

# Commissioning of ITS R/O system

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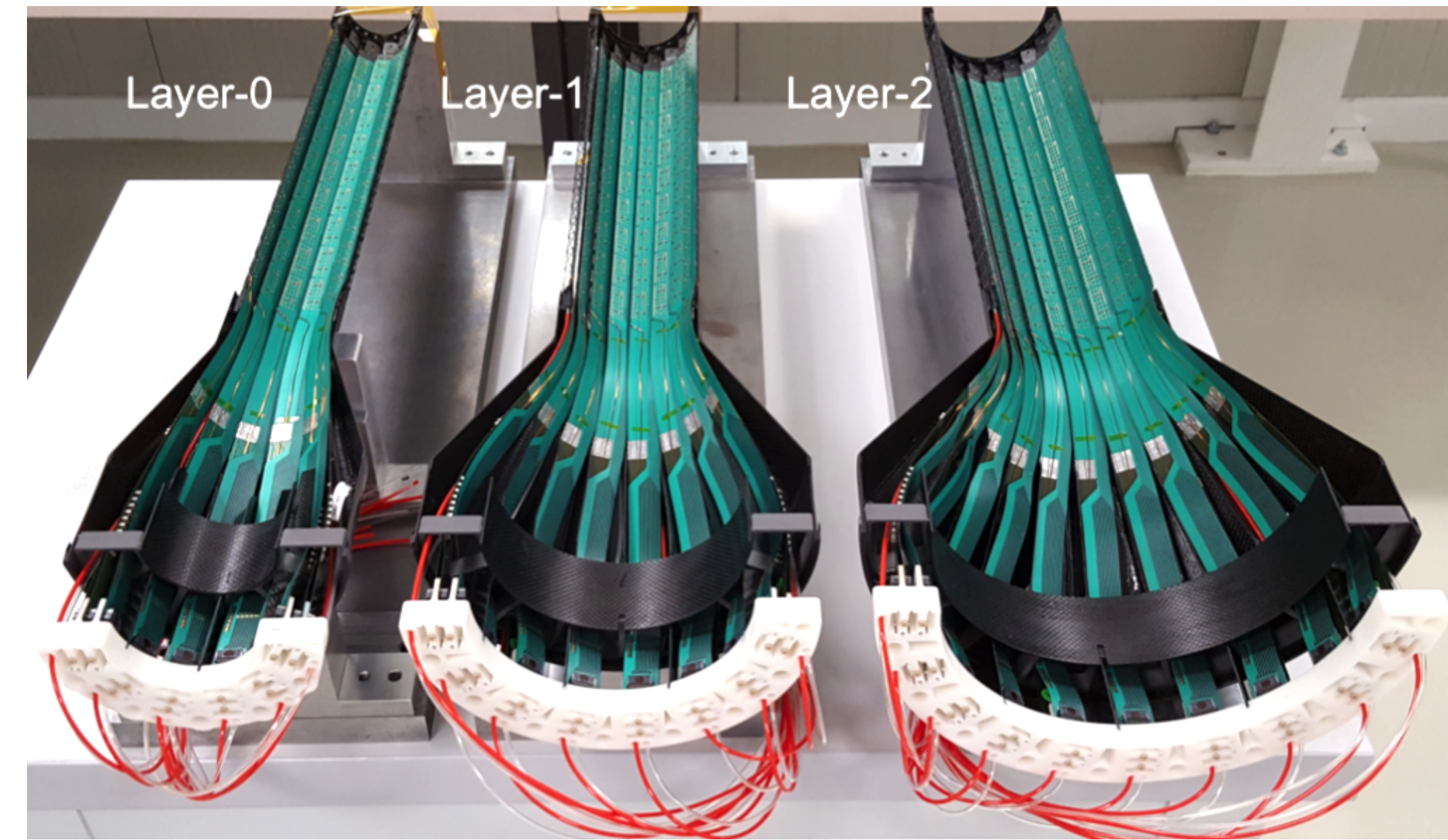


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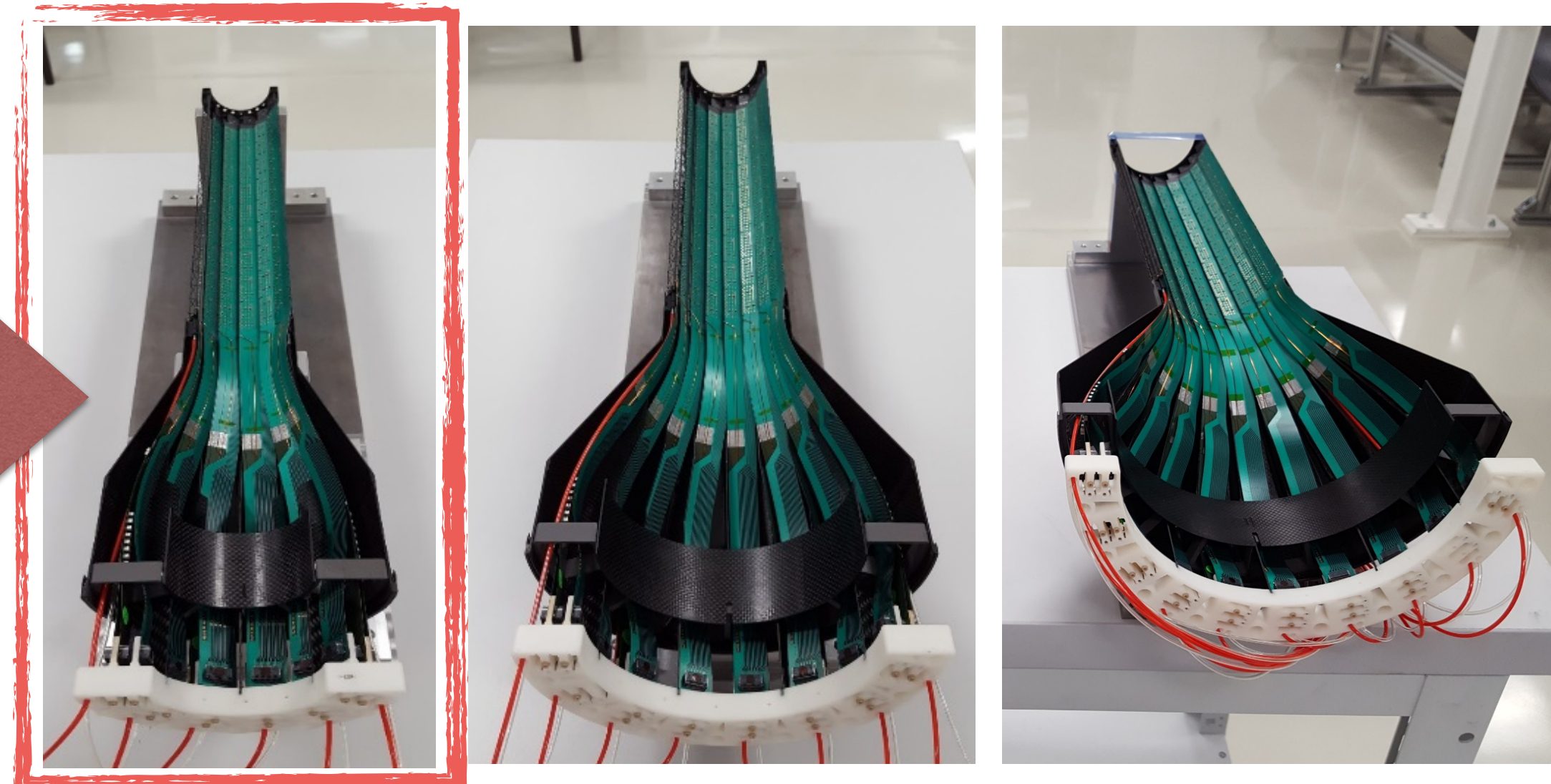


