MCH status

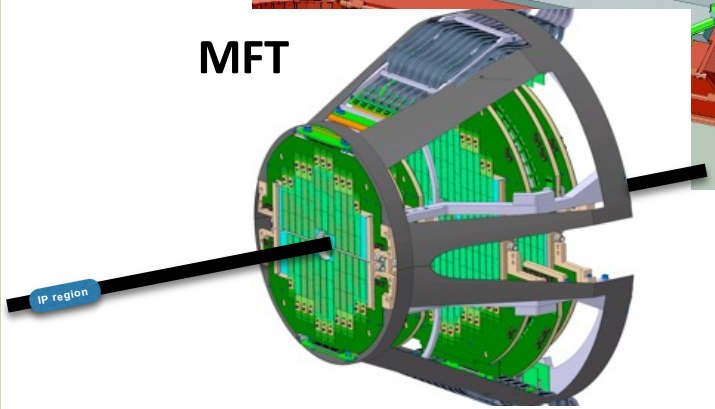
20 luglio 2023

Corrado Cicalò – Cagliari

Il muon tracking

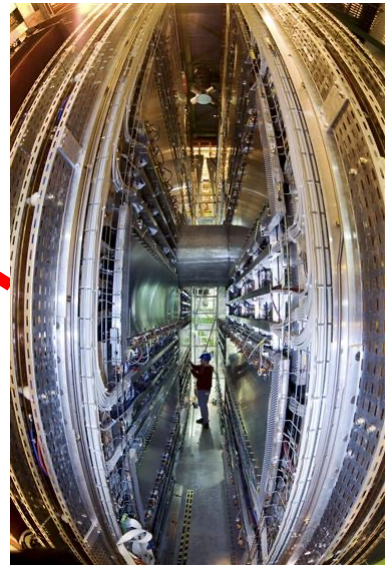
MCH

MFT

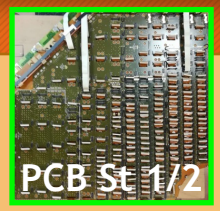


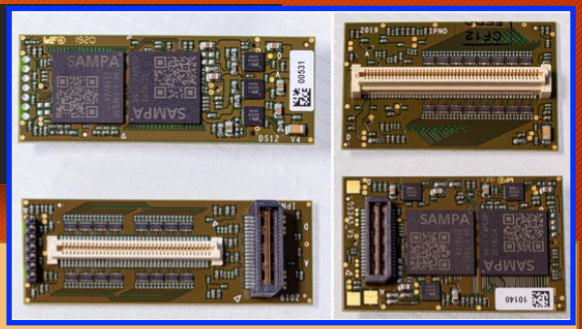
MCH

MTR



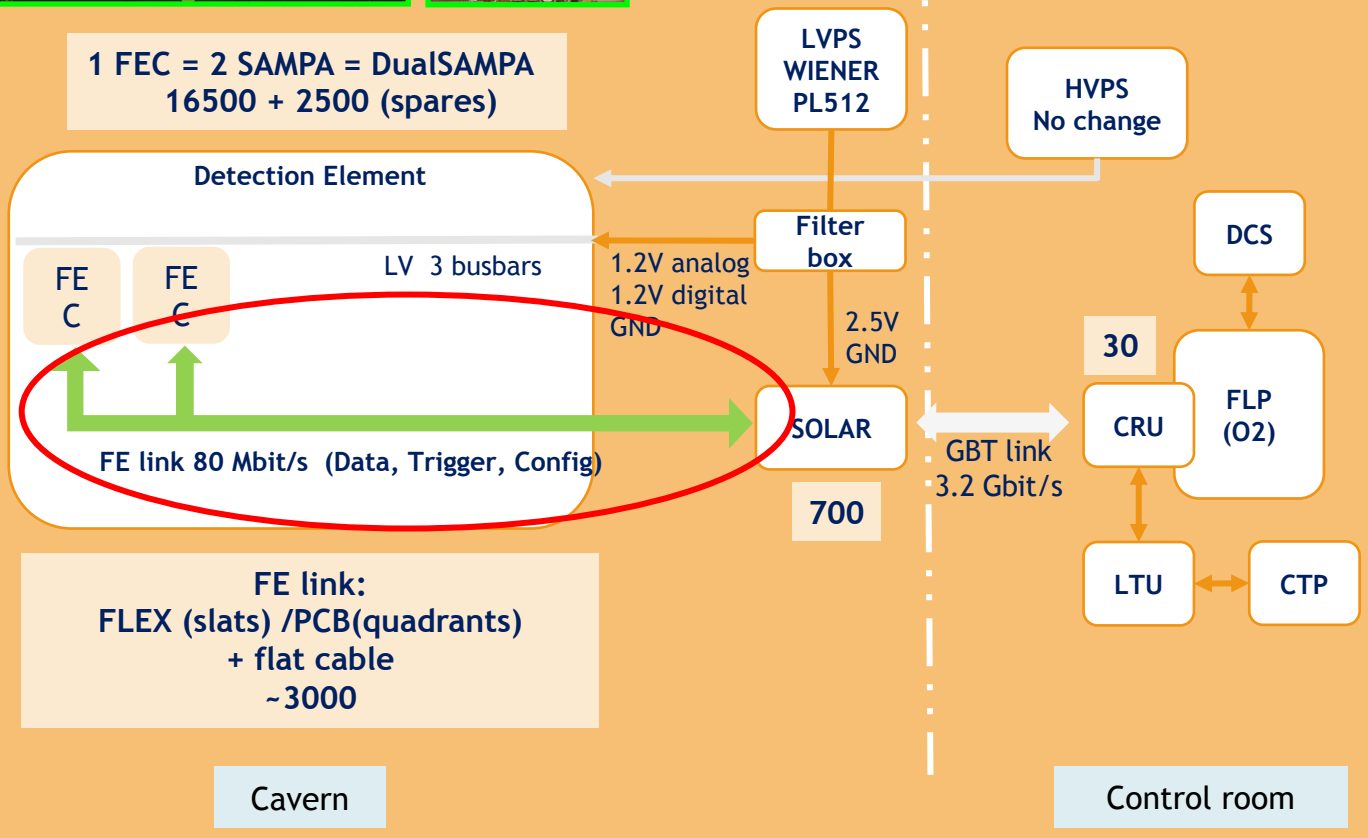
MCH upgrade project





DualSampa FEC

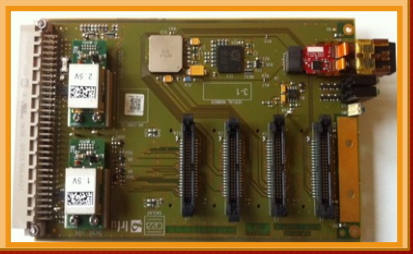
1 FEC = 2 SAMPA = DualSAMPA
16500 + 2500 (spares)



