



**INAF**  
ISTITUTO NAZIONALE  
DI ASTROFISICA

# YESTERDAY AND TODAY TRACKING AT TNG, TOMORROW SOXS AT THE TWIN NTT

**P. SCHIPANI**

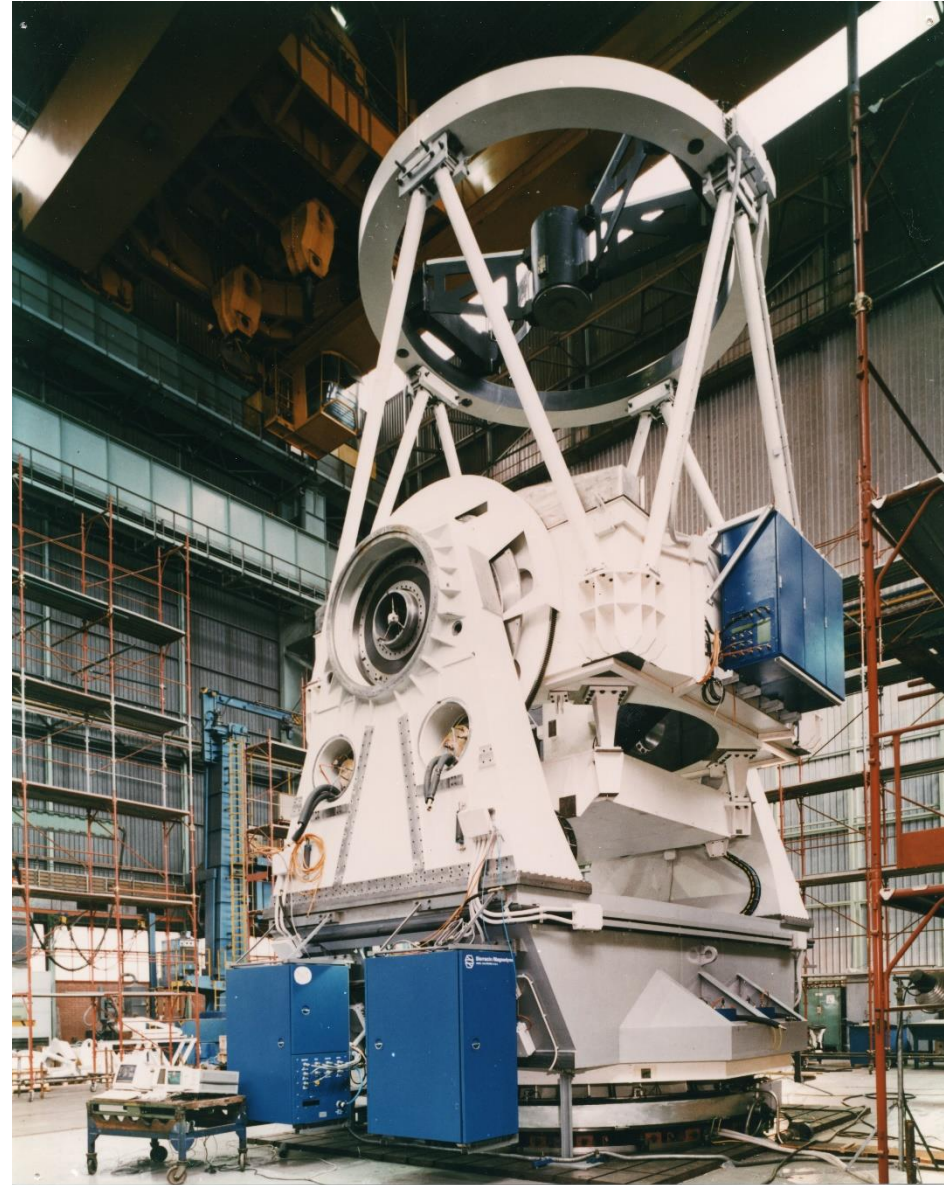
ON BEHALF OF THE SOXS TEAM

**TELESCOPIO NAZIONALE GALILEO: 25 YEARS OF ASTRONOMY IN LA PALMA**

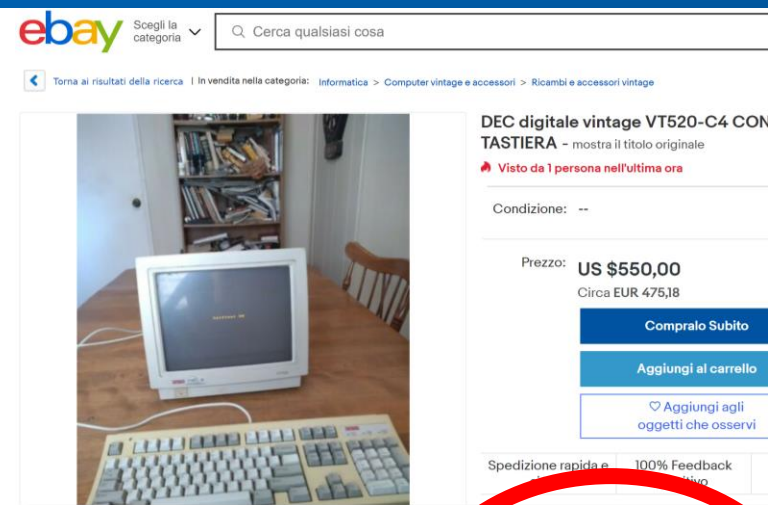
**19.10.2021**

# **TNG Inaugurations**

## **Photo album & Backstage**



# Ansaldo Milano, December 1994



ebay Scegli la categoria

Torna ai risultati della ricerca | In vendita nella categoria: informatica > Computer vintage e accessori > Ricambi e accessori vintage

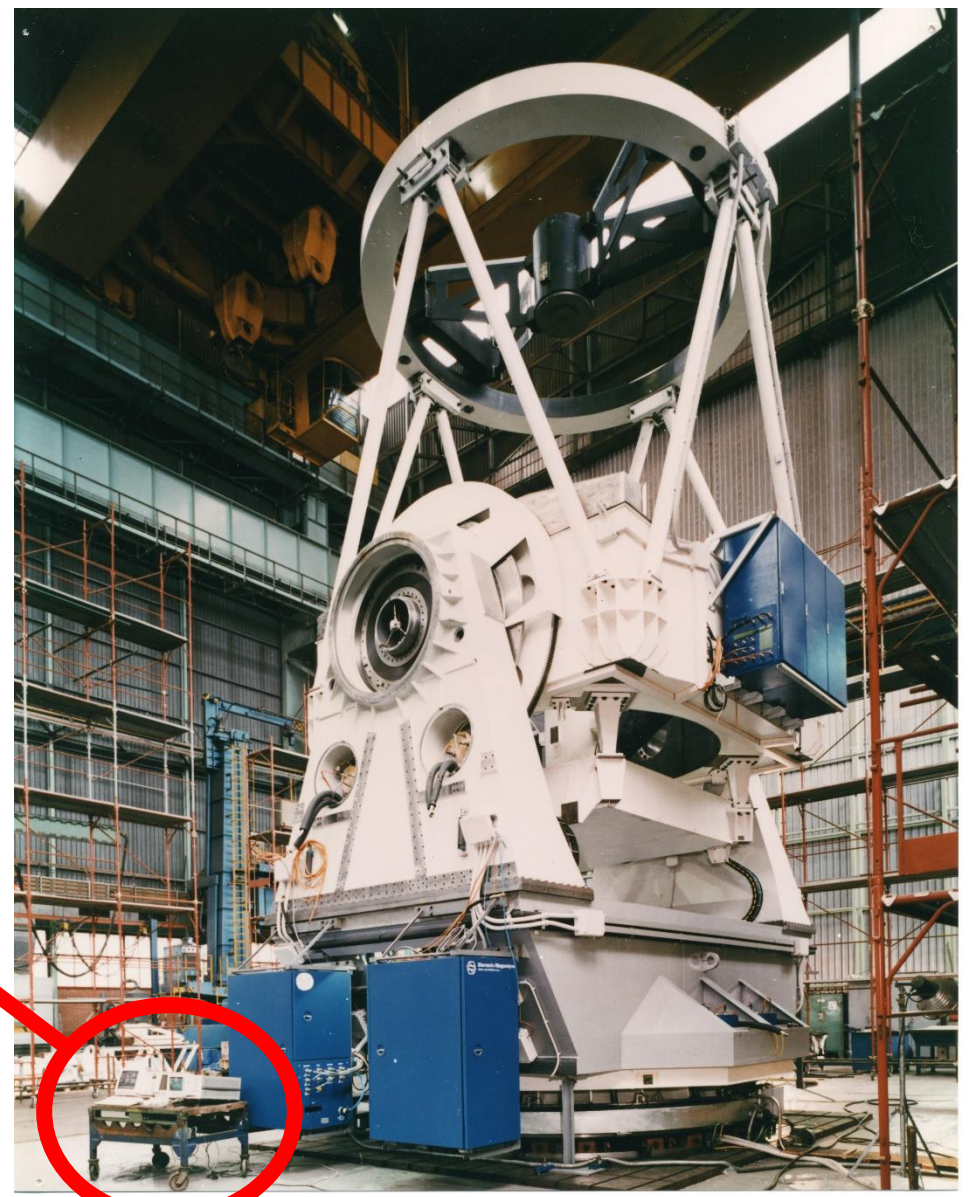
**DEC digitale vintage VT520-C4 CON TASTIERA** - mostra il titolo originale  
Visto da 1 persona nell'ultima ora

