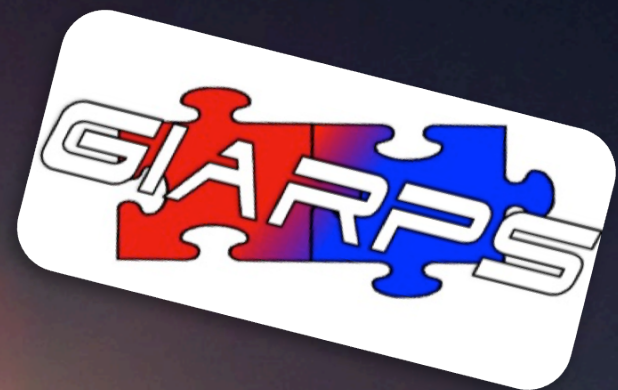


GIARPS

R. Claudi, S. Benatti, I. Carleo, A. Ghedina,
A. Tozzi and the GIARPS Team



TNG Meeting
Padova, March 1st – 3rd 2017



The Project I

GIARPS is the new common feeding for HARPS-N and GIANO

Aim: high resolution VIS-NIR spectra
+ high precision radial velocities

Method: simultaneous use of:

- HARPS-N ($0.38 \mu\text{m} < \lambda < 0.69 \mu\text{m}$)
 - GIANO ($0.95 \mu\text{m} < \lambda < 2.45 \mu\text{m}$)
- already on duty at TNG





The Project II

Funded by: Premiale WOW (350 k€) + 12 FTE
(Arcetri; Merate; Padova; Palermo; TNG)

Schedule:

- Commissioning III: March 2017
- Available from April 2017 (AOT35)

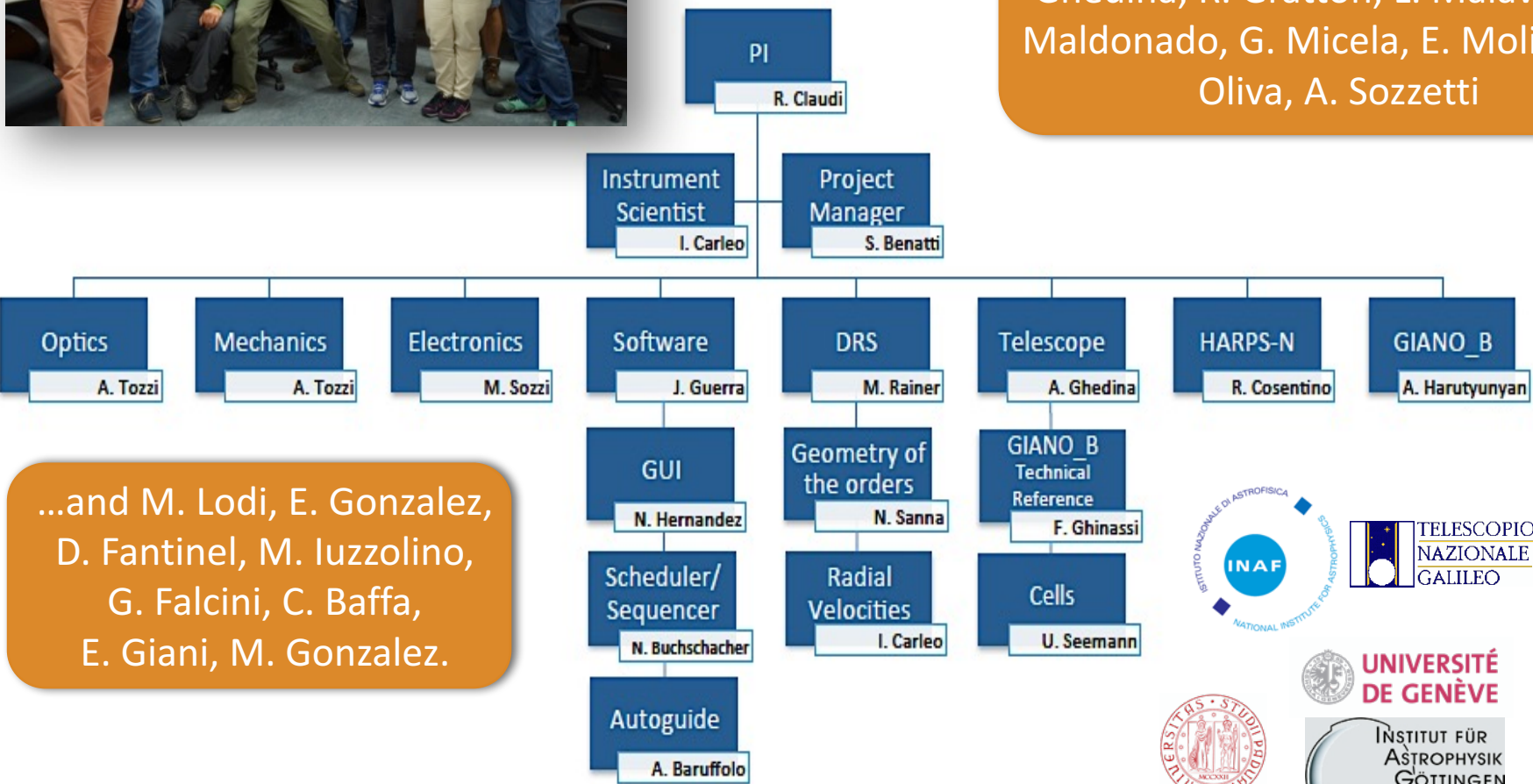




GIARPS People



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



...and M. Lodi, E. Gonzalez, D. Fantinel, M. Iuzzolino, G. Falcini, C. Baffa, E. Giani, M. Gonzalez.





HARPS-N



- ❑ Agreement among INAF and several foreign institutes (head: Univ. Geneva)
- ❑ Fiber-fed cross-dispersed high resolution echelle spectrograph, offered at TNG since 2012
- ❑ Twin instrument of HARPS@3.6m ESO-La Silla
- ❑ Optical range: 380 - 690 nm at $R=115,000$
- ❑ Extreme instrumental stability
- ❑ Scientific driver: exoplanet search
(RV accuracy ≈ 1 m/s)



GIANO_B

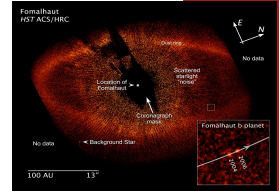


- ❑ NIR high resolution echelle spectrograph of TNG, offered in 2015
- ❑ Spectral range from Y to K band (0.95 – 2.45 μm) in a single exposure
- ❑ Resolution of 50,000
- ❑ RV accuracy \approx 10m/s (Carleo et al. 2016)
- ❑ Science case: Exoplanets, stellar populations, galactic stars, star clusters, ...



