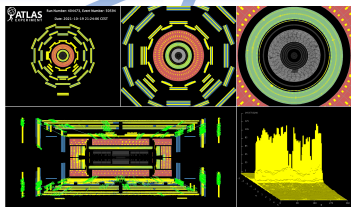


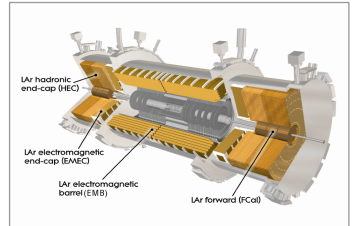
ATLAS LAr Calorimeter Readiness for LHC Run 3



ATLAS Liquid Argon Calorimeters

- Sampling calorimeters use liquid argon as active medium [1]
- The electromagnetic barrel (EMB) and end-caps (EMEC) have accordion-like structures of lead absorbers allowing fast readout and full azimuthal coverage
- The hadronic end-caps (HEC) use conventional design with parallel copper plates as absorbers

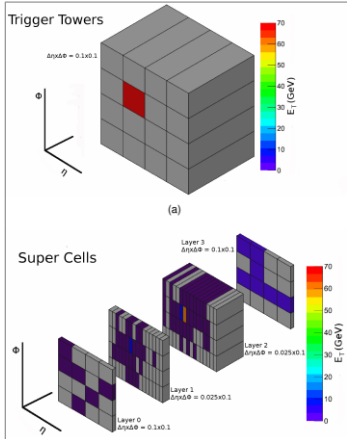
- The forward calorimeters (FCal) consist of a copper/tungsten matrix with liquid argon tiny gaps
- Pseudorapidity regions covered are:
 - EMB: $|\eta| < 1.475$
 - EMEC: $1.375 < |\eta| < 3.2$
 - HEC: $1.5 < |\eta| < 3.2$
 - FCal: $3.1 < |\eta| < 4.9$
- LAr Calorimeters signals serve as inputs to level-1 trigger (L1Calo)



Phase-I Upgrade / Digital Trigger

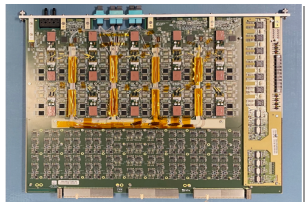
Motivation

- Replace old *Trigger Towers* with *Super Cells* (SCs) [2]:
 - Finer granularity (factor ~10)
 - Access to longitudinal shower shapes
- Move to digitized samples
- Allows to keep p_T thresholds with increased luminosity due to better electron vs. jet rejection power

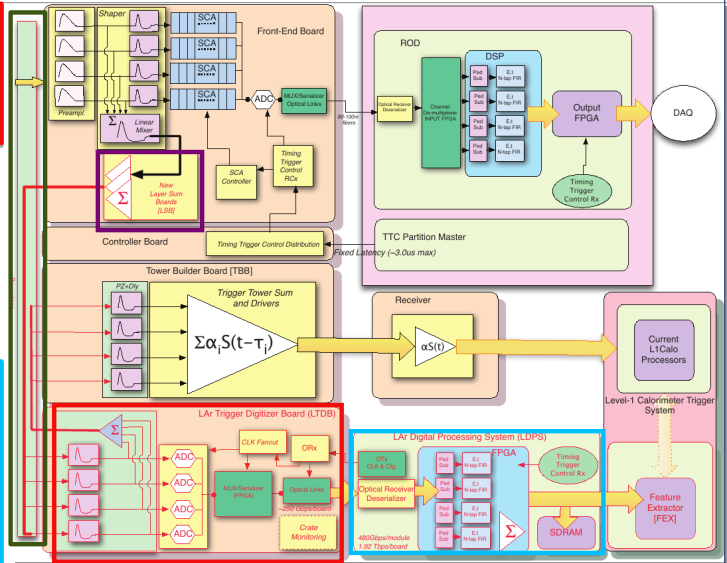
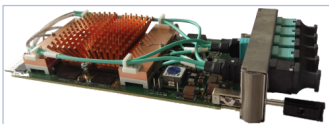


Readout Electronics Upgrades

- LAr Trigger Digitizer Board (LTDB):**
- Digitize super cell signals
 - Send signals to back-end electronics
 - Form layer sums similar to Run 2 conditions for legacy readout



- LAr Digital Processing Blade (LDPB):**
- LArC + LATOMES + IPMC
 - LATOMES (see photo below) for reconstruction of transverse energy
 - Send information to L1Calo system
 - IPMC unit for control and monitoring

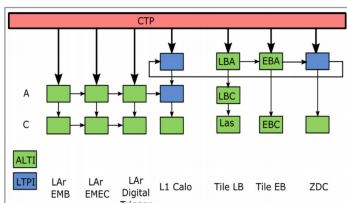


- New Baseplanes installed:**
- New slots for LTDBs
 - Handle increased transmission of signals

- New Layer Sum Boards (LSBs):**
- Produces finer cell signal sums
 - Every readout board taken out of cavern and refurbished

Further updates and Validation

TTC changes



- LTPIs replaced with new ALTI boards
 - Combine functionalities of four modules in one board
 - Fewer cables, prevent aging effects
 - Allow to run A and C side in parallel
 - New firmware fixed many issues
- Timing aligned for legacy and digital system
- Now stable TTC system

Cosmics Data Taking

- Cosmics data taking in September
- First physics data measured by new Digital Trigger system, matching well with main readout
- Validation of all components in new readout chain

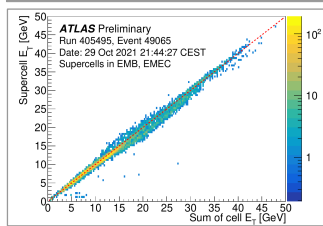
Legacy analog trigger validation

- Half FE crate calibrations to hunt dead channels after FE crate installation
- Analog connectivity scans to check trigger tower mapping
- Timing mapping looks good

DCS status

- LTDB FSM added to LAr tree at P1
- ATCA project added, include LATOME temperature and fan level monitoring

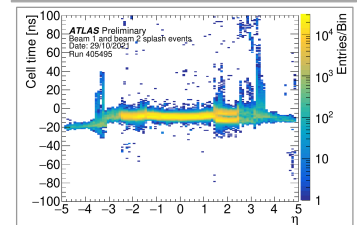
Pilot Run



Digital trigger validation

- Pulsing scans used to verify channel mapping
- Energy and timing of SCs checked with pedestal and pulsed runs, stability monitored with long runs
- Computed energies show good agreement with main readout data [3]

- Successful participation in Pilot Run
- Data taken with both readout paths in splashes and test collisions [3][4]



Summary

- Phase-I installation finished
- LTDB validation in final stages
- New TTC system: LTPIs replaced with new ALTI boards
- DCS project updated to new setup
- Legacy analog trigger path validated and tuned
- Successfully taken first data

References

- [1] ATLAS Collaboration, The ATLAS experiment at the CERN Large Hadron Collider, JINST 3 (2008) S08003.
- [2] ATLAS Collaboration, ATLAS Liquid Argon Calorimeter Phase-I Upgrade Technical Design Report, CERN-LHCC-2013-017, ATLAS-TDR-022.
- [3] ATLAS Collaboration, LHC Pilot Run LAr Performance Plots, <https://twiki.cern.ch/twiki/bin/view/AtlasPublic/LArCaloPublicPilotBeam2021>
- [4] ATLAS Collaboration, Event Displays from Run 3 splashes and collision data, <https://twiki.cern.ch/twiki/bin/view/AtlasPublic/EventDisplayRun3Collisions>

➔ LAr is ready for Run 3!