

# **Telescopio Nazionale Galileo**

# HARPS-N Quick Start Guide

Manual version 2.8 TNG-MAN-HARPN-0001

Date: 6/2/2024

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V1.2	19-07-2012	Troubleshooting added	
V1.2	31-07-2012		
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V2.5	23/08/2017	New AG	
V 2.6	08/07/2021	§ 5.3.4	Web Interface for astronomers
V 2.7	10/01/2022	§ 5.9	Added new ESPRESSO DRS
V 2.8	06/02/2024	§ 5.6 and following	New Brunello machine

## **Change Record**

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# **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 Quick Start Manual (TNG-MAN-HARPN-0001)
- The New Short Term Scheduler User Manual (NSTS)
- The DRS User Manual (OG-MAN-HAN-13-0004)
- HARPS-N DRS User manual (TNG-MAN-HARPN-0006)
- HARPS-N Autoguide Manual (TNG-MAN-HARPN-0005)
- HARPS-N LCU manual (TNG-MAN-HARPN-0004)
- The standard calibration

These manuals 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 <u>cosentino@tng.iac.es</u>

## **1.4 Reference documents**

[RD01] TNG-MAN-HARPN-0002\_HARPS-N USER MANUAL

- [RD02] TNG-MAN-HARPN-0003\_ HARPS-N OPERATION GUIDE
- [RD03] TNG-MAN-HARPN-0003\_HARPS-N OPERATION GUIDE
- [RD04] New Short Term Scheduler User Manual (NSTS)
- [RD05] The DRS User Manual
- [RD06] TNG-MAN-HARPN-0006\_HARPS-N\_DRS\_Manual
- [RD07] UCAM User manual
- [RD08] Templates Reference Guide
- [RD09] Thorium-Argon Atlas
- [RD10] Design of the LCU for HARPS-N
- [RD11] TNG-MAN-HARPN-0006\_HARPS-N\_DRS\_Manual
- [RD12] The standard calibration

# 2 System Overview

The following parts compose the HARPS-N instrument control software:

- The Front End and Calibration Unit control software (LCU)
- The telemetry system (part of the LCU)
- The exposure meter counter
- The Autoguider (AG)
- The Sequencer
- The New Short Time Scheduler (NSTS)
- The scientific camera software (UCAM)
- The Data Reduction Software (DRS) using the TRIGGER to automatically execute reduction

The parts of the control software reside in various computers and communicate one with the other according with the scheme in Figure 1

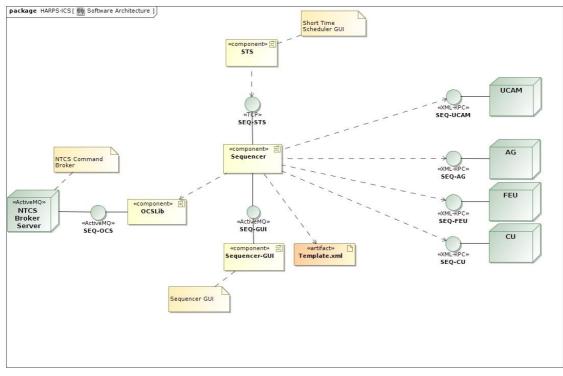


Figure 1 - The software architecture (to be upgraded)

Unit	Machine	IP	User
AG core	hanmgr	161.72.92.27	harps
Short Time Scheduler	brunello.tng.iac.es	161.72.44.35	guest
	barbera.tng.iac.es	161.72.53.4	guest
Sequencer/Expmeter	harps-ics.hn	161.72.92.10	hanmgr
Ucam	ucam.hn	161.72.92.32	ucam
Data Reduction Software	drs32.hn	161.72.92.15	harpn
Front End Unit (NEW)		161.72.92.20	harps
ESPRESSO DRS		161.72.92.17	drs

Table 1 - Units addresses

# 3 Important points to be aware of

## 3.1 Life time of ThAr lamps

The ThAr lamps have two important roles in a HARPS-like spectrograph. The first is to allow for precise wavelength calibration. The wavelength calibration sets the nightly 'zero point' of the instrument and is extremely important for the long-term radial-velocity repeatability. Therefore, always the same lamp should be used, which should live as long as possible. The second role is to track possible instrumental drifts. For this purpose, the 'simultaneous reference fiber' (fiber B or fiber 2) of HARPS is illuminated with the ThAr spectral reference, which is able to measure these drifts.

Given these two roles, we have foreseen in HARPS-N two different ThAr lamps:

A) **ThAr1** will be dedicated to the calibration. It is always used on fiber A and is switched ON only for calibration. The operational time must be as short as possible, typically of

10-15 minutes per day. **Immediately after ThAr calibration this lamp MUST be switched OFF.** 

B) ThAr2 is always used on fiber B (sim. reference) for drift measurement. It is generally switched ON at the beginning of the night and switched OF at the end of the night by the 'End night' script. If not used for longer than an hour, it might be switched OFF during the night as well.

Note: The ThAr2 lamp now is used only in case or emergency, in substitution of the Fabry-Perot calibrator.

**Important note:** One should not forget to apply a warm-up time of **5-10 minutes after switching ON** again and before using it!

## 3.2 Observations without data reduction

The data reduction is an automatic but completely 'off line' process. The observations can be carried out without any loss of data or information even WITHOUT starting the DRS. For no reasons the observations should be halted because of the DRS is not able to run or simply not running. The one note of caution is that no quality feedback will be available from the DRS in these cases. The Observer should make sure that the instrument parameters are all ok and that a full calibration set has been carried out at the beginning or the end of the night.

## 3.3 Efficiency of the instrument

Efficiency of a spectrograph is a concern because it can strongly change with seeing, cloud conditions, calima, and air mass. The NSTS has some build-in functions to estimate the expected count rate and SNR as a function of seeing, airmass, stellar magnitude and exposure time. This function is called Exposure-Time Calculator.

At any time during the observations, the Observer may want to compare the obtained values with the expected values. It is therefore recommended to compare the NSTS/ETC predictions with the measured values provided by the DRS. The can be found in the headers of the reduced \*e2ds\_A.fits files in the reduced file folder:

drs32>/data/reduced/YYYY-MM-DD/ The keywords HIERARCH TNG DRS SPE EXT SNXX, where XX is the order number, provide the SNR per extracted pixel of the corresponding order, which can be directly compared with the ETC value.

A script is available in the directory ~harpn/scripts/get\_mes which will provide some general information on the scientific exposures, and in particular the SNR for the orders 1 (390nm), 46 (550 nm) and 68 (690 nm). The script can be called as follows:

```
cd
cd scripts
./get_mes 2012-06-23
```

And the output file "night\_2012-06-23.rdb"

Contains the information of the scientific exposures.

Another mean to verify instantaneous efficiency is to observer the exposure meter counts in the HARPS-N Exposure Meter panel on the LCU machine, or watching the "estimate SNR', shown in the sequencer GUI (Figure 12). As a reference, the expected count rate is given, as well as the 'efficiency', which is nothing else that the measure/expected count rate.

The efficiency given by the ETC has been verified to be 'realistic'. In case of big discrepancies between measured and expected SNR, the problem may be due to:

- de-focus of the telescope or bad image quality -> ask the operator to do Shack-Hartmann and/or focus procedure
- Calima (nothing can help)
- Clouds (nothing can help)
- Wrong seeing estimation

In case that none of them apply, please contact as soon as possible the HARPS-N Instrument Scientist.

## 3.4 Instrumental drifts

The data reduction software provides shortly after a thorium-calibration 'thoAB' exposure and a simultaneous-thorium 'tho\_simult' exposure a measure of the instrumental drift (since the last calibration). **If this drift happens to be higher than 2 m/s we strongly recommend to re-do a wavelength calibration.** 

We strongly recommend to monitor the instrumental drifts given by the DRS. In case of faint objects are observed in objAB mode (sky light on fiber B), at least one tho\_simult observation on a bright target should be done every hour to monitor the drifts.

## 3.5 The 'End Night'

It is extremely important to execute the 'End Night' command from the Sequencer. This command will ensure that, among other, that:

- The dust cover is closed
- The AG is stopped
- The lamps are switched OFF

The Observer and the Operator must verify that at least these three tasks have been carried out correctly.

## 4 Start-up procedures

## 4.1 Telescope start-up procedure

Actor:	Telescope Operator
Reference start time:	Nautical night start NN

Procedure: NN-90 min.	Telescope start-up
NN-80 min.	Start-up the instrument
	Start-up LCU (5.2)
	Start-up AG (5.3)
	Start exposure meter (par. 4.5)

Important: Before the calibration acquisition and during the scientific observations, the operator have to verify that all the light of the dome, nasmyth, stairs, storehouse, etc. are turned off.