SAMPA: Brazil
CRU: Hungary, India

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

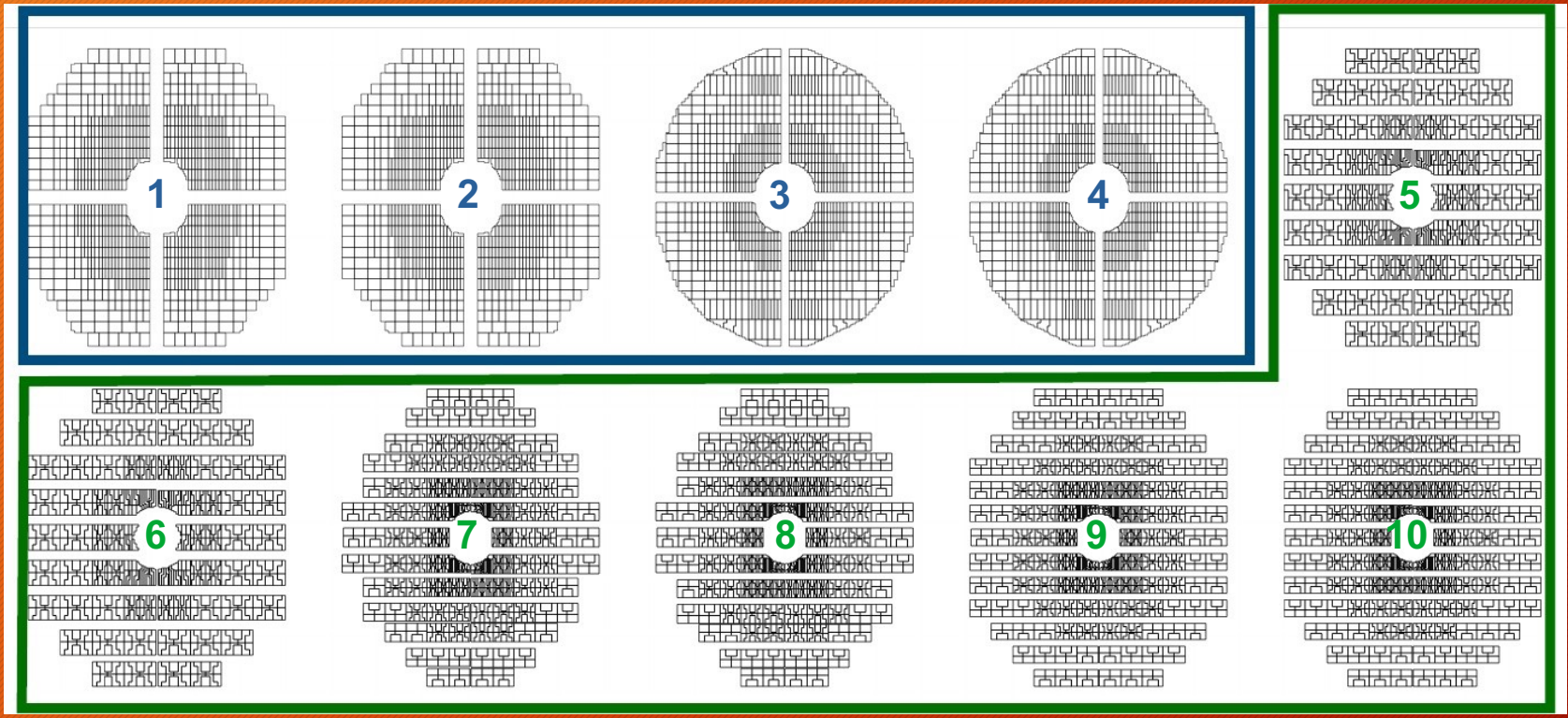
FE link:
FLEX (slats) /PCB(quadrants)
+ flat cable
~3000



