

Report on trigger and WaveDAQ



Chi è dappertutto, non è da nessuna parte.

— Seneca

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FOOT Collaboration Meeting, 09/12/2020

Outlook

- Preparation for CNAO run
 - *Updated WaveDAQ configuration*
 - *Updated trigger menu*
- Status of the HW procurement
- Plan for 2021

WaveDAQ crate for CNAO 2022Z

DCB
Read out board

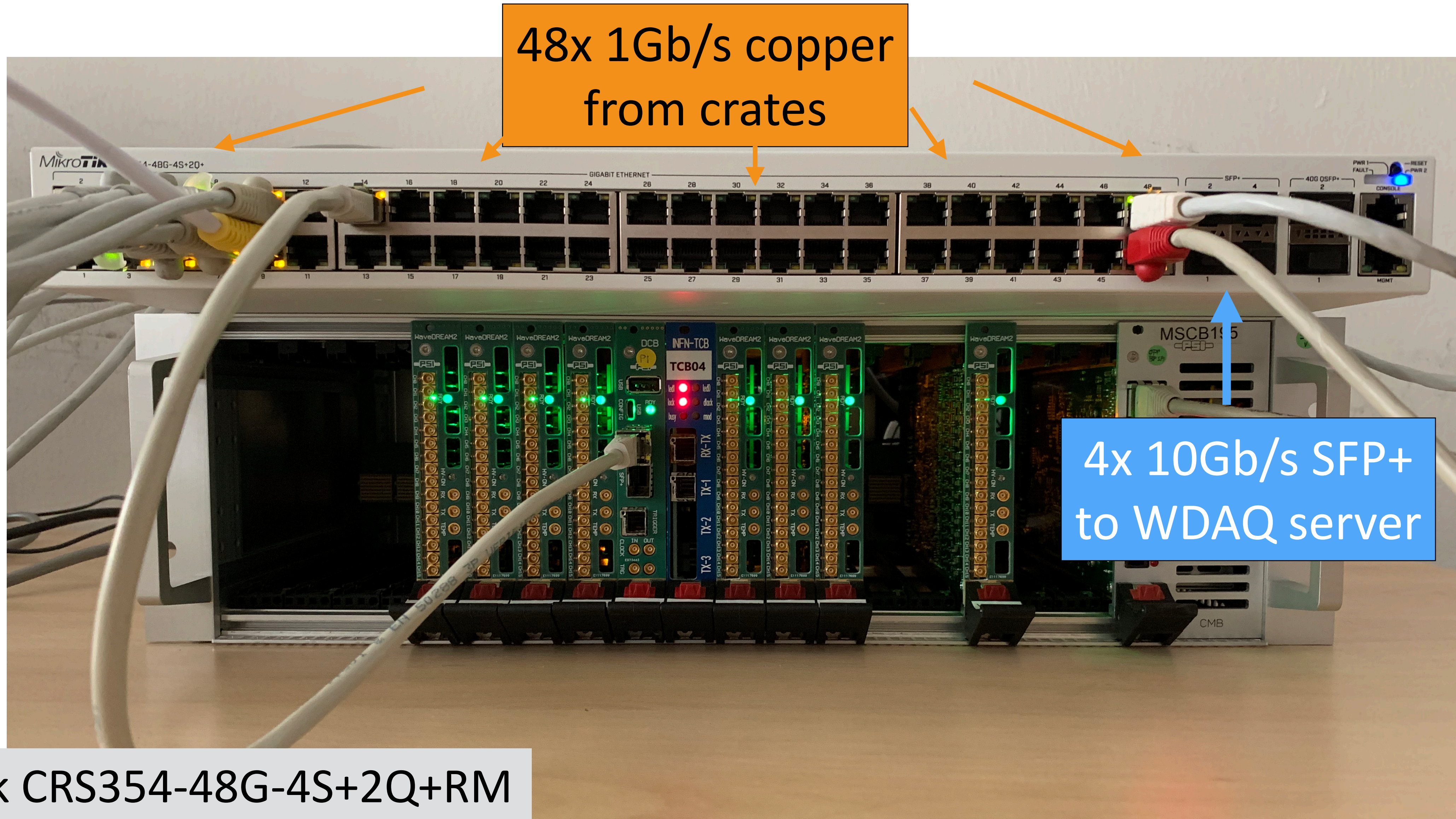


slot	0	1	2	3	4	5	6	7	DCB	TCB	8	9	10	11	12	13	14	15	
node association					WD157 Margarita	WD158 TOF X0	WD159 TOF X1	WD160 TOF X2/Y0	DCB	TCB FOOT	WD160 TOF Y1	WD161 TOF Y2	WD163 VETO			WD164 CALO			
					bar0x	bar8x	bar17x				bar5y	bar14y	bar9x			CALO (9 ch)			
					bar1x	bar10x	bar18x				bar6y	bar15y	bar9y						
					bar2x	bar11x	bar19x				bar7y	bar16y	Neutron veto						
				Cha 0 -> 7	bar3x	bar12x	bar0y				bar8y	bar17y	empty						
				empty	bar4x	bar13x	bar1y				bar10y	bar18y	empty						
				empty	bar5x	bar14x	bar2y				bar11y	bar19y	empty						
				empty	bar6x	bar15x	bar3y				bar12y	empty	empty						
				empty	bar7x	bar16x	bar4y				bar13y	empty	empty						
	EMPTY	EMPTY	EMPTY	EMPTY	ch 0->7	ch 0->15	ch 0->15	ch 0->15			ch 0->15	ch 0->11	ch 0->3	EMPTY	EMPTY	Neutrons (7 ch)	EMPTY	EMPTY	MSCBXXX

