Upgrade of the LHCb ECAL LED monitoring system

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The LHCb ECAL is a shashlik calorimeter of 6016 cells, covering $7.68 \times 6.24 \text{ m}^2$ area. The light produced in each cell is read out by a photomultiplier and digitized by an ADC. The details of the ECAL design can be found in [1].

To monitor the functionality of the readout chain of each ECAL cell and the stability of its characteristics, the LHCb ECAL is equipped with the LED based monitoring system. The value of average photomultiplier response to light flashes of fixed intensity can be used to follow up the behavior of each readout channel, mostly determined by the stability of the PMT gain.

The monitoring system is organized such that each LED illuminates a group of 9 or 16 ECAL cells; the stability of LED flash magnitude is monitored by PIN photodiodes. The LEDs, PIN photodiodes and corresponding electronic boards are installed below and above the calorimeter, outside the high radiation area. The light is distributed to each calorimeter cell by means of 2 – 8 m long light guide made of polystyrene-based KURARAY Clear-PCM fiber of 1 mm diameter.

During the LHC Run I (2009-2012) it was found that the precision of the monitoring suffers from the radiation degradation of transparency of the light guides. In order to improve the performance of the monitoring system, and especially in view of the significant increase of LHCb working luminosity foreseen after 2018, the present plastic light guides have been replaced by radiation hard ones, made of pure silica high-OH quartz fiber with 200 µm diameter core (FVP200220240, Polymicro Technologies, Inc.).

The performance of the old LHCb ECAL monitoring system during LHC Run I and the design of the upgraded system are discussed in this talk.

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References