

# MARBLE (Multiple Antenna Radio-interferometry for Baseline Length Evaluation): Development of a compact VLBI system for calibrating GNSS and electronic distance measurement devices

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34m antenna

Compact VLBI system



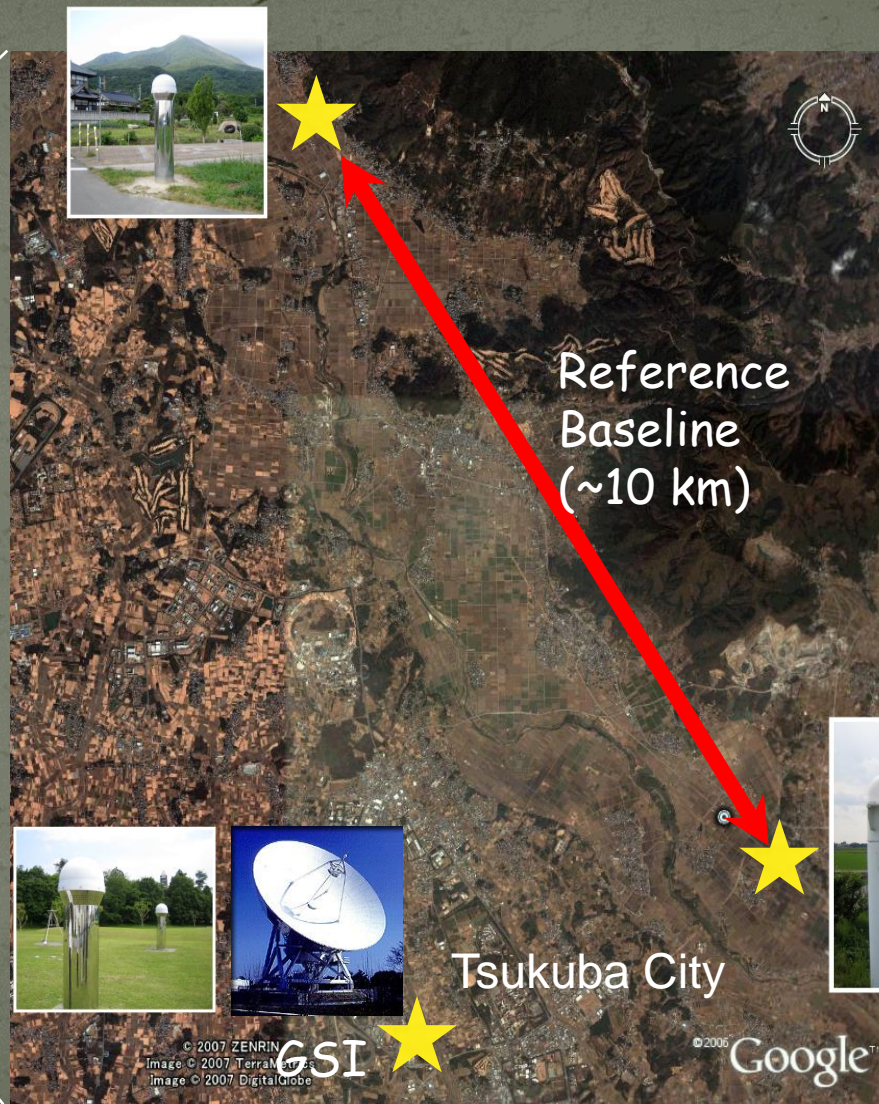
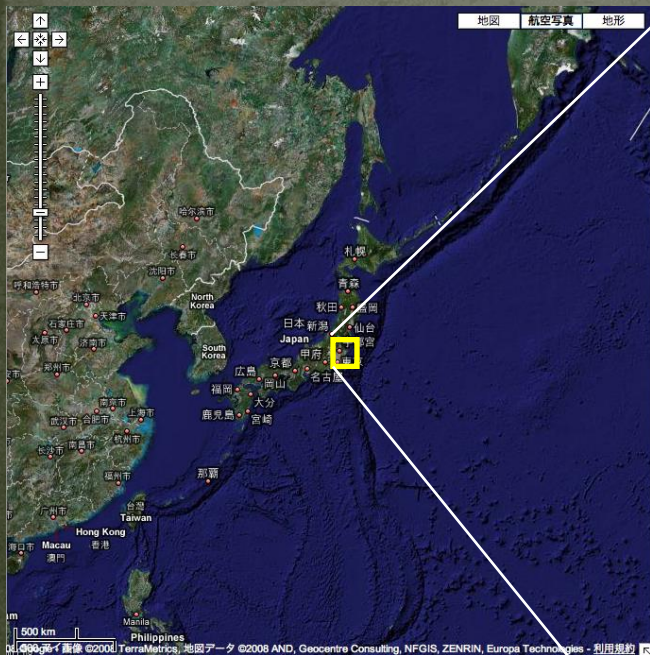
# Outline