TCB
Trigger board

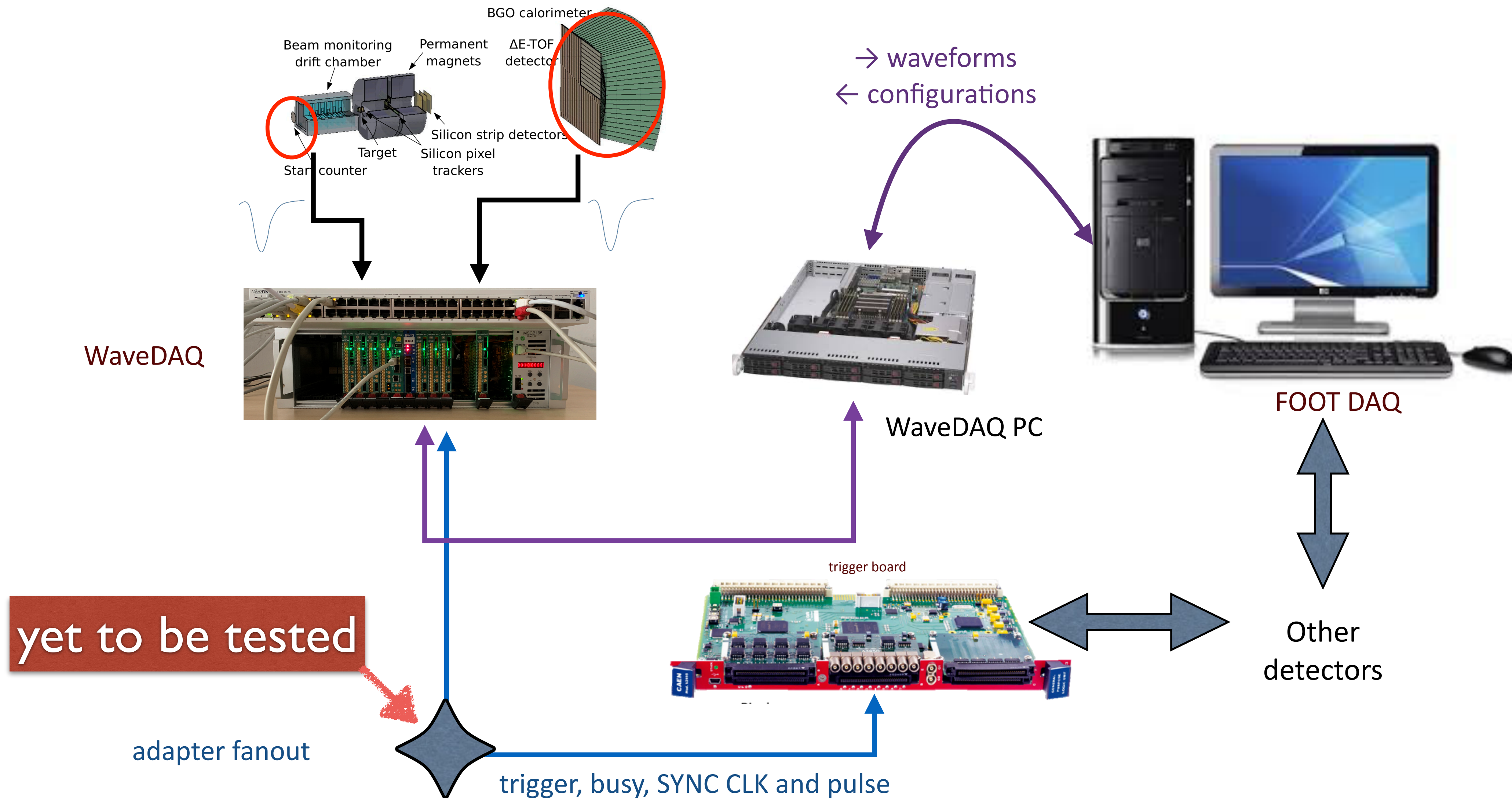
NEW
BGO

WaveDAQ crate for CNAO 2022Z



Mikrotik CRS354-48G-4S+2Q+RM

Connection to central DAQ



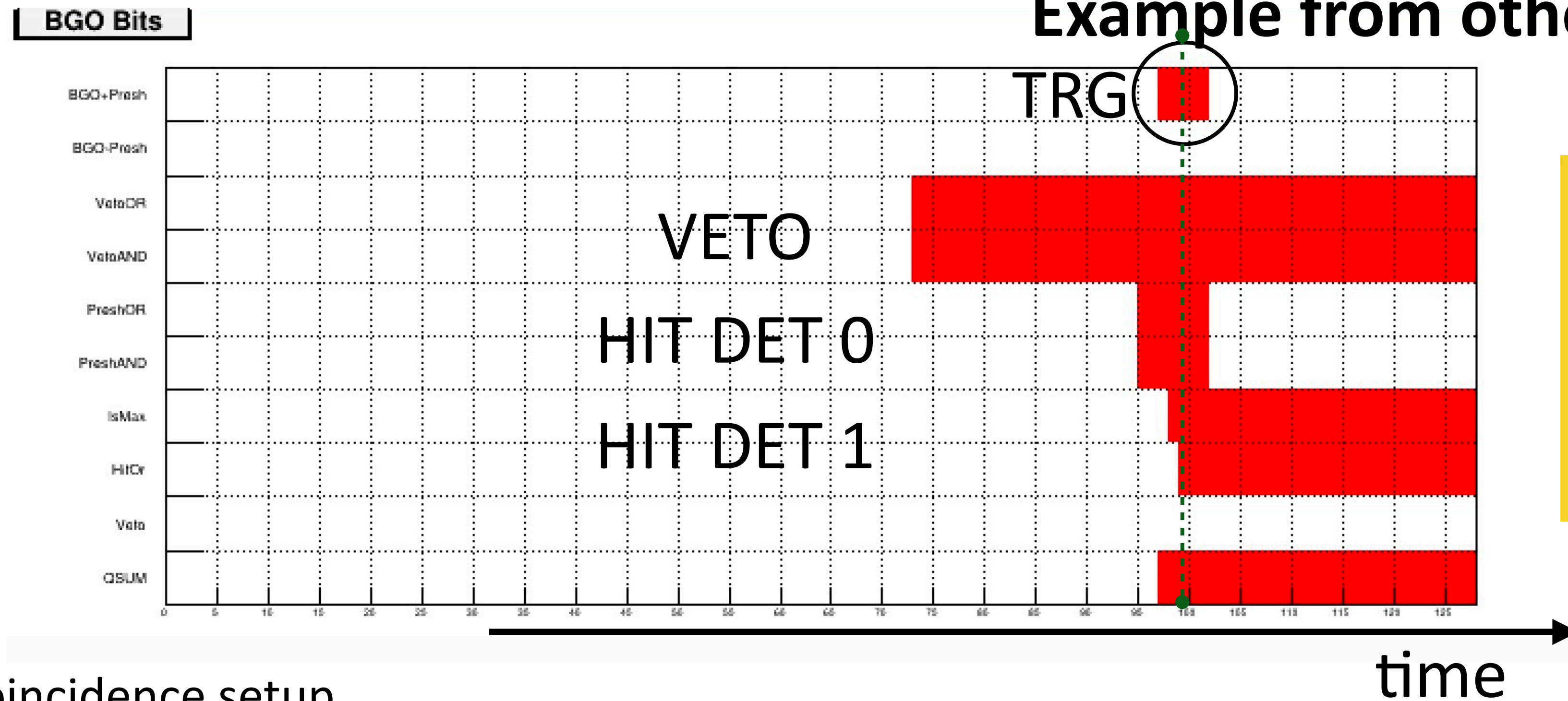
Trigger menu (even not comprehensive)

- Fragmentation *Combined*
Margarita+TOFWALL
- *“Pisa” and “Rome” algorithms available*
- Margarita with and w/o Calo*
 - *also for fragmentation with full Calo*
- Margarita + Neutrons*
- * yet to be tested

- Margarita *Single detector*
 - *majority, channel OR*
- TOF WALL: programmable to be single channel, single bar or front back bar coincidence
- Calo: OR of 9 crystals (with masks)*
- Neutron: OR of the 7 channel available (with masks)*
- Pedestal (“random”)

Coincidence trigger setup

Example from other experiment



TCB bank
readout to be
implemented
in SHOE

- Interface for coincidence setup
 - *timeline of single detectors triggers*
 - *in case of large differences (as an example due to cables) apply individual detector trigger pulse delay*
 - **SW parameter, no need of FW recompilation**
- Feedback from offline also needed

