SWIMS Overview

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on behalf of SWIMS development team
and TAO project team

TAO PROJECT
The University of Tokyo Atacama Observatory

東京大学 大学院
理学系研究科・理学部
SCHOOL OF SCIENCE, THE UNIVERSITY OF TOKYO

東京大学
THE UNIVERSITY OF TOKYO

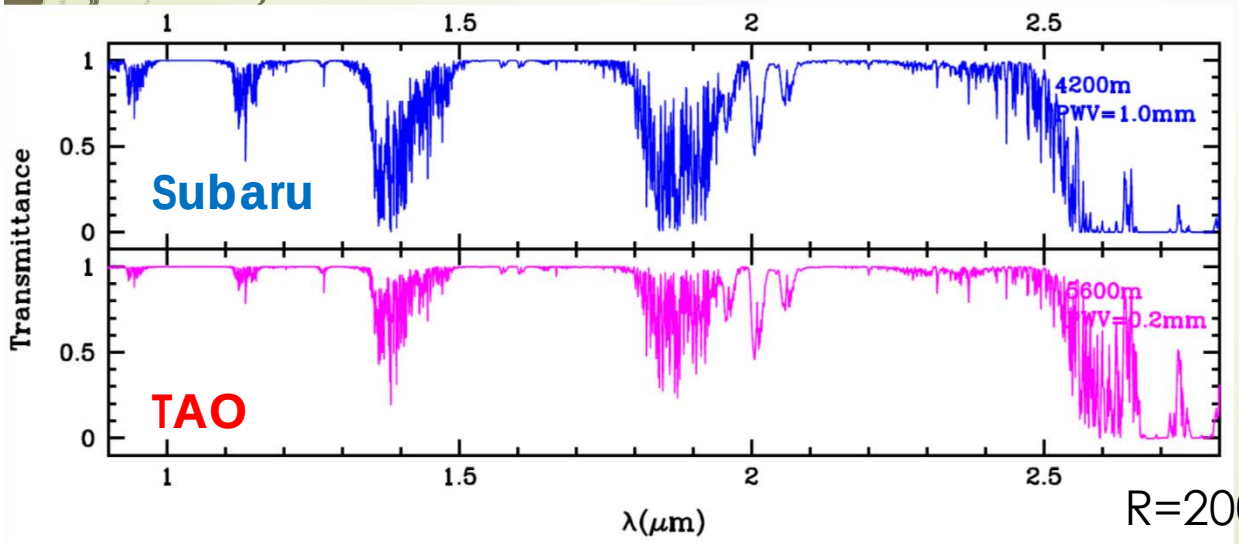
SWIMShrine

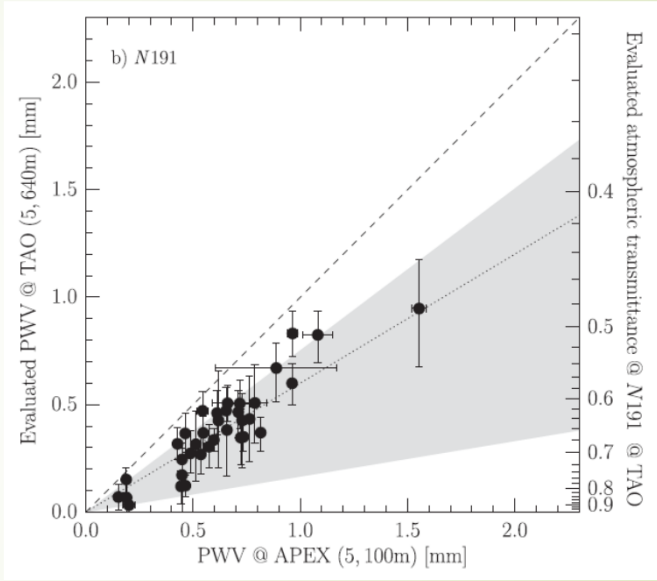
- 水無神社 : Usually pronounced “minashi jinja (shrine)”
- However, 水無神社 at Kiso-fukushina is called “Suimu jinja” !
- We now consider it to be the protective deity of SWIMS

