Hyper-Kamiokande

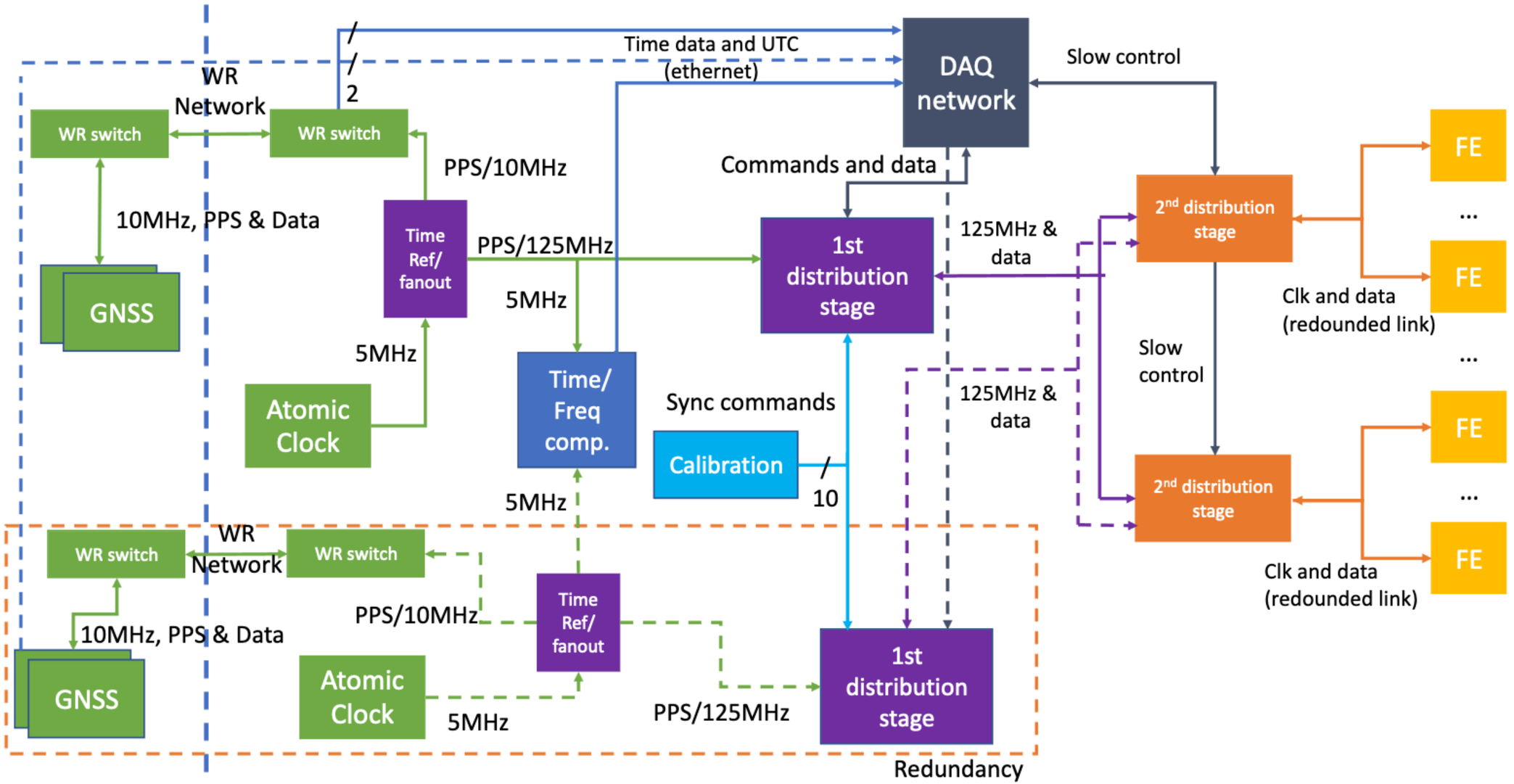
Validation of HK timing system@LPNHE
Monitoring and control of timing system

