

ATLAS Upgrade Electronics

ACES 2011

Bruce Gallop - RAL

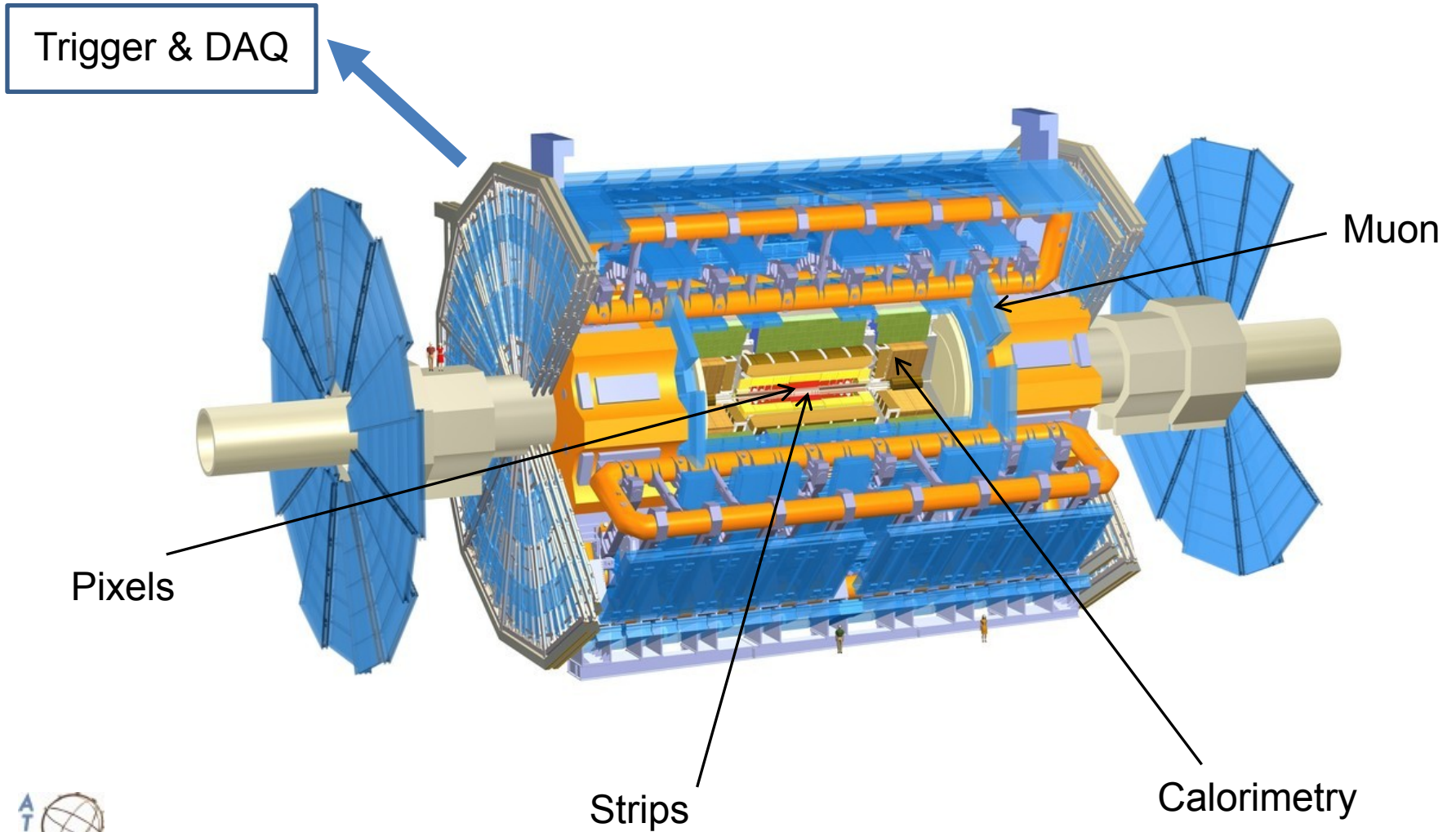


Challenges

- Maintain physics performance
- Radiation hardness – 3000fb^{-1}
- Increase in occupancy – pileup ~ 200
- Integration with legacy architecture
- Power/cooling for more channels
- Limited time to make changes
- Flexibility in scheduling



ATLAS



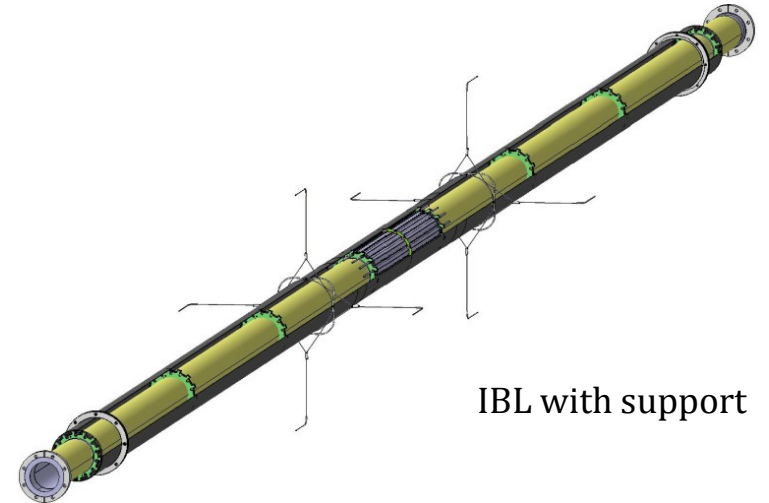
Schedule

- Phase 0 – 2013
 - Instrument more muon trigger electronics
 - Update pixel services and IBL
- Phase I – 2017
 - Upgrade forward muon wheel
 - Topological trigger
- Phase II – 2021
 - Replace inner detector
 - L1 track trigger



