

GISMO

Ingest Software

Operational Manual

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minor modifications by J. Staguhn

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Introduction

This document describes how to operate the Goddard-IRAM Super-conducting 2-Millimeter Observer (GISMO) software ingest system. This document does not describe the data reduction software.

Please feel free to provide comments 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 (typically a one-button procedure), the

ingest system will nominally operate without human intervention, producing FITS files for each observation. Operators still prepare and initiate observations with IRAM's *Pako* system, but the GISMO system automatically detects observations, archives detector data, and merges IRAM positional information with the detector data.

Calibrations (e.g., skydips, shuttered LED) are handled automatically and the operator can control which calibrations are performed.

Architecture Overview

The GISMO ingest system consists of three computers. Two of the computers, *Detector* and *Merge*, generally don't have a user interface. The third, *Control*, has a (Java Swing) user interface to initiate and monitor the ingest system.

Detector Computer

The Detector computer is dedicated to reading the detector data and realtime TTL signals (IRIG, wobbler, calibration LED, etc.) and sending the data to the Control computer. It also sends all commands to the electronics and runs the tuning algorithm when requested. The code is Java and the operating system is Debian Linux with some custom kernel drivers for a custom PCI card that reads data from the MarkIII electronics.

Control Computer

The Control computer manages the ingest process. The software is Java and runs on Windows XP.

The Control computer does the following for ingest

- Receives the data from the Detector computer
- Listens to IRAM Elvin messages and archives data during scans
- Moves the data to the Merge computer when a scan is complete

It 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

The Control computer also optionally runs a separate Java program to log data from a magnetometer.

