Director's Report

Satoshi Miyazaki

2025-01-28

Presentation for Subaru UM FY2024 at Mitaka

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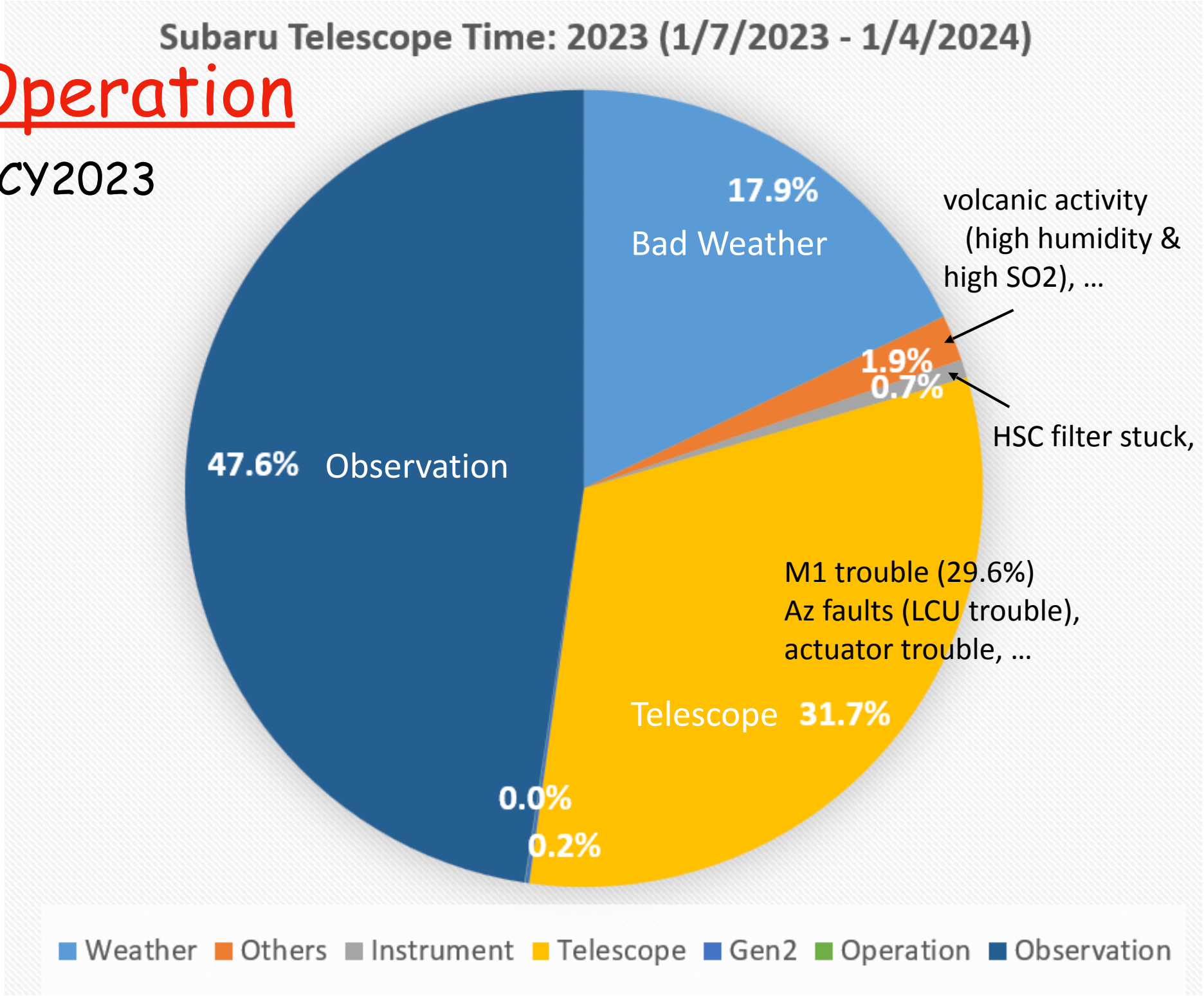
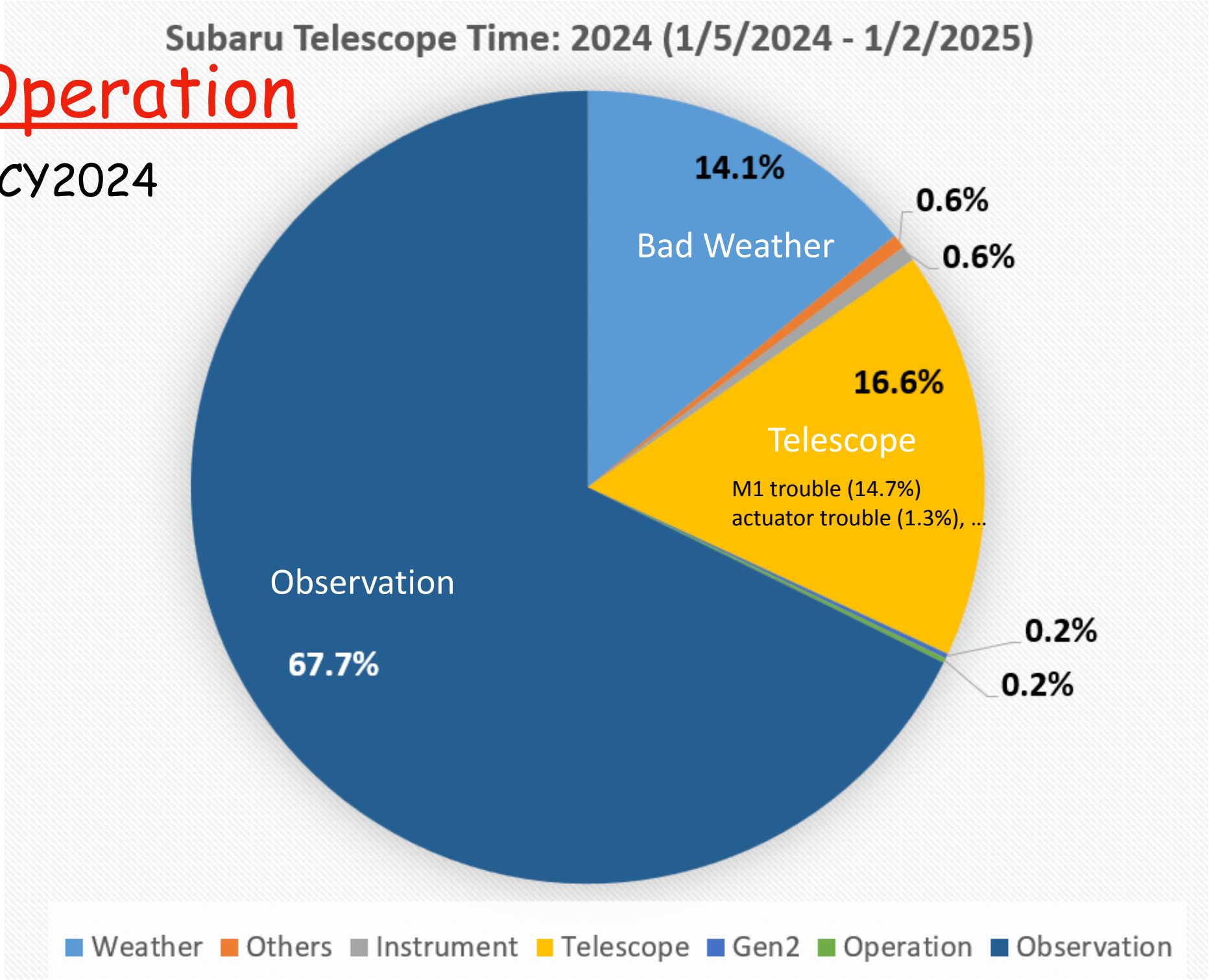
Operation

