



Contribution ID: 25

Type: **not specified**

Improving the selection on MPI using multiplicity and leading charged-particle transverse momentum

Tuesday, November 19, 2019 9:20 AM (20 minutes)

We present a phenomenological study of the number of Multiple Parton Interactions (MPI) as a function of mid-rapidity charged-particle multiplicity and leading transverse momentum (p_T^{leading}) in proton-proton collisions at $\sqrt{s} = 13$ TeV using the event generator PYTHIA 8.240. We observe important correlations between leading charged particle p_T and charged particles multiplicity with MPI. Namely, when we combine both quantities the details of the MPI become more visible compared with the selection based purely on multiplicity. The observed effects survive even when the pseudorapidity interval is increased from $|\eta| < 1$ to $|\eta| < 4$. Similar results are obtained when a selection on the leading partonic transverse momentum is implemented. We have complemented the study documenting the contribution of quarks and gluons collisions to the different p_T^{leading} /multiplicity classes.

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Session Classification: High Multiplicities (small system)

Track Classification: High Multiplicities (small system)