PiE5

PiE5 Operation Manual

Introduction

Quick system description

- Detector Systems
    - Vertex
    - SciFi
    - SciTiles
- Services
    - Power distribution (TDK + MPDC boxes)
    - DCDC crates
    - HV boards
    - Environmental sensors
    - FrontEnd Crates (FEC)
- Cooling
    - Liquid cooling (chiller) for FEC (electronics, Water/Glycol)
    - Liquid cooling (chiller) for Sci* (Silicon oil)
    - Helium system for Vertex
    - Liquid cooling (chiller) for Helium

General principles

- **During beam time** Services and DAQ should be on all time
- **During cosmics** DAQ is off when no operations are going
    - Turned on at the beginning of the day
    - Turned off at the end
    - This means that all subsystems follow
- Single systems:
    - **During beam time** They should be on all time
    - **During cosmics** They should follow the DAQ (see above)
    - There should be a responsible on call or on site for each subsystem (?). This should take a decision if to turn off for any reason
- Shift handover
    - Each subsystem should take care of handing over a debriefing for the next shift (including a shift Elog)
        - Suggestion: open an elog and keep writing during shift
- Coordination
    - Check if there are conflicts before doing something on systems

    - Ask all interested systems if you can proceed and wait to receive an answer
    - Tools:
        - Mattermost
        - Stay in the integration Zoom room

Shift operation

Awareness / Safety

This manual focuses on system integrity, and is not an alternative for PSI (Personal) Safety Rules.

Before doing any work on the system check what is happening. Things like: is the magnet on? Is anyone working on the cage? Which systems are running? Is anyone debugging a piece of code?

MIDAS Alarms are implemented. Do not ignore any alarm! Alarm instructions linked here

Shift guidelines

Shifters are in charge! No system intervention without consulting shift crew (this includes PIs).

Priorities in this order:

1. Check system (e.g. **custom pages** and **history plots**)
2. Check data quality
3. Do your personal tasks (debugging, analysis,...)

Coordination

Before performing anything that alters the state of some systems, we must check that no-one else is working on it to avoid conflicts.

- Check with run coordinator and/or shift crew
- On-site checks:
    - Go around a specific set of locations (TBD) and check nobody is working there
        - This set depends if PiE5 is accessible or not
        - First check if PiE5 is closed
- Online checks:

    - Make a page where every service and subsystem report if they are on and running
    - Check this page at the beginning of the shift or operation
        - If something is not what you expect, call responsible

Summer 2025 Cosmic run

- [ ] Shift schedule with some instructions: signup sheet
- [ ] Non-expert / MEG walkthrough checklist Mu3e daily area checklist
- [ ] Shift rules
    - [ ] During remote operation, there should one on-call PSI person
    - [ ] At the end of the last shift, the system should be put in a safe state, and a check(list) of the system state should be reported in the elog
    - [ ] Non-shift days still need a completed checklist

Safe state

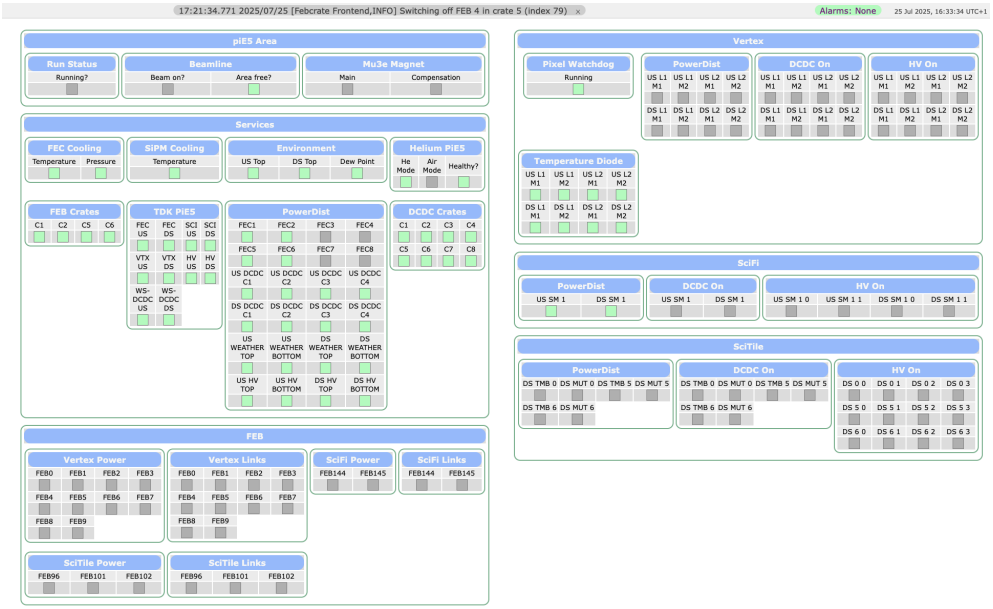
This might change, but currently:

- [ ] No Detector power
- [ ] FEBs off
- [ ] All SC (FEs) on
- [ ] All cooling running, set temperatures ≥ 15C

System checklist

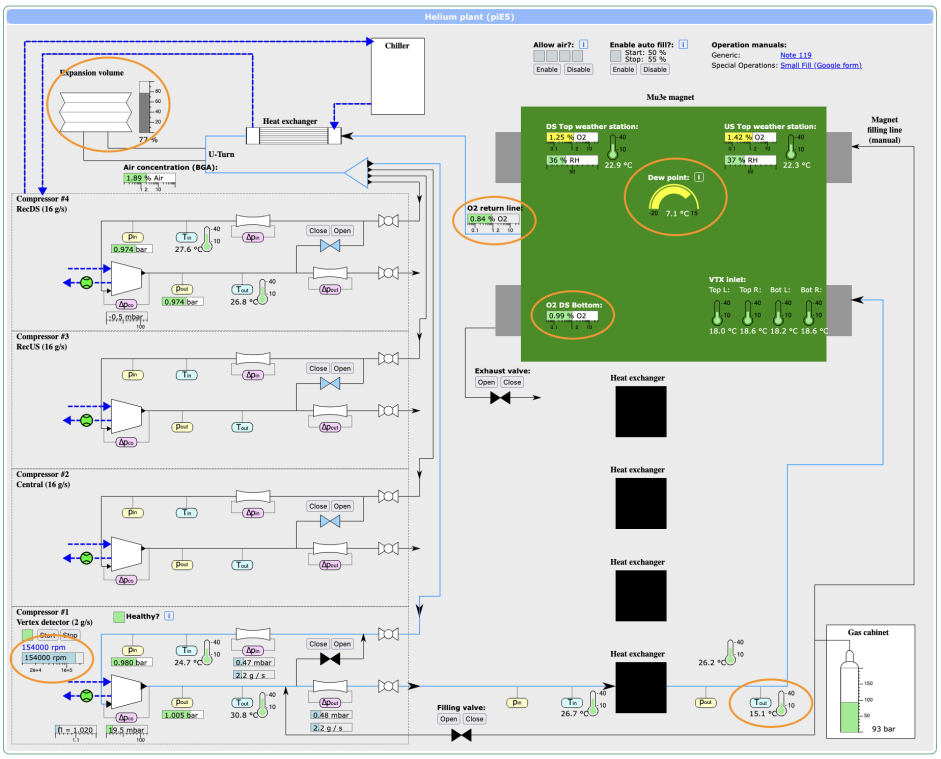
- [ ] Check and post the system status page

What you expected to see at the end of the last shift of the day (SciFi PowerDists can be on):



In addition:

- ☐ Helium: Compressor speed, O2 concentration DS Bottom, O2 concentration in return line, dew point, T after heat exchanger, expansion volume %
  Go Services/Helium piE5 page and check the values circled in orange
  (⚠️ Anything that turns red should be reported immediately):

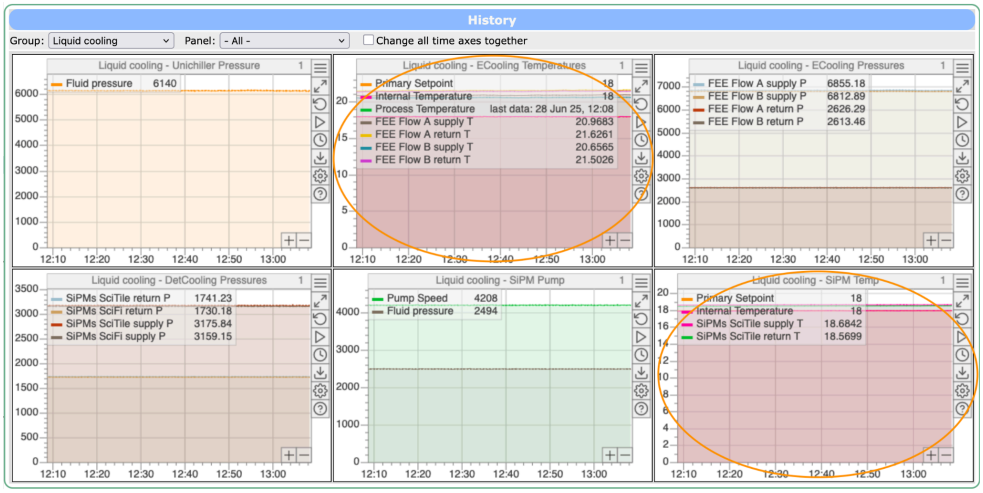


☐ Vertex: TDIODE max T

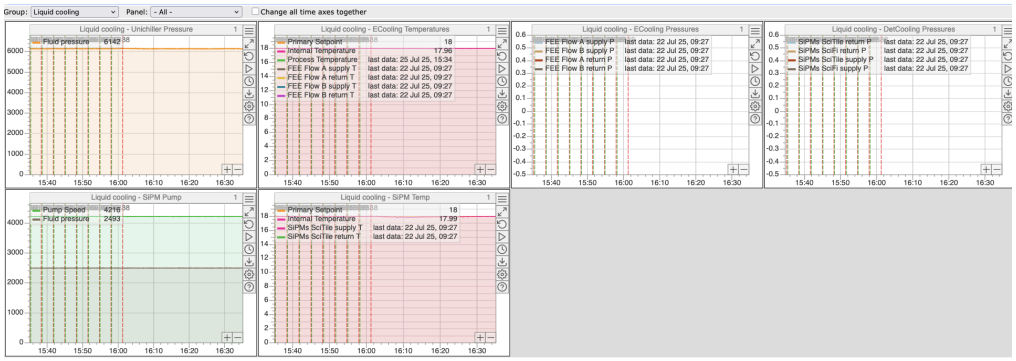
Go History/Vertex Power/Temperature Diode (⚠️ not plural!) and record the highest diode temperature:

☐ E-Cooling and SiPM (Unistat) temperature, max FEB and FEB crate temperatures

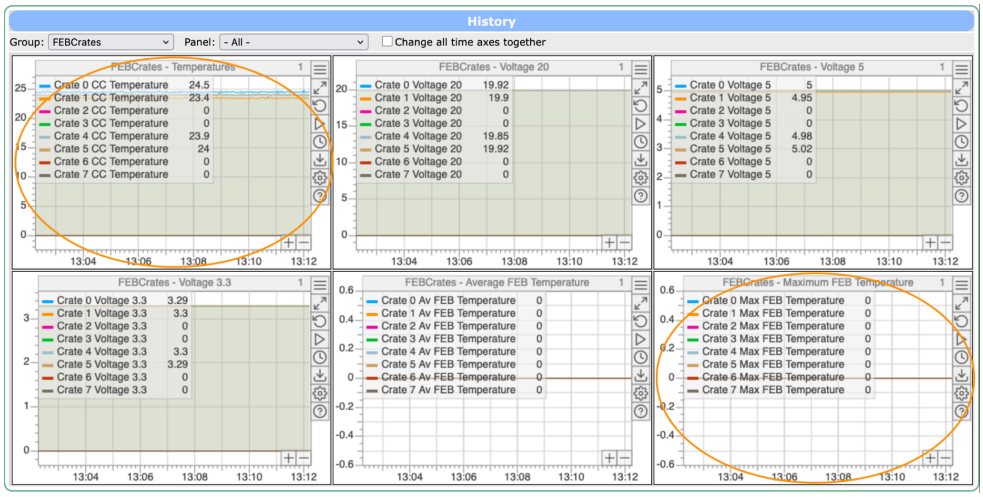
E- & SiPM-Cooling temps: Go History/Liquid cooling and check the ‘Internal Temperature’ circled in orange:



⚠️ As of 22.07.2025, Chiller manifolds is temporarily disabled due to mscb334 issue. Hence, you will only see 'Primary Setpoint' and 'Internal Temperature' in those two plots:



Max FEB and FEB crate temps: Go History/FEBCrates and check Temperatures and Maximum FEB Temperature - you should see 0 for the former as all FEBs are off at the end of the last shift of the day:



⚠️ you get ‘no data available’ on the FEB temp readings? Check if SW Downstream is on, also see https://mattermost.gitlab.rlp.net/mu3e/pl/5z6ifyrojbggupy6hapcyuyy6h

Services and their respective monitoring that should be running all time under normal operation

- Electronics chiller
- Detector cooling
- Helium system
    - Compressors
    - Chillers
- Interlock System
- Magnet
    - Power supplies
    - Compressors
    - Monitoring
-

Visual checks on site

Note: Walkthrough checklist for the No-beam run after the June 2025 beamtime:
Mu3e daily area checklist

To enter the area you need instruction from Andreas Knecht (or deputy)

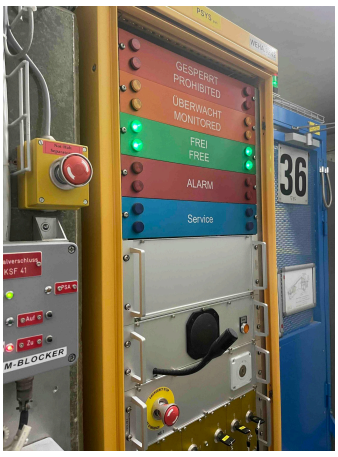
- Understand what you see
- Risks (e.g. Magnet on)
- Entrance procedures

Before startup after a period of interruption, or at least once a day the shift crew should do a walk through. Assess the state of all services as a non-expert = common sense approach. Ask questions if needed. Non exhaustive list

- Something leaking, making weird noises?
- Any device in an error state (Note that the Huber chillers have a maintenance warning which we ignore for the 2025 beamtime)
- Anything not connected which you think should be (e.g helium cooling tubes)
- Chiller running at sensible set points
- After a helium system startup the interlock system needs to be unlatched (reset) https://elog.psi.ch/elogs/Testbeams/3539 . If the interlock is engaged for any other reason first understand why. Reference status for 2025

Some PiE5 basics

Area state , and magnet warning. One can walk around the magnet with the field on, but no loose metal objects allowed.



- FEC chiller manifolds in nominal condition:

- 
- Chiller for helium return running on platform 2
- 

Operations on site (if needed)

Also have a looks at
https://physi.uni-heidelberg.de/Forschung/he/mu3e/wiki/index.php/Operation_Procedures

Opening magnet flanges

2 people: one performing one checking. Open carefully. Make sure the flanged are hooked

Closing magnet flanges

3 people: one performing, two checking. Check that the power cables do not get squeezed on the top of the flanges (1 person) and the fibres do not get squeezed on the bottom of the flanges (1 person).

