ATLAS hadronic calorimeter, iron as absorber and plastic scintillator as active material. Scintillation light is collected to photomultiplier tubes (PMTs) through wavelength shifting fibers and a total of ~10,000 PMTs are used. (Figure 1)

In order to cope with the increased luminosity, a completely new on-detector and off-detector electronics are being developed, aiming for increased trigger rates and high-performance data acquisition.

The TileCal Demonstrator is designed to evaluate the detector performance with new readout electronics without compromising the present data taking.
The Demonstrator modularizes a **legacy TileCal Drawer** in four Mini-drawers (MDs), each MD (Figure 2) serves up to 12 channels consisting of 12 Photomultiplier (PMTs), 12 Front-End Boards (FEBs), An Adder based board, a Daughterboard (DB) (Figure 2)

The data is sent off-detector to be stored in pipelines, reconstructed and triggered-out by: Tile Preprocessors (TilePPr) that receives legacy TTC (Timing Trigger and Control) commands and triggers, DCS (Detector Control Systems) commands, and sends the triggered data to the legacy ROD (Read Out Driver). (Figure 3)

The Demonstrator was inserted inside the ATLAS detector in June 2019. Laser calibration pulse in empty bunches and cosmic events were successfully recorded.
The pedestal value is estimated in special calibration runs and it is subtracted from the received digital samples. Digitized ADC samples for each channel $i$ can be expressed as $y_i = \text{ped}_i + Ag(t_i + T) + n_i$, where $\text{ped}$ is the signal pedestal, $A$ is the true amplitude, $g(t)$ is the normalized reference pulse shape at time $t$, $T$ corresponds to the phase between the expected and measured times, and $n_i$ is the background noise.

Pedestal tests showed slightly lower noise in the demonstrator for April run 2021 (Figure 4, 5).

The Demonstrator readout was fully integrated in the TDAQ software with very stable links (Figure 5).
Correlations for pedestal measurements in-between all 12 channels within mini-drawers MD1, MD2, MD3 a Reduced correlation coefficients show that no linear association exists between pedestal measurements and MD4 were performed (Figure 6) for mini-drawer channels sharing the same electronics.

Conclusion/Summary

- Replacement of MBs and fixing noisy channels was completed for the Tile demonstrator module and is now fully integrated with the TileCal TDAQ system.
- The Demonstrator data acquisition runs which included a new optimized TilePPr firmware have taken place without data losses. The pedestal analysis showed better performances compared with the legacy system.

References


Poster Link: https://indi.to/KryHB