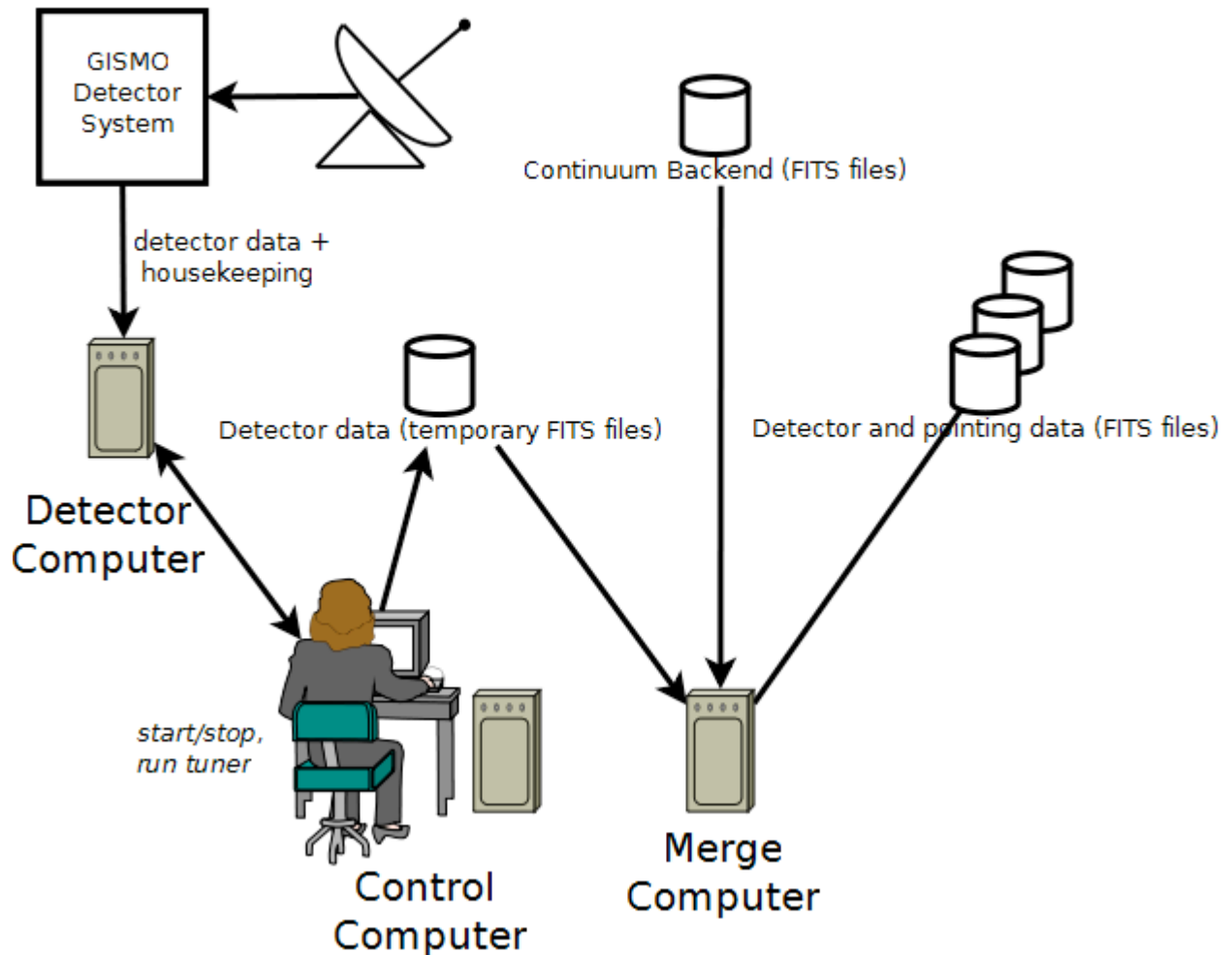
Merge Computer

The Merge computer takes the detector data and merges it with the telescope astrometry data. The system runs the same operating system as the Detector computer (so it can be used as a backup). The software for the merge is IDL and shell script. The software is located in /usr/local/iramintegration with a sandbox/cvs access in ~smaher/workspace/GISMO/tools/iram.

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 interpolation (timestamps are synchronized using IRIG)
5. Copy resulting merged file, original detector files, IRAM astrometry files, ancillary files such as IV curves and skydip results to archive

GISMO Ingest System



Starting the Software

Detector Computer

Eventually the Detector computer will automatically start the GISMO software upon bootup. Until then, double-click the GISMO icon on the desktop.

Control Computer

Double-click the GISMO icon on the desktop. To start the magnetometer logger, double-click on the Magnetometer on the desktop.

Merge

The Merge computer is ready to operate upon bootup. It uses a cron job to look at /usr/local/iramintegration/incoming for incoming data.

Using the Software

Only the Control Computer is designed for operator interaction. Administrators may use the interface on the Detector Computer for more advanced functionality (e.g., change the autotune parameters). Working with this advanced functionality is beyond the scope of this document.

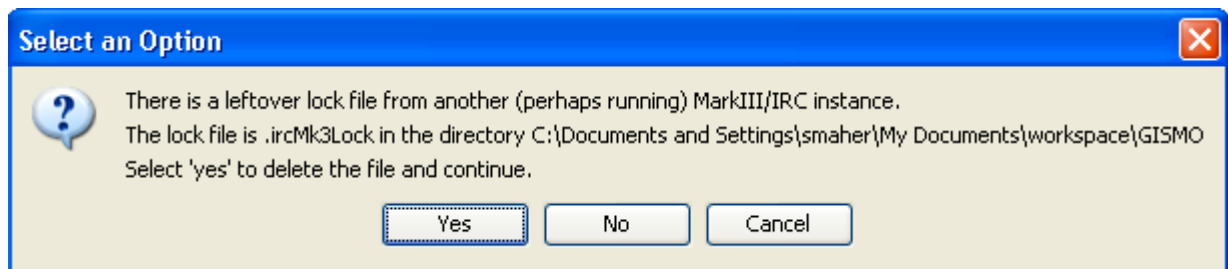
This section describes the main screens an operator will deal with.