Scientific Drivers

- **Mainly Exoplanets (WOW):** hot atmospheres; hot planets around cool stars; Giant planets in OC and around young nearby stars
- **Other science:** Young Stellar Object; X Ray Binaries & Magnetostars; CVs and Novae; Intermediate Luminosity Optical Transients; SN I; GRB and SN





Science with GIARPS: RVs

- Crucial to distinguish planetary signal from stellar “noise”
 - Activity
 - Pulsation
 - *Any colored signal*

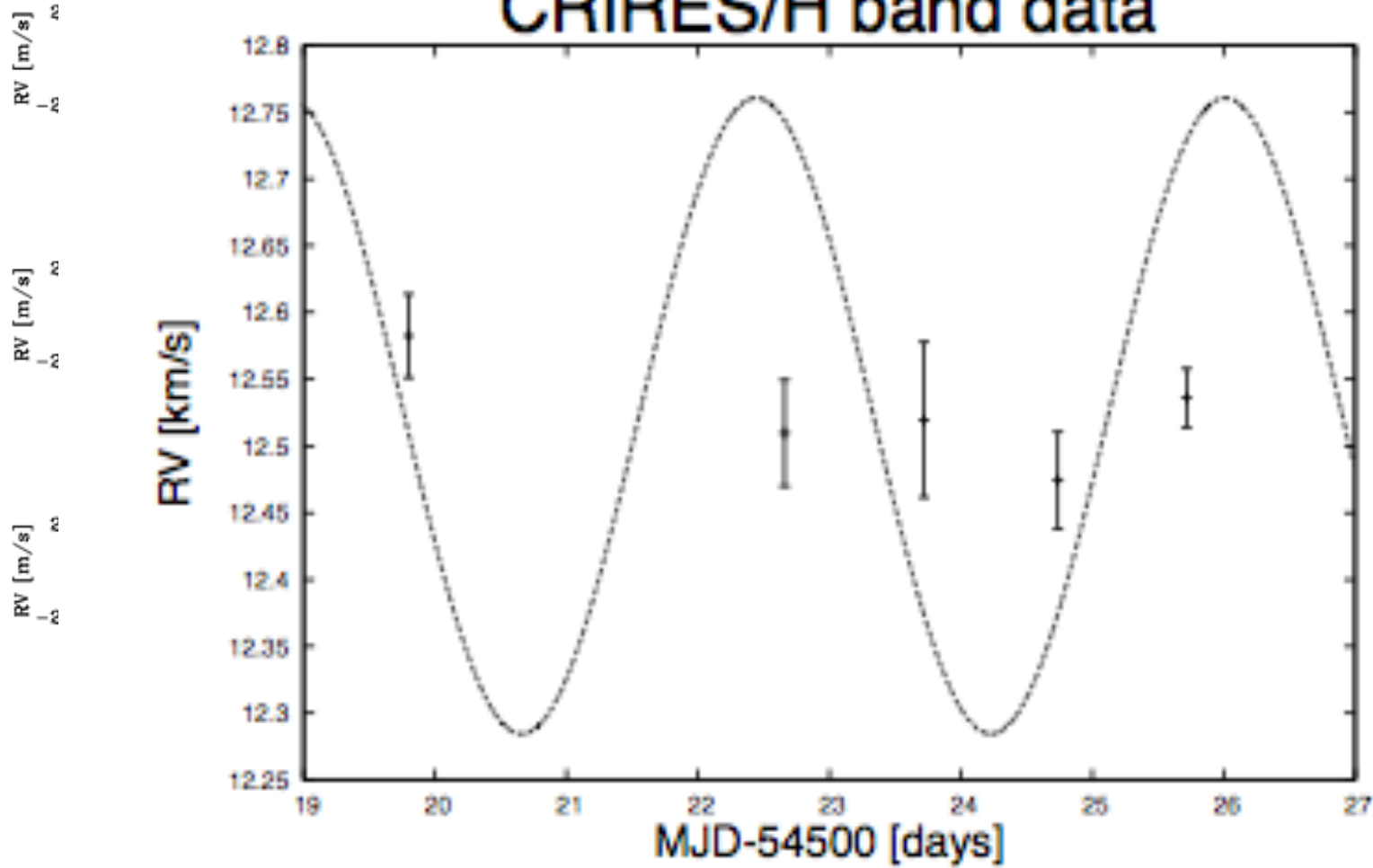
Better if simultaneous or quasi-simultaneous



TW Hydrae

Huelamo et al. 2008

CRIRES/H band data



inction.

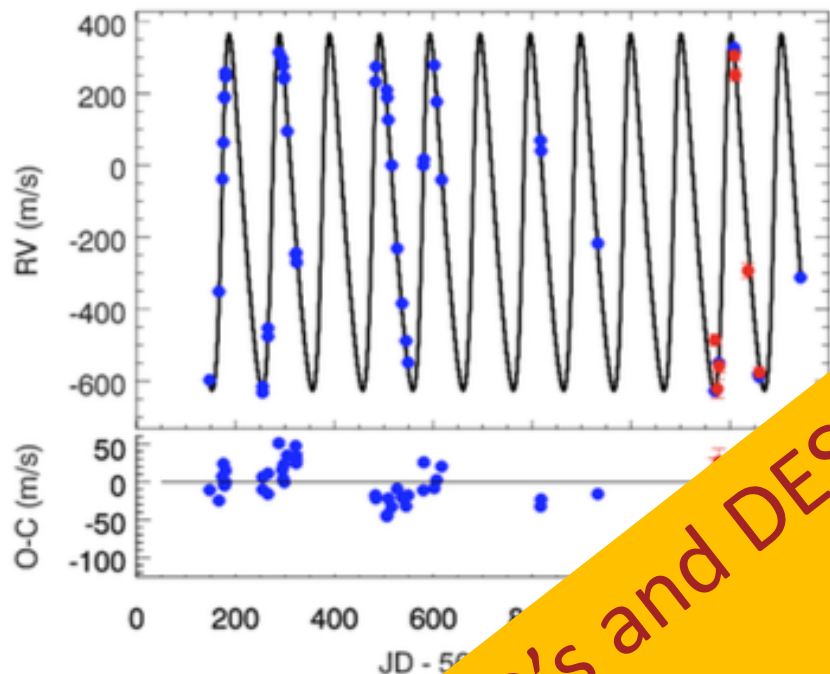
002	[d]
: 0.3	[d]
16	[km s ⁻¹]
011	[km s ⁻¹]
08	[km s ⁻¹]
	[deg]
	[m s ⁻¹]
	[m s ⁻¹]

