# Orbit Determination Analysis Operation Optimization Tool for Spiral Orbit Raising Phase

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## Responsible Representative

Takeshi Takashima, Project Manager, DESTINY$^+$project team

## Contact Information

Takayuki Yamamoto(yamamoto.takayuki@jaxa.jp)

## Members

Kazuma Fujimoto, Masakazu Iwabuchi, Kotaro Mori, Kota Morizane, Kazuki Takezawa, Sho Taniguchi, Takayuki Yamamoto

## Abstract

Perform Monte Carlo simulations of orbit planning and orbit determination operations during the spiral orbit raising phase of DESTINY$^+$.

Ref. URL: https://destiny.isas.jaxa.jp/

## Reasons and benefits of using JAXA Supercomputer System

Parallel computation is possible, thus reducing analysis time.

## Achievements of the Year

Through Monte Carlo simulations for the orbital planning and orbital determination operations during the spiral orbit ascent phase of DESTINY$^+$, evaluations were conducted on the necessary ground station pass assignments, ground station observation data, capture operation requirements including IES stop conditions and durations, assessment of consistency between longterm and shortterm station adjustments, optimization of parameters for orbit determination, evaluation of the onboard orbit propagation functionality, improvement of pass assignment consistency, and evaluation of the Y-axis inversion control logic. A paper was submitted for the operational design report of the spacecraft, demonstrating the operational feasibility during the spiral orbit ascent phase.

