

# Standard Operating Procedure

## Side-Port Imager (SPIM)

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## Scope

This document provides the standard operating procedure to conduct observations using the Side-Port Imager (SPIM) instrument mounted on the 3.6m Devasthal Optical Telescope.

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Figure 1: The OFF and ON positions of the knob in AMOS-Panel-2.

## 1 Basic parameters of the Instrument

SPIM parameters	
Parameter	Values
Mount position	Side port2
Array size	4096 × 4108
Pixel size	15 micron
Pixel scale	0".1
Field of view	6'.5 × 6'.5
Minimum exposure time	1ms

## 2 Starting the telescope

- **Powering on:** Go to the place near the lift on the ground floor and power on the telescope in three consecutive steps:
  1. Turn the knob of AMOS Panel-2 in **ON** position as shown in Fig. 1 .
  2. Turn the knob of AMOS Panel-1 in **ON** position as shown in 2.
  3. Turn the knob of the Power supply panel in **ON** position as shown in Fig. 3.
- Now go to the control room and turn on the Telescope Control System (TCS) and Adaptive Optic System (AOS) PCs as shown 4.
- When the TCS gets powered on, generally the TCS engineering GUI and remote display open automatically; if not, then open them from the Desktop. The engineering window will ask for the access password as shown in the 5, give the password, and start the engineering window.
- Currently, the engineering window will show the status of the telescope as "Standby" as shown in Fig. 6. Now, click the "Startup" button, and the telescope will move to the "Running" status.



Figure 2: The OFF and ON positions of the knob in AMOS-Panel-1.



Figure 3: The OFF and ON positions of the knob in the power supply panel.



Figure 4: The TCS and AOS PCs in the cabinet of the control room.

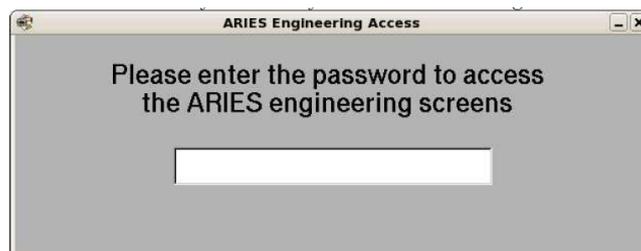


Figure 5: Engineering access screen.

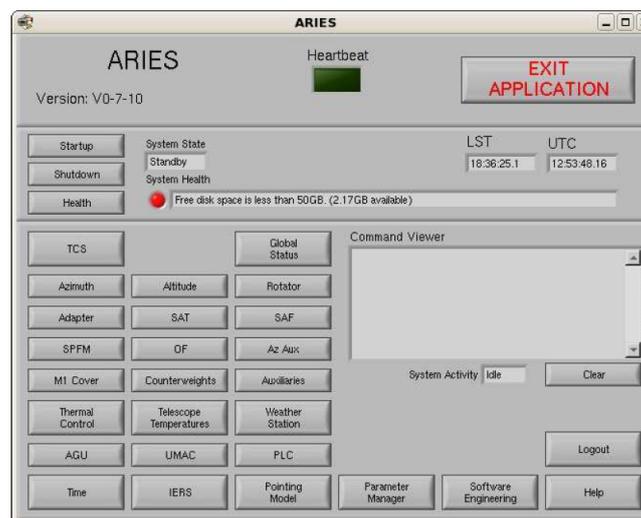
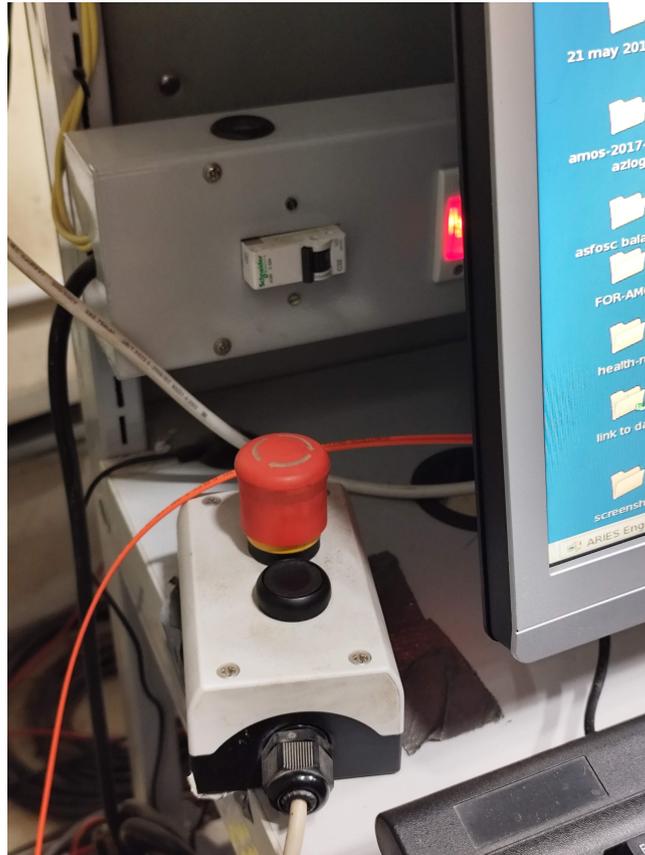


Figure 6: The initial display of the ARIES engineering screen.