CY2023



Operation

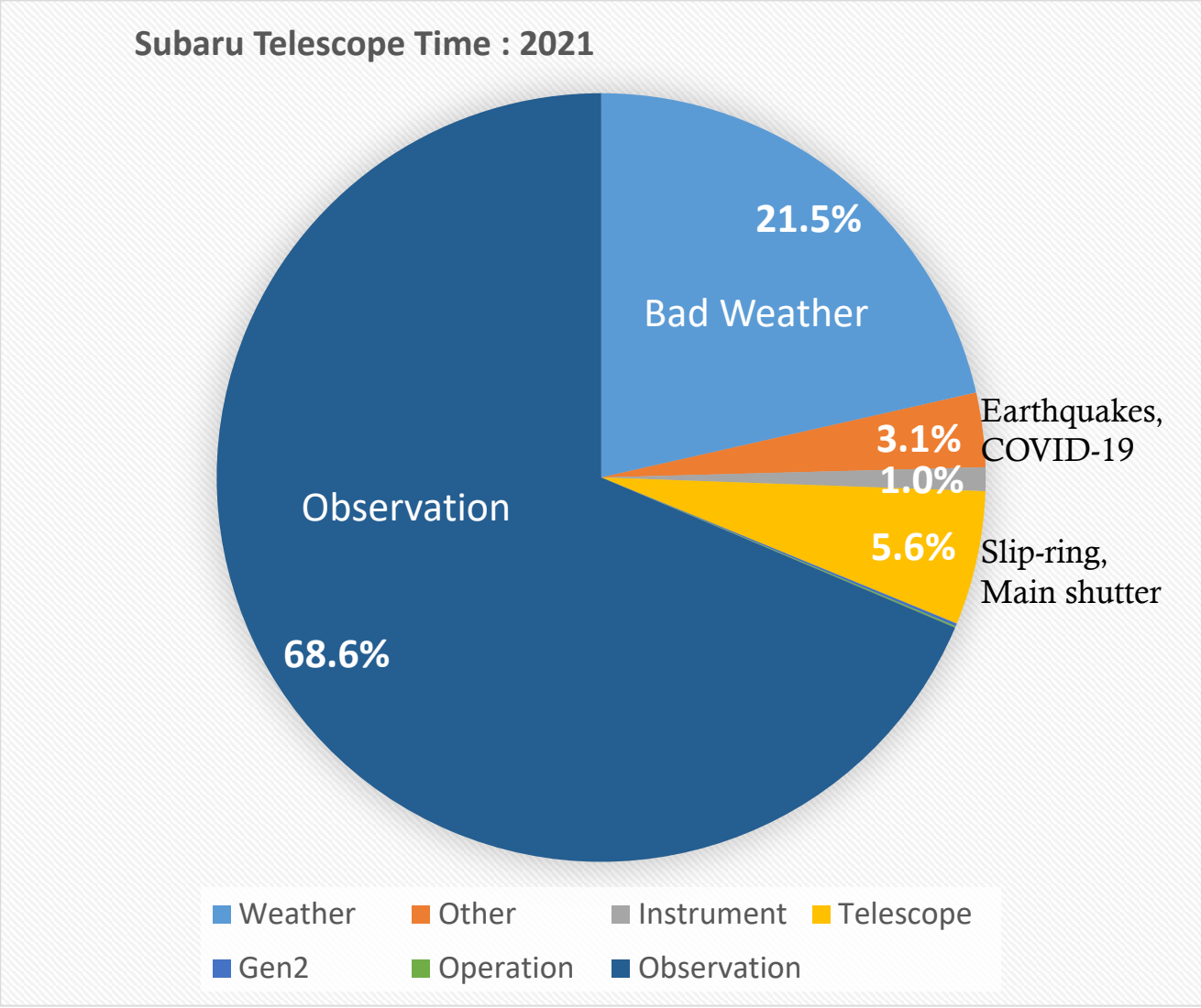
CY2024



Operation

Telescope Time Statistics in 2021

CY2021



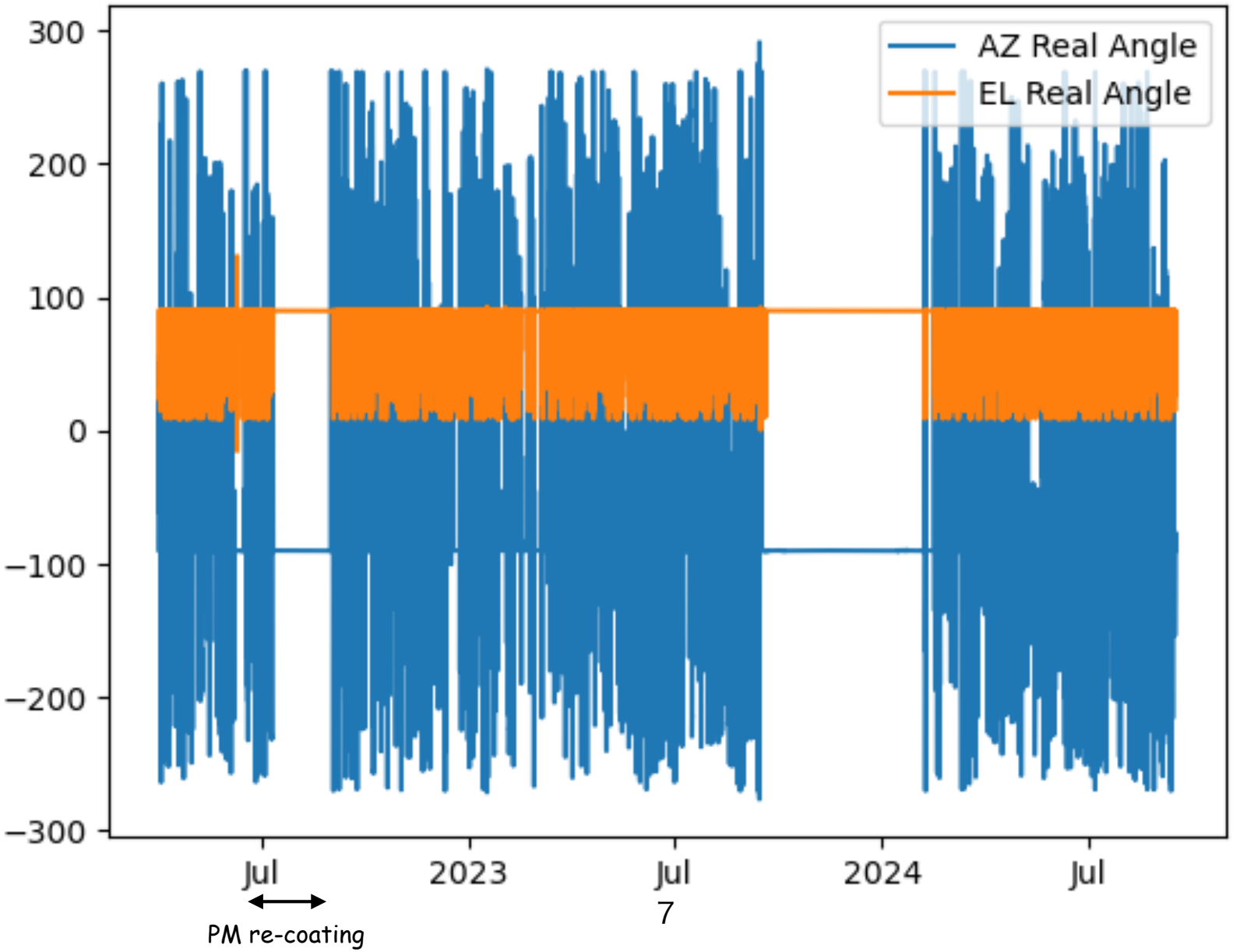
Presented by Yoshida-san in FY2021

Telescope

Incidents on the Primary Mirror …

Telescope

Incidents on the primary mirror results in 6 months shutdown: the longest shutdown in the Subaru operation history ⟷



Telescope

2023 年度ハワイ観測所主鏡事象最終報告書

2024 年 12 月 10 日

文書番号：NAOJ-SUBARU-000-A (T.B.D.)

Version 1.0

国立天文台ハワイ観測所

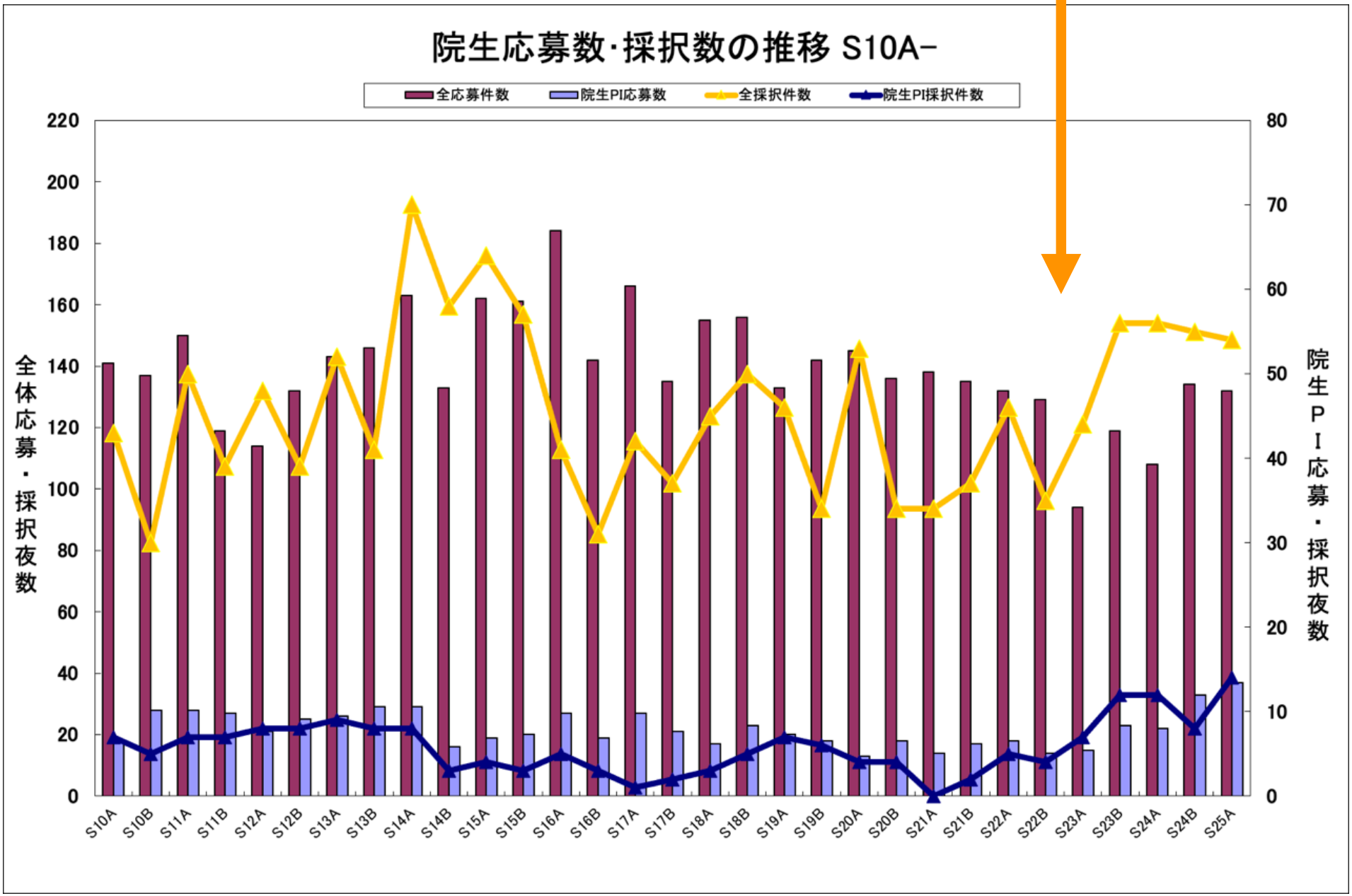
1

- Final Report submitted to the NAOJ management
  - 72 pages long
  - Main author: Kambe
  - Root causes
    - Lack of skilled staff on site (both in contractors and the observatory personel)
    - Lack of a firm emergency report line from the scene to a management team member who can decide the cancel of observing nights
    - Lack of imagination of the management team member

Operation

Proposal Statistics

Crisis !

