

Reports from Subaru Telescope — Abstract —



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2024-01-23

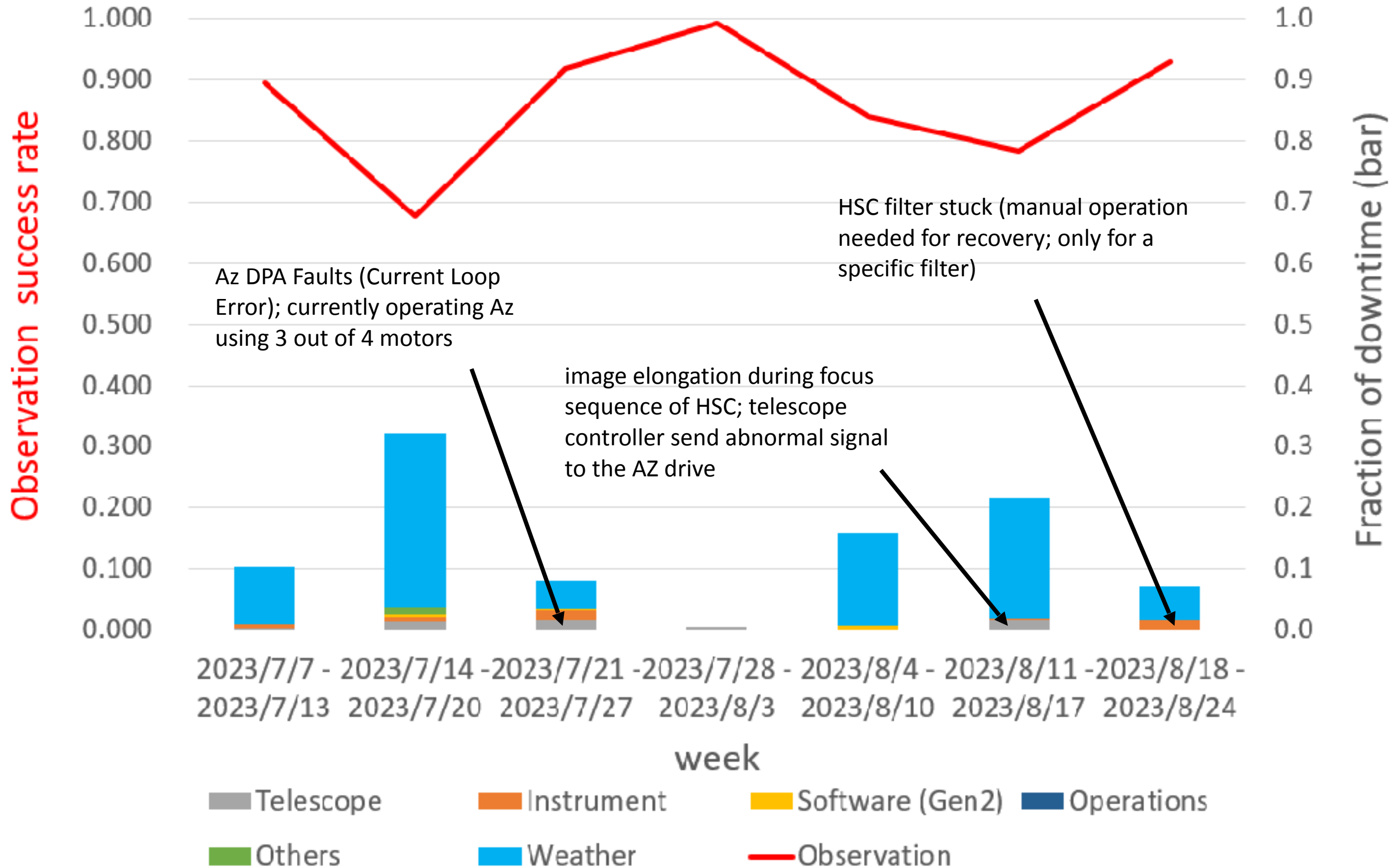
Presentation for Subaru UM FY2023 at Mitaka

- Operation
- Telescope Maintenance and the Upgrade
- Observing Instrument Development
- Others
 - Science Highlights
 - Annual budget
 - Impact from the exchange rate and the inflation

Operation

From Subaru SAC Aug. 29, 2023

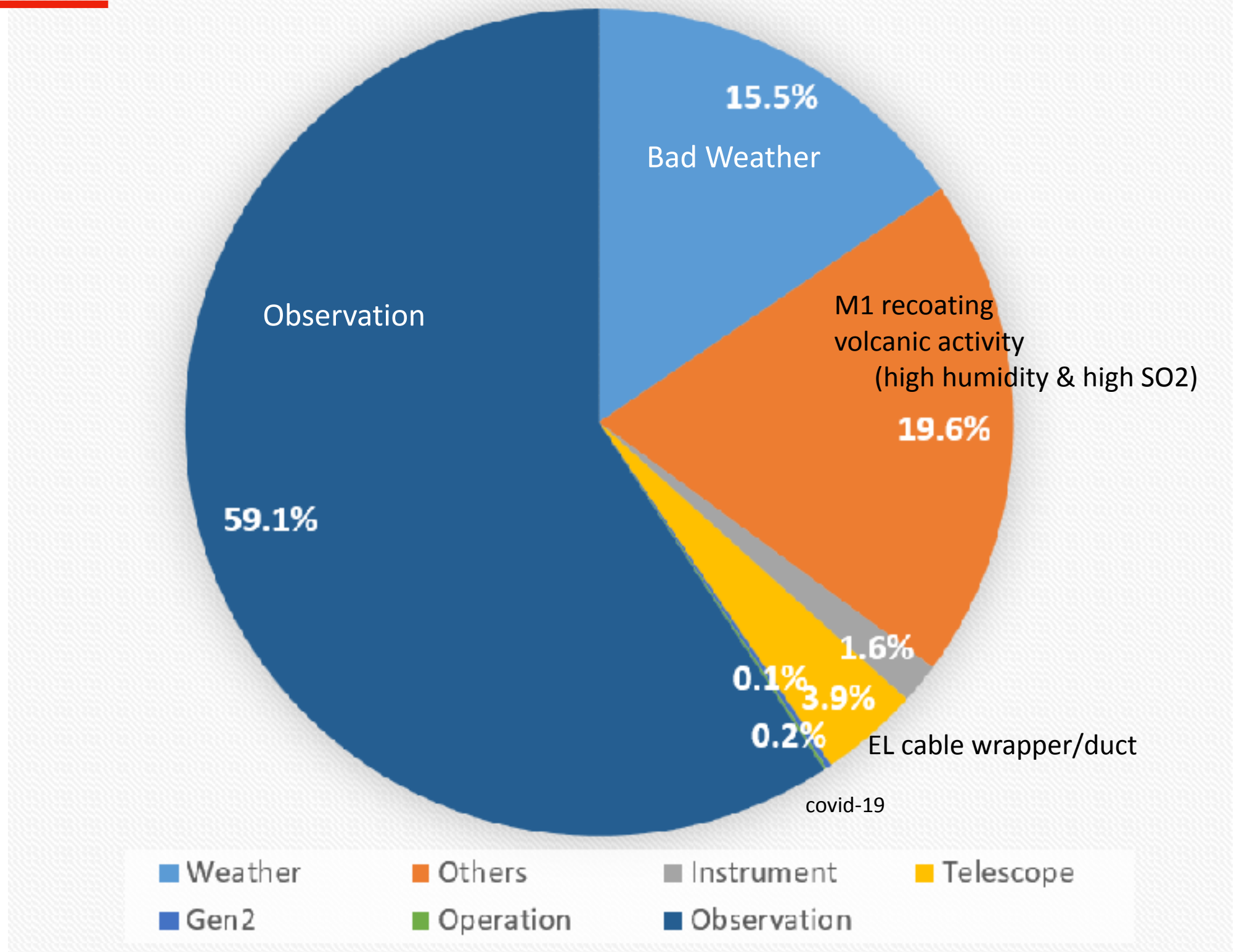
Telescope Time Statistics (2023/7/7-2023/8/24)