**Figure 7:** The black rearm button located near the TCS PC.

- Now rearm the telescope from the remote switch (black switch) which can be found near the TCS PC as shown in Fig. 7.
- Now open the remote display in the TCS PC. Several error messages will appear on the TCS display screen as shown in Fig. 8 and keep acknowledging them till they stop appearing.
- Now we have to initialize the telescope, which can be done in two ways:
  1. In the TCS remote display, go to "System" under "Command Panel" and click the "Init" button as shown in Fig. 8 and monitor the motion of the telescope, and also check the status of the telescope axes and their positions. The indicator lights for all the axes in the TCS should turn green. The positions of the altitude, azimuth, and rotator axis should be at their datum positions, which are  $78^\circ$ ,  $-45^\circ$ , and  $7^\circ$  respectively.
  2. Go to "Command Panel" and select "Main Axes". Now enable all three axes one by one and follow by clicking the "Datum" button, then check if all the axes reach their "Datum" positions as mentioned in the above point.
- Move the altitude axis to  $90^\circ$  by clicking the "Move" button of the "Altitude" axis in the "Main Axes" after giving a value of 90.



**Figure 8:** The error messages in the TCS screen.

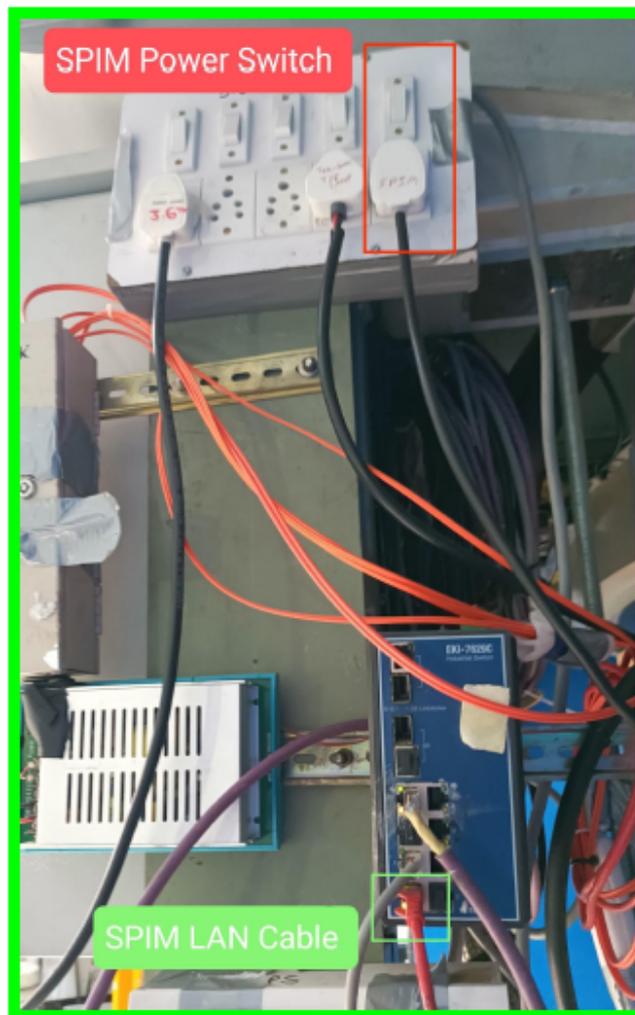


**Figure 9:** The indicators showing the status of different components of the telescope.

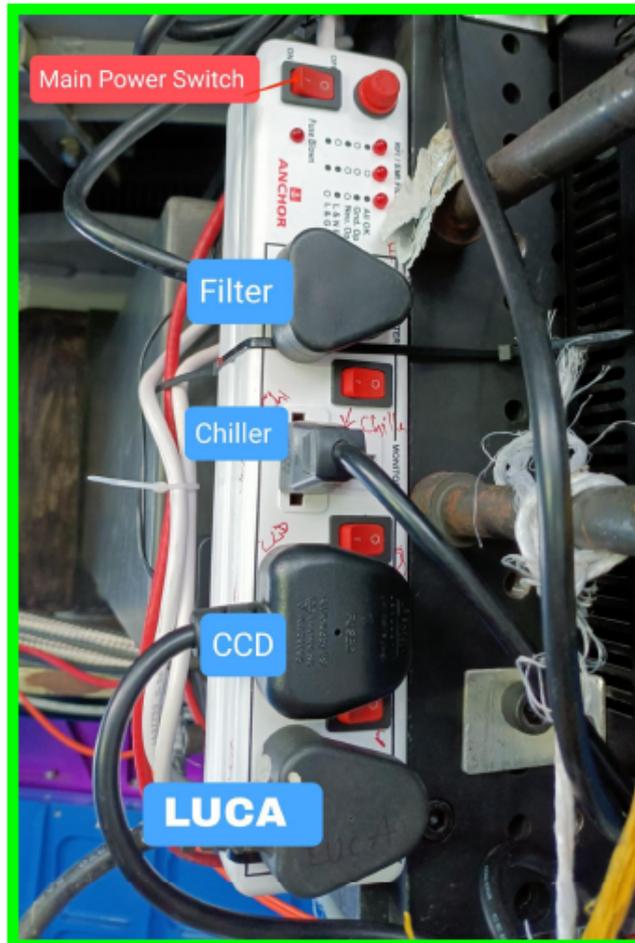
- Now open the AOS GUI and make sure that the telescope is at 90 deg and then click the "Startup" button. The completion of the process can be confirmed by all the green lights in the TCS GUI as shown in Fig. 9.
- After this process, the alt axis will be disabled, which needs to be enabled from the "Main Axes" Panel in TCS.
- Now the telescope is ready to use.

