# The opportunity of GIARPS@TNG

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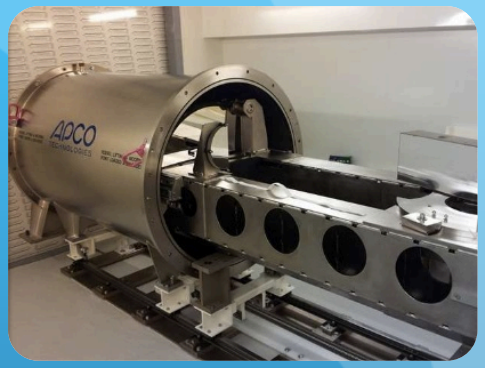
& GIARPS Team

Riunione Macroarea 2
Bologna, 15-16 Giugno 2016

# The GIARPS Project

*Aim:* high resolution VIS-NIR spectra + high precision RVs




*Method*: combining two instruments already in use @TNG:

- ✓ HARPS-N (0.38 μm < λ< 0.69 μm)
- ✓ GIANO (0.95 μm < λ < 2.45 μm)

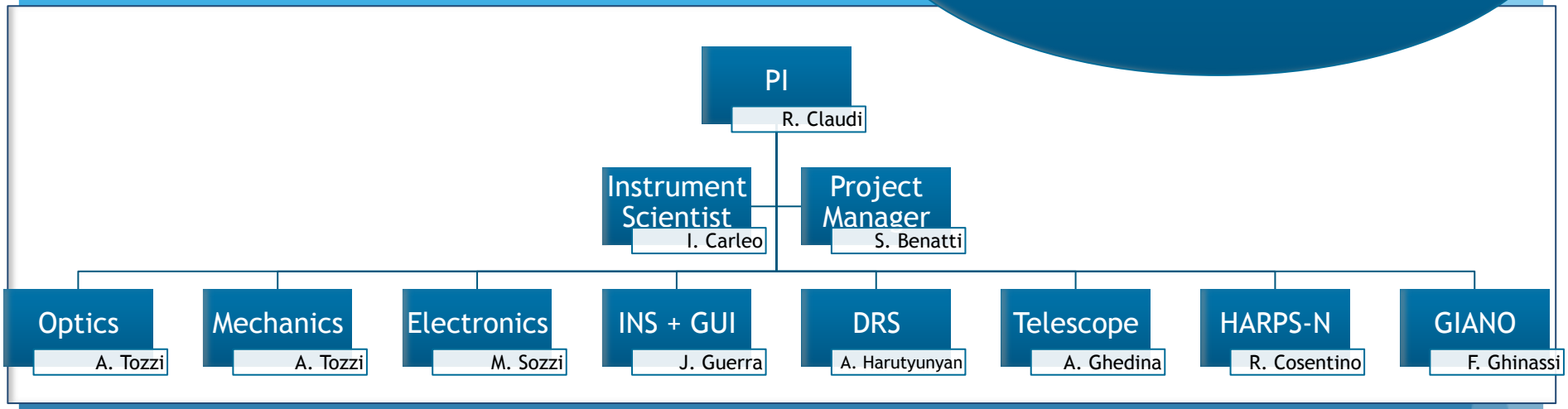
*Supported by:* Premiale WOW

*Schedule:*

- ➢ Commissioning & SV December 2016/March 2017;
- ➢ Available to the community from April 2017

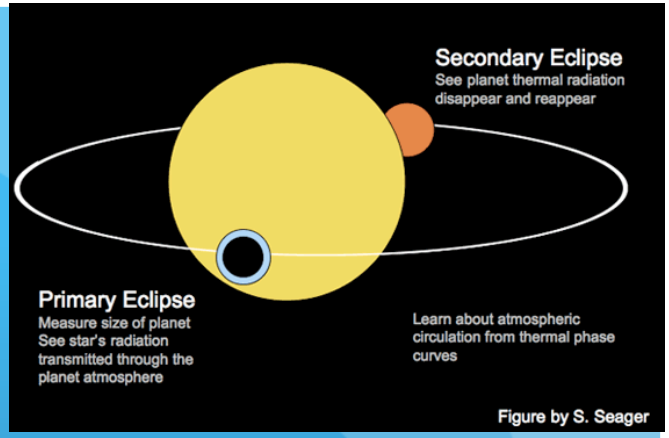
# GIARPS People

SCIENCE TEAM:
S. Benatti, I. Carleo, R. Claudi, A. Ghedina, R. Gratton, L. Malavolta, J. Maldonado, G. Micela, E. Molinari, E. Oliva, A. Sozzetti




Ulf Seemann, Francesca Ghinassi, Nicoletta Sanna, Andrea Tozzi, Avet Harutyunyan, Alfio Puglisi, Marcello Lodi, Salvo Scuderi, Mauro Sozzi, Nauzet Hernandez, Esther Gonzalez, Andrea Baruffolo, Bernardo Salasnich, Daniela Fantinel, Marco De Pascale, Marcella Iuzzolino, Jose Guerra, Rosario Cosentino, Nicolas Buchschacher

# GIARPS Science Case: Planetary atmospheres




- **Transiting planets:**
  transmission spectroscopy & secondary eclipse
- **Non transiting exoplanets:**
  dayside spectroscopy
- **Orbital phase variation**

