First Results from an Aging Test of a Prototype RPC for the LHCb Muon System

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We present the first results of an aging test being performed at the CERN Gamma Irradiation Facility on a single-gap RPC, a prototype of those foreseen for the LHCb muon system. The results are based on an accumulated charge of about 0.4 C/cm^2, corresponding to about 4 years of LHCb running at worst conditions. We have measured regularly the performance of the chamber with test beam facilities. We observed the expected degradation of the rate capability above 1 – 2 kHz/cm^2. We also found that the dark current and the noise increased after irradiation. However, the chamber still meets the LHCb operation requirements.

Summary of Talk: RPC detectors have been chosen for equipping a large fraction of the LHCb muon system. The maximally expected rate, after application of all safety factors, depends mainly on the polar angle and varies between 250 and 750 Hz/cm^2. The corresponding expected integrated charges for ten years of operation are 0.35 and 1.1 C/cm^2, respectively. These are significantly larger than those expected in ATLAS and CMS, whose aging studies reached accumulated studies of at most 0.3 C/cm^2. The LHCb aging study started in January 2001 at the CERN Gamma Irradiation Facility, where a ^{137}Cs photon source of about 675 GBq is installed, and is expected to last until December 2001. The tested chamber is a single-gap RPC of dimensions 50 $\times$ 50 cm^2. A second chamber is operated under the same conditions (gas composition and exchange rate, temperature, pressure) except for the irradiation. The comparison between the two chambers allows disentangling the effects solely due to irradiation. During the test, the currents drawn by the two chambers are continuously monitored. To accelerate the test the chambers are operated at a voltage such that the current density in the irradiated chamber is about 60 nA/cm^2. The resulting charge integration rate is about 0.08 C/cm^2/month, and the charge collected so far is about 0.4 C/cm^2. At this rate, it should be possible to collect 0.8 – 0.9 C/cm^2 by the end of 2001, close to the 'ten-LHCb-years-operation' target. An overall decrease of the current drawn by the irradiated chamber is observed. The performances of the two chambers have been regularly measured with test beams. The irradiated chamber is behaving as the reference one up to rates of 1 – 2 kHz/cm^2, well within the LHCb requirements. Aging effects are observed at larger rates. We also observe an increase in noise and dark currents, which remain, however, well below the maximum acceptable values.