

CASTLE

Calar Alto Schmidt-Lemaitre Explorer

Design & Science Cases



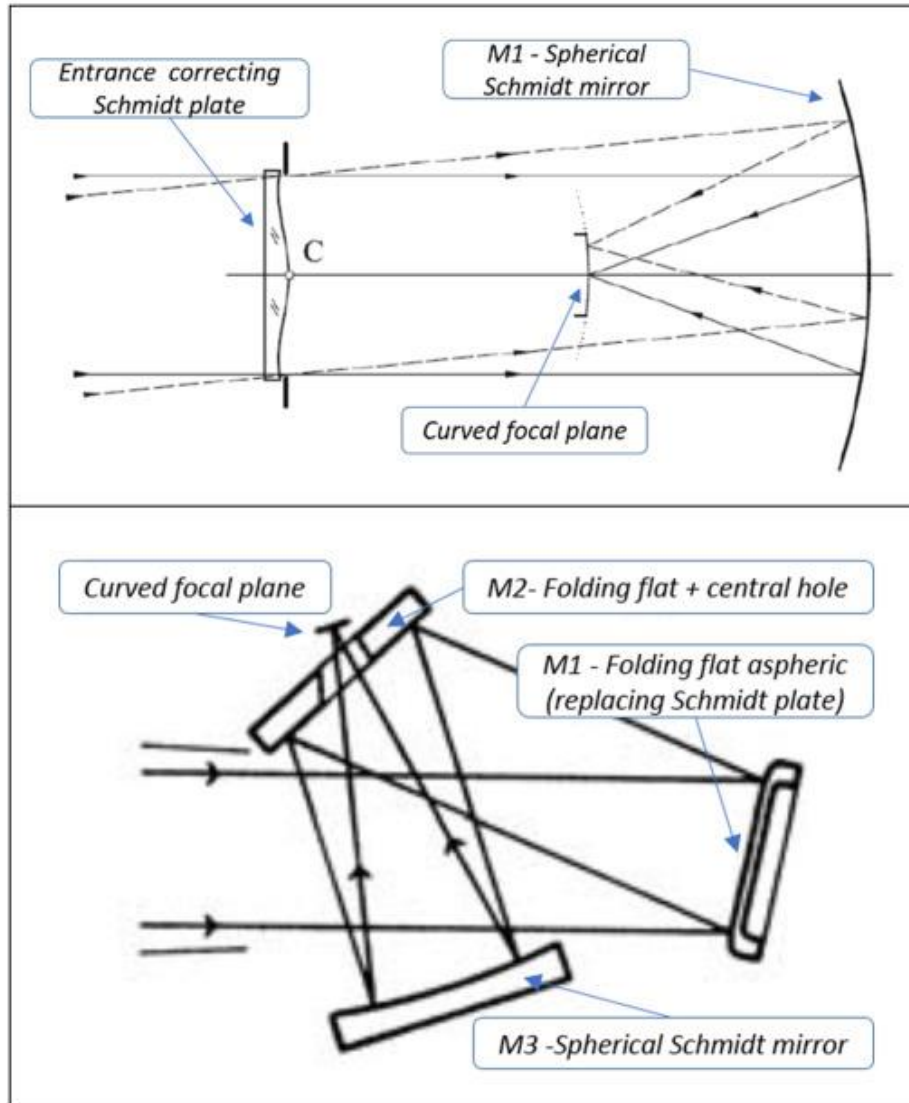
Simona Lombardo, Manal Chebbo, Emmanuel Hugot, Samuel Boissier,
Eduard Muslimov, Liu Jiawei, Ali Fahad, Pierre Alain Duc (ObAS),
Francisco Prada (IAA, Spain), Jesus Aceitun (CAHA)



Observatoire astronomique
de Strasbourg



CASTLE design: folded Schmidt



Repliement du tube d'un telescope de Schmidt

- Permet de placer le bloc détecteur hors du faisceau
- Évite les araignées de tenue
- Évite les effets diffractifs

Courbure du capteur en plan focal:

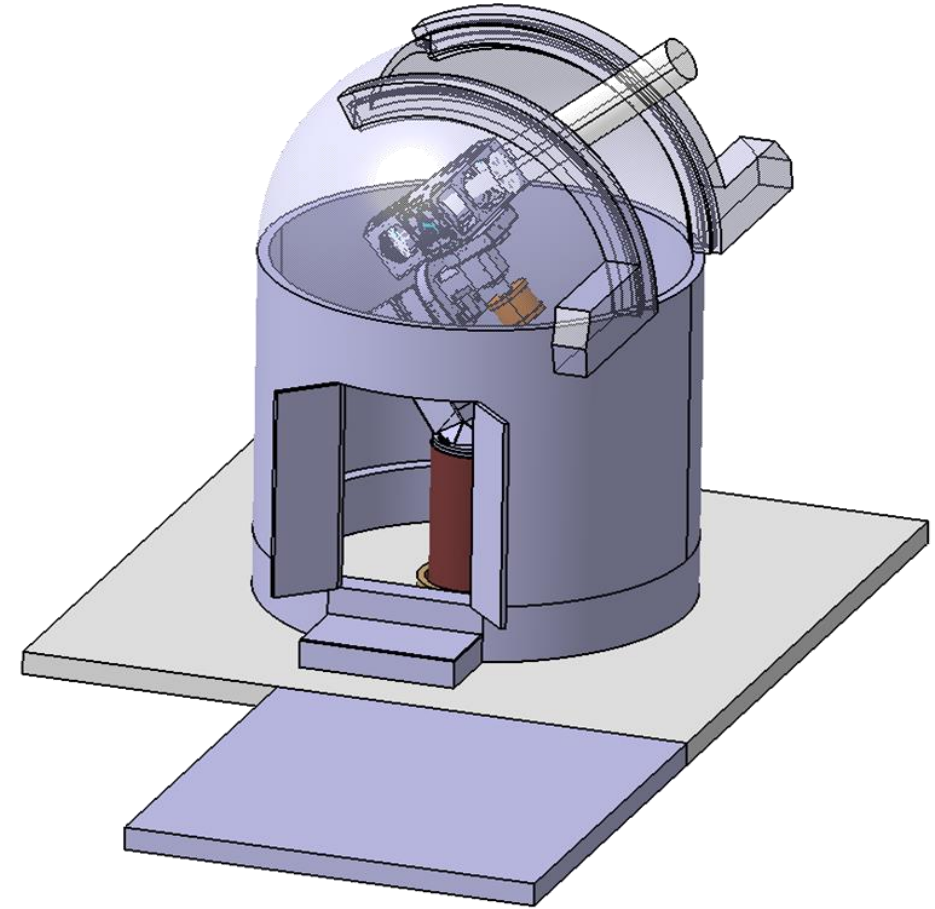
- Evite les lentilles d'aplanissement
- Assure une PSF homogène sur tout le champ (3,7 deg²)
- Pas d'aberration chromatique



Un design qui a inspiré les étudiants-artistes

CASTLE, why?

- A technology demonstrator
 - Freeform optics
 - Curved sensors for wide field ($2.4 \times 1.6 \text{ deg}^2$)
 - No spider \rightarrow smooth PSF
- Aiming at creating a psychological impact for the astro community
 - On-sky demonstration of Curved detectors
 - Pave the way for Blue MUSE
 - and others : ELT-MOSAIC expression of interest



CASTLE, why?

