

HPS DAQ Operations Manual v2.4.2

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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

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distributes a trigger signal to all detector subsystems to read out a selected event. Figure 4 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.

It is critical to get the hostname and username correct!

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.

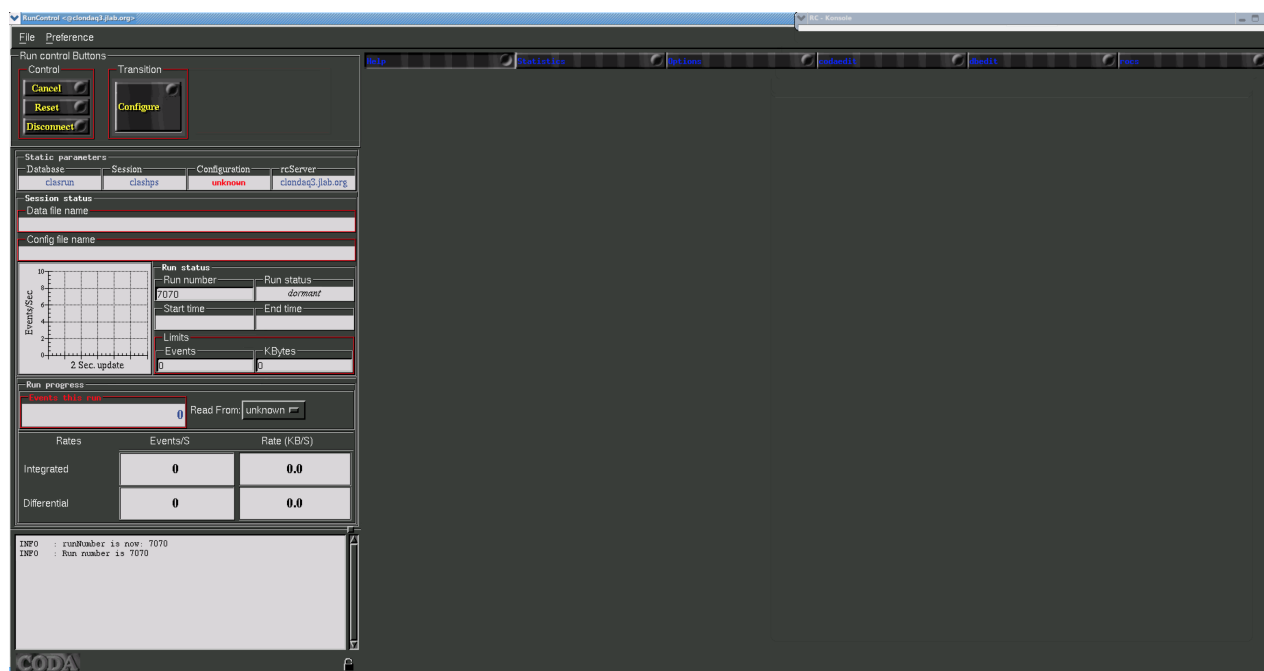


Figure 1: CODA workspace.

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.

