Instrument Report

Takashi Hattori (Instrument Division, Subaru Telescope)

Subaru UM2022

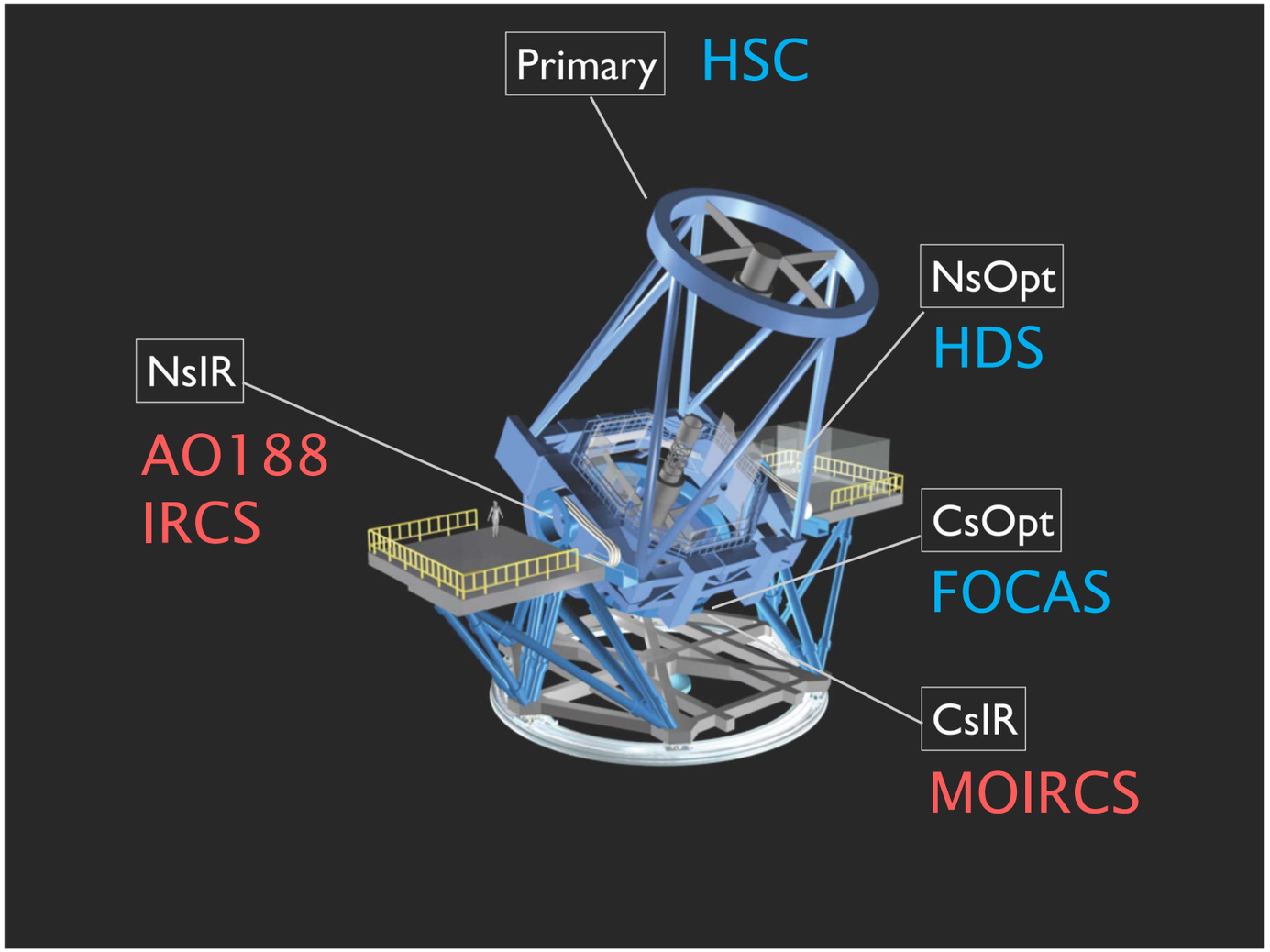
Outline

- InstDiv new member
- Facility instrument status
- Current PI instruments
- Planned PI instruments

InstDiv new member

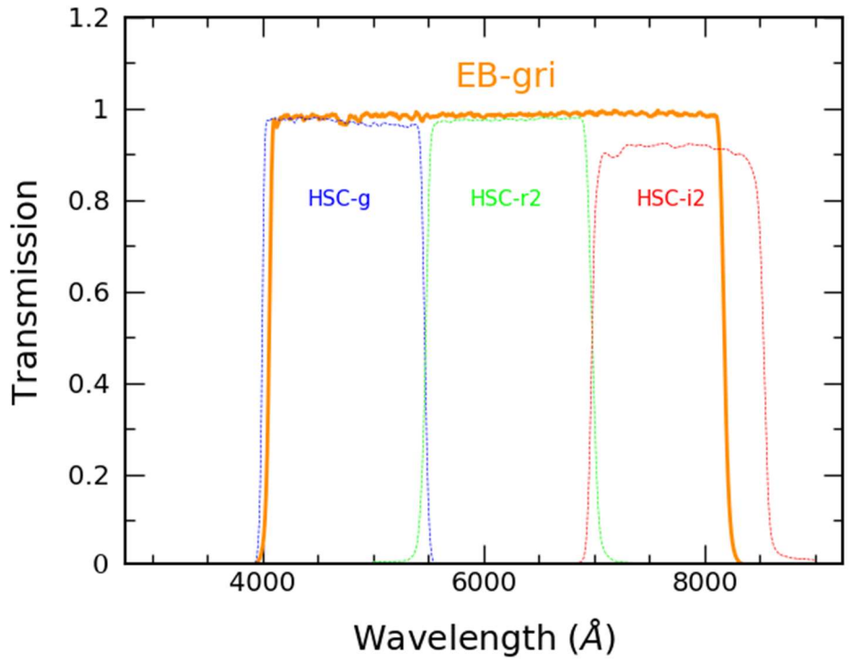
- Gee, Wilfred
  - PFS/Instrument software engineer (PFS:other instruments=1:1)
  - since June, 2022
- Morihana, Kumiko
  - Instrument/research specialist (PFS:other instruments=1:1)
  - since July, 2022

Facility Instrument status



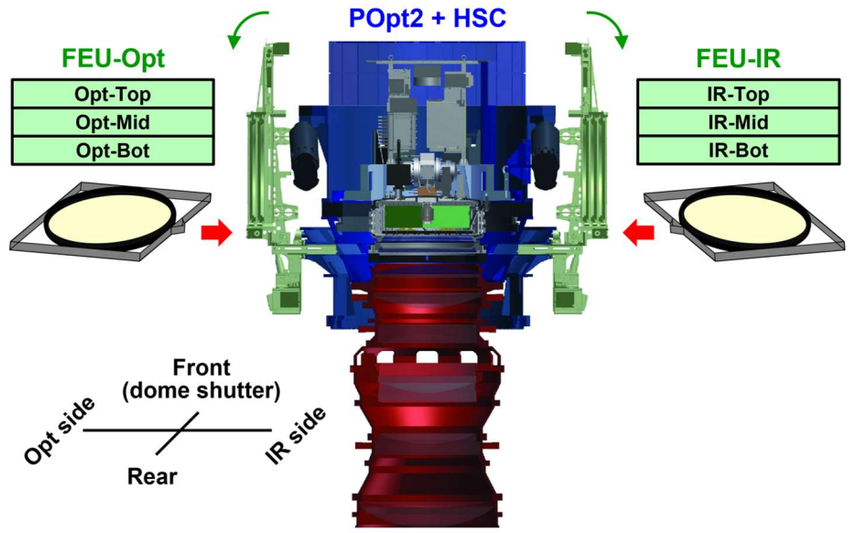
HSC

- Filter management
  - newly opened user filters
    - S22B : NB506, EB-gri
    - S23A : NB872
  - project to fabricate medium-band filters
    - P09 Nishizawa et al.



