Slow Control System

A. Fava

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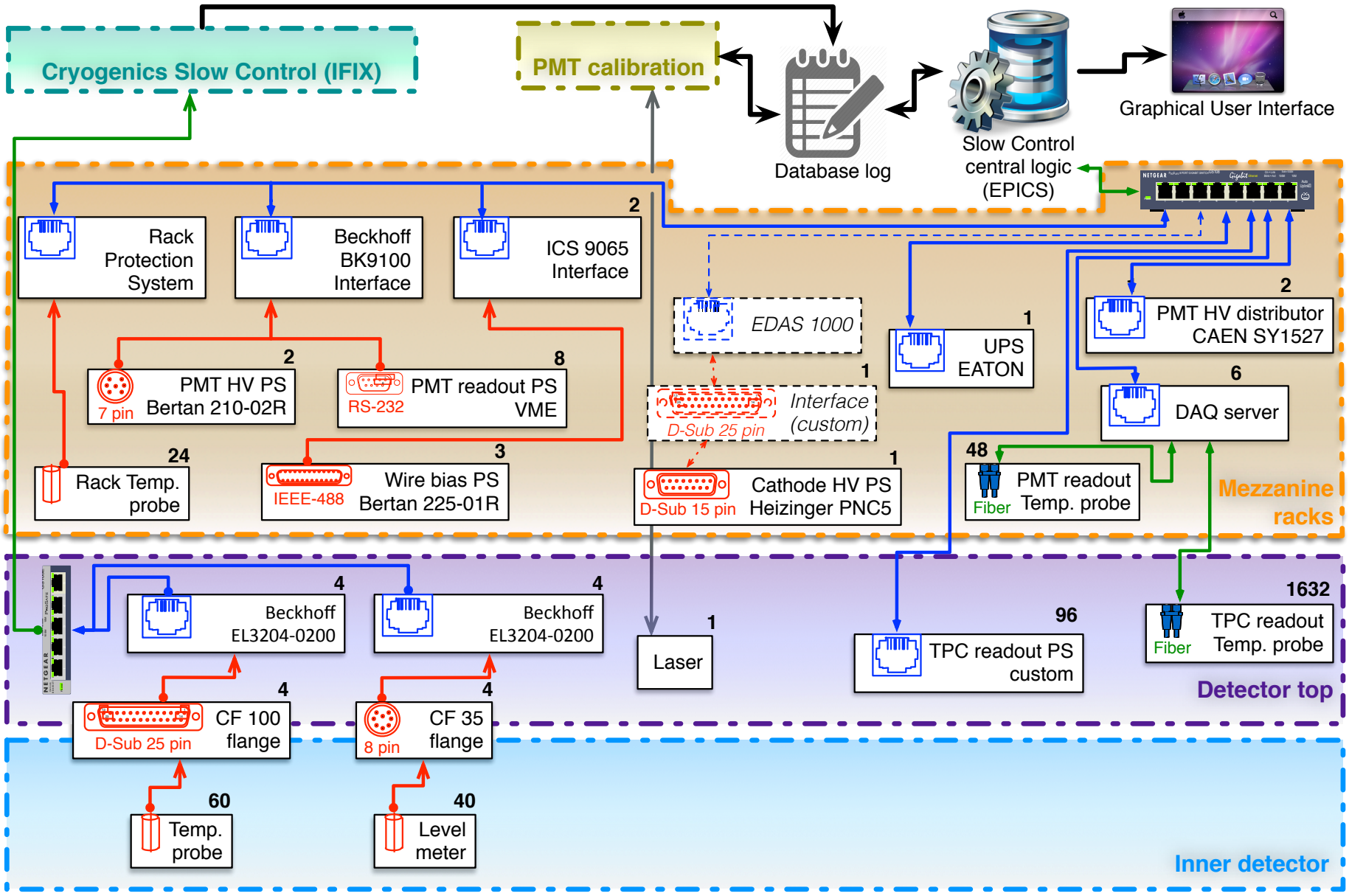
T. Nichols, D. Nicklaus, GL. Raselli, M. Rossella, G. Sava

… more people welcome!

