

The scientific role of the  
Osservatorio Polifunzionale del Chianti  
in the GAPS and TFOP networks

6<sup>th</sup> Chianti Topics - International Focus Workshop  
Florence 26-29 February 2024

Lorenzo Betti



UNIVERSITÀ  
DEGLI STUDI  
FIRENZE



## Location

# 1. Osservatorio Polifunzionale del Chianti (OPC)

Osservatorio Polifunzionale del Chianti (OPC) is located in the district of Barberino-Tavarnelle, up to the hill in Montecorboli between the vineyards, less than 1km from medieval village of San Donato in Poggio.

## Coordinates

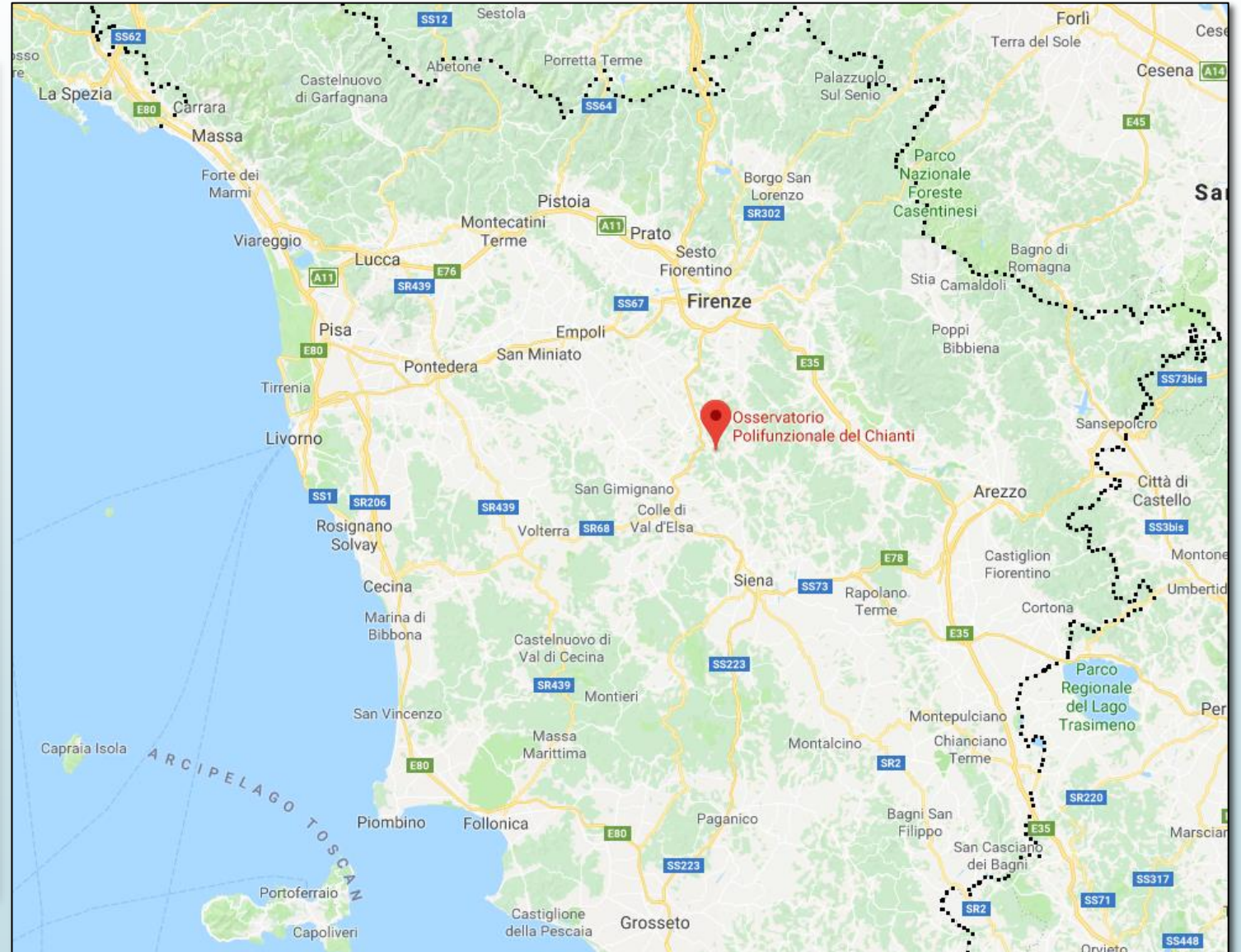
