Muon IDentifier: status e richieste

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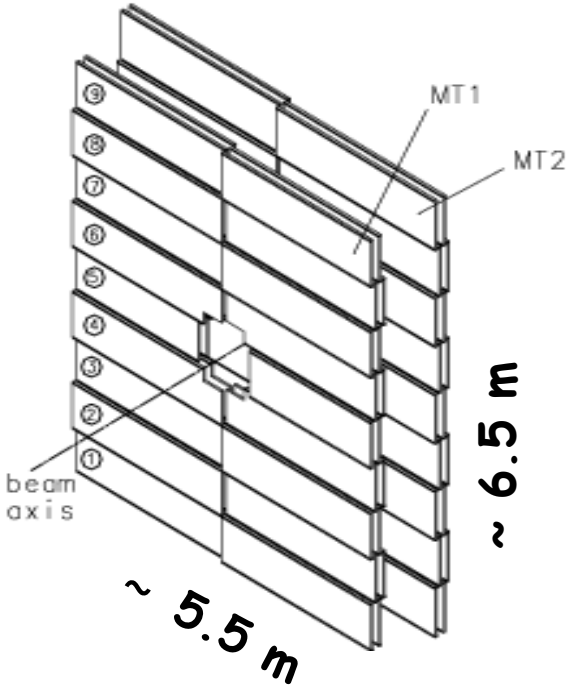
ALICE Muon Identifier

-72 Resistive Plate Chambers
arranged in 4 detection planes

- Single RPC areas range from
72x223 cm^2 to 76x292 cm^2



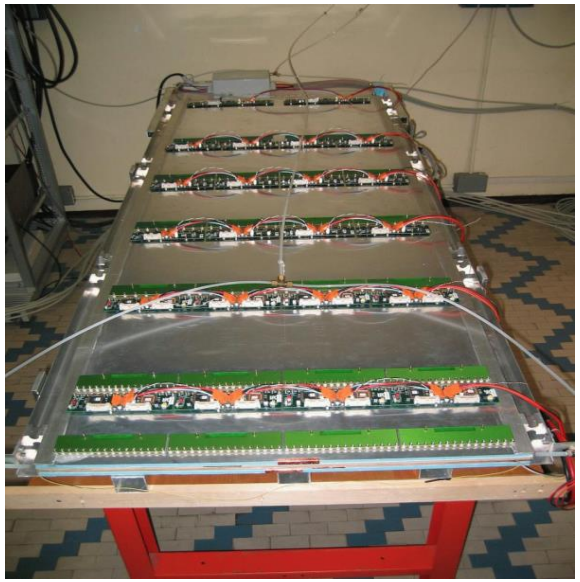
Responsibilities:

Torino: Gas gaps, external mechanics, control system, gas system.

- ~ 7 FTE
- Ruoli di responsabilità in MID:

Muon Identifier Sub-Project Leader (A. Ferretti)

Muon Identifier Technical Coordinator (P. Mereu)



Clermont-Ferrand + Nantes (F), iThemba (SA):
front end and readout electronics, software

The Muon Trigger upgrade to Muon Identifier

- **Goal #1**: detector performance and safe long-term operation in such a scenario
  -> **detector and FEE upgrade** (**INFN Torino**, LPC Clermont-Ferrand)

  a) reduce charge-per-hit by a factor 3-5 by developing FEE cards with amplification
  b) replace ~30% most irradiated RPCs → **production of new RPCs**

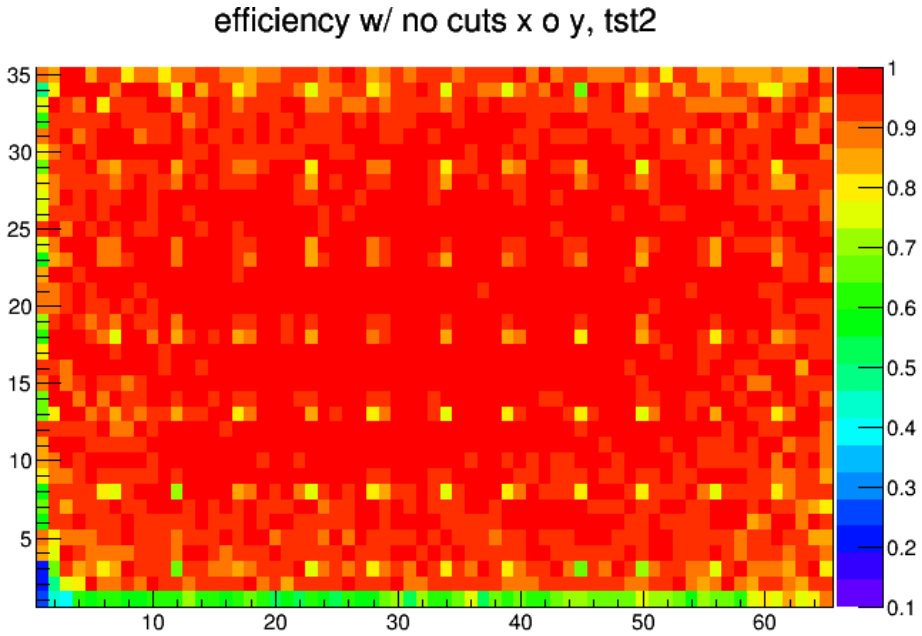
- **Goal #2:** dead time-free readout (vs present 150 μs)
  -> **readout electronics upgrade** (Subatech Nantes, LPC Clermont Ferrrand)