NN-60 min.	Open telescope dome (after the end of standard calibrations)
NN-50 min.	<b>Configure instrument for HARPS-N</b> Set derotator to 'HARPS-N'
NN-30 min.	If the image quality is poor, do a Shack-Hartmann (usually, only to be done when starting a run) Must be followed by a focus procedure
NN-20 min.	Check telescope telemetry running Start the exposure meter (see par. 4.5)

**Very important:** verify that active optic is ok, the 'look up table' upgraded and that the focus of the telescope is set to HARPSN position.

NOTE: The telescope has to be ready for HARPS operation before the 18:00 UT

## 4.2 Instrument start-up procedure

<b>4.2</b> Instrument start	up procedure				
Actor:	Support Astronomer/Visitor Astronomer				
Reference start time:	Nautical night start NN				
Procedure:	Instrument verification				
	Verify that telemetry is running and that the values are in green.				
	Monitor specific HARPS-N sensors (see Figure 2):				
	(From the http://tngweb.tng.iac.es/telemetry/systems/HARPS)				
	CCD temperature				
	Echelle temperature				
	Detector-body temperature				
	Head-Heater temperature				
	Nitrogen level				
	Pabry-Perot pressure				
	Pabry-Perot temperature				
	Enclosure T3 temperature				
	Enclosure T2 temperature Vessel pressure				
	vessei pressure				
	Start-up the instrument				
	From HARPS-ICS Terminal: Start-up Sequencer (multimedia, par 5.4)				
	From <b>brunello</b> : Start-up NSTS (par. 4.6)				
	Ask to the TO for the state of Expose meter				
	From UCAM Terminal: Start-up UCAM (wsastro par 5.8)				
	From DRS32 Terminal: Start up TRIGGER/DRS (brunello, par.4.8)				
	Initialize instrument				
	<b>Initialize instrument</b> From Sequencer: Press ' <b>LCU Init</b> ' button (it takes ~ 1 minutes)				
	From Sequencer: Press ' <b>LCU Init</b> ' button (it takes ~ 1 minutes)				
	From Sequencer: Press ' <b>LCU Init</b> ' button (it takes ~ 1 minutes) Verify on LCU that <b>init</b> is executed Verify in the Sequencer that no errors are reported				
	<ul> <li>From Sequencer: Press 'LCU Init' button (it takes ~ 1 minutes)</li> <li>Verify on LCU that init is executed</li> <li>Verify in the Sequencer that no errors are reported</li> <li>Calibrate instrument (daily calibrations)</li> </ul>				
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	<ul> <li>From Sequencer: Press 'LCU Init' button (it takes ~ 1 minutes)</li> <li>Verify on LCU that init is executed</li> <li>Verify in the Sequencer that no errors are reported</li> <li>Calibrate instrument (daily calibrations)</li> <li>From Sequencer: Set ThAr1 and ThAr2 lamps to 'ON'</li> <li>In NSTS: Insert File-&gt;OB-&gt;Standard calibration</li> </ul>				
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	<ul> <li>From Sequencer: Press 'LCU Init' button (it takes ~ 1 minutes)</li> <li>Verify on LCU that init is executed</li> <li>Verify in the Sequencer that no errors are reported</li> <li>Calibrate instrument (daily calibrations)</li> <li>From Sequencer: Set ThAr1 and ThAr2 lamps to 'ON'</li> <li>In NSTS: Insert File-&gt;OB-&gt;Standard calibration</li> <li>From sequencer press the 'Close' button in Dust Cover</li> <li>From Sequencer: Press Next OB to execute</li> </ul>				
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	From Sequencer: Press 'LCU Init' button (it takes ~ 1 minutes) Verify on LCU that init is executed Verify in the Sequencer that no errors are reported Calibrate instrument (daily calibrations) From Sequencer: Set ThAr1 and ThAr2 lamps to 'ON' In NSTS: Insert File->OB->Standard calibration From sequencer press the 'Close' button in Dust Cover From Sequencer: Press Next OB to execute On DRS: Verify that quality control passes After calibration and from Sequencer: SWITCH OFF ThAr lamps				
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NN-15 min.	From Sequencer: Press 'LCU Init' button (it takes ~ 1 minutes) Verify on LCU that init is executed Verify in the Sequencer that no errors are reported Calibrate instrument (daily calibrations) From Sequencer: Set ThAr1 and ThAr2 lamps to 'ON' In NSTS: Insert File->OB->Standard calibration From sequencer press the 'Close' button in Dust Cover From Sequencer: Press Next OB to execute On DRS: Verify that quality control passes After calibration and from Sequencer: SWITCH OFF ThAr lamps Start night: On sequencer: Press 'Start Nigth' button (it takes ~ 2 minutes) On sequencer: verify that no errors are reported Verify the status in the 'instrument status webpage' (Figure 3)				
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Very important: before the beginning of the observation ask to the TO if the active optic is ok, the 'look up table' upgraded and if the focus of the telescope is set to HARPSN position. NOTE: HARPS has to be ready for observation before the 18:00 UT

## TNG-MAN-HAN-0001

All NICS LRS GIANO HARPS		
nsor	Current	:
HARPS_CE02_HEADSEC_T	CCD Temperature	-114.99 °C
toreload	Echelle Temperature	(17.01 °C
0.0000	Detector-Body Temperature	19.36 °C
	Remove All Add Head-Heater Temperature	(19.51 °C
	riedd-riedder feinperatare	
CE02	<ul> <li>✓ Ø</li> <li>Nitrogen Level</li> </ul>	38.46 %
CE02		
	<ul> <li>✓ 𝔅</li> <li>Nitrogen Level</li> </ul>	38.46 %
19.1775 19.175	Image: Nitrogen Level       Fabry-Perot Pressure	(38.46 % (0.78 mbar
19.1775	Nitrogen Level       Fabry-Perot Pressure       Fabry-Perot Temperature	38.46 % 0.78 mbar 22.00 °C

Figure 2 – HARPS-N sensors webpage (http://tngweb.tng.iac.es/telemetry/systems/HARPS)

Hydrostatic	Instruments Status	Remote Power S	ervices Temperature			the state and	l
					Instru	iments	Statu
	HARPS-N		LRS		NICS		
	Mirror 3	NOTOK	Mirror 3	NOTOK	Mirror 3	ок	
	Nas. Selected	ок	Nas. Selected	ок	Nas. Selected	NOTOK	
	Der. Angle	NOTOK	Instr. Selected	NOT OK	Instr. Selected	ΝΟΤΟΚ	
	EntranceSlider	NOTOK	Motors Power	ок	Der.A Mirror 4	ΝΟΤΟΚ	
	Der. Cover	NOTOK	CCD Power	NOTOK	Fasti Power	ок	

Figure 3 - Instrument Status webpage (ntcs-glassfish2.tng.iac.es:7080/webcontrolpanel/ui/remotepowercontrolpanel.jsf)

# 5 How to start-up the various subsystems

## 5.1 The HARPS-N Workstation environment

The workstation environment in the control room is shown in Figure 4. The workstation WSOPER is under the control of the Telescope Operator (TO), the Brunello and WSASTRO workstations are under the control of the Visitor Astronomer (VA) and finally the Multimedia workstation is shared between the TO and the VA.



Figure 4 - Control room workstations

## 5.2 The Front End and Calibration Unit (LCU) Start-up

The software used to operate with the FEU runs on a Windows PC that is located in Nasmyth B, in a rack close to the Calibration Unit. The user will interact with the FEU software by a remote connection from a linux machine.

In order to connect to FEU computer and start the LabView software, is necessary to open a remote desktop connection (from the **wsoper** workstation located in the control room):

a) Click on the HarpsN-NewLCU icon (Figure 5), or open a shell from any linux machine and type: rdesktop -T LCU 161.72.92.20 -g89% This will start the remote connection with the FEU PC.