- Motivation
- Observation Concept
- Development of Compact VLBI System
- Geodetic Experiments
- Summary
- Outlook
  - T&F transfer using VLBI

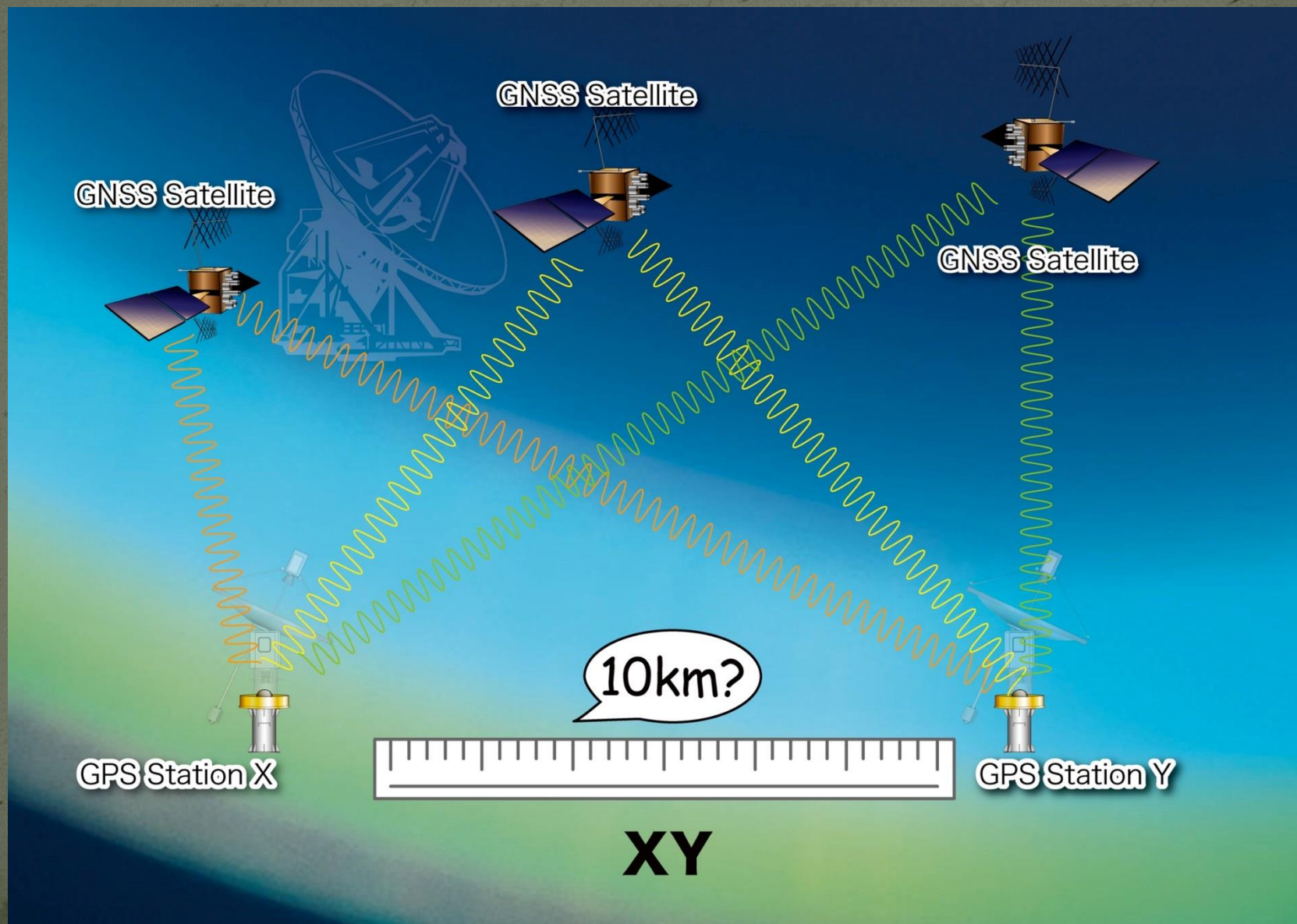
# Motivation

to validate accuracy of GPS and EDM  
survey instruments

# GSI baseline calibration site



# Observation Concept



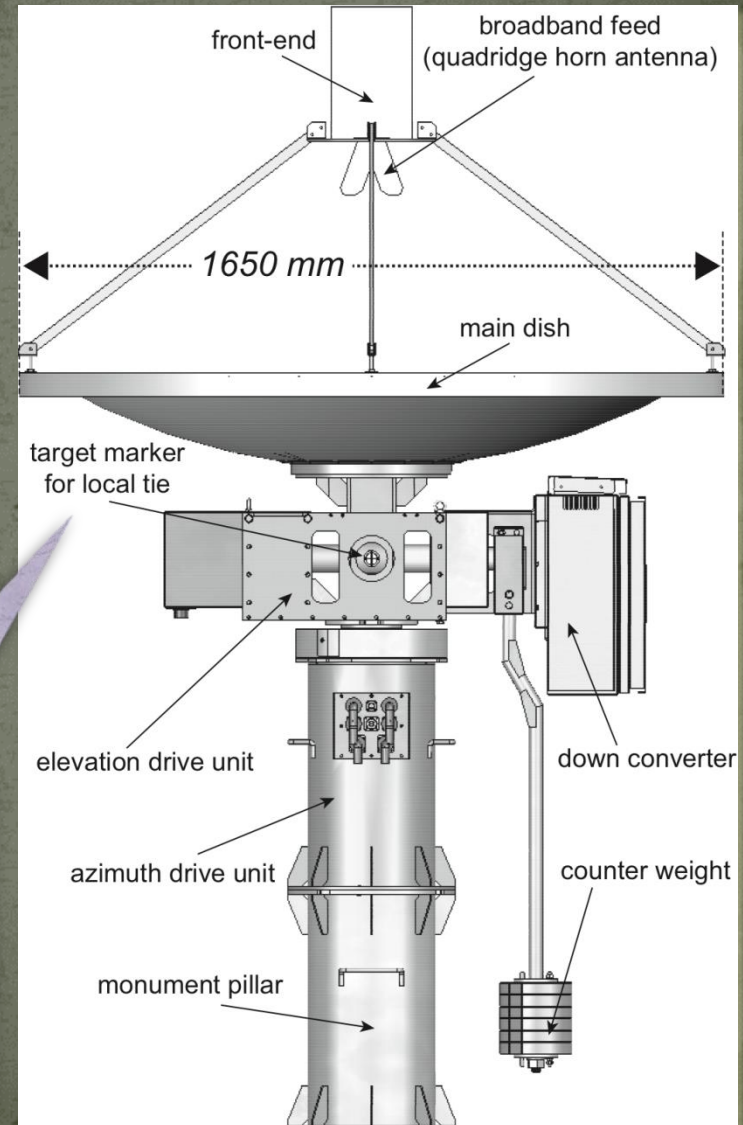
# Multiple Antenna Radio-interferometer for Baseline Length Evaluation **MARBLE** System



