ACE Control System
SARA CTIO 0.6-m Observatory
User's Manual

Created for:

SARA Consortium

Created By:

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CHANGE RECORD

Date	Affected Sections	Reason/initiation/remarks
28 February 2010	N/A	**Initial Release**
03 May 2010	Networking	Start of general observing
02 April 2013	Networking & passwords	Add Spectrograph. Add section on All Sky Camera.
05 Feb 2015	Passwords and minor updates	

NOTE: MAJOR CHANGES TO ACE WILL OCCUR IN MID 2015 MAKING THIS COPY OF THE MANUAL OBSOLETE.

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1.0 INTRODUCTION

1.1 PURPOSE

This User's Manual gives details of the ACE Observatory Control System. The information contained herein is proprietary and the intellectual property of Astronomical Consultants & Equipment, Inc. (A.C.E.) and was produced entirely at private expense without public funding. Nothing in this manual is to be considered as "public domain".

This manual is a primer for the daily operating procedures of the telescope, instruments and dome.

1.2 OVERVIEW

The SARA South Observatory is the re-birth of the Lowell 24-inch telescope located on the south-east ridge of Cerro Tololo, Chile. Installed in 1968 this Boller & Chivens telescope fell into disuse for almost 20 years. The telescope and observatory have undergone a major restoration.

A new dome with a wide slit has been fully automated with an ACE SmartDome controller featuring autonomous closure. The telescope was completely gutted, repainted, and virtually every electronic component and wire replaced. Modern infrastructure, such as USB, Ethernet and video ports have been incorporated into the telescope tube saddle boxes.

Absolute encoders have been placed on the Hour Angle and declination axes with a resolution of less than 0.7 arc seconds. The secondary mirror is also equipped with an absolute encoder and temperature sensor to allow for fully automated focus.

New mirror coatings, automated mirror covers, a new 150mm refractor, and new instrumentation have been deployed. An integrated X-stage guider and dual filter wheel containing 18 filters is used for direct imaging. The guider camera can be easily removed and a standard 2-inch eyepiece used for occasional viewing by VIP's at C.T.I.O.

A 12 megapixel all-sky camera produces color images every two minutes showing details in the Milky Way and Magellanic Clouds. Two low light level cameras are deployed; one on the finder and one at the top of the telescope showing a 30° field. Other auxiliary equipment, including daytime color video cameras, weather station and remotely controllable power outlets permit complete control and servicing of the system.

There is no "night assistant" available for this facility. It is intended to be run unattended by an experienced observational astronomer. It is not recommended to operate this facility on those nights that experience marginal weathers conditions, especially when rain or snow is predicted within the next 12 hours.

1.3 ACRONYMS

A list of acronyms are presented in Table 1-1.

TABLE 1-1 ACRONYMS	
ACE	Astronomical Consultants & Equipment, Inc.
AES	ACE Echelle Spectrograph
B&C	Boller & Chivens (the original telescope manufacturer)
CTIO	Cerro Tololo Interamerican Observatory
NOAO	National Optical Astronomical Observatory
NSF	National Science Foundation
PDU	Power Distribution Unit
SDSS	Sloan Digital Sky Survey
VPN	Virtual Private Network

1.4 QUICK VIRTUAL TOUR

The Boller & Chivens telescope is an equatorial torque tube mount. The instrument can swing past the mount when pointing at the south celestial pole.

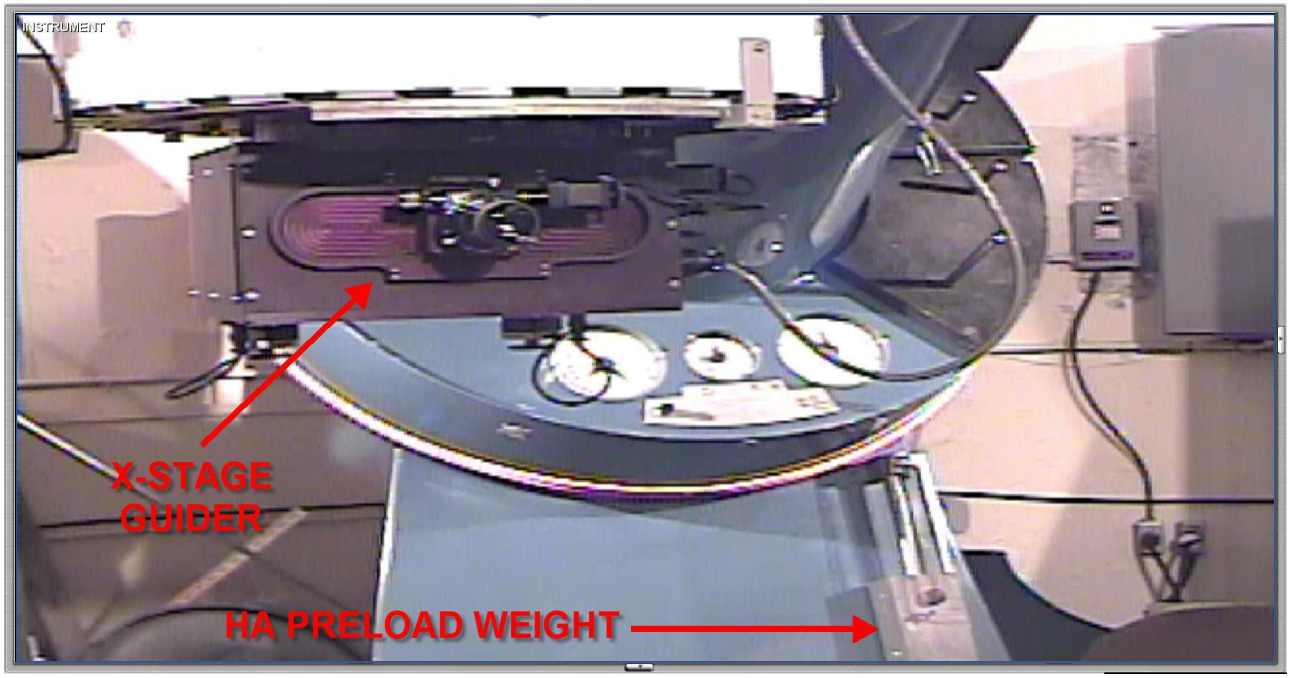
The telescope tube sits on the WEST side of the mount (Yes, it was designed for use in the northern hemisphere so the telescope is balanced counterweight heavy). It is capable of moving to large hour angles (unlike the classical German mount). However, at this time movement is restricted because of preload counterweights (see Table 1-3 Telescope Horizon Map). The wiring has been designed for complete access to the dome horizon in the future.

The telescope tube has two saddle boxes. The south box (seen above) contains USB ports and specialized camera cables. The north box contains a 15° mercury tilt sensor and two pairs of remotely switchable power outlets.

The telescope is equipped with a 152mm f/6.5 achromatic air-spaced doublet finder. It can be used for eyepiece viewing or as a finder scope with a low-light level camera.

The dome is a wide slit with two shutter doors. The main door goes "up and over" and the dropout door hinges down to reveal the horizon. The dome has power slip rings so it can be opened and closed at any azimuth. It is also equipped with a real-time rain detector.

A set of video cameras gives a remote observer key views of the facility. The INSTRUMENT camera shows the main detector. A preload counterweight is also visible in this camera. This moves up and down as the telescope moves in Hour Angle. It effectively limits the movement of the telescope.



The equipment is all housed in a control cabinet located on the dome wall to the northeast of the telescope and in a computer rack cabinet located on the dome floor. Two computer monitors are located on a small desk to the east of the dome (not visible in the video cameras). It is important for on-site observers to turn these off before leaving to prevent light pollution. (They can be turned off by remote users).

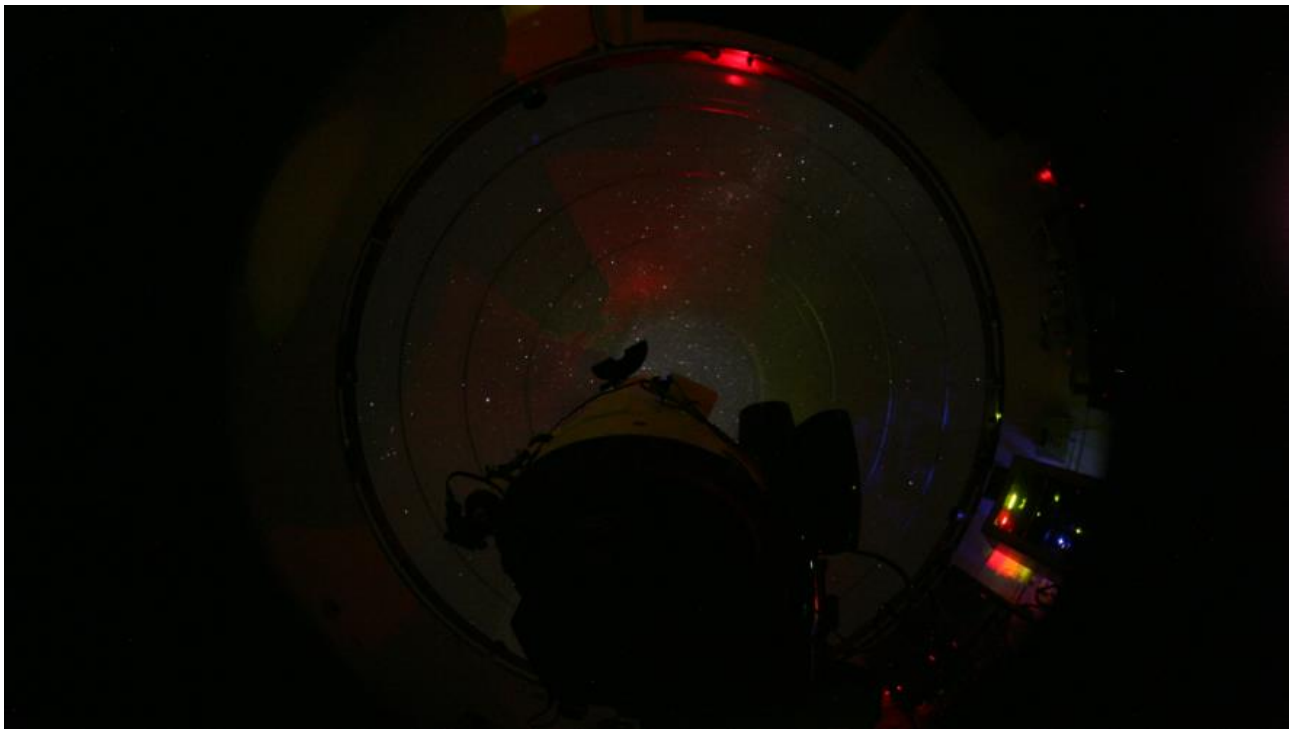
There is a wireless weather station located on a small bluff to the southeast of the observatory.

The wind speed at the site is typically very low. It often reaches a maximum in late afternoon but after darkness it decreases to less than a few km/hr and very often zero. The humidity can change quite rapidly. On many evenings a fog settles in the valleys below, which is great for blocking light pollution. It can occasionally by dawn, have reached the summit. The sky above will be near perfect but everything is dripping wet, so beware of this. The rain-snow detector will probably be set off and close the dome when this happens.

This is a view to the northeast. The village of Vicuna, the biggest source of local light pollution, is hidden under the fog. The nearest big city, La Serena, is 55km away (85km by road) and pollutes the western horizon. If you observe at an airmass of 2.0 or less it should not be an issue as the sky is pristine everywhere but very low down on the western horizon.

Unlike the SARA North facility this observatory has a generator backup for coping with long power outages. The telescope is on a 115 VAC 3kw UPS and the dome is on a 240 VAC 3kW UPS. Power glitches are fairly common, several times a month, but should be unnoticeable to the remote observer.

An all-sky camera and an outdoor color video camera are located to the west side of the dome. You may recognize this piece of concrete we hijacked as an equatorial mount. The very first piece of equipment on Cerro Tololo was a site testing telescope mounted on this structure.



All the control equipment is located in the dome. During this exposure the dome made a complete revolution. Orion can be made out to the left of the image and the southern cross to the top right. (Hint: *zoom in to see the details*).

1.5 PLANNING YOUR OBSERVATIONS

The SARA South observatory is located at Cerro Tololo, Chile. On site observers cannot just turn up un-announced! Permission must be granted for each visit to the observatory.

The facility is not intended to be used by on-site observers other than local astronomers using it for public viewing with VIP's.

The following information will help you when planning your observations:

Table 1-2 Observatory Parameters	
Time Zone	UTC -4
Longitude	WEST 70 DEG 47 MIN 57.0 SEC
Latitude	SOUTH 30 DEG 10 MIN 19.6 SEC
Elevation	2126 METERS
Altitude Limit	15 DEG
North Limit	+38 DEG
South Limit	-89.8 DEG

The telescope will become out of bounds when one or more of the limits is reached. The software will not permit slews outside of the observing boundaries. If you need to observe between -89 degrees and the south celestial pole please contact ACE so that this region can be opened up. It is normally closed to prevent accidental reversal of the telescope by using the local hand paddle or by using telescope offsets.

Table 1-3 lists the permissible motion east and west as a function of declination. Use this Telescope Horizon Map when planning your observations. This map is implemented inside the telescope control software and the system checks in real time to make sure the telescope is above this horizon.

Please note that the longitude of the observatory is almost 71° and that the time zone is centered on 60°. Chile observes *double* daylight savings time. This means that Chileans enjoy long hours of daylight in the evening compared to the morning. At civil noon the Sun is still almost two hours to the east of the meridian.

As of JANUARY 2015 the Chilean government announced that it will stay at GMT-4 for the whole year in an effort to save fuel.

Table 1-3 Telescope Horizon Map

DEC (Degrees)	EAST (Hours)	WEST (Hours)
-90	-6.421	6.750
-88	-6.421	6.750
-86	-6.421	6.750
-84	-6.421	6.750
-82	-6.421	6.750
-80	-6.421	6.750
-78	-6.421	6.750
-76	-6.421	6.750
-74	-6.421	6.750
-72	-6.421	6.750
-70	-6.421	6.750
-68	-6.421	6.750
-66	-6.421	6.750
-64	-6.421	6.750
-62	-6.421	6.586
-60	-6.421	6.445
-58	-6.421	6.345
-56	-6.421	6.145
-54	-6.421	6.085
-52	-6.421	6.025
-50	-6.421	5.978
-48	-6.421	5.833
-46	-6.421	5.792
-44	-6.421	5.745
-42	-6.350	5.667
-40	-6.370	5.572
-38	-6.284	5.500
-36	-6.199	5.467
-34	-6.118	5.339
-32	-6.038	5.250
-30	-5.961	5.261
-28	-5.885	5.164
-26	-5.810	5.076
-24	-5.735	5.026
-22	-5.662	4.943
-20	-5.589	4.888
-18	-5.517	4.833
-16	-5.433	4.814
-14	-5.367	4.750
-12	-5.300	4.684
-10	-5.217	4.617
-08	-5.117	4.544
-06	-5.067	4.467
-04	-4.983	4.391
-02	-4.917	4.300

DEC (Degrees)	EAST (Hours)	WEST (Hours)
00	-4.833	4.275
+02	-4.750	4.173
+04	-4.667	4.118
+06	-4.583	4.000
+08	-4.483	3.900
+10	-4.400	3.807
+12	-4.300	3.700
+14	-4.200	3.600
+16	-4.083	3.500
+18	-4.000	3.400
+20	-3.833	3.300
+22	-3.728	3.200
+24	-3.541	3.035
+26	-3.417	2.940
+28	-3.250	2.584
+30	-3.000	2.363
+32	-3.000	2.142
+34	-3.000	1.935
+36	-2.725	1.667
+38	-2.725	1.517

1.6 TELESCOPE OPTICS

The B&C Telescope has two interchangeable top ends. They give f/13.5 and f/75 fields. At f/75 Jupiter fills the whole field of the CCD. But that's academic as the f/75 has not be renovated.

The original optical diagram is shown in Figure 1-1. The key relevant parameters are translated into metric units in Table 1-4.

TABLE 1-4 OPTICAL PARAMETERS

Primary		
	Diameter (Clear Aperture)	609.6 mm
	Focal Length	2438.4 mm
	f/ratio	4
Secondary		
	Diameter (Clear Aperture)	192.5 mm
	Focal Length	-971.0 mm
	Prime focus intercept	683.3 ± 12.7 mm
System		
	Effective f/ratio	13.5
	Primary-Secondary spacing	1743.0 mm
	Effective Focal Length	8230 mm
	Field diameter	102 mm (42.5 arc min)
	Plate Scale	Arc seconds / mm
	Mounting flange to focal plane	355.6 mm
	ACE Instrument Thickness	
	Instrument to focal plane	

The optical quality of the f/13.5 is 80% of the light to fall in 0.5 arc seconds diameter.

