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Assessing critical point signatures through proton intermittency in NA61/SHINE

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The search for experimental signatures of the critical point (CP) of strongly interacting matter is one of the main objectives of the NA61/SHINE experiment at CERN SPS. One such candidate observable is local fluctuations of the proton density in transverse space, constituting an order parameter of the chiral phase transition, and expected to scale according to a universal power-law in the vicinity of the CP. Their scaling can be probed through an intermittency analysis of the proton second scaled factorial moments (SSFMs) in transverse momentum space. The first such analysis [1] revealed power-law behavior in NA49 Si+Si collisions at 158A GeV/c, the fitted power-law exponent being consistent with the theoretically expected critical value, within errors.

In the present talk, we propose a novel technique for conducting intermittency analysis, and explore its efficacy on the available NA61/SHINE collision systems (Be+Be, Ar+Sc, Pb+Pb). We discuss the experimental and methodological challenges posed by such an analysis, and apply a dedicated, new method of handling statistical and systematic uncertainties that solves several known problems of the standard intermittency analysis in the face of low to moderate event statistics. In particular, we present the outline of a Monte Carlo simulation scan used in assessing and weighing alternative models with critical and background components versus the experimental results, which would allow us to obtain reliable estimates and confidence intervals for the intermittency index (power-law exponent) ϕ_2 compatible with the experimental data.

References:
[1] T. Anticic *et al*, Eur. Phys. J. C **75**: 587 (2015).

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