# NAOMI Start-up and Shutdown Procedure

wht-naomi-51

This note describes the procedure as of 16 September 2000. It is still very much subject to change on a daily basis, but the main concepts of what needs to be done are reflected here.
Button pushes are 'quoted' to avoid typing 'click on' throughout.

This procedures document does not at present give any help for what to do if any of the actions fails to complete or if the system does not reflect the expected state at each stage. Some known faults and crashes with recovery procedures are described in a separate document (NAOMI_faults_and incomplete.doc)

## Nomenclature

ER1: Electronics Rack 1, the Durham electronics large rack that is the LH of the two NAOMI racks in the GHRIL control room. The equipment in this rack is described in detail in Paul Clark's Electronics documentation.
ER2: Electronics Rack 2, the NAOMI (ATC) electronics large rack that is the RH of the two NAOMI racks in the GHRIL control room. A diagram showing the units in ER2 is given in Brenda Graham's Electronics documentation.
DM: the Electra Deformable Mirror
NEG: Naomi Engineering Gui (should come up on login to Navis) – it's the long Gui on the RH side of the screen).
OAP1: the first off-axis paraboloid mirror, also known as the FSM (Fast Steering Mirror).
OAP2: the second off-axis paraboloid, mounted near the GHRIL bench alignment telescope.
LFF: the Large Folding Flat mirror that sits opposite the DM.
Dichroic: infrared-reflecting mirror that feeds the IR science port and passes light to the WFS.
Field Lens: negative lens that sits behind the dichroic and makes the WFS optics *almost* telecentric.

## Starting from Completely Cold

### *Assumptions*

All electronics is cabled up correctly.
All opto-mechanics for WFS and OMC are in place and aligned.
NCU is in place and aligned. TheNAOMI optical bench is not floated but resting on its kinematic mounts, 'Facilities' (cooling to WFS cameras and NCU lamp) are connected correctly and the SDSU cameras chiller is on.
All NAOMI systems are powered down (note though that the VME crates, the C40 racks and the embedded Sparc aocontrol1 are usually left on).
The NAOMI computer NAVIS is on but user is logged out.

### *Procedures*

IN GHRIL Room:

1. Remove mirror covers: NCU output cover if on, DM cover, FSM cover, folding flat cover, OAP2 cover, dichroic cover, field lens cover (?? Not sure of cover situation since dichroic was moved forward as dichroic and field lens used to be in same mount. Probably needs a new cover to be made, unless Tully's plan to remount the dichroic in a combined unit again is adopted).
2. Put in the focal plane pinhole mask that you propose to use, if any.
3. If anyone is likely to have been in GHRIL doing work that could have resulted in mirrors being knocked or disturbed (e.g. by a bump to the whole bench), check location of folding flat, FSM and

OAP2 against their eccentrics. The best procedure for the FSM and OAP2 is to push them firmly against the two 'long axis' eccentrics then slide them up to the single remaining eccentric. The folding flat must be pushed first up against a 'bar' underneath itself and then slid firmly but gently towards the NCU until it won't move further. Try to avoid doing it so firmly that you get a 'clunk' at the end of the slide because this can cause bounce and registration is not as repeatable.

4. Start GHRIL Bench flotation system. Using the 3rd button from the right on the compressed air supply, set the pressure to 5 mBar. This can take about 10 minutes to stabilise. Make sure the air supply is actually connected. The hose is sometimes disconnected from the supply when the system is being let down onto its kinematic mounts in order to speed up deflation.
5. If required, insert the focal plan pinhole mask at the first focus point on the GHRIL bench. [repeats 2]

IN GHRIL Control Room:

1. Switch on chiller for cameras and NCU lamp (same chiller is also currently used to cool INGRID SDSU controller, so once on the chiller should be left on). Check temperature is set for 10 C.
2. Check that all front panel switches of ER2 are off.
3. Switch on ER2.
4. Ensure all front panel switches on ER1 are in an **off** position, **especially the high voltage power supply at the bottom of the rack.**
5. Switch on ER1.
6. Switch on embedded Sparc aocontrol1 and the C40 processors (all in the top section of ER1). There is a single black rocker switch at the top RH end of the unit.
7. Switch on VME crates for SDSU control and OMC mechanisms control in ER2.
8. Switch on the two grey/black SDSU camera power supplies at the bottom of ER2.
9. Press the two white RESET buttons on the SDSU camera VME crate.
10. After several minutes (or immediately if they were already running before you began) feel the SDSU controller boxes to check they are cold (i.e. chiller is running OK).
11. Currently there is also a fibre fed lamp used to augment the NCU lamp brightness. It sits on top of ER1. If required the power for this should also be switched on.

In WHT Control Room:

Getting the DM ready

1. Log on to Navis as naomi pwd asksomeonewhoshouldknow
2. If the NEG is not running (column of buttons, generally on LHS or screen), then 'NaomiLauncher.py'
3. A window will come up that gives the opportunity to enter parameters. *Do not enter anything*, just select OK.
4. In a terminal window, type 'xon aocontrol1'
5. Type 'NaomiRestart – slave' then minimise this window.
6. In the aocontrol1 terminal window, type 'NaomiRestart –slave'. This starts the c40Comms process and boots the c40 Real-Time DSPs including the strain gauge loops control.
7. Select RealTime from the tall thin GUI panel, the NAOMI Engineering GUI (NEG) that comes up with NaomiLauncher).
8. 'Update' on RealTime.
9. To operate buttons in this GUI, the action or value wanted must be selected or typed then the corresponding button on the left of the GUI pressed to activate it. This does not apply to the Open Loop and Close Loop buttons or the corresponding buttons for the Strain Gauge (SG) loops, *all of which act immediately*.
10. After Update the status of the loops and the current (or default for cold start) decimate rate for the diagnostics (CCD pixels and centroids) used by the diagnostics data stream will be shown.
11. Ensure the WFS and SG Loops are open ( 0 in appropriate boxes).
12. 'Mirror Mimic' on NEG and 'Mid Range' the DM.
13. 'TipTilt' on NEG, then 'Zero Values', 'Quit mimic'.
14. If you just want the DM system up, now go back up to GHRIL Control Room and to *1 in this document. If you want the Mechanisms running also, continue from here.

Starting up (or rebooting) EPICS mechanisms.

15. 'MechVxWorks' from NEG
16. If rebooting is required, type Reboot
17. This should automatically run the EPICS mechanisms start-up scripts and make the 'Mech EPICS' Gui usable.
18. If you also want to start up the camera system, continue from after this paragraph. If you want to get the mechanisms going go to ***1**.

Starting up the SDSU Controllers and WFS CCD cameras.

19. 'Cam VxWorks' from NEG.
20. Unlike for the Mech system, this will not automatically start the camera start-up sequence. Therefore this must be started manually.
21. Type '< startup_cam_no_epics' (note that all commands to run scripts for the camera in this window must be prefaced by the '<' sign).
22. Go to *1.

***1.**

In the GHRIL control room.

(You may have come to this point from one of three places. The DM/TipTilt Mirror , the EPICS mechanism and the camera control steps are all independent of each other at this point, so you can safely proceed with any or all of the following steps for the appropriate mechanisms).

DM / TTM power and control

1. (DM must have been set to mid-range with strain-gauge loops OPEN, Durham Tip-tilt mirror must be set to zero volts).
2. Switch on power to DACs (rocker switch lower-middle of ER1).
3. Switch on High Voltage Power Supply (lowest rocker switch on ER1).
4. Switch on tip-tilt mirror power supply. For Durham TTM this is the narrow unit at the top of ER2.

