

ATLAS LAr Calorimeter Commissioning for LHC Run-3

19th – 23rd September, Bergen, Norway
 Topical Workshop on Electronics for Particle Physics 2022

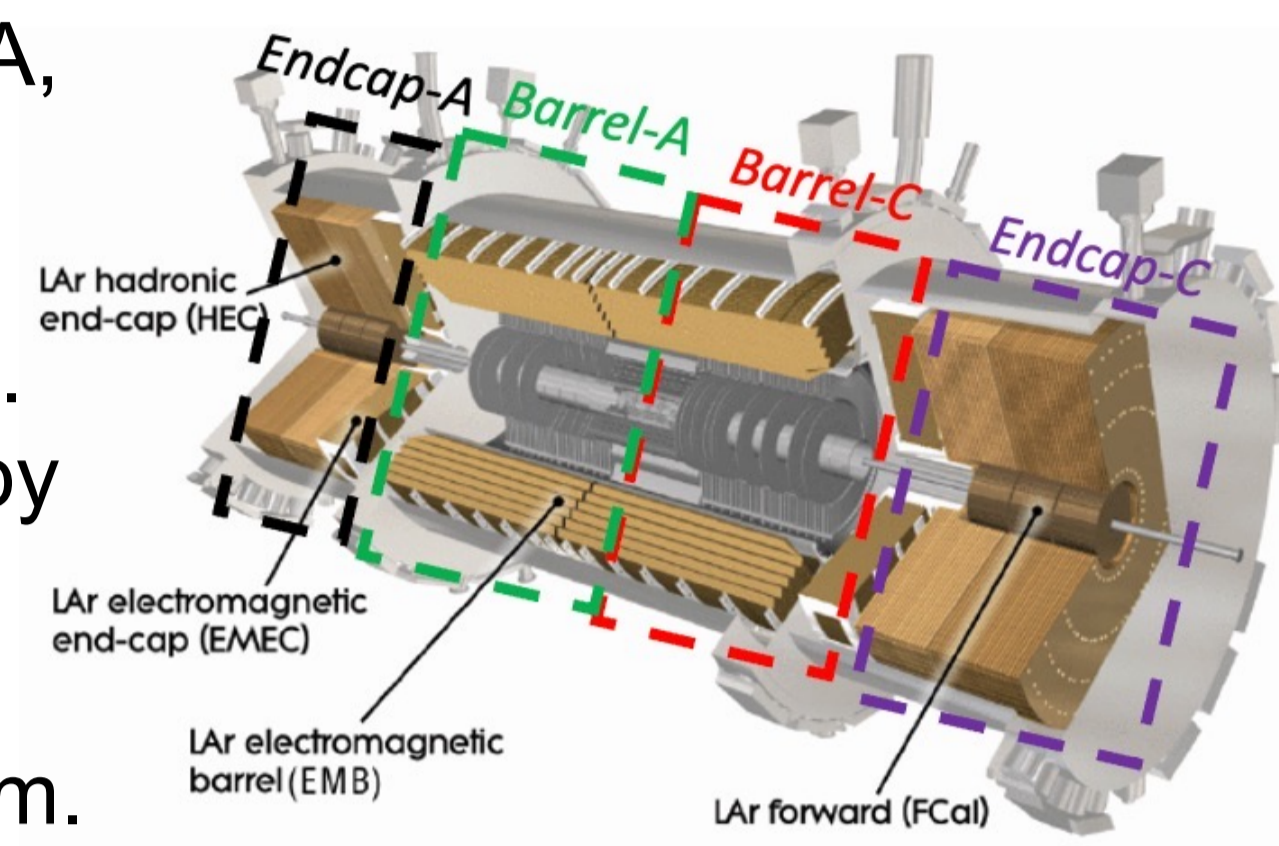
A new trigger readout system has been installed on the Liquid Argon Calorimeters to cope with an increase of luminosity at Run-3 of the Large Hadron Collider (LHC).

The LAr Calorimeter

Consist of 4 major components (Barrel-A, Barrel-C, Endcap-A, Endcap-C).

Contain both EM and hadronic calorimeters. Cover the wide range of $0 < |\eta| < 4.9$ by EMB, EMEC, HEC and FCal.

Provide information for level-1 trigger system.



