

Memphyno setup in Paris for mPMT tests in water

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Memphyno setup for KM3Net

Setup for testing mPMT for KM3Net at APC in Paris (but not part of LPNHE)

2 m × 2 m × 2 m water tank

4 identical planes of scintillators

- 2 top, 2 bottom
- 2 planes perpendicular to each other
- 64 strips per plane

Water filtering system

Currently Digital Optical Module (DOM) at bottom of tank

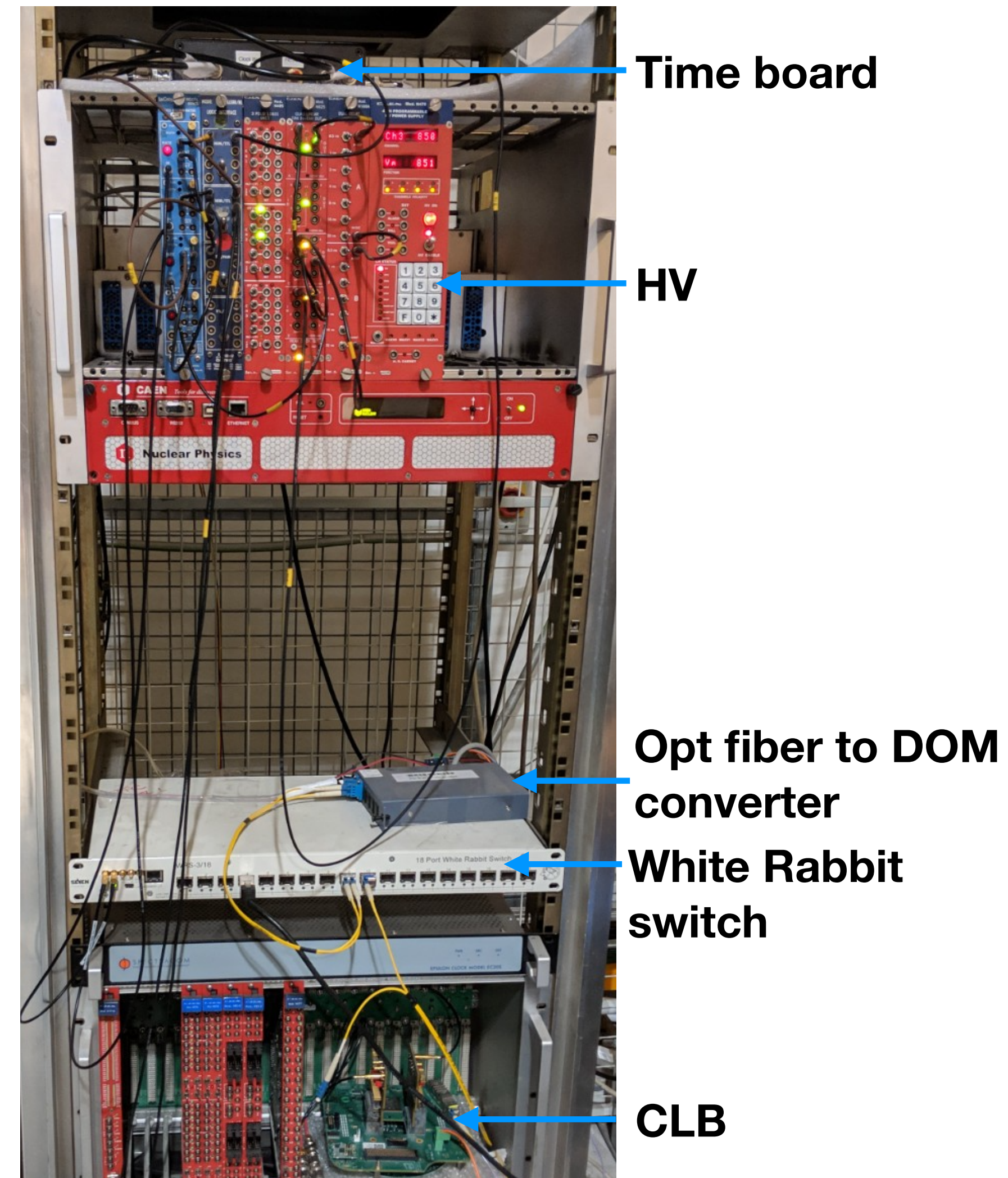
More details in Theodoros Avgitas's thesis