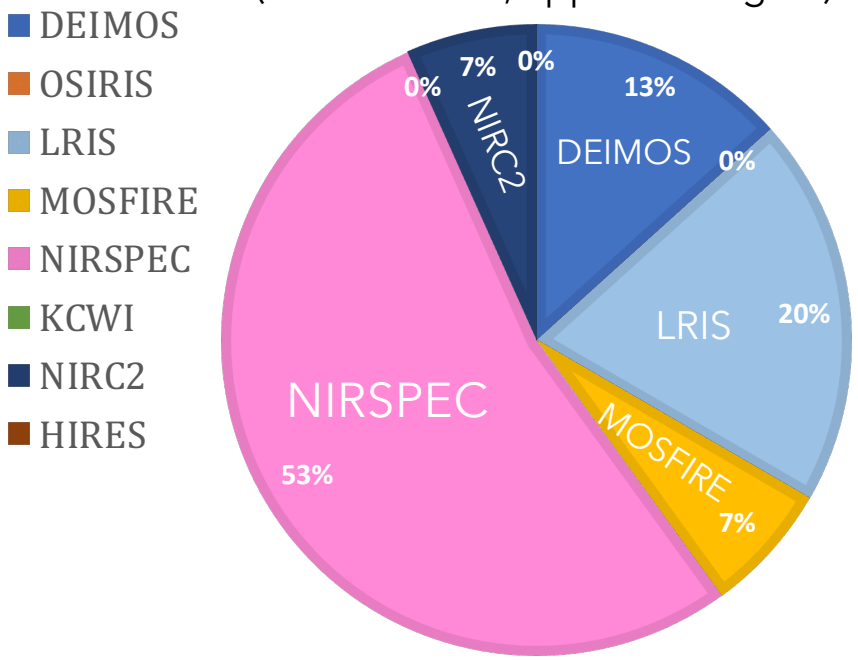


Operation

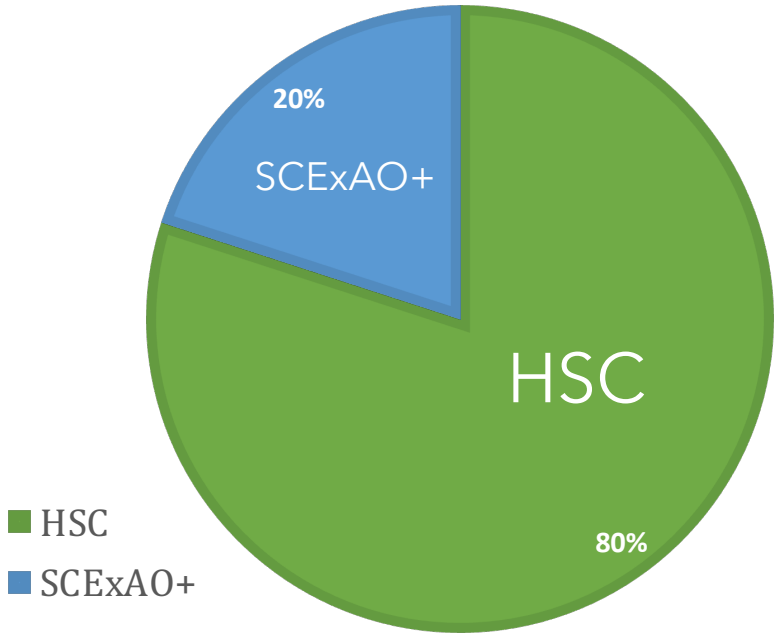
Subaru-Keck exchange summary

We exchanged 5.0 nights in S24A, 2.5 nights in S24B with Keck.

Subaru → Keck
(S24A & S24B, approved nights)



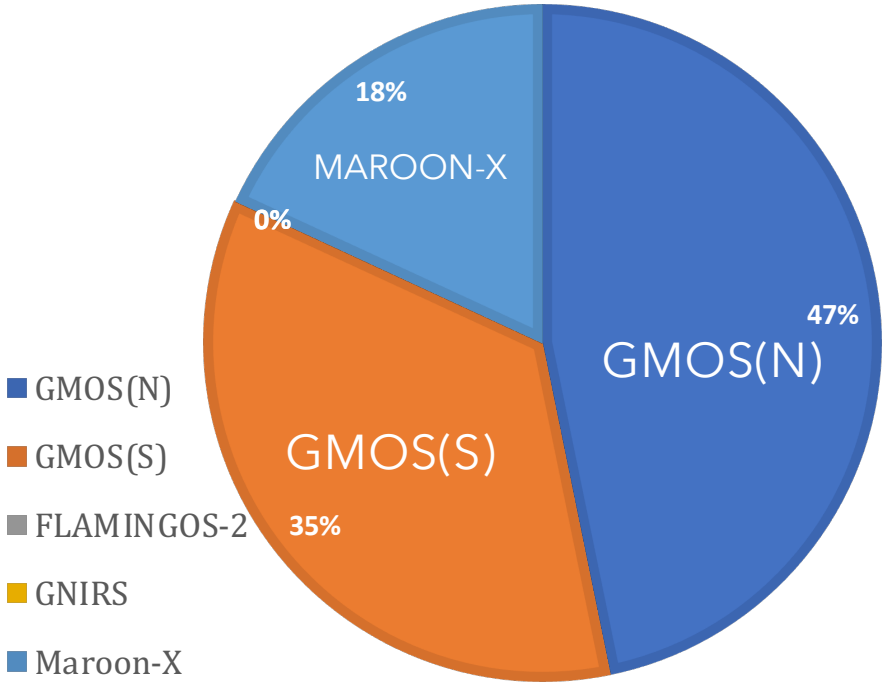
Keck → Subaru
(S24A & S24B, approved nights)



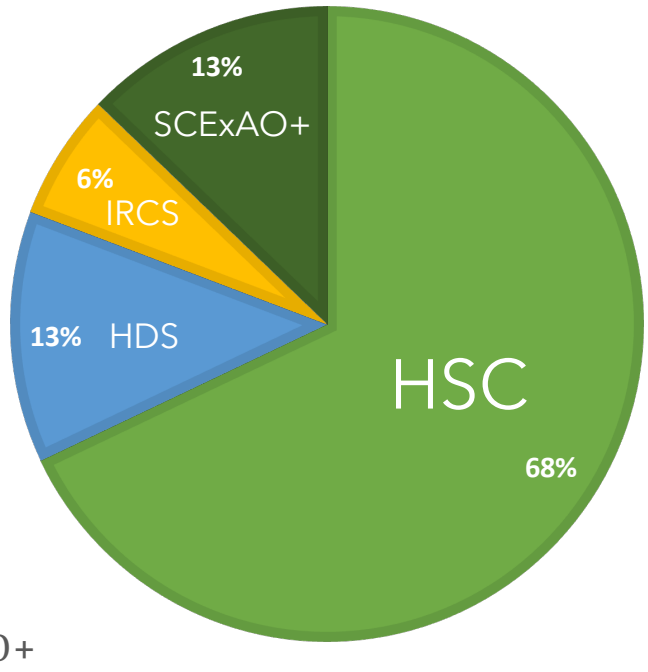
Operation

Subaru-Gemini exchange summary

Subaru → Gemini
(**8.55 nights approved** in S24A & S24B)



Gemini → Subaru
(**7.8 nights approved** in S24A & S24B)



