The OAdM and its relationship with the SVO

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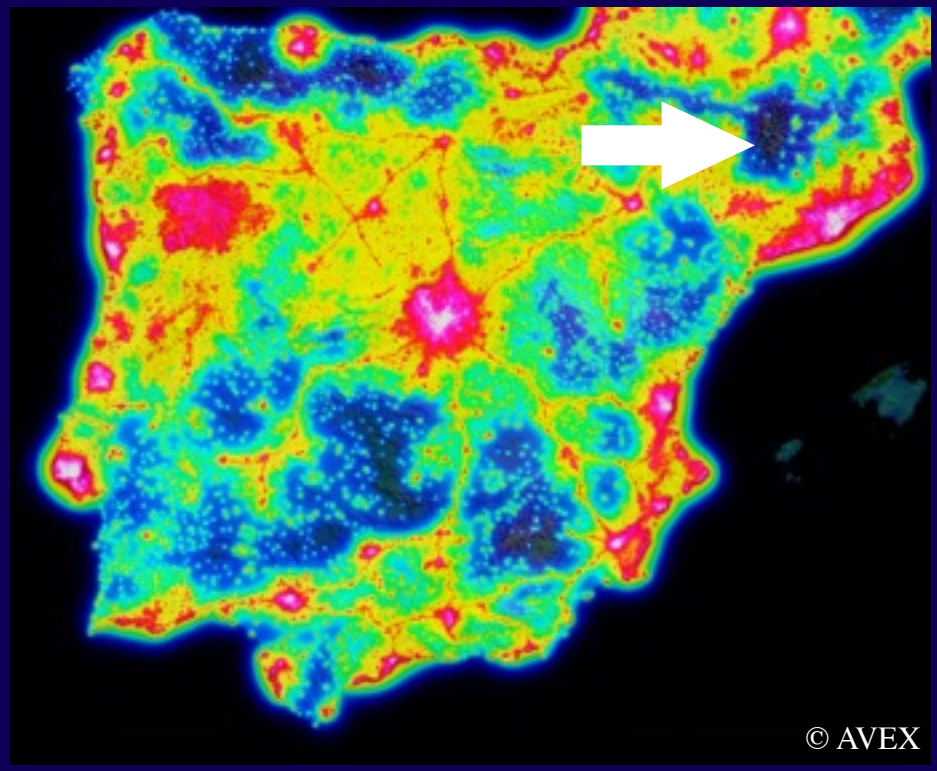
The Observatori Astronòmic del Montsec (OAdM)

- Main astronomical observatory in Catalunya
- Western part of Catalunya (1570 m):
  - ✓ Dark skies
  - ✓ Good weather (similar to Calar Alto)
  - ✓ Good seeing (median ~1 arcsec)
- **Observatory operations:** IEEC (since 2007)
- Six facilities of six institutions operating
  - ✓ **SMC:** XEMA weather station
  - ✓ **ICTJA-CSIC:** XVPCA air pollution network
  - ✓ **ICE-CSIC:** Allsky camera for meteors detection
  - ✓ **STScI:** XO exoplanet search network
  - ✓ **RACAB & ROA:** TFRM 0.5m Baker-Nunn camera
  - ✓ **Generalitat de Catalunya:** TJO 0.8m Ritchey-Crétien telescope