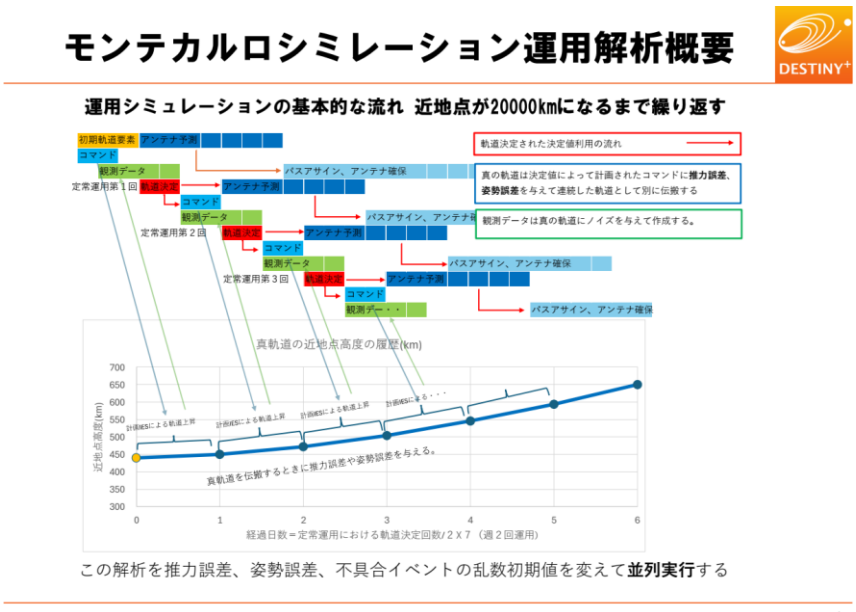


Fig. 1: Monte Carlo simulation operational analysis overview

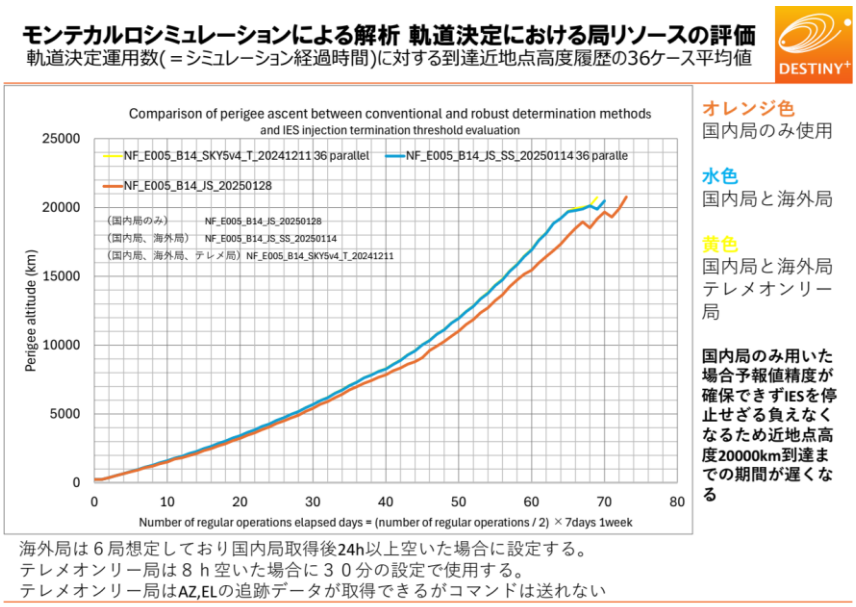


Fig. 2: Monte Carlo simulation - Evaluation of station resources in orbit determination

