



# Institutional contributions to TARSIS

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(IAA-CSIC, UCM, INAOE, Fractal SLNE, U. Sevilla, U. Granada, U. Almería, CAB (INTA-CSIC)).

**Abstract:** TARSIS is the new IFU instrument proposed for the CAHA 3.5m telescope. It will have a  $3 \times 3$  arcmin<sup>2</sup> IFU with  $\sim 2 \times 2$  arcsec<sup>2</sup> spaxels at the Cassegrain focus of the telescope covering  $\frac{3}{4}$  of the FoV with 3 identical spectrographs optimized for the NUV/blue range of the optical spectrum, 320 - 520 nm, and  $\frac{1}{4}$  being covered with a red-optimized spectrograph, from 510 to 760 nm. TARSIS instrument relies on the replication of a high-efficiency, all-refractive, VPH-based, blue-optimized spectrograph which is based on that developed for the MEGARA instrument for the Gran Telescopio Canarias. TARSIS is composed by (1) its focal-plane optics and (2) four spectrographs, which host four I-optimized CCDs. Here we describe the facilities and expertise of three of the TARSIS consortium institutions, UCM, IAA-CSIC and INAOE for the development of TARSIS (other participating consortium institutions are US, UGR, UAL, CAB). The project was selected by the CAHA board on July 3<sup>rd</sup> 2020 to move on the Conceptual Design phase along with another competing instrument.

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## Tetra-ARmed Super-Ifu Spectrograph

### TARSIS

Focal-plane optics F/10 → F/3

Fiber system or image slicer

Fore optics

F/3 col & F/1.5 camera

Pupil diameter = 160 mm

Volume phase holographic (VPH) gratings

5 lenses collimator, VPH, 7 lenses camera & CCD (a 15 $\mu$ m 4k x 4k)

Each spectrograph projects 2 parallel slits on the CCD → doubling the FoV (8 portions)

R= 1300 @ 420 nm wavelength (blue spectrograph)

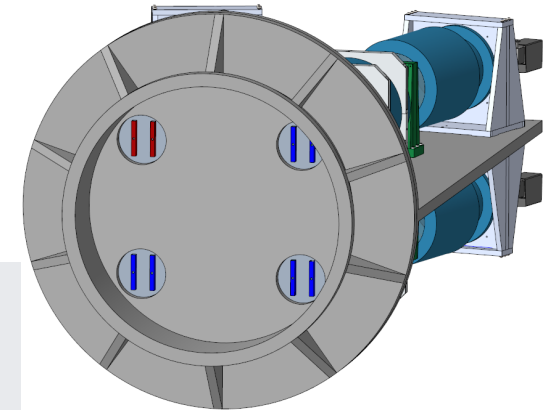
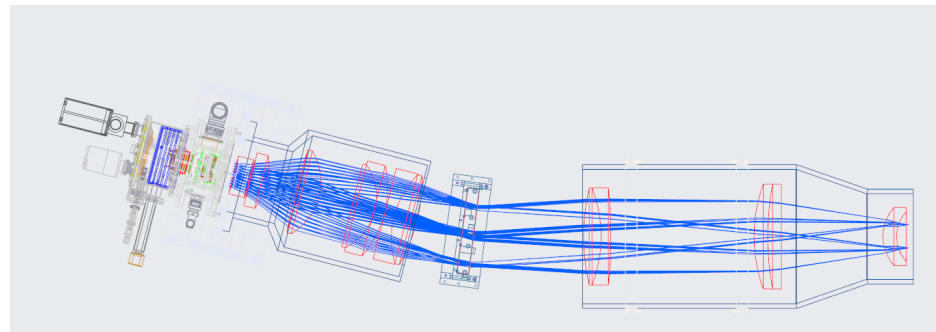
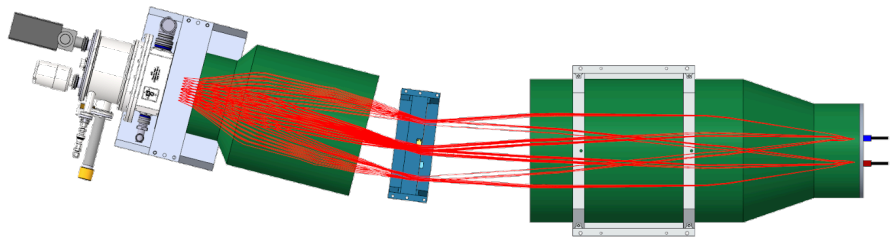
**Control system.** Instrument Control System (ICS) for mechanisms (focus), CCD electronics, control & power cabinets @ Cassegrain and real time Data Reduction Pipeline (DRP)