Service checks (online)

The prinicple is that services will be on all time.
Services (random)

- Magnet status
- Power distribution
- Helium
- Chillers
- FEBs
- Environment

Re-turning on

If something went off by any accident. List same as above but with turning on procedures rather than checks

- Magnet status
- Power distribution
- Helium
- Chillers
- FEBs
- Environment
-

Liquid cooling (FEC)

- Ideally, one should go & visually observe that valves are running in operations mode
- If valves are in bypass mode or chiller is not running, you are limited to running 1-2 FEBs per side & DCDC current draw at most 5-6 A
- ~~Observe the values on the history page under Liquid Cooling~~
- Temperatures should ideally be stable at 15C

Turning on

Note: The circulation should not be toggled regularly.

step 1: Set the valves in DS + US LOOP configuration.
-> See attached picture for valve positioning.

step 2: Make sure the "Unichiller Temperature" Midas Alarm is active
Enable the "Unichiller running" warning

step 3: Make sure Liquid Cooling Frontend is running

step 4: Turn on temperature control
Go to the Liquid Cooling FECs Midas equipment
Check if the primary setpoint is set in the range 14-18 C
Start circulation by setting Temperature Control to 1.

step 5: Watch the system stabilize (pressure and temperature) in the History. If something is off, visually inspect the system again (Unichiller controller and manifold)

Turn Off

- Turn the chiller off Temperature Control to 0
- Watch the circulation stop in the history pages (pressure goes to 1 bar , flow goes down)
- Disable the Unichiller running warning in the midas alarm system

Operation

Temperature alarm has to be running
If the PID gets unstable (like in the top picture), or the alarm triggers:

- Turn the chiller off Temperature Control to 0
- Set system in bypass mode (See valve positions)

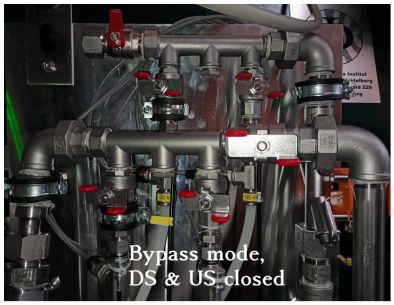
Monitoring

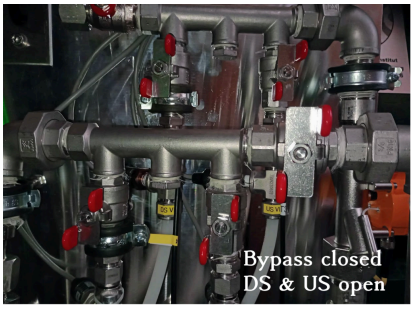
- It is observed that, if the valves are in bypass mode, the Unichiller Pressure runs at 4500
  Note: This mode means there is no cooling water to the electronics - hence no cooling!
- While if the valves are in operations mode, the Unichiller Pressure runs above 6000
- Monitoring plots in the history system:
  Temperatures:
  Setpoint: Target outlet temperature of the chiller
  Internal Temperature: Sensed by the chiller, outlet fluid temperature.
  Flow A / B inlet & outlet Temperatures: Similar to setpoint Temperature, < 2°C difference between outlet and inlet, following the Internal temperature reading from the chiller
  Flow:

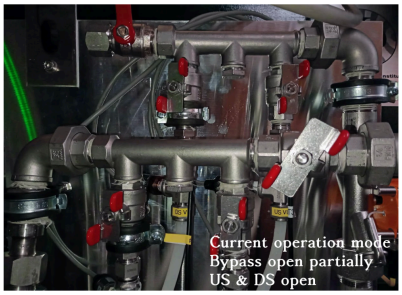
To be calibrated. We see about 20l/min on the display

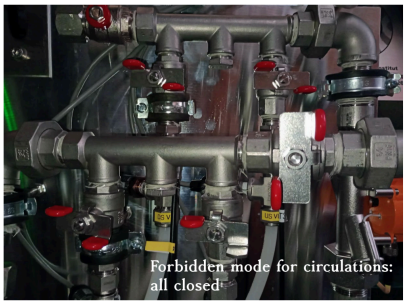
Pressures:

To be calibrated. Outlet pressures should both be around 6.5bar absolute; Inlet Pressures TBD









Running Helium System

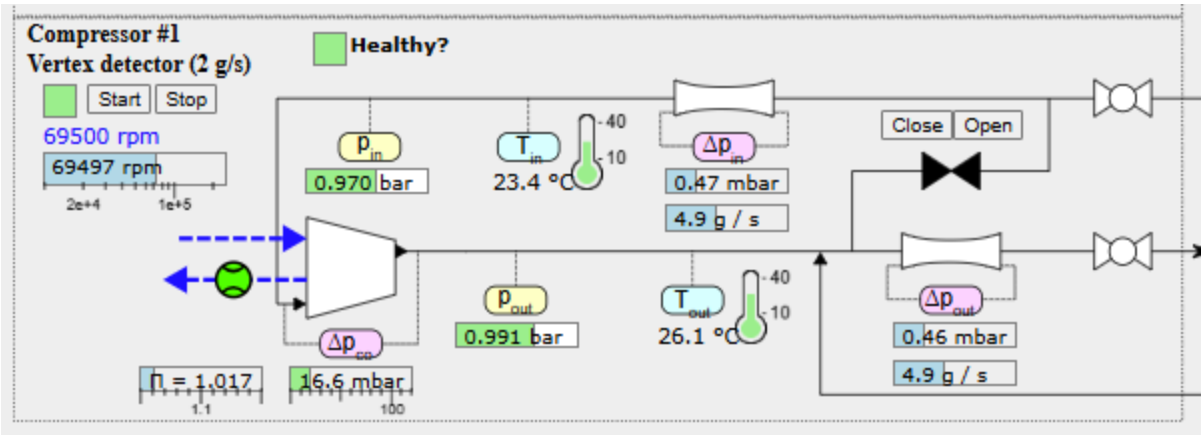
Refer manual in Internal Note: https://www.physi.uni-heidelberg.de/Forschung/he/mu3e/restricted/notes/Mu3e-Note-0119-HePlantPiE5.pdf

Running Helium System in Air Mode FW comment: we are running

Refer manual in Internal Note: https://www.physi.uni-heidelberg.de/Forschung/he/mu3e/restricted/notes/Mu3e-Note-0119-HePlantPiE5.pdf

Turn on

1. Ensure that Helium PiE5 FE is running and that all Allow Air? Indicators are dark green and not grey
2. Visually ensure that He lines are connected & not blocked
3. Set the demand compressor speed value to 20000 rpm
4. Start the compressor
5. Increase the compressor speed in steps of 10000 + 5000 to 35000 rpm
6. Check that the bypass is closed (black color, not blue). If unsure, you can hover your mouse over the bypass icon to read the status. If bypass is not closed, then press the Close button.
7. Increase the compressor speed in steps of 10000 to 60000 rpm.
8. Ensure that Healthy? Icon turns to green



Turn off

1. Make sure that no one needs cooling in the first place and that Pixels is off
2. Reduce the speed to 35000 rpm
3. After a few seconds, reduce the speed to 20000 rpm
4. Stop the compressor

Small refill of Helium System

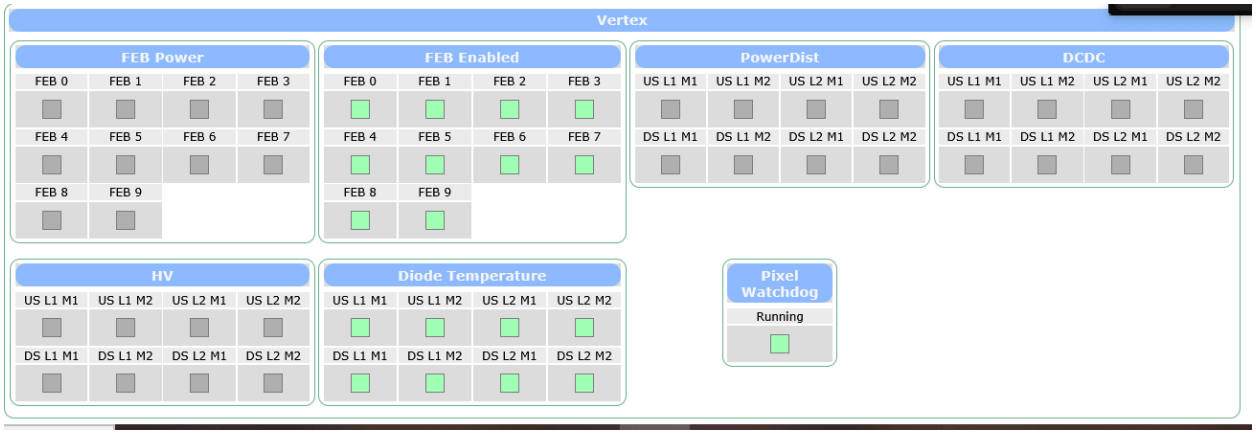
1. The expansion volume level approaches 20%
2. Please perform a so called “small refill”
3. The procedure is described in a google form, also the some documentation is directly stored:
    a. https://forms.gle/WDXufxyse1PEVEDD8
4. Please create also an ELOG

Turn on systems (only when necessary)

Turning on a system means turning on the Power Distribution, DCDC and HV channels specific to that system.
3 subsytems ran in parallel. They can be turned on all or just some. Must be clarified for each shift.
Turning on can be done only one by one.

Before starting

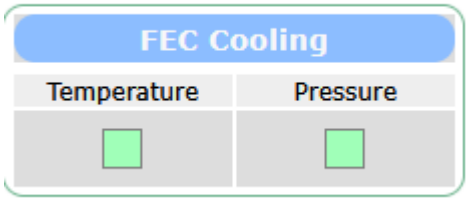
Go to the page Services/System Status and make sure the your equipment is in the status you expect it. For instance, for Vertex:



This means that the Vertex is off (Power Dist, DCDC and HV all gray), the temperatures are OK, Watchdog running, but the FEBs are off. All FEBs are enabled.

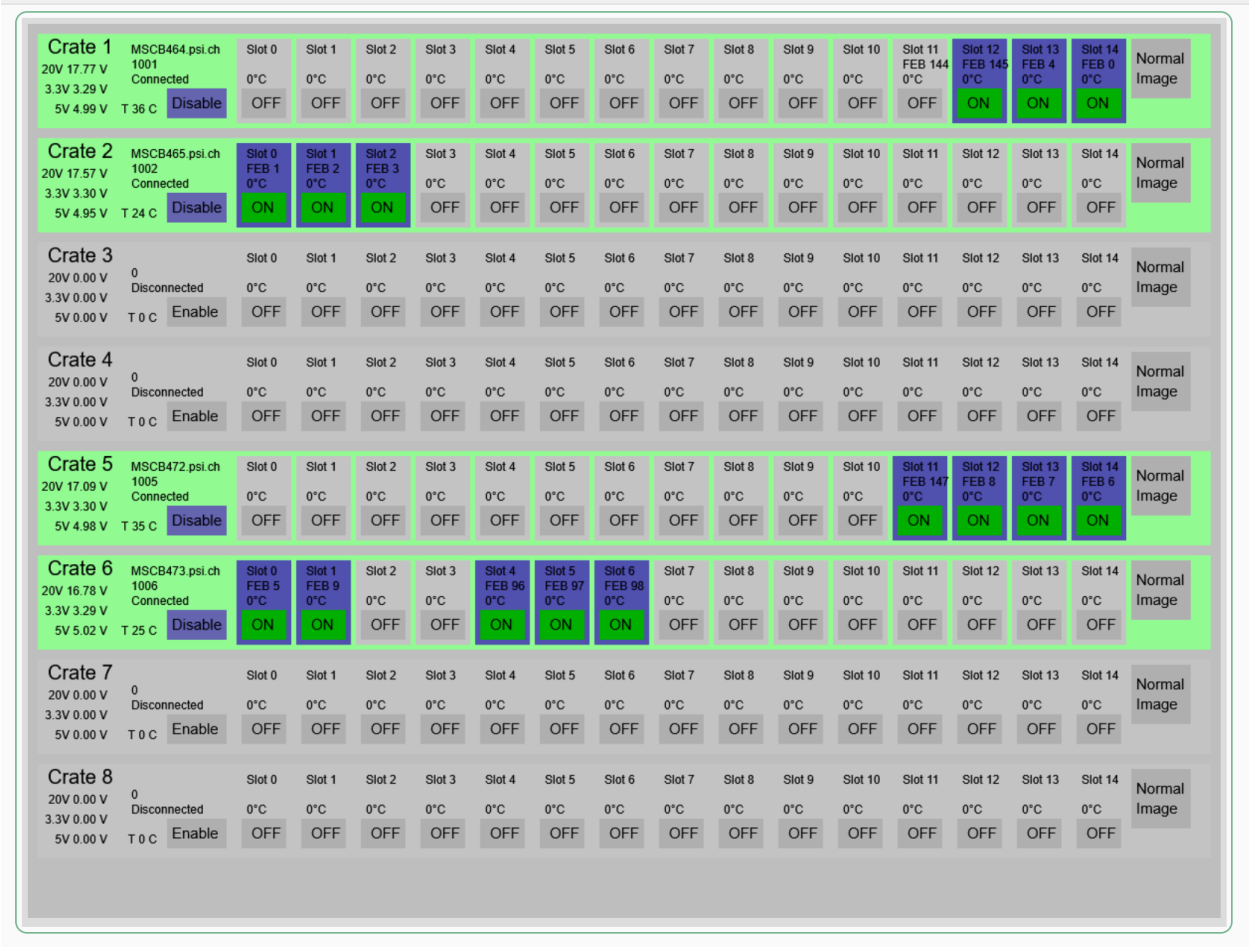
Frontend boards

You can turn on FEBs from the DAQ/FEB Crates page. For running a FEB, make sure it is enabled in the ODB. **MAKE SURE THE COOLING IS WORKING BEFORE!** This can be



verified in the System Status page:

This is how the page looks when all FEBs are on:



Vertex FEBs

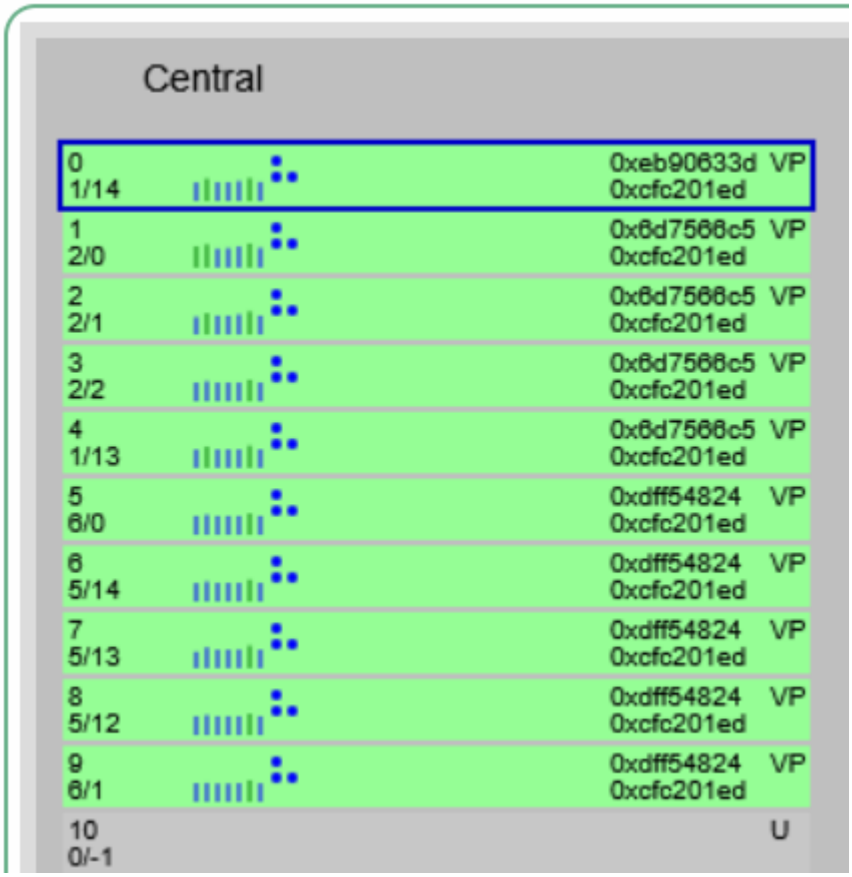
The vertex FEBs are the ones labelled from 0 to 4 (US) and 5 to 9 (DS). If you want to use a portion of them, make sure you disable them before running SW Central. To enable/disable a FEB, go to /Equipment/LinksCentral/Settings, set LinkMask to 3 (enabled) or 0 (disabled) to the value at the corresponding index. The tables in Services/System Status will help you.
To turn on from scratch:

- Turn on all FEBs (Feb 0 to Feb 9)
- You can tell if the buttons are working as you should see messages about turning on FEBs
    - If you don't see the messages, reload the page or restart FebCrate Frontend
- And you should see messages like these in the Messages page (x10):

```
[Febcrate Frontend,INFO] Switching on FEB 2 in crate 1 (index 17)
[Febcrate Frontend,INFO] Switching on FEB 1 in crate 1 (index 16)
[Febcrate Frontend,INFO] Switching on FEB 0 in crate 1 (index 15)
[Febcrate Frontend,INFO] Switching on FEB 14 in crate 0 (index 14)
[Febcrate Frontend,INFO] Switching on FEB 13 in crate 0 (index 13)
```

-

- →**<u>Wait one minute</u>** until all links are stabilized**!!!**
- Start SW Central from the Programs page
    - Wait for receiving the message “Done” in the “switch” message section
    - Make sure there are no errors in the Message page regarding FEB connections
    - To cross-check everything worked fine, check the page DAQ/FEBs, it should look like this:



    - If one of the FEBs on the top left has red dots:
        - Stop SW Central
        - power-cycle the FEB(s) from the DAQ/FEB crates page as above
        - Wait a bit
        - Start SW Central

Known issues:

- You receive a message like this:

```
11:03:07.673 2025/03/24 [SW Central,ERROR] [switch_fe.cpp:222:frontend_init(),ERROR] No switching board present or driver not loaded
11:03:07.665 2025/03/24 [SW Central,ERROR] [switch_fe.cpp:632:init_mudaq(),ERROR] Could not open device
```

    - Go to switch0 ~/online/common/kerneldriver and run sudo ./load_mudaq.sh
- If a FEB malfunctions and causes all chips to lose configuration, avoid power-cycling the FEBs with the Vertex detector still on. Power down vertex then power-cycle the FEBs.

