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## The Next Generation Front-End Controller for the Phase 1 Upgrade of the CMS Hadron Calorimeters.

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In the Phase 1 Upgrade of the CMS Hadron Calorimeters, the ngFEC is the system responsible for distributing the LHC clock, the synchronization signals and the slow controls to the frontend electronics using a GBT bidirectional link. It is based on the FC7, a  $\mu$ TCA AMC developed at CERN and built around the Xilinx Kintex-7 FPGA. Its main features are: a fixed latency for fast signals across power cycles, a redundancy scheme in the communication with the frontend modules, and the ability to program all frontend modules. This contribution reviews the characteristics and the development status of the ngFEC.

### Summary

The ngFEC (next generation FrontEnd Controller) is the system responsible for fast and slow control within the Phase 1 Upgrade of the CMS Hadron Calorimeters. It is based on the FC7, a  $\mu$ TCA compatible Advanced Mezzanine Card developed at CERN and built around the Xilinx Kintex 7 FPGA. The ngFEC decodes the 40.07888 MHz LHC clock and the synchronization signals received from the backplane and distributes them to the frontend electronics using a GBT link. The latency of the fast control signals is fixed across power cycles and across identical ngFEC channels. Even if the direct link to a frontend module is broken, a redundancy scheme ensures a successful communication using the link to the neighboring frontend module. Thanks to the ngFEC all frontend modules can be remotely programmed through the JTAG standard. The CCM server software interfaces the ngFEC to the Detector Control System (DCS) which constantly monitors voltages and temperatures on the frontend electronics. This contribution reviews the characteristics and the development status of the ngFEC.

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