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LHCb RICH Upgrade: an overview on the photon detector and the electronics system.

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This presentation is meant to summarize the photon detector chain designed for the Upgraded RICH detector for the LHCb experiment. The photosensitive surface is composed of 64-channel MaPMTS (R11265 or R12699, produced by Hamamatsu) coupled with an external read-out electronics. The front-end chip, the CLARO, is an 8-channel ASIC in AMS 0.35 μm CMOS technology. The CLARO is able to sustain a photon counting rate of 40 MHz, with a power consumption < 1 mW/channel. A 12-bit digital register allows to select thresholds, attenuation and gives information for testing and debugging.

Summary

The LHCb experiment is one of the four detectors operating at the LHC at CERN and it is mainly devoted to CP violation measurements and the search for new physics in beauty and charm hadrons rare decays. The data from the two Ring Image Cherenkov (RICH1 and RICH2) detectors are essential to identify particles in a wide momentum range. Up to now the luminosity has reached up to $4 \cdot 10^{32}$ cm^{-2} s^{-1} with 50 ns bunch spacing and 3 fb^{-1} have been collected since 2010. From 2019 onwards 14 TeV collisions with luminosities reaching up to $2 \cdot 10^{33}$ cm^{-2} s^{-1} with 25 ns bunch spacing are planned, with the goal of collecting 5 fb^{-1} of data per year. In order to avoid degradation of the RICH detectors particle identification performance at such high rate (40 MHz), a detector upgrade is necessary. The present photodetectors (HPDs equipped with encapsulated 1 MHz readout chips) will be replaced with flat panel MaPMTs read out by external chips, designed for this purpose. The 25.4×25.4 mm^2 8×8 pixels R11265 MaPMTs (produced by Hamamatsu) are chosen to be used in RICH-1 and in the central part of the RICH-2, where a high spatial resolution is required. Larger tubes, the 50.8×50.8 mm^2, 8×8 pixels R12699 MaPMTs, will cover the peripheral RICH-2 area. Both tubes have been extensively studied, and the results are briefly summarized. These devices will be read out using an external 8-channels chip, the CLARO, able to integrate the input charge and provide a digital information if its amplitude overcomes a settable threshold. The CLARO was designed to sustain a photon counting rate up to 40 MHz, minimizing the power consumption and the cross-talk. A 12-bit digital register allows to select thresholds and attenuation values and provides features useful for testing and debugging. MaPMTs and CLAROs have been recently tested on a beam in November 2014. An overview on the CLARO features and on the EC electronics is presented.

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