NATIONAL OBSERVATORY OF ATHENS

Institute for Astronomy, Astrophysics, Space Applications and Remote Sensing

KRYONERI OBSERVATORY

Operation Manual

For

Telescope

Autoguiding System

Camera Selection system

Fast Frame Imager System

Science CCD Camera

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Contents

1. Introduction

The Kryoneri Observatory was established in 1975 by the British company *Grubb Parson Co*. The telescope is equipped with a primary mirror of 1.2 m and up to 2016 was operating as a Cassegrain reflector with a focal ratio f/13. In 2016, in the framework of *NELIOTA* project, the telescope was upgraded by the company *DFM Engineering Inc.*.The optical design was changed and the telescope was transformed to a prime focus reflector with a focal ratio of 2.8 or 3 depending on the instrumentation used.

1.1 Infrastructure

The infrastructure of the Kryoneri telescope consists of the following:

1. Telescope (TEL)
2. Automated Dome
3. Telescope control system (TCS)
4. Fast frame imager system (FFIS)
5. Science CCD system (CCD)
6. Camera selection system (CSS)
7. Positioning system (GPS)
8. High performance storage array (STO)
9. Power back up system (UPS)
10. Server
11. Computer for CCD control and monitoring (Science and monitoring pc -- SMPC)
12. Autoguiding system (A/G)
13. Meteo station (MET)
14. Aluminization unit
15. Power generators

The TCS, the SMPC and the controllers of the server for FFIS (i.e. monitors, keyboard and mouse) are located in the **control room** (Fig. 1.1).
The GPS, the STO, the UPS, and the MET station receiver are located in the **computer room** (Fig. 1.2).
The telescope, the dome, the FFIS, the CCD, the CSS, and the A/G are located in the **dome floor** (Fig. 1.3).
The aluminization unit is located in the **basement.**
The MET station is located in the western area outside the Observatory building (Fig. 1.4).
The power generators are located in another building west north-west of the Observatory building (Fig. 1.4).

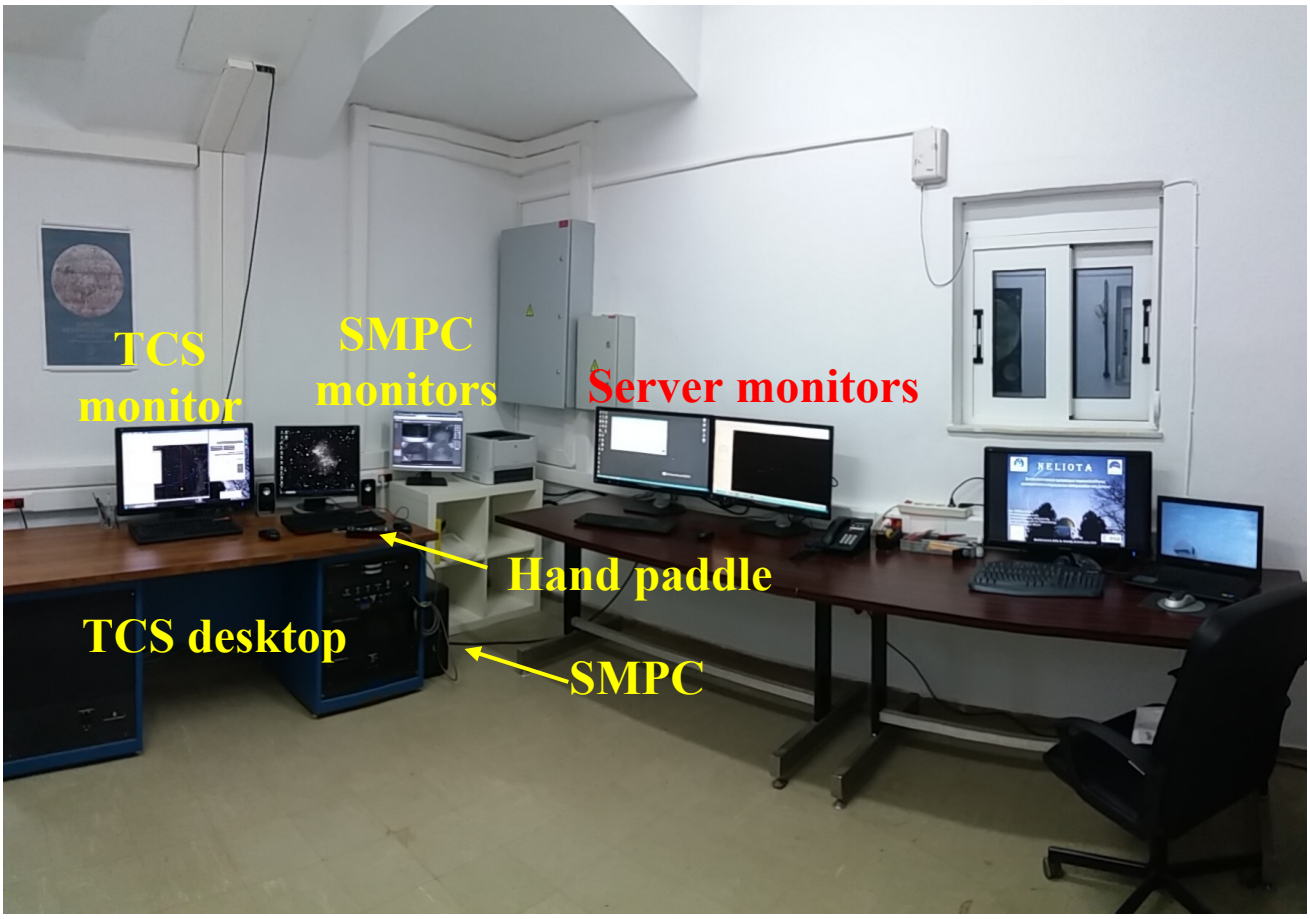


Fig. 1.1. The control room.

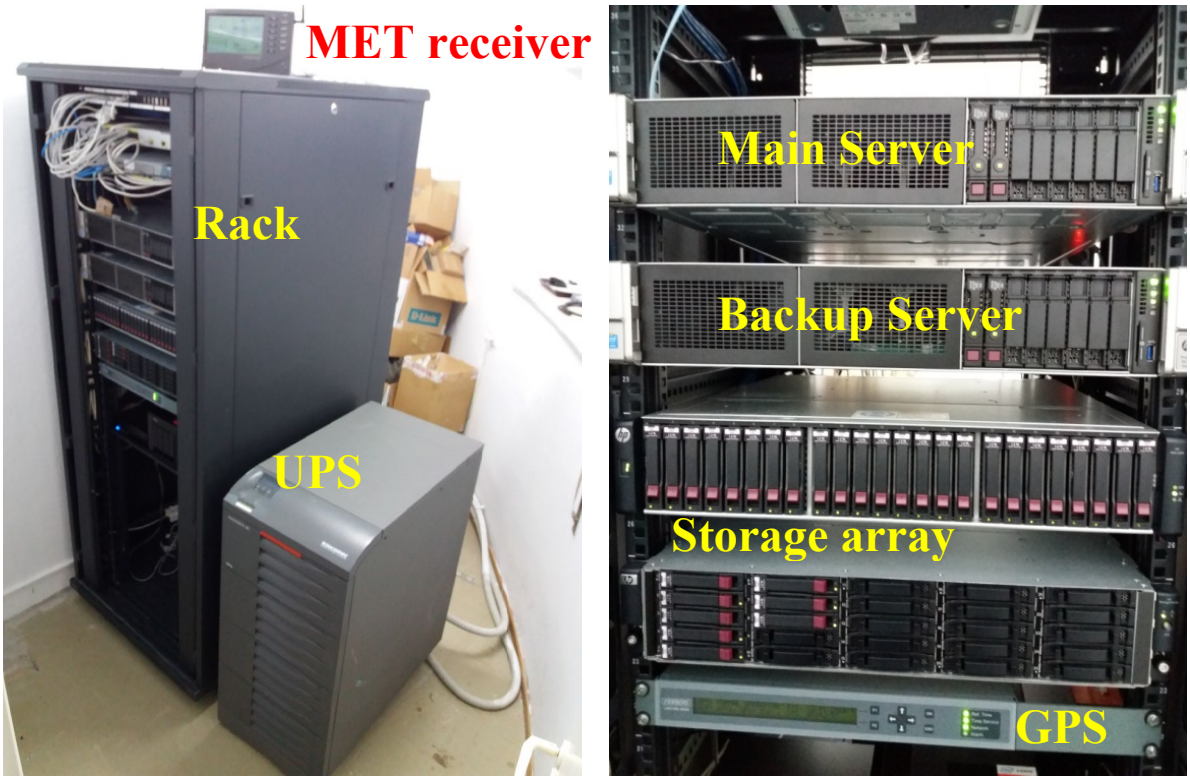


Fig. 1.2. The computer room. Left: The UPS, the MET receiver, and the rack. Right: Hardware installed on rack.

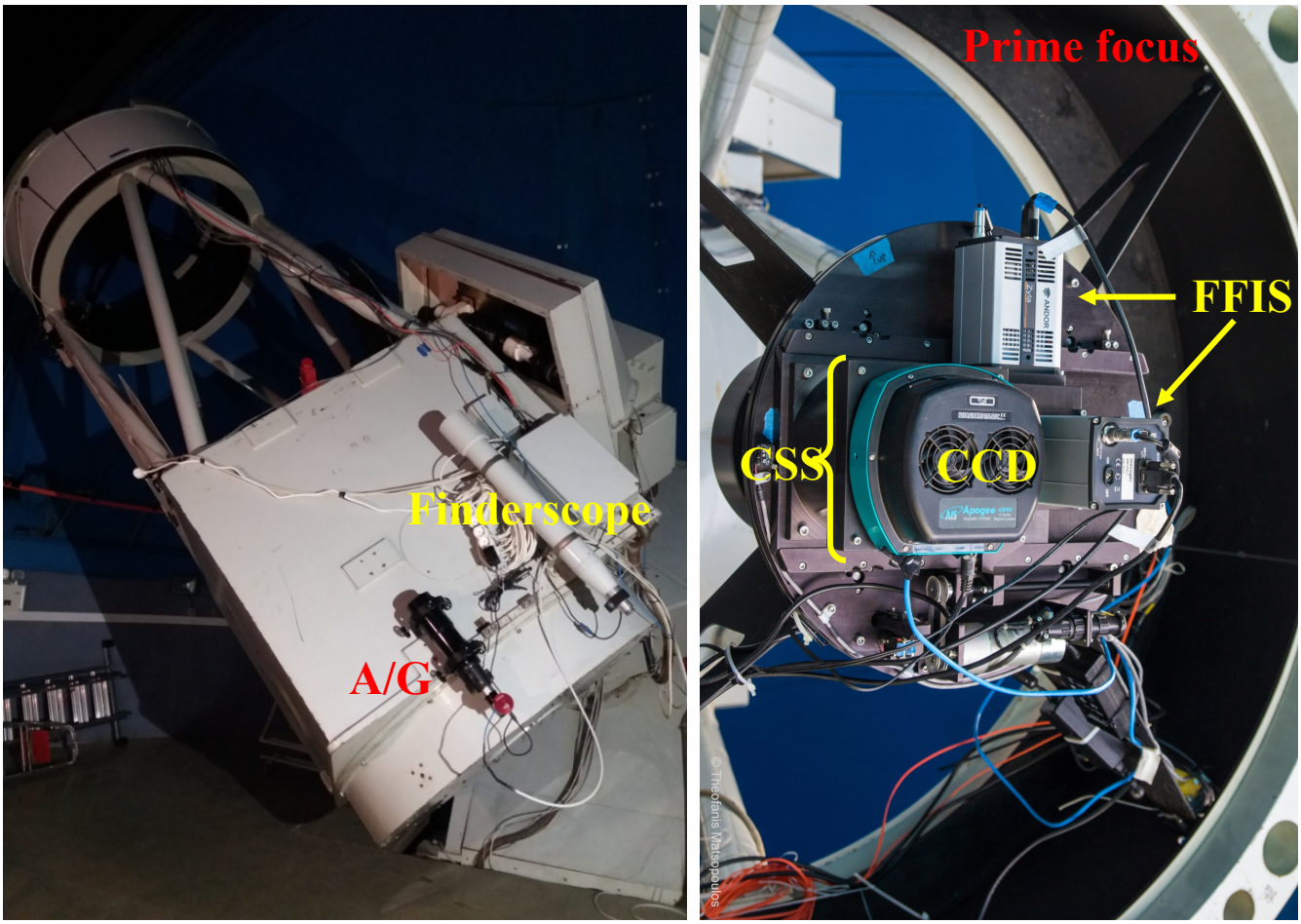


Fig. 1.3. Left: The dome floor, the telescope, one of the two finder scopes, and the A/G system. Right: The prime focus of the telescope on which the CSS, the FFIS, and the CCD are installed.

Fig. 1.4. Aerial view of the Kryoneri Observatory.

1.2 Weather restrictions

To check the weather visit the following web page: http://penteli.meteo.gr/stations/kryoneri/

Check the humidity and the wind values (Fig. 1.5). Also check the date, since many times the web application is not working properly. If the latter is the case, go to the computer room and check these values from the MET receiver (Fig. 1.2 left). The weather limits for nominal telescope operation as set by the headquarters of NOA are given in Table 1.

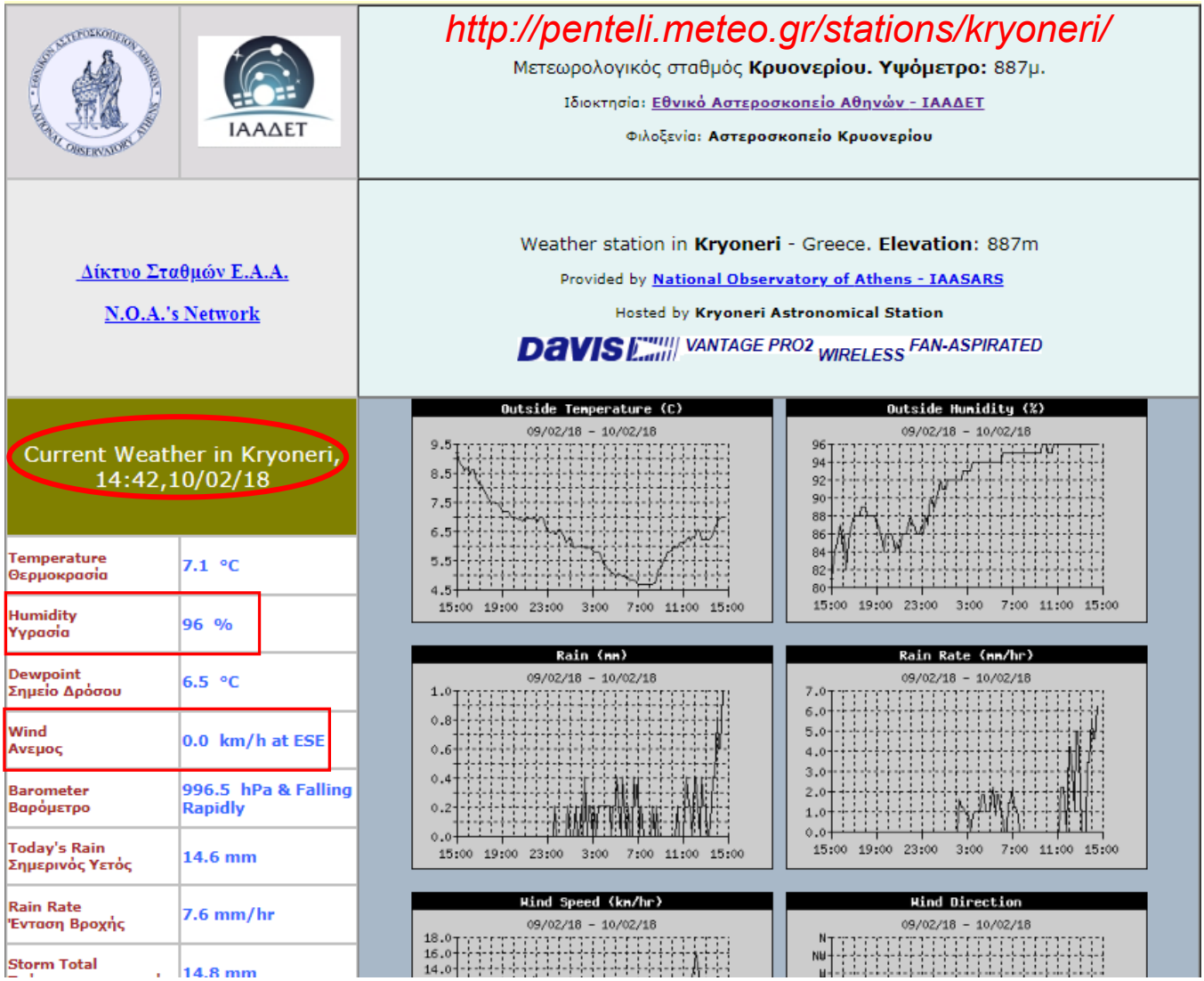


Fig. 1.5. Kryoneri weather station web page.

Table 1. Weather limits for the Kryoneri Observatory

Humidity	Wind	Characterization	Observing Status
<80%	<50 Km/hr	Nominal	Operational
80%-85%	50-55 Km/hr	Critical	Operational
>85%	>55 Km/hr	Emergency	Stop

2. Telescope operation

The telescope control system (TCS) operates the telescope (TEL), the autoguiding system (A/G), the dome, and the camera selection system (CSS). The TCS desktop (Fig. 2.1) contains one rack on each side. The left rack includes the voltage transformer from 220 V to 110 V. The right track includes two amperometers (one for each equatorial direction), the switches for the telescope and dome modes, the main switch (MTR driver chassis), the drives switch, various fuses, and the emergency stop button (upper right part). It includes also a computer (middle part) with the DFM control software installed. On its bottom part is located the mirror doors switch. Two hand paddles connected to the TCS are available for manual positioning of the telescope, focus, and dome. The first one is located in the control room on the TCS desktop and the other on the dome floor on the western side of the telescope assembly.

Fig. 2.1. The TCS desktop in the control room.

2.1. Initialization

To initialize the telescope a few steps including checks and actions are required. All checks and actions take place in both the dome floor and the control room. The following steps assume that the whole system is turned off, the telescope and dome are parked and all the switches are set to their default positions. There are four steps to be made to enable the whole system (dome floor part 1 – control room part 1– dome floor part 2 – control room part 2) and their order has to be strictly maintained.

Dome floor part 1

1. Action: Turn on the lights. The switch is located on the wall on the left outside the dome floor's entrance.
2. Check: The switch of the dome shutter should be set to the "OFF" position (middle position) (Fig. 2.2 lower left). Now the dome shutter can be controlled via the TCS software.
3. Action: Set the power supply switch to the "UP" position (Fig. 2.2 lower right). The dome and the dome shutter are now power enabled.

Fig. 2.2. Upper: The default positions (power off) of the power supply switch and the dome shutter switch. Lower left: The position of the dome shutter switch for normal operation (middle position: OFF). Lower right: The position of the power switch for normal operation (UP: power ON).

Dome floor part 1 (continue only if A/G is required for the observations)

4. Action: Connect the RJ45 (Ethernet) cable to the USB extender (Fig. 2.3 No 1-2).
5. Action: Plug in the power supply of the USB extender to the multi plug (Fig. 2.3 No 3-4).

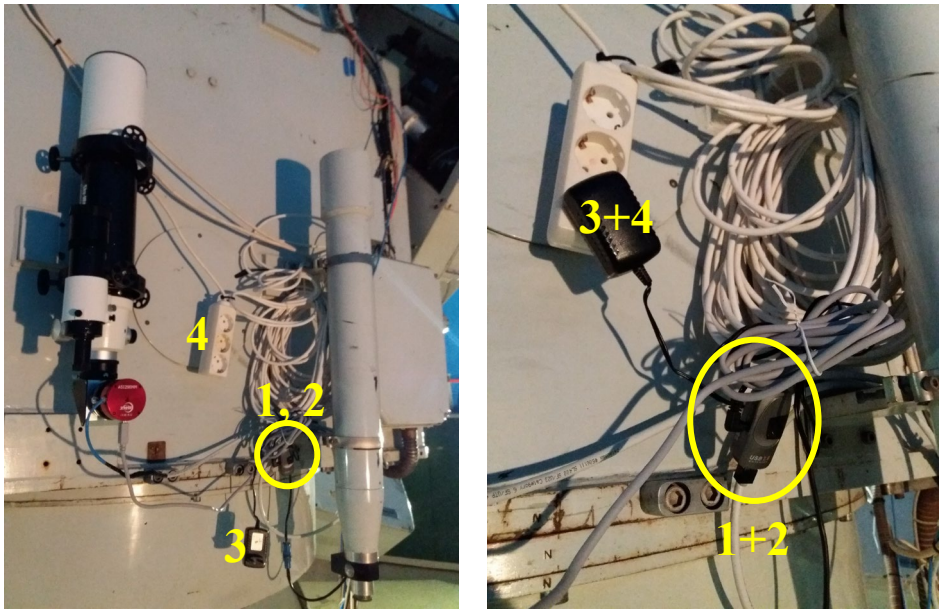


Fig. 2.3. Left: The A/G system unplugged. Right: The connections between devices, cables, and the multi plug. 1: RJ45 (Ethernet) cable, 2: USB extender, 3: Power supply of the USB extender, and 4: Power multi plug.

Checks

1. The upper part of the electrical ladder must be away (~20 cm) from the dome shutter's power supply rings (orange rings) (Fig. 2.4 left).
2. The electrical ladder is at a position which will not affect the telescope's positioning (south south-east side of the telescope).
3. The dome is at the Home position (Fig. 2.4 right).
4. There is nothing either near the telescope's tube or on the floor near to the base of the telescope's assembly that potentially could prevent its motion (e.g. chairs, tools, cables).

Fig. 2.4. Left: The position of the electrical ladder on the south south-east side of the telescope. The upper part of the ladder has to be approximately 20 cm away from the power supply rings. Right: The dome's home position indicator located on the south south-west wall.

Control room part 1

On the TCS console check the following (Fig. 2.5):

i. The voltage transformer switch is at the “OFF” position (down) (No 1)
ii. The Mirror doors switch is at the “OPEN” position (up) (No 2)
iii. The computer is turned off (i.e. no signal on the monitor) (No 3)
iv. The MTR DRIVER CHASSIS switch is at the “OFF” position (down) (No 4)
v. The lefter TRACK switch is at the “TRACK” position (up) (No 5)
vi. The righter TRACK switch is at the “OFF” position (down) (No 6)
vii. The DRIVES switch is at the “OFF” position (down) (No 7)
viii. The AUTO DOME switch is at the “OFF” position (down) (No 8)
ix. The DOME TRACK switch is at the “DOME TRACK” position (up) (No 9)

Attention: The above switches positions are the defaults (system OFF). In case any of the above has not been set to its default position it must be set immediately to it.

Fig. 2.5. The TCS desktop in the control room and the default switches positions (system OFF).

To enable the system the following actions should be made (Fig. 2.5):

1. Set the voltage transformer switch to the “TRANSFORMER ON” position (up) (No 1).
2. Set the MTR DRIVER CHASSIS switch to the “ON” position (up) (No 4).
3. Turn on the computer: Unlock the screw (CW) (No 3a) and release the lid. Press the power button (Fig. 2.6), close the lid, and lock the screw (CCW) (No 3a).
   ----------At this point wait at least 15 sec after Windows has been loaded----------
4. Login to the TCS computer using the credentials given in the passwords document.
5. Set the DRIVES switch to the “DRIVES” position (up) (No 7).
6. Set the AUTO DOME switch to the “AUTO DOME” position (up) (No 8).

Fig. 2.6. Turning on the TCS computer.

7. Open the **DFM-TCS software** that is located on the upper right part of the desktop (yellow shortcut). The following window (Fig. 2.7 left) opens.

Checks (Fig. 2.7 left):

i. The Galil status. It should display “Initialized” (No 1). If not, close the software and re-open it.
ii. The Zenith Dist (No 2). It should display “0.1”.
iii. The Dome Shutter (No 3). It should display “Closed”.
iv. The Mirror doors (No 4). It should display “PM-closed”.

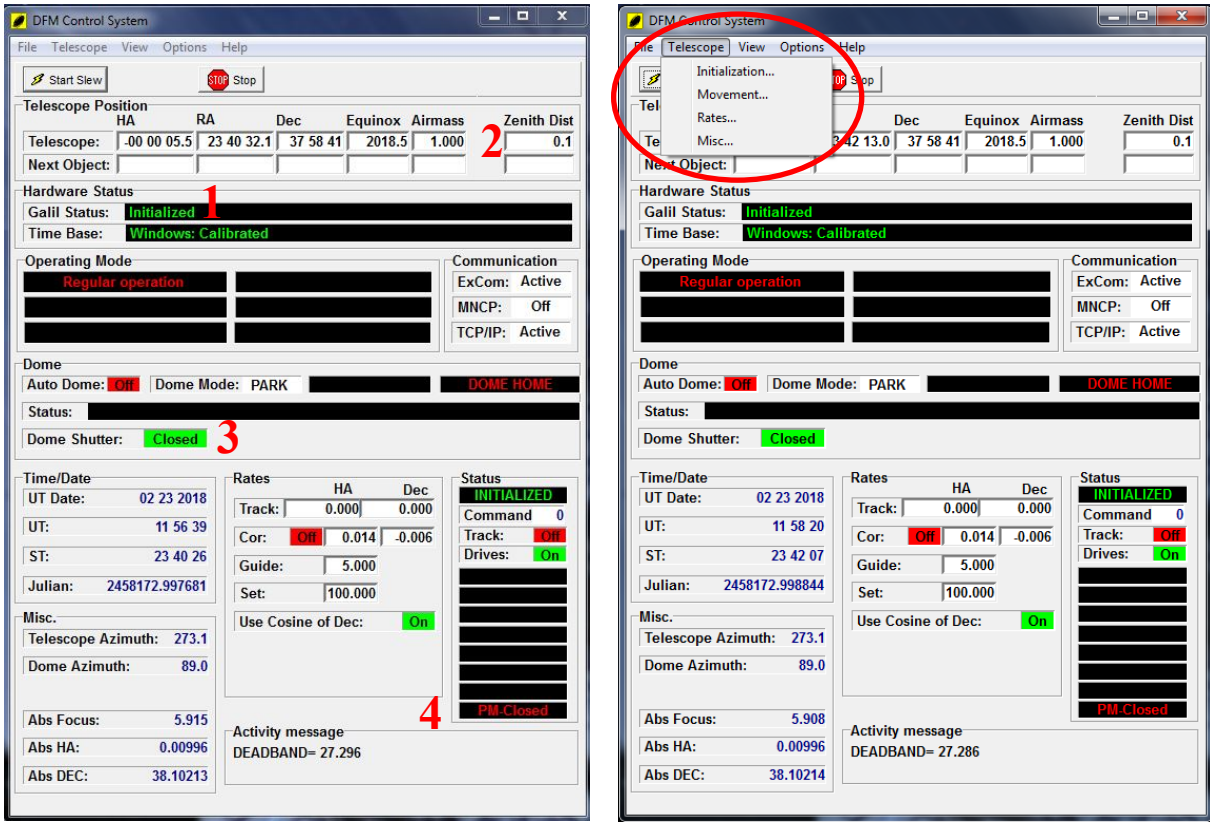


Fig. 2.7. Left: The initial status screen of the DFM software. Right: Menu of the “Telescope” tab

Actions:

i. Click on the “Telescope” tab and select “Misc…” (Fig. 2.7 right). The “Misc…” window opens (Fig. 2.8 left).
ii. In the “Misc…” window click on the “Display Epoch / Dome” tab (Fig. 2.8 No 1) and press the button “Shutter Open” (No 2). Now the dome shutter begins to open. You must be able to hear the noise from the dome floor. The opening lasts ~ 90 sec and the status (No 3) displays the message “*Dome Shutter takes 90 seconds to open or close*” and the “Dome shutter” message box turns to “*Open*” (No 4). Wait before any further action until the shutter is completely open and the command box to change from 36 to 0 (No 5).

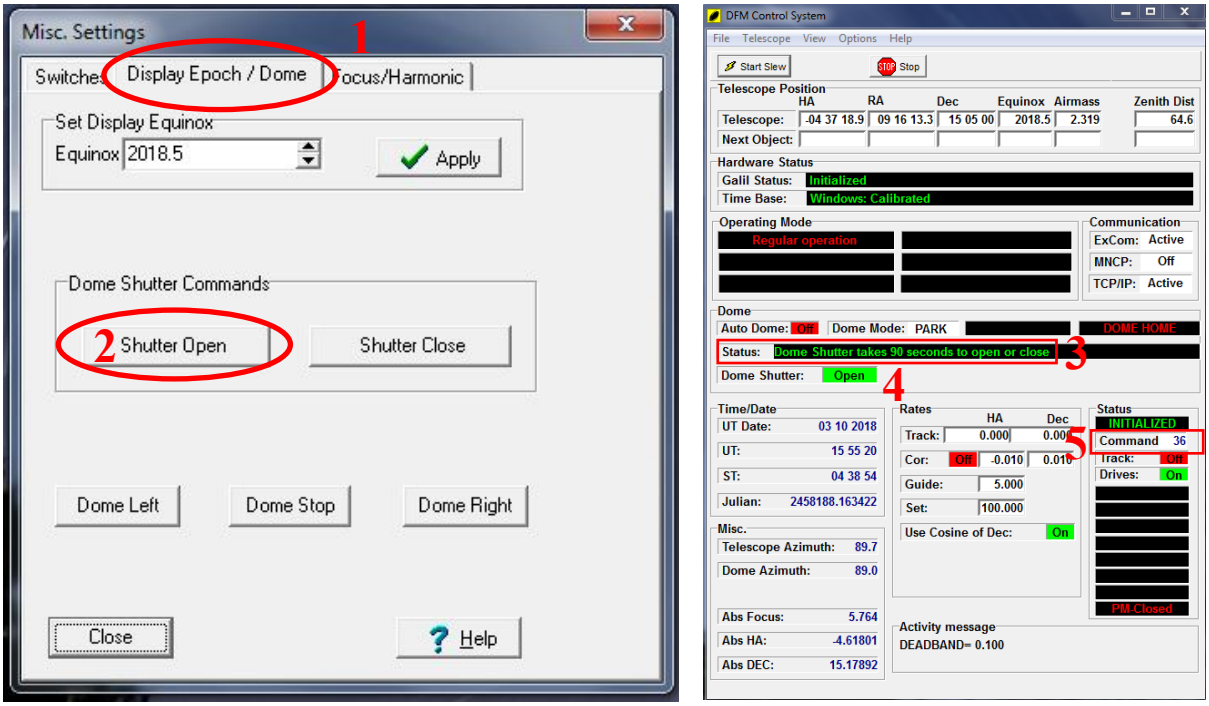


Fig. 2.8. Left: The window with the dome shutter controlling commands. Right: The status messages for the dome shutter.

iii. In the "Misc…" window click on the "Switches" tab (Fig. 2.9 left). Then, click on a) the "OFF" red box of the upper Dome switch (No 1) (it will change to "ON"), b) on the "HOME" box of the lower Dome switch (No 2) (it will change to "Track"), and c) on the "OFF" red box of the Rate correction switch (it will change to "ON") (No 3). Press "Apply" (No 4).

iv. In the same window press the "Open mirror doors" button (No 5). The mirror doors need approx. 2 min to open. Click on the "Close" button to close the window (No 6). In the meanwhile the message "*PM-closed*" disappears. Once the mirror doors are open, a message "*PM-Open*" appears (Fig. 2.15 No 8). If the latter message does not appear constantly, check section 8.2.

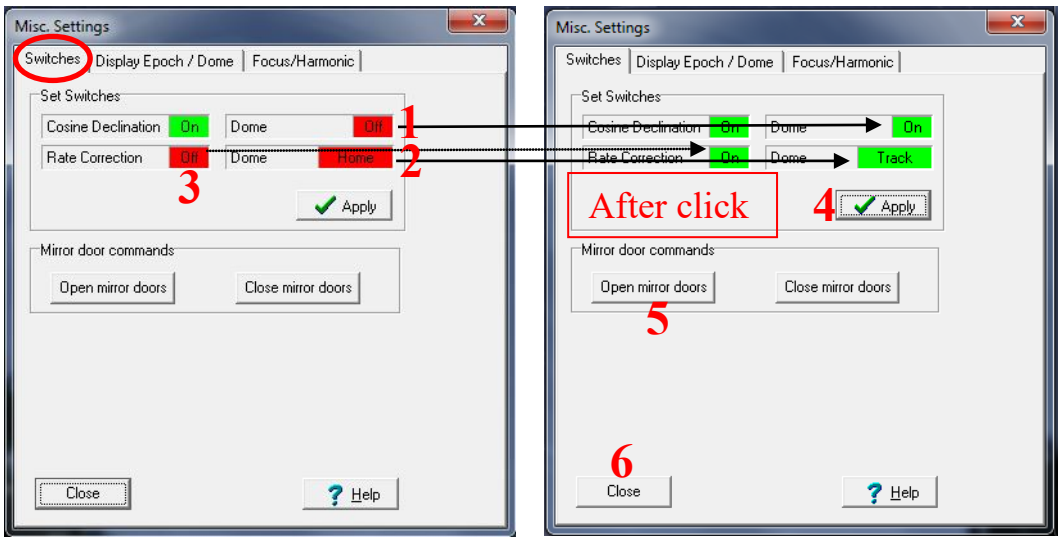


Fig. 2.9. The switches menu. After clicking on the No 1-3 red boxes (left) they change to green (right).

v. Click on the “Telescope” tab and select “Rates” (Fig. 2.7 right). The “Rates” window opens by default in the “Track rates” menu (Fig. 2.10 left). If the “R.A. Rate” is “0”, then type “15.041” (Fig. 2.10 left No 1). If not, leave it as it is. Press “Apply” (Fig. 2.10 left-No 2).

vi. Click on the “Telescope” tab and select “Movement” (Fig. 2.7 right). The “Movement” window opens (Fig. 2.10 right). Click on the button “Manolis Term Yes” (Fig. 2.10 right-No 1) and press “Close” (Fig. 2.10 right No 2).

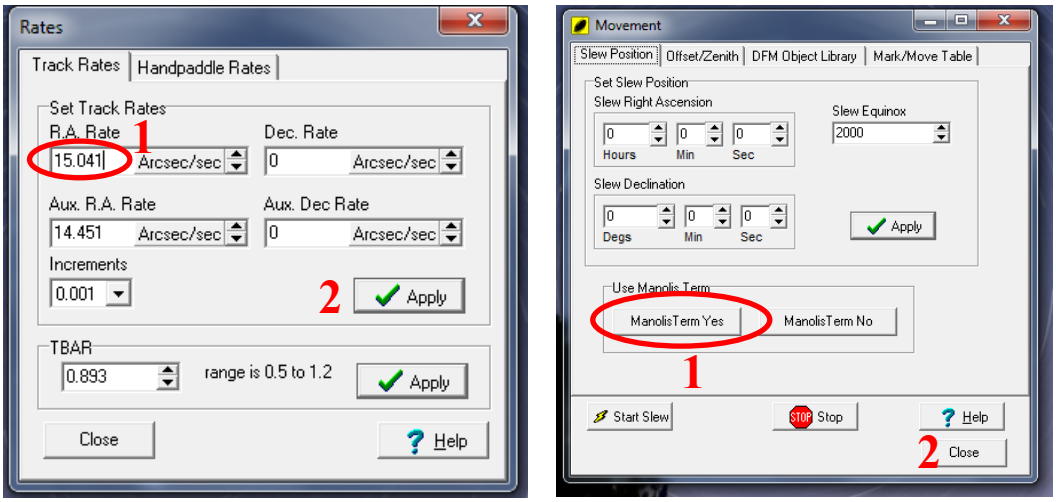


Fig. 2.10. Left: The “Track Rates” menu. Right: The “Movement” menu.

