

# Muon Shift Training DCS

Muon DCS Community

# Introduction

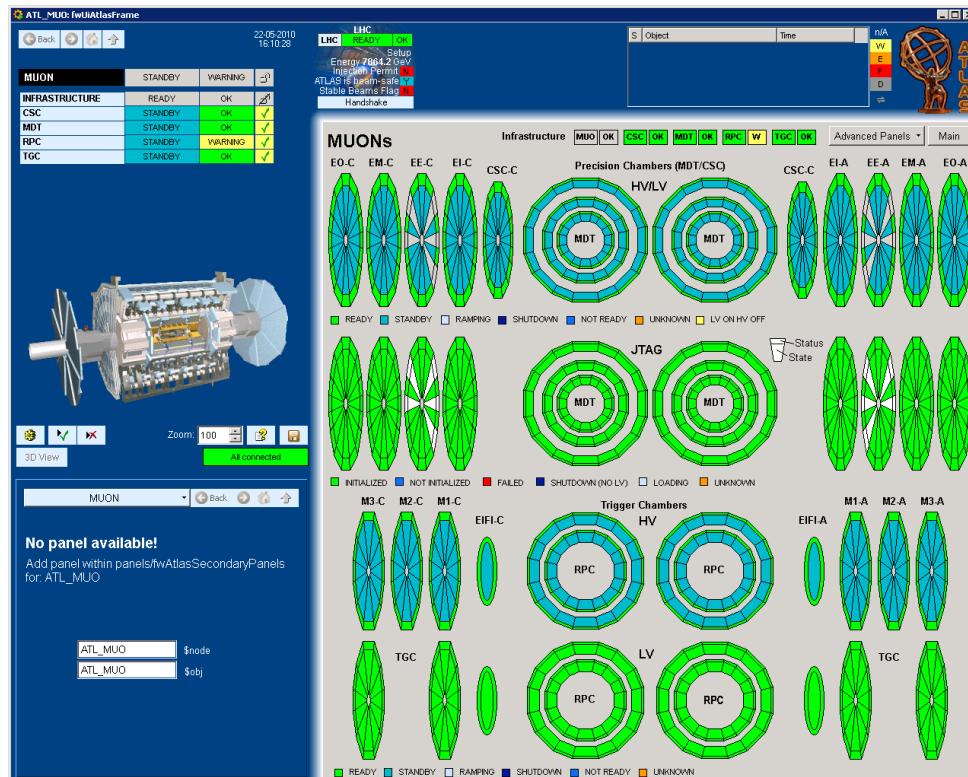
We assume you already followed the ATLAS general DCS training module, such that you are familiar with DCS concepts of the FSM :

- *alarms.*
- *alarm screen features and alarm screen operation, ....*

# Shifter DCS Tools

There are 2 DCS User Interfaces for Shifter Use in the ATLAS Control Room

- The Finite State Machine (FSM) UI
- The DCS Alarm Screen



**Vision\_1: ATLASAlarmScreen**

Group Acknowledgement  
Acknowledge  Unacknowledged  Individual/Group acknowledged

Sh	Dir	Description	Alarm text	Online Value	Ack	Time	C0
E	CAME	MUO CAENReset Chan81 TGC YTI04XA State	CHAN OFF	FALSE	<input type="checkbox"/>	2010/05/21 18:42:42 964	
E	CAME	MUO CAENReset Chan84 TGC YTI02XA State	CHAN OFF	FALSE	<input type="checkbox"/>	2010/05/21 18:42:42 990	
E	CAME	MUO CAENReset Chan85 TGC YTI06XA State	CHAN OFF	FALSE	<input type="checkbox"/>	2010/05/21 18:42:42 996	
E	CAME	MUO CAENReset Chan87 TGC YTI10XA State	CHAN OFF	FALSE	<input type="checkbox"/>	2010/05/21 18:42:43 001	
E	CAME	MUO CAENReset Chan88 TGC YTI109XA State	CHAN OFF	FALSE	<input type="checkbox"/>	2010/05/21 18:42:43 011	
E	CAME	MUO CAENReset Chan89 TGC YTI111XA State	CHAN OFF	FALSE	<input type="checkbox"/>	2010/05/21 18:42:43 027	
E	CAME	MUO CAENReset Chan90 TGC YTI112XA State	CHAN OFF	FALSE	<input type="checkbox"/>	2010/05/21 18:42:43 043	
E	CAME	MUO CAENReset Chan92 TGC YTI004XA State	CHAN OFF	FALSE	<input type="checkbox"/>	2010/05/21 18:42:43 043	
E	CAME	MUO CAENReset Chan93 TGC YTI010XA State	CHAN OFF	FALSE	<input type="checkbox"/>	2010/05/21 18:42:43 058	
E	CAME	MUO CAENReset Chan94 TGC YTI020XA State	CHAN OFF	FALSE	<input type="checkbox"/>	2010/05/21 18:42:43 074	
E	CAME	MUO CAENReset Chan95 TGC YTI060XA State	CHAN OFF	FALSE	<input type="checkbox"/>	2010/05/21 18:42:43 089	
E	CAME	MUO CAENReset Chan96 TGC YTI070XA State	CHAN OFF	FALSE	<input type="checkbox"/>	2010/05/21 18:42:43 105	
E	CAME	MUO CAENReset Chan97 TGC YTI070XA State	CHAN OFF	FALSE	<input type="checkbox"/>	2010/05/21 18:42:43 121	
E	CAME	MUO CAENReset Chan99 TGC YTI100XA State	CHAN OFF	FALSE	<input type="checkbox"/>	2010/05/21 18:42:43 136	
E	CAME	MUO CAENReset Chan98 TGC YTI090XA State	CHAN OFF	FALSE	<input type="checkbox"/>	2010/05/21 18:42:43 136	
F	CAME	MUO LCSD1 Script fwAtlasAgilentCTRL.cpl	NOT RUNNING	FALSE	<input type="checkbox"/>	2010/05/21 18:55:54 521	
F	CAME	MUO LCSD1 Script fwAtlasAgilentReadoutLoop.cpl	NOT RUNNING	FALSE	<input type="checkbox"/>	2010/05/21 18:55:58 912	
E	CAME	MUO CAENReset ReadoutLoop RunState	NOT RUNNING	FALSE	<input type="checkbox"/>	2010/05/21 18:56:18 334	
W	CAME	MDT EC DDC-DT RCD AliveCounter	Not updating	FALSE	<input type="checkbox"/>	2010/05/22 12:24:00 000	
W	CAME	MDT EA DDC-DT RCD AliveCounter	Not updating	FALSE	<input type="checkbox"/>	2010/05/22 12:24:00 000	
W	CAME	MDT BA DDC-DT RCD AliveCounter	Not updating	FALSE	<input type="checkbox"/>	2010/05/22 12:24:00 000	
W	CAME	MDT BC DDC-DT RCD AliveCounter	Not updating	FALSE	<input type="checkbox"/>	2010/05/22 12:24:00 000	
W	CAME	MDT EA DDC-DT Information from DAQ	Not updating	FALSE	<input type="checkbox"/>	2010/05/22 12:26:00 000	
W	CAME	MDT BA DDC-DT Information from DAQ	Not updating	FALSE	<input type="checkbox"/>	2010/05/22 12:26:00 000	
W	CAME	MDT BC DDC-DT Information from DAQ	Not updating	FALSE	<input type="checkbox"/>	2010/05/22 12:26:00 000	
W	CAME	TGC C DCS bus12	Problematic	20	<input type="checkbox"/>	2010/05/22 16:12:29 194	
W	CAME	TGC C DCS bus11	Problematic	20	<input type="checkbox"/>	2010/05/22 16:12:29 725	
W	CAME	TGC A DCS bus10	Problematic	20	<input type="checkbox"/>	2010/05/22 16:12:29 960	
W	CAME	TGC A DCS bus11	Problematic	20	<input type="checkbox"/>	2010/05/22 16:12:30 041	

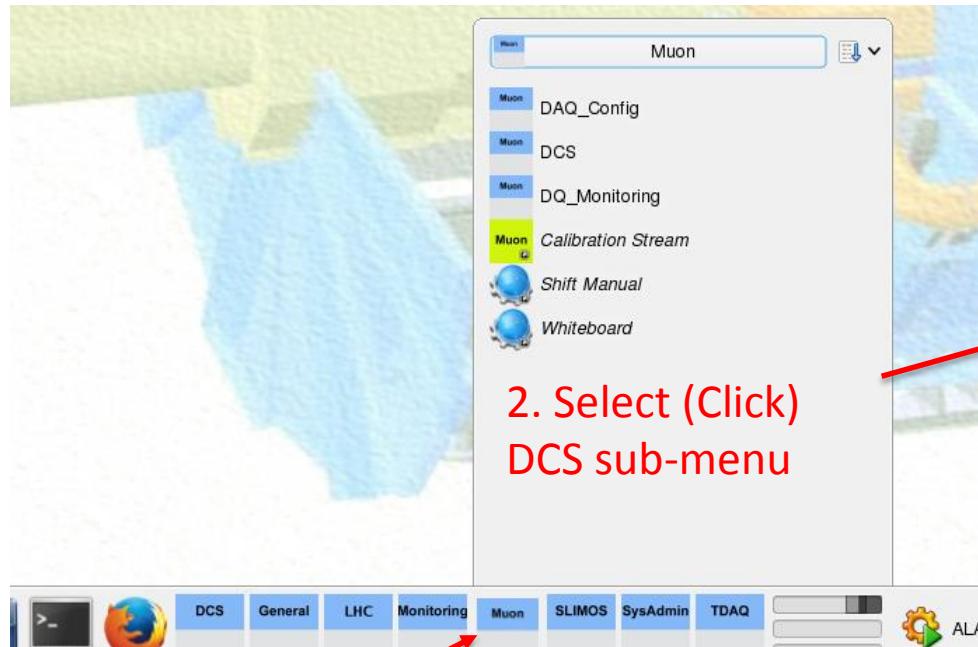
Filter settings  
 Systems       Severity       Description       Acknowledgment  
 All       Acknowledged       Unacknowledged       Not Acknowledgable  
 DPE Name       Pending

Displayed: 119 Unacknowledged: 103 Masked: 0 Masked Alerts Lock Line Position Deselect Settings Close

Both shall be open at all times and monitored – you are expect to react to them !

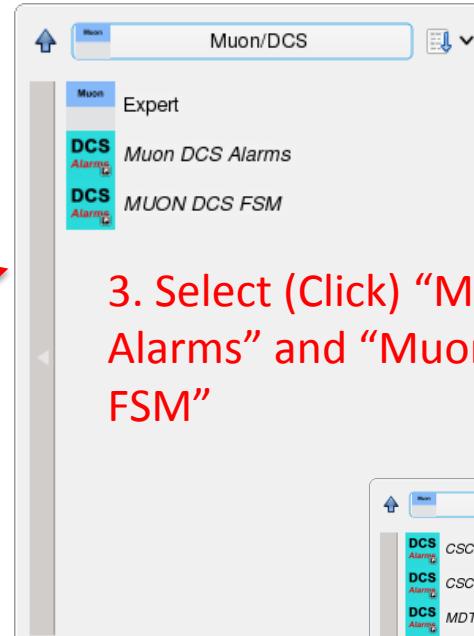
# Muon FSM and Alarm Screen UI

How to start the Muon DCS user interfaces: Muon desk

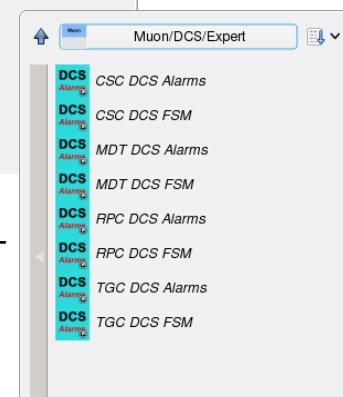


1. Click on  
“Muon” menu

Note: The alarm screen/FSM UI can be open also per sub-detector (CSC, MDT, RPC, ...), this is usually for experts → shifters use the MUON FSM/Alarms !



3. Select (Click) “Muon DCS Alarms” and “Muon DCS FSM”



At the start of your shift, make sure there is one FSM UI and one alarm screen open --- close duplicate and superfluous interfaces, number of open UIs is limited and the system may become unusable eg for an expert on call otherwise

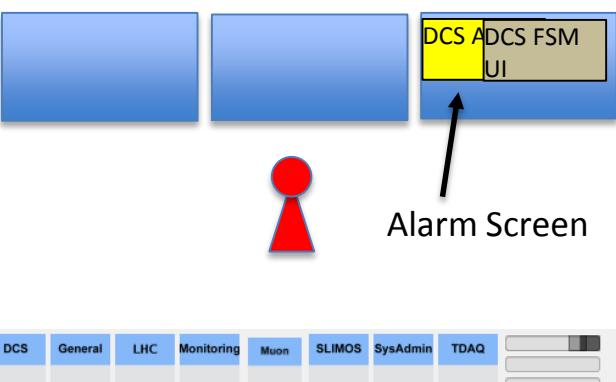
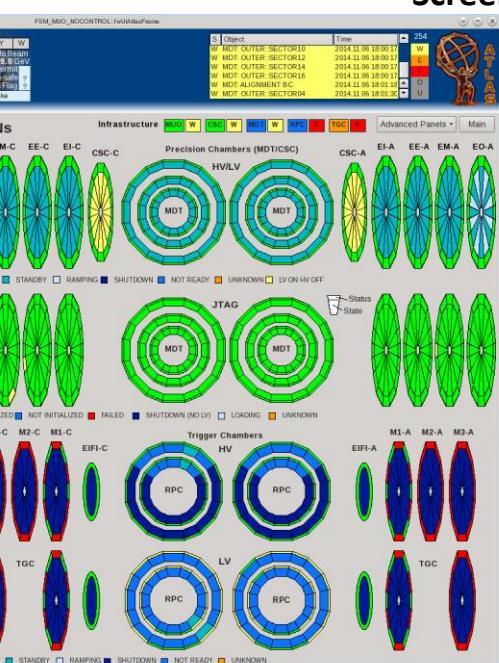
# Recommended Screen Layout for DCS UIs

User Interfaces were developed over the course of several years, optimized for the then standard 4:3 screen size ..... Which is no longer in use, so Panels no longer nicely fit one to a ACR display/monitor/screen ↗

Screen



Screen



Screen

- Recommended overlapped placement on the right most monitor
- Toggle between FSM and Alarm Screen by clicking into the Panels
- Display DCS UIs on all 3 virtual Desktops !

# Recap: (Muon) Shifter DCS Duties

Muon shifter shall ensure that

1. In the FSM, the MUON as well as the sub-detector state should always be

(nominal HV, stable beams or no beam)

(safe HV, outside stable beams)

State      Status

2. The Alarm Screen should be empty (no alarms)

3. When reaching stable beams, the system shall correctly ramp to nominal HV for physics data taking

4. When in STANDBY, the system shall give the safe for beam flag, and grant the injection permit → this shall be explicitly checked during Injection and Adjust Handshakes

1. and 2. **hold while taking physics data and in interfill periods etc.** – different from maybe DQ ...

# Recap: DCS Best Practice (Policy) -- Alarms

1. At the start of your shift **log in** to the alarm screen UI, reapply the default alarm screen filter
2. Understand what an alarm is about. Check the alarm help and/or instructions.
3. **Document** alarms in **separate elogs**, at the time when they appear and not only in the shift summary. Put as much details as you can, including circumstances, time, name of an expert you called, actions taken yourself
4. Alarms can be of Severity **WARNING** or **ERROR** or **FATAL**.
  - If you can not resolve a **ERROR** or **FATAL** and it persists for more than a few 10s of seconds or a minute, you must **call an expert**.
  - **WARNINGS** are a type of pre-alarm. Observe for a while. **Report in elog**, do not need to call an expert (especially out of hours) if not stated explicitly in the instructions/alarm help.
5. If a new alarm is for a **float** type parameter, observe it for a few minutes (trend plot). If it comes and goes or just “crazes” the warning limit, document it in elog, take a pragmatic decision whether to call an expert (example: environmental temperatures)
6. **Acknowledge** or **mask alarms** only when instructed to do so (alarm help/shift manual/expert). Document the acknowledgement in a separate elog. **Muon alarms are acknowledged or masked by the muon shifter, not the SL**

# Recap: DCS Best Practise (Policy) -- FSM

1. Do not forget to **log in** to the FSM UI at the start of shift
2. **Monitor** the system **from 'high up in the tree'**
3. **Navigate** to nodes at the bottom of the hierarchy only **if MUONs or a Muon sub-detector is no longer in state READY/OK.**
4. **Disable** anything in the FSM **only if instructed** to do so
  - For certain specific situations covered in the sub-detector sections, if you can not recover the state to READY—OK
    - Only cases where overall affected part of the detector is small – single chamber
    - MDT tripping channels upon second or more reoccurring trip
    - TGC and CSC tripping HV channels once max. number of automatic recoveries is exceeded
  - Upon instruction from the on-call expert
5. **Document** in a separate e-log entry (not the shift summary) what you excluded/disabled, the circumstances and who instructed you to do so. **No nodes shall be disabled by the SL**

# DCS related e-log entries

- Make sure you select “Default Message Type” when making e-log entries for a DCS issue
- Make sure you select “DCS” + the concerned sub-detector (CSC, MDT, RPC, TGC, MMG) as affected system, and not only the sub-detector

Flat View Threaded View New Entry Advanced Search Display Thread Contact us @

**Message Type:** Default Message Type ↗ **Author:** Stephanie Ulrike Zimmermann **Status:** open closed

**System Affected:** Select system affected

**Subject:** ✓ Check all ✘ Uncheck all

<input type="checkbox"/> Pixel	<input type="checkbox"/> SCT	<input type="checkbox"/> TRT	<input type="checkbox"/> ID Gen. (IC)	<input type="checkbox"/> BCM
<input type="checkbox"/> Beam Conditions	<input type="checkbox"/> LArg	<input type="checkbox"/> Tile	<input type="checkbox"/> Lucid	<input type="checkbox"/> ZDC
<input type="checkbox"/> CSC	<input type="checkbox"/> ALFA (RPO)	<input checked="" type="checkbox"/> MDT	<input type="checkbox"/> RPC	<input type="checkbox"/> TGC
<input type="checkbox"/> Monitoring	<input type="checkbox"/> DAQ	<input type="checkbox"/> HLT	<input type="checkbox"/> LVL1	<input type="checkbox"/> FTK
<input type="checkbox"/> Magnets	<input type="checkbox"/> DataQuality	<input type="checkbox"/> Event Displays	<input type="checkbox"/> Network	<input type="checkbox"/> SysAdmins
<input type="checkbox"/> GAS	<input type="checkbox"/> Cryo	<input type="checkbox"/> DSS	<input type="checkbox"/> DSS	<input type="checkbox"/> Counting Room
<input type="checkbox"/> RunCoord Info	<input type="checkbox"/> Radioprotection	<input type="checkbox"/> Tech. Infra	<input type="checkbox"/> Safety	<input type="checkbox"/> Tier0
<input type="checkbox"/> Other				

**Message text:**

Insert  

Sun Nov 16 14:16:42 CET 2014 Contact us: Bugs, feedback, improvements (access from outside P1 only). Currently supported browsers: Firefox, Safari, IE.

