The Imager

General information and things to know

Getting Going quickly: The no frills guide to running the Imager

beginning of the night

- start the telescope
- fill the dewars
- calibrate the telescope

CICADA - The Computer Interface

Taking BIAS frames

Taking Flat Fields

Taking Object Frames

Changing Filters/GRISMS etc.

Focussing the Telescope

Saving Data to Tape

end of night

- fill the dewars
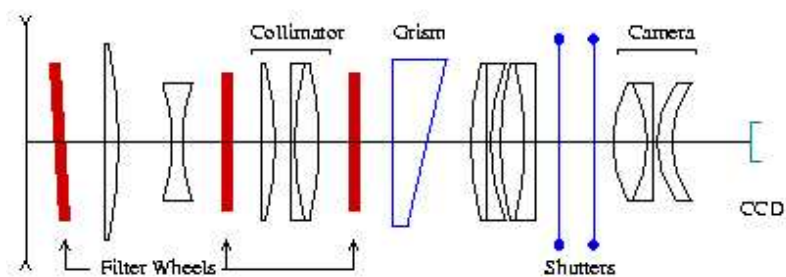- shutdown the telescope
- If last night, Do Run Report

Landolt Standard Star Charts

something missing? Please tell us!

Trouble Shooting

Search Documentation

2.3m Optical Imager

Optical path of the 2.3m imager.

The ANU 2.3m Imager - A Synposis of Capabilities

The Imager provides a 6 arminute in diameter circular field at a scale of ~0.3 arcsec/per 24micron pixel.

Image throughput:

- U: 1 electron/sec = 21.2 mag
- B: 1 electron/sec = 23.8 mag
- V: 1 electron/sec = 24.4 mag
- R: 1 electron/sec = 24.3 mag
- I: 1 electron/sec = 23.6 mag

Imager Exposure Calculator

A wide range of filters are available, including a ramp Halpha filter. The imager can be used simultaneously with the Double Beam Spectrograph by changing the tertiary mirror to direct the light to Nasmyth A. This takes about 3 or 4 minutes per change over.

Some things to be aware of

The detector has been changed in October 2004. CCD #11 has been removed from the Imager and has now replaced CCD #7 in the DBS Blue arm. The Imager is currently equipped with an E2V detector and a new CCD controller. For more information, see the Detectors'webpage. CCD #11 on the Imager had a scale of 0.6 arcsec/per 24micron pixel (or 0.37 arcsec/15 micron pixel).

The Imager and the DBS blue are currently controlled via the same workstation, "mallorn", located in the Peripherals'Room and accessible by the Observer via the workstation "moist" in the control room. Switching between Imager and DBS blue involves switching two cables at the back of "mallorn". This is a temporary arrangement and the Observer needs to check with Technical Staff before their run to make sure that everything is set up correctly. "mallorn" has also been known for hanging during the night, causing loss of exposures. Please make sure that the file ".cshrc" in your home area contains the lines:
"unset autologout"
"limit coredumpsize 0k"
to limit this (and other) problems.

Some limitations

- The Autoguiding facility is difficult to use (but will soon be upgraded). Therefore 300s exposure are the maximum recommended, but these will be trailed at the 0.7" level. There also appears to be random walk motion probably due to telescope motion. The total image quality of the imager seems to be limited to approximately 1.2" even for very short exposures
- Experience shows that it is difficult to reach below R=23, I=22.5 with any reasonable integration time.
- Throughput is severely compromised below 3500 Angstroms due to optics.
- For unclear reasons, flatfields depend on the rotator angle. This tends to leave residual gradients of 1% in the reduced data which is difficult to remove.
- Image quality tends to be around 2", with the best 300s images acheived as of 1999 of 1.4".
- There is some circular "barrel" distortion
- The Instrument also provide a slit and grism capability. However, the throughput of this part of the instrument appears far worse than from the DBS, and users are advised to think carefully before attempting to use this feature.

Click on the Underlined areas to get a more detailed description with pictures

Setting Up the Telescope in the Afternoon

You should plan to start setting up for your nights observing in the afternoon before observing at a bare minimum. This will allow you to contact the technical staff to help you before they leave for the day.

- check that the instrument is working properly, taking Bias frames, dome flats, and dark frames.
- You may also want to check the focus of the imager. This can be done by bringing an internal mask into the beam, and turning on a back illumination light. The holes in this mask can be focused by moving the imager focus control on the Imager control PC up and down until the points of light are as small as possible.
- Finally check to make sure the telescope is working properly

    1. Make sure the *Console on* and *Power on* buttons (located above the CD player) are illuminated. If not - turn them on.
    2. Hit the *BREAK* key on the telescope computer to get the login prompt.

    3. Log in as TELESCOPE. The password is written in the back of the CCD temperature book.
    4. Give the observer ID. You can create your own or just use someone elses. If you are using the IMAGER I can recommend BRIAN or JEN, if using CASPIR, try PETER or WOOD. It doesn't really matter who you log in as ... you can always reconfigure parameters on the command line.
    5. At the **TEL>** prompt, type *STARTUP*. The telscope will start up by itself and return the **TEL>** prompt when finished. If the WARNING or ERROR lights (located above the telescope display screen) come on.
    6. Type *display config* to view the configuration of the telescope.
        - Make sure you are set up for the correct focal station:
            - DBS - Nasmyth A
            - IMAGER - Nasmyth B
            - CASPIR - Cassegrain
          If the focal station is wrong, you can change this by typing:
          configure focal_station nasmyth_b
          at the **TEL>** prompt.
        - Unless you are doing something unusual, you will need to use the rotators. Make sure you have plenty of twisting space. Good values to set the rotator limits to are -520 - +520. If the limits are set to less than this type:
          configure rotator_ccw_limit -520
          configure rotator_cw_limit +520
          You also need the rotator to rotate with the field of view:
          configure rotator_reference position_angle

        NOTE: Complete information about configuring the telescope is contained in the COMMANDS REFERENCE MANUAL and the OBSERVERS MANUAL which are located in the console room. You should refer to these texts if you want to know how to configure something.

    7. Type *display* to return to the telescope display screen.

Filling the Dewars

THE DEWAR NEEDS TO BE FILLED EVERY TWELVE HOURS. DO IT AT THE START AND END OF THE NIGHT. IT IS THE OBSERVER'S RESPONSIBILITY TO MAKE SURE THAT THE DEWARS ARE FILLED.

You should also ask the technical staff in the afternoon whether you need to keep additional dewars

cold for the next observer.

FOR SAFETY REASONS, WHEN FILLING THE DEWAR, PLEASE WEAR SAFETY GOGGLES AND USE THE GLOVES PROVIDED. AVOID STANDING UNDERNEATH OR VERY CLOSE TO THE DEWAR SINCE LIQUID NITROGEN WILL SPILL OUT WHEN THE DEWAR IS FULL.

Opening up

To Make the telescope point properly, it is necessary to zero point the pointing, and to define an aperture which the telescope knows is the center of the field you are interested in.

Calibrating the Pointing

The first things you have to look for are the pre-determined offsets for each instrument. These are written on the white-board under telescope offsets. Before fiddling the pointing you should enter these. Type:
calibrate pointing a b
e.g. calibrate pointing -46 -514

Next, go to a bright star with position supplied in the Astronomical Almanac which is usually near the computer console, and make sure that you either see it in the TV guider, or

Take an image with whatever imaging device you have (TV/GUIDE CCD/TIPTILT/CCD) and see that it is where it is supposed to be. If it isn't, move the telescope so that star lands where it should, and then either press the calibrate pointing button on the console, or type *calibrate point* at the telescope prompt.
If the star is no where to be seen, try a bright globular cluster - it is much easier to centre up on.

Calibrating an Aperture

At the telescope prompt type *calibrate aperture aa*
where aa can be any name.
Follow the ensuing instructions. Centre the star on the screen/CCD using the telescope controls (mark with a marker on the screen to remind you where this is). Once you have told the program that this has been accomplished, it will rotate the telescope a 120 degrees. While it does this, if you have a detector (e.g. autoguider or tiptilt) that has a small field of view, it will usually rotate the star out of your field of view. It is best therefore to try to keep the star within the box using the telescope control. When it has finished rotating, recentre the star on the marked point, and then continue.
Answer N to question about defining a slit. You do not want to calibrate orientation, and don't worry if the star moves out of position once calibrating is done.
At the end of this procedure, aperture aa is defined and is automatically selected as the current aperture. That means that the telescope is moved to align this position with the optical axis.

CICADA - The Computer Interface

1. Log on to the Sun station named **mallorn** as yourself. You should already have an account on the system. If not, you will have to submit an account request.
2. On mallorn in an xterm, type **cicada &**. Cicada is the software which controls the CCD instrumentation.

3. Under the menu **Start observing**, select **Imager**. This will bring up the **AM3200 Controller Window**

4. If a warning box appears concerning user-defined FITS keywords from a previous cicada session, choose to display the FITS keywords window. If this window does not appear, under the **Options** menu, select **Show Fits Keyword Window**.

   Here you enter non-default keywords that you want in the headers of the FITS images. Most of the standard iraf keywords are automatically put in, but **you MUST enter the keyword FILTER and the value in this box**. The filter keyword is not automatically put in the headers at the moment since Cicada does not directly control the filter wheel.

5. You will need to start up an Ximtool for Cicada to display things in. This Ximtool is owned by Cicada - you must start up another private Ximtool elsewhere if you want to reduce your data. To get Cicada's Ximtool, under the **Tools** menu select **Start Ximtool**.
6. The default parameters in the Cicada (AM3200) window need to be set to something reasonable...
   - **Filename prefix** I usually leave this as ccd - the images are then called ccd0001, ccd0002 etc... You can change this to whatever you want.
   - **Run Number** This is the number of your first image and will increment by 1 as each image is taken.
   - **X bin**, **Y bin** The 2.3m has a scale of ~ 0.3" per pixel. Hence for most work 1x1 binning is fine.
   - **Overscan columns** I recommend at least 100.

