TELESCOPE

Table of Contents

1 **TELESCOPE** 1
- 1.1 **Preliminaries** 1
- 1.2 **Filling the WFC cryostat** 1
- 1.3 **Zeroset encoders** 2
- 1.4 **Opening up** 3
- 1.5 **Switching TCS in computer mode** 3
- 1.6 **Closing down** 4
- 1.7 **Switching TCS in engineering mode** 4
- 1.8 **Filling cryostat - morning** 4
- 1.9 **Writing tapes** 5
- 1.10 **Printing observing log** 5
- 1.11 **Filling logbook** 5

2 **OBSERVING-SYSTEM** 5
- 2.1 **Starting up the TCS** 6
- 2.2 **Starting up the ICS and DAS** 6
- 2.3 **Starting up the reduction sparc** 7
- 2.4 **Shutting down the DAS and ICS** 7
- 2.5 **Shutting down the TCS** 8
- 2.6 **Shutting down the reduction sparc** 8

3 **ALERT** 8
- 3.1 **Weather precautions** 8
- 3.2 **How th close dome quickly** 9
- 3.3 **Observing at low elevation** 9

4 **FAULTS** 10
- 4.1 **In General** 10
- 4.2 **No guide stars, bad pointing** 10
- 4.3 **The TCS disconnects** 11
- 4.4 **The WFC disconnects** 11
- 4.5 **Shutter problems** 11
- 4.6 **Filter wheel problems** 11
- 4.7 **Data acquisition problems** 12
- 4.8 **Pickup noise from autoguider of +/- 10 counts** 12

5 **COMMANDS** 13
- 5.1 **Object catalogue handling** 13
- 5.2 **Initial TCS commands** 13
- 5.3 **Twilight Sky-flats** 14
- 5.4 **Single Star Calibrate** 14
- 5.5 **Seven Star Calibrate** 15
- 5.6 **Focusing the Telescope** 16
- 5.7 **Finding Guide Stars** 16
- 5.8 **TCS/AutoGuider interface commands** 17
- 5.9 **Filter Wheel control** 18
- 5.10 **Command dictionary for UltraDAS** 18

6 **CHECK-LIST** 18
- 6.1 **Telescope** 18
- 6.2 **Commands** 19

6.3 **Observers handover check** 20

1 TELESCOPE

1.1 Preliminaries

1. Switch off lights on all floors, close the blind in the restroom.

2. In the control room, first check the **Operations Logbook** for any restrictions that may be still in force. Turn on the DOME LIGHTS from the console and raise the control room blind.

3. Make a visual inspection of the observing floor (and the balcony above the control room if the telescope is at ACCESS PARK) to check that the telescope is free to move *e.g.* no ladders or steps are close to the telescope or test instruments connected.

4. Put the Telescope in ENGINEERING MODE by pressing the ENG/COMP push button. The button should now be illuminated with an yellow light, indicating ENG mode has been selected.

5. Clear any emergency overrides by pressing the RESET button close to the ENG/COMP button.

6. Ensure that none of the SELECT MANUAL CONTROLS buttons have been activated on the console

7. Make sure that the TCS/DAS/ICL software is running. If not, please follow this link before proceeding.

8. Turn on OIL PUMP from the engineering rack.

1.2 Filling the WFC cryostat

1. **Moving the telescope to ACCESS PARK**

   To do this, on the engineering rack:

   - Ensure the telescope is at ZENITH PARK and the HA synchro pointers are at the "12:00" position.
   - Turn the DEC QM variable speed control fully clockwise.
   - Push the DEC QM button to release the slow motion clamps.
   - Push and hold the DEC [+] button. This will move the telescope down towards the balcony.
   - At declination 100 degrees the HORIZON LIMIT alarm activates. The telescope will stop and the slow motion clamps will re-engage.
   - Push the ACCEPT button to mute the alarm.
   - In order to move to 106 degrees (position for filling the cryostat) turn and *hold* the LIMIT keyswitch clockwise in the OR (override) position *whilst pushing* the DEC QM button to release the slow motion clamps.
   - Push the DEC [+] button until close to 105 degrees, the telescope will then stop at about 106 degrees.

2. **Filling Cryostat**

- When the telescope is at ACCESS PARK, wheel the N2 dewar close to the platform.
- Connect the dewar to earth; use the earthing point on the hand rail to the right of the telescope.
- FULLY insert the filler tube into the cryostat.
- On the dewar, **CLOSE** the PRESSURE RELEASE valve.
- **OPEN** the DECANT valve.
- **OPEN** the PRESSURE AUTO valve.
  n.b. Check the pressure does **not exceed** 15 psi.
- If the dewar is low on liquid nitrogen, the PRESSURE MANUAL valve can be opened. Use precaution when doing this as the pressure can build up very quickly if the dewar is close to full.
- Wait until liquid nitrogen is SEEN to be coming out of the cryostat.
- **CLOSE** the DECANT valve and the PRESSURE valve(s).
- **OPEN** the PRESSURE RELEASE. Removing the filler tube with care.

