

Power Supplies for the Tracker (Firenze & Torino)

- The System (Outside solution, long cables)
- The Prototypes (Design goals)
- Prototype qualification (Performance, functionality)
- Measurements (Procedures, Setups)
- System test (Evaluation of the behaviour of N modules connected through long cables to the PS)
- Cables (Multiconductor, low resistance, low impedance)

The System

- Large number of detector modules
 - Group detectors together (up to 60 APVs) and power them in parallel
 - Use sense wires to regulate voltages on the load (Low Voltage only)

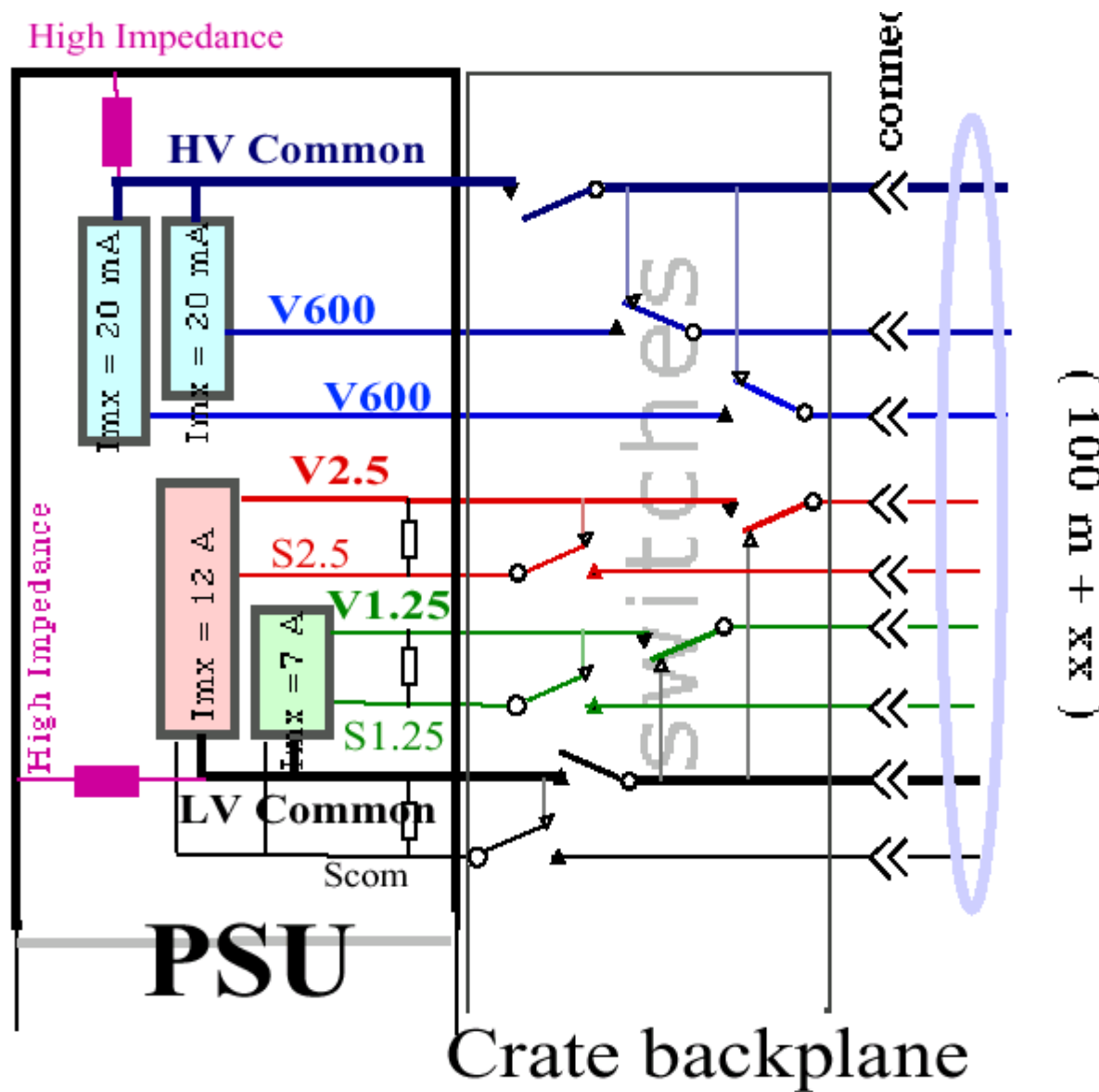
Implications:

