Multiple parton interaction in jets from forward-backward multiplicity correlations

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Introduction

One of the first results in p+p collisions on the Forward-Backward (F−B) multiplicity correlations was from the Intersecting Storage Ring (ISR) at CERN at √s = 52.6 GeV [1], finding positive values for the correlations. Experimental studies of long-range rapidity correlations can give us the information about the initial stage of the hadronic interactions at high energies. It has been proposed that the study of the long-range F−B multiplicity correlations between two separated rapidity windows can provide a signature of the string fusion and percolation model in ultrarelativistic heavy ion collisions [2]. Recent studies show the possibility of extracting the number of multiple parton interaction (nMPI) [3]. In this work, we extend these studies to jet event classes, taking into account color reconnection (CR).

Jet Study

A reconstructed jet is a narrow cone of hadrons created by the hadronization of a quark or gluon produced in hadron-hadron or heavy ion collisions.

Color reconnection

Hadronization process which contribute to the hadrons production, is implement in terms of interaction probability between partons, from lowest to highest pT, a reconnection probability is given by $P_{\text{rel}}(p_T)$:

$$P_{\text{rel}}(p_T) = \frac{(R_{\text{rec}} p_T)^2}{(R_{\text{rec}} p_T)^2 + p_T^2} \tag{1}$$

where the range of CR, $0 \leq R_{\text{rec}} \leq 10$, is a phenomenological parameter and $p_T$ is energy dependent parameter used to damp the low $p_T$ divergence of the 2→2 QCD cross section.

Multiple Parton interactions

The Number of Multiple Parton Interaction indicates how many collisions between partons occur in an event as a function of $p_T$. An average nMPI per event is related to the cross section given by:

$$\langle n_{\text{MPI}}(p_T) \rangle = \sigma_{\text{int}}(p_T) \sigma_{\text{jet}} \tag{2}$$

where $\sigma_{\text{int}}$ and $\sigma_{\text{jet}}$ correspond to cross section for non diffractive events and the integrated one.

Discussion and conclusion

The hardness of the events can be associated with the number of jets in the event. Large quantities of jets indicate high average multiplicity and imply lower multiplicity correlations. The $b_{\text{Corr}}$ multiplicity correlation as a function of the number of jets in an event is similar to those observed when this correlation is analyzed with multiple parton interactions. Therefore it is possible to study the number of multiple parton interactions as a function of the number of jets. Analyzing experimental correlation it is possible to extract the average number of jets as well as the average of nMPI in an event. Moreover, of course, all the analysis is model dependent.

References


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