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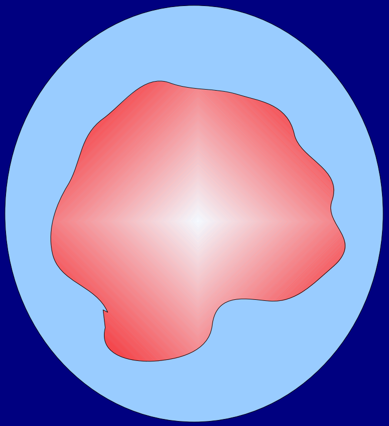
Strangeness production in the NICA energy range

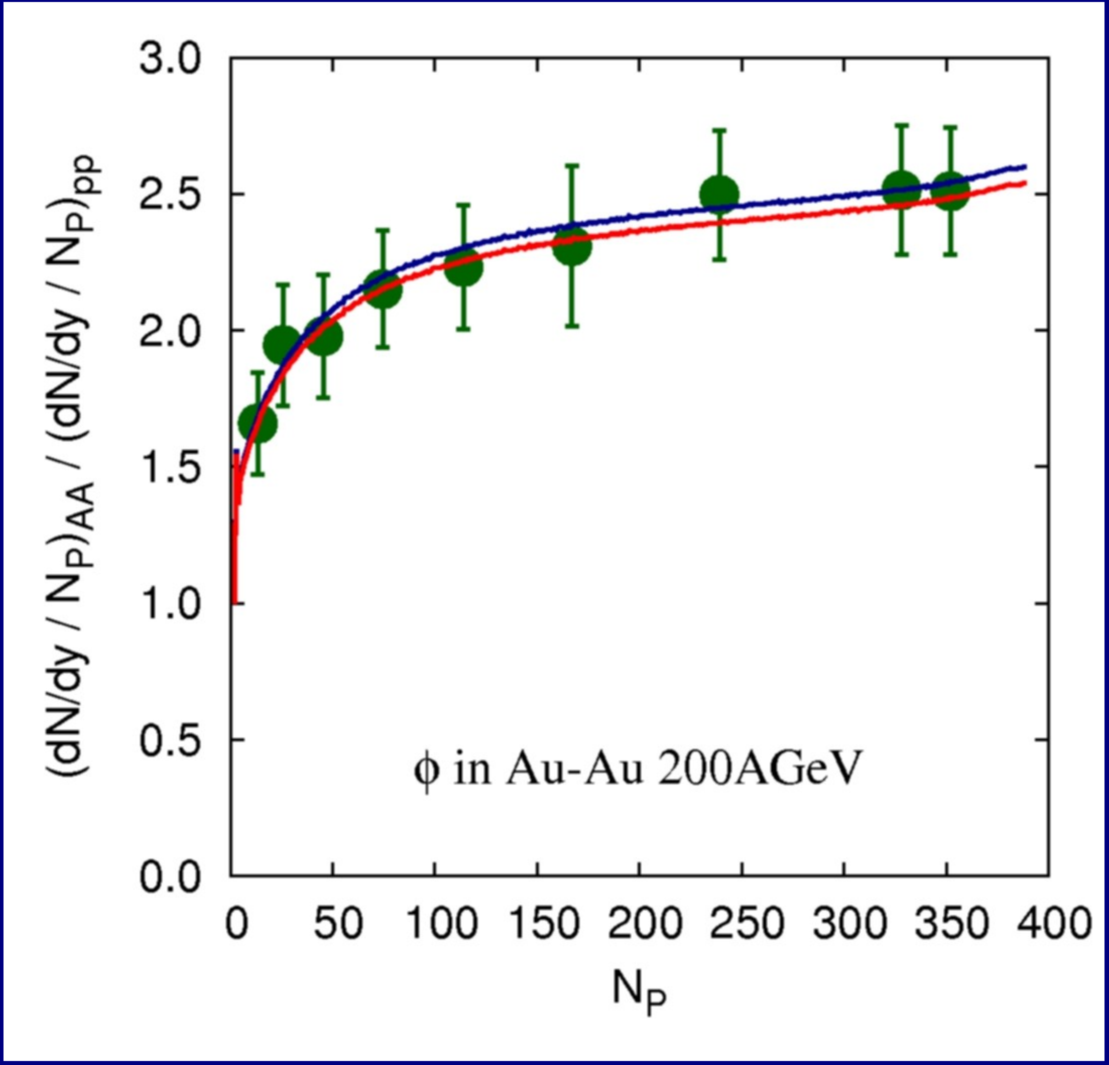
CPOD Round Table, Dubna, Aug 28 2010

It is my belief that, after 15 years, we have understood something of strangeness production in heavy ion collisions at high energy: the production stems from the superposition of two sources: independent NN collisions, described by a strangeness-undersaturated statistical model or other models, and a large core at full chemical equilibrium *(Core-corona).*