HSC

- Filter management
  - FEU-OPT filter exchange
    - to increase the number of filters usable in an observing run
    - only 2-3 HSC runs in a semester
    - every run in S22B-S23A

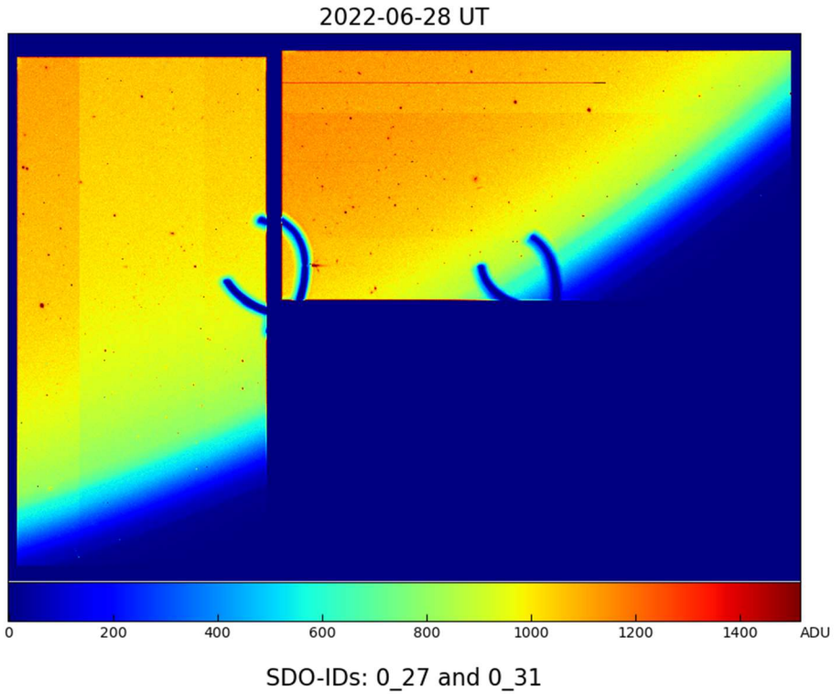


Date	Opt-Top	Opt-Mid	Opt-Bot	IR-Top	IR-Mid	IR-Bot
10/18-10/23	EB-gri	NB816	HSC-g	NB921	HSC-r2	HSC-i2
10/24-11/2	HSC-z	NB497	HSC-g	NB921	HSC-r2	HSC-i2

2022-October run

HSC

- CCD readout issues (follow-up from FY2021 report)
  - https://www.subarutelescope.org/Observing/Instruments/HSC/hsc_ccd_anomaly.html
  - shadows by broken cable ties



HSC

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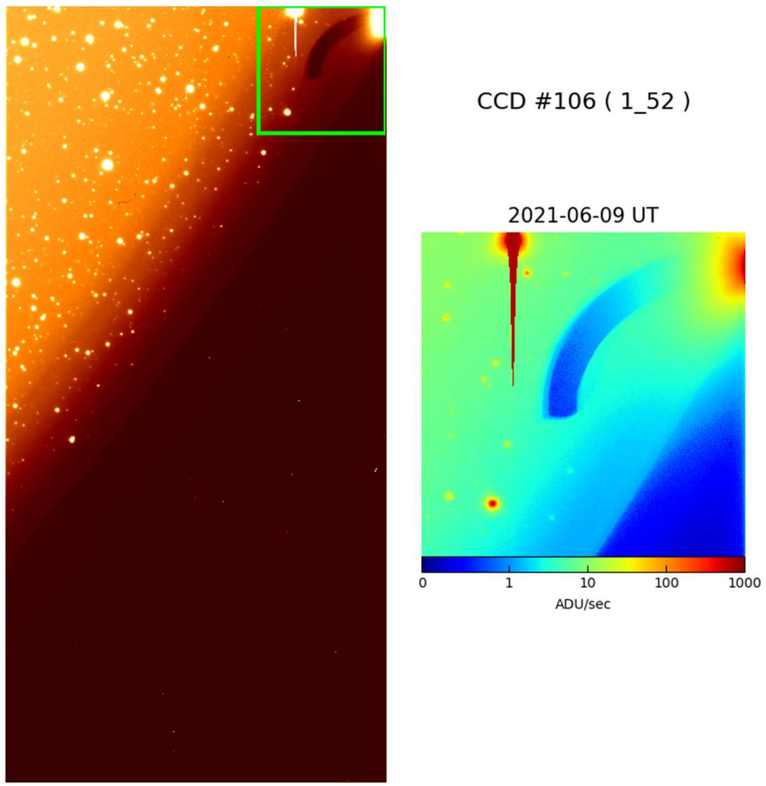
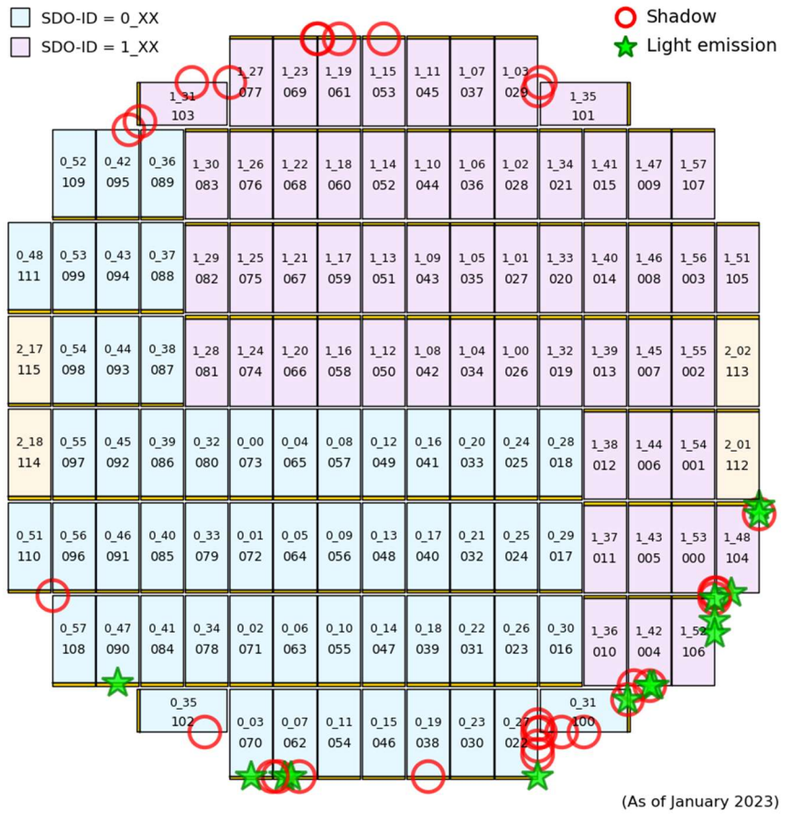
  - https://www.subarutelescope.org/Observing/Instruments/HSC/hsc_ccd_anomaly.html
  - shadows by broken cable ties
    - a few broken cable ties
    - sometimes it causes emission
    - does not enter the space between CCD and window
      - only limited to the edge of the FoV