# The Inner “Barrel”

- Construction of Inner Barrel is complete
- First commissioning is done half-layer by half-layer “HL”
- Starting with “IB-HL-0”

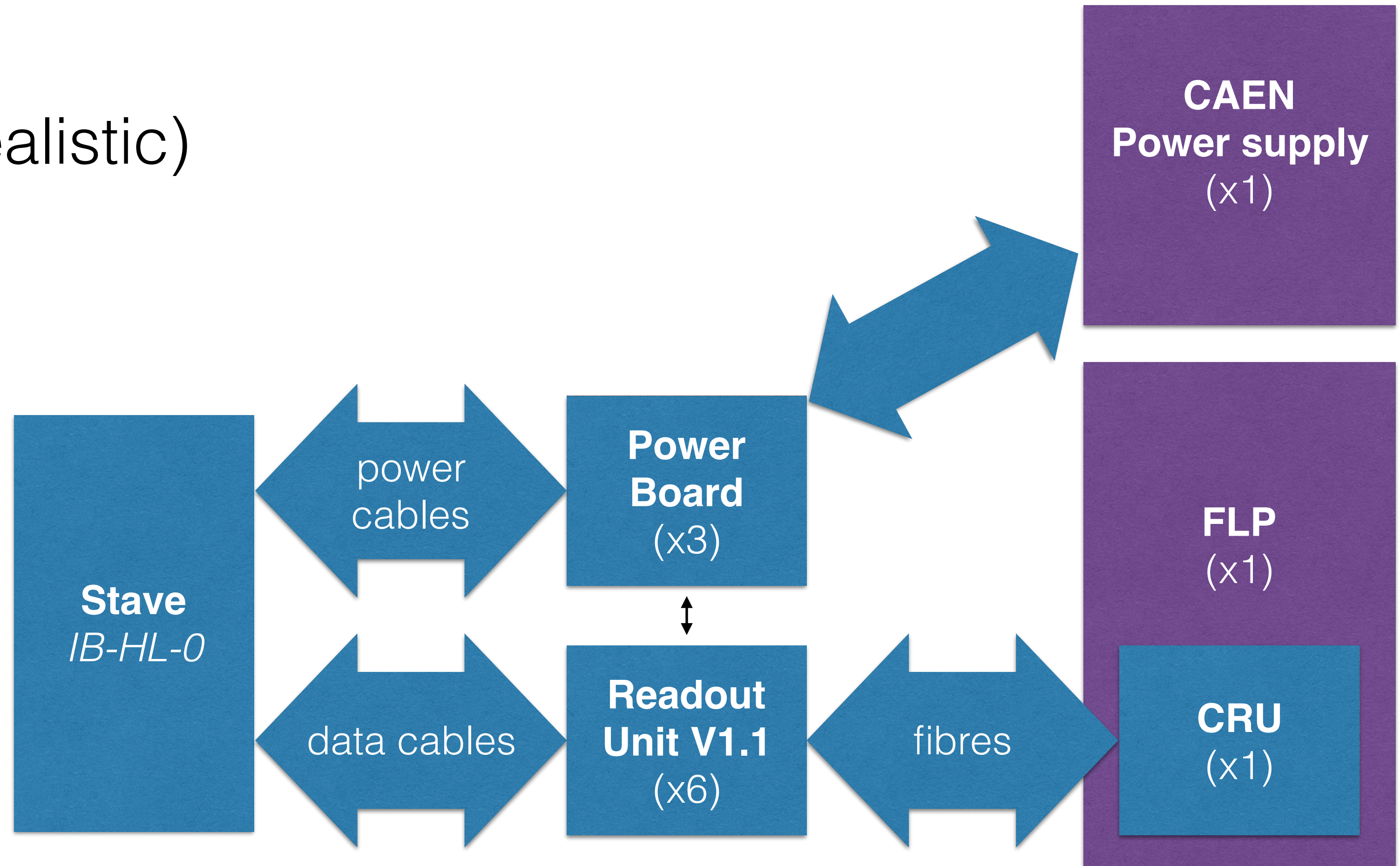


start here



# Setup

- Setup is based on final (or realistic) components

