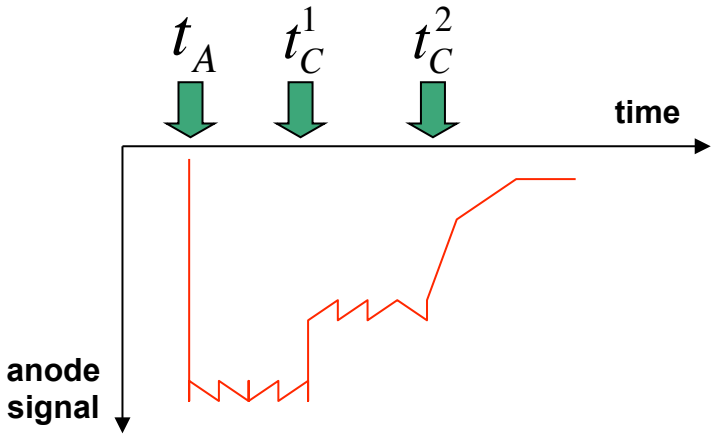
Electronics for Commissioning

- Signal characteristics.
- Readout & electronics overview.
- Plan.

Tracker Cells



Note : $t_{\text{drift}}^{\text{max}} \sim 5\ \mu\text{s}$

$\left(t_C - t_A\right)^{\text{max}} \sim 100\ \mu\text{s}$

Cell recovery time ~ 1 ms

Signal Properties :

- The transverse distance is inferred from the drift time, which is the difference between the anode time and an external (calorimeter) time.
- Cathode times can be measured at the wire ends or, in principle, inferred from the shape of the anode pulse plus a singe cathode time to break the 2-fold degeneracy.
- Longitudinal distances calculated as :

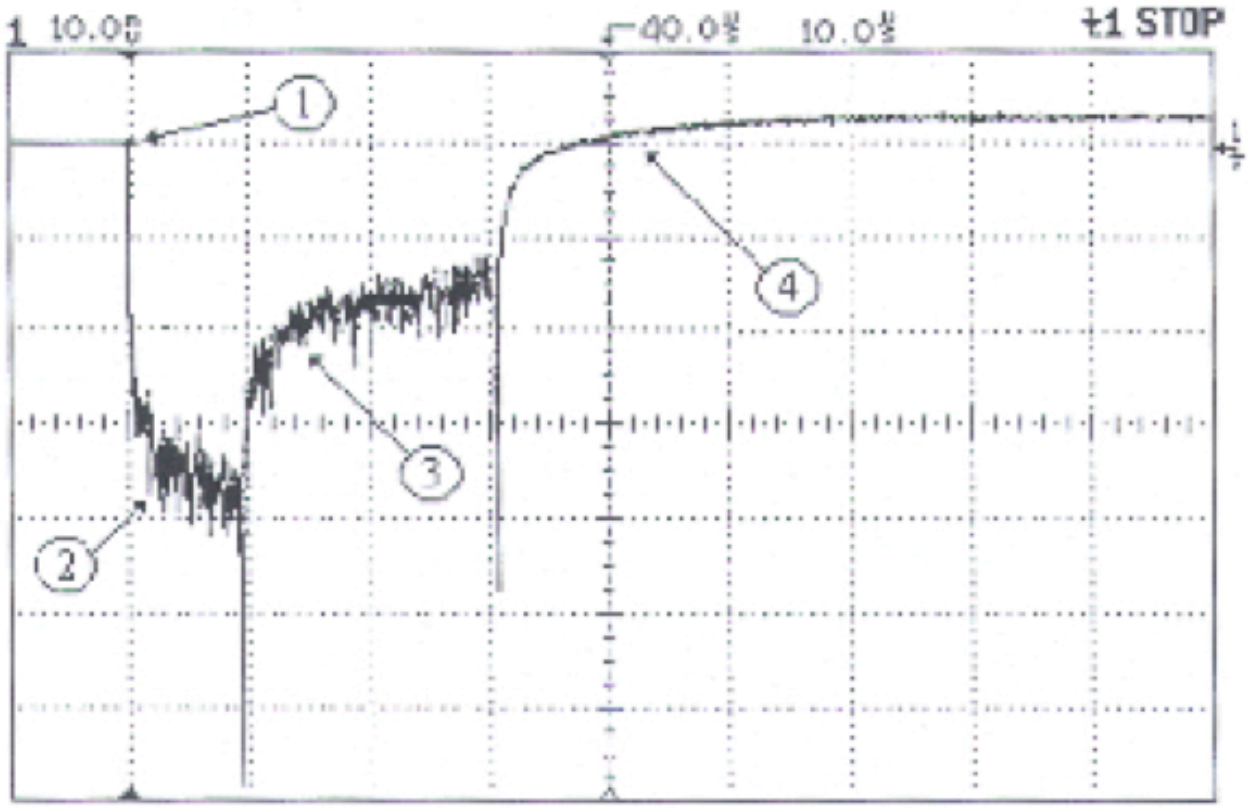
$$\left(t_C^{1,2} - t_A\right) \times v_{\text{plasma}}$$

- No information in pulse shape (Geiger mode) other than timing.