GIARPS ante litteram: TYC 4282-



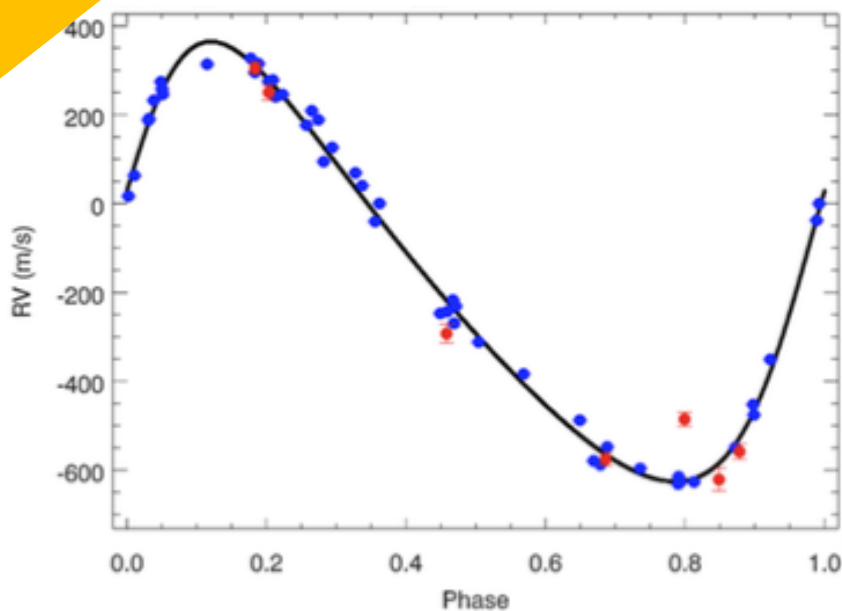
605-1

- HARPS-N
- GIANO



$0.25 M_{\text{sun}}$
 $T_{\text{eff}}=4500$
 $\text{Log}(g)=2.5$
 $[\text{Fe}/\text{H}]=0$

Gonzalez Alvarez et al., in prep



Compan

$P_{\text{orb}}=1$
 $a=$

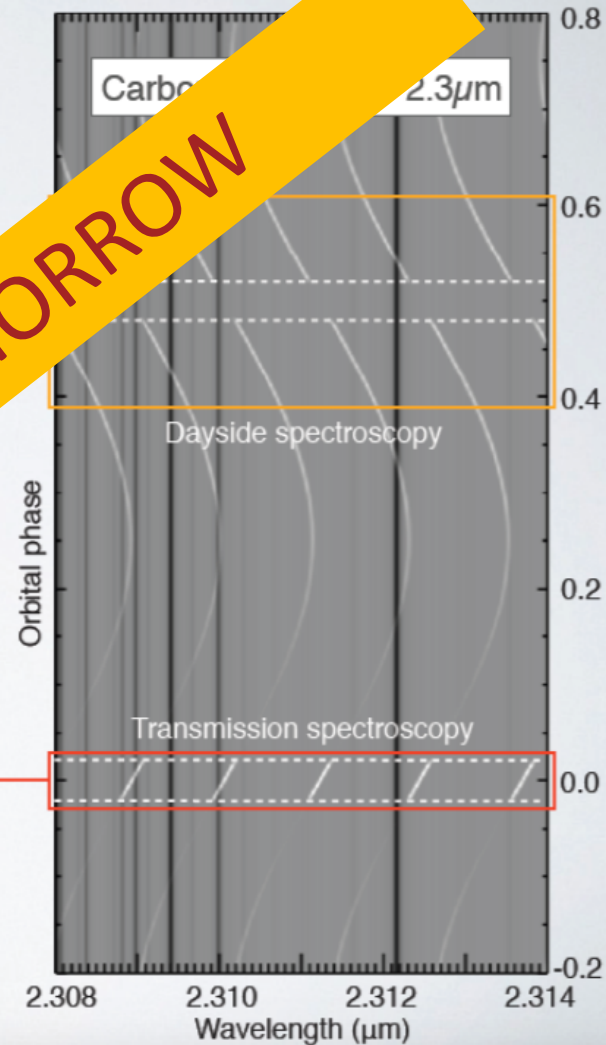
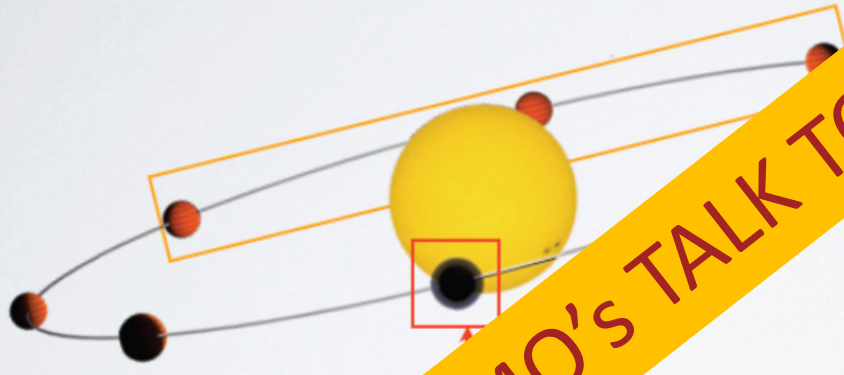
SEE BONOMO'S and DESIDERA'S TALKS
TOMORROW



Exoplanets at high-spectral resolution

Transiting planets are observable:

- During **transit**
- Before/after **secondary eclipse**



SEE BONOMO'S TALK TOMORROW



Other Science

THIS MEETING (Tomorrow):

- **Antoniucci:** The innermost regions of T Tauri stars investigated with GIARPS;
- **Bragaglia:** Gaia follow-up : HARPS/Giano spectra of bright stars in open clusters

TNG SCHEDULE AOT35:

- **TAC_14 Andretta:** Characterization of stellar active regions from exoplanetary transits with GIARPS
- **TAC_18 Faggi:** First High Resolution Survey of Comets with the GIARPS/TNG Spectrograph: C/2015 V2 (Johnson)
- **TAC_26 Albrecht:** HARPS-N+GIANO spectroscopy of the special transit of MASCARA-1b



GIARPS Milestones

- Transferring** GIANO from Nasmyth-A to B
(since no impact on HARPS-N is allowed)
- Feeding GIANO through a **new** train of **optics**
rather than fibers
- Insertion of a **dichroic** to split the VIS and
NIR light to HARPS-N and GIANO
- Similar **GUIs** for GIANO and HARPS-N
- New reduction **pipeline** for GIANO_B
- Insertion of an ammonia **cell** for H and K
bands for high accuracy NIR RVs measure

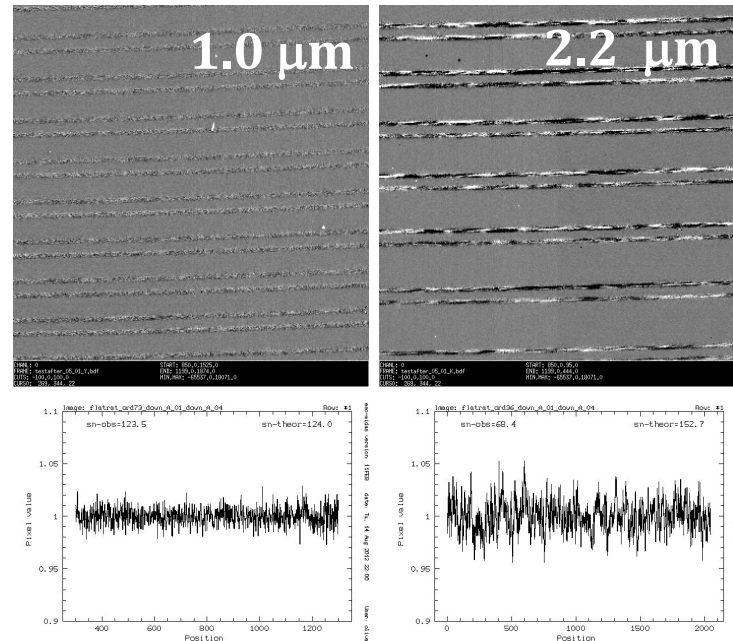


GIANO upgrade

The removal of GIANO fibers implies:

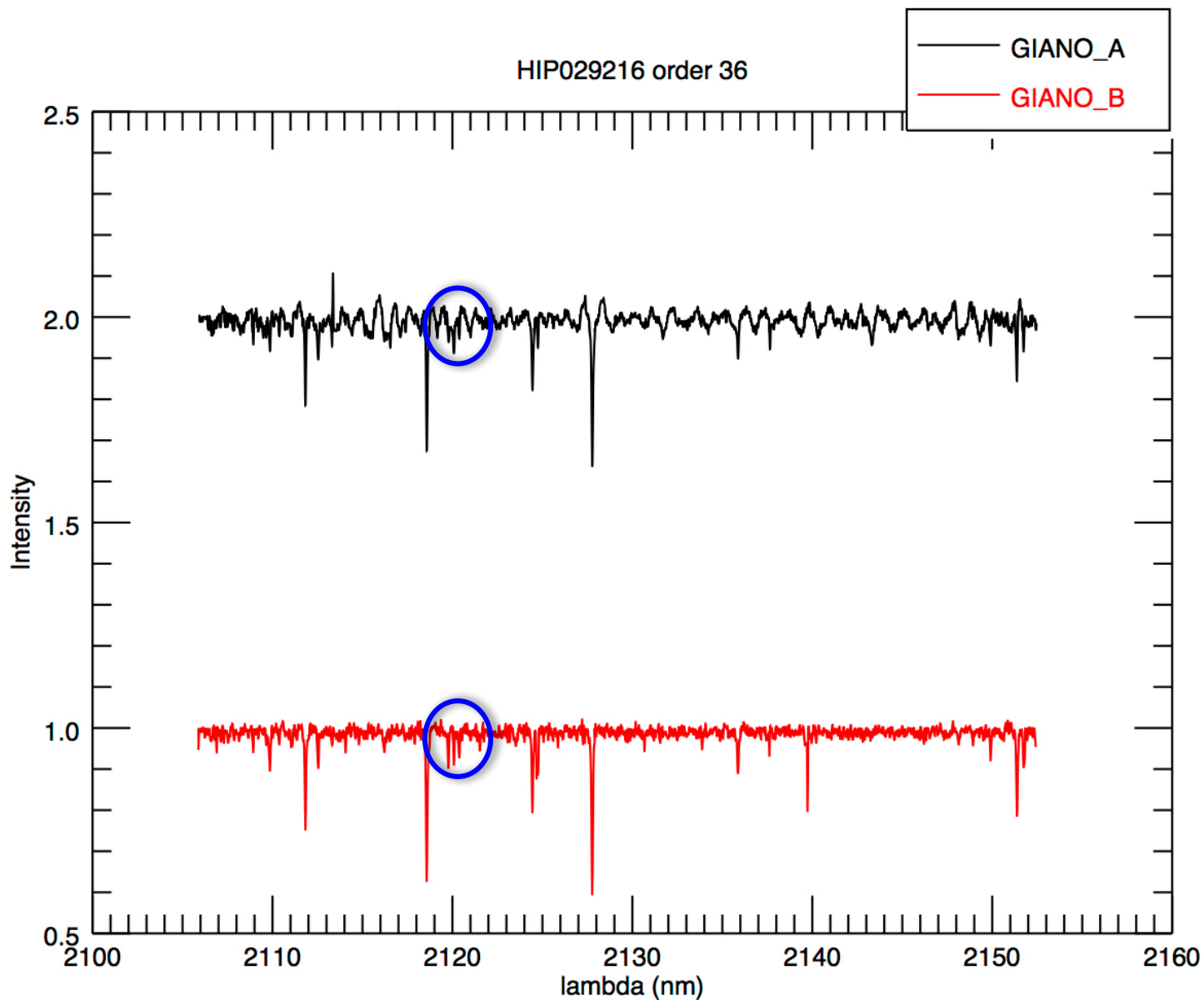
- Higher efficiency
- Elimination of modal noise
- Stable slit illumination with a closed loop active tip/tilt mirror