SCIENCES SORBONNE UNIVERSITÉ

LPNHE PARIS

cnrs dépasser les frontières IN2P3 Les deux infinis

Overall timing scheme



+ additional direct optical link to compare GNSS with local time

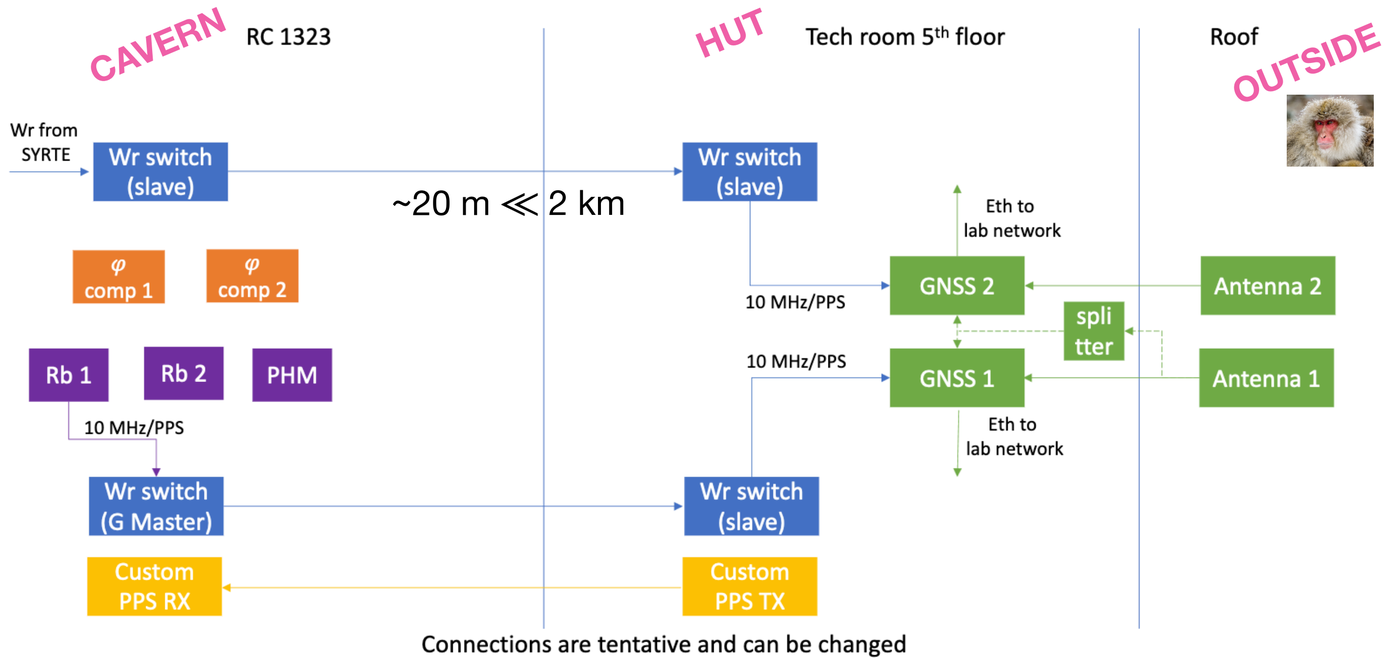
New setup at LPNHE

From Stefano HK CM

The time generation and comparison with UTC is ongoing to perform long runs tests.
We are also building a setup closer to the final HK configuration in which the GNSS receivers are placed far from the atomic clocks and connected via WR link.

At LPNHE we have:
- 2 SRS SF725 Rubidium atomic clocks
- 2 Septentrio PolaRx5TR receivers + antennas
- 2 clock and Frequency counter Keysight 53220
- 1 PH1008 Passive Hydrogen Maser Atomic clock
- 5 White Rabbit switches

Work in progress:
- Finish by the end of this month
- Development of the control software
- Possible tests with first-stage distributor (Denis)



Context: interface with DAQ

Interesting discussions with FD5 DAQ WG
- WG intends to “provide" online monitoring and slow-control tools
- unclear what will be provided and when…

Critical informations to be transported from First Stage Distribution Board (1st-Distrib) to FE
- TDC reset, 125MHz clock, 1PPS+timestamp?
- No up-link from FE to 1st-Distrib?

Possibility for the clock link to transport “data” from FE to 2nd Stage Distribution Boards (2nd-TDM)
- PMT monitor rate
- other critical components (emergency stop)?

