LERF RF User Guide

Last updated
2/5/2019, 09:30 PST
S. Hoobler

Contents

I. Standard Controls and Information 2

1. CPUs and IOCs 2
2. Chassis IPs 2
3. Start/Restart the EPICS IOC 2
4. View RF EDM displays 4
5. Initialize/Checkout LLRF Hardware 5
6. View RF Waveform Plots 8
7. Raw SEL Amplitude Control 10
8. Control Stepper Motor Tuner 11
9. Control Piezo Tuner 12
10. Drive Cavity With Simple Tone Signal 13
11. Run SEL Pulsed RF 14
12. Ramp Cavity to CW/SELAP and Perform Cavity Characterization 15

II. Occasional Issues 16

1. Mystery Rack Checkout Error 16
2. Recover Non-Updating EPICS Waveforms 17
3. Ping Test 18
4. View the EPICS IOC Console 18
5. RF 'Background Process' 19

I. Standard Controls and Information

1. CPUs and IOCs

JLab Cryomodule Number	*LCLS-II Cryomodule Name*	*CPU Node Name**	*EPICS IOC Name**
1	ACCL:L1B:0200	lcls-llrfcpu01	sioc-l1b-rf01
2	ACCL:L1B:0300	lcls-llrfcpu02	sioc-l1b-rf02

**CPU Node Name is referred to as <cpuname>in the commands shown below.*
EPICS IOC Name is referred to as <iocname> in the commands shown below.

2. Chassis IPs

These are the IP addresses used in the LLRF internal network. They are the same for each cryomodule.

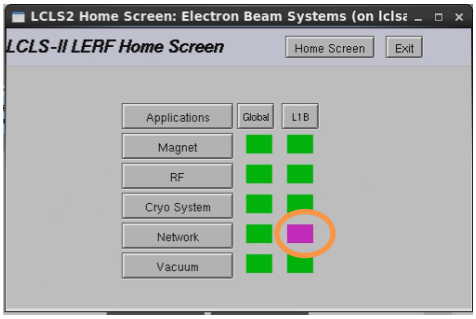
Rack	*Chassis*	*IP*
Cavities 1-4 (aka Rack A)	RES	192.168.0.100
Cavities 1-4 (aka Rack A)	RFS1 (cavities 1,2)	192.168.0.101
Cavities 1-4 (aka Rack A)	RFS2 (cavities 3,4)	192.168.0.102
Cavities 1-4 (aka Rack A)	PRC	192.168.0.103
Cavities 5-8 (aka Rack B)	RES	192.168.0.200
Cavities 5-8 (aka Rack B)	RFS1 (cavities 5,6)	192.168.0.201
Cavities 5-8 (aka Rack B)	RFS2 (cavities 7,8)	192.168.0.202
Cavities 5-8 (aka Rack B)	PRC	192.168.0.203

PRC=Precision Receiver Chassis
Reads cavity probe signals
RFS=RF Station
Provides RF drive; reads forward , reverse, detune signals
RES=Resonance/Interlock Chassis
Controls tuners; performs interlock logic

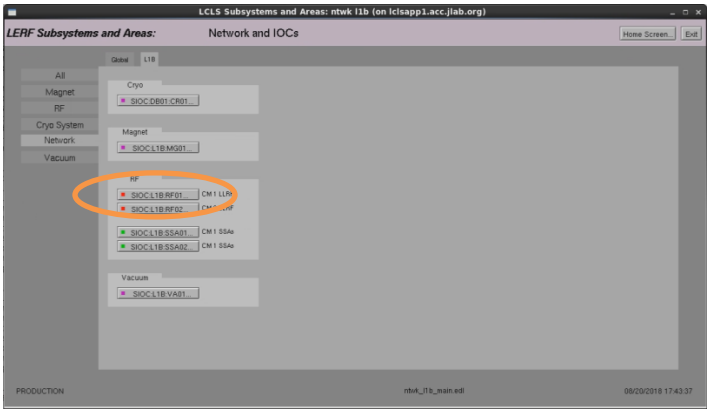
3. Start/Restart the EPICS IOC

1. Log into LERF workstation or server
   (lcls01/2/3/lclsapp1 with individual user id)

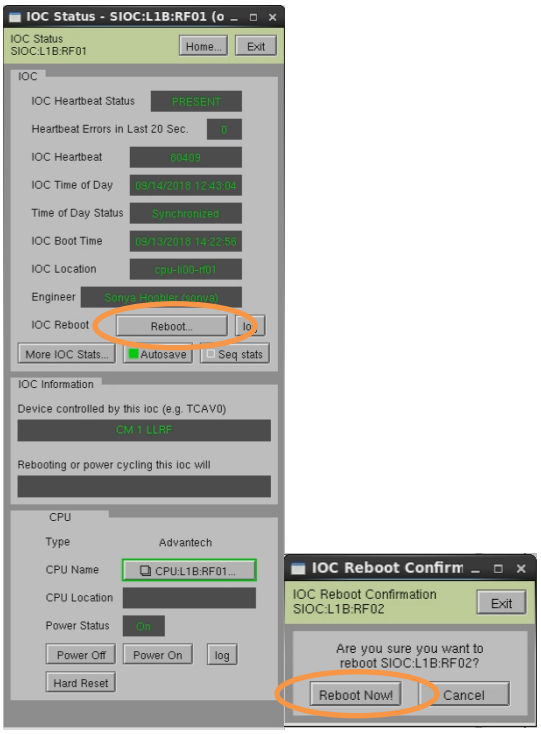
2. Type lerfhome&



3. Click on box intersecting Network and L1B



4. Click on IOC of interest

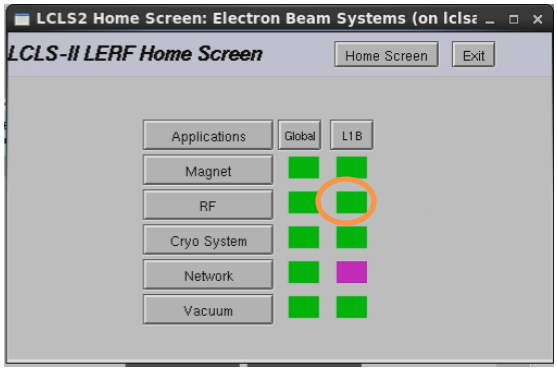


5. Click on ‘Reboot’. Then click on ‘Reboot Now!’

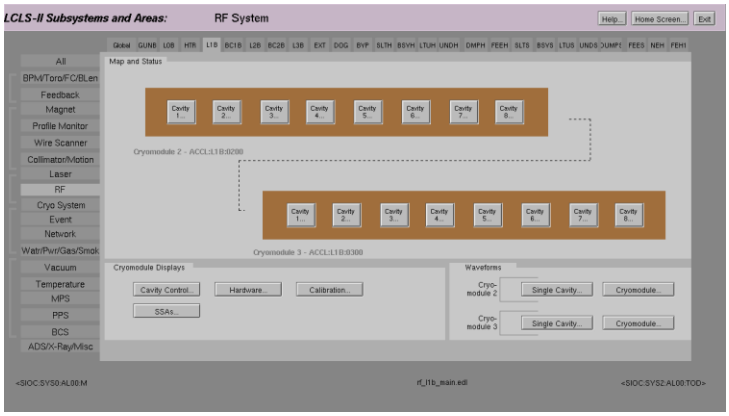
4. View RF EDM displays

a. Log into LERF workstation or server (lcls01/2/3/lclsapp1 with individual user id)

