

# HPS DAQ Operations Manual v2.3

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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 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 2 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

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\*Contact person for document.

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 clondaq5 as clasrun.
2. To start all DAQ processes, open a terminal and run:  
`> hps_start`  
`> roc_xterms_start`

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

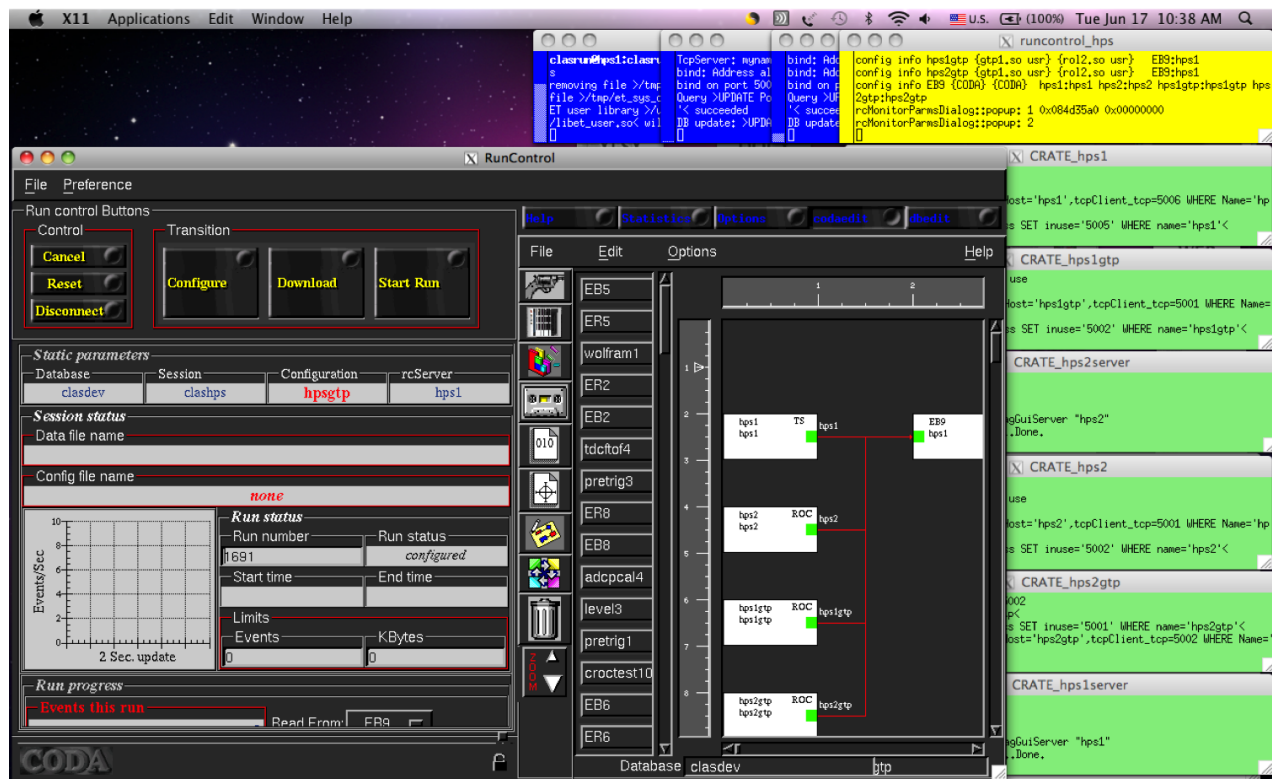


Figure 1: CODA workspace.

### 2.2 Killing the DAQ

Log into clondaq5 as clasrun, then execute the two commands:

- `> hps_exit`
- `> roc_xterms_exit`

This does not have to be done from the same terminal used for Section 2.1. Do not proceed with DAQ operations until all the windows in Fig. 1 have disappeared.

## 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 and DISC2 scaler displays are running.

### 3. SVT Checklist

- (a) SVT position is appropriate for the run. **Check with shift leader if not sure.**
- (b) 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:**

- i. 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.
  - ii. Power all the flange channels from SVT/Flange GUI.
  - iii. 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.
- (c) 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 Resetting 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)!**

- (d) SVT DAQ is in a state ready to run:

- i. 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.

- ii. Check that error counts in the SVT/svtDpmLinkStatus GUI are zero and not updating.

- iii. In `/SVT/DPM Status GUI`: check that all data DPMs are in the appropriate CODA Run state e.g. if you are in 'Download' all should be in that state, etc. NOTE: This may be not updated if there was a DAQ restart, e.g. the DPMs might be in 'End' as they doesn't know that CODA was restarted until 'Download' is initiated.
- 4. **If continuing with same the same run configuration from a stopped run continue to 10.**
- 5. Go to the `RunControl` GUI: click `connect`, a new GUI window opens.
- 6. Click on `DAQ Configuration`, choose 'HPS' and choose the configuration that has been explained to you: either on the run plan wiki or on the whiteboard. Click OK.
- 7. Check that run number, data filename and run configuration filename shown on `RunControl` GUI are correct. The "download" button should appear.
- 8. Press `Download`. Wait until the "Prestart" button appears and `RunControl` GUI reports that Download was completed. This might take up to 30s to complete.
  - (a)
  - (b) Go to the `/SVT/svtDpmRunState` GUI and check that all DPM's are in "Download" state.
  - (c) When `Prestart` button shows up the DAQ is ready to take data.
- 9. Open the hybrid GUI and check that the hybrids are on (currents are green). If not, push the `On` button on the `All hybrids ON/OFF` switch and wait about 30 seconds for hybrids to turn on. The hybrid GUI will freeze while the hybrids turn on; check the FEB GUI to watch FEB currents rise as the hybrids are switched on.
- 10. Press `Prestart` and wait for "transition Prestart succeeded" message in `RunControl` window (about 30 seconds). The "Go" button should appear.
  - (a) Push the "Manual Update" button in the `DIAG` GUI a few times. The "Cluster Latency" plot should show a single spike. If it shows two spikes, issue the following command on `clondaq5`:  

```
> tcpClient hps11 'tiSyncReset()'
```
  - (b) Check the `FADC SCALERS` and `DISC SCALERS` GUIs. The two should be smooth and similar to each other, no blank blocks or stripes (if you see these, do a full DAQ teardown and ROC reboots).
  - (c) Prestart SVT DAQ checklist (for experts):
    - i. Go to the `/SVT/svtDpmRunState` GUI and check that all DPM's are in "Prestart" state.

