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Forward-backward centrality fluctuation in heavy ion collisions

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Centrality fluctuations is one of the main uncertainties for interpreting the centrality dependence of many experimental observables. The centrality fluctuation is constrained by selection based on particle multiplicity in a reference subevent, and contributes to observables measured in another subevent. Due to the asymmetry between forward- and backward-going participating nucleons, the number of sources for particle production is a function of η even in a single event, which leads to centrality decorrelation between different rapidities. Using a Glauber-based independent source model, we study the influence of centrality decorrelations on multi-particle cumulants. In mid-central collisions, a general relation is established between the multiplicity fluctuation and resulting centrality resolution in given subevent. In ultra-central collisions, where distribution of particle production sources is strongly distorted, we find these cumulants exhibit different behavior, due to observable-dependent non-Gaussianity in the underlying distributions. Furthermore, we investigate the influence centrality fluctuations in HIJING and UrQMD models. This study can be considered as a first step towards detailed understanding of the longitudinal dynamics for particle production in heavy-ion collisions.

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