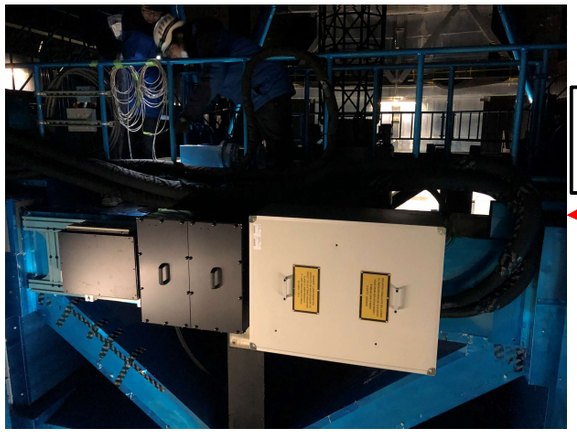
HSC

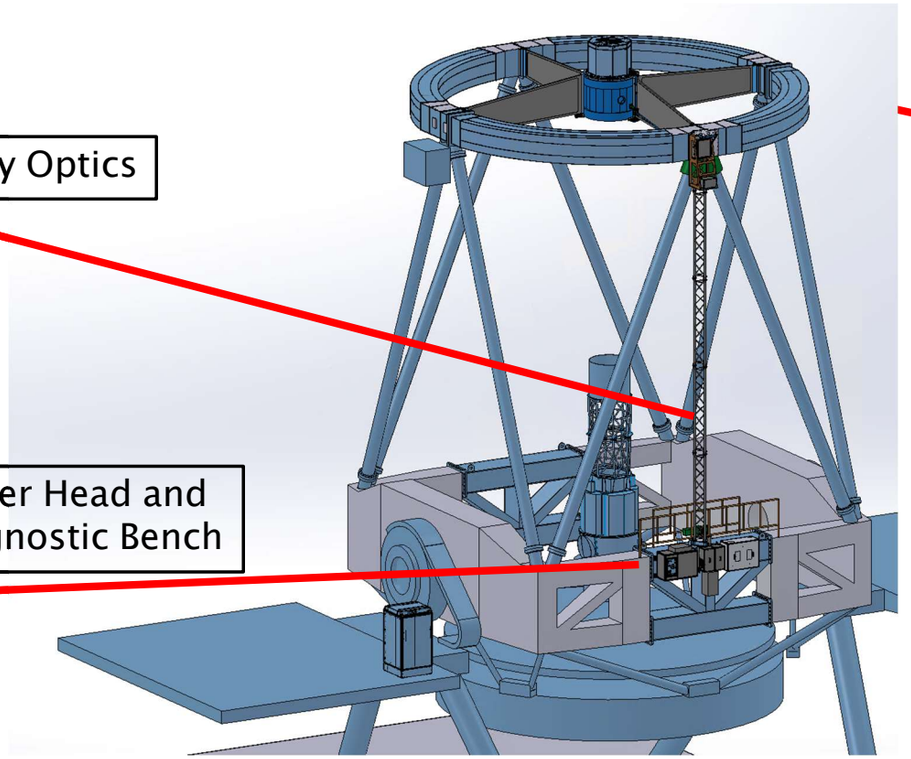
- CCD readout issues (follow-up from FY2021 report)
  - https://www.subarutelescope.org/Observing/Instruments/HSC/hsc_ccd_anomaly.html
  - shadows by broken cable ties
    - a few broken cable ties
    - sometimes it causes emission
    - does not enter the space between CCD and window
      - only limited to the edge of the FoV
      - location of the shadow changes with time
    - opening the Dewar will be the only way to solve
  - possible overhaul work
    - proposed by HSC development team
    - CCD replacements, maintenance for cabling etc.
    - 0.5-1 year down time, huge amount of work

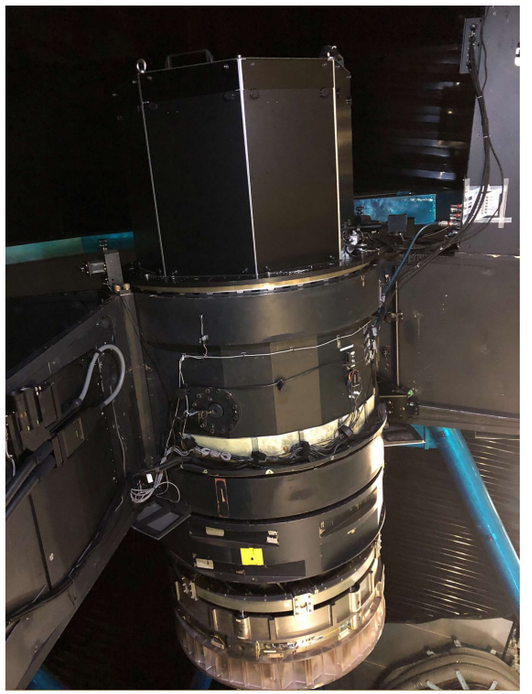


LGS/AO188

- new Laser Guide Star Facility system
  - All of the laser components were successfully installed in 2021



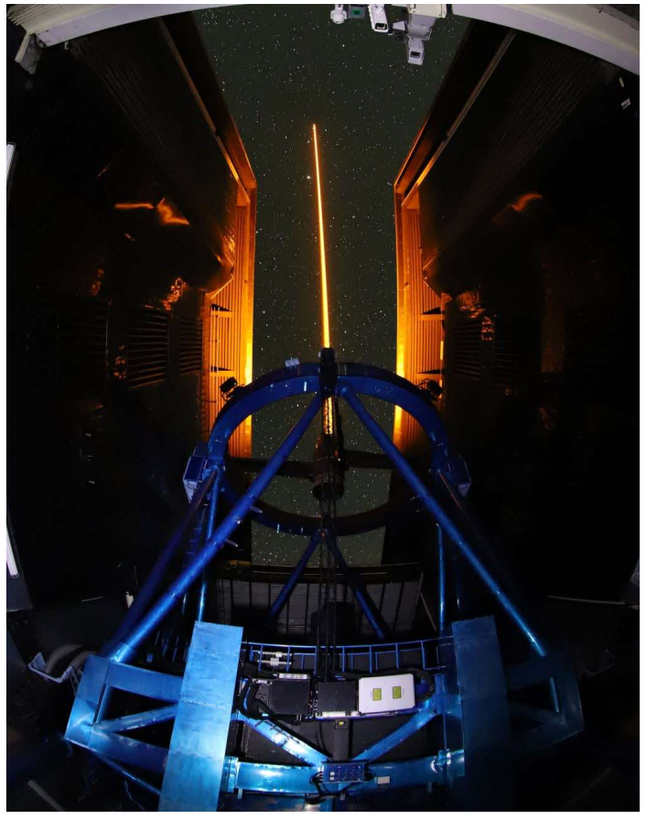


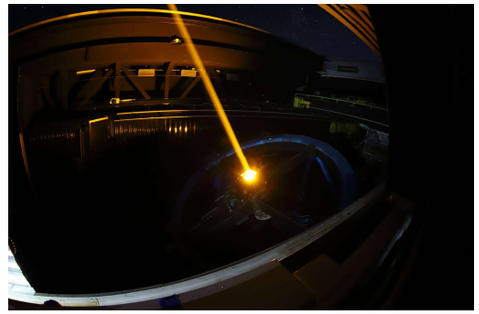


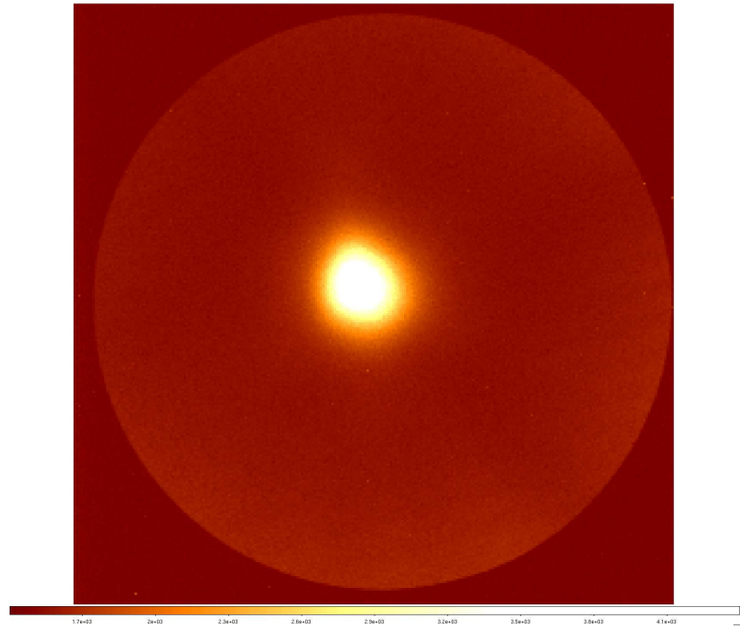
Laser Launching Telescope (LLT)

