

The ATLAS Tile Calorimeter performance at LHC in pp collisions at 7 TeV

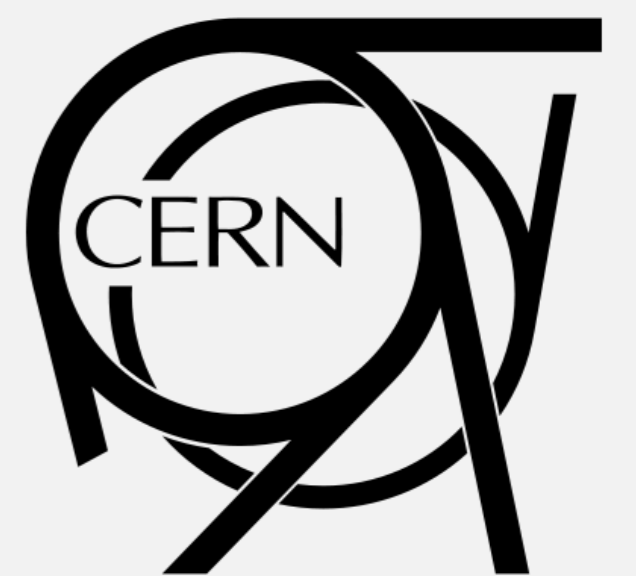


Federico Bertolucci - INFN e Università di Pisa
federico.bertolucci@cern.ch

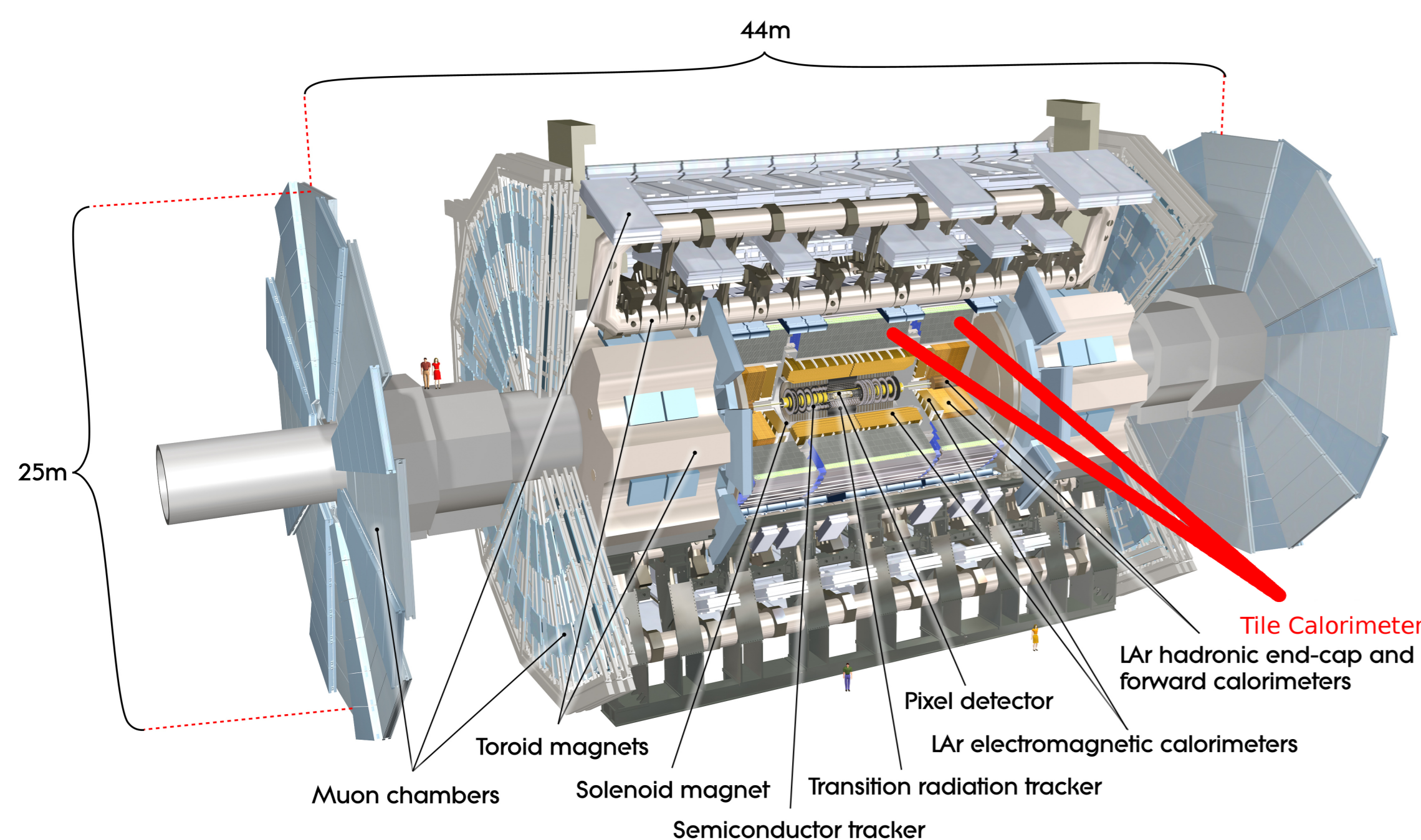
On behalf of the ATLAS Collaboration

