DAQ software implementation in the TileCal ALTI Module

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The Tile Calorimeter

- Central hadronic calorimeter ($|\eta| < 1.7$) in ATLAS detector
- Mechanically partitioned into 3 barrels, 2 extended barrels and 1 central long barrel
- Split into 4 partitions, 2 in long barrel and 1 for each extended barrel
- Each barrel is assembled out of 64 wedge-shaped modules staggered in the $\phi$ direction
- Each module is made up of steel and scintillating plastic tiles
- Double photomultiplier readout using wave length shifting fibers
The TileCal BE read-out electronics in the ATLAS USA15 counting room consist of four partitions, while B175 test bench consists of one partition.
ALTI Module

- ATLAS is replacing the ageing Timing Trigger and Control (TTC) hardware with newer electronics.
Main issues:

- new sub-detectors for the Phase-1 upgrade require TTC modules
- low on spares, just barely reaching the 10% per module type
- the TTC modules are now very old (>15 years) with obsolete components
- not possible to re-produce modules for new sub-detectors and for stocking-up spares cupboard
- ALTI (ATLAS Local Trigger Interface) module replaces the 4 legacy modules in the TTC crate (LTP, LTPi, TTCvi, TTCex)

Main task:

- update the Tile Online software in order to make use of the ALTI board for the TTC and drawer configuration
- Run tests in B175 test bench and later in the USA15 counting room
ALTI Schematics

- LTPi, LTP, TTCvi, TTCex and the ALTI module
4 of the TTC legacy modules, to be replaced with the ALTI module
Functionalities of the 4 modules, integrated into the ALTI module.
Tile Online software

A set of TDAQ software used for the operation of the Tile Calorimeter. It is built up of CMake packages which are stored in Gitlab (atlas-tile-online) Tile Online Release projects are built on the TDAQ release tile-07-01-02 on tdaq-07-01-00 [x86_64-slc6-gcc62-opt]

- Used in 2017/2018 data taking, HLT based on off-line 21.1.*
- To continue using it during LS2
- /afs/cern.ch/user/t/tiledaq/public/tilercd/tile-7.1.0.2

**tile-8.2.0.0 [x86_64-slc6-gcc8-opt]**

- LCG 95, HLT 22.0.1/2
- Includes ALTI package
- /afs/cern.ch/user/t/tiledaq/public/tilercd/tile-8.2.0.0
- /afs/cern.ch/atlas/project/TicalOnline/tilercd/tile-8.2.0.0 (B175 test bench)
tile-8.3.1.0 [x86_64-centos7-gcc8-opt] → B175 test bench

- LCG 96, HLT 22.0.3
- Includes ALTI package
- /afs/cern.ch/atlas/project/TicalOnline/tilercd/tile-8.3.1.0

Next after **tdaq-08-03-01 is tdaq-09-** in 2020

B175 ROD lab machines migrated from SLC 6 to CentOS 7
Plan to migrate all TileCal machines to CentOS 7

The ALTI software is organised into two levels:

- low-level software, including test and menu programs:
  [https://gitlab.cern.ch/atlas-tdaq-software/ALTI](https://gitlab.cern.ch/atlas-tdaq-software/ALTI)

- high-level software: DAQ controller:
  [https://gitlab.cern.ch/atlas-tdaq-software/AltiController](https://gitlab.cern.ch/atlas-tdaq-software/AltiController)

Tools: C++ and OKS (Object Kernel Support) - an object oriented database with storage based on XML
Dependence graph

TileCal Online software package dependence
29 packages

Package Dependence
A \rightarrow B
B depends on A

Packages to be modified for ALTI
TileALTI GitLab project

TileALTI

Project ID: 81178

- 42 Commits
- 3 Branches
- 0 Tags
- 2.5 MB Files

Modification of the Tile Online software, to integrate ALTI

**Update TileTTC.cpp**

Humphry Tlou authored 4 minutes ago

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<tr>
<td>TileCIS</td>
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In general ALTI replaces the functionality of TTCvi and LTP boards. Hence 'TileTTC' class compatible with TTCvi and ALTI modules has been added.

'TileTTC' includes constructor with next arguments:

\[
\text{TileTTC}(\text{int ttcBoardType, int ch, unsigned long addr, unsigned int slot, bool useDVS = false, unsigned int tm=10000});
\]

**where:**

- 'ttcBoardType = 0' - ttcvi functionality, '1' - ALTI
- ch - channel as in ttcvi class, but for ALTI could be only: 0 - L1A, 1 - TTR1, 2 - TTR2, 3 - TTR3
- addr - VME address only for ttcvi, if 'ttcBoardType = 1' addr is not used at all
- slot - slot number only for ALTI, if 'ttcBoardType = 0' slot is not used at all
- 'useDVS = true' - standalone configuration of ALTI for all tests during reset() function. Implemented in the same way as in AltiController for AltiModeAltiMaster. During normal run 'useDVS = false' we will use AltiController to configure and control all other functionality as LTP, BCR etc.
ALTI module to replace the 4 legacy TTC modules

Schematics for the connections within the TTC crates are now available for anyone who wants to make use of them

ALTI software package included Tile release tile-8.2.0.0 and tile-8.3.1.0

B175 ROD lab machines migrated from SLC 6 to CentOS 7

Modifications of the packages, stored in the TileCal GitLab project

To perform tests and assess the performance of the ALTI module in 2020