LGS/AO188

- new Laser Guide Star Facility system
  - successfully achieved the first light on 3/2/2022



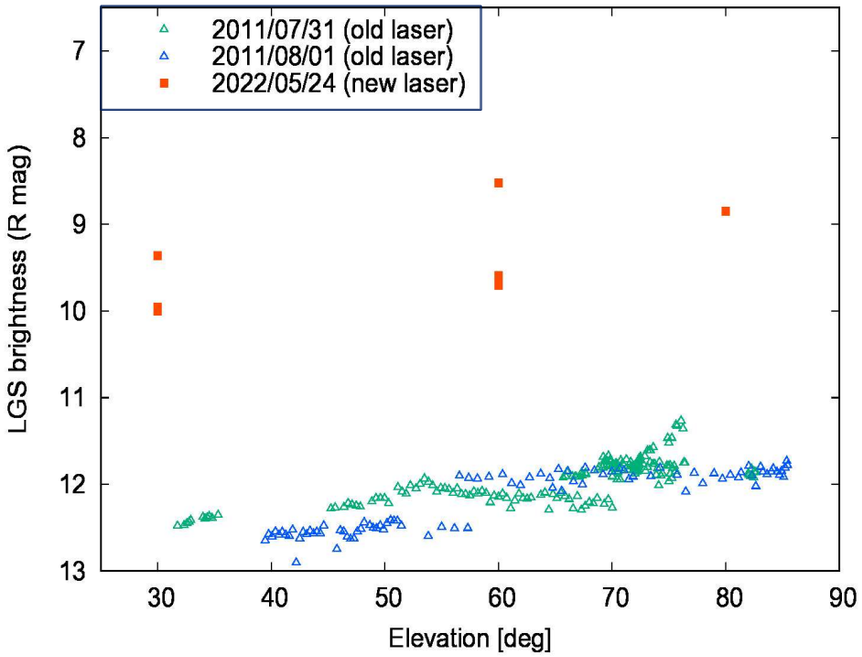




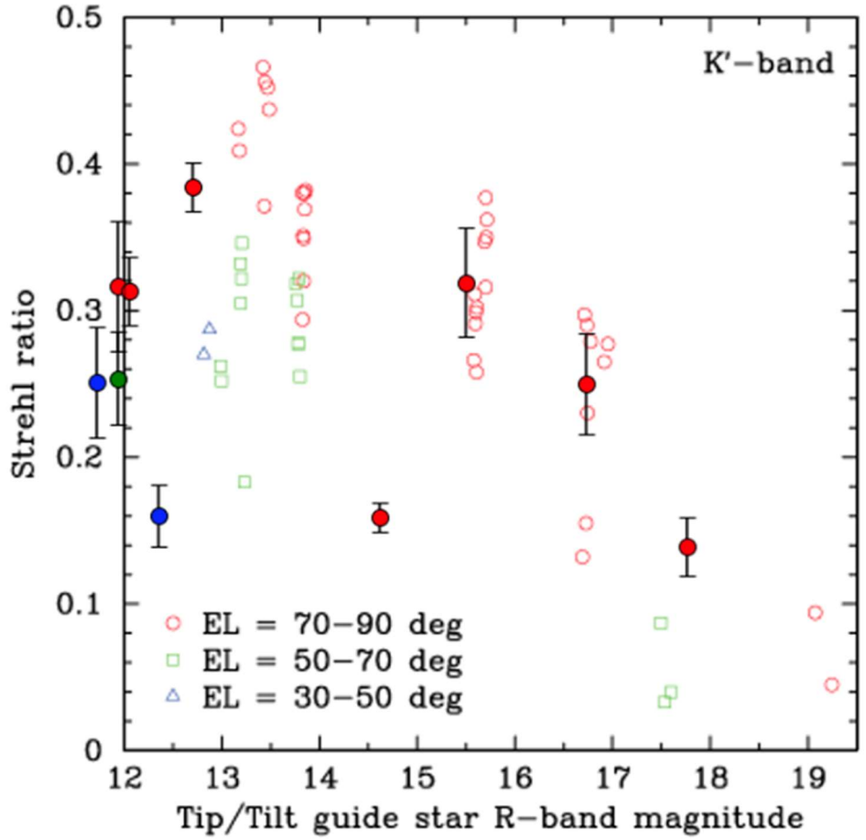
Minowa et al.
可視赤外線観測装置技術ワークショップ 2022

LGS/AO188

- new Laser Guide Star Facility system
  - performance
    - R=9-10 mag.



LGS brightness (R-band)

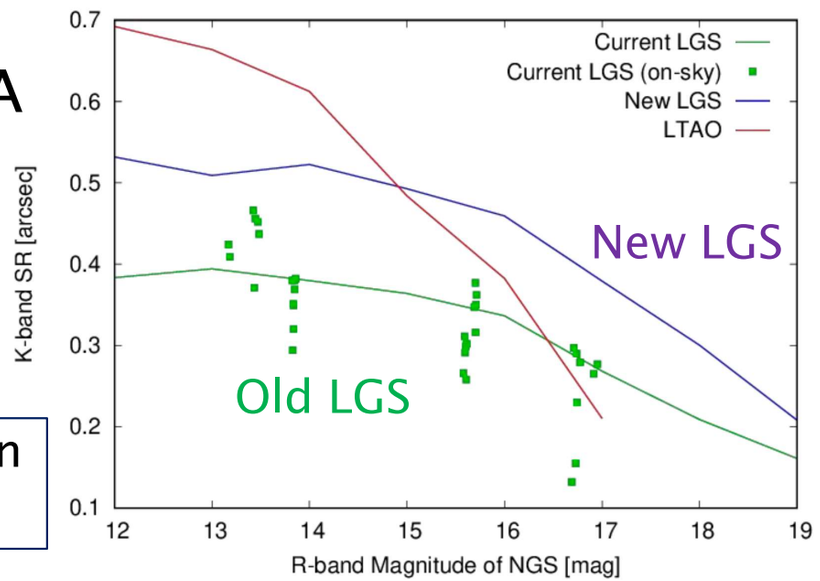


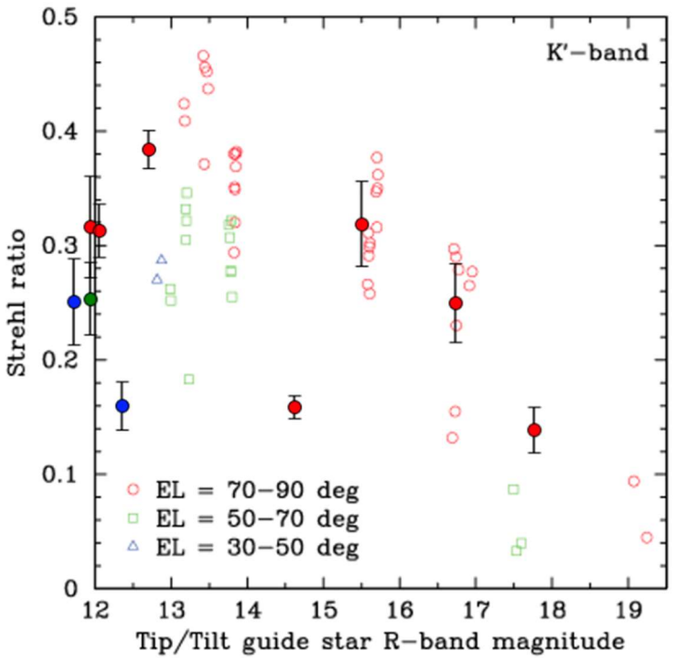
Strehl Ratio in K'-band (IRCS)

