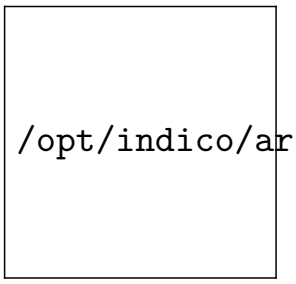

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Phase-I Trigger Readout Electronics Upgrade for the ATLAS Liquid-Argon Calorimeters

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Content

The upgrade of the Large Hadron Collider (LHC) scheduled for shut-down period of 2018-2019, referred to as Phase-I upgrade, will increase the instantaneous luminosity to about three times the design value. Since the current ATLAS trigger system does not allow sufficient increase of the trigger rate, an improvement of the trigger system is required. The Liquid Argon (LAr) Calorimeter read-out will therefore be modified to use digital trigger signals with a higher spatial granularity in order to improve the identification efficiencies of electrons, photons, tau, jets and missing energy, at high background rejection rates at the Level-1 trigger. The new trigger signals will be arranged in 34000 so-called Super Cells which achieves 5-10 times better granularity than the trigger towers currently used and allows an improved background rejection. The readout of the trigger signals will process the signal of the Super Cells at every LHC bunch-crossing at 12-bit precision and a frequency of 40 MHz. The data will be transmitted to the back-end using a custom serializer and optical converter and 5.44 Gb/s optical links. In order to verify the full functionality of the future Liquid Argon trigger system, a demonstrator set-up has been installed on the ATLAS detector and is operated in parallel to the regular ATLAS data taking during the LHC Run-2. Noise level and linearity on the energy measurement have been verified to be within our requirements. In addition, we have collected data from 13 TeV proton collisions during the LHC 2015 run, and have observed real pulse from the detector through the demonstrator system. The talk will give an overview of the Phase-I Upgrade of the ATLAS Liquid Argon Calorimeter readout and present the custom developed hardware including their role in real-time data processing and fast data transfer. This contribution will also report on the performance of the newly developed ASICs including their radiation tolerance and on the performance of the prototype boards in the demonstrator system based on various measurements with the 13 TeV collision data. Results of the high-speed link test with the prototypes of the final electronic boards will be also reported.

Summary

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