8. Open **“TheSkyX” software** that is located on the upper right part of the desktop. The following screen (Fig. 2.11) displays on the left side of the software’s window.

i. Click on the “Tele…” tab (No 1). Then, click on the “Start up” button (No 2) and select “Connect to telescope” (No 3).

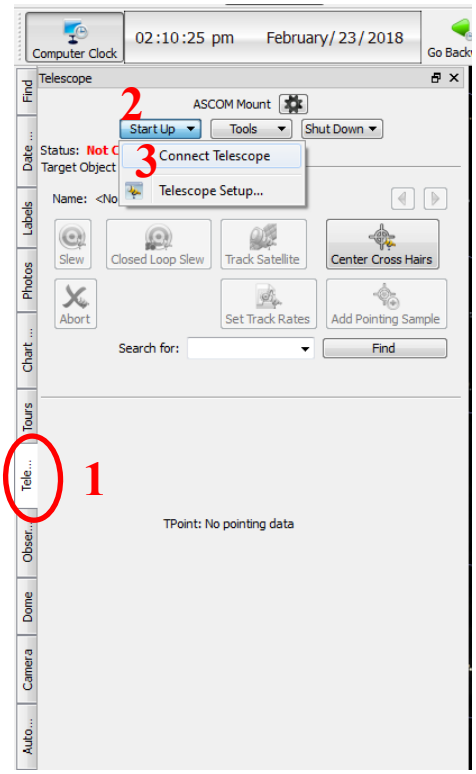


Fig. 2.11. The connection establishment between the telescope and “TheSkyX” software.

ii. Click on the “Tools” tab (Fig. 2.12 left) and select “Slew to coordinates…” (Fig. 2.12 left). The “Navigate” menu opens as a new window (Fig. 2.12 right).
iii. In the “Navigate” menu (Fig. 2.12 right) click on the “Enter Coordinates” tab and set to the Horizon coordinates boxes: Azimuth=90° and Altitude=25° (No 1-2). Press “Slew to Az/Alt” (No 3). This will move the telescope to a position, where the cameras multi plug can be easily reached.
iv. Press “Close” to close the window (No 4).

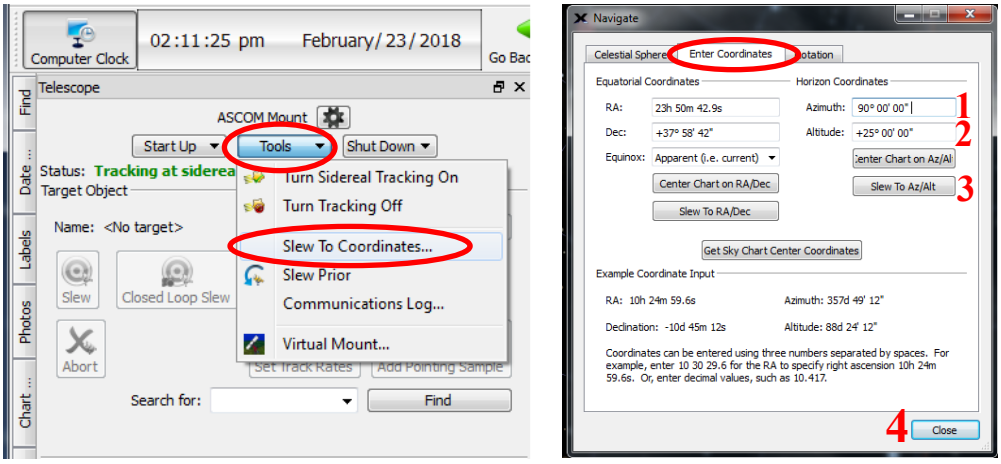


Fig. 2.12. The Tools menu (left) and the Navigation menu (right) of “TheSkyX” software.

<u>Continue with the following steps (8-10) only if A/G is required for the observations</u>

9. Open the “MaxIm DL” software that is located on the upper right part of the desktop.
10. Click on the “Toggle Observatory” button (Fig. 2.13 No 1). The “Observatory” window opens by default on the “Setup” menu. Press the “Connect” button (No 2). Close the window.
11. Click on the “Toggle camera control” button (No 3). The “Camera Control” window opens by default on the “Setup” menu. Press the “Connect” button (No 4). The “Camera Idle” status appears in the Guider information area (No 6).

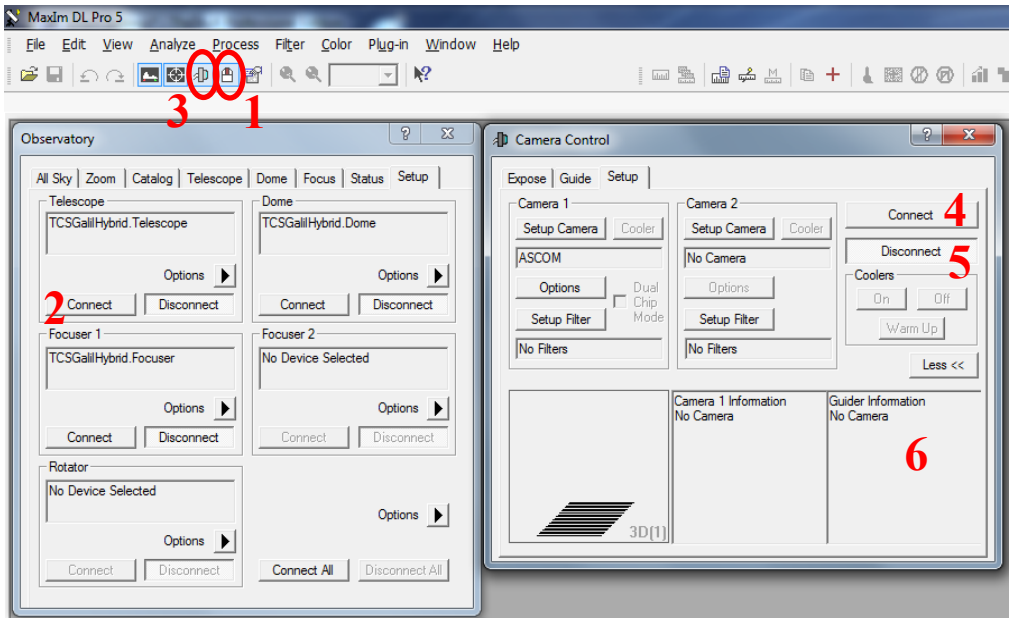


Fig. 2.13. Connection between the telescope and the A/G using the MaxIm DL software.

Dome floor part 2

1. Press the power button of the multi plug (Fig. 2.14 left No 1) to turn on the FFIS and the science CCD. If the CCD is not required for the observations, unplug its power supply cord (Fig. 2.14 left No 2).
2. If A/G is required for the observations, then remove the primary lens cap (Fig. 2.14 right) extremely gently (see also Fig. 1.3 to check the location of the A/G telescope).

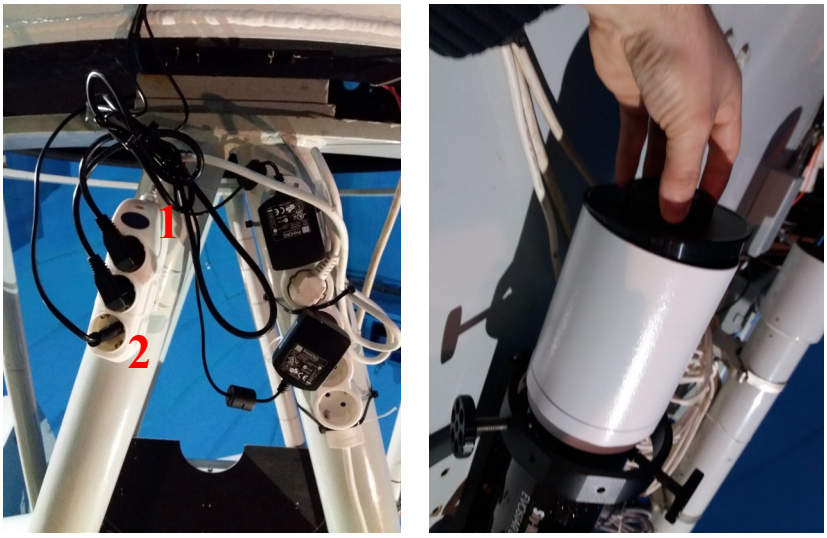


Fig. 2.14. Left: The multi plug where the power supply cords of the FFIS and the CCD are attached to. Right. Removing the primary lens cap from the telescope of the A/G.

3. Turn off the lights and close the dome floor's entrance door.

Control room part 2

On the TCS console set the righter "TRACK" switch to the "TRACK" position (up) (Fig. 2.5 No 6).

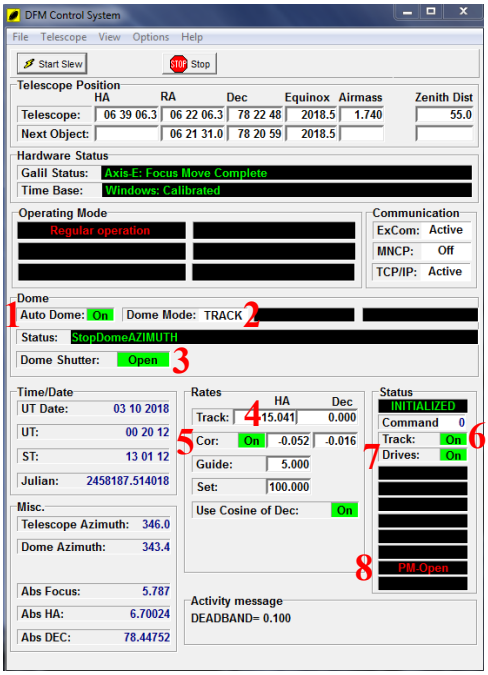


Fig. 2.15. The TCS window under regular operation of the telescope and the dome.

1. Auto Dome: ON
2. Dome Mode: Track
3. Dome shutter: Open
4. Track rate on HA: 15.041´´/sec (sidereal)
5. Cor: ON
6. Track: ON
7. Drives: ON
8. PM Open

2.2. Temporary shutdown

In this section is described the procedure that should be followed for a temporary shutdown of the system (i.e. the observations will continue in the following nights). For a permanent shutdown (i.e. the telescope will not be used in the following night) check section 2.4. There is no problem if only the steps of section 2.4 followed even on nightly basis. The only differences between the steps of this section and those of section 2.4 are the parking position of the telescope, the disconnection of the A/G, and the dome's power supply switch.

Control room

1. If A/G was previously connected, then in "MaxIm DL" software (Fig. 2.13):
   i. Click on the "Setup" tab (No 5) on the "Camera Control" window and press the "Disconnect" button (No 7).
   ii. Close the software.

2. On the TCS console set the righter "TRACK" switch to the "OFF" position (down) (Fig. 2.5 No 6).

3. In "TheSkyX" software:
   i. Click on the "Tools" tab (Fig. 2.12 left) and select "Slew to coordinates…" (Fig. 2.12 left). The "Navigate" menu opens as a new window (Fig. 2.12 right).
   ii. In the "Navigate" menu (Fig. 2.12 right) click on the "Enter Coordinates" tab and set to the Horizon coordinates boxes (right side): Azimuth=90° and Altitude=25° (No 1-2). Press "Slew to Az/Alt" (No 3). This will send the telescope to a position, where the cameras multi plug can be easily reached.

-------At this point wait until both telescope and dome reach their positions------

   iii. On the "Tele…" tab (Fig. 2.12 left) click on the "Shut Down" button and select "Disconnect Telescope" (Fig. 2.16).
   iv. Close the software.

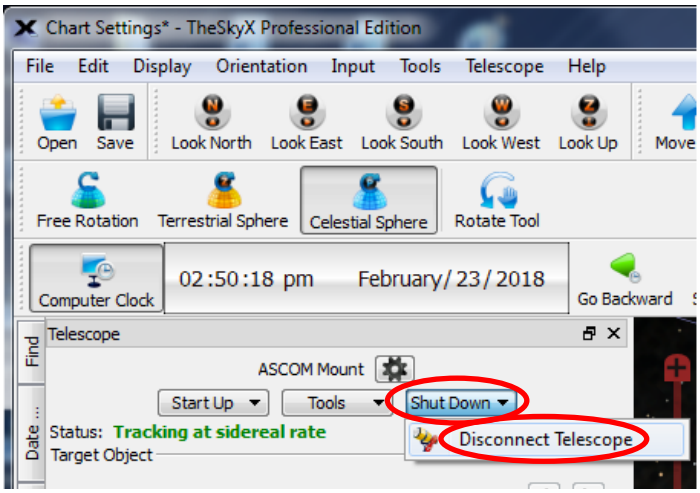


Fig. 2.16. Disconnecting the telescope from "TheSkyX" software.

4. In DFM software:

   i. Click on the “Telescope” menu and select the “Misc…” tab (Fig. 2.7 right). The “Misc. settings” window opens (Fig. 2.17 left).
   ii. Click on the “Switches” menu (Fig. 2.17 No 1) and press the “Close mirror doors” button (No 2). Wait ~2 min until the message “*PM closed*” appears in the status boxes (Fig. 2.7 left No 4). If the latter message does not appear check section 8.2.
   iii. In the “Switches” menu click on the “ON” box (Fig. 2.17 No 3) of the upper “Dome”. It will change to red displaying “OFF”. Press “Apply” (No 4).
   iv. In the “Misc. Settings” window click on the “Display Epoch / Dome” tab (Fig. 2.17 No 5) and press the button “Shutter Close” (No 6). Now the dome shutter begins to close. You must be able to hear the noise from the dome floor. The opening lasts ~ 90 sec and the status (Fig. 2.8 No 3) displays the message “*Dome Shutter takes 90 seconds to open or close*” and the “Dome shutter” message box turns to “*Closed*” (Fig. 2.7 left No 3). Wait before any further action until the shutter is completely closed and the command box to change from 36 to 0 (Fig. 2.8 No 5).
   v. Click on the “Close” button (Fig. 2.17 right No 7).

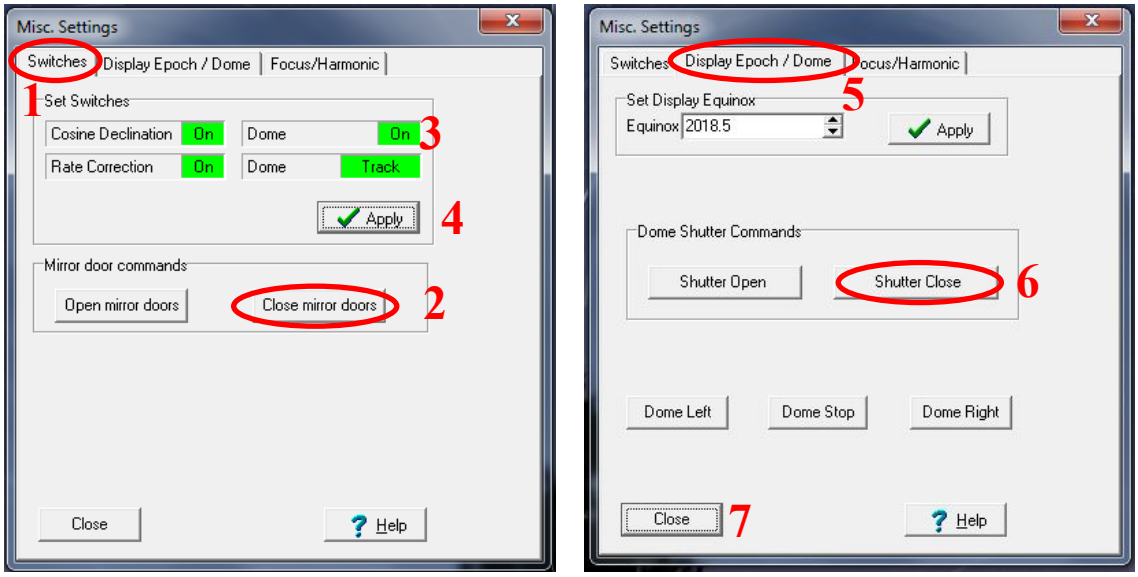


Fig. 2.17. The “Misc… Settings” menu. Left: The options for the switches and the mirror doors. Right: The dome and the some shutter software control.

   vi. Using the dome positioning buttons of the hand paddle (Fig. 2.18 right) rotate the dome to the azimuth position of 89.0±0.1° (Home position) (Fig. 2.18 left). The button “R” increases the azimuth value (CW rotation), while “L” decreases it (CCW rotation)[1].
   vii. Close the software.

Attention: If the CSS was used, then the NOA-controller software has to be closed properly now (see section 4) before proceeding to the following step.

   viii. Turn off computer using the windows shutdown.

[1]This step is very critical because the dome has relative encoding system. Therefore, the current parking position is automatically set as home position (89°) when the TCS is restarted.

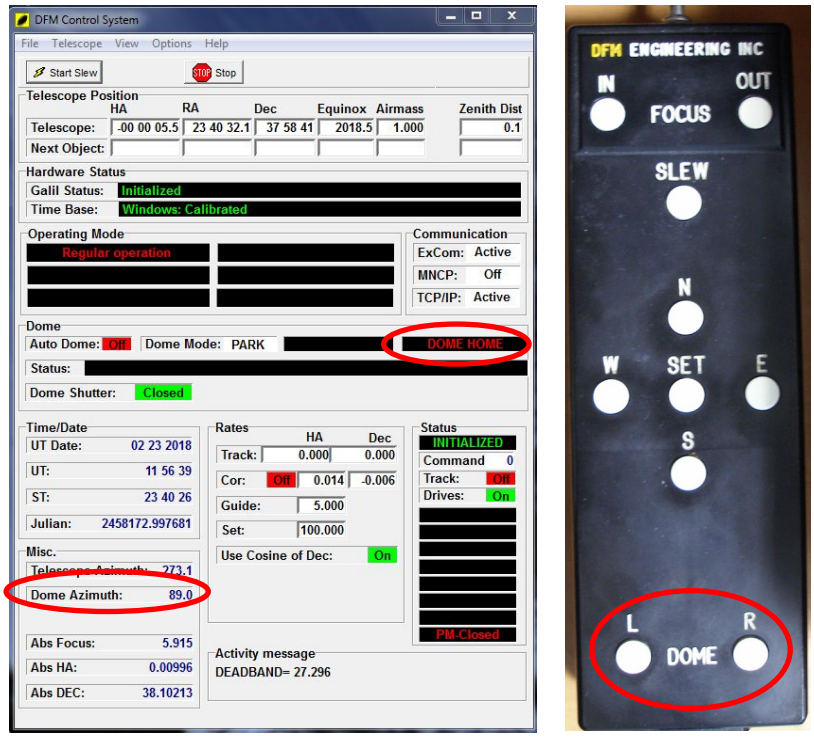


Fig. 2.18. Left: The DFM status window where the azimuth position of the dome and the "*DOME HOME*" position message are indicated when dome is parked. Right: The hand paddle where the dome positioning buttons are marked.

5. On TCS console (Fig. 2.5):
   i. Set the AUTO DOME switch to the "OFF" position (down) (No 8).
   ii. Set the DRIVES switch to the "OFF" position (down) (No 7).
   iii. Set the MTR DRIVER CHASSIS to the "OFF" position (down) (No 4).
   iv. Set the voltage transformer switch to the "OFF" position (down) (No 1).

Dome floor

Attention: If the CCD was used during the observations, then check that was properly warmed up and disconnected (section 5.4) before proceeding to the next steps.

Actions

1. Turn on the lights. The switch is located on the left side outside the dome's entrance.
2. Press the power button of the multi plug (Fig. 2.14 left No 1) to disable the FFIS and the CCD.
3. If the A/G was used for the observations, then cover extremely gently its primary lens using the special cap (Fig. 2.14 right).

Checks

1. The dome shutter must be completely closed. Check the left side of the shutter from the zenith to the lowest limit (Fig. 2.19).
2. The dome is roughly at the home position (Fig. 2.4 right).

If the dome shutter is not completely closed, see section 8.1. If the dome's Home position is not that as illustrated in Fig. 2.4-right, it is ok, just inform the technical staff on the next day.

Action: Turn off the lights and close the dome floor's entrance door.

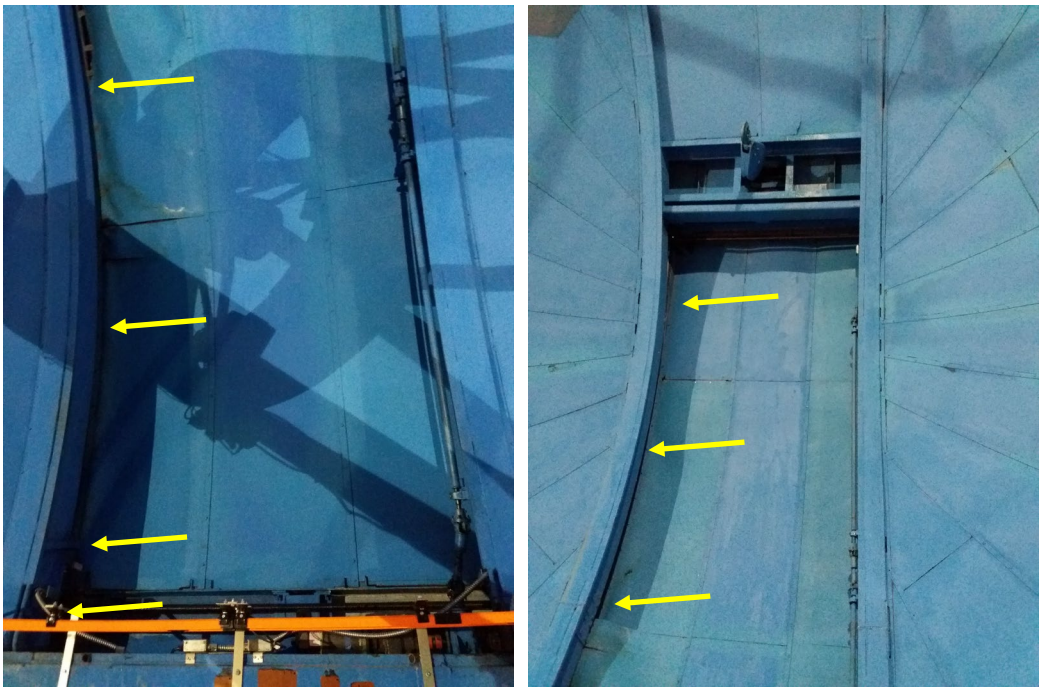


Fig. 2.19. The dome shutter completely closed. Left: The lower part of the dome shutter. Right: The upper part of the dome shutter (zenith). The points to be checked are indicated.

2.3. Re-Initialization

This section describes the procedure that should be followed in case the system was temporarily shutdown (section 2.2) and not permanently. If you are not sure about the procedure followed by the previous observer, just check the position of the telescope. If the telescope points at Zenith, then the permanent shutdown procedure was followed. Therefore, you should follow the steps of section 2.1 to initialize the system. If not, then, just continue with the guidelines of this section.

Dome floor

Actions

1. Turn on the lights. The switch is located on the left side outside the dome's entrance.
2. Press the power button of the multi plug (Fig. 2.14 left No 1) to enable the FFIS and the CCD. If the CCD is not required for the observations, unplug its power cord (Fig. 2.14 left No 2).
3. If A/G is required for the observations, then remove the primary lens cap extremely gently (see also Fig. 1.3 to check the location of the A/G telescope).

Checks

1. The upper part of the electrical ladder must be away from the dome shutter's power supply rings (orange rings) (Fig. 2.4 left).
2. The electrical ladder is at a position which will not affect the telescope's positioning (south south-east side of the telescope).
3. The dome is at the Home position (Fig. 2.4 right).
4. There is nothing either near the telescope's tube or in the floor near to the base of the telescope's assembly that potentially could prevent its motion (e.g. chairs, tools, cables).

Action: Turn off the lights and close the dome floor's entrance door.

Control room

Follow the steps 1-11 described in the section 2.1 “Control room part 1” except for the 7ii-7iv. The only difference in the TCS software is that the zenith distance will be approx. 65° (step 6ii).

On the TCS console set the righter “TRACK” switch to the “TRACK” position (up) (Fig. 2.5 No 6).

2.4. Permanent shutdown

The following procedure should be followed in case when no observations will be performed the following night(s). It is very similar to the one described in section 2.2 except for the final positioning of the telescope, the disconnection of the A/G cables, and the turning off of the dome power.

Control room part 1

Follow the steps 1-4vi described in section 2.2.

Attention: Do not close the DFM software or shut down the computer at this point.

Dome floor

Attention: If the CCD was used during the observations, then check that was properly warmed up and disconnected (section 5.4) before proceeding to the next steps.

Actions

1. Turn on the lights. The switch is located on the left side outside the dome’s entrance.
2. Press the power button of the multi plug (Fig. 2.14 left No 1) to disable the FFIS and the CCD.
3. Set the dome’s power supply switch to the “DOWN” position (Fig. 2.2 lower right).

If A/G was used for the observations, continue to the next steps:

4. Cover extremely gently the primary lens of the A/G using the special cap (Fig. 2.14 right).
5. Disconnect the RJ45 (Ethernet) cable from the USB extender (Fig. 2.3 No 1-2).
6. Unplug the power supply of the USB extender from the multi plug (Fig. 2.3 No 3-4).

Checks

1. The dome shutter must be completely closed. Check the left side of the shutter from the zenith to the lowest limit (Fig. 2.19).
2. The dome is roughly at the home position (Fig. 2.4 right).

If the dome shutter is not completely closed, see section 8.1. If the dome’s Home position is not that as illustrated in Fig. 2.4-right, it is ok, just inform the technical support team on the next day.
Action: Turn off the lights and close the dome floor’s entrance door.

Control room part 2

1. In the DFM software:
   i. Click on the “Telescope” tab and select “Movement” (Fig. 2.20. No 1). The “Movement” window opens.
   ii. Click on the “Offset/Zenith” tab (No 2), press the “Apply” button in the “Set Zenith position” section (No 3), and press the “Start Slew” button (No 4). Wait until the telescope reaches the Zenith position. A sound will be heard when it does and the Zenith distance box should display “0.1” (No 6).

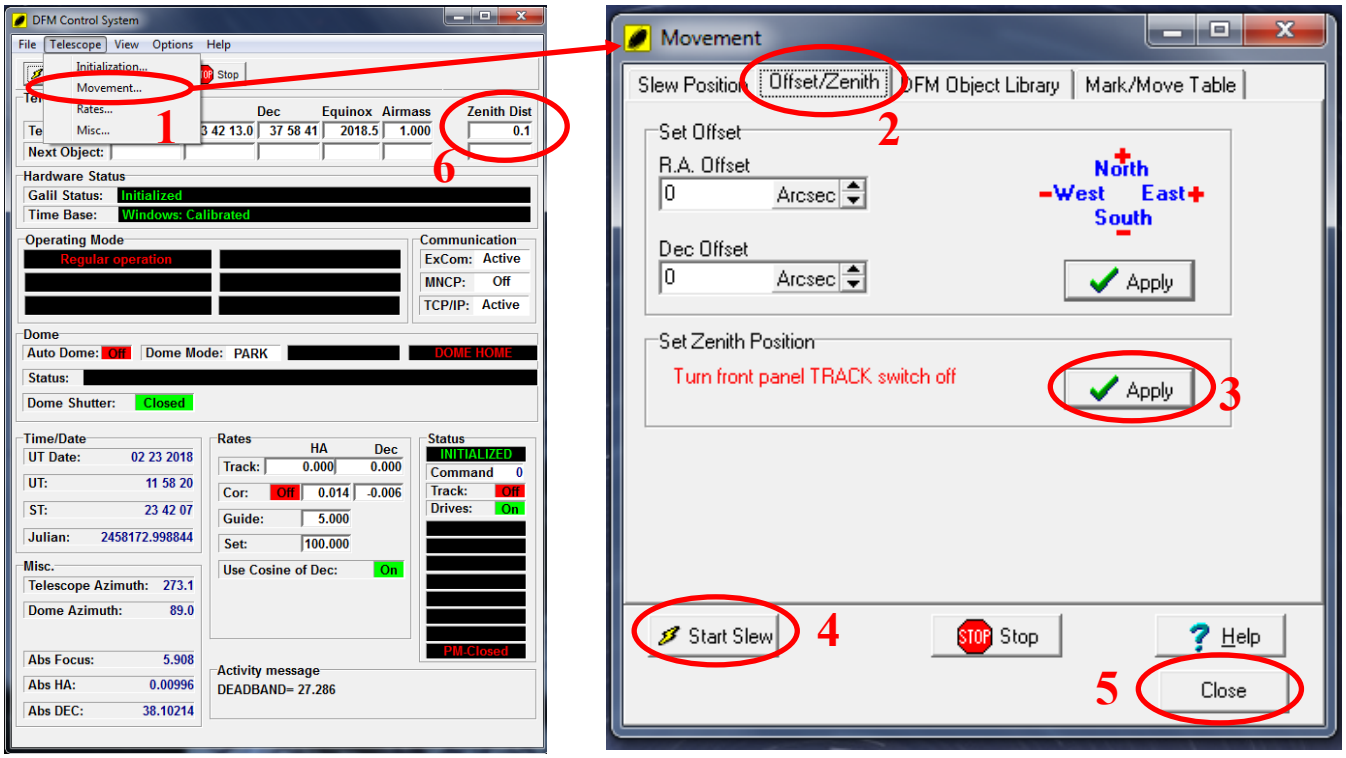


Fig. 2.20. Pointing the telescope at the zenith (parking) position.

   iii. Close the software.

Attention: If the CSS was used, then the NOA-controller software has to be closed properly now (see section 4) before proceeding to the following step.

   iv. Turn off computer using the windows shutdown.

2. On TCS console (Fig. 2.5):
   i. Set the AUTO DOME switch to the “OFF” position (down) (No 8).
   ii. Set the DRIVES switch to the “OFF” position (down) (No 7).
   iii. Set the MTR DRIVER CHASSIS to the “OFF” position (down) (No 4).
   iv. Set the voltage transformer switch to the “OFF” position (down) (No 1).

2.5. Pointing to a target

There are two different ways to send the telescope to a specific position for observation. The first concerns the use of “TheSkyX” software and the second the use of the “DFM-TCS” software. The first is the recommended one, especially if you are familiar with object catalogues. The following procedures are based on the assumption that all the steps described in section 2.1 or 2.3 have been properly done, and that the telescope is in regular operating mode (Fig. 2.15).

2.5.1. TheSkyX software

This software is widely used in many professional observatories and has many abilities such as connection with many telescopes, CCDs, domes etc, while it includes many catalogues of astronomical objects.

2.5.1.1. Setting coordinates

The simplest way to send the telescope to a specific position is to set to the software its equatorial coordinates and the equinox.

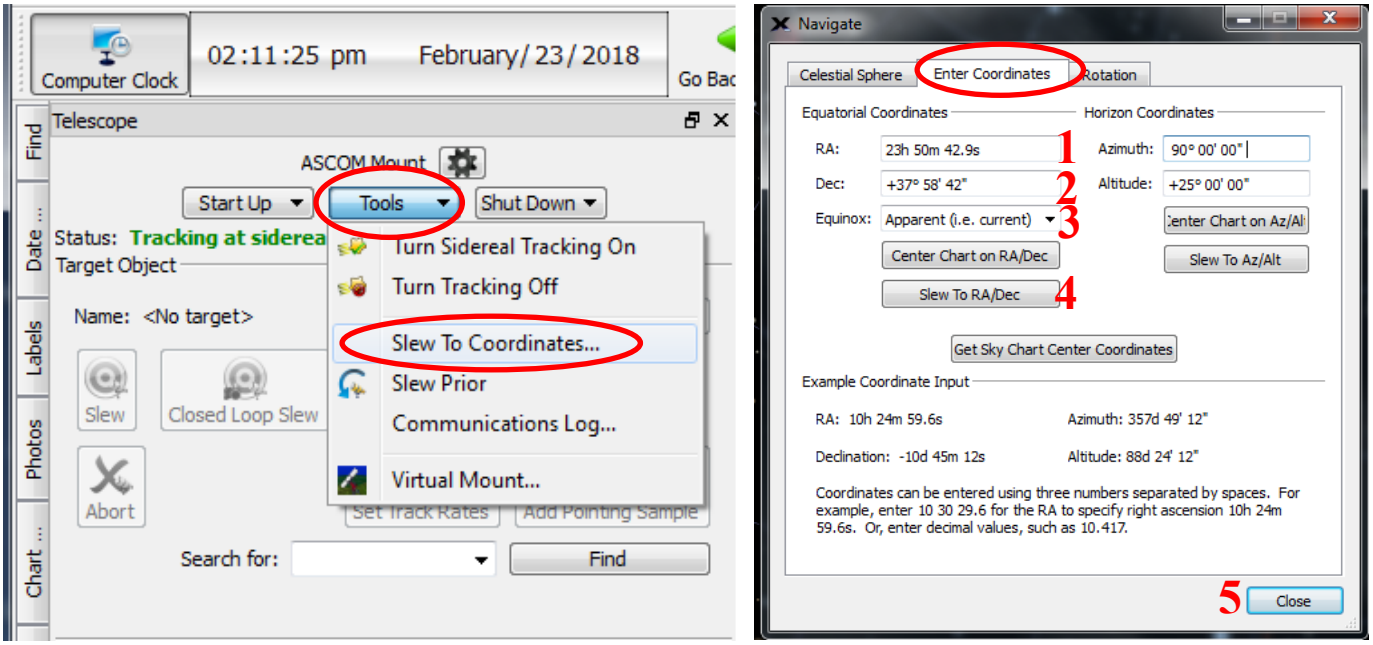


Fig. 2.21. The Tools menu (left) and the Navigation menu (right) of “TheSkyX” software.

1. Click on the “Tools” menu and select “Slew To Coordinates…” (Fig. 2.21 left). The “Navigate” menu opens as a new window.
2. In the “Navigate” menu, click on the “Enter Coordinates” tab. Fill in the RA and DEC boxes (Fig. 2.21 right No 1-2). Select “Equinox” (e.g. J2000) (No 3), and press the “Slew To RA/Dec” (No 4).
3. Wait until the telescope reaches the defined position (a sound will be heard from the TCS monitor when it does).
4. Press “Close” to close the window (No 5).

2.5.1.2. Selecting a target from a catalogue

The second way to send the telescope to a named target is to use the software's databases. For more information regarding the names that should be set in the "Search For:" box can be found in the help menu of the software.

1. Click on the "Find" tab located on the left side of the window (Fig. 2.22 No 1).
2. Type in the "Search for:" box the catalogue and the name of the object (No 2).
3. Press the "Find" button to see the information (No 3).
4. Check in the information window that the object is inside the range of telescope's limits (i.e. -7 hr < HA < 7 hr and Altitude>15°) (No 4-5).
5. Press the slewing button (No 6).