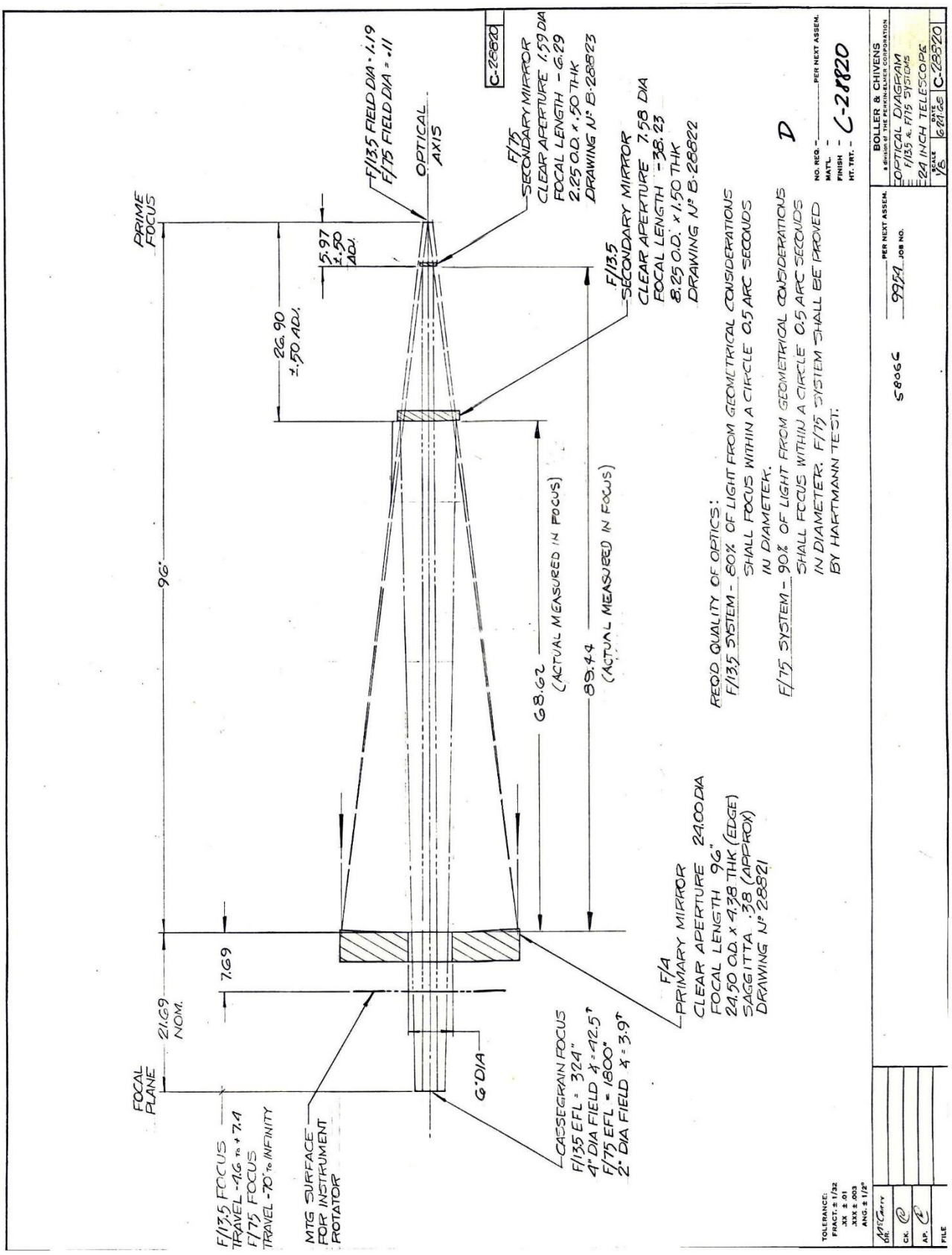
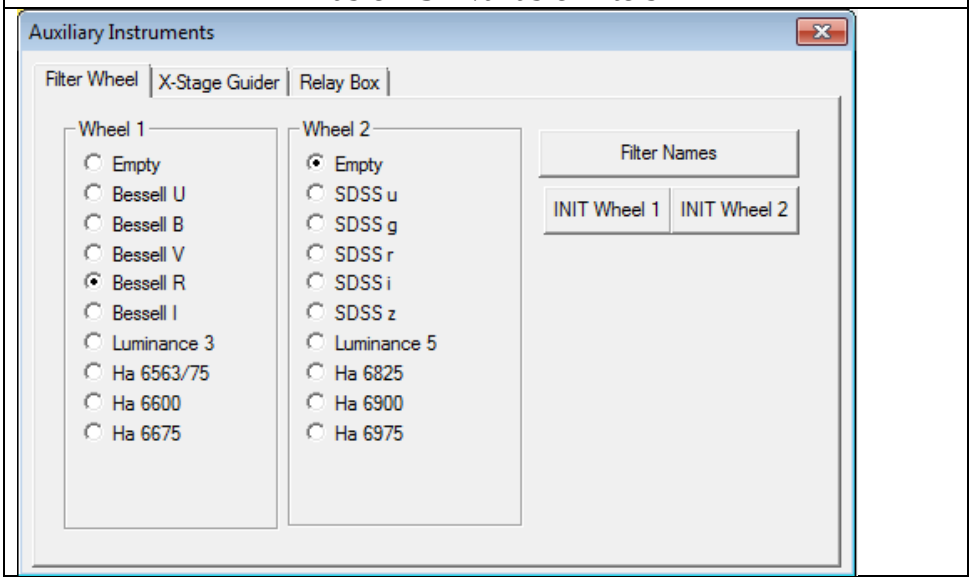


FIGURE 1-1 TELESCOPE OPTICAL DIAGRAM

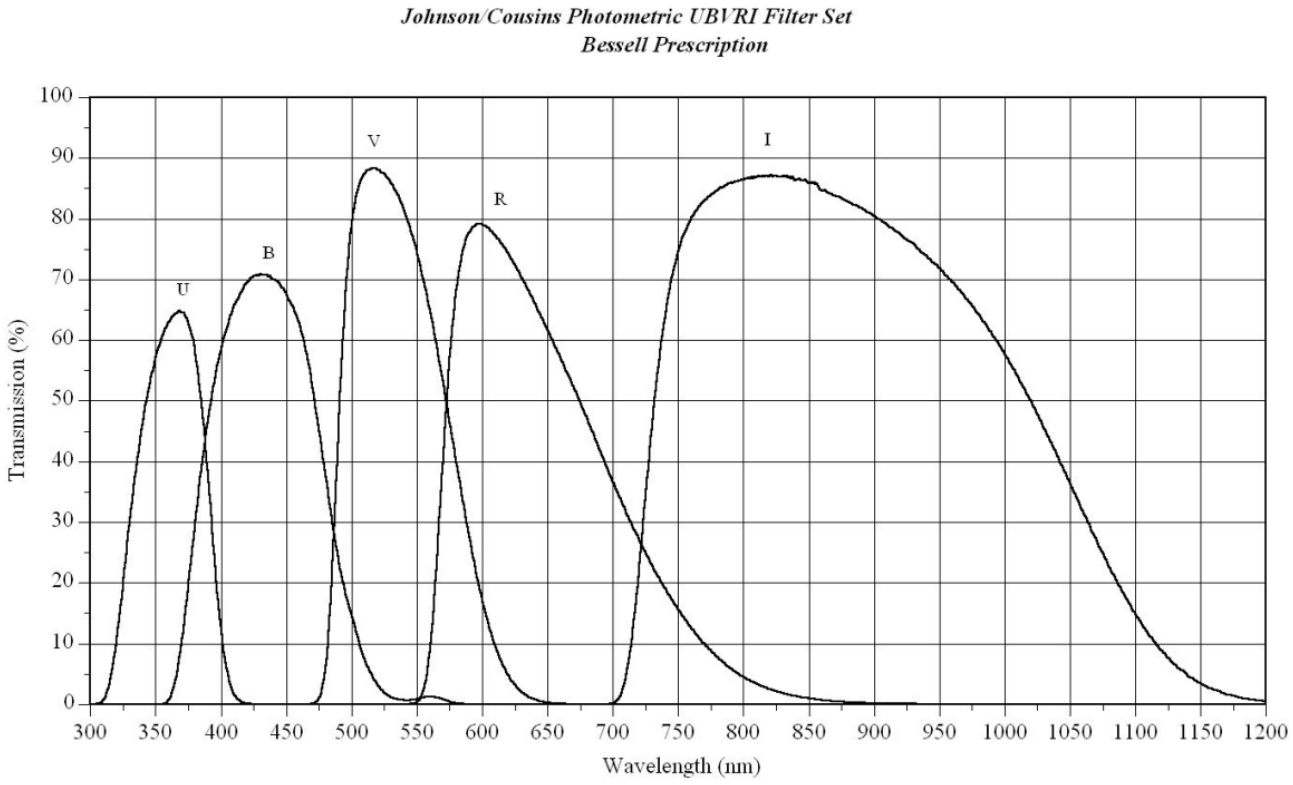
1.7 FILTERS

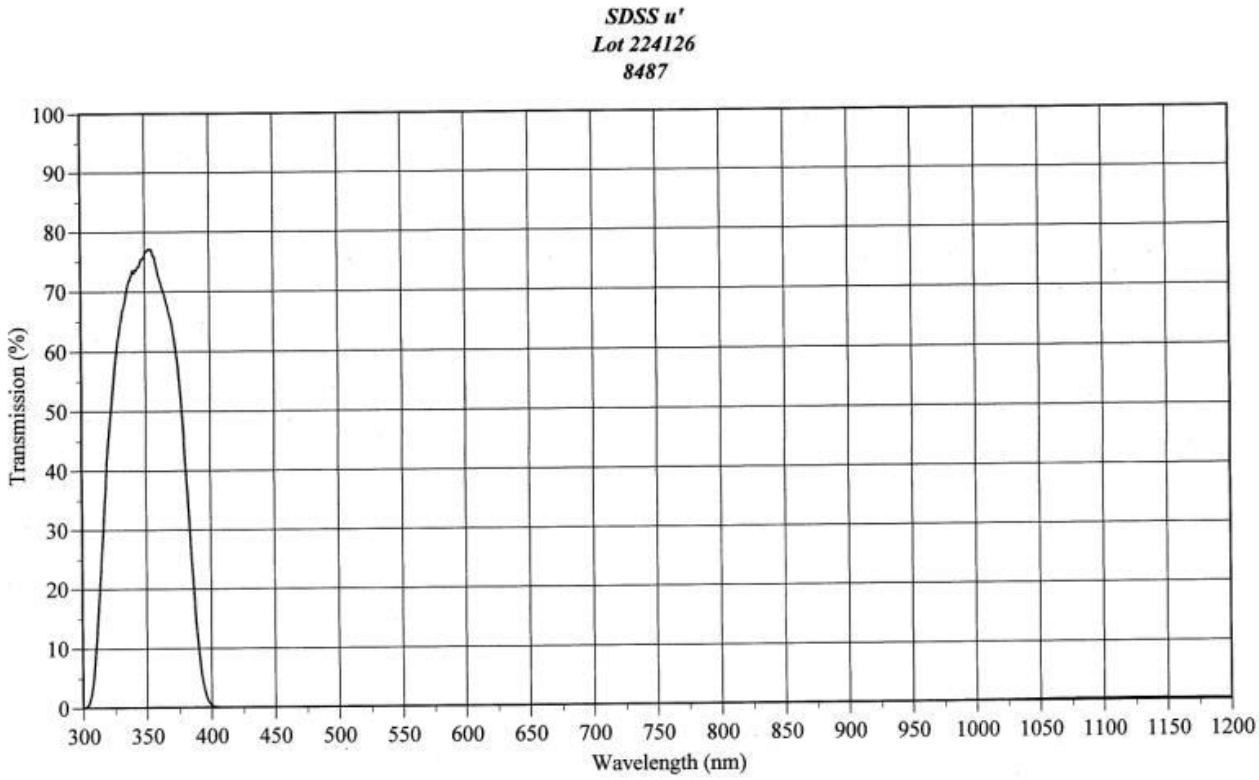
The following filters are normally available. Since every slot is already taken adding additional filters is not possible. Any additional filters will require additional filter jackets, available from ACE.

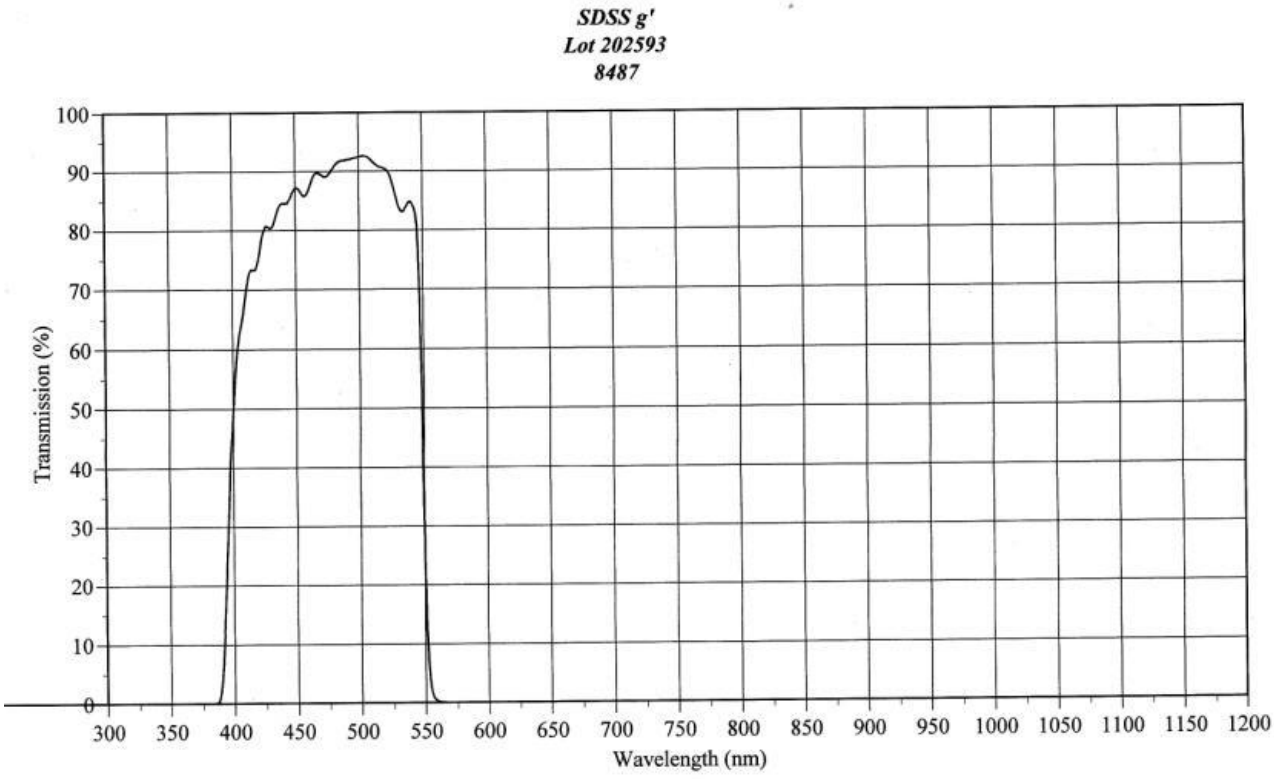
Table 1-5 Available Filters

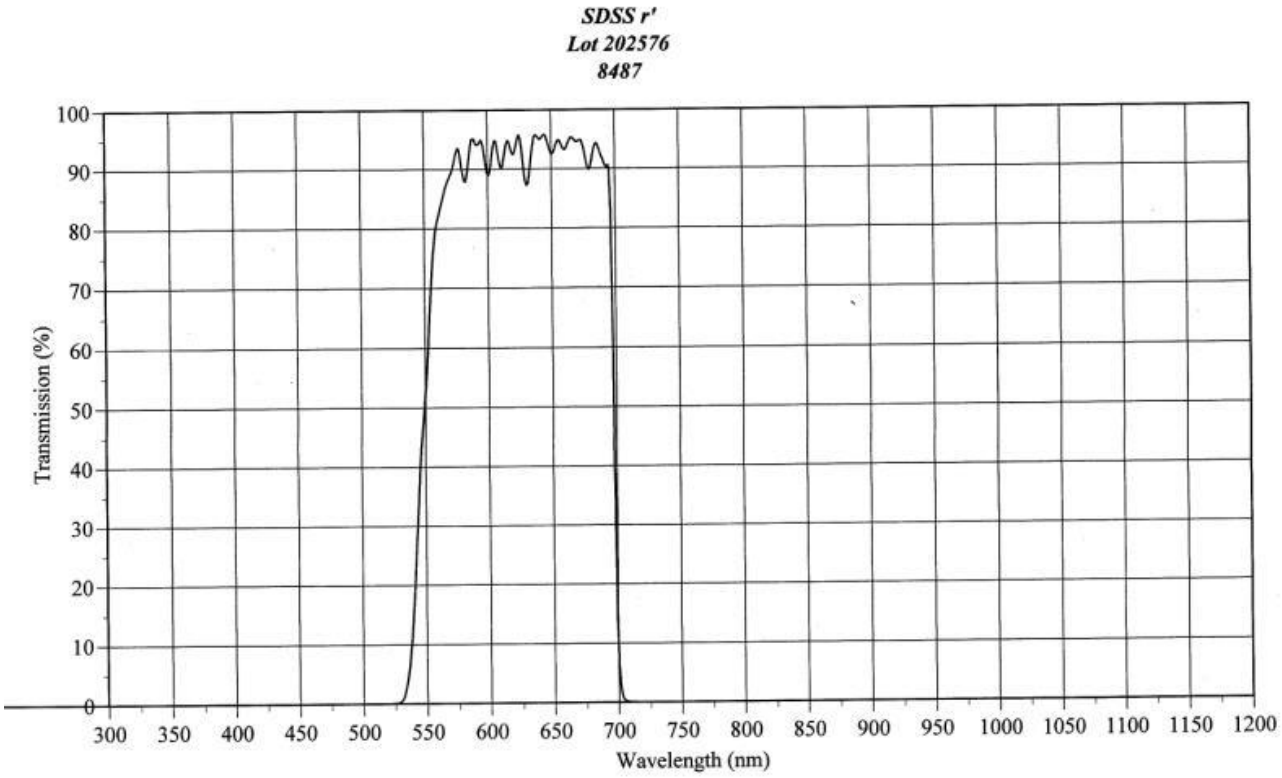


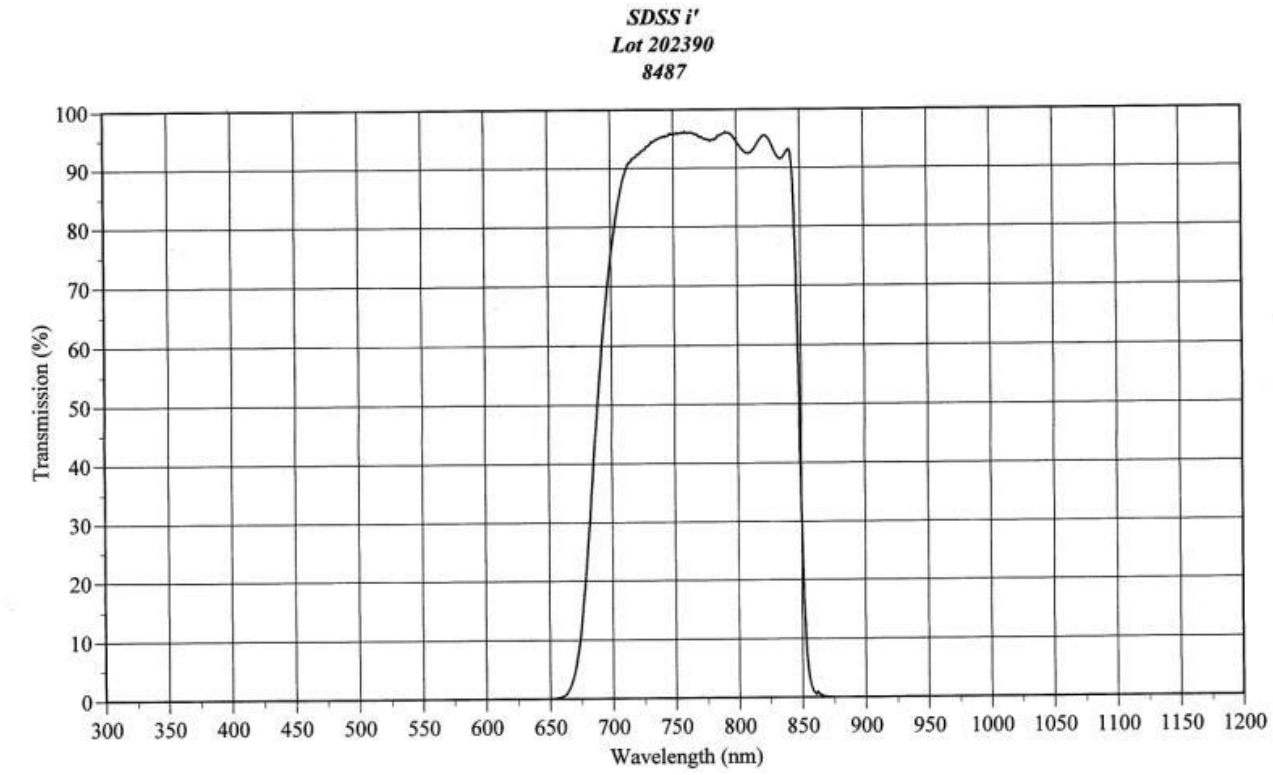
1.7.1 Transmission Curves for Bessell, SDSS and Luminance Filters



