



# **SARA- JKT @ ORM**

## **USER'S MANUAL**

### **THE OBSERVING GUIDE**



Telescope  
Operations  
Group



02-2018

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 (OCC). 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 the following tasks:

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## 1. Introduction (How to get familiar with the interface of the telescope control)

The main characteristics of the science camera (Andor Ikon L-2048) are:

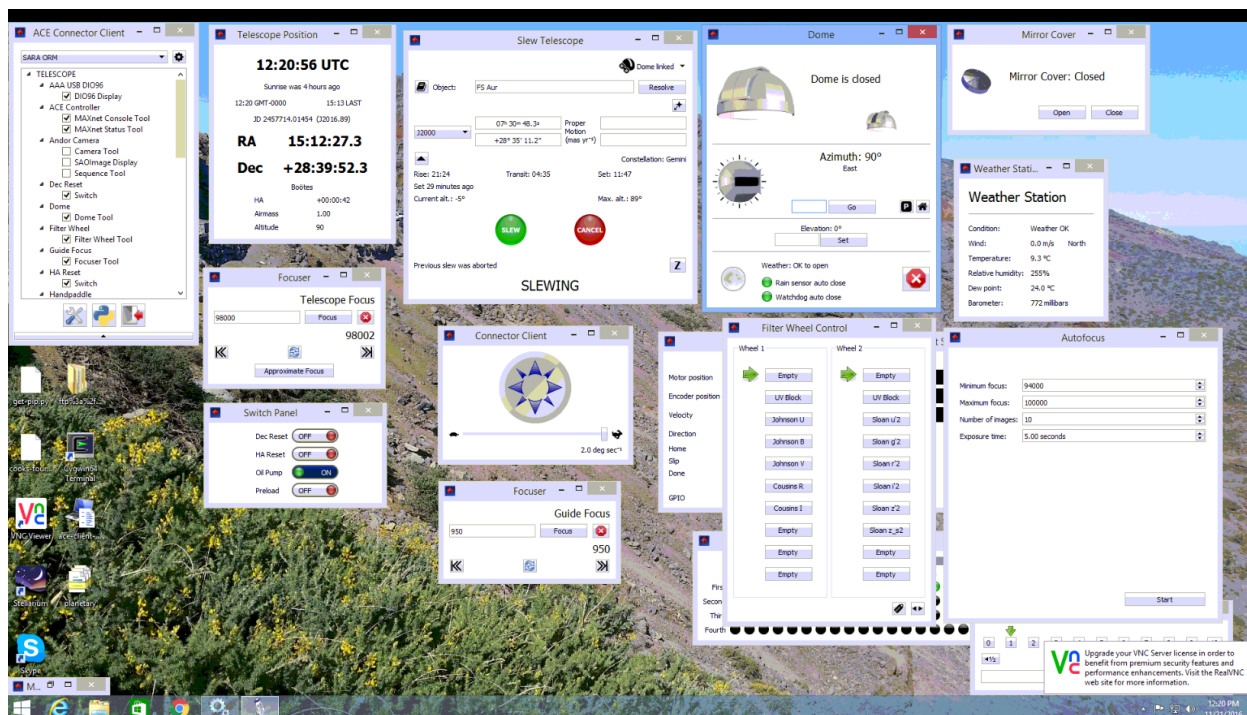
- Field-of-View: 11.6x11.6 arcmin<sup>2</sup>
- Pixel scale: 0.34"/pixel
- QE > 90%
- Lineal up to ~60000ADU.

We strongly suggest to the new users to read the original SARA-JKT manual before to start to use this document. In that manual, the reader will find how to make the corresponding connections.

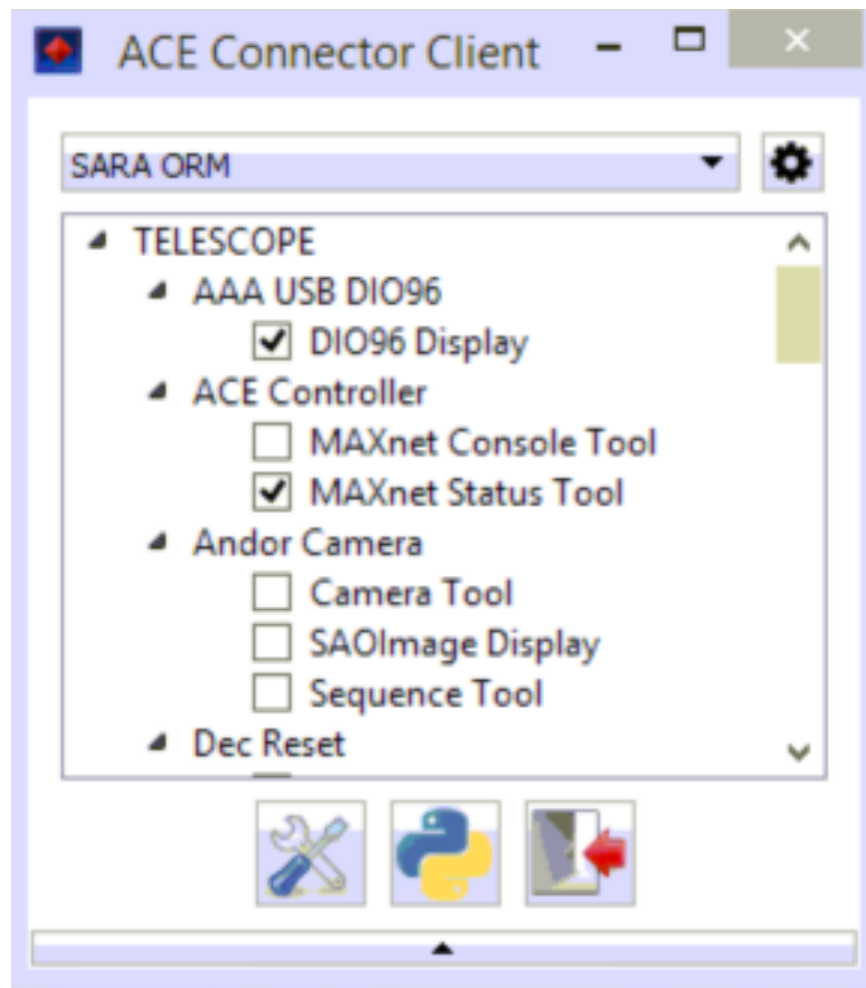
There are **THREE computers** to which the observer has to make the connection; the Telescope computer, the CCD computer & the Observatory computer (IP's, username & passwords are provided separately by the staff of the Telescope Operations Group, contact them at ttnn\_a at iac.es).

### 1.1 The Telescope Computer

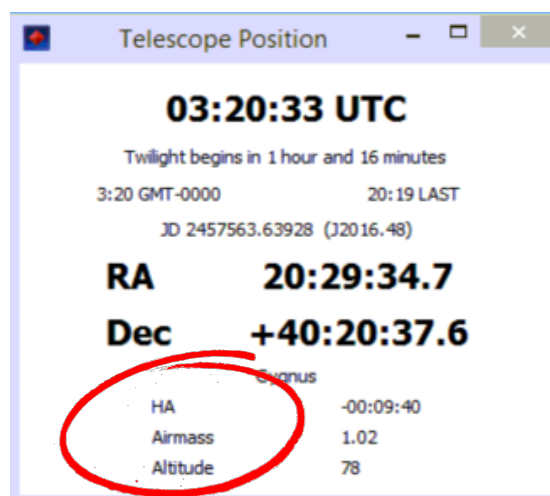
General view of the telescope control computer:



Don't freak out!! There are a lot of windows, but you can control which ones are visible or not from the **Connector Client** window; just tick on/off in the desired checkbox.



The **Telescope information** window; shows the position of the telescope. When telescope is parked at zenith the airmass is 1.0, altitude  $\sim 90^\circ$  and H.A.  $\sim 00:00:00$ .

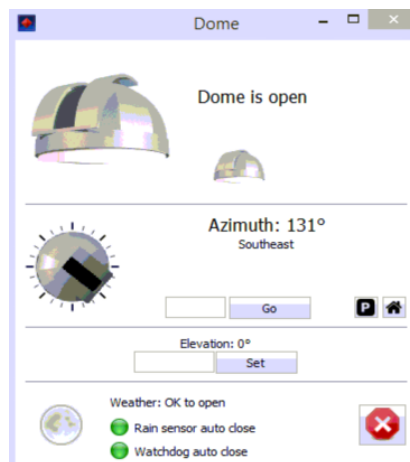




The telescope controlling window.



