

The LHCb Outer Tracker Front End, what does it look like and what is the status

A Collaboration of:

Nikhef

Heidelberg

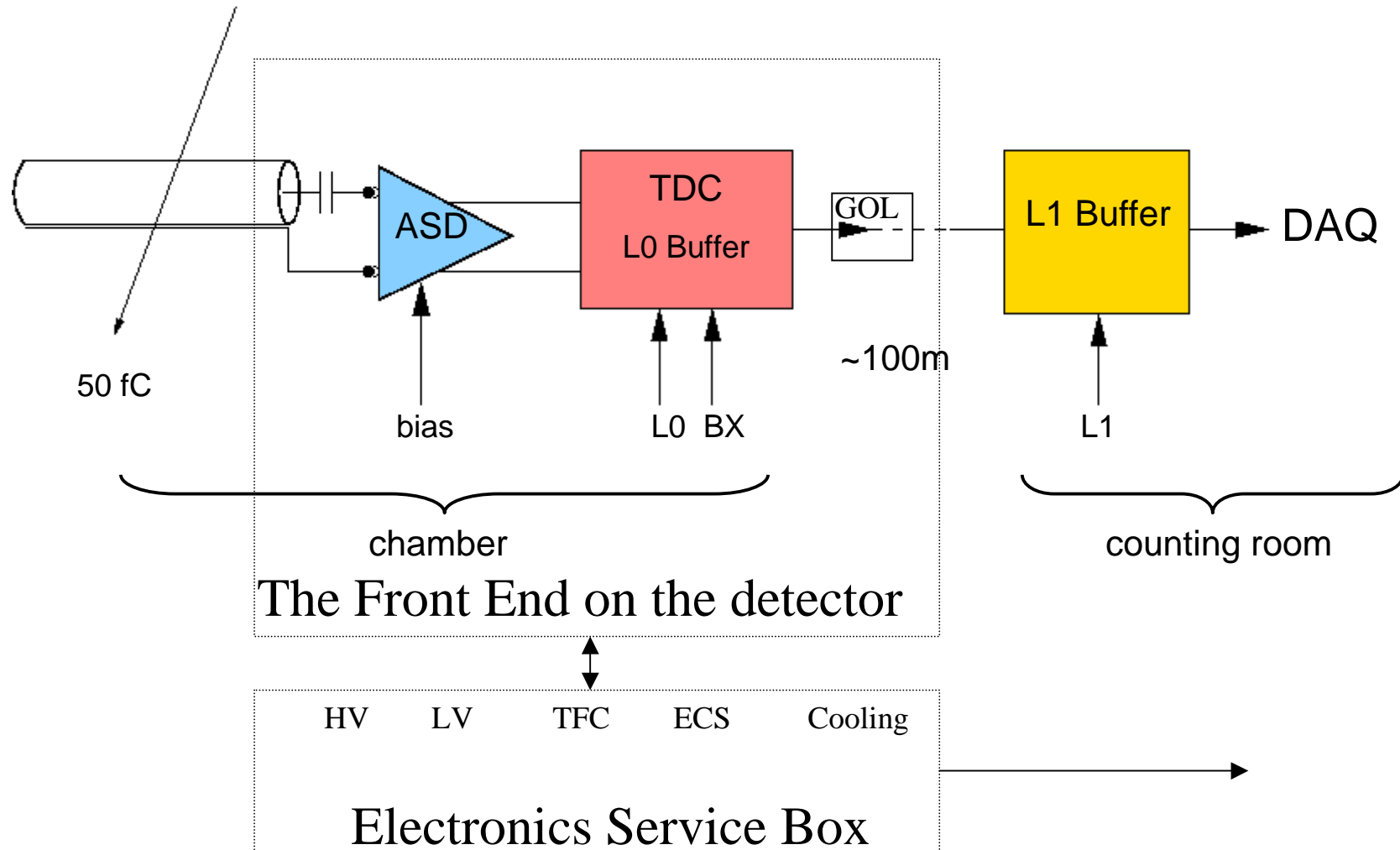
Krakow

Warsaw

Beijing

Talk for the LHCb Electronics Working Group 5-2-2003/TS

What part is on the Detector



Inside of a straw module prototype

Straws without
alu outside



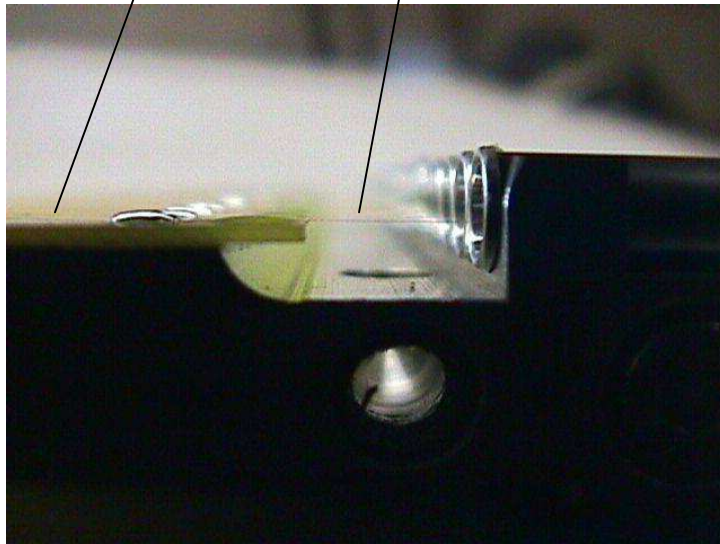
Alu shielding

Gas volume
Feedtrough Board

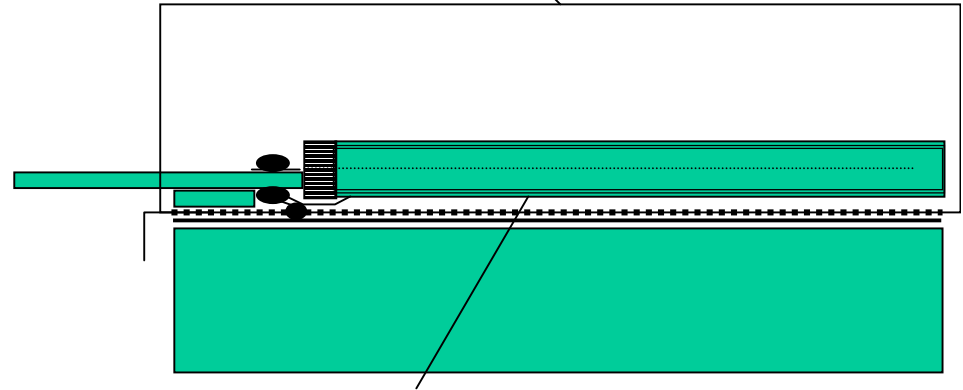
Feed-trough board grounding and shielding

Chamber Feed-trough board (gas tight by gluing)