SOLAR board

ALICE Muon Spectrometer : 10 chambers

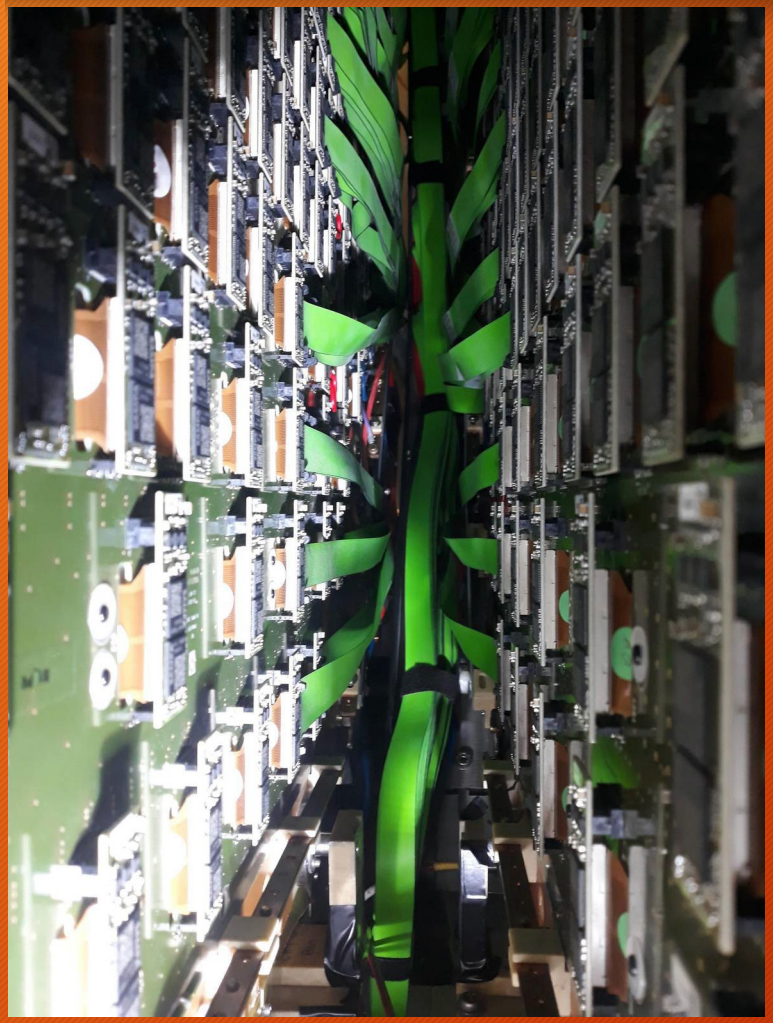
16 DE quadrants, 2 types, 43% of pads

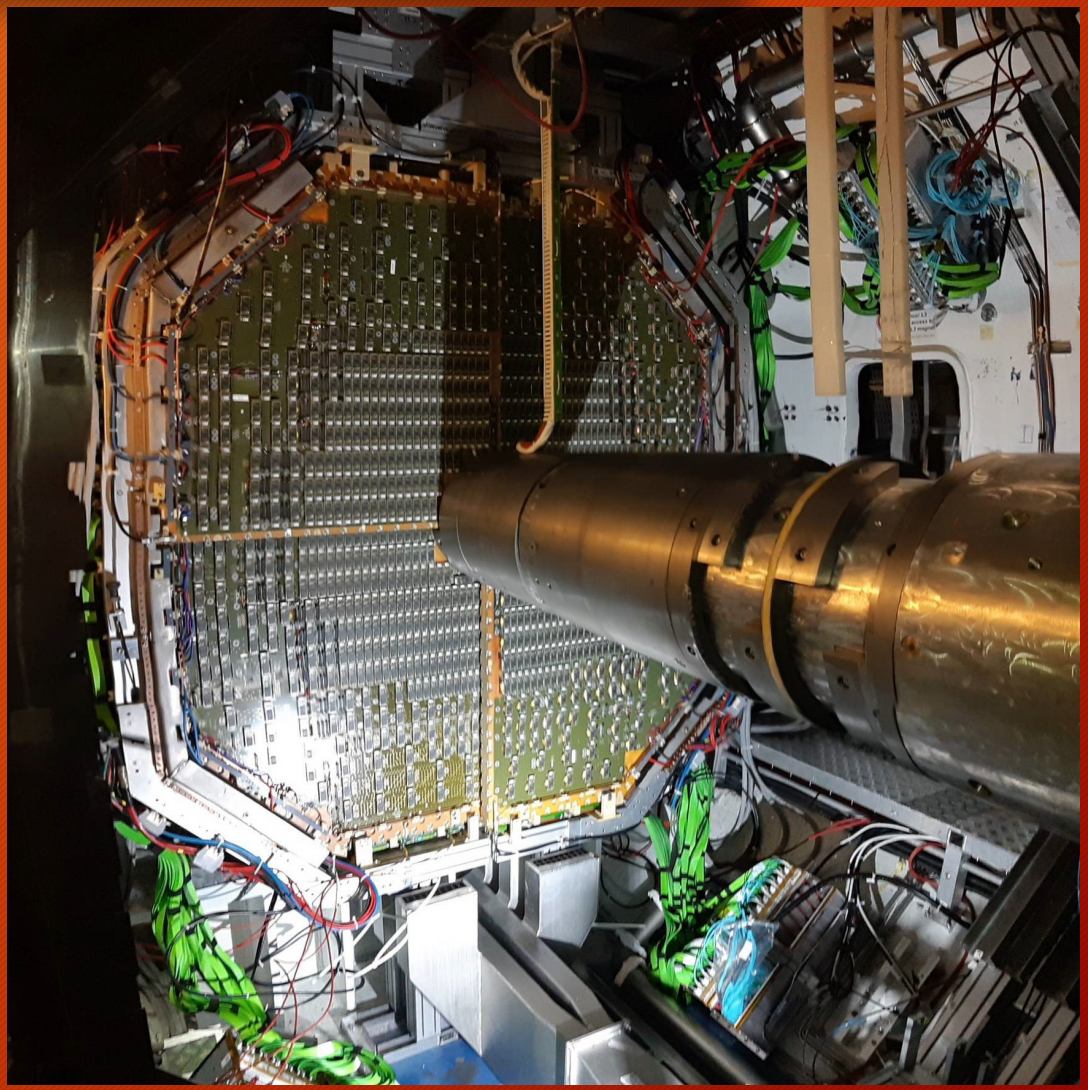


140 DE slats, 19 types, 67% of pads

1063528 pads readout by 16820 Dual Sampas readout by 624 Solars readout by 30 CRUs.

Station 1



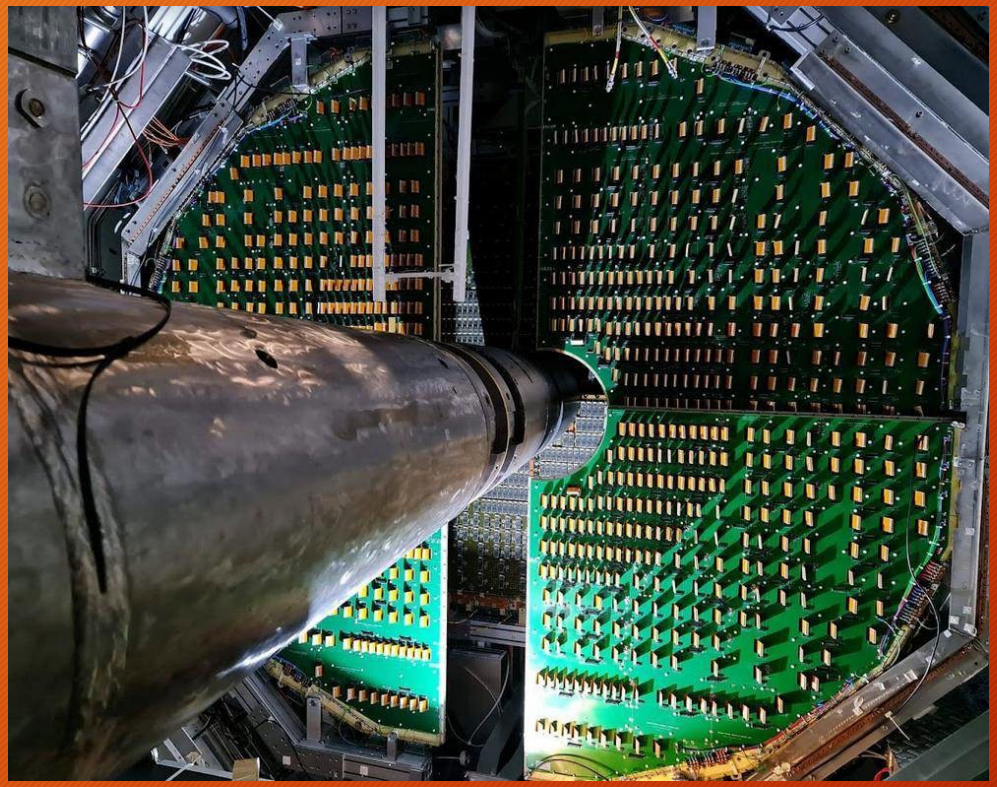


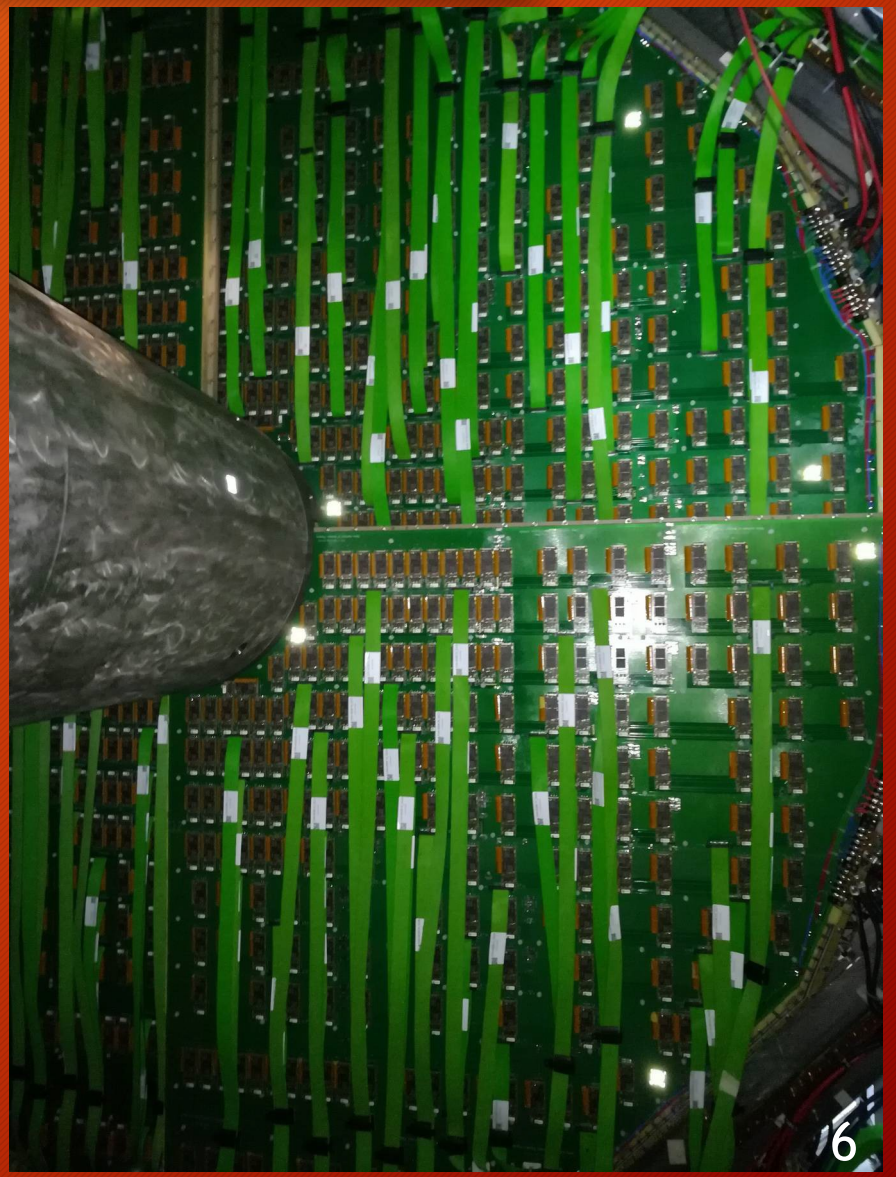
↑ View between chamber 1 and 2
Chamber 2 closed →
Four sides still to be connected

