



**TCS @ OT**

**FAST-CAM**

**USER MANUAL**



Telescope  
Operations  
Group



04-2018

The aim of these series of user guides is to help the observer in some specific tasks concerning the telescopes and instruments available at the Observatorios de Canarias (OOC). The information is supplied in a clear and simple manner, and it comes illustrated with screen captures in order to make the manual easy to use.

In particular, here, the user will find a practical description of how to observe with FastCam at the TCS telescope:

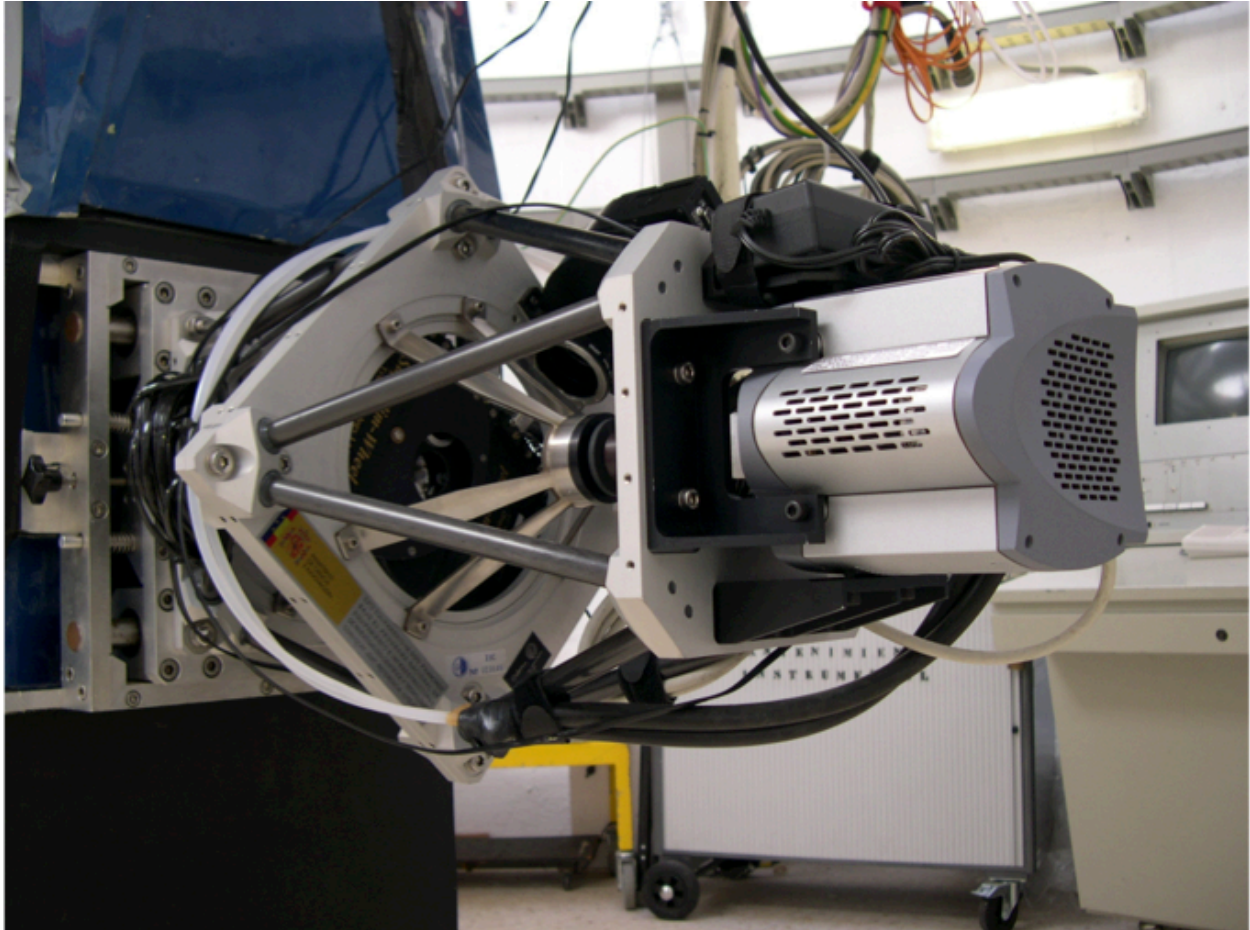
1. Introduction	pg1
1. Start up	pg3
2. Making the connections	pg5
3. Taking BIAS	pg9
4. Taking FLATS	pg11
5. Making the FOCUSS & Alignment	pg13
6. Autoguiding with FOVIA	pg17
7. Observing with FastCam	pg19

For any comment, please contact to the staff of the Telescope Operations Group (ttnn\_a at iac.es)

April 2018

## 1. Introduction

FastCam (<http://www.iac.es/proyecto/fastcam/>) is an instrument jointly developed by the Spanish Instituto de Astrofísica de Canarias and the Universidad Politécnica de Cartagena, designed to obtain high spatial resolution images in the optical wavelength range from ground-based telescopes by using the Lucky Imaging technique.



The basic characteristics of FastCam @ TCS are:

Field of View	$22 \times 22 \text{ arcsec}^2$
Pixel scale	$0.043 \text{ arcsec pix}^{-1}$
Image size	$512 \times 512 \text{ pix}$
Read-out speed	$30 \text{ exposures sec}^{-1}$

## IMPORTANT NOTE

The raw data volume generated by FastCam is quite large. For example, a cube of 1000 512x512 pixel images contains 1GB of data. If the exposure time is 30ms, one cube like this is created every 30s. Therefore, the observation of a target during 30min will add 60GB to the disk and in a full observing night more than 500GB can be collected. Given that a FTP transfer of this data volume at the end of the observing session is no possible, we encourage the astronomers using FastCam to bring their own USB external disk. Disks have to be formatted in FAT32 mode and the file transfer should be done at the end of the night or when the two internal disks (scratch and/or scratch1) are full. The file transfer can be done by using the “cp” or “rsync” commands.