     Since the field of view of the Imager is much smaller than the CCD, you will need to set the values below in order to window the detector to the size of the field.
   - **X-offset-1**, **Y-offset-1**
   - **Width-1** , **Height-1**

   If this is the first night of your run you will need to clear the data disk and have a directory owned by you created. To do this, under the **Tools** menu select **Start Teldisk**. Then select **Clear Disk**. This will create a directory called /data/mallorn/cicada/ *yourusername*. If this does not happen, please contact sysman@mso.
7. To tell Cicada where to put your images (the default is your home area - and you won't fit many images in there), under the **Options** menu, select **Preferences**. Then type in the path of the directory you want the data to go into. e.g. /data/mallorn/cicada/ *yourusername*.
8. Initialise the CCD hardware at the start of each night and every time the bias level is considerably higher or lower than it should be (this should happen rarely with the new controller). Under the menu **Actions**, choose **Initialise CCD Hardware**. Two windows will pop up as it initialises, a Temperature etc window and a Voltages window. Once the voltages window appears - initialisation is complete and you can dismiss these 2 windows. Check the bias level to make sure everything is fine.
9. If you wish to change the gain for your images, under the **AM3200** menu, select **Edit Gain Values**. It is advisable that you talk to the Technical Staff before doing this, as they know what the current status of the detector is. **You will need to re-initialise the hardware once you have changed the gain value.**

Data Calibration

Like any CCD system, certain data calibrations are recommended for proper data reduction, and some data calibration data is good to make sure there is nothing wrong with your data. We recommend taking

10. A Dark Frame (600s). There should be essentially no dark signal if things are properly working.
11. A series of 10 Biases. The bias level should be around 1000-1200 counts if the hardware has been initialised properly.
12. A series of twilight flats (although lots of exposures in V, R, and I will allow you to create a data flat by medianing of your data set).

Taking data

Taking Data at the 2.3m is as easy as making sure the imager is correctly configured, and then using cicada to take an object exposure. Configuring the imager is done on the left last computer on the main desk - the monitor is labelled IMAGER/DBS.

1. This is usually left open either for the DBS or the IMAGER. If it is DBS mode, select from the top left corner, the DBS menu and EXIT. This will leave you with a DOS prompt.
2. Type *imager*. You will have a grey screen with 2 menus. Go to Imager and then select Control/Status (or F6). This should bring up a screen with lots of columns topped with M1, M2 etc.. A few important bits...
3. **Slide:** This moves the autoguider camera around its focal plane. -52 is a good place to keep it so that it can see a pick off mirror outside the CCD FOV. 0 places the small camera in the centre of the imaging field where it almost completely vignettes the CCD.
4. **Turret:** Clear for imaging, but other modes available for focusing up the instrument, or testing instrument during the daytime, when used in conjunction with the **Back Illumination: in**
5. **T100 Filter:** one place filters can be placed
   Tilttune: for tuning the ramp filter?
6. **T50 filter:** another place filter can be placed. (usually clear) **CBeamFocus:** 0 by default, but should be tuned during the day using the mask on the turret with the back illumination, if you are using filters in the T50 area.
7. **PBeamFilter:** U,B,V,R,I **Here is where you change your filter if you are using the standard UBVRI**.
8. **Camfocus:** 0, but should be tuned to make sure telescope is in focus using the mask on the turret with the back illumination turned on.

Focussing the Telescope

First, you should, during the day, ensure that the instrument is in focus. This is accomplished by putting a mask in with the turret on the Imager control PC, and turning the back illumination on. You can then take a very short image of this mask with the CCD, and adjust the Camfocus (or CBeam focus if you are using filters in this part of the imager) so that the mask appears as a series of sharp dots on the CCD.

There are two main ways of focussing the telescope. A quick and dirty way which seems to work quite well if you are using the DBS/Imager, and a more involved (and more typical) process if this isn't working for you.

Quick & Dirty

The idea here is to use the auto-guiding camera of the Imager (or you may find it easier to move the telescope over the Nasmyth A, and use the DBS autoguider), and image a star in realtime, adjusting the focus until the star is in focus. You should, if the seeing is 2" or better, be able to adjust the focus to about 4 units with this method.

The more standard approach

Take a series of images, offseting the telescope between each image, and then read out the image. You can then use IRAF, or GIT to see which image is the best, and move the telescope to that focus value. Make sure that cicada is set to not readout/flush images between exposures, but **flush** the image manually at the beginning of the first exposure! The board may give you some guidance where to put the focus. I increment by about 4 units of focus, and make sure you do a different offset on the last exposure, so you know which is your first image.

Saving Data to Tape

1. There is 1 DAT drive and 1 EXABYTE drive located on **mudslide**. You should have brought your own DAT or EXABYTE tapes with you on which to save your data.
2. In an xterm on **mudslide** type:
   - *allocate mt0* - for the uncompressed DAT drive
   - *allocate mt1* - for the compressed DAT drive
   - *allocate ex0* - for the uncompressed EXABYTE drive
   - *allocate ex1* - for the compressed EXABYTE drive
3. Put your new tape in the relevant drive
4. CICADA saves the imager files as fits files so you can either write these with IRAF or tar them onto the tape. I always tar them onto the tape. The command will be something like:
   tar cvf $TAPE dec11/* if we use the example of the data put into a directory called dec11.

Shutting Down the Telescope

The telescope is made to shutdown very quickly an efficiently

5. Simply typing *shutdown* at the **TEL>** prompt will completely shutdown the telescope for you. Watch the computer screen to make sure everything shuts down OK.

   If you get a message that says **Telescope not safe to leave unattended** then try starting up the telescope points 3,4 and 5 again and then shutting down once more. If this message still comes back, go out into the dome and make sure that the primary mirror cover is closed and that the dome shutters are closed. Then write a telescope fault report and leave it up to the technicians.

   If the dome is not closed, it is best to call for help.

1. Make sure you have filled the dewar/s!. If you shutdown and you need to rotate the instrument to fill a dewar, you must restart the Telescope control.

   At the end of your run, please leave a observing report so that we can know how things are going, what can be improved, etc.

To begin the Night

- [start the telescope](#)

- [fill the dewars](#)

- [calibrate the telescope](#)

Setting Up the Telescope in the Afternoon
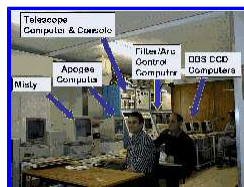
This should be done in the afternoon, so that if you have any trouble, the technical staff will be on hand to help. You should plan to start setting up for your nights observing in the afternoon before observing at a bare minimum. This will allow you to contact the technical staff to help you before they leave for the day.

•   check that the instrument is working properly by taking Bias frames and Dome Flats.
•   You may also want to check the focus of the imager. This can be done by bringing an internal mask into the beam(M2), and turning on a back illumination light. The holes in this mask can be focused by moving the imager focus control on the Imager control PC up and down until the points of light are as small as possible.
•   Finally check to make sure the telescope is working properly

1. Make sure the *Console on* and *Power on* buttons (located above the CD player) are illuminated. If not, turn them on.
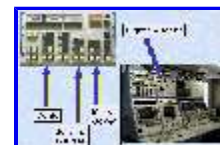
2. Hit the *BREAK* key on the telescope computer to get the login prompt.

3. Log in as TELESCOPE. The password is written in the back of the CCD temperature book.

4. Give the observer ID. You can create your own or just use someone elses. If you are using the IMAGER I can recommend BRIAN or JEN. It doesn't really matter who you log in as, you can always reconfigure parameters on the command line.

5. At the **TEL>** prompt, type *STARTUP*. The telscope will start up by itself and return the **TEL>** prompt when finished. If the WARNING or ERROR lights (located above the telescope display screen) come on, type "diagnose" and see the Trouble Shooting webpage.

6. Type *display config* to view the configuration of the telescope.
    ○ Make sure you are set up for the correct focal station:
        ■ DBS - Nasmyth A
        ■ IMAGER - Nasmyth B
        ■ CASPIR - Cassegrain
    If the focal station is wrong, you can change this by typing:
    configure focal_station nasmyth_b
    at the **TEL>** prompt.

    ○ Unless you are doing something unusual, you will need to use the rotators. Make sure you have plenty of twisting space. Good values to set the rotator limits to are -520 - +520. If the limits are set to less than this type:
    configure rotator_ccw_limit -520
    configure rotator_cw_limit +520
    You also need the rotator to rotate with the field of view:
    configure rotator_reference position_angle

NOTE: Complete information about configuring the telescope is contained in the COMMANDS

REFERENCE MANUAL located in the console room. You should refer to this text if you want to know how to configure something.

7. Type *display* to return to the telescope display screen.

Filling the Dewar

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You should also ask the technical staff in the afternoon whether you need to keep additional dewars cold for the next observer.

FOR SAFETY REASONS, WHEN FILLING THE DEWAR, PLEASE WEAR SAFETY GOGGLES AND USE THE GLOVES PROVIDED. AVOID STANDING UNDERNEATH OR VERY CLOSE TO THE DEWAR SINCE LIQUID NITROGEN WILL SPILL OUT WHEN THE DEWAR IS FULL.

1. Make sure that the Telescope is stationary - type *park* or *halt* at the **TEL>** prompt.
2. Record the pre-filling temperatures (CCDTEMP1 and SINKTEMP) in the CCD temperature book.
3. Move the rotators so they are in their parked position.
     - Imager - cables not twisted, metal bar underneath
     - DBS - cables not twisted, metal bar over the top - blue DBS on the left, red DBS on the right

4. Use the hair dryer to melt the ice that has accumulated. When you can turn the black cover at the end of the dewar, move it to reveal the filling hole for the dewar.
5. Make sure that the metal fill tube leading from the liquid nitrogen is dry. Push the metal fill tube all the way into the filling hole and secure it by turning the black cover from the position marked *load* to *fill*.

6. Lift the lever marked *liquid* and the LN **2** will start to flow into the dewar. Nitrogen gas will escape from the dewar as it is filling.

7. Check the pressure gauge on the filler container. It should be somewhere between 7 and 14. If it is reading < 7 the dewar will take forever to fill. If this is the case, take the curly yellow hose that is located near each dewar and attach it to the pipe on top of the filler container that has nothing attached to it. Then lift the lever that marked

   air. This will pump more pressure into the filler container.

8. Once liquid nitrogen starts to drip from the dewar, return the *liquid* (and **air** lever to it's original position).
9. Use the hair dryer to thaw out the hose before removing it from the dewar. AVOID MOVING THE FILLER HOSE DURING FILLING OR WHEN FROZEN AS IT MAY SPLIT THE SHEATH INSIDE.

   NOTE: There is the possibility that the metal tube may become frozen in the filling tube. Simply continue to apply heat via the hair dryer on to the metal tube. This may take awhile for the heat to distribute through out the tube melting the ice that has made it stuck. Keep pulling the tube as it is slowly freed.