Overall architecture



Inner sensors

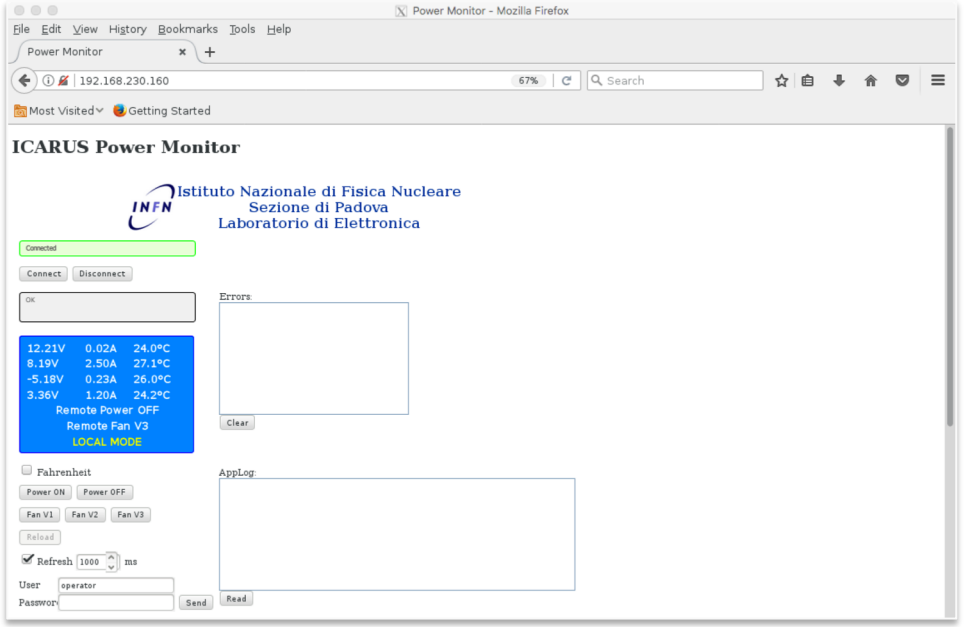
- 60 temperature probes, 8 level meters.
- 4 control panels on top of the cryostats, near corner chimneys. Beckhoff universal RTD modules.
- Controlled by a PLC performance CPU.
- Connected to main cryogenic controls.
- Data accessible through cryogenic control system (iFIX HMI).
- **EFFORT NEEDED SOON FOR IMPLEMENTATION, TESTS AND SOFTWARE DEVELOPMENT.**
- **To be delivered early 2019.**
- *Contact person: T. Nichols*

Control Panel

Power Supply for TPC readout electronics

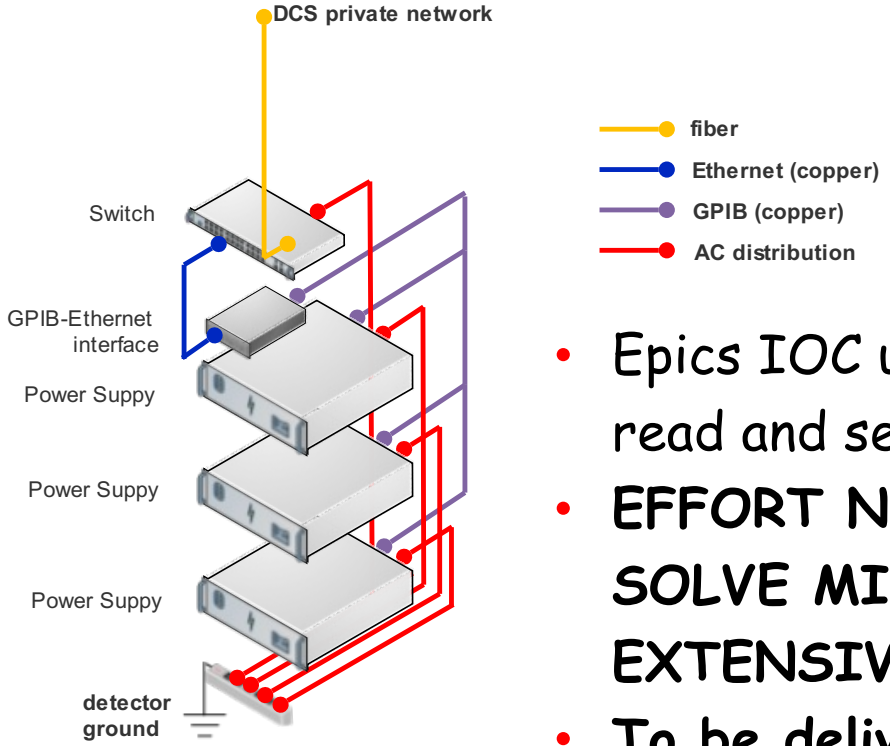
- 96 Power Supplies, custom design of INFN-Padova, with Ethernet connectivity.

