

Design and hardware evaluation of the optical-link system for the ATLAS Liquid Argon Calorimeter Phase-II Upgrade

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An optical link system based on lpGBT and VTRx+ is being developed for the ATLAS Liquid Argon Calorimeter Phase-II upgrade. The optical link system is responsible to transmit the detector data and clocks/control signals for 1524 Front-End Boards (FEBs) through 26 optical fibers per FEB over 150 meters.

The optical links can be divided into two categories, data links and control links. For data links, each FEB has 22 simplex optical links, each operating at 10.24 Gbps. The detector data come from 640-Mbps e-ports of 8-analog-channel ADCs. In order to recover the ADC word boundary, which is lost after optical links, each ADC implements two dedicated output channels with a special data format. For control links, each FEB employs 2 duplex optical links for the following functions. Firstly, control links provide recovered clocks for ADCs. Secondly, we offer a bunch crossing reset signal for each ADC via an e-port. Thirdly, we utilize the I2C masters of lpGBTs to access remotely the internal registers of all ASICs. Fourthly, control links remotely control and monitor ASICs via the Digital Input and Output (DIO) ports. Finally, temperatures and power supply voltages/currents are monitored via the intrinsic ADC of lpGBTs.

A printed circuit board has been designed to evaluate the major functions of the optical link system. The board has an lpGBT, a VTRx+, and two FMC connectors interfacing with an FPGA. The uplink and the downlink data transmissions have been successfully verified. The word boundary recovery has been demonstrated. The initial evaluation of the recovered clocks, the DIOs, the I2C interface, and the intrinsic ADC of the lpGBT have been done and extensive evaluation is still ongoing. The evaluation results will be presented in the symposium and the future paper.

Submission declaration

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