  VERY IMPORTANT!
  Wear safety helmet (with visor) and gloves when filling cryostats!

  *Always remember to leave the PRESSURE RELEASE valve on the dewar **OPEN**. If this is forgotten, pressure can build up over time and burst the relief valve on the dewar. This is especially true if the dewar is close to full.*

3. **Moving the telescope out of ACCESS PARK**

   To do this, on the engineering rack:

   - Turn the DEC QM variable speed control fully clockwise.
   - Turn and *hold* the LIMIT keyswitch clockwise in the OR (override) position *whilst pushing* the DEC QM button to release the slow motion clamps.
   - When the clamps have disengaged, still holding the LIMIT keyswitch to OR, push the DEC [-] button. This will move the telescope up and away from the balcony.
   - When declination is below 90 degrees you may release the keyswitch. If the audible alarm sounds, push the ACCEPT button to mute it.

   If the encoders have already been zeroset, push the DEC SM button and put the TCS into Computer Mode. Bring telescope to zenith by USER>park zen. If no zeroset has been done yet then,

   - Continue to push the DEC [-] button until the telescope is vertical. The DEC synchro pointers should be close to the "9:45" position.
   - When the telescope is vertical, push the DEC SM button to re-engage the slow motion clamps.

1.3 Zeroset encoders

1. Visually check that the telescope is near zenith park (*i.e.* vertical). The HA synchro position indicator pointers should be near the "12 O‘Clock" position with the DEC indicator pointers near the "9:45" position. If the position indicators are some way off, move the telescope close to these positions using the HA and DEC [+]/[-] buttons on the engineering rack. Select quick motion (QM) if the telescope is a long way off position then go to slow motion (SM) to make the final

adjustments.

2. In the TCS User window, enter:

```
USER>zeroset ha target  (or: zero ha tar)
USER>zeroset dec target (or: zero dec tar)
```

3. Using the HA and DEC [+]/[-] buttons with slow motion (SM) selected and the drive rate controls adjusted for a very slow speed, move the telescope so that the synchro dial pointers MOVE THROUGH the "12 O' Clock" position in HA and the "9:45" position in DEC.

   The TCS will beep if the zeroset is successful. The yellow LED's mounted above the synchro dials will momentarily flash also confirming that the telescope has been zeroset.

1.4 Opening up

1. **Opening the dome top shutter**

   On the engineering rack:

   - Use RAISE MICRO until the OVERTRAVEL indicator goes off.
   - Push RAISE MAIN until the shutter stops moving. The shutter is now fully open.

   n.b. If the dome or shutter does NOT work from the engineering rack push buttons, go up to the balcony and check the manual controls on the large grey cabinet mounted on the dome. The switches (key operated) associated with the dome and shutters must all be pointing to REMOTE, not to LOCAL.

   To operate the **lower shutter**, follow these instructions.

2. Push and hold the PRIMARY MIRROR OPEN button. Check the mirror petals open fully (petals can be seen moving through a gap in the telescope structure).

3. Push the DOME VENT FAN button to enable dome ventilation. The red light will go OFF when the ventilator is on.

4. Turn off the DOME LIGHTS from the console and close the control room blind.

1.5 Switching TCS in computer mode

1. Put the telescope into Computer Mode by turning the COMP keyswitch. The green section of the ENG/COMP push button switch should illuminate showing that Computer Mode has been selected.

   n.b. The HA and DEC slow motion (SM) push buttons **MUST** be set for SM mode (*i.e.* All the lower green sections of the buttons illuminated) before Computer Mode can be selected. If the yellow section of a QM button is illuminated, push the adjacent SM button to re-engage the slow motion clamps. Computer Mode should now be available.

1.6 Closing down

1. Bring the Telescope to zenith by typing `USER> park zen`

2. Push and hold the PRIMARY MIRROR CLOSE button. Check the mirror petals close fully (petals can be seen moving through a gap in the telescope structure).

3. Push the DOME VENT FAN STOP button to turn off dome ventilation. The red light will go on when ventilator is stopped.

4. **Closing the dome top shutter**

   *Always remember to bring down the **lower shutter** first*

   On SELECT MANUAL CONTROLS activate the button labeled dome/shutter.

   On the engineering rack:

   - Push LOWER MICRO until the MAIN OVER TRAVEL light goes off.
   - Use LOWER MAIN until the shutter stops moving.
   - Push LOWER MICRO to *fully close* the shutter.

   Release the button labeled dome/shutter on SELECT MANUAL CONTROLS.

   n.b. There are a few rules concerning dome shutter and bad weather.
   When windy and raining from behind the shutter water can penetrate into the dome; there is a seal but it isn't perfect. Therefore in this case please turn the dome to point the shutter into the wind. On the other hand with temperatures below zero we would like to avoid the build up of ice on the shutter, in this case point the shutter out of the wind.

1.7 Switching TCS in engineering mode

1. Put the Telescope in ENGINEERING MODE by pressing the ENG/COMP push button. The button should now be illuminated with an yellow light, indicating ENG mode has been selected.
2. If an audial alarm sounds, type
   `USER>ack`
   to mute the alarm.