A mechanical agitator could mitigate but not remove the **modal noise** effects on GIANO spectra



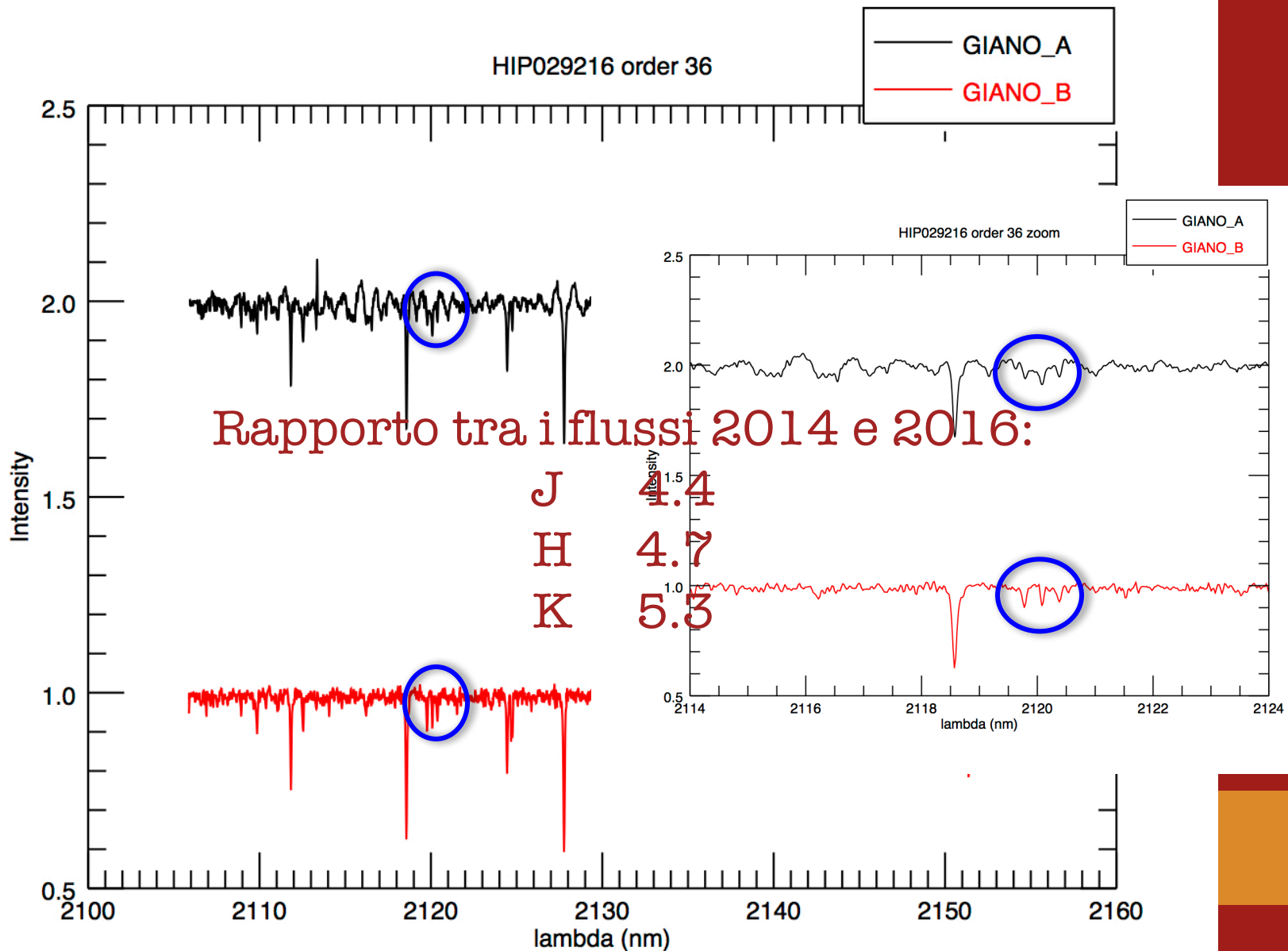


GIANO_A vs GIANO_B spectra