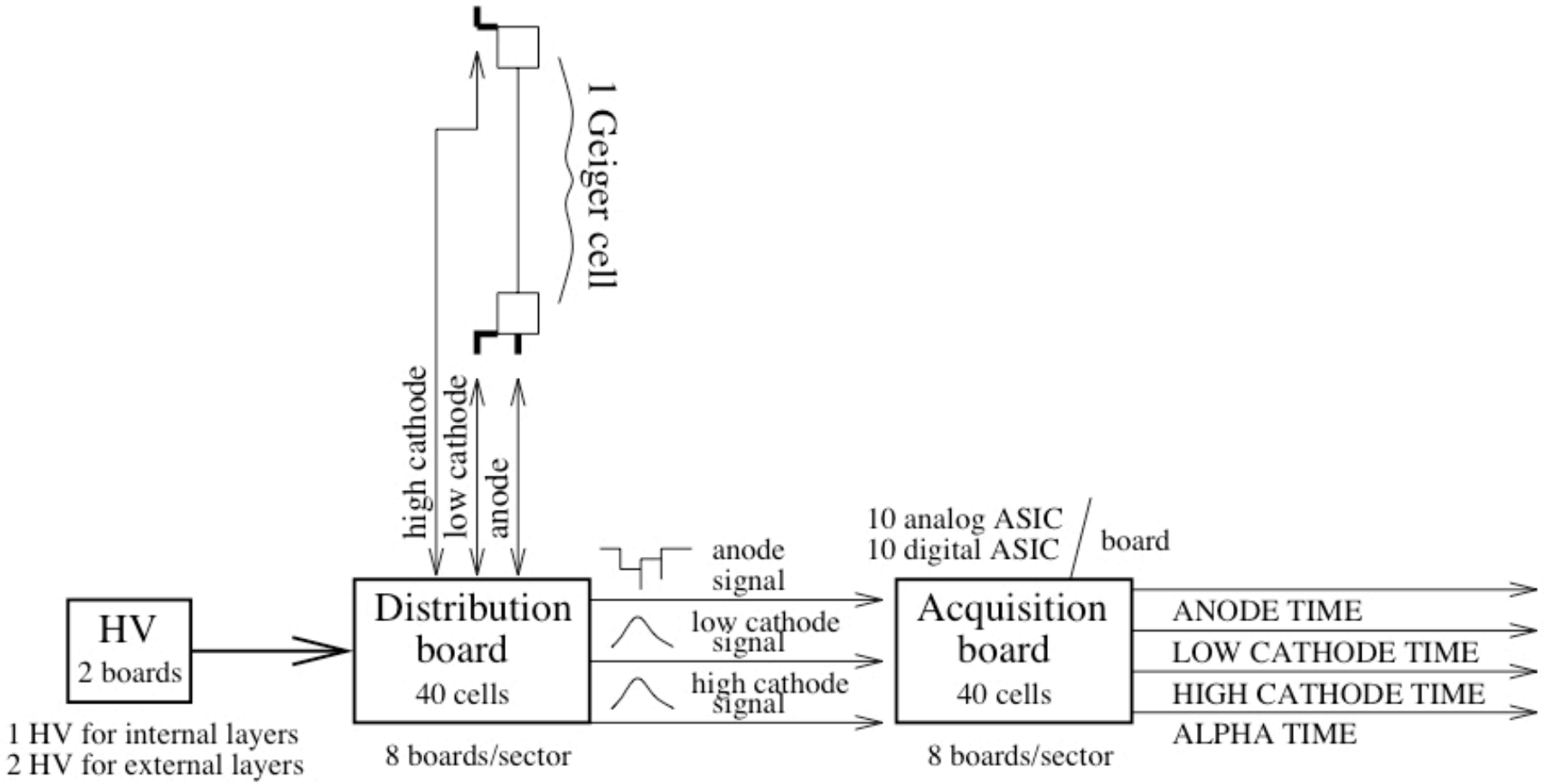
Anode Pulse Structure

Real anode pulse :