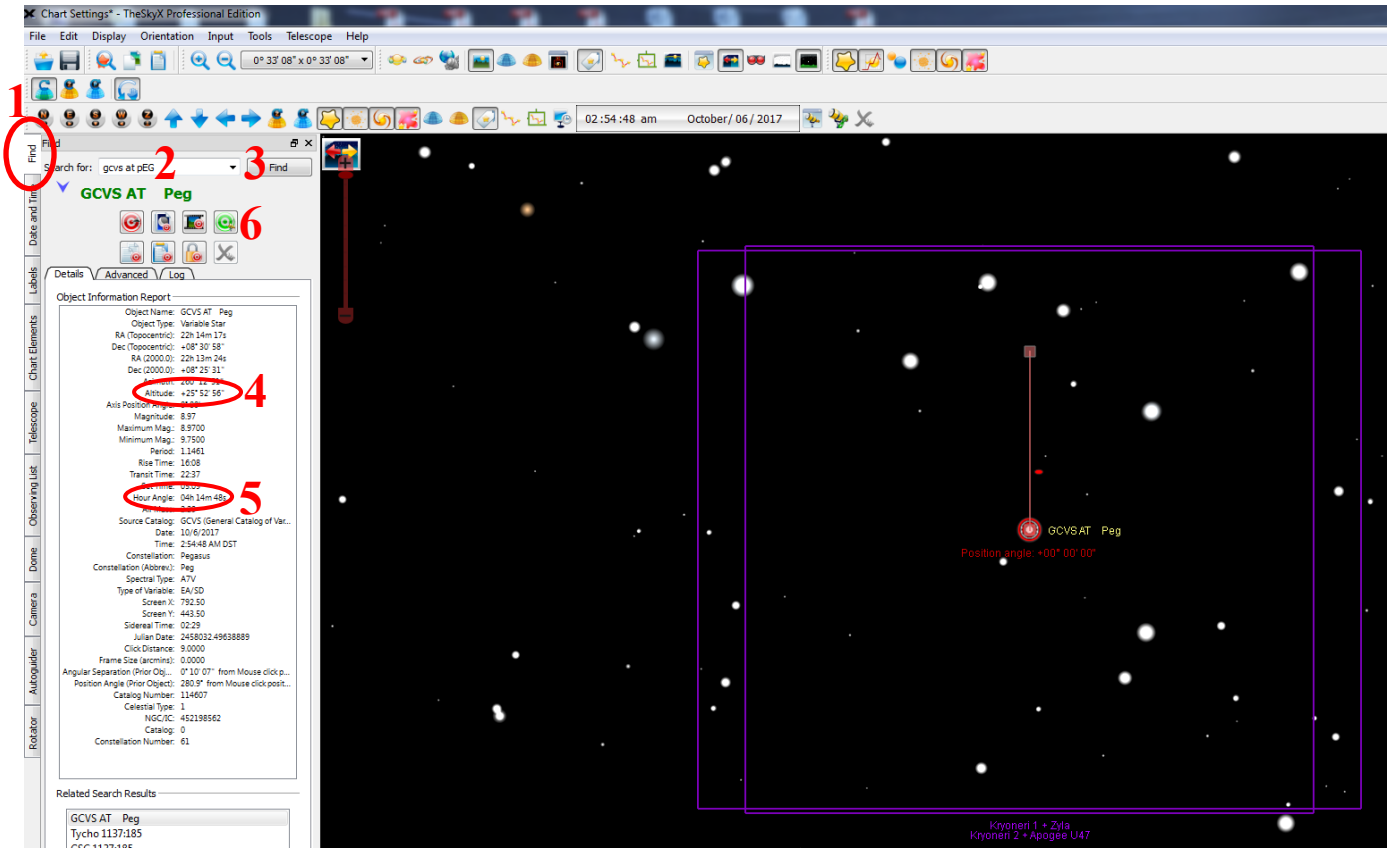


Fig. 2.22. Pointing the telescope to a named target using "TheSkyX" software. The catalogue along with the object's name (GCVS AT Peg) are set in the "Search For" box. In the Sky View the FoV for both the science CCD and the FFIS are indicated as rectangles.

- ✓ There are rectangles in the Sky view screen of the software indicating the Field-of-View of each camera attached to the telescope
- ✓ By clicking on an object the information window shows details for it when the "Find" menu is selected

2.5.2. DFM software

Likely previous section, the equatorial coordinates of the object should be set in the DFM software.

1. Click on the “Telescope” tab and select “Movement” (Fig. 2.23 left). The “Movement” window opens by default in the “Slew Position” menu (Fig. 2.23 right No 1).
2. Enter the RA and the DEC coordinates of the object and the Equinox (No 2-4).
3. Press “Apply” (No 5) and “Start Slew” (No 6). Wait until telescope reaches the defined position (a sound will be heard from the TCS monitor when it does).
4. Press “Close” (No 7).

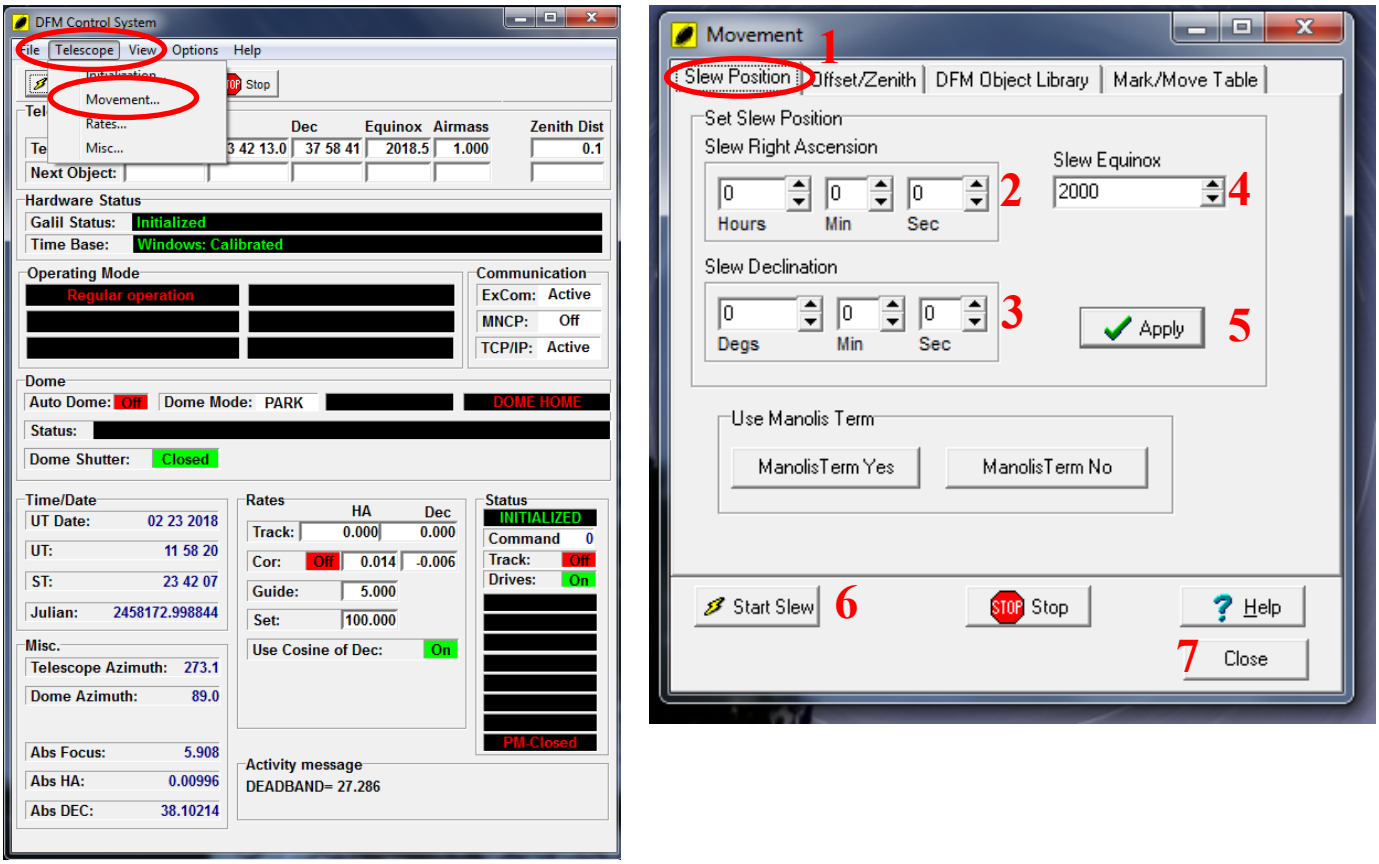


Fig. 2.23. Sending the telescope to a defined position using the DFM software.

2.6. Manual control of the telescope

The telescope can be moved in every direction using also the hand paddle. The dome, if has been previously set to tracking mode, will follow the telescope's movement. If the dome's movement is not necessary (e.g. the movement of the telescope is made for reasons other than observing), then set the AUTO DOME switch to the "OFF" position (down) (Fig. 2.5 No 8).

The movement of the telescope using the hand paddle can be done with three different speeds of the motors. Fig. 2.24 shows the positions of all the telescope movement buttons on the hand paddle.

1. Guide speed (Slow)→ Press and hold up to two direction buttons (N, E, S, W).
2. Set speed (Medium)→ Press and hold "Set" and up to two direction buttons simultaneously.
3. Slew speed (Fast)→ Press and hold "Slew" and up to two direction buttons simultaneously.

Attention: Do not press at the same time opposite direction buttons (e.g. N+S or W+E).

Note: Always press and hold up to two different direction buttons at the same time (i.e. N+E, N+W, S+E, S+W) and only one speed button (e.g. SET + N+E or SLEW + S+W) if necessary.

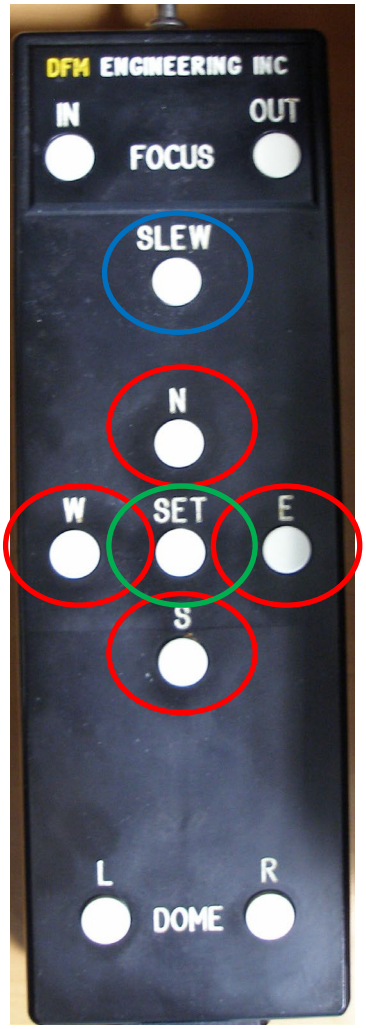


Fig. 2.24. The hand paddle of the telescope. The direction buttons (red circles), the "Set" button (green circle), and the "Slew" button (blue circle) are indicated. These buttons can be used for manual movement of telescope.

3. Autoguiding system

The autoguiding system (A/G) consists of a refractor telescope equipped with a CCD camera and is attached to the north side of the telescope's tube (Fig. 1.3) as piggyback to the main telescope. The CCD camera has two communication ports, one standard ST-4 guiding port (6-pin for guiding) and one USB port (for data transmission). It is directly connected to the motors of the telescope through the hand paddle cable of the dome floor, that leads to the TCS, and to the TCS computer through a USB cable using a USB extender. Fig. 3.1 displays the individual parts of the A/G system.

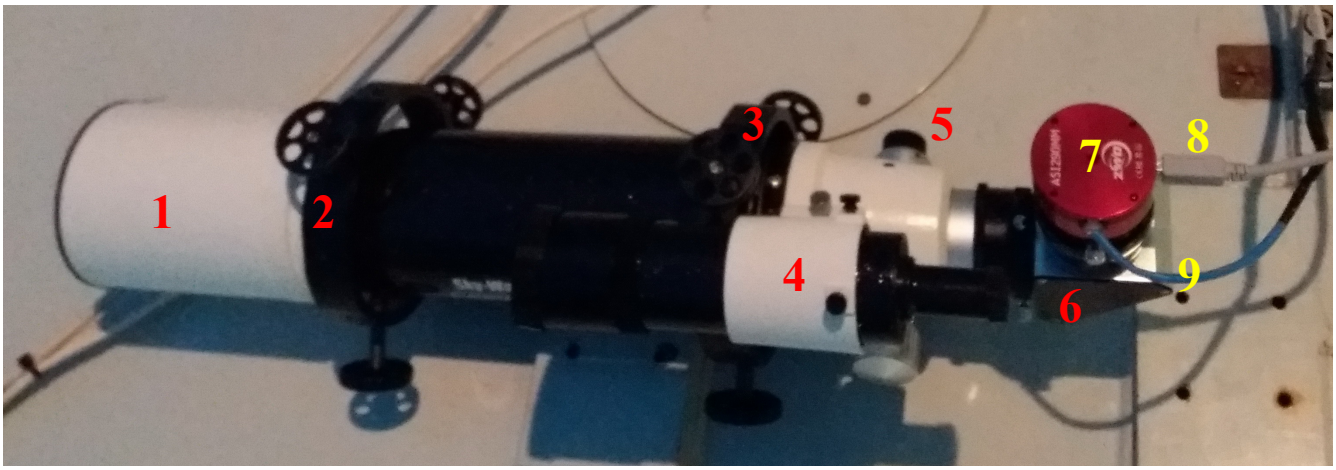


Fig. 3.1. The A/G system. 1: Telescope; 2, 3: Rings for fine adjustment; 4: Finder scope; 5: Focuser (position is locked); 6: Diagonal prism; 7: CCD Camera; 8: USB cable that is connected to the USB extender that leads it to the TCS; 9: ST-4 cable that is connected to the cable of the hand paddle of the dome's floor.

Attention: The above details are given for information only. Do not attempt to change anything in the A/G (e.g. orientation of the camera, focus etc.). If you face any problem, inform the technical support team.

Note: It should to be noted that the A/G does not correct perfectly the mis-tracking of the telescope, especially on the Dec Axis. This is due to the off-axis setup of the A/G system. On one hand the A/G is able to correct the tracking errors due to mechanical reasons (e.g. balance) but, on the other hand, not those that come from the optical system of the telescope (i.e. distortion of the primary mirror). The telescope's tracking errors depend on the altitude and the HA of the telescope. It is recommended to avoid long exposures (e.g. >3 min).

The following guidelines for the A/G operation are based on the assumption that the steps described in sections 2.1 or 2.3 (dome floor parts, i.e. connections, primary lens cap removal) have been properly followed.

The A/G control software is the MaxIm DL that is installed on the TCS computer. Although the software connection between the A/G and the TCS has been already described in section 2.1 (control room part 1), it is also placed here for coherence reasons.

1. Open the “MaxIm DL” software that is located on the upper right part of the TCS computer desktop.
2. Click on the “Toggle Observatory” button (Fig. 3.2 No 1). The “Observatory” window opens by default on the “Setup” menu. Press the “Connect” button (No 2). Close the window.
3. Click on the “Toggle camera control” button (No 3). The “Camera Control” window opens by default on the “Setup” menu. Press the “Connect” button (No 4).

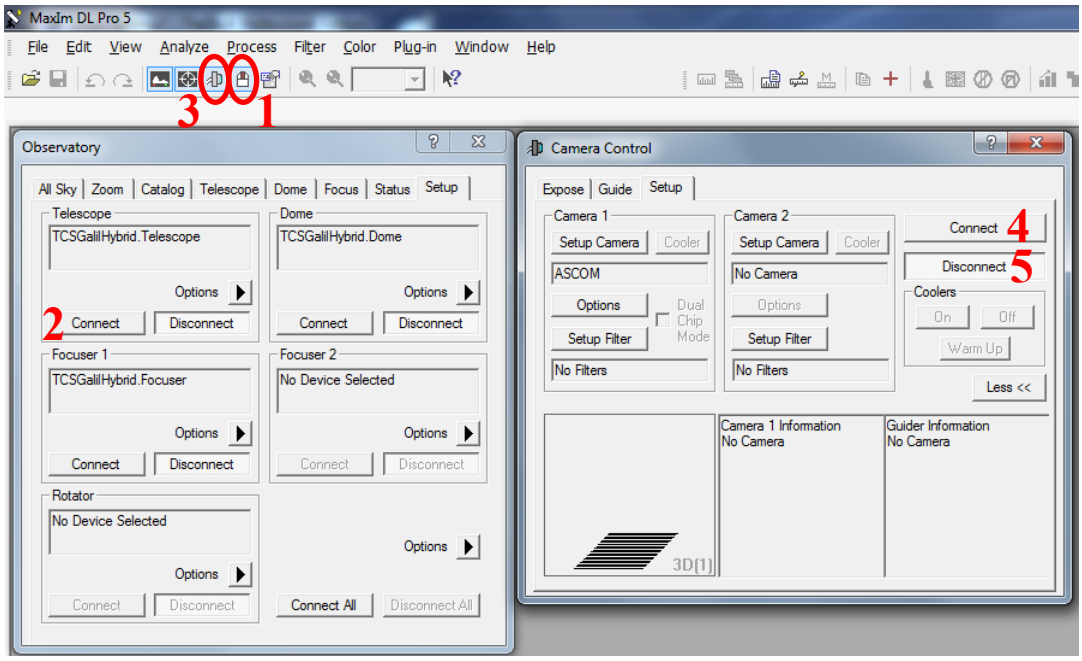


Fig. 3.2. Connection between the telescope and the A/G using the MaxIm DL software.

3.1. Calibration

The first action that should be made to use the A/G concerns its calibration. This must be done every time the TCS starts (i.e. at the beginning of the night). It is recommended to perform the calibration at a sky position near the meridian and at a zenith distance approximately 20°-25°.

1. Click the “Guide” tab on the camera control window (Fig. 3.3 No 1).
2. Select the “Expose” option (No 2), set a relatively small exposure time (e.g. 0.5-3 sec) (No 3), and press “Start” (No 4).
3. On the CCD image that appears, click on a star that a) has no faint stars close to it, b) has sufficient intensity (i.e. 10,000-30,000 ADUs) to be measured, and c) has a distance of at least 100 pixels from the edges of the image. The software recognizes automatically its photo-center (No 5).
4. Select the “Calibrate” option (No 6) and press “Start” (No 7). The software will move the telescope along both equatorial directions. A red opposite “L” with the star near to its corner will appear on the screen after it finishes (Fig. 3.4). Once the calibration is done, in the “Guider information” section the message “*Camera Idle*” appears (Fig. 3.3 No 8).

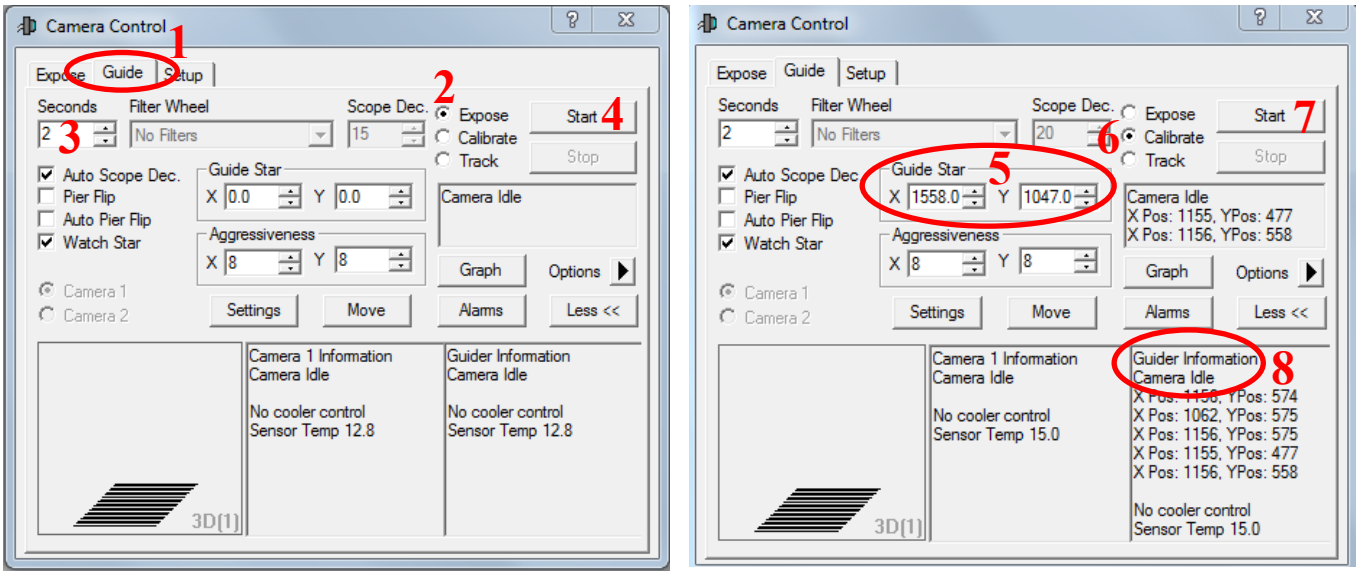


Fig. 3.3. The “Guide” menu in the A/G camera control window. Left: Exposing for first time in order to select a guide star to calibrate the A/G. Right: Steps for the calibration process.

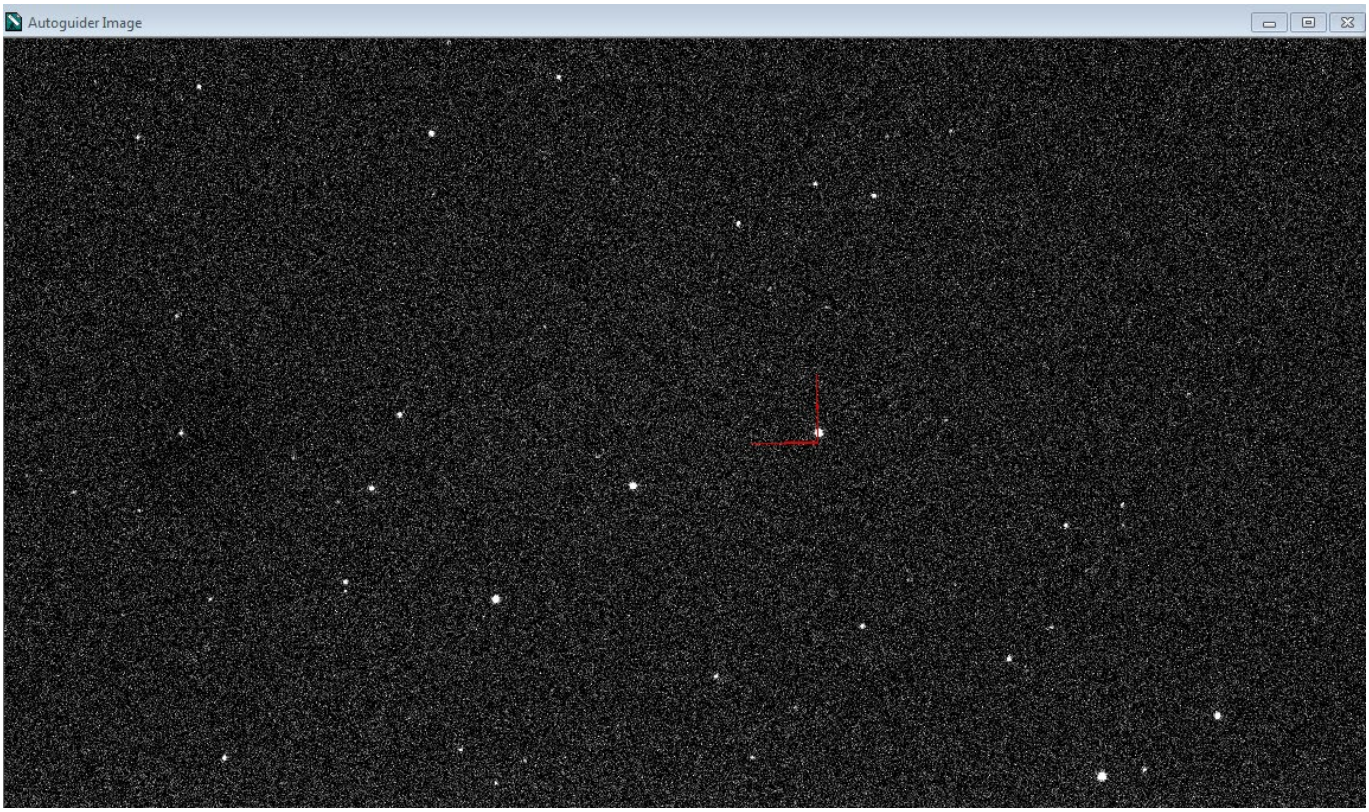


Fig. 3.4. The movement of the guiding star (red lines) after the calibration is complete. The star appears very close to the position initially had before the calibration.

From now on, the A/G is calibrated and can be used until the MaxIm DL software closes or a restart of the TCS is made. If the calibration fails, see section 8.9.

3.2. Operation

Point the telescope to the target of interest (section 2.5). If necessary, use the direction buttons of the hand paddle (section 2.6) to set exactly the desired FoV. Once ready, then in the “Guide” menu (Fig. 3.3):

1. Select the “Expose” option (Fig. 3.3 No 2), set a relatively small exposure time (e.g., 0.5-3 sec) (Fig. 3.3 No 3), and press “Start” (Fig. 3.3 No 4).
2. On the CCD image that appears, click on a star that a) has no faint stars close to it, b) has sufficient intensity (i.e. 5,000-30,000 ADUs) to be measured, and c) has a distance of at least 100 pixels from the edges of the image. Once clicked, the software recognizes automatically its photo-center.
3. Select the “Track” option (Fig. 3.5 No 1) and press “Start” (No 2).
4. Press “Graph” if you want to see the “Tracking Error Graph” (No 3).

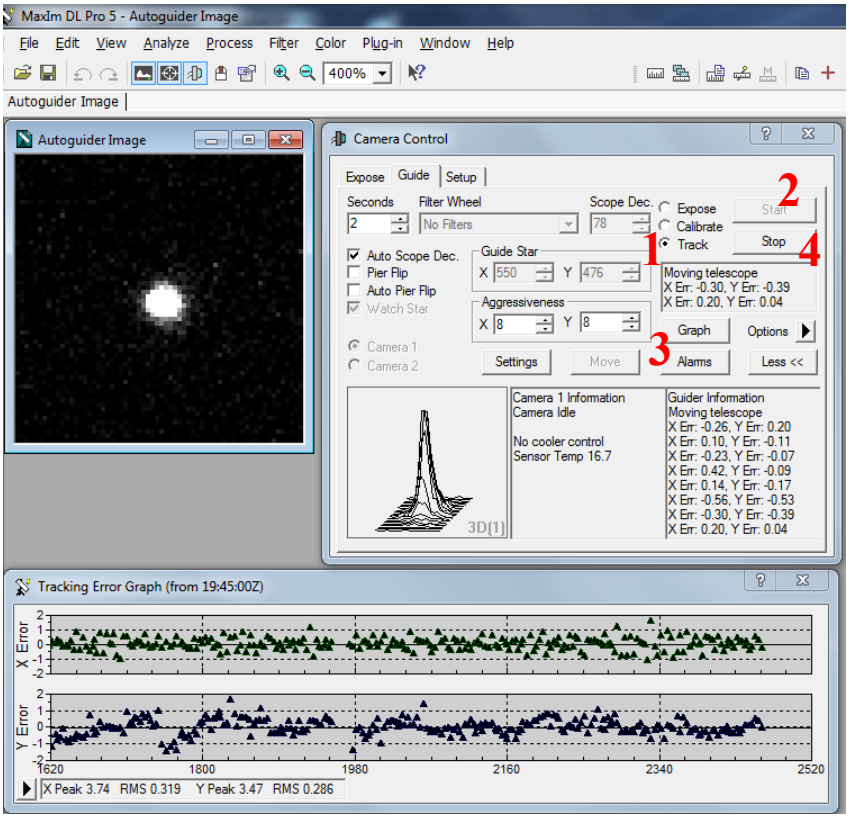


Fig. 3.5. The A/G system under regular operation.

5. To stop the A/G, press the “STOP” button (No 4).

Attention: Remember to always stop the A/G in the case of pointing to another object.
Attention: DO NOT use the hand paddle direction buttons while A/G is working.

Shutdown

1. On the “Camera Control” window, click on the “Setup” tab and press the “Disconnect” button (Fig. 3.2 No 5).
2. Close the software.

To disconnect the hardware parts of the A/G system, just follow the respective steps described either in section 2.2 (temporary shutdown) or in 2.4 (permanent shutdown).

4. Camera selection system

The telescope is equipped with two imaging systems. The first is the Fast Frame Imager System (FFIS) that is also called “Lunar Camera” and consists of two twin sCMOS cameras. The other is a classical CCD camera. All cameras are attached to a slider which is able to move along the focal plane and to change the cameras’ order (Fig. 1.3 right). The latter is called Camera selection system (CSS) and is controlled by the “DFM – NOA controller” software, located on the upper right part of the TCS desktop.

By default the FFIS (lunar camera) is placed on the prime focus of the telescope. If the observations will be performed with the FFIS, then no further action is needed. Skip this section and proceed to section 6. If the CCD camera is intended to be used for the observations, then follow the steps:

1. Open the “DFM – NOA controller” software, and wait to initialize by moving the CSS on its home position. The A-Axis status (Fig. 4.1 No 1) should display “*Initialization complete_home found*” and the General status “*TCP/IP: Connected to Galil controller*” (No 2). If not, restart the software (this might be repeated 3-4 times).
2. Click on the “Imaging Camera” (No 3) and then click on the button “Move To Stage Position” (No 4). Wait (approx. 20 sec) until it reaches the final position (the progress bar is filling—No 5). The message “*Move Complete*” (No 6) appears when it does and the red arrow showing the current CCS position is moved to the “Imaging Camera” (No 7).
3. Do not close the software, just minimize it. Proceed to section 5 for controlling the CCD.

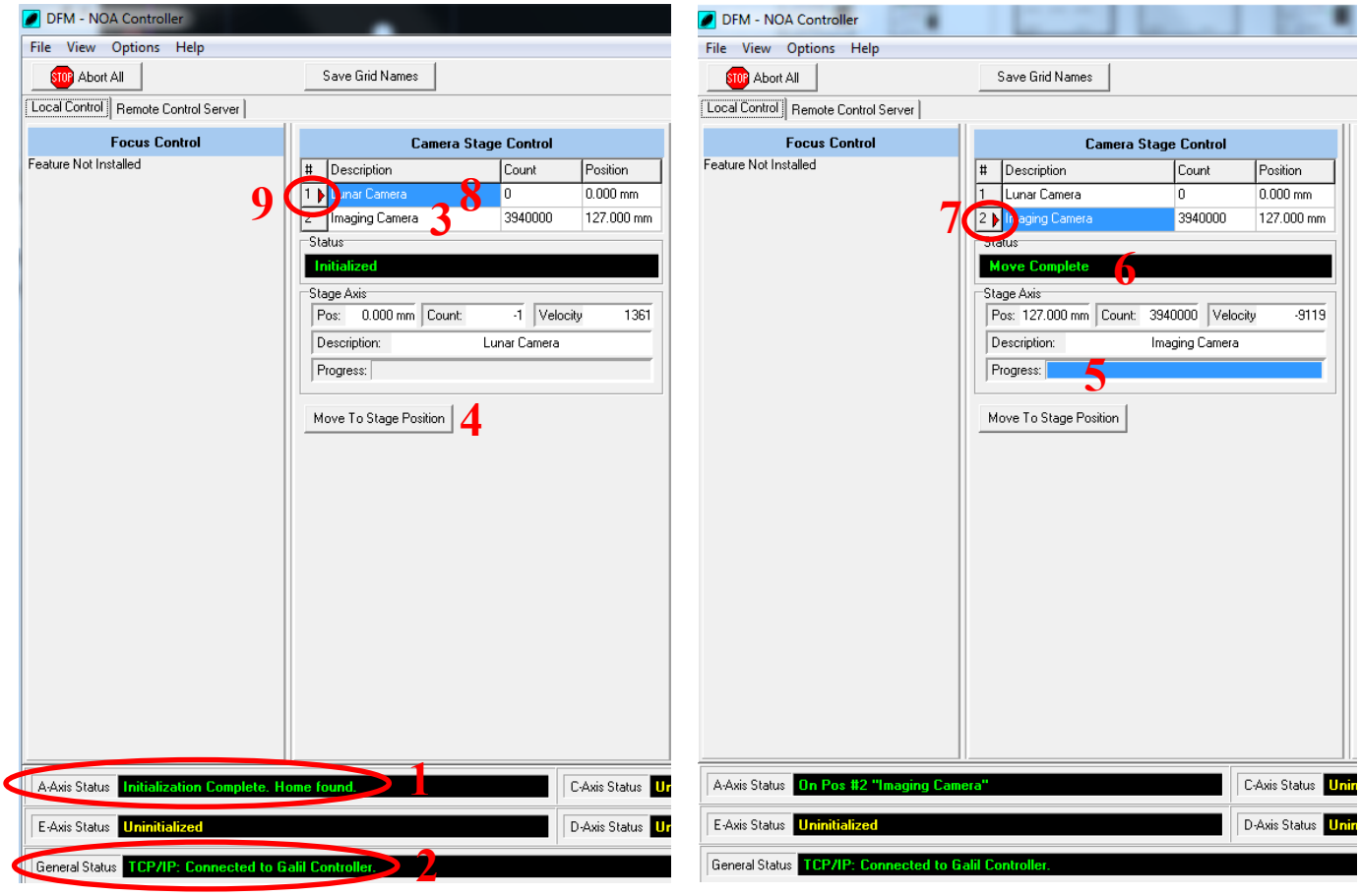


Fig. 4.1. Initializing the CSS (left) and selecting the science CCD (Imaging Camera) position (right).

After the observations with the science CCD complete:

1. In the “DFM – NOA controller” software, click on the “Lunar Camera” (Fig. 4.1 No 8) and then click on the button “Move To Stage Position” (No 4). Wait (approx. 20 sec) until it reaches its position (the progress bar is filling—No 5). The message “*Move Complete*” (No 6) appears when it does and the red arrow showing the current CCS position is moved to the “Lunar Camera” (No 9).
2. Close the software.

5. Science CCD control system

The CCD is the Apogee Aspen CG47 and is used for unfiltered observations. The camera is connected to the private network of the observatory via TCP/IP and is controlled from the Science and Monitoring PC (SMPC) and particularly from the MaxIm DL software that is installed on it. The following steps are based on the assumption that the CCD has been previously turned on (Section 2.1, dome floor part 2, Fig. 2.14 left).

5.1. Technical information

The following two subsections include the technical specifications of the science CCD and provide details about its Field-of-View using the Kryoneri telescope.

5.1.1. Specifications

The following table includes all the necessary information for the user as given by the *Apogee* company. In Fig. 5.1 the quantum efficiency plot is illustrated.

Table. 2. Apogee Aspen CG47 technical specifications.

