

EQAlign 2.0

<http://eqalign.sourceforge.net/>



Polar Align Quick Start Guide

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Introduction

Hello and welcome to EQAlign 2.0!

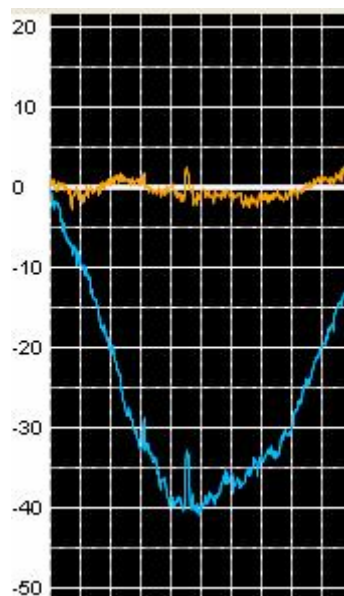
Although EQAlign allows for various processes, this small guide only seeks to explain the procedure to polar align. In further documents we will expose other program features.

A typical polar align session always consider the next steps:

- * Well level your mount; If not, any mount-azimuth movement will cause a little real-altitude change and any mount-altitude change will cause a little real-azimuth change.
- * Well balance the scope. If not, a little amount of measured drift, would be due to gravity action!
- * Rough polar align. The closest previous align, the more fast the whole process will be.
- * Measure camera angle. Each meridian needs a camera angle measure.
- * Measure drift for correcting azimuth or altitude.
- * Measure drift for correcting the other axis (altitude or azimuth).
- * If a more accurate align is needed, we can measure again first axis.

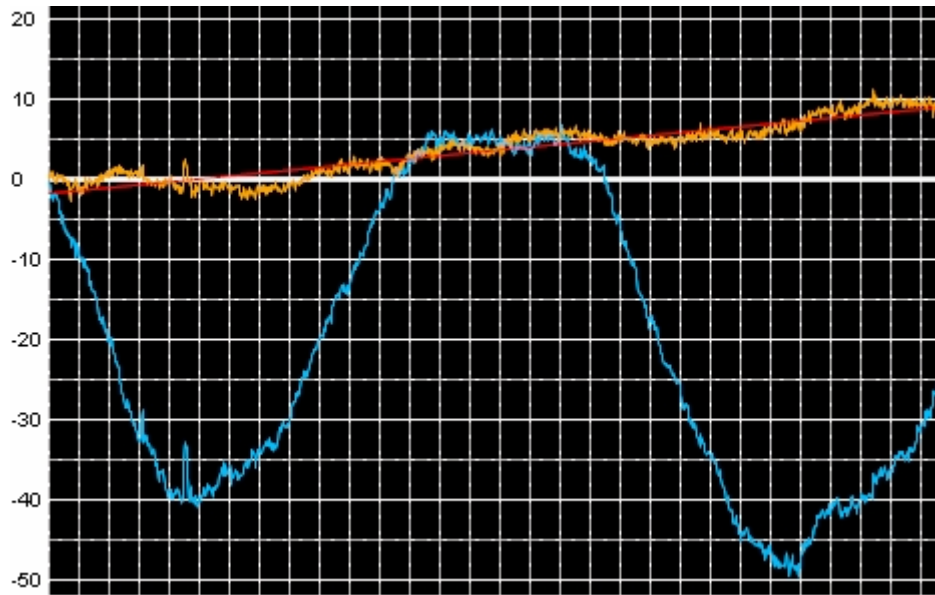
We recommend the measure drift time for each axis to be between 10 and 15 minutes. Although EQAlign does a linear fit to estimate the trend angle of drift, depending on several cases, the declination drift may present a low amplitude and long period waveform.

Let see a real case. The next figure show the first 5 minutes of a real measure:




Orange curve represent declination measures and blue curve right ascension measures. Declination drift fits to an almost zero rect, i.e. it could seem that there is not drift and in consequence we could think the axis is correctly aligned.

But this measure data belongs to a larger measure session:

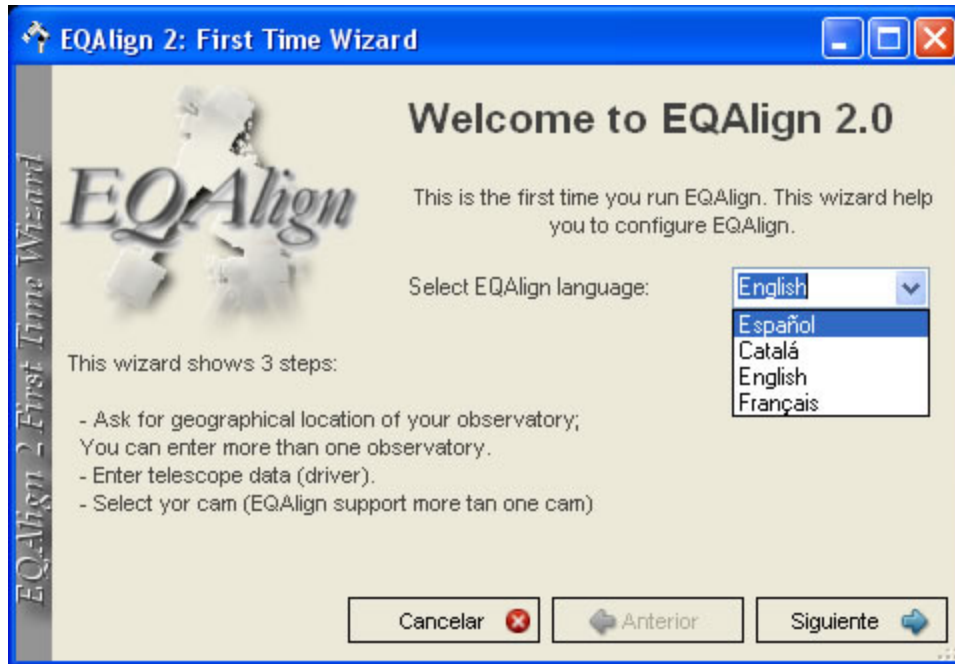


As you see, there is an evident declination drift. At about 10 minutes EQAlign could fit to the real drift angle (red line).