Station 2

Chamber 4 fully cabled →

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



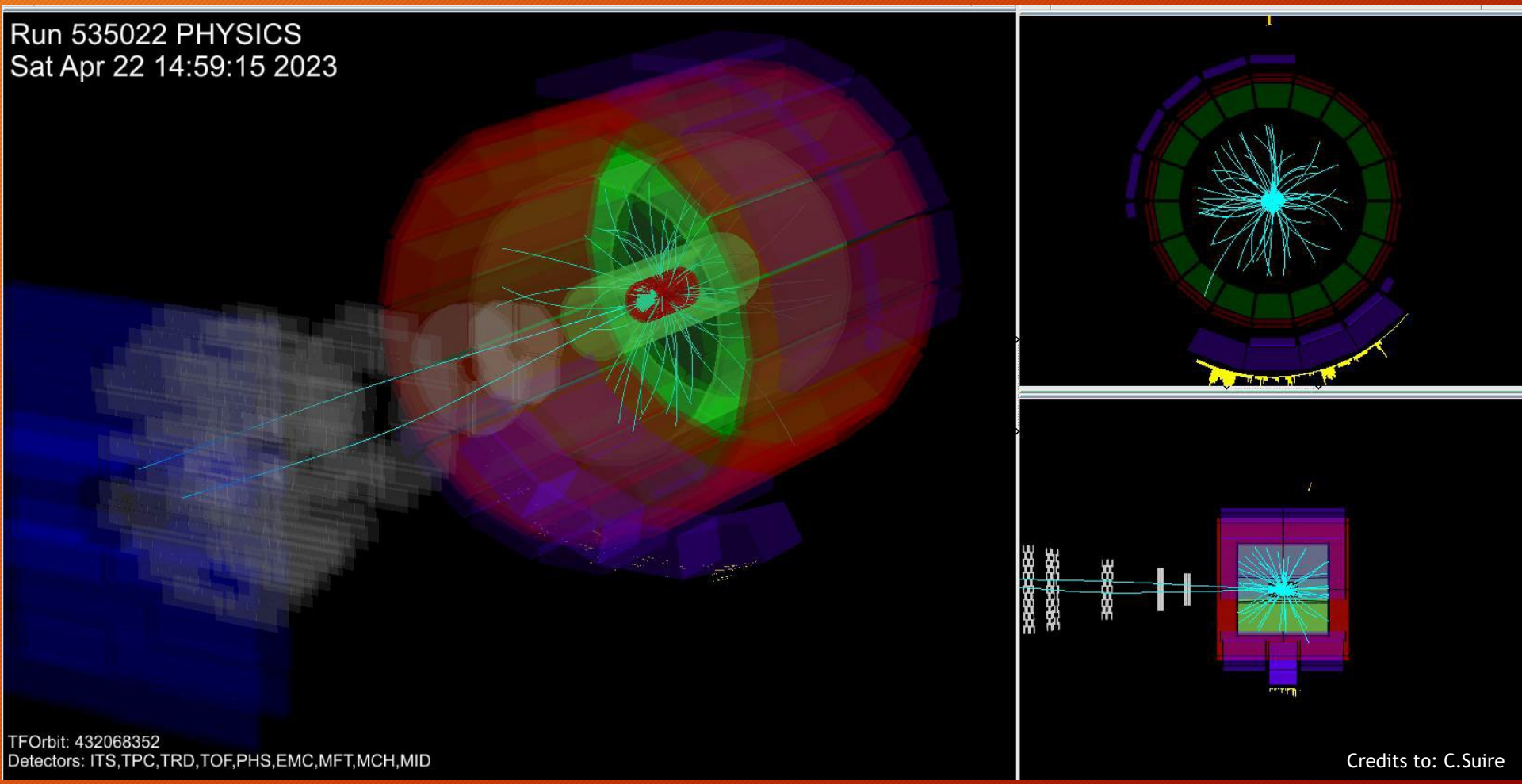


Stations 4 and 5

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

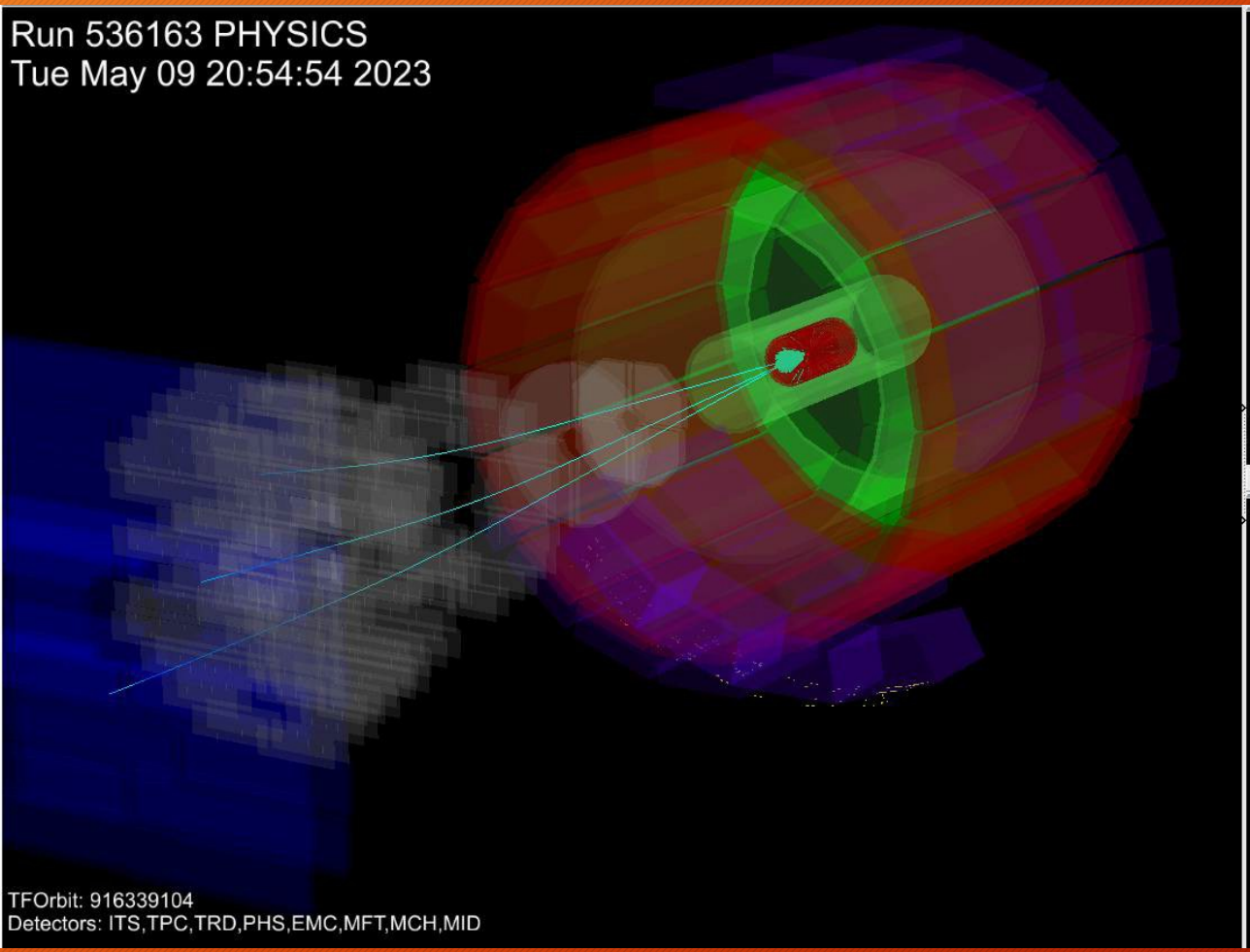
MCH data taking in pp (2023)

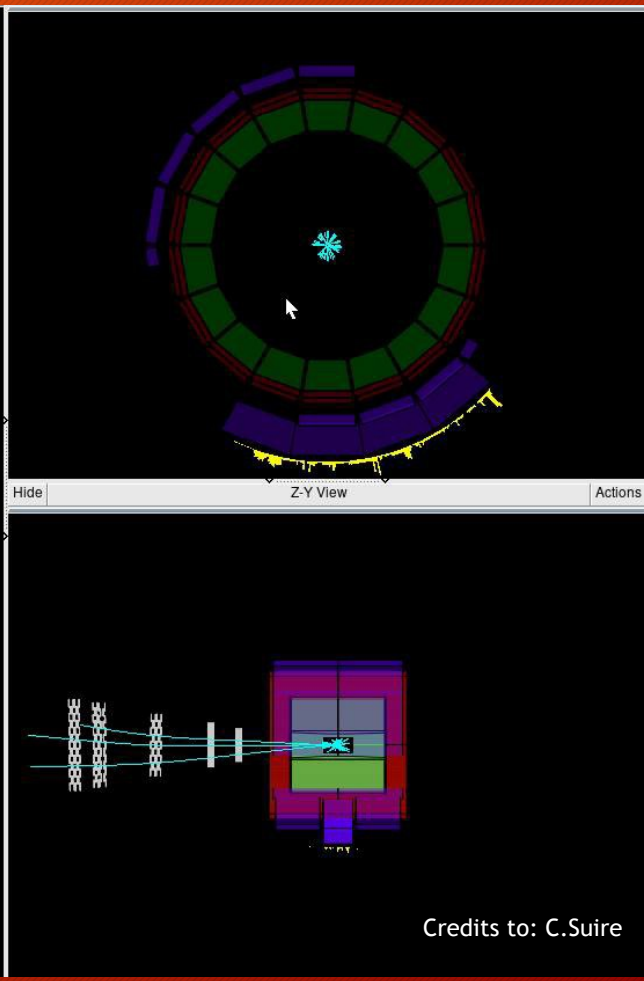
Dimuons are still here at low rate…. Run 535022 (Single_12b_8_8_8_2018)



MCH data taking in pp (2023)

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