- Web-based interface for remote monitoring of voltages, currents and temperatures and remote setting of voltages and fan speed.
- **Integration with Epics to be worked out by end 2018.**
- Contact person: D. Nicklaus



Power supply for wire bias

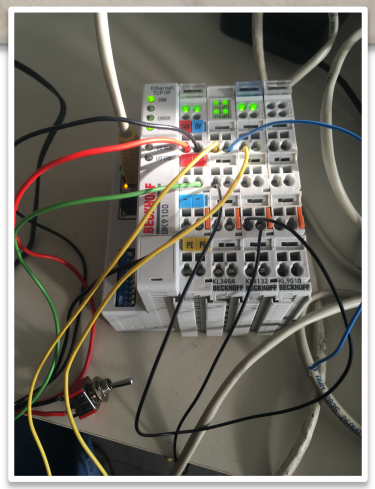
- 6 Bertan 225-01R from past operations.
- IEEE-488 (GPIB) connectivity, cabled in daisy chain.
- Interfaced to Ethernet via ICS-9065 device.



- Epics IOC using the pythonIoc code developed to read and set HV, Voltage on/off, and V/I limits.
- **EFFORT NEEDED TO RELEASE SOFTWARE, SOLVE MINOR CONFLICTS AND MAKE EXTENSIVE TEST CAMPAIGN.**
- **To be delivered by December 2018.**
- *Contact person: D. Nicklaus*

Power supplies for PMT HV

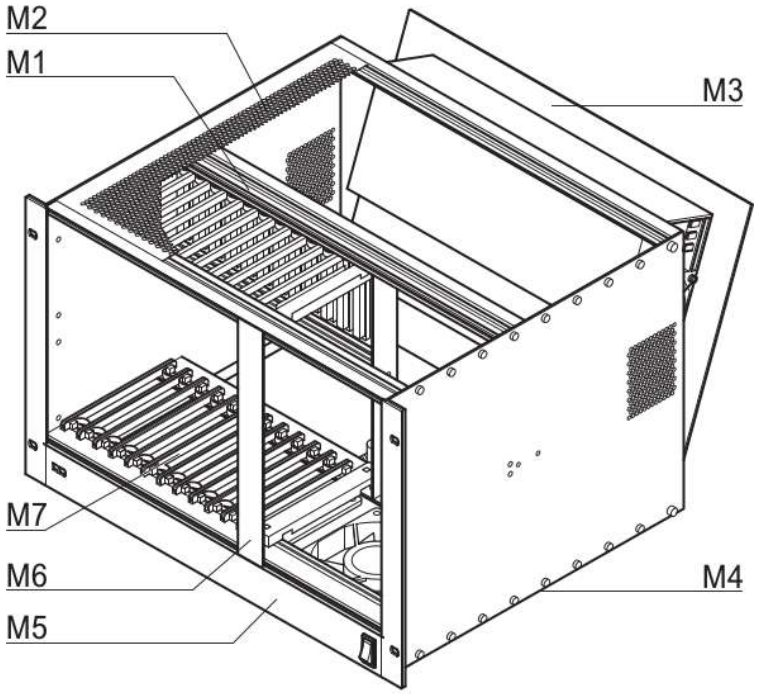
- 2 Bertan 210-02R for primary HV.
- Analogue 7-pin I/O interface.
- Interfaced to Ethernet through Beckhoff analogue I/O modules without PLC.
- Control of voltage with ramp up/down
  Monitor of current and voltage signal
- Epics software developed.
- **TO BE TESTED AT CERN by end 2018**
- *Contact person: N. Moggi*



- 2 CAEN SY1527 high voltage distribution crates, with Ethernet connectivity.
- **EFFORT TO COMPLETE SOFTWARE DEVELOPMENT AND TEST AT CERN**
- *Contact person: N. Moggi*

