

# Upgrade of the ATLAS Tilecal High Voltage system

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The high voltage (HV) system of TileCal, the ATLAS central hadron calorimeter, is being upgraded for the HL-LHC, in the so called Phase II Upgrade. In the new configuration for the upgrade, the HV regulation boards are not located inside the detector anymore, they are deployed far from the radiation in a room where there is permanent access for maintenance. This option requires a large number of 100 m long HV cables but removes the requirement of radiation hard boards. HVremote regulation boards and the respective HV supplies boards have been developed and tested, as well as a crate to

## Summary (500 words)

The High Voltage system of Tilecal after the Phase II upgrade will consist of HVremote boards and HV supplies boards, located far from the detector in crates, connected to the detector by 100 m long cables. Inside the detector there will be passive HVbus boards that are used to bring the HV to each of the photomultiplier tubes (PMTs) located in mini-drawers inside the girders of the modules.

The HVremote boards are the boards that regulate the HV for each individual PMT of Tilecal. The number of boards needed for the Tilecal operation is 256. There is one input HV (-830 or -950 V) for each 24 channels and the voltage of each channel can be regulated down individually in a range of the order of 350V as in the current Tilecal design [1]. The primary HV is provided by Hamamatsu C12446-12 modules located in the HV supplies boards, and two primary HV inputs are used to provide HV for 48 channels in the case of the Barrel modules or for 32 channels in the case of the Extended Barrel ones. Relative to the current Tilecal HV system, the main functional improvement is the addition of on/off control for each group of 4 channels complemented by a jumper for each individual channel. The operation in the absence of radiation allowed the simplification of the regulation loops with the removal of some transistors. The control and monitoring, that in the current Tilecal version is done with HVmicro boards [1] that communicate with the DCS PCs via CANbus, was completely redone.

The communication and control is done via SPI bus through an ethernet interface. Most of the tests and development of the control and monitoring of the HVremote and HV supply boards was done using Raspberry Pi, with the solutions being later moved to a System on Chip solution (Zybo Z7 Zynq) that allows the simultaneous usage of two SPI buses, one for the HVremote boards and the other one for the HV supply boards.

HVremote and HV supply boards prototypes have been tested in the laboratory and performance results will be presented.

[1] R. Chadelas et al., "High voltage distributor system for the Tile hadron calorimeter of the ATLAS detector", ATLAS-TILECAL-2000-003, 2000, <https://cds.cern.ch/record/436230>

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