1.8 Filling cryostat - morning

As at the start of the night, the WFC cryostat needs to be filled:

1. Bring the Telescope to Access Park.

2. Fill the Cryostat. These procedures are described here.

3. Turn off OIL PUMP from the engineering rack.

1.9 Writing tapes

There is a possibility that torn images are related to the writing of tapes while doing exposures (and the consequent reading of the chips). For this reason the following advice:
Please do not write tapes while doing observations; start writing them in the morning when observations are finished.

1. Check whether the drives need cleaning, this is the case if a LED is flashing every 4 seconds. The cleaning cartridge is placed together with the empty tapes together with instructions on how to use it.

2. Insert the DDS3 (125m) tape in the drive /dev/rmt/0n or /dev/rmt/1n

3. Logon to lpss8 as intguest and change directory to the data directory /obsdata/...

4. `lpss8>fitsinit` - follow the displayed instructions on how to initialize the tape.

5. `lpss8>fitsout` - again follow the instructions on the screen. On a DDS3 tape (12GB) should be enough space for 150 runs. Note that a list of missing runs will appear on the screen which you have to acknowledge before the writing process begins.

1.10 Printing observing log

Fill in the observing log html form, select how many printed copies you need and submit. Please archive one copy of the observing log in our log folder.
URL: http://scorpio.roque.ing.iac.es:9999/intlogentry.html
(http://scorpio.roque.ing.iac.es:9999/intlogentry.html)

1.11 Filling logbook

The printed logbook in the control room contains fields which *must* be filled out during the night:

1. CCD cryostats : Initials and local time for filling the CCD(s).

2. Breakdown of observing time: Fill in any downtime that was encountered (bad weather, technical problems, etc.) and note the **time lost.**

OBSERVING-SYSTEM

2 OBSERVING-SYSTEM

The INT observing system comprises four computers. These currently being:

- `ICS  Instrument Control System  (lpss13) Sparc`
- `DAS  Data Acquisition System  (lpss14) Sparc`
- `DRS  Data Reduction System  (lpss8)  Sparc`

- `TCS  Telescope Control System  (lpas2)  Dec Alpha`

Normally these systems are up running after the Duty Engineer afternoon checks, but if not, or if the system has to be taken down during the night, follow these instructions.

2.1 Starting up the TCS

1. On lpx22 open up a telnet window and connect to lpas2 as INT_LOGIN.
2. From main menu, type start. This starts up two other windows, the **info display** and the **user interface** window, the original window continues being active as the telescope d-task window; be patient this takes a few seconds.

2.2 Starting up the ICS and DAS

The ICS

1. On the ICS Sparc. Log on as:

   ```
   Username: intobs
   Password: ****** (as shown on monitor)
   ```

2. Two windows pop up, a pink window from where you run the observing system on this machine and an orange window which is connected to the DAS (lpss14).
   In the orange DAS window enter:

   ```
   obssys
   ```

3. Choose the menu option number for running the correct version (see white board).

4. In the same orange DAS window, enter:

   ```
   startobssys
   ```

5. Now enter in the pink ICS window

   ```
   obssys
   ```

   using the same menu option as for the DAS and

   ```
   startobssys
   ```

   to start the observing system.

6. Check you have the prompt:

   ```
   SYS>
   ```

   in the pink window and make sure the following windows on either the ICS monitor or it's second display screen are present:

   - TALKER
   - LOG of observations
   - TCS INFODISPLAY (Check UTC and LST are updating)
   - AUTOGUIDER
   - MIMIC for the WFC

After the mimic has started and communications have been setup, the software will carry out some self tests on the WFC. Check the mimic for:

- The WFC SHUTTER opening and closing.
- The FILTER WHEEL moving to determine what filters have been installed and in what positions.

Important note
On WFC startup, it is NOT uncommon for the MCA controller (the electronics rack mounted on the WFC which drives the shutter and filter wheel), to have problems identifying the filters which are loaded. In this case, it may be necessary to repeat, perhaps several times, the command:

```
SYS> cmd MCA RESET
```

to resolve this problem.

2.3 Starting up the reduction sparc

1. Log on to the INT Data Reduction Sparc.

```
Username: intguest
  Password: ******** (as shown on monitor)
```

2. After logging on, three windows should startup:

   - A pink Xterm
   - IRAF showing the "cl>" prompt
   - XIMTOOL

   n.b. If the IRAF or XIMTOOL windows do NOT start, bring them up manually using the procedure below:

   - Move the mouse over the background and press the right mouse button.
   - Keeping it pressed, select "Programs" and then "XGterm". A blue XGterm window will appear.
   - Repeat the above procedure and select XIMTOOL from the "Programs" menu.
   - To start IRAF, enter "ncl" in the XGterm window.