We also advise that the algorithm and software to process and reduce the raw data are not publically available. Therefore, we suggest the users to reduce and process the raw data before the end of the observing run.

## 2. Start up

**This section is ONLY for the Telescope Operator NOT for the observer**

- Switch on the instrument, connect it to the 220AC red plugs just behind the mirror of the telescope.
- Turn on the “telesforo” computer, in the dome.
- Switch on the cooler box. Press the “start/Stop” button, then you should see a “-“ sign in the display. The sign is “\*” when the cooler is off (see picture). Check the level of glycol (water & alcohol).





### 3. Making the connections

If you are going to observe in remote mode, make sure that you are into the IAC network; if you are in the IAC control room, don't worry for this, otherwise you will need a VPN connection to the IAC (just ask to the CAU people on how to do this).

First you can make the connections to the PC-CONTROL and PC-USUARIO, to do so you need VNC software and username/passwords, just ask for the instructions to the staff of the Telescope Operation Group (ttnn\_a at iac.es).

Then proceed starting a session on ALEBO computer; in a terminal:

```
[local computer] $ ssh -X root@alebo (password: FastCam#2009)
```

If you are at the TCS, then you can start from this point (skip the previous instructions). On a terminal of the ALEBO computer, make a connection to TELESFORO computer, like this:

```
[alebo] $ ssh -X fastcam@161.72.82.90 (password: fastcam)
```

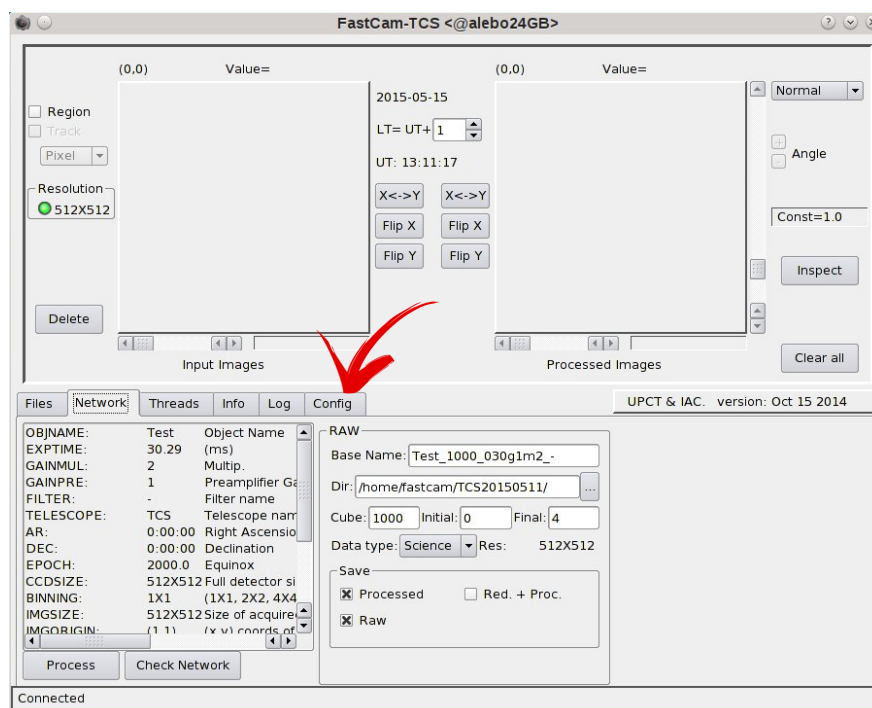
Now you are logging in TELESFORO, then type:

```
[telesforo] $ andorcontrol
```

Some windows will appear, but you really don't need them, so it's better to minimize all of them. Now, go back to ALEBO and open a new terminal (in remote mode, just make a new ssh connection from your local computer). Then type:

```
[alebo] $ FastCam
```

