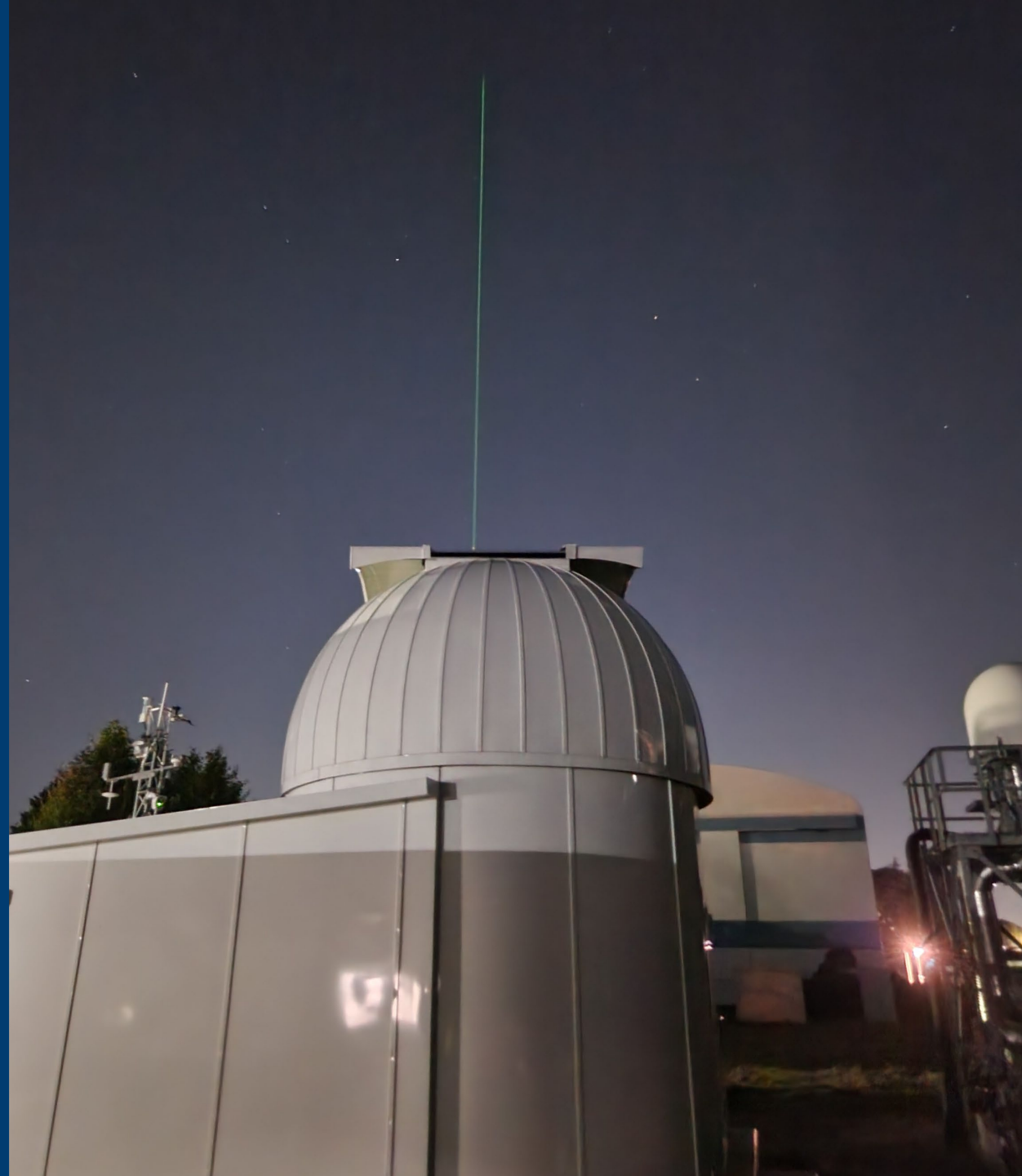


# Development Status of JAXA's New SLR Station in Tsukuba

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# Table of Contents



## 1. Introduction

## 2. Station Design

## 3. Development Status

## 4. Preliminary Results of Laser Ranging

## 5. Summary

# Background and Motivation



- JAXA had operated Tanegashima Station (GMSL) since 2004
- GMSL was closed on 1st April 2021 due to aging and repeating system failures
- JAXA has developed a new SLR station since 2018
  - To replace GMSL
  - To introduce state-of-the-art SLR technology
- The new SLR station is built in the Tsukuba Space Center (TKSC)
  - Much better accessibility than GMSL because our office is in TKSC
  - Easy to change the H/W configuration for experiments and investigate the cause of a system failure
  - Enhance our knowledge and skills of SLR