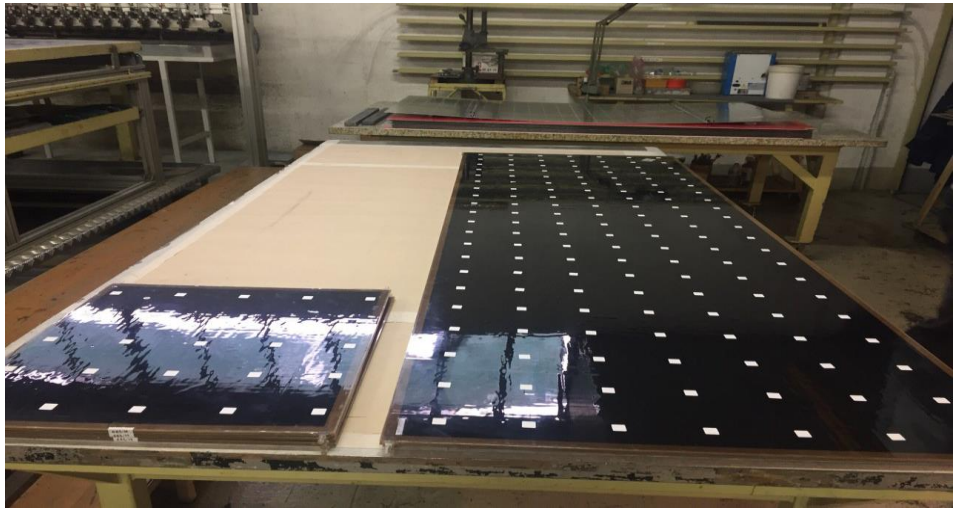
RPC production and status in INFN-TO lab (1)

- RPCs production before 2019 highly unsatisfactory
  - → inefficiency holes at the HV working point (WP)
  - → high currents
  - → general carelessness in the production process
  - → not possible to use them in ALICE

- New pre-production batch of 3 RPCs at the end of 2019, after several interactions with the firm

- All 3 RPCs tested in early 2020 showed:
  - → an efficiency higher than 95% at working point
  - → low currents (lower than 1μA)
  - → can be used in ALICE

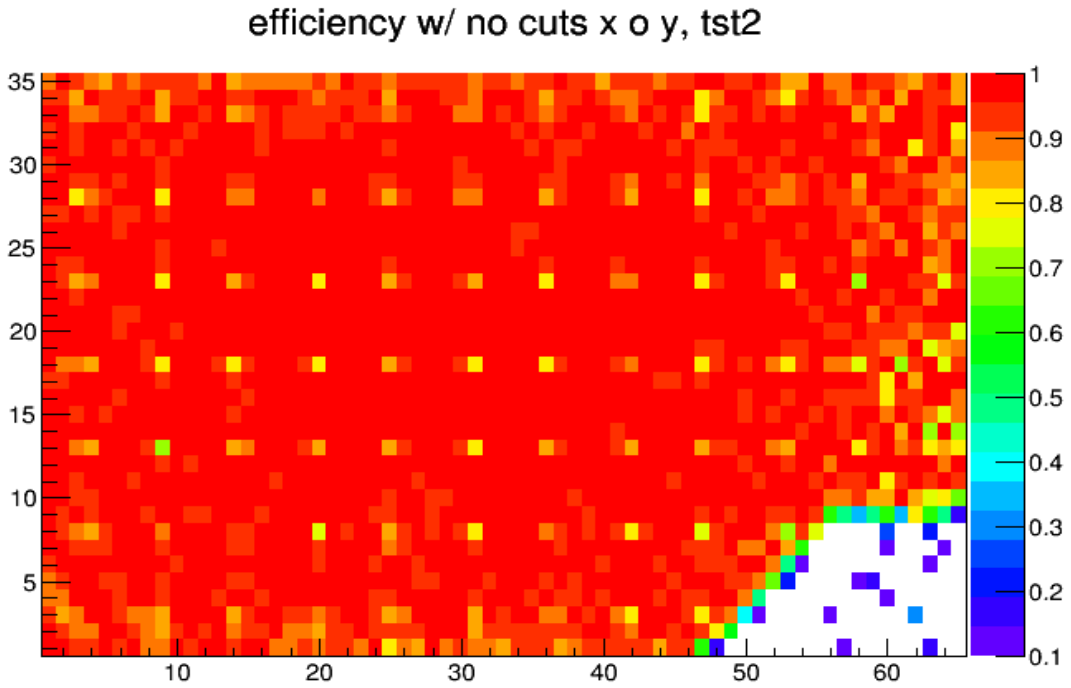




RPC production and status in INFN-TO lab (2)