Model	Apogee Aspen CG47
CCD	E2V CCD47-10
Array Size	1024×1024 pixels
Pixel Size	13×13 μm
Imaging Area	13.3 mm × 13.3 mm (177 mm^2)
Gain	1.34 e^-/ADU
Read out noise	17.38 e^- RMS
Pixel Binning	1×1 to 8×1024 on chip
Anti-blooming	None
Exposure Time	100 ms to 183 min (2.56 μm increments)
Cooling	TE with forced air. Maximum cooling up to 65°C below ambient temperature
Dark Current (typical)	0.2 e^-/pixel/sec (at -20°C)
Shutter	Mechanical (35 mm)
Computer Interface	USB 2.0; Network interface with built-in web server, up to 2 MHz throughput

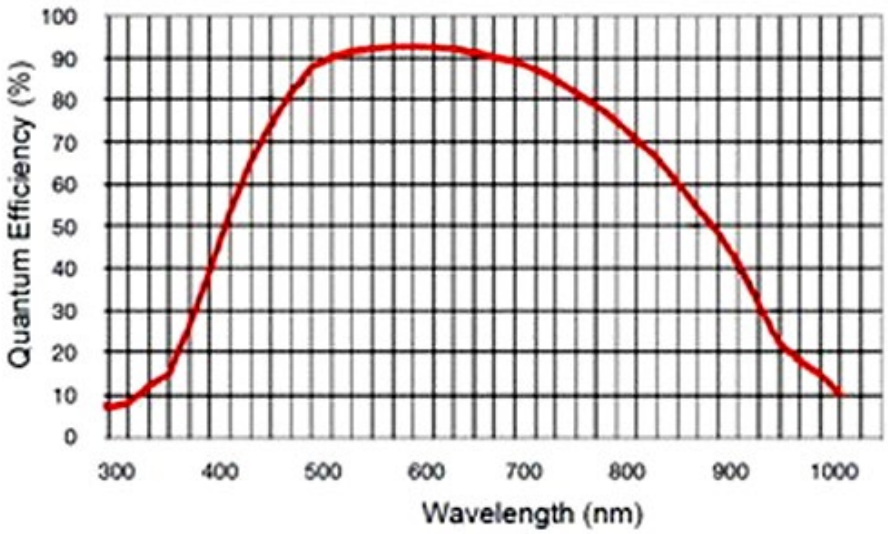


Fig. 5.1. Quantum efficiency plot of Apogee Aspen CG47 CCD camera.

5.1.2. Field of View and orientation

The science CCD's field of view (FoV) depends on the optical system of the telescope. Although the positions of the CSS have the same distance from the primary mirror, the FFIS and the science CCD have different optics in front of their chips that affect slightly the effective focal length. For the science CCD the effective focal ratio is f/3.1 and provides a FoV of 12.3´×12.3´ and a pixel scale of 0.72´´ /pixel. Fig. 5.2 shows the orientation of the CCD in the sky.

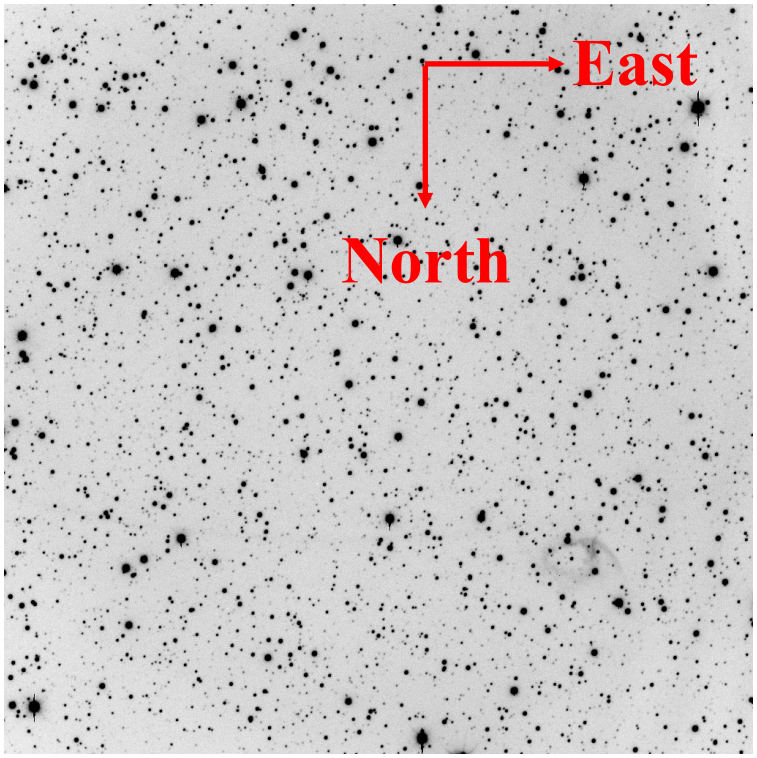


Fig. 5.2. The FoV of the Apogee Aspen CG47 CCD camera on the sky when attached to the prime focus of the Kryoneri telescope using the MaxIm DL software. The size of the FoV is 12.3´×12.3´ and the orientation is: North→Down, East→Right.

5.2. Initialization, connection and cooling

1. Turn on the SMPC (Fig. 1.1).
2. Log in using the password written in the “Password documents” located on the rack under the printer.
3. Open the “Internet Explorer” (IE) web browser.
4. On the favorites menu click on the “Apogee Aspen Web Server” (Fig. 5.3 left No 1). The home page is loaded.
5. On the menu, click on the “Reboot” (Fig. 5.3 left No 2). A pop up window opens with prefilled the Username and the Password boxes (Fig. 5.3 right). Press “OK”. The “Reboot” menu opens (Fig. 5.4 left).
6. Click on the “Reboot” button (Fig. 5.4 left). A white page with the message “*OK*” on the upper left is loaded (Fig. 5.4 right). Close this IE session.

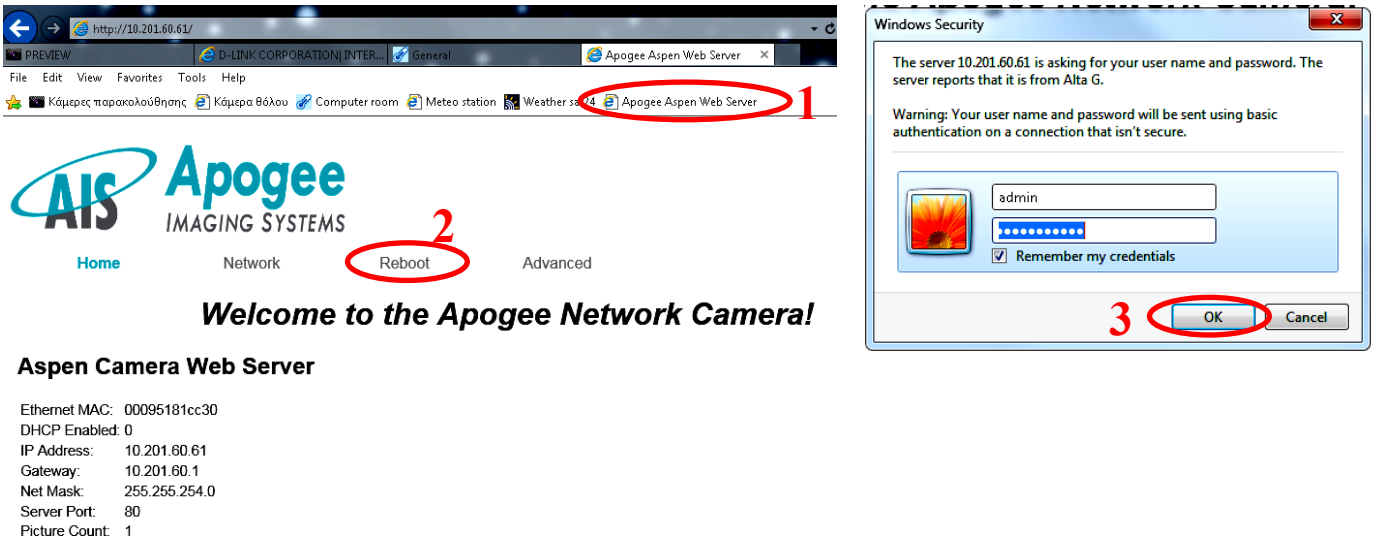


Fig. 5.3. Logging in the Apogee Aspen Web Server using the IE.

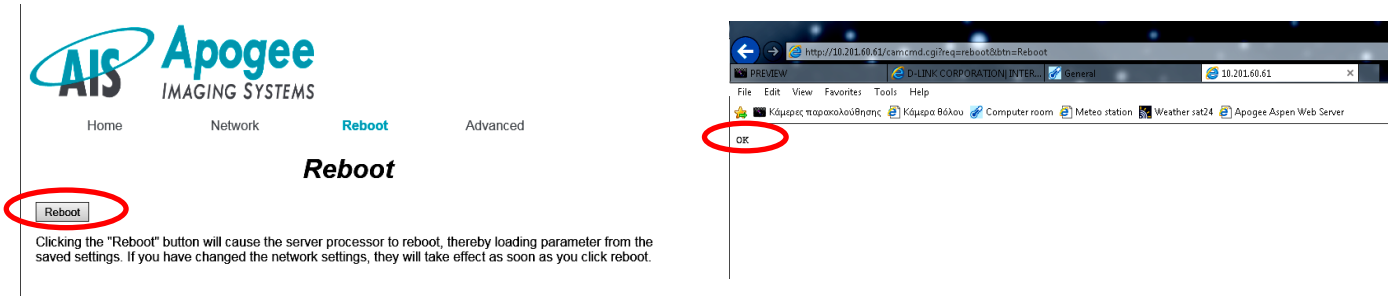


Fig. 5.4. Rebooting the Apogee Aspen CCD using the IE. Left: The Reboot menu. Right: The “*OK*” message after reboot is completed.

Open the MaxIm DL software that is located on the SMPC desktop.

1. Click on the “Toggle camera control” button (Fig. 5.5 No 1). The “Camera Control” window opens by default on the “Setup” menu (No 2).
2. Press the “Connect” button (No 3).
3. Click on the “On” button in the “Cooler” section (No 4).

4. Click on the “Cooler” button in the Camera 1 section (No 5). A pop-up window “Set Camera’s Cool point” appears.
5. Set the temperature value setpoint (No 6) and press “OK” (No 7).

Attention: Be advised that this CCD can cool down up to approximately -65°C from the ambient temperature. However, it is recommended for the cooler to use about 75%-80% of its power when reaches the setpoint and the temperature is stabilized. Check the temperature given by the meteo station and set a setpoint approximately 45-50°C lower than the current ambient temperature. Once the set temperature is reached, check the Cooler power (Fig. 5.5 No 8) and increase the temperature setpoint if necessary. The cooling rate is approximately -2°C/min.

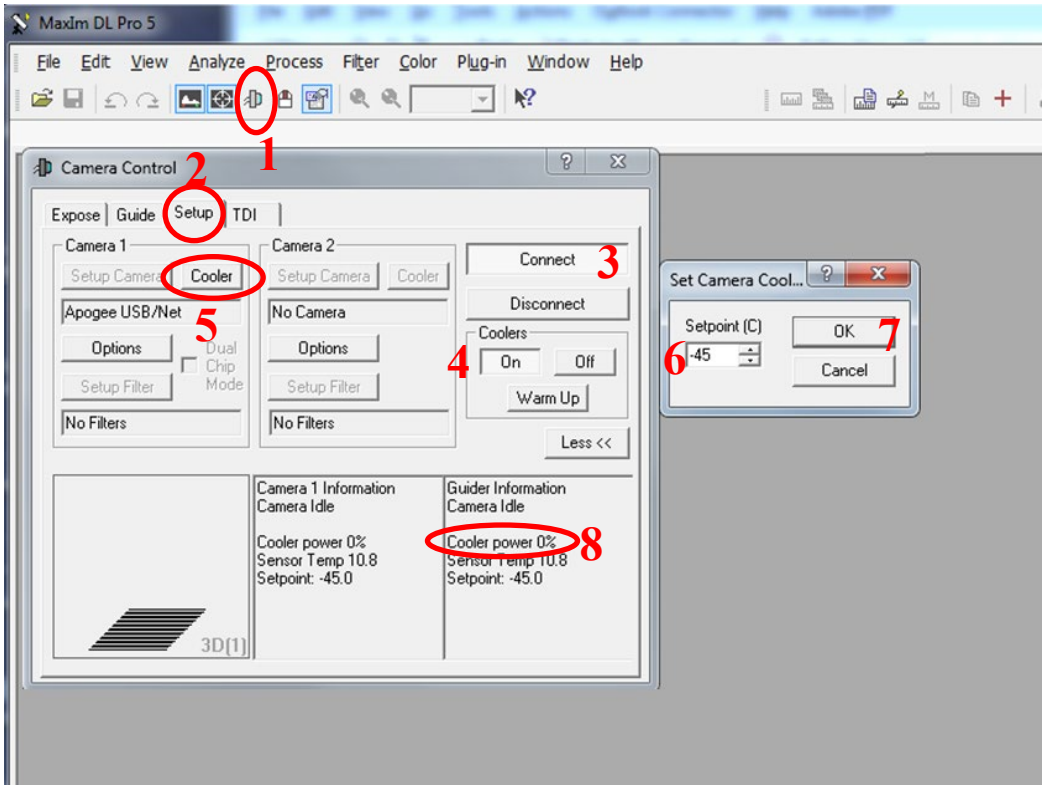


Fig. 5.5. Connecting the CCD to the MaxIm DL software and initializing the cooler.

5.3. Operation

This section describes the recommended focusing method and the general guide lines in the MaxIm DL software to perform either single or automatic observations (image sequence acquisition and recording). The following subsections are based on the assumption that the CCD has been at the prime focus of the telescope using the CSS (section 4).

5.3.1. Focus

Focusing is in general a great issue in optics. The focusing distance of the primary mirror depends strongly on the ambient temperature and potentially changes during the night, when typically temperature decreases. It is highly recommended to open the dome shutter and the mirror doors at least one hour before the beginning of the observations to allow the optical system to reach thermal equilibrium. Based on this, an empirical relation between focus values

and ambient temperature has been established for the Kryoneri system that allows to set a rough focus value before the beginning of the observations. The final value of the focus is determined later using a star.

Initial focus value setting

On the SMPC:

1. Open the “focus.xlsx” program located on the desktop.
2. Click on the sheet “Apogee Aspen” (Fig. 5.6 No 1).
3. Check the ambient temperature value from the meteo station (section 1.2) and set it to the cell F19 (No 2).
4. The Focus value that should be set is given in the cells H19-I19 (No 3).

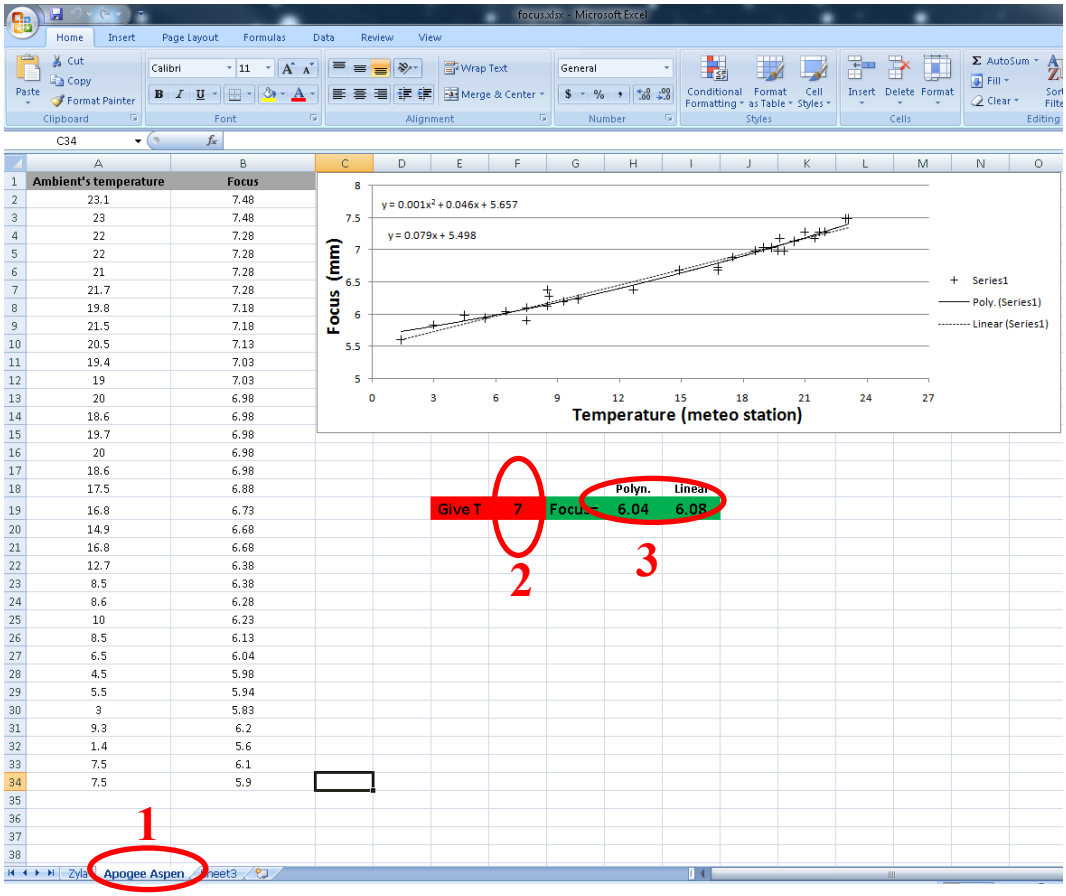


Fig. 5.6. The focus-ambient temperature empirical relation.

Use either the focus buttons of the hand paddle or the DFM software to set that focus value.

Using hand paddle: Constantly press and hold the “IN” or “OUT” buttons (Fig. 5.7 right). You may also press and hold at the same time the “SET” button for faster change.

Using the DFM Software:

1. Click on the “Telescope” menu and select the “Misc…” tab (Fig. 5.7 No 1). The “Misc settings” window opens (No 2).
2. Click on the “Focus/Harmonics” tab (No 3), set the focus value in the “Target position” box (No 4), press “Apply” (No 5), and press “Close” (No 6).

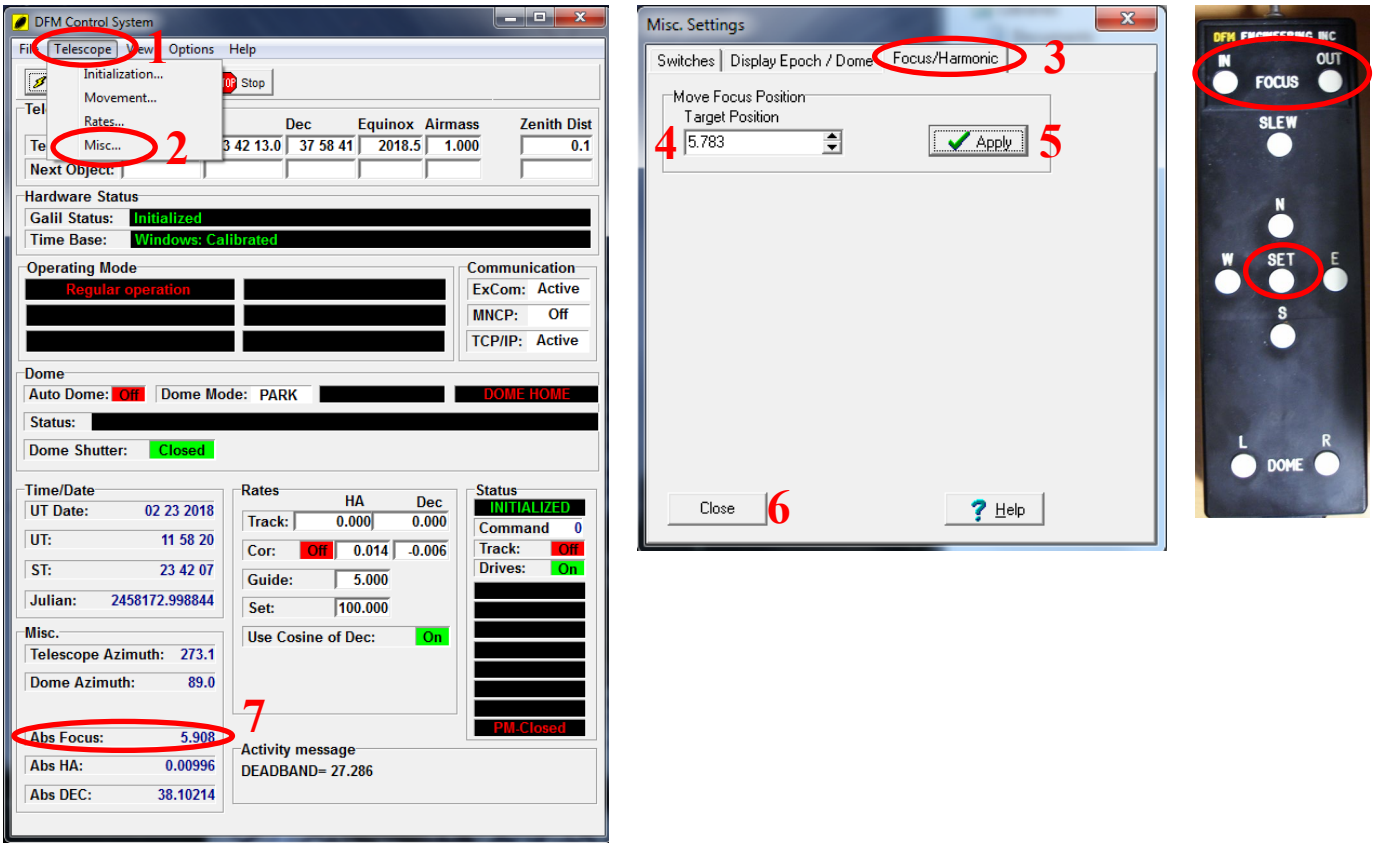


Fig. 5.7. Left: The TCS window and the selection of the “Misc…” menu. No 7 shows the current focus value. Middle: The “Focus/Harmonic” menu, where the focus value can be typed in. Right: The hand paddle where the focus change buttons are indicated.

Real focus value determination

So far, the focus has been only roughly estimated. To determine the actual focus value, use MaxIm DL tools and follow the next steps:

1. Send the telescope to a relatively bright target (9-11 mag) near the meridian and at a Zenith distance up to 30°. If possible, choose a dense field with both faint and bright stars.
2. Set the empirical focus value in the TCS software (Fig. 5.7 No 7).
3. In the MaxIm DL click on the “information” and the “Screen stretch” buttons (Fig. 5.8 No 1-2). The respective windows open. The “Screen stretch” can be used to change the image contrast if necessary.
4. Acquire 2-3 images (see section 5.3.2.2 for single acquisition) and check the FWHM and the Maximum value of 3-4 non saturated stars (Fig. 5.8 No 3-4). For this put the cursor (three circles) on the stars (Fig. 5.8. No 5) and double click it for locking one.
5. Using either the hand paddle or the DFM software (Fig. 5.7), change slightly the focus value (0.05-0.1 mm as a step is highly recommended) towards one direction (e.g. increase).
6. Continue to change the focus value towards the same direction and repeat steps 4-5.
7. Stop when you clearly see defocus stars.
8. Change the focus value towards the opposite direction and repeat steps 4-5.
9. Stop when you clearly see defocus stars.

10. Choose the focus value for which the smallest FWHM has been systematically obtained. Typical values for the Kryoneri site range between 1.8΄΄-3΄΄ (mean value ~ 2.3΄΄)[2].
11. At this time, check the ambient temperature given by the meteo station (section 1.2).
12. In the xlsx file (Fig. 5.6) add the new values for the temperature and focus and save changes[3].

Note: The steps 4-9 have to be made for focus values at least ±0.25 mm from the initial empirical one with constant step (e.g. 0.05-0.1 mm).

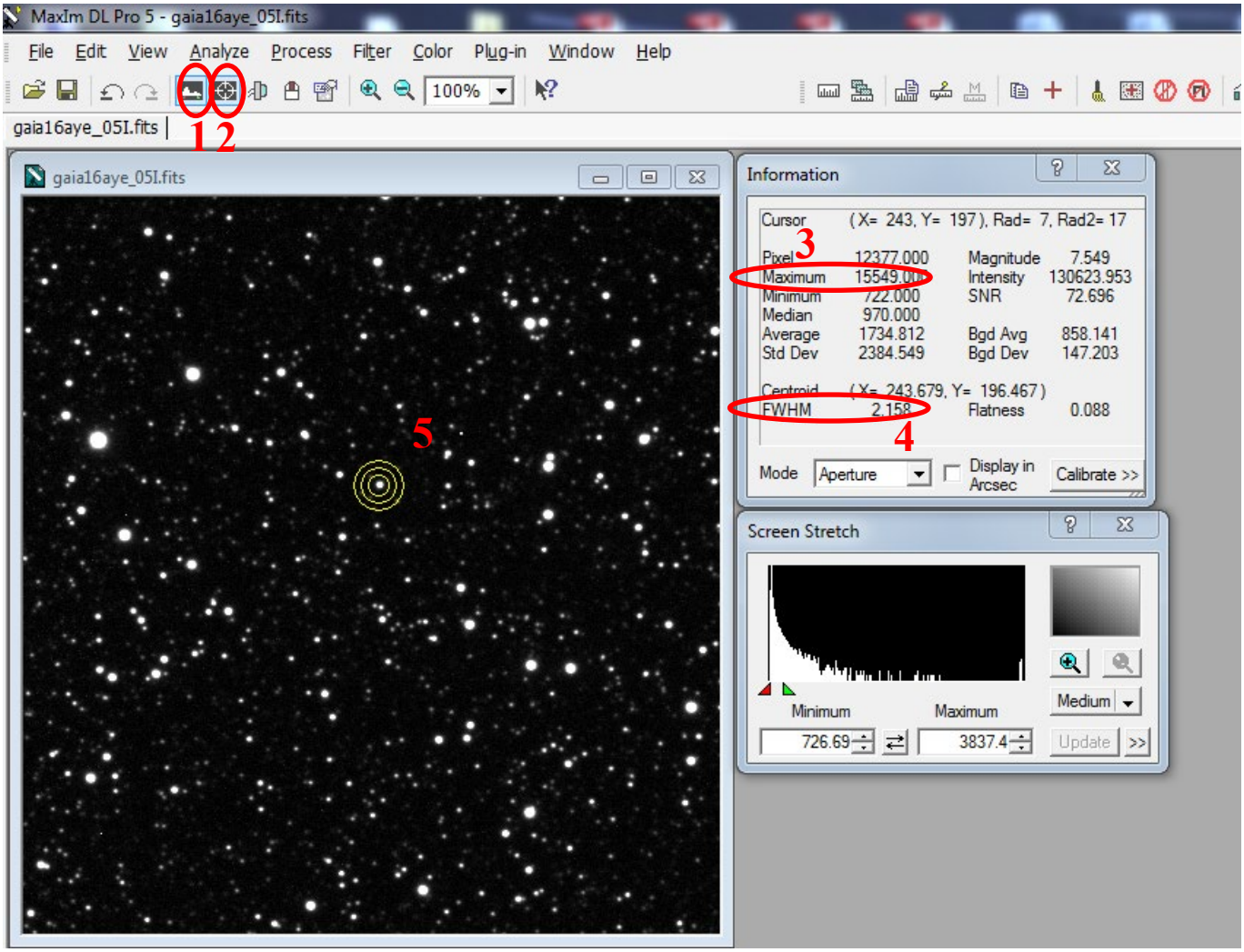


Fig. 5.8. Checking the ADUs and the FWHM of a star using the MaxIm DL tools.

[2]The focus value is subject to change during the night. Check frequently the temperature (e.g. every 1 hr) and repeat the focus procedure if significant difference is noticed.
[3]Focusing has to be made only in totally clear sky (i.e. no clouds). Do not update the values in the xlsx file if the sky clearance is questioned.

5.3.2. Observations

The observations procedure consists of two different parts. The first one is the acquisition of the images and the second one is their storing in a hard disk. In MaxIm DL software the observations can be made either manually (i.e. single image acquisition and manual save) or automatically by enabling the “Sequence” mode.

5.3.2.1 FITS HEADER change

If you like to input some values in the FITS header of the images such as target coordinates, observer’s name, target’s name etc. follow these steps:

1. Click on the “File” menu (Fig. 5.9 No 1).
2. Select “Settings” (No 2). The “Settings” window opens.
3. Click on the “FITS header” tab (No 3).
4. Click on the keyword you want to change (No 4).
5. Type in the value or the string (No 5).
6. Press “Set”, “Apply”, and “OK” (No 6-8).

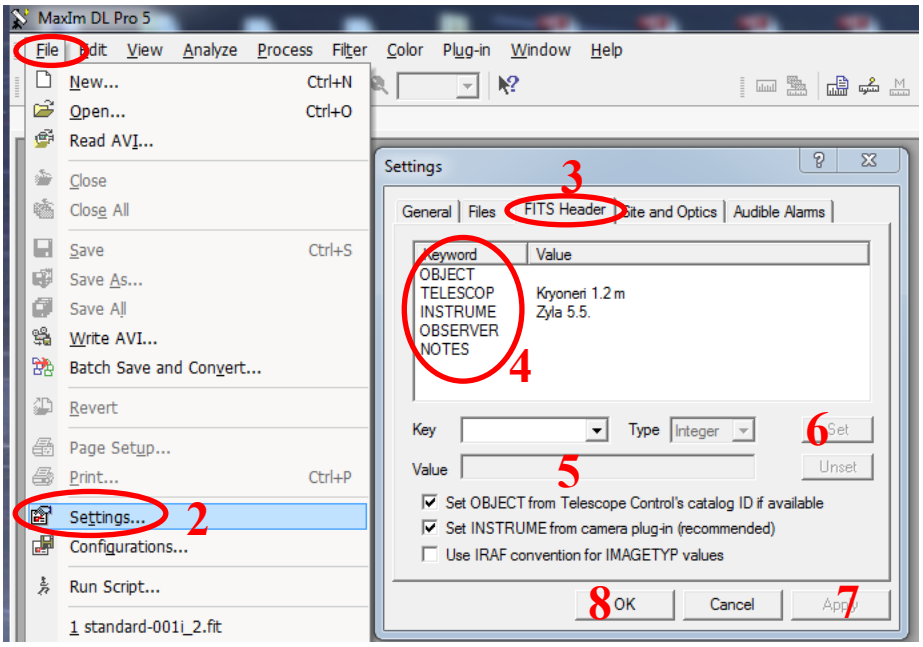


Fig. 5.9. Changing FITS header values/strings in MaxIm DL.

5.3.2.2. Acquisition modes

Single acquisition

In the camera control window (Fig. 5.10):

1. Go to the “Expose” tab (No 1).
2. Select “Single” (No 2).
3. Set the desired exposure time in sec (No 3).
4. Set the frame type (Light, Flat, Dark, Bias) (No 4).
5. Set the desired “Binning” (No 5).
6. Press “Start” (No 6).
7. If you want to keep this image, press the “Save” button (No 7), type a name for the image, and select a directory for saving it.

Continuous acquisition

In this mode the acquired images cannot be saved. It is mostly used either for focusing, testing or for fine adjustment of the telescope's position.

1. Select "Continuous" (Fig. 5.10 No 8).
2. Follow steps 3-6 as described in the previous operating mode.
3. Press "Stop" to stop (Fig. 5.10 No 10).

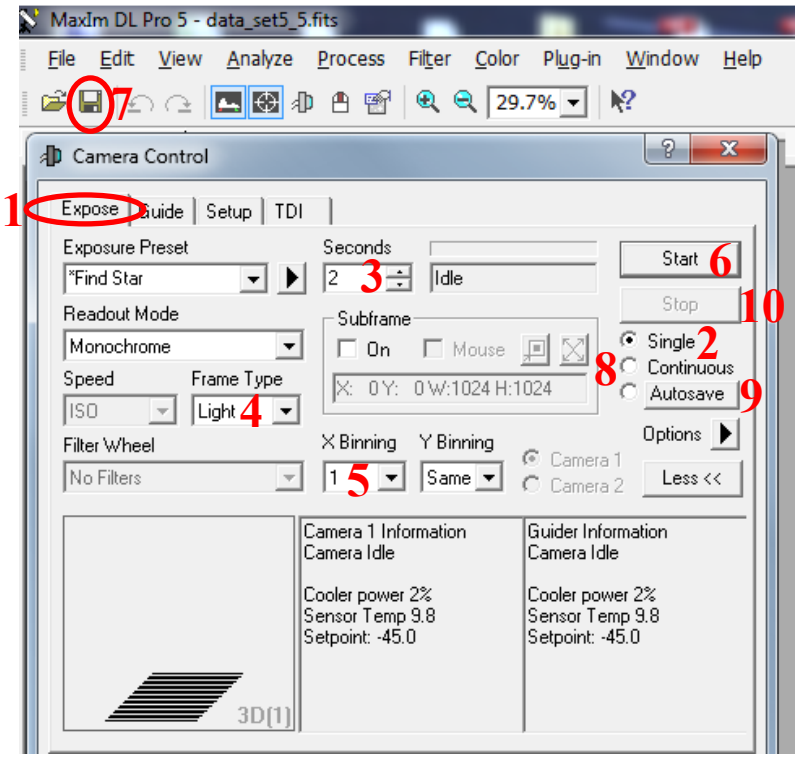


Fig. 5.10. The settings for various acquisition modes in MaxIm DL software.

Automatic acquisition

This mode should be used in the case of acquisition of a lot of images in a certain time range (e.g. time series photometry). The settings for the parameters can be initially defined and all images are automatically saved at a pre defined directory.
After you have determined the focus and the exact positioning of the telescope (i.e. desired FoV), and you have started the A/G operation (if necessary) follow these steps:

1. Click on the "Autosave" button (Fig. 5.10 No 9). The "Autosave Setup" window opens (Fig. 5.11).
2. Type in the desired filename (Fig. 5.11 No 1). This will be included in the names of all images.
3. Enable one or more slots (No 2) and select the desired settings for: "Frame type", "Suffix" at the name of the filename (e.g. WeDe1c), "Exposure" time in sec, "Binning", and the number of "Repeat" (No 3-7).
4. If necessary, you can choose to "delay the first" acquisition in sec (No 8) or add a "Delay between" successive images in sec (No 9). The latter applies only if multiple slots are enabled.

5. Click on the “Options” (No 10) and select “Set image Save Path” (No 11). A browsing window opens (Fig. 5.12 left)
6. Browse to a folder or create a new one (Fig. 5.12 left No 1) for saving the images. It is highly recommended to create a new folder with name “YYYYMMDD” in the directory “D:\\Astronomical data\” (No 2). Once the folder is created, press “OK” (No 3), and then again “OK” (No 4) to close the window.
7. In the “Autosave Setup” window press “Apply” (Fig. 5.11 No 12) and then “OK” (Fig. 5.11 No 13). The “Autosave Setup” window closes.
8. In the “Expose” menu press “Start” (Fig. 5.10 No 6).
9. If you want to interrupt the automatic acquisition press “Stop” (Fig. 5.10 No 10).