10. Record the post-filling temperatures (CCDTEMP1 and SINKTEMP) in the CCD temperature book.

Moving the Rotators From the Hand Paddle

1. Make sure that you are logged into the telescope

2. On the hand paddle at Nasmyth level, press the *MANUAL* button
3. To rotate the rotator, hold down the *CONTROL* key while pressing in the *rotator CW* or *rotator CCW* buttons. When you stop pressing the rotator buttons the rotator will stop.
4. Return control to the telescope by pressing *AUTO*
5. Make sure that the control paddle lights are turned right down by turning the knob at the bottom.

NOTE: Each rotator has its own separate hand paddle.

Telescope Calibration

To make the telescope point properly, it is necessary to zero point the pointing, and to define an aperture which the telescope knows is the center of the field you are interested in.

Calibrating the Pointing

The first things you have to look for are the pre-determined offsets for each instrument. These are written on the white-board under telescope offsets. Before fiddling the pointing you should enter these. Type:
calibrate pointing a b
e.g. calibrate pointing -46 -514

Next, go to a bright star with position supplied in the Astronomical Almanac which is usually near the computer console, and make sure that you either see it in the TV guider, or

Take an image and see that it is where it is supposed to be. If it isn't, move the telescope so that star lands where it should, and then either press the calibrate pointing button on the console, or type *calibrate point* at the telescope prompt.
If the star is nowhere to be seen, try a bright globular cluster - it is much easier to centre up on.

Calibrating an Aperture

At the telescope prompt type *calibrate aperture aa*
where aa can be any name.
Follow the ensuing instructions. Centre the star on the screen/CCD using the telescope controls (mark with a marker on the screen to remind you where this is). Once you have told the program that this has been accomplished, it will rotate the telescope a 120 degrees. While it does this, if you have a detector (e.g. autoguider or tiptilt) that has a small field of view, it will usually rotate the star out of your field of view. It is best therefore to try to try to keep the star within the box using the telescope control. When it has finished rotating, recentre the star on the marked point, and then continue.
Answer N to question about defining a slit. You do not want to calibrate orientation, and don't worry if the star moves out of position once calibrating is done.
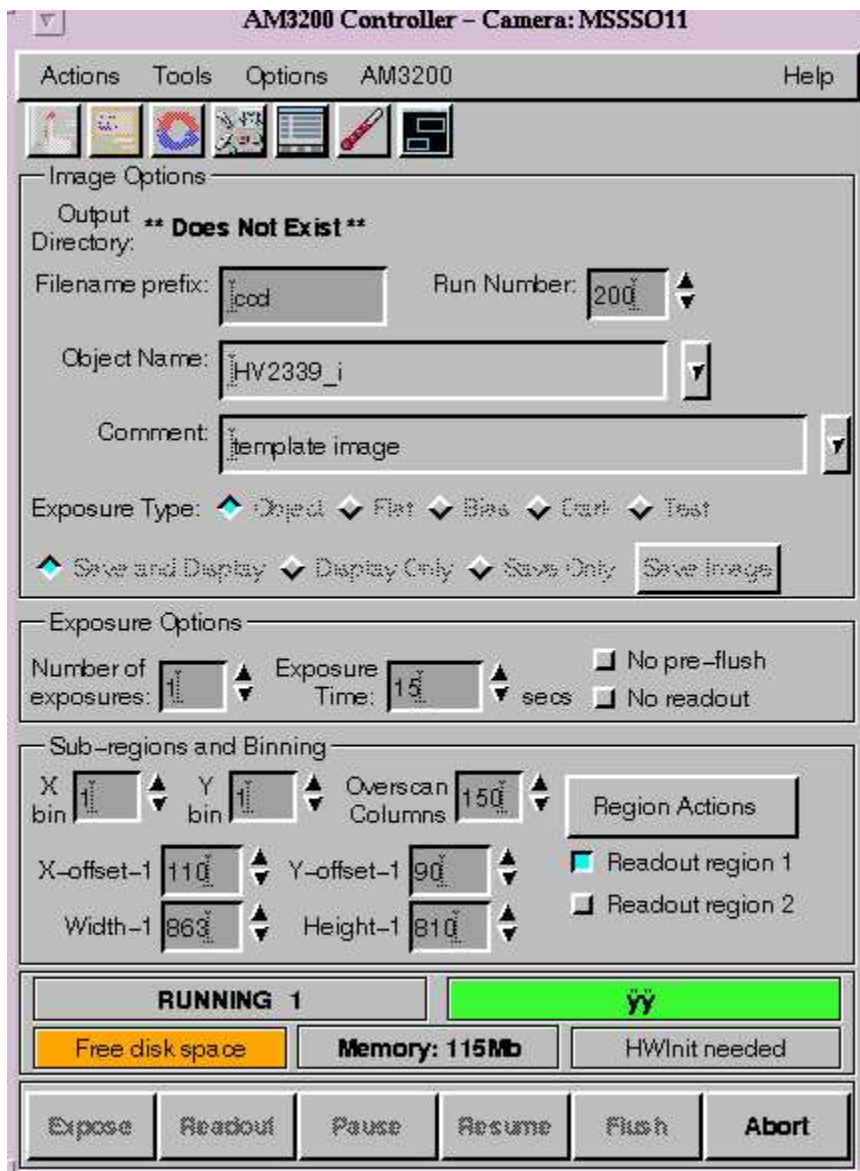At the end of this procedure, aperture aa is defined and is automatically selected as the current aperture. That means that the telescope is moved to align this position with the optical axis.

CICADA - The Computer Interface

1. From one of the two workstations on the main desk in the control room ("moist" or "mouldy") log on to the Sun station named **mallorn** as yourself. You should already have an account on the system. If not, you will have to submit an account request.
2. In an xterm, type **cicada &**. Cicada is the software which controls the CCD instrumentation.
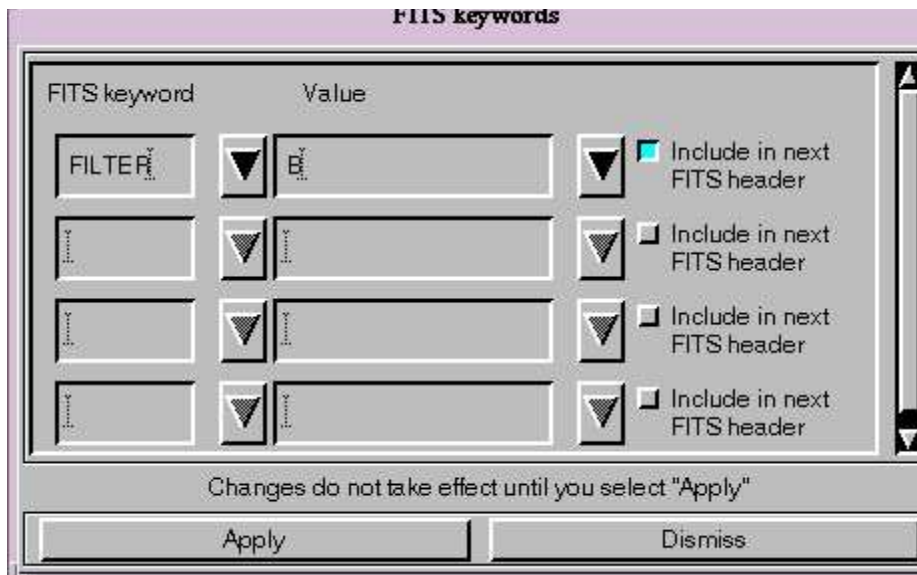

3. Under the menu **Start observing**, select **Imager**. This will bring up the **Controller Window**. The one below is slightly different from the current one but you can access all the functions shown below from the main pulldown menu.

4. If a warning box appears concerning user-defined FITS keywords from a previous cicada session, choose to display the FITS keywords window. If this window does not appear, under the **Options** menu, select **Show Fits Keyword Window**.

Here you enter non-default keywords that you want in the headers of the FITS images. Most of the standard iraf keywords are automatically put in, but **you MUST enter the keyword FILTER and the value in this box**. The filter keyword is not automatically put in the headers at the moment since Cicada does not directly control the filter wheel.

5. You will need to start up an Ximtool for Cicada to display things in. This Ximtool is owned by Cicada - you must start up another private Ximtool elsewhere if you want to reduce your data. To get Cicada's Ximtool, under the **Tools** menu select **Start Ximtool**.
6. The default parameters in the Cicada (AM3200) window need to be set to something reasonable...
   - **Filename prefix** I usually leave this as ccd - the images are then called ccd0001, ccd0002 etc... You can change this to whatever you want.
   - **Run Number** This is the number of your first image and will increment by 1 as each image is taken.
   - **X bin**, **Y bin** The 2.3m has a scale of 0.6" per pixel. Hence for most work 1x1 binning is fine.
   - **Overscan columns** I recommend at least 100
   - **X-offset-1** 110
   - **Y-offet-1** 90
   - **Width-1** 863
   - **Height-1** 810

   Since the field of view of the Imager is much smaller than the CCD, these are the values I use. It saves on readout time if you define a smaller area to read out. These values keep the full field of view with a bit of extra space around the outside.
7. If this is the first night of your run you will need to clear the data disk and have a directory owned by you created. To do this, under the **Tools** menu select **Start Teldisk**. Then select **Clear Disk**. This will create a directory called /priv/monster/ *yourusername*.
8. To tell Cicada where to put your images (the default is your home area - and you won't fit many images in there), under the **Options** menu, select **Preferences**. Then type in the path of the directory you want the data to go into. e.g. If it is the 11th of December and you wish to put the data for the night in a directory called dec11 then type in /priv/monster/*yourusername/dec11*. This is also where you change which directory the data goes into on subsequent nights. The output directory is displayed at the top of the Cicada window.
9. You need to make sure that you initialise the CCD hardware each time you start up Cicada. Under the menu **Actions**, choose **Initialise CCD Hardware**. It will take a few minutes for the hardware to initialise. It pops up 2 windows as it initialises, a Temperature etc window and a Voltages window. Once the voltages window appears - initialisation is complete and you can dismiss these 2 windows.
10. If you wish to change the gain for your images, under the **AM3200** menu, select **Edit Gain Values**. The numbers are reasonably meaningless but basically it equates to the following:
   8 = Gain of 1
   4 = Gain of 2
   These are the only 2 I've worked with. You will need to re-initialise once you have changed the gain

value.