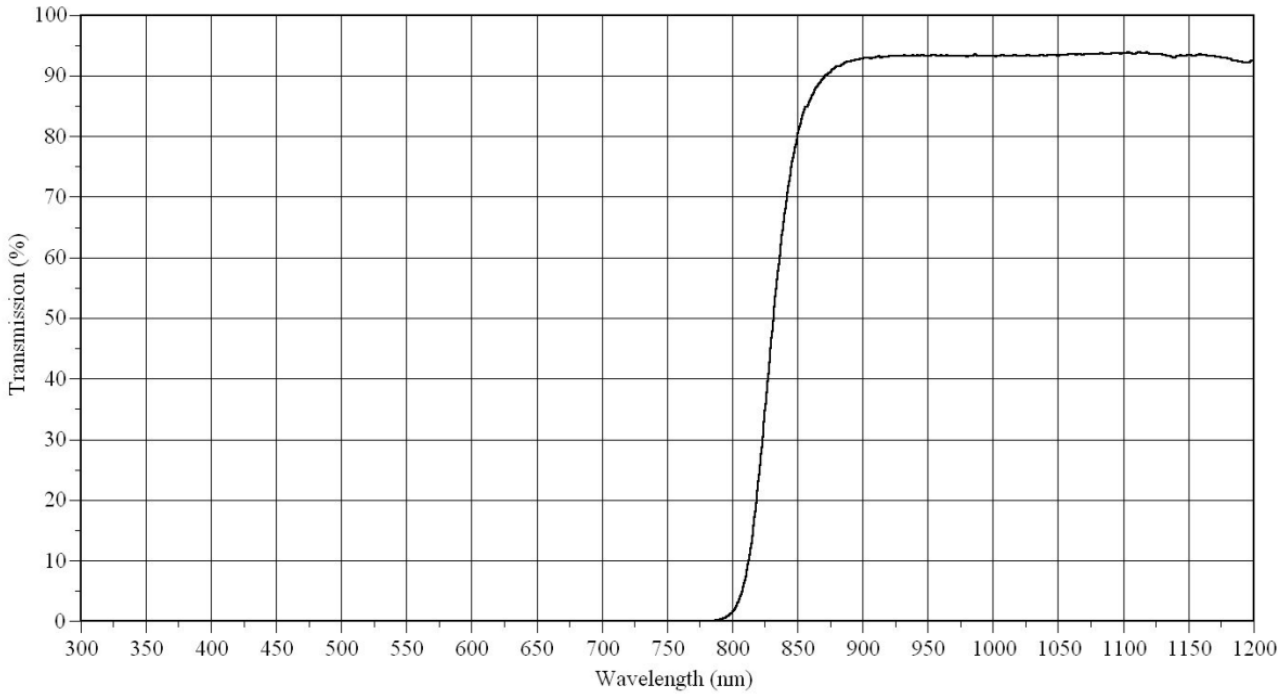

SDSS u'
Lot 224126
8487
Transmission (%)
Wavelength (nm)
0
10
20
30
40
50
60
70
80
90
100
300 350 400 450 500 550 600 650 700 750 800 850 900 950 1000 1050 1100 1150 1200


SDSS g'
Lot 202593
8487
Transmission (%)
Wavelength (nm)
0
10
20
30
40
50
60
70
80
90
100
300 350 400 450 500 550 600 650 700 750 800 850 900 950 1000 1050 1100 1150 1200

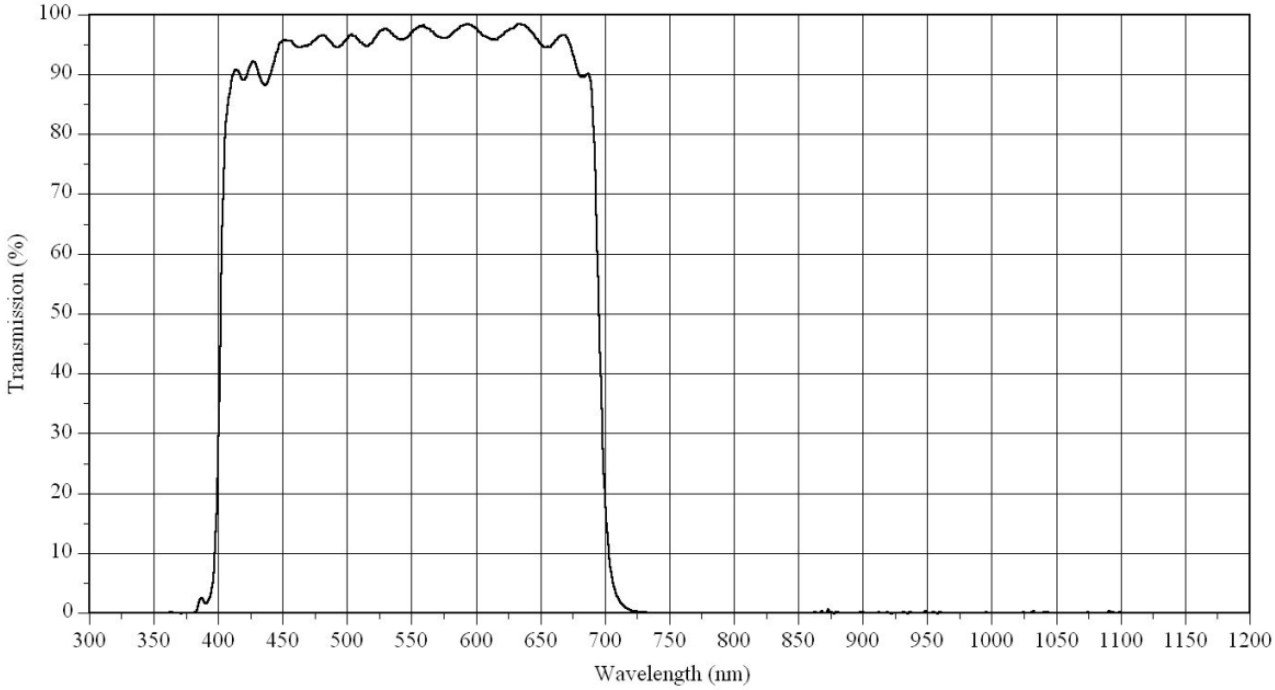

SDSS r'
Lot 202576
8487
Transmission (%)
Wavelength (nm)
0
10
20
30
40
50
60
70
80
90
100
300
350
400
450
500
550
600
650
700
750
800
850
900
950
1000
1050
1100
1150
1200


SDSS i'
Lot 202390
8487
Transmission (%)
Wavelength (nm)
0
10
20
30
40
50
60
70
80
90
100
300
350
400
450
500
550
600
650
700
750
800
850
900
950
1000
1050
1100
1150
1200

SDSS z'



Luminance
IR-Blocked Clear



1.8 DETECTORS.

The telescope is equipped with 4 cameras.

Location	Camera	Array (pixels)	Field (arcmin)
f/13.5 Cassegrain	Alta-E6-1105	1024x1024	9.5 x 9.5
Guider Port		510 x 765	
152 mm f/6.5 Guider	WATEC Video		
Top end of telescope			30 degrees

It is important to put the cameras back in the same orientation, should they be removed for any reason.

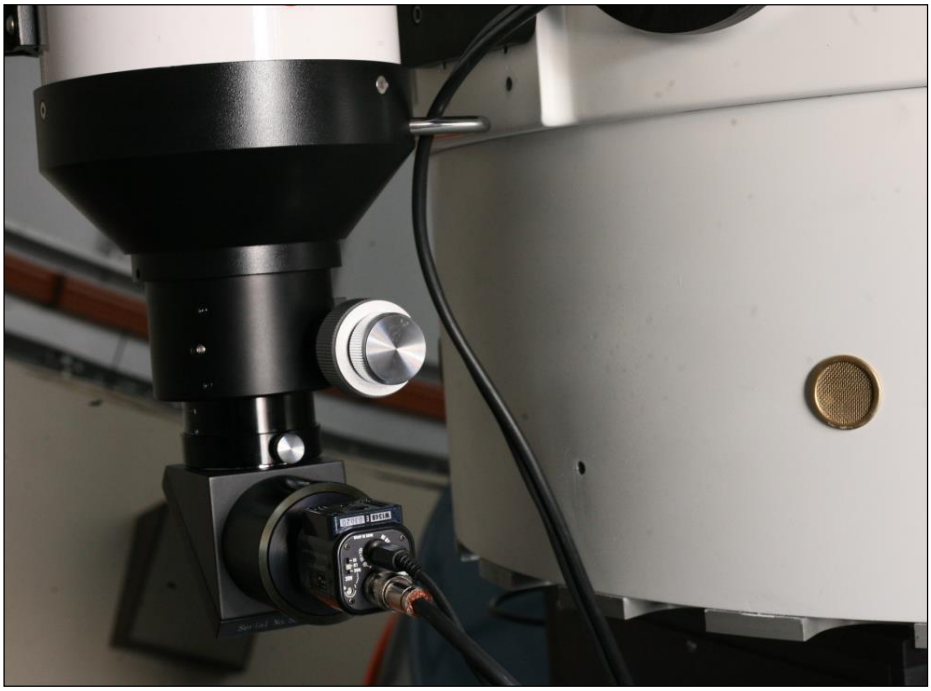


FIGURE 1-2 FINDER VIDEO CAMERA

The Finder video is aligned on the N/S axis as seen in Figure 1-2. Remember to focus the camera on a bright star. The field in the video system is SOUTH to the top and EAST to the left. Sorry, there is no way to invert this at present but we are working on a solution.

1.9 FAILURES AND EMERGENCIES

There are no on-site staff available for you to contact. Do not use this facility when precipitation is predicted within 12 hours or if conditions are marginal. Internet failures are common and the outages have been known to last for half a day or more when cables are severed.

Emergencies are categorized as situations like the dome being unable to close after an earthquake, as opposed to a camera being inoperable. If a piece of equipment fails in the night it will be at least the next day (or over the weekend the following Monday) before it can be seen to. The CTIO staff work Mondays through Fridays from approximately 09:00 through 16:00 local time with very few staff available during the night. Observers should report non-critical equipment failures in the usual manner and a response team will see to getting things back to normal.

Fill out the nightly report log so that ACE can see to non-critical concerns during normal business hours if there is a non-critical equipment failure. Some limited help may also be available during evenings and weekends on an ad-hoc basis, but it is not guaranteed help and is at the sole discretion of the staff.

Peter can also be reached on Skype (address tcb142). Please note that ACE staff do not provide training or observing assistance. They are only available for technical support. For non-technical issues contact the Observatory Director.

In the event of a true emergency contact ACE 24x7.

Table 1-6 Emergency Contact Information

From within USA	From CTIO IP Phone	
520 219 8722	01-219 8722	ACE Office / Peter's home
520 979 0101	01-979 0101	Peter's Cell Phone

2.0 COMPUTERS

2.1 ACCESS TO THE OBSERVATORY

The SARA Observatory computer system is a part of the NOAO network. Please bear in mind that the privilege to access the system comes with the responsibility to use it properly and keep the NOAO network safe. As NOAO is considered a large research facility by the NSF all users of the north or south networks are required to follow the NOAO Cybersecurity and Acceptable Use Policy. Please refer to and agree to follow the policies and guidelines in the document found at:

http://www.noao.edu/cis/secbasics/cybersec/cybersecurity_and_acceptableuse.html

To access the NOAO South network requires installing a VPN. This software can be obtained from

ftp://www.ctio.noao.edu/pub/software/VPN_CLIENTS

Download and install the software according to the platform (Windows 7, Linux, etc.) that you will use.

The VPN requires settings and passwords which, for obvious security reasons, are not published in this document. Please contact your supervisor or the Observatory Director for the security information. It is your responsibility to keep that information safe. Do not transmit this information by email.

Once you have the VPN going (see instructions of the following page) you can gain remote control of the computers using the software described in Section 0.

Please note that the VPN works in "hairpin" mode, which means that casual VPN surfing while the VPN tunnel is in place will actually originate from CTIO. Entering www.google.com you will see google Chile! Please do not surf through the VPN. Besides, it's real slow.

Finally, one more responsibility. The computers at the observatory should not be treated simply as another desktop computer. Rather, think of them as dedicated control computers designed for a specific task, like moving the telescope. Therefore, do not download and install any software on these computers. The only files that should be created are your own CCD images and telescope catalog files.

Do not update any system files, windows updates, etc. This will be done on a regular basis by the System Engineer.

2.1.1 The 'vpnc' VPN Client for OpenBSD, Linux and OS x.

To get going from a user's computer running linux, one can use the standard open-source Cisco compatible VPN client 'vpnc' available for most Unix style OSes via `'apt-get','yum'`, by downloading an RPM, tarball, etc.

One would just edit a configuration file (see the end of document) called 'vpn2ctio' or whatever, and then in linux type 'vpnc vpn2ctio' and that should ask for username and password, and make the connection. Configuration files are usually stored in a directory `'/etc/vpnc'.`

WARNING: if you actually put the accounts and *passwords* in this file, make sure to protect the file from prying eyes! For example,

```
chmod 600 vpn2ctio
```

It is safest to just leave the last two lines with the username/password out of the 'vpn3ctio' file and let the VPN client prompt for the name/password.

2.1.2 The official Cisco Client for Windows and Mac

For Windows download:

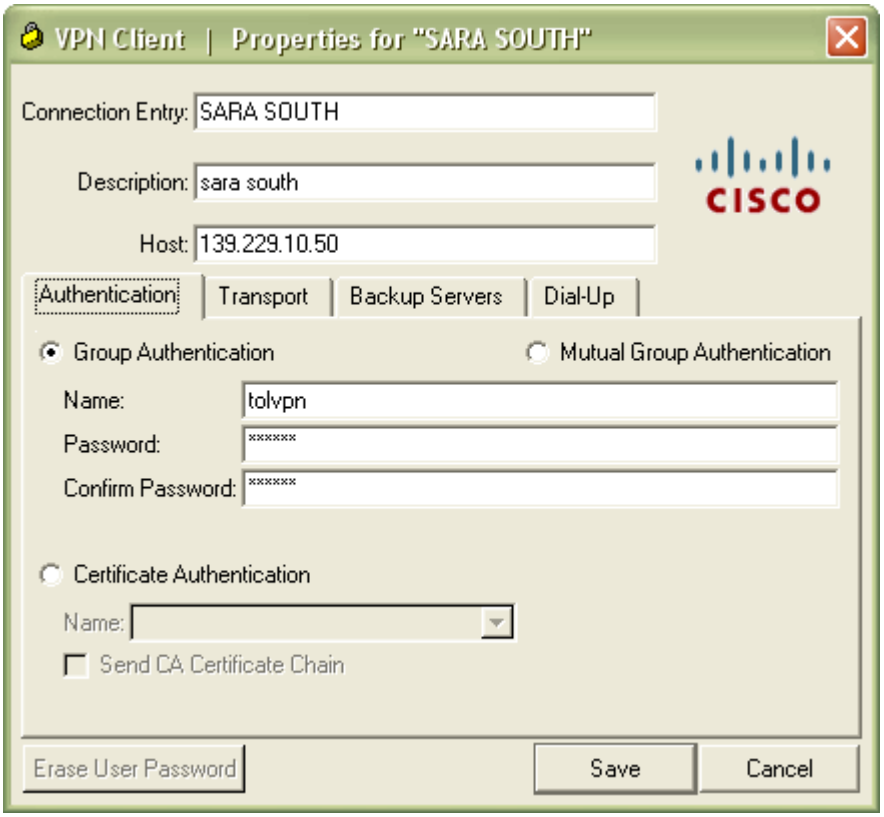
vpnclient-win-msi-5.0.00.0340-k9-bundle.exe

This works great with win XP Pro but it does not work with 64 bit editions.

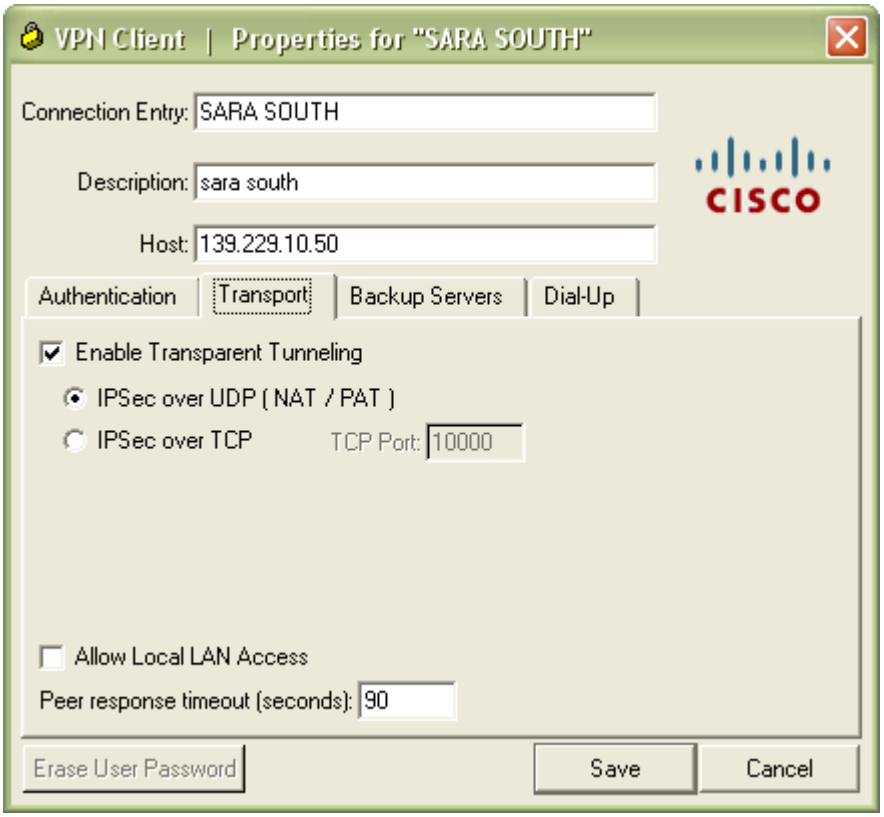
For MAC download:

vpnclient-darwin-4.9.01.0030-universal-k9.dmg

Here are screen captures for setup in a windows environment:



The password is z0nkeR (with a zero). Next, select the transport tab.



Press the save-button. From the main VPN menu highlight SARA South and press connect. You will be presented with a logon window:

The password is t01gEn_
This is a summary of the addresses, user names and passwords:

IP Sec	139.229.10.50	
IP Sec ID	tolvpn	
IP Sec secret	z0nkeR	That's a zero
Xauth username	tolgen	
Xauth password	t01gEn_	That's zero one

2.2 SARA PASSWORDS

One you get the VPN setup (see previous section) you can access the observatory as decribed in the following sections. There are only two usernames and passwords in use.

They are:

Username: SARA
Password: Kpn0CTI00rm

It's easy to remember!! It's the three observatories, KPNO, CTIO and ORM. We have just morphed it up a bit. Each of the three words starts with a capital letter or the number zero (since all letter O's are turned into zero's). Then capitalize the observatory you are using.

Use this username and password for radmin, realvnc and Windows login. Also for login to ACE.