Control Computer

Startup Warnings

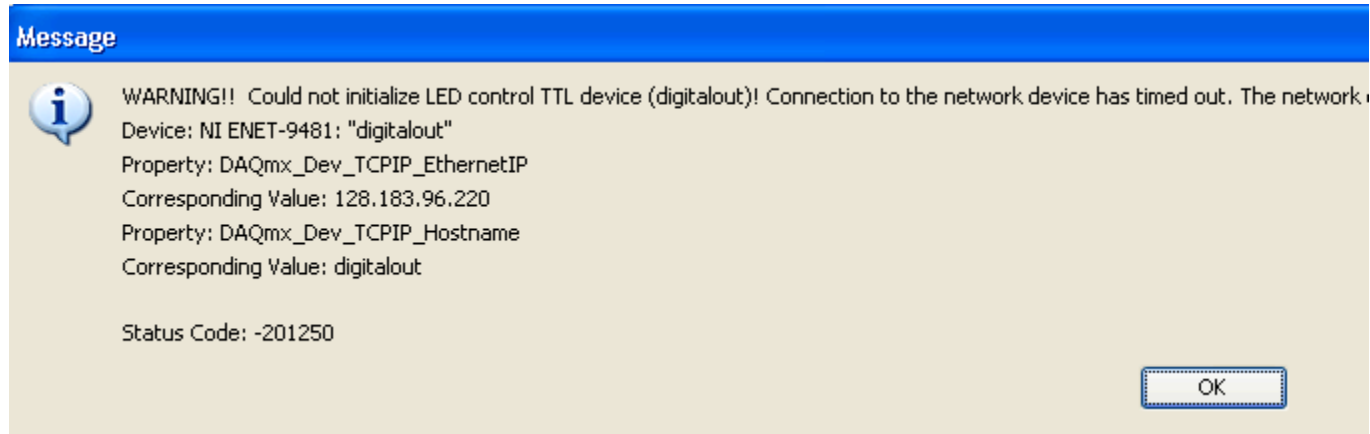
Simultaneous Clients

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

The Control computer needs to communicate with two ethernet-based National Instruments ENET devices to control the LED flasher, shutter, and the filter flippers. If the ENETs are not available, the following error will appear:

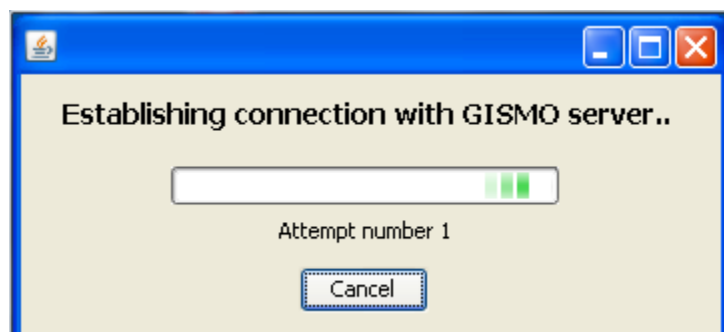


To diagnose connection issues with the ENET devices:

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

Connecting to Detector Computer

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



Note, 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, but this is only useful in special situations such as when you're doing analysis of previously generated IV curves.

Main Window

The following is the main GISMO Control window.

GISMO Console

☒ Archiving

Source: Uranus (subscan 1 of 4)