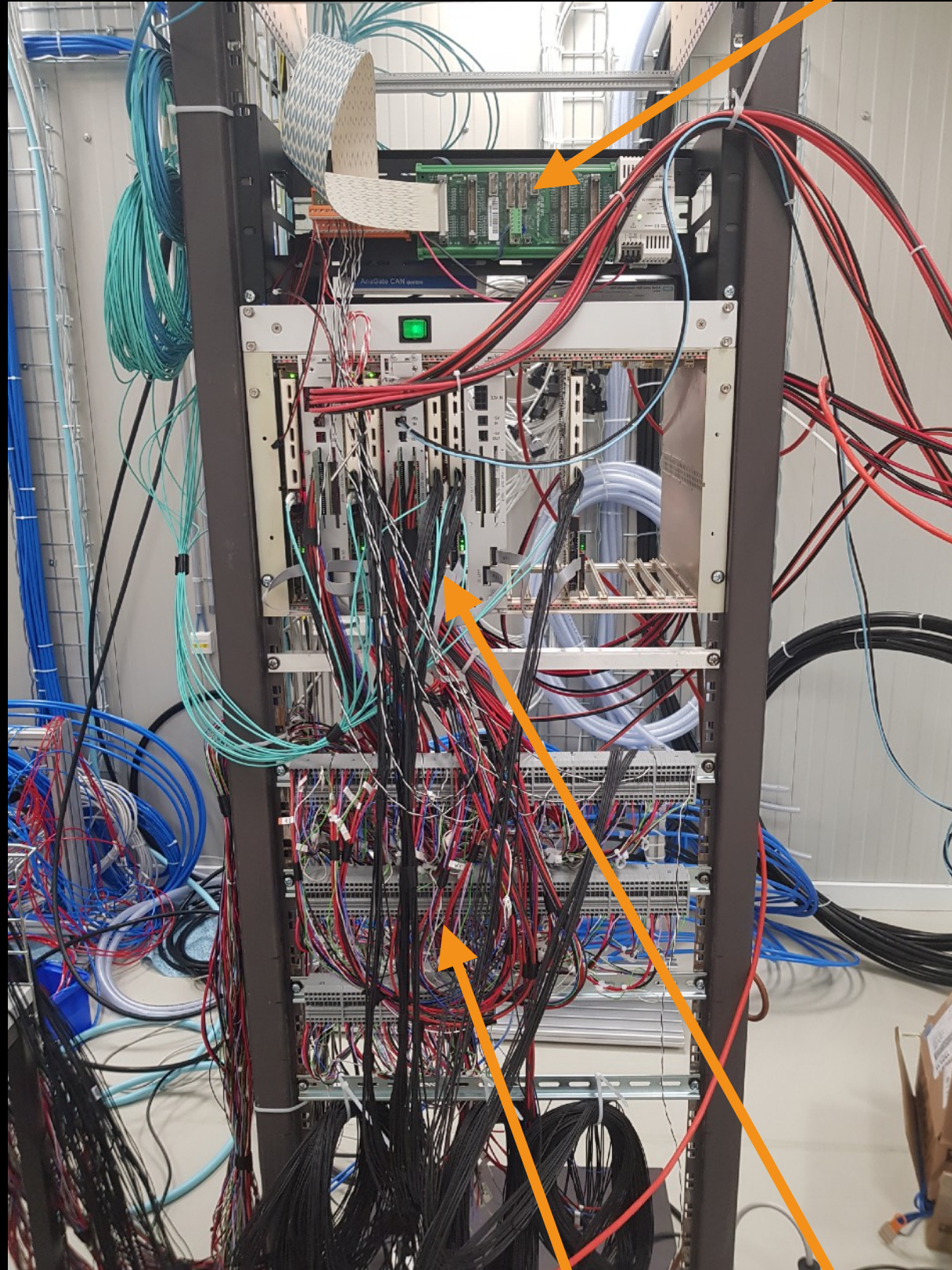
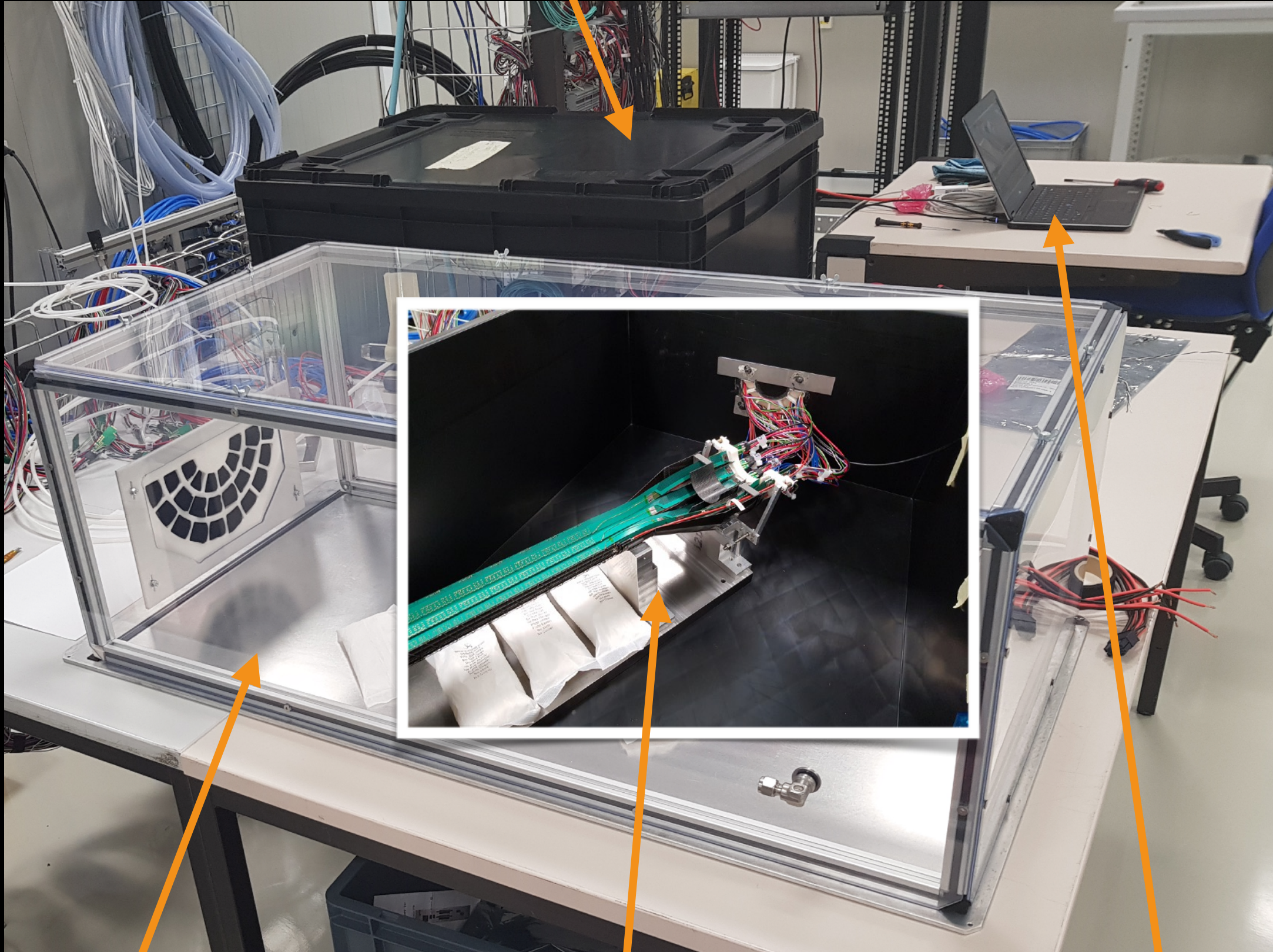




# Set-up Overview

“black box”  
IBO-HL0

ELMB for PT100 (DCS)



new enclosure

HL-0 in  
black box

control PC

(now mostly working from  
counting room)

