Atlas - Liquid Argon calorimeter

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Atlas Calorimetry System - Overview

the Liquid Argon (LAr) Calorimeter –

measures the energy of electrons and photons.

the Tile Hadronic Calorimeter –

measures the energy of hadronic particles

(those do not deposit all of their energy in the LAr Calorimeter)

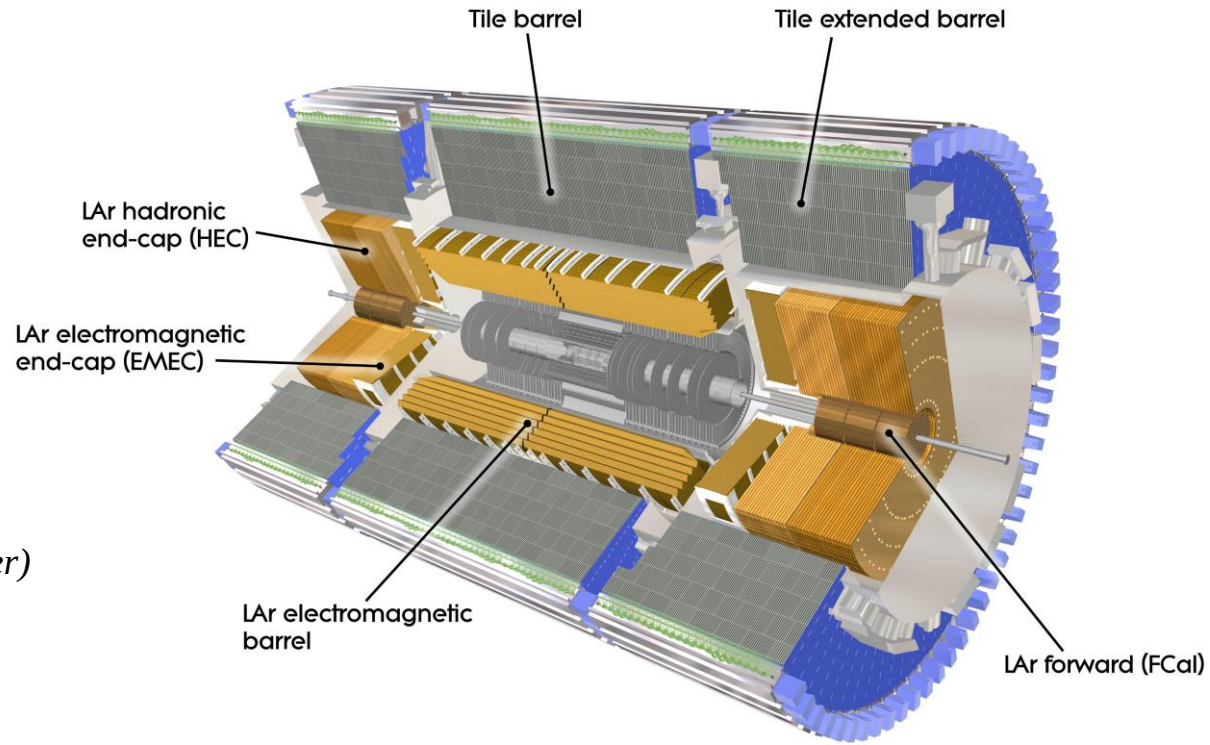


Fig1. the overall structure of the Atlas calorimeter [1]

