Chapter 1

HERMES Overview

The High Efficiency and Resolution Multi-Element Spectrograph (HERMES) is a four channel spectrograph, housed in a clean, temperature controlled room located inside the AAT west coudé laboratory. HERMES provides a nominal spectral resolution of $R \sim 28,000$ and an option of higher resolution with a slit-mask at $R \sim 45,000$, at the cost of approximately 50% light loss. With the AAT+2dF system, HERMES provides high resolution multi-object capability for up to 392 objects. In its current fixed grating setup, HERMES provides simultaneous observations in the following wavelength regions:

- BLUE: 471.5 - 490.0nm
- GREEN: 564.9 - 587.3nm
- RED: 647.8 - 673.7nm
- IR: 758.5 - 788.7 nm

1.1 HERMES Components

1.1.1 Slit Assembly

The HERMES receives light from the 2dF positioning system. The spectrograph slit assembly holds two interchangeable slit units. It provides accurate and stable interfaces for the two fiber feeds coming from 2dF, each containing 400 fibres regrouped in 40 slitlets. Each of the 2 x 40 V-grooved channels in the slit bodies houses a lens relay that changes the F/3.16 focal ratio.
output of the fibres to feed the collimator at F/6.32. To optimize image quality, the slit is curved (convex and spherical) with a radius of curvature of 935.9 mm.

For high spectral resolution, a slit mask can be inserted manually on a kinematical mount. Installation of the slit mask is a daytime operations task, and the slit mask cannot be exchanged during night-time observations. The slit assembly also holds a back illumination system, used to position precisely the fibres on the sky target positions.

1.1.2 Collimator and Beam splitters

Post slit, a F/6.3, 9.3 degree off-axis collimator with two spherical corrector lenses produces a 195 mm diameter parallel beam.

Three large dichroic beam splitters separate the beam into the four HERMES channels. The beam splitters that define the wavelengths for the four channels are as follows: 370-492 nm (BLUE); 560-593 nm (GREEN); 643-679 nm (RED); 754-1000 nm (IR).

1.1.3 Gratings

HERMES uses four Volume Phase Holographic (VPH) gratings, one in each channel. Two of the four gratings require a mosaic of two gratings on one substrate due to the aperture and line frequency required. The HERMES "BLUE" and "GREEN" channels use single exposure gratings, while the HERMES "RED" and "IR" channels use mosaic gratings. The central wavelengths of the gratings are Blue: 483.3 nm, Green: 578.8 nm, Red: 664.2 nm, IR: 777.8 nm. The actual angle of incidence within the assembled spectrograph is within ±0.1 degrees of the nominal value of 67.2 degrees.

1.1.4 Cameras and Detectors

Each HERMES channel has four F/1.7 cameras, respectively optimized in the Blue (370-550 nm), Green (500-650 nm), Red & IR (600-1000 nm). Four independent shutter systems allows the four channels to have individual exposure times. Each camera feeds one 4096 (spectral direction) x 4112 (spatial direction), 15 μm pixel, Charge Coupled Device (CCD) from the E2V CCD231-84 family. The "BLUE" and "GREEN" detectors are both 16 micron, standard silicon devices with broadband and mid band coatings. The "RED" detector is a 40 micron, deep depletion device with fringe suppression and an ERI coating. The "IR" detector is a 100 micron bulk silicon device with fringe suppression and a "Multi-9" coating.

The detectors are housed in cryostats operating at about 170 K. Each detector is controlled with an AAO2 CCD controller. These controllers are configured for operation with the E2V CCD detectors to permit readout from one, two or four detector outputs, at various readout rates with windowing and binning options.

1.2 Resolution and Efficiency

Spectral resolution across the detector ranges from 25,000-30,000 for the 4 pixel sampling of the 2 arcsecond slit width (the averaged projection over a circular fibre reduces the projected 5 pixel sampling to an effective 4 pixels). Spectral coverage is ≈ \( \lambda_c/25 \) around the 4 central wavelengths \( \lambda_c \) set by the VPH gratings. A slit mask can be inserted to get the same wavelength coverage with a higher 2-pixel spectral resolution from 40,000-55,000 at the cost of 50% light loss.