# Muon DCS Issues: Whom to call for help

On-call phone numbers are listed on the Muon Whiteboard

## Telephone Numbers

System	Numbers	Who/Where/What
Control Rooms	71365	ACR Muon Desk 1 ( <a href="#">3162-R-K01</a> )
	71363	ACR Muon Desk 2 ( <a href="#">3162-R-K01</a> )
	62941	Muon SCR ( <a href="#">3196-R-025</a> )
Run Coordinator	160226	<b>On-Call Phone</b> Philipp Fleischmann Nicoletta Garelli
CSC DAQ	164832	Cenk Yildiz
<b>MDT/CSC primary on-call</b>	<b>162018</b>	Tiesheng Dai
RPC L1 / DAQ	161853	<b>On-Call Phone</b>
RPC DCS / Detector	160664	<b>On-Call Phone</b>
<b>TGC primary on-call</b>	<b>161905</b>	<b>On-Call Phone</b>
MMG on-call	168679	Paolo Iengo
Additional Numbers		
Extended list of on-calls	see <a href="#">Current On-Call List</a>	
Collection of muon expert phone numbers	see <a href="#">Muon Expert Phone List</a>	
Other Systems	see the <a href="#">ATLAS Phone List</a>	

- For MDT and CSC DCS issues, call the **MDT/CSC primary on call**.
- For TGC DCS issues, call the **TGC primary on call**.
- The primary on call will contact the DCS (secondary) experts when needed
- For RPC DCS issues, call the **RPC DCS & Detector on-call**
- For Muon global DCS issues (BIS system, Muon cooling, Muon overall FSM UI stuck, ....) call the **MDT/CSC primary on call**
- DCS experts on-call may contact you for follow-up, to announce interventions or for questions in case of a problem

# Muon FSM

# Main Muon FSM Panel

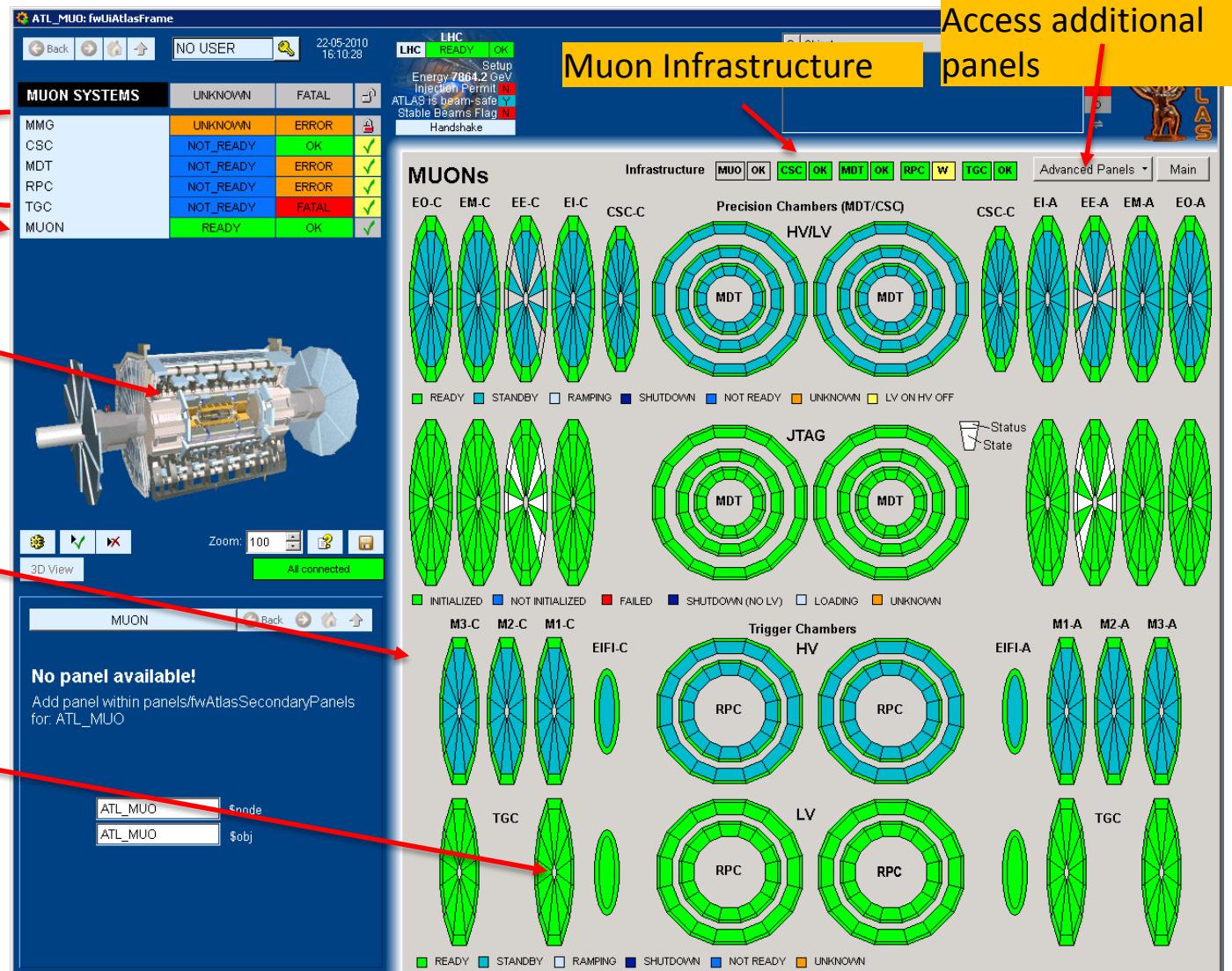
Sub-Detectors  
MMG = MicroMegas

Muon common  
infrastructure

“Click”: bring me home  
to MUON node

Overview over most  
important detector  
states: LV, HV, JTAG –  
Partition graphical  
representation

“Click”: Navigate to  
sector/layer



# CSC FSM

## FSM structure

### CSC

- Endcap Side A
- Endcap Side C
- Infrastructure

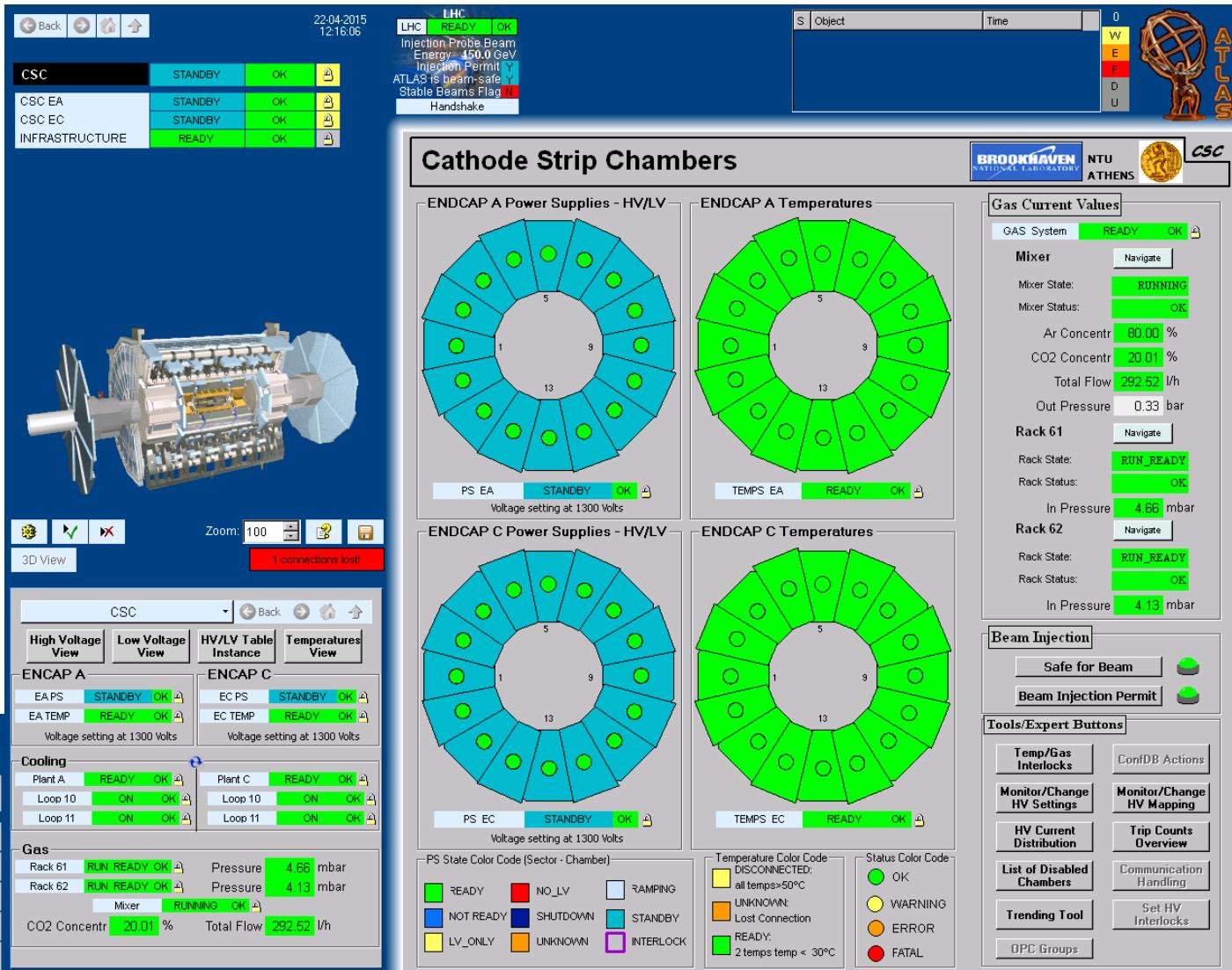
### Side A/C

- PS (Power System)
- Temperature

### Infrastructure

- ...

ATLAS	CSC
<b>INFRASTRUCTURE</b>	
CSC COOLING	READY OK
CSC GAS	READY OK
CSC ATCA	READY OK
RACKS	READY OK
CSC SYSTEMS	READY OK



# MDT FSM

## FSM structure

### MDT

- Barrel Side A
- Barrel Side C
- Endcap Side A
- Endcap Side C
- Infrastructure

### BA/BC/EA/EC

- PS Power System
- JTAG Initialization

### Infrastructure

- ....

The screenshot displays the MDT FSM control interface with several windows:

- MDT Status:** Shows the state of MDT BA, BC, EA, EC, and INFRASTRUCTURE components.
- LHC Status:** Displays LHC parameters: Energy 450 GeV, Injection Permit Y, ATLAS is beam-safe Y, Stable Beams Flag N, and Handshake.
- Monitored Drift Tubes:** A grid of circular plots representing drift tubes across EC, BC, BA, and EA sectors. A legend indicates states: READY (nom. HV), STANDBY (safe HV), LV ON, HV OFF, SHUTDOWN, RAMPING, UNKNOWN, and NOT READY (MIX).
- FE ELECTRONICS:** A detailed panel showing chamber statistics (e.g., 1159 chambers in state READY), chamber connections (e.g., BMG6A14, BMG6C12, BMG6C14, BOL4C01), and connection status (e.g., MDM PCs, PS PCs, Copying Mechanism).
- Statistics:** A table showing chamber counts by state: READY (1159), NOT READY (0), UNKNOWN (0), LV\_OFF (0), and MON\_OFF (13).
- Infrastructure:** A table listing infrastructure components and their status: GAS SYSTEM (READY OK), GAS MONITORING (READY OK), RACKS (READY OK), 48V GENERATORS (READY OK), CAEN SYSTEM (READY OK), MROD CRATES (READY OK), TTC CRATES (READY OK), EALIGN CRATES (READY OK), EELMB POWER (READY OK), HV STDBY CTRL (OPERATIONAL OK), FE ELTX MOH (READY OK), BARREL ALIGN (READY OK), ENDCAP ALIGN (READY OK), BEAM INTERLOCK (READY OK), CAEN RESET NET (READY OK), MDT DCS SYSTEMS (READY OK), and MUON COOLING (READY OK).
- Run Status/DAQ/DDC:** A table showing run details: Run 262480, Evt 12722.9 k, Type Physics, Dropped 0, State UNKNOWN Mezz 0, Info not updated! LB 829.
- LHC / MDT Beam Injection Permit:** A table showing beam mode (INJECTION PROBE BEAM), Inj. Permit (MDT TRUE), Muon (TRUE), Stable Beams Signal (FALSE), BeamSafe (TRUE), and HV StandBy Ctrl (V0\_UNSTABLE).
- Magnets:** A table showing Toroid (-0 A) and Solenoid (7730 A) currents.
- Configuration:** A large empty panel for configuration settings.

# RPC FSM

## FSM structure

### RPC

- Barrel Side A
- Barrel Side C
- Infrastructure

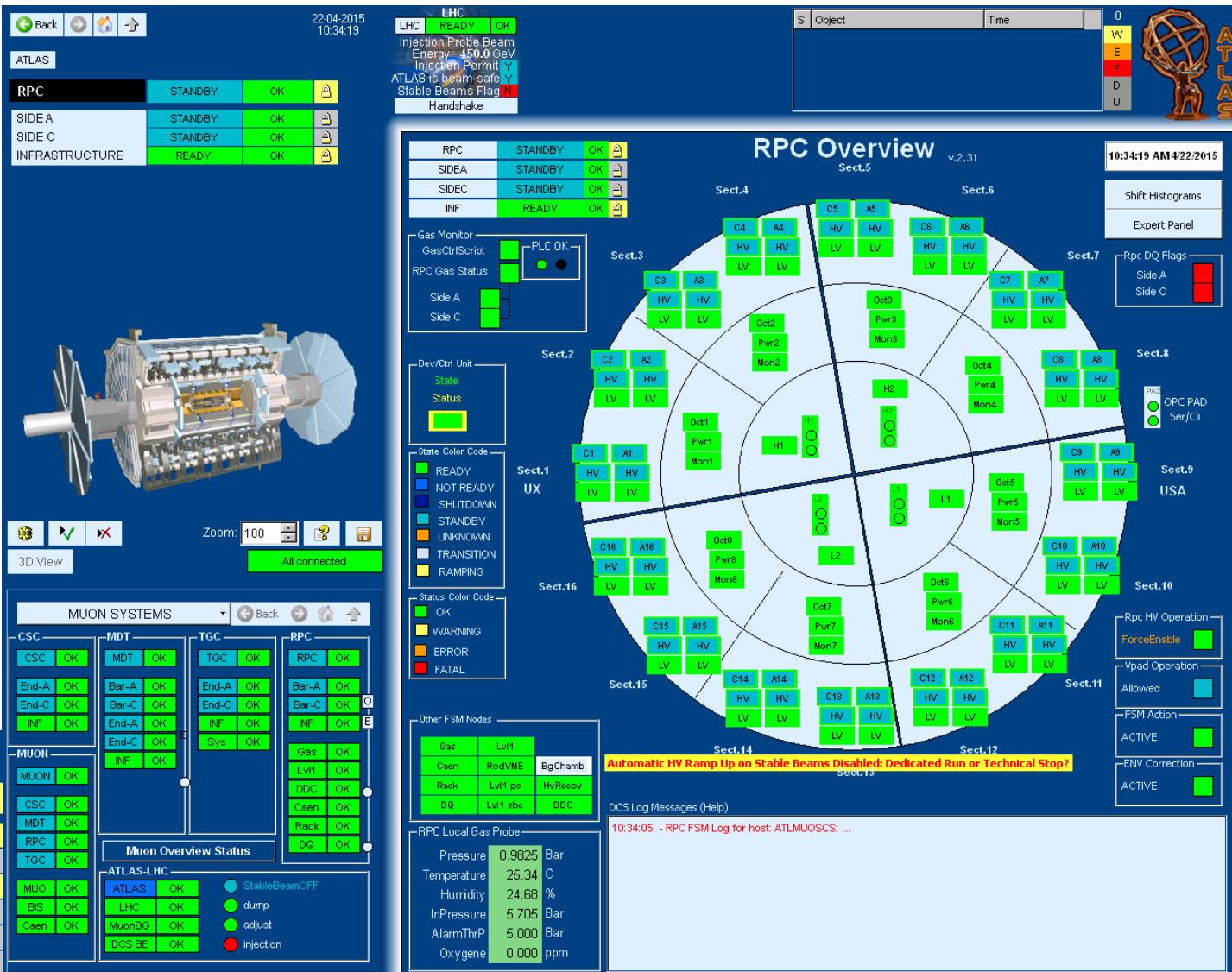
### Side A/Side C

- Sector 01
- ...
- Sector 16

### Infrastructure

- ....

ATLAS	RPC
INFRASTRUCTURE	READY OK
RPC GAS	READY OK
CAEN SYSTEM	READY OK
RPC LVL1	READY OK
RPC HV RECOVERY	READY OK
RPC SYSTEMS	READY OK
RACKS	READY OK
BEAM PERMIT	READY OK
Data Quality	READY OK



# TGC FSM

22-04-2015 10:29:01

ATLAS

TGC	STANDBY	OK
TGCA	STANDBY	OK
TGC C	STANDBY	OK
INFRASTRUCTURE	READY	OK

**LHC**

LHC	READY	OK
Injection Probe Beam		
Energy: 1500 GeV		
Injection Permit Y		
ATLAS is beam-safe		
Stable Beams Flag N		
Handshake		

**Thin Gap Chambers**

**Infrastructure**

GAS SYSTEM	READY	OK
RACKS	READY	OK
48V SIDE A	READY	OK
48V SIDE C	READY	OK
CAEN SYSTEM	READY	OK
HV STBY CTRL	OPERATIONAL	OK
BEAM INTERLOCK	READY	OK
VME CRATES	READY	OK
DCS SYSTEMS	READY	OK

**MUON SYSTEMS**

CSC	CSC	OK
End-A	MDT	OK
End-C	Bar-A	OK
INF	Bar-C	OK
MUON	End-A	OK
CSC	INF	OK
MDT	INF	OK
RPC	Sys	OK
TGC	OK	OK
MUO	OK	OK
BIS	OK	OK
Caen	OK	OK

**Muon Overview Status**

- StableBeamOFF
- dump
- adjust
- injection

**ATLAS-LHC**

ATLAS	OK
LHC	OK
MuonBG	OK
DCS BE	OK

## FSM structure

### TGC

- Endcap Side A
- Endcap Side C
- Infrastructure

### TGC A/TGC C

- HV
- LV
- Temperature
- Threshold

### Infrastructure

- ....

# MMG FSM

## FSM structure

### MMG

- MSW
- Infrastructure

### MSW

- HV
- LV

### Infrastructure

- ....

MMG	READY	OK	
CAEN SYSTEM	READY	OK	
VME CRATES	READY	OK	



# Special “MDT”-RPC nodes

Exception to FSM organization by sub-detector:

MIDDLE	SHUTDOWN	OK	🔒
SECTOR01	SHUTDOWN	OK	✓
SECTOR02	SHUTDOWN	OK	✓
SECTOR03	SHUTDOWN	OK	✓
SECTOR04	SHUTDOWN	OK	✓
SECTOR05	SHUTDOWN	OK	✓
SECTOR06	SHUTDOWN	OK	✓
SECTOR07	SHUTDOWN	OK	✓
SECTOR08	SHUTDOWN	OK	✓
SECTOR09	SHUTDOWN	OK	✓
SECTOR10	SHUTDOWN	OK	✓
SECTOR11	SHUTDOWN	OK	✓
SECTOR12	SHUTDOWN	OK	✓
SECTOR13	SHUTDOWN	OK	✓
SECTOR14	SHUTDOWN	OK	✓
SECTOR15	SHUTDOWN	OK	✓
SECTOR16	SHUTDOWN	OK	✓
RPC	UNKNOWN	UNINITIALIZED	✗

JTAG BA MIDDLE	SHUTDOWN	OK	🔒
SECTOR01	SHUTDOWN	OK	✓
SECTOR02	SHUTDOWN	OK	✓
SECTOR03	SHUTDOWN	OK	✓
SECTOR04	SHUTDOWN	OK	✓
SECTOR05	SHUTDOWN	OK	✓
SECTOR06	SHUTDOWN	OK	✓
SECTOR07	SHUTDOWN	OK	✓
SECTOR08	SHUTDOWN	OK	✓
SECTOR09	SHUTDOWN	OK	✓
SECTOR10	SHUTDOWN	OK	✓
SECTOR11	SHUTDOWN	OK	✓
SECTOR12	SHUTDOWN	OK	✓
SECTOR13	SHUTDOWN	OK	✓
SECTOR14	SHUTDOWN	OK	✓
SECTOR15	SHUTDOWN	OK	✓
SECTOR16	SHUTDOWN	OK	✓
RPC	NOT_READY	UNINITIALIZED	✗

OUTER	READY	OK	🔒
SECTOR01	READY	OK	✓
SECTOR02	READY	OK	✓
SECTOR03	READY	OK	✓
SECTOR04	READY	OK	✓
SECTOR05	READY	OK	✓
SECTOR06	READY	OK	✓
SECTOR07	READY	OK	✓
SECTOR08	READY	OK	✓
SECTOR09	READY	OK	✓
SECTOR10	READY	OK	✓
SECTOR11	READY	OK	✓
SECTOR12	READY	OK	✓
SECTOR13	READY	OK	✓
SECTOR14	READY	OK	✓
SECTOR15	READY	OK	✓
SECTOR16	READY	OK	✓
RPC	READY	OK	✓

MDT Barrel Middle and Outer PS, JTAG and FE Electronics FSM trees have a “sector” RPC

- Contains BMR and BOR related controls.
- BMR/BOR: RPC chambers which are additionally read out also via the MDT system for electronics studies

In case of problems – can be disabled (Upgrade study, not for physics data taking) – note that it also needs to be disabled in the DAQ then

# DCS Operations

## LV, HV

- Operating instructions are described according to functionality.
  - Instructions are not always the same for all Muon sub-detectors.
- 
- You may feel overwhelmed by the instructions if hearing them all one after the other. **Don't panic !**
  - Actions and procedures explained here shifters usually handle without need to referring to the shift manual after a few shifts
  - Use your shadow shifts or first shifts to go through the slides again, in front of the ACR computer !

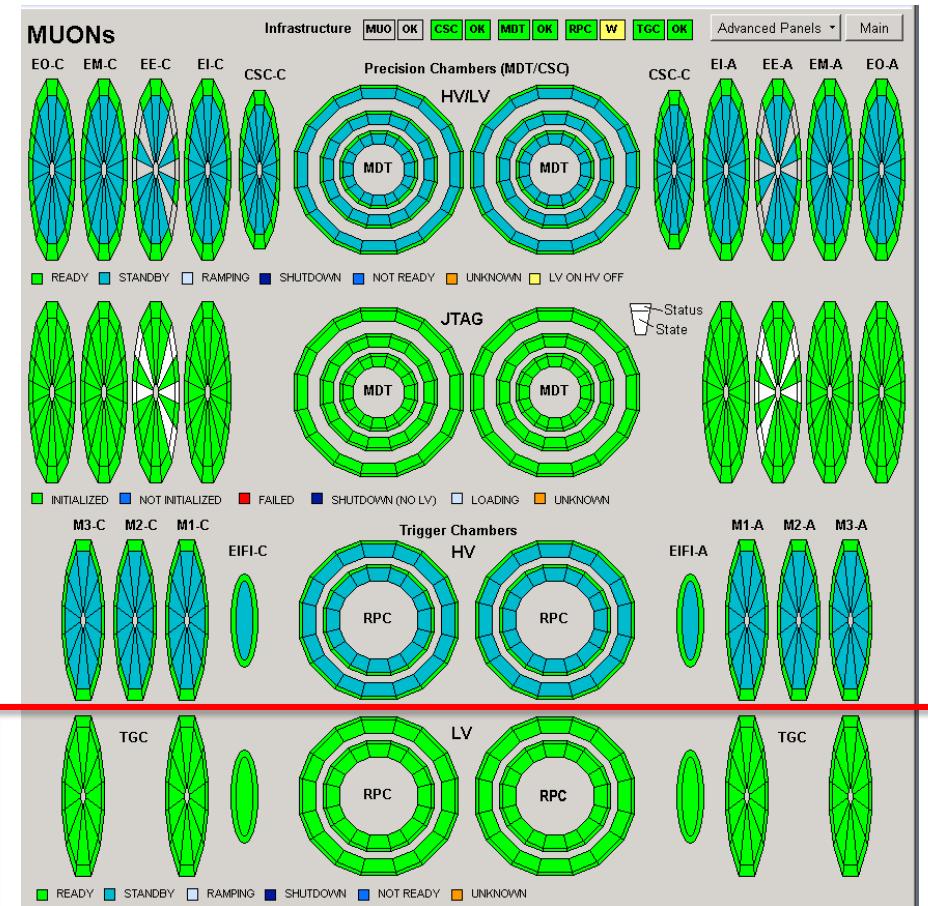
# LV Operation I – Assessing LV State

Normally, when you come on shift, the detector will be powered

- For **RPC** and **TGC**, HV and LV are separate FSM trees (for RPC up to sector level)



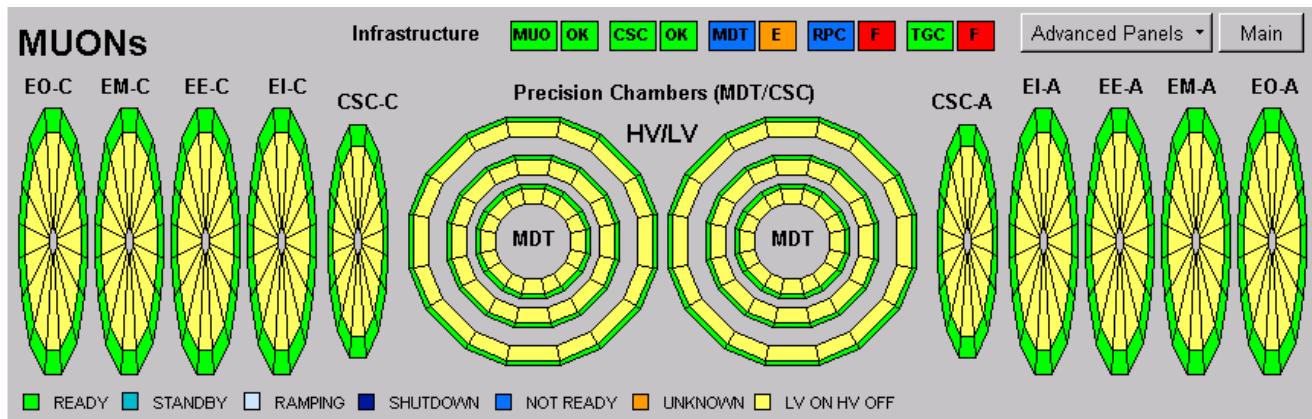
LV state must be READY for any run, even if calibration data taking with no HV – DAQ will fail at Configure otherwise, miserably !!!



