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MicroTCA and AdvancedTCA equipment evaluation and developments for LHC experiments

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The MicroTCA (MTCA) and AdvancedTCA (ATCA) industry standards have been selected as the platform for many of the current and planned upgrades of the off-detector electronic systems of two of the LHC experiments at CERN. We present a status update from an ongoing project to evaluate commercial MTCA and ATCA components with particular emphasis on infrastructure equipment such as shelves and power-supplies. Shelves customized for use in the existing rack infrastructure have been tested, and electrical and cooling measurements and simulations were performed. Inhouse developments for an automated test system and for hardware platform management will be shown.

Summary

Originally developed for the telecommunication industry, the MicroTCA (MTCA) and AdvancedTCA (ATCA) standards have been selected as the platform for many of the current and planned upgrades of the off-detector trigger and data-acquisition systems of the ATLAS and CMS experiments at the LHC. Therefore the support group for the electronic systems of the experiment at CERN has been running a project to evaluate commercial MTCA and ATCA components from different vendors with the goal to provide equipment recommendations and eventually support to the users of these modular electronics standards. The emphasis was placed on infrastructure components such as shelves and power-supplies as well as shelf and module management hardware and software. Throughout the project, equipment from various vendors has been acquired, evaluated and interoperability tests have been performed. The test procedures used and the tools that have been developed in-house for this evaluation program will be introduced. In particular an automated test system for MTCA power modules has been designed and will be presented in more detail. The latest results from power-module electrical performance measurements, shelf cooling evaluation and IPMI compliancy testing will be shown. Prototypes of customized shelves compatible with the existing rack cooling infrastructure have also been tested. For instance, an MTCA shelf suitable for vertical airflow to be used in the LHC experiments has been specified, pre-series production units were evaluated and the shelf is now commercially available. In a similar manner, a prototype ATCA shelf customized for the vertical airflow used in the existing LHC experiment rack infrastructure has been evaluated and electrical and cooling measurements were performed. In addition detailed thermal and airflow simulations of these shelves installed inside an LHC rack have been carried out. Finally a technical specification of an ATCA shelf complying with the experiments requirements has been defined in view of future equipment procurement. In-house developments for hardware platform management will also be presented. The firmware of the existing Module Management Controller (MMC) has been significantly improved and extended to include features such as remote firmware upgrade as well as simplifying the user customization required for adapting the code for a specific Advanced Mezzanine Card (AMC). In addition a commercial package including all the required hardware and software to design an Intelligent Platform Management Controller (IPMC) to be used on ATCA blades has been acquired and evaluated. It will be tested on existing custom ATCA blades using a custom adapter card.

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