The beam splitters, gratings and cameras coatings are optimized for their respective spectral ranges. The HERMES system provides approximately 10% total efficiency from the telescope to the detector signal, such that a 1 hour integration time results in a signal to noise ratio of 100 per resolution element for a 14th mag star.
The currently available beam splitters and gratings have been optimized for the Galactic Archaeology Survey case. Alternatives might be purchased later in order to cover other science domains.

Figure 1.2: Optical layout of the HERMES spectrograph.

1.3 Spectrograph Focus

The HERMES spectrograph is focused by moving the CCDs. Each CCD is mounted on a moveable stage within the dewar which provides three degrees of freedom: overall piston, a tilt along the spatial axis, and a tilt along the spectral axis. Only the piston and spectral tilt focus mechanisms are motorized. The spatial tilt is fixed at the nominal best position such that all fibres fall within the boundary of the detector. The spatial tilt should only be moved manually by technical staff.

The spectrograph is typically focused each afternoon. The best focus values can differ between the two HERMES slits, hence the focus should be set independently on both slits. Once the best focus values are set, it usually changes minimally day to day.

Note HERMES is sensitive to temperature changes in the spectrograph room, such that if there have been heavy daytime activities in the room or the room door was accidentally left open, the spectrograph focus should be checked prior to starting the science observations. Good focus minimises cross talk between spectra on the detector, and ensures the fibre tramlines can be accurately identified in the data reduction process.

1.4 References

- “Integrating the HERMES spectrograph for the AAT” : Heijmans et al. 2012 SPIE 8446 17 s
- “HERMES: revisions in the design for a high-resolution multi-element spectrograph for the AAT” : Barden et al. 2010 SPIE 7735 19
Chapter 2

Calibrations and Overheads

Here we discuss the overheads incurred and the minimum calibration requirements for HERMES data.

2.1 Detector Settings

HERMES CCDs can be readout using SLOW, NORMAL and FAST readout modes with 1, 2 or 4 amplifiers. Tables 2.1 show the gain, readout noise, and readout times for the various readout modes using a single top left amplifier. The values for other individual amplifiers are very similar to those in Table 2.1. A faster NON-ASTRO readout mode is also possible but not supported for science observations due to known spurious effects. This mode is only made available for engineering tests.

Using the two Left amplifiers or two Right amplifiers readout the detector in the spatial direction where fibres 1 - 200 are readout with the bottom amplifier and fibres 201 - 400 are readout with the top amplifier. This avoids splitting the data in the spectral direction and is the default amplifier setting.

Using two Top amplifiers or two Bottom amplifiers readout the detector in the spectral di-

<table>
<thead>
<tr>
<th>CCD</th>
<th>Mode</th>
<th>Readout time (sec)</th>
<th>Gain (e⁻/ADU)</th>
<th>Read Noise (e⁻)</th>
</tr>
</thead>
<tbody>
<tr>
<td>BLUE</td>
<td>Fast</td>
<td>144</td>
<td>2.6</td>
<td>4.1</td>
</tr>
<tr>
<td></td>
<td>Normal</td>
<td>282</td>
<td>1.8</td>
<td>3.2</td>
</tr>
<tr>
<td></td>
<td>Slow</td>
<td>420</td>
<td>1.2</td>
<td>2.9</td>
</tr>
<tr>
<td>GREEN</td>
<td>Fast</td>
<td>144</td>
<td>3.0</td>
<td>4.4</td>
</tr>
<tr>
<td></td>
<td>Normal</td>
<td>282</td>
<td>2.0</td>
<td>3.1</td>
</tr>
<tr>
<td></td>
<td>Slow</td>
<td>420</td>
<td>1.4</td>
<td>2.6</td>
</tr>
<tr>
<td>RED</td>
<td>Fast</td>
<td>144</td>
<td>3.1</td>
<td>4.9</td>
</tr>
<tr>
<td></td>
<td>Normal</td>
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<tr>
<td></td>
<td>Slow</td>
<td>420</td>
<td>1.4</td>
<td>2.9</td>
</tr>
<tr>
<td>IR</td>
<td>Fast</td>
<td>144</td>
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<td>4.4</td>
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<td>1.5</td>
<td>3.5</td>
</tr>
<tr>
<td></td>
<td>Slow</td>
<td>420</td>
<td>0.7</td>
<td>3.0</td>
</tr>
</tbody>
</table>
Table 2.2: HERMES Calibration exposure times