Operation

CY2022

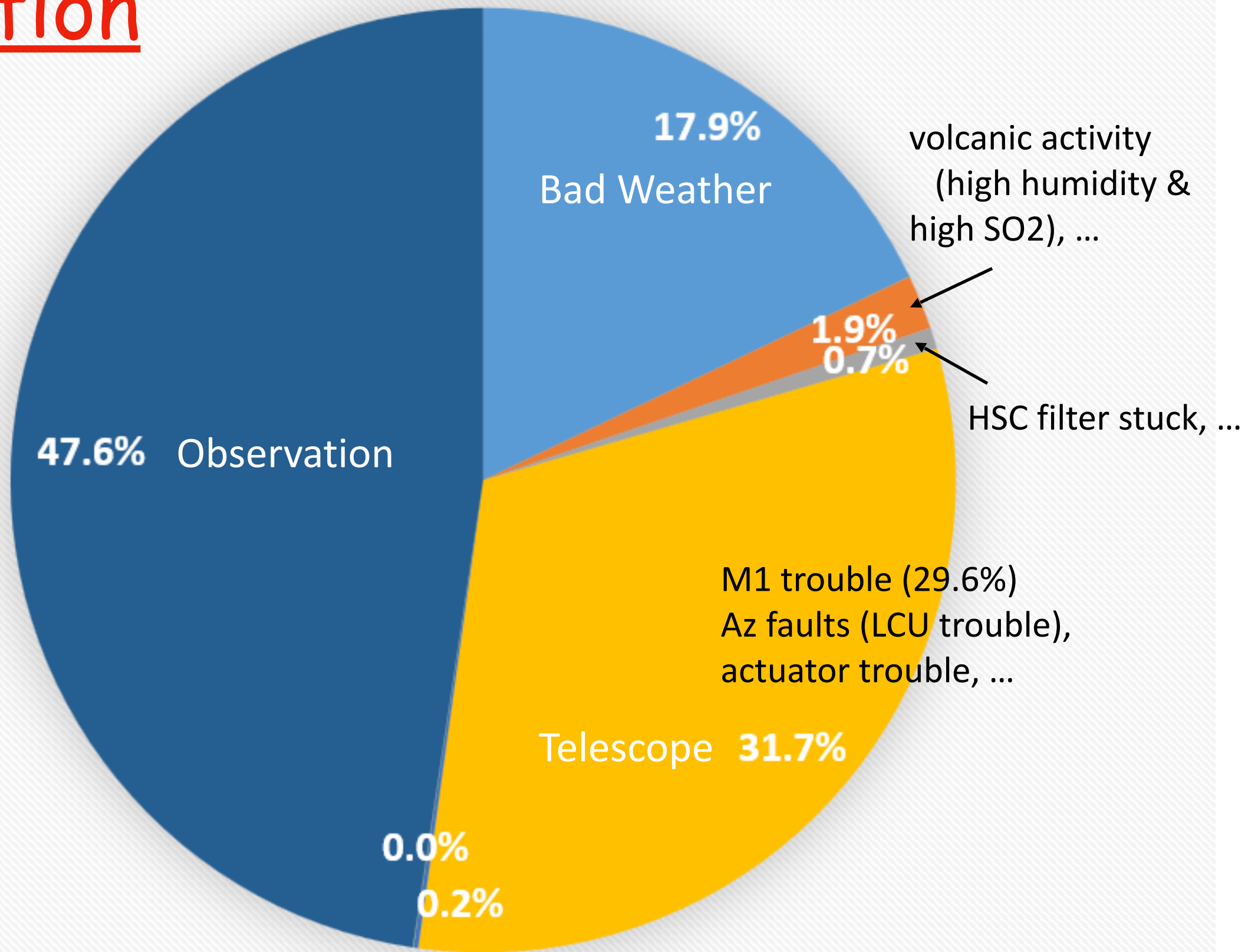
Subaru Telescope Time: 2022 (12/31/2021 - 1/6/2023)



Subaru Telescope Time: 2023 (1/7/2023 - 1/4/2024)

Operation

CY2023



Weather Others Instrument Telescope Gen2 Operation Observation

Telescope

Incidents on Primary Mirror



1. Incidents that occurred and research abnormalities and/or damages (1/4)

- * Three incidents occurred during the annual maintenance of the Subaru Telescope from September 11 to September 25.
- * We pointed the telescope near horizon to inspect the positions of the limit switches of the elevation axis on September 15, 2023. After inspection, an excessive load was applied to the three fixed points, when we pointed the telescope to Zenith. Then, the load sensors of the fixed points showed abnormal values, after we activated the telescope's actuators.
- * On the same day, a part of the primary mirror cover opened by its own weight and was damaged during the above maintenance work. On September 19, 2023, a metal part (gear rail) fell and damaged the surface of the primary mirror during the repair work of the primary mirror cover. (Similar damages on the primary mirror occurred in the past and have been repaired. We also found minor scratches on the mirror surface that may have been from a different cause related to this incident. The repair of the damage on the mirror itself is possible. Still, since the primary mirror is a fragile material, it is necessary to carefully examine the repair method, the finished shape, and the strength analysis of the repaired mirror, as well as to conduct the repair work safely on telescope site in Hawaii.)

1. Incidents that occurred from Briefing Sessions for observers (2023/12)

abnormalities and/or damages (2/4)



(abnormal values at the fixed points)

The supporting system of the primary mirror has 261 actuators (open black circles) and three fixed points (filled blue circles).

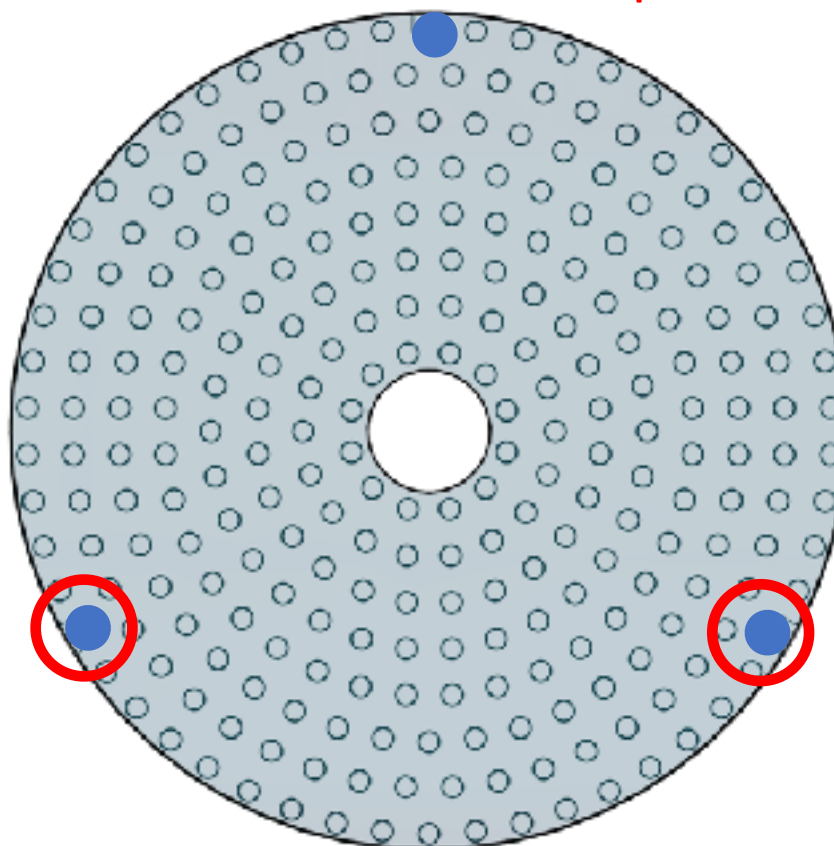
The load sensors at the two fixed points (open red circles) indicated the abnormal values.

The top view of the primary mirror

○ are the positions of the actuators

fixed point #8-61, normal value

fixed point #8-63
smaller value by
3,000N



fixed point #8-62
smaller value by
700N



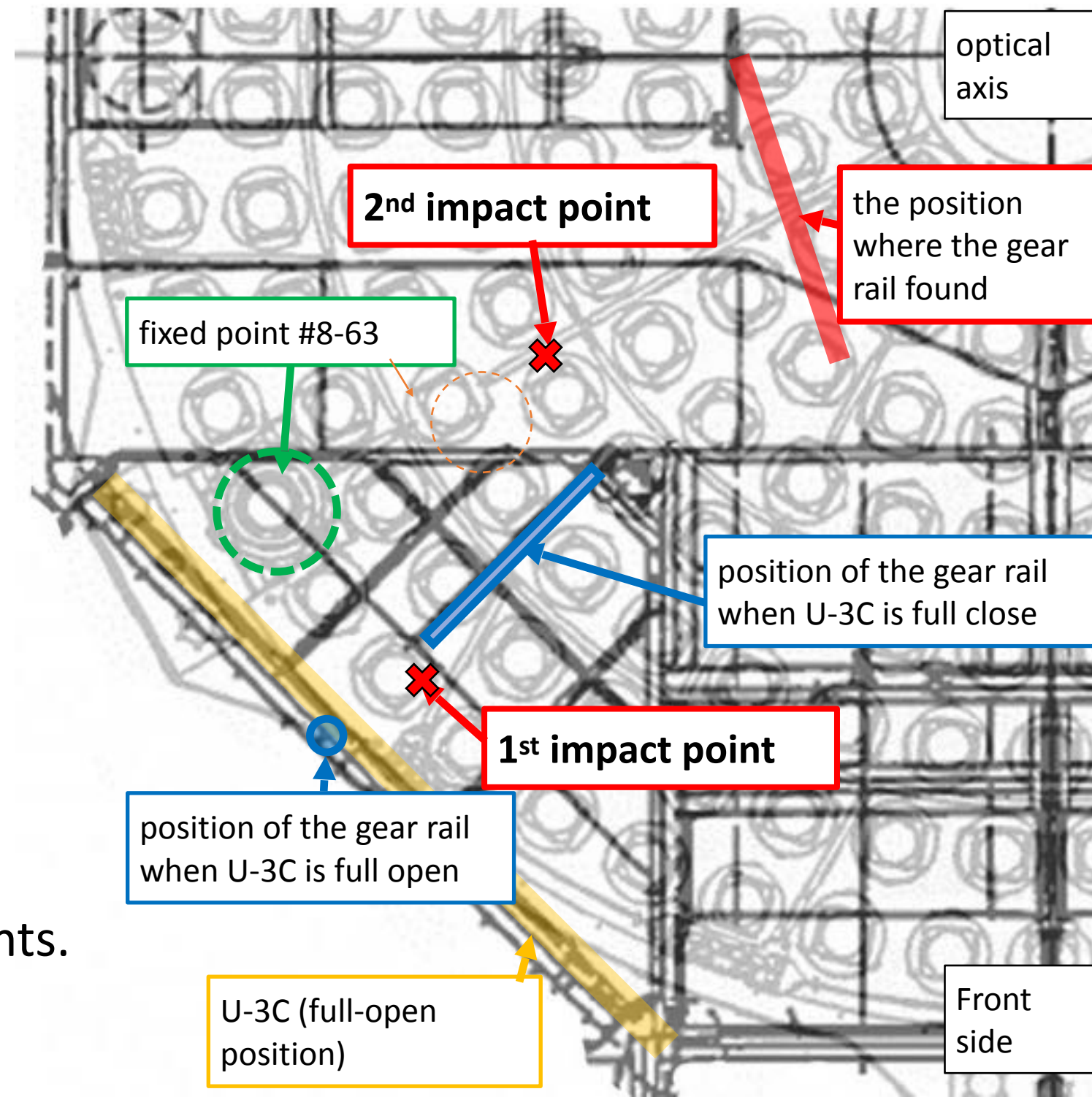
1. Incidents that occurred and resultant abnormalities and/or damages (3/4)

(damages on the primary mirror)

Gear rails, which is felled on the mirror, are used to slide ventilation doors.