EPICS mechanism control

1. (This assumes the EPICS VxWorks system has already been booted up).
2. Turn on both the EPICS motor power supplies (rocker switches in about the lower-middle of ER2).
3. If likely to be required, switch on the power supply to the NCU lamp (rocker switch in unit sitting on top of the EPICS motor power supplies, probably next to PI NCU tip-tilt mirror control).
4. Power to all the other NCU facilities (beam-splitter drive, motorised mask) is enabled by individual switches accessed at the back of ER2 and these are usually left switched on. Therefore they come up when as soon as the rack is switched on. If a facility does not work check that (a) it is properly cabled and (b) that its individual switch on ER2 is on.

SDSU Cameras

1. (This assumes the SDSU MVME 167 + VxWorks system has already been started up).
2. Switch on the master power supply (rocker switch on the left-hand unit (number 7) of two black units at the bottom of ER2).
3. Switch on the slave power supply (rocker switch on right-hand (number 6) of two units at bottom of ER2).

Back at WHT Control Room

Starting Camera Reading. This starts up both cameras. For most of the actual observing in September we used only the first line of the following, leaving cam2 not running (see section on use of WFS synched/unsynched modes).

<readoutC40_cam1_no_epics
<readoutC40_cam2_no_epics
<synch_appl4

## General use of WFS synched/unsynched modes

**1. Summary**

Synched mode (full frame) (appl 4) is useful for alignment because the CameraSwitch.py GUI can be used to switch the pixel source from one camera to another on the fly. Otherwise, for real-time use, use unsynched master mode with all light going to the master CCD (by removing the WFS beam splitting system using the manual slide).

IT IS IMPORTANT NOT TO HAVE BOTH CAMERAS RUNNING IN UNSYNCHED MODE WITH THE REAL-TIME SYSTEM FRAMING AS THIS WILL CAUSE A PANIC - REQUIRING THE REAL_TIME SYSTEM TO BE RE-BOOTED WITH c40Run.

To start and stop framing of the real-time system:

On Navis:

WFS Start
WFS Stop

**2. Synched mode**

To prepare for Real-time processing in synch mode (master pixels selected) enter the following with the WFS framing stopped (or not yet started):

WFS SetFrameProcess masterSynch

Once the cameras are actually running, synch using:

On camera VME
<synch_appl4

then the WFS may be started

**4. Unsynched modes**

**5.**

To use unsynched modes, start one camera (almost certainly the master) and stop the other. To prepare the real-time system (with framing stopped) use:

On navis:
WFS SetFrameProcess master

(this is the default after re-boot)

framing may then be started.

3.1 Switching between Unsynched Camera modes:

to change between full-frame, 2x2, and 4x4 respectively:

On Camera VME:
<cam1_appl1
<cam1_appl2
<cam1_appl3

**4. Changing integration times**
to change integration time:
On Camera VME:
<cam1_50
<cam1_100
<cam1_200
<cam1_500
<cam1_1000
<cam1_2000

where x in cam_x is the number of units of 25us which the system will
wait between the end of readout and the next frame transfer.

DO NOT GO BELOW 100 UNITS IN FULL-FRAME MODE AS THIS WILL CAUSE A PANIC REQUIRING A REAL-TIME RE-BOOT USING c40Run. CHANGE THE INTEGRATION TIME TO A SAFE LEVEL BEFORE GOING FROM APPL3 or APPL2 to APPL1. A SIMILAR WARNING APPLIES TO PIXEL AND CENTROID DIAGNOSTIC DECIMATION FACTORS. THESE MAY BE SET TO LOW NUMBERS (EG. PIXEL=5 CENTROID=1) WHEN INTEGRATION TIMES ARE LONG (EG. >1000) BUT SHOULD BE SET TO HIGHER VALUES (PIXEL=20 CENTROID=5) WHEN USING SHORTER INTEGRATION TIMES. FAILURE TO DO THIS MAY STOP THE REAL-TIME SYSTEM RESPONDING TO FURTHER MESSAGES AND REQUIRE A RE-BOOT.