Taking BIAS frames

It is a good idea to take 10 BIAS frames at the beginning of the night and 5 more at the end of the night. In order to take BIAS frames, in the CICADA window set the following parameters:

- **Object Name:** BIAS
- **Exposure Type:** Make sure you select BIAS. This is what goes in the IMAGETYP header keyword so you need to get it right. By selecting this the exposure time is automatically set to 0.
- **Save and Display**
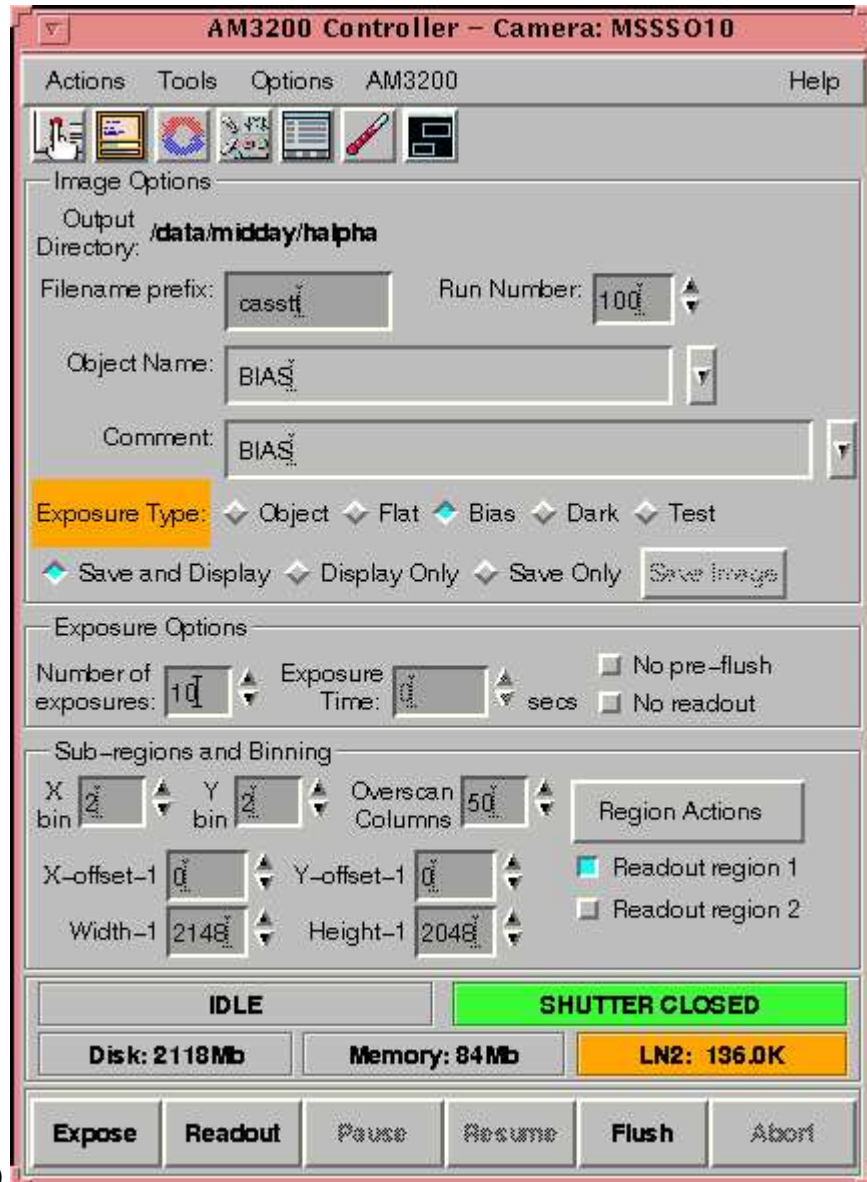
- **Number of Exposures:** 10

Taking Flat Fields

Flats are a must for the imager. But be warned, it is difficult to really flatfield your data to better than 1% because of scattered light inside the imager - it depends on rotator angle.

For Dome Flats:

Dome Flats: A ring of small lamps is installed on the telescope top-end ring and may be used to illuminate the dome ceiling. The lamps are controlled from the telescope console with the commands:
TEL$ **SWITCH FLAT ON**
and
TEL$ **SWITCH FLAT OFF**
The following suggested procedure requires you to first start the telescope control computers and log on. The flourescent strip lights in the dome must be switched off. The incandescent lights are less important. Move the telescope to zenith park and then slew it down slightly in altitude to prevent any harsh specular reflection off the ceiling. For example:
TEL$ **PARK**
TEL$ **SLEW * 75**
Flats are best taken against the wind-screens rather than the actual dome roof,so issue the command:
TEL$ **CONFIGURE WINDSCREEN_CONTROL CLOSED**
Open the mirror covers once the wind-screens have stopped moving. The lamps' brightness is controlled by a dial marked "Flat field illumination control" on the telescope console. It is located with other light controls near the top centre of the console. With the lamp brightness set around 20%, expect exposures of between 1 (not recommended) and 10 seconds.

For Sky Flats:

You need to out onto the sky just out sunset for U, and towards the end of twilight for I. You are shooting for something in the vicinity of 30000 counts in a flat, but anything between 3000 and 50000 counts is probably OK. You want a minimum of 3 per filter to remove cosmic rays, and exposure times less than 2 seconds are to be avoided, or you will have to do a shutter correction

---

Set the following parameters in the CICADA window:

- **Object Name:** sky_b
- **Exposure Type:** Make sure you select FLAT. This is what goes in the IMAGETYP header keyword so you need to get it right.
- **Save and Display**
- **Number of Exposures:** 1
- In the **FITS keyword window** make sure you have entered the correct filter and **click APPLY**. If you do not click APPLY the filter keyword will not change. To check you have the correct filter going into your headers, have a look on the right hand side of the field where you enter the object name. The Filter selected should be highlighted here.

Now We're Imaging

Imaging is very straightforward - 3 simple steps.

1. Set Telescope to the desired position.
2. Change the FILTER to correct position, and then update the object name, exposure time and number of exposures you want in CICADA and press SAVE AND DISPLAY.
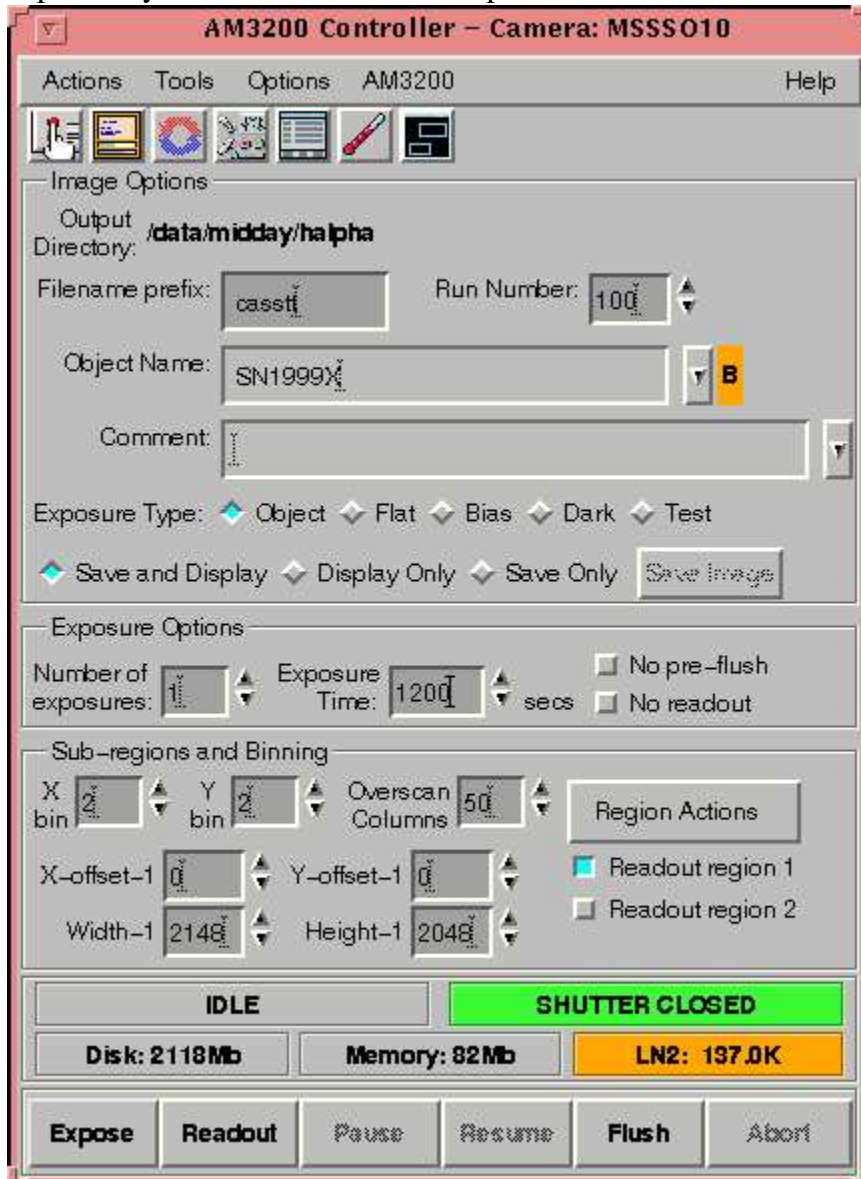
What is in the Light Path of the Imager? - Changing Filters

All this is done on the last computer on the main desk - the monitor is labelled IMAGER/DBS.

