

Subaru Nasmyth Beam Switcher: Commissioning Status

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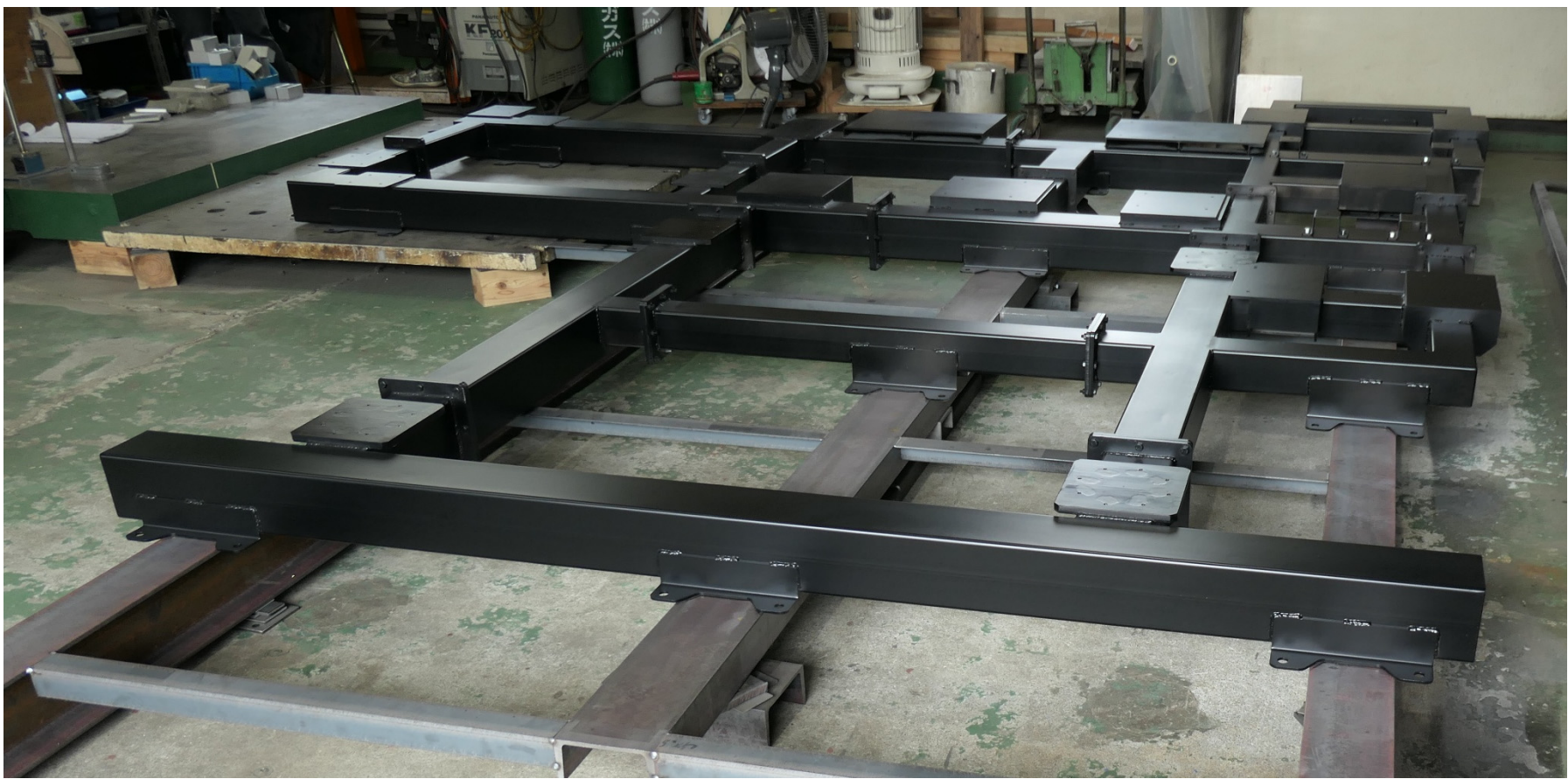
Abstract

Nasmyth Beam Switcher (NBS) is a device for redirecting the beam from the facility AO system (AO188/AO3k) to the backend science instruments at Subaru's Nasmyth IR (NslR) focus. The NBS is a key device to realize the flexible instrument switch among the AO fed science instruments, which significantly reduces the workload of the daytime instrument exchange and, more importantly, enables quick switching of the instruments which allows a new queue mode operation for improving the observing efficiency of AO observations.

