



# COLIBRI

## status report



**D. Corre, S. Basa**  
**Laboratoire d'Astrophysique de Marseille**

# A transient sky follow-up telescope!

## **COLIBRI plays a key role in the SVOM system:**

- To observe the early optical afterglow during the slew of the satellite.
- To provide fast accurate positions of faint and dark GRBs.
- To provide a fast redshift estimator to trigger instantly the largest facilities (VLT and NTT in particular).
- To complement the photometric follow-up of sources observed by SVOM during the General Program (between GRBs).

**But it will be also interested in all the scientific questions dressed by the transient sky.**

# COLIBRI

**A dedicated robotic telescope:**

**Delay between alert reception and start of an observation: <20 sec.**

**Primary mirror diameter: 1.3 m.**

**Two (probably three) simultaneous arms:**

- Wide field of view: 26 arcmin.
- Visible domain.
- Infrared domain: up-to H band.

**A dedicated telescope:**

- to observe all the GRB alerts (even the low thresholds from SVOM).



# San Pedro Martir Observatory

## A very nice astronomical site:

- Median seeing: about 0.8 arcsec.
- About 80% of observable night (60% photometric).
- Located in a protected national park.



## Main requirements on the telescope

Mount type	<b>Alt-Azimuthal</b>
Diameter of the primary mirror	<b>1.3 m</b>
Field of View (diameter)	<b>26'</b>
Delay to start an observation after an alert reception	<b>&lt;20 seconds</b>
Pointing accuracy	<b>&lt; 5 arcsec RMS</b>
Tracking accuracy without autoguider	<b>&lt; 0.8 arcsec RMS (exposure time: 30 min)</b>

## Main requirements on the instruments

Number of simultaneous arms

- **Minimum : 2 arms** (1 in the visible et 1 in the NIR).
- **Goal : 3 arms** (2 in the visible et 1 in the NIR).

Sensitivity (300 sec, 5 sigma)

- **R = 22.0**
- **J = 20.0**

Spectral band

- Each arm has its own filter wheel :**
- **Visible : B, g, r, l, z and y.**
  - **IR : J et H.**

## Main requirements on the software

Delay between receiving the alert and beginning an observation	<b>&lt; 20 seconds</b>
Management of GCN and VOEvent notices	<b>Permanent network connection</b>
Data processing management	<b>Automatic processing, with predefined strategy in the case of bursts</b>
Deadlines to send information to the SVOM Burst Advocate	<b>First information delivered about 5 minutes after the alert reception</b>

# Main institutional partners

**OCEVU** plays a key role in this project by providing the telescope.

**FOCUS** agrees to fund the near-infrared sensor.

**CNES** agrees to support the developments on the near-infrared camera (CAGIRE).

**INSU/CNRS** identified the project as one of its *P0* at the latest Colloque de Prospective (Giens, 2013).

**CONACyT** and **UNAM** agrees to actively participate to the project: very strong motivation and long experience in this domain through the RATIR telescope.



# Sharing of the responsibilities

The GFT is a French-Mexican cooperation.

Sharing of the responsibilities:

## France:

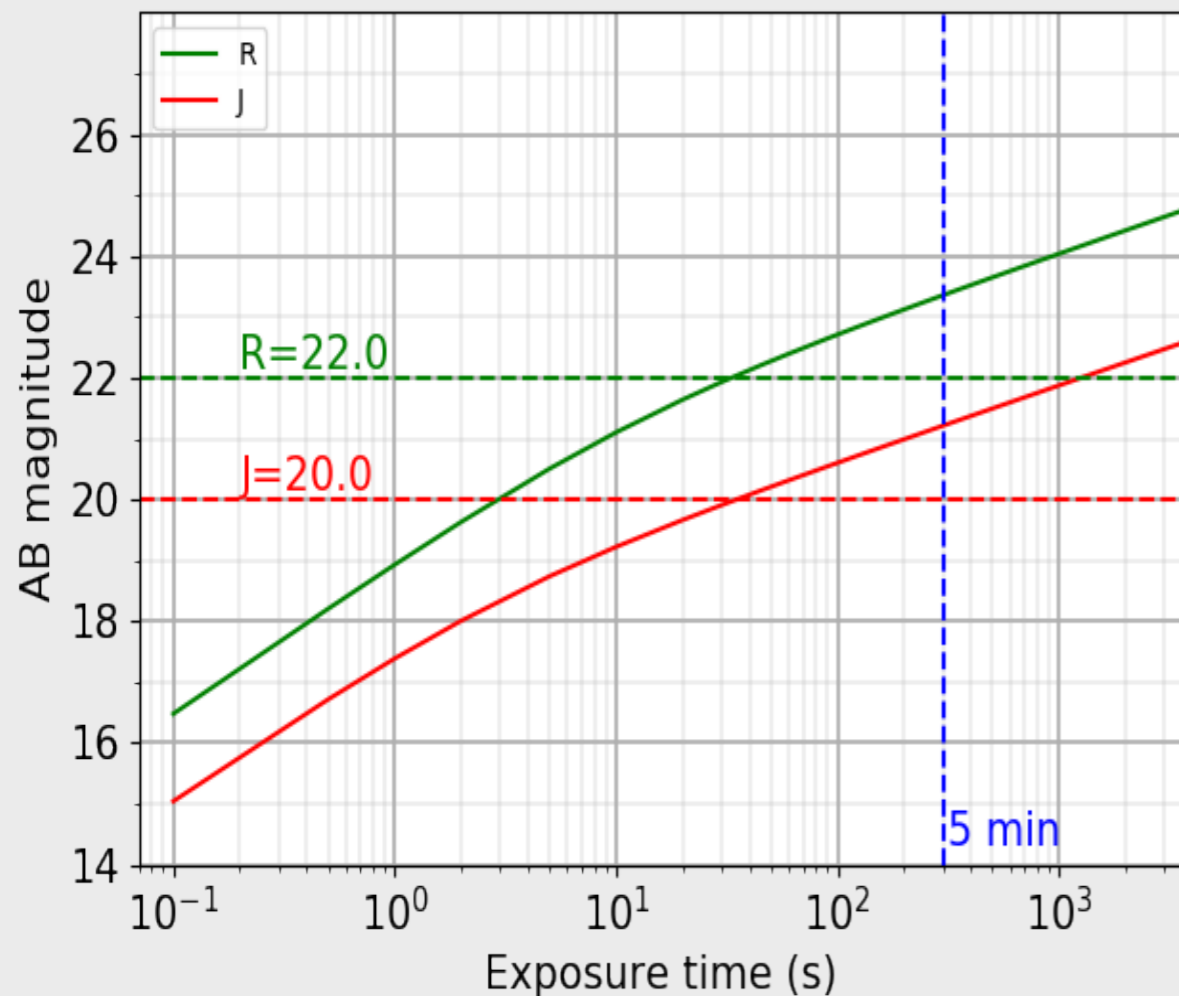
- Telescope (mirrors, alt-az mount, tube, derotator, etc.).
- Telescope acceptance at OHP, France.
- Telescope safety operations (robots, weather stations, etc.).
- Project Management and Systems Engineering.
- NIR instrument.
- *GFT Control Center.*
- *GFT Instrument Center.*

