NSTX Real-Time Control GUI

User's Guide

March 28, 2008

This document is meant to describe the use of the Power Supply Real-Time Control (PSRTC) Graphical User Interface (GUI), shown below.

PSRTC/ACQ Control

PSRTC
Mode: Test Operations

shot #   [   ] Restore   50% Test   100% Test   Plasma
         50% CHI   100% CHI   Plasma CHI   Latency

☐ pcs ☐ nohcs ☐ ctf ☐ mds   Start PSRTC   Reset PSRTC   Stop PSRTC   rtcsim

NSTX Control
Start
Stop
Reset Errors

FPDPIO   ACQ   PSRTC   GISCTL   CTF
Active   NOT ACTIVE   NOT ACTIVE   Active   NOT ACTIVE

T 23:38   Slow Clock   SOP_EOP   Archiving

OH 24.60 kA
pcs psrtc I V

PF1AU 16.00 kA
pcs psrtc I V

PF1AL 16.00 kA
pcs psrtc I V

PF1B 10.30 kA
pcs psrtc I V

PF2U 20.30 kA
pcs psrtc I V

PF2L 20.30 kA
pcs psrtc I V

PF3U 15.40 kA
pcs psrtc I V

PF3L 15.40 kA
pcs psrtc I V

PF5 20.50 kA
pcs psrtc I V

CHI 51.30 kA
pcs psrtc I V

TF 66.90 kA
pcs psrtc I V

PF4 3.00 kA
pcs psrtc I V

SPA1 3.40 kA
pcs psrtc I V

SPA2 3.40 kA
pcs psrtc I V

SPA3 3.40 kA
pcs psrtc I V

Modify Setup Parameters   Save Setup Changes

View Log   PSRTC Log   System Log   Browse for log file   Done

Aside from the PCS, the NSTX control system is made up of several executables/applications that each function independently. They are the front panel data port input/output program (FPDP_IO), data acquisition (ACQ), power supply real time control (PSRTC), and gas control (GISCTL). The COE/PCEIC GUI is the main user interface used to start and stop ACQ and PSRTC. This interface also displays status and error information about each of these applications. Additionally, it allows the management and setup of input parameters for the PSRTC both for the next shot and other user pre-defined setups such as those for CHI shots. The GUI is divided into sections which will all be described in detail in later sections. The upper left section is devoted to PSRTC control. It allows for loading of default PSRTC shot setups and various PSRTC flags for different modes of operation. The upper central section contains the main on/off buttons for all the NSTX control applications. The upper right section monitors status information for each of the applications, indicating whether or not each of the necessary processes is running and also indicates any possible errors from each application. The four buttons in the center give status information related to the progress of the software through the NSTX discharge. The bottom section allows the operator to change the status of each coil locked out /in, modify other PSRTC setup parameters and view log files.

I. Running the GUI

The GUI is run from pcs-srv-2. To use it one should log on to pcs-srv-2 as pceic and type:

 gui

The pceic environment is set up automatically by the execution of the user's .cshrc file which occurs automatically upon logging in. Environmental variables specific to the operation of NSTX are contained in the module nstx/pcs.

II. Setting up next shot configuration

The upper left corner of the gui, labeled "PSRTC" has several options for loading pre-saved shot configurations, setting "command-line" options and starting and stopping PSRTC.

Stored Shot Configurations:

For use with the "mds" command line option mode, described below. Selecting any of these options requires a reset of PSRTC.

- 50% Test
- 100% Test
- Plasma
- 50% CHI
- 100% CHI
- Plasma CHI
- Latency – for testing

Clicking one of these buttons will cause the chosen configuration to be put into the MDSplus "model tree" in preparation for the next shot. Additionally, it is possible to re-load a configuration from a particular shot by entering the shot number in the field labeled "shot #" and clicking "Restore". **Once you have loaded a configuration using one of these methods you must click the "mds" button below in order to indicate that PSRTC should read its setup from MDSplus.**

Command Line Options:

- pcs - indicates the PSRTC should retrieve its output requests from the PCS. This option is typically set after completion of the morning engineering test shots but is not used for engineering test shots.   Setting or unsetting this option requires a restart (stop/start not a reset) of PSRTC if it is already started.

