Telescopio Nazionale Galileo

HARPS-N OPERATION GUIDE

Draft Manual version 2.2.2

TNG-MAN-HARPN-0003

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Change Record

Issue/Rev.	Date	Section/Page affected	Reason/Remarks
V1.0	14-12-2012	First version	
V1.1	14-01-2013		Autoguider added
V1.2	04-02-2013		
V2.0	12-02-2013		New sequencer and Labview SW
V2.1			
V2.2.2			

Contents

1 Introduction

1.1 Scope

This User Manual is intended to give all necessary information to potential users of the HARPS-N instrument, to help them to use the instrument and manages the observation at the TNG telescope.

The following documents are closely related to this manual and should be consulted as well:

- The HARPS-N User Manual (TNG-MAN-HARPN-0002)
- The HARPS-N Startup Manual (TNG-MAN-HARPN-0001)
- The New Short Term Scheduler User Manual (NSTS)
- The DRS User Manual (OG-MAN-HAN-13-0004)

Both are available through the TNG web page

http://www.tng.iac.es/instruments/harps/

1.2 Additional information

The latest information updates about the HARPS-N instrument can be found on the HARPS-N web pages

http://www.tng.iac.es/instruments/harps/

1.3 Contact information

Feedback on this User Manual from users is encouraged. Please email to cosentino@tng.iac.es

2 Before the observations

Starts up the system following the instructions of the “HARPS-N Quick Start Guide” and take care to read all the advices reported at the beginning of the manual.

3.1 The Observation blocks preparation

From the NSTS the observer can prepare the sequence of observation blocks of the night ().
The target can be inserted directly in the NSTS or by using a catalog file that contains the objects information. The format of the catalog file is an ascii file and the fields separator is a TAB (ascii code = 9).
The fields of the catalog are shown in Table 1, the mandatory fields are shown in bold format.
An example of catalog file is shown in the HARPS-N webpage:
(http://www.tng.iac.es/instruments/harps/data/SpStdHARPSN.cat)

Table 1- Catalog file entries

name	**object code**
alpha	**right ascension (nn:nn:nn.nn)**
delta	**Declination (nn:nn:nn.nn)**
mualpha	proper motion alpha(arcsec/year)
mudelta	proper motion delta (arcsec/year)
mv	**magnitude V**
bv	Bv
TypSp	**spectral type**
radvel	**mean radial velocity (KM/sec) or -99999**
snr	Signal/Noise (550nm)
spectr	spectral type for the mask(two chars only)
remarks	Remarks
acquisition	Acquisition template (es. HARPN_ech_acq_objA)
equinox	Equinox
progid	**program identificator (es. TAC_xx)**
piname	**PI name**
exptime	**Exposure time**