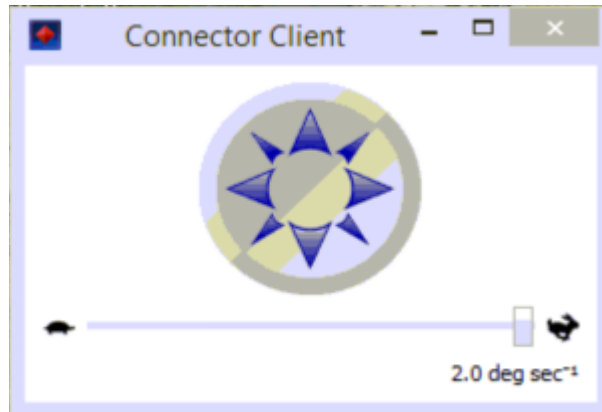
The DOME controlling window



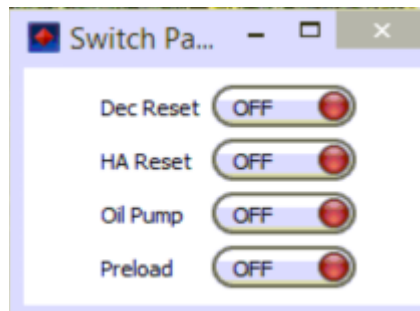
The mirror shutter window:



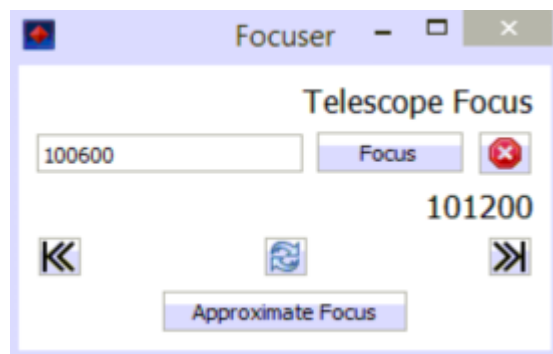
Manual control of the slew of the telescope:



Switch panel of the telescope motors:

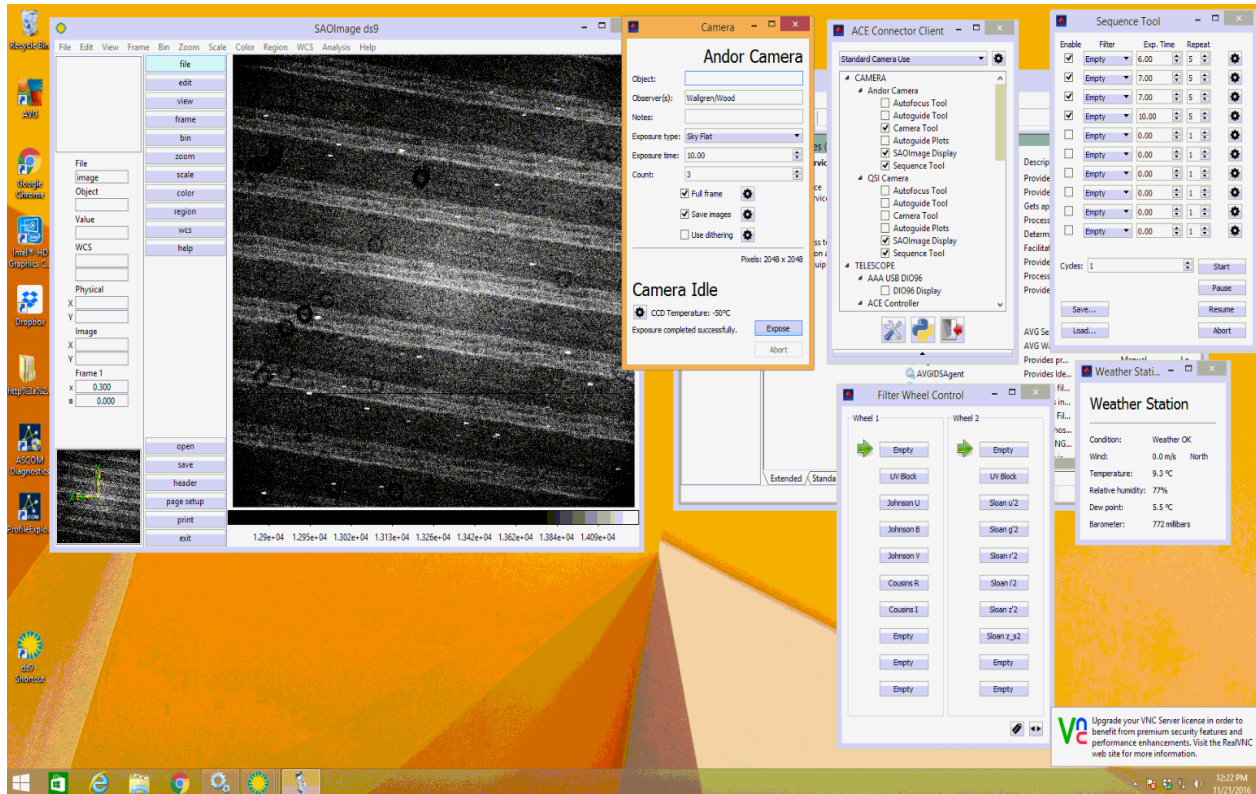


Telescope focus window:



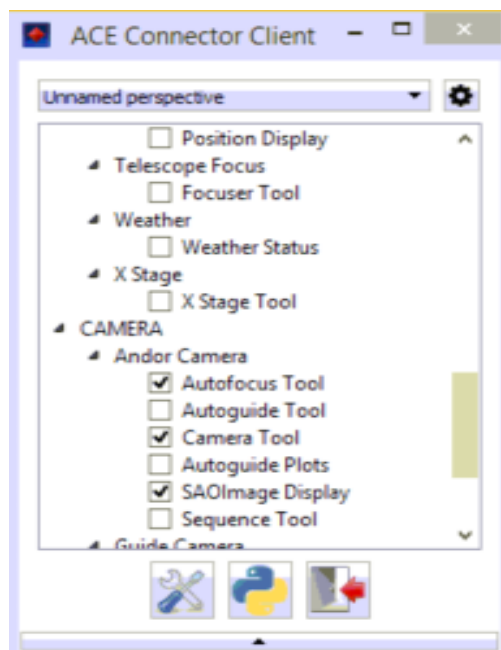
1.2 The CCD computer.

General view of the CCD controlling computer:

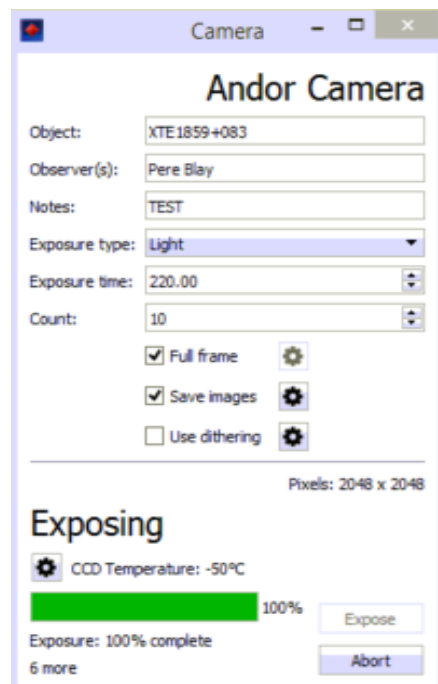


The most used & useful windows are:

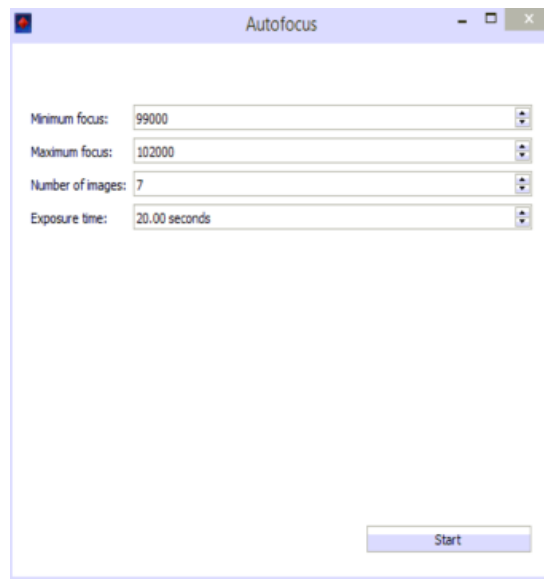
The connector client window, which is used to activate/deactivate other windows:



The exposition/acquisition window:



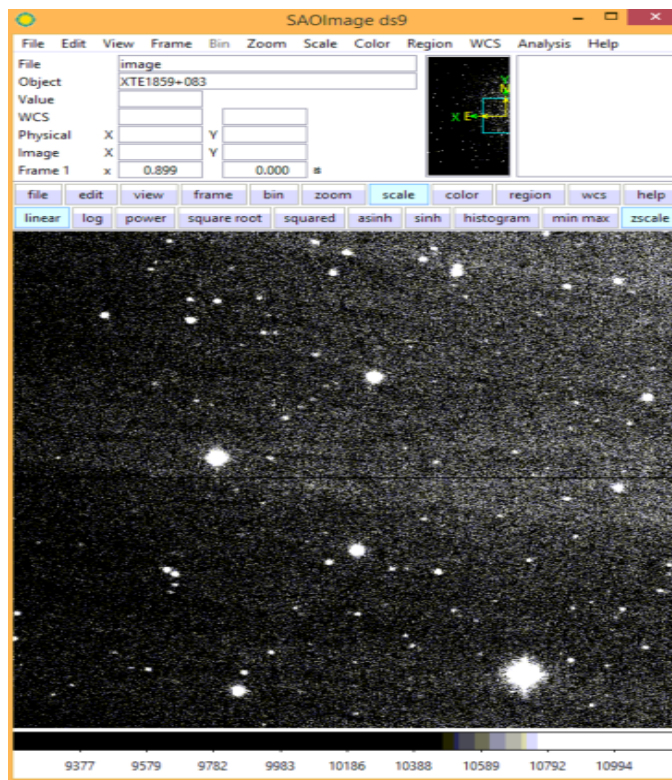
The auto-focus window:



The filter wheel window:

