Proton High-order Cumulants Results from the STAR Fixed-Target Program

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Abstract

Fluctuations of conserved charges in heavy-ion collisions are expected to be sensitive to a critical point in the phase diagram of QCD matter [1, 2]. Such a critical point is increasingly predicted to be located in the high baryon chemical potential (μ_B) region around μ_B=500-650 MeV [3–8]. In 2018, the STAR Experiment started collecting data in a fixed-target configuration in order to map the high baryon chemical potential region of the phase diagram at μ_B=420-720 MeV. Critical fluctuations may be observed by measuring various orders of cumulants, C_n, of the distributions of baryon number. The collision-energy dependence of net-proton C_4/C_2 from STAR's measurements in Beam Energy Scan I hinted at a possible non-monotonic deviation from the non-critical baseline in Au+Au collisions from $\sqrt{s_{NN}}$ = 7.7 GeV to 19.6 GeV, and the first published result from the fixed-target program, in Au+Au collisions at $\sqrt{s_{NN}}$ = 3.0 GeV is consistent with the non-critical baseline [9–13]. We report here new results on proton-number high-order cumulants from STAR's Fixed-Target Program. Implications for the QCD phase diagram and critical-point search will be discussed.

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