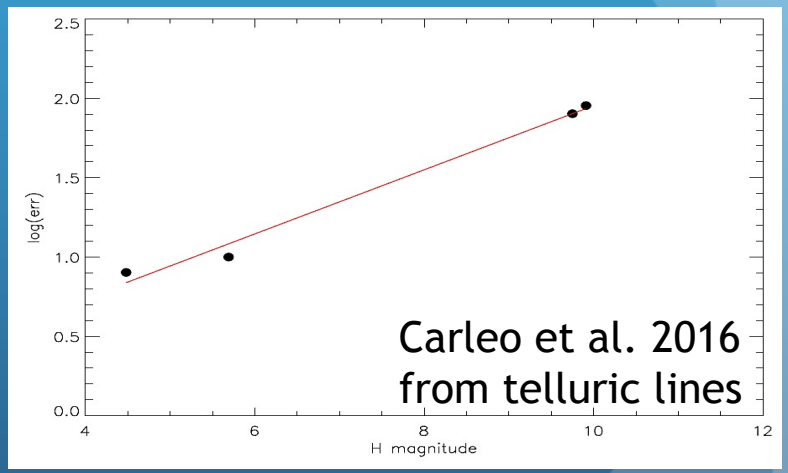
**GIARPS contribution:**

- Observation of molecular absorption bands
- Exploration of the K-band (e.g. $H_2O$)
- TiO in the visible

Ongoing study (PI: A. Bonomo): preliminary detection of $H_2O$ with GIANO in the atmosphere of the transiting exoplanet HD189733b

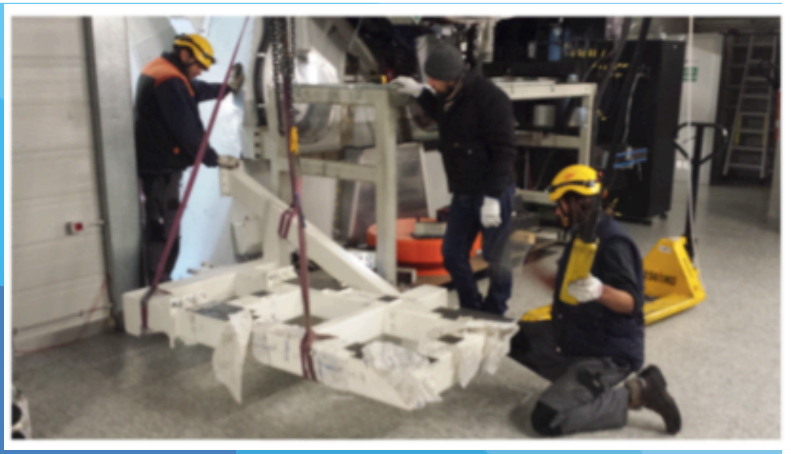
# GIARPS: RV Exoplanet Search

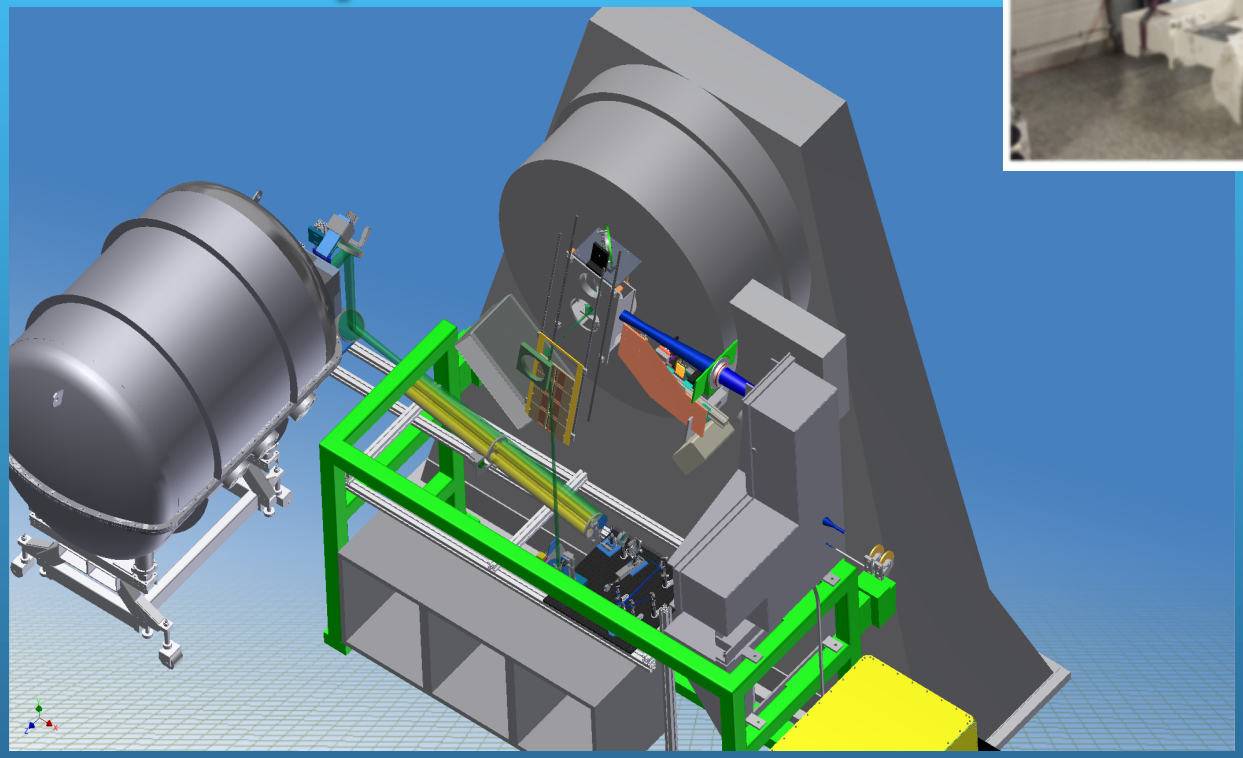
- VIS + IR to discriminate the origin of Radial Velocities variation
- Extension to stars with late spectral types
- Improvement in RV accuracy (less than 10 m/s) with absorbtion cell




