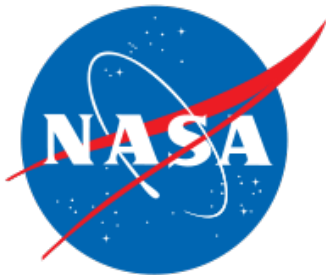


Goddard-IRAM Super-conducting 2-Millimeter Observer (GISMO)

Ingest Software Architecture Overview and Operational Manual

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[Change Log](#)

[Introduction](#)

[Principle of Operation](#)

[GISMO Development Wiki](#)

[Architecture Overview](#)

[Detector Computer](#)

[Control Computer](#)

[Merge Computer](#)

[User Interaction](#)

[Operator Interaction](#)

[Detector Computer](#)

[Control Computer](#)

[Start Acquisition System](#)

[Tune](#)

[Merge Computer](#)

[Administrator Interaction](#)

[Detector Computer](#)

[Control Computer](#)

[Main Window](#)

[Plots Tab](#)

[Tuning Tab](#)

[Configuration Tab](#)

[IV Curves Tab](#)

[Running IV curve](#)

[IV Curve Analysis Twinkle](#)

[IV Curve Debug Plots](#)

[Calibration Tab](#)

[Skydips](#)

[Observing Scans](#)

[Output](#)

[Filters Tab](#)

[Typical Use](#)

[Miscellaneous Tab](#)

[Startup Warnings](#)

[Connecting to Detector Computer](#)

[Simultaneous Clients](#)

[Can't connect to TTL devices](#)

[Thermometry Computer](#)

[Starting the System](#)

[Startup Checklist](#)

[Details on Starting](#)

[Detector Computer](#)

[BIOS errors](#)

[Network not working on cold boot](#)

[Won't start](#)

[Control Computer](#)

[Merge Computer](#)

[Thermometry Computer](#)

[Monitoring](#)

[LabView](#)

[Cycling](#)

[Stopping the Software and Computers](#)

[Detector Computer](#)

[Control Computer](#)

[Merge Computer](#)

[Temperature Computer](#)

[Computer Administration](#)

[Overall](#)

[Detector Computer](#)

[Software Location](#)

[Disk Usage](#)

[Backup](#)

[Control Computer](#)

[Software Location](#)

[Disk Usage](#)

[NTP](#)

[Merge Computer](#)

[GISMO Nexus Reprocess](#)

[Thermometry Alarm](#)

[Thermometry Computer \(Mac\)](#)

[Networking](#)

[Project Startup](#)

[GISMO Cabling](#)

[Grounding](#)

[Disconnecting \(Connecting\) the Dewar from the Electronics](#)

[More Detailed Cabling Information](#)

[Power Supply Settings](#)

Change Log

Date	Description	Author
4/16/12	More cabling instructions	S. Maher
4/19/12	Updated tower schematic, info on Mac, other small changes	S.Maher
4/21/12	Updated with new GUI screens, auto-relock functionality	S. Maher
4/23/12	Updated wiring diagram with opto-isolator, updated block diagram, added text on thermometry computer and new features of Nexus	S. Maher
10/26/12	Comments on Detector computer startup, startup checklist, NTP comments, Nexus maintenance	S. Maher

Introduction

This document describes the architecture and operation of the Goddard-IRAM Superconducting 2-Millimeter Observer (GISMO) software ingest system. This document does not describe details of the CRUSH data reduction software, since the documentation is included in the tarball that can be downloaded from: <http://www.submm.caltech.edu/~sharc/crush/>. For information about the specific pieces of IRAM data that are used by the GISMO system, refer to the *GISMO NCS Interface* document.

Please feel free to provide comments or questions to stephen.f.maher@nasa.gov.

Principle of Operation

The GISMO ingest system is designed to be simple to operate and as automated as possible. After tuning the GISMO detector (a one-button procedure), the ingest system operates without human intervention, producing FITS files, quick-look images, and pointing information for each observation. Operators still prepare and initiate observations with IRAM's *Pako* system, but the GISMO system automatically detects the starting and stopping of observations and uses this information to control the processing flow and data reduction pipeline.

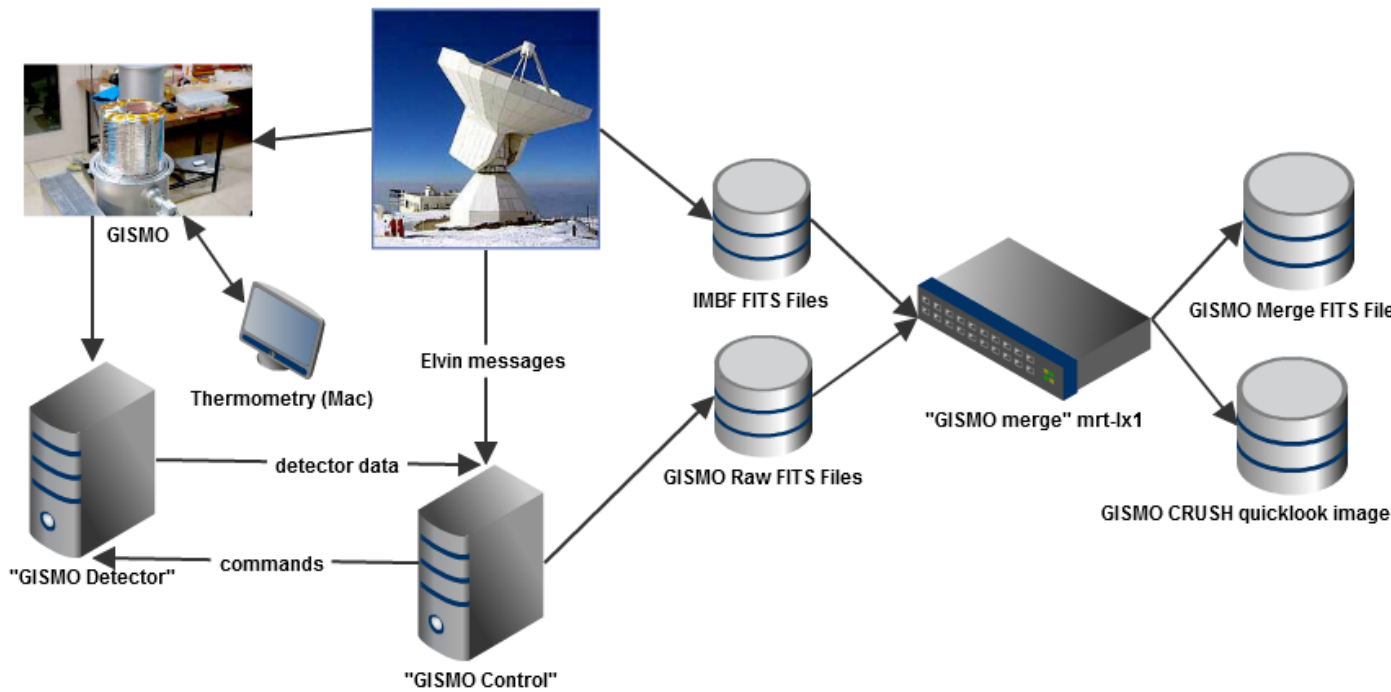
Calibrations (e.g., skydips, shuttered LED) are handled automatically and the operator can control which calibrations are performed. (Note, the CRUSH data reduction software has essentially made calibration procedures unnecessary).

GISMO Development Wiki

A primitive wiki was used during the development of GISMO. It mostly contains internal notes and much of it is outdated and not well organized, however, there is some good reference material and this document will sometimes reference the wiki for more detail. It should be noted that the wiki runs on the GISMO Detector computer and care should be taken so as to not impact the performance of observations by stressing the wiki too much. The wiki URL <http://gismo-detector.iram.es:8080/JSPWiki/>.

Architecture Overview

The GISMO ingest system consists of several computers working in tandem. The *Detector* computer receives and decodes the detector readings and commands the detector electronics. The *Control* computer lets the operator monitor the GISMO system, perform automatic tuning, and change calibration procedures. It also archives the raw data to disk. The *Merge* computer takes the raw data, and merges it with the telescope astrometry to create GISMO merge files. The Merge computer also reduces the data using the CRUSH data reduction software to create a "quicklook" image and automated log entries that are posted on an IRAM website called the GISMO Nexus. Typically, more thorough data reduction is subsequently performed using CRUSH on one or more of the GISMO merge files.



GISMO Ingest Architecture

Detector Computer

The Detector computer is dedicated to reading the detector data and housekeeping and sending the data to the Control computer. It also sends all commands to the electronics and runs the tuning algorithm and IV curves when requested. The software is written in Java and the operating system is Debian Linux.

Control Computer

The Control computer manages the ingest process. The software is Java and runs on Windows XP. The choice of Windows is because the system requires National Instruments drivers and those aren't well supported on Linux.

The Control computer does the following for ingest:

- Receives the data from the Detector computer
- Listens to IRAM Elvin messages which tells the Control computer when scans occur and thus when to archive
- Moves the data to the Merge computer when a scan is complete
- Commands the National Instruments flipper controllers to move neutral density filters into and out of the beam (this is done rarely)

Note, the Control computer has two RAID 1 (mirroring) disk volumes; one for the system and one for the data archives.

The Control computer also provides users with various functions

- Allows users to initiate auto-tuning
- Allows users to see realtime plots of data
- Allows users to modify calibration options
- Allows users to set optical filter positions
- Allows users to run diagnostics such as I(V) curves

Merge Computer

The Merge computer takes the detector data and merges it with the IRAM telescope astrometry data. It also runs the CRUSH data reduction software to create a map of the scan using default parameters as well as diagnostic information about the reduction (pointing information, noise levels, etc). This is referred to as "quick look" information and provides quick diagnostics to the astronomer. Starting with the fifth GISMO run, the merge software runs on an IRAM computer (mrt-lx1). The software for the merge is written in IDL and shell scripts.

More specifically, the Merge computer does the following:

1. Receives data from the Control computer and queues the data for processing
2. If scan was a skydip, perform *tau* reduction
3. Retrieves the appropriate IRAM astrometry file(s)
4. Merge astrometry with detector data using cubic interpolation (the two data sources are synchronized using IRIG timestamps)
5. Copy resulting merged file, original detector files, IRAM astrometry files, ancillary files such as IV curves and skydip results to an archive
6. Run the CRUSH data reduction software and archive the results
7. Publish the CRUSH quicklook images and reduction summary (e.g., pointing information) (also known as the GISMO "log") to a webserver running on the Merge computer. The URL for the website is <https://mrt-lx1.iram.es/Devices/GISMO/>
8. Provide an audio queue to the operator that the GISMO data processing has completed
9. Receive GISMO dewar temperature readings from the GISMO Mac for display and alarming
10. Allow the user to add entries to the GISMO log using a web page

User Interaction

The GISMO system requires very little user intervention. Astronomers command Pako to observe sources and GISMO data files, logs, and “quicklook” display are automatically produced.

Administrators, however, need to be able to understand how to start the system and perhaps run various diagnostics.

The first section below presents the normal steps required to run the GISMO system (“Operator”). The second section presents functions more appropriate for an “Administrator”.

Operator Interaction

Detector Computer

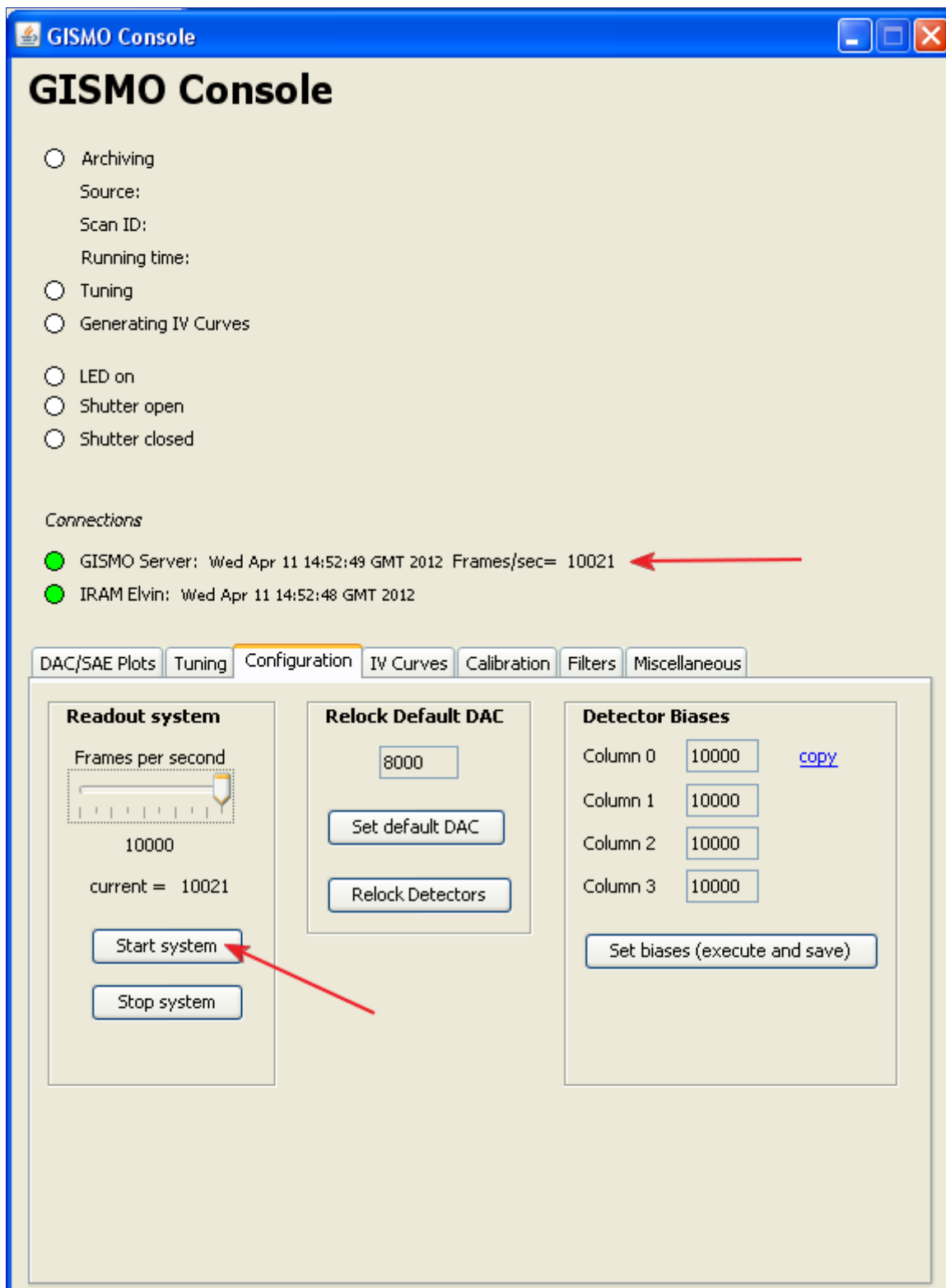
No interaction is required.

Control Computer

Once the GISMO system is powered up, the operator needs to start and tune the system. Then no interaction is required (although monitoring is recommended).

Start Acquisition System

To start the system, go to the Configuration tab on the GISMO Console and click the *Start System* button. After a few moments, the *GISMO Server* entry under the *Connections* section should turn green and the Frames/sec entry should display roughly 10,000 after things settle down. Note, the *IRAM Elvin* indicator indicates a successful receipt of IRAM Elvin messages and should be green.

