

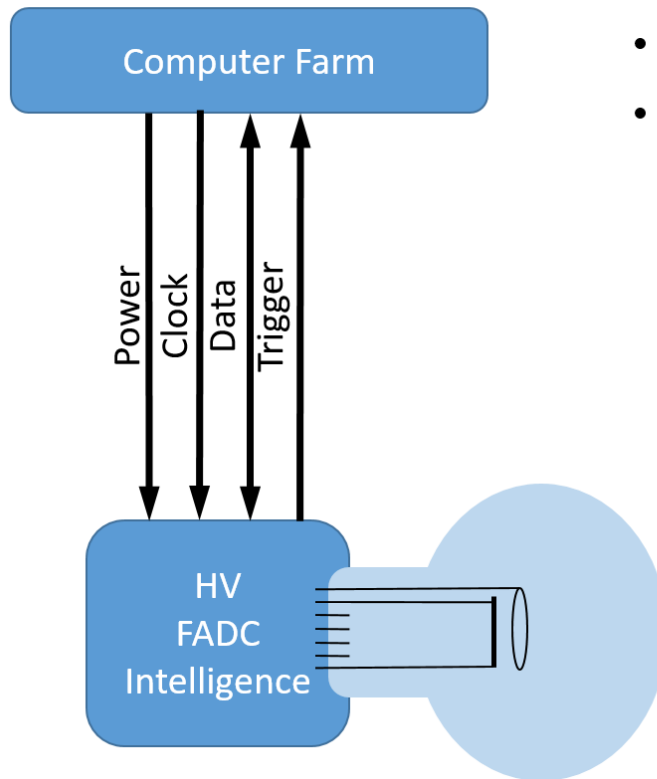
Status Electroncis Development

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19.09.2017

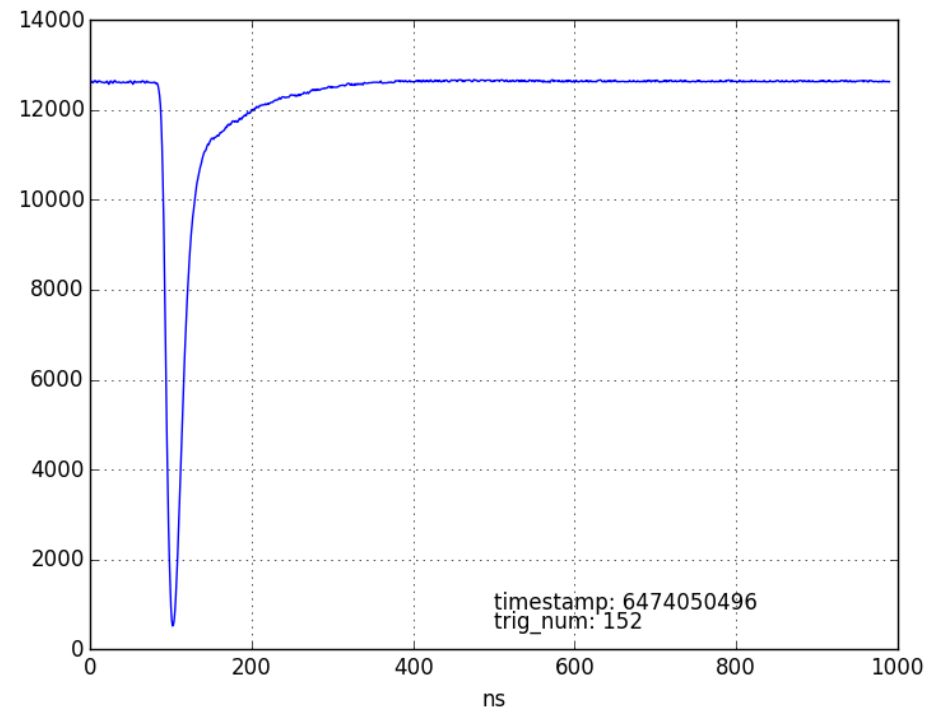
Old BX scheme

Readout – Intelligent PMT



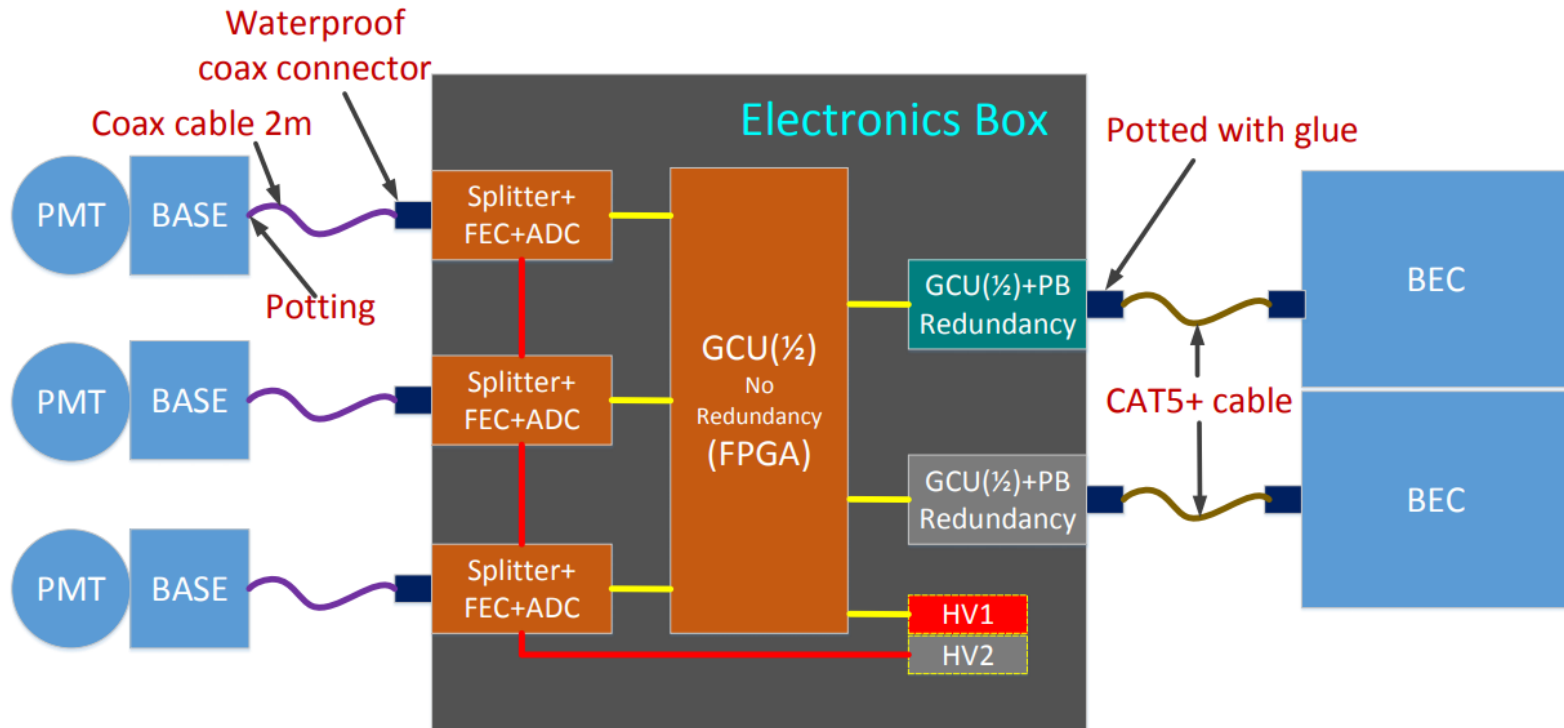
- Electronics mounted onto the PMT
- Intelligence:
 - Monitoring the noise level
 - Adjustment of HV
 - Data buffer
 - Generating trigger signals
 - Waveform reconstruction

First Measurements with the Stack



In June the BX-scheme was rejected as the baseline for the JUNO-experiment

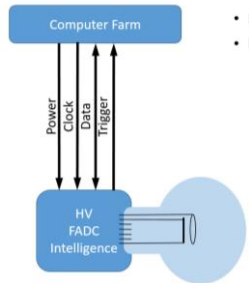
New Scheme: 1F3



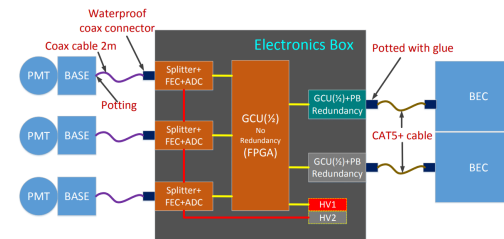
From Xiaoshan Jiang

PMT potting and Electronics development is independent!