*Tanegashima station (GMSL)*



# Table of Contents



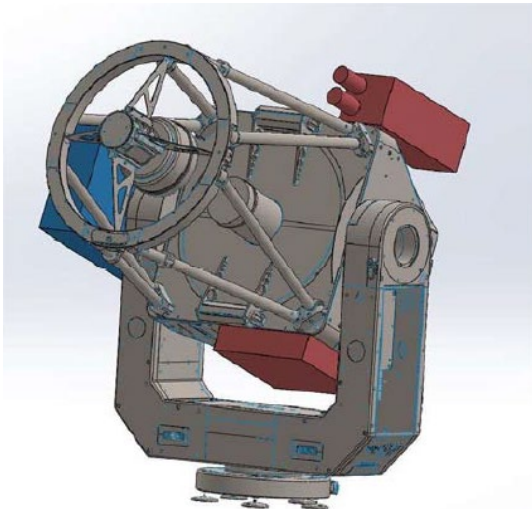
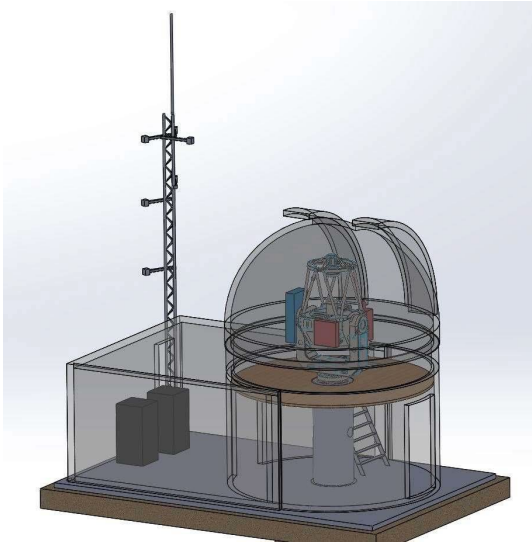
1. Introduction
- 2. Station Design**
3. Development Status
4. Preliminary Results of Laser Ranging
5. Summary

# Basic Concept



- Tsukuba station is mainly developed by KDK (Japan), TOYO (Japan), and DiGOS (Germany)
- The design is modern and flexible which follows a standardized concept
- Ranging capability is from LEO to GEO
- Key-technology
  - Single-photon mode with 1 kHz repetition rate
  - Two lasers with the wavelength of 532 nm (primary) and 1064 nm (experimental purpose)
  - Piggyback (lasers and detectors are mounted on the telescope) to avoid any Coudé Path
  - Fiber-based calibration system
  - Radar and ADS-B for aircraft detection

# Specification



## Telescope

Model	AZ800 (ASA)
Optical diameter	800 mm

## Laser

Model	Compiler Compact (Passat)	
Wavelength	532 nm	1064 nm
Repetition Rate	1 kHz	1 kHz
Pulse Energy	260 $\mu$ J	350 $\mu$ J
Pulse Width	7 ps	8 ps