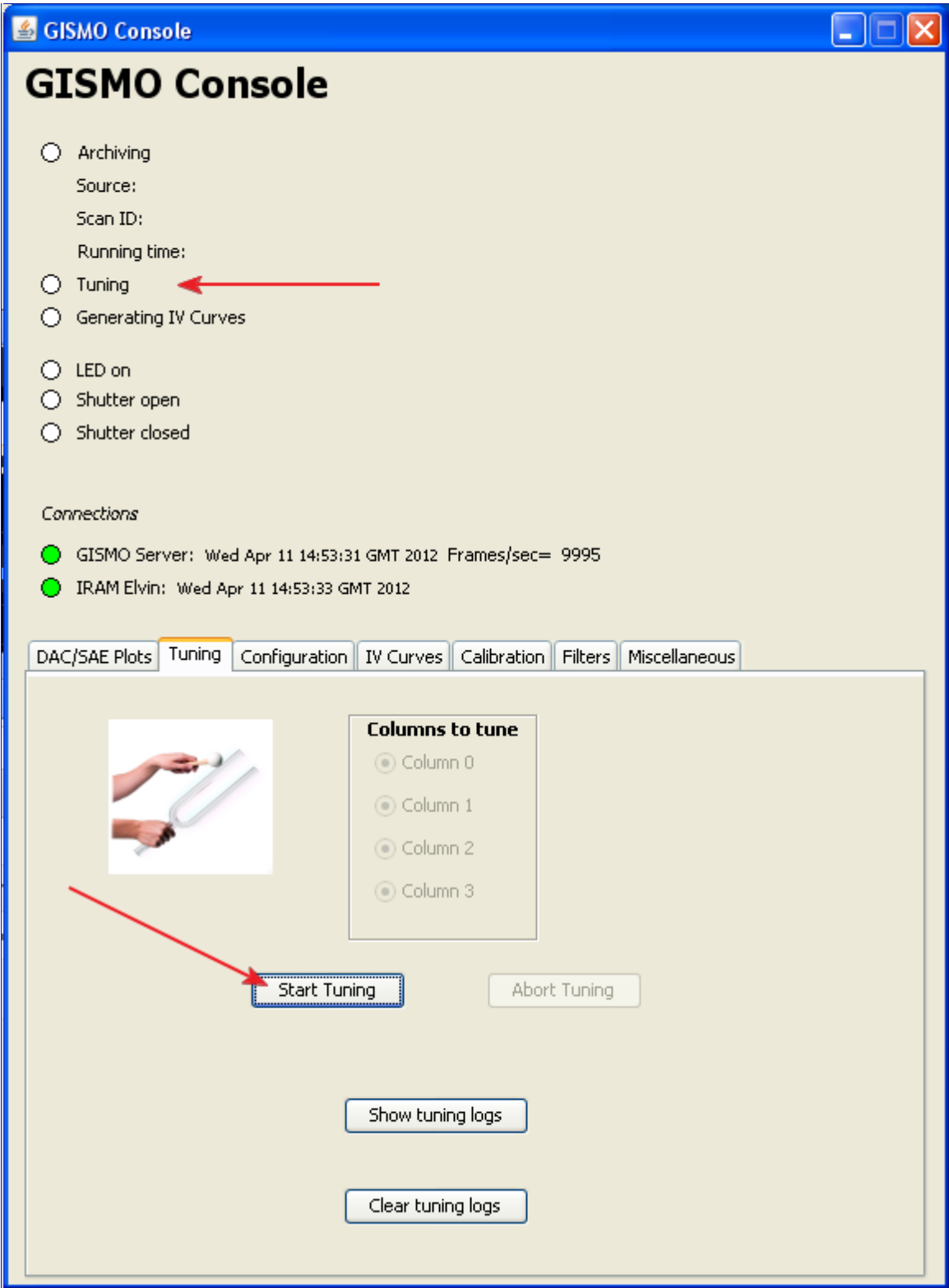


Starting the GISMO acquisition system

Tune

The system needs to be tuned after an initial cool-down or a power cycle. Tuning has shown to be stable and does not need to be performed after cycling the dewar. Tuning automatically selects optimum SQUID parameters. To run the tuning, click the *Start Tuning* button on the Tuning tab, as shown below. The *Tuning* indicator near the top of the window will show the

progress of the tuning. The complete tuning cycle takes approximately ten minutes.



Merge Computer

Below are samples of the quicklook images and reduction summary that are available to GISMO operators within a minute or two after an observation. The page also includes project observation times, pixel status display, and select GISMO temperatures (with alarm indicators). The URL is <https://mrt-lx1.iram.es/Devices/GISMO/>.

GISMO Nexus

← → ↻ <https://mrt-lx1.iram.es/Devices/GISMO/> ★

GISMO Nexus

[Latest](#) [Older](#) [View log](#) [Make log entry](#) [Targets](#) [Gismo WIKI](#)

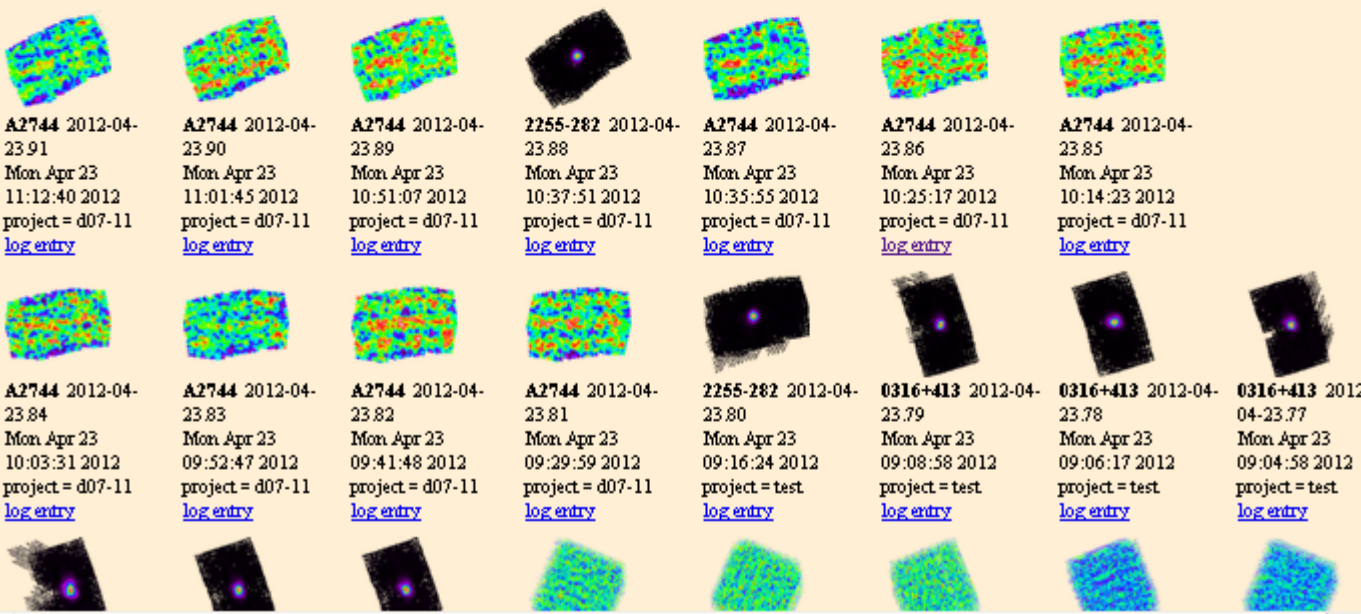
Time	4He bath	LN2 bath	1st det	Alarm OFF
14:00:14	3.745	73.914	2.132	<input type="button" value="enable"/>

Latest scan:

A2744 2012-04-23 91
Mon Apr 23 11:12:40 2012
project = d07-11
[log entry](#)

Total observation time = 59.12 hours

- 190-11 = 6.55 hours
- 209-11 = 2.81 hours
- 233-11 = 3.03 hours
- 239-11 = 0.26 hours
- 245-11 = 2.38 hours
- 247-11 = 6.78 hours
- 248-11 = 3.63 hours
- 249-11 = 5.67 hours
- 250-11 = 9.32 hours
- 251-11 = 4.74 hours
- badweather = 0.45 hours
- d007-11 = 1.81 hours
- d07-11 = 1.60 hours
- gismo11 = 1.82 hours
- test = 8.25 hours



A2744 2012-04-23 91
Mon Apr 23 11:12:40 2012
project = d07-11
[log entry](#)

A2744 2012-04-23 90
Mon Apr 23 11:01:45 2012
project = d07-11
[log entry](#)

A2744 2012-04-23 89
Mon Apr 23 10:51:07 2012
project = d07-11
[log entry](#)

2255-282 2012-04-23 88
Mon Apr 23 10:37:51 2012
project = d07-11
[log entry](#)

A2744 2012-04-23 87
Mon Apr 23 10:35:55 2012
project = d07-11
[log entry](#)

A2744 2012-04-23 86
Mon Apr 23 10:25:17 2012
project = d07-11
[log entry](#)

A2744 2012-04-23 85
Mon Apr 23 10:14:23 2012
project = d07-11
[log entry](#)

A2744 2012-04-23 84
Mon Apr 23 10:03:31 2012
project = d07-11
[log entry](#)

A2744 2012-04-23 83
Mon Apr 23 09:52:47 2012
project = d07-11
[log entry](#)

A2744 2012-04-23 82
Mon Apr 23 09:41:48 2012
project = d07-11
[log entry](#)

A2744 2012-04-23 81
Mon Apr 23 09:29:59 2012
project = d07-11
[log entry](#)

2255-282 2012-04-23 80
Mon Apr 23 09:16:24 2012
project = test
[log entry](#)

0316+413 2012-04-23 79
Mon Apr 23 09:08:58 2012
project = test
[log entry](#)

0316+413 2012-04-23 78
Mon Apr 23 09:06:17 2012
project = test
[log entry](#)

0316+413 2012-04-23 77
Mon Apr 23 09:04:58 2012
project = test
[log entry](#)

GISMO Nexus Main Page

https://mrt-lx1.iram.es/Dev

https://mrt-lx1.iram.es/Devices/GISMO/gismo.log.html

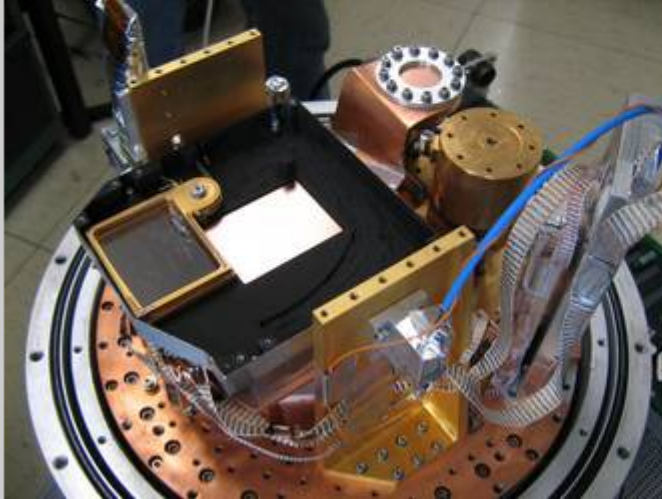
11.11																
id	object	UTh(f2)	obsmins(f1)	tau.225GHz(f3)	NEFD(f4)	okchannels	scanspeed(f1)	Tamb(f1)	AZd(f0)	ELd(f0)	RAh(f1)	DECd(f0)	PAd(f1)	pnt.dAZ(f1)	pnt.dEL(f1)	
2012-04-11.12	Mars	1.68	15.5	0.126	0.0298	101	32.4	-1.8	-95	28	10.4	13	54.8	---	---	
2012-04-11.14	1253-055	2.25	2.0	0.110	0.0150	89	75.2	-1.9	-134	36	12.9	-6	35.3	-12.7	7.1	
2012-04-11.15	1253-055	2.34	1.9	0.116	0.0134	93	74.4	-1.6	-133	35	12.9	-6	36.2	-1.6	1.1	
2012-04-11.16	1253-055	2.40	15.5	0.126	0.0197	89	32.4	-1.5	-132	34	12.9	-6	37.9	---	---	
2012-04-11.18	R1350+09	2.77	9.1	0.101	0.0143	96	38.1	-1.0	-128	51	13.8	10	40.8	---	---	
id	object	UTh(f2)	obsmins(f1)	tau.225GHz(f3)	NEFD(f4)	okchannels	scanspeed(f1)	Tamb(f1)	AZd(f0)	ELd(f0)	RAh(f1)	DECd(f0)	PAd(f1)	pnt.dAZ(f1)	pnt.dEL(f1)	
2012-04-11.19	A2052	3.62	9.3	0.103	0.0111	97	38.2	-1.5	-142	54	15.3	7	31.0	---	---	
#	Wed	Apr	11	03:49:51	UTC	2012	-	Made	small	M6	adjustments	before	scan	19	and	
2012-04-11.20	A2052	3.86	9.1	0.076	0.0157	94	38.2	-0.7	-137	52	15.3	7	34.6	---	---	
2012-04-11.21	A2052	4.63	9.3	0.120	0.0123	95	38.0	-0.6	-123	45	15.3	7	43.1	---	---	
2012-04-11.23	SgrA	5.41	8.3	0.108	0.0090	92	198.4	-0.4	-169	23	17.7	-29	11.2	---	---	
id	object	UTh(f2)	obsmins(f1)	tau.225GHz(f3)	NEFD(f4)	okchannels	scanspeed(f1)	Tamb(f1)	AZd(f0)	ELd(f0)	RAh(f1)	DECd(f0)	PAd(f1)	pnt.dAZ(f1)	pnt.dEL(f1)	
2012-04-11.24	SgrA	5.41	8.3	0.108	0.0090	92	198.4	-0.4	-169	23	17.7	-29	11.2	---	---	

GISMO Nexus Log Page

Enter a comment for the GISMO observation logi - please include your name

(Note, a timestamp will automatically be added)

Submit your GISMO log comment



GISMO Nexus "Make Log Entry" page

Administrator Interaction

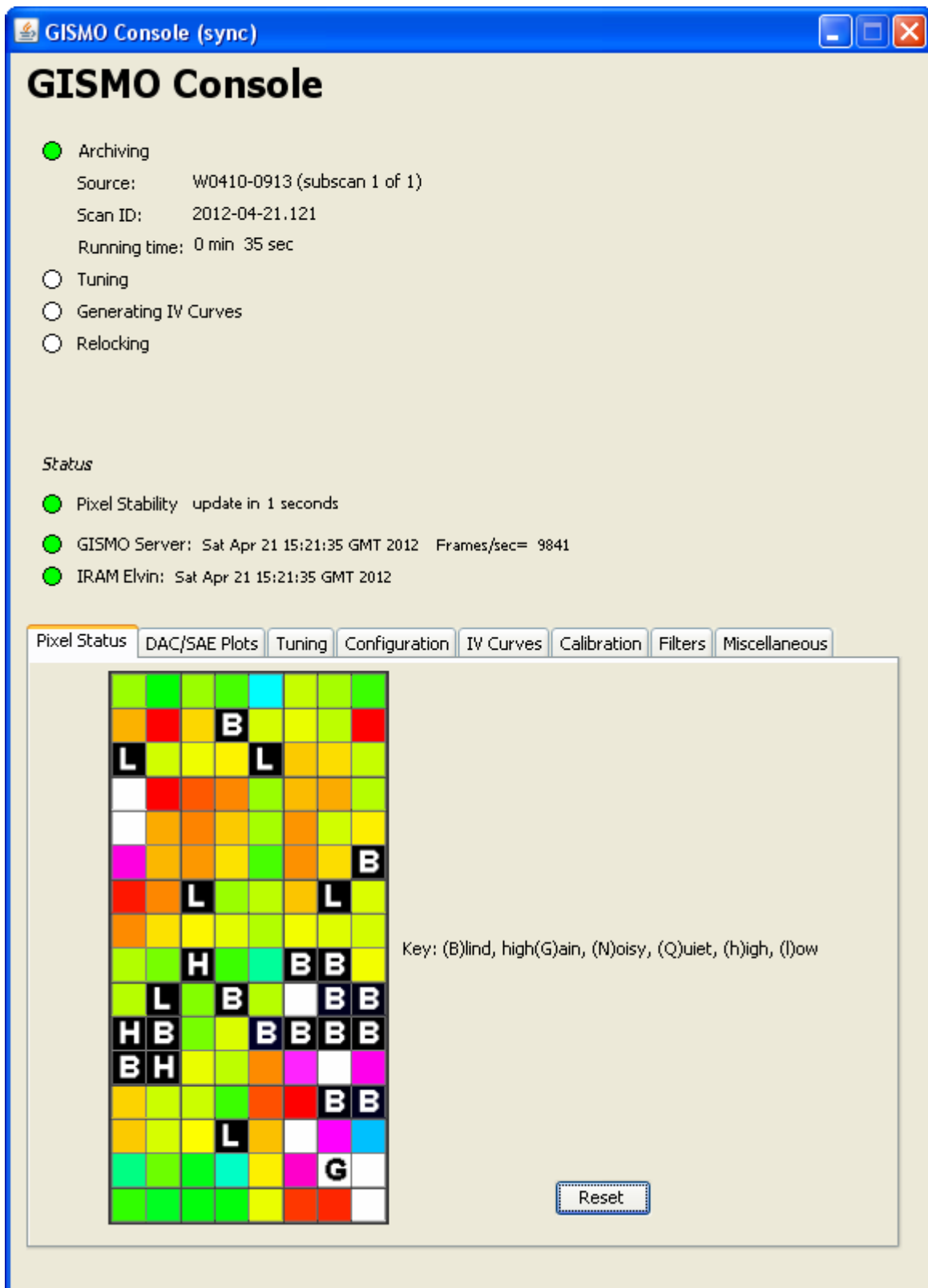
Detector Computer

Typically very little interaction occurs on the Detector Computer. Administrators may use the interface on the Detector Computer for more advanced functionality (e.g., change the auto-tune parameters, run a ramp against one of the SQUID stages). Working with this advanced functionality is beyond the scope of this document.

Control Computer

Main Window

The following is the main GISMO Control window.