3. In the IRAF window, move into the "date" directory where the images are stored. The current date is entered in the format 'yyyymmdd' *e.g.*

```
cl> cd /obsdata/inta/19990225/
```

2.4 Shutting down the DAS and ICS

1. On the **ICS** computer, enter in the pink window:

```
SYS> shutdownobssys
 Do you want to wipe out the system Y/N? y
 SYS> cleanup
 SYS> exit
```

2. On the **DAS** computer, telnet session to lpss14 :

```
SYS> shutdownobssys
 Do you want to wipe out the system Y/N? y
 SYS> exit
```

This will shut down the observing system.

3. If there are any other windows seen on the ICS Sparc (or it's second display screen), shut them down too.

   ```
   intobs@lpss13> exit
   ```

   Graphics windows without a prompt can be exited as follows:

   - Move the mouse cursor over the "-" sign at the top left corner.
   - Click on it with the left mouse button.
   - Choose "close" or "exit".

4. Click the right mouse button over the background and choose the "exit" option at the bottom of the menu. This will log you right out of windows.

2.5 Shutting down the TCS

The TCS is run from the X terminal in the console. In the user window, enter:

1.

   ```
   USER> tcsexit
   ```

2. Exit any other windows.

2.6 Shutting down the reduction sparc

1. In the IRAF window, at the "cl>" (or "in>") prompt, to exit use: `lo`

2. Shut down any remaining windows and exit the system as previously shown for the ICS.

ALERT

3 ALERT

3.1 Weather precautions

The dome must be closed when

- outside humidity reaches 90%, OR
- the mirror temperature approaches within 2 degrees of the dew-point, OR
- the wind speed gusts for more than 10 sec above 80km/hr, OR
- the wetness alarm goes off.

All these alarms are indicated on the Casella MET display. In case of an alarm the field with the concerned value will turn red and the system will start beeping. This can be silenced by typing 'A' on the PC's keyboard.

Mostly you will have to close the dome due to high humidity

To give you early warning about rising humidity, an additional alarm will sound from the MET receiver box:

- Pointing left you will be warned if humidity rises over 75%,
- pointing right the alarm will sound with humidity >= 90%.
- In the middle position the alarm is muted.

n.b. Remember to re-activate this alarm before re-opening the dome!

The dome can be reopened when humidity has dropped below 80% and no other alarm (dew-point, wind, wet) is present anymore.

If there is ICE on the dome

- The telescope log book will tell you if it's OK to open the dome.
- If in doubt ask the DE/IO.
- If the shutter shows any resistance to movement (watch it while opening), don't force it.
- Always wear a hard hat when on the roof, never ever try to chip ice free on dome or shutter!

3.2 How th close dome quickly

1. First close the primary mirror cover.
2. Then switch the TCS to engineering mode: press the button 'COMP/ENG' (the telescope control will start beeping, acknowledge with `USER>ack`) OR simply type `USER>eng`.
3. Close the dome. Bring the lower shutter down first: press 'lower micro' while in 'main over travel', otherwise 'lower main'.
4. Now bring the upper shutter down using the same technique.

3.3 Observing at low elevation

If you want to observe at a zenith distance between 57 and 70 degrees (33-20 degrees elevation) then you need to rise the lower shutter. There won't be any warning from the telescope control, so you will have to check the ZD from time to time.

1. Push the yellow button under "SELECT MANUAL CONTROL", labeled "DOME SHUTRS" to get the control of the shutters.
2. On the engineering rack, under "LOWER SHUTTER", push the "RAISE MICRO" button until the "MAIN OVER TRAVEL" light underneath goes off.
3. Push the "RAISE MAIN" button on the side of the previous; while rising you hear two bangs caused by the segments of the shutter catching the next, keep the button pressed until you hear the motor stop. It takes approximately 30 seconds.
4. * Undo * the "DOME SHUTRS" button, otherwise the dome wont track the object anymore.

You can now observe below 33 degrees elevation.

Remember to lower the shutter again when you go to a new source above 33 degrees elevation. To do this:

1. Select manual control as before with the "DOME SHUTRS" button.
2. With "LOWER MAIN" bring the shutter down as far as it goes.
3. With "LOWER MICRO" fully lower the shutter, keep the button pressed some 10 seconds to be sure.
4. Undo the "DOME SHUTRS" button.

Note that if you don’t lower the bottom shutter completely the upper shutter won’t seal the dome at the top, so with rain and wind water will penetrate into the dome.

FAULTS

4 FAULTS

4.1 In General

Most of the faults can be cleared by typing:

SYS> startobssys

Try to avoid ’shutdownobssys’ followed by ’startobssys’ as in most cases such a drastic measure isn’t needed. SYS> shutdownobssys should only be used to shutdown the observing system at the end of the night.

If a sub-system (DAS, TCS or Autoguider) is corrupted ’shutdownobssys’ wont help. First the sub-system has to be brought back, then
SYS> startobssys
will re-establish contact between the observing system and the sub-systems.