Condizione: --

Prezzo: **US \$550,00**  
Circa EUR 475,18

[Compralo Subito](#)  
[Aggiungi al carrello](#)  
[Aggiungi agli oggetti che osservi](#)

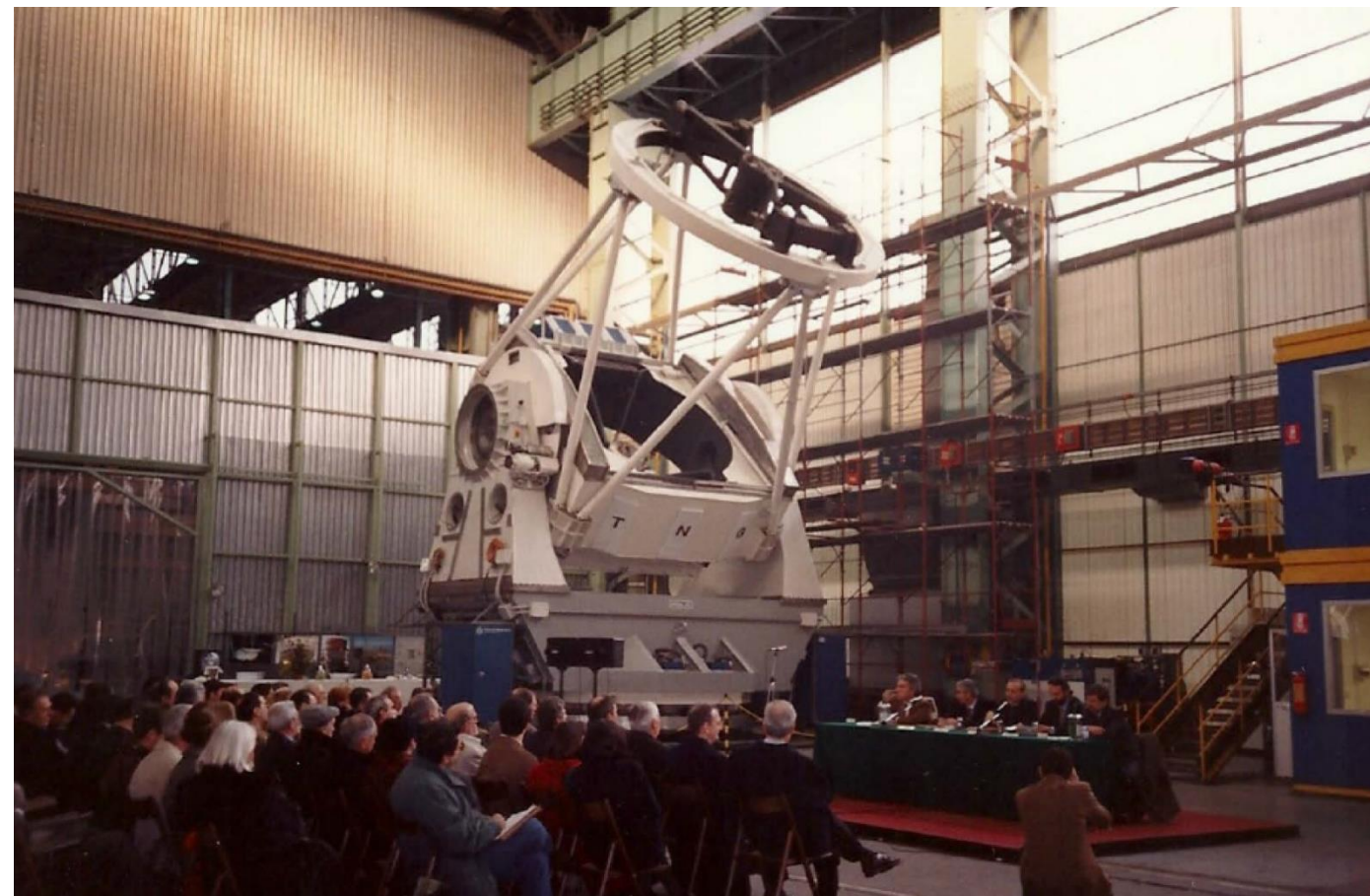
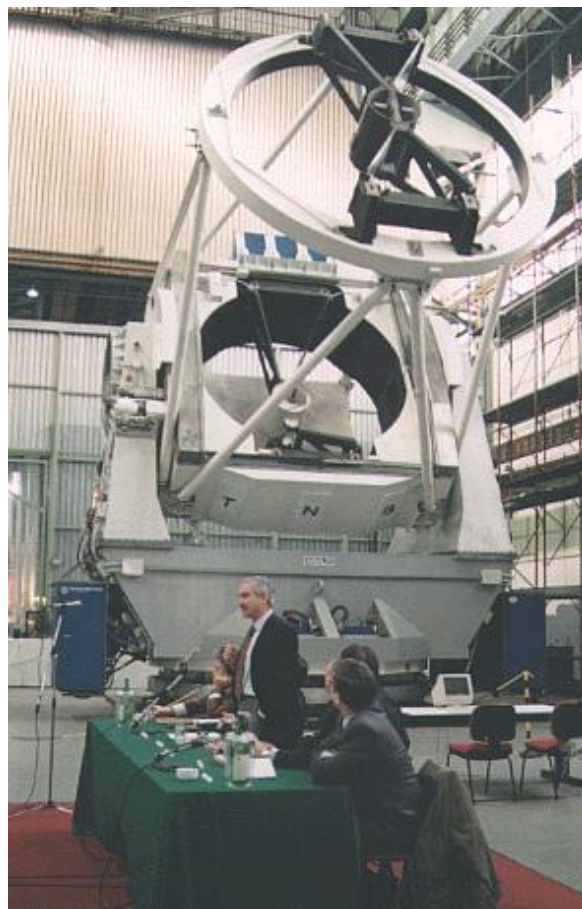
Spedizione rapida e 100% Feedback



## Show at the inauguration: sinusoidal speed Alt-Az dance...

*“The TNG silently and elegantly turned in azimuth and then lowered in elevation as if bowing to the audience in an effortless ballet, and one could not help imagining it inside its dome while pointing some far-off object in the incredibly bright Milky Way shining over the Roque.”*

*TNG Newsletter no.9*



Position loop closed with encoders in June 1995. First “tracking” of a position trajectory.



