

# The ATLAS Tile Calorimeter Performance at LHC

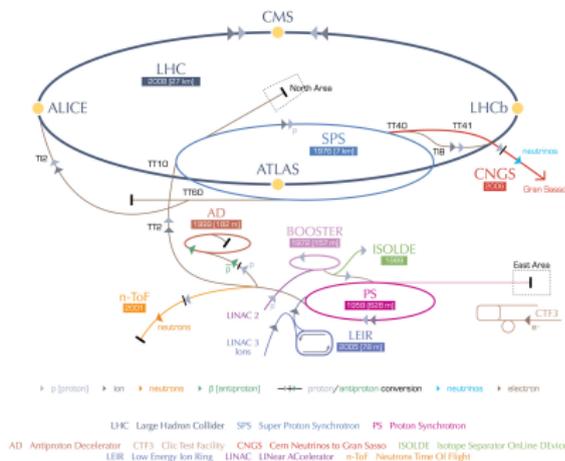
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on behalf of the ATLAS Collaboration

Stockholm University

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# The Large Hadron Collider

## CERN's accelerator complex



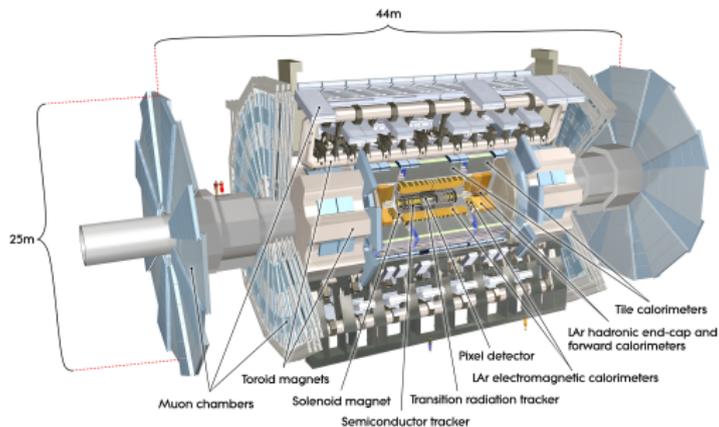
- Largest of the accelerators at CERN
- Currently highest energy in the world
- Four main experiments:
  - ATLAS
  - CMS
  - ALICE
  - LHCb



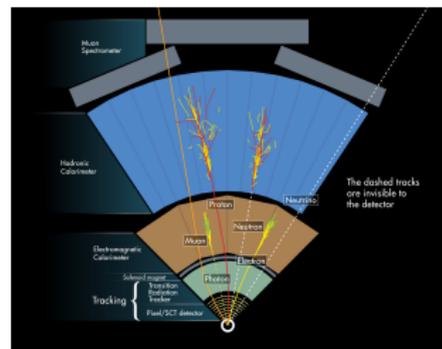
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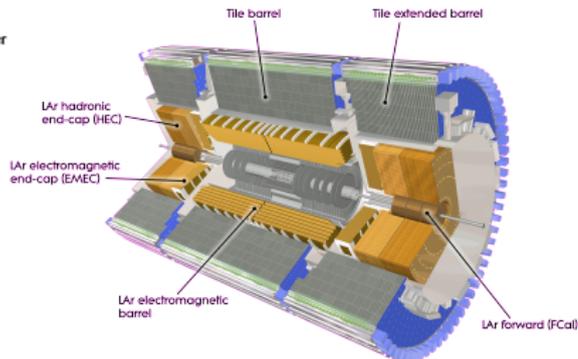
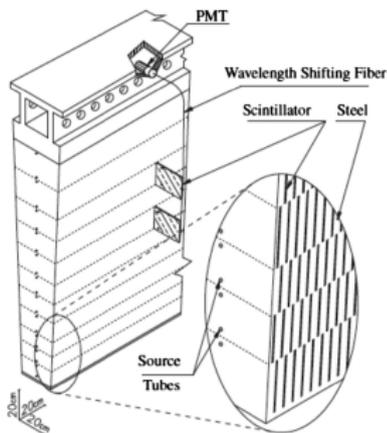
# The ATLAS experiment



- General purpose experiment
- Consists of several sub-detectors:
  - Tracker
  - EM calorimeter
  - Hadronic calorimeter
  - Muon spectrometer

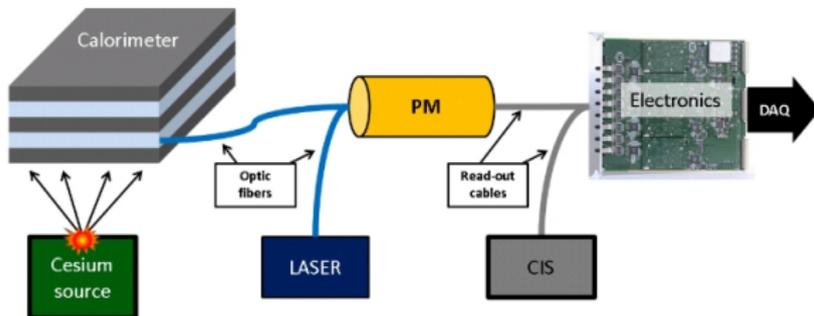


# Tile Calorimeter



- One of two hadronic calorimeters in ATLAS
- Scintillating sampling hadron calorimeter
- Covers  $|\eta| < 1.7$
- Key detector in the measurement of hadron and jet properties and missing ET; assists in muon identification
- 5182 cells in total
- Cells read out by wavelength shifting fibers on both sides for redundancy

