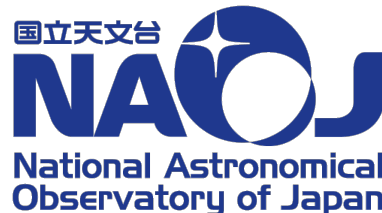


# ASTE Status Report & Future Prospect

Tetsuhiro MINAMIDANI

(ASTE Project Manager - based in NAOJ Mitaka since 2023 April)

National Astronomical Observatory of Japan, NAOJ  
Observatorio Astronómico Nacional de Japón





# Short Summary of Recent Status ASTE

- **ASTE has backed to Science Operation!!**
  - Start up: 2023 May –
  - Recovery from Sub-Reflector Driving System malfunction
  - Heterodyne session:
    - CSV: June -
    - Science Observations: July – Sep.
  - DESHIMA Session:
    - Oct. – Dec.
- **Suspended due to Sub-Reflector Driving System Malfunction**
  - middle of Nov. -
- Recovery activities at the ASTE Site will be resumed from middle of Feb. 2024.
- Plan to resume operation as planned.

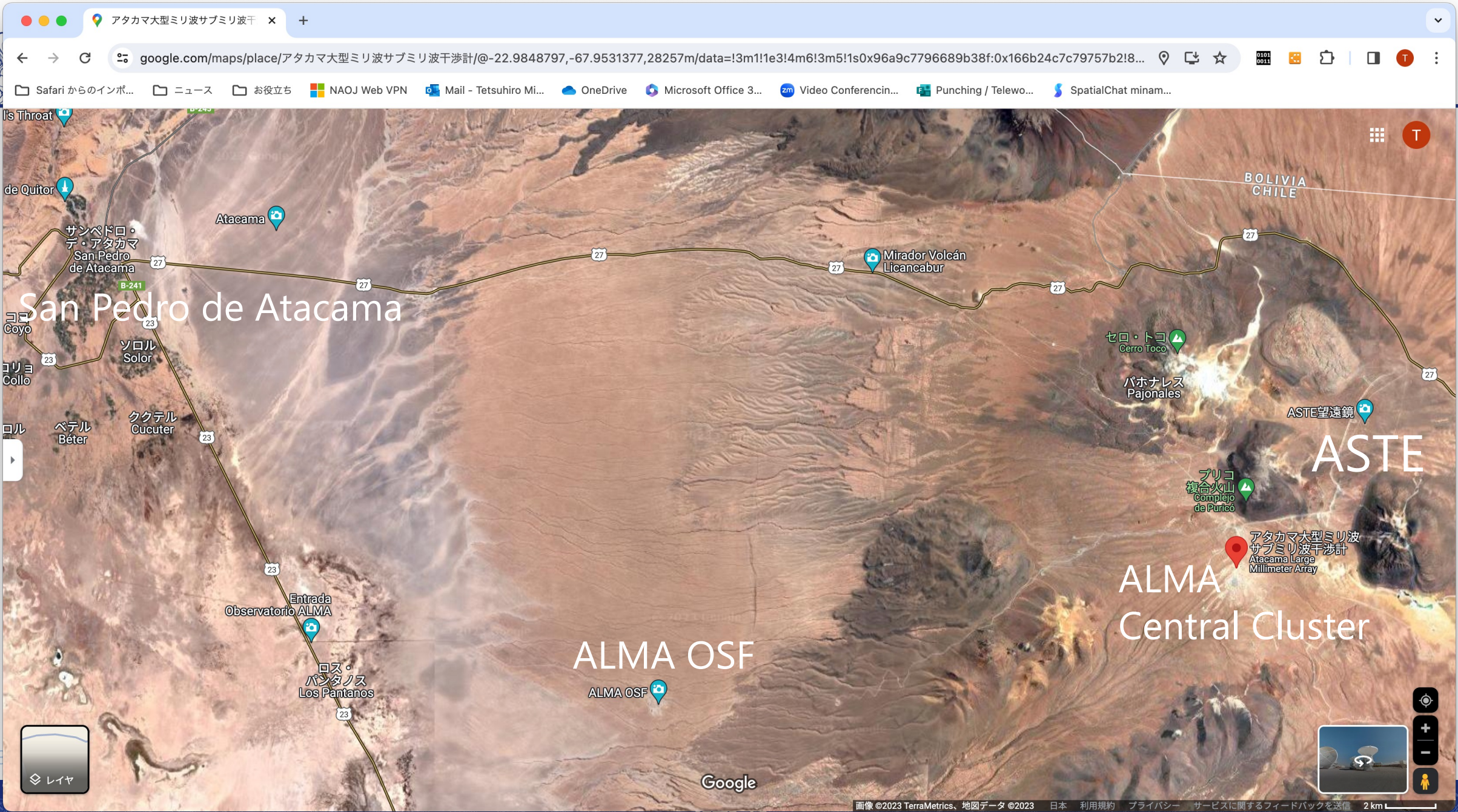


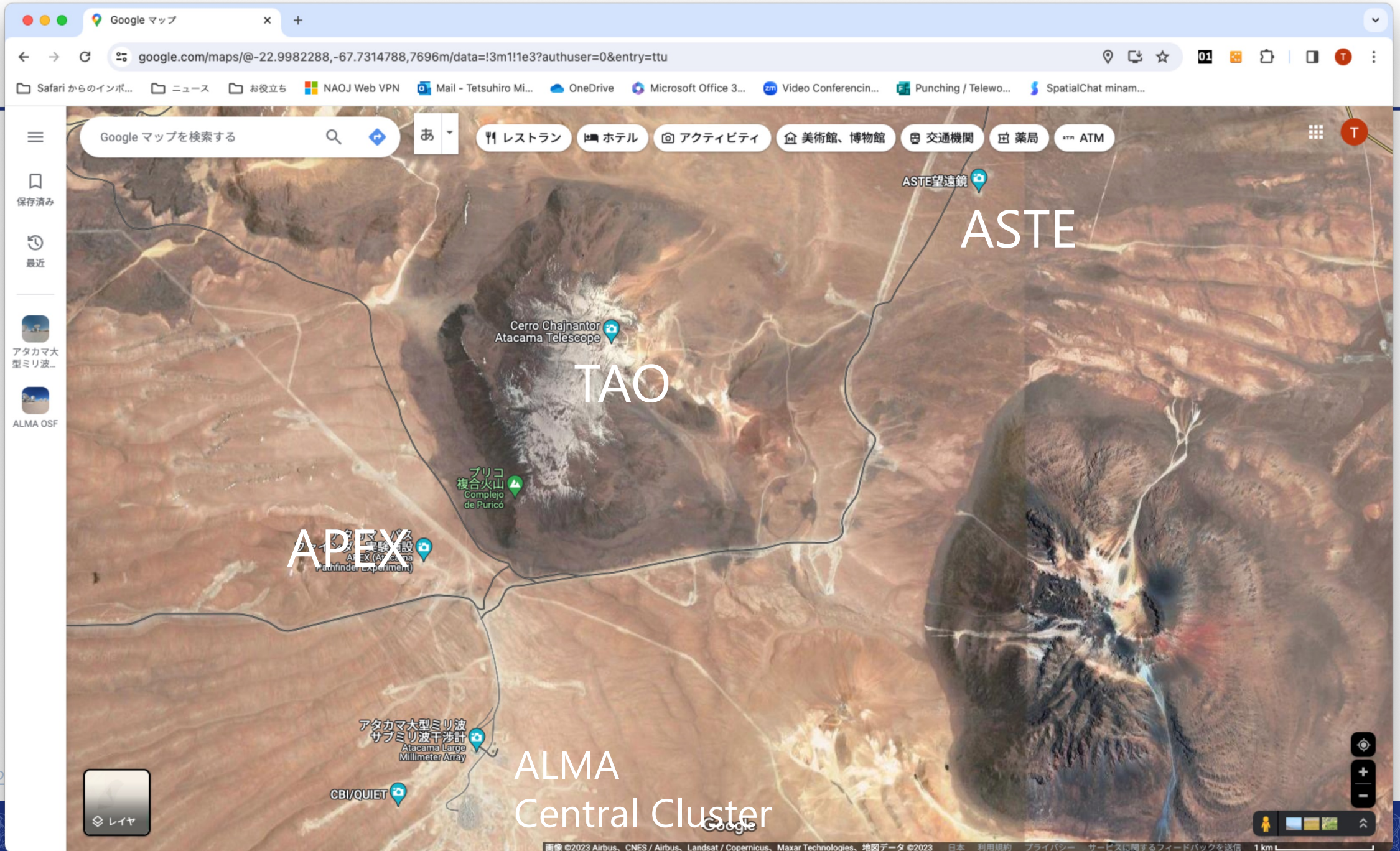


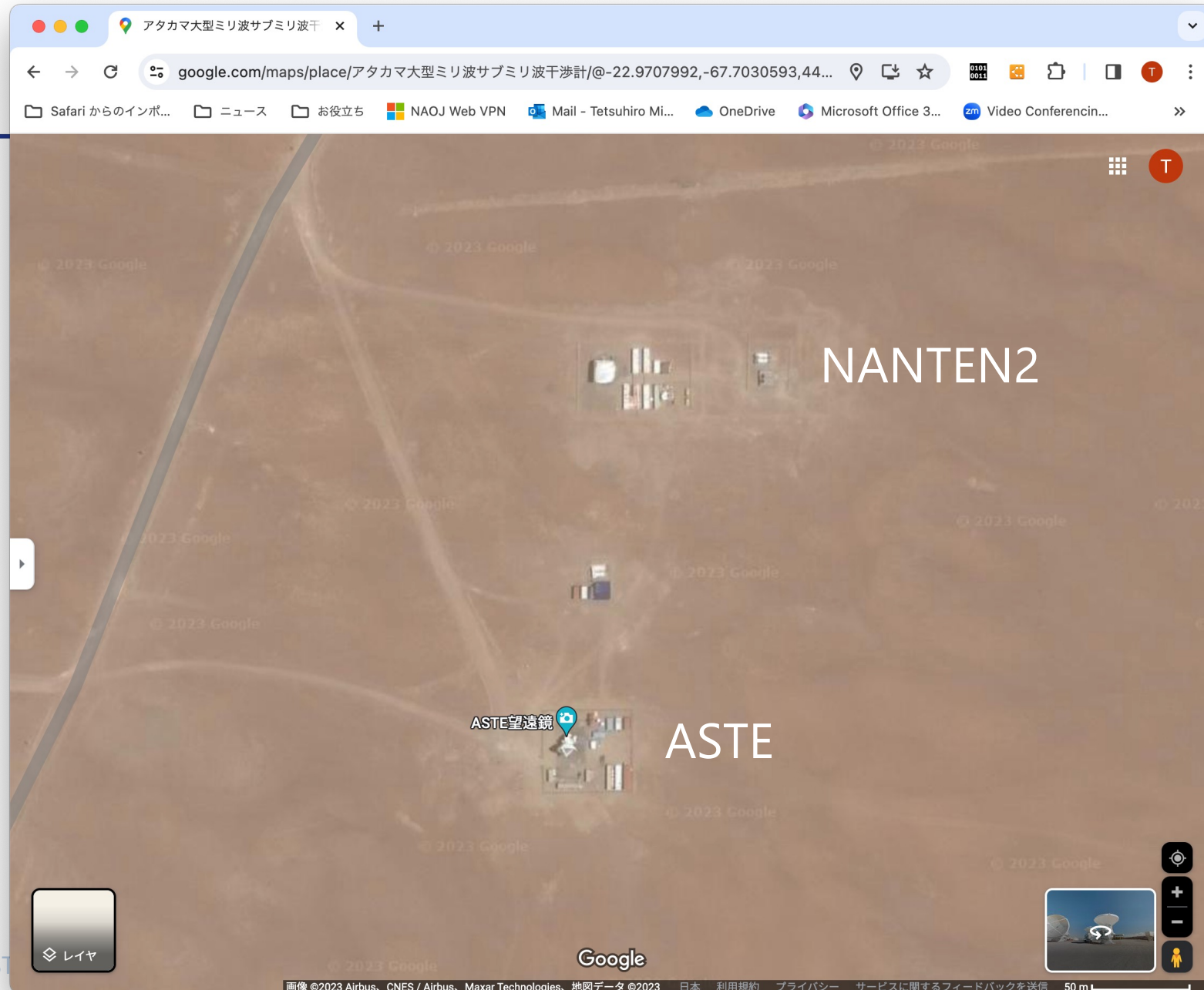
# Atacama Submillimeter Telescope Experiment

- The prime objectives of ASTE Project
  - **Promote science** with the submm single-dish telescope
  - **Promote development** of instruments and techniques for astronomical observations
    - ➔ A precursor to ALMA and Submm Astronomy in terms of Science and Instrumentation
- 10-m sub-mm telescope at Pampa la Bola 4800m alt. (within the ALMA Site)
  - Since 2002
  - Surface accuracy:  $19\mu\text{m}$  ( $\rightarrow \sim 40\mu\text{m}$ ?)
  - Pointing accuracy:  $\sim 2''$  (rms)
- Site infrastructure
  - Diesel generator (150kW-220V  $\times 2$ )
  - Fuel tank (15kL  $\times 2$ , consumption 300L/d)
  - Satellite network (1Mbps)
  - Monitor (weather station, web cameras, etc.)
- [https://aste.nao.ac.jp/index\\_e.html](https://aste.nao.ac.jp/index_e.html)