http://www.nagano-jinjacho.jp/shibu/02cyusin/04kiso/suimu.html

Precipitable Water Vapor and Transmittance

- ✓ Satellite Survey : 0.5mm(25%-tile)
- ✓ NIR narrow-band imaging by miniTAO/ANIR
  - ✓ Utilizing NBF @ ~1.9μm
  - ✓ Lower than ALMA Site by 30-40% (Konishi, KM+15)
  - ✓ PWV<0.5mm, Far better than expected
- ✓ Provides continuous window in the NIR





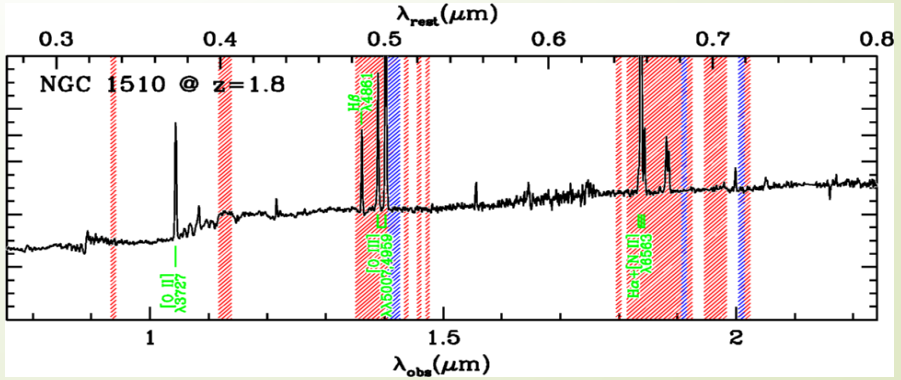
Konishi et al. 2015

R=2000 atmospheric transmittance

NIR Science at TAO Telescope

- Spectroscopic Survey of z>1 Galaxies : Probe Formation and Evolution of Galaxies at high redshift by
  - Metallicity Evolution
  - Gas inflow / outflow
  - Morphology

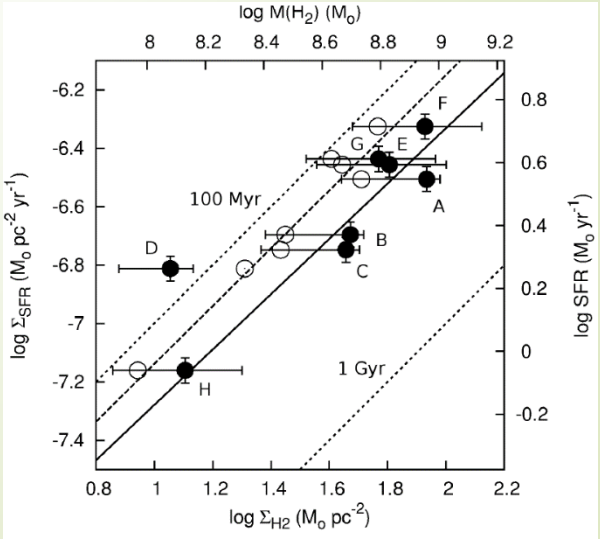
Supreme atmospheric condition provides us a seamless wavelength coverage in the NIR, which is very important for multi-line analysis in the rest-optical



