

Cumulants of Net-Proton, Net-Charge and Net-Kaon Multiplicity Distributions in Au+Au Collisions at $\sqrt{s_{NN}} = 27$ and 54.4 GeV from STAR

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Higher-order cumulants of conserved quantities (B, Q, S) are sensitive observables to study the QCD phase structures, nature of quark-hadron phase transition and freeze-out dynamics. However, they could be affected by background contributions, such as volume fluctuations. An event plane detector (EPD) was installed at forward rapidity ($2.1 < |\eta| < 5.1$) in the STAR experiment and recorded data for Au+Au collisions at $\sqrt{s_{NN}}=27$ GeV in 2018. The EPD provides independent centrality estimation with high resolution, and hence allows one to study the effects of volume fluctuations on the cumulant measurements at midrapidity.

In this talk, we present results of higher-order cumulants (up to the 4th order) of net-proton, net-charge and net-kaon multiplicity distributions in Au+Au collisions at $\sqrt{s_{NN}}= 27$ GeV and 54.4 GeV. The cumulants at 27 GeV are investigated including various different centrality definitions with the new EPD. The physics implications of the results, a detailed discussion of the background contributions and the status and prospects of Phase II of the STAR Beam Energy Scan program are discussed.