Readout units for trigger:

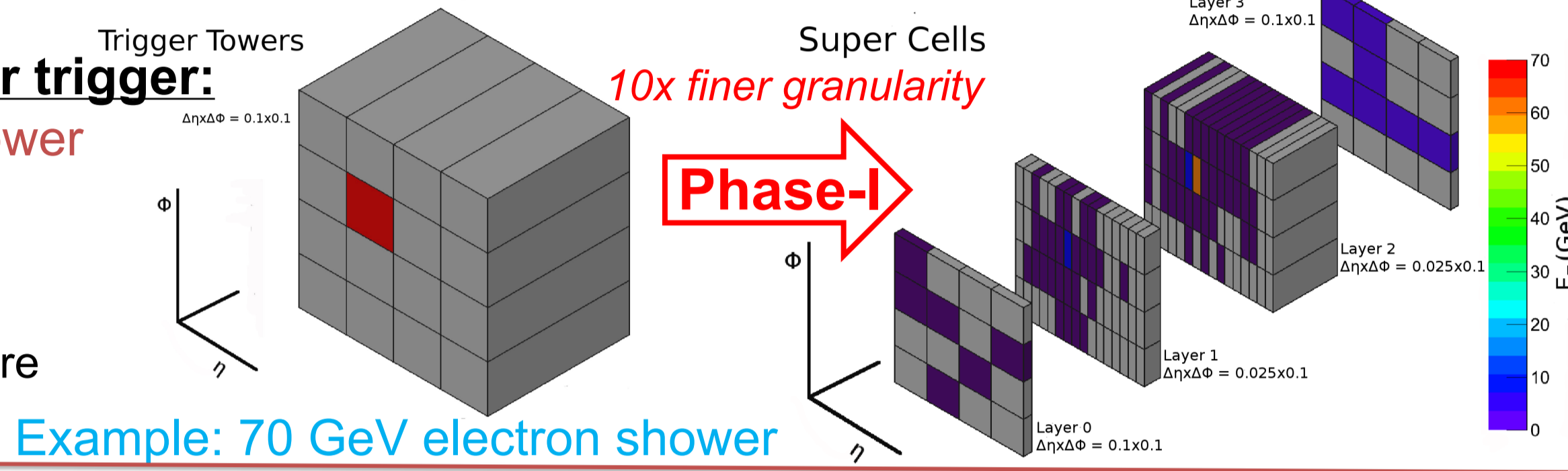
Legacy: Trigger Tower

→ Used in Run-2

New: Super Cell

→ Higher granularity

→ Multi-layer structure

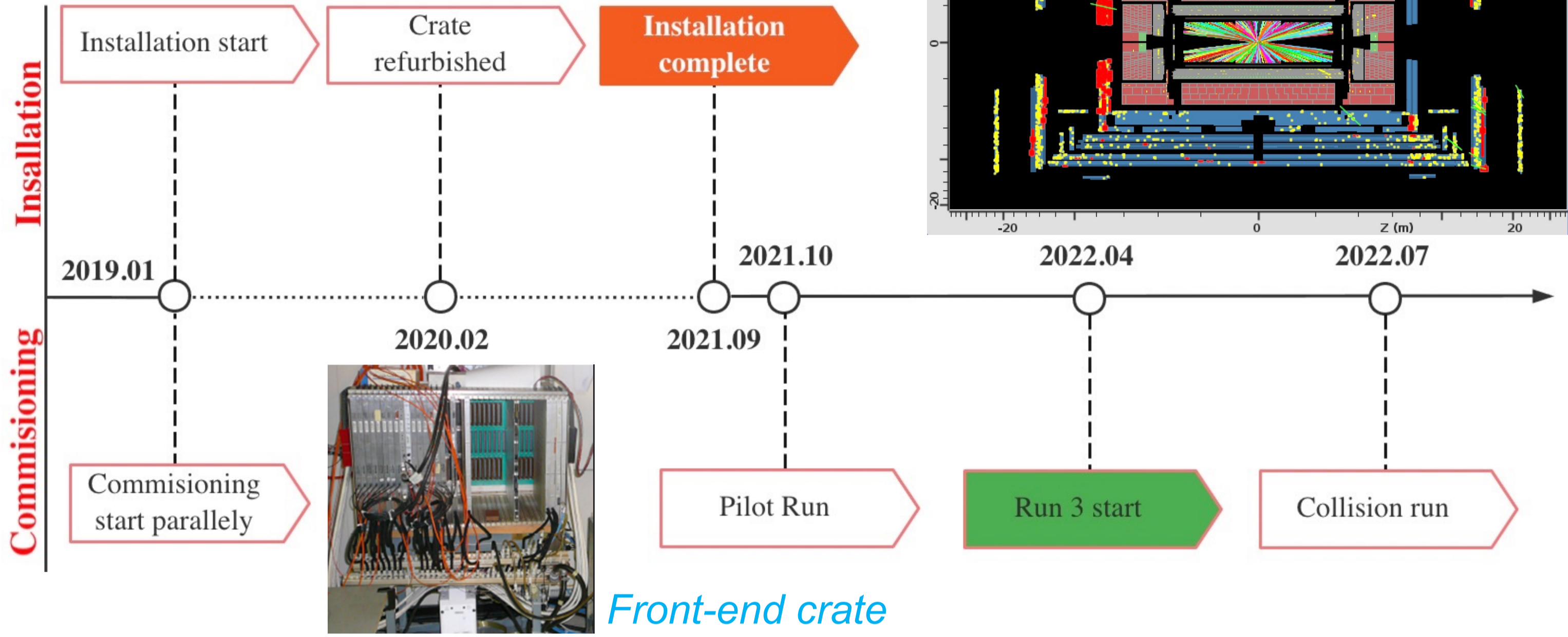


Example: 70 GeV electron shower

Phase-I Upgrade Towards Run-3

- The installation started in April 2019 and finished in December 2021.
- All the monitoring and control infrastructure is being adapted and commissioned as well.