Official group picture



# La Palma, 1996.06.29 TNG Inauguration

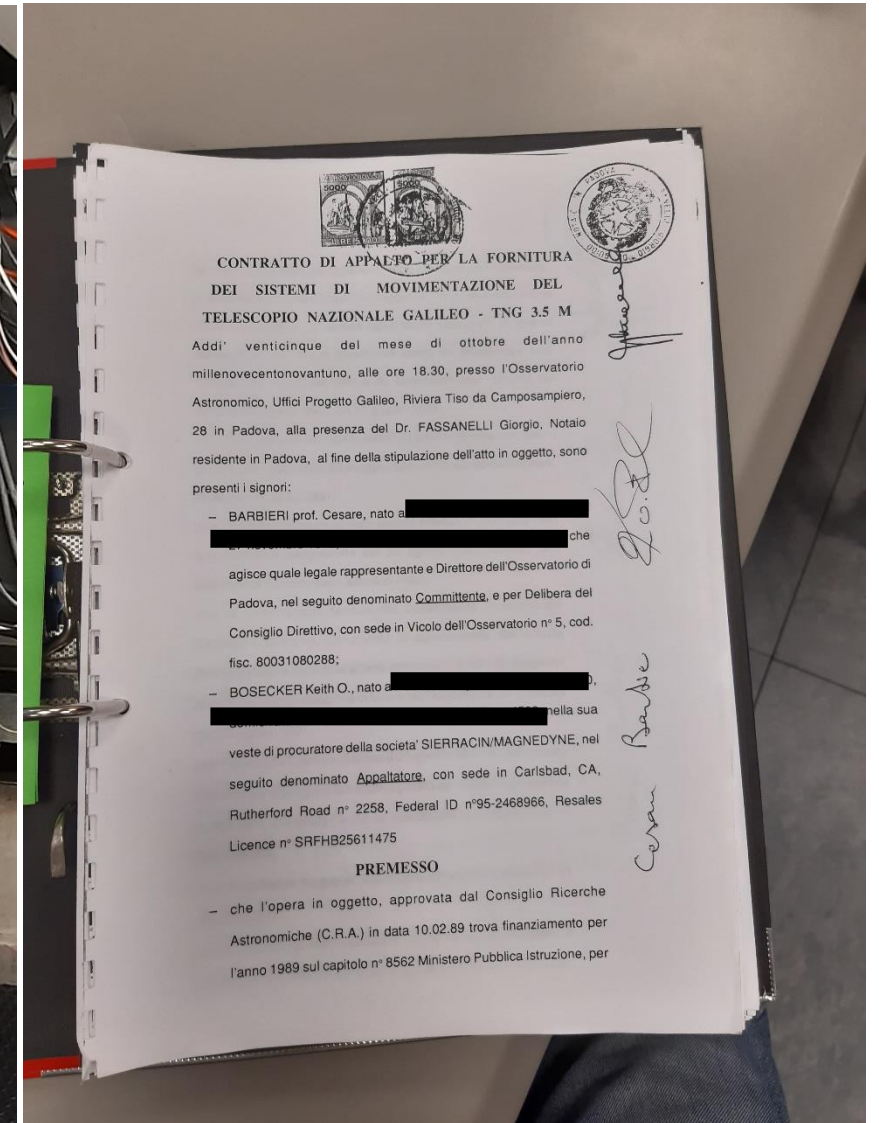






# La Palma, 1996.06.29 TNG Inauguration

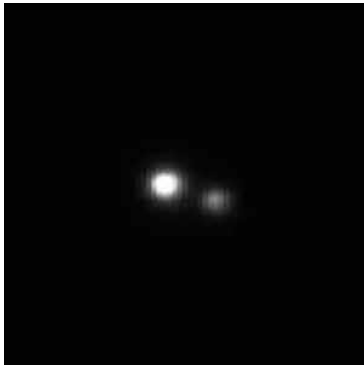




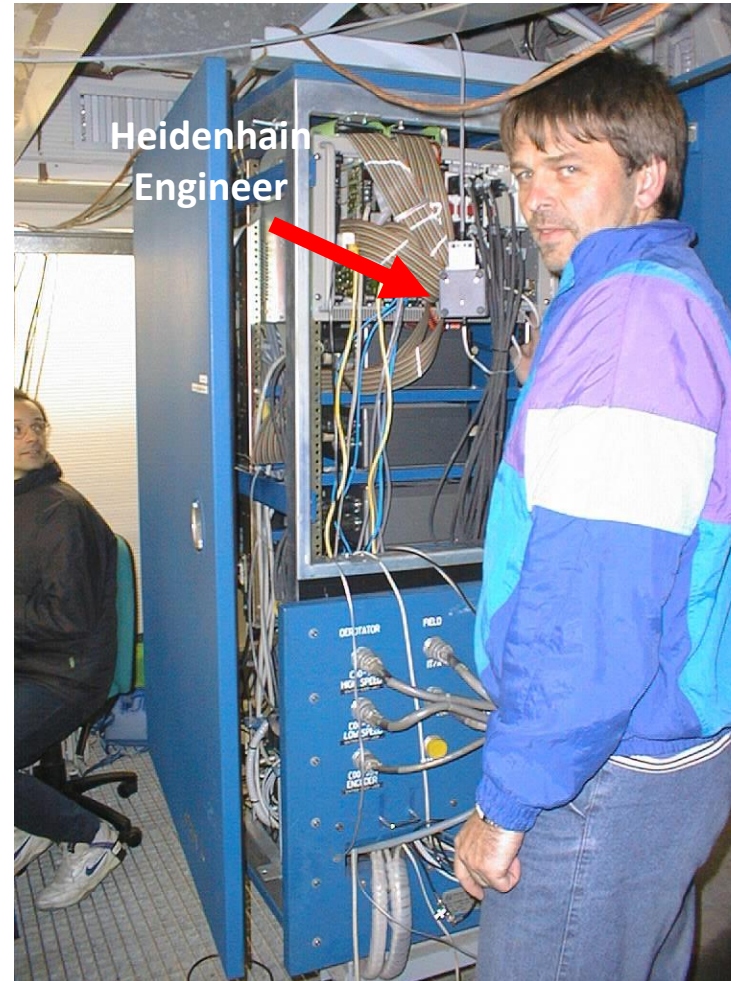
# My 'Tracking at the TNG'

- Lot of fun
- Heavy work
- Unrepeatable week-ends: alone at the TNG
- Exciting moments

TNG first light: 9 June 1998  
But also the days after...



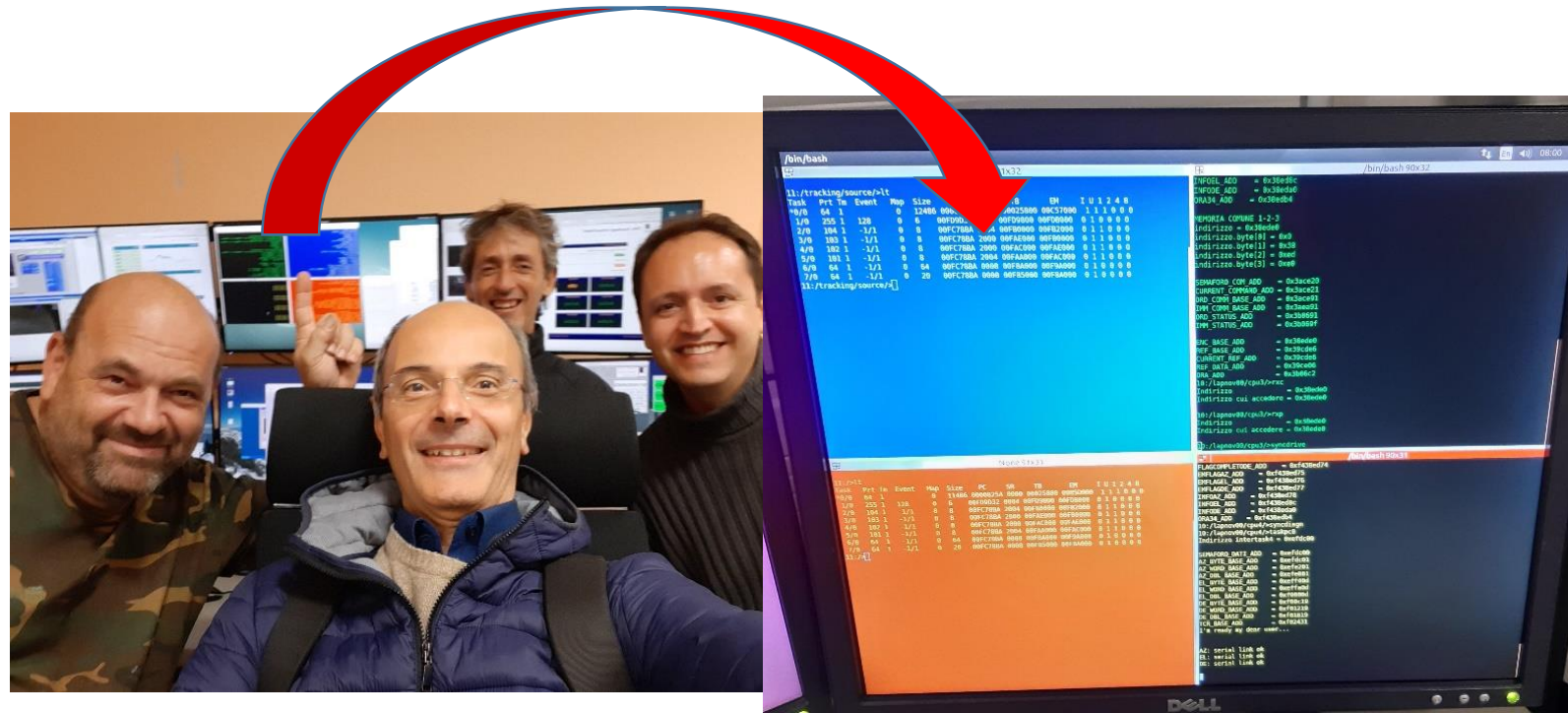
- Work completed in 2000
- But keeping always in touch later
- Onsite again in 2003 (good job with Tino)
- Fruitful collaboration with Manuel over the years. Now, working together again.
- Axes Control System and SW operational all the nights in 25 years!