LGS/AO188

- new Laser Guide Star Facility system
  - performance
    - R=9-10 mag.
    - similar Strehl ratio in K-band compared with the old LGS
      - simulation suggests better performance than the old system
      - need more measurements in various conditions
  - opened for science observation from S23A

performance in simulation

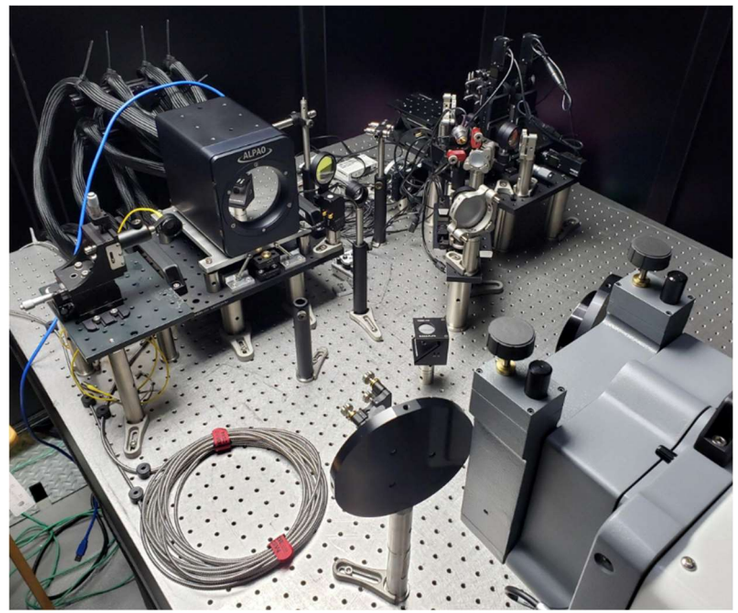




LGS/AO188

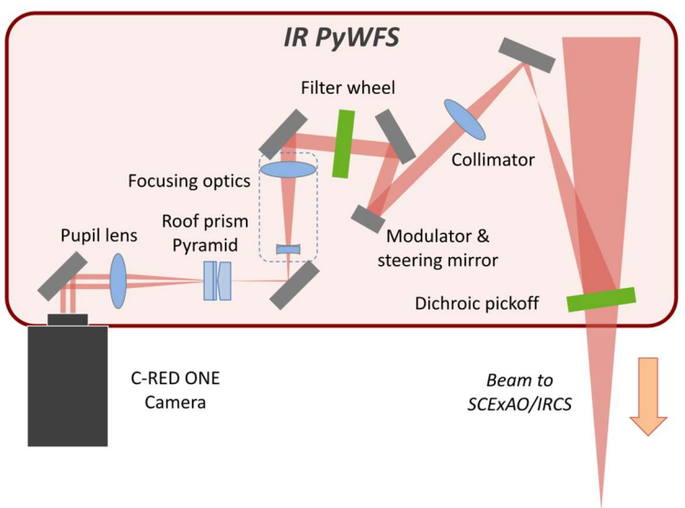
- Deformable Mirror upgrade
  - 64x64 ALPAO DM (AO3000)
  - engineering observation is planned in early S23B
    - will not affect open-use observation with the current 188-element DM
    - engineering readiness review to be scheduled
  - possible opening in S24A or S24B
    - with NIR WFS (next page), expected Strehl ratio ~0.8 in H-band

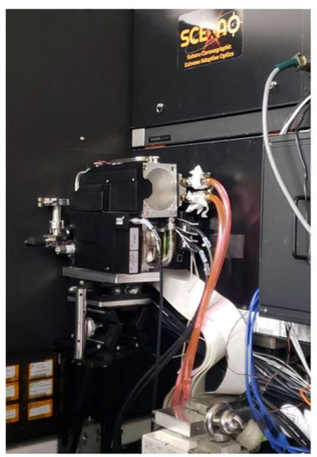
New 64x64 ALPAO Deformable Mirror under testing

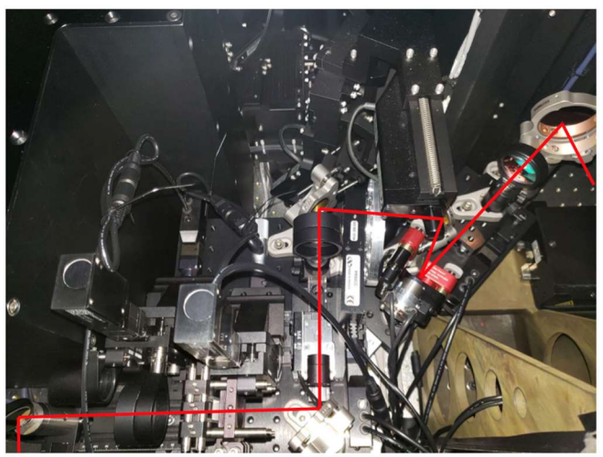


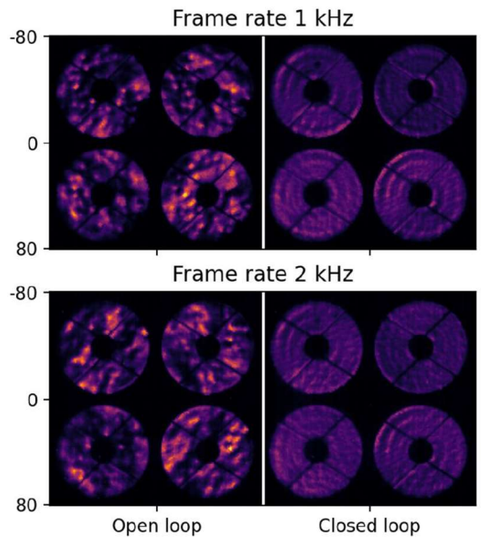
LGS/AO188

- NIR Pyramid Wavefront Sensor
  - with First Light Imaging C-RED ONE camera
  - implemented in AO188 and tested on-sky in May 2022
  - commissioning still in progress









Optical layout of the module and implementation in AO188 next to the existing curvature WFS (Lozi 2022).

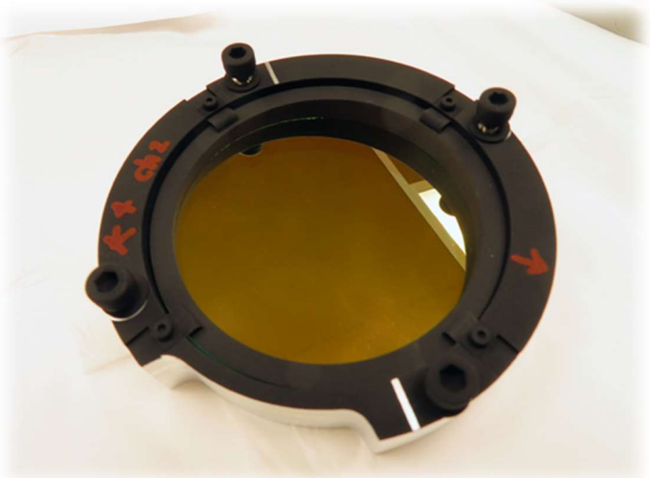
Images taken during the engineering observation in May 2022 (Lozi et al. 2022).