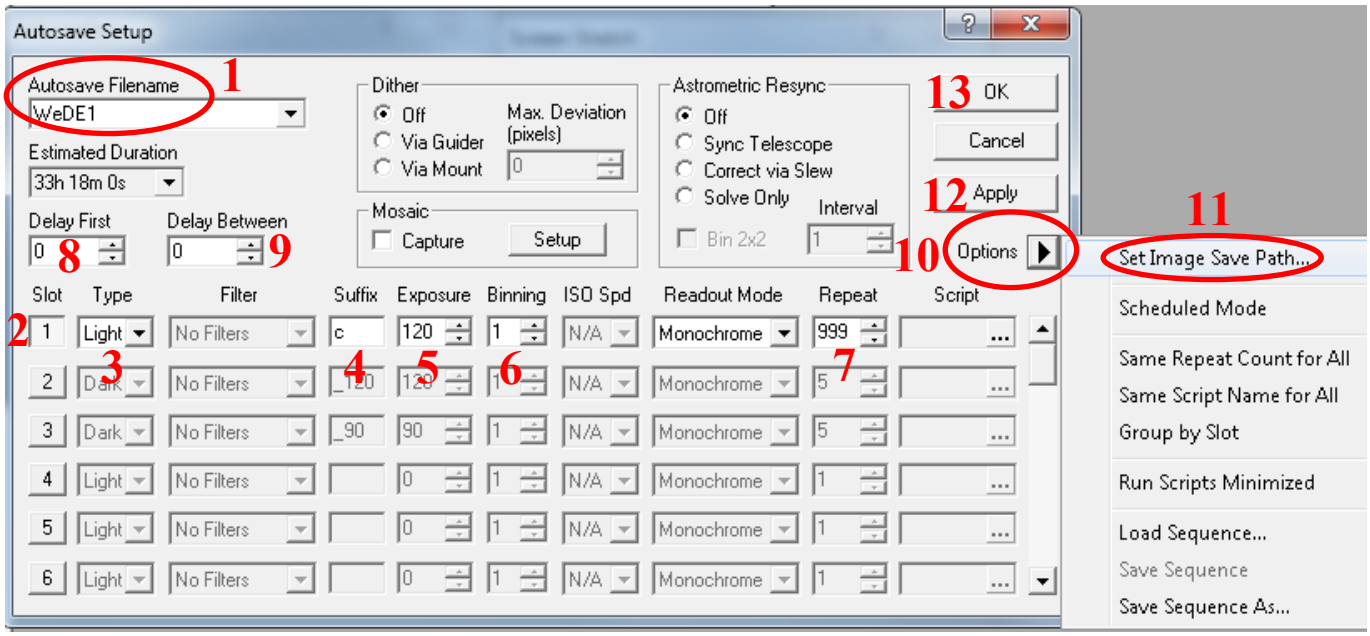


Fig. 5.11. The “Autosave Setup” menu for observations with predefined settings in MaxIm DL.

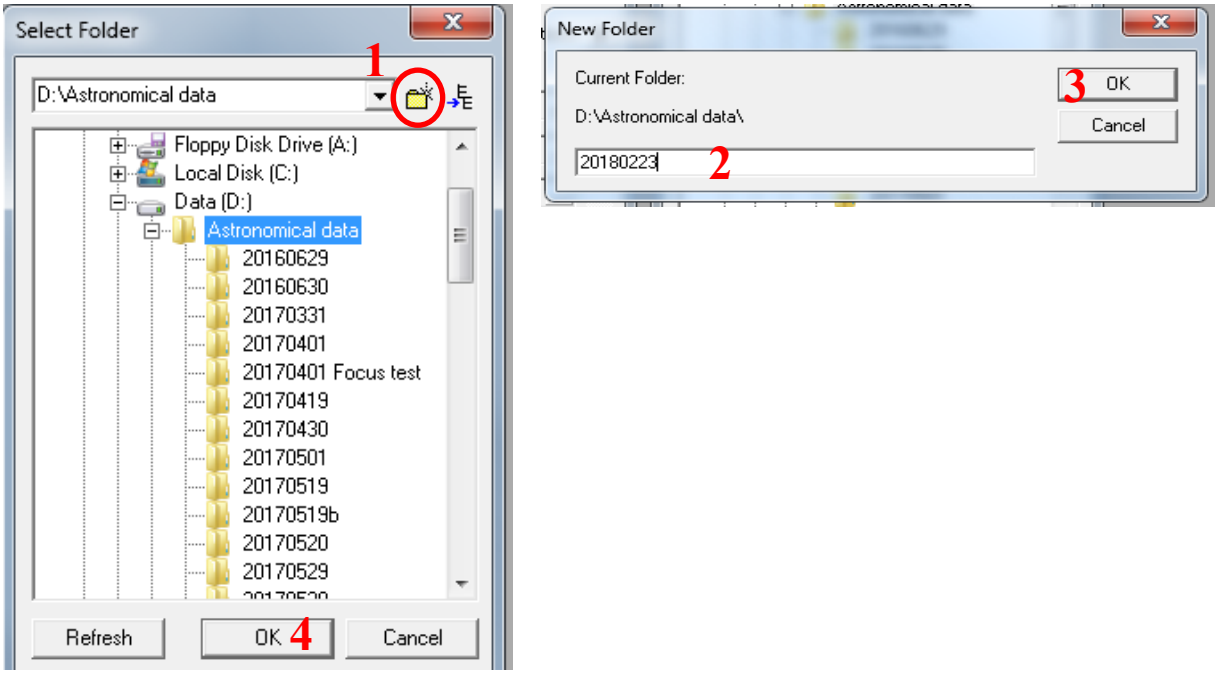


Fig. 5.12. Left: Selecting the directory to create a folder for autosaving sequence images. Right: Naming the folder in which the images will be stored.

5.4. Shutdown procedure

After the observations complete, the CCD should be properly turned off. The shutdown procedure has two steps. The first is to warm up the CCD and the second to disconnect it from the software.

1. Click on the “Setup” tab (Fig. 5.13 No 1) and press the “Warm Up” button (No 2). Wait until the “Sensor temp” to reach a value near the ambient temperature (i.e. approximately 10°C below the ambient temperature) (No 3). This process may last between 20-30 min depending on the Setpoint (the warming up rate is approx. +2 °C/min).
2. When no significant increase in the temperature is noticed (i.e. the Sensor Temp shows the same value for more than 1 min), then press the “Off” button (No 4) in the “Coolers” section, wait 2 sec until the message “*Cooler is off*” in the Camera 1 Information section appears and then press the “Disconnect button” (No 5).
3. Close the MaxIm DL software.

To turn off the power of the CCD follow the steps described either in section 2.2 or in 2.4 (dome floor, see also Fig. 2.14 left).

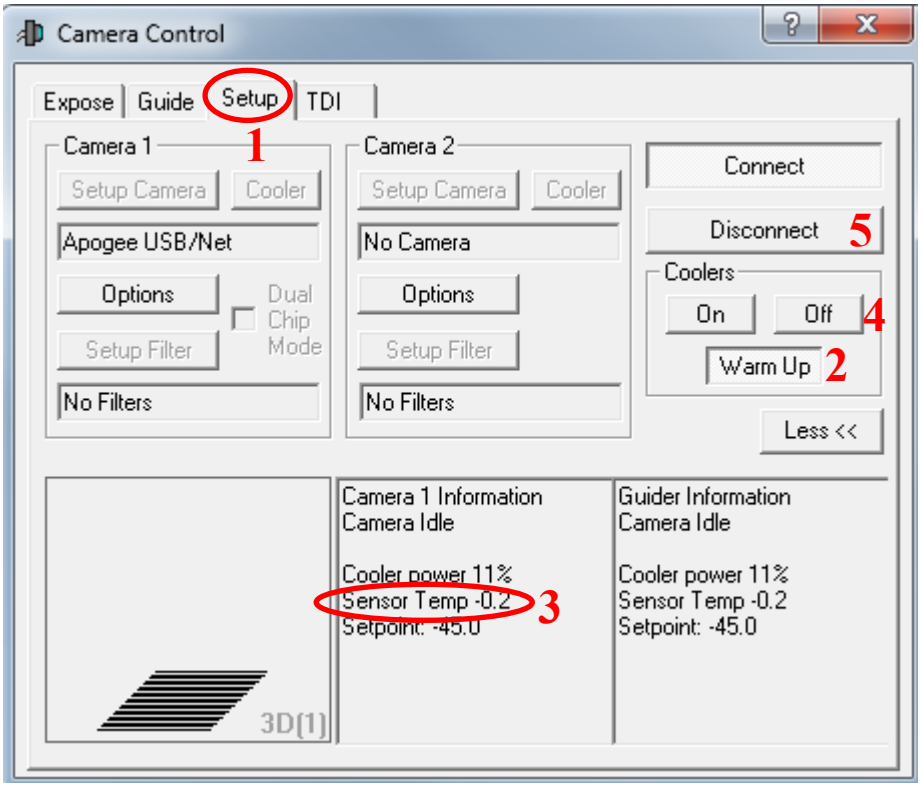


Fig. 5.13. Shutting down the CCD after warming it up properly.

5.5. Data access

To receive your data use either a Flashdisk drive or an external hard disk drive. Attach it to the front side USB 2.0 ports of the SMPC (located under the power button) and just copy and paste the data into it. For safety reasons do not delete or remove the data from the SMPC hard drive.

Attention: Before attaching a USB device on SMPC an antivirus check has to be performed.

6. Fast frame imager control system

6.1. Description

The fast frame imager system (FFIS) consists of the following subsystems:

1. Fast frame cameras (CAM)
2. Telescope (TEL)
3. Weather (meteo) station (MET)
4. Positioning system (GPS)
5. Storage (STO)

All subsystems are connected together with the “Kryoneri Observation Software” that is installed on the server (Fig. 1.2). The software uses both monitors of the server (Fig. 1.1). The first monitor displays the status window of the software, while the second one the images from the cameras.

6.2. Cameras technical information

The FFIS CAM consists of two twin Andor Zyla 5.5 sCMOS cameras. The cameras are installed on the prime focus of the telescope (Fig. 6.1), and particularly on the CSS (section 4). The cameras are placed perpendicular to each other and they are attached to a dichroic beam splitter. The first camera (CAM1 – VS 3311 - NIR CAM) is equipped with the I_c and the other one (CAM2 – VSC 3421 - RED CAM) with the R_c photometric filters (Johnson-Cousins specification). CAM 1 is installed on axis, while CAM2 is vertical to this direction. The cameras are connected to the server that controls also the storage array. More specifically, the cameras are connected via USB 3.0 to a USB-to-fiber converter, which is placed on the outer side of the prime focus ring, and from that point, using long optical fibers, are connected directly to the server in the computer room.

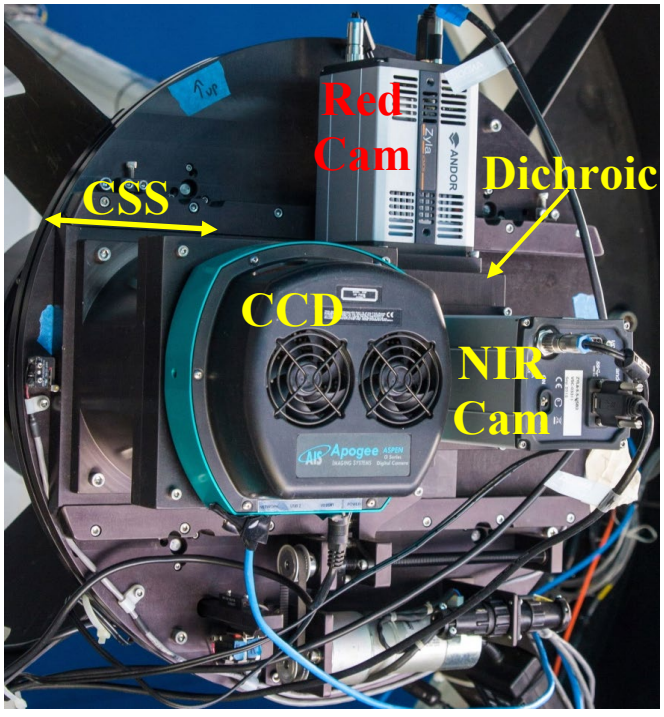


Fig. 6.1. The FFIS on the prime focus of the telescope.

6.2.1. Specifications

Zyla 5.5 cameras are able to operate in many different modes in contrast with the most classical CCDs. The modes refer to the use of different shutter, gain, and read out rate options. The following tables include all the necessary information for the user as given by the *Andor* company. For more information for the modes please check the official manual of the camera. The present manual aims only to inform the user about the available options regarding the operation modes. In Fig. 6.2 the performance of the FFIS is illustrated.

Table 3. Zyla 5.5 camera technical specifications.

Model	Andor Zyla 5.5
Type of sensor	Front Illuminated Scientific CMOS
Shutter	Electronical
Shutter options	i) Global; ii) Rolling
Gain options	i) High well capacity (12 bit) ii) Low noise (12 bit) iii) Low noise & High well capacity (16 bit)
Read out rate options	i) 560 MHz; ii) 200 MHz
Sensor size	16.6 mm ×14.0 mm
Pixel size	6.48 μm
Total pixels	2560×2160 pixels
Frame rate	0.033-40 fps
Exposure time	0.012-30 sec
Linearity	Up to 60,000 ADUs (16-bit); Up to 4,000 ADUs (12-bit)
Cooling	TE (constant at 0°C)
Computer Interface	USB 3.0

Table 4. Gain (Sensitivity) and Read out (RO) noise for each operating mode of Zyla 5.5 camera.

		Rolling Shutter		Global shutter	
RO rate	Gain settings	Sensitivity (e^-/ADU)	RO Noise (e^- RMS)	Sensitivity (e^-/ADU)	RO Noise (e^- RMS)
560 MHz	High well capacity (12 bit)	7.53	6.62	7.59	7.06
	Low noise (12 bit)	0.30	1.39	0.42	2.58
	Low noise & High well capacity (16 bit)	0.47	1.41	0.47	2.62
200 MHz	High well capacity (12 bit)	7.40	6.93	7.73	6.59
	Low noise (12 bit)	0.30	1.19	0.42	2.45
	Low noise & High well capacity (16 bit)	0.45	1.15	0.46	2.51

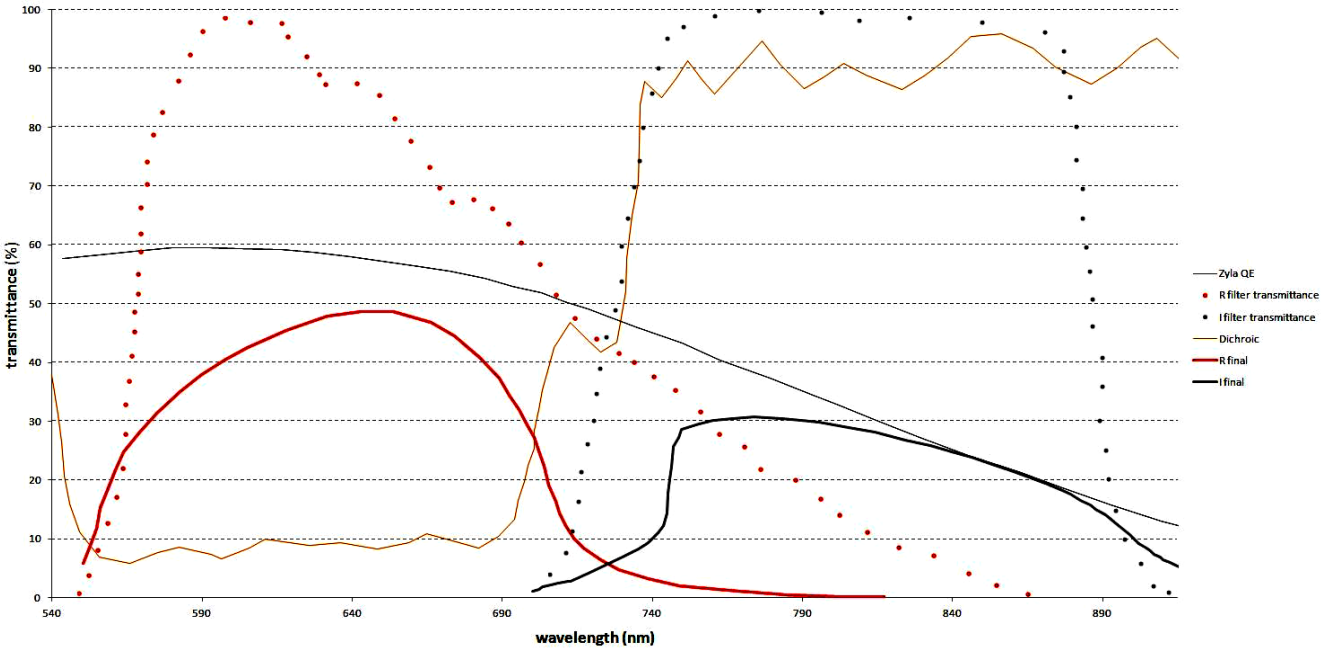


Fig. 6.2. Performance of the FFIS. Red and black solid lines represent the performance of the RED CAM and the NIR CAM, respectively. Dotted lines correspond to the specifications of the R_c (red) and I_c (grey) filters, respectively. Yellow and dark grey solid lines represent the dichroic beam splitter and the quantum efficiency of Zyla, respectively.

6.2.2. Field of View and orientation

The FoV of the cameras, although they are same, is not exactly identical due to their different position with respect to the optical axis. Moreover, between the images of the cameras there is a slight offset in both directions (i.e. x and y axes) and, in addition, a small rotation shift (z axis). Due to the optical design of the FFIS, the images from the cameras are mirrored. For both cameras the horizontal display axis (longer) corresponds to the declination equatorial axis, while the vertical (shorter) one to the Right Ascension axis. On the other hand, the saved images of both cameras are automatically rotated and flipped and they have the same orientation. However, the orientation depends on the software used for viewing. Table 5 includes details regarding the FoV of each camera and the respective orientation, while Fig. 6.3 illustrates the different orientations.

The “Kryoneri Observation Software” follows different rules for the display and for the saving of the images.

1. The software display rate is 1 fps regardless the exposure time of the images. That applies for images with exposure times less than a second, while for those with longer integration times the display rate is the same with the fps of the sequence acquisition. That means that in the case of fast acquisition (e.g. 30 fps), 30 images will be stored in a second but only one will be displayed.
2. The images are saved with different orientation than that of the display. Table 5 includes relevant details.

Table 5. Details for the FoV and the orientation of the cameras of the FFIS.

Camera	FoV (arcmin)	Scale (arcsec/pixel)	Display images orientation	Stored images orientation	
				MaxIm DL	DS9
NIR	16.8×14.2	0.394	North→Left	North→Down	North→Up
RED	17.0×14.4	0.398	East→Down	East→Left	East→Left

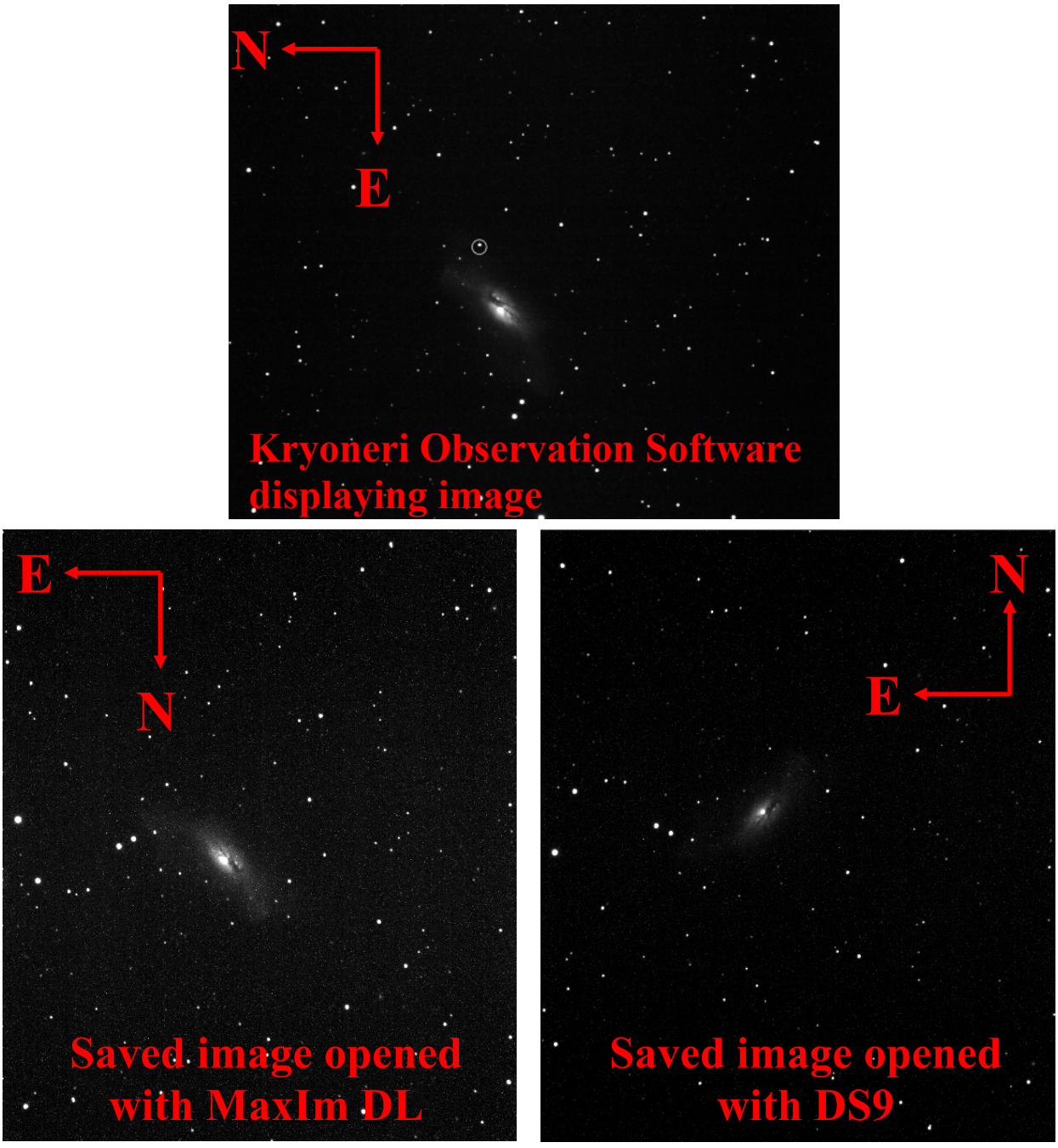


Fig. 6.3. The orientation of the displaying images (upper image) in the Kryoneri Observation Software and the orientation of the saved images (lower left: Image display with MaxIm DL software; lower right: Image display with the DS9 software).

6.3. Operation

This section describes the connections of all subsystems to the “Kryoneri Observation Software”, the recommended focusing method, and the general guide lines for the observing process.

To operate the software follow these steps:

1. Log in to the server if locked. For this, use the credentials written in the passwords document.
2. Click on the “Kryoneri Observation Software” that is located on the upper right side of the left monitor of the server. The “Observer Login” pop up window opens (Fig. 6.4).
3. Fill in the requested fields and press “OK” (Fig. 6.4). The software opens.

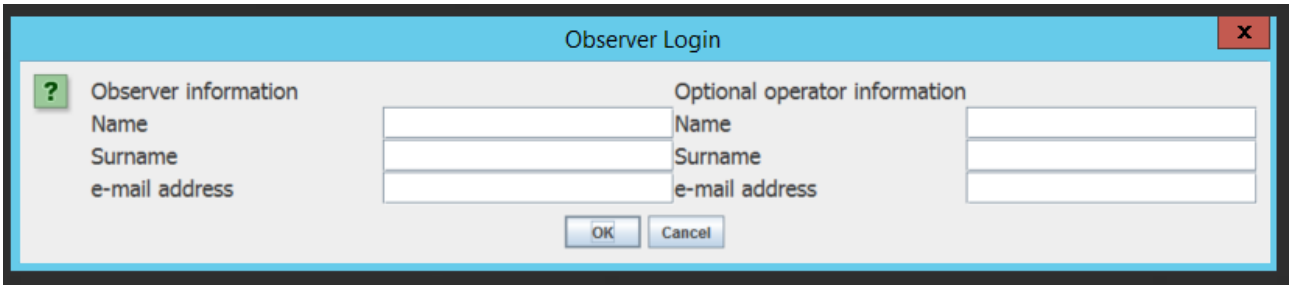


Fig. 6.4. Logging in to “Kryoneri Observation Software”.

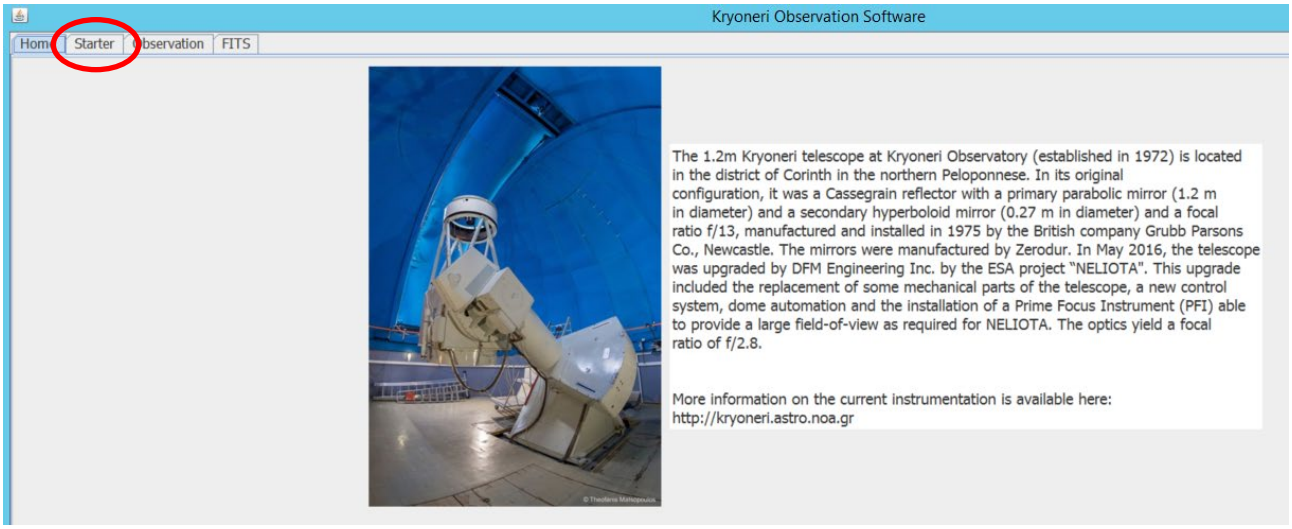


Fig. 6.5. The Home screen of the “Kryoneri Observation Software”.

6.3.1. Connection establishment with the subsystems

The connection of the software with all subsystems is made as follows:

1. Click on the “Starter” tab (Fig. 6.5) to open its menu.
2. Select “Real” (Fig. 6.6 No 1)
3. Click on the “GPS” button (No 2) and press the “Init” button (No X).
4. Click on the “MET” button (No 3) and press the “Init” button (No X).
5. Click on the “STO” button (No 4) and press the “Init” button (No X).
6. Click on the “TEL” button (No 5) and press the “Init” button (No X)[4].

[4]The telescope must be in regular operational status when connection with the Kryoneri Observation Software occurs (Fig. 2.15).

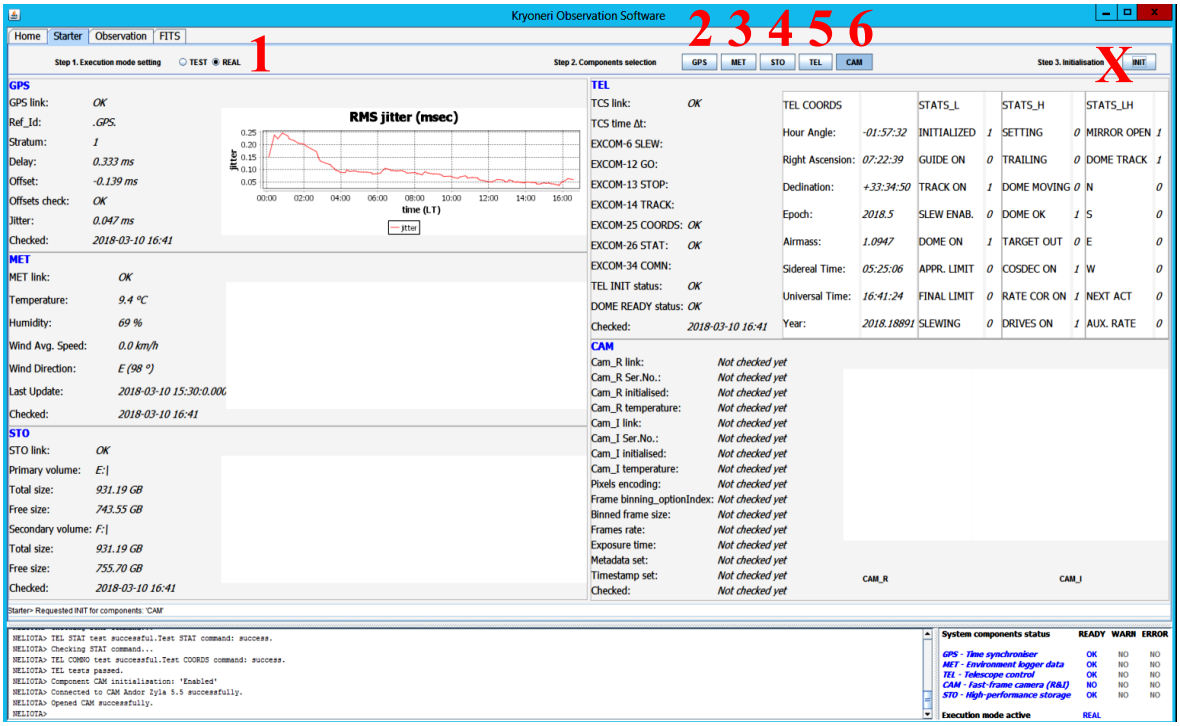


Fig. 6.6. The "Starter" menu where all the connections with the subsystems must be established.

7. Click on the "Andor Camera Interface" software, which is located on the upper right side of the lefter server monitor. Once the window opens, the screen shown in Fig. 6.7-left appears ("*Found 2 installed…*" and "*Listening*").
8. On the "Kryoneri Observation Software", click on the "CAM" button[5] (No 6), and press the "Init" button (No X). The camera selection window opens (Fig. 6.7 upper right).
9. Select the "Andor Zyla 5.5" and press "OK" (Fig. 6.7 upper right).
10. The "Opening camera system" pop up window appears with the message "*Start the cooling?*". Press "Yes" (Fig. 6.7 lower right). The cooling begins and approximately up to 4 minutes are required to complete. Once the setpoint of 0°C is reached, another window with the cameras displays opens (Fig. 6.9), while the "Andor Camera Interface" window (Fig. 6.10) displays that temperature's set point has been reached and communicates with server.
11. Move the camera display window (Fig. 6.9) to the righter monitor of the server.

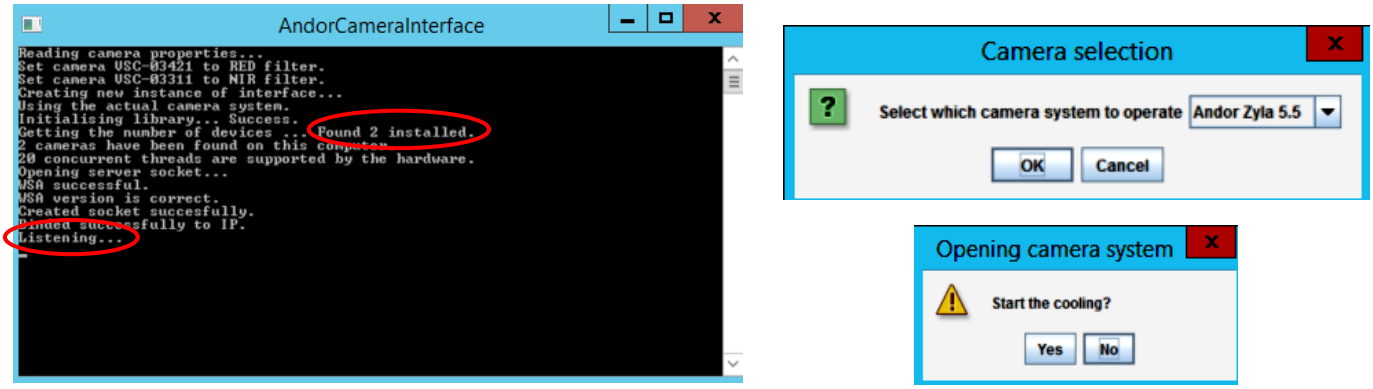


Fig. 6.7. Left: The "AndorCameraInterface" window. The connection to both cameras and the "*Listening*" status are indicated. Upper right: Selecting the Zyla 5.5 cameras. Lower right: Starting the cooling of the cameras.

[5]The cameras must have been previously enabled (Fig. 2.14).

If everything is working as it should, then all subsystems are now normally connected to the software. Check the “System Components status” box (Fig. 6.8 No 1). If everything is set to OK, then you can proceed to the observing procedure. If not, check which sub system failed to connect and scroll up the “log” box (No 2) for finding the reason. If the latter is the case, check also section 8 for possible malfunctions.

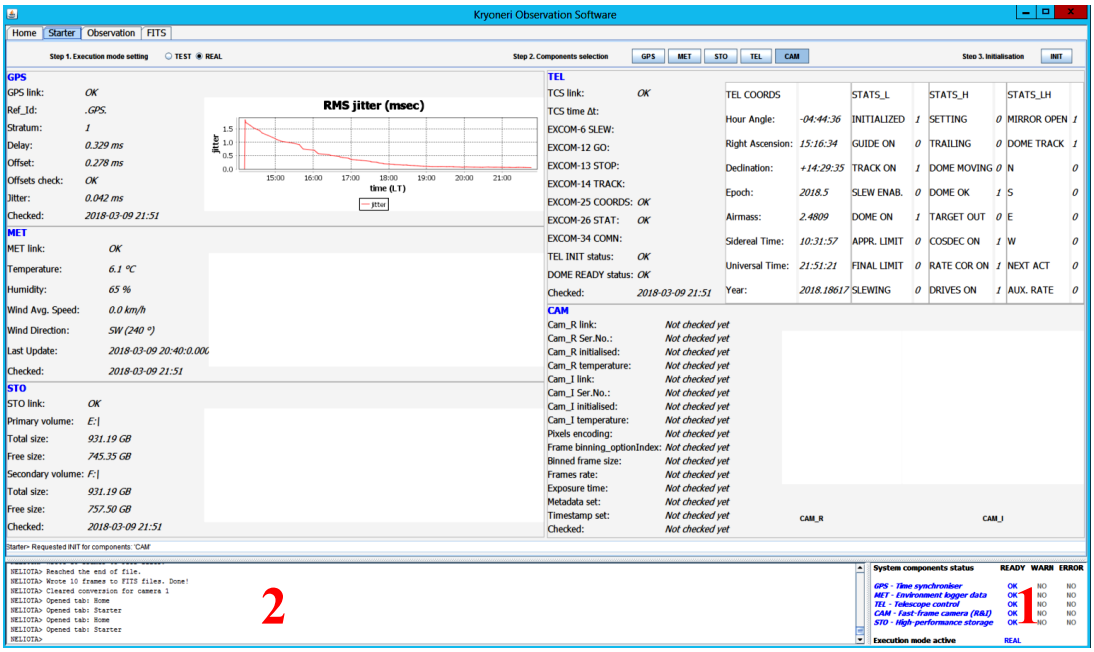


Fig. 6.8. The “Starter” menu of the subsystems after all connections to the software have been successfully established.