- ~~A technology demonstrator~~

- Freeform optics
- Curved sensors
- No spider → smooth PSF



A NEW FACILITY

- Aiming at creating a psychological impact for the astro community

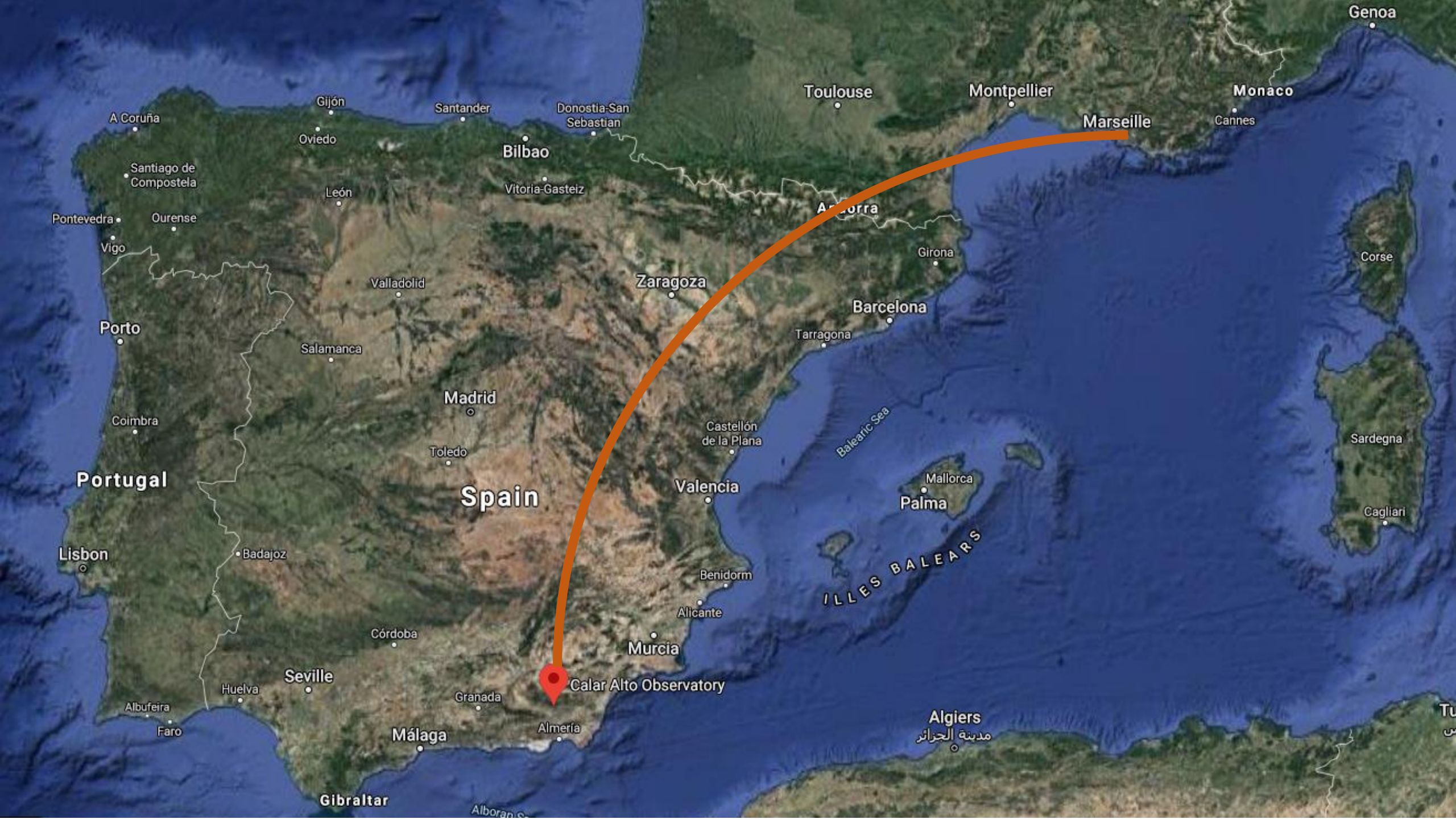
- On-sky demonstration of Curved detectors
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- and others : ELT-MOSAIC expression of interest

CASTLE, science cases

- Original design → smooth regular PSF over wide field
- Can target LSB Universe
- Fully robotic: transients follow-up
- White paper written in 2020 by Simona Lombardo,
 - Gathering a science group
 - New science cases appeared: Transients, TNO




NGC474 galaxies. Image credit: CFHT/CoelumJ.- C.Cuillandre & G.Anselmi.