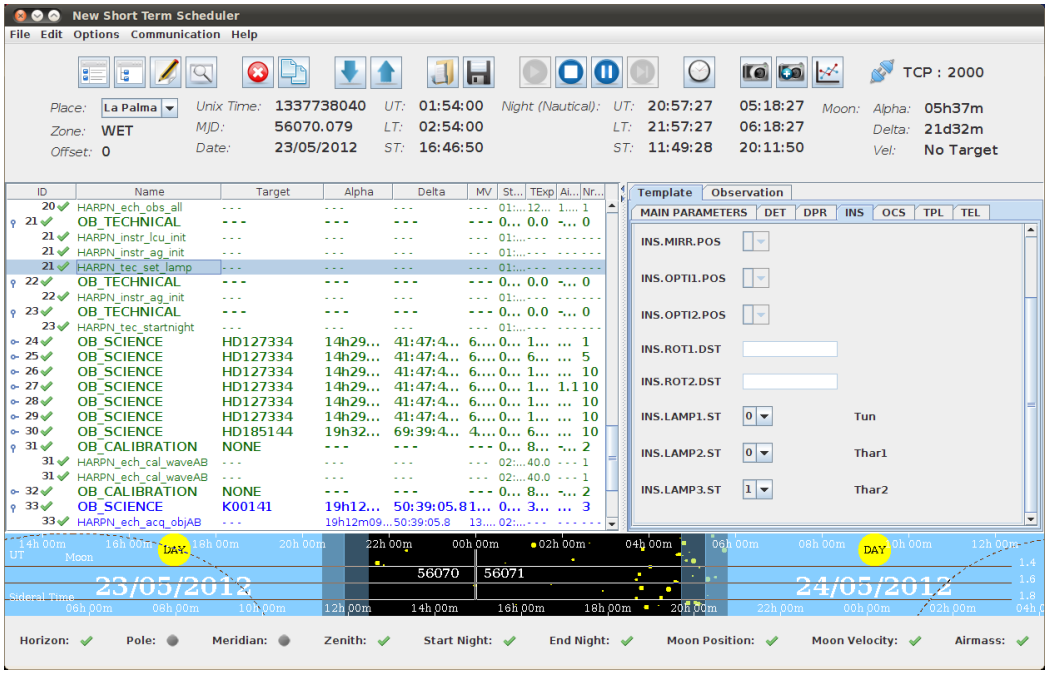


Figure 1 - Short Term Scheduler

3.2 The Sequencer GUI (initialization and operation)

After the startup of HARPS-N the instrument is ready to the initialization of the subsystems and the start of operation.

The sequencer GUI (

) is divided into several sections:

- ***The sequence control*** buttons, for the interaction with the observing blocks
- ***The Instrument control*** buttons, for the interaction with the HARPS-N's subsystems
- ***The observation Execution logs*** window, where the commands execution and the errors are shown
- ***The acquisition control*** buttons, (expose, repoint, etc), allows to do actions related with the autoguider's image visualized by the DS9 application.

The DS9 application shows the autoguider's image and interacts with the sequencer.

During the command execution the status is visualized into the observing status window and, at the end of execution, a bell sound confirms the correct execution of the command (if the sound is a horn noise, this means that something goes wrong and an error should be shown in the *observing status* window).

3.2.1 Initialization

From the ***instrument control*** section, click on the ***LCU Init*** button and wait until the command ends.

Then click on the ***AG Init*** button and wait until the command ends.

The system now is ready to calibrations (but not for the observations).