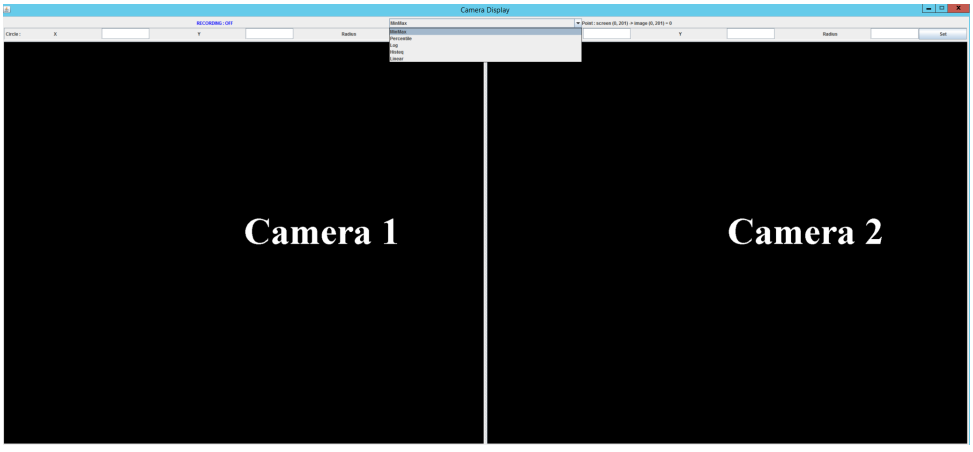


Fig. 6.9. The cameras displays window after the cooling is complete.

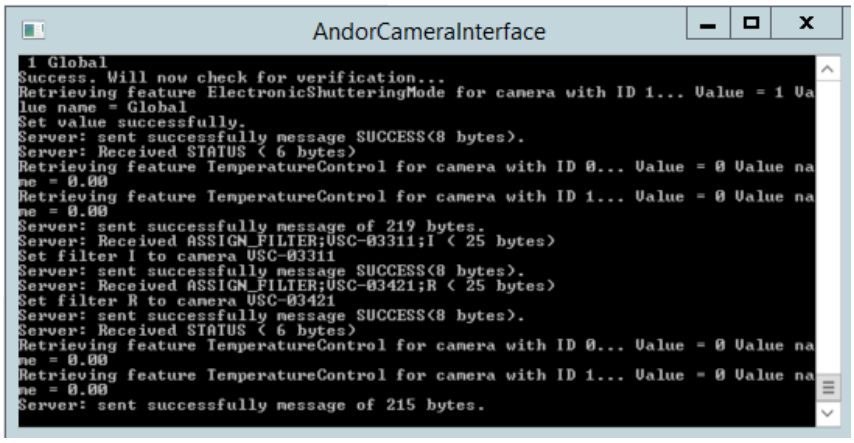


Fig. 6.10. The “Andor Camera Interface” after the cameras initialized and cooled down.

6.3.2. Observations

To begin the setup of observations, first click on the “Observation” tab of the software (Fig. 6.11 No 1). There are many options that can be set in this menu (e.g. which camera to operate, binning, shutter, read-out rate etc.) and they are presented in the following subsections.
This menu splits in three sections (Fig. 6.11 A-C):

A. Status of the four out of five subsystems (Telescope, Storage, Meteo, and GPS). In this section the user cannot change any values.
B. Camera System: This is the menu of the camera(s) settings (B1) and status (B2). This will be used to set the settings for the mode operation (B1). B2 is for camera status display only and no changes can be done (unless filters are changed).
C. Setup Recording: This part concerns the data saving and their conversion to FITS files after the observations complete.

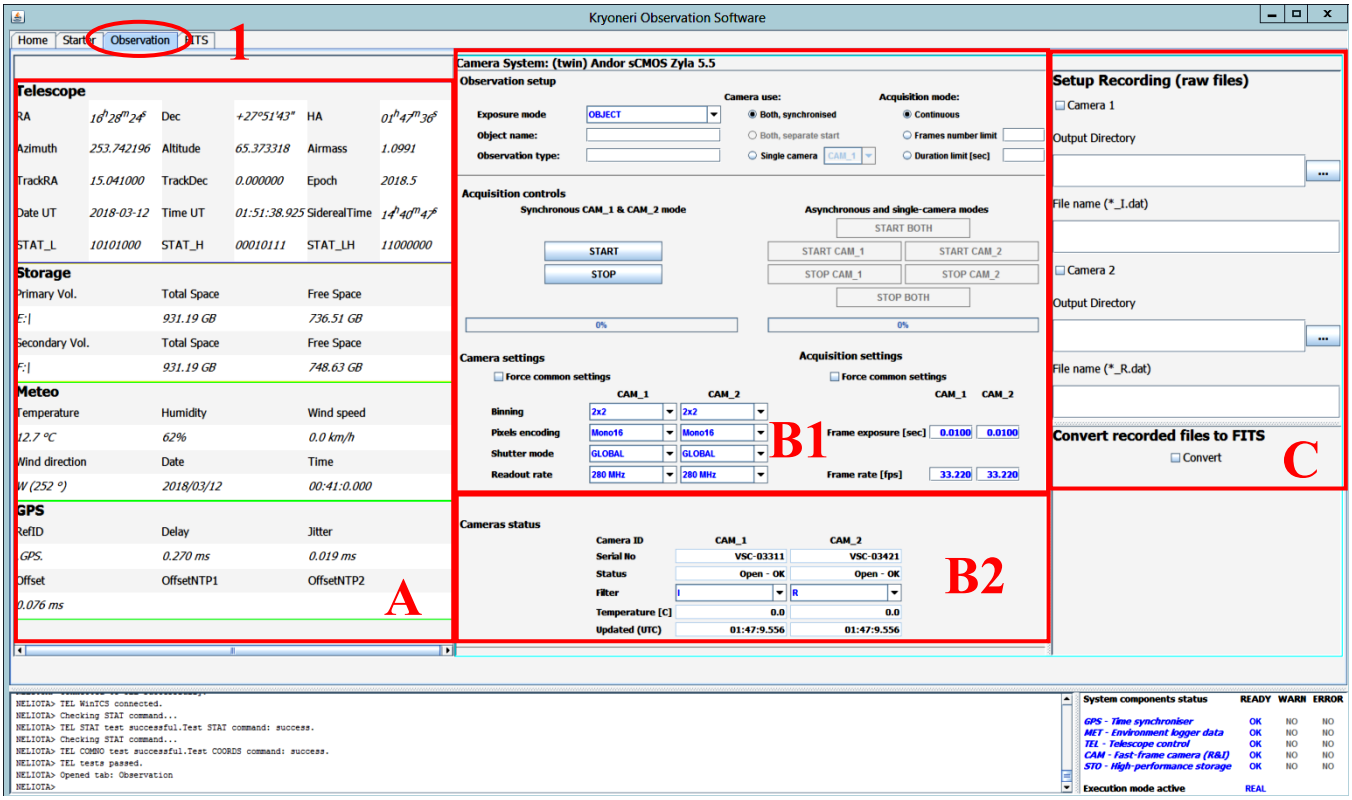


Fig. 6.11. The “Observation” menu of the software.

6.3.2.1. Camera selection, settings, and acquisition modes

To select specific camera(s) to operate and to set the respective settings follow the following steps that refer to the Camera system section of the software (Figs 6.11 B and 6.12):

1. The first step is to select specific camera(s) to operate. On the “Camera use” (Fig. 6.12 No A) select either “Both synchronized” (A-1) if both cameras are required for the observations or select the “Single camera” option (A-2) and using the drop down menu (A-3) select the desired camera (i.e. “CAM 1” is the NIR camera, and “CAM 2” is the RED camera).
2. Then, in the camera settings section (Fig. 6.12 B) you can set the binning, pixel encoding, shutter mode and read out rate (B-1-4) as given in Tables 3-4. The default values are those that are mainly used. In case both cameras are selected (Fig. 6.10 A-1), then is possible to select “Force common settings” (B-5) if you want both of them to run under the same operation mode.

3. In the “Acquisition settings” menu (Fig. 6.12 C) type in the “Frame exposure” boxes the exposure time in seconds. In case of both cameras are selected (Fig. 6.10 A-1), then both boxes are enabled, otherwise only the box of the camera selected is enabled. In order to set the exposure time, type in the boxes (C-1) and then press “ENTER”[6]. (Check Table 3 for the range of the exposure times).
4. The software calculates and sets automatically the maximum frame rate (fps) for the given exposure time. Be advised that the read out time is taken into account in this calculation (i.e. 0.04 sec in binning 1×1 and 0.01 in binning 2×2). However, if a slower frame rate is desired, you can type in the respective boxes the value (C-2) and press “ENTER”[8] again. For example, if you set an exposure of 0.1 sec the frame rate is set approximately at 9 fps. However, if you want (for reducing the data file size) only one image per second to be recorded, except for the exposure time (0.1 sec) then set 1 fps. (Check Table 3 for the range of the frame rates).
5. If you want the same acquisition settings for both cameras (not recommended given their different performance), select the “Force common settings” (C-3).
6. Select the acquisition mode (Fig. 6.12 D). You can select either “Continuous” for non-stop acquisition (D-1) or “Frames number limit” (D-2) for a specific number of images to acquire (type in the box) or “Duration limit” for a specific time duration in seconds (D-3).
7. Press “START” to begin the acquisition (E-1)[7].
8. Once done, regardless the mode used for the acquisition, press “STOP” (E-2) to enable again all the settings.

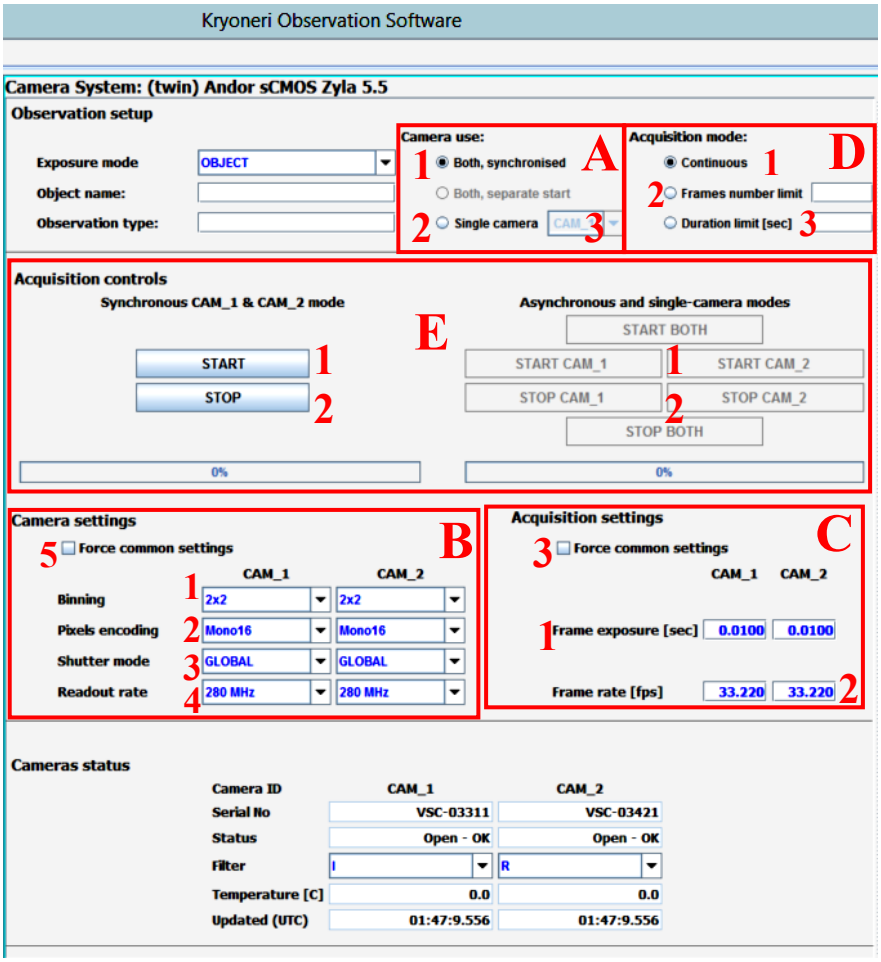


Fig. 6.12. The camera system section of the observation menu of the software.

[6]Only the values in **BOLD** face are indeed set (“ENTER” must has been pressed). That applies in both Fig. 6.12 C-1 and C-2 settings.
[7]The data are not to be saved yet. For saving and converting check section 6.3.2.3.

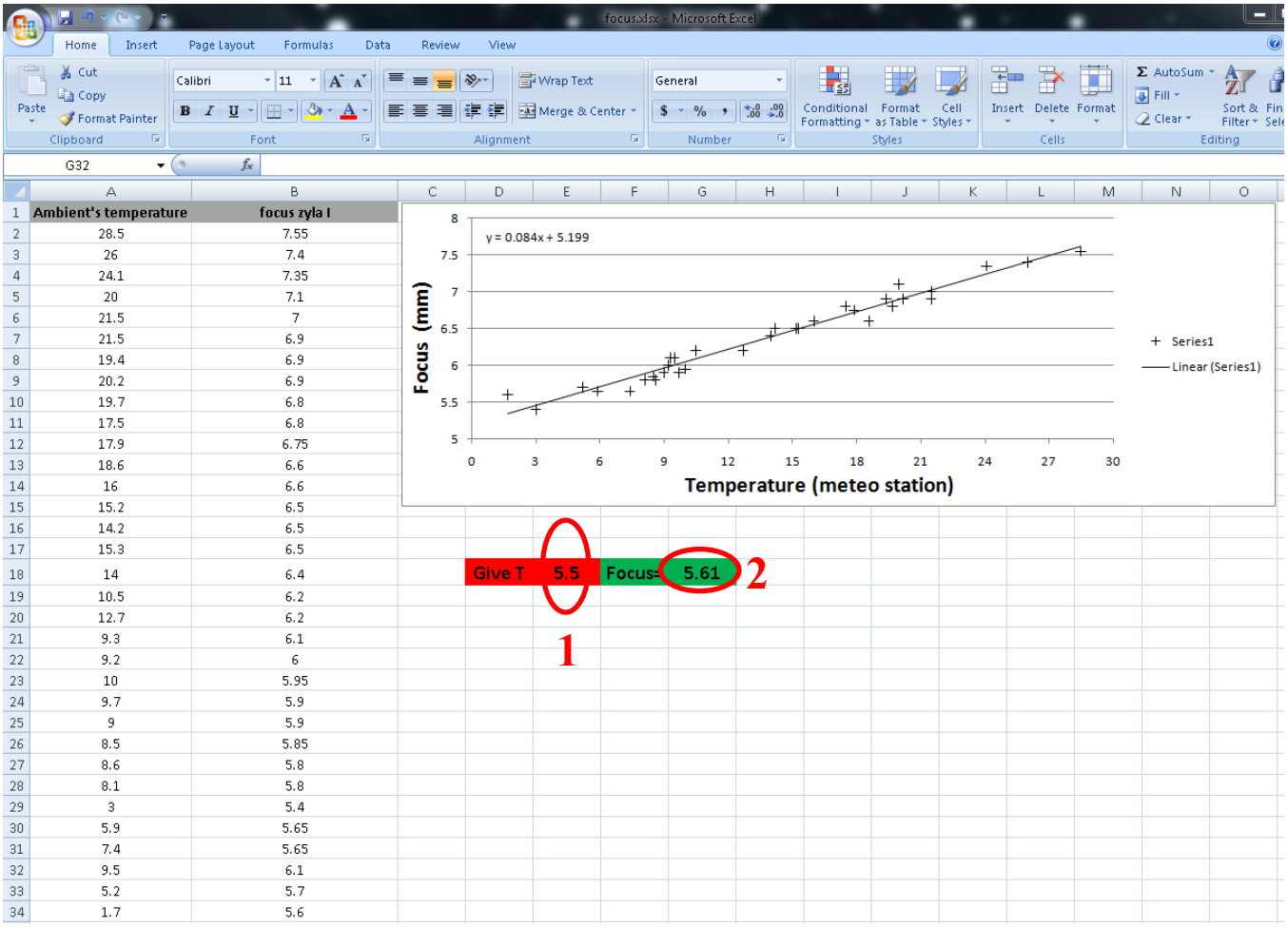
6.3.2.2. Focus

Due to the slight position offset of the cameras (see section 6.2.2), a slight focus offset exists also. If you choose to operate both of them simultaneously, then only one can have the correct focus value, while the other will be slightly out-of-focus. In general, the NIR cam is used for the focus given that the light scatter in I-band is less than in R-band. However, it is up to the user which one will have better focus. The following process is based on the case that both cameras are selected and for focus will be used the NIR cam (CAM 1). Similarly to section 5.3.1 an initial focus value can be set using an empirical relation between focus-ambient temperature and after that the real focus value must be determined using a star.

Initial focus value setting

On the SMPC:

1. Open the “focus.xlsx” program located on the desktop.
2. Click on the sheet “Zyla” (Fig. 6.13).
3. Check the ambient temperature either in the Meteo status box of the software (Fig. 6.11 A) or in the meteo station’s web page (section 1.2) and set it to the cell E18 (Fig. 6.13 No 1).
4. The Focus value that should be set is given in the cells G18 (Fig. 6.13 No 2).



	Ambient's temperature	focus zyla I
2	28.5	7.55
3	26	7.4
4	24.1	7.35
5	20	7.1
6	21.5	7
7	21.5	6.9
8	19.4	6.9
9	20.2	6.9
10	19.7	6.8
11	17.5	6.8
12	17.9	6.75
13	18.6	6.6
14	16	6.6
15	15.2	6.5
16	14.2	6.5
17	15.3	6.5
18	14	6.4
19	10.5	6.2
20	12.7	6.2
21	9.3	6.1
22	9.2	6
23	10	5.95
24	9.7	5.9
25	9	5.9
26	8.5	5.85
27	8.6	5.8
28	8.1	5.8
29	3	5.4
30	5.9	5.65
31	7.4	5.65
32	9.5	6.1
33	5.2	5.7
34	1.7	5.6

Fig. 6.13. The focus of Zyla CAM 1 (NIR cam)-ambient temperature empirical relation.

5. Use either the focus buttons of the hand paddle or the DFM software to set that focus value (Fig. 6.14).

Using the fand paddle: Constantly press and hold the “IN” or “OUT” buttons (Fig. 6.14 right). You may also press and hold at the same time the “SET” button for faster change.

Using the DFM Software:

i. Click on the “Telescope” menu and select the “Misc…” tab (Fig. 6.14 No 1). The “Misc settings” window opens (No 2).
ii. Click on the “Focus/Harmonics” tab (No 3), set the focus value in the “Target position” box (No 4), press “Apply” (No 5), and press “Close” (No 6)

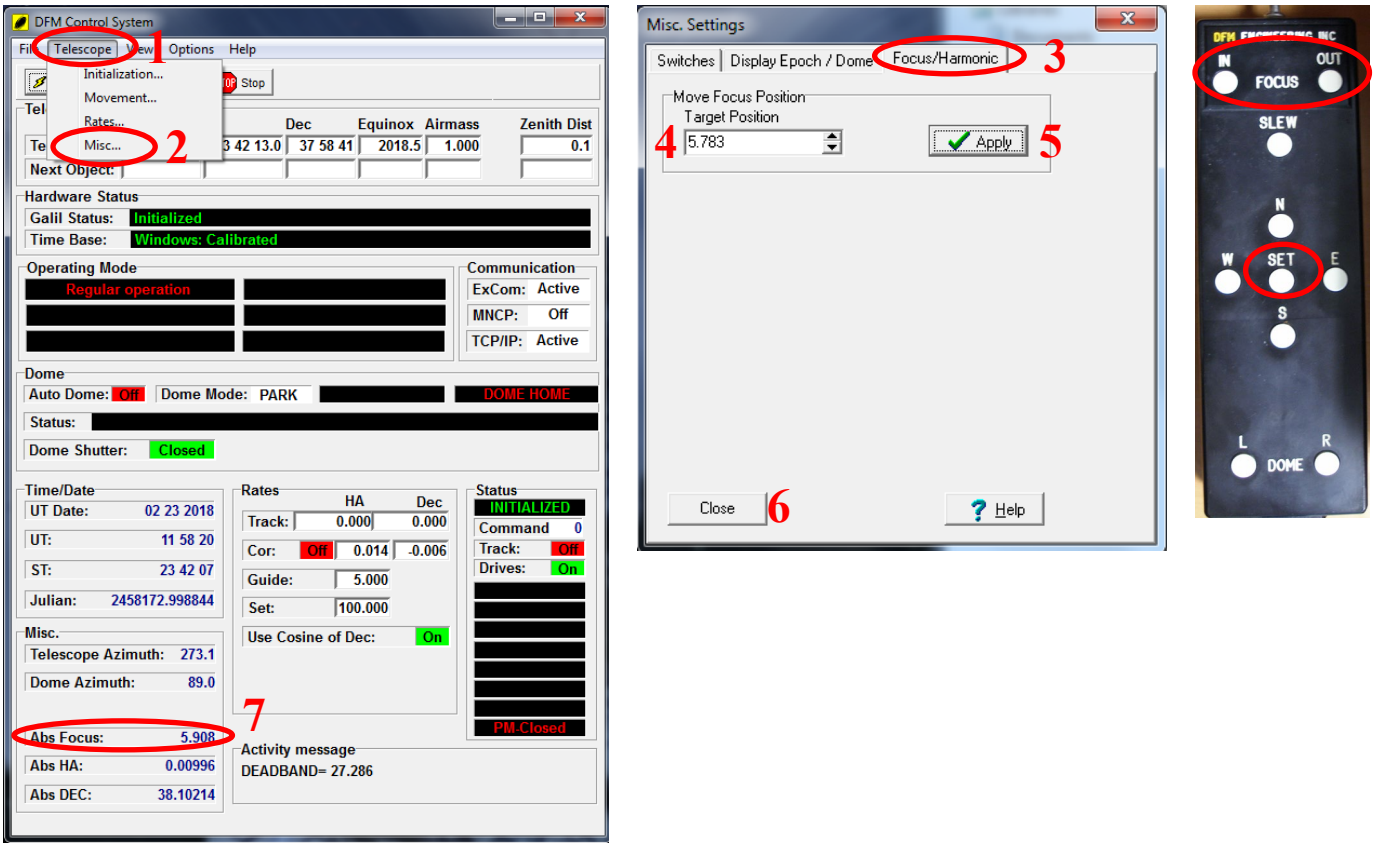


Fig. 6.14. Left: The TCS window and the selection of the “Misc…” menu. No 7 shows the current focus value. Middle: The “Focus/Harmonic” menu, where the focus value can be typed in. Right: The hand paddle where the focus buttons are indicated.

Real focus value determination

So far, the focus has been only roughly estimated. To determine the actual focus value, follow the next steps:

1. Send the telescope to a relatively bright target (9-11 mag) near the meridian and at a Zenith distance up to 30°. If possible, choose a dense field with both faint and bright stars.
2. Set the empirical focus value in the TCS software (Fig. 6.14 No 7).

3. Acquire 2-3 images using the “Frame limit” option (Fig. 6.10 D2) and check the Maximum value of 3-4 non saturated stars by simply clicking on them (Fig. 6.15 No 1-2) in the NIR cam (CAM 1) window[8]. A circle around the star appears. You may also change the radius of this circle (Fig. 6.15 No 3). You can also change the contrast for your convenience (Fig. 6.15 No 4) using the drop down menu.
4. Using either the hand paddle or the DFM software (Fig. 6.14), change slightly the focus value (0.05-0.1 mm as a step is highly recommended) towards one direction (e.g. increase).
5. Continue to change the focus value towards the same direction and repeat step 3.
6. Stop when you clearly see defocus stars.
7. Change the focus value towards the opposite direction and repeat step 3.
8. Stop when you clearly see defocus stars.
9. Choose the focus value for which the highest maximum ADU value has been systematically obtained.
10. At this time, check the ambient temperature either in the Meteo status box of the software (Fig. 6.11 A) or in the meteo station’s web page (section 1.2).
11. In the xlsx file (Fig. 6.13) add the new values for the temperature and focus and save changes[9,10].

Note: The steps 3-8 have to be made for focus values at least ±0.25 mm from the initial empirical one with constant step (e.g. 0.05-0.1 mm).

Attention: The focus value is subject to change during the night. Check frequently the temperature (e.g. every 1 hr) and repeat the focus procedure if significant difference is noticed.

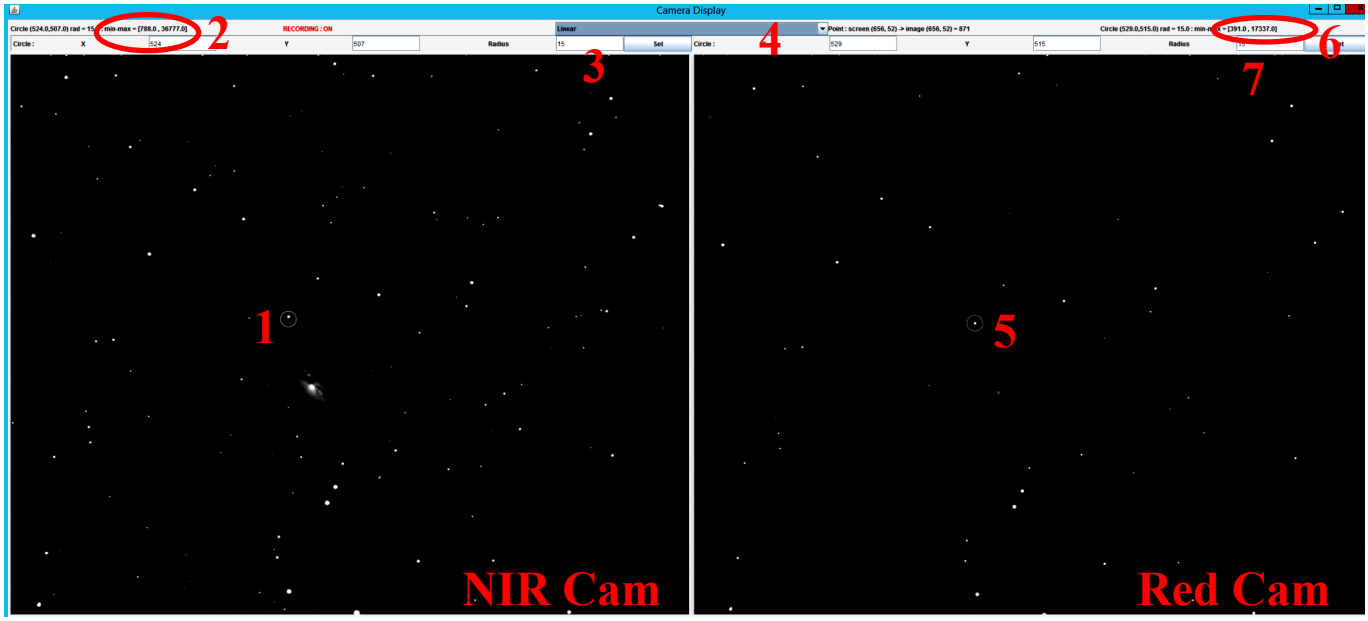


Fig. 6.15. The camera display window of the software.

[8]If CAM 2 (RED cam) is used for focus, then Fig. 6.15 No 1-3 should be replaced by Fig. 6.15 No 5-7, respectively.
[9]Follow only in case the focus was determined using the NIR cam, otherwise just skip it.
[10]Focusing has to be made only in totally clear sky (i.e. no clouds). Do not update the values in xlsx file if the sky clearance is questioned.

6.3.2.3. Data recording and converting

So far all the steps described in section 6.3.2 reach up to the point of displaying images. In this section are presented the steps that should be followed to store the data in the storage array. It is assumed that the exact FoV has been found, focus procedure has been made, the settings of the cameras are set, the desired exposure time and the frame rate have been also set, and the A/G has already begun its operation (if required).
By default the software saves the data in dat format, which is not very common for astronomical purposes. For this, there is also the option, after the observations complete, to convert the data in FITS format.

1. Press the "STOP" button (Fig. 6.12 E2).
2. In the "Setup Recording (raw files)" menu (Fig. 6.11 C) check the boxes to enable the camera(s) recording (Fig. 6.16 No 1-2).
3. Browse for output directory (Fig. 6.16 No 3-4). Once the browse button is clicked the default windows of the "Observe_A" and "Observe_B" hard disks open for each camera, respectively. Unless you are told to, do not select another hard disk for saving the data.
4. Create a new folder (Fig. 6.16 No 5), give a name (Fig. 6.16 No 6), select it and press "Open" (No 7). It is recommended to follow the format: YYYYMMDD_XX, where XX are the observer's initial letters. This step has to be done for each camera. You can give the same name to the directory, since it is stored in another hard disk (Fig. 6.17 No 3-4).
5. Give "File name" (Fig. 6.16 No 8-9). You can give the same file name. The suffixes "_R" and "_I" are automatically given by the software.
6. Check the "Convert" box (Fig. 6.16 No 10).

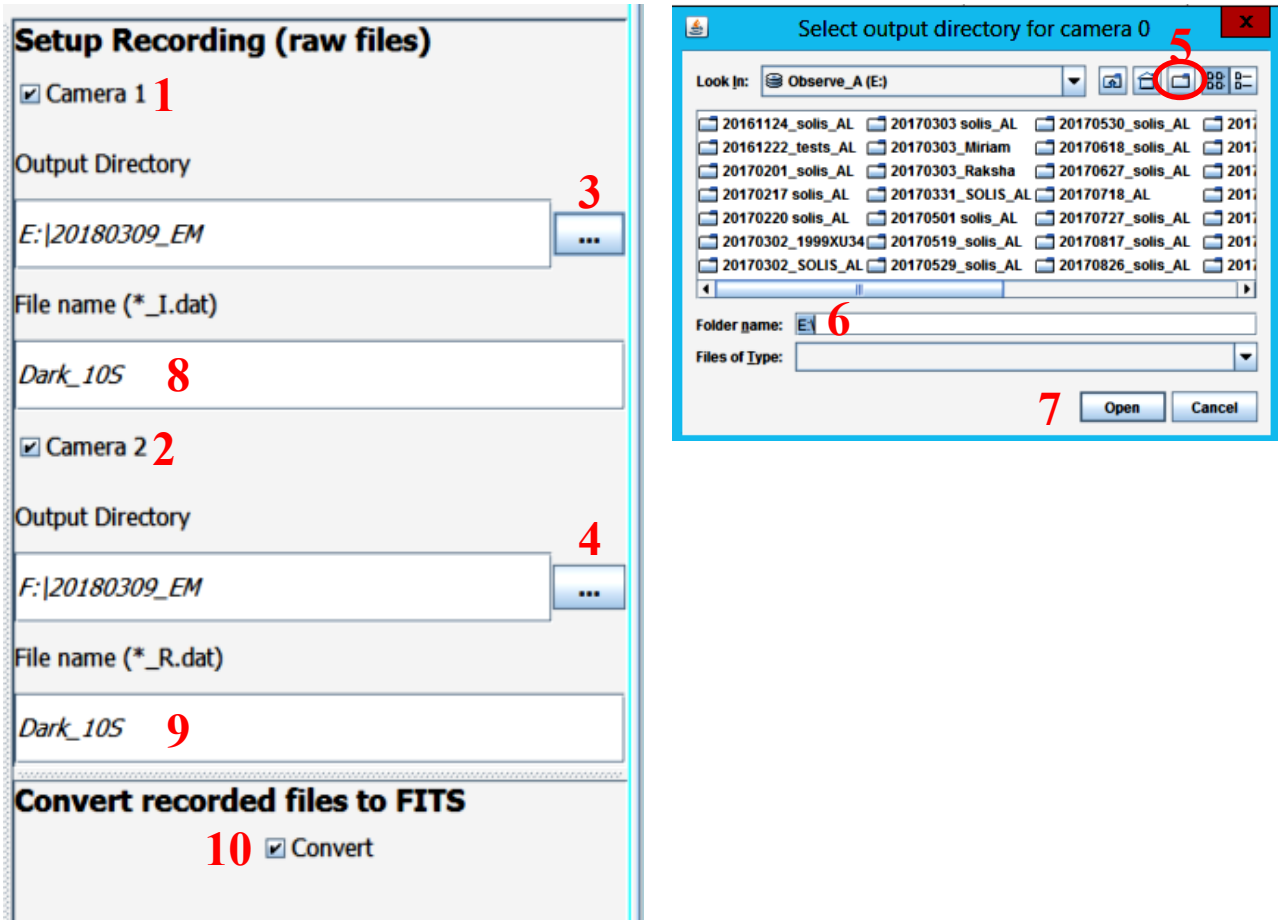


Fig. 6.16. Left: The "Setup Recording" menu. Right: Browsing for output directory.

7. In the “Observation Setup” menu (Figs 6.11 B1 and 6.17) select the appropriate “exposure mode” (Fig. 6.17 No 1) from the drop down menu[11]. This is only for the FITS header. The “observation type” box is then automatically filled (Fig. 6.17 No 2).
8. Add an “Object name” (Fig. 6.17 No 3). This is only for the FITS header.

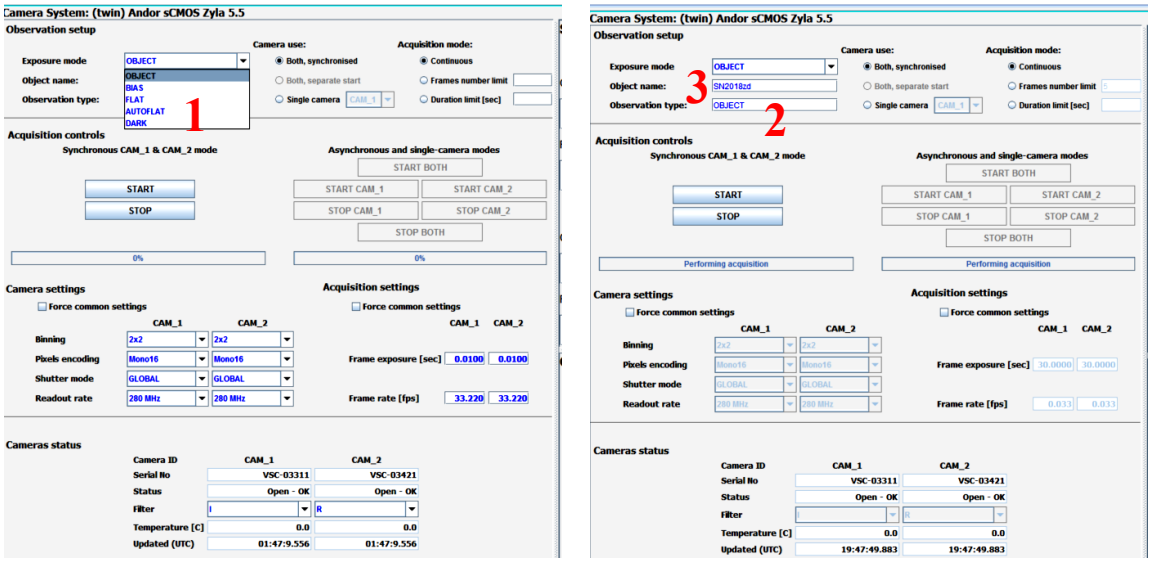


Fig. 6.17. Selecting exposure mode and typing the name of the object to be included in the FITS header.

9. Press “START” (Fig. 6.12 E1) to begin the observations. The “RECORDING: ON” indicator appears in the cameras displays window (Fig. 6.18).
10. When the observations complete, press “STOP” button (Fig. 6.12 E2) to stop the acquisition. Wait until the conversion of the data is complete (two pop up windows with green progress bars appear on the upper left side of the status window). Once done, check the output folder(s) for your data.