- New production batch of 30 RPCs in 2021
  - → delayed at the firm due to Covid-19 pandemic

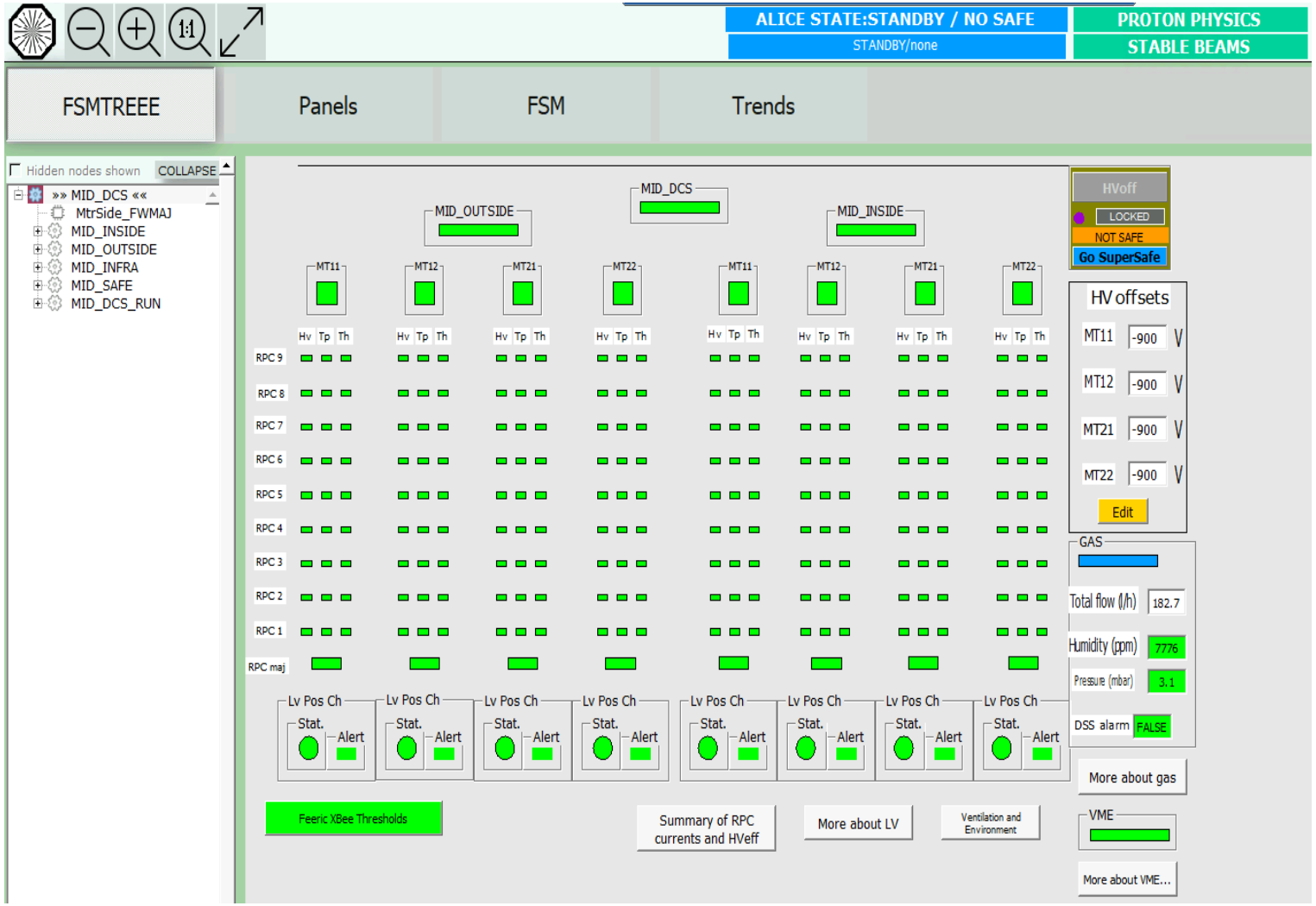
- RPCs tests started in Spring 2022
  → delay due to the commissioning of the brand new INFN-TO laboratory and re-assignment of manpower to the commissioning at CERN



