PERFORMANCE OF THE REMOTE HIGH VOLTAGE POWER SUPPLY FOR THE PHASE II UPGRADE OF THE ATLAS TILE CALORIMETER

Main goals

- To supply the 9852 PMTs of the ATLAS Tile Calorimeter.
- To reproduce performance of LHC Run1.
- To overcome increased radiation effects.
- To increase working reliability.
- To implement active PMT Dividers (with transistors) and supply sets of 12 channels (instead of 24).

Run 1 performances

- HV stability ~ 100 mV at HV 690 V.
- Problematic channels 0.6%.

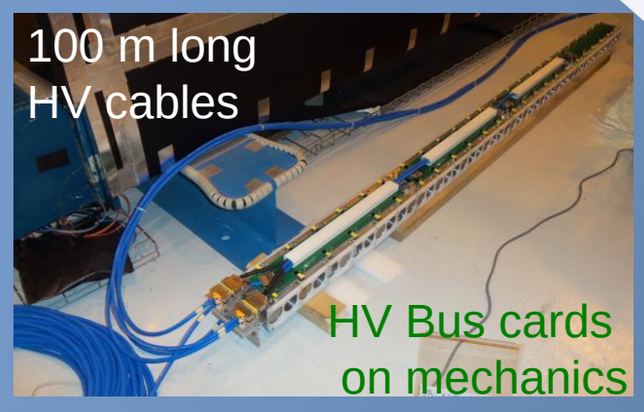
2 R&D projects

- Evolution of the current design.
- Remote HV option, shown here.

Remote HV

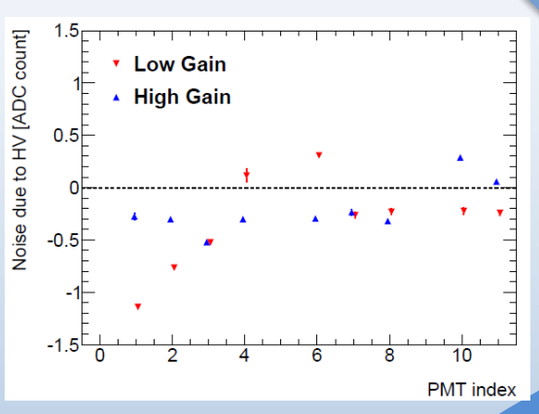
- 12-channel passive HV Bus cards on mechanics, supplied by 100 m multi-conductor long HV cables.
- HV Regulation + LV/HV Power Supplies inside a crate in the counting room.


Regulation crate



HV Bus cards on mechanics

HV induced readout noise, with statistical errors, once noise without HV is subtracted



Negative values are indications of systematics

Noise and stability challenges due to long cables + both transistors on Dividers/Regulation loops

⇒ **Regulation loop design without transistors:** systematic tests at LPC and at CERN.

Results

HV noise at PMT input / applied HV

→ constant ratio: 2.6-2.7 10^{-6} over HV range [550, 850].

HV noise at readout, from pedestal widths without/with HV

→ Negligible HV effects on High/Low gains, within ADC data uncertainties.

Regulation stability at PMT level

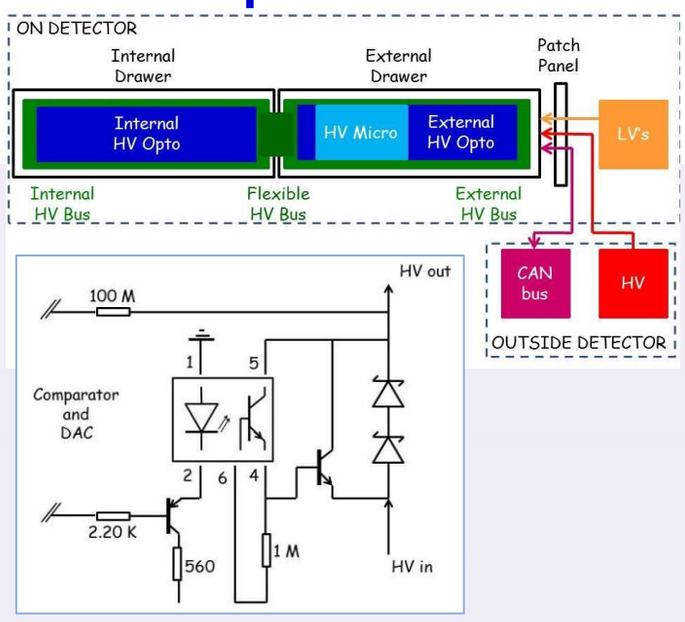
→ Better than 90 mV rms during runs > 13 hours.