1. This is usually left open either for the DBS or the IMAGER. If it is in the IMAGER mode you are home and hosed. If it is DBS mode, select from the top left corner, the DBS menu and EXIT. This will leave you with a DOS prompt.
2. Type *imager*. You will have a grey screen with 2 menus. Go to Imager and then select Control/Status F6. This will bring up a screen with lots of columns topped with M1, M2 etc..
3. Here are the settings for each of the bits:

   M1

   - **Main Filter:** clear
   - **TV Focus/Filter:** not important
   - **Slide:** -52 (we will move this when <u>foccusing</u> and <u>calibrating the telescope</u>
   - **Autoguider Focus/Filter:** not important - not using the autoguider
   - **Arcs:** not important
   - **Arc mirror:** out - (only used with the grisms)
   - **Arc filter:** not important - (only used with the grisms)

   M2
   - **Turret:** Clear for imaging, Slit for>focussing, pointing and calibrating the aperture.
   - **Slit:** 0.48 = about 2''
   - **Decker:** At reverse limit
   - **Back Illumination:** out

   M3
   - **T100 Filter:** clear
   - **Tilttune:** 0
   - **T50 filter:** clear

   M4
   - **CBeamFocus:** 0
   - **PBeamFilter:** U,B,V,R,I **Here is where you change your filter**.
   - **Grism:** clear

   M5
   - **Camfocus:** 0
   - **slowshutter/fastshutter:** you can't do anything about.
4. To change the filter, click on **PBeamFilter** under **M4** then select which filter you like.
5. To put the slit in, click on **Turret** under **M2** then select *slit*. Remember to change this back to *clear* when you are finished with the slit!!
6. If you are using different filters to the ones found here look under **T100 Filter** and **T50 filter** to find it. In this case select which filter you like and put the **PBeamFilter** to clear.
7. To move the **slide**, click on **slide** and type the number (-52 or 0 usually).

Focussing the Telescope

There Are two ways of focussing the telescope. A quick and dirty way which seems to be great if you are using the DBS/Imager, and a more involved (and more typical) process if you are using the Imager or CASPIR at Cassegrain. The later two use the more involved method simply because the quick and dirty way is unable to focus the telescope properly if the seeing gets better than 1.5".

The Quick but Effective Way

1. Put the slit in the imager
2. Slide the TV slide to 0
3. Move to a bright star from the Astronomical Almanac (a blue book which should be on the desk somewhere - look right up the top).
4. Increase the intensifier value (it goes up to 31) until you can see the star clearly but it is not too bright.
5. Watch the star as you play with the focus. Take it right out of focus in one direction, the go through focus and out the other side. Do this a few times until you get the feel for where focus is and stop there.

   Don't forget to move the TV slide back to -52 and the slit out of the way after you have finished.

The more standard (and more time consuming method)

- Moveto any field that does not contain a very bright star.
- Change the control mode to *offset* and type *off/step 30* at the **TEL>** prompt
- You are going to take a series of exposures with CICADA that will go through focus and out the other side. To begin, take the telescope out one side of focus (a good indicator of focus is the value that it is set at already - unless you have come on straight after CASPIR). A good amount would be by 15 units from nominal focus. Look at the board for focus values...As of 1999 DBS/Imager Focus values are around 390 and CASPIR around 500.
- In CICADA, select *No pre-flush* and *No readout*. Select the FLUSH button at the bottom to flush the CCD
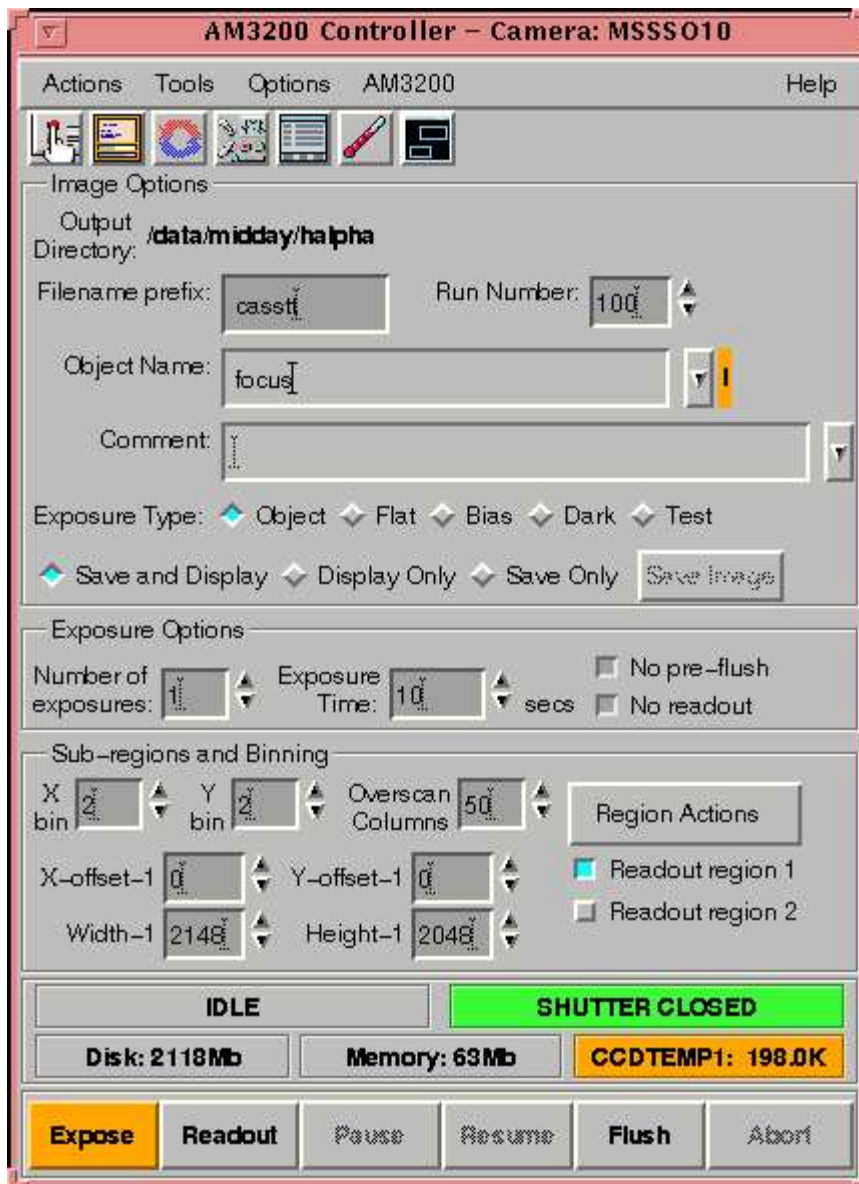
before beginning.

• Take an exposure, and then offset the telescope by pushing the W slow button once (making sure that the offset button is also pushed), change the focus value by 5 units heading towards focus and take another exposure.

• Repeat about 7 times but before taking the last exposure, move to the N rather than the W. This lets you know which was the last focus position.

• In CICADA, select READOUT. This is very important!

• Check each of the stars in the focus run to determine the best focus using IRAF or GIT.

• Set the focus at this value by typing *focus xx.x* at the **TEL>** prompt or by just pressing the focus buttons until you reach it.

Saving Data to Tape

1. There is 1 DAT drive and 1 EXABYTE drive located just to the right of **misty**. You should have brought your own DAT or EXABYTE tapes with you on which to save your data.
2. In an xterm on **misty** type:
   - *allocate mt0* - for the uncompressed DAT drive
   - *allocate mt1* - for the compressed DAT drive
   - *allocate ex0* - for the uncompressed EXABYTE drive
   - *allocate ex1* - for the compressed EXABYTE drive
3. Put your new tape in the relevant drive
4. CICADA saves the imager files as fits files so you can either write these with IRAF or tar them onto the tape. I always tar them onto the tape. The command will be something like:
   tar cvf $TAPE dec11/* if we use the example of the data put into a directory called dec11.

Night's End

- fill the dewars

- shutdown the telescope

- If last night, Do Run Report

Filling the Dewar

THE DEWAR NEEDS TO BE FILLED EVERY TWELVE HOURS. DO IT AT THE START AND END OF THE NIGHT. IT IS THE OBSERVER'S RESPONSIBILITY TO MAKE SURE THAT THE DEWARS ARE FILLED.

You should also ask the technical staff in the afternoon whether you need to keep additional dewars cold for the next observer.

FOR SAFETY REASONS, WHEN FILLING THE DEWAR, PLEASE WEAR SAFETY GOGGLES AND USE THE GLOVES PROVIDED. AVOID STANDING UNDERNEATH OR VERY CLOSE TO THE DEWAR SINCE LIQUID NITROGEN WILL SPILL OUT WHEN THE DEWAR IS FULL.

1. Make sure that the Telescope is stationary - type *park* or *halt* at the **TEL>** prompt.
2. Record the pre-filling temperatures (CCDTEMP1 and SINKTEMP) in the CCD temperature book.
3. Move the rotators so they are in their parked position.
   - Imager - cables not twisted, metal bar underneath
   - DBS - cables not twisted, metal bar over the top - blue DBS on the left, red DBS on the right

4. Use the hair dryer to melt the ice that has accumulated. When you can turn the black cover at the end of the dewar, move it to reveal the filling hole for the dewar.
5. Make sure that the metal fill tube leading from the liquid nitrogen is dry. Push the metal fill tube all the way into the filling hole and secure it by turning the black cover from the position marked *load* to *fill*.

6. Lift the lever marked *liquid* and the LN **2** will start to flow into the dewar. Nitrogen gas will escape from the dewar as it is filling.

7. Check the pressure gauge on the filler container. It should be somewhere between 7 and 14. If it is reading < 7 the dewar will take forever to fill. If this is the case, take the curly yellow hose that is located near each dewar and attach it to the pipe on top of the filler container that has nothing attached to it. Then lift the lever that marked

   air. This will pump more pressure into the filler container.

8. Once liquid nitrogen starts to drip from the dewar, return the *liquid* (and **air** lever to it's original position).
9. Use the hair dryer to thaw out the hose before removing it from the dewar. AVOID MOVING THE FILLER HOSE DURING FILLING OR WHEN FROZEN AS IT MAY SPLIT THE SHEATH INSIDE.

   NOTE: There is the possibility that the metal tube may become frozen in the filling tube. Simply continue to apply heat via the hair dryer on to the metal tube. This may take awhile for the heat to distribute through out the tube melting the ice that has made it stuck. Keep pulling the tube as it is slowly freed.

10. Record the post-filling temperatures (CCDTEMP1 and SINKTEMP) in the CCD temperature book.

Moving the Rotators From the Hand Paddle

1. Make sure that you are logged into the telescope

2. On the hand paddle at Nasmyth level, press the *MANUAL* button
3. To rotate the rotator, hold down the *CONTROL* key while pressing in the *rotator CW* or *rotator CCW* buttons. When you stop pressing the rotator buttons the rotator will stop.
4. Return control to the telescope by pressing *AUTO*
5. Make sure that the control paddle lights are turned right down by turning the knob at the bottom.

NOTE: Each rotator has its own separate hand paddle.