Little transmittance at TAO Little transmittance at VLT

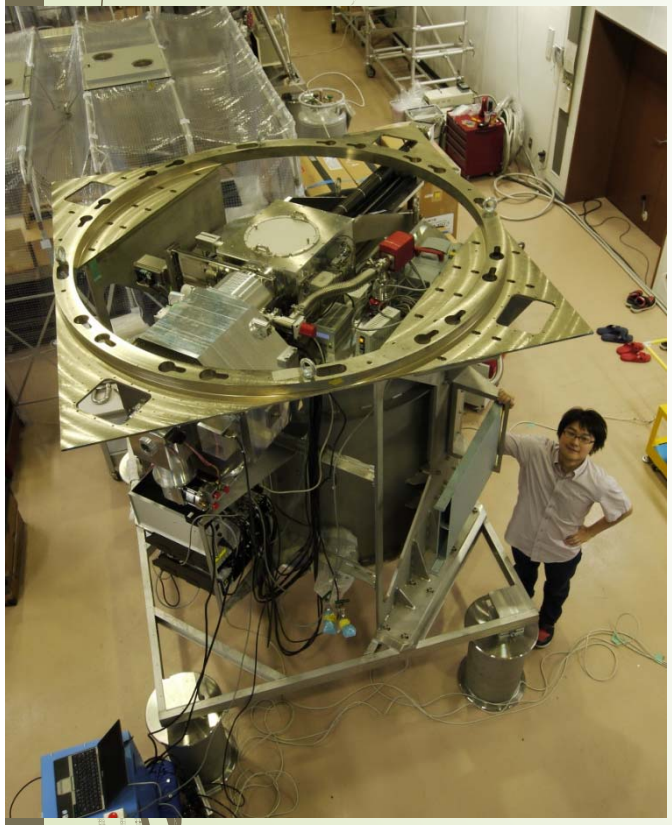
NIR Science at TAO Telescope (cont'd)

- Hydrogen Paschen-α Observations provide hidden activities in the local universe
  - Local star forming regions
  - Probe dust-obscured star formation in high spatial resolution and wide FoV, which is not attainable by FIR/Submm single-dish observations