- High currents (of the order of 10 Amps)
- Relatively high voltage drops on the cables (4 Volts)
- Efficiency issues (differing loads depending on the number of APVs belonging to a group)
- Isolation even at high frequencies (floating power supplies)
- HV & LV generators belong to the same power module

WHY OUTSIDE ?

- Accessibility
 - Ease of maintenance
 - Debugging
- Proven technology
 - NO Radiation
 - NO Magnetic field

The Prototype



- PWM (Switching PS)
 - (less power dissipation in the PSU)
- 2 HV generators
 - (extra flexibility in detector biasing inside a given group)
- Relay switches
 - (to disconnect the cable from the PSU)
- Low stray capacitance transformers
 - Improve isolation

Prototype qualification

- Performance

- Noise (BW – 20 MHz)
- Isolation (up to 5-10MHz)
- Stability (Voltage drifts, Load dependence)
- Sense response

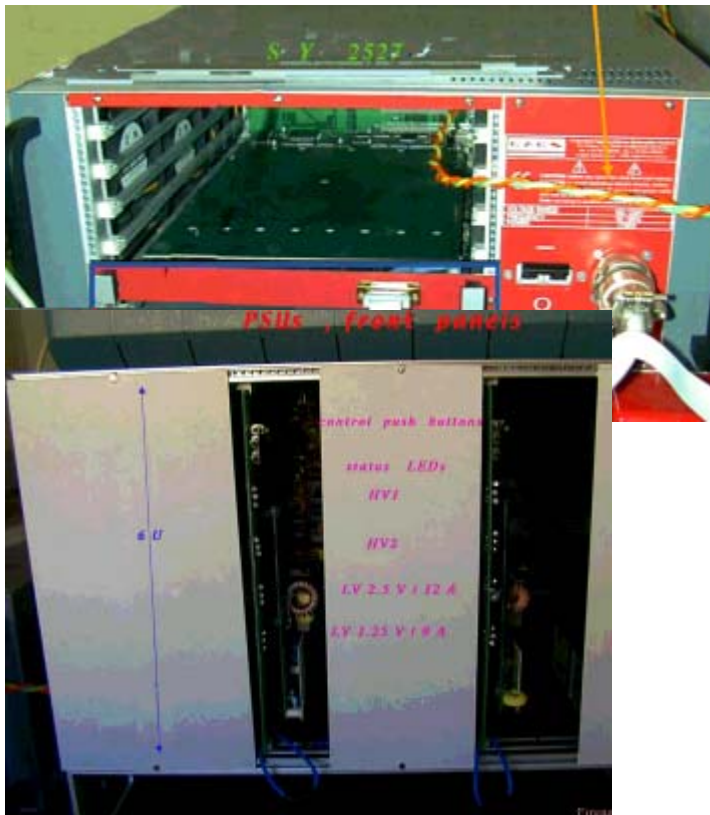
- Functionality

- Over-currents (behaviour and alarms)
- Over-voltages (behaviour and alarms)
- Voltage & current settings
- Voltage & current monitors
- PSU insertion and removal interlocks

Delivered prototypes

CAEN and LABEN the two chosen manufacturers.

Were first delivered at the end of 2001!



Both prototypes were delivered in their revised form, at the end of May. LABEN has made a complete revision, CAEN modifications to the existing one.