Figure 5 - WSOPER workstation desktop

b) Start the control software by clicking the icons corresponding to the control (Figure 6):



Figure 6 - FEU desktop screenshot

The LCU GUI starts and appears as shown in Figure 7. The LCU GUI is made up by three parts:

1. The Device status frame

- 2. The control system frame
- 3. The log report frame

#### More details about the LCU GUI are described in <u>TNG-MAN-HARPN-0003\_HARPS-N</u> <u>OPERATION</u> GUIDE

RD021						
FrontPanel_alt.vi						-
Edit Operate	Fools Window	Help				
۵ 👁 🖷						
il arps-N	Designed by	🥑 sı	VISS OPTICS	SYSTEMS	HAI	RPS-N LCU DEVICE MONITOR
						CONTROL SYSTEM
DEVICE STA	TUS					DCOVER CAL MIRROR FIBER SELECTOR ADC ND FILTER ND FILTER AG LAMPS INIT ALL
DEV. NAME	POS.NAME	POS.SET	DEV.STAT	POS.READ		
ADC 1	ZERO	-90,00	WAIT	270		SET TUNGSTEN LAMP
ADC 2	ZERO	-90,00	WAIT	90		OFF
CAL Mirror	NONE	24"	DONE	50		SET THAR1 LAMP
ND FILTER 1		0,00	DONE	100		OFF
ND FILTER 2		0,00	DONE	75		Un
DCOVER	CLOSE	NEG.Limit	DONE	0.01		SET THAR2 LAMP
FIBERSEL A	NONE	8"	DONE	8		OFF
FIBERSEL B	NONE	8"	DONE	8		
ND FILT AG1			DONE	180		LOG REPORT
ND FILT AG2			DONE	270		12/9/2019 5:43 PM STARTING CALMIRROR
OFF	THA		OFF	2	LAMPS OK	12/9/2019 5:49 PM STARTING DUSTCOVIER 12/9/2019 5:49 PM STARTING RERESELEC 12/9/2019 5:48 PM STARTING RIDFLITERS, AG 12/9/2019 5:48 PM STARTING RADFLITERS 12/9/2019 5:48 PM AIADIC SALAMAR 12/9/2019 5:44 PM Initialization C.ALMAR 12/9/2019 5:44 PM Initialization C.ALMAR
ALFAST	PARALL		ELENC	DELAST		
5.62869	0.23829	7	1.33149	0.26179	99	



## 5.3 Autoguider (AG) Start-up

The autoguide (AG) system is made up by two parts:

1. The CORE (new AG CORE) that is executed in the AG computer (nag = 161.72.92.27, user =

hanmgr, password = 'the standard harpsn password')

2. The WEB-GUI, that is launched in a Chrome browser (different browsers are not fully

compatible)

To use the autoguide in a proper way the user has to follow the instructions described below.

## 5.3.1 Start the autoguide

- 1. Start the AG core as described in the paragraph 5.3.3
- 2. Make sure that the "AG core" starts in a correct way, checking that the terminal shows the line:: AG Core Ready ! at the end of the log
- 3. Open the WEB GUI in a Chrome browser as described in paragraph 5.3.4.

## 5.3.2 Stop the autoguide

- 1. Make sure that the AG camera is NOT acquiring images; if yes stop the acquisition before of all.
- 2. Go into the "AG core" terminal and do CTRL+C
- 3. Make sure that the "AG core" ends in a correct way, checking that the terminal shows the line: **Exit AG Core. Bye !** at the end of the log

The WEB GUI will show the message of Figure 9 at the end of the operations.

#### 5.3.3 The AG Core (start and stop)

The AG core manages the communication with the autoguide system (camera, tip tilt), with the telescope control system (TCS) and with the sequencer.

The first operation is the execution of the AG core from the nag machine. This operation can be done by a ssh connection from any machine of the control room or by click in the **CORE** icon in the **wsoper** machine (Figure 8).



Figure 8 - wsoper machine: Icons to start the HARPSN features

After the connection the following operations can be done:

Start of the AG core  $\rightarrow$  ag

Stop of the AG core  $\rightarrow$  CTRL+C (to close all the connection properly)

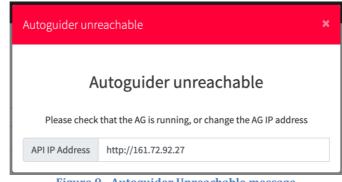
At the end of observation the AG-CORE mast be closed with CTRL+C

# **VERY IMPORTANT NOTES:**

## NOT EXIT the Core software while the camera is taking images

#### 5.3.4 Start the WEB GUI

The WEB-GUI starts a connection with the AG core, it has to be started after the AG core. In case of the AG core was down the browser will show an error message (Figure 9).





The WEB-GUI can be started from the wsoper machine (Figure 8) and from Brunello with the **AG-GUI** icon, at the same time. The WEB-GUI available for the astronomer is a read-only version of the interface.

To launch the WEB-GUI click on the GUI icon in the wsoper /Brunello and enter with the TO user (Figure 10) in wsoper and with ASTRO user in brunello. For advanced operation there is available the EN account.

The credentials for the astronomer version are:

Login: ASTRO Password: 1234

The astronomer user must to use only the ASTRO user.

Login:			
то			
Password:			
••••			
			Login

Figure 10 - WEB GUI login

After the introduction of the credentials the web interface will start.

## 5.4 Start up the Sequencer

From the **multimedia** workstation, click on the **HARPS-ICS** icon (the icon can be different from the Figure 11).

The icon opens a terminal in the Instrument Control System machine.



Figure 11 - Multimedia Workstation desktop

In another way, the terminal can be opened with the following command:

Open a HARPS-ICS terminals by executing: **ssh** -**X** hanmgr@161.72.92.10 from a linux machine)

After that, to start the Sequencer the commands are:

- 1. Change to run directory  $\rightarrow$  cd /home/hanmgr/run
- 2. Run the sequencer  $\rightarrow$  ./run\_sequencer.csh

The script opens the Sequencer GUI and a DS9 terminal.

## TNG-MAN-HAN-0001

Sequence & Instrument Control Commands Simulation									
Observations Execution logs	Sequence Control			Instrument Cor	itrol				
	Next OB 💮 Terminate Exposure			Jre Start/End Nigh	Start/End Night				
09:30:26: Get Next OB from STS 09:30:26: START	Single OB	● Single OB ○ Queue Mode		Sta	Start Night		d Night		
IARPN_ech_sol_wavesimult	Current OB Status	Current OB Status							
09:30:26: Execute EXPM_SetMagnitude 09:30:26: OK 09:30:26: Execute	Exposure:		00:00:00	Start/End Tele	Start/End Telescope				
NTERNAL_SwitchLedsToShutter 9:30:26: OK	Estimated SNR:	0		Start Te	I End Tel	$\bigcirc$	UNDEFINED		
9:30:26: Execute CU_LampsSelect 9:30:29: OK	OB Block ID:	5		Auto Guiding					
9:30:29: Execute FEU_CalMirrorSet 9:30:32: OK	OB Block name:	-	R	Auto Guide	r:	-	NOT READY		
9:30:32: Execute	Template ID:	1							
NTERNAL_ComputeNDFilter 19:30:32: OK	Template name: HARPN_ech_sol_wavesimult			LCU					
9:30:32: Execute FEU_NDSet 9:30:36: OK	NEXP:	1		LCU Init			ONLINE		
9:30:36: Execute NTERNAL_EXPM_PowerOFF	Status: CONFIGUR		RING	Exposure Mete	Exposure Meter				
19:30:36: OK									
19:30:36: Execute NTERNAL_EXPM_PowerON	Acquisition Control Add Magnitude:			Start EM	L .	-	RUNNING		
9:30:36: OK				Dust Cover	Dust Cover				
9:30:36: Execute NTERNAL_CheckTharUsage	🖌 Save	Focus	X Coordinate: 0.0	Dust cover					
99:30:37: OK	🕘 Cancel	l Focus	Y Coordinate: 0.0	Open	Close	-	CLOSED		
	FWHM X: [arcsec] 0.0			TUN Lamp	TUN Lamp				
	ilie) Exp	0050	FWHM Y: [arcsec] 0.0						
	💛 Re-Sta	art DS9	Peak: 0.0	Turn Of	Turn OFF	-	OFF		
	Get info from DS9     Get DSS field in DS9		Background: 0.0	THAR1 Lamp	THAR1 Lamp				
				Turn ON	Turn OFF		OFF		
	- Rep								
		20		THAR2 Lamp					
	Automatic Acquisit	10		Turn ON	Turn OFF	-	OFF		

Figure 12 - Sequencer GUI

Note-1: If an error message "remove .#lock file in .Nsequencer" appears, see the par. 8.3.1 Note-2: 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.