Scan ID: 2010-03-12.89

Running time: 0 min 3 sec

☐ Tuning

☐ Generating IV Curves

☐ LED

☐ Shutter open

☐ Shutter closed

Connections

☒ GISMO Server: Fri Mar 12 10:13:01 EST 2010 Frames/sec= 10162

☒ IRAM Elvin: Fri Mar 12 10:13:02 EST 2010

DAC/SAE Plots

Tuning

Configuration

IV Curves

Calibration

Filters

Miscellaneous

Show SAE plot

Show DAC plot

Show DAC twinkle

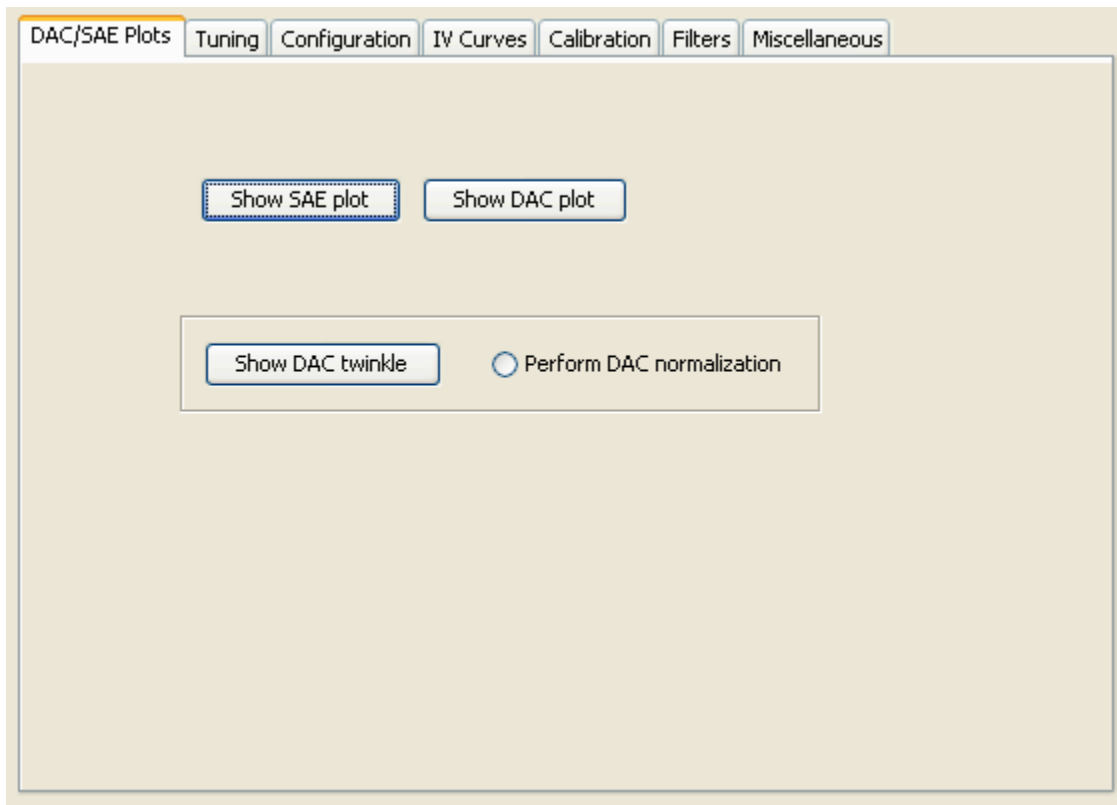
☐ Perform DAC normalization

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 the calibration "LED" is on or not (note, this indicator only samples the data and may not exactly reflect when the LED is on)
- Whether the Shutter is fully open
- Whether the Shutter is fully closed

