

: Distributed low voltage power supply system for front end electronics of the TRT detector in ATLAS experiment

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We present a low voltage power supply system which has to deliver to the front end electronics of the ATLAS TRT detector ca. 24 kW of electrical power over the distance of 40-50 m (which adds another 24 kW). The system has to operate in magnetic field and under radiation environment of the LHC experimental cavern. The system has ~ 3000 individual channels which are all monitored and controlled (voltage and current measurement). The hardware solutions are described as well as the system control software.

Summary

Modern, highly integrated front end electronics of the experimental physics profits from the technological progress in the field of modern electronics. Higher the functional density of custom designed chips, higher the power consumed. The space constraints in design of the collider experiment detectors create severe problems with the power delivery to the front end (to say nothing about evacuation of this power when converted to heat).

Amount of heavy material –copper –in cables is another negative aspect of the supplying harnesses for electronics (both economical and affecting the detector performance).

The detectors and its electronics will have to withstand also the high radiation level produced by proton-proton collisions at LHC. Peripheral system, those like power supply have to be radiation tolerant as the minimum. The ATLAS configuration of magnets adds another aggressive factor –magnetic field –which has to be tolerated by the power supply systems. This concern all electronics located in the experimental cavern.

ATLAS TRT is a straw detector with > 400000 individual channels. Front end electronics located on the detector surrounding the interaction point consumes power of ~ 24 kW and another 24 kW is dissipated in cables and regulators.

System consists of three basic parts :

1. Control unit and AC-DC converters located in the control room delivering 380 V DC to 2/. (distance ~70 m)
2. DC-DC converters located on the supporting structure within experimental cavern serving as bulk power supplies delivering voltages in 2-8 V DC range. (distance ~ 40 m)
3. Control , monitoring and regulating boards located within the volume of ATLAS setup, supplying individual loads located on the detector (distance ~ 12 m)

The parts 1 and 2 are commercially available units produced by WIENER. Control unit and AC-DC converter are not resistant to either radiation nor magnetic field thus stay in friendly environment of the control room.

Part 3 consists of custom designed boards where by means of the regulators is realized distribution (or fan-out) function to individual loads. The components used are special design radiation hard regulators and radiation tolerant industrial IC and optocouplers.

The regulators can be disabled/enabled allowing for switch off/on of every channel. The output voltage can be adjusted in range of ~ 1.5 V to compensate for possible changes in necessary voltage due to radiation aging of front end chips. This is done with help of radiation hard DAC'located in a custom design chips.

The control of the board is performed via ELMB (Embedded Local Monitoring Board) which is interfaced to the industrial SCADA system PVSSII. Some additional piece of

software has been designed for performance optimization and ease of digital control of the DAC's.

64 channels ADC on the ELMB board allows for current and voltage measurement of the individual channels. Whole software has been embedded into CERN FrameWork (extension to PVSSII) to allow for use of CERN-specific functions.

Functionalities description and conclusions from running experience will be given.

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