**Note-3:** The yellow log "[...] Warning Final AG guide FITS file not found!" is a warning that don't affect the observation (we are working to fix this bug)

Add magnitude	Increases/decreases the value of the magnitude of the selected star
Save Focus	send to OCS the command that update the serrurier focus
Cancel Focus	Moves M2 to the position prior to the focus procedure execution
Expose	Takes a new image with the AG camera
Re-Start DS9	Restart the DS9 window (when the DS9 window crash)
Get info from DS9	Takes coordinates and FWHM from the point clicked in the DS9 image
Get DSS fields in DS9	Visualizes the compass in the DS9
Repoint	puts 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
	and the exposure
Automatic acquisition	Selects , puts in the fibre and start the acquisition of the brightest star of the field

#### Table 2- Acquisition Control panel

## 5.4.1 Sequence Control buttons

Next  $OB \rightarrow$  executes the next block available of the NSTS Single  $OB \rightarrow$  if checked executes one block when the user click on **Next OB** button Queve Mode  $\rightarrow$  if checked executes a series of NSTS blocks (according with the NSTS rules) when the user clicks on **Next OB** button Terminate exposure  $\rightarrow$  ends the current exposure and save it

Abort block  $\rightarrow$  aborts the current block

#### 5.4.2 Instrument control buttons

Start Night button $\rightarrow$  executes the Telescope Start night and open the dust coverStart Tel button $\rightarrow$  executes the Telescope Start nightDust Cover buttons $\rightarrow$  Open and Close the dust coverStart EM button $\rightarrow$  starts the exposure meter and open the GUINote: The Start Night button includes the preparation to observation of the telescope

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

More details about the **instrument control buttons** are shown in Appendix B - Actions of **multi task commands** (pag. 34)

#### 5.4.3 The command simulation check window

In this window the user can simulate the execution of commands by clicking in the simulated check box (Figure 13).

- The "Turn on Simulation" button puts the telescope in simulation mode
- The "pointing with standard focus" button enables the automatic focus corrections (M2 movement)

Image: Command Name         Simulation         Deponding with standard focus           C_Expose	See a HARPS-N NSequencer And Observations Control System					
Command Name         Simulated           C_SEpose	Sequence & Instrument Control Commands Simulation					
G. Expose	TELESCOPE: NOT SIMULATED TUM ON	Simulation Pointing with standard focus				
C. GuidingStart       C. GuidingStartRec         C. GuidingStartRec       C. GuidingStartRec         C. GuidingStartRec       C. GuidingStartRec         C. GuidingStartRec       C. GuidingStartRec         G. Juit       C. GuidingStartRec         G. Juit       C. GuidingStartRec         G. Juit       C. GuidingStartRec         U. Juit       Faite StartRec         U. Juit       Faite StartRec         U. JampSelet       C. GuidingStartRec         U. TelmentySendStart       C. GuidingStartRec         U. TelmentySendStart       C. GuidingStartRec         U. TelmentySendStart       C. GuidingStartRec         U. TelmentySendStart       C. GuidingStartRec         U. TarSwitchON-OFF       C. GuidingStartRec         U. TarSwitchON-OFF       C. GuidingStartRec         U. TuraSwitchON-OFF       C. GuidingStartRec         U. TuraSwitchON-OFF       C. GuidingStartRec         W. MitterStart       C. GuidingStartRec         W. MitterStart       C. GuidingStartRec         W. MitterStart       C. GuidingStartRec         W. MitterStart       C. GuidingStartRec         W. MontorStart       C. GuidingStartRec         RVM StortErStart       C. GuidingStartRec         U. ADCKonst	Command Name	Simulated				
G. GuidingStarkec	AG_Expose					
C. CuidingStopRet       C. CuidingStopRet         G. LinkingStopRet       C. CuidingStopRet         U. Juntost       C. CuidingStopRet         U. Juntost       C. CuidingStopRet         U. Juntost       C. CuidingStopRet         U. LampSwitchON-OFF       C. CuidingStopRet         U. TelemetrySendStart       C. CuidingStopRet         U. TalemetrySendStart       C. CuidingStopRet         W. MeterStart       C. CuidingStopRet         W. Monitofstart       C. CuidingStopRet         SPM Send       C. CuidingStopRet         SPM Start       C. CuidingStopRet         EU. ADCKonStart       C. CuidingStopRet         EU. ADCKonStart       C. CuidingStopRet         EU. ADCKonStart       C. CuidingStopRet         EU. ADCKonStart       C. CuidingStopRet	AG_GuidingStart					
C, CuitingStopRet	AG_GuidingStartRec					
C, Init         C, Init           U, FunctionsNove         C           U, LampsSwitchN-OFF         C           U, LampsSwitchN-OFF         C           U, TeilemetrySendStart         C           U, TalemetrySendStart         C           U, TalexentyChN-OFF         C           U, Thar2SwitchN-OFF         C           U, TalexentyChN-OFF         C           U, TalexentyChN-OFF         C           V, MaterStart         C           V, MeterStart         C           XPM, MonitorStart         C           XPM, PowerOF         C           XPM, PowerOFN         C           XPM, StarterUse         C	AG_GuidingStop					
U. Junit         Image: Select Se	AG_GuidingStopRec					
U.Init         U.LampsSettchON-OFF           U.LampsSettchON-OFF         Image: Comparison of the compariso	AG_Init					
U_LampSselect	CU_FunctionsMove					
U_LargsSwitchON-OFF	CU_Init					
U_TelemityAendStart	CU_LampsSelect					
U, TeleritySendStop            U, Thar/SwitchON-OFF            U, Thar/SwitchON-OFF            U, TurdsWitchON-OFF            U, TurdsWitchON-OFF            W, MitterStart            SYPM_MeterStart            SYPM_MonitorStart            SYPM_PowerON            XPM_Start            XPM_Start </td <td>CU_LampsSwitchON=OFF</td> <td></td>	CU_LampsSwitchON=OFF					
U, Thar2SwitchON-OFF         Image: SwitchON-OFF						
U_Tba32Mitch0N-OFF						
U_TurswitchON-OFF         Image: Constraint of Constra						
xhM, Init            xhM, MeterStop            XhM, ShutterSte            XhM, ShutterSte            XhM, ShutterSte            LJ, ADCMorStart            EU, JADCMorStart            EU, JADCMorStart            EU, JADCMorStart            EU, JADCStart            EU, JADCStart            EU, JADCStart            EU, JADCKrafterOfen            EU, JAUKrofen            EU, Zufilvrofen            EU, JAUKrofen						
XPM_MeterStart						
XPM_MeierStop            XPM_MonitorStart            XPM_MonitorStart            XPM_PowerOFF            XPM_ShutterUse            XPM_Start            XPM_Start            U_ADCMonStart            U_ADCMonStart            U_ADCStartStart            U_ADCMonStart            U_ADCStartStart            U_ADCStartStart            U_ADCStartStart            U_ADCStartStart            U_ADCStart            U_ADCMonStart            U_ADCMonStart            U_ADCMonStart            U_ADCStart            U_ADCMonStart            U_ADCMonStart            U_ADCMonStart            U_ADCMonStart            U_ADCStart            U_AUMONTOR            U_DUMCNORCOPEN            U_DUMCNORCOPEN            U_DUMCNORCOPEN            U_DUMCNORCOPENCENCENCENCENCENCENCENCENCENCENCENCENCE	EXPM_Init					
XPM_MonitorStart         Image: Constant Co						
XPM_PowerOFF            XPM_PowerON            XPM_Stop            XPM_Stop            XPM_Stop            U_ADCMoristart            U_ADCCMoristop            U_ADCStop            U_ADCStop            U_ADCMoriopen            U_ADCStop            U_CaMirroSpen            U_LauroStop            U_ADCStop            U_LauroSpen            U_LauroSpen            U_LauroSpen            U_LauroSpen            U_DustCoverClose						
XPM_PowerON						
XPM_ShutterUse						
XPM Start     Image: Comparison of the c						
XPM_Stop						
EU,ADCMonStart         Image: Comparison of the comp						
EU.ADCKinStop         Image: Constraint of the const						
EU_ADCStetToZero						
EU_ADCStart						
EU_ADCStop  EU_CalMirrorOpen  EU_CalMirrorSet  LU_LostCoverClose  EU_DustCoverClose  EU_CalMirrorSet  EU_DustCoverClose  EU_DUstCoverClose EU_DUstCoverCl						
EU_CalMirrorOpen  EU_CalMirrorOpen  EU_CalMirrorOt  EU_CalMirr						
EU_CalMirrorSet						
EU_DustCoverClose						
51 Duct CoverOpen						
	FEU_DustCoverOpen					
	FEU_FunctionsMove					
	FEU_Init					
	FEU_LcuUsbinit					
	FEU_NDSetByExptime					
	FEU_NDSetForTun					
	FEU_NDSetToZero					
	FEU_TelemetryStart					
EU_TelemetryStop	FEU_TelemetryStop					

#### Figure 13 - Sequencer simulation window

#### 5.4.4 Other changes

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

😣 W	Varning
	Problem while trying to send Block feedback to STS!
	OK

Figure 14 - warming of NTST connection failure

		dit Vie	w Frame	Bin Zo	iom Scale	Color	Region	WCS	Analysis		Help
	Object Value FK5 Image	a	1069 135,32767 237,791	d		185			N		
linear       log       power       square root       squared       histogram       min max       zscale         Image: Stress of the s	file	edit	view	frame	bin	zoom	scale	colo	r region	WCS	help
	linear	log	powe	r sq	uare root	squa	ared	histog	gram min	max	zscale
· ·											
					÷						

Figure 15 - The DS9 GUI with the star into the fiber, the field of view is 2.5

The compass is represented by the yellow axis, with the orientation shown in Figure 15.

