RAPIDITY WINDOW DEPENDENCES OF HIGHER ORDER CUMULANTS OF CONSERVED CHARGES

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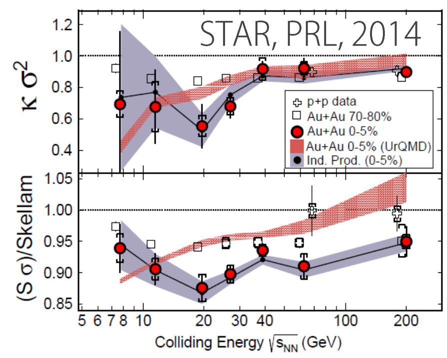
BACKGROUND

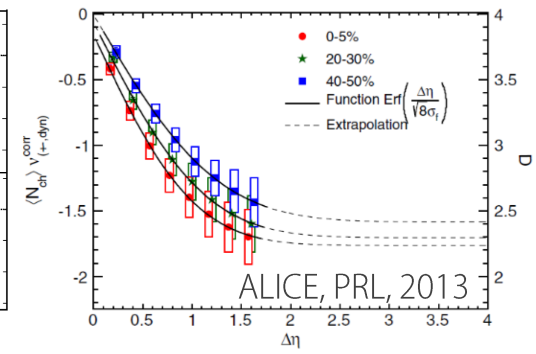
Refs.: MK, Asakawa, Ono, PLB**728**, 386 (2014)
Sakaida, Asakawa, MK, PRC**90**, 064911(2014)
MK, NPA**942**, 65 (2015); Talk by Asakawa, Monday

Active experimental analysis of fluctuation observables, especially their **non-Gaussianity**

Q0 Are these fluctuations the equilibrium one generated at some time during time evolution?

A0 **NO!** Fluctuations continue to change until the medium arrives at the detector.

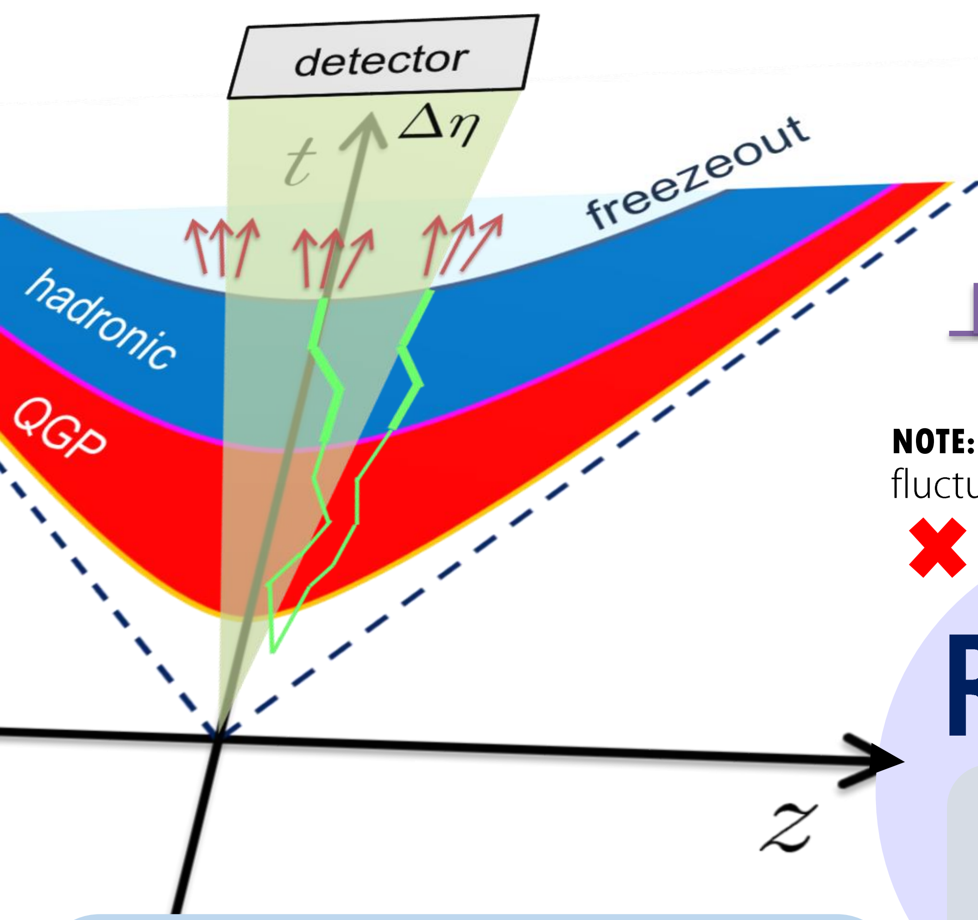




Experimental results should be interpreted taking the **non-equilibrium effects** into account.

