Calo layer 2 online SW: On-call tutorial

Alessandro Thea, Tom Williams
Rutherford Appleton Laboratory

Introduction

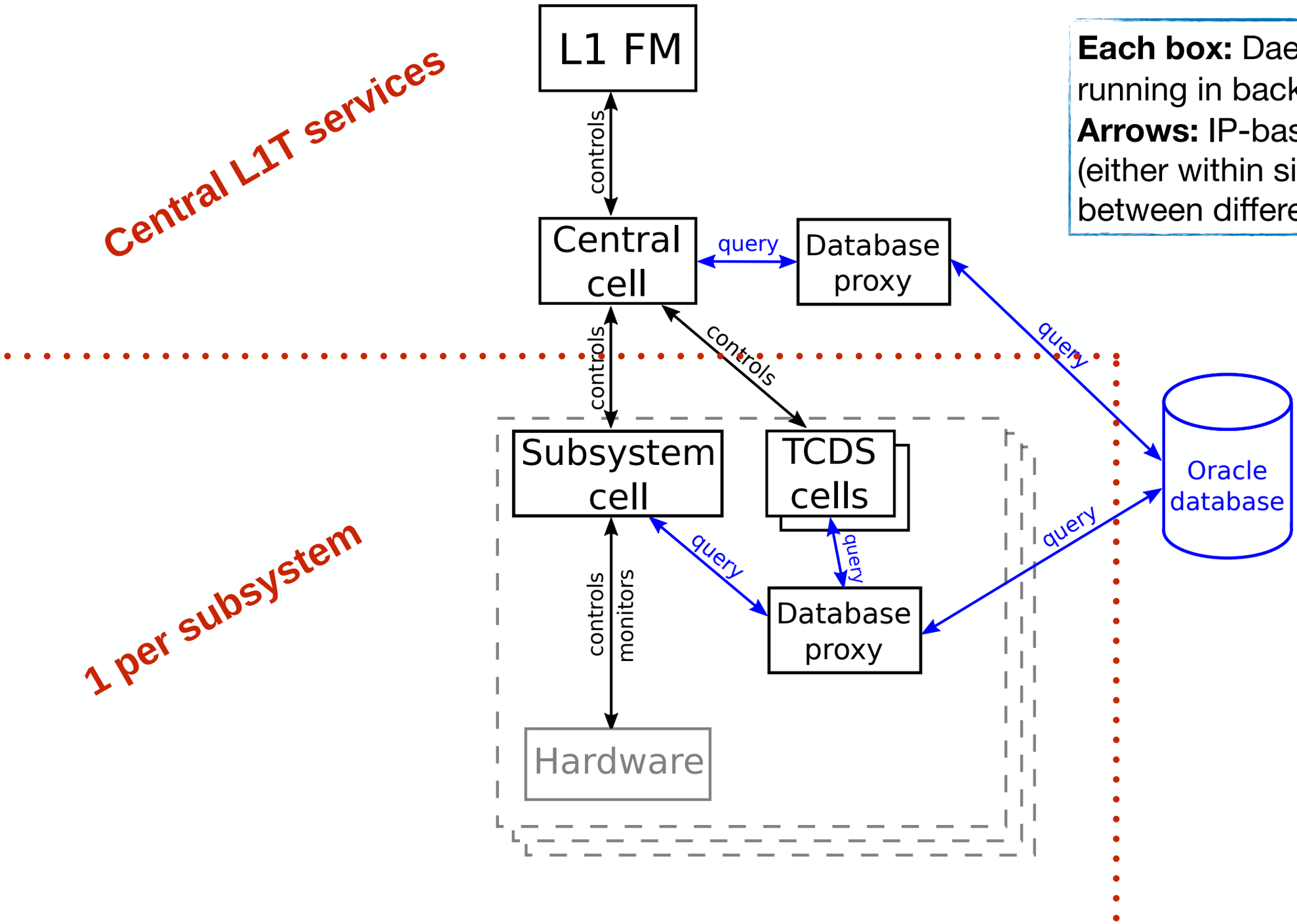
- Online software
  - Configures the electronics boards
  - Monitors various status registers during runs
  - … highlights if anything goes wrong

- Quick links
  - l1page: https://l1page.cms
  - calo layer 2 SWATCH cell: Click on **link in l1page**
    - http://l1ts-calol2.cms:3333/urn:xdaq-application:lid=13

- N.B. All ".cms" websites **only** accessible from within the Point 5 network — firewall'ed from general CERN network
  - Instructions for setting up P5 tunnel: *See CaloLayer2OnCall twiki*
    - **.cms account required!** **Contact me & Alessandro if you don't already have one!**
  - **Make sure you can access these pages** before starting on-call

L1T control & monitoring hierarchy

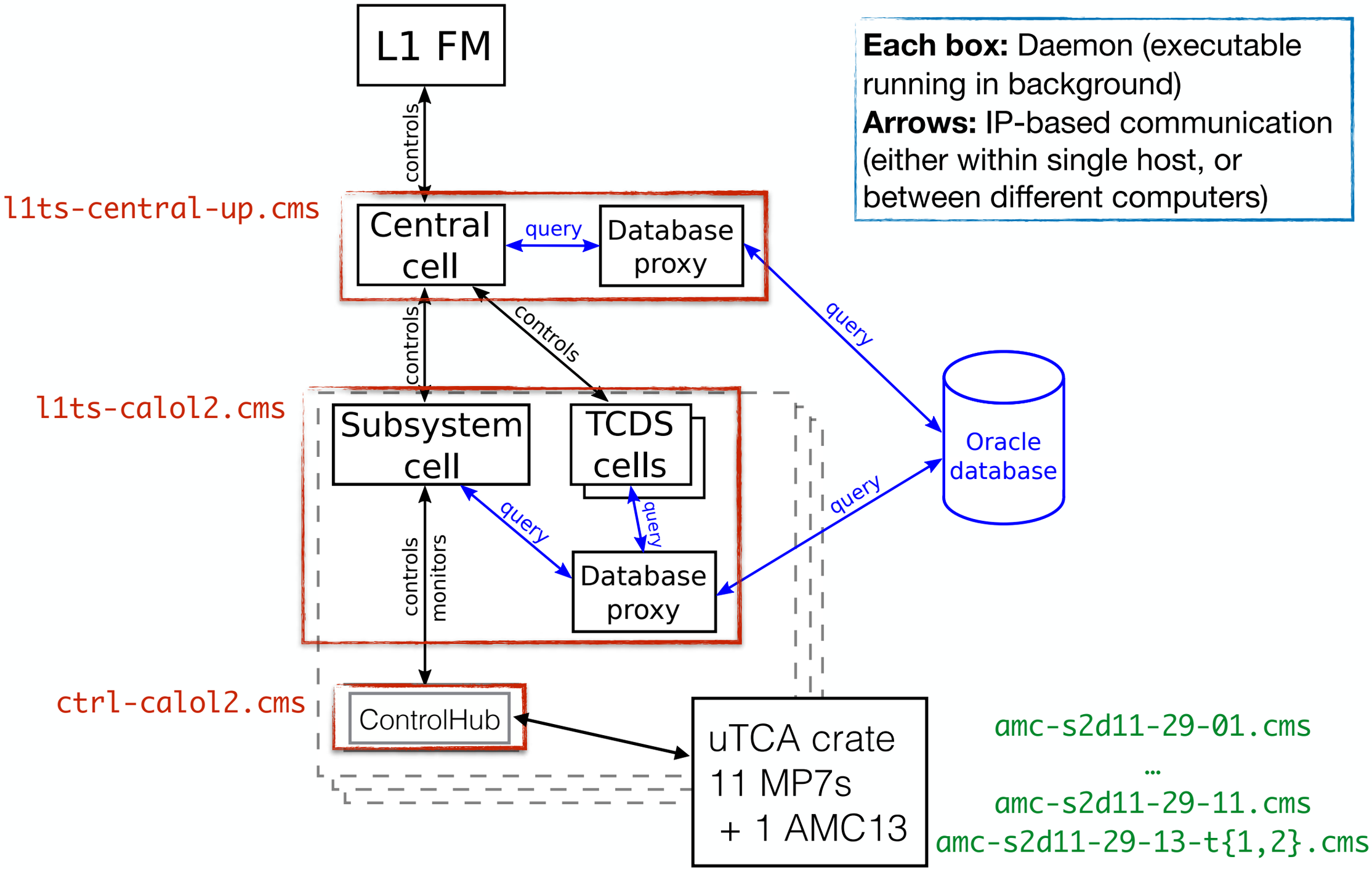
- Many software daemons …



Each box: Daemon (executable running in background)
Arrows: IP-based communication (either within single host, or between different computers)

L1T control & monitoring hierarchy

- Many software daemons, spread across several servers



Each box: Daemon (executable running in background)
Arrows: IP-based communication (either within single host, or between different computers)

Level-1 page

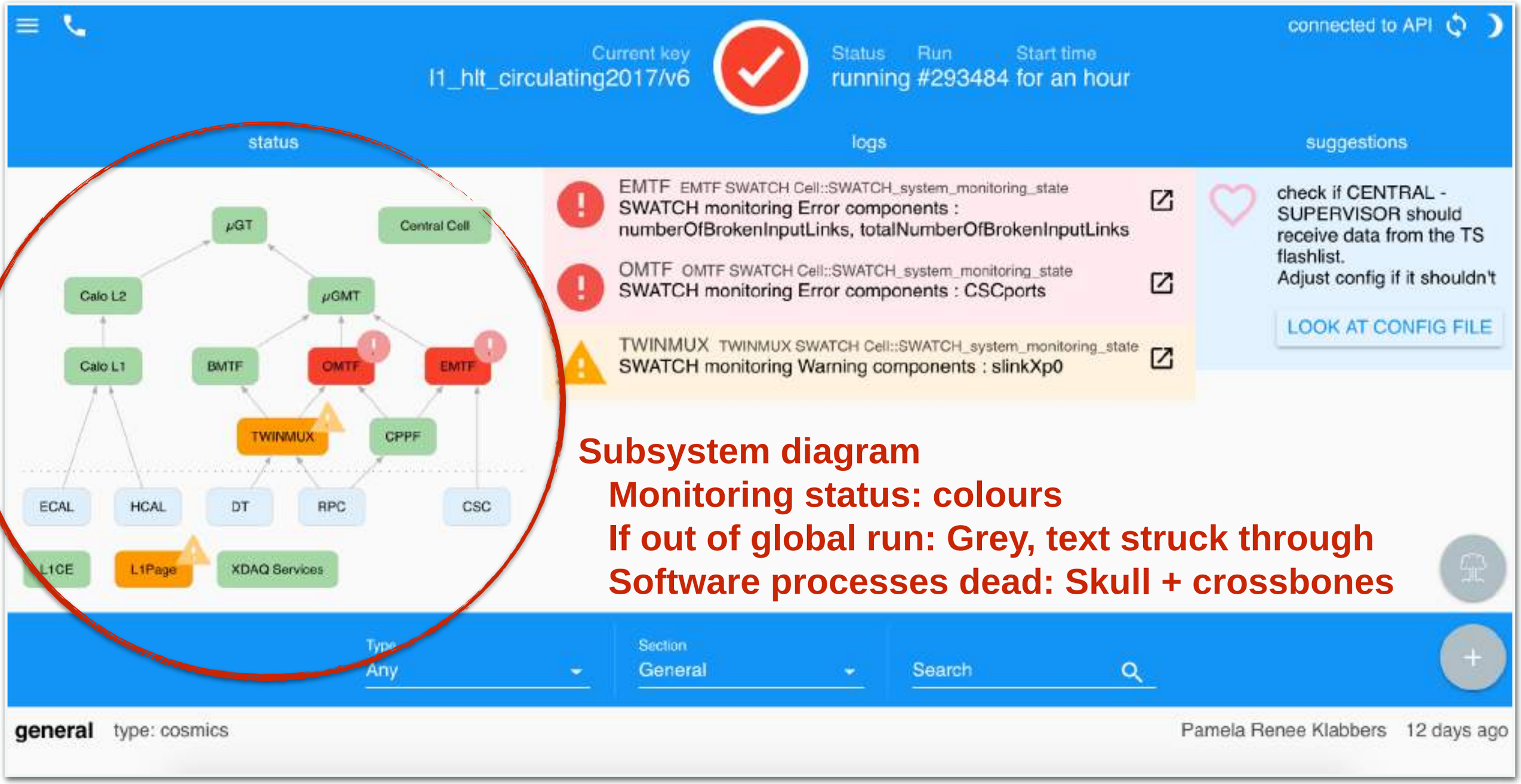
Level-1 page (1)

