The electronic system in charge of the control and distribution of high-voltage (HV) to the 9852 PMTs of the TileCal detector at the ATLAS experiment is currently being upgraded. Its core comprises two cards [1]: the HVOpto and the HVMicro. There are problems in the current setup, such as:

- The system is inside the detector, thus working under high doses of radiation.
- The servicing and replacement of faulty cards is possible only when LHC stops at least for a few months.
- The power supplies of the HVRemote board will now be linked through a bunch of 100 m long cables, which degrades stability and noise levels.

The large number of long cables and their installation/integration is the weakest point of the HVRemote solution. There is an alternative solution [4] developed by the ANL team that keeps the HV electronics in the detector.

To alleviate these constraints, in the upgrade it is proposed to move the TileCal’s HVOpto electronic control system to the USA15 room (far from radiation), with the goal of increasing the expected lifetime of the system and providing for immediate maintenance and replacement [2][3]. However, the power supplies of the HVRemote board will now be linked through a bunch of 100 m long cables, which degrades stability and noise levels.

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The architecture of the upgraded system is shown in Figure 1. The control master is a PC/workstation configured as a node of the DCS of ATLAS. The DCS commands and the data read from the HVRemote boards flow through a tree of Ethernet links, connecting the PC and 256 boards, each of these managing 48 PMT channels. The control software comprises DCS (high-level commands), C++ and Python programs, running in the PC, which use the DCS API (Figure 2), and C programs running in the Tibbo EM1206 modules. These modules (one for each HVRemote board) are used to read commands from the Ethernet channel, convert them into raw digital signals and send them to HVRemote’s digital control circuits through a SPI link. The reverse data flow (from the HVRemote to the upstream DCS computers) is also managed by the system.

To evaluate the supervising and control electronics of the HVRemote, it was built a test card, the HVRemote-Ctrl (Figures 3 and 4), which has the same control components of the HVRemote, but lacks the front-end electronics of the PMTs. This provides means to test the digital control hardware and the Tibbo module, and to assess the transfer speeds. A DC/DC converter is used to couple the 3.3 V signals from Tibbo to 5 V in CMOS hardware. The test card has a 16-bit port expander with SPI, a 12-bit DAC, a 16-bit analog multiplexer, an instrumentation amplifier, a 12-bit ADC, a temperature sensor, and a voltage reference. These are the same components (albeit in less quantity) and architecture used in the HVRemote full card.

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