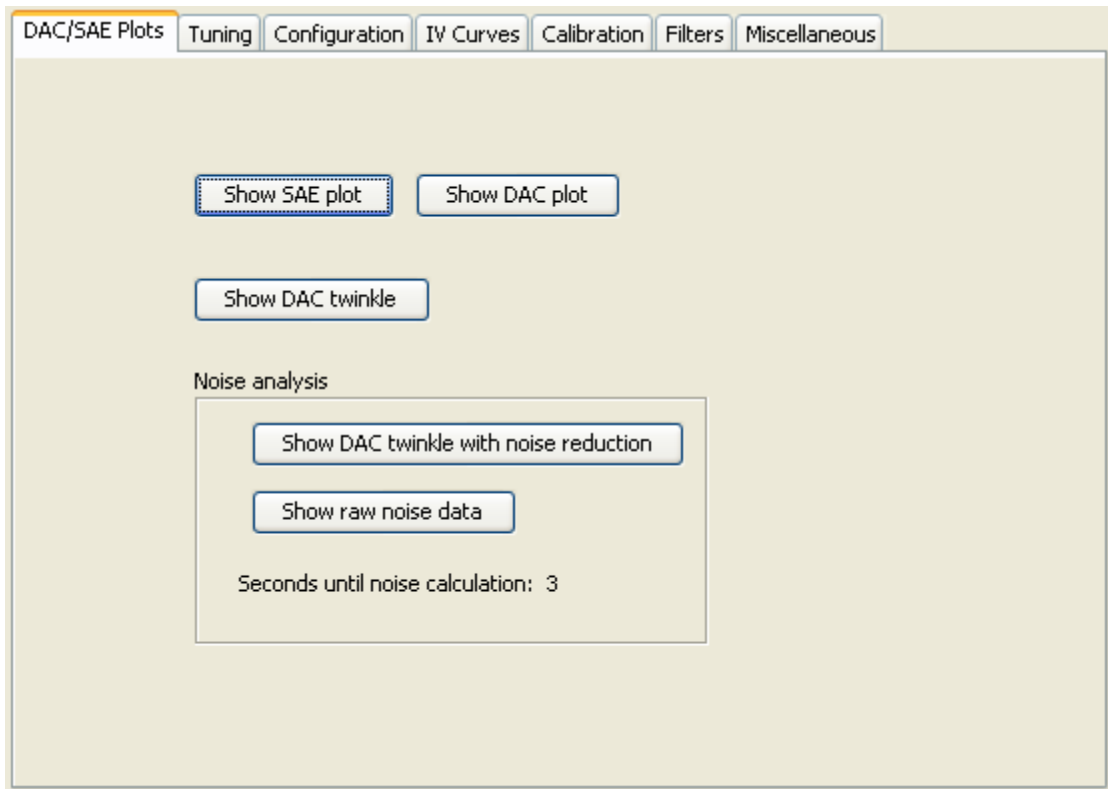
The top half provides status information and the bottom half has tabs to reach more detailed information and functionality.

The status at the top includes

- Whether "Archiving" is occurring and if so, details about the source and archive duration

- Whether the system is currently "Tuning"
- Whether the system is "Generating IV Curves"
- Whether a feedback relock is being performed
- Whether an acceptable number of pixels are operating within specification and also a detailed plot of the pixel status

Plots Tab



The plots tab is used to open XY line plots of the SAE and DAC values ("Show SAE Plot" and "Show DAC plot"). These are actually 3D graphics windows that extend pixels down the Z axis. Use all mouse functions (including wheel) to manipulate the plots) Press 'h' on the plot window for some help.

"Show DAC Twinkle" opens a "twinkle" chart of the DAC values. Optionally pressing the "Perform DAC Normalization" will average the DAC values for a few seconds and then subtract the average from subsequent data.

Also available (but not pictured in the image) are twinkle charts that automatically remove noise from the pixel values.

Note: when operating in closed loop (which is the nominal state of the data acquisition), "DAC" is the linearized detector signal, and "SAE" is the error signal (Scaled Accumulated Error).

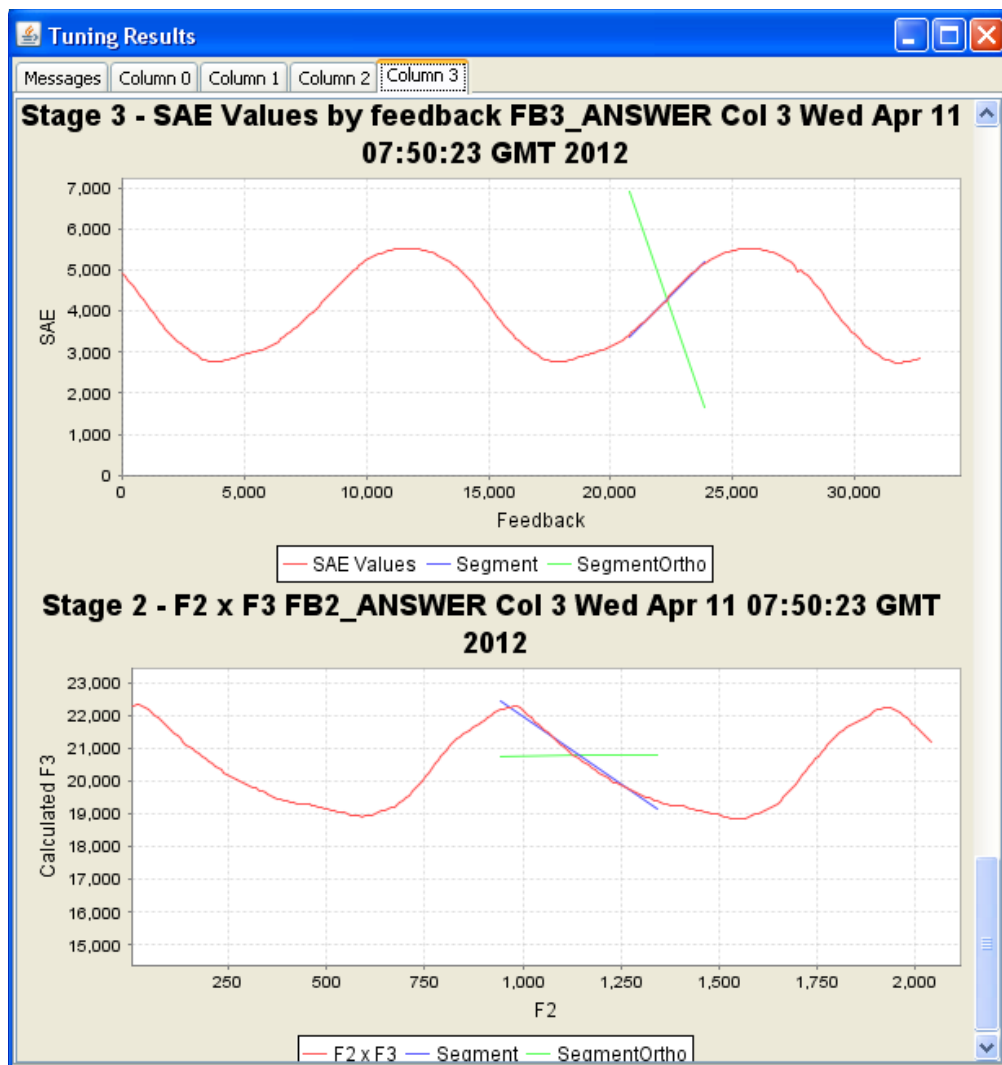
Tuning Tab



The screenshot shows a software window with a tabbed interface. The 'Tuning' tab is selected and highlighted with an orange border. The window contains the following elements:

- Tab Bar:** Pixel Status, DAC/SAE Plots, **Tuning**, Configuration, IV Curves, Calibration, Filters, Miscellaneous.
- Image:** An illustration of a hand holding a tuning fork.
- Buttons:**
 - 'Start Tuning' (active, blue border)
 - 'Abort Tuning' (disabled, grey)
 - 'Show tuning logs' (active, blue border)
 - 'Clear tuning logs' (active, blue border)
- Checkboxes:** A checked checkbox labeled 'Advanced'.
- Tuning type:** A dropdown menu currently set to 'Complete tuning'.

The Tuning tab lets an operator run the auto-tuner. The auto-tuner will tune the bias and feedback values for the SQUID multiplexers and the SQUID series arrays. Some detailed information about the tuning can be seen when "Show tuning logs" is pressed. The tuning may be aborted but then the biases and feedbacks will most likely not be in an optimal state, or worse. An advanced option allows for a shorter tuning cycle, but this is not recommended.



Example tuning log contents

Configuration Tab

This tab is used to start the system after power up, set the detector biases, and relock the detector's feedback mechanism.

The screenshot shows the 'Configuration' tab of a software interface. It features three main panels: 'Readout system' with a 'Frames per second' slider (set to 10000) and 'current = 10216', with 'Start system' and 'Stop system' buttons; 'Relock Default DAC' with a text box set to '8000' and 'Set default DAC' and 'Relock Detectors' buttons; and 'Detector Biases' with four columns (0-3) each set to '8000', a 'copy' link, and a 'Set biases (execute and save)' button. At the bottom, there are two checked checkboxes: 'Advanced' and 'Automatically relock detectors before each scan'.

The configuration tab is used for the following:

- Start, stop, and set the rate of the readout electronics
- Set the default DAC value used for relocking
- Relock the detectors
- Set the detector biases

Setting the default DAC and Detector Bias values in this interface will immediately command the values on the Detector computer.

Values that are set are saved in a file and will be remembered.

If an incorrect value is entered, a message will appear, the field in question will change appearance, and the operator must correct the value (and press "Enter") before proceeding.

The Advanced option of "Automatically relock detectors before each scan" is a little mislabeled. It arms an automatic relock when there is a large (3 degree) elevation shift between scans. Then when the the telescope is within two degrees of the next source, the relock is executed. If successive scans don't deviate by more than three degrees, no relock will be performed. The operation is needed because changing sky loads (due to different elevations) can cause the detectors to lose feedback lock.

IV Curves Tab

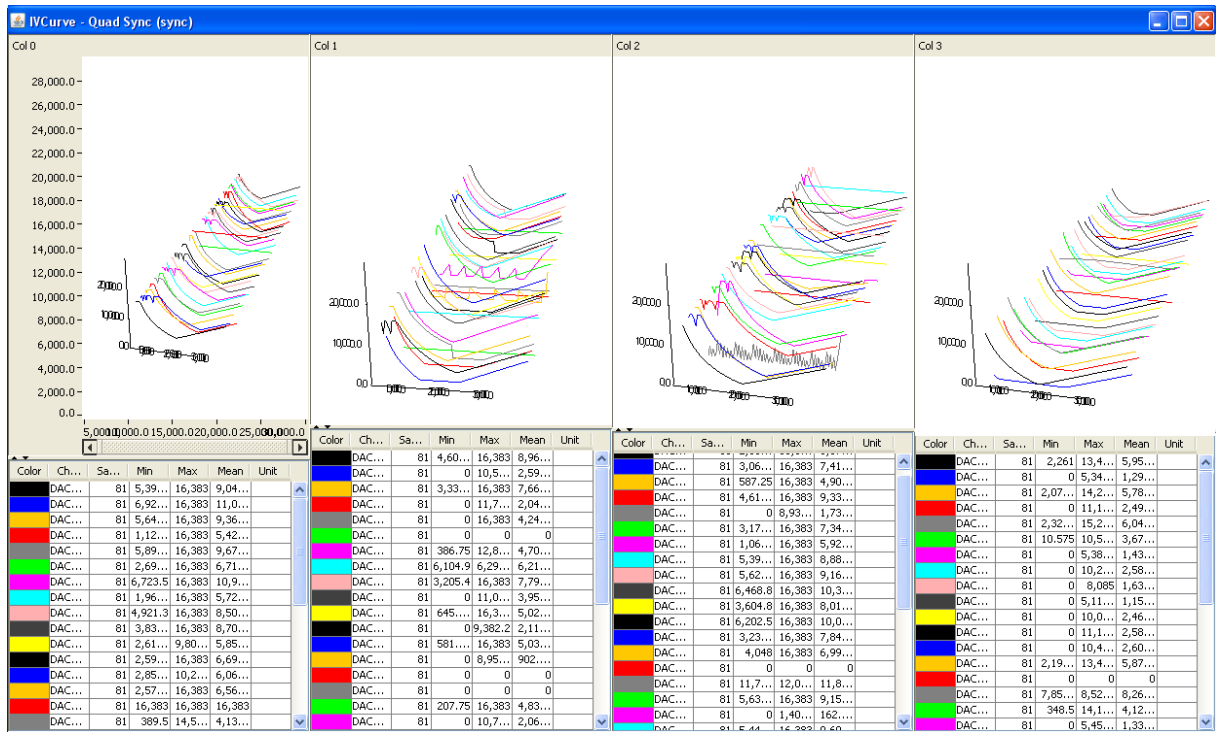
This tab is used to generate IV curves for diagnostic analysis.

The screenshot shows a software window with several tabs: DAC/SAE Plots, Tuning, Configuration, IV Curves (selected), Calibration, Filters, and Miscellaneous. The 'IV Curves' tab contains a 'Run IV Curve' section on the left with three input fields: 'Bias start' set to 40000, 'Bias end' set to 15000, and 'Bias delta' set to 200. Below these fields are two buttons: 'Start IV Curve' and 'Abort IV Curve'. Further down is a button labeled 'Show IV Curve plot'. To the right of the 'Run IV Curve' section is a checkbox labeled 'Analyze old IV curve'. At the bottom of the tab, there are two buttons: 'Show IV Curve analysis twinkle' and 'Show per-pixel analysis plots'. To the right of these buttons is a dropdown menu labeled 'small plots'.

The IV Curves tab allows users to *run new IV Curves* as well as *analyze previously run IV Curves*.

Running IV curve

Running an IV curve is on the left side of the tab and involves setting bias parameters and pressing "Start IV Curve". During the curve the bias will go from "start" to "end", incrementing at intervals of size "delta". It will then return back to the start value, also increment by "delta". The curve data is only record for the "start" to "end" segment. The data is stored in the standard archive location (e.g., F:/). Optionally, press "Show IV Curve plot" to see a live output of the curve. (It is useful to use the "flat" version of the plot - option "f").



IV Curve Plots

IV Curve Analysis Twinkle

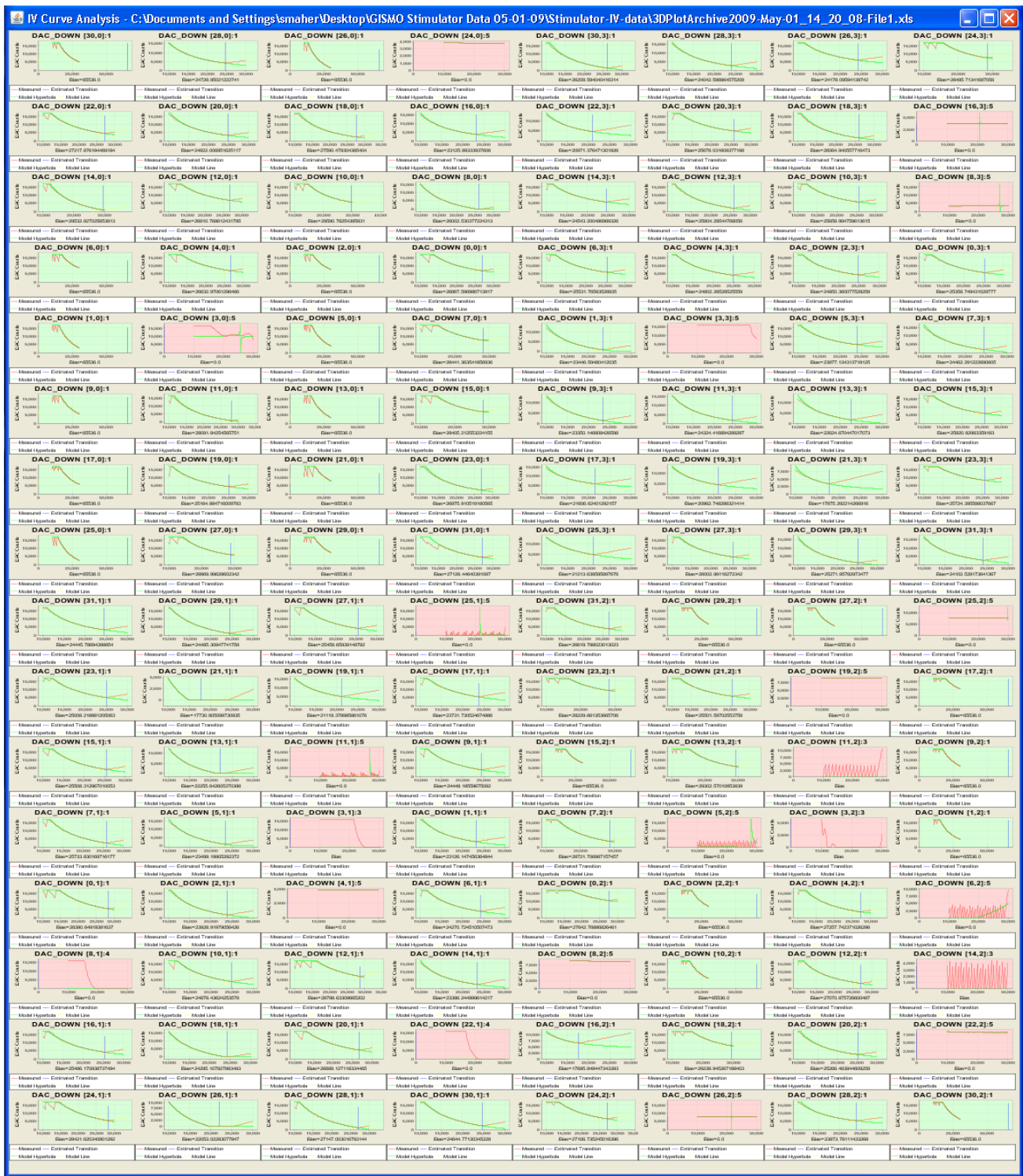
When an IV curve is run, the results are analyzed (fitted with hyperboli and lines) to determine the transition point and power. The raw data and the results are stored in files. Optionally, pressing "Show IV Curve analysis twinkle" *before the curve is run* will present a plot similar the one below, showing transition bias, slope of normal, and absolute power. A value of 65,565 (usually white in the plot) indicates the transition is estimated to be higher than the starting bias of the IV curve.



