Contribution ID: **276** Type: **Poster**

Extension of the Identity Method to Measurements of Differential Correlation functions

Tuesday, 15 May 2018 19:10 (30 minutes)

Studies of integral and differential correlation functions of elementary particles produced in high-energy nucleus-nucleus collisions provide invaluable information on the particle production dynamics, the collision system evolution, and might also enable the determination of fundamental properties of the quark matter produced in these collisions. Extensive measurements of general balance functions, in particular, should provide detailed probes of the formation, evolution, and hadronization of the quark matter produced in relativistic heavy-ion collisions. The difficulty arises, however, that such measurements are particularly statistics hungry and severe particle losses may be incurred experimentally to achieve high species purity and contamination free measurements of correlation functions. However, the identity method, invented by Gazdzicki, provides a technique to essentially recover the full statistics and extend the kinematic range of measurements while providing reliable disambiguation of particle species. The technique was first proposed for measurements of first and second moments of particle multiplicities (integral correlation functions) with two particle species but successively extended to handle an arbitrary number of species, higher moments, and measurements of moments in the presence of transverse momentum dependent efficiency losses. I present yet another extension of the method towards measurements of differential correlation functions, more specifically for differential measurements of the normalized two-particle cumulants, R_2, but the method can be extended to other types of two-particle correlators or towards multiple-particle correlation functions. The method is developed for an arbitrary number of particle species and in the presence of particle losses, as well as multiple sources of particle identification (dE/dx, TOF, etc).

Content type

Experiment

Collaboration

Centralised submission by Collaboration

Presenter name already specified

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Session Classification: Poster Session

Track Classification: Correlations and fluctuations