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Input Mezzanine Board for the Fast Tracker(FTK) at ATLAS

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The Fast Tracker(FTK) is an integral part of trigger upgrade program for the ATLAS experiment. At LHC Run2, which started operation in June 2015 at a center-of-mass energy of 13 TeV, the peak luminosity has exceeded $2\times10^{34}cm^{-2}s^{-1}$ and the LHC produce an average of 60 simultaneous collisions.
The higher luminosity demands a more sophisticated trigger system with increased use of tracking information. The Fast Tracker is a highly-parallel hardware system that rapidly reconstructs tracks in the ATLAS inner detector at the triggering stage. This paper focuses on the Input Mezzanine Board that is an input module of entire system.

Summary

The ATLAS[1] Fast Tracker[2] is a custom electronics system that will operate at the full level-1 accept rate, 100kHz. The Fast Tracker need to reconstruct clusters from hit information from the inner detector, The Input Mezzanine Board perform full reconstruction of all clusters.
The functions of this board are to receive the insertable b-layer, pixel and micro-strip data from the ATLAS Silicon read-out drivers, perform clustering, and forward the data to its motherboard. The FTK Input Mezzanine processes all inputs data for the Fast Tracker and performs clustering at a rate of 100 kHz, therefore a powerful processing mechanism is absolutely imperative. In order to achieve this goal, for the FTK Input Mezzanine Board, in total 128 Mezzanine Boards are required. In addition, several outstanding algorithms have been implemented in the form of the Field Programmable Gate Array(FPGA). In each FPGA firmware handle two input links from the ATLAS silicon read-out
drivers at 40MHz. The design of clustering algorithm are based on parallel processing function and fast 2-dimensional clustering method.
Mass production and quality control tests of Mezzanine Boards were completed, and staged installation and commissioning are ongoing. Details of its
functionality and installation as well as first results from data taking are reported.
[1] ATLAS Collaboration., The Fast Tracker (FTK) Techinical Design Report CERN-LHCC-2013-007 ; ATLAS-TDR-021;
[2] The ATLAS Collaboration, The ATLAS Experiment at the CERN Large Hadron Collider, Journal of Instrumentation 3 S08003, 2008.

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