

Measurements of Luminosity in ATLAS with Tile Calorimeter

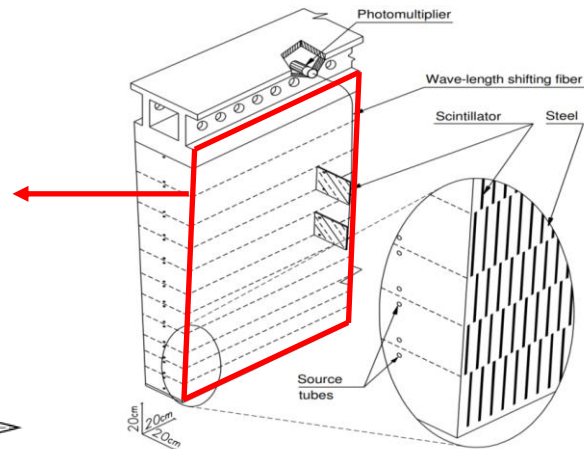
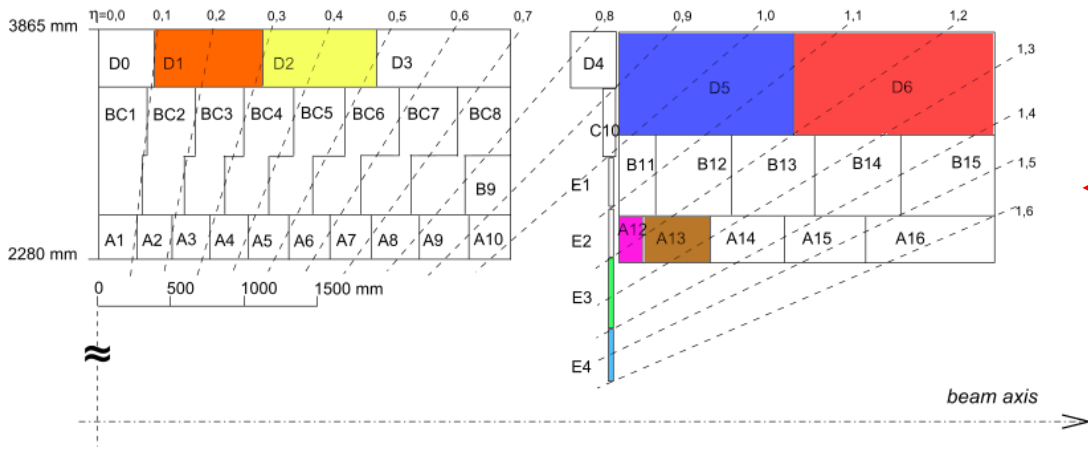
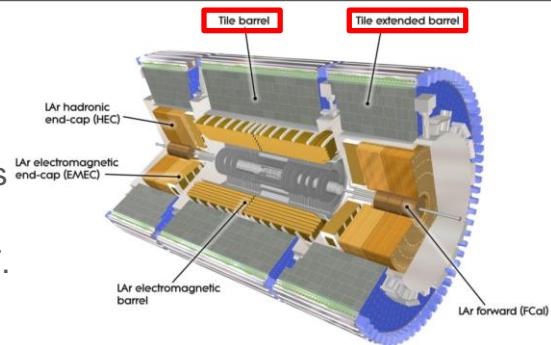
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on behalf of the ATLAS Tile Calorimeter System



