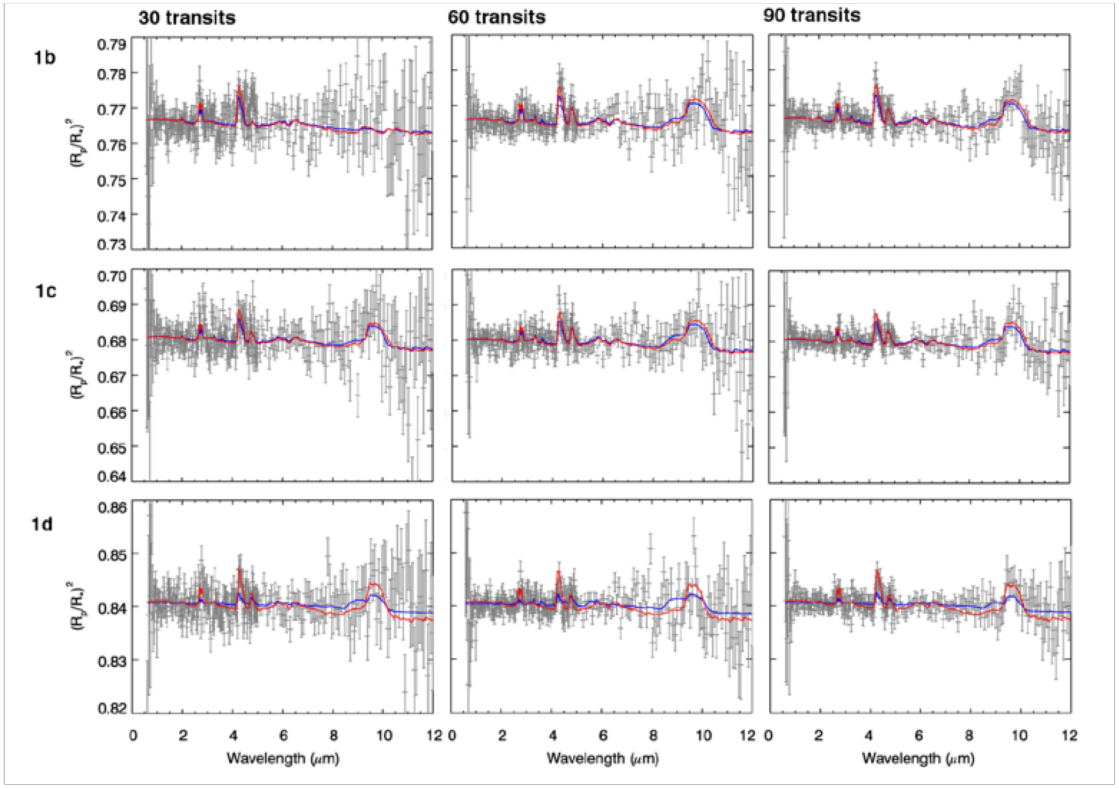
Trappist 1

A first opportunity to study the atmosphere of temperate, Earth-sized planets



Barstow & Irwin (2016)