4.2 No guide stars, bad pointing

First repeat ZEROSET at zenith in engineering mode followed by:
USER> CAL LAST

Check pointing with a pointing grid star and the autoguider:
USER> GOCAT pointing-star
USER> AP 5
mark the autoguider window center (SETUP/TOGGLE CENTER CROSS)
SYS> agwin acq pos 1032 512
SYS> autotv on
If the star comes up within 15 arcsec from the center, the pointing is fine.

If no bright star is seen may be the last pointing solution is wrong or got corrupted somehow. Before calling for help try this:
Repeat ZEROSET at zenith in engineering mode followed by:
USER> CAL DEFAULT
and check again the pointing with a pointing grid star and the autoguider.

To recalibrate the telescope pointing follow this commands.

4.3 The TCS disconnects

Most likely the TCS TELD task has died. To restart go to the xterminal were the TCS user interface and info display are running. Open a LAT terminal and log on to lpas2 (see label on screen for uid and passwd). From the main menu then select 'options' and 'teld' from the options menu, afterwards
SYS> startobssys
will re-establish contact between the observing system and the TCS.

4.4 The WFC disconnects

If WFC disconnects, as shown by the orange warning-label on the mimic, the DAS has probably crashed.
Check the orange telnet window that's logged on to the DAS (lpss14). If not available you have to start a new telnet connection to lpss14 from the background. Run first 'obssys' with the actual option first in order to get the DAS> prompt.
Type return to see if there is a termination message for udas_server (the WFC task is an instance of the udas_server program). If udas_server has stopped running, do this:
1. Type startobssys at the DAS> prompt.
2. Watch the talker. Wait until you have seen WFC come on-line.
3. Type startobssys at the SYS> prompt.
4. Wait for the mimic to reconnect to WFC.

4.5 Shutter problems

It happens when you start an exposure that you get the message 'The shutter failed to open at the start of the exposure' (red/blinking/beeping).
Simply quit the alarm and repeat the last command in this case.

Elapsed time is counted in a blue box on the GUI while the shutter is open. After the read out the box turns to green. There is a fault when the box goes orange with time elapsed=0. The exposure is logged with 0 seconds exposure time or not quoted at all in the observations log and in the headers. The fault has to do with the MCA controller. To recover type:
SYS> cmd MCA RESET
With the next exposure the exposure time should be recorded correctly again.

If this doesn't help bring the telescope to access park and power cycle the MCA controller, this is the controller on the bottom of the WFC assembly (rotator at 180 deg.), followed by:
SYS> cmd MCA RESET

4.6 Filter wheel problems

On WFC startup, it is NOT uncommon for the MCA controller (the electronics rack mounted on the WFC which drives the shutter and filter wheel), to have problems identifying the filters which are loaded. In this case, it may be necessary to send the command:
SYS> cmd MCA RESET

When changing filter-position you might get the message 'The filter-wheel detent pin is malfunctioning' (red/blinking/beeping) or 'filter wheel movement timed out'.
Simply quit the alarm and repeat the filter command if this happens.

If this doesn't help bring the telescope to access park and power cycle the MCA controller, followed by:
SYS> cmd MCA RESET

4.7 Data acquisition problems

By Data acquisition we mean the management of an exposure, reading of data from the CCDs and saving to disk. This may fail in one of several stages, for example:

- Run, Finish, Abort or Re-time commands are not successful
- Run process stops after CCD clearing
- Run spontaneously aborts during readout or transfer to disk
- Transfer to disk does not complete to 100%
- Data on disk is corrupted (e.g. torn frames)

These may or may not be accompanied by a pop-up error box/alarm. If the error pop-up mentions the (ultra)DAS or "reset the camera", **and you cannot continue observing,** then the following procedure is recommended (pink window):

SYS>dasreset WFC (i.e. startobssys is unnecessary, unlike in e.g. WFC fault)

When this completes, try a new Run and see if the above fault recurs. If it does, then a lower-level reset of the CCD controller may necessary and you need to move the telescope to access park.

Power cycle the unit labeled SDSU CCD controller, located to the left of the cryostat, followed by:
SYS>dasreset WFC

4.8 Pickup noise from autoguider of +/- 10 counts

The problem is pickup noise from the autoguider on chip 1 and 4. So if the autoguider is off no noise patterns are seen. The magnitude of the effect is +/- 10cts. Using signal we estimate that for typical exposure times (5min.) poisson noise from sky is higher than this effect (in U we get 122 photons/pix). This effect shouldn't be a killer for most science exposures. However narrow band / U imaging of faint extend objets might suffer.
The workaround is to stop guiding when reading out, this can be done by typing:

SYS>guide off
when the ccd starts to read. A more simple procedure is to include in your script the following comand:

SYS>run 500 object &
SYS>udas_detect_ro WFC; guide off
This will ensure that when you are taking the exposure, as soon as reading starts the autoguider is turned off.