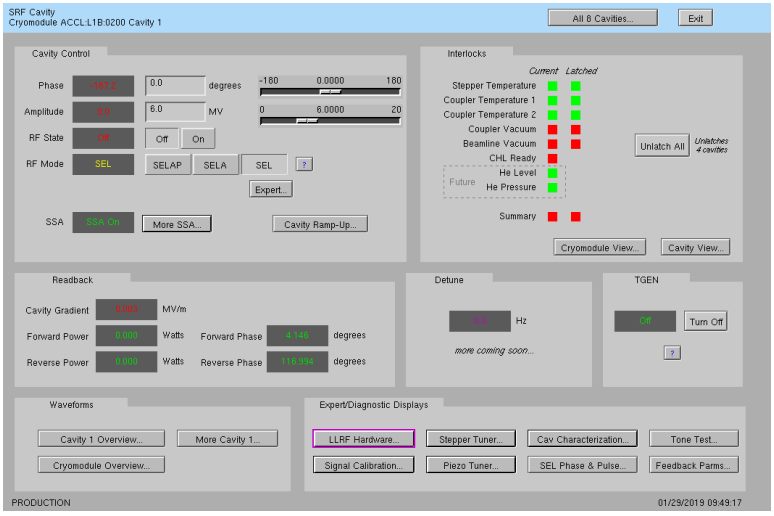
b. Type lerfhome&



c. Click on box intersecting RF and L1B



L1B Overview Display



Single Cavity Display

5. Initialize/Checkout LLRF Hardware

Needed after power outage, hardware swap, etc.

a. Click on Hardware… (from either L1B Overview or Single Cavity display—see above).

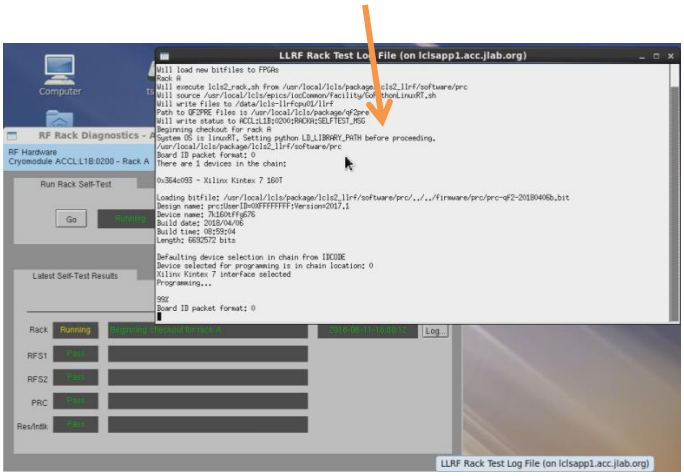
b. For appropriate rack (A or B), open display labelled Rack Hardware Init and Test…

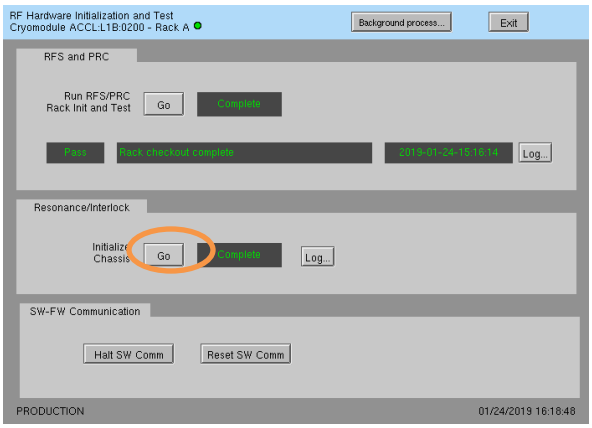
c. Execute RFS/PRC initialization and checkout. Click Go

(The script will disable and then re-enable communication with EPICS.)

To view the rack test script output, click on Log…

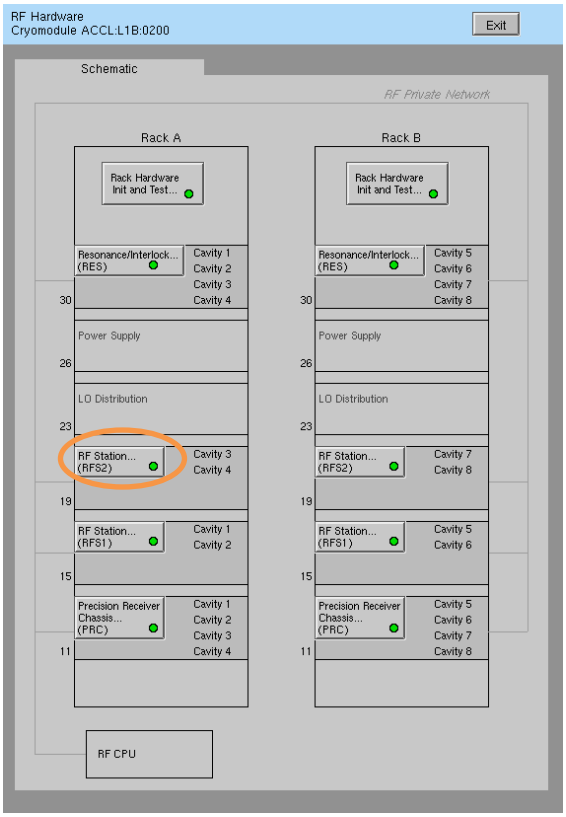
It will open an xterm window and display the script output as it progresses.