This year, we completed (1) fabrication, transportation, assembly, and installation of the common platform, (2) assembly of mechanical and electrical components, optical alignment, performance measurement of the NBS at Hilo base, (3) installation and alignment of the NBS at the NslR floor, and (4) recommissioning of IRCS and SCExAO with the NBS. We report those AIT works and the commissioning status.

Common Platform

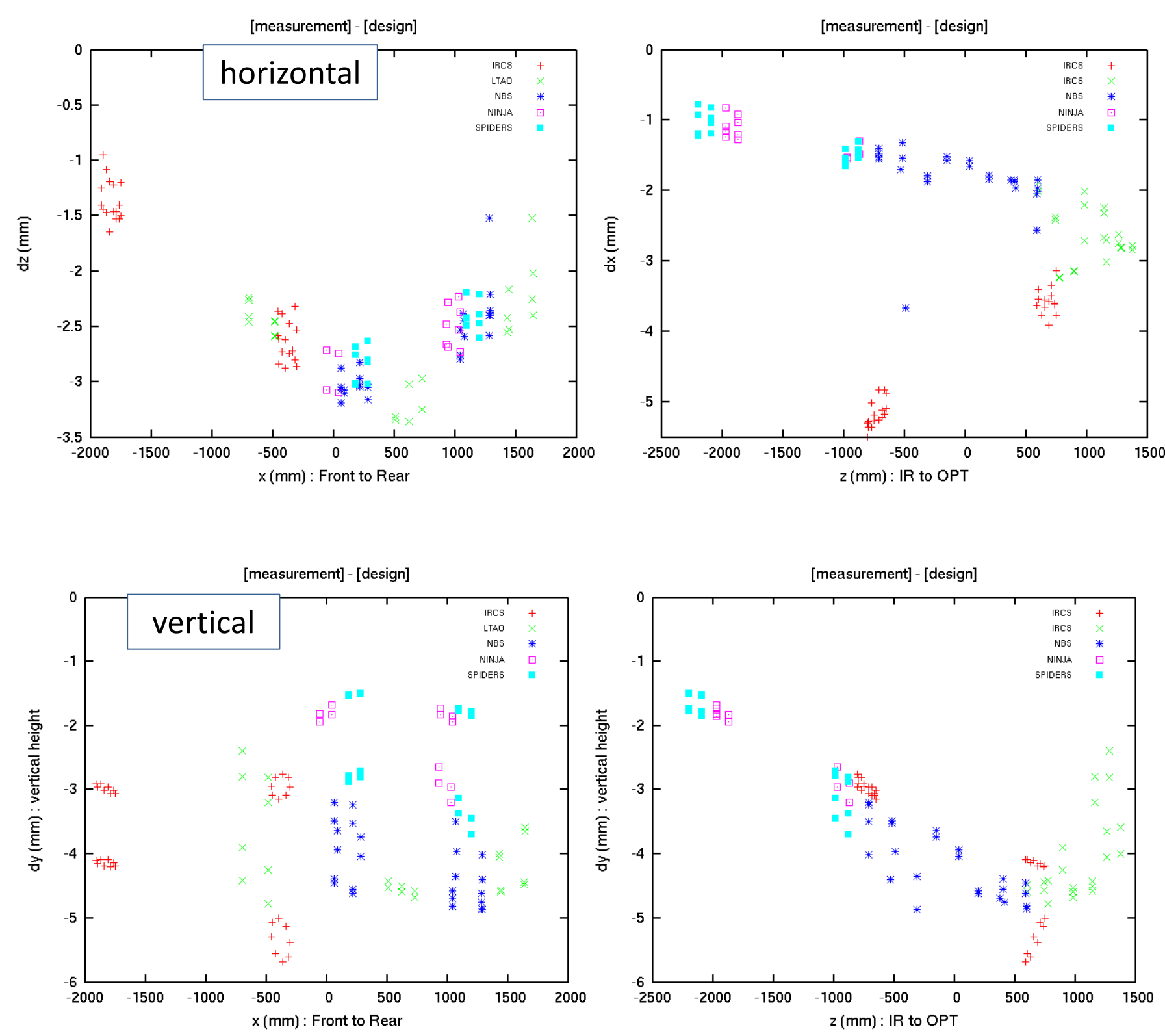
- Fabrication in Japan (Jan. to March, 2025)