Current DAQ implementation

Hodoscope DAQ different DOM DAQ

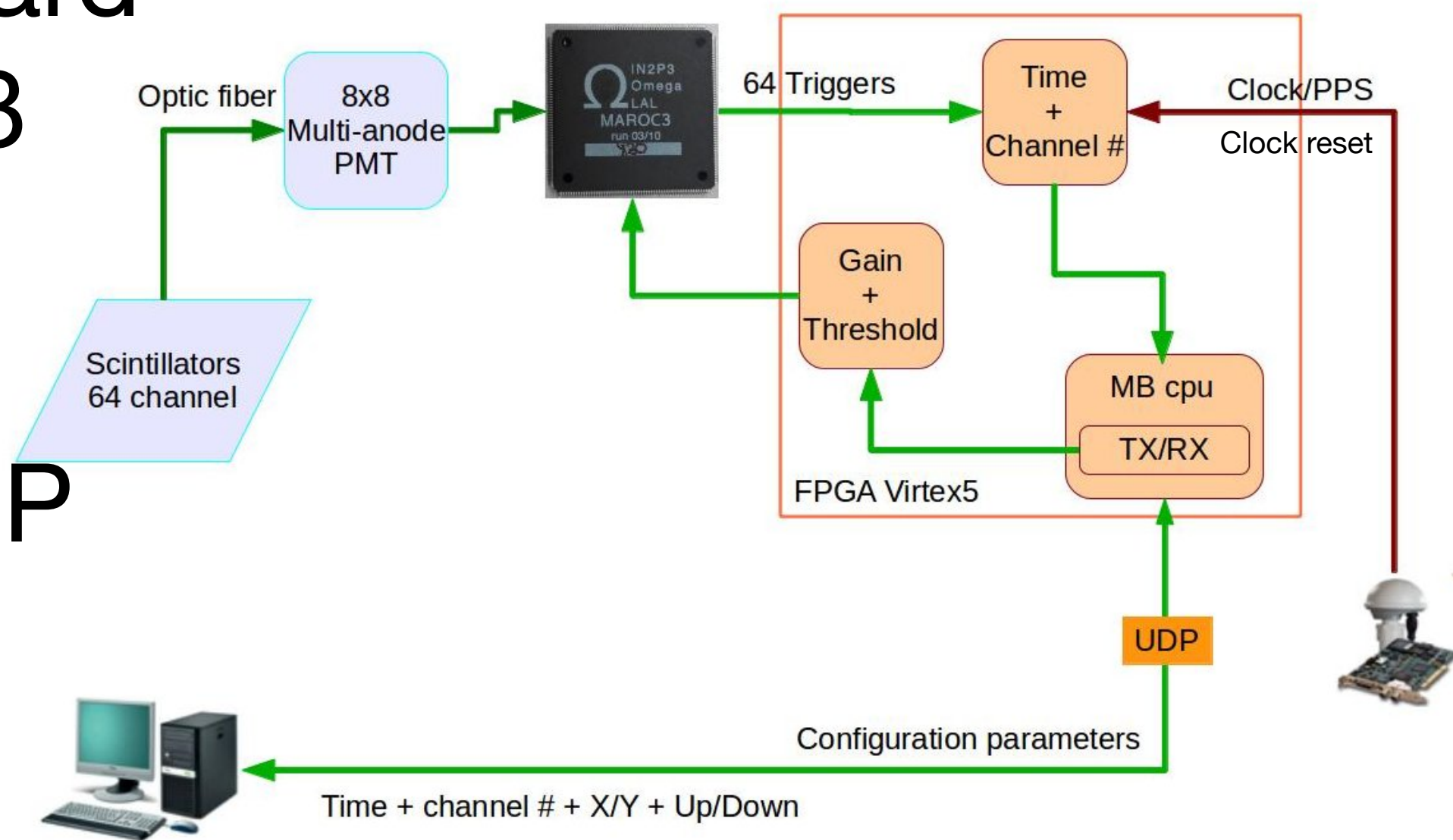
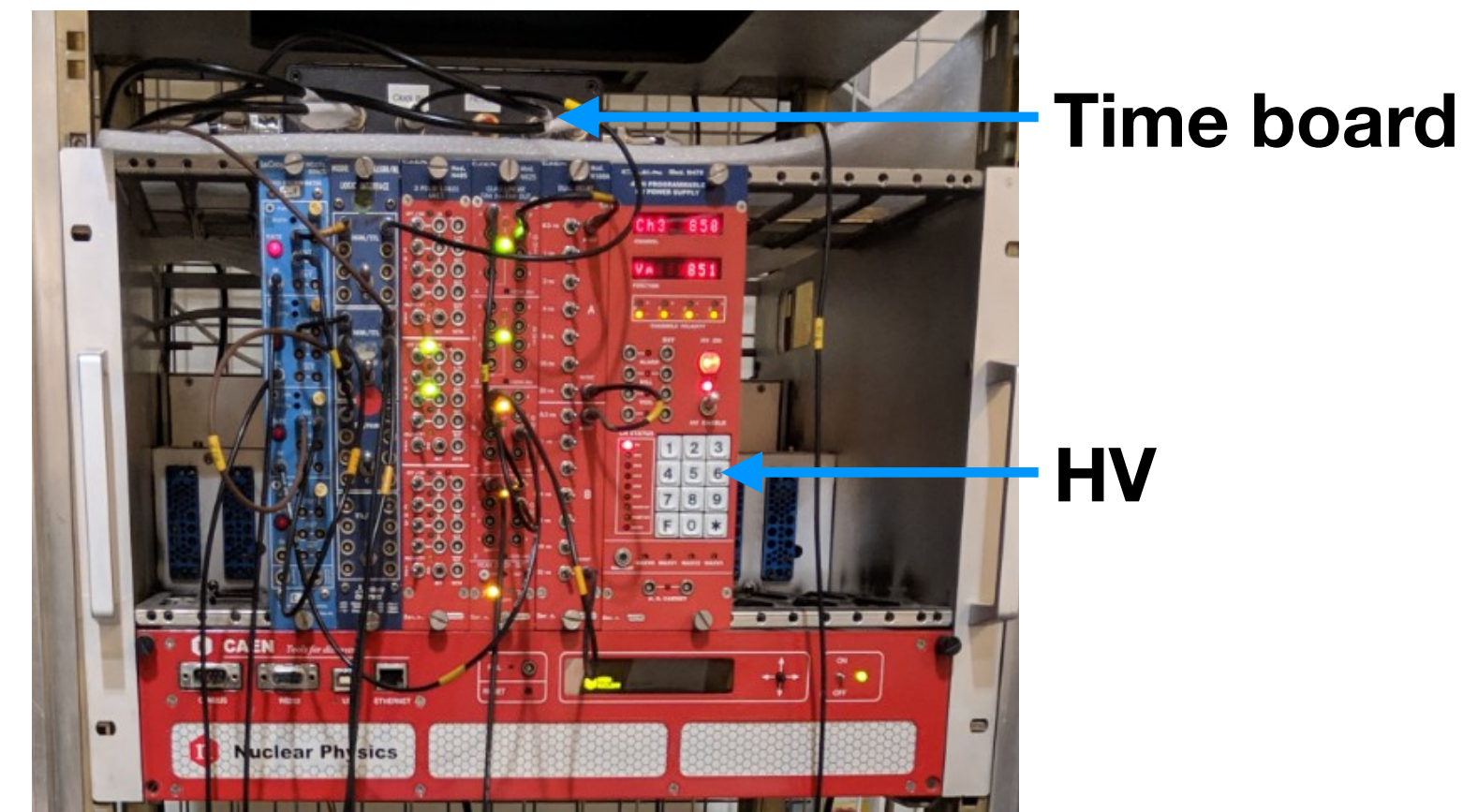
- Hodoscope via Ethernet/Ethernet
- DOM via White Rabbit (WR)