Fig. 6.18. The cameras displays window while recording.

[11]The “AUTOFLAT” mode is not to be used.

6.3.2.4. Bias and Dark frames acquisition

The cameras of FFIS have no mechanical shutter in front of their sensors. To obtain bias and/or dark images follow these steps:

1. Press the “STOP” button (Fig. 6.12 E2).
2. Select the appropriate exposure mode from the drop down menu (Fig. 6.17 No 1).
   If “Bias”[12] is selected, then the “Frame exposure” options (Fig. 6.12 C) are automatically disabled and they are set to the minimum exposure times.
   If “Dark” is selected, then a pop up window with the message “*Switching to the acquisition of BIAS frames. Please close the mirror shutter*” appears. Press “OK”.
3. Close the primary mirror doors and the dome shutter following the steps 4i-v described in section 2.2 (control room).
4. Follow the steps 1-6 described in section 6.3.2.3 (you may skip steps 3 and 4 if you want to keep the same output directory with that used for storing the observations).

6.4. Shutdown

The shutdown procedure is quite simple, given that no warming up of the cameras is needed. Follow the next steps:

1. Press the “STOP” button (Fig. 6.12 E2). Wait for the conversion to complete (if recording was previously occurring).
2. Close the software status window (Fig. 6.11). The message “*Don’t forget to convert your files into FITS! Bye!*” appears. Press “OK”. The cameras displays window closes automatically.
3. Click on the “Andor Camera Interface” window that displays the message “*Press any key to continue…*” (Fig. 6.19) and just press any key. The window closes.
4. To turn off the cameras follow the steps described either in section 2.2 or in 2.4.

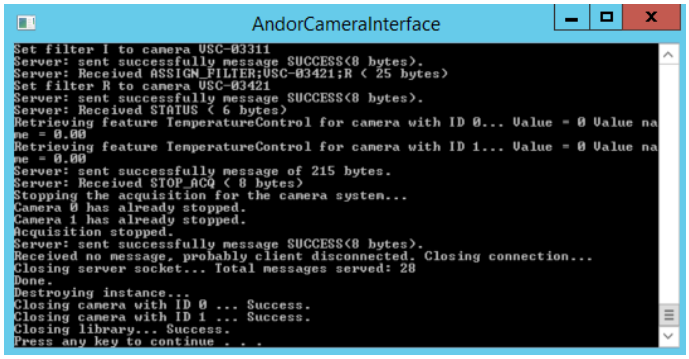


Fig. 6.19. Closing the Andor Camera Interface.

6.5. Data access

A secure ftp route will be provided. Contact technical staff.

[12]An image with the minimum exposure time of a camera does not represent exactly its Bias. Therefore, it is recommended to obtain only Dark images.

7. Reports and log

7.1. Observing report

After the observation is complete you must fill in an observing report (Fig. 7.1 left) to be sent to the headquarters of NOA. Follow the link: http://kryoneri.astro.noa.gr/form/form.html and fill in all the required fields. Press “Submit” to send the report.

7.2. Engineering report

In case you have made any engineering work (e.g. fuse replacement or other unrelated to the observations) you must fill in an engineering report (Fig. 7.1 right) to be sent to the NOA headquarters. Follow the link: http://kryoneri.astro.noa.gr/form/engform.html and fill in all the required fields. Press “Submit” to send the report.

Attention: Both reports above have to be sent from a computer connected either to the Kryoneri local network (via TCP/IP or via WiFi) or to the NOA network or via VPN if you have a valid NOA account.

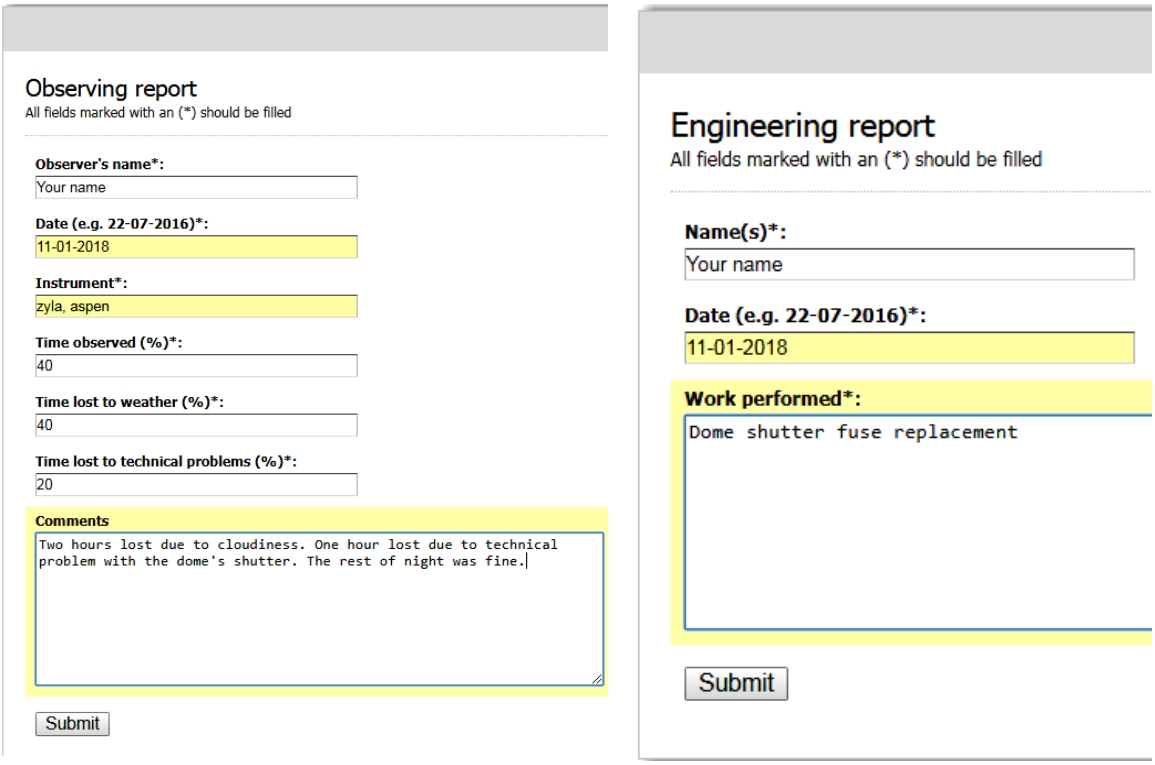
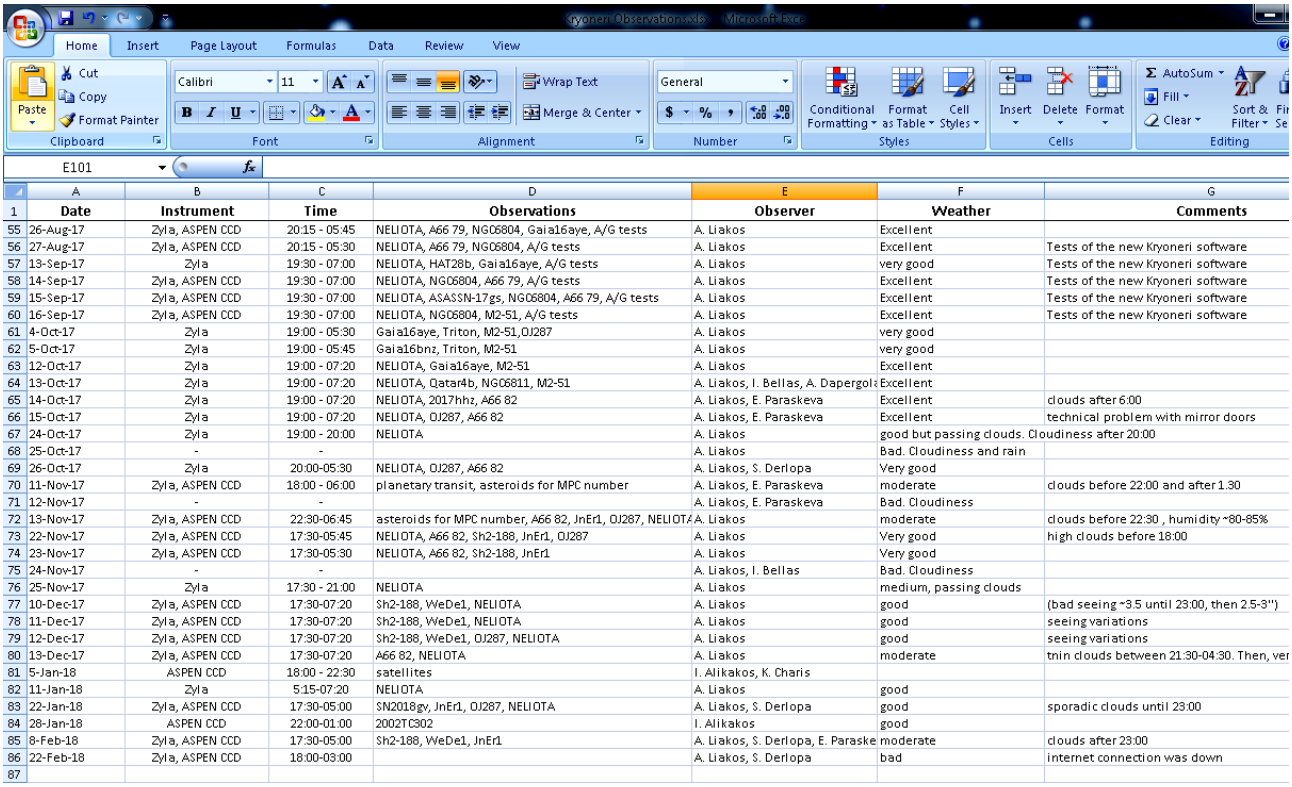


Fig. 7.1. Left: The observing report. Right: The engineering report

7.3. Observations e-log

On the SMPC desktop there is an xlsx file called “Kryoneri Observations” (Fig. 7.2). Open this file and fill in the cells under the last line with the details of your observations (e.g. Date, instruments, comments etc.). Press save, and close the file.



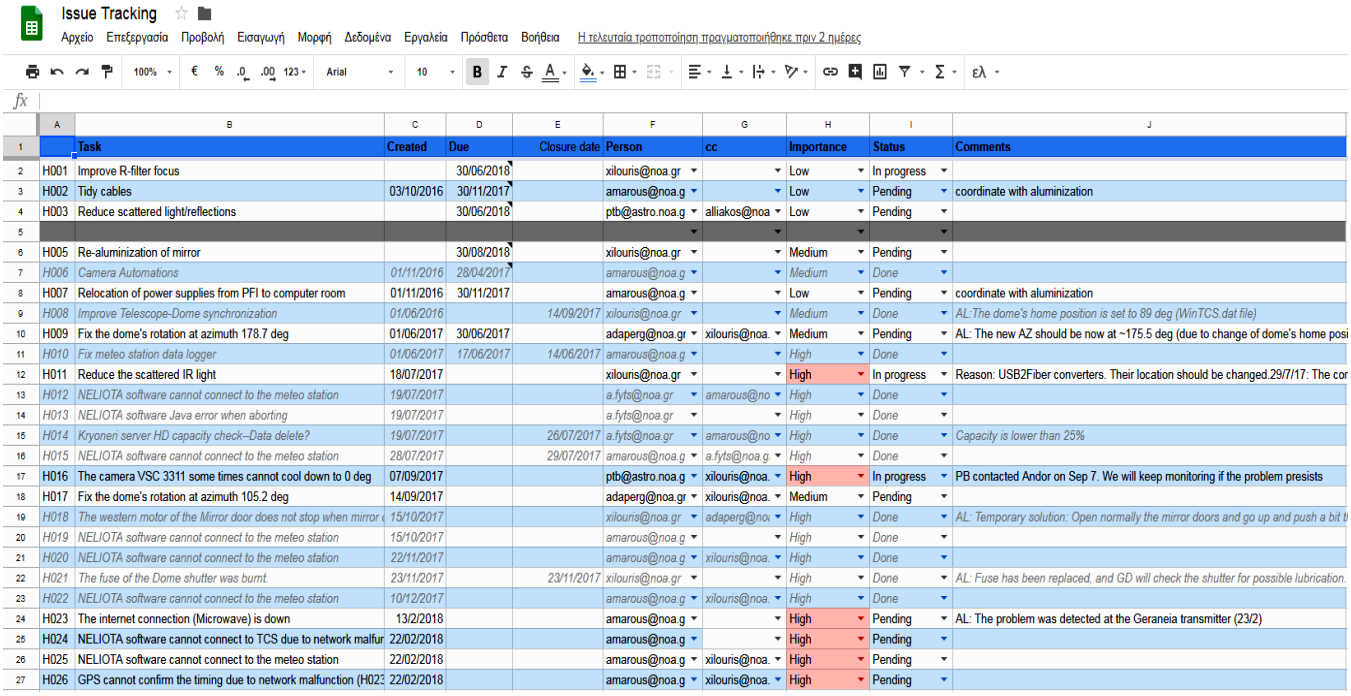
	Date	Instrument	Time	Observations	Observer	Weather	Comments
55	26-Aug-17	Zyla, ASPEN CCD	20:15 - 05:45	NELIOTA, A66 79, NGC6804, Gaia16aye, A/G tests	A. Liakos	Excellent	
56	27-Aug-17	Zyla, ASPEN CCD	20:15 - 05:30	NELIOTA, A66 79, NGC6804, A/G tests	A. Liakos	Excellent	Tests of the new Kryoneri software
57	13-Sep-17	Zyla	19:30 - 07:00	NELIOTA, HAT28b, Gaia16aye, A/G tests	A. Liakos	very good	Tests of the new Kryoneri software
58	14-Sep-17	Zyla, ASPEN CCD	19:30 - 07:00	NELIOTA, NGC6804, A66 79, A/G tests	A. Liakos	Excellent	Tests of the new Kryoneri software
59	15-Sep-17	Zyla, ASPEN CCD	19:30 - 07:00	NELIOTA, ASASSN-17gs, NGC6804, A66 79, A/G tests	A. Liakos	Excellent	Tests of the new Kryoneri software
60	16-Sep-17	Zyla, ASPEN CCD	19:30 - 07:00	NELIOTA, NGC6804, M2-51, A/G tests	A. Liakos	Excellent	Tests of the new Kryoneri software
61	4-Oct-17	Zyla	19:00 - 05:30	Gaia16aye, Triton, M2-51,OJ287	A. Liakos	very good	
62	5-Oct-17	Zyla	19:00 - 05:45	Gaia16bnz, Triton, M2-51	A. Liakos	very good	
63	12-Oct-17	Zyla	19:00 - 07:20	NELIOTA, Gaia16aye, M2-51	A. Liakos	Excellent	
64	13-Oct-17	Zyla	19:00 - 07:20	NELIOTA, Qatar4b, NGC6811, M2-51	A. Liakos, I. Bellas, A. Dapergol	Excellent	
65	14-Oct-17	Zyla	19:00 - 07:20	NELIOTA, 2017hhz, A66 82	A. Liakos, E. Paraskeva	Excellent	clouds after 6:00
66	15-Oct-17	Zyla	19:00 - 07:20	NELIOTA, OJ287, A66 82	A. Liakos, E. Paraskeva	Excellent	technical problem with mirror doors
67	24-Oct-17	Zyla	19:00 - 20:00	NELIOTA	A. Liakos	good but passing clouds. Cloudiness after 20:00	
68	25-Oct-17	-	-		A. Liakos	Bad. Cloudiness and rain	
69	26-Oct-17	Zyla	20:00-05:30	NELIOTA, OJ287, A66 82	A. Liakos, S. Derlopa	Very good	
70	11-Nov-17	Zyla, ASPEN CCD	18:00 - 06:00	planetary transit, asteroids for MPC number	A. Liakos, E. Paraskeva	moderate	clouds before 22:00 and after 1.30
71	12-Nov-17	-	-		A. Liakos, E. Paraskeva	Bad. Cloudiness	
72	13-Nov-17	Zyla, ASPEN CCD	22:30-06:45	asteroids for MPC number, A66 82, JnEr1, OJ287, NELIOTA	A. Liakos	moderate	clouds before 22:30 , humidity ~80-85%
73	22-Nov-17	Zyla, ASPEN CCD	17:30-05:45	NELIOTA, A66 82, Sh2-188, JnEr1, OJ287	A. Liakos	Very good	high clouds before 18:00
74	23-Nov-17	Zyla, ASPEN CCD	17:30-05:30	NELIOTA, A66 82, Sh2-188, JnEr1	A. Liakos	Very good	
75	24-Nov-17	-	-		A. Liakos, I. Bellas	Bad. Cloudiness	
76	25-Nov-17	Zyla	17:30 - 21:00	NELIOTA	A. Liakos	medium, passing clouds	
77	10-Dec-17	Zyla, ASPEN CCD	17:30-07:20	Sh2-188, WeDe1, NELIOTA	A. Liakos	good	(bad seeing ~3.5 until 23:00, then 2.5-3")
78	11-Dec-17	Zyla, ASPEN CCD	17:30-07:20	Sh2-188, WeDe1, NELIOTA	A. Liakos	good	seeing variations
79	12-Dec-17	Zyla, ASPEN CCD	17:30-07:20	Sh2-188, WeDe1, OJ287, NELIOTA	A. Liakos	good	seeing variations
80	13-Dec-17	Zyla, ASPEN CCD	17:30-07:20	A66 82, NELIOTA	A. Liakos	moderate	tnin clouds between 21:30-04:30. Then, ver
81	5-Jan-18	ASPEN CCD	18:00 - 22:30	satellites	I. Alikakos, K. Charis		
82	11-Jan-18	Zyla	5:15-07:20	NELIOTA	A. Liakos	good	
83	22-Jan-18	Zyla, ASPEN CCD	17:30-05:00	SN2018gv, JnEr1, OJ287, NELIOTA	A. Liakos, S. Derlopa	good	sporadic clouds until 23:00
84	28-Jan-18	ASPEN CCD	22:00-01:00	2002TC302	I. Alikakos	good	
85	8-Feb-18	Zyla, ASPEN CCD	17:30-05:00	Sh2-188, WeDe1, JnEr1	A. Liakos, S. Derlopa, E. Paraske	moderate	clouds after 23:00
86	22-Feb-18	Zyla, ASPEN CCD	18:00-03:00		A. Liakos, S. Derlopa	bad	internet connection was down
87							

Fig. 7.2. The e-log of Kryoneri observations located on the SMPC desktop.

7.4. Issue tracking log

This section refers either to the systematic observers/technicians of the Kryoneri Observatory (such as Post doctoral researchers, Ph.D. students, non permanent technical staff affiliated to IAASARS/NOA) or to the permanent NOA staff. If you are a guest observer, you can skip this section.

If a technical issue occurred during the observations related to the telescope system, cameras, communications, software, building etc., then, except for the comments you must leave in the observing and/or technical reports (sections 7.1-7.2), you have also to add this issue in the Kryoneri Issue tracking log. If you are not included in the list with the people that can access this application, please contact the technical staff for further details. Issue tracking is a google document (excel spreadsheet) in which all the active and past issues related to the Kryoneri Observatory are gathered. Once the access to this document is allowed, click on the sheet that is more relevant to the issue you want to report and simply add it below the previous ones.



Issue Tracking

Αρχείο Επεξεργασία Προβολή Εισαγωγή Μορφή Δεδομένα Εργαλεία Πρόσθετα Βοήθεια Η τελευταία τροποποίηση πραγματοποιήθηκε πριν 2 ημέρες

	Task	Created	Due	Closure date	Person	cc	Importance	Status	Comments
H001	Improve R-filter focus		30/06/2018		xilouris@noa.gr		Low	In progress	
H002	Tidy cables	03/10/2016	30/11/2017		amarous@noa.g		Low	Pending	coordinate with aluminization
H003	Reduce scattered light/reflections		30/06/2018		ptb@astro.noa.g	alliakos@noa	Low	Pending	
H005	Re-aluminization of mirror		30/08/2018		xilouris@noa.gr		Medium	Pending	
H006	*Camera Automations*	*01/11/2016*	*28/04/2017*		*amarous@noa.g*		*Medium*	*Done*	
H007	Relocation of power supplies from PFI to computer room	01/11/2016	30/11/2017		amarous@noa.g		Low	Pending	coordinate with aluminization
H008	*Improve Telescope-Dome synchronization*	*01/06/2016*		*14/09/2017*	*xilouris@noa.gr*		*Medium*	*Done*	*AL:The dome's home position is set to 89 deg (WinTCS.dat file)*
H009	Fix the dome's rotation at azimuth 178.7 deg	01/06/2017	30/06/2017		adaperg@noa.gr	xilouris@noa.	Medium	Pending	AL: The new AZ should be now at ~175.5 deg (due to change of dome's home posi
H010	*Fix meteo station data logger*	*01/06/2017*	*17/06/2017*	*14/06/2017*	*amarous@noa.g*		*High*	*Done*	
H011	Reduce the scattered IR light	18/07/2017			xilouris@noa.gr		High	In progress	Reason: USB2Fiber converters. Their location should be changed.29/7/17: The cor
H012	*NELIOTA software cannot connect to the meteo station*	*19/07/2017*			*a.fyts@noa.gr*	*amarous@no*	*High*	*Done*	
H013	*NELIOTA software Java error when aborting*	*19/07/2017*			*a.fyts@noa.gr*		*High*	*Done*	
H014	*Kryoneri server HD capacity check--Data delete?*	*19/07/2017*		*26/07/2017*	*a.fyts@noa.gr*	*amarous@no*	*High*	*Done*	*Capacity is lower than 25%*
H015	*NELIOTA software cannot connect to the meteo station*	*28/07/2017*		*29/07/2017*	*amarous@noa.g*	*a.fyts@noa.g*	*High*	*Done*	
H016	The camera VSC 3311 some times cannot cool down to 0 deg	07/09/2017			ptb@astro.noa.g	xilouris@noa.	High	In progress	PB contacted Andor on Sep 7. We will keep monitoring if the problem presists
H017	Fix the dome's rotation at azimuth 105.2 deg	14/09/2017			adaperg@noa.gr	xilouris@noa.	Medium	Pending	
H018	*The western motor of the Mirror door does not stop when mirror*	*15/10/2017*			*xilouris@noa.gr*	*adaperg@no*	*High*	*Done*	*AL: Temporary solution: Open normally the mirror doors and go up and push a bit t*
H019	*NELIOTA software cannot connect to the meteo station*	*15/10/2017*			*amarous@noa.g*		*High*	*Done*	
H020	*NELIOTA software cannot connect to the meteo station*	*22/11/2017*			*amarous@noa.g*	*xilouris@noa.*	*High*	*Done*	
H021	*The fuse of the Dome shutter was burnt.*	*23/11/2017*		*23/11/2017*	*xilouris@noa.gr*		*High*	*Done*	*AL: Fuse has been replaced, and GD will check the shutter for possible lubrication.*
H022	*NELIOTA software cannot connect to the meteo station*	*10/12/2017*			*amarous@noa.g*	*xilouris@noa.*	*High*	*Done*	
H023	The internet connection (Microwave) is down	13/2/2018			amarous@noa.g		High	Pending	AL: The problem was detected at the Geraneia transmitter (23/2)
H024	NELIOTA software cannot connect to TCS due to network malfur	22/02/2018			amarous@noa.g		High	Pending	
H025	NELIOTA software cannot connect to the meteo station	22/02/2018			amarous@noa.g	xilouris@noa.	High	Pending	
H026	GPS cannot confirm the timing due to network malfunction (H023	22/02/2018			amarous@noa.g	xilouris@noa.	High	Pending	

Fig. 7.3. The Kryoneri Observatory Issue Tracking log.

8. Malfunctions

This section includes all the possible malfunctions that may potentially exhibit during the observations. All of them have occurred at least once in the past and their re-appearance is totally by chance. They are gathered here in order the telescope operator and/or the technical staff to be able react properly and quickly. If a malfunction occurs and is not listed here, please report it in detail to the technical staff.

8.1. Dome shutter failure

Index: The dome shutter cannot completely close or open.
Reason: The leading axes of the dome's shutter got dry and the fuse in the dome shutter's control box fails.
Check: Open the dome shutter's control box (Fig. 2.2 & 8.1). If the fuse is indeed burnt, then the series of red LEDs on the lower part should not lit (Fig. 8.1 right No 1). If this is the case, proceed with the following steps:
Solution (temporary):

1. Set the dome's power switch to the "DOWN" position (Fig. 2.2). Wait 10 sec.
2. Replace the fuse in the dome shutter's control box (Fig. 8.1 right No 2). Spare fuses are available in a box labeled as "DFM Spare parts" on the upper rack in the left part of the closet in the control room. Carefully check the characteristics of the failed fuse (e.g. Amperes and possibly "SLOW BO" index) and use only replacements with same properties.
3. Close the dome shutter control box.
4. Set the dome's power switch to the "UP" position (Fig. 2.2 lower right). Wait 10 sec.

5. Use the MANUAL SWITCH on the dome shutter's control box (Fig. 8.1 left) to open (set the switch to the "OPEN"→up position) or to close (set the switch to the "CLOSE"→down position) the dome shutter. Wait for the shutter to open or close.
6. Set the MANUAL SWITCH on the dome shutter's control box to the "OFF" position.

Solution (long-term): Inform the technical staff to lubricate the leading axes.

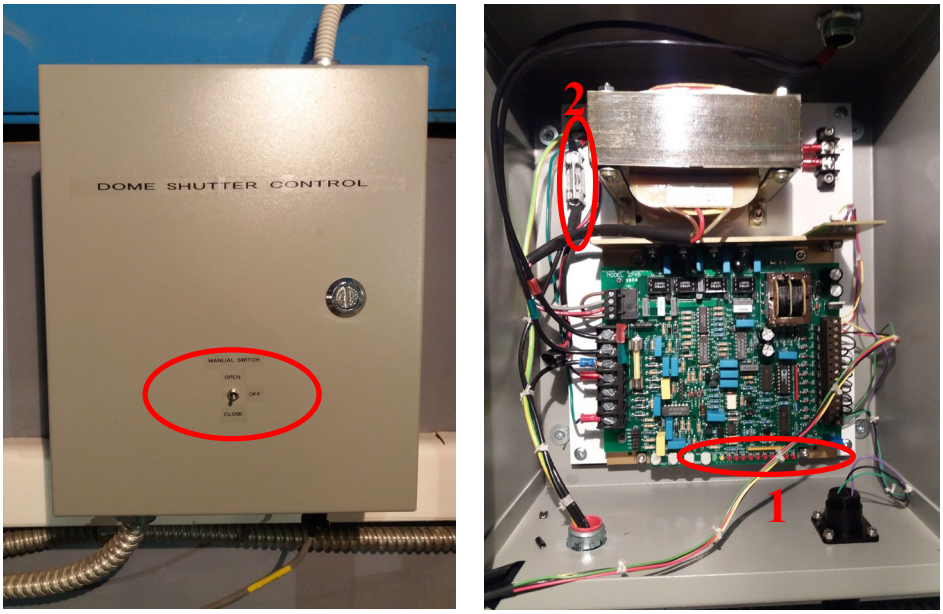


Fig. 8.1. Left: Dome shutter control box. The switch for manual (OPEN or CLOSE positions) or automatic control (OFF position) of the dome shutter is indicated. Right: The content of the box. The fuse to be replaced (No 2) and the series of the red LEDs (No 1) that should not lit if this fuse fails are indicated.

Fig. 8.2. The leading axes (red rectangles) of the dome shutter.

8.2. Mirror doors failure

Index: The status of the mirror doors disappears after the message "*PM-open*" appeared (Fig. 2.8 right No 3).
Reason: The metal relay on the mirror door does not contact the mirror door properly.
Check: A constant strong motor sound is being heard inside the dome floor but the mirror doors do not move at all.
Solution (temporary): Shake a bit with your hand both mirror doors until the sound stops. If necessary, move the telescope to a position suitable to access the mirror doors (e.g. Azimuth=10° Altitude=20°--Check Fig. 2.12 and the details in the text for moving the telescope with the software or simply use the hand paddle of the dome floor (section 2.6)).
Solution (long-term):

1. Move the telescope to a position suitable to access the mirror doors (e.g. Azimuth=90° Altitude=25°--Check Fig. 2.12 and the details in the text for moving the telescope with the software or simply use the hand paddle of the dome floor (section 2.6)).
2. Turn off TCS following the procedure described either in section 2.2 or in 2.4. You can omit the steps for the cameras and the A/G.
3. Use a gripping tool to curve a bit the metal relay (Fig. 8.3) towards the mirror door in order to contact it properly.

Fig. 8.3. The proper contact between the metal relay and the mirror door while the latter is open. Both mirror doors have same relays.

8.3. Dome rotation failure

There are three possible malfunctions related to the dome rotation failure. The reasons and the proper reactions differ for each case.

Dome cannot move from the home position

Index: The dome cannot move at all when the telescope is moving to another position than home (zenith).
Check 1: Move the telescope to a position with a low DEC value (e.g. +10°). If the dome persists not to follow proceed with the next check.

Check 2: Check that the dome switches on the DFM console are on the correct positions (Section 2.1, control room part 1, action No 5, Fig. 2.5 No 8-9) and that the respective software switches were properly set (Section 2.1, control room part 1, step No 6, action iii, Fig. 2.9).

Solution (temporary): If the problem persists, restart TCS. If nothing happens after that, contact the technical staff.

Dome rotation cannot move suddenly

Index: The dome's motor sound is being heard but the dome cannot move, although so far has been working properly.
Reason: There are a few dome's azimuth positions (the currently known are Az=175.5° and Az=105.2°) where the dome's and the dome motor's gears are very tight together. The problem occurs when the dome stops exactly at these positions while observing. Therefore, when a new movement is required, the power of its motors is not enough to override the gears' tightness.
Solution (temporary):

1. On the TCS console set the "AUTO DOME" switch to the "OFF" position (Fig. 2.5 No 8). The dome motor sound stops.
2. Note the current Azimuth value of the dome (Fig. 2.18 left).
3. Using the hand paddle's dome movement buttons (Fig. 2.18 right), move the dome 1-2° towards the opposite tracking direction (i.e. if the dome's tracking direction was CW=increasing azimuth, then decrease the azimuth. That applies when observing targets with DEC<38°. The opposite situation takes place when observing targets with DEC>38°).
4. Again, using the hand paddle's dome movement buttons, move the dome towards the tracking direction and stop approximately 1° after the azimuth position where the problem was occurred.
5. On the TCS console set the "AUTO DOME" switch to the "UP" position (Fig. 2.5 No 8).
6. Report the azimuth value at which the problem was found to the technical staff.

Dome cannot stop rotating

Index: The dome rotates constantly and cannot stop.
Reason: Possible malfunction in the dome relays box.
Check: The dome has performed at least two full rotations.
Solution (temporary):

1. On the TCS console set the "AUTO DOME" switch to the "OFF" position (Fig. 2.5 No 8).
   i. If dome stops, then set the "AUTO DOME" switch to the "ON" position (UP) (Fig. 2.5 No 8), let the dome rotate and try to set the "AUTO DOME" switch to the "OFF" position when it reaches to the HOME position (Az=89°).
   ii. Restart the TCS.

2. On the TCS console set the "AUTO DOME" switch to the "OFF" position (Fig. 2.5 No 8).
   i. If dome does not stop, then set the dome's power switch to "OFF" position (Fig. 2.2)
   ii. Shutdown the TCS.
   iii. Set the dome's power switch to "ON" position (Fig. 2.2). Now, normally the dome does not rotate. If this is the case, close manually the dome shutter (Fig. 8.1) and immediately call the technical staff.

8.4. Telescope motor failure

Index: The telescope is moving to a direction without sending it.
Reason: The axis motor or the axis motor encoder is malfunctioning.
Solution (temporary):

1. Set the DRIVES switch to the “OFF” position (down) (Fig. 2.5 No 7).
2. Shutdown TCS.
3. Contact immediately the technical staff.

Solution (long-term): Axis motor replacement and/or cleaning the axis encoder.

8.5. DFM and NOA controller software connection failure

Index: DFM and NOA controller software cannot initialize properly after they are opened.

DFM software

Reason: The most possible reason is that you did not wait for at least 15 sec after the windows has been loaded (Section 2.1, control room part 1, action No 3).
Solution: Close the software and open it again. Check the steps described in Section 2.1, control room part 1, action No 6 to ensure that the software is properly connected to the Galil. If after the software restart the issue remains, restart the TCS. If after restarting the TCS the issue still remains contact the technical staff.

DFM-NOA controller software

Reason: Unspecified.
Solution: Close the software and open it again. It might need 3-4 times to establish the connection. If after many restarts the issue remains, restart TCS. If after that, the issue remains, contact the technical staff.

8.6. Meteo station connection failure

Index: The FFIS cannot connect to the Meteo Station. A message “*Failed to connect to Meteo station*” appears.
Reason: The meteo station lost its connection with the private network or run out of energy.
Check 1: Open the MET station web page (Section 1.2.) and check the time under the “Current weather in Kryoneri”. If the time is at most 10-20 min before the current local time, then the MET station is working and the problem concerns the private network. There is nothing to do. Mention it in your reports (Section 7.1) and to the Issue tracking (Section 7.3).
Check 2: However, if the time shown is many hours before the current local time, then the problem is the MET station itself. Probably the battery run out of energy. There is nothing to do. Mention it in your reports (Section 7.1), to the Issue tracking (Section 7.3), and to the technical staff on the next day or so.

8.7. Telescope reached its limits

This issue may occur in two cases. The first is due to the bad monitoring of the telescope from the observer or due to a repositioning of the telescope that passes through the software limits (i.e. Zenith distance=75° and HA=±7 hr). The second case occurs when an axis-motor or an

axis-motor encoder fails and the movement of the telescope cannot be controlled (section 8.4) any longer, leading it to the hardware altitude limit (10°).

Case 1

Index: The telescope cannot move and the message "*LIMIT REACHED*" appears in the status box (Fig. 8.4 No 1). Before that, the message "*APPROACHING LIMITS*" had already appeared (No 2).
Reason: This issue occurs when the telescope reaches either its software altitude limit (15°, i.e. Zenith distance = 75°) or its Hour Angle limit (±7 hrs) during the observations. It may also occur when pointing already at a low altitude and a repositioning command is given with the course between the present and the new positions to pass through the limit.
Solution:

1. Press the "Stop" button in the DFM software (No 3).
2. Using the hand paddle's direction buttons (Section 2.6) move the telescope manually (press and hold the SET+E buttons if telescope is currently pointing to west or the SET+W buttons if telescope is pointing to east) to a Zenith distance (No 4) lower than 75° or to an HA lower than 7 hr or greater than -7 hr (No 5) depending on the limit reached. Once the telescope moves away from the limit, it is again fully operational.
3. Send the telescope to a valid target.

