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Development of a Multi-points Wireless Temperature Monitoring System for Optohybrid for CMS GEM Project

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We will present a multi-points wireless temperature monitoring system being designed for the optohybrid for the CMS forward moun detector upgrade project. Optohybrid is a readout board which will be installed inside CMS to control 24 front-end electronics chips and transfer the concentrated data to off-detector electronics through high speed optical fiber. An efficient cooling system is extremely important for reliable operation. We therefore designed such a system which can precisely measure the temperature of different components continuously without affecting normal run. We will report on the system design and the performance of the prototype board.

Summary

In 2009, a dedicated CMS R&D program was launched to study the feasibility of using micro-pattern gaseous detectors (MPGD) for the instrumentation of the $|\eta| > 1.6$ region in the CMS muon endcap system. The proposed detector for CMS is a triple-GEM trapezoidal chamber, equipped with 1D readout, with dimensions (990x440-220) mm2. Triple-GEM detectors can provide precision tracking and fast trigger information, contributing on one hand to provide missing redundancy in the high-eta region and on the other hand to the improvement of the CMS muon trigger.

Finally a few hardware components have to be developed specifically for this project: the GEM Electronic Board (GEB) and the Opto-Hybrid board. The GEB consists in a large multi-layer PCB board, matching the size of the Triple-GEM detector. The Opto-Hybrid is a small (typically 10 x 20 cm2) mezzanine, mounted on the low-η side of the GEB, equipped with an FPGA and the GBT chipsets. The Opto-Hybrid will collect the trigger and tracking data from the 24 VFAT3 chips and ensure the sparsification and the formatting of these data for the optical links. The data are transmitted from the VFAT3s to the Opto-hybrid through the GEB PCB at 320 MHz. From the Opto-hybrid, three GBT links will transmit the tracking data and one GBT link will transmit the trigger data to the back-end electronics. In addition one optical link will transmit the trigger data directly to the CMS CSC trigger mother board (TMB).

Since opto-hybrid will be installed inside CMS detector and not accessible until next shut down, a very high reliability is essential, besides carefully hardware and firmware design, an efficient cooling system plays an extremely important role. According to the experience from similar system, an estimate of the power of the opto-hybrid board is up to 30W, since the power consumption of a programmable component is highly depends on the firmware design, the most accurate way to verify the thermal distribution is to measure directly at different parts of the board continuously . We therefore designed such a temperature monitoring system which can measure as many as 8 points on board and can communicate with PC directly through bluetooth or indirectly through the opto-hybrid slow control path. It can be powered in different ways thus it can be used not only for opto-hybrid board but also most print circuit board, the measuring range is from −40℃ to +105℃ with 16-bits resolution and ±0.5℃ accuracy.

We will report the technical detail as well as the result of the first prototype board.

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