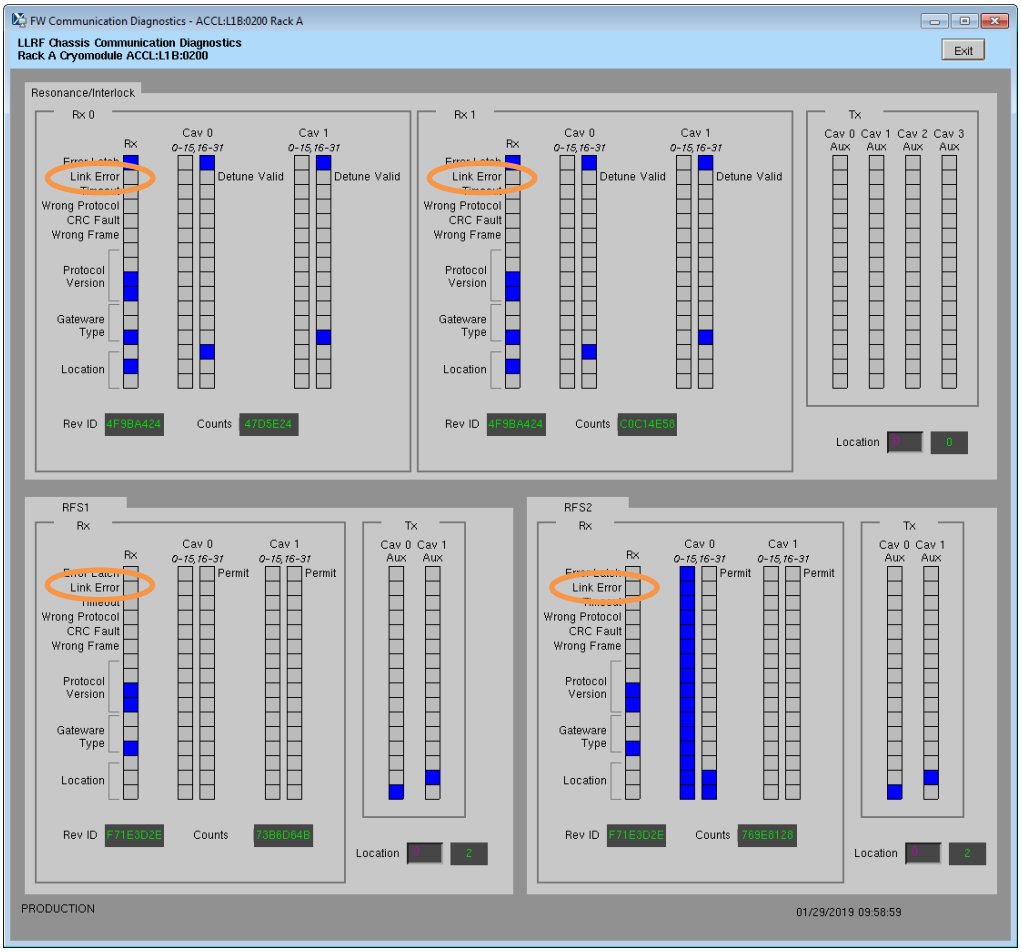




d. Initialize RES chassis. Click Go
(The script will disable and then re-enable communication with EPICS.)

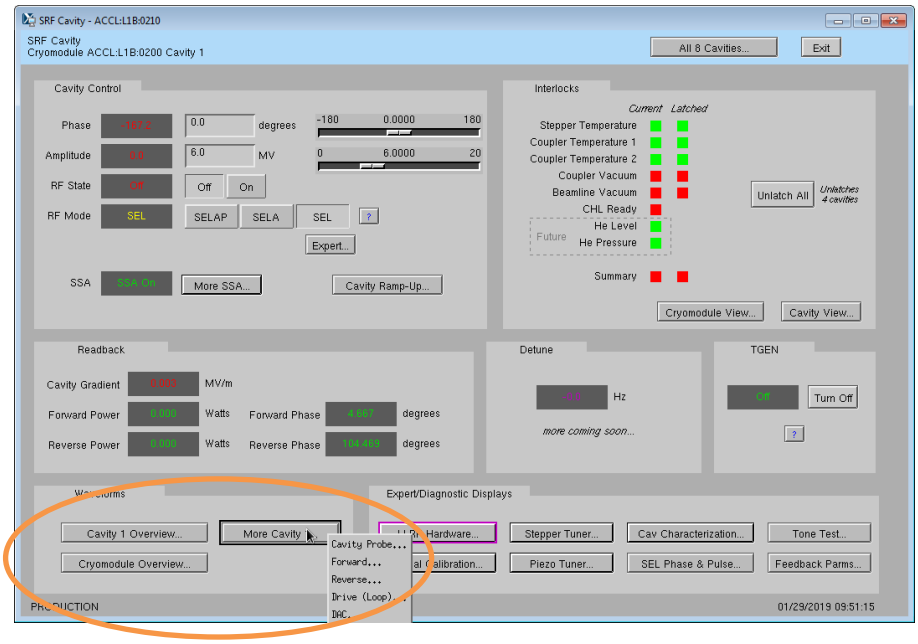
There are currently no automated checks for RFS<->RES communication. You'll need to look at the diagnostic display. From the Hardware display, for the appropriate rack, click on an individual chassis, then click on Comm Diag…





The top row shows the RES status; the bottom the RFS status. In the ‘Rx’ sections, the ‘Link Error’ bit is set (blue) if there is a problem. (This snapshot shows no communication errors.)There is other useful data on this display too.

6. View RF Waveform Plots

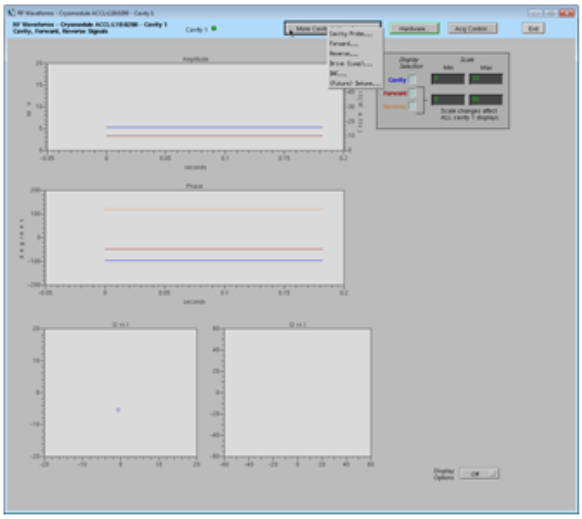


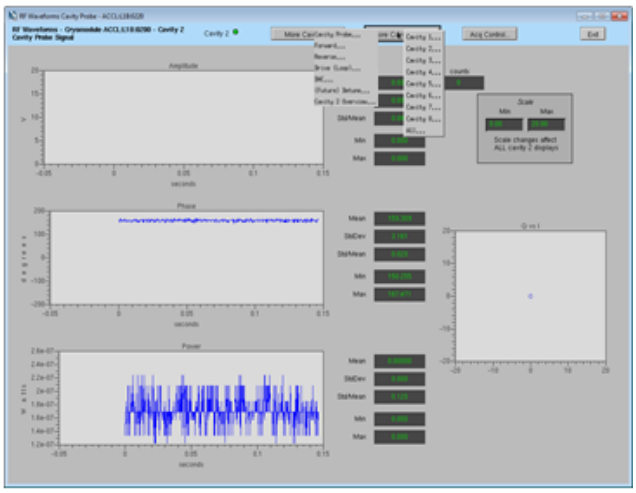
Cavity Overview -- Cavity, Forward, Reverse signals for single cavity

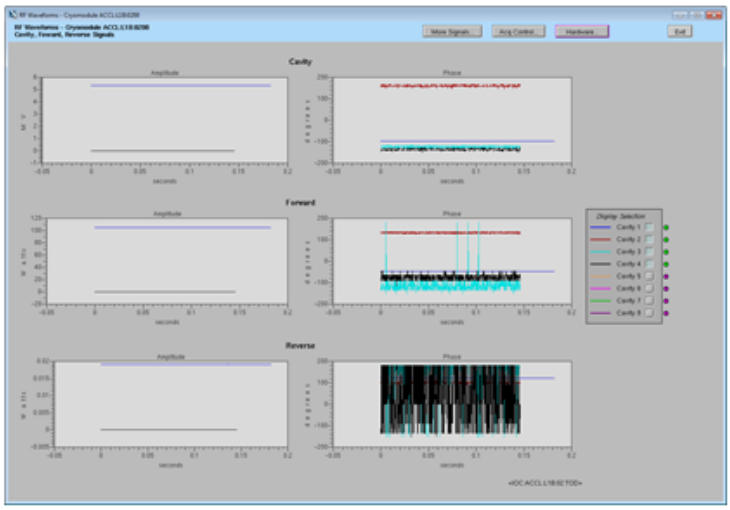
Cryomodule Overview -- Cavity, Forward, Reverse signals for all 8 cavities