Repair work was being conducted with the mirror cover (U-3C) in full-open position. When we tried to remove the motor to re-install the ventilation door, the gear rail dropped onto the primary mirror.

We have found two major impact points.





1. Incidents that occurred and resultant abnormalities and/or damages (4/4)

(damages on the primary mirror)

Primary damage

Location : About 180mm from the primary mirror edge.
Size : 26mm x 19mm x 23mm
Depth : about 5~9mm in maximum



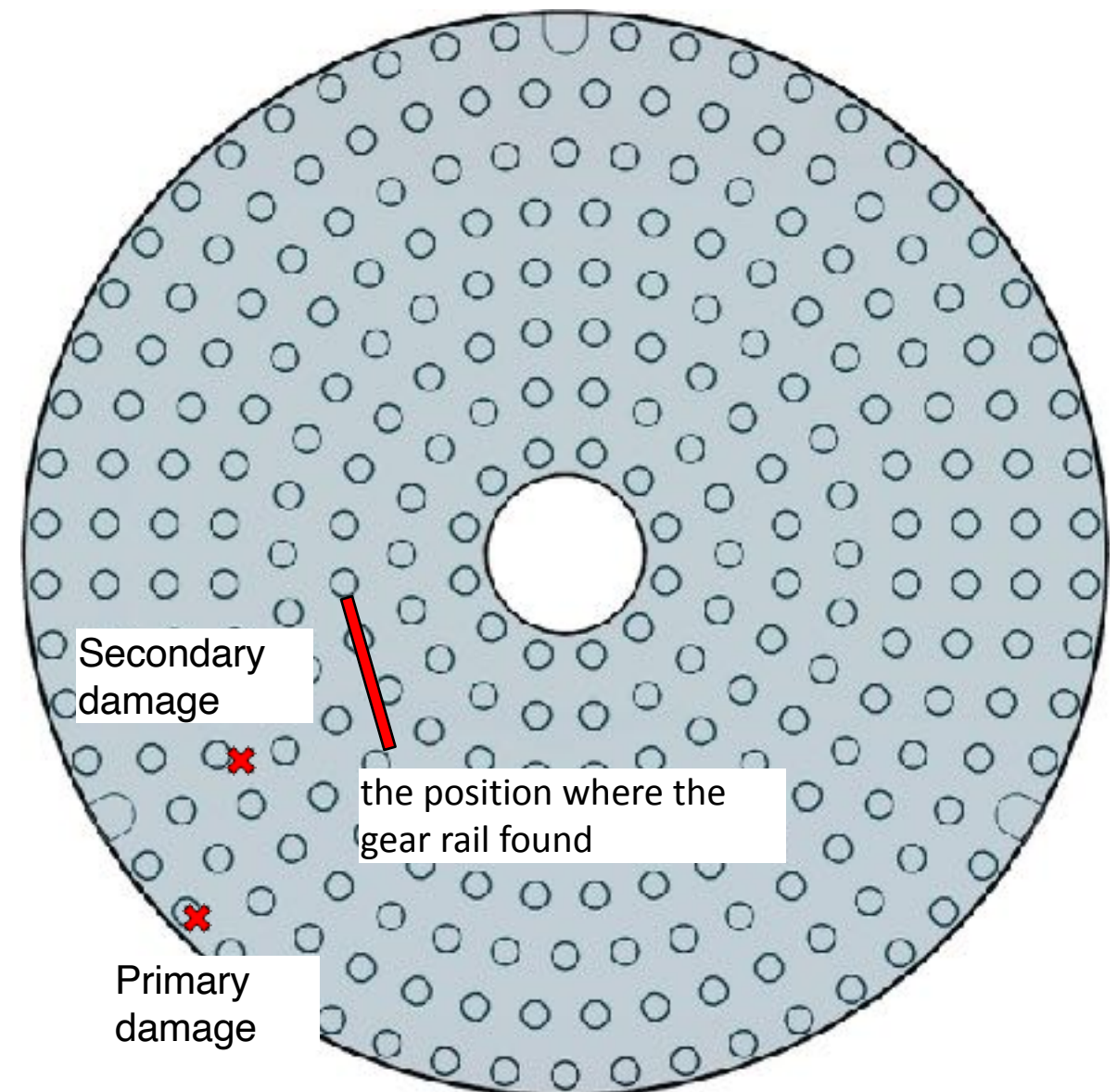
Secondary damage

Location : About 1220mm from the primary mirror edge.
Size : 10mm x 7 mm
Depth : Shallower than the primary damage. Further investigation is required.



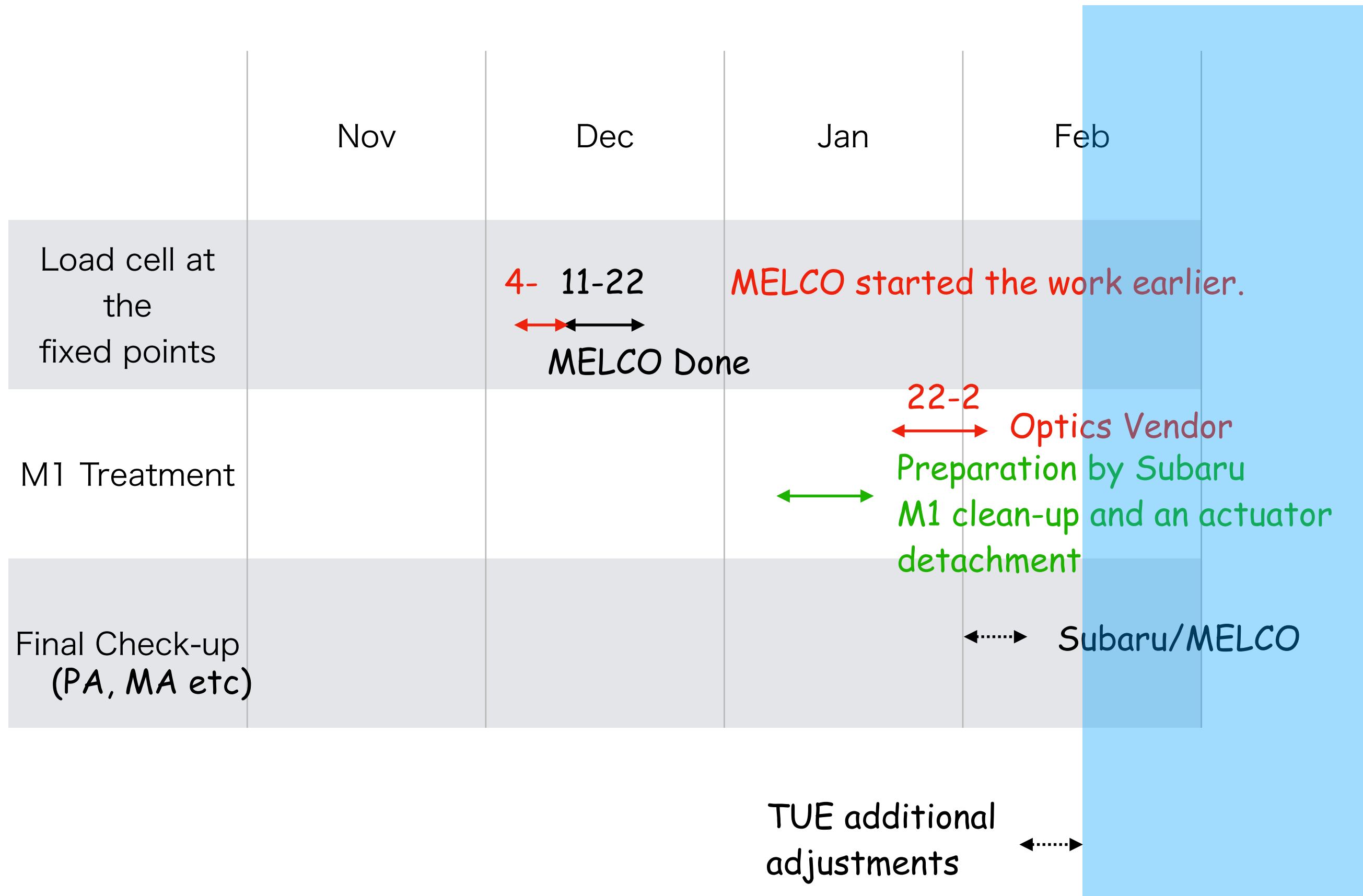
The top view of the primary mirror

○ are the positions of the actuators



Possible Recovery Schedule

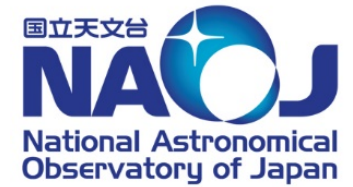
This schedule is not final. Do not distribute.