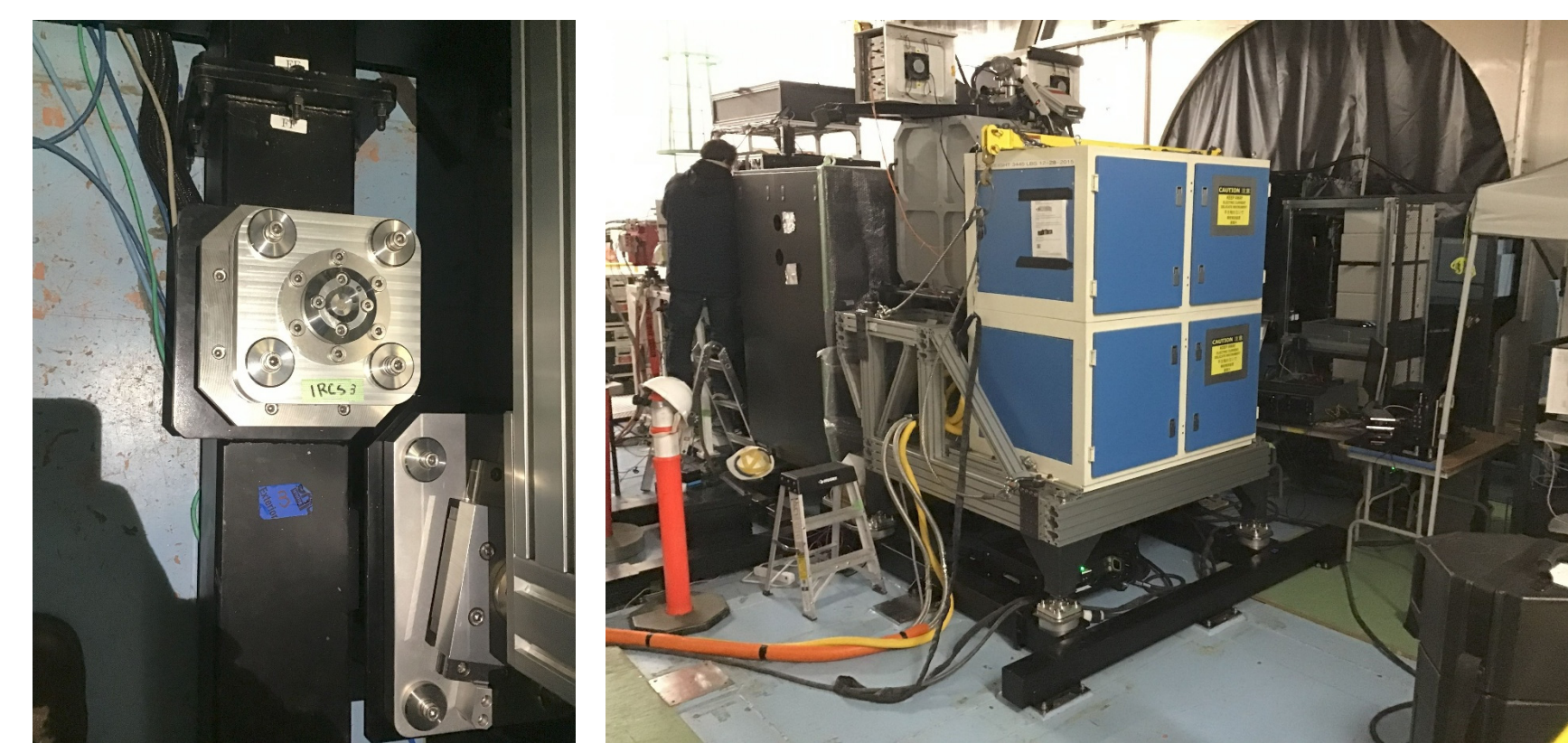
- Test assembly in Hilo base (June, 2025)
- Installation to the NslR floor (July, 2025)



- FARO measurement of the common platform



FARO measurement result revealed up to ~6mm difference compared to the design. IRCS position had to be adjusted by modifying the interface plates between the common platform and IRCS.