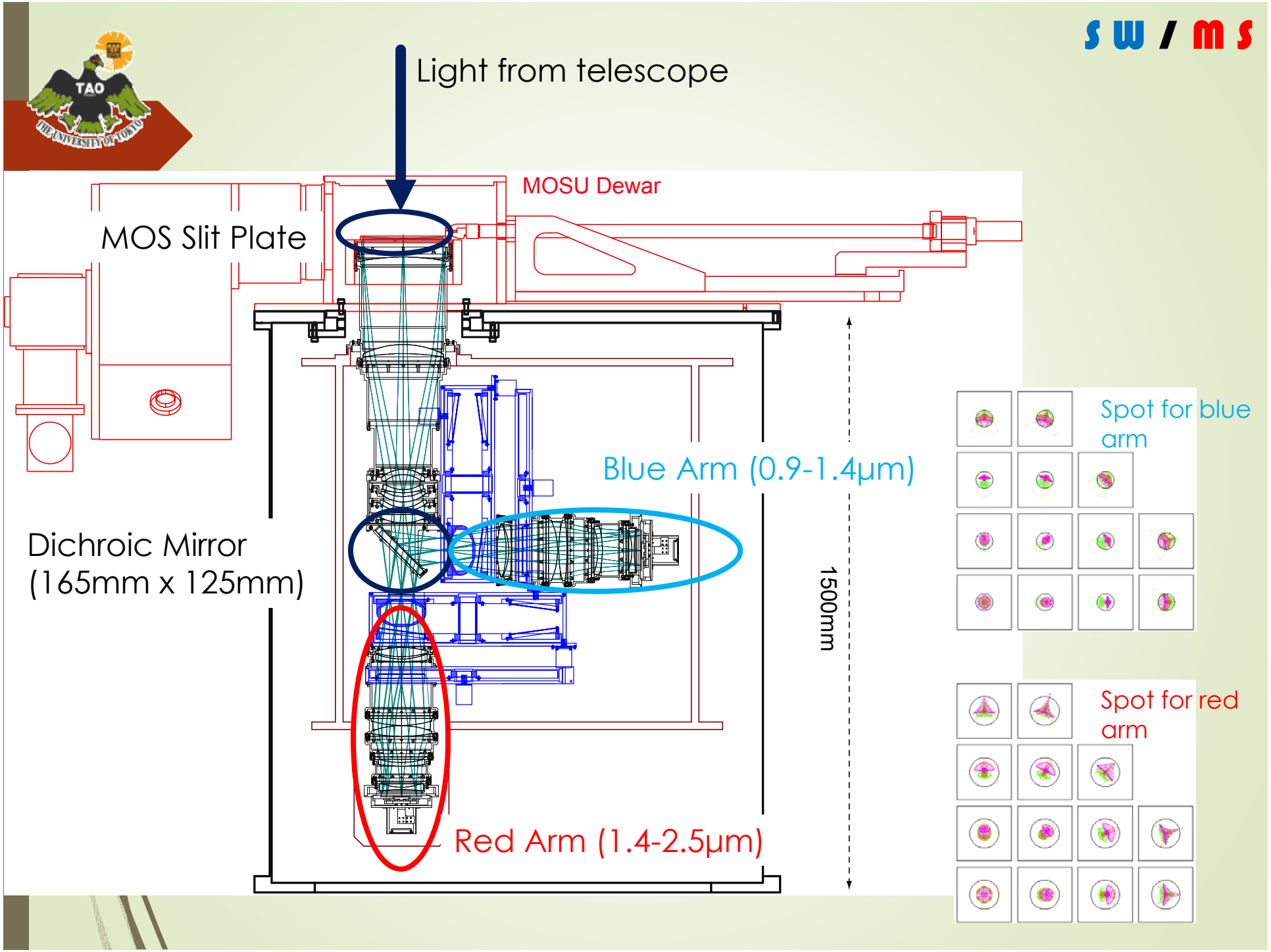


Very tight Kennicutt-Schimidt law discovered in VV114 by Pa α imaging (Komugi et al. 2012)

Main Features of SWIMS



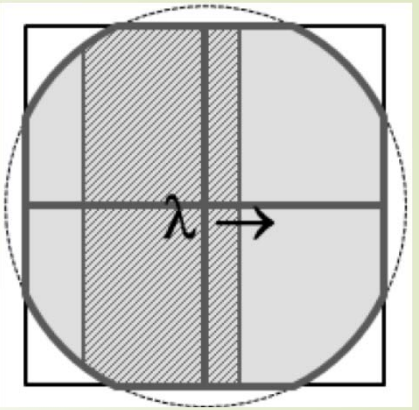
- Simultaneous two-color imaging/spectroscopy utilizing a dichroic mirror in the collimated beam
- Wide FoV of φ 9.6'covered by 4 HAWAII-2RG arrays for each channel
- 10 narrow-band filters, 8 medium-band filters and 4 broad-band filters
- MOS spectroscopy with R~1000, covering the whole wavelength of 0.9-2.5μm simultaneously
- Optional IFU unit enables us to carry out 3-D spectroscopy with FoV of 18" x 14"
- 2m x 2m x 2m, 2,5 tons