Science Highlight

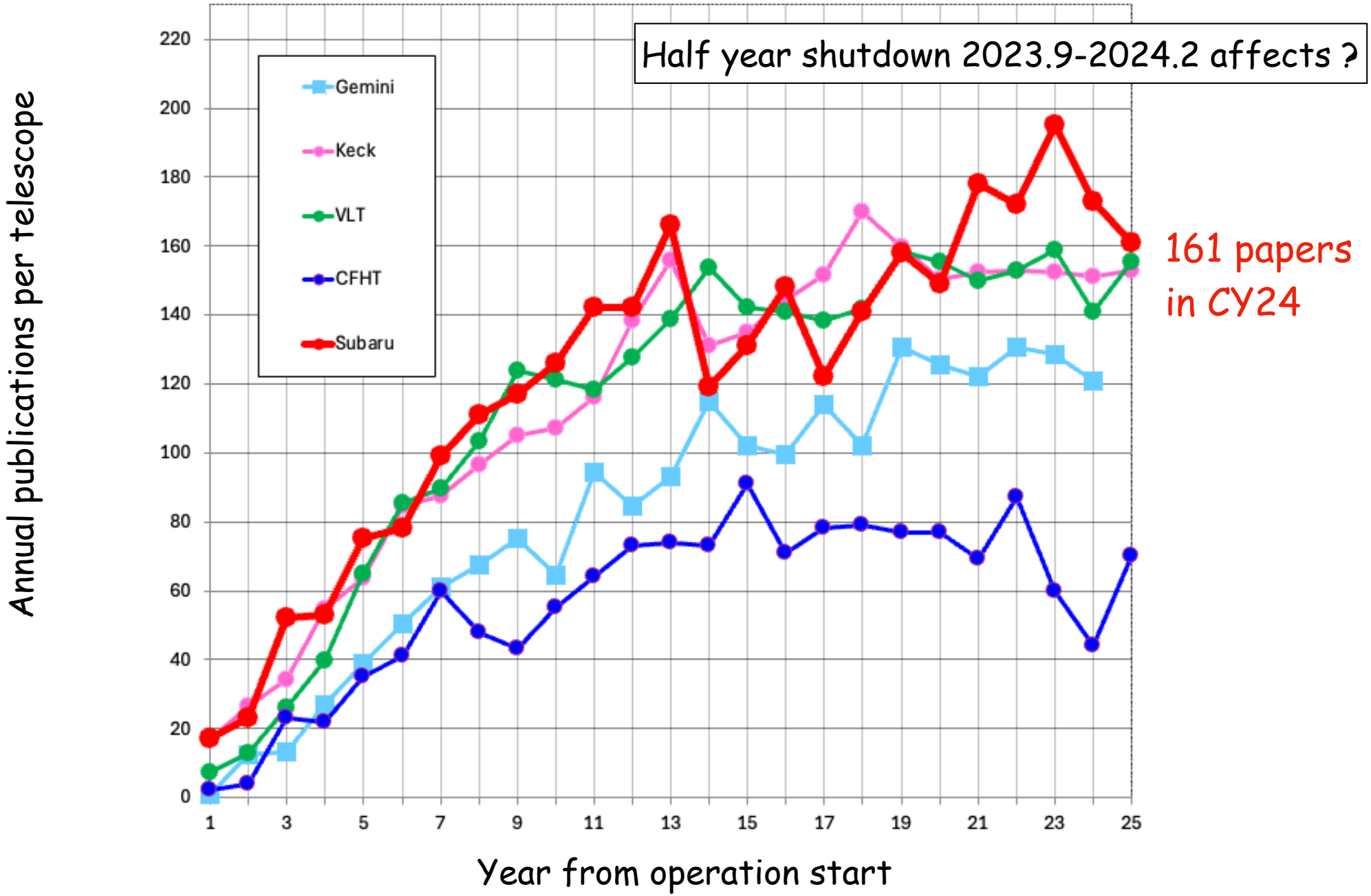
Subaru Press/Web Release 2024

1. **Cosmic Dark Matter Web Detected in Coma Cluster (Feb. 7)**
2. **Subaru Telescope Discovers the Faintest Moon Around Icy Giant Planets (Mar. 5)**
3. **Citizen Astronomers and AI Discover 30,000 Ring Galaxies (Mar. 13)**
4. **Discovery of an Exo-Venus: a Key to Find Extraterrestrial Life (May 23)**
5. **Earliest Twin Quasars Irradiated Young Universe (Jun. 17)**
6. **A New Horizon for the Kuiper Belt: Subaru Telescope's Wide-Field Observations (Jun. 25)**
7. **Too Many Missing Satellite Galaxies Found (Jun. 27)**
8. **Structure of the Outer Solar System Revealed (Sep. 4)**
9. **Subaru Telescope Inspires JWST "Firecracker" Discovery (Sep. 12)**

Solar system **Exoplanets** **Stars** **Galaxies** **Cosmology** **Others**

from Ishii-san's list

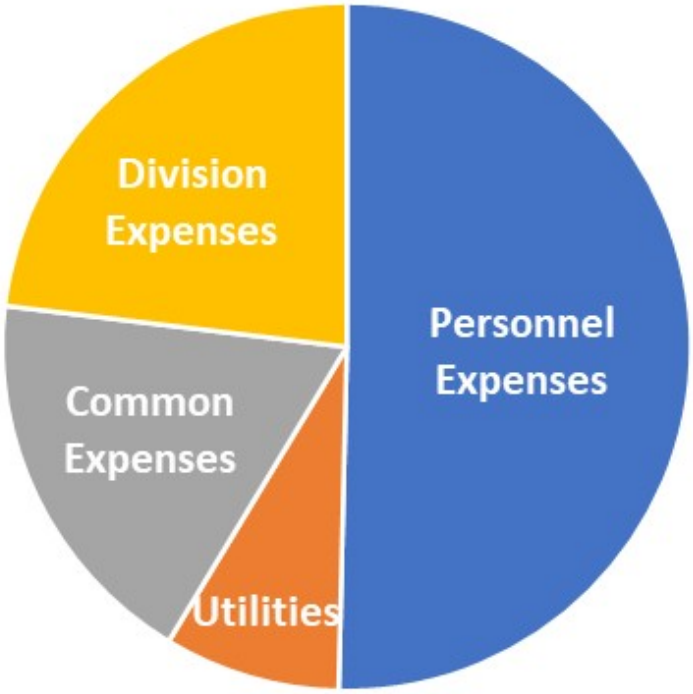
Publications



Breakdown of Annual Budget

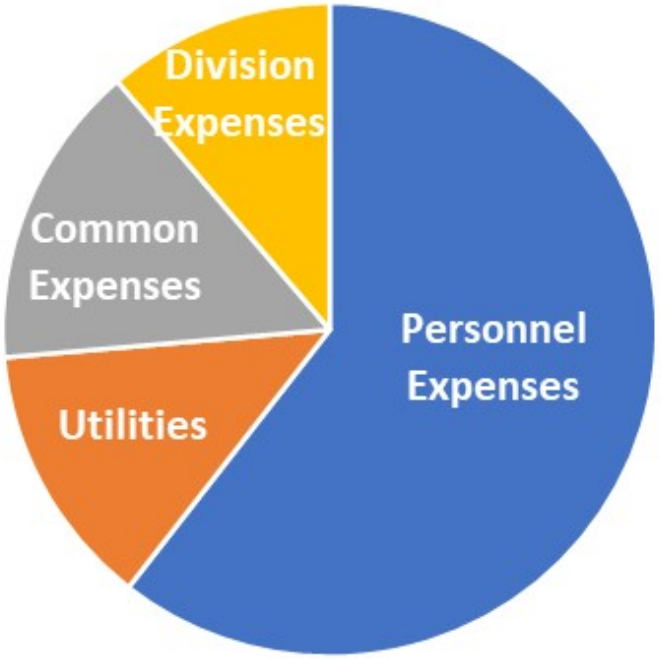
Regular budget of Subaru, PFS and GLAO A project

FY2021



Total: 15.6 oku JPY

FY2024



Total: 14.1 oku JPY

Amount is getting smaller and …

Operation Budget Summary

- Government funding for "the regular operation" is decreasing, and the JPY/USD exchange rate and the inflation is continuously reducing the degree of freedom of operations.
- Reduction of electricity bill is urgent.
- Identifying international partners is crucial.

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 **Remote observation & recoating system overhaul (SB)**
補正予算　遠隔観測システム、蒸着装置改修・蒸着

④ **GLAO development (SB)** 補正予算　GLAO開発費

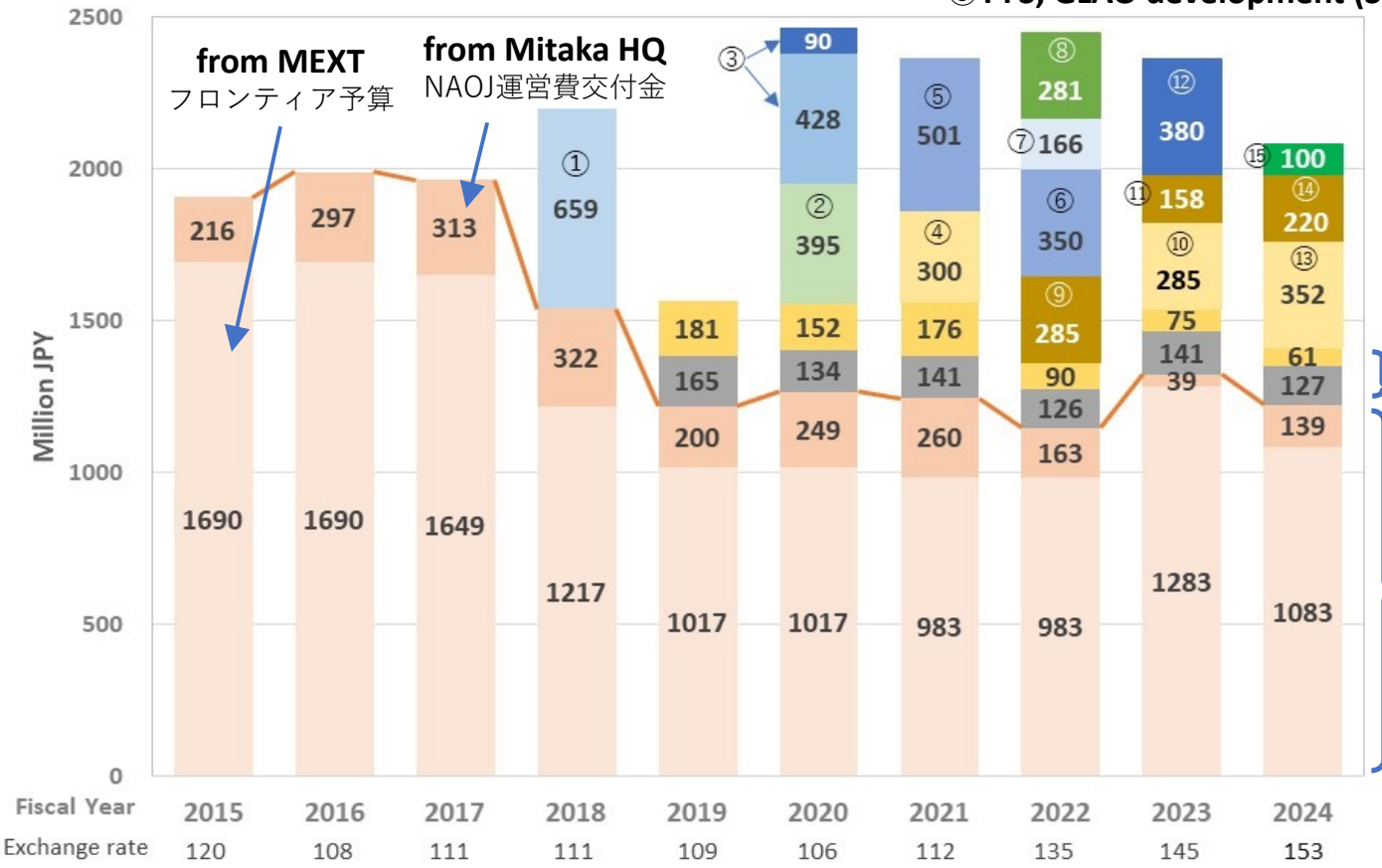
⑤ **AZ/EL refurbishment and chiller renewal (SB)**
補正予算　方位高度軸改修、チラー更新

⑥ **AZ/EL refurbishment**　施設整備費　方位高度軸改修

⑦ **Dome drive sys refurbishment and TUE overhaul (SB)**
補正予算　ドーム駆動システム改修、TUEオーバーホール

⑧ **Base A/C renewal (SB)**　補正予算　山麓空調更新

⑨ **PFS, GLAO development (SB)** 補正予算 PFS設置/GLAO開発費



⑩⑬ **GLAO development**
施設整備費 GLAO開発費

⑪⑭ **GLAO development (SB)**
補正予算　GLAO開発費

⑫ **Recoating sys repair, dome drive & leakage repair (SB)**
補正予算　蒸着装置改修、ドーム駆動制御改修、ドーム気密性保持

⑮ **Unmanned night operation (SB)**補正予算 山頂夜間無人運用化

PFS, GLAO Development from Mitaka HQ
PFS, GLAO Aプロジェクト経費

Regular operations
通常運営経費

Annual Budget

- At the end of year 2024, we are informed that the FY2025 Subaru budget for regular operation will keep the similar level, plus "Special Budget for Disaster Recovery" in the government plan proposed for the congress.

