Contribution ID: **268** Type: **Poster**

Upgraded readout and trigger electronics for the ATLAS liquid argon calorimeters for future LHC running

The ATLAS Liquid Argon (LAr) calorimeters produce almost 200K signals that must be digitized and processed by the front-end and back-end electronics at every triggered event. Additionally, the front-end electronics sums analog signals to provide coarse-grained energy sums to the first-level (L1) trigger system. The current design was optimized for the nominal LHC luminosity of $10^{34}\mathrm{cm}^{-2}\mathrm{s}^{-1}$. However, in future higher-luminosity phases of LHC operation, the luminosity (and associated pile-up noise) will be 3-7 times higher. An improved spatial granularity of the trigger primitives is therefore proposed, in order to improve the trigger performance at high background rejection rates. For the first upgrade phase in 2018, new LAr Trigger Digitizer Boards are being designed to receive the higher granularity signals, digitize them on-detector and send them via fast optical links to a new digital processing system (DPS). This applies digital filtering and identifies significant energy depositions in each trigger channel. The refined trigger primitives are transmitted to the L1 system, allowing extraction of improved trigger signatures.

This talk will present the concept for the upgraded readout and describe the components being developed for the new system. R&D activities as well as architectural and performance studies will be described, as will details of the on-going design of mixed-signal front-end ASICs, radiation tolerant optical-links, and the high-speed FPGA-based DPS units. These studies also guide the way towards the second upgrade phase, in which all LAr Calorimeter read-out electronics must be replaced due to radiation damage, ageing, and a new ATLAS trigger scheme.

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Track Classification: Sensors: 1a) Calorimetry