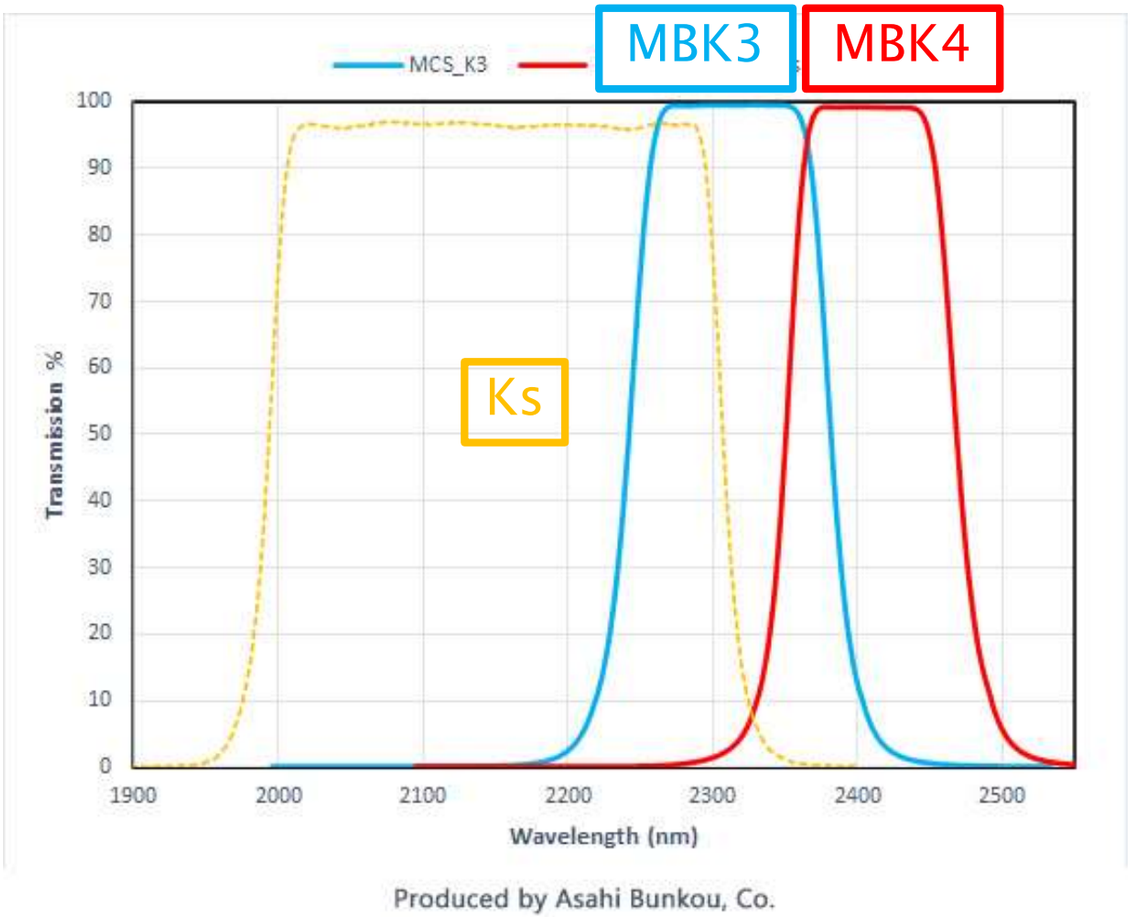
MOIRCS (summary)

- Waking up from 2-years of Hibernation
  - cooled down in the first week of January
  - no major issue so far
  - engineering observation on 2/3/2023 for the restart
- New Medium-band filters (MBK3, MBK4)
- New Grism Project
  - Volume-Binary grating for K-band
- Others
  - VPH-Y is back online in S23A
  - Update of MOS data reduction package MCSMDP
    - for new grisms

MOIRCS

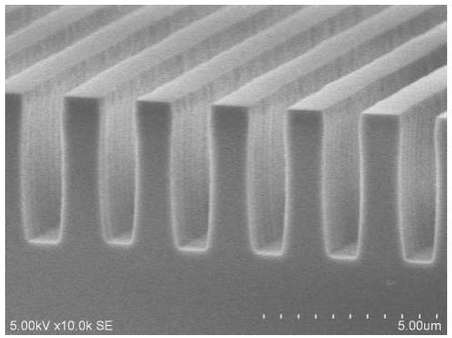
- 2 medium-band filters
  - by Dr. Koyama
  - supported by ULTIMATE-Subaru project
  - decommission of K-cont filter

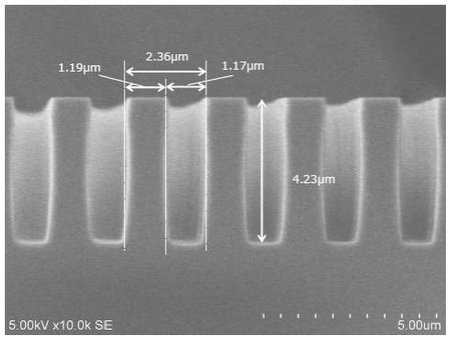


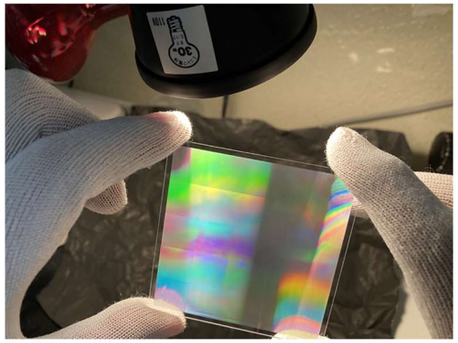


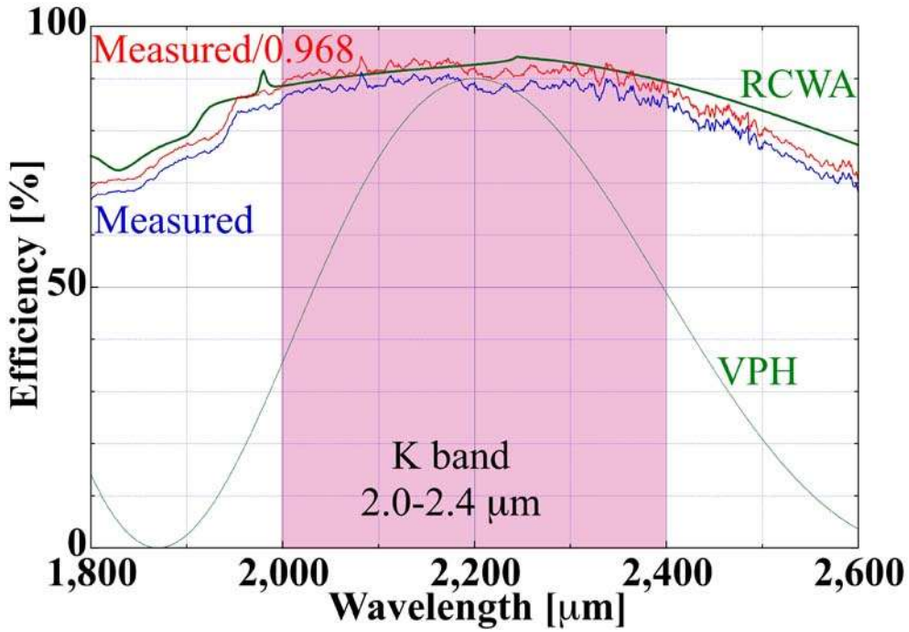
MOIRCS

- New VB-K grism project
  - N. Ebizuka (Riken), Y.Koyama (NAOJ Subaru), C. Tokoku (NAOJ ATC), I. Tanaka (NAOJ Subaru), T. Hattori (NAOJ Subaru), K. Motohara (NAOJ ATC), Y. Minowa (NAOJ Subaru), ULTIMATE-Subaru(*)
  - Volume-Binary grating for K-band (2-2.4um)
    - very high (~90%) and flat efficiency curve
      - will replace VPH-K grism
    - grating fabrication and measurement completed
    - preparing prisms and holders for final assembly
    - possible opening in S24A