- Cool stars
- Active stars and giants
- Open clusters
- Young nearby stars

# Mechanical solution & new preslit





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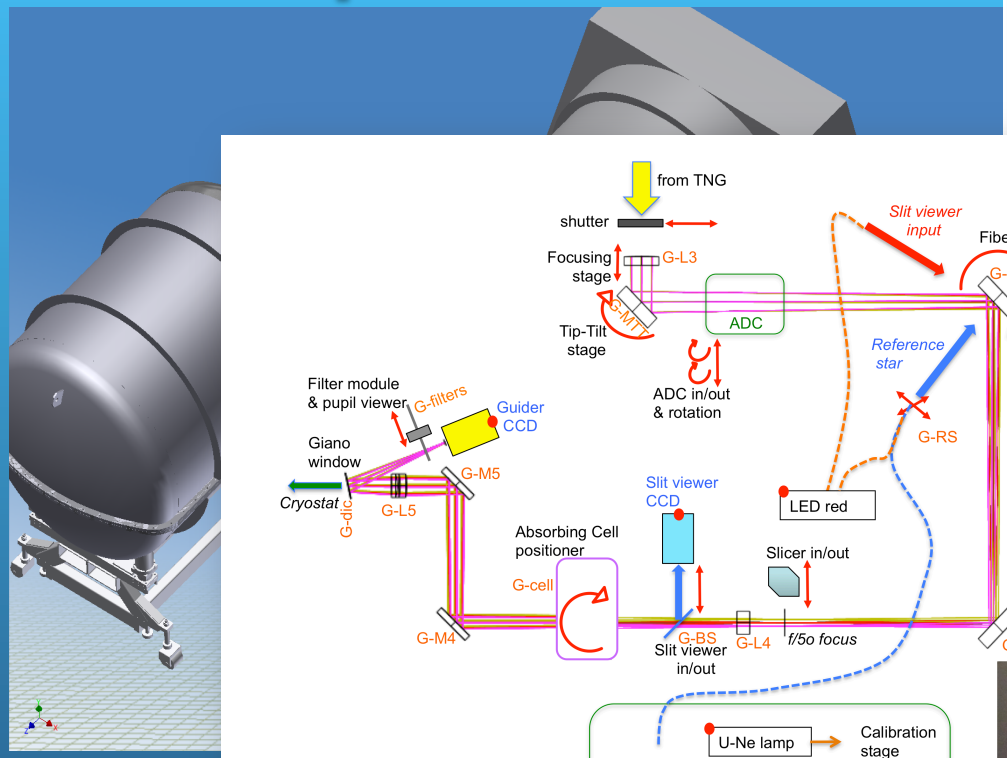