- Summarises status of whole L1T …

L1T run control state:
- **halted**
- **configured**
- **running**

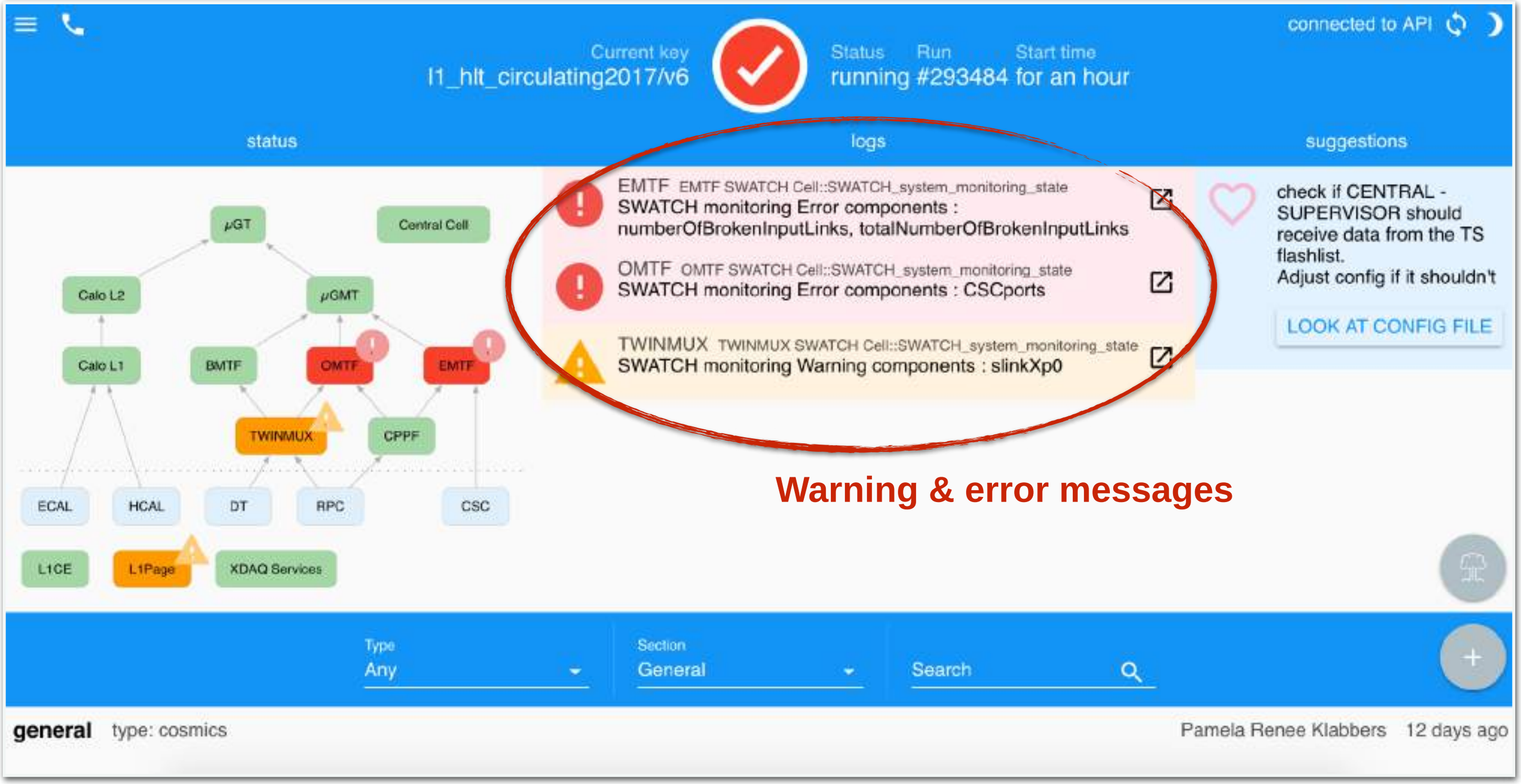
Level-1 page (2)

- Summarises status of whole L1T …



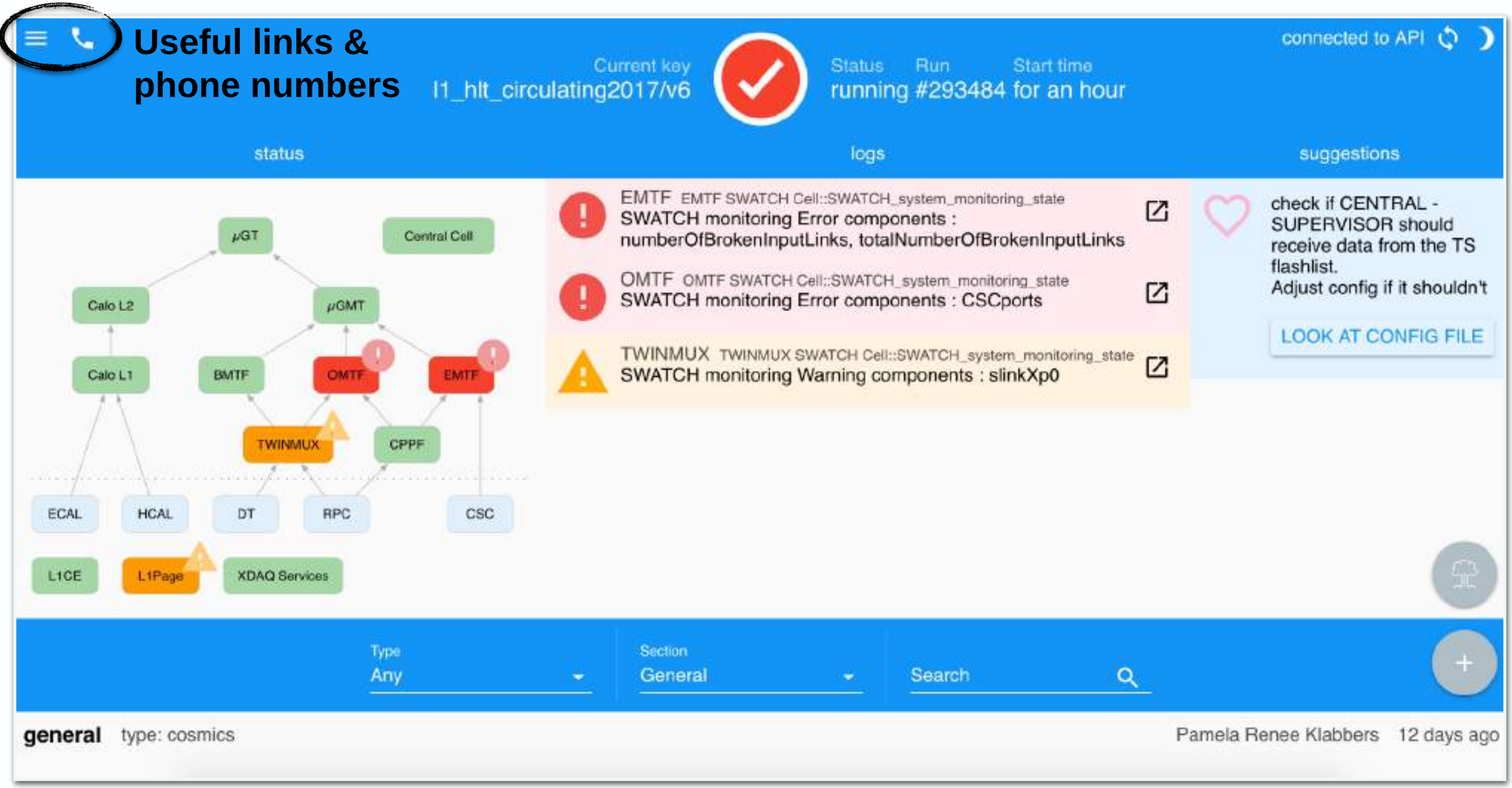
Level-1 page (3)

- Summarises status of whole L1T …



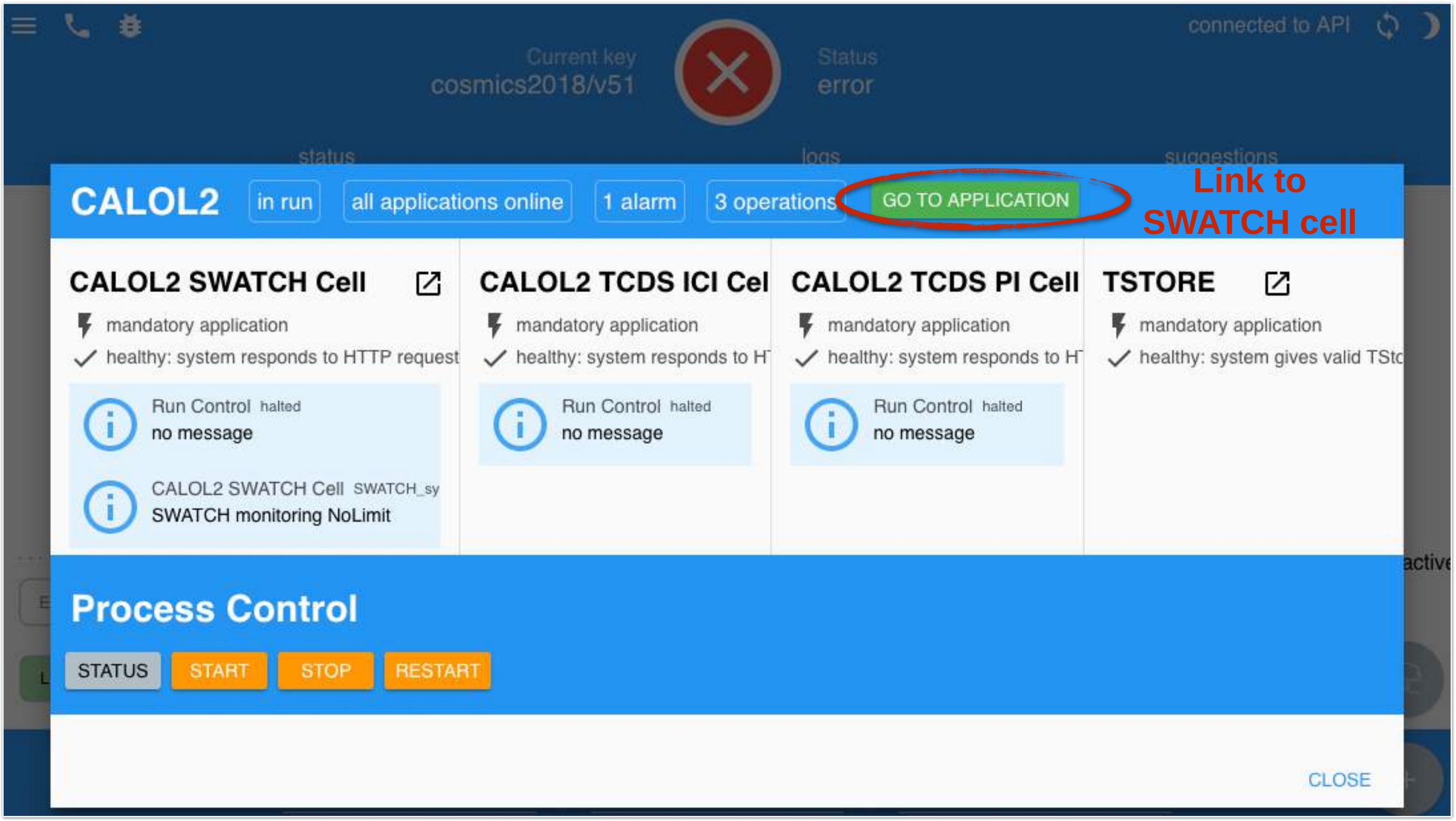
Level-1 page (3)

