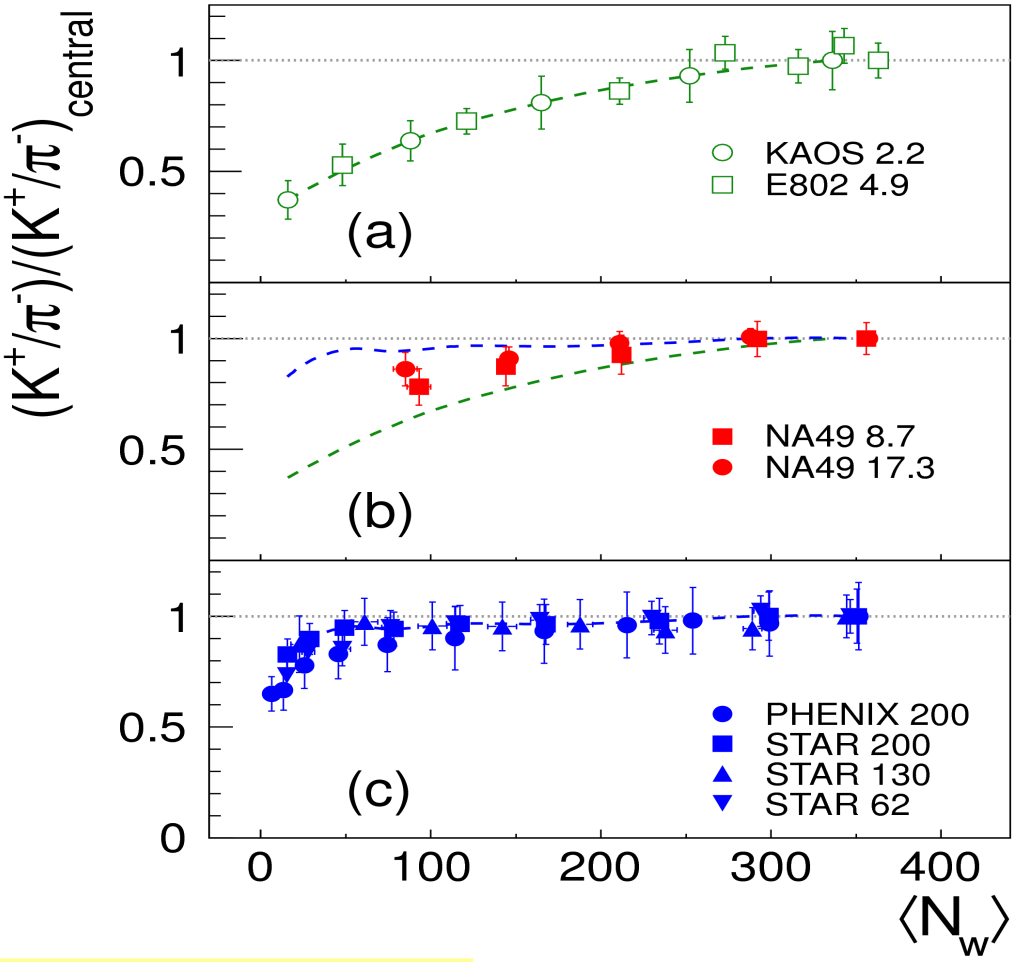
Interpretation

K/π ratios normalized to K/π at mid-rapidity versus N_w in different energy regimes.

Continuous rise at $\sqrt{s}$=2.2 GeV

Saturation for Mid-central collisions around $\sqrt{s}$=10 GeV

Saturation already For N_w < 100 at $\sqrt{s}$=200 GeV



NA49 authors

(more than 10 years after last data taking)

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(**Recently active members of the collaboration are in bold letters**.)