Four windows will turn up: The FastCam controlling interface

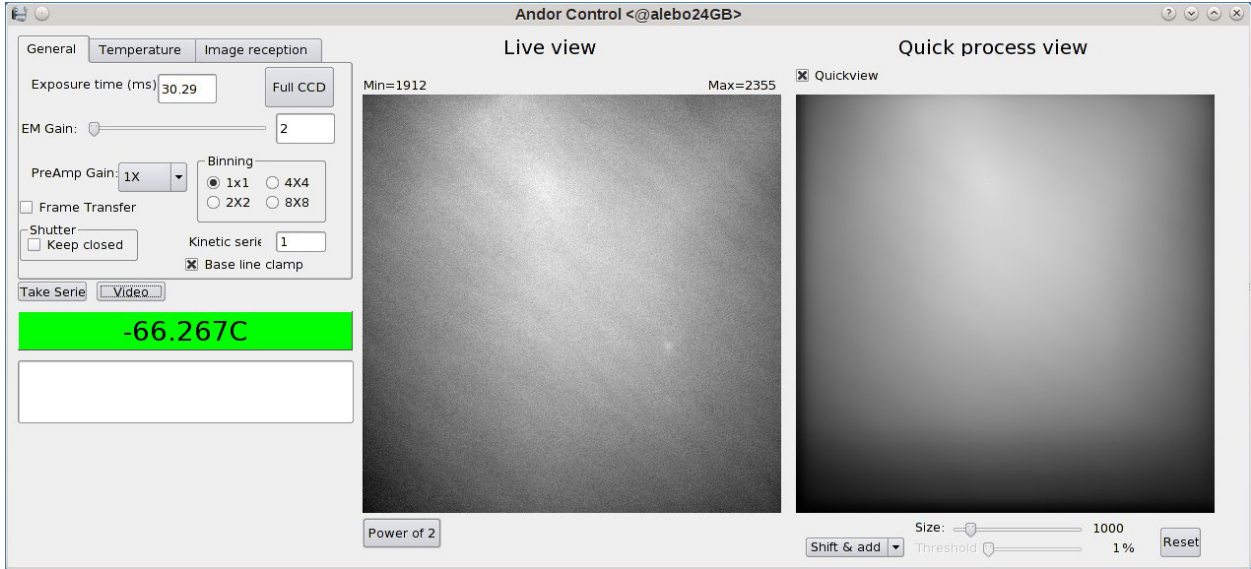




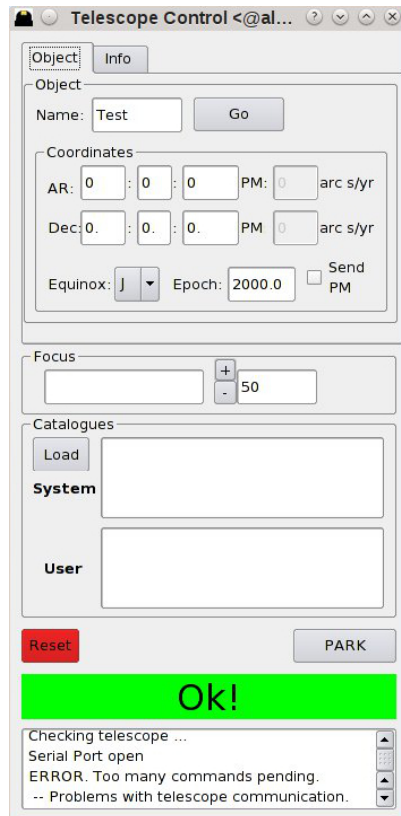
The Filter wheel window



The Andorcontrol window

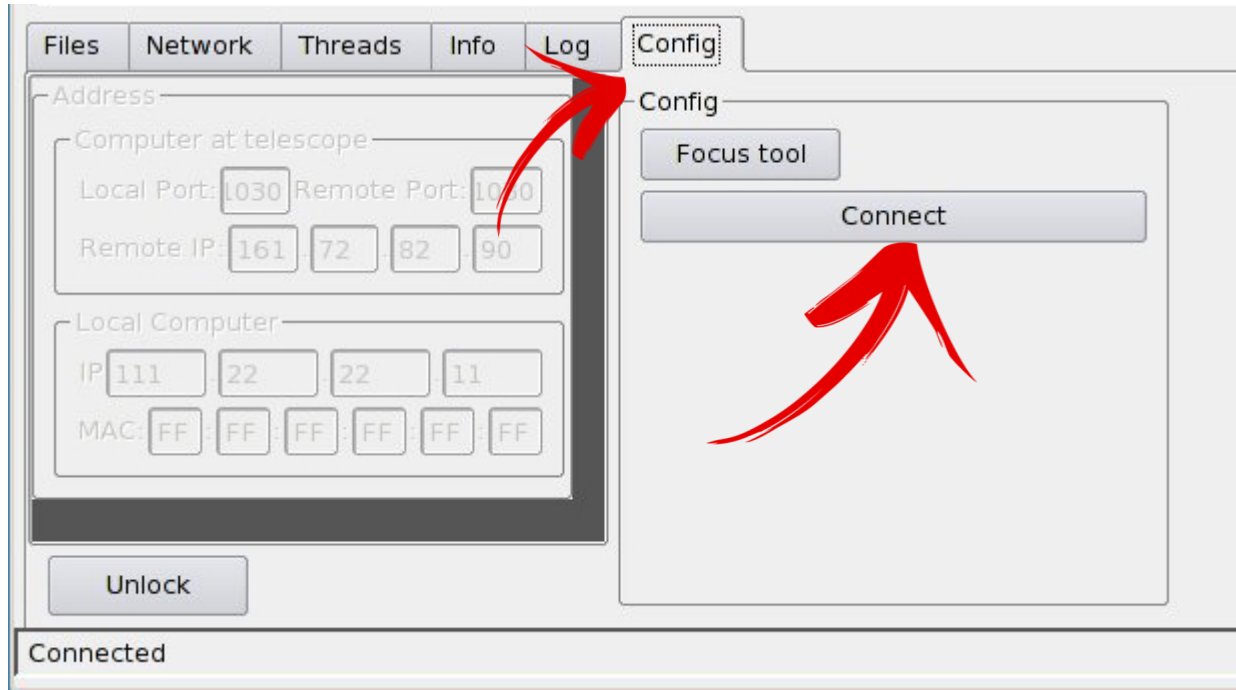


And the Telescope Control window

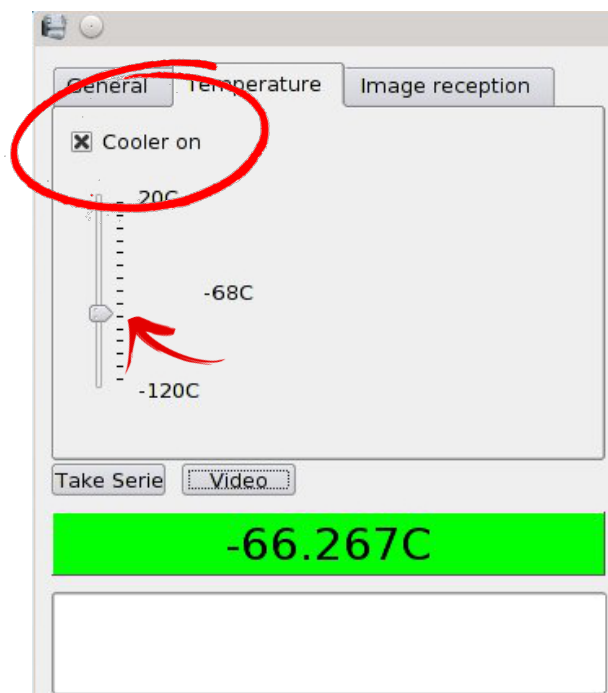




In the FastCam-TCS window, select the “Config” tag, and then click on “Connect” button, this will establish a communication between ALEBO and the CCD, the filter wheel and the Telescope



On the Andor control window, click on the “Temperature” tag, and set the temperature to -120° (just use the sliding bar) and then click on the “Cooler on” check box



Now you should have FastCam ready to work.