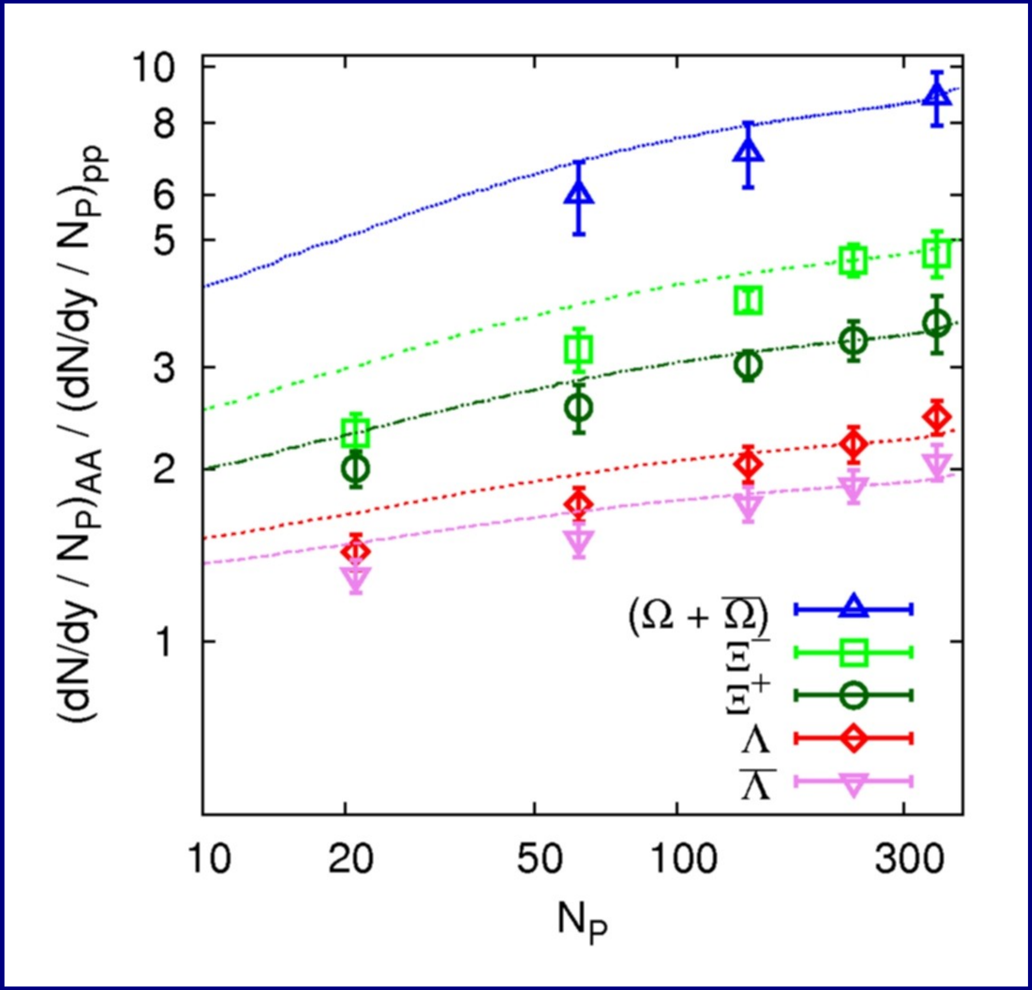


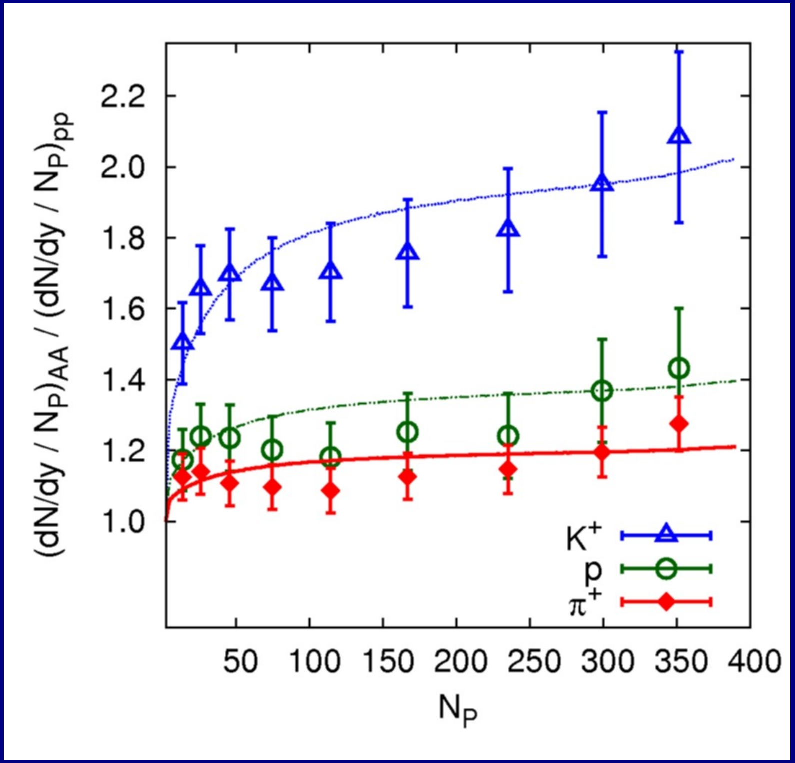
This picture seems to be confirmed by several recent studies

- Run a Glauber Monte-Carlo and calculate N_{PC}, N_P
- Fix A from, say, the most central bin and compare with the data of ϕ meson at RHIC