<table>
<thead>
<tr>
<th>CCD</th>
<th>Mode</th>
<th>Arc Exposure (sec)</th>
<th>Flat Exposure (sec)</th>
</tr>
</thead>
<tbody>
<tr>
<td>BLUE</td>
<td>Nominal</td>
<td>180</td>
<td>16</td>
</tr>
<tr>
<td></td>
<td>Mask mode</td>
<td>300</td>
<td>40</td>
</tr>
<tr>
<td>GREEN</td>
<td>Nominal</td>
<td>180</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td>Mask mode</td>
<td>300</td>
<td>10</td>
</tr>
<tr>
<td>RED</td>
<td>Nominal</td>
<td>180</td>
<td>2</td>
</tr>
<tr>
<td></td>
<td>Mask mode</td>
<td>300</td>
<td>5</td>
</tr>
<tr>
<td>IR</td>
<td>Nominal</td>
<td>180</td>
<td>2</td>
</tr>
<tr>
<td></td>
<td>Mask mode</td>
<td>300</td>
<td>5</td>
</tr>
</tbody>
</table>

rection, such that the first half of all fibres are readout with the Left amplifier and the second half of all fibres are readout with the Right amplifier. This splits the spectrum in a single fibre. Using all four amplifier reads the detector in 4 quadrants.

Using any two amplifiers gives 1/2 the readout time and four amplifiers gives 1/4 readout times from the values given in Table 2.1.

Each CCD can be binned independently in spatial (Y) and up to 2 X in the spectral (X) direction for all readout modes. The readout times for binned data using two Left amplifiers with FAST readout are as follows:

\[
\begin{align*}
X=1, Y=1, & \quad 71\text{sec} \\
X=2, Y=1, & \quad 52\text{sec} \\
X=1, Y=2, & \quad 36\text{sec} \\
X=2, Y=2, & \quad 26\text{sec}
\end{align*}
\]

All readout modes in all CCDs reach saturation at 65536 adu. The level of dark current in the four CCDs is between 1.5-3.0e/pixel/hour.

2.2 Calibrations

At minimum each configuration observed with HERMES requires a flat and arc exposure. More frequent arcs (eg. before and after a science frame) can be taken for higher precision wavelength calibration requirements. Flats need to be taken only once for a given configuration, provided the slit unit has not been moved.

HERMES wavelength calibration uses 2 ThXe lamps installed within 2dF. Both ThXe lamps should be selected in order to get sufficient flux level in a timely manner. For Flats, there are a selection of quartz lamps within 2dF, however the 75W lamp with diffuser installed on the 2dF calibrations flaps is recommended for HERMES flat exposures. The typical exposure times for HERMES arcs and flats are given in Table 2.2 for both nominal and high res mask mode using 2xThXe lamps and the 75W Quartz lamp.

The values in Table 2.2 are approximate and only given for guidance. These exposure times have provided sufficient flux for wavelength accuracy within 0.1 pixels and flat field counts to achieve a signal-to-noise of 100 per resolution element. For different science requirements the exposure times should be adjusted.
Chapter 13

Preparing the instrument

13.1 Focusing HERMES

The HERMES focus procedure uses pairs of Hartmann shutter arc frames to derive the focus values. A pair of arc frames are observed, each with an occulting shutter closed across half of the collimator mirror (left and right half in turn). When the system is in focus, the obstruction in the beam will merely result in a loss of system throughput. However, if the system is not correctly focused, the two frames will project arc lines onto slightly different places on the CCD (moving the line pattern as a whole to the left or the right).

The principle of the focus technique is to measure these shift as a function of position on the CCD, and then adjust the detector position (Piston and Spectral tilts only, the Spatial tilt is not motorized) to minimize the observed shifts.

An analysis script takes as input a Left+Right Hartmann pair, smooths the images to reduce the impact of bad pixels, cross-correlates 9 subregions of the images, in a 3×3 grid, to determines shifts, and then returns suggested values to adjust the focus.