The APC switch racks are slightly different as they don't allow as many characters. So it is:

Username: SARA
Password: CTI0 (That's a zero of course!).

2.3 NETWORK OVERVIEW

The control system utilizes three computers, one called "*TELSECOPE"*, one called "*CAMERA"* and one called "*OBSERVATORY*".

Various additional devices are controllable over the network including two switchable power outlet racks and an 8-channel video switcher

Under normal circumstances these devices are all left powered on all the time and protected from surges and power outage by a UPS system.

The IP addresses 139.229.14.226 through 239 are available for the SARA CTIO Observatory:

Address	Device	Notes
139.229.14.226	GPS CLOCK	
139.229.14.227	APC RACK #1	
139.229.14.228	APC RACK #2	
139.229.14.229	TELESCOPE COMPUTER	
139.229.14.230	OBSERVATORY COMPUTER	
139.229.14.231	CAMERA COMPUTER	
139.229.14.232	H.264 VIDEO	
139.229.14.233		
139.229.14.234		
139.229.14.235		
139.229.14.236	Swann Eye Camera	
139.229.14.237		
139.229.14.238		
139.229.14.239	ACE Echelle Spectrograph	

The following parameters are recorded for maintenance staff:

- ☑ Mask: 255.255.255.240
- ☑ Gateway: 139.229.14.225
- ☑ DNS1: 139.229.2.3
- ☑ DNS2: 139.229.11.18

Computer	What's on it?
TELESCOPE	ACE Control System
OBSERVATORY	Weather Station Cloud Sensor Security cameras (Swann Eye)
CAMERA	ACE Connector Client Leach Camera Connector Client DS9 MaxIm-DlLfor Autoguider

2.4 REMOTE CONNECTIONS

*** Remote connections only work through the VPN Tunnel ***

2.4.1 Remote Administrator

Remote Administrator viewer is available free of charge at www.radmin.com. It will only work on a windows platform but it is much faster than real vnc and is able to perform remote shutdown, file transfer, **chat tool** and remote access.

The port selection is as follows:

TABLE 2-1 RADMIN PORT ASSIGNMENTS

Computer	IP Address	Port Address
TELESCOPE	139.229.14.229	5229
OBSERVATORY	139.229.14.230	5230
CAMERA	139.229.14.231	5231

Note that you cannot use the default port assignment of 4899, you must use the port addresses shown above. They are easy to remember! It is 5 + the last three numbers of the IP address.

For the system to work efficiently the screen resolution of your computer must be equal or greater than the (1600 x 900) setting of the remote computer otherwise the screen will pan and scroll all the time making the experience very slow and frustrating. To avoid this problem right mouse click on the connection icon and select Properties from the pop-up menu (Figure 2-1). Select Fullscreen from the Video Mode. You can dramatically speed up the connection by reducing the amount of color. For normal use 16 bits is fine. It even works with 1 bit although the screen looks odd!

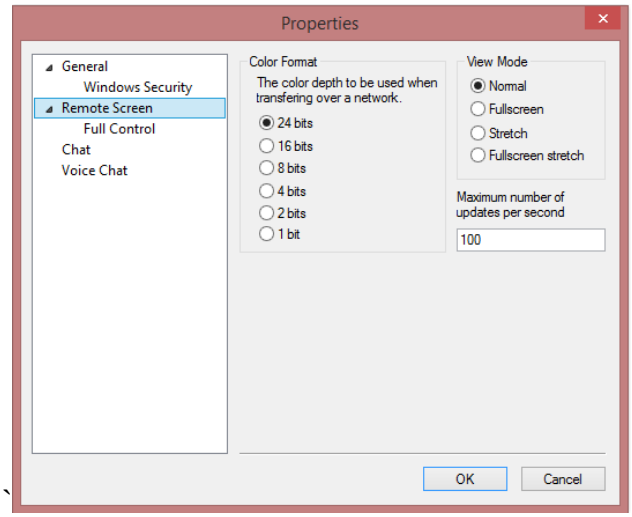


FIGURE 2-1RADMIN REMOTE SCREEN PROPERTIES

Radmin also has a CHAT tool. Much better than Notepad! Try it out if talking with ACE or you have multiple observers.

2.4.2 Real VNC

Real vnc can also be used to connect remotely. The viewer is available free of charge at www.realvnc.com. This works from any platform (choose the correct operating system for your remote computer). However, it does not allow for a chat tool and file transfer, and it is not as fast as Radmin.

TABLE 2-2 REAL VNC PORT ASSIGNMENTS

Computer	IP Address	Port Address
TELESCOPE	139.229.14.229	6229
OBSERVATORY	139.229.14.230	6230
CAMERA	139.229.14.231	6231

2.5 APC SWITCHED RACK PDU

The Switch Rack PDU (Power Distribution Unit) is a networkable device with eight power outlets. It is possible to turn on/off and reboot each individual outlet or a set of outlets. The system has been setup so the choosing the control action "*Reboot Immediate*" will turn off a given device for a pre-determined number of seconds and then turn it back on again. The longest reboot cycle to turning back on is set at 25 seconds.

There are two PDU's in the system with the following assignments:

TABLE 2-3 SWITCHED RACK PDU ASSIGNMENTS

Outlet #	Rack #1 http://139.229.14.227	Rack #2 http://139.229.14.228
1	TELESCOPE Computer	Weather Station
2	OBSERVATORY Computer	Digital Video Recorder
3	CAMERA Computer	ACE SmartDome
4	ARC Camera	GPS Clock
5	Guider Camera	ACE Echelle Spectrograph
6	All Sky camera	Not in use
7	ACE Control Cabinet	All Sky Camera USB Extender
8	Telescope USB Extender	Boltwood Cloud Sensor

To access the Switched Rack PDU use a web browser and enter the address shown above. Alternatively, from one of the SARA computers use internet explorer to find the device from the favorites list. (Please do not alter or *delete* the favorites list!!).

The username and password for both PDU's is:

User Name: `SARA`
Password: `CTIO`

2.6 8-PORT VIDEO SWITCHER

This device is currently out of service. Due to Windows 7 64 bit upgrade.

The observatory has a suite of video cameras attached to a digital video switcher. To access the video you must be connected through the VPN. Use your remote browser to point to

http:// 139.229.14.232

USE YOUR OWN COMPUTER TO DISPLY THE CAMERAS. IT IS MUCH FASTER THAN DISPLAYING IT IN CHILE AND LOOKING AT THE REMOTE COMPUTER WITH RADMIN

The software may ask you to install a local applet. The screen will fill with a blank black window. Click once in the area and a login dialog will appear. The user name is `sara` and the password is `1234`.

There are currently six cameras installed:

CAMERA	TITLE	NOTES
1	NORTH	Color, inside dome looking north
2	WEST	Color, inside dome looking west
3	EAST	Color, outside, looking east.
4	INSTRUMENT	Color, details of instrument X-Stage guider, etc.
5	FINDER	WATEC mono, attached to 152mm refractor
6	WIDESKY	WTEC, mono, attached to top of the telescope secondary.

3.0 ACE CONTROL SOFTWARE: MAIN SCREEN

3.1 STARTING THE SOFTWARE

FIGURE 3-1 THE ACE START ICON

The ACE software is always run out of the directory D:\ACE\Current Release. An icon appears on both the desktop and the START menu. The date in the icon reports the version of the software.

3.2 LOGON

If your administrator requires logging onto the system then the logon dialog appears (Figure 3-2).

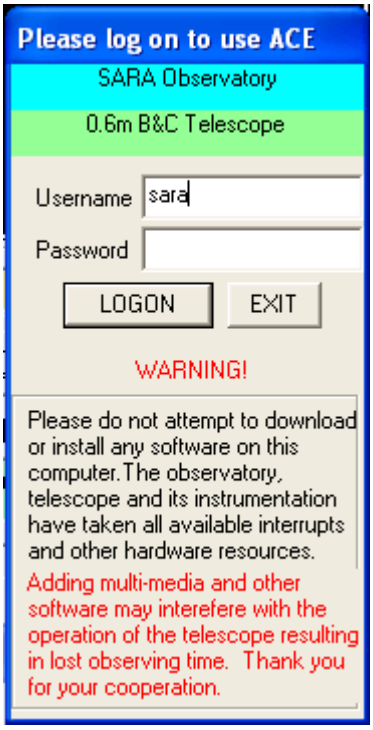


FIGURE 3-2 ACE LOGON DIALOG

WARNING.

THIS IS A TELESCOPE CONTROLLER, NOT A GENERAL PURPOSE COMPUTER. DO NOT LOAD ADDITIONAL SOFTWARE AND KEEP THE DATA STRUCTURES NEAT AND TIDY BY FOLLOWING THE PROTOCOLS OUTLINED IN THIS MANUAL

The standard login is:

Username: `SARA`
Password: `Kpn0CTI00rm`

The login and logout functions are available from the `User` menu. When you have finished with the system it is best to log out. It is possible to log on as another user without disturbing tracking or other critical settings. The menus displayed in ACE change depending on the user level. Unless otherwise noted all the features described in this manual are available to all users.

3.3 INITIAL SCREEN

Assuming that the software has just been started and that no user has yet logged on the screen will look like Figure 3-3. (Note*: some screen captures are from other ACE installations and there may be small differences in the screen captures where the content is not important*)

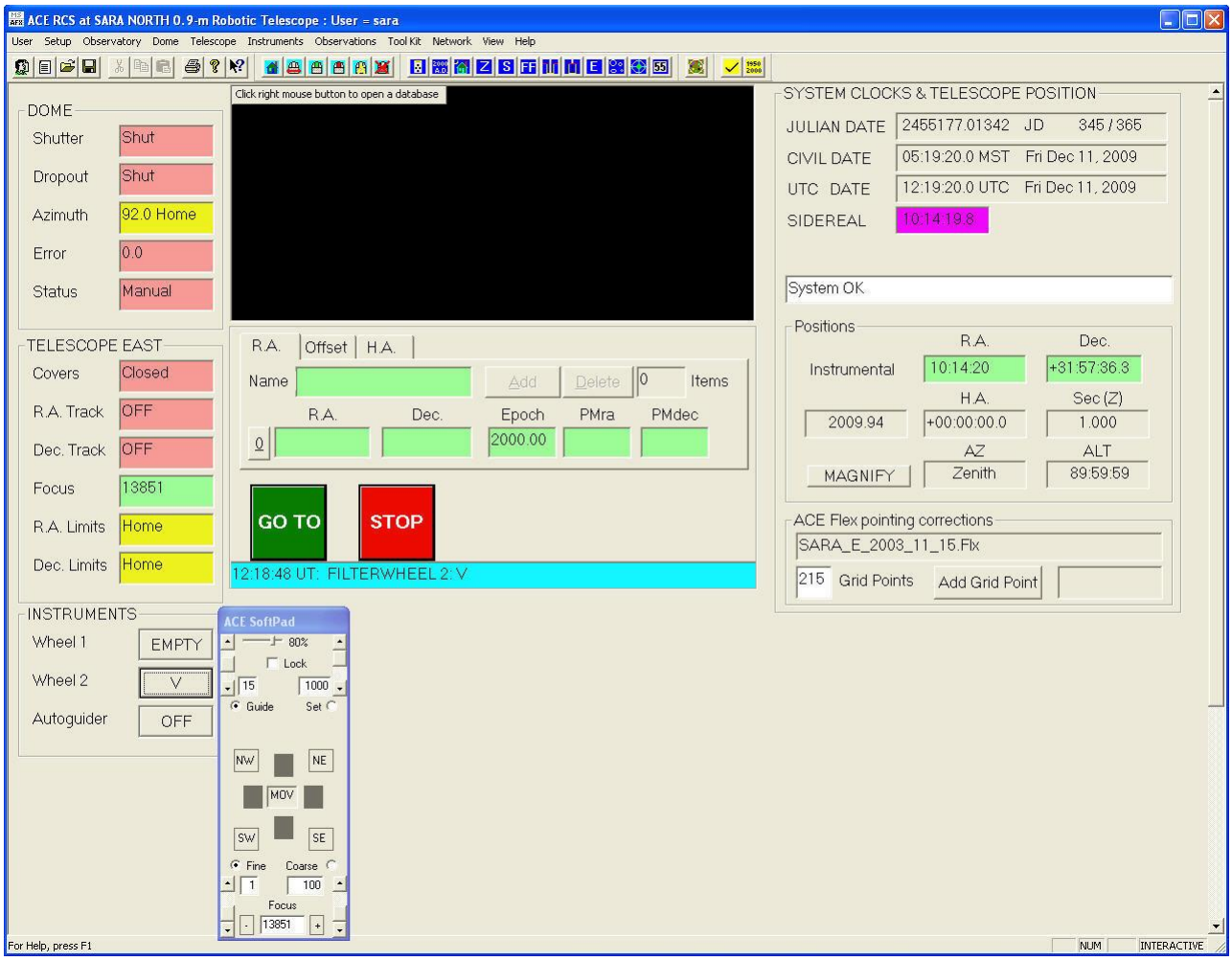


FIGURE 3-3 INITIAL SCREEN APPEARANCE

The ACE Control System uses a "traffic light" scheme for colors. Red items are closed, at a limit or otherwise in a non-observing state. Yellow objects are changing or at a temporary "home" position, and green items are ready for use.

The status of the dome, telescope and instruments is shown at the left of the screen. The center of the screen has a catalog area, GOTO and STOP buttons, and a series of message boxes. The right side displays system clocks and the current position of the telescope.

Other features are accessed by a series of menus.

3.4 STOP BUTTON

Pressing the STOP button is the software equivalent of pressing the physical emergency stop button located on the dome floor. It will stop all motion and issue a statement.

This button also resets many of the velocity, acceleration and other parameters in the system back to their default values.

The system fully recovers from using the STOP button without any loss of position, etc. When performing a GOTO move and wishing to stop the motion the CANCEL button can be used which prevents the statement dialog from appearing.

3.5 R.A., OFFSET AND H.A. TABS

The GOTO button moves the telescope to the coordinates specified by the data fields in the R.A, Offset or H.A. tabs.

Using the R.A. tab will send the telescope to a (RA,DEC) position and the tracking will automatically start. The boxes will be green and the RA and DEC tabs will be highlighted to the right side of the screen.

Using the H.A. tab will send the telescope to a static (HA, DEC) position and the tracking will automatically stop. The boxes will be orange and the HA and DEC tabs will be highlighted to the right side of the screen.

Using the Offset. tab will offset the telescope in (RA, DEC) by a given number of arc seconds. The tracking must be turned on to use this feature. The boxes will be yellow with red numbers and the RA and DEC tabs will be highlighted in yellow to the right side of the screen.

These fields automatically check in real time the data entry. If a user makes a error (Figure 3-4) such as entering -10 11 76 for the declination then a warning message appears and the GOTO button will not do anything until the condition is cleared.

FIGURE 3-4 BAD DATA ENTRY

3.6 CATALOGS

The area above the data entry tabs is for catalogs. Three standard catalogs are provided.

- Yale Bright Star Catalog (`ACE_BSC5.cat`)
- Messier Catalog (`Messier.cat`)
- NGC Catalog (`NGC.cat`)

Other catalogs can be imported. Users are also able to create, modify and save there own catalogs.

3.6.1 Opening a Catalog

Point anywhere on the screen and press the right mouse button. A pop-up menu appears.

FIGURE 3-5 DATABASE POPUP MENU

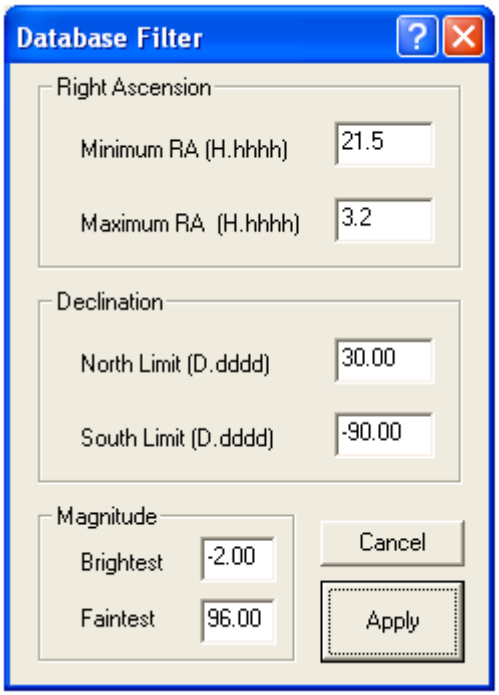
Select **Open Existing Catalog…** A list of available catalog files appears. They all have the file extension `.cat`.

The catalog is loaded and the number of entries in the catalog is displayed in the **Items** box at the right side of the Tabs pane.

If nothing appears in the catalog area then the database filters may be set so as to exclude all items (see below).

3.6.2 Filter a Catalog

Catalogs can be filtered (Figure 3-6) according to the user requirements. Use the right mouse button and select the **Filter Catalog** option from the pop-up menu. The most obvious filter is to remove objects which are below the declination limit of the observing site. These objects remain in the catalog; they are just not displayed. However, it is possible to permanently remove objects, as discussed in section 3.6.3.



MESSIER	R.A.	Dec.	AltName	Notes	m#
M2	21 33 27.00	-00 49 24.00	N7089	Gb	002
M30	21 40 22.03	-23 10 44.60	N7099	Gb	030
M74	01 36 41.84	+15 46 59.60	N0628	Gx	074
M77 CETUS A	02 42 40.83	-00 00 48.40	N1068	Gx	077

FIGURE 3-6 FILTER CATALOG

If the minimum RA is greater than the maximum R.A. as in the example shown above then the wrap through zero hours will occur. The result of this filter being applied to the Messier Catalog is to reduce the listing to four items. Once the filters have been applied click on the red X button to quit the dialog.

3.6.3 Sorting Catalogs

Catalogs can sorted by clicking on the column header. Note that the ACE_BSC5 catalog is sorted by magnitude. You can save the catalog (under a different name please!) so that is sorted by R.A. To do this sort by R.A. and then use **Save Catalog As….** Note that only the objects which are displayed will be saved. Any objects which have been filtered out will not be saved.

3.6.4 Editing Catalogs

Catalogs can edited by selecting the **Catalog Cells Editable** option from the pop-up menu. The background of the catalog changes from green to pink. You can then select any one of the cells and change values.

If you wish to edit one of the three standard catalogs please save your private version under a different name so as not to corrupt the original.

When a catalog has been changed and not saved (Figure 3-7) the column headers will turn red to warn the user.

Name	R.A.	Dec.	V	B-V	R-I	U-B
SA_140-84	00 03 37.90	-28 41 46.00	11.96	0.67	0.36	0.14
SA_140-85	00 03 38.50	-28 37 25.00	12.22	0.72	0.37	0.20
HD_315	00 07 44.10	-2 32 55.27	6.44	-0.14	-0.06	-0.50
SA_116-99	00 17 40.70	-13 53 41.00	12.13	0.73	0.36	0.34
SA_68-280	00 18 04.80	15 54 21.00	11.26	0.88	0.42	0.51
SA_116-180	00 18 04.90	-13 57 22.00	12.25	0.43	0.27	-0.03
SA_68-216	00 18 18.40	15 49 16.00	12.41	0.58	0.36	-0.03
SA_44-28	00 29 04.60	30 23 06.00	11.33	0.74	0.37	0.22
SA_44-113	00 29 36.90	30 23 18.00	11.71	1.21	0.57	1.03
PG_0029+024	00 31 42.10	02 37 45.00	15.27	0.36	0.34	-0.18
HD_2892	00 32 12.15	01 11 17.30	9.37	1.32	0.62	1.41
BD-15_0115	00 38 20.26	-14 59 54.15	10.88	-0.19	-0.10	-0.86

FIGURE 3-7 CUSTOM CATALOG NOT SAVED

To create a custom catalog either use the **Open New Catalog** tool from the pop-up menu or use the **Import Catalog** tool from the Toolkit menu.