- nohcs – indicates that hardware control faults should be suppressed. This option is typically used for software testing. Setting or unsetting this option requires a restart (stop/start not a reset) of PSRTC if it is already started.

- ctf - stands for "Coil Test Facility" and is not used for NSTX. Setting or unsetting this option requires a restart (stop/start not a reset) of PSRTC if it is already started.

- mds – indicates that PSRTC setup values should be read from the MDSplus tree instead of from local files. Setting or unsetting this option requires a restart (stop/start not a reset) of PSRTC if it is already started.

One important thing to note about the "command-line" options – those labeled "pcs", "nohcs", "ctf" and "mds": The PSRTC is a code that was ported from an older version where these options were command line options or switches that could be set only by running the program with these options declared – on the command line. This is still true! So, changing any of these items requires restarting PSRTC rather than just issuing a reset command. All other changes to PSRTC configuration from this gui require only issuing a reset by clicking the "Reset PSRTC" button. The "Reset PSRTC" button causes

PSRTC to re-read its setup parameters either from MDS or from setup files depending on the options selected.

PSRTC process control

- Start PSRTC - starts the mpi_rtc process on both the host and rt machines
- Reset PSRTC – Issues a reset signal which causes PSRTC to clear any errors, and re-read setup parameters.

- Stop PSRTC – stops the mpi_rtc process on both the host and rt machines

- rtcsim – runs PSRTC in simulation mode

Running PSRTC without MDS

The PSRTC used to be configured by text files called c.d ant t.d and can still be operated this way. First make sure the "mds" command line option is not selected. If logged into pcs-srv-2 as pceic log files can be found in the area $RTC_INPUT. Files are named c.d.plasma c.d.plasma_CHI, t.d.50_percent etc. You must copy the desired c.d.<config> into c.d and likewise for the t.d file. For example, if you wanted to run a 50% test shot you would type the following:

cp $RTC_INPUT/t.d.50_percent $RTC_INPUT/t.d
cp $RTC_INPUT/c.d.testshot $RTC_INPUT/c.d

note: 50% and 100% both use the same c.d file

or if you wanted to run a CHI plasma you would type:

cp $RTC_INPUT/t.d.plasma_CHI $RTC_INPUT/t.d
cp $RTC_INPUT/c.d.plasma_CHI $RTC_INPUT/c.d

Again make sure the "mds" option is NOT selected.

III. Running NSTX Control from the GUI

The above section referred to starting and stopping the PSRTC only. On the top Center of the gui is the heading "NSTX Control". This section has the main start/stop button for all the other user started control processes.

- Start - Starts the following processes: Acq, Psrtc and hostsrv on both the host and rt machines. Fpdp_io and gisctl should already be running on the rt machine.

    Once these processes have been started you should see the following:

    1) a new xterm window with the heading NSTXctrlHost which should scroll with the following information:

        o   index - number of input data sets should always increase monotonically),
        o   Time - value coming directly from the timing module
        o   Time Diff - difference in time from timing module since last sample should always be approximately 1 second
        o   nstxtime - the time in seconds since the last shot
        o   Proc time - the time since we last updated the screen in seconds should always be approximately 1 second..

```
NSTXctrlHost                                                              X
 Proc time= 1.006769
 index = 36     Time = 400498745      Time Diff = 999996 us   nstxtime=398.498749 s
 Proc time= 1.006546
 index = 37     Time = 401498741      Time Diff = 999996 us   nstxtime=399.498749 s
 Proc time= 1.007003
 index = 38     Time = 402498737      Time Diff = 999996 us   nstxtime=400.498749 s
 Proc time= 1.006649
 index = 39     Time = 403498733      Time Diff = 999996 us   nstxtime=401.498749 s
 Proc time= 1.006791
 index = 40     Time = 404498729      Time Diff = 999996 us   nstxtime=402.498749 s
 Proc time= 1.006801
 index = 41     Time = 405498724      Time Diff = 999995 us   nstxtime=403.498718 s
 Proc time= 1.006628
 index = 42     Time = 406498720      Time Diff = 999996 us   nstxtime=404.498718 s
 Proc time= 1.006763
 index = 43     Time = 407498716      Time Diff = 999996 us   nstxtime=405.498718 s
 Proc time= 1.006768
 index = 44     Time = 408498712      Time Diff = 999996 us   nstxtime=406.498718 s
 Proc time= 1.006734
 index = 45     Time = 409498708      Time Diff = 999996 us   nstxtime=407.498718 s
 Proc time= 1.006725
 index = 46     Time = 410498703      Time Diff = 999995 us   nstxtime=408.498718 s
 Proc time= 1.006807
```