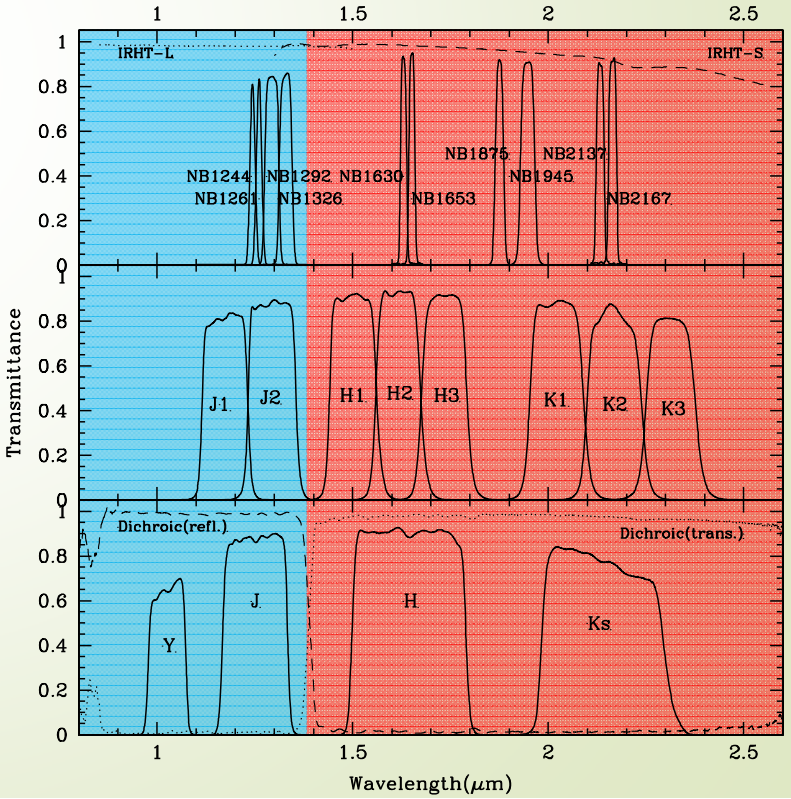

Light from telescope
MOSU Dewar
MOS Slit Plate
Blue Arm (0.9-1.4μm)
Dichroic Mirror
(165mm x 125mm)
1500mm
Red Arm (1.4-2.5μm)
Spot for blue arm
Spot for red arm

Imaging Capabilities

- φ 9.6' FoV
- Simultaneous 2-color observation
- Expected seeing is <0.6″, better than that at Paranal/VISTA(0.7″-1.0″),and can go deeper
- Various Filters
  - 4 Broad-band filters (Y, J, H, Ks)
  - 8 Medium-band filters (J1, J2, H1, H2, H3, K1, K2, K3)
    - Photo-z survey of hi-z galaxies (SWIMS-18)
  - 10 Narrow-band filters
    - Paα, Paβ, Redshifted Paα, Paβ
    - Redshifted (z>1) optical lines (SWIMS-18)