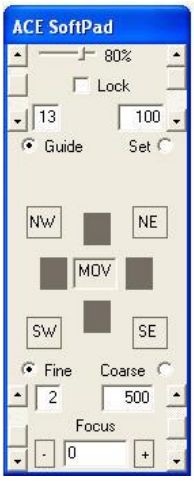
Also, it is possible to enter values into the data entry boxes above the GoTo button and then use the **Add** button to add this entry to a catalog.

4.0 ACE CONTROL SOFTWARE: TELESCOPE MENU

4.1 OVERVIEW

The Telescope menu gives access to additional telescope functions not included on the main screen. The icons shown at the left side of the menu are also available from the toolbar at the top of the main screen.

4.2 ACE SOFTPAD™



The ACE SoftPad™ automatically displays when the application starts. There is only one way to alter the visibility, by clicking on the menu (or the Toolbar shortcut).

The four black squares (■) represent the cardinal N S E W directions.

It is also possible to move in two axes at once using the **NE NW SE SW** buttons.

To move simply click the left mouse button over the square and hold it down for as long as motion is required.

The speed at which the telescope moves depends upon the **Guide** and **Set** radio buttons.

The slider bars permit changing the guide and set rates

In the same manner the **Fine** and **Coarse** radio buttons dictate the **Focus** speeds. The **Lock** check box hides the slider bars.

The physical hand paddle (located in the dome) reads the **SoftPad** speeds. You can change the focus speeds for eyepiece viewing this way. Otherwise we do not recommend moving the telescope focus using the ACE SoftPad™. There are better ways such as using the Focus Tool.

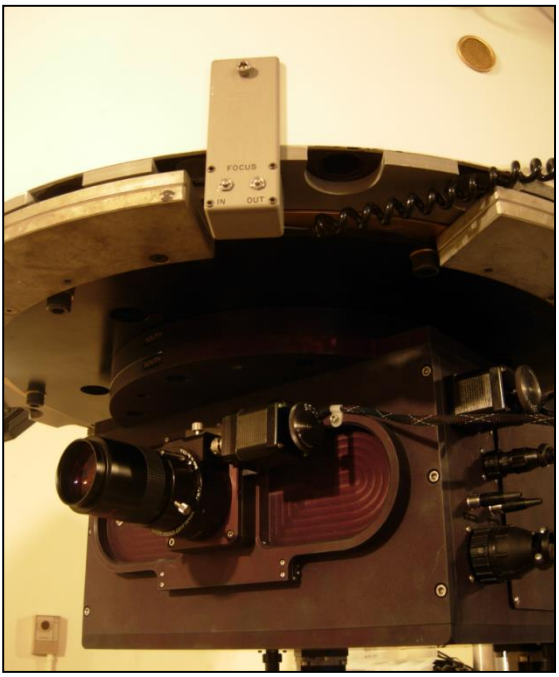
Both the actual hand paddle and the ACE SoftPad™ have little use in everyday observing. To move the telescope while observing remotely use the RA, Offset and HA tab fields and the GoTo button.

For on-site observers there is a wireless hand paddle.
The paddle has four buttons for the cardinal directions NSEW. Pressing the buttons moves the telescope at guide speed, which is very slow. Press and hold the SET button with the desired NSEW to go faster. Use SLEW to go even faster.

SET and SLEW also give three speeds for all the other functions.

XSTAGE moves the eyepiece port left-right but it is best kept close to the center.

AUX Focus moves the GUIDER PORT or EYEPIECE.



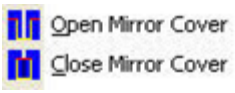
There is an auxiliary paddle fixed to the telescope. It permits the eyepiece to be focused which is a convenient way to give visitors the chance to change focus without using the main hand paddle, where they could press the wrong button and accidentally move the telescope. Pressing the SET and SLEW buttons on the main hand paddle also affect the auxiliary paddle.

4.3 TELESCOPE PARKING

By definition a Park position is one where the telescope tracking is turned off. There are three pre-canned positions. Pressing these will enter values into the HA tab data entry fields. The Zenith will move on a Yes/No answer and the other requires pushing the GOTO button.

Parking the telescope is a safe way to leave the system. The tracking will be off.

4.4 MIRROR COVERS



The telescope primary and secondary mirrors have automated covers. A single command is used to operate both covers. The status of the mirror covers is shown in the Telescope Status window.

The mirror covers are designed to automatically close in the event of a computer power loss or when restarting the computer.

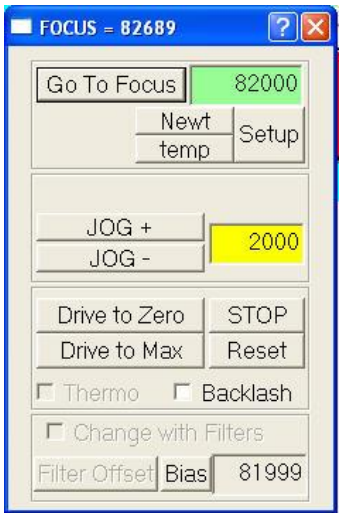
4.5 RESET ENCODERS

Only available from the toolbar, not the menu, to discourage its use. This function is used to reset the position of the telescope with a known bright star. Use this function with caution as resetting on a wrongly identified star will cause other objects to be out of the field. For systems with absolute encoders the amount of reset is limited to a fraction of a degree and it adds a DC offset to the encoder values.

4.6 HOME

This function will park the telescope at the zenith for absolute encoder systems. The RA and DEC Limits will report HOME. (The main purpose of this routine is for telescopes without absolute encoders).

4.7 FOCUS

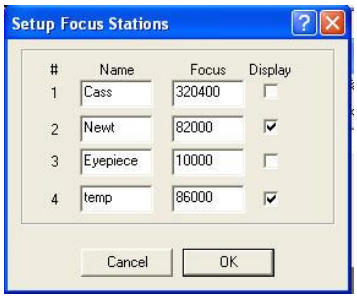


The **Telescope Focus** menu toggles the visibility of the **Focus** dialog. This dialog is multitasking - it can remain on the screen while other tasks are being executed.

The current value of the telescope focus is displayed In the title bar of the **Focus** dialog and in the TELESCOPE status pane at the left of the screen. The latter display will be green unless at a limit when it turns red.

Clicking on the **Go To Focus** button will move the focus ram to the absolute value displayed in the green box.

The focus is equipped with a 24-bit absolute multi-turn encoder. The Reset button is disabled and cannot be used. It is not possible for the user to change the value of the encoder to some arbitrary value.



The **Setup** button displays a modal dialog that requires immediate attention. It can be used to store default values for up to four instruments.

Clicking on the instrument button name (e.g. **Newt**) will load the default value into the green Go To Focus edit box. This is a convenient way to store approximate values of different instruments.

It is also possible to move the focus by an incremental amount. Use the **JOG +** and **JOG -** buttons to offset the focus by the amount shown in the yellow edit box. A focus change of 50 units can be detected. When starting to get to focus use 2000 units.

Drive to Zero will send the focus ram all the way to the OUT limit at high speed. Zero is defined as the maximum separation of the primary and secondary mirrors.

Drive to In moves the focus ram all the way to the in limit switch (minimum primary-secondary separation).

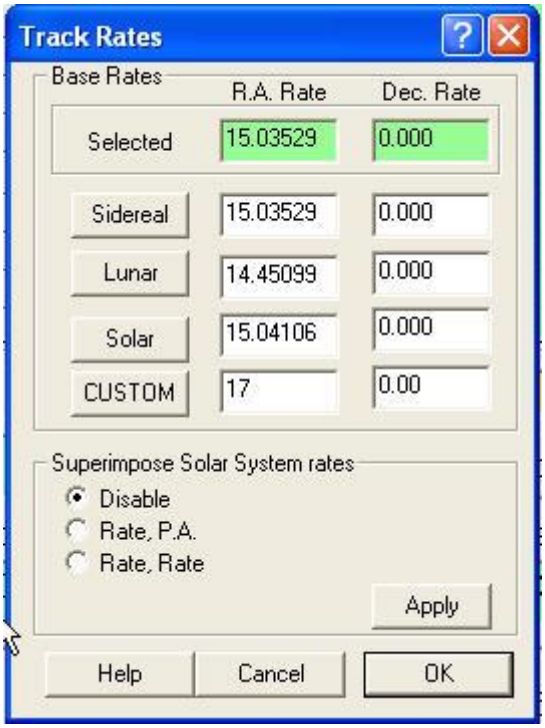
The **STOP** button will arrest the focus ram. It is useful when using a real-time video camera or for stopping the ram when an unintended destination was issued.

It is possible to compensate for different thickness filters loaded in an ACE Filter Wheel. Focus the telescope and then press the **Bias** button. This will set the DC level and it is displayed in the read-only edit box. To calculate the offset for a given filter press the **Filter Offset** button.

4.8 TRACK ENABLE

This toggles the status of the tracking if you want to manually turn it on or off. Otherwise just let the system take care of tracking. It knows when you want to track or park.

4.9 TRACK RATES



The **Track Rates** menu command permits sidereal or non-sidereal tracking. The desired rates are entered in arc seconds per second. The rates are limited to the following ranges:

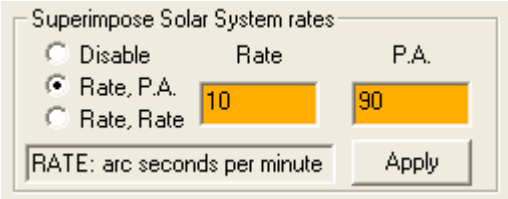
- R.A. 15.000 ±3.000 arc_seconds/s
- Dec 0.000 ±3.000 arc_seconds/s

Click the **Sidereal** button to load the standard tracking rates. Mean Lunar and Solar rates are also available. It is possible to **Save Custom Rates** for a comet or asteroid. Use the **Load Custom Rates** to retrieve the settings.

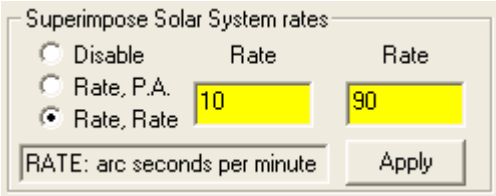
The current tracking rates are shown in the TELESCOPE pane at the left of the main screen. Sidereal tracking has a green background. Non-sidereal tracking has a yellow background.

4.9.1 Superimpose Solar System rates

You can also enter non-sidereal tracking rates as listed in web sites such as the Minor Planet Circulars (MPC). This site, and others, give the motion of the solar system object either as a rate and position angle, or as a rate in both R.A. and Dec.



The **Rate, Position Angle** dialog requires rates in arc seconds per minute and a position angle in degrees, which are the same units used by the MPC.
(Note: The required units are displayed when the cursor is placed in each edit box).



The **Rate, Rate** dialog requires rates in arc seconds per minute for R.A. and Declination. Again, these rates are relative to sidereal motion.

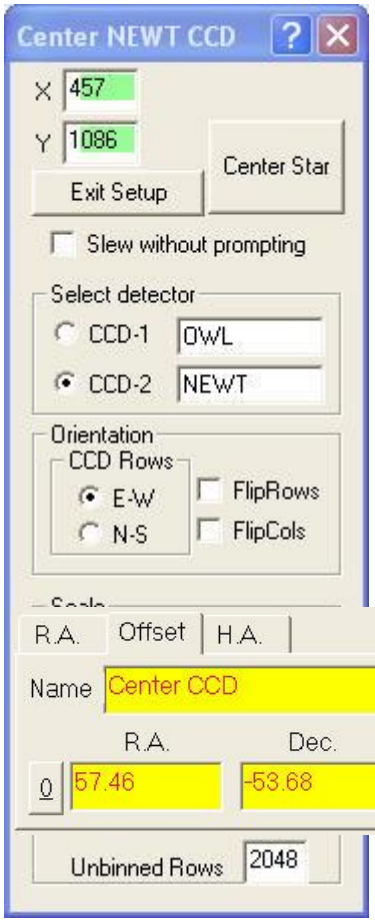
Pressing the **Apply** button will add these rates to the current (sidereal) tracking rate.

When you have finished with this feature re-enter the Track Rates dialog if it is not already displayed and press the **Disable** button. The tracking will go back to the previous state, which is usually sidereal, and the declination tracking will turn off.

4.10 CENTER CCD

This tool is in the telescope menu because its function is really to center the telescope.

Enter the pixel (X,Y) coordinates of a star from the CCD frame and the dialog will calculate the offset in R.A. and Declination to put that star at the center of the CCD. Using MaxIm-DL on the CAMERA computer the coordinates will be displayed in the center of the bottom window pane.



Setup Options

This expands the dialog to show setup parameters. Two sets of parameters are stored catering for two CCD's. In this example we have stored information for the two cameras called OWL and NEWT.

The most important first step is to ensure that the CCD images are being displayed with NORTH up and EAST to the left. If not change the parameters in your display tool.

Now select a star that is in the NE of the frame. To center this star you know that the telescope has to move NE. This means that the offset tab must display positive numbers for both R.A. and Declination.

Click on Center Star and examine the offset tab:

Alter the FlipRows and FlipCols check boxes until both entries are positive.

The Scale pane specifies the current Binning Factor. The number of arcseconds per unbinned pixel and the number of unbinned rows and columns complete the required information.

Press Exit Setup to get back to the smaller dialog and to save the information to disk.

Note: *All this has already been set and you only need to do this for new configurations.*

5.0 ACE CONTROL SOFTWARE: DOME MENU

5.1 OVERVIEW

The dome can be controlled by push buttons on the ACE SmartDome™ Controller located on the dome floor. The ACE SmartDome™ lower box talks to the upper box by means of a radio. In the event of a radio failure or other equipment failure the dome doors can be operated by the top box push buttons.

Caution for on-site personnel: The top box buttons are for emergency use only. They purposefully bypass the limits and computers to provide the simplest failsafe solution to close the dome.

The dome has two shutter doors. The main door takes approximately 2 minutes to open. The horizon door takes approximately 1 minute. The two door are interlocked. The main door must be partially opened before the lower door will operate.

Under normal circumstances the dome is operated in "synchronized mode" which means that where possible both doors will operate simultaneously.

The dome is connected to the telescope controller by a COM serial port.

The following functions are available for software control:

5.2 HOME

The dome is equipped with an encoder. When it passes a "home" position it automatically resets the dome azimuth to the home value. The main purpose of the home function is to reestablish the position in the event of a power loss. For this reason it is recommended to park the dome at the home position.

5.3 AZIMUTH

Select Dome>Azimuth from the Dome menu.

The dome can be sent to a particular azimuth. Just enter the desired azimuth in degrees (0 to 359) measured North through West.

If AutoDome is currently engaged a dialog requesting to turn it off pops up. Answering No will deny your request.

5.4 RESET ENCODER

This function is not available for domes equipped with absolute encoder systems.

If the dome has been moved with the SmartDome controller off then the dome position will be lost. You can easily re-establish position by placing the dome due south. Standing under the polar axle and against the north pier look south. The telescope polar axle should bisect the view of the dome. It is then at 180°. However, the preferred method for reestablishing position remotely is to use the Home function.

Select Dome>ResetEncoder from the Dome menu.

The reset azimuth defaults to the current azimuth.
Enter a new value (0 to 359) and press reset.

5.5 OPEN SHUTTER

Select Dome>OpenShutter from the Dome menu.

It is not possible to open the lower shutter without first opening the upper shutter. The status of the dome doors is reported in the DOME pane at the top left of the screen. If selected, the lower door will start to open approximately 5 seconds after the main shutter has fully opened or after the main shutter has cleared its interlock is the SmartDome controller has been set to allow synchronized opening.

5.6 CLOSE SHUTTER

Select Dome>CloseShutter from the Dome menu.

If the SmartDome™ has synchronized closing enabled and the main door is fully opened then both doors will close together. Otherwise the dropout will close followed by the main door. The status of the dome doors is reported in the DOME pane at the top left of the screen. If selected, the main door will start to close approximately 5 seconds after the dropout horizon shutter has fully closed.

5.7 AUTODOME

Select Dome>AutoDome from the Dome menu. This makes the dome slave to the telescope. The dome will move approximately every two minutes when the telescope is tracking.

If you use the Hand Paddle the dome will go into "sleep" condition until the next GOTO command. This feature allows offsetting the dome to get an auxiliary instrument centered in the slit.

5.8 SMARTDOME DIALOG

The SmartDome Dialog permits low level control of the dome and is used by the *SystemEngineer* for setup purposes.

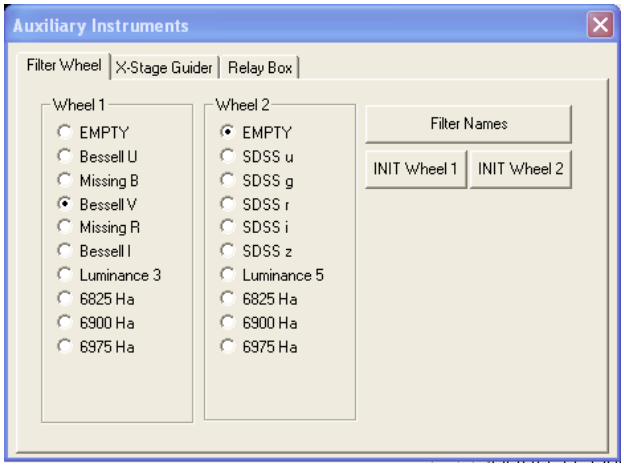
6.0 ACE CONTROL SOFTWARE: INSTRUMENTS MENU

6.1 OVERVIEW

The instruments menu may vary depending on the equipment installed.

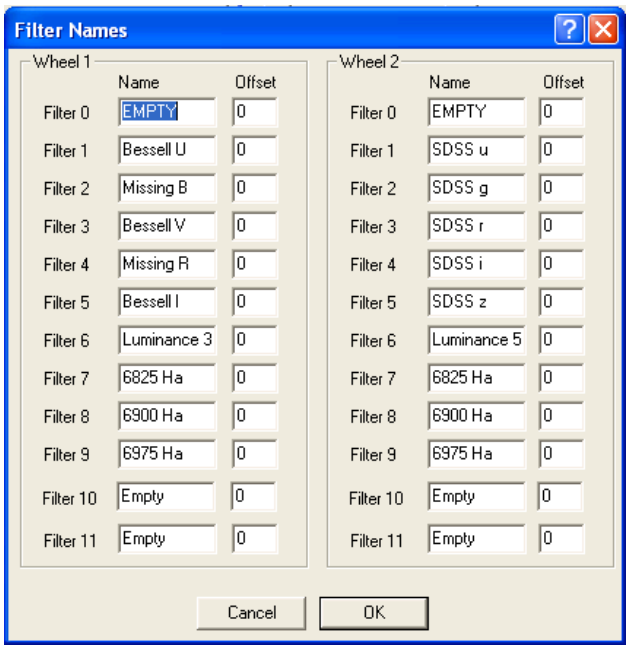
Clicking on the filter wheel icon on the main toolbar will also display the tabbed instruments dialog button.