If you are unsure about any of the recovery procedures or if they fail, call for WHT TO, SA or DT/IO support. COMMANDS

5 COMMANDS

5.1 Object catalogue handling

`USER>incl <virgo>` - Includes a user catalog named virgo.cat, stored in /int/cat. Check that the catalog has been loaded properly by listing it from the TCS using the command:

```
USER>out term
```

To add objects to the catalog type:

```
SYS> object name 12 20 30 −10 5 40 J2000
SYS> add
```

to move to the object type:
`SYS> next` - for the last one entered or

```
SYS> gocat name
```

However, objects added with the object/add sequence are passed directly to the object catalogue held on the TCS computer, and are not stored on the system computer.

TO write a catalogue back to disk use:

```
USER> output file int:[cat]newfile
```

which saves the file newfile.cat on a disk also visible to the system computer as /int/cat.

5.2 Initial TCS commands

`USER>show focal` - Show the focal station setup. If not set to PRIME/WFC, run the command `SYS>startobssys` from the pink observing window.

Check that the PF rotator angle is set to **180**° from the TCS DISPLAY window. This is the default rotator position. *The automatic auto-guiding system will only work for this rotator position and the nominal aperture (object centred on CCD#4).* To move the rotator, follow these (http://lpss1.ing.iac.es/~pms/tonotes/int/int_rotator.html) instructions carefully.

`USER>show aper` - Lists the defined apertures. The list should read:

nominal aperture, object centred on CCD#4 centre object on CCD#1 centre object on CCD#2 centre object on CCD#3 nominal aperture, object centred on CCD#4 centre object on AG-CCD (X=1032, Y=512) centre object on RC (rotator centre) You can change the default pointing aperture (ap 0) by entering e.g.

```
USER>enter ap 0 0 0
```

In this case, the telescope will point at the rotator centre instead of centre of CCD#4.
*NB: Do **NOT** change the default apertures before calibrate.*

New apertures can be defined by entering e.g.:
`USER>ENTER AP 7 0 −350` or from the observers console with

```
SYS>cmd TCS USER "ENTER AP 7 0 −350"
```

Apertures > 0 are invoked by entering e.g.:
`USER>AP 1` or from the observers console with
`SYS>cmd TCS USER "AP 1"`
and are only active until the next `SYS>gocat 'source'` command.

`USER>focus 46` - Set focus to a 'good' value.

`USER>calibrate last` - Load the last TCS pointing model.

5.3 Twilight Sky-flats

There is an automatic procedure which, by continually reading the auto-guider chip, tells the observer what exposure time to use in order to achieve about 20000 counts:

Goto a blank field. Suitable fields are listed below:

`SYS> guide on pixel 1032 512` - To start the auto-guider.
The guider is only used to measure the sky brightness, we don't want to guide. To open the guide loop click the 'open loop' button on the AG GUI.

`SYS> smartflat &`
A dialog box will pop up and tell the observer the needed exposure time. Exposures are taken by simply clicking the 'take this flat' button. Remember to **OPEN THE SHUTTER**!
Once all twilight flats are done, type:

`SYS> guide off`

5.4 Single Star Calibrate

If the telescope pointing the previous night was acceptable, all you need to type is:
`USER>cal last`

However, if you experience problems finding guide-stars, it might be necessary to re-determine the pointing model. The first attempt should be to do a fast (this takes about 5 minutes) single star calibrate with the auto-guider:

`SYS>agwin acq pos 1032 512` - Readout the auto-guider centre.

`USER>cal` - This sends the telescope to a suitable calibrate star. When the HANDSET menu appears, hit `<ctrl-Z>` to break out.

`USER>aper 5` - Centre telescope pointing on the auto-guider.

On the auto-guider, mark the window centre by using the menu items on the auto-guider GUI (SETUP/TOGGLE CENTRE CROSS).

`SYS>autotv on` - Turn on continuous readout mode for auto-guider.

Use HANDSET to centre star on cross (in XY mode for the 180 deg. rotator position the cursors are reversed).

```
USER>point calibrate

USER>cal anal zero
```
The rms of this solution is typically 0.01", type "Y" to accept.

5.5 Seven Star Calibrate

After an instrument change or if the single star calibrate isn't giving a satisfactory result a seven star calibrate either automatic or manual is performed (this takes 20 to 30 minutes).

Automatic mode using autocal-script:

```
Before you start calibrate you should enter the parameter which affect
the calculation for the atmospheric refraction e.g.

USER> temp 6.7
      press 770
      humi 0.1
      wave 0.65               (example for Halpha narrow band filter,
                               if you use B then type 'wave 0.45')
```

Make sure that the guiding is OFF (remember to turn off after flats).

```
SYS>autocal
```
Ensure all pointing grid stars were found by the auto-guider - only then accept the pointing solution.

```
USER>cal anal
```
If the pointing solution is ok (in the order of rms < 5-6"), type "Y" to accept.