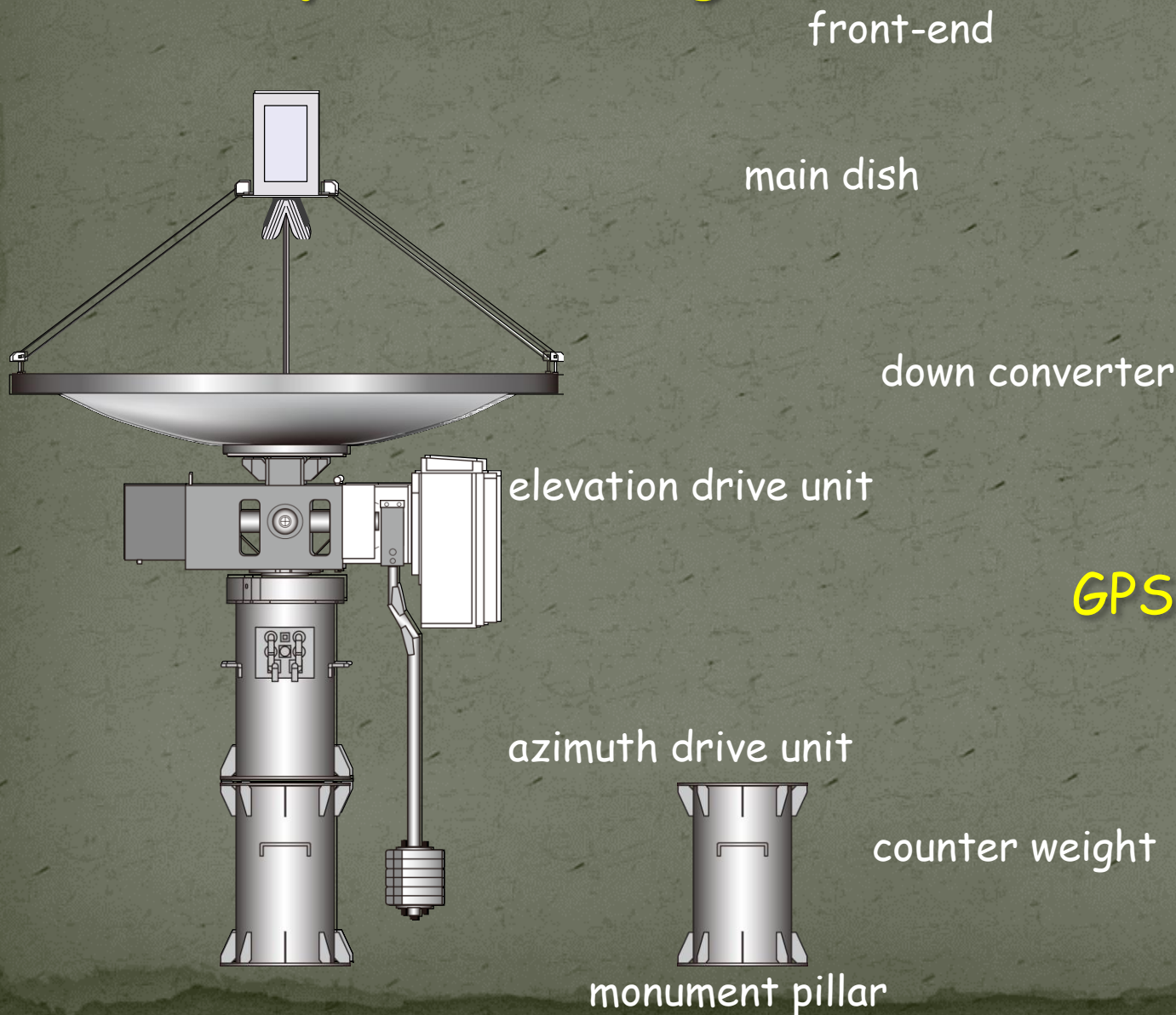
# Development

# Specifications of MARBLE compact VLBI system

- Dish Diameter: 1.5–1.65m
- Primary Focus Feed
- Mount: AZ/EL
- Slew Speed:  $> 5^{\circ}$  /sec
- Transportability