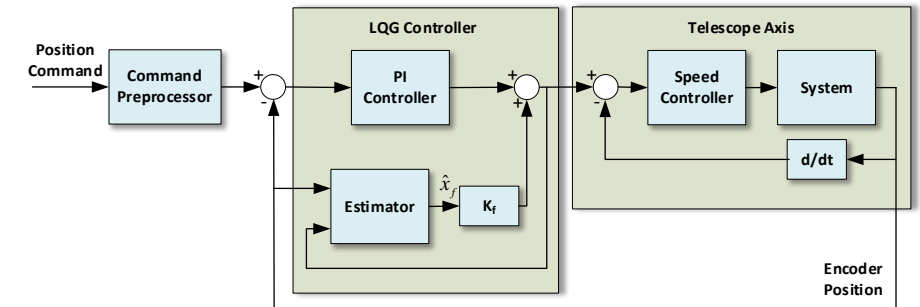
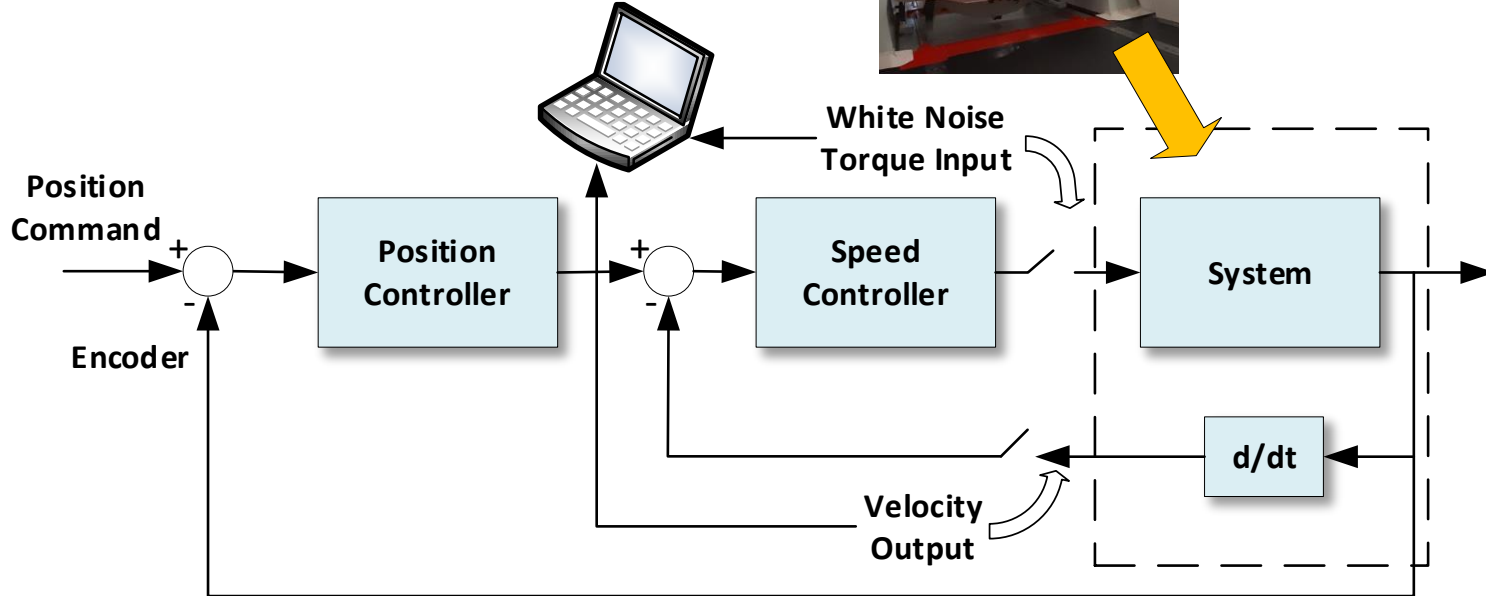
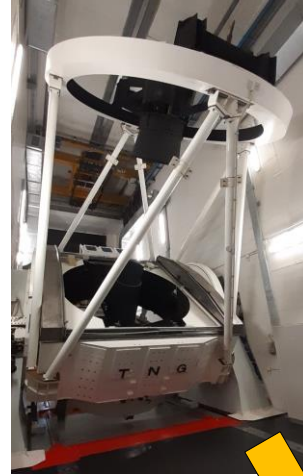
!!

*TNG Tracking experience paved the way for the VST Tracking  
INAF optical telescopes point&track with internal work and know-how*

- Back to the TNG
- TNG Servo Control Redesign
- Azimuth, Altitude



## New System Identification



## Studying new control strategies

- Command shaper
- LQG Control

INAF Telescopes Pointing & Tracking is cool



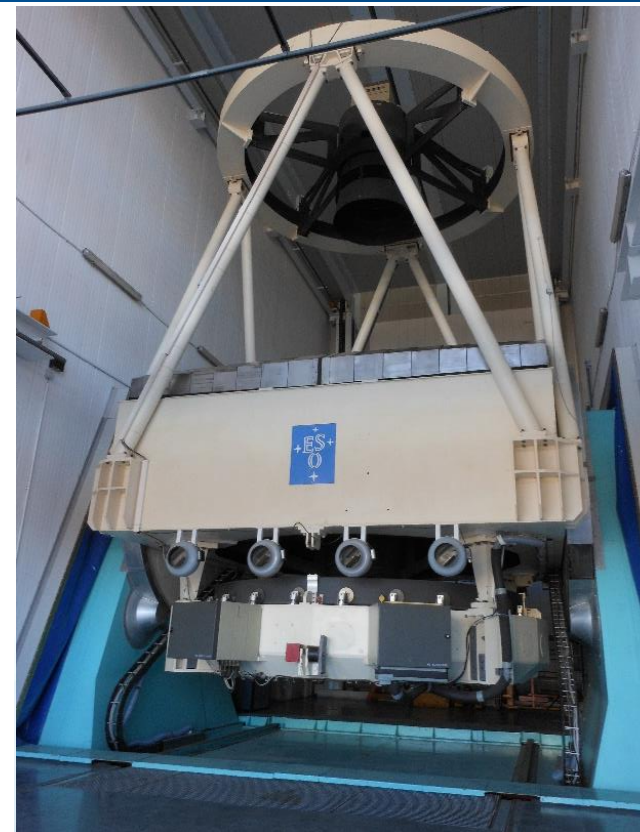
Switching to the twin NTT...





# SOXS: Son Of X-Shooter

- ❑ Single-object wide band spectrograph from U to H band @ESO-NTT 350-2000 nm
- ❑ '*Similar*' to X-Shooter @VLT
- ❑ Two arms (VIS + NIR) with partial overlap around 800 nm to cross-calibrate spectra
- ❑  $R \sim 4,500$  (3,500-6,000)
- ❑ Acquisition camera to perform photometry ugrizY-V (3.5'x3.5')



ESO La Silla (LPO)





