



NIRPS – “state of the union”

NIRPS co-PI's

# A project with an excellent timing!

- **Science:** The need to dedicate a substantial amount of time for follow-up of transiting planets
- **Science:** The strong interplay with the upcoming facilities/missions
- **ESO community:** justification to update La Silla rather than closing it
- **Political:** the “eminent” Brazilian ratification and the need to integrate Brazil with ESO and its community

# Initial ideas

- **Fastrack instrument** to keep the pace with space facilities: built in 3/4-years (and hence, simple the opposite of Xmas tree-style)
- Transforming La Silla in a unique place for exoplanetology
- Strong Brazilian participation to learn technical and managerial aspects of ESO projects and build trust within the ESO community towards future projects.

# NTT call for ideas – the ideal opportunity

- NTT call for ideas (including operations) issued on Feb with a deadline March 31, 2014
- 150 nights/year during 5 years
- Lol prepared by Melo et al. describing the science cases, synergies with the ESO program and the top-level requirements for a NIR spectrograph
- Initial core team already formed by the time of the Lol: Brazil, Canada and Switzerland
- 16 colleagues co-signed the letter: Brazil, Switzerland, Canada, Portugal, Spain, UK, Chile, Sweden
- “Inclusiveness statement”, we would welcome additional partners from the community sharing the same vision.
- Selected to answer the CfP on July 2014.

# The way towards a proposal

- Took sometime to convince ourselves to answer the call as there was no filtering after the Call for Ideas
- We wanted to be sure that after the call a decision would be made
- Problems to assemble the technical team on the Brazilian side as the only partner with experience in instrumentation withdrew
- Preliminary optical design done by Bernard in November during his visit to Natal and discussed with Francesco and Claudio
- Core of the science case done by Figueira et al.
- Submitted on Feb 13, 2015

# Things changed... NIRPS not selected

- SOXS chosen for the NTT
- ESO started to consider to have a new instrument on the 3.6-m
- The approval of the ratification by the Brazilian Senate on May 15 gave a decisive push to have NIRPS on the 3.6-m
- Letter received with the invitation to build NIRPS on May 29

# Is this worth the effort...

- as we are competing with HARPS? (taking time instead of adding time...)
- as the whole design gets complicated? (AO solution not so simple)

# A way forward for everybody

- ESO could Keep La Silla open and renew some of the infrastructure benefiting existing equipment like HARPS and CORALIE
- The extratime provided by a RV machine in the NTT is now spread over a period of 5-10 years in a fully (almost) dedicated “planet” telescope
- Brazil can engage in a instrumentation project
- These were key arguments to consolidate Geneva and Canada’ positions towards NIRPS  
(without them there in no NIRPS)



# The “old” NIRPS

**Table 2: Summary of the instrument configuration**

<b>Subsystem</b>	<b>Parameters</b>
Fiber feed, HPM-mode Baseline configuration	0.3” object fiber, AO-assisted feed 0.3” sky fiber 0.3” sim. reference fiber
Fiber feed, IFU-mode	3 x 3 square elements of 0.3”, 0.9” FOV, AO-assisted feed 9 x 0.3” object fibers aligned on a long slit.
Environment	T-controlled environment ( $17^{\circ}\text{C} \pm 0.01^{\circ}\text{C}$ ) Pressure controlled instrument ( $< 10^{-4}$ mbar) Cryogenic instrument ( $180\text{K} \pm 0.01\text{K}$ )
Covered spectral range Possible extention	0.95-1.8 $\mu\text{m}$ 2 – 2.4 $\mu\text{m}$ (K-band) 0.8 - 0.95 $\mu\text{m}$ (Z-band)
Spectral resolution	100,000
Calibration sources	U-Ne lamp, Stabilized Fabry-Perot, LFC
Detector and format	Hawaii-4RG, 4kx4k, 15 or 10 $\mu\text{m}$ pixels
Sampling	3 pixels per spectral element

<b>Optical element</b>	<b>Efficiency@peak</b>
Atmosphere	0.70
Telescope	0.70
NFA and AO system	0.80
Slit losses (efficiency)	0.50
Fiber Link	0.80
Spectrograph	0.47
Detector	0.90
<b>Total</b>	<b>0.07</b>

Input F/N	F/9 (spectral) x F/7.5 (spatial)
Fiber diameter (projected on slit)	45 $\mu$ m (spectral) x 37 $\mu$ m (spatial)
Collimated beam [mm] (pupil)	80 (spectral) x 107 (spatial)
Main disperser grating	13 mm <sup>-1</sup> , 76°
Grating off-plane angle	4.8°
Order numbers	From 83 to 165
Cross disperser	VITRON IG-4, 22 ° Prism

# Financial situation

**Table 1 Capital cost estimate of the NIRPS project excluding operations**

WP	Item	FTE Estimate (Integrated over the project)	Capital Cost (k€)
1000	Project Management	2.0	
2000	System Engineer	2.0	
3000	Software System Engineer	1.0	
4000	Science Matters	3.0	
7000	Front-end + AO	3.0	500
	Calibration Unit	1.5	200
8000	Spectrograph Mechanics	3.0	200
9000	Spectrograph Optics	1.5	800
10000	Fiber-link	2.5	300
11000	Detector Unit	3.0	1000
	Controller + Cryostat+ Dewar	3.0	300
12000	Vacuum & Cryogenics	9.0	300
13000	Thermal system	3.0	200
14000	Software OS/ICS	3.0	5
15000	Maintenance Software	0.2	5
16000	DRS	3.0	5
17000	Observations Preparation	2.0	5
18000	Electronics	9.0	100
18500			
19000	System AIV	6.0	100
19500			
	<b>Total Phase A to E</b>	<b>60.7</b>	<b>4020</b>
	<b>Travel &amp; Transportation</b>		<b>100</b>
	General Travel		300
	Transportation	1.0	50
	Installation	0.1	15
	<b>Total Project without operations</b>	<b>61.8</b>	<b>4485</b>