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

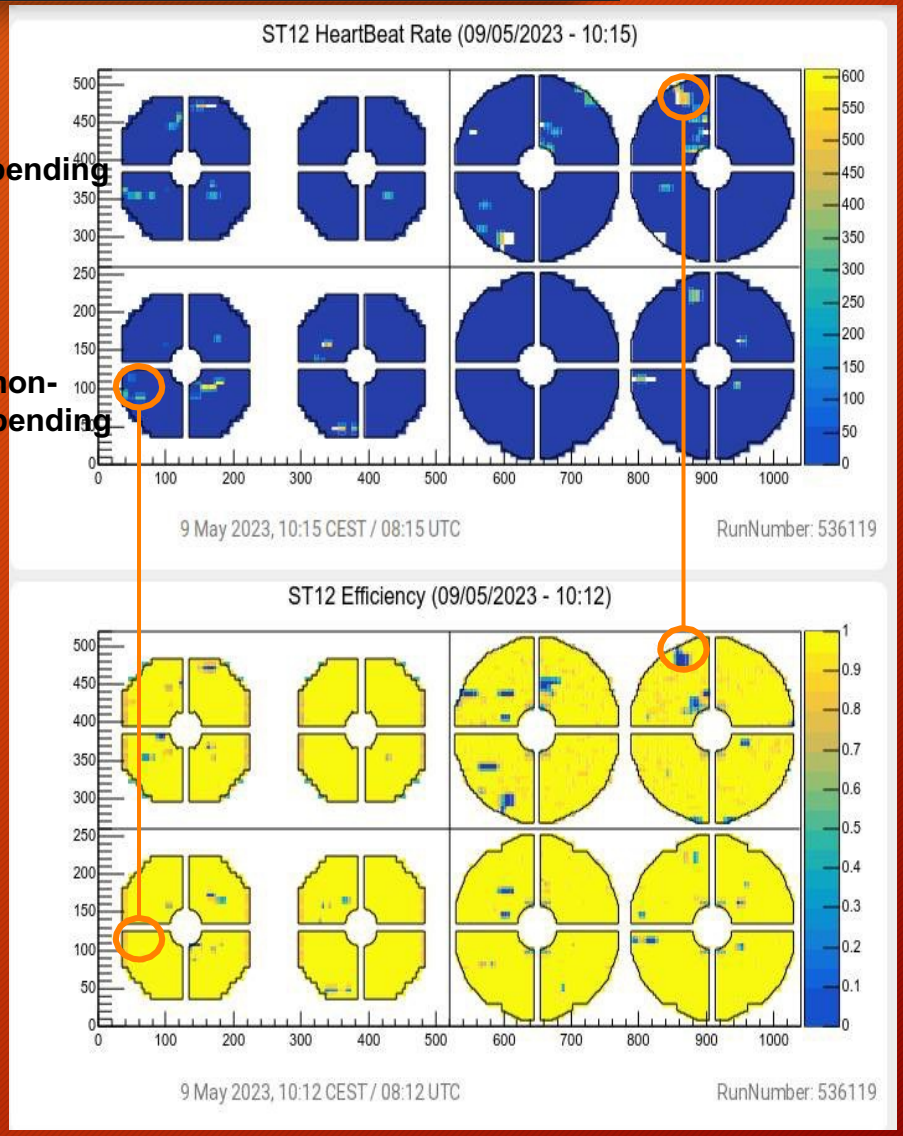
Run 529469		
CRU #	HB packets	Chambers
0	**14812698**	St1
1	**24933734**	St1
2	**7817242**	St1
3	**10179539**	St1
4	**5668707**	St2
5	0	
6	**21402043**	St2
7	**2398127**	St2
8	**4806929**	St2
9-12	0	St345
13	4	St345
14-18	0	St345
19	4	St345
20-22	0	St345
23	1280903	St345
24-30	0	St345
31	18077	St345

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.