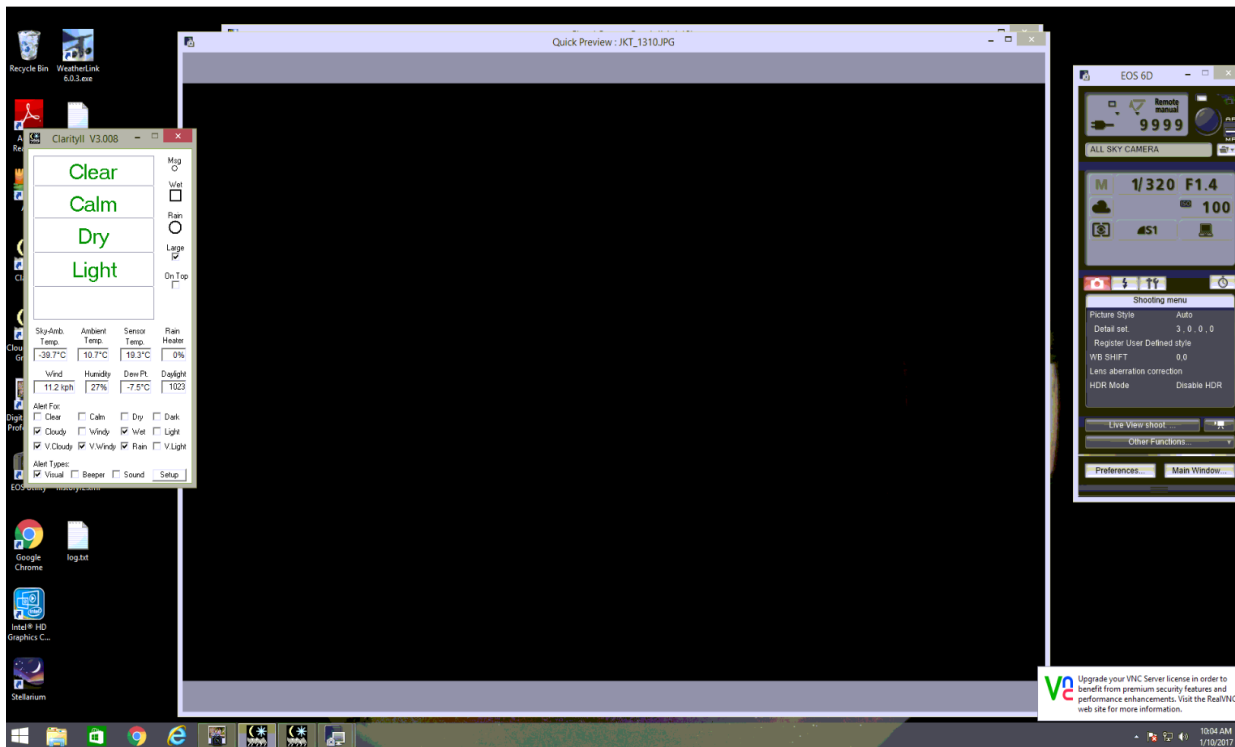


The SAO DS9 image display software:

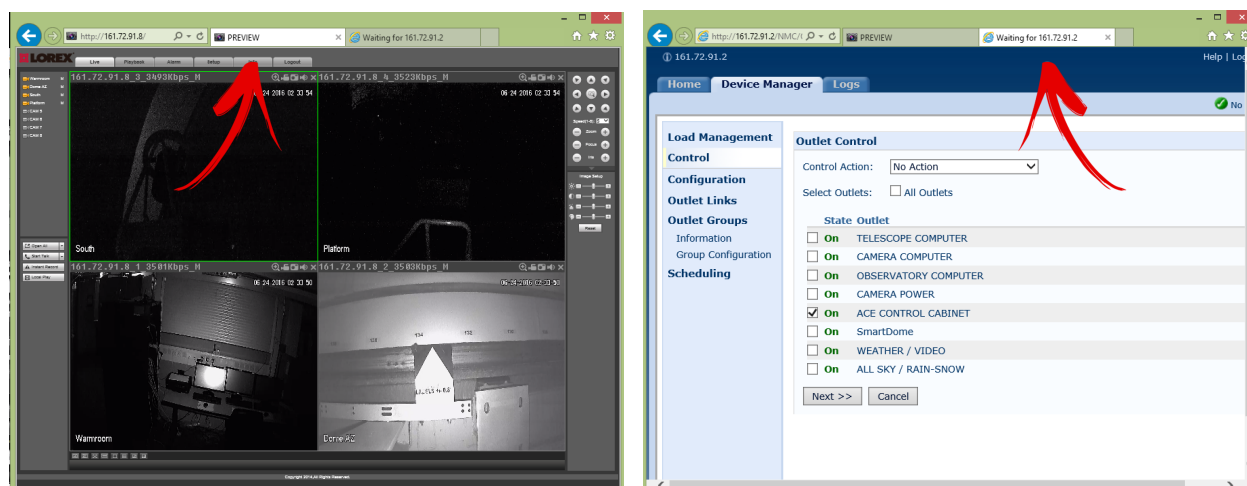


### 1.3 The Observatory computer.

General view of the windows in the observatory computer:

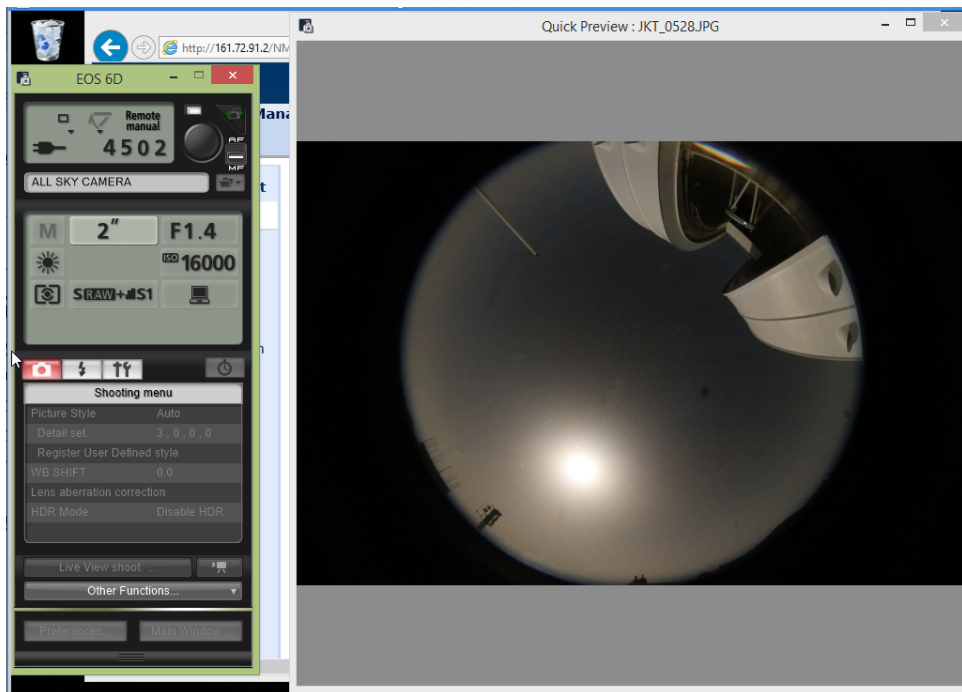


Internet explorer with some tags already opened, such as the telescope cameras and the device manager:

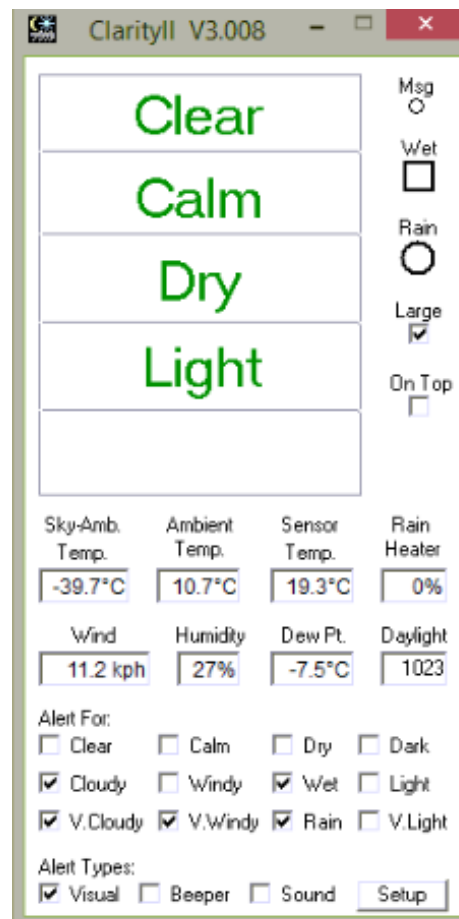




Camera all-sky and its controls:



The weather information window:

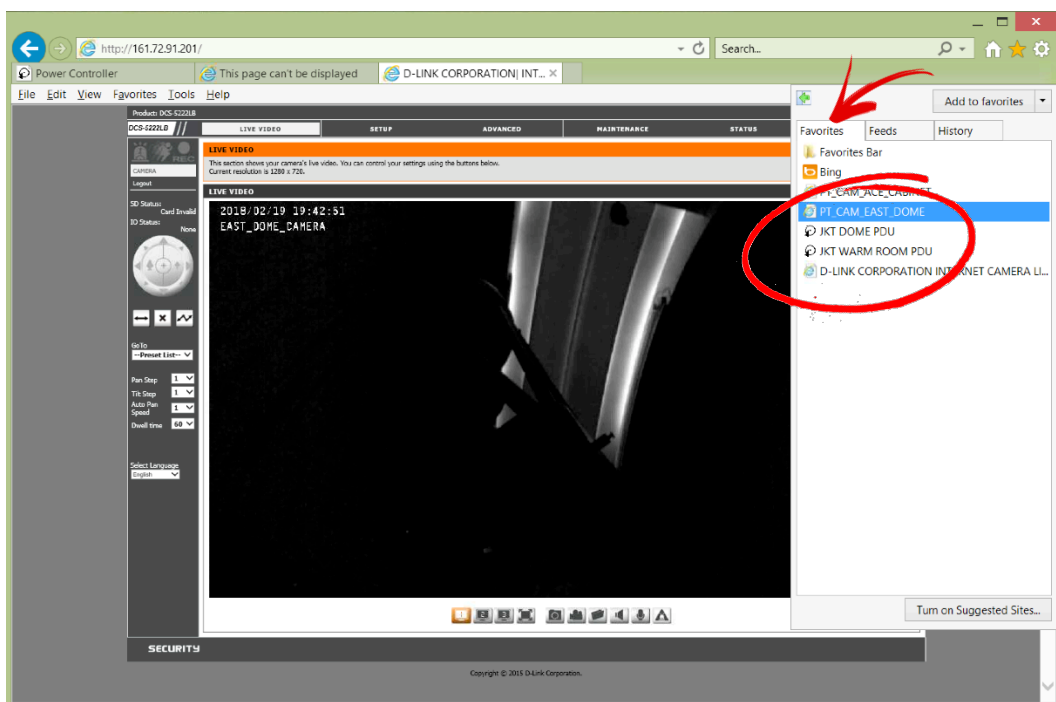


## 2. Preparing the observation night.

- ✓ **Make the connections to the THREE computers** (telescope, CCD & Observatory) and check that all windows you need are visible (remember to use the ACE connector client window to activate/deactivate windows).
  - ✓ In the Observatory computer: **Watch the webcams** of the dome and the control room to check that everything is ready for the observations: make sure that the window of the control room is covered. The all-sky camera can be used to see the dome.
  - ✓ In the CCD computer: **check that the CCD is responding** by taking a couple of BIAS. Also check that the filter wheel is responding.
  - ✓ In the Telescope computer: you have to **check that the system is responding correctly**; if you select one window and all “X” buttons (at the top right corner of the window, which is used to close the window) turn to red, this means that the ACE connector client must be re-initialized. If everything is OK (make sure that the mirror petals are closed!!), we can open the dome, by moving the dome to the East (at zenith), we will avoid the direct incidence of the sun on the telescope and we will also have it in position to start with the sky flats.
  - ✓ If you think that something is **not working** properly, you have to re-initialize the Connector Client (see troubleshooting section, at the end of this document)
- How to proceed if there is no window open in the Observatory computer:

The software that will be needed in this computer is the following:

1. Internet explorer
2. Canon EOS (to control the all-sky camera)
3. Weather



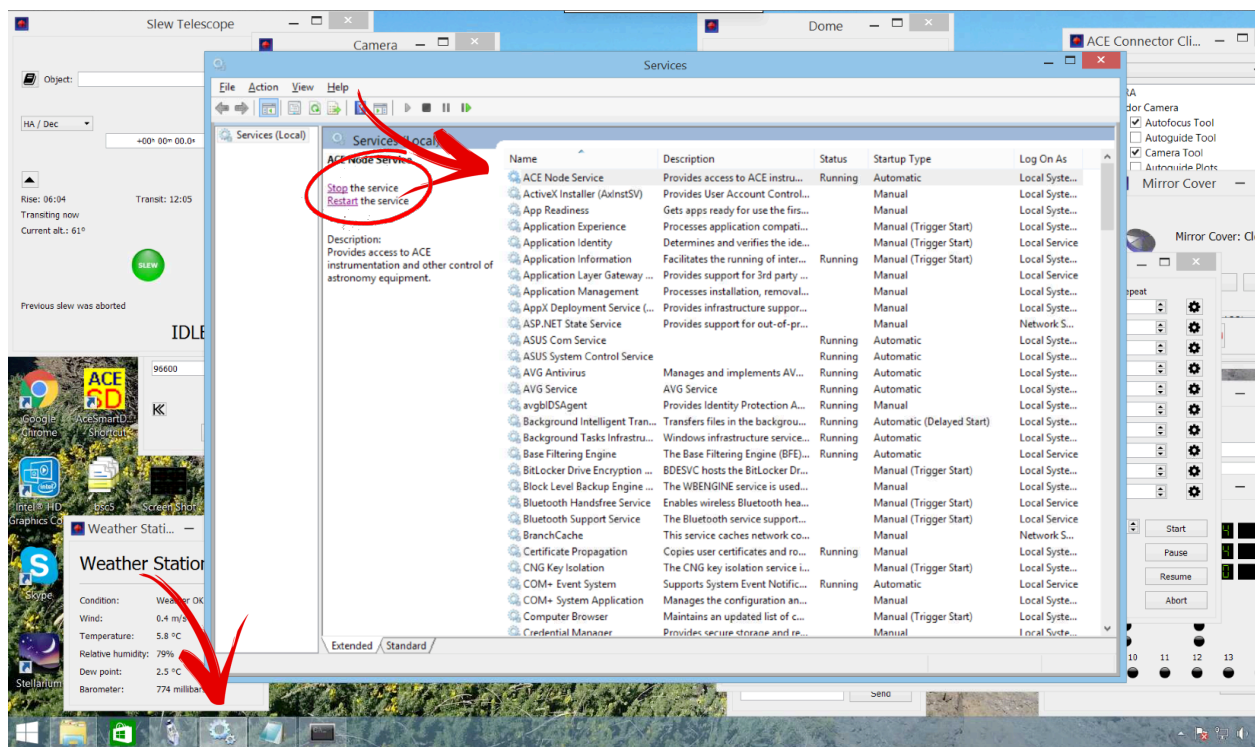
All this software can be found in the “Start” Menu. All links to the IP’s of the webcams and the device manager appear in the “favorites” tag of the internet explorer browser (please use the official manual for usernames and passwords, or IPs if needed). After that you can check that everything is working following the instructions above.

➤ How to proceed if there is no window open in the CCD computer:

Firstly, make sure that the computer is working, if so, we launch the “Connector Client” from the “Start” menu, then we can take a couple of BIAS to check that the CCD is responding.

➤ How to proceed if there is no window open in the Telescope computer:

In that case, we have to launch the software “Services”, which shows all the windows services that are running in the computer. This software can be found in the Windows toolbar as a two-gear icon, if not go to the “Start” menu.

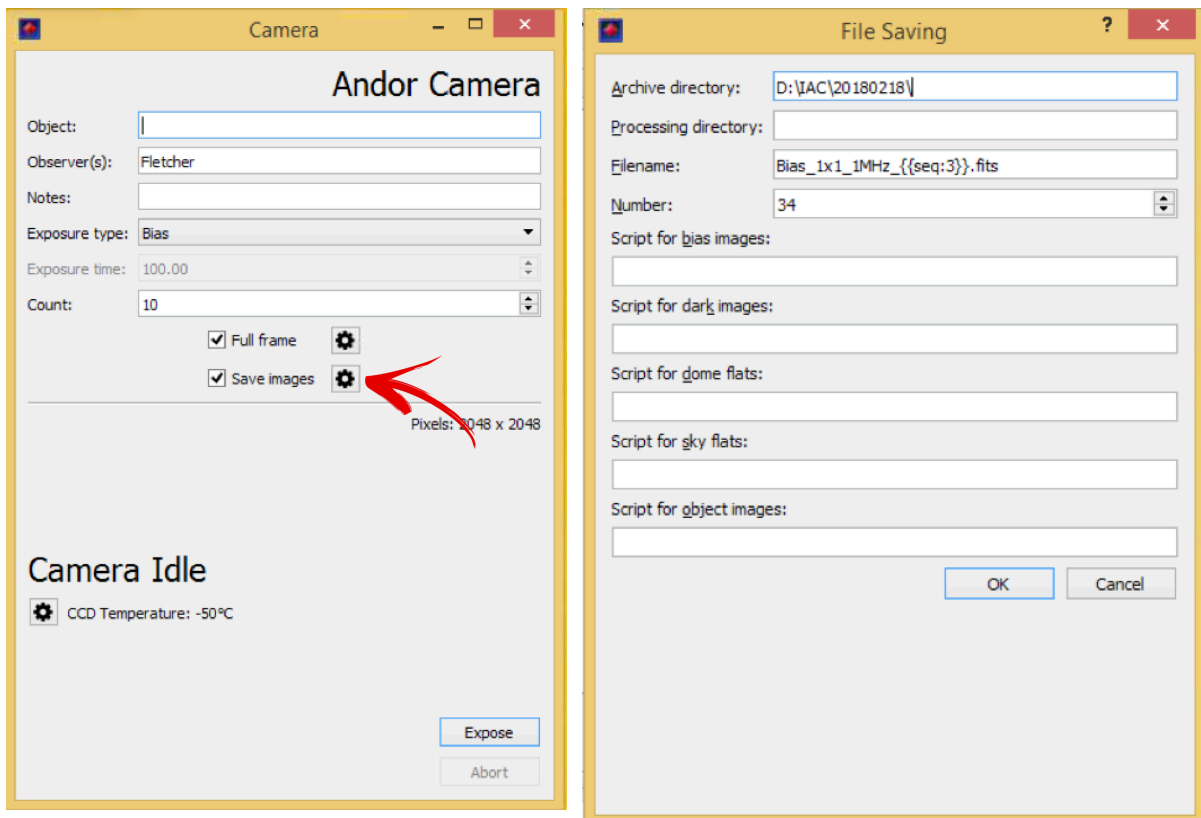


The first service in the list should be “ACE Node Service”, if the options stop & restart appear on the left (as shown in the picture) when we select this service, this means that the service is running, otherwise we should only have one option (“start”), so we click on this and wait until the service is running.

Once the ACE Node service is running, we can then launch the Connector Client.