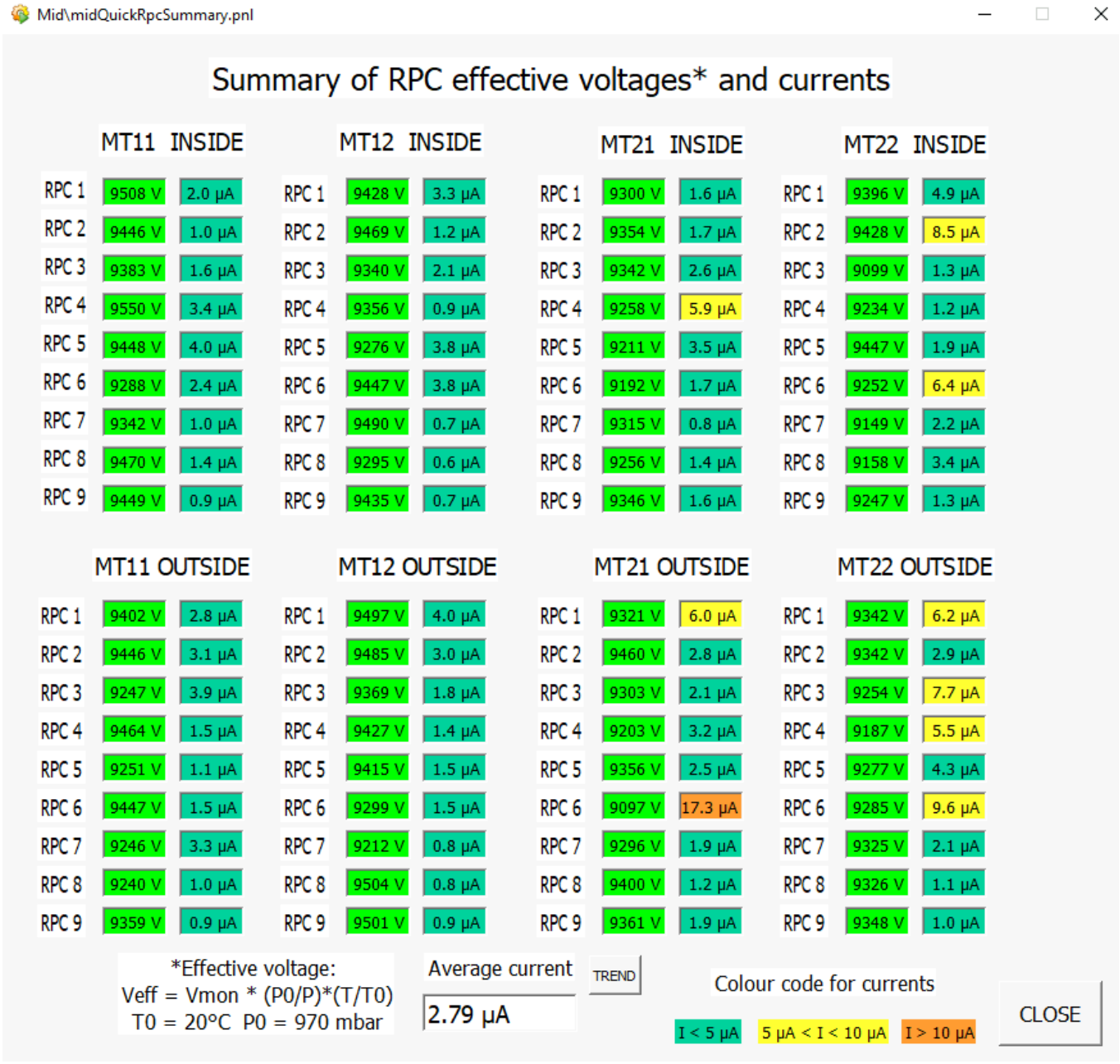
- 4 RPCs tested so far. All of them show:
  → an efficiency even higher than the 2019 pre-production batch (lower working point)
  → slightly higher currents, between 2μA and 10μA (causes under investigation)
  → can be used in ALICE

MID re-commissioning and operation at CERN (1)

- Several **hardware interventions** during the first phase of the commissioning without beam (gas system, HV cables, gas leak recovery…)
- Online systems (RO, QC, DCS) re-commissioned (some with basic functionalities only), fine-tuning ongoing
- The entire system was **READY** during the first Run 3 STABLE BEAMS on July 5th
- **Commissioning with first pp collisions ongoing** → need to tune working parameters RPC by RPC
- Up to now, MID has **always been READY and taking data** with pp collisions



RPC currents at (tentative) working point



MID plans 2022-2023

2022
- as stable as possible data-taking with pp collisions, fine-tuning of RPC HV and thresholds and improvement of online systems in parallel, with the goal to be in the best possible shape for the Pb-Pb run (November 2022)
- complete tests of the new RPC batch

Winter shutdown 2022-23
→ installation of up to 10 new RPCs
(sblocco 4.5 kEuro s.j. a settembre)

2023
- stable data-taking with proton and heavy-ion beams
- maintenance interventions as needed (gas leaks, HV cables are typical culprits)
- installation of more RPCs from the new batch