We recommend running the focus procedure every night, a few hours before observing starts (with the dome lights off). The best focus values can differ between the two HERMES slits, hence the focus should be set independently on both slits. Once the best focus values are set, it usually changes minimally day to day. Below we outline the focus procedure:

1. In the HERMES Spectrograph Control Window (see Figure 13.1), click AutoFocus - Hartmann. The sequence of hartmann exposures will commence immediately after. The exposure time is fixed at 180sec per exposure.

2. The Automatic Focus window 13.2 will also pop up at the start of the script. This displays the Piston, Spectral tilt and Spatial tilt for all four CCDs for various settings, which are filled in as the focus script proceeds. The Current Position and Settings at Image Capture should be the same.

3. Once the two set of exposures have readout, the calculated pixel shifts will be updated in the Automatic Focus Window. Inspect the suggested new settings and the difference.

4. If the difference in pixel shifts is less than 0.1 then the focus is fine. If not, click the Apply button to move the selected setting to the suggested new value. Clicking Apply Arm will move all mechanisms per CCD, and clicking Apply All will move all CCDs.
Figure 13.1: HERMES Spectrograph Control Window.
Figure 13.2: Automatic Focus Window.

Figure 13.3: Focus Mech Window.

Figure 13.4: Confirm changes to focus values.
5. If the shift was large, it may be worth to repeat the script to confirm the movement has been applied correctly. This should not be needed 😕

6. At the end of the script both hartmann shutters will be left open. If for some reason the focus script was aborted mid-way, ensure both Hartmann shutters are opened prior to taking science frames.

7. Once you are happy with the focus values, select the Focus Mech button from the HERMES Spectrograph Control Window. The Focus Mech Windown will opo-up as shown in Figure 13.3. In here, select the Save Settings button to save the current focus values for the slit used. A window as shown in Figure 13.4 will come up asking to confirm the settings. Select Save current settings as the new standard. This will ensure the correct settings are applied each time you tumble between slits.

8. Repeat the above steps for the other slit and ensure both sets of focus values are saved. In the HERMES Spectrograph Control Window select the Focus Follows Slit button to ensure the focus values automatically change to the saves values when you tumble between slits.
Chapter 14

Science Observing

14.1 Configuring a Field

Before configuring a field in the afternoon, the instrument must be released to the observers. Check with the AAT staff that no work is being performed on the instrument, and that it is safe to begin configuring.

“Configuring a field” is the process of moving the fibres around in the telescope’s focal plane for a new field. As input, this process requires an .sds file that is the output of “running configure” (see Chapter 5: Using Configure).

14.1.1 Making .sds Files Available

The .sds file must be copied to a directory that is accessible to the robot. Typically, the user should copy the .sds to a subdirectory of

/configs/

This directory is available on any of the computers in the control room. Then, on the instrument control computer (aatixy), the file is copied into a directory for the night’s observing, e.g.,

~2dF/config/oct13/20oct.

14.1.2 Configuring the field plate

Once the .sds file is in place, the configure is set up and started using the Positioner window, Figure 14.1.

1. If the plate to be configured is not in the configure position, click Tumble in either the Plate 0 or Plate 1 tab to exchange the plates.

2. Under the Wavelength tab, set the spectrograph central wavelength. The autoguider default of 5000Å should not be changed except on expert advice.

3. Under the Weather tab, set appropriate values for the weather at the start of the observation. Except for fields configured during the afternoon, the best is to use the Met System values. Select Using Dialogue, then the Fetch button will update the values with the current conditions.
NOTE 1: Write these values down in case of software crashes. If you don’t record these values, and have to restart the positioner mid-configuration, you may be faced with a time consuming tweak to positions if conditions change. A convenient log sheet can be found at ∼2dF/config/LogSheet.conf.ps.

NOTE 2: If configuring during the day remember to set realistic night-time temperatures, etc. Check the Met system and guesstimate the temperature based on what it was 24 hours ago and the current trend.

4. Select the Plate tab for the plate to be configured.

5. Set the start time (in 24h local time) and duration (in hours) of the observing sequence for the field, which is known as the “tweak”.