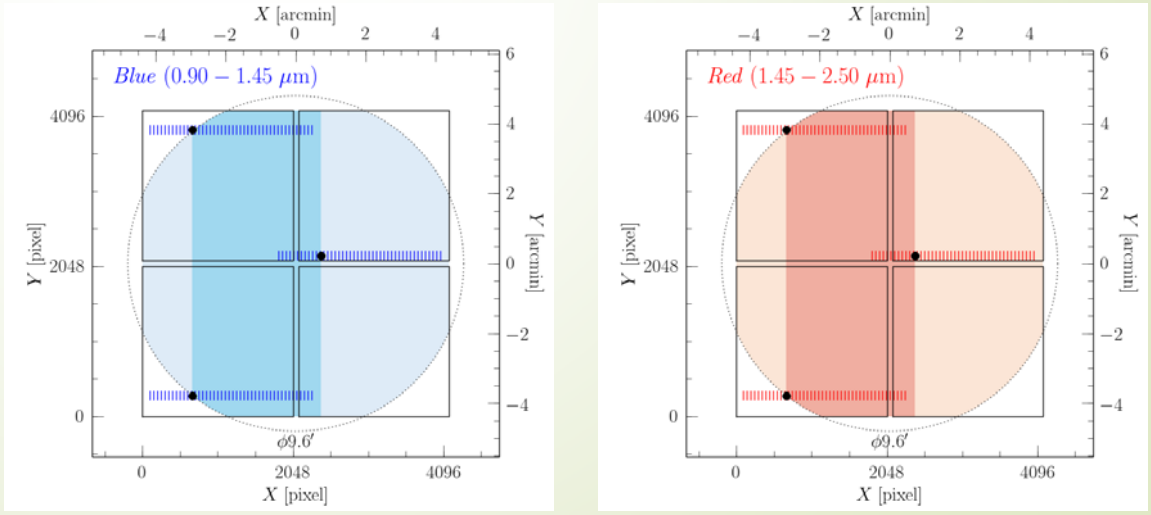
φ9.6'
0.126"/pix





Spectroscopy Capabilities

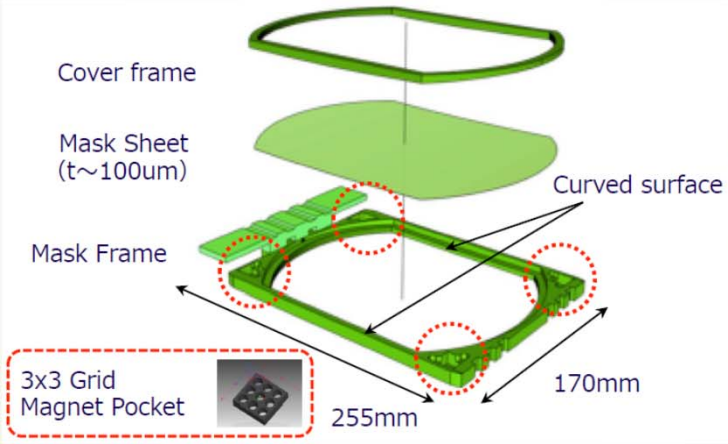
- 1 Grism for each arm
  - zJ-Grism : 2.49A/pix @ 0.9-1.4μm
    →R(λ/⊿λ)=900-1400 for 4pixel (0.5″) slit
  - HK-Grism : 4.90A/pix @ 1.4-2.5μm
    →R(λ/⊿λ)=700-1200 for 4pixel (0.5″) slit
- FoV in which full spectra can be obtained is limited to **8.6′ x 3.7′**

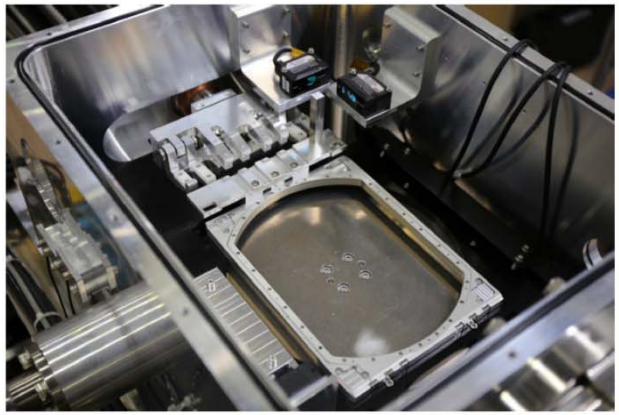


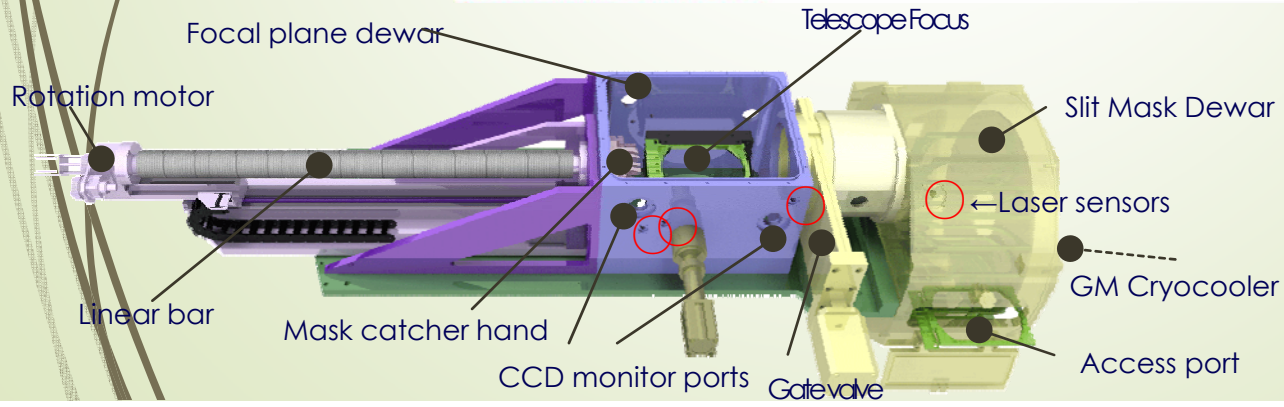
Extracted spectra distribution on the focal plane arrays.
Black dots represent positions of source in the imaging mode.

