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Fabrication and Characterization of MicroTCA Electronic Components and Optical Splitters for CMS HCAL Electronics Upgrade.

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The present CMS-HCAL (Hadron Calorimeter) will require an upgrade of the instrumentation electronics to meet the expected performance of high luminosity upgrade of the LHC. The ongoing research has established the µTCA (Micro Telecommunication and Computing Architecture) as a potential candidate to replace the existing VME for the backend electronics upgrade which will provide more accessible environment and high bandwidth for global DAQ in the CMS experiment. To support the efficient and phased installation of the upgrade, it is important to demonstrate the working with the existing data link. This is done by operating the upgrade electronics (µTCA) in parallel with the present electronics (VME), and achieved by splitting the incoming optical stream using passive optical splitters. A µTCA crate as well as a proto type optical splitter has been installed at the CMS experimental site (USC) in June-2012 and January-2013. We present the test results of µTCA electronic components and optical splitter performed in India as well as at CERN. Based on the tests performed, the validation of backend electronics (µTCA) is established

Summary

In the proposed LHC running condition, the existing CMS-HCAL back-end electronics does not support the upgraded front-end data transfer rate (4.8Gbps). Hence an attractive alternative is to replace the current VME by TCA electronics which offers a flexible, high density, high performance backplane that is based on the serial standards in use today (GbE, PCIe, SRIO, SATA, etc). In order to validate the performance of µTCA in real data taking condition, six of the AMC (Advance Mezzanine cards) are successfully installed in a µTCA crate at the CMS in June 2012. For one week the bit error rate test (BERt), link validation and data synchronization tests are performed for one HCAL slice. All cards are successfully found to receive the data, and error rate is found to be zero. A big milestone is achieved with visibility of 50 ns spacing in data. Recently a proto-type optical splitter with splitting ratio of 50:50 is fabricated and characterized by DU and successfully installed at CERN. The proto-type optical splitter worked well and less optical losses (˜3dB) are measured as compared with old splitters (OSB) where optical losses were measured to be greater than 5dB. The proto-type optical splitter has been tested at P5, CERN. Only one channel was found to be weak. This is a good result as compared with OSB where 12 channels were inactive. Also Power Mezzanine (PM) tests have been performed in India to get the stable performance of PM before mounting them on µHTR (HCAL Trigger and Readout) cards of µTCA crate. Optical Margin tests are carried out successfully at CERN to verify the optical sensitivity of PPOD receivers using variable attenuator. Based on the tests performed, the validation of backend electronics (µTCA) is established.

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