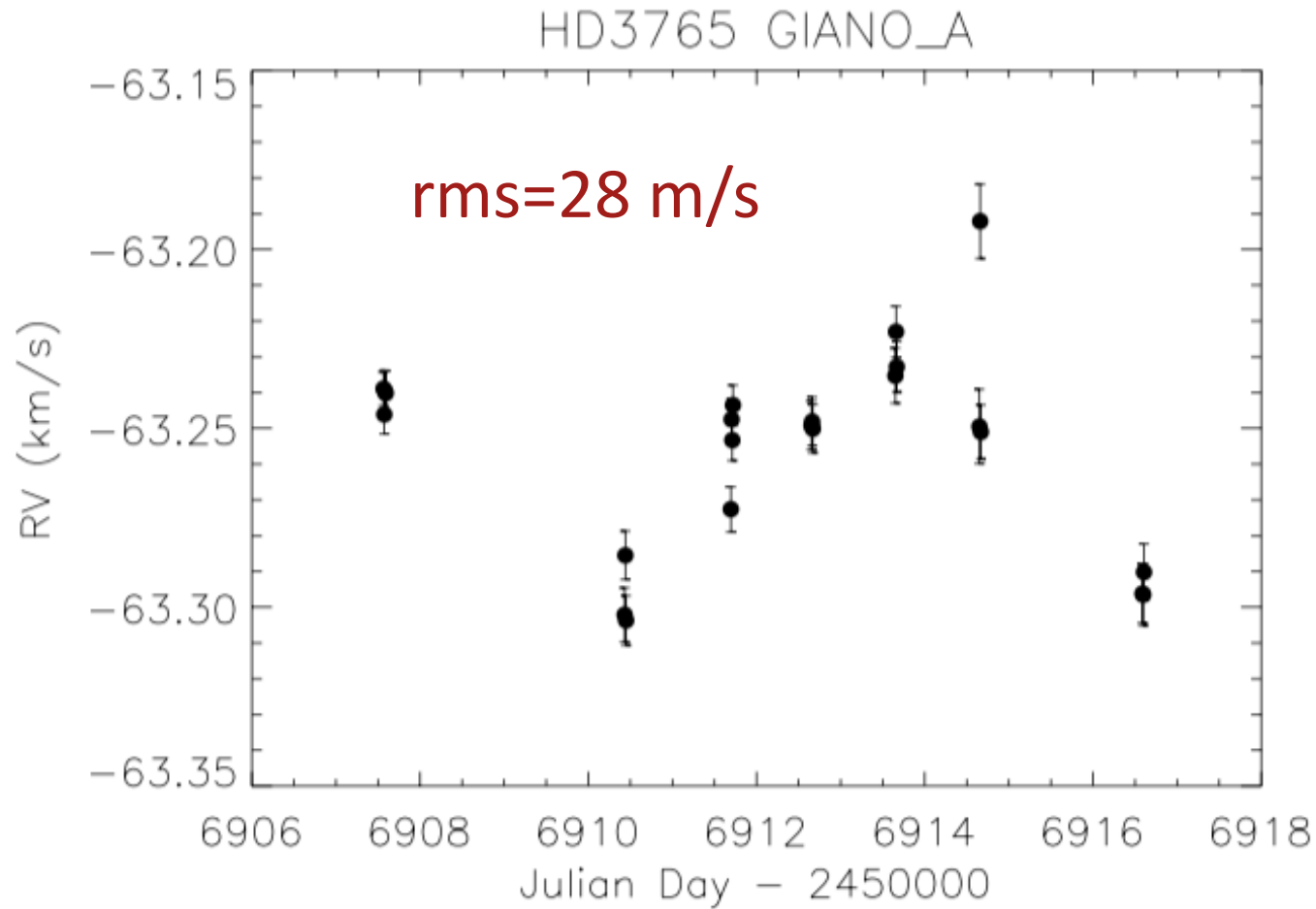


GIANO_A vs GIANO_B spectra





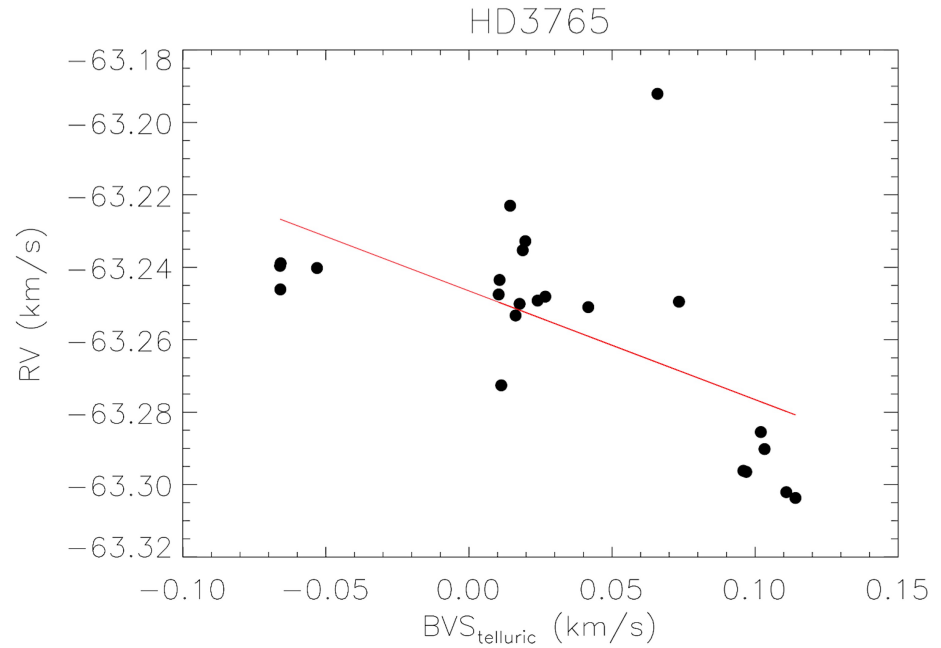
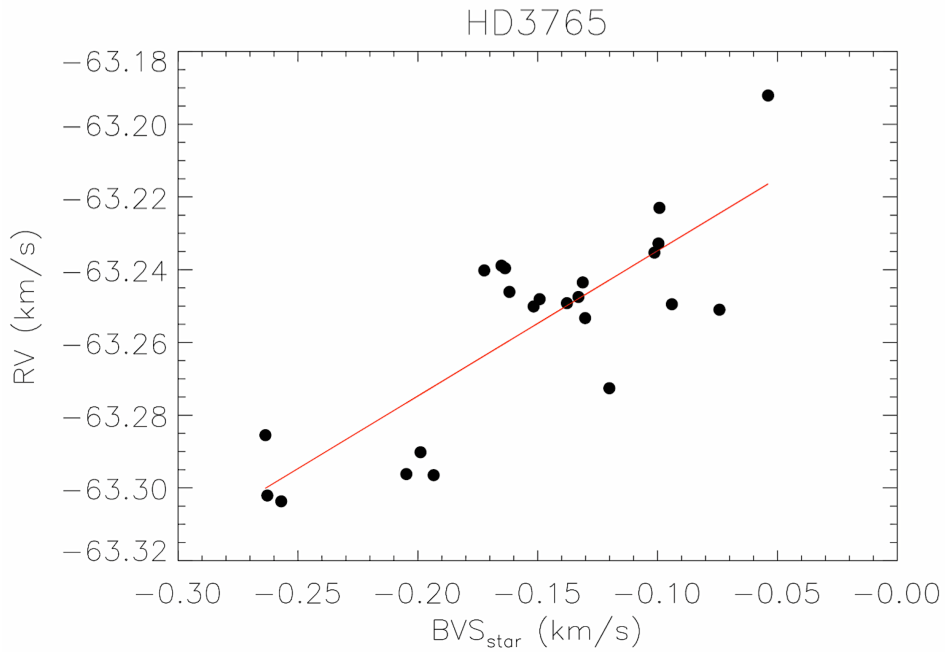
From GIANO_A RVs ...