Lat.: 43°31'24" N

Lon.: 11°14'44" E

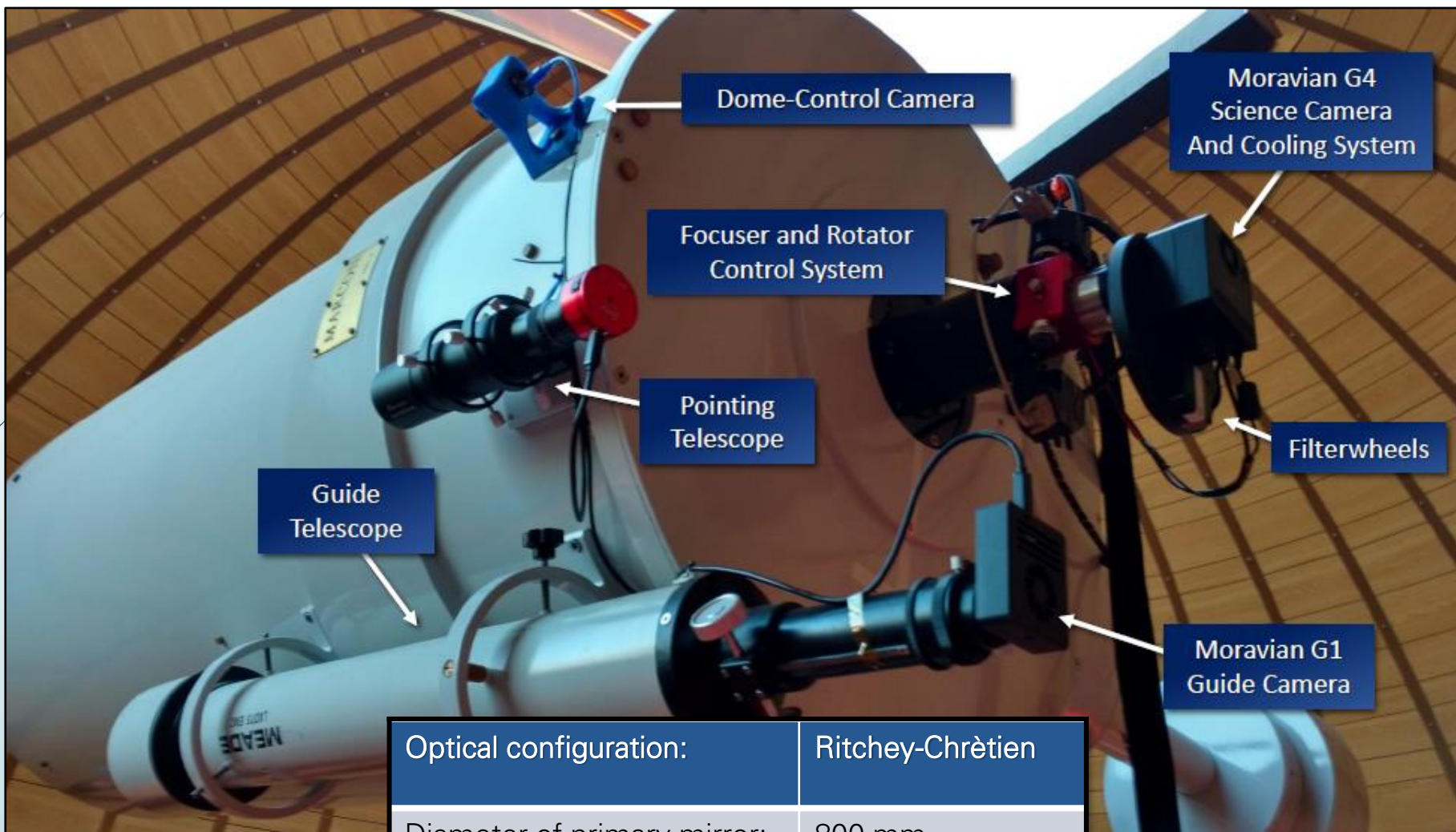
Alt.: 455m

## Light pollution Classification

Class 4 Bortle

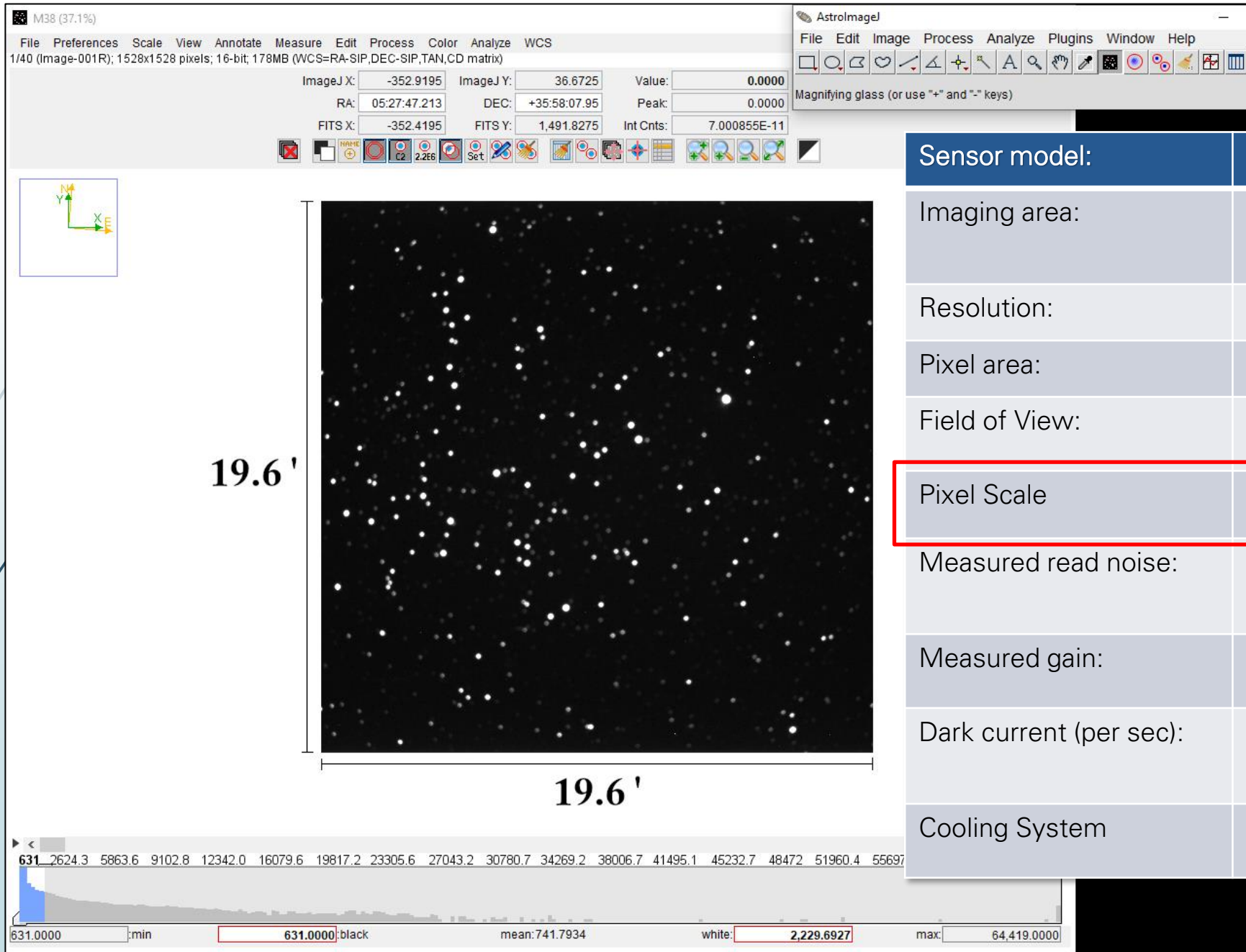


# Telescope



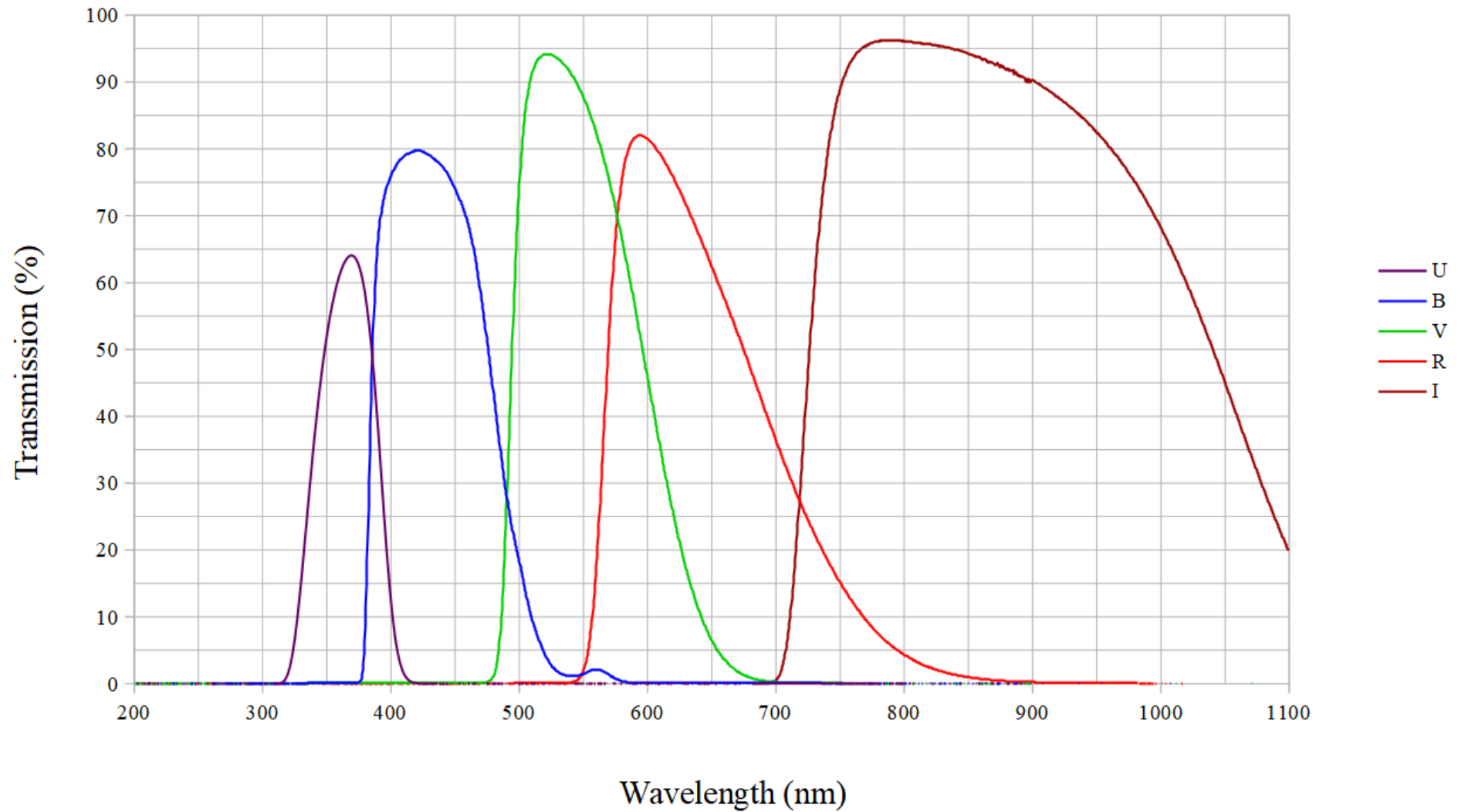
Optical configuration:	Ritchey-Chrétien
Diameter of primary mirror:	800 mm
Focal length:	6400 mm
Focal ratio (f/#):	f/8

CCD



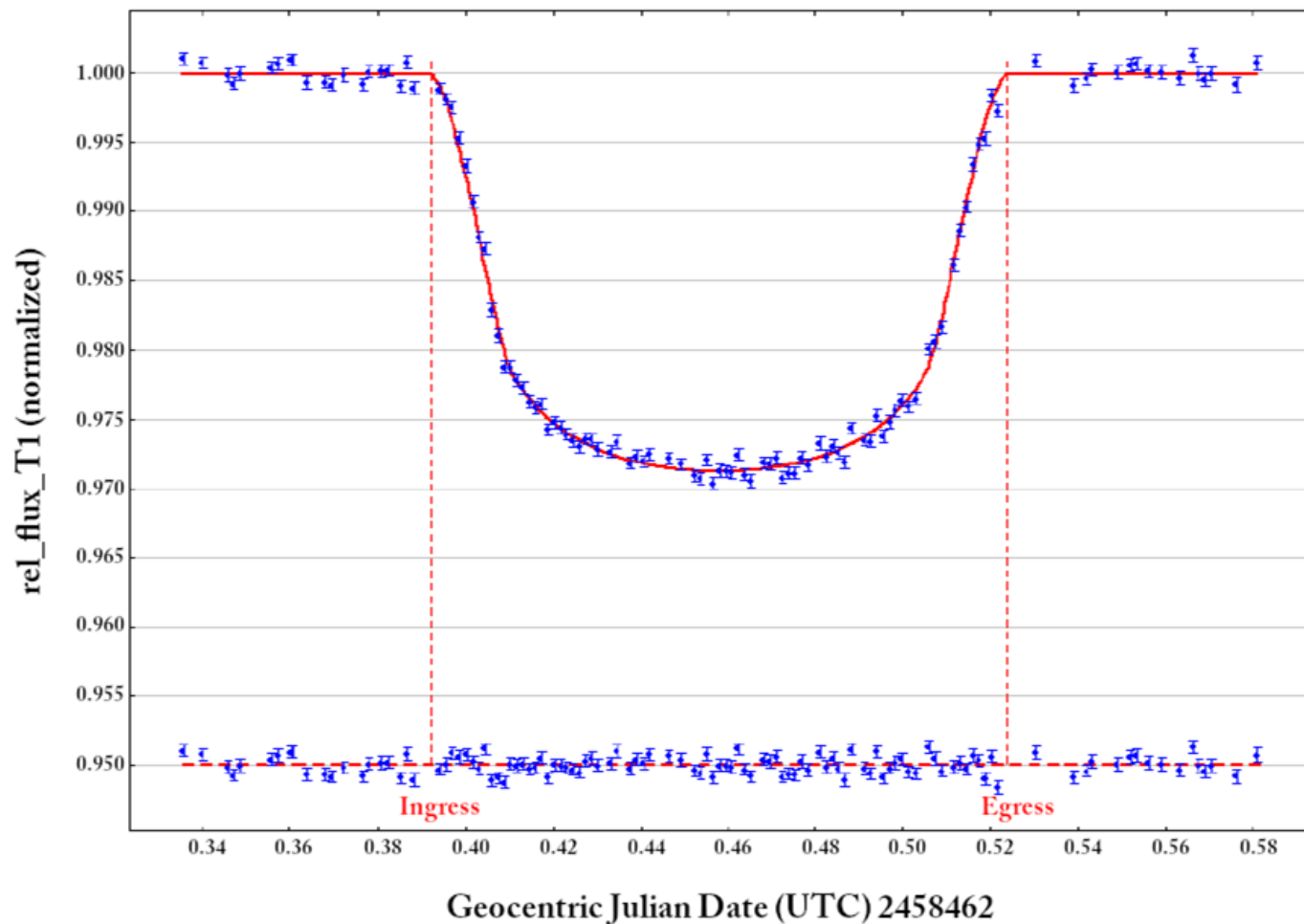
Sensor model:	KAF-09000
Imaging area:	36.7 mm x 36.7 mm
Resolution:	3056 x 3056
Pixel area:	12 $\mu\text{m}$ x 12 $\mu\text{m}$
Field of View:	19.6 arcmin x 19.6 arcmin
Pixel Scale	0.38676 arcsec/pix
Measured read noise:	7 $e^-$
Measured gain:	1.5 $e^-$ /ADU
Dark current (per sec):	0.6 $e^-$ /pixel at 0°C
Cooling System	Thermoelectric

# UBVRI - Johnson Filters Transmission

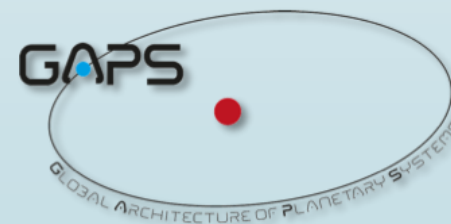


## 2. Exoplanetary Transit

### HAT-P-32 b



- ▶ Photometric precision:  $\sim$  ppt (or mmag)
- ▶ Exoplanetary Transit Follow-up Networks





## Ground-based follow-up group Objectives

- ▶ Confirm new exoplanets and check for false positive events (2018 -...)
- ▶ Update transit ephemeris with high temporal uncertainty (2019 -...)