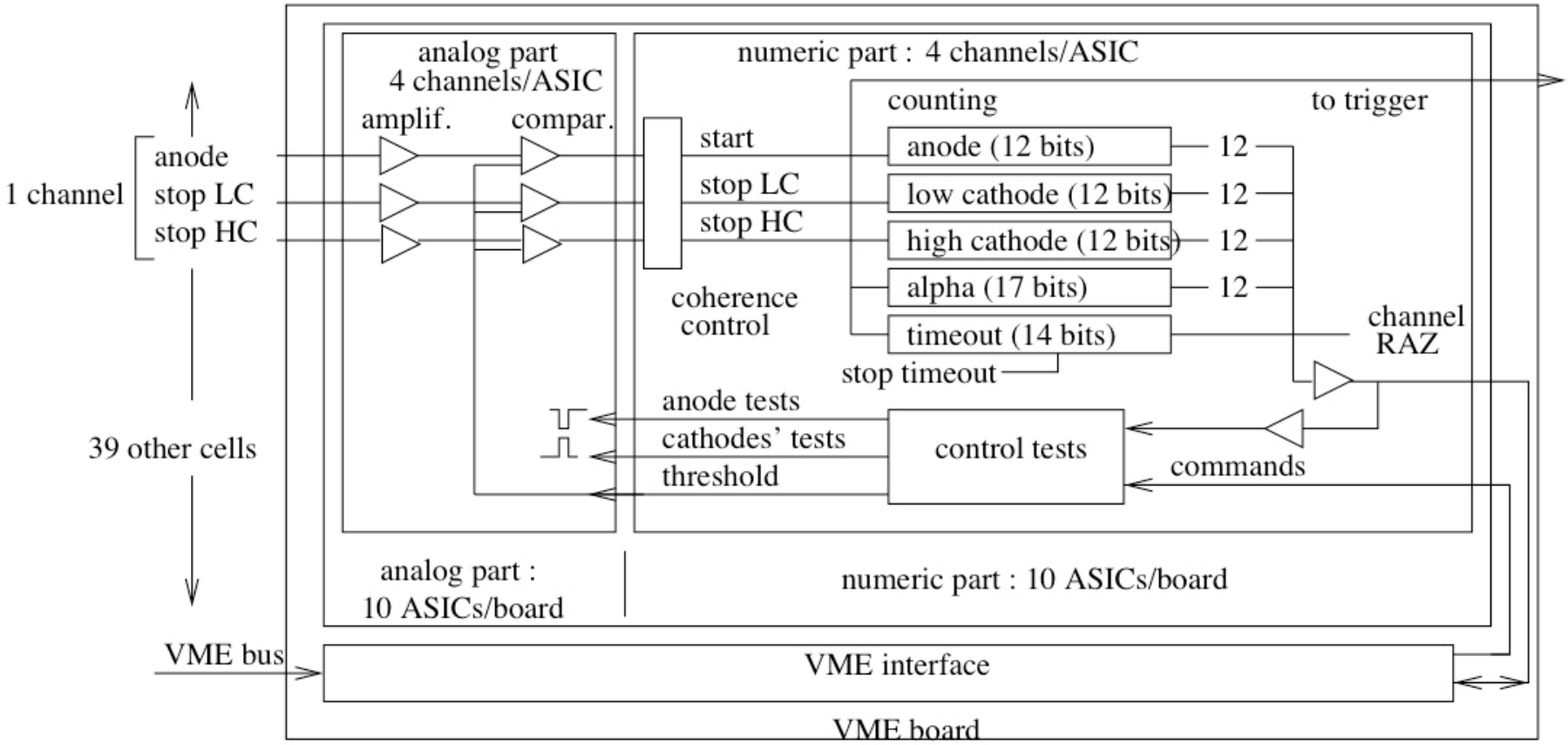
- Pulse height 25-50 mV (input impedance = 250Ω)
- Total pulse duration ~50-100 μs