2022-08-23 Collision Run 432180



Readout Path Upgrade

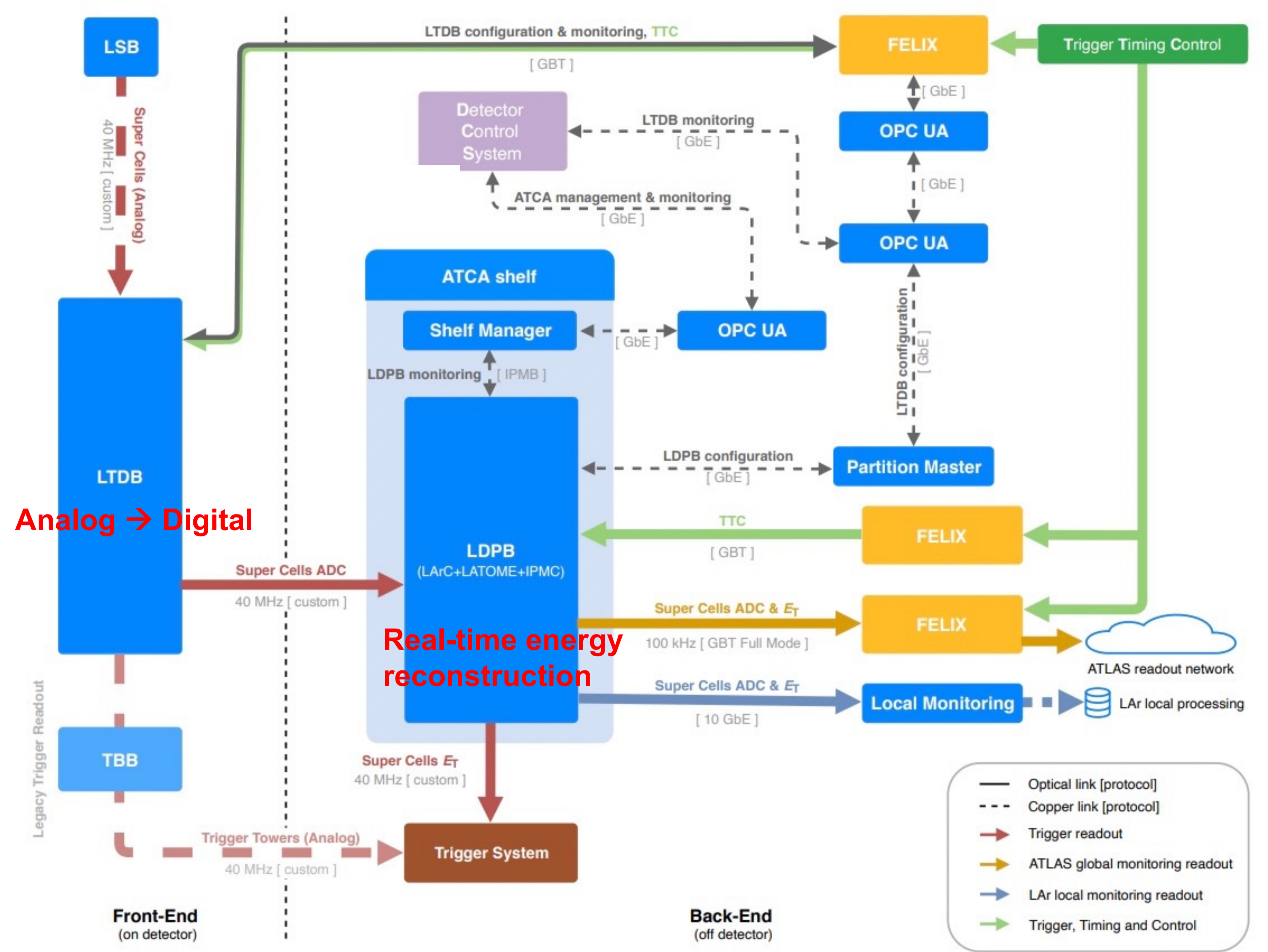