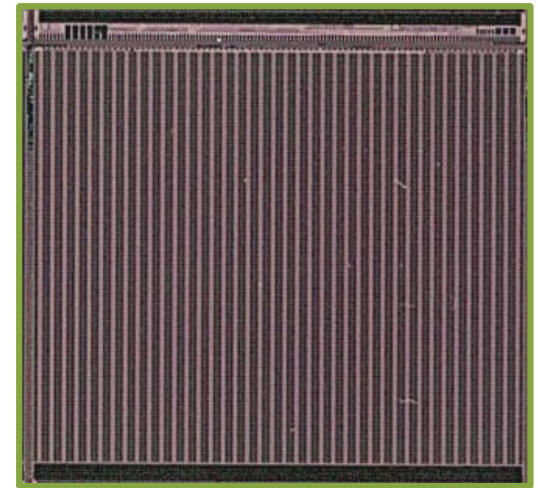
Pixel detector

- Inner B-layer
 - Addition to current B-layer inside the current ones
 - New FE-I4 ASIC in 130nm
 - 4 * area of FE-I3
 - 27k 50x250um pixels
 - 8b/10b on chip
 - Prototype successful
 - Install in Phase 0 (Success driven)
- Move services to area with lower radiation
 - Easier to replace VCSELs if necessary
 - Take advantage of IBL design

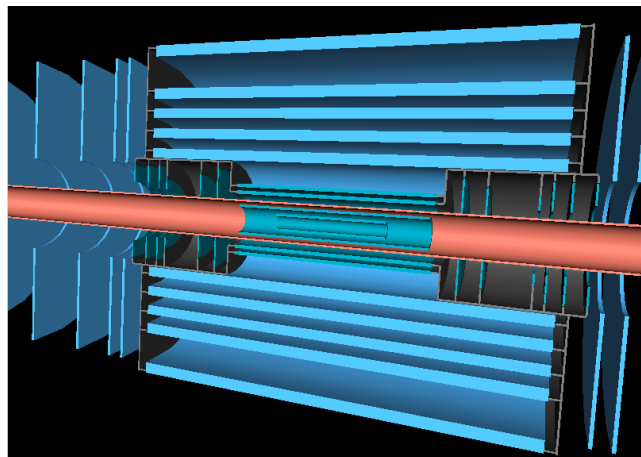


Tracker for high luminosity

- Replace pixels for high luminosity
 - New ASIC to handle further increase in occupancy
 - Detector technologies
 - Planar, 3D ...
- New layout, could change pixel/strip boundaries