MOS Plate and Exchanger

- Max ~30 objects/mask (15″ slit width)
- Maximum ~20 slit masks are stored in the Slit Mask Dewar, as well as the IFU unit



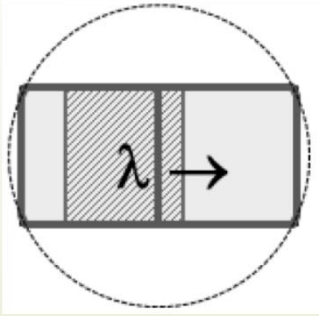




Takahashi, KM+14

SWIMS on Subaru

- Planned to be carried into Subaru telescope for engineering test and initial science
- Also open to the community as a PI-type instrument
- Spec. is different, due to the different telescope size
  - Due to the limited number of the detectors, FoV is limited to 6.6′x 3.3′
  - Pixel scale is 0.096″/pix → 20% lower spectral resolution with same slit width



6.6'x3.3', 0.096"/pix
@Subaru

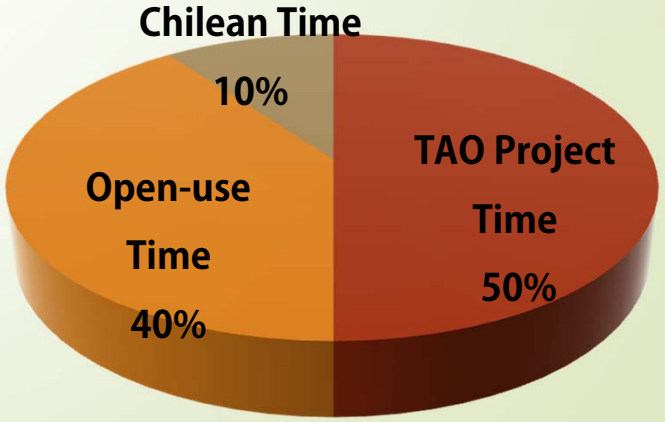
SWIMS

Schedule

- ~2016/2 : Assembly and test at Mitaka, Tokyo
- 2016/2-3 : Transportation to Subaru telescope
- 2016/4-2018/6 : Engineering and first science observations at Subaru telescope (will be served to open-use observations as a PI instrument)
- 2018/6 : Transportation to Chile
- 2018/12 : First light observation at TAO 6.5m