## Detector

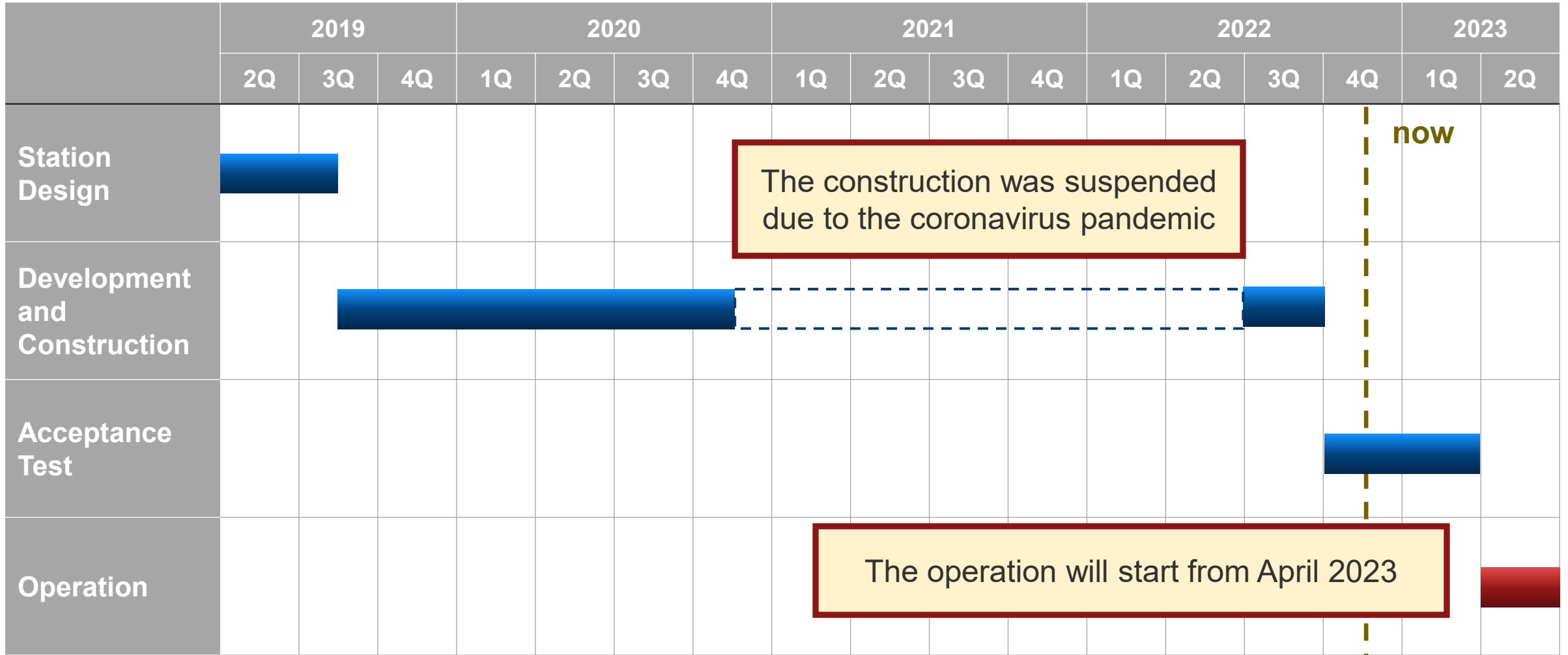
Model	C-SPAD (Peso Consulting)	PGA-200 (RMY)
Wavelength	532 nm	1064 nm
Quantum Efficiency	> 40%	Max 30%
Single Photon Jitter	< 40 ps	< 100 ps