Strangeness enhancement for hyperons



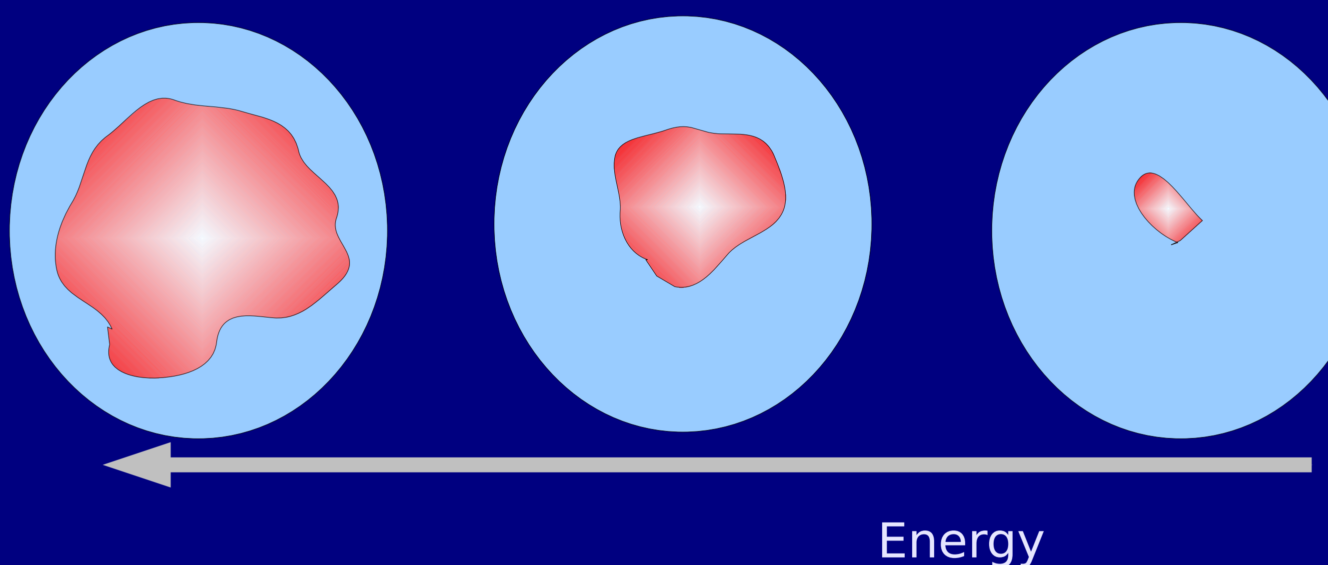


Canonical suppression is a only a correction at low N_P

Working hypotheses