Manual mode:

```
Within normal calibrate you can't apply AP5 to move the stars to the
auto-guider, hence you have to redefine AP 0 to be

USER> enter ap 0 1065 -42     (the sum of the nominal AP 0 and AP 5)

Before you start calibrate you should enter the parameter which affect
the calculation for the atmospheric refraction e.g.

USER> temp 6.7
      press 770
      humi 0.1
      wave 0.65               (example for Halpha narrow band filter,
                               if you use B then type 'wave 0.45')

On the auto-guider mark the window centre use the menu items on the
auto-guider GUI (SETUP/TOGGLE CENTRE CROSS).

SYS> autotv on       Turn on continuous readout mode for auto-guider.

USER> cal faint

      Use "handset" to centre all seven stars on the centre cross
      (in RaDec mode for the 180 deg. rotator position the cursors
      are reversed). If a star is centred press the 'DO' key.
```

```
Note the values in the log book and ** most important ** set the nominal
aperture back to the default by:

USER> enter ap 0 -251 326
```

5.6 Focusing the Telescope

To determine the best telescope focus the observer should select a suitable field (eg. one of the WFC photometric standard fields (http://www.ing.iac.es/~pms/tonotes/misc/systemcat.html#flandolt)) and run a focus script:

1. `SYS>gocat sa101-427`
2. `SYS>focusrun &`

   A dialog box will pop up and the appropriate values may be filled in and a focusrun started. All "#n" exposures will be taken on the same frame with the a double spacing between #1 and #2.

   Make sure the first focus position is different from the actual focus position as otherwise focusrun won't start, due to a missing acknowledgment from the TCS.

   Remember to set focus to the best value at end of focusrun and to repeat gocat if you need the target back in the centre.

5.7 Finding Guide Stars

Automatic predicting guide stars with rotator at 180 degrees and nominal pointing:

`SYS>cmd INFODISP PREDICT ON`

`SYS>gocat 'name'`
See guide star positions in the TALKER window. You can then take these and start guiding with:

`SYS>guide on pixel x y` (with x y taken from the prediction)

Whenever you use a rotator position different from 180 degrees or an aperture different from nominal you need to run gsc_apm!

```
The HST guide star catalogue to V of approximately 15.5 magnitude is
stored on /catalogs/hstguide.sun. This 300 Mbyte file contains the complete
GSC catalogue and can be efficiently searched for guide stars for the WFC.

To run the software the following environment variables and alias have to
be set up in an observing system xterm window on LPSS13 or on the TO
window (these are automatically setup by startobssys but if you want to
run it from some other window then type

>setenv GSC_DATA /catalogs/hstguide.sun      - pointer to the HST catalogue
>alias gsc_apm '/home/mike/soft/wfc/gsc_apm' - the latest version with 6+Nom
                                               beamswitch options

The program is usually invoked using command line options such as:

SYS>gsc_apm RaDec="10 30 0 -1 0 0" Rotpos=180 Equinox=J2000 Beam=N
SYS>gsc_apm Rotpos=90 Equinox=B1950 RaDec="21 30 11.3 12 10" Beam=C
```

```
 Command lines arguments are:

 RaDec="hh mm ss dd mm ss"
 RotPos=angle (180 default)
 Equinox=J2000 (or B1950)
 Beamswitch=N (or A,B,C,D,E,F)

        (A=centre of CCD#1, B=centre of CCD#2,
         C=centre of CCD#3, D=centre of CCD#4
         E=centre of Autoguider
         F=rotator centre, located on CCD#4)
```

5.8 TCS/AutoGuider interface commands

```
SYS> focus 46.0             - set telescope focus [default best focus]

SYS> rotate sky 180         - move PF rotator to 180 degrees [default]

SYS> gocat 12+30            - go to faint pointing grid star (http://www.ing.iac.es/~pms/tonotes/mis

SYS> gocat N12+30           - go to bright pointing grid star (http://www.ing.iac.es/~pms/tonotes/mi

SYS> offset arc -30 30      - offsets telescope from current pointing
                              by -30 and 30 arcsec

SYS> autotv [on|off]        - continuous readout mode

SYS> field                  - do a field and search for potential guide objects

SYS> guide on star n        - pick "n"th brightest detected object and guide

SYS> guide on pixel x y     - guide on at position x,y on auto-guider CCD
                              default is to specify x y = -1 -1 which
                              cause A/G to guide on current guide star
                              location
SYS> guide off              - turn guiding off

SYS> agwin acq pos x y      - set centre of field window for acquisition

SYS> autotime t             - set integration time "t" in ms.

Closed loop offsets
-------------------
You can offset by some arcseconds you may do this without opening
the guide loop using either aperture offsets on the TCS handset or
you can use the "tweak" command:

SYS>cmd TCS USER "TWEAK 10 10 0"

10 arcsec correspond to 27 pixels on the A/G (0.37"/pix) so you need
a guide window which can cope with the offset.

Below you find how the star on the AG will move using the TCS handset
in x-y APOFF mode:

    rot mount 180   S               rot mount 90    E
    +---------------+               +---------------+
    | |  ---> x     |               | |  ---> x     |
    | |             |               | |             |
  E | v  0.37"/pix  | W           N | v             | S
```