Radial Velocities from *GIANO_A* spectra

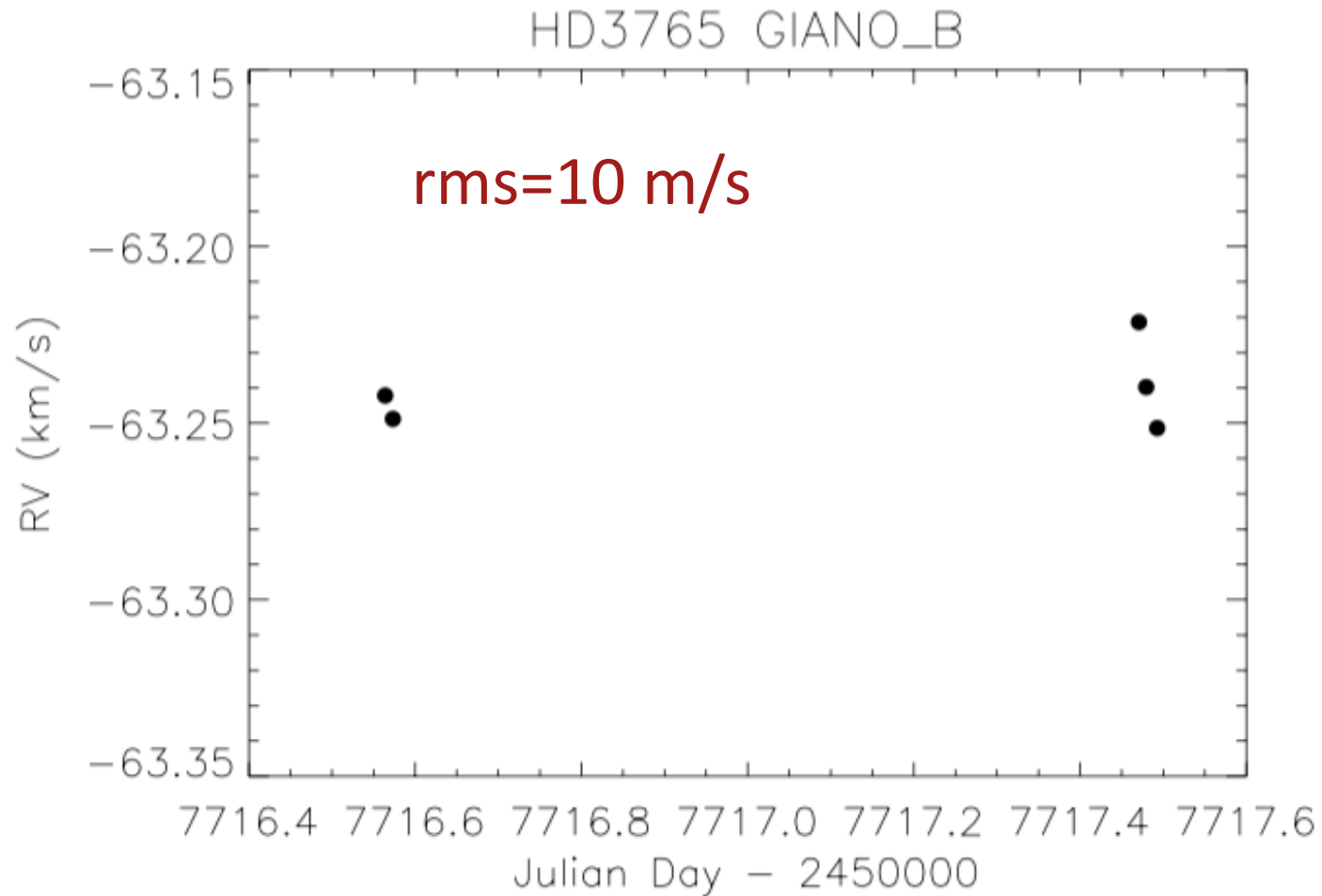
Correlations



≈8 m/s



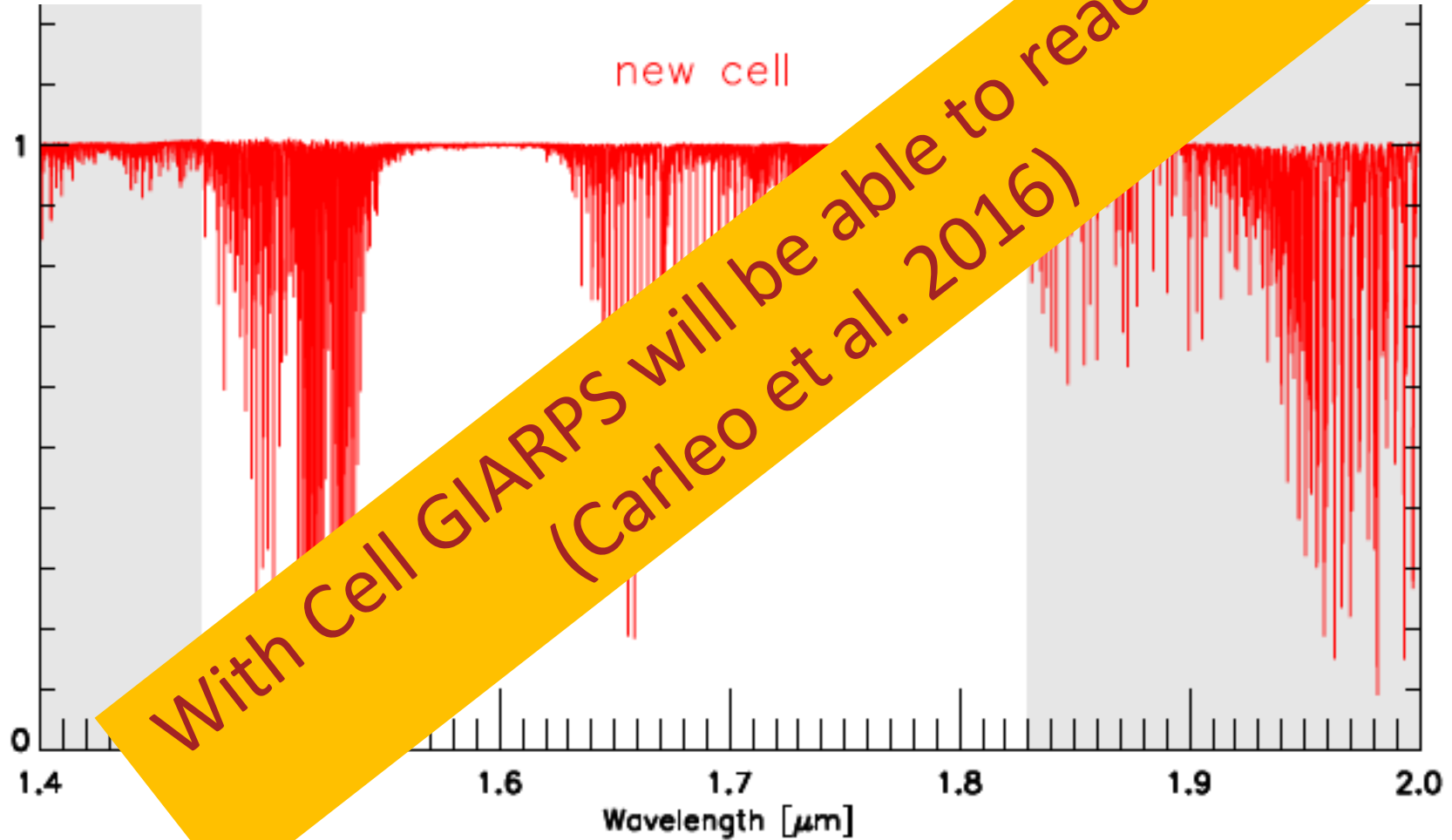
... to GIANO_B RVs





GIARPS Absorption Cell

mixture of $^{13}\text{CH}_4$, NH_3 , C_2H_2

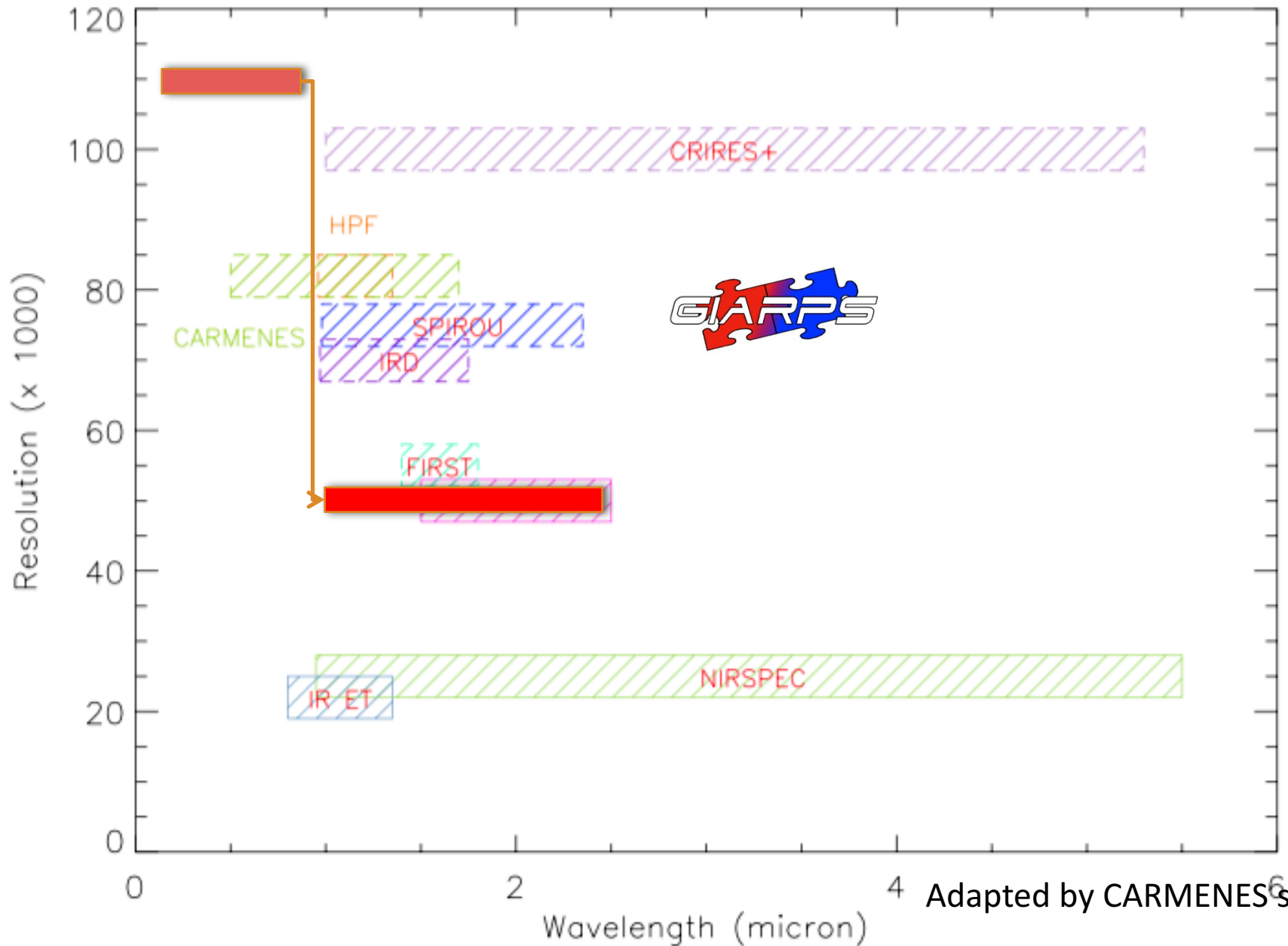




Toward GIARPS

- ❑ **Mar 2017:** Comm III, delivery of the DRS
- ❑ **April 2017:** GIARPS offered
- ❑ **April/May(?):** Delivery of the absorption cells, tests, data for NIR-AUSTRAL

NIR WORLD FRAMEWORK





GIARPS @ TNG

A unique facility to provide simultaneous high resolution spectroscopy on a wide wavelength range between $0.38 \mu\text{m}$ and $2.45 \mu\text{m}$:



- ❑ in the world until HARPS+NIRPS@3.6m/ESO
- ❑ in the northern hemisphere for years

Forerunner of HIRES@E-ELT