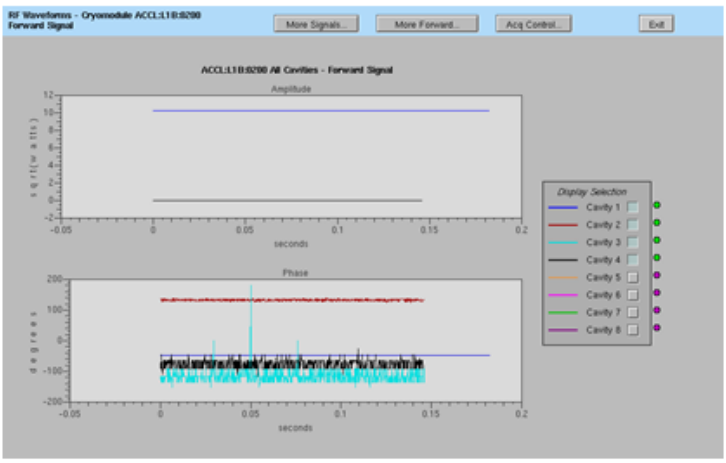
More Cavity -- Drop-down menu for single-cavity single-signal display

From those displays, you can navigate to other cavities, other signals, or display a single signal for all 8 cavities. Example displayshots:



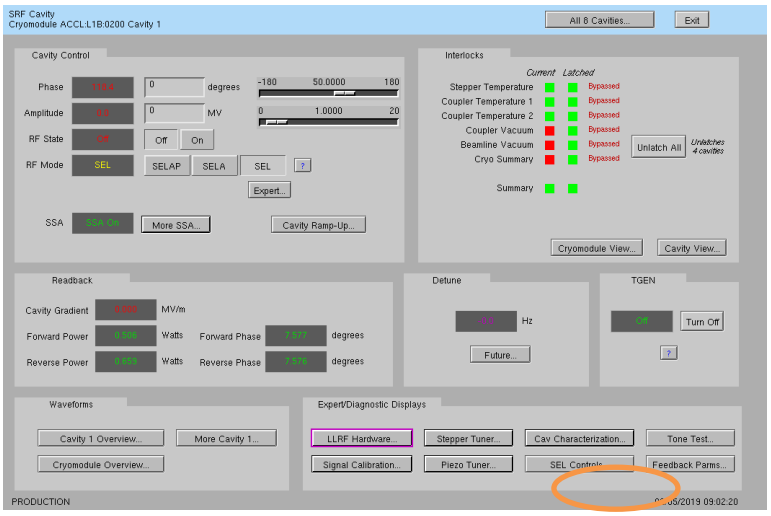



Cavity
Forward
Reverse

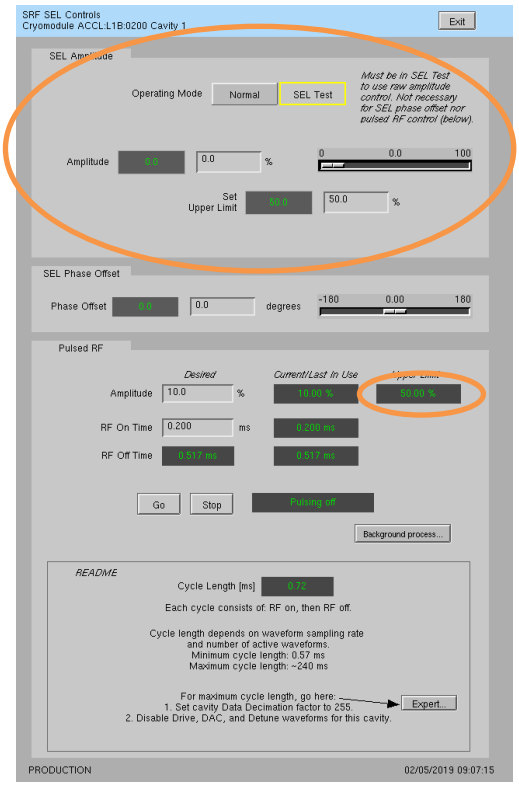

RF Waveforms - Cryomodule ACCL:L1B:0200
Forward Signal
More Signals...
More Forward...
Acq Control...
Exit
ACCL:L1B:0200 All Cavities - Forward Signal
Amplitude
sqrt(watts)
seconds
Phase
degrees
seconds
Display Selection
Cavity 1
Cavity 2
Cavity 3
Cavity 4
Cavity 5
Cavity 6
Cavity 7
Cavity 8

7. Raw SEL Amplitude Control

If the SSA parameters and cavity signals are not yet fully calibrated, you can run in SEL using raw amplitude control.



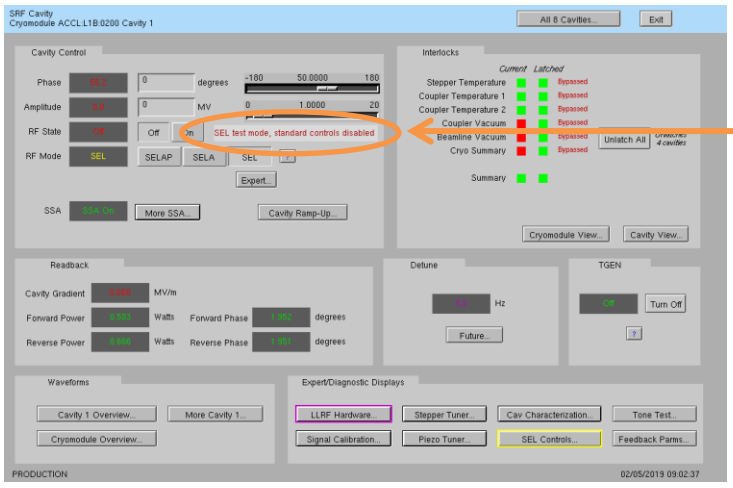
a. Click on SEL Controls…



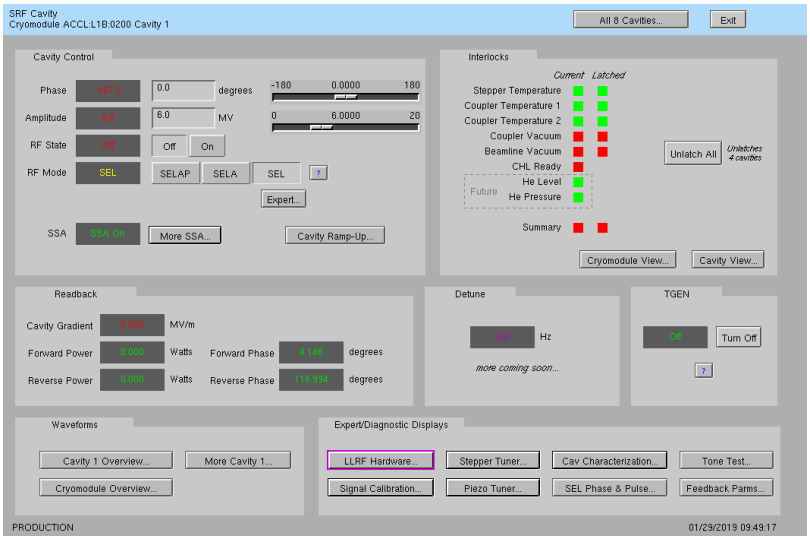
To use the raw amplitude control, you'll need to switch Operating Mode to SEL Test. You do *not* need to be in SEL Test to control the SEL Phase Offset nor to run SEL Pulsed RF.