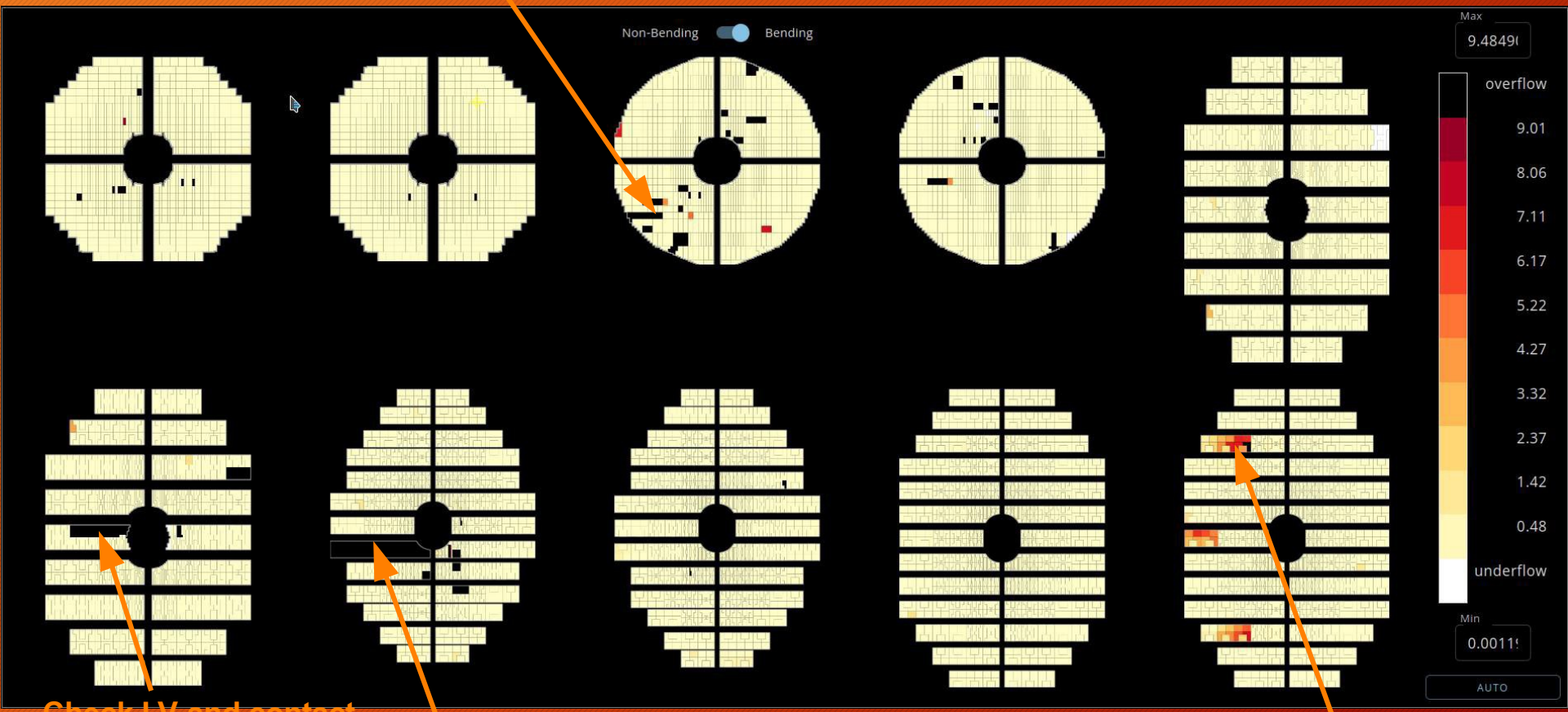
Station 345

- 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

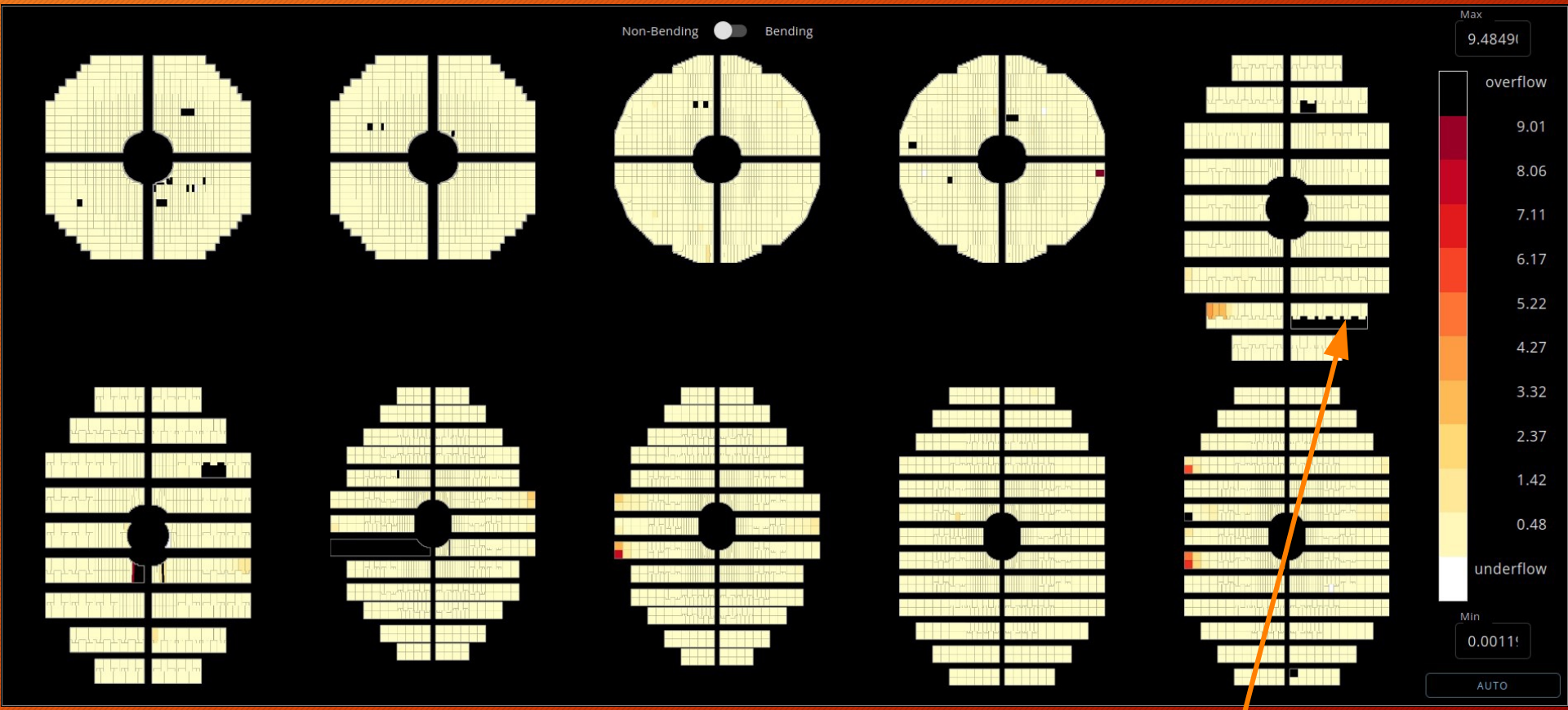
Current MCH readout status (occupancy plot)