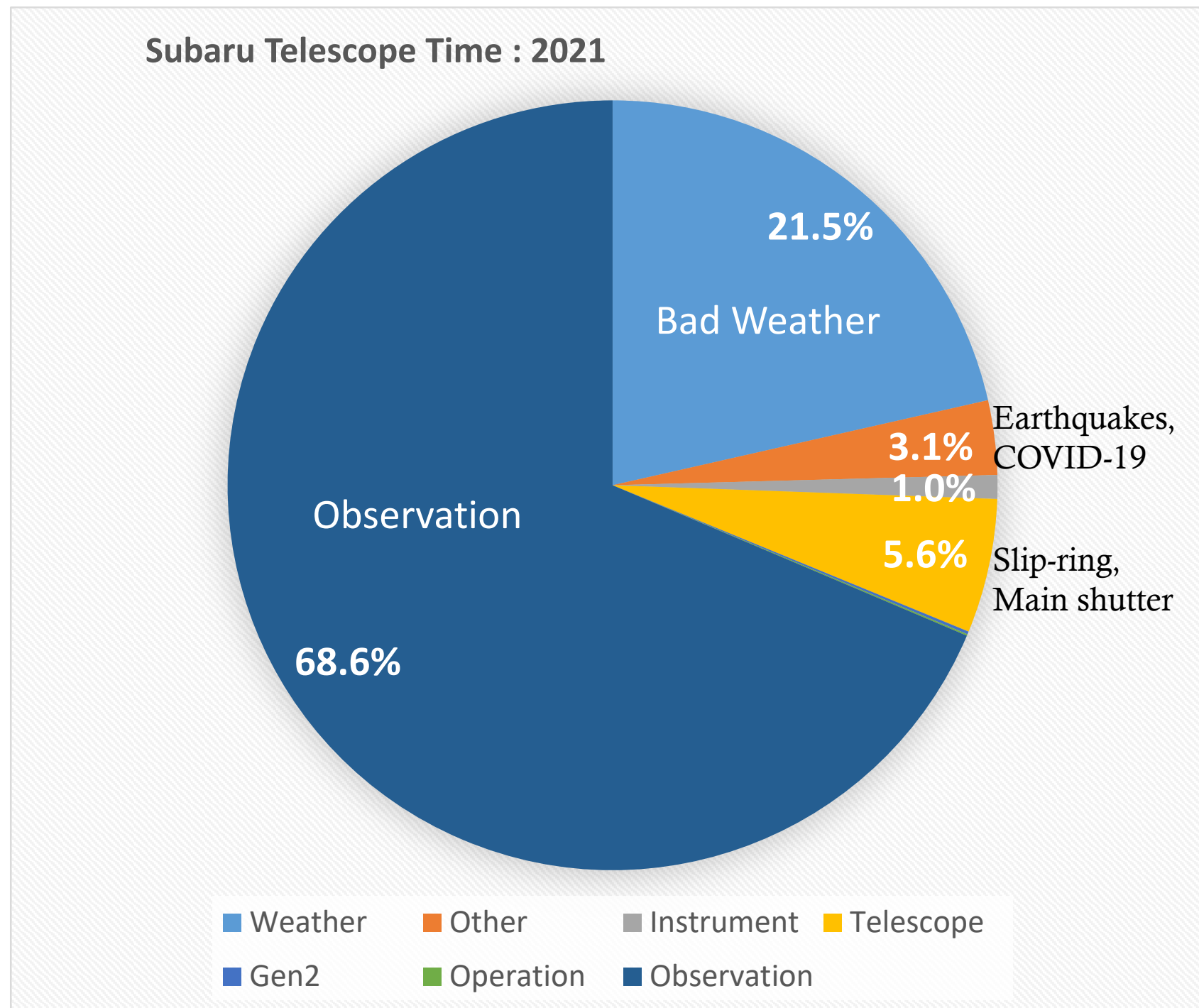
Operation



Telescope Time Statistics in 2021



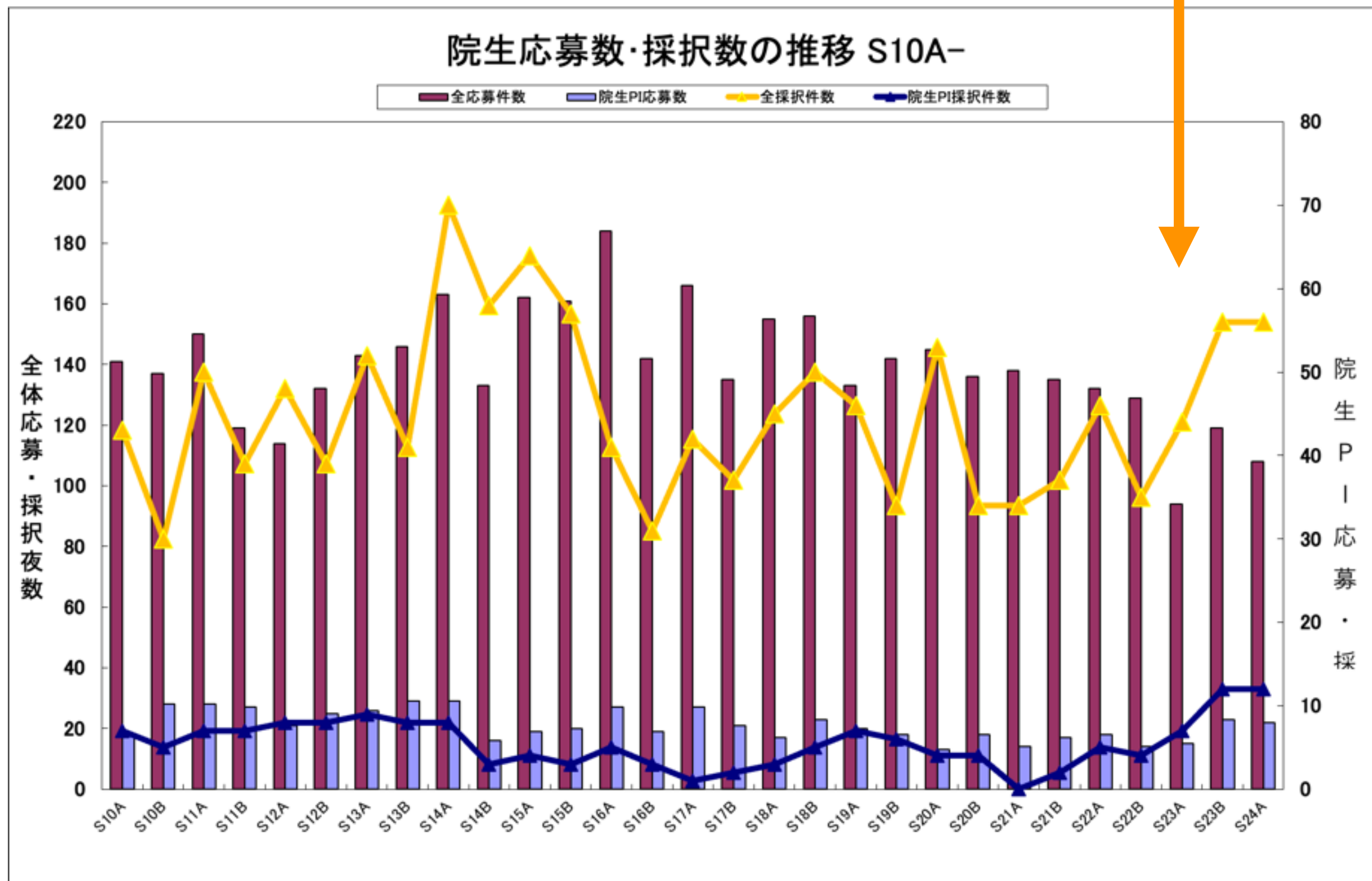
CY2021



Operation

Proposal Statistics

Crisis !



Operation

Subaru-Keck exchange summary

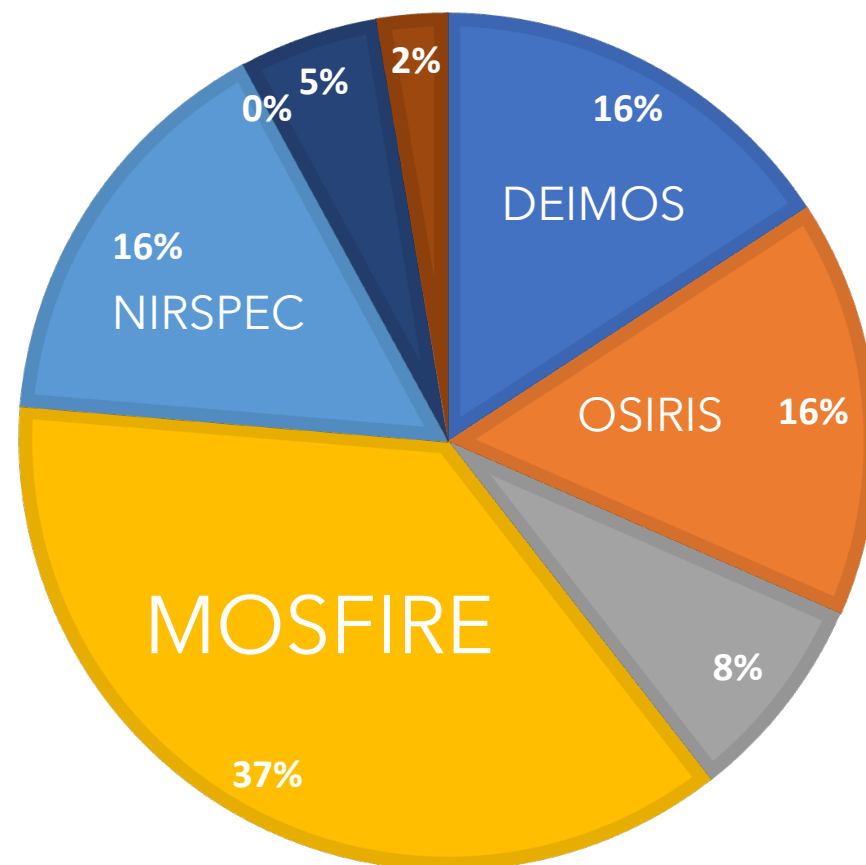
We exchanged **~5.0 nights / semester** with Keck.

