

# **2MASS Observer's Guide**

**Steward Observatory  
61" Kuiper Telescope**

v1.0  
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## General Instructions for Observing with 2MASS

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### Normal Hardware Startup

There are two buttons on the electronics boxes mounted to the camera that need to be switched on to power the camera and the readout electronics. Please wear the grounding wrist strap when powering on this equipment. One switch is on the square grey box (which powers the control electronics and is labeled 'Controller Power Supply'); the other is on the rectangular gold box (which contains the control electronics and is labeled 'CCD Power Supply'). The day crew may or may not leave these powered on the first day; if you can hear the fans running, then they are powered on.

### Normal Software Startup

The 2MASS camera control software is run exclusively on the big2mass computer. In an open konsole window, start ds9 and then start the camera control software (Astrocam) by typing `astrocam &` at the prompt. The astrocam gui has multiple tabs and should open on the "Setup" tab. If not, select the Setup tab. (See Figure 1)

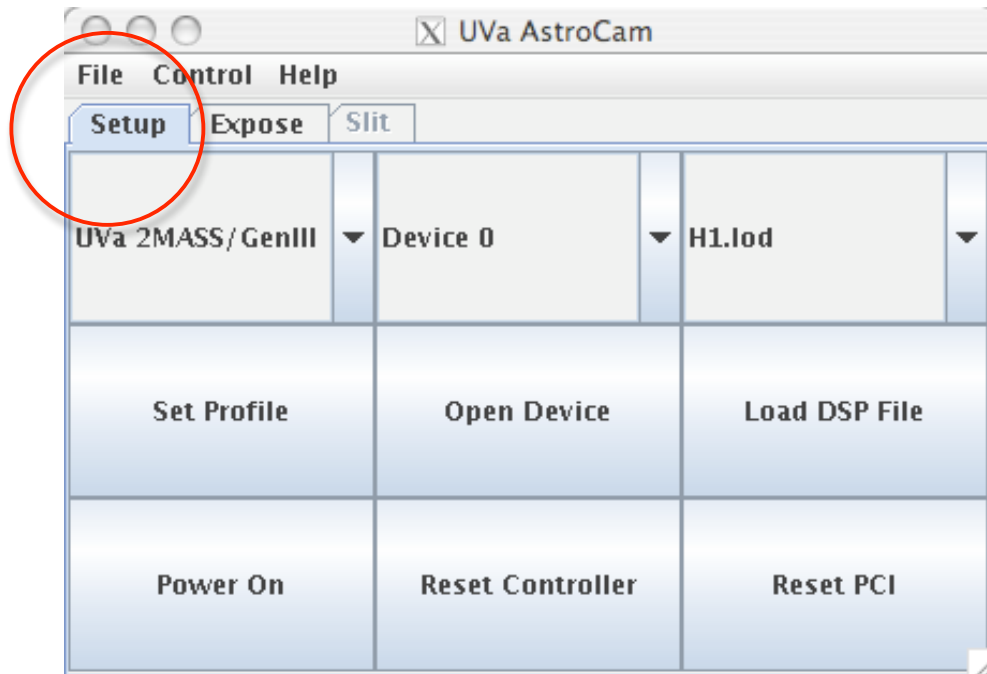
Select "Open Device". The program will run through some diagnostic utilities and print the results to the open konsole window. These diagnostics end with the statement "Utility card not ok"; this is normal.

Open the drop down menu on the far right of the window (above the "Load DSP File" button) and select "NICMOS\_GenIII.lod". (See Figure 2)

