

Tile Calorimeter Performance with calibration, cosmic rays and LHC single beam data



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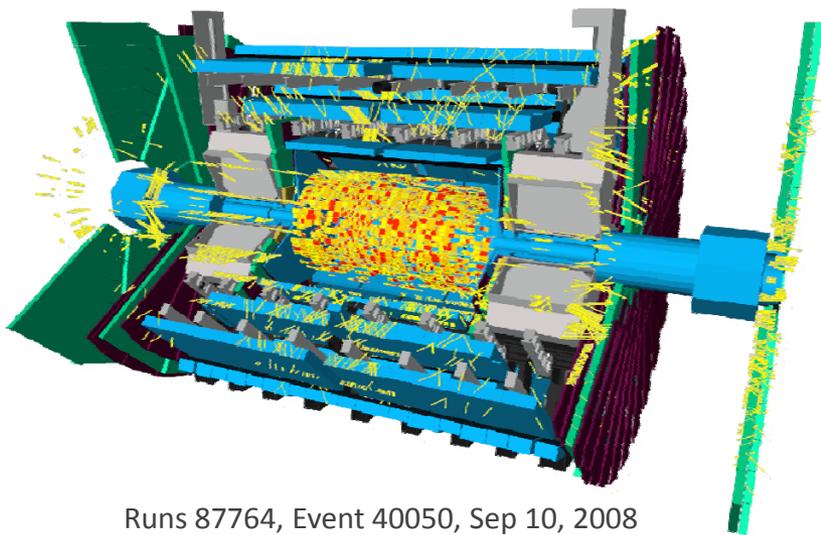
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Hadronic calibration workshop 2009 (Lisbon)

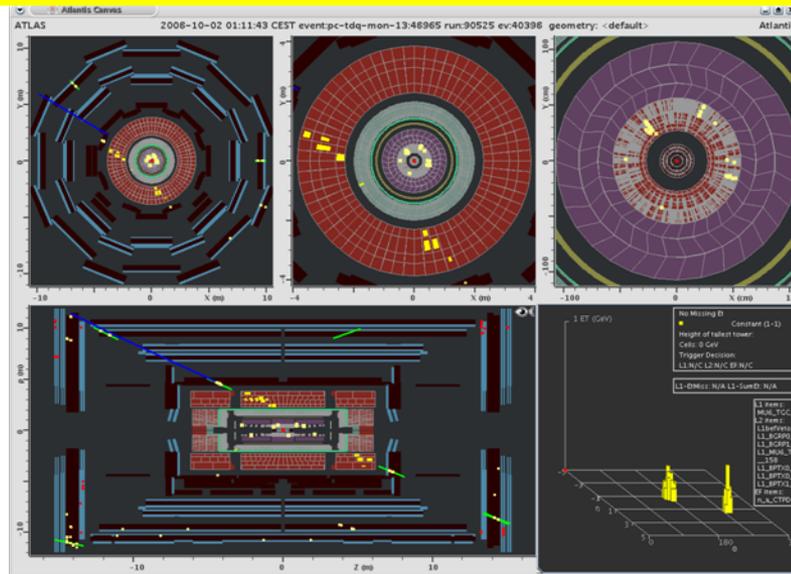
Introduction

- During 2008, 2009 the Tile Calorimeter was commissioned in a series of integration tests with the other ATLAS sub-detectors, trigger and DAQ systems.
- Cosmic data was analyzed to verify the Data Preparation.
- The commissioning culminated when the Large Hadronic Collider (LHC) circulated **proton beams** at 450 GeV.

Most spectacular: collimator “splash” event in ATLAS
“Splash” event in ATLAS 3D display



Runs 87764, Event 40050, Sep 10, 2008



Online monitoring: Atlantis display of cosmic muon event.