# Table of Contents



1. Introduction
2. Station Design
- 3. Development Status**
4. Preliminary Results of Laser Ranging
5. Summary

# Schedule

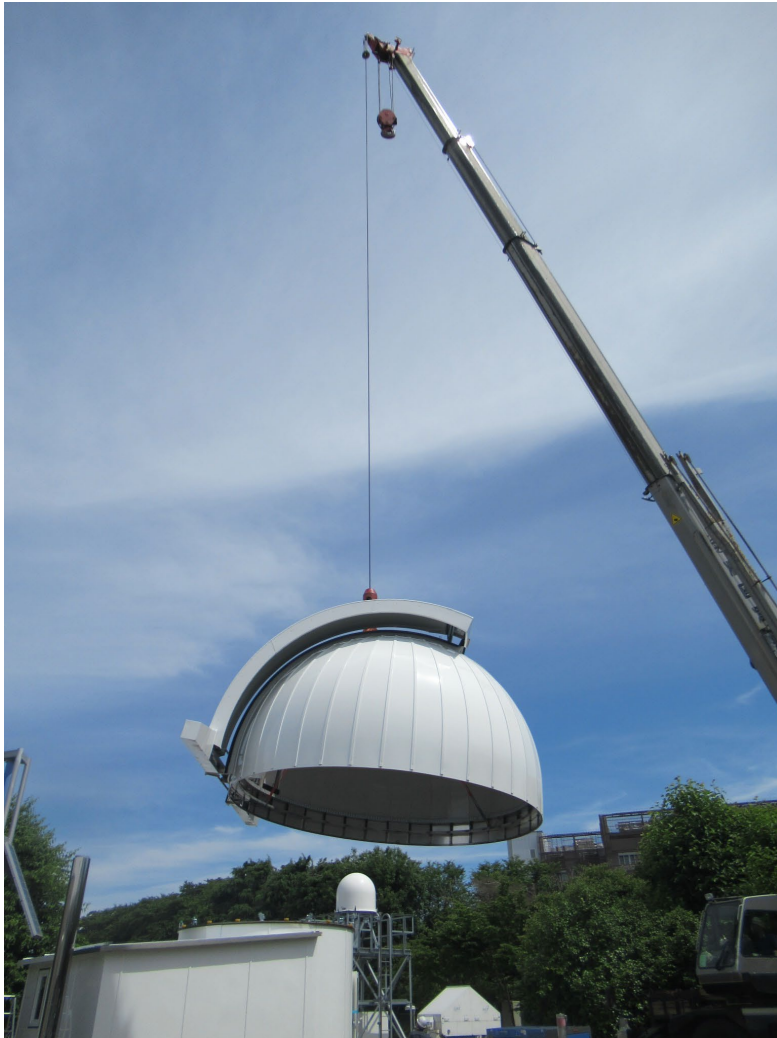




# Construction at TKSC – Foundation



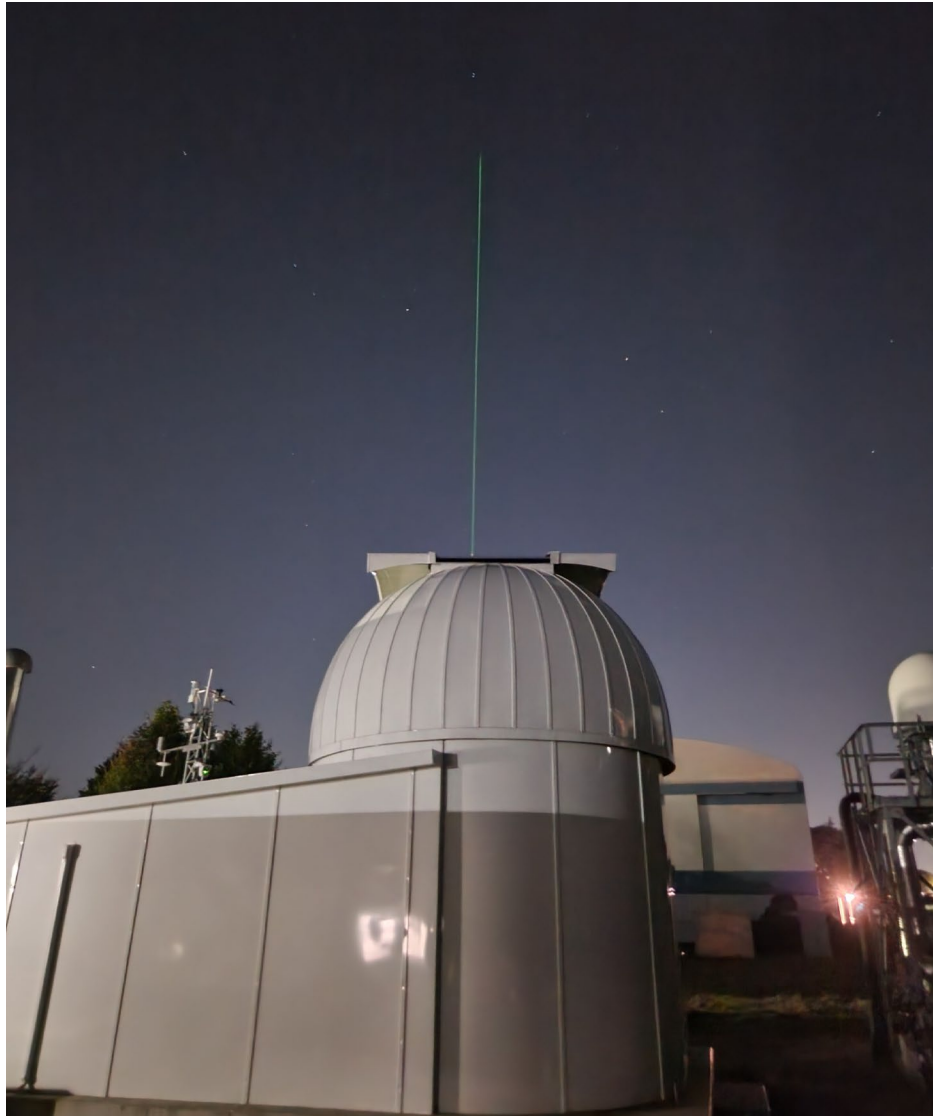
# Construction at TKSC – Container & Dome



