STAR measurement of local parton density fluctuations with azimuthal partitions to search for critical phenomenon at RHIC

Roli Esha (for the STAR Collaboration)

Local parton density fluctuations are the natural observable to search for the critical point. Such fluctuations, in a domain of phase space, have direct connections to the characteristic correlation lengths in theoretical models. In a coalescence picture of particle production, local parton density fluctuations can be reflected in baryon distributions. Our method introduces azimuthal partitions and examine the relative baryon number fluctuations among all partitions. We can also investigate the systematic impact on the fluctuations due to different experimental artifacts, like multiplicity-dependent detection efficiencies, pile-up etc., by using the mixed-event sample as a reliable baseline. In this talk, we present the measurements of proton density fluctuations using the data from Au+Au collisions from the STAR Beam Energy Scan program ($\sqrt{s_{NN}} = 7.7 - 62.4$ GeV). We found that the beam-energy dependence of the higher-order cumulants varies significantly with the number of partitions in the azimuthal direction. For the most central 0-5% collision data, the fourth-order cumulant for the proton density fluctuations when compared with the mixed-event baseline with three azimuthal partitions resembles the non-monotonic trend observed in the event-by-event fluctuations previously reported by STAR. The fluctuation trend changes when the number of partitions increase. Implications on possible critical phenomenon and the characteristic correlation length from the beam energy scan data will be discussed.