FE-I4

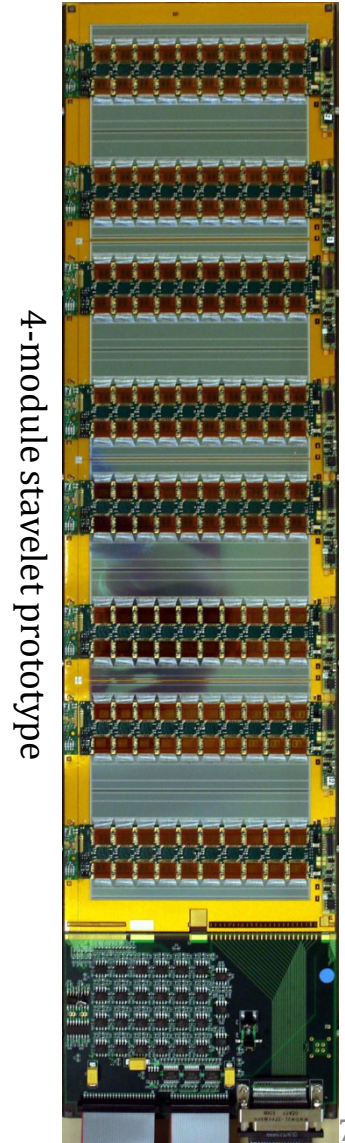


Tracker layout



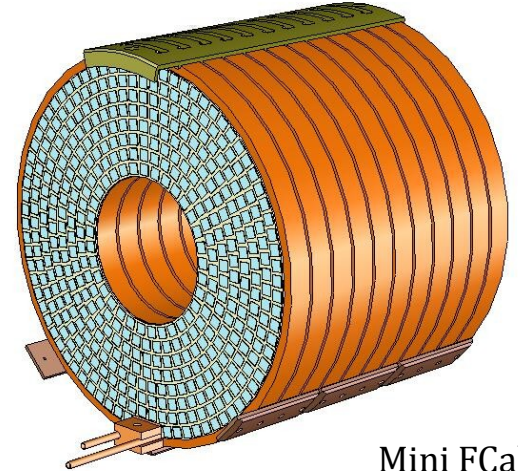
Strip detector

- Increase in occupancy
 - Short strips in inner layers 2.5cm/10cm
- New front end chips
 - Prototype ASIC ABCN-25 in 250nm
 - ABCN-13 in 130nm design underway
 - Improvements for radiation hardness
 - 2 * strips to minimize hybrid width
 - Trigger latency
- Services are important
 - Minimize material for power distribution
 - Serial powering vs DC-DC
 - High speed links (12 modules -> ~4Gb)



Calorimeters

- Upgrade LV distribution
 - DC-DC regulation on detector
- Most radiation in fwd region
 - MiniFCal
 - Detection planes using diamond
 - Reduces energy deposited in current detector
- New electronics
 - Higher granularity input to L1
 - Move digitization on detector, possible ASIC
 - Longer pipelines
 - Trigger decision off detector



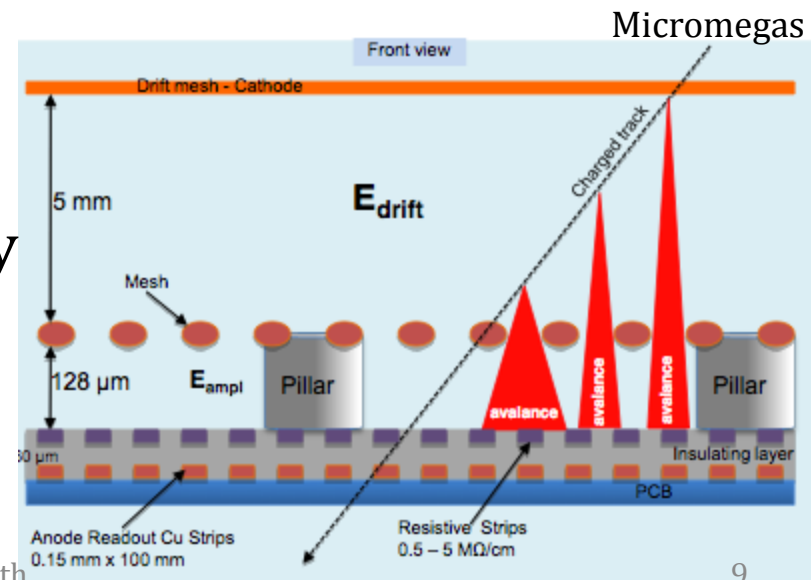
Mini FCal

Muon

- Fill in gaps in coverage
 - Feet, lift shaft
- Further integration into L1
 - Add trigger layers in barrel
- New fwd small wheels
 - Due to increased occupancy
- Upgrade electronics
 - Particularly for larger latency

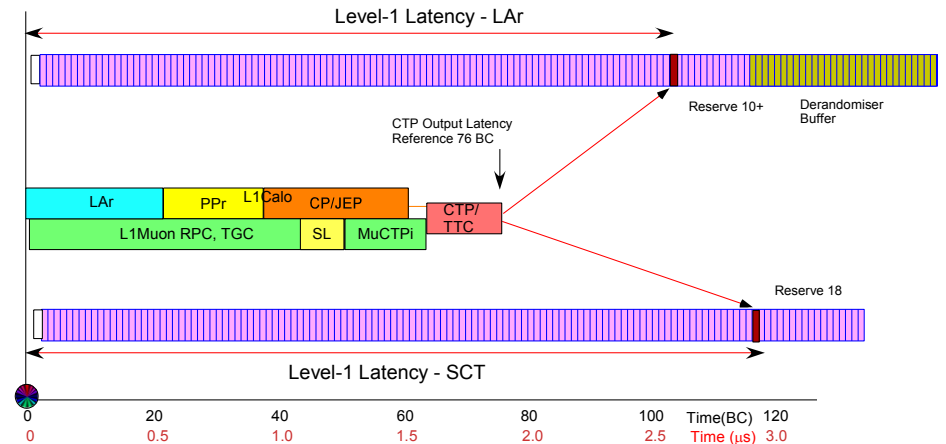


MDT



Trigger and DAQ

- Additional L1 inputs
 - L1MDT, L1Calo
- Input to L2
 - Fast tracking using L1 data from Pixel/SCT RODs
 - Staged, start upgrading interfaces in Phase 0
- Before Phase II latency budget limited
 - SCT (fixed pipeline) and LAr (derandomizer)
- Topological trigger
 - Combine primitives from multiple detectors



Latency27Jul2010



Trigger and DAQ

- Phase II
 - New L0 trigger 500kHz but longer latency
 - Pipeline of L0 data to extend L1 further
 - Interface to detectors changes
- Track trigger
 - Readout portions of tracker at L0
 - Input into L1 trigger
 - Commercial vs custom associative memories



The end

- Lots to fit in
- Lots of high bandwidth links
- Preparations well underway