- Summarises status of whole L1T …



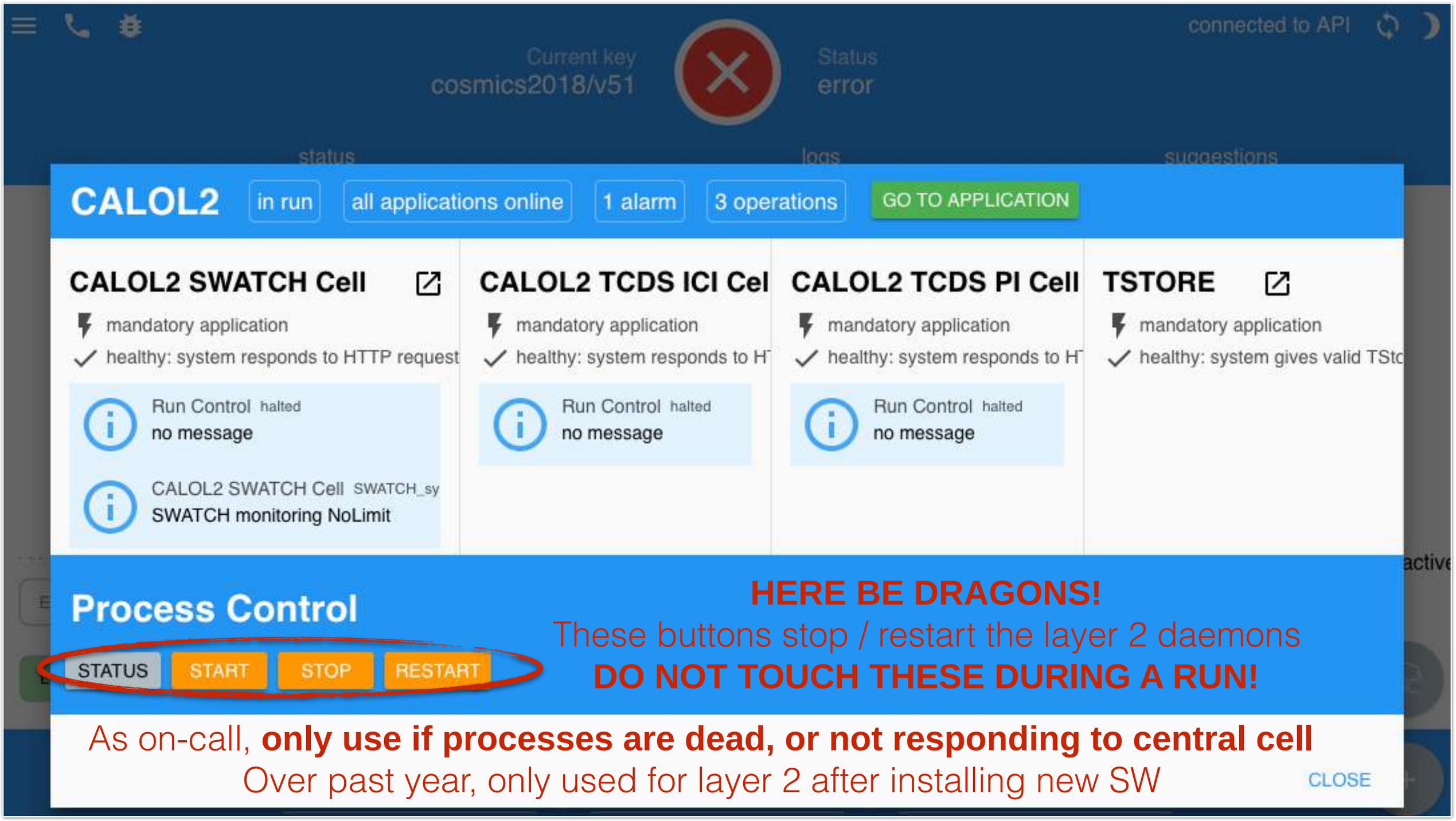
Calo layer-2 details (1)

- After clicking on calo layer-2 box …



Calo layer-2 details (2)

- After clicking on calo layer-2 box …

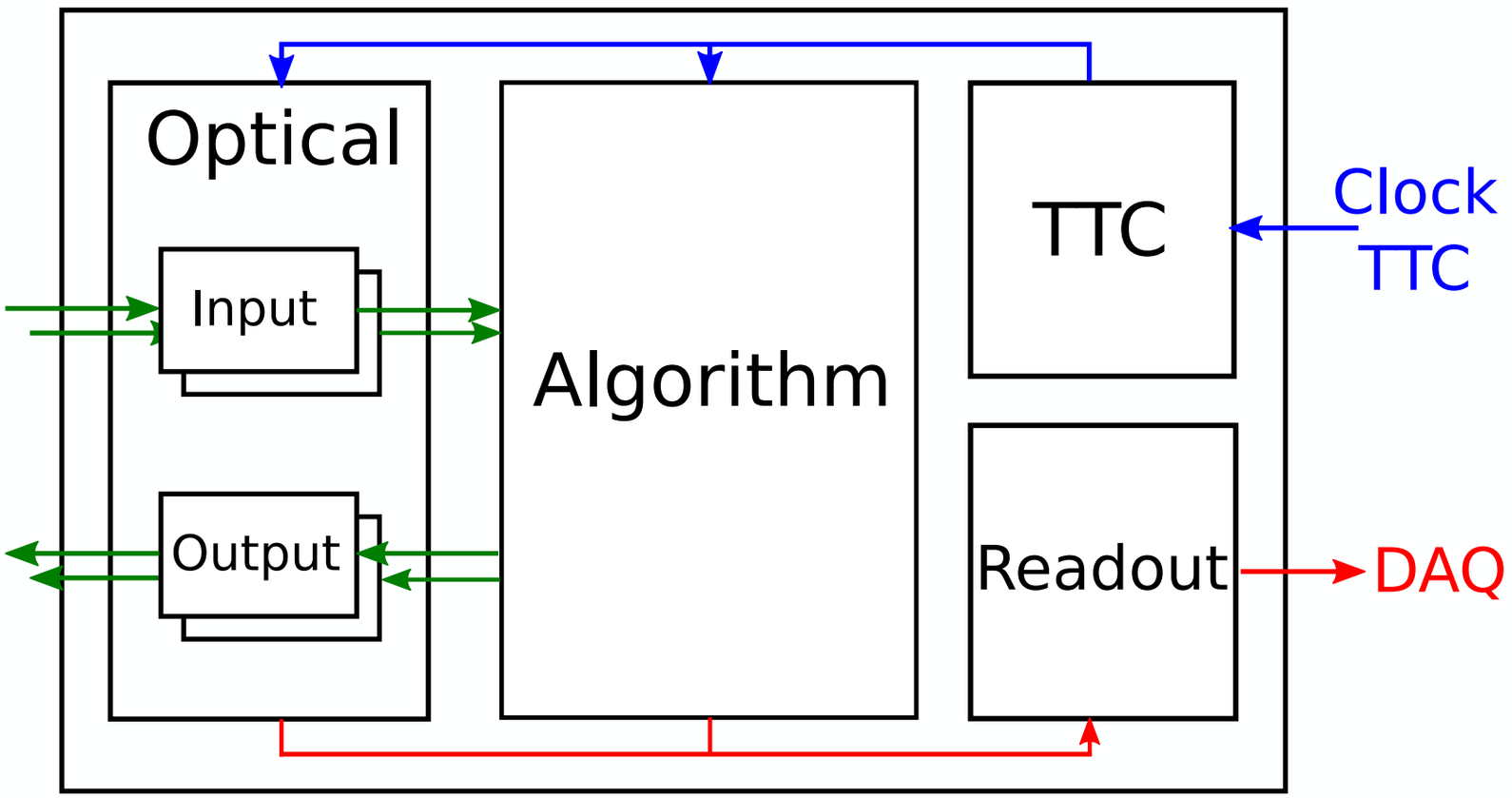


SWATCH

Software for Automating the conTrol of Commonn Hardware
= common framework for controlling & monitoring electronics in L1T Phase-1 upgrade

SWATCH: Common processor model

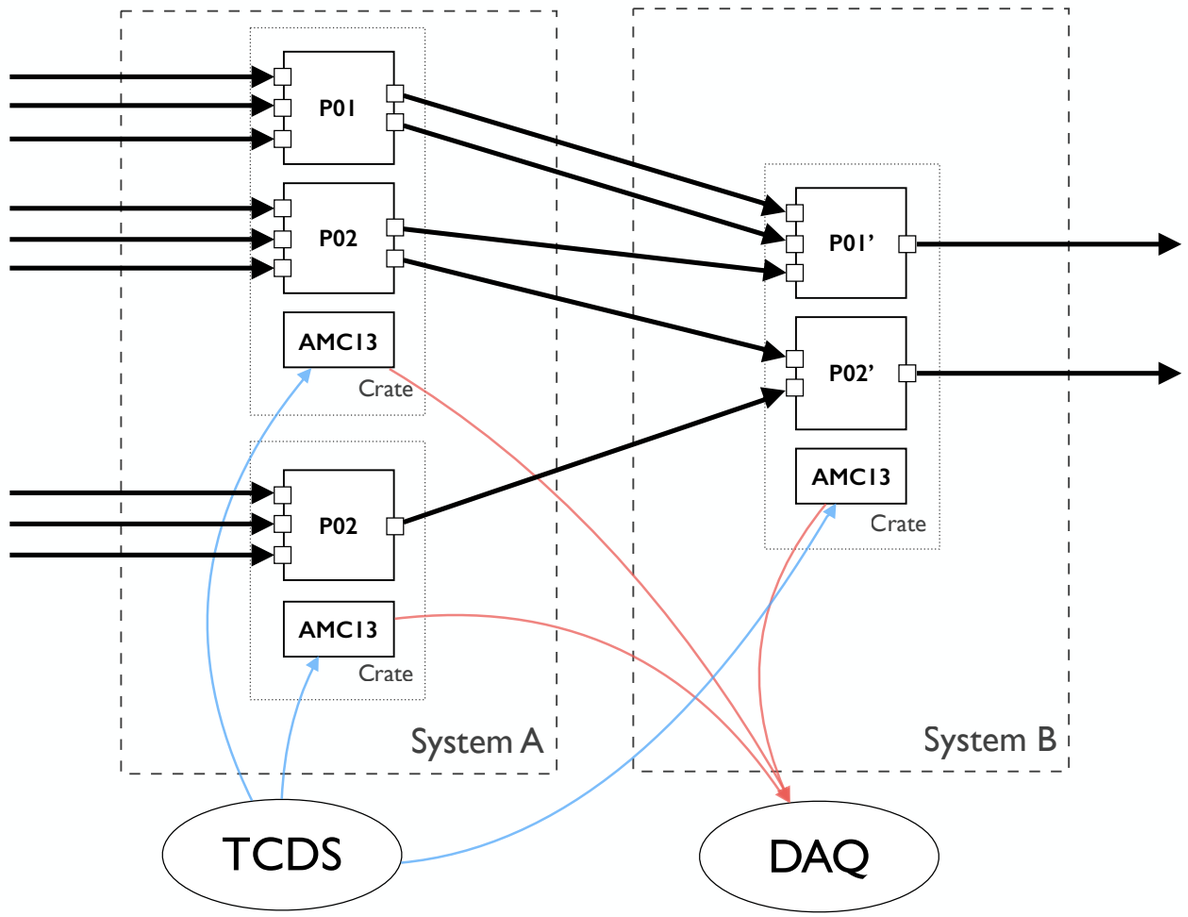
- Covers the main data processing nodes — commonalities …
  - **all AMCs** following MicroTCA specification
  - transmit/receive the trigger data on **high-speed serial optical links**
  - implement the processing logic in an **FPGA** (mainly Virtex 7)