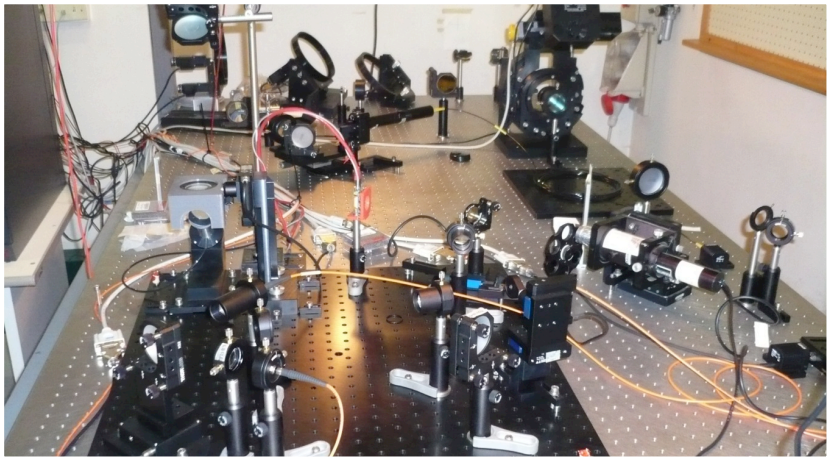

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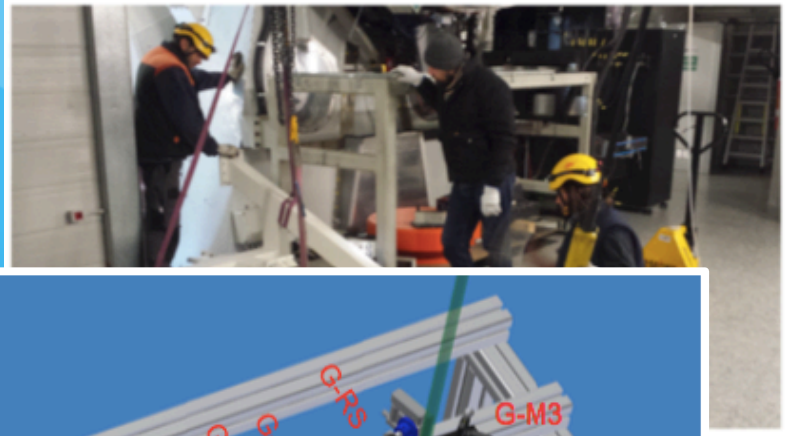
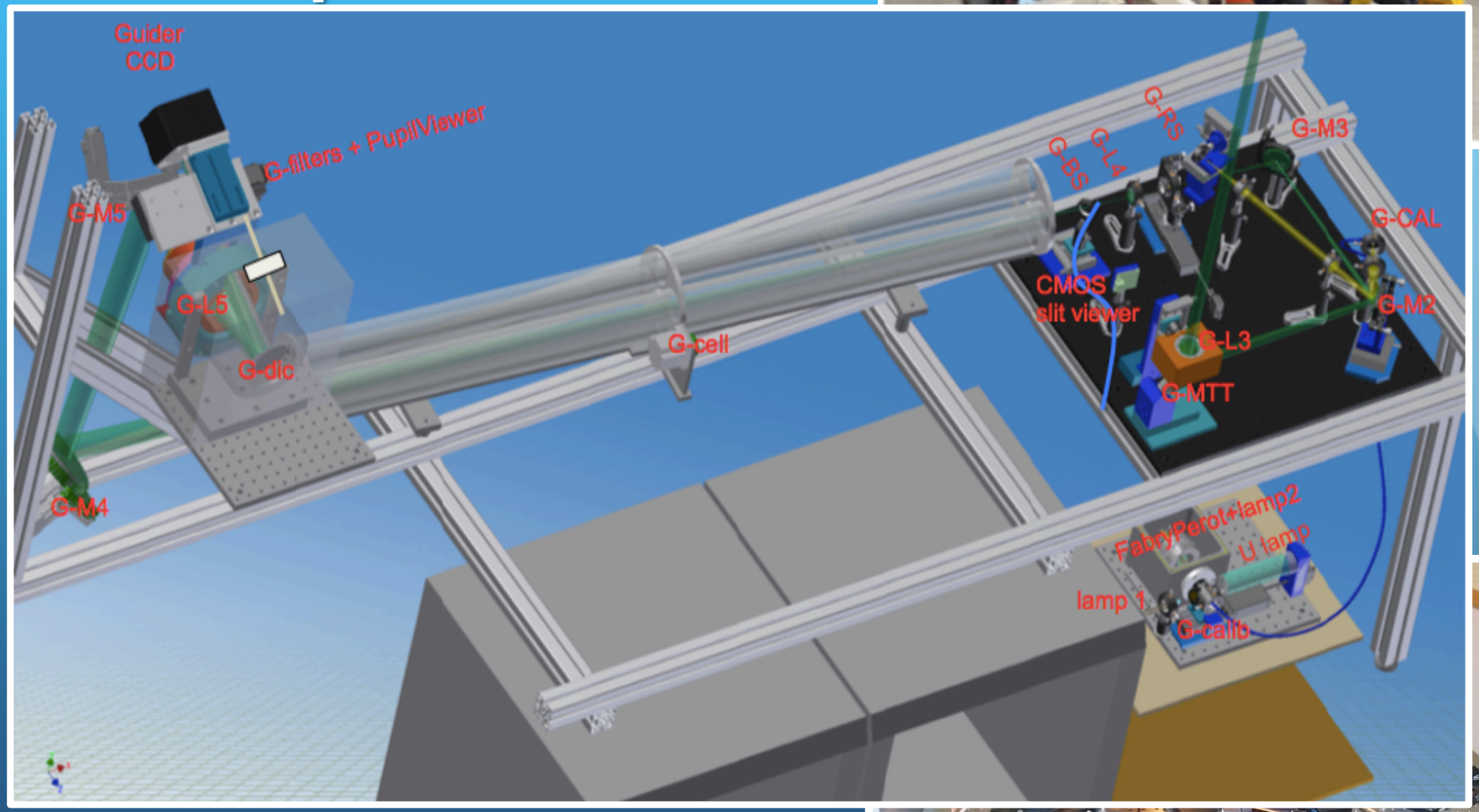
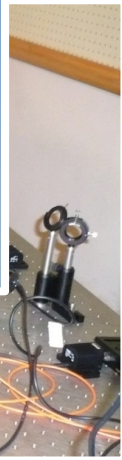
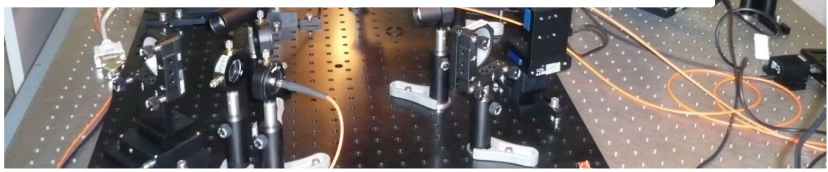