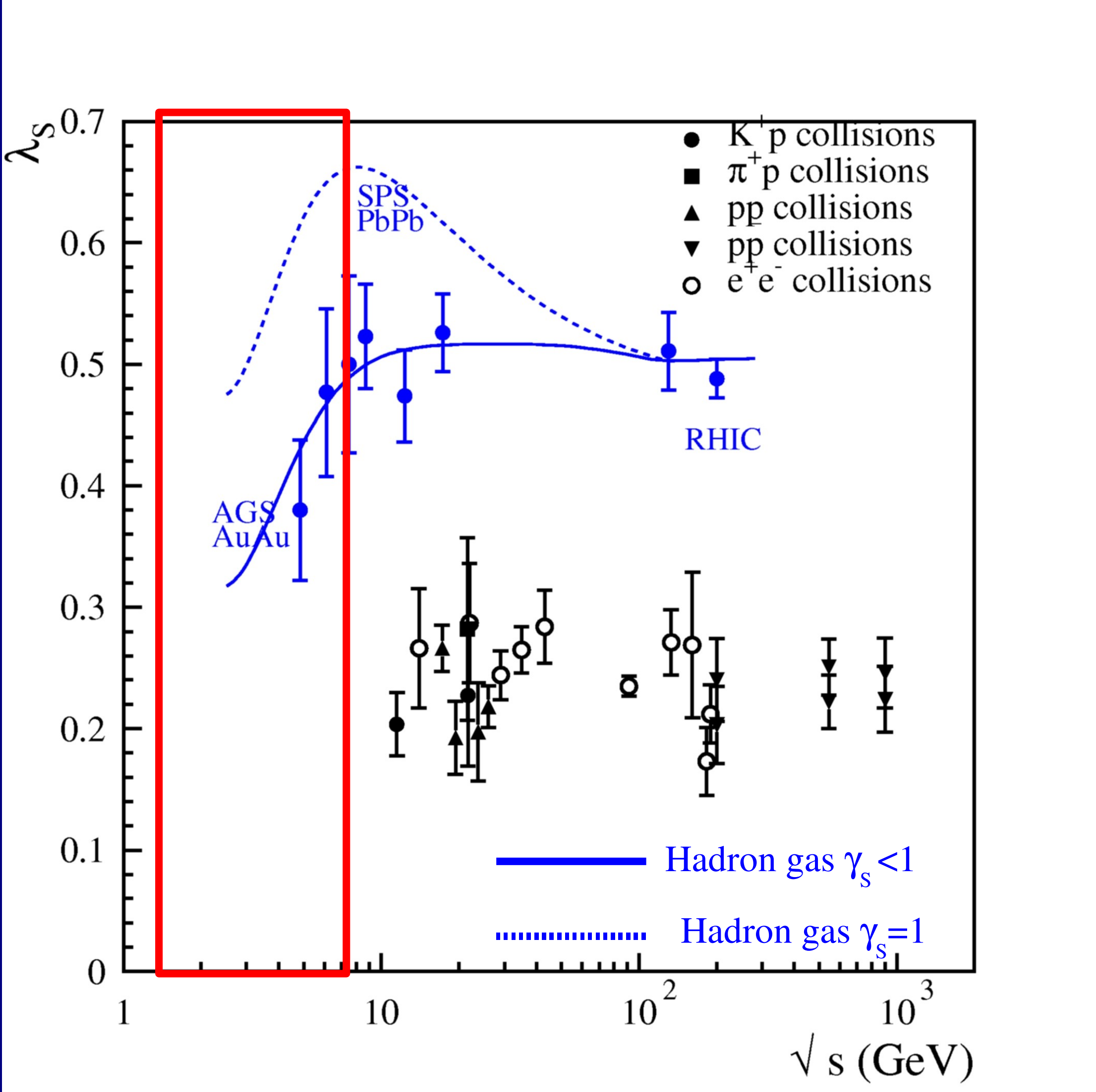
Core: *large* (=deconfinement) region successor of the plasma producing a hadron gas at full chemical equilibrium