## Mexico:

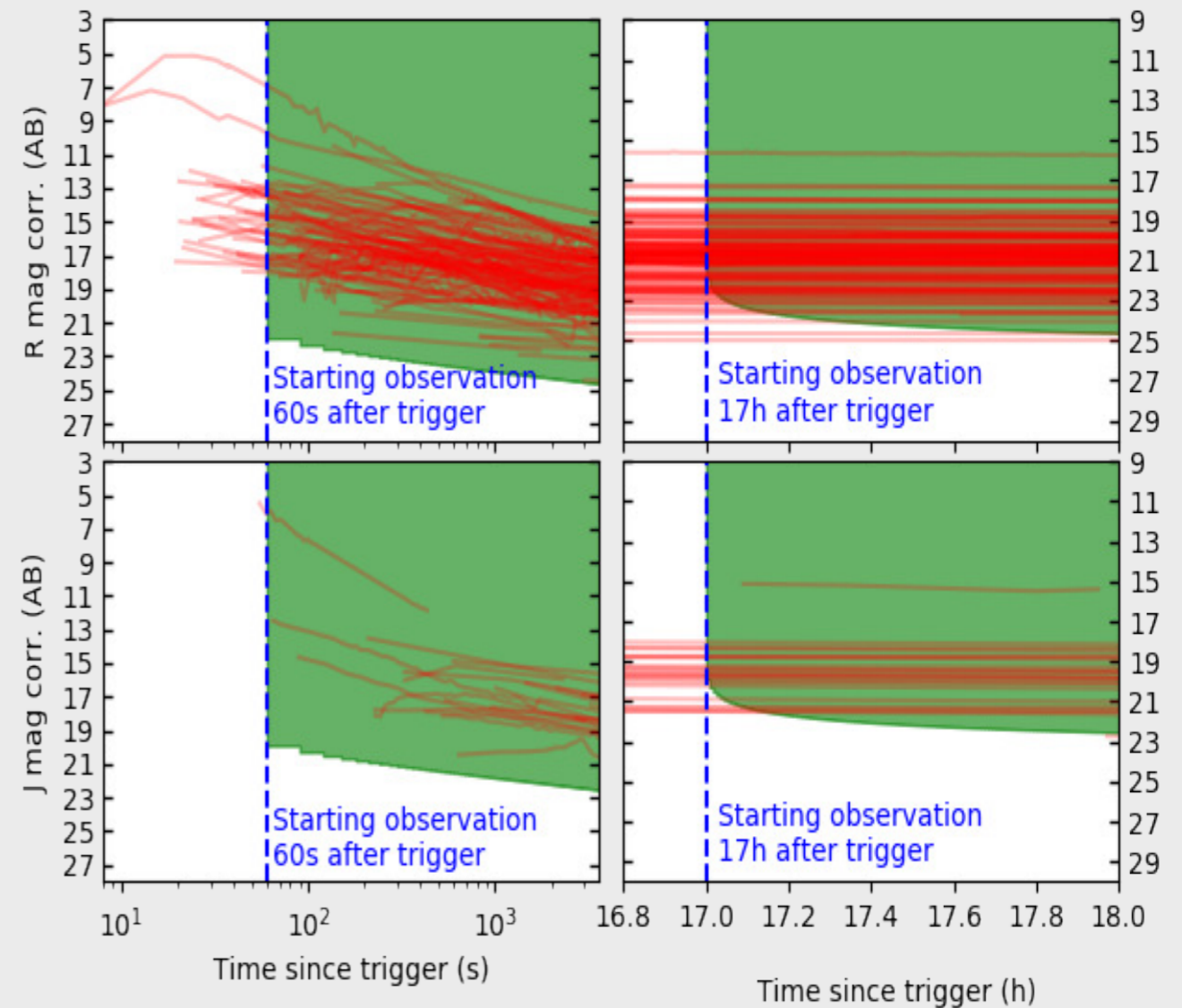
- Site (power, Internet, building permits, customs, etc.).
- Building, including dome.
- *Warm optics: visible instrument and optics for the near-infrared instrument.*
- *Light splitting system.*
- Telescope transportation from OHP to SPM.
- Installation and commissioning on site.
- Routine operations and local support.