AL-4404

 Azimuth - Visitas
Observatorio Calar Alto

AL-4404


Azimuth, Educación
y Turismo Científico
Temporarily closed


AL-4404

Sierra de
Los Filabres 

AL-4404

AL-4404

Calar Alto 

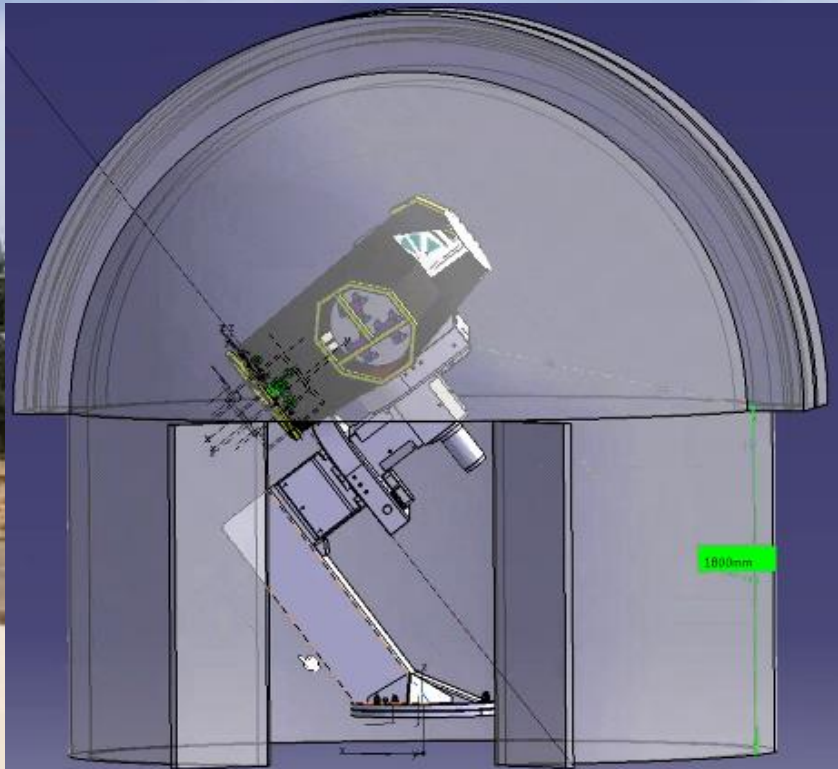
 Calar Alto Observatory





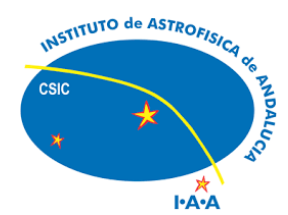
Sierra de Los Filabres





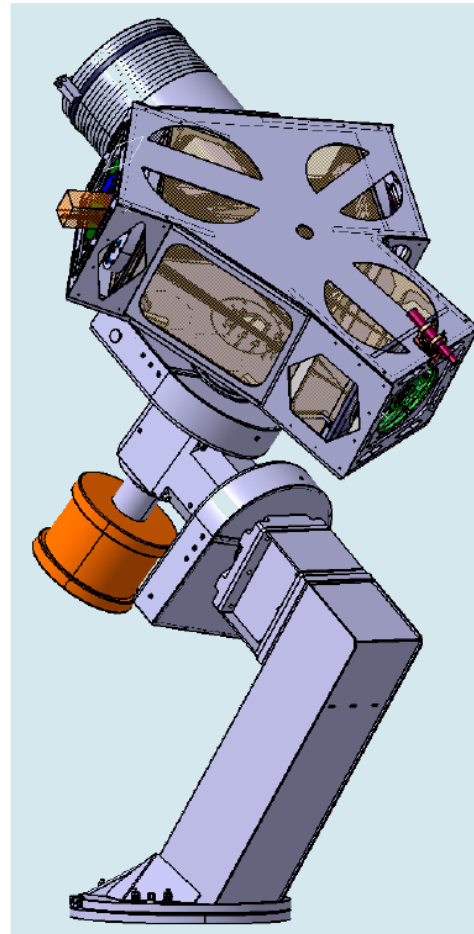
CASTLE @ Calar Alto

First on-sky demonstration of a curved sensor for astronomy:
the Calar Alto Schmidt Lemaitre Explorer

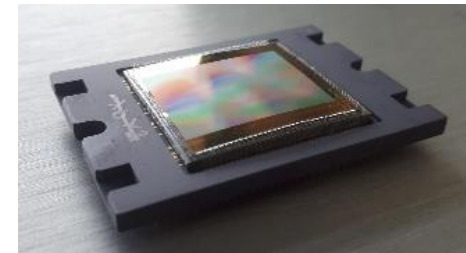


- Dome installation completed in September 2021
- Mirrors received
- Engineering Curved detector delivered in October 2021
- First light planned in October 2023
- Robotic mount funded by INSU
- Science-grade detector unit funded by FOCUS