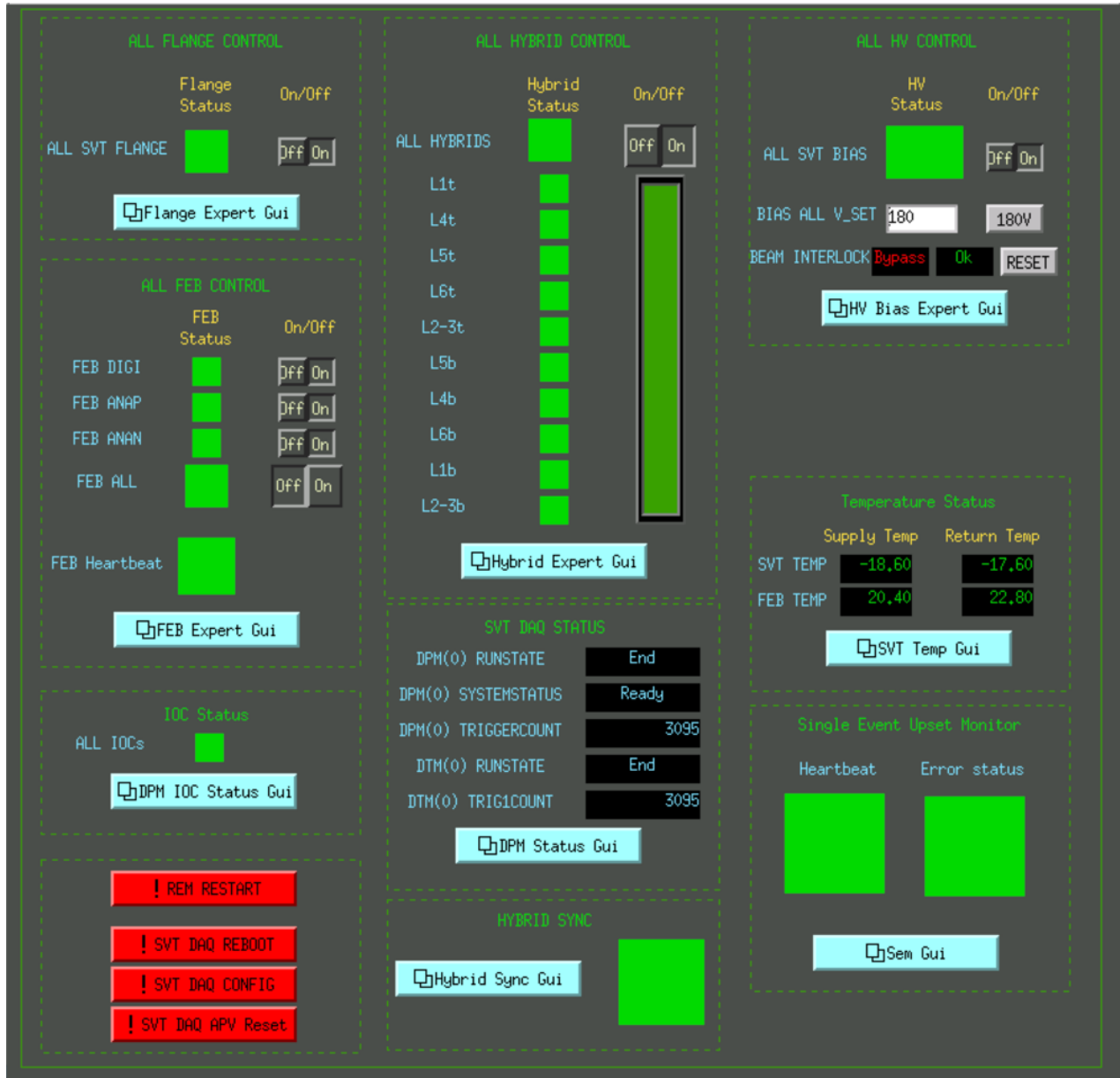


Figure 2: SVT summary GUI.

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.
 - (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 Run Control GUI reports that **Download** was completed. This might take up to 1 minute to complete.
9. Check SVT status
 - (a) In the **SVT summary** GUI under section **SVT DAQ STATUS** and check that both **DPM(O) RUNSTATE** and **DTM(O) 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) Fill out the popup GUI for the run log. See Figure 3.
 - (b) Wait for the message of **Prestart succeeded** in Run Control GUI. This can take up to 1 minute.
 - (c) The **Go** button should appear.
 - (d) 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.
 - (e) Check SVT status
 - i. In the **SVT summary** GUI under section **SVT DAQ STATUS**, check that both **DPM(O) RUNSTATE** and **DTM(O) RUNSTATE** are saying **Prestart**.
 - ii. In the **SVT summary** GUI under section **HYBRID SYNC**, check that status is **GREEN**.
11. Press **Go** to start the run.
 - (a) Wait for **transition Go succeeded**' message in the Run Control GUI. This can take about 10 seconds.
 - (b) The **End Run** button should appear.