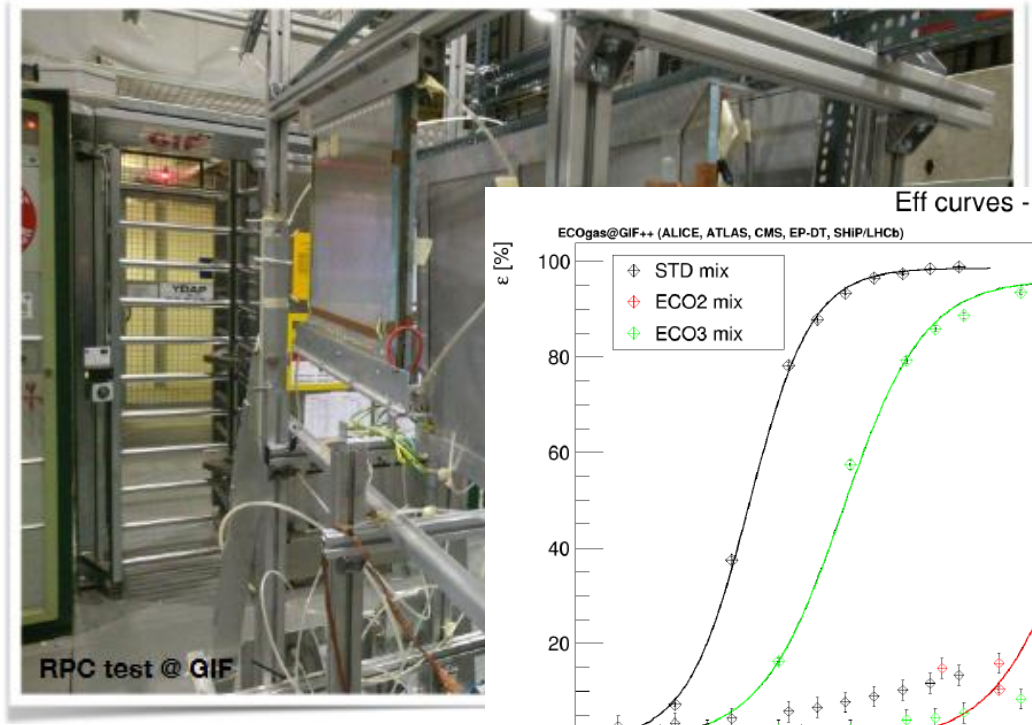
Milestones

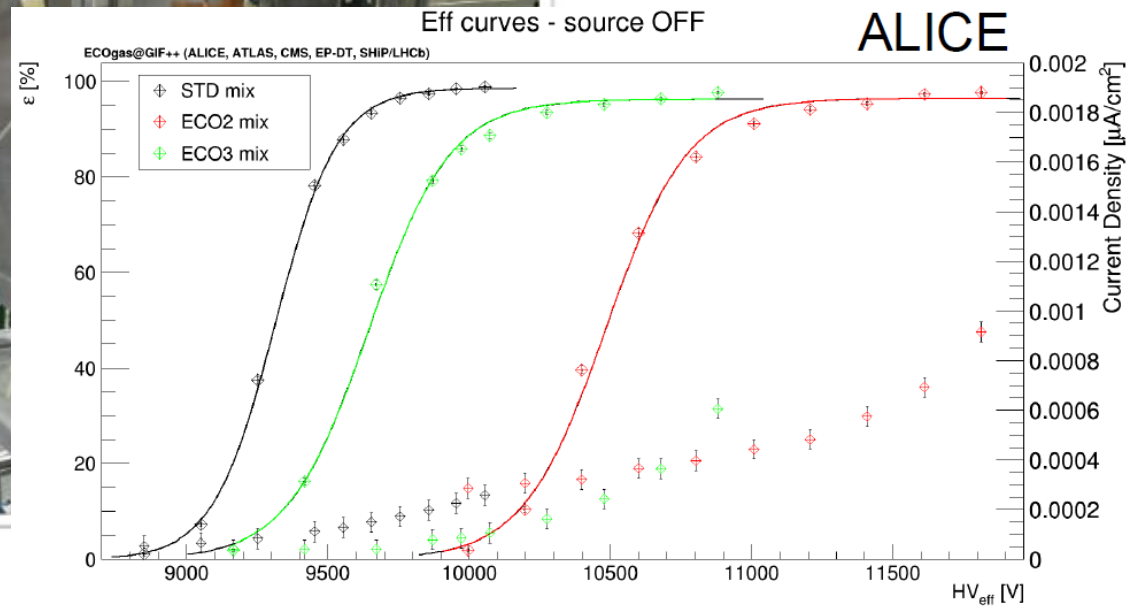
Anno	Milestone	Compl. al 30/06/22	Commenti
2021	Completamento test nuove RPC (dal 2020)	20%	test ancora in corso
2022	Partecipazione presa dati con collisioni pp e Pb-Pb	50%	presa dati Pb-Pb ancora da svolgere, rivelatore pronto e integrato in ALICE
2023	Partecipazione costante e regolare alla presa dati con collisioni pp e Pb-Pb		