# Construction at TKSC – Telescope



# Construction at TKSC – Laser Ranging



# Table of Contents

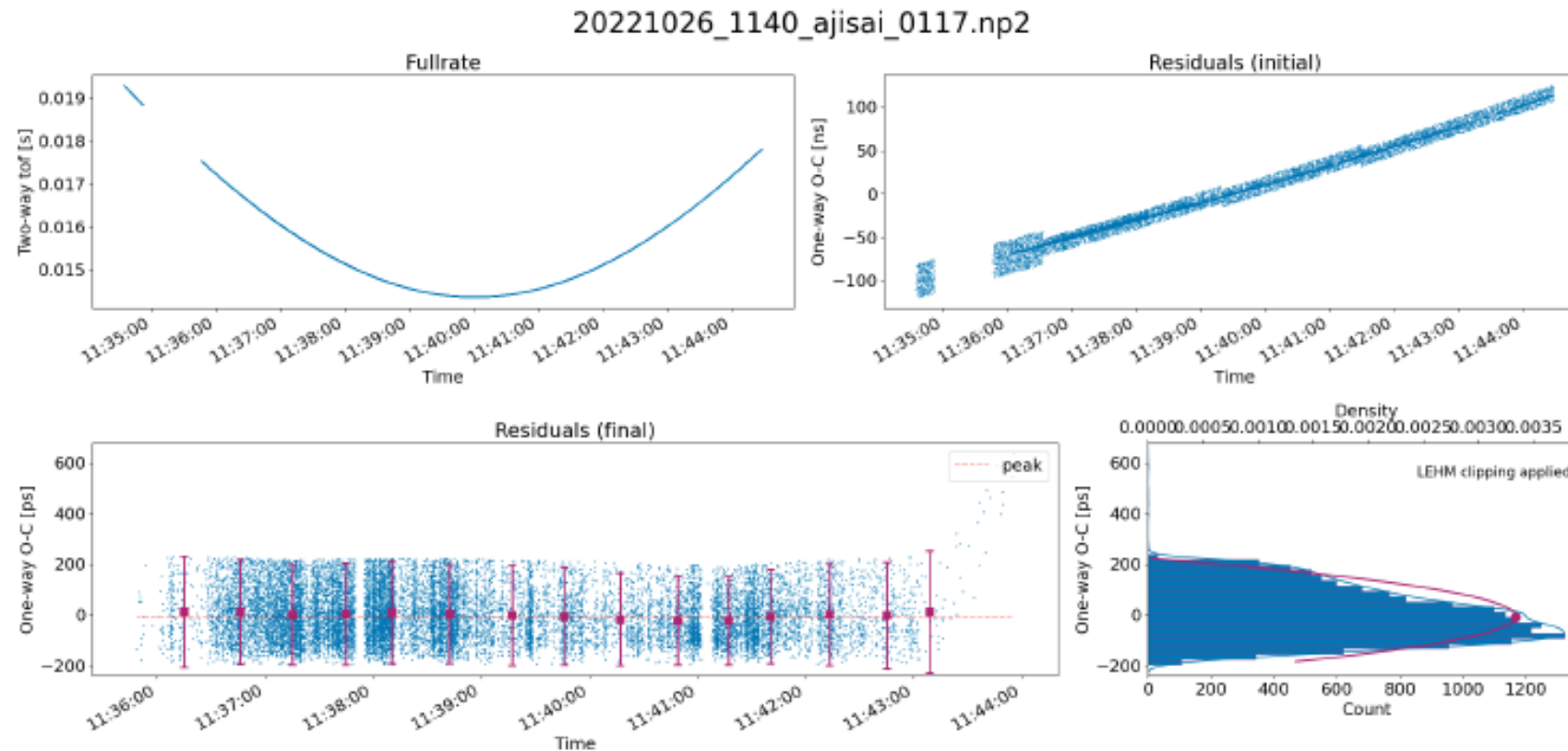


1. Introduction
2. Station Design
3. Development Status