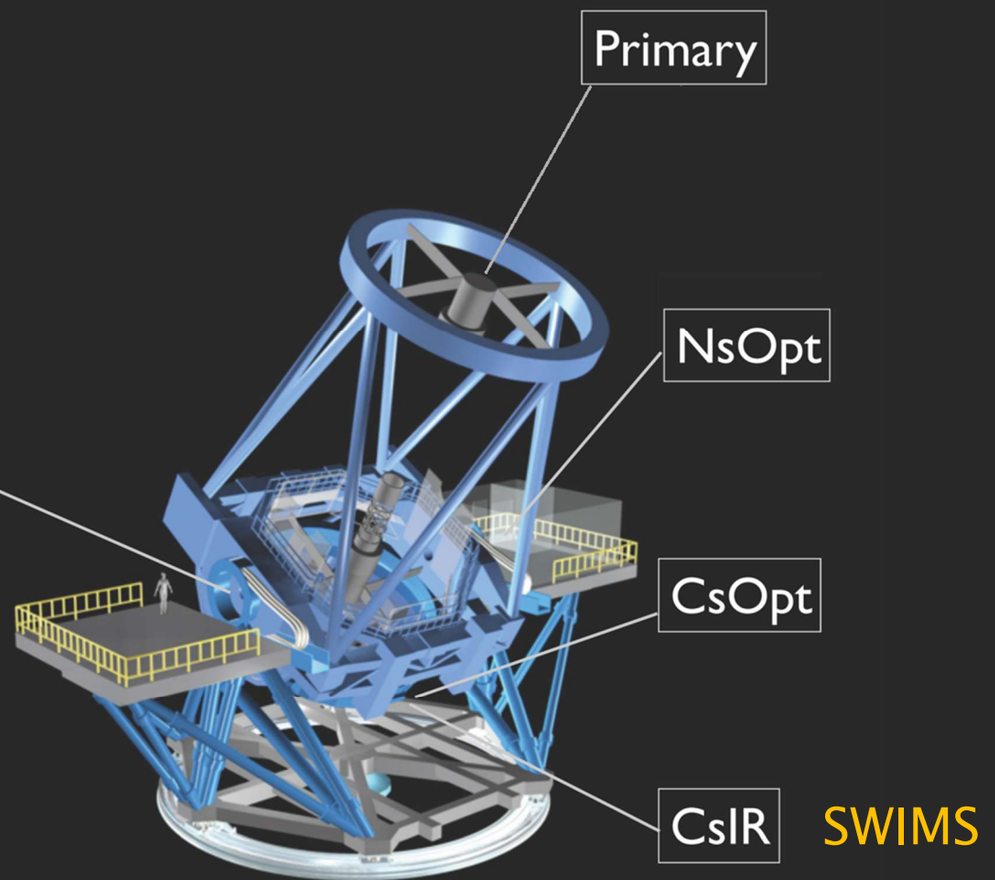
FOCAS/HDS/IRCS

- no major issue or activity

Current PI instruments

visitor instruments

AO188	IRD
AO188 + SCExAO	CHARIS
	FastPDI
	MEC
	REACH (IRD)
	VAMPIRES

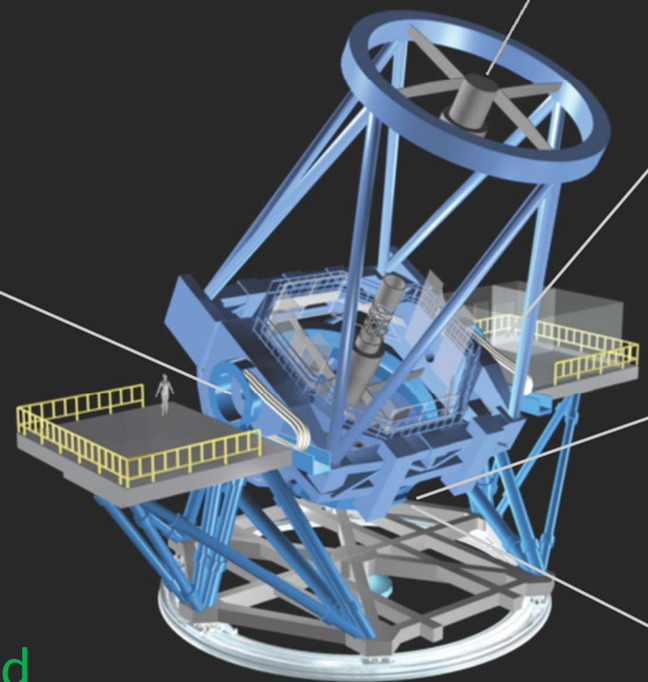


Current PI instruments/devices

- SWIMS (S21A–S22B)
  - Finished open-use observation in December, 2022
  - IFU was tested in March, 2022, and opened for S22B
- SCExAO
  - CHARIS
  - FastPDI (S21B–)
  - MEC (S22A–)
  - REACH
  - VAMPIRES : detector upgrade is planned before S23B
- IRD
- NsIR Wave Plate Unit
  - PI device, used for IRCS and SCExAO observations

Planned PI instruments/devices

- Official proposal received and approved
- Started discussion, official proposal to be submitted

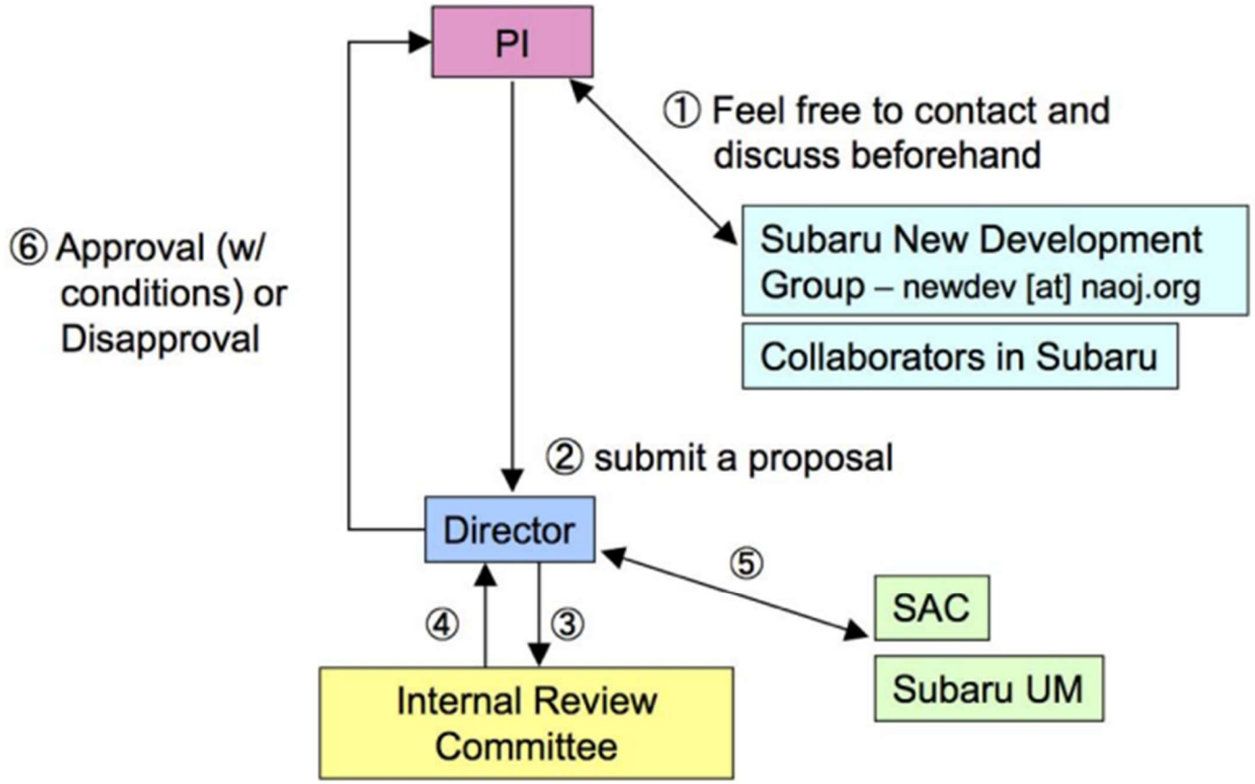


- High Speed CMOS Camera
- HDS Comb

- ULTIMATE-START
- NINJA
- SPIDERS
- K-REACH
- New Thermal Infrared Coronagraphic Imager