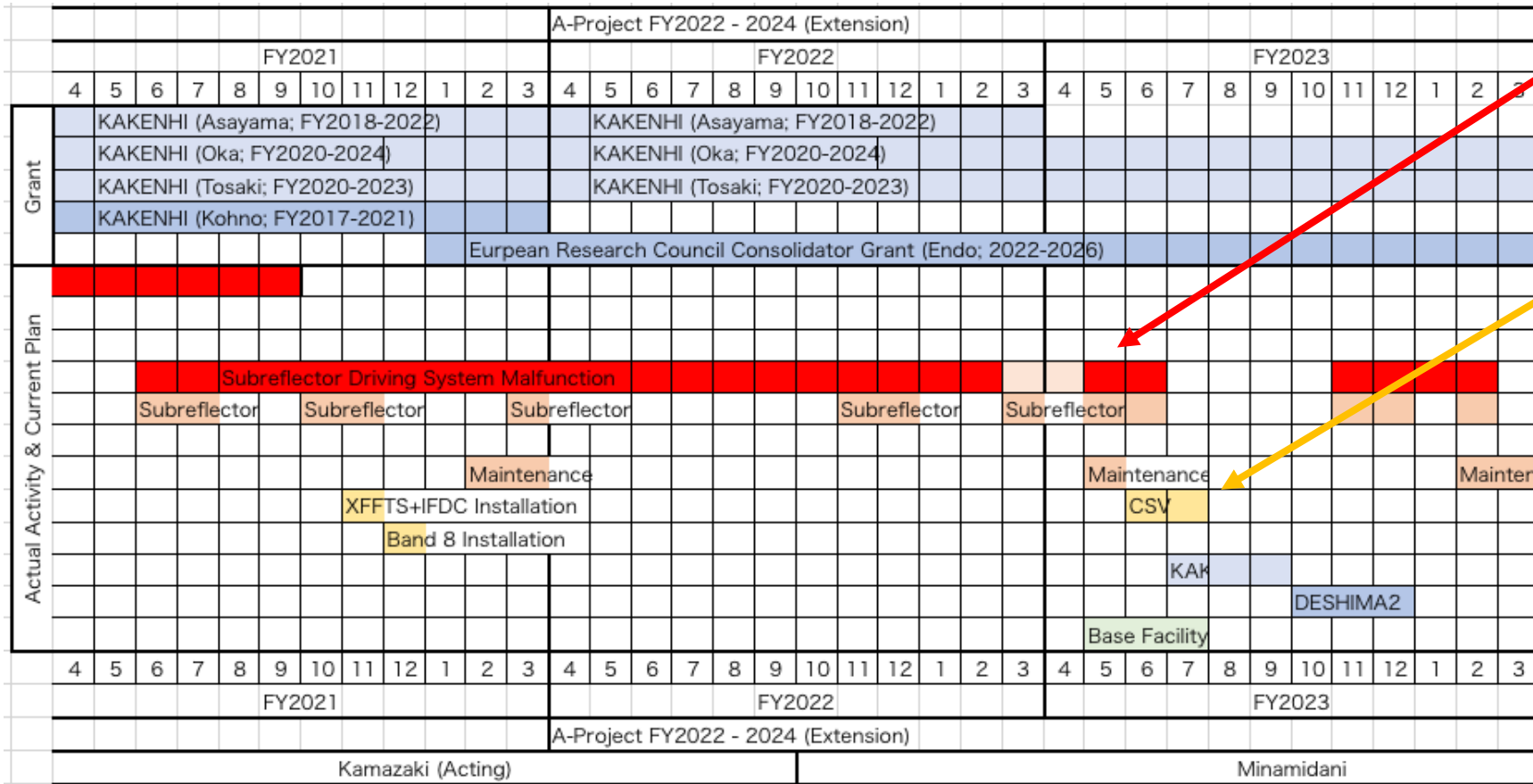




- Struggled with Sub-reflector Problems
  - 2022 Mar.
  - 2022 Nov. – Dec.
  - On-Site Investigation and Recovery Works
    - One of the blocker was solved.
    - Another problem was occurred.
  - 2023 Mar.: On-Site Investigation
    - The problem is NOT reproduced.



# Operation in CY2022 and CY2023



## • Sub-Ref Problem

- Recovered by replacing motor for X3 (Chopping axis)

## • CSV

- Wide-IF-bandwidth Band 8 Receiver (CAT8W)
- Digital Spectrometer (XFFTS) and IF Down Converter