<https://twiki.cern.ch/twiki/bin/view/AtlasPublic/WebHome>

Hadron Collider Physics Symposium 2011 - Paris, France
November 14-18, 2011

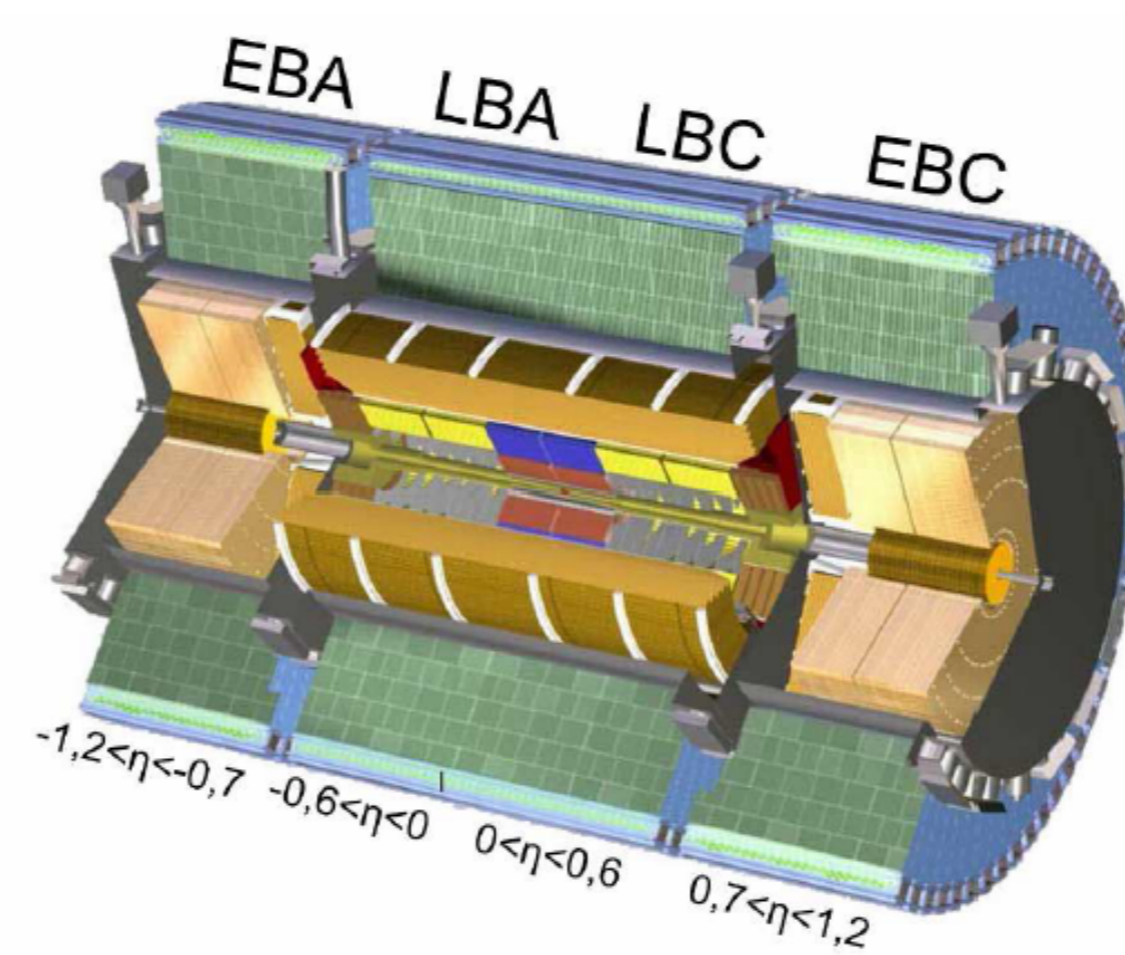


The ATLAS detector

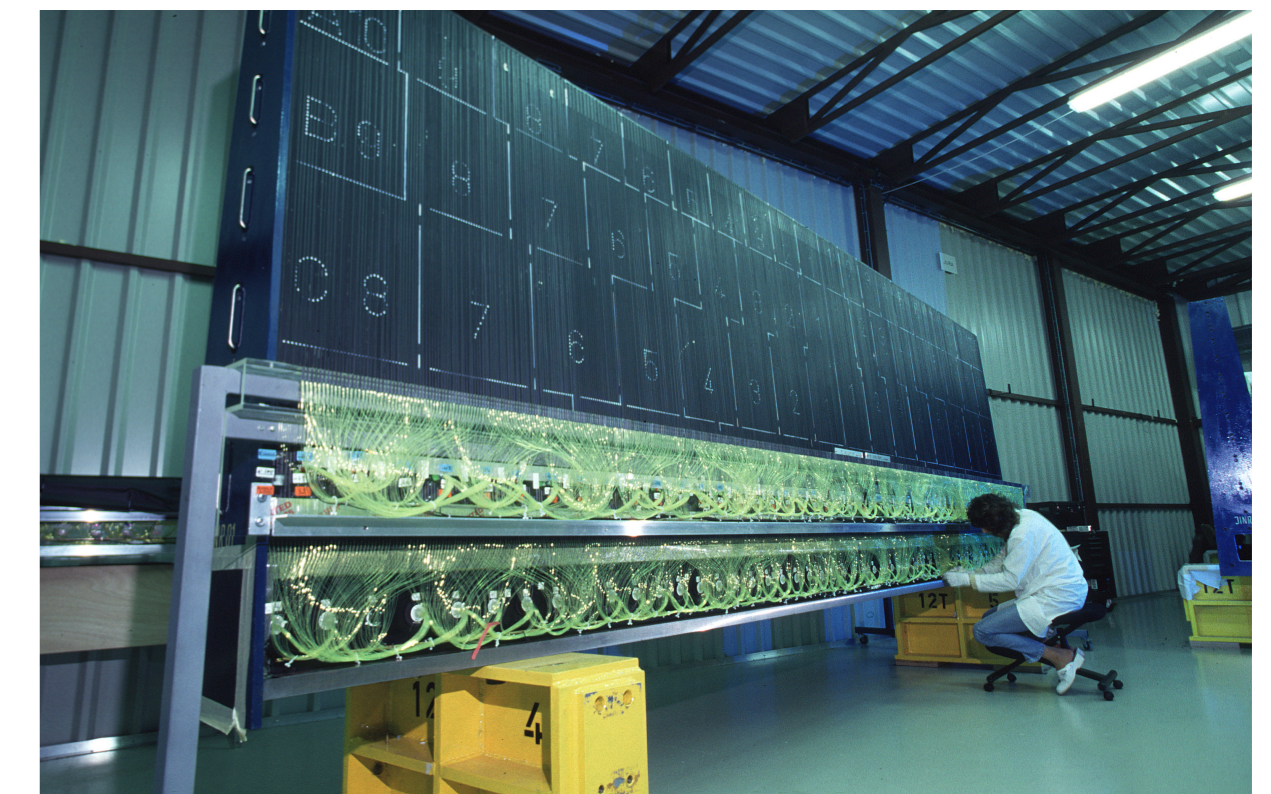


The Tile Calorimeter

The Tile Calorimeter (TileCal), the central section of the hadronic calorimeter of the ATLAS experiment, is a key detector component to detect hadrons, jets and taus and to measure the missing transverse energy. Due to the very good muon signal-to-noise ratio it assists the muon spectrometer in the identification and reconstruction of muons.



