

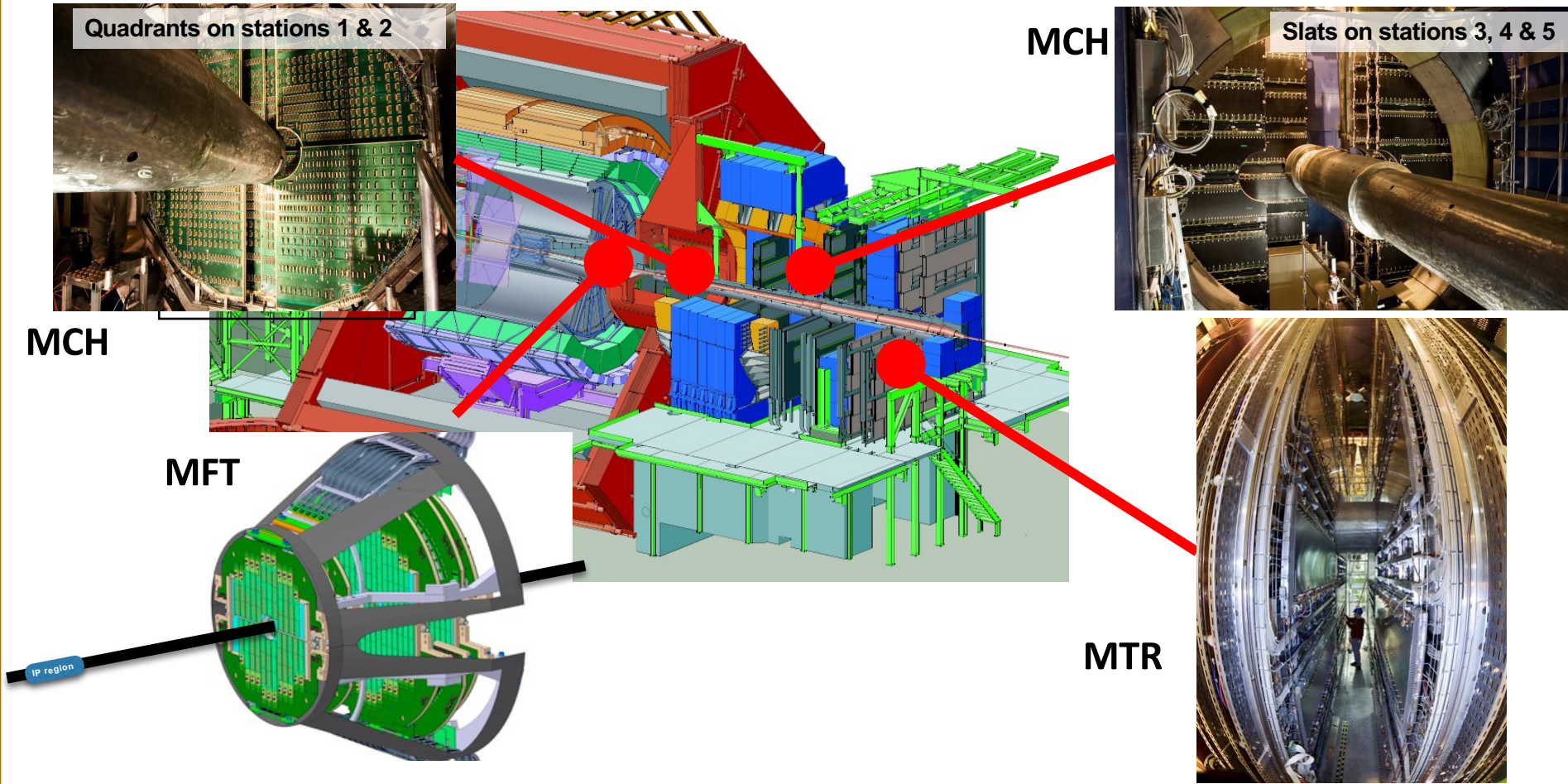


# MCH status

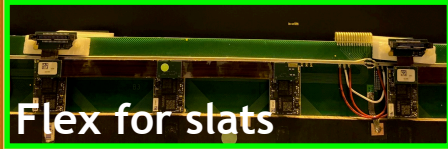
20 luglio 2023

Corrado Cicalò - Cagliari

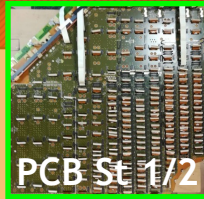
# Il muon tracking



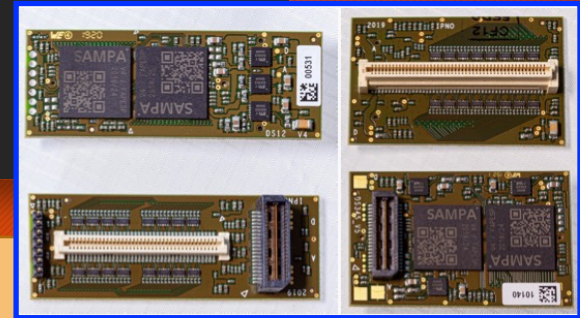
# MCH upgrade project



Flex for slats

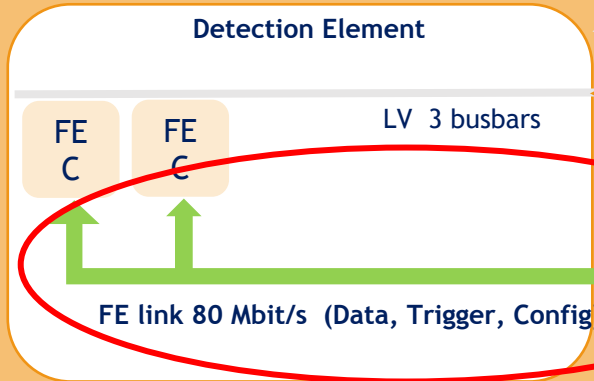


PCB St 1/2



DualSampa FEC

1 FEC = 2 SAMPA = DualSAMPA  
16500 + 2500 (spares)



FE link:  
FLEX (slats) /PCB(quadrants)  
+ flat cable  
~ 3000

Cavern

LVPS  
WIENER  
PL512

HVPS  
No change

Filter  
box

DCS

2.5V  
GND

30

SOLAR  
700

CRU  
FLP  
(O2)

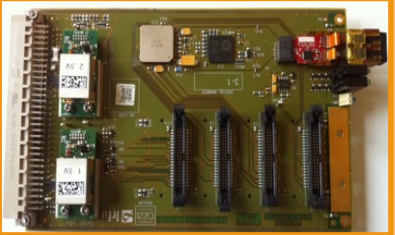
GBT link  
3.2 Gbit/s

LTU ↔ CTP

SAMPA: Brazil  
CRU: Hungary, India

FEC: Orsay  
FLEX: Cagliari  
SOLAR : Saclay  
CRU: India  
(Kolkata, Aligarh)

