Near-threshold strangeness production in pp, πp and πA systems with the UrQMD transport model

A comparison to recent data from the HADES experiment

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Overview

Strangeness inside the UrQMD transport model

- Strange particle production via resonance decay and strangeness exchange
- Investigation of near-threshold energy regime $\rightarrow$ particle production dominated by resonance decay
- General cross section for resonance production in NN collisions involves a fit to experimental data:

$$\sigma_{1,2 \rightarrow 3,4}(\sqrt{s}) \sim (2S_3 + 1)(2S_4 + 1)\frac{\langle p_{3,4} \rangle}{\langle p_{1,2} \rangle}\frac{1}{(\sqrt{s})^2}|\mathcal{M}(m_3, m_4)|^2 \quad (1)$$

- Seven classes of resonance production reactions from two nucleons, one process newly introduced

Experiment at HADES [1]

- Acceleration of π^- beams at C and W targets with $p_\pi = 1.7$ GeV
- Data on ϕ and $K^{+/-}$: rapidities, transverse momenta and ratios
- p_T-y distributions of K^+ show large deviation of UrQMD version 3.4
  - $\Rightarrow$ Similar investigations with version 3.5 will be discussed in this talk

[1] results by Joana Wirth, Laura Fabbietti and Alessandro Scordo

# ϕ/K^- ratio: UrQMD model and experiment
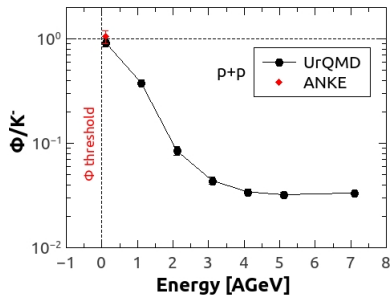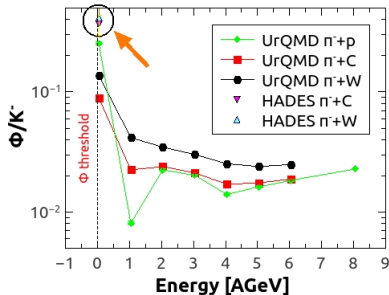
Figures: ϕ/K^- ratio in dependence of ϕ threshold in $\pi^- p$ collisions, comparison of UrQMD results to HADES and ANKE data

ϕ/K^- ratio: UrQMD model and experiment

- UrQMD: ratio rises together with system size and falling energy
  - Contradiction to some theoretical cosiderations
  - Accordance with HADES: even bigger ratio near threshold and same behavior in $Au + Au$ collisions
- Biggest ratio at threshold in elementary collision systems
- Good agreement to ANKE data at threshold energy

$K^{+/-}$ transverse momentum
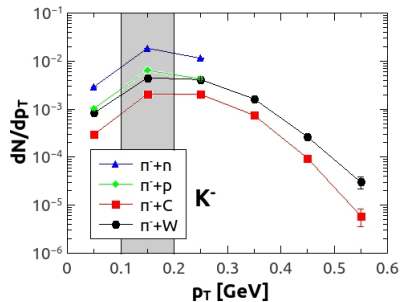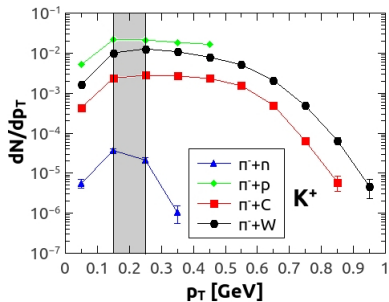
Figures: Multiplicity of K^+ and K^- in dependence of transverse momentum in the laboratory frame, grey fields: range of the distribution-maxima of the HADES data

$K^{+/-}$ transverse momentum

- Maxima in all systems for $K^{+/-}$ are in range between 0.15 and 0.25 GeV/c
- HADES results: consider separate rapidity intervalls
  $\rightarrow$ Still: same range for maxima
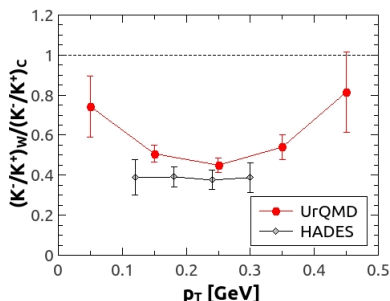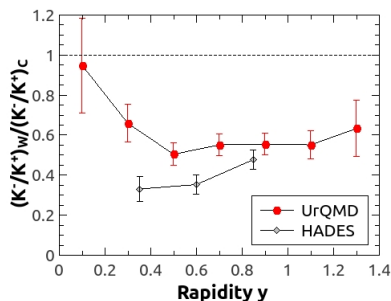
K^+ **transverse momentum**

- High p_T: early production in dense matter
  $\rightarrow$ biggest effect in carbon and tungsten targets, more nucleons

K^- **transverse momentum**

- Small p_T: early produced K^- are reabsorbed
  $\rightarrow$ production later in collision, free distribution in medium

$(K^-/K^+)_W/(K^-/K^+)_C$ ratio: UrQMD model and HADES

Figures: Double ratio $(K^-/K^+)_W/(K^-/K^+)_C$ in dependence of rapidity and transverse momentum in laboratory frame, from UrQMD and HADES

Summary

- Ratio of ϕ/K^- fits nicely to experimental data
- New UrQMD results on K^+ transverse momenta fit in with HADES results better than the old version, good fit of K^- data too
- General behavior of the $(K^-/K^+)_W/(K^-/K^+)_C$ double ratio in UrQMD corresponds to HADES results
- <u>Outlook:</u> With more experimental data in the future a better comparison with simulation results will be possible $\rightarrow$ further improvement of simulation models

Thank's for your attention!