# LV Operation II – Assessing LV State

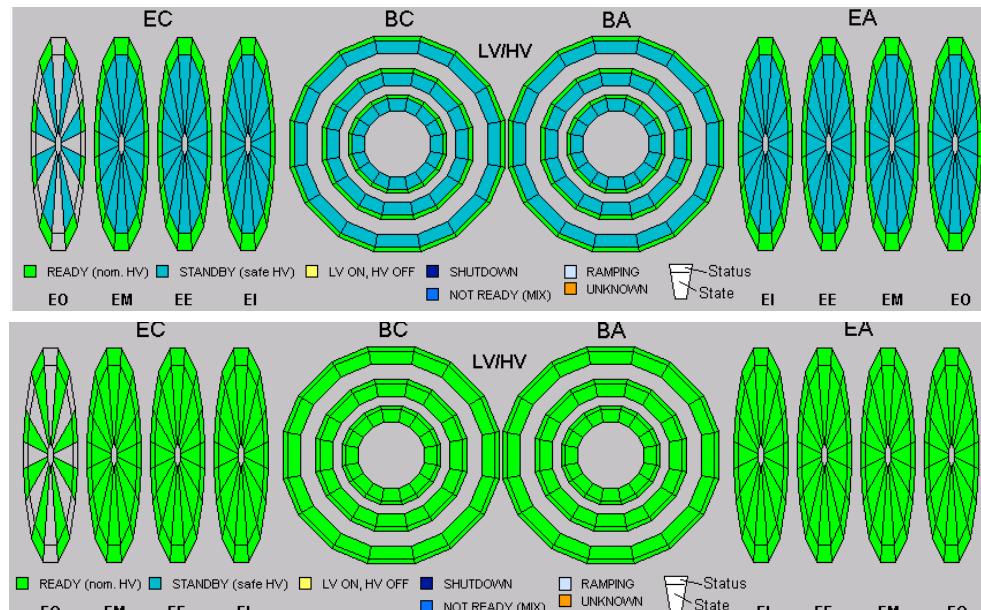
- For MDT and CSC, LV and HV are combined into a “PS” state for each chamber

MDT	
MDT BC	NOT_READY
PS BC	LV_ONLY
JTAG BC	READY



- If LV is ON and HV is off, MDT (partition) state is **NOT\_READY**. Sectors and chamber state is **LV\_ONLY**
- If LV is ON and HV is ON and at safe voltage, MDT (partition) state is **STANDBY**

MDT	
MDT BC	STANDBY
PS BC	STANDBY
JTAG BC	READY

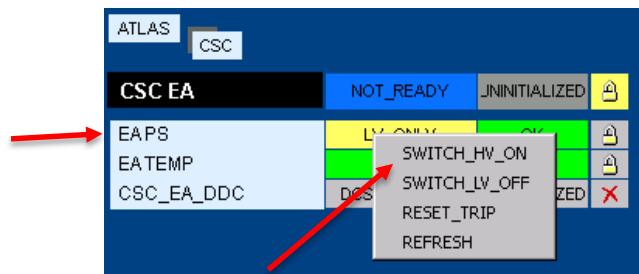
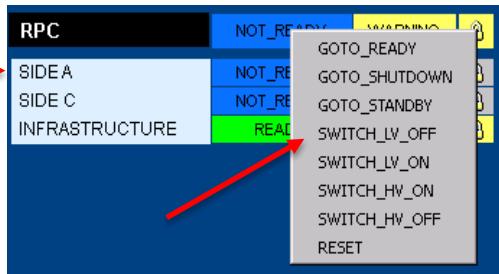
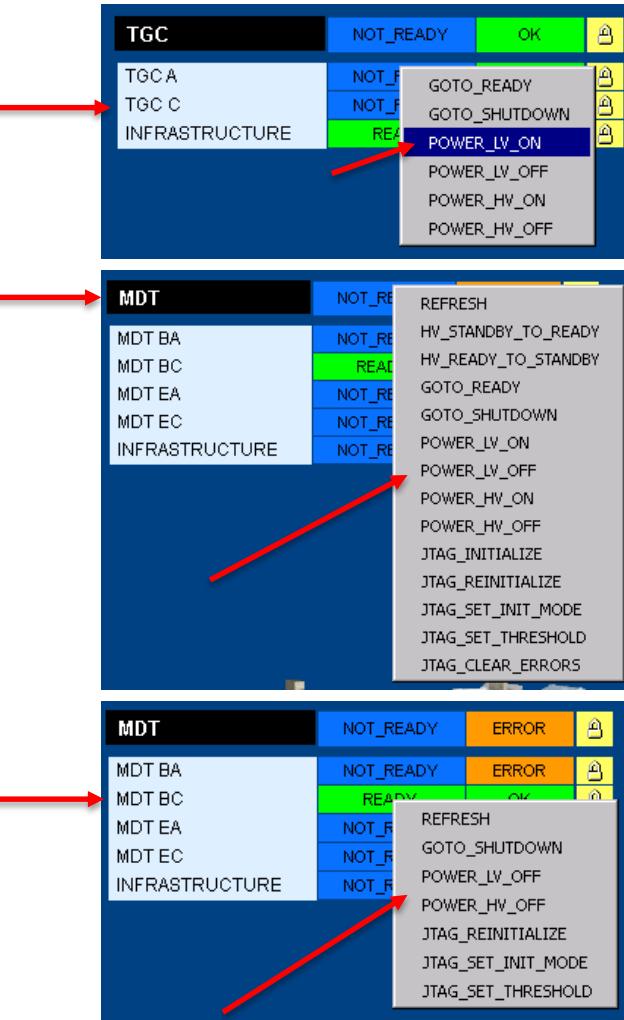


LV must be ON/READY for any RUN !!

# LV Operation III – Global Actions

Occasionally you may be asked to “TURN” the full detector (LV) “OFF” or “ON” – usually before or after an intervention. Only in close interaction/communication with an expert !

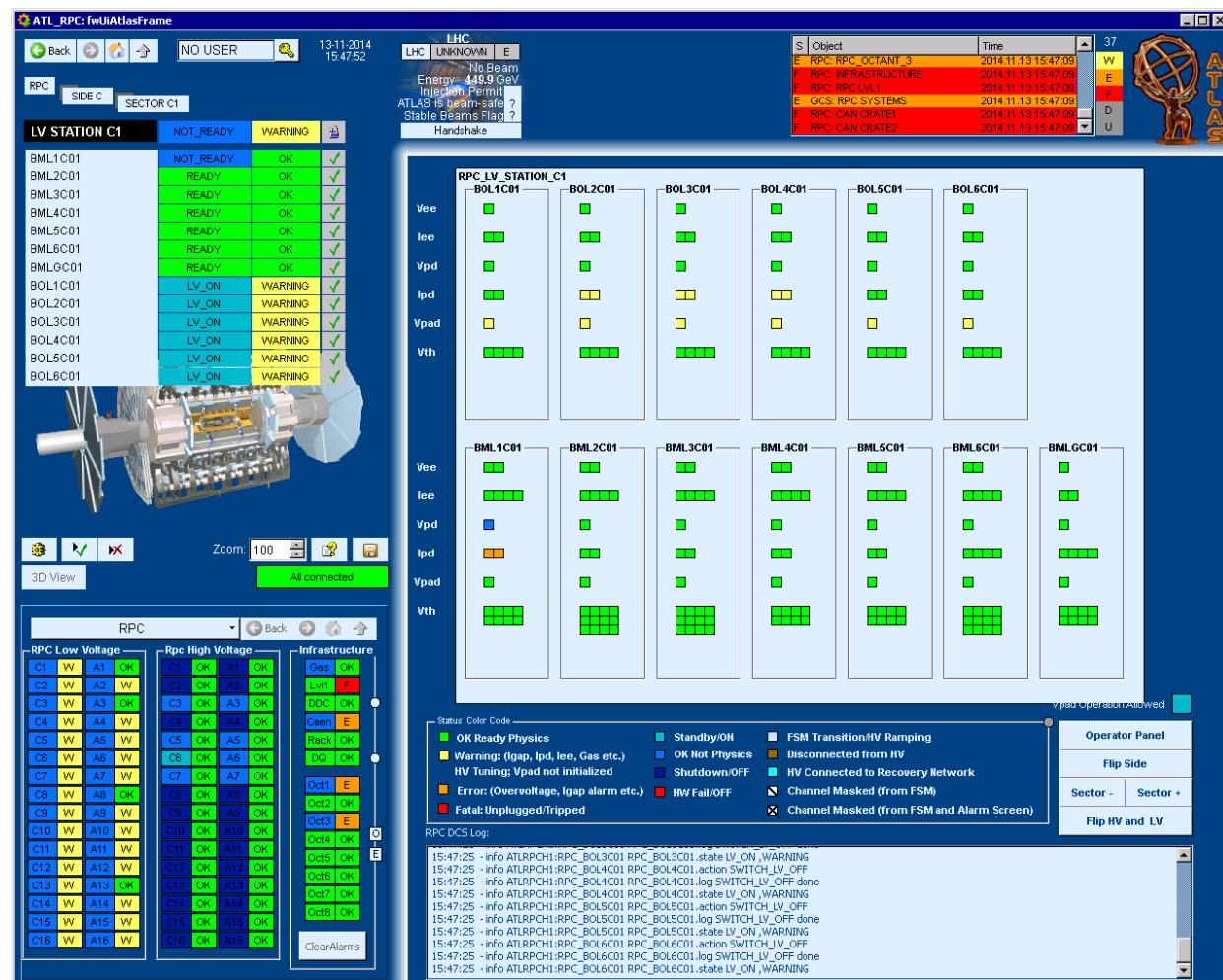
- For **TGC**, execute a **POWER\_LV\_ON** or **POWER\_LV\_OFF** from the TGC A and TGC C node
- For **MDT** execute a **POWER\_LV\_ON** or **POWER\_LV\_OFF** from the main MDT node (same command can also be used on partition, layer or sector level)
- For **CSC** execute a **SWITCH\_LV\_OFF** or **SWITCH\_LV\_ON** on the CSC PS level under CSC A and CSC C node
- For **RPC**, execute a **SWITCH\_LV\_OFF** or **SWITCH\_LV\_ON** on main RPC node or on the Side A/C level



# LV Operation IV – Problems and single channel operation -- RPC

## RPC LV not READY

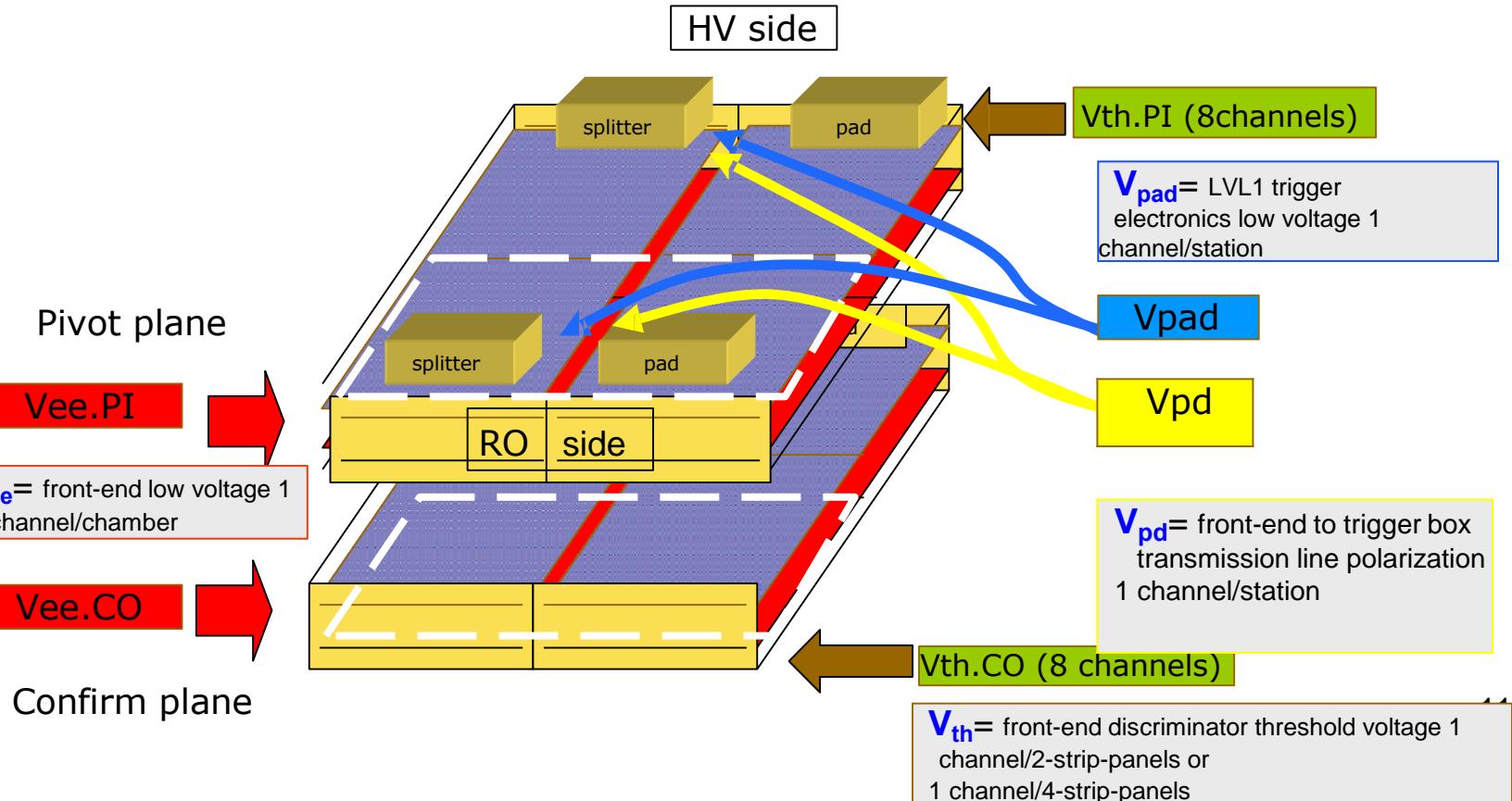
1. Navigating to STATION panel gives details on the status of the various voltages supplied to chambers (of a sector)
  - Alerts/color coding are based on PS channel status, voltage settings, current driven
2. If a LV trips, for Vpd, Vth, Vee you may try to recover it with a **GOTO\_READY** once.
  - Recovering Vpad is reserved to experts !!



3. Alarms other than a channel being tripped/off require expert intervention

# Backup: RPC LV Architecture

Each RPC chamber is connected to 4 different LV channels and voltages



# LV Operation V – Problems and single channel operation – CSC, TGC

CSC or TGC LV not READY:

- DCS does not prevent shifters from turning LV channels ON or OFF (there is no access control restricting this to experts only), however
- If a LV channel trips or unexpectedly goes to OFF state, **you ABSOLUTELY MUST check with the expert before/when repowering it !**

After a LV power cycle, frontend electronics need to be configured again correctly to be able to take events → DAQ actions involved !!

If forgotten, CSC/TGC may look perfectly fine (READY/OK) in DCS while data is junk and the run will be discarded !!

AL01	LV_ONLY	OK	✓
AL01 L1	OFF	OK	✓
AL01 L2	OFF	OK	✓
AL01 L3	OFF	OK	✓
AL01 L4	OFF	OK	✓
AL01 LV	ON	OK	✓

LV C 01 M1	READY	OK	✓
all ASD-POSITIVE	ON	OK	✓
all ASD-NEGATIVE	ON	OK	✓
all HSC	ON	OK	✓
all DCS-ELMB	ON	OK	✓
all DCS-VBIAS	ON	OK	✓
all PS-DIGITAL	ON	OK	✓

- If you are asked to power cycle/switch on/off a LV channel, you do so by executing the **SWITCH\_OFF/ON** action on the corresponding LV channel node
- If LV fails or trips again, more in-depth investigations are needed – **do not try many times**
- If an individual LV channels unexpectedly goes to OFF state, it may have been cut by an **interlock** – CSC temperature, TGC LV board temperature ...

# LV Operation VI – Problems and single channel operation -- MDT

- For MDT power cycling/switching on/off an individual LV channel is a shifter operation
- Execute action **SWITCH\_ON/SWITCH\_OFF** on the concerned LV node

BOL4C13	NO_LV	OK	✓
BOL4C13_ML1	STANDBY	OK	✓
BOL4C13_ML2	STANDBY	OK	✓
BOL4C13_LV	OFF	OK	✓

SWITCH\_ON  
REFRESH  
EXPERT COMMAND: LOCK\_UNLOCK

- Power cycling a chamber's LV during a run will cause a loss of JTAG initialization
  - If a chamber's LV is switched off, LV and JTAG is usually also lost for a second chamber due to the LV distribution
1. In case a chamber LV trips or unexpectedly goes to OFF:
    - Attempt ONCE to recover by switching LV back on on chamber level via the LV node **SWITCH\_ON** action, followed by a **JTAG\_INITIALIZE** of the concerned chambers
    - If it trips again, call an expert. Disable the individual channel in the FSM, and corresponding chamber in JTAG if told to do so.
  2. Power-cycling a chamber on purpose:
    - Try if a chamber continuously fails JTAG initialization
    - Attempt if DQ shows data from a specific data is corrupted, and simply JTAG reinitializing it does not help
    - Do not repeat many times, if once does not help, usually something else is wrong → expert

# HV Operation I – Assessing HV State

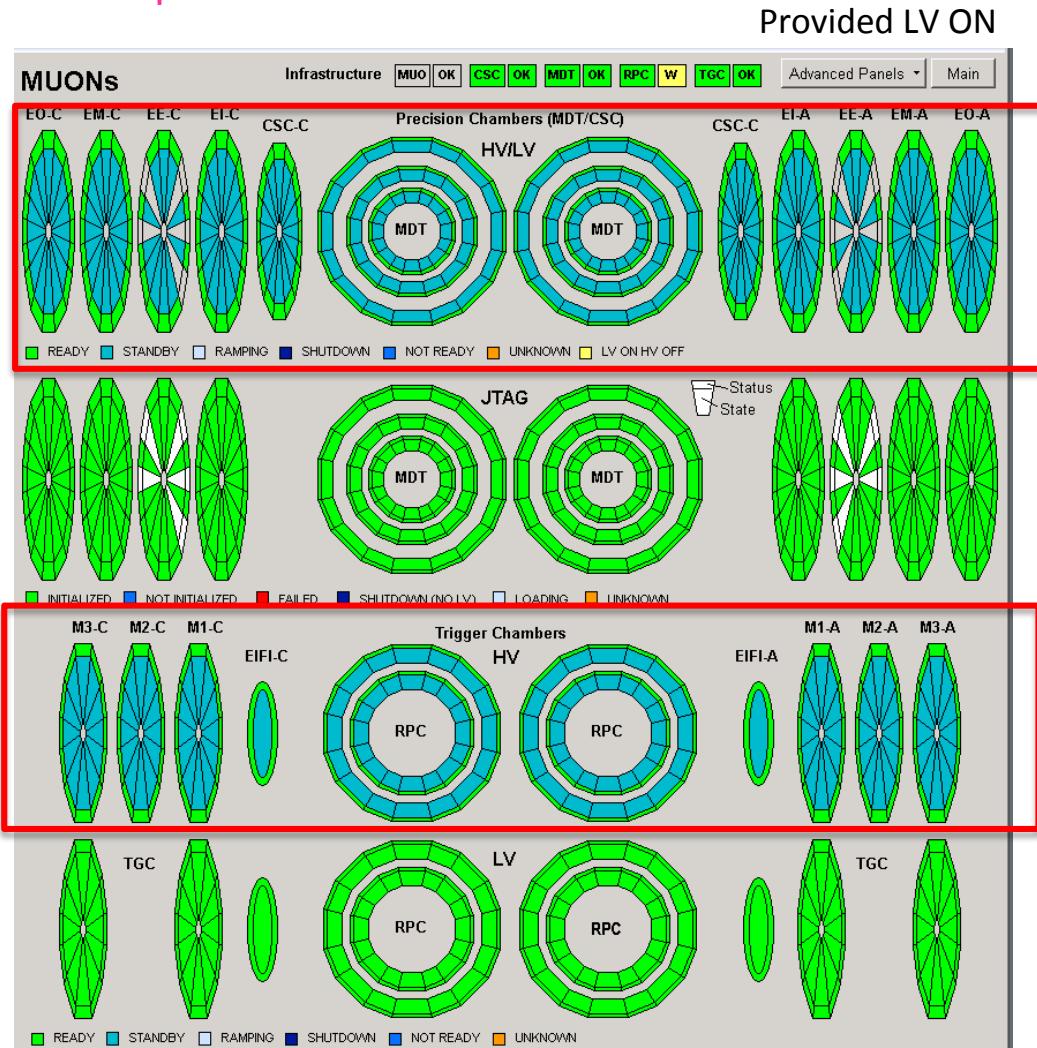
You can assess the HV state from the MUON main panel