wire

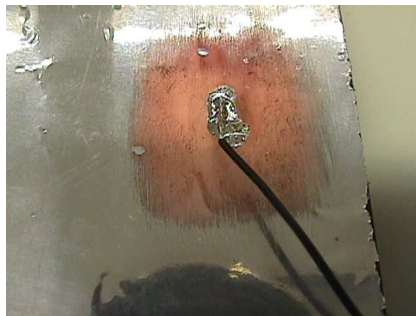


Faraday cage
Shielding alu foil inside chamber box



Alu straw wall for crosstalk shielding
And transmission of fast signals

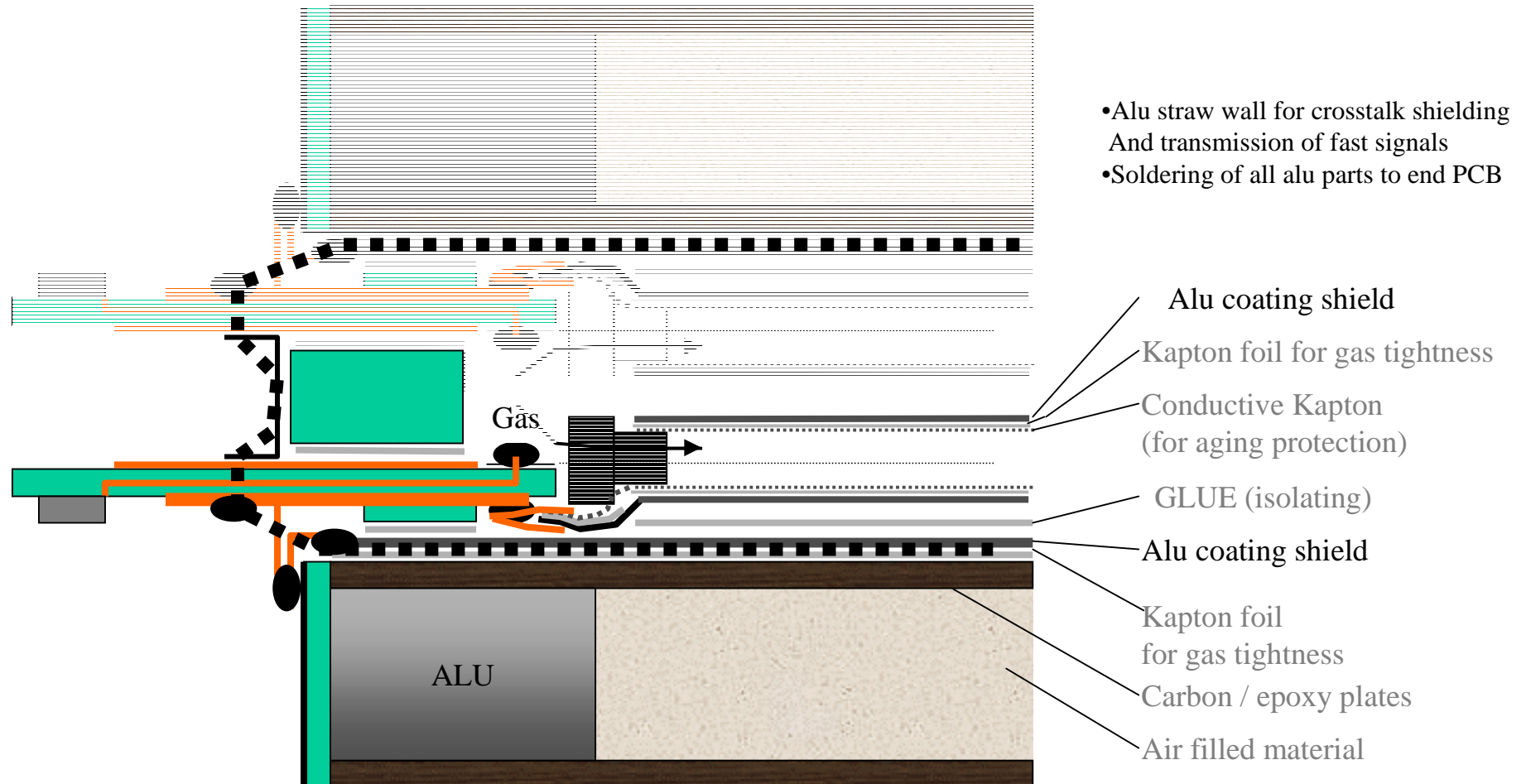
Aluminum connection developments



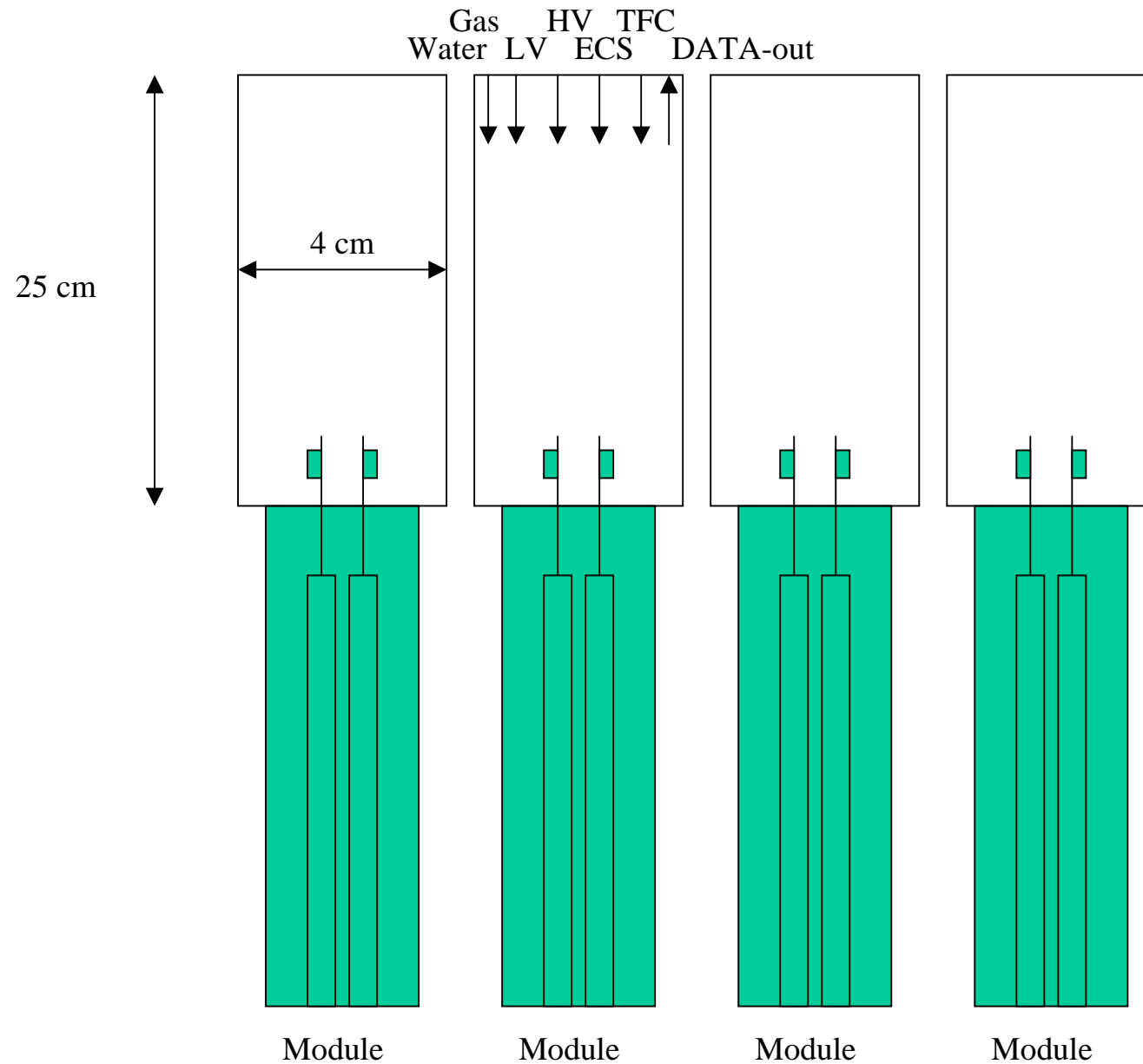
Aluminum soldering after copper plating not reliable
can be pulled of.