Instrument related Work Packages:

Optics & Mechanics:

Optics manufacturing:

Fore optics and DRP:





# Calar Alto “Tetra-ARmed Super-Ifu Spectrograph” Survey

## IAA – CSIC expertise

2<sup>nd</sup> largest astrophysics research institute in Spain

### TARSIS co-PI from IAA-CSIC (J. Iglesias)

Consolidated scientific teams @ extragalactic astronomy, Solar System, Planetary nebulae & High energy astrophysics

### MEGARA @ GTC

Software architecture

Control of robotic positioners

FMPT (Fiber MOS positioning tool)

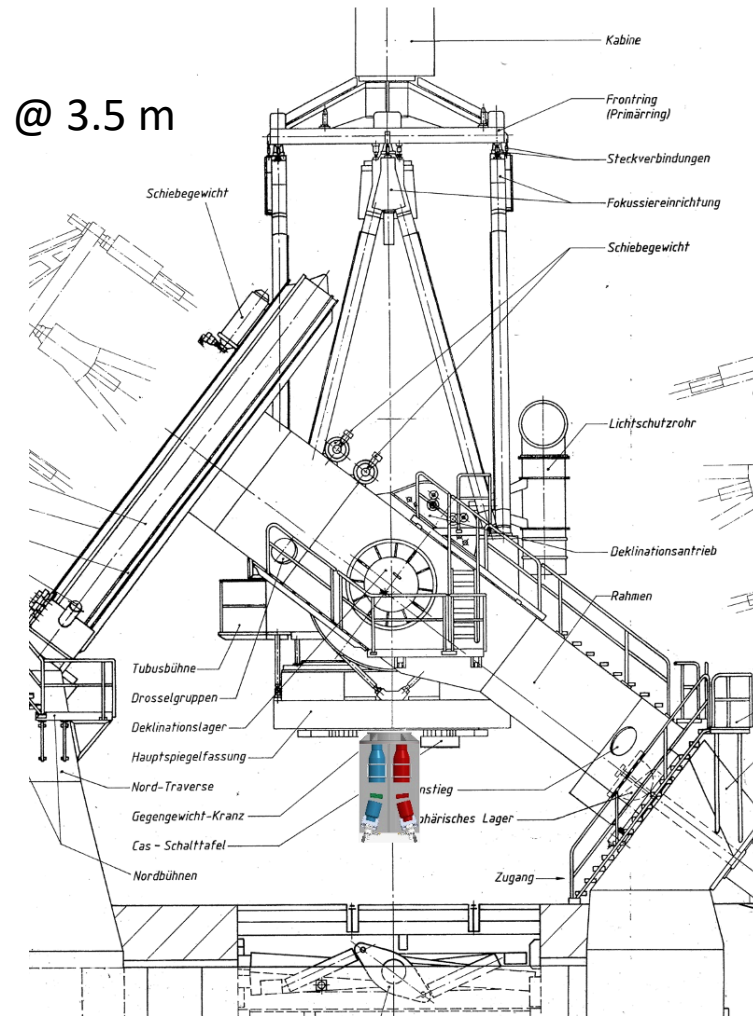
### CARMENES@ CAHA

Cryogenic control (CARMENES)

### PANIC @ CAHA

Data Reduction Pipeline

TARSIS @ 3.5 m



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# Calar Alto “Tetra-ARmed Super-Ifu Spectrograph” Survey

UCM facilities for optics, mechanics, detectors and integration

UCM: leader institution of MEGARA @ GTC - a case of success!