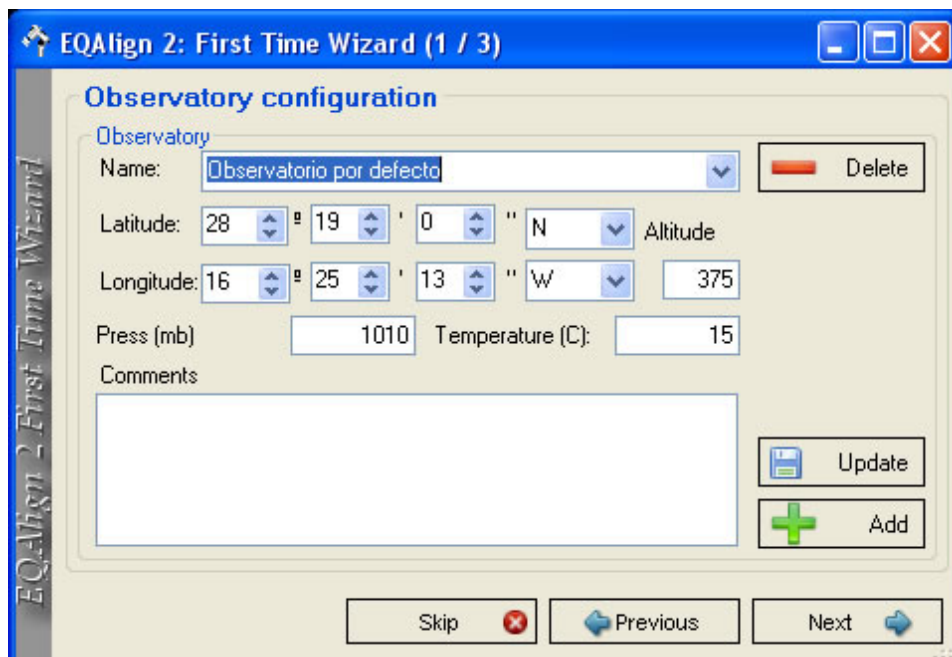
1. Setting configuration parameters

You will access to "First Time Wizard" (FTW), the main configuration parameters dialog, when you run EQAlign for the first time. Also you will access to this FTW dialog when you select "File" -> "Config Assistant" menu option or press the tool bar button 

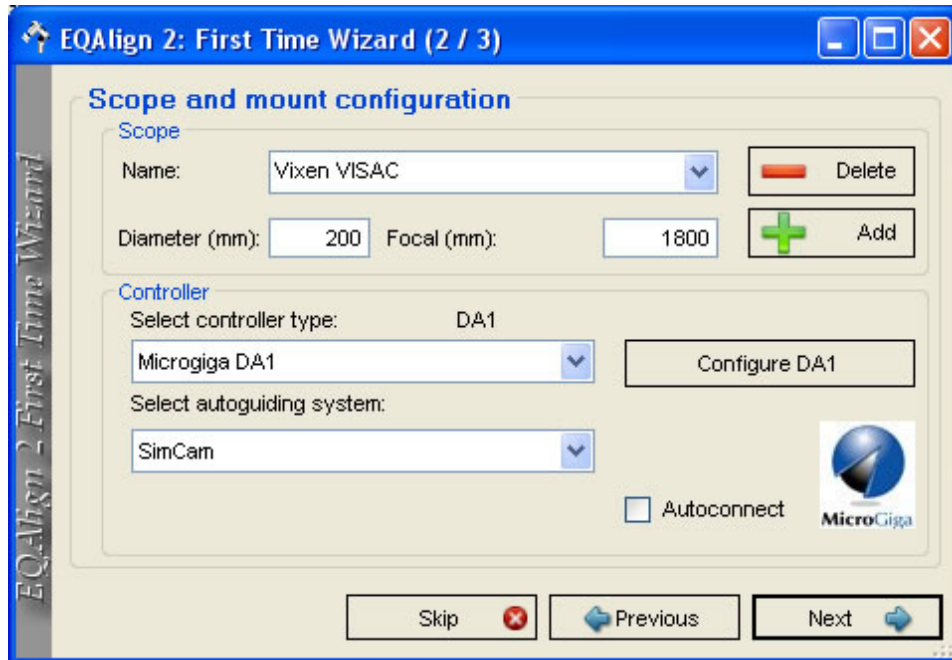
The first step in FTW allow you to select user interface language, there you will be able to select into Spanish, Catala, English or Francais:



As the default language es Spanish, you will se a button labeled "Siguiente" that means "Next". Please select it to access to next config step, where you'll be able to add and delete as observatory sites as you desire. It's usefull if you use to observe in same few places, you can add them once and they will be stored in the program database. Do not set sign for North/South or West/East but select the N/S W/E values from the combobox. There you will also be able to introduce the site altitude, press and temperature:



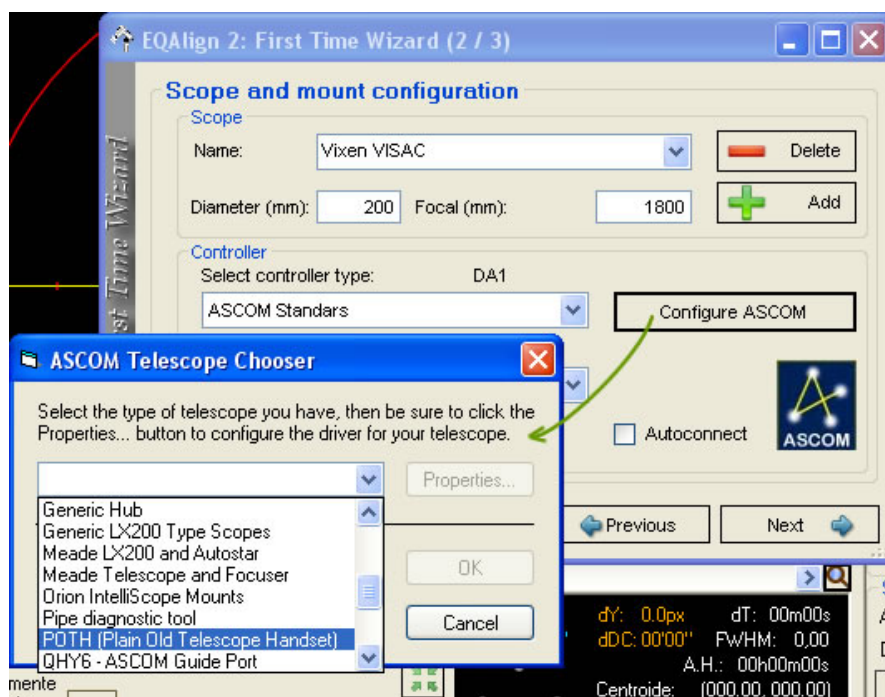
The next step will allow you to select scope name, diameter (in mm) and focal length (in mm), and the Scope and guider controller. You may add or delete any number of scopes, as sometimes you will want to measure from main or guide scope:



EQAlign can manage different ways to control your scope and guider. If you have a ASCOM, LX200 or DA1 from MicroGiga, you may control goto and sync commands but also your guide commands by ASCOM, LX200 or DA1 protocol. EQAlign is able to manage many cases of use:

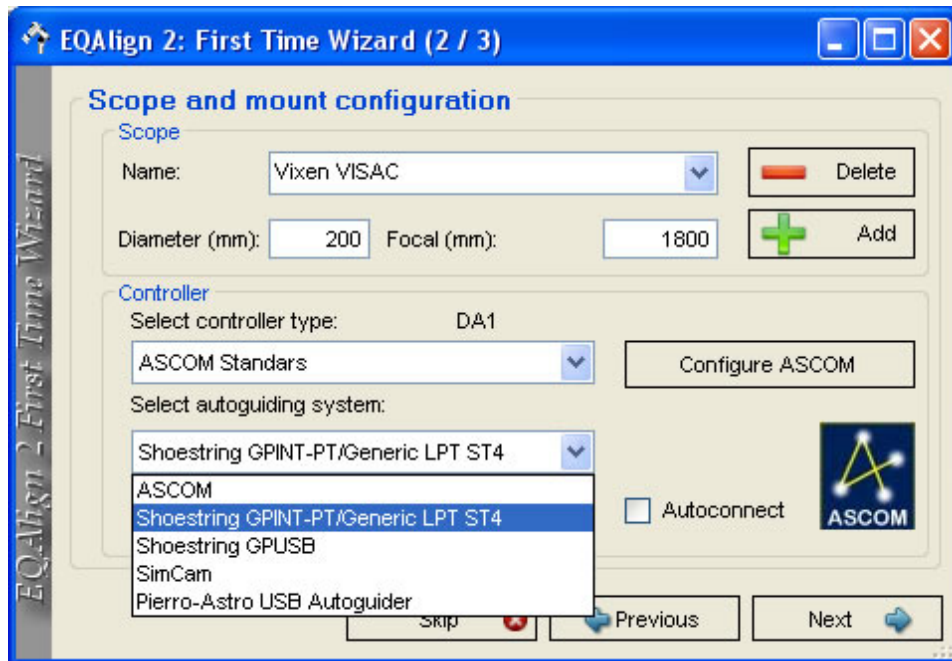
- SCOPE: ASCOM – GUIDER: ASCOM – Camera: QHY5
- SCOPE: ASCOM – GUIDER: QHY5 – Camera: QHY5
- SCOPE: ASCOM – GUIDER: GPUSB – Camera: QHY5
- SCOPE: ASCOM – GUIDER: QHY5 – Camera: Toucam
- ... and so on.

First you can select scope control, let's suppose you wish to select ASCOM-POTH. First select ASCOM from "Selected controller type" combobox and then press "Configure ASCOM" button:

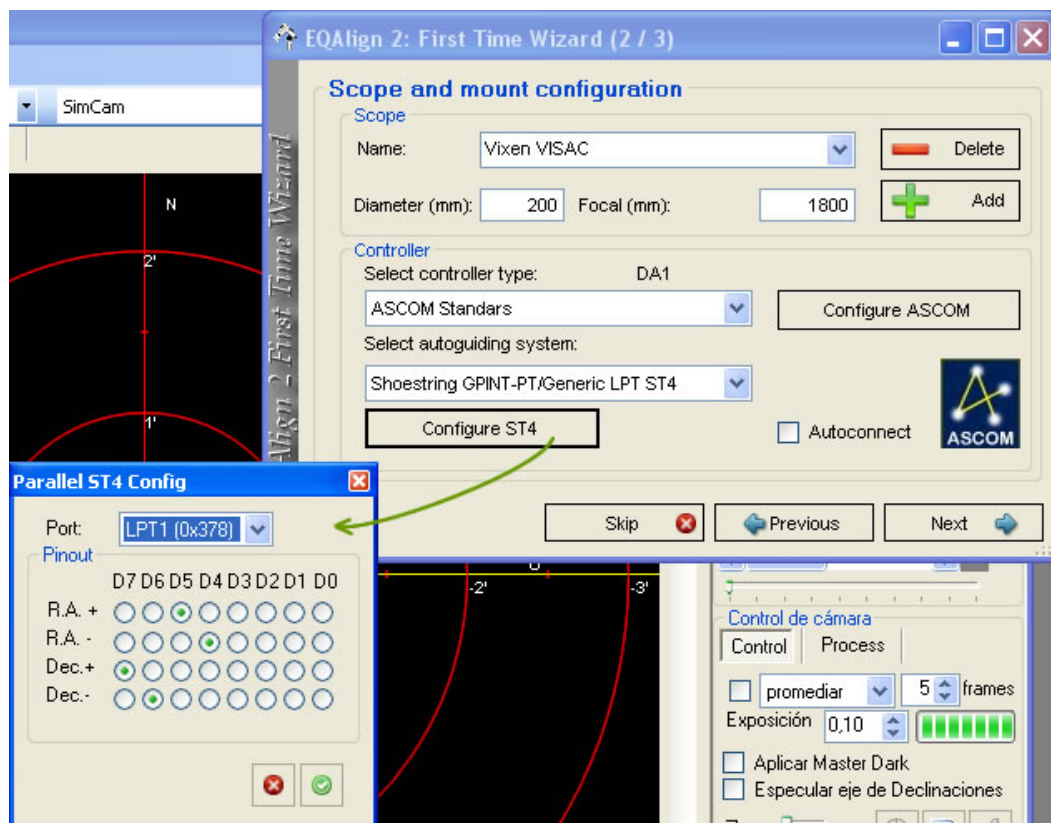


EQAlign do not need a scope controller, although it will make many things easy you can align without it. If it is your case, please select "Manual" option in controller type combobox.