- Sub-Ref Parameter
- Pointing
- Linearity measurement
- Spurious survey





# Recent Upgrade: Wide-IF-bandwidth Band8 receiver cartridge

- **Wide-IF-bandwidth Band8 receiver (CAT8W)**

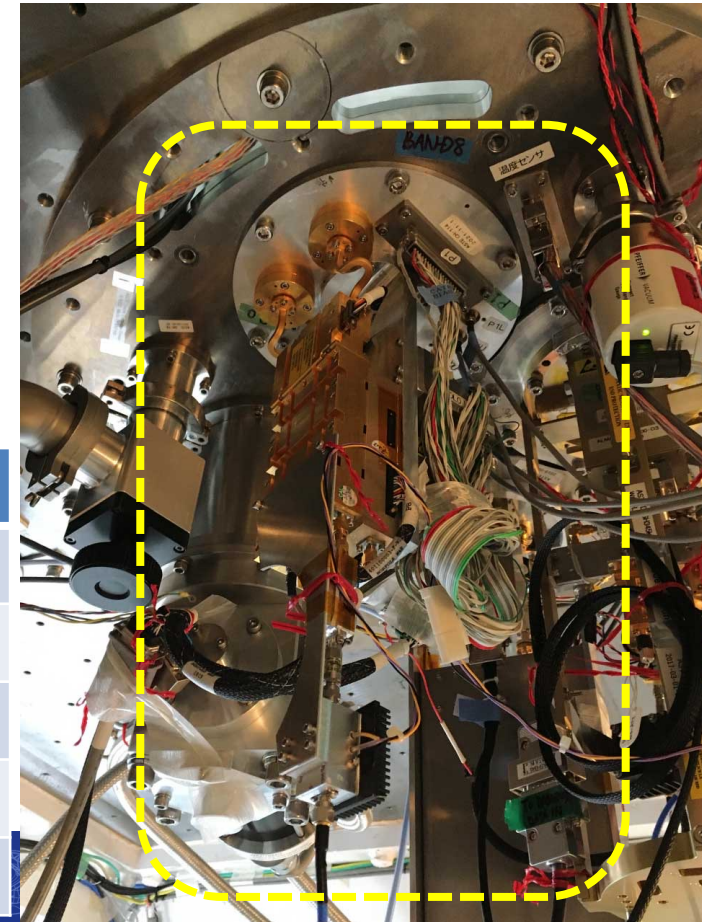
- Supported by the KAKENHI project (P.I. Oka; Keio U.)
- The current Band8 receiver cartridge is **upgraded with SIS mixers employing high- $J_c$  junctions developed by ATC**
- Same RF range, but **IF bandwidth is expanded from 4-8 GHz to 4-18 GHz**
  - e.g.) Simultaneous observations of CO and [CI] in Band 8 become available.
  - Trec ~ 150-250 K,
  - IRR ~ 10-15 dB at Mitaka

- Tsys ~ 600 – 1000 K (492 GHz)

- Issue

- one Pol. -> DSB

Receiver	Band8	CAT8W
Beam	1	
RF range	387-498 GHz	
IF range	4-8 GHz	4-18 GHz
Sideband	USB, LSB	
Polarizations	X, Y	





# Recent Upgrade: Digital Spectrometer and IF Down Converter

- **RPG eXtended bandwidth FFT Spectrometer (XFFTS)**

- Supported by the KAKENHI project (P.I. Tosaki; JUEN)
- 2.5 GHz BW / 32K channels [/Spw]
  - $\Delta v = 0.047$  km/s, velo. width  $\sim 1500$  km/s@492 GHz
- 10-bit ADC, 5Gsp/s
  - Good linearity

- **IF Down Converter (IFDC)**

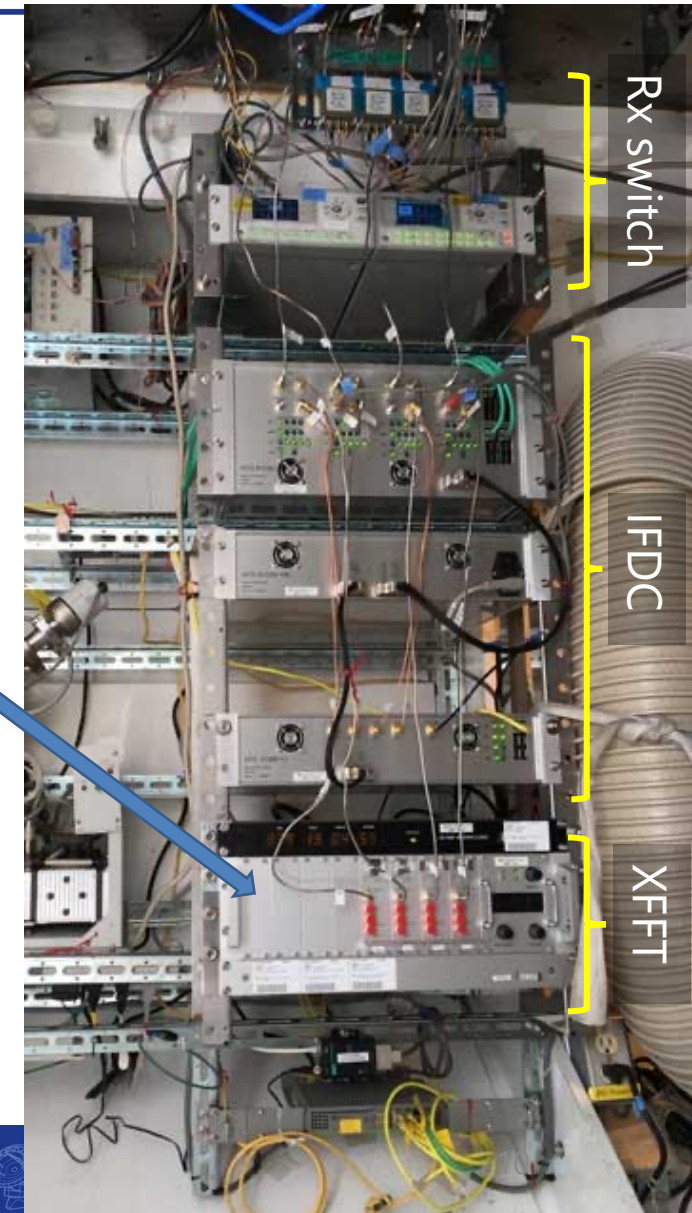
- 4 spectral windows (2.5 GHz BW)  
from 4 IF signals of a receiver
- Support of IF BW = 4-8GHz (**DASH345**, **CAT10**)  
and 4-18 GHz (**CAT8W**)



