

Development Status of NIR Camera/MOS Spectrograph

Kentaro Motohara (kmotohara@ioa.s.u-tokyo.ac.jp)¹, Masahiro Konishi¹, Hidenori Takahashi¹, Natsuko M. Kato¹, Yutaro Kitagawa¹, Yasunori Terao¹, Hirofumi Ohashi¹, Tsutomu Aoki², Mamoru Doi¹, Takafumi Kamizuka¹, Kotaro Kohno¹, Takeo Minezaki¹, Takashi Miyata¹, Tomoki Morokuma¹, Kiyoshi Mori¹, Ryou Ohsawa¹, Kazushi Okada¹, Shigeyuki Sako¹, Takao Soyano², Yoichi Tamura¹, Toshihiko Tanabe¹, Masuo Tanaka¹, Masahito S Uchiyama⁴, Shintaro Koshida³, Mizuho Uchiyama⁴, and Yuzuru Yoshii¹

1. Institute of Astronomy, University of Tokyo

2. Kiso Observatory, University of Tokyo

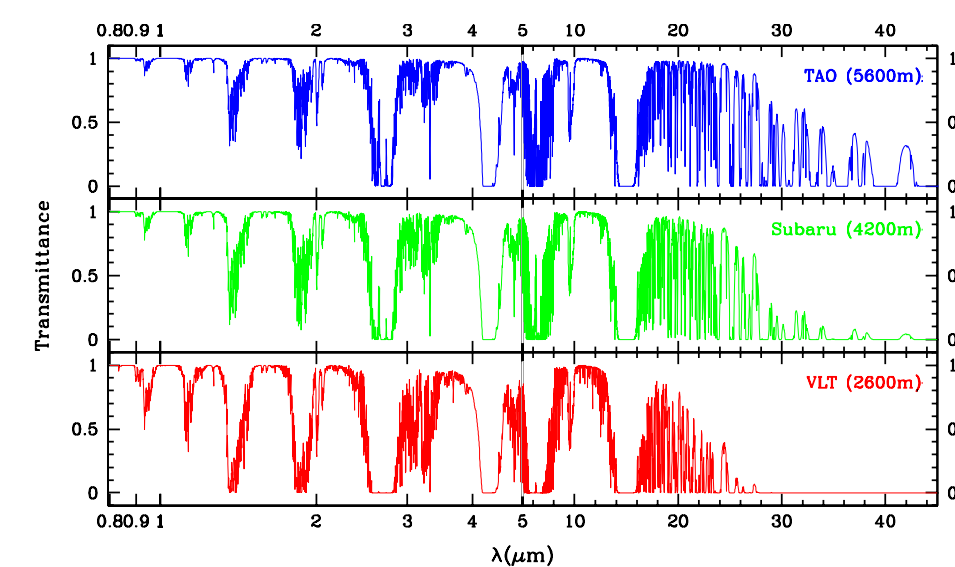
3. Subaru Telescope

4. National Astronomical Observatory of Japan

5. University of Denver

1. University of Tokyo Atacama Observatory : the Highest Observatory on the Earth

Institute of Astronomy, University of Tokyo is now constructing a 6.5m telescope at the summit of Co. Chajnantor (5640m altitude) in northern Chile, called the University of Tokyo Atacama Observatory (TAO) Project (PI: Yuzuru Yoshii).



(Left) Co. Chajnantor, an altitude of 5640m, is located at Atacama plateau in northern Chile.

(Middle) Simulated atmospheric transmittance by ATRAN. Blue line shows that at Co. Chajnantor(PWV=0.5mm), green at Mauna Kea (PWV=1.0mm), and red at 2600m altitude (PWV=2.6mm).