Note: When the sequencer is restarted after an error, the status buttons are not refreshed to the correct status (except the lamps buttons, the LCU status and the Expose meter status, which are refreshed after a while). The undefined (yellow) status of the other buttons is not real and can be ignored if the user is sure that the instrument is initialized and ready to work.

## 5.5 Start up the Exposure Meter

The exposure meter can be started from the "**Start EM**" button in the sequencer GUI or from the **wsoper** workstation. The advised option is to start the Exposure meter from the wsoper workstation.

From the **wsoper** workstation click on the **HARPS-ICS** icon.

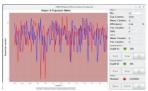
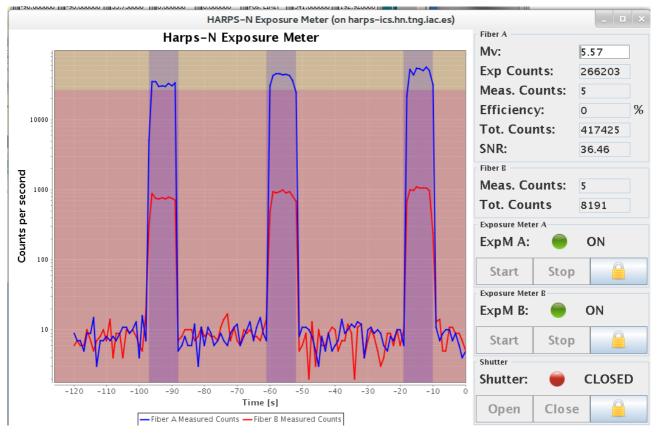


Figure 16 - Exposure meeter icon

The exposure meter have to be executed from a terminal in the following way:

- Open a HARPS-ICS terminals by clicking the HARPS-ICS icon in the wsoper workstation (or execute: ssh -X hanmgr@161.72.92.10 from a linux machine)
- 2. Change to run directory  $\rightarrow$  cd /home/hanmgr/run
- 3. Run the expose meter  $\rightarrow$  ./run\_hexpm.csh

The script opens the exposure meter GUI.





The exposure meter GUI shows the status of the two exposure meters, the status of the shutter, some information about the observation and allows the user to change the Mv of the observed star (take care with this option).

The background of the graphic panel turns to darker when the shutter is open.

Mv	Magnitude of the observed star (can be changed by user)
Exp Counts	Expected counts ( counts/second)
Meas counts	Current number of counts ( counts/second)
Efficiency	Current calculated efficiency
Tot. counts	Total number of counts
SNR	Signal to Noise Ratio (calculated)
ExpM	Status indicator of exposure meter
Shutter	Status indicator of shutter condition

#### Table 3 - Exposure meter panel

## 5.6 The HARPS-N shortcut in brunello

In the menu Application  $\rightarrow$  HARPS are available all the shortcut that can be used to start the HARPS-N applications and facilities (see fig. Figure 18)

- AG-GUI  $\rightarrow$  Start the Graphic interface of the autoguide
- HARPS-CONNECT-NEW-DRS → start an ssh connection to the "ESPRESSO DRS" machine
- HARPS-DRS  $\rightarrow$  start an ssh connection to the "DRS32" machine
- HARPS-ICS → start an ssh connection to the ICS machine (that host the sequencer and the exposure meter)
- HARPS-NSTS  $\rightarrow$  start the New Short Time Scheduler (NSTS)
- HARPS-Start-DRS-Browser  $\rightarrow$  open the new DRS GUI
- HARPS-START-NEW-DRS(NO-SOLAR) → Start the ESPRESSO DRS
- HARPS-UCAM  $\rightarrow$  start the UCAM software

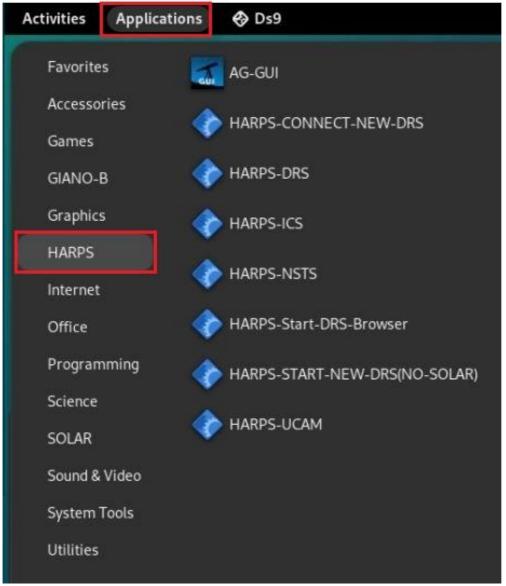


Figure 18 – brunello workstation desktop

## 5.7 Start up the New Short Time Scheduler (NSTS)

From the **brunello** workstation click on the **HARPS-NSTS** item (see Figure 18).

	New Short Term Sched Options Communication		• 1			D			) 🗠 🛛 🖉 т	CP : 2000
Plac Zon	C	x Time: 13377 D: 56070		JT: 01:54 T: 02:54		UT LT:		05:18:27 06:18:27	integritari	05h37m 21d32m
Offs	set: <b>0</b> Da	te: 23/05/	2012	57: <b>16:46</b>	:50	ST.	11:49:28	20:11:50	) Vel:	No Target
ID	Name	Target	Alpha	Delta	MV St TExp Ai Nr	1	Template Obs	ervation		
20 🗸	HARPN ech obs all				01:12 1 1	<b>•</b>	MAIN PARAMETE	DE L'DET	DPR INS OCS	TPL TEL
o 21 🖌	OB TECHNICAL				00.00		MAIN PARAMETE	NS DET	DPK INS OCS	IPL IEL
21 🗸	HARPN instr Icu init				01:		INS.MIRR.POS			
21 🖌	HARPN instr ag init				01:		1N3.P110.F03			
21 🗹	HARPN tec set lamp				01:					
o 22 🖋	OB TECHNICAL				00.00		INS.OPTI1.POS			
22 🗸	HARPN instr ag init				01:					-
o 23√	OB TECHNICAL				00.00		INS.OPTI2.POS			
23 🗸	HARPN tec startnight				01:					
o- 24 🖌	OB SCIENCE	HD127334	14h29	41:47:4	6 0 1 1					
o⊷ 25 🖌	OB SCIENCE	HD127334	14h29	41:47:4	6 0 6 5		INS.ROT1.DST			
o- 26 🖌	OB SCIENCE	HD127334	14h29	41:47:4	6 0 1 10					
o- 27 ✔	OB SCIENCE	HD127334	14h29	41:47:4	6 0 1 1.110		INS.ROT2.DST			
o- 28 🖌	OB SCIENCE	HD127334	14h29	41:47:4	6 0 1 10					
o- 29 ✔	OB SCIENCE	HD127334	14h29		6 0 1 10		INS.LAMP1.ST	0 -	Tun	
o- 30 ✔	OB SCIENCE	HD185144	19h32	69:39:4		-8				
o 31 🖌	OB CALIBRATION	NONE			0 8 2					
1.	HARPN ech cal waveAB				02: 40.0 1	= 3	INS.LAMP2.ST	0 🔻	Tharl	
	HARPN ech cal waveAB				02: 40.0 1					
o⊷ 32 🖌	OB CALIBRATION	NONE			0 8 2		INS.LAMP3.ST	1 🔻	Thar2	
	OB SCIENCE	K00141	19h12		81 0 3 3					
	HARPN ech acq objAB			50:39:05.8	13 02:					
14h 00m	16h 00m DAY 18h	00m 20h 00r			0h 00m 02h 00m		4h 00m 06h	00m -	08h 00m DAY	00m 12h 00m 1.
Sideral Time	23/05/20	12			· · · ·				2 <mark>4/05/2</mark> 0	
0	6h 00m 08h 00m	10h00m	12h 00m	14h 00m	16h 00m 18h	00m	- 20 <b>h 0</b> 0m	22h  00n	n 00h,00m	02h 00m 04
Horizon:	🖌 Pole: 🌒 I	Meridian: 🌘	Zenith: 🧹	Start I	Night: 🛷 🛛 End Night	: 🗸	Moon Posit	ion: 🖌	Moon Velocity: 🔹	🖉 Airmass: 🖋

Figure 19 - Short Time Scheduler GUI

In another way, the NSTS can to be executed from a brunello terminal with the following commands: java –jar /home/guest/NSTS/NSTS.jar

## 5.8 Start up the scientific camera (UCAM)

From the **wsastro** workstation, click on the **HARPS-UCAM** icon (the icon can be different from the Figure 20 ).