Shutting Down the Telescope

The telescope is made to shutdown very quickly an efficiently

•   Simply typing *shutdown* at the **TEL>** prompt will completely shutdown the telescope for you. Watch the computer screen to make sure everything shuts down OK.

If you get a message that says **Telescope not safe to leave unattended** then try <u>starting up the telescope points 3,4 and 5</u> again and then shutting down once more. If this message still comes back, go out into the dome and make sure that the primary mirror cover is closed and that the dome shutters are closed. Then write a telescope fault report and leave it up to the technicians.

If the dome is not closed, it is best to call for help.

•   Make sure you have <u>filled the dewar/s!</u>. If you shutdown and you need to rotate the instrument to fill a dewar, you must <u>restart the Telescope control.</u>

Run Report

At the end of your run, please leave a [observing report](#) so that we can know how things are going, what can be improved, etc.

UBVRI Photometric Landolt

Standards

Chart	RA (J2000)	Dec (J2000)	# in 2.3m field
			>5 obs
Tphe	00:30:14	-46:30:10	4
95_330	03:54:38	+00:27:20	2
98_653	06:52:12	-00:18:00	9
R149	07:24:16	-00:32:00	8
R152	07:29:56	-02:05:39	7
pg0918	09:21:34	+02:47:00	5
pg1047	10:50:09	-00:01:08	4
104_330	12:42:21	-00:40:29	4
pg1323	13:25:45	-08:50:00	3
pg1633	16:35:32	+09:47:00	5
110_229	18:40:48	+00:01:51	4
markA	20:43:58	-10:47:00	4

All stars observed more more than 5 times by Landolt (1992; AJ, 104, 340).

Field Center: RA = 00:30:14 Dec = -46:30:10 (J2000)

Star	RA (J2000)	Dec (J2000)	V	B-V	U-B	V-R	R-I	Color
TPHE A	0:30:09	-46:31:22	14.651	0.806	0.390	0.429	0.405	0.835
TPHE B	0:30:16	-46:27:55	12.334	0.407	0.168	0.259	0.271	0.531
TPHE C	0:30:17	-46:32:34	14.376	-0.295	-1.116	-0.148	-0.212	-0.354
TPHE D	0:30:18	-46:31:11	13.118	1.546	1.822	0.843	0.811	1.658
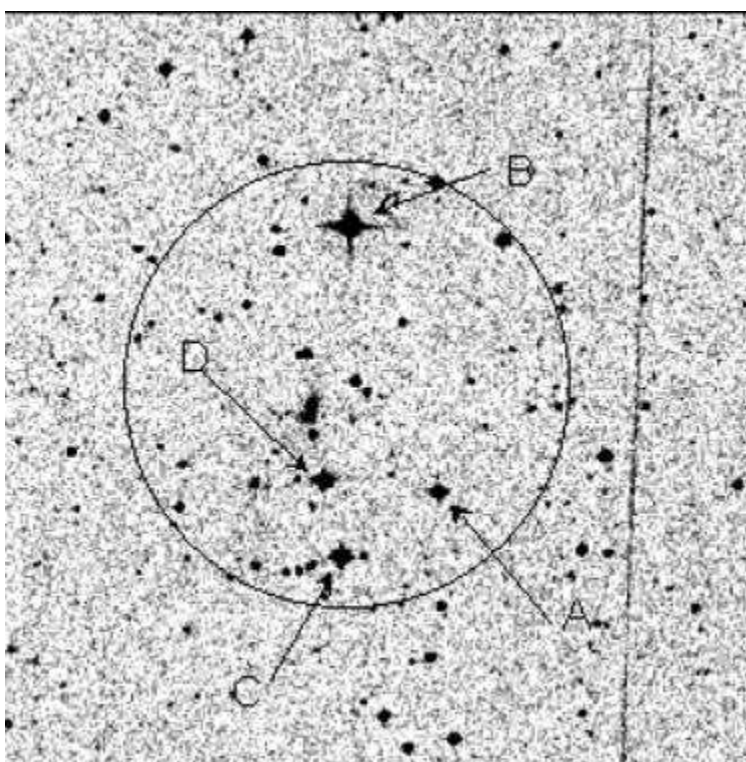
Field Center: RA = 03:54:38 Dec = +00:27:20 (J2000)

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Star	RA (J2000)	Dec (J2000)	V	B-V	U-B	V-R	R-I
95 330	03:54:31	+00:29:05	12.174	1.999	2.233	1.166	1.100
95 275	03:54:44	+00:27:20	13.479	1.763	1.740	1.011	0.931
95 276	03:54:46	+00:25:54	14.118	1.225	1.218	0.748	0.646
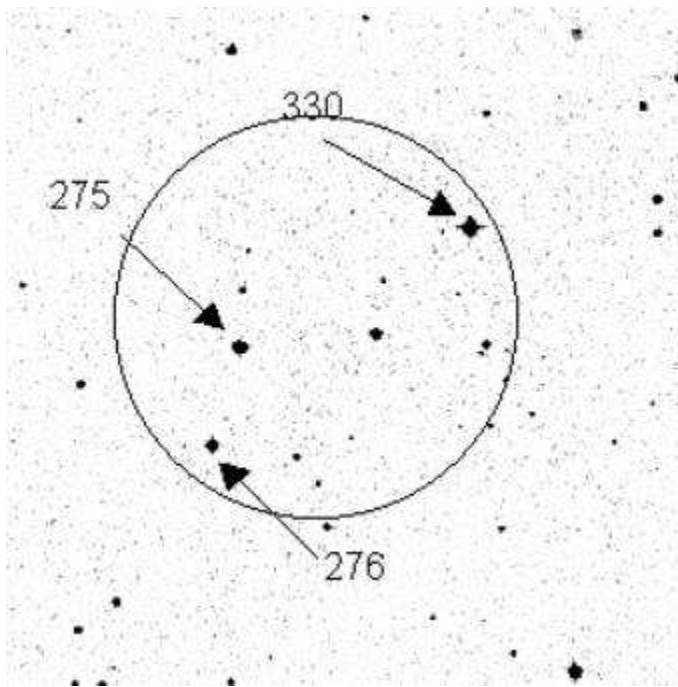
Field Center: RA = 06:52:12 Dec = -00:19:17 (J2000)

Star	RA (J2000)	Dec (J2000)	V	B-V	U-B	V-R	R-I
98 653	06:52:05	-00:18:19	9.539	-0.004	-0.099	0.009	0.008
98 650	06:52:05	-00:19:40	12.271	0.157	0.110	0.080	0.086
98 671	06:52:12	-00:18:22	13.385	0.968	0.719	0.575	0.494
98 670	06:52:12	-00:19:17	11.930	1.356	1.313	0.723	0.653
98 676	06:52:14	-00:19:21	13.068	1.146	0.666	0.683	0.673
98 675	06:52:14	-00:19:19	13.398	1.909	1.936	1.082	1.002
98 L5	06:52:16	-00:19:39	17.800	1.900	-0.100	3.100	2.600
98 682	06:52:17	-00:19:42	13.749	0.632	0.098	0.366	0.352
98 685	06:52:19	-00:20:19	11.954	0.463	0.096	0.290	0.280
98 1087	06:52:21	-00:15:50	14.439	1.595	1.284	0.928	0.882
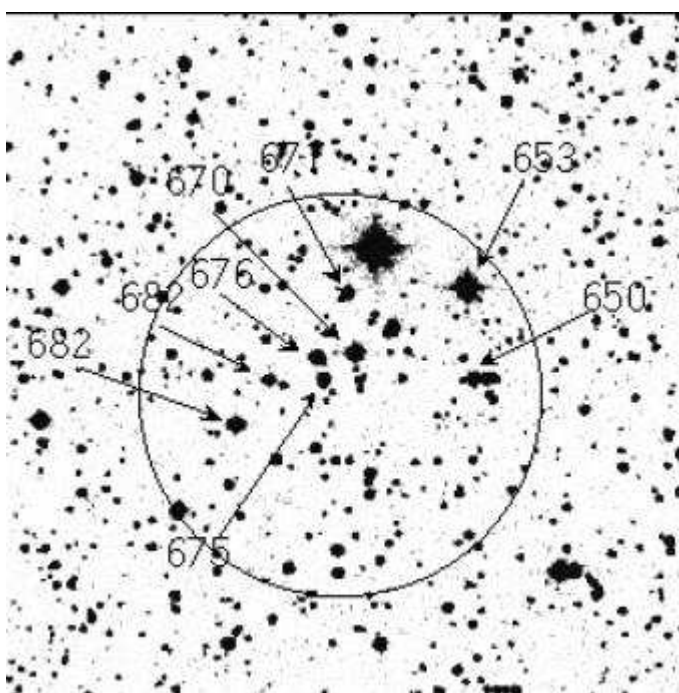
Field Center: RA = 07:24:16 Dec = -00:32:00 (J2000)

Star	RA (J2000)	Dec (J2000)	V	B-V	U-B	V-R	R-I
RU 149G	07:24:12	-00:31:46	12.829	0.541	0.033	0.322	0.322
RU 149A	07:24:14	-00:32:44	14.495	0.298	0.118	0.196	0.196
RU 149F	07:24:15	-00:30:58	13.471	1.115	1.025	0.594	0.538
RU 149	07:24:15	-00:32:55	13.866	-0.129	-0.779	-0.040	-0.068
RU 149D	07:24:16	-00:32:38	11.480	-0.037	-0.287	0.021	0.008
RU 149C	07:24:18	-00:32:17	14.425	0.195	0.141	0.093	0.127
RU 149B	07:24:18	-00:32:58	12.642	0.662	0.151	0.374	0.354
RU 149E	07:24:19	-00:31:08	13.718	0.522	-0.007	0.321	0.314
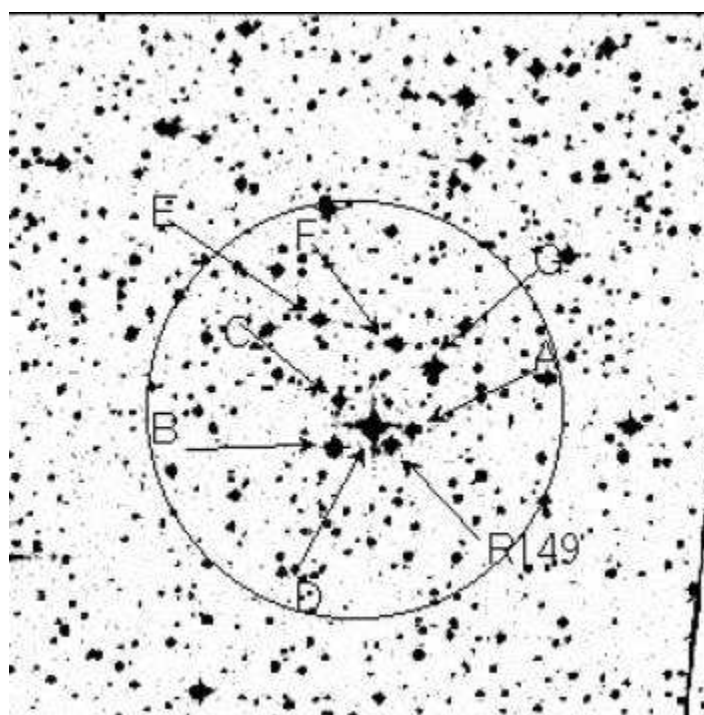
Field Center: RA = 07:29:56 Dec = -02:05:39 (J2000)