# Transportability



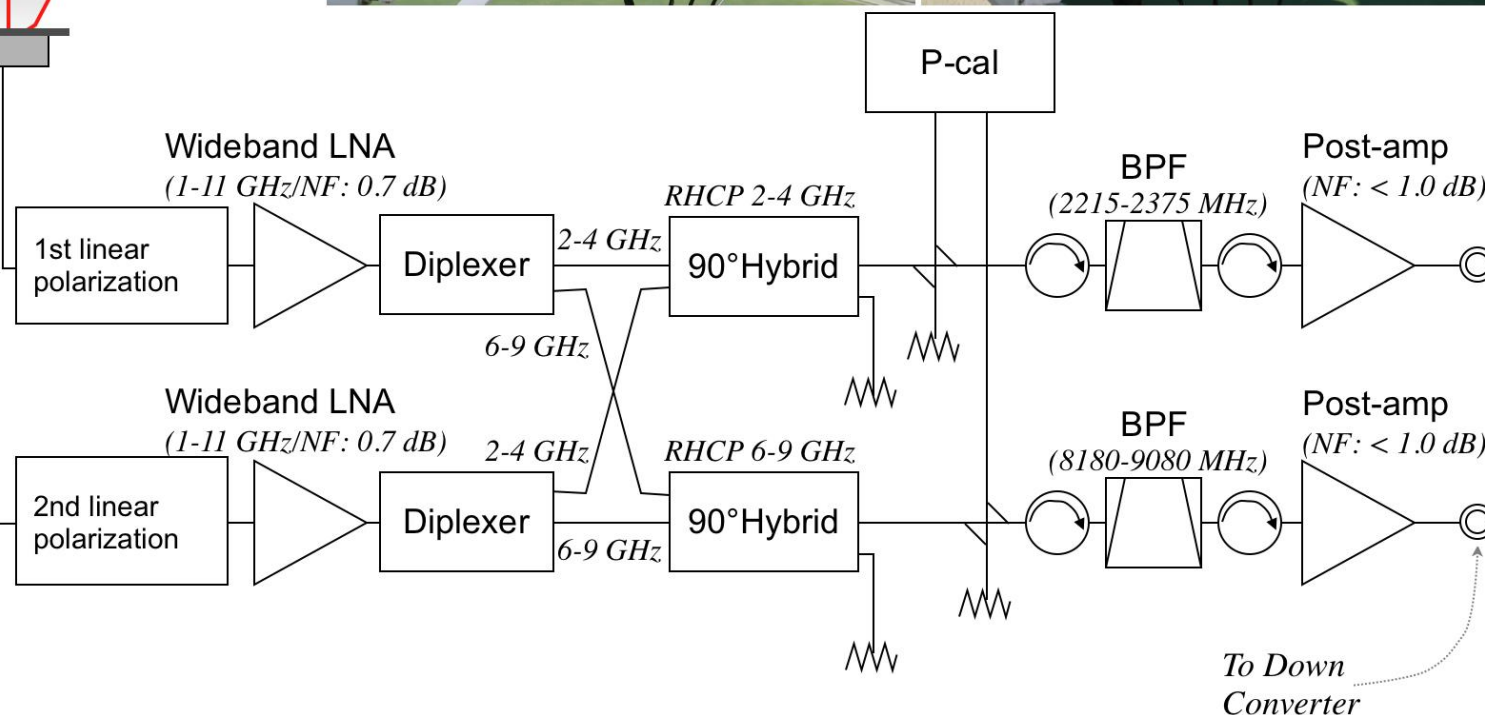
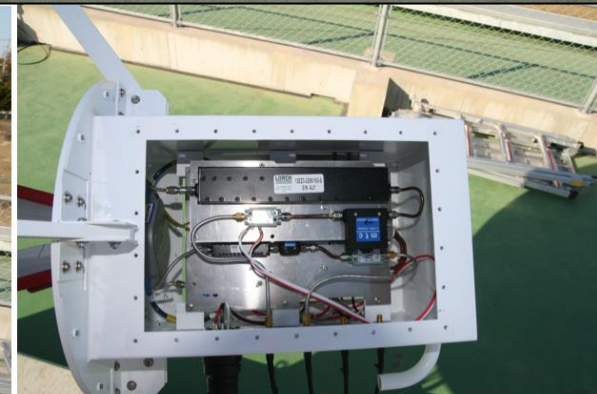
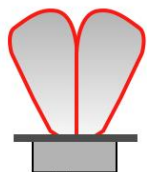
GPS Observation

# Installation



# Front-end system

Dual-Polarized Quad-Ridge Horn Antenna (2-18 GHz)