  - Monitoring data organised under these blocks in SWATCH cell

SWATCH: Common system model

- Each subsystem
  - One or more processor boards, in MicroTCA crates
  - One "**AMC13**" board in each crate
    - Common CMS board; provides **clock, timing & DAQ services** via backplane



Trigger Control & Distribution System
clock & fixed-latency commands

Data AcQuisition network
sink for readout data

SWATCH cell: Configuration

SWATCH cell: Run control

Hides left-hand menu

CALOL2 SWATCH Cell 〉Operations 〉Run Control

Commands

Default

Operations

Click to expand

Run Control

Control Panels

Monitoring

Peers

DB

MON

Configuration Key (string)

calol2_commissioning2017/v12

FED Map (string)

1200&11%1201&11%1202&11%1203&11%1204&11%
1205&11%1206&11%1207&11%1208&11%1209&11%
1212&11%1213&11%1214&11%1215&11%1216&11%
1217&11%1218&11%1219&11%1220&11%1221&11%

Run Number (unsigned long)

293474

Run Settings Key (string)

calol2_rs_tmtMode10/v4

TTC Map (string)

{HO=3, FPIXP=3, LTC_TRG=0, LPM_RPC=0, EE+=3,
DTUP=0, FPIXM=3, EE-=3, CALSTAGE1=0,
CALTRIGUP=3, MUTFUP=3, LPM_HCAL=0,
CTPPS=0, TIBTID=0, DT+=3, LPM_CSC=0, DT-=3,

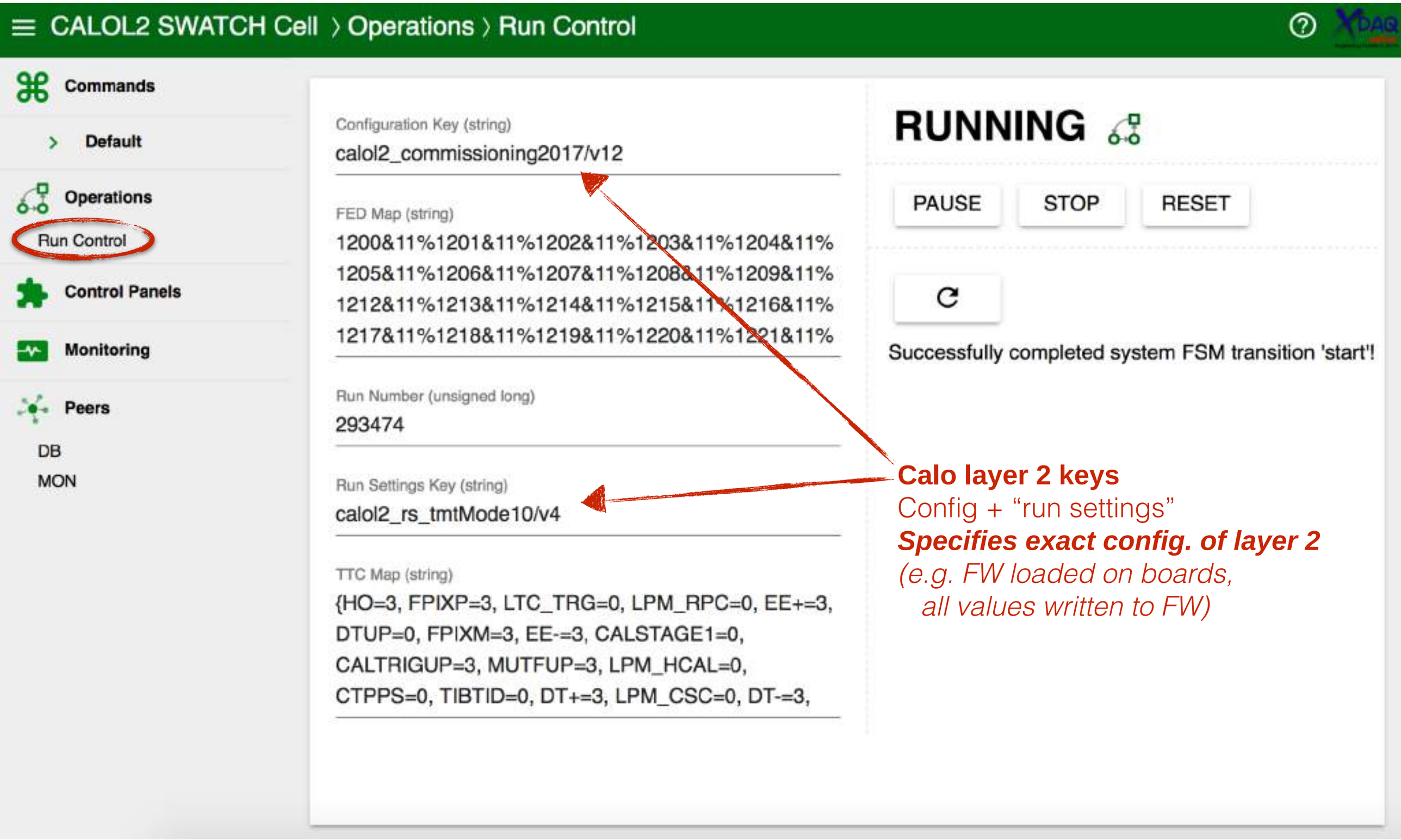
RUNNING

PAUSE STOP RESET

Successfully completed system FSM transition 'start'!

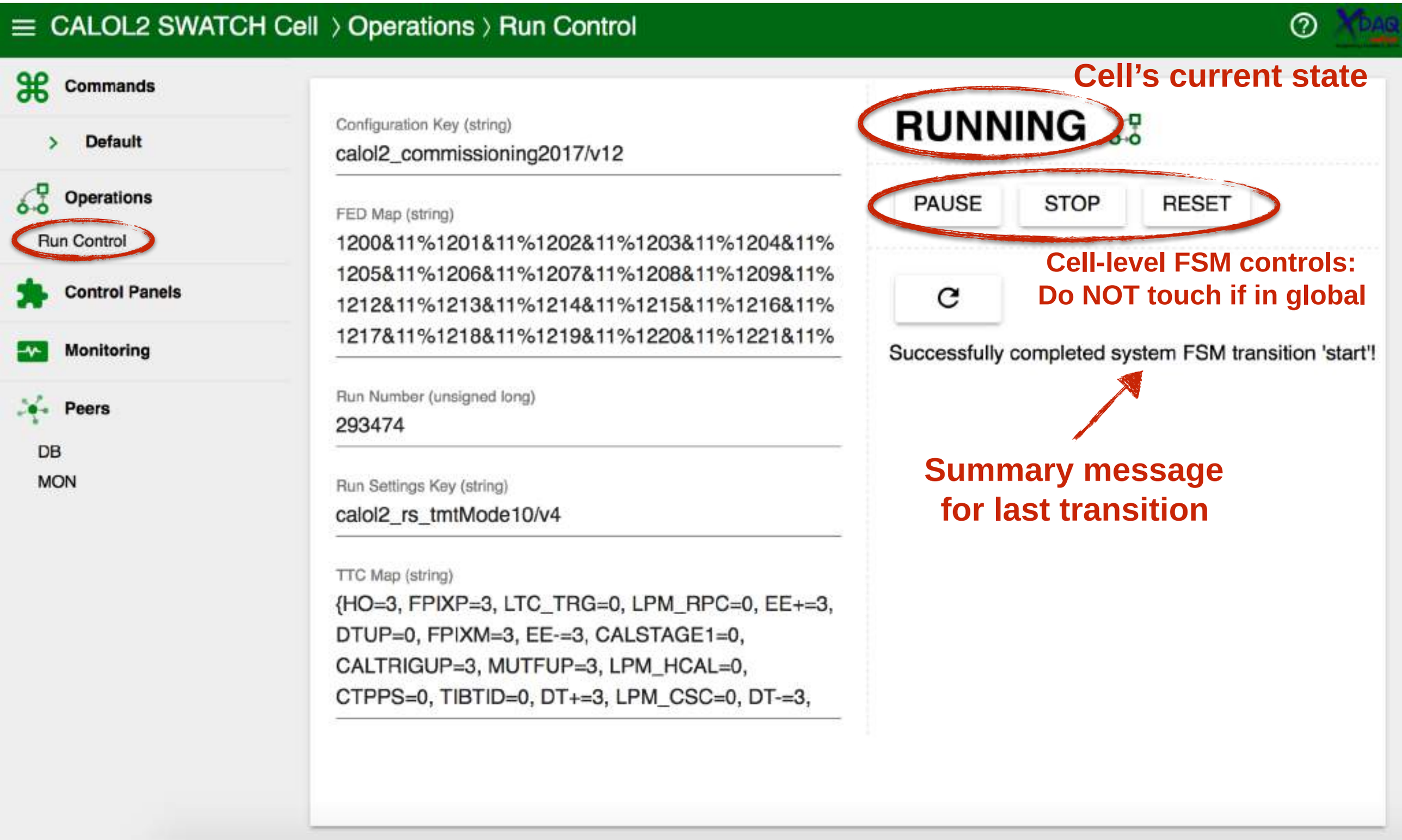
Configuration parameters sent by central cell

