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LHCb experience on Triple-GEM detectors and upgrade perspective

Abstract content

The LHCb muon system consists of more than a thousand gas detectors, mostly MWPC, located in five different stations. The muon detector is used to define the muon trigger and to identify muons at the reconstruction stage. The first station of the muon detector, located in front of the calorimetric system, is made of 274 chambers. The 12 most irradiated chambers, the ones closer to the beam pipe, are double triple-GEM detectors with pad readout. These detectors have an active area of 200x240 mm2 and are routinely operated at rates closer to 500 kHz/cm2. With the gas mixture used (Ar/CO2/CF4 45/15/40) these detectors have the requested efficiency (>96% in a 25 ns time window for the logical OR of the two sensitive gaps) when operated at gains of about 4300. In this presentation we will report on the performance of these 24 triple-GEM detectors after more than 2 years of operation in the harsh LHCb conditions. We will also discuss some problems occurred during data taking, in particular the failure of a few GEM foils following repeated discharge phenomena and the solutions implemented to reduce the occurrence of such problems. Thanks to their excellent performances, we are considering the possibility of using triple-GEM technology also for the muon system upgrade. The LHCb upgrade, that will be installed and commissioned during LHC long shutdown 2 (LS2) starting in 2018, will allow the sub-detectors' readout at 40 MHz while running at an instantaneous luminosity of $2x10^{33}$, ten times larger than LHCb design luminosity. Upgraded detectors will have to be able to operate in these difficult operating conditions. While station M1 will be removed because the extremely large occupancies will make it useless for triggering purposes, station M2 will experience particle rates similar to the ones currently seen today in M1. For this reason we believe that triple-GEM detector technology will be perfectly adequate for detectors located in the innermost region of M2. An R&D for these new detectors has been started.

Summary

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