- ii. Go to the `/SVT/Hybrid Sync` GUI and check that all hybrids are in "sync" i.e. the `SyncDetected` variable should be `0x1f` and indicator should be **green** for all hybrids.
- 11. Press **Go** to start the run. Wait for "transition Go succeeded" message in RunControl window (about 10 seconds). The "End run" button should appear.
  - (a) Check that the run status is "running" and that triggers are issued at the typical rate.
  - (b) Reset the ECal and SVT monitoring plots (connect). Check SVT occupancy and max sample plots.
  - (c) Fill out a row in the run spreadsheet. Check the whiteboard and run plan wiki for any other logging requirements.
  - (d) Start of run SVT DAQ checklist (for experts):
    - i. Go to the `svtDpmRunState` GUI and
      - A. Check that all DPM's are in "Go" state
      - B. Check that the `TrigCount` is incrementing for both DPM and DTMs and are similar.
      - C. Check that the `EventCount` is incrementing.

## 2.4 Stopping a run

1. Go to the RunControl GUI and press **End Run** to stop data taking. Wait for "End run succeeded" message in RunControl window (about 15 seconds). The "Prestart" button should appear.
2. End of run SVT DAQ checklist (for experts):
  - (a) Go to the `/SVT/svtDpmRunState` GUI and:
    - i. Check that the CODA run state is **Stopped** for all DPMs and DTMs.
    - ii. Check that the `TrigCount` and `EventCount` variables for DPMs and DTMs are identical and the indicators are **green**.
  - (b) **If starting a new run with the same configuration, go to section 2.3, starting at item 10.**

## 2.5 Beam trips: actions and recovery for DAQ

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

*All of this must be executed as user **clasrun** on machine **clondaq5**.*

### 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) If any of the 'dpm' or 'dtm' has problem this means the SVT DAQ is in a bad state: GOTO Section 2.6.6, else
  - (b) GOTO Section 2.6.2.
3. GOTO Step #9 in Section 2.3.

### 2.6.2 Full DAQ Teardown and ROC Reboots and Restart

1. These two commands can be done in parallel (simultaneously) in two different terminals and will gradually kill all the terminals in Figure 1. Do not wait for them to finish before proceeding to the next step.

```
hps_exit
roc_xterms_exit
```

2. `roc_reboot hps11`

3. Wait 30 seconds, then reboot the rest of the ROCs (these can all be done in parallel):

```
roc_reboot hps1
roc_reboot hps2
roc_reboot hps12
```

4. Confirm Successful Login to all ROCs (and logout afterwards):

```
ssh hps11, hps12, hps1, hps2, hps1gtp, hps2gtp
```

This will not work instantaneously; keep trying until all the ROCs are fully alive. Should not be more than a couple minutes. Pings will work before sshes. If any fail to ssh successfully without error after 5 minutes, reboot the culprit ROC. *If you need to rereboot hps11 here, GOTO STEP #2.*

5. After all 6 sshs are succesful and Step #1 has completed, do the following. These can be done in parallel in two different terminals:

```
hps_start
roc_xterms_start
```



6. After rebooting ROCs, you may have to reboot the trigger scalers GUI (REBOOT button at the bottom right).
7. GOTO Step #5 in Section 2.3

### 2.6.3 Rebooting a 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).

### 2.6.4 Restarting Individual CODA Commands

This is more advanced.

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.

Otherwise, here is a list of the CODA commands to be run on each ROC. These should be executed in a terminal that is logged into the appropriate ROC (`hps1`, `hps2`, `hps11`, `hps12`, `hps1gtp`, or `hps2gtp`) as user `clasrun`.

- `prxt_linux_ts.tcl hps11`
- `prxt_linux_gef.tcl hps1`
- `prxt_linux_gef.tcl hps2`
- `prxt_linux_gef.tcl hps12`
- `prxt_linux.tcl hps1gtp`
- `prxt_linux.tcl hps2gtp`

### 2.6.5 Debugging deadtime

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`)

### 2.6.6 FIX SVT DAQ

Before following the below procedure please record in a log entry what the status:

- 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 15 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?
- If this happened during Open the `/SVT/Hybrid Sync` GUI and write down if the status: which ones are red/green?

To try and resolve the SVT DAQ state try to follow these instructions.

1. If one or many of the DPMs failed to or prestart

- (a) Reboot the software by login into `clondaq5` as 'clasrun'.

```
> cd $CLAS/slac_svt/svtdaq/daq/rceScripts
```

```
> ./rem_restart.sh
```

You will see the script connecting to each host. Wait until finished, can be up to 20s.

Wait until you can ping host 'dtm0'

Open the `/SVT/DAQ IOC Status` GUI and verify that the control DPMs are green; it may take up to 30s (the FEBs need to be powered).