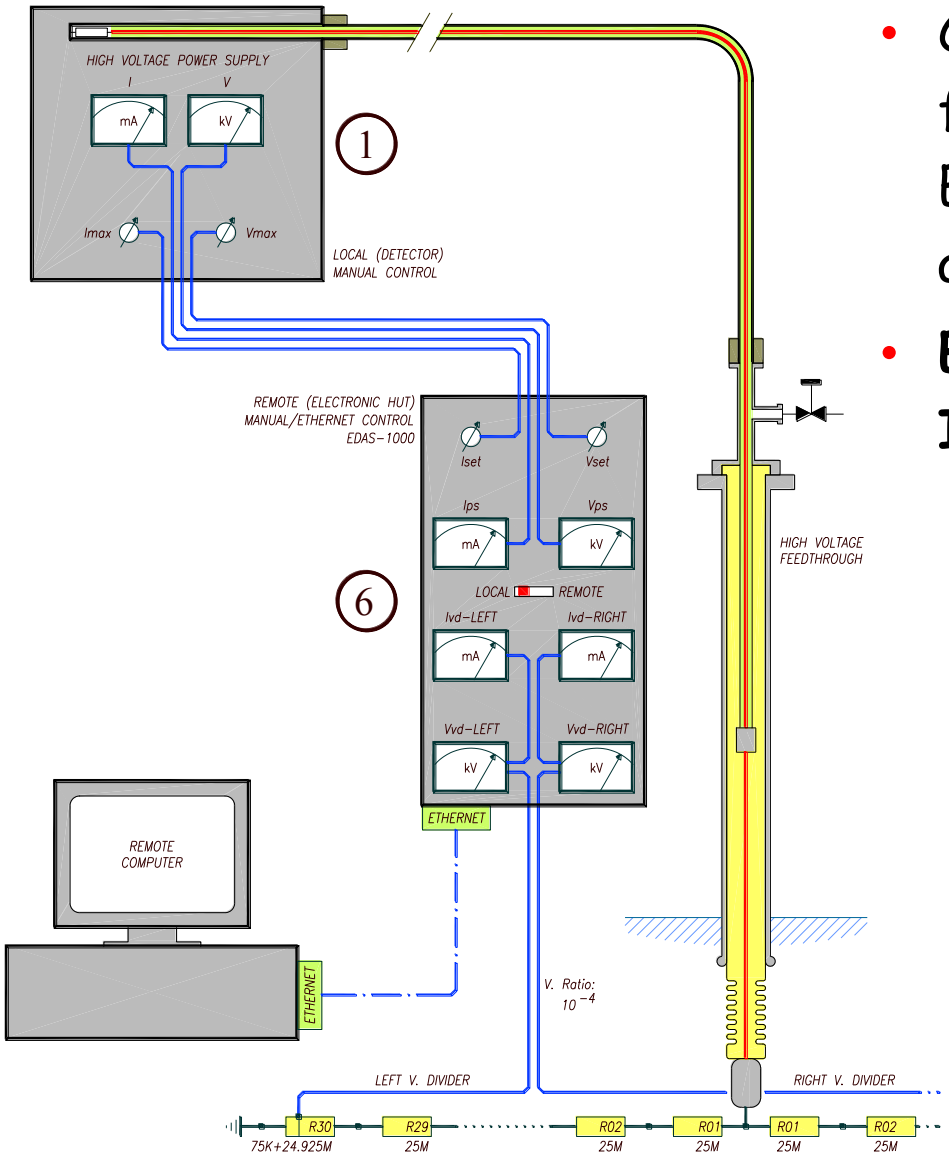
VME crates for PMT readout electronics

- 8 VME crates, containing the CAEN V1730B digitizer boards.
- 9-pin RS-232 I/O interface.
- Interfaced to Ethernet through Beckhoff analogue I/O modules without PLC.
- Male 9-pin plug with a voltage divider to bring the 12V down to the 10V of the Beckhoff prepared.

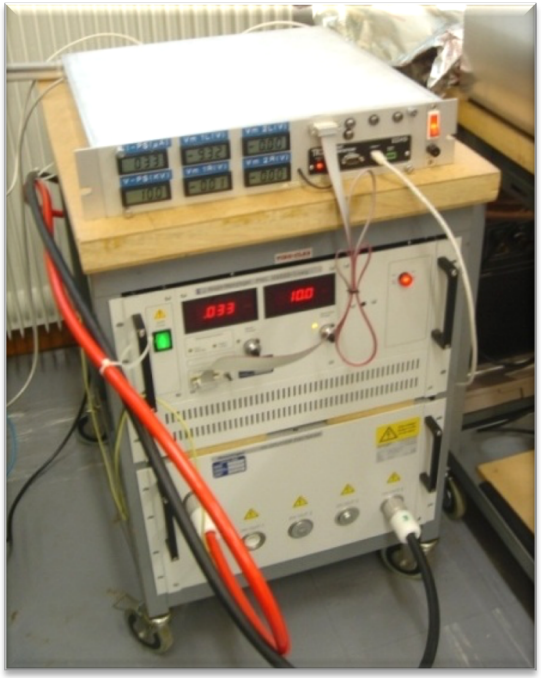


- Control of operation voltages through Epics software developed.
- **TO BE TESTED AT CERN by end 2018**
- Contact person: N. Moggi