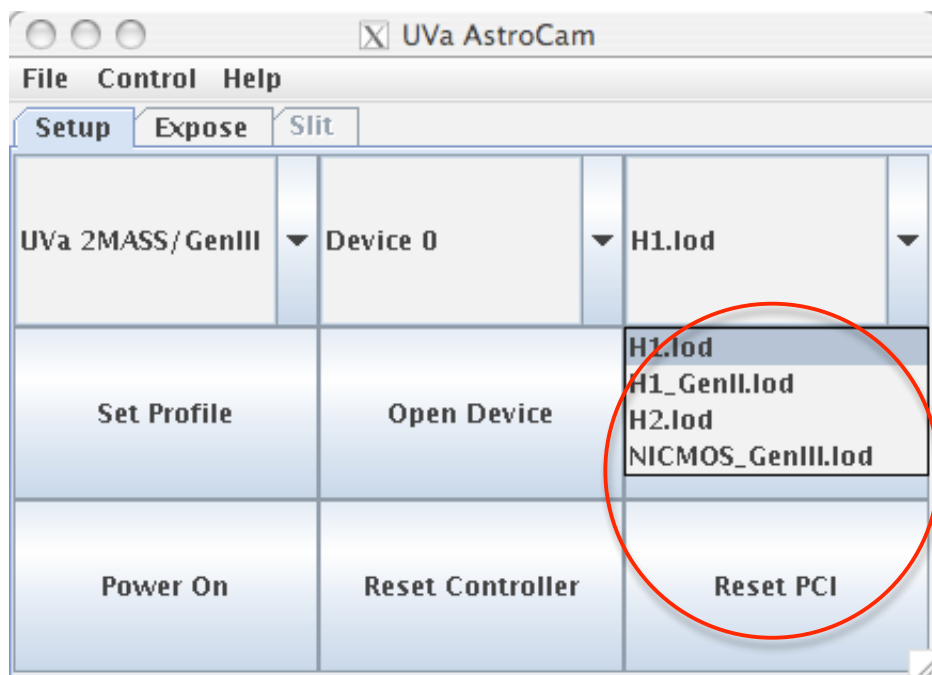
Select the Load DSP File button below the drop down menu. The program will run through various settings and report "# of frames per read 1(2) is 1, setting SNR".

Select the "Power On" button in the lower left of the window.

Select the "Expose" tab to switch to the expose window. (See Figure 3 to see the Expose window as it first appears).



**Figure 1.** The Setup tab.



**Figure 2.** How to select the DSP to load. The “Load DSP” button is covered up by the drop down menu in this image.

Last, you must start xeif to allow astrocam to converse with the telescope control software. To run, type xeif & at the konsole prompt. A small window called Xephem TCCIF will open which can be minimized at this point.

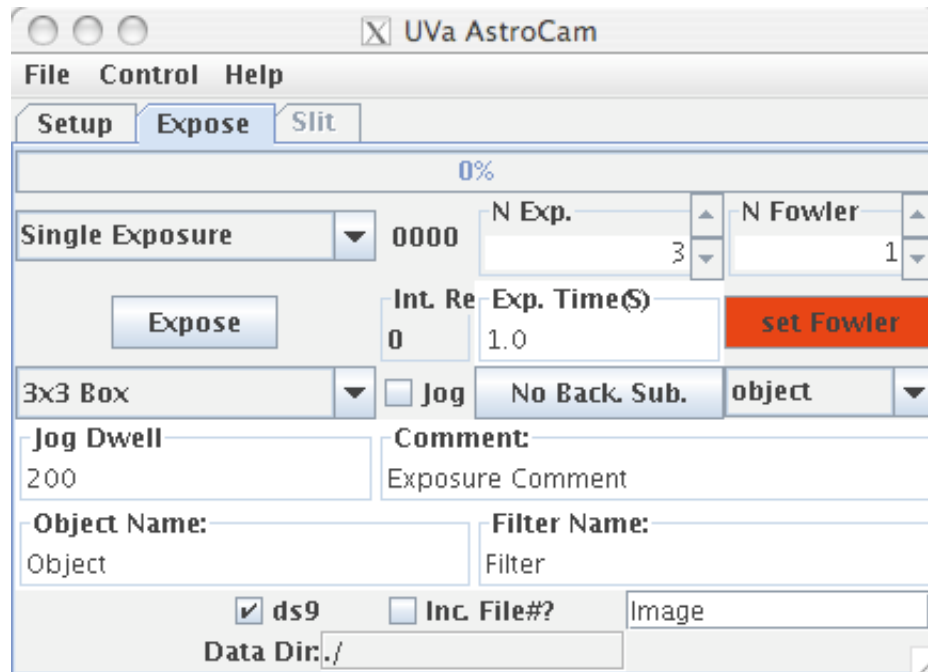


Figure 3. The Expose Tab.