Star	RA (J2000)	Dec (J2000)	V	B-V	U-B	V-R	R-I
RU 152F	07:29:51	-02:04:29	14.564	0.635	0.069	0.382	0.315
RU 152E	07:29:51	-02:05:09	12.362	0.042	-0.086	0.030	0.034
RU 152	07:29:55	-02:06:18	13.014	-0.190	-1.073	-0.057	-0.087
RU 152B	07:29:56	-02:05:39	15.019	0.500	0.022	0.290	0.309
RU 152A	07:29:57	-02:06:02	14.341	0.543	-0.085	0.325	0.329
RU 152C	07:29:59	-02:05:18	12.222	0.573	-0.013	0.342	0.340
RU 152D	07:30:03	-02:04:16	11.076	0.875	0.491	0.473	0.449
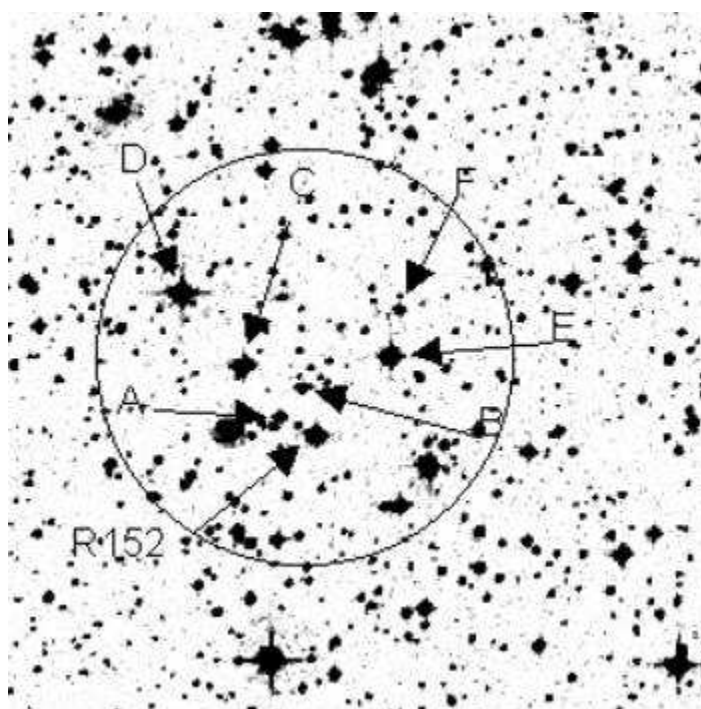
Field Center: RA = 09:21:34 Dec = +02:47:00 (J2000)

Star	RA (J2000)	Dec (J2000)	*V*	*B-V*	*U-B*	*V-R*	*R-I*
PG0918+029D	09:21:22	+02:47:30	12.272	1.044	0.821	0.575	0.535
PG0918+029	09:21:28	+02:46:03	13.327	-0.271	-1.081	-0.129	-0.159
PG0918+029B	09:21:34	+02:48:01	13.963	0.765	0.366	0.417	0.370
PG0918+029A	09:21:35	+02:46:20	14.490	0.536	-0.032	0.325	0.336
PG0918+029C	09:21:42	+02:46:38	13.537	0.631	0.087	0.367	0.357
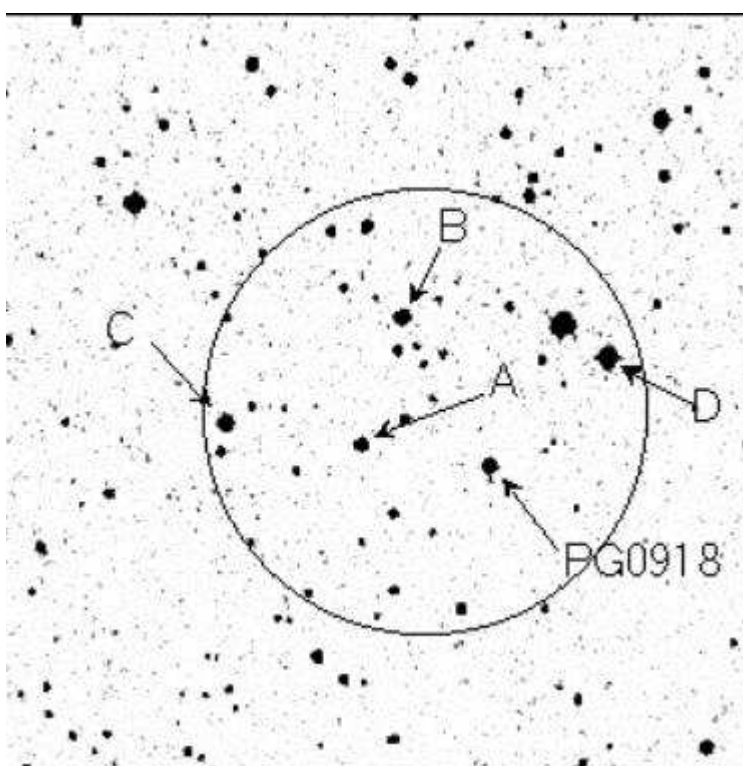
Field Center: RA = 10:50:09 Dec = -00:01:08 (J2000)

Star	RA (J2000)	Dec (J2000)	V	B-V	U-B	V-R	R-I
PG1047+003	10:50:03	-00:00:32	13.474	-0.290	-1.121	-0.132	-0.162
PG1047+003A	10:50:06	-00:01:08	13.512	0.688	0.168	0.422	0.418
PG1047+003B	10:50:09	-00:02:00	14.751	0.679	0.172	0.391	0.371
PG1047+003C	10:50:18	-00:00:23	12.453	0.607	-0.019	0.378	0.358
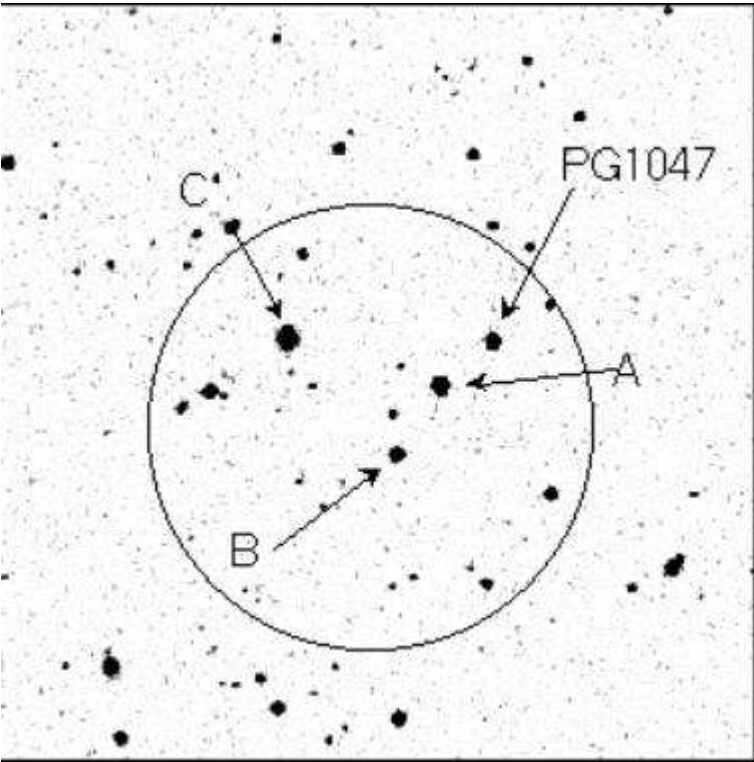
Field Center: RA = 12:42:22 Dec = -00:40:00 (J2000)

Star	RA (J2000)	Dec (J2000)	V	B-V	U-B	V-R	R-I
104 330	12:42:12	-00:40:40	15.296	0.594	-0.028	0.369	0.371
104 334	12:42:21	-00:40:28	13.484	0.518	-0.067	0.323	0.331
104 336	12:42:25	-00:39:58	14.404	0.830	0.495	0.461	0.403
104 338	12:42:31	-00:38:32	16.059	0.591	-0.082	0.348	0.372
104 339	12:42:34	-00:41:39	15.459	0.832	0.709	0.476	0.374
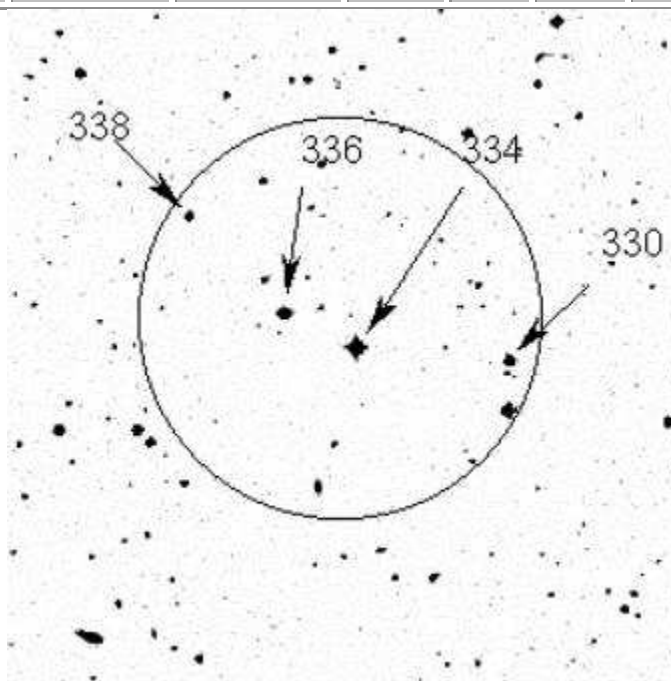
Field Center: RA = 13:24:45 Dec = -08:50:00 (J2000)