NOTE:
Tweaking a field does not change the actual time a field is valid for (which is fixed by the physics of the atmosphere and 2dF corrector system). It just sets how the software will configure the field to get the most possible light down the fibres over the period observed (however little that might actually be!). Generally, fields are valid for up to two hours, sometimes much less. See §XXX!!! for more information if you are confused.

6. Select the configuration file by clicking the Find button and finding the file in the file system.

7. Finally, press the Configure fibres button to start the configuration. The system then:
   - Checks that the configuration (including tweak) is valid — i.e., no fibres will collide;¹

¹If the requested configuration fails this test, then the robot will not be able to configure the field. It is
• Does a survey of the plate to be configured with the gripper gantry (note, the FPI Gantry cannot be moved while this happens);
• Moves all the fibres to their new positions (for a full field, this takes 30-50 minutes).

14.1.3 Hints for configuring fields

Changes in Fibre Status

If, during the course of an observing run, the status of the fibre changes (usual with broken fibres being disabled), then the user may want to re-configure the .sds file. The tdFconstants400.sds file on aatlxy is updated by the 2dF software every few seconds. The version of the file on the configure web site is only updated at 8:30am each morning. If configure is run on aatlxa the updated version will be used. On the user’s own computer, the new files will have to be obtained from:

aatlxy:/instsoft/2dF/positioner/tdFconstantsDF.sds

Configuring a field without parking unused fibres

The default mode of operation is for the positioner to park all unused fibres in a new configuration. However in some circumstances this is not the behaviour which is required. For example if the new configuration is to observe a few bright stars at the end of the night then the observer might not want to spend a lot of time parking the unused fibres. To change the mode of operation select the flags tab on the positioner subwindow and click on the right hand button (provided with help dialogue) to select the mode where unused fibres will be left in the field unless they are in the way of the future configuration. Remember to unset the flag after doing the configuration (it also automatically resets on the next restart of 2dF.)

14.2 Acquiring a New Field

Acquiring the first field of the evening and slewing to a new field is a complex task.

1. If changing fields, check that all required calibrations have been taken with the current field before tumbling to the new field.\(^2\)
2. In the Telescope Control window, select the source for the next observing positions, typically Config Plate File. Clicking Load Position from File should update the position boxes on the left hand side of the window.\(^3\)
3. Check with the night assistant that it is safe to slew the telescope, then click Commence Slew and Track in the same window.
4. While the telescope slews, exchange the field plates using the Tumble button in the Positioner Control window.
5. Once the new plate is in position, and the spectrograph slit exchange has completed, take the required calibration frames (usually an arc and a flat). While these frames read out, there is generally time to check the seeing and centre the field using the FPI camera.

\(^2\)In general it is safe to take calibrations while slewing, but large slews do affect the fibre throughput, probably at the \(\lesssim 5\%\) level.

\(^3\)Alternately, particularly for non-configured locations such as standard stars, the position information can be given directly to the night assistant.
6. Confirm that the ADC is tracking — look for “Tracking” under the ADC in the HERMES Main Window.

7. After calibrations are complete, ask the night assistant to set up the guiding.
   
   - If the Night Assistant asks for the plate rotator, find the Clone Rotation to NA button which is under the Rotation tab in the Positioner Control window.
   
   - Usually the field is acquired straight away by the Night Assistant. If not, it may be necessary to acquire with the FPI as described in § 11.3.

8. Once the Night Assistant confirms that the telescope is guiding, start the science frames.

9. Finally, do not forget to start the positioner configuring the next plate.

14.3 Taking Data

14.3.1 Typical Observing Sequence

1. **FLAT** — For identifying fibres on the CCD and tram-line fitting.

2. **ARC** — For wavelength calibration.

   **NOTE:** You can take a seeing measure with the FPI while CCDs are reading out.

3. **OBJECT frames** — These should be split up into at least 3 separate exposures so that cosmic rays can be removed by reduction software.
The coudé room is not thermally stable, particularly if the room was accessed during the day, and so it is wise to intersperse ones observations with flats and arcs if high precision observations are required (at the 0.5 pixel level there should be little change over 1-2 hours).