**STANDBY** state is the **nominal** state (all ok) during operation with beam **outside STABLE BEAMS**.

- HV is lowered to a safe voltage level.
- Occupancy histograms show no hits where voltage is lowered

**READY** state is the **nominal** state (all ok) during operation with beam **during STABLE BEAMS**.

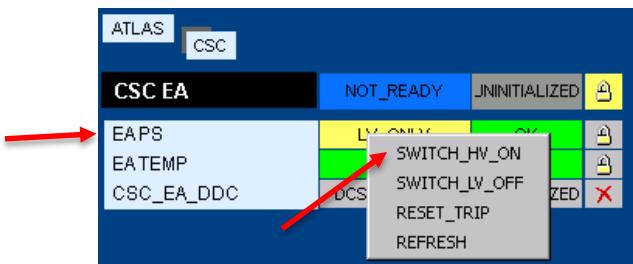
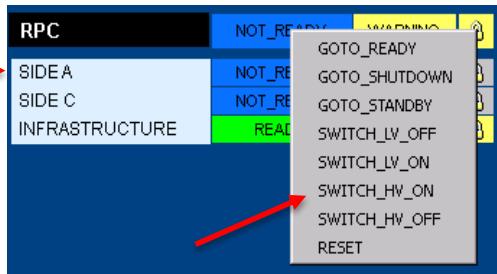
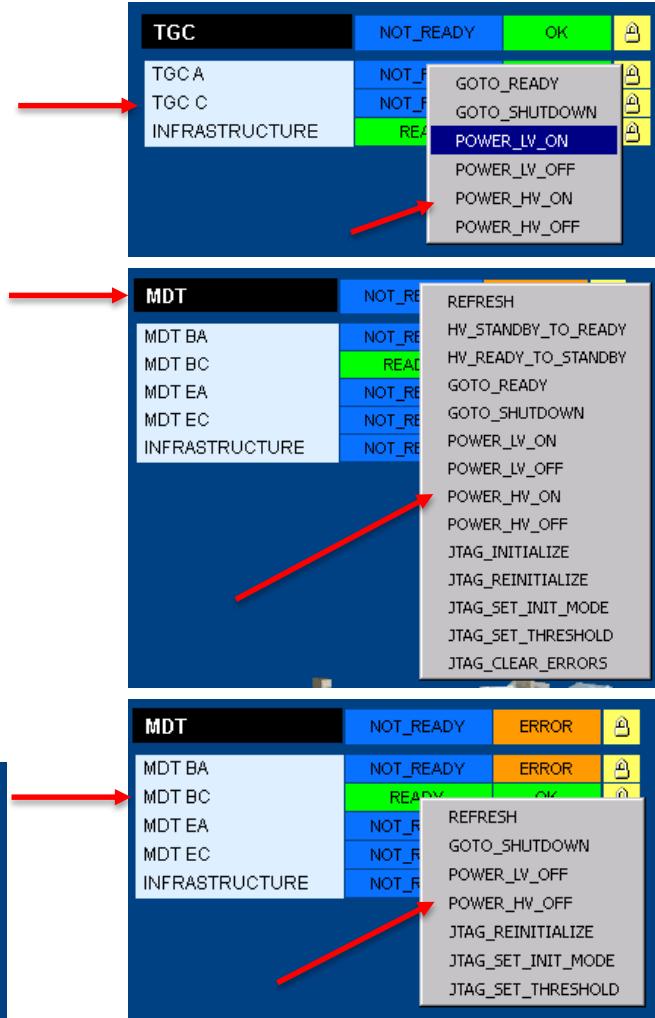
- HV is at nominal voltage, detector is fully efficient.



# HV Operation II – Global Actions

Occasionally you may be asked to “TURN” the full detector (HV) “OFF” or “ON” – usually before or after an intervention. Only in close interaction/communication with an expert !

- For **TGC**, execute a **POWER\_HV\_ON** or **POWER\_HV\_OFF** from the TGC A and TGC C node
- For **MDT** execute a **POWER\_HV\_ON** or **POWER\_HV\_OFF** from the main MDT node (same command can also be used on partition, layer or sector level)
- For **CSC** execute a **SWITCH\_HV\_OFF** or **SWITCH\_HV\_ON** on the CSC PS level
- For **RPC**, execute a **SWITCH\_HV\_OFF** or **SWITCH\_HV\_ON** on main RPC node or on the Side A/C level



# HV Operation III – Dealing with Trips

- A HV channel trips if its current exceeds a programmed limit for longer than a programmable grace period (trip time)

## HV TRIP

### CSC and TGC:

- Occasional trips are a normal “feature” of multi-wire chambers
- Trip recovery is handled automatically by a script

### RPC and MDT:

- Trips in stable operations are rare
- Trips are NOT handled automatically, but require manual actions

### RPC:

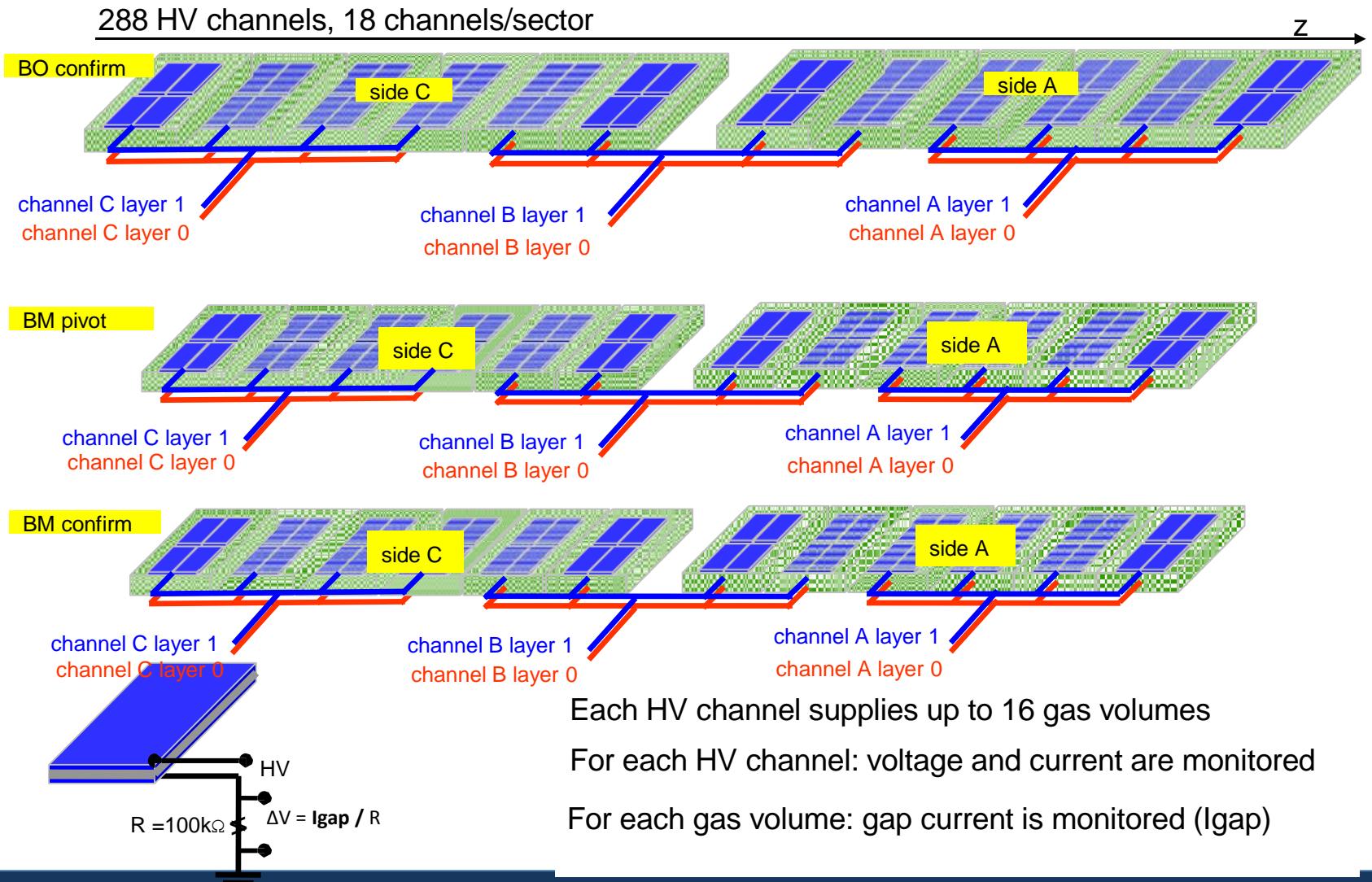
- HV recovery is reserved for expert, alert the on-call (yes, also in the night, 1 RPC channel = 16 gas gaps)

### MDT:

- Shifter Action

# Backup: RPC HV Architecture

For CSC, MDT and TGC each chamber multilayer/layer corresponds to a separate HV channel.  
This is not the case for RPC



# Dealing with HV Trips – CSC, MDT

## MDT:

1. Check the tripped channel's HV history. If it looks “normal”, ie no instabilities/over voltages,
2. Attempt **ONCE** to recover by switching HV back on on multilayer level via the **SWITCH\_ON** action

If the multilayer trips again

3. Try to clear the TRIP error with a **RESET\_TRIP** (ML level)
4. Disable the multilayer node from the FSM
5. Document in elog for expert follow up

BOL1C05	NOT_READY	ERROR	✓
BOL1C05_ML1	OFF	ERROR	✓
BOL1C05_ML2	STAND	SWITCH_ON	
BOL1C05_LV	ON	RESET_TRIP	

BOL1C05	STANDBY	OK	✓
BOL1C05_ML1	OFF	OK	✗
BOL1C05_ML2	STANDBY	OK	✓
BOL1C05_LV	ON	OK	✓

Correct: Disable the affected channel only !

## CSC:

- If automatic trip recovery fails, **disable** the concerned layer from the FSM and inform the expert

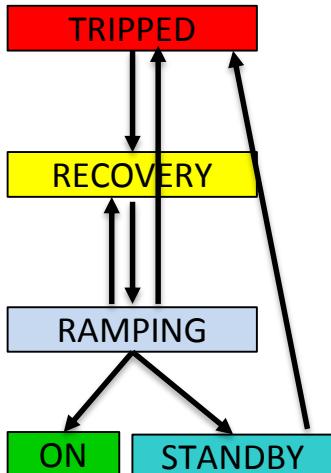
Excuse: How not to disable FSM nodes

BIS6A08	SHUTDOWN	OK	✗
BIS6A08_ML1	OFF	OK	✓
BIS6A08_ML2	OFF	OK	✓
BIS6A08_LV	OFF	OK	✓

Wrong: Also ML2 and LV disabled

SECTOR08	SHUTDOWN	OK	✗
BIS1A08	SHUTDOWN	OK	✓
BIS2A08	SHUTDOWN	OK	✓
BIS3A08	SHUTDOWN	OK	✓
BIS4A08	SHUTDOWN	OK	✓
BIS5A08	SHUTDOWN	OK	✓
BIS6A08	SHUTDOWN	OK	✓

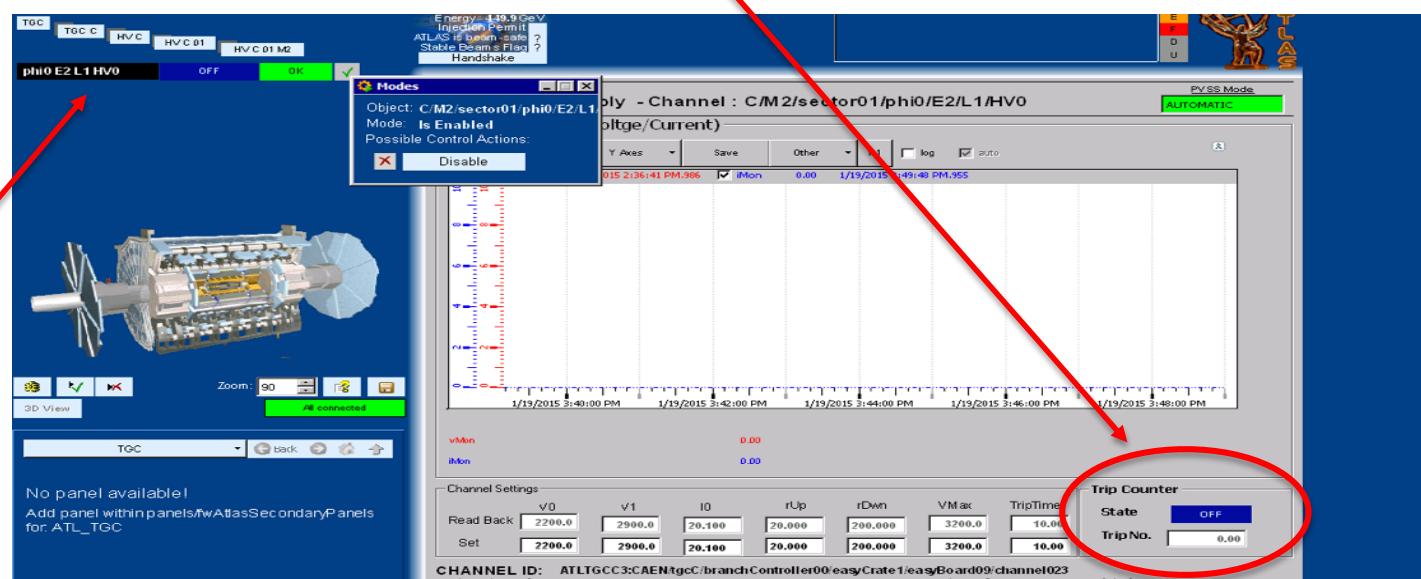
# Dealing with HV Trips -- TGC



- Automatic trip handling puts tripped channels into state RECOVERY.
- Some wait time
- Try to ramp HV up again, in steps, with some waiting time. RECOVERY state propagates as READY
- No more automatic recovery after 4 trips !

Shifter instructions:

- While channel is in RECOVERY, do nothing
- If a channel remains in TRIPPED, navigate to the channel node
- Check the trip counter. If it is 4 or above, disable the channel from the FSM, mask the alarm and report the disable in elog



# Dealing with HV Trips -- TGC

Individual HV channel information can be found in :

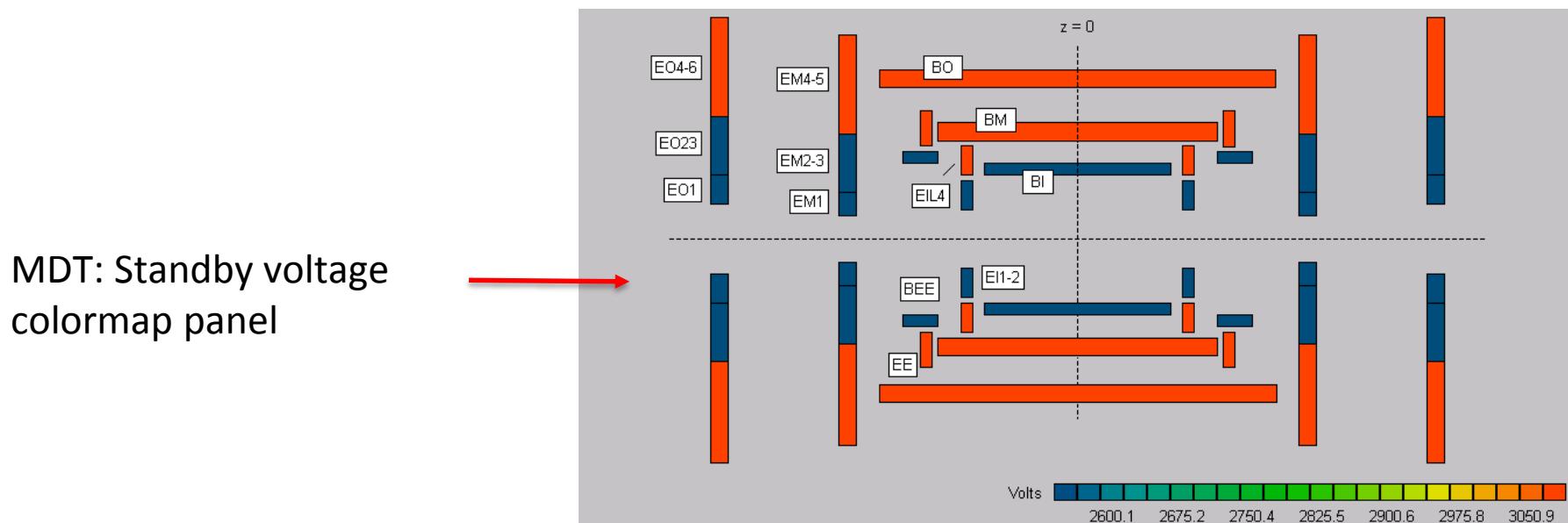
- TGC → TGC A/C → HV A/C → Choose the sector reporting ERROR or UNKNOWN state.
- Summary table: Displays relevant information for the different channels.
- Pressing on “# Trip” in the table, it will arrange the channels according to the number of trips.

The screenshot shows the Muon DCS Control System interface. On the left, there's a tree view with nodes like TGC, TGC C, HVC, and HV C 01. Below it is a table for HV C 01 M2 with rows for various HV channels (phi0 E1 L1 HV0, phi0 E1 L2 HV0, etc.) and their current states (OFF or OK) and trip status (green checkmark or red X). A status bar at the bottom says "All connected". On the right, a main window titled "High Voltage Information" displays a table of HV channel data. The table has columns for HV channel Name, State, Status, Trip, # Trip, and Last Update. A red circle highlights the "# Trip" column header. A yellow callout box with a red arrow points to the last update timestamp of the row for "sector01\_phi0\_E3\_L2\_HV0", which is "01.19 14:30:56". This timestamp is highlighted in pink. The table lists many other sectors and their status.

HV channel Name	State	Status	Trip	# Trip	Last Update
sector01_phi0_E1_L2_HV0	OFF	OK	FALSE	0	01.19 15:48:26
sector01_phi0_E2_L2_HV0	OFF	OK	FALSE	0	01.19 15:48:13
sector01_phi0_E3_L2_HV0	OFF	OK	FALSE	0	01.19 15:47:06
sector01_phi0_E4_L2_HV0	OFF	OK	FALSE	0	01.19 15:48:26
sector01_phi0_E5_L2_HV0	OFF	OK	FALSE	0	01.19 15:48:15
sector01_phi0_F_L2_HV0	OFF	OK	FALSE	0	01.19 13:40:56
sector01_phi1_E1_L2_HV0	OFF	OK	FALSE	0	01.19 15:48:03
sector01_phi1_E2_L2_HV0	OFF	OK	FALSE	0	01.19 15:48:28
sector01_phi1_E3_L2_HV0	OFF	OK	FALSE	0	01.19 15:47:57
sector01_phi1_E4_L2_HV0	OFF	OK	FALSE	0	01.19 15:48:28
sector01_phi1_E5_L2_HV0	OFF	OK	FALSE	0	01.19 15:48:17
sector01_phi2_E1_L2_HV0	OFF	OK	FALSE	0	01.19 15:48:30
sector01_phi2_E2_L2_HV0	OFF	OK	FALSE	0	01.19 15:48:28
sector01_phi2_E3_L2_HV0	OFF	OK	FALSE	0	01.19 15:48:28
sector01_phi2_E4_L2_HV0	OFF	OK	FALSE	0	01.19 15:48:15
sector01_phi2_E5_L2_HV0	OFF	OK	FALSE	0	01.19 15:48:24
sector01_phi2_F_L2_HV0	OFF	OK	FALSE	0	01.19 15:48:30
sector01_phi3_E1_L2_HV0	OFF	OK	FALSE	0	01.19 15:48:30
sector01_phi3_E2_L2_HV0	OFF	OK	FALSE	0	01.19 15:48:24
sector01_phi3_E3_L2_HV0	OFF	OK	FALSE	0	01.19 15:48:26
sector01_phi3_E4_L2_HV0	OFF	OK	FALSE	0	01.19 14:32:22
sector01_phi3_E5_L2_HV0	OFF	OK	FALSE	0	01.18 02:06:41
sector01_phi0_E1_L1_HV0	OFF	OK	FALSE	0	01.19 15:46:06
sector01_phi0_E2_L1_HV0	OFF	OK	FALSE	0	01.19 14:36:41
sector01_phi0_E3_L1_HV0	OFF	OK	FALSE	0	01.19 15:48:19
sector01_phi0_F4_L1_HV0	OFF	OK	FALSE	0	01.19 15:48:30

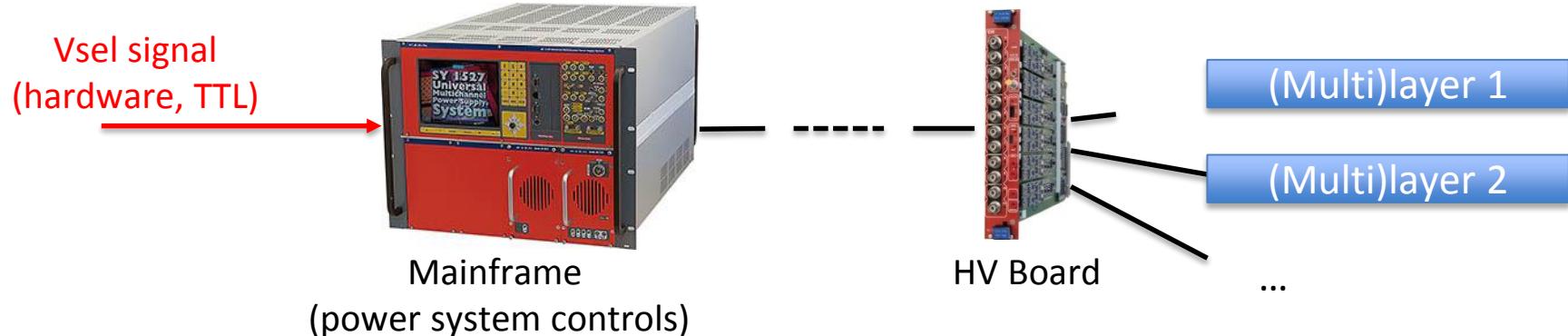
# HV Operation -- STANDBY $\leftrightarrow$ READY I