# GFT-COLIBRI scientific performances

*Sensitivity (SNR=5)*



*Sensitivity (SNR=5)*



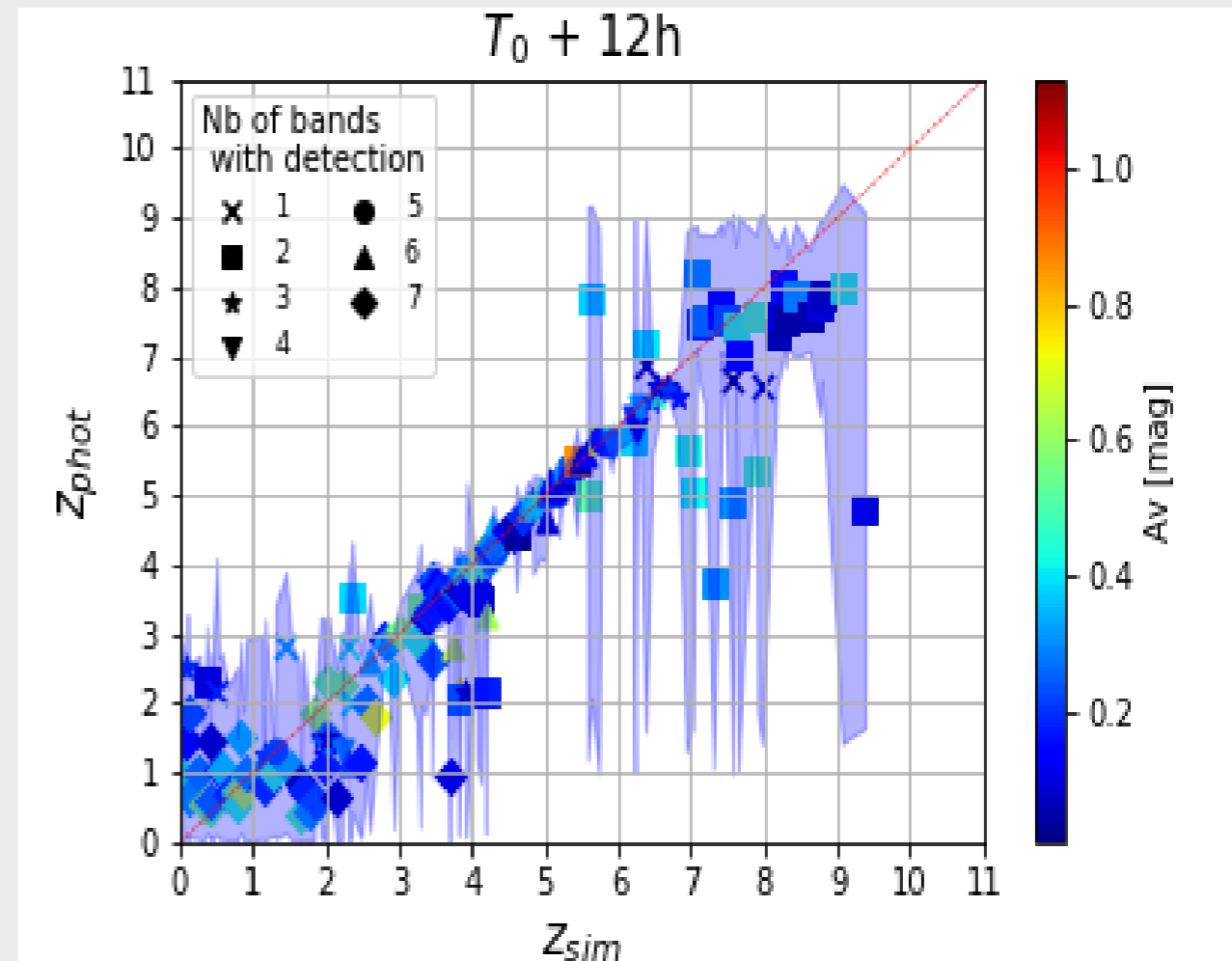
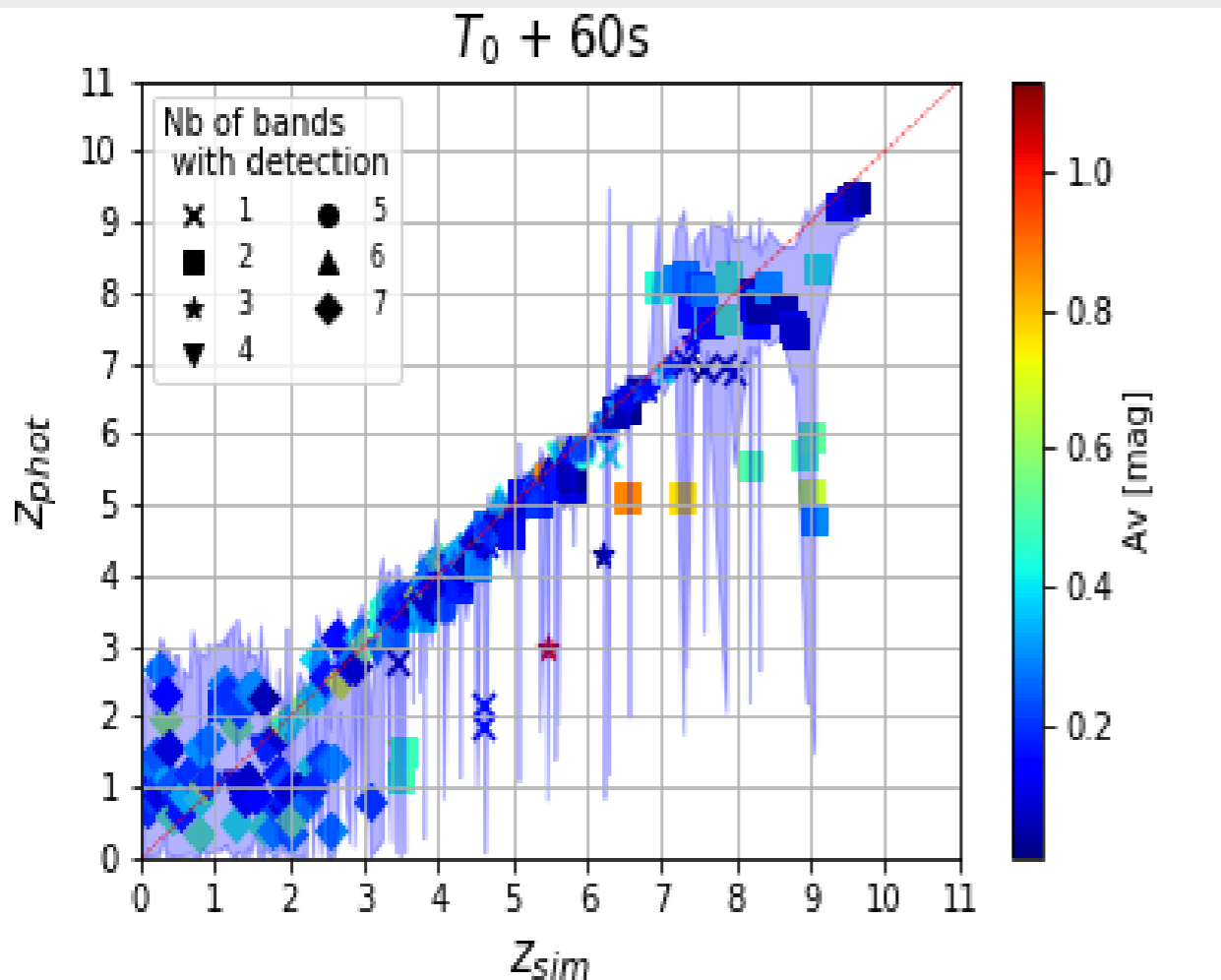
- Follow close to 100% of the GRBs detected so far.
- Follow ~75% of GRBs detected so far 17h after trigger.
- Gain of about 2.5 mag. in R at the early times !
- New data in NIR at early times