To switch centroid/pixel decimate:-

On navis:
WFS SetPixelDecimate 10
WFS SetCentroidDecimate 5
(also available from the interim Real-Time Engineering GUI)

4.1 NOTE on understanding integration times:

You must add the time taken to readout the number of pixels (which
depends on the readout mode and appll) to get the actual exposure time.
This can be obtained for the currently running mode using:

ON navis:
WFS EstimateFrameInterval

## *Further procedures.*

### Laser Flat

(Note: any reference to Fisba GUI in this or other sections means the Fisba x 2 GUI as we always use it in double-pass mode).
'Real Time' on NEG, SG loops Open, 'Exit'
'Mirror' on NEG, 'Midrange' DM, 'Hysteresis' a couple of times, 'Quit'
Check interferometer patttern against template

Adjust small interferometer return mirror next to optical rail to get correct pattern if necessary (this adjusts the tilt epoch of the fringes).
Ensure pinhole in the focal plane mask is installed (in future could instead use pinhole in motorised mask when it is fixed – this would obviously be more convenient).
Set SDSU camera integration time to 2000 units ('<cam1_2000' in SDSU control screen)
'Real Time' on NEG
Close SG loop
Set pixel and centroid decimates to 5 and 1 respectively (remember to press buttons as well as enter values)
'Exit'
'Fisba x 2' on NEG, then 'Continuous' (may need to set count scale to ~50 on the display)
'Mirror' to call up the DM mirror mimic
Recall a previous white light flat
Run a 4-bucket flat using the Fisba GUI (test with 'One Shot' first, then set iterations to 4 – 6 depending on how much work you think the system needs to do).
Save the resulting mirror configuration: WFSAlign, 'Save' will give a name automatically based on date and time.
Take Fisba display off 'Continuous' if not done automatically.
If necessary, touch up any recalcitrant tilted segments using 'Mirror' from NEG, 'Properties', drop down menu to XY setting, select segment number and move x and y until segment is flat. It is usually helpful to have the WFS Align GUI and spots visible when you do this as you can tell which way the segment needs to be tilted and watch it come in. To get this up, go to the start of the White Light Flat procedure.
Exit from Fisba control panel. This should take the Fisba display GUI down with it. After a short delay the live video feed from the Fisba interferometer will re-activate. Look out for segments that remain permanently grey. These have large tilts. The best way to adjust these back is by looking at the WFS spots using WFSAlign as a badly centred spot will be readily visible and indicate which way the segment must be tilted to recover the fringes.

## White Light Flat

(Note in all use of the 'Pick-off Mechs' display in the 'NAOMI Mechs' GUI, the current position is not meant to reflect the demand position; there is an offset introduced during the initialisation stage. It is worth noting the 'Current Position' values when the demand positions are 0. These are then the offsets used at initialisation. Having a feel for these is useful if any failures occur.)

Ensure NCU Focal Plane Mask is in place (unless using internal NCU mask at some future date, when a new mask has been provided).
Start by recalling a good recent Laser Flat or doing a new Laser Flat ('MIRROR' Gui from NEG, 'Load', select file name).
'FISBA2' Gui from NEG, 'Continuous' (takes ~ 10 secs to start up). Fisba interferometer fringes should now show that mirror is very flat. Display can also be used to check that segment corners are well located relative to lenslets.
'Tip Tilt' and 'Mid Range'
'WFSAlign' from NEG, 'Continuous'
Get spots onto the WFS (check beam-splitter is in, calibration lamp on, shutter is open)
Set CCD integration time to suitable value (currently 50 msecs or 2000 units), using 'SDSU' from NEG, type '<cam1_2000'.
In WFSAlign GUI, ensure centroiding is on then 'Tools', 'Alignment' shows average x, y offsets and focus etc.
Set pick-off values if necessary to ensure average x, y offsets are 0 (watch out for whole sub-aperture displacement errors) using Mechs', 'WFS', 'Pick-off Mechs'. As long as only small motions (<1mm) are required, set time of motion to 0.7 secs. 'Move', 'Start'. The scale is such that to move x pixels on the alignment display, change the x value on the pick-off by -x/6. Similarly for y. Units of x, y are about 3.5 pixels, although this is non-linear as alignment values approach 1. Iterate until mean x, y are each hovering around 0. (Note: for centering in the poor seeing lenslet array the scale will be ~ -x/3. This is not used for WLF of course).