IV Curve Diagnostic Display

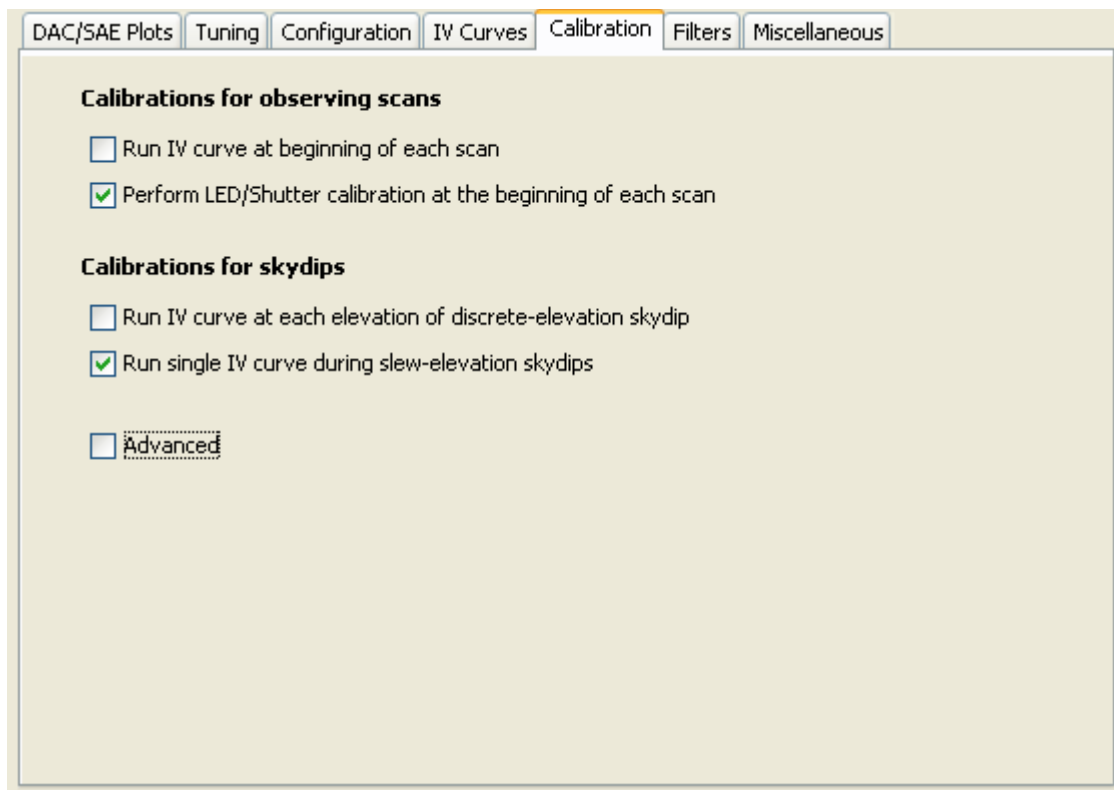
IV Curve Debug Plots

If "Show per-pixel analysis plots" is checked, the curves of all pixels will be displayed.



IV Curve Diagnostic Debug Display

Calibration Tab



The Calibration tab lets operators adjust what calibrations are automatically performed during skydips and standard scans. The options are saved to a file automatically. (Note that the LED is currently not available).

Note, the calibrations described are typically not needed when using the CRUSH data reduction system. CRUSH retrieves TAU from IRAM systems (and also does internal calculations) and that is sufficient.

Skydips

The operator has the option to run a single IV curve at the beginning of a slew-elevation skydip. Additionally the operator has the option to run a single IV curve at the beginning of *each elevation* of a discrete elevation skydip. The GISMO Ingest system automatically identifies the various skydips and performs the requested calibration.

Note, recently Skydips have not been needed when using CRUSH

Observing Scans

The operator can automatically run an IV curve at the beginning of a standard scan or run an LED/Shutter calibration. The LED/Shutter calibration closes the shutter, flashes the LED, and opens the shutter. (Note that the LED is currently not available).

Output

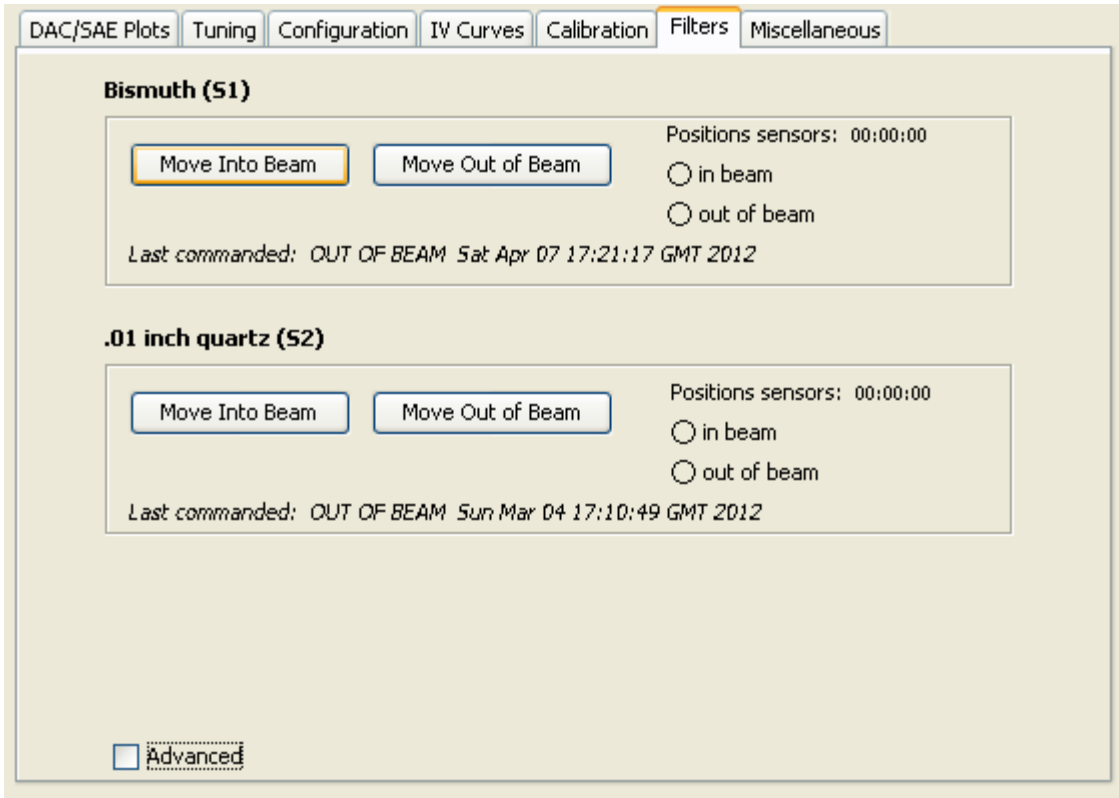
There is a CALIB_FLAG in the FITS file that indicates when and what calibration was performed. All IV curve data is archived with the FITS files. Skydips trigger a TAU reduction

IDL program execution whose output is included 1) with the skydip scan archive and 2) in the primary header of the FITS files of subsequent observing scans.

Filters Tab

Typical Use

This functionality is not needed in standard operational mode. Two neutral density filters can be moved in and out of the beam on this tab. The need for these filters is TBD.



The Filter tab allows an operator to open and close the two neutral density filter flippers in GISMO. The system tries to remind the operator of the state of the filters, but since there are no position sensors for the flippers, it is an estimate.

Miscellaneous Tab

DAC/SAE Plots
Tuning
Configuration
IV Curves
Calibration
Filters
Miscellaneous

Start archiving
Stop archiving

Note, normally archiving is controlled automatically by the telescope

☒ Advanced

Restore State
Refresh command history

☒ Respond to IRAM Elvin messages (auto archive, calibrate, etc.)

Antenna actualEl: 77.532807

Details:

Version: GISMO-MarkIII GSFC 4-?-12 Canyon

Pointing Center
Row
Col

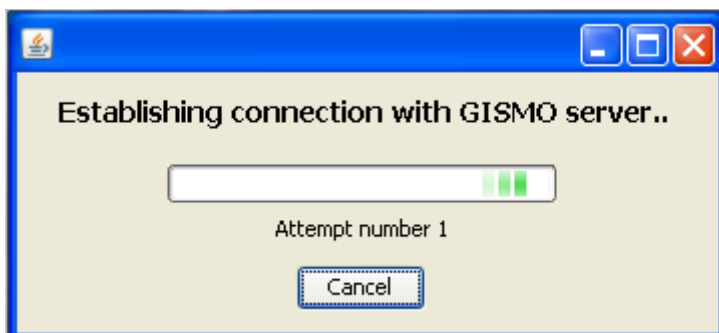
The Miscellaneous tab is a catch-all for various functions, some being obsolete. The operator does have the ability to manually start and stop the archiver on this tab. This can be useful if for some reason the GISMO Ingest system doesn't stop archiving after a scan during some anomalous condition (e.g., IRAM computer failure).

Startup Warnings

There can be various warnings that can occur when starting the Control software. This section describes them.

Connecting to Detector Computer

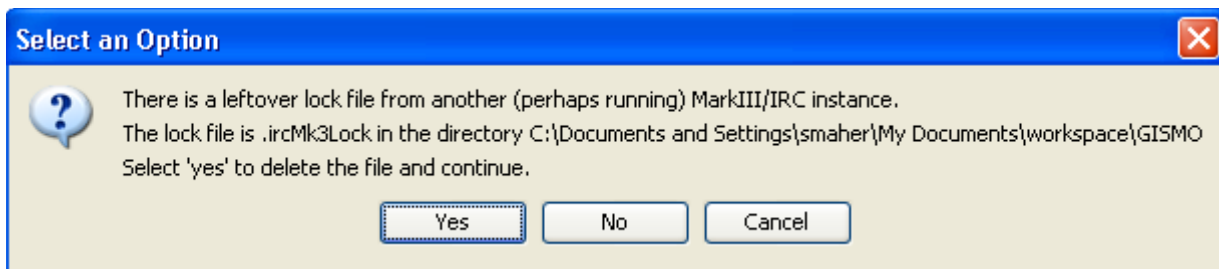
Upon startup the Control computer will try to connect to the Detector computer. The following dialog box will appear:



This isn't necessarily a warning, but it may take numerous attempts (1-20) to connect to the server (the connection is a lower priority item on the Detector computer). The connection may be cancelled by the user by pressing the *Cancel* button, but this is only useful in special situations where communication with the server is not needed, such as when you're doing analysis of previously generated IV curves (which is not described in this document).

Simultaneous Clients

The Control computer uses a lock file to prevent multiple clients from running simultaneously. If you start more than one client at a time, or a client terminated prematurely (and didn't erase the lock file), you will see the following error dialog. If you are running only one client, select "Yes". Otherwise select "No"



Can't connect to TTL devices

NOTE: The TTL devices are no longer used but are still in the software. Any errors can be ignored.

The Control computer needs to communicate with two ethernet-based National Instruments 9401 devices (<http://sine.ni.com/nips/cds/view/p/lang/en/nid/208809>) to control the LED flasher, shutter, and the filter flippers. If the 9401's are not available, the following error will appear:



To diagnose connection issues with the ENET devices:

1. Try pinging the devices (IPs TBD)
2. Use the National Instruments MAX ("Measurement and Automation") software to see if the devices are enabled and have the correct device names (TBD)

Thermometry Computer

The Thermometry computer (Mac) runs the thermometry system (monitoring, heating, and cycling). The monitoring software does not require interaction in general. Important temperature values are displayed on the GISMO Nexus.

Starting the System

Startup Checklist

This is a checklist for connecting and starting the electronics and computers. Note, there are more details and pictures in other parts of this document.

1. Connect thermometry cables to dewar
2. Connect dewar power cable from GISMO black power box to crate
3. Connect tower power cable from tower to crate (has DB connector)
4. Make sure power switches on tower and crate are turned off
5. Connect fibers to crate and tower. Feed tower fibers up through hole in plate on top of crate. Two D0+/- (IRIG) SMB cables remain disconnected.
6. Tape tower fiber to top of tower to prevent disconnect
7. Connect BNC from connector 9 on front of gold box ("Clean" side) under computer in GISMO electronics rack to small (5x5 cm) green BNC->SMB(x2) box connected to the crate. This is for IRIG.
8. Connect long black ethernet cable in back of GISMO electronics rack (with "GISMO" label) to IRAM network switch (1 GB ethernet preferably).
9. Connect IRAM IRIG BNC cable to BNC cable in back of GISMO electronics rack that has silver tape with hand-written "IRAM IRIG" label - it is connected to the back of the PC. (Note, there is another unused IRIG connection connected to the main fiber cable; this is not used). The IRAM IRIG BNC cable is a pink BNC cable that is usually located

- under the M3/M4? arm (near NIKA) under the floor tile with the circular cable port
10. Connect power, ethernet, and USB cables from GISMO electronics rack to Mac. These cables are usually kept bundled together in the back
 11. Connect keyboard, mouse, and monitor (use VGA connection) to GISMO electronics rack computer (the server)
 12. Locate white, American power strip with 110V connections
 13. Connect 110V black power cable from GISMO electronics rack to power strip
 14. Connect 110V power cable from GISMO black power box to power strip
 15. Connect rectangular 110v power cable (with transformer) (from Ethernet hub in GISMO electronics rack) to power strip
 16. Connect computer monitor power cable to power strip
 17. Connect American power strip to transformer. Make sure the power strip is turned off.
 18. Connect 220v-110v transformer to IRAM power. Make sure the ground IS CONNECTED (i.e., do not put in a ground breaker), otherwise GISMO will experience additional noise
 19. Connect power strip to the transformer
 20. Turn on power strip
 21. Turn on GISMO black power box (maybe not needed? Is there a switch?)
 22. WARNING: do not turn on crate and tower while cooling down!
 23. Turn on the crate - to test the power. If there are any red lights, refer to the troubleshooting section of this document
 24. Turn off the crate
 25. Power on the Mac and login (password on tape on front)
 26. On the Mac start a web browser on the Mac to verify network connectivity.
 27. On the Mac start GISMO Labview program (currently "GismoV2" link on the desktop). Double click on it and click on the "run" arrow.
 28. Make sure the switch on the power supply on the back of the PC is on.
 29. Turn on the PC monitor
 30. Open the front of the PC and depress the large rocker switch until the lights come on (about one second)
 31. On the PC the BIOS will complain about settings. Press the key to edit settings (F2?) (not the key to restore to defaults, although this may be harmless). When the BIOS editor appears, press ESC and exit the editor. The computer will continue to boot.
 32. After the PC boots, run Applications > Internet > Mozilla Firefox and see if the home (Google) page loads. Usually after a cold boot the networking doesn't work.
 33. If the networking doesn't work: open a terminal and type 'sudo halt'. After halting, depress smaller rocker switch on front of PC. Repeat BIOS editing and let reboot. Repeat networking test. If fails again, then repeat the procedure.
 34. That completes the work in the receiver cabin
 35. Log into mrt-lx1 as user t16
 36. On mrt-lx1 change directories to /usr/local/gismo.
 37. On mrt-lx1 run `./cleanAll.sh` to reset the GISMO Nexus and logs for a new project/pool. Make sure you want to do this as this will remove all the Nexus content!
 38. On mrt-lx1 run `crontab -u t16 /usr/local/gismo/cron/gismocrontab.file` to register the cron jobs
 39. Open a web browser to the GISMO Nexus (<https://mrt-lx1.iram.es/Devices/GISMO/>) and verify it loads and doesn't have old data.
 40. Down in the control room connect the GISMO client to power, keyboard, mouse, monitors, and ethernet. Power on. I believe this computer has a similar BIOS issue as the server, so go ahead and "edit" the BIOS and save (without changing parameters).
 41. Double click on the "Run GISMO" icon on the desktop
 42. Run the tuner (Tuning Tab > Start Tuning)
 43. GISMO is now ready to observe. Initiate observations with Pako

Details on Starting

Detector Computer

The Detector computer will automatically start the GISMO software upon bootup. To power-up the detector computer (which is in the large electronics box), open the front door and press the large, rocker switch momentarily. Of course, the power supply switch in the back needs to be turned on.

BIOS errors

The computer must have at least a monitor connected during boot. It is recommended to not connect the keyboard and mouse. On this particular computer we occasionally see the BIOS require attention on a cold boot (i.e., after power up). It merely requires the administrator to enter the BIOS menu and then exit the BIOS menu without changing any parameters. However, if the keyboard and mouse are NOT connected, the computer boots without the BIOS message (from our experiments).

Network not working on cold boot

Also, it has been observed that the network doesn't work on the computer from a cold boot. The easiest test is to start Firefox from the Applications pulldown menu at the top of the screen. If Firefox fails to find the home page (Google), and the network cable is connected (a good test is to open an internet browser on the Mac), then reboot the computer (e.g., type "sudo halt" and press small rocker switch - "sudo reboot" does not work). You may have to do this a third time. We have no idea what causes this problem but once the network is up it has never failed on us.