2) FPDPIO, ACQ, PSRTC, and GISCTL buttons on the GUI should change from "NOT
   ACTIVE" green buttons to "ACTIVE" red buttons.

3) Looking at the running processes on the rt machine using approximately like the following:

```
pcs-rt-2                                                                  X
top - 09:45:58 up 1 day, 16:54,  2 users,  load average: 4.46, 4.51, 4.47
Tasks: 123 total,   5 running, 117 sleeping,   0 stopped,   1 zombie
Cpu(s): 47.8% us,  2.2% sy,  0.0% ni, 49.8% id,  0.1% wa,  0.0% hi,  0.0% si
Mem:   7923256k total,  7858764k used,    64492k free,    70412k buffers
Swap:  8191992k total,        0k used,  8191992k free,  7338288k cached

  PID USER      PR  NI  VIRT  RES  SHR S %CPU %MEM    TIME+  COMMAND
 5714 root      25   0  100m   45m  45m R  100  0.6  2439:37 fpdp_io
 9257 pceic     25   0  222m  165m 165m R  100  2.1 107:24.86 acq
10287 pceic     25   0  507m  163m  48m R  100  2.1  83:36.74 mpi_rtc
 9253 pceic     15   0  328m  325m 163m S   52  4.2  51:13.15 hostsrv
 5720 root      25   0 58332   45m  45m R   49  0.6  2043:22 gisctl
30039 pceic     17   0  5852 1584 1188 S    0  0.0  2:06.76 top
    1 root      16   0  2188  552  472 S    0  0.0  0:01.27 init
    2 root      RT   0     0    0    0 S    0  0.0  0:00.01 migration/0
    3 root      34  19     0    0    0 S    0  0.0  0:00.01 ksoftirqd/0
    4 root      RT   0     0    0    0 S    0  0.0  0:00.00 migration/1
    5 root      34  19     0    0    0 S    0  0.0  0:00.00 ksoftirqd/1
    6 root      RT   0     0    0    0 S    0  0.0  0:00.00 migration/2
    7 root      34  19     0    0    0 S    0  0.0  0:00.00 ksoftirqd/2
    8 root      RT   0     0    0    0 S    0  0.0  0:00.00 migration/3
    9 root      34  19     0    0    0 S    0  0.0  0:00.00 ksoftirqd/3
   10 root      RT   0     0    0    0 S    0  0.0  0:00.00 migration/4
   11 root      34  19     0    0    0 S    0  0.0  0:00.00 ksoftirqd/4
```

This can be done by logging into pcs-rt-2 machine as pceic and typing 'top' at the command line.
You should see the following named processes:

- o   fpdp_io – the FPDPIO process should take up 100% of one processor
- o   acq – the ACQ process should take up 100% of one processor
- o   mpi_rtc – the PSRTC process should take up 100% of one processor
- o   hostsrv – the host process responsible for communication between the rt and srv machines should share a processor with gisctl process
- o   gisctl – the GISCTL process should share a processor with the host process. Together they should use 100% of one processor

- Stop – Stops the ACQ, PSRTC and hostsrv processes on both the host and rt machines.

- Reset Errors – In the event of an error (see sections IV. Monitoring the Status of Control Processes and IX Clearing Errors) clicking his button will clear error indicators from the GUI only. If the error is a PSRTC error, you must first click the "Reset PSRTC" button.