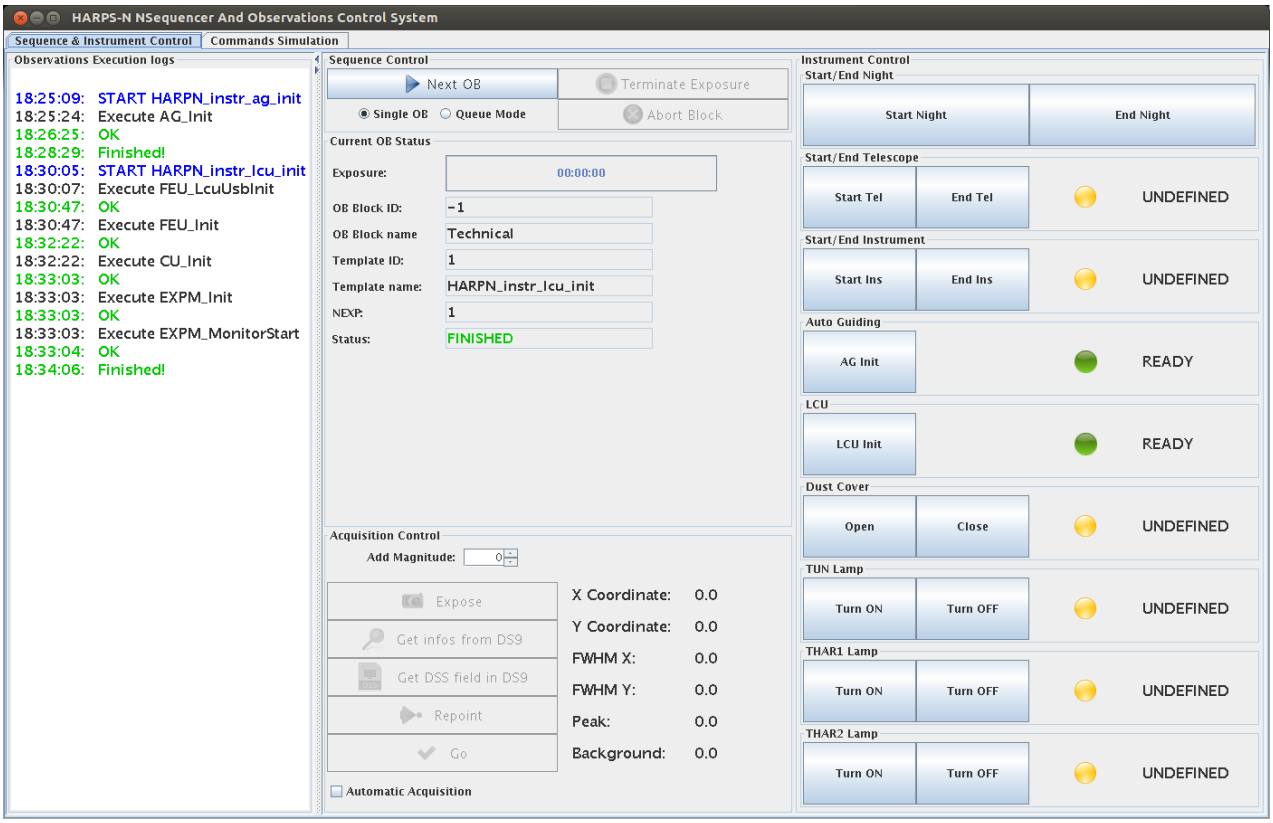


Figure 2 - The Sequencer GUI

Note: The red log "Failed to fetch data from telemetry!" is not an error and can be ignored as error if appears during calibrations or in acquisition with exposure time less than 5 seconds.

Table 2 - Acquisition Control buttons

Add magnitude	Increases/decreases the value of the magnitude of the selected star
Expose	Take a new image with the AG camera
Get infos from DS9	Take coordinates and FWHM from the point clicked in the DS9 image
Get DSS fields in DS9	Visualize the compass in the DS9
Repoint	put the point clicked in the DS9 image into the fiber position and acquire a new image
Go	put the point clicked in the DS9 image into the fiber position and start the autoguider
Automatic acquisition	Selects , put in the fibre and start the acquisition of the brightest star of the field

3.2.2 Sequence Control buttons

Next OB → executes the next block available of the NSTS

Single OB → if checked executes one block when the user click on **Next OB** button

Queve Mode → if checked executes a series of NSTS blocks (according with the NSTS rules) when the user clicks on **Next OB** button

Terminate exposure → ends the current exposure

Abort block → aborts the current block

3.2.3 Instrument control buttons

Start night button → executes the **Telescope Start night** and the **Instrument start night**

Start Tel button → executes the **Telescope Start night**

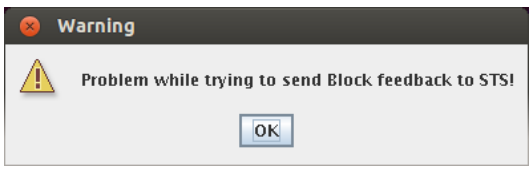
Start Ins button → executes the **Instrument start night**

Dust Cover buttons → **Open** and **Close** the dust cover

Note: The ***Start Night*** button includes the preparation to observation of the telescope and of the instrument. With the new two buttons the user can do this operation separately by using the **Start Tel** and the **Start Ins** Buttons .

3.2.4 Other changes

The sequencer now has a feedback with the NSTS. If the NSTS is not in execution the sequencer visualizes a warning.