BX vs 1F3



- 1 cable per PMT
- 1 FPGA per PMT
- 1 Powerboard per PMT
- 1 HV per PMT
- ADC located at PMT



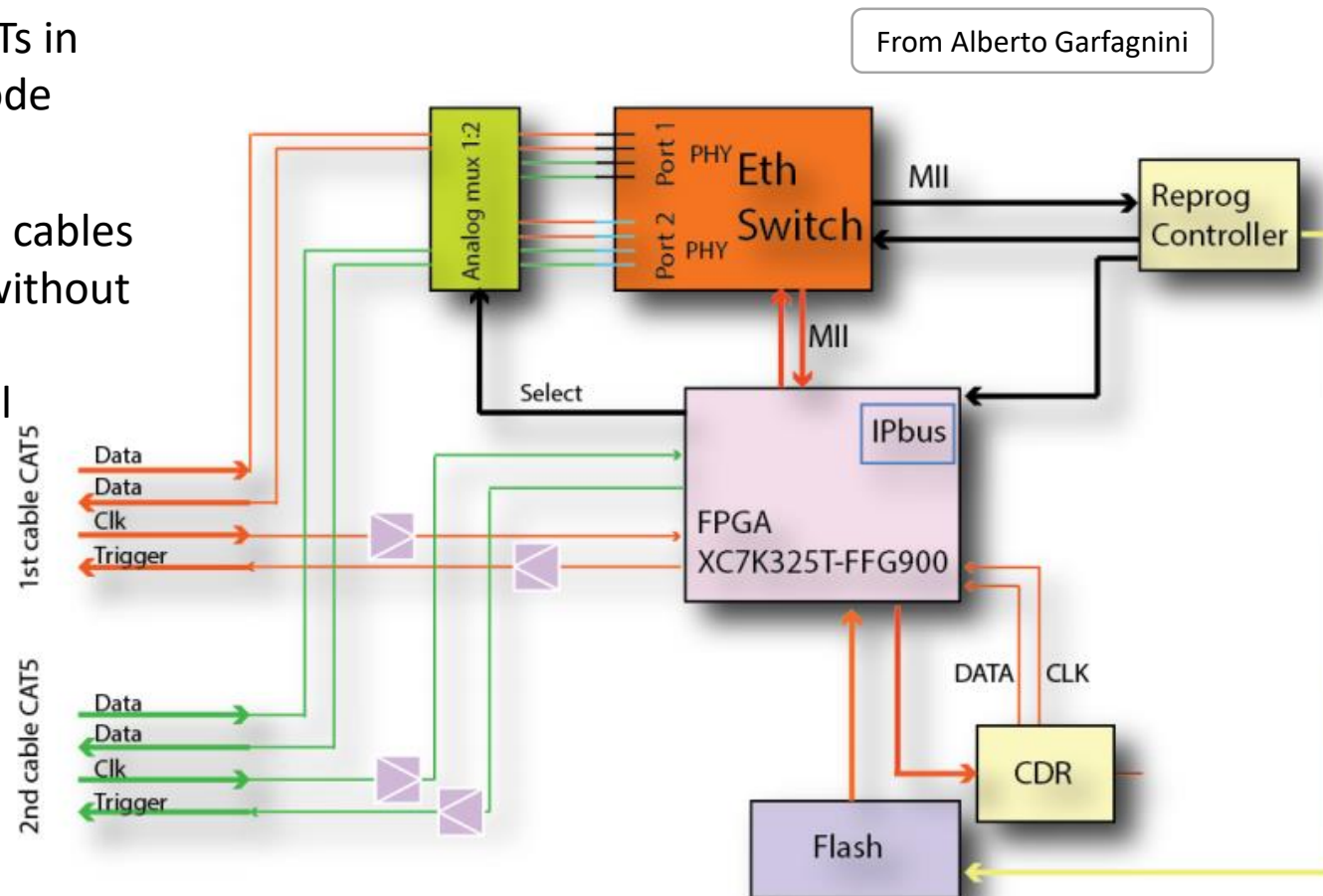
- 2 cables for 3 PMTs
- 1 FPGA for 3 PMTs
- 2 Powerboards for 3 PMTs
- 2 HVs for 3 PMTs
- ADC connected via 1m cable

Status 1F3

- Single 100 Mbit connection not enough for 3 PMTs in self-triggered mode

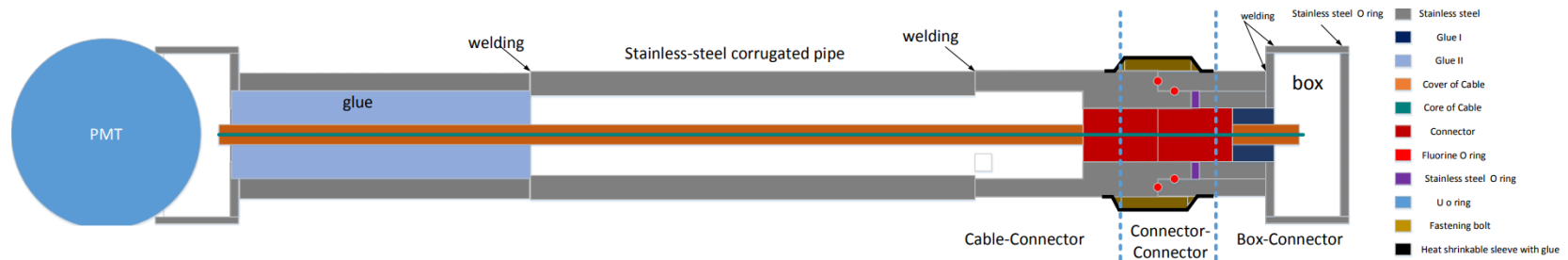
Proposal:

- 2 redundant cat5 cables
- 1 Gbit ethernet without cable fail
- 100 Mbit with fail



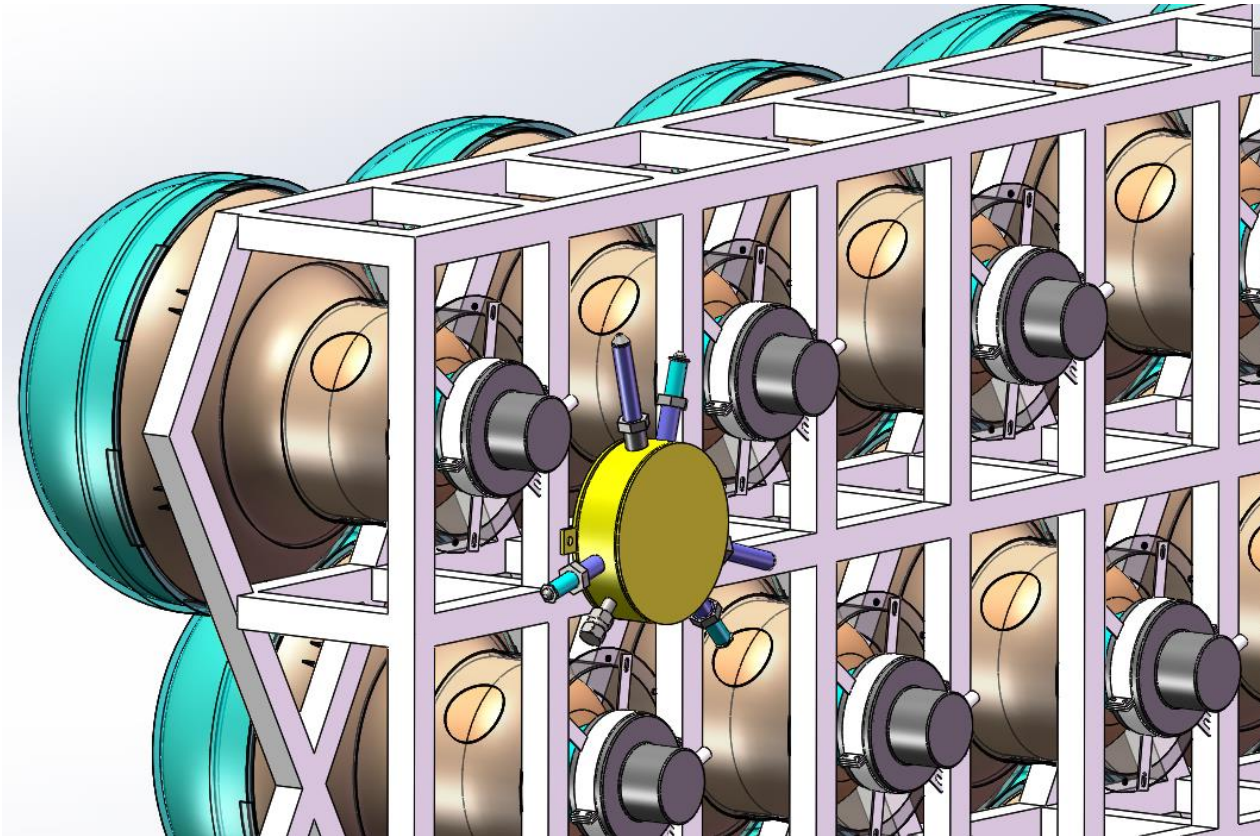
Connection of the PMT to the Box

- Two options:
 - HV and signal on the same cable
 - Two cables for signal and HV
- Flexible steel tube welded to the PMT and the connector