RPC activities @ GIF

- RPC Gas R&D join effort (ATLAS, CMS, ALICE) in view of Run 4 and beyond
  - Replace tetrafluoroethane from the RPC gas mixture (high value of Global Warming Potential)
  - Tetrafluoropropene-CO2-based gas mixtures already tested with cosmics with promising results

- Tests @ GIF
  - Since 2020, prototype RPCs flushed with the new mixture have been exposed to gamma irradiation at CERN GIF to check the aging, working current and dark current have been monitored





- Several beam tests carried out in 2021 and 2022
  - cluster size, efficiency, rate capability…
  - systematic study vs gas mixture

  → results are being analysed and will be presented at relevant conferences and workshops in the field in Autumn 2022

Richieste 2023

Richieste specifiche

- Interventi di maintenance durante i technical stop:
  → 3 settimane al CERN per 2 tecnici + 1 fisico/tecnologo
    → *9 kEuro missioni*

- Partecipazione ad attività progetto Ecogas@GIF++ (beam + ageing tests)
  → 2 settimane al CERN per 2 persone
    → *4 kEuro missioni*

+M&O-B: *29 kCHF Servizi*

Backup

MID M&O-B 2023

budget description	Spesa (kCHF)	Commenti
Mechanics	4	
Gas Systems	4	
Cooling Systems		
FEE spares		
Standard Electronics LV/HV PS	5	
Standard Electronics Crates	5	
Standard Electronics R/O modules		
Controls (DCS & DSS)		
Sub-Detector spares	5	
Areas		
Communications	3	
Store Items	2	
Technical Manpower @ CERN: Industrial Support		
Technical Manpower @ CERN: subsistence	38	
Totale	**66**	

INFN share in MID M&O-B: 44% → INFN contribution = 29 kCHF

MID status at ALICE at CERN (2)

Istituto Nazionale di Fisica Nucleare
Sezione di Torino

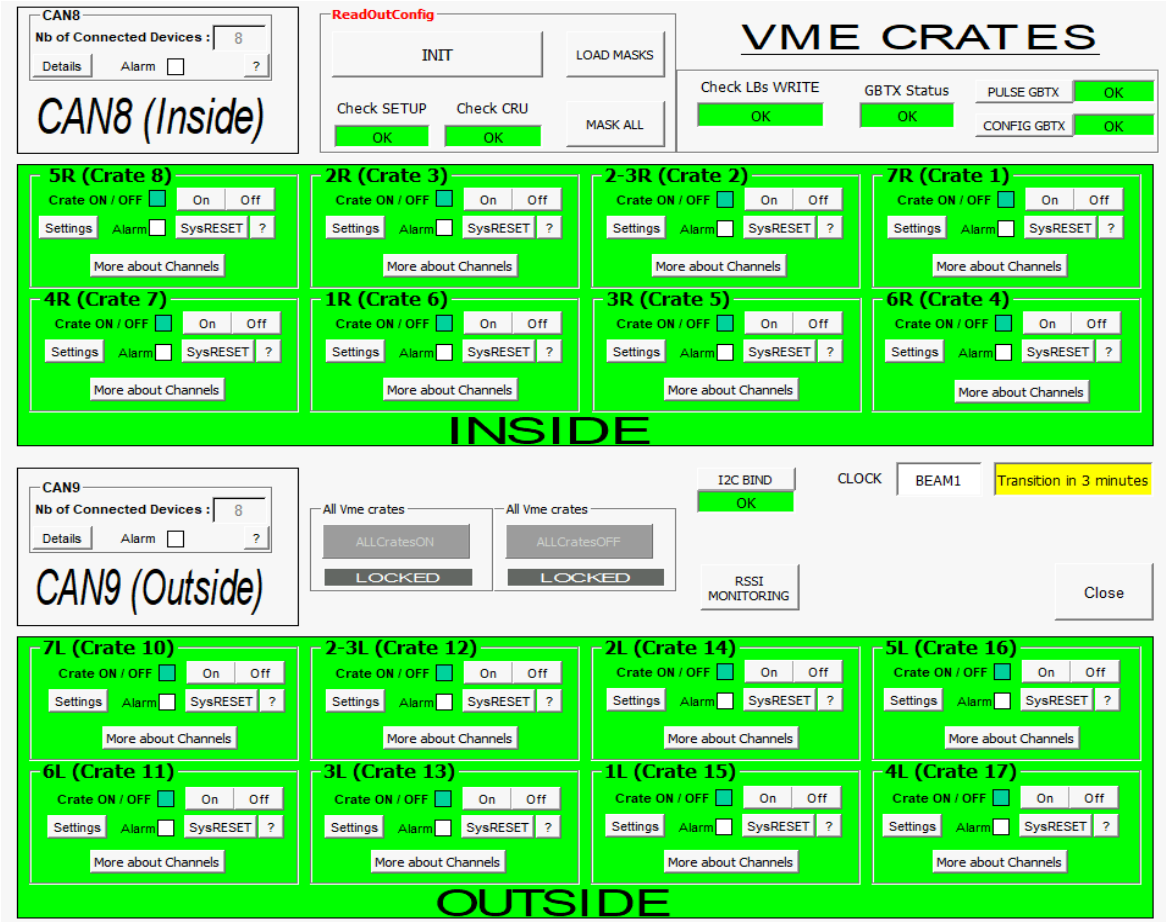
Several improvements on the VME side:

1) GBTx links down by clock transition on Beam1
→ automatic “bring-up” done and working

2) Calibration run of the detector after the BEAM DUMP
→ done and working, took less than 4 min

3) Firmware update of LOCAL cards
→ restoring the default registers and masking corresponding channels done and working

4) CRU UL bug: logic broken because of timing issues, resource usage too large
→ bug fix to be validated and deployed

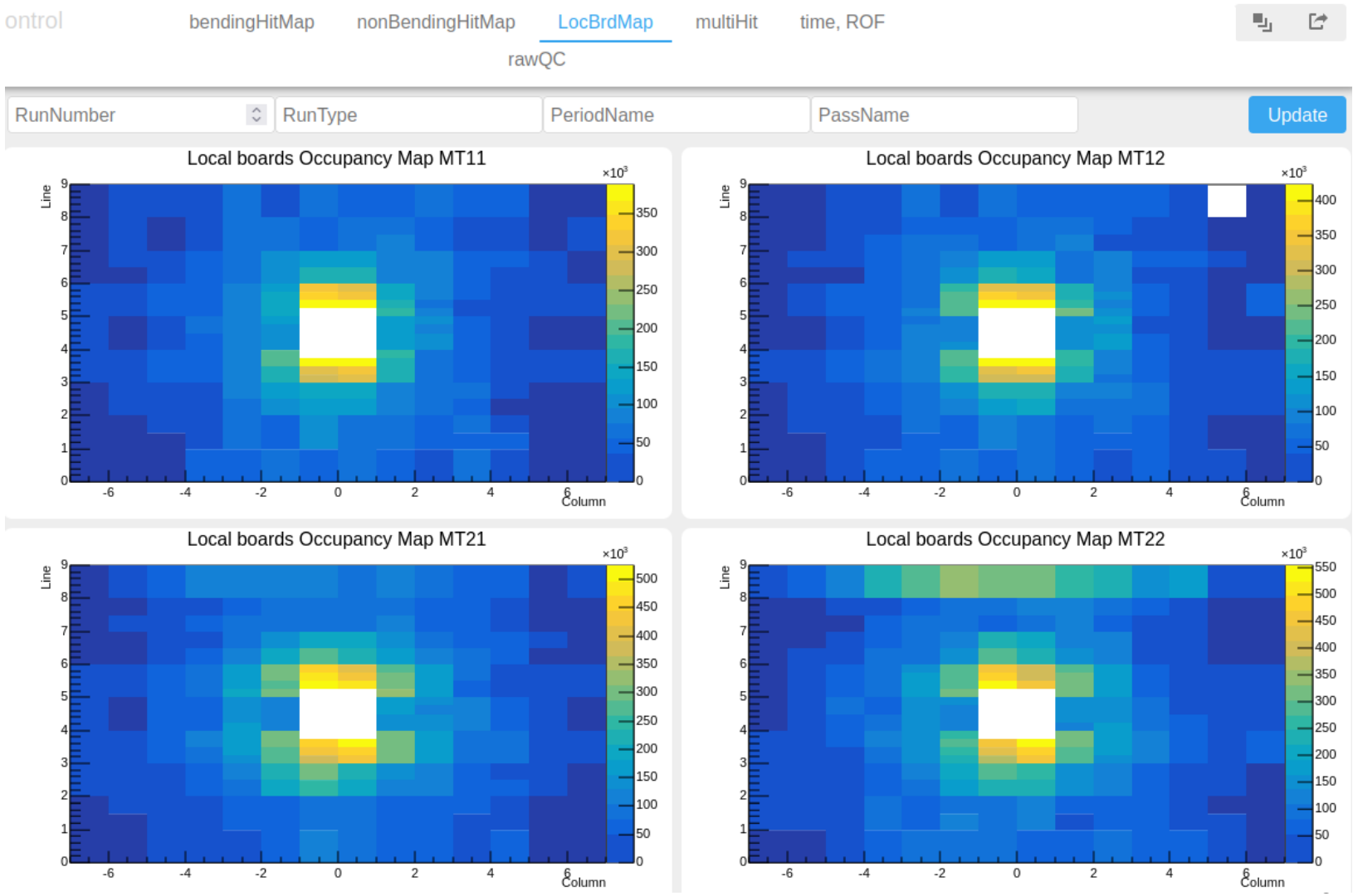


MID status at ALICE at CERN (3)