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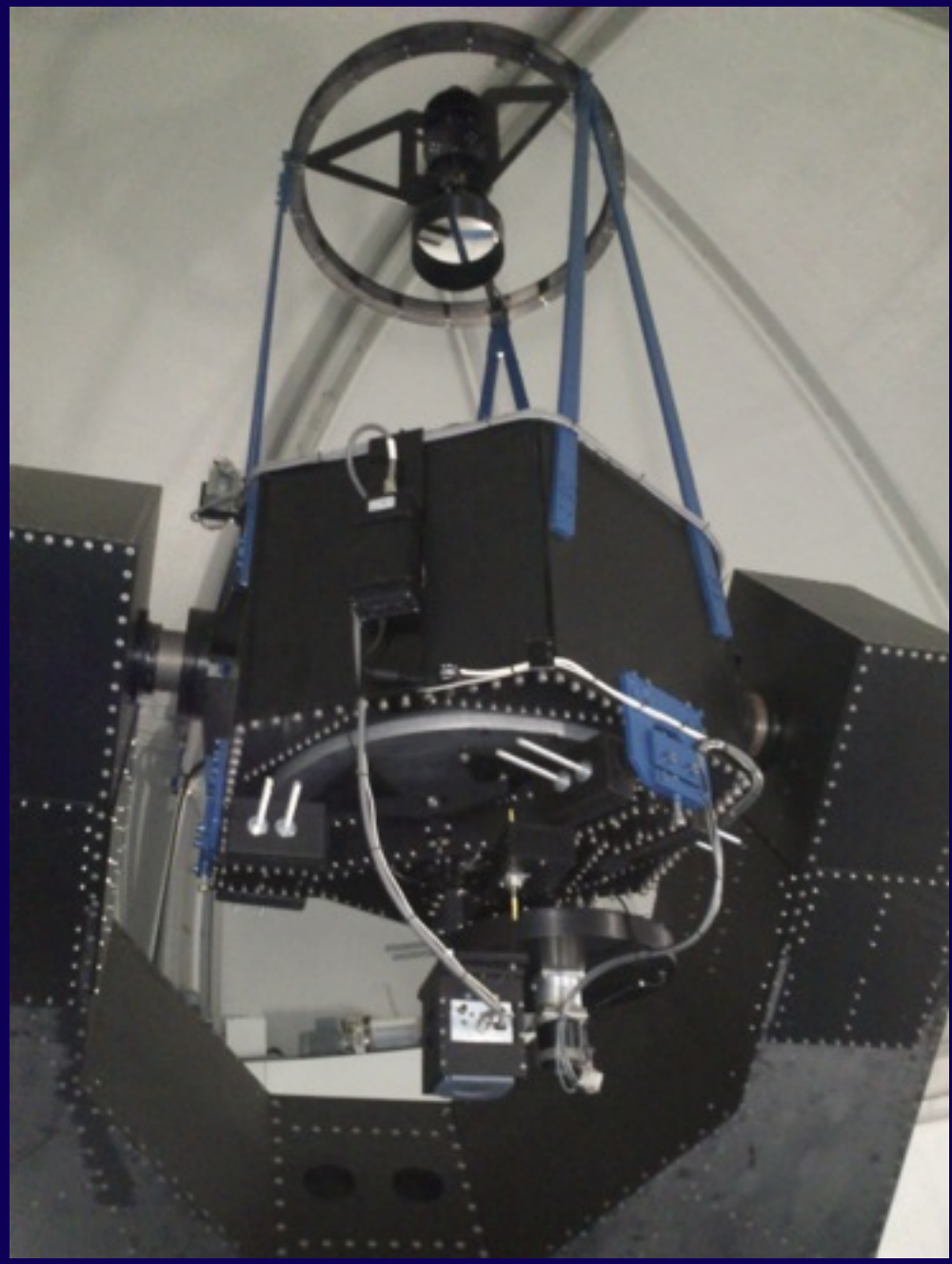
The Telescopi Joan Oró (TJO)

- **The largest telescope in Catalunya:**
  - ✓ Primary mirror: 0.8 m
  - ✓ Ritchey-Chrétien optical configuration (f/9.6)
- **Scientific & technical exploitation:** IEEC
  - ✓ Three FTE (including OAdM management)
  - ✓ 100 k€/year
- Open to institutions **all around the world** since February, 2013
- **Robotic** supervised operations (May 1, 2013)
  - ✓ No human intervention, only scheduling

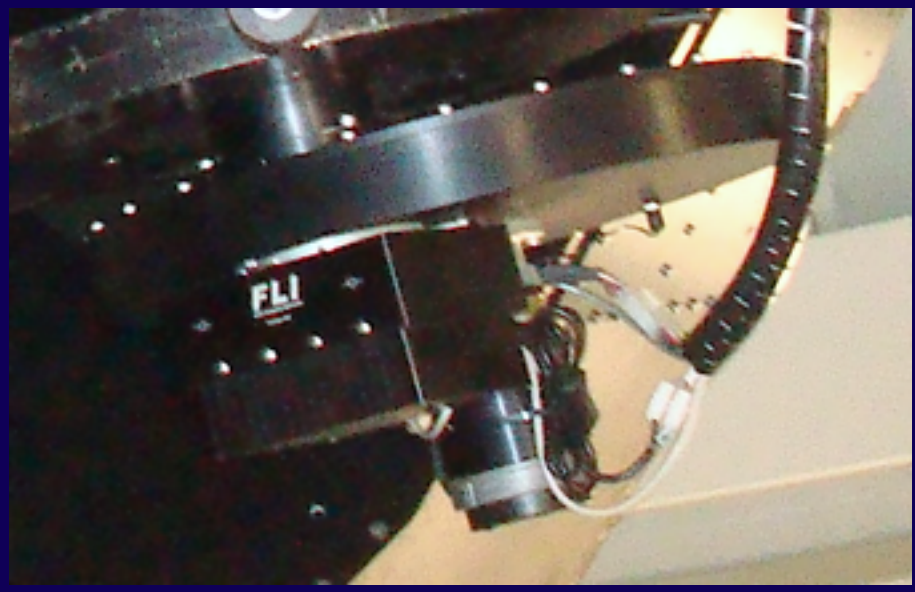


Current TJO instrumentation

MEIA:

- Imaging camera
- **Manufacturer:** Finger Lakes Instrumentation
- 2k×2k back illuminated chip
- **Pixel size:** 0.36×0.36 arcsec
- **Field of view:** 12.3×12.3 arcmin
- **Five Johnson-Cousins filters:** U, B, V, R_C, I_C

Band	S/N~100 in 300 seconds
U	13.2
B	17
V	17
R	17.2
I	17



Imminent TJO instrumentation

MEIA2:

- Imaging camera
- **Manufacturer:** Andor Technology™
- 2k×2k back illuminated chip
- **Pixel size:** 0.36×0.36 arcsec
- **Field of view:** 12.3×12.3 arcmin
- **Five Johnson-Cousins filters:** U, B, V, R_C, I_C
- **First light:** September, 2013