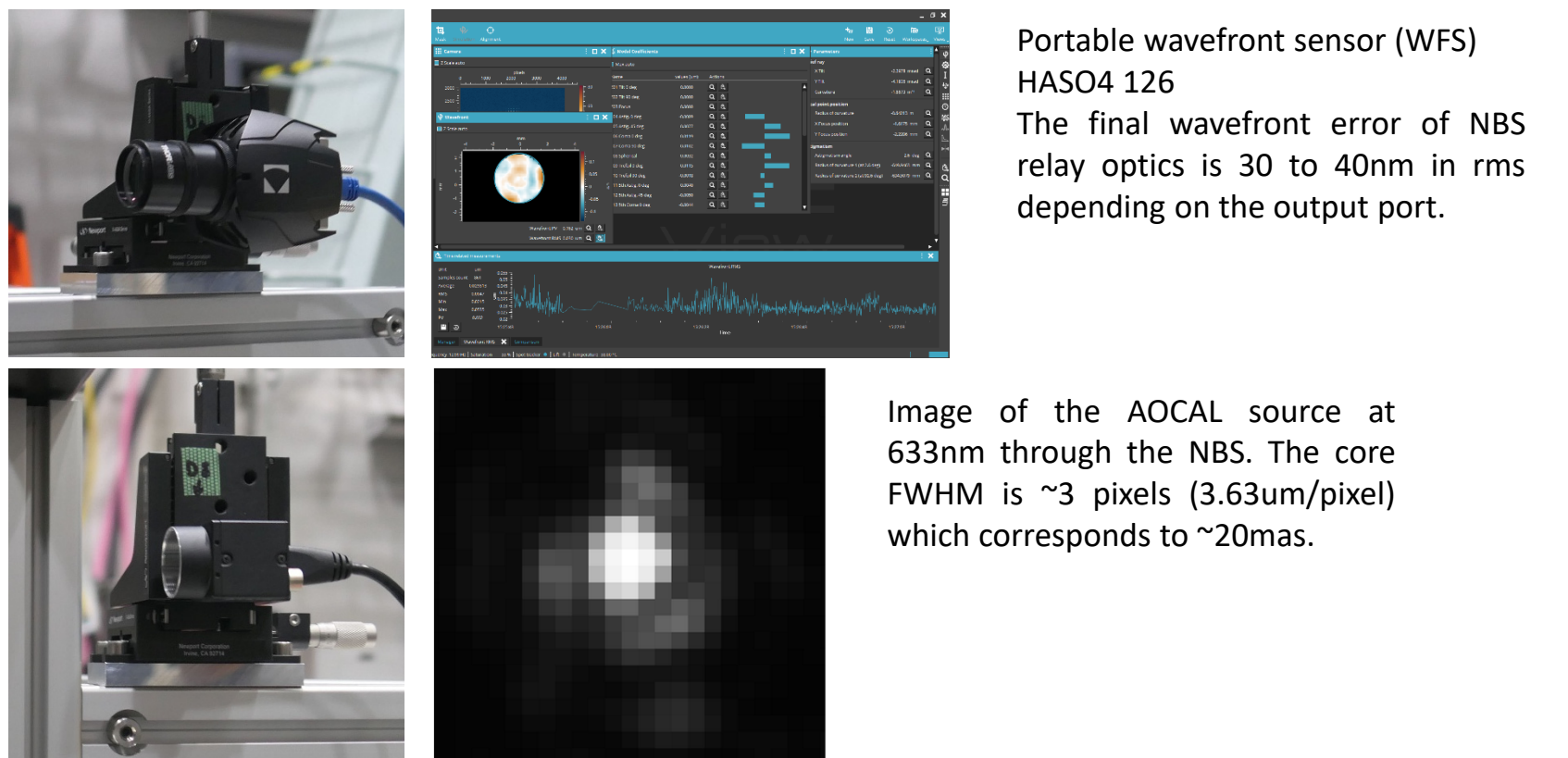