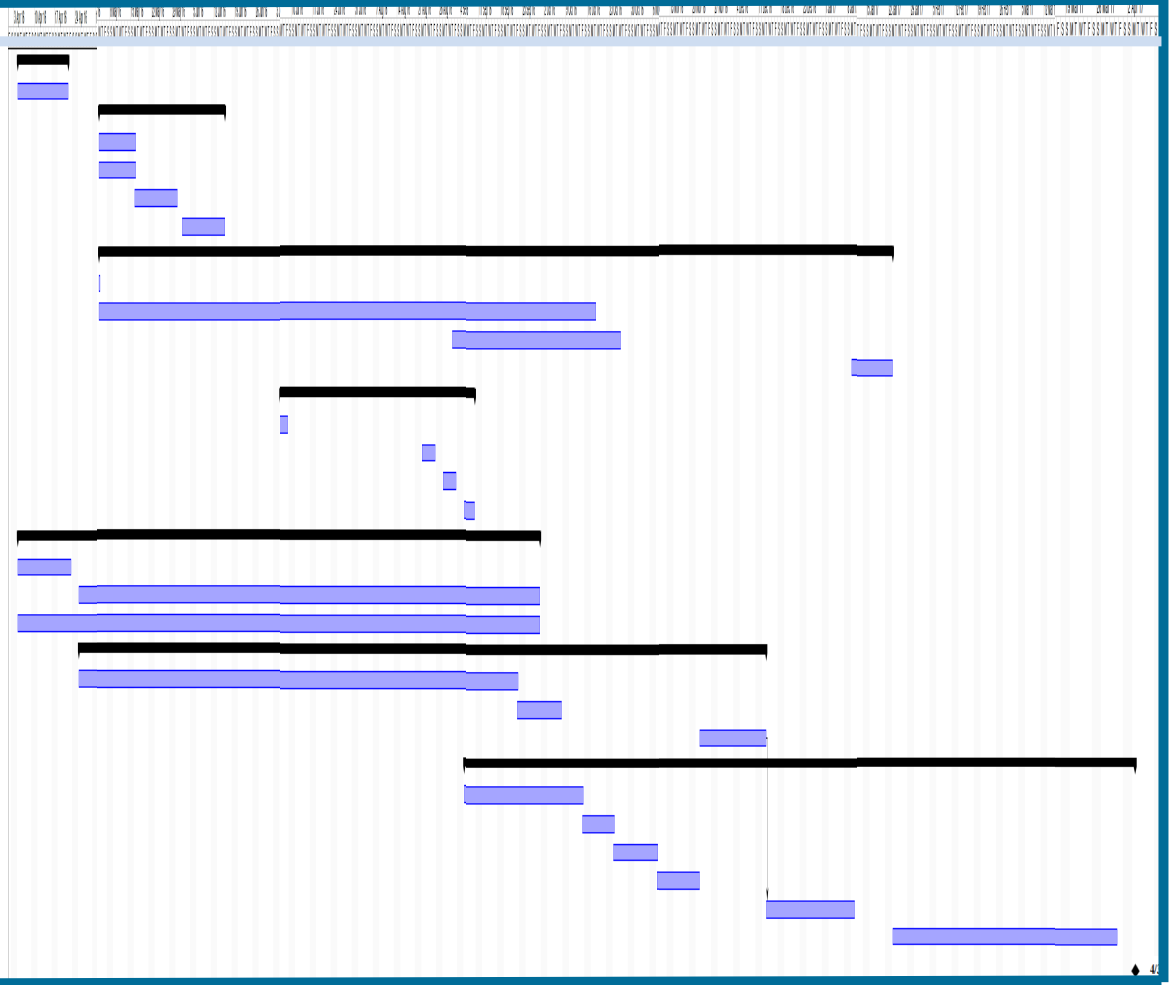




# GIARPS Schedule

| | Name | Duration | Start |
|---|---|---|---|
| 1 | **Preslit Arcetri** | 14 days? | **4/4/16 8:00 AM** |
| 2 | Allineamenti (Presli) | 14 days? | 4/4/16 8:00 AM |
| 3 | **TNG Activity** | 31 days? | **5/4/16 8:00 AM** |
| 4 | Montaggio PU@TNG | 9 days? | 5/4/16 8:00 AM |
| 5 | Assembly Rack | 9 days? | 5/4/16 8:00 AM |
| 6 | GIANO Dammy Suppo | 11 days? | 5/16/16 8:00 AM |
| 7 | Carpenteria BOSH | 11 days? | 6/1/16 8:00 AM |
| 8 | **Dicroico** | 188.125 d... | **5/4/16 8:00 AM** |
| 9 | Ordine | 1 day? | 5/4/16 8:00 AM |
| 10 | Delivery | 120 days? | 5/4/16 8:00 AM |
| 11 | Meccanica | 40 days? | 9/1/16 8:00 AM |
| 12 | Integration | 10 days? | 1/9/17 9:00 AM |
| 13 | **PRESLIT** | 50 days? | **7/4/16 8:00 AM** |
| 14 | Spedizione Preslit | 5 days? | 7/4/16 8:00 AM |
| 15 | Montaggio | 5 days? | 8/22/16 8:00 AM |
| 16 | Allineamento | 5 days? | 8/29/16 8:00 AM |
| 17 | Commissioning | 5 days? | 9/5/16 8:00 AM |
| 18 | **Absorption Cell** | 130 days? | **4/4/16 8:00 AM** |
| 19 | Drawing | 15 days? | 4/4/16 8:00 AM |
| 20 | Mechanics | 115 days? | 4/25/16 8:00 AM |
| 21 | Manufacturing | 130 days? | 4/4/16 8:00 AM |
| 22 | **NEW PLC** | 166.125 d... | **4/25/16 8:00 AM** |
| 23 | Assembly | 110 days? | 4/25/16 8:00 AM |
| 24 | Spedizione | 11 days? | 9/23/16 8:00 AM |
| 25 | Integration | 15 days? | 11/22/16 9:00 AM |
| 26 | **GIARPS** | 151 days? | **9/5/16 8:00 AM** |
| 27 | GIANO heating | 30 days? | 9/5/16 8:00 AM |
| 28 | Window Mounting | 7 days? | 10/14/16 8:00 AM |
| 29 | GIANO in Nasmyth B | 11 days? | 10/24/16 8:00 AM |
| 30 | GIANO Cooling | 11 days? | 11/7/16 9:00 AM |
| 31 | GIANO Commissioning | 20 days? | 12/13/16 9:00 AM |
| 32 | GIARPS Commisioning | 48.875 d... | 1/23/17 9:00 AM |
| | | | |
| 33 | AOT35 | 0 days | 4/1/17 9:00 AM |