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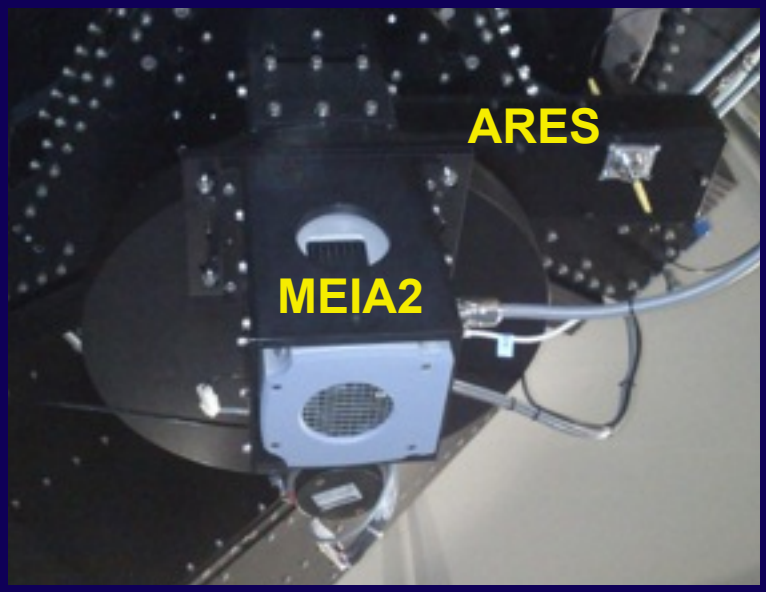
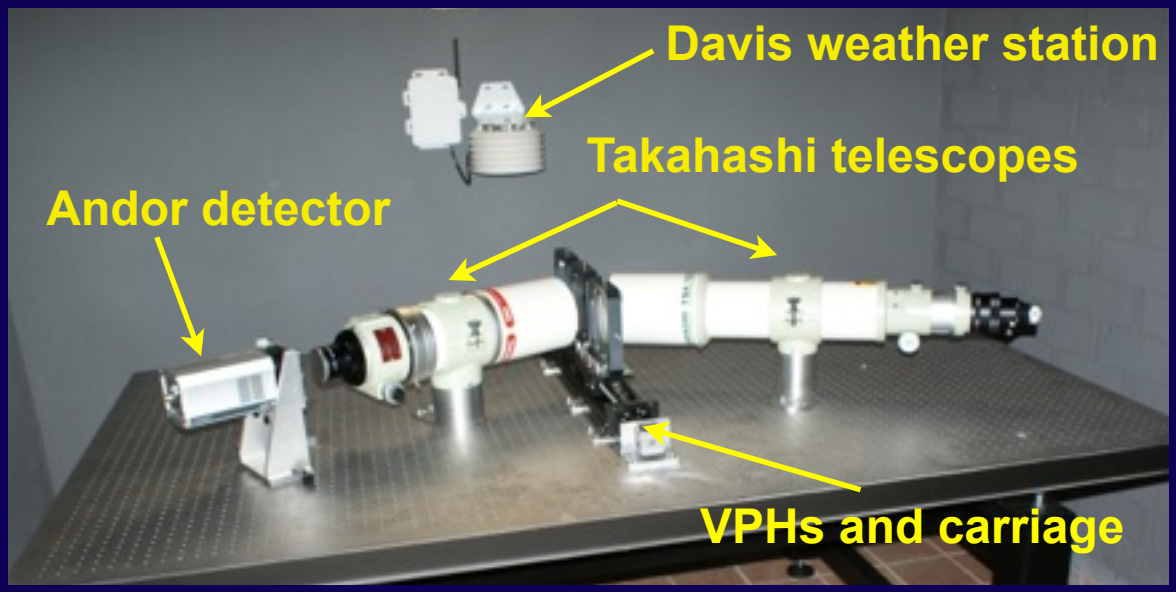
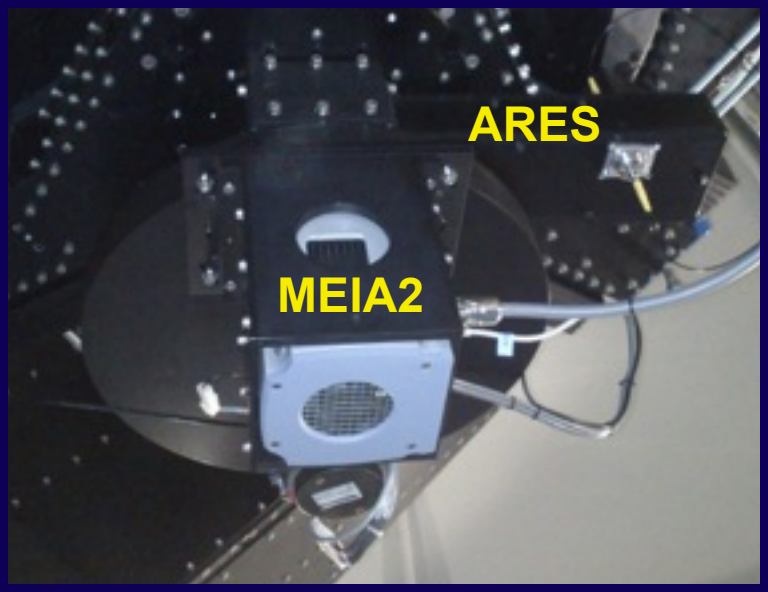