x4

Spectrometer	WHSF → XFFTS	
IF bandwidth	2 / 4 GHz	2.5 GHz
# of channels	2,048 <sup>*1</sup>	32,768
# of IFs	4 / 2	4

\*1 NEWSTAR/NOSTAR limit



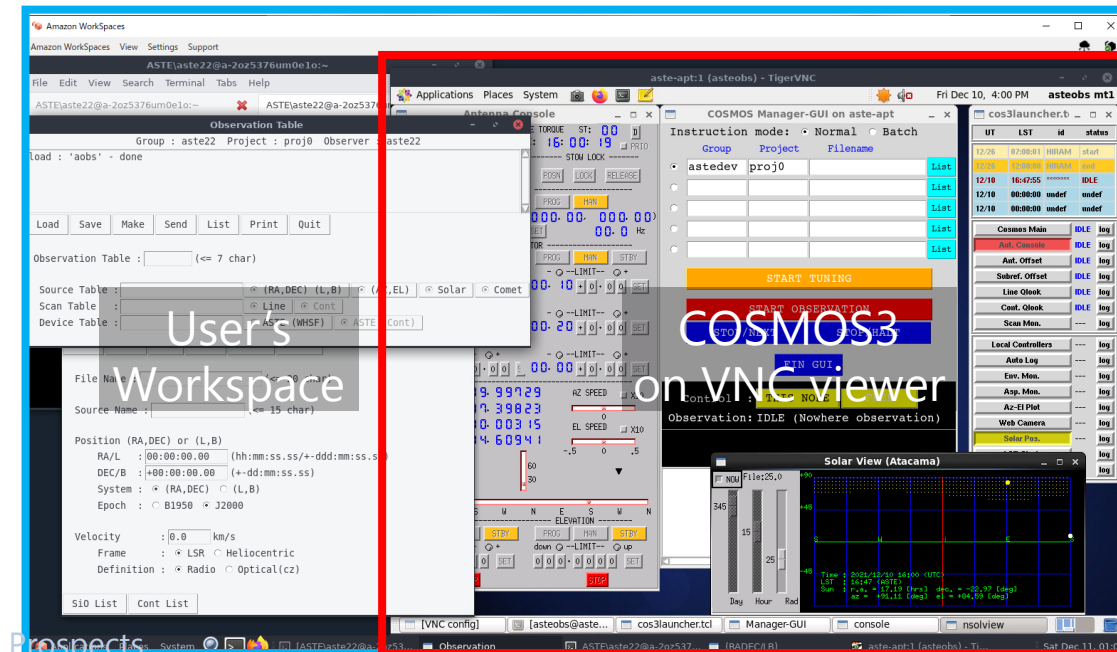


# Recent Update: User's Workspace, Remote Control Terminal

- **Amazon Workspaces** – Virtual Desktop Infrastructure

- A workspace is provided for a user
  - Observation preparation
  - VNC viewer to access the remote-control Virtual PC (on Amazon Web Services)

- A user can connect its own workspace using AWS client (Win, Mac, Linux, ...) from EA (even from Chile if network is stable)