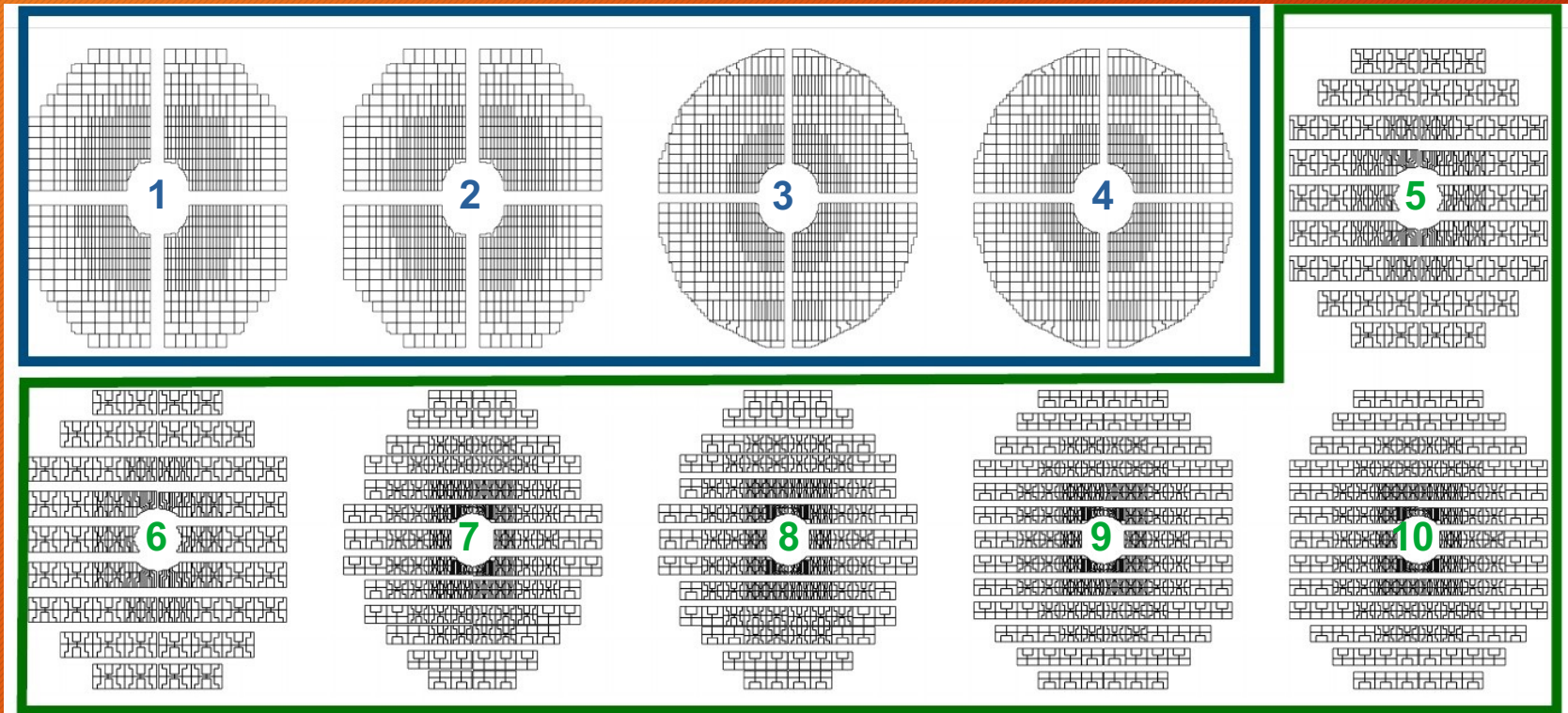
Control room



SOLAR board

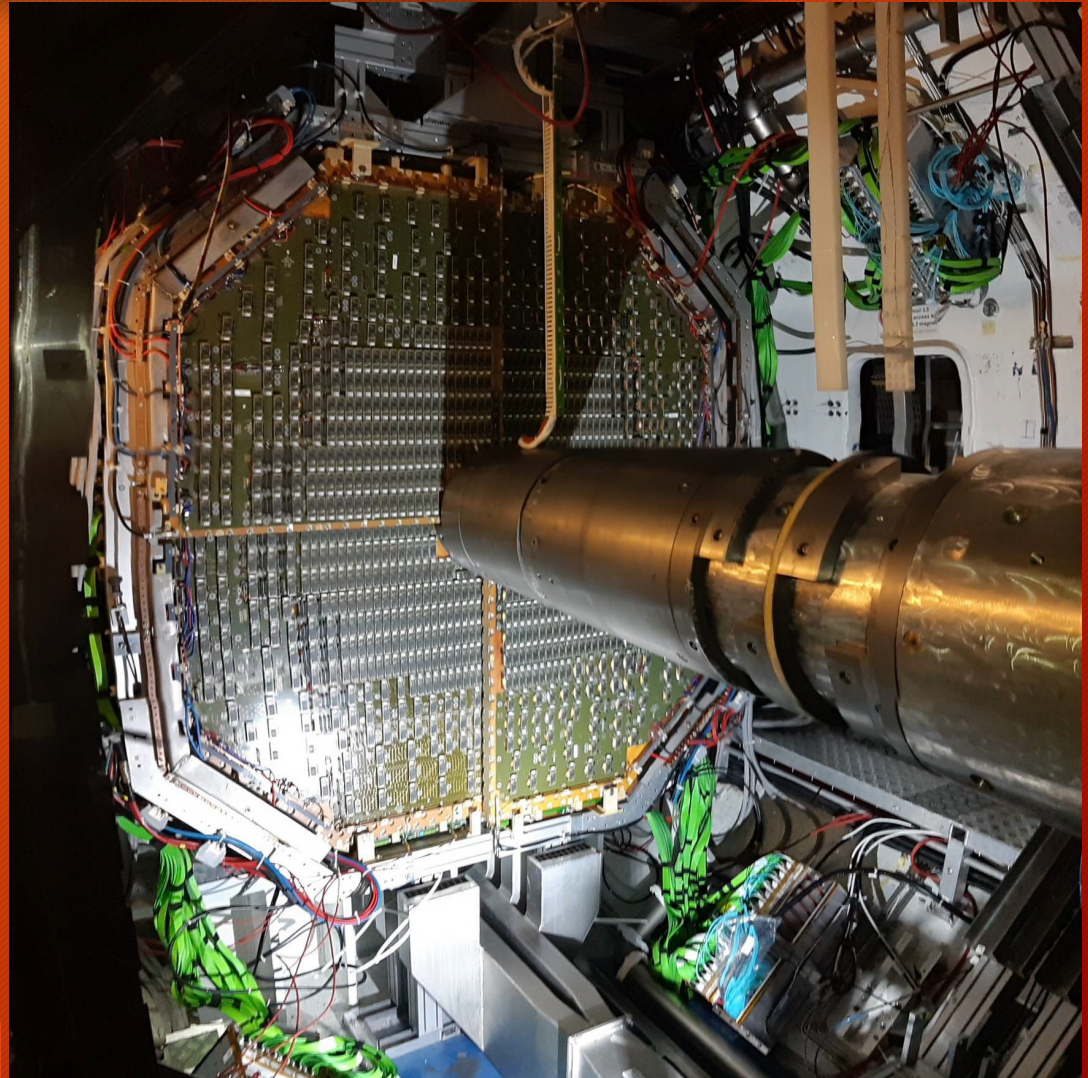
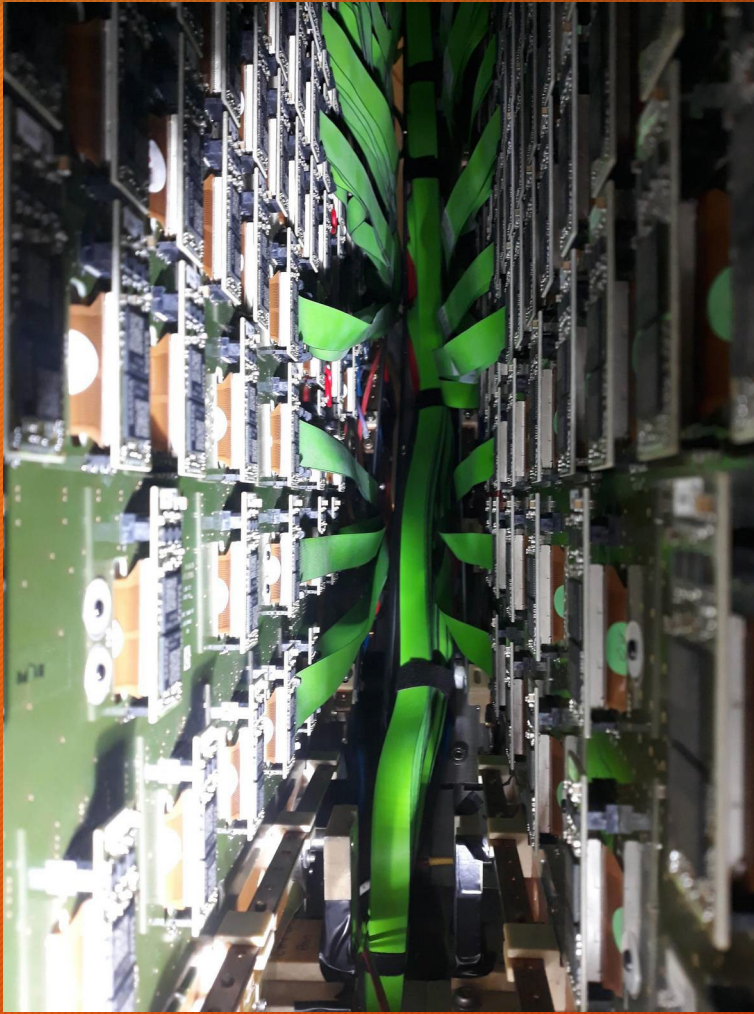
# ALICE Muon Spectrometer : 10 chambers

16 DE quadrants, 2 types, 43% of pads



140 DE slats, 19 types, 67% of pads  
1063528 pads readout by 16820 Dual Sampas readout by 624 Solars  
readout by 30 CRUs.