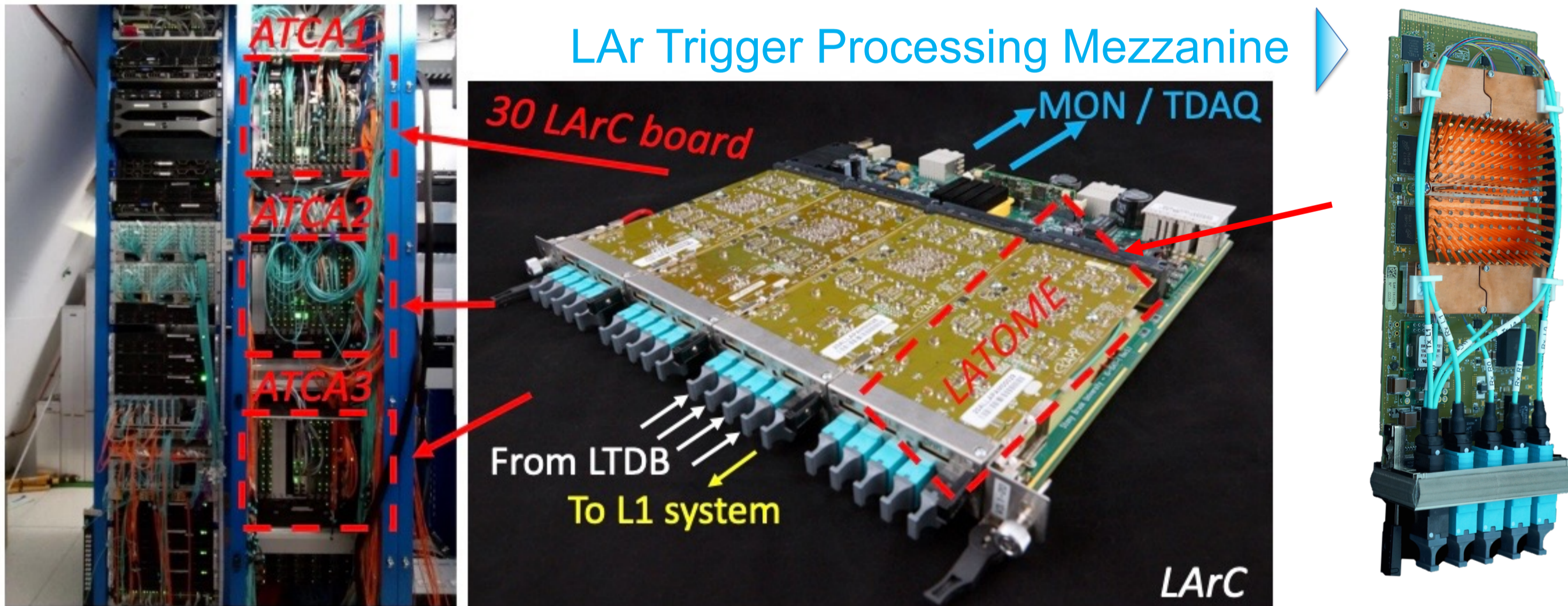
- The new readout path use **digital signals** instead of legacy **analog signals**.