- If approvd this budget is stacked on the "FY2024 bar" in the previous slide.

"Disaster"

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Chipping off the dome paint due to the (perhaps icy) high wind by a tropical storm in Aug. 2024.

Annual Budget

(Salary of NAOJ permanent staff is not included)

① **Supplemental Budget from MEXT(SB) for natural disaster**
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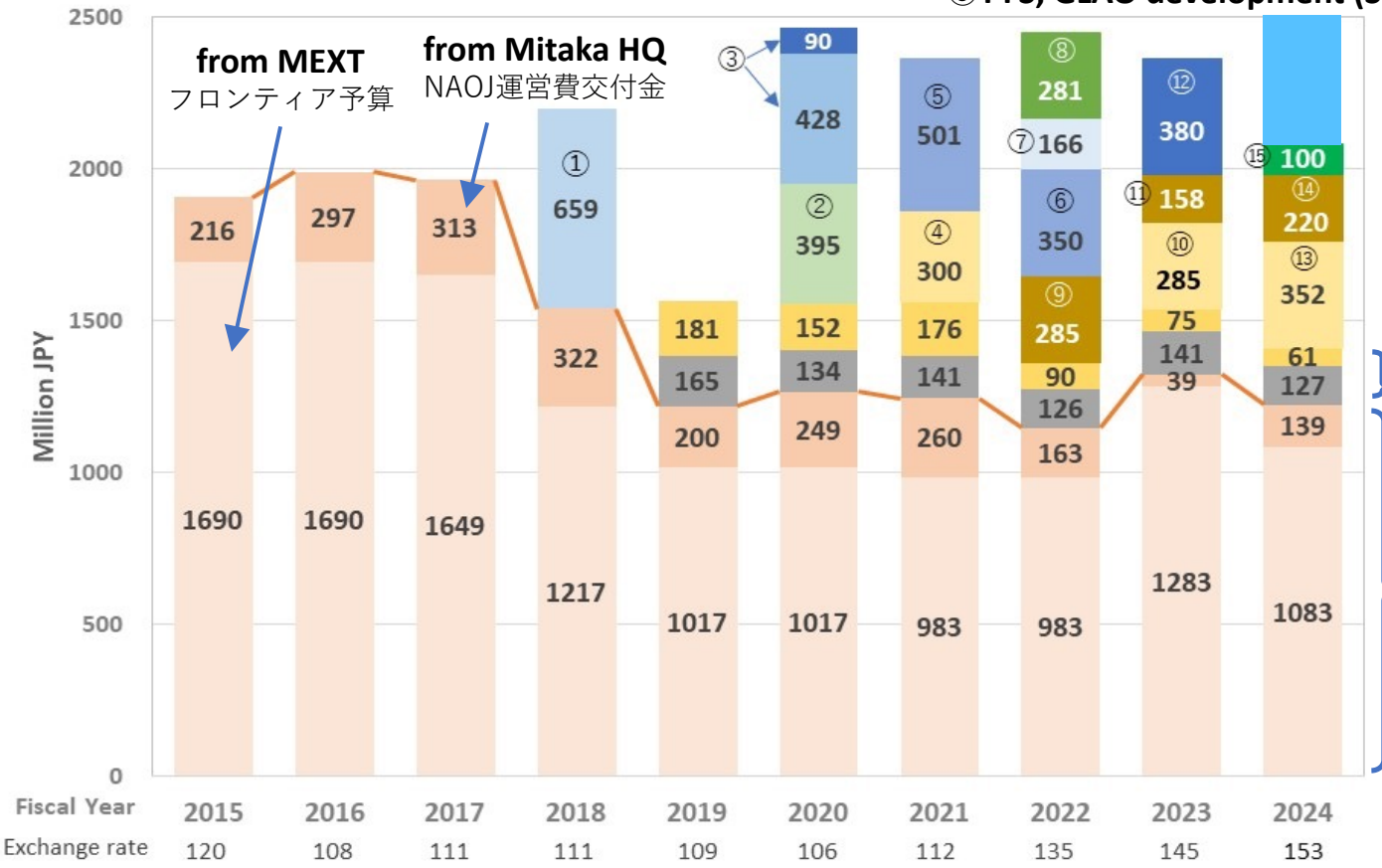

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PFS, GLAO Aプロジェクト経費

Regular operations
通常運営経費

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Long term prosepcts of operation of Subaru

Concerns:

- Increase of telescope troubles due to aging
- Relative complexity of Subaru Telescope
- Decrease of skilled personnel on-site
- Likely decrease of operation budget

Long term prosepcts of operation of Subaru

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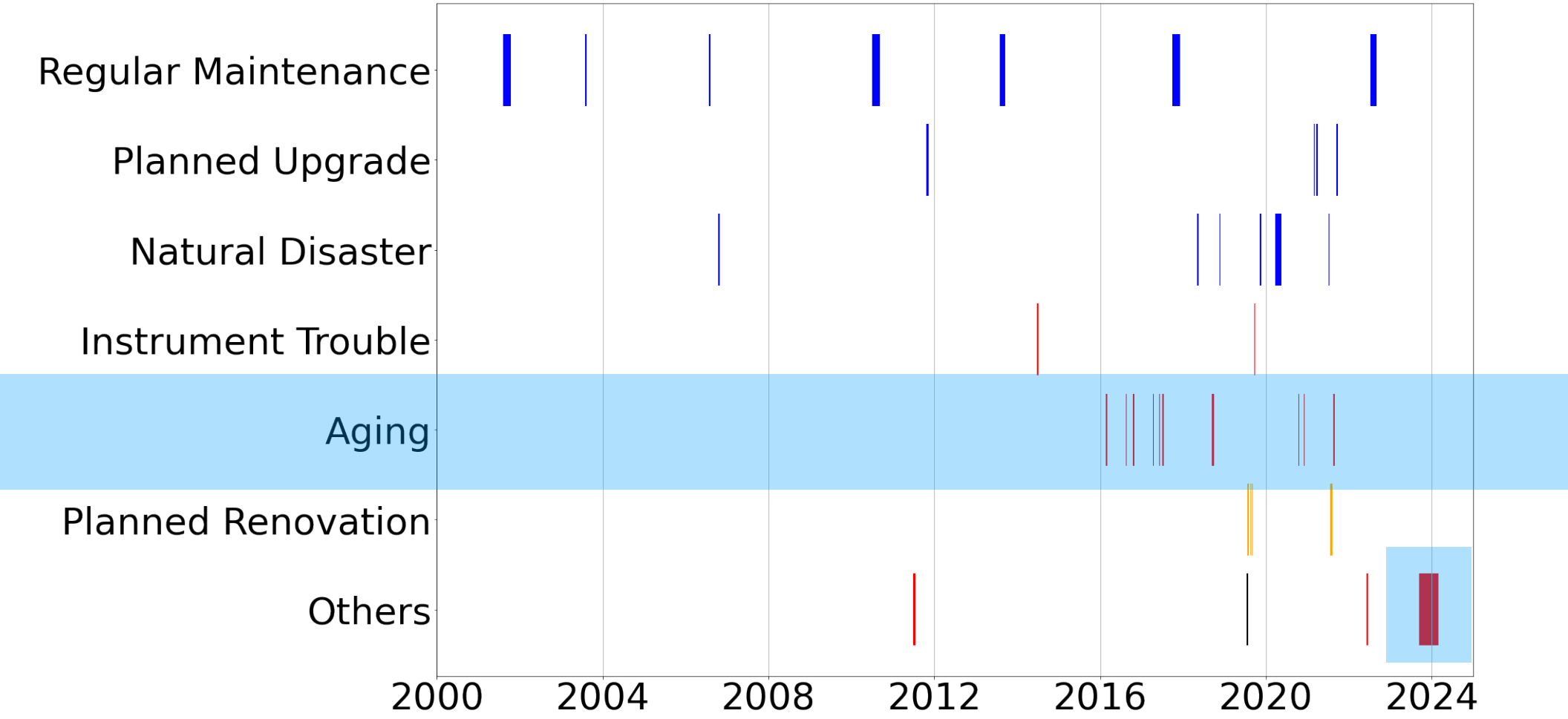
- Increase of telescope troubles due to aging



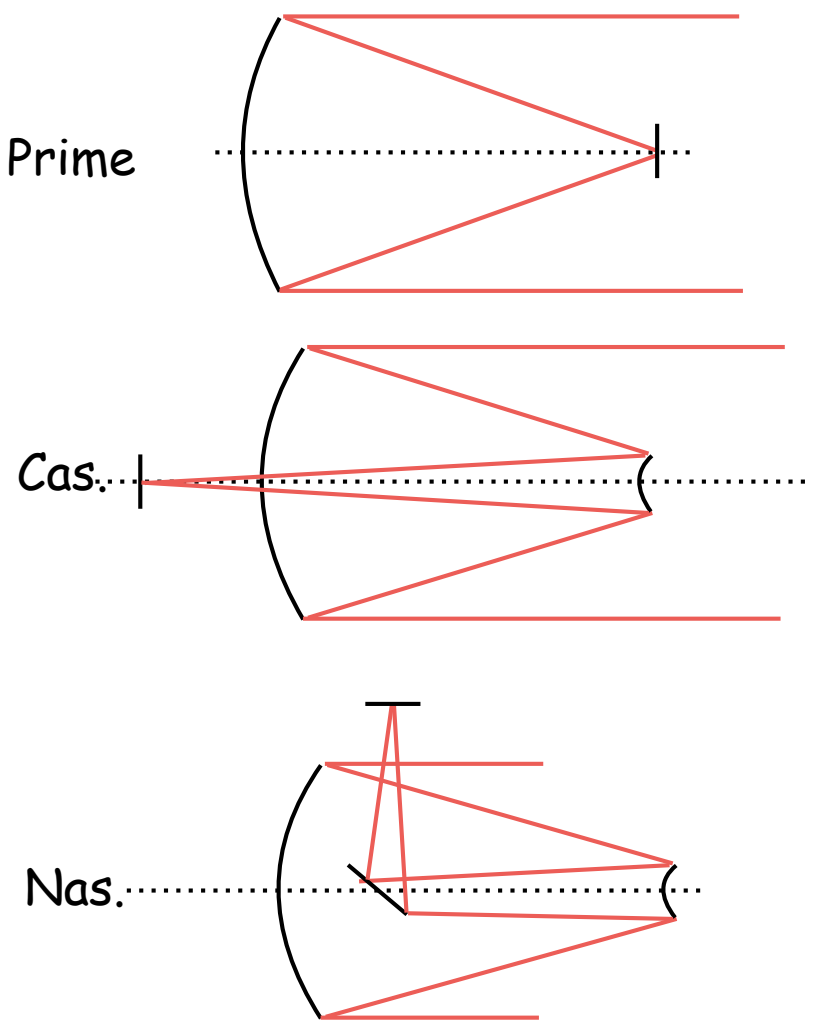
Shutdown Period since the first light

Long term prosepcts of operation of Subaru

Concerns:

- Relative complexity of Subaru Telescope

	Keck	Gemini	Subaru
Prime			✓
Cas.	✓	✓	✓
Nas.	✓		✓



Long term prosepcts of operation of Subaru

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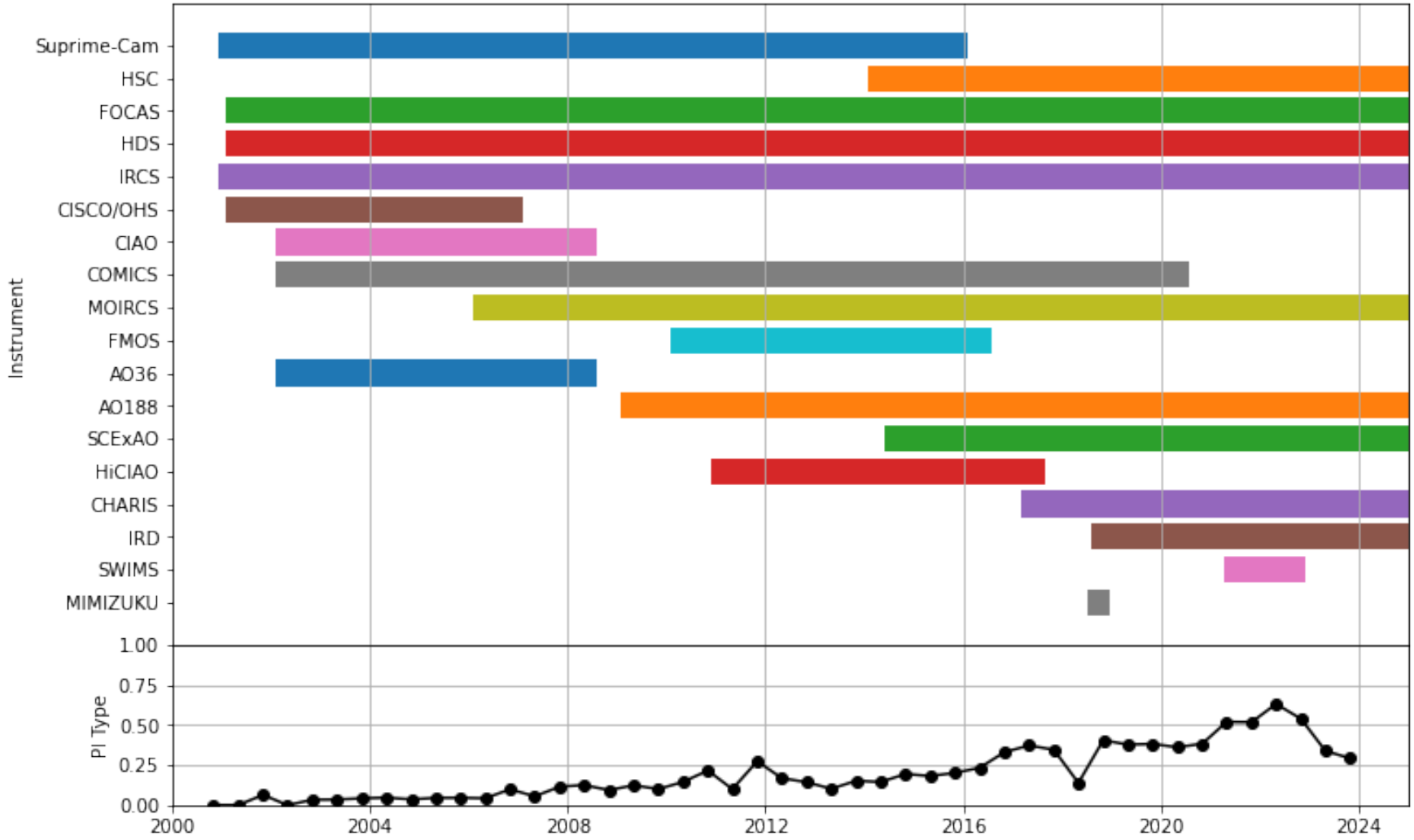
- Relative complexity of Subaru Telescope



Long term prosepcts of operation of Subaru

Concerns:

- Relative complexity of Subaru Telescope
  - Top Unit Exchange (TUE) is complex, and delicate process because the change is made above the primary mirror.
    - Required skilled personel on site
  - Cas. Instrument Exchange is also complex.
  - Number of instruments: Large
    - Fraction of usage of PI type instrument: Large
      - Is this healthy ?

Long term prosepcts of operation of Subaru

Concerns:

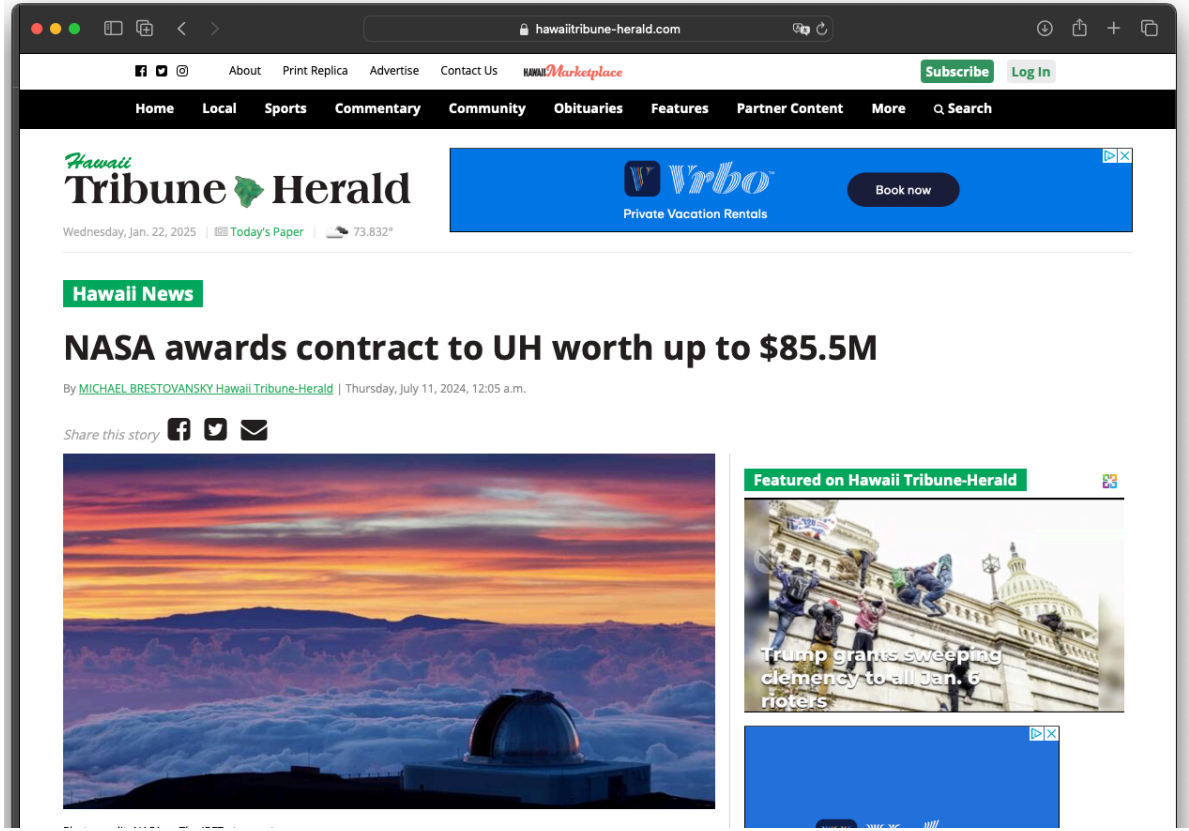
- Decrease of skilled personnel on-site
  - Stay limit of A2 Visa holders introduced
  - Majority of NAOJ techinical staff have to retun to Japan by 2026/08
  - Rotation of personel is being planned and implemented based on the NAOJ wide discussions, and understanding of the NAOJ leadership

Long term prosepcts of operation of Subaru

Concerns:

- Likely decrease of operation budget

  - In particular after the TMT activity starts to ramp up



	Subaru	IRTF
Diameter	8.2 m	3.0 m
Staff	82	~ 25
Annual Budget	~$10M including special budget allocated for refurbrishments	$8.55M

Long term prosepcts of operation of Subaru

Concerns:

- Likely decrease of operation budget

  - In particular after the TMT activity starts to ramp up

> Subaru is currently super-efficient but it will certainly not last for long because people work too hard with less salary.

Changes is highly required allowing the reduction of d.o.f.

