

P13 Infrared Two-field Camera and Spectrograph MIMIZUKU: Current Status and Commissioning Plan on Subaru



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Abstract

MIMIZUKU (Mid-infrared Multi-field Imager for gaZing at the UnKnown Universe) is an infrared camera and spectrograph developed as a first-generation instrument on the TAO (The University of Tokyo Atacama Observatory) 6.5-m telescope. MIMIZUKU has a unique capability to observe a target and a calibrator within 25 arcmin simultaneously. It leads to accurate atmospheric calibration, and long-term monitoring observations are realized even for ground-based mid-infrared observations. Science operations of MIMIZUKU on Subaru had been proposed in the past, but currently, only commissioning operations are proposed to Subaru. Currently we are aiming at commissioning tests on Subaru in S17B or S18A. We report the latest development status and commissioning test plan at Subaru.

TAO & MIMIZUKU

TAO (the University of Tokyo Atacama Observatory)

- New observatory in Chile (2018 Eng. First Light)
- High site (5640-m alt.) and dry climate → Clear sky
- Medium-sized telescope (6.5-m dia.)

→ Powerful facility for infrared astronomy!!

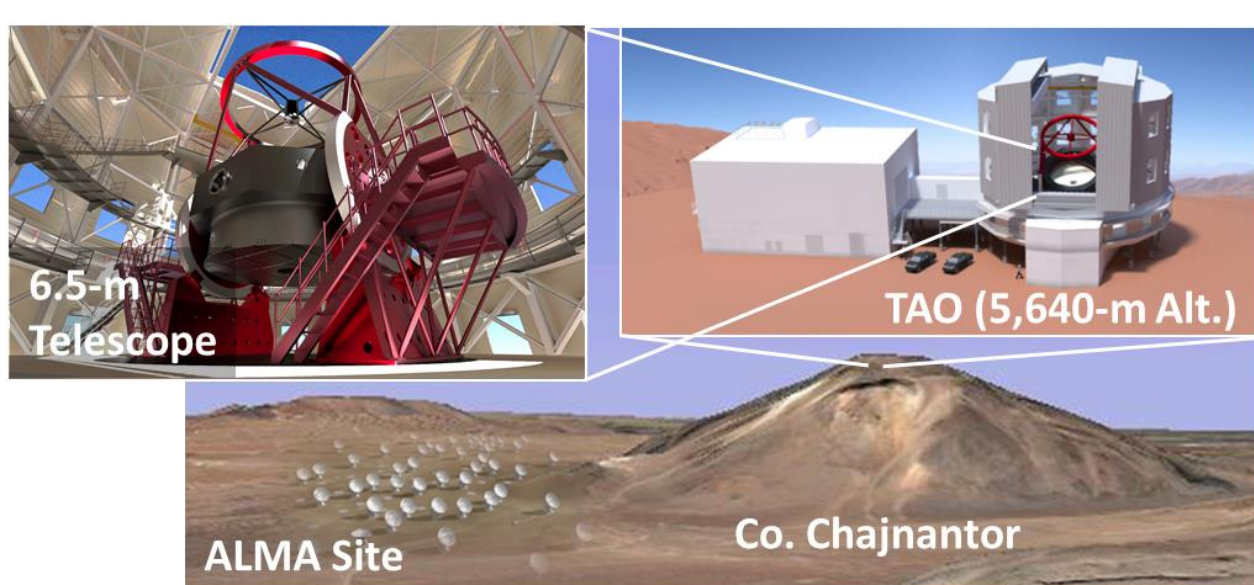


Figure 1. TAO and 6.5-m telescope.

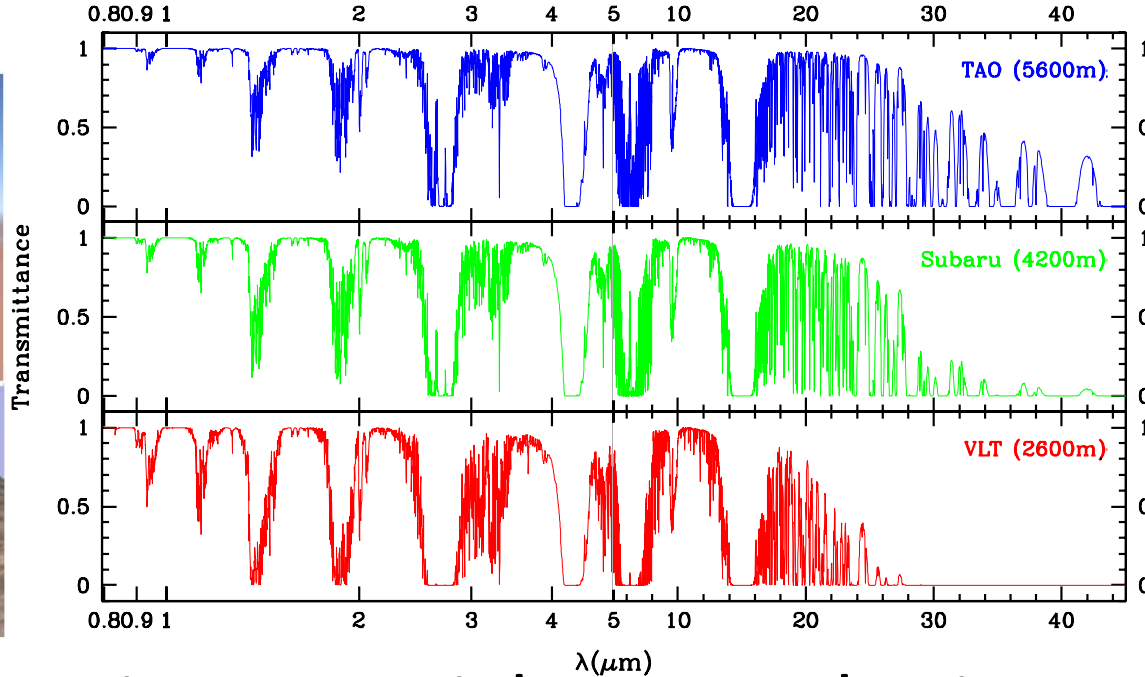


Figure 2. High atmospheric transmittance on the TAO site.

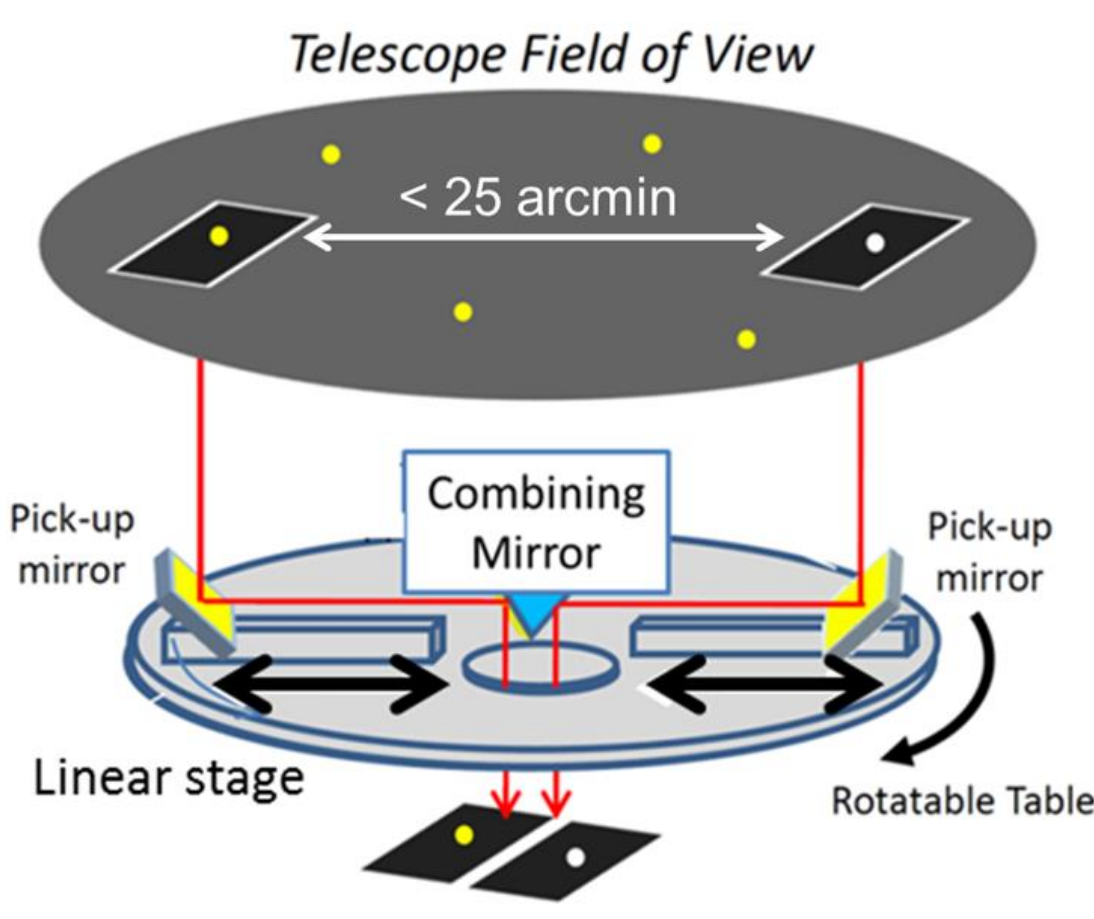
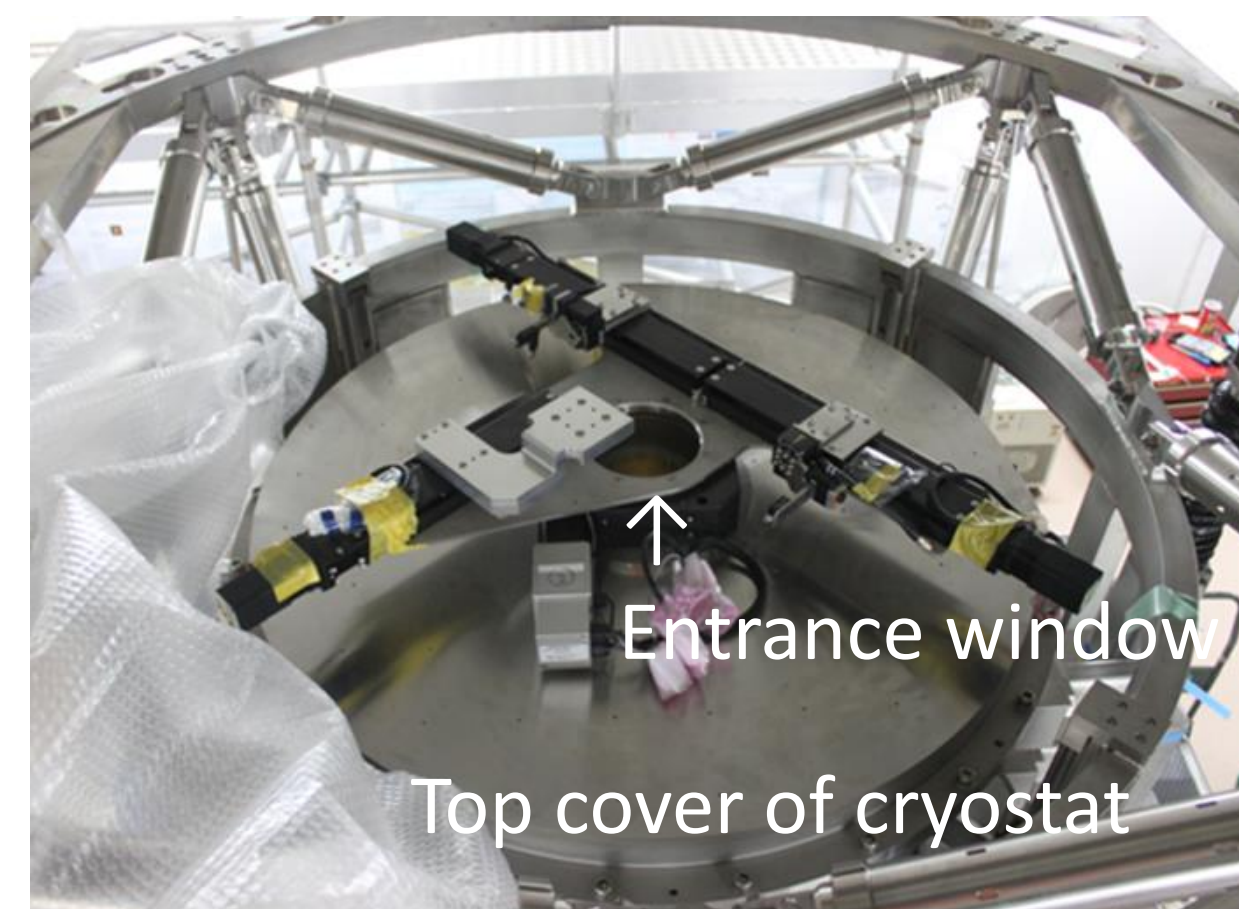


Figure 5. Field-Stacker (Left: Real view, Right: Schematic view).



Figure 3. Appearance of MIMIZUKU.

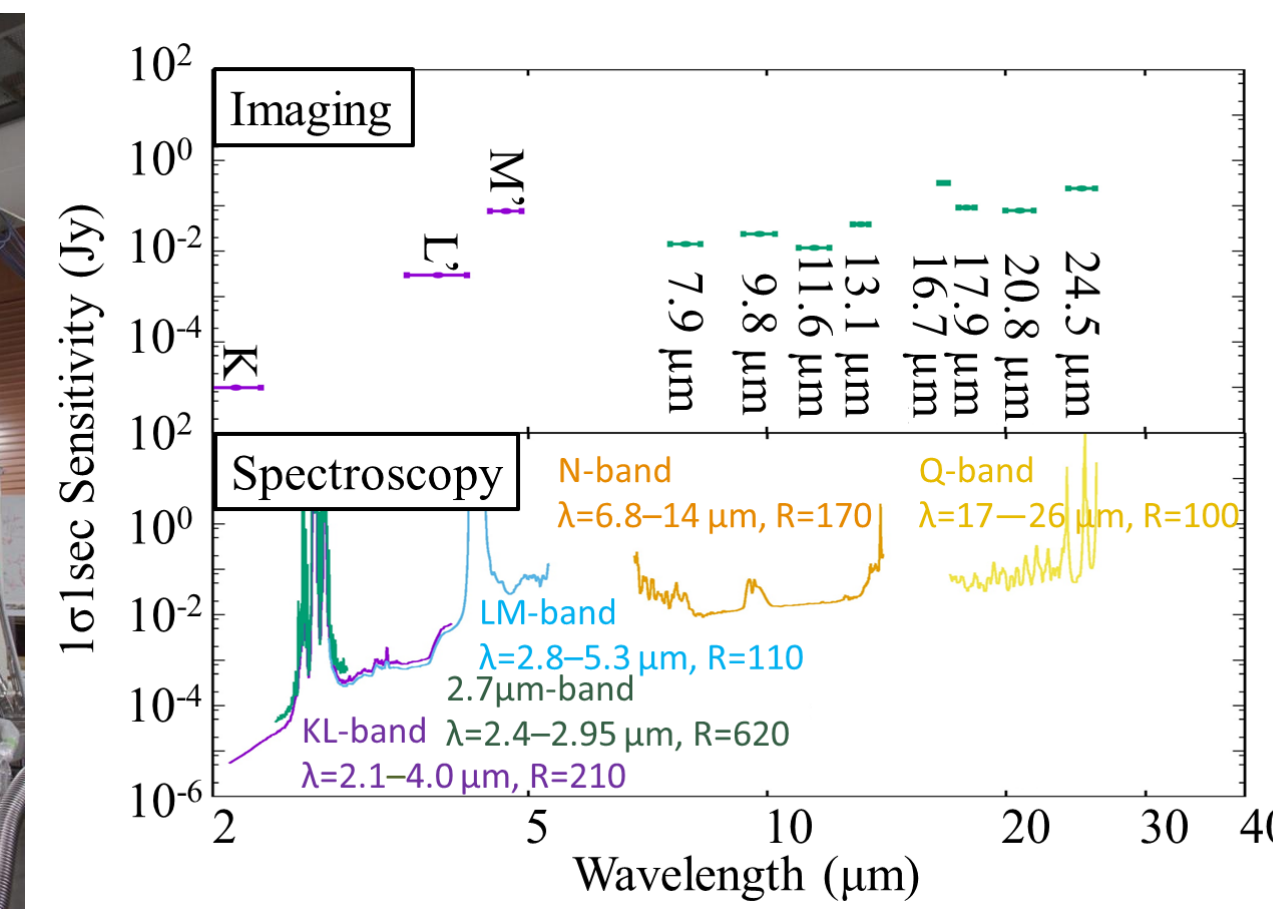


Figure 4. Expected sensitivities of MIMIZUKU on Subaru.

Table 1. Specifications of MIMIZUKU on Subaru.

Channel	NIR	MIR-S
Wavelength	2.0–5.3 μm	6.8–26 μm
Detector	H1RG 5.3-μm cutoff 1k × 1k pix	Aquarius (Si:As) 1k × 1k pix
Pixel Scale	0.052"/pix	0.087"/pix
Field of View	54" × 54"	1.5' × 1.5'
Spatial resolution	Seeing-limit	Diffraction-limit
Spectroscopy	KL-band [†] 2.1–4.0 μm, R=210	N-band 6.8–14 μm, R=170
	LM-band 2.8–5.3 μm, R=110	Q-band 17–26 μm, R=100
	2.7 μm-band 2.4–2.95 μm, R=620	

[†]Gray parts are optional

MIMIZUKU (Mid-Infrared Multi-field Imager for gaZing at the UnKnown Universe)

- Infrared camera and spectrograph developed for TAO
- Commissioning operations at Subaru are proposed
- 2 – 38 μm covered with 3 channels (NIR, MIR-S, and MIR-L)
- MIR-L channel ($\lambda = 25 - 38 \mu\text{m}$) not available on Subaru

Field-Stacker (FS) device

- Optical device placed on the top of MIMIZUKU
- Combines two fields separated with < 25 arcmin

→ Simul. obs. of a pair of target and calibrator

→ Accurate atmospheric calibration

→ Long-term monitoring is realized!!

FS is the key device to open the way for ground-based MIR monitoring.
→ Validate its effectiveness!!

Commissioning Proposal

Purpose of commissioning operations at Subaru

- Validating FS effectiveness (Testing new technology)
- Fast and secure start-up
 - Difficult on the TAO site (Harsh condition)
- Benefits also for the community
 - 40% obs. time of TAO/MIMIZUKU will be opened

Items found in review held on 2016/09/30

- Large inrush current → Measured and reported to Subaru
 - Too much weight → Weight cut incl. decommissioning MIR-L ch.
- Waiting for answer from Subaru

Operation plan

Step	Items	Nights
1	Basic func. tests Imaging tests w/o FS FS func. tests	0.6
2	Imaging tests w/ FS Spc. func. tests w/o FS	1.0
3	Photometric acc. checking w/ FS Spc. tests w/o FS Spc. func. tests w/ FS	1.5
4	Perf. checking for a very bright star Spc. Performance tests w/ FS	0.9
5	Long-time img. of a faint star Long-time spc. of a faint star	1.0

Figure 6. Night operation plan and success levels of this proposal.

3 nights are requested to validate FS effectiveness as the minimum success level.

Development Progress

Schedule

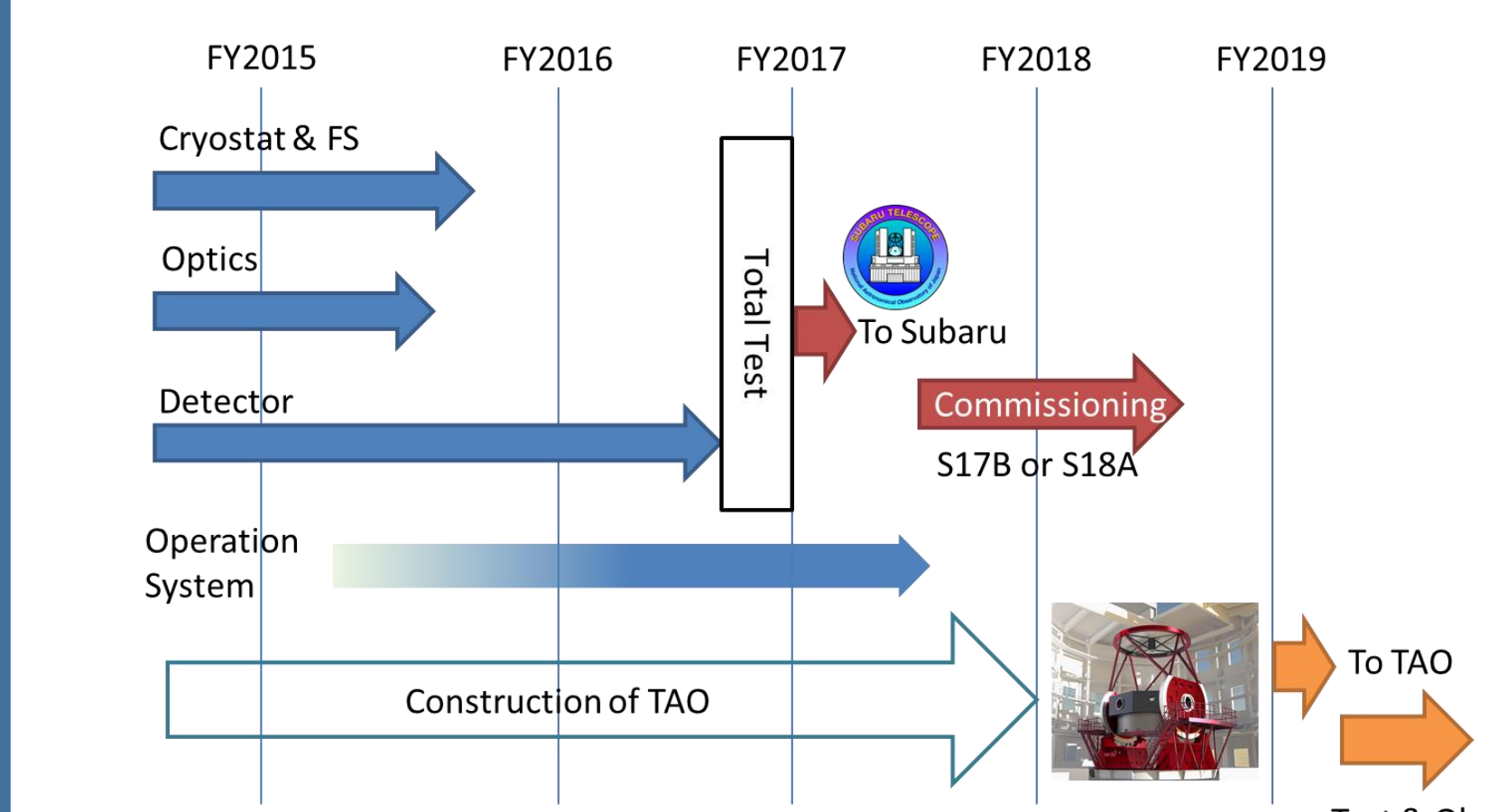


Figure 7. Current status and schedule of MIMIZUKU.

Installing filter/slit wheels

Motion test in MIMIZUKU

→ Confirmed

- Low heat gen.
- Stable motion

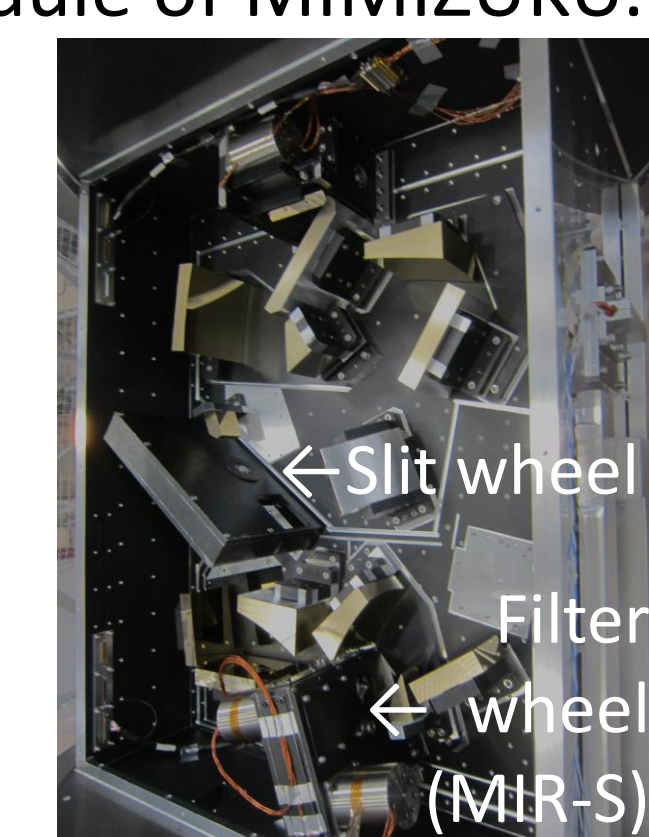


Figure 8. Installed wheels.

Detector testing

Cryogenic multiplexer (MUX) tests are done for both NIR and MIR-S.

→ Array controller is properly functioning

→ Detector test (not MUX) will begin soon

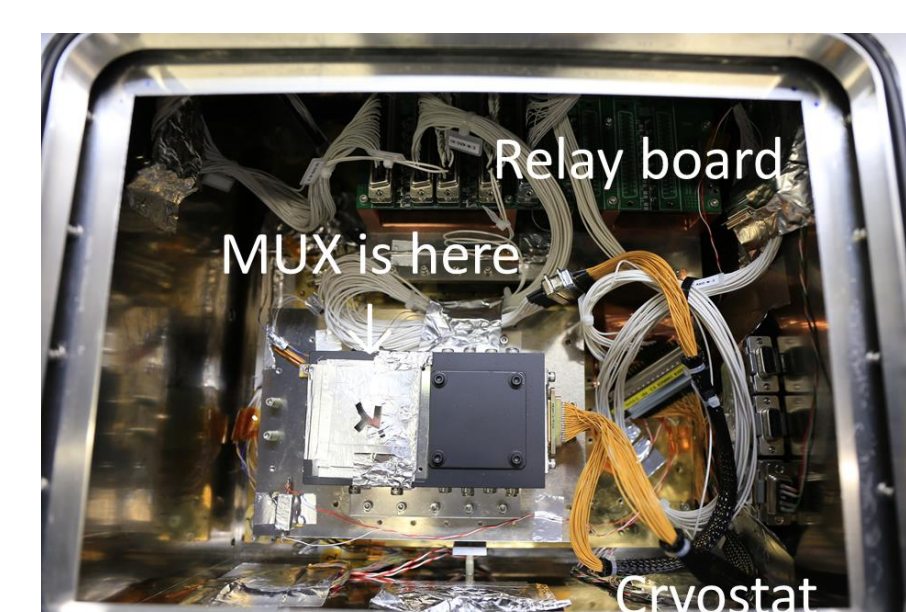


Figure 10. Cryogenic test for NIR MUX. (Left: Exp. setup, Right: Obtained frame).

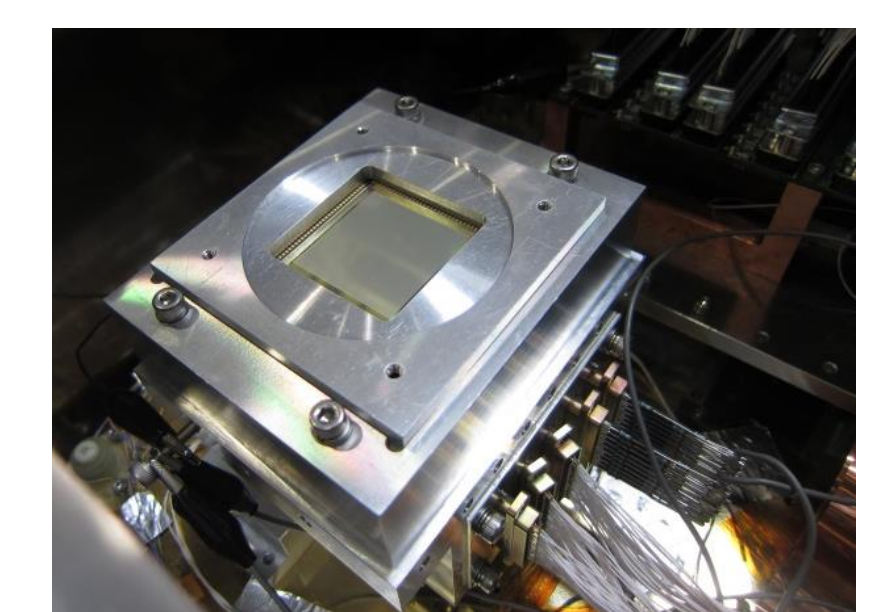


Figure 11. Cryogenic test for MIR-S MUX. (Left: Exp. setup, Right: Obtained frame).

(Half array)

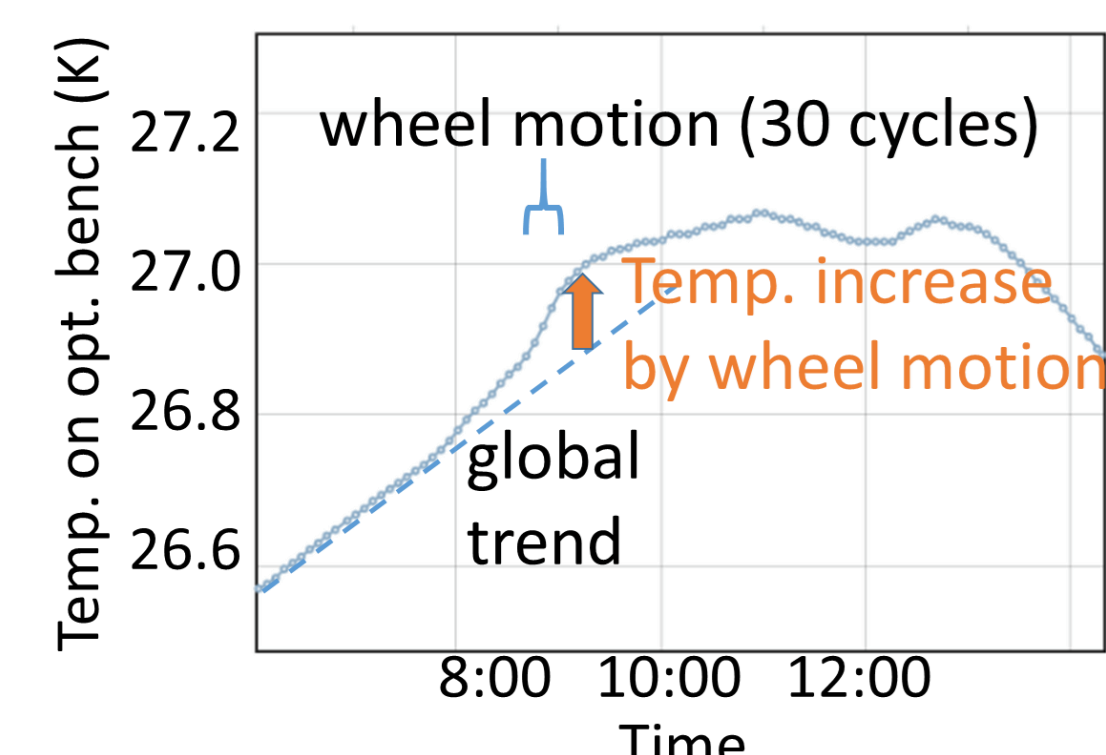
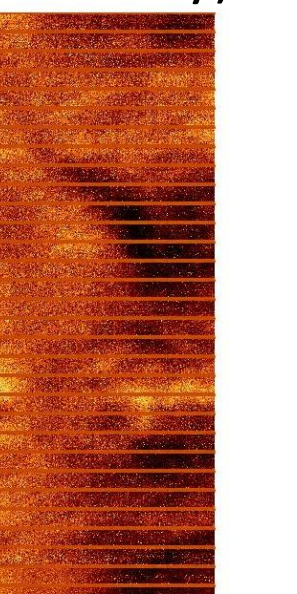


Figure 9. Temp. increase by wheel motion.

Acknowledge

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