

HPS DAQ Operations Manual v2.3.4

Per Hansson Adrian, Omar Moreno, Sergey Boiarinov*, Nathan Baltzell, Sho Uemura

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1 System Description

The HPS experiment data acquisition (DAQ) handles the acquisition of data for the two sub-detectors: the SVT, and the ECal. HPS employs two DAQ architectures: the SVT is readout with Advanced Telecom Communications Architecture (ATCA) hardware while

*Contact person for document.

the ECal use VXS based hardware. The trigger system receives input from the ECal, and distributes a trigger signal to all detector subsystems to read out a selected event. Figure 3 gives a schematic block diagram of the DAQ system.

For the ECal, every VXS crate contains a Readout Controller (ROC) that collects digitized information, processes it, and sends it on to the Event Builder (EB). The ROC is a single blade Intel-based CPU module running DAQ software under CentOS Linux OS. For the SVT ATCA system, a multi-ROC setup runs on embedded processors situated on the ATCA main board. The EB assembles information from the SVT and ECal ROCs into a single event which is passed to the Event Recorder (ER) that writes it to a RAID5-based data storage system. The DAQ network system is a Foundry router providing high-speed connections between the DAQ components and to the JLab computing facility.

2 DAQ Control

2.1 Starting the DAQ from scratch

1. Log into clondaq3 as clasrun.
2. To start all DAQ processes, open a terminal and run:
> `runcontrol -rocs`

This opens up all windows needed on the current workspace. The workspace should look like Fig. 1.

It is important to be able to see all the roc terminals. To do so it may be necessary to click on the **rocs** button in the top right corner to make the roc terminals visible.

Note: if the roc terminals are oddly sized or not displaying properly, try slightly resizing the window.

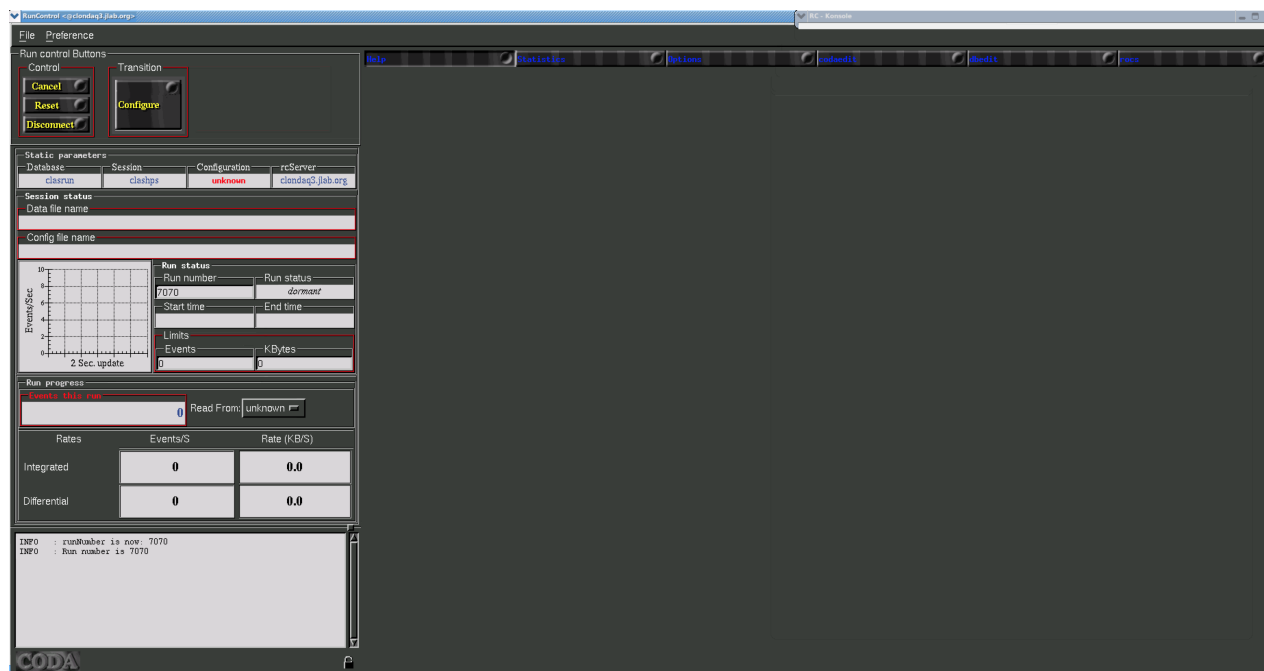


Figure 1: CODA workspace.