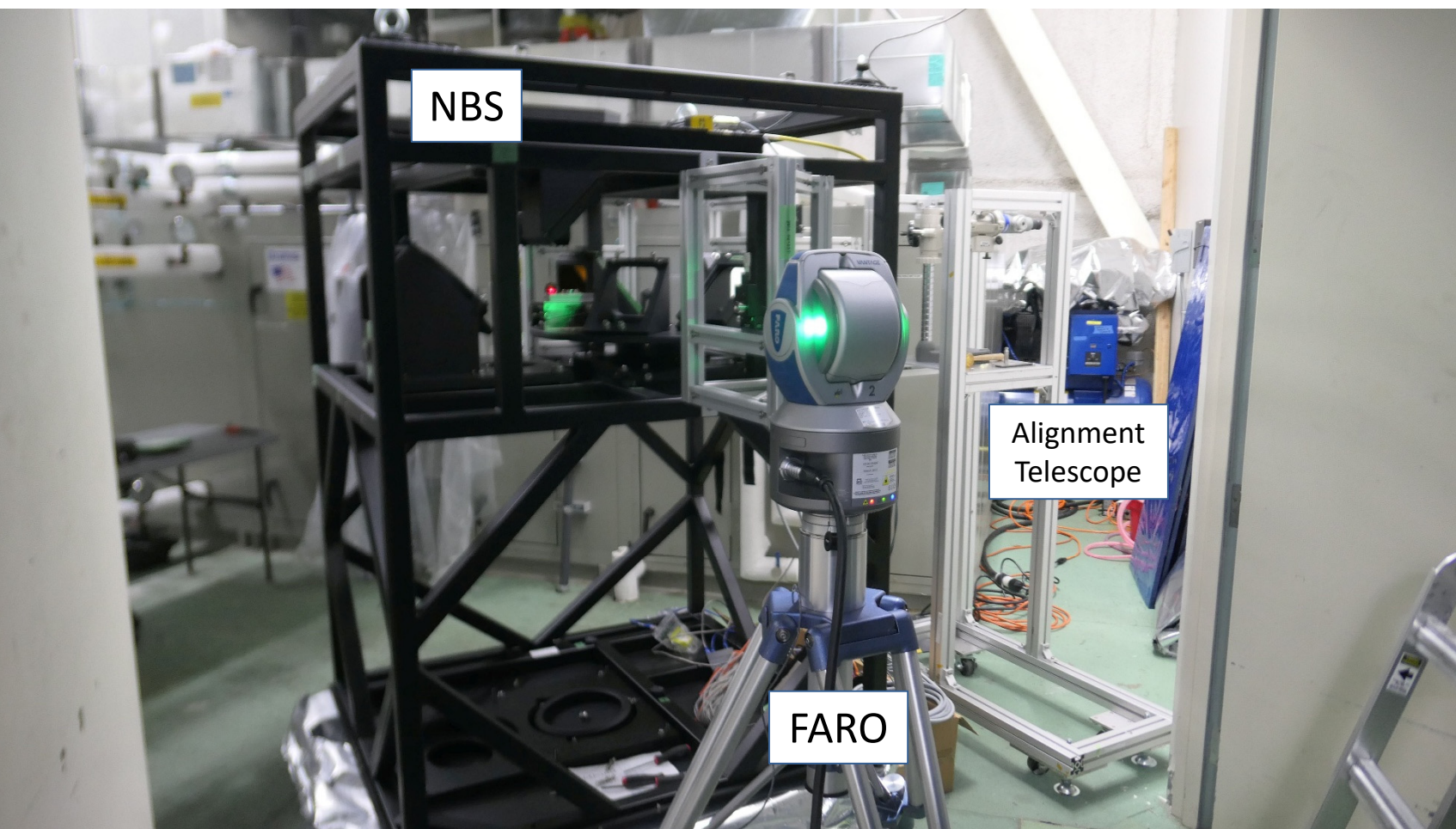


