Upgrade of the ATLAS Tile Calorimeter for the High Luminosity LHC

**Tile Calorimeter**
- is the ATLAS central hadronic calorimeter made of plastic scintillators lined with tungsten alloy and steel.
- two options are being investigated:
  - HVOpto prototype (Super-D PMTs and Front-End electronics mounted in 3 m long drawers)
  - four PMTs with WLS fibres (in long drawers, Super-D PMTs at the other end)

**Upgrade motivations**
- This R&D is part of the ATLAS Tile calorimeter
- able to readout sub-mm granularity with high resolution.
- better precision and fine granularity in the trigger to cope with increased interaction rate
- ageing of components will require the design redundancy
- improve the reliability
- reduce and simplify the maintenance costs by reducing radiation exposure

**Read-out architecture**
- complete replacement of Front End and Back-End electronics
- digital information with full granularity and precision: for L0/1 trigger levels
- functions moved to the BE electronics
- three FE options being investigated

**Demonstrator prototype**
- hybrid prototype to be integrated into ATLAS for evaluation of the new architecture
- full compatibility with the current system: provide both analog digital trigger (new L0/1 FE options)
- ATCA board prototype receive TDC/CANBUS commands and send data back to the current ROD
- setup with a complete SD operational at CERN
- DCS integration well advanced
- calibration data (Charge Injection, LED pulses, ped) used in assess the performance

**HV regulation**
- two options are being investigated:
  - local HVstatic regulation (present)
  - HV remote regulation + long cables
  - active dividers are used to assure good PMT linearity in cells with large minimum bias currents

**Radiation test**
- 3 FE board options are being investigated.
- Final choice after test beam:
  - improved 3in1 FE (current system) using discrete components + separate board (Mezzboard) for digitization and services
  - ASIC solution (FATALIC) combining current conveyor, 3 shaping stage and improved 3in1 FE (current system) using discrete components + separate board (Mezzboard) for digitization and services

**Front End & R&D**
- R&D integrated ROD
- 3in1 card concept
- FATALIC FE prototype
- FATALIC concept

**Conclusions**
- Tile demonstrator prototype was built and is being validated towards the integration into the ATLAS detector during the 2016 Christmas shutdown.
- Revision of many components is ongoing to improve performances. Exposure to beam test is planned during 2015/16, and the final technology choice thereafter.

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