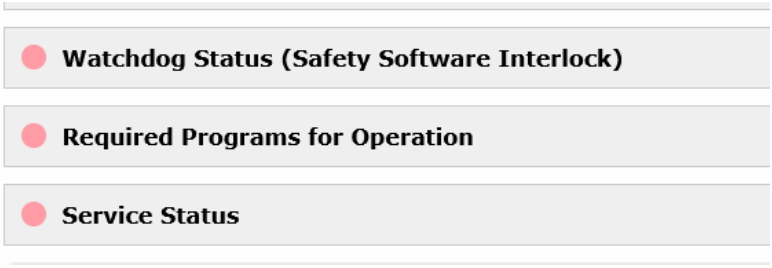
Vertex

Glossary and general guidelines:

- Turn-on power partition (PP): turn on LV and HV, adjust HV to operational
- Adjust VDD power partition: adjust LV trim to hit target VDD
- Turn-off power partition: turn off HV and LV
- Power-up a chip: bring the chip to full power mode
    - This can be done to all chips in a power partition
- Power-down a chip: bring the chip to the minimum power mode
    - This can be done to all chips in a power partition
- Most buttons in the custom page start a sequencer script
    - They get gray (disabled) while the sequencer is running
    - The get blue again (enabled) when it is over
    - Wait every time you press a button

Check status

From the page Pixel/Pixel Control check the 3 dots on top left, they should be green:



If any is red, click on the bar to see details. Typical reasons:

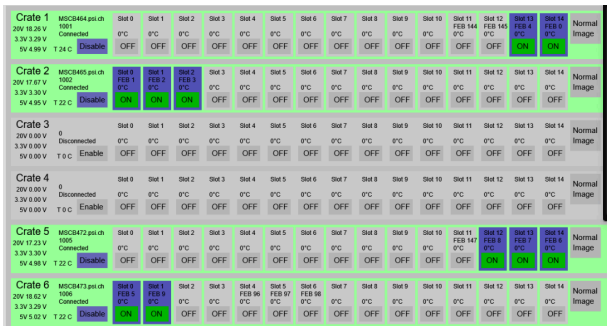
- Watchdog is red
    - TDK: likely interlocked
        - Toggle interlock in the area
        - Go to Status, click TDK PiE5 and set on the pixel TDK

#	Name	Output On	Mode	Demand	Voltage	Current limit	Current
0	FEC US	Yes	CV	20.00 V	19.99 V	7.00 A	0.23 A
1	FEC DS	Yes	CV	20.00 V	19.99 V	11.00 A	0.25 A
2	TDK13	No	OFF	20.00 V	0.00 V	0.50 A	0.00 A
3	TDK14	No	OFF	20.00 V	0.00 V	0.50 A	0.00 A
4	TDK15	No	OFF	20.00 V	0.00 V	0.50 A	0.00 A
5	TDK16	No	OFF	20.00 V	0.00 V	0.50 A	0.00 A
6	SCI US	Yes	CV	20.00 V	19.99 V	2.00 A	0.00 A
7	SCI DS	No	OFF	20.00 V	0.00 V	5.00 A	0.00 A
8	VERTEX US	Yes	CV	20.00 V	19.99 V	7.00 A	0.00 A
9	VERTEX DS	Yes	CV	20.00 V	19.99 V	7.00 A	0.00 A
10	HV US	Yes	CV	20.00 V	20.00 V	3.00 A	1.41 A
11	HV DS	Yes	CV	12.00 V	12.00 V	3.00 A	2.43 A
12	TDK23	No	OFF	5.00 V	0.00 V	0.50 A	0.00 A
13	TDK24	No	OFF	5.00 V	0.00 V	0.50 A	0.00 A
14	SC US	Yes	CV	12.00 V	12.00 V	1.00 A	0.30 A
15	SC DS	Yes	CV	12.00 V	12.00 V	1.00 A	0.47 A

The mode should be CV

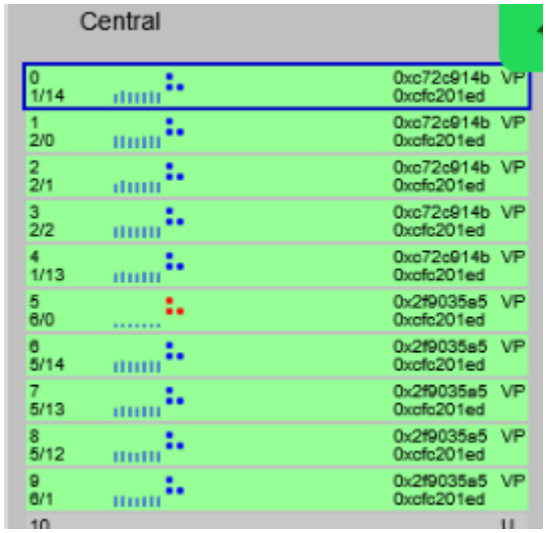
- Required programs red
    - Some programs not running

        - Open the bar, check which program and start it from the Program page
        - Note: SW Central depends on FEBs, see next point
- Service Status red:
    - DCDC Crates off
        - Use the button “Set Crates on”. Press it multiple times if it does not work.
    - FEB Power off
        - SW Central program might be stuck. Stop and start it from the Programs page.
        - If the FEBs are off:
            - Turn them on from the DAQ/FEB Crates page:



this is how it should appear. Make sure you also see messages on the top bar showing they are being turned on.

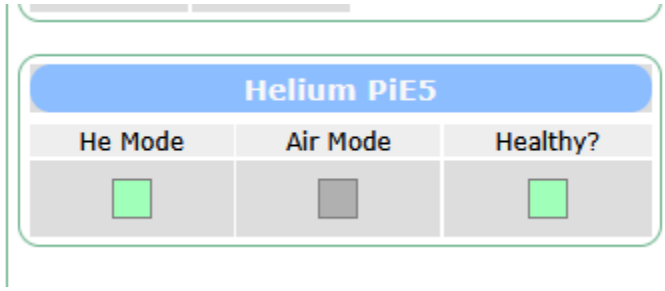
            - Wait 30-60 seconds and start SW Central
            - Check the DAQ/FEBs page, and make sure all dots for the FEBs 0-9 are blue:



            - If some is red:
                - Restart SW Central (and wait up to a minute, display will also not update until it starts again)
                - If multiple restarts doesn’t work, try to power-cycle the FEB

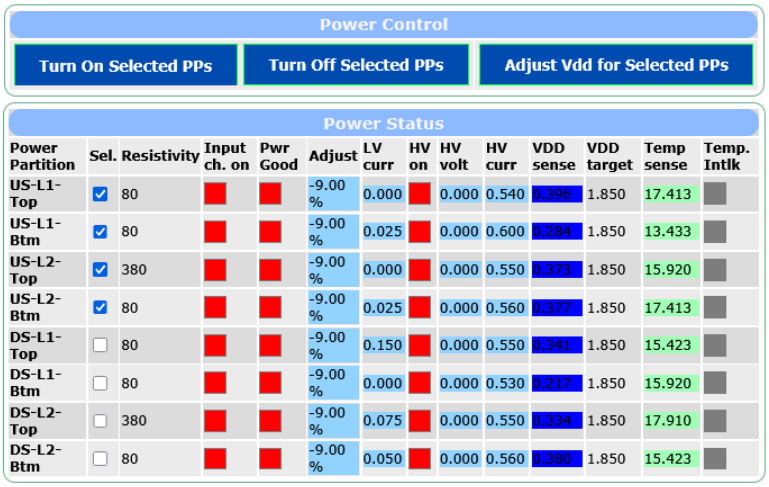
Check Helium

From the System Status page, check the Helium table:



Turn on

Make sure the status dots on top right are green
From the Pixel/Pixel Control page, in the power tab, select the power partitions you want to turn on and click “Turn On Selected PPs”:

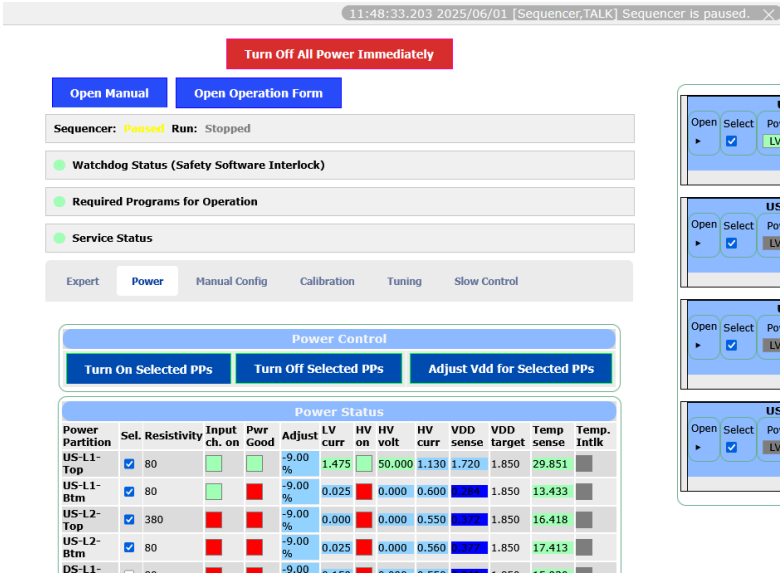


Power Partition	Sel.	Resistivity	Input ch. on	Pwr Good	Adjust	LV curr	HV on	HV volt	HV curr	VDD sense	VDD target	Temp sense	Temp. Intlk
US-L1-Top	☑	80			-9.00 %	0.000		0.000	0.540	0.396	1.850	17.413	
US-L1-Btm	☑	80			-9.00 %	0.025		0.000	0.600	0.284	1.850	13.433	
US-L2-Top	☑	380			-9.00 %	0.000		0.000	0.550	0.373	1.850	15.920	
US-L2-Btm	☑	80			-9.00 %	0.025		0.000	0.560	0.377	1.850	17.413	
DS-L1-Top	☐	80			-9.00 %	0.150		0.000	0.550	0.341	1.850	15.423	
DS-L1-Btm	☐	80			-9.00 %	0.000		0.000	0.530	0.217	1.850	15.920	
DS-L2-Top	☐	380			-9.00 %	0.075		0.000	0.550	0.334	1.850	17.910	
DS-L2-Btm	☐	80			-9.00 %	0.050		0.000	0.560	0.380	1.850	15.423	

Here will we turn on US PPs
[If Temp Intlk is red contact experts]
Now the buttons should become gray (disabled) until all selected power partitions are on.

Known issues

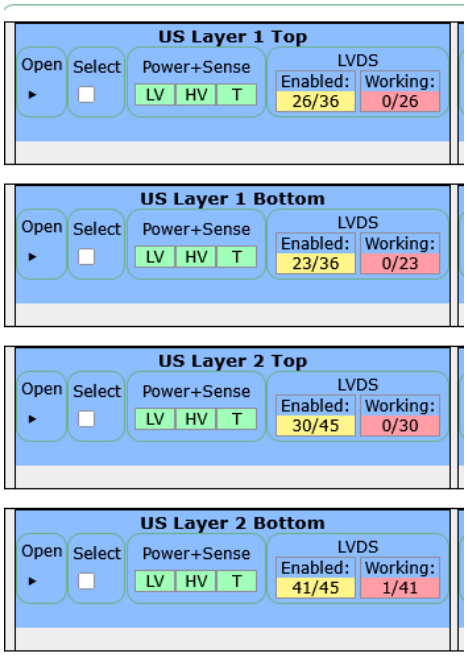
- The Watchdog gets red and the Sequencer gets paused, an error should appear on the top bar, buttons get blue



    - Call an expert (LV, TS, J)

Adjust Voltage

Click “Adjust Vdd for Selected PPs”
At the end, in the geometry view on top right, you should find Power and Sense boxes all green:



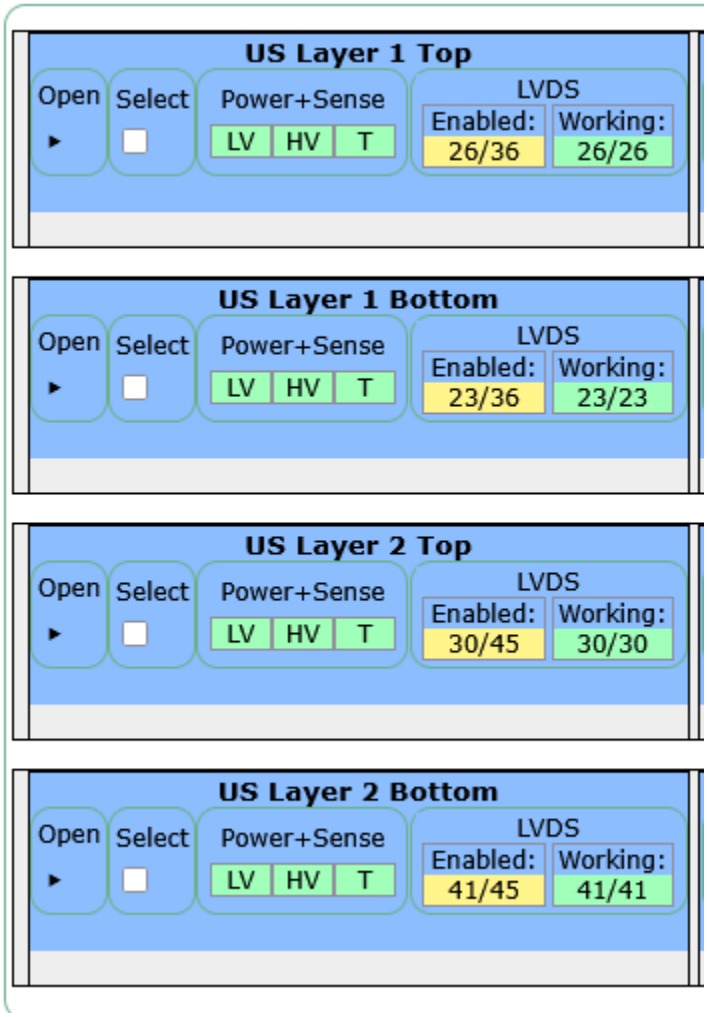
DO NOT CLICK “Set HV for selected PPs” yet!

