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Front-End card, a key element of the CMS ECAL readout chain: design-oriented tests, performance, quality control

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Abstract

Performance and stability of the CMS ECAL HL-LHC readout system depends on the good functionality of the Fron-End card (FE) –an interface between on-detector and off-detector section of the readout electronics. Series of the design-specific integration tests were performed, including dependence of the readout chain functionality on the system clock quality, recovery from the clock loss and from the SEU etc. with the emphasis on the custom chips performance and possible limitations.
The quality assurance procedure was defined and implemented in the custom FE card test setup hardware and software.

Summary (500 words)

Summary

A series of the performance tests with the pre-production version of CMS ECAL readout tower, made of VFEv3, FEv3.3P, containing lpGBTv2, connected to BCPv1 were performed with the goal to evaluate the possible performance limitation rising from the custom chips features, in particular lpGBT and GBT-SCA and validate the reset and recover algorithms.
The FE cards resistance to the power and thermal cycling as well as the accelerated aging was done with the set of 16 FEv3.3 (made of lpGBTv1). Two failures observed cannot be attributed to the known lpGBTv1 issues.
The readout tower irradiation at the CERN CRARM facility and PSI pion beam also show a certain custom chips feature to be controlled during production.
Analysis of the system performance tests will be presented.
The quality assurance procedure for the production FE cards, based on the results obtained with be presented and discussed.

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