5.5n (S22A), **4.5n** (S22B), **5.0n** (S23A), **5.0n** (S23B)

Subaru → Keck

(approved in S22A/S22B/S23A/S23B)

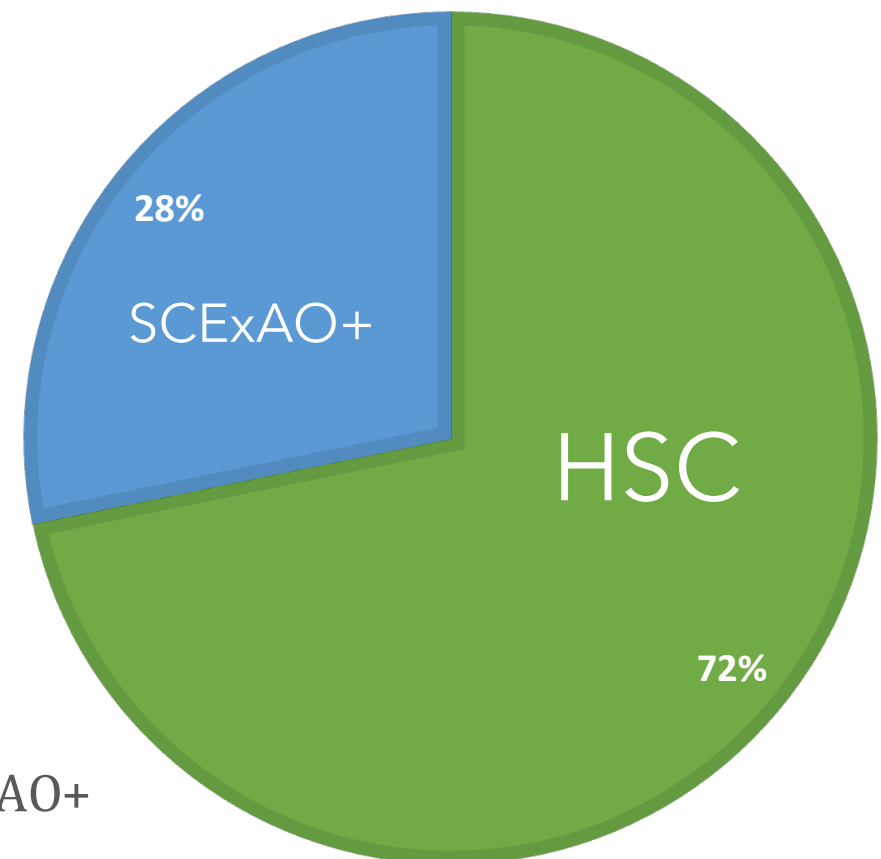
- DEIMOS
- OSIRIS
- LRIS
- MOSFIRE
- NIRSPEC
- KCWI
- NIRC2
- HIRES



Keck → Subaru

(approved in S22A/S22B/S23A/S23B)

- HSC
- SCExAO+

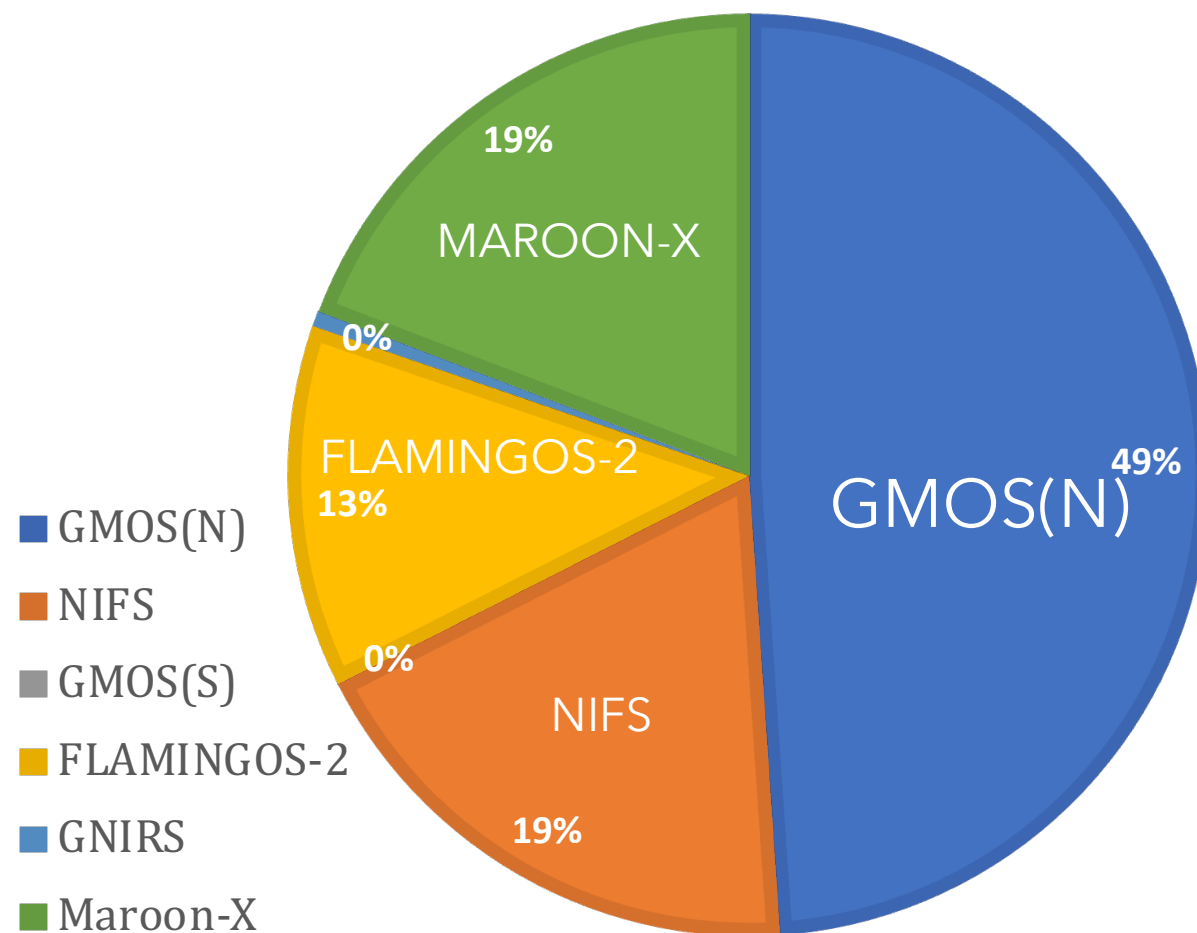


Operation

Subaru-Gemini exchange summary

Subaru → Gemini

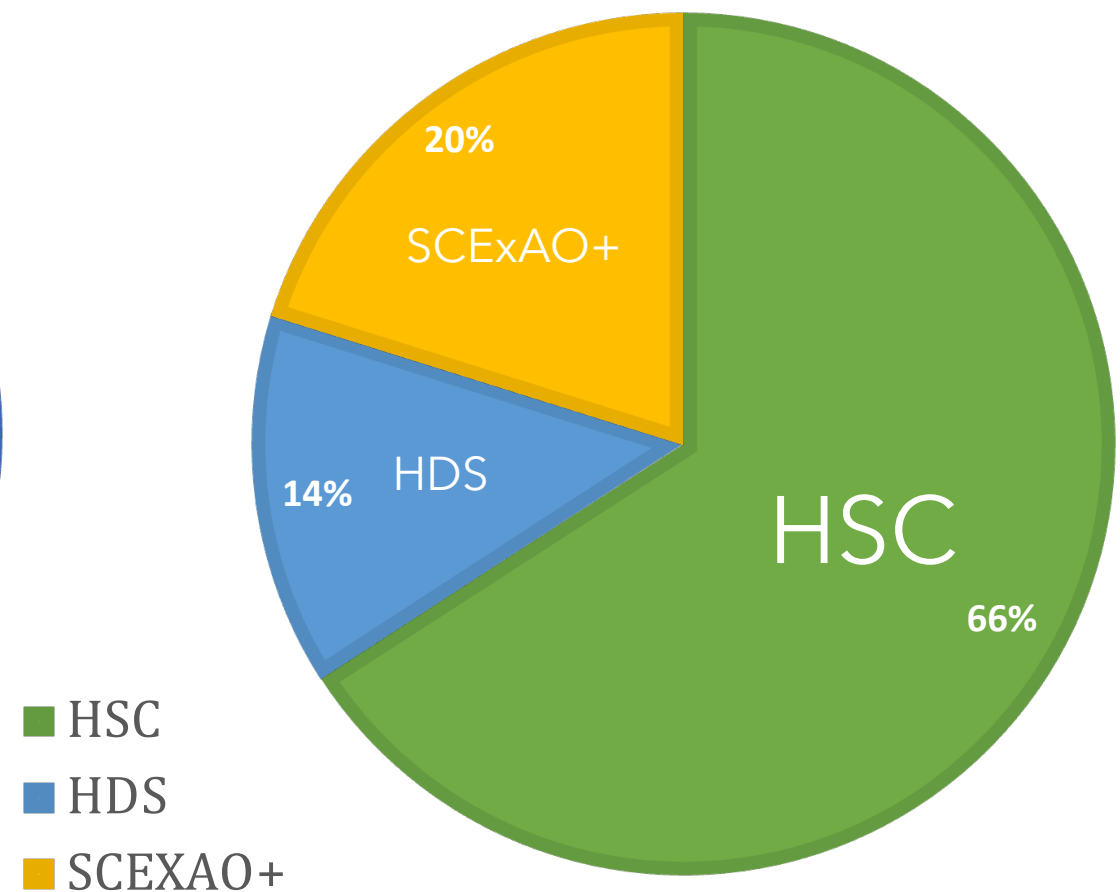
(**approved** in S22A/S22B/S23A/S23B)