Each TileCal module is radially segmented in three sections: A , BC and D cells.



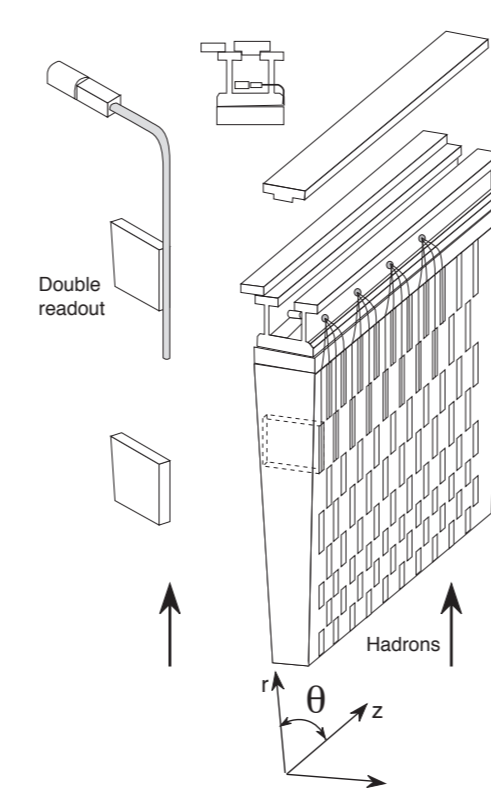
TileCal characteristics:

- **hermeticity**: tiles perpendicular to the beam axis
- **longitudinal sampling**: three layers of 1.5, 4.1 and 1.8 λ at $|\eta| = 0$
- **redundancy**: double PMT read-out for each cell
- **granularity**: ~ 10000 channels in 256 modules

Performance goals:

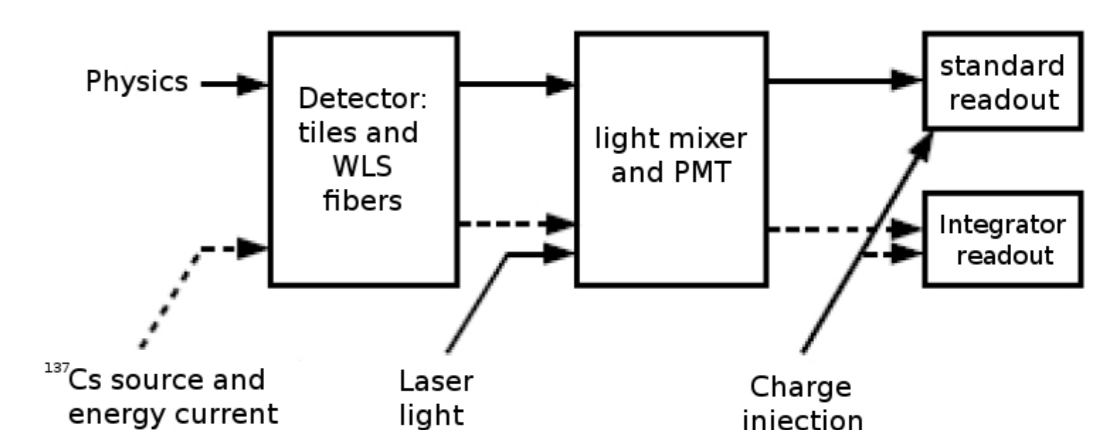
- **resolution for hadrons**: $\frac{\sigma(E)}{E} = \frac{50\%}{\sqrt{E}} \oplus 5\%$
- **linearity**: within 2% between ~ 30 MeV and 1.6 TeV

Picture of a ϕ wedge (module)