Won't start

In Oct 2012 the detector computer did not POST after 5 or 6 attempts in the receiver cabin (where it had been stored). I brought the computer down to the building and it booted fine. We moved it back up to the receiver cabin and had no problems.

Control Computer

Double-click the GISMO icon on the desktop.

Merge Computer

The Merge computer is currently mrt-lx1. The GISMO software runs as user "t16".

Cron jobs

As user t16, run `crontab -l`. There should be two entries. If not, run `crontab -u t16 /usr/local/gismo/cron/gismocrontab.file`

After a minute at most the GISMO watchdogs will start. To verify, run "pgrep -l gismo" and make sure the following are running:

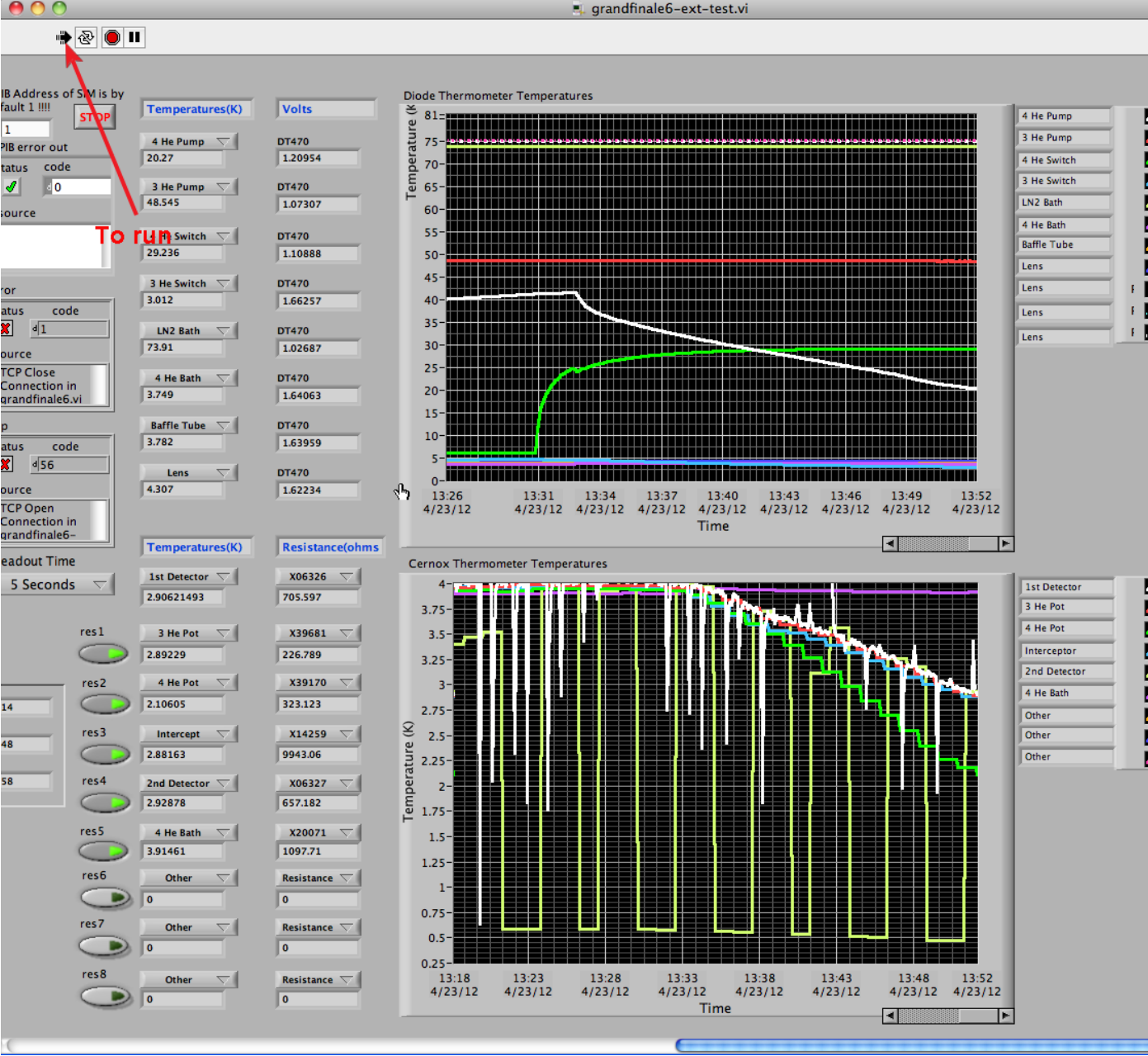
1. gismoMrgChk.sh
2. gismoCrushChk.sh

Thermometry Computer

Monitoring

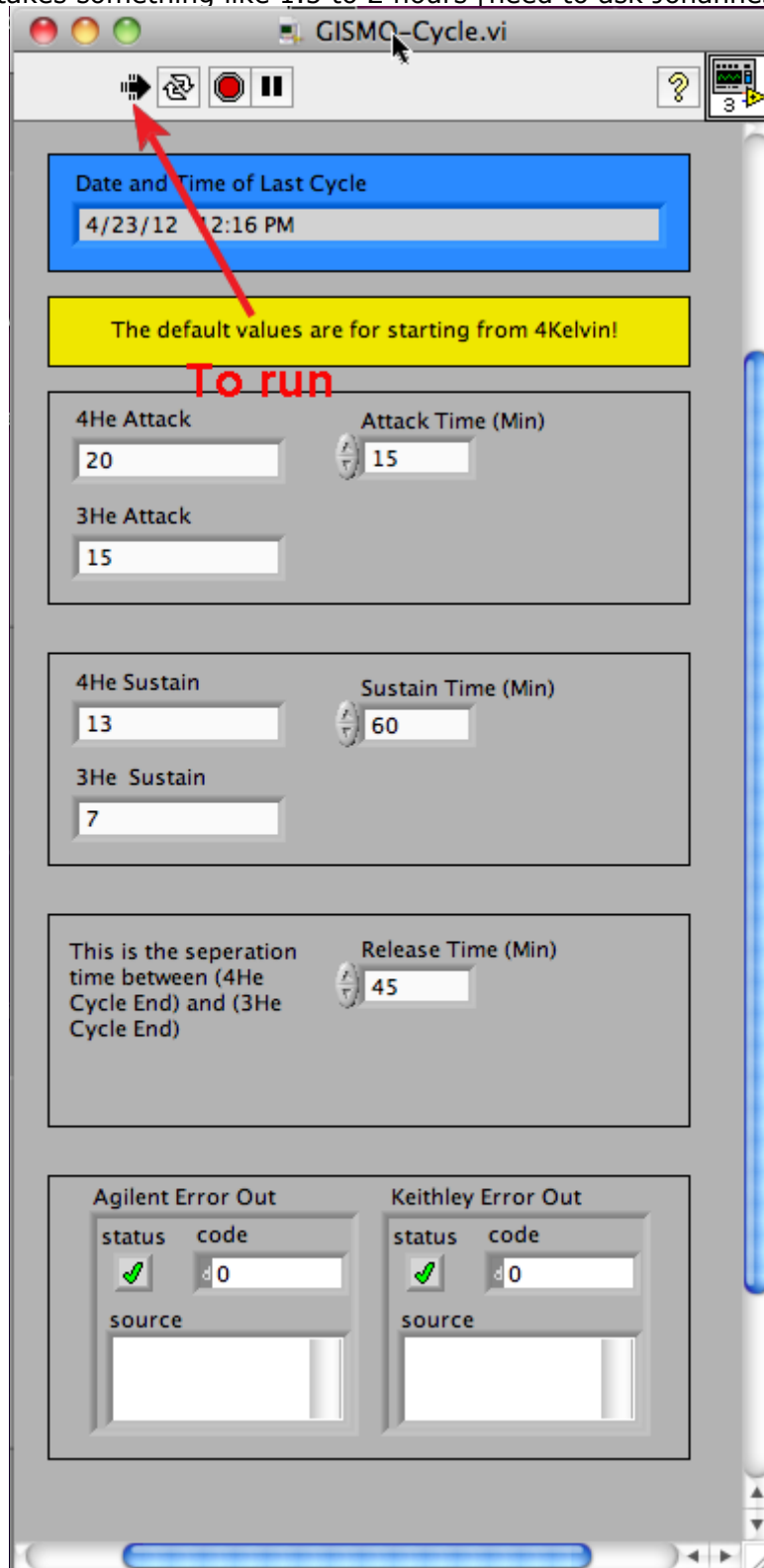
LabView

The Thermometry computer (the Mac) uses LabView for GISMO Dewar thermometry interaction. To start the main monitoring software, double-click on the "GismoV2" link on the desktop. When the main "panel" opens, click the arrow on the upper left, as shown in the following image:



Cycling

To start the cycling software, double-click on the "GISMO-Cycle.vi" on the Desktop. The main panel should appear. Press on the upper left arrow to start the cycle as indicated in the image below. The cycle takes something like 1.5 to 2 hours [need to ask Johannes or Elmer].



Stopping the Software and Computers

Detector Computer

When the GISMO software is running there is an "IRC" window. Select File -> Exit (or Quit) on this window to terminate the software. To shutdown the computer, execute "sudo halt" in a shell. The password is the same as that used on the Control Computer. Note, if the console for the computer is not available, it is probably okay to execute "sudo halt" after ssh'ing remotely and without shutting down the GISMO software.

Control Computer

When the GISMO software is running there is a small "IRC" window. Select File -> Exit (or Quit) on this window to terminate the software. The computer is shutdown using standard Windows methods (e.g., through the Start menu).

Merge Computer

If it is desired to disable the GISMO merging and quicklook pipelines, perform the following steps:

1. Delete the crontab for user t16 (`crontab -u t16 -r`)
2. Kill the two processes returned by the command `ps x | grep gismo.*Chk | grep -v grep`

To reinstall the cronjobs, see the Merge Computer section of the Starting the Software section.

Temperature Computer

1. Stop any running LabView programs (via the "stopsign" button on the upper left)
2. Exit LabView
3. Select "Shutdown" from the Apple menu

Computer Administration

Overall

All computers use ntp (server 150.214.224.192). More information on configuration is at <http://gismo-detector.iram.es:8080/JSPWiki/Wiki.jsp?page=NTP>.

Detector Computer

Overview

The Detector computer runs an older version of Debian Linux. We are locked into this version due to a unmaintained kernel driver for the NIST MarkIII PCI card that communicates with the GISMO (MarkIII) acquisition electronics. In general the system should be left "as is" and new applications and software should not be installed.

A VNC server is running on the computer for remote access. The address is gismo-detector.iram.es. The password is "gismo".

There are currently issues with the BIOS loading (on the client computer as well).

Software Location

GISMO releases are installed in *~smaher/GismoSoftware/<release>*. The *~/Desktop/GISMO_DETECTOR* script is run by the gnome startup mechanism at boot (after autologin of smaher account). The last line of this script indicates which version of the GISMO software is being used. Logs for the GISMO software are stored in the directory of the current version of the software. For example, if GISMO_DETECTOR points to *~smaher/GismoSoftware/3-07-12-ski*, then logs are stored in *~smaher/GismoSoftware/3-07-12-ski/GISMO/gismoServerJavaLog.0.txt*. The logs are rotated and incremented (e.g. *gismoServerJavaLog.1.txt*, etc.).

Disk Usage

The detector computer does not store the GISMO data locally and thus disk usage increases relatively slowly. Logs from the GISMO software (and of course system logs) are probably the biggest users of disk space. The location of the logs is noted in the Software Location section. Older, rotated logs can be removed from the system if needed.

Backup

There is a backup server hard drive at the 30m (currently in blue crate in laboratory off of control room). This can be swapped in if the server has a disk failure. There is also a backup server with an additional backup hard drive at the 30m (currently in blue crate in laboratory off of control room). The backup server has all the necessary hardware except the IRIG card (this would have to be transferred from the other server).

NOTE: the backup hard drives were cloned from original server Oct 26, 2012

Control Computer

The Control Computer runs Windows XP and the *smaher* account has administrator privileges. There is a cygwin installation on the system for those wanting a Unix-type command support (e.g., ssh, grep, tail, etc.). Windows XP is used mainly to support National Instruments drivers (used for filter flipper controllers).

Remote Desktop Server is running for remote access (from a Windows machine). There is also a TightVNC server installed.

Software Location

GISMO releases are installed in *C:\Documents and Settings\smaher\My Documents\GISMO Software*. The *GISMO* shortcut on the desktop will point to the current release. The (Eclipse) development sandbox is in *C:\Documents and Settings\smaher\My Documents\Heliosworkspace*.

Disk Usage

There are two RAID 1 (mirroring) disk volumes on the machine. The system volume is one and the F: drive is another. All the GISMO archive data is stored in F: (in the top directory). Besides GISMO raw files, a log of Elvin messages, tuning logs, and IV curve summaries are stored on the F: drive. It is expected that the data will be migrated off the F: drive for each new project that uses GISMO.

Each RAID drive is 500GB. If a volume has a drive failure, a new 500 GB drive needs to be installed. The Intel Matrix Storage software the Control Computer (Windows) will help identify the drive.

NTP

After powerup, the control computer seems to take a long time for NTP syncing. (Note, NTP synchronization on this computer is not critical). To manually resync ntp, run `w32tm /resync` on the command line (either MSDOS or cygwin).

Merge Computer

The GISMO merge and quicklook systems are stored in `mrt-lx1:/usr/local/gismo/iramintegration` and `mrt-lx1:/usr/local/gismo/quicklook` respectively. One exception is the website of quicklook which includes the contents (scripts, html, and other files) of `mrt-lx1:/var/www/Devices/GISMO` and a cgi-bin script in `mrt-lx1:/usr/lib/cgi-bin/gismoLog.pl`.

The merge and quicklook systems are triggered into action when files appear in special locations. Scripts, which are started by *cron*, watch for these files and when found, start other scripts to process the data. The crontab for both merge and quicklook are stored in `/usr/local/gismo/cron/gismocrontab.file`. Currently it is registered under the t16 user. The contents are as follows:

```
* * * * * /usr/local/gismo/quicklook/crushAutorun/bin/
gismoCrushCron.sh >> /usr/local/gismo/quicklook/crushAutorun/logs/
gismoCrushCron.txt 2>&1
* * * * * /usr/local/gismo/iramintegration/bin/gismoMrgCron.sh >> /
usr/local/gismo/iramintegration/logs/gismoMrgCron.txt 2>&1
```

To start these cronjobs, run `crontab -u t16 /usr/local/gismo/cron/gismocrontab.file`

These scripts run every minute and make sure the “watchdog” scripts are running. If they are not, they are started.

These scripts are run under the t16 account.

There are some README files scattered throughout `/usr/local/gismo` that provide more information.

GISMO Nexus Reprocess

If the GISMO Nexus web page becomes corrupt for some reason, the information can be rebuilt by doing the following:

1. As user t16 on mrt-lx1, cd into `/var/www/Devices/GISMO`
2. Run `./reprocess.sh`

Thermometry Alarm

The Gismo Nexus includes an audible alarm in the IRAM control room when certain thermometry readings go above certain thresholds. The alarm is three beeps. The alarm is disabled (and enabled) on the Gismo Nexus website (<https://mrt-lx1.iram.es/Devices/GISMO/>).

The alarm thresholds are in `/usr/local/gismo/thermo/thermoweb.py` around line 19:

HE4_BATH_LIM
LN2_BATH_LIM
FST_DET_LIM

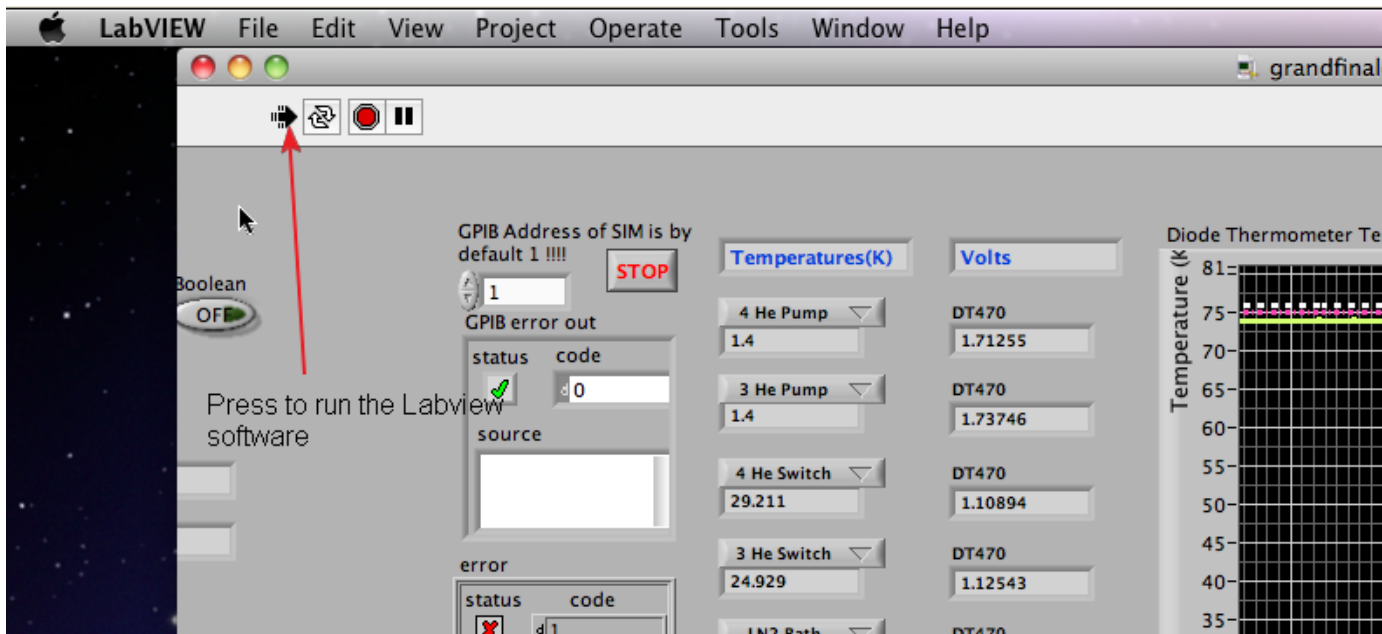
The script to sound the alarm is in /usr/local/gismo/quicklook/crushAutorun/bin/soundAlarm.sh.