OUTLINE

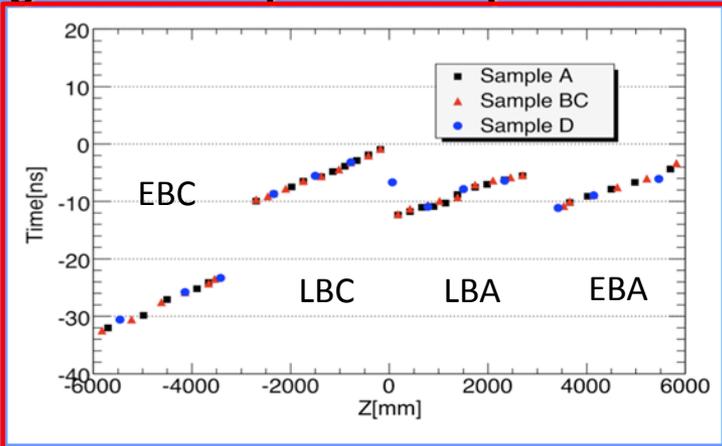
- Timing study with single beam and cosmic events with TileCal
- Energy study with single beam events with TileCal
- Jet slice algorithms and TileCal with cosmics



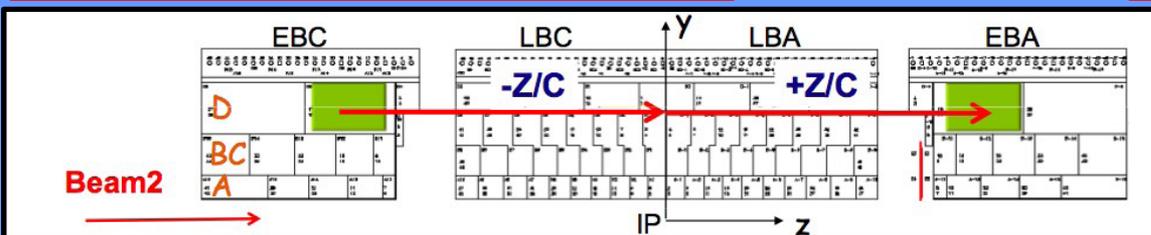
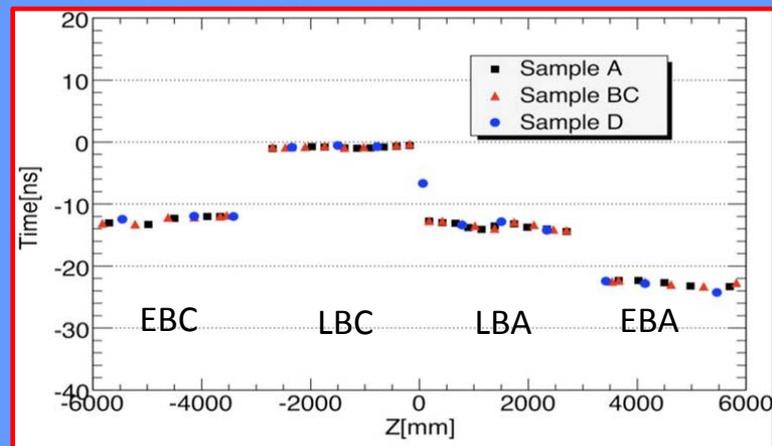
Time studies in TileCal with cosmic and splash events

Measure of the timing inter-calibration with splash events.

Within each partition, an almost flat distribution was observed, demonstrating the very good time equalization performed with laser data, as of the first beam data.

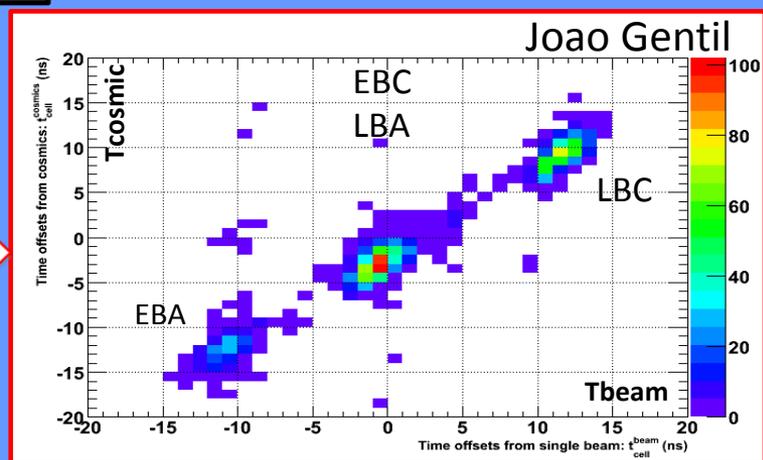


TOF Correction



For first beam data the different baselines are due to different references.

Direct correlation between cosmic results and beam results. Cosmic cell time response vs beam cell time response both referenced to the time of one channel. Two measurements agree within 2ns on per cell level.