## Consortium

Institutes from 6 Countries

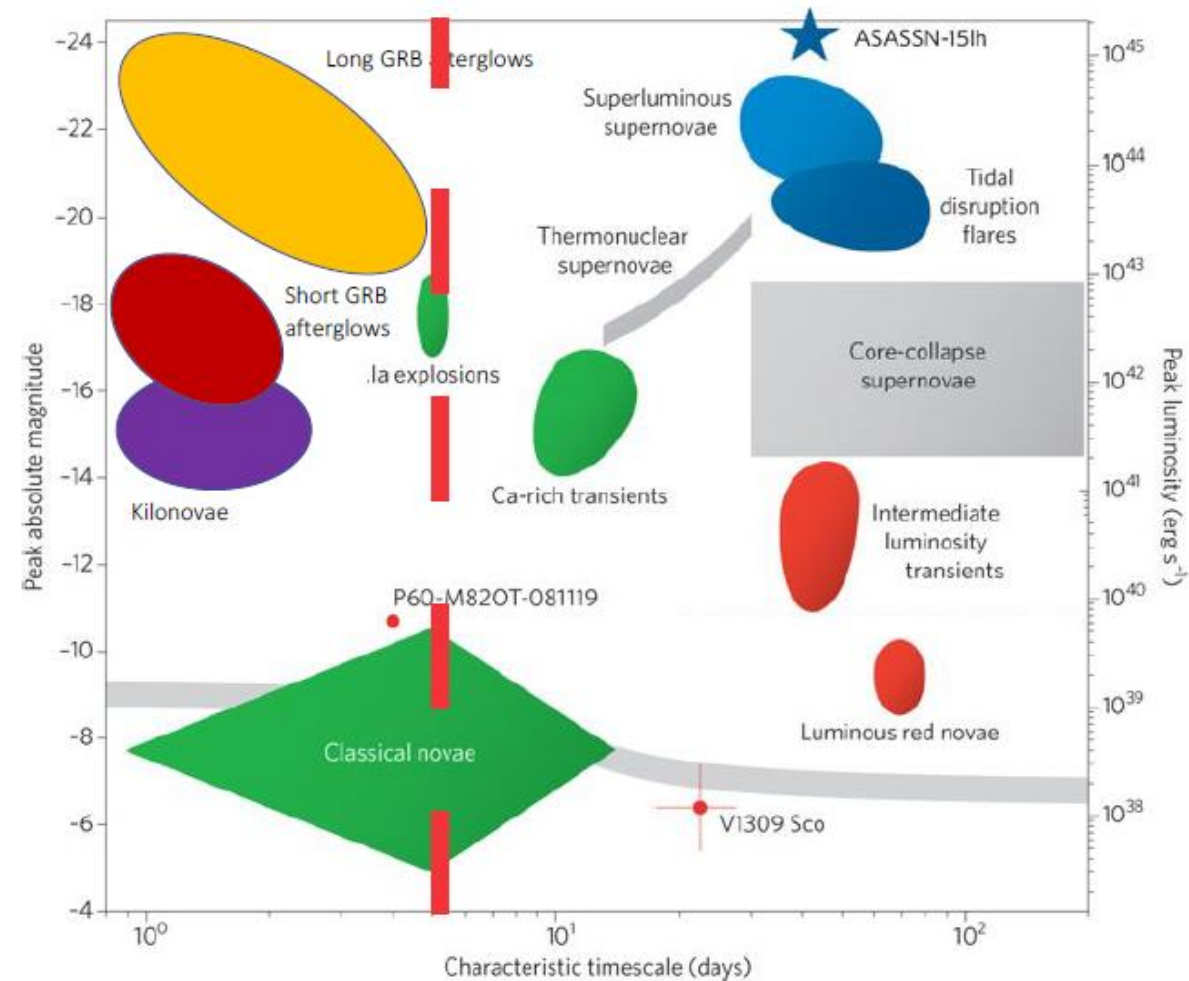
- ❑ Istituto Nazionale di AstroFisica (INAF), Italy
- ❑ Department of Particle Physics and Astrophysics, Weizmann Institute of Science, Rehovot, Israel
- ❑ Universidad Andres Bello & Instituto Milenio de Astrofisica (MAS), Santiago, Chile
- ❑ FINCA - Finnish Centre for Astronomy with ESO & Turku University, Turku, Finland
- ❑ Queen's University Belfast, UK
- ❑ Tel Aviv University, Israel
- ❑ Niels Bohr and Aarhus University, Copenhagen, Denmark





## Spectroscopic follow up of transients

- Classification of transients
- Supernovae (all flavours)
- Gravitational Wave events
- Neutrino events
- Blazars and AGN
- Nuclear transients and Tidal Disruption Events
- GRB and FRB
- Transient X-ray binaries, magnetars, ultra-luminous X-ray sources (NS & BH)
- Asteroids and Comets
- Young Stellar Objects, stellar variability, exoplanets
- The Unknown



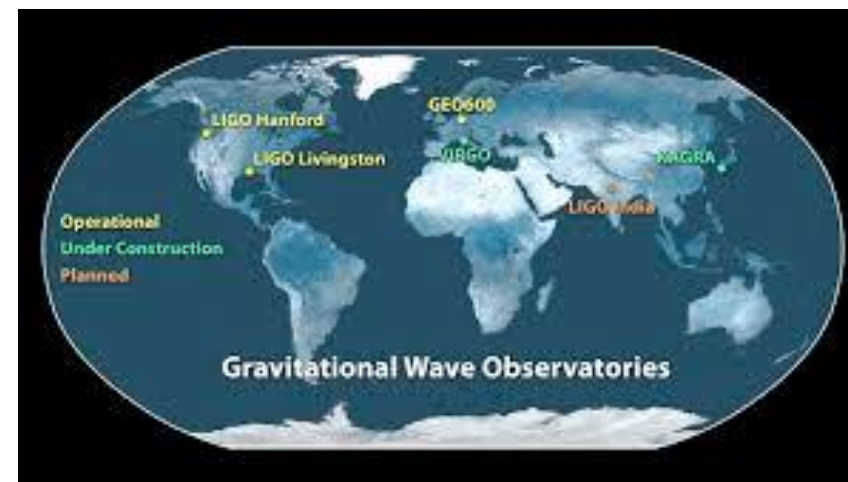


## Sinergies

SOXS will have 180 n/yr (for  $\geq 5$  yr)  
 $\sim 3,000-4,000$  spectra/yr

### A spectroscopic machine for the transient sky

- New deeper survey: Vera Rubin, PanSTARSS, DES, ZTF, ...
- Space optical missions: Gaia, EUCLID, ...
- Space high-energy missions: Swift, Fermi, SVOM, ...
- Radio new facilities: MeerKAT, SKA, ...
- VHE: CTA
- Messengers: aLIGO-Virgo, KM3Net, ANTARES, ...

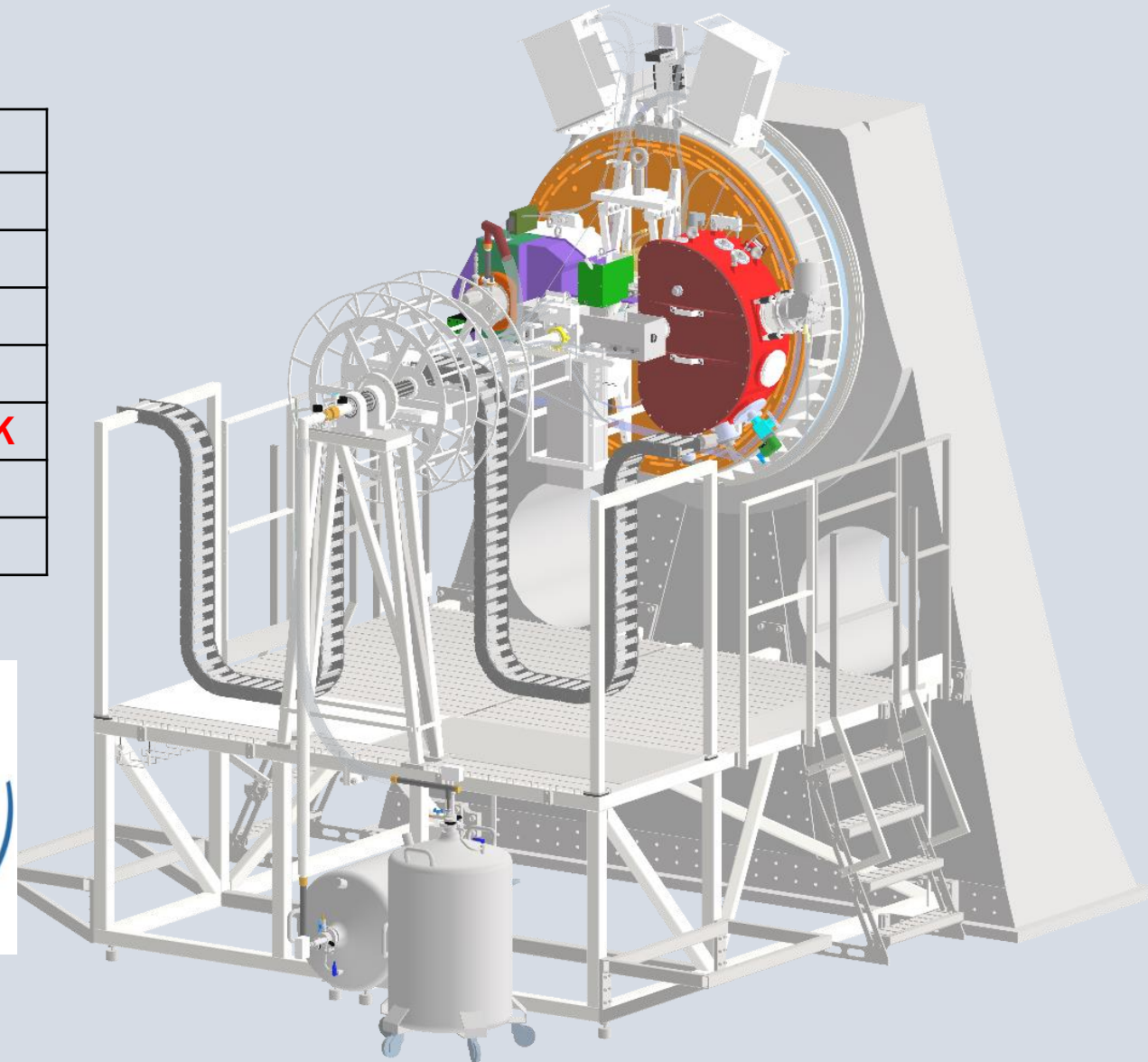




# SOXS: Son Of X-Shooter

	UV-VIS	NIR
Spectral range	350-850 nm	800-2000 nm
Resolution (1" slit)	>3600 ( $\approx$ 4500 avg)	5000
Slit widths	0.5 - 1 - 1.5 - 5 arcsec	0.5 - 1 - 1.5 - 5 arcsec
Slit height	12 arcsec	12 arcsec
Detector	e2V CCD44-82 2Kx4K	Teledyne H2RG 2Kx2K
Pixel Size	15 $\mu$ m	18 $\mu$ m
Detector Scale	0.28"/pixel	0.25"/pixel