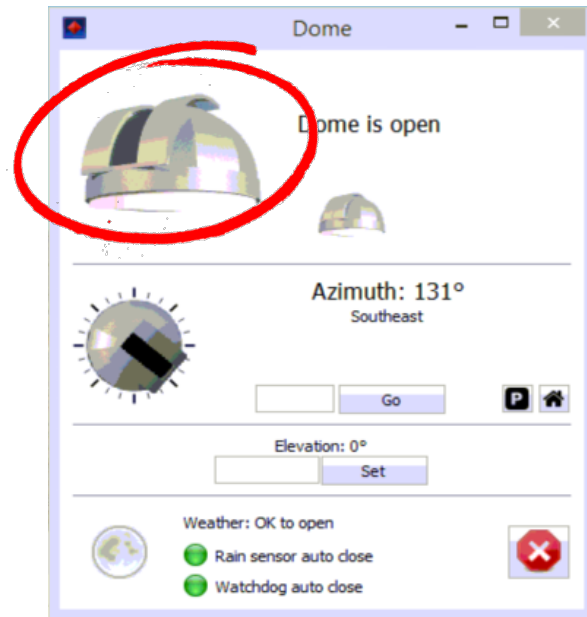
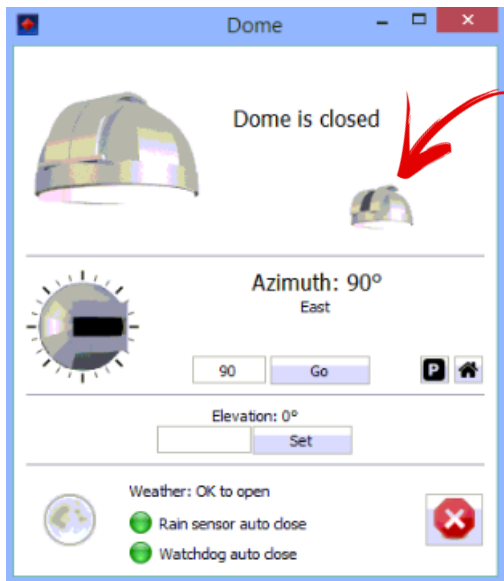
NOTE. Please, realize that there are two different “Connector Client”, one in the CCD computer and the other in the Telescope computer. As the service manager is only in the Telescope computer, the recommended sequence for re-initialize this software is: 1<sup>st</sup>. ACE node service in the telescope computer. 2<sup>nd</sup>. Connector Client in the telescope computer. And 3<sup>rd</sup> Connector Client in the CCD computer.

After checking all this, you have to make the directory where all images will be saved. To do so, you have to go to unit D:\ (Images) and into the folder IAC, you can make a new folder for your data, following this structure YYYYMMDD, which corresponds to the data of the beginning of your night (going there you will see folders of former IAC observers). You have to write this path (D:\IAC\YYYYMMDD\)) in the “Camera” acquisition window. In that window click on the gear to the right of the “Save Images” (left picture), and the “File Saving” new window (right picture) will pop up:

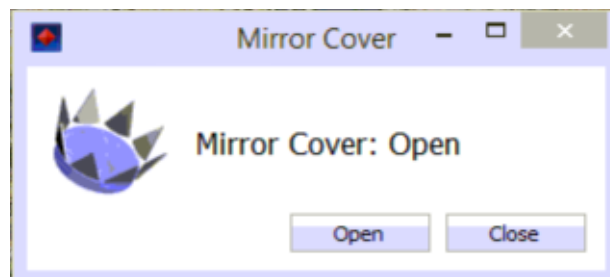


As can be seen, the first field is the path of our directory (D:\IAC\YYYYMMDD\), you have previously defined. In the third field (“Filename”), you have to define the format of the filenames, use the structure `{{seq}}`, which increase sequentially the number used to label the filenames, starting with the number specified in the fourth field “Number” (34 in the snap).

Check the weather conditions, and if these are good, you can proceed to open the dome. To do so, you only have to click on the icon of the open dome in the dome window of the telescope computer (see the snap to the left). Once the dome is open, you should see the snap to the right.



Next step, is to open the mirror cover...go ahead, that's really easy!!

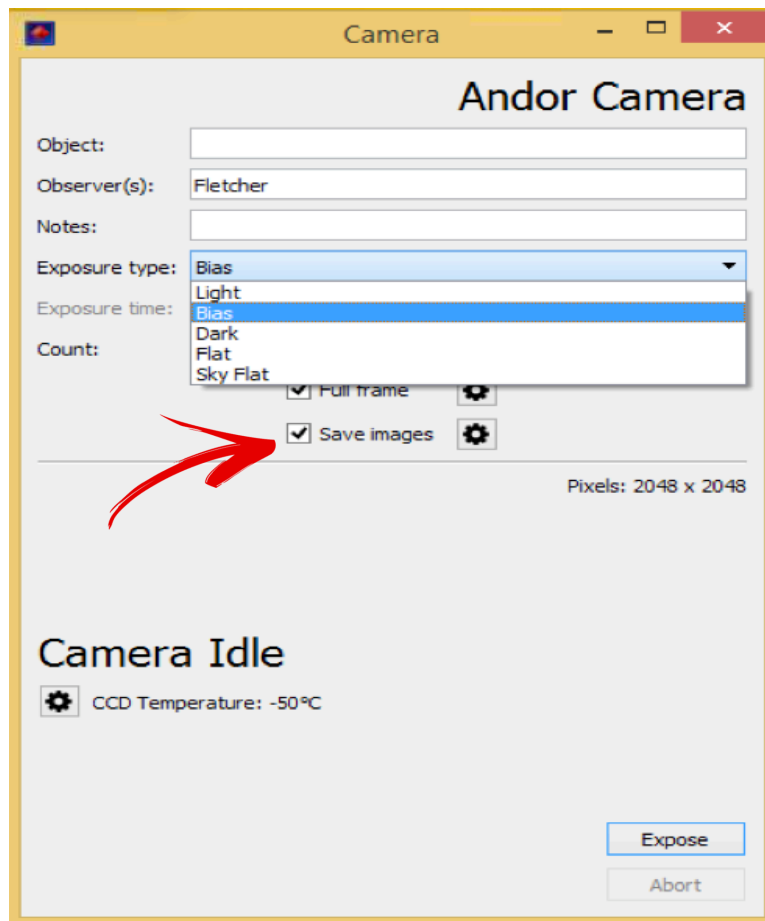


Let's summarize the tasks in order to prepare the night:

1. Make the connection to the THREE control computers
2. Check that everything is working, in particular the Connector Client, if not, launch it. Also check that the ACE Node Service is running.
3. Check that the weather conditions are good to open the telescope.
4. Define the folder where you will save your images.
5. Open the dome, and after that open the mirror petals.

### 3. BIAS & FLATS

The two types of images are taken from the CCD computer. In the Camera window:



In the fourth field, “Exposure type”, we pick out the option “Bias”, and you will see that the exposure time is set to zero, in the “Count” field, you define the number of BIAS images you wish. Make sure that the “Save Images” checkbox is ticked. You can fulfill the fields “Object”, “Observer” and “Notes” as you wish to appear in the header of the fits files, and finally click on the “Expose” button.

Concerning the flats, just pick out this option in the “Exposure type”, and proceed as described above. Just remember that in that case, you have to define the exposure time. It is not possible to take **dome flats** (there are no lights that can be controlled), so only **sky flats**. ([here](#) you will find some blank fields).

Some tips to take into account for the flat images:

- Take an image of 1 second exposure time and depending on the counts you measure on the image, rescale the exposure time in order to achieve a value between 35000-45000 (~2/3 of the dynamical range, where the CCD response is linear).
- At the beginning of the night, the filters should be sorted as:

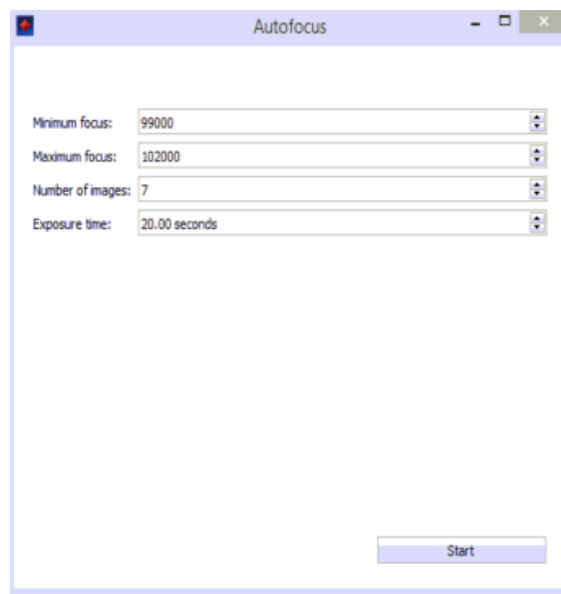
U u' z' B g' V R r' I i'

At the end of the night the filters should be sorted inversely.