Check focus is correct: x,y separation should be symmetric about 8.0 pixels (slight intrinsic astigmatism prevents them both being 8.0 simultaneously). Step focus of fore-optics stage in 'Pick-off Mechs' to achieve this. If it is already close, step sizes of ~0.1 should suffice. The best 'Demand' value as of end September is ~0.4 ('Current Position' value ~210).
Once the offsets are ~0 and the separations are correct, a good laser flat will give an RMS value in x and y of ~ 0.1 (0.08 - 0.15, depending also on how noisy the signal is).
Offset spots in Y using offset lenslets; 'Pick-off Mechs', type in 'f195_1.1_offets' for lenslet, set time of motion to 25 secs, 'Move', 'Start'. (Entries in text boxes can be cleared for typing in new text by holding down the right mouse button and clicking on 'Clear'. It is especially advisable to do this if you are changing a long text entry as characters can be lost or not deleted properly otherwise).
'Real Time' GUI from NEG. set decimate to 5,1
Start the WLF procedure: At Navis session, type 'WhiteLightProcedure <filename of last good laser flat>' (with full path /software/Electra/save/flat/<name>). A series of numbers from 1 to 119 should run through twice on the console, then a prompt to shift in X will be given. RETURN to the normal lenslet f195_1.1 first (this is where it is sensible to use the 'Clear' facility for text entry).
Offset the spots in X by moving the DM. 'NAOMI Mechs' GUI, 'WFS', 'DM', 'Device Display', set DM X stage position to 3.0 mm more than current centred position (Should be 3.8mm but this causes stress in DM cabling and twists DM out of face-on alignment. Even 3.0mm puts a small number of fringes across the DM that can be seen on the Fisba display).
(A problem with the DM translation stage causes the stage motion to fail sometimes. If this occurs, in the 'Device Display', set target position to current position (i.e. the position at which it has just stopped), set index to 0, 'Index', 'Go', set target position to desired position again, 'Move', 'Go').
Continue WLF procedure by hitting return in Navis window. The number of segments fitted, the RMS error of the fit in DAC units and the tip and tilt found will scroll up. RMS is typically 38 - 45. Number of segments fitted should be 72. If 73 are fitted it has also fitted on of the central four segments. The slopes should be <200. If significantly more than this, the interferometer set up should be tweaked and the WLF procedure should be repeated.
The WLF mirror configuration is saved automatically, with the same name as the laser flat but extension '.white'.
Return the DM translation stage to it central position using the 'Device display' level control. Any failures to move should be treated in the same way as when offsetting the translation stage. Any residual fringes across the whole DM should be small (~1) but there is hysteresis so the process is not 100% repeatable.
Load the new WLF: 'Mirror', 'Load', select appropriate '.white' file. Check this looks flat on the Fisba display.

It is helpful also to take all the mirror state raw data and save it in the TemperatureLog, as this can be used to calibrate the strain gauge - temperature relation. This is done as follows -
Saving temperature log: type in a terminal window

SGlogData /software/Electra/save/TemperatureLog/

Note: For a quick look at the results of the WLF , use command line

'PlotFlat /software/Electra/save/flat/yourflatname'

Until the last night of commissioning, if the WLF had too big a gradient (>200), it was necessary to try improving the starting setting of the Interferometer by tweaking the mirror.