# Station 1



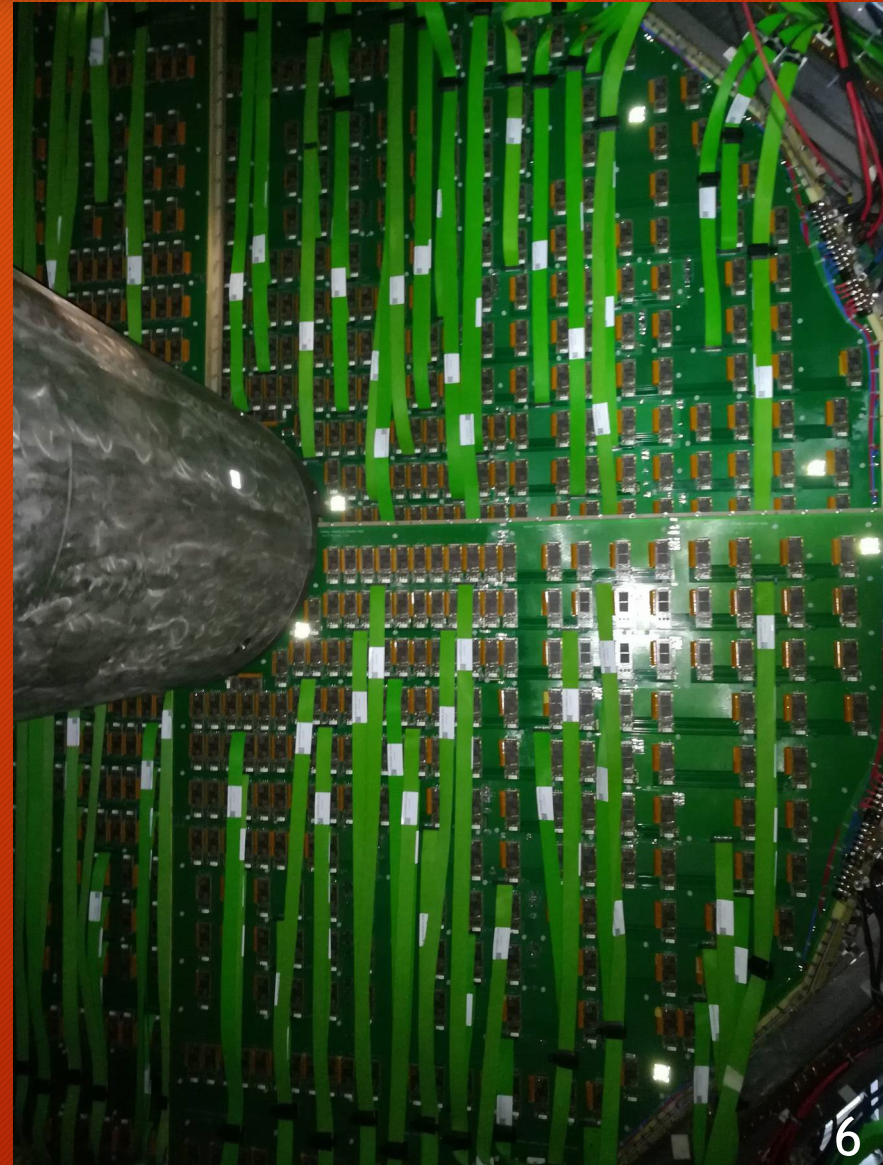
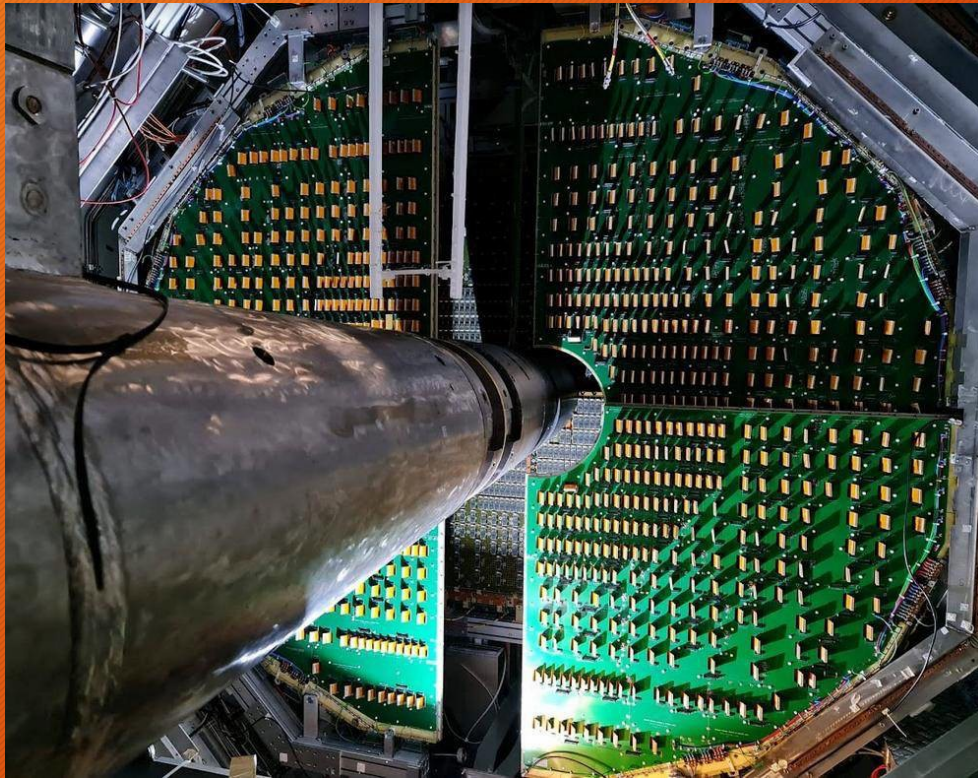
↑ View between chamber 1 and 2  
Chamber 2 closed →  
Four sides still to be connected