Planned PI instruments/devices

- approval process
  - https://www.naoj.org/Observing/Instruments/ApprovalProcessPIinstrument.pdf



PI instruments/devices

- ULTIMATE-START
  - official proposal approved in 2022
  - subcomponents
    - LTAO-WFS (4 Shack-Hartmann wavefront sensor) : passed pre-ship review
    - 4 LGS upgrade : review in 2023
    - Turbulence Profiler : engineering observation ongoing
    - Kyoto3DII upgrade and installation : review to be scheduled
  - Akiyama-san's presentation on Day3

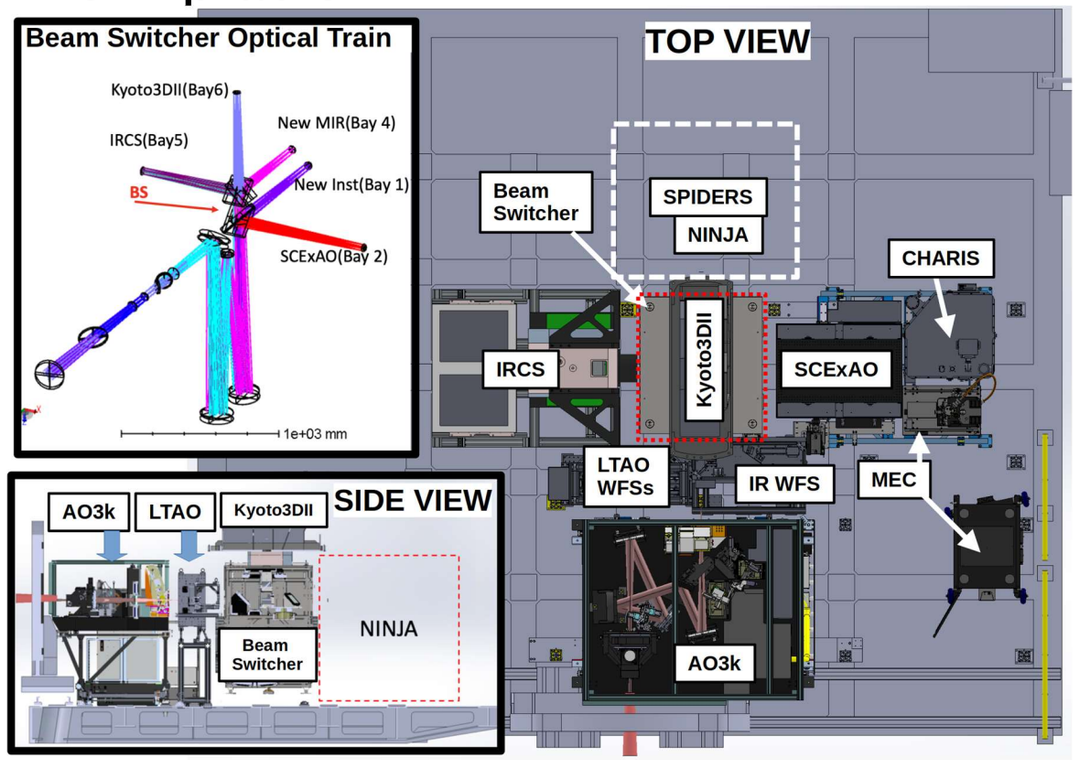
Planned PI instruments/devices

Instrument	PI	Description
NINJA	Yoshida (NAOJ)	Optical to NIR spectrograph, to be combined with ULTIMATE-START
SPIDERS	Marois (NRC)	Pathfinder for Fast Atmospheric Self-Coherent Camera technique
K-REACH	Kotani (NAOJ/ABC)	High-contrast and high-dispersion spectroscopy with SCExAO+IRCS.
Thermal-IR Coronagraphic Imager	Currie (UTSA)	Coronagraphic imager for 2-5um. Possible extension to 8-13um.
HDS Comb	Inaba (AIST)	Lasercomb for HDS (PI device)
High Speed CMOS Camera	Komiyama (Hosei U)	Wide-field and high-speed imager at the prime focus

※ Official proposal needs to be submitted and approved to start the review/acceptance process

Planned PI instruments/devices

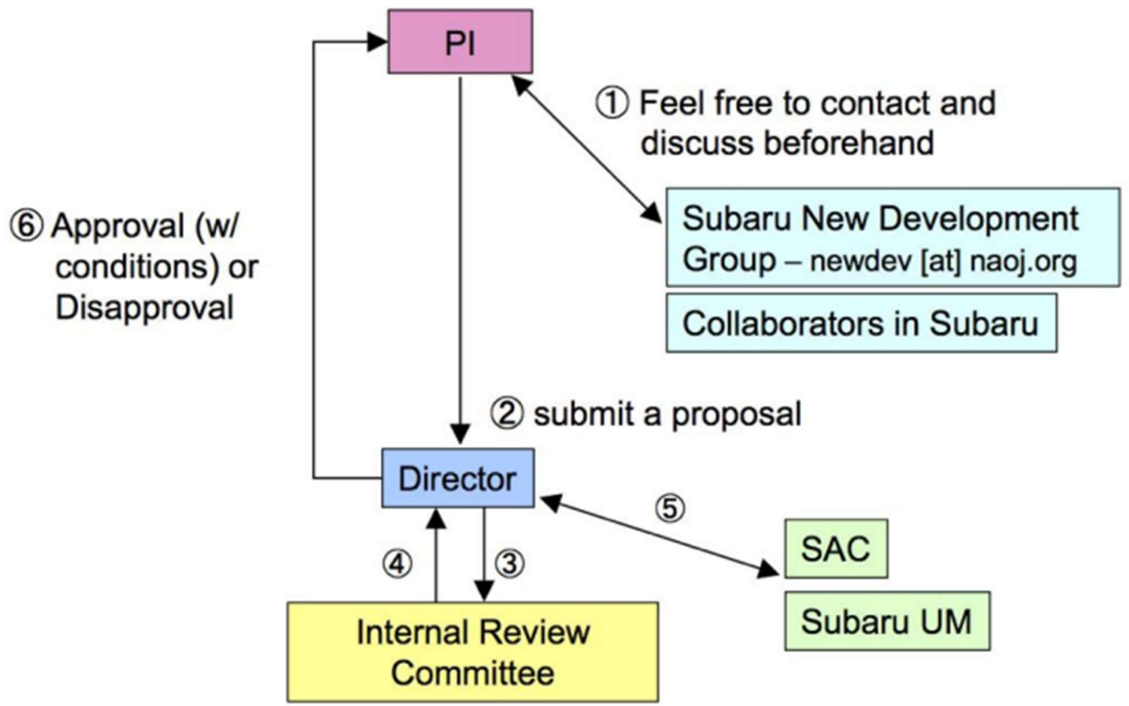
- issues
  - very limited manpower at Subaru for acceptance and review processes
  - increasing number of instruments on NsIR platform
    - Nasmyth Beam Switcher
      - relay optics + instrument switching
        - mirrors, beam-splitters
      - reduce instrument exchange work
      - more stable operation
    - **weight (max 6,000 kg)**
    - coolant supply and heat removal



Guyon et al. (2022)

Planned PI instruments/devices

- approval process
  - https://www.naoj.org/Observing/Instruments/ApprovalProcessPIinstrument.pdf
  - discussions are ongoing to improve the process
    Please send us comments



Summary 2022

Prime Focus

HSC	Filter management, CCD readout issues

Nasmyth

AO188	New LGS commissioned, DM upgrade and NIR WFS under commissioning
IRCS	No major issue/activity
HDS	No major issue/activity

Cassegrain

MOIRCS	Restart from hibernation, Medium-band filters, VB-K grism development
FOCAS	No major issue/activity

PI instruments

Status and upgrade plan of existing PI instruments
Planned PI instruments/devices and their approval process