2.2 Killing the DAQ

First, in the runcontrol GUI, click "File" → "Exit". You may have to do that twice.

Then, to ensure that all underlying processes are gone, log into clondaq3 as clasrun, *being sure you are on the correct host*, and then execute the two commands:

- ```
> killall rcServer
> killall rocs
```

## 2.3 Start and stop a run

1. Beamline checklist
  - (a) Beam conditions are ready for running (see beam line manual for more details).
2. ECal Checklist
  - (a) All HV are on.
  - (b) ECal monitoring app is running.
  - (c) ECal FADC scaler display is running.

3. SVT Checklist

**For most of the steps below use the SVT summary GUI from Fig. 2 which can be started from the SVT sub-menu in the main EPICS control GUI.**

- (a) SVT position is appropriate for the run.
  - (b) High voltage bias is ON and at 180V (unless SVT expert or run coordinator has told you something different).

NOTE: If the the HV is OFF and won't come on you might need to go and reset the interlock by going to the `Devices/SVT Soft Interlocks` GUI and Reseting the MPOD interlock. This happens after a beam trip.

**Important: Check that beam conditions for turning on bias voltage is OK before switching on!**
  - (c) FEB Status
    - i. Under section "ALL FEB CONTROL" check that the status of FEB ALL is GREEN.
    - ii. Under section "ALL FEB CONTROL" check that the status of FEB Hearbeat is GREEN.
  - (d) IOC status
    - i. Under section "IOC Status" check that the status of ALL IOCs is GREEN.
  - (e) Hybrid status
    - i. Under section "ALL HYBRID CONTROL" check that the status of ALL HYBRIDS is GREEN.
4. **If continuing with same the same run configuration from a stopped run continue to 10.**
  5. In the `RunControl` GUI: click `connect`, the GUI should update with new windows.
  6. Click on `Configure` in the transition section, choose configuration 'HPS35. Click OK.
  7. (a) Check that `run number`, `data file path` and `run configuration filename` shown in the updated GUI make sense.



Figure 2: SVT summary GUI.

- (b) The `download` button should appear.
8. Press `Download`.
- (a) A popup window should appear to choose the trigger file, which should be defined in the run plan in the short term schedule on the HPS Run Wiki and/or the whiteboard in the counting house.
  - (b) Wait until the `Prestart` button appears and `RunControl` GUI reports that `Download` was completed.  
This might take up to 30s to complete.
9. Check SVT status
- (a) In the `SVT summary` GUI under section `SVT DAQ STATUS` and check that both `DPM RUNSTATE` `DPM RUNSTATE` are saying `Download`.
  - (b) In the `SVT summary` GUI under section `ALL HYBRID CONTROL`, check that `ALL HYBRIDS` status is `GREEN`.
10. Press `Prestart`
- (a) Wait for the message off `Prestart succeeded` in `RunControl` GUI  
This can take up to 30 seconds.
  - (b) The `Go` button should appear.
  - (c) Check `ECAL` status
    - i. Check that `FADC` scaler rates are reasonable by comparison with a previous run with a similar trigger. Sharp, odd patterns are a sign of misconfiguration.
  - (d) Check SVT status
    - i. In the `SVT summary` GUI under section `SVT DAQ STATUS` and check that both `DPM RUNSTATE` `DPM RUNSTATE` are saying `Prestart`.
    - ii. In the `SVT summary` GUI under section `SVT DAQ STATUS` and check that both `Hybrid Sync` status is `GREEN`.
11. Press `Go` to start the run.
- (a) Wait for `transition Go succeeded`' message in the `RunControl` GUI.  
This can take about 10 seconds.
  - (b) The `End run` button should appear.
  - (c) Check that the run status is `running` and that triggers are issued at the expected rate.
  - (d) In the `SVT summary` GUI under section `SVT DAQ STATUS` and check that both `DPM RUNSTATE` and `DPM RUNSTATE` are saying `Go`.