Need to monitor the health of our system:
- health of the link TDM ↔ DPB (TDC reset received; SFP temp & power; laser multiplexer status?)
- health of the link TDM ↔ DAQ (ping), if needed
- TDM housekeeping (temperature, current, voltages on boards…)

All recorded values can be placed in DB shared with DAQ
BUT clock group needs to have control on our items (power supplies, system health, clocks, GNSS…)
→ custom control interface, custom communication protocol

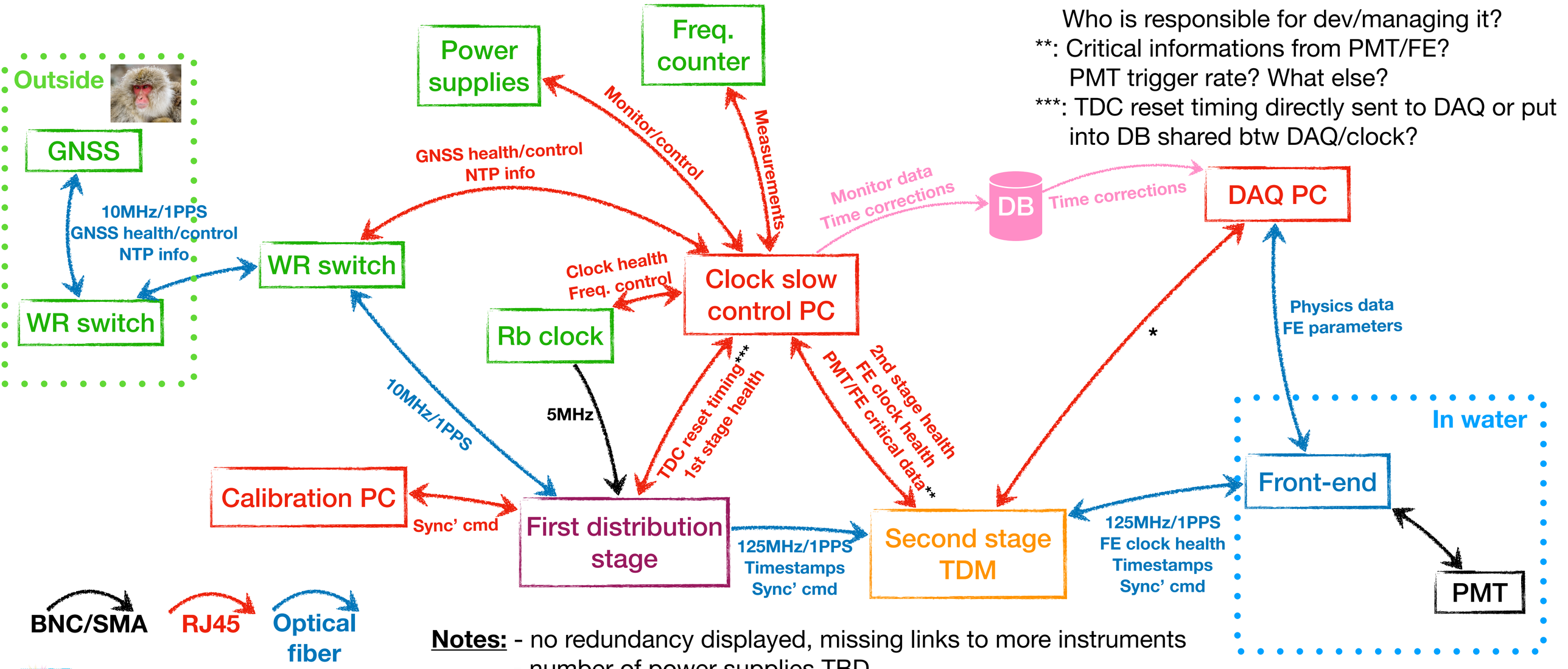
Simplified functional scheme

Questions:

*: Nature of this link?
Who is responsible for dev/managing it?

