

Search for the QCD Critical Point: Higher Moments of Net-proton, Net-charge Multiplicity Distributions from the RHIC Beam Energy Scan

One of the main goals of the RHIC Beam Energy Scan (BES) program is to search for the QCD critical point and the phase boundary in the QCD phase diagram. Due to high sensitivity to correlation length and direct connection to thermodynamical susceptibilities calculated in Lattice QCD and the Hadron Resonance Gas (HRG) model, higher moments of event-by-event net-proton and net-charge multiplicity distributions are used to search for the QCD critical point.

In this talk, we will present various moments (variance (σ^2), skewness (S), kurtosis (κ)) and moment products ($\kappa\sigma^2$ and $S\sigma$) of the net-proton, net-charge multiplicity distributions measured by STAR detector at RHIC. The moment products $\kappa\sigma^2$ and $S\sigma$ of net-proton (net-charge) distributions are related to baryon (charge) number susceptibility ratios and are volume independent. The mix-ratio of the moments of proton and kaon multiplicities, which are predicted to be without any dependence on model parameters including the correlation length

, will be also presented to establish the baselines. The data presented in this talk will include the measurements from Au+Au collisions at energies $\sqrt{s_{NN}} = 7.7, 11.5$ and 39 GeV collected in the year 2010 and $\sqrt{s_{NN}} = 200$ GeV in the year 2004. Deviations from HRG models for $\kappa\sigma^2$ and $S\sigma$ of net-proton and net-charge distributions are observed for BES energies.

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