## 4. Taking BIAS.

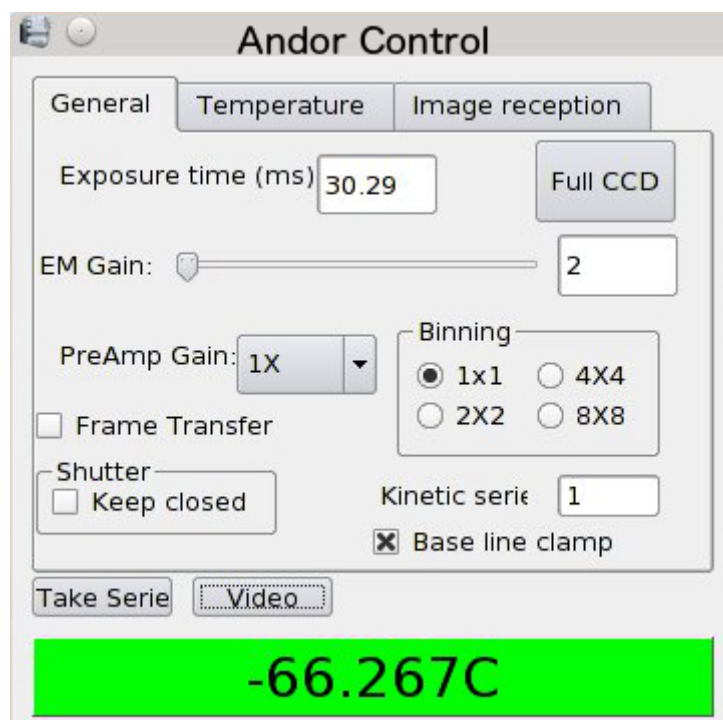
Make sure that the primary mirror covers are closed (petals closed), if not ask to the Telescope Operator to do so. Make sure that the dome lights are off.

**TIP:** Take bias for each value of EM GAIN that we will use on the observations (if you still don't know this, then is better to take bias for several values of EM GAIN, 20, 50, 100, 200, 300, preamp is normally left to 1.0).

Now you can proceed as follows:

On the **Andor Control** window, under “**General**” tag:

1. Activate the “Shutter keep closed” option by clicking on its check box.
2. Make sure that “Frame Transfer” is NOT activated.
3. Activate the “Base line Clamp” option.
4. Select the value of the “EM Gain” by sliding the bar and the “PreAmp gain”.
5. Set the “Exposure time” to 30ms.

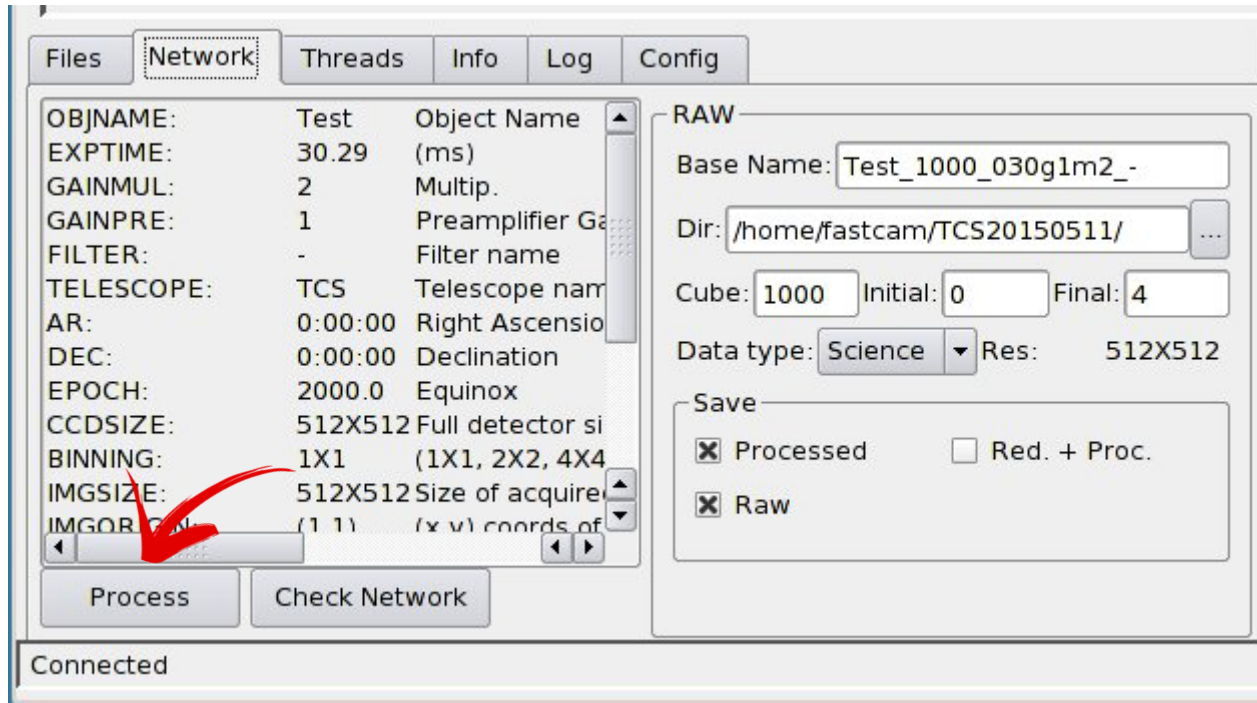


On the **FastCam-TCS** window under the “**Network**” tag:

6. Define the directory path, where all images will be saved
7. If you want to use the FastCam software for a on-time data reduction, then set the values for a ONE cube of 500 images (initial=0, final=1, this will produce one single cube). Otherwise, we recommend to take 5 cubes of 200 iamges each (initial=0, final=4).