Power up

We do it all PPs together

- In the geometry view on the top right, click “Select all active sensors”
- In the Manual Config tab, click “Configure Min -> SC”
- In the Manual Config tab, click “Configure SC -> Full”
    - If the LV box gets blue on the top of the power partition (pic above), the VDD went down
        - Go to the Power page
        - Select the power partition
        - Click “Adjust VDD…”

At this stage you should see something like this:



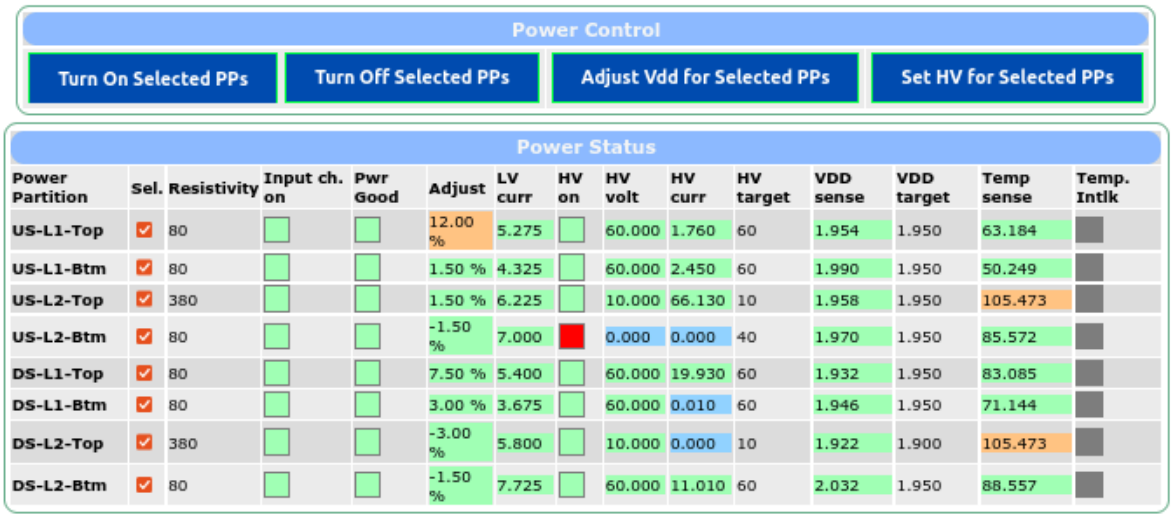
All Power+Sense green, all enabled LVDS links working

Set HV voltage

Go back to the power tab and click “Set HV for selected PPs”

Noise Scan Procedure with PySequencer

1. Prepare the Scan



Power Partition	Sel.	Resistivity	Input ch. on	Pwr Good	Adjust	LV curr	HV on	HV volt	HV curr	HV target	VDD sense	VDD target	Temp sense	Temp. Intlk
US-L1-Top	☑	80			12.00 %	5.275		60.000	1.760	60	1.954	1.950	63.184	
US-L1-Btm	☑	80			1.50 %	4.325		60.000	2.450	60	1.990	1.950	50.249	
US-L2-Top	☑	380			1.50 %	6.225		10.000	66.130	10	1.958	1.950	105.473	
US-L2-Btm	☑	80			-1.50 %	7.000		0.000	0.000	40	1.970	1.950	85.572	
DS-L1-Top	☑	80			7.50 %	5.400		60.000	19.930	60	1.932	1.950	83.085	
DS-L1-Btm	☑	80			3.00 %	3.675		60.000	0.010	60	1.946	1.950	71.144	
DS-L2-Top	☑	380			-3.00 %	5.800		10.000	0.000	10	1.922	1.900	105.473	
DS-L2-Btm	☑	80			-1.50 %	7.725		60.000	11.010	60	2.032	1.950	88.557	

-Dont write TDACs

-If Vertex is started properly and all power partitions should look like this:

-Start manually a run.

-Then open the tmux session on the backend to monitor the PySequencer.

- Open the file `vtx_noise_scan.py` (e.g. in VSCode) and edit the parameters according to the table below:

VPDAC_value TDAC_value start_iteration

	5	0	20000
	5	1	21000
	5	2	22000
	5	3	23000
	5	4	24000
	5	5	25000
	5	6	26000
x	5	7	27000

It's recommended to change and save the parameters directly in VSCode to avoid mistakes.

2. Start the PySequencer

1. Go to `odb/Equipment/PySequencer/State` → Check that the `Filename` is set to `vtx_noise_scan.py`.

2. Go to `odb/Equipment/PySequencer/Command` → Click “Load new file”.

3. Go to `odb/Equipment/PySequencer/Param/Value` → Verify that the parameters are correctly loaded from your script.

4. In `odb/Equipment/PySequencer/Command`, click “Start script” to begin the scan.

3. Troubleshooting Tips

- In the tmux session, watch the initial output:

- If the parameters are not initialized properly, click “Start script” again. (This is a known MIDAS bug.)

- If many chips show noisy pixels immediately:

- Click “Stop”, then click “Start script” again. This usually resolves the issue.

The script takes approximately 5–7 hours to complete.

4. Organize Output Files

Once the scan is finished:

1. Navigate to: /home/mu3e/online/online/userfiles

2. Create a new folder named: vpdac_5_tdac_<TDAC_value> (Replace <TDAC_value> with the actual TDAC value used in your scan)

3. Copy the hitmap files from the correct iteration range:

```
find . -maxdepth 2 -wholename
"./tdac_files_runs/hitmap_chip_*_iteration_*.bin" \
| awk -F'[_./]' '{for (i = 1; i <= NF; i++) {if ($i == "iteration" && (i+1) <= NF
&& $((i+1)) ~ /^[0-9]+$/) {if ($((i+1)) >= 20000 && $((i+1)) <= 21000)
print}}}' \
| xargs -I{} cp {} vpdac_5_tdac_<TDAC_value>/
```

Update the iteration range based on the scan settings.

5. Copy Final TDAC Masks

1. Inside your folder vpdac_5_tdac_<TDAC_value>, create a subfolder:

```
mkdir vpdac_5_tdac_<TDAC_value>/final_tdacs
```

2. Copy the final TDAC mask files into this folder:

```
cp tdac_files/* vpdac_5_tdac_<TDAC_value>/final_tdacs/
```

Again, make sure to replace <TDAC_value> accordingly.

Write TDACs

We do it all PPs at a time for now

- Make sure the active sensors are still selected
    - otherwise on the top right click “Select all active sensors”

- From the Manual Config tab click “Write TDACs”
- The
- If you click on the LVDS box you should see something like this:

			Locked	Ready	DPA	Alignments	Phase	Out of Phase	Disp. Err	8b10b Err	Hits	Active	Inverted	Matrix
Ladder 1 (FEB 0)	Chip 1 gID=1	Link 0	-1	1	1	52	1	0	0	0	1650	yes	no	C
		Link 1	-1	1	1	46	2	0	0	0	1211	yes	no	B
		Link 2	-1	1	1	12	1	0	0	0	3174	yes	yes	A
	Chip 2 gID=2	Link 3	-1	1	1	37	0	0	0	0	192	yes	yes	B
		Link 4	-1	1	1	46	0	0	0	0	282	yes	yes	A
		Link 5	-1	1	1	40	0	0	0	0	276	yes	yes	C
	Chip 3 gID=3	Link 6	-1	1	1	40	2	0	0	0	7055	yes	yes	A
		Link 7	-1	1	1	10	2	0	0	0	135	yes	yes	C
		Link 8	-1	1	1	52	2	0	0	0	1560	yes	yes	B
Ladder 2 (FEB 0)	Chip 1 gID=33	Link 9	-1	1	1	49	2	0	0	0	1341	yes	yes	C
		Link 10	-1	1	1	37	2	0	0	0	1088	yes	yes	B
		Link 11	-1	1	1	40	2	0	0	0	2507	yes	yes	A
	Chip 2 gID=34	Link 12	-1	1	1	23	0	0	0	0	1163	yes	yes	B
		Link 13	-1	1	1	55	0	0	0	0	2417	yes	yes	A
		Link 14	-1	1	1	38	0	0	0	0	1730	yes	yes	C
	Chip 3 gID=35	Link 15	-1	1	1	6	1	0	0	0	1433	yes	yes	C
		Link 16	-1	1	1	54	1	0	0	0	6950	yes	yes	A
		Link 17	-1	1	1	24	1	0	0	0	86	yes	yes	B
Ladder 3 (FEB 0)	Chip 1 gID=65	Link 18	-1	1	1	30	3	0	0	0	149	yes	no	B
		Link 19	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	no	no	-
		Link 20	-1	1	1	50	3	0	0	0	139	yes	yes	A
	Chip 2 gID=66	Link 21	-1	1	1	52	3	0	1	1	3544	yes	yes	B
		Link 22	-1	1	1	10	3	0	0	0	4948	yes	yes	A
		Link 23	-1	1	1	57	3	65536	0	0	9710	yes	no	C
	Chip 3 gID=67	Link 24	-1	1	1	56	3	65536	0	0	185	yes	yes	A
		Link 25	-1	1	1	14	3	0	0	0	123	yes	yes	C
		Link 26	-1	1	1	20	3	0	0	0	234	yes	yes	B

  with a certain hit rate due to noise. (Out of phase should be 0 as well)

At this point, if you close all power partitions on

SciFi

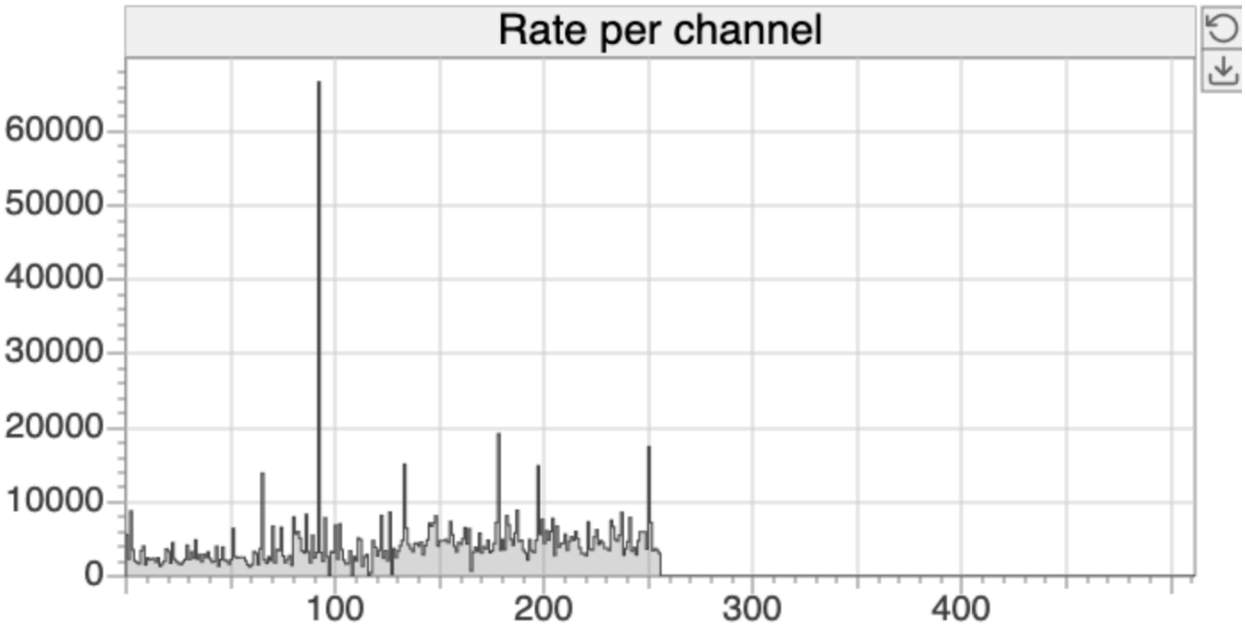
Basic startup sequence:

1. LV on
2. HV on
3. Configure
4. Toggle all resets

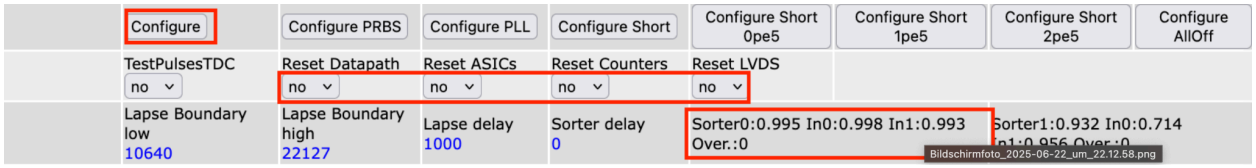
See also https://elog.psi.ch/elogs/Testbeams/4958 and the SciFi monitoring custom page

Monitoring during Cosmic Run Jul 25

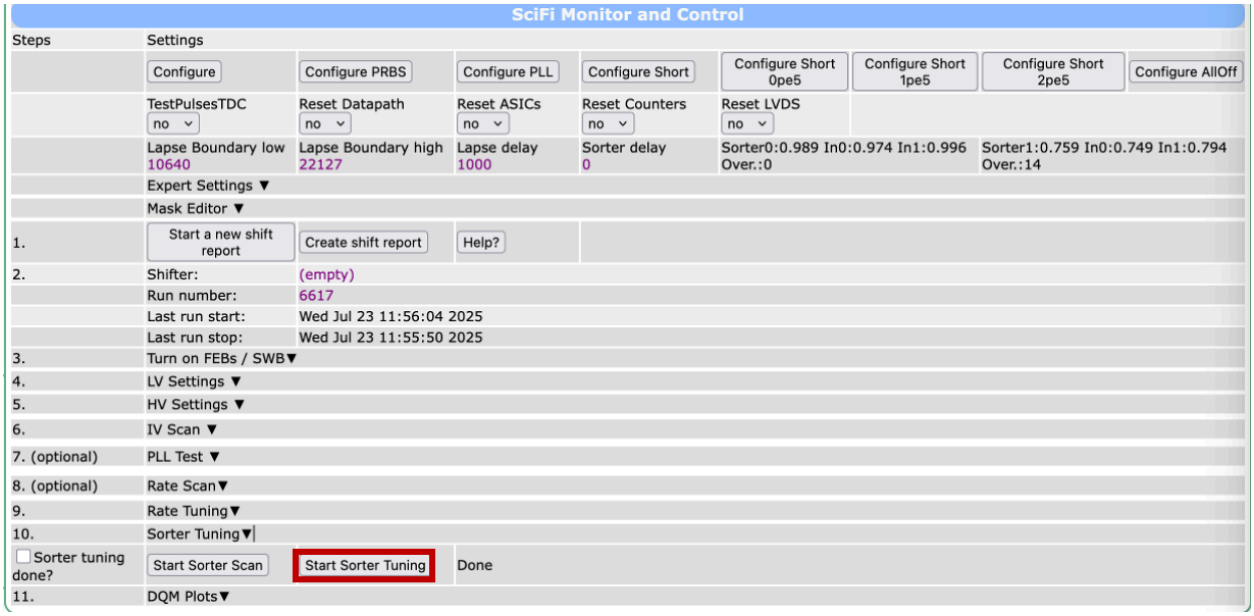
- In the “Scifi-Monitor” custom page, check the LV and HV current
  - LV should be in the region of 6.5 ± 0.1 A
  - HV should be 6-10 uA



- Under DQM Plots check the plot “rate per channel”, this should look something like the one above, i.e. somewhat flat
    - Some outliers are ok
    - Channels 128-255 have generally a bit a higher rate than 0-127
- Check the efficiency of sorter 0, it should be in the high 90ies



- If not, try pressing configure and the resets (will jump back to no immediately) and restart a run
- If this does not work, try turning off HV, then LV and then restarting LV then LV



-
- If it's still low, click start sorter tuning

Normal operation:

Go to the SciFi/Scifi-Monitor page

- check that the Crates are on (green light)
- Start the FEBs by ticking these two boxes
- Click on SW Fibre on/off to be directed to the Programs page, there start the SW Fibre if it is not yet running

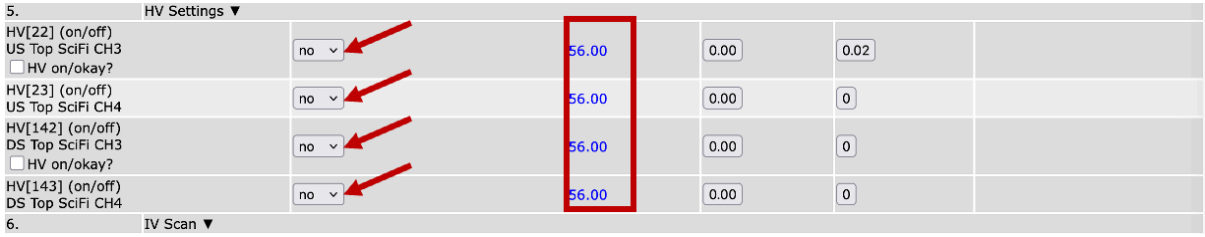
LV

- turn on the HV by setting the dropdown selectors to "yes"
    - before configuring the current is somewhat random, but usually around 8 A and slowly dropping