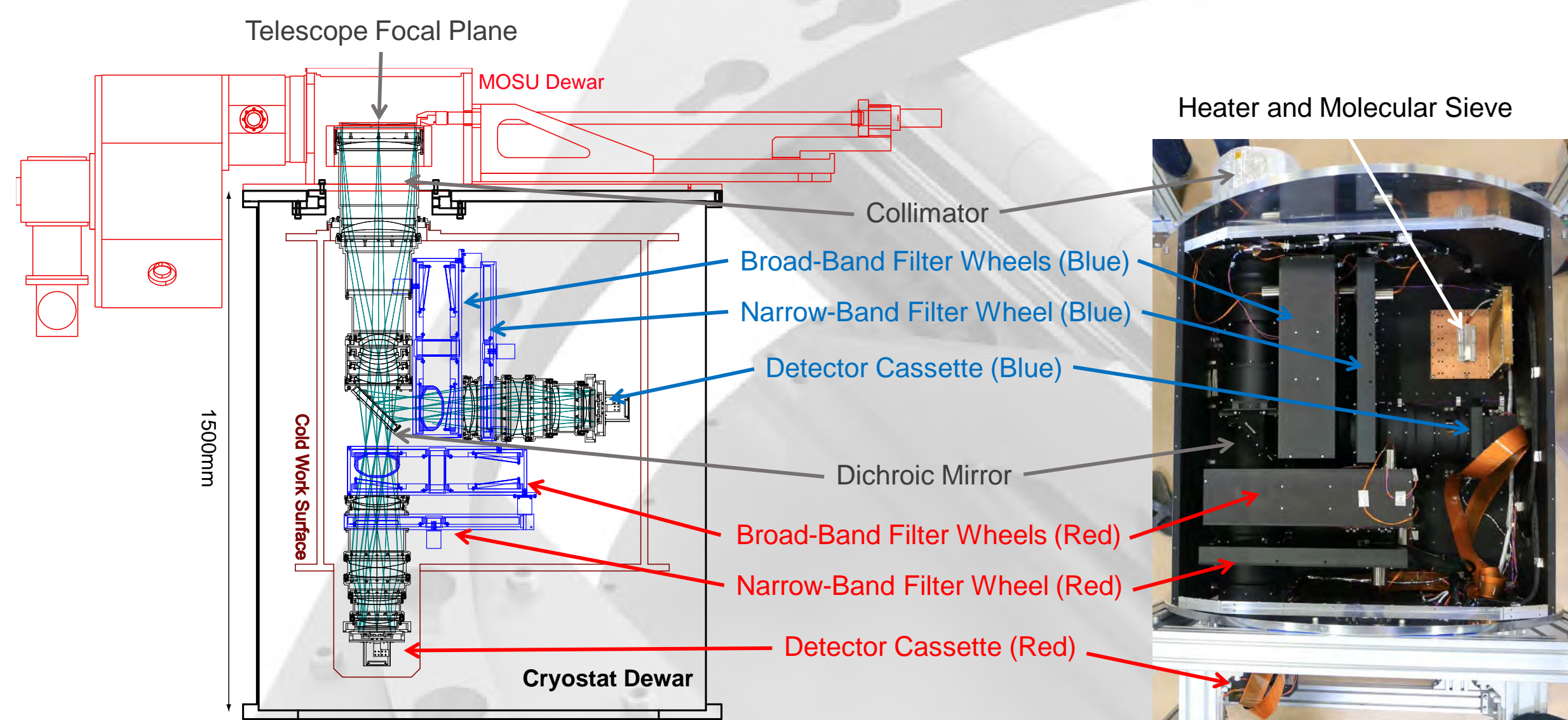
(Right) The 6.5m telescope, preassembled in Japan

SWIMS is on of the 1st generation instrument for the telescope, to cover the almost continuous atmospheric window which appears in the NIR wavelength of 0.9 to 2.5 μ m.