Member roles

Hattori	Project management and coordination, NBS optical alignment
Bando	NBS electronics, mechanical assembly
Doi	NBS mechanical assembly, common platform design
Lozi	NBS optical alignment, SCExAO commissioning
Minowa	Design, advisor
Takagi	NBS optical alignment, IRCS commissioning
Wung	NBS electronics, transportation, scheduling

NBS assembly and alignment

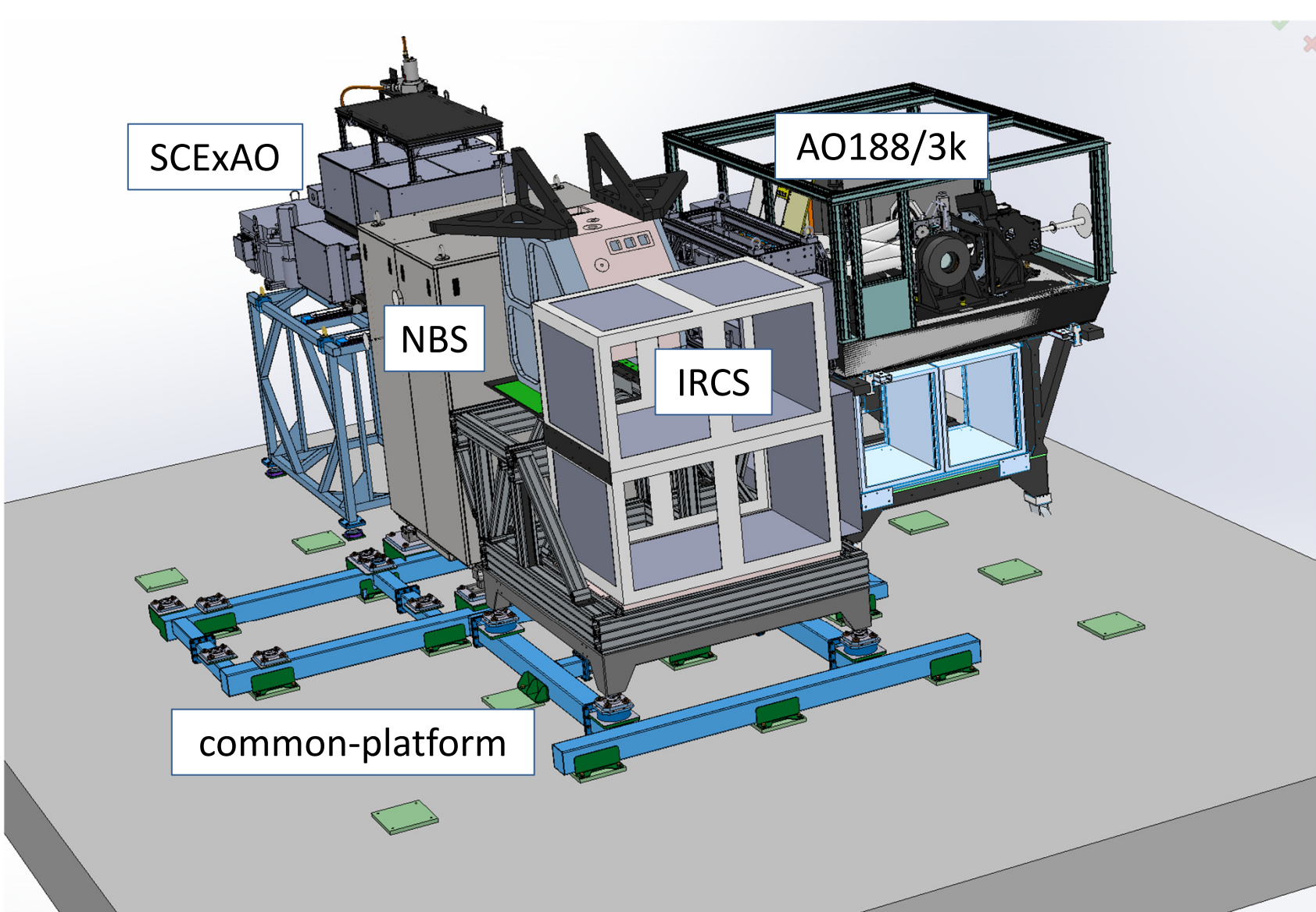
- mechanical assembly (May, 2025)
- optical alignment in Hilo base (June to July, 2025)
 - FARO** : to position the mirrors and establish the coordinates
 - Alignment Telescope** : to align the mirrors
 - Portable WaveFront Sensor (WFS)** : to do fine-tuning of the alignment and measure the optical performance
- optical alignment at the summit (August, 2025)
- installation onto the common platform and test with the calibration source in AO188/3k (September, 2025)



Portable wavefront sensor (WFS)
HASQ4 126
The final wavefront error of NBS relay optics is 30 to 40nm in rms depending on the output port.