## Taking an Image

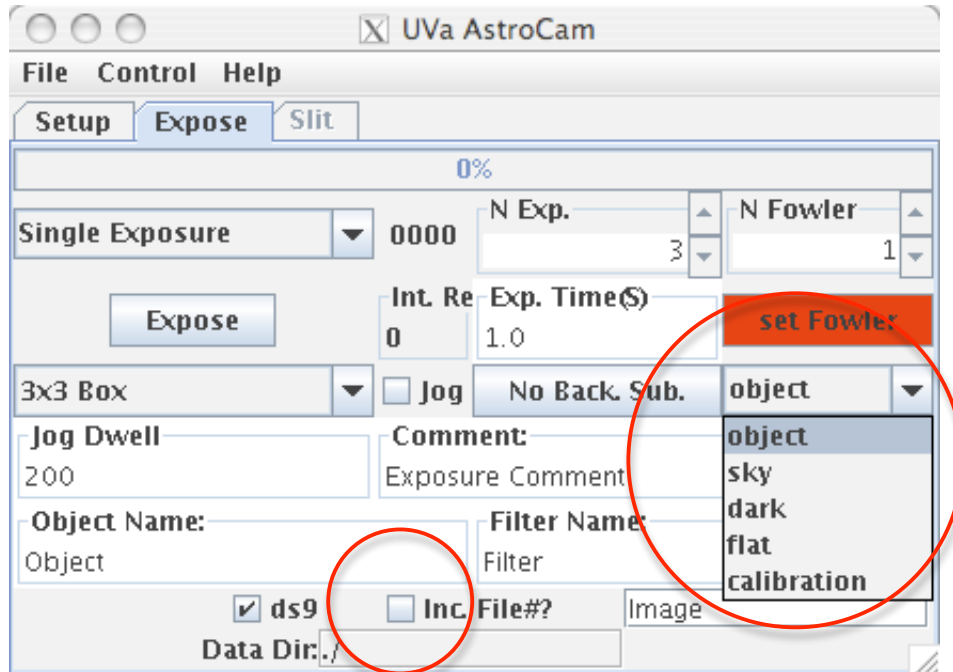
Settings that you should consider before taking an image include (1) data location, (2) filename & header information, (3) image display, (4) number of exposures (5) fowler sampling, (6) dithering, (7) background subtraction. All of these are set within the Exposure tab in astrocam.

(1) Data Location: The default data directory is /home/observer (noted as ./ in the Data Dir at bottom center of the expose window in Figure 3). If you wish to change this (and you probably should), feel free to make a subdirectory for yourself within /home/observer and then direct astrocam to put your data there by clicking on the Data Dir box and navigating to the appropriate directory. Select 'Open' once you've made your choice and the path in the Data Dir. box will change to reflect your selection.

(2) Filename & Optional Header Information: The default filename in astrocam is Image. Simply type a new filename in the white filename box (located above and to the right of Data Dir.) to set as desired. The Inc. File #? checkbox to the left of the filename (see Figure 4) needs to be selected if you want sequential image names; if selected, astrocam will start with image # 000 and automatically label the images, incrementing by 1 each time. If the Inc. File Button is *not* selected

and the filename is not changed between subsequent frames, astrocam **will** write over the existing file with each new one of the same name.

Optional text boxes that can be utilized are “Comment”, “Object Name” and “Filter Name”; any text in these boxes will be written to the header of the fits file. There is also an optional drop down menu that can be used to designate an object frame, a sky frame, a dark frame, a flat frame, or a calibration frame. (See Figure 4). Keywords will be added to the fits header if any of these are selected. Note that 2MASS does *not* have a shutter available to take true dark frames.



**Figure 4.** From left to right: the Increment File button and image type settings.

(3) Image Display: Enable the checkbox labeled ds9 to display each image in the open ds9 window as it is read. (The ds9 button is the check box to the left of the Inc. File #? button in Figure 4). If more than one ds9 window is open, astrocam tends to open the new image in the window most recently active.

(4) Number of Exposures: You can set the number of exposures you wish to take in the N Exp. box at the top of the window. To the left of this box is a drop down menu that allows you to select Single Exposure or Multiple Exposures; if Single Exposure is selected, astrocam will only take 1 exposure, no matter what numerical value is set in the Number of Exposures box. (See Figure 5). Note: Continuous Exposures is not a usable setting in the current software.

(5) Background Subtraction: astrocam does not do background subtraction by default. If you want to display a simple background-subtracted image, enable this feature by selecting the No Back Sub. button. (See Figure 6). The button name will change to Back. Sub once selected. The image most recently taken

will be used as the background; all subsequent images will be displayed in ds9 with this image subtracted until the background subtraction feature is turned off by clicking on Back. Sub again. *Both* the raw and background subtracted images will be saved.