While in SEL Test, the 'standard' on/mode/phase/amplitude controls (back on the main cavity display) are disabled.

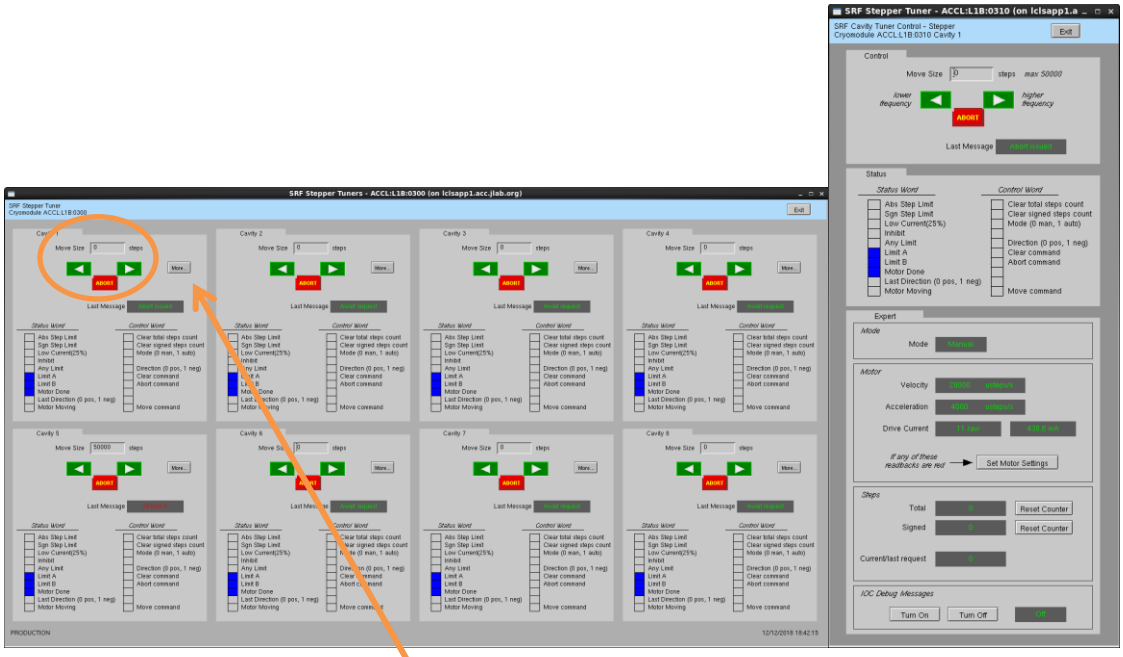
You can set an upper limit on the raw control. This upper limit will also apply to the pulsed RF amplitude setpoint.



8. Control Stepper Motor Tuner

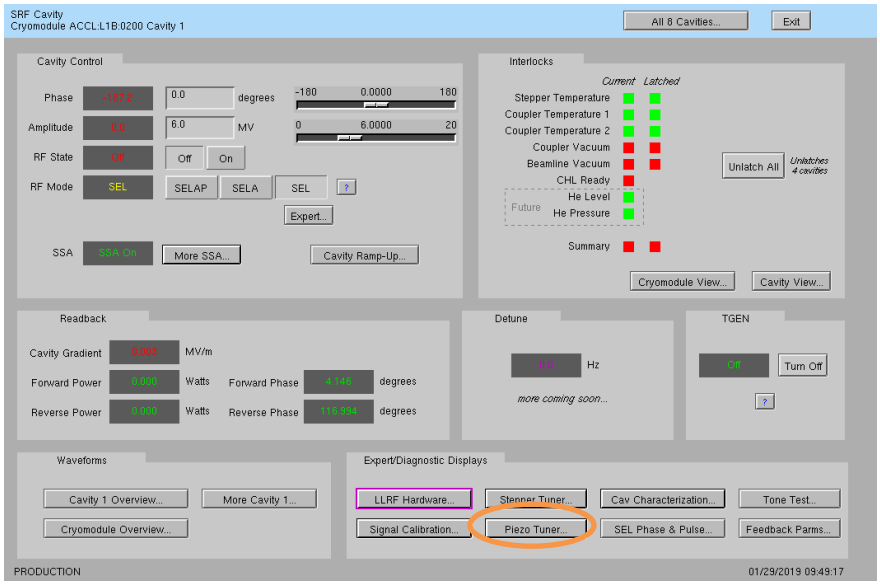


b. Click on Stepper Tuner…

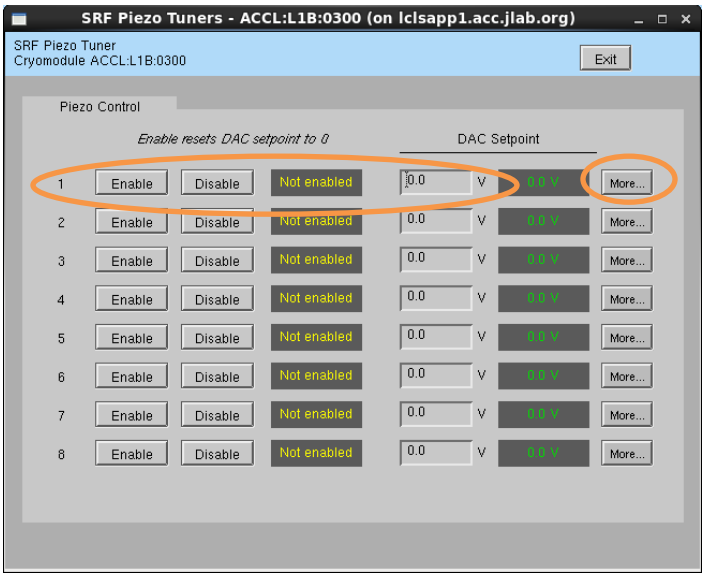


c. 8-cavity display. From here you can enter number of steps and then click the green arrow to go in one direction or the other. (Relationship between direction and frequency is not yet known.) Click More… for single tuner display