WaveDAQ @full throttle

- CNAO configuration, i.e. GSI 2019 + 1 board for Calo + neutrons
- *pedestal trigger @6.4kHz, DAQ rate almost 2.3kHz with no event building issue*
 - **i.e. events ready to be transmitted to central DAQ**

```
printing monitoring data: press 'q<ENTER>' to exit
average being calculated on last 37 seconds
```

```
-----
Buffers:
  Pkts ( 0.0%):
  BuildEvs ( 5.0%):-----|1.000000:20.000000|
  Evts ( 0.0%):
  Cals (100.0%):-----|-----|
-----

Threads:
  Msgs/s ( 3.0%):-----|6.000000:200.000000|
  Pkts/s ( 6.8%):-----|68436.000000:1000000.000000|
  DropPkts/s ( 0.0%):-----|0.000000:1000000.000000|
  builder is building
  builder is not dropping
  BuiltEvt/s (100.0%):-----|2281.000000:2000.000000|
  DropEvt/s ( 0.0%):-----|0.000000:2000.000000|
  OldEvt/s ( 0.0%):-----|0.000000:2000.000000|
```


DAQ speed with TCB readout

- Needed for trigger efficiency studies
 - *when the WaveDAQ FW will completed will be as fast as WDB one*
 - *It is currently limited to ~90Hz (as a function of the required amount of data)*

```

printing monitoring data: press 'q<ENTER>' to exit
average being calculated on last 7 seconds
-----
Buffers:
  Pkts ( 0.0%):
  BuildEvs ( 20.0%):-----| 4.000000:20.000000 |
  Evts ( 0.0%):
  Cals (100.0%):-----|
-----
Threads:
  Msgs/s ( 2.5%):---| 5.000000:200.000000 |
  Pkts/s ( 0.3%):-| 2789.000000:1000000.000000 |
  DropPkts/s ( 0.0%):| 0.000000:1000000.000000 |
  builder is building
  builder is not dropping
  BuiltEvt/s ( 4.5%):---| 90.000000: 000.000000 |
  DropEvt/s ( 0.0%):| 0.000000:2000.000000 |
  OldEvt/s ( 0.0%):| 0.000000:2000.000000 |
  