- Tracking detectors (Muons: CSC, MDT, TGC, PIX + IBL + SCT) lower HV to “safe STANDBY state” while there are beam manipulations (inject, ramp, adjust) with increased risk of high intensity dumped into detector region
- MDT Standby voltage is 2500/3080 V depending on the detector region (for “Inner Chambers” BI;BEE;EM1,2,3;EO1,2,3;EI1,2 lower standby voltage due to smaller tube), compared to 3080V nominal
- TGC Standby voltage is 2200V, compared to 2800V nominal
- CSC Standby voltage is 1300V, compared to 1850V nominal



# HV STANDBY $\leftrightarrow$ READY II - CSC,MDT,TGC

Switch between Standby and Ready is hardware signal driven



- Vsel signal TRUE  $\rightarrow$  HV channel output is pre-configured voltage setpoint V1
  - Vsel signal FALSE  $\rightarrow$  HV channel output is pre-configured voltage setpoint V0
- >Switching channels ON is a single command, HV ramped to V0 or V1 according to Vsel presence



During operations with beam:

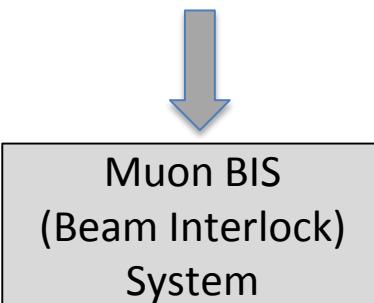
- Use LHC stable beams signal as Vsel input  $\rightarrow$  no stable beams, ie beam conditions unsafe  $\rightarrow$  STANDBY voltage

# HV STANDBY $\longleftrightarrow$ READY III

Simple hardware-signal coupling has 2 complications:

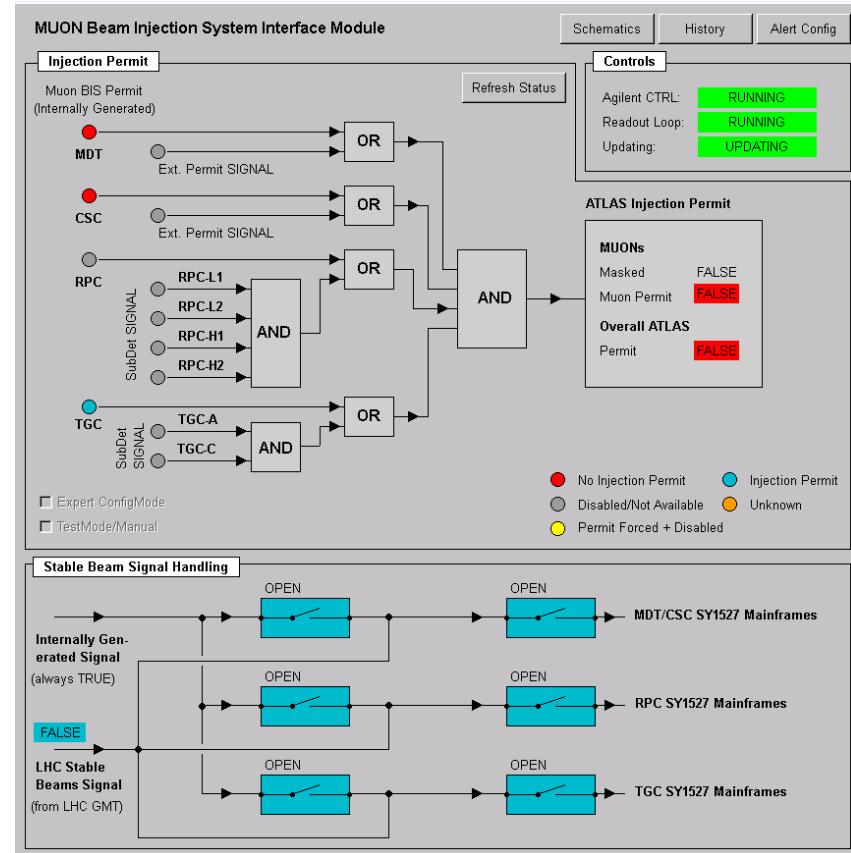
- Want to have a possibility to go to nominal HV when there is no beam at all (no stable beams, no unsafe beam conditions)
- LHC requires detectors to be put into safe state @ Adjust Handshake --- before the stable beams flag is dropped.

MUON SYSTEMS	UNKNOWN	FATAL	
CSC	NOT_READY	ERROR	
MDT	NOT_READY	WARNING	
RPC	NOT_READY	FATAL	
TGC	UNKNOWN	FATAL	
MUON	READY	WARNING	



ATLAS			
MUON	READY	WARNING	
BEAM INTERLOCK	READY	OK	
CAEN RESET NET	READY	OK	
MUON COOLING	READY	OK	
DCS SYSTEMS	READY	WARNING	

ATLAS	MUON			
BEAM INTERLOCK	READY	OK		
StableBeamHd1 MDT/CSC	BEAM_MODE	OK		
StableBeamHd1 TGC	BEAM_MODE	OK		



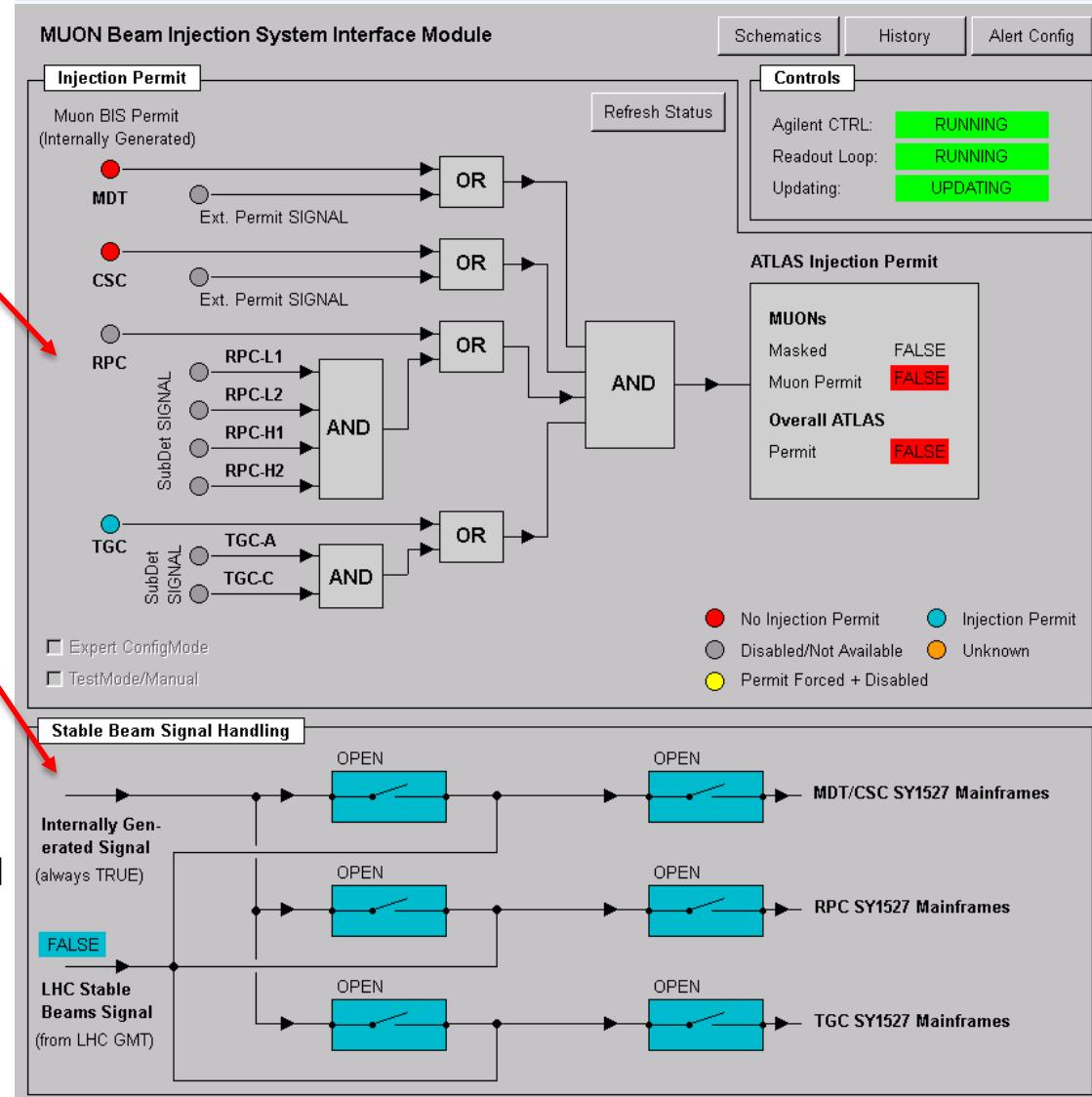
# Muon BIS System

Upper part:

- Injection Permit handling

Lower Part: Standby/Ready Handling

- LHC stable beams signal goes to Mainframe via a remote (DCS) controllable simply electrical on/off switch or breaker
- With signal present (stable beams), go to STANDBY by opening the switch – ADJUST HANDSHAKE
- Override Mode: Fake stable beam signal by parallel Muon BIS generated signal

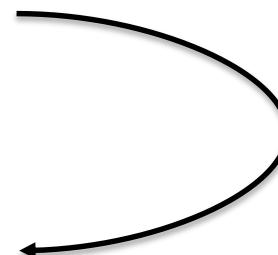


# Muon BIS Actions – CSC, MDT, TGC

## 1. Override Mode (Nominal HV without stable beams flag)

- Override mode can only be asserted by the Muon run coordinator and selected experts, not the shifters → call
- Shifter may be requested to return to BEAM\_MODE when LHC is ready to reinject after a period without beam
  - Execute **HV\_READY\_TO\_STANDBY** on the Muon top node, followed by
  - Execute **GOTO\_BEAM\_MODE** on the Beam Interlock node

BEAM INTERLOCK			
	READY	OK	
StableBeamHdI MDT/CE	OVERRIDE_LHC	OK	
StableBeamHdI TGC	OVERRIDE_LHC	OK	



BEAM INTERLOCK			
	READY	OK	
StableBeamHdI MDT/CE	BEAM_MODE	OK	
StableBeamHdI TGC	BEAM_MODE	OK	

MUON SYSTEMS	NOT_READY	WARNING	
	READY	HV_STANDBY_TO_READY	
MMG	READY	HV_STANDBY_TO_READY	
CSC	STANDBY	HV_READY_TO_STANDBY	
MDT	STANDBY		
RPC	NOT_READY	WARNING	
TGC	STANDBY	OK	
MUON	READY	OK	

Detailed description in shifter manual, make sure you go thru it before shifts with beam !

# Manual STANDBY ↔ READY transitions

Transition between **STANDBY** and **READY** are normally automatic, for all 4 muon sub-detectors

## 2. Manual transition -- CSC, MDT, TGC:

If stable beams flag is present or Override Mode asserted, you can manually switch between the 2 states by executing the actions

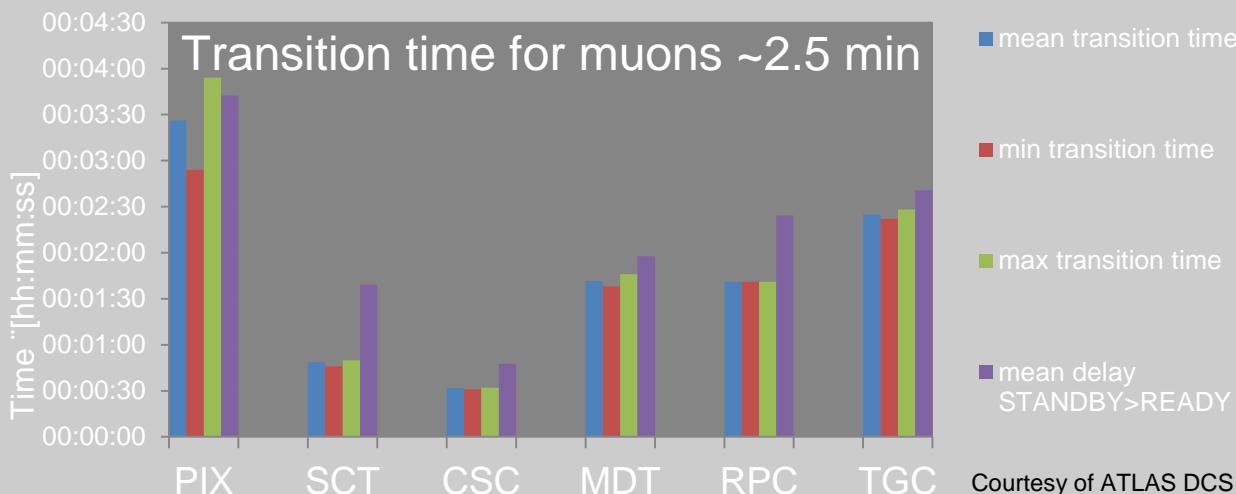
- **HV\_STANDBY\_TO\_READY**
- **HV\_READY\_TO\_STANDBY**
- Note that CSC are a part of the MDT system for this

## 3. Manual transition -- RPC:

If stable beams flag is present or Override Mode asserted, you can manually trigger going to nominal HV by executing the action

- **GOTO\_READY**
- **GOTO\_STANDBY**

on the RPC top node or side A/side C



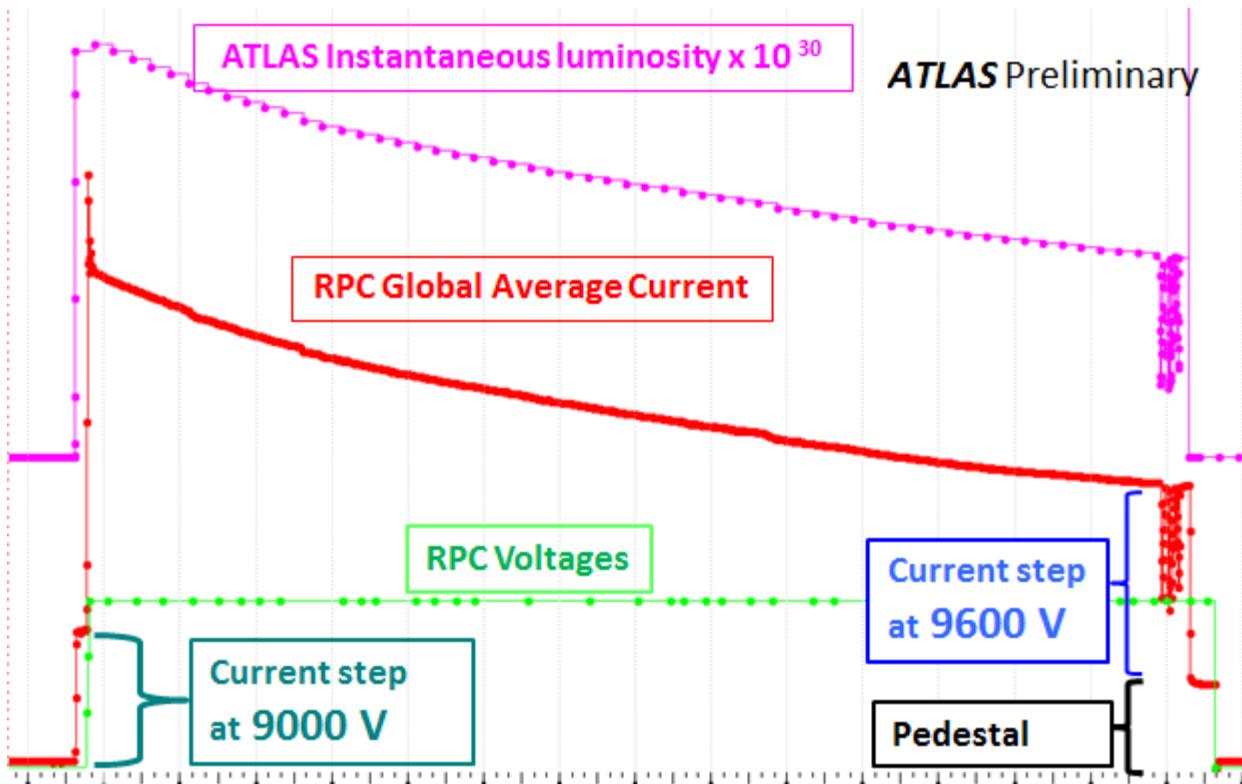
The screenshots show the ATLAS DCS interface with three panels: MUON, MDT, and TGC. Each panel has a table of actions and a context menu. Red arrows point from the menu items to the corresponding table rows.

- MUON Panel:**
  - Action: REFRESH
  - Action: HV\_STANDBY\_TO\_READY (highlighted in red)
  - Action: HV\_READY\_TO\_STANDBY
  - Action: FATAL
  - Action: UNKNOWN
  - Action: NOT\_READY
  - Action: READY
  - Action: WARNING
- MDT Panel:**
  - Action: REFRESH
  - Action: HV\_STANDBY\_TO\_READY (highlighted in red)
  - Action: HV\_READY\_TO\_STANDBY
  - Action: GOTO\_READY
  - Action: GOTO\_SHUTDOWN
  - Action: POWER\_LV\_ON
  - Action: POWER\_LV\_OFF
  - Action: POWER\_HV\_ON
  - Action: POWER\_HV\_OFF
  - Action: JTAG\_INITIALIZE
  - Action: JTAG\_REINITIALIZE
  - Action: JTAG\_SET\_INIT\_MODE
  - Action: JTAG\_SET\_THRESHOLD
  - Action: JTAG\_CLEAR\_ERRORS
  - Action: NOT\_READY
  - Action: SHUTDOWN
- TGC Panel:**
  - Action: REFRESH
  - Action: HV\_STANDBY\_TO\_READY (highlighted in red)
  - Action: HV\_READY\_TO\_STANDBY
  - Action: GOTO\_READY
  - Action: GOTO\_SHUTDOWN
  - Action: UNKNOWN
  - Action: FATAL
  - Action: TRANSMIT
  - Action: NOT\_READY
  - Action: UNKWN

# RPC HV Regime – a closer look

More complex scheme for RPC, Voltage set points beam mode dependent

- Before the beam injection the HV is kept at 7000V or changed by experts for calibration purposes
- At injection the HV is raised automatically to STANBY (9000V)
- As stable beam is declared the DCS ramp HV to READY (9600V)



- After beam dump, HV is kept nominal for ~20 mins for calibration

## Shifter Actions

- If HV is not ramping automatically as expected, call the RPC DCS on-call

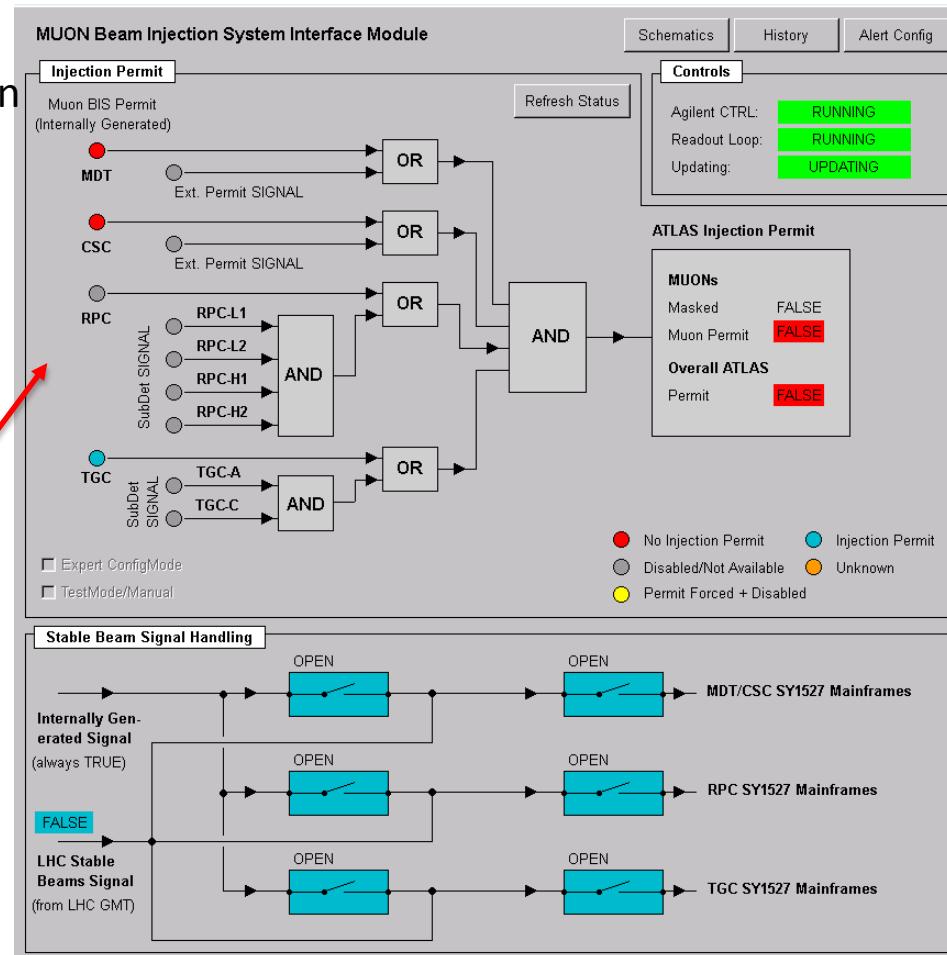
# Muon Injection Permit

- You learned yesterday that LHC can not inject beam if hardware injection permit signal is not given by ATLAS
- Injection permit is the AND of several sub-detectors signals, for Muons: CSC, MDT and TGC

To find out which Muon system withholds injection permit, and thus to know which expert to call:

ATLAS	MUON		
	READY	WARNING	🔒
BEAM INTERLOCK	READY	OK	🔒
CAEN RESET NET	READY	OK	🔒
MUON COOLING	READY	OK	🔒
DCS SYSTEMS	READY	WARNING	✓

- Navigate to the Beam Interlock node
- Check the upper part of the diagram
- BIS permit “circles” are **blue** if permit is given, and **red** if not
- RPC are not part of the Muon injection permit logic in run2 --- “grey” = disabled



