

Proton-Cumulant Analyses in an Energy Scan of the STAR Fixed-Target Program at $\sqrt{s_{NN}} = 3.2, 3.5, 3.9, 4.5, 5.2, 6.2,$ 7.2, and 7.7 GeV

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Abstract

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Non-monotonic variations in higher-order cumulants of proton number distributions produced in heavy-ion collisions are expected to be an indicator of a critical point in the QCD phase diagram. Proton-fluctuation results from Au+Au collisions in Beam Energy Scan I (BES-I) demonstrated deviations from the non-critical baseline, starting at $\sqrt{s_{NN}} = 27$ GeV and continuing to the lowest BES-I energy of $\sqrt{s_{NN}} = 7.7$ GeV. The STAR Fixed-Target Program has extended the energy range available at the Relativistic Heavy-Ion Collider down to $\sqrt{s_{NN}} = 3.0$ GeV. Proton-cumulant results at 3.0 GeV have indicated a return to the expected baseline behavior. The remaining fixed-target analyses aim to identify whether critical behavior is observed in the region between 3.2 and 7.7 GeV. Au+Au data from the Fixed-Target Program from $\sqrt{s_{NN}} = 3.2$ GeV to 7.7 GeV are now available and proton-cumulant analyses are underway. A status report on the challenges, methods, and statistical significance of these analyses will be presented.