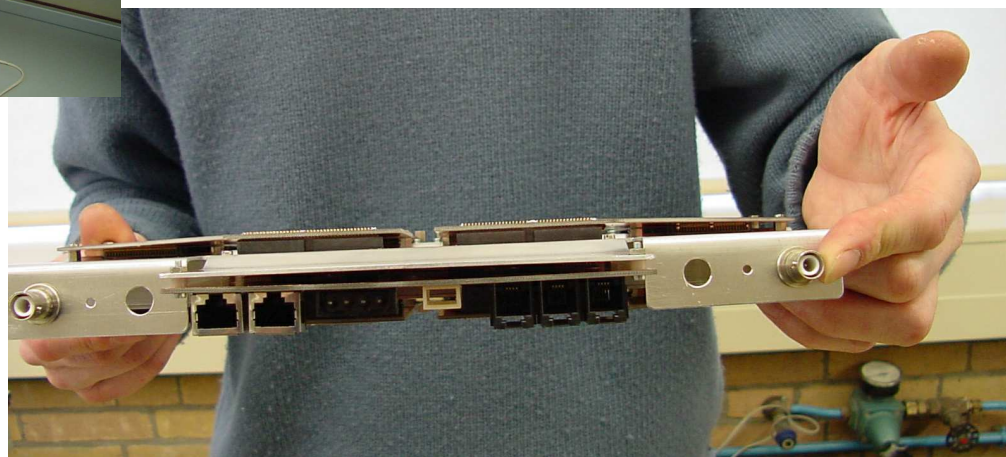
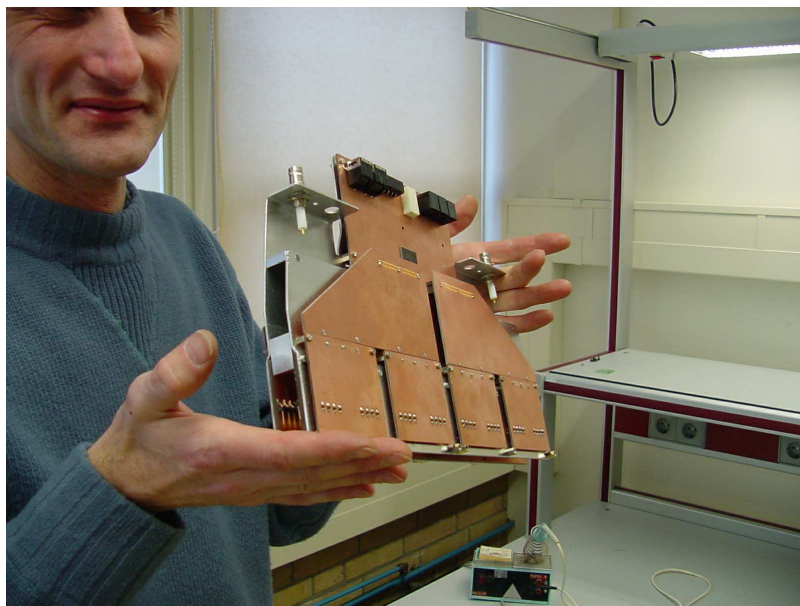
Grounding and shielding of the critical detector sensor part



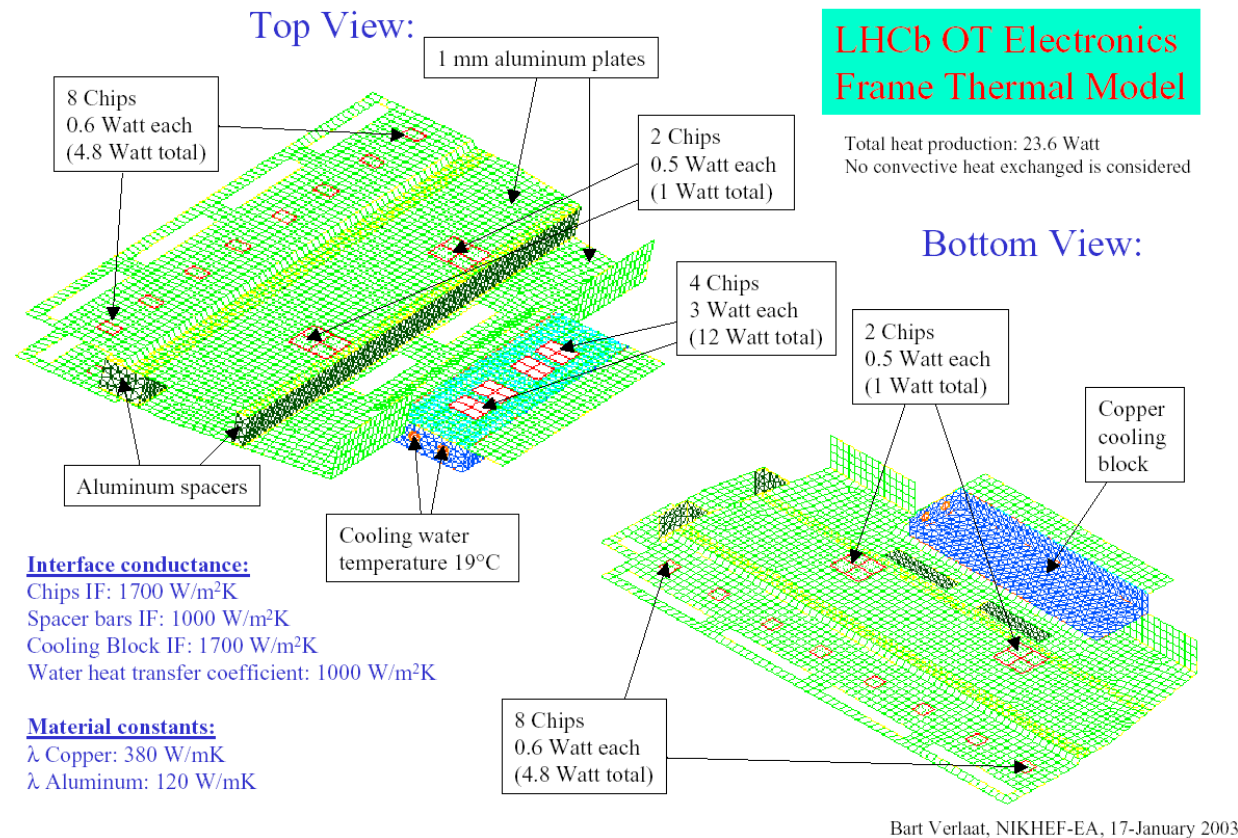
Tight packing of 4 module layers in 1 station demands packed electronics and cooling