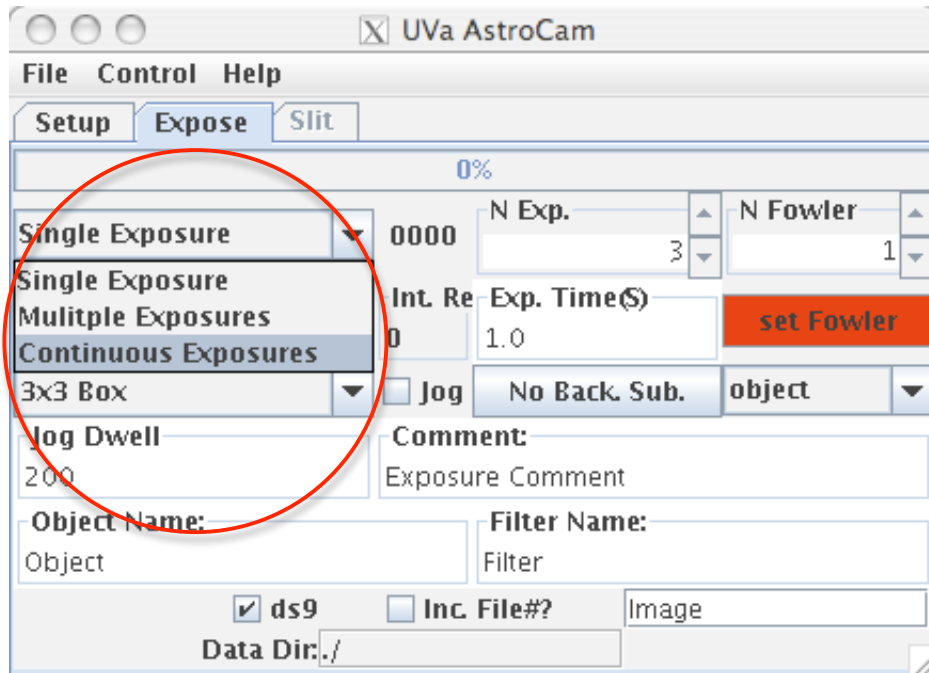


Figure 5. How to choose single or multiple exposures.

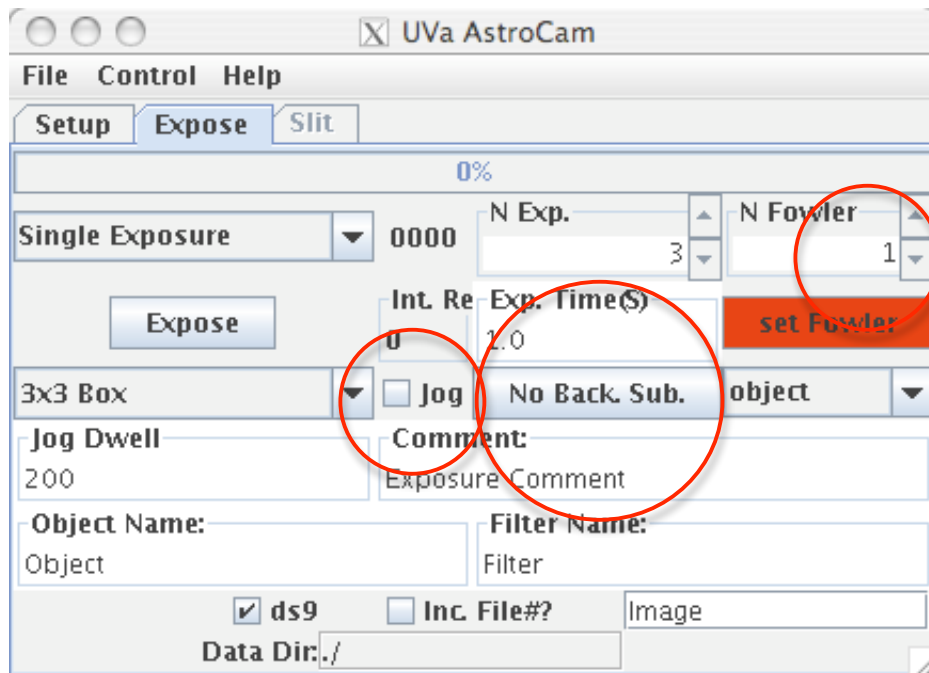


Figure 6. From left to right: the Jog, Background subtraction, and Fowler sampling settings.

