

The quality control procedure of the CMS GE2/1-M5 GEM detectors

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February 19, 2021

Keywords— CMS, LHC, Quality control, Gaseous detectors, GEMs

Abstract

Gas Electron Multiplier (GEM) detectors are being integrated into the Compact Muon Solenoid (CMS) experiment at CERN to cope with the increased muon flux resulting from the High Luminosity upgrade of the Large Hadron Collider. The GE2/1 chamber is composed of four modules: the M5–M8 modules in the front chamber (closest to the interaction point), and M1–M4 in the back chamber. These chambers will eventually be mounted back-to-back to create a GE2/1 superchamber which will be installed at the second muon station in the CMS endcaps. This presentation details our process for ensuring quality control of the M5 module. The quality control procedures include a gas-leak test that ensures the GEM is gas-tight; a test for determining the spurious signal rate while also measuring the linear ohmic response of the high voltage divider; and a test for measuring the effective gas gain in one readout sector while under irradiation from an X-Ray gun. The leak test resulted in an exponential decrease in pressure with a time constant of $\tau = (1.07 \pm 0.01)$ hr. The module's voltage divider showed a linear ohmic response with a fitted divider resistance of (4.98 ± 0.78) M Ω with a maximum spurious rate of (30.3 ± 1.7) Hz. The effective gain measurement is currently in progress. This prototype chamber will eventually be used for electronics integration testing at Florida Tech's test stand.