You can select autoguider controller by pressing "autoguiding system" combobox. If a QHY5/Artemis/ATIK is present and detected, eqalign will show it in the list as this camera has a ST4 port. For example let's suppose that you wish to control guider by a generic parallel port ST4 raly box. In this case select "Shoestring GPINT-PT/Generic LPT ST4" option:



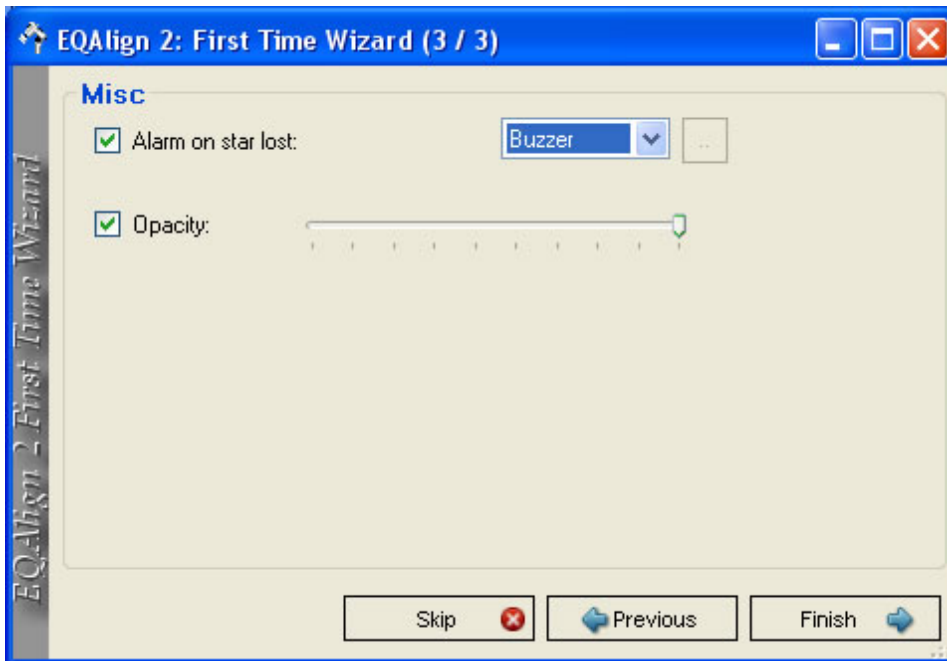
and then press "configure ST4" button:



There you can select individually each parallel port pin (D0-D7) assigned to each ST4 pin. When finished, press Ok button.

If you select option "Autoconnect", program will try to connect to selected controllers (for scope and guider) each time you run EQAlign.

Next step will allow you to select miscellaneous options:



If you check "Alarm", you can select the sound that the program will play when a star is loosened (for example if it's cloudy). This option can be useful or molest, you have to experiment with it.

Also you can select the global form opacity. This could be useful if you want to "semi-see" the main camera acquisition on background while you are guiding from EQAlign.

This is the last step, you may press "Finish" button to save selected option. In any step you can also push "Skip" button to cancel and return to the previous state, but scope and sites added will not be cancelled.

Next page you can see the main program window:

Observatory select: at main tool bar, allow you to select the current observatory coordinates from the ones you added in FTW.

Camera select: at main tool bar, allow you to select into the cameras that program has detected at launch. If you connect a new cam, EQAlign will not recognize it until you exit and run again the program.

Scope select: at main tool bar, allow you to select into the scopes you added in the FTW configuration dialog.

Main process buttons: at the left, allow you to select into the different processes into EQAlign (Projection, measure camera angle, measure and correct polar align, autoguide, measure mount periodic error, analyze measures and database object search)

Scope movement control: at bottom left allow you to direct control move direction as you do with the scope control pad.

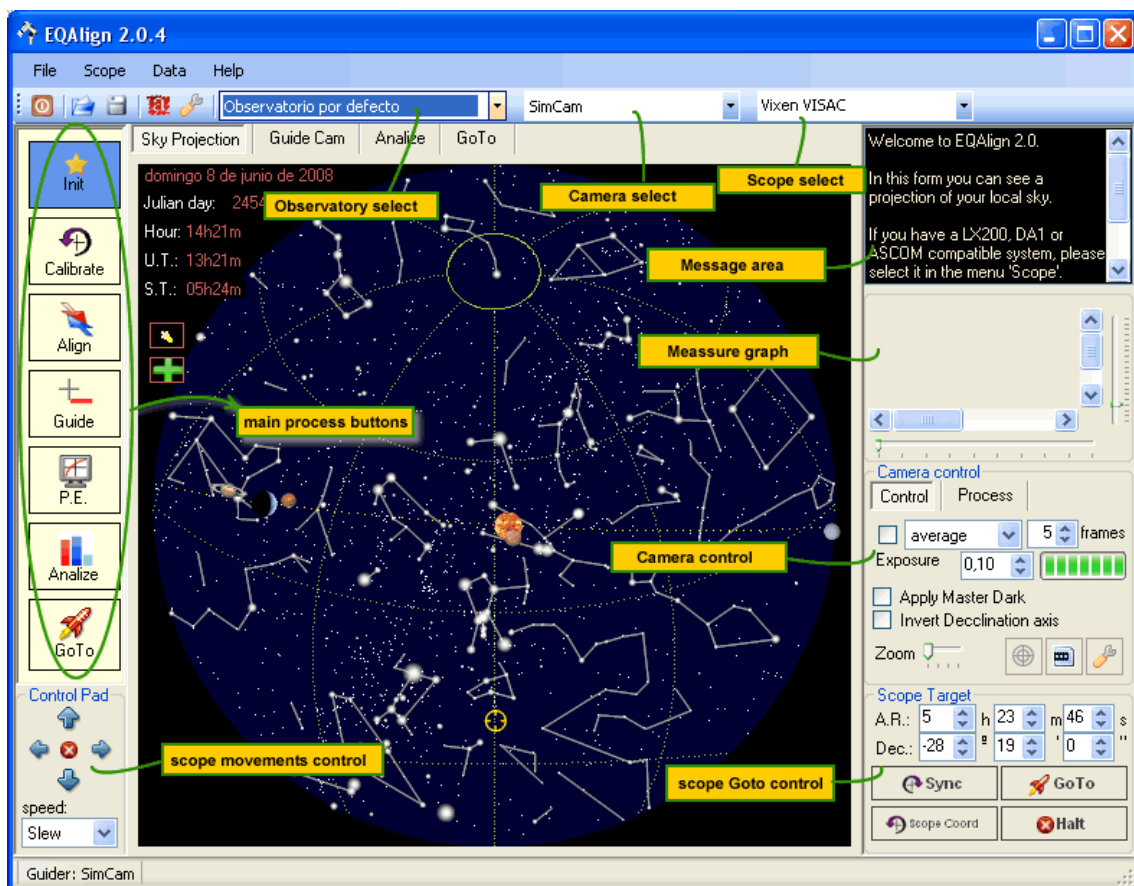
Message area: will show you the different welcome messages to any process and status messages at different stages.

Measure graph: will show the current measure graphically. Blue color for Right Ascension values, Red color to Declination values. You can slew two slide bars for zoom vertically (arcsec values) and horizontally (time).

Camera control: in this control you can change the mode you acquire images; you can average or sum a certain selected number of frames (very useful if you are working with no modified webcams), select the exposure time, compute and apply masterdark, invert declination axis direction, zoom into a selected star or launch camera config dialog. Each camera has its own config dialog. For a modified webcam, for example, you can select LX control mode into parallel LPT or serial COM ports.