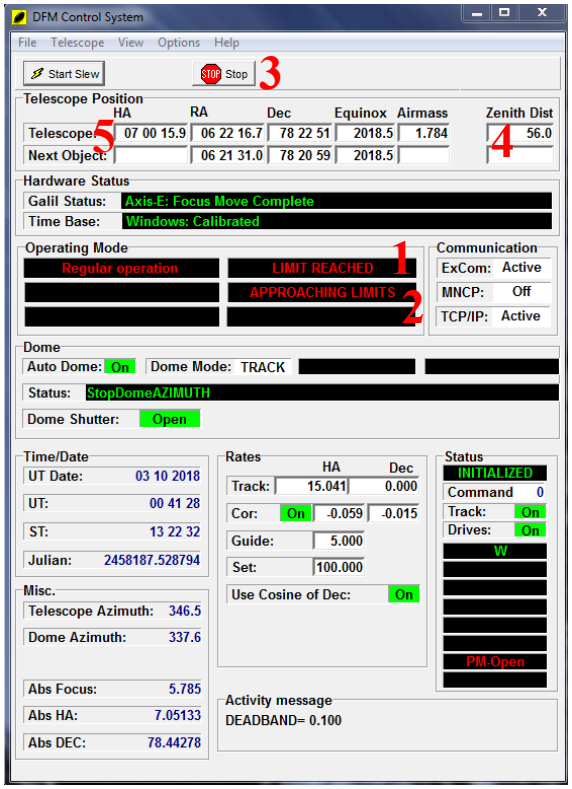


Fig. 8.4. The status when the telescope has reached the software limits of HA (7 hr) - No 5.

Case 2

Index: The telescope cannot move with any way (i.e. via software or hand paddle) and has reached the hardware limit.
Reason: Axis-motor or axis-motor encoder failure.
Solution: Shutdown everything and contact immediately the technical staff. Do not attempt anything. You may harm the telescope permanently.

8.8. Telescope pointing accuracy is bad

The pointing accuracy of the telescope is approximately 1΄. Therefore, if your object is not near the center of the FoV when using either the FFIS or the science CCD, then probably something is wrong with the pointing model.

Index: The object is not inside the FoV of the camera.
Reason: Problem with the pointing model or possible mismatching between the sky chart and the real FoV by the observer.
Check 1: Check the coordinates you set to either “TheSkyX” software or to the DFM software and the equinox (Section 2.5). If they are correct, continue with the next check.
Check 2: Check your sky chart. Be advised that the orientation of both FFIS and the science CCD are not the standard ones (i.e. North→Up, East→Left). You may need to rotate your sky chart to indentify properly the FoV (see sections 5.1.2 and 6.2.2 for cameras FoV). If none of the above checks applies, then the telescope does not follow properly its pointing model.
Solution:

1. In “TheSkyX” software select a bright star (e.g. 9-11 mag) near the meridian with DEC value between 30°-50° and send the telescope to it (Section 2.5.1).
2. Acquire one image with the camera using very low exposure time (e.g. 0.01-0.1 sec). If the star is inside the FoV, then use the hand paddle’s telescope movement buttons (Section 2.6) to place the star exactly at the center of the FoV (CCD image center= 512, 512; FFIS image center=1280, 1080 in binning 1×1). For this, the use of continuous acquisition mode of the cameras is recommended.
3. Once the star is at the center of the image, go back to “TheSkyX” software and click on the specific star. Then, click on the “Start up” button (Fig. 8.5 No 1) and select “Synchronize…” (No 2). The “Telescope synchronization” window opens. Press the “Sync” button (Fig. 8.6).

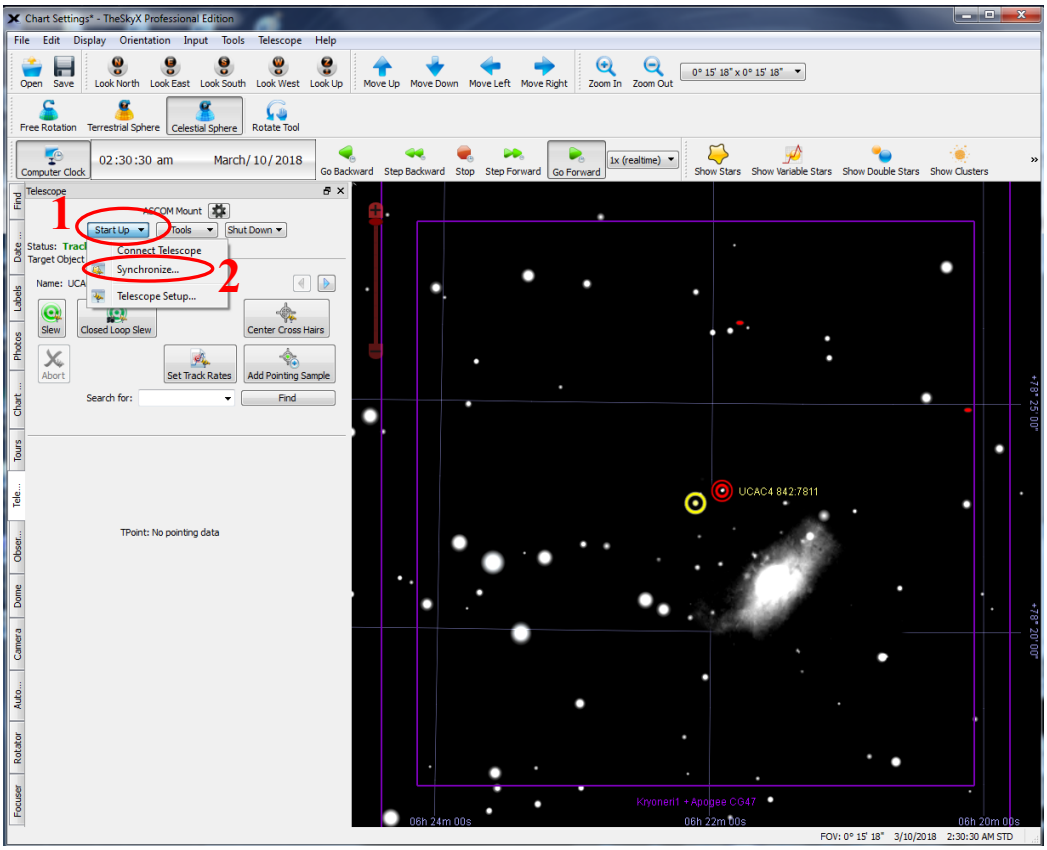


Fig. 8.5. Entering the synchronization menu of “TheSkyX” software.

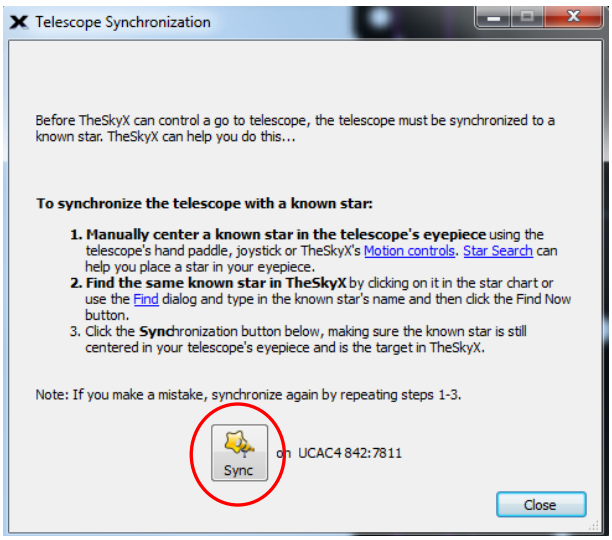


Fig. 8.6. Synchronizing the telescope with a star using “TheSkyX” software.

Attention: You must be absolutely certain that the star selected to synchronize the telescope is indeed the one you see at the center of the camera image. If synchronization is wrong, the telescope’s pointing will still be inaccurate. A test for this is to send the telescope to other bright stars very near to the one previously selected and check that indeed appear in the center of the FoV. If not, repeat the process and select a very bright star or an easily recognized object (e.g. the ring nebula, M42).

If the star you chose to send the telescope in step 1 is not at all in the FoV (step 2), then you have to point manually the telescope to a bright star. Go to the dome floor and follow the next steps:

4. Use the hand paddle to move the telescope (section 2.6 – Set or Slew speeds are recommended) to very bright star (e.g. Vega, Deneb, Arcturus, Betelguese) by looking inside of the one of the two finder scopes (Fig. 1.3), that are installed as piggyback to the telescope. Set the bright star exactly at the center. In the eyepieces of the finder scopes there is a cross at the center of the FoV indicating the point where the star should be placed. The telescope is equipped with two finder scopes. The first is on the north and the other to the south side of the telescope. Use the one that is more suitable for you.
5. Return to the control room and repeat the steps 2-3.

8.9. Autoguiding system failures

In case of noticing that although the A/G is properly working, the stars in the scientific images move after several minutes of observations, then, indeed it is an A/G problem. The explanation for this issue has been already mentioned in Section 3 but is also repeated here for clarity reasons:

It should to be noted that the A/G does not correct perfectly the mis-tracking of the telescope, especially on the Dec Axis. This is due to the off-axis setup of the A/G system. On one hand the A/G is able to correct the tracking errors due to mechanical reasons (e.g. balance) but, on the other hand, not those that come from the optical system of the telescope (i.e. distortion of the primary mirror). The telescope’s tracking errors depend on the altitude of the telescope. It is recommended to avoid long exposures (e.g. >3 min).

8.9.1. Calibration failure

Index: The A/G fails to calibrate. The message "*star moved <5 pixels*" appears.
Reason: The A/G cannot move the telescope in a sufficient way to measure its movement.
Check: The star selected for autoguiding a) is at least 100 pixels from the edges, b) has no other stars of similar brightness on its vicinity (i.e. 100 pixels), c) provides sufficient ADUs to be measured (i.e. 10,000-30,000 counts), and d) its DEC value ranges between -15° up to 65°. If after these checks the problem remains follow the next steps:
Solution:

1. On the "Guide" tab, click on the "Settings" button (Fig. 8.7 left No 1). The "Guider Settings" window opens (Fig. 8.7 right) by default in the "Settings" menu.
2. Increase by a step of 5 sec the "Cal. Time" on both axes (Fig. 8.7 right No 1-2). Press "OK" (Fig. 8.7 right No 3). The window closes.
3. Repeat the calibration procedure.

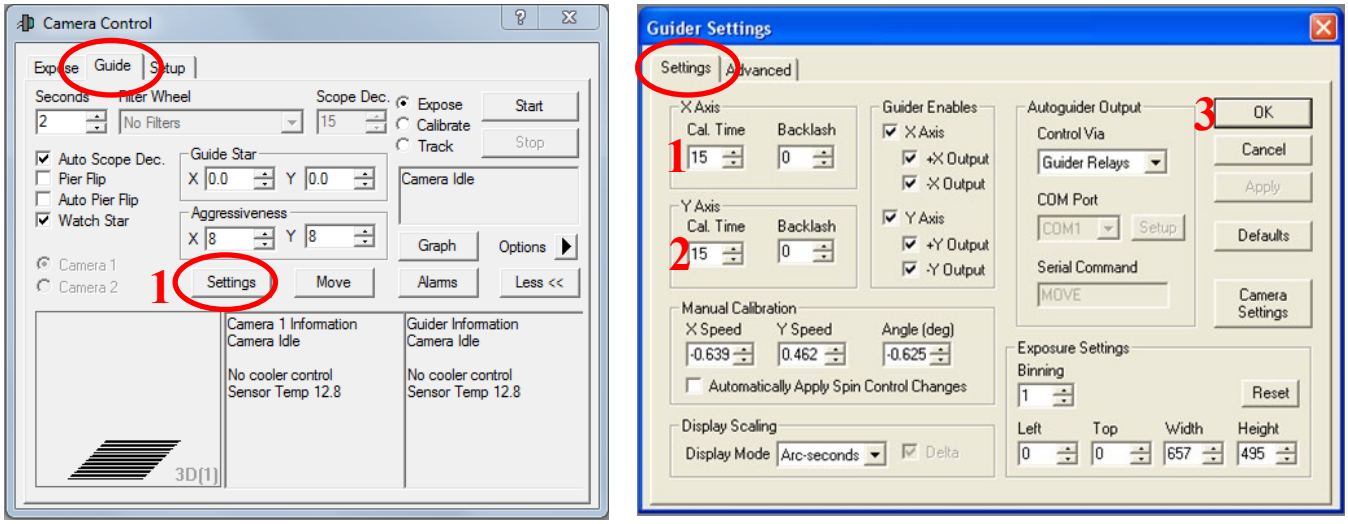


Fig. 8.7. Left: Guide control window. Right: Guider settings window and the changing of the calculation time of the A/G in the MaxIm DL software.

If the problem remains and there is no absolute need to use the A/G for your observations, just close the A/G system. If the observations are useless without the use of the A/G, inform immediately the technical staff.

8.9.2. The guiding star disappears

Index: The autoguiding star suddenly disappears, a warning sound is constantly being heard from the TCS monitor, and the telescope is moving slowly.
Reason: The most possible reason is that clouds have appeared and the star is fading, so the software cannot locate its photo-center. Another reason could be an accidental "jump" of the telescope (it happens some times due to some worn gears of the telescope motor). Another reason could also be the hiding of the incoming light towards the A/G from the dome. The continuous slow movement of the telescope is due to the A/G. The A/G control software moves the telescope in order to relocate the guiding star.
Check 1: Check somehow if there are clouds in the sky.
Solution 1: If yes, then stop the A/G and start again when the clouds are gone.

Check 2: If there are no clouds, the telescope might has “jumped”.
Solution 2:

1. Stop the A/G.
2. Stop the exposure of the cameras
3. Repeat the procedure described in section 3.2 (no new calibration is needed).

Check 3: If the previous two checks are negative, then the dome is might hiding the incoming light beam. Go to the dome floor and check if indeed the A/G telescope is hidden by the dome. If this is the case, then the dome is not properly following the telescope.
Solution 3:

1. Stop the A/G.
2. Stop the exposure of the cameras.
3. Set the dome track switch to the “OFF” position (down) (Fig. 2.5 No 8).
4. Go to the dome floor and using the dome rotation buttons of the hand paddle (Fig. 2.18) move the dome to its home position as shown in Fig. 2.4-right.
5. Return to the control room.
6. On the DMF software:
   i. Click on the “Telescope” menu and select “Initialization…” (Fig. 8.8 left).
   ii. Click on the “Other Positions” tab (Fig. 8.8 No 1) and type in the “Dome position” box the value 89.0° (Fig. 8.8 No 2).
   iii. Press the “Apply” and “Close” buttons (Fig. 8.8 No 3-4).
7. Set the dome track switch to the “ON” position (UP) (Fig. 2.5 No 8).
8. Wait for the dome to stop rotating.
9. Repeat the procedure described in section 3.2 (no new calibration is needed).

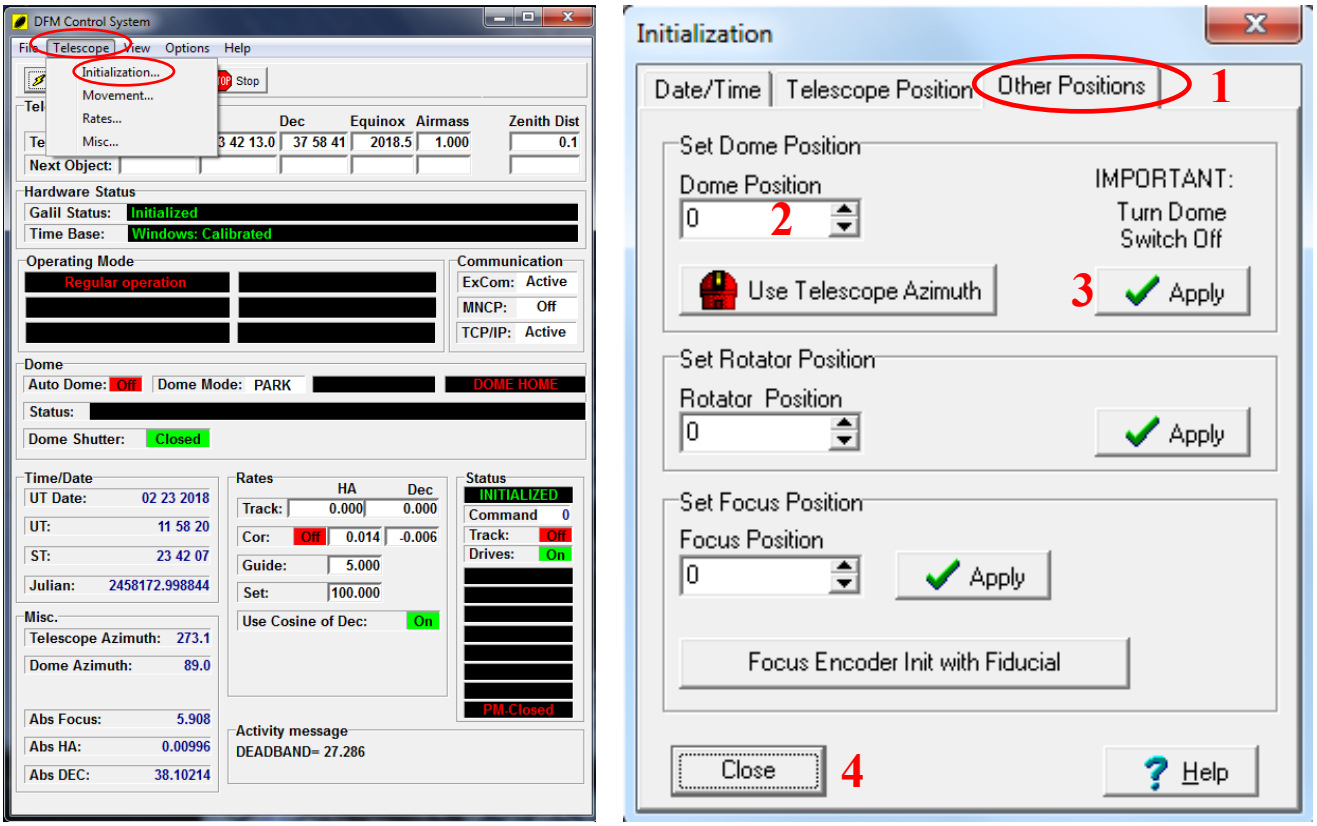


Fig. 8.8. Left: Telescope settings menu. Right: Setting dome position in the “Initialization” menu.

8.10. No stars are displayed in cameras images

Index: The cameras images are empty of stars.
Reason: Various, see below:

Check 1: Check if the dome shutter and the mirror doors are opened and if the dome is properly following the telescope's movement (Section 2.1, control room part 1, step 6, action iii).
Solution 1: Act accordingly.

Check 2: Check if there are clouds in the sky.
Solution 2: If yes, wait for the clouds to go away.

Check 3: Check if the CSS (section 4) is on the correct position.
Solution 3: Check steps in section 4.

Check 4: If the science CCD is being used, then check what frame type has been set (Fig. 5.10 No 4 and Fig. 5.11 No 2).
Solution 4: Choose "Light" as frame type.

8.11. Stars are displayed when acquiring dark frames with the FFIS

Index: Although the Dark or the Bias frame type has been selected, there are stars in the images.
Reason: The mirror doors are open.
Solution: Close the mirror doors and preferably close the dome shutter or change cameras position using the CSS (section 4).

8.12. The FFIS files were saved in a non standard format

Index: The FFIS files were saved in dat format.
Reason: You forgot to select the automatic converter.
Solution:

1. Open the "Kryoneri" Observations software and log in.
2. Click on the "FITS" tab (Fig. 8.9 No 1).
3. Browse for the directory in which the dat files were previously saved and select it (No 2).
4. Browse for the directory in which the converted files (FITS) will be saved and select it (No 3).
5. Give a file prefix (No 4).
6. Press "Convert" (No 5)
7. Repeat steps 1-6 for other dat files (do not forget that you were saving into two different locations if both cameras were used).
8. Close the software after conversion is complete.

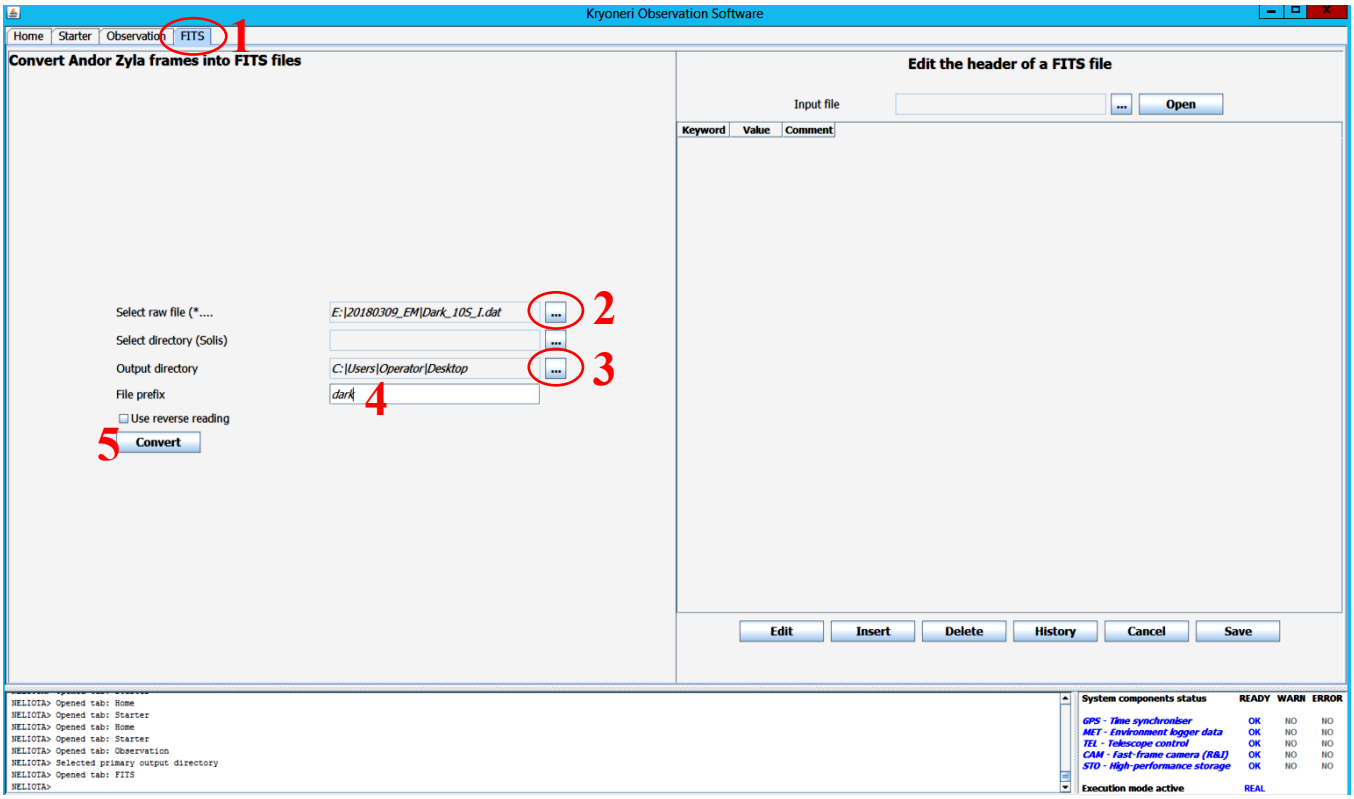


Fig. 8.9. The "FITS" menu of the Kryoneri Observation Software, that is used for manual conversion of dat files to FITS files.

8.13. Wrong values in the FITS header of the FFIS frames

Index: The airmass, the telescope's horizontal coordinates, the weather values, and the R.A. values are wrong.
Reason: Software bug for the RA. For the rest parameters, the software can only insert in the HEADER the values at the beginning of the observations (i.e. when you press the "START" button), therefore all these correspond to that timing.
Solution: Ignore these values, calculate them, if necessary, based on the "time-obs" value.

8.14. Science CCD failure

Index: The image exposing progress bar appears to freeze or after the downloading of an image MaxIm DL is not responding.
Reason: The communication via TCP/IP between the SMPC and the CCD has been lost for a while.
Solution: Wait approximately 60 sec. Then a pop-up window appears with the message "*synchronization error (-4)…..*" (the exact text is currently missing). Press "OK" in this message and just press again the "Start" button (Fig. 5.10 No 6).

9. Other operations

9.1. Dome shutter and dome manual control

Both the dome and the dome shutter can be operated without the use of the TCS.

Dome shutter opening or closing

1. Set the dome's power switch to the "ON" (up) position (Fig. 9.1 No 1). Wait 10 sec.
2. Use the MANUAL SWITCH on the dome shutter's control box (Fig. 9.1. left No 2) to open (set the switch to the "OPEN"→up position) or to close (set the switch to the "CLOSE"→down position) the dome shutter. Wait for the shutter to open or close.
3. Set the MANUAL SWITCH on the dome shutter's control box to the "OFF" position when finish.

Dome control

1. Set the dome's power switch to the "UP" position (Fig. 9.1 left No 1). Wait 10 sec.
2. Open the lid of the dome azimuth control relay box (Fig. 9.1 left No 3).
3. Use the dome rotation switch to move the dome (Fig. 9.1 right) CW or CCW.
4. Close the lid of the dome azimuth control relay box when finish.

Attention: Do not touch the relays in the dome azimuth control relay box. Carefully hold the dome rotation switch with both hands.

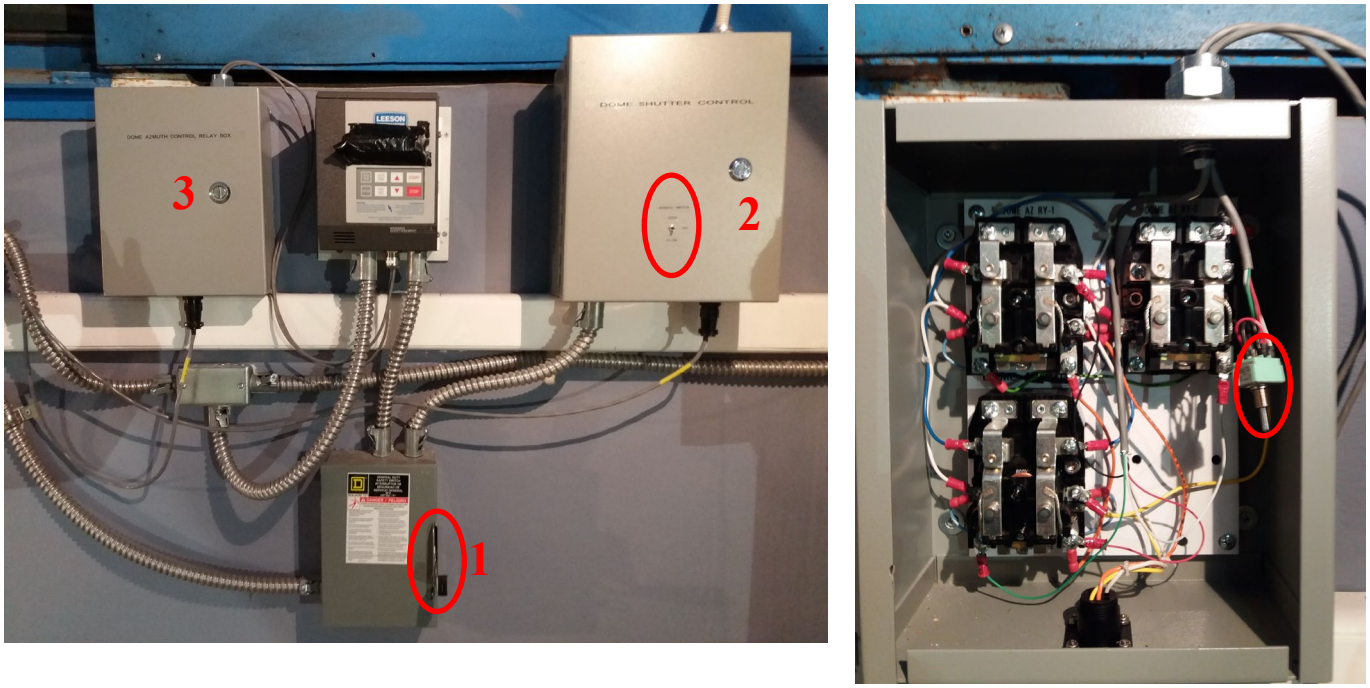


Fig. 9.1. Left: The location of the dome azimuth control relay box in the dome floor (No 3), the dome shutter control box (No 2) and the power supply switch (No 1). Right: The content of the dome azimuth control relay box, where the dome rotation switch is indicated.

9.2. Set other tracking rates

The telescope can be set to track also on other rates than the sidereal. If you want to set a specific rate on each equatorial axis for a special observation (e.g. follow a satellite, comet, Moon, Sun, planet etc.), then proceed with the following steps:

1. On the DFM software:
   i. Click on the “Telescope” menu and select “Rates…” (Fig. 9.2 left No 1-2). The “Rates” window opens (Fig. 9.2 right).
   ii. Click on the “Track Rates” tab (Fig. 9.2 right No 1) and type in the “Aux. R.A. Rate” and in the “Aux. Dec Rate” boxes (Fig. 9.2 right No 2-3) the values you want.
   iii. Press “Apply” and “Close” (Fig. 9.2 right No 4-5)

2. On the DFM console, set the lefter TRACK switch to the “AUX TRACK” position (down) (Fig. 2.5 No 5).

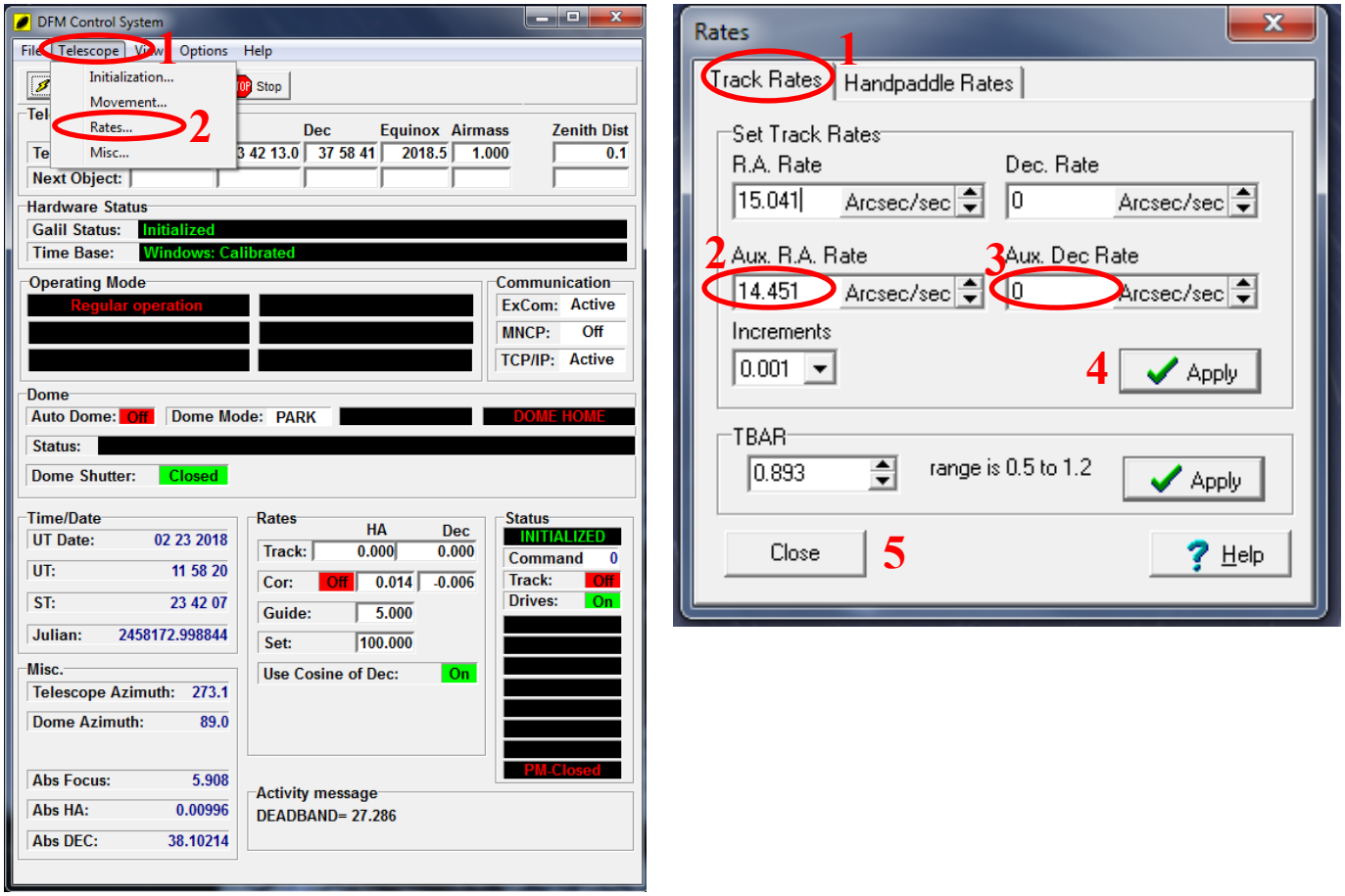


Fig. 9.2. Left: The “Telescope” menu and the selection of “Rates” menu. Right: Setting auxiliary tracking rates to the telescope in the “Track Rates” submenu.

9.3. Security cameras

Five cameras have been installed for monitoring both the area outside the observatory building and the dome floor at the Kryoneri observatory. The four of them are controlled by the same web based software and are located outside the observatory building. They cover the south (main) entrance of the building, the west side of the building, the west view of the building, and the west side of the power generators building. All of them are equipped with a night vision system, so they are operational during the night. The fifth camera is located in the dome floor and is used to monitor the movement of the telescope and dome only when sufficient light luminance exists in the dome floor (no night vision).

To access the monitoring cameras log in to the SMPC:

1. Open the “Internet explorer” (IE) web browser and click on the “Κάμερες παρακολούθησης” tab on the favorites menu (Fig. 9.3 No 1).
2. Log in using credentials written in the passwords document. Click on the “Open all” button on the lower left side. The displays of all cameras are now enabled.
3. Open another tab in IE and click on the “Κάμερα θόλου” tab on the favorites menu (Fig. 9.3 No 2).
4. Log in using credentials written in the passwords document or click on the “OK” button if they are pre-filled. This enables the display of the camera in the dome floor.

9.4. Computer room temperature monitoring

Another useful monitoring system concerns the temperature of the computer room (Fig. 1.2). To access the monitoring application, log in to the SMPC, open the “Internet explorer” (IE) web browser and click on the “Computer room” tab on the favorites menu (Fig. 9.3 No 3).

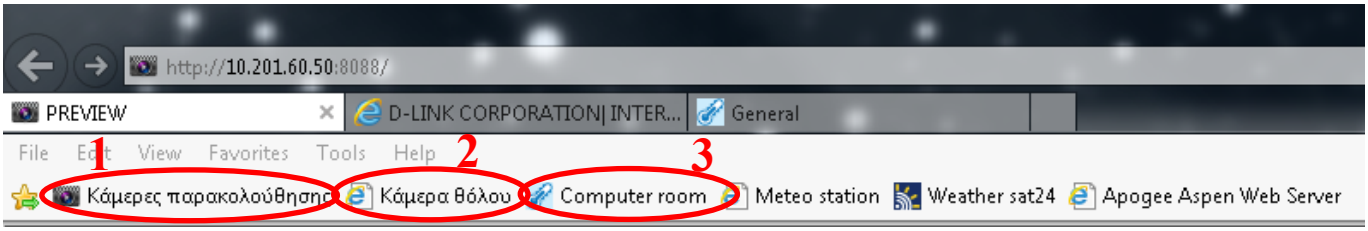


Fig. 9.3. The favorites menu on the IE browser in the SMPC. 1: The security cameras web page, 2: the dome floor monitoring camera web page, and 3: the computer room temperature monitoring web page.