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

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The High-Luminosity LHC will start operations for physics in 2029.

This expansion of the dataset will be achieved by increasing the number of collisions per bunch crossing, leading to higher radiation doses and busier events. To cope with those harsher conditions and to be compatible with the new ATLAS data acquisition paradigm, the ATLAS Liquid Argon Calorimeter on-detector electronics will have to be replaced.

The presentation will cover the validation of the performance of the new boards boards, a critical step before launching the full production of about 1500 boards and their installation which is planned to start in 2027.

Summary (500 words)

The High-Luminosity LHC will start operations for physics in 2029, allowing to collect ten times more data than what will have been achieved by the LHC.

This expansion of the dataset will be achieved by increasing the number of collisions per bunch crossing, leading, however, to higher radiation doses and busier events. To cope with those harsher data taking conditions and to be compatible with the new ATLAS data acquisition paradigm, the ATLAS Liquid Argon Calorimeter on-detector electronics will have to be replaced. The two main elements, the Front-End readout Board and the Calibration Board, had to be fully redesigned and rebuilt.

The Front-End board will amplify, shape and digitize the calorimeter ionisation signal at 40 MHz and on two gains over a 16-bit dynamic range with 11 bit precision. Custom Preamplifier/Shaper and ADC ASICs have been designed to meet the stringent requirement in terms of linearity and radiation hardness. The Calibration board will inject a calibration signal into the detector with a non-linearity of one permille and non-uniformity between channels of 0.25% with a pulse rise time smaller than 1 ns, facilitated by two additional custom-designed ASICs: The LADOC, a high frequency pulser and the CLADOC, which is the DAC part. Mass ASIC testing procedures are being established while, in parallel, full prototype boards are being assembled and tested.

The presentation will cover the validation of the performance of those boards, a critical step before launching the full production of about 1500 boards and their installation which is planned to start in 2027.

Authors: MILIC, Adriana (CERN); PANCHAL, Devanshu Kiran (University of Texas at Austin (US))

Presenter: PANCHAL, Devanshu Kiran (University of Texas at Austin (US))

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