PI from UCM: A. Gil de Paz

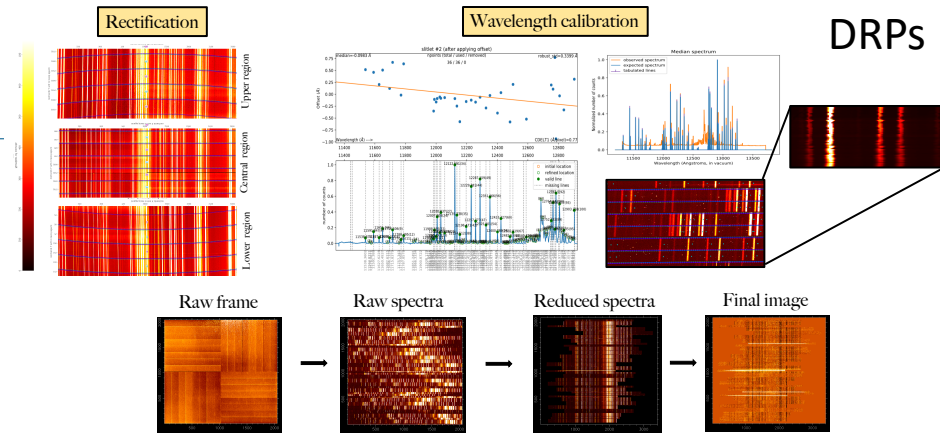
Responsibilities in MEGARA:

- Management
- Optical bundles
- Spectrograph & CCD
- Control System
- Data reduction pipeline

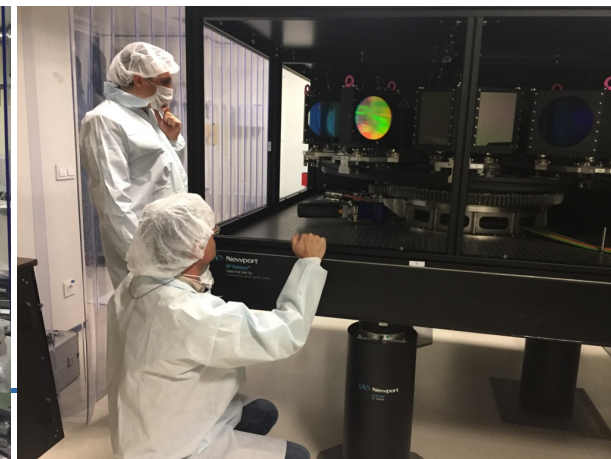
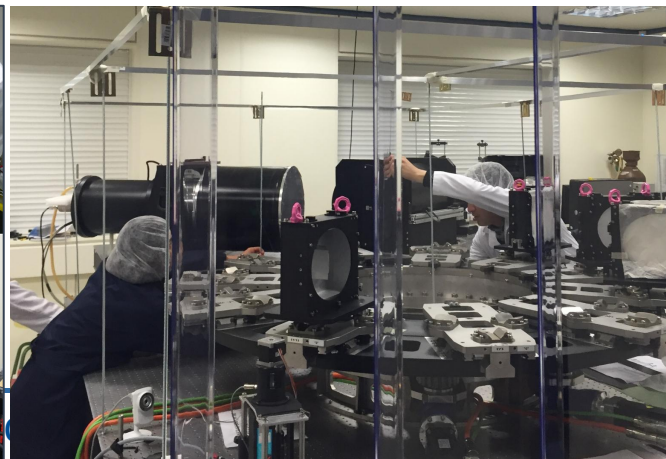


