Method for High Accuracy Multiplicity Correlation Measurements

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Abstract

Forward-backward multiplicity correlation measurements play an important role in understanding the underlying event in proton-proton collisions. This observable depends more on the dynamics of the collision than on the hadronization process when compared to many other observables. Extended to heavy-ion collisions, these measurements can shed light on effects such as gluon saturation.

The measurement itself requires the determination of the quantities $\mathrm{Cov}(n_F, n_B)$, $\mathrm{Var}(n_F)$, and $\mathrm{Var}(n_B)$, where n_F and n_B are the detected number of particles per event. The (charged) particle multiplicities are determined in bins with positive and negative pseudo-rapidity centers, respectively. Detector effects, such as non-uniform acceptance and efficiency, will distort the measured quantities. Unlike for first order measurements, the distortion is not straight forward nor intuitively obvious. Correcting for such effects is a challenge. Consequently forward-backward correlation measurements are often corrected using simulation based correction methods which are dependent on both the event-generator and the particle propagator. In some cases, modified correlation measures are used instead.

This talk will have its main focus on a new method to measure multiplicity correlations, in the presence of reduced acceptance and imperfect particle detection. The aim of the method is to provide a Monte Carlo independent approach to measure the relevant quantities with the least bias and make these measurements accessible to less than ideal detectors, which, on the other hand, often possess larger η acceptances.