Hodoscope DAQ currently works on separate desktop connected via Ethernet

Current behaviour:

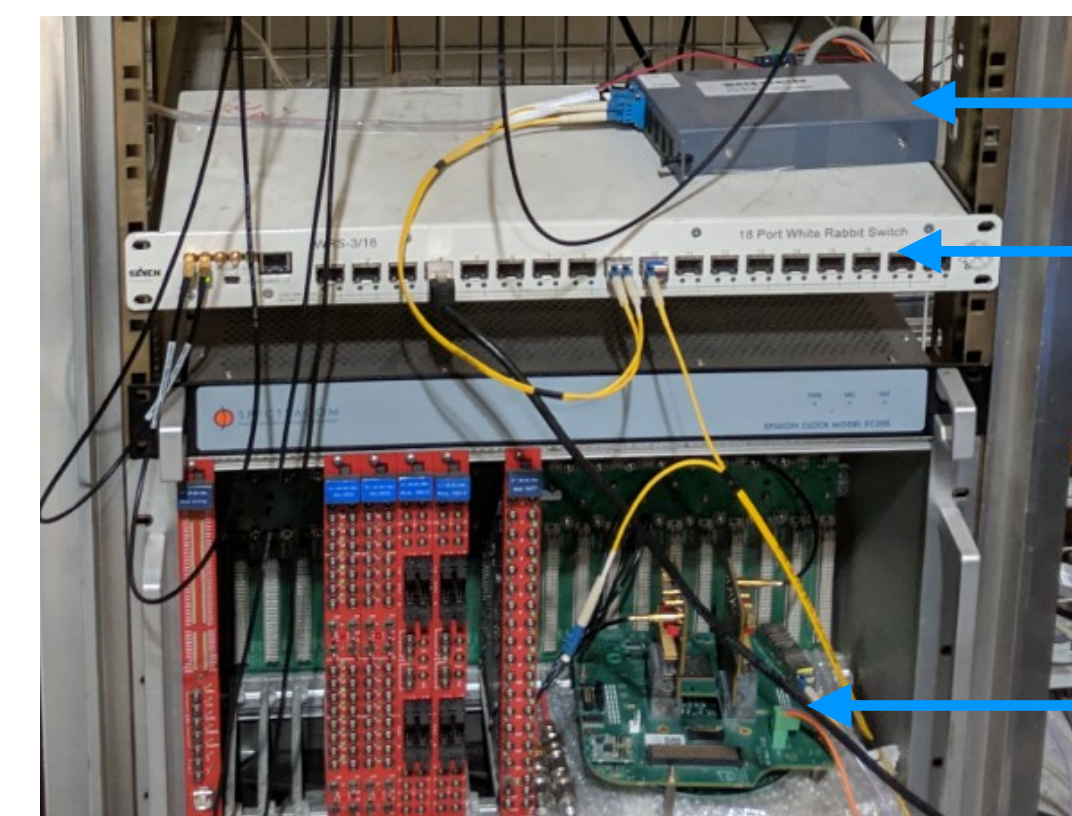
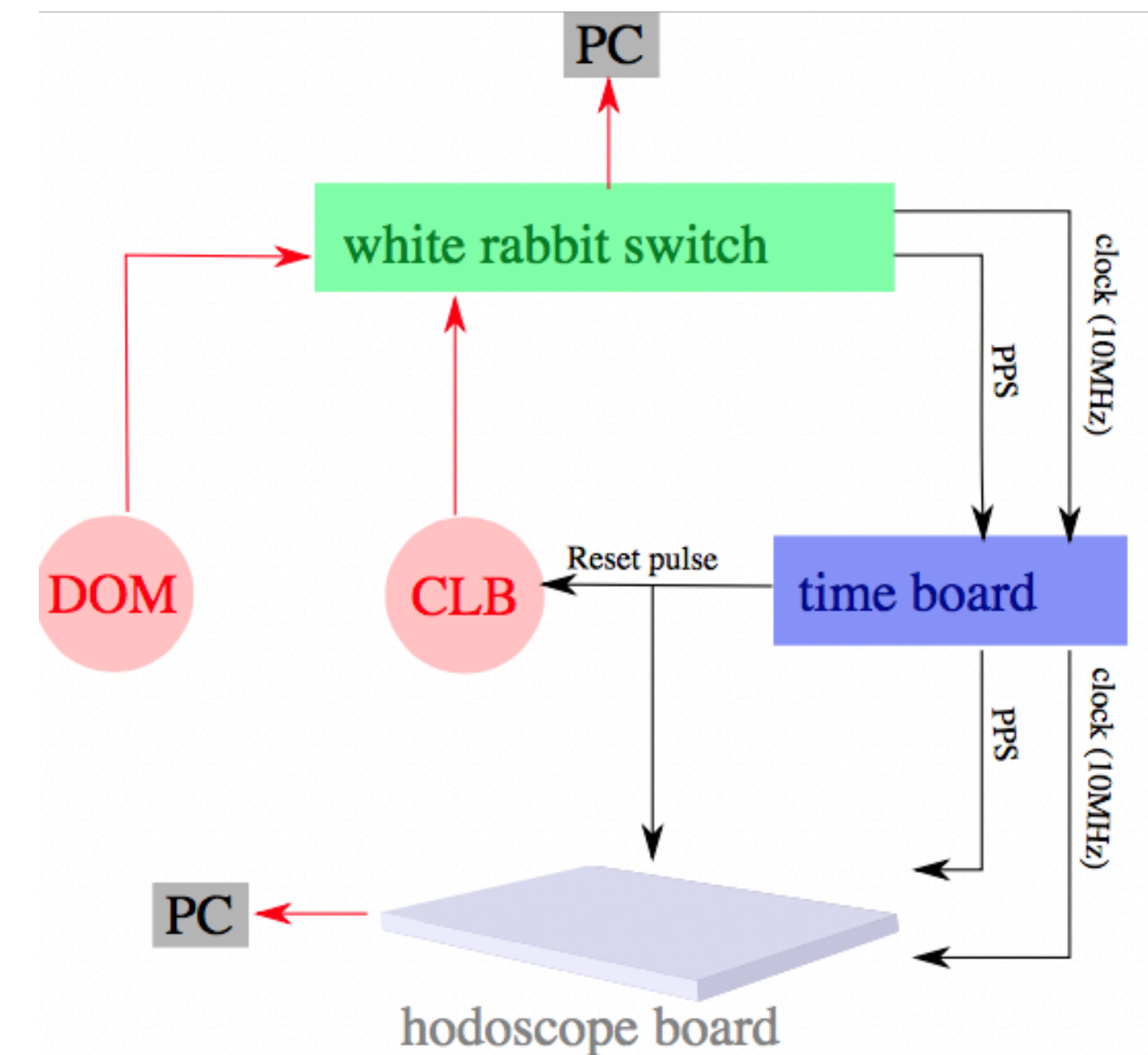
- Clock/PPS comes from WR
- Clock reset by pressing button on Time board
- Preamp gain for each channel via MAROC3
- Time trigger by MAROC3 and FPGA
- Configuration sent to FPGA via Ethernet
- Data (time since reset, scint. ID) via Eth/UDP