## Requirements

- ▶ Differential Photometry Precision  $\sim$  ppt (or mmag)
- ▶ Cover large range of star-magnitudes with ppt precision ( $7 < V\_mag < 16$ )
- ▶ Tracking telescope precision  $\sim$  5-10 pix throughout the night



## Ground-based follow-up group Objectives

- ▶ Confirm new exoplanets and check for false positive events (2018 -...)
- ▶ Update transit ephemeris with high temporal uncertainty (2019 -...)

## Requirements

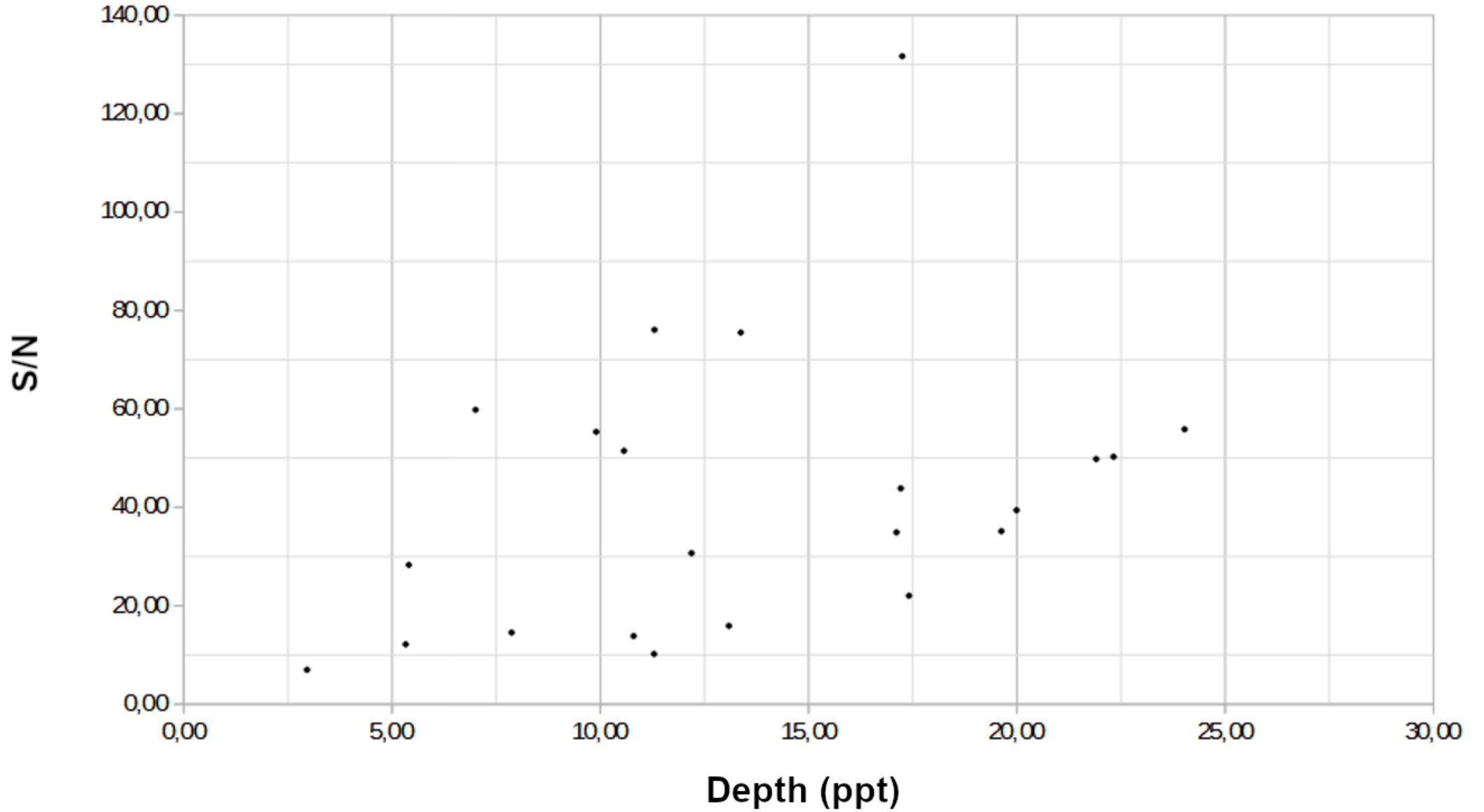
Wedn. 28<sup>th</sup> February – Chianti Topics Talk