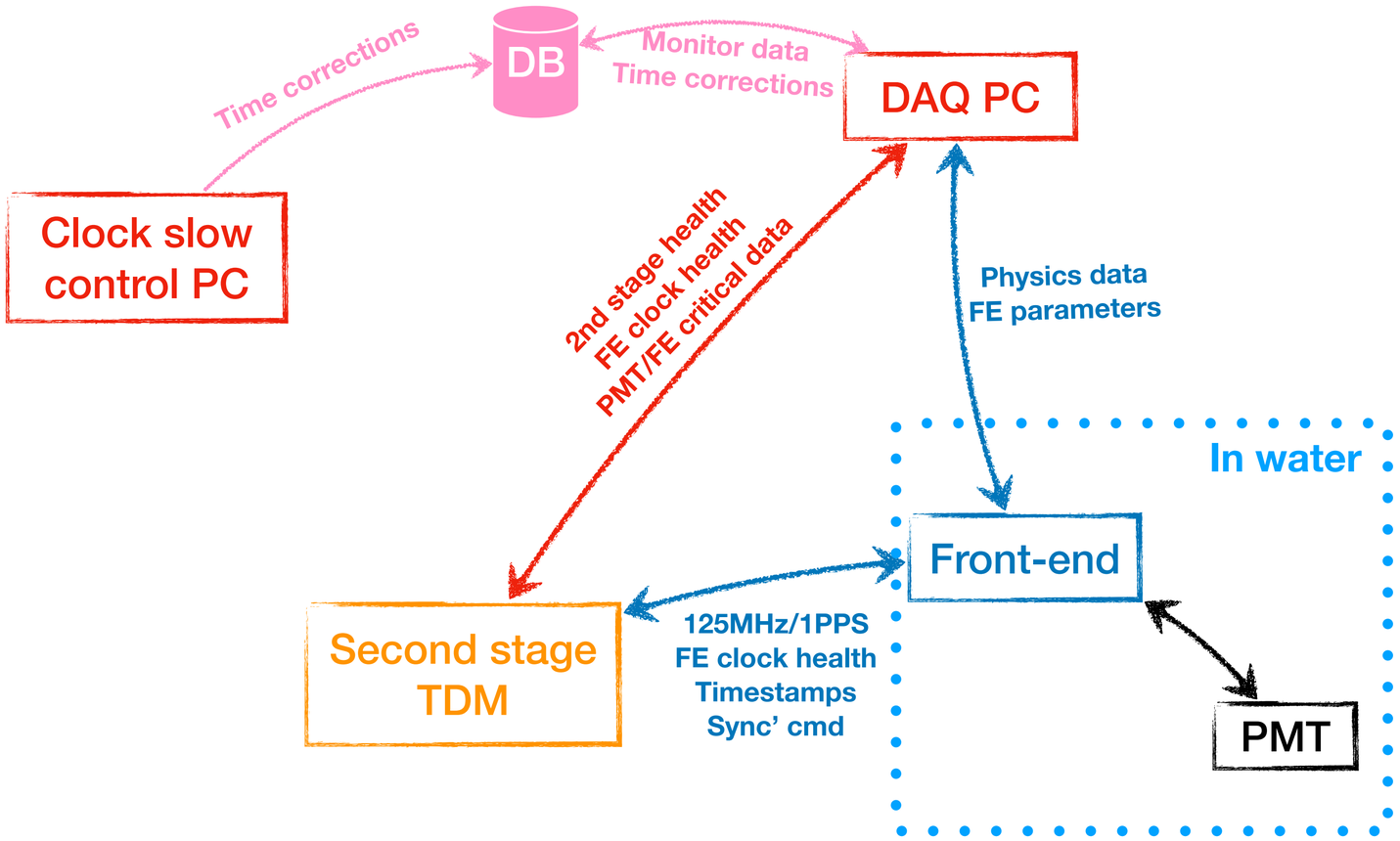
**: Critical informations from PMT/FE?
PMT trigger rate? What else?

***: TDC reset timing directly sent to DAQ or put into DB shared btw DAQ/clock?



Notes: - no redundancy displayed, missing links to more instruments
- number of power supplies TBD

Option 1 (current?): DAQ owns clock link



Only DAQ can discuss connect to 2nd stage distributor (2nd-TDM)
Slow control and monitoring (FE + 2nd-TDM) go to DAQ computer via DAQ link
DAQ WG responsible to collect monitoring informations from TDM

What data on which link?

- FE↔DAQ:
  - physics data
  - slow control (monitoring+FE control)
- FE↔2nd-TDM↔DAQ (managed/dev by DAQ)
  - 2nd stage health and control
  - FE clock health
  - PMT critical data (PMT rate monitor, what else?)