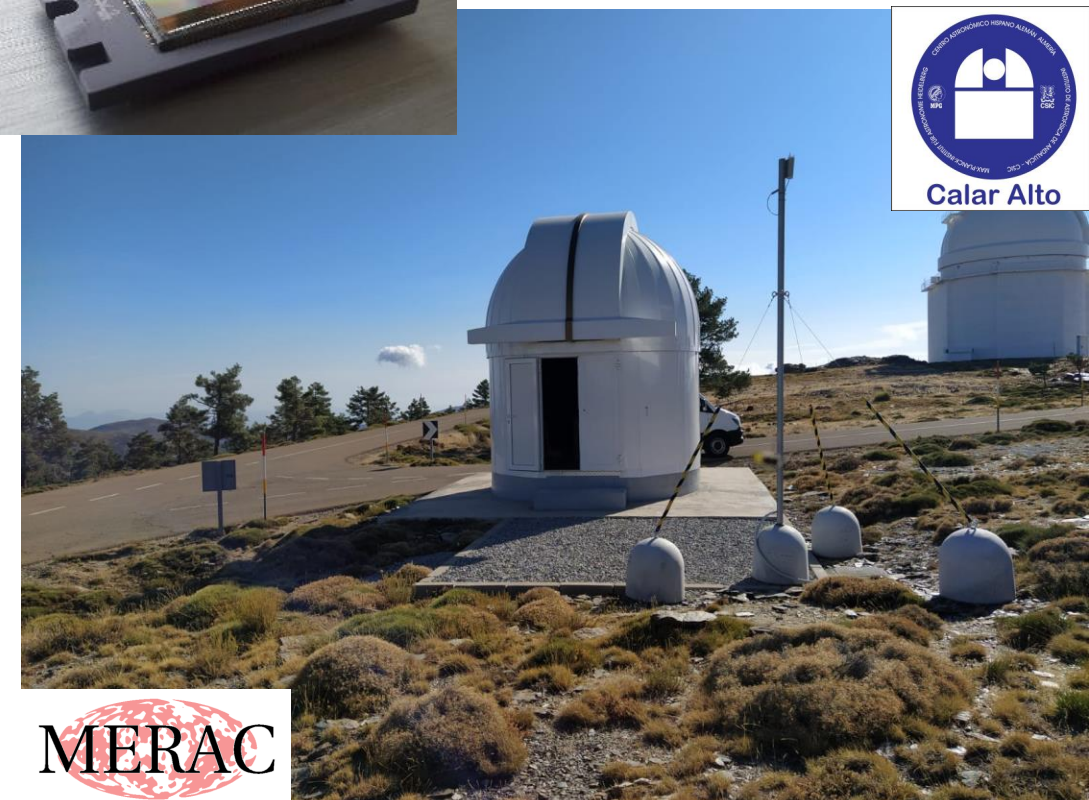
Complete CAD model of the telescope



Engineering Convex CMOS sensor, 12 MPixels



CASTLE Dome installed in September 2021



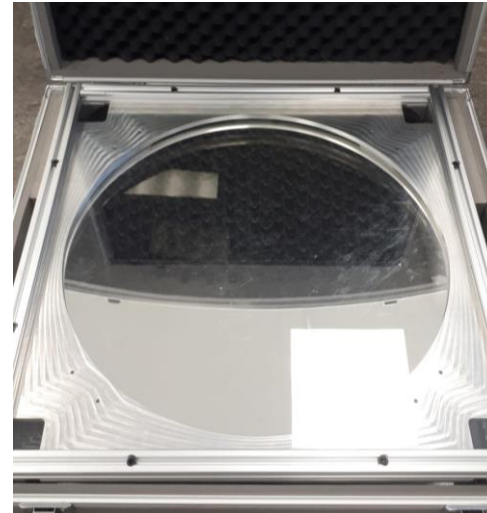
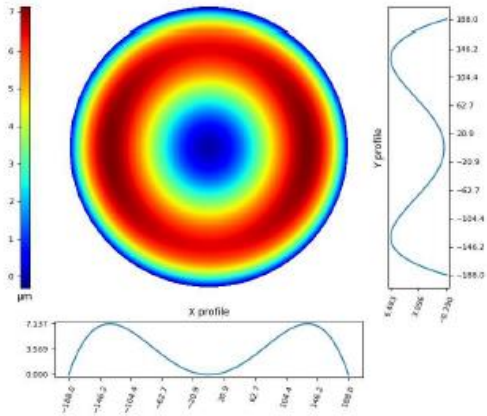
CASTLE hardware

