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Timing reference distribution in CMS iRPC time measurement

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The improved Resistive Plate Chambers (iRPC) will be installed in the challenging forward region during the CMS phase II upgrade with new FrontEnd Electronics Boards (FEBs) to record the rising edge of signals from both ends by a Time-to-Digital Converter[1]. TDC data of each end has two parts of time information—the coarse time (2.5 ns) and the fine time (around 10ps, 2.5ns/256). The backend provides fast control (timing reference distribution, reset, clock, etc.) and slow control (powering up, FEB TDC configuration, etc) for the FEB.

The Bunch Cross 0 (BC0) signal as the timing reference is distributed to each FEB located in different RPC stations by Backend Electronics Board (BEB). Arrival times of BC0 between links are different because of different lengths.

This paper discusses the measurement, comparison, and way to minimize this difference by adding an adjustable correction value. A 12-bit counter of the 2.5ns step is developed in BEB and used to measure the loopback time of different links through a self-defined handshake mechanism. By taking the faster link as the reference we apply a correction value to the slower link according to the loopback time via slow control. So TDC data on each FEB will minus this specific correction value to minimize the latency difference between paths. A test system was set up and the preliminary results show that the loopback time measurement mechanism satisfied the requirement.

[1]CMS collaboration, The Phase-2 Upgrade of the CMS Muon Detectors, CERN-LHCC-2017-012, CMS-TDR-016 (2017).

Minioral

Yes

IEEE Member

No

Are you a student?

Yes

Author: SONG, Jianing (Institute of High Energy Physics, Chinese Academy of Sciences (CN))

Presenter: SONG, Jianing (Institute of High Energy Physics, Chinese Academy of Sciences (CN))

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