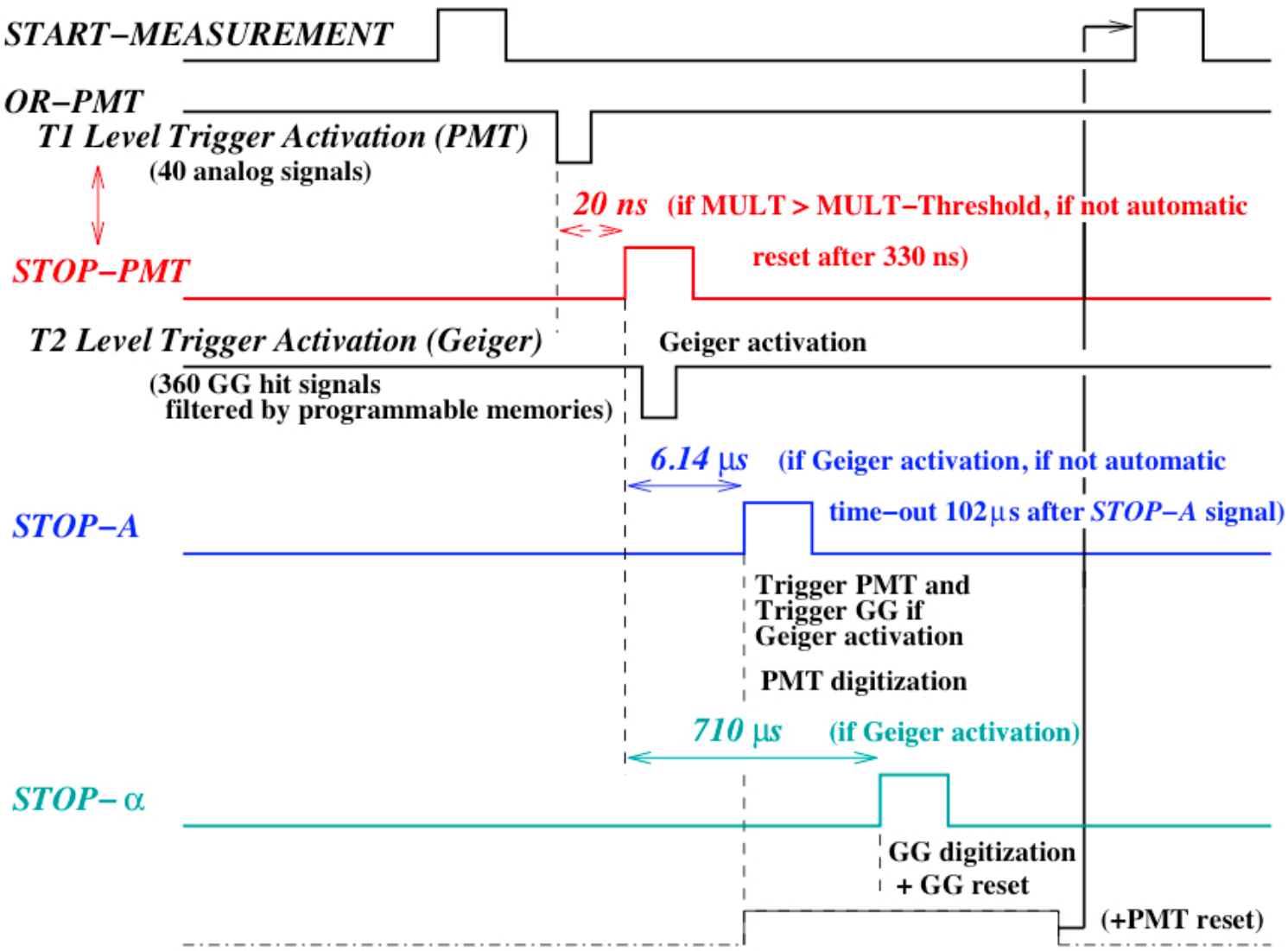
Tracker Decoupling and Readout Schematic