Also you can apply some image process (Process button) as histogram, gamma, contrast or blur. Image process are performed at 32bpp precision. For example in a non-modified webcam, when average or sum images you will have a more large dynamic range than 256.

Scope Goto control: will allow you to input coordinates to perform a Goto or/and synchronize, get current scope coordinates (if supported by controller) and halt a current slew.



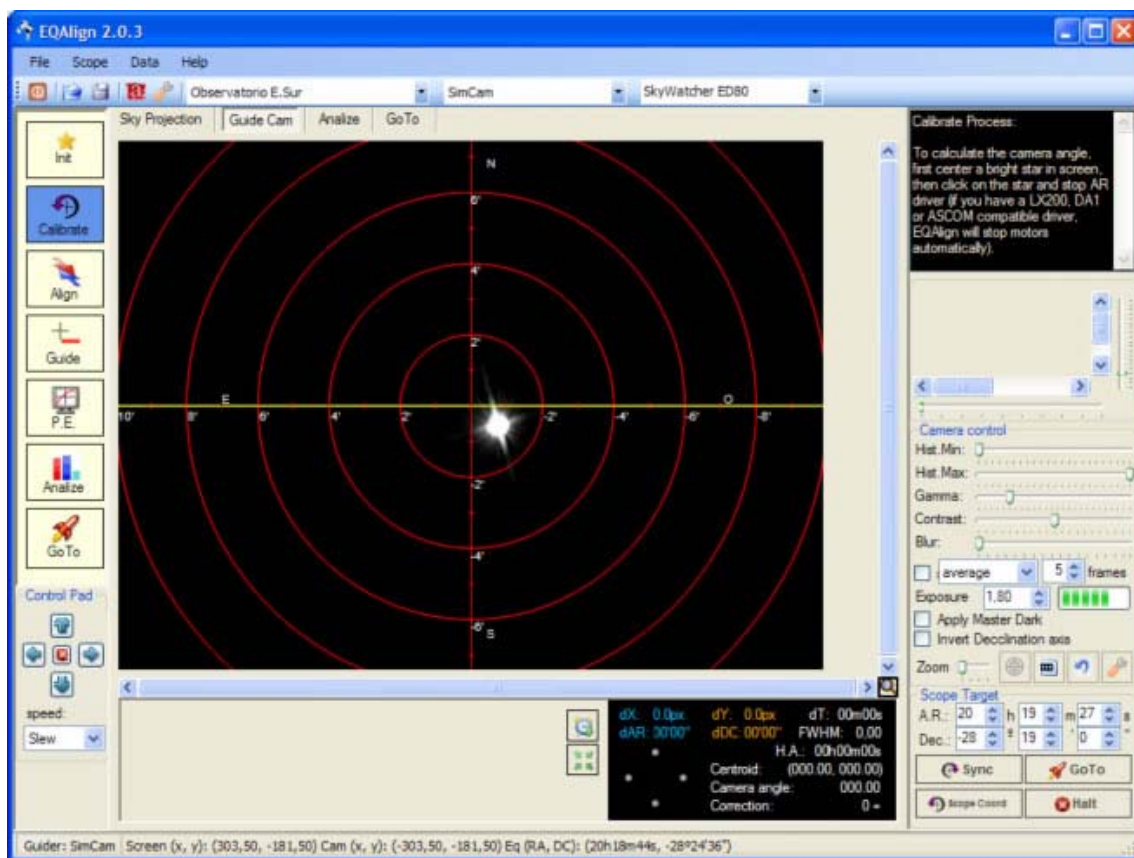
2. Measuring Camera angle

Before doing any measurement, the system must know the camera rotation angle. Although theoretically only have to do this once, due to the German equatorial mount design, the camera East-West direction is reversed when the telescope switch pointing to a star that is the other side of the meridian. The process of measuring the angle does not require a much time and it is advisable to do so in each star that we are going to be measured.

We will suppose that you already have a star on the camera field of view.

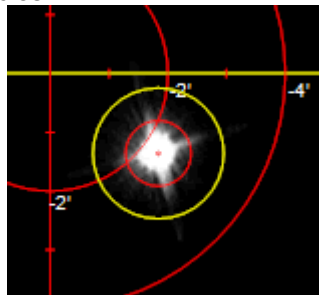
a) Select Calibrate process:

By clicking "Calibrate" button at the left vertical toolbar:



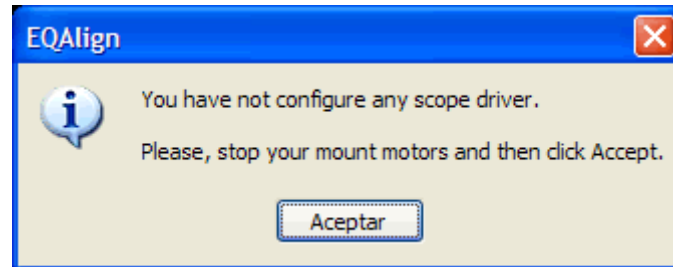
b) Select star:

Center star with the R.A./Dec button pad and then mouse click on it. The star will be shown rounded by two yellow and red circles.




c) Push start button: 

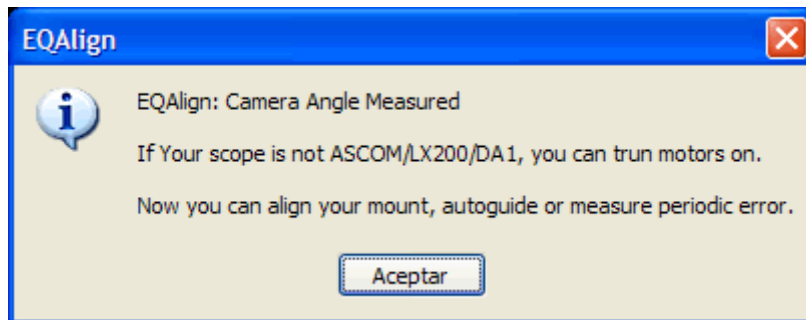
If you have an ASCOM/LX200/DA1 compatible system, EQAlign will either send east pulses or stop motors (depending on the system). If you do not have a computerized scope or it is not connected, EQAlign will show the next dialog:



If you can not stop motors, also you could send east commands by pressing button pad, but be sure to have selected guide rate first!!

d) Wait while measuring angle:

While the star is taking its own movement in the West direction, EQAlign will compute the camera rotation angle. It is imperative that you let the program to measure for a few seconds to exclude the effects of turbulence. The program ends automatically when it detects that the star is close to about 50 pixels from the edge, but you can manually stop it when you consider by pressing the button . The program will show the following message:

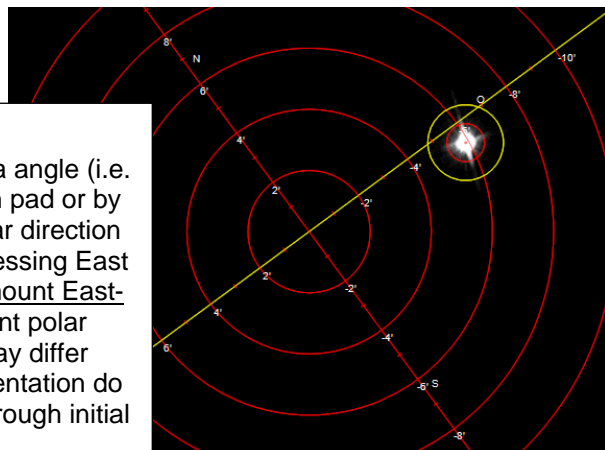


If an ASCOM / LX200 / DA1 system is connected to EQAlign, the program will automatically start motors on, if not you must manually connect motors or stop sending east pulses.

The camera angle is now measured!

Tip!

It is not exactly the same to measure camera angle (i.e. East-West direction) by pressing East button pad or by stopping motors. By stopping motors, the star direction will show the sky East-West direction. By pressing East pad button, the star direction will show the mount East-West direction. Depending on the initial mount polar align, mount and real East-West direction may differ considerably. Several scope control implementation do not allow to stop motors and in this cases a rough initial align is recommendable.




3. Measuring and correcting Altitude axis

a) Select Align process:

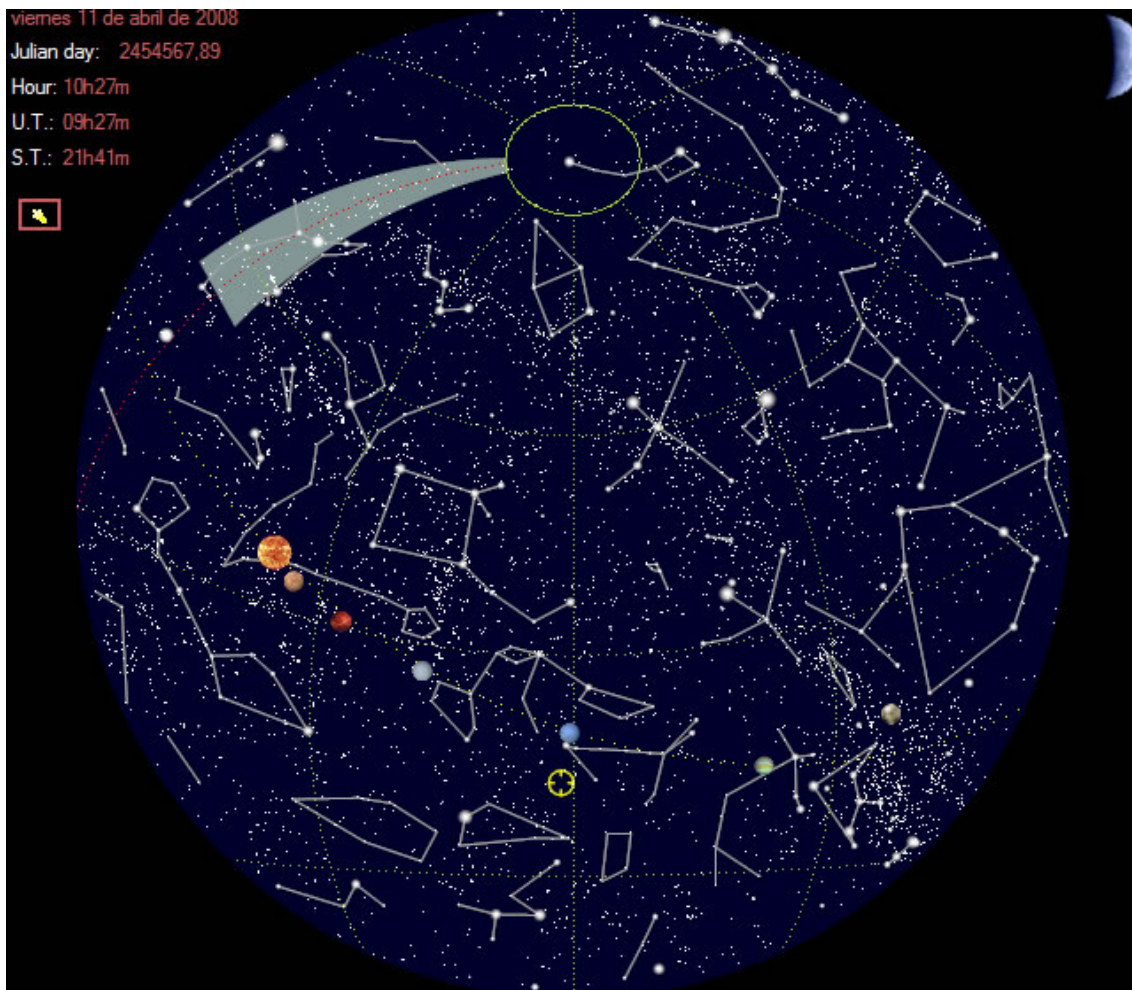
By clicking "Align" button at the left vertical toolbar:

b) Selecting a star:

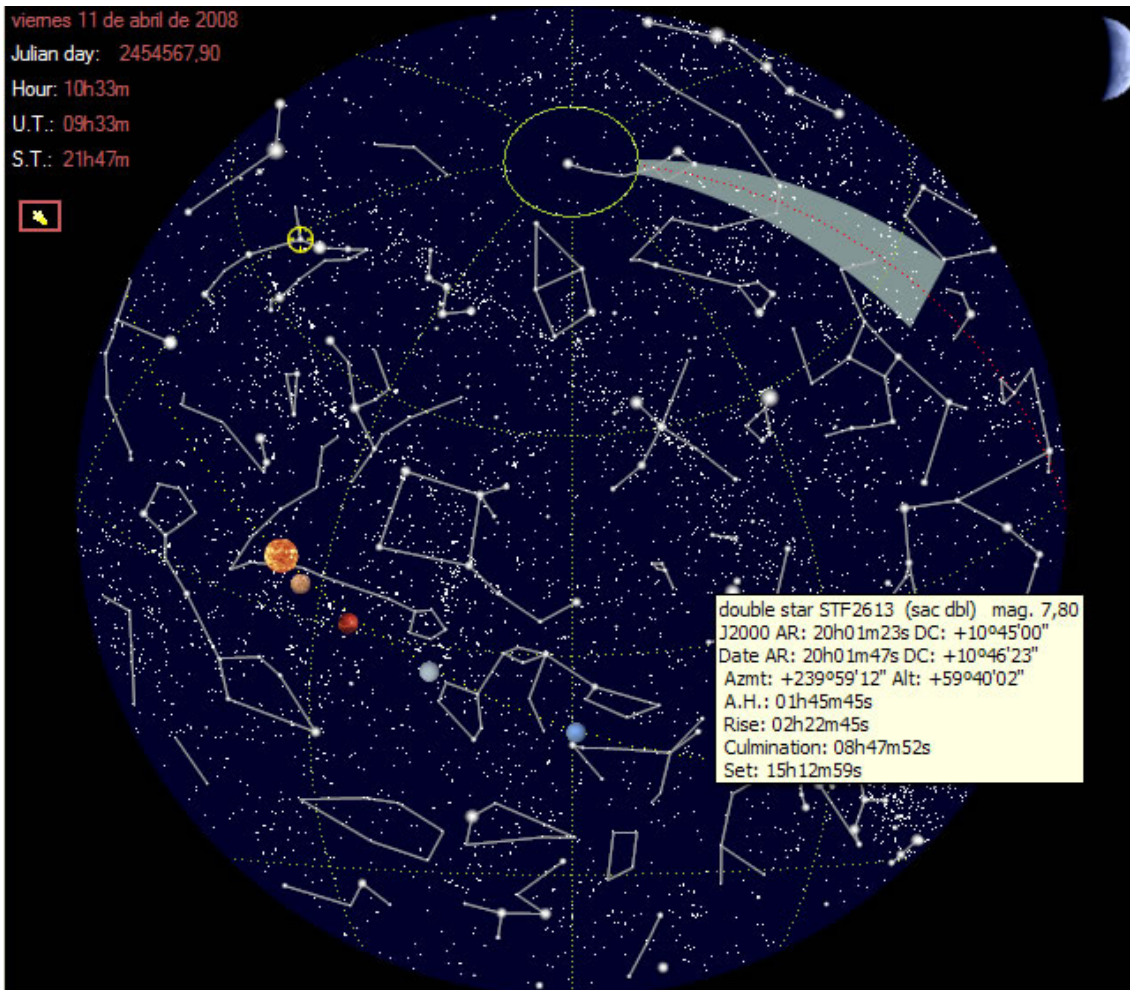
On bottom screen, select to correct Elevation, East or West, option and then select  button to find a suitable star.



EQAlign will show the projection screen, where the selected zone is highlighted. You only need to mouse click in a star in the highlighted zone that fits to your real visibility conditions. Remember that the more near to 6h or 18h Hour Angle the star is, the more accurate the correction will be.



East secure zone around 18h hour angle



West secure zone around 6h hour angle

When you select a star (mouse-click) the program will return to align process screen. The star equatorial coordinates will be updated on scope target control:


Scope Target			
A.R.:	4	h	15 m 30 s
Dec.:	48	°	25 ' 46 "
Sync		GoTo	
Scope Coord		Halt	

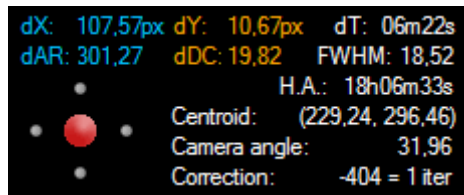
If the scope is connected, you can click on "GoTo" button to slew to selected star coordinates.

The status control will also show information about star hour angle (in this example, 17h57m):



c) Starting measures:

First center star and then push start button . EQAlign will now compute centroid difference measures. The computation results will be shown into information control:



dX: Show centroid differences in pixels in X axis of rotated camera system reference.

dY: Show centroid differences in pixels in Y axis of rotated camera system reference.

dAR: Show the drift value in Right Ascension in arcsec.

dDC: Show the drift value in Declination in arcsec.

dT: Show the time lapse from start in minutes

FWHM: Show the star FWHM (Full Width at Half Medium) value in arcsec.

H.A.: Show star Hour Angle


Centroid: star centre in screen coordinates X and Y

Camera angle: Show camera angle in degrees

Correction: Show the current amount of correction needed.

d) Ending measure and correcting error:

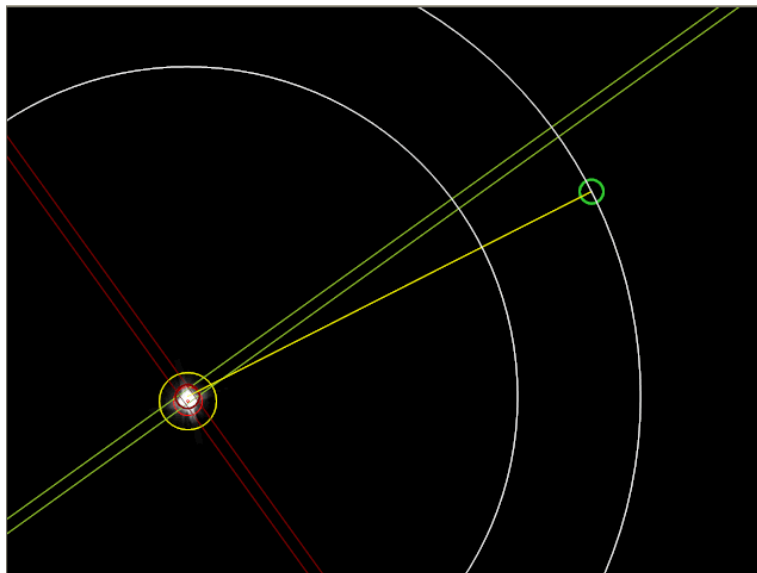
As we discussed, always give system at least 10 minutes to measure drift and compute error.

After that you can stop measure process by pressing stop button , EQAlign will show the next message at main message control:

”Please place the star with the control pad into the init correction point (little red circle). If you have a compatible computerized mount, you can push the ‘autoguide to init point’ button. Then turn the Altitude axis screw until the star fall into little green circle or near the perimeter of the larger white circle.”

If measured error is larger than screen possible correction, EQAlign propose to do <n> iteration (multiple of maximum allowed screen correction) and it still be a rest. This rest to complete correction will be indicated by a minor white circle, and the message will be something as:

“The measured error is larger than the window dimensions. You must repeat the axis correction 2 times. The last correction you must carry the star from initial correction pint (red circle) to the perimeter of the smallest white circle.”