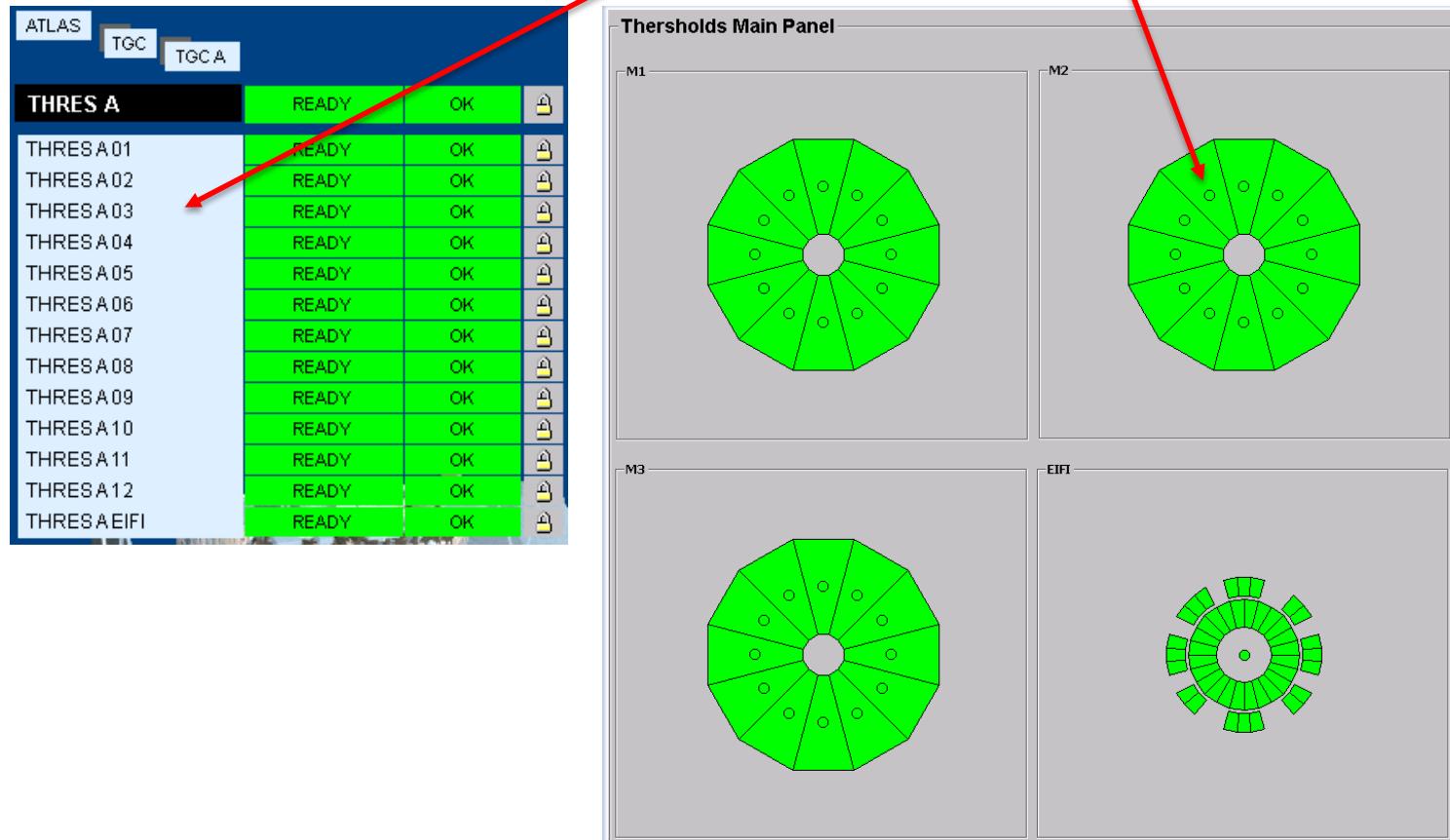
# DCS Operations Thresholds and JTAG

- Threshold settings define which pulse height is needed for a signal to create a hit in the frontend amplifier – shaper – discriminator.
- CSC thresholds are set during CONFIGURE transition of the RunControl -- not covered here, not DCS controlled
- RPC threshold settings are part of the RPC LV architecture – covered in the LV section

→ **Here: MDT and TGC**

# TGC Thresholds I

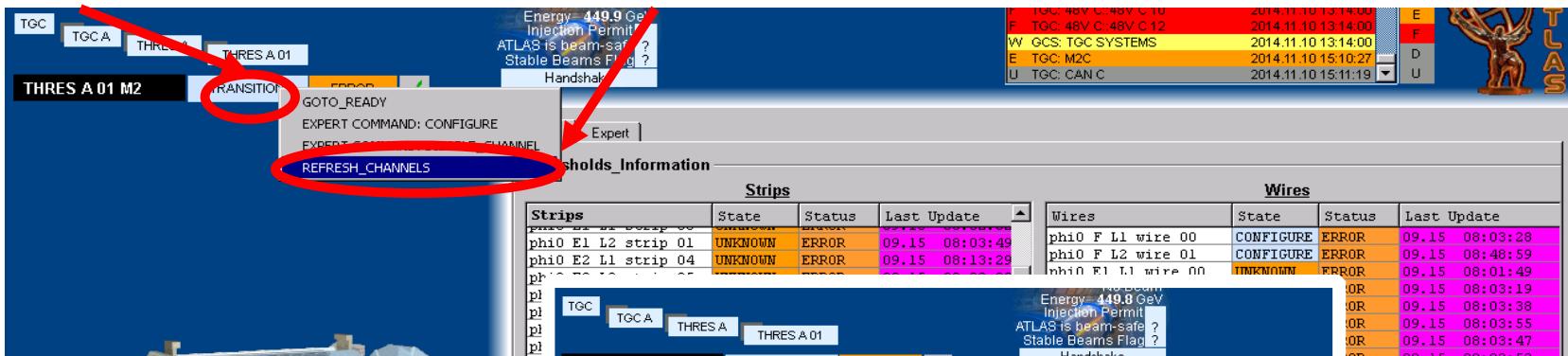
- TGC thresholds detailed state and status can be found in: TGC □ TGC A/C□ THRES A/C
- The panel indicates the state and status per wheel: M1,M2,M3 and EIFI (M4)
- Navigation to detailed table information is possible via two ways:
  - Pressing on the graphical image of the corresponding sector
  - Pressing on the navigation panel on the left



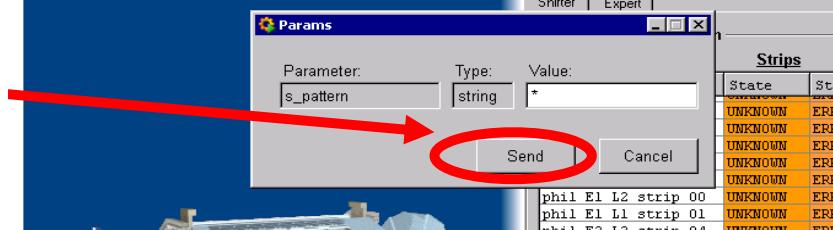
# TGC Thresholds II: “Not Responding” Error

- In case the **alarm screen** indicates a threshold strip/wire “**Not Responding**”:
  - Click on the graphic image of the sector or follow the relevant channel’s path: TGC □ TGC A/C □ THRES A/C □ THRES A/C + “Sector Number” + “Wheel”

- Click on



- Click “Send” in the pop-up window  
→ action will issue a refresh command to the entire list of channels



- The thresholds might transfer to READY state, however one needs to verify that they stay in READY after a few minutes, if not please report to the TGC On-call

# MDT JTAG Operation I

- JTAG initialization refers to the loading of configuration, reset and setup of the frontend electronics (CSM + mezzanines) for data taking.
- Logically, JTAG initialization belongs to the CONFIGURE step of the DAQ state machine – **not initialized chambers can not provide data**, ie **MDT JTAG state must be READY before starting a run**
- For MDT, DCS is in charge of frontend electronics (JTAG) init, via CanBus, and not DAQ

Remarks:

- JTAG initialization is not possible if chamber LV is OFF
- JTAG initialization can be lost during a run (**JTAG FSM transition**)
  - JTAG initialization will be lost if LV is lost (trip, switch off, ...)
  - JTAG initialization will be lost if TTC clock is lost (TTC crate power loss)

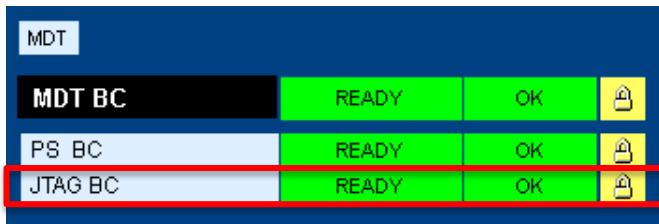
## ATTENTION

- While a JTAG **INITIALIZED** state is a necessary pre-requisite for the chambers providing intact data, **situations exist also where JTAG is ok and data are corrupted → DQ checking !!**

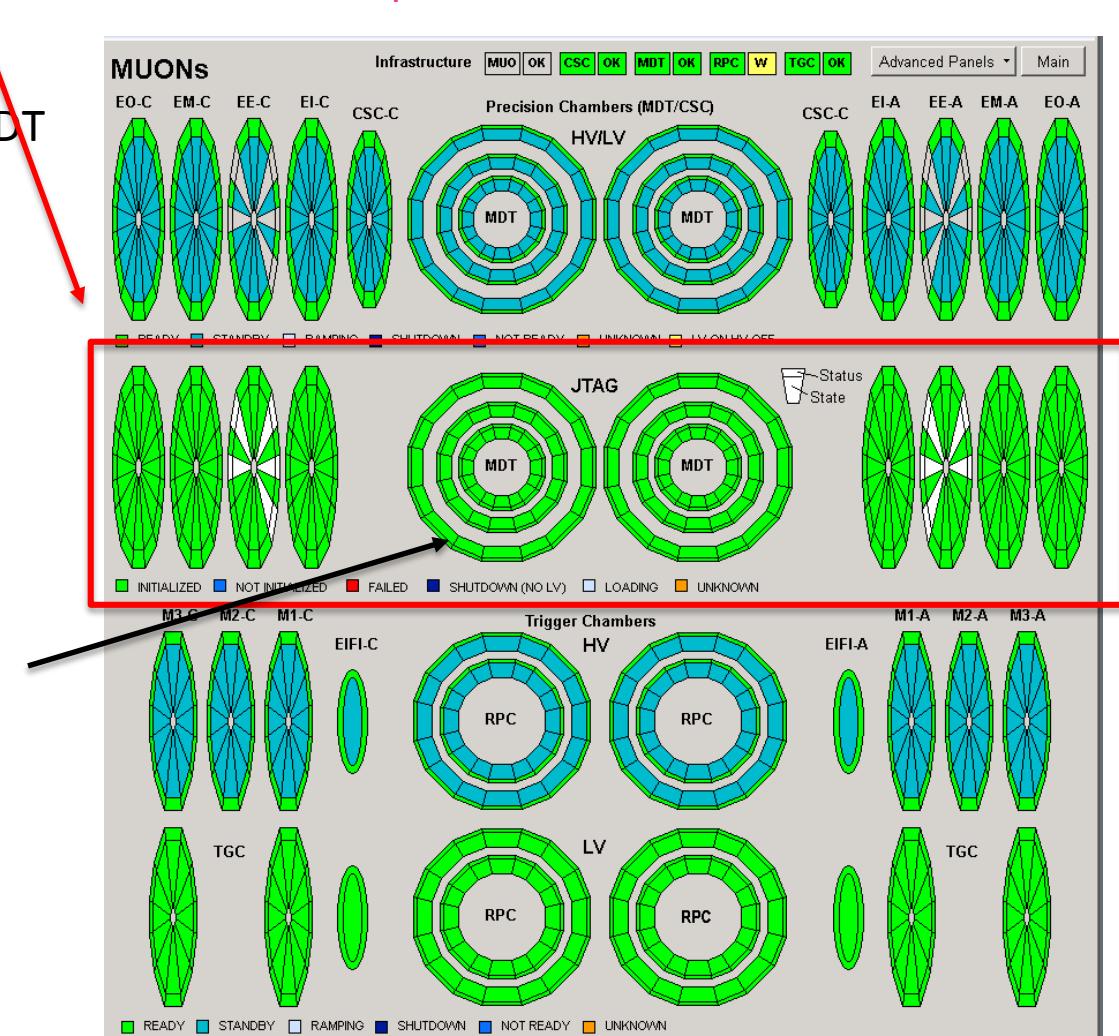
# MDT JTAG II – Assessing JTAG State

You can assess the MDT JTAG state from the MUON main panel

and of course also from within the MDT partitions ....



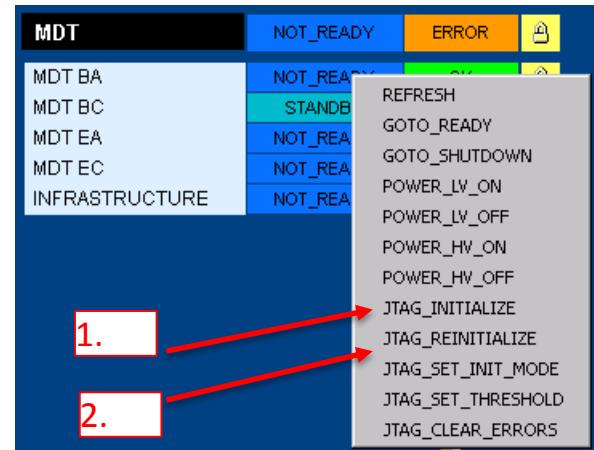
- Clicking on a (NOT\_READY) sector allows easy navigation to the problematic part



# MDT JTAG Operation III -- Actions

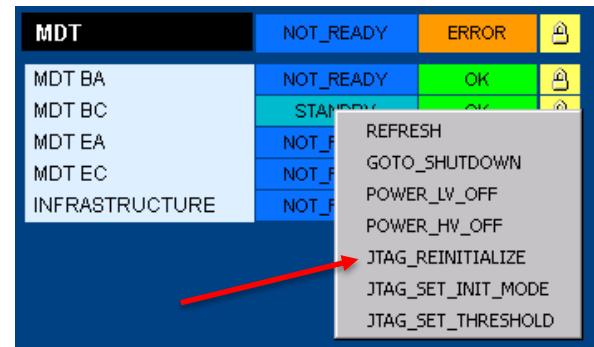
## 1. INITIALIZE

- Execute the action **JTAG\_INITIALIZE** to init **chambers** which are currently not in **INITIALIZED** state
- Easy way to avoid navigating individually to chambers with a failed or unsuccessful init
- Can be executed without problems more than once
- On chamber level: Action is called **INITIALIZE** (without JTAG prefix)
- If a chamber persistently fails JTAG INIT, disable it from the FSM (and DAQ) and inform an expert (elog)



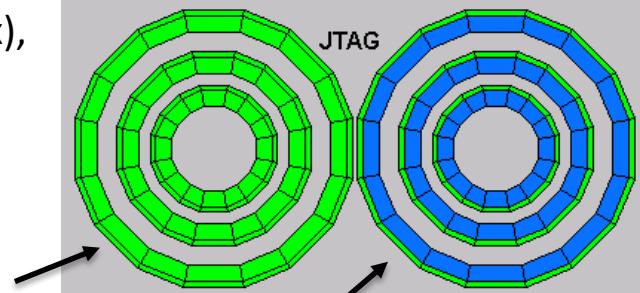
## 2. REINITIALIZE

- Execute the action **JTAG\_REINITIALIZE** to force-reload the configuration of all chambers, irrespective of the current init state.  
Example: Apply database change, eg latency
- On chamber level: Action is called **REINITIALIZE** (without JTAG prefix), only available in state **INITIALIZED**
- Never do a REINITIALIZE on a global level during a run !**
- Can try a REINITIALIZE (once) on an individual chamber in case of corrupted data



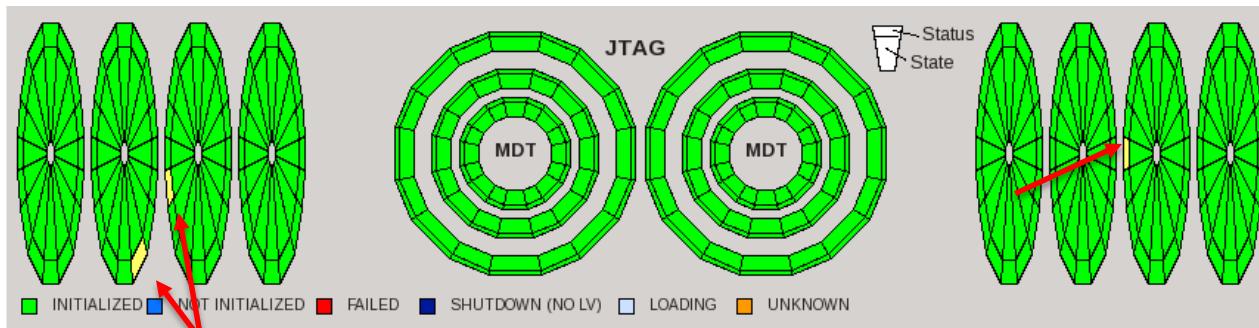
Initialize: no effect

Initialize and Reinitialize effect



# MDT JTAG Operation IV – Problems

## 3. How to deal with JTAG WARNINGS: FSM state/status INITIALIZED/WARNING (instead OK)



- A Warning status for JTAG indicates a mismatch in expected CSM firmware or mezzanine mask. Please [check with the expert](#). Temporary differences in mezz masks should be listed on the whiteboard
- Note that there is no corresponding DCS alarm (relevant only during data taking)

## 4. How to deal with a JTAG UNKNOWN

- The JTAG FSM state relies both on information directly monitored on the hardware as well as the results of the last INIT sequence.
- If communication with the Can nodes/CanBus is lost for more than few minutes, JTAG state is set to UNKNOWN, and kept as UNKNOWN also when nodes are back responding
- Recovery: Perform another [INITIALIZE](#) on the detector/affected part – **DO SO ONLY OUTSIDE a run**, during data taking rely on DQ information to assess if chamber state is good or not

# DCS Operations Infrastructure FSM Nodes

# Infrastructure FSMs

The figure consists of four separate status displays for different ATLAS infrastructure systems:

- MDT:** Shows a table with columns for Infrastructure, Status (READY or OK), and Action (represented by a small icon). Most entries are green (READY/OK).
- TGC:** Shows a table with columns for Infrastructure, Status (READY, NOT\_READY, ERROR), and Action. It includes entries like TGC GAS, TGC 48V, HV STANDBY CTRL, etc.
- RPC:** Shows a table with columns for Infrastructure, Status (NOT\_READY, OK), and Action. It includes entries like RPC GAS, CAEN SYSTEM, RACKS, BEAM PERMIT, and Data Quality.
- CSC:** Shows a table with columns for Infrastructure, Status (READY, OK), and Action. It includes entries like CSC COOLING, CSC GAS, RACKS, and CSC SYSTEMS.

- There are **no actions shifters shall perform** on the Infrastructure trees **without** an expert instructing them to do so, with **2 exceptions**:
  - Clearing Override Mode when returning from no beam to beam situation,
  - Specific action on endcap alignment crates, see later
- Different from most other ATLAS sub-detectors, in particular MDT and some TGC/CSC infrastructure actions are available to shifters – save time when an expert is reachable by phone but not near the ACR or in front of a PC.
  - **know how to do things**
  - **for when you are told to do them!**

# MDT VME Crate Operations/Power Cycling

MDT INFRASTRUCTURE			
VME CRATES	READY	WARNING	LOCK
TTC	READY	OK	✓
MROD	READY	WARNING	✓
ALIGNMENT	READY	OK	✓

- MDT VME crates are used either for DAQ (MROD/ TTC) or endcap alignment readout
- (MROD “Test” and “Spare” Crates are by default OFF and disabled in the FSM tree)

VME CRATES	NOT_READY	WARNING	LOCK
TTC	READY	OK	✓
MROD	READY	WARNING	✓
ALIGNMENT	SHUTDOWN	OK	✓

GOTO\_READY  
EXPERT COMMAND: LOCK  
EXPERT COMMAND: UNLOCK  
REFRESH

1. Switch on/off all crates of a Group:
  - Execute the action **GOTO\_READY/GOTO\_SHUTDOWN** on crate GROUP level

2. Switch on/off and individual Crate
  - Execute the action **SWITCH\_ON/SWITCH\_OFF** on crate level
3. Reboot a SBC
  - MROD and TTC crates contain single board computers SBCs) which are part of the DAQ
  - To reboot a stuck SBC, issue a **VME\_SYSRESET** action to the crate. Identify the crate from the SBC name  
sbc-mdt-rcc-ba-01 → MROD crate BA01.  
sbc-mdt-ttc-ba-01, ec-01 → TTC Barrel/Endcap

TTC	READY	OK	LOCK
TTC Barrel	ON	GOTO_OFF	✓
TTC Endcap	ON	VME_SYSRESET	✓

REFRESH

1. Switch on/off all crates of a Group:
  - Execute the action **GOTO\_READY/GOTO\_SHUTDOWN** on crate GROUP level
2. Switch on/off and individual Crate
  - Execute the action **SWITCH\_ON/SWITCH\_OFF** on crate level
3. Reboot a SBC
  - MROD and TTC crates contain single board computers SBCs) which are part of the DAQ
  - To reboot a stuck SBC, issue a **VME\_SYSRESET** action to the crate. Identify the crate from the SBC name  
sbc-mdt-rcc-ba-01 → MROD crate BA01.  
sbc-mdt-ttc-ba-01, ec-01 → TTC Barrel/Endcap

TTC	READY	OK	LOCK
TTC Barrel	ON	GOTO_OFF	✓
TTC Endcap	ON	VME_SYSRESET	✓

REFRESH

# MDT Endcap Alignment System

MDT INFRASTRUCTURE			
ENDCAP ALIGNMENT	READY	OK	
PROCESS CHECKER	RUNNING	OK	
LTX	RUNNING	OK	
CYCLE LOGIC	PAUSED	OK	
DB READING	RUNNING	OK	

MDT INFRASTRUCTURE VME CRATES			
ALIGNMENT	READY	OK	
CEM	ON	OK	
AEM	ON	OK	
EI	ON	OK	
CEO	ON	OK	
AEO	ON	OK	
EE	ON	OK	

- Endcap alignment is monitored via MDT Infrastructure FSM
- One data block per ~day is needed from alignment system → unavailability for a few hours is uncritical

1. If a Endcap Alignment node goes to NOT\_READY or UNKNOWN, disable the node from the FSM tree, report in elog, call the expert only during the day

2.