8. Select “BIAS” option in the “Data type”

9. Make sure that ONLY “Raw” check box is activated in the “Save” area.



Click on “PROCESS” button to start taking data.

## 5. Taking FLATS

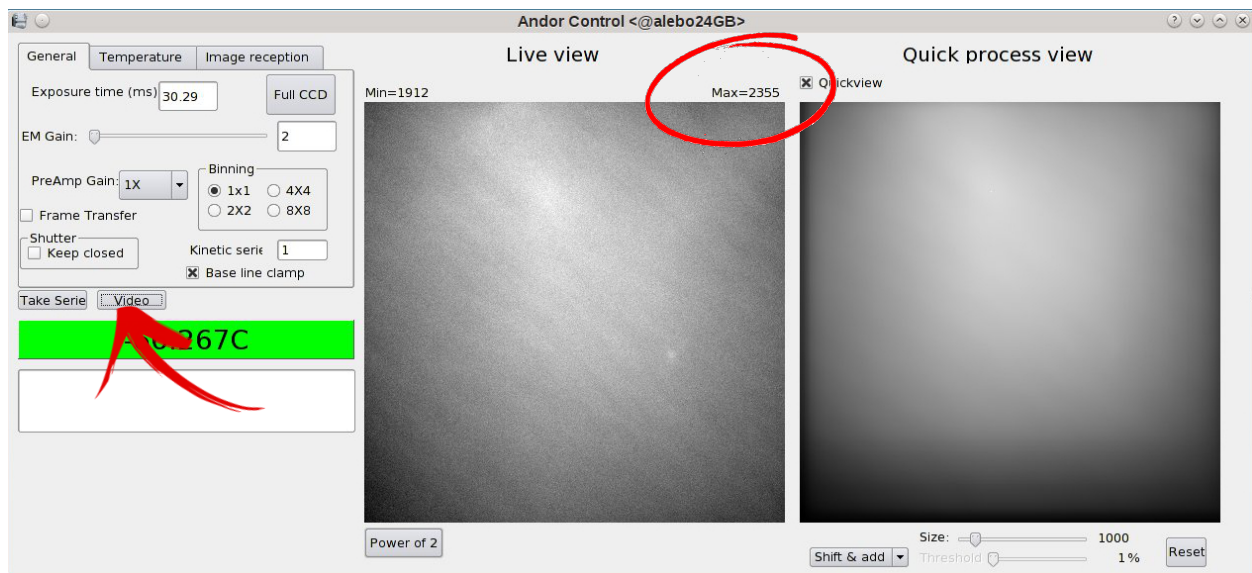
**THIS MUST BE DONE BY THE TELESCOPE OPERATOR:** Park the telescope to the “Flat” position. Make sure that the petals of the primary mirror are open, and turn on the dome lights.

**TIP:** Take flat fields for each value of EM GAIN that we will use on the observations (if you still don’t know this, then is better to take bias for several values of EM GAIN, 20, 50, 100, 200, 300, preamp is normally left to 1.0).

On the “Filter Wheel” window, make sure that the correct filter is selected.

On the **Andor Control** window, under “**General**” tag:

1. De-activate the “Shutter keep closed” option by clicking on its check box.
2. Make sure that “Frame Transfer” is NOT activated.
3. Keep the “Base line Clamp” option activated.
4. Select the value of the “EM Gain” by sliding the bar and the “PreAmp gain”.
5. Set the “Exposure time” to 100ms. (recommended) and adjust the dome light intensity in order to achieve ~3000 counts. Click on “video” button and read the max value of the counts on the top right corner of the display.



On the **FastCam-TCS** window under the “**Network**” tag:

6. If you want to use the FastCam software for a on-time reduction of the data, then set the values for a ONE cube of 500 images (initial=0, final=1, this will produce one single cube). Otherwise, we recommend to take 5 cubes of 200 images each (initial=0, final=4).

8. Select “FLATS” option in the “Data type”

9. Make sure that ONLY “Raw” check box is activated in the “Save” area.

Click on “PROCESS” button to start taking data.



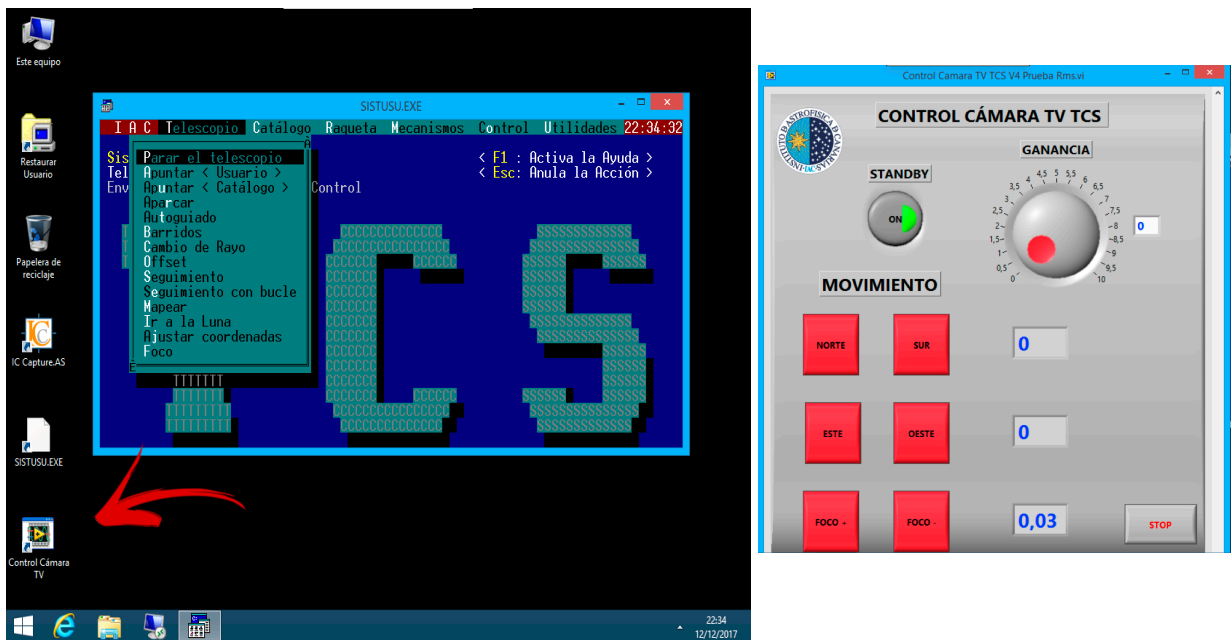
## 6. Making the focus & the alignment.