DOM DAQ relies on White Rabbit for data transfer and synchronisation

Current behaviour:

- Clock/PPS comes from WR
- Additional Central Logic Board (CLB) used for timing the hodoscope clock reset (TTL signal)
- WR synchronisation between CLB and DOM



Opt fiber to DOM
converter
White Rabbit

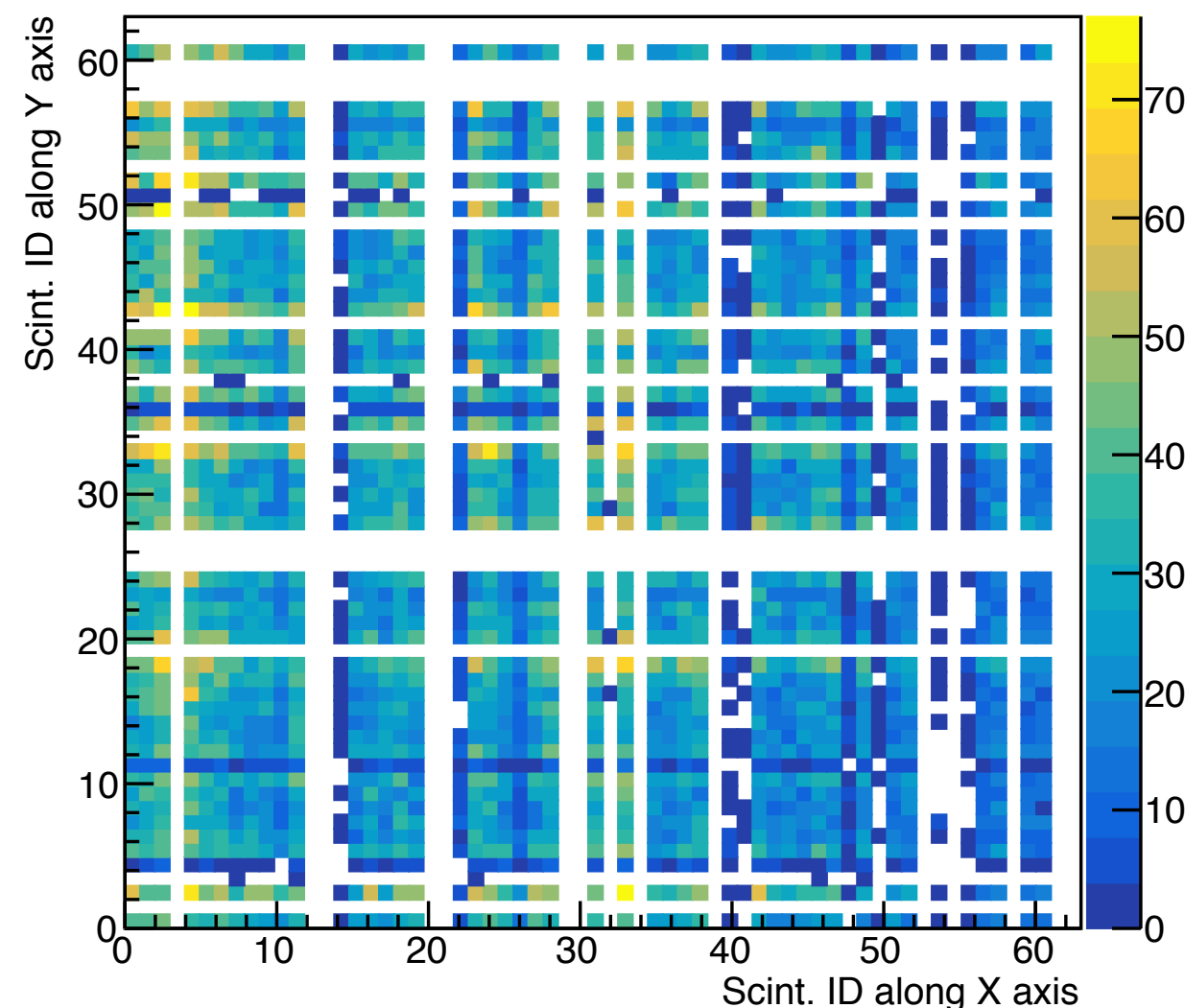
CLB

Trigger levels set by Theodoros

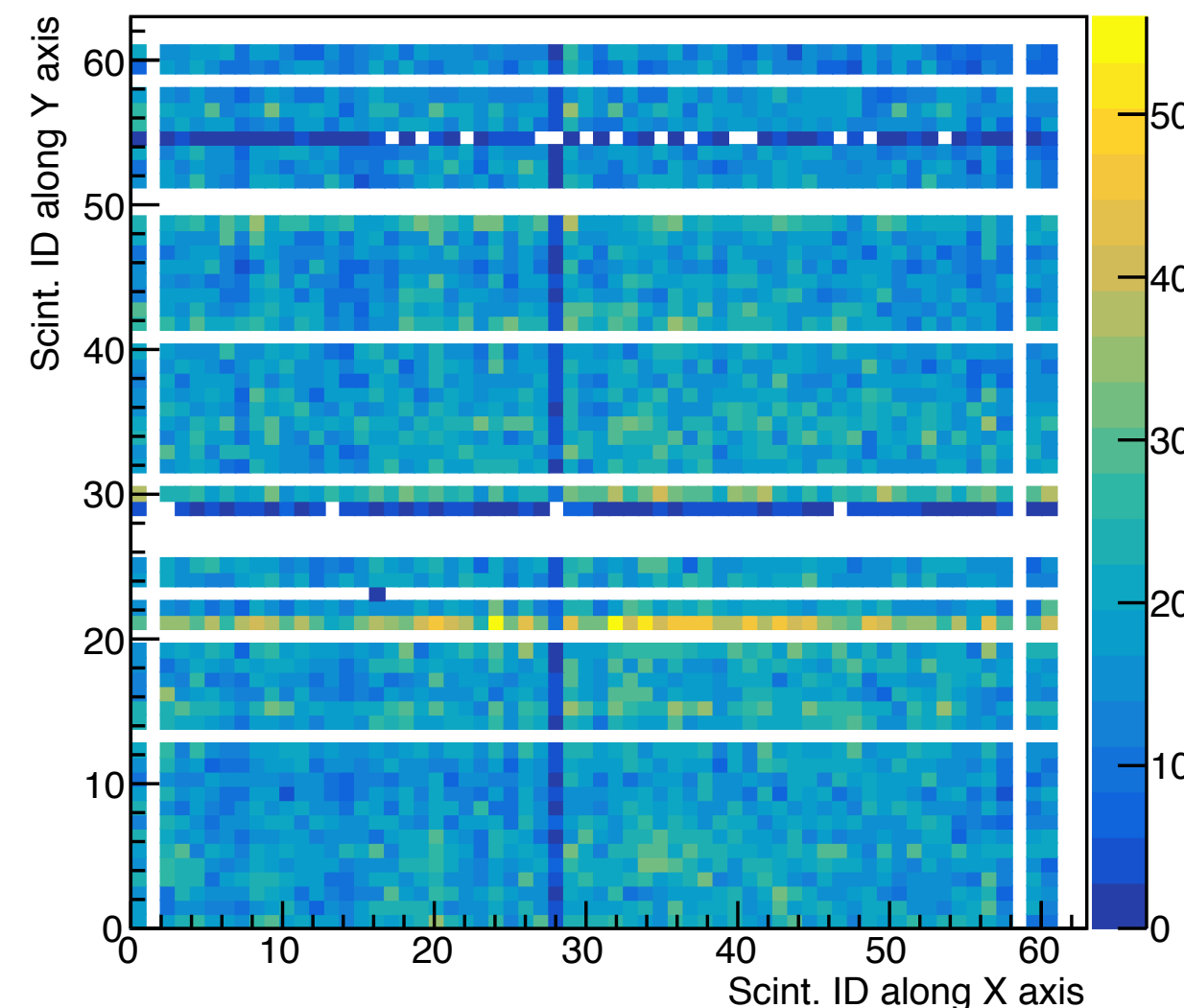
- ~50 Hz per scintillator strip
- ~55000 events in 30 min coincidence
- 2e6 events per day

Some scintillator strips deactivated (bad gain response)

