Contribution ID: **42** Type: **Poster**

Calibration and performance tests of the Very-Front-End electronics for the CMS electromagnetic calorimeter

Thursday 6 September 2007 16:45 (1 minute)

The Very-Front-End electronics processing signal from photodetectors of the CMS electromagnetic calorimeter, have been put through extensive test program to guarantee functionality and reliability. The final characteristics of the VFE boards designed for the calorimeter barrel and endcaps are resented. The results, which have been also verified during test beam at CERN, confirm the high quality of the boards production and show that the CMS detector specifications are reached.

Summary

On detector electronics of the CMS electromagnetic calorimeter (ECAL), which consist of 75,848 radiation hard scintillating crystals PbWO4, contain almost 16,000 Very-Front-End (VFE) boards that process signals from Avalanche Photodiodes (APDs) in the central barrel region and Vacuum Phototriodes (VPTs) in the forward endcaps regions, respectively. The VFE board was designed in two types: covering a dynamic range up to 50 pC corresponding to incident particle energy of ˜1.7 TeV for barrel and 16 pC for energy up to ˜3 TeV for the endcaps. Both types comprises five identical and independent read-out channels. Each channel, processing the signal from one crystal, consists of a Multi-Gain Pre-Amplifier (MGPA), a multi-channel ADC, and two level adapters LVDS-RX. The MGPA contains a pre-amplifier and three parallel gain stages with nominal gains 1, 6, and 12 that shape and amplify the photodetector signal. The three analogue output signals of the MGPA are then digitized in parallel by the multi-channel 40 MHz 12-bit ADC (AD41240). An ADC internal logic determines whether a gain is saturated and then outputs the data from the highest non-saturated channel. In addition, the barrel VFE board also incorporates a Detector Control Unit (DCU) chip for measuring the APD leakage current and the crystal temperature.

All the VFE boards have to pass an extensive quality and assurance program to guarantee their functionality and reliability. The program includes an optical inspection by the manufacturer, a power-on test - the first electrical test that measures voltages, currents and performs a functional test, a burn-in for 72 hours at a temperature of 60℃, which is followed by a complete calibration and characterization of each channel. The calibration procedure covers an absolute calibration of each channel for the three gain stages in ADC counts per pC, channel-to-channel relative calibration, and gain ratios and linearity studies. Moreover, other relevant tests, such as a simulation of leakage current of the APDs, a test of temperature read-out channel on its complete dynamic range are also performed. Results are registered in a database and are used for a first intercalibration of the ECAL. To date, the test program for all the 12,800 barrel and the ˜3,000 endcap VFE boards has been completed. The dispersion in the gains is found to be small (˜ 1%) complying with the CMS detector specifications. Only around 2% of them failed the test criteria and have been rejected, the rest have been assembled into barrel supermodules and endcap supercrystals. The results obtained during the Q&A program have been verified in summers 2006 and 2007, when several fully equipped supermodules and supercrystals were tested and calibrated with high energy electrons.

Author: BLAHA, Jan (Institut de Physique Nucleaire de Lyon (IPNL))

Presenter: BLAHA, Jan (Institut de Physique Nucleaire de Lyon (IPNL))

Session Classification: Poster session