From Xiaoshan Jiang

Electronics Box

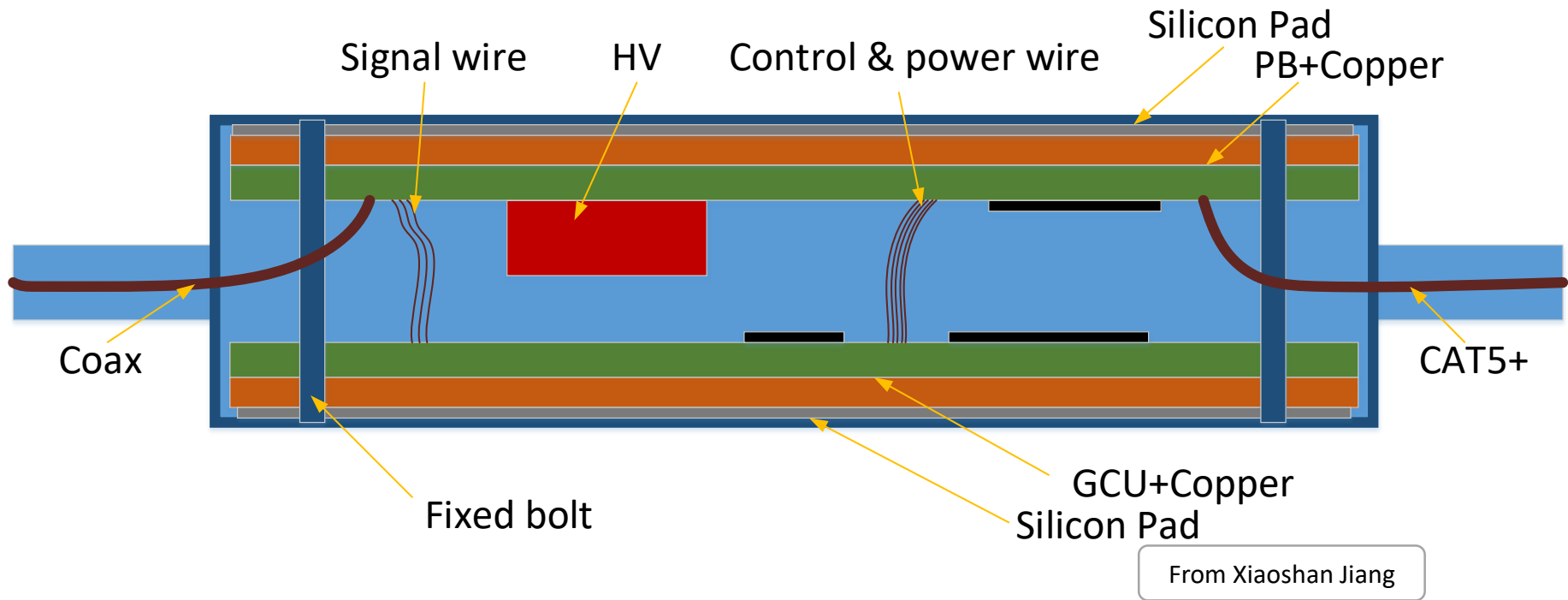


Old:



From Xiaoshan Jiang

Layout of the Electronics Box



Requirements for the Powerboard in BX

Power:

- Vulcan: 1.8V + 3.3V
- HV: 24V
- GCU: 12V

Ripple (Full Bandwidth):

- Power VULCAN:
 - 10mV @ 1.8V
 - 10mV @ 3.3V
- Power HV:
 - 20mV @ 24V
- Power GCU:
 - 30mV @ 12V

Synchronous Link (2 pairs):

- 250MBit/s Up / Down

Ethernet (2 pairs):

- 100Mbit/s

Slow Control:

- Temperature
- Input Current/Voltage

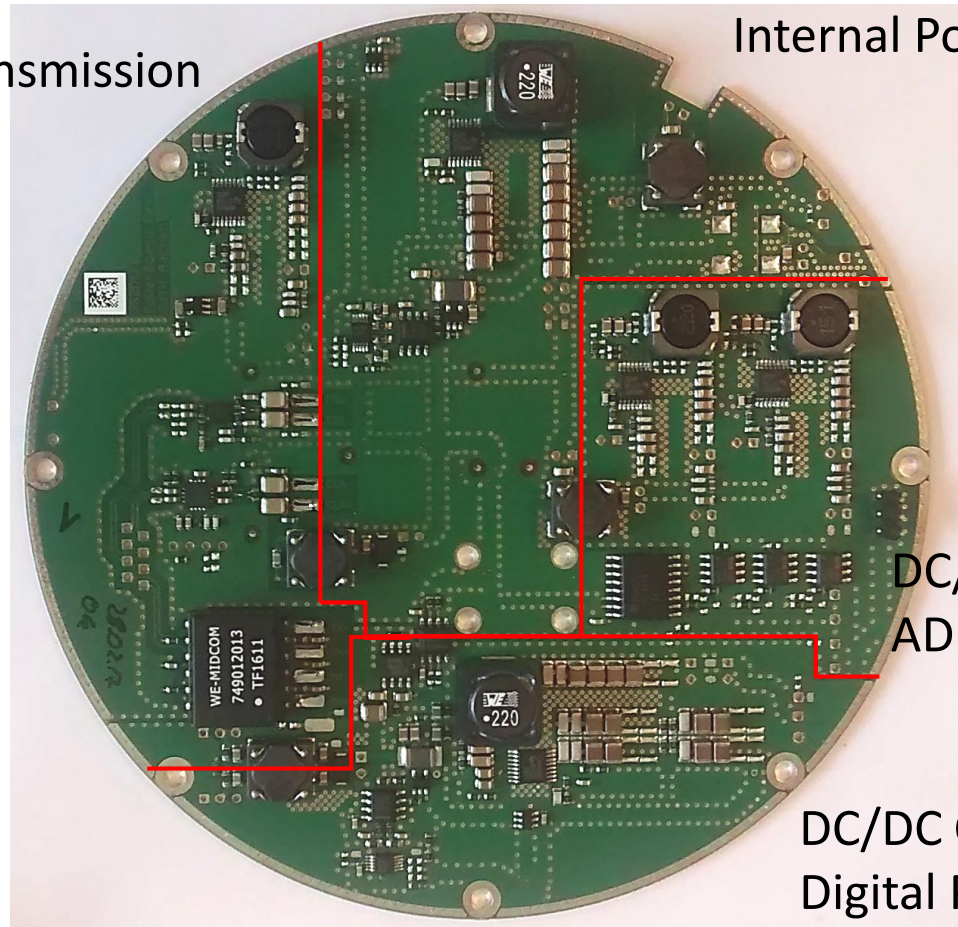
Through 100m CAT5 cable! (4 pairs)

Powerboard V3

Everything is
working, most
tests are done!

Data Transmission

DC/DC Converter
Internal Power



DC/DC Converter
ADU

DC/DC Converter
Digital Part

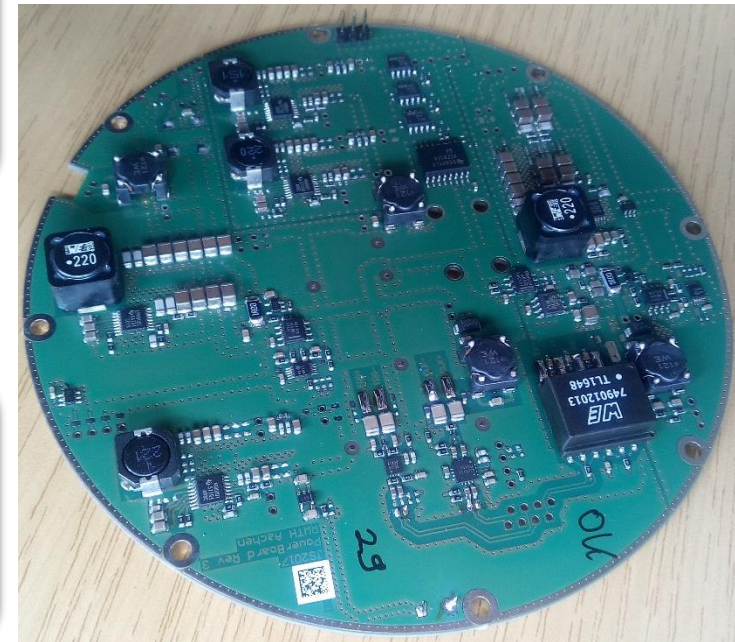
Summary

Bx scheme:

- Potting of 10 prototypes in October
- Trying to demonstrate that BX+Vulcan is working

1F3 scheme:

- No specifications until now
- Meeting next week in Padua
- First prototype early next year



Thank you for your attention!

Questions?

Supported by

DFG Deutsche
Forschungsgemeinschaft

Requirements on the JUNO Electronics

Data taking requirements:

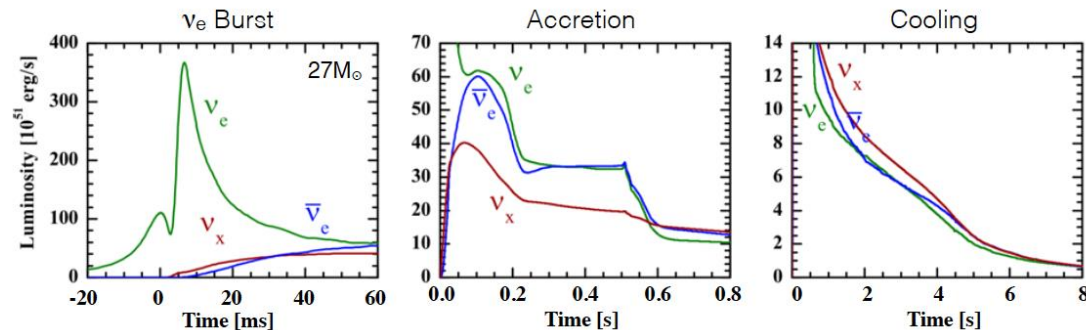
- High Dynamic Range:
 - 0.1 – 1000 PE
- High resolution:
 - 0.1 PE @ 1 PE
 - 1 PE @ 100 PE
 - 10 PE @ 1000 PE
- High sampling rate:
 - 1 Gs/s
- Possibility of continuous data taking for 1s