20 Luglio 2023

# Station 2

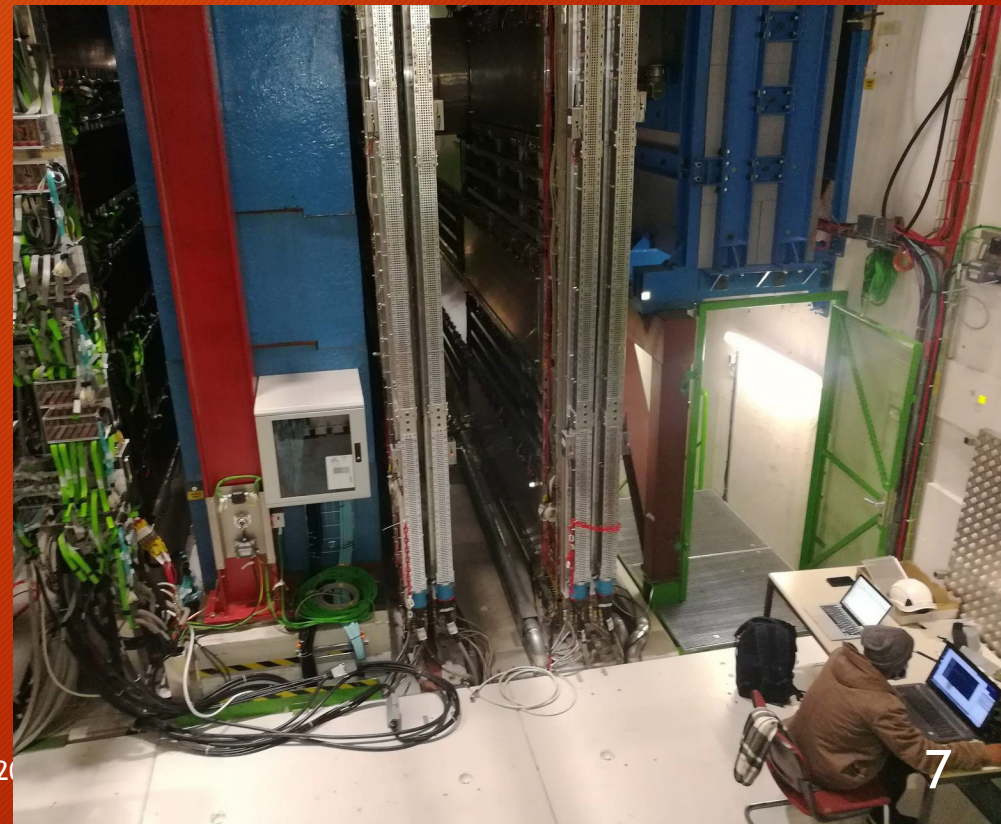
Chamber 4 fully cabled →

Chamber 3 half closed during installation (chamber 2 visible behind) ↓



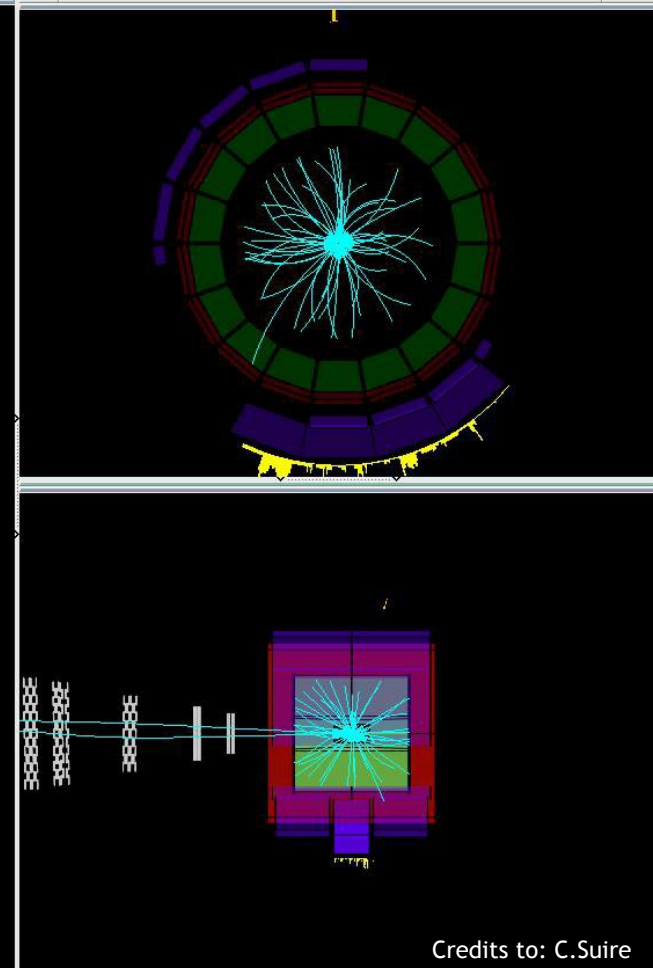
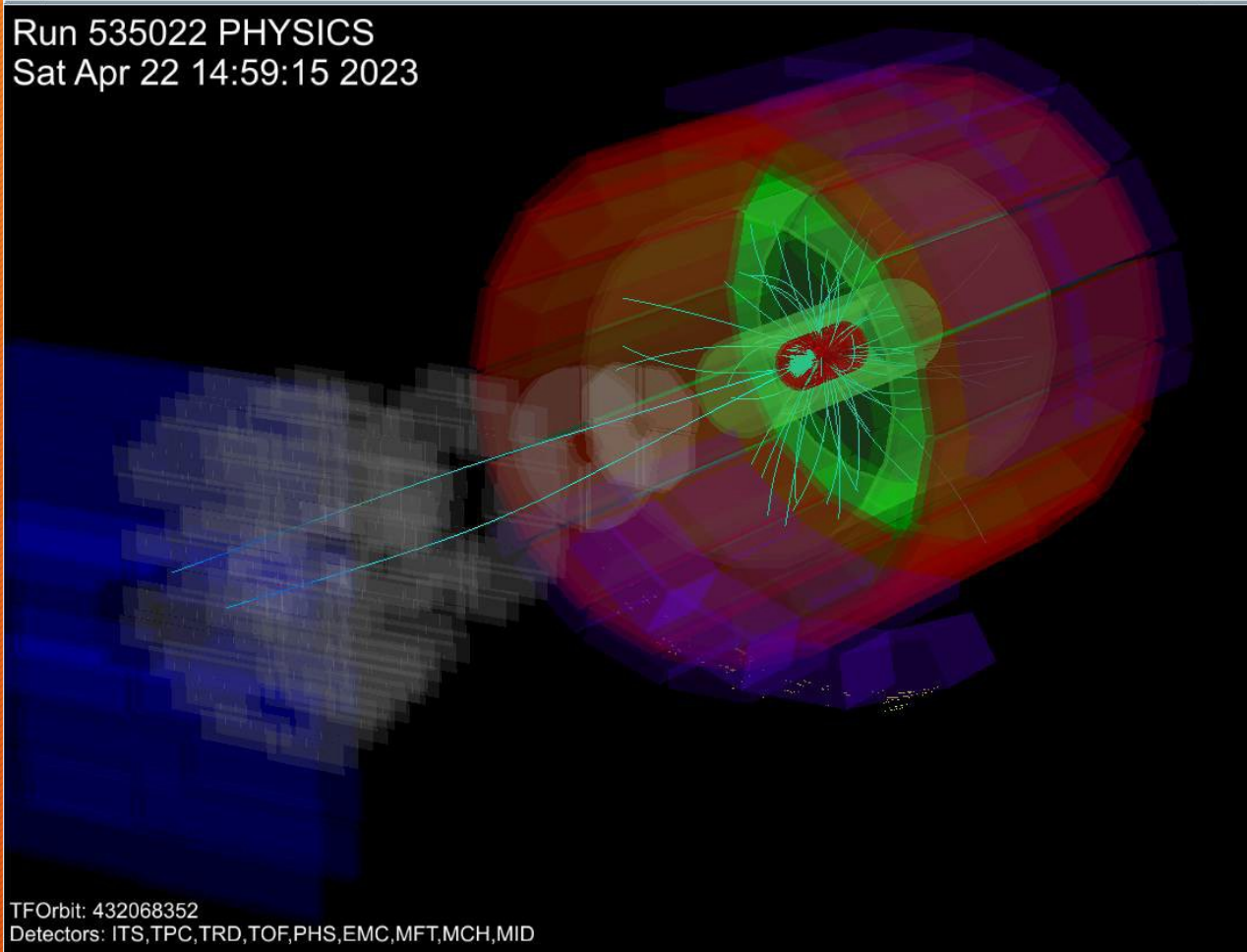
# Stations 4 and 5

Station 4 and 5 during installation  
People at work...



# MCH data taking in pp (2023)

Dimuons are still here at low rate.... Run 535022 (Single\_12b\_8\_8\_8\_2018)