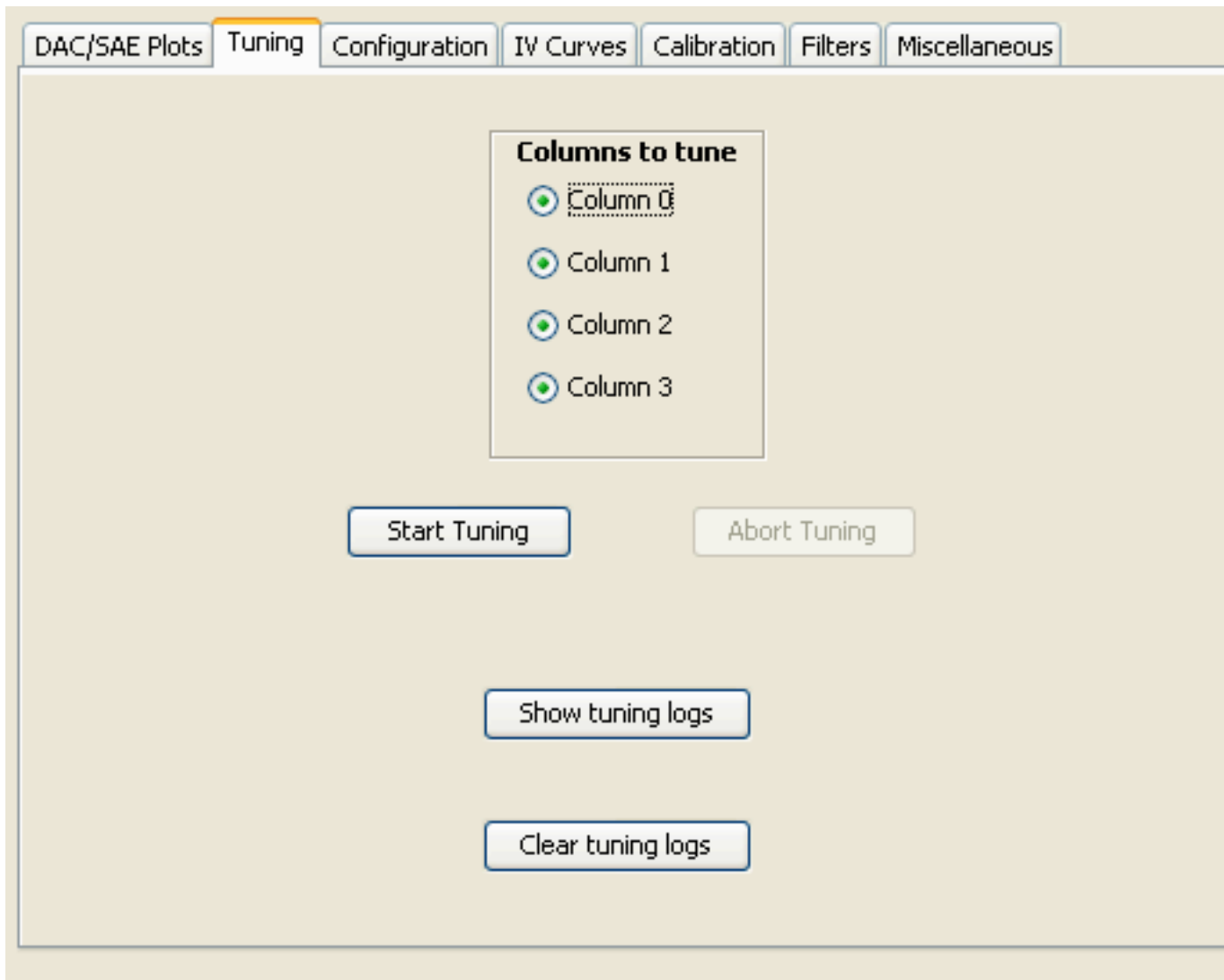
Plots Tab



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.

Tuning Tab



The Tuning tab lets an operator run the autotuner. The autotuner 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. Usually all columns are tuned but the operator may optionally tune a subset of the columns. The tuning may be aborted but the biases and feedbacks will most likely not be in an optimal state.

Configuration Tab

The screenshot shows a software interface with a tabbed menu at the top: DAC/SAE Plots, Tuning, Configuration (selected), IV Curves, Calibration, Filters, and Miscellaneous. The main area is divided into three panels:

- Readout system:** Features a slider for 'Frames per second' with a scale from 0 to 10000. The current value is 10021. Below the slider are two buttons: 'Start system' and 'Stop system'.
- Relock Default DAC:** Contains a text input field with the value '7100'. Below it are two buttons: 'Set default DAC' and 'Relock Detectors'.
- Detector Biases:** Contains four rows, each with a label (Column 0, Column 1, Column 2, Column 3) and a text input field, all containing the value '0'. To the right of the first input field is a blue 'copy' link. At the bottom of this panel is a button labeled 'Set biases (execute and save)'.

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.

IV Curves

The screenshot shows a software window with several tabs: DAC/SAE Plots, Tuning, Configuration, IV Curves (highlighted), Calibration, Filters, and Miscellaneous. The main area is divided into two sections. The left section, titled 'Run IV Curve', contains a group box 'Detector Biases' with three input fields: 'Bias start' (40000), 'Bias end' (15000), and 'Bias delta' (200). Below these are two buttons: 'Start IV Curve' and 'Abort IV Curve'. At the bottom of this section is a 'Show IV Curve plot' button. The right section has a checkbox labeled 'Analyze old IV curve'. At the bottom of the window, there are two checkboxes: 'Show IV Curve analysis twinkle' and 'Show per-pixel analysis plots'. To the right of these 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

