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CMS RPC Background studies in LHC Run 2 and Run 3

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The Compact Muon Solenoid (CMS) is a general purpose experiment to explore the physics of the TeV scale in pp-collisions provided by the CERN LHC. Muons constitute an important signature of new physics and their detection, triggering, reconstruction and identification is guaranteed by various sub-detectors using different detection systems: Drift Tubes (DT) and Resistive Plate Chambers (RPC) in the central region and Cathode Strip Chambers (CSC) and RPC in the endcap. During Run 2 and Run 3 the higher instantaneous luminosity leads to a substantial background in the muon system. In this contribution we will describe the method used to measure these backgrounds in the RPC detectors. The analysis is based on data collected in pp collisions at 13 and 13.6 TeV in 2018 and 2022-2023, respectively, with instantaneous luminosities up to 2.2 10ˆ34 cmˆ-2sˆ-1. Thorough understanding of the background rates provides the base for the upgrade of the muon detectors for the High-Luminosity LHC, where the instantaneous luminosity will reach 5-7.5 10ˆ34 cmˆ-2sˆ-1, resulting in 140-200 simultaneous pp-collisions. We will discuss in detail the origin and characteristics of the background introduced by the pp-collisions, we will analyze the response of the RPC detectors and illustrate the dependence of the background on the instantaneous luminosity and the LHC fill scheme. The reported analysis allows to distinguish and showcase the contributions from long-lived background rates and the promptly induced background.

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