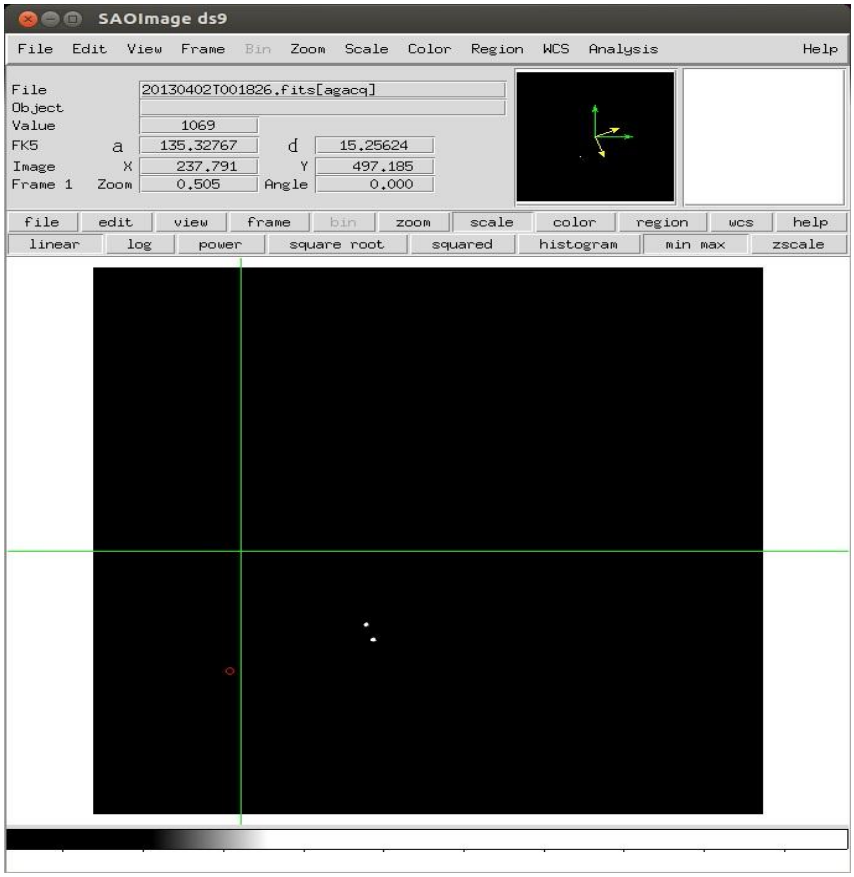


Figure 3 - DS9 terminal with a binary star in the field

3.2.5 Before the calibration

Few minute before the start of calibration (about 10 minutes), the observer has to turn on the thorium lamps.

In the ***Instrument control*** section:

1. Click on the **Turn ON** button of THO1 lamp
2. Click on the **Turn ON** button of THO2 lamp
3. On the ***LCU Device Monitor*** verify the lamps status (Figure 4)

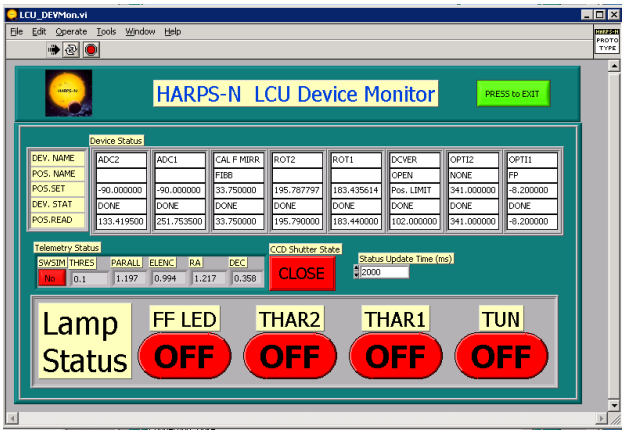


Figure 4 - LCU Device Monitor

A bell sound confirms the correct execution of the command

3.2.6 The standard calibration (daily calibration)

The daily calibration is very important to do in the afternoon (about 1 hour before the start of observation).

1. From the NSTS selects the '***standard calibration***' OB
2. From the sequencer GUI, click in the ***'Next OB'*** button.
3. Verify in the DRS if the calibration goes without errors

During the command execution the status is visualized into the ***observation Execution logs*** window and, at the end of execution, a bell sound confirms the correct execution of the command (if the sound is a horn noise, this means that something goes wrong and an error should be shown in the ***observation Execution logs*** window).

The standard calibration procedure is about 11 minutes long.

Very important: When the calibration ends, turn off the thorium 1 lamp:

1. Click on the **Turn OFF** button of THO1 lamp
2. Click on the **Turn OFF** button of THO2 lamp (if you will **not observes** in thorium simultaneous mode)
3. On the ***LCU Device Monitor*** verify the lamps status (Figure 4)

4 Observations

4.1 The start night

Before the start of observation the system needs that some processes starts and that the telescope is ready to work in HARPS-N mode.