# GFT-COLIBRI scientific performances

## Photometric redshift

To + 5 min (253 / 500 det.)

To + 12 hours (173 / 300 det.)



- Follow close to 100% of the GRBs detected so far.
- Follow ~75% of GRBs detected so far 17h after trigger.
- Gain of about 2.5 mag. in R at the early times !
- New data in NIR at early times
- Good redshift precision for  $3 < z < 7.5$ .

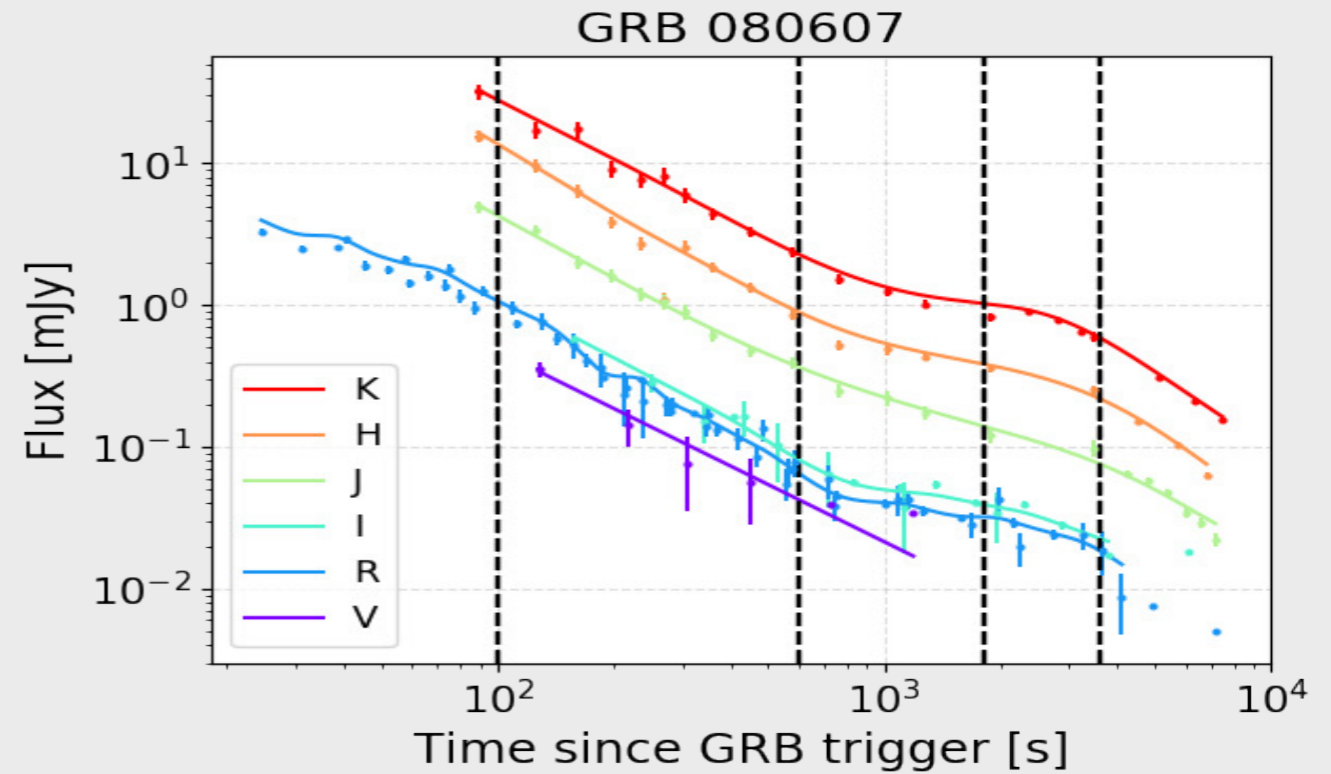
# GFT-COLIBRI scientific performances

**GRB 080607**

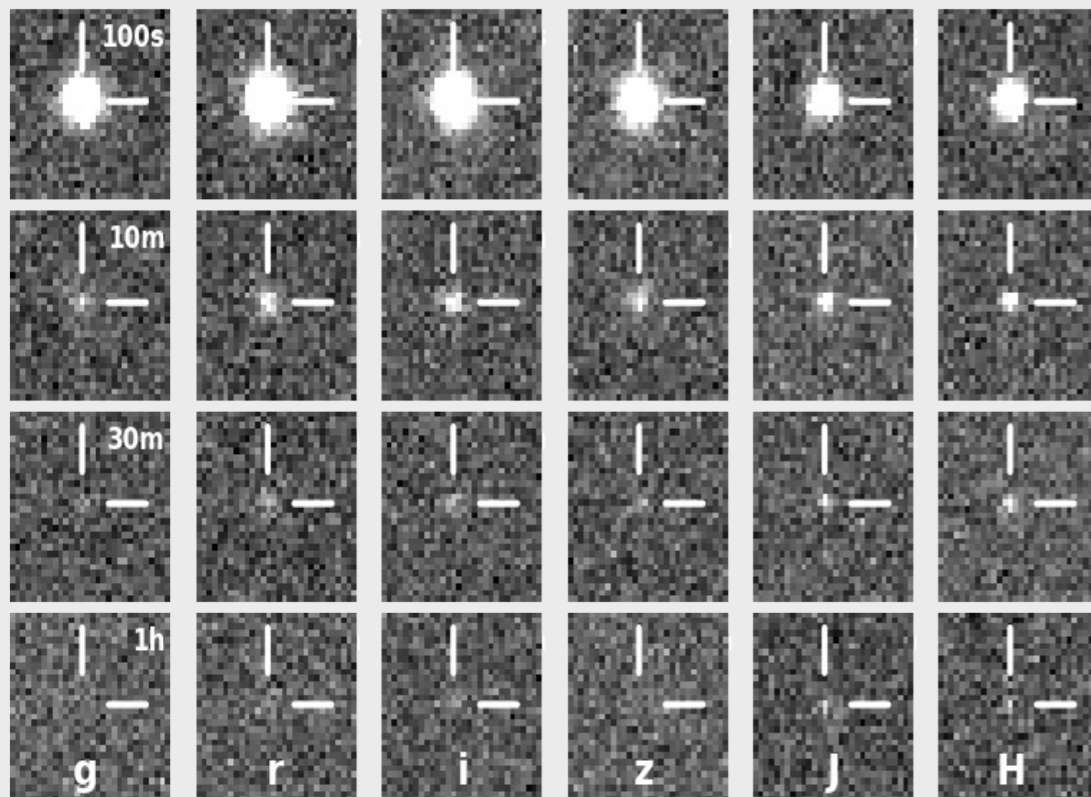
$z = 3.03$

$A_v = 2.3$  mag

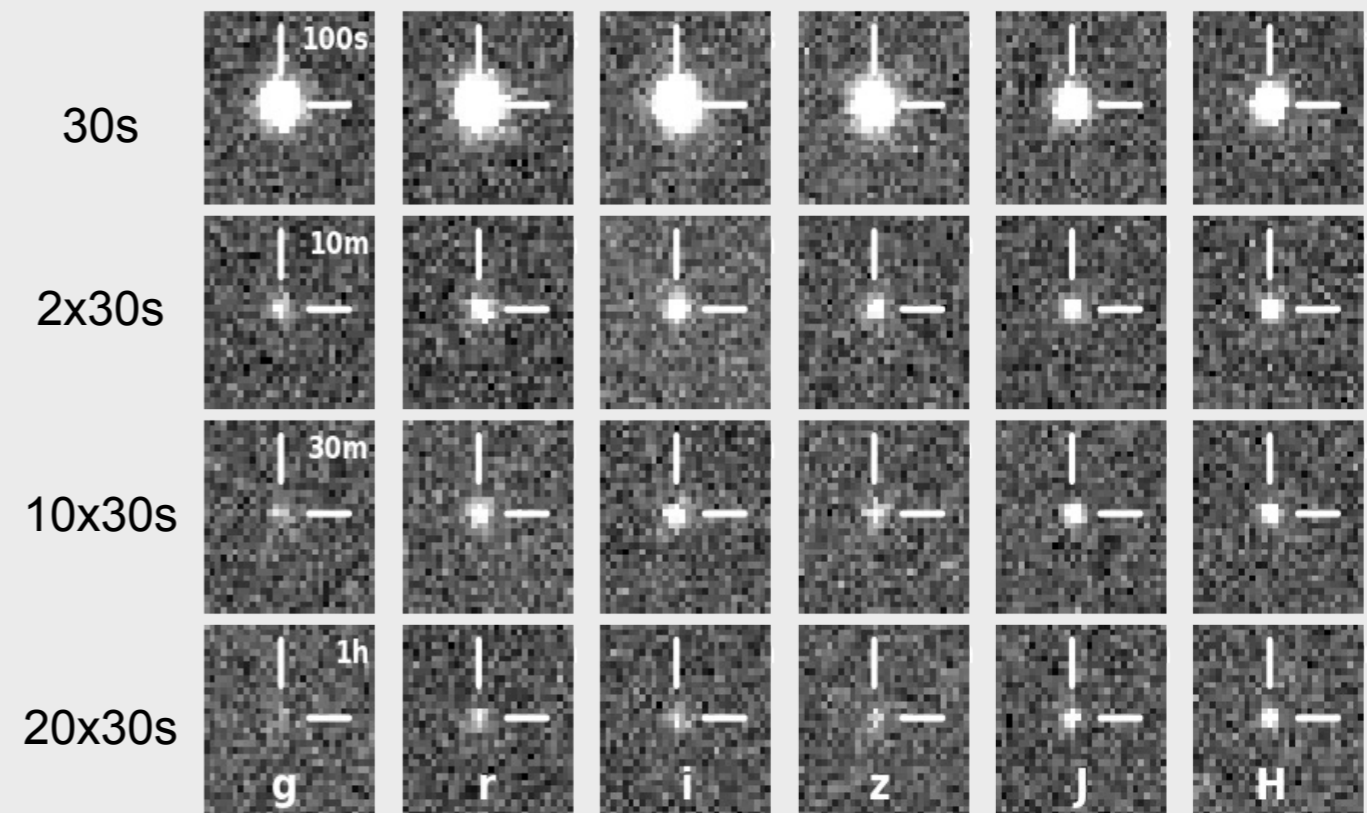
Follow-up in less than 30s in optical,  
100s in NIR



Single exposures of 30s



Exposure time adapted



# Main actions performed in 2017

## **Design of the GFT infrastructure:**

- Selection of the dome provider (October 2017).
- Permits accepted by the Mexican authorities (January 2018).
- PDR on the infrastructure (May 2018)

## **Infrastructure at OHP:**

- Platform for the tests ready (April 2018).

## **Instruments:**

- PDR instrument (February 2017).
- Selection of the SOFRADIR IR sensor for CAGIRE (July 2017).

## **Polishing of the M1&M2 :**

- Reception of the blanks and start of the polishing at LAM (June 2017).