Imminent TJO instrumentation

ARES:

- Optical spectrograph
- **Manufacturer:** Fractal SLNE
- **Spectral resolution:** R=12.000
- **Overall throughput:** >10%
- **Magnitude limit at the TJO:**
  V<11 mag (up to 1 million stars)
- Up to three spectral windows (VPHs):
  - ✓ Blue: 439 - 469 nm ➡ postponed
  - ✓ **Green:** 495 - 529 nm ➡ MgI triplet
  - ✓ **Red:** 634 - 678 nm ➡ Hα line
- Non-dedicated instrument
- **First light:** September, 2013





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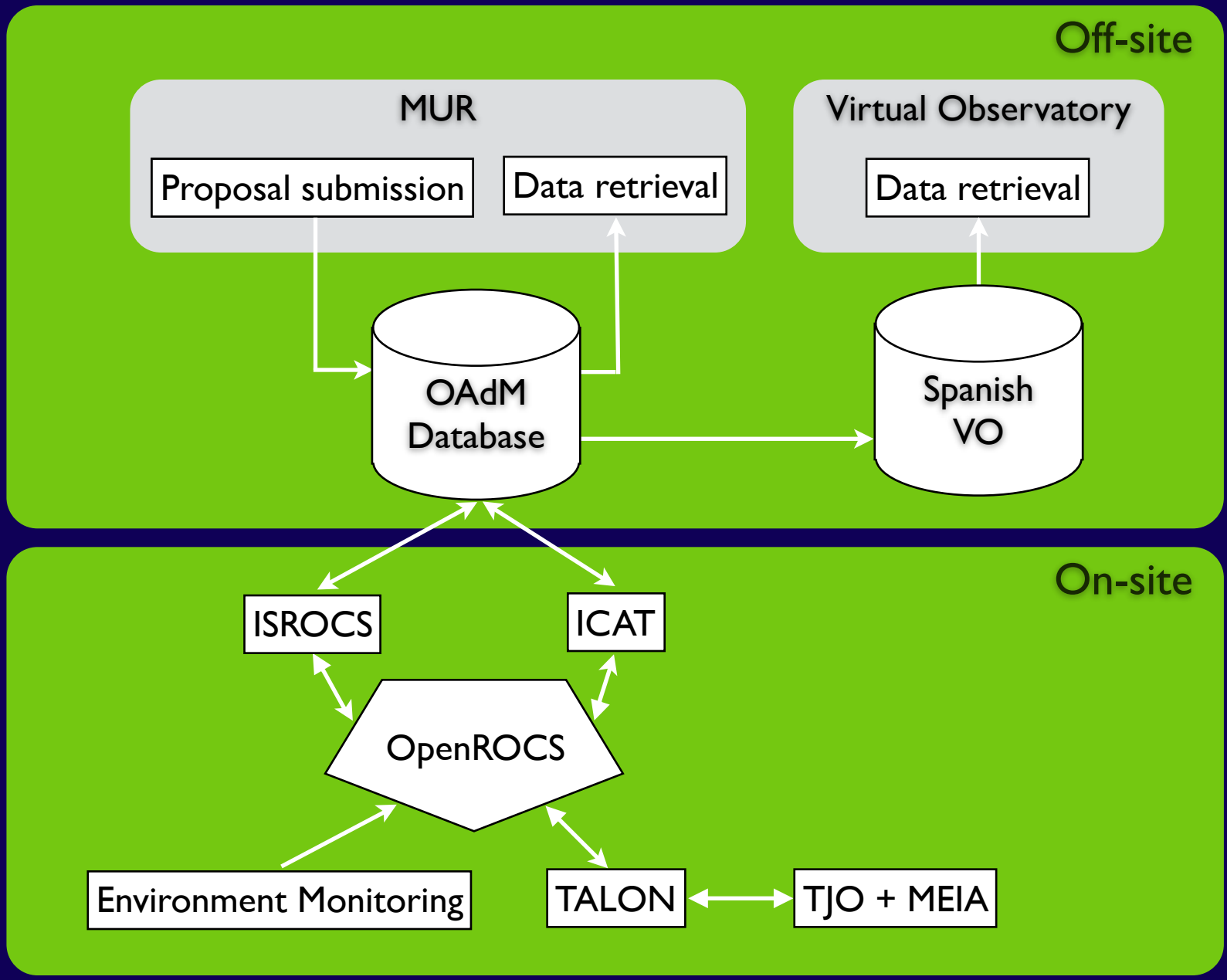
The robotization concept