Thermometry Computer (Mac)

The mac runs Labview software to readout GISMO temperatures and also to run the cycling.

Software Location

The main Labview VI is "grandfinale6-ext-test.vi" on the Desktop. Double-click on it to load the thermometry software in Labview. Then you must click the "run" button as shown below:



A VNC server is running on the computer for remote access. The address is 150.214.224.247. The password is "gismo". Note, the vnc connection seems to "hang" on occasion.

Networking

IP address info

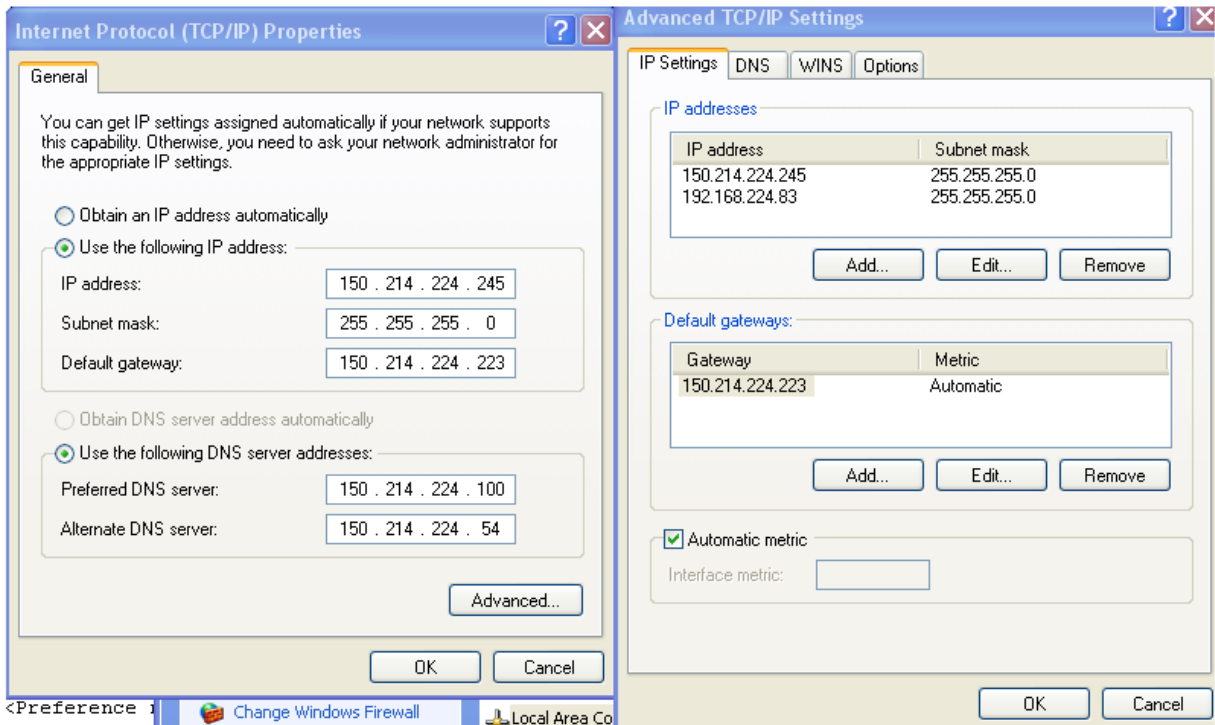
- primary dns: 150.214.224.100
- 2nd dns: 150.214.224.54
- netmask: 255.255.255.0
- gw: 150.214.224.223
- ntp: 150.214.224.192
- gismo-detector 150.214.224.244
- gismo-control 150.214.224.246
- gismo-mac 150.214.224.247

IP addresses of the two small National Instruments TTL devices in the larger electronics box in the receiver cabin are:

- (digitalout1) 192.168.224.80
- (digitalout2) 192.168.224.81

<http://gismo-detector.iram.es:8080/JSPWiki/Wiki.jsp?page=How%20do%20I%20set%20the%20IP%20address>

The client (control) computer needs to be assigned both the gismo-control.iram.es AND gismo-client.local.iram.es addresses so that it can communicate on both networks. This is done on the "Advanced" section of the TCP/IP properties. See image below for details:

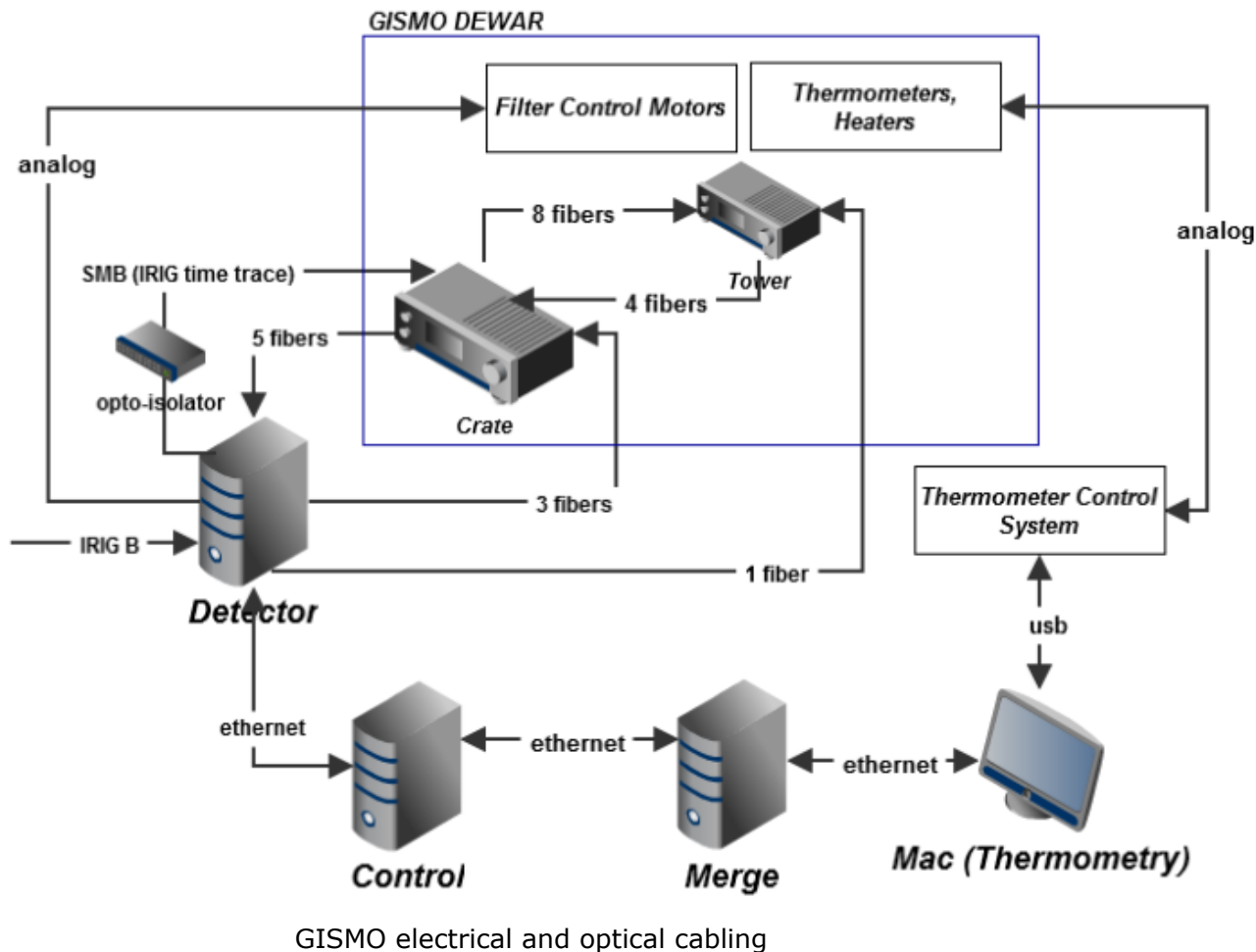


Project Startup

Before a GISMO Project or Pool is started the following should be performed:

1. On the Detector computer, check the disk space. If the disk space is getting low, migrate off the GISMO logs and/or system logs (see Software Location in Detector Computer section)
2. On the Control computer, migrate off the contents of the F:/ drive
3. On the Merge computer, run `/usr/local/gismo/archive.sh` to archive the scripts, logs and Nexus website. The archive is created in `/usr/local/gismo`.
4. Also on the Merge computer, copy the contents of `/usr/local/gismo/iramintegration/logs` and `/usr/local/gismo/quicklook/crushAutorun/logs` and give to project.
5. On the Merge computer (mrt-lx1), run `/usr/local/gismo/cleanAll.sh`. This cleans the buffers and logs of the merging and quicklook systems and resets the GISMO Nexus for the next project.
6. On the Merge computer, migrate the contents of `~gismo*/observationData/gismo`

GISMO Cabling



Grounding

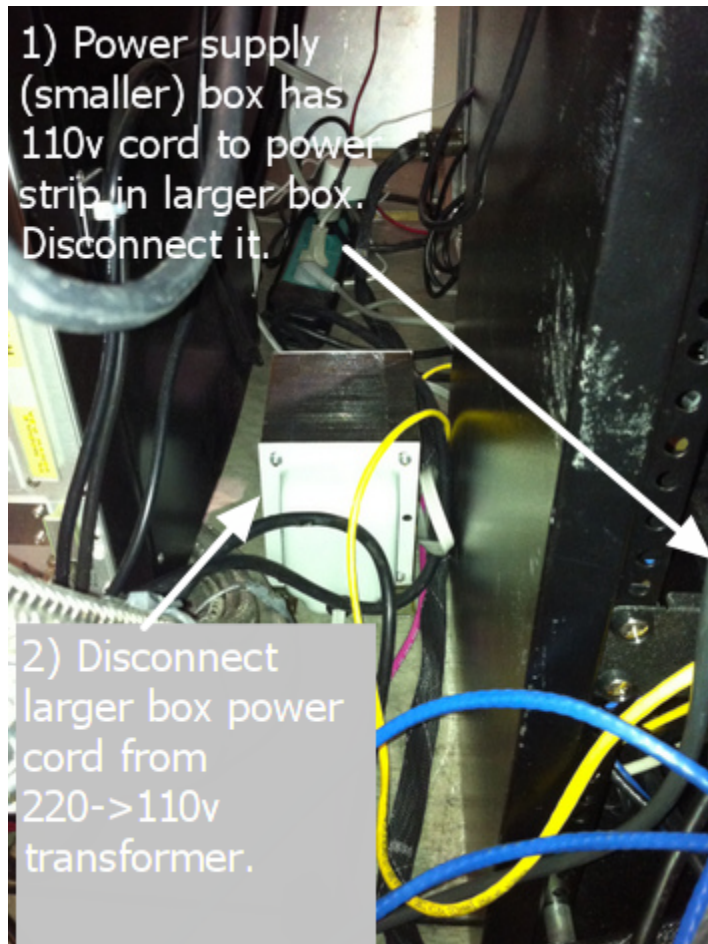
IMPORTANT: All power to the electronics goes through a 110-220 volt transformer. The 220 volt side of the transformer, which is connected to IRAM power, **MUST** be grounded. Do **NOT** introduce a ground breaker.

The GISMO Dewar should be electrically isolated from the stand and other metal (it should only be grounded to the power ground).

Disconnecting (Connecting) the Dewar from the Electronics

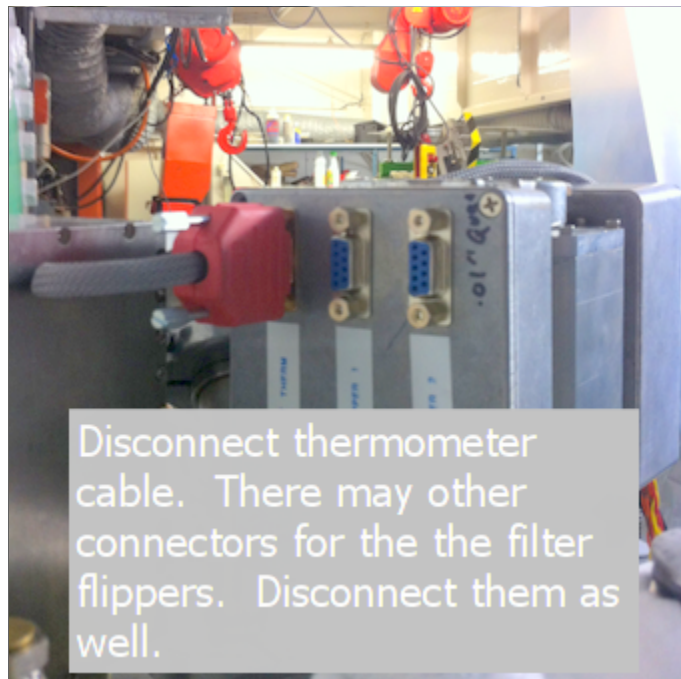
This sections describes the minimal work to disconnect the electronics box from the dewar (for example, when leaving GISMO in place and moving the electronics boxes to storage). To reconnect, perform the steps in reverse. Both the **Crate** and **Tower** are located on top of the GISMO dewar.

- 1) Shutdown the Detector Computer (see the section on Shutting Down Software and Computer). Also shutdown the Thermometry Mac (through Apple menu).
- 2) Turn off the Tower and Crate using the toggle switches. See pictures of Crate power card and Tower. (Note the Tower and Crate can also be turned off with the computers turned on)
- 3) Follow instructions in the picture to disconnect the main power supplies from the smaller and larger electronics boxes:

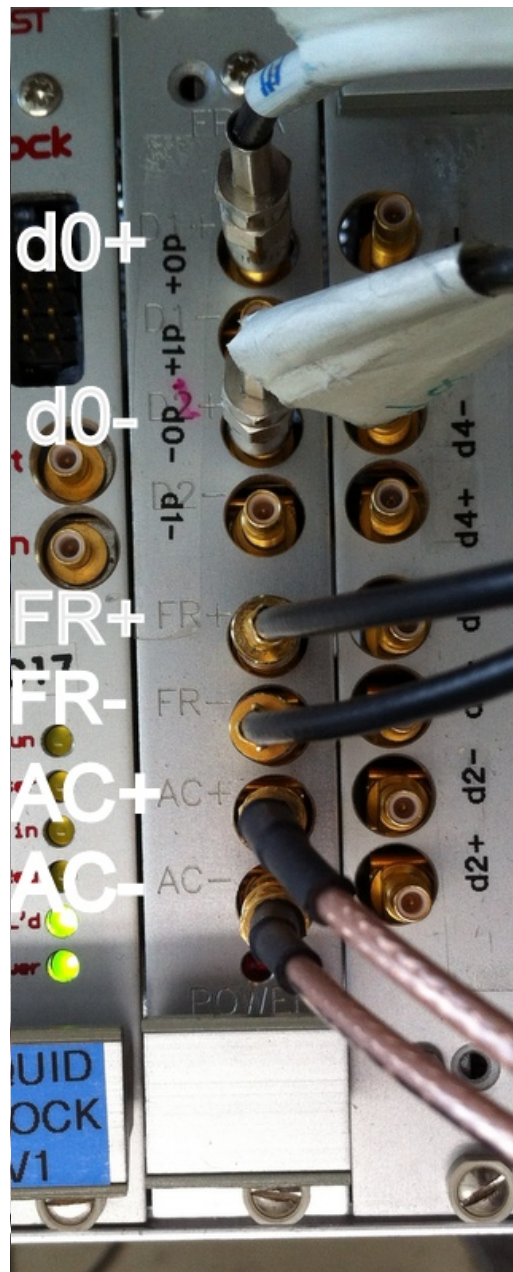


- 4) Disconnect thermometry cables as shown in the following pictures:





5) Disconnect d0+ AND D0- SMB cables from Interface Card on top side of Crate



Crate (interface card) showing d0+/- SMB connectors (from gismo-detector) and FR+/- and AC+/- (to Tower)