Progress made

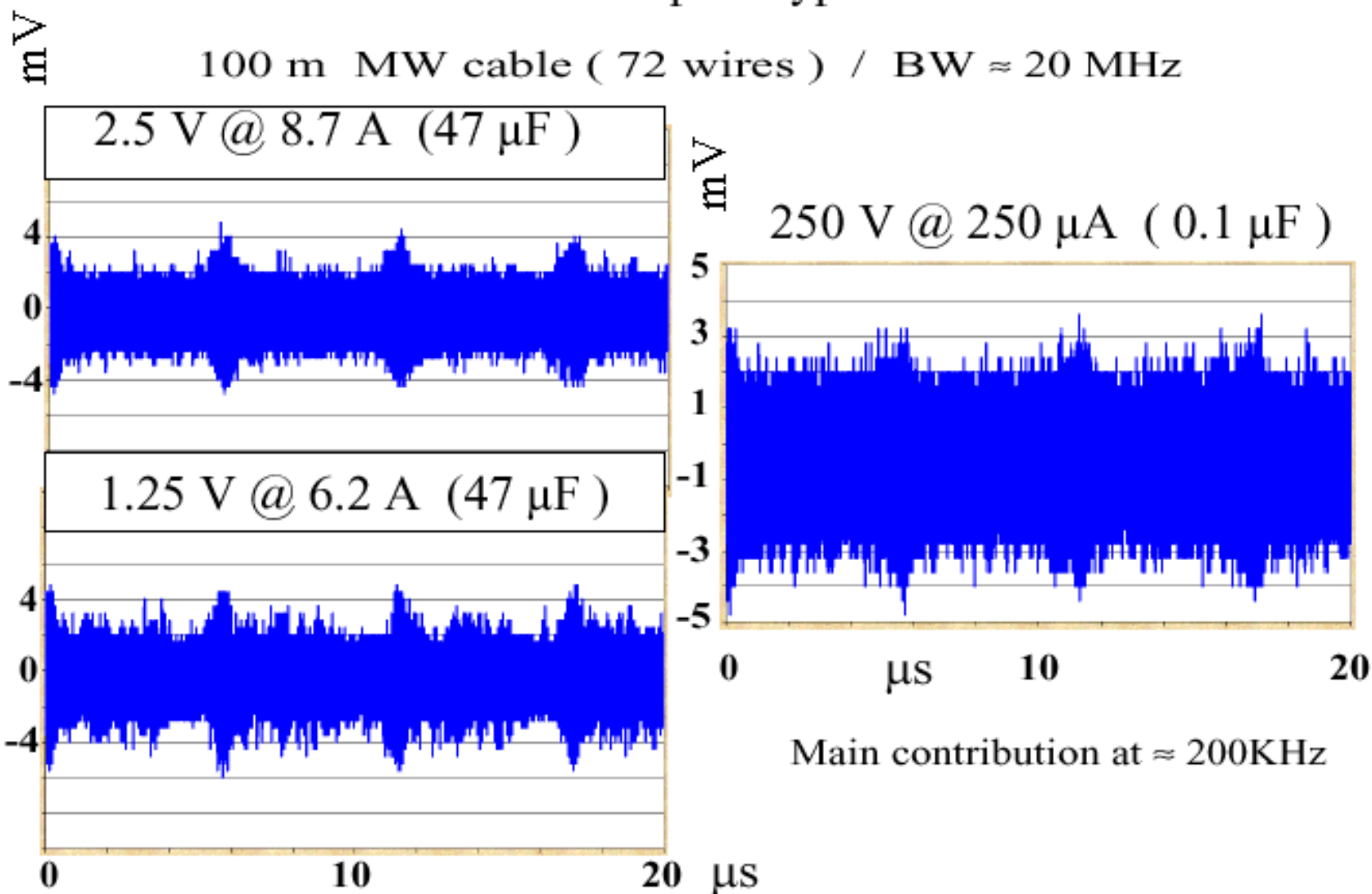
- LABEN prototype tested in Florence, CAEN in Turin (an exact repeat of the testing sequence performed on the earlier version with the Turin test box)
- Both manufacturers readily answered queries and sent personnel to Turin and Florence to solve minor issues.

