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Single-muon production in pp collisions at $\sqrt{s} = 13.6$ TeV with ALICE

Muons produced in W-boson and heavy-flavour (HF) hadron decays provide useful information on particle production in proton-proton (pp) collisions. Both mother particles have large masses and are produced in hard-parton scattering in the initial stages of the collision. W-boson studies can probe light-quark parton distribution functions and serve as a baseline for the study of initial-state nuclear effects. HF measurements in pp collisions help to understand the heavy-quark production mechanisms, fragmentation, hadronisation, and are an important test of perturbative Quantum Chromodynamics. The ALICE detector is uniquely equipped to probe HF and electroweak processes via the single-muon decay channel across both low- and high-transverse momentum probing small Bjorken- x dynamics.

In this contribution, realistic simulations of pp collisions at $\sqrt{s} = 13.6$ TeV are used to determine the two-particle correlations of forward-rapidity ($2.5 < y < 4.0$) single muons from B-hadron decays with charged particles ($|y| < 0.8$) to study the hadronisation mechanism of b quarks. Machine Learning (ML) techniques, specifically neural networks, are used at low p_T ($p_T < 20$ GeV/c) to separate HF semileptonic decay muons ($\text{HF} \rightarrow \mu$) from background candidates. The ML technique is extended to high p_T ($p_T > 20$ GeV/c) to isolate electroweak $W \rightarrow \mu\nu$ signals from HF and $Z \rightarrow \mu^+\mu^-$ background contributions.

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