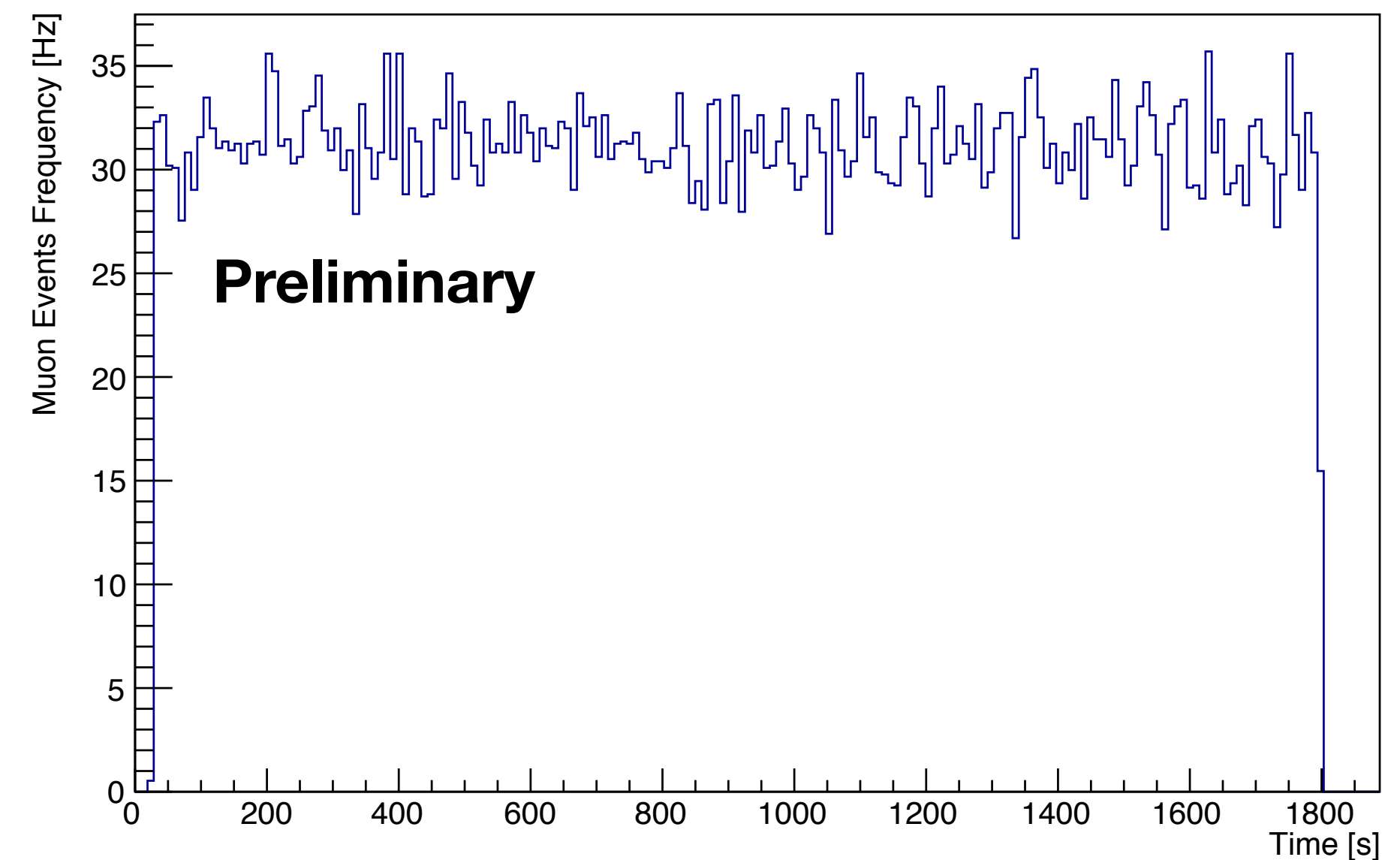
Top layer



Bottom layer