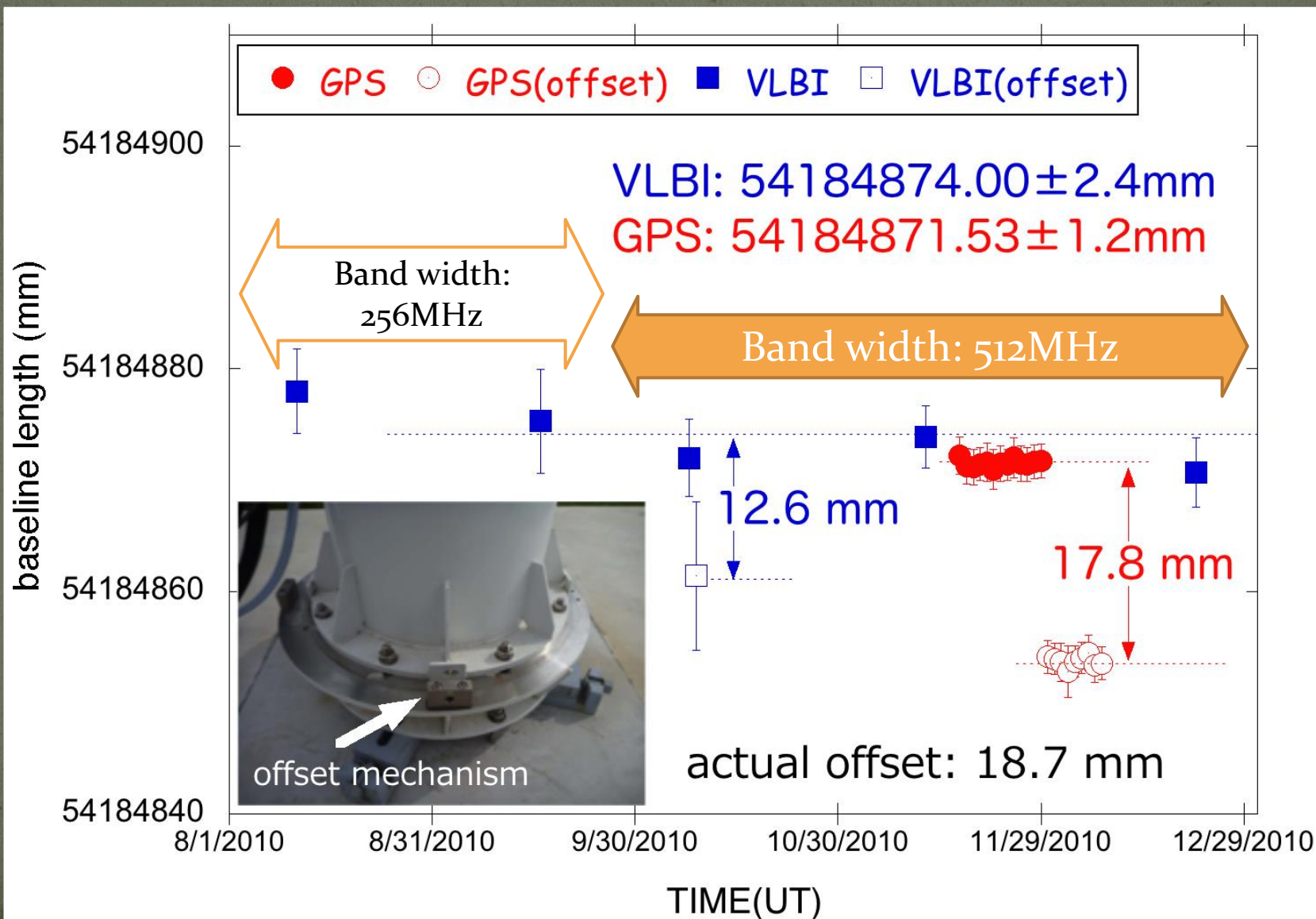


# Geodetic experiments

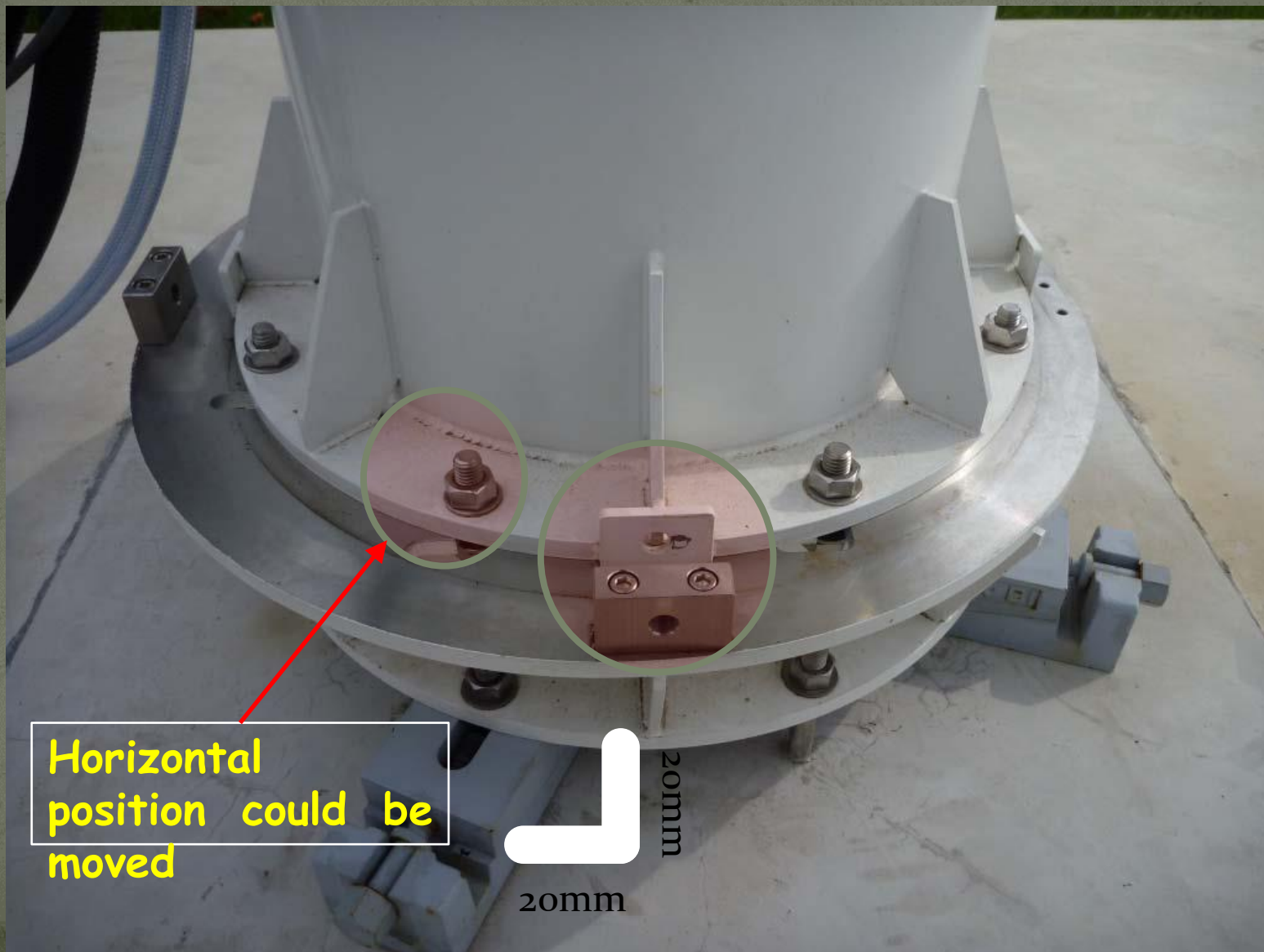
# Station location



# Results



# Accuracy assessment using slide mechanism



18mm

GSI@Tsukuba

~54 km

NICT@Kashima

Narita Airport

5 km

2 マイル