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

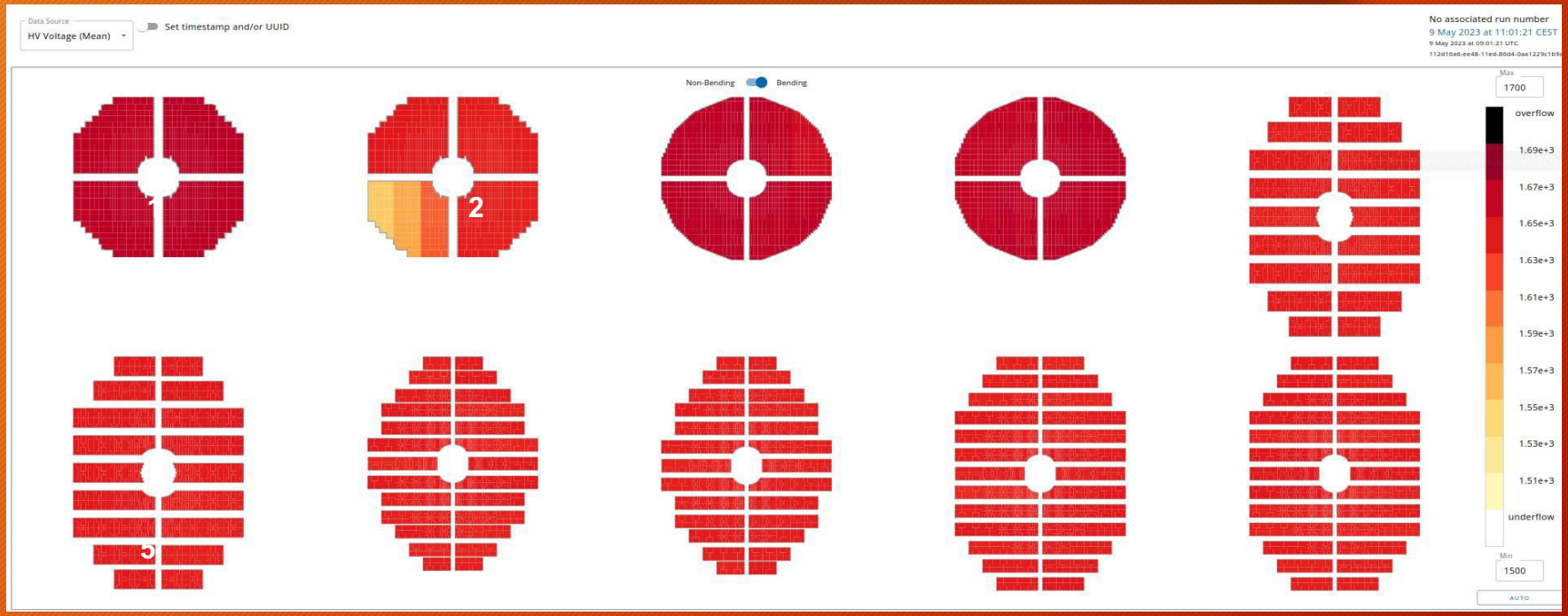


Current MCH readout status

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

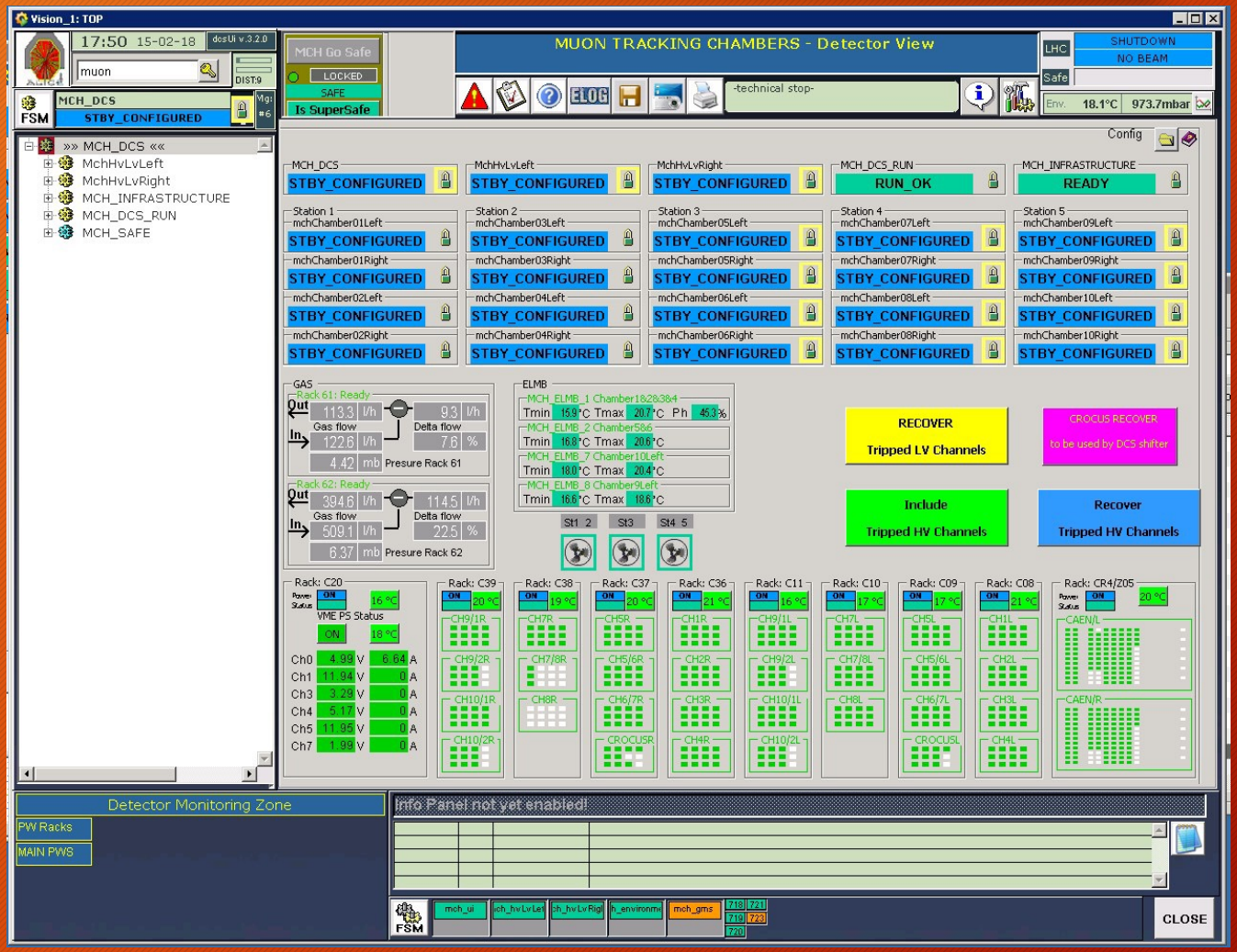


HV status: everything nominal

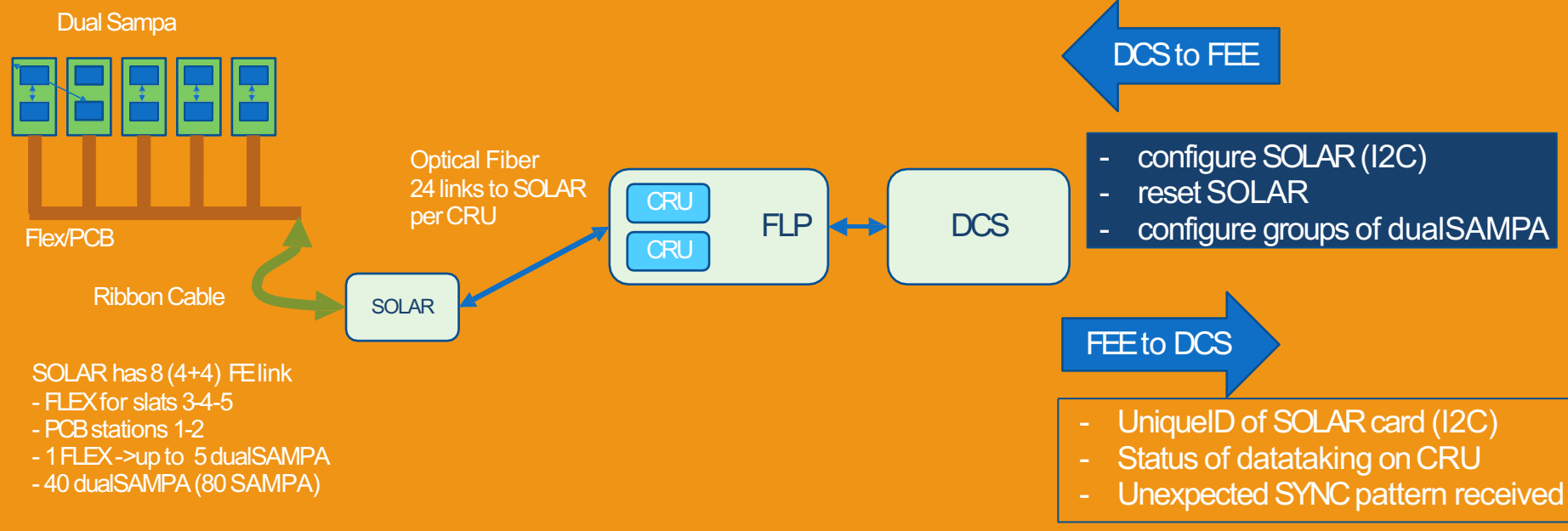


- HV are very stable at pp 500 kHz
  - Chambers 1,3 and 4 at 1675 V
    - Chamber 1 gain is high enough so we will probably operate it at 1650 V (as Ch2)
  - Chambers 2 at 1650V, one quadrant with large gain has custom HV settings (same efficiency as the other)
  - Chambers 5-10 at 1650V