Examine for staircase. Look at the INGRID grab image at a low level / long exposure. The tell-tale signs are extra light in a 'blob' exactly to the right or left or above or below the core of the image. To remove (or test if a blob is real staircase), go to a terminal window: type

'AddStaircase x 40' (typical size of motion) for x staircase change, 'AddStaircase y 40' for y motion. Play until you can no longer see any sign of staircase. The values are cumulative (i.e successive operation of adding 40 and then -40 would revert to starting position, adding 40 then 20 would result in an overall increase of 60).

### Simplex

Start by recalling a mirror configuration from a previous recent Simplex at this or another wavelength or a recent White Light Flat.
'Ingrid Align' from NEG

### Setting and Saving Offsets

Done after a Simplex result (normal) or sometime just a White Light Flat.
Make sure there are no offsets currently applied (can use 'ZeroMasterOffsets' in the RT GUI).
Ensure spots are centred well on CCD (using 'Tools', 'Alignment' in WFS Align).
In a terminal type

SetWFSoffsetsToCurrentCentroids master
SaveWFSoffsets master This then returns the file name of the offsets, with a .wcnof extension.

***Look out for a message listing segments with large value offsets.*** Consider taking the offsets again or, if in a hurry, tilting the poor segment to close to the appearance of its neighbours on the Fisba interferometer screen. The offsets are immediately loaded ready for use.

It is very important that these offsets are tested with the reconstructor before being used on sky. This is because a poor offset picked up on even one segment can propagate through the reconstructor as the neighbouring segments try to fit their edges to it.

### To test the offsets.

'Reconstructor Mimic' in NEG.
Select 'SOR' from scroll bar in top button, ELECTRA (not Naomi at present – bug) in the next box and enter values of 109, 105 respectively for the x and y values. 'Run', 'Quit'.
'Real Time GUI' in NEG, set 'Tip Tilt Gains' to 0 'Gain' to 0.3, 'Tip Tilt Limit' to 0.1 (Remember to press each appropriate button as well as entering values).
Set IngridAlign in continuous mode, looking at the pinhole image with a display level of about a quarter of the peak height and also watching the up-dating display of peak values.
'Real Time GUI', 'Close Loop'. ***Look for significant (>5 –10%) drop*** in peak values or a very noticeable change of shape in the image.
'Tip Tilt Mimic', change either x or y DAC values in steps of 100 up to about 600 from their current (usually mid-range 6144) values and confirm that the image does not break up.
If the offsets fail either of the last two tests, take them again.

You may wish to take a set of offsets for the poor seeing lenslet array as well. If you have done Simplex code for more than one wavelength each of the mirror shapes will require a set of offsets in every lenslet array you intend to use. Early indications are that you can use the same offsets for full frame, 4x4 and quadcell modes, but this needs to be confirmed by more experience.

## Observing

Remember to remove the focal plane mask, lower the GHRIL bench and switch off the NCU lamps (including the fibre-fed lamp power) before observing.

### *Some Recovery Procedures from Crashes or Common Mistakes*

*Symptom:* WFS Align GUI Freezes (centroids stop updating, GUI stops responding generally).

*Likely Explanation(s):* Either (A) you have started a camera operation mode (_appl2 or _appl3) that WFS Align does not support OR (B) you have gone to a short integration time with a pixel and/or centroid

decimate rate that is lower than the speed of displays can support OR (C) there has been a hang-up in one or more of the C40's for another reason.

*Possible Solutions:*
A. If (A) is the probable cause, kill the GUI using the right-button screen facility Window – Kill Window. Change the camera mode to full frame and run up the WFS Align GUI again. There are also partly-completed facilities to look at the other camera modes that could be tried if you want to see modes 2 or 3. One of these can be accessed by command line, type 'NaomiWfsGui &' at a prompt (note the more-than-usually non-conventional small/capital usage in this name). On this GUI select 'Display Naomi Frames', 'Continuous' (this bit incomplete are present, can't remember the third option).
TopGui (the next-up level of GUI not released yet but very well developed) will display all modes.