The following actions must be done by the Telescope Operator: Make sure that mirror covers are closed, turn the lights off, open the upper hutch and then the lower hutch, and finally open the mirror covers.

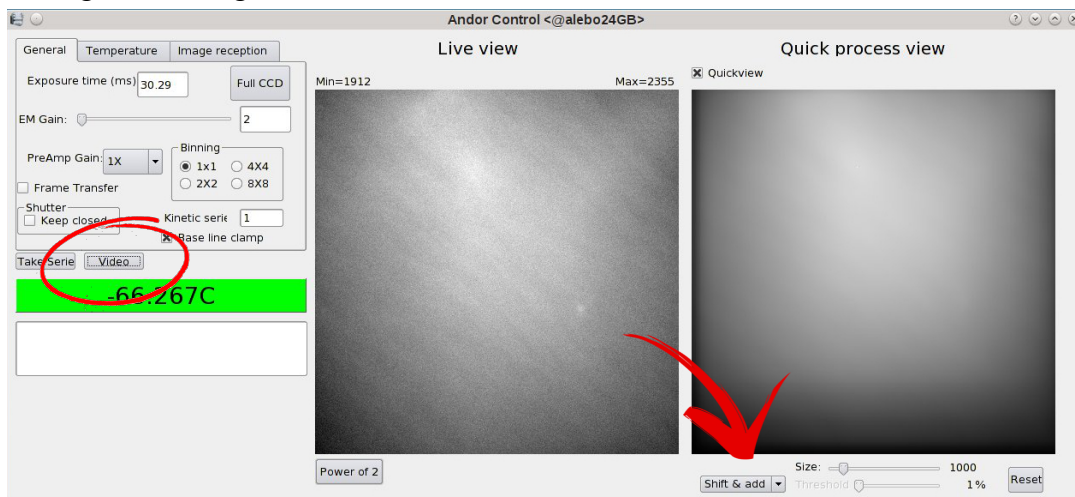
Once the telescope is ready, the two of you (Observer and Telescope Operator) have to proceed in collaboration as follows:

### Alignment.

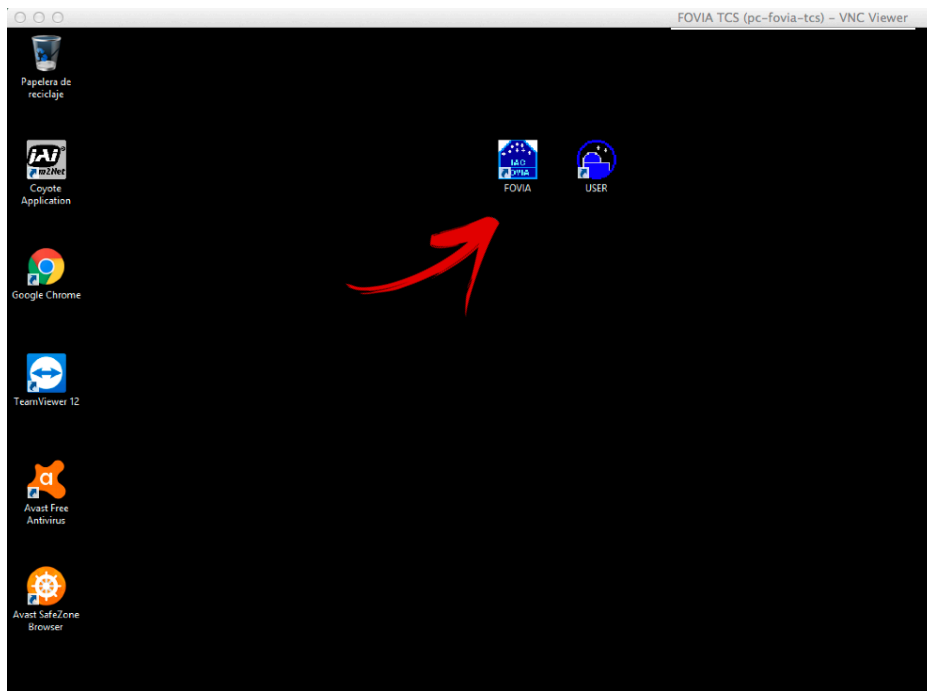
The FOVIA camera can be shifted in the EW direction using the “Control Camera TV TCS” window, which can be launched from the PC-CONTROL. **NS direction is blocked and MUST be done by hand ONLY by the Telescope Operator.**