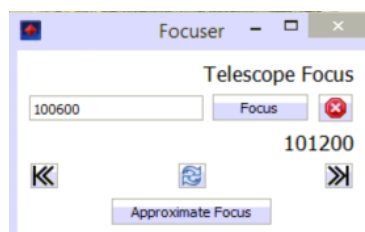


## 4. Autofocus

Dear observer, you are lucky!!!! The JKT has an autofocus script!! Normally, the focus should lie between the positions 95000 and 100000. The best option is to find a field with a  $\sim 8$  magnitude stars from any catalogue available (click [here](#) to check out some catalogues of standard stars), or using the Stellarium application (installed on the Telescope computer), and point to this field. The JKT autofocus takes a series of images at different positions of the focus, then determines the mean FWHM of the stars that are in the images, and calculates the position of the focus that minimizes the FWHM. So, in the window of autofocus (in the telescope computer):

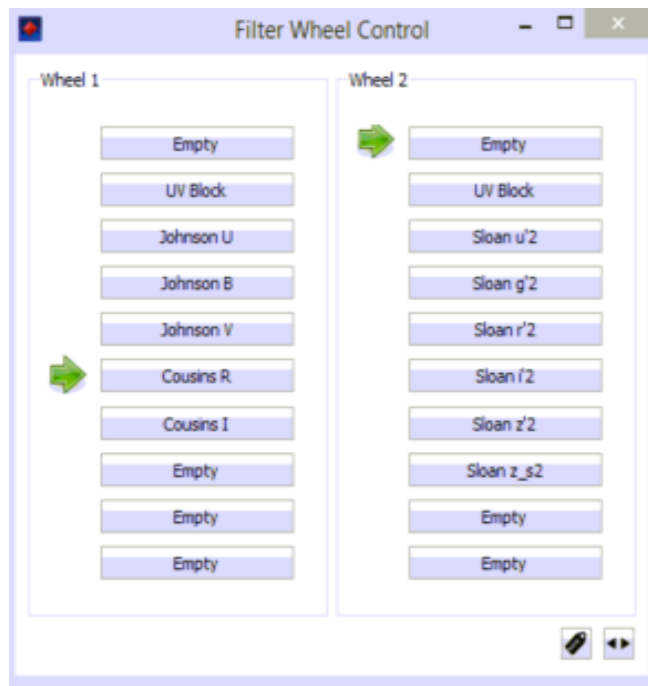


You have to fulfill the data needed to run this task, it is as simple as it pretends to be!!... Define the minimum and the maximum position of the focus you want to scan and the number of images to be taken, and the exposure time for each image. Take into account that the counts to be read, should fall inside the dynamical range of the CCD (so large exposures times could saturate the image). Clicking on the “Start” button, the script will do all the job, finding out the best focus position, you only have to “Accept” the estimated optimal value and then go to the “Focuser” window, to check that the focus position of the telescope is the same that the one calculated. If not, you have to type it by hand and then click on the “Focus” button.



## 5. Taking science images

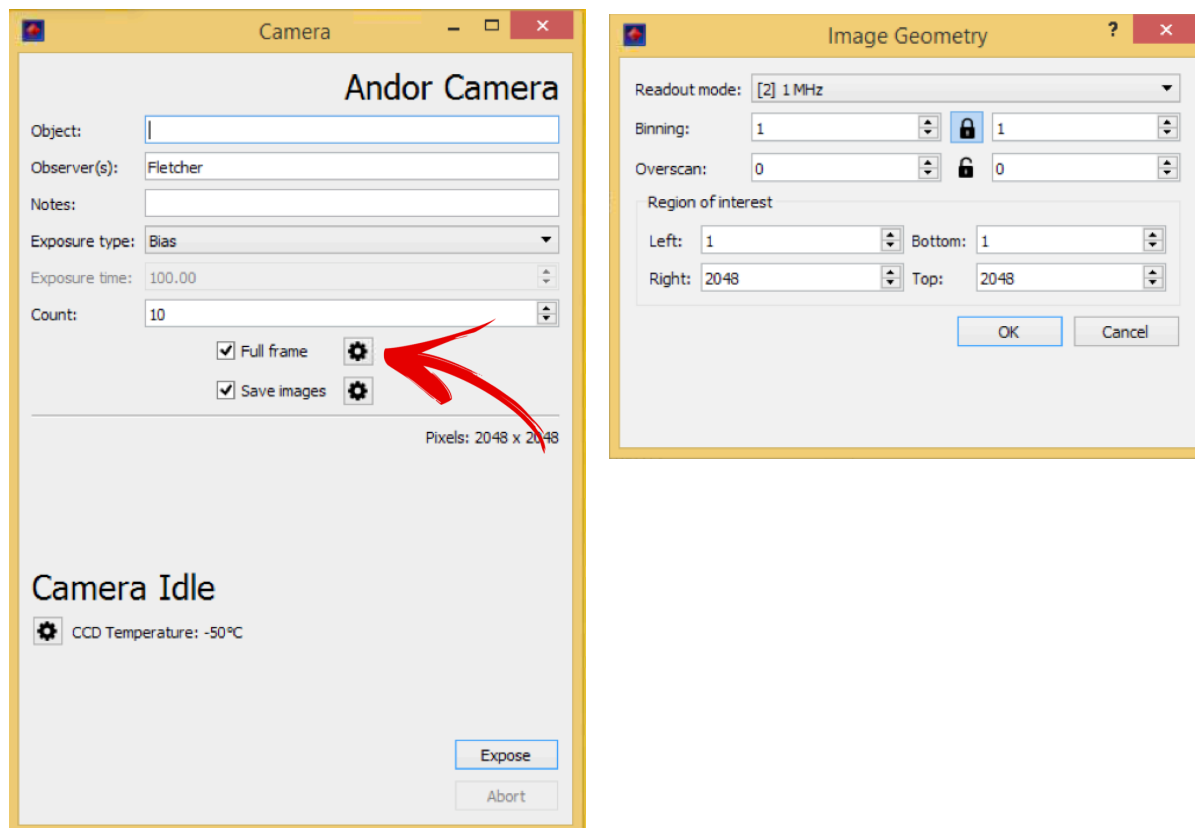
As described in section 3 (bias & Flats), you have to pick out the option “Light” in the “Exposure type” field, and then we proceed as usual: decide the exposure time, make sure that the “Save Images” checkbox is ticked, write the information about the “object”, “Observer” and “Notes”. Also remember to check that the filter is the one you need; to do so, use the filter wheel control window:



Just click on the filter you wish, and the filter wheel will do the rest...the green arrow indicates that the action is done.

About the **AUTOGUIDING**: The JKT does NOT have any auto-guiding system. Our experience shows that the tracking of the telescope is good enough for exposures times below 300 seconds. So, if you have to expose larger than that, consider to split it up in shorter exposures considering the above limit.

**BINNING & WINDOWING**. This option is available in the “Camera” window (PC CCD). You have to deactivate the “Full Frame” checkbox and click on the gear button just on the right, a new window “Image geometry” will appear, from which you can define the binning and the size of the window. Binning options start from 1x1 (default) up to 16x16, and any window size is possible, although square pattern would be typical.

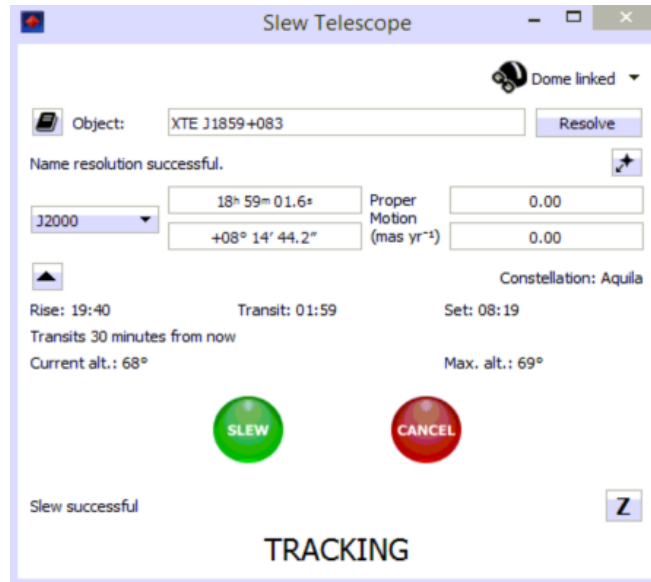


To summarize:

1. Pointing the telescope to your target (see next section)
2. Select "Exposure type" as "light"
3. If you want to change the file names (starting from a different number, for example), click on the gear right to the "Save Images" in the "Camera" window.
4. Make sure that the "Save Images" checkbox is ticked.
5. Fulfill the "Object", "Observer" and "Notes" fields to appear in the fits header.
6. Click on "Expose"

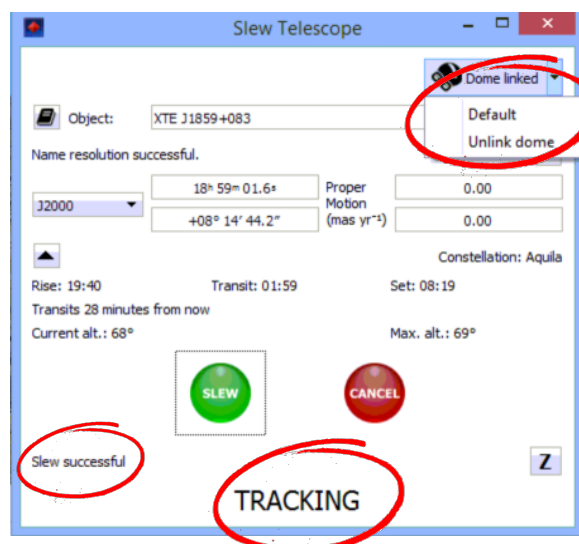
## 6. Pointing the telescope

This task is done from the Telescope computer, where you will find the “Slew Telescope” window, which allows you to move the telescope:



In the field “Object”, we can write the name of our object according to SIMBAD or NED databses. Clicking on “Resolve” button, the application will search the object in these databses and will download coordinates and proper motion.

With the correct coordinates, you have to make sure that the dome follows the telescope pointing, to do so the dome must be “linked” to the telescope, as shown at the top-right corner. If not, just click there and select the “Default” option:



Finally, just click on the green “Slew” button to point the telescope to the coordinates introduced.

You also can write the coordinates of your target manually in the corresponding fields; on the left menu you can choose between four options: J2000/B1950: in that case you have to introduce R.A. and Decl. coordinates. HA/DEC: Hour Angle & Declination coordinates. Solar System: you can pick out several objects of the Solar System. Once you have introduced the coordinates, follow the above instructions (dome linked and Slew).