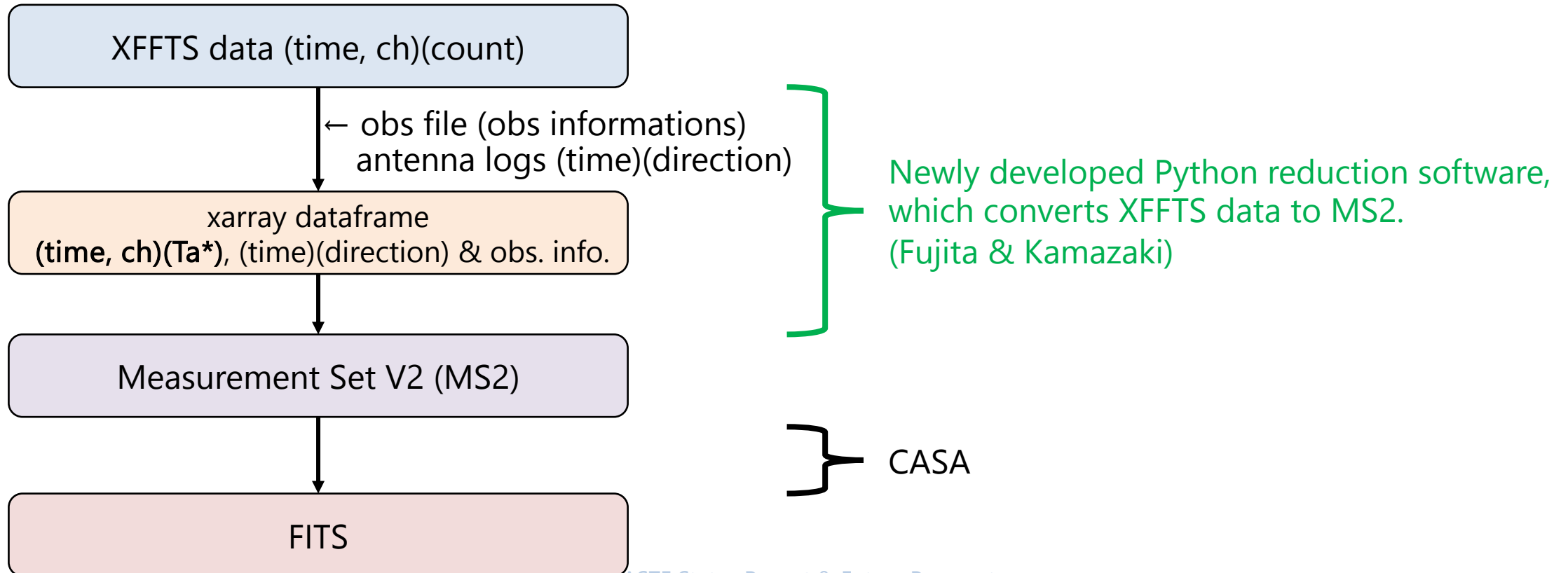
ASTE Status Report & Future Prospects



# Recent Update: Data Reduction with CASA

- **Data reduction with CASA**

- XFFTS data are reduced with CASA.
  - No plan to update NEWSTAR and NOSTAR to support XFFTS data.



ASTE Status Report & Future Prospects



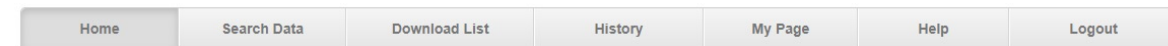
# Recent Update: Data Reduction with CASA

## • Data reduction with CASA

- XFFTS data are reduced with **CASA**.
  - No plan to update NEWSTAR and NOSTAR to support XFFTS data.
- MSv2 data generator (aka MERGE2) for WHSF and MAC is also under testing.
- These CASA MSv2 format data will be delivered and distributed through the NRO/ASTE Science Data Archive.

Nobeyama-45m/ASTE Science Data Archive

(<https://nobeyama-archive.nao.ac.jp/>)



## Nobeyama-45m / ASTE Science Data Archive

### Overview

This site, Nobeyama 45m and ASTE Science Data Archive, provides public science data obtained at the Nobeyama 45m radio telescope at Nagano, Japan and the ASTE telescope at Atacama, Chile.

[See more »](#)



### News

**2021/1/4**

The service was resumed. Thank you for your cooperation.

**2020/12/15**

Due to server maintenance, you cannot login, search or download data from this archive since 9 (Wed) December 2020. The service will be resumed in late-December. Sorry for inconvenience.

**2020/10/12**

We're planning to release MS2 data (data format for CASA) and pipeline-processed calibrated products (FITS cubes) for Nobeyama-45m. Firstly these data observed in two observation seasons 2018-2019 and 2019-2020 will be released in January 2021, and the other seasons data will follow. The pipeline processing is now on-going. Please stay tuned!

**2019/7/26**

This site has been expanded into "Nobeyama-45m / ASTE Science Data Archive" from previous "Nobeyama 45m Science Data Archive". Now the NOSTAR or

### To use all functions

User ID:

Password

[Login](#)

You can search public data but cannot download them unless you do not have user account.

[Sign Up](#) if you do not have user account yet.

[Reset Password](#) if you forgot your password.

Contact [Helpdesk](#), if you need more help.





# Science Observations

- July.31 – Sep.22



# KAKENHI Projects

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- Tosaki et al.
  - Investigation of physical/chemical properties of ISMs
  - Presentation by Fujita-san.
- Oka et al.
  - Search for Missing Black Holes in the Galaxy based on Submillimeter-wave Observations
  - Presentation by Oka-san.





