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Technique for Performing High Accuracy Forward-Backward Multiplicity Correlation Measurements

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Forward-backward multiplicity correlation measurements are used to study the soft component of high energy collisions. The observable is sensitive to the dynamics of the collision and is relatively less affected by the following hadronization processes. In proton-proton collisions, forward-backward multiplicity correlation measurements allow one to study the underlying event while, in heavy-ion collisions, they can provide insight into effects such as gluon saturation.

The measurement requires one to determine the variances of and covariance between the forward and backward multiplicities. Realistic detector effects such as acceptance and efficiency alter the required measured quantities. Exactly how these quantities are altered is neither straightforward nor intuitive compelling one to use Monte Carlo simulations to determine the unaltered values. However, the robustness of using Monte Carlo simulations is difficult to determine as they depend on the initial assumptions.

A Monte Carlo independent technique to determine multiplicity correlation measurements which accounts for acceptance and efficiency is presented here. The goal is to allow one to perform these measurements while minimizing measurement bias and allowing one to exploit the full capability of their detector (full acceptance and largest pseudorapidity separations), where one may otherwise limit the acceptance with a fiducial cut. Larger separations and highest accuracy provide the maximum ability to distinguish between various models implementing different mechanisms for particle production.

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