### 3 Starting the Instrument

- Power on the SPIM's main switch located on the telescope's side as shown in Fig. 10 and marked with the red box. Also, check if the SPIM LAN cable is connected properly; the location of the LAN cable is shown in Fig. 10 inside the green box.
- Power on the switches of CCD, chiller, and filter wheel located close to the SPIM as shown in Fig. 11.
- Now turn on the chiller with the black color switch as shown in Fig. 12 inside the red box. The active status of the chiller can be confirmed by the blue light.
- Turn on the CCD by pushing the button as shown in Fig. 13, and the green light will turn on, which represents the active status of the CCD.
- Turn on the filter system using the switch indicated by the red box in Fig. 14.



**Figure 10:** The main switch of SPIM is located on the side of the telescope.



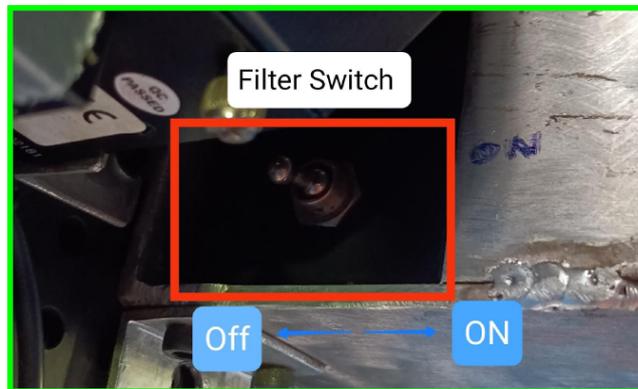
**Figure 11:** The switches of CCD, chiller, LUCA, and filter wheel located close to the SPIM.



