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Finite-Size-Finite-Time Scaling of susceptibilities and susceptibility ratios; Implications for the search for the QCD Critical Point

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Studies of the fluctuations of conserved charges (baryon number, electric charge, strangeness, etc.) can be used to chart the phases of strongly interacting QCD matter, as well as to locate the critical end-point (CEP) in the associated QCD phase diagram. The cumulants (and cumulant ratios) of the multiplicity distributions for conserved charges, which are linked to susceptibilities and their ratios, are predicted to be sensitive to the growth of fluctuations near the critical point, leading to detectable non-monotonic signatures for the CEP [1]. However, the effects of Finite-Size (FS) and Finite-Time (FT) complicate the search for the CEP, because they nullify the possible non-monotonic patterns, and shift the CEP's location to a so-called pseudo-critical point, different from its genuine location. Alternatively, Finite-Size-Finite-Time scaling (FSFTS) of susceptibilities and susceptibility ratios provide a robust avenue to search for the CEP and to characterize its critical exponents. I will describe the rudiments of FSFTS and present the scaling functions for the inverse compressibility (κ^{-1}) obtained from both the cumulant ratio C_1/C_2) for net-protons, and two-pion HBT radii, measured over a broad range of collision centralities in Au+Au collisions spanning the energy rage $\sqrt{s_{NN}} = 7.7 - 200$ GeV. The location of the CEP and the critical exponents estimated from these disparate measurements will be presented and discussed.

[1] M. Stephanov, PRL 102, 032301 (09)

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