The UCAM programs will start automatically:

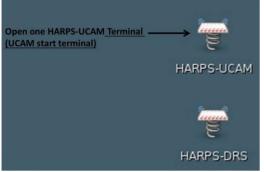


Figure 20 - Wsastro workstation desktop

In another way, these programs can to be executed from a terminal with the following commands:

- 1. Open a HARPS-UCAM terminals by executing: ssh –X ucam@ucam.hn from a linux machine
- 2. Start the UCAM software with the command  $\rightarrow$  *goucam*

The command opens three terminals and starts the DS9 GUI and the UCAM GUI. Once UCAM has been launched, the camera must be initialized and enabled.

To do so, go in the UCAM GUI do the following step and click OK when requested

- 1) Click on reset button
- 2) Click on the *initialise* button
- 3) Click on the *enable* button
- 4) Click in the *refresh* button
- 5) In the *camera applications* panel choose *ccd231\_read\_2ch\_app.xml* and click on the *select* button
- 6) click on the *Execute* button to verify the image acquisition

SAOImage ds9			
File Edit View Frame Bin Zoom Scale Color Region WCS	Analysis Help		
File Object Value	¥		. Simple Scan
🔕 👁 🔊 WxUCam (on ucam)	color region wcs help ge setup print exit .		<pre>[Information] Full frames: 1. Columns: 4036. Rows: 4112 [Information] Beginning at characterist 1574 [Information] Beginning at characterist 1574 [Information] Beapth: //now.reave/ucaw/data/ccc231/MRPPL_1574 [Information] Processing 'config' request: [Information] Configure with application coct231_read_2ch_cfg.ml, force download [Information] Configure with application coct231_read_2ch_cfg.ml" [Information] Desting new filesce saver thread [Information] Beatroged 10f lises saves files [Information] Beatroged 10f lises saves saves files [Information] Beatroged 10f lises saves saves files [Information] Beatroged 10f lises saves saves files [Informatio</pre>
<u>File View H</u> elp			[Information] Data acquisition saved 1 frames [Information] Data path: /home/ucam/ucam/data/ccd231/HARPN_1535
Application FITS Temperature Status Information Camera status IDLE Filesave status IDLE	Window Layout 4196 x 4112 pixels	Image Settings None	U UCam Demux (on ucam) d231/HRPN_1534.fits
Controller status ENABLED Version A5.6/ Exposure count 1 Countdown 0.00 Application name ccd231 read 2ch app.xml	A3.3	Extended 💠 Single 🗘	[Debug] Reading FIFD device: /dev/rtf15 [Information] Processing meta-data XML file: /home/ucam/ucam/data/ccd231/HRPN_1 55.xal [Information] Processing data file: /home/ucam/ucam/data/ccd231/HRPN_1555.dat [Information] Parsing meta-data XML file /home/ucam/ucam/data/ccd231/HRPN_1555.
Last run number HARPN_00012	_	Temperature Channel 1 Unknown K	n] parse_data) frame_status has no npixels [information] Verifying meta-data XML file /home/ucam/ucam/data/ccd231/HMRPN_153 5.xml werify_unldoc) missing data_status:frame_status:npixels element
Successfully found run number HARPN_00012 FITS imag	e file	Channel 2 Unknown K	Vering Judge / Missing Gata Status: Frame Status: Firets element (Information) Toreated FITS File: / howe/woard/data/cclus/Usad/data/cclus/Usad/HafPM_1535.fits [Bebug] Reading FIFD device: /dev/rtf15 [Debug] Reading FIFD device: /dev/rtf15
			UCam Camera (on ucam)
Camera Applications	Application Parameters	Application	[Information] Processing 'config' request: [Information] Configure with application ccd231_read_2ch_cfg.xml, force download
Initialise     ccd231_read_1ch_app.xml     ccd231_read_2ch_app.xml	# Parameter Value	Execute	Linformation; Lonrigure with application cozys_read_con_cfg,xml, force download no L/O warning : failed to load external entity "cod231_read_2ch_cfg,xml" [Information] Processing 'exec' request; 60
ccd231_read_4ch_app.xml	4 EL_GAIN 1		[Information] Processing 'config' request: [Information] Configure with application ccd231_read_2ch_cfg.xml, force download
X Disable	5 SPEED 1 6 SER REG 1	Extend	:n0 I/O warning : failed to load external entity "ccd231_read_2ch_cfg.xwl" [Information] Processing 'exec' request: G0
	7 CLK_MON1 0	10000	[Information] Processing 'config' request: [Information] Configure with application ccd231_read_2ch_cfg.xml, force download
dss.1	8 CLK_MON2 1	Stop	: no 1/D warning : failed to load external entity "ccd231_read_2ch_cfg.xwl" [Information] Processing 'exec' request: G0
Refresh 🞸 Select	🔁 Restore	Abort	
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		<u> </u>	ndare at the TNIC

Figure 21 - A view of the UCAM machine after the 'goucam'execution

## 5.9 Start up the data reduction online software (DRS)

The DRS is an ensemble of recipes to reduce various frame type produced by HARPS-N. To each observation template, a specific reduction recipe has been associated, which will reduce the so recorded raw frames and produce second-level data products.

From 2012 to 2021 the operative DRS was the DRS-32 (Original DRS) but, from 28th of October 2021 the ESPRESSO DRS was added at the HARPS-N reduction system to operate simultaneously in the data reduction of the calibration and scientific frames. Today, and for a limited period of time, the two DRS will be executed at the same time. More information about the two DRS and the way of use can be found in the HARPS-N DRS User Manual.

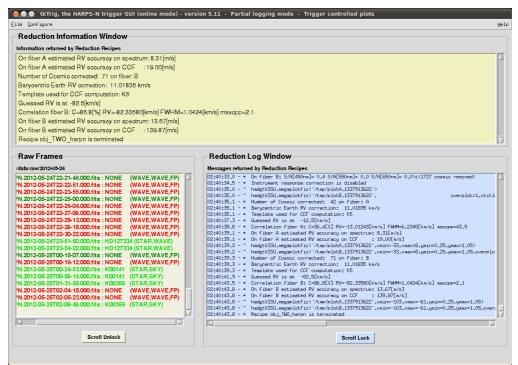
The automatic execution of the DRS and the association between template and recipe is carried out by the Trigger. In order to execute the trigger, one has to proceed as follows:

## 5.9.1 The DRS-32 Start-up procedure (original DRS)

The procedure to start the original DRS is the following:

- 1) Open a HARPS-DRS terminals by clicking the **HARPS-DRS** item in the **brunello** workstation, Figure 18 (or execute: ssh –Y harpn@drs32.hn from a linux machine)
- 2) Run the trigger and DS9  $\rightarrow$  ./start\_DRS.csh

The trigger will show any new raw frame arriving in the *current* night directory and automatically execute the corresponding recipe. (the trigger can be started without ds9  $\rightarrow$  trig.csh online)





**Important note:** The data reduction is an automatic but completely 'off line' process. The observations can be carried out without any loss of data or information even WITHOUT starting the DRS. For no reasons the observations should be halted because of the DRS is not able to run or simply not running. The one note of caution is that no quality feed-back will be available from the DRS in these cases. The Observer should make sure that the instrument parameters are all ok and that a full calibration set has been carried out at the beginning or the end of the night.

In case the Observer would like to reduce another night that the current one, he/she may launch the trigger in the 'offline' mode by typing: trig.csh 'online YYYY-MM-DD'. If the night had already been reduced, but the Observer would like to re-reduce it, then he/she will first have to remove the file YYYY-MM-DD.r in the folder /data/msg/.