**Figure 12:** The chiller can be turned on by the black switch indicated by the red box.



**Figure 13:** The CCD can be turned on using the push button.

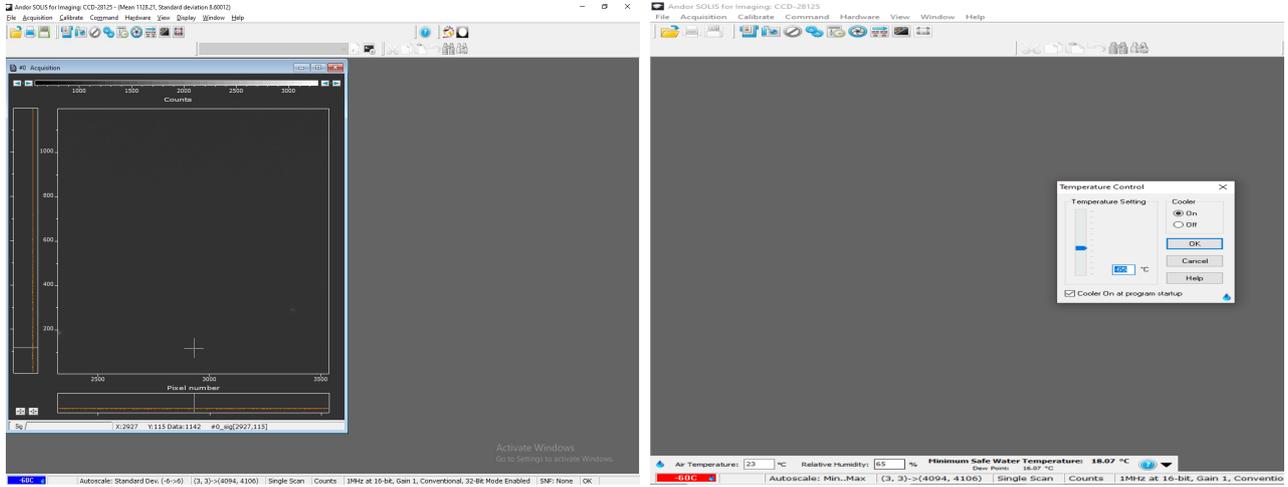


**Figure 14:** The filter system can be turned on using the switch inside the red box.

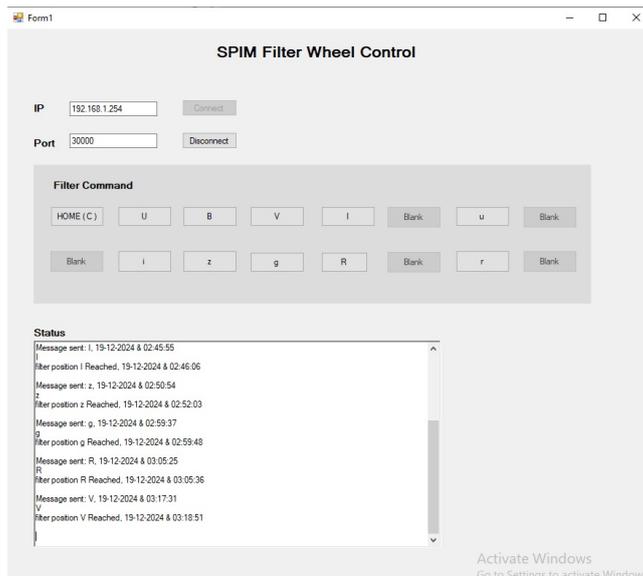
- Power on the SPIM PC in the control room. The password of the PC can be provided by the observing assistant present in the control room.
- Make a folder in the SPIM computer to store the data of the observation night, having the format YYMMDD. The path of this folder should be `"/Desktop/SPIM-Data/YYYYCX/"`. Here, YYYY is the year and CX is the observing cycle name, e.g., 2024C2.

## 4 Setting up the instrument

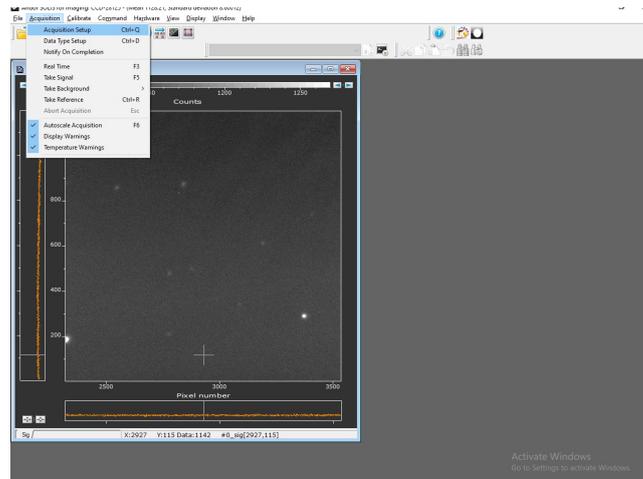
- Open the Andor GUI named "Andor SOLIS 64-bit" on the Desktop. The GUI will be displayed as shown in the left panel of Fig. 15. Set the stabilizing temperature for the camera at the left corner of the GUI as shown in the right panel of Fig. 15. Right now the stabilizing temperature is  $-60^{\circ}$  and wait
- Open the GUI for the filter from the Desktop named "SPIM Filter wheel". Write the "IP" as "192.168.1.254" and "Port" as "3000" and then click the "Connect" button as shown in Fig. 16. The connection status can be seen in the status window of this GUI. Click the "HOME" button in the GUI if it is not appearing by itself.
- Now select the desired filter from this GUI, which will be used for the observations. The filter change process will take a few seconds, and the current status can be seen from the "Status" window of the GUI. Currently, 10 filters are mounted in the filter wheel.



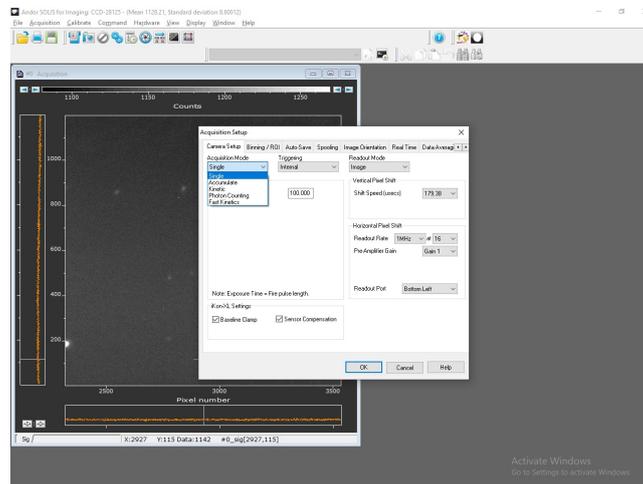
**Figure 15:** The Andor GUI is shown on the left, and the temperature setting is shown in the right panel.