Long term prosepcts of operation of Subaru

What can we do to cope with the situation:

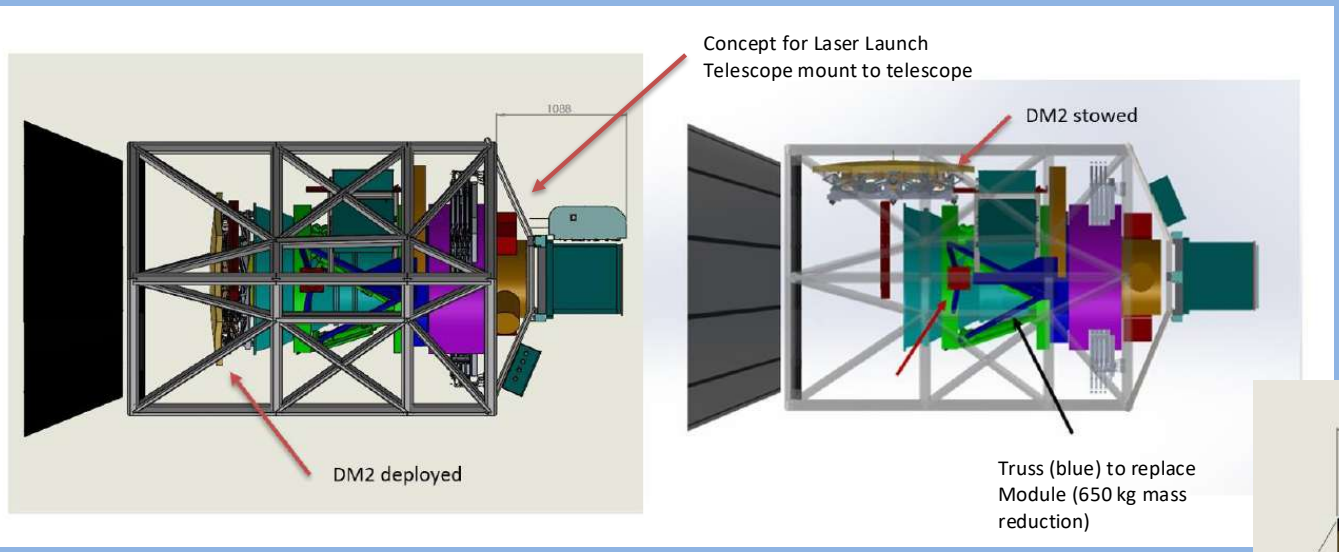
- Less frequent risky Top Unit Exchange (TUE)
  - Twice a year for example
    - TUE is carried out by vistitors from Mitaka
    - But we should accept the introduction of PFS semester, HSC semester, GLAO semester, Nasmyth semester

Long term prosepcts of operation of Subaru

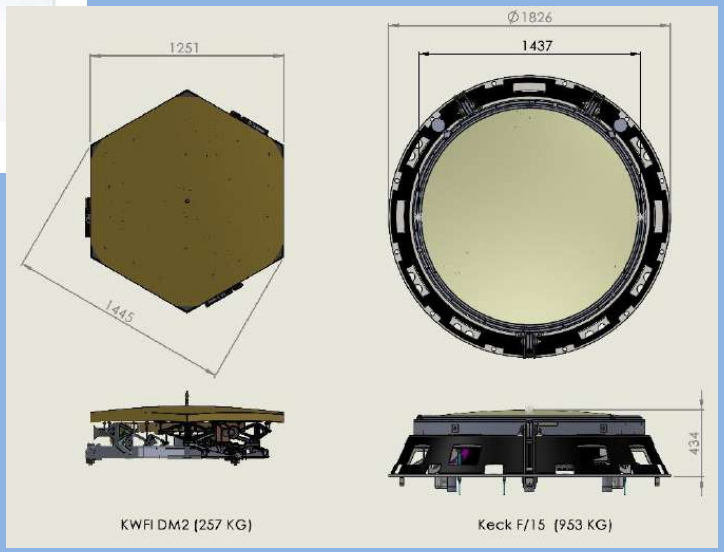
What can we do to cope with the situation:

A deployable M2 for KWFI?

UNIVERSITY OF CALIFORNIA OBSERVATORIES



TMT/ELT style M2 vs Keck F/15



What we know about DM2

1. Existing modules are not going to work, we need a new solution
2. Laser launch telescope mount needs to be moved from the Module to the telescope
3. Existing M2 mirror will not fit. Mirror will need to be a hexagon and lightweight with minimum back depth. TMT/ELT M1 style, silicon carbide, lightweight Zerodur or ULE are all

What we don't know about DM2

1. How will we move it?
2. How will it attach to the camera?
3. What are the implication to the design of the corrector barrel?
4. What is the total mass?
5. Approximately what will it cost?

4

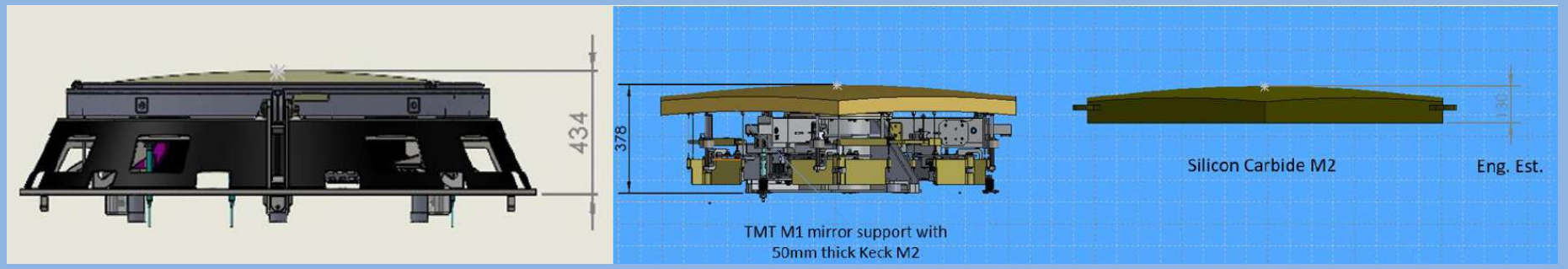
Slide by Matthew Radovan (UCO)

Long term prosepcts of operation of Subaru

What can we do to cope with the situation:

UNIVERSITY OF CALIFORNIA OBSERVATORIES

DM2 Mirror Options



Existing Keck F/15 Mirrors

- Cell includes tip/tilt/piston actuators
- Vacuum support on 3 hard point (axial support)
- Mercury girdle (radial support)
- 434 mm deep
- 953 Kg

TMT/ E-ELT style Mirror

- Keck M2 is the same size as M1 mirror
- TMT and E-Elt
- Hexagonal shape allow the mirror to tuck into the storage position
- Approx 380 mm deep for TMT style support
- Estimated mass- 260 Kg

Light weight monolithic mirror

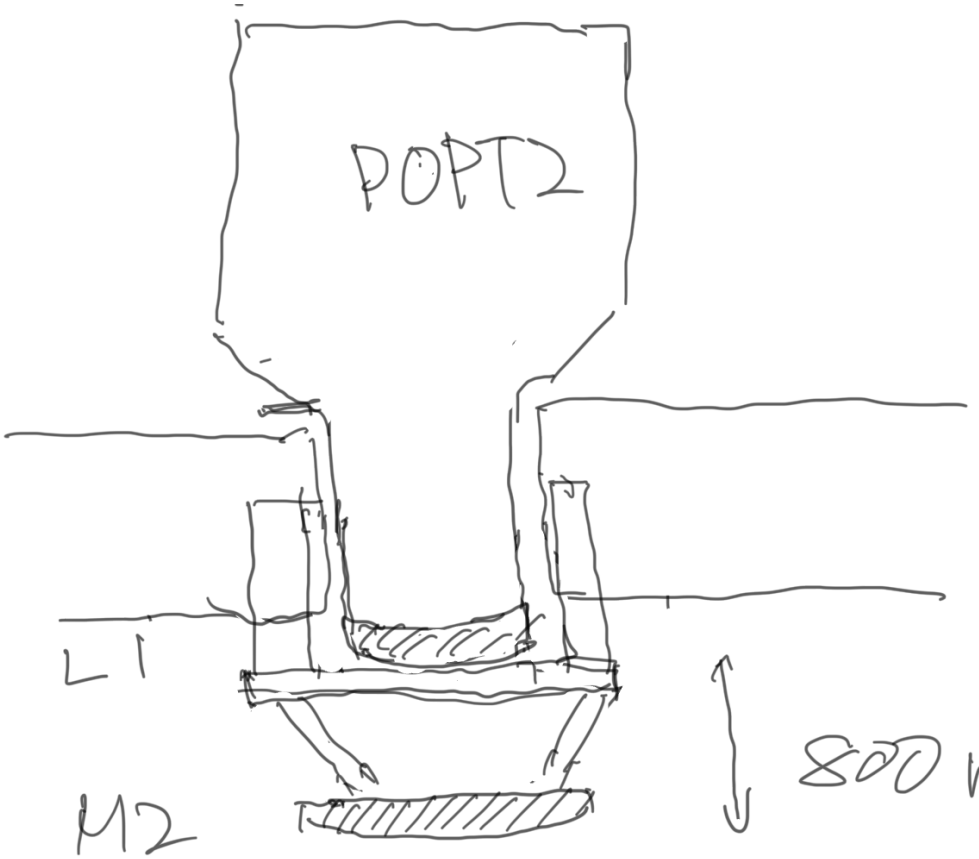
- Silicon Carbide or Zerodur or ULE
- Mirror needs structure for mounting
- Estimated depth < 200 mm
- Estimate mass 75 Kg

6

Slide by Matthew Radovan (UCO)

Long term prosepcts of operation of Subaru

What can we do to cope with the situation:



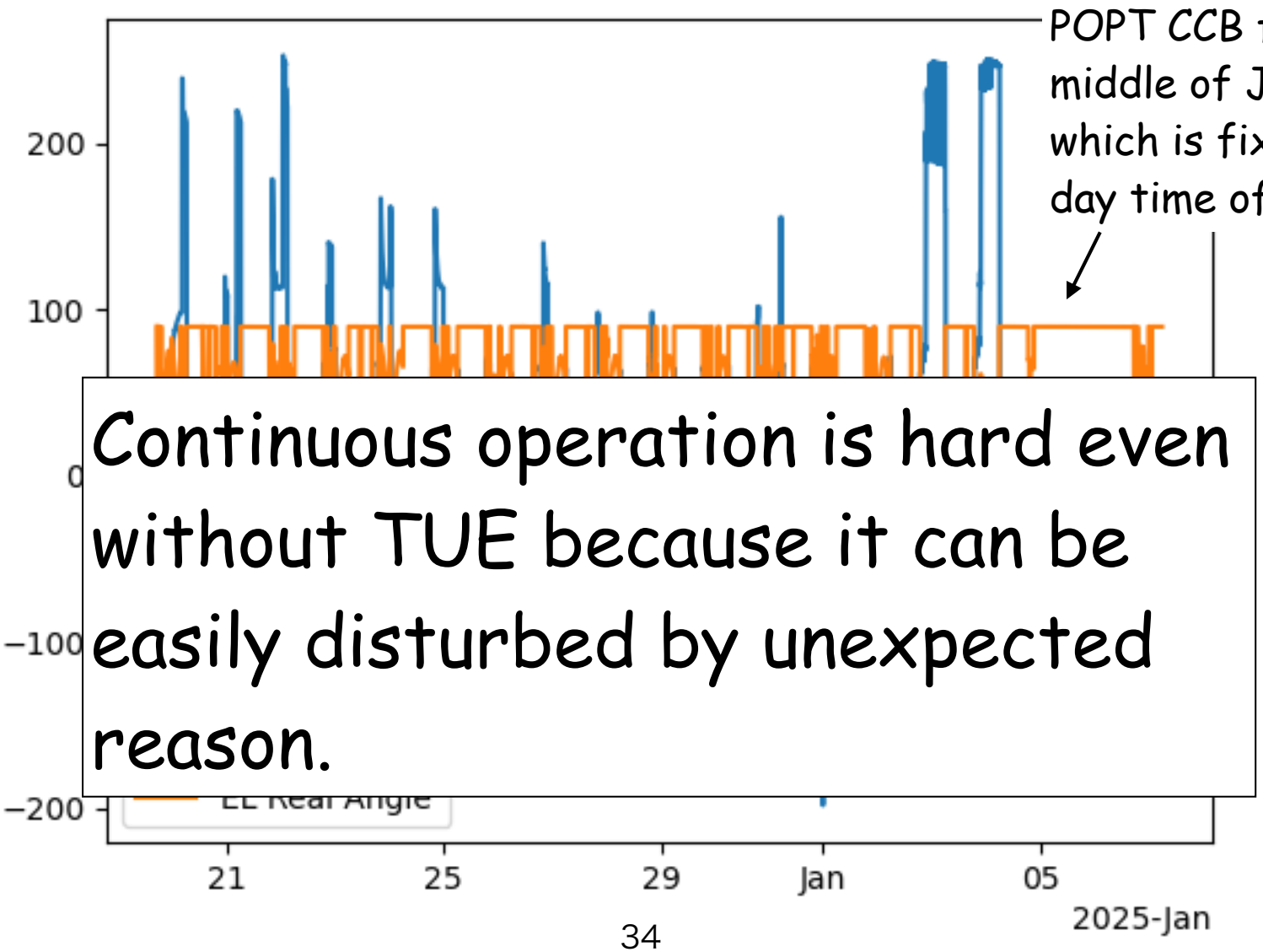
Long term prosepcts of operation of Subaru

What can we do to cope with the situation:

- If easy-to-install light weight M2 is developed …
  - We will have the following selections:
    - HSC/Nasmyth semester
    - PFS/Nasmyth semester
    - GLAO semester

Acceptable ?

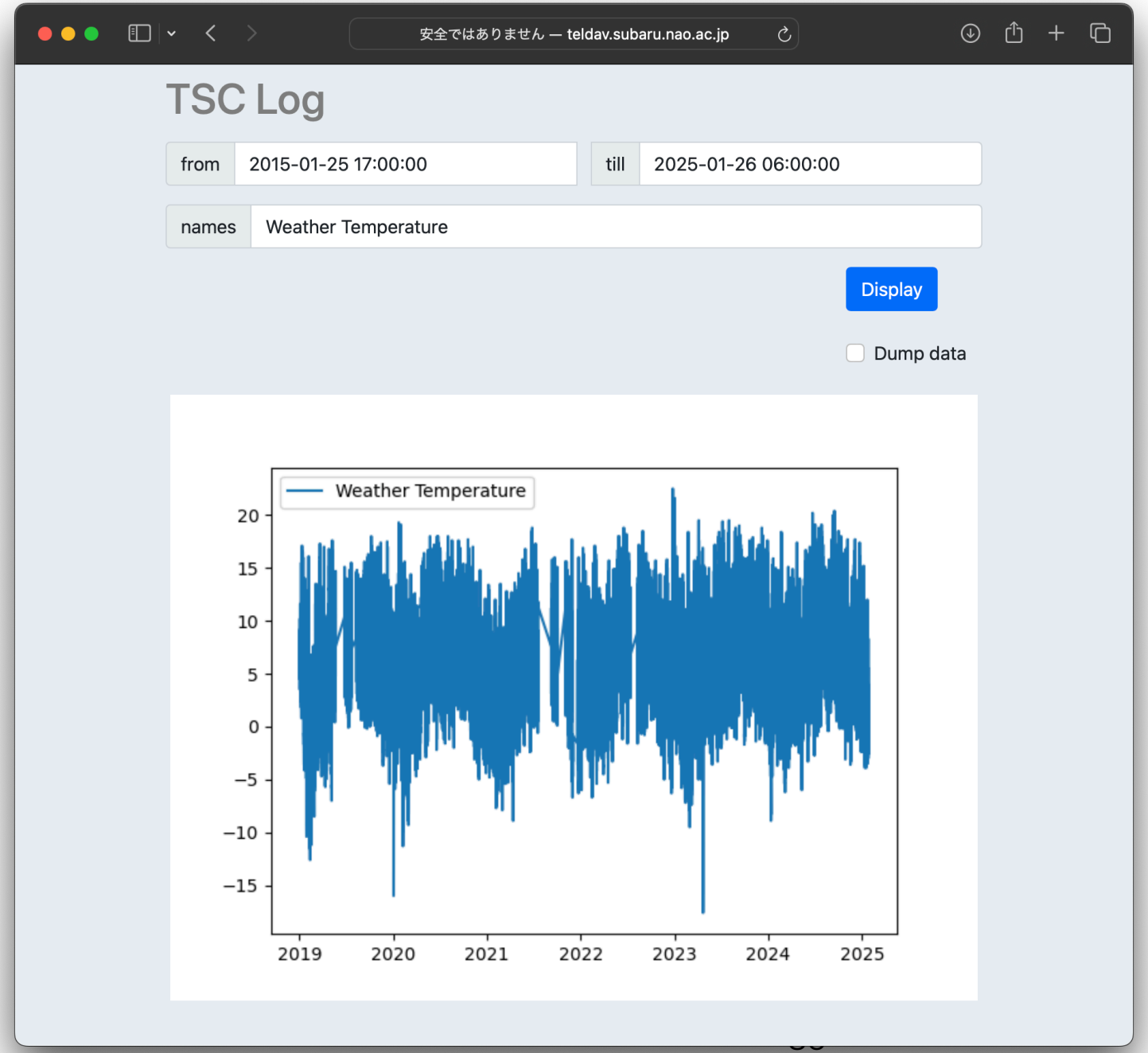
Long term prosepcts of operation of Subaru



POPT CCB failed in the middle of Jan.4 night, which is fixed in the day time of Jan 6 .

Continuous operation is hard even without TUE because it can be easily disturbed by unexpected reason.

Long term prosepcts of operation of Subaru



The observatory is recording all kinds of time series data including the telescope motion, euquipment status and environmental data over 25 years.

Number of recorded parameters ~ 20,000

These are 'big data' and sorterd out on a SQL database ready for advanced trend and clustering analysis.

Long term prosepcts of operation of Subaru

M1 D [m]	Name	Foci	Altitude [m]	Operational
5.08	Hale	P3.3, Cs9 & 16 & 30	1900	1948
4.2	Discovery	RC; P2.3, Cs6.1	2361	(2009)
4.2	WHT	P2.8, Cs10.9, Ns11.1	2370	1987
4.1	SOAR	RC; Cs16, Ns16	2738	2004
4	VISTA	RC; Cs3	2600	(2007)
4	Blanco	RC; P2.87, Cs8 & 14.5 & 30	2399	1974
4	LAMOST	F5	700	2007
3.89	AAT	RC; P3.3, Cs8 & 15, Cd36	1200	1974
3.58	CFHT	P3.8, Cs8&36, Cd110	4200	1979
3.57	ESO 3.6 m	RC; Cs8 & 35	2400	1977
3.5	WIYN	RC; Cs13.7, Ns6.3	2096	1994
3.5	SDSS 3.5m	RC; Ns10	2788	1993
3.5	MPI 3.5m	RC; P3.48 & 3.93, Cs10 & 35, Cd35	2200	1985
3.5	Starfire 3.5m		1900	1997
3.05	Shane	P5, Cs17, Cd36	1290	1959
3	IRTF	Cs37, Cd120	4160	1979

Subaru will be definitely purchaced by somebody if we give up and abondan the operation !

List of 4 m class telescopes in 2006
(generated by Usuda-san for Rika-nenpyo)

No telescope decommissioned so far in year 2025

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Annaouncement

Education at Subaru

- On-site observation for student PI programs.
- OISTER student internship program (started in FY2024).
  - Supported 2 students for ~1-month stay in Hawaii in FY2024.
- Rebooting the "Observatory Experience" program for undergraduate students (学部生体験企画) in FY2025.
  - Suspended since COVID-19 pandemic.

S. Ichihara (Kyoto U) / T. Kanai (Saitama U) stayed in Hawaii as OISTER intern in FY2024

Taiken-kikaku in FY2017

Annaouncement

- For Mitaka Remote Observers:
  - We cover travel/stay cost of up to 3 observers / run.
  - Hotel fees in Tokyo inflates dramatically these days, and the usage of "Cosmos-Kaikan" is stronogly preferred to save money.
  - If you want to make Mitaka remote observing, please sign up three weeks before the observing date as is required on the web.

Failure to sign up 3 weeks ahead and no room left at "Cosmos Kaikan" anymore will result in your pyament of the outside hotel fee.

Summary: What you can do to save Subaru Telescope

- Developement of the Ultra-light secondary mirror
- Advanced analysis of telescope/dome data logs to predict possible near-future failure
- Submit remote observing application 3 weeks ahead

Thank You !