L. Fini, "*Evaluating and enhancing the performances of a small telescope*"

- ▶ Tracking telescope precision ~ 5-10 pix throughout the night

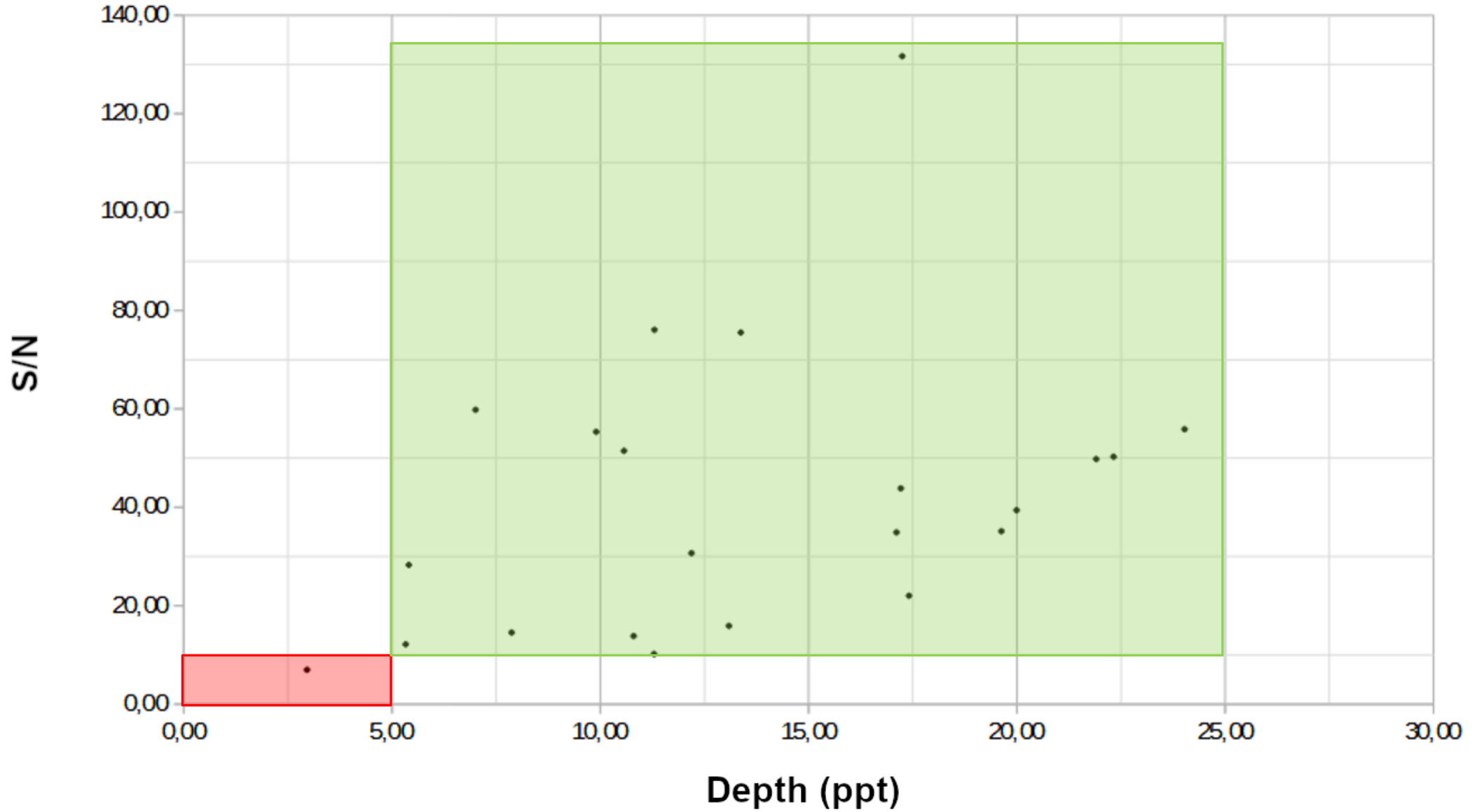


# Transit Feasibility



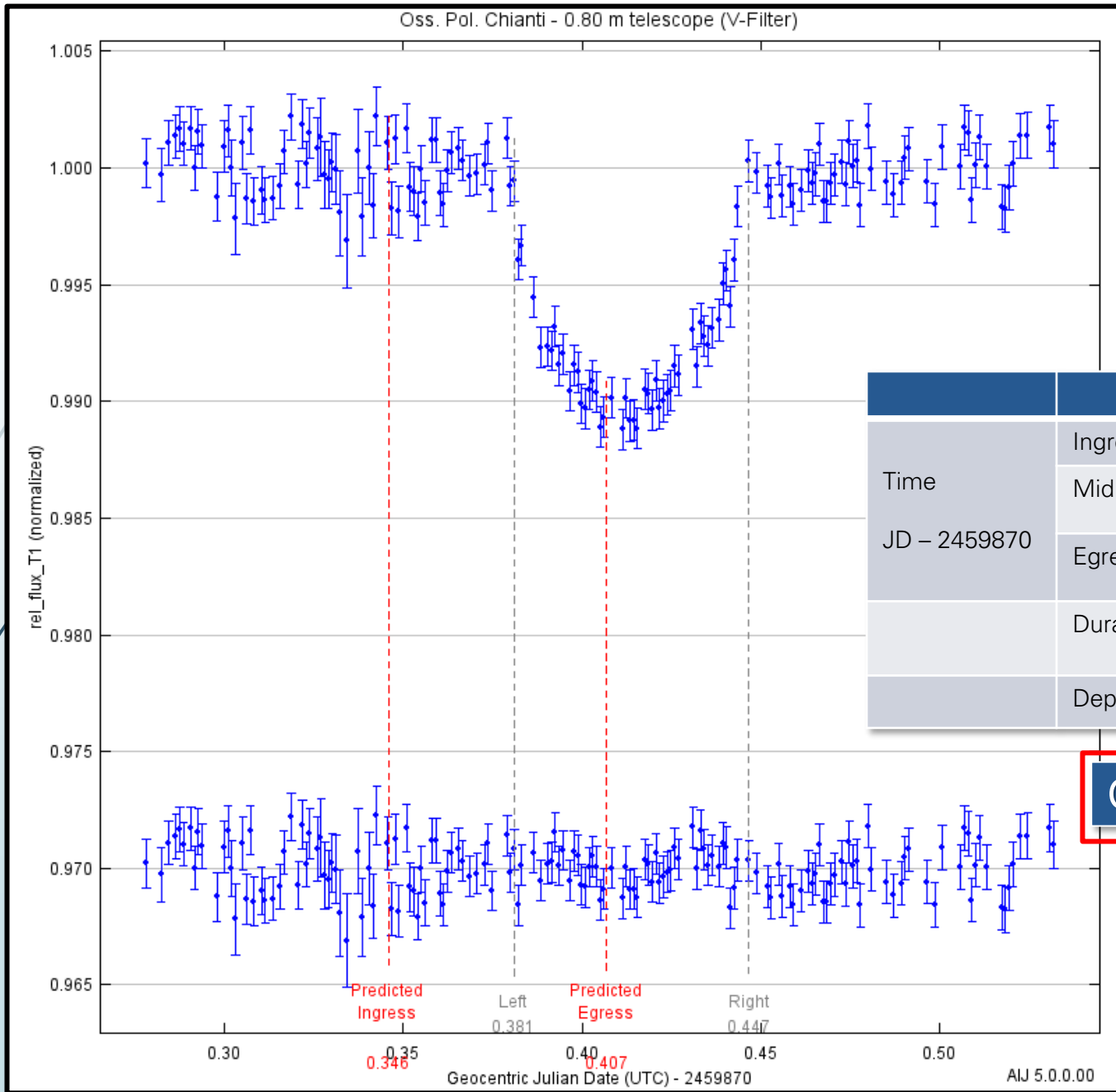
Transit Feasibility

# Transit Feasibility



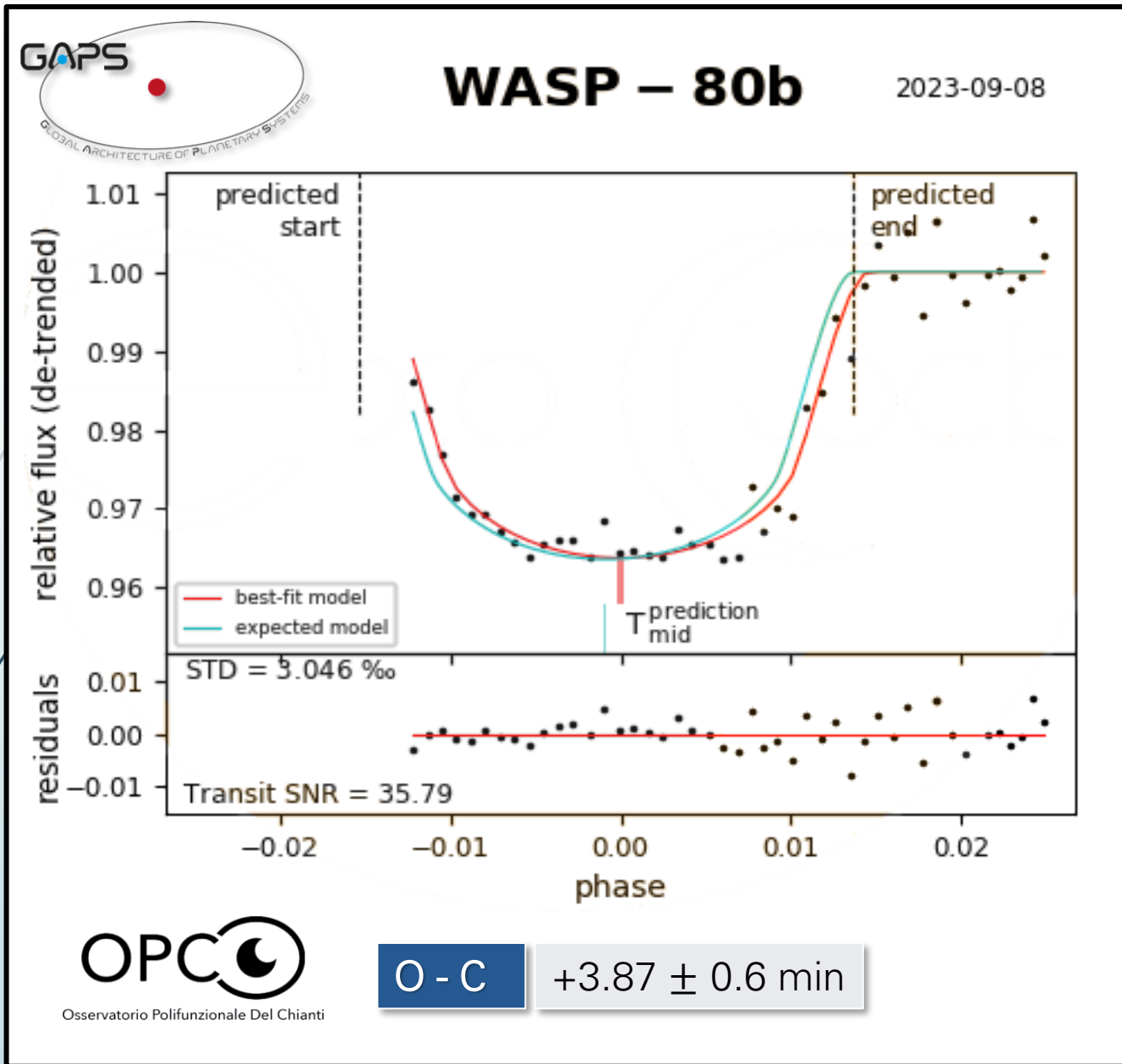
# TOI 3540 Ab – 17-18/10/2022

TESS – SG1