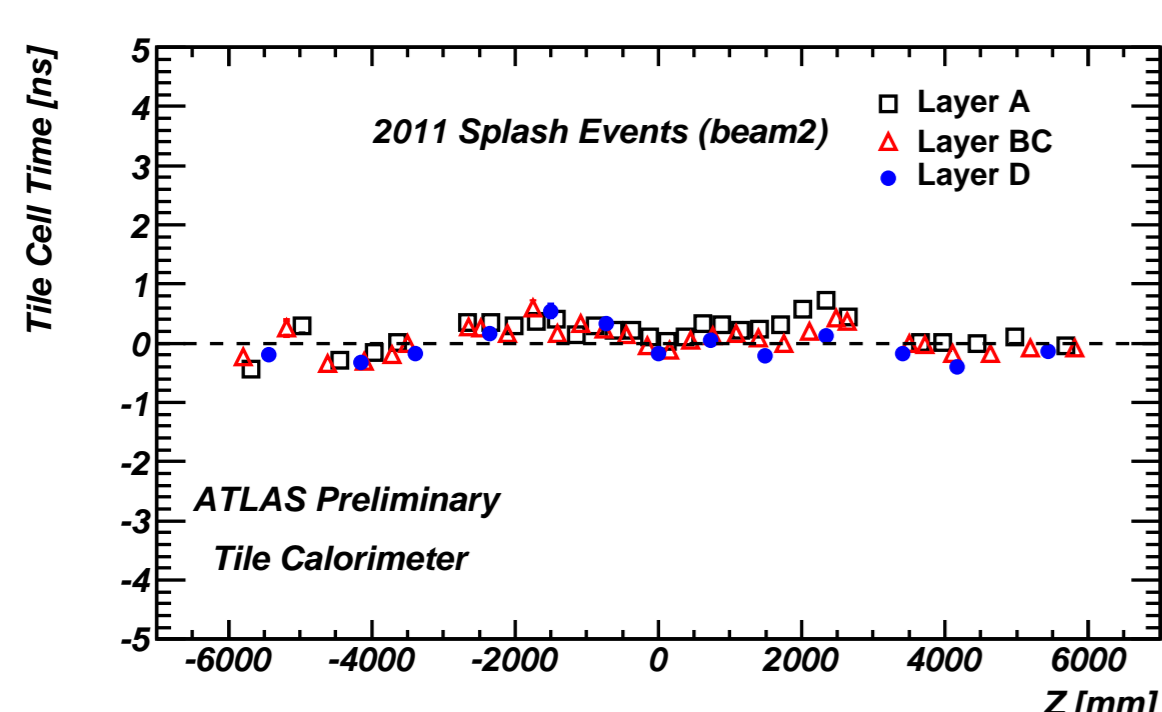


TileCal is made of steel and scintillating tiles coupled to optical fibers and read out by photomultipliers. The WLS fibers are coupled to form cells of about 0.1×0.1 in $\Delta\eta \times \Delta\phi$.

TileCal signal flow and calibration chain:



