# Search for critical point in NA61/SHINE

(poster presentation)

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Strangeness in Quark Matter
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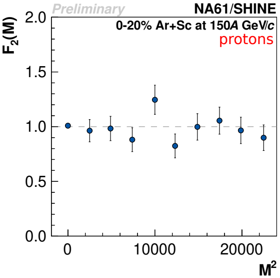
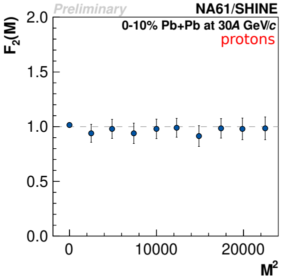
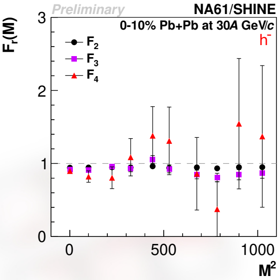



$$F_r(M) \equiv \frac{\left\langle \frac{1}{M} \sum_{i=1}^{M} n_i(n_i-1)\ldots(n_i-r+1) \right\rangle}{\left\langle \frac{1}{M} \sum_{i=1}^{M} n_i \right\rangle^r}$$

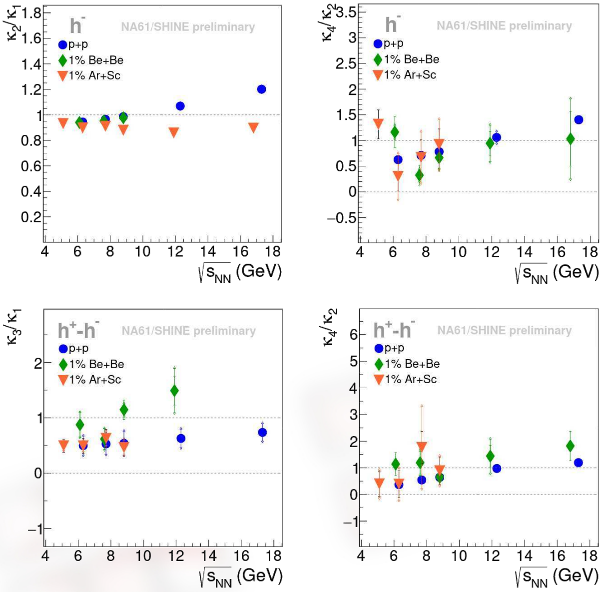
At the second order phase transition the system is a simple fractal and the factorial moment exhibits a power law dependence on M:

$$F_2(M) \sim (M)^{\varphi_2}$$




- Statistically independent points, cumulative variables
- No indication of critical point in these analyses (power-law scaling $F_r(M) \sim M^{\phi_r}$)
- More details → talk by N. Davis

# Multiplicity and net-charge fluctuations in p+p, Be+Be and Ar+Sc collisions

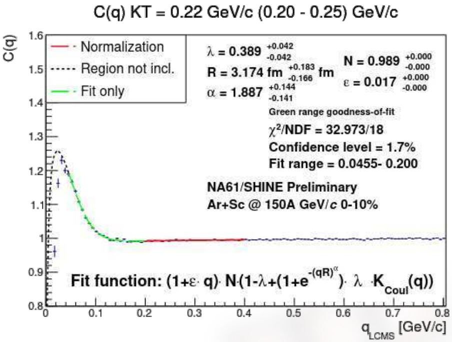


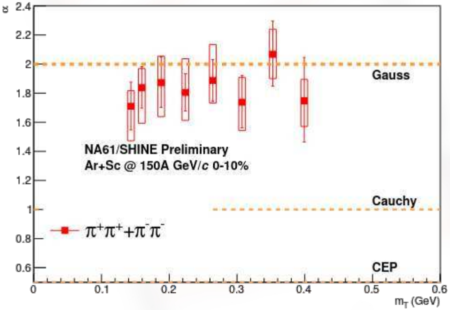

$$\kappa_1 = \langle N \rangle$$
$$\kappa_2 = \left\langle (\delta N)^2 \right\rangle = \sigma^2$$
$$\kappa_3 = \left\langle (\delta N)^3 \right\rangle = S\sigma^3$$
$$\kappa_4 = \left\langle (\delta N)^4 \right\rangle - 3\left\langle (\delta N)^2 \right\rangle^2 = \kappa\sigma^4$$

where: N – multiplicity, $\delta N = N - \langle N \rangle$
$\sigma$ – standard deviation
S – skewness
K – kurtosis

- No structure indicating critical point
- Negatively charged $\kappa_2/\kappa_1$: increasing difference between small systems (p+p and Be+Be) and a heavier system (Ar+Sc) with collision energy
- Net-charge $\kappa_3/\kappa_1$: increasing difference between Be+Be and other systems (p+p and Ar+Sc) with collision energy
- $\kappa_4/\kappa_2$: consistent values for all measured systems at given collision energy

# Symmetric Lévy HBT correlations




- The Lévy stability parameter $\alpha$ describes shape of the source
- 3D Ising model with random external field predicts $\alpha = 0.50 \pm 0.05$ at critical point

# Conclusions

- proton and negative hadron intermittency analyses (scaled factorial moments of multiplicity distribution dependence on number of momentum bins) in Ar+Sc and Pb+Pb collisions do not show power-law scaling
- Multiplicity and net-charge fluctuations in p+p, Be+Be and Ar+Sc collisions do not show significant deviation from 1
- Lévy HBT correlations analysis $\alpha$ parameter value is close to 2 (Gaussian source)
- **So far no convincing indication of the critical point**


**References**

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**Thank You!**