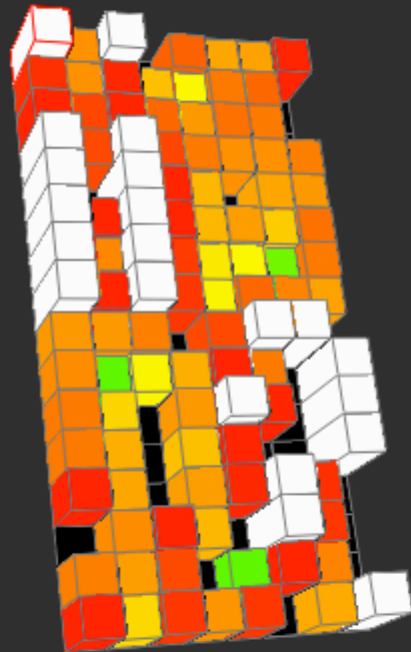
Running an IV curve is on the left side of the tab and involves setting bias parameters and pressing "Start IV Curve". During the curve the bias will go from "start" to "end", incrementing at intervals of size "delta". It will then return back to the start value, also increment by "delta". The curve data is only record for the "start" to "end" segment. The data is stored in the standard archive location (e.g., F:/Gismo2010). 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 Analysis Twinkle

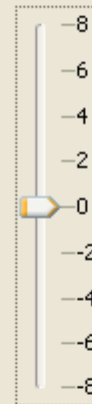
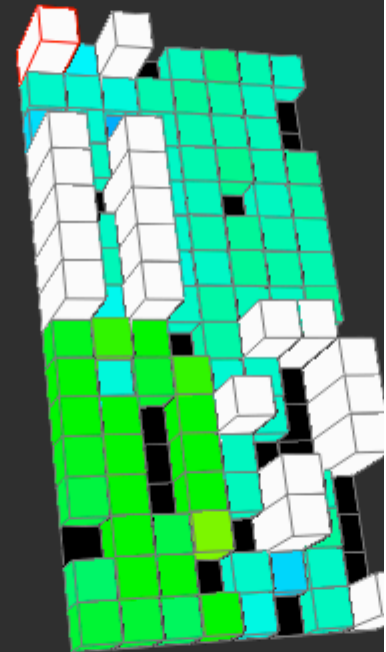
When an IV curve is run, the results are analyzed (fitted with hyperboli and lines) to determine the transition point and power. The raw data and the results are stored in files. Optionally, pressing "Show IV Curve analysis twinkle" *before the curve is run* will present a plot similar the one below, 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 Analysis - Mapped (sync)

