Precision Measurement of Kinematic Range Scan of Fluctuations of (Net-)proton Multiplicity Distributions in Au+Au Collisions from RHIC-STAR

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Abstract

Higher-order cumulants of (net-)proton multiplicity distributions serve as sensitive observables for probing the QCD phase diagram and searching for the QCD critical point (CP). Critical point is a long range collective phenomenon, and within a larger kinematic range, the critical point signal is significantly enhanced, especially in the higher-order cumulants of net-proton multiplicity distributions. To explore these critical phenomena we conduct a detailed kinematic range scan of the (net-)proton number cumulants up to fourth order.

In this talk, we present the precision measurements of systematical kinematic range scans of the (net-)proton multiplicity cumulants along both rapidity and transverse momentum axes in Au+Au collisions at $\sqrt{s_{NN}} = 7.7$ to 27 GeV from the beam energy scan program (phase-II) of the STAR experiment at RHIC. We apply both cumulative and differential scans to explore long-range correlations and examine the behaviors of cumulants within localized rapidity (y) and transverse momentum (p_T) bins. The results from 0-5% most central collisions are compared with non-critical model calculations and with data from 70-80% peripheral collisions, both of which are used as references.