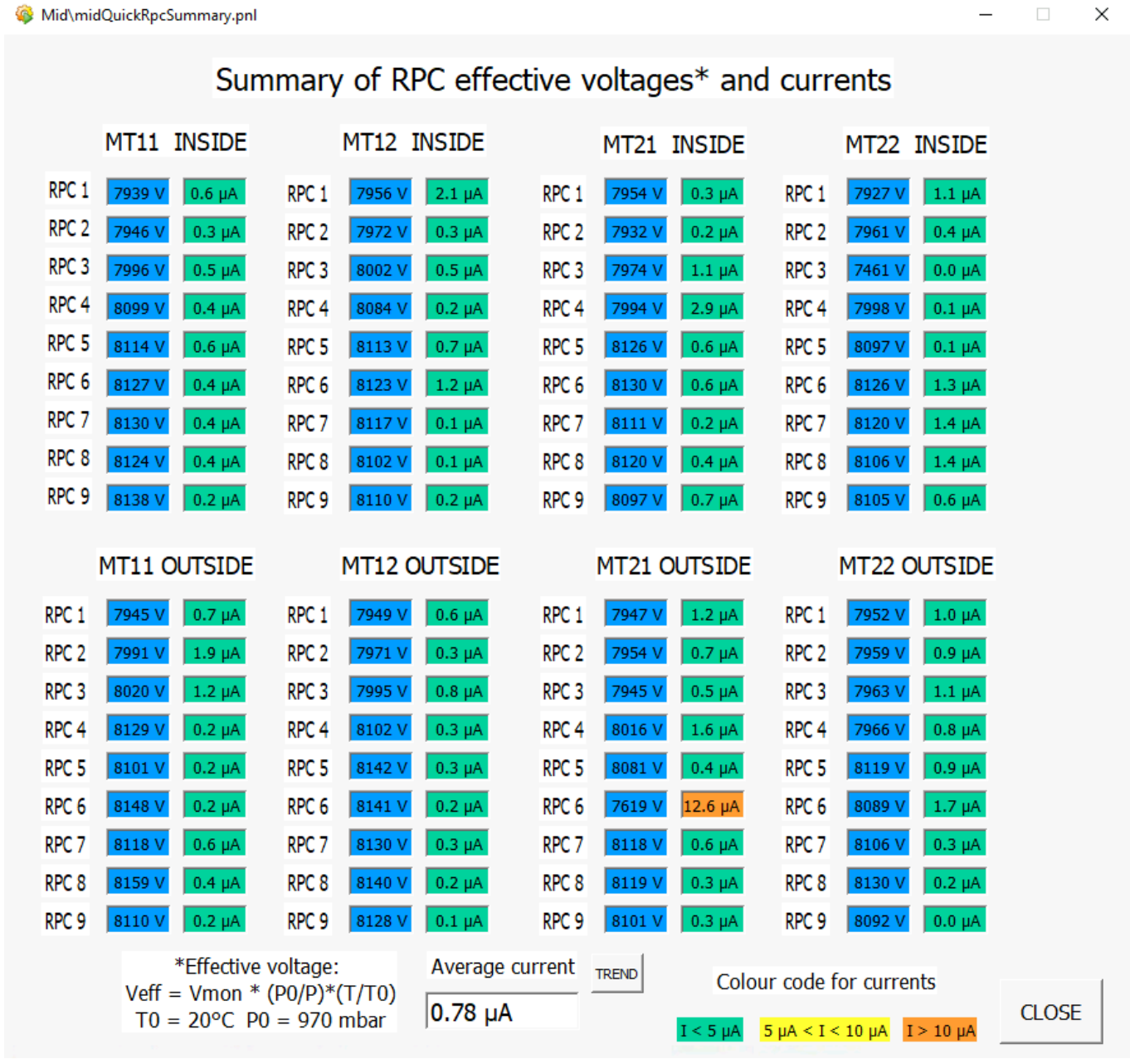
- Online Quality Control (QC) development ongoing:

  → digits QC done
  → raw QC t.b.d.
  → MID tracks t.b.d.
  → matching between MID and others ALICE muon detectors ongoing

- Status sum-up:
  → all 72 RPCs are operational
  → readout electronic is ok
  → no issue on data taking
  → QC under development



RPC currents at BEAM-SAFE voltage



Profilo di spesa RPC + gas system

	2015	2016	2017	2018	2019	2020	2021	Tot
MoU (kCHF)	41	17	7	37	0	0	0	102
Finanziamento INFN (kCHF)	41	17	7	0	23	5-9 (sblocco s.j. settembre)	13 s.j.	93-97+13 s.j.

Profilo di spesa FEERIC

	2015	2016	2017	2018	2019	2020	Tot
MoU (kCHF)	16.5	32	30.5	10	5	0	94
Effettivo (kCHF)	17.5	48		0	10	0	75.5
Finanziamento INFN (kCHF)	30	32	3.5	0	10	0	75.5