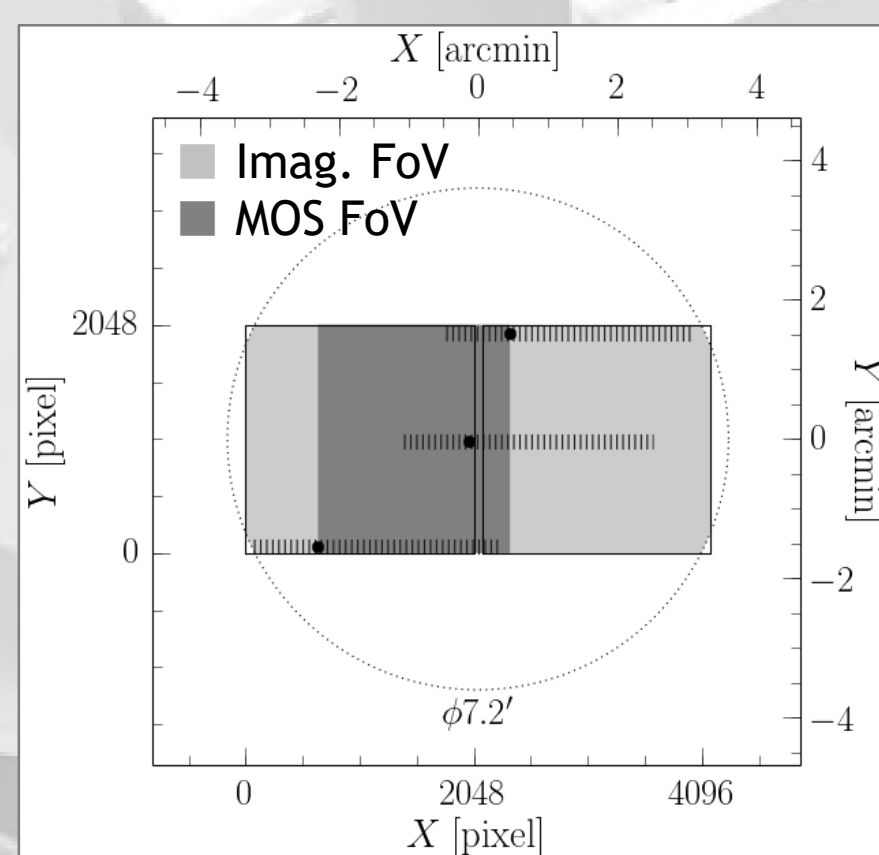
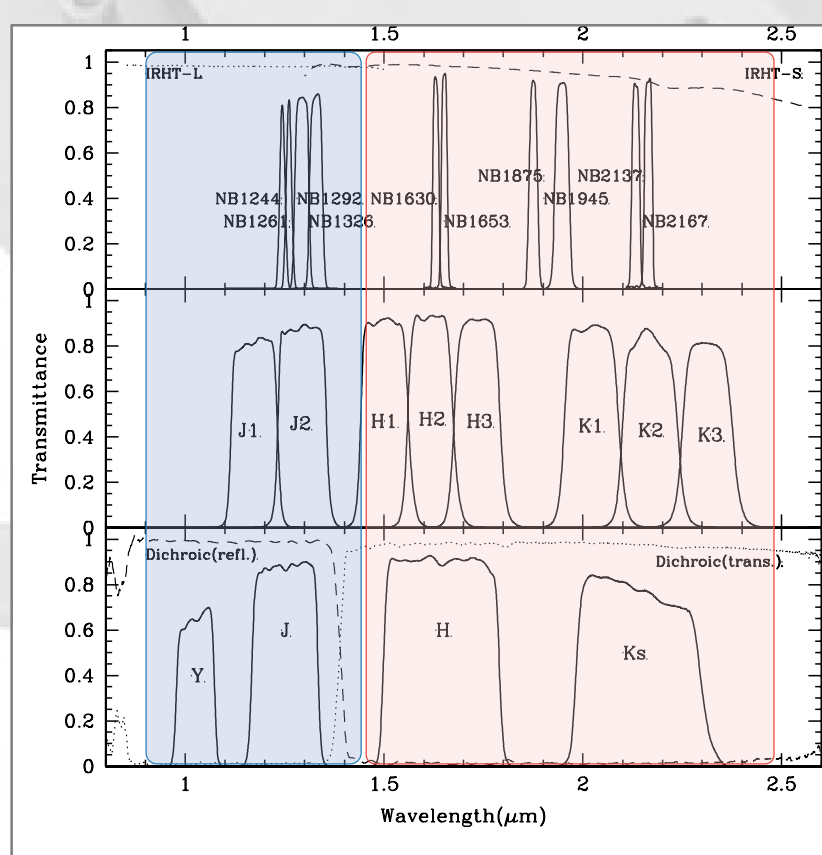
SWIMS will be carried into Subaru telescope on FY 2017, and is planned to carry out engineering observations.

2. SWIMS Overview

SWIMS is capable of simultaneous two-color imaging with a field of view of 9'.6 in diameter and $\lambda/\Delta\lambda \sim 1000$ multi-object spectroscopy at 0.9-2.5 μ m in a single exposure, utilizing a dichroic mirror inserted in the collimated beam.



Overall schematics inside the dewar of SWIMS. All the components fully assembled on the cold work surface.

