

INTERCOMPARISON BETWEEN VLBI FREQUENCY TRANSFER AND OTHER TECHNIQUES

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Introduction

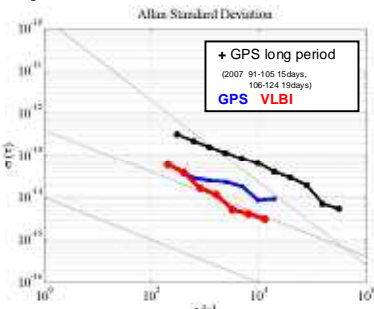
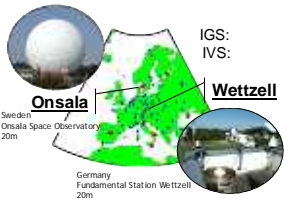
As one of the new frequency transfer technique to compare the next highly stable frequency standards, we proposed the **geodetic VLBI technique**.

- Developing a compact VLBI system**
MARBLE SYSTEM
Multiple Antenna Radio-interferometry of Baseline Length Evaluation
- Verifying the ability of VLBI frequency transfer**
to show the capability of the current VLBI system
Intercomparison between VLBI and other techniques



Previous Study

Comparison between VLBI and GPS using IVS and IGS data



Onsala-Wettzell baseline at each site
VLBI and GPS are *sharing* the H-maser

In general, the VLBI frequency transfer stability follows a $1/\tau$ law very close when averaging up to 10^3 s.

The geodetic VLBI technique has the potential for precise frequency transfer

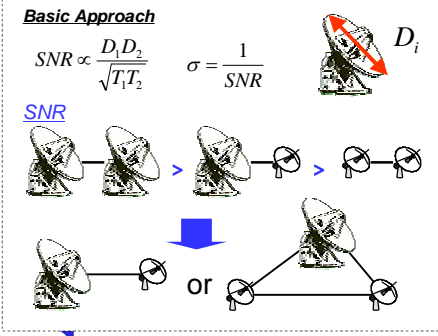
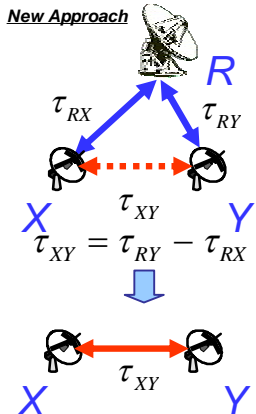
Development of a Compact VLBI System

We are developing a compact and transportable VLBI system to certify the length of the reference baseline, based on a collaboration between Geospatial Information Authority of Japan and NICT.



- MARBLE SYSTEM**
(Multiple Antenna Radio-interferometer of Baseline Length Evaluation)
- Diameter 1.6m
 - S/X-band
 - Front-fed paraboloidal reflector
 - Az-EI mounting
Max speed Az/EI 5 deg/sec
 - Transportable by few person

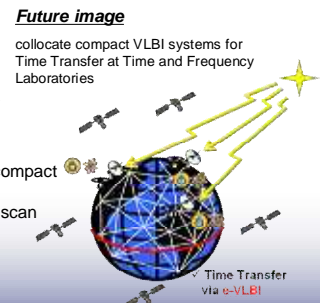
now under test experiment



That is calculate the group delay of compact-compact antenna baseline from the two large-compact antenna baseline.