Coincidence times

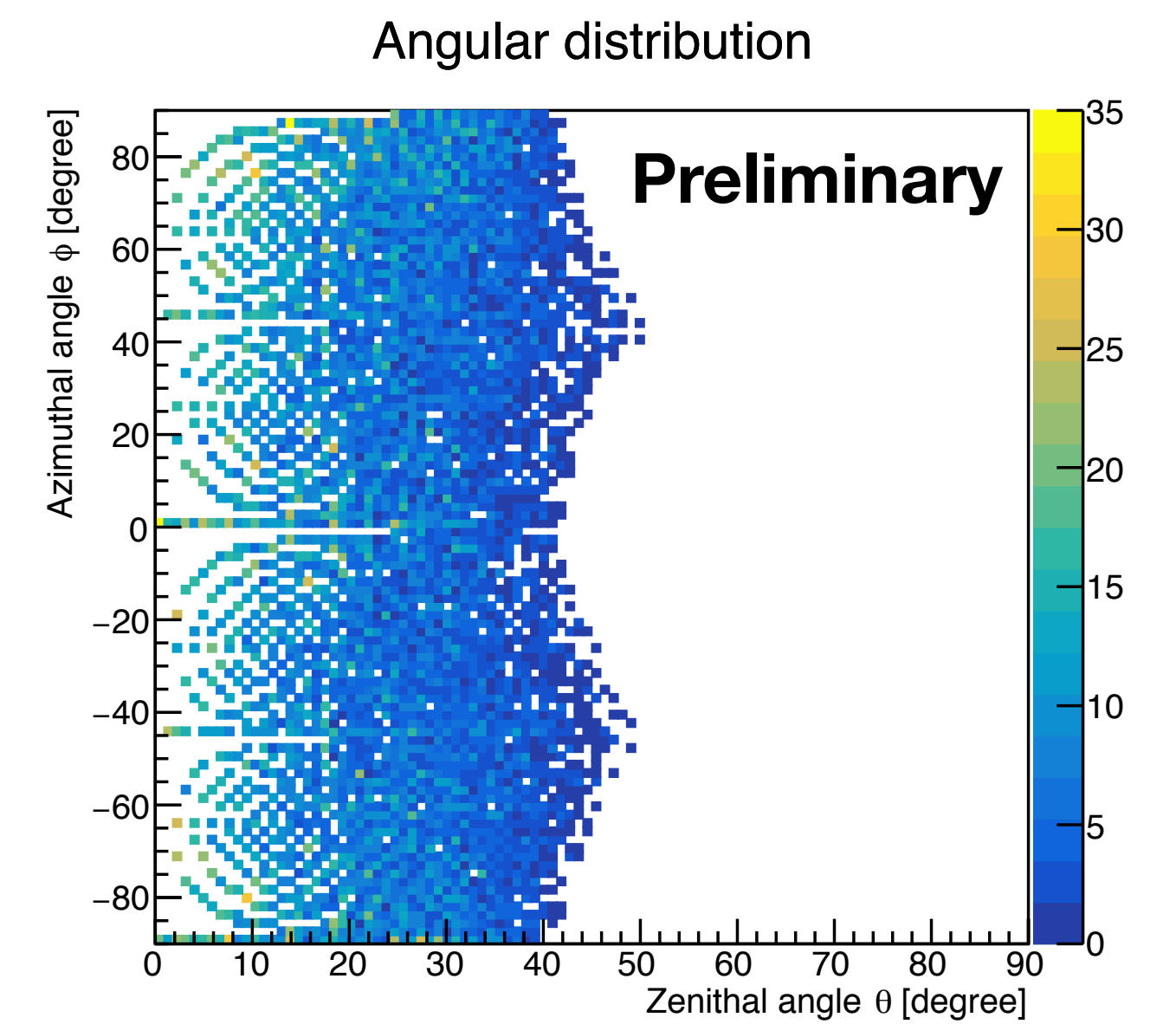