Highly modular with two main nodes: on-site and off-site



MUR

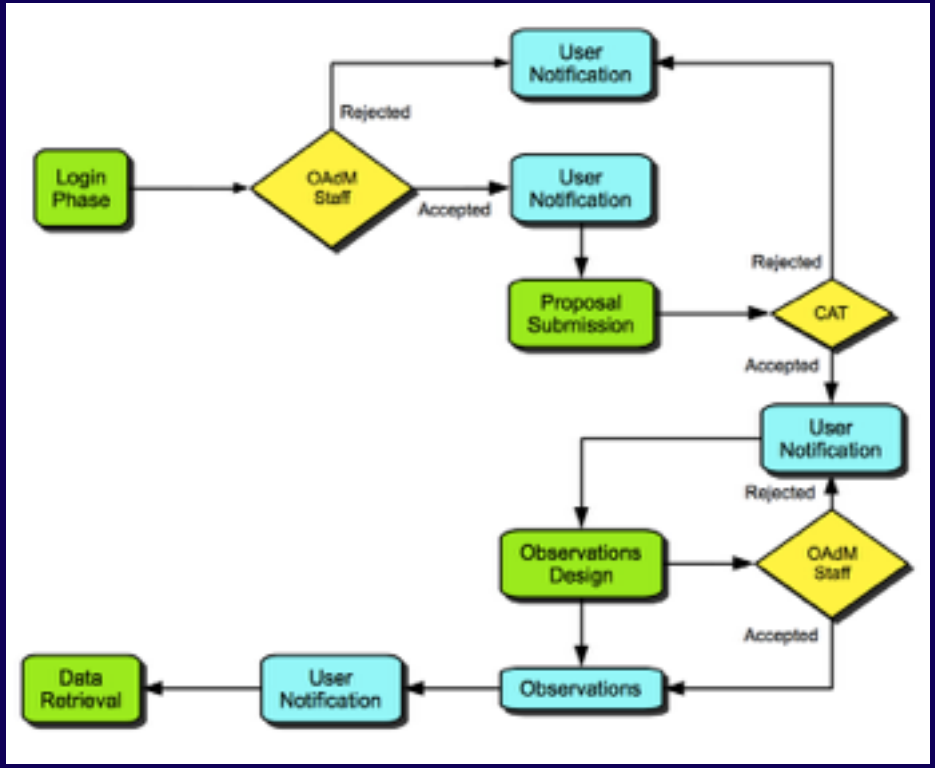
Proposal submission procedure entirely on-line since November 1, 2011:

www.oadm.cat

But similar to other robotic telescopes

MUR

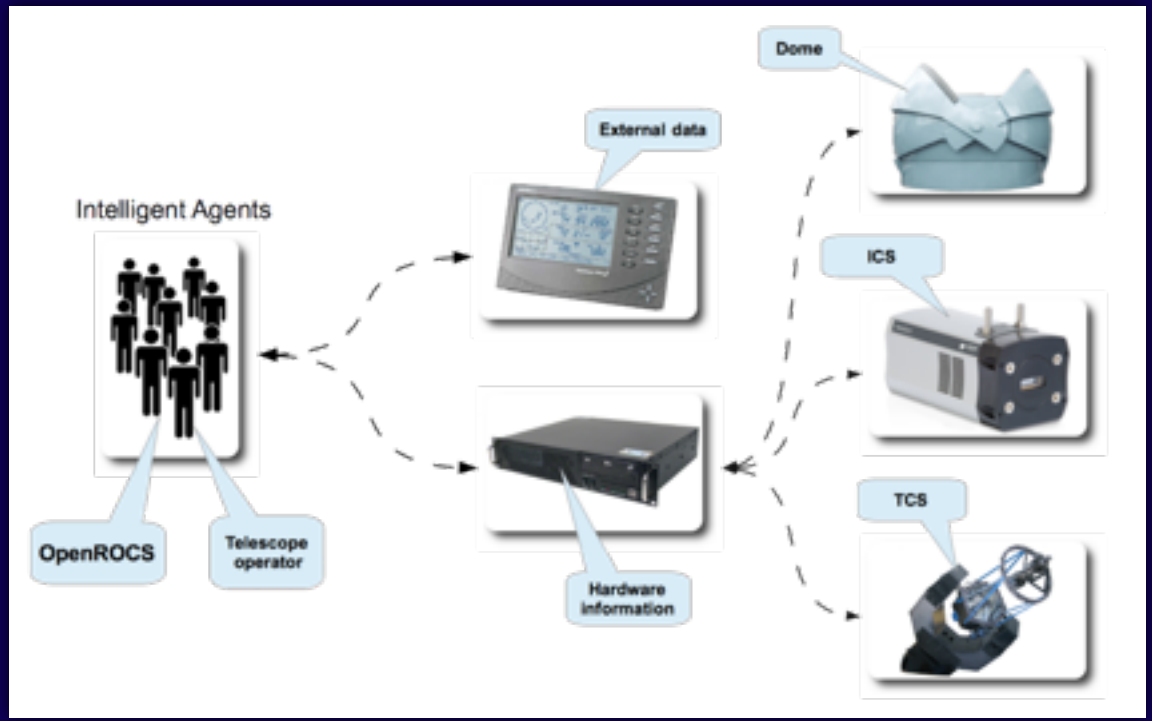
- **Phase 0:** registration to MUR ➡ OAdM staff
- **Phase 1:** with science case + total required time + targets ➡ CAT
  - ✓ Hans Deeg (IAC)
  - ✓ Glòria Sala (UPC)
  - ✓ Eduard Masana (UB)
- **Phase 2:** with observation details ➡ TJO
- **Phase 3:** preliminary data retrieval method