6) Disconnect Tower serial fiber ("TWR SER") from Tower

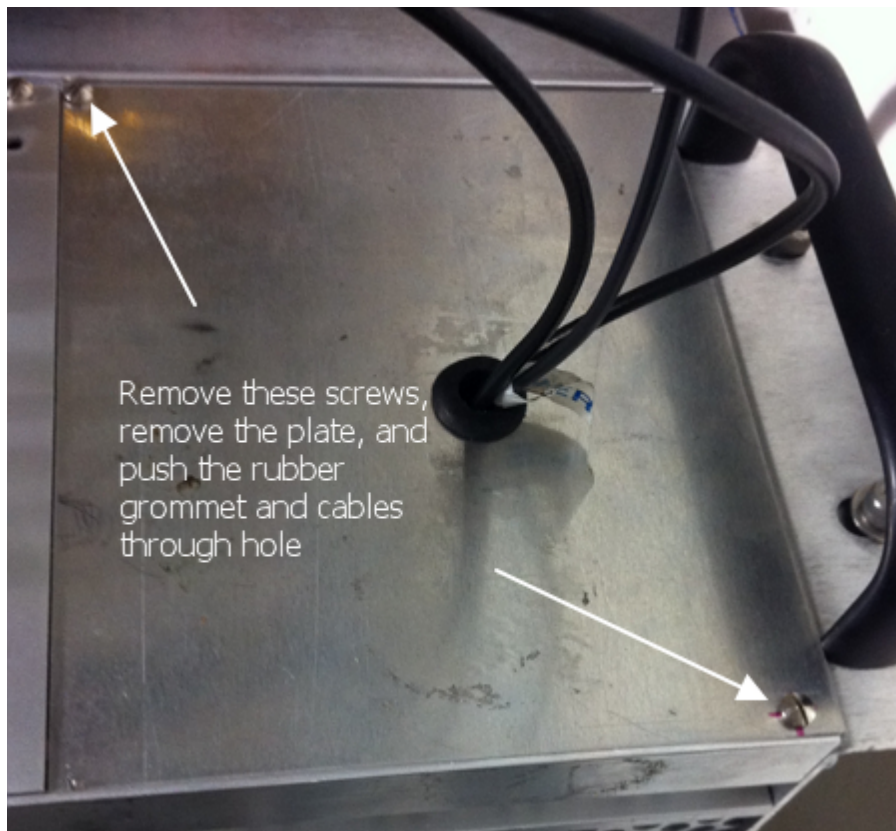


Top part of the Tower showing tower serial fiber ("TWR SER") connection (from gismo-detector), tower power connection, and nominal light indicators (the "Data" light will flash when data is sent [e.g., during startup or tuning])

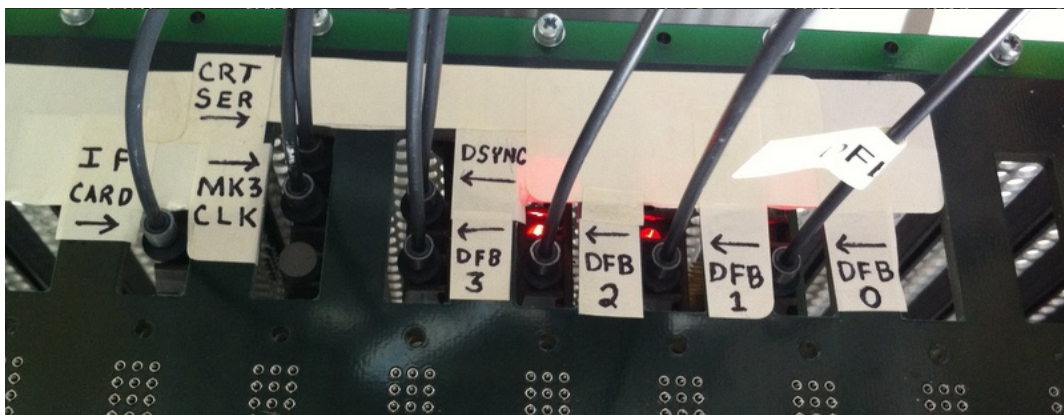
7) Remove bottom cover of Crate



8) Unscrew and remove plate on **top right** of Crate (shown below). Push rubber grommet and fiber and SMB cables through plate. Replace plate for easy storage.



9) Remove fibers from bottom of Crate. For the "CRT SER" and "MK3 CLK" fibers you must pull the associated (Clock) card from the backplane (about two inches). You need to loosen screws on the top of the crate on the card and pull it out a bit. The fibers are removed by pulling them out.



Bottom side of Crate showing fiber connections from gismo-detector computer. Note, the "CRT SER" and "MK3 CLK" connections require the associated card, the "Clock" card to be pulled out an inch or two. The "CRT SER" connection is a little "above" the backplane and gets a little compressed when the card is put back in position.

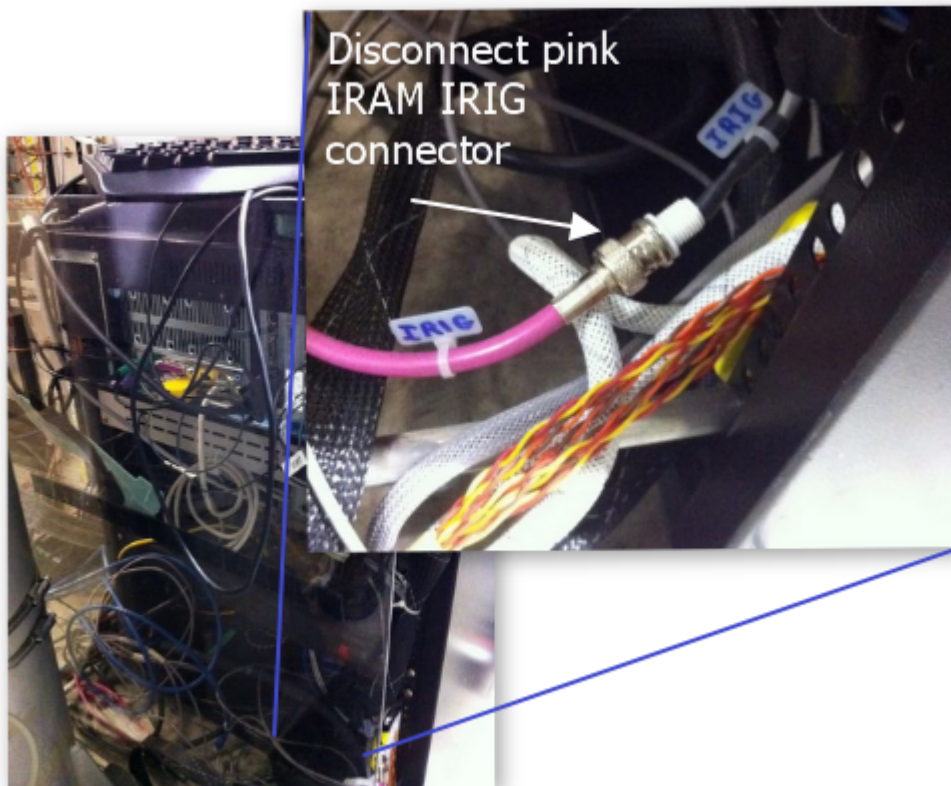
10) Remove fiber cable connector and power connector from side of crate. Gently guide the fiber heads through the opening.



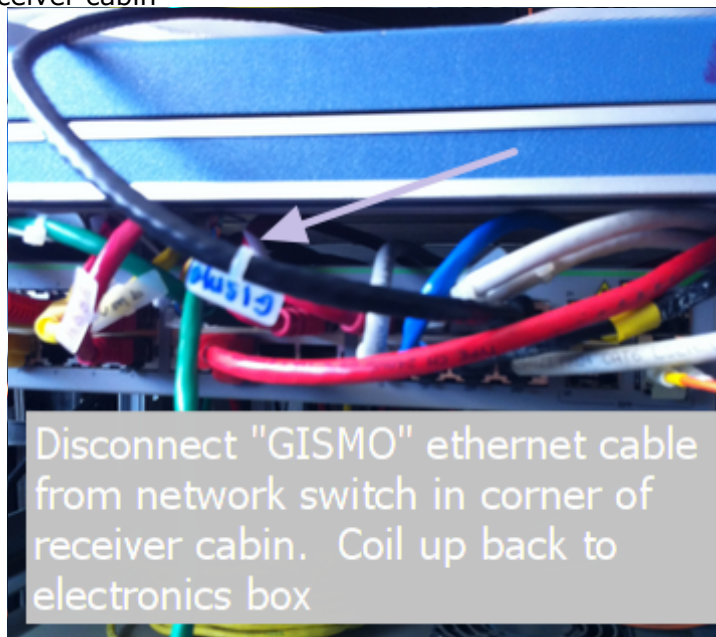
11) There is an "opto-isolator" for the IRIG-B trace signal. The isolator box is a flat, gold-colored box. There is also a small aluminum box velcroed to the Crate for cable breakout. The signal that is being isolated is the "time tracer" going into the Interface Card on the crate (d0+ and d0-). The signal comes from the IRIG PCI card in the computer, connects to the "Dirty Side" "Inputs" (e.g., connector number "9") on the back of the gold isolator box. Then out the "Clean Side" "Outputs" (e.g., connector number "9") on the front of the gold isolator box and to the d0+ and d0- connections on the Crate's Interface Card (see image in step 6). Currently we are using a small aluminum breakout box and other small piece to convert the BNC to dual SMB connectors (on the "-" connector both contacts are ground, on the "+" connect both leads are positive [need to confirm]).

12) At this point the electronics should be completely disconnected from the dewar. You can feed the cables through the floor and coil it. NOTE, we have since added an opto-isolator to the IRIG-B signal (a flat, gold-colored box and a small aluminum box velcroed to the Crate). This box and cables must be disconnected as well. It should be straightforward; all cables can be disconnected.

13) Disconnect the IRIG cable



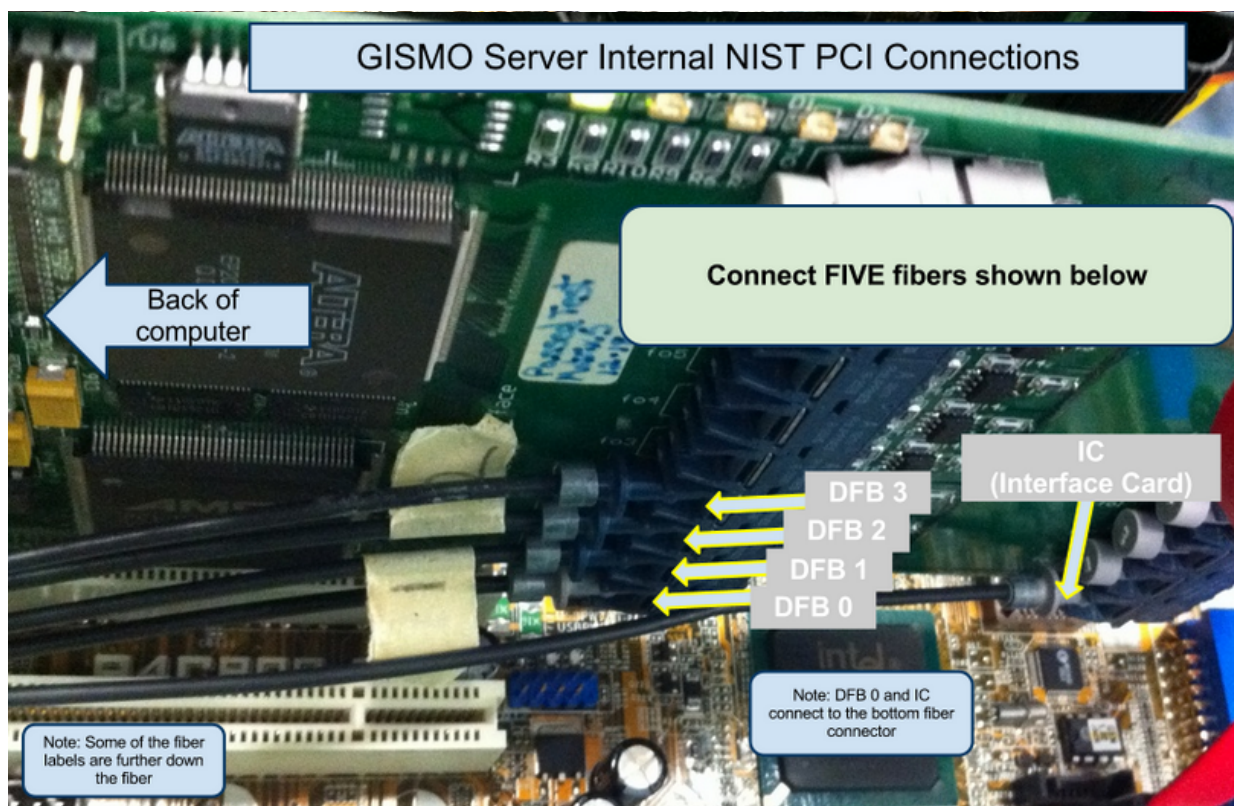
14) Disconnect the GISMO ethernet cable. It's connected to the network switch/router in the far corner of the receiver cabin



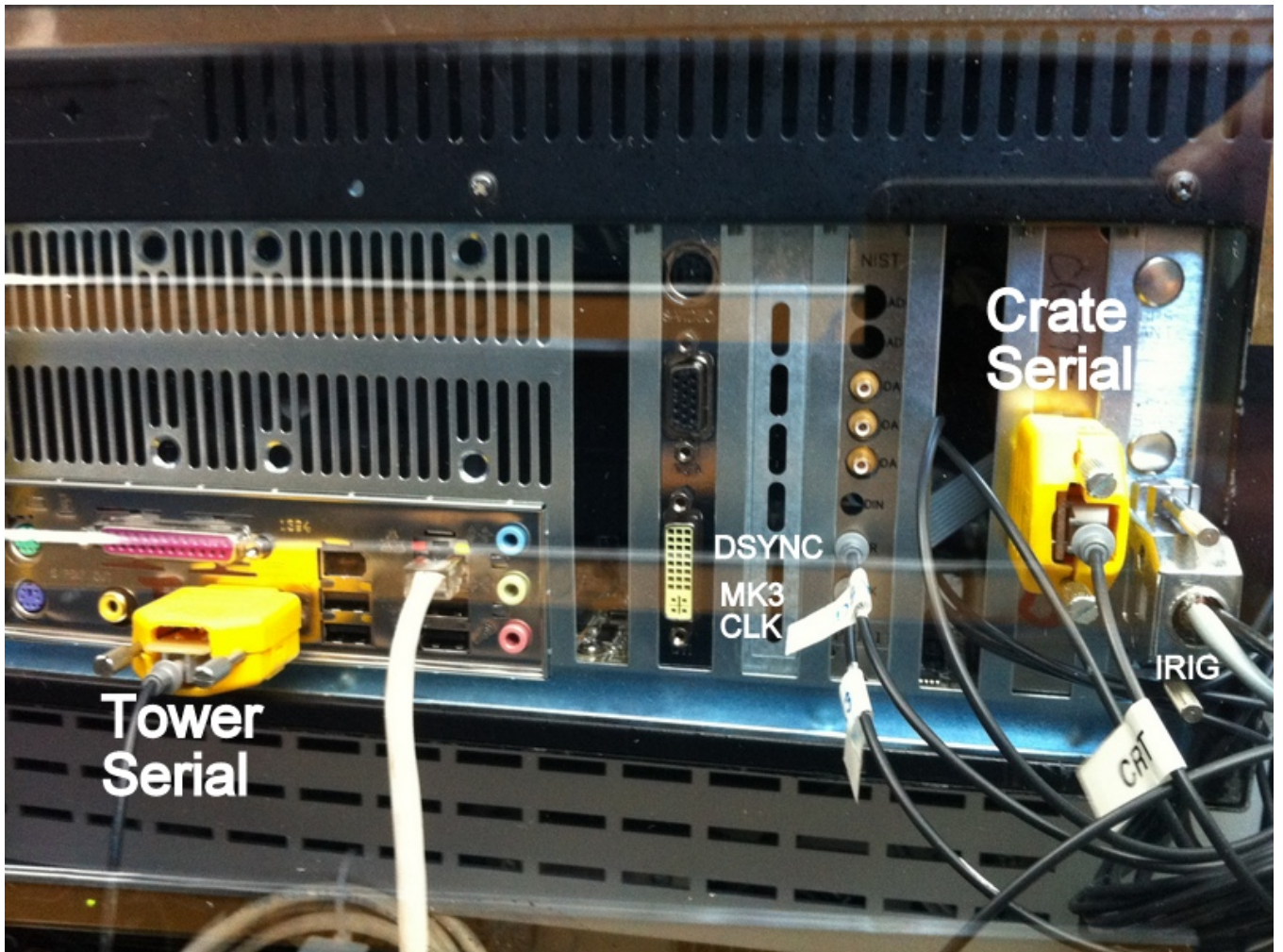
15) Coil all cables and stow in back of electronics box

At this point the electronics boxes are disconnect.