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# Summary

- We have developed two compact VLBI system with 1.6 m diameter aperture antenna in order to provide reference baseline lengths for GPS and EDM calibration.
- We have carried out seven VLBI experiments on the Kashima–Tsukuba baseline (about 54 km) using the compact VLBI system during December 2009 – December 2010. The averaged baseline length and repeatability of the experiments is  $54184874.0 \pm 2.4$  mm.

# Outlook

T&F transfer using compact VLBI system

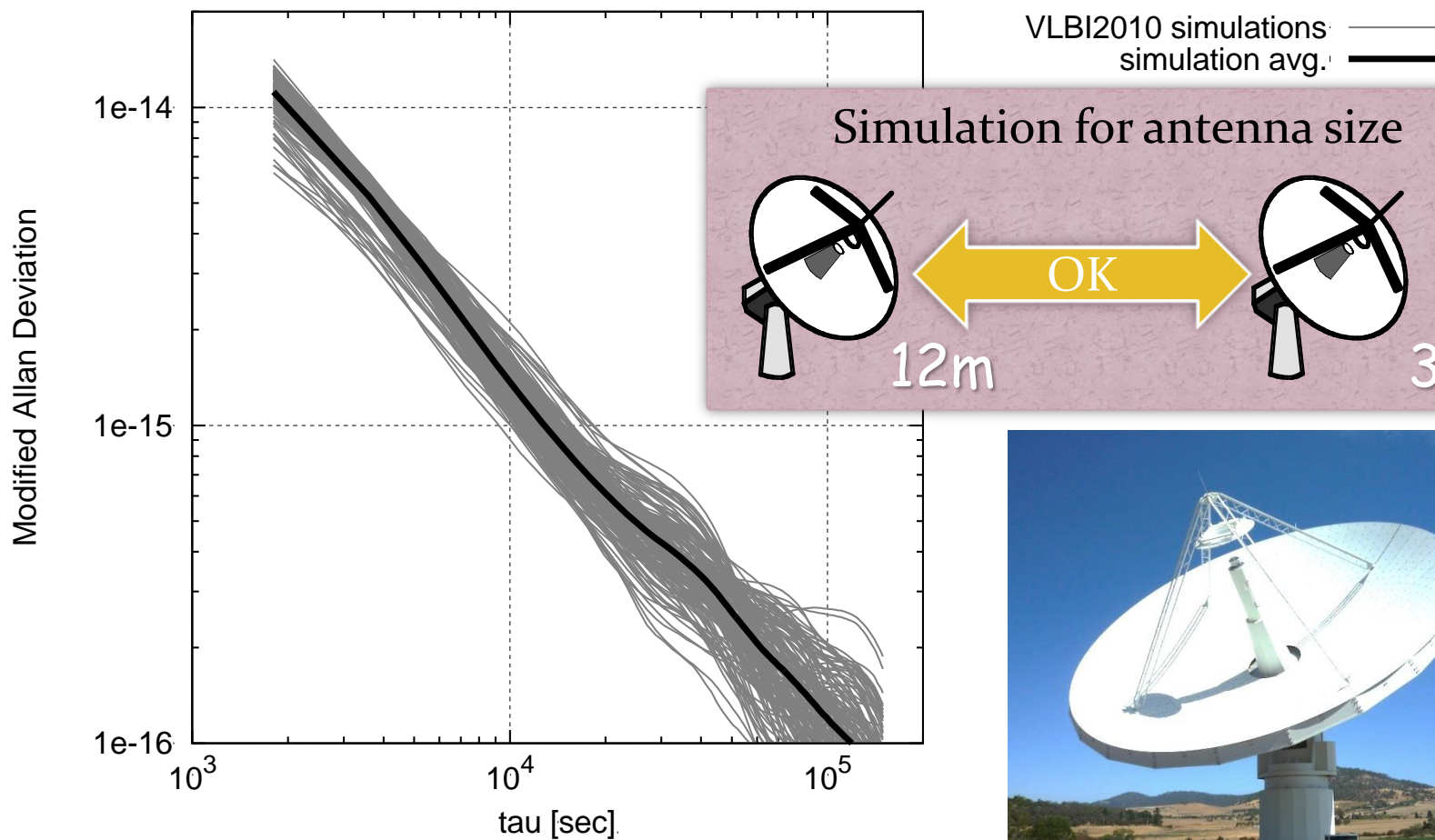
# Potential for T&F Transfer using VLBI?