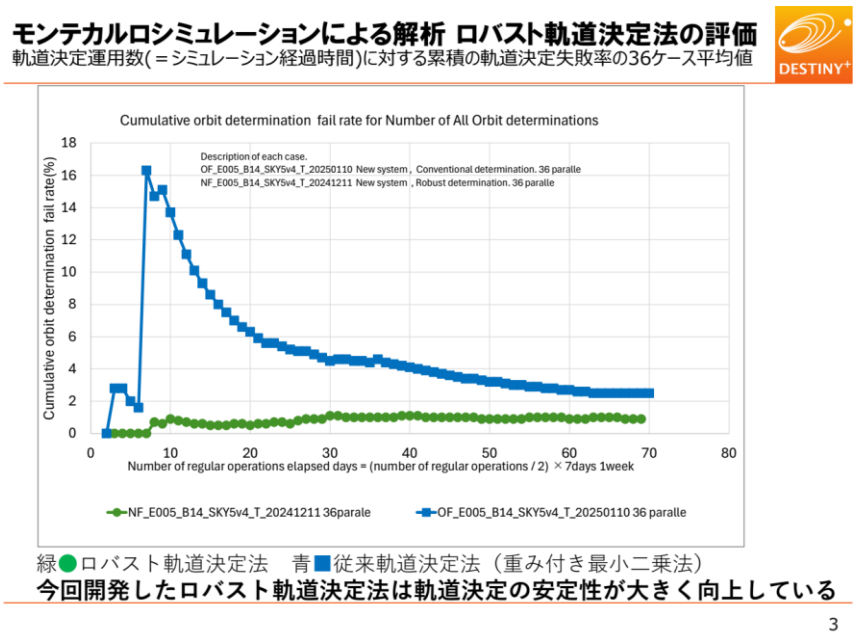


Fig. 3: Monte Carlo simulation_Evaluation of robust orbit determination methods

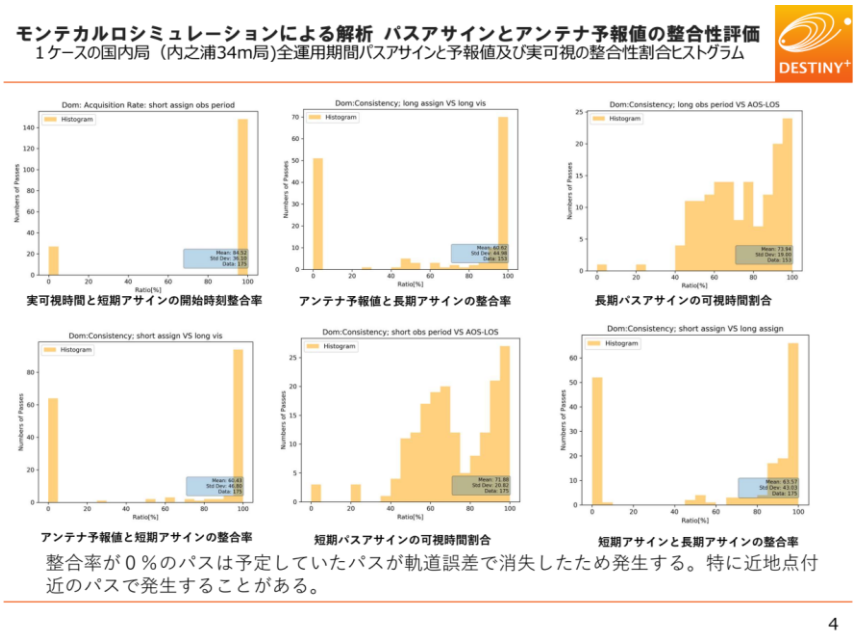


Fig. 4: Monte Carlo simulation_Evaluation of consistency between path assignment and antenna forecast values

## Publications

- Non peer-reviewed papers

1) S.Taniguchi, T. Yamamoto, T. Ichikawa, Y.Sugimoto, H.Takeuchi, H,Imamura T.Takashima, Member, JAXA, K,Fujimoto, Member, Fujitsu.Limited, "Stability of Orbital Determination During the Spiral Ascent Phase in DESTINY$^{+}$", SICE FESTIVAL 2024 with Annual Conference, Kochi.

2) Sho Taniguchi, Takayuki Yamamoto, Tsutomu Ichikawa, Yoshihide Sugimoto, Hiroshi Takeuchi, Hiroshi

Imamura, Ken Takashima (JAXA) and Kazuma Fujimoto (Fujitsu Limited) ,"Orbit determination and operational feasibility study for DESTINY plus spiral ascent phase", 4N14, The 68th Japan Society for Aeronautical and Space Sciences (JSASS)

- Oral Presentations

Kazuma Fujimoto (Fujitsu Limited), Takayuki Yamamoto, Hiroshi Takeuchi, Tsutomu Ichikawa, Yoshihide Sugimoto, Hiroshi Imamura, Takeshi Takashima, Sho Taniguchi (JAXA), DESTINY$^+$ Flight Dynamics Operation Analysis for the Spiral Orbit Raising Phase, 34th Workshop on JAXA Astrodynamics and Flight Mechanics

## Usage of JSS

### Computational Information

| | |
|---|---|
| Process Parallelization Methods | Parallelization in the process control shell |
| Thread Parallelization Methods | N/A |
| Number of Processes | 1 - 108 |
| Elapsed Time per Case | 240 Hour(s) |

### JSS3 Resources Used

Fraction of Usage in Total Resources[*1](%): 0.06

Details

| Computational Resources | | |
|---|---|---|
| System Name | CPU Resources Used (core x hours) | Fraction of Usage[*2](%) |
| TOKI-SORA | 0.00 | 0.00 |
| TOKI-ST | 280,944.31 | 0.29 |
| TOKI-GP | 0.00 | 0.00 |
| TOKI-XM | 0.00 | 0.00 |
| TOKI-LM | 0.00 | 0.00 |
| TOKI-TST | 0.00 | 0.00 |
| TOKI-TGP | 0.00 | 0.00 |
| TOKI-TLM | 0.00 | 0.00 |

| File System Resources | | |
|---|---|---|
| File System Name | Storage Assigned (GiB) | Fraction of Usage[*2] (%) |
| /home | 1,990.00 | 1.34 |
| /data and /data2 | 203,100.00 | 0.97 |
| /ssd | 15,060.00 | 0.81 |

| Archiver Resources | | |
|---|---|---|
| Archiver Name | Storage Used (TiB) | Fraction of Usage*2 (%) |
| J-SPACE | 0.40 | 0.00 |

*1: Fraction of Usage in Total Resources: Weighted average of three resource types (Computing, File System, and Archiver).

*2: Fraction of Usage：Percentage of usage relative to each resource used in one year.

- **ISV Software Licenses Used**

| ISV Software Licenses Resources | | |
|---|---|---|
| | ISV Software Licenses Used (Hours) | Fraction of Usage*2 (%) |
| ISV Software Licenses (Total) | 0.00 | 0.00 |

*2: Fraction of Usage：Percentage of usage relative to each resource used in one year.