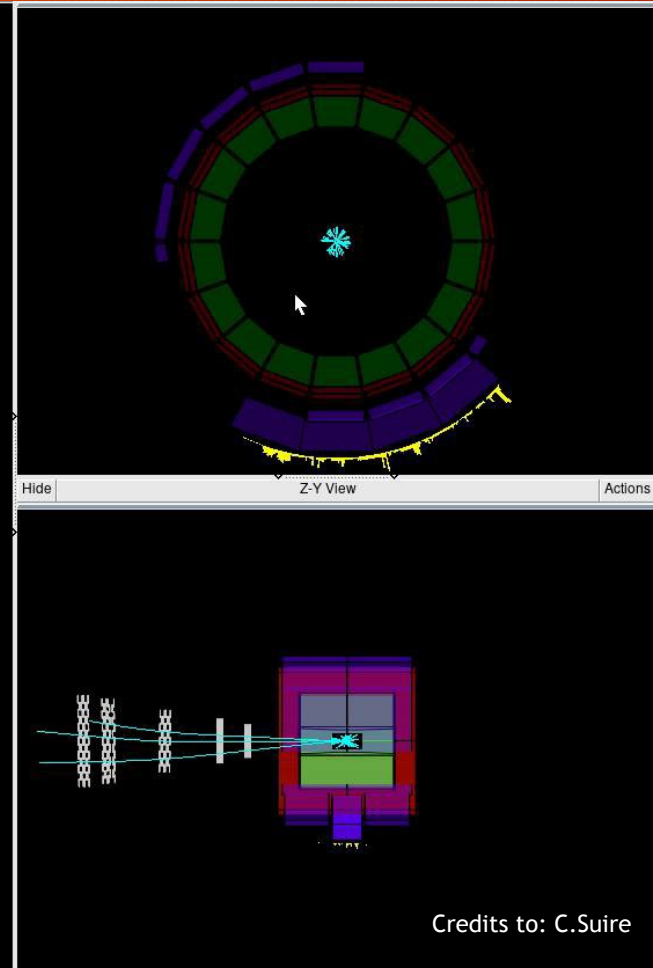
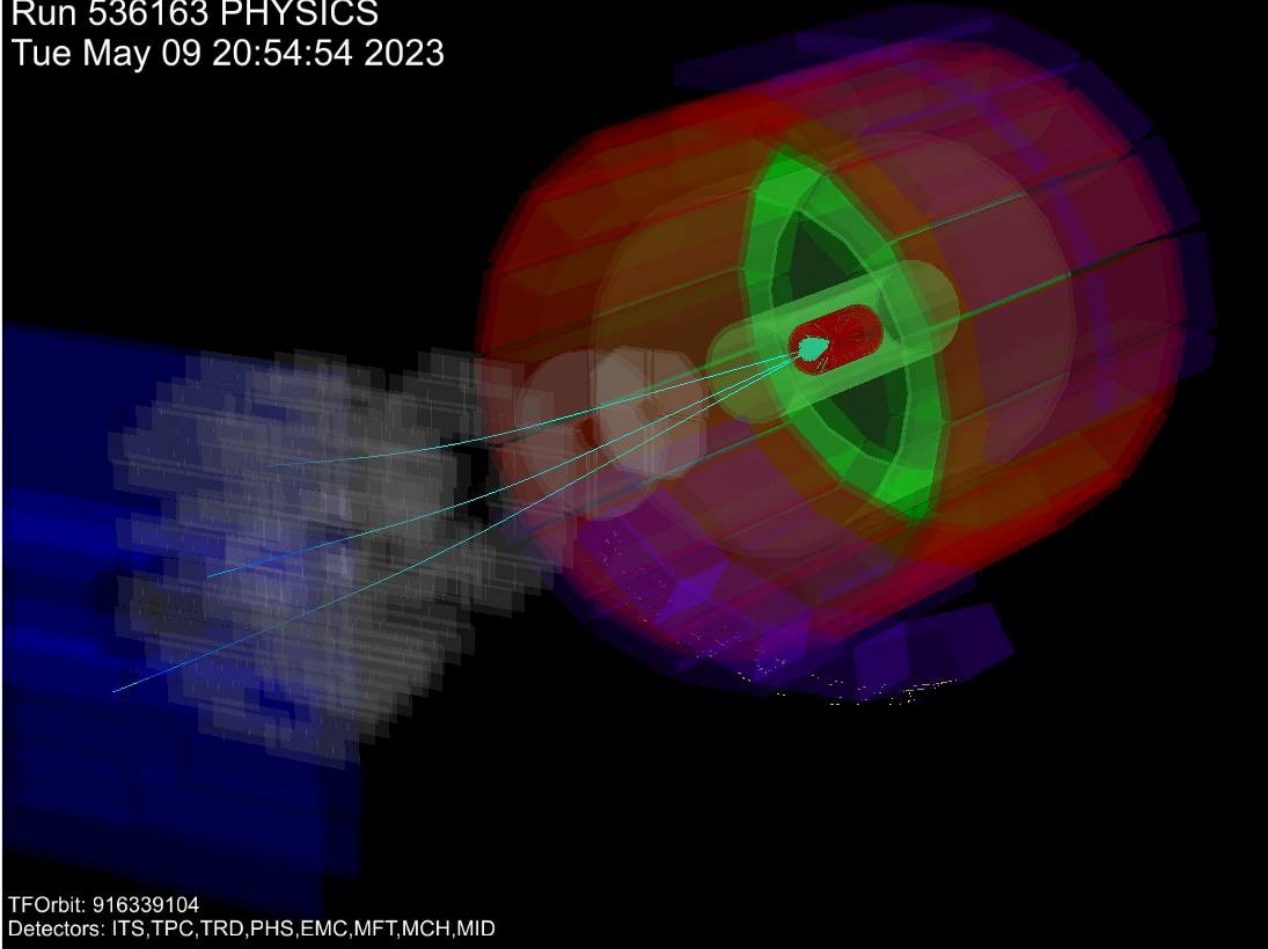




# MCH data taking in pp (2023)

And even tri-muons (3-4MHz pp High rate tests, so could be pile-up)

Run 536163 PHYSICS  
Tue May 09 20:54:54 2023



TForbit: 916339104  
Detectors: ITS,TPC,TRD,PHS,EMC,MFT,MCH,MID

Credits to: C.Suire

# MCH general status (since january 2023)

- **MCH is in good shape**
  - HV + LV are stable
    - Few hardware issues with the LVPS but it should improve with the arrival of repaired ones.
  - Physics pp data taking at **500 kHz is very smooth**
- **Many cavern activities** since the beginning of the year
  - Station 2, Indian Team (5 people) came for more than one month to change 2 quadrants
  - Station 1 cabling/readout improvements
  - Station 345 noise and gas leak fixes
- **High rate pp 4 MHz test** and HV behaviour

# Low and High Voltage Power Supplies status

- About Low Voltage Power Supplies (LVPS) located in racks on C-side (*below* the muon chambers)
  - Few issues that we could not fix immediately due the lack of spares (which were already faulty)
    - Lot of expenses in 2022, could not do everything at once...
    - 4 LPVS to be repaired in 2023, 2 are back
  - Follow-up all issues and LVPS availability
    - Might consider to buy a new one (type 116L : 2x100 + 8x50 A outputs) to increase redundancy (11.5 kCHF).
- About the HV Crates (in CR4)
  - No major issues
    - Excepted the fault of the power unit of the right-side crate after the AUG test
  - Seeing a recurrent fault in the DCS alarms
    - Monitoring...

# Heartbeat issue in stations 1 and 2

- Readout issues:
  - **HB packets sent a very large rate** (mostly in station 1 and 2) : increase the data volume and may saturates some e-links.
  - **Origin of the HB packets pollution is still not established:**
    - Frequency/noise induced in the HB packet trigger lines ?  
→ Many occurrences simply cured by “isolating” the cables from DS board and power lines.
  - missing buses in the readout.  
Configuration fails for part/full bus
    - Fixed by cleaning connectors