- (e) In the `SVT summary GUI` under section `SVT DAQ STATUS` and check that both `DPM TRIGGERCOUNT` and `DTM TRIG1COUNT` are incrementing.
- (f) Reset the ECal and SVT monitoring plots (connect).
- (g) Check SVT occupancy and max sample plots.
- (h) Fill out a row in the run spreadsheet. Check the whiteboard and run plan wiki for any other logging requirements.

## 2.4 Stopping a run

1. Press `End Run` in the `RunControl GUI` to stop data taking.
  - (a) Wait for `End run succeeded` message in `RunControl` window. This can take about 15 seconds.
  - (b) The `Prestart` button should appear.
  - (c) In the `SVT summary GUI` under section `SVT DAQ STATUS` and check that both `DPM RUNSTATE` and `DPM RUNSTATE` are saying `Stopped`.

## 2.5 Beam trips: actions and recovery for DAQ

THIS NEEDS TO BE UPDATED

Beam trips are frequent and in the most normal case the SVT high voltage bias will trip and will need to be restored before continuing. If a beam trip happens:

1. When beam is back and we are ready (check BPM strip charts/scaler GUI to see that 2H02 position is back to normal) go to the SVT Bias GUI. Push the “RESET” button to reset the beam interlock, and push the “180V” button to ramp bias up to 180 V.
2. Reset the SVT monitoring plots (disconnect and connect). Check the occupancy and max sample plots.

## 2.6 FIX DAQ

### 2.6.1 What to do if you get an Error During Download

1. In run control GUI: *Cancel* and then *Download*
2. If still fails:
  - (a) Try to identify which of the ROCs (in the Runcotrol GUI message window or in the individual ROC windows) has a problem.
  - (b) If only ONE of the TI, GTP or FADC indicates a problem, it may be possible to just restart it's process in Appendix B. If more than one, just GOTO Section 2.6.3.
  - (c) If TI, GTP or FADC are OK but any of the 'dpm' or 'dtm' has problem, this might mean only the SVT DAQ is in a bad state: GOTO Sec. 2.6.5
3. GOTO Step #9 in Section 2.3.

### 2.6.2 What to do if you get an Error During Prestart

1. Try to identify which of the ROCs (in the Runcotrol GUI message window or in the individual ROC windows) has a problem.
2. Check specifically in the ROC windows for the 'dtm0' and 'dtm1'. If they are the only ROCs that got killed and they show an error saying that they cannot get "Run state" then
  - (a) In the ROC xterm window: restart the roc process, typically hit up arrow on keyboard and press enter.
  - (b) In run control GUI: *Cancel* and then *Download* and continue from there.
  - (c) If it happens more than 3 times in a row, report the status of the roc window in dpm7 and contact SVT expert
3. GOTO Step #9 in Section 2.3.

### 2.6.3 Full DAQ Reboot

1. Reboot the master TI and ECal DAQ by executing this command in a terminal:  

```
hpsRocRebootAll.sh
```

This will reboot hps11, hps12, hps1, and hps2, and then wait for a ping response from hps2, meanwhile giving some progress messages. When finished it will display "DAQ FIXED" in the terminal.
2. Reboot the SVT DAQ: GOTO Sec. 2.6.5



## 2.6.4 Debugging deadtime

THIS NEEDS TO BE UPDATED

If you start a run and see an event rate of under 1 Hz and a livetime of 0%:

1. On any clon,

```
> tcpClient hps11 tiStatus
```

2. Look for “BUSY input source”:

| HFBR # | ROC and system |
|--------|----------------|
| 1      | hps1 (ECal)    |
| 2      | hps2 (ECal)    |
| 3      | hps12 (ECal)   |
| 4      | SVT DAQ        |
| 5      | SVT DAQ        |

3. Do a full DAQ teardown, rebooting the problem ROC (if SVT DAQ, do a FIX SVT DAQ including `rem_restart.sh`)

## 2.6.5 FIX SVT DAQ

Before following the below procedure, please record in a log entry the answer to these questions to help us debug and improve the DAQ:

- What is the status of CODA: Did any of the ECAL ROCs crash? Did the EB, ET or ER crash?
- When did it fail: In state transition 'Download', 'Prestart' or 'Go' or during a run?
- What is the status of the ROCs (There are 14 DPMs and 2 DTMs): did they crash or report any error message?
- Open the `/SVT/DAQ IOC Status GUI` and write down the status: which ones are red/green?

