Electroweak physics in the forward region

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Abstract

The LHCb Electroweak Physics working group has an ongoing program of measurements of the inclusive W, Z, and Z+jets cross sections and of the charge asymmetry in W production. Measurements of $W \to \mu\nu_\mu$ and $Z \to \mu\mu$ have been carried out with the limited dataset of 2010 [1]. The 2011 dataset has been used to measure production cross sections in $Z \to ee$ [2], $Z \to \tau\tau$ [3], $Z \to \mu\mu$+jets [4], and $W \to \mu\nu_\mu$ [5] with work on $W \to (e, \tau)\nu_{(e,\tau)}$ and $Z \to \mu\mu$ [6] ongoing. Measurements of these decay channels at 8 TeV with reduced uncertainties are also in progress.

The precision measurements of W/Z production that are performed at LHCb act as tests of QCD and electroweak theory in unprobed regions of $x - Q^2$ phase space. The LHCb detector is unique in the angular coverage of some of its subdetectors and is, therefore, complementary to the general purpose detectors, ATLAS and CMS. With the higher cross sections of 13(14) TeV and with increased luminosity, measurements of $t\bar{t}$, single top, and possibly the Higgs will also become feasible. The current work thus gives crucial knowledge and experience, acting as a proof of principle for these measurements and prospective new physics searches in the forward region. Since the detector has high precision tracking, calorimetry, and a muon system close to the beamline, measurements extend up to boson rapidities of 4.5. Consequently, partons with extremely low ($x \sim 10^{-4}$) and high ($x \sim 0.1$) momentum fractions are probed. This enables these measurements to be used in constraining PDF sets, which has an indirect impact on all measurements made at the LHC.

References

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[3] LHCb collaboration, R. Aaij *et al.* A study of the Z production cross-section in pp collisions at $\sqrt{s} = 7$ TeV using tau final states. *J. High Energy Phys.*, 1301:111, 2013.

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