The work done by both manufacturers is evident in the progress made both for what concerns the prototypes functionality and the over-voltage and over-current behaviour.

Measurements in progress

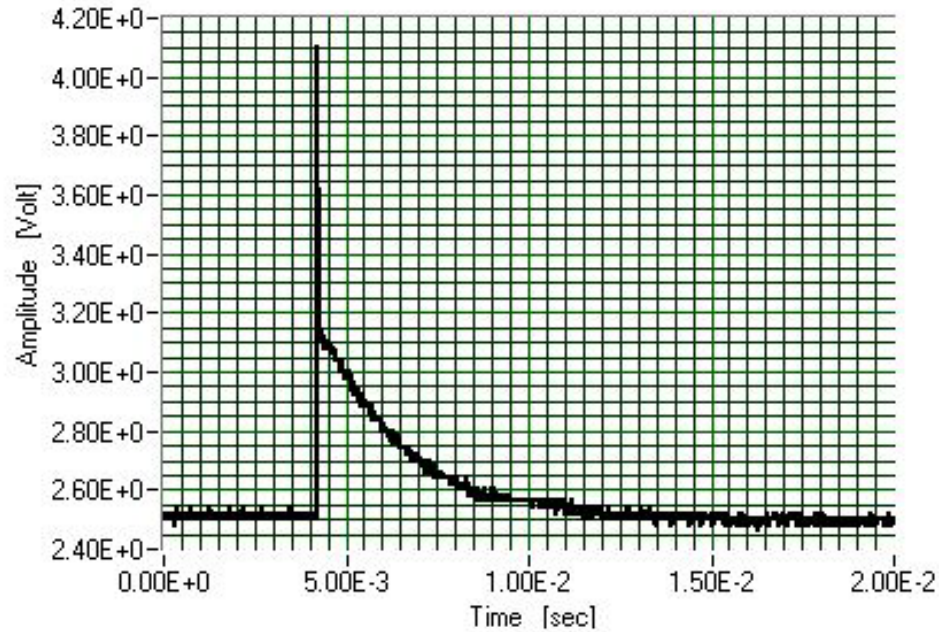
- Noise measurements under different loads with small ($\sim 47\mu\text{F} + 100\text{nF}$) capacitors.
 - Results seem compatible with what was observed in the previous versions of the prototypes. (10 mV pk-pk)
- Isolation has been greatly improved.
- Behaviour during over currents now OK.
- Overvoltage response has been improved.

Noise

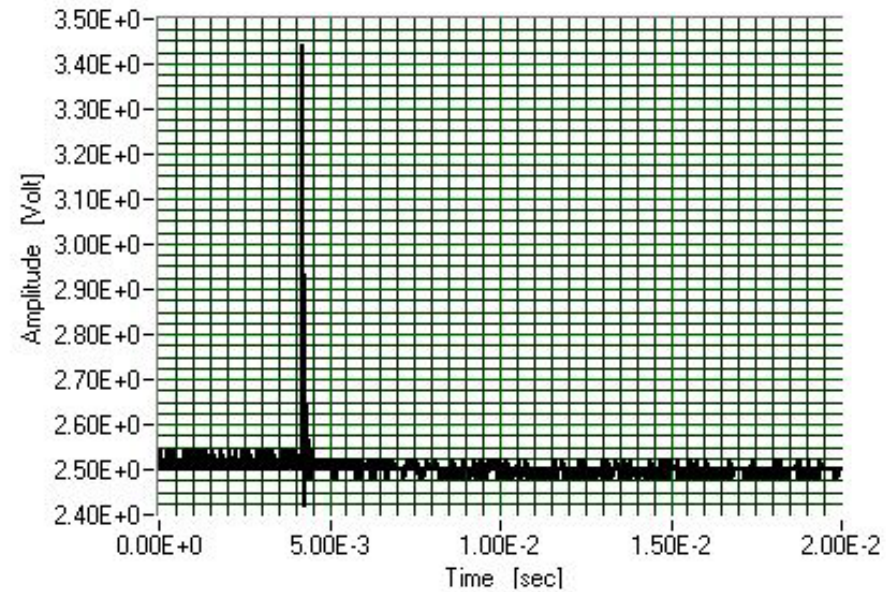


Over voltage

17/04/02 15.42.18
Configuration file Default.conf
PSU-ID:caen0-LV-100m (Testrun2)
Channel
LV2.5
Number of Loads
1
Test: Overvoltage
Test Number: 1