Additional Requirements:

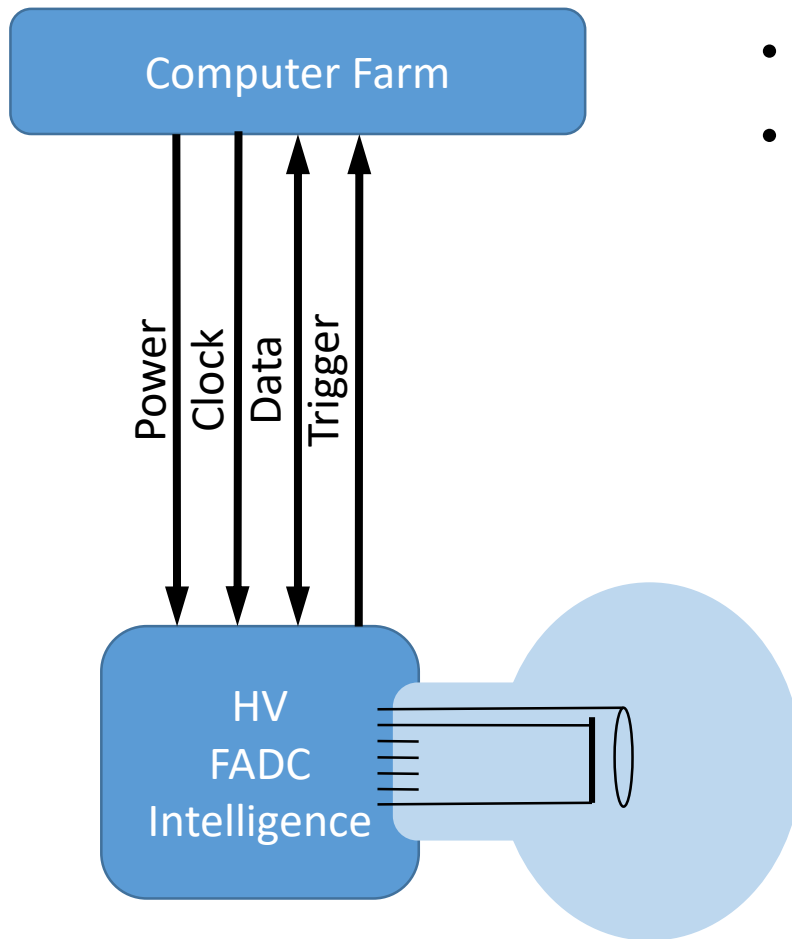
Low failure rate:

- 0.5% failure in 6 years

Supernova neutrino rate:



Readout – Intelligent PMT



- Electronics mounted onto the PMT
- Intelligence:
 - Monitoring the noise level
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 - Data buffer
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 - Waveform reconstruction

Advantage of the iPMT-Concept

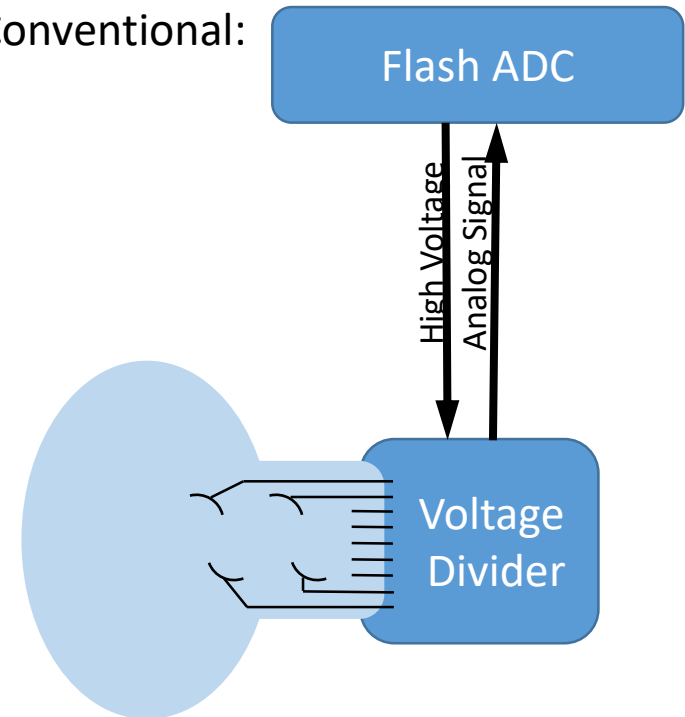
Conventional:

- PMTs read out with 14bit/1Ghz (high linearity needed 0.1-1000p.e.)
- JUNO: 35 TByte/s raw data to be analyzed by the trigger hardware

Intelligent PMT:

- Increased signal to noise ratio
- Better bandwidth
 - Better rising time

Conventional:



Details of the iPMT

High Voltage Unit:

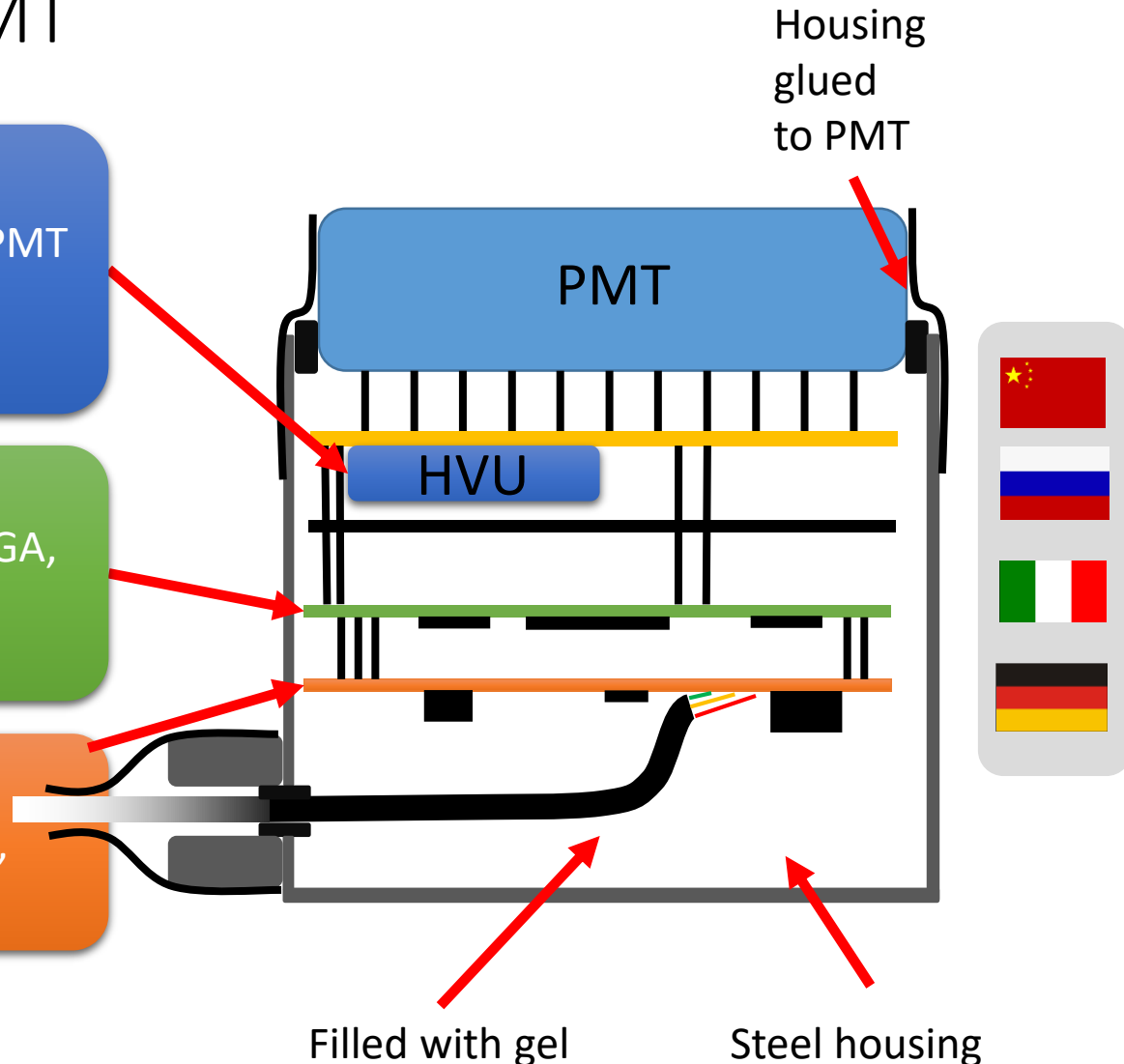
- Provides the HV for the PMT
- Programmable by the control unit

Signal Board:

- General Control Unit (FPGA, RAM)
- ADU

Power Board:

- Provides voltage for HVU, GCU, ADU



Concept of the Powerboard