Brazil	1.0 M€
Canada	0 – 4.5 M€
Portugal	0.2 M€
Spain	0.5 M€
Sweden	0.2 M€
Switzerland	1.0 M€
UK	1.0 M€
<b>Total</b>	<b>3.9-8.4M€</b>

**THE AGREEMENT SO FAR**

# The agreement so far

- **July 15.** Discussion with Tim (ESO DG) followed by a meeting with Luca on the spirit of the agreement and the way forward to NIRPS bringing benefits for both parties
- **July-August 15.** First (internal) draft written by PI's
- **August 15.** Iteration with Luca in Natal. First ESO draft produced
- Since then many iterations back & forth with some remaining hard points (see below)

# Key elements of the agreement:

## **Consortium takes care of everything**

- The consortium is in charge of everything: design, construction, operations and maintenance of NIRPS during the duration of the agreement
- Set to be initially of 5 years renewable for another 5.
- The consortium will receive 145 nights/year of GTO on the 3.6-m (HARPS or NIRPS) during 5 years.

# Key elements of the agreement:

## **Fast track approach**

- The project structure is simplified, i.e., the reviews, milestones and progress meetings are organized by the consortium with participation of ESO
- much lighter than in the VLT-type contracts. Justified by the speed of the science case, the size/simplicity of the project and the of the interface of La Silla (telescope and HARPS)
- Schedule and top-level requirements and simplified SOW have been agreed

# Schedule

<b>Key milestones</b>	<b>Estimated time</b>
Kick off	T0
Preliminary Design Review (PDR)	T0 + 6 months
Final Design Review	T0 + 18 months
Preliminary Acceptance	T0 + 36 months
Provisional Acceptance in Chile	T0 + 42 months



# Key elements of the agreement:

## Top-level requirements are stated

- The spectrograph's spectral range must cover the Y, J, H bands
- Optionally, the spectrograph's spectral range can be extended to the Z and/or the K band.
- Optionally, the K band can include a polarimeter.
- The total efficiency at blaze peaks (including atmosphere, telescope and slit losses for a 1arcsec seeing in V band) in the mandatory spectral bands shall be at least of 6%.
- A spectral resolution of at least  $R = 80'000$  must be achieved.
- Spectroscopic fidelity and stability is a main objective. A resolved spectroscopic line shall be reproduced with a precision of 1/100 of the local continuum and a repeatability of 1/1000 of the local continuum when not limited by photon noise.
- The NIRPS RV precision (after calibration and data reduction) must be better than 1m/s over short and long time scales (years) , in order to execute coherent and long-lasting programs.
- The operations must be organized in an efficient, flexible and reliable way in order to optimize the scientific output. The reference shall be HARPS.

# Top-level requirements, cont'd

- NIRPS and HARPS should be able to be operated independently.
- By no means the presence of NIRPS and its sub-systems should pose a threat to HARPS performance and stability.
- Given the above, at best-effort basis, simultaneous observations with HARPS and NIRPS shall be made possible on the same target.
- NIRPS shall make use of VLT standard components and instrument software as far as reasonable. Should this not be the possible, well-documented or commercial products should be added.
- NIRPS shall comply with the 3.6-m telescope interface requirements and with the VLT data-flow system.
- The online pipeline and the data reduction package shall provide the required radial velocity precision and spectral fidelity. The online pipeline shall be able to process one typical night (series of 15 min exposures) in real time.
- The instrument must be safe for people and to avoid damaging itself or other equipment.
- For standard observations, no night calibrations shall be needed to reach the performances specified.
- Necessary documentation should be provided by the Consortium at PAC (or at a later date if mutually agreed by the parties) with the aim of allowing ESO to operate and maintain, disassemble and re-assemble the instrument for a period after the termination of this MoU

# Hard points:

## **ESO obligations**

- ESO is willing to pursue operations of the 3.6-m telescope beyond the duration of the present agreement, dedicating a large fraction of the telescope to exoplanet science including a substantial and sustained effort for the follow-up of space missions in the field with particular emphasis on ESA missions. The exact definition of the forementioned fraction is to be decided by ESO considering the scientific priorities of the parties at the moment of the Provisional Acceptance in Chile.
- ESO will grant full access and assign the Cassegrain Cage and the Coudé room east to the NIRPS consortium.
- ESO will maintain its open-sky policy so that the Canadian astronomical community can have access to both HARPS and NIRPS in non-GTO time through the standard ESO proposal process.

# Hard Points #2

- **General Conditions.** Comprehensive document regulating complex commercial relations. Applicable parts were added to the agreement.
- **PI affiliation.** The centralized PI-model is not applicable here. We need all 3 co-PIs to provide support to the agreement & PI will move to Brazil whenever possible (second half of 2016/beginning of 2017)
- **GTO expenses.** We ask ESO to cover travel costs during GTO runs.
- Instrument property in case ESO changes plans about La Silla (closing it)

# Next steps

- ESO has the latest version of the agreement
- To be discussed with Luca in Feb 1<sup>st</sup> in Santiago
- Hard points also briefly discussed with Tim