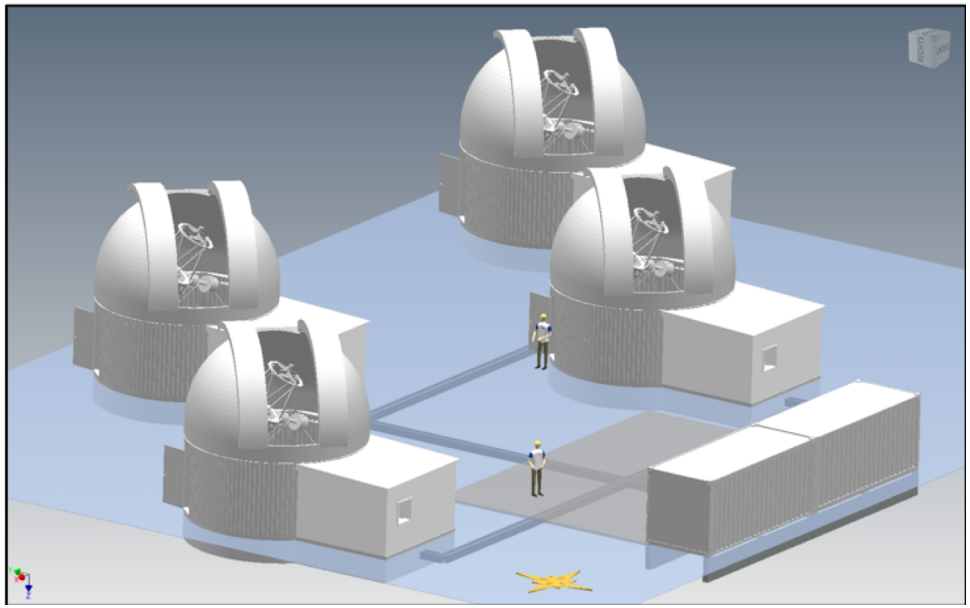
Trappist 1

https://events.uliege.be/trappist-1/

An optimized Southern Survey

The **SPECULOOS-Southern Observatory**

- 4 robotic telescopes of 1m
- installed at **ESO Paranal Observatory**, Chile
- Constructions started end 2016
- Consortium: Liege, Cambridge, & Birmingham



An optimized Southern Survey

The **SPECULOOS-Southern Observatory**

- **Telescopes**
  - Ritchey–Chrétien System (F/8)
  - ASTELCO NTM-1000 mount (no meridian flip)
  - Dome 6.25m
  - Completely robotic

Consortium:
Liege, Cambridge, & Birmingham

An optimized Southern Survey

The **SPECULOOS-Southern Observatory**

- **Telescopes**
  - Ritchey–Chrétien System (F/8)
  - ASTELCO NTM-1000 mount (no meridian flip)
  - Dome 6.25m

- **Instruments**
  - Andor iKon-L CCD camera (2k x 2k)
  - FOV 12’ (0.34’’ pixel scale)
  - Low fringing in IR (<1%)
  - FLI Filterwheel (Sloan g’r’i’z’, I+z & Exo)