(6) Fowler Sampling: The default fowler sampling setting is 1. Up to fowler sampling of 8 is possible and can be set in the NFowler box in the upper right. (See Figure 6). Once you have chosen a fowler sampling setting, click the set Fowler button below that box to send the command to the FPA controller. (Note: If the set Fowler box is shaded red, then the fowler sampling value has been changed in the gui, but the command has not been sent to the FPA controller. Make sure to click Set Fowler).

(7) Dithering: In order to automatically dither sequential images, select the Jog checkbox near the center of the window. (See Figure 6). The value in the Jog Dwell box (to the left of the Comment box) determines the distance moved on each dither. Every 20 units corresponds to ~1 arcsecond; the default is 200 units (~10 arcseconds), but this can be changed by the user. *Update (Jan 2011)*: There are multiple dither patterns available; a 3x3 box is the default pattern. Select the desired pattern from the drop down menu (as shown in Figure 7). *Note*: the available dither patterns need to be confirmed.

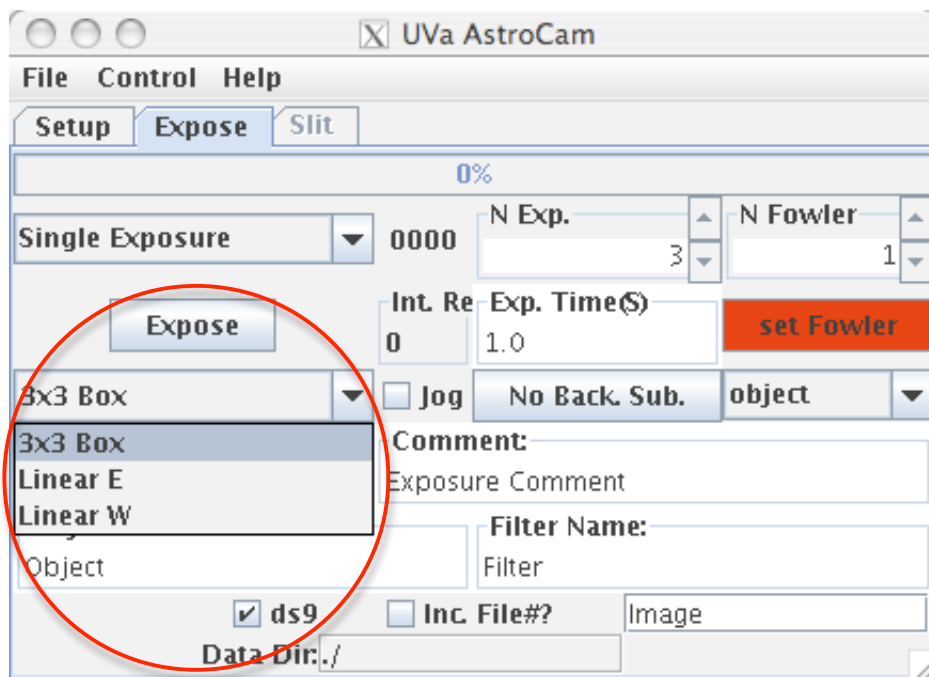


Figure 7. Drop down menu for dither patterns.

(8) Remaining Buttons and Options: Once you are satisfied with the settings for your image, click the Expose button to take an image. Once an exposure starts, this becomes the Stop button. If the Stop button is selected, astrocam will finish the current exposure before reading out, but will not continue on to additional exposures if multiple exposures were requested. After an exposure is started, the GUI counts down the integration time remaining in the Int. Re. box to the right of the exposure button and the progress bar at the top of the box tracks the progress of the exposure and the readout.

## Additional Notes

The three images for a single exposure (one in each filter) are displayed vertically from top to bottom as  $K_s$ , H, and J. The H band image has the most obvious structure across the detector, which is removable with flat field images. The bright part in the upper right corner of the H frame is usually the first area to saturate in that band.

Telecom 150 server –The Telecom 150 server runs on the BigAg computer and allows communication between big2mass and the telescope control computer. This is the portal by which astrocam obtains telescope information such as RA/Dec and airmass for image headers as well as sends dither requests to the telescope control software. If the telecom server is not running, it can be started by double-clicking on the TELECOM icon on the BigAg computer.

IRAF is installed on the camera control computer for observers who wish to use it.