- Press “Configure Short” with the desired threshold
    - the current should drop to ~6.5 A

HV

- Never turn on HV when not configured in short mode



- In the red box is where we set the HV value
    - normal operation point is 56 V
    - this can only be set per HV board, i.e. per side
- set the dropdown selectors (red arrows above) to yes for the channels you want to turn on
    - the expected current (last line) changes with irradiation (and if there is beam), currently (after June 25 TB) it is around 10 uA for noise runs

PLL Test

- turn on LV, make sure HV is off
- configure short
    - the LV current should go to ~6.5 A
- configure PLL
    - the LV current should go to ~6 A
- now choose channels you want to look at by clicking on them and setting mask to “y” **->click Configure**
- start a run
- you should see under PLL Test a peak at 200 k, sometimes there are also some other peaks, but as long as the 200 k one is there it is locked
- **ch 128-159 and 192-223 will not lock, should be masked**
- if not locked
    - the vnvcodelay0, vncnt0, vncnt0 are for channels 0-31, vnvcodelay1… for ch 32-63 etc
    - change mostly vnvcodelay to get it to lock (usually values between 10 and 30)
        - first try to go to 0 and then back to what is was
    - if you can’t get it to lock with vnvcodelay, try vncnt and vncnt

IV Scan

- turn on LV
- in HV settings set the channel you wanna test to yes
- in IV Scan press start scan
- download the scans (csv and png) on top right of plot and post them here: https://elog.psi.ch/elogs/Testbeams/4795

Turn Off

- In the Scifi-Monitor custom page, under 5. HV, turn off the HV (set the dropdown selector to “no”, you can leave the set value at 56 V
- Under 4. LV set the dropdown selectors to “no”

- Under 3 uncheck the two boxes on the right to turn off the FEBs

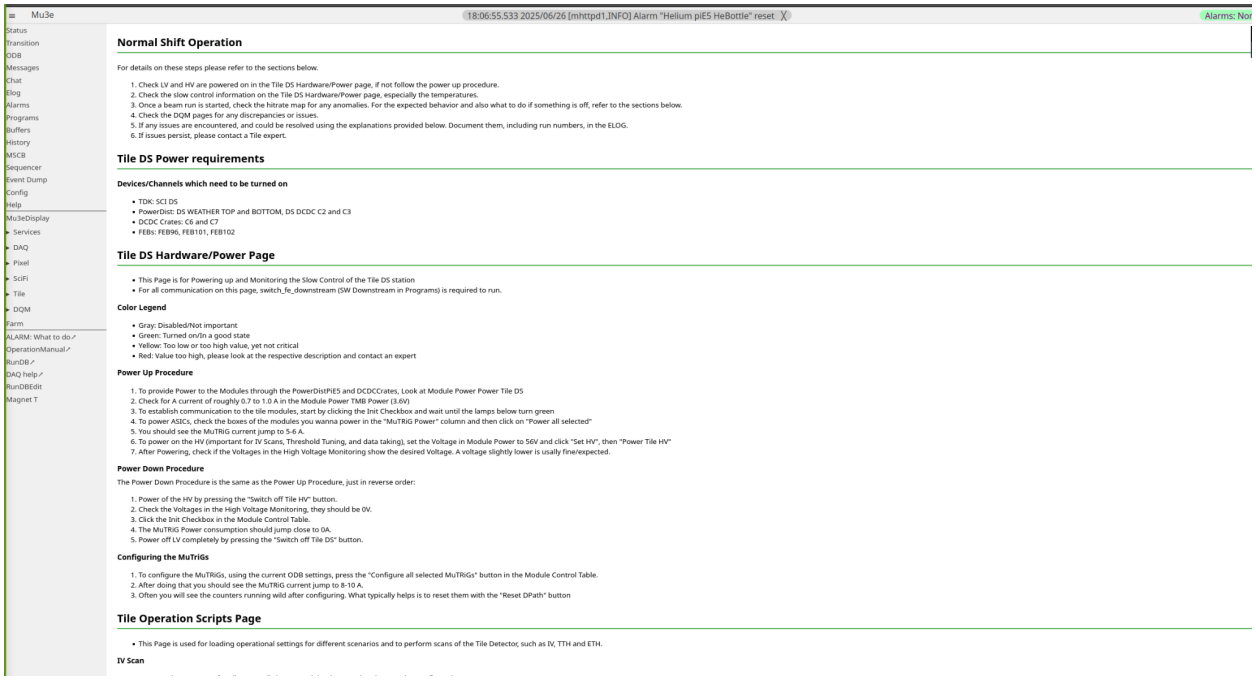
General Notes

when there are problems, i.e. data looks weird.

- try reset datapath, reset asics and reset counters at top of scifi page
- under Programs restart "SW Fibre"

SciTiles

Documented on the tile custom page: cmd=custom&page=tile/Tile-Instructions

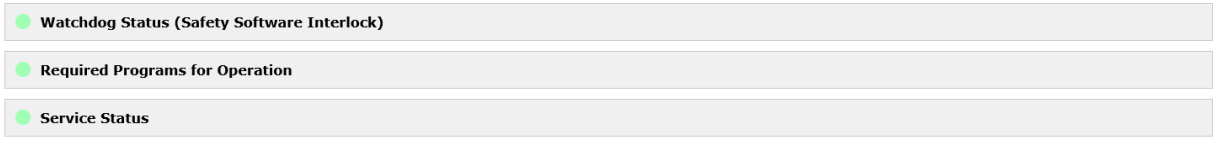


Operating systems

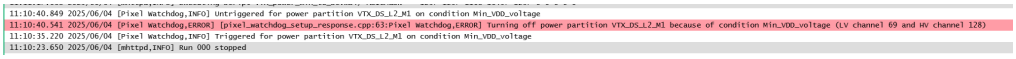
Vertex

While running check:

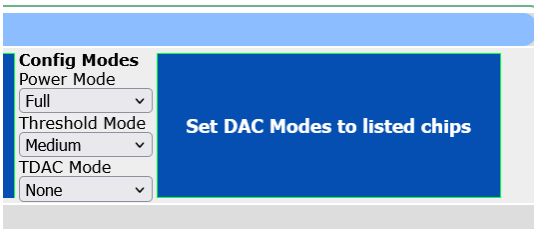
- The 3 dots on top left bars are green:



    - If Service Status is red: click on bar, it will open. Then you see a breakdown of the issues:
        - FEB Power not OK (correlated with LVDS links bad)
            - Stop SW Frontend
            - Start SW Frontend
            - Wait
    - If Watchdog is red
        - If for a short time and nothing happens, OK
        - If it is really bad, it will turn off some PPs
            - The PP LV box will show gray LV and HV
            - Check on messages->Vertex for a red watchdog message
        - Sometimes the issue goes away and you do not see it in the watchdog anymore (the dot gets green)
        - If it is there (the dot is red), click on the bar and check which issue is red

-


    - Check Power and LVDS boxes
        - Power all green
            - If LV Blue: underpower
                - Click
        - LVDS working links green
            - If not: open the power partition and spot the bad chips (with orange/red dots)
            - Click on them
            - Go to the Manual config tab
            - Click configure
            - [Ask expert for this, if this is the case we have to update TDACs]

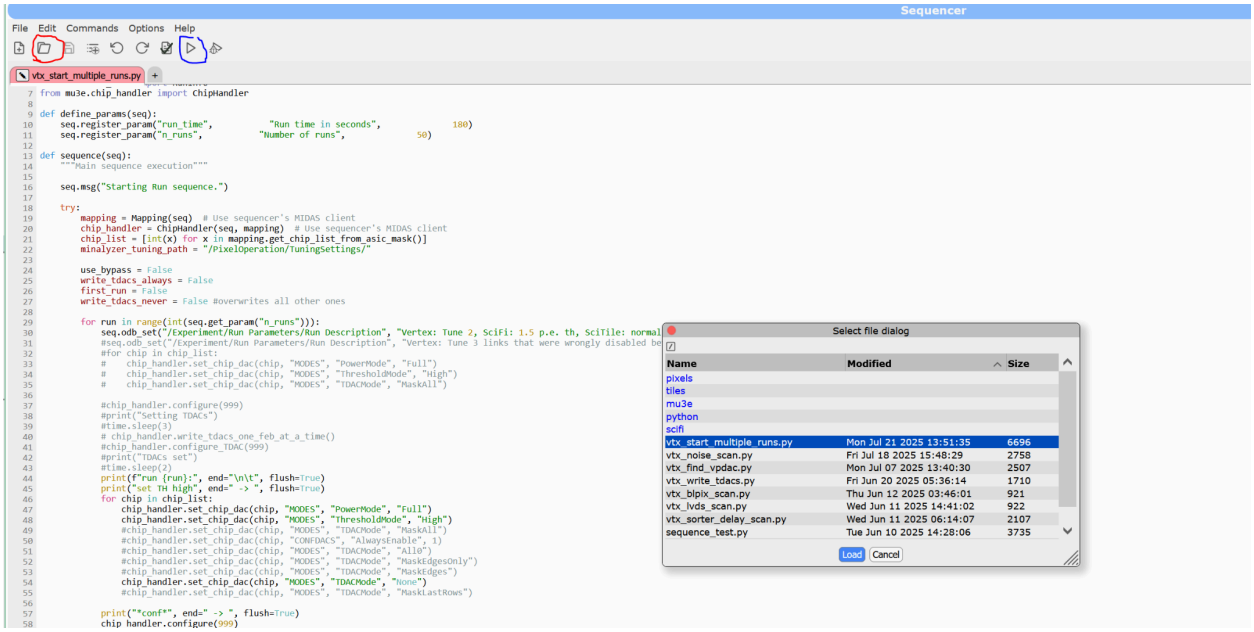


            Check config mode
                - Set Power to full
                - Set Threshold to Medium
                - Set TDAC to None
                - Click Set DACs Modes to listed chips
                - Click configure
            - If not good, click reset PLL
            - If not good, click reset Biasblocks
            - Very worst:
                - Click Configure Full->Min
                - Click Configure Min->SC
                - Click Configure SC->Full
            - If nothing works call experts

Data taking

Starting runs

We use the pySequencer for now
Open the pySequencer page, load “vtx_start_multiple_runs.py” (highlighted in red below) and start (highlighted in blue below)



The page will ask you for the total number of runs and their length. Typical value of a length is 180 (3 min) or 300 (5 min). The total number depends on how long you wish to take data for in total.

Stopping runs

To stop the pySequencer and all runs

- Go to the pySequencer page and press stop
    - The button highlighted in blue above becomes a square while the pySequencer is running
- Go to the Sequencer page and press stop
    - There is a similar button
- Stop the run from the State or Transition page

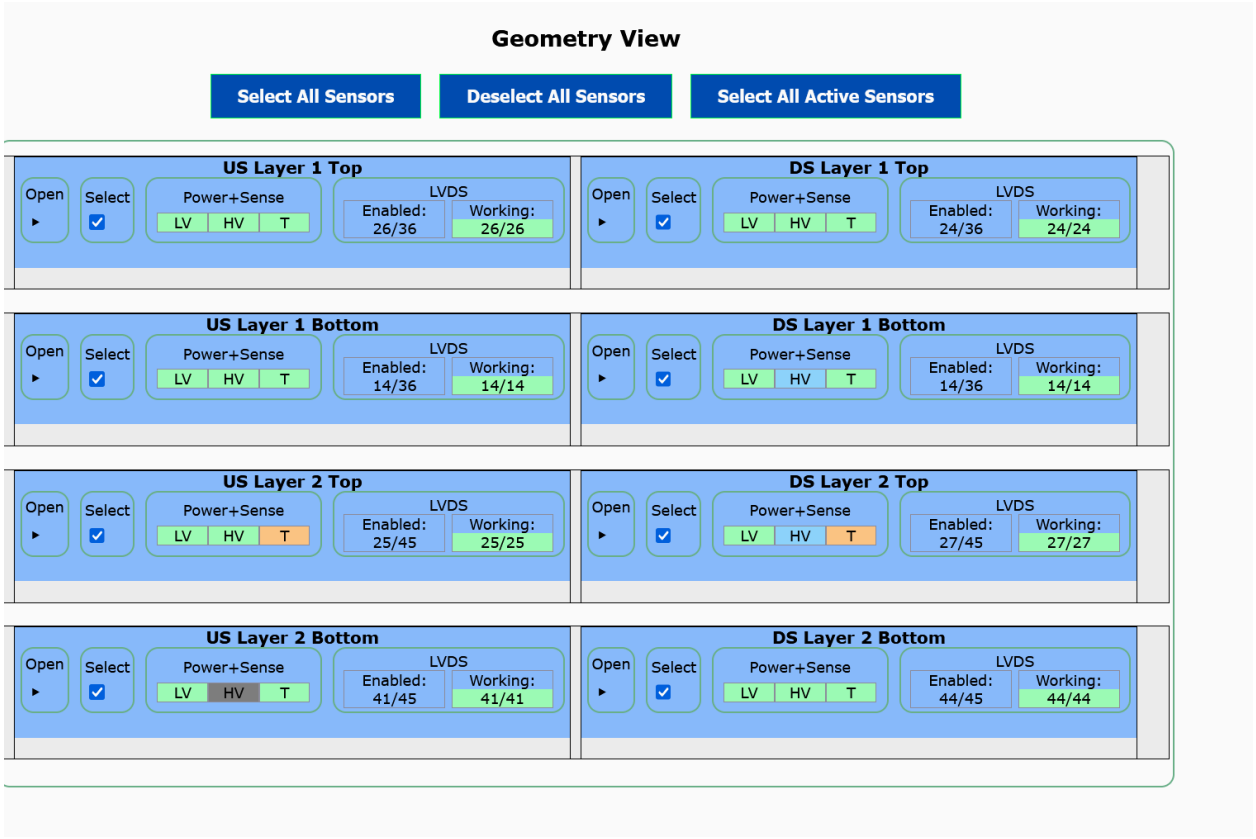
Before run

Checks for DAQ

Generic check?

Checks for Vertex

Check LVDS link stability: the geometry view should look like this:



Checks for Scifi

Add

Checks for SciTiles

Add

During run

Checks for DAQ

DQM? History?

Checks for Vertex

During cosmic run, just check for link stability same as above

Checks for Scifi

Add

Checks for SciTiles

Add

After run

Checks for DAQ

Generic check?

Checks for Vertex

Data quality checks?

Checks for Scifi

Add

Checks for SciTiles

Add

Turn off systems (only when necessary)

3 subsytems in parallel. They can be turned on all or just some. Must be clarified for each shift.

Vertex

Power down

We do it one PP at a time for now

- In the geometry view on the top right, open the power partition
- Select all chips with at least one green dot
    - Or yellow/orange/red if the link is not running
    - It should not be gray (disabled)
- In the Manual Config tab, click “Configure Full-> Min”

Turn off

From the Pixel/Pixel Control page, in the power tab, select the power partitions you want to turn off and click “Turn Off Selected PPs”:

SciFi

- In the Scifi-Monitor custom page, under 5. HV, turn off the HV (set the dropdown selector to “no”, you can leave the set value at 56 V
- Under 4. LV set the dropdown selectors to “no”

- Under 3 uncheck the two boxes on the right to turn off the FEBs

SciTiles

Add here

Extra notes

One day Vertex had to do this: US Layer 1 Ladder 2:

- Ladder 3 Min to SC
- Ladder 1+2 Min to SC
- Ladder 3 SC to Full
- Ladder 1+2 SC to Full

Still the case?

👀 Staging setup

Staging setup Operation Manual

Add here relevant notes when you find out peculiarities in how things work

Turn off everything before touching anything on cage!!

Form

A compact set of instructions as a Google form can be found here. This should be filled every time the Vertex operation is started.