1. https://atlas.cern/Discover/Detector/Calorimeter

LAr Calorimeter - Components

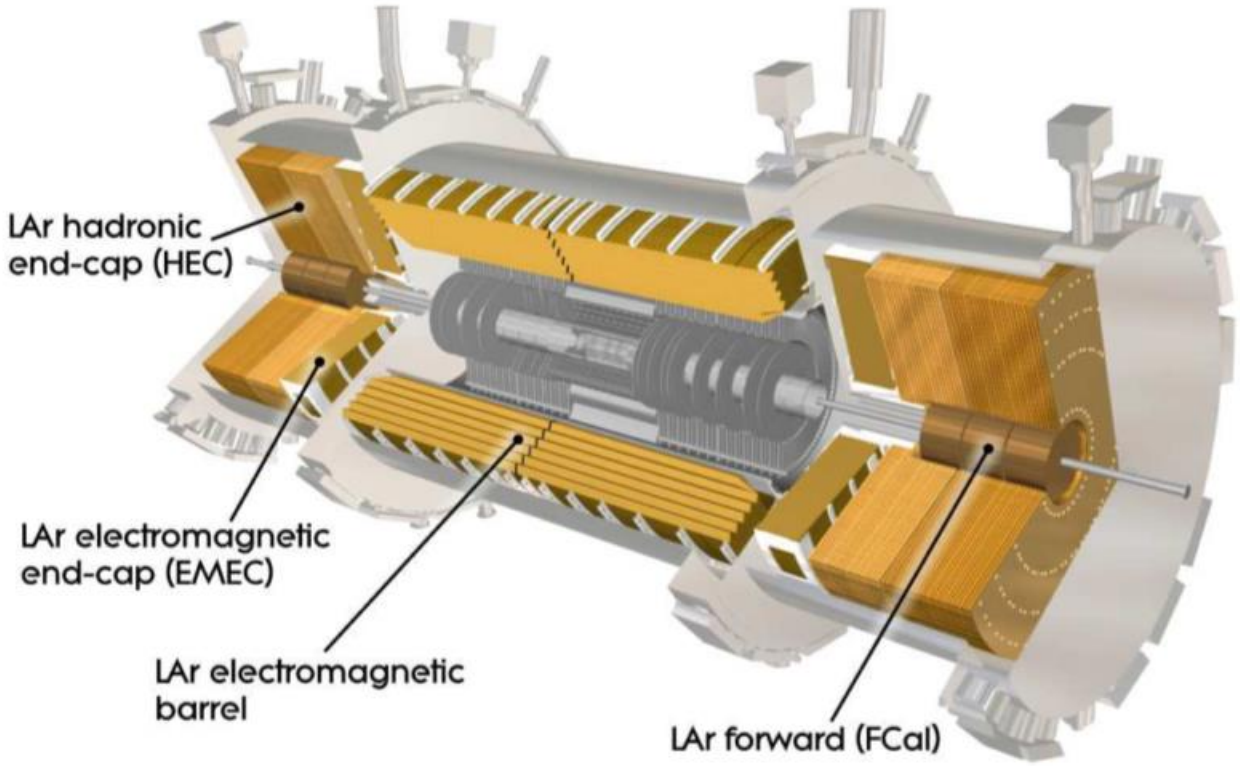


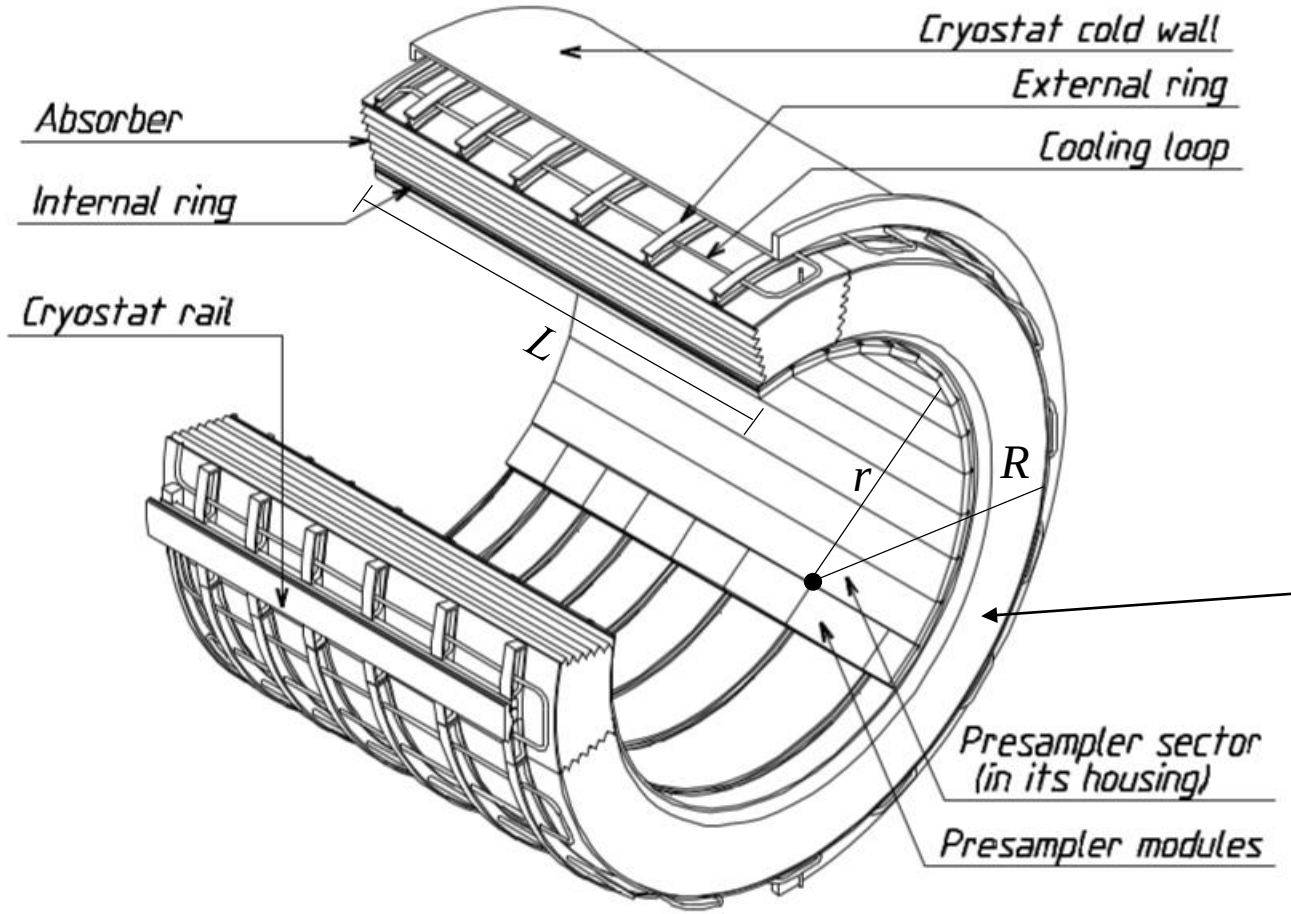
Fig2. the overall structure of the LAr calorimeter[1]

Electromagnetic barrel -
main part to deposit energy of electrons & photons

End-cap calorimeter -
act as supplementary detectors to the main electromagnetic calorimeter and the hadronic calorimeter

1. Wilkens H, on behalf ofthe ATLAS LArg Collaboration. The ATLAS liquid argon calorimeter: An overview[C]//Journal of Physics: Conference Series. IOP Publishing, 2009, 160(1): 012043.