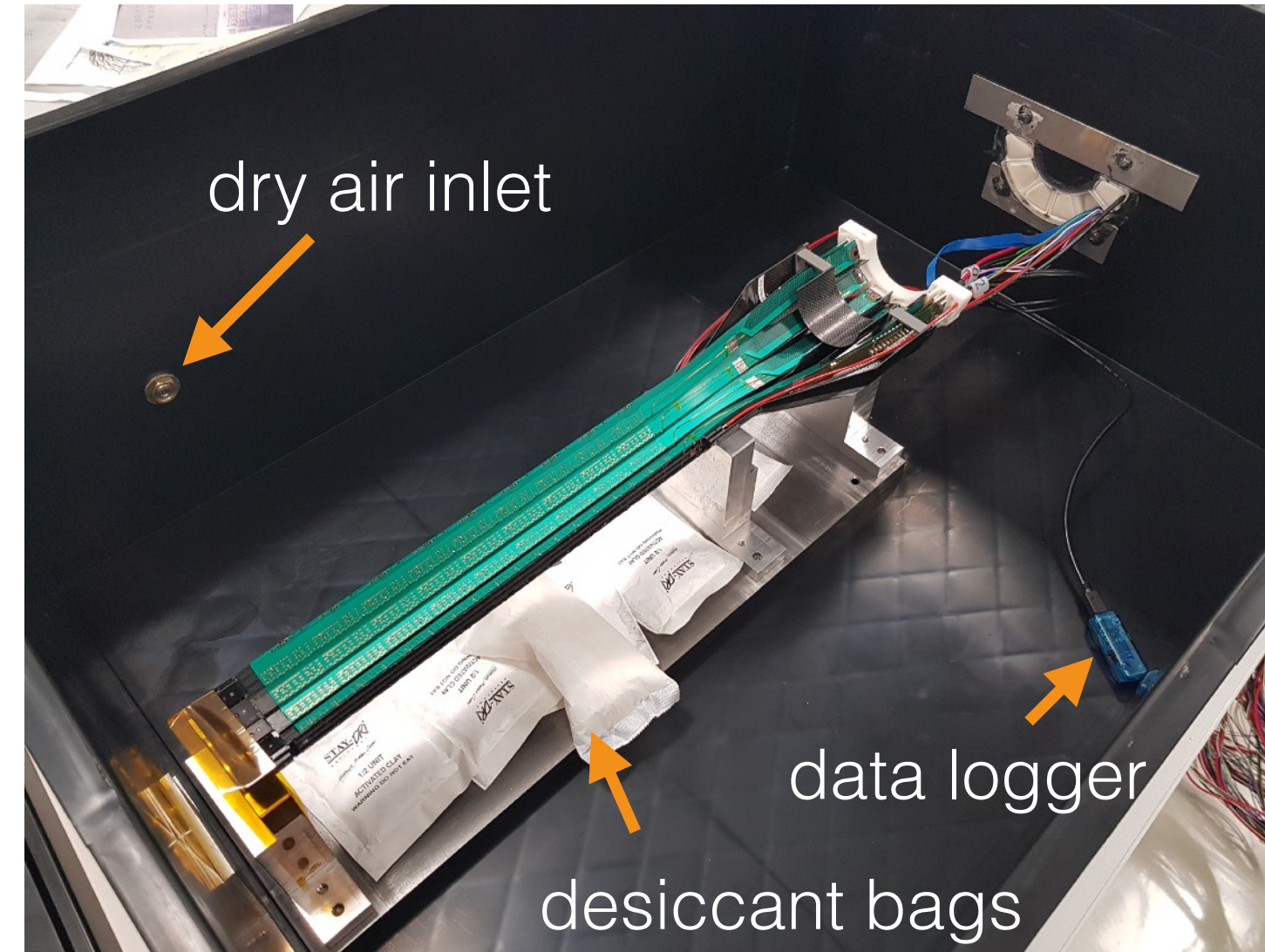
power patching

PB, RU

CAEN crate

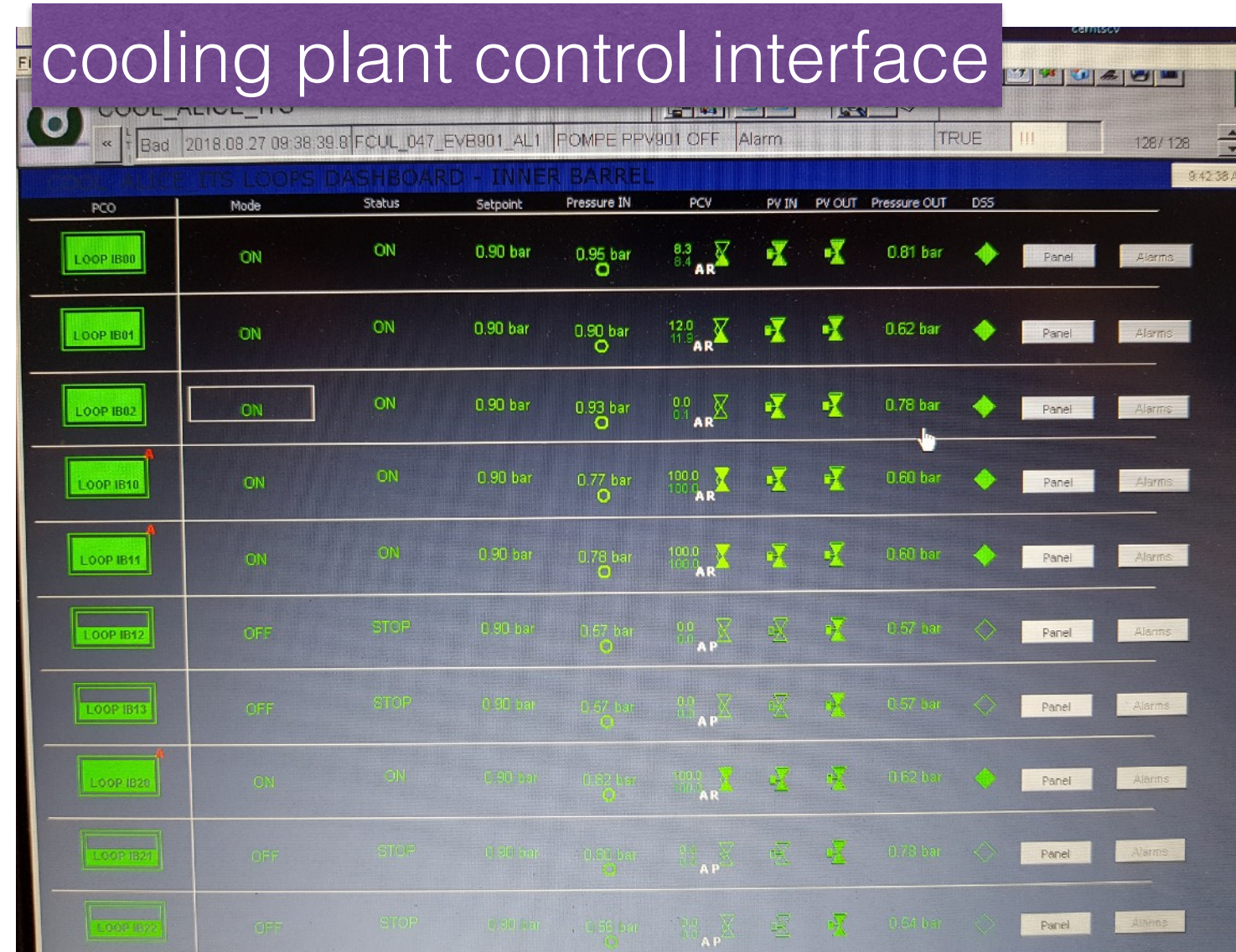
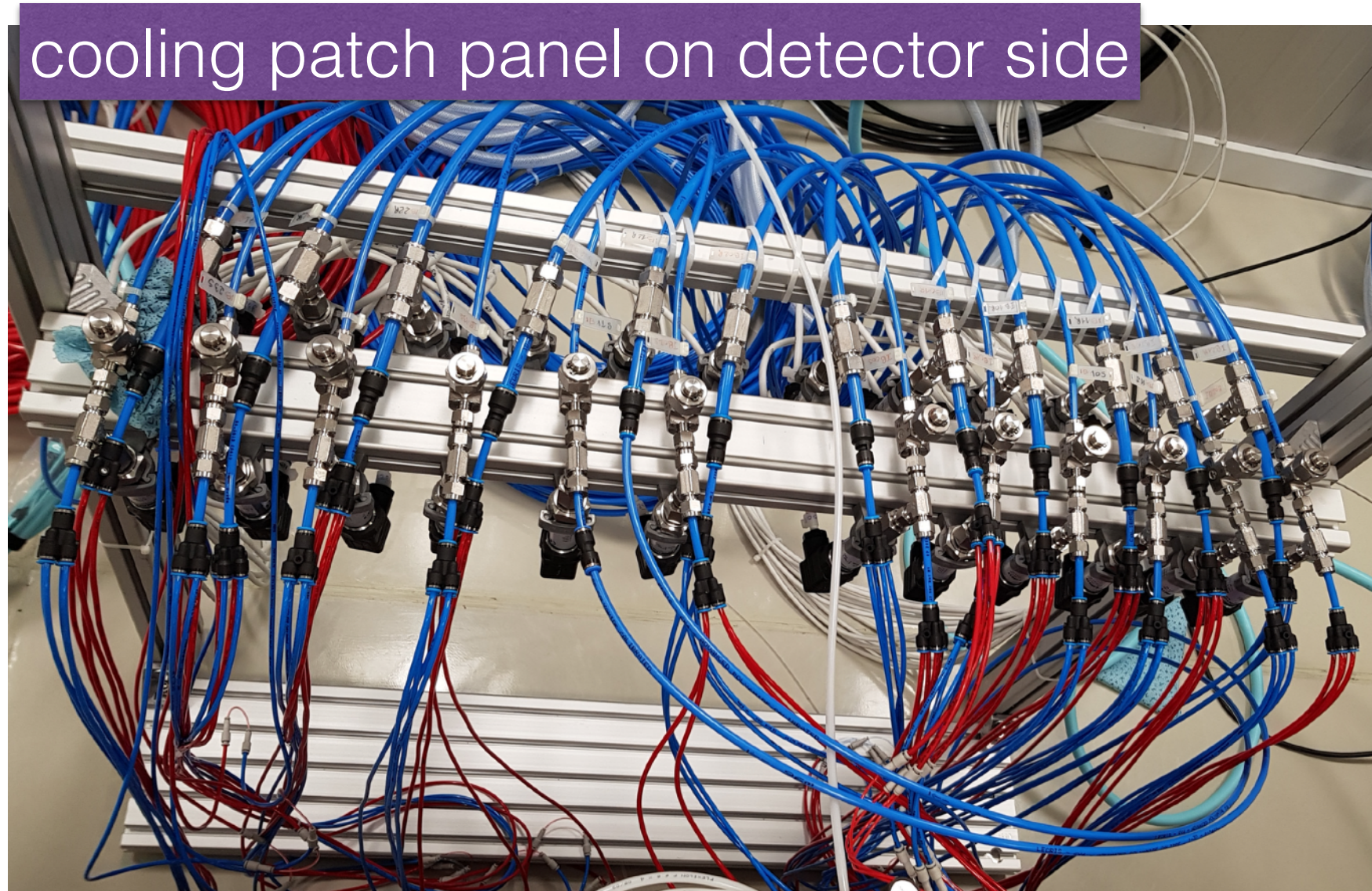
# Enclosure