**Figure 16:** SPIM: filter control.



**Figure 17:** The various acquisition settings can be done from here.



**Figure 18:** The current available observation modes for SPIM.

- Now edit the acquisition settings from the "Acquisition setup" from the "Acquisition" option in the GUI as shown in Fig. 17
- Go to the camera GUI, click "camera setup" in the " settings" and select the desired observation mode. Currently, the SPIM has three options: Single, Accumulate, and Kinetic. 18
- Now set the other camera settings such as exposure time, Readout rate, readout port, and Gain values.
  1. Select "Internal" in the "Triggering" section and "Image" in "Readout mode" as shown in the top left panel of 19.
  2. Currently, there are four options for the readout rates available, which can be selected from the "readout rate" option as shown in the top right panel of Fig. 19.
  3. Gain can be selected among three gain options as shown in the bottom left panel of Fig. 19.

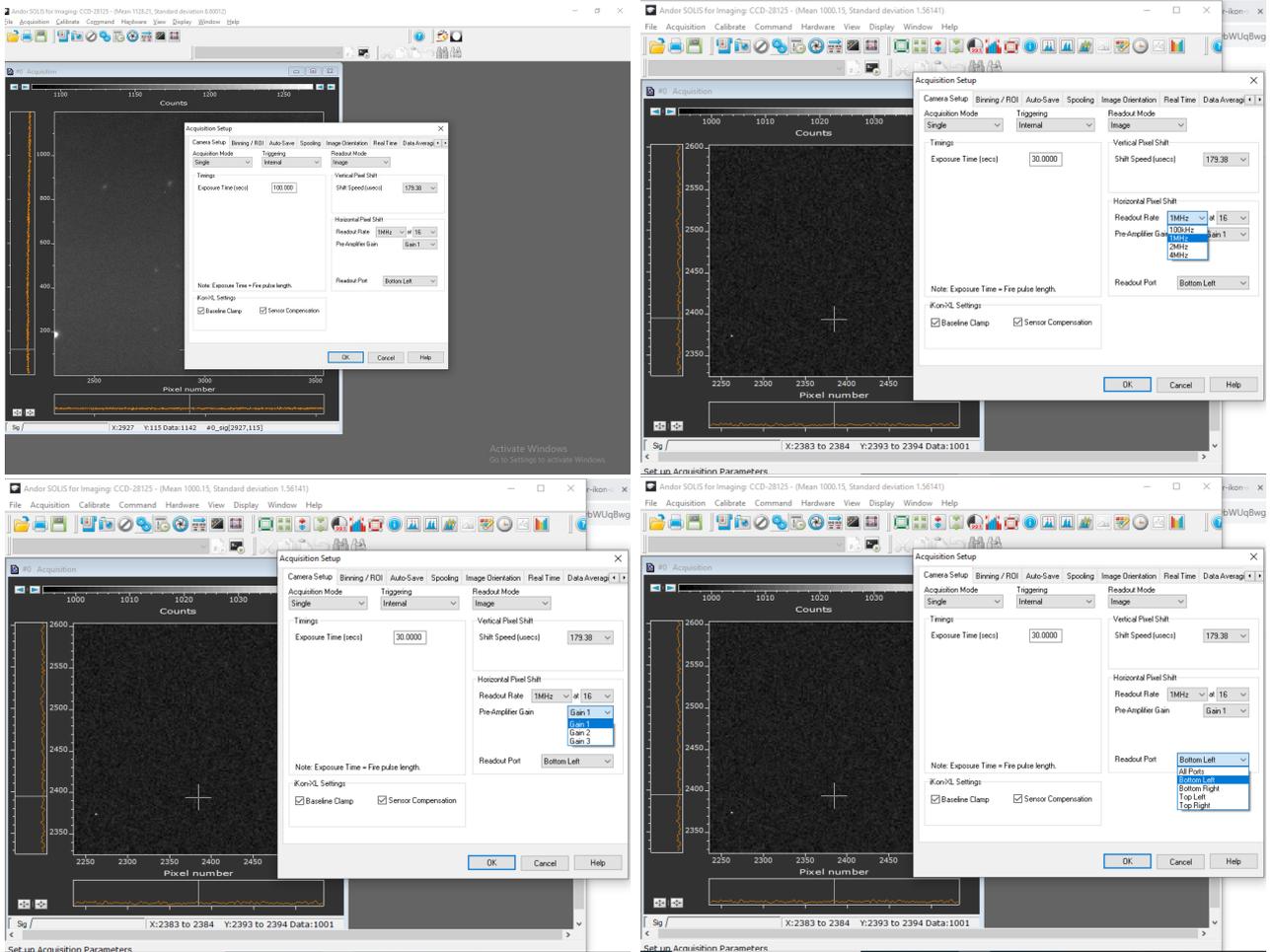


Figure 19: The camera settings can be performed here.