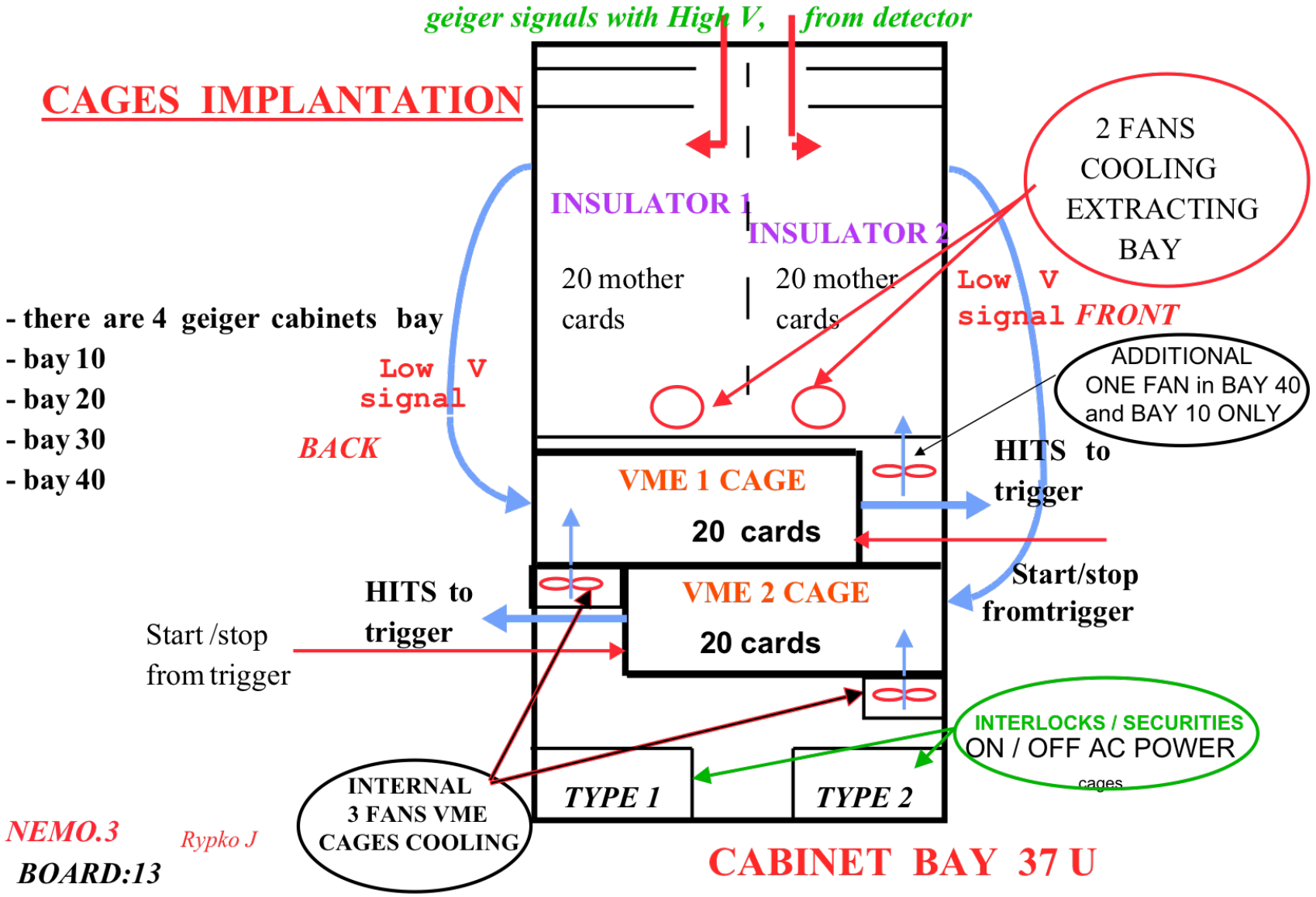
Geiger Card Schematic



Readout Timing Diagram



NEMO-3 Geiger Racks



NEMO-3 Electronics In-Situ