14.3.2 Multi-Fibre Flat Fields (FLATs)

Multi-Fibre Flat Fields are taken using the quartz lamp in the calibration unit. The default is the 75W lamp with exposure times BL: 18s, GN: 5s, RD: 2s, IR: 3s in the nominal resolution mode. Using the high-resolution slit mask, the default exposure times are BL: 40s, GN: 10s, RD: 5s, IR: 5s. Set up is as follows:

1. Check that the Night Assistant is not guiding.
2. Select Fibre Flat run type.
3. Set your exposure time for each channel.
4. Select type of run (Normal, Dummy, Glance).
5. Select readout speed.
6. Click on Start CCD Run.
7. Now you will be given a choice of lamps (see Figure ??). See Table ?? for appropriate Flat Lamps and Exposure Times.

**NOTE:** NEVER mix quartz lamps!, this will create an illumination that not only varies in intensity across the FoV, but also in spectral response, and would be useless as a flat field.

8. You can click whether to leave the flaps closed after the exposure; this is useful if you are doing another calibration frame (e.g., ARC) immediately after, as no time is wasted opening and closing the flaps.

**NOTE:** The flat field lamps require a few moments to warm up to their operation temperature. This is of the order of the time required for the flats to close. However, if the flaps are left closed between observations, the flat lamps may not reach their intended stable illumination spectrum before the exposure is started.

14.3.3 Wavelength Calibration Frames (ARCs)

Wavelength calibration (or ARC) frames are taken using the lamps in the calibration unit. These illuminate the flaps below the corrector. There are two Copper-Argon (CuAr), two Iron-Argon (FeAr) lamps, two Thorium-Xe (ThXe) lamps, a Helium (He) lamp and a Neon (Ne) lamp, which can be turned on separately or in combination.

The recommended lamps for HERMES wavelength calibration are the two ThXe lamps. While its possible to expose with other lamps, they are have not been tested and are currently not supported by 2dfdr. The default exposure time is 180sec in all channels with both lamps in nominal resolution mode, and 300sec in all channels when using the high resolution mask mode.

1. Ask the Night Assistant to stop guiding.
2. Select Arc run type.
3. Ensure the exposure time is as required.
4. Select **type of run** (Normal, Dummy, Glance).

5. Click on Start CCD Run.

6. Choose **arc lamps** (see Table ?? for appropriate time combinations depending on the grating used), and select whether or not to leave flaps closed after exposure.

14.3.4 **Object Frames**

1. Select **object** run type.

2. Set the **exposure time**.

3. Choose **type of run** (Normal, Dummy, Glance).

4. Click in **count** and set for **number of repeat exposures** (typically 3).

5. Check the **type of offset observations**: None, Beam switch, Cross beam switch or Shuffle. This will typically be set to **None**.

6. When you are happy with your configuration, click in **Start CCD Run**.
Chapter 10

The Observing GUI

The observing GUI or “control task” that manages the instrument is called `tdfct` for the “Two-Degree-Field Control Task”. The basic software is shared between 2dF-AAOmega, HERMES, SAMI, and KOALA. Typically, the control task is brought up by the AAT technicians before you arrive. If it is not running, it is necessary to check with the afternoon tech before starting it.

10.1 CCD Control Window

Data acquisition is controlled via the CCD Control window (Figure 10.1).

At the top, the status of the four channels are displayed. Green indicates the channel is available and displays as “idle”. During an exposure the panels turns to blue and displays as “Observing”. Next the CCD Telemetry information are displayed, indicating the current dewar temperature and the heater voltage per channel.

Below this are four panels, corresponding to the exposure status of each channel. When idle, the panels are white, during exposure a green bar indicates the exposure time and status, and during readout a light blue bar indicated the progress of the readout time.

The next panel indicates the next or current run number. A series of buttons under `Select Observations` determine the observation type. The selected observation type is written in the header of the generated files. They are:

**Object** Take a regular science frame of the target(s).

**Dark** Take a dark frame.

**Bias** Take a zero length frame

**Offset Sky** Used for an offset sky frame (for sky subtraction and/or throughput calibration).

**Offset Flat** This is used for twilight flat-fields (it might also be used for a dome flat, but make sure to keep a log!)

**Detector Flat** This is used for flat fielding the detector response. Selecting this will move the slit to illuminate the entire detector.