4. Now select the readout port from the four available options in the bottom right panel of Fig. 19.

- In the "Binning/ROI" section, users can select the desired binning options as shown in Fig. 20. Users can select from four available binning modes or make their own bins using the custom option.
- Now go to the "Autosave" section and select "Enable Auto-save" and select "FITS" in the "File type" option. Here, write the file stem and the path of the directory where all data will be saved.
- The user can select the orientation of acquired images in the "Image orientation" option as shown in Fig. 22.
- Save the information by clicking the "OK" button.
- Go to the "Shutter" option and select the "Fully Automatic" option as shown in Fig. 23.

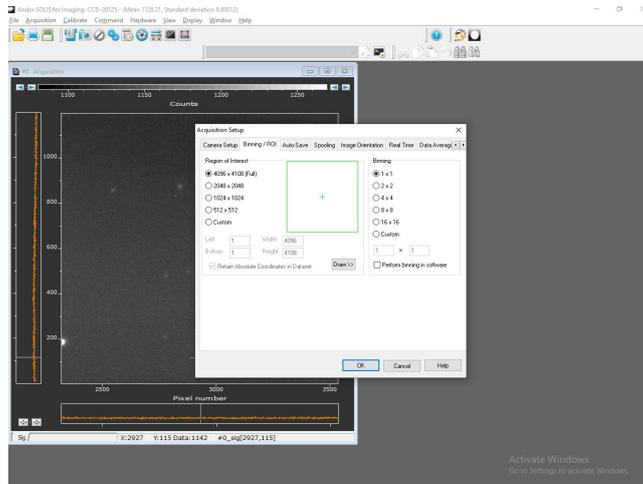


Figure 20: The available binning modes for SPIM.

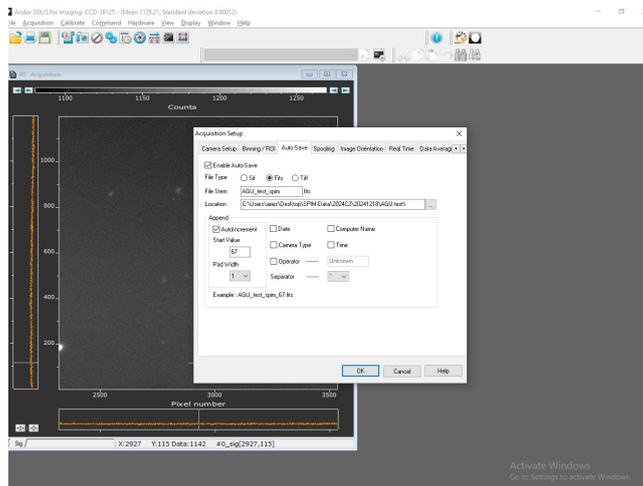


Figure 21: The auto-save settings can be done from this section.

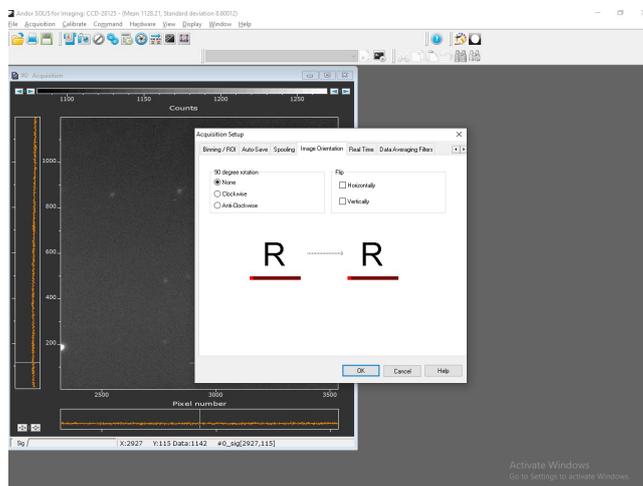
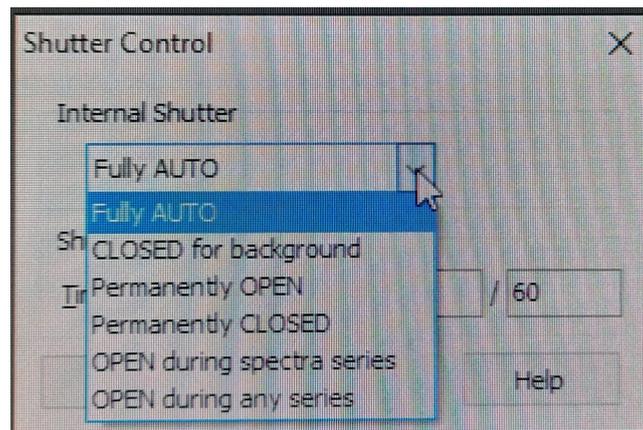


Figure 22: The orientation of the images can be selected from here.