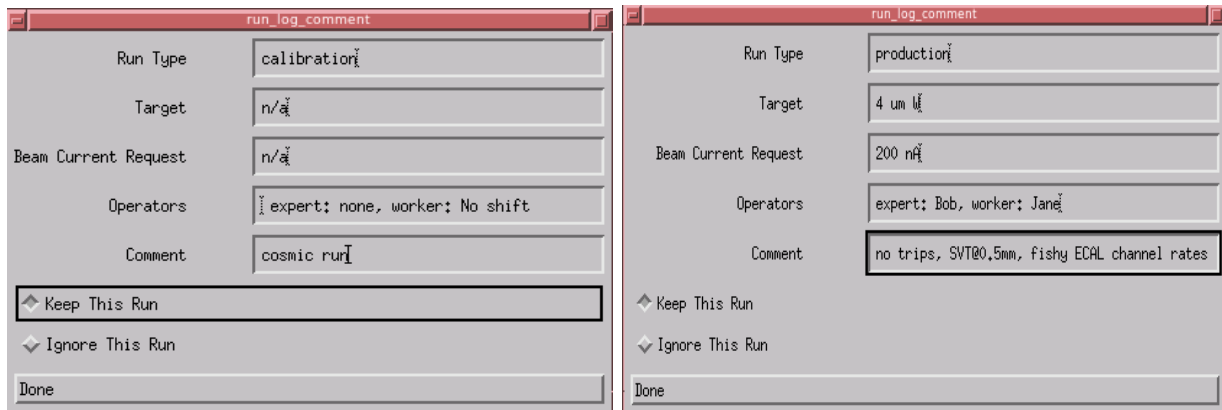


Figure 3: The gui used for input to the run log database. This pops up during Prestart (and again during End), and pressing “Done” is a requirement before moving forward. Filling it out appropriately is very useful, but note that it is only entries in a database and does not directly affect what happens to the data. Appropriate “Run’ Type” could be production, calibration, etc. And do complete the “Comment” section with anything you might deem relevant.

- (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**, check that both **DPM(0) RUNSTATE** and **DTM(0) RUNSTATE** are saying **Go**, and both **DPM(0) TRIGGERCOUNT** and **DTM(0) TRIG1COUNT** are incrementing.
- (e) Reset the **ECal** and **SVT** monitoring plots (disconnect+connect).
- (f) Check **SVT** occupancy and max sample plots.
- (g) 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) Confirm the run log gui by pressing “Done” (see Figure 3). Here you have an opportunity to update and overwrite the info given during “Prestart”.
 - (c) The **Prestart** button should appear.
 - (d) In the **SVT summary GUI** under section **SVT DAQ STATUS** and check that both **DPM RUNSTATE** and **DTM RUNSTATE** are saying **Stopped**.

2.5 FIX DAQ

Follow this procedure if:

- Any CODA transition (**Download**, **Prestart**, **Go**, **End Run**) failed (Run Control GUI says it failed) or timed out (no new message in Run Control GUI for over a minute)
 - A run was started (**Go** succeeded) but the trigger rate is 1 Hz or less (either from the beginning, or after the run has been going for some time)
 - Any of the ROC xterms in the Run Control GUI has died (the xterm is showing a command prompt)
1. Click through the three ROC tabs in the Run Control GUI to check on all of the ROC xterms. If any are showing command prompts at the bottom (for the xterms on the bottom row, you may have to hit Enter a few times in the xterm to make it scroll up), restart the command that was running in the xterm (Up, then Enter).
 2. Log what CODA transition you had most recently done, and which (if any) xterms were dead. If you had just started a run, log how many events were in the run.
 3. In Run Control, click **Cancel** (click twice just to be sure), **Reset** (you will get a confirmation dialog). Then start the run as normal starting with **Download** (procedure in Section 2.3, starting at step 8).
 4. If the run fails for a second time, start this procedure from the beginning (including a log of the new failure). This time start the run starting with **Configure** (procedure in Section 2.3, starting at step 6).
 5. If the run fails for a second time, log the new failure, then reboot the DAQ (the TI and ECal DAQ, then the SVT DAQ) by following the procedure in 2.5.1. Then start the run as normal starting with **Connect** (procedure in Section 2.3, starting at step 5).
 6. If the run fails for a third time, reboot the DAQ again.
 7. If the run fails for a fourth time, call the SVT DAQ expert (unless there are special instructions this is Pelle, whose phone number should be on the whiteboard in the counting house).

2.5.1 Full DAQ Reboot

1. Exit Run Control using the procedure in Section 2.2.
2. Reboot the master TI and ECal DAQ by executing this command in a terminal:

```
hpsRocRebootAll.sh
```

This will reboot hps11, hps1, and hps2, and then wait for a ping response from them all, meanwhile giving some progress messages. When finished and all rebooted rocs are

again alive, it will then restart the trigger scaler IOC, causing a popup about disconnected channels, and then finally display “ROCS REBOOTED and TRIGGER IOC RESTARTED” in the terminal.

3. Reboot the SVT DAQ: GOTO Sec. 2.5.2
4. After reboot is done, start Run Control using the procedure in Section 2.1.

2.5.2 FIX SVT DAQ

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 SVT DAQ 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.