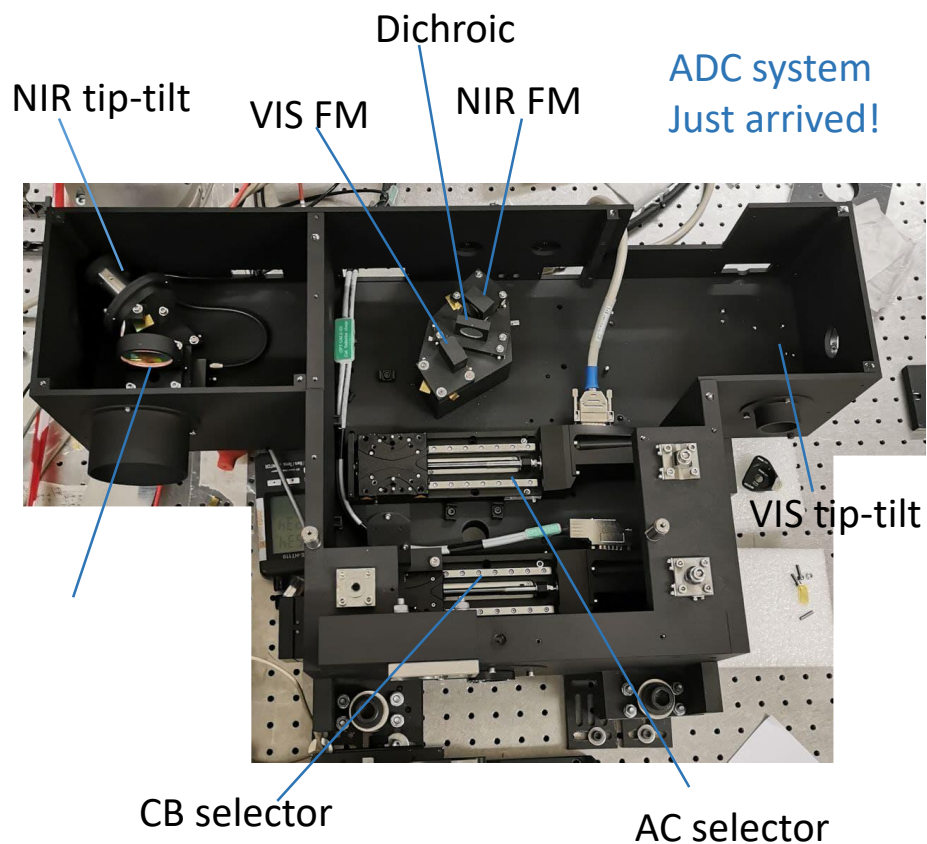
	Camera
Spectral range	360-970 nm
Detector	Andor iKon M-934 1Kx1K
Field of View	3.5'x3.5'
Pixel Size	13 $\mu$ m
Detector Scale	0.205"/pixel



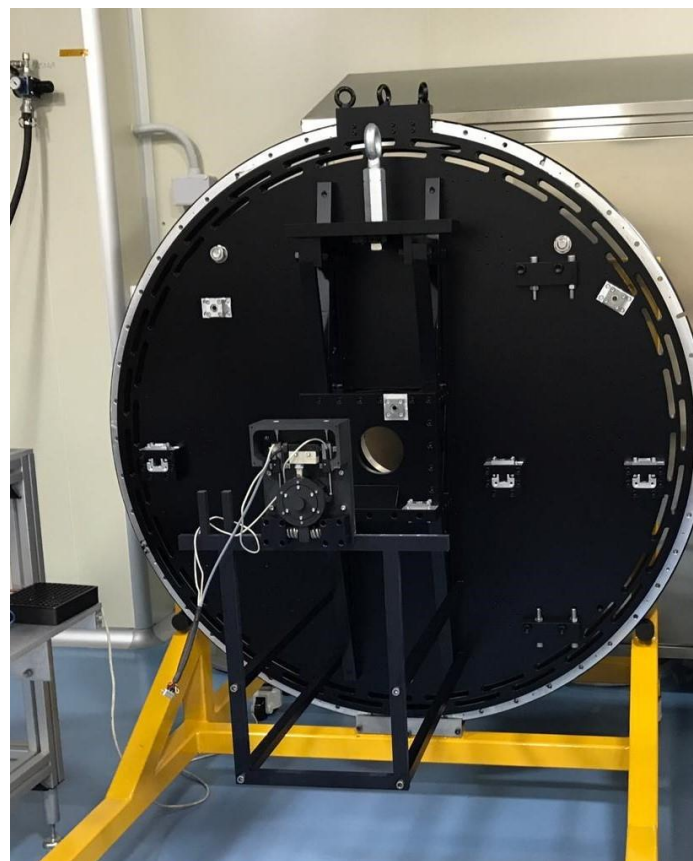


## Taking shape

### Common Path



### Flange



### Co-Rotator

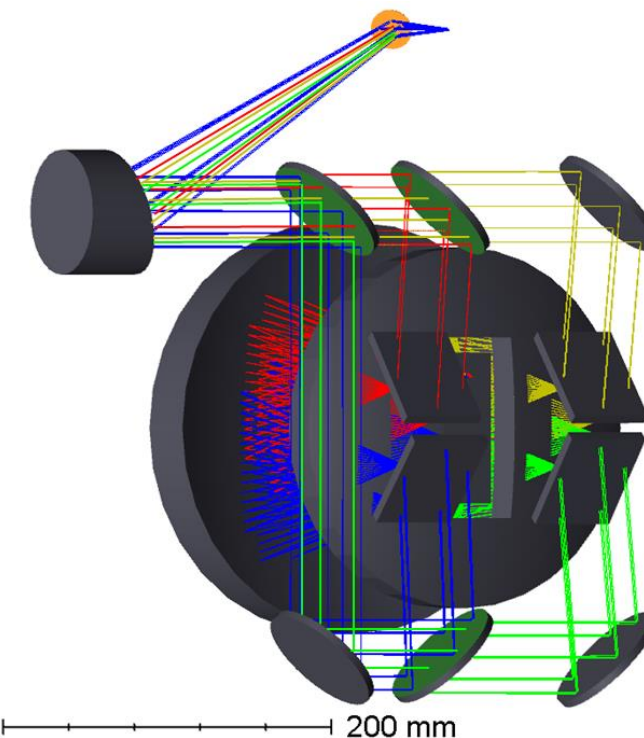
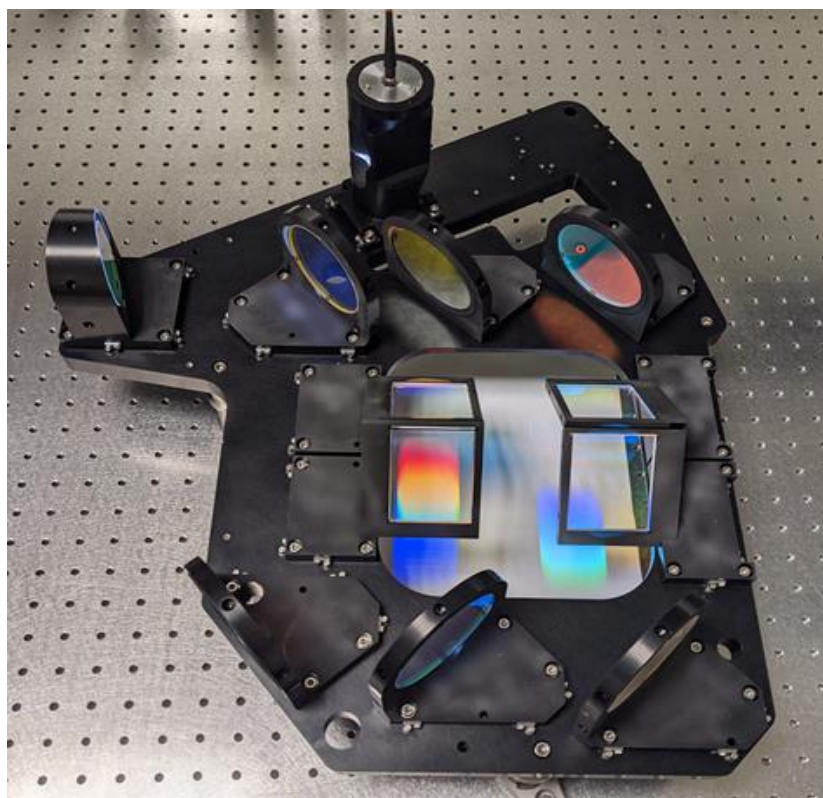
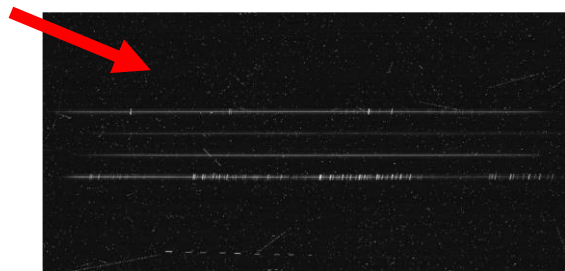