```

DAQ speed with TCB readout

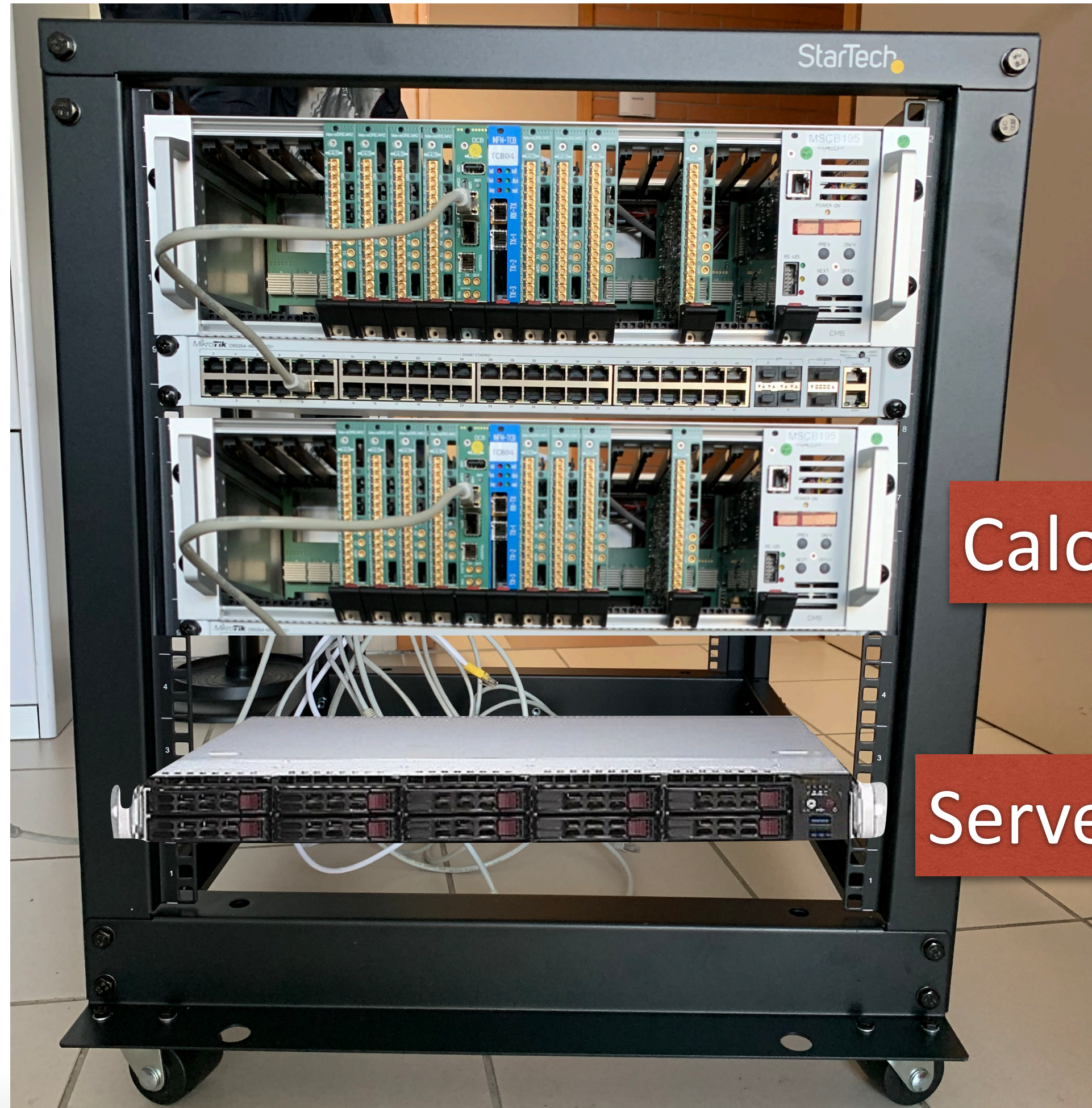
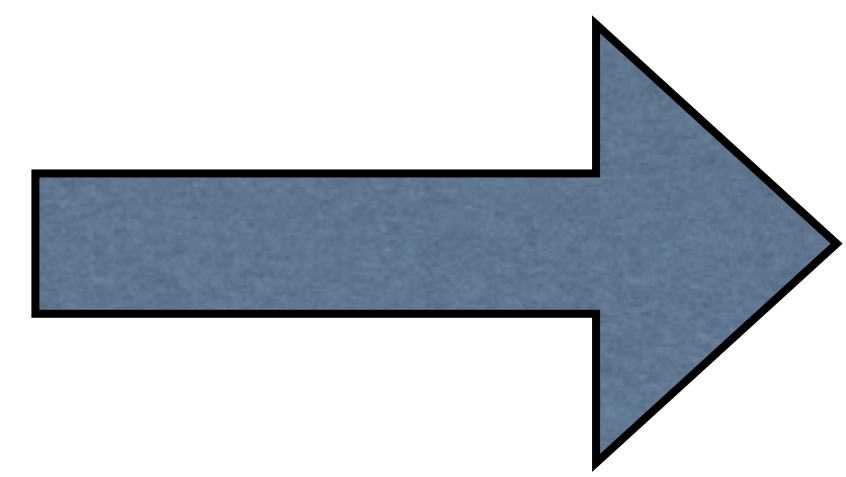
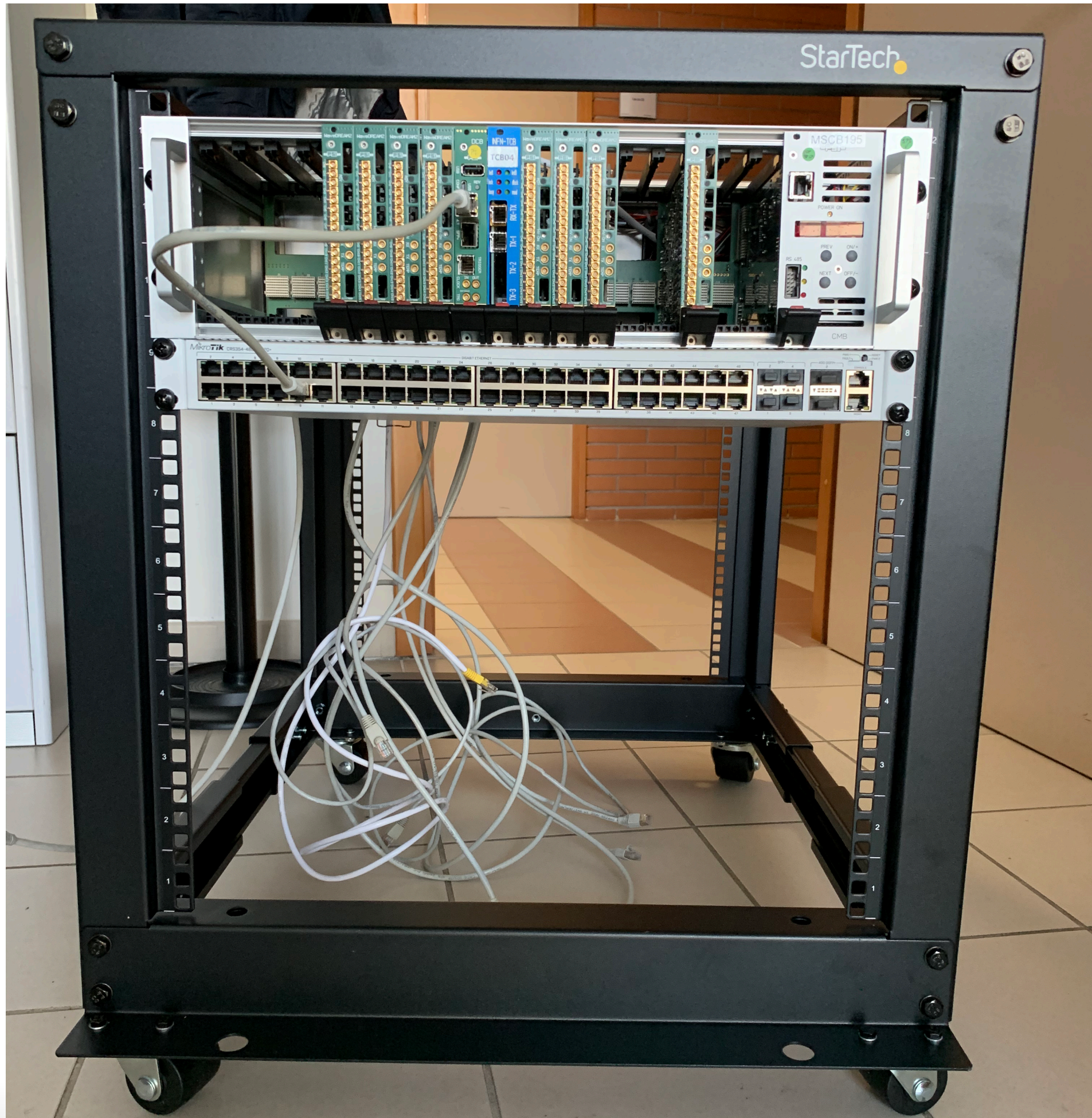
- Needed for trigger efficiency studies
 - *when the WaveDAQ FW will be completed will be as fast as WDB one*
 - *It is currently limited to $\sim 90/100\text{Hz}$ (as a function of the required amount of data)*