!! Certain conditions where alignment internal communication with the hardware is stuck can damage the equipment → we automatically cut power by turning off alignment crates in this conditions

2. If there is a message on the alarm screen on a Alignment crate turn-off action having been taken, verify crates are indeed off.
  - If yes, acknowledge the alarm
  - If no, turn crates off manually, then acknowledge the alarm
- Document in elog, you may call expert during day time
- If crates are off, disable them in the FSM to return overall Infrastructure state to READY

# RPC LV1 DDC

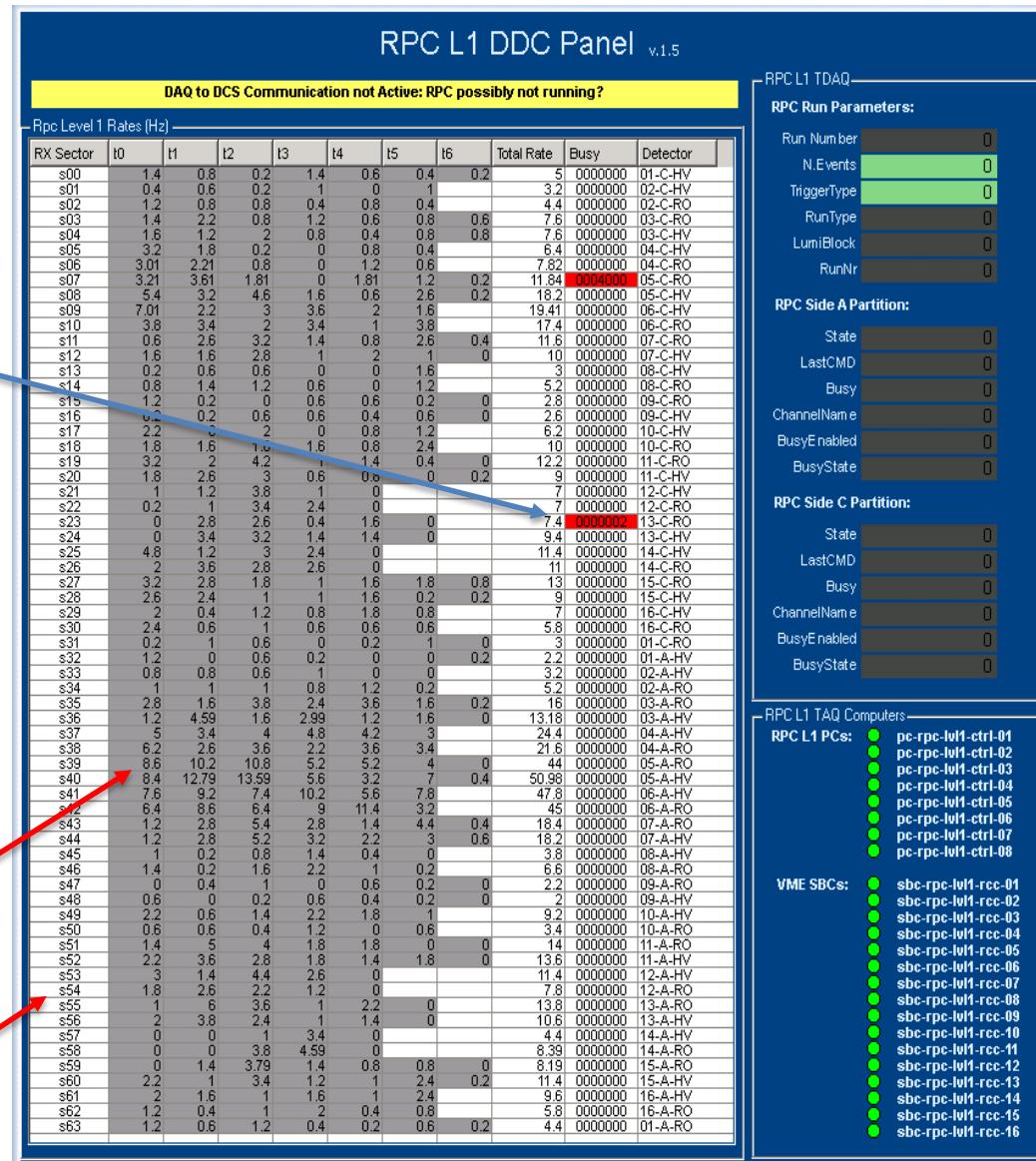


Panel can be used to check

- BUSY trigger towers
- Killed trigger towers
- Noise/Rate of trigger towers
- Call the DAQ/LV1 expert if too many towers appear BUSY or KILLED

Trigger Tower

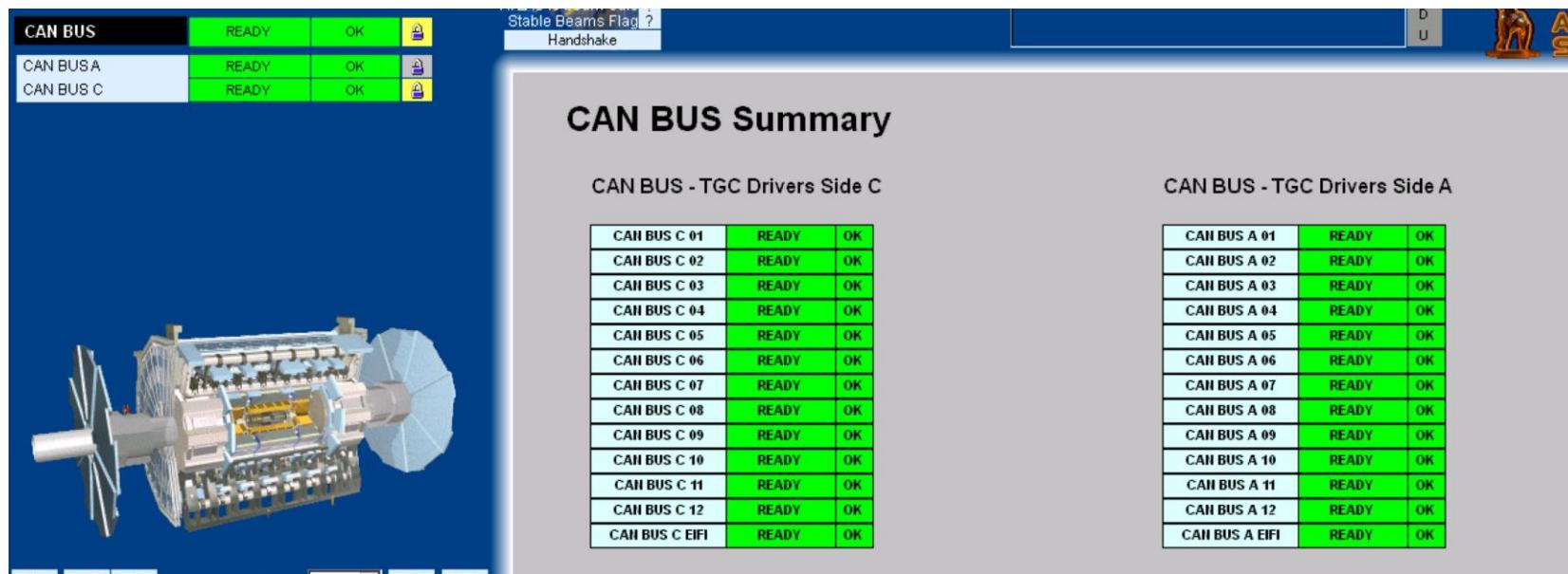
Sector logic



# TGC CAN Bus Errors

## Can Bus Reporting an Error

- Can Bus detailed **state** and **status** can be found in :
  - **TGC → INFRASTRUCTURE → CAN BUS** (see figure below)
- The panel indicates the **state** and **status**
  - **from sectors 01 to 12 + EIFI**
- If the Can Bus is reporting an Error, the solution by the shifter should be the same as for the thresholds, i.e. “refresh channels” procedure to the relevant Thresholds sector (slide 43,44)



# DCS Operation MDT Dropped Chamber/Mezz Recovery

# MDT Dropped Recovery I

If a mezzanine or a chamber gives corrupted data (e.g. messed up BCID, L1ID, headers/trailers)  
→ CSM and/or MROD can not build the event fragment → Get stuck in a “Wait” condition  
→ Assert BUSY → ATLAS trigger suspended



MROD can dynamically kick-out chambers or mezzanines (i.e. ignore them = no longer wait for their data) → Chamber or mezzanine is “dropped”

- BUSY is cleared, triggers continue to flow
- But hole in chamber or overall hit map
- Lower level (smaller granularity) action compared default TDQ stopless removal of a ROD,
- MDT specific
- Takes place without explicitly holding the trigger, on the fly
- MDT **mezzanine drops** occur **routinely** ( $O(\text{handful/run})$ ) during data taking with **high luminosity**, especially for EI\* chambers: highest background → single event upsets of registers.

# MDT Dropped Recovery II

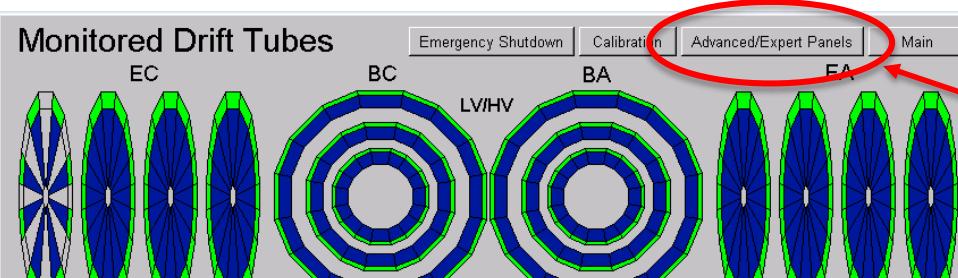
## Detecting dropped chambers/mezzanines:

- A chamber drop is notified by a **WARNING** message in **ERS (DAQ)** stating that a CSM channel was **DISABLED** and the chamber name
- A mezzanine drop is notified by a **WARNING** message in **ERS (DAQ)** stating that a mezzanine card was disabled, the concerned chamber name and mezzanine mask
- **Data quality** will show a hole in the occupancy histograms
- **DCS alarm screen** will show an alarm if there are dropped chambers or chambers with dropped mezzanines in any of the 4 partitions. This alarm will be replaced by Shifter Assistant rules in the future.

## Automatic Recovery:

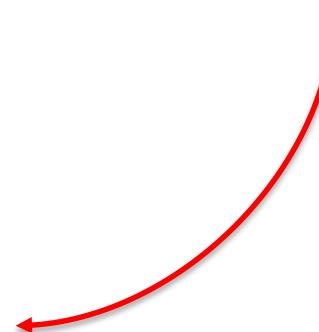
- Per default, recovery of dropped chambers ands mezzanines is automatic
- Automatic recovery does not take place if a chamber/mezzanine drops too often, or if too many chambers drop at the same time → **Manual Recovery after understanding what happened**

# Dropped Recovery Panel



From main Muon FSM panel

- click on “Advanced/Expert Panels”
- Select MDT



MDT Advanced Panels and Tools for Shifters and Experts

Sys: ATLMUOSCS: SysNum: 248 UI Man:6

Main

Power System. High Voltage. Low Voltage.

Overall HV/LV State CAEN Board Browser HV/LV Color Maps PS DCS Configuration Settings. Recipes.

Update Board Info Group Ops/Connectivity LV Scan (Vcc Optim) HV Current OffsetCalib

Gas System.

Gas/HV Interlock Status Configuration/Mapping

Magnetic Field.

BSensor ColorMaps

DCS + PVSS Projects. System Information.

DCS Interlock Actions Chamber Whiteboard PVSS System Overview FSM Configuration DP Monitor (Observer)

Installed Components RDB Manager Settings DCS SYS Overview

DAQ and Run Status. MROD.

DAQ/Run Status Dropped Recovery MROD Rates MROD Busy MROD Temperatures

JTAG Initialization. Frontend Electronics Monitoring.

Mdm Node Browser Overall JTAG State Eltx Color Maps Eltx Alarm Details Eltx Alarm Config

Beam Actions.

Autom. Beam Actions DSS and Detector Safety

DSS Actions DSS Alarms - DCS Actions

- Click on Dropped Recovery

# MDT Dropped Recovery IV: Manual Op

DAQ Dropped Chambers/Recovery Actions Panel

EC	Dropped	Mezz	0	BC	Dropped	Mezz	4	BA	Dropped	Mezz	0	EA	Dropped	Mezz	0
UNKNOWN	UNKNOWN	Trig	UNKNOWN	RUNNING	NOT BUSY	Trig	ACTIVE	RUNNING	NOT BUSY	Trig	ACTIVE	UNKNOWN	UNKNOWN	Trig	UNKNOWN
RCD Heartbeat Count	36			RCD Heartbeat Count	7883			RCD Heartbeat Count	7885			RCD Heartbeat Count	36		
IS Publications (MDTPParams)				IS Publications (MDTPParams)				IS Publications (MDTPParams)				IS Publications (MDTPParams)			
RunParams	<input type="radio"/>	<input checked="" type="radio"/>	Chambers	RunParams	<input type="radio"/>	<input checked="" type="radio"/>	Chambers	RunParams	<input type="radio"/>	<input checked="" type="radio"/>	Chambers	RunParams	<input type="radio"/>	<input checked="" type="radio"/>	Chambers
Updating	DT	FALSE		Updating	DT	TRUE		Updating	DT	TRUE		Updating	DT	FALSE	
	RCD	FALSE			RCD	TRUE			RCD	TRUE			RCD	FALSE	

Recovery actions not possible      Recovery actions possible      Recovery actions possible      Recovery actions not possible

Recovery Control

Auto **ENABLED**      Manual      NOT ACTIVE      State **IDLE**

Set Active      Release      Take Ctrl      Force Ctrl

Dropped EC 0 BC 4 BA 0 EA 0      Dropped Mezz EC 0 BC 1 BA 1 EA 0

Active Actions EC 0 BC 0 RA 0 EA 0

Display/Table

MROD Map Load **Loaded** Show:  Dropped  All Pattern: \* Filter Clear Selection Pause Update

Manual Actions (selected chambers)

JTAG (Re)Init JTAG Reset LV Off LV On Request Reinclude Reset ChStat

Crate	Slot	Chan	Tower	D	Chamber	E	Drop	#	Mezz	#	Mask	P	R	Incl?	JTAG	Mask	LV
BC	BC04	17	4	38	BOL5C13	Y	0x3fff	X	1	0	0x0	Y	INITIALIZED	0x3fff	ON		
BC	BC04	18	3	39	BML6C15	Y	0xffff	0	X	1	0x10	N	INITIALIZED	0xffff	ON		
BC	BC04	10	5	14	BOG2C14	Y	0x3ff	X	1	0	0x0	Y	INITIALIZED	0x3ff	ON		
BA	BA02	10	4	10	BOS1A06	Y	0x3fff	0	X	1	0x4000	N	INITIALIZED	0x3fff	ON		
BC	BC04	17	5	38	BOL6C13	Y	0x3fff	X	1	0	0x0	Y	INITIALIZED	0x3fff	ON		
BC	BC04	10	3	14	BOF1C14	Y	0x3fff	X	1	0	0x0	Y	INITIALIZED	0x3fff	ON		

Chambers currently dropped or with dropped mezzanines

X = mezz dropped

X = chamber dropped

Note: Panel takes some 10-15 secs to initialize, be patient !

Partition/Run state. Indicator if run state allows a recovery

Automatic or Manual Recovery selector/indicator

Indicator on how often a chamber already dropped/had mezz drops this run

To do any **manual actions**:

1. Check recovery control is **IDLE**
2. Set **Manual Control** active (suspends auto actions) – do not forget to release when done

# MDT Dropped Recovery V: Manual Op

DAQ Dropped Chambers/Recovery Actions Panel

Config/Advanced Close

EC Dropped 0 Mezz 0 UNKNOWN UNKNOWN Trig UNKNOWN	BC Dropped 4 Mezz 1 RUNNING NOT BUSY Trig ACTIVE	BA Dropped 0 Mezz 1 RUNNING NOT BUSY Trig ACTIVE	EA Dropped 0 Mezz 0 UNKNOWN UNKNOWN Trig UNKNOWN
RCD Heartbeat Count 36 IS Publications (MDTParams)	RCD Heartbeat Count 7933 IS Publications (MDTParams)	RCD Heartbeat Count 7935 IS Publications (MDTParams)	RCD Heartbeat Count 36 IS Publications (MDTParams)
RunParams Chambers Chambers	RunParams Chambers Chambers	RunParams Chambers Chambers	RunParams Chambers Chambers
Updating DT FALSE RCD FALSE	Updating DT TRUE RCD TRUE	Updating DT TRUE RCD TRUE	Updating DT FALSE RCD FALSE

Recovery actions not possible      Recovery actions possible      Recovery actions possible      Recovery actions not possible

Recovery Control

Auto SUSPENDED (MANUAL CTRL) Manual ACTIVE, LOCKED, YOU HAVE CTRL State IDLE

Set Active Release Take Ctrl Force Ctrl

Dropped EC 0 BC 4 BA 0 EA 0 Dropped Mezz EC 0 BC 1 BA 1 EA 0 Active Actions EC 0 BC 0 BA 0 EA 0

Display/Table MROD Map Load Loaded Show:  Dropped  All Pattern: \* Filter Clear Selection Pause Update

Manual Actions (selected chambers)

JTAG (Re)Init JTAG Reset LV Off LV On Request Reinclude Reset ChStat

	Crate	Slot	Chan	Tower	D	Chamber	E	Drop	#	Mezz	#	Mask	P	R	Incl?	JTAG	Mask	LV
BC	BC04	17	4	38	BOL5C13	Y	0x3ffff	X	1		0	0x0	Y	INITIALIZED	0x3ffff	ON		
BC	BC04	18	3	39	BML6C15	Y	0xffff			0	X	1	0x10	N	INITIALIZED	0xffff	ON	
BC	BC04	10	5	14	BOG2C14	Y	0x3ff	X	1		0	0x0	Y	INITIALIZED	0x3ff	ON		
BA	BAD2	10	4	10	BOS1A06	Y	0x3ffff			0	X	1	0x4000	N	INITIALIZED	0x3ffff	ON	
BC	BC04	17	5	38	BOL6C13	Y	0x3fff	X	1		0	0x0	Y	INITIALIZED	0x3ff	ON		
BC	BC04	10	3	14	BOF1C14	Y	0x3ffff	X	1		0	0x0	Y	INITIALIZED	0x3ffff	ON		

Having taken manual control → ready for some action !

# MDT Dropped Recovery VI: Manual Op

**DAQ Dropped Chambers/Recovery Actions Panel**

Chamber	Status	Mezz	Action
EC	Dropped	0 Mezz	UNKNOWN
BC	Dropped	4 Mezz	RUNNING
BA	Dropped	0 Mezz	RUNNING
EA	Dropped	0 Mezz	UNKNOWN

**Recovery actions not possible**    **Recovery actions possible**    **Recovery actions possible**    **Recovery actions not possible**

**Recovery Control**

**Auto** SUSPENDED (MANUAL CTRL)    **Manual** ACTIVE, LOCKED, YOU HAVE CTRL

State IDLE

Active Actions EC 0 BC 0 BA 0 EA 0

Dropped EC 0 BC 4 BA 0 EA 0    Dropped Mezz EC 0 BC 1 BA 1 EA 0

**Display/Table**

MROD Map Load Loaded Show:  Dropped  All Pattern: \* Filter Clear Selection Pause Update

**Manual Actions (selected chambers)**

JTAG (Re)Init JTAG Reset LV Off LV On Request Reinclude Reset ChStat

Crate	Slot	Chan	Tower	D	Chamber	E	Drop	#	Mezz	#	Mask	P	R	Incl?	JTAG	Mask	LV
BC	BC04	17	4	38	BOL5C13	Y	0x3fff	X	1	0	0x0	Y	INITIALIZED	0x3fff	ON		
BC	BC04	18	3	39	BML6C15	Y	0xffff		0	X	1	0x10	N	INITIALIZED	0xffff	ON	
BC	BC04	10	5	14	BOG2C14	Y	0x3ff	X	1	0	0x0	Y	INITIALIZED	0x3ff	ON		
BA	BA02	10	4	10	BOS1AD6	Y	0x3ffff		0	X	1	0x4000	N	INITIALIZED	0x3ffff	ON	
BC	BC04	17	5	38	BOL6C13	Y	0x3fff	X	1	0	0x0	Y	INITIALIZED	0x3fff	ON		
BC	BC04	10	3	14	BOF1C14	Y	0x3ffff	X	1	0	0x0	Y	INITIALIZED	0x3ffff	ON		

**The Fineprint:**  
Reinclude has no effect if a) chamber flagged as pathologic (P) = dropped too often; b) chamber out due to ROD stoplessly removed; Include? Column shows if a Reinclude action is possible or not

- 1. Dropped chambers**
  - Select the chamber or chambers to reinclude (chamber must be dropped)
  - Check their JTAG and LV state is ok
  - Click Request Reinclude and confirm the popup
- 2. Dropped Mezzanines**
  - Select the chamber or chambers
  - JTAG Reinitialize** it/them
  - Wait for the chamber(s) to drop
  - Click **Request Reinclude** and confirm the popup
- 3. Release the manual control**

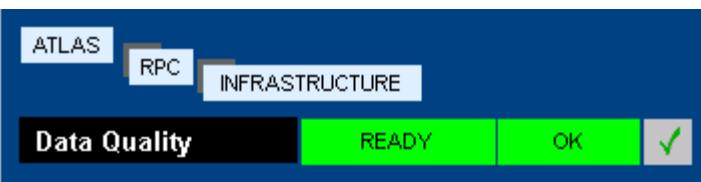
# MDT Dropped Recovery VII

Recommendation and Best Practice:

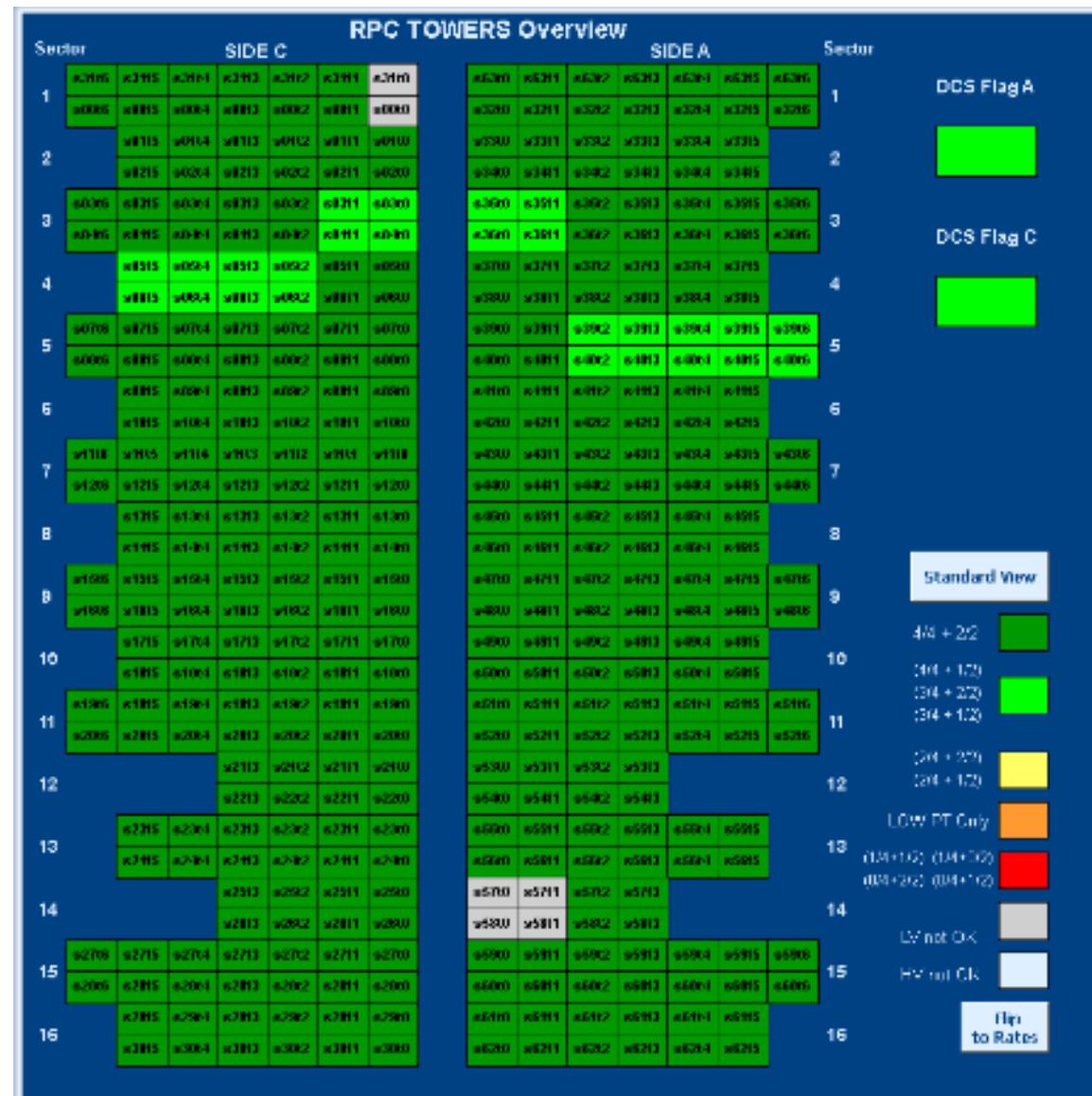
- Normally dropped recovery should be automatic
- If a **chamber** is dropped and not auto-recovered, **try to reinclude it ONCE**
- If a chamber has **dropped mezzanines** and they are not auto-recovered, **JTAG Reinitialize** the chamber to **make the chamber drop**. Issue a **Reinclusion** request. If this is not successful and the mezzanine drops immediately again, leave it out

# Global Tools

# RPC DCS DQ Panel

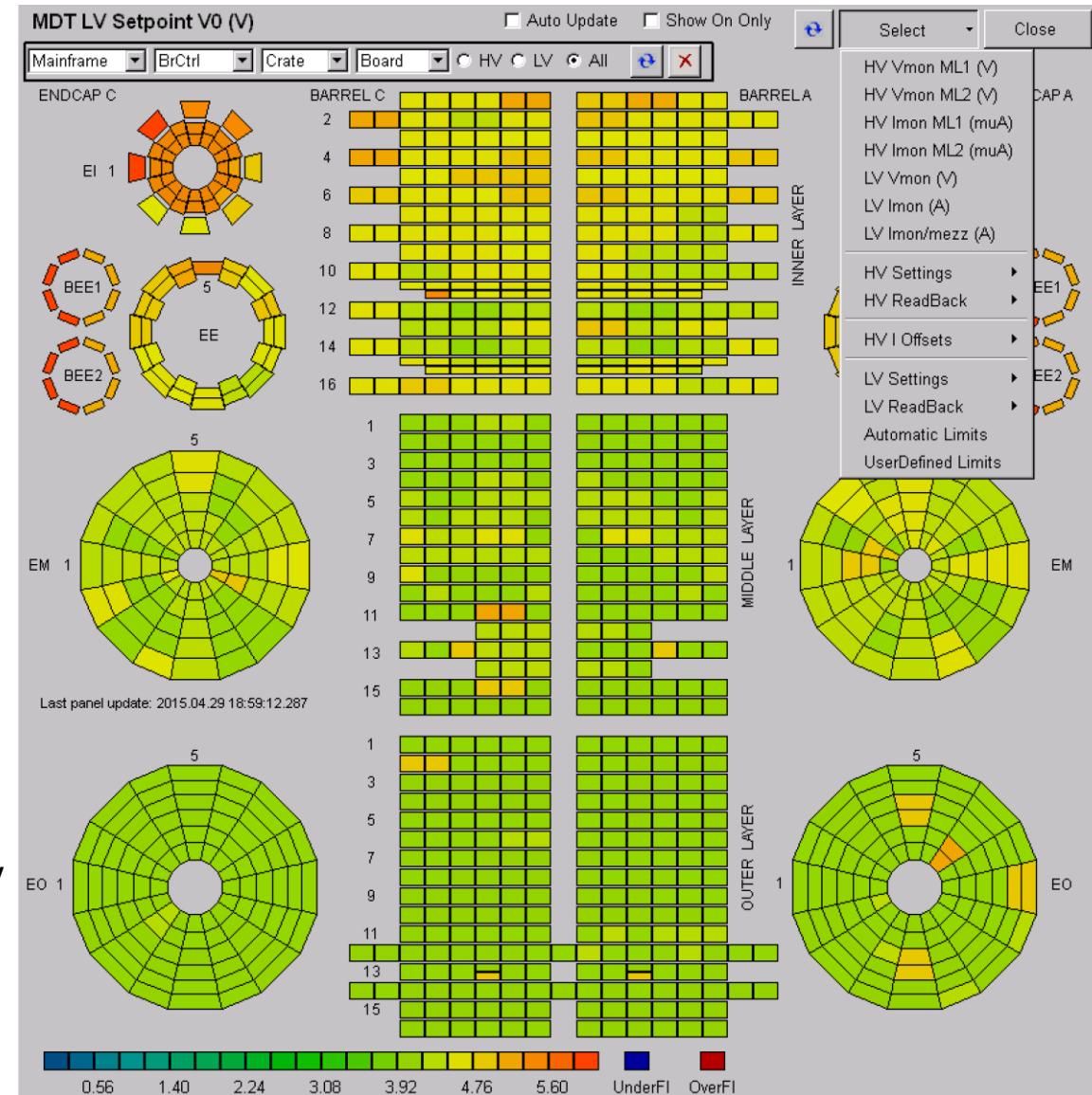
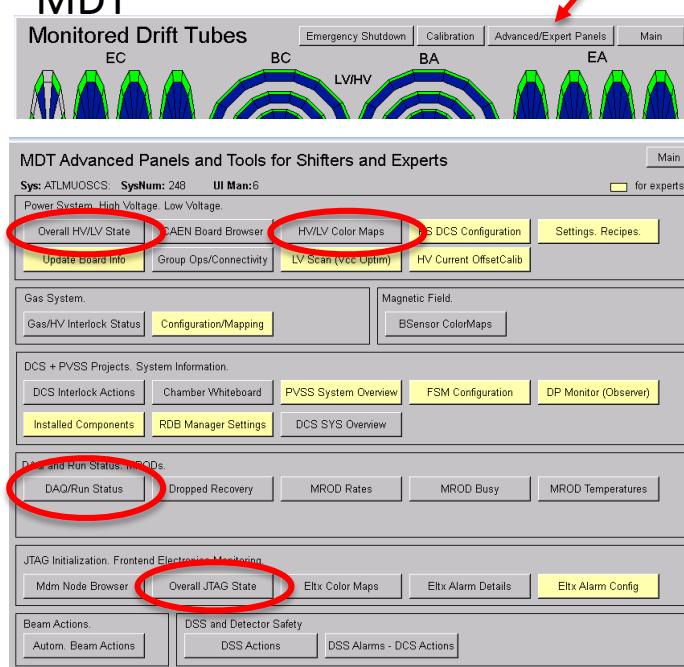


- RPC Data Quality FSM panel provides an easy way to assess fraction of the detector in good state for data taking
- Toggle between Standard and Detailed view with the “View” buttons
- Toggle between Rates, DAQ/LV1 and DCS views with the “Flip” button
- Combines LV, HV, ... information by trigger tower = relevant physical granularity



# MDT Detector Overview Panels

Global MDT overview panels can be accessed via the “Advanced/Expert Panels” → “MDT”

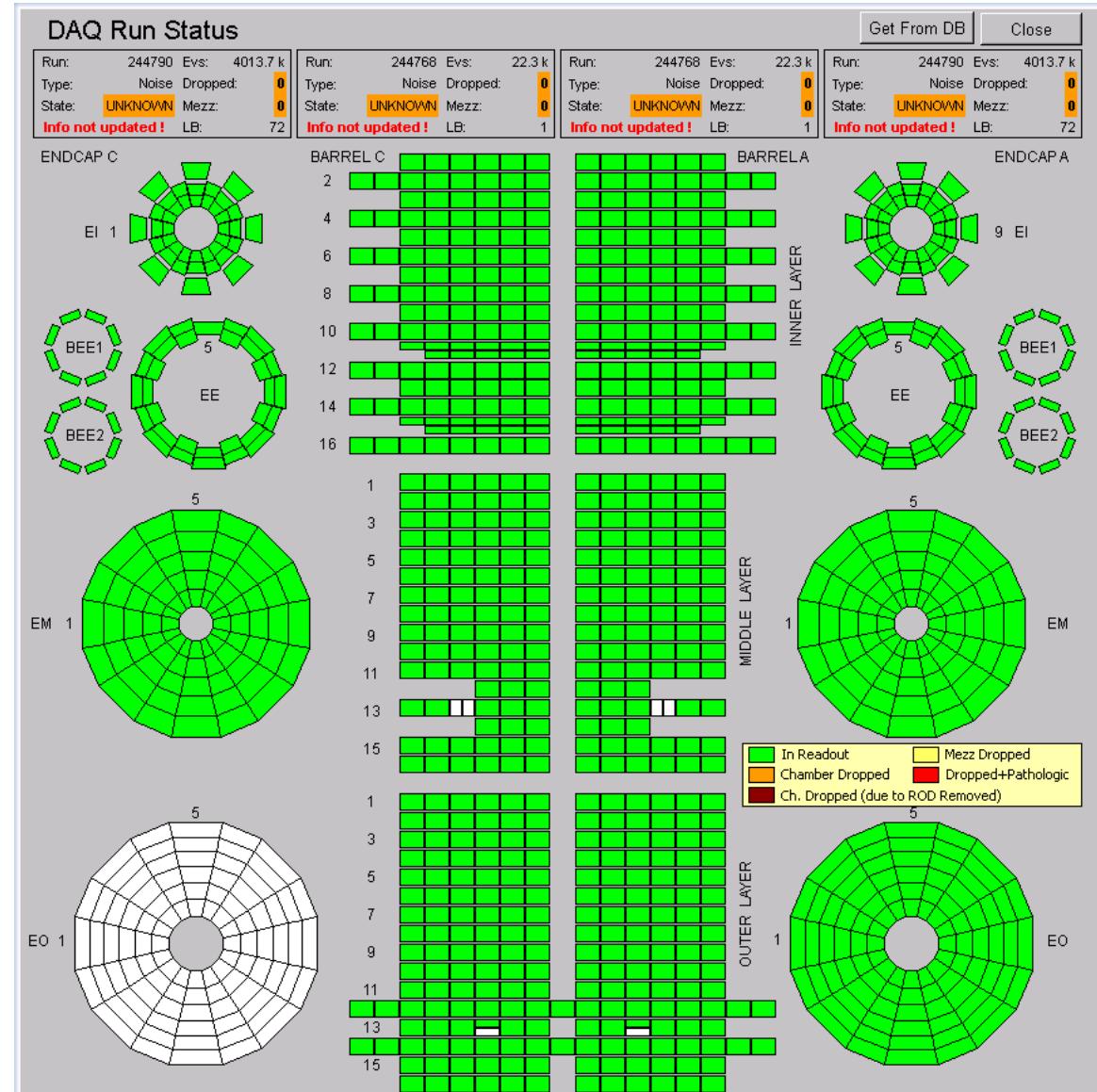


- Color Maps: Graphical display of HV/LV settings and momentary readings (select from drop menu)
- Panel update on request (Refresh button)

# MDT Detector Overview: DAQ/Run Status

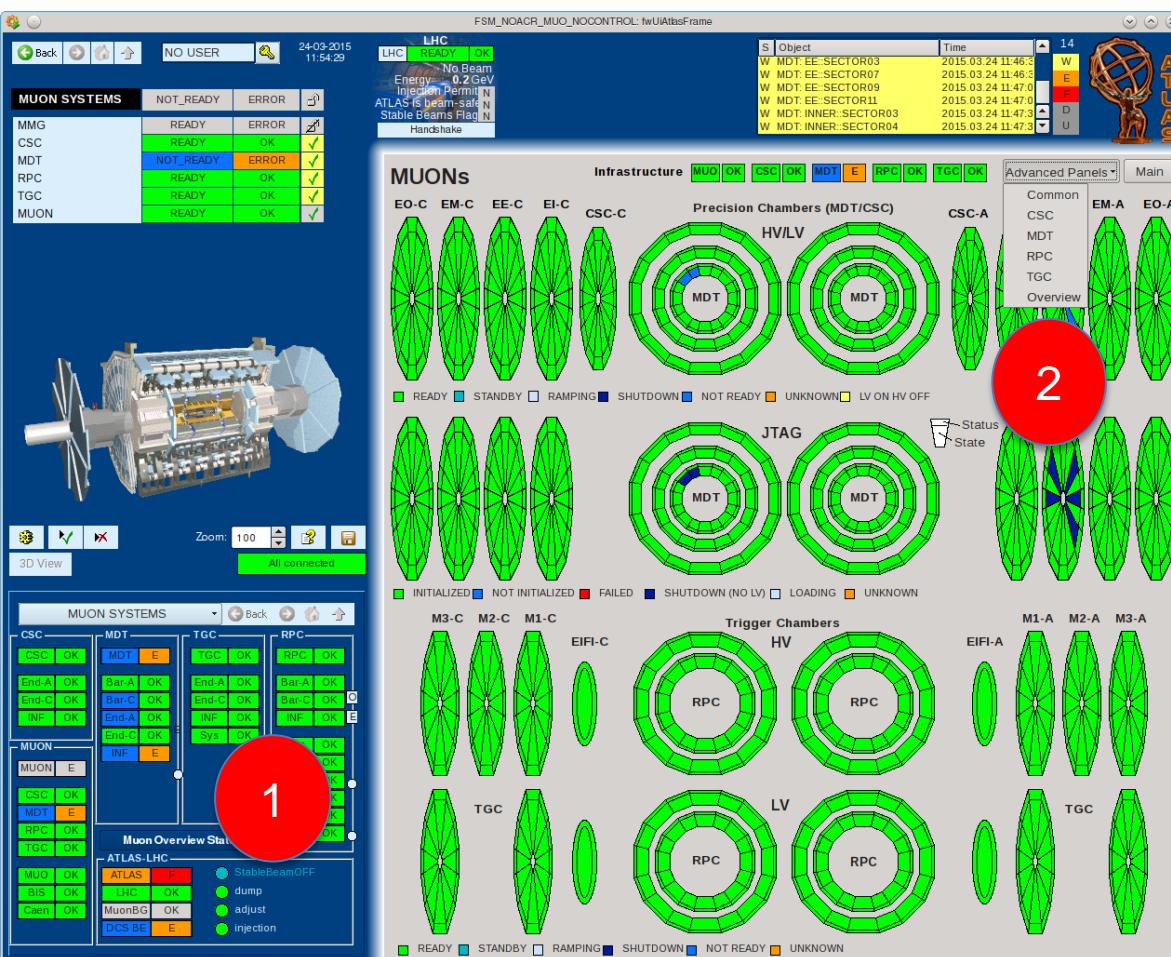
## DAQ/Run Status

- Chambers included/ excluded in readout (DAQ/OKS)
- Dropped chambers
- Chambers with dropped mezzanines
- Removed chambers due to ROD removal
- Up to date information if a run is ongoing, otherwise show situation during last Configure transition
- Auto updating during a run
- Panel available via web monitoring



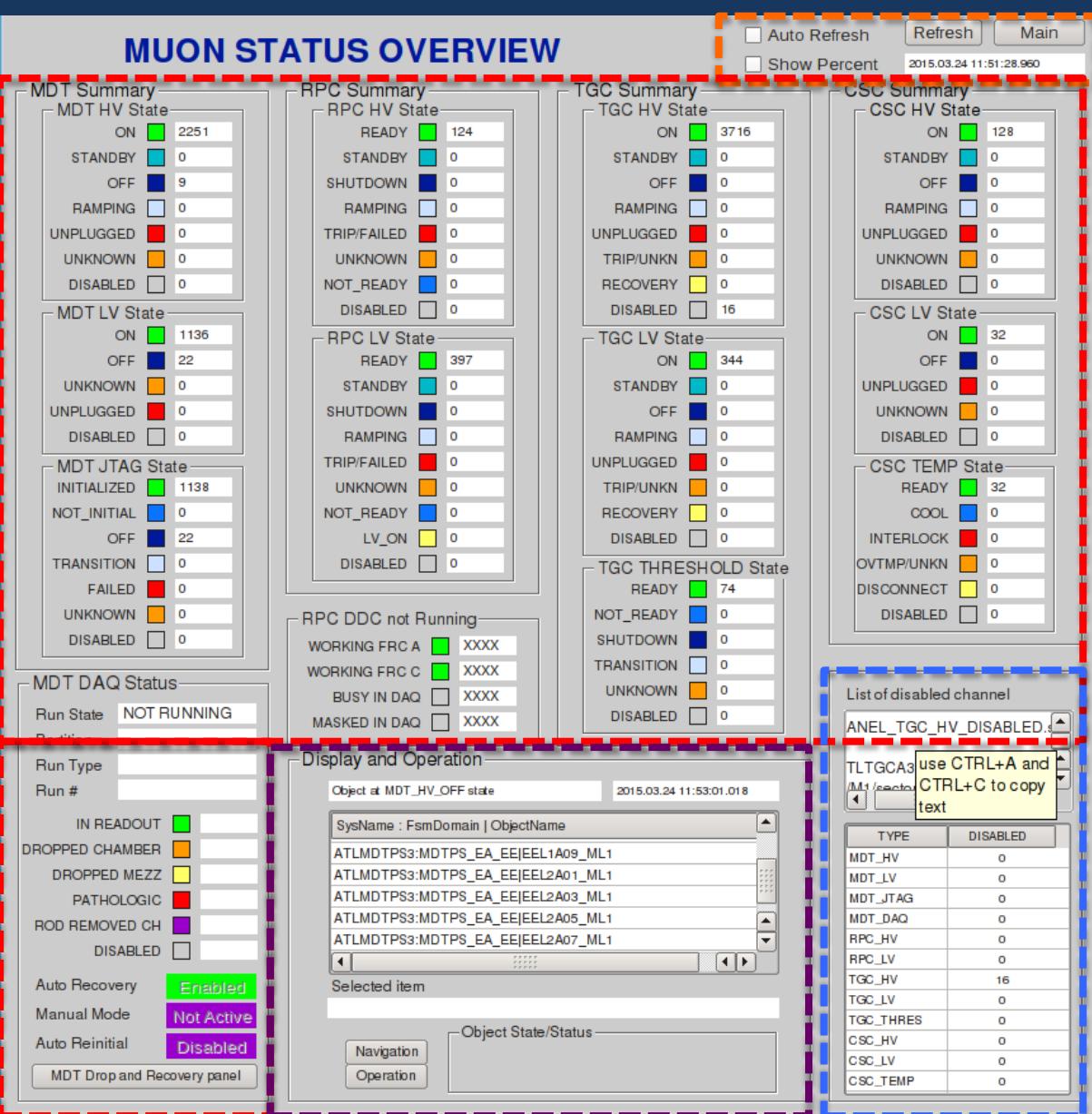
# Muon STATUS Overview Panel (1/2)

- Additional tool for shifter to check the Muon system overview
- Before the data taking(combined run), make sure no unexpected disabled channels
- Report the disabled channel list into shifter summary (tbd)



- How to access panel
  - ① To open an individual panel, click “Muon Overview Status” button via Muon system secondary main page
  - ② To open it inside main Muon FSM page, via Advanced Panels menu and click “Overview” option

# Muon STATUS Overview Panel (2/2)



- Summary of Muon FSM device objects (HV/LV/etc except INFRASTRUCTURE)
- MDT DAQ status

- Available options
  - 1) Auto refresh with interval time 1 minute
  - 2) Show percentage instead of number
  - 3) Manual refresh

- Text field to allow copy and paste disabled channel list
- Summary table of disabled channel

- Display the channel list at certain state
- Simple navigation or operation on selected channel

We need your feedback!!