B. This 'mistake' causes a timeout somewhere. Kill the WFS Align GUI as above, then change either the CCD integration time to a longer one or increase the decimate rate by (say) a factor of two. Re-start the GUI.

C. Otherwise, there is a data diagnostics CPU failure or a C40Comms problem. There are various options for recovery from this depending on the depth of the failure.

The surest one is to go to a Navis terminal and use the command 'NaomiRestart'. There are also several qualifying options on this command, for example 'noC40Reboot'. It is best not to use these options at present as a spelling mistake in them can cause a further crash (i.e. they are not error-trapped).
'NaomiRestart' cleans up all real-time processes and reboots the C40s.
Next the diagnostics streams must be re-started.

Type WFS Status
This should bring up a string of CPU status information ,including a 'frame 1' message against each CPU and transaction information, mostly 0's and a 1000.
Type WFS Start
Type WFS Status
This time the frame numbers should be incrementing, indicating the frames are being received and interpreted correctly.

Remember that a c40 reboot will open the strain gauge loops and reset all real-time parameters such as loop gains, diagnostic decimations and the reconstructor matrix to default values. It will therefore be necessary to set or recall these before proceeeding.

*Symptom:* Problem starting INGRID Align. You press the INGRID Align GUI on NEG and nothing happens after >10secs (the time it usually takes to come up).

*Likely Explanation/Solution:* There is already an INGRID GUI running. Switch to using this one.

*Symptom:* INGRID Align stops working.

*Likely Explanation/Solution:* There are 3 stages of recovery from this situation.
A. Kill any INGRID Align that is started, including looking for an INGRID Align process (ps –ef | grep Ingrid then kill the process ID number, on a terminal). Do any normal INGRID exposure using the DAS system. Try re-running INGRID Align after this exposure has completed.

B. If the above fails: pull up the window running the Drama Server. CTRL-C from the server.
Type stop-DramaServer.sh
Often this does not come back to a prompt because it has already stopped, so CTRL_C out of it after several seconds.
Type drama-cleanup
Type Dserver.csh
Type start-DramaServer.sh

C. If this doesn't work (rare), start again but also re-start INGRID's own software after CTRL_C from DramaServer and going through the Stop and cleanup routines above.

### Image and Diagnostic Data Stream Saving

The WFS Align image of spots can be grabbed by a terminal command ' WFStoFITS . Such images are now automatically saved in the /software/Electra/save/Grabs/WFS directory.

INGRID images can be grabbed by using the Grab facility in INGRID Align. Note that if subsequently you want to use the Eclipse software Strehl meter you should grab images with dimension 31 x 31 (or 63 x 63). This will give you actual image size of 32 x 32 (or 64 x 64) because of a software 'feature' in INGRID Align. Such images are now automatically saved in the /software/Electra/save/Grabs/Ingrid directory.

## Shutdown

The following describes a 'shutdown for the end of a night' procedure, not a 'finish with NAOMI for days/weeks' procedure.

In the WHT control room:

Ideal Mechanism placements for shut-down:
Y pick-off to index 5 using device level control
Beamsplitter out
CCD shutter closed

NCU Calibration lamp off: 'NaomiMechs'
'Real Time' from NEG, Loop 'Open'
'Real Time' from NEG, SG loops 'Open'
'Mirror' from NEG, DM 'Mid-range'
'Tip Tilt' from NEG, TTM 'Mid-range' (for Durham DM: use 'ZeroValues' instead of 'MidRange')

Then in the GHRIL control room:
High Voltage power off, bottom rocker switch in ER1 **(must be done before DACS are turned off)**
Tip-Tilt Mirror power off, rocker switch on small unit at top of ER2 **(must be done before DACS are turned off)**
DACS power off, rocker switch next to bottom in ER1.
WFS Motors power off, two green rocker switches in the middle
Turn of power to fibre-fed NCU Calibration Lamp if on.