- (b) Check that error counts in the `SVT/svtDpmLinkStatus` GUI are zero and not updating.

- (c) 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.

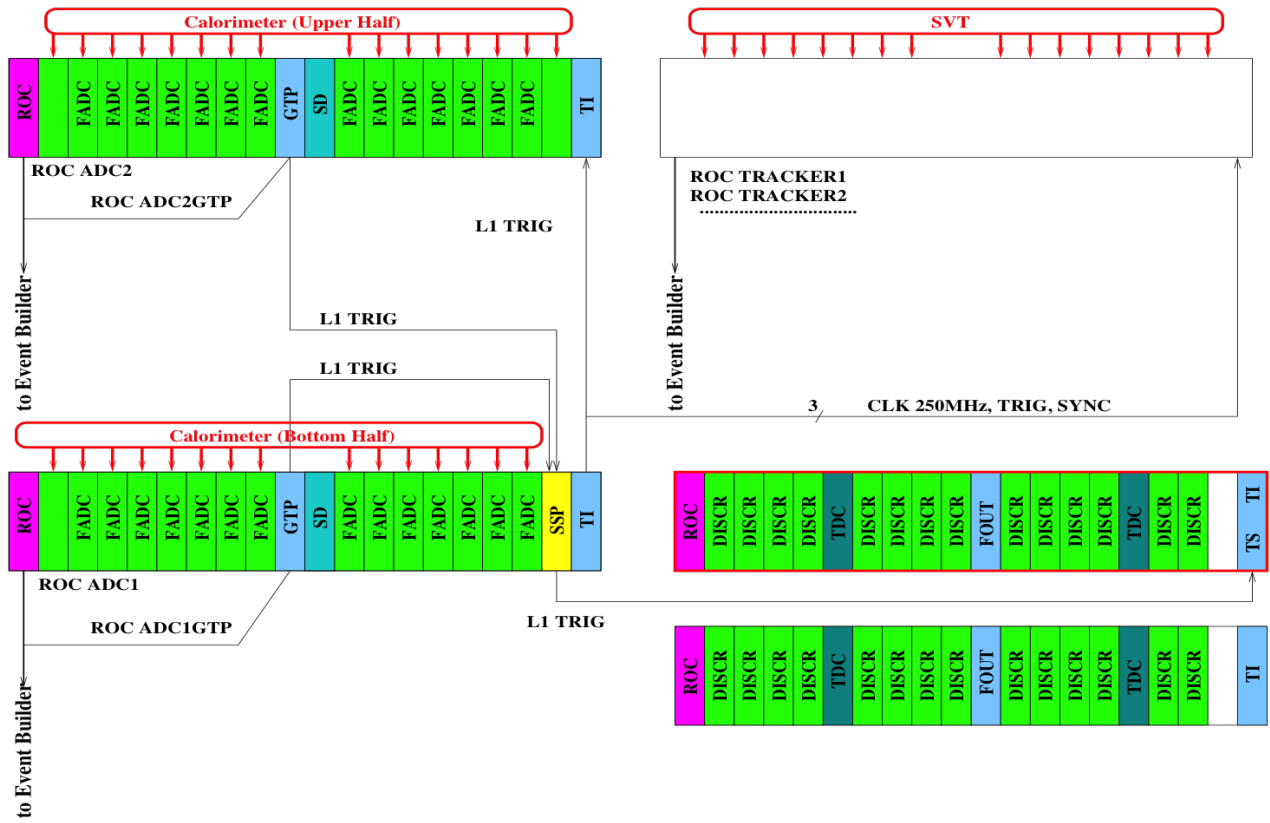


Figure 4: Schematic overview of the DAQ and trigger system.

A Changing 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
```

Here the TRIGGER argument is 1-4, where 1 is singles-0, 2 is singles-1, 3 is pairs-0, and 4 is pairs-1. And the PRESCALE argument is N , a number between 0 and 15 inclusive, where the real prescale factor is 2^N .

B 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” and see if any of the HFBR#1-5 are labeled BUSY.

C Rebooting an Individual ROC

Execute this command (where ROC is one of hps11, 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 BEFORE PROCEEDING.

After rebooting any or all the above ROCs, you must reboot the trigger scalers GUI (REBOOT button at the bottom right). To do this, as user=hpsrun:

1. softioc_console iocjscalers
2. ctrl-x
3. ctrl-]
4. quit

D 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
```