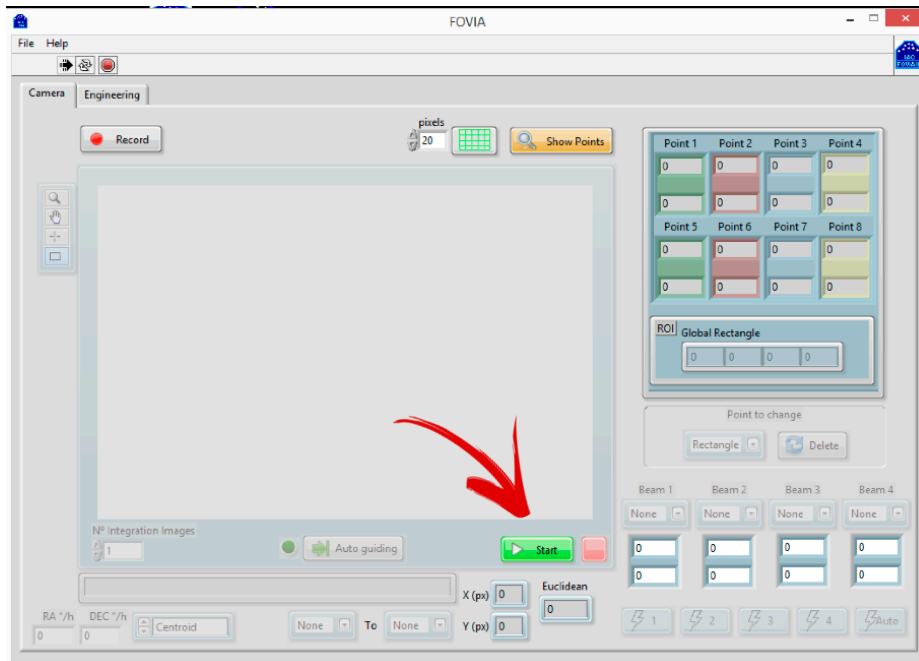
1. On the Andor Control window, run the video and select the “shift & add” option for the processing of the images:



2. You have to connect to the FOVIA PC using VNC (see remote connections instructions to find the IP's and passwords needed). Once the connection is done, you will see this desktop



3. Click on FOVIA icon, and the interface of FOVIA will turn up



4. Click on the “START” green button in order to switch on the FOVIA CCD and display the images. Make sure that “stand by” button is “on” (in green) in the “Control Camera TV TCS” window.

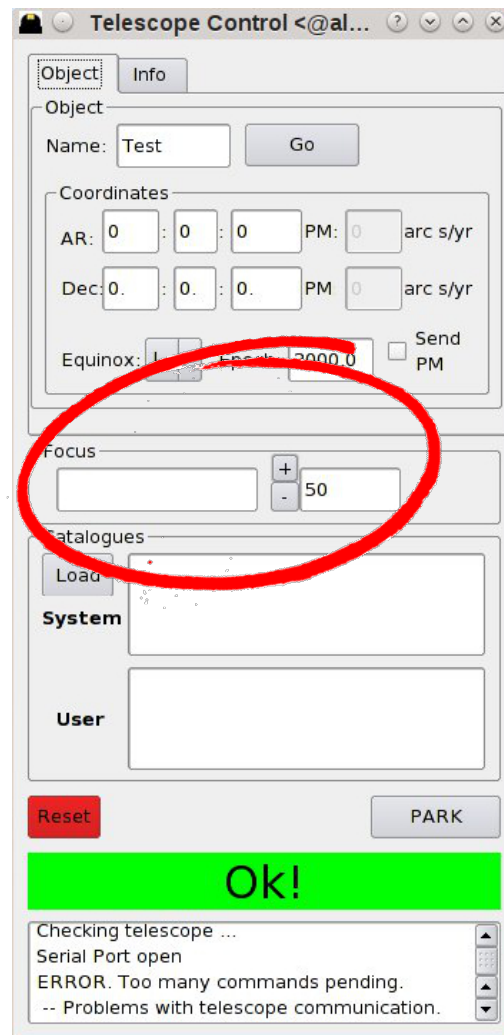
5. Use the EW (Este-Oeste) buttons to perform offsets in this direction, and with the help of the

Telescope Operator make the offsets in NS direction needed to have the guiding star within the Field of view of the FOVIA camera.

### Focusing.

Keep in mind that you have to focus the science camera (FastCam) and the auto-guiding camera (FOVIA).

1. Use the “focus” tool in the “Telescope control” window to adjust the focus of FastCam. (TIP: keep the video on while you are changing the focus of the telescope).



This will affect the focus of FOVIA, therefore start always with this focus.

2. Unfortunately, **FOVIA can ONLY be focused by hand and this MUST be done by the Telescope Operator**. So keep an eye on the video display on the Andor Control window, while the Telescope Operator is modifying the focus until it would be good enough for you.



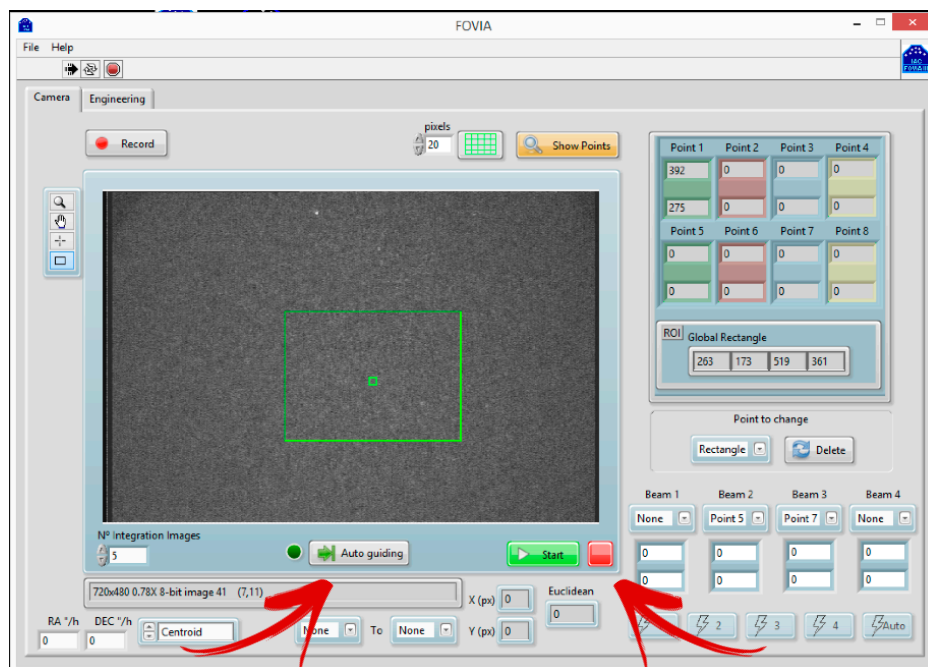
## 7. Autoguiding with FOVIA.