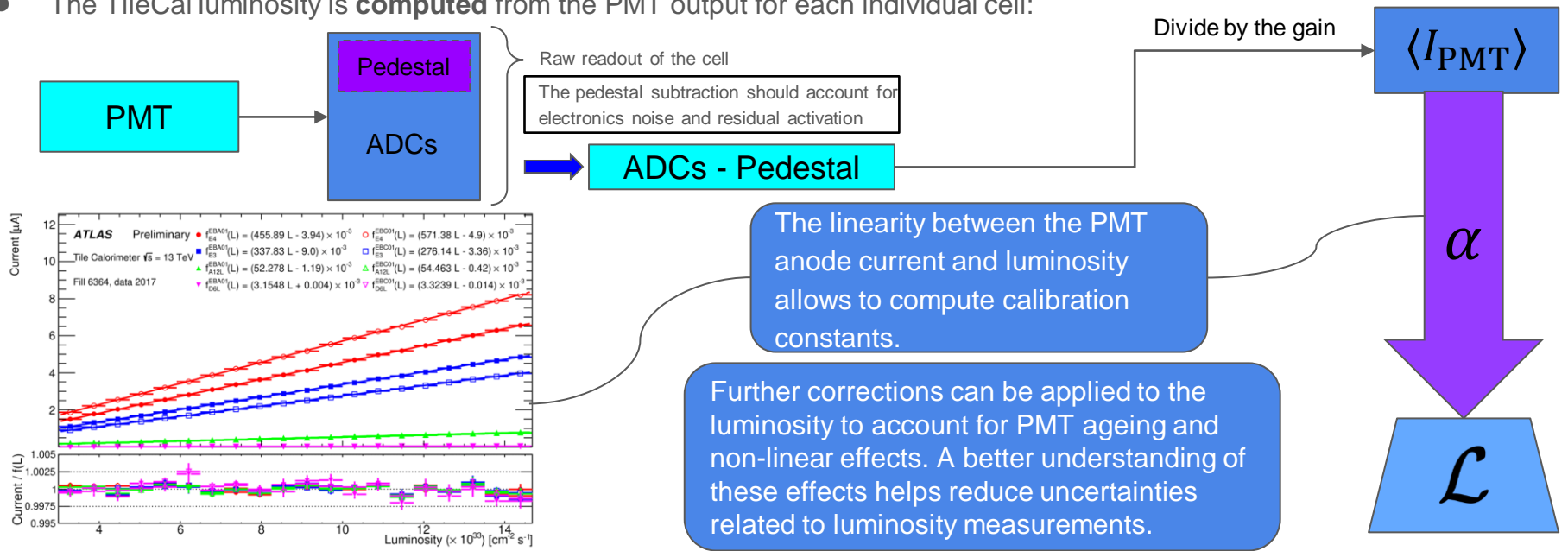
Tile Calorimeter

- The **Tile Calorimeter** is made of low-carbon absorbing steel plates alternating with plastic scintillator tiles as active material.
- The calorimeter consists of four **partitions** each with 64 wedge shaped **modules**.
- Particles traversing a tile produce scintillation light that is read out by photo multiplier tubes (**PMTs**).
- The scintillation light is carried via **wavelength shifting fibers** from both sides of the PMT.
- **Cells** are defined by bundles of fibers from different scintillators fed into the same **PMT**.



TileCal Luminosity

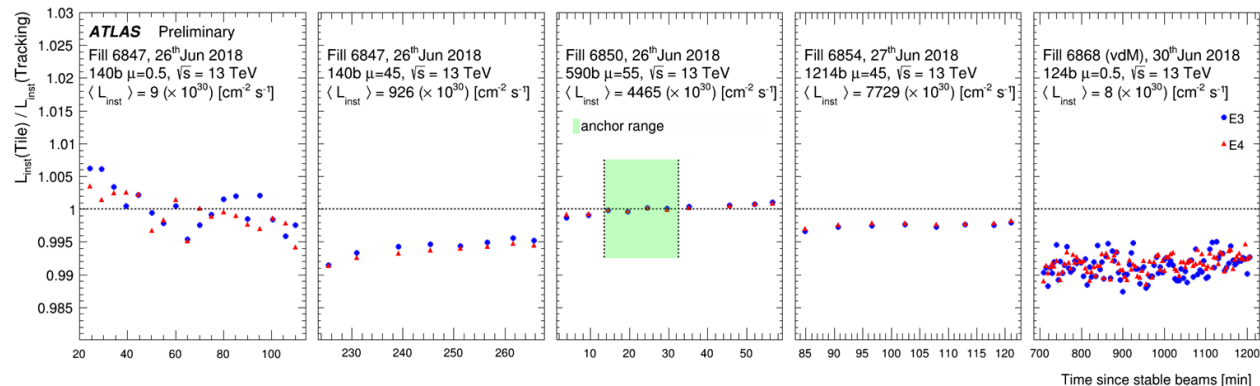
- **Luminosity** is a fundamental parameter in particle colliders since it provides a measure of the number of produced collisions.
- Several ATLAS **subdetectors** can be used in luminosity measurements, such as the inner tracking detector, the electromagnetic calorimeter and the Tile Calorimeter.
- The TileCal luminosity is **computed** from the PMT output for each individual cell:



ATLAS Luminosity calibration



- The **absolute** luminosity **calibration** in ATLAS is done in the **van der Meer runs** using the LUCID detector.
- These runs are performed under low luminosity conditions and with isolated bunches in order to reduce the uncertainty in the measurements. The calibration needs therefore to be extrapolated to physics data-taking conditions (**calibration transfer**).
- The extrapolation is done using the tracking detector. In order to set an **uncertainty** to the calibration transfer the **Tile Calorimeter** is used.



The deviation between the luminosity provided by TileCal and the tracking detector gives a measure of the uncertainty in the calibration transfer, which is dominant in some precision cross section measurements.

- In summary, the fact that TileCal is **sensitive** to a wide range of luminosity signals together with the **linearity** of Tile measurements; make the Tile Calorimeter an attractive luminosity-sensitive detector (luminometer).
- The main role of TileCal in luminosity measurements is to provide the **uncertainty** for the **calibration transfer** which can be reduced with a better **understanding** of factors that affect the luminosity computation, such as **activation**.