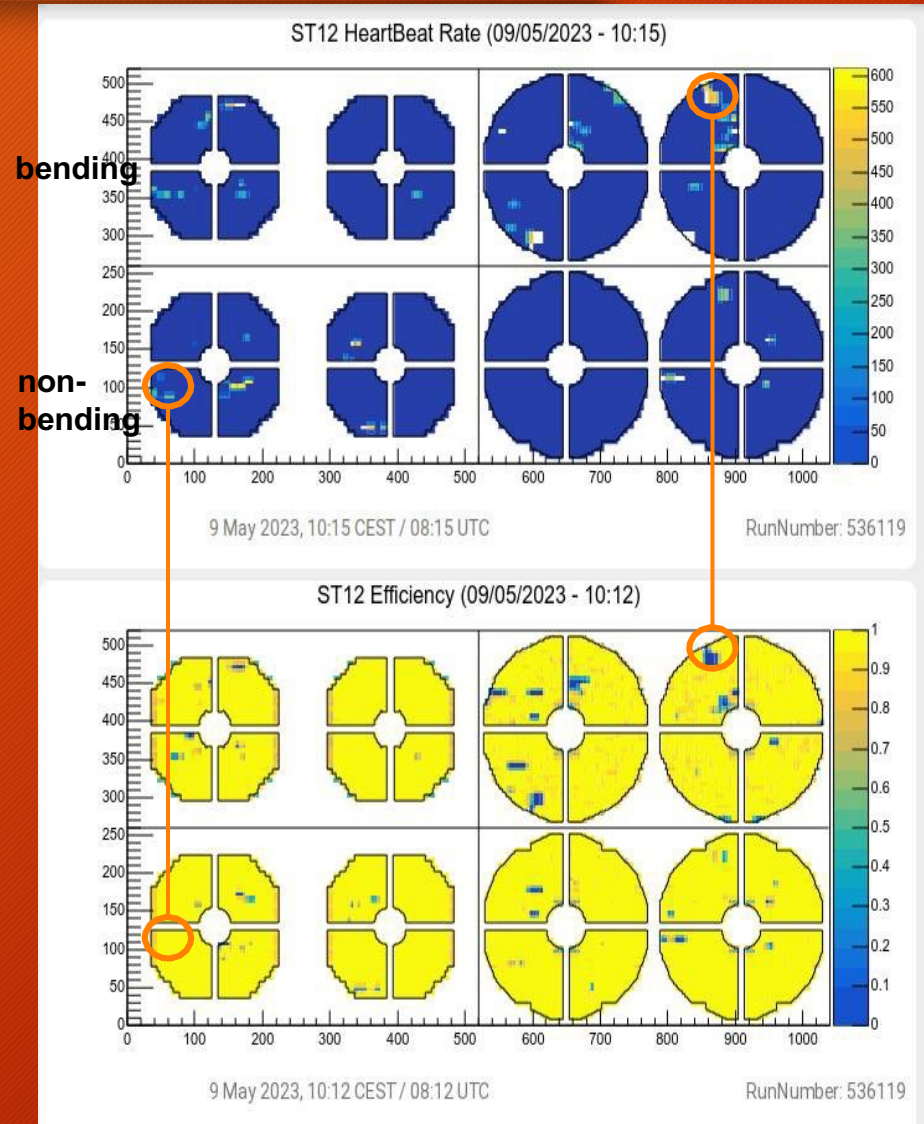
Run 529469			
CRU #	HB packets	Chambers	
0	<b>14812698</b>	St1	
1	<b>24933734</b>	St1	
2	<b>7817242</b>	St1	
3	<b>10179539</b>	St1	
4	<b>5668707</b>	St2	
5	0		
6	<b>21402043</b>	St2	
7	<b>2398127</b>	St2	
8	<b>4806929</b>	St2	
9-12	0	St345	
13	4	St345	
14-18	0	St345	
19	4	St345	
20-22	0	St345	
23	1280903	St345	
24-30	0	St345	
31	18077	St345	

# Heartbeat issue in stations 1 and 2

- Readout issues:
  - **HB packets sent a very large rate** (mostly in station 1 and 2) : increase the data volume and may saturates some e-links.

→ Local impact on pseudo-efficiency (visible correlation)

**Further investigations will be conducted during TS1.**



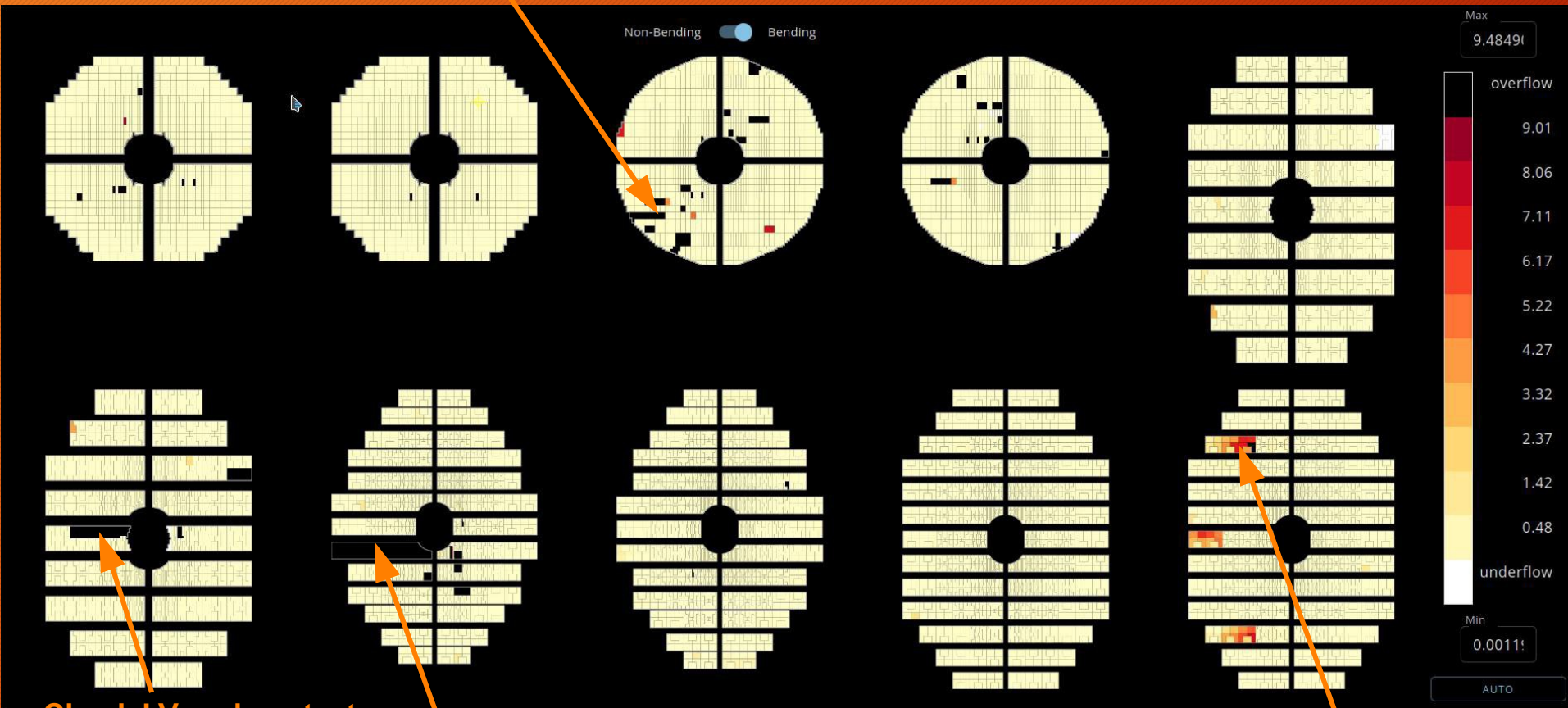
# Station 345

- Most of the work already done end of 2022
  - two slats exchanged
- Noise issues
  - local noisy spots (Ch9 L/R) near the beam pipe absorber.
    - Spacer added fixed the issue
  - global noise (sort of common mode) not caught during the calibration
    - Generates high occupancy on many DE → back pressure on EPN
    - Cannot be fixed with a new calibration run
    - Happened ~ 4 times in 2022 and 3 times already in 2023 :
- One faulty LVPS on Ch7L to be exchanged at next access (spare back)
- **Few noisy spots have appeared** (most likely LV connection issues) → TS1