9. Control Piezo Tuner

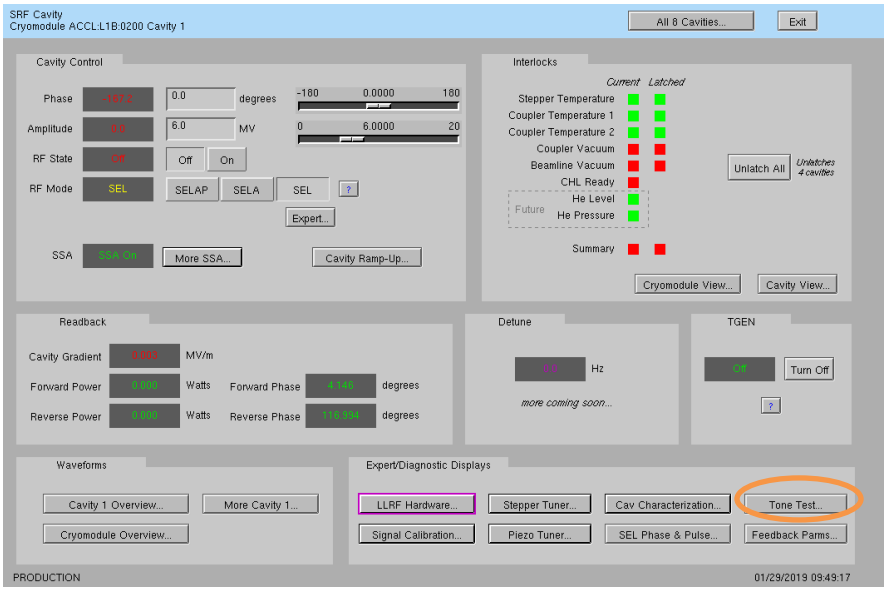


a. Click on Piezo Tuner…

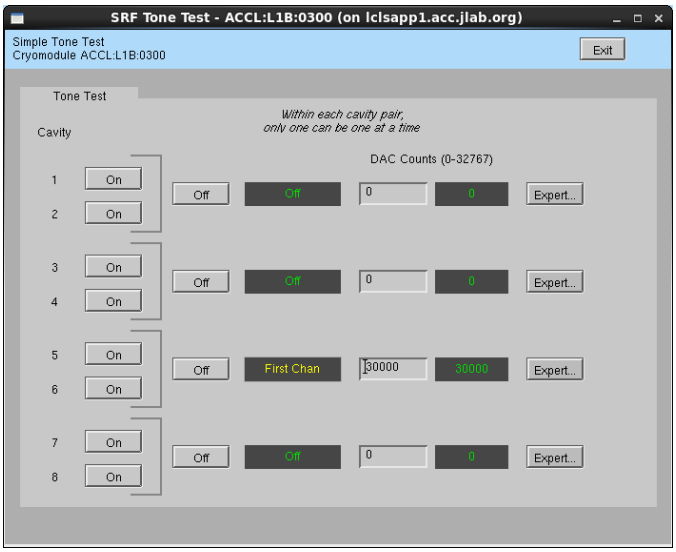


b. 8-cavity display. From here you can enable the piezo tuner and enter a DC DAC voltage. Click More… for single piezo tuner display

10. Drive Cavity With Simple Tone Signal



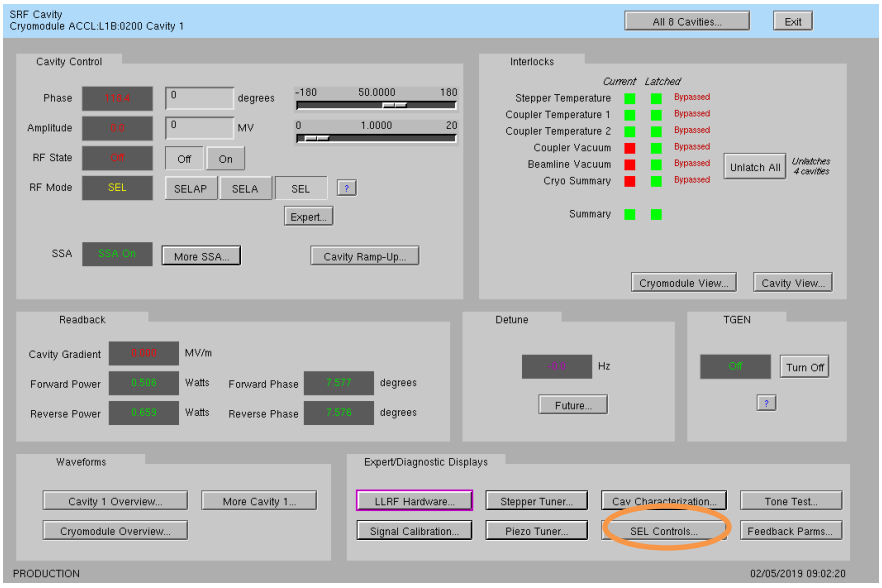
a. Click on Tone Test…



b. Turn desired cavity ‘On’, then enter number of DAC counts…

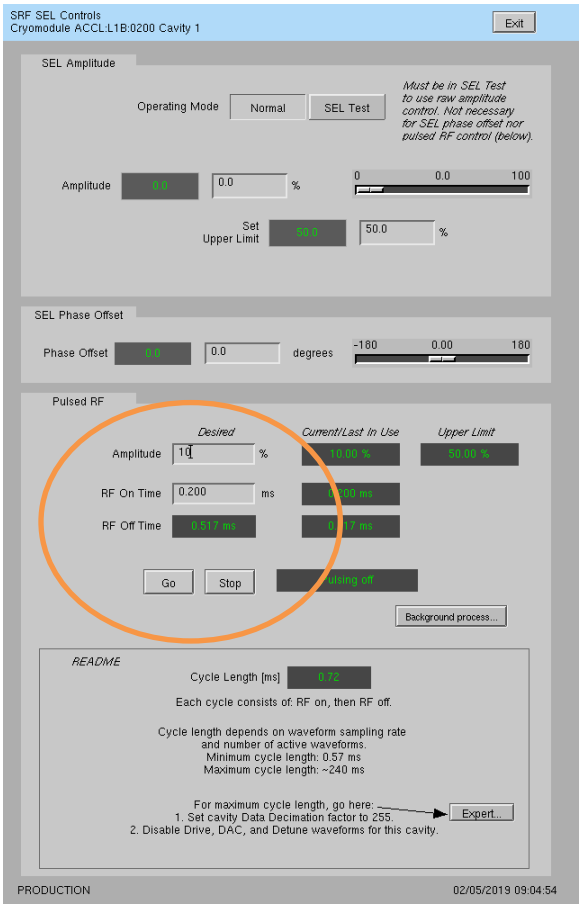
d. When done, click ‘Off’

11. Run SEL Pulsed RF



a. Click on SEL Controls…

The settings/options for pulsed mode are more complicated than you'd think. It's a good idea to read the README at the bottom of the display.



b. Enter desired amplitude (settings will be 'yellow' if they do not match Current/Last In Use)

