

ATLAS Liquid Argon Calorimeter Upgrades for High-Luminosity LHC

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The Large Hadron Collider (LHC) at the Conseil Européen pour la Recherche Nucléaire (CERN) features a 27km ring of superconducting magnets that accelerate protons into extremely high-energy collisions to probe for new physics. Found along the ring is ATLAS (A Toroidal LHC ApparatuS), a cylindrical multi-purpose detector with various subsystems. At the heart of the detector, the electromagnetic calorimeter is instrumental in measuring the energy of particles generated during high-energy collisions. The electromagnetic (EM) calorimeter measures the energy of charged particles and photons using liquid argon (LAr) and lead layers.

After the High-Luminosity (HL-LHC) upgrade, the LHC will achieve an instantaneous luminosity nearly 10 times greater than that of the original LHC. To withstand the higher radiation and data rates, the ATLAS experiment will be upgraded to maintain or improve detector performance in this new challenging environment. The planned upgrades to the LAr Calorimeter system include new front-end and readout electronics. Notably, the requirements include radiation tolerance of on-detector electronics, trigger and DAQ upgrades, revision of electronics architecture where all data is sent off-detector, and novel readout electronics. For the latter, a novel approach incorporating cutting-edge technology and a more flexible electronics architecture will be implemented. With the new system, all raw analog data will be digitized on-detector and then quickly sent off-detector via optical fibres to be processed using novel digital signal processing algorithms. A description of the new readout electronics system as well as the current development status will be presented.

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