6.2 FILTER WHEEL



The Filter Box contains two wheels, each with 8 slots. The wheels are stacked together so that light passes through both wheels. Therefore, slot 0 of each wheel is left empty.

To change filters click on the desired radio button. The filter wheel is equipped with an absolute encoder so it knows the status at all times. When moving, or not at a filter location, the radio buttons will be grayed out. It is possible to initialize the wheel to the nearest slot by clicking on the Init Wheel 1, Init Wheel 2 buttons.



To change the names of the filters click on Filter Names.

The position and filter name for each wheel is recorded in the FITS header.

6.3 X-STAGE GUIDER

The X-stage guider is a linear stage that moves a 57mm minor axis diagonal pick-off mirror east-west across the main field. When the stage is centered the diagonal mirror blocks the main science detector and the guider port then has the same view that the science detector had.

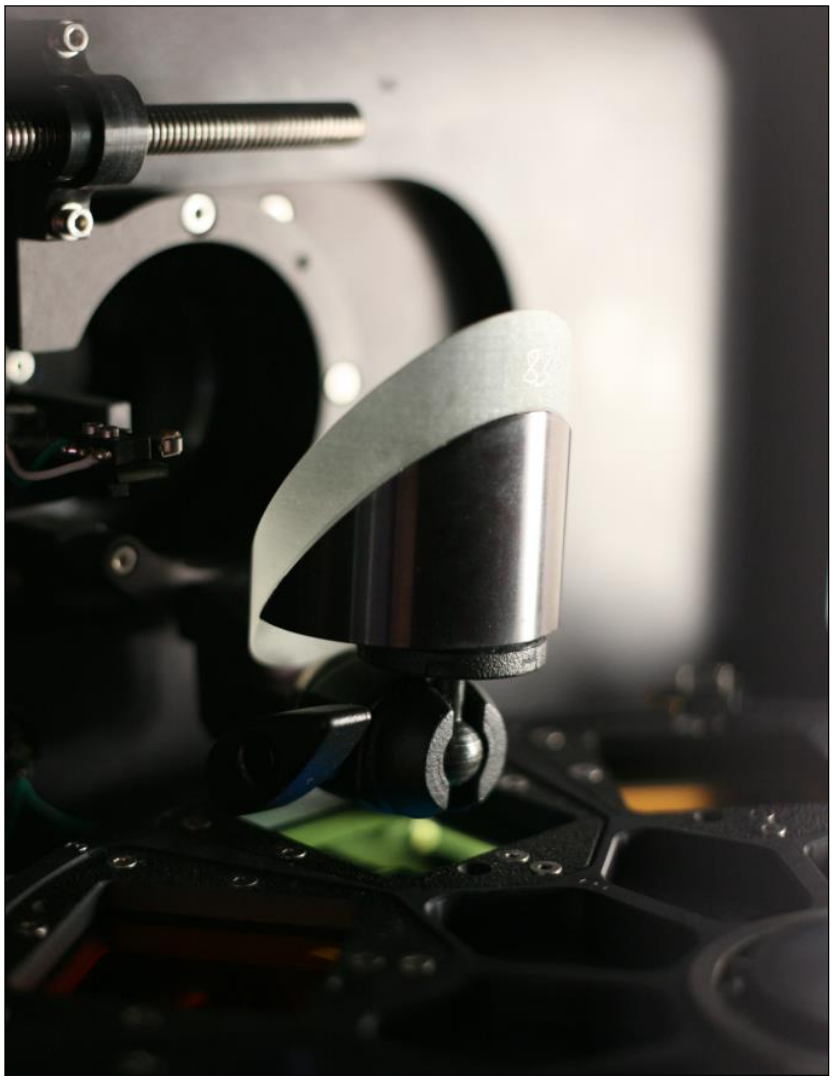


FIGURE 6-1 PICK-OFF MIRROR BLOCKING SCIENCE BEAM.

The situation for the X-Stage being centered is shown in Figure 6-1. The green filter, which is in the science beam, is completely blocked by the pick-off mirror which is directing the beam to the guider camera or eyepiece.

If you cannot find your object (or see any stars in the main CCD) check that position of the pick-off mirror!

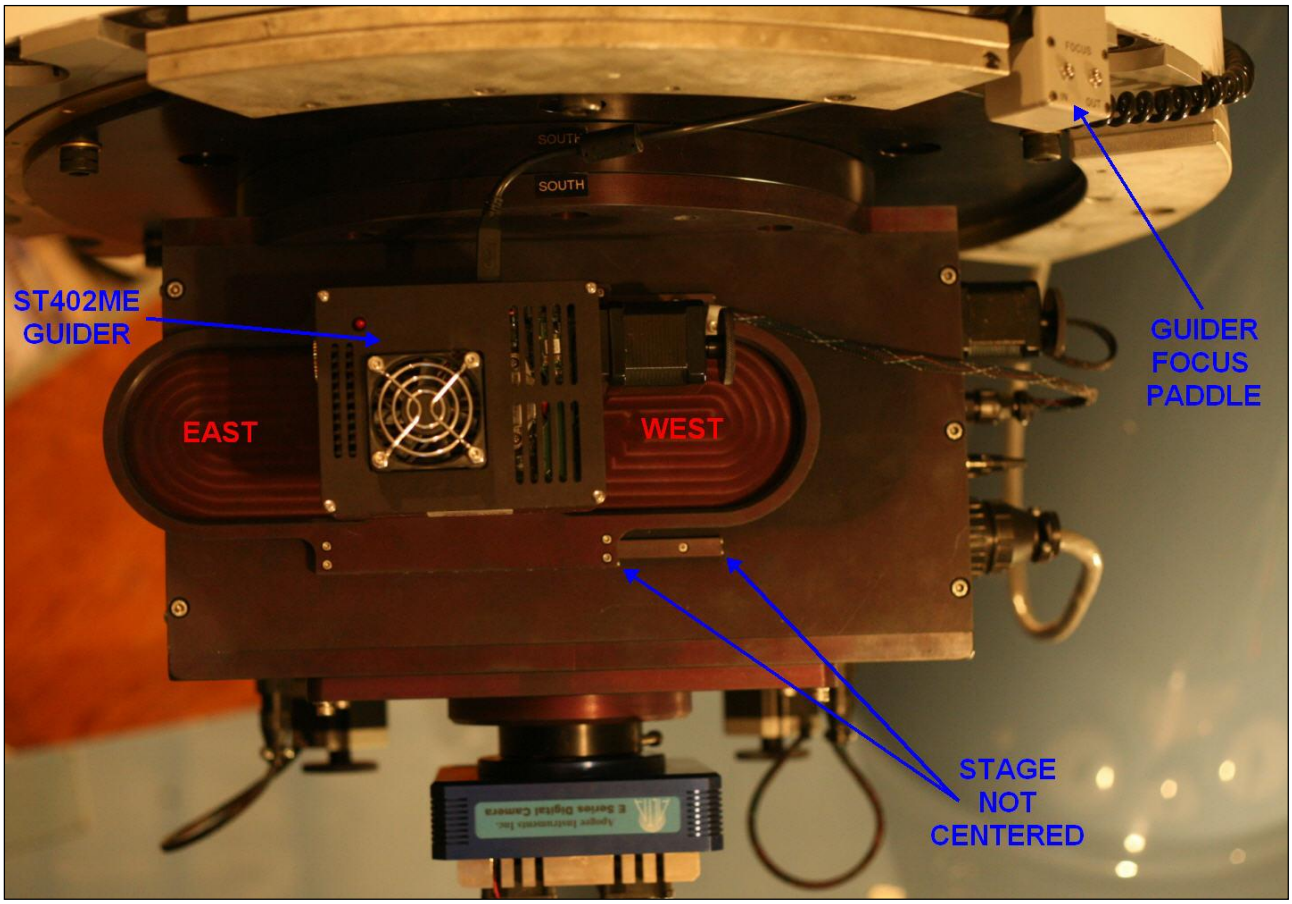


FIGURE 6-2 DUAL FILTER WHEEL & X-STAGE GUIDER INSTRUMENT

When the X-Stage is not centered the diagonal pick-off mirror is used for finding guider stars. When the stage is moved "left" as seen from the front of the instrument the camera is looking at stars in the EAST, as shown in Figure 6-2. This photograph was taken near position E2 (Refer to the Control Dialog Figure 6-4). There is often confusion about this. The stage has actually moved west but it has gone further east on the sky, which is all that you really need to be concerned about. The layout in the software control dialog is also with east at the left and west at the right.

There is a small paddle attached to the telescope for changing the focus of the eyepiece.

A ST402 auto-guider camera is mounted in a "standard" 2-inch focuser. It can be swapped out for an eyepiece or other equipment. It is necessary to use an eyepiece extension tube to keep the main CCD camera in focus and at the same time have the eyepiece in focus.

Figure 6-3 shows the X-stage centered. It is symmetric about the box walls and the lower part of the ball slides, visible in Figure 6-2, are now no longer visible.

FIGURE 6-3 X-STAGE CENTERED WITH EYEPIECE INSTALLED

The focuser is driven by a digital stepper motor and is equipped with limits (which are hidden inside the box). The minus limit is when the camera is closest to the guider box; the plus limit is when the focus unit is at its maximum extension.

The X-Stage guider control is a page in the Auxiliary Instruments dialog.

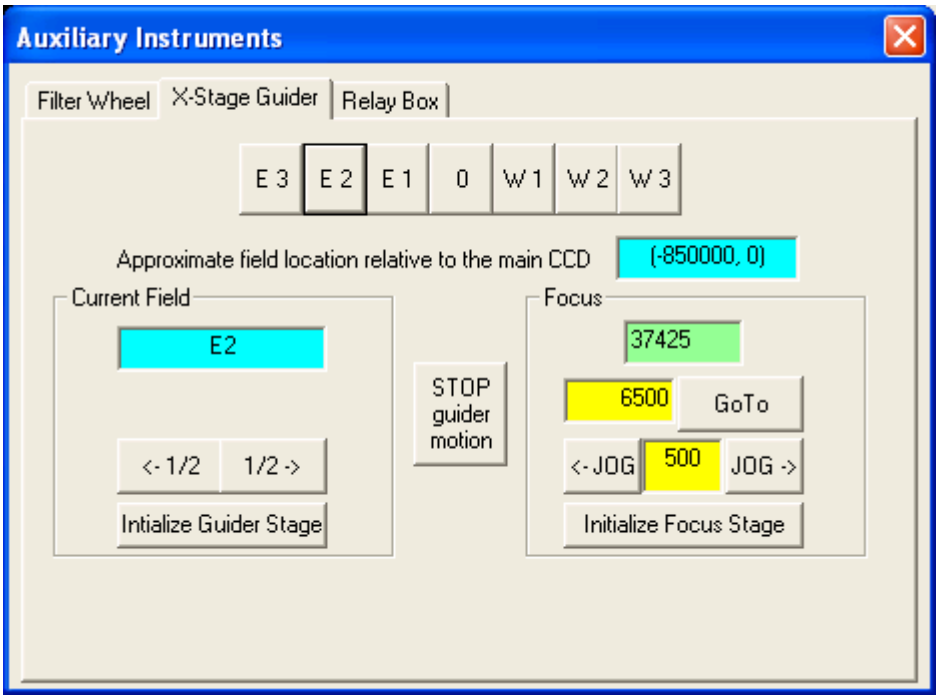


FIGURE 6-4 X-STAGE GUIDER DIALOG

To move the stage press the desired East, West or 0 (centered) button. The current position is reported. The two buttons called **<-1/2** and **1/2->** allow the stage to be moved half way between standard fields. Pressing the **Initialize Guider Stage** button will send the stage all the way to the left (minus) limit, load a predetermined value, and then move to a position specified by the *System Engineer*, typically the E1 field so as not to block the main beam.

To focus the autoguider use the buttons in this dialog. Pressing **Initialize Focus Stage** will drive the guider focus to the in limit, reset the counts to zero, and then move the stage to the approximate focus. (This value is pre-determined by the *System Engineer*). The stage can also be sent to an absolute value or jogged incrementally, in exactly the same manner as the main telescope focus.

Figure 6-5 shows the movement of the stage between field W3 and the two intermediate fields using the half buttons. Note that the CCD is orientated with the long axis N-S while the stage moves E-W. This gives the maximum possible coverage on the sky to find guide stars. The field orientation is the usual NORTH to the top and EAST to the left.

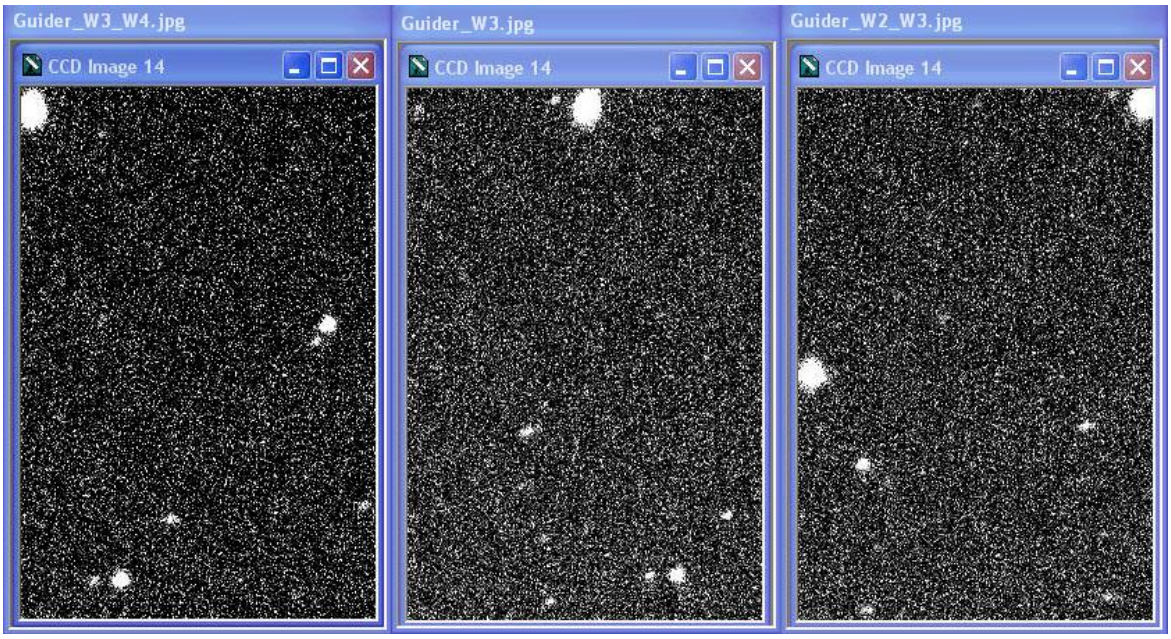
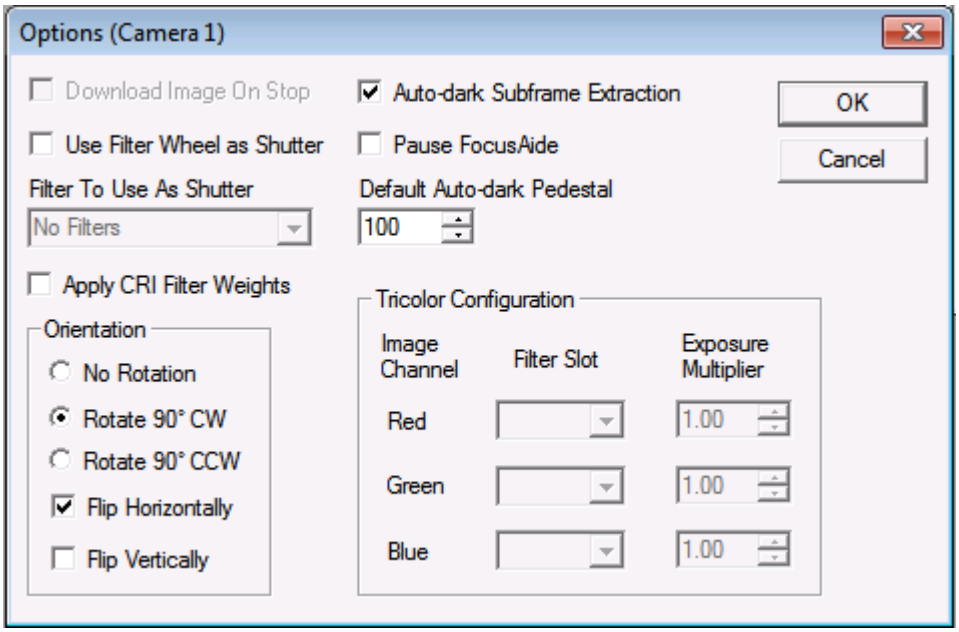


FIGURE 6-5 X-STAGE GUIDER FIELDS

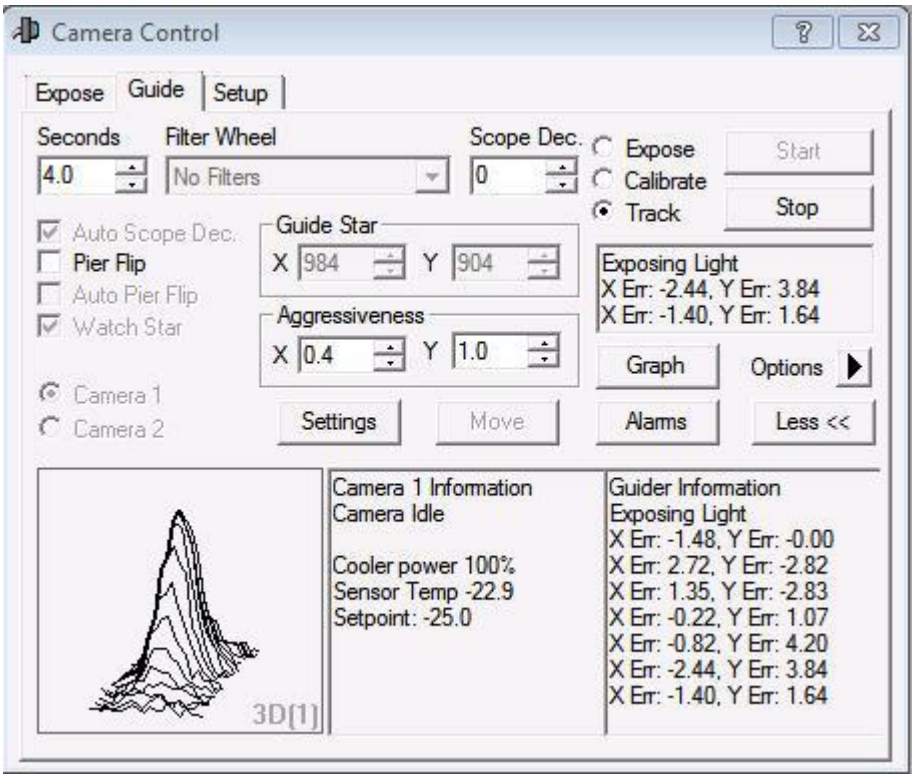
For the guider to work the orientation settings must be maintained in MaxIm-DL.

