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(POS-51) Preliminary Data Transfer Integration Tests for ATLAS Liquid Argon Calorimeter Upgrade

Tuesday 10 June 2025 18:00 (2 minutes)

The Large Hadron Collider (LHC) at CERN is a powerful particle accelerator designed to push the frontier of particle physics. There are four main detectors along the LHC ring; ATLAS is a cylindrical multipurpose detector with multiple specialized subsystems. At its core, the electromagnetic calorimeter plays a crucial role in measuring the energy of charged particles and photons produced in high energy collisions using liquid argon (LAr) as its active medium, segmented with copper absorbers.

The High-Luminosity (HL) upgrade aims to increase the LHC instantaneous luminosity to nearly 10 times its original design to improve its sensitivity to rare processes and statistically limited measurements. To withstand higher radiation and data rates in the HL-LHC environment, ATLAS is undergoing significant upgrades. The LAr Calorimeter system will feature new front-end and read-out electronics, including improvements in radiation tolerance, new trigger and DAQ (Data Acquisition) systems, revised electronics architecture, and novel read-out technology. At the core of the upgraded read-out electronics are the new Liquid Argon Signal Processing (LASP) boards, responsible for handling all digitized data.

This poster will present preliminary data transfer tests between the future LASP Field Programmable Gate Arrays (FPGAs) and the Global Trigger Board prototype (GCMv3), which manages event selection. This communication is vital for the overall data readout and trigger system. Integration tests between these two systems are performed by evaluating link performance using PRBS31 and Core1990-protocol data structures by conducting bandwidth, latency, jitter, and optical power attenuation measurements. Results demonstrated error-free data transmission over 12+ hours, confirmed theoretical bandwidth predictions, and showed latency values consistent with expectations based on the implemented firmware logic. Additionally, attenuation tests indicated significant bit errors emerging at 6 dB. These findings contribute to optimizing high-speed data links between the primary data processing and trigger boards, both essential for informing the final design of the LAr calorimeter readout scheme for HL-LHC.

Keyword-1

Data transfer

Keyword-2

Field Programmable Gate Arrays

Keyword-3

Signal Processing

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