- No trips observed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

Detector Control System (DCS)



CONTROL AND CONFIGURATION THROUGH DCS

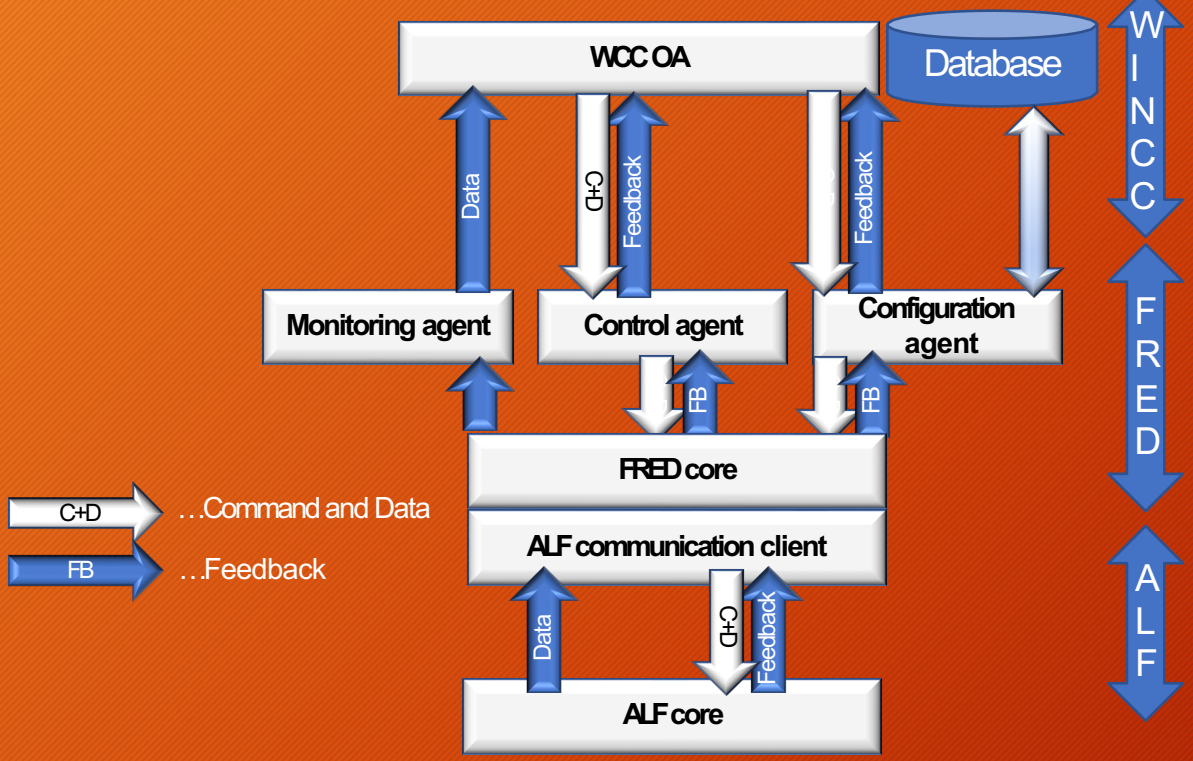


SOLAR has 8 (4+4) FE link
- FLEX for slats 3-4-5
- PCB stations 1-2
- 1 FLEX ->up to 5 dualSAMPA
- 40 dualSAMPA (80 SAMPA)

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



WINCC

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

FRED

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

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

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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