In underlying event (UE) studies the components of particle production in hadronic interactions, which are not directly related to the hardest interaction, are studied.

These results are valuable inputs to tune Monte Carlo event generators, e.g., to describe the uncorrelated background in jet studies.

Judgment of the composite nature of nucleons, multi-par t on scatters becomes common at high energies.

Control the underlying-event activity by varying $p_T^{\text{leading}}$.

Compare the particle production in pp and p–Pb collisions with same $N_{\text{ch}}$ and $p_T^{\text{leading}}$.

Where $p_T^{\text{leading}}$ is the track with the highest transverse momentum in the event.

Data samples:
- p–Pb 2015: $\sqrt{s_{NN}} = 5.02$ TeV
- pp 2016: $\sqrt{s} = 5.02$ TeV

Larger UE activity is observed in p–Pb collisions as compared to pp collisions.

Number density and sum $p_T$ density as a function of $p_T^{\text{leading}}$ in transverse region (TS, transverse side).

Both number density and sum $p_T$ density show steep rise for $p_T^{\text{leading}} \leq 5$ GeV/c. The number density saturates at high $p_T^{\text{leading}}$ while sum $p_T$ increases.

EPOS LHC underestimates the densities at high $p_T^{\text{leading}}$. Pythia 8 describes data in pp collisions while underestimates (overestimates) the low (high) $p_T^{\text{leading}}$ part.

To investigate jet-like modifications, the transverse region (transverse side, TS) is subtracted from near region (near side, NS) and away region (away side, AS).

At high $p_T^{\text{leading}}$, pp and p–Pb data are in agreement suggesting the absence of medium effects.

At low $p_T^{\text{leading}}$, small difference is observed which is possibly due to the effect of flow.

Qualitatively similar behavior in pp and p–Pb collisions is observed, but the underlying-event activity is larger in p–Pb compared to pp collisions.

In the search for jet-like modifications, a similar number density in pp and p–Pb collisions at high $p_T^{\text{leading}}$ values is observed.

The results suggest that the underlying event activity in p–Pb collisions share the same features as observed for pp collisions.