The LAr Calorimeter

Electromagnetic Barrel (EMB): $|\eta| < 1.475$, accordion lead plates
Electromagnetic End-Cap (EMEC): $1.375 < |\eta| < 3.21$, accordion lead plates
Hadronic End-Cap (HEC): $1.5 < |\eta| < 4.9$, parallel copper plates
Forward Calorimeter (FCAL): $3.1 < |\eta| < 4.9$, copper & tungsten rod and tube structure

Sampling calorimeter with liquid Argon as ionizing medium. Up to 4 layers, total 182,468 channels. Provides input to the Level-1 trigger and precise measurement of $e, \gamma$.

Towards Run-3: Upgrade on Trigger path

A new finer granularity scheme called “Super Cells” (SCs), providing:
- information for each of the 4 sampling layers
- finer segmentation ($\Delta\eta \times \Delta\phi = 0.025 \times 0.1$) in EM layer 1 and 2
- improves efficiency on EM objects with suppressing jets and pileup contributions under high luminosity of $\mathcal{L} = 3 \times 10^{34}$ cm$^{-2}$s$^{-1}$, $\sqrt{s} = 13.6$ TeV.

Upgrade in On-detector

Front-End (FE)
- 2968 Layer Sum Boards (LSB)
  - Analog sum SC signals with finer granularity.
  - 114 Base Planes
  - Routing of signals for SCs
  - Maintain legacy Level-1 trigger system
  - 124 LTDBs
  - Receive, digitize and transmit digital SC signals

Back-End
- Digitizer Board (LTDB)
- Forward Calorimeter (FCAL)
- Calibration, tuning & validations for Phase-1 Upgrade
- LAr Digital Processing Mezzanines
- Real-time digital processing:
  - Computation of $E_T$
  - Bunch Crossing Identification (BCID)

Validation plots

Calibration, tuning & validations for Phase-I Upgrade

Calibration runs for the new Phase-I hardware, reading out Super Cells data (Fig 1, Fig 2)
- Connectivity checks, SCs mapping, calibration constants, energy, BCID adjustments, noise...
- Automatic processing of data & threshold values/criteria

Pilot runs in Oct 2021, Apr 2022, collecting splashes and test collisions (Fig 3, Fig 4)
- Consistent SCs energy with legacy readout, uniform timing, good LAr cells coverage...

⇒ LAr Calorimeter Phase-I Upgrade has been completed, ready for Run-3 data taking!

References


The Large Hadron Collider (LHC) has been in Long Shutdown (LS2) since the end of Run-2 in 2018. As a part of the ATLAS Phase-I Upgrade program, the Liquid Argon (LAr) Calorimeter has been equipped with new trigger readout electronics to enhance the physics reach during the upcoming Run-3 operation (2022-2025) at increased LHC luminosity. This poster provides an overview of the LAr Calorimeter Commissioning status for LHC Run-3.