Front-End

- 34k SuperCells → Readout Units
- 114 Base Planes → Signal Routing Board
- 124 LTDBs → Digitizer Board

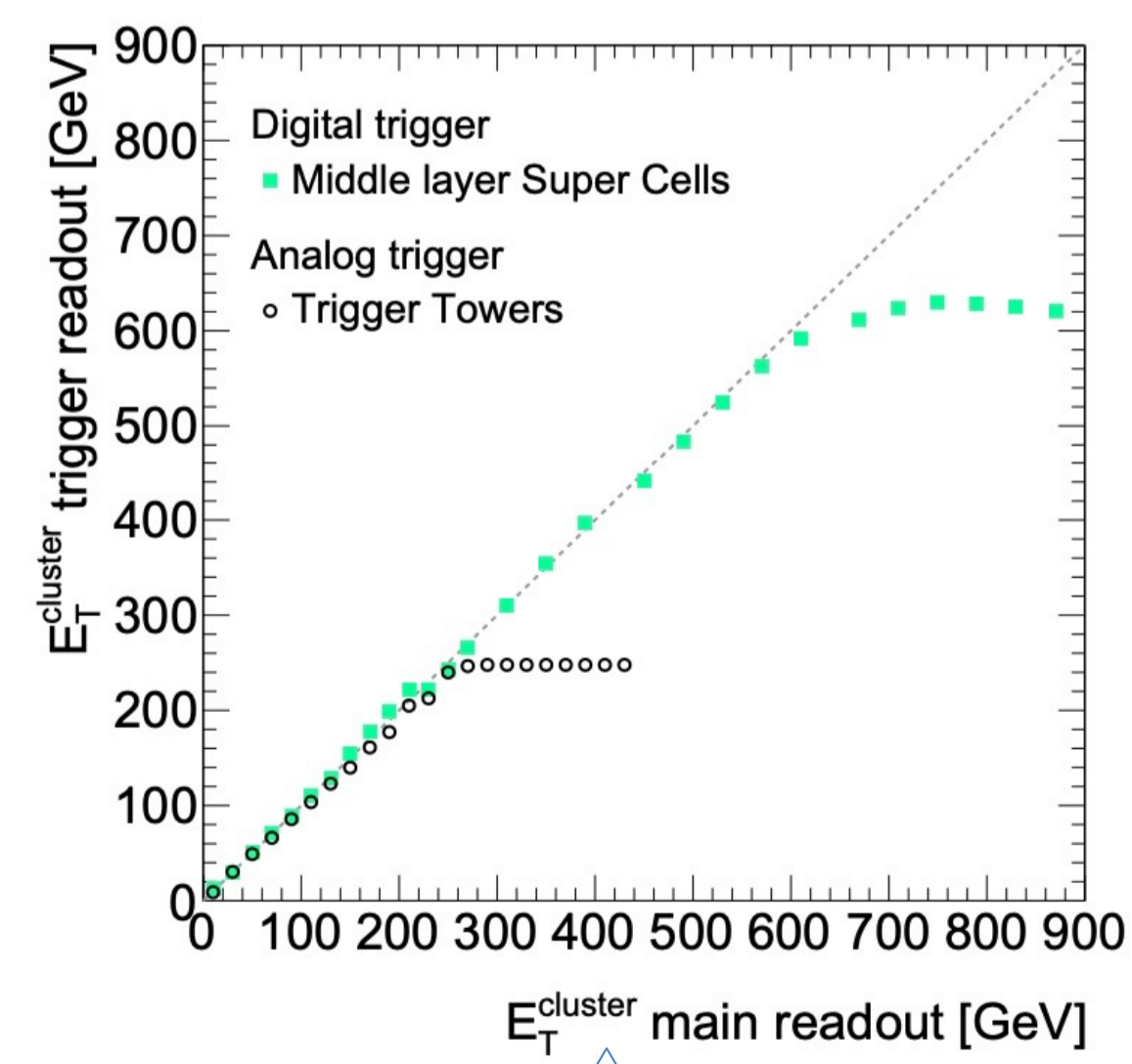
