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Measurement of forward electroweak boson production in Run 3 Pb–Pb collisions at $\sqrt{s_{\text{NN}}} = 5.36$ TeV with ALICE

With the increased luminosity of the Run 3 data-taking at the LHC, more precise measurements of the electroweak bosons ($W^\pm/Z^0$) are now possible. Studying the production of the electroweak bosons in heavy-ion collisions is useful for a variety of physics reasons, with the main goal being to study the formation of the Quark Gluon Plasma (QGP). Since electroweak bosons are produced during the initial hard-scattering of the collision and carry no colour charge, they serve as medium-blind probes of initial-state nuclear effects of the collision, such as the nuclear modified parton distribution functions (nPDFs). In addition, the W^+/W^- charge-asymmetry as a function of collision centrality can aid in probing the neutron skin effect of lead nuclei. The ALICE detector includes a muon spectrometer in the forward rapidity region ($2.5 < \eta < 4.0$), which allows for the measurement of electroweak bosons through their leptonic decay channels ($W^\pm \rightarrow \mu^\pm + \nu_\mu$ and $Z^0 \rightarrow \mu^+ \mu^-$). Currently, ALICE is the only experiment at the LHC that has measured electroweak bosons at forward rapidity in Pb–Pb collisions, which can help to constrain the small Bjorken- x region of nPDFs. In this work, the analysis strategy to measure $W^\pm$ bosons in ALICE Run 3 Pb–Pb data at $\sqrt{s_{\text{NN}}} = 5.36$ TeV will be explored. Results from Pb–Pb Monte Carlo simulations of the relevant signal and background processes will be presented, as well as a first look at the inclusive experimental yield of high- p_T muons. Improvements to the analysis procedure used in Run 2 for the same measurement will also be suggested, through the investigation of machine-learning methods that can serve as event-by-event triggers and potentially reduce the impact of systematic uncertainties.

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