Conclusion/next steps

- Fulfills all specifications.
- Permanent access, with possible individual channel switching using straps.
- Next steps:
  - Test beams at CERN (2015-2016).
  - Better crate organisation (Regulation cards, LVs, HVs, DCS).
  - Final choice of HV cables and routing in ATLAS.

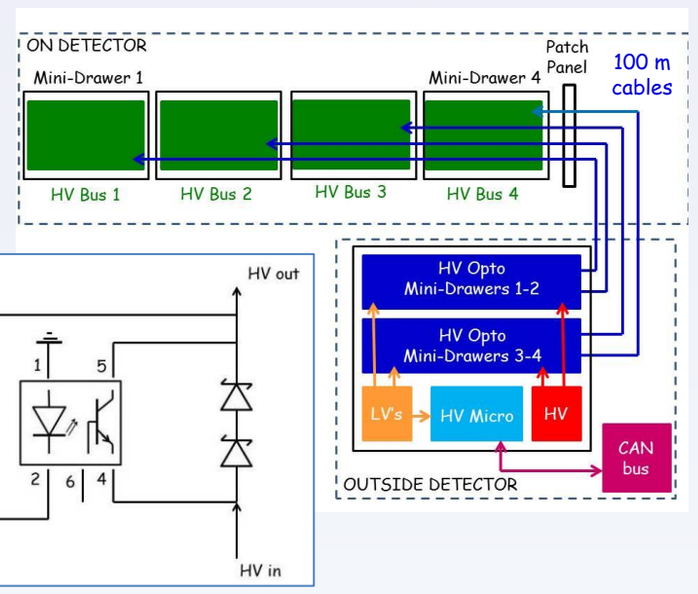
Current ATLAS set-up

- Embedded.
- Sensitive to radiation.
- No access when running.
- Individual regulation loop: optocoupler + 2 transistors

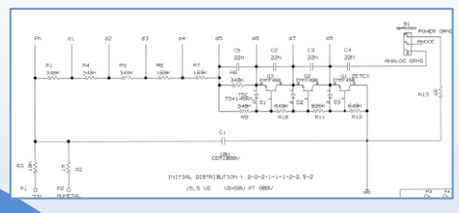


Proposed Phase II set-up

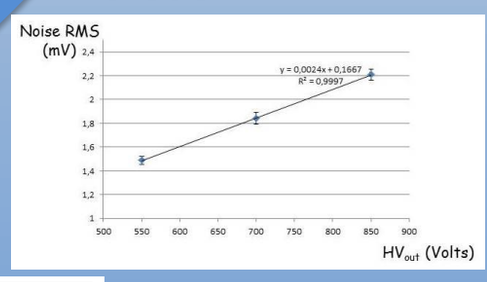
- Remote.
- No radiation.
- Permanent access.
- Loop without transistors.



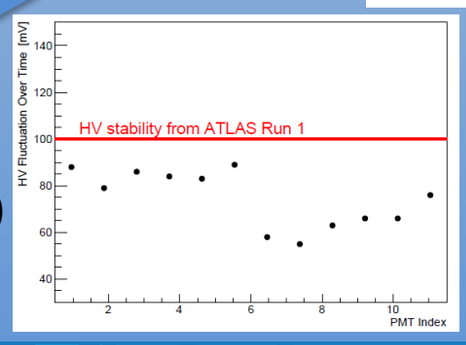
- Passive HV Bus cards: 4 layers (2 internal for HV, 2 external as shielding).
- Multiconductor HV cable (12 twisted pairs each).


Active Dividers: transistors and diodes in the 3 last stages

HV Noise (mV) versus HV



HV stability (mV)



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