SWATCH cell: Run control



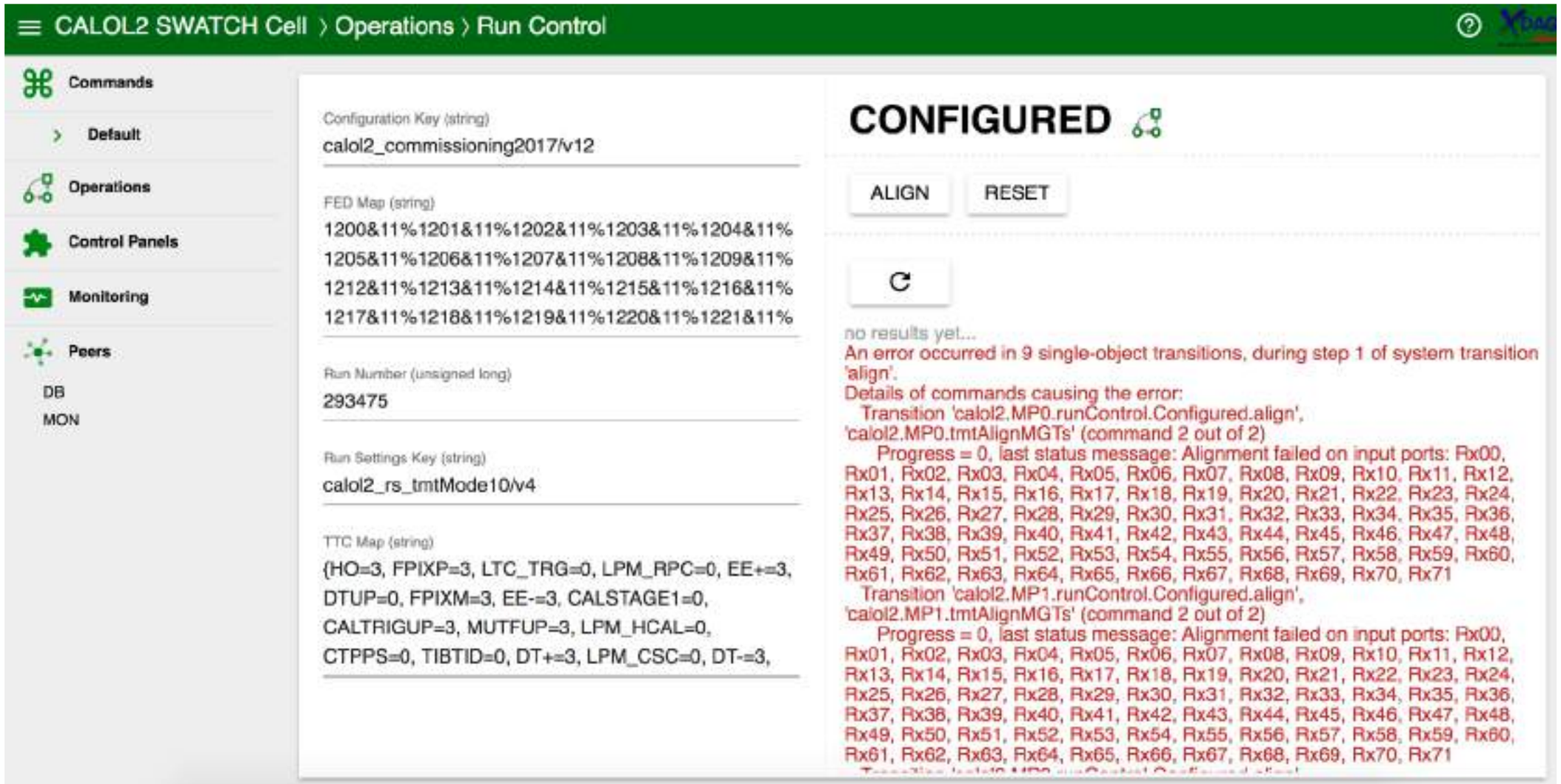
Calo layer 2 keys
Config + “run settings”
Specifies exact config. of layer 2
(e.g. FW loaded on boards,
all values written to FW)

SWATCH cell: Run control



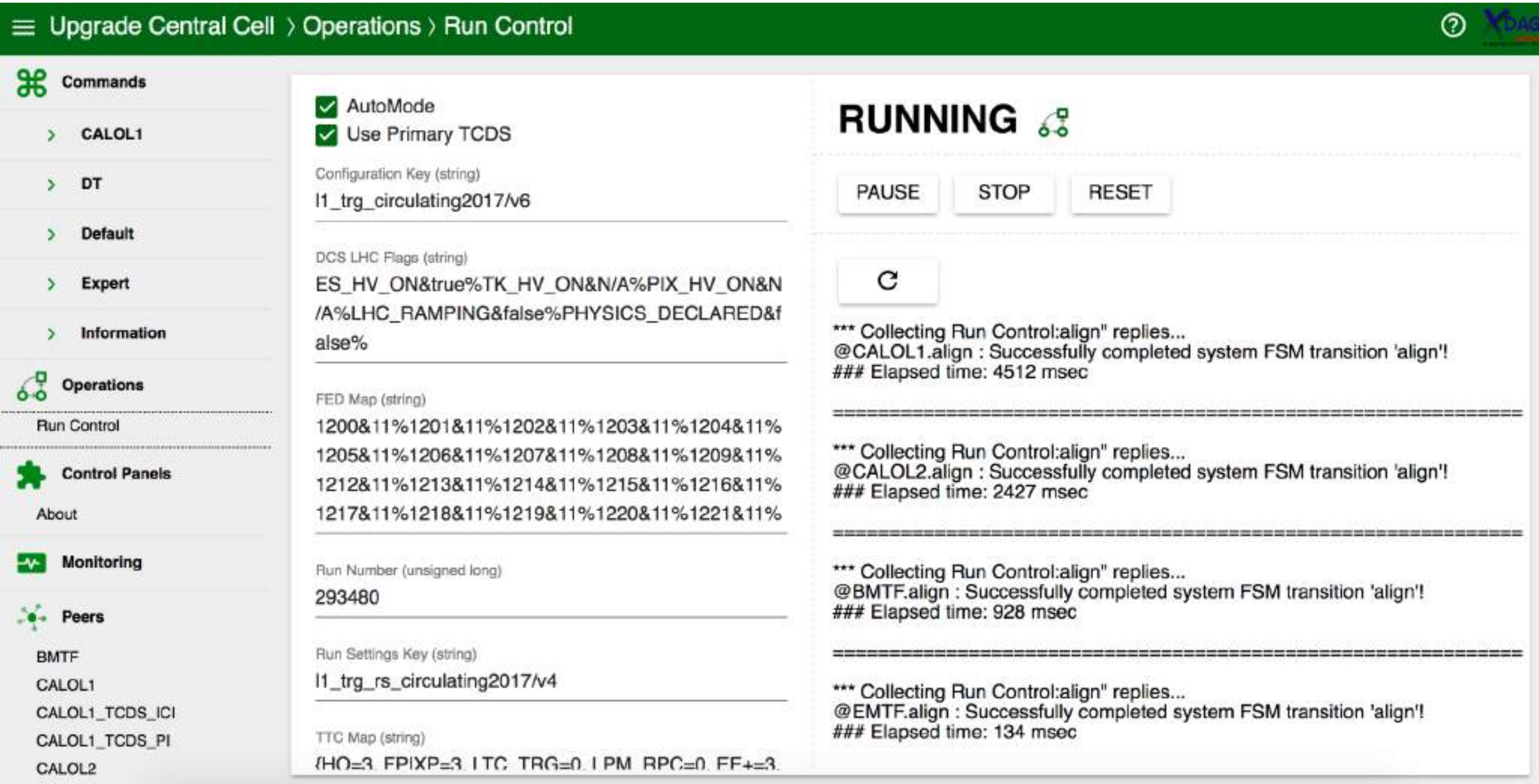
Debugging configuration errors (1)

- *Scenario:* L1 DOC calls you to say that there was an error in calo layer 2 during configuration …
  - E.g. Disruption of LHC clock, but L1T not re-configured, only ‘stop-start’ed



Debugging configuration errors (2)

- Extremely rarely, error may not appear in calo layer-2 cell — e.g. if central cell is having problems talking to it
  - Look in central cell — http://l1ts-central.cms:3333/urn:xdaq-application:lid=13



SWATCH cell: Monitoring

Reading various registers & comparing values with error/warning conditions (after at least some configuration has taken place)

System overview (1)

Hides left-hand menu

CALOL2 SWATCH Cell › Control Panels › 1. Summary

Commands

Default

Operations

Click to expand

Control Panels

1. Summary
2. Logging
3. System setup
4. Masking
5. Monitoring
6. Commands
7. Sequences
8. State machines
9. System state machines

About

Monitoring

Peers

DB

MON

calol2 Status: Warning State machine: runControl::Aligned

System Processors Object Details Ports

S2D11_29 fed-id: 1360

1 2 3 4 5 6 7 8 9 10 11 12 13

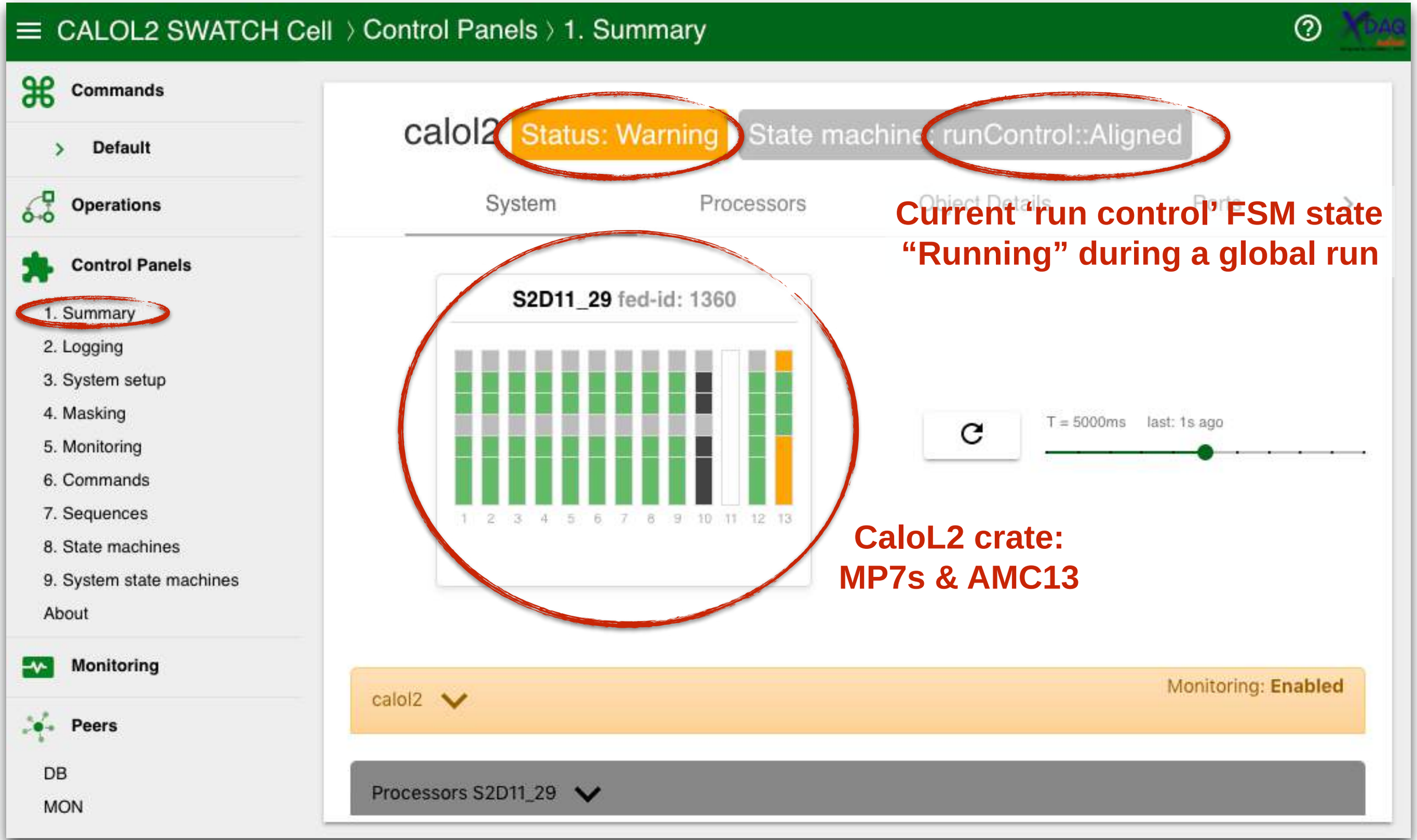
T = 5000ms last: 1s ago

calol2

Monitoring: **Enabled**

Processors S2D11_29

System overview (2)



System overview (3)