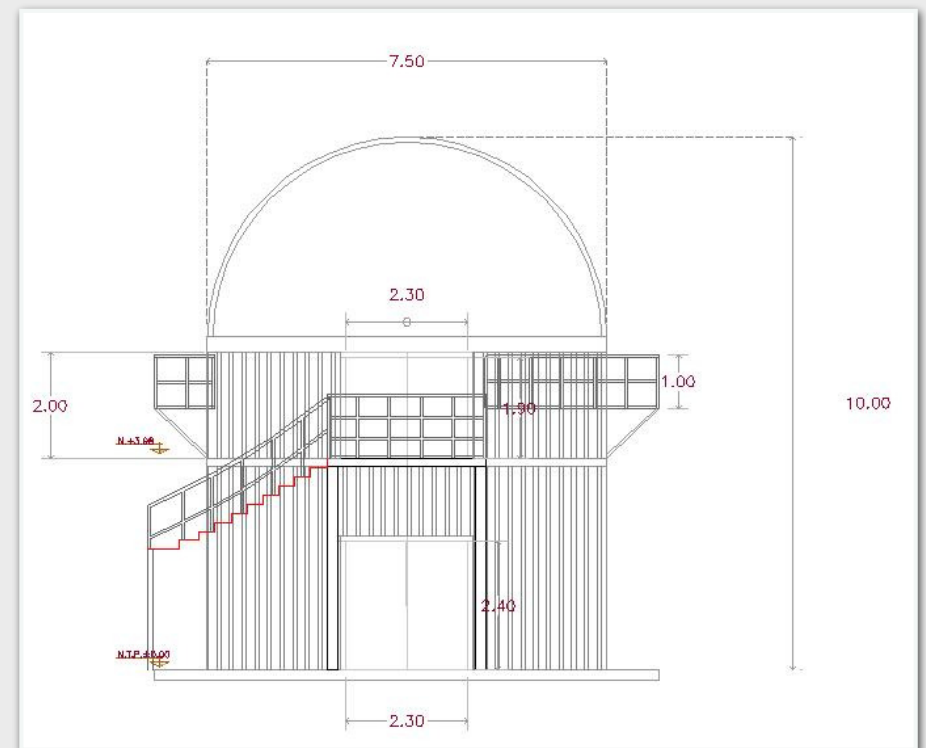
## **Control Center and Instrument Center:**

- PDR soft (November 2017)

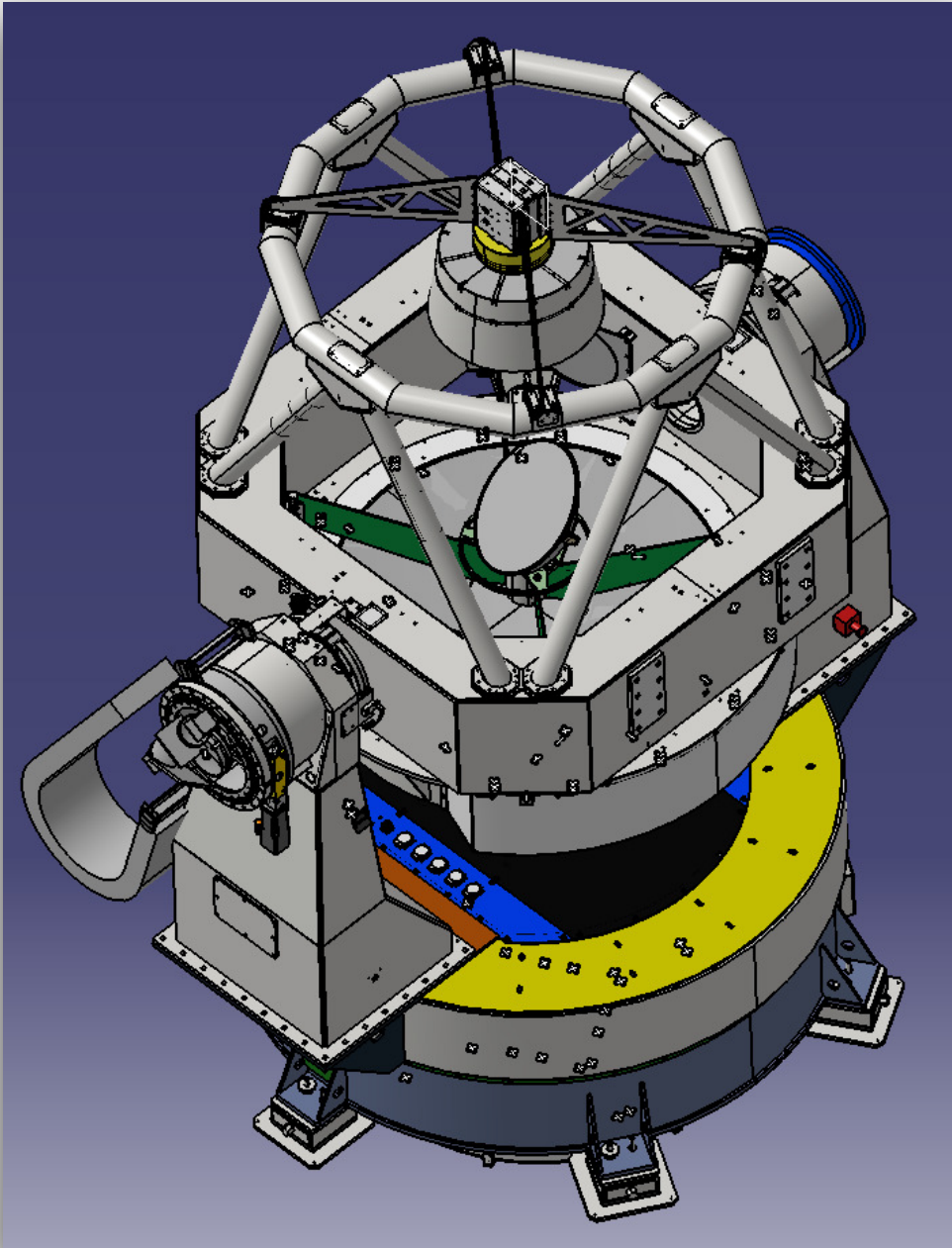
# Infrastructure at OAN-SPM



- Groundbreaking ceremony: 5th of May, 2018.
- Building foundation and pillar done this year, rest of the building in 2018.