Big problems and delays with COVID



## UV-VIS: Multi-Imaging Transient Spectrograph

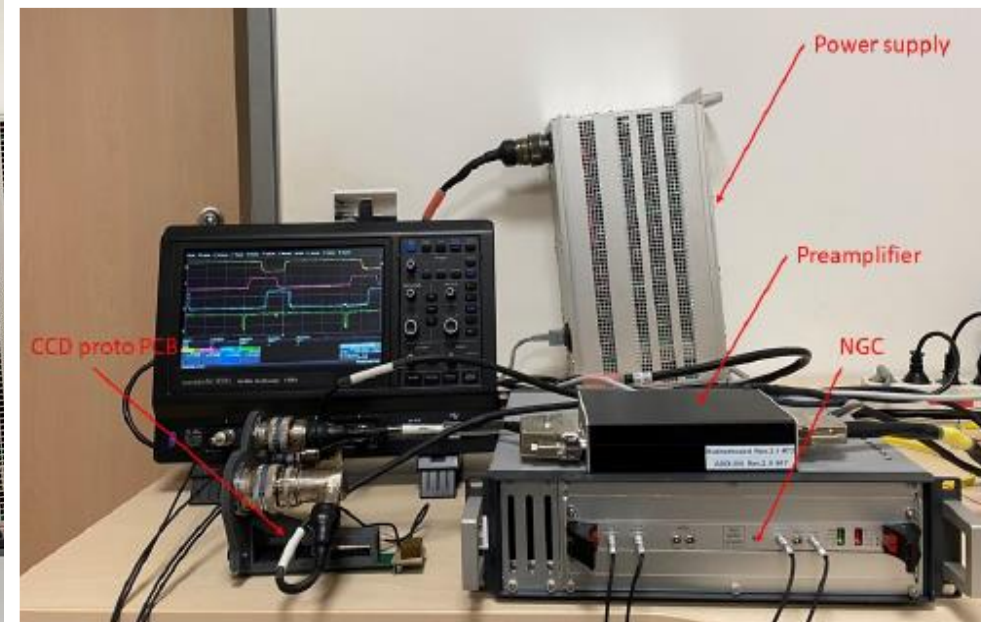
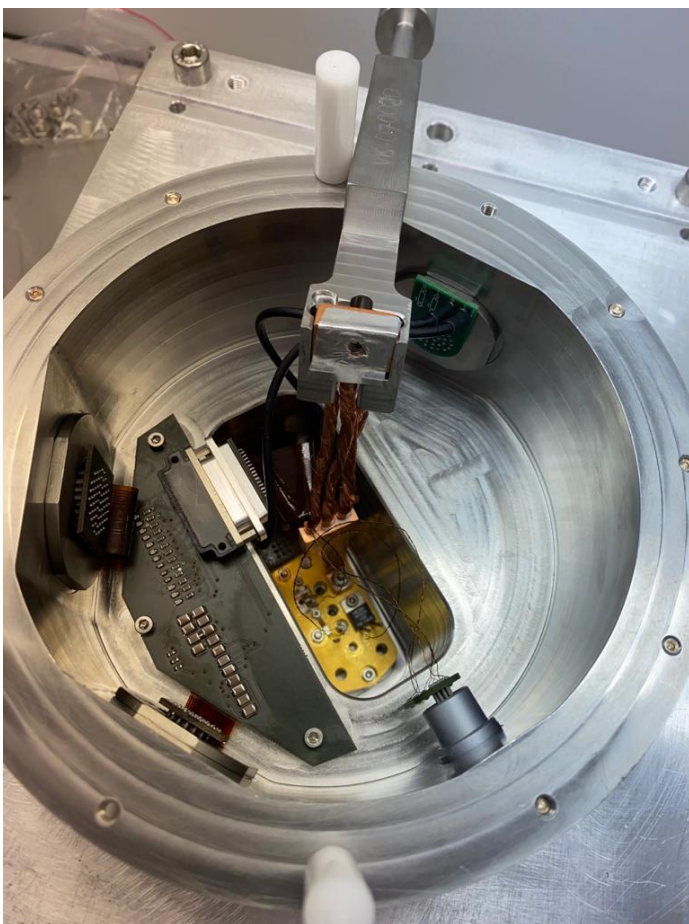
- ❑ Collimated beam is divided to 4 bands using 3 dichroics.
- ❑ Each band has its own optimized disperser
- ❑ Single camera
- ❑ 1<sup>st</sup> order dispersion,  $\mathcal{R} \sim 4500$  at  $\alpha_{Lit}$ .
- ❑ 4 bands quasi-orders are imaged onto a single 4kx2k CCD.



Quasi-Order	Wavelength Range [nm]
<i>u</i>	350 – 439.5
<i>g</i>	427 - 547
<i>r</i>	527 - 680
<i>i</i>	664 – 850

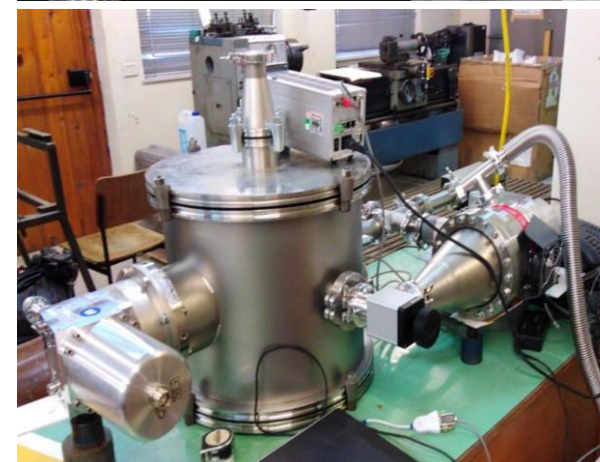
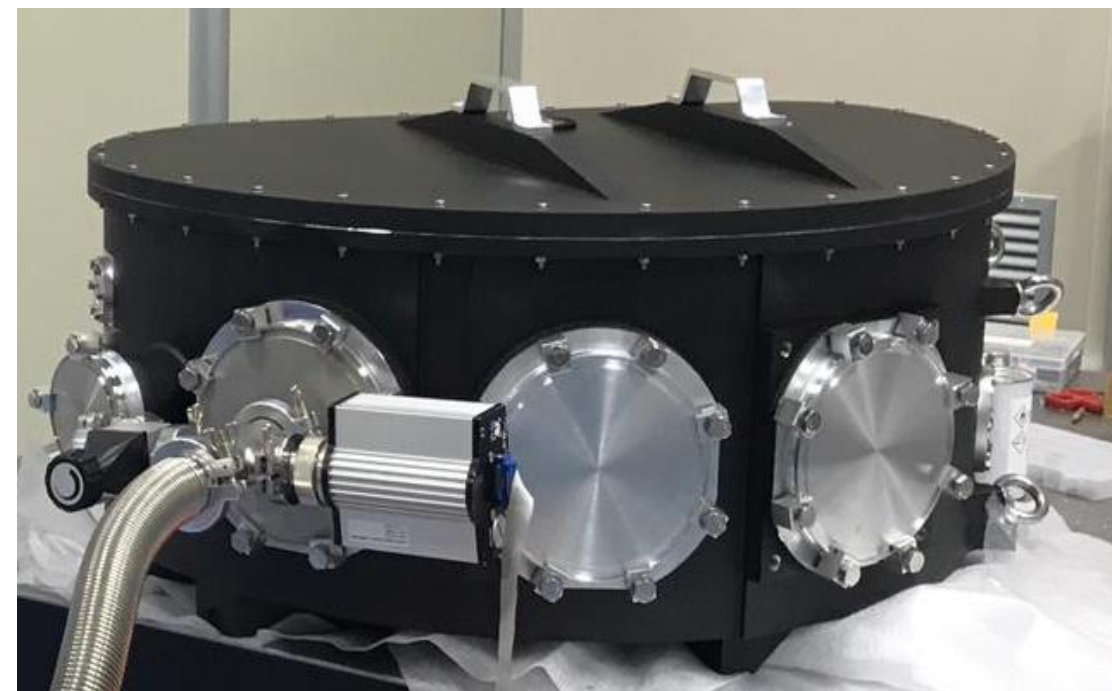
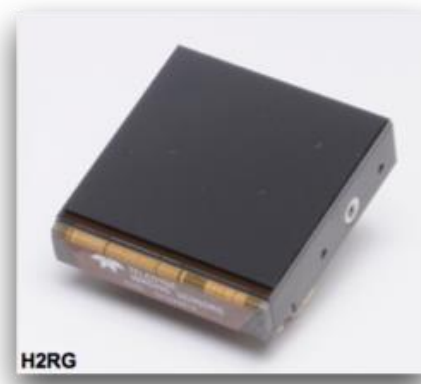
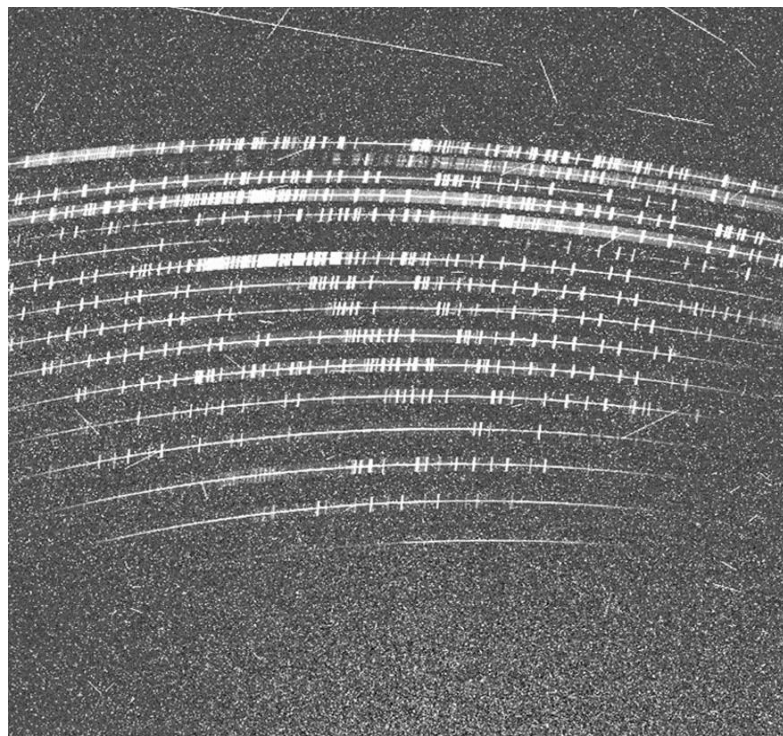