OpenROCS (Open Robotic Observatory Control System)

- In charge of the complete operations of the observatory
- Capable to interact with all the different devices
- An intelligent software capable to respond to unexpected situations
- Highly modular and flexible: any device or software could be used
- Open source registered ICE-CSIC/IEEC product:

  http://sourceforge.net/projects/openrocs/
- Already exported to SQT (formerly SAFT)



Data retrieval

Proprietary data:

- All observed data is proprietary for a period of one year
- Observers download nightly tar balls from MUR

Public data:

- Public images synchronised with SVO on a daily basis since April 10, 2011
- Data can be retrieved from the web page:

http://sdc.cab.inta-csic.es/joro/jsp/homepage.jsp

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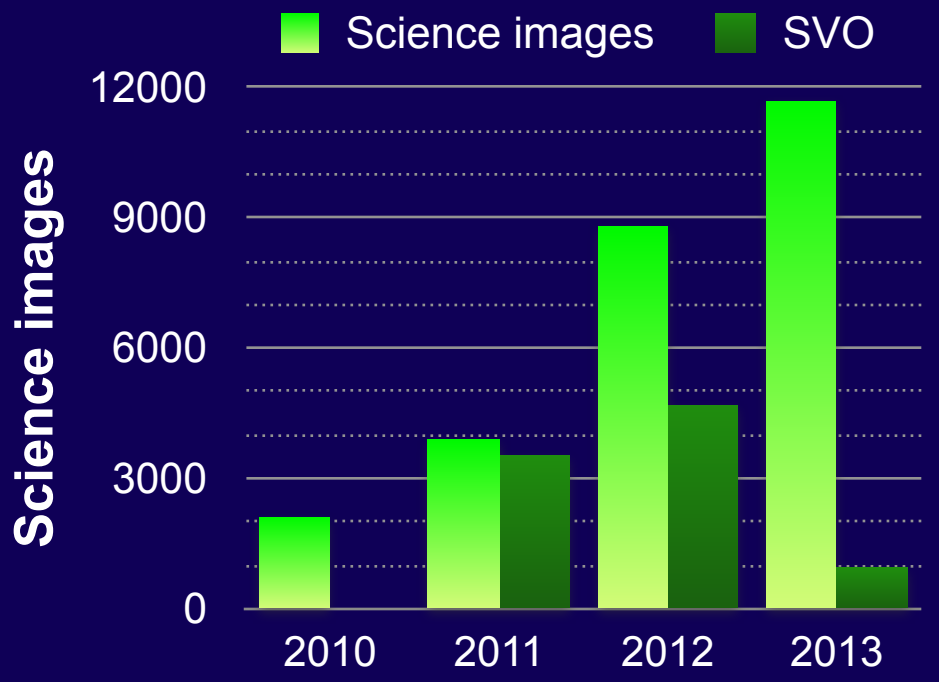
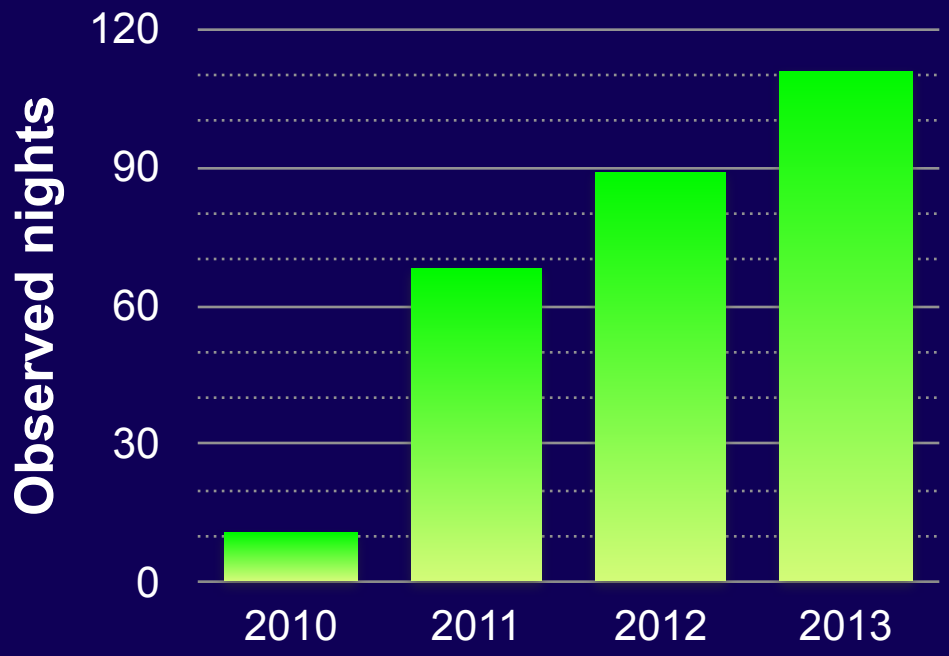
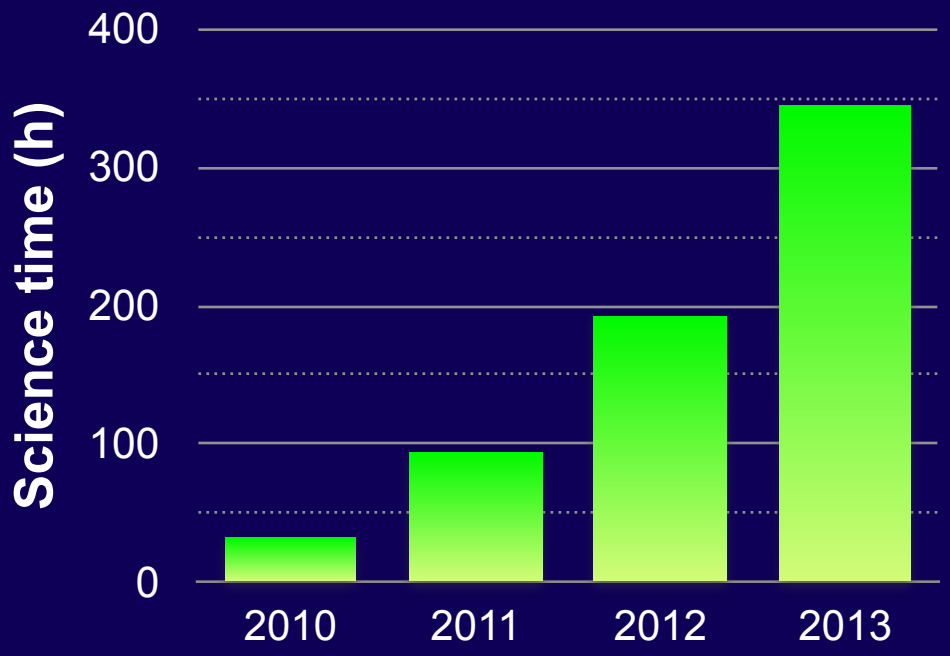
Statistics of observations