SPECULOOS

Search for habitable Planets EClipsing ULtra-cOOl Stars

An optimized Southern Survey

The **SPECULOOS-Southern Observatory**

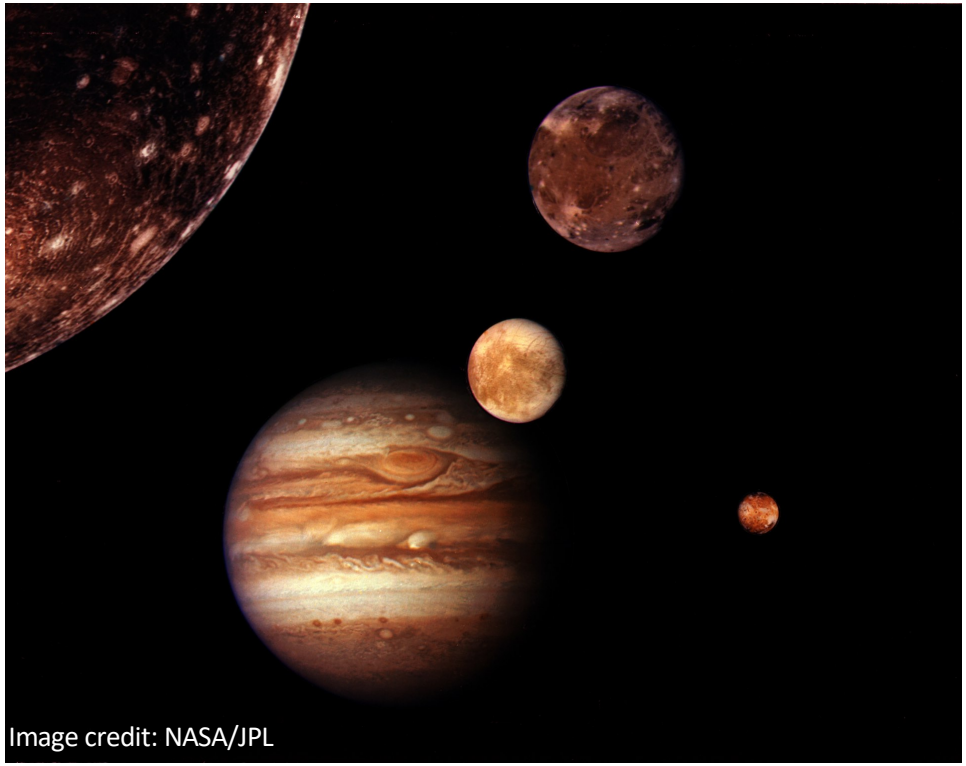


Image credit: NASA/JPL

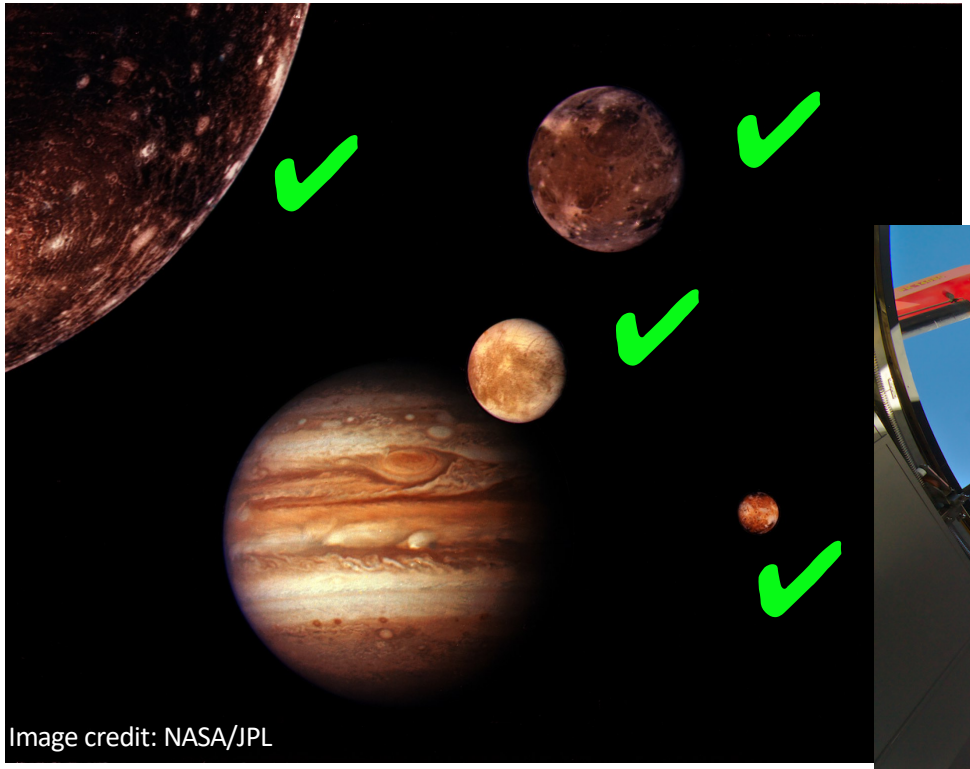
Consortium:
Liege, Cambridge, & Birmingham

SPECULOOS

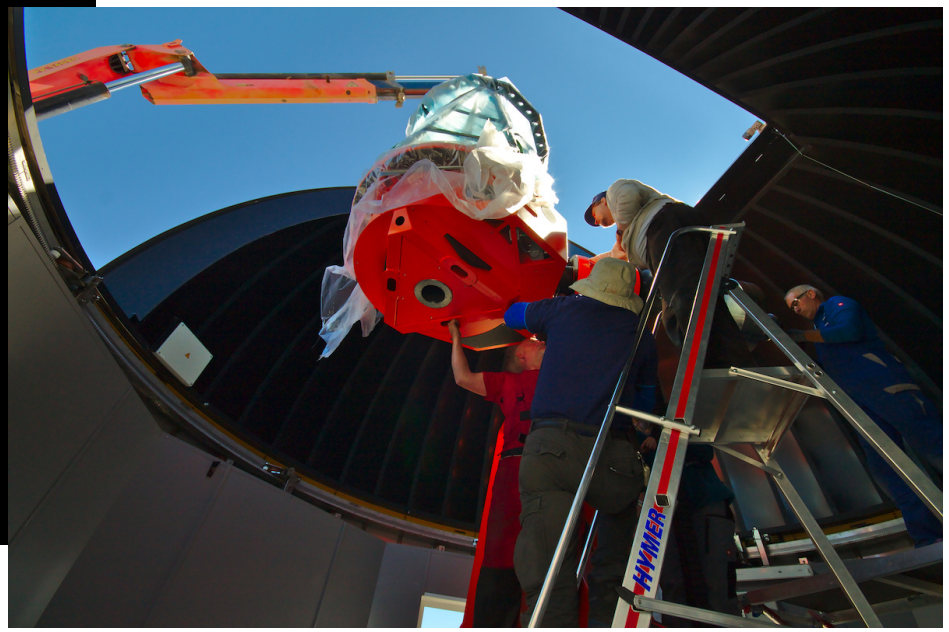
Search for habitable Planets ECLipsing ULtra-cOOl Stars