# Operation in CY2022 and CY2023

			A-Project FY2022 - 2024 (Extension)																																	
FY2021												FY2022												FY2023												
	4	5	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
Grant	KAKENHI (Asayama; FY2018-2022)											KAKENHI (Asayama; FY2018-2022)																								
	KAKENHI (Oka; FY2020-2024)											KAKENHI (Oka; FY2020-2024)																								
	KAKENHI (Tosaki; FY2020-2023)											KAKENHI (Tosaki; FY2020-2023)																								
	KAKENHI (Kohno; FY2017-2021)																																			
											European Research Council Consolidator Grant (Endo; 2022-2026)																									
Actual Activity & Current Plan																																				
FY2021												FY2022												FY2023												
												A-Project FY2022 - 2024 (Extension)																								
Kamazaki (Acting)																								Minamidani												

## • DESHIMA 2.0 Session

- Oct. – mid Dec.
- Presentation by Tamura-san.

## • Sub-Reflector driving system malfunction

- Nov.18. –





# Operation/Activities in CY2022 and CY2023

- Relocation of Base Facility in San Pedro de Atacama
  - TAO Base Facility -> Hotel Takha Takha
- NAOJ A-Project Extension for 3 years: FY2022 – 2024
  - Suspended process due to the COVID-19 and SubRef Malfunction has been resumed and on-going.
  - Completion of process in January is expected.
- Survey of Thesis/Dissertations: PhD, MC, 卒論
  - On-going.
  - Plan to use ryunet / tennet.





# Atacama Submillimeter Telescope Experiment

- 10-m sub-mm telescope at Pampa la Bola
  - Surface accuracy:  $19\mu\text{m}$  ( $\rightarrow \sim 40\mu\text{m}?$ )
  - Pointing accuracy:  $\sim 2''$  (rms)
- Heterodyne Receivers
  - Frontends:
    - DASH345 (321-376GHz)
    - **Wide-IF-bandwidth Band8** (387-498GHz)
    - Band10 (790-940GHz)
  - Backend: **XFFTS**
- **DESHIMA2.0**
- [https://aste.nao.ac.jp/index\\_e.html](https://aste.nao.ac.jp/index_e.html)





- Repair of CAT8W in Japan
- Recovery of Sub-Reflector issue
  - mid. Feb. – Mar.
- DESHIMA 2.0
- Heterodyne
  - KAKENHI Projects
  - Open-Use Programs carried over from 2020.
  - Chilean Time



# Plan: CY2024 -

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- ASTE Science Workshop
  - planning...
- International External Review
  - Mar.25 – 26 @ NAOJ Mitaka
- Improvement of Sub-Reflector Driving System
- A-Project Extension / New A-Project Application for FY2025 – 27
- NAOJ Science Roadmap, NAOJ Project Implementation Plan for FY2028 -





# Summary

- The prime objectives of ASTE Project
  - **Promote science** with the submm single-dish telescope
  - **Promote development** of instruments and techniques for astronomical observations
  - ➔ **A precursor to ALMA and Submm Astronomy in terms of Science and Instrumentation**
- 2022 Jan. – 2023 Mar.
  - Struggled with Sub-reflector Problems
  - Updates and Commissioning of New Systems
- 2023 Apr. – Dec.
  - 2023 May – Sep.: Heterodyne Session (321-376 GHz / 387-498 GHz / 790-940 GHz)
  - 2023 Oct. – Dec.: DESHIMA2.0 (220 – 440GHz)
  - **2023 Nov. - Sub-Ref Driving System malfunction**
- 2024 Jan. –
  - Recovery of Sub-Ref. Driving System
  - 2024 Apr. – June: DESHIMA2 (220 – 440 GHz)
  - 2024 June – Dec.: Heterodyne Session (321-376 GHz / 387-498 GHz / 790-940 GHz)





# Notes – Q&A

- Prediction of Sub-Reflector malfunction?
  - It seems impossible. Need some monitor points, etc. but...
- Surface Accuracy
  - No recent measurements, such as holography.
  - Asayama et al. 2022, PASJ, 74, 678
    - ASTE Band 10 (787-950 GHz) heterodyne receiver: System description, commissioning, and science verification
    - <https://ui.adsabs.harvard.edu/abs/2022PASJ...74..678A/abstract>
    - Aperture efficiency ~ 10 % @ 890 GHz
    - Main beam efficiency ~ 12 % @ 890 GHz: Consistent with Sugimoto et al. 2004 (~ 13 %)
- Approach to the Sub-Reflector Driving System malfunction
  - Short-Term: Replacement of a malfunctioned jack out of 6 jacks to resume observations as soon as possible.
  - Mid-Term (FY2024): Replacement of a whole system.