Publications (scientific and technical)

Scientific results:

- M. Ergon, J. Sollerman, M. Fraser, et al., 2014, A&A, 562, A17
- C. von Essen, S. Czesla, U. Wolter, et al., 2014, A&A, 561, A48
- E. Herrero, J. C. Morales, I. Ribas, and R. Naves, 2011, A&A, 526, L10
- J. M. Trigo-Rodríguez, C. E. Moyano-Cambero, K. J. Meech, et al., 2013, EPSC2013, 985
- J. M. Trigo-Rodríguez, D. Rodríguez, J. Lacruz, A. Sánchez, 2013, EPSC2013,1029

Technical publications:

- J. Colomé et al., 2012, Proceedings SPIE
- J. Colomé et al., 2010, Proceedings SPIE
- J. Colomé et al., 2008, Proceedings of the VIII Scientific Meeting of the Spanish Astronomical Society
- J. Colomé et al., 2008, Proceedings SPIE

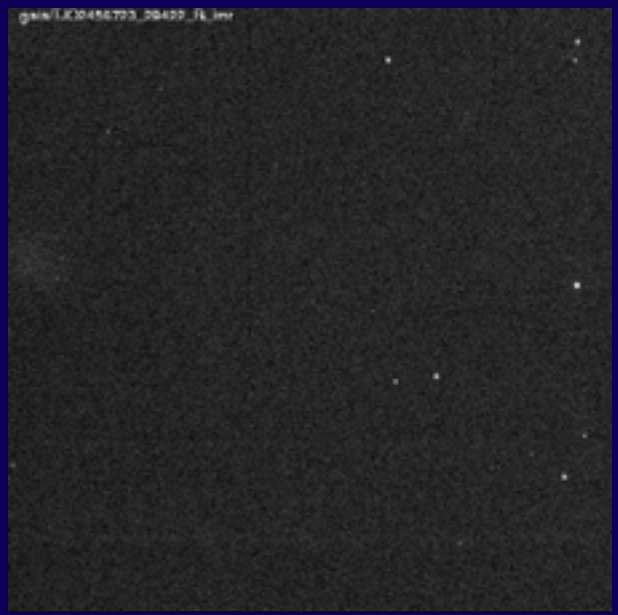
Additional examples

Solar System bodies

2012 DA14

C/2011 L4 (Panstarrs)