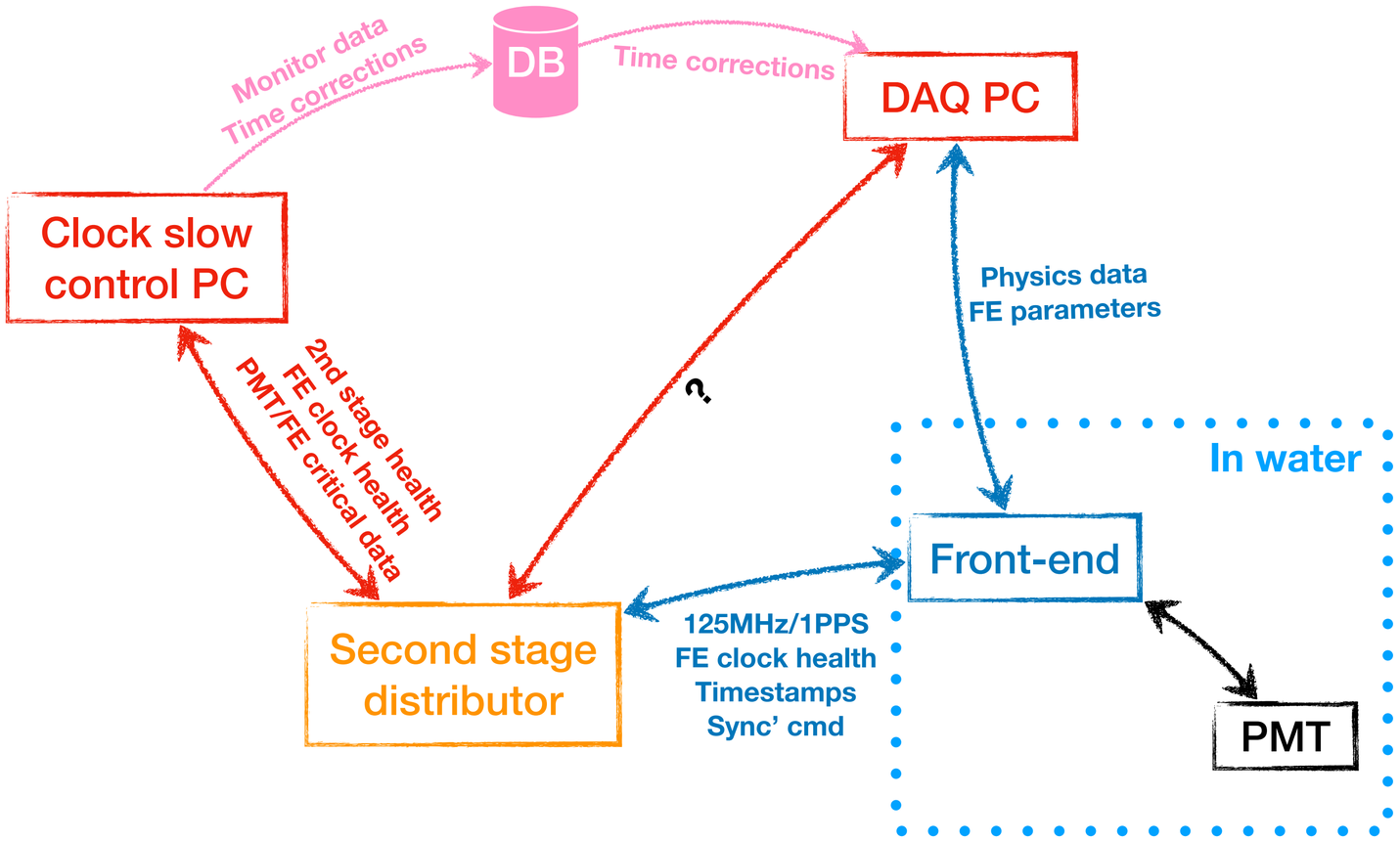
Notes and requirements:

- not ideal configuration…
- most of the clock control developed by DAQ?
- Clock SC and monitor transitioned via DAQ PC

→ DAQ & SC links not real redundant

- Cannot use clock protocol
- If using same DAQ protocol, no guarantee of restriction access to non-experts