An optimized Southern Survey

The **SPECULOOS-Southern Observatory**



Ganymede installed in Oct. 2018



Consortium:
Liege, Cambridge, & Birmingham

An optimized Southern Survey

The **SPECULOOS-Southern Observatory**


Image credit: P. Aniol

- All telescopes installed
- **Commissioning finished** in 2018

SPECULOOS

Search for habitable Planets ECliping ULtra-cOOl Stars

An optimized Southern Survey

The **SPECULOOS-So**

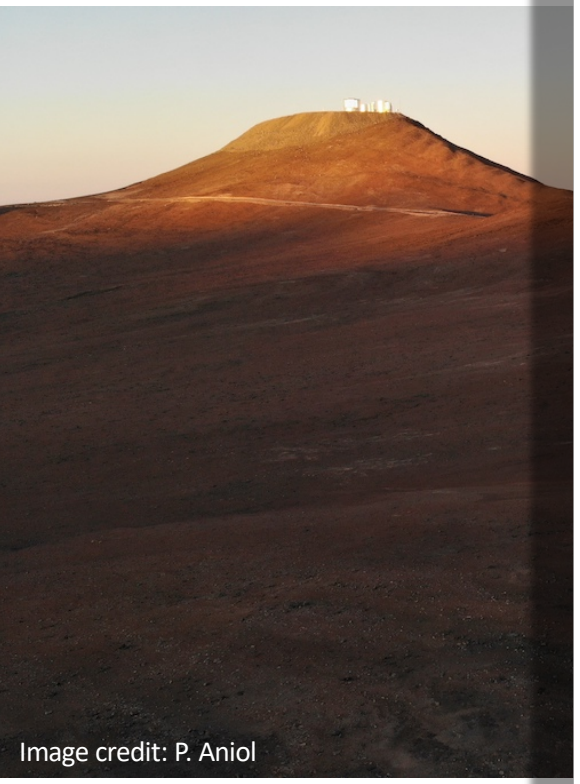


Image credit: P. Aniol

Telescopes and Instrumentation

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The SPECULOOS Southern Observatory Begins its Hunt for Rocky Planets

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The SPECULOOS Southern Observatory (SSO), a new facility of four 1-metre robotic telescopes, began scientific operations at Cerro Paranal on 1 January 2019. The main goal of the SPECULOOS project is to explore approximately 1000 of the smallest ($\leq 0.15\ R_\odot$), brightest ($K_{mag} \leq 12.5$), and nearest ($d \leq 40$ pc) very low mass stars and brown dwarfs. It aims to discover transiting temperate terrestrial planets well-suited for detailed atmospheric characterisation with future giant telescopes like ESO's Extremely Large Telescope (ELT) and the NASA James Webb Telescope (JWST). The SSO is the core facility of SPECULOOS. The exquisite astronomical conditions at Cerro Paranal will enable SPECULOOS to detect exoplanets as small as Mars. Here, we briefly describe SPECULOOS, and present the features and performance of the SSO facility.

Search for Planets ECIipsing ULtra-cOOl Stars (SPECULOOS)

One of the most thrilling questions posed by humankind is whether inhabited worlds similar to Earth exist elsewhere in the Universe. The most direct way of answering this question is through the detection and detailed atmospheric characterisation of terrestrial exoplanets orbiting in the habitable zones of nearby stars. The nearest ultra-cool dwarf (UCD) stars represent a unique opportunity to reach this goal within the next couple of decades. UCD stars are very low mass stars at the bottom of the main sequence, with masses approximately 10% that of the Sun, sizes similar to Jupiter, effective temperatures lower than 2700 K, and luminosities less than one thousandth that of the Sun.

The habitable zones in these systems are very close to the host stars, corresponding to orbital periods of only a few days. This proximity to the host star maximises the transit probability and the likelihood of detecting habitable planets. In addition, an Earth-sized planet transiting a small UCD star produces a 1% transit signal, 100 times deeper than that of an equivalent transit around a Sun-like star, and well within the reach of ground-based telescopes. With these properties, it is possible to characterise the atmospheres of UCD habitable zone planets — including the potential detection of spectroscopic biosignatures — with forthcoming giant telescopes such as ESO's ELT (Rodler & López-Morales, 2014) and the JWST (Kaltenegger & Traub, 2009).