Electromagnetic barrel - Structure



length L: 6.8m

outer radius R: 2.22m

inner radius r: 1.15m [2]

a total thickness: $22X_0$

Fig3. the overall structure of the electromagnetic barrel [1]

1. ATLAS/Liquid Argon Calorimeter Collaboration. Liquid Argon Calorimeter Technical Design Report[J]. CERN/LHCC, 1996: 96-041.
2. Wilkens H, on behalf ofthe ATLAS LArg Collaboration. The ATLAS liquid argon calorimeter: An overview[C]//Journal of Physics: Conference Series. IOP Publishing, 2009, 160(1): 012043.

Accordion calorimeter

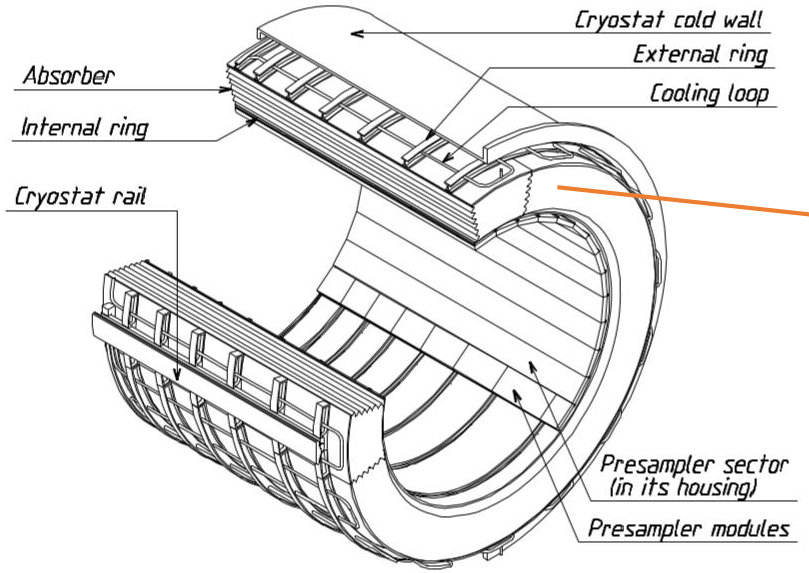


Fig4. the overall structure of the electromagnetic barrel [1]