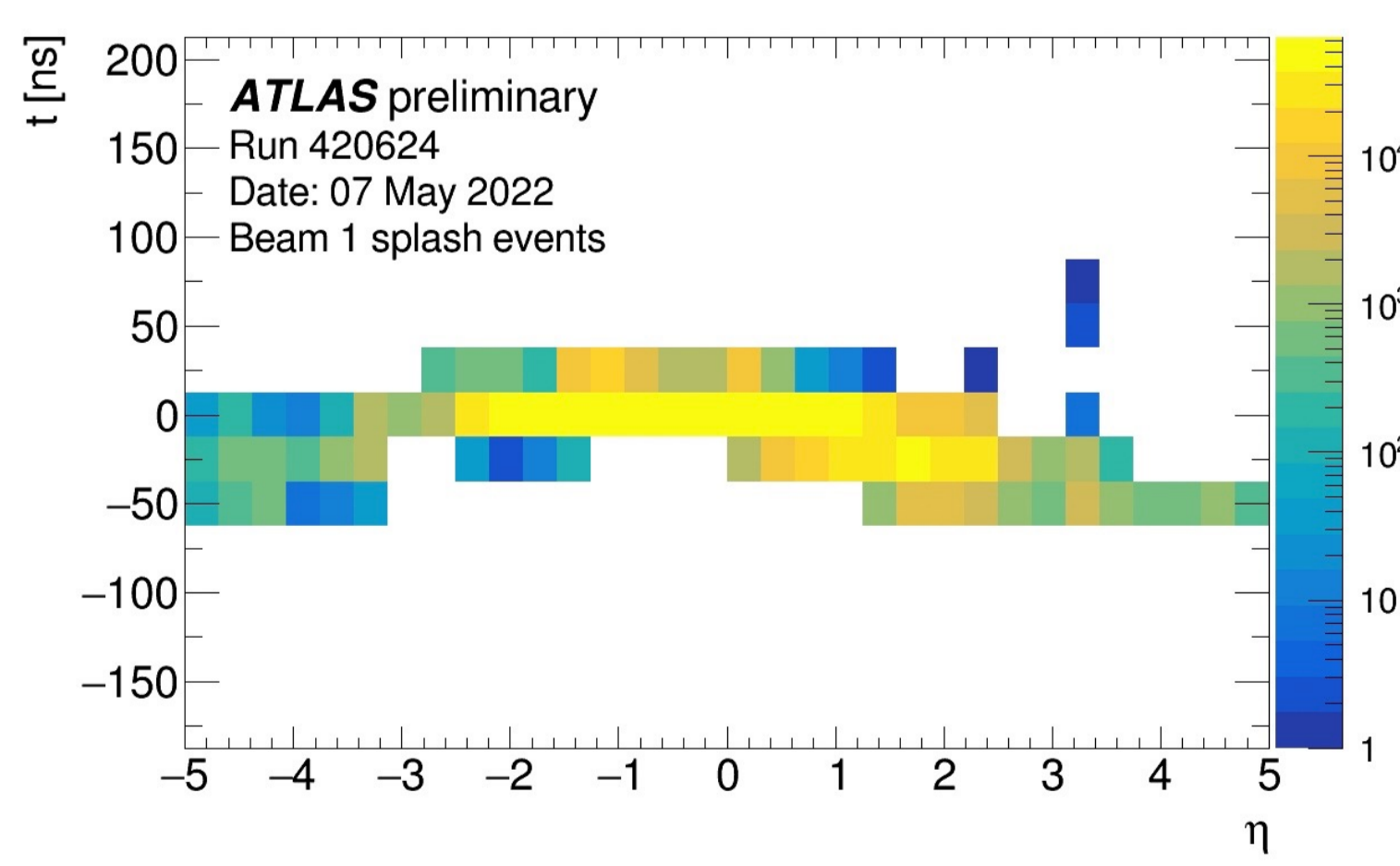
Back-End

- 3 ATCA shelves → Compact hardware system
- 30 LAr Carrier → ATCA cut-out blade
- 116 LATOMEs → Real-time energy reconstruction board