First the camera orientation must be correct. From the Camera Control Dialog select the Setup tab and then Options for camera 1.



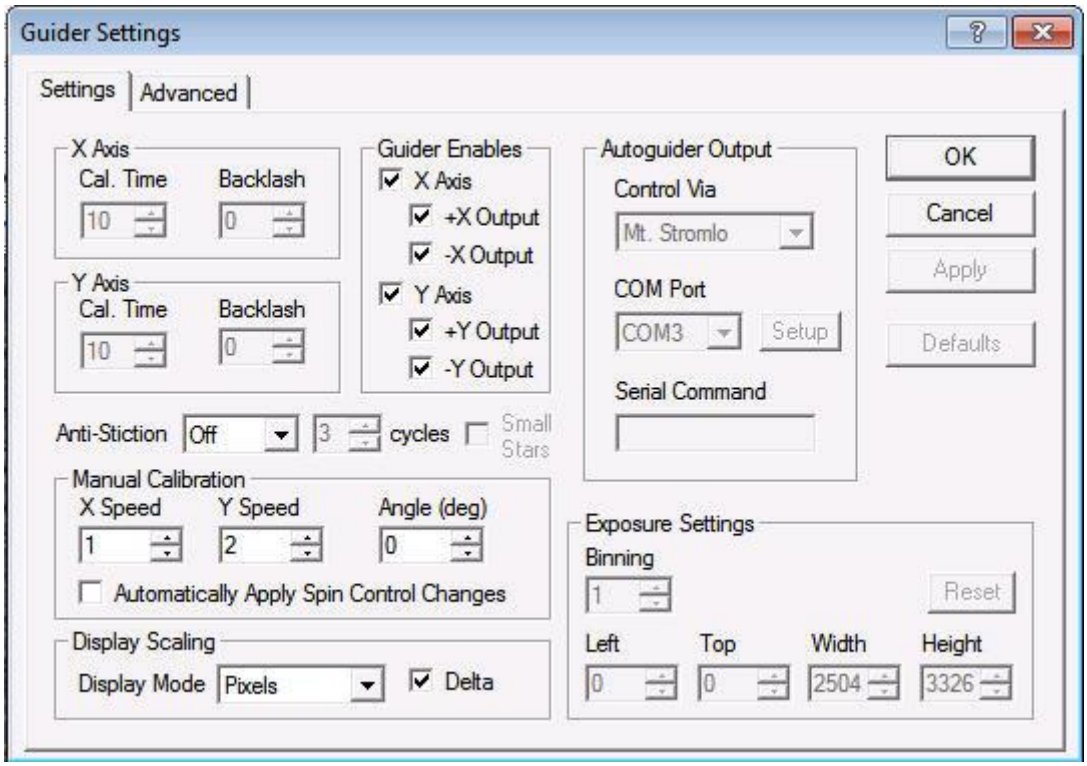
Make sure that the above settings are loaded to get N top and E left.

To auto-guide use the guide tab and ONLY use the Expose and Track radio buttons.



If you accidentally use calibrate you will destroy the settings and so read on to get them back to the correct state.

The **Settings** button brings up the following dialog:



Make sure that all the settings are EXACTLY as shown here! Also, in the Advanced tab make sure that the check box for Simultaneous corrections in RA and DEC is enabled.

AUTO GUIDER

The auto-guider is used for long exposures, or when staying on an object for an extended period of time.

To successfully use the autoguider the following conditions must be met:

- The autoguider camera must be orientated and have the settings described above.
- The telescope must be tracking on an object.
- A cable between the serial port of the TELESCOPE and CAMERA computers must be present.

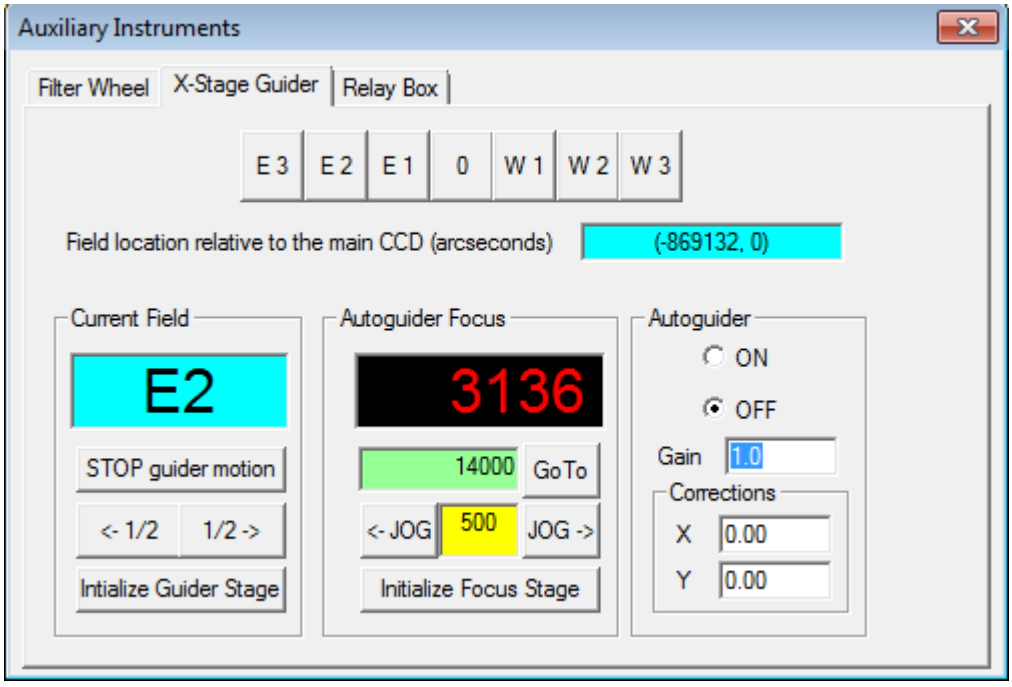


FIGURE 6-6 AUTO GUIDER

Start taking guider images in maxim-Dl then turn the Autoguider ON in ACE.

When operating the guider corrections are reported in the dialog. A ceiling of 2 arc-seconds per second is imposed on the guider.

6.4 RELAY BOX

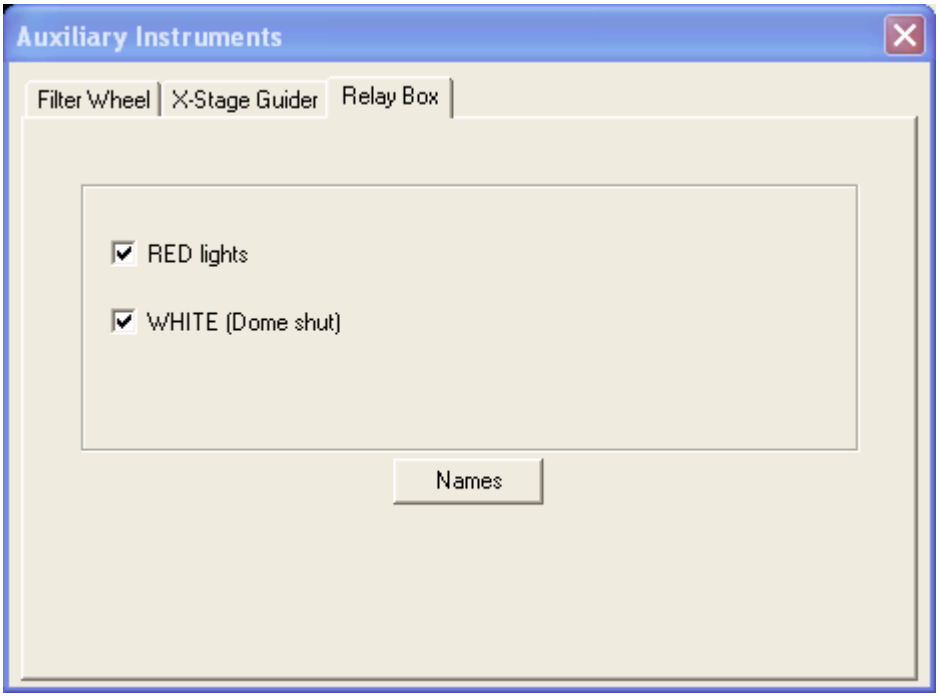


FIGURE 6-7 POWER OUTLETS DIALOG

The Relay Box tab allows for different external devices to be controlled.

The RED LIGHTS controls the strip of lights around the dome. These red light provide sufficient illumination for the video cameras in the dome. Turn them off while collecting data.

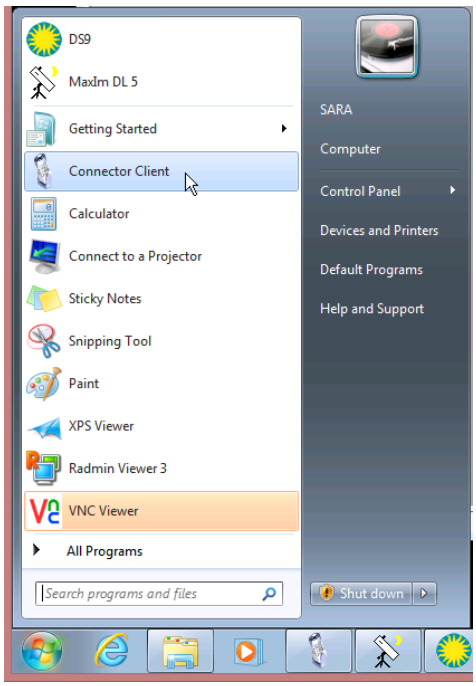
The WHITE lights can only be operated when the dome is shut so as not to disturb the neighbors! Please do not leave them on during the day. They total 800 Watts and heat the place up.

7.0 ACE CONTROL SOFTWARE: OBSERVATIONS MENU

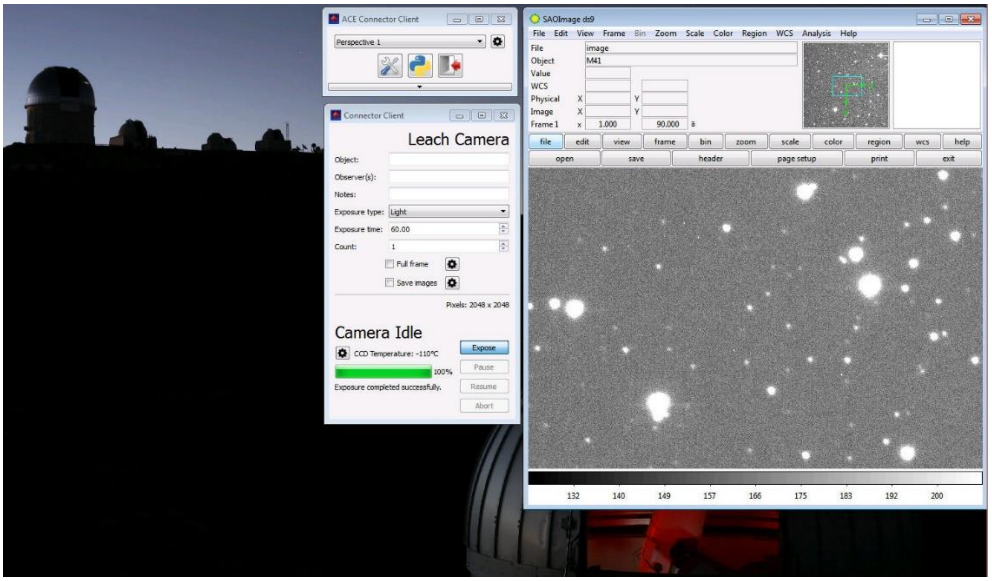
7.1 OVERVIEW

An Astronomical Research Cameras device is controlled through ACE. The ARC camera is often called the Leach camera after its creator.

First, on the CAMERA computer start the Connector Client:

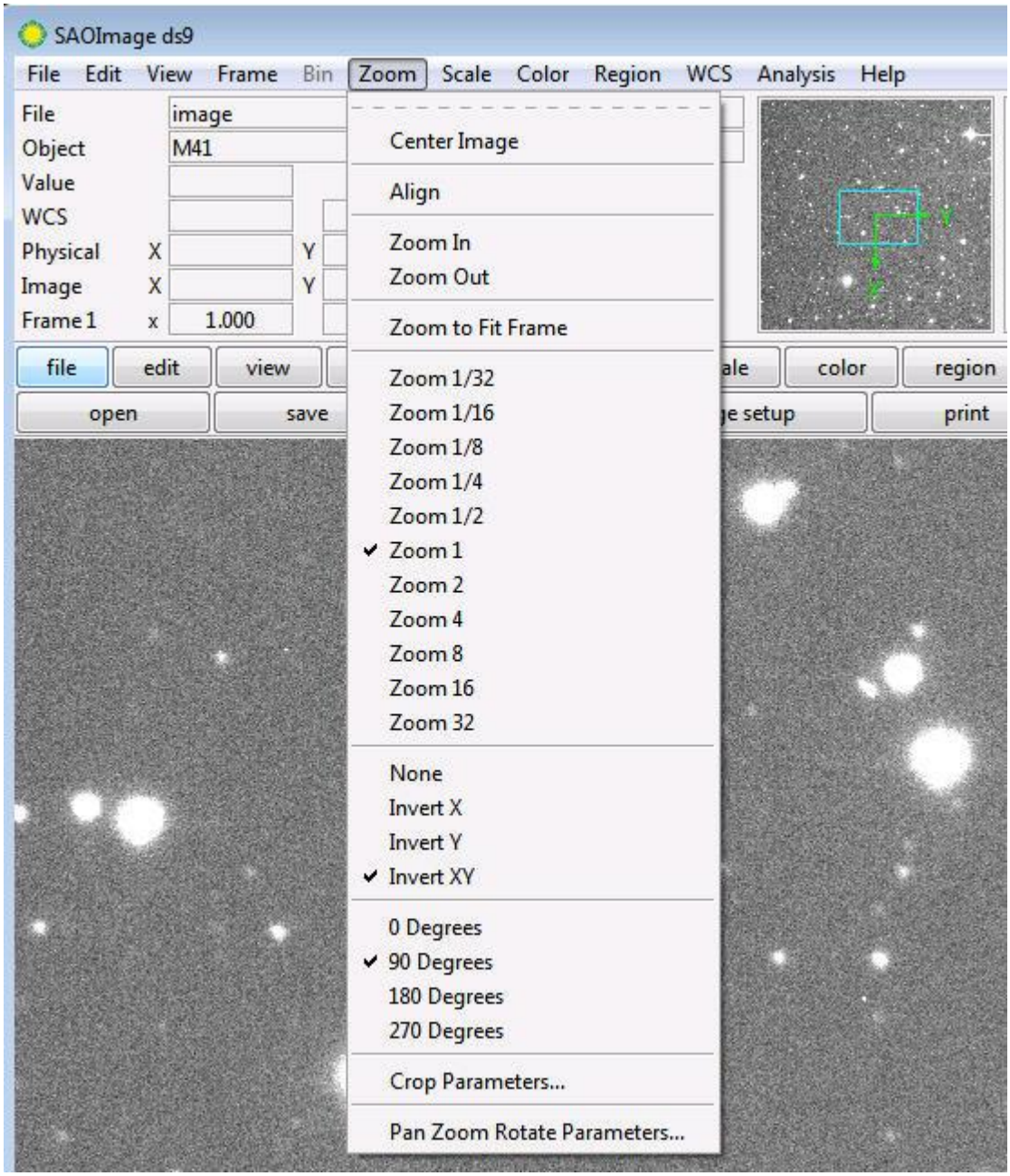


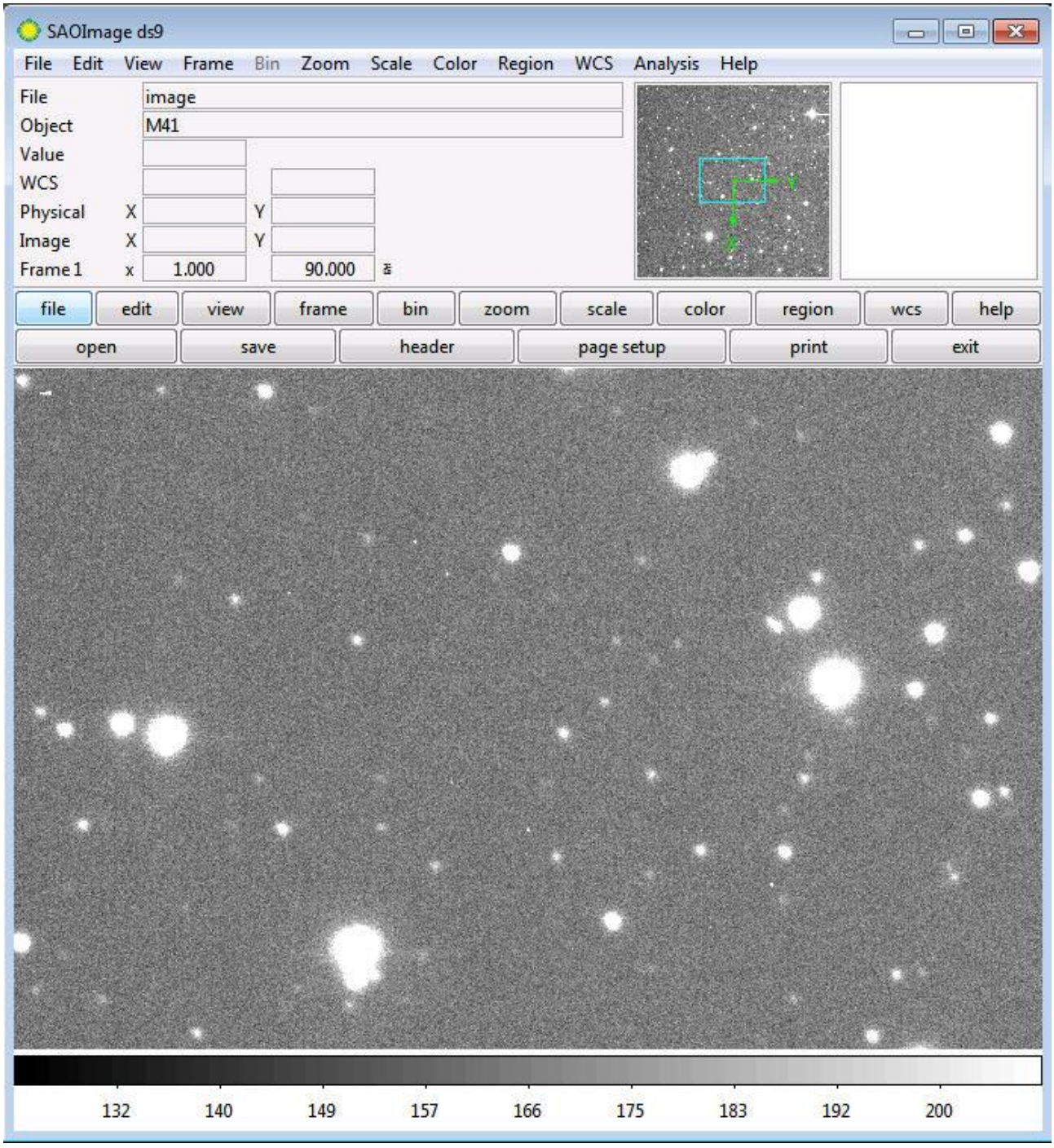
Also start the DS9 image display tool. The screen will then look something like this:



You can start taking images straight away using the Leach Camera Connector client. However, you won't get FITS headers from the telescope until you take at least one image from the ACE side. After that you will get all the header information.