Star	RA (J2000)	Dec (J2000)	V	B-V	U-B	V-R	R-I
PG1323-085	13:25:39	-08:49:16	13.481	-0.140	-0.681	-0.048	-0.078
PG1323-085C	13:25:50	-08:48:37	14.003	0.707	0.245	0.395	0.363
PG1323-085B	13:25:50	-08:51:53	13.406	0.761	0.265	0.426	0.407
PG1323-085D	13:26:05	-08:50:34	12.080	0.587	0.005	0.346	0.335

Field Center: RA = 16:35:32 Dec = +09:47:00 (J2000)

Star	RA (J2000)	Dec (J2000)	V	B-V	U-B	V-R	R-I
PG1633+099	16:35:24	+09:47:50	14.397	-0.192	-0.974	-0.093	-0.116
PG1633+099A	16:35:26	+09:47:53	15.256	0.873	0.320	0.505	0.511
PG1633+099B	16:35:34	+09:46:22	12.969	1.081	1.007	0.590	0.502
PG1633+099C	16:35:38	+09:46:16	13.229	1.134	1.138	0.618	0.523
PG1633+099D	16:35:40	+09:46:43	13.691	0.535	-0.025	0.324	0.327
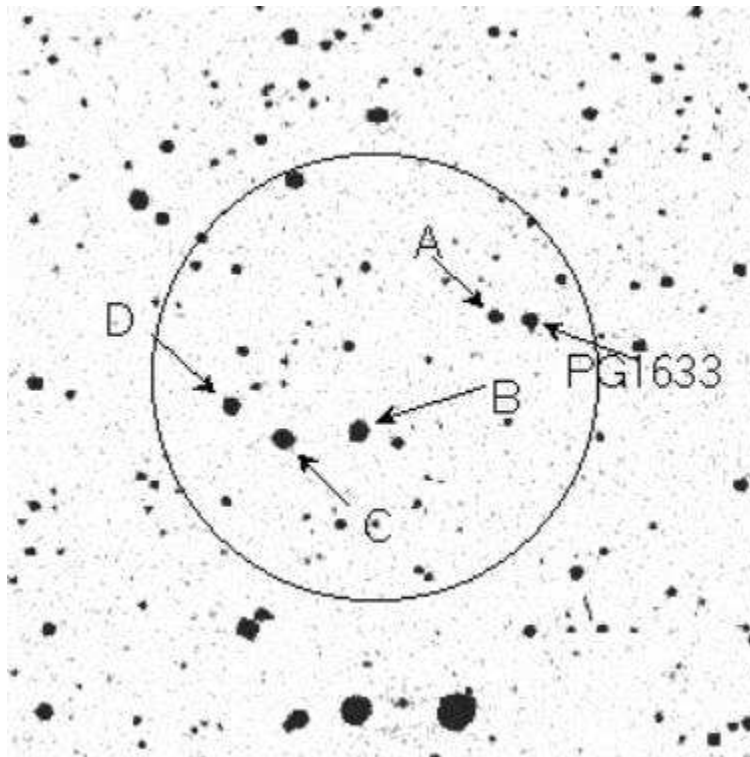
Field Center: RA = 18:40:48 Dec = +00:01:51 (J2000)

Star	RA (J2000)	Dec (J2000)	V	B-V	U-B	V-R	**R-I**
110 229	18:40:45	+00:01:51	13.649	1.910	1.391	1.198	1.155
110 230	18:40:51	+00:02:23	14.281	1.084	0.728	0.624	0.596
110 232	18:40:52	+00:01:58	12.516	0.729	0.147	0.439	0.450
110 233	18:40:52	+00:00:51	12.771	1.281	0.812	0.773	0.818
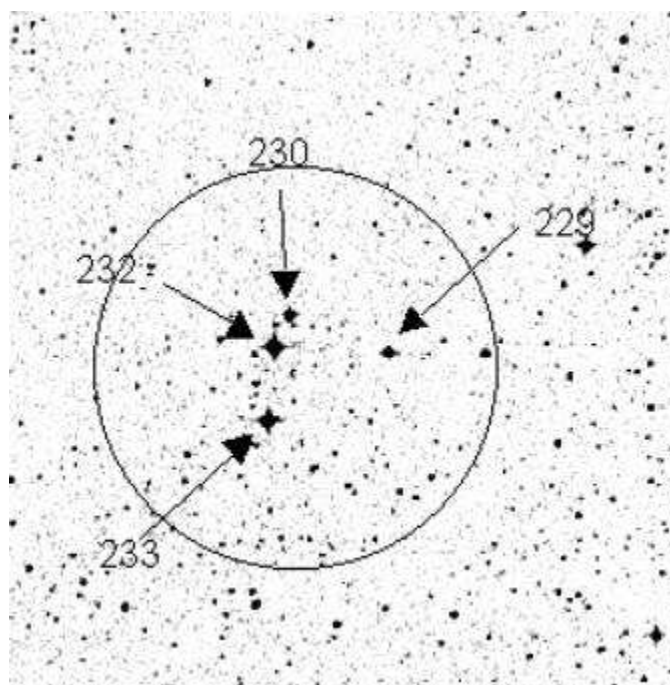
Field Center: RA = 20:43:58 Dec = -10:47:00 (J2000)

Star	RA (J2000)	Dec (J2000)	V	B-V	U-B	V-R	R-I
MARK A2	20:43:54	-10:45:32	14.540	0.666	0.096	0.379	0.371
MARK A1	20:43:58	-10:47:11	15.911	0.609	-0.014	0.367	0.373
MARK A	20:43:59	-10:47:42	13.258	-0.242	-1.162	-0.115	-0.125
MARK A3	20:44:02	-10:45:39	14.818	0.938	0.651	0.587	0.510
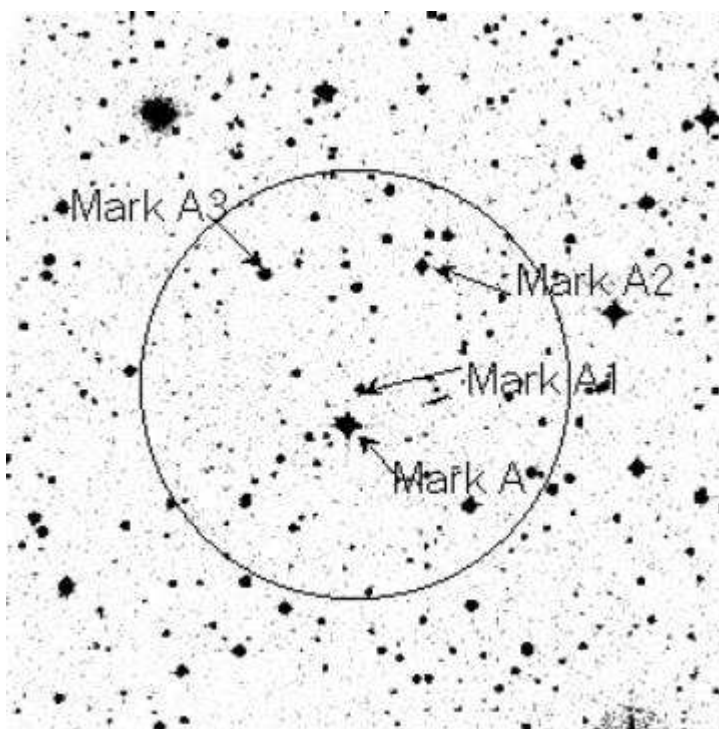
Documentation Suggestions

Your name and email so that we may contact you.

Name:

Email:

Comments on how to make this documentation more complete, or better, please put them here, and then press the submit button.

RESET FORM	Submit

Trouble Shooting

Here are some common problems. If your problem is not here, try <u>searching the telescope fault database</u>. If your problem cannot be fixed, then you should <u>report it to the telescope fault system</u>.

If you have a WARNING or ERROR lamp illuminated, a diagnosis will be given on the telescope display computer immediately below these lamps. Here are some of the more common problems....

Telescope Problems

1. WARNINGS
    You are still able to observe while the WARNING light is on.
    - Humidity exceeds telescope operating limit.
      This warning comes on when the humidity level reaches 90%. The observer **MUST** close the mirror covers and building shutters when the humidity exceeds 95%. While this warning lamp is on, the observer should make regular journeys to the nasmyth level to feel for condensation on the railings. If there is condensation present - observing should cease immediately.
2. ERRORS
    The orange ERROR lamp is usually accompanied by one or more other red lights on the console. You must fix these problems before you are able to observe.
    - Telescope motion interlock
      This is accompanied by red *Servo Reset* and *Building Drive Reset* buttons. If one or both of these is illuminated, turn off the telescope systems, press the *Servo Reset* and the *Building Drive Reset* buttons that were illuminated and then switch the Telescope Systems back on.
    - Telescope exceeds zenith limit
      Type *park* at the **TEL>** prompt, then reset the Telescope Systems as described in the Telescope motion interlock.
    - Tertiary Mirror not positioned correctly for selected focal station
      Give it some time.....
      If it persists, try shutting the telescope down and then starting up again.

CCD and Cicada Problems

- Noisy CCD

  The Astromed controllers are particularly prone to producing patterned noise in addition to the normal Bias frame. This can usually be remedied by initialising the CCD in Cicada under the Action TAB.

- Cicada is having problems

  Cicada problems are best solved by completely leaving Cicada, and then retyping "cicada &" in an xterminal. Note...You should give the system a few seconds to clean cicada processes up if you have exited cicada ungracefully. You can check if this has occurred by typing, at the UNIX prompt
       ps -eadlf | grep cicada

  If anything owned by cicada (the 2nd column) comes up, wait a minute. And check again.

IF YOU STILL HAVE PROBLEMS -- RING THE TECHNICAL STAFF FOR ASSISTANCE --- But not outside the times listed on the Board except for extreme circumstances
They can be found in the 16 inch telescope usually. The number is written in the top left hand corner of the white board. Next to this (on the wall) is the number to ring after hours.