- For humidity control, setup is place in a gas- (and light-)tight box
- Humidity is controlled by:
  - continuous flushing with dry air
  - desiccant bags
- Monitored by USB data logger
- New box prepared: switch over with next HL



# Cooling

- Cooling of staves **up and running**
- Cooling of RUs and PBs: **currently air cooling only**
- **Working on monitoring/interlock/DCS integration**



# Power I/II

Power to RUs, PBs

- CAEN rack is being used to supply all power
  - no interlock with cooling
  - no remote control via scripts (only GUI)



# Power II/II

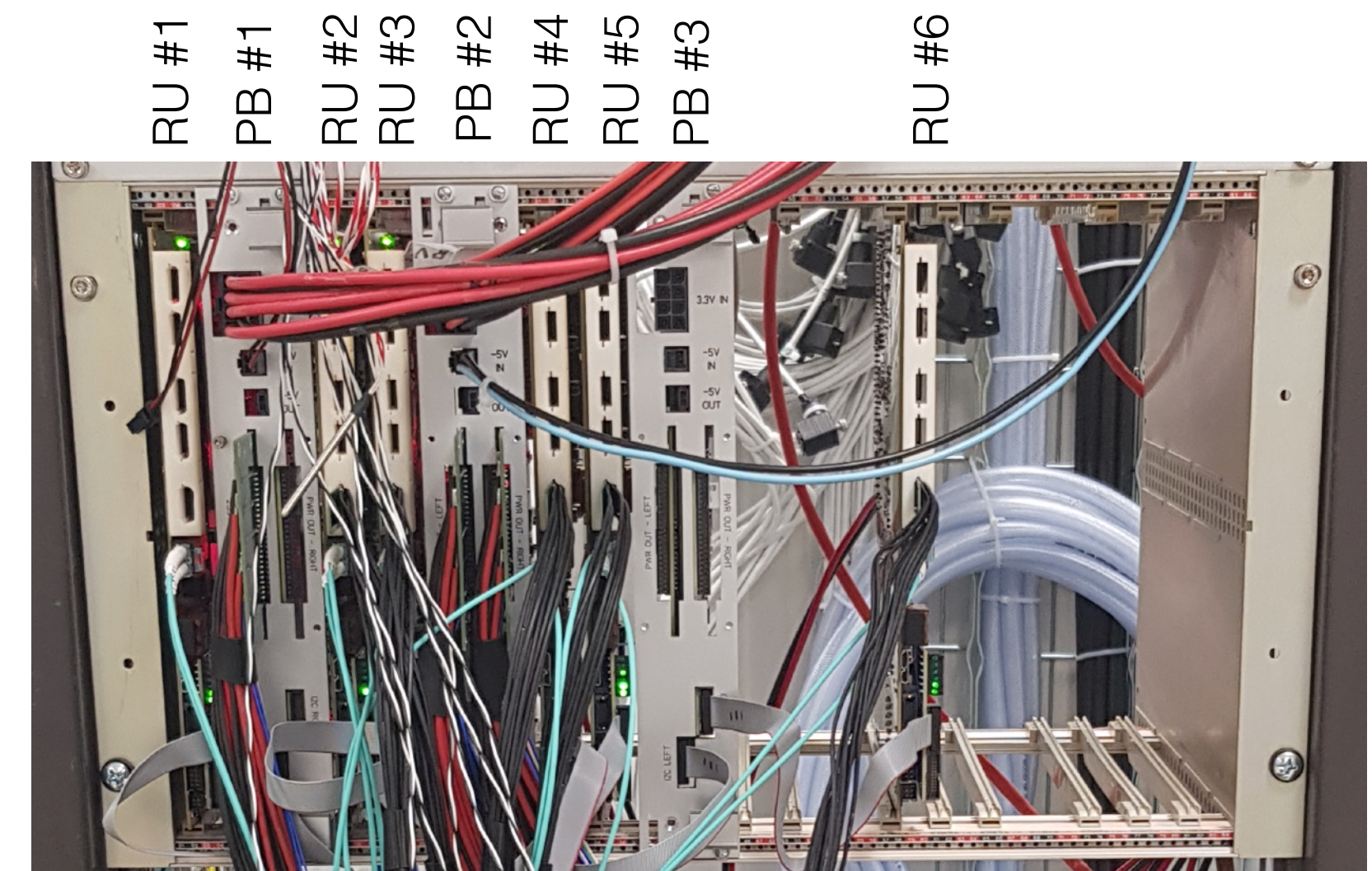
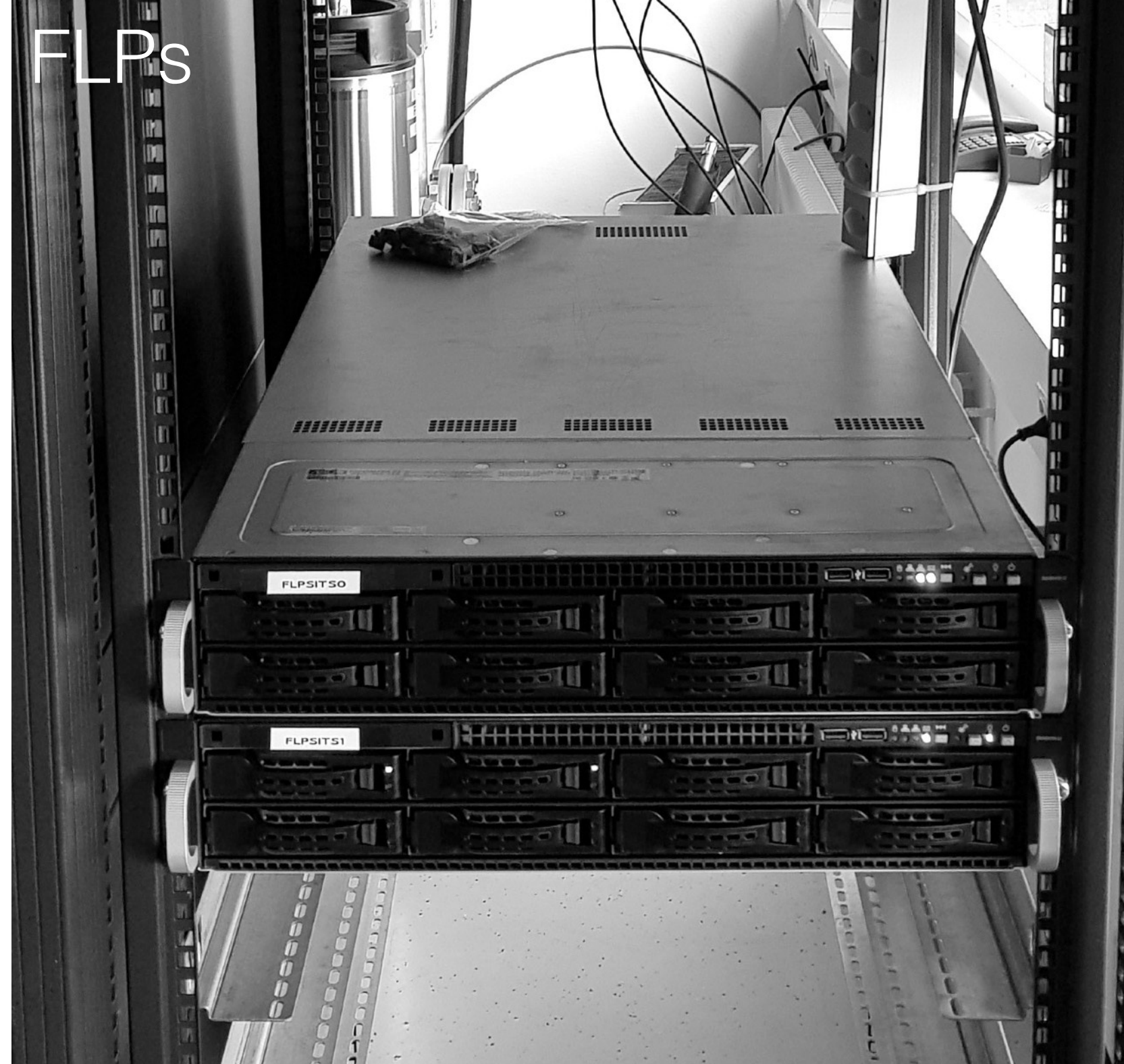
## Power to staves

- *Temporary mapping* of PB channels to staves
  - non-availability of enough PBs