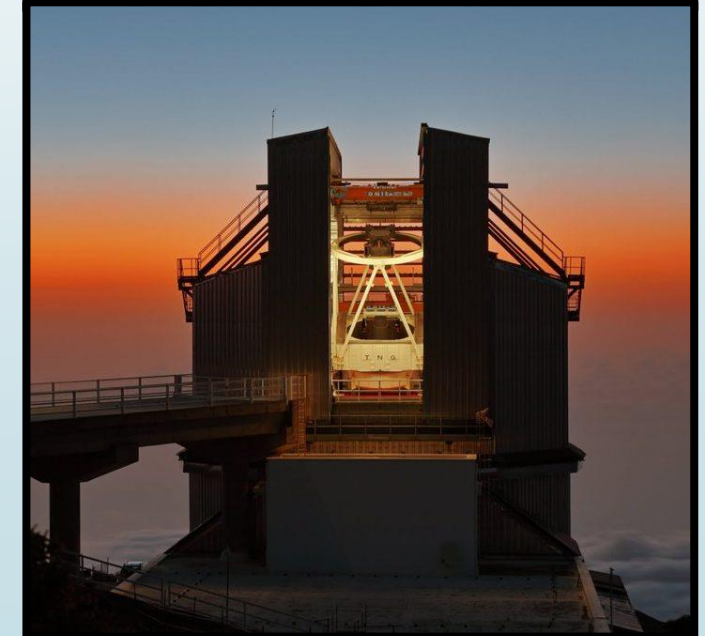
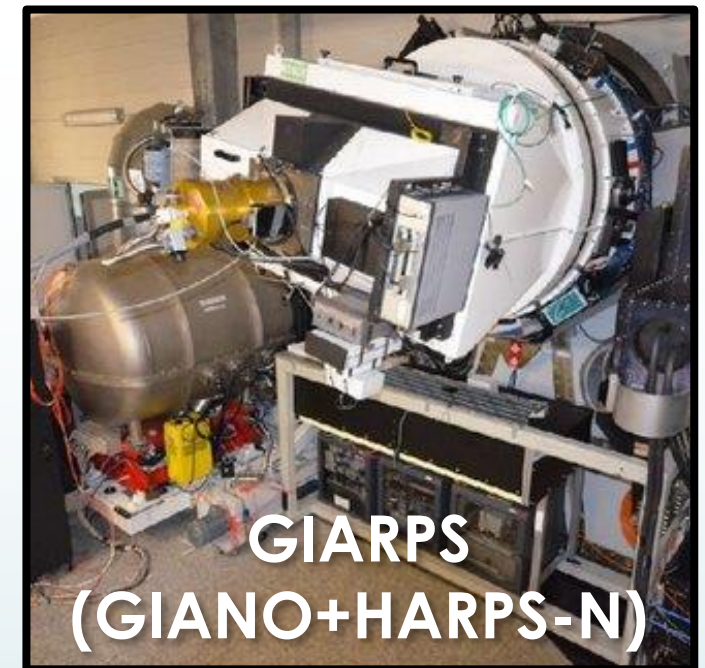


		Measured	Predicted
Time	Ingress Time	$0.380998 \pm 0.000813$	$0.345833 \pm 0.001181$
	Mid - Time	$0.412708 \pm 0.000813$	$0.376389 \pm 0.001181$
	Egress Time	$0.446698 \pm 0.000813$	$0.406944 \pm 0.001181$
	Duration	~ 95 min	~ 88 min
	Depth	$(8.87 \pm 0.63)$ ppt	$(8.74 \pm 0.31)$ ppt