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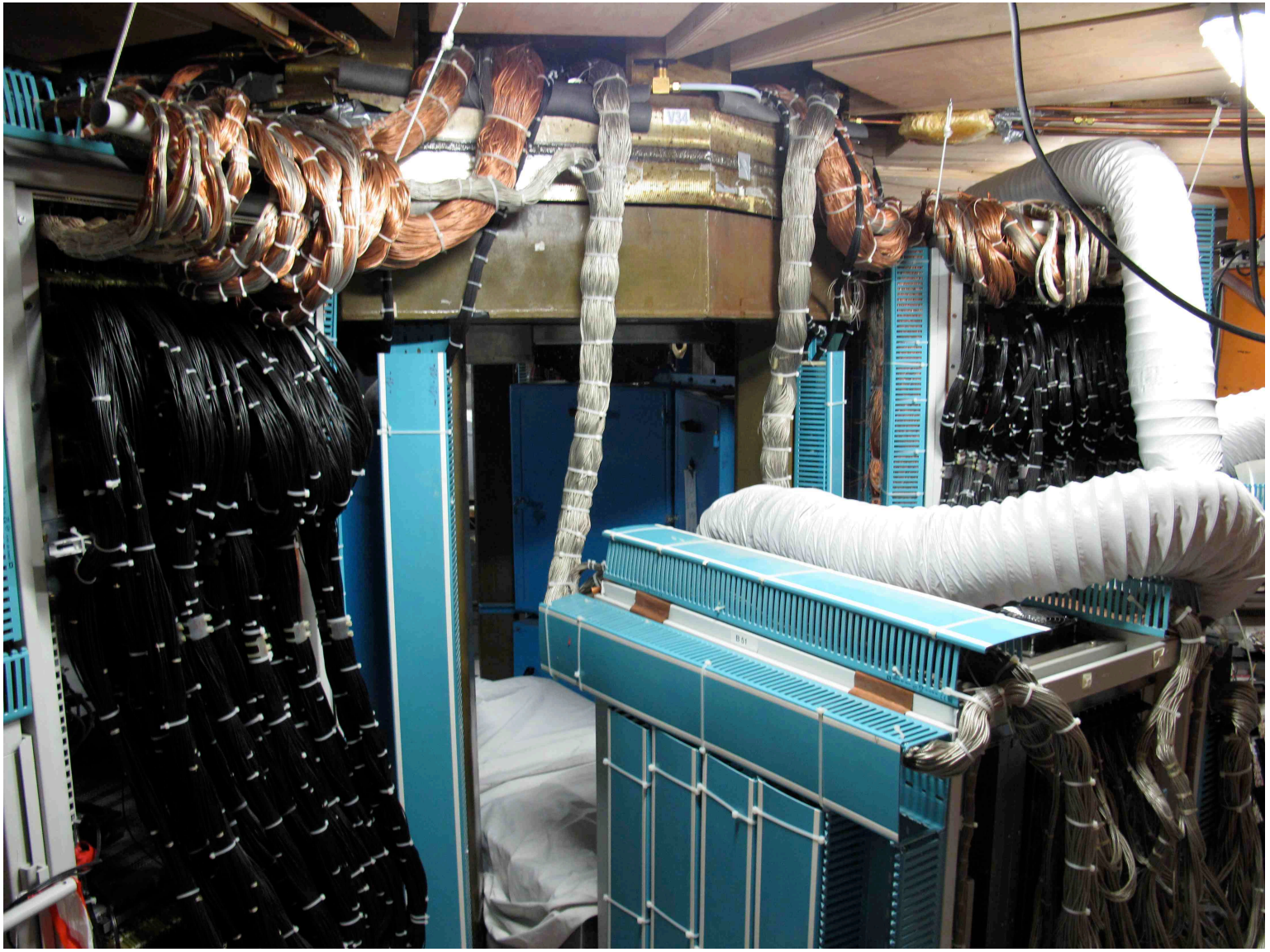
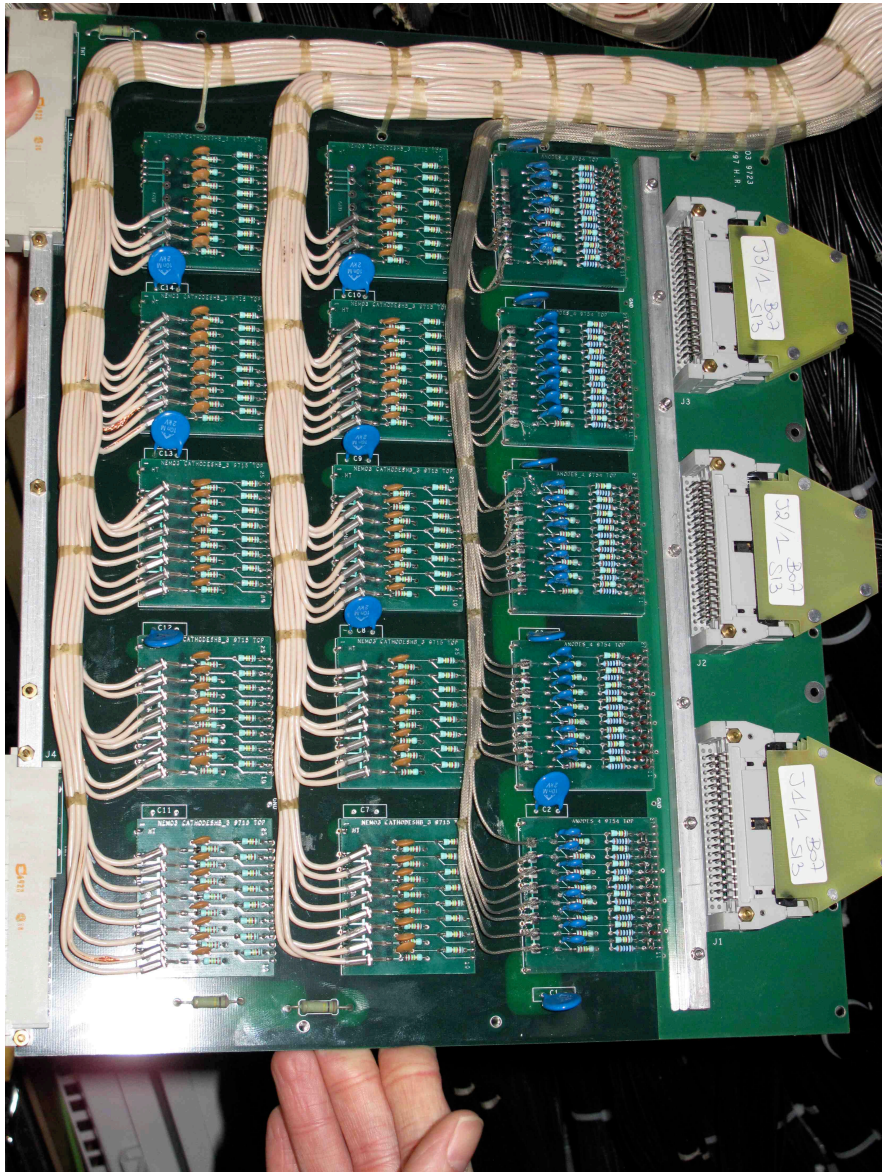
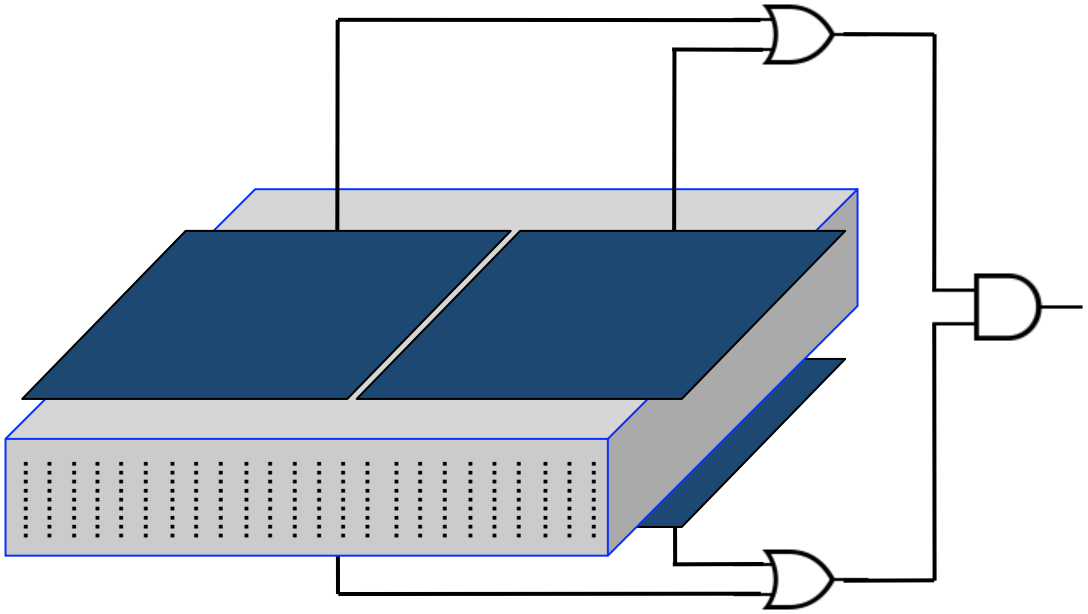