Option 2: Dual connection



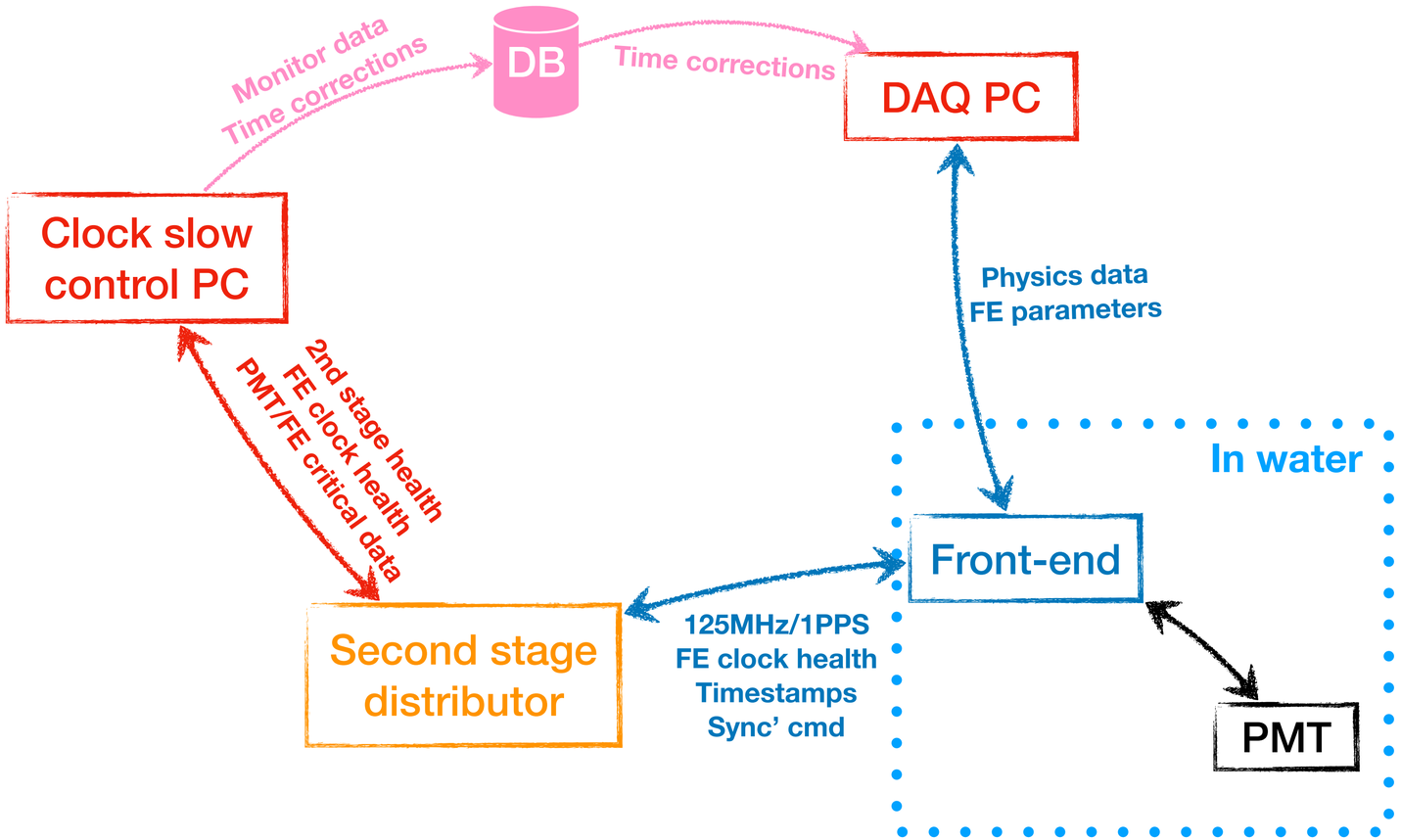
DAQ and clock SC can discuss connect to 2nd stage distributor (2nd-TDM):
- most (all) FE slow control and monitoring go to DAQ computer via DAQ link
- clock control separate and managed by clock WG
- some critical FE control made by clock link?

What data on which link?

- FE↔DAQ:
  - physics data
  - slow control (monitoring+FE control)
- FE↔2nd-TDM↔DAQ (managed/dev by DAQ)
  - Which data?
- FE↔2nd-TDM↔Clock SC (managed/dev by clock WG)
  - 2nd stage health and control
  - Monitoring of 2nd-TDM↔DAQ
  - FE clock health
  - PMT critical data (PMT rate monitor, what else?)

Notes and requirements:
- best option (modular, redundancy…)
- not sure yet if feasible → will investigate!

Option 3: Clock owns clock link



Only clock SC can discuss connect to 2nd stage distributor (2nd-TDM):
- most (all) FE slow control and monitoring go to DAQ computer via DAQ link → no need to additional link
- clock control separate and managed by clock WG
- some critical FE control made by clock link?

What data on which link?

- FE↔DAQ:
  - physics data
  - slow control (monitoring+FE control)
- FE↔2nd-TDM↔Clock SC (managed/dev by clock WG)
  - 2nd stage health and control
  - Monitoring of 2nd-TDM↔DAQ
  - FE clock health
  - PMT critical data (PMT rate monitor, what else?)

Notes and requirements:
- good option (modular…)
- less redundancy if DAQ link breaks (big troubles in this case anyway!)