N (proposal) = 4.8 /semester
N (approved nights) = **4.5 n/semester**

Gemini → Subaru

(**approved** in S22A/S22B/S23A/S23B)

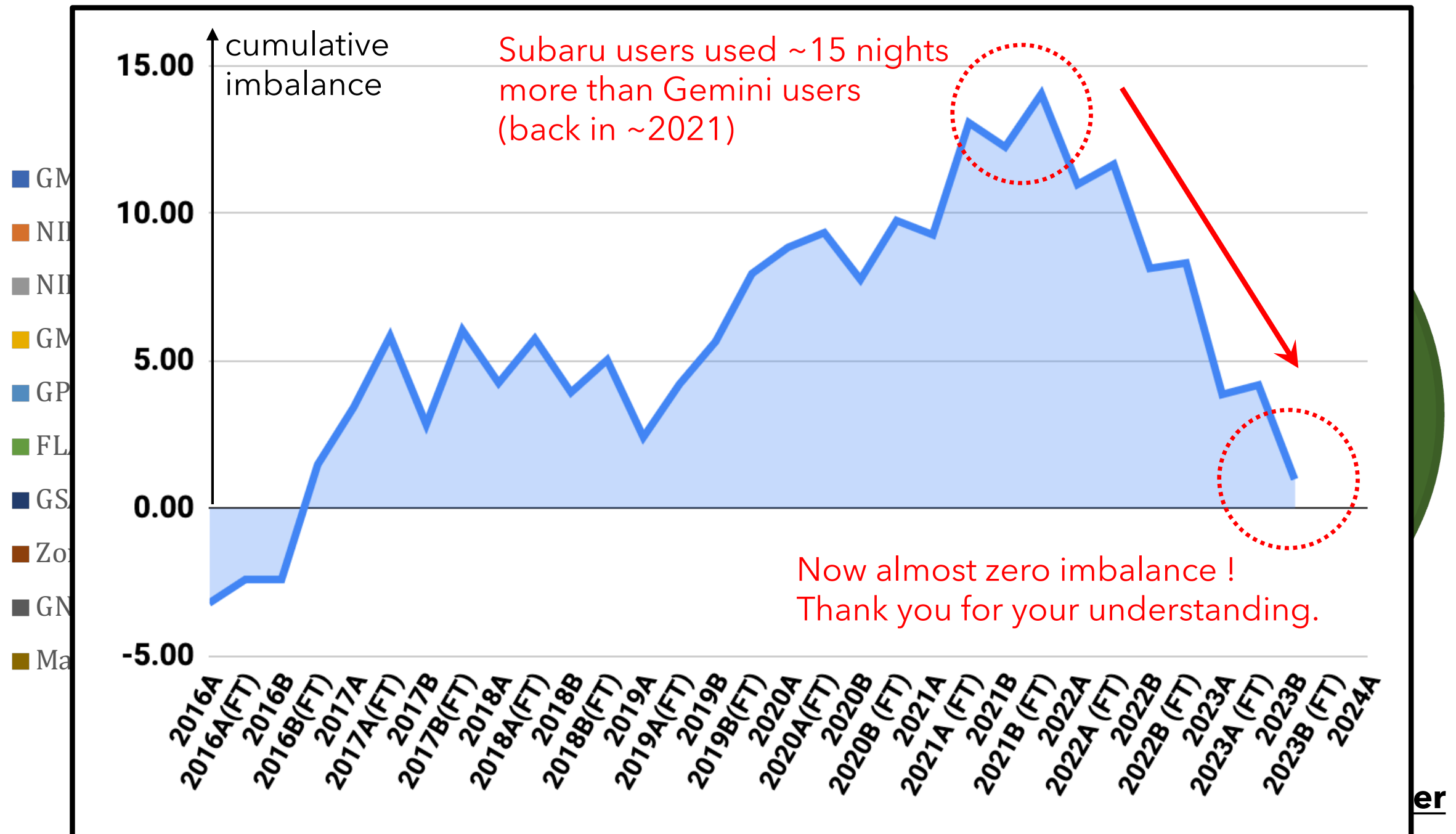


N (proposal) = 5.8 /semester
N (approved nights) = **8.1 n/semester**

This large difference reflects our strong action to reduce the imbalance between Gemini-Subaru exchange.

Operation

Subaru-Gemini exchange summary

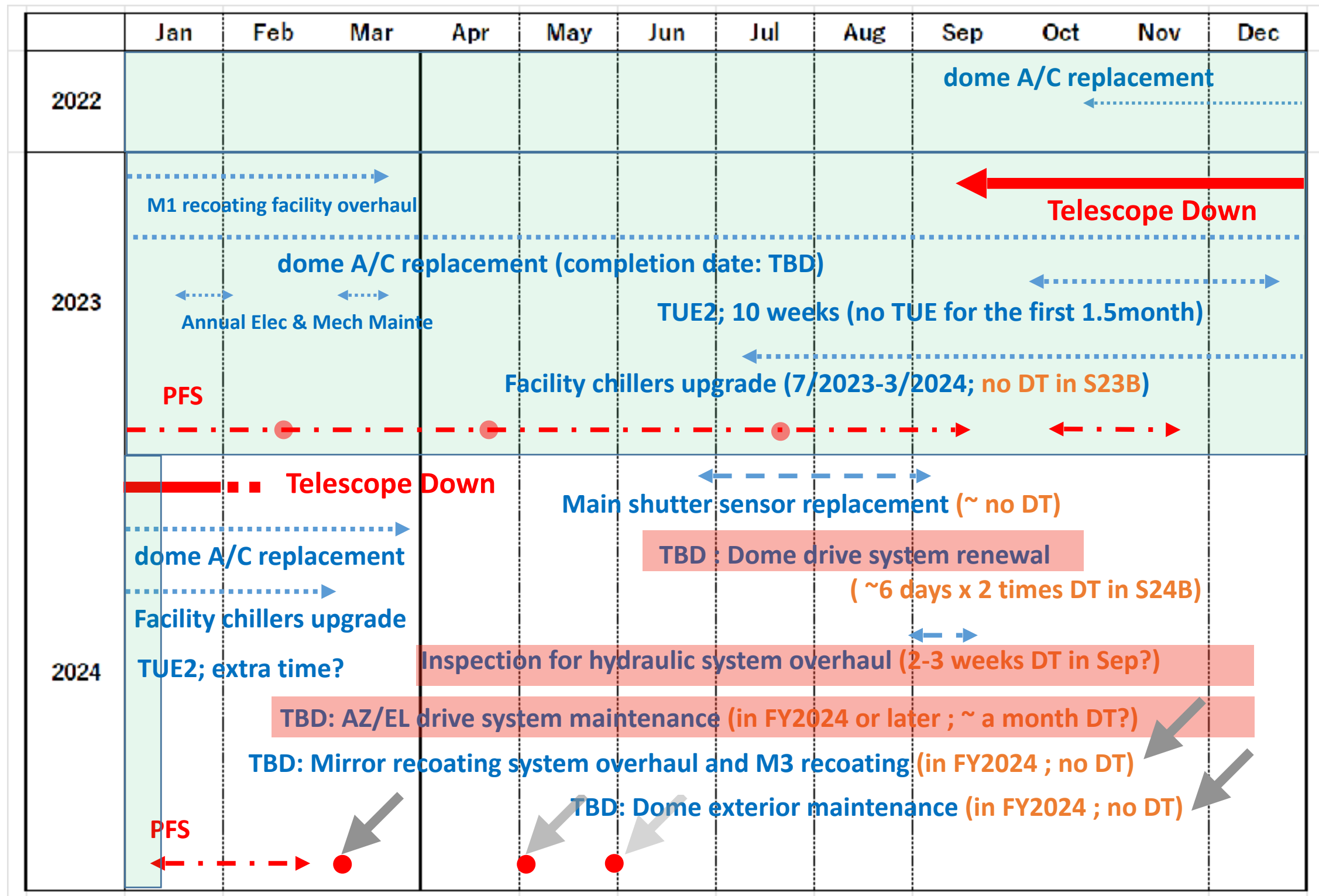


This large difference reflects our strong action to reduce the imbalance between Gemini-Subaru exchange.