M1 freeform
finished @ Winlight

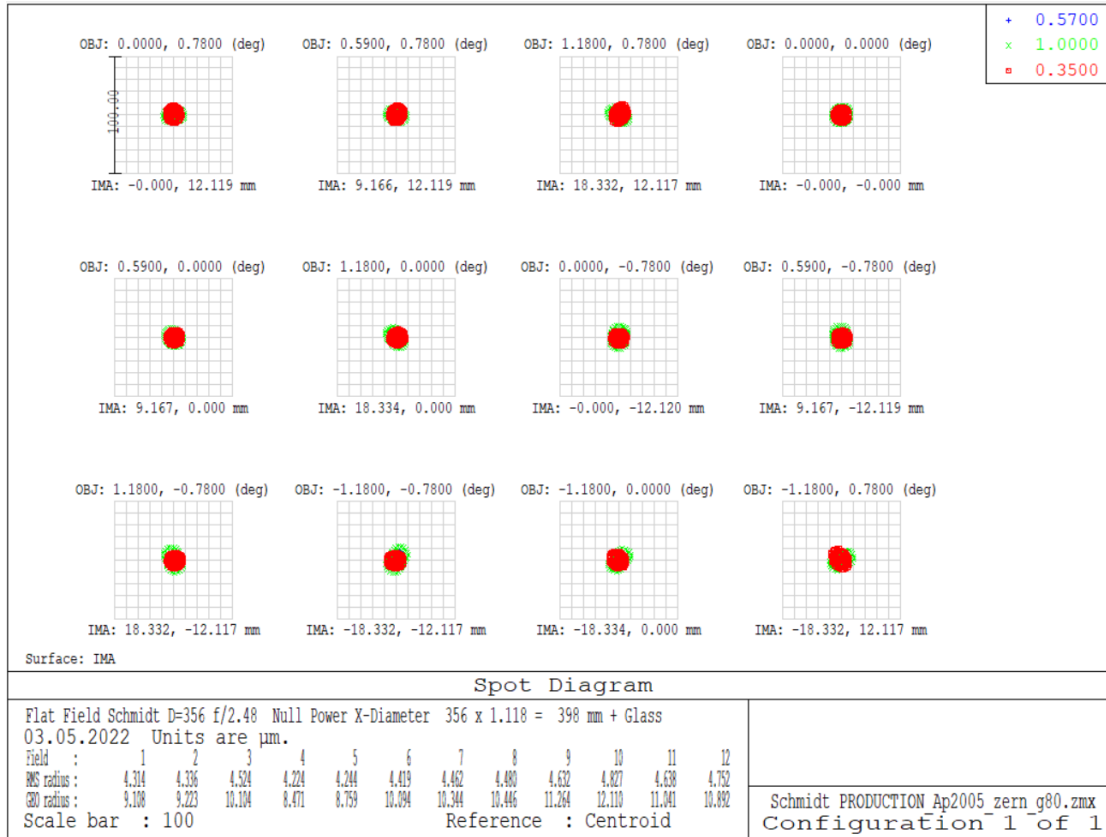
M2 folding flat
with central hole

M3 Spherical collimator
= Schmidt camera

Dome Installed
September 2021

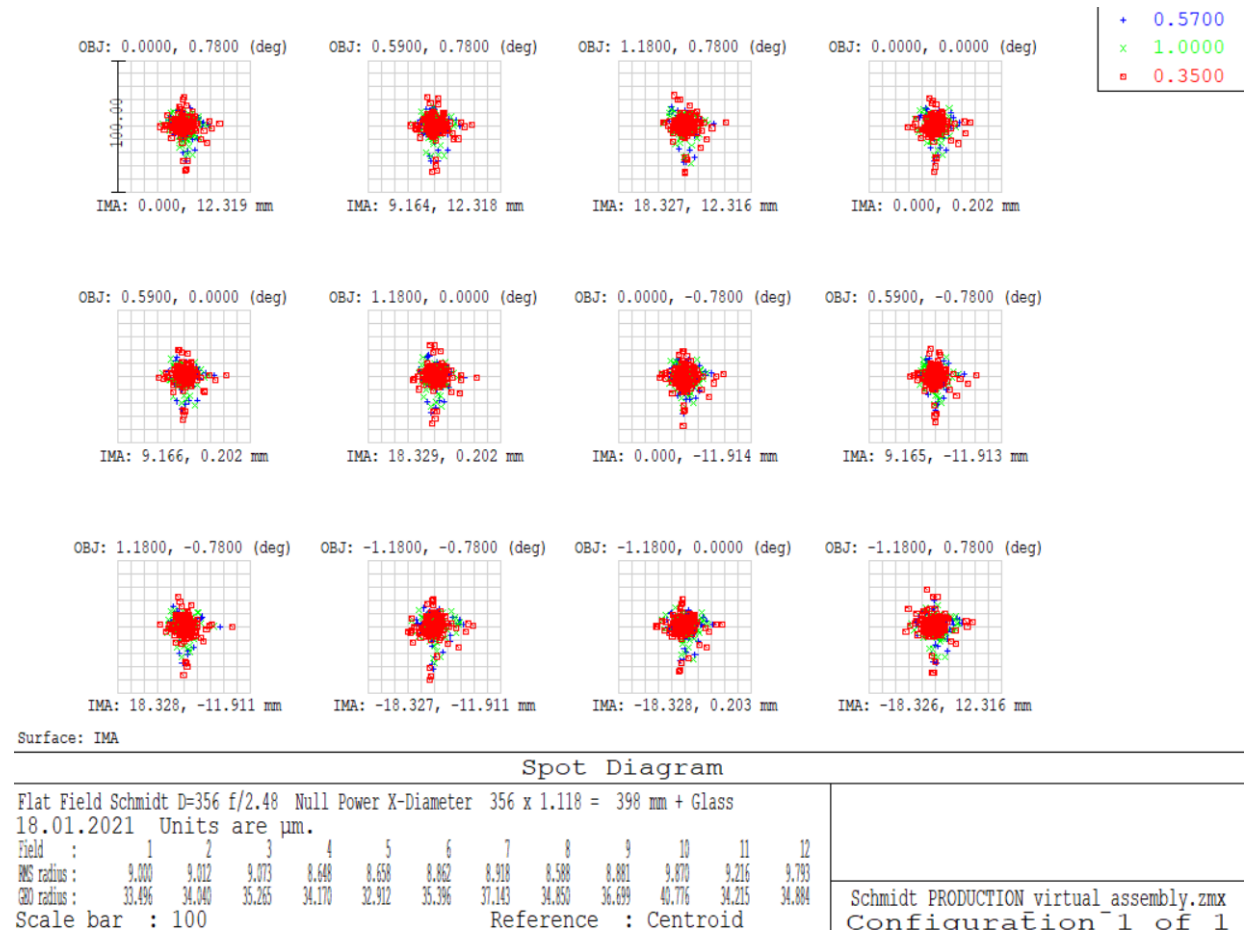


Nominal imaging performance



→ Smooth & homogeneous optical quality over the entire field!

Virtual assembly with as-built mirrors



CASTLE detector unit

- Selected the GigaPix sensor from Pyxalis
46MPixels – CMOS, BSI, 4.2cm diagonal.
 - Back up design with standard flat sensor and camera for risk mitigation
 - Curved, convex, option for the science grade sensor for on-sky operations.
 - Current activity: develop a cooling system compatible with the current camera housing. Collab with Nexvision
- Science grade sensor with cooling expected for summer 2023