Mechanical model of detector electronics without shielding box



Dissipation and cooling



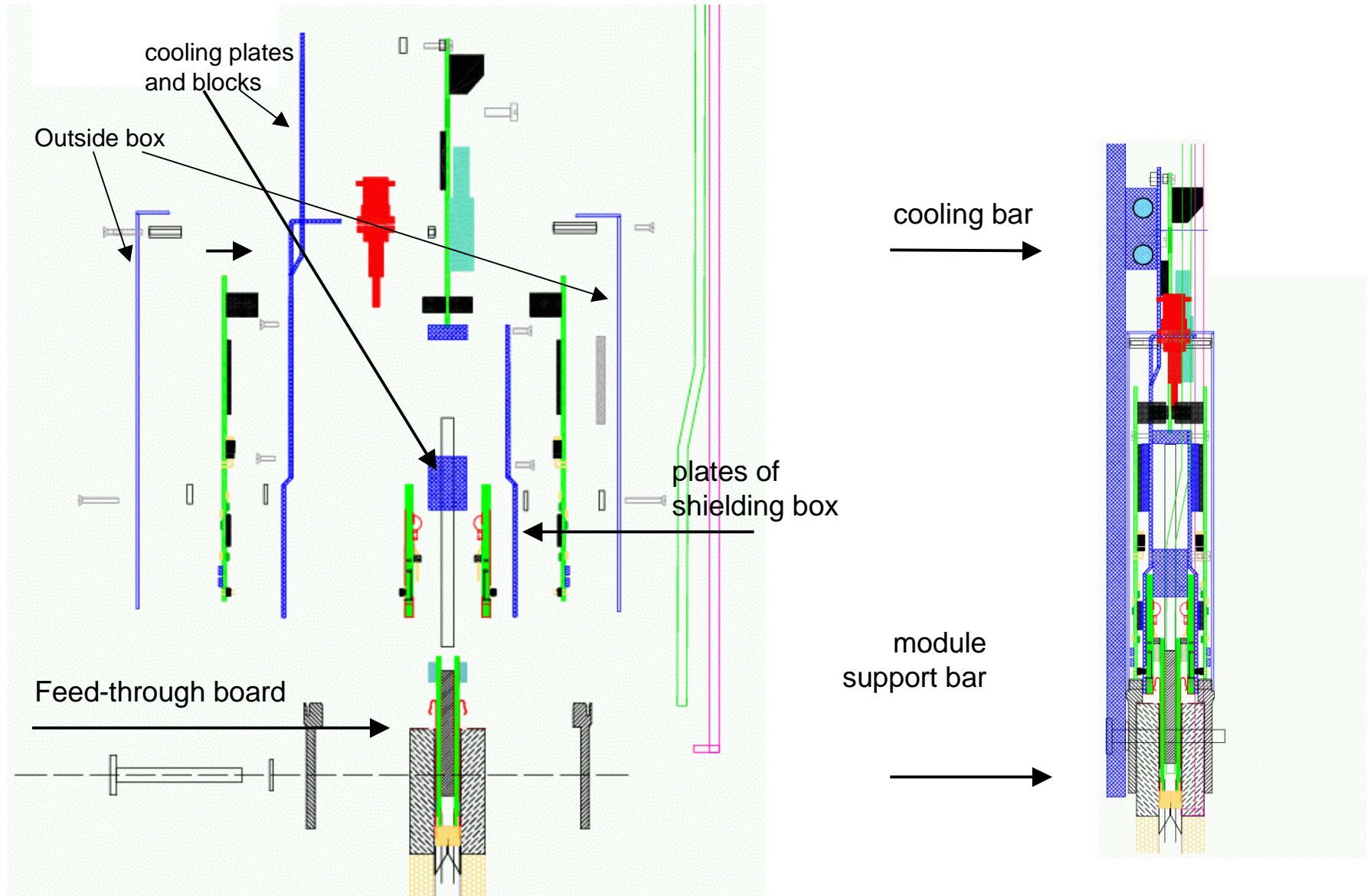
- Airco hall can cool only 80 kW in total, so no dumping in hall !

-our Detector electronics Heat production = 10-15KW

- if using air cooling should be closed circuit with water cooler
But air gives dust on HV boards

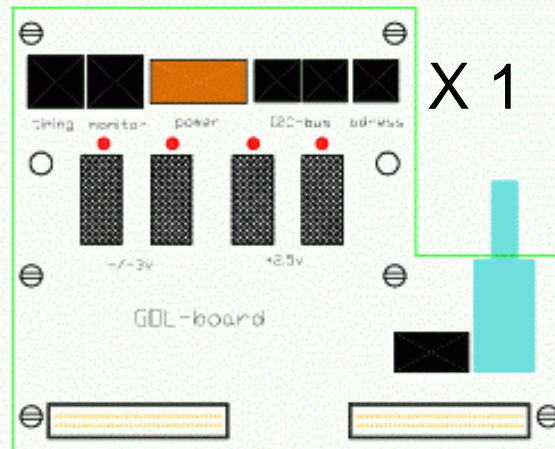
-Water cooling ok for HV board leakage currents, if above dewpoint (13 degr guaranteed?)