**O - C**  $+52.3 \pm 0.2$  min



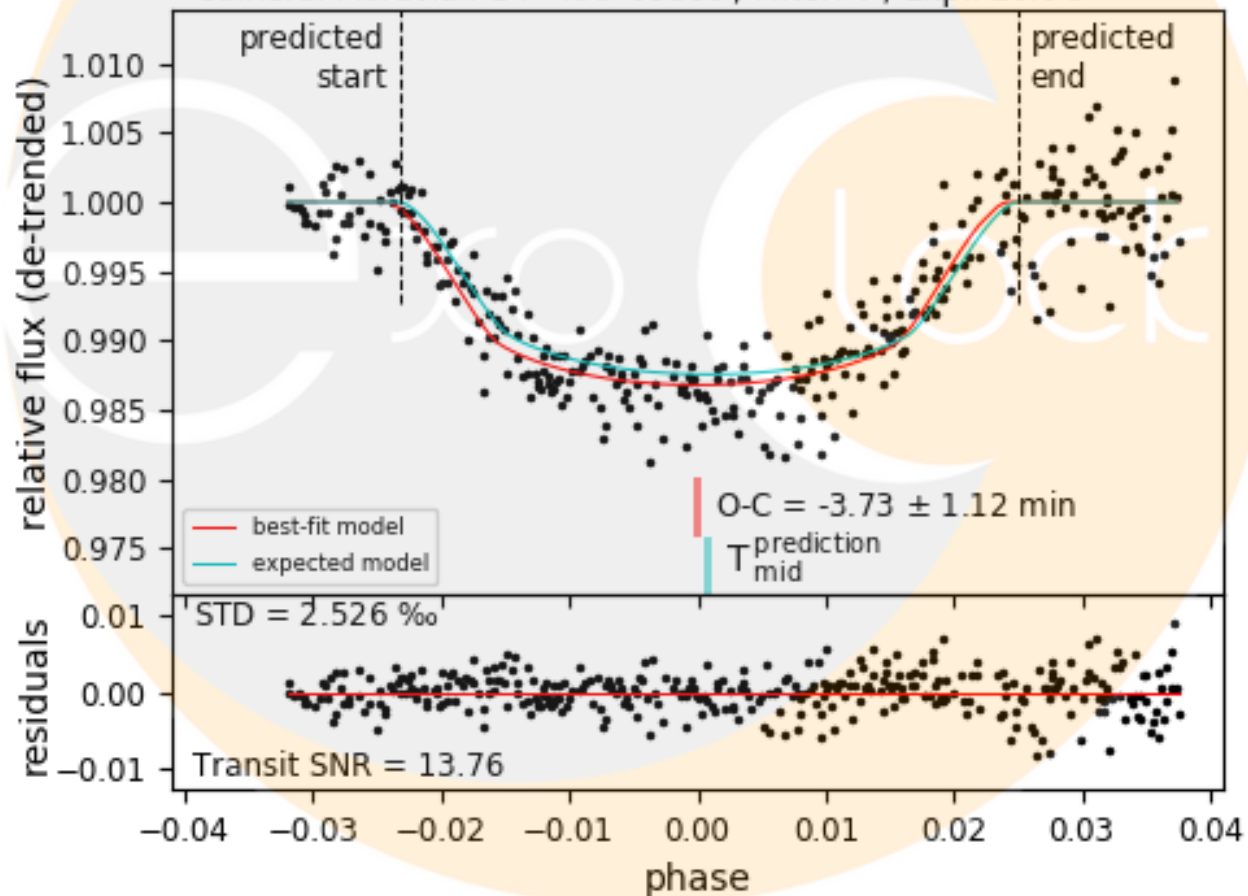
+



2021-03-31

# KELT-4Ab

Osservatorio Polifunzionale del Chianti / Telescope: RC-80cm (31.5")  
Camera: Moravian G4 - KAF 09000 / Filter: V / Exp.: 20.0 s



## Evaluation Report

### Results

$R_p/R_s = 0.1122 \pm 0.0041$  (expected:  $0.1089 \pm 0.0005$ )

O-C =  $-3.73 \pm 1.12$  minutes

### Diagnostics

**Step 1: Transit SNR = 13.76**

Transit SNR is good (strong detection of the transit)!

**Step 2:  $R_p/R_s$  drift =  $0.8\sigma$**

The  $R_p/R_s$  drift is good ( $R_p/R_s$  in good agreement with the literature)!

