

Development of the ATLAS Liquid Argon Calorimeter Readout Electronics for the HL-LHC

Thursday 28 November 2019 09:00 (20 minutes)

Following new TDAQ buffering requirements and high expected radiation doses in the pileup conditions of the high-luminosity LHC, the ATLAS Liquid Argon Calorimeter electronics will be upgraded to readout the 182,500 calorimeter cells at 40 MHz with 16 bit dynamic range.

The triangular calorimeter signals are amplified and shaped by the analogue electronics over a dynamic range of 16 bits, with low noise and excellent linearity. Developments of low-power preamplifiers and shapers to meet these requirements are ongoing in CMOS 130nm. In order to digitize the analogue signals on two gains after shaping, radiation-hard, low-power 40 MHz 14-bit ADCs are developed using a SAR architecture in 65 nm CMOS. Characterization of the first prototypes of the frontend components show good promise to fulfill all the requirements. The signals will be sent at 40MHz to the off-detector electronics, that will make use of FPGAs connected through high-speed links to perform energy and time reconstruction through the application of corrections and digital filtering. Reduced data are sent with low latency to the first level trigger, while the full data are buffered until the reception of trigger accept signals. The data-processing, control and timing functions will be realized by dedicated boards connected through ATCA crates. Results of tests of the first prototypes of front-end components will be presented, along with design studies on the performance of the off-detector readout system.

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Session Classification: Electronics, DAQ