  - non-availability of steering boards (MOSAICs or RUs)
- Flexibility given by patch panels
- Uses cables of *final length and cross-section*
- 3 PBs are ready and installed
  - only 2 can be used at the moment due to missing breakout boards/cables
  - *no show-stopper at the moment*

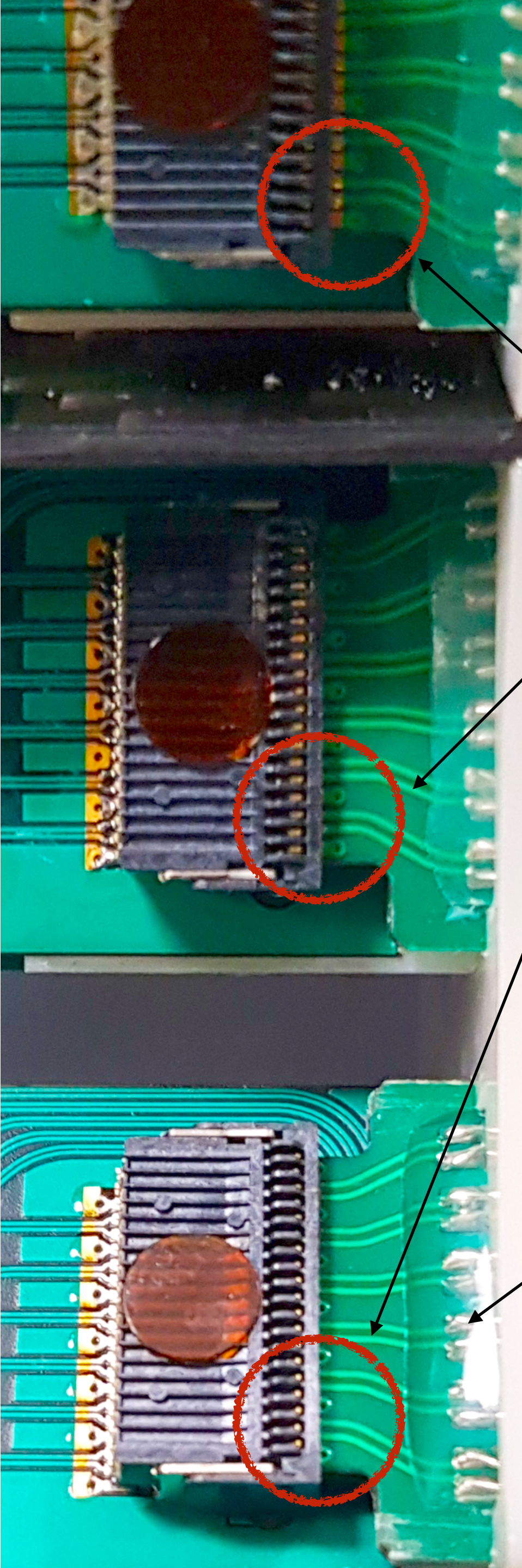




# Readout Hardware



- Now based entirely on RUs v1.1
- 6 RUs installed already
  - integration with FLPs ongoing, firmware and software under development
  - enough for HL-0
  - up to 3 more expected in the following weeks
- Cables:
  - 8m prototypes from Samtec: first try, but connector causes problems (see next slide)
  - 8m commercial cables: different dielectric (slightly worse electrical performance), but better connectors + softer cables