5.9 Filter Wheel control

```
SYS> filter R                  - change to R filter

SYS>/int/S8-2/bin/wfc_mdb_gui  - enable access to WFC filter database (eg. set
                                 telescope focus offsets)

After exiting from gui type:

SYS>cmd MCA RESET              - to update the volatile use of the database
                                 and enable the changes.
```

5.10 Command dictionary for UltraDAS

Command dictionary for UltraDAS
(http://www.ing.iac.es/~docs/ins/das/ins-das-29/cmd_dictionary.html)

CHECK-LIST

6 CHECK-LIST

Quick Check-List]

6.1 Telescope

```
- Switch off lights on all floors, close the blind in the restroom.
- Check the Operations Logbook for any restrictions.
- Make a visual inspection of the observing floor.
- Put the Telescope in ENGINEERING MODE.
- Clear any emergency overrides.
- Ensure that none of the SELECT MANUAL CONTROLS buttons have been activated.
- Make sure that the TCS/DAS/ICL software is running.
- Turn on OIL PUMP from the engineering rack.
- Move the telescope to ACCESS PARK.
    HA synchro pointers at the "12:00", turn DEC QM speed clockwise, push the
    DEC QM button, push and hold the DEC [+] button, later turn and hold the
    LIMIT keyswitch, push the DEC [+] button until close to 105 degrees.
- Fill the WFC, wear safety helmet (with visor) and gloves when filling
    cryostat! Always remember to leave the PRESSURE RELEASE valve on the
    dewar OPEN.
- Move the telescope out of ACCESS PARK.
    Turn DEC QM speed clockwise, turn and hold the LIMIT keyswitch, push the
    DEC QM button, push and hold the DEC [-] button.
- Zeroset encoders.
    Check telescope is vertical, HA synchro "12 O'Clock" position and DEC
    synchro "9:45" position.
    USER>zeroset ha target  (or: zero ha tar)
    USER>zeroset dec target (or: zero dec tar)
    Using the HA and DEC [+]/[-] buttons with slow motion (SM) and very slow
    speed, move the telescope so the synchro dial pointers MOVE THROUGH the
    "12 O' Clock" position in HA and the "9:45" position in DEC.
```

- Open up dome top shutter.
  Use RAISE MICRO until the OVERTRAVEL indicator goes off, RAISE MAIN until the shutter stops moving.
- Open up primary mirror cover.
- Switch dome vent fan on.
- Turn off dome lights and close control room blind.
- Switch telescope into Computer Mode.
  The HA and DEC slow motion (SM) push buttons MUST be set for SM mode (i.e. All the lower green sections of the buttons illuminated) and the oil pump must be on before Computer Mode can be selected.

6.2 Commands

- Object catalogue handling.
  USER>incl catalogue
  USER>out term
  SYS> object name 12 20 30 -10 5 40 J2000
  SYS> add
  SYS> gocat name
  USER> output file int:[cat]newfile
- Initial TCS commands.
  USER>show focal
  USER>show aper
  USER>AP 1 (or from the observers console) SYS>cmd TCS USER "AP 1"
  USER>focus 46 (or from the observers console) SYS> focus 46.0
  USER>calibrate last
- Twilight Sky-flats.
  SYS> guide on pixel 1032 512
  SYS> smartflat &
  SYS> guide off
- Focusing the Telescope.
  SYS>gocat sa101-427
  SYS>focusrun &
- Finding Guide Stars.
  SYS>cmd INFODISP PREDICT ON
  SYS>guide on pixel x y
  observing not with nominal aperture or rotator not at 180 degrees use e.g.:
  SYS>gsc_apm Rotpos=90 Equinox=B1950 RaDec="21 30 11.3 12 10" Beam=F
- TCS/AutoGuider interface commands.
  SYS>rotate sky 180
  SYS>offset arc -30 30
  SYS>autotv [on|off]
  SYS>agwin acq pos x y
  SYS>field
  SYS>guide on star n
  SYS>guide on pixel x y
  SYS>guide off
  SYS>autotime t
  SYS>cmd TCS USER "TWEAK 10 10 0"
- Filter Wheel control.
  SYS> filter R
  SYS>/int/S8-2/bin/wfc_mdb_gui
  SYS>cmd MCA RESET
- Command dictionary for UltraDAS.
  arc, abort, bias, bin, dark, dasreset, finish, flash, flat, glance, keep, multarc, multbias, multdark, multflash, multflat, multrun, multsky, newtime, obssys, promote, rspeed, run, sscratch, sky, startobssys, udas_camera_mimic, udas_detect_ro, udas_hct, udas_server, ximtool

6.3 Observers handover check

Ready to go it alone? Please check you are familiar with the following tasks:

- use of Intercom and Telephone
- safety precautions when using liquid nitrogen
- weather precautions, knowing when the dome must be closed
- observing at zenith distance between 57 and 70 degrees
- opening and closing the dome
- moving the telescope in engineering mode
- starting up and shutting down the observing system
- knowing about the most common faults and how to solve them
- writing your data to tape at the end of every night
- filling in fault reports
- filling in log book in control room
- producing the observing log
- filling in observing feedback form at the end of your run

Quick Check-List]