Upgrade of the ATLAS Tile Calorimeter High Voltage System

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Tile extended barrel Tile barrel LAr hadronic end-cap (HEC) LAr EM end-cap (EMEC) LAr EM barrel LAr forward calorimeter (FCAL)

Fig.2 ATLAS calorimeter system *Fig.3 Scintillator; polystyrene with PTP and POPOP*



Fig.4

Photomultiplier Tube (PMT) used in the Tile Cal; converts photons into electrical signals





Fig.5 Internal Structure of the PMT



Fig.6 Voltage divider for the PMT



Fig.7 HVSupply board, interface board and HVRemote board



Fig.8 HVSupply board; powered by +3.3V, ± 12V and +24V



Fig.9 DC-DC voltage converter



Fig.10 Interface board



Fig.11 HVCrate (HVSupply side)





Fig.13 Optocoupler circuit design; it works as a switch and as a current controller

Fig.12 HVRemote board



Control loop

HV Supplies Tester							
New Board Select Boa	ard ₊ Set SPI Fr	equency ADC Measurements: 1	Reset Board Exit		HV Remote		
Enable/Disable Supplies High Voltage Adjustment							
Enable Sequence	isable All	HV1		0 V 🌲	Set HV1	0 V	
		HV2		0 V 🌲	Set HV2	0 V	
SV3		Set ALL HV					
e Enable D	Disable	Continuous Acquisition					
		Status: Stopped	Start	Pause	Stop	Delay between runs: 0.000 s	
Voltage and Current Readings							
e Enable D	visable	HV1	Voltage	V ADC	HV2	Voltage	V ADC
24 V Enable D	isable	Read	Current	A ADC	Read	Current	A ADC
HV	isable	24 V	Voltage	V ADC	3V3	Voltage	V ADC
			Current			Current	

Fig.14 HVSupply GUI









Figs.15-18 Electrical noise





Fig.20 HVRemote GUI

Fig.19 HVSupply board, interface board and HVRemote board



Control range: [max(0, HVIn - 360), HVIn]



Fig.21 Relay board with Arduino UNO





Figs.22-23 PMT and LED montage



Fig.24 High-amplitude spikes in the time scale of 10ns/div



Fig.25

Minor oscillation of 50Hz for lower high voltage values in the time scale of 10ms/div

Fig.26 Noise band for higher high voltage values in the time scale of 10ms/div



Fig.27 Sawtooth waveform in the time scale of 500us/div



Figs.28-29 Differences between the 2 sides of the HVSupply board

Solid line: side of the HVSupply board with 2 condensers and a $1.5k\Omega$ resistor at the output Dashed line: side of the HVSupply board without the condenser and the resistor at the output