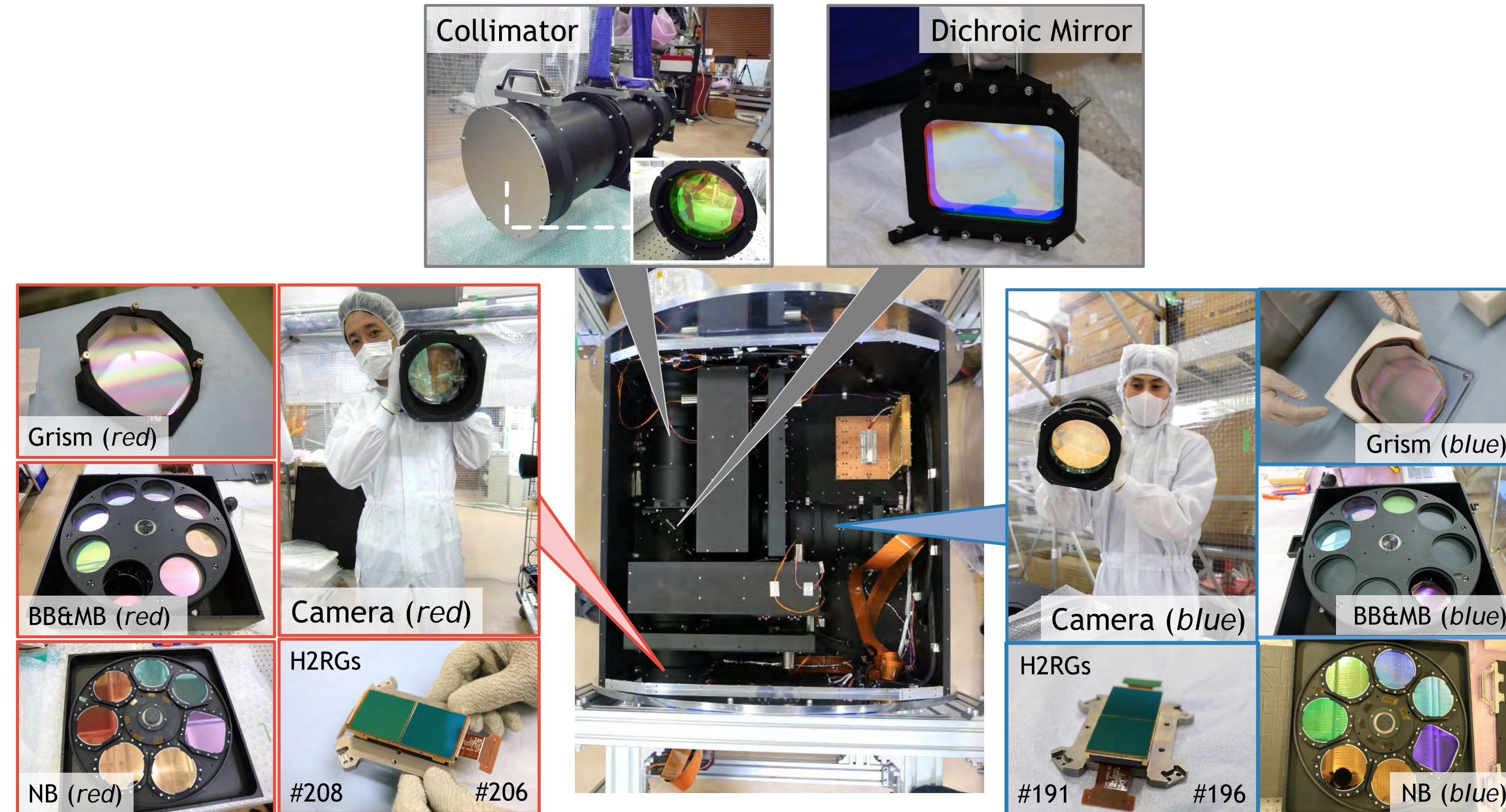


(Left) Transmittance curve of filters. (Right) Layout of field-of-views

Observation Mode	Imaging Multi-object spectroscopy(MOS) Integral field spectroscopy (IFS) : optional
Field of View (current)	8.2' \times 4.1' (Imag.), 3.5' \times 4.1' (MOS), 14" \times 5.1" (IFS)
Field of View (goal)	9.6' ϕ (Imag.), 3.5' \times 8.2' (MOS), 14" \times 10.2" (IFS)
Spatial Resolution	0.126"/pixel (@TAO)
Wavelength Range	0.9-1.45 / 1.45-2.5 μ m (blue / red arm)
Detector	HAWAII-2RG 2.5 μ m-cutoff (two arrays/arm)
Filters	
Broad-band (BB)	Y, J, H, K _s
Medium-band (MB)	J1, J2, H1, H2, H3, K1, K2, K3
Narrow-band (NB)	N1244, N1261, N1292 (Pa β), N1326, N1630, N1653, N1875 (Pa α), N1945, N2137, N2167