Commissioning Plots

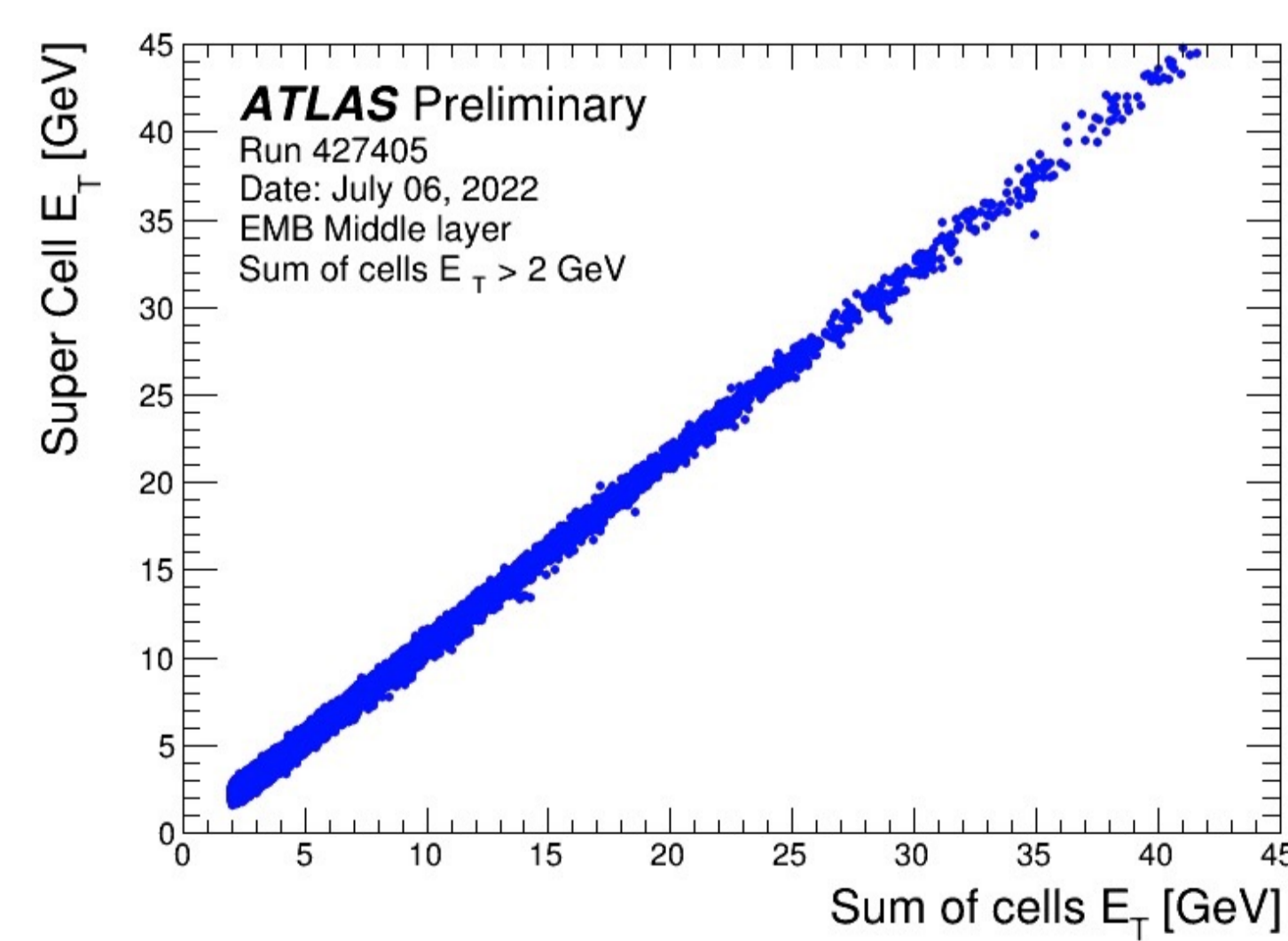
The Super Cell timing uniformity was tuned at the BCID level using the beam splash Run 420624.



A good agreement is found between the Super Cell energy and the sum of the corresponding cells energies.

The commissioning ensures that there is no mismatching and that all super cells are well timed and calibrated.