1. Be sure that the system is initialized and ready to work (Start-up procedures, in the HARPS-N Quick Start Guide)
2. In the sequencer GUI, click in the ***Start Night*** button in the ***Instrument Control*** section and wait the end of execution of the command.

Now HARPS-N is ready for observations.

Note: The ***Start Night*** button includes the preparation to observation of the telescope and of the instrument.

The user can do that operation separately by using the **Start Tel** and the **Start Ins** Buttons

4.2 The focus procedure

At the beginning of the night, may be suitable do a focus procedure doing the following actions:

1. In the NSTS selects a star from the catalog and delete the **HARPN_ech_obs_all** template

ID	Name	Target	Alpha	Delta
9	HAM_OB_SCIENCE	9596	03h52m54.000	00:00:19.000
9	HARPN_ech_acq_objAB	- - -	03h52m54.000	00:00:19.000

2. Add the HARPN_focus template

ID	Name	Target	Alpha	Delta
9	HAM_OB_SCIENCE	9596	03h52m54.000	00:00:19.000
9	HARPN_ech_acq_objAB	- - -	03h52m54.000	00:00:19.000
9	HARPN_focus	- - -	- - -	- - -

3. From the sequencer execute this OB by clicking the ***Next OB*** button.
   (The sequencer sends the commands to: move the telescope, acquire an image from the autoguider camera and shows the image in the ***DS9***.)

4. Click on the star and then click on the ***Go*** button in the ***Acquisition*** Image window.
   (The sequencer sends an offset to the telescope, puts the star in the fiber position, starts the autoguide, executes the focus procedure and moves the M2 mirror at the best position)

The focus procedure is about 10 minutes long.

4.3 The pointing model procedure

Sometimes the pointing precision can be poor and the telescope could need the execution of a pointing procedure. The pointing procedure must be done in collaboration with the telescope operator (TO) and the TO has to know some information during the procedure.

The sequences of actions to manage the pointing procedure are:

1. In the NSTS select a star from the catalog ***HARPSN-PointingModel.cat*** located in /home/guest/GAPS/CATALOGS
2. Delete the HARPN_ech_obs_all template

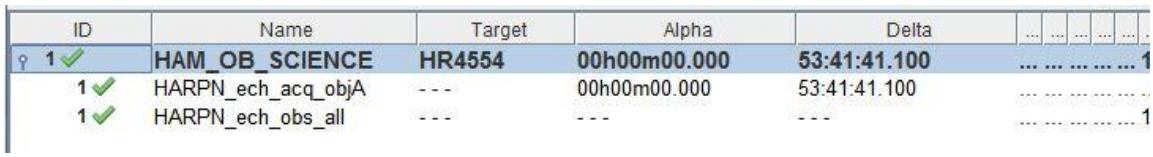
ID	Name	Target	Alpha	Delta	...	...	...	...	...	...
1	HAM_OB_SCIENCE	HR4554	00h00m00.000	53:41:41.100	...	...	...	...	...	0
1	HARPN_ech_acq_objA	---	00h00m00.000	53:41:41.100	...	...	...	...	...	...

3. From the sequencer execute this OB by clicking the **Next OB** button and tell to the TO when the AG image starts, (this is the critical point of this procedure) :
   Sequencer: Thu Dec 27 23:12:29 UTC 2012 -> launch AG_expose
4. When the image of the star appears, clicks on the star, then clicks on the ***Repoint*** button in the ***Acquisition*** Image window and tell to the TO that the offset has been applied.
5. The TO takes note in the VME of the offset applied, the paralactic angle and uses these data in the pointing procedure.
6. Repeat the cycle with another star (from point 1.) until the pointing procedure reaches the precision expected.

4.4 The science OB execution

In the execution of a scientific OB the object has to be pointed and centered in the fibre with the intervention of the observer.

1. In the NSTS select a star from the catalog



ID	Name	Target	Alpha	Delta	...	...	...	...	...	...
1	HAM_OB_SCIENCE	HR4554	00h00m00.000	53:41:41.100	...	...	...	...	...	1
1	HARPN_ech_acq_objA	---	00h00m00.000	53:41:41.100	...	...	...	...	...	...
1	HARPN_ech_obs_all	---	---	---	...	...	...	...	...	1

2. From the sequencer execute this OB by clicking the ***Next OB*** button.
   (The sequencer sends the commands to: move the telescope, acquire an image from the autoguider camera and shows the image in the ***DS9***.)