The Detector Electronics box

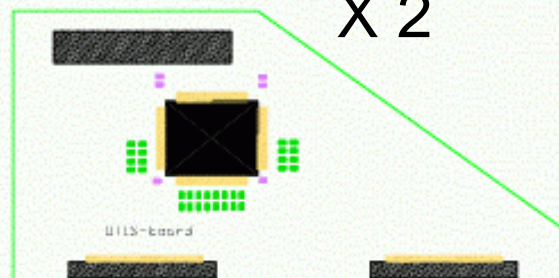
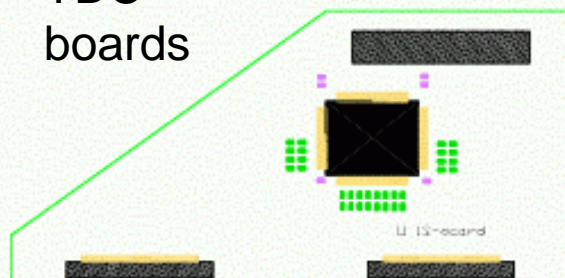


The Boards inside the box

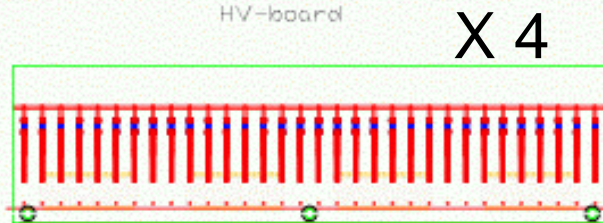
GOL/Aux Board



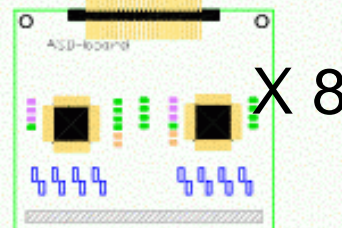
TDC boards



HV boards



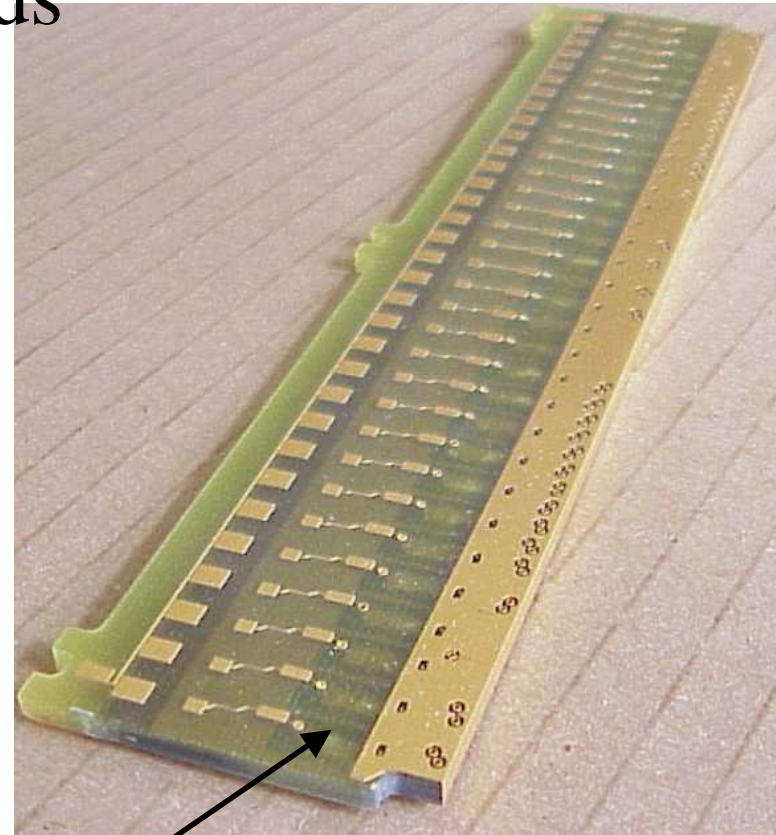
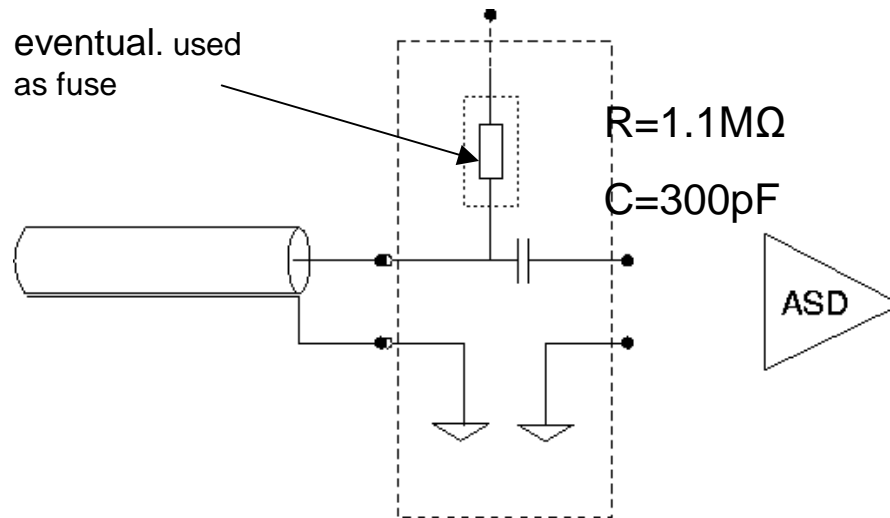
ASD boards



Front-end cards:

- have to fit inside a closed metal shielding box: 22 x 30 x 4 cm
- excellent ground connection to straw-tubes and module reference ground
- power dissipation of cards is about 25 W / box → water cooling
- easy access should be maintained

HV boards

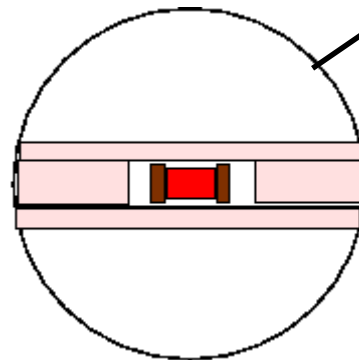


Capacitors:

JOHANSON 302R29W331KV4E

Max. Volt.: 4kV

Size: 5x4x2 mm³



32 channels per board

Capacitors embedded in PCB:
Company xyz in GB

Results HV Board tests

We want much less than 50 on 50000 channels broken, less than 0.1%

With 32 caps in a board we have to throw away too much.