Resources

- Hardware

Fully covered by ERC, ERC-Poc, FOCUS, INSU-CSAA and Fondation MERAC

- Human resources

- FTEs covered by ERCs so far - ending this year

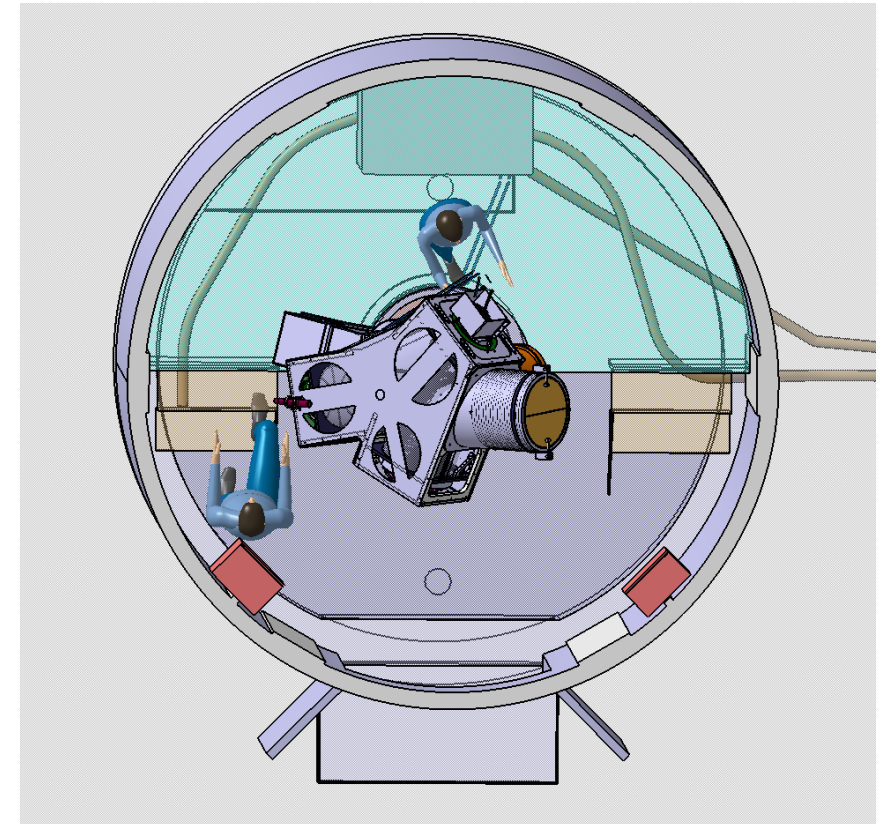
- Team still solid with Simona Lombardo, Eduard Muslimov, Manal Chebbo, Emmanuel Hugot, Liu Jiawei.

- Half PhD thesis on detector unit characterization and pipeline development from FOCUS
→ **Need for the second half!**

- 1 Year Spanish post doc to complement the operational needs.

- Commissioning

Missions partially covered by PNCG (PA Duc) and Merac funding (Ehu)

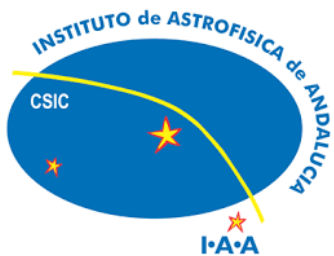


CASTLE the partners

- Mechanical manufacturing of the structure handled by ASTRON/NOVA
- Project co-led by LAM and ObAS (Strasbourg), gathering interest of OCA and IAS (TBC)
- Science collaborations with IAA (Grenada, Spain)
- MoU under writing to secure the partnership
- Discussions on-going to enter the AMU-Origins Institute next year



Observatoire astronomique
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CASTLE – Take home messages

- A new robotic facility with original design
 - Very smooth and homogeneous optical quality with no diffraction figure
 - Adapted to Low Surface Brightness Universe and Transients follow up
 - 15% time for educational purposes
- The very first on-sky demonstration of a large format curved sensor for astronomy
 - Would benefit to Blue-MUSE and ELT-MOSAIC
 - Detector Bloc funded by FOCUS
- AIT On going at LAM, first light planned in Fall 2023
 - Need to reinforce the team for the detector unit characterization and the pipeline development. → Half PhD obtained from FOCUS.

CASTLE : Entre tempêtes de neige et de sable...