**Fibre Flat** This is the standard “flat-field”. These files are used in the data reduction to find fibre tramlines (spectra) across the detector, and also to take out variations in response
Figure 10.1: The CCD Control Window.
with wavelength. The lamp to use is selected after the **Start CCD Run** button has been pressed. See Figure 10.3

**Arc** The standard wavelength calibration frame. The lamp to use is selected after the **Start CCD Run** button has been pressed. See Figure 10.2.

**Flux Cal** This identifies the frame as having a flux standard in it. The software will ask you to identify which fibre the flux standard is illuminating.

Next, the type of run needs to be selected.

**Normal** A normal run is taken. These data are archived and stored in the regular data directories.

**Dummy** These data are written to a separate dummy directory, and are not archived.

**Glance** In this case, the CCD readout is displayed on screen, but not saved.

The exposure time is set in the next box. A separate exposure time for each camera can be set. BL is for the Blue camera, GN for the Green camera, RD for the RED, and IR for the Infra-red camera. For some standard exposures, such as Fibre Flats and Arc frames, the standard exposure time is pre-loaded into the boxes upon selecting the observation type. Ensure the exposure time is correct for all cameras prior to starting the exposure.

The **Sky Subtraction modes** are defined in §XXX!!!. None is set as default.

The **Select CCDs** buttons allows one to choose which channels/CCDs are used. All should be selected by default.

The **Repeat Mode** selection can be a **Single** frame, **Continuous** frames (until manually stopped) or a **Count** number of repeats. The number is set in the box below **Count**.

Options for selecting CCD readout amplifiers, windows, and readout speed are accessed using the **Amps/Speed/Windows** button. The default modes are displayed in green, and any non-standard setting is displayed in orange.

(ask Tony for Amps/Speed/Windows GUI images)

The **Seeing** box allows the observer to enter the seeing value at the time of the exposure, which will be written in the header.

The **Plot Fibre Errors** button, when selected, generates a plot to be displayed upon starting an observing sequence which shows the difference between the physical location of the fibres on the plate and the actual location of the targets. The difference is the result of atmospheric affects not accounted for by the 2dF corrector.

Finally, **Start CCD Run** starts the requested exposure. If the requested frame requires lamps, a box (see Figure 10.2 for Arcs and Figure 10.3 will appear where the specific lamps required can be selected. Calibration flaps, if needed, will automatically be closed during the exposure and opened at the end of the exposure, unless they are requested to be left closed for consecutive lamp exposures, by selecting the **Select to leave flaps closed** button.
Figure 10.2: The ARC lamp selection window.
10.2 Starting Up \texttt{tdfct}

Typically, the AAT technicians will start the control task for you. If it is not running, you should enquire with them before starting it.

This section is for advanced users only. If you have not done this before, seek help from AAO staff before proceeding.

The main rules for starting the 2dF control system are to make sure the software is in a tidy state and to start the control systems before applying power to anything. The startup procedure depends on exactly how the system was shutdown (see Section 10.3).

\textbf{NOTE:} \texttt{tdfct} cannot be run over the network, e.g. via \texttt{ssh}. Remote observing depends on a VNC connection to the observing console at the AAT.

\underline{This is the step-by-step guide to starting 2dF/HERMES from scratch:}

1. Before starting determine what state the system is in, and why \texttt{tdfct} has not already been started. Ask the technicians.

2. At the console for \texttt{aatxdb} in the control room, select \texttt{aatlxy} from the system chooser and log in as \texttt{aatinst}. The password is known by AAT staff.

3. Type \texttt{cleanup} into the \texttt{xterm} to make sure nothing has been left running.

4. Type \texttt{hermes} into the \texttt{aatlxy} terminal window to get the 2dF/HERMES control system running. The 2dF main window will appear (see Fig. 10.4).

5. To initialise all of the hardware choose the \textbf{Initialise} item from the \textbf{Commands} menu.

6. During the initialisation of the HERMES system, a prompt asking to confirm trust in the HERMES position will pop-up (see Figure 10.5). If you are sure the HERMES mechanisms...
Figure 10.4: The 2dF main window upon start up. After initialising the system will show the status as Available in green.

have not been moved since last clean shutdown, then proceed with Trust button. Ask the afternoon tech staff. If unsure click Don’t Trust, and all the mechanisms will be moved to the home position prior to making any subsequent moves.