IV. Monitoring the Status of Control Processes

The top right section of the GUI displays the status of each of the processes necessary for control. During normal NSTX operation all buttons, except CTF, should be red "ACTIVE" buttons. Before any processes are started, each of these buttons will be green and read "NOT ACTIVE". In the event of an error, these buttons will turn yellow and read "ERROR". Clicking on any of these buttons will display the relevant error.

- FPDPIO
- ACQ
- PSRTC
- GISCTL
- CTF – Stands for Coil Test Facility. Under normal NSTX operations it will always be a green "NOT ACTIVE" button.

V. Monitoring the Shot Cycle

The middle section of the GUI consists of 4 buttons, which help to monitor the shot cycle as it progresses.

- T 0 – When the control processes are running this button shows the current NSTX time. It is updated every few seconds and shows the time relative to the last NSTX shot.
- Slow Clock – Is red between shots when the control system is running in its slow mode and yellow during the discharge when the control system changes into fast mode.
- SOP_EOP – Is yellow between shots and turns red during the discharge
- Archiving – Is yellow between shots and during the discharge. It turns red after the shot when the data for that shot is being archived.

VI.. Editing Coil Configurations

In the Bottom center of the GUI are a series of buttons one for each of the coils in use on NSTX. Each is either red or green with red indicating the coil is in use for the next shot and green meaning that it is not. These buttons act as toggle buttons. So if the coil is labeled in red (in) and it is clicked it will change to green (out) for the next shot. After changing one or more of these you will notice that the button at the bottom of the GUI labeled "Save Setup Changes" will turn red. You will need to click "Save Setup Changes" in order for them to be saved for the configuration of the next shot. Finally, after saving the changes it is necessary to "Reset PSRTC" in order for those changes to be used on the next shot. So:

1) Click the coils you want to toggle in/out
2) Click "Save Setup Changes"
3) Reset PSRTC

VII.. Modifying Setup Parameters

In section II. Setting up next shot configuration, the loading of various standard pre-saved configurations was discussed. Section VI. Editing Coil Configurations discussed a method for changing one particular parameter in preparation for the next shot. The button Modifying Setup Parameters allows the modification of all other setup parameters that configure the operation of PSRTC. Typically this would be done by Ron Hatcher or his appointee. Clicking this button opens another interface shown below. Modifying setup parameters from the GUI in this way will only effect the "Next Shot" configuration. Changes made will remain in place for all future shots until an alternate configuration is loaded.
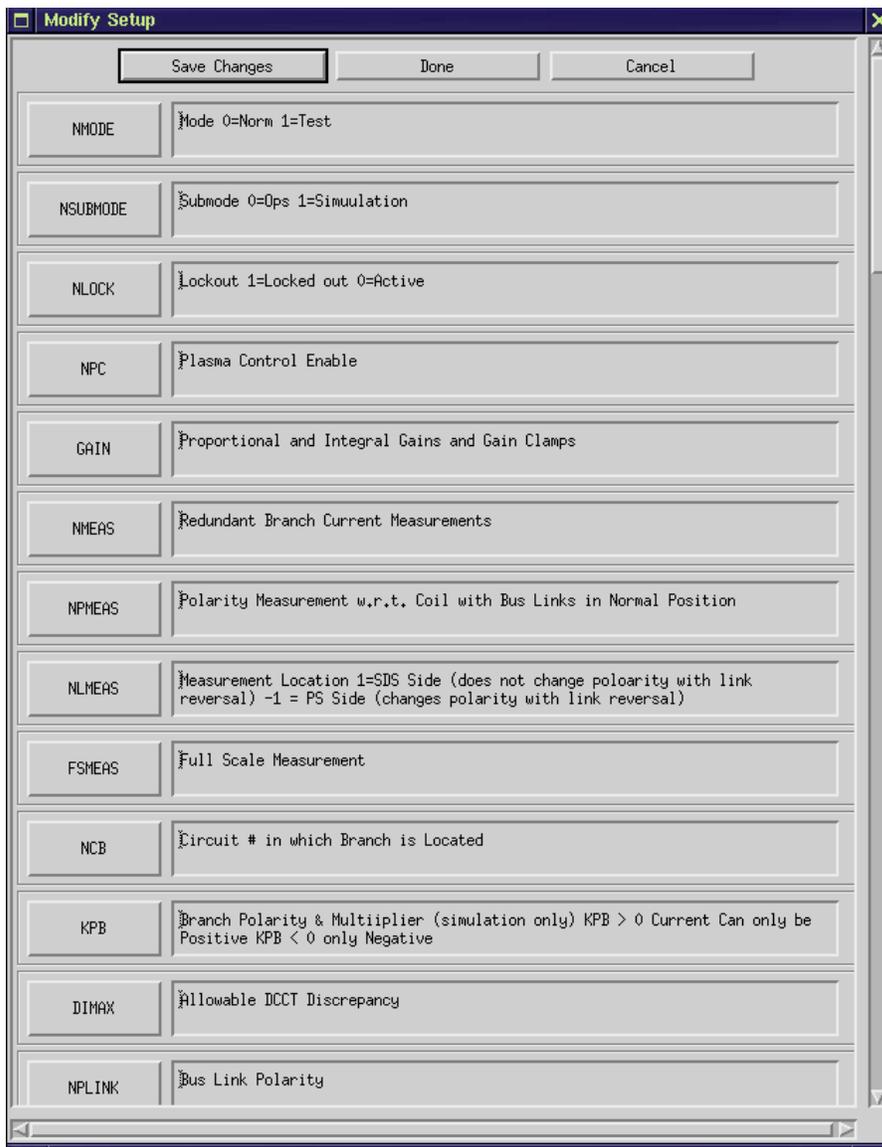