- *In principle the DCB FW should be ready for March 2021*
 - **in case the TCB readout will be as fast as WDB**
 - **32bit BCO counter will then be used for event building**

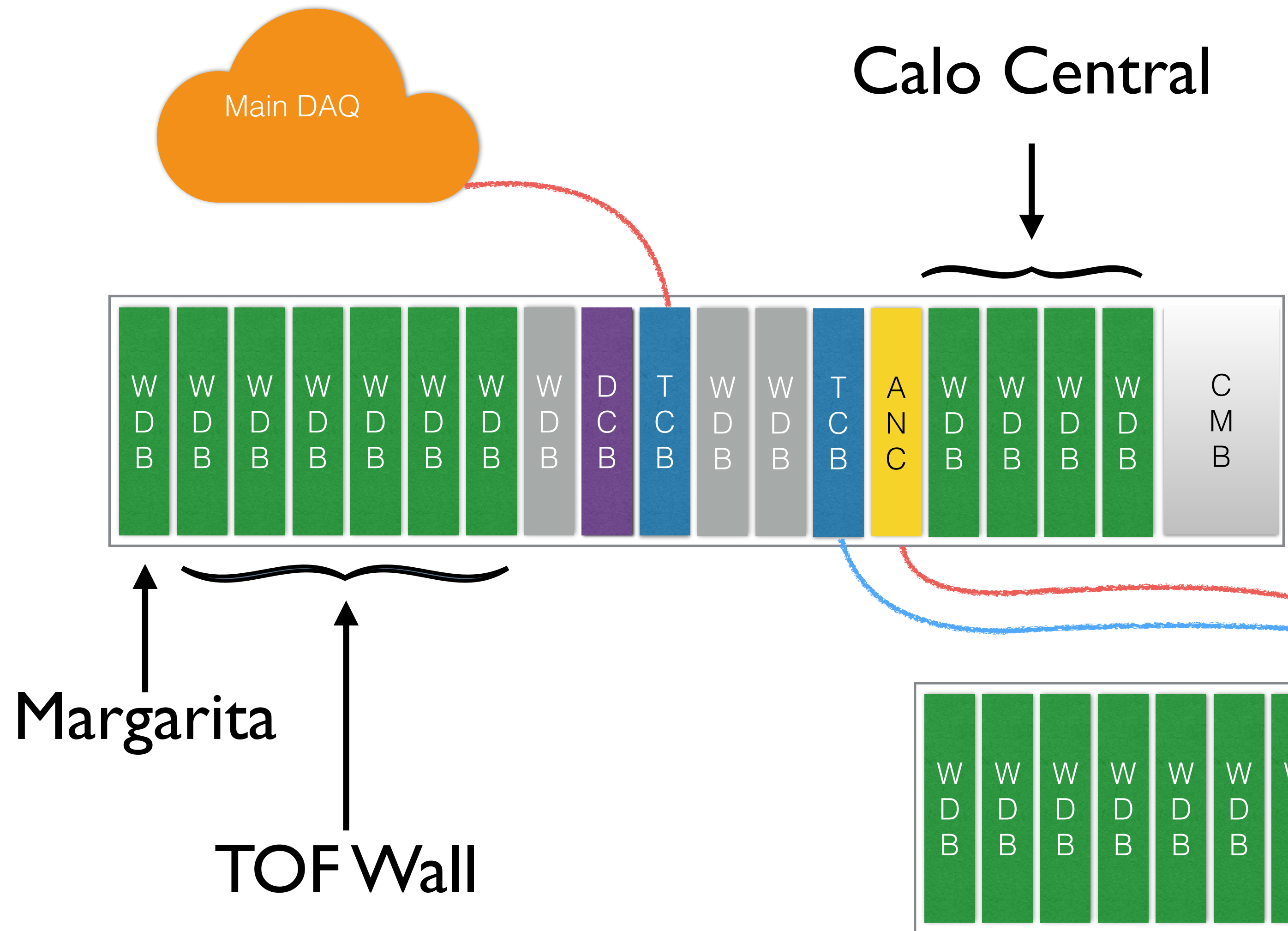
A transportable system

NOW

FINAL



Configuration with full calo



The 2 new TCB can be considered "optional".
 CAVEAT: needed to trigger on signals on second crate

Anc HW available, to be assembled

Calo !Central

Boards production

- WaveDREAM
 - *Production finally started!*
 - Last batch of WaveDREAM boards expected @PSI at mid of March
 - *Order for one more WaveDAQ crate (for Calo) placed in time to join the main production*
- Trigger Concentrator Boards
 - *Order placed for 2 more TCB boards for FOOT*
 - production started
 - shipment to Pisa expected within end of January

WaveDAQ server

- Supermicro server ordered
- CPU 16core/32threads
 - processes parallelisation if needed (with full calo)
 - *code already supporting this option*
- RAM 32GB
- 1 TB Disk
 - Compatibility with SSD upgrade (if/when needed)
 - *partial local data logging?*
 - *also used for standalone calibrations*
- Intel X710, dual port SFP+ 10 Gb/s network card
 - 10 Gb/s connection to main DAQ may be used
- Delivery expected soon, hopefully in time for CNAO

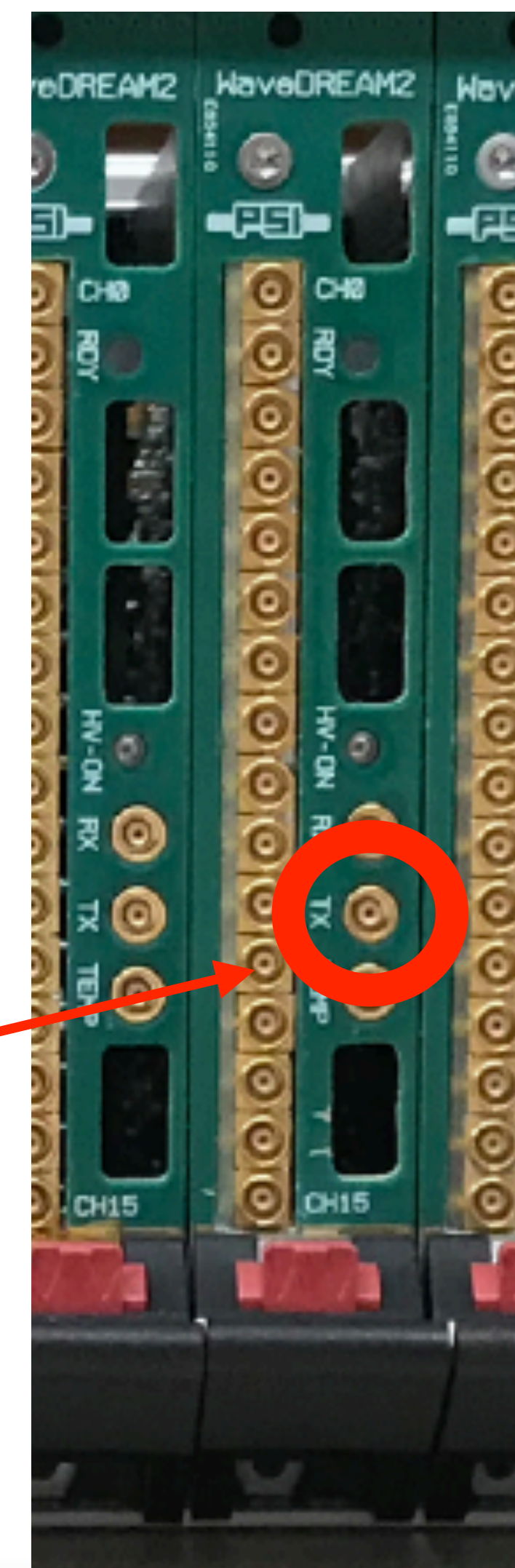


Plan for GSI data taking

- We should have the full WaveDAQ available
 - *DCB FW included*
 - **final commissioning of the WaveDAQ readout for FOOT**
- Some of the triggers will be tested in CNAO
 - *refinements for full Calo channels will be done*
- Possible improvements to trigger algorithms from CNAO data and simulation studies