When the telescope will reach the desired pointing, it can be read “TRACKING” at the bottom of the window and also “Slew successful”. In case you read another message, such as “IDLE” or “**Previous slew aborted**”, don’t be scared, just go to the troubleshooting section and follow the instructions.

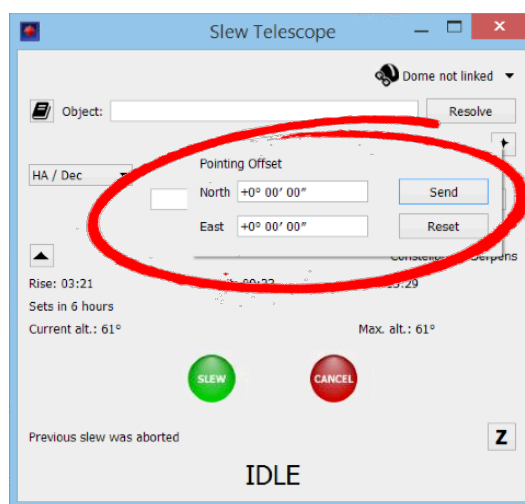
There are two extra buttons in this window:



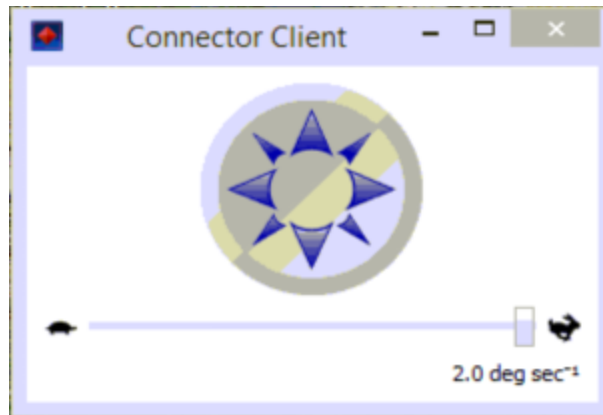
This is used to send the telescope to the zenith position. Once you click this button, you don’t need to click on the green “Slew” button. If the telescope doesn’t respond properly (giving a message like “Previous slew aborted”), then we can introduce the coordinates manually: choose HA/Dec and type 00:00:00 as HA and 28:XX:00 as Decl. and then click on the “Slew” button.



This is used to make offsets with the telescope. Once you click on it, a new window will appear, in which you can define the offset you wish:



Offsets can also be done manually using the “Connector Client” window:



In that window, use the sliding bar at the bottom to define a slow motion (turtle) or a quick motion (hare). The direction of the offset will be given by the blue arrow that you will click; then the telescope will be moving while you keep the arrow clicked and will halt when you stop to click the arrow.

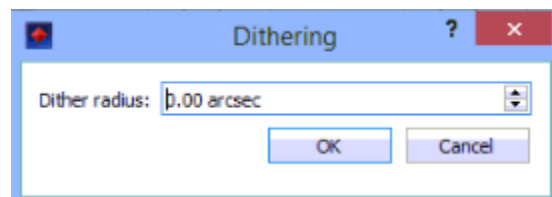
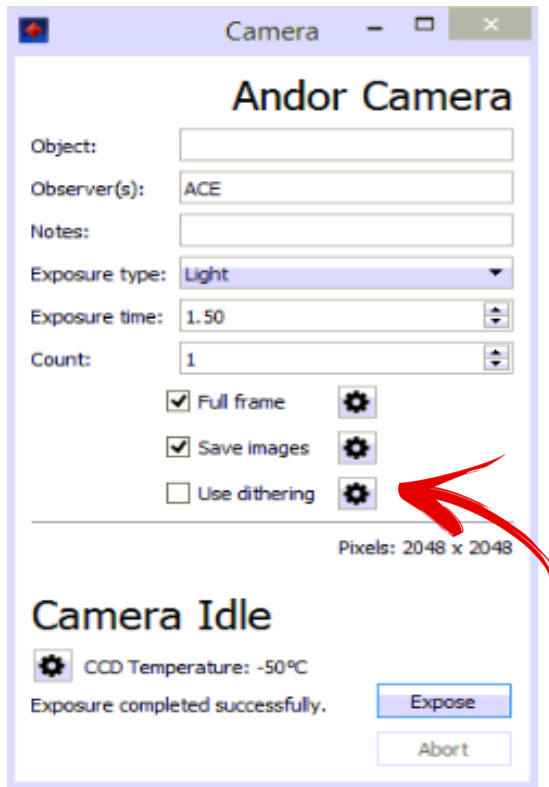
To summarize:

1. Define the object or its coordinates by resolving the object or by introducing its coordinates manually.
2. Make sure that the dome is linked to the telescope.
3. Click on “Slew” green button.



## 7. Dithering patterns & differential tracking

The JKT offers very restricted options for the dithering patterns; this is done in the Andor Camera control window, which can be found in the CCD computer, but also in the Telescope computer.

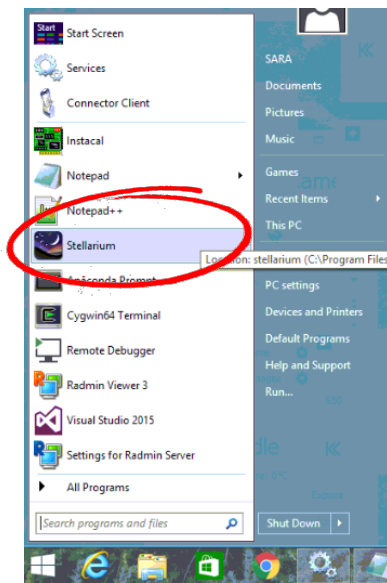


As easy as it seems...just click on the gear button on the right of the “Use dithering”, and a new window will pop up, in that window define the dithering offset to be applied after each exposition. After that, remember to tick on the corresponding checkbox.

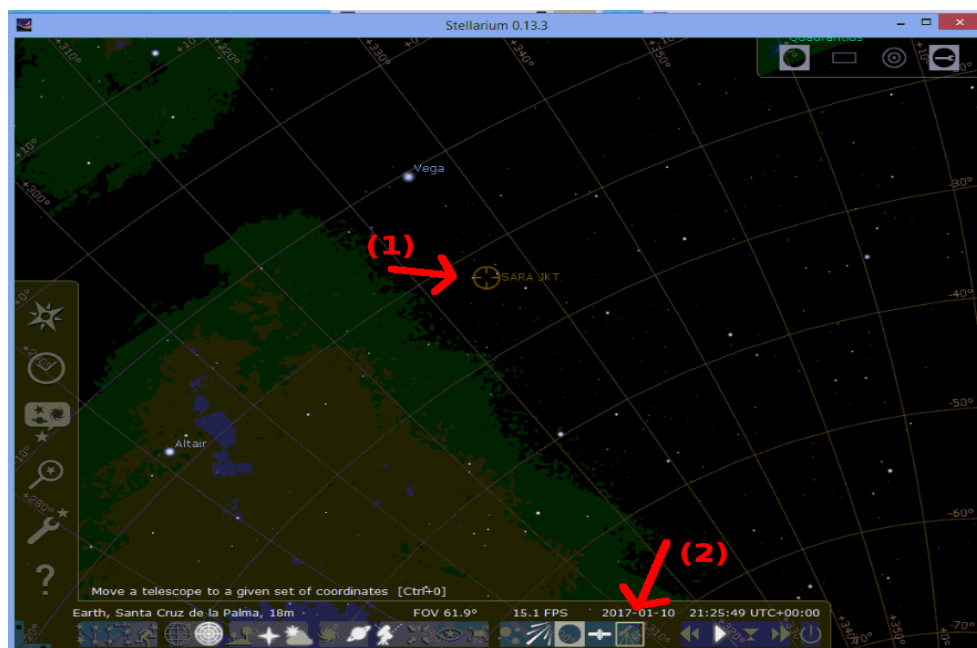
Concerning the Differential tracking, this option is only available for objects of the Solar System, so far.

## 8. Stellarium

*Stellarium* is a planetarium software that shows exactly what you see when you look up at the stars, this means from the JKT. The application is already installed in the Telescope control computer. The software can be found in the “start” menu:

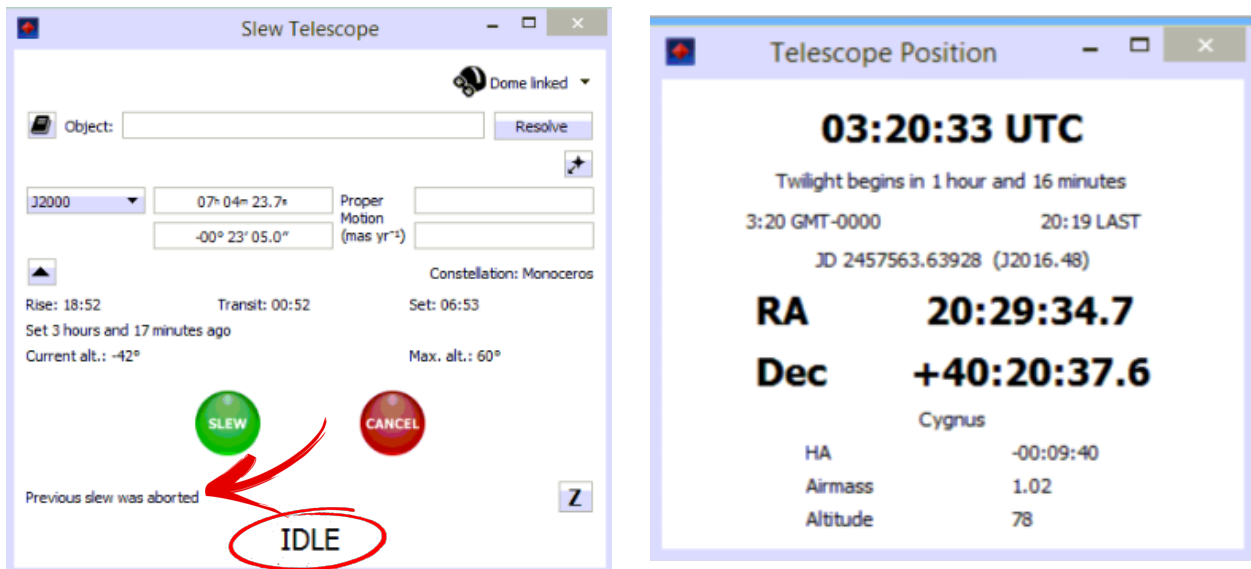


The application also displays the telescope pointing (1) and you can also pick out an object and send the telescope to point to that object directly (2):