Must be reliable over the years.

Thorough testing and thermal cycling needed

HV caps Johanson come tested to 4KV

Typical need 1500V

RESULTS UPTO NOW:

-14 days tested at 2.5 KV: 1 “shorted capacitor 100k ohm”

then high current burnout, then sawn open, noting to see

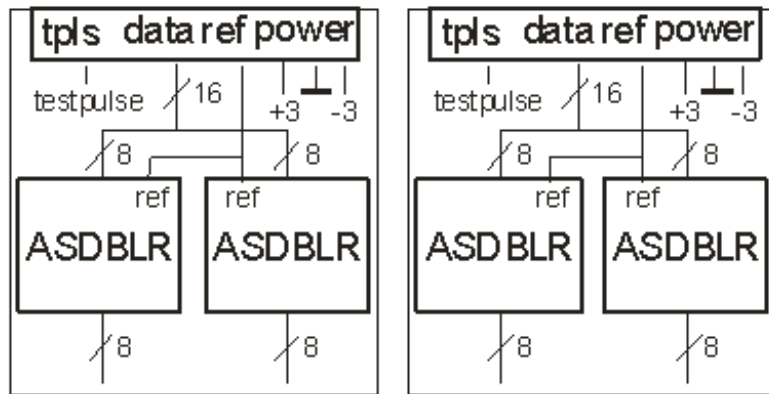
After this 14 days cycling from 25 to 65 deg C

1 open connection, broken by stress? Still to be investigated.