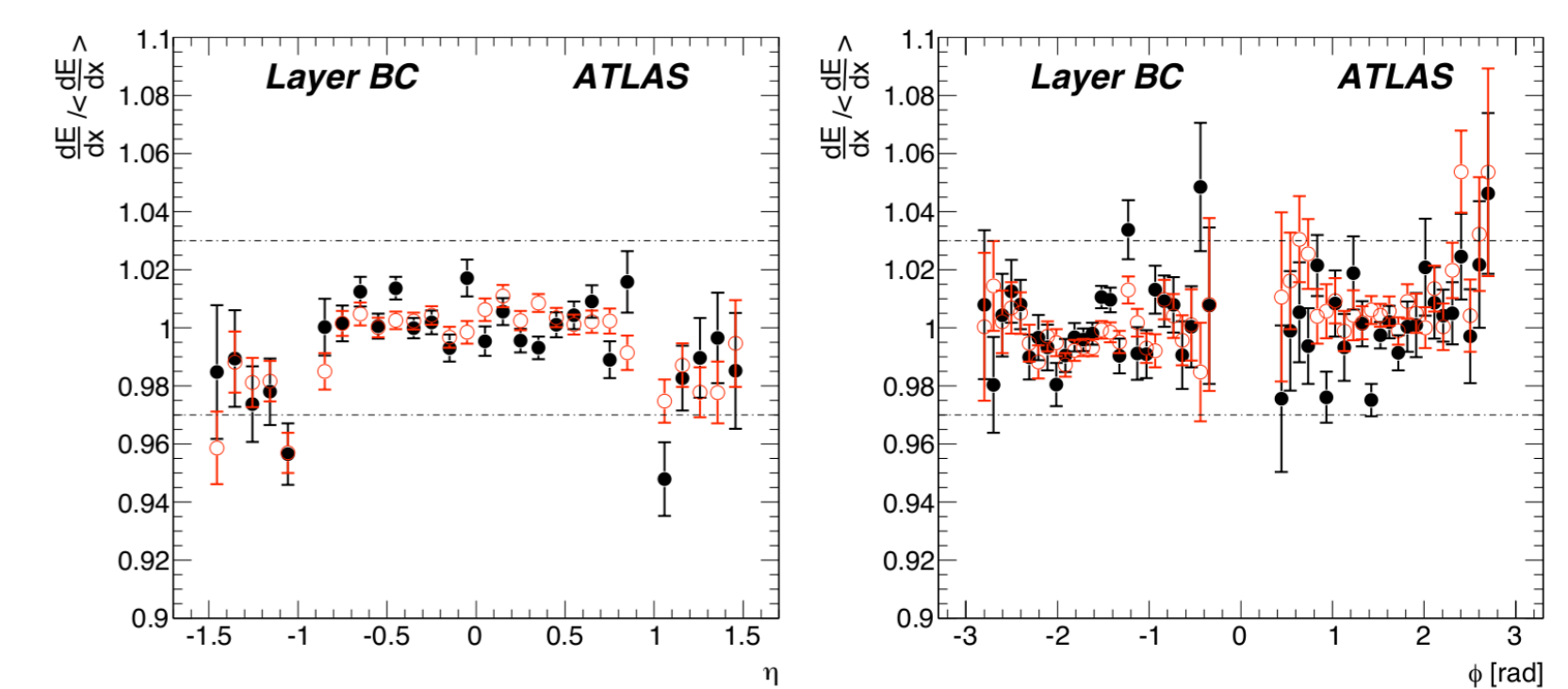
TileCal Timing SINGLE BEAM DATA



During special single-beam runs, the beam reaches a closed collimator near the ATLAS detector; the resulting event is called a *splash event*; splash events are used to evaluate the TileCal timing, after corrections have been applied for particle time-of-flight and fiber length. The TileCal cell synchronization is over the whole calorimeter within 1 ns.

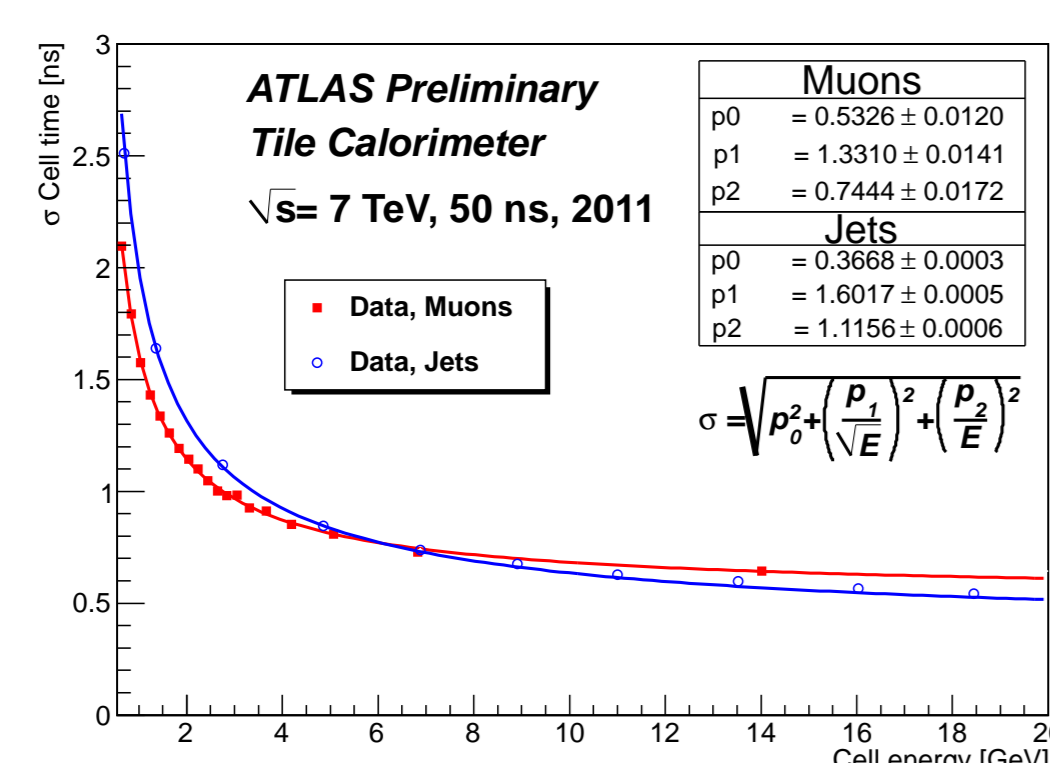
Cell energy scale and uniformity MUON COSMIC RAY DATA