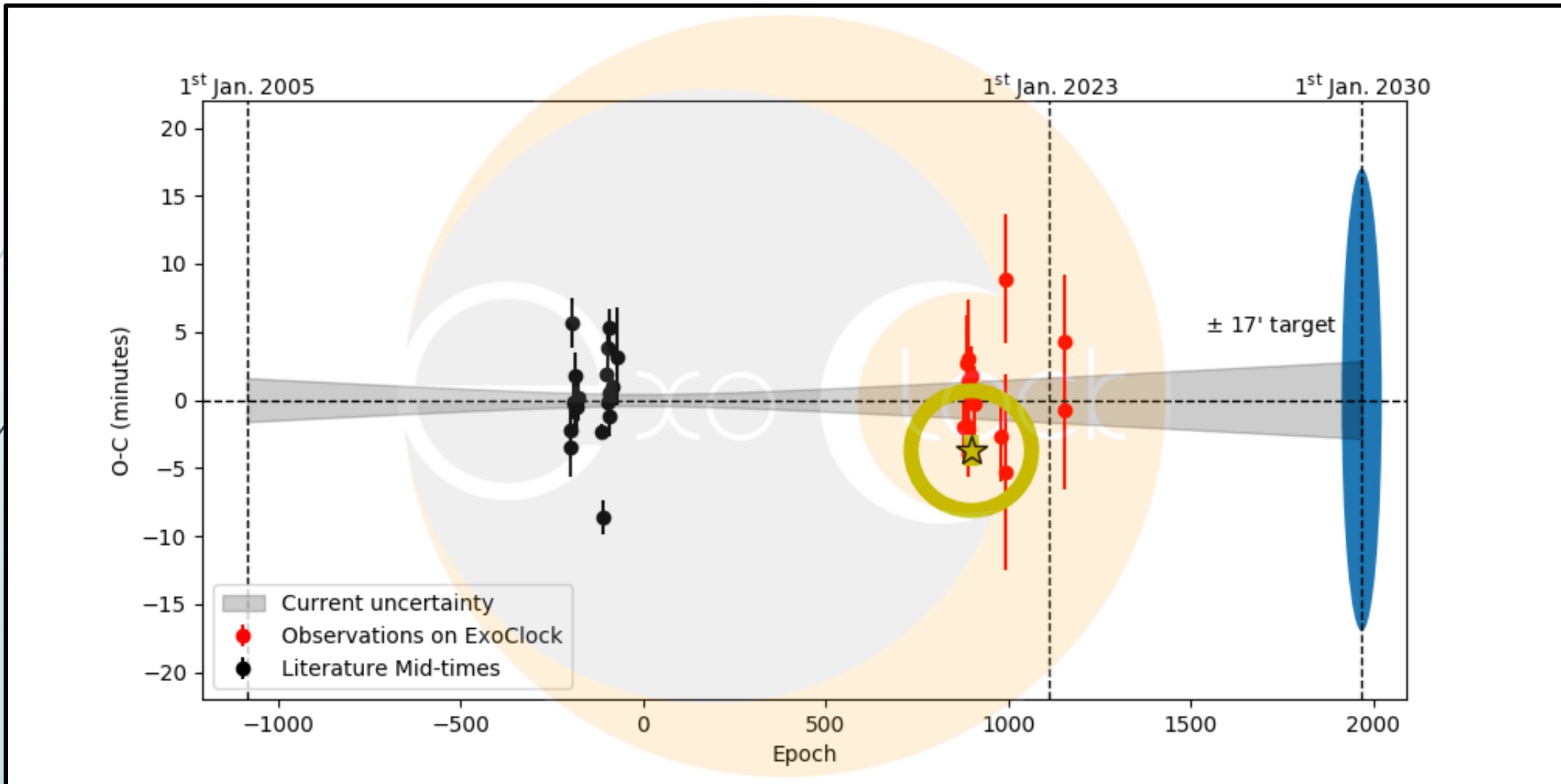
**Step 3: AutoCorrelation = 0.166**

The AutoCorrelation is good (no systematics in the data)!

**Step 4: Shapiro test = 0.007**

The Shapiro test is good (few or no outliers in the data)!

# KELT- 4Ab O-C



## 3. Young Stellar Objects



- ▶ Star formation and analysis of outburst phenomena
- ▶ Long-Period Observation Campaigns on Young Star Clusters
- ▶ Focused Observations on short-period transient phenomena to find presence exo-planets around Young Star

IC 1396 A



IC 1396 N

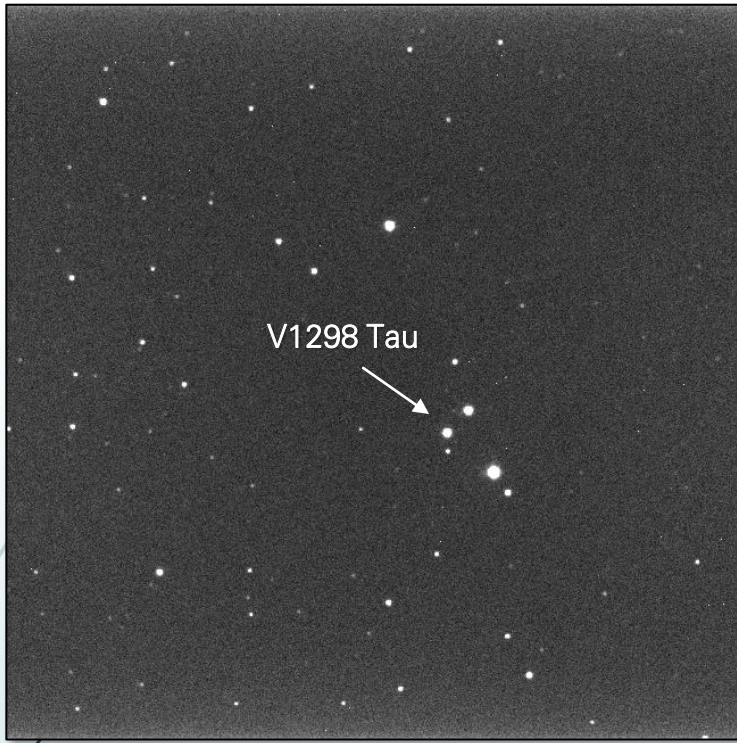


M. T. Beltrán, F. Massi et al.; *The stellar population and complex structure of the bright-rimmed cloud IC 1396N*; *Astronomy and Astrophysics* vol. 504, n.1, p.97-107 (2009) ([link](#))



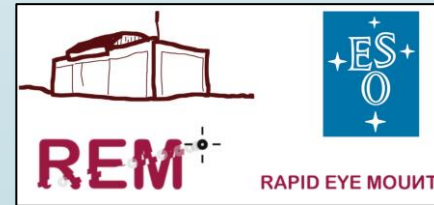
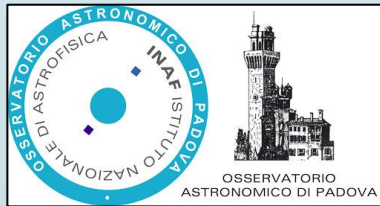


V1298 Tau



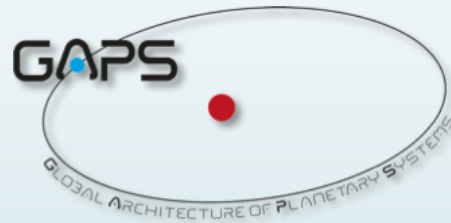
Mon. 26<sup>th</sup> February – Chianti Topics Talk

A. Biagini, *The use of small and medium-class telescopes for spot modelling through multiband photometry*

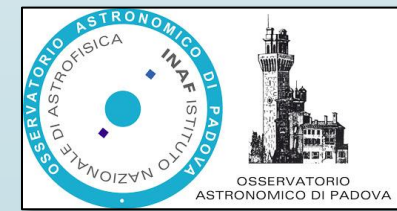
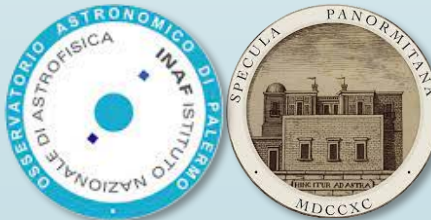


## Conclusions

- ▶ Photometrical Precision:  $\sim$  ppt (or mmag)
- ▶ Exoplanetary Transit Collaborations



- ▶ Young Stellar Object Followup Collaborations



## Info

e-mail: [e.pace@osservatoriochianti.it](mailto:e.pace@osservatoriochianti.it)

[l.betti@osservatoriochianti.it](mailto:l.betti@osservatoriochianti.it)

website: <http://www.osservatoriochianti.it/>

## Published Articles

Kokori, A., et al.; ExoClock Project. III. 450 New Exoplanet Ephemerides from Ground and Space Observations. *The Astrophysical Journal Supplement Series* **265**, n.1, 4 (2023) ([link](#))

Kokori, A., et al.; ExoClock Project. II. A Large-scale Integrated Study with 180 Updated Exoplanet Ephemerides. *The Astrophysical Journal Supplement Series* **258**, n.2, 40 (2022) ([link](#))

Naponiello L., Betti L., Biagini A. *et al.*; Photometry of exoplanetary transits at Osservatorio Polifunzionale del Chianti. *Exp Astron* **50**, 169–183 (2020) ([link](#))

## Work in progress...

Biagini A., Petralia A., Di Maio C., Betti L., Pace E., Micela G.; *Spot Modelling through Multiband Photometry V1298 Tau Spots Analysis*

Thanks for your attention