- CCD and CMOS characterization
- Optical components characterization
- Surface quality tests
- Gratings: VPH quality
- Filter transmission quality
- Optical fibers characterization
- Assembly of opto-mech. instruments @ LICA
- ISO7 clean area @ LICA (ISO5 requested)

MEGARA at UCM LICA



New ISO7  
Clean Room





## Calar Alto “Tetra-ARmed Super-Ifu Spectrograph” Survey

### INAOE facilities for optical manufacturing

TARSIS: (5 coll lenses + 2 VPHs windows + 7 cam lenses) x 4 spectrographs = **56** optical elements

MEGARA: INAOE manufactured **73** elements: 13 lenses + 36 VPHs windows + 24 VPHs prisms

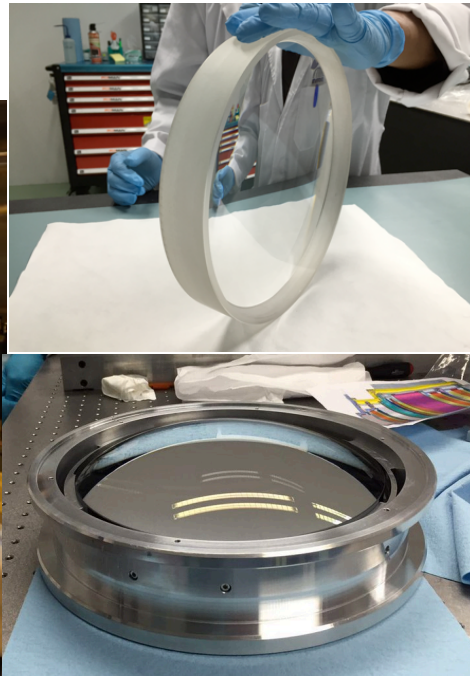
WEAVE: INAOE manufactured **15** elements: 1 collimator mirror + 14 camera lenses

INAOE:

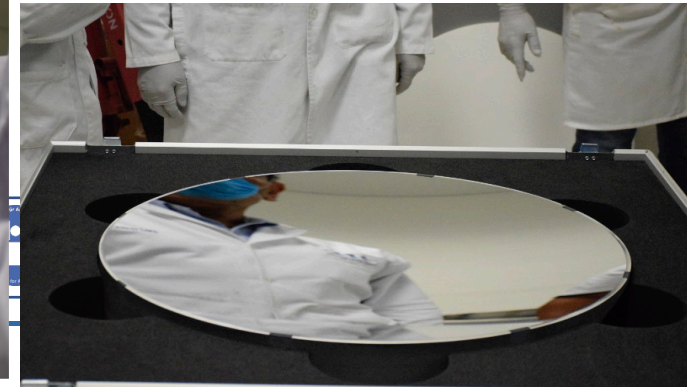
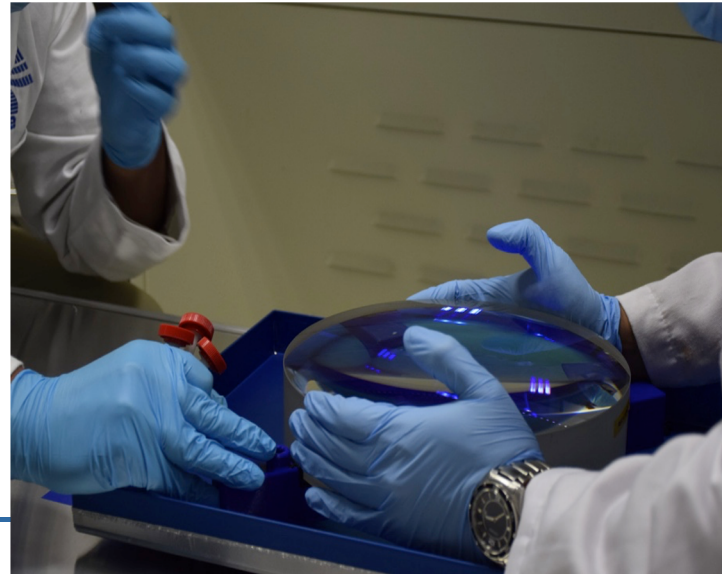
Demanding specifications  
Large diameters (320 mm)  
Different materials