# GIARPS Schedule

**July 2016:** shipping the new preslit to TNG

**August 2016:** test the preslit@TNG

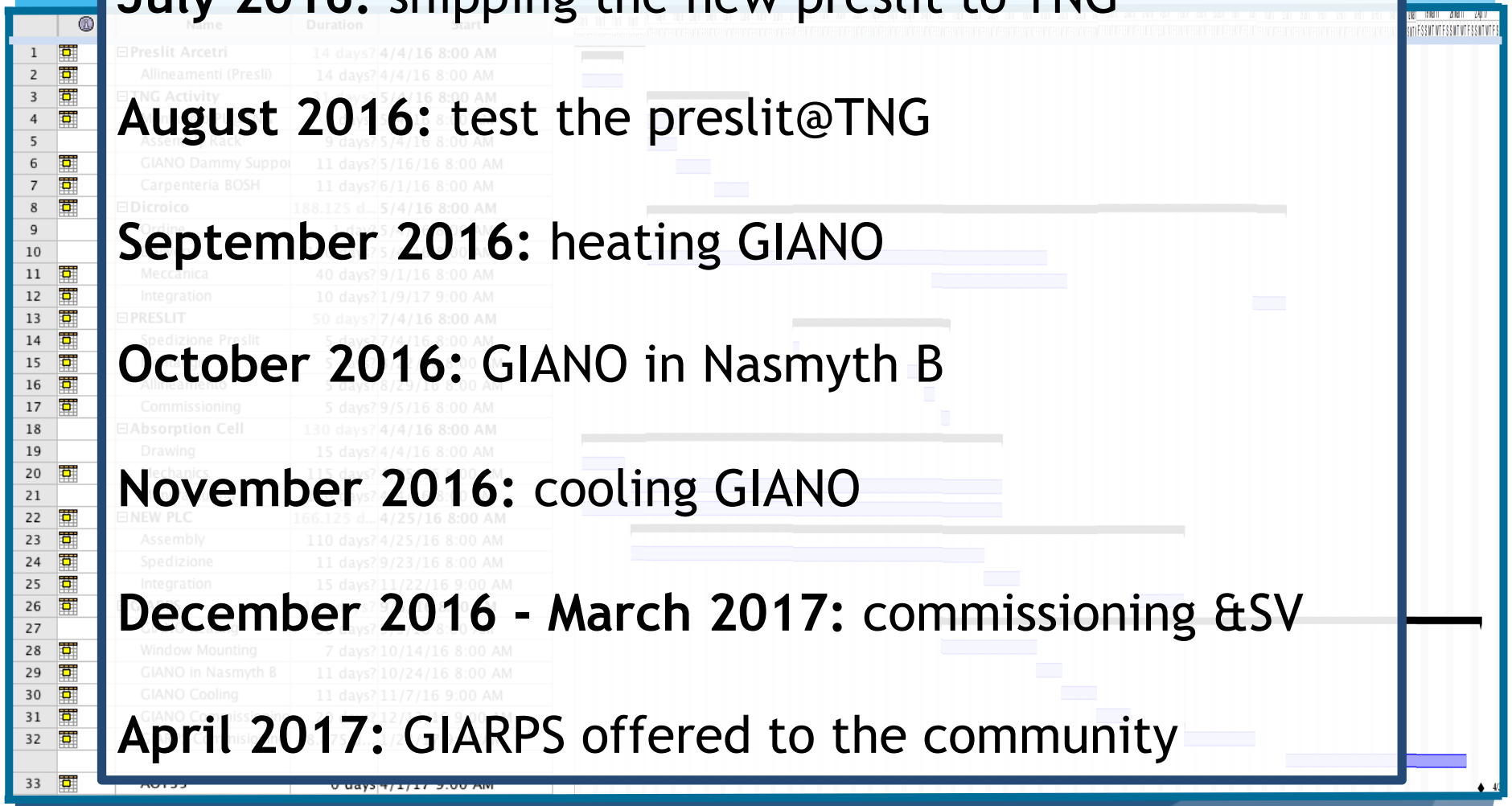
**September 2016:** heating GIANO

**October 2016:** GIANO in Nasmyth B

**November 2016:** cooling GIANO

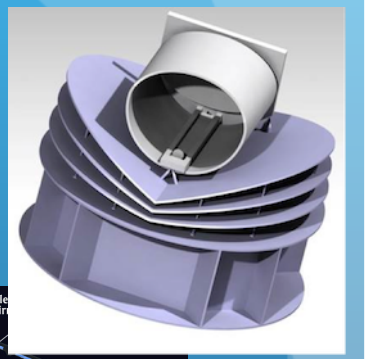
**December 2016 - March 2017:** commissioning &SV

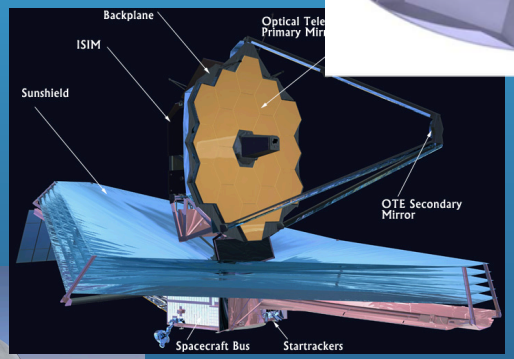
**April 2017:** GIARPS offered to the community



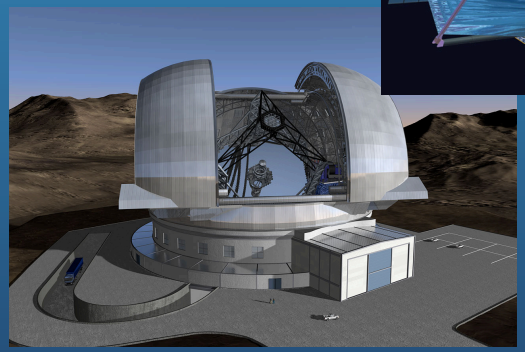
# Waiting for JWST, ARIEL and HIRES

GIARPS will be available years before more competitive instruments such as JWST and ARIEL (proposed for ESA Cosmic Vision)



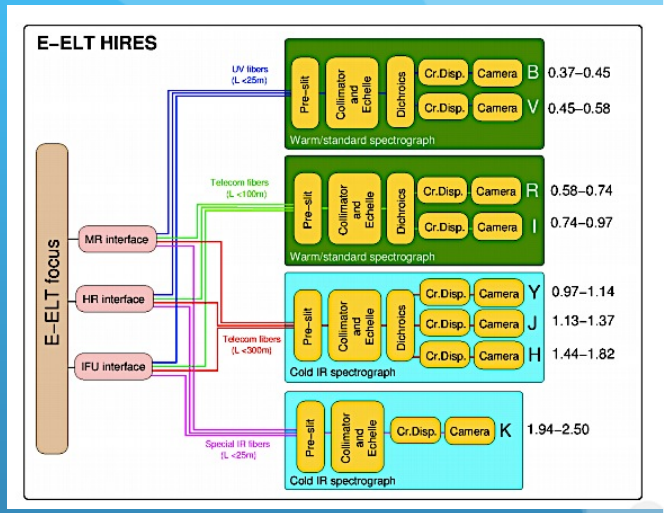



Moreover it will be a forerunner for HIRES @ E-ELT



# GIARPS & HIRES: similarities

- ✓ Merging of Phase A study of CODEX (VIS) and SIMPLE (NIR)
- ✓ Dichroics split the light into 4 wavelength channels
- ✓ Full coverage 0.37<λ<2.5 μm in a single exposure




See the talk by Livia Origlia

Science cases:

- Exoplanets
- Stellar Populations
- Stellar Astrophysics
- Intergalactic Medium
- Protoplanetary Disks

**GIARPS will be a forerunner for HIRES for data analysis, simulations, ETC & technology**

# GIARPS@TNG is going to be a unique facility


- in the world until NIRPS (HARPS+NIR spectrograph @3.6m/ESO,201?)
- in the northern hemisphere for years

providing simultaneous high resolution spectroscopy on a wide wavelength range between 0.38 μm and 2.45 μm.