CALOL2 SWATCH Cell › Control Panels › 1. Summary

- Commands
  - Default
- Operations
- Control Panels
  1. Summary
  2. Logging
  3. System setup
  4. Masking
  5. Monitoring
  6. Commands
  7. Sequences
  8. State machines
  9. System state machines
  - About
- Monitoring
- Peers
  - DB
  - MON

calol2 | Status: Warning | State machine: runControl::Aligned

System | Processors | Object Details | Ports

AMC13

MPs

Redundant MP

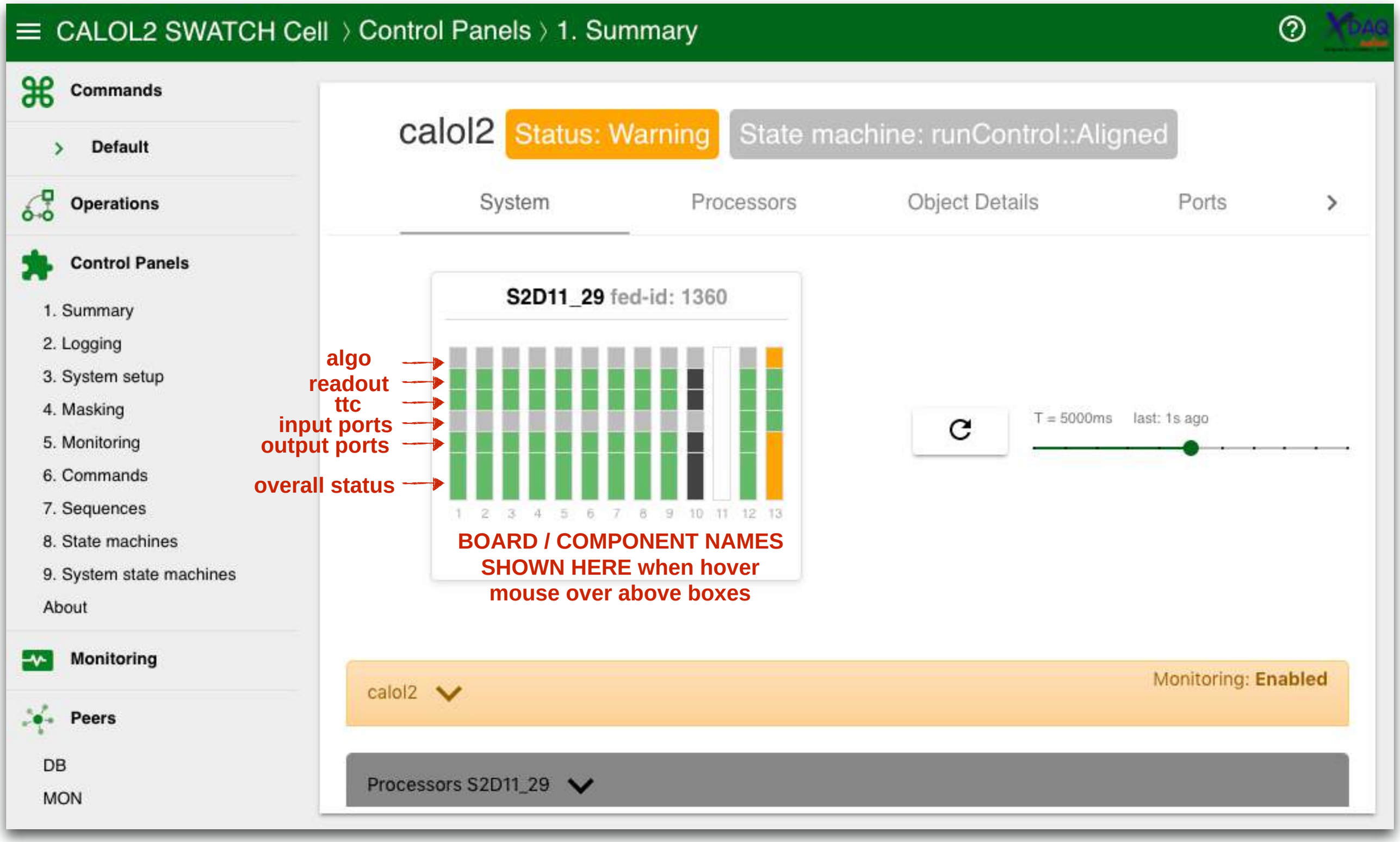
Demux

T = 5000ms last: 1s ago

calol2 Monitoring: **Enabled**

Processors S2D11_29

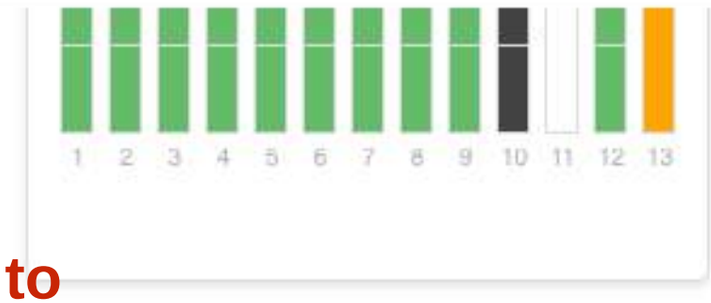
System overview (4)



System overview (5)

CALOL2 SWATCH Cell 〉Control Panels 〉1. Summary

- Commands
  - Default
- Operations
- Control Panels
  1. Summary
  2. Logging
  3. System setup
  4. Masking
  5. Monitoring
  6. Commands
  7. Sequences
  8. State machines
  9. System state machines
  - About
- Monitoring
- Peers
  - DB
  - MON



Click to expand

Processors (MPs and demux) status table

calol2 Monitoring: **Enabled**

Processors S2D11_29

Processor ID	Slot	Status	algo	readout	ttc	inputPorts	outputPorts
MP0	1	Good	NoLimit	Good	Good	NoLimit	Good
MP1	2	Good	NoLimit	Good	Good	NoLimit	Good
MP2	3	Good	NoLimit	Good	Good	NoLimit	Good
MP3	4	Good	NoLimit	Good	Good	NoLimit	Good
MP4	5	Good	NoLimit	Good	Good	NoLimit	Good
MP5	6	Good	NoLimit	Good	Good	NoLimit	Good
MP6	7	Good	NoLimit	Good	Good	NoLimit	Good

System overview (6)

CALOL2 SWATCH Cell 〉Control Panels 〉1. Summary

Commands

Default

Operations

Control Panels

1. Summary
2. Logging
3. System setup
4. Masking
5. Monitoring
6. Commands
7. Sequences
8. State machines
9. System state machines

About

Monitoring

Peers

DB

MON

Click to expand

calol2 — Monitoring: **Enabled**

Processors S2D11_29

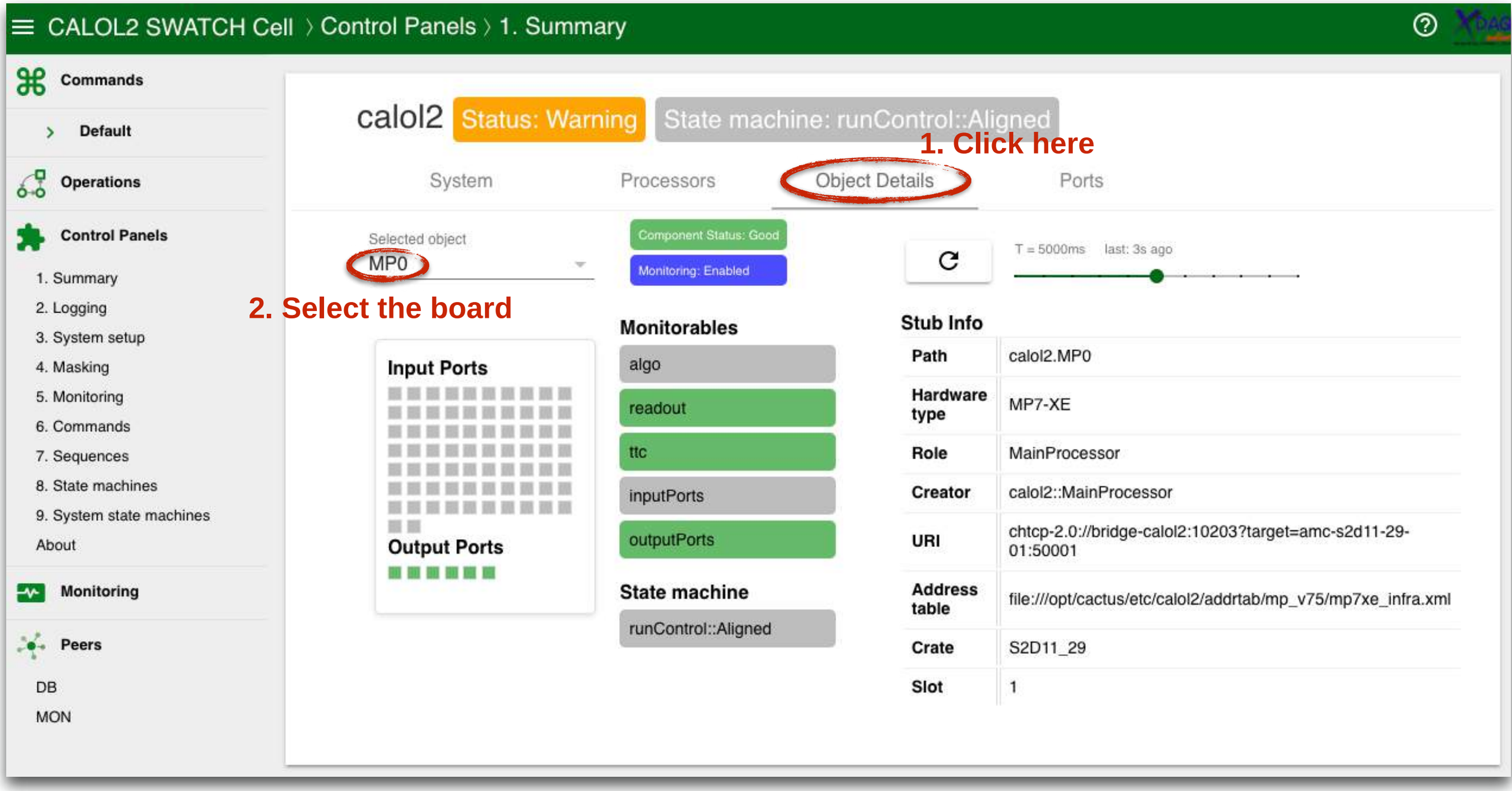
TTC / DAQ

AMC13 status table

AMC13 ID	Crate	Status	evb	slinkXp0	ttc	amcports
AMC13	S2D11_29	Warning	Warning	Good	Good	Good

Internal Links

Processor details (1)



Processor details (2)

- Scrolling down the “Object details” page …

CALOL2 SWATCH Cell 〉Control Panels 〉1. Summary

Commands

Default

Operations

Control Panels

1. Summary
2. Logging
3. System setup
4. Masking
5. Monitoring
6. Commands
7. Sequences
8. State machines
9. System state machines