03/06/02 11.05.21
Configuration file testcursors.conf
PSU-ID:o2 (Testrun1)
Channel
LV2.5
Number of Loads
1
Test: Overvoltage
Test Number: 1



System test

- Readout of up to 6 TIB modules with optical decoupling (analog and digital) using long cables connected to the PS prototypes.
- Setup now nearly ready, analog optical readout for up to 8 channels implemented and working.
- Digital optical link being readied (FEC modification needed)
- New CCUs have been made available by Marchioro and are now being integrated in the readout.

MINIMUM SYSTEM UNIT = 1 CCU RING + 1-2 RODS

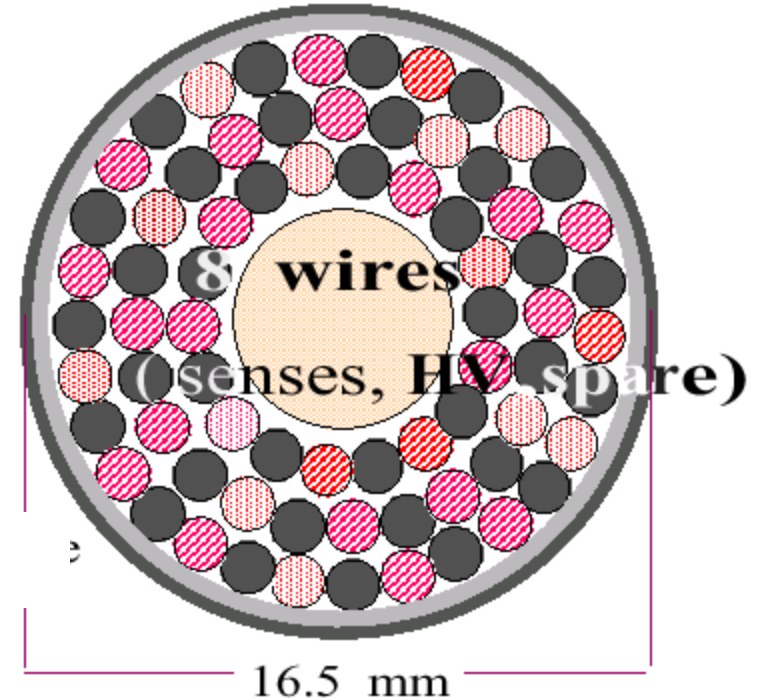
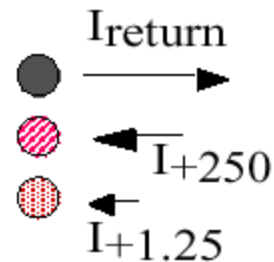
Cables

A great amount of work has been done on the cables that will connect the PSU to the rod of modules.

Finally we have reached a cable design that shows a very low impedance ($Z \sim 2$ Ohms) and has also a very low DC resistance (~ 0.1 Ohms).

Within the same cable also travel the HVs and the LV sense wires + eventual spares.

$80 \times 0.8 \text{ mm}^2$ (Kapton / enamel ins.)



- Minimize voltage drops
- Tightly couples supply lines
- Good behaviour during transients
- Robust
- Rad Hard
- Copper braid shield

Brief Roadmap

- LABEN prototype now back in Milan for small reworks on the HV board.
- By the 20th of June BOTH prototypes back in Florence where final qualification will begin.
- In parallel the system test setup is being readied for the first use of the PS with long cables with TIB modules.