Addendum: Margarita for emulsions

- Need of dose monitoring and give a end-of-run to accelerator crew
- Possible solution with Margarita
 - *Margarita WaveDREAM to send hits to TCB*
 - *The trigger board counts the number of particles (triggers) and generate a pulse after N-particles*
 - use of trigger prescaling
 - max value 2^{32}
 - *the trigger is sent out from the crate by the WDB and sent to accelerator group*
- This proposal is the result of a discussion with G. Traini
 - *it can be tested, if agreed upon the collaboration (also in CNAO)*

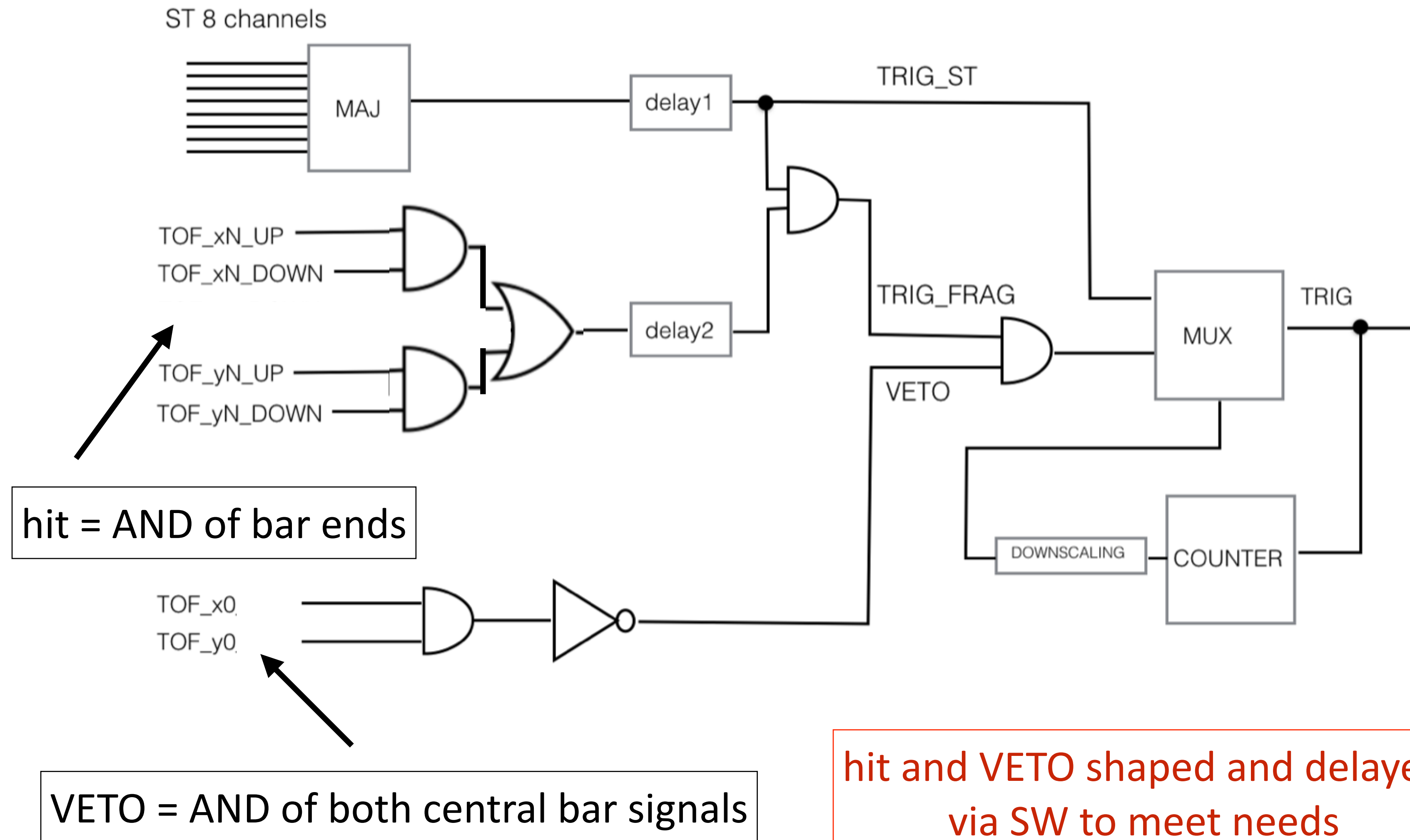


Conclusions

- The WaveDAQ is in good shape
 - *Full HW (should be) available early in 2021*
 - maybe also for CNAO
 - *Inclusion in main FOOT DAQ on going well*
- Trigger menu is following the experimental needs
 - *combined triggers to be commissioned in 2021*

backup

FOOT trigger "Pisa"



FOOT trigger "Rome"