Transition Bias



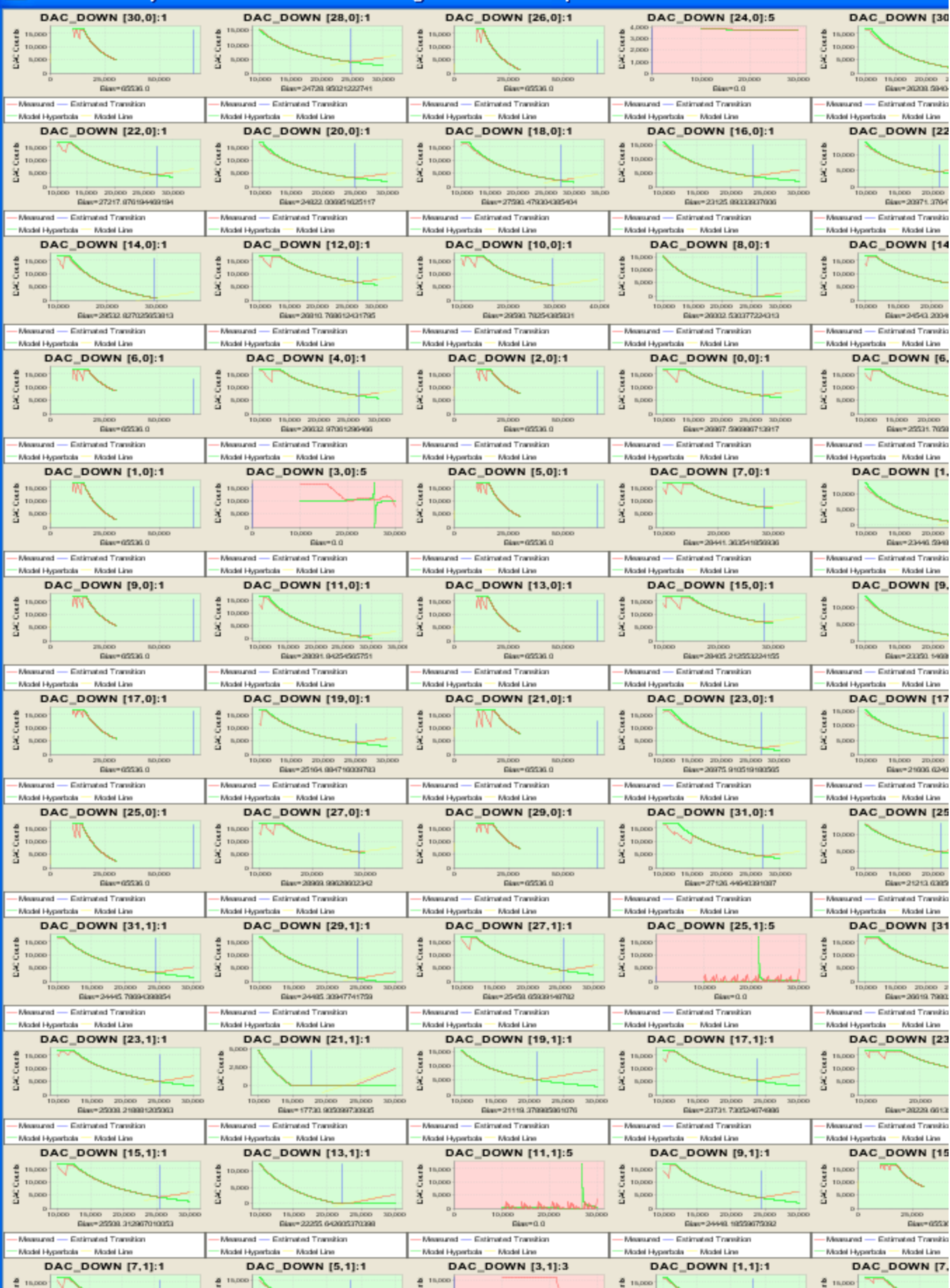
Slope of normal



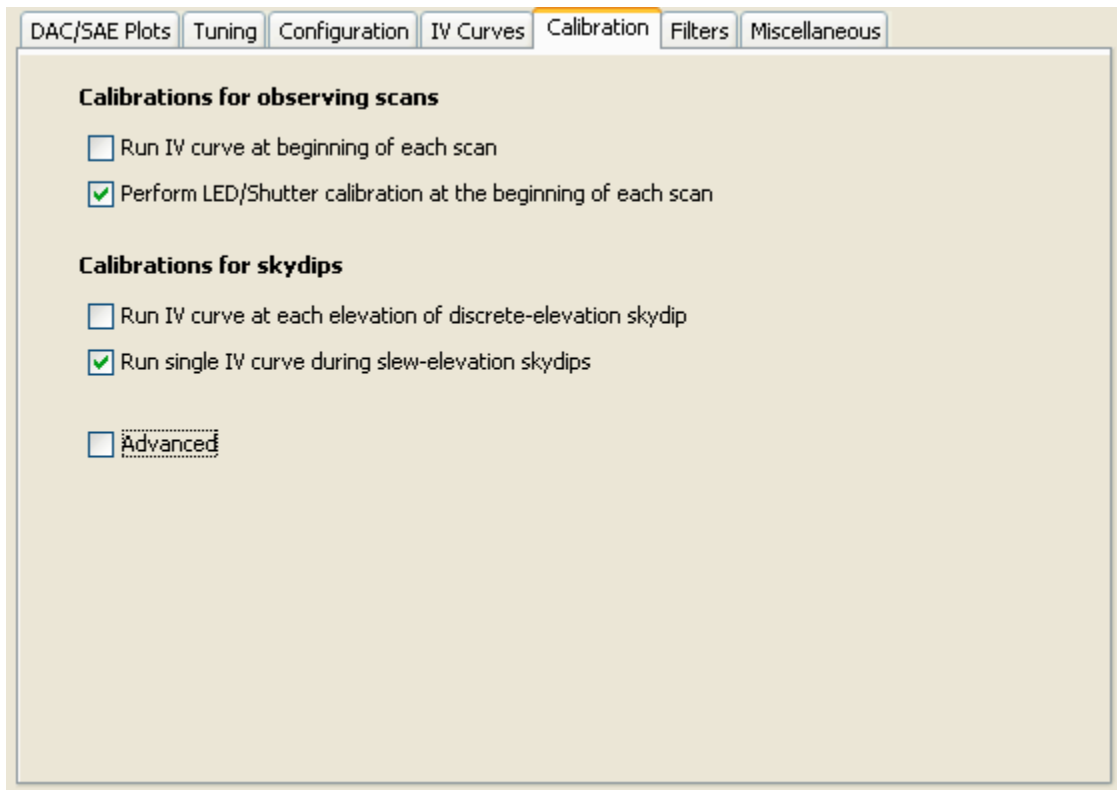
IV Curve Debug Plots

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

IV Curve Analysis - C:\Documents and Settings\smaher\Desktop\GISMO Stimulator Data 05-01-09\Stimulator



Calibration



The screenshot shows a software window with a tabbed interface. The tabs are: DAC/SAE Plots, Tuning, Configuration, IV Curves, Calibration (selected), Filters, and Miscellaneous. The Calibration tab is active and contains two sections: 'Calibrations for observing scans' and 'Calibrations for skydips'. Under 'Calibrations for observing scans', there are two checkboxes: 'Run IV curve at beginning of each scan' (unchecked) and 'Perform LED/Shutter calibration at the beginning of each scan' (checked). Under 'Calibrations for skydips', there are three checkboxes: 'Run IV curve at each elevation of discrete-elevation skydip' (unchecked), 'Run single IV curve during slew-elevation skydips' (checked), and 'Advanced' (unchecked).

Section	Option	Status
Calibrations for observing scans	Run IV curve at beginning of each scan	Unchecked
	Perform LED/Shutter calibration at the beginning of each scan	Checked
Calibrations for skydips	Run IV curve at each elevation of discrete-elevation skydip	Unchecked
	Run single IV curve during slew-elevation skydips	Checked
	Advanced	Unchecked

The Calibration tab lets operators adjust what calibrations are automatically performed during skydips and standard scans. The options are saved to a file automatically.

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.

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.