Cementing  
High precision opto-mechanics  
Integration of optics + optomechanics  
Tests at subsystem level

MEGARA @ GTC



WEAVE @ WHT





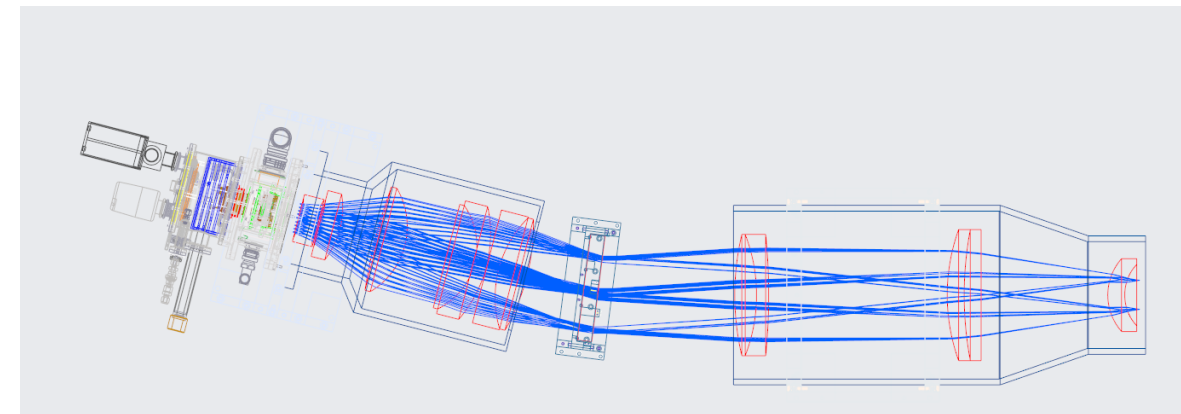
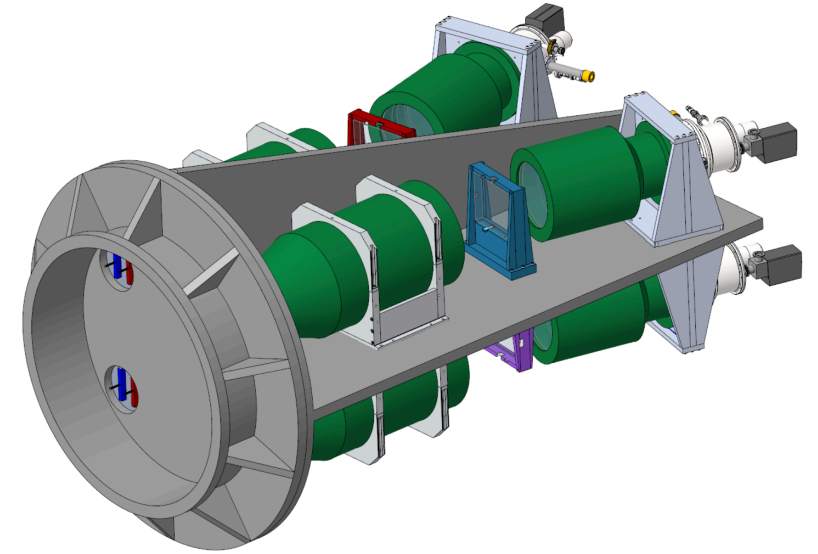
## Conclusion and future work

### IAA-CSIC, UCM & INAOE

Offer expertise in key areas for TARSIS development:

- Facilities as laboratories & workshops
- Experienced manpower
- Know-how from MEGARA, CARMENES & PANIC: design, construction, commissioning and scientific exploitation
- A consolidated & committed team

→ Ready for **TARSIS** Conceptual Design Phase



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