**Figure 23:** The shutter controls can be edited from here.

## 5 Starting the Dome

*(For the detailed pictorial explanation, refer to the manual for the Dome control)*

- Go to the technical room behind the main panel on the ground floor.
- Put the knob of the "dome drive panel" to UPS power.
- Go to the telescope floor.
- Switch ON the main switch of the "SLIT INCOMER".
- Put the knobs of "INTERLOCK CONTROL PANEL-E 27" in the "SLIT ON" and "DOME ON" positions.
- Push the green button on the "SLIT & WINDSCREEN DRIVE REMOTE PADDLE" to open the slit. The "white" and "black" buttons can be used to move the slit "up" and "down" sides respectively.
- Go to the "DOME DRIVE CONTROL PANEL - E 18" and :
  1. Push the "MAIN CONT ON" (blue) button.
  2. Select AUTO (A) mode with the help of the A/M selector switch.
  3. Select "DOME DRIVE" speed (L) mode.
- Go to the TCS control room.
- Switch ON the power supply of the microcontroller box.
- Turn on the Dome Control System (DOS) computer.
- Ping the TCS (192.168.0.100) and microcontroller (192.168.0.192) servers and delete the four \*.ini files.
- Click the DomeControlSystem icon on the Desktop to open the DOS GUI. The DOS is shown in Fig. 24.

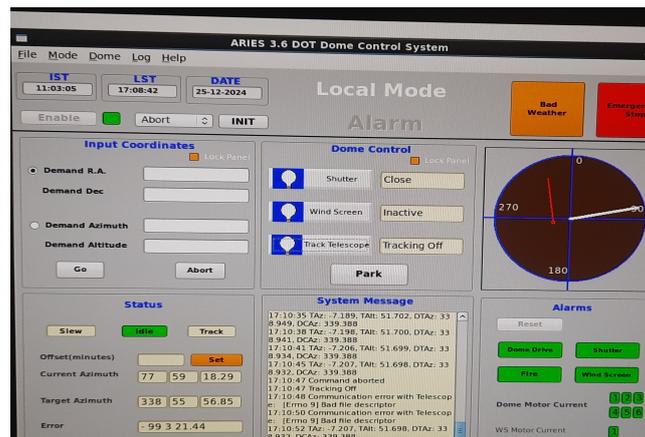


Figure 24: The Dome Control System GUI.

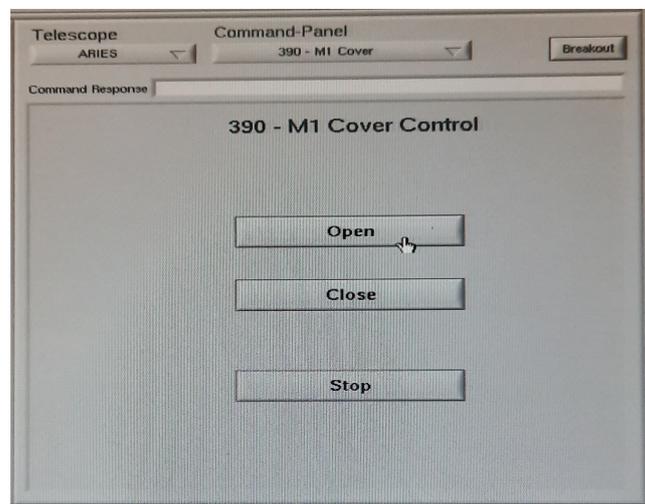
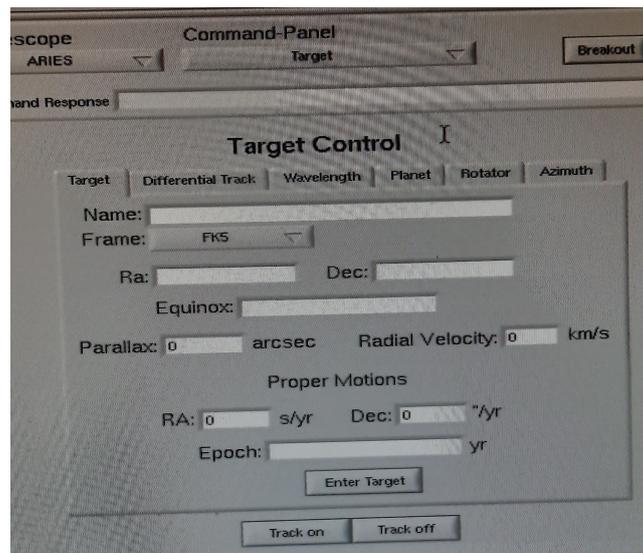


Figure 25: The controls for the primary mirror in TCS.

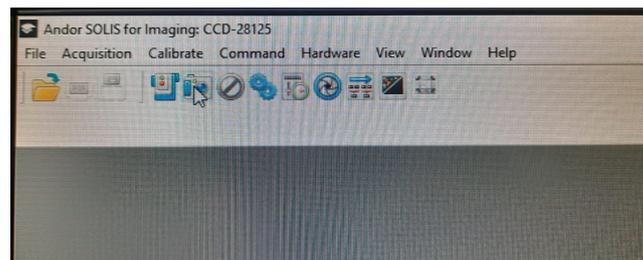
- Click the "Enable" button to "home" the dome. The completion of the homing process can be confirmed by the green color near the "Enable" button.
- Now the Dome is ready for the observations.