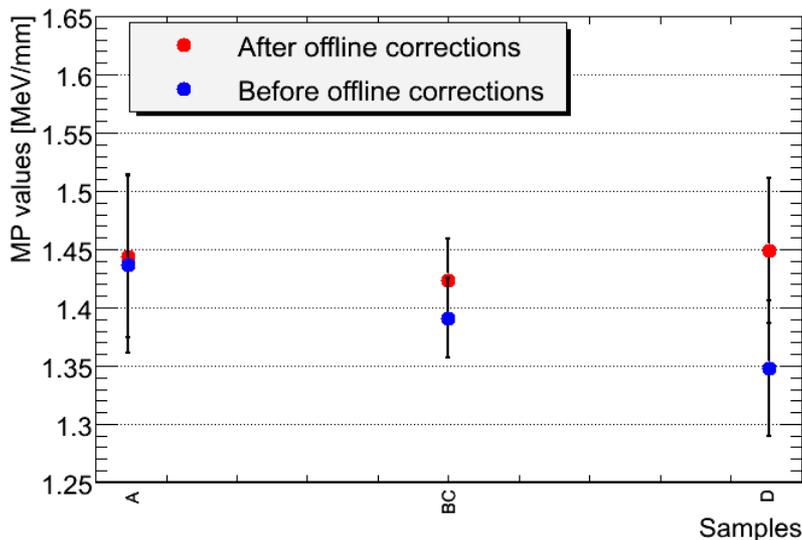
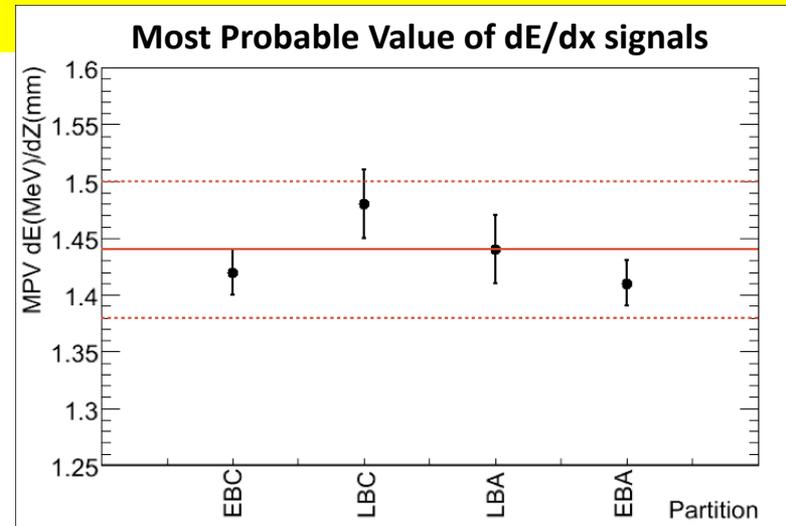
Energy studies in TileCal with scraping events

Data taken with the collimator partially closed. Few muons per event passing through TileCal.

We measure the response to muons for each partition. No sufficient statistic is available for individual modules.

We select muons impacting in the first cells in EBC partition and crossing all Tile until the last cell in EBA partition at the same phi (90deg muons).

The average over all cells within a given partition response to horizontal muons is shown for each partition. We verify the inter-calibration of Tile calorimeter cylinders, already calibrated with radioactive gamma sources, down to the 4% precision level. The red lines represent the average MPV value of the 4 barrels and its 4% uncertainty.