About

Monitoring

Peers

DB

MON

readout — Monitoring: **Enabled**

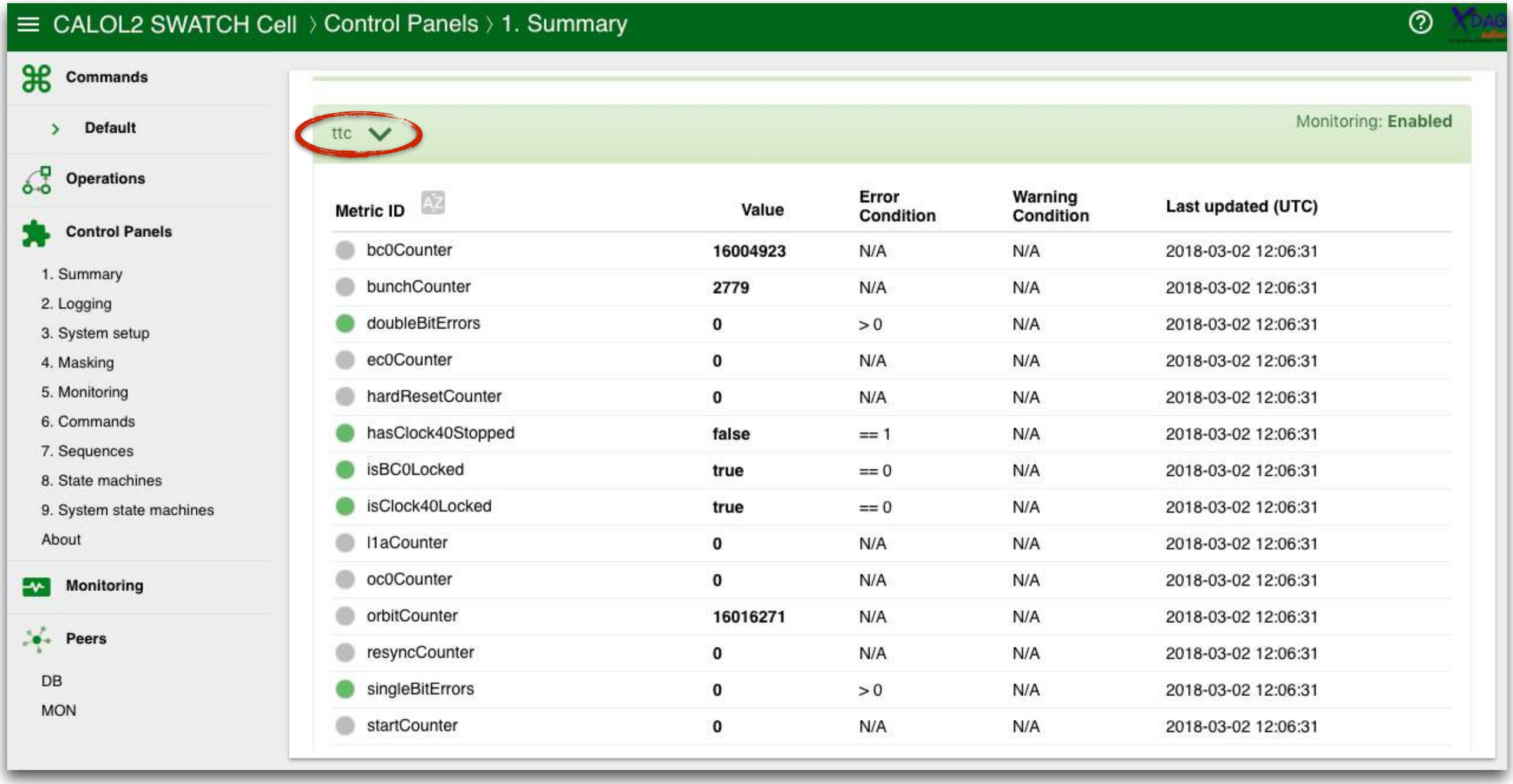
Metric ID	Value	Error Condition	Warning Condition	Last updated (UTC)
amcCoreReady	**true**	== 0	N/A	2018-03-02 12:04:51
busyTime	**8.04113**	N/A	N/A	2018-03-02 12:04:51
eventCounter	**0**	N/A	N/A	2018-03-02 12:04:51
oosTime	**0**	N/A	N/A	2018-03-02 12:04:51
readyTime	**1318.82**	N/A	N/A	2018-03-02 12:04:51
tts	**Ready (0x8)**	== Error (0xc)	!= Ready (0x8)	2018-03-02 12:04:51
upTime	**1326.86**	N/A	N/A	2018-03-02 12:04:51
warnTime	**0**	N/A	N/A	2018-03-02 12:04:51

ttc — Monitoring: **Enabled**

inputPorts — Monitoring: **Enabled**

Processor details (3)

- Scrolling down the “Object details” page …



Processor details (4)

- Scroll down the “Object details” page …

CALOL2 SWATCH Cell 〉Control Panels 〉1. Summary

Commands

Default

Operations

Control Panels

1. Summary
2. Logging
3. System setup
4. Masking
5. Monitoring
6. Commands
7. Sequences
8. State machines
9. System state machines

About

Monitoring

Peers

DB

MON

inputPorts — Monitoring: **Enabled**

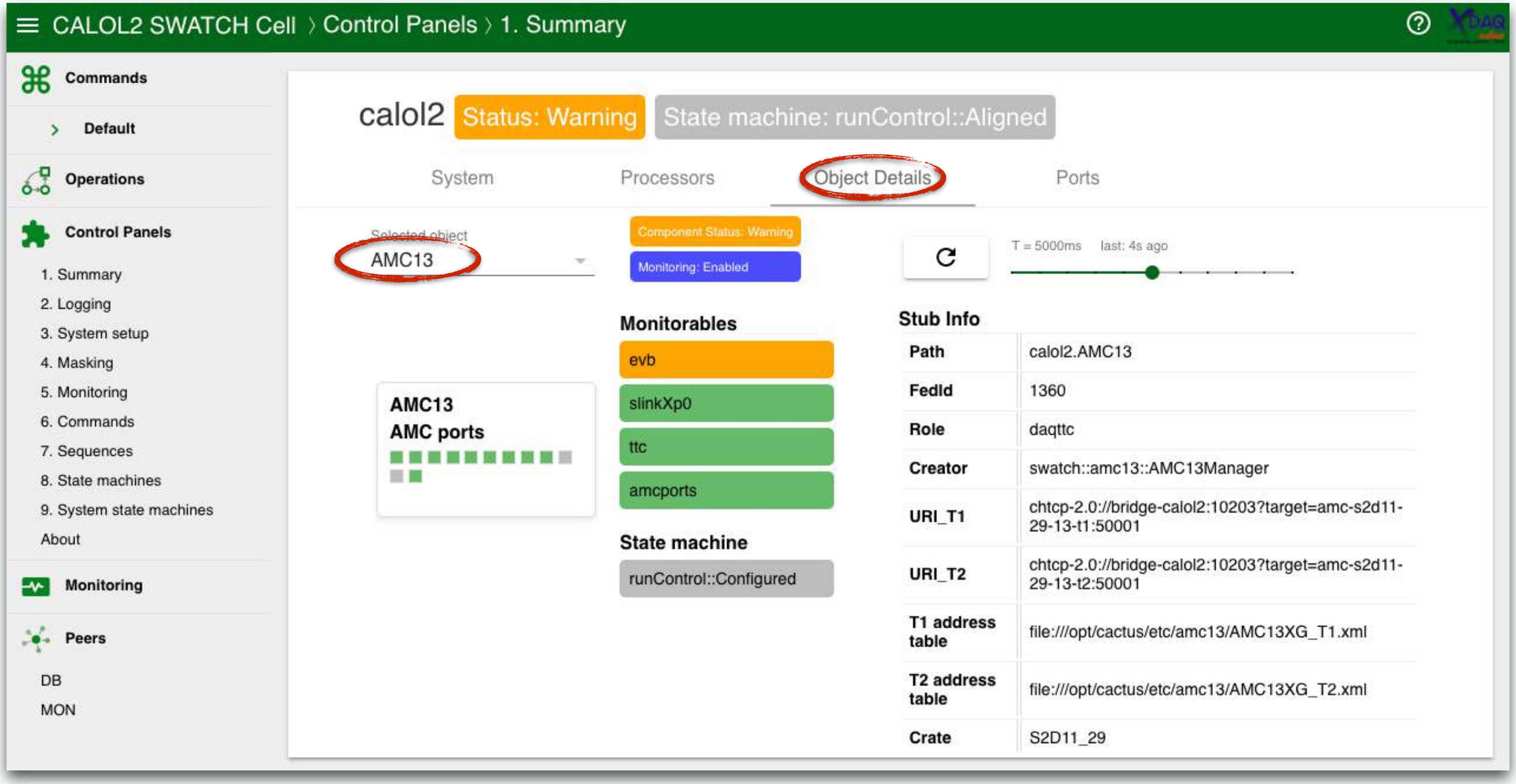
Rx00 — Monitoring: **Enabled** Masked: **False**

Rx01 — Monitoring: **Enabled** Masked: **False**

Rx02 — Monitoring: **Enabled** Masked: **False**

Metric ID	Value	Last updated (UTC)	Monitoring	Error Condition	Warning Condition
alignBx	**3495**	2017-05-07 16:20:14	Enabled	N/A	== 4095
alignCycle	**0**	2017-05-07 16:20:14	Enabled	N/A	== 7
alignErrors	**0**	2017-05-07 16:20:14	Enabled	!= 0	N/A
crcErrors	**0**	2017-05-07 16:20:14	Enabled	== 255	> 0
isAligned	**true**	2017-05-07 16:20:14	Enabled	== 0	N/A
isLocked	**true**	2017-05-07 16:20:14	Enabled	== 0	N/A
packetCounter	**255**	2017-05-07 16:20:14	Enabled	N/A	== 0

AMC13 details (1)



AMC13 details (2)

- Scrolling down the page …

CALOL2 SWATCH Cell 〉Control Panels 〉1. Summary

Commands

Default

Operations

Control Panels

1. Summary
2. Logging
3. System setup
4. Masking
5. Monitoring
6. Commands
7. Sequences
8. State machines
9. System state machines