# Current MCH readout status (occupancy plot)

- Bending Run 537546 4 June 2023 at 21:28:49 CEST : occupancy

FEE does not configure



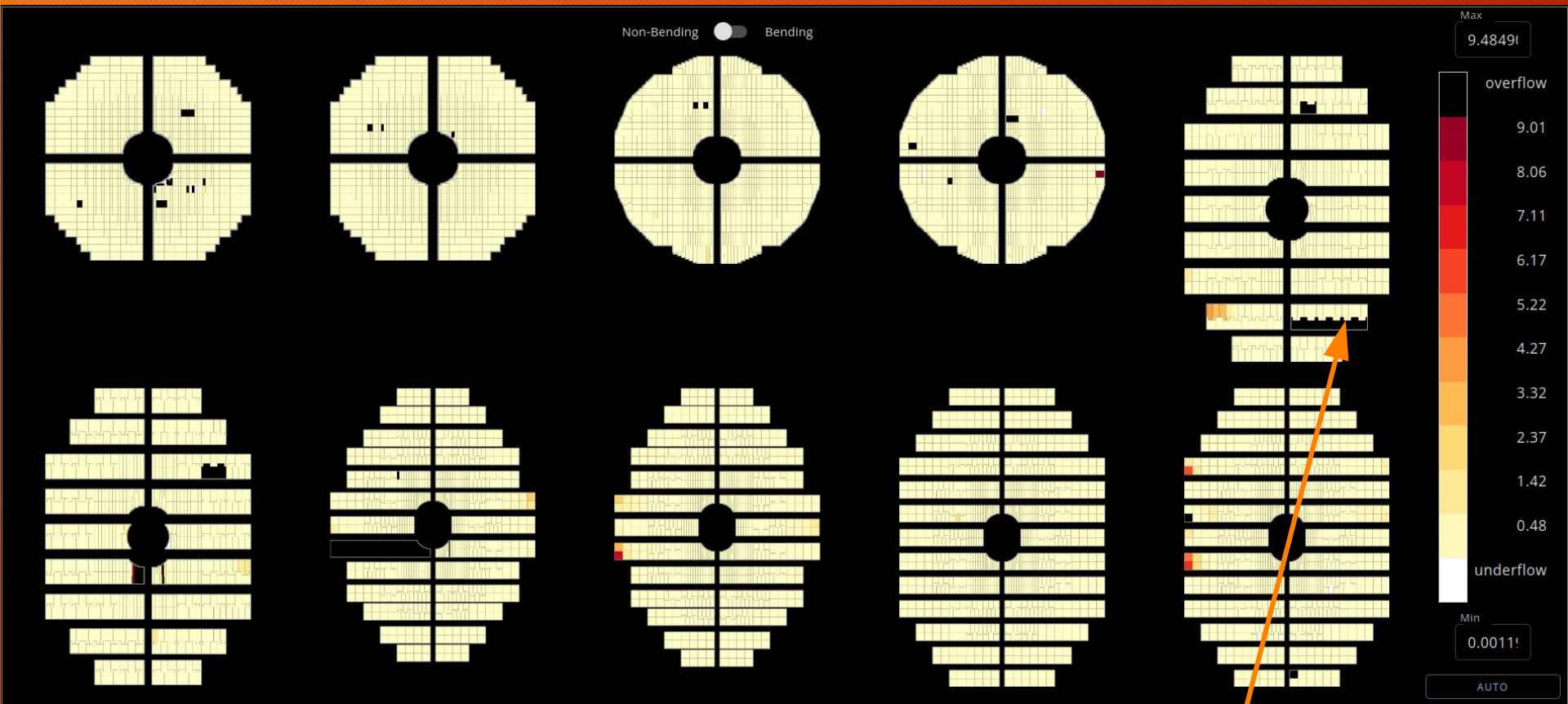
Check LV and contact with pipe absorber.

Faulty LVPS

Noise 15

# Current MCH readout status

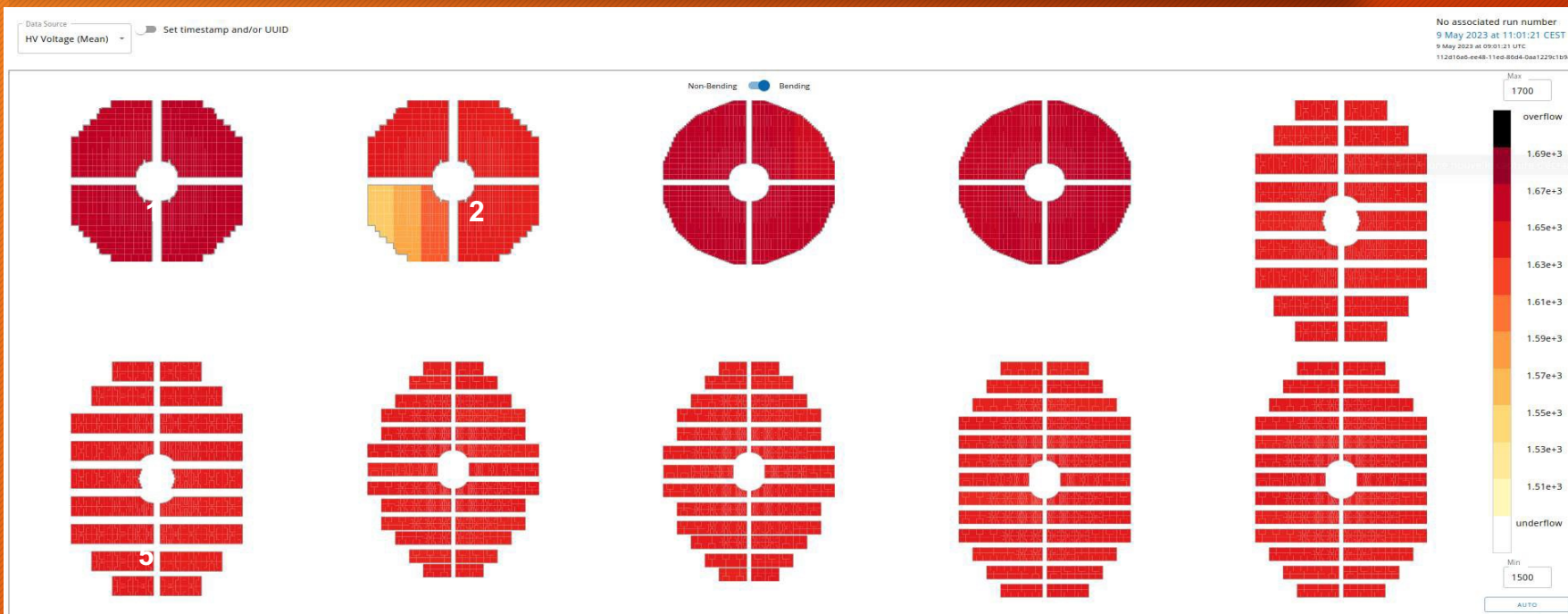
- Non-bending Run 537546 4 June 2023 at 21:28:49 CEST : occupancy



LV connection to check



# HV status: everything nominal



- HV are very stable at pp 500 kHz
  - Chambers 1,3 and 4 at 1675 V
    - Chamber 1 gain is high enough so we will probably operate it at 1650 V (as Ch2)
  - Chambers 2 at 1650V, one quadrant with large gain has custom HV settings (same efficiency as the other)
  - Chambers 5-10 at 1650V
- No trips observed so far ( $8.7 \text{ Hz}/\mu\text{b}^{-1}$ ,  $\sim 500 \text{ kHz FT0VX}$ ) but few DE have current spikes.

# Detector Control System (DCS)

**VISION\_1: TOP** | 17:50 15-02-18 | dcs UI v.3.2.0

**MUON TRACKING CHAMBERS - Detector View**

**MCH Go Safe** | LOCKED | SAFE | Is SuperSafe

**LHC** | SHUTDOWN | NO BEAM | Safe | Env. 18.1°C 973.7mbar

**MCH\_DCS** | FSM | STBY\_CONFIGURED

**Config**

- MCH\_DCS: STBY\_CONFIGURED
- MchHvLvLeft: STBY\_CONFIGURED
- MchHvLvRight: STBY\_CONFIGURED
- MCH\_DCS\_RUN: RUN\_OK
- MCH\_INFRASTRUCTURE: READY

**Station 1** (mchChamber01Left to 02Right): STBY\_CONFIGURED

**Station 2** (mchChamber03Left to 04Right): STBY\_CONFIGURED

**Station 3** (mchChamber05Left to 06Right): STBY\_CONFIGURED

**Station 4** (mchChamber07Left to 08Right): STBY\_CONFIGURED

**Station 5** (mchChamber09Left to 10Right): STBY\_CONFIGURED

**GAS**

Rack 61: Ready  
 Out: 113.3 l/h, In: 122.6 l/h, Delta flow: 9.3 l/h, 7.6 %  
 Pressure Rack 61

Rack 62: Ready  
 Out: 394.6 l/h, In: 509.1 l/h, Delta flow: 114.5 l/h, 22.5 %  
 Pressure Rack 62

**ELMB**

- MCH\_ELMB\_1 Chamber1828384: Tmin 15.9°C Tmax 20.7°C Ph 45.3%
- MCH\_ELMB\_2 Chamber586: Tmin 16.8°C Tmax 20.6°C
- MCH\_ELMB\_7 Chamber10Left: Tmin 18.0°C Tmax 20.4°C
- MCH\_ELMB\_8 Chamber9Left: Tmin 16.8°C Tmax 18.6°C

**Recover Buttons:** RECOVER (Tripped LV Channels), GROCUS RECOVER (to be used by DCS shifter), Include (Tripped HV Channels), Recover (Tripped HV Channels)

**Rack Monitoring:** Racks C20, C39, C38, C37, C36, C11, C10, C09, C08, CR4/205. Each rack shows power status (ON/OFF) and temperature (e.g., 16°C, 20°C, 19°C, 21°C, 15°C, 17°C, 21°C, 20°C).