Note the DS9 settings for displaying the images with N at the top and E to the left.

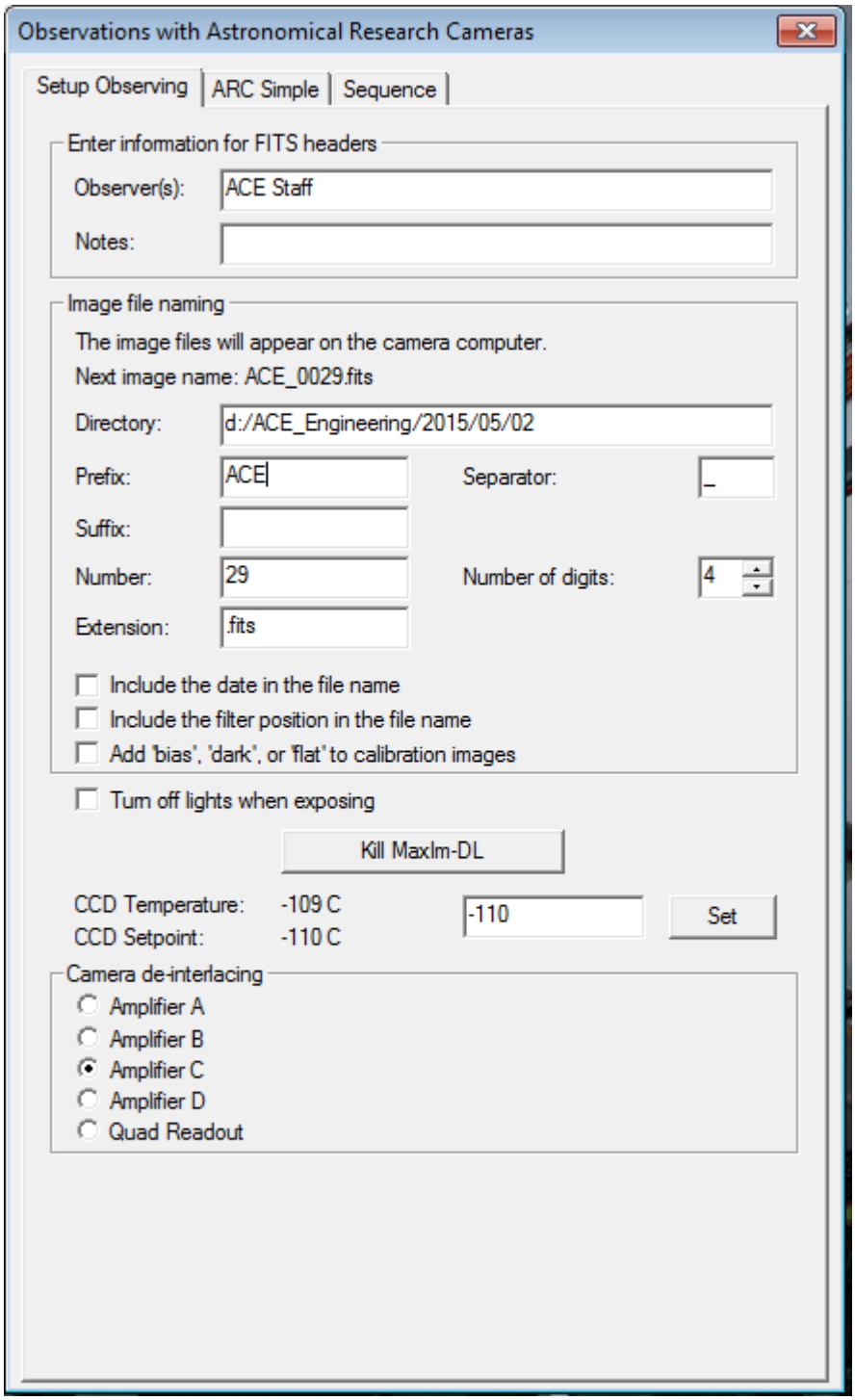




A DS9 image with N to the Top and E to the left, showing X pointing down and Y to the right.
The DS9 image defaults to centering each time a new image is read out. If you want to default to looking at the same region go to **File, Preserve During Load** and select **Region**.

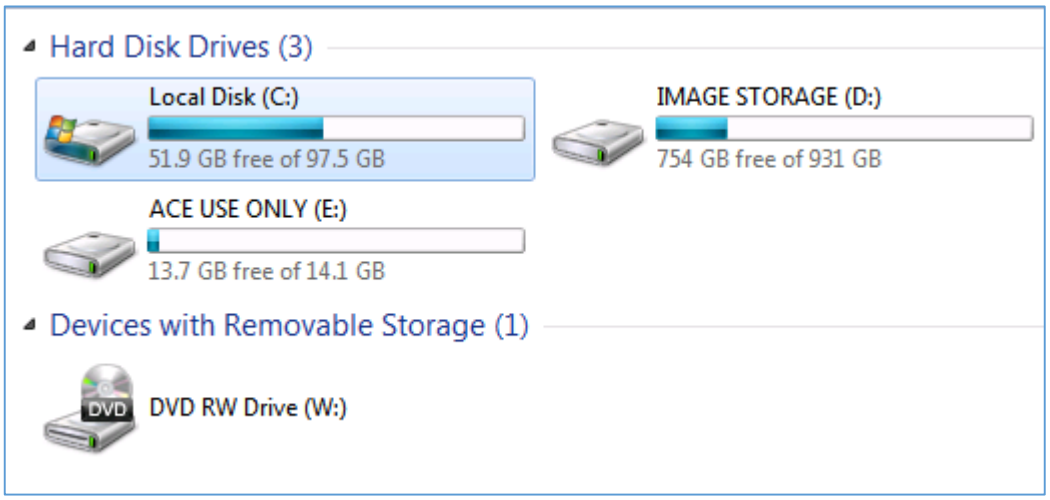
Now you have prepared the CAMERA computer it's time to set things up on the TELESCOPE computer.

From the Observations menu select **Science Camera**:



The **Observations with Astronomical Research** cameras dialog appears.

Images are stored on Camera. There is a 1TB solid state drive called IMAGE STORAGE (D:)



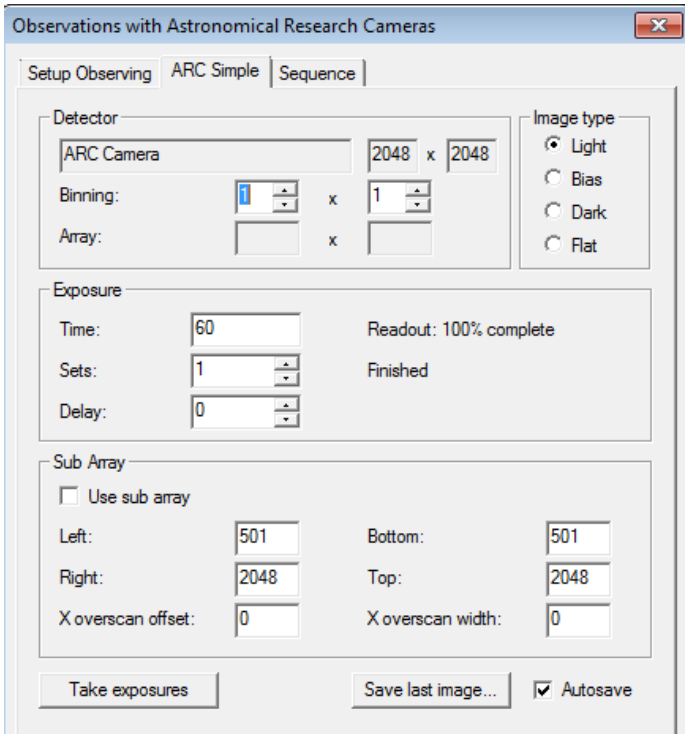
Please be considerate of others and clear your data off the disk when done with it.

Create your own directory on the D: disk. If the directory does not exist ACE will create it for you.

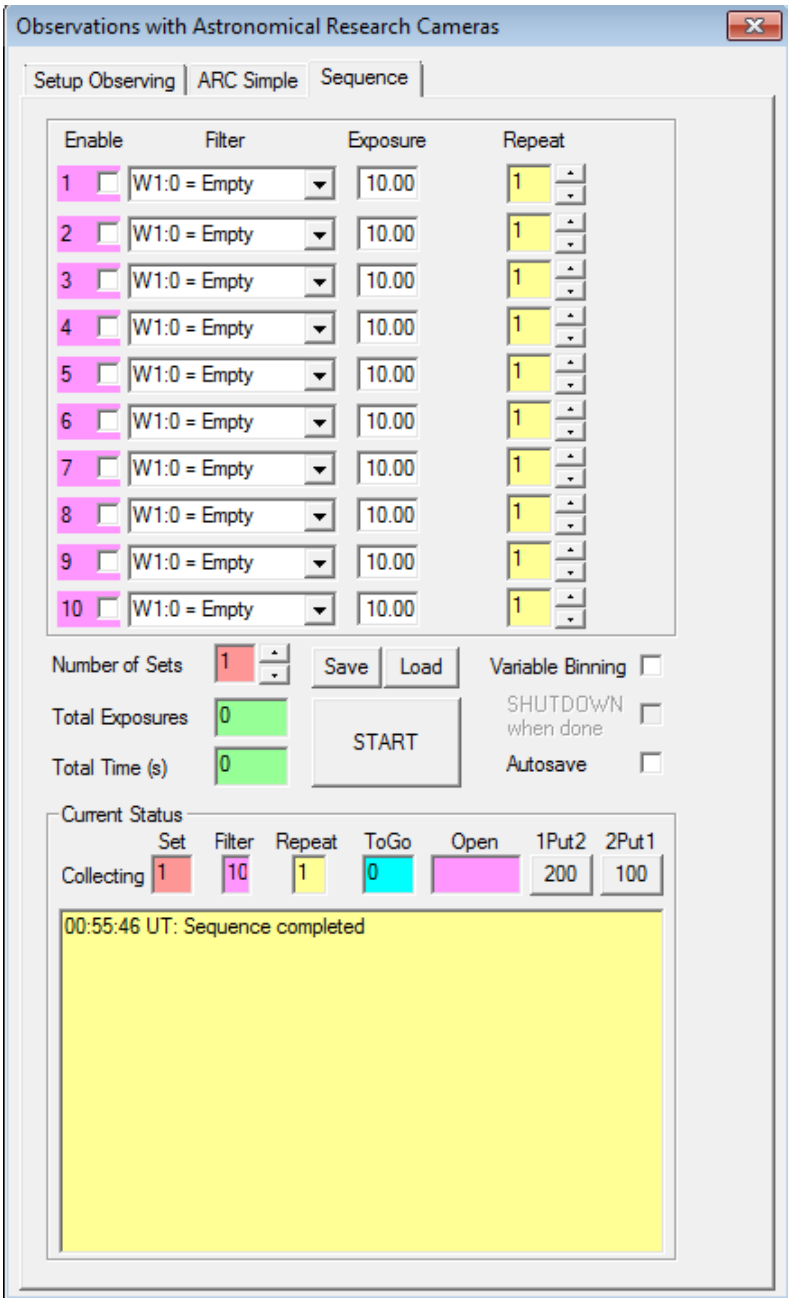
You have a choice of prefixes, separators, suffix, etc. As you change these choices a sample image name is displayed in the dialog so you know what to expect.

The CCD temperature is normally left set at -110C.

The ARC Simple tab is used to take single exposures.



It is also possible to do sequences:



This page is designed for multi-color photometry. There are 10 entry fields; only those checked will be executed. Select the filter and the time and the number of repeats required in each field. It is also possible to have different binning factors for each field.

The **Sets** spin control allows multiple repeats of the selected (enabled) fields. It is possible to **Save** and **Load** your sequences.

The **1Put2** and **2Put1** buttons allow you to specify where the other wheel will be positioned. The positions are 100, 101, 102 etc for wheel 1 and 200, 201, 202 etc for wheel 2.

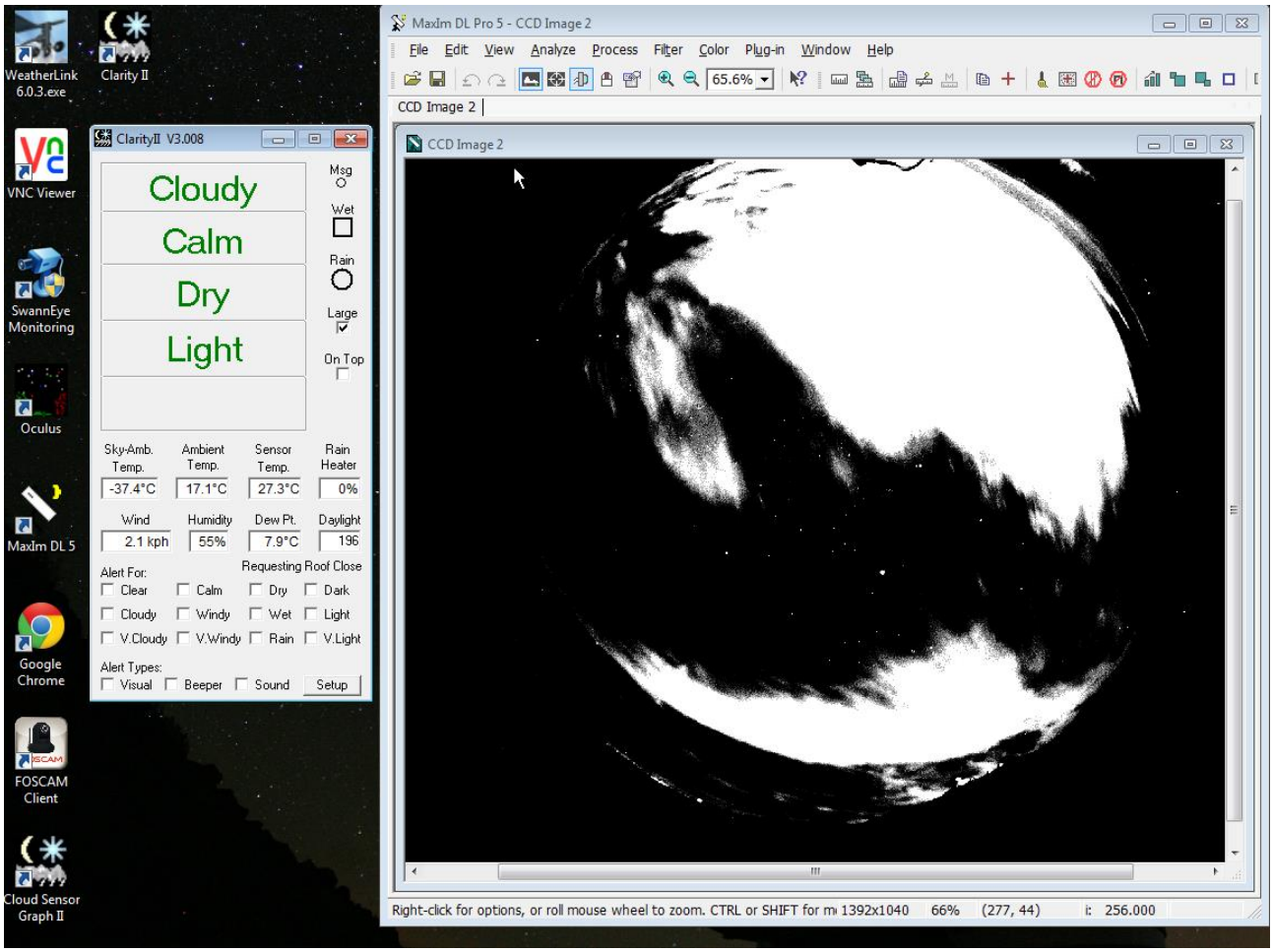
8.0 ENVIRONMENTAL MONITORING

8.1 INTRODUCTION

The observatory is equipped with four different environmental monitoring devices:

- An outdoor camera
- An all-sky camera
- A cloud sensor
- A weather station

They can all be found on the OBSERVATORY computer:



8.2 ALL SKY CAMERA

This Canon All Sky device is currently out of service due to Canon not having a 64 bit driver.
We are looking at the possibility of running this under linux soon. However, in the meantime we have an Oculus all sky camera. Start MaxIm-DL on the OBSERVATORY computer and select the StarlightExpress camera. 30 second exposure s work well, but only after twight.

8.3 BOLTWOOD CLOUD SENSOR

This sensor works with the ACE SmartDome. If a threshold is reached the dome closes. Close conditions include too cloudy, too bright (daylight), too windy and raining. Please do not alter the thresholds to extend your observing time in marginal conditions!! The Boltwood is designed to close the dome in bad weather even if the Boltwood software is not running.

8.4 WEATHER STATION

The Davis Instruments Pro Vantage 2 wireless weather station is located on top of a small rocky outcrop just to the south east of the dome.

The prevailing wind direction at the site is from the North. The relative humidity can change very rapidly if coastal fog is coming up the valley.

9.0 TROUBLESHOOTING

The SARA South Observatory has no local technical support that can be directly accessed by the observer. See section 1.7 for emergency contact information.

Table 9-1 outlines possible solutions which can be tried by the observer.

Notes:

Hard boot: Power turned off the computer *after* an orderly shutdown.
Soft boot: Windows restart button is used.

TABLE 9-1 TROUBLESHOOTING TIPS

Symptom	Remedy?	Notes
Cannot Find *any* Star	X-Stage in way? Dome in way? Mirror petals closed? Tracking turned off? Camera shutter not opening? Telescope way out of focus?	All system should be green or yellow on the left side of screen. Increase exposure time to 30 seconds. Is it the same as a bias frame?
ACE not responding. Mirror covers report is flashing closing / closed.	A hard reboot can sometimes cause this	The MaxP driver has failed.
ACE hangs when trying to start Maxim	Make sure you are already logged into the camera computer. Also be sure another instance of Maxim is not already running.	It takes about 20 seconds for ACE to get back an OK signal from Maxim when establishing the link.
ACE-Maxim not talking anymore.	The camera is probably not talking to Maxim. Try restarting Maxim. If that does not work restart the camera and a hard boot on the camera computer (after an orderly shutdown).	If you cannot "connect" using Maxim then no amount of trying from ACE will work! If you have TWO cameras attached (main, guider) disconnect one of them to see if the remaining camera connects. This will tell you which camera is misbehaving.
Target out of range.	Check coordinates	Did you forget the minus sign in the declination!?
Autoguider signals not getting through to ACE	Use Task Manager processes to kill all copies of MaxIm-DL.	Phantom copy of Maxim-DL running? This ties up the serial port so the "real" Maxim-DL cannot use it.
Autoguider signals not getting through to ACE	Check Guider Settings.	COM4 is used on both the telescope and the camera computers for guiding.

No FITS Headers	Stop MaxImDL and restart using ACE.	In the Task Manager Maxim-DL should be shown as owned by *System* and not the local user.