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Validating the Muon Endcap Chamber 0 Segment Finder (ME0SF) with Cocotb CHLOE GRUBB, ANDREW PECK, INDARA SUAREZ, Boston University, CMS TEAM — As part of the 2026 HL-LHC upgrade, the CMS group has planned to enhance its muon system with an introduction of new detector technology using Gas Electron Multipliers (GEM). The Muon Endcap Chamber 0 (ME0) is a 6-layered GEM detector which uses gases and a high voltage electric field to detect ionizing muons. It serves as the first muon detecting station outwards of the CMS interaction point. The ME0 will work with the Cathode Strip Chamber, GEM, and Resistive Plate Chamber systems to back up their muon data for track finding purposes. The ME0 will also work to increase the existing muon system coverage to include the pseudorapidity window, $2.4 < |\eta| < 2.8$. The ME0 Segment Finder is an algorithm purposed for the detection of multi-layered patterns of hits in a ME0 chamber. It is implemented in the firmware of a Field Programmable Gate Array. My work with cocotb, a python environment for hardware simulation, focuses on validating these firmware designs through a series of testbenches, Monte Carlo data generators, and software emulators of the firmware algorithm designs. Using these testbenches, we have been able to debug and validate the performance of the firmware in simulation.

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