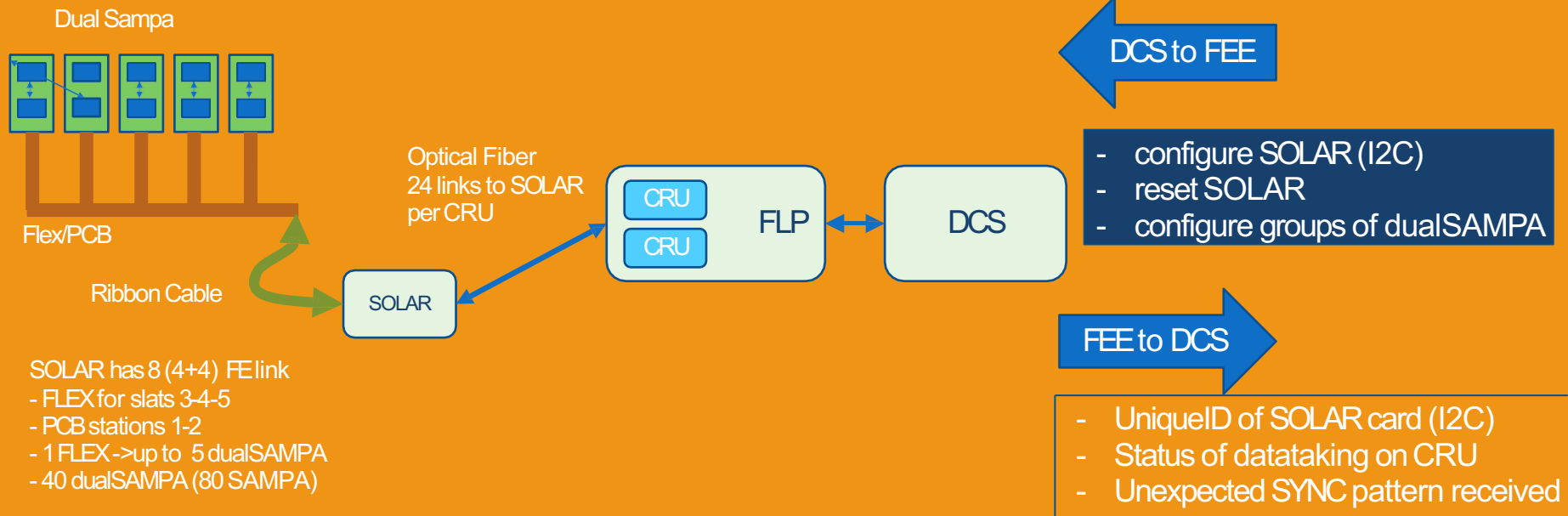
**Detector Monitoring Zone:** PW Racks, MAIN PWS

**Info Panel:** not yet enabled!

**FSM:** mch\_ui, mch\_hvLvLeft, mch\_hvLvRight, p\_environment, mch\_gms (218/221, 110/122, 770)

**CLOSE**

# CONTROL AND CONFIGURATION THROUGH DCS

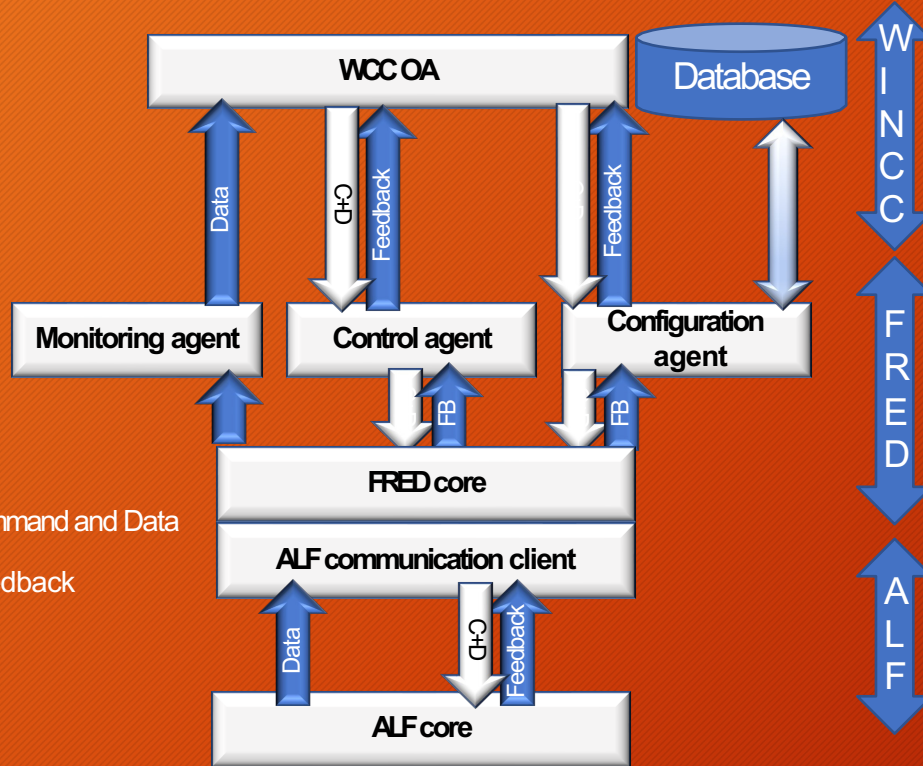


- SOLAR has 8 (4+4) FElink
- FLEX for slats 3-4-5
  - PCB stations 1-2
  - 1 FLEX -> up to 5 dualSAMPA
  - 40 dualSAMPA (80 SAMPA)

Numbers are different for the 5 stations:  
Every ALF: (max) 48 SOLAR  
1900 DS, 3800 SAMPA

Credits to Mauro ARBA – INFN Cagliari

# DCS SOFTWARE COMPONENTS



 C+D ...Command and Data  
 FB ...Feedback

- WINCC tasks**
- Full control functionality
    - Alert handling
    - Configuration
    - Control and Monitoring
    - Archival
    - User interface

- FRED tasks:**
- Execution of macro commands
    - Translates complex DCS subscriptions to ALF commands
  - Can decode and analyze data
  - Publishes data to WINCC (possibility to add smoothing)

- ALF tasks:**
- Basic I/O
  - Translation of commands (read I2C) into atomic I/O operations
    - Possibility to execute periodically
  - No detailed knowledge on detector structure

*Credits to Mauro ARBA – INFN Cagliari*

# Implementation

- Prepare for RUN → done
  - New FSM command to be sent to detectors before SOR, allowing to anticipate configuration or other procedures.
  - The aim is to advance potential failures of SOR when we have enough time to retry, and be as READY as possible when CollisionReady or BEAM STABLE is declared
- FRED update → to be done after lead beam
  - Central repository of detector code
  - Separation of core and detector code
  - Version tracking of core and detector code on each production node
  - Deployment direct from Gitlab

# Conclusions

- MCH working fine in pp 500 kHz
  - **No HV trip so far, no particular issues at SOR or during runs.**
  - Few specific issues with LVPS → repaired ones are back
  - **Noise episodes** on right side of stations 345 : not understood yet
  - **Major hardware work** (3 quadrants qualified and exchanged) on station 2
- Readout configuration : minimize of the number FEE not properly configured
  - Clear issue with metallic dust in the FASS that may be responsible of the losses/misconfiguration of buses
    - Simple cleaning with brush recover them
  - **HB spurious triggers rate has been lowered but some remains**
    - Isolating the readout cable from “signal” sources does remove spurious HB
    - Will take time to “clean” everything
  - Check analog and digital power lines on the detectors and **connection robustness**
- **High rates test (500 kHz → 4 MHz) went well**
  - **Very clear improvement** w.r.t first test in 08/22
  - 2 sectors (on St1 left and St2 right) had issues at 3 and 4 MHz, 1 trip recovered in-flight
    - Behavior to be confirmed in the next high interaction rate test
  - **Will not impact the MCH tracking efficiency**

# Richieste per il 2024

**Composizione del gruppo ALICE Cagliari: 9.1 FTE (leggero calo rispetto al 2023, causa partenza PhD indiano e fine dottorato)**

- **Le richieste sono in linea con le tabelle di ALICE Italia**
- **Richieste specifiche Missioni:**
  - Per interventi sull'apparato: 8 kEuro
- **Richieste specifiche consumo:**
  - 5.5 keuro auto CERN x turni e oncall
  - 1.5 keuro consumo per interventi su MCH (e ZDC)

# END

