Fluctuations in Lambda Multiplicity Distribution in Au+Au collisions at $\sqrt{s_{NN}} = 3$ GeV at STAR

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The study of nuclear matter over a wide range of collision energy is provided by the RHIC Beam Energy Scan (BES). One focus of the program, namely to locate the critical point (CP) in the QCD phase diagram, is closely tied to the measurement of kurtosis in net-proton multiplicity distribution as a function of $\sqrt{s_{NN}}$. Previous results from BES-I showing non-monotonic energy dependence with 3.1σ significance motivated us to increase the statistics and to extend the collision energy down to $\sqrt{s_{NN}} = 3.0$ GeV in the BES-II.

Various proxies are used to determine the properties of the QCD-phase boundary, in the case of net-strangeness quantum number, kaons alone do not provide a complete proxy since they only represent 70% of the strangeness of the system. Most of the remaining strangeness is in the lambda baryon, therefore along with kaon fluctuations we can study the fluctuations of net-strangeness quantum number.

The event-by-event fluctuations in net-lambda multiplicity distribution from the BES-I showed that the cumulant ratios (C_2/C_1, C_3/C_2) have a similar energy and multiplicity dependence compared to those for protons, and the observed deviation from Poisson baseline can be attributed to baryon number and strangeness conservations. It is also known from the previous work that the derived freeze-out parameters show sensitivity to the quark content of the hadrons, implying a quark mass dependence in the process of hadronization. We present the lambda fluctuation analysis in Au+Au collisions at the lowest collision energy ($\sqrt{s_{NN}} = 3.0$ GeV), where we continue the comparison with proton fluctuations (up to the kurtosis measurement), and study the behaviour of both baryons, specifically in terms of their difference in quark content and applicable conservation laws.