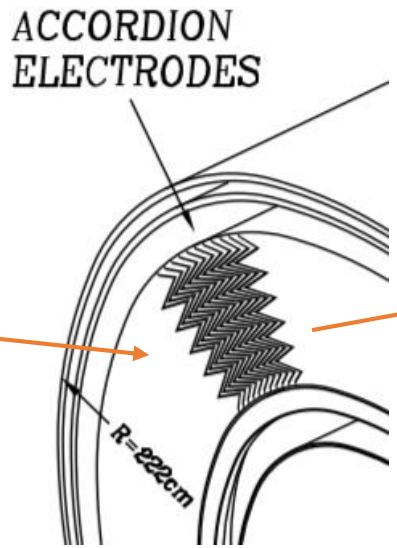
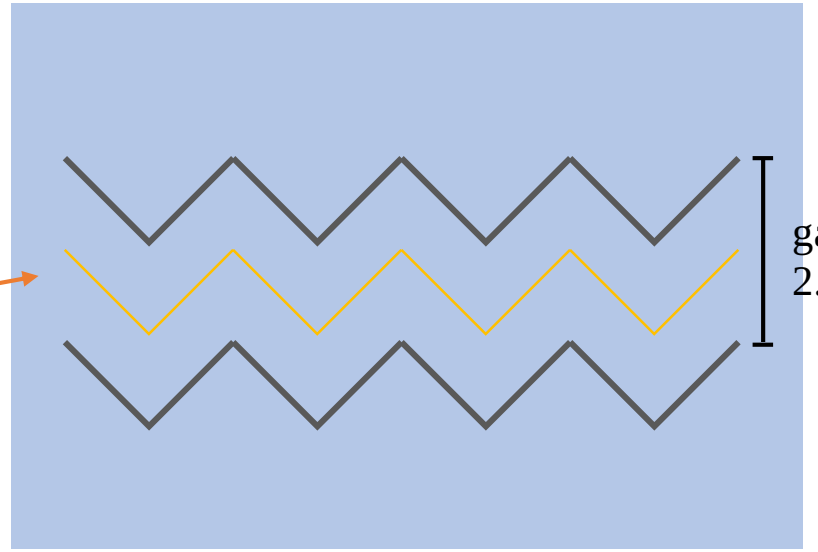


Fig5. details of the accordion calorimeter [1]



Blue Shade - Liquid Argon

Grey Line - Lead Absorber

Yellow Line – Copper Electrode

1. ATLAS/Liquid Argon Calorimeter Collaboration. Liquid Argon Calorimeter Technical Design Report[J]. CERN/LHCC, 1996: 96-041.

Energy Reconstruction and Identification

Methods: combine with the inner tracking detector and cluster algorithm*(sliding window or topological ways).* [1]

Electron: a cluster built from energy deposits in the calorimeter and a matched track.
Photon: a cluster matched to a conversion vertex or no track at all.[2]

1. Aaboud M, Aad G, Abbott B, et al. Measurement of the photon identification efficiencies with the ATLAS detector using LHC Run 2 data collected in 2015 and 2016[J]. The European Physical Journal C, 2019, 79: 1-41.
2. Aad G, Abbott B, Abbott D C, et al. Electron and photon performance measurements with the ATLAS detector using the 2015–2017 LHC proton-proton collision data[J]. Journal of Instrumentation, 2019, 14(12): P12006-P12006.

Other details

Why argon:

The anticipated benefit of liquid krypton in terms of mass resolution was not found large enough to counterbalance the excess in cost and complexity.

Operational conditions of the detectors:

Operating temperature of 87K[1]. Following its cool down each cryostat was filled with liquid Argon, via condensation of gaseous Argon.

1. ATLAS/Liquid Argon Calorimeter Collaboration. Liquid Argon Calorimeter Technical Design Report[J]. CERN/LHCC, 1996: 96-041.