# Readout Cables

Clearly different penetrations

***Not all work reliably!***

Impossible (for me) to insert them more

***For now: switched to commercial cables***

Glue and cable attachment of these prototypes is too close to connector → fixed in final cables

***Need final cables ASAP***

Data cables

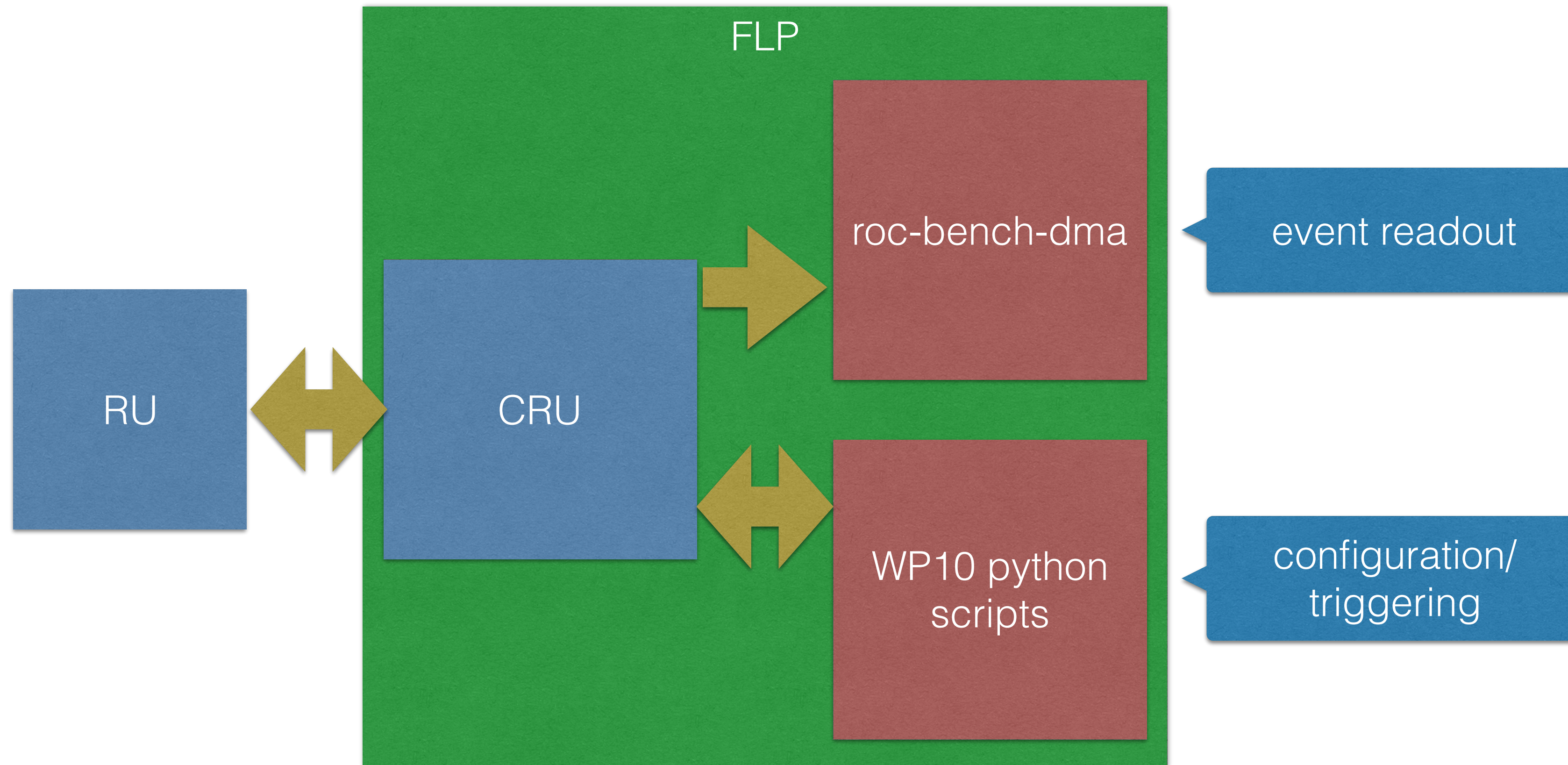


# Readout

Software(s)/Firmware(s)

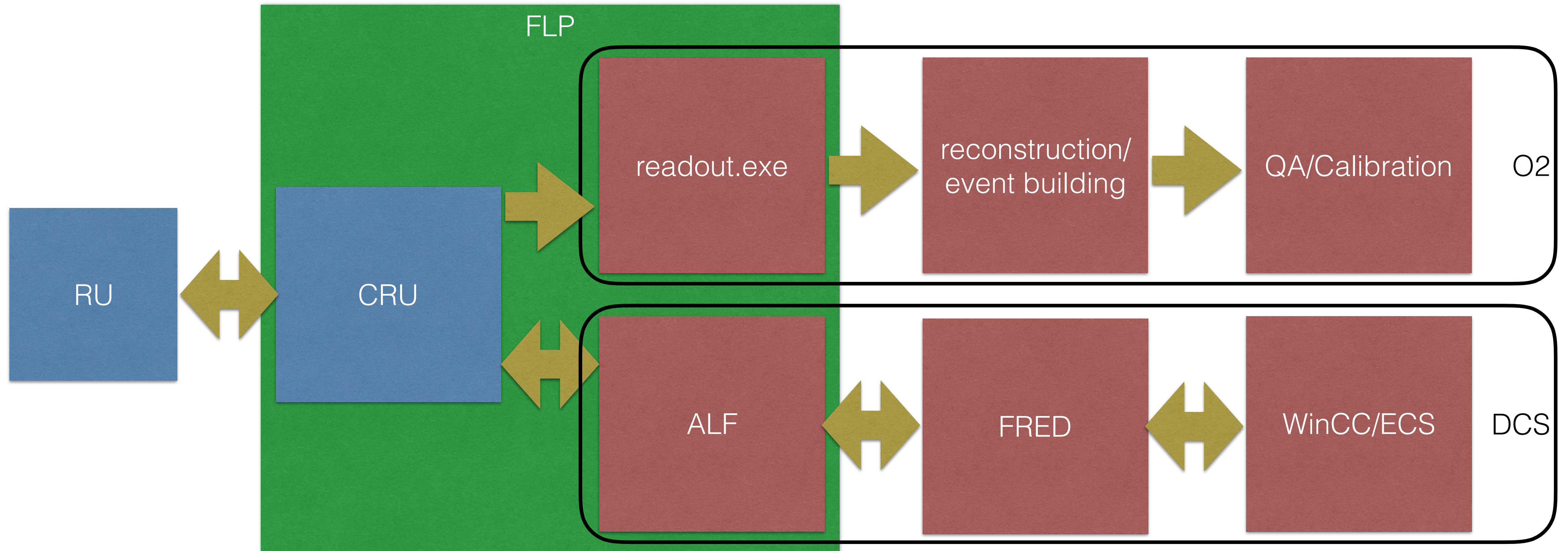
- Stave-RU-CRU-FLP+PB communications *working*
  - *at least sometimes for some of the channels*
  - still a lot of debugging needed!
- Software based on RU test bench and DAQ tools
  - moving to “**readout.exe**”, the DAQ readout tool for DAQ
  - need discussion on tools for detector configuration/monitoring
- Very good support from O2