Grism	YJ (2.49 Å/pix, R ~ 900 - 1460 w/ 0.5" slit) HK (4.90 Å/pix, R ~ 740 - 1250 w/ 0.5" slit)
MOS multiplicity	~20 (40 goal) objects/mask (w/ 12" length per slit)
IFS parameters	0.5" sampling/slice, 13 (26 goal) slicers
System Throughput	Imag. ~ 40%, Spec. ~ 30%
Limiting AB mag (1hr, 5 σ)	
Imag.	Y=24.8, J=24.6, H=24.0, K _s =24.4
Spec. (R=1000, 0.5" slit)	Y=(TBD), J=21.1, H=20.4, K _s =20.4

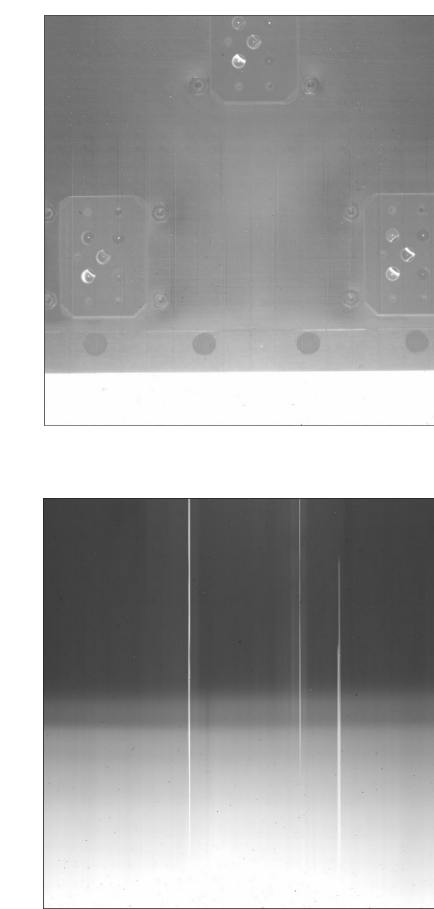
3. Assembly Status

All the components are fully installed!!



4. In-Laboratory Performances

- Image quality : OK
<1.5pix(0.2") FWHM both in imaging and in spectroscopy
- Image shift caused by flexure : OK : <2pix (from El=0 to 90degree)
- Detector RON : OK
<15 electron r.m.s. (with Fowler sampling)
- Six filter wheels operations : OK
- MOS exchanger operation : OK