- 4. Preliminary Results of Laser Ranging**
5. Summary

# Example of Ranging Results – Ajisai



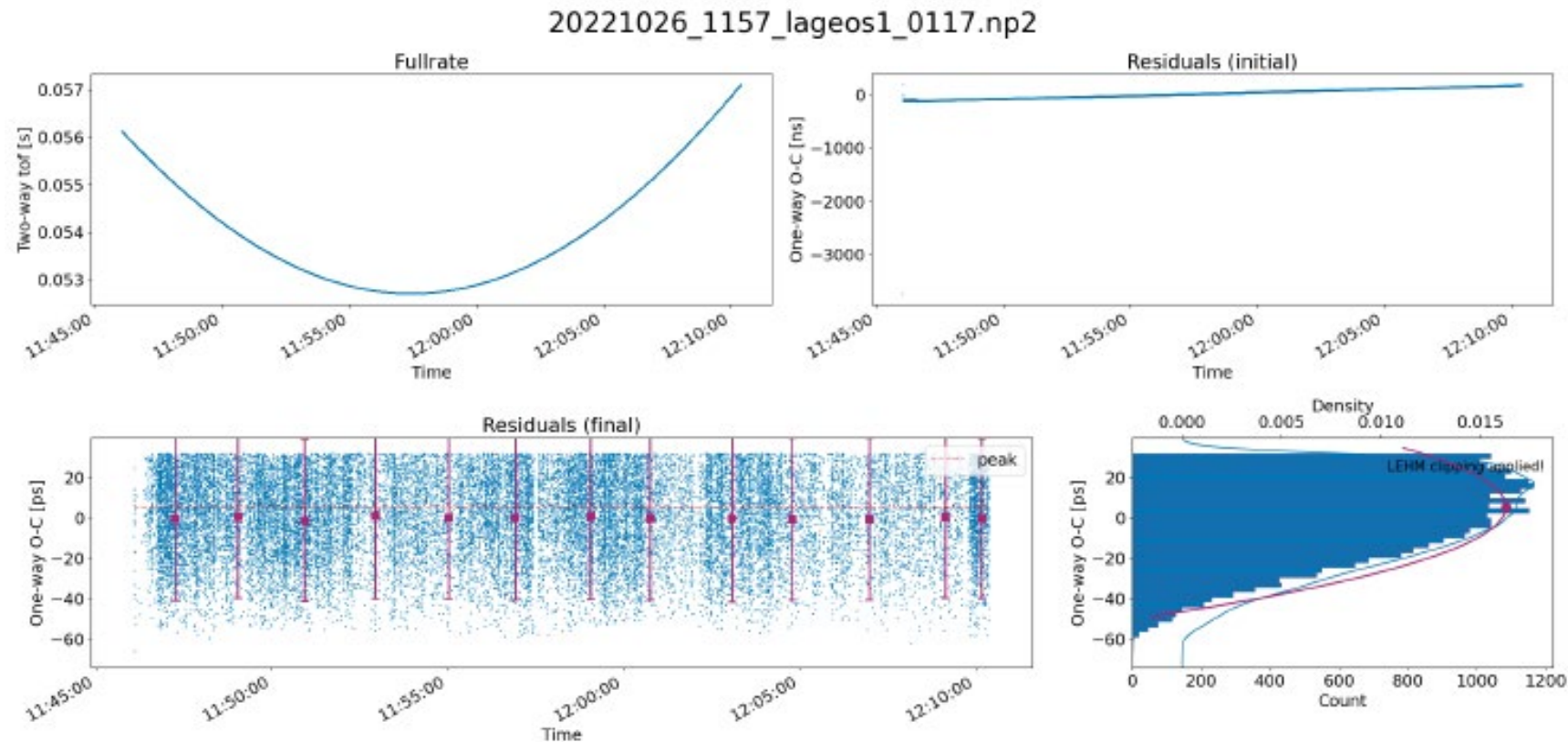
- Wavelength: 532 nm
- Altitude: 1485 km
- RMS: 29.81 mm