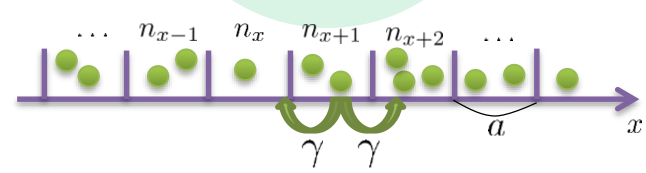
Q1 How to describe the **non-eq. diffusive process of non-Gaussian** cumulants?

Q2 How to verify this picture **experimentally**?



A1: MODEL

Diffusion master equation
(Brownian particles' model)



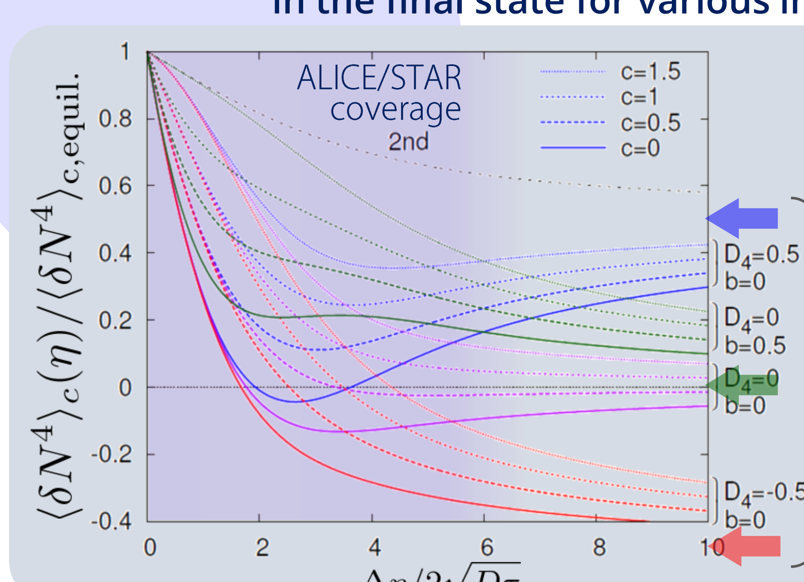
$$\frac{\partial}{\partial t}P(\mathbf{n}) = \gamma\sum_x\Big[(n_x+1)\{P(\mathbf{n}+\mathbf{e}_x-\mathbf{e}_{x+1}) + P(\mathbf{n}+\mathbf{e}_x-\mathbf{e}_{x-1})\} - 2n_xP(\mathbf{n})\Big]$$

NOTE: This model can describe the approach of **non-Gaussian** fluctuations toward the **equilibrated hadronic value**.

✖ Langevin-type eqs. ➡ Non-Gaussianity vanishes in equil.

RESULT

Rapidity window dep. of 4th-order cumulant in the final state for various initial conditions



initial values

$$\frac{\langle\delta N^4\rangle_{c,\rm initial}}{\langle\delta N^4\rangle_{c,\rm equil.}}$$

$$b=\frac{\langle Q_{(\rm net)}^2 Q_{(\rm tot)}\rangle_c}{\langle Q_{(\rm net)}\rangle}$$

$$c=\frac{\langle Q_{(\rm tot)}^2\rangle_c}{\langle Q_{(\rm tot)}\rangle}$$

$$D_2=\frac{\langle Q_{(\rm net)}^2\rangle_c}{\langle Q_{(\rm tot)}\rangle}=0.5$$

- Cumulant at a Δη **differs from** their initial values.
- Experiments can distinguish different lines in the Fig.

A2: CONCLUSION

Measure the **rapidity-window dependences** of various cumulants in experiments!
→**transport** and **thermodynamic** properties

Do **NOT** compare experimental results directly with theory assuming equilibrium!
→Take Δη→large limit for comparison!