At this point you should have FastCam and FOVIA aligned and focused. So, no time to loose!! Point to your object (you can use the telescope control window) and to start to autoguide follow these instructions:

1. Make sure that FOVIA is not in “Stand by”, you can check this on the “Control Camera TV TCS” window

2. Tune the gain of the FOVIA camera in order to make your guiding star as pointless as possible (also from the “Control Camera TV TCS” window).

3. Click on the “START” green button in order to switch on the FOVIA CCD



4. Draw a box (in green) around the star.

5. Click on the “AUTO GUIDING” button. Then, the green box will become smaller until the guiding star is caged inside the green box. If the box is not drawn the algorithm sweeps all the field of view in order to identify the best guiding star. The limiting magnitude of the FOVIA camera is ~13.

6. If you want to finish to auto-guide, just click again on the “AUTO GUIDING” button.

7. If you want to switch off FOVIA, you have to click on the red button (just on the right of the “START” button, and then we can close the application (clicking on the red X on the top right corner).

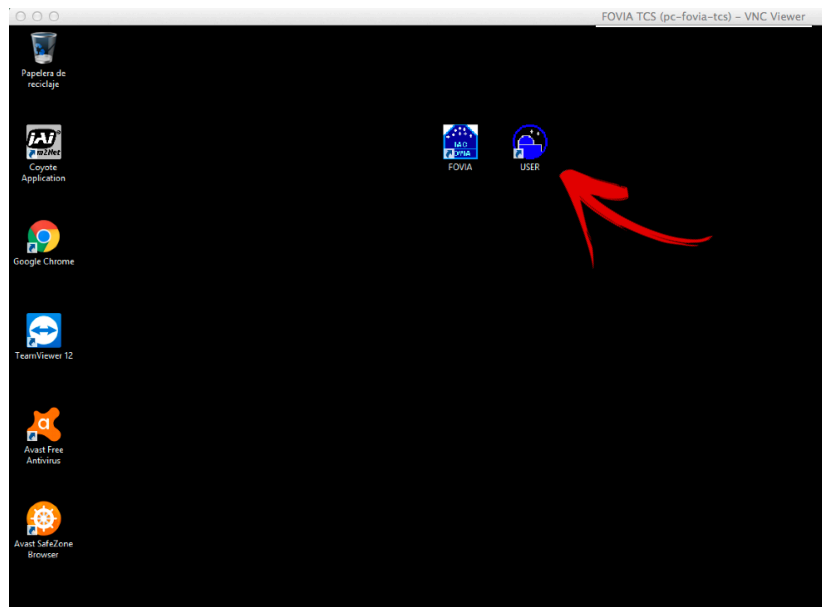




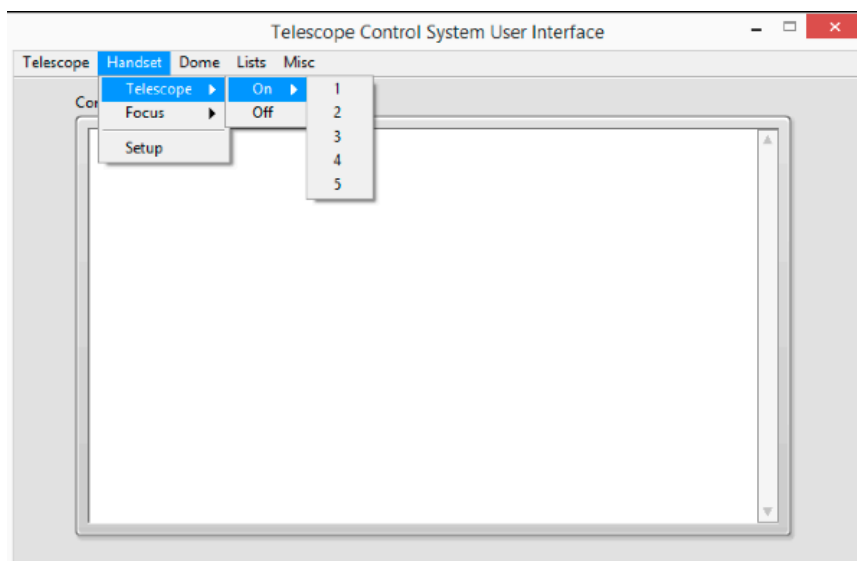
## 8. Observing with FastCam.

You did all the hard work, so now it's time to enjoy!!

1. Point to your object (use the Telescope control window to introduce the coordinates and the name)
2. If the object is not in the center of the field of FastCam, you can make offsets. To do so, you can use the "Telescope Control System User Interface", which can be launched from the FOVIA computer.
  - 2.a. Connect to the FOVIA PC using VNC (see remote connections instructions to find IP's and passwords needed).



- 2.b. Click on USER icon, and the telescope control system user interface will turn up





4. On the **FastCam-TCS** window under the “**Network**” tag, choose the “**Science**” Data type, The number of cubes to produce, this is done defining “**Initial**” and “**Final**”, and the size of each cube (in the image, we will produce 5 cubes of 1000 images each).
5. Decide which data you want to save by clicking on the corresponding check box.
6. Click on “**Process**” to go ahead. (TIP: be careful with “**initial**” and “**final**” values that are used to label the files, if you have to stop observing for any reason, and want to resume the observations, you could have files overwritten if you don’t change these values accordingly).