# Architecture (lab)



This clearly needs to evolve to include (more) final DAQ/DCS tools

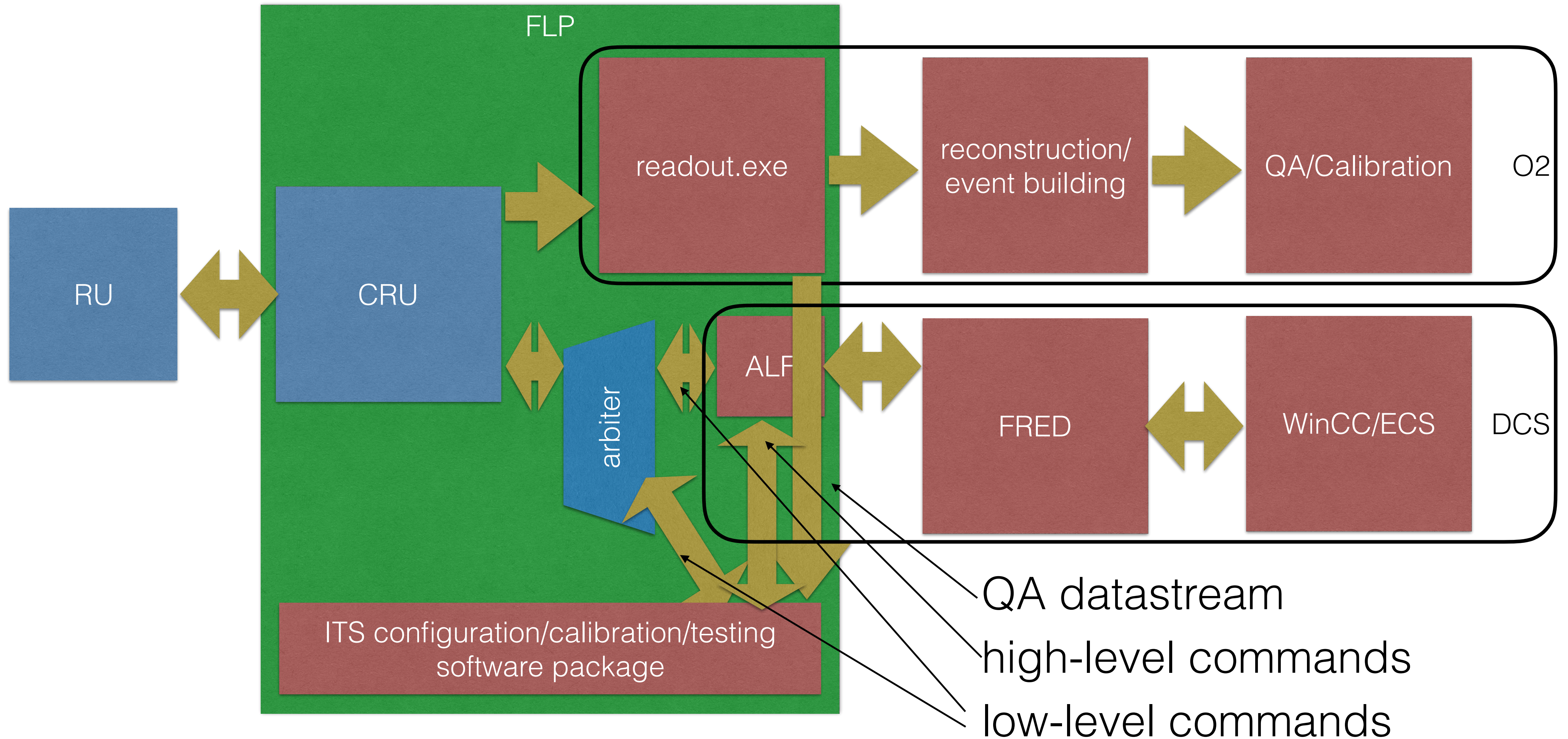
# Architecture (experiment; simplified)



OK, for data taking

... but we would like something in-between for configuration/calibration/testing

# Architecture proposal



# Next commissioning plan

- ▶ Establishing slow control communication with all staves
  - works since last week after move to commercial Samtec cables
  - stress testing started, using FIFO test with magic patterns:  
data=(3\*\*stave.ru\_link\*5\*\*chip\*7\*\*region\*11\*\*fifoaddr)%(2\*\*24-1)  
data=0xFFFFFFFF  
data=0x000000
  - found 2 stuck bits (one at zero, one at one)
- ▶ Establishing readout of all chips
  - started, but not yet systematic
  - working on tool to gather and cross-check all data flow monitor counters in the system (chip, RU, CRU, data)
  - need to synchronise data amongst chips and staves (see next slide)

# Triggering – feature requests

Table 1: Trigger Types

Bit	Name	Comment
0	ORBIT	ORBIT
1	HB	Heart Beat flag
2	HB <sub>r</sub>	Heart Beat reject flag
3	HC	Health Check
4	PhT	Physics Trigger
5	PP	Pre Pulse for calibration
6	Cal	Calibration trigger
7	SOT	Start of Triggered Data
8	EOT	End of Triggered Data
9	SOC	Start of Continuous Data
10	EOC	End of Continuous Data
11	TF	Time Frame delimiter
...	...	Spare
29	TPC <sub>sync</sub>	TPC synchronisation
30	TPC <sub>rst</sub>	TPC reset
31	TOF	TOF special trigger

→ send BCRST command  
(only once, armed by SOT/SOC?)

→ send TRIGGER command

→ send PULSE command (maskable)

→ send DEBUG command (only once, arm-able)

Currently implemented: only PhT trigger, selectable TRIGGER or PULSE



# Summary & Outlook

- *Commissioning* of IB still required and still requires a lot of developments
- Stability of results has to be closely monitored (~ appearing FIFO memory faults)
- DCS need to be implemented in a way that still allows monitoring, interlocks, while still offering full control via our tools at the same time
- Cross-check of results from Stave testing



감사합니다!