- Current systems provide a frequency link stability of about  $2 \times 10^{-15}$  @ 1d (ADEV) (Rieck et al. [2010])
- VLBI2010 is expected to perform much better than current systems
- VLBI2010 will be a continuously operating space geodetic technique
- Only initial cost
- No transponder cost
- prototype VLBI2010 system currently under development → no data for verifying T&F potential

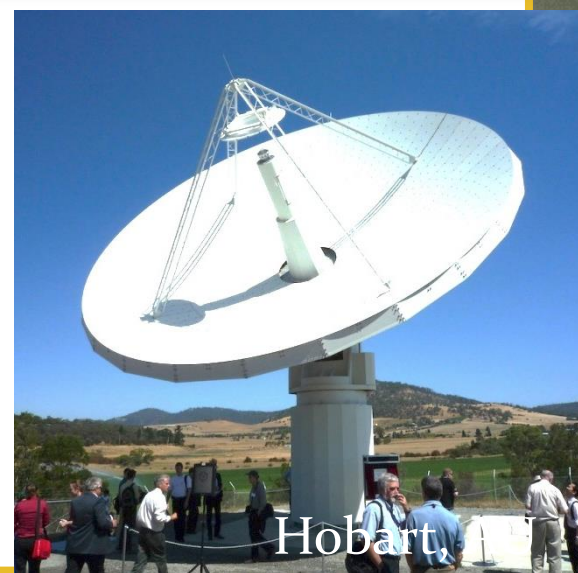


simulations based on VLBI2010 specifications

# Simulation result



After Hobiger et al.[2011]

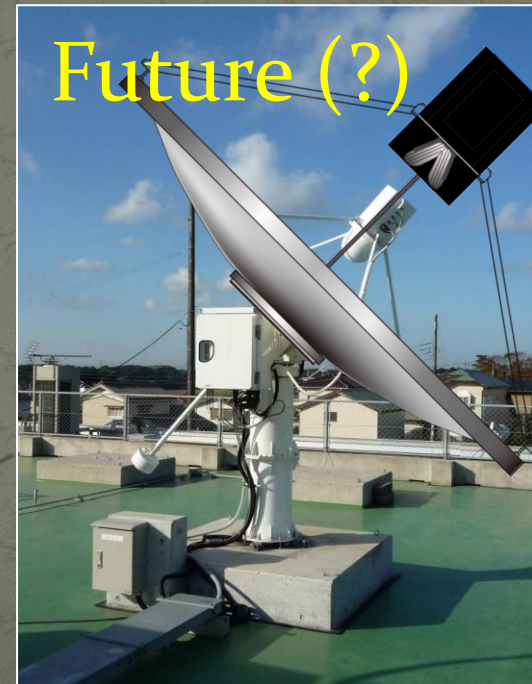


Hobart

# T&F transfer using compact VLBI system

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- NICT will develop a compact VLBI system that includes the VLBI2010 specification for the purpose of T&F transfer.





Thank you very much for your attention.