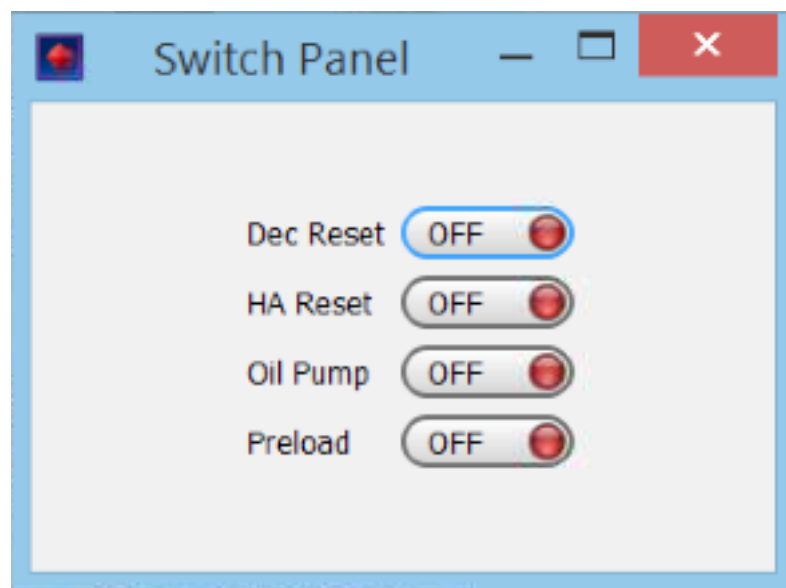


## 9. Troubleshooting

- ❖ The telescope does not reach the desired position and apparently keeps moving. The symptoms are the following:
  - (a) In the “Slew Telescope” window you read this message: “**IDLE**” or “**Previous slew was aborted**”.
  - (b) In the “Telescope position” information window, you see a significant variation of the R.A. and Dec. coordinates.



You should go to the “switch panel” windows, from which you can control the motors of the telescope:

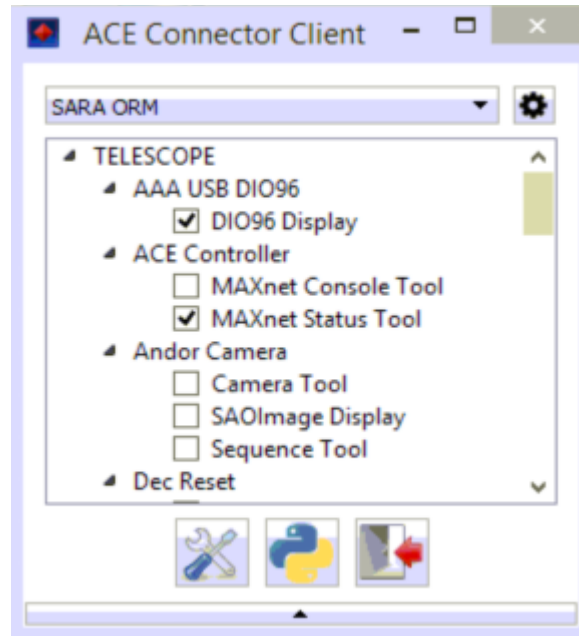


You have to turn on the “Dec Reset” switch and then off. We repeat the process for the “HA Reset” switch, once the two switches are back to off position, you then click on the green button “Slew”.

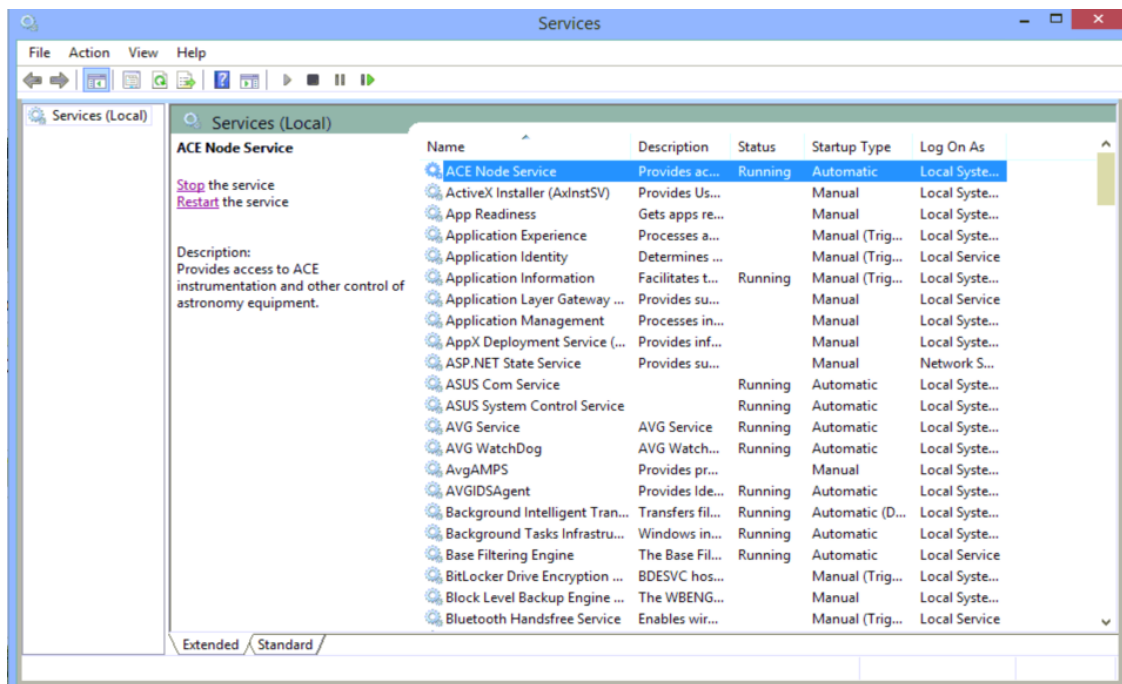
All windows show the “X” button (used to close the window) in red and/or the windows don’t respond.

In than case, there are three levels of actions to fix it.

First level: you should close the “ACE Connector Client” window, and reinitialize the application from the “start” menu of the telescope computer.

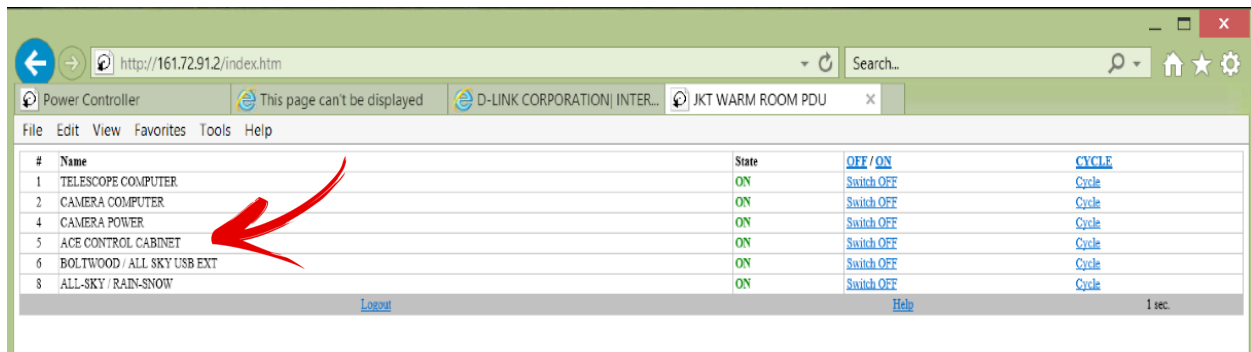


Second level: In case that the problem persists (first level action doesn’t succeed), then you have to shut down again the “ACE Connector Client” window, and go to the “services” window and restart the “ACE Node Service” (just click on the “restart” clickable word in red)



Once this service is restarted, you have to initialize again the “ACE Connector Client” from the “start” menu.

Third level: If the problem still persists, then Switch off the “ACE Connector Client” window, after “stop” the “ACE Node Service” (click on “stop” instead of “restart”), then go to the “device Manager”, which is in one tag in the Internet Explorer of the Observatory computer, and from there you have to switch off and on the “ACE CONTROL CABINET” (line 5), simply click on the blue “Switch OFF” to the right.



If this tag is not available in the Explorer browser, you can login using this IP: 161.72.91.2 (user: SARA, password: orm).

After some seconds, the ACE Control system is initialized, and you can proceed starting the “ACE Node Service” (just click on the “start” word), and finally switch on the “ACE Connector Client” window.

If you find any other problem with JKT that should be included in the troubleshooting section, or you have any comment on this manual, please send an e-mail to the Telescope Operation Group staff: [ttnn\\_a@iac.es](mailto:ttnn_a@iac.es)