For users familiar with XEphem, this software is available on the camera control computer as well. If observers have a XEphem catalog with the target list, this can be placed in the .xephem directory and loaded into XEphem for display. In addition, xeif (which is started during the software setup procedure) can interface between XEphem and the telescope control software (TCS) to allow observers to send target coordinates directly to TCS from within XEphem. To access this capability, go to the Xephem TCCIF window that was minimized during startup and under the File menu, select Enable Goto. (You can minimize the TCCIF window again once this is complete). Right-clicking on a source displayed in XEphem should now include Telescope Goto in the list of options; choosing Telescope Goto will send the target's coordinates to the TCS as the next target. The telescope *cannot* be slewed from within XEphem, only the coordinates will be sent. The slew command must be sent from within TCS. Note: If the telecom server described above is not working then the Telescope Goto function will not work either. XEphem by itself is unaffected by the telecom server, however, and will still display your catalog.

## Normal Shutdown

At the end of a normal observing night, please shut down the camera by first selecting Power Off within astrocam in the Setup tab. Then, upstairs on the camera electronics assembly turn the power switches off on the square grey box (labeled 'Controller Power Supply') and the gold rectangular box (labeled 'CCD Power Supply'). Back in the control room, open the minimized xeif window and select Disable Goto from the File Menu; quit out of xeif, astrocam, ds9, and xephem (if necessary). Proceed with shutting down the telescope and TCS as directed in the 61" User's Guide.



If 2MASS needs to remain cold for use the following night, you need to top off the liquid nitrogen dewar at the end of your observing night. The rubber fill tube is typically left attached to the appropriate brass fill port on the dewar; the silver port is for venting, so do *not* attach the fill tube there. Topping of the dewar after a night of observing (~24 hours after the last fill) usually takes 15-20 minutes and can be done while shutting down the rest of the telescope, etc. provided that the platform is not raised or lowered during that time (to avoiding disturbing the frozen rubber fill tube).

## Lightning Shutdown & Post-Lightning Startup

### **LIGHTNING SHUTDOWN:**

If a lightning shut down of the 2MASS system is required, you must first power down the camera and then unplug all components from power outlets. Turn off the camera by selecting the Power Off button in the Setup tab of astrocam. Upstairs on the camera electronics assembly, turn off the power switches on the square grey box (labeled 'Controller Power Supply') and the gold rectangular box (labelled 'CCD Power Supply'). Unplug the camera power supply (plugged into an orange outlet on the base of the telescope), FPA control power supply (also plugged into the telescope), and the FPA temperature controller located on a table next to the telescope control panel in the dome (the outlet is beneath the table). Back downstairs in the control room, quit out of any software running on the computer, including astrocam, ds9, xeif, and xephem. Disconnect the Ethernet cable from the back of big2mass (the camera control computer).

The rest of the telescope and facility lightning shut down procedure can be found in the 61" User's Guide.

### **POST-LIGHTNING STARTUP:**

If the facility has been shutdown in lightning mode, there are additional steps required before the normal startup procedure for the 2MASS camera. After completing the cold startup procedure for the telescope as dictated by the 61" User's Guide, go upstairs to the observing platform to begin starting up the camera again. Put on the wrist strap attached to the telescope and plug the power cords associated with the CCD Power Supply and Controller Power Supply into the orange outlets on the base of the telescope.

Plug in the focal plane array temperature control unit that typically sits on a table next to the telescope control panel. The K band controller was known to be a bit flaky and could fail to display accurately; if this happens during set up (or after a lightning shut down) the accepted procedure is to simply unplug the unit and plug it back in. Repeat if necessary. *Update:* The K band controller was replaced in December 2010 and this behavior is no longer typical. When functioning

correctly the displays should match what is shown in Figure 8. The temperature displayed in red is the set point for each array. Monitors internal to the 2MASS dewar record the current temperature of each array; this is shown in green.

Power on both the square grey box ('Controller Power Supply') and the gold rectangular box ('CCD Power Supply') on the electronics assembly mounted to the camera before returning downstairs to the control room to start the computer.

Making sure that the ethernet cable remains *disconnected* from big2mass, start the computer using the power button on the front of the computer. If the faceplate is not open, the key is taped to the top of the computer. Log into the computer as usual (username: observer, password: irgrp\$2mass) and then plug in the ethernet cable. At this point, you can return to following the normal software startup procedure at the beginning of this manual.



Figure 8: Focal Plane Array temperature controller.