HV Distribution Board



Planned Arrangement for Commissioning

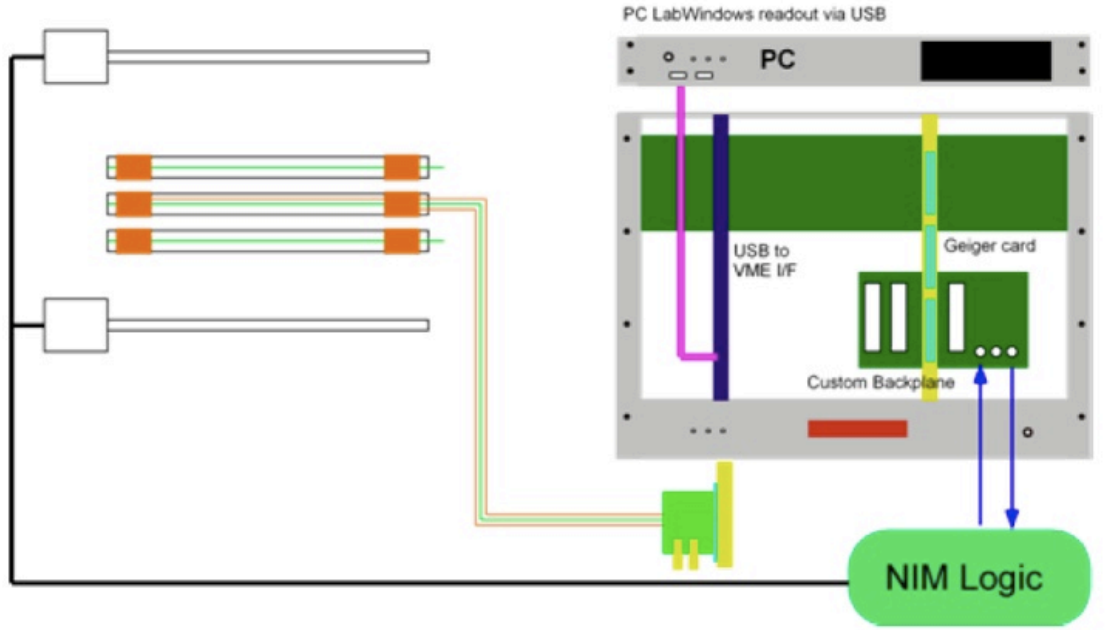
- Plan to use scintillators from MINOS ~ 1m×1m to trigger on cosmic rays :



- In addition to DAQ work, need to prepare hardware – scintillators, frame etc.