Visual Check Before Turning Things On

To ensure it is truly safe before powering the detector, operators need to make a quick round to make sure that:

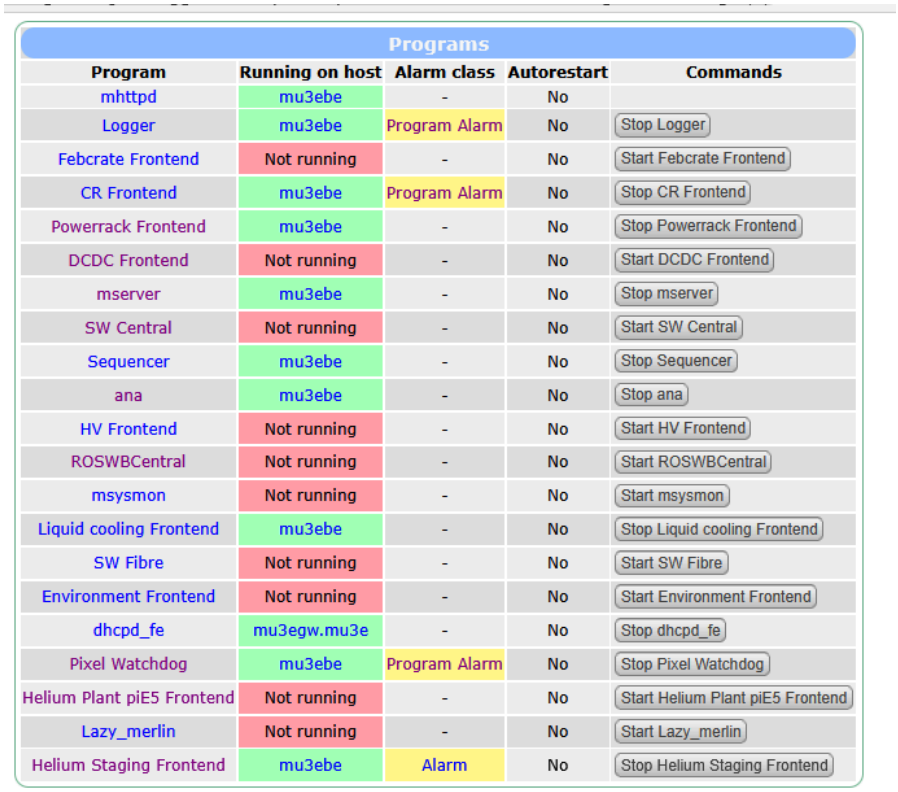
- No personnel is doing maintenance/intervention near the detector that poses a risk to themselves if power is applied
- Visually, the helium intake/outtake connections are connected
- Chillers are running and at nominal temperature (~15C)
- Nothing looks off around the magnet & helium area
- If TDKs are at Fault Mode, then reset the PLC interlock

Turn on Helium

In the notes:
https://www.physi.uni-heidelberg.de/Forschung/he/mu3e/restricted/notes/Mu3e-Note-0107-Helium_Staging_Setup_Manual.pdf

Check programs and alarms

When nothing is on, the programs page should look like this:



Programs

Program	Running on host	Alarm class	Autorestart	Commands
mhttpd	mu3ebe	-	No	
Logger	mu3ebe	Program Alarm	No	Stop Logger
Febcrate Frontend	Not running	-	No	Start Febcrate Frontend
CR Frontend	mu3ebe	Program Alarm	No	Stop CR Frontend
Powerrack Frontend	mu3ebe	-	No	Stop Powerrack Frontend
DCDC Frontend	Not running	-	No	Start DCDC Frontend
mserver	mu3ebe	-	No	Stop mserver
SW Central	Not running	-	No	Start SW Central
Sequencer	mu3ebe	-	No	Stop Sequencer
ana	mu3ebe	-	No	Stop ana
HV Frontend	Not running	-	No	Start HV Frontend
ROSWBCentral	Not running	-	No	Start ROSWBCentral
msysmon	Not running	-	No	Start msysmon
Liquid cooling Frontend	mu3ebe	-	No	Stop Liquid cooling Frontend
SW Fibre	Not running	-	No	Start SW Fibre
Environment Frontend	Not running	-	No	Start Environment Frontend
dhcpd_fe	mu3egw.mu3e	-	No	Stop dhcpd_fe
Pixel Watchdog	mu3ebe	Program Alarm	No	Stop Pixel Watchdog
Helium Plant piE5 Frontend	Not running	-	No	Start Helium Plant piE5 Frontend
Lazy_merlin	Not running	-	No	Start Lazy_merlin
Helium Staging Frontend	mu3ebe	Alarm	No	Stop Helium Staging Frontend

The programs in green in the picture above should be running all the time independently on the current state of services/detectors (especially those with Alarm conditions).
Note: “Helium Staging Frontend” is valid for the staging setup, it should be moved to “Helium Plant piE5 Frontend” in piE5.
Also, from the Alarm page, check that no Program Alarm is disabled and that all states are OK. If a state is OK but the alarm is ringing, reset the alarm.

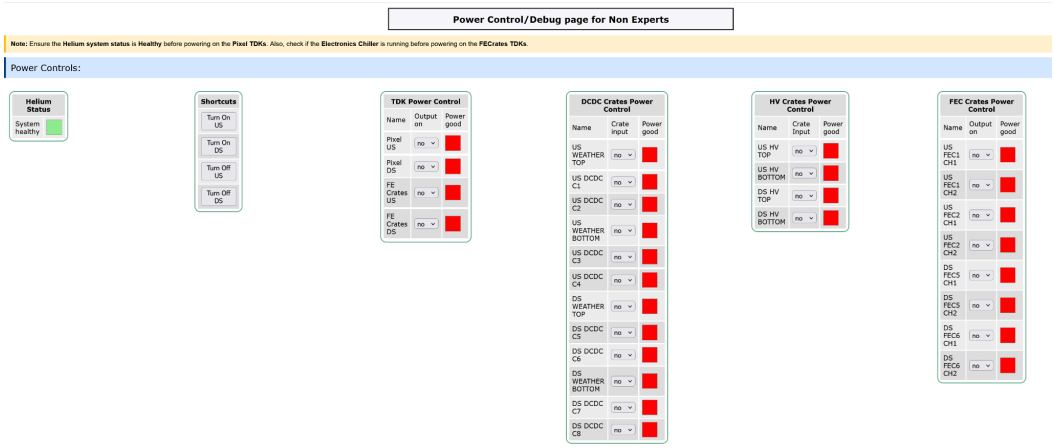
Turn on services

Before turning on the FEC TDK, make sure the electronics chiller is on in the area by going to the physical chiller

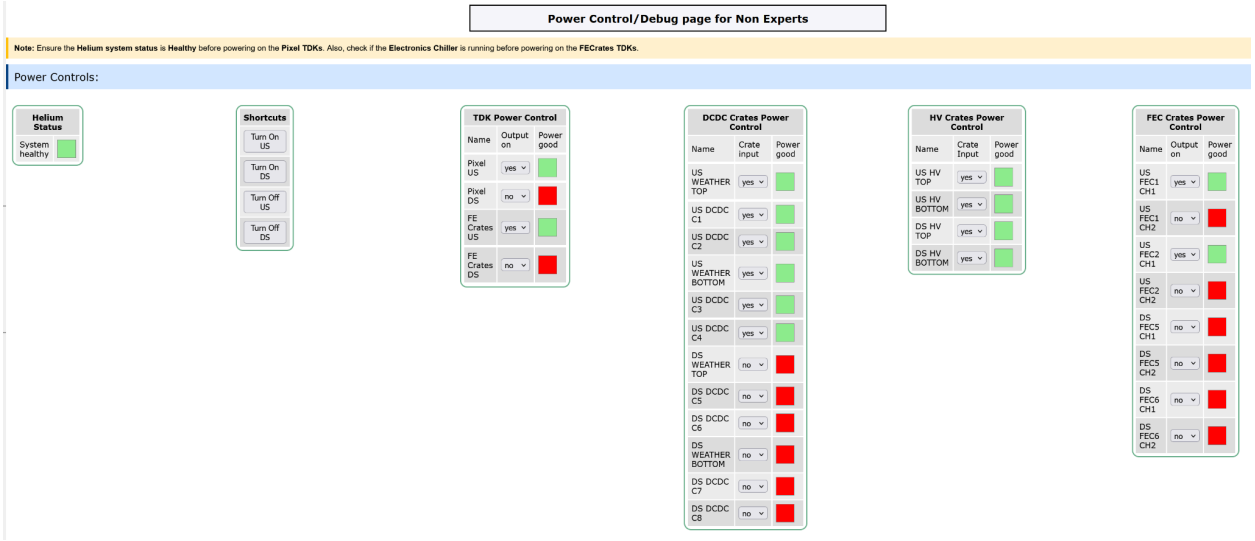
- If the light is off, Click “Run/Stop”
- If the light is on, it means it is already running (check with others if it was meant to be so)

Make sure the Powerrack frontend is running
Note: sometimes it crashes or gets stopped. You should realise it as some select boxes are set to no but its color box is still green (or vice versa). Restart the frontend in this case.

Go to Services/Staging Power, it should look like this:



If the Helium Status is red something went wrong with turning on the Helium system. Contact experts.
Note: If the TDKs cannot be turned on because of an intervening interlock and if the He interlock had triggered before (e.g. because of having turned off the He), the toggle the two switches for resetting the interlock.
Click turn on US. This is then how the page should look like:



Known issue: the Pixel US has output on to yes but the box is red: likely Helium interlock. Put output on to no and reset the interlock switches (manually on the power rack, requires presence)
If not all expected boxes are green, press the button again
Notes:

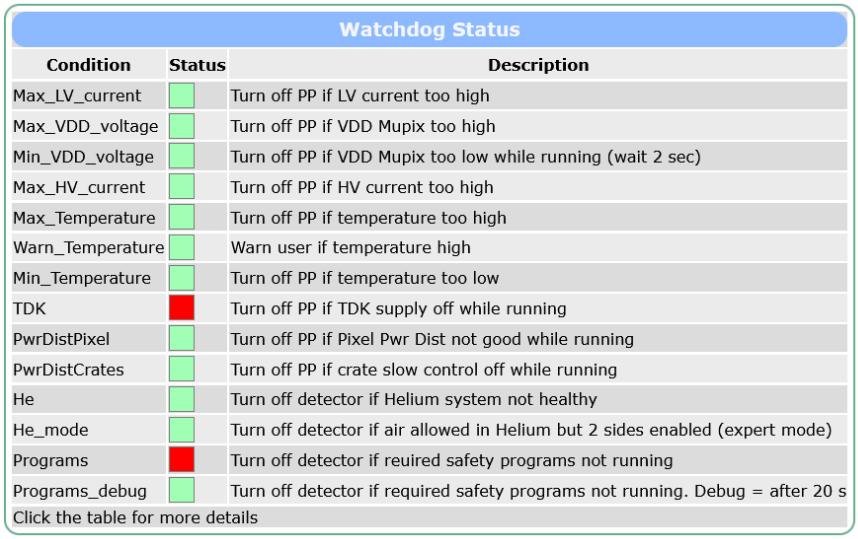
- **There are 2 channels per FEC but only one needs to be on (bug in the power distribution board, two connections recognized as short, only one required for Vertex operation)**
    - **For US can be 0 and 2 on the Power Distribution page**
    - **These are US FEC1 CH1 and US FEC2 CH1 in the page above**

Pixel watchdog

Start Pixel watchdog from the programs page (it should be already on)

Note on watchdog operation:

- The watchdog checks a series of conditions which can be seen in the table in the Pixel Control page (when expanding its section)



Watchdog Status		
Condition	**Status**	**Description**
Max_LV_current		Turn off PP if LV current too high
Max_VDD_voltage		Turn off PP if VDD Mupix too high
Min_VDD_voltage		Turn off PP if VDD Mupix too low while running (wait 2 sec)
Max_HV_current		Turn off PP if HV current too high
Max_Temperature		Turn off PP if temperature too high
Warn_Temperature		Warn user if temperature high
Min_Temperature		Turn off PP if temperature too low
TDK		Turn off PP if TDK supply off while running
PwrDistPixel		Turn off PP if Pixel Pwr Dist not good while running
PwrDistCrates		Turn off PP if crate slow control off while running
He		Turn off detector if Helium system not healthy
He_mode		Turn off detector if air allowed in Helium but 2 sides enabled (expert mode)
Programs		Turn off detector if reuired safety programs not running
Programs_debug		Turn off detector if required safety programs not running. Debug = after 20 s
Click the table for more details		

- When one of this condition is triggered, the box gets red and a message appears in the Message page under Vertex as an info
    - This does not necessarily means that the watchdog intervenes, as the power partition(s) might be already off or there might be a timer
- When the watchdog intervenes and turns off a power partition, a message appears in the same page as error (red), indicating which power partitions are turned off and the condition (i.e. reason)

DCDCCrates Frontend

- **[Optional: do not touch unless you know what you are doing]** If you want to run it with certain crates, and not the ones shown above
    - Stop DCDC Frontend before turning on/off crates
    - Make sure that the channels for those crates are on
        - Go to on Services/Staging Power and under the DCDC Crates Power Control turn on the crates you want
        - Turn on also the weather channels
            - these depends if the crates are US/DS and Top/Bottom
    - set disable to the non-used crates
        - In the ODB/Equipment/DCDCCrates/Settings/ set the values of “Enabled” and “Crate on” to true or false depending which crates you want to use
- Start DCDC Frontend on Programs page

HV frontend

- Start HV Frontend on programs page

Extra note: all HV crates must be turned on, as the Frontend does not allow to disable crates (US Top, US bottom, DS top, DS bottom)
Note 2: as for now, it might trigger the pixel watchdog on a DS power partition. No problem for now **(to be fixed before we connect DS)**

Turning on FEBs (US only so far)

- Start FebCrate Frontend
- Go to the DAQ/Feb Crates page from left panel
- The Crates you turned on should be green
    - If they are yellow, try to refresh the page or restart FebCrate Frontend
- The slots with a FEB number underneath have the FEB connected, you can turn them on by clicking on the 'OFF' button (yes, it's a button)
    - Turn on all US (Feb 0 to Feb 4)
    - You can tell if the buttons are working as you should see messages about turning on FEBs
        - If you don't see the messages, reload the page or restart FebCrate Frontend
    - It should look like this at the end:

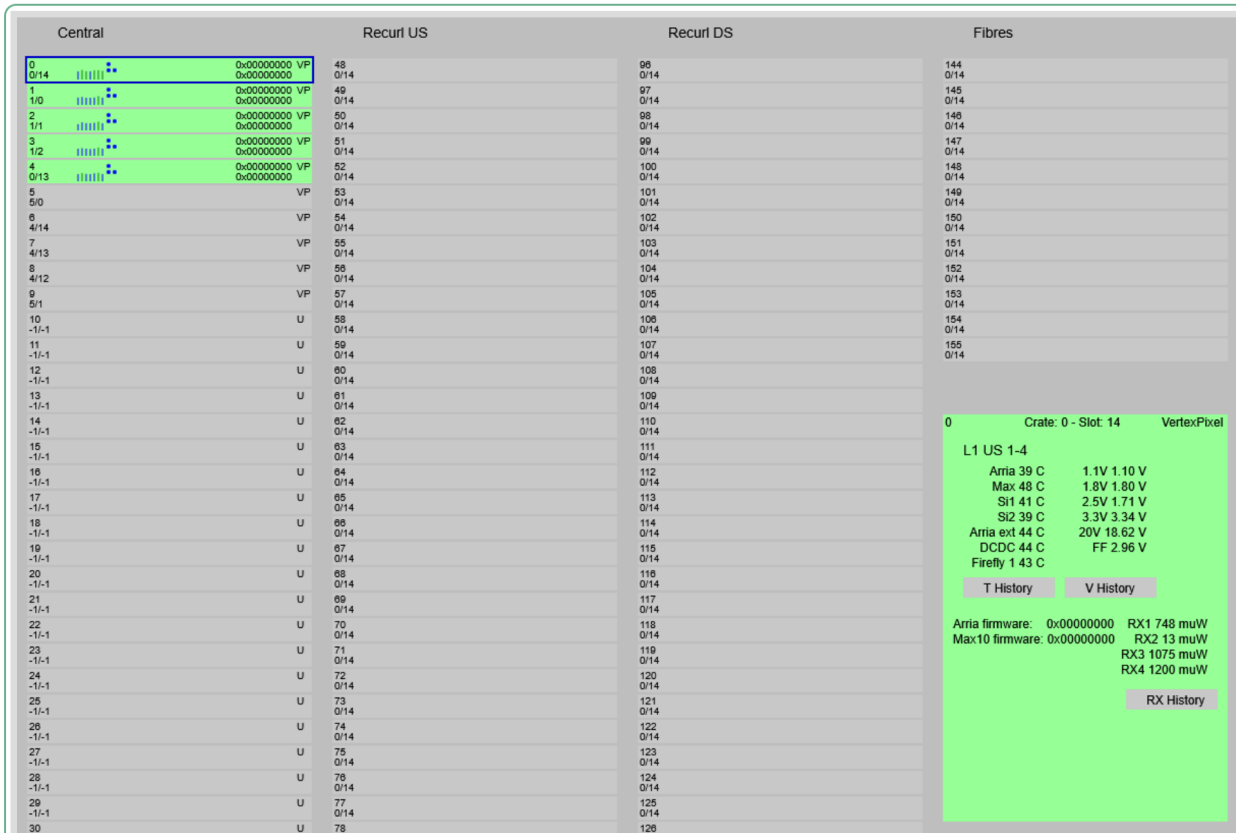
    - And you should see these messages in the Messages page:

```
[Febcrate Frontend,INFO] Switching on FEB 2 in crate 1 (index 17)
[Febcrate Frontend,INFO] Switching on FEB 1 in crate 1 (index 16)
[Febcrate Frontend,INFO] Switching on FEB 0 in crate 1 (index 15)
[Febcrate Frontend,INFO] Switching on FEB 14 in crate 0 (index 14)
[Febcrate Frontend,INFO] Switching on FEB 13 in crate 0 (index 13)
```

    - →**<u>Wait one minute</u>** until all links are stabilized**!!!**

- **[this point should be already done]** In ODB /Equipment/LinksCentral/Settings/ Make sure:
    - LinkMask have 3 **on the FEBs that are on**

        - For US only these are FEBs 0-4
    - For LinkFEB have the values same as the index (for the FEBs that are on?)
    - FEBType = 1 for pixel (FEBs 0-9)
    - LVDSLinkMask to
        - 0x7FFFFFF for FEBs 2,4,7,9
        - 0xF FFFF FFFF for the others
    - LVDSNumLinksMax
        - 27 for FEBs 2,4,7,9
        - 36 for the others
    - NumASICsMax to
        - 9 for FEBs 2,4,7,9
        - 12 for the others
- Start SW Central from the Programs page
    - Wait for receiving the message “Done” in the “switch” message section
    - Make sure there are no errors in the Message page regarding FEB connections
    - To cross-check everything worked fine, check the page DAQ/FEBs, it should look like this:



    - If one of the FEBs on the top left has red dots:
        - Stop SW Central
        - power-cycle the FEB(s) from the DAQ/FEB crates page as above
        - Wait a bit
        - Start SW Central

Known issues:

- You receive a message like this:

```
11:03:07.673 2025/03/24 [SW Central,ERROR] [switch_fe.cpp:222:frontend_init(),ERROR] No switching board present or driver not loaded
11:03:07.665 2025/03/24 [SW Central,ERROR] [switch_fe.cpp:632:init_mudaq(),ERROR] Could not open device
```

    - Go to switch0 ~/online/common/kerneldriver and run sudo ./load_mudaq.sh
- If a FEB malfunctions and causes all chips to lose configuration, avoid power-cycling the FEBs with the Vertex detector still on. Power down vertex then power-cycle the FEBs.

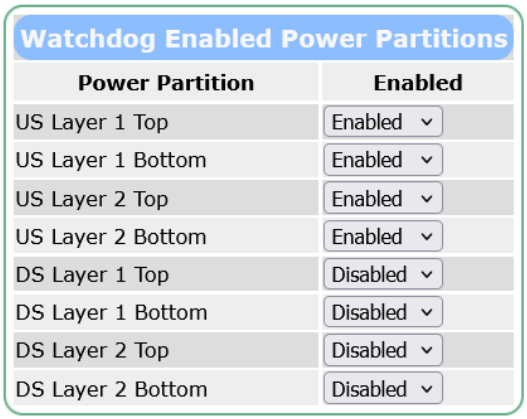
Pixel Control via Page

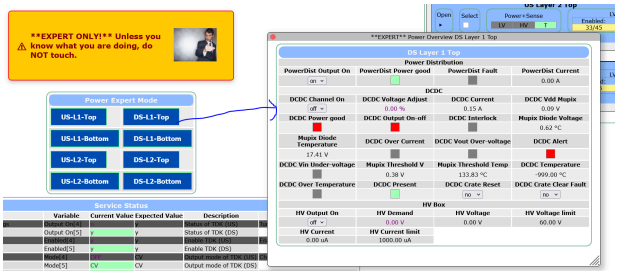
- Go to Pixel/Pixel Control
    - At the moment this has been fully tested only with firefox, it seems to work on chrome, not on chromium
    - Not compactified yet, adjust the zoom in case the elements are overlapping
        - ~50% on laptop
        - ~60% on large screen
- Check that the three dots on top left are green:

    - Click on the bar to expand the details
- Known issues:
    - If Service Status is red, it is generally the case that crates are off: there is a button on the right to set them on: 

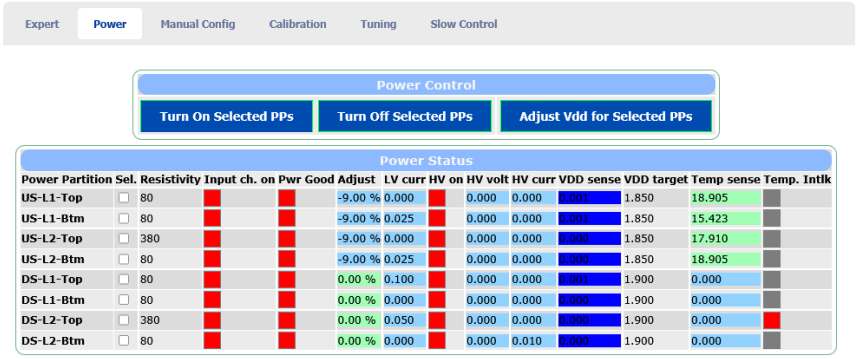
(click it more times if it does not work)
    - If the watchdog is red, expand the details and check
        - Known case: if running only US and for some reason the watchdog restarted, the DS power partitions have to be disabled:
            - Go to the expert tab
            - Scroll to the end

- Disable the DS power partition from the table in the bottom center:



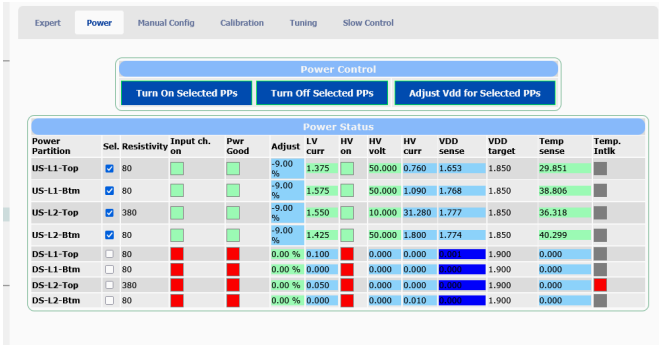
  - If on the power tab you see some NaN values
    - try to stop and restart DCDC Frontend
    - Maybe multiple times
  - If an interlock is red on the power tab
    - Go to the expert tab
    - Click on the power partition tab
    - Try to turn “DCDC Crate Reset” and “DCDC Crate Clear Fault” multiple times
    - 

- **Turn on a power partition:**
  - In the power tab, select the power partition(s) you want to turn on and click “Turn On Selected PPs”

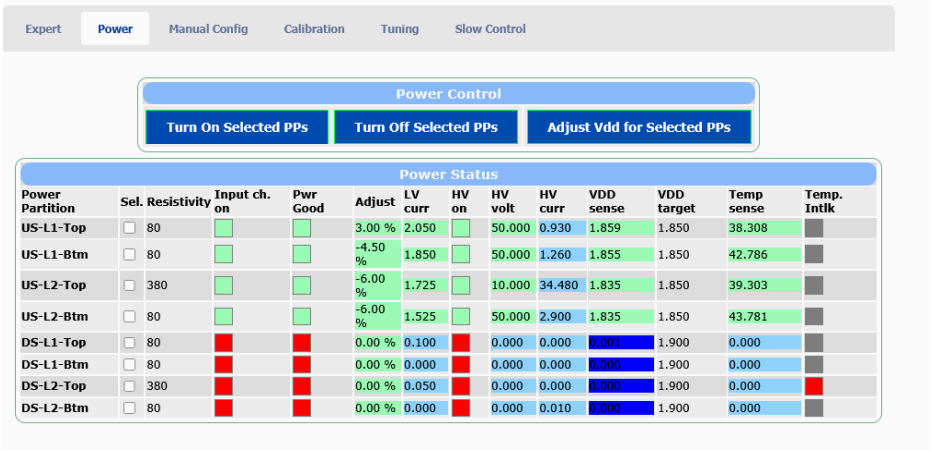


  -
  - The buttons will turn grey, indicating that the sequencer script is running

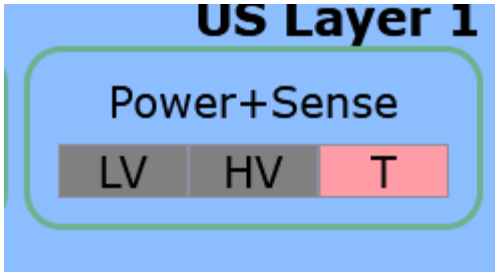
- Do not worry about messages from the Watchdog saying “Triggered” and then “Untriggered”
  - Watchdog is faster than DCDC read-back, but in this case it won’t intervene before 2 seconds
- Wait until the buttons become blue (enabled) again
  - There should be a message “Sequencer is finished”
  - This might take a bit, still doing things slow
- This is how it should look like at the end:

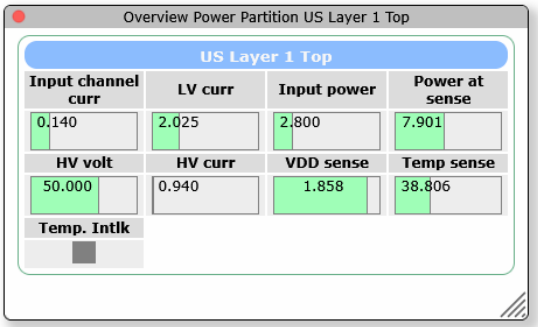


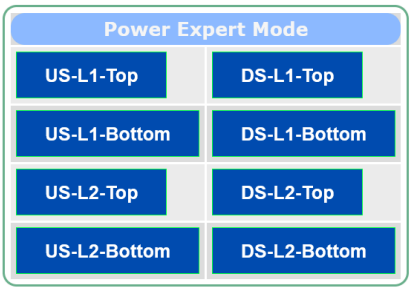
- By default the DCDC output is set to minimum. To reach the target VDD, select power partitions and click “Adjust Vdd for Selected PPs”
  - This aims to set the adjust such that the VDD sense (11th column) reaches the VDD target (12th column)
  - ~~This can be done one power partition at a time for now (currently a sequencer error will terminate the script, once it is finished with a power partition, don’t worry about it.)~~
  - It should look like this at the end:



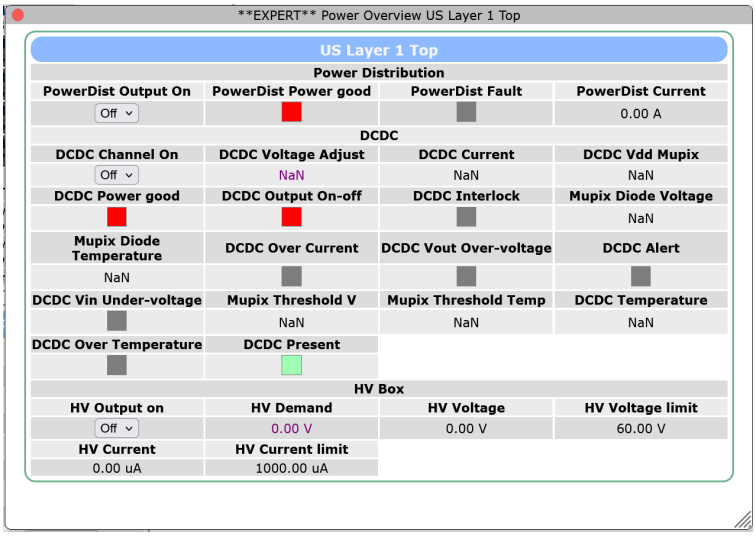
- To monitor power all time, click any “Power+Sense” box on the top right and you have a smaller and more user-friendly monitoring dialog (recommended)

- Click this: 

  - To get this:  which can be placed anywhere in the window

- **[CAUTION] Expert mode (to be used in case user mode does not work and/or something is off, call an expert before):**
  - Go to the Expert tab, you should see the power partition buttons
  - 

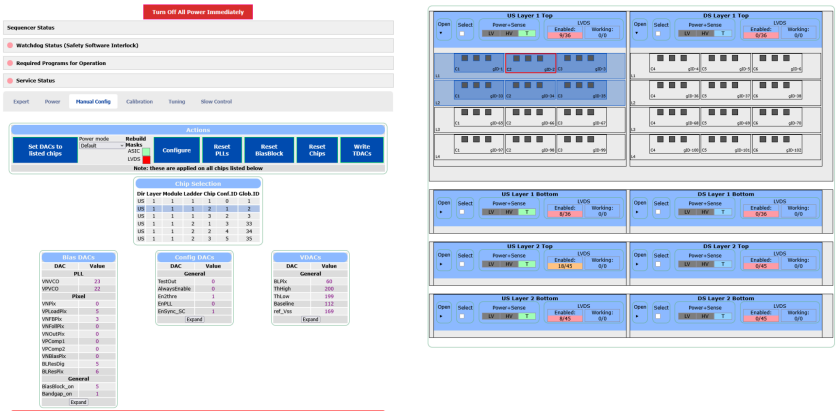
  - Click on the power partition you want to turn on, a pop-up window should open



- Set “PowerDist Output On” to ON
  - PowerDist Power good should become green
- Set “DCDC Voltage Adjust” to -9% (low power to avoid spikes)
- Set “DCDC Channel On” to ON
  - “DCDC Power good” and “DCDC Ouptut on-off” should become green
  - Nothing else should become red
- Make sure “HV Demand” is 10
- Set “HV Output on” to ON
- For 80 Ohmcm modules, set “HV Demand” to 50 V in small steps (NOTE: the value you write is positive but the HV board sets it to negative)
  - Recommended is steps of 10 V
  - Check that the “HV Voltage” matches
  - The current and voltage might jump between one change and the other… **is this an issue?**
- Set “DCDC Voltage Adjust” to match VDD sense to be 1.9V
  - Increase it gradually (minimum step is 1.5%) until you have DCDC VDD Mupix to about 1.9 V
- You may close the popup window if you prefer
- **To turn off a power partition in expert mode:**
  - Do the opposite of turning on:
    - Move “DCDC Voltage Adjust” to -9% gradually
    - Move “HV Demand” down to 10 V gradually
    - Set n “HV Output on” to off
    - Set “DCDC Channel On” to off
    - Set “PowerDist Output On” to off

- **Set DACs and Configure chips [this is the generic way, to learn the specific procedures for each case go to the next point or follow the google form]**
  - Go on the Manual Config tab
  - To select chips, go on the top right, open a power partition and click on any chip/ladder/module

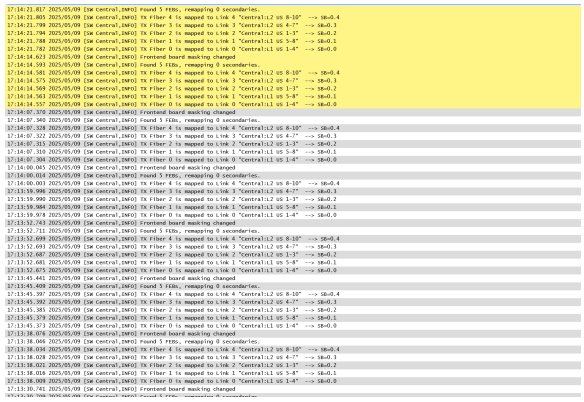
- Whatever is blue is “listed” in the Manual Config page



- [Above: example where we selected ladder 1 and 2 from Layer 1 US]
- The list of selected chips appears in the table “Chip Selection”
- To manually change DACs (only one chip at a time for now)
  - Select the chip from the row on the “Chip Selection” page
  - The row becomes blue, while the chip on the right gets red borders (see pic above)
  - The DACs appear underneath the table in 3 more table, one for each DAC regime
    - The most relevant DACS appear first
    - Click expand to see them all
- **Note**: the DACs remain at the same values they were left the last time they were changed. If you think they were left in a usable/optimised state, you do not need to change them
- To change DACs to standard configurations
  - Click the button “Set DACs to listed chips” with the Power mode chosen on the select box on the right. Options:
    - Default: full power, very high threshold
    - Slow-control only: clock and LVDS, no line driver no comparator
    - Minimum power: all circuits off
- Operations on listed chips:
  - Configure: configure chips to the settings shown as above
    - Can be used if LVDS links are lost
  - Reset PLLs: disable and re-enable PLLs (clocking on chip)
    - Can be used if LVDS links are lost and configure did not help
  - Reset BiasBlock: turn off and on bias blocks on chips
    - Can be used if LVDS links are lost and configure and reset PLLs did not help
  - Reset chips: send a reset signal
    - To **all** chips, not only the listed ones [to be fixed?]
  - Write TDACs: write TDACs, i.e. single pixel masks and/or fine threshold
    - **CAREFUL**: Write TDACs does not work on multiple FEBs at the same time. Write TDACs one ladder at a time.