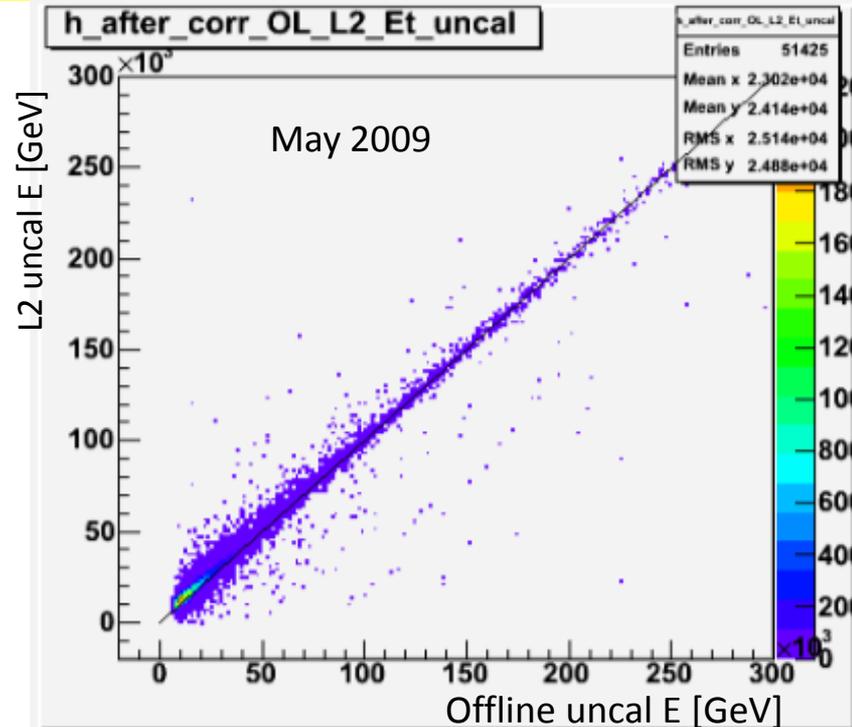
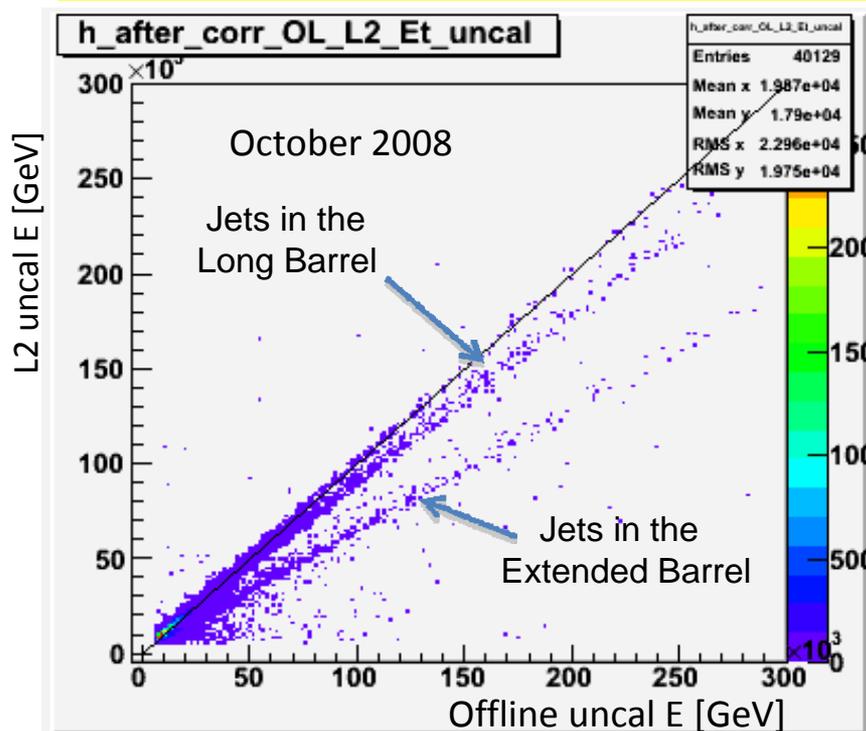


The average over all cells within a given radial sample response to horizontal muons is shown as function of the radial sample. Colors represent calorimeter response before (blue) and after (red) the per sample corrections to EM scale were applied. Corrections derived from dedicated test beam measurements and Sr radioactive source scans

Monitoring the Jet trigger slice with cosmic events in TileCal

Analyzed "jets" that deposited energy in TileCal.

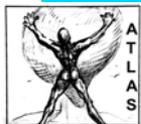
Energy correlation plot with fake jets. Correlation plots between the Offline raw energy and the LVL2 uncalibrated energy from October 2008 to May 2009.



Important to look at online vs offline energies help to understand the calo trigger performances and debug.

Non-diagonal structure in the correlation plots.