Each of the buttons lining the left side of the Modify Setup GUI represents a different PSRTC configuration parameter with a brief description of its intended function. Clicking any one of these will in turn open another window with appropriate fields for modifying that parameter. For example, the

parameter that controls the coil configuration that can be manipulated from the GUI as described in section VI is called NLOCK. Selecting NLOCK from Modify Setup GUI opens the following:
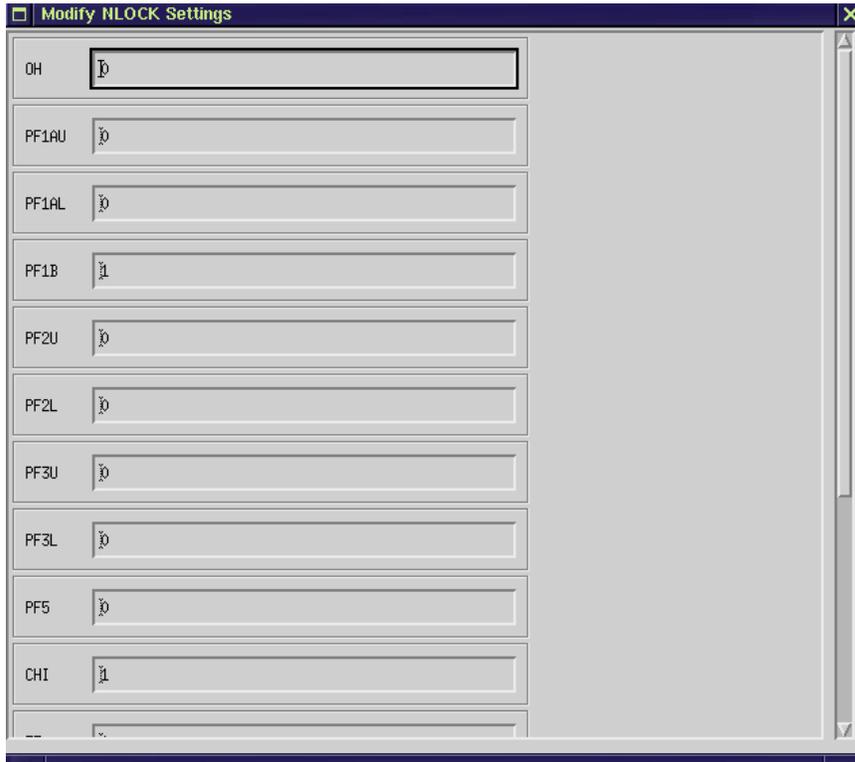
From here you can change the value for each coil where a 1 indicates the coil will not be active for the shot and 0 indicates that it will be active. For another example, the parameter DAT corresponds to the values of the old t.d setup files which control the pre-programmed coil currents used for engineering test shots. Choosing DAT from the Modify Setup GUI brings up a list of coils and subsequently a graphical editor for the pre-programmed current shown below:
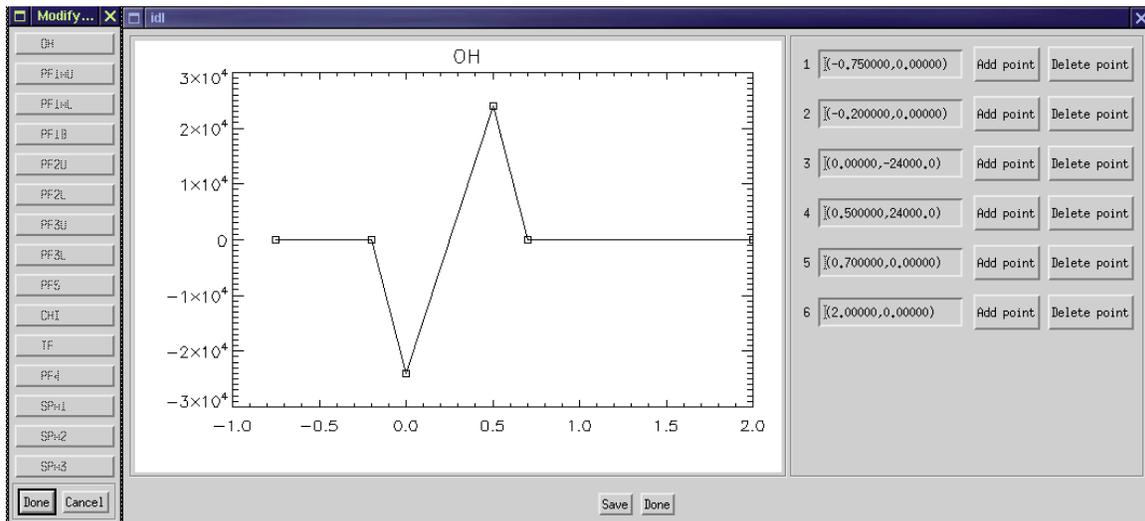
Once these changes have been saved by clicking the save button on the GUI the changes are saved to the MDSplus model tree for use on the next shot, however a PSRTC reset must then be completed causing PSRTC to read the new setup parameters.

VIII. Viewing Logs

- View Log – Shows the GUI log which shows the changes made from the gui by pceic as well as any GUI errors.