Cosmic muons are used to test the cell response at the electromagnetic scale; the uniformity versus η and ϕ is within 3% over the considered range and it is well reproduced by the MonteCarlo predictions (black dots). The energy scale is comparable to the one set in the testbeam by -3% to $+1\%$, depending on the layer.



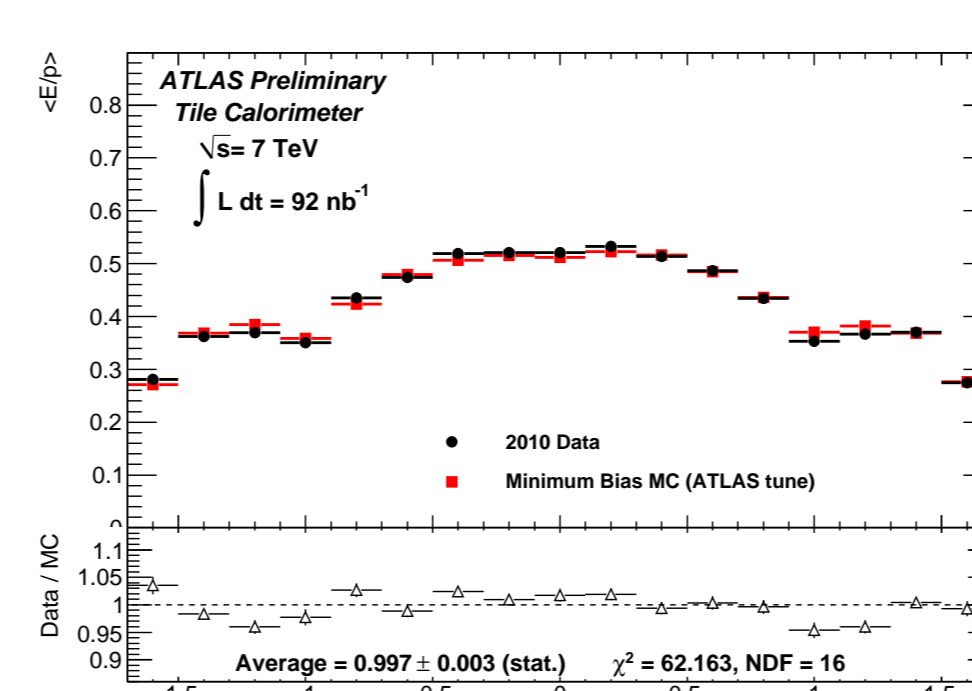
Cell time resolution COLLISION DATA

The TileCal cell time resolution has been studied for muons and jets during collisions events at $\sqrt{s} = 7$ TeV and high luminosity. The resolution decreases at higher energy as expected, and it is below 1% at 3 GeV for both muons and jets.



In-situ measurement of the single hadron response using E/p COLLISION DATA

The mean value of the ratio between the energy deposited in TileCal by isolated charged particles and their momentum, measured in the inner tracking system, as a function of η for 2010 data is reproduced by the MonteCarlo model at the level of a few percent.



Luminosity measurement COLLISION DATA

The integrated Minimum Bias currents over few ms are useful to estimate the relative luminosity during collisions. TileCal deploys a dedicated readout per channel for this. In 2010 the data were proved to follow the luminosity evolution within 5% (errors are only statistical).