At sufficiently low energy one expects no core, so the search of the onset of deconfinement could be possibly accomplished by finding the energy range where a core at full chemical equilibrium is a model failing beyond any reasonable doubt



Where is the onset of full chemical equilibrium in the core?

Need to re-analyze carefully SPS, AGS data as a function of centrality and system size but we also need new data, especially between $\sqrt{s}_{NN}$ = 2 and 7 GeV



ISSUES

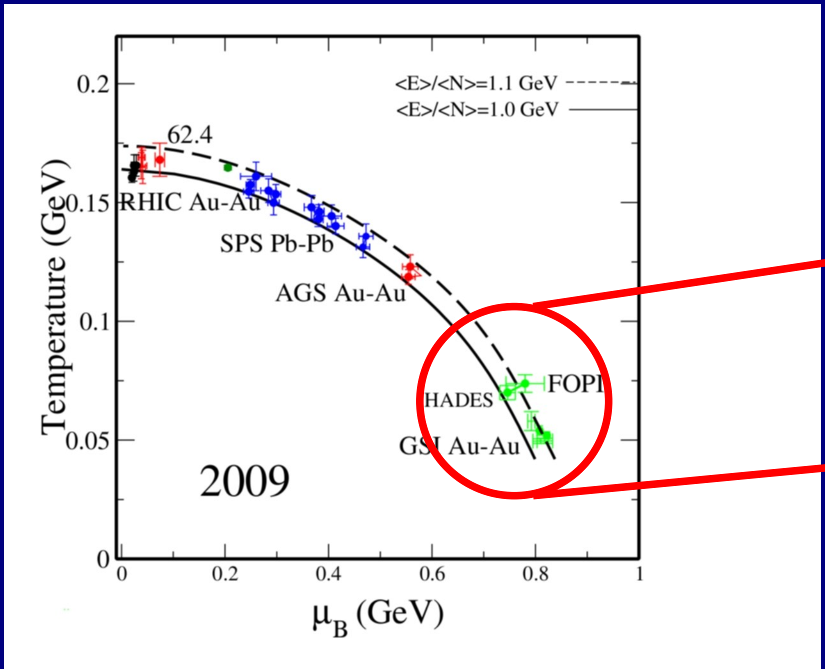
- Does the hadron-resonance gas model hold when T < 100 MeV ?

Based on the theory (Dashen-Ma-Bernstein theorem) one expects corrections due to non-resonant interactions. Difficult to assess, no study in literature.

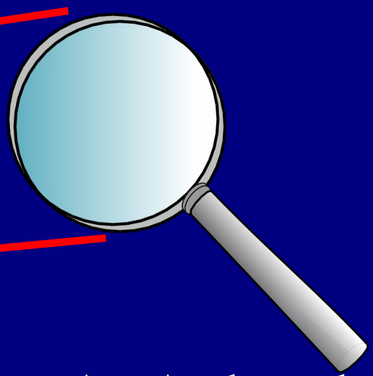
- How to subtract the “corona” ? Can the “corona” be defined the same way as at high energy?