Telescope

Items that require down time

major summit work plan for 2022 - 2024 (as of 1/8/2024)



Latest Changes

Development

- New laser
 - Test of TBAD is being planned. Until it becomes operational, human will be allocated to watch airplanes.
- PFS
 - Commissioning observing scheduled in Oct and Dec were canceled due to the M1 trouble.
 - Start of open use slipped from S24B to S25A
 - Commissioning run will resume from Mar. 2024
- GLAO
 - Next milestone is the FDR

Science Highlight

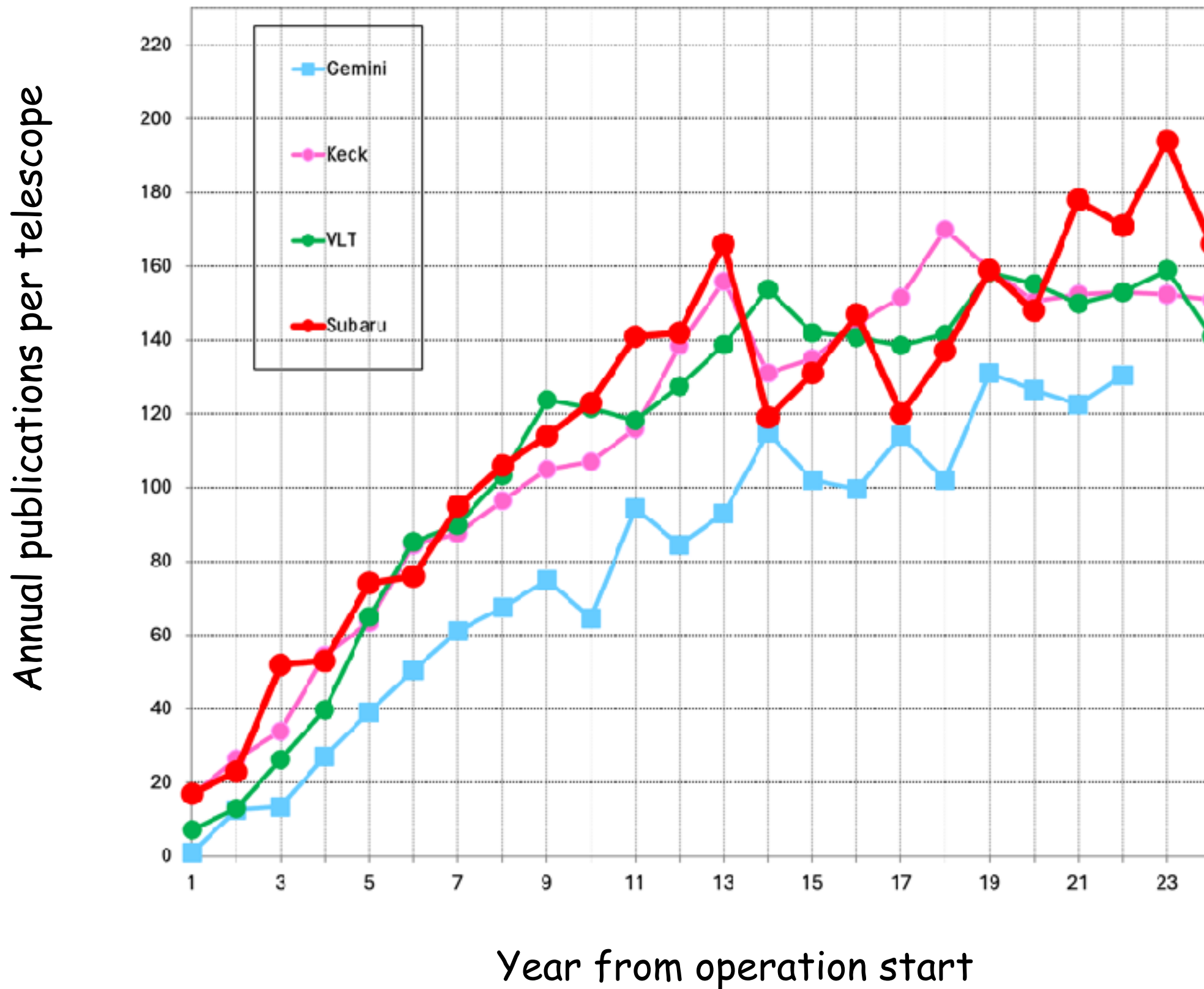
Subaru Press/Web Release 2023

1. **Discovery of the Largest-class Monster Supercluster of Galaxies 5.5 Billion Light-Years Away (Jan. 19)**
2. **Direct Imaging Uncovers a Giant Planet-Like Brown Dwarf in the Hyades Cluster (Jan. 23)**
3. **A Tale of a Tail: A Tidally-Disrupting Ultra-Diffuse Galaxy in the M81 Group (Jan. 26)**
4. **12 New Jovian Moons Discovered (Feb. 12)**
5. **AI Finds that First Stars were Clustered Together (Mar 12)**
6. **How to See the Invisible: Using the Dark Matter Distribution to Test Our Cosmological Model (Apr. 3)**
7. **Subaru+GTC Collaboration to Target Gravitational Wave Events (Apr. 12)**
8. **Subaru Telescope Images, Weighs, and Tracks Massive Benchmark Exoplanet (Apr. 13)**
9. **Galactic Recycling Confirmed in Ancient Galaxy (May. 31)**
10. **Signature of Very Massive First Stars Recorded in a Milky Way Star (Jun. 6)**
11. **Survey of Star Masses in Early Universe Analog (Jul. 5)**
12. **A Joint Team of Astronomers and Citizen Astronomers Addresses Mysteries of Galaxies! (Oct. 9)**
13. **"A New Lens" into the Universe's Most Energetic Particles (Oct 11)**
14. **10 Billion Year, 50,000 Light-year Journey to Black Hole (Dec. 3)**

Solar system Exoplanets Stars Galaxies Cosmology

Publications

167 papers in CY23



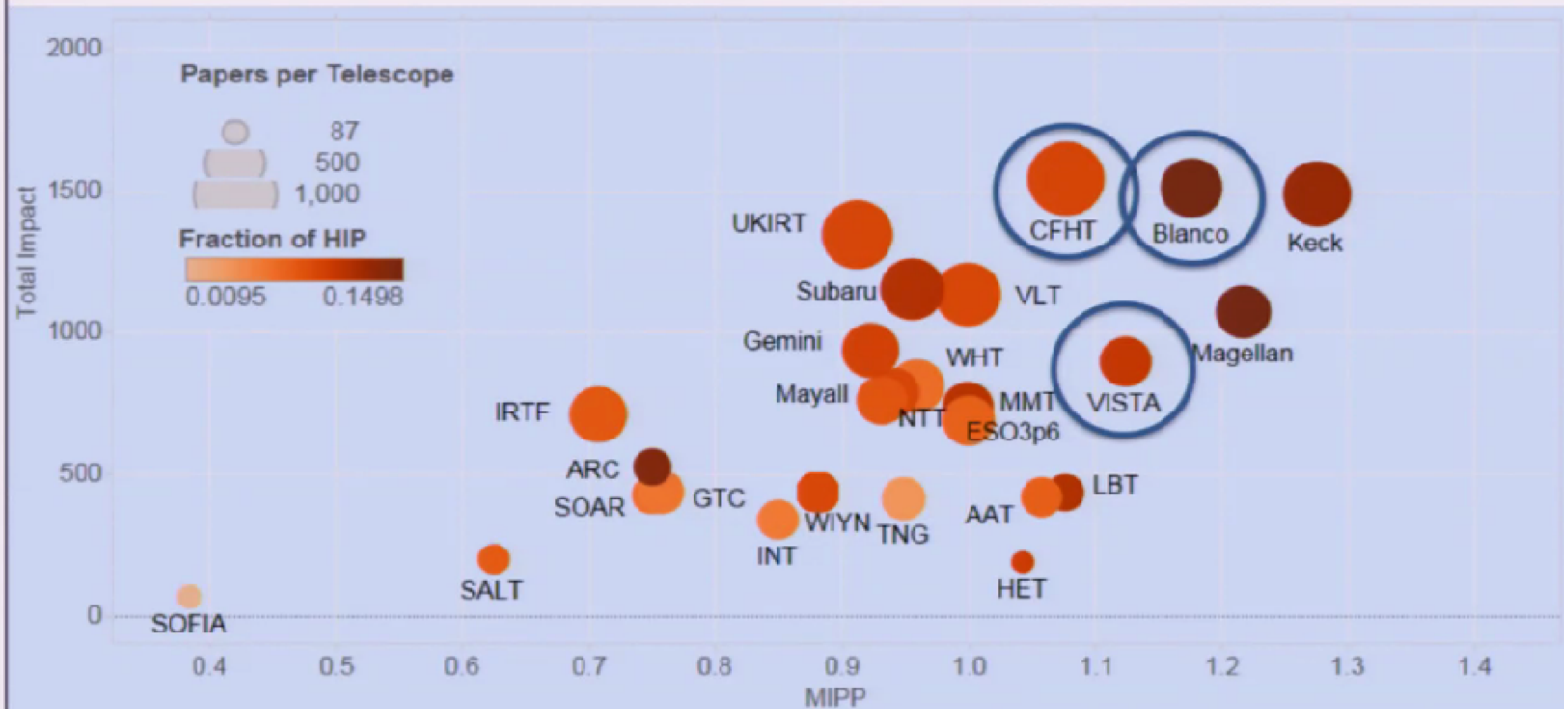
Impacts

KWFI on Keck — maintaining leadership

Impact of wide-field imagers — (plot credit Hilton Lewis, Dennis Crabtree)

KWFI will help Keck maintain its leadership in the era of 30m-class telescopes

Why KWFI?