Gaia



Additional examples

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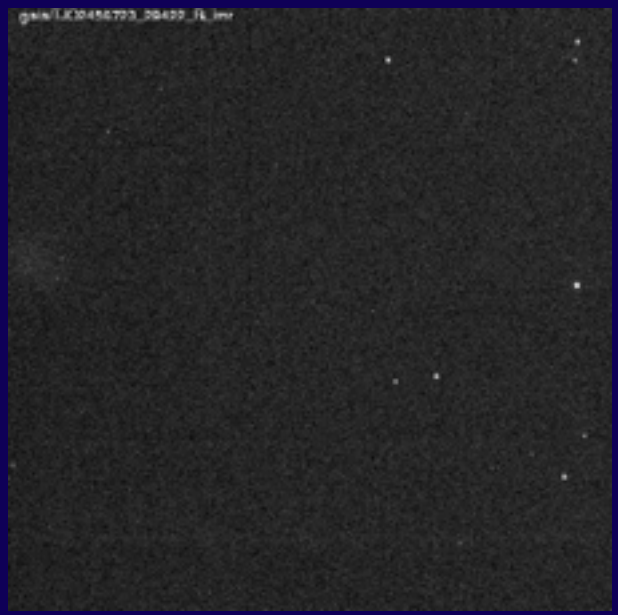
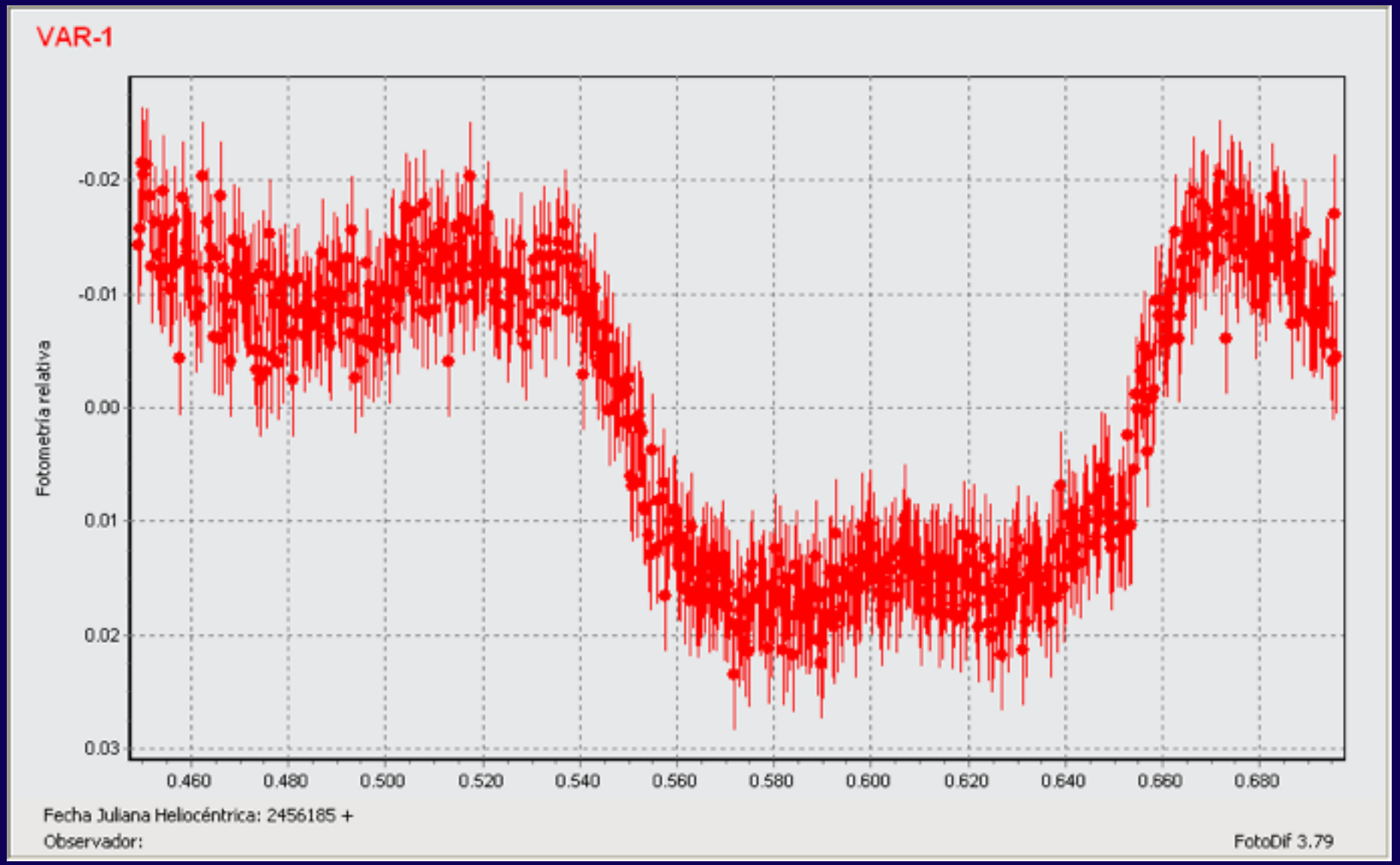


Additional examples

Transiting exoplanet obtained in B filter on 2012 Sep, 14
RMS: ~3 mmag



Additional examples

Extragalactic objects

Arp 316

NGC 4490

M82 + SN 2014J

Summary

- The OAdM is starting to host a large number of facilities and becoming international
- New instrumentation (ARES) will open a new science niche for spectroscopic surveys
- Two IEEC products: MUR and OpenROCS
- Robotization of the TJO has matured providing IEEC a strong know-how on this topic and already being exported to other facilities (SQT)
- Obtained data is being provided to VO in strong collaboration with SVO
- Robotic TJO observations have become common and are improving with more proposals, less supervision and better efficiency

Thank you for you attention