SPECULOOS[1,b] (Principal Investigator: Michaël Gillon) is a new photometric survey based on a network of 1-metre-class robotic telescopes. It aims to seize the opportunity to detect temperate terrestrial planets transiting nearby UCDs that are bright enough in the near-infrared to make possible the atmospheric characterisation of their planets in the near future (see Gillon et al., 2018; Delrez et al., 2018a; Burdanov et al., 2017).

Figure 1. The four 1-metre telescopes Io, Europa, Ganymede, and Callisto (from right to left)[a] of the SPECULOOS Southern Observatory starting the night under Paranal's sky.

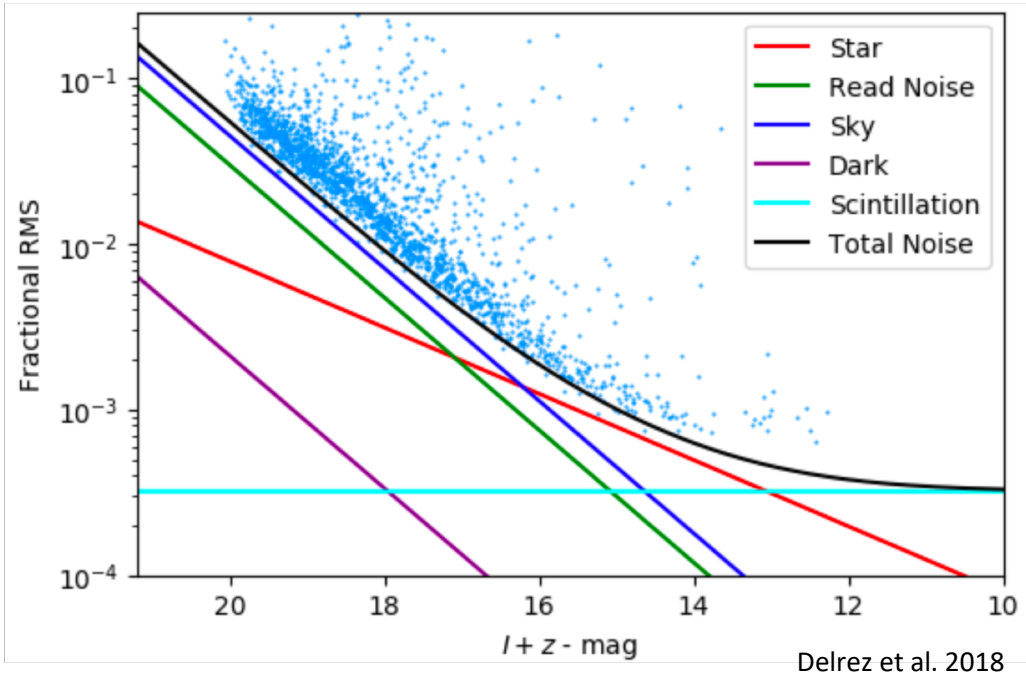
Pedro Aniol

- All telescopes installed
- Commissioning finished in 2018
- Official start: **01.01.2019**

An optimized Southern Survey

The **SPECULOOS-Southern Observatory**

Photometric precision:



Delrez et al. 2018

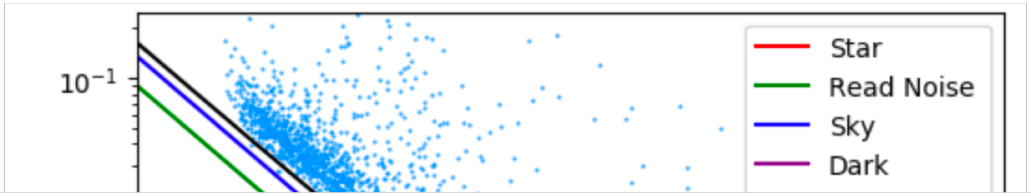
SPECULOOS

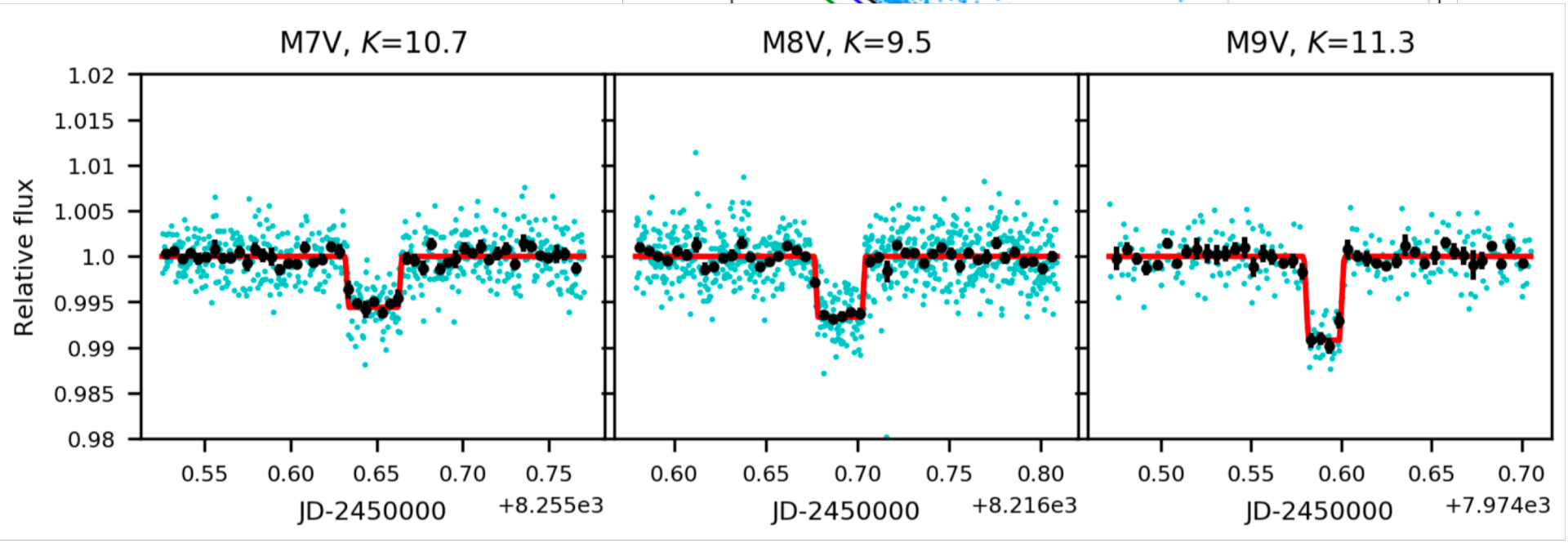
Search for habitable Planets ECliping ULtra-cOOl Stars

An optimized Southern Survey

The **SPECULOOS-Southern Observatory**

Photometric precision:





Delrez et al. 2018

An optimized Southern Survey

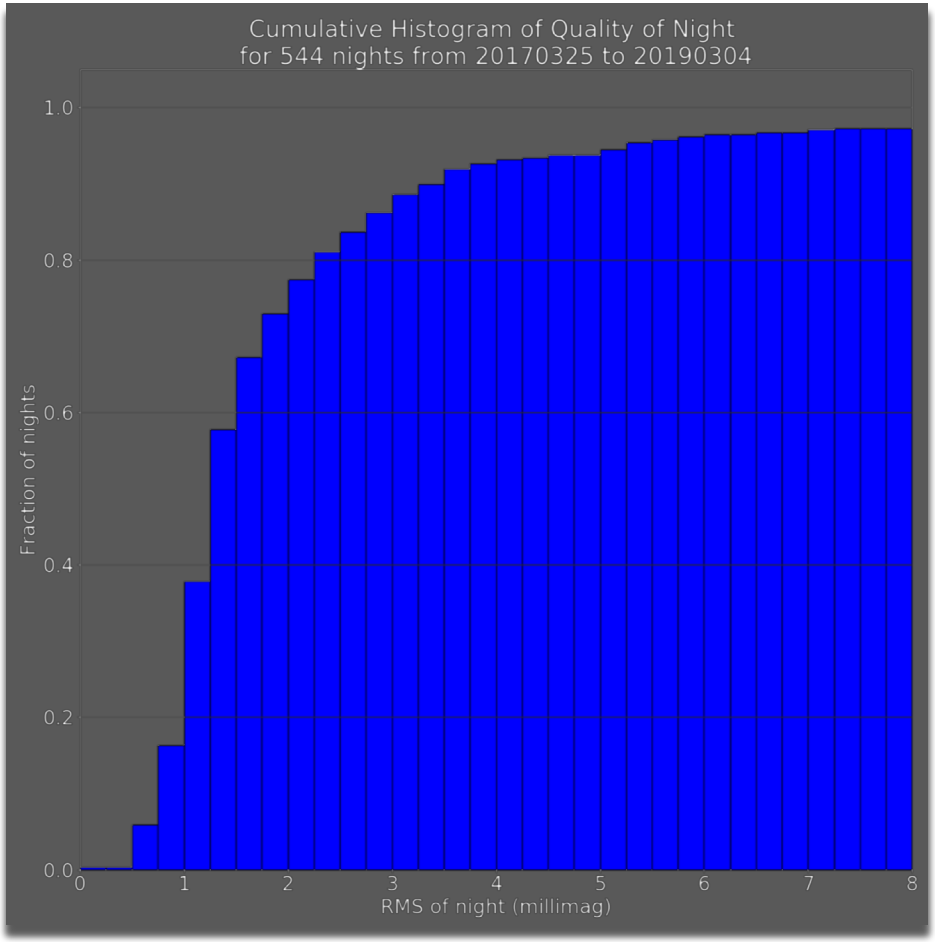
The **SPECULOOS-Southern Observatory**

Photometric precision:

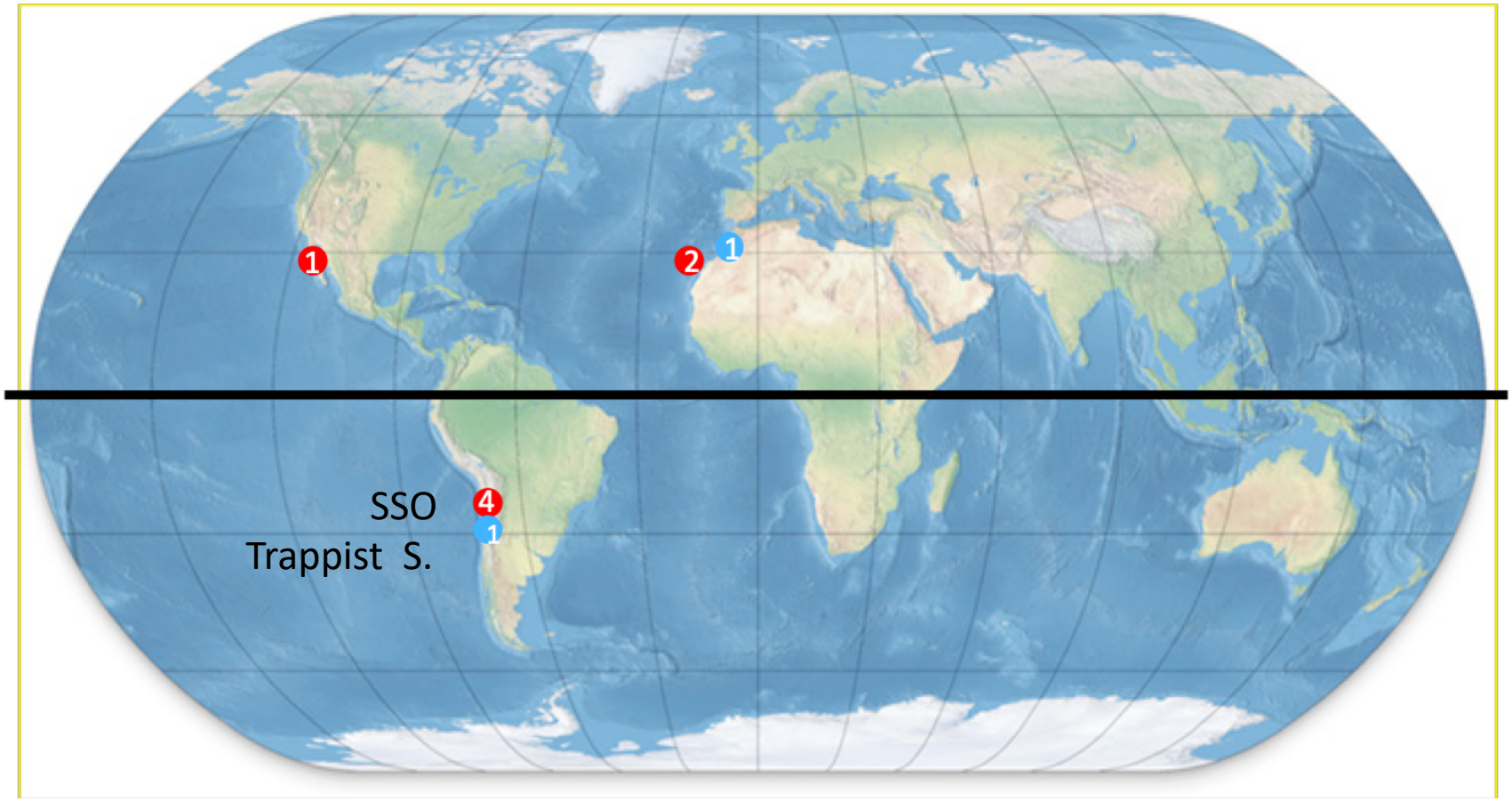
< 1mmag ~ 15%
< 3.25mmag ~ 90%

Efficiency:

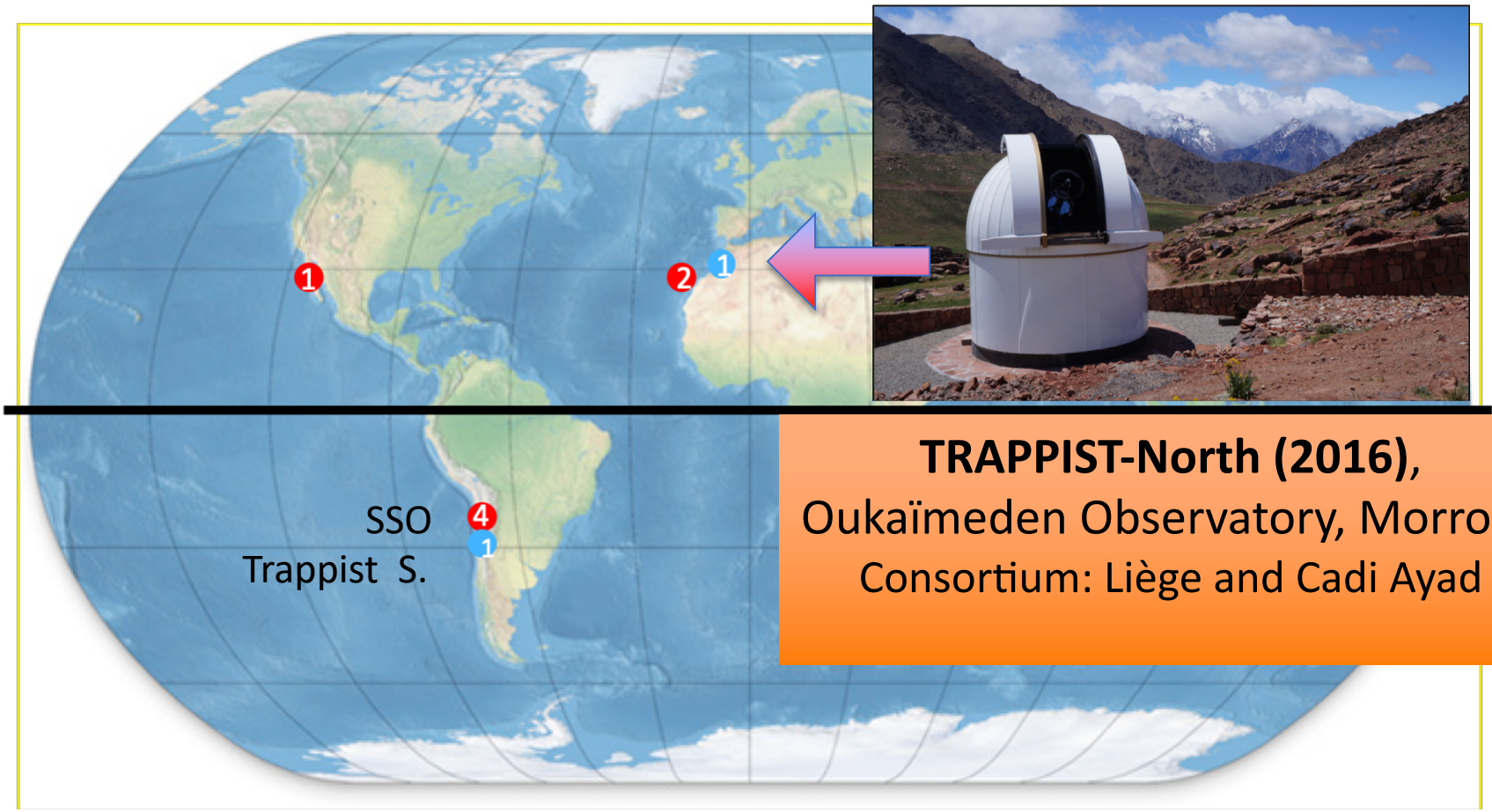
~85% during Commissioning phase (>90% expected)



Extending the project to the North



Extending the project to the North



TRAPPIST-North (2016),
Oukaïmeden Observatory, Morroco
Consortium: Liège and Cadi Ayad