## TNG staff responsible of the UV-VIS Detector System





## NIR Spectrograph





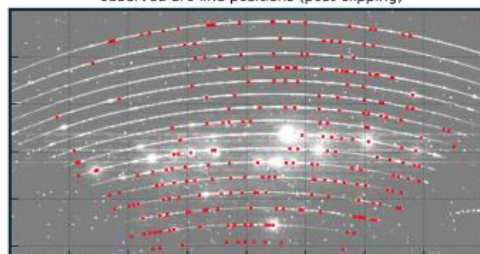


## Operations

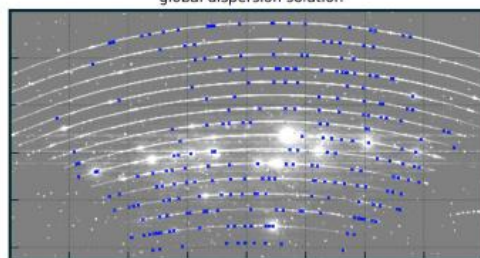
Consortium responsibility for 5 years

- ETC
- Pipeline
- Scheduler
- Quality Control
- Help desk

**soxs\_disp\_solution**  
 residuals of global dispersion solution fitting - single pinhole  
 mean res: 0.12 pix, res stdev: 0.06  
 observed arc-line positions (post-clipping)



global dispersion solution



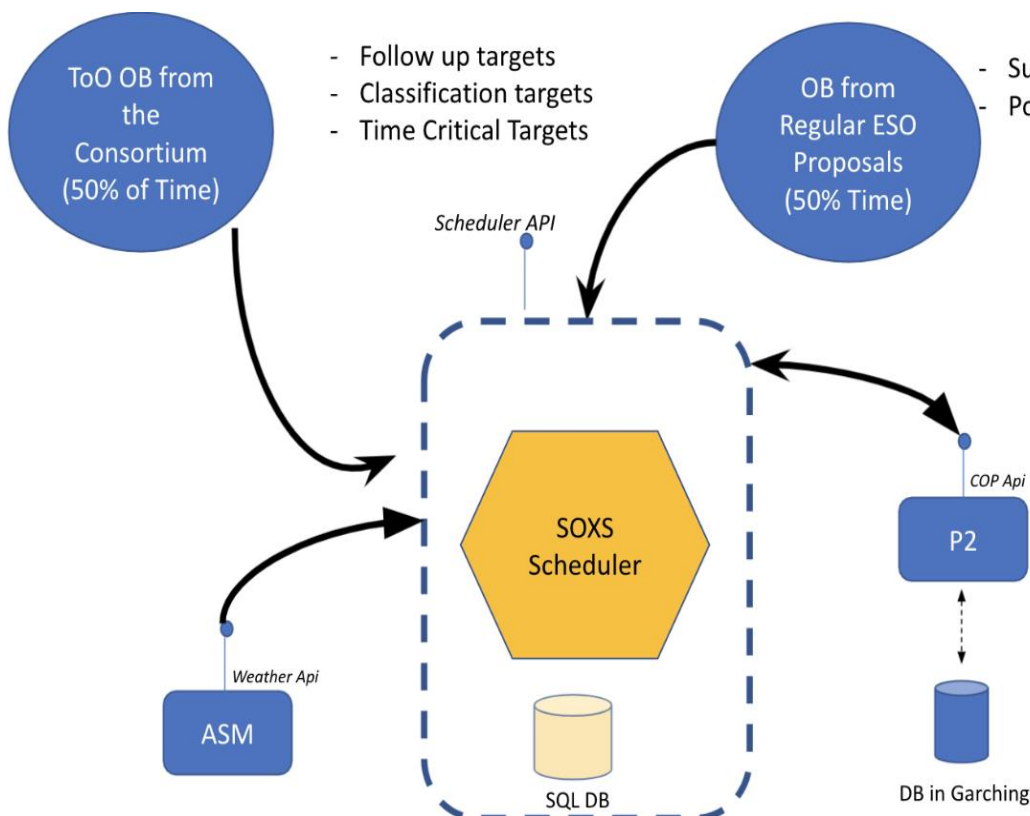


## Scheduling

- ☐ Schedule is updated daily
- ☐ Telescope operator on site

- ☐ P2 system, vOT interface with ESO La Silla
- ☐ Web based app

AID	OB Type	Target Name	Ra.	Dec.	Magnitude	Exp. Time	Actions
1	Undefined	PKS 1553+113ms	09h43m00s	+10d00m00s	11.5	3	[actions]
4	Classification	AT2018fq	17h03m49.68s	+15d18m28.44s	16.4	2070	[actions]
5	Proposal ESO	AT2018fn	09h25m7.88s	+09d39m00.072s	17.3	752	[actions]
6	Classification	AT2018fv	19h08m06s	-15d22m09.12s	16.8	2994	[actions]
7	Follow up	AT2018fx	01h44m34.56s	-00d26m05.52s	16.4	2070	[actions]
8	Follow up	SN2018fy	02h26m47.304s	-05d04m02.316s	16.1	1570	[actions]
10	Follow up	AT2018fc	04h48m54.48s	-41d56m18.24s	17.4	824	[actions]
11	Undefined	SN2018fk	05h45m08.16s	-79d23m47.4s	17	570	[actions]
12	Classification	SN2018fu	23h24m56.64s	+09d25m02.68s	17.8	1192	[actions]



- Follow up targets
- Classification targets
- Time Critical Targets

- Submitted only through P2
- Possible ToO coming from proposals

## Marshall

### Feeders:

- ☐ ZTF, ATLAS, PanStarrs, LSST-Lasair, etc.
- ☐ TNS, Atel, GCN, etc.

The screenshot shows the Marshall web interface for a transient named **PS1-12zrr**. It displays various data points including **ra & dec**, **galactic coords**, **discovery date**, and **discovery magnitude**. The interface also includes tabs for **overview**, **comments**, **photometry**, **contact**, **ticket history**, and **dryx**.

# **FUERZA LA PALMA**

## **Grazie Fabio**