3. Click on the star and then click on the ***Repoint*** button in the ***Acquisition*** Image window.
   (The sequencer sends an offset to the telescope, puts the star in the fiber position, acquires another image from the auto-guider camera and shows the image in the ***Acquisition*** Image window)
4. When the image appears, if the star is in the fiber position (red circle), click in the ***Go*** button in the ***Acquisition*** Image window.

After that the sequencer starts the auto-guide and the spectroscopic acquisition.

When the OB ends, a bell sound confirms the correct execution of the command and the Next Acquisition button turns in active mode.

4.5 The Autoguide

The autoguider starts when the observer clicks on the accept button of the sequencer GUI and two windows opens (Figure 5 and Figure 6):

1. The HARPS-N AutoGuider windows
2. The Integrated Image window

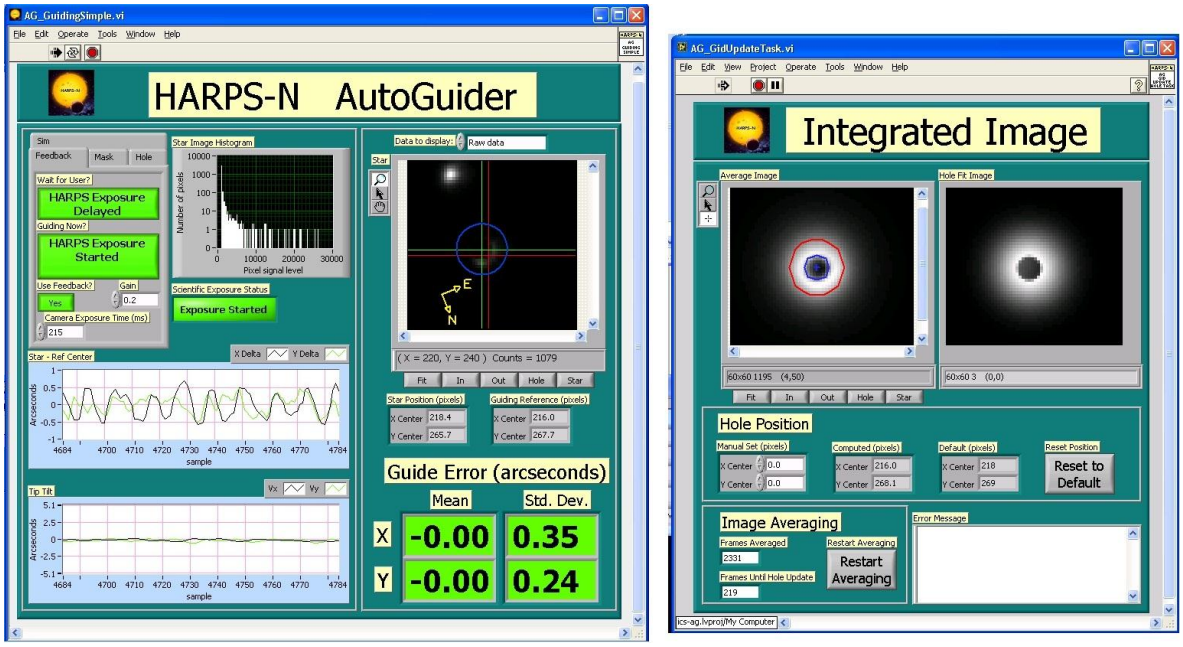


Figure 5 - Autoguider and Front End Monitor (automatic mode).