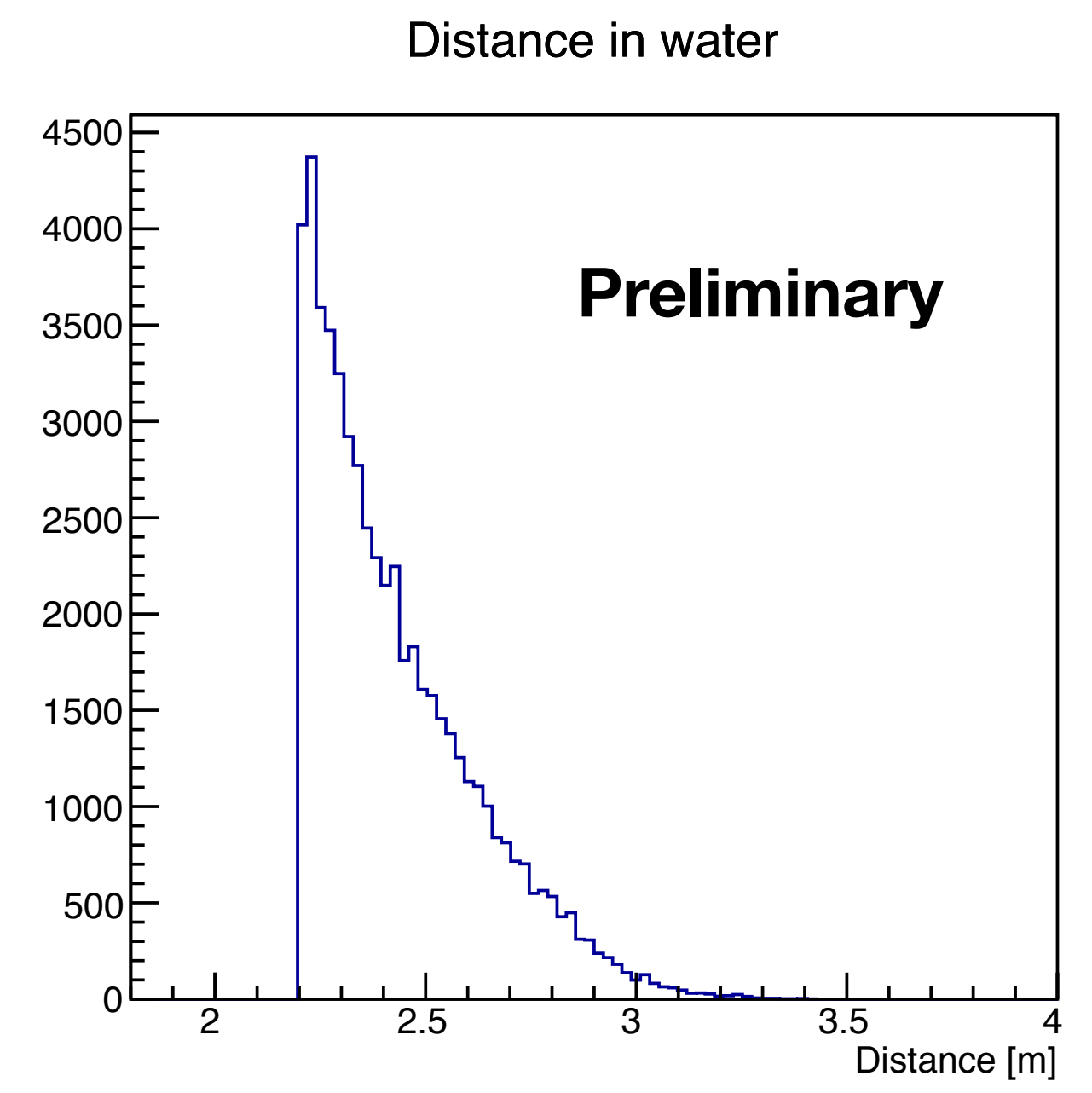
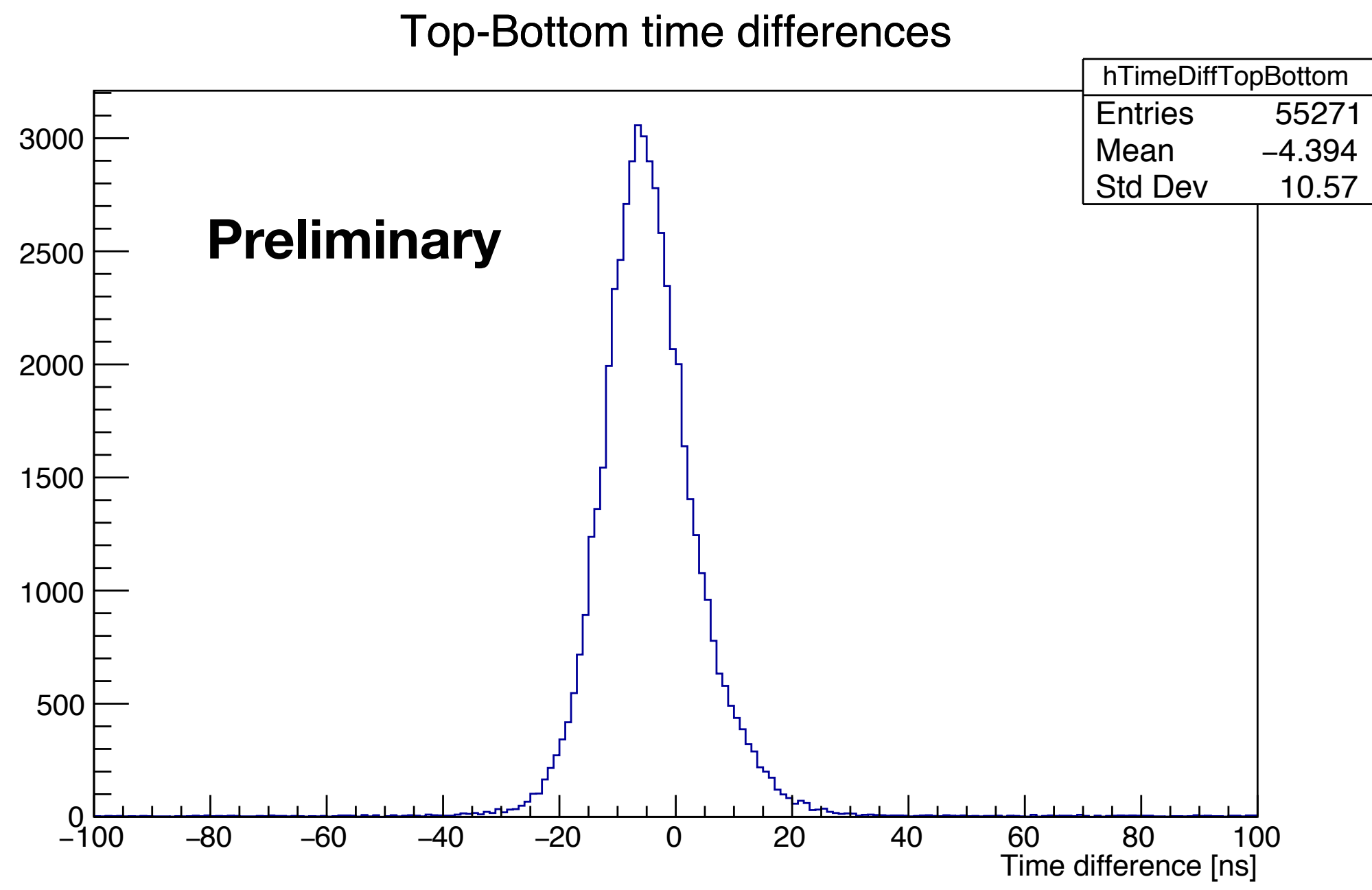