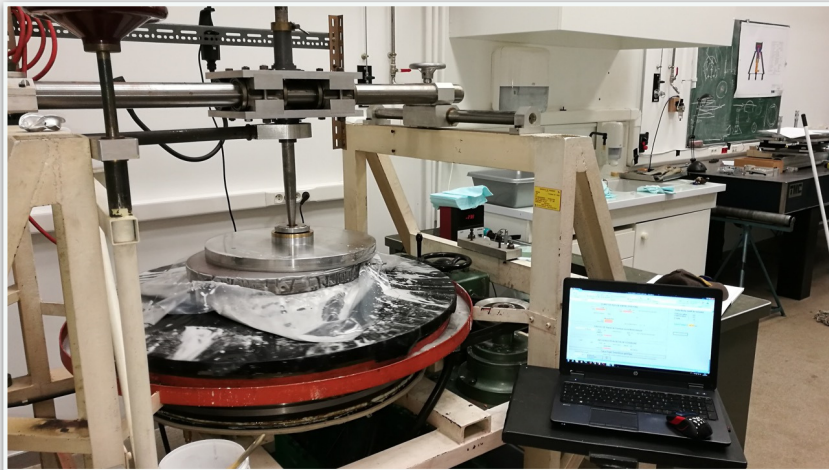
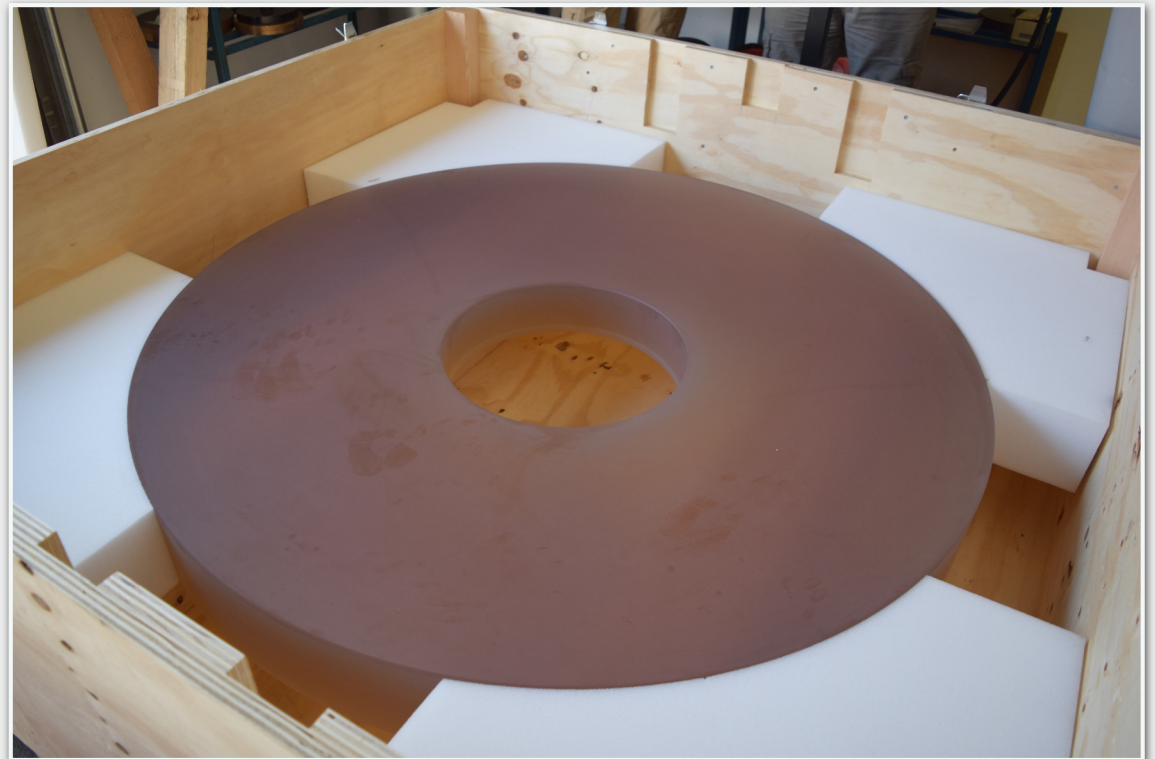


# Telescope design



- Telescope design now finalized, but was a long process to check all the key parameters (in particular the cable wrap and the Nasmyth tunnel).
- Manufacturing is starting.

# Polishing of the two main mirrors @ LAM





# An infrared camera with a french sensor

**SOFRADIR** in the process of developing a large format infrared matrix: partnership with Labex FOCUS, ESO and ESA.

**IR sensor with properties similar to those developed by Teledyne.**

**➔ Labex FOCUS retained our proposal for the first scientific use of this new sensor: CAGIRE will be the "showcase" for this sensor!**



# Next steps

## **Next steps:**

- PDR Infra: beginning of May 2018.
- CDR DDRAGO & Delta-PDR Soft: 22-24 May 2018.
- Delivery of the telescope at OHP: October 2018.
- End of the acceptance phase at OHP and departure to OAN: June 2019.
- Installation in OAN: Fall 2019.