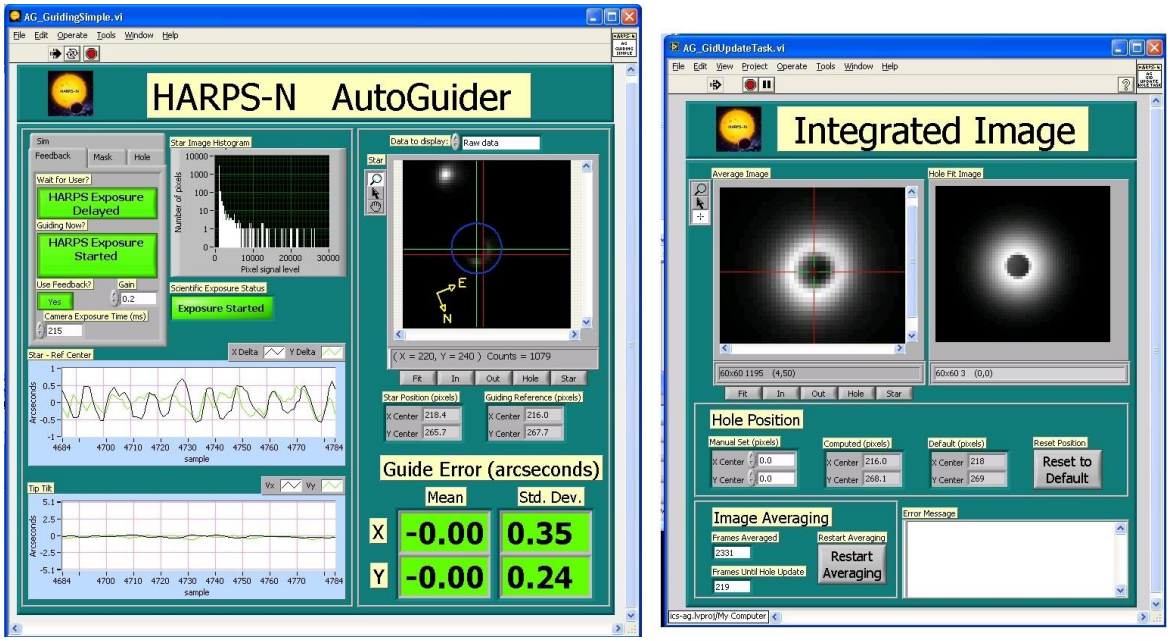


Figure 6 - Autoguider and Front End Monitor (manual mode).

4.5.1 The HARPS-N AutoGuider windows

This window shows the autoguider images, some information about the guide settings and status and allows to change the guide mode:

4.5.1.1 Feedback (offload) tab

The ***feedback*** tab open a menu where the user can change the parameter of the tip-tilt correction.

- Use Feedback → enable/disable the tip tilt correction and offload
- The gain and delay value change the behaviour of tip-tilt
- Wait for user → freeze the starting of autoguider
- Guiding now → unfreeze the starting of autoguider (start autoguide)

Figure 7 - Feedback panel

The ***Wait for user*** button remains active few seconds before the automatic starting of autoguide. If the user sets this button on ***Yes*** the autoguide get stuck until the ***Guiding Now*** button is selected.

4.5.1.2 Mask tab

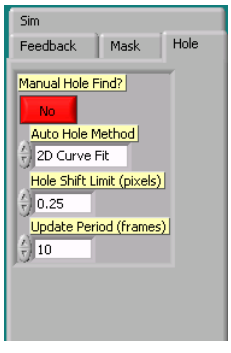
To avoid the contamination of others star close to the guide-star in the guide, a mask around the guide star can be selected.

[to be completed](Masksize, On/off)

4.5.1.3 Hole tab

With this panel is possible to select the hole- find method, the centering algorithm, and the hole's dimension (optional)

- ***Manual Hole Find*** → selects the manual or automatic method
  The ***auto hole method*** → select the algotithm for guiding end for the hole-center calculation



- ***Fix fit Hole Radius*** → change the default hole dimension to a user selected

In the The HARPS-N AutoGuider windows (Figure 6) the white cross represent the center of the star and the red cross is the center of the fiber.

At the bottom of the panel, a button menu allow the user to change the zoom, ...

auto hole method : The algorithm for the calculation of the fiber position and for the star's center position can be choose between the ***centroid*** or ***2Curve*** algorithm.

4.5.2 The Integrated Image window

This window shows the integrated images, some informations of the guide's execution and allows to change the reference point (fiber position) when the manual mode is setted. The information shown depends by the hole's find method selected:

Manual mode: the fiber's reference position is based on a table and can be modified by the user dragging with the mouse the green cross pointer.

Automatic mode: the fiber's reference position is calculated by the selected algorithm. The red circle represent the contour of the star, the blue circle the shape of the hole.