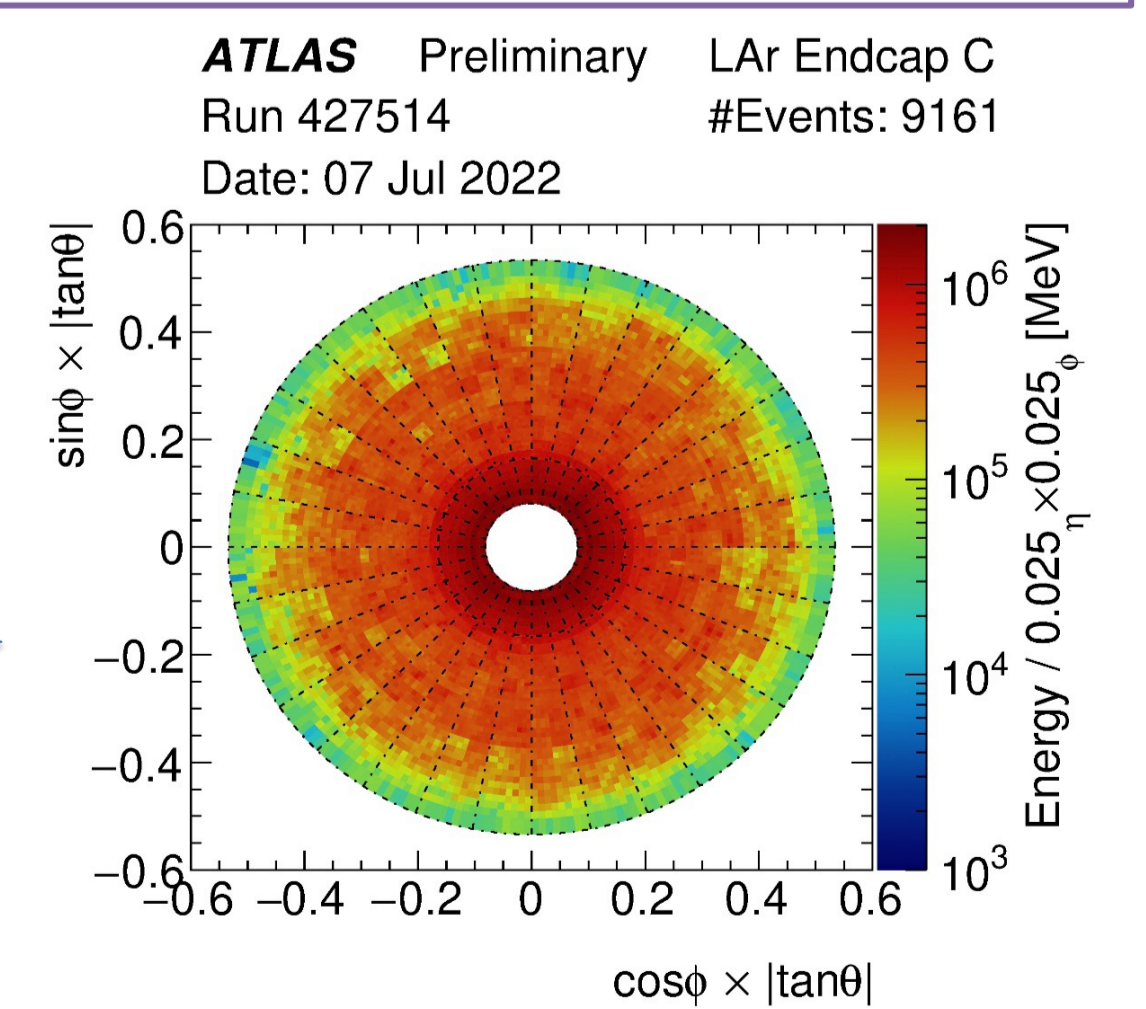
13.6 TeV Stable Beam Collisions



The measured Super Cells (SC) transverse momentum E_t computed on LATOME in real-time are compared to the summed transverse momentum from their constituent calorimeter cells obtained through the main readout path.

LAr cell energy sums on the EM layer for 9161 proton-proton collision events triggered by the LAr calorimeter.

The data taking is ongoing!



References

- [1] ATLAS Collaboration, The Phase-I trigger readout electronics upgrade of the ATLAS Liquid Argon calorimeters, arXiv:2202.07384
- [2] ATLAS Collaboration, ATLAS Liquid Argon Calorimeter Phase-I Upgrade Technical Design Report, CERN-LHCC-2013-017, ATLAS-TDR-022