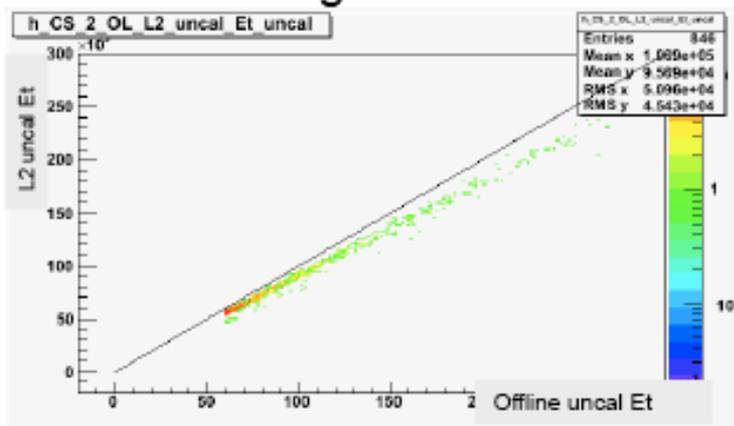
Problems fixed since December 2008, thanks to a change in the way the energy reconstruction is done at the DSP level in TileCal.



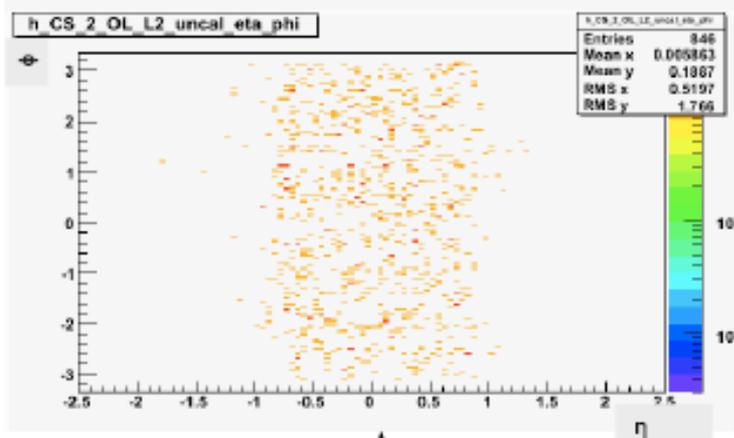
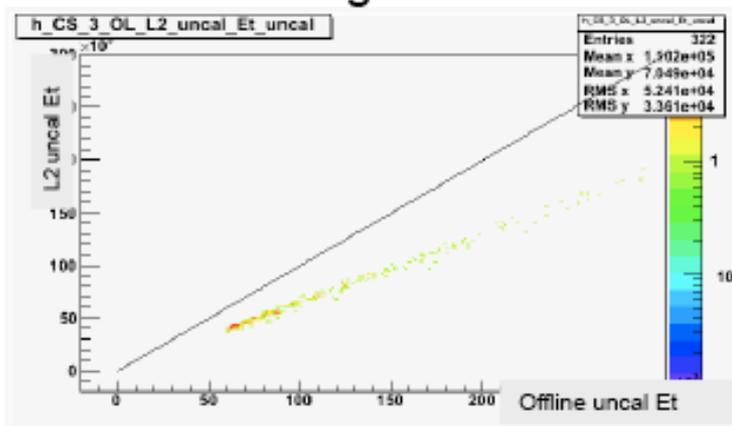
Back-up slide

Lines in the energies correlation plots

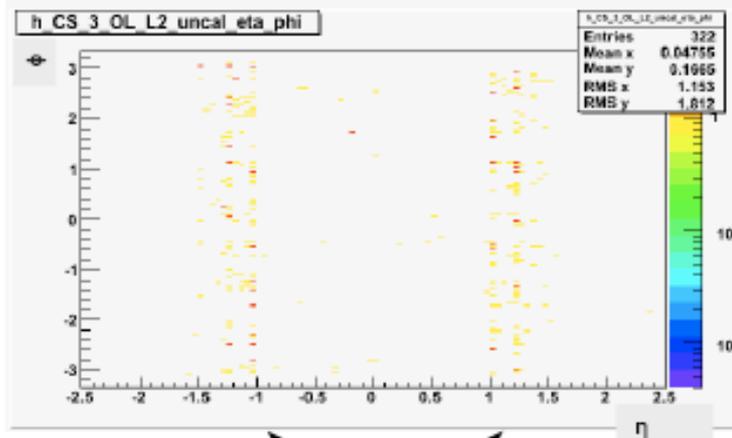
Region 1



Region 2



TileCal long barrel



TileCal extended barrels