- Calibration Systems
- Collision data taking
- Cosmic muons

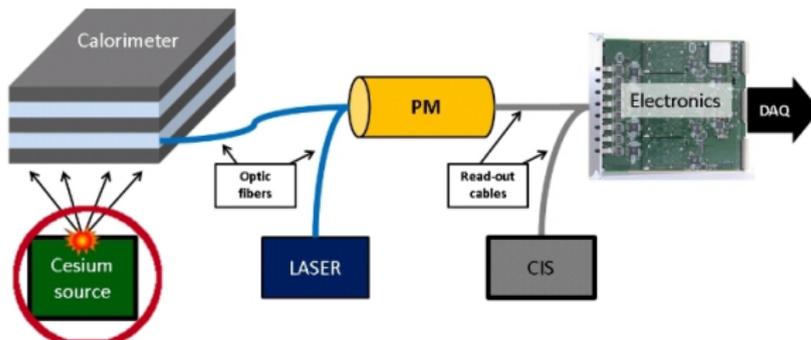


- Three independent systems with partial overlap for complementarity:
  - Movable radioactive Cs source system
  - Laser
  - Charge injection system

$$E[\text{GeV}] = A_{opt}[\text{ADC}] \cdot C_{CIS} \cdot C_I \cdot C_{Cs} \cdot C_e$$

# Calibration

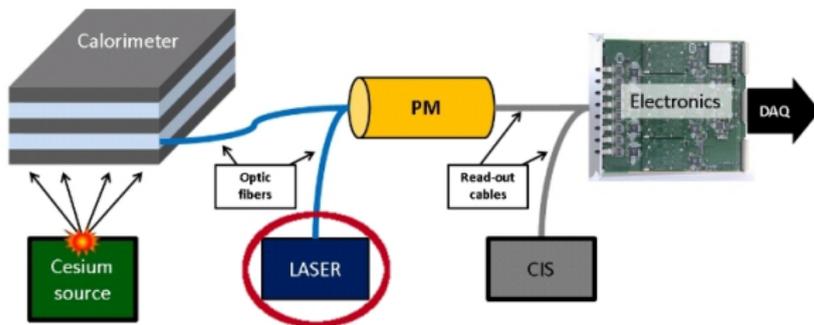
## Cesium Decay System



- Monthly calibrations of optics and PMTs.
- Tubes with  $^{137}\text{Cs}$  pushed through the scintillators using hydraulics.
- Calibration precision: 0.3%.
- Used for transferring test beam electron em scale calibration to all cells.

# Calibration

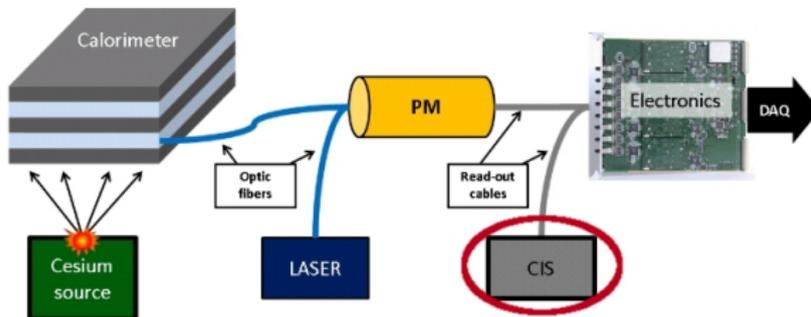
## Laser System



- Pulses laser corresponding to known particle energy into PMT
- Monitor gains of PMTs weekly and interpolates to account for PMT gain drifts between Cs calibrations.
- Precision: better than 1%.

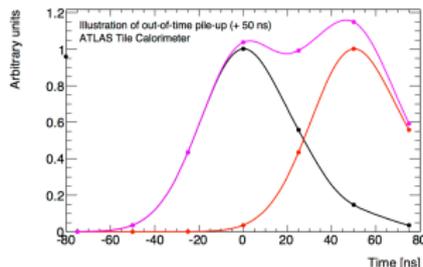
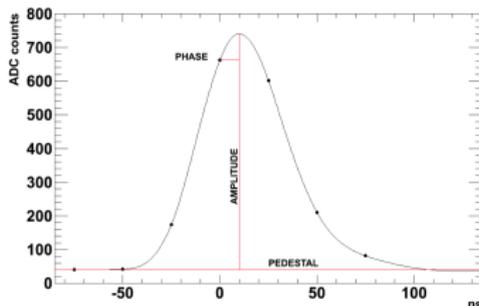
# Calibration

## Charge Injection System

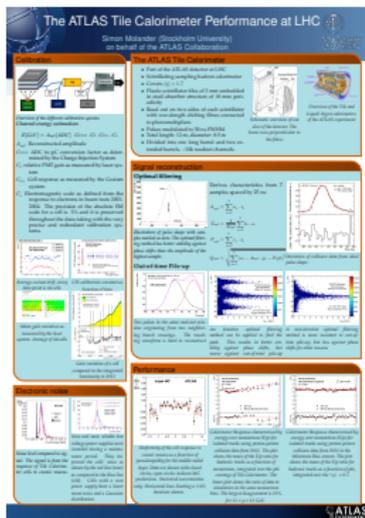


- Injects known charge into electronics
- Weekly calibration of front end electronics
- Precision: 0.7 %
- Determines the conversion factor from the pulse amplitude in ADC counts to charge in pC.
- Constants updated twice a year.

# Signal Reconstruction



- Pulses modulated to FWHM 50 ns.
- Pulse sampled at 7 time stamps every 25 ns.
- Amplitude reconstructed using optimal filtering.
- Out-of-time pile-up biasing the pulse amplitude calculation.



- Calibrations performance
- Signal reconstruction properties
- In situ performance validation with single particles

Thank you, and see you there!