#### 5.9.2 Start up the data reduction offline software (Original DRS: OFFDRS)

In case the Observer would like to analyse the results of the pipeline, he/she may launch the DRS offline by typing the command: *offdrs.csh* and selecting the night and the reduced data from the user interface.

tkDRS, the HARPS-N Offline	DRS GUI - version 5.1	- Partial logging mode	- Trigge 🗕 🗖 🗙
ile <u>R</u> educed Frames			He
Information returned by Reduction	n Recipes		
			-
-Reduced Frames			
Directories	/home/cosentino/da	ta/reduced/2012-12-15	
<up directory="" parent="" to=""></up>	HARPN,2012-12-14T2 HARPN,2012-12-14T2 HARPN,2012-12-14T2 HARPN,2012-12-14T2 HARPN,2012-12-14T2 HARPN,2012-12-14T2 HARPN,2012-12-14T2 HARPN,2012-12-15T1	0-21-24,447_ccf_TH_A,fits ( 0-21-24,447_ccf_TH_B,fits ( 0-21-24,447_e2ds_A,fits ( 0-21-24,447_e2ds_B,fits ( 0-21-24,447_wave_B,fits ( 0-21-24,447_wave_B,fits ( 0-23-04,151_e2ds_A,fits ( 0-23-04,151_e2ds_B,fits ( 6-56-37,343_loco_A,fits ( L	WAVE,WAVE,THAR2 ) HAVE,WAVE,THAR2 ) HAVE,WAVE,THAR2 ) HAVE,WAVE,THAR2 ) HAVE,WAVE,THAR2 ) HAVE,WAVE,THAR2 ) HAVE,WAVE,FP ) HAVE,WAVE,FP ) ts (LAMP,DARK,TUN )
Change Directory	Update List	Eilter Files	Special Reduction
Offline Reduction			off_visu_e2ds_harpn
Command lines			o <u>f</u> f_visu_s1d_harpn
Command lines			off_visu_bis_harpn
			off_v <u>i</u> su_ccf_harpn
			off_vi <u>s</u> u_SN_harpn
			off_visu_rvo_harpn off_visu_dark_harpn
			off_wake_bis_harpn
J			off_make_ccf_harph

Figure 23 - Offdrs User interface

#### 5.9.3 The DRS trigger (ESPRESSO DRS)

The fast method to start the ESPRESSO DRS is by click the **HARPS-START-NEW-DRS** item in the Brunello desktop (Figure 18). This shortcut starts the ESPRESSO DRS and the WebGUI (Figure 24).

Another way to start the ESPRESSO DRS is the following:

- 1) Open a HARPS-DRS terminals by clicking the HARPS-CONNECT-NEW-DRS icon in the **brunello** workstation, Figure 18.
- 2) Run the trigger:
  - a. cd Trigger
  - b. python OnlineTrigger.py [options] → *python OnlineTrigger.py -i HARPN*
  - c. start the WEBGUI by clicking in the HARPS-START-DRS-GUI

The WEB GUI will show any new raw frame arriving in the *current* night directory and the trigger automatically execute the corresponding recipe (Figure 24). More information about the ESPRESSO DRS can be found in the TNG-MAN-HARPN-0006, HARPS-N DRS User Manual.

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ARPN.2021-10-21T13-11-2	2.206.fits OBJ FP	Sun	2021-10-21 13:16:46 Ok	[ INFO ] esores: Created product /mnt/ing-archive-harps/reduced/DRS-2.3.3/esores-reduced/tmp-2021-10-21T14:21		
ARPN.2021-10-21T13-16-4		Sun	2021-10-21 13:22:14 Ok	[ INFO ] esorex: Created product /mnt/tng-archive-harps/reduced/DRS-2.3.3/esorex-reduced/tmp-2021-10-21T14:21		
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	-			[INFO] esorex: Created product /mnt/tng-archive-harps/reduced/DRS-2.3.3/esorex-reduced/tmp-2021-10-21T14:21		
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ARPN.2021-10-21T13-54-4	2.037.fits OBJ FP	Sun	2021-10-21 14:00:09 Ok	[INFO] esorex: 10 products created		
ARPN.2021-10-21T14-00-0	6.774.fits OBJ FP	Sun	2021-10-21 14:05:34 Ok	[ INFO ] esores: Recipe operation(s) took 41.4 seconds to complete.		
ARPN.2021-10-21T14-05-3		Sun	2021-10-21 14:10:59 Ok	[ INFO ] esores: Size of single raw input frame = 35.37 MB		
ARPN 2021-10-21T14-00-5	-	Sun	2021-10-21 14:16:22 Ok			
ARPN 2021-10-21T14-10-5				[ INFO ] esorer: => processing rate of 0.85 MB/sec		
	1.763.fits OBJ_FP	Sun	2021-10-21 14:21:46 Ok			
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Figure 24 - The WEB GUI

Further information on the ESPRESSO DRS can be found in TNG-MAN-HARPN-0006\_HARPS-N\_DRS\_Manual [RD11].

# 6 How to shut-down HARPS-N (end of observations)

## 6.1 How to shut-down the subsystems

- 1. From the sequencer do an "END NIGHT" and wait until the processes ended
- 2. Close the NSTS
- 3. Close the exposure meter
- 4. Close the Sequencer GUI, the DS9 and the remote connections to harps-ics.hn
- 5. Close the DRS, the DS9 and the remote connection to drs32.hn
- 6. Close the UCAM software (the ds9, the GUI and the tree terminals) and close the remote connection to ucam.hn
- 7. Close all the AG CORE  $\rightarrow$  CTRL+C (to close all the connection properly)
- 8. Close the LCU. (TO)
- 9. Power off the Dolores electronics (TO, if needed)

# 7 Troubleshooting

In the following, we will describe a series of known bugs and problems, and how to solve them. This chapter will evolve very rapidly due to the on-going software upgrades.

## There is no light of the guiding camera after acquisition

- Have you changed the cuts and moved the image around in the DS9?
- Has there been any error in the Sequencer or elsewhere, which prevented the acquisition to be carried out?
- Has the telescope received and executed the pointing command and respective coordinates?
- Is the telescope dome open and the telescope started?
- Is the telescope configured for HARPS-N (ask the telescope operator):
  - M2 position for HARPS-N nominal focus
  - M3 position on Nasmyth B
  - M4 position 'ADC' for HARPS-N
  - Derotator position set for HARPS-N and stable!
- Has the L1-lens cover on the derotator been opened?
- Is the 'cal mirror' out of the beam ('NONE' position)? Check on LCU Device Monitor and whether there have been errors in the Sequencer. If necessary, move it 'manually' from the LCU Simple\_client panel on the LCU machine

## The Sequencer does not execute the expected action

It might happen that the OB doesn't executed the expected actions (i.e. telescope slew) and the "Next OB" button is inactive. In this case there are probably a communication problem between the sequencer and the NSTS.

In this case the solution is :

- Abort the current OB (only if the "next OB" button is shadowed)
- Close the sequencer (GUI and DS9)
- Close the NSTS (save the list before)
- Close the exposure meeter
- Execute the sequencer (paragraph 5.4)
- Execute the exposure meeter (5.5)
- Execute the NSTS (paragraph 5.6)

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Figure 25 - TNG Observing Manager

#### **Other Sequencer errors**

- Error: The OB ends/frozen immediately after
   \*\*\*\*\*\* NEXT OBSERVATION \*\*\*\*\*\*
   Solution: → close and restart the NSTS (save the list before)
- **Problem**: The sequencer is frozen and you want to stop it **Solution**: see *0 This part* will be completed after analyzing the "Bugzilla" and after receiving the feedback from the HARPS-N users that are encouraged to send me any comments and suggestion to revise this manual and, above all, to complete this paragraph.

The procedure to recovery LCU errors is the following:

- 1) Stop of the LCU by clicking the "STOP LCU" button (Figure 7).
- 2) Close the interface
- 3) Start the LCU again
- 4) Select the 'INIT ALL' tab
- 5) Click on "INITIALIZE ALL HARDWARE" button

Sequencer errors

• **Problem**: The sequencer terminate the exposure with an ABORT 1. **Solution**: see

#### UCAM errors (5)

#### The Trigger/DRS remains stuck or crashed on a specific exposure

In case of DRS/trigger crashes, look into the terminal window to see if there is any python error message. Most of the time it is necessary to exit and restart the trigger.

- 1) Close the DS9 associated with the DRS
- 2) Close the terminal (CTRL+c)
- 3) Restart the DRS

If the problem persists, (stops always on the same exposure) proceed as follows:

- On the drs32.hn machine, edit the file "/data/msg/<night>.r"
- Add a line indicating the exact name of the RAW frame the DRS has to skip. Follow the format of the previous line considering that only the file name column is needed. In general you may add/remove frames that you want to skip or re-reduce, respectively.
- Save the file and re-start the Trigger.

Note: If this procedure don't work the reason is a file format problem. Try to re-edit the file and delete the spaces after the line added.

If the DRS shows the error message "CalibDB locked. Waiting...", delete the file "/data/calibDB/lock\_calibDB".

#### The Trigger/DRS return errors in all the calibration reduction

The reason can be a wrong configuration of the instrument, due to a LCU fail. To verify it, consults the "standard calibration" document [RD12].