    - The “Extra care” section is for debugging only
- More info about LVDS links can be found by clicking on the LVDS box on the top of each power partition in the Geometry View
- **Recommended procedure with 6 ladders US only** (mode 1 in the google form)
    - Select ONE ladder at a time and click Configure
        - Wait until all red boxes get green
        - Click Reset PLLs if not green
        - Click Reset BiasBlock if still not green
    - Click Write TDACs
    - Ladders used:
        - Layer 1 Ladder 2 (top side)
        - Layer 1 Ladder 7 (bottom side) .
        - Layer 2 Ladder 2 (top side)
        - Layer 2 Ladder 3 (top side)
        - Layer 2 Ladder 7 (bottom side)
        - Layer 2 Ladder 8 (bottom side)
    - If you want to change ladders: **make sure only 6 are running**
        - Select the ladder you want to turn off and click “Configure Full->Min”
            - The Buttons will get disabled and enabled multiple times
            - Do not leave the page
            - Wait until the buttons do not change anymore for few seconds
        - Disable the links for this ladder (they should not be working, i.e. lot of red)
            - From the LVDS dialog, “Active” should be yes, click it and it becomes no
            - If there were any links previously disabled, note them down in case
            - The row should become gray
        - Deselect the ladder
        - Select the next one
        - Enable the links for this ladder
            - From the LVDS dialog, “Active” should be no, click it and it becomes yes
            - The row should become colorful
        - Click “Rebuild ASIC and Link Masks” at the bottom of the dialog
        - Set the Power mode to “Minimum Power” and click “Configure”
        - Set the Power mode to “Slow-control only” and click “Configure”
            - Links should become green
        - Set the Power mode to “Default” and click “Configure”
        - If 1 or 2 links inside a chip are not running:
            - Verify with experts they are broken
            - Disable the links eventually
        - Check the Link Matrix (last row in the LVDS dialog table, yellow)
            - There are 3 per chip, they should be A,B and C
            - If one link shows ND, the inversion is wrong

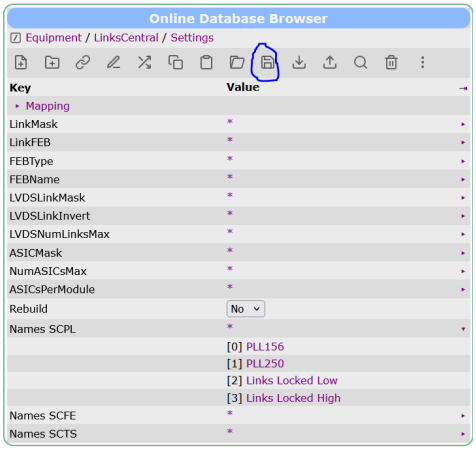
        - Inverted should be either yes or no, but it is wrong
        - Click it to change its value
        - Click “Rebuild ASIC and Link Masks” at the bottom of the dialog
        - You should see the Matrix type now
    - Decrease thresholds if needed
- **To monitor data links**:
    - The 3 dots on each chip correspond to the link status
        - Gray: masked (bugfix: you have to refresh the page if you mask them externally)
        - Green: good
        - Orange: fairly high 8b10b error rate
        - Yellow: low 8b10b error rate
        - Green: zero 8b10b error rate
    - Click on the LVDS box on the top of the power partition to see more details
    - If some links gets lost (corresponding box gets red)
        - Click the entire chip
        - Click “Configure”
        - If it does not work, click “Reset PLLs”
        - If it does not work, click “Reset Biasblock”
- Known issues:
    - Some FEBs are down
        - You see error messages from switch FE
        - Turn off the Vertex
        - Stop SW Central and ROSWBCentral
        - Power cycle the misbehaving FEBs from the DAQ/FEB Crates page
        - Start SW Central and ROSWBCentral
        - Turn on Vertex
    - SW Central gets stuck
        - Keeps sending messages like this (in the switch bank):

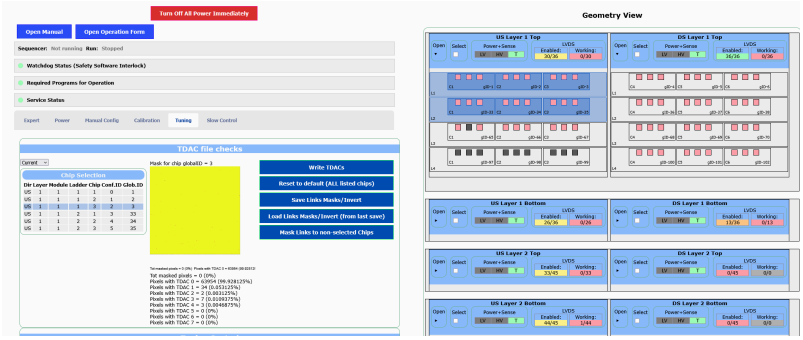


        - Stop and start it
        -

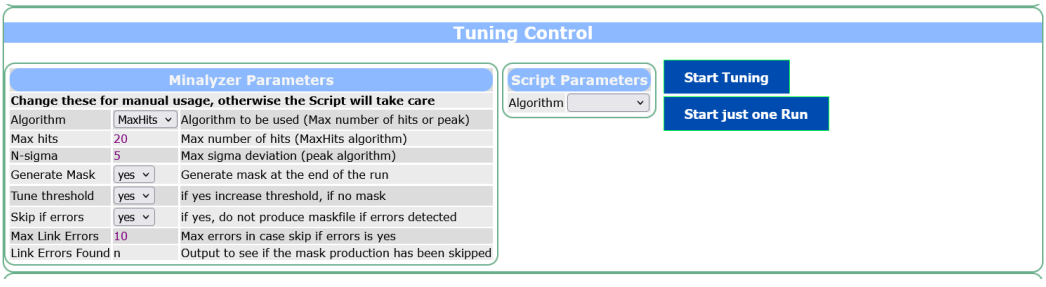
Tuning

(temporary procedure, US only)
NOTE: in this procedure, if you are focusing on few ladders only, you can also turn on their power partition only

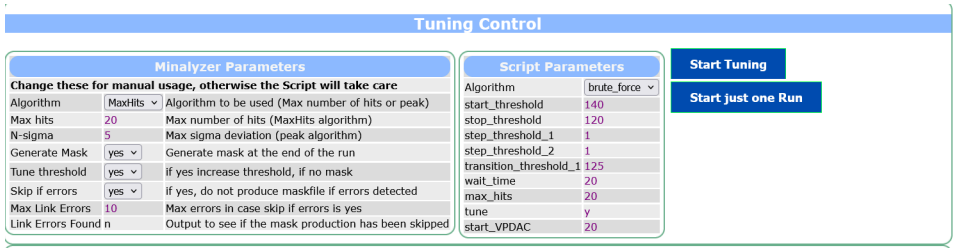
- To save the FULL LVDS links mask (the one used for operating the US detector)
  - This should be already done, no need to redo it, but just in case..
  - Go to ODB -> /Equipment/LinksCentral/Settings
  - Click on this button: 

  - Save ODB folder as VTX_link_settings.json (OK to overwrite it)
- To reload the FULL LVDS links mask (the one used for operating the US detector)
  - Same page as above but the button on the left
  - Same filename
  - This will trigger a long loop on SW Central (see known issue above)
    - Stop and Start it
- To inspect TDAC files:
  - Go to the Tuning tab
  - Select chips from the geometry view
  - Click on the chip in the list
  - 

  - Bad mask if:
    - 100% of pixels have TDAC 0 (no hits)
    - Vertical and horizontal structures appear (8b10b errors picked up)
- To reset a mask file
  - On mu3ebe go to /home/mu3e/online/online/userfiles/sequencer/mu3e/operation/cosmic_run_24

    - python3 reset_tdac_file.py XXX
        - XXX is the chip global ID (the one on top of the mask)
- Power up one ladder
    - Select the ladder
    - Click “Configure Min→SC”
    - Click “Configure SC→Full”
    - Click Write TDACs
    - If some links are bad:
        - Reset PLL
        - Reset Biasblock
        - Re-power
            - Configure Full→Min
            - Configure Min→SC
            - Configure SC→Full
- Mask all other links
    - While selected, go to Tuning tab and click “Mask links to non-selected chips”
    - Click Configure
- For the first time, or when you redo some masking, make sure the DACs are OK
    - Put power mode to default
    - Click “Reset DACs to listed chips”
    - Put the thrshold down to sensitive values
        - 125 ThHigh and 124 ThLow for 80 Ohccm
        - 140 ThHigh and 139 ThLow for 380 Ohmcm
    - Click Write TDACs
- Make sure you see some hits in the LVDS box
    - Otherwise lower the threshold
- Start one run
    - Go to tuning tab
    - Check tuning control:
    - 

        - Algorithm: MaxHits
        - Generate Mask: yes
        - Skip if errors: yes
        - Max Link errors: 10 (can be modified in case)
    - Select algorithm brute force (the only one)



    - Wait_time and Max hits can be tuned, but let's keep both at 20 for now
    - Click "Start just one run"
  - Check than link errors found is n at the end of the run
    - If y, reset PLL or something, then retry
- Write TDACs
- Move thresholds down
  - From Manual configuration tab
  - Make sure ThLow is ThHigh -1

Collect data

Before starting roswb_fe go to /Equipment/ROSWBCentral/Settings and

- mask_n_generic masks the FEBs bit-wise (e.g. mask = 8 =0b1000 unmask the 4th FEB)

Make sure "ROSWBCentral" and "ana" are running.
Go to the status page and start a run.
Monitor via the DQM page

Turn off Vertex

With this procedure, only the Vertex detector itself is off. For the moment, to be used when you leave the detector unsupervised for a bit, but you do not want to turn off all services (typical case: lunch break)

- In the power tab, select the power partition(s) you want to turn on and click "Turn Off Selected PPs"
- Wait until the buttons become blue (enabled) again
  - There should be a message "Sequencer is finished"
  - This might take a bit, still doing things slow

Turn off Services

THE VERTEX MUST BE OFF BEFORE THIS

This turns off all services (FEBs, crates, power distribution,...). For the moment, this should be done at the end of the day. In the long run, services should be able to run overnight.

- Stop SW Central and ROSWBCentral
- Turn off FEBs on the DAQ/Feb Crates page
- Stop FebCrate Frontend, DCDCFrontend, HV Frontend

    - In any order
    - Wait until the status is red on each one at a time
- Turn off all channels on the Services/Staging Power page
    - Click Turn off US until all boxes are red
- Turn off Helium system **(how? -> note107 linked below)**
- Turn off chillers (press Stop on the chillers themselves)

Turn off Helium

In the notes:
https://www.physi.uni-heidelberg.de/Forschung/he/mu3e/restricted/notes/Mu3e-Note-0107-Helium_Staging_Setup_Manual.pdf

Update microcontrollers on DCDC crates

- The code and output is in backend in /home/mu3e/midas/mscb/embedded/projects/mu3e/PDCC
- Run
    - 'msc -d mscbXXX.psi.ch'
    - with XXX the mscb number
        - see ODB under /Equipment/DCDCCrates/Settings/MSCB Device, compare the right index
- Run
    - 'addr Y'
    - with Y the mscb address
        - See ODB under /Equipment/DCDCCrates/Settings/MSCB Address compare the right index
- Run
    - 'upload "/home/mu3e/midas/mscb/embedded/projects/mu3e/PDCC/pdcc.hex"'

Similar with HV controllers

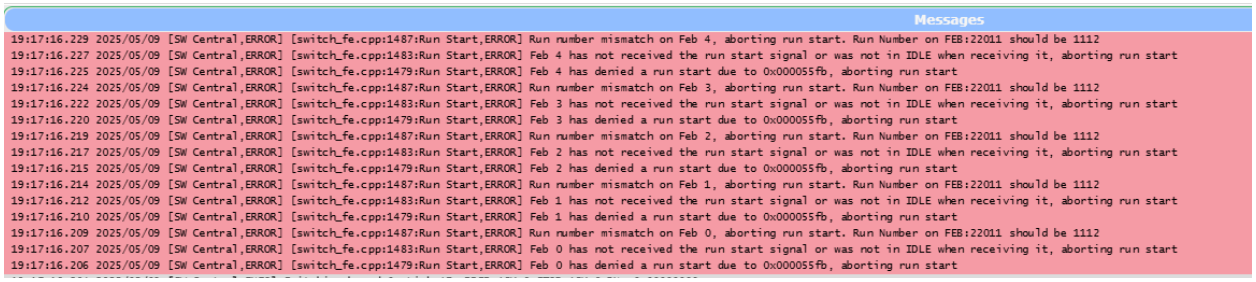
Known issues

Switch0 freezes

SW Central and ROSWBCentral do not respond anymore, can't ssh into mu3esw0

Reset Switch0 physically from the hut downstairs

Run start fails



In addition to re-powering FEBs and restarting the clock and reset FE, If your run fails to start and there is a "waiting for more switching boards" message from the clock/reset FE, go to ODB/Equipment/Clock reset/Settings/ and make sure the Switching Board Mask is only on for the switching boards you are using (0 for the vertex pixel)

Notes for PiE5 operation

Modes

We are now (week 21) in hybrid mode. Missing:

- DS operation
- He cooling
- FEC cooling
- DAQ

No shifts, everybody together running from ~9am till the end of the day.

We should go soon to cosmic mode, after fixing the points above. This means still debugging (HW, FW, SW, anything)
This should last one week…? Before beam anyway.
We should have a draft of shifts, called slots, but the shifter should know that data taking is not priority. The slots can be 2 per day, 8-14 and 14-20 or something similar.
Note: there will be beam tuning, so PiE5 might be closed.
Goal is to have a live understanding of the detector (with DQM).

Then we go to startup mode.
First beams, stuff will be confusing.

Then we go to Nominal data-taking mode.
For both startup and nominal we need shifts.

Awareness

Before doing any work on the system check what is happening. Make a checklist. Things like: is the magnet on? Is anyone working on the cage? Is anything on? Is anyone debugging a piece of code?
Shifters are in charge!

Alarms are being implemented. Do not ignore any alarm!

Documentation

Try and maintain the same scheme.

Shift guidelines

Shifters are in charge!

Priorities:

1. Check system
2. Check data
3. Do more stuff (debugging, analysis,...)