The procedure below is a full reboot of the SVT DAQ and may take up to 2 minutes to finish.

1. In the SVT summary GUI, bottom left section, click the SVT DAQ REBOOT button.
2. A new x terminal should popup. If it asks for a password it's the same as for user `clasrun` or `hpsrun`.

3. The terminal will print out status of the reboot and will not close after finishing. You have to manually close it.

This may take up to 2 minutes.

**While rebooting the SVT crate the ssh process can hang while halting DAQ nodes. If this happens it will get stuck one one or a few nodes in the beginning of the process. If it happens, wait 15 seconds before hitting *Ctrl-c* and the process should continue to the next.**

4. After a successful finish, go to the the **SVT summary** GUI, and look for any errors following the check list starting from item 3 in Sec 2.3.
5. In case of failure, copy the output of the x terminal into a logbook post and call the expert.

### 3 Detailed SVT checklist

1. SVT Flange boards (**SVT/Flange** GUI) and SVT Front end boards (**/SVT/FEB Main** GUI) are powered with no alarms.

**IF ON:** check that currents are updating: if not, try to reboot the "iochvCaen" IOC.

**IF OFF:**

- (a) Restart the FEBs turning on in the order: 1) 'DIGI', 2) 'ANAP' and then 3) 'ANAN'; buttons are at the top of the **/SVT/FEB Main** GUI.
  - (b) Power all the flange channels from **SVT/Flange** GUI.
  - (c) Go to the **/SVT/Link Status** GUI and check that no FEB link errors are stably incrementing. If they do, try to cycle the flange board power (wait 10-20s between cycles). You may need up to 4 cycles.
2. Bias high voltage is ON and at 180V (unless SVT expert has told you something different).  
If the the HV is OFF and won't come on you might need to go and reset the interlock by going to the **Devices/SVT Soft Interlocks** GUI and Reseting the MPOD interlock. This happens after a beam trip.  
**Important: Check that beam conditions for turning on bias voltage is OK before swiching on (see above)!**
  3. SVT DAQ is in a state ready to run:

- (a) Check that all the Control and Data DPMs and DTMs in **SVT/DAQ IOC Status** GUI are OK.

NOTE1: If there was a reboot of the SVT DAQ software or COB (see below) the data DPMs might not show green until after the 'Download' transition.

NOTE2:The control DPM should be OK as soon as a single FEB (and flanges are powered). It might take up to 30s for it to become green.



## A Chaning Prescale Factors on the Fly

This script will change the prescale factors immediately (during a run) and update the EPICS prescales such that the trigger GUI always uses the active prescales:

```
hpsTiPrescale.sh TRIGGER PRESCALE
```

## A Rebooting an Individual ROC

Execute this command (where ROC is one of hps11, hps12, hps1, hps2):

```
roc_reboot ROC
```

\*Note that hps1gtp lives in hps1, so rebooting hps1gtp is done via `roc_reboot hps1` (and similarly for hps2gtp).

*IF YOU REBOOT hps11, YOU MUST WAIT 30 SECONDS AND SUBSEQUENTLY REBOOT ALL OTHER ROCS hps1, hps2, hps12 BEFORE PROCEEDING.*

After rebooting ROCs, you may have to reboot the trigger scalers GUI (REBOOT button at the bottom right).

## B Restarting Individual CODA Processes

If a CODA command dies (returns to prompt in the corresponding terminal) or a ROC must be rebooted, the CODA command for that ROC must be restarted. The command can be manually executed again in the same terminal it was initially running in without a full DAQ restart.

If the ROC was not rebooted and only the CODA command died, the command should be the most recent in the shell history. In this case you should be able to press *up* in the terminal and re-execute the command.

Alternatively, this command will start the appropriate CODA process for the host it is run on:

```
hpsRocStart.sh
```