PI type instrument
Yosuke Minowa
(New development group, Subaru telescope)
Outline

1. Role of the PI type instrument at Subaru
2. Acceptance procedure of the instrument
3. Lineup of the PI type instrument
4. Schedule of the new PI type instrument

Discussion:

Future of the PI type instrument at Subaru
Role of the PI type instrument

Subaru encourages to carry in the PI type instrument for:

1. **Unique science capability**
   - Complementary to the facility instrument
   - Can be a single purpose science to pursue the PI’s own science

2. **Test bed of the latest technology for future instrument**

3. **Flexible operation compared to the large facility instrument**
   - Short turnaround time (<5 yrs) from development to science output
   - Provide a good educational ground especially for graduate students
Carry-in proposal

Proposal is reviewed based on:
- Science merit
- Feasibility
- Impact to the observatory
  - Infrastructure
  - Man power
- Budget
- Schedule

If the carry-in proposal is approved,
- Subaru will support its installation and engineering observation.
  - Less supported by the observatory compared to the facility instrument.
- Science time is not guaranteed
  (PI team have to apply for the open use time).
Review process after the approval of the instrument

- The PI is occasionally requested to submit the status report, which will be reviewed by the internal review committee.

  - Readiness review:
    - before shipping to Hawaii
    - before transporting to the summit

  - Engineering acceptance review
    - before starting engineering observation.

  - Final acceptance review
    - before starting science observations.
Applying open use time

**Requirement**
- A fact sheet that summarizes the readiness and the performance
  - It must be provided by the PI team before the deadline of the proposal submission.
  - Referees will assess the feasibility of the proposed science based on the fact sheet.

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<tr>
<th>Table 2-1. Observing parameter for IFS mode</th>
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$^1$Only a part of the wavelength range is observed simultaneously; five (two) wavelength bands cover the whole wavelength range at Cassegrain (Nasmyth) focus.

$^2$Conditions: 30, in 1 lens, in 2 wavelength pixels, 30-minute exposure with present CCD. The estimated total efficiency in IFS mode with present and new CCDs is shown [here](#).

- Instrument operators must be provided by the PI team for engineering and science obs.
  - Subaru does not provide a support astronomer for the PI instrument.

**Who can apply?**
- Not only the PI team, but also general users can use the PI type instrument.
  - General users have to obtain permission from the PI.
  - Subaru strongly recommends the PI team open their instrument to general users.
New Rule from 2014:
Term of science operations

• The period of the PI type instrument operation is 3 years after starting science observations.

• If the PI wants to extend the operation, the observatory will review the instrument in terms of the following merits of the instrument.
  - Uniqueness
  - Importance of the proposed science case
  - Educational merit (instrument development, science)
Current PI type instruments lineup

Kyoto-3DII: Visible IFU spectrograph and Fabry-Perot imager — (PI: Sugai at IPMU)
- Moved to NsIR from Cassegrain. *K3DII at Cs is no longer available.*
- Provide the only IFU capability at the Subaru
- Used with AO188 at NsIR, which provides FWHM~0”.1 at R-band.
- IFU mode was successfully commissioned with AO188 at 2012
- Fabry-perot mode will be tested during S15A.
- CCD will be replaced from EEV to Hamamatsu FDCCD, which largely improve the sensitivity at around 9000A from S14B.

HiCIAO – Coronagraphic Image in Near-Infrared — (PI: Tamura, M. at Univ. of Tokyo)
- DI, SDI, PDI with and w/o coronagraph for exoplanet and disk survey
- Used with AO188, SCExAO at NsIR
- Start operation since 2008
- SEEDS program (120 nights) are on going until S15B *Tamura,M ’s talk tomorrow for SEEDS*

SCExAO – Extreme AO system in Visible and NIR — (PI: Guyon at Subaru) *Guyon’s talk, Jovanovic’s poster*
- High-contrast with pupil apodization with PIAA + Coronagraph
- Speckle nulling, Visible aperture masking interferometry
- Low-order Tip/Tilt IR WFS + High-order visible Pyramid WFS
- Used with AO188, HiCIAO, and CHARIS at NsIR
- Start Science operation with Phase-I capability (Coronagraph, LOWFS, Speckle nulling) since 2014.

RAVEN – Multi-Object AO system — (PI: Bradley at Univ. of Victoria) *Oya’s talk*
- Simultaneous observation of two objects within Φ3’.5 FOV
- Used with IRCS at NsIR
- Test bed for TMT MOAO system (first MOAO science demonstrator)
- Successful first light on 2014A
- Available at the Subaru until S15A.

All located at NsIR!
“Approved” new PI type instruments

**CHARIS – IFU spectrograph in NIR** — (PI: Kasdin at Princeton)
- Exoplanet search and characterization of its atmosphere
- J + H (+ K), R~40, > 1.8” x 1.8”
- Use with AO188, SCExAO
- Start commissioning from S16A

*Guyon’s talk for more detail*

**IRD – High-Dispersion Spectrograph with laser comb** — (PI: Tamura, M at Univ. of Tokyo)
- Systematic radial velocity survey of M-type star
- R=70,000, Y, J, H, Optical Frequency Comb (OFC), < 1 m/s
- Fiber feed from AO188
- Spectrograph will be installed to the Coude room
- *Recently, IRD is approved as a new PI instrument at Subaru by the Subaru’s internal review committee*

- *First light will be at the end of S15B or beginning of S16A*

*Kotani’s talk for more detail*
“Proposed” new PI type instruments

GIGMICS : MIR high-dispersion spectrograph — (PI: Hirahara at Nagoya Univ.)
- Study of physical and chemical condition of interstellar molecules
- Germanium immersion grating echelle spectrograph —> R~40,000 at 8-13 micron
- Engineering obs. is requested to be conducted at S16A or later.
- Stay only 1 or 2 semesters at Subaru.