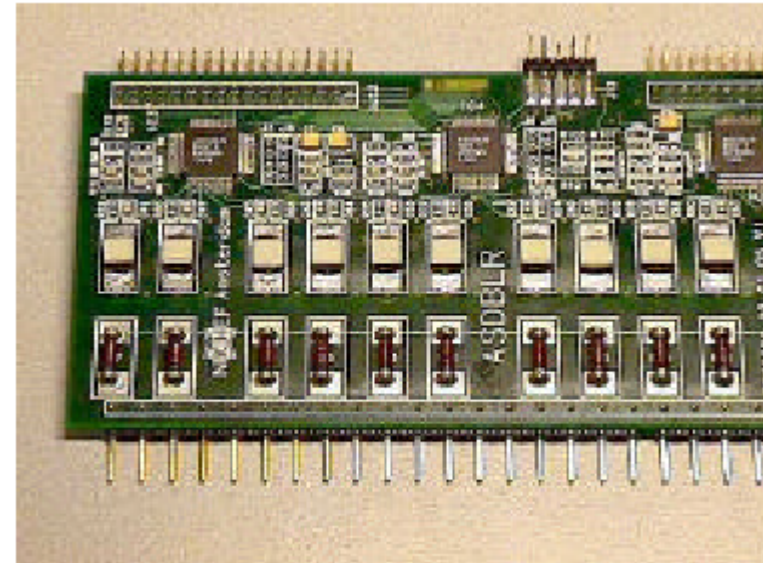
Further investigation needed

Second revision will be made

ASDBLR boards



min.
38 pins
connector

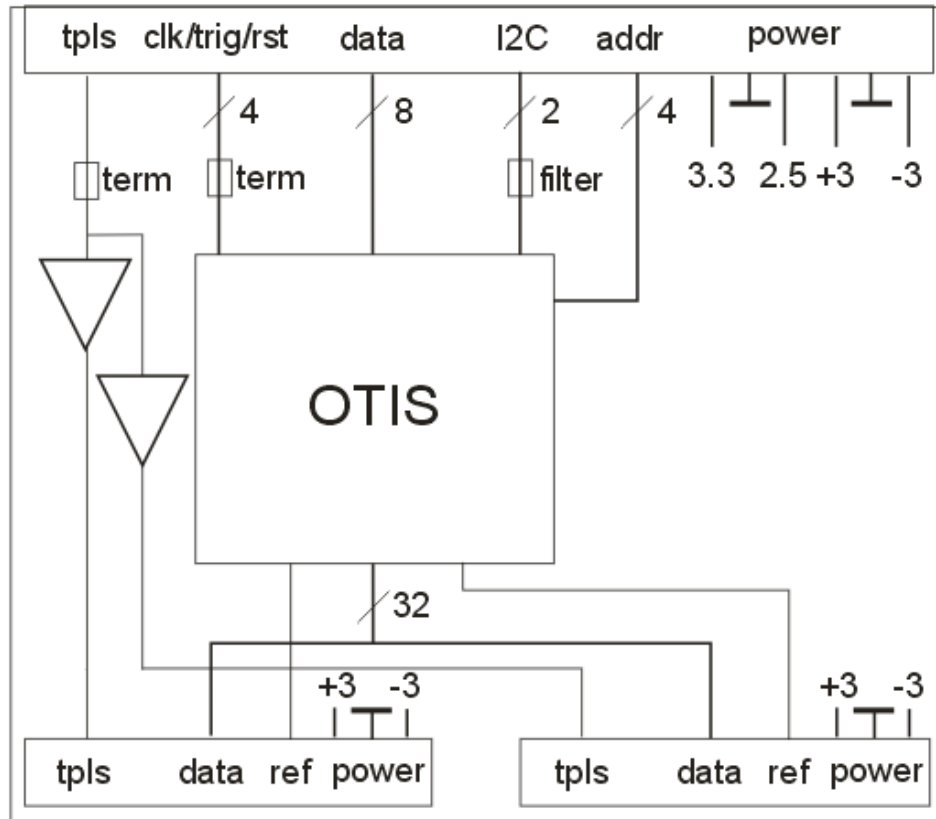


Older prototype (98) with asdbl, HV caps, and regulators on backside, No tdc yet

ASDBLR chip:

ATLAS DMILL version

OTIS card

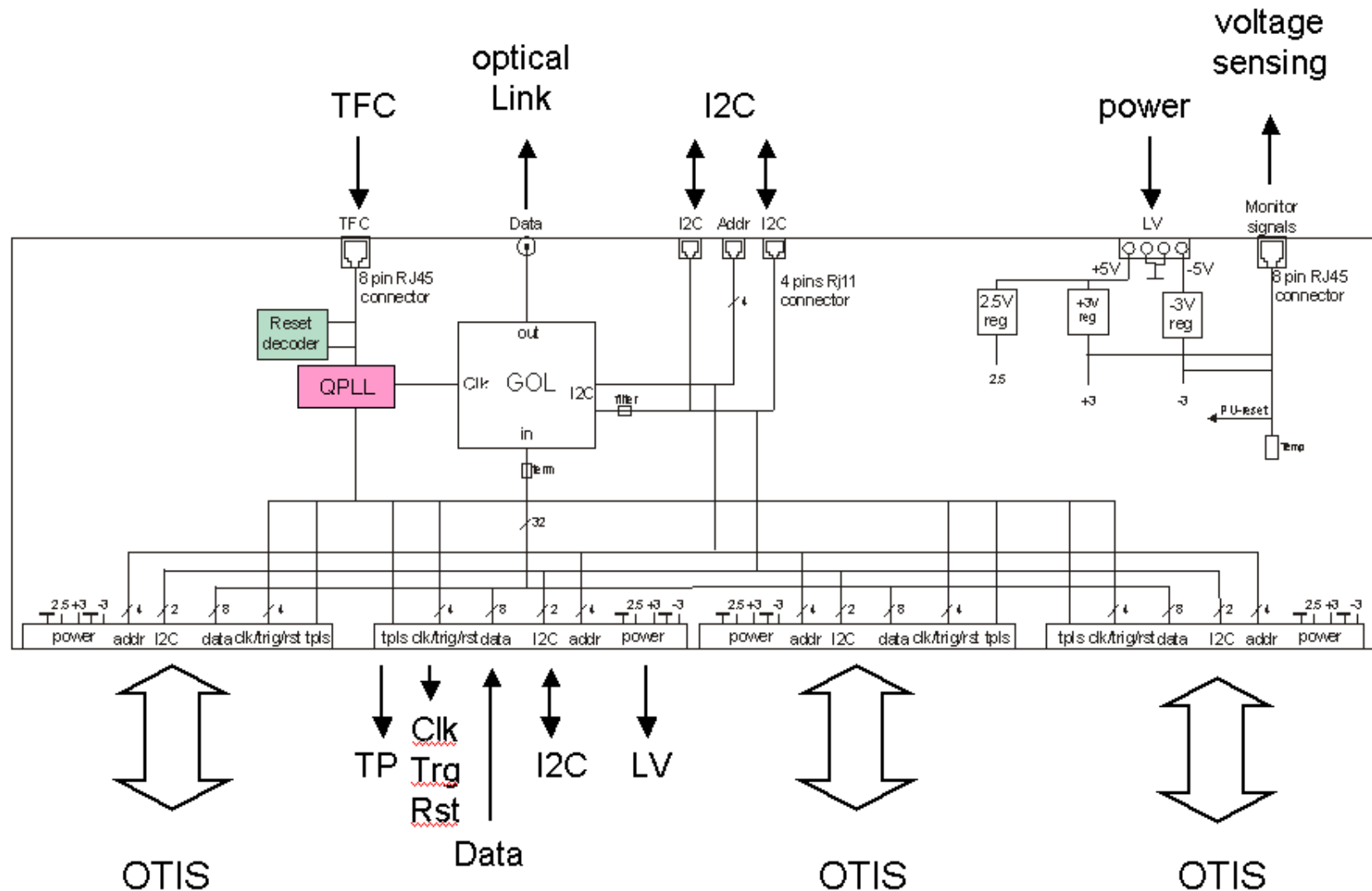


TDC board:

- radiation hard OTIS TDC chip
- provides bias voltage for ASD
- power rooting for ASDBLR card
- test pulses for ASDBLR

GOL/AUX CARD

the interface to the outside world



Conclusion

- Design: what we want seems clear. (in collaboration)
- Pre-designs have done well in beam-tests in 1998-2000
- Detector Electronics still to be finalized
 - Cooling construction, prototype boards, pre-production boards
- Some parts already in Mass Production Ordering
 - ASDBLR (with ATLAS)
 - RAD hard regulators
 - TTC components TTCrx
 - GOL