Reconstruction and timing

Using scintillators ID, can reconstruct angular distribution

Travel time between top and bottom: 4.3 ns

Std dev large due to walk effect (can be corrected)



Main components are working; some upgrades desired

Synchronisation:

- Currently offline coincidence; lot of data but manageable locally
- Need to define a common mPMT synchronisation scheme
 - If no technology yet preferred, we could use White Rabbit
- If feasible, implement something that “time-stamp”s the hodoscope clock reset (similar to the CLB)
 - If WR chosen, one WR-compatible ADC could do
- Possibly, integrate WR response into hodoscopes FPGA (need WR/FPGA experts)
- Another (expensive) option: change all the MAROC3 chip to WR-compatible ADCs

Main components are working; some upgrades desired

Data Management:

- Transfer to CC-IN2P3 as Storage Element (integration into Dirac FC?)
- First analysis pass (offline trigger) done on cluster for monitoring

Software:

- Strongly depends on the electronics/DAQ upgrade
- At least, fusion of/interface between the hodoscope and DOM/mPMT DAQ
 - Stand-alone applications sharing a common communication framework
 - Lab instruments software control (HV, clock reset, data taking start/stop...)
 - Transfer to Storage Element
 - For long-term tests, develop monitoring tools
 - ...
- Depending on synchronisation system, setup an online analysis/trigger

Conclusions and outlook

Memphyno could be a setup for (m)PMT underwater standardised testing

Hodoscope works as is!

Need for a planning and desired tests on the setup

Some upgrades are desired, depending on the deployed mPMT synchronisation system

- Possibly one or more WR-compatible ADC
- Possible online trigger between hodoscope and mPMT
- Automated data transfer to CC-IN2P3 SE

Feedbacks are welcome!