TAO 6.5m telescope’s facility instruments.
- Provide opportunities for initial instrument test
- Perform early science with Subaru

SWIMS – NIR wide field multi-color imager and MOS muti-color — (PI: Motohara at Univ. of Tokyo)
- 3’.3 x 6’.6 FOV at Subaru
- Simultaneous two-band imaging at NIR (zJ and HK)
- Wider spectral coverage than MOIRCS
- First light will be at the end of 2016.

MIMIZUKU – MIR multi-filed imager and spectrograph — (PI: Miyata at Univ. of Tokyo)
- Wider wavelength coverage than COMICS: 2-26 micron
- Field stacker
- enable precise photometry in mid-infrared by simultaneously observing science and reference objects in the discrete two fields

Konishi’s poster

Kamizuka’s poster
## Schedule of the PI type instruments

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Cf. Facility Instrument

| PFS   | H. Murayama | IPMU |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |

![Color key]

- **Science Operation Phase**
- **Engineering Phase**
- **TBD**

- K3DII (Cs) is now moved to NsIR and no longer available at Cassegrain.
- HiCIAO and K3DII (NsIR) will be decommissioned in 2015, if there is no proposal from the PI to extend the operation.
- GIGMICS installation has been delayed to 2016 or later.
Discussion:
Future of the PI type instruments at Subaru

1. Acceptance of the large PI type instruments
2. Acceptance procedures of SWIMS/MIMIZUKU
3. PI type instruments in the era of TMT
Discussion (1)
Acceptance of the large PI type instruments

• Nowadays, PI type instruments are no longer small instruments, but are large instruments comparable to or even larger than the 1st or 2nd gen. facility instruments in terms of the size, budget, and/or science operation (e.g. IRD, SCExAO, GIGMICS, SWIMS, MIMIZUKU)
  • We have to follow the almost similar acceptance procedure as the facility instrument.

• On the other hand, the Subaru’s resources (HR, infrastructure such as electricity and cooling water, budget) are limited and already consumed by the larger facility instruments (HSC, PFS)

• Subaru is trying to encourage the activity of the PI type instruments, especially for the exoplanet instruments, which is not covered by the future survey type facility instruments, but probably the observatory cannot accommodate the request from the PI team as proposed with the existing resources.
  • Some restrictions (such as schedule delay, limited terms of the operation, etc.) may occur.

• Most of the PI type instruments are/will be installed at NsIR
  • Makes time allocation at the NsIR difficult
  • PI instruments have to be lower priority than the facility instrument
Discussion item (2)
Acceptance of SWIMS/MIMIZUKU

• SWIMS/MIMIZUKU are TAO’s facility instruments who proposed to carry out the commissioning and initial science verification at the Subaru. Subaru internal reviewers (+ some external reviewers for judging science importance) are reviewing their proposal to see if we can approve to carry in SWIMS/MIMIZUKU to the Subaru.

• Even if they are approved, we cannot accommodate them without decommissioning or hibernating the existing facility instruments because of the lack of the Subaru’s resources.

• If their carry-in proposals are approved,

Our plan is to hibernate MOIRCS/COMICS, which have similar capabilities as SWIMS/MIMIZUKU.

- In order not to loose the existing functions offered by MOIRCS/COMICS while commissioning SWIMS/MIMIZUKU, we cannot accept SWIMS and MIMIZUKU simultaneously, because of the limitation of the Cs flange and electricity at the Subaru’s obs. floor.

- We will start from the SWIMS commissioning first while operating MOIRCS and COMICS as usual.

- Once we confirmed the readiness of the SWIMS for science operation, we will hibernate MOIRCS operation.

- Follow the same procedure for MIMIZUKU/COMICS after SWIMS offered to the open use.

- We also have possibility to decommission MOIRCS/COMICS.

  - This topic will be discussed on 1/15 (Thu) by Iata-san.

• Is this acceptance procedure reasonable for the community?
**Discussion(3)**

**PI type instruments in the era of TMT**

- Subaru’s Future Strategy toward 2020
  - Concentrate on the wider field survey with HSC, PFS, and ULTIMATE.
  - Most of 1st and 2nd generation facility instruments will be decommissioned.

- How can we accommodate science which cannot be performed with the wide field survey instruments and TMT?
  - For example, TMT 1st gen. instrument will not have high-contrast imaging and/or high-resolution spectrograph capabilities, which are important for exoplanet science.
    - ex.) SCExAO could beat 1st gen. TMT in terms of the contrast
  - Deformable secondary mirror, which is a part of the ULTIMATE-Subaru project, should enhance the uniqueness of those capabilities at Subaru by implementing high-performance AO with DM2 to the existing PI-type and facility instruments (SCExAO, IRD, HDS).

- In 2020, can we expect more strategic observations with the PI type instruments (especially for exoplanet studies)?
  - Do we need to change the current PI-type acceptance policy with limited support from the observatory?

- In 2020, do we need the PI type instrument at Subaru?
  - We might need to consider about the PI type instrument at the other observatories (Keck, Gemini?), by extending the concept of the time exchange between the Maunakea observatories.