7. To bring up the various control windows, click the more button under the corresponding part of the system in the 2dF Main Window. The FPI window starts up minimised, and can be found in the task bar at the bottom of the screen.
Figure 10.5: The HERMES Trust Prompt.

10.3 Shutting down 2dF

This section is for advanced users only. If you have not done this before, seek help from AAO staff before proceeding.

NOTE:
It is important to realise that if there have been positioning problems or errors then you should NOT attempt to shut down 2dF without expert technical assistance (by phone or in person) particularly if the gripper is carrying a fibre when it is stopped.

These are the steps needed to perform a regular shutdown of 2dF:

1. From the main tdfct window choose the exit option from the File menu item.
   - A subsystem selection menu will appear. This allows 2dF to be fully shutdown while leaving the CCD system and PTCS still running, which is the normal method of shutdown during a 2dF run. If there has been errors with the CCD system or PTCS then these system(s) should also be selected for shutdown.
   - A number of error messages will pop up as various parts of the system lose communication with each other. Communication errors can be cleared.

2. Once all of the subtasks have exited, a small dialogue box will appear asking you to confirm the exit for the main control task.
   - Before accepting this, check that a message appears in the tdfct text box, “shutting down the positioner power supplies”. If not, seek expert assistance.
There are several push-button options on the right hand side of the window, vme systems, HermesICS and local system. The buttons toggle select which subsystems should be cleaned up on shutdown. Normally, local system should be selected. (Ask Tony for clean-up GUI images)

10.4 Restarting 2dF

When restarting 2dF during the night a complete logout from aatlxy is not required. The two main actions to carry out prior to a restart is to power-cycle 2dF and the CCD controllers if needed. Here are the steps to follow to restart 2dF:

1. First shut down 2dF following steps included in the previous section (Sect. 10.3).

2. An internet power switch allows the power to the 2dF top end to be cycled from the control room via an internet browser. To use the system, follow these steps:

   (a) start up a web browser on any machine on the AAT network. The power switch is bookmarked on the browser tool bar (for reference IP address for the switch is 10.88.90.66). This should pop up a password request box. You do not need a password, just leave the entries blank and click OK (DO NOT click Cancel).

   (b) A web form interface to the 2dF top end network power switch will appear (see Fig 10.6). Select the **Boot radio button from the form for the VME Crate**, and then hit the **Apply button** to reboot the top end power supplies VME crate.

   (c) Finally, although the system has a 2 minutes auto time out on it, click the **log out button** to exit the system.

   (d) Now wait for the two boot messages to appear on the aatlxy. The pop up window notifying the reboot of the **2dFsys** will appear first, while the pop up window indicating the resetting of **2dFPos** may need some time (a couple of minutes, even a bit more sometimes).\(^1\)

3. After a clean 2dF shutdown a CCD reset is NOT required. The CCD system only needs resetting if the VME system was *Cleaned up* during shutdown or if there have been CCD problems. If you need to do this, follow these steps:

   (a) There are two VME systems that control the HERMES CCDS. The names of these will be noted on the control room white board.

   (b) One system (VME 17/10) is in the control room, behind the blue screen. The system is at shoulder height, next to the network switch cabinet. Find the relevant reset switch. It’s a big red button at the bottom of aatvme10 but only a small black lever switch for aatvme15. Both are clearly labelled with “RESET”. Press/flip this once to reset the CCD system.

   (c) The other system (VME 16/6) is located next to the HERMES room in West coude area. This cannot be reset manually. You need to telnet into aatvme16 machine by typing telnet aatvme16. Login as hermes (or aatinst?), password is hermes009. Once logged in, at the command prompt type vmeReset.

4. Finally, follow the steps included in Section 10.2 to initialise 2dF, starting from item 2.

\(^1\)If the boot messages don’t appear then “telnet 2dfpos” and look for “− >” which is the VXworks prompt. To exit telnet, press <Ctrl>-D and then quit. It may be necessary to start syss (see §XXX!!!).