c. Enter desired RF pulse length

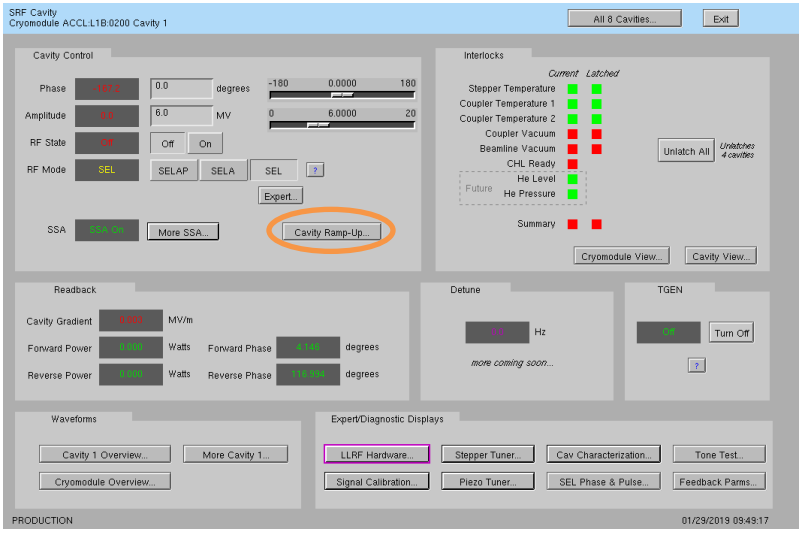
d. Click Go

e. When done, click Stop

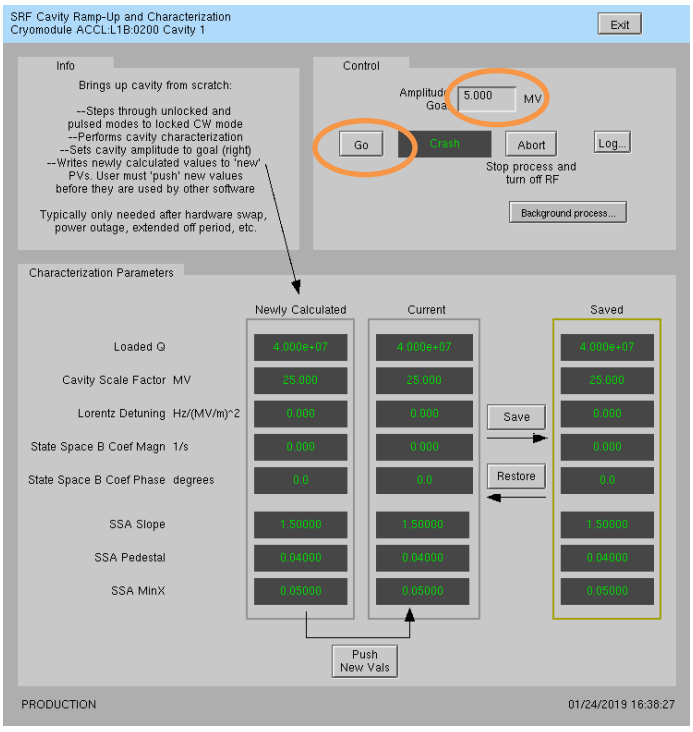
f. To update amplitude or time settings, enter new values and then click Go again

12. Ramp Cavity to CW/SELAP and Perform Cavity Characterization

This is used to bring up a cavity 'from scratch' or if there is some need to re-characterize the cavity/SSA. You do not need to run this every time you turn a cavity on.



a. Click on Cavity Ramp-Up…



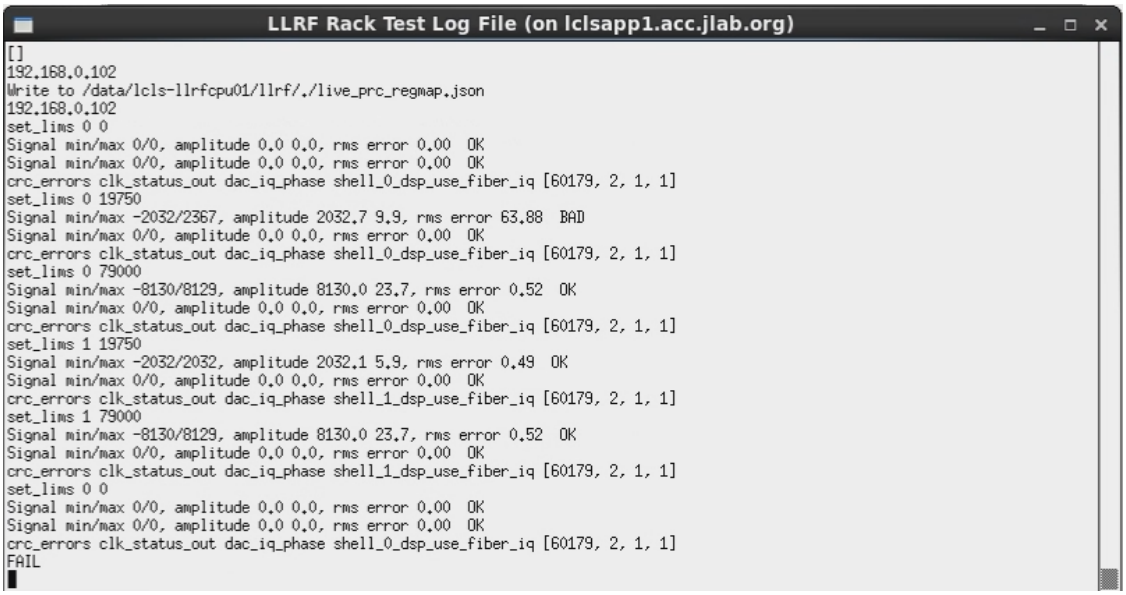
b. Set Amplitude Goal and click Go

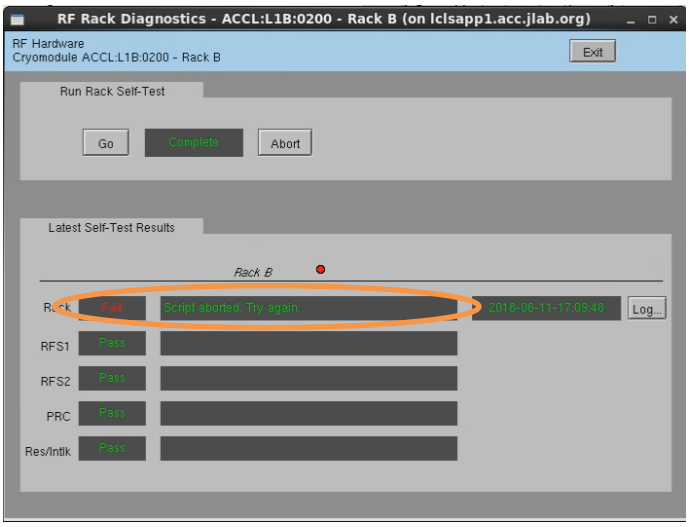
c. Future (not yet done 1/29/2019): the script will write is calculated characterization parameters to the Newly Calculated values on the display. You can review these and if they seem reasonable, click Push New Vals. You can also save the Current values as a known good set—to possibly restore in future.

II. Occasional Issues

1. Mystery Rack Checkout Error

We occasionally see a problem during the first cryomodule rack A checkout. This is what it looks like:

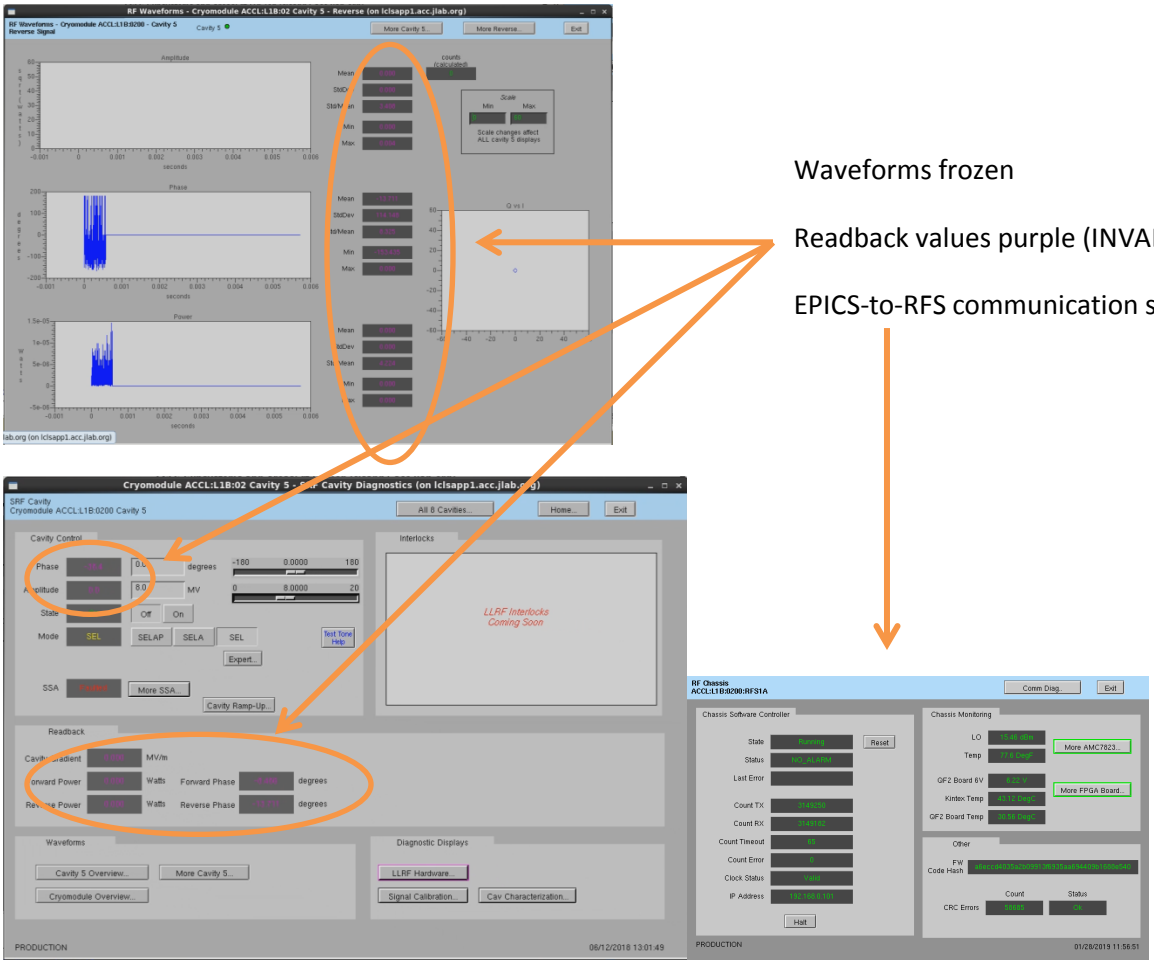




It is an intermittent failure and is not understood. You'll have to simply re-run rack checkout and hope it passes. (We have observed that if the system was previously set up correctly and there has been no outage/hardware swap since, it will probably work fine in spite of this error.)

2. Recover Non-Updating EPICS Waveforms

Once in a while, I've seen the EPICS waveform data stop updating. Displays will look like this:



If you see this and nothing else seems to be wrong, try pressing 'Halt', then 'Reset' on the appropriate RFS display. If that does not recover it, then there is a problem somewhere else.

3. Ping Test

To test if a chassis pings from a CPU:

a. Log into LERF workstation or server
(lcls01/2/3/ lclsapp1 with individual user id)

b. Log into cpu (using CPU Node Name from Section 1):

iocConsole <cpuname>

OR

ssh laci@<cpuname>

(If prompted for login, type 'laci' and hit enter.)

c. Type: ping <ip>

4. View the EPICS IOC Console

a. Log into LERF workstation or server
(lcls01/2/3/lclsapp1 with individual user id)

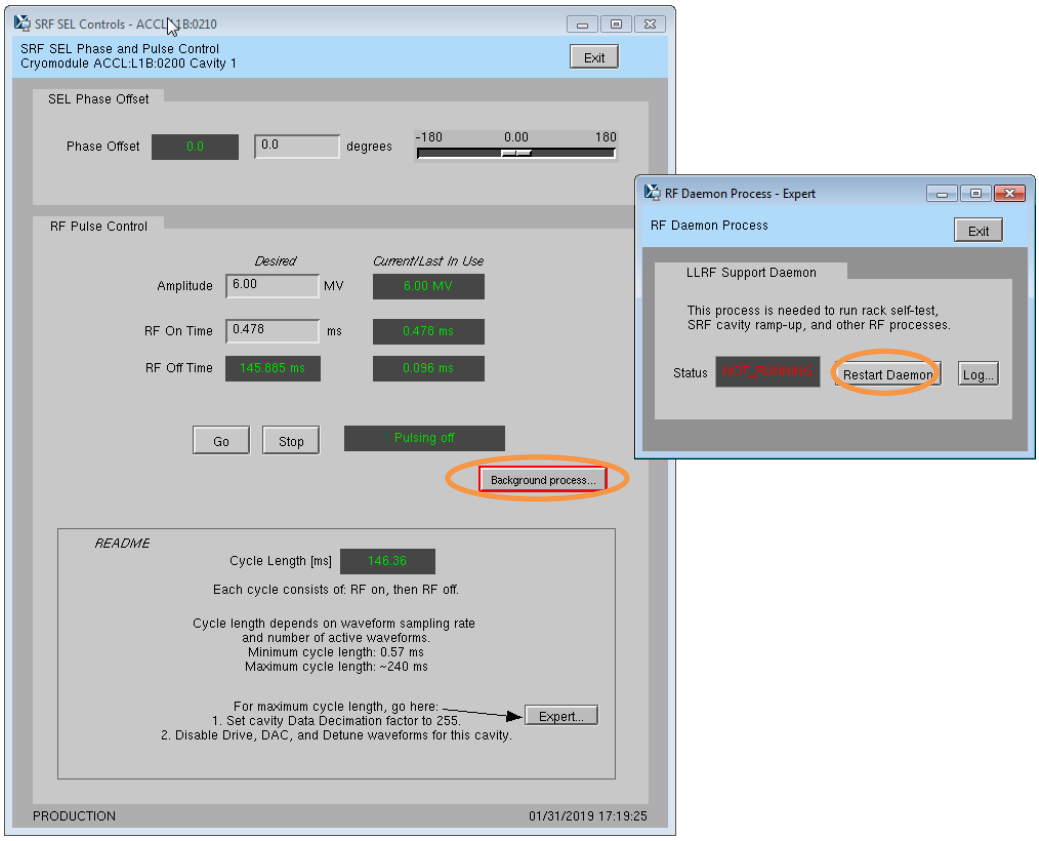
b. iocConsole <iocname>
c. To exit viewer, press these 3 keys together: Ctrl, a, d.
d. To scroll up in viewer, press these 3 keys together: Ctrl, a, [. Then use arrows to move up/down. To exit scroll mode, press these 3 keys together: Ctrl, a,].

(If you inadvertently kill the ioc, you can restart it using the instructions in section 2.)

5. RF 'Background Process'

Much of the current RF functionality (rack checkout, pulse control, cavity ramp, etc.) is performed by scripts external to the EPICS IOC. This is facilitated by a continuously running background process that is driven by EPICS PVs. This allows us to execute these functions from EPICS PVs on EDM displays—and not have to manually run scripts from the command line.

On every display that relies on this, there is a button titled 'Background process…'. If that process is not running, there will be a red rectangle around it. Click on that button to open a display from which you can start/restart the process. Example:



This process will not successfully launch if the EPICS PVs it relies on are not all online. Both LLRF EPICS IOCs must be on.