(top) Pinhole image, and (bottom) pinhole spectra

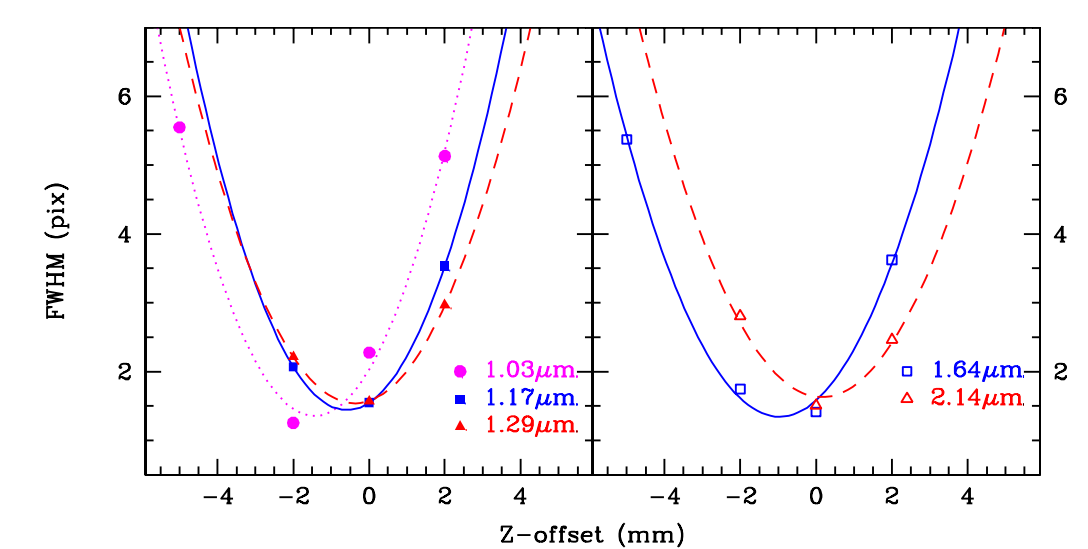
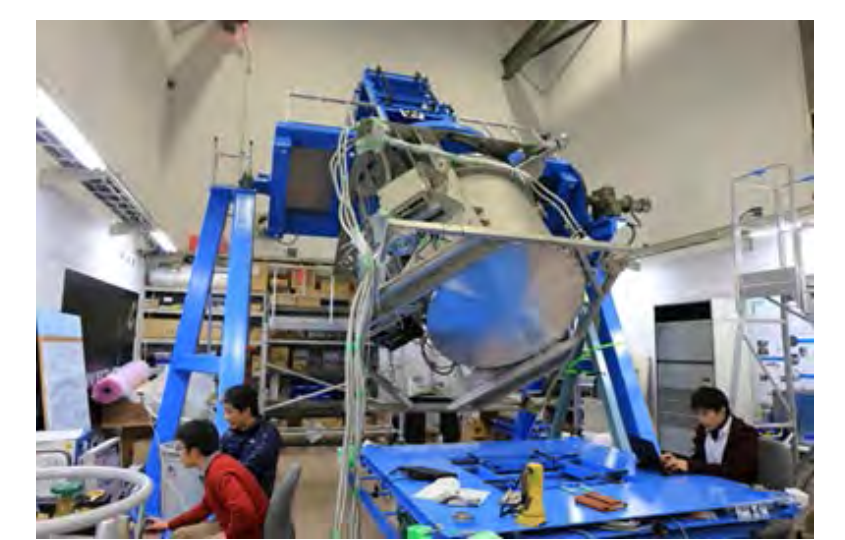


Image sizes of pinholes plotted against Z-axis offsets at the telescope focal plane for the blue arm (left) and the red arm (right).