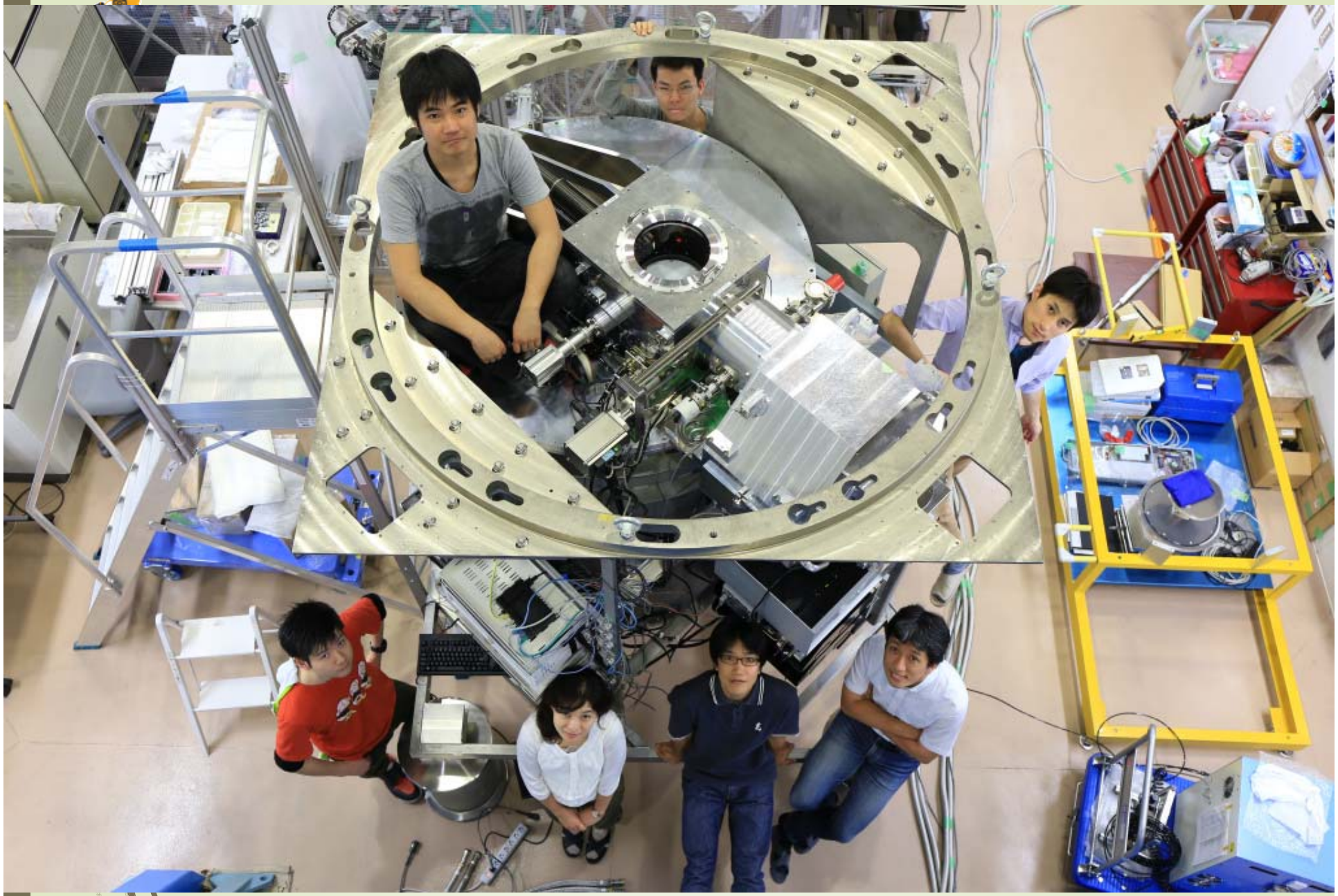
Large Telescope Time of TAO/SWIMS

- 50% of the total nights will be assigned to large projects (>150 Nights)
- 40% for Open-use time (>120 Nights)
- 10% for Chilean community
- Large, and long-timescale survey is possible
  - 600 nights/5yrs, why not?



Summary

- ✓ SWIMS is a 0.9-2.5μm Imager/MOS spectrograph
- ✓ FoV of φ9.6'
- ✓ Capable of simultaneous 2-color imaging, and of taking 0.9-2.5μm spectra in a single shot.
- ✓ Now being assembled and tested
- ✓ Scheduled to see the first light in FY 2016 at the Subaru telescope
- ✓ Will see the first light at TAO 6.5m telescope in 2018



SWIMS Development Team (2015/6)