Image of the AOCL source at 633nm through the NBS. The core FWHM is ~3 pixels (3.63um/pixel) which corresponds to ~20mas.

Current Status



NslR web camera (2025/10/24)

Completed

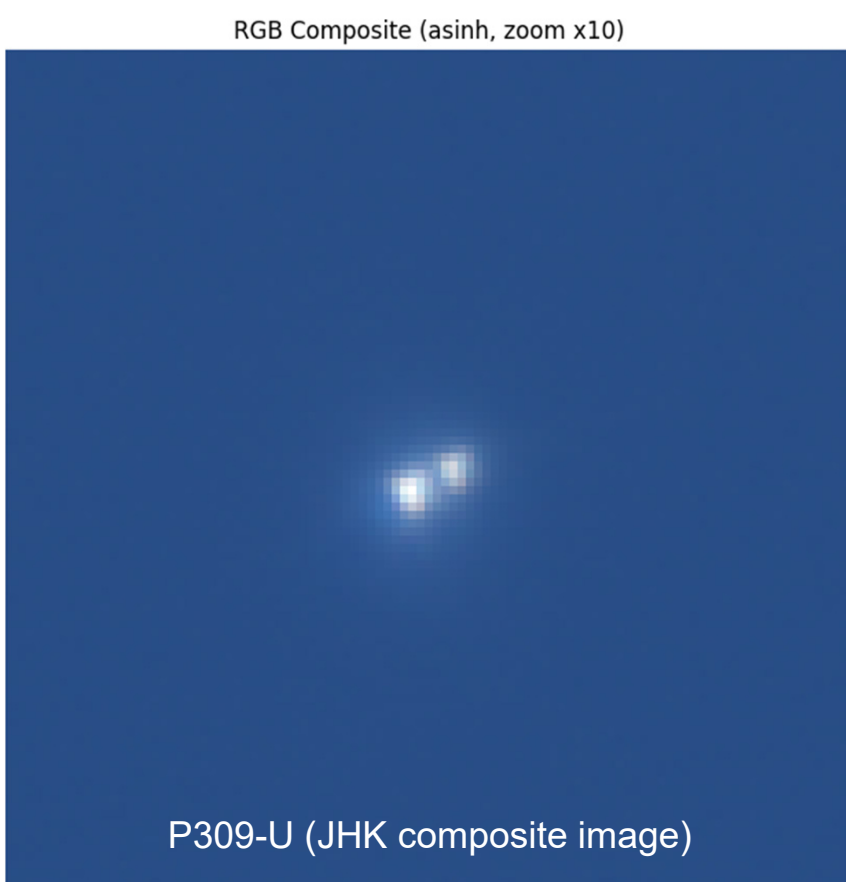
- Installation of the common platform to the NslR floor
- Installation and alignment of the LTAO WFS and upgraded AO3k NIRWFS
- Installation of the NBS to the common platform and alignment to the AO188/3k
- Installation of IRCS and SCExAO and alignment to AO188/3k+NBS

Engineering Observation

- 10/3, 10/4, 10/5 (0.5x3 nights) : NBS+SCExAO engineering
 - on-sky alignment check
 - photometric standard stars
 - PDI calibration
 - astrometric calibration
 - AO performance check and optimization
- 10/8, 10/10 (0.5x2 nights) : NBS+IRCS/SCExAO
 - instrument switching with NBS rotation stage
 - PFS with new DM calibration with IRCS
 - polarized standard with IRCS and SCExAO
 - astrometric calibration for IRCS and SCExAO
 - IRCS background
 - ~15% increase in K-band with NBS
 - consistent with model prediction (18%, UM2024)
 - IRCS photometric standard (preliminary)
 - NBS efficiency ~89.7% in K-band (97.85% per mirror)
- 11/4, 5 (0.5x2 nights) : NBS+IRCS/SCExAO
 - to be done



NBS first light on 10/3/2025



IRCS JHK-band image of 0".11 separation binary star. FWHM 0".06-0".07. No degradation in the imaging performance has been found.