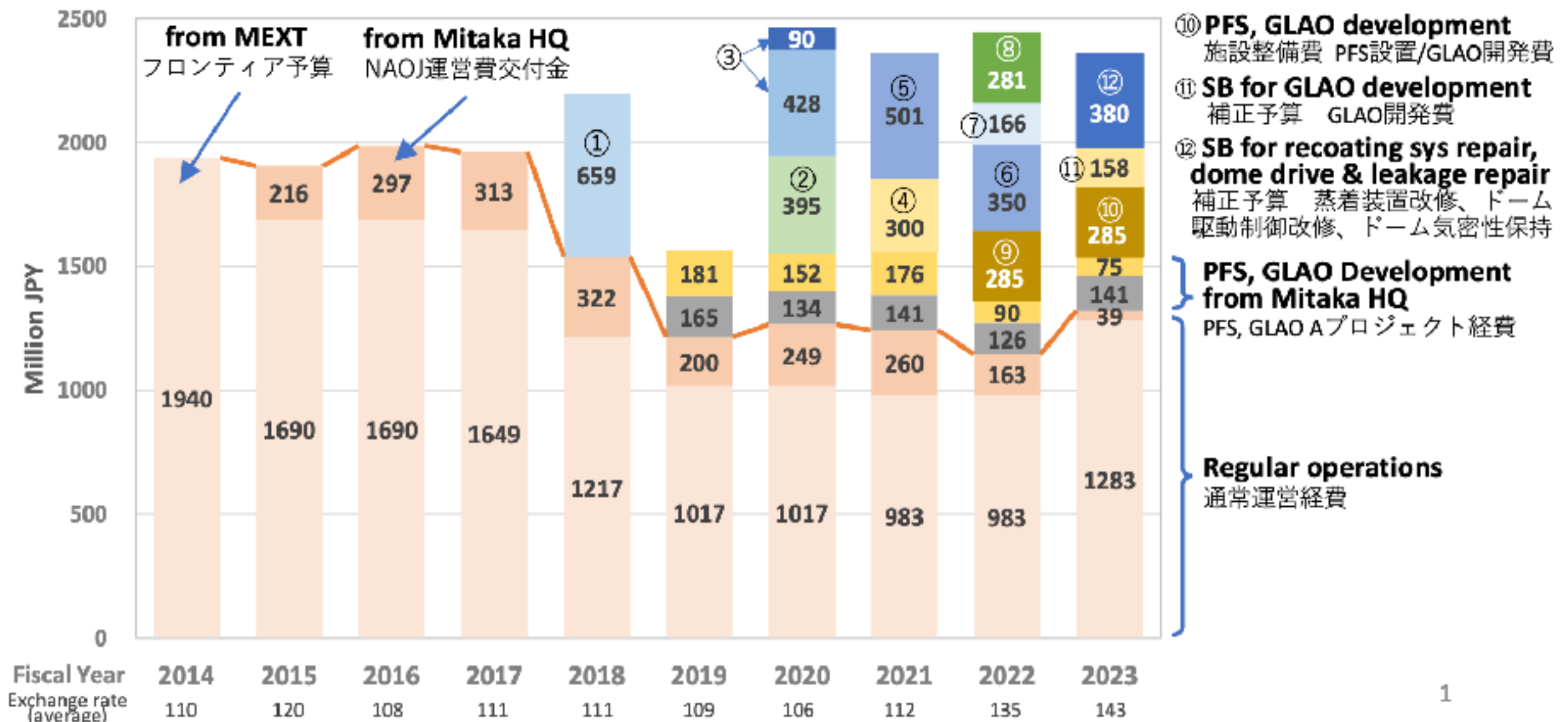
MIPP vs. Total Impact. Color shows sum of % Hip. Size shows sum of P/T. The marks are labeled by Telescope.

from KWFI presentation by Jeff Cooke

Annual Budget

Salary of NAOJ permanent staff is not included

- ① Supplemental Budget from MEXT(SB) for natural disaster 災害復旧経費(補正予算)
- ② Dome A/C renewal from MEXT 施設整備費 ドーム空調更新
- ③ SB for remote observation & recoating system overhaul 補正予算 遠隔観測システム、蒸着装置改修・蒸着
- ④ SB for GLAO development 補正予算 GLAO開発費
- ⑤ SB for AZ/EL refurbishment and chiller renewal 補正予算 方位高度軸改修、チラー更新
- ⑥ AZ/EL refurbishment 施設整備費 方位高度軸改修
- ⑦ SB for dome drive sys refurbishment and TUE overhaul 補正予算 ドーム駆動システム改修、TUEオーバーホール
- ⑧ SB for base A/C renewal 補正予算 山麓空調更新
- ⑨ SB for PFS, GLAO development 補正予算 PFS設置/GLAO開発費

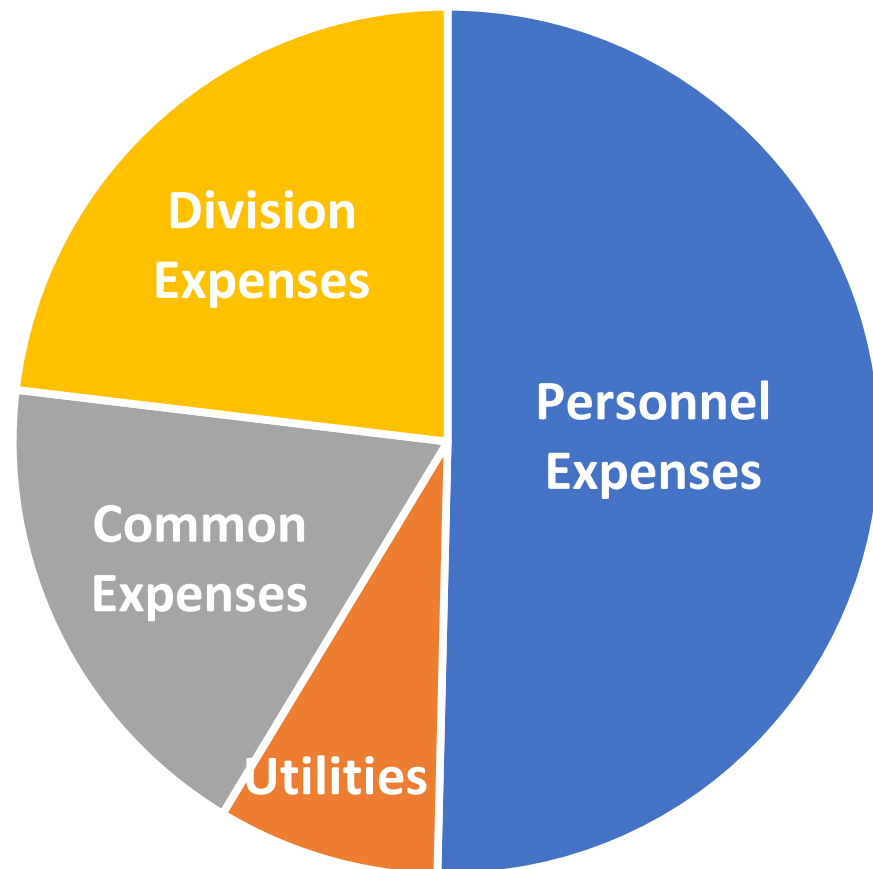


Support from the funding agency is steady but ...

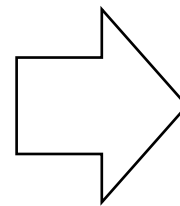
Breakdown of Annual Budget

Regular budget of Subaru, PFS and GLAO A project

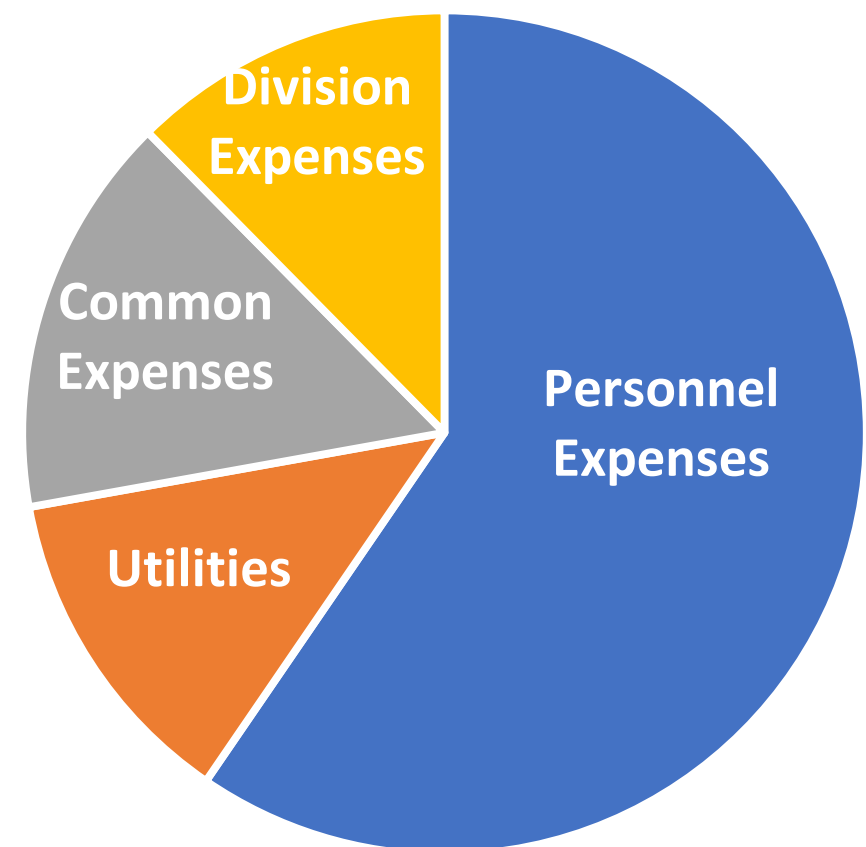
FY2021



Total: 15.6 oku JPY



FY2023



Total: 15.4 oku JPY

Amount is almost the same but ...

Operation Budget Summary

- Government support is steady but the exchange rate and the inflation is continuously reducing the degree of freedom of operations.
- Potential impacts on:
 - Implementation of unmanned night operation
 - Travel support to student PI
- Reduction of electricity bill is urgent.
- Identifying international partners is crucial.