Glauber model is not expected to work at low energy.

Common wisdom is that statistical model in its simplest hadron-resonance gas implementation works for AB collisions at low energy even without γS

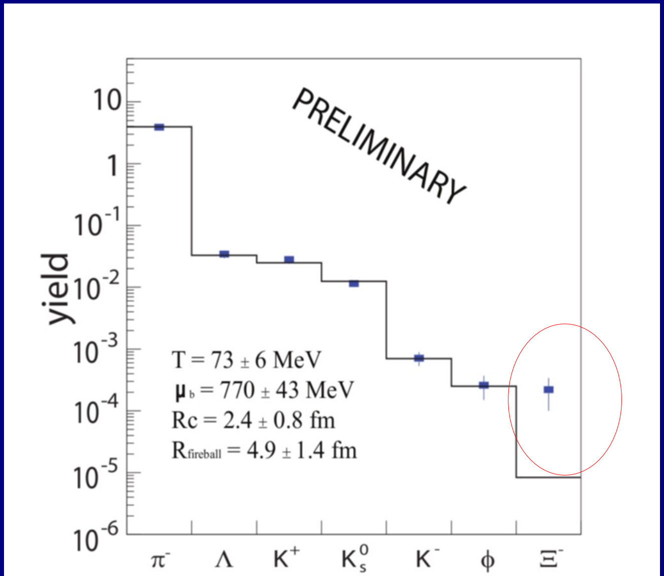


J. Cleymans, arXiv:1005.4114

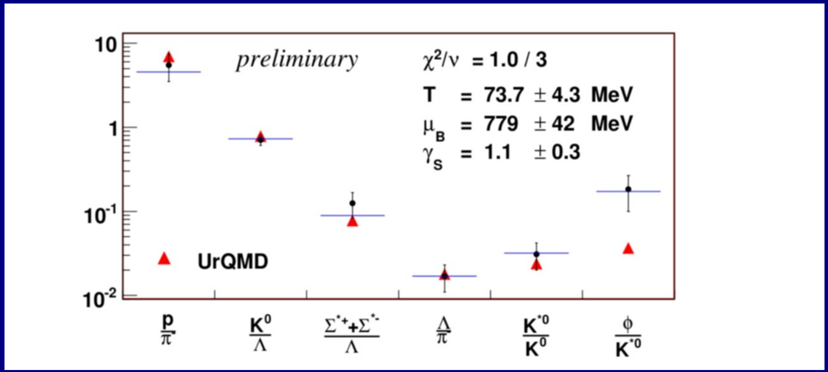


Some points are Au-Au based on very few and old measurements

However, there are two recent analyses (2009-2010) based on new data: HADES Ar-KCl T_{beam} = 1.76 A GeV and FOPI Al-Al T_{beam} =1.9 A GeV



HADES, arXiv:0911.0516



FOPI coll., Acta Phys. Pol. 41 (2010) 405

Cross-check: using the same data set, we get fairly consistent results.

However, it seems that the fit sensitivity is rather poor, at least in FOPI case. POSSIBLE REASON: the FOPI fit uses ONLY ratios, which is not suitable when the system is small, because the volume dependence is only through the canonical chemical factors and no longer as an overall normalization factor...

OUR FITS (preliminary)

By replacing ϕ/K and K/Λ with ϕ and K yields (published in FOPI coll., arXiv:1006.1905 and Acta Phys. Pol. 41 379, 2010) in FOPI fit we obtain

PARAMETER	Value	Error
T(MeV)	80.6	4.2
μ_B (MeV)	815	35
γ_S	0.47	0.13
V(fm3)	169.	90
χ2	9.5/3	

PRELIMINARY

To be confirmed...

It would be interesting to have a Ξ measurement in FOPI to compare with HADES

CONCLUSIONS

- To understand strangeness production and confirm – in this respect - the production of a deconfined system at large energy, more and more accurate data is needed at collision energy between $\sqrt{s}_{NN} =$ 2 and 7-8 GeV

- The data should include pp, (pn), light ions and heavy ions

- It will be a long, laborious work