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Upgrading the ATLAS Tile Calorimeter electronics

The Tile Calorimeter (TileCal) is the hadronic calorimeter covering the most central region of the ATLAS experiment at LHC. The TileCal readout consists of about 10000 channels. Its main upgrade will occur for the High Luminosity LHC phase (phase 2) where the luminosity will have increased 5-fold compared to the design luminosity (1034 cm−2s−1) but with maintained energy (i.e. 7+7 TeV). An additional luminosity increase by a factor of 2 can be achieved by luminosity leveling. This upgrade will probably happen around 2022.
The upgrade aims at replacing the majority of the on- and off- detector electronics so that all calorimeter signals are directly digitized and sent to the off-detector electronics in the counting room. To achieve the required reliability, redundancy has been introduced at different levels. An ambitious upgrade development program is pursued studying different electronics options. Three different options are presently being investigated for the front-end electronic upgrade. Which one to use will be decided after extensive test beam studies. High speed optical links are used to read out all digitized data to the counting room. Here two different options are considered with 5 or 10 Gbps transmission rates. For the off-detector electronics a new back-end architecture is being developed, including the initial trigger processing and pipeline memories.
A demonstrator prototype read-out for a slice of the calorimeter with most of the new electronics, but still compatible with the present system, is planned to be inserted in ATLAS already in mid 2014 (at the end of the phase 0 upgrade).

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