# Example of Ranging Results – LAGEOS1



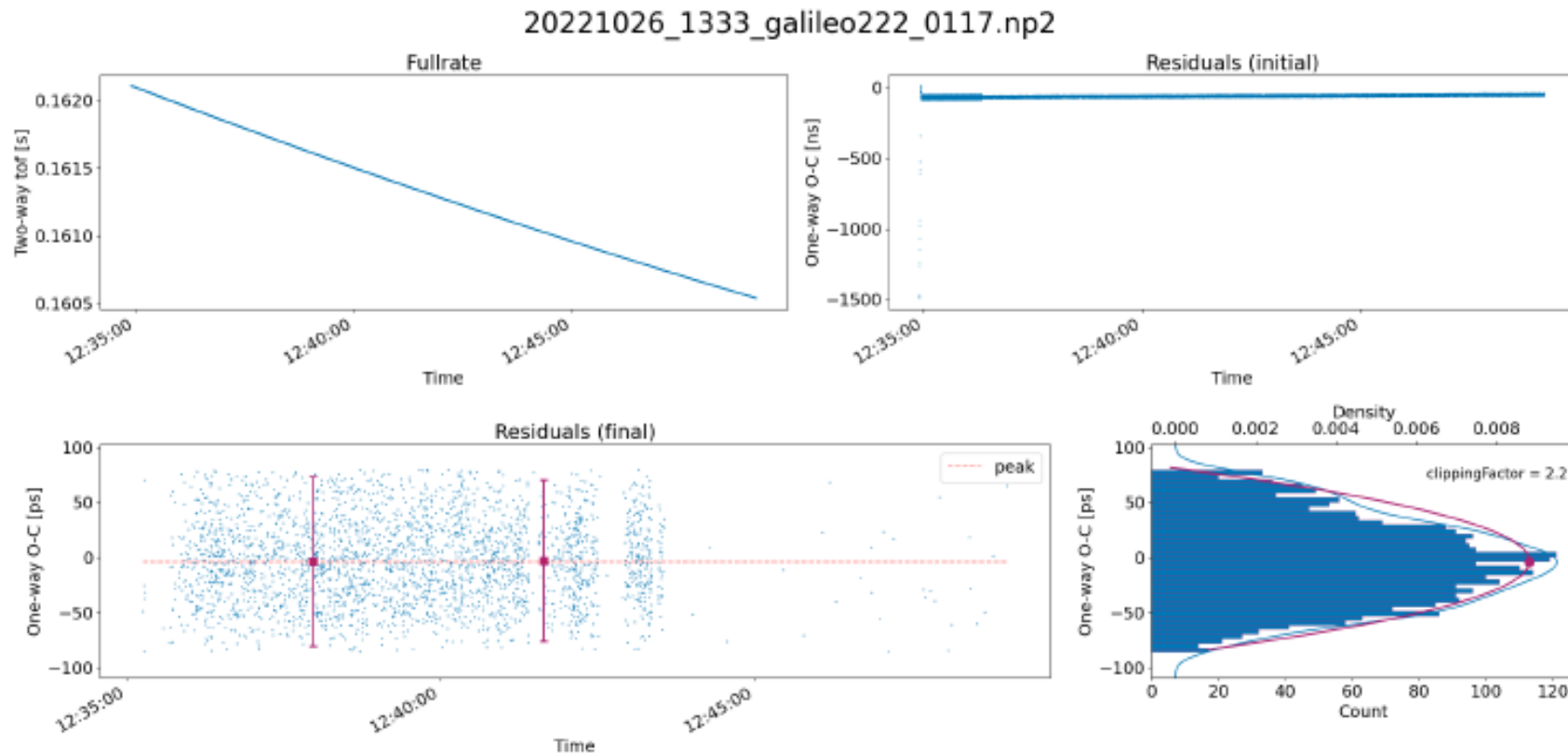
- Wavelength: 532 nm
- Altitude: 5850 km
- RMS: 6.04 mm



