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Measurement of associated production of electrons and muons from heavy-flavour decays in pp collisions with ALICE

Measurements of the production of open heavy-flavour hadrons in high-energy heavy-ion collisions provide unique access to the transport properties of heavy quarks (charm and beauty) in the quark-gluon plasma (QGP). Charm and beauty measurements in small collision systems, such as proton-proton (pp) and proton-Pb (p-Pb) collisions, serve as a crucial test of perturbative quantum chromodynamics (pQCD) calculations. They also help explore cold nuclear matter effects and act as a baseline for interpreting results in heavy-ion collisions. In ALICE, open heavy-flavour measurements can be conducted via semimuonic decays at forward rapidity and semielectronic decays at midrapidity, offering key input for studying charm and beauty production.

Associated production of electrons and muons from heavy-flavour decays enable the study of different production mechanisms such as single-parton scattering (SPS), where both heavy quarks are produced in the same hard scattering process, and double-parton scattering (DPS), where the two quarks originate from independent parton-parton interactions within the same collision. These two mechanisms exhibit distinct patterns in angular, rapidity, and invariant-mass distributions. In particular, contributions from DPS are expected to be more pronounced at large rapidity separations between the electron and the muon detected in ALICE. Taking advantage of these kinematic features, the study of electron-muon pairs serves as a powerful tool to investigate heavy-quark production mechanisms. Furthermore, the associated production of electrons and muons from heavy-flavour decays is particularly valuable for probing correlated charm and beauty production. Unlike other dilepton channels, they are largely unaffected by contaminations from resonance decays, thermal radiation, or Drell-Yan processes, thus directly reflecting the original heavy-quark correlations.

In this poster, the status of the first measurement of correlated charm and beauty production via the invariant mass analysis of unlike-sign electron-muon pairs in pp collisions at $\sqrt{s} = 13.6$ TeV collected during LHC Run 3 with the upgraded ALICE detector is reported. Model calculations incorporating both SPS and DPS contributions are also presented.

Secondary track

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