You need to locate the star into the red circle (in the example at the left) with the **AR/Dec control pad**, then move altitude axis by turning altitude screw to the direction that follows star to the green circle. Iterate this procedure 2 more times (i.e. locating star with AR/Dec control pad at red circle, and locating star into red circle with the mount altitude screw).

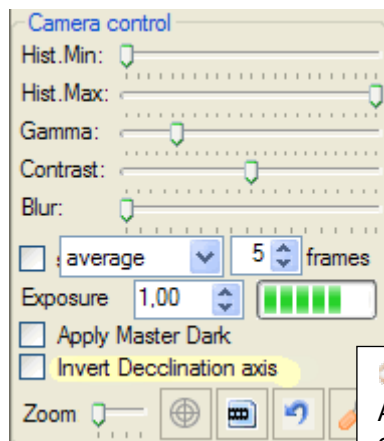
After you have iterated the proposed times this operation, a rest of correction still. This rest will be proposed by an inset white circle. You need to locate again star at red circle with AR/Dec control pad, and then locate star into the perimeter of inset drawn white circle.

That's all. Elevation axis is well aligned now.

Tip!

Depending on optical configuration, the North-South axis could be inverted. In that case drift measures (and in consequence correction proposed) is also inverted. It is necessary that you know your system configuration before. A good idea is to do a previous test align measure. After measure and correcting proposed error, make another measure on the same star. If the star still drift and proposed correction for the same axis is (surely) double as before, then the declination axis must be inverted.

There is a specific option on camera control panel to invert declination axis:



Tip!

As the other axis is not aligned yet, a little amount of error can be due to the other axis misalignment. The more far the star is from 6h/18h hour angle, the more amount of error due to the other axis are involved.

When an accurate polar align is needed, you can proceed now to measure and correct the other axis, the one we just corrected (in this case elevation) is enough well aligned, so no or little error will be involved in azimuth measuring error.


Then by measuring and correcting again elevation axis will eliminate the azimuth error contribution and the polar alignment will be very accurate.

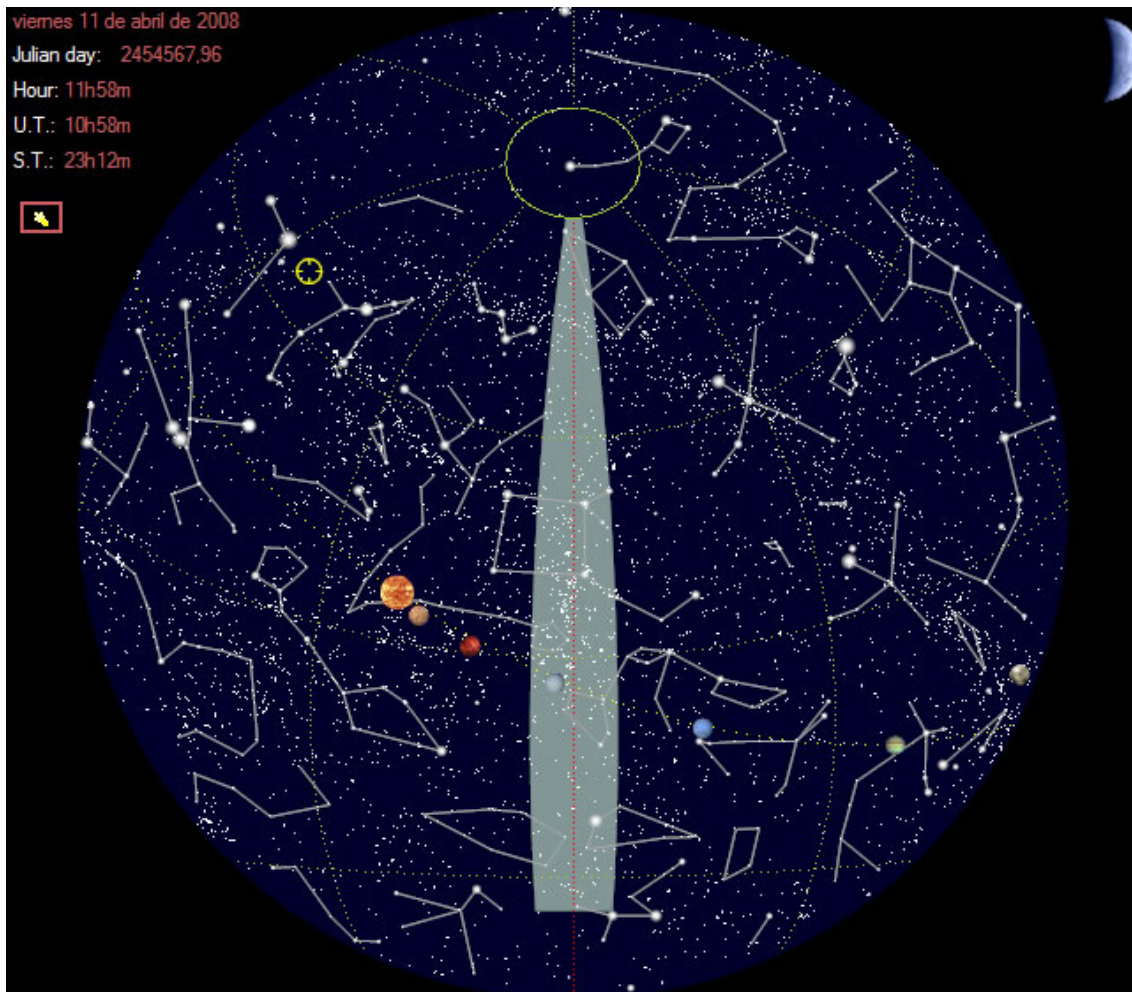
Of course if star is exactly on 6h/18h or 0h, this is not necessary.

4. Measuring and correcting Azimuth axis

a) Selecting a star

As on previous Elevation process, we need first to select a suitable star.

On bottom screen, select to correct Elevation option and then select  button to find a suitable star.




Meridian secure zone around 0h hour angle


You can select any star at highlighted zone; again the more near to 0h Hour Angle the star is, the more accurate the correction will be. Also it is preferable not to select a star near Zenith or it will drift very quickly and a enough long measure would not be possible.

As we show in Elevation correction, star equatorial coordinates will be updated on scope target control and if you have a scope connected you can perform a GoTo command. In any case you must point at that coordinates and centre the star on screen.

b) Starting measures.

As in Elevation correction, when the star is centred, you can start measure process by pressing start button .

c) Correcting error:

Remember to let EQAlign to measure at least 10 minutes, you can stop measure process by pressing stop button . To perform proposed correction, please read Elevation “**Ending measure and correcting error**”.