## 6 Observing through the SPIM

- Open the cover of the primary mirror. For this, go to the "390 - M1 Cover" section in "Command-Panel" and click the "Open" button as shown in Fig. 25.
- Select the side port2 in the TCS GUI and load the SPIM pointing model.
- Go to the "Target" in the "Command Panel" of TCS and insert the RA and DEC and name of the target to be observed, and then click the "Enter Target" button as shown in Fig. 26. Now, start tracking the telescope by clicking the "Track on" button.
- Go to the DOS window as shown in Fig. 24, either click the "Demand Azimuth" and



**Figure 26:** The target information can be entered here.



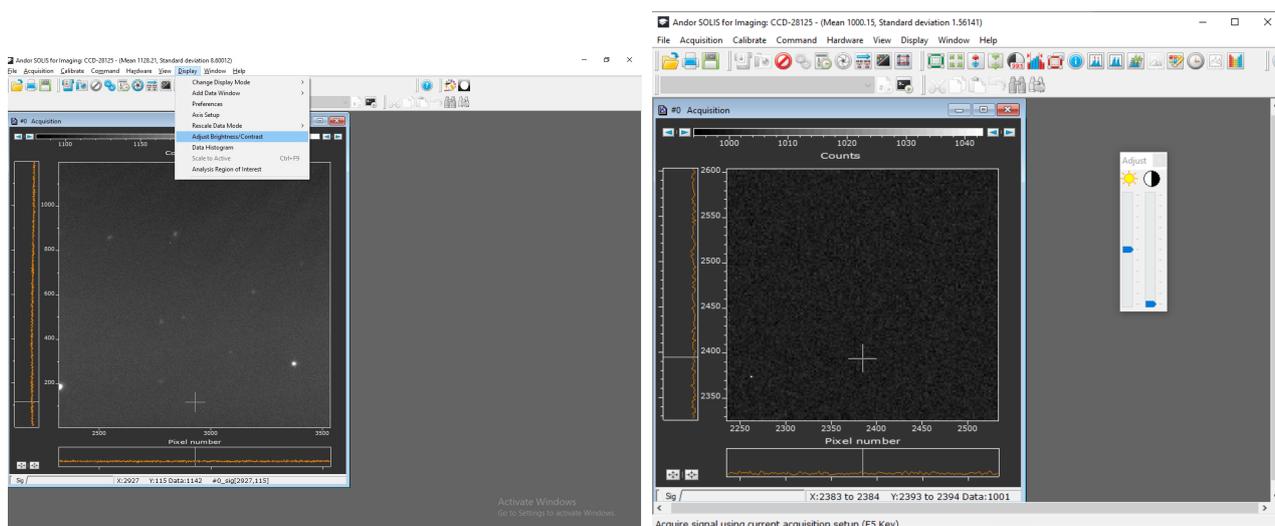
**Figure 27:** The image can be exposed by clicking the expose button.

"Demand Altitude" or click "Demand R.A." and "Demand Dec" options in the "Input coordinates" and click the "Go" button.

- The dome will slew to the telescope position and then click the "Track Telescope" button to start tracking.
- Go to the main window of the SPIM GUI and click the acquire button represented by the camera icon as shown in Fig. 27 or press the "F5" key on the keyboard. The user can also abort the exposure.
- The acquired image can be seen in the display area of the GUI. The image's contrast can be adjusted from the "View" option in the GUI as shown in Fig. 28.
- All the images can also be checked by opening in DS9.

## 7 Closing the observation

- Close the telescope tracking by clicking the "Track off" button in TCS.
- Close the dome tracking by clicking the "Track Telescope" button in DOS. The status of it can be seen in the "Dome control" section of DOS.



**Figure 28:** The contrast of the display area can be changed from the "View" option.

- Close the M1 cover by clicking the "Close" button in TCS's "Command Panel".

## 8 Turing off the instrument

- Put the filter wheel in the homed position.
- Warm up the camera by setting the temperature to room temperature.
- After warming up, switch off all the switches of SPIM, such as the Camera, filter, cooling system, and the main switch.
- Shutdown the SPIM PC.

## 9 Closing down the telescope

- Park the telescope by clicking the "Park" button in the TCS's "Command Panel".
- Close the TCS and AOS GUI.
- Turn off the Power supply.
- Turn off the knob in the AMOS panel-1.
- Turn off the knob in the AMOS panel-2.

## 10 Closing the dome

- Park the dome by clicking the "Park" button in DOS and then close it.
- Switch off the power supply of the Microcontroller from the TCS room.

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- Go to the telescope floor and close the slit by pressing the close (Yellow) button in the "Slit & windscreen drive remote paddle".
- Switch off the "SLIT INCOMER" main switch.
- Put the knob of "dome drive" in "OFF" position.