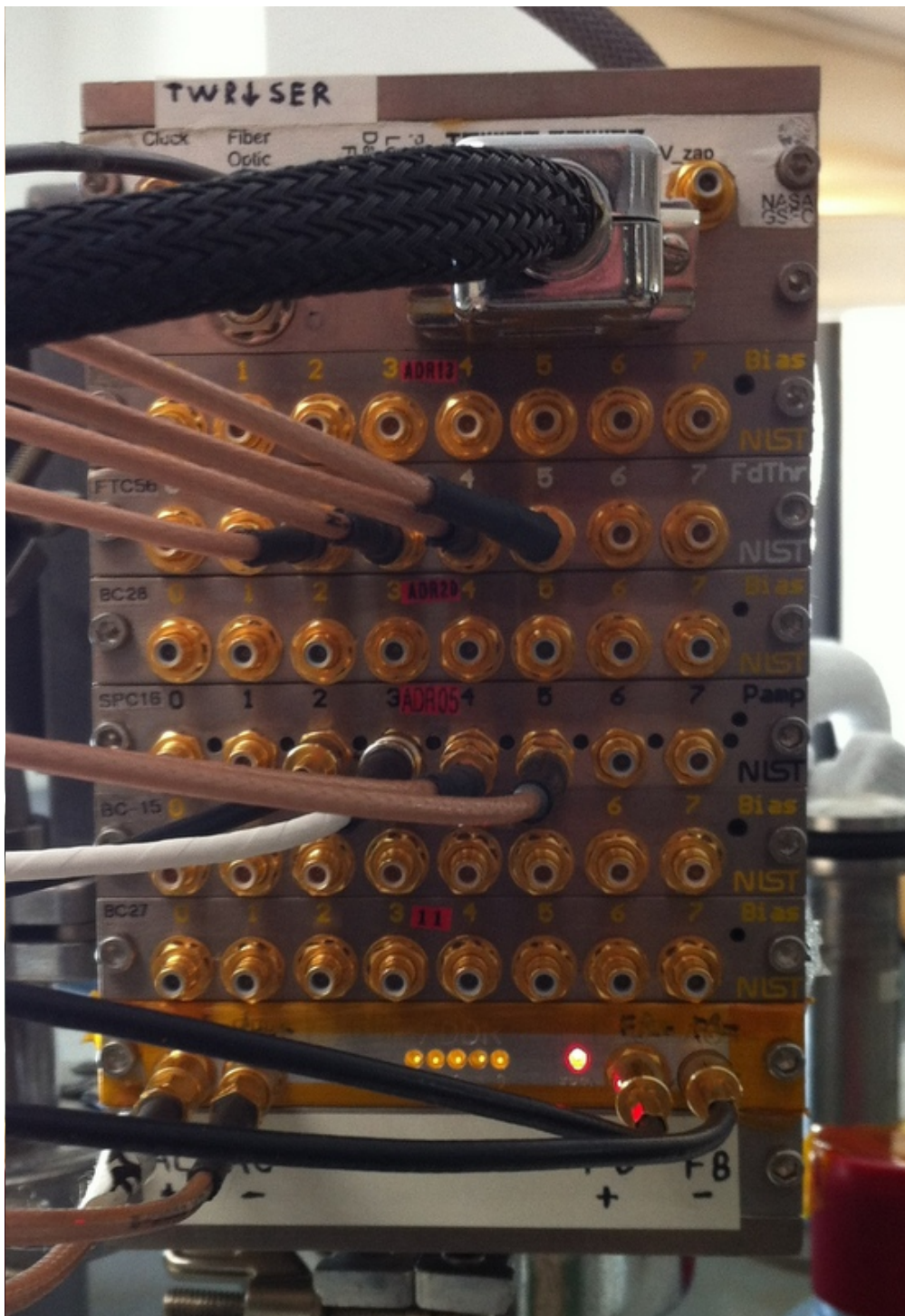
More Detailed Cabling Information



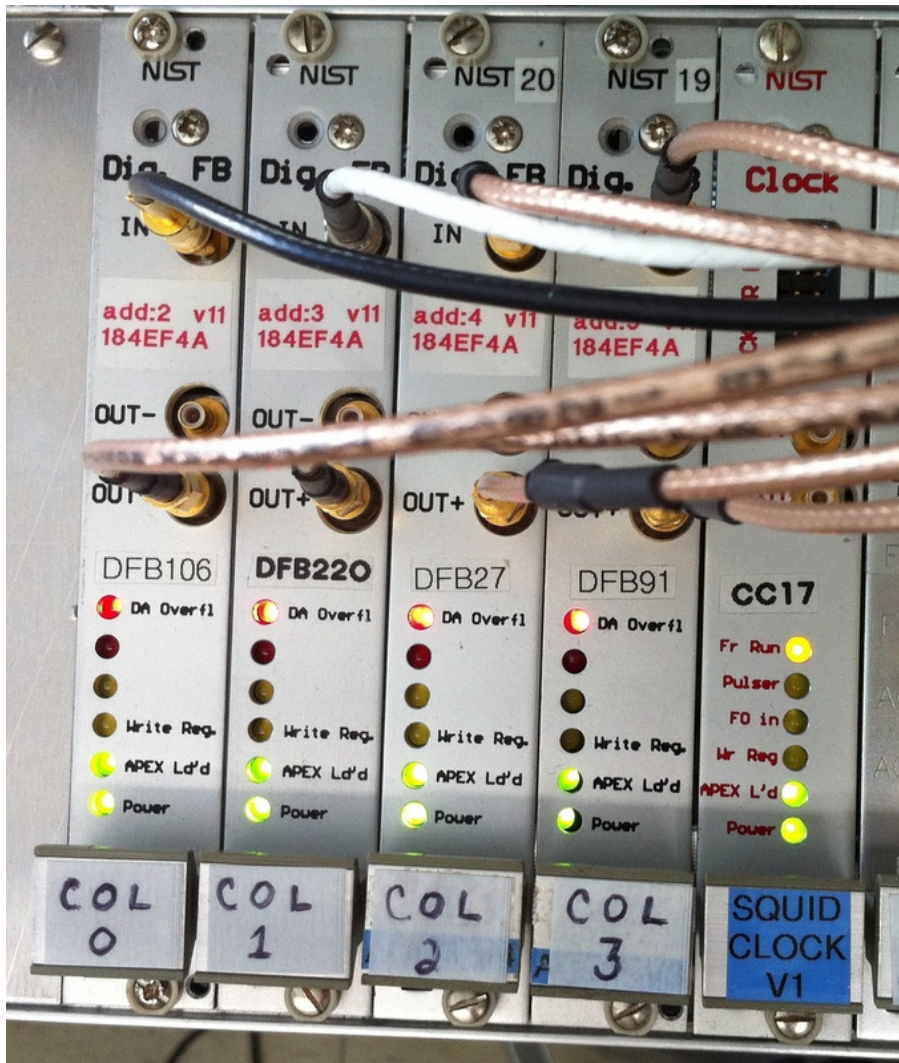
Inside of gismo-detector computer showing fiber connections to NIST PCI card. The other fiber ends connect to the bottom of the Crate



Back of gismo-detector showing three additional fibers (dsync, mk3 clk, crate serial) that connect to the Crate and one fiber (tower serial) that connect to the Tower. There is also an IRIG DB9 connector that connects to the IRIG PCI card in gismo-detector.

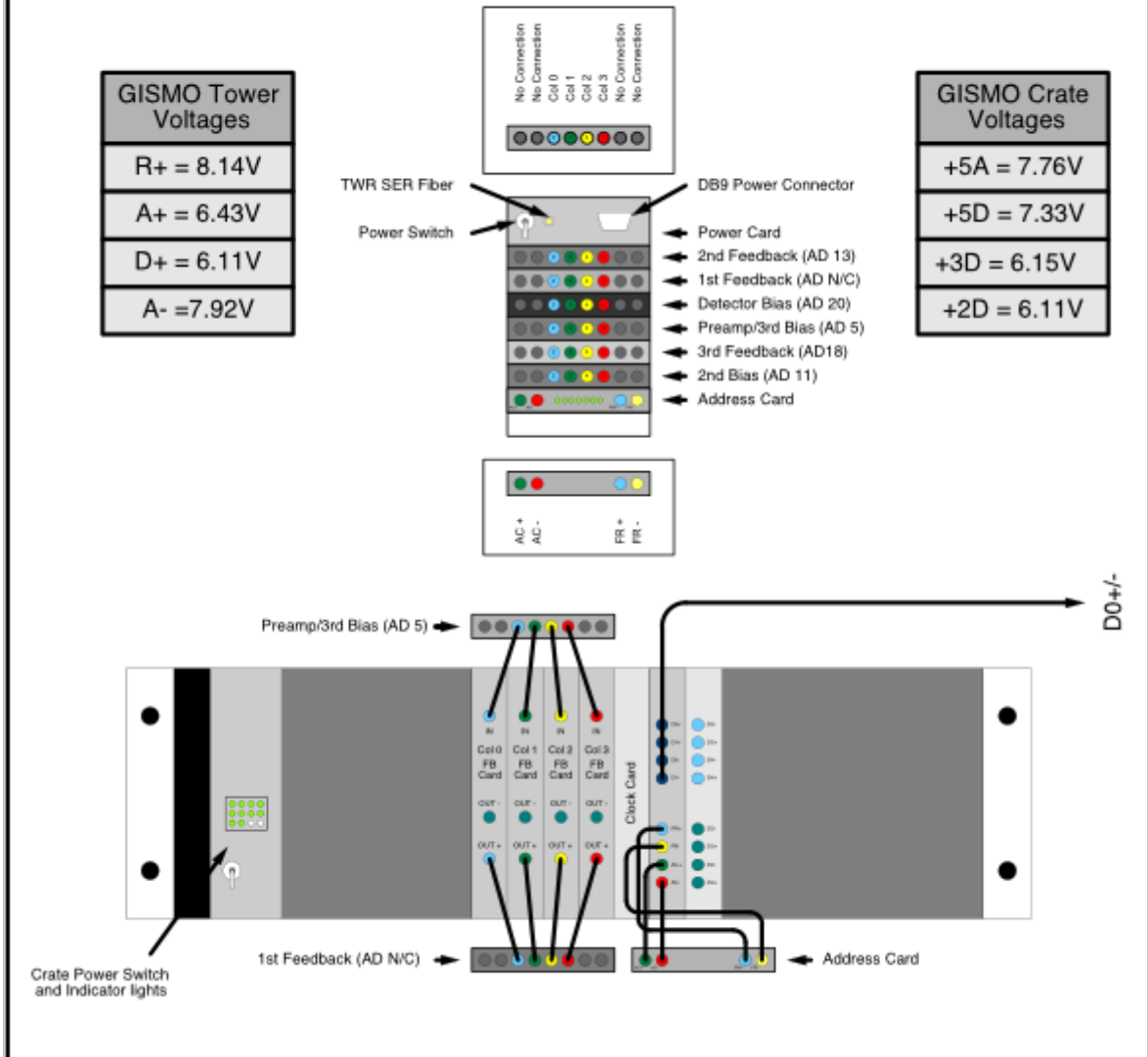


Tower showing SMB connections (to Crate). Note bank of yellow “addressing” lights on the bottom



Crate DFB Cards showing SMB connections (to Tower)

GISMO TOWER TO CRATE DIAGRAM



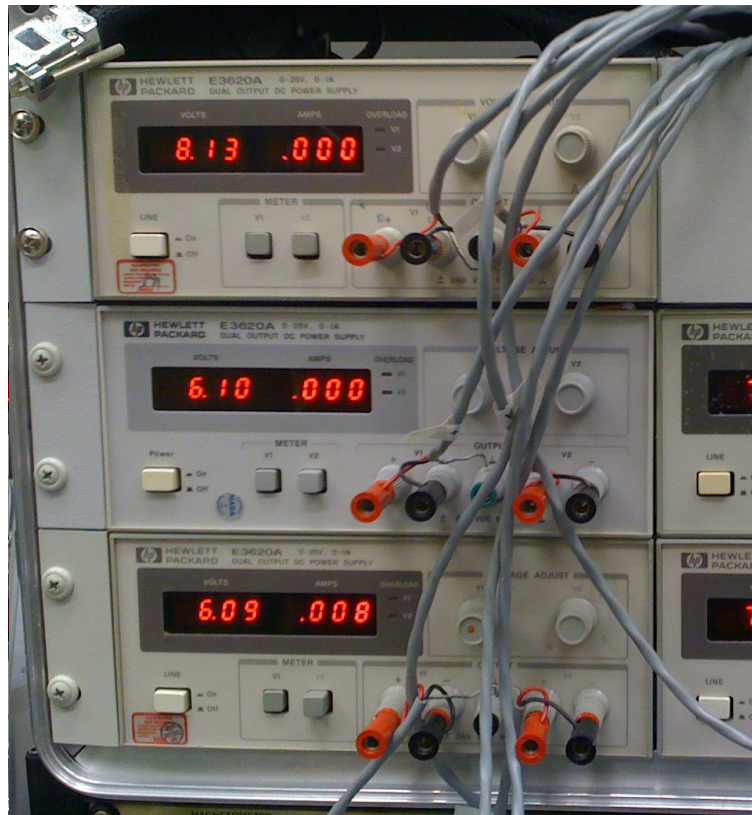
Schematic of SMB connections between Crate and Tower. Also includes voltages for power supplies.

Power Supply Settings

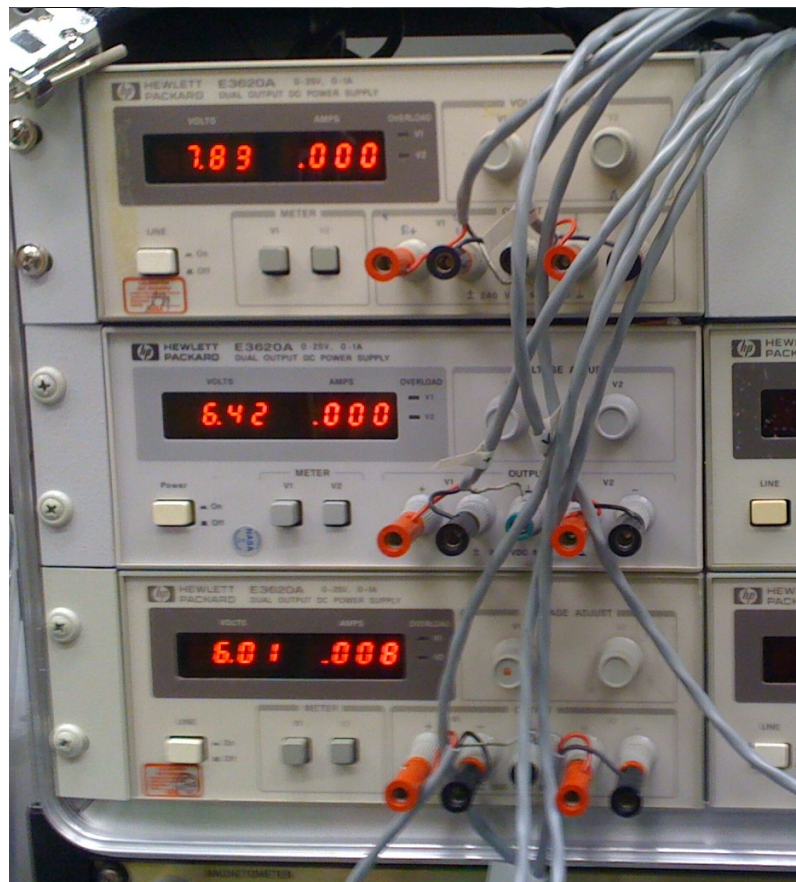
These pictures show the voltage settings for the Crate and Tower power supplies.



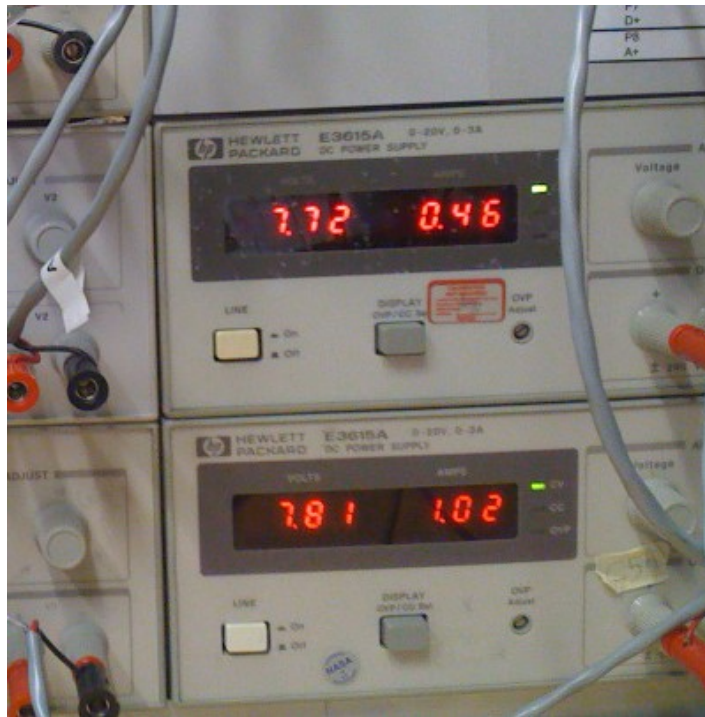
Crate power card shown with nominal lights. If any lights are red then try power cycling. If that doesn't work then make sure the power supply voltages are set properly (see images below. Also refer to tower wiring schematic in previous section)



Channel 1 values of power supplies on left side of power rack



Channel 2 values of power supplies on left side of power rack



Values of power supplies on right side of power rack