Planned Arrangement for Commissioning

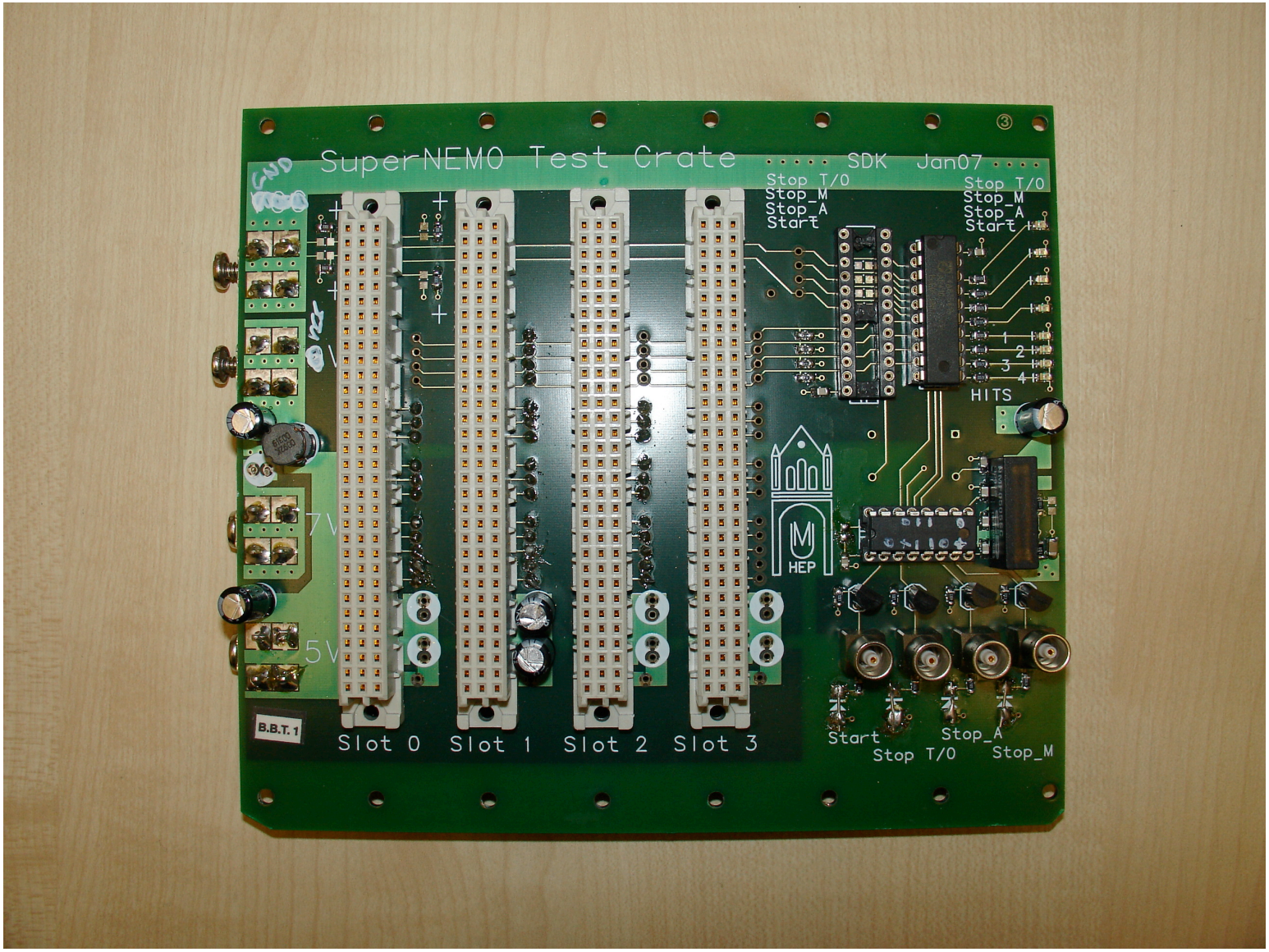
- Plan A is to adapt/extend the readout scheme for the 90-cell prototype at Manchester.
- [Plan B : recover and re-use the entire NEMO-3 DAQ system]



Adapting the Manchester DAQ

- Scale up from 90-cells to ~500 cells. Possible bandwidth bottlenecks ?
- Existing custom backplane only accommodates 4 cards, we need 13 cards. Use NEMO-3 crate or make an extended custom backplane.
- We'll need to re-write readout software.

Manchester Backplane



Plan

- Put the Geiger cards we have into a VME crate.
  - What to use for backplane – Manchester spare, custom/breadboard ?
  - Try reading them out over VME – start the development of the readout software etc. Do we have something we can start from ?

- Develop a very simple signal generator capable of testing the Geiger cards.
  - Matt's ideas for an FPGA development board based approach.
  - Doesn't need to be complicated. We need to test 1800 channels or about 15 cards including spares – not impossible to do it by hand in batches of ~40 channels a time. If the basic unit of testing was a whole card (120 channels) that would be convenient.
  - Should also simulate the delayed "STOP" signals from the trigger system.

- In March we will recover the racks themselves at MSSL.
  - Decide whether to use the NEMO-3 VME crates (already customised, but can we use our existing VME-USB card to read them out ?)
  - We'll need to test (and possibly refurbish) the HV distribution cards.