- PSRTC Log – Shows Logging of status and error information from PSRTC application only. The end of this file (most recent 2000 entries can also be viewed by typing rtclog at the command line when logged in as pceic. Shows only the most recent log file.
- System Log – Shows Logging of status and error information from all the other system processes. This end of this file (most recent 2000 entries) can also be viewed by typing psclog at the command line when logged in as pceic. Shows only the most recent log file.
- Browse for log file – Allows you to browse for a log file. This allows for viewing of logs from previous dates etc.

IX.. Clearing Errors

- PSRTC Errors – PSRTC errors can be reported for a number of reasons. If the PSRTC status button turns yellow and reads ERROR the PSRTC will need to be reset before another shot can successfully executed. The procedure for clearing PSRTC errors is as follows:

    1) Click The 'Reset PSRTC' button
    2) Wait about 1 second for PSRTC to respond on the rt machine
    3) Click the 'Reset Errors' button to clear errors from the GUI

    The PSRTC log file should indicate that a reset has been received and return to normal operation.

- All others

    1) Click the 'Reset Errors' button to clear errors from the GUI

If errors persist or reappear after clearing errors it is an indication that there is a continuing problem that will require further investigation.

X. Stopping Control Functions

Stopping the NSTX control processes can be done by clicking the 'Stop' Button.

XI. Closing the Control GUI

Click the 'Done' Button at the bottom.