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.

Optical Filters

The screenshot shows a software window with a tabbed interface. The 'Filters' tab is selected and highlighted. It contains two sections for filter control:

- first filter**: Contains 'open' and 'close' buttons. Below them, the text reads: *Probable last state: CLOSED Wed Mar 10 14:38:59 EST 2010*.
- Second filter**: Contains 'open' and 'close' buttons. Below them, the text reads: *Probable last state: CLOSED Thu Mar 11 12:07:27 EST 2010*.

At the bottom of the window, there is a checkbox labeled 'Advanced' which is currently unchecked.

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.

Filter names are TBD.

Miscellaneous

The screenshot shows a software window with a tabbed interface. The tabs are: DAC/SAE Plots, Tuning, Configuration, IV Curves, Calibration, Filters, and Miscellaneous. The Miscellaneous tab is selected and highlighted with an orange border. Inside the Miscellaneous tab, there are two buttons: "Start archiving" and "Stop archiving". Below these buttons is a note: "Note, normally archiving is controlled automatically by the telescope". Under the note is a checkbox labeled "Advanced", which is currently unchecked. At the bottom of the window, the version information is displayed: "Version: GISMO-MarkIII GSFC X/X/09 Bridge".

DAC/SAE Plots Tuning Configuration IV Curves Calibration Filters Miscellaneous

Start archiving Stop archiving

Note, normally archiving is controlled automatically by the telescope

☐ Advanced

Version: GISMO-MarkIII GSFC X/X/09 Bridge

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).