If the error depends of a wrong configuration of the instrument:

- Close the LCU.
- Restart the LCU and verify if there are errors\*.
- Init the LCU and repeats the standard calibration, following the *standard calibration* document
- \*) In case of LCU errors, contact Manuel Gonzalez or Rosario Cosentino

# 8 Re-starting specific components in case of troubles

## 8.1 Autoguide errors

This part will be completed after analyzing the "Bugzilla" and after receiving the feedback from the HARPS-N users that are encouraged to send me any comments and suggestion to revise this manual and, above all, to complete this paragraph.

The procedure to recovery AG errors is the following:

- 1) Stop of the AG core  $\rightarrow$  CTRL+C (to close all the connection properly)
- 2) Wait 30 seconds
- 3) Start of the AG core  $\rightarrow$  ag

## 8.2 LCU errors

This part will be completed after analyzing the "Bugzilla" and after receiving the feedback from the HARPS-N users that are encouraged to send me any comments and suggestion to revise this manual and, above all, to complete this paragraph.

The procedure to recovery LCU errors is the following:

- 6) Stop of the LCU by clicking the "STOP LCU" button (Figure 7).
- 7) Close the interface
- 8) Start the LCU again
- 9) Select the 'INIT ALL' tab
- 10)Click on "INITIALIZE ALL HARDWARE" button

## 8.3 Sequencer errors

## 8.3.1 The sequencer don't start

If an error message "remove .#lock file in .Nsequencer" appears follow the following instructions:

- 1. Connect to ICS-machine:
  - ssh -X hanmgr@161.72.92.10 from a linux machine)
- 2. Change to .Nsequencer directory  $\rightarrow$  cd /home/hanmgr/.Nsequencer
- 3. Delete the lock file  $\rightarrow$  rm .#lock
- 4. Start the sequencer again

If appears this warning in the sequencer log: FRM\_TIME Keyword hasn't been extracted correctly. Defined exposure time will be used instead

## 8.3.2 The sequencer remains frozen

When a sequencer remains frozen or doesn't get the next block from the STS, the procedure to restart depends on the last operation executed and not terminated. First verify with TO the status of exposure meter.

Case 1: The sequencer is crashing during a UCAM acquisition,

- 1. Close the sequencer GUI
- 2. Close the expose meter
- 3. Close all the windows of the UCAM software (only if the acquisition system is blocked)
- 4. Start the UCAM software (if it was closed before)
- 5. Start the sequencer GUI and the expose meter

Case 2: The sequencer is crashing during other conditions (telescope slew, repoint, init, etc) the procedure is the following:

- 1. Abort the current OB (only if the "next OB" button is shadowed)
- 2. Close the sequencer GUI and the expose meter
- 3. Start the sequencer GUI and the expose meter

#### 8.3.3 The DS9 unexpectedly closes

When the DS9 unexpectedly closes, and the button "*Re-Start DS9*" doesn't work, the procedure to restart is the following:

- 1. Abort the current OB (only if the "next OB" button is shadowed)
- 2. Close the sequencer and the expose meter
- 3. Start the sequencer and the expose meter again

Note: When the sequencer is restarted the status buttons are not refreshed to the correct status (except the lamps buttons, which are refreshed after a while). The undefined (yellow) status of the other buttons is not real and can be ignored if the user is sure that the instrument is initialized and ready to work.

## 8.4 Expose meter errors

If the exposure meter is still running but the GUI is not visible on the screen or an error message "remove .#lock file in .HEXPM" appears, follow the following instructions:

- 2. Connect to ICS-machine:
- ssh -X hanmgr@161.72.92.10 from a linux machine)
- 3. Change to .HEXPM directory  $\rightarrow$  cd /home/hanmgr/.HEXPM
- 4. Delete the lock file  $\rightarrow$  rm .#lock
- 5. Start the exposure meter again

## 8.5 UCAM errors

#### 8.5.1 The sequencer ABORT the Exposure

## When the sequencer terminates the exposure with an 'ABORTED'

Example: Sequencer: Fri Nov 23 03:59:03 UTC 2012 /ObsBlockStatus/ABORTED /ObsBlockStatus/ABORTED *Terminating Exposure...* 

#### Or the exposure ends after about 20 seconds

The solution is to restart the UCAM from the UCAM-GUI (Figure 21) as following:

- 1) Click on **reset** button
- 2) Click on the *initialise* button
- 3) Click on the *enable* button
- 4) Click in the *refresh* button
- 5) In the *camera applications* panel choose *ccd231\_read\_2ch\_app.xml* and click on the *select* button (if not selected)
- 6) click on the *Execute* button to verify the image acquisition

#### **8.5.2** The sequencer get stuck during exposure

*If the exposure counter in the sequencer GUI exceeds the expected time (Exptime + 40 seconds) this means that the UCAM got stuck.* 

The solution is:

a) Abort the current OB (only if the "next OB" button is shadowed)

- b) Restart the Sequencer and the sequencer GUI
- c) restart the UCAM from the UCAM-GUI (Figure 21) as following:
- 1) Click on reset button
- 2) Click on the *initialise* button
- 3) Click on the *enable* button
- 4) Click in the *refresh* button
- 5) In the *camera applications* panel choose *ccd231\_read\_2ch\_app.xml* and click on the *select* button (if not selected)

click on the *Execute* button to verify the image acquisition

HARPS-N TNG webpage	http://www.tng.iac.es/instruments/harps/
TNG Observing Manager	http://ntcs-glassfish1.tng.iac.es:7080/ntcs-ocsservice/manager/ui/observingmanager.jsf
HARPS-N Sensors	http://tngweb.tng.iac.es/telemetry/systems/HARPS
Instrument status	http://ntcs-glassfish2.tng.iac.es:7080/webcontrolpanel/ui/instrumentstatuspanel.jsf
Serrurier & M2 status	http://ntcs-glassfish1.tng.iac.es:8080/aopt-service/gui/ui/serrurier.jsf
TNG Telemetry Cache Service	http://ntcs-glassfish1.tng.iac.es:7080/ntcs-cacheservice/monitor/ui/telemetry.jsf
HARPSN wiki page	http://dokuwiki.tng.iac.es/dokuwiki/doku.php/instruments:harps:start

## **Appendix A - Useful Harps-N webpages**

# Appendix B - Actions of multi task commands

## **Telescope Start Night:**

- Open the Dust Cover
- Open the HARPSN derotator cover
- Power on the Dolores electronics
- Initialize the Dolores movements
- Move the 'entrance slider' (M4) to the HARPS position
- Power on the M3 control
- Move M3 to Nasmyth-B (the TO had to set the telescope in Nasmyth-B mode)
- Power off the M3 control

## **Telescope End Night:**

- Stop the guide
- Stop the telescope
- Close the HARPSN derotator cover
- Stop the LCU (move the motors at the default position)

## Start Telescope:

- Open the HARPSN derotator cover
- Power on the Dolores electronics
- Initialize the Dolores movements
- Move the 'entrance slider' (M4) to the HARPS position
- Power on the M3 control
- Move M3 to Nasmyth-B (the TO had to set the telescope in Nasmyth-B mode)
- Power off the M3 control

## **End Telescope:**

• Close the derotator-B cover

# **Appendix C** - Actions of focus procedure commands

- Start the pointing (move the telescope)
- acquire an image from the autoguider camera and shows the image in the DS9
- Wait for User selects and puts the star in the hole position
- Send the offset to telescope (repoint)
- Send a M2 offset (- 0.25)
- start a loop of M2 offsets (0.083) and exposure meter acquisitions (default 7 step)
- Calculate best focus
- move M2 to best focus
- acquire an image from the autoguider camera and shows the image in the DS9
- wait for user actions (save or cancel focus) (While the user can execute actions: repoint, expose, get info, etc)

# Appendix C – List of acronyms

ADC	Atmospheric Dispersion Compensator
AG	Auto-Guider
CCD	Charge Coupled Device
CCF	Cross Correlation Function
CFC	Continuous Flow Cryostat
CU	Calibration Unit
DFS	Data Flow System
DRS	Data Reduction Software
E2DS	Extracted 2-Dimensional Spectrum
ETC	Exposure Time Calculator
FEU	Front End Unit
FITS	Flexible Image Transport System
FWHM	Full Width at Half Maximum
HARPS-N	High Accuracy Radial velocity Planet Searcher in the North hemisphere
ND	Neutral Density
NSTS	New Short Time Scheduler
OB	Observing Block
RV	Radial Velocity
SA	Support Astronomer
SNR	Signal to Noise Ratio
TBC	To Be Confirmed
TBD	To Be defined
TBF	To be fixex
ThAr	Thorium Argon
TNG	Telescopio Nazionale Galileo
ТО	Telescope Operator
VA	Visiting Astronomer