# Conclusions

- GIARPS is the new common feeding for GIANO and HARPS-N
- GIARPS will improve GIANO performances without affect HARPS-N
- Which are the opportunities?
  1. GIARPS will be a unique facility for years
  2. GIARPS will be a benchmark for HIRES
  3. GIARPS will allow to study planetary atmospheres and to reduce the observative bias of planet search RVs surveys

# Supplementary material

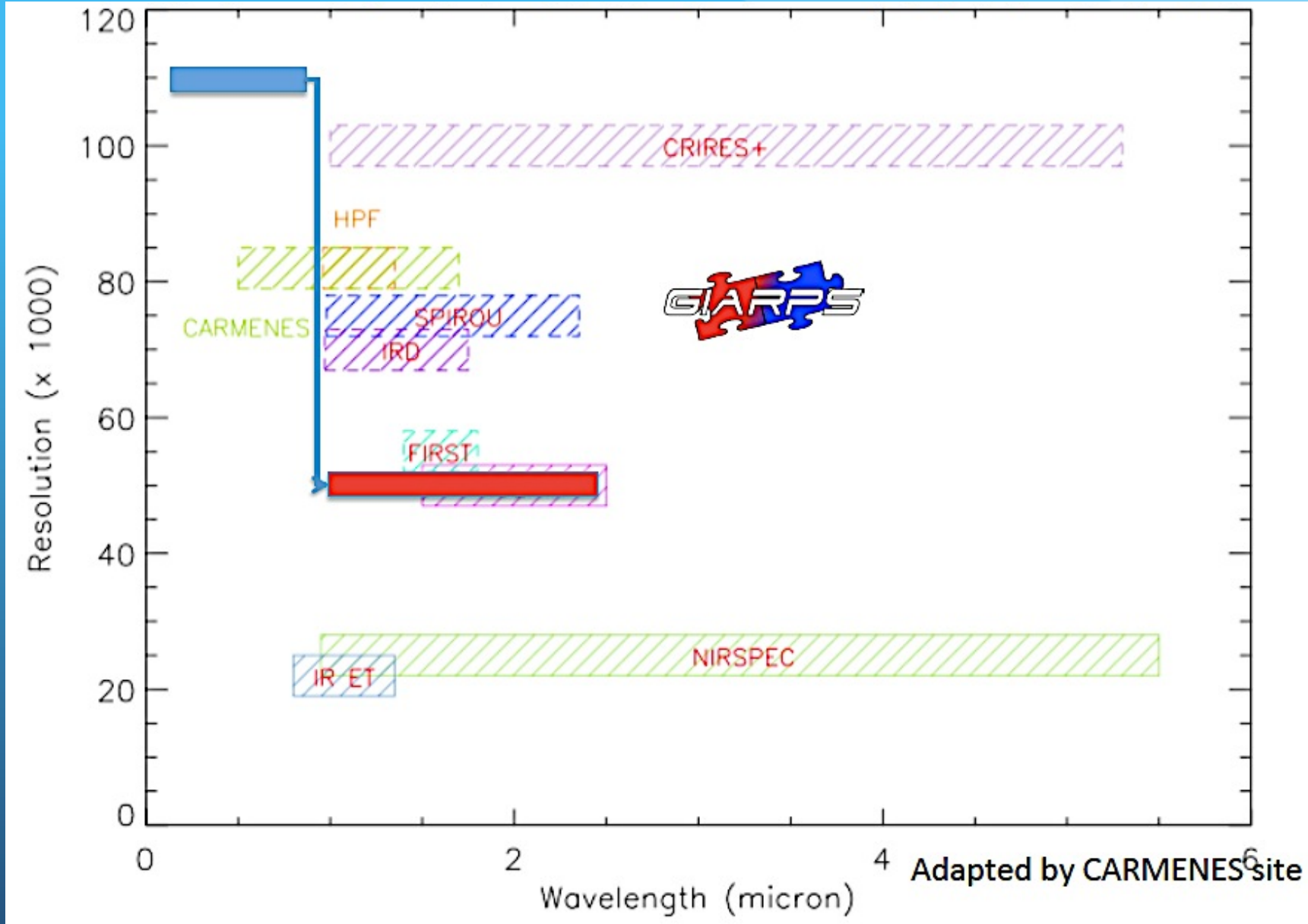
# GIANO in Nasmyth B

- Direct feeding from the telescope: **new preslit**
- Stable slit illumination: **Tip Tilt Mirror**
- **No fibers** = no modal noise, long slit, higher S/N, higher efficiency, ~2 mag deeper (H~12)

2 fibers and 1 slicer: 4 traces each order

no fibers: uniform illumination

- **New DRS**


120
100
80
60
40
20
0
Resolution (x 1000)
0
2
4
6
Wavelength (micron)
CRIRES+
HPF
CARMENES
SPIROU
IRD
FIRST
NIRSPEC
IR ET
GIARPS
Adapted by CARMENES site

# Other GIARPS Science Cases

- Young stars and proto-planetary disks
- Cool stars and stellar populations
- Minor bodies in the Solar System
- Bursting young stellar objects
- Cataclysmic variables
- X-ray binary transients in our Galaxy
- Supernovae up to gamma-ray bursts in the very distant and young Universe

$$Err_{HARPS\text{-}N} = 10^{0.2V - 4.5}$$
$$Err_{GIANO} = 10^{0.2H - 3.05}$$