About

Monitoring

Peers

DB

MON

evb — Monitoring: **Enabled**

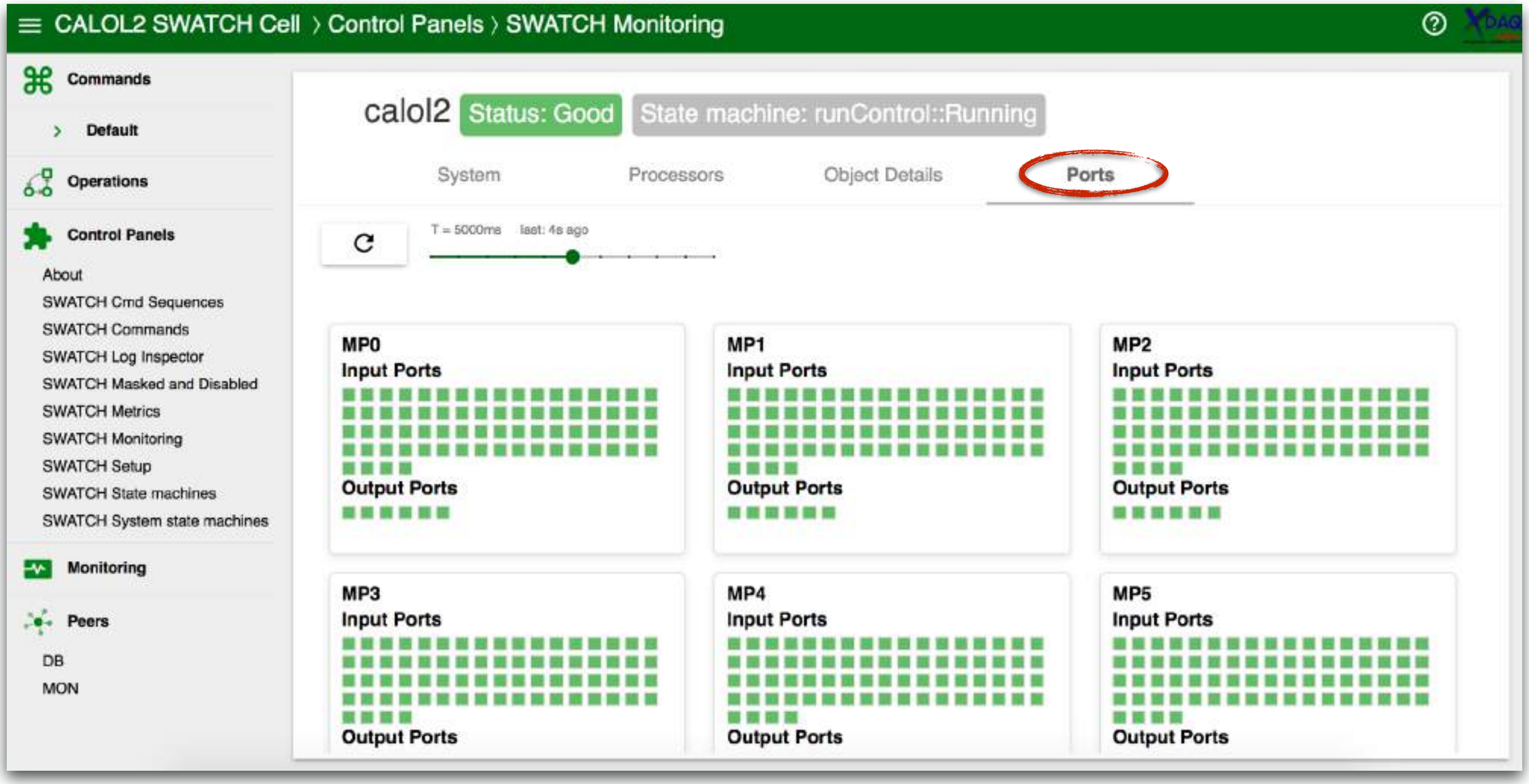
slinkXp0 — Monitoring: **Enabled**

ttc — Monitoring: **Enabled**

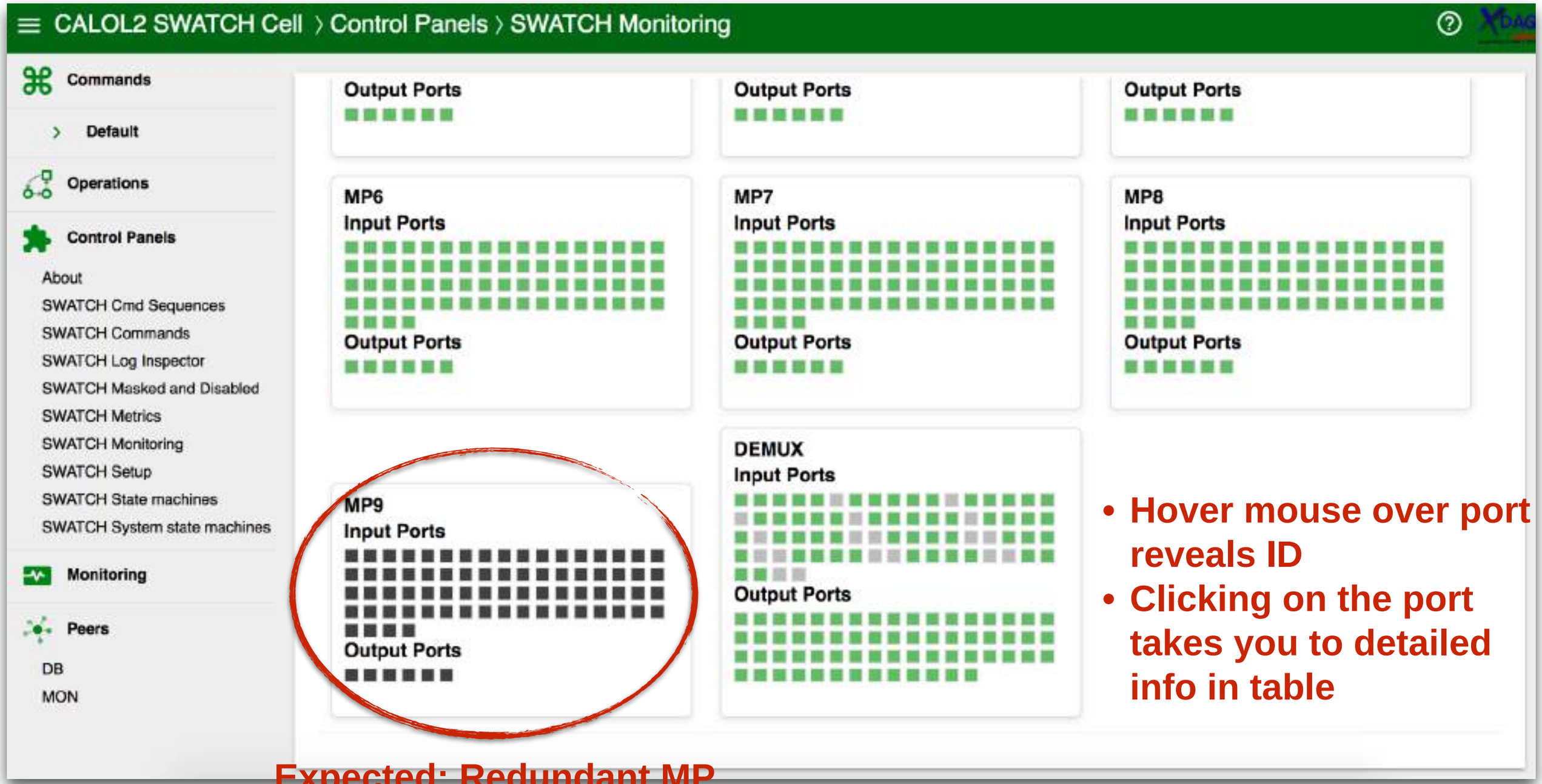
Metric ID	Value	Error Condition	Warning Condition	Last updated (UTC)
bc0Counter	**35263**	N/A	N/A	2018-03-02 12:15:12
bc0Errors	**0**	N/A	N/A	2018-03-02 12:15:12
clkFreq	**4.0079e+07**	< 3.99e+07 or > 4.01e+07	N/A	2018-03-02 12:15:12
resyncCount	**1811939336**	N/A	N/A	2018-03-02 12:15:12
ttcDoubleBitErrors	**0**	> 0	N/A	2018-03-02 12:15:12
ttcSingleBitErrors	**0**	> 0	N/A	2018-03-02 12:15:12

amcports — Monitoring: **Enabled**

Port summary (1)



Port summary (2)



- Hover mouse over port reveals ID
- Clicking on the port takes you to detailed info in table

Expected: Redundant MP (Dark grey = disabled)

Port summary (3)

- Scrolling down the page …

CALOL2 SWATCH Cell 〉Control Panels 〉SWATCH Monitoring

Commands

Default

Operations

Control Panels

About
SWATCH Cmd Sequences
SWATCH Commands
SWATCH Log Inspector
SWATCH Masked and Disabled
SWATCH Metrics
SWATCH Monitoring
SWATCH Setup
SWATCH State machines
SWATCH System state machines

Monitoring

Peers

DB
MON

Input Port Details

MP0 — Monitoring: **Enabled**

MP1 — Monitoring: **Enabled**

Port ID	Status	Monitoring	Masked	alignCycle	alignErrors	alignBx	packetCounter	crcErrors	isAligned	isLocked
Rx00	Good	Enabled	False	0	0	3496	255	0	true	true
Rx01	Good	Enabled	False	0	0	3496	255	0	true	true
Rx02	Good	Enabled	False	0	0	3496	255	0	true	true
Rx03	Good	Enabled	False	0	0	3496	255	0	true	true
Rx04	Good	Enabled	False	0	0	3496	255	0	true	true
Rx05	Good	Enabled	False	0	0	3496	255	0	true	true
Rx06	Good	Enabled	False	0	0	3496	255	0	true	true
Rx07	Good	Enabled	False	0	0	3496	255	0	true	true
Rx08	Good	Enabled	False	0	0	3496	255	0	true	true
Rx09	Good	Enabled	False	0	0	3496	255	0	true	true
Rx10	Good	Enabled	False	0	0	3496	255	0	true	true

Port summary (4)

- Scrolling down the page …

CALOL2 SWATCH Cell › Control Panels › SWATCH Monitoring

Commands
Default
Operations
Control Panels
About
SWATCH Cmd Sequences
SWATCH Commands
SWATCH Log Inspector
SWATCH Masked and Disabled
SWATCH Metrics
SWATCH Monitoring
SWATCH Setup
SWATCH State machines
SWATCH System state machines
Monitoring
Peers
DB
MON

Hx71 NoLimit Disabled True Unknown Unknown Unknown Unknown Unknown Unknown Unknown

Output Port Details

MP0 — Monitoring: **Enabled**

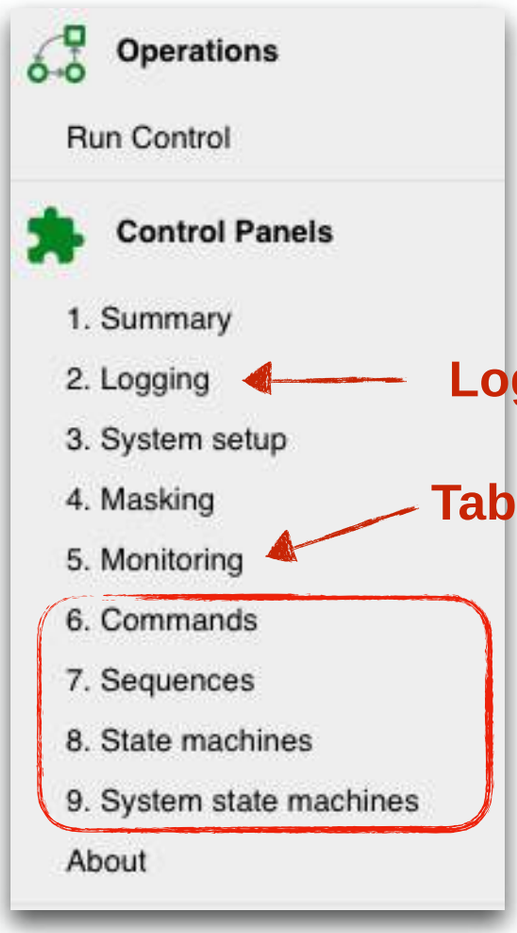
MP1 — Monitoring: **Enabled**

Port ID	Status	Monitoring	isOperating
Tx60	Good	Enabled	true
Tx61	Good	Enabled	true
Tx62	Good	Enabled	true
Tx63	Good	Enabled	true
Tx64	Good	Enabled	true
Tx65	Good	Enabled	true

MP2 — Monitoring: **Enabled**

SWATCH cell: Anything else?

- As on-call, you should only need to look at …
  - “Run control” FSM page
    - Operations -> “Run control”
  - Monitoring summary page
    - Control panels -> “1. Summary”
- … the other SWATCH panels provide more expert tools



Logs

Tables / Graphs of individual metrics

Configuration GUIs — HERE BE DRAGONS!
Don’t touch buttons here if calo layer 2 in global run

Summary

- Online software
  - Configures the electronics boards
  - Monitors various status registers during runs
  - … highlights if anything goes wrong

- Main interfaces for calo layer-2 on-call
  - l1page: https://l1page.cms
  - calo layer 2 SWATCH cell: Click on **link in l1page**
    - “Run control” FSM page
    - Monitoring summary page

- **Check that you can access these websites** before starting on-call
  - Instructions for setting up P5 tunnel: *See CaloLayer2OnCall twiki*