# Example of Ranging Results – Galileo-222



- Wavelength: 532 nm
- Altitude: 23220 km
- RMS: 11.24 mm

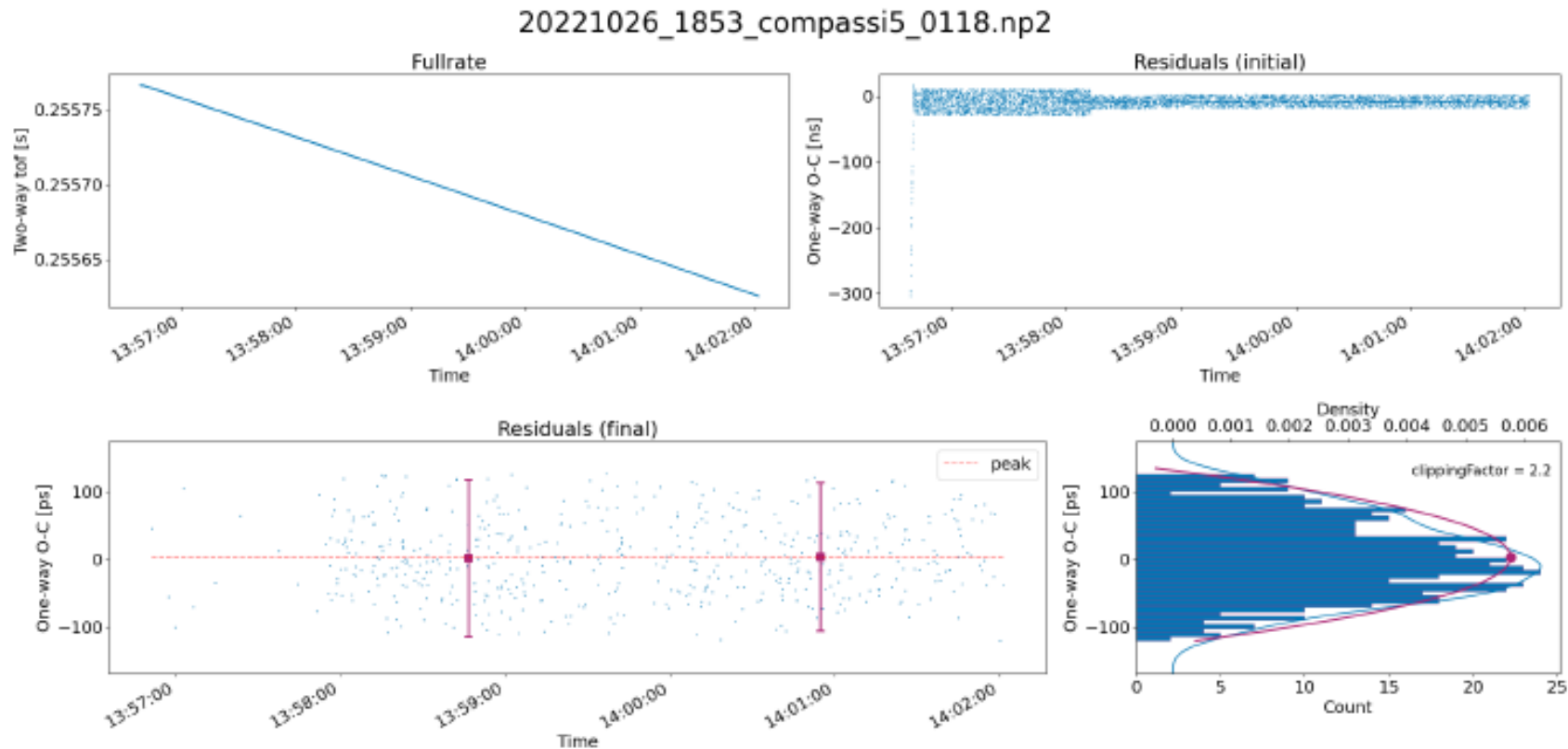




# Example of Ranging Results – COMPASS-I5



- Wavelength: 532 nm
- Altitude: 35786 km
- RMS: 16.97 mm



# Table of Contents



1. Introduction
2. Station Design
3. Development Status
4. Preliminary Results of Laser Ranging
- 5. Summary**

# Summary



- JAXA is developing a new SLR station in TKSC (Tsukuba, Japan)
- State-of-the-art SLR technology is introduced
- The construction has finished, and Tsukuba station is undergoing an acceptance test
- Tsukuba station is already able to track some satellite including GEO, but fine tuning remains
- JAXA plans to start the operation of Tsukuba station from April 2023