HV system for TPC cathode

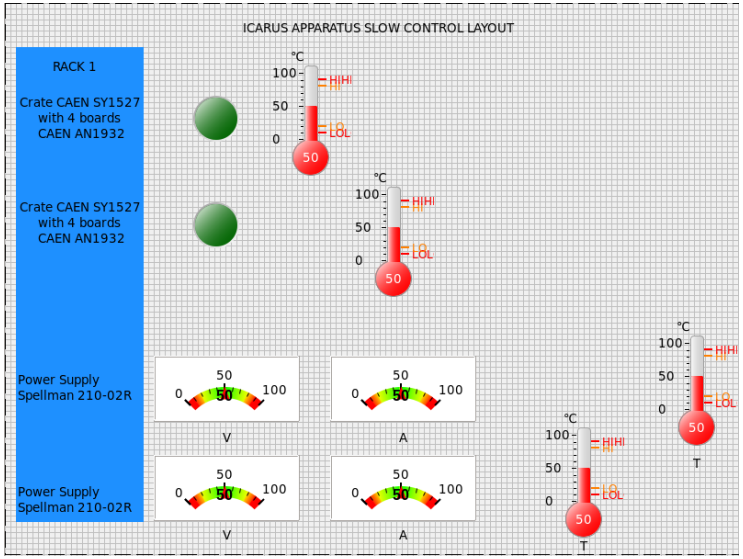


- Control system of the cathode HV from previous operations based on EDAS-1000 interface to Ethernet and LabView software.
- **EFFORT URGENTLY NEEDED FOR INTEGRATION WITH EPICS.**



Other components and high level software

- Other components (ex: building webcams, managed power distribution units) common with SBND.
- Most of the high level software in common with SBND:
  - ✓ interface from cryogenic control (IFIX) to detector control (Epics);
  - ✓ data archiving into database;
  - ✓ graphical user interface based on CSS.



- **EFFORT NEEDED FOR TAILORING COMMON TOOLS TO ICARUS NEEDS. To be completed by June 2019.**
- Test-stand facility set-up at Fermilab D0 building: TPC electronics, power supplies for wire bias, power distribution units and servers.
- **OPPORTUNITY FOR ONE PERSON TO TAKE RESPONSIBILITY OF THE TEST FACILITY!**

Backup

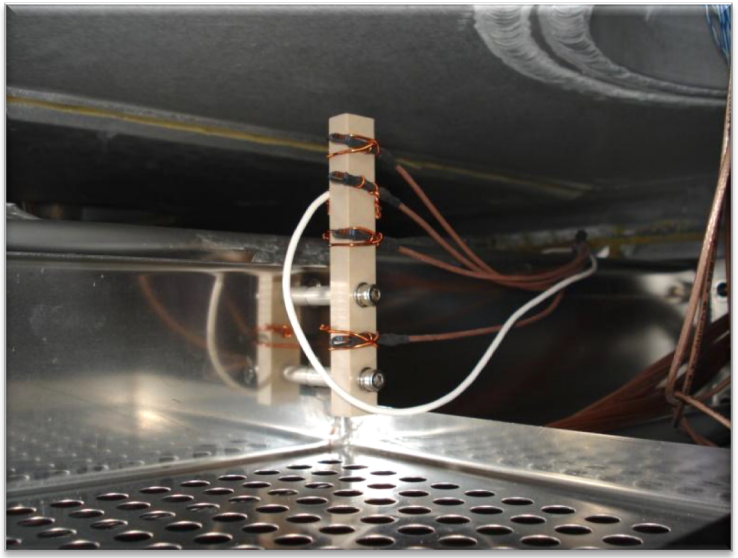
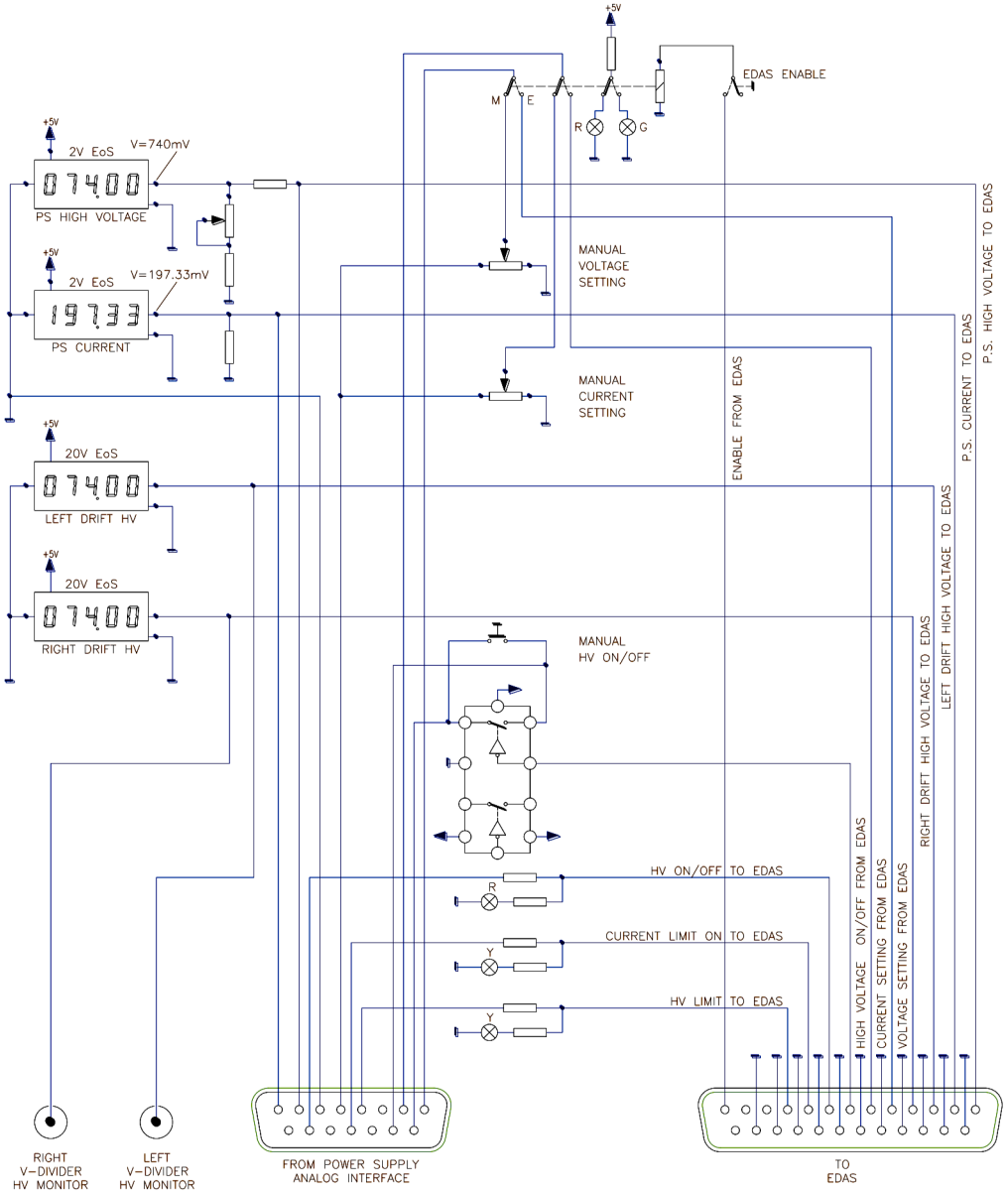
Inner sensors

Resistance Temperature Detector (RTD)

- 30 per T300 cryostat
- Pt1000 in cryostat 1, Pt10k in cryostat 2
- Provide interlock during initial LAr fill ($T_{max}-T_{min}<50^{\circ}$ C)
- Monitor LAr temperature during normal operation

Resistive Level Meters (RLM)

- 4 per cryostat (five 470Ω resistors per RLM)
- Resistance lowers ~25% in LAr
- Alert when nearing top during initial fill
- Monitor LAr level during normal operation



Cathode HV control schematics