SWIMS under flexure test

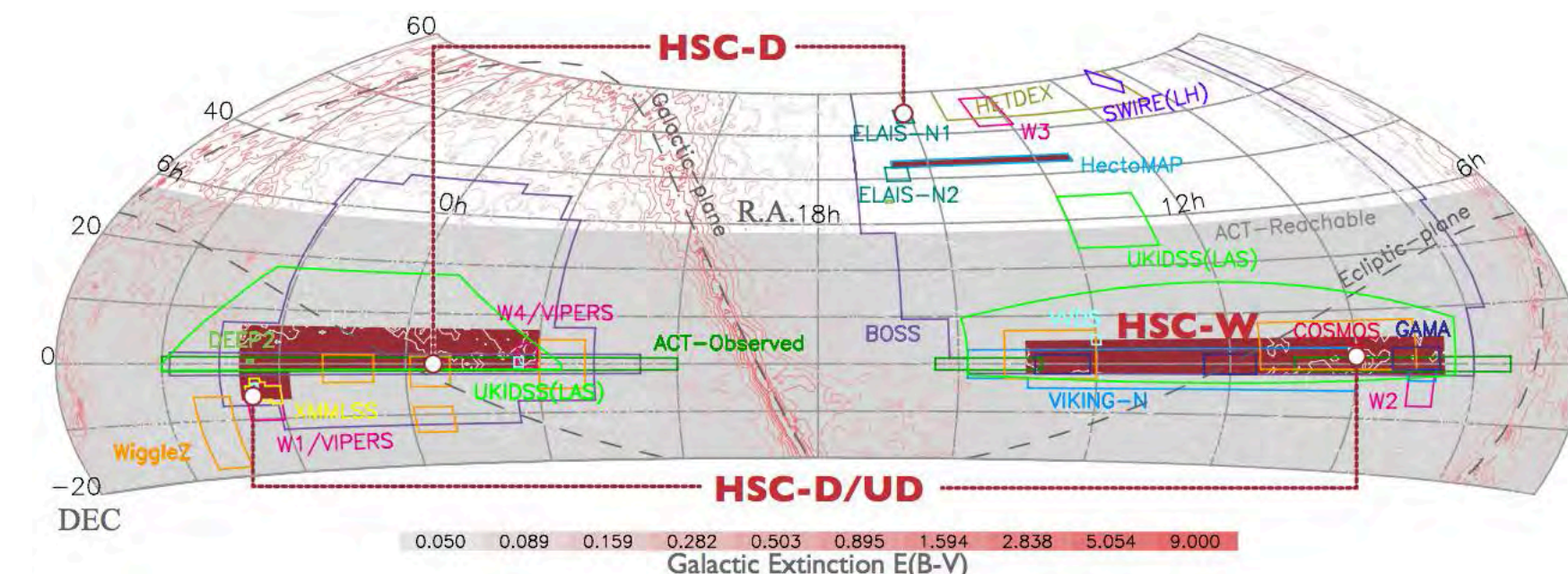
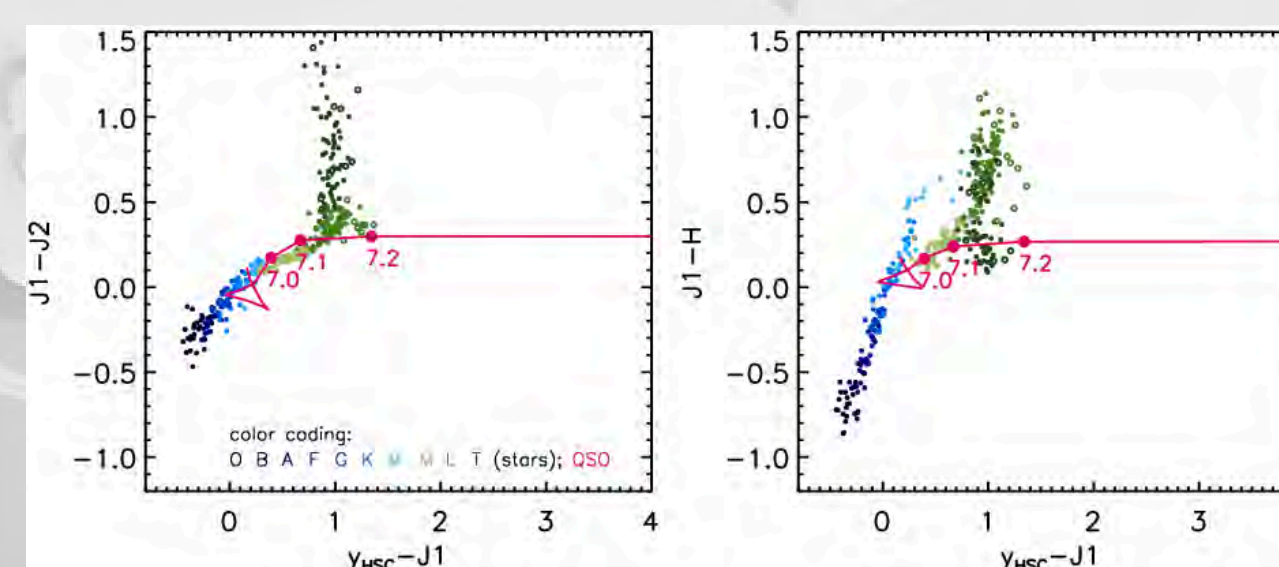
5. Target Sciences

[SWIMS18]

- NIR 18-band z=1-5 Galaxy Imaging Survey
- Medium-band filters : Y, J1, J2, H1, H2, H3, K1, K2, K3
 - Btter photometric redshifts
 - Balmer breaks features up to z=5
- Narrow-band filters : N1244, N1261, N1630, N1653, N2137, N2167
 - z=1.48, 1.52, 2.26, and 2.30
 - Pair detection of [OIII] and H α

[NIR Follow-up of Subaru/HSC QSO survey]

- Identification of z>7.2 QSOs
- 10-1000 \square° imaging



By courtesy of Y. Matsuoka

[And More...]

- Spectroscopic follow-up of SWIMS-18 galaxies, HSC/PFS surveys, ...
- IFU surveys, etc...

6. Future Schedule

2015/09
~2016/Q4

Subaru Acceptance Review : Completed.
Assembly and test at Mitaka, Tokyo

2017/Q2

Transportation to Hilo, Hawaii

2017/Q3

Re-assembly, performance verification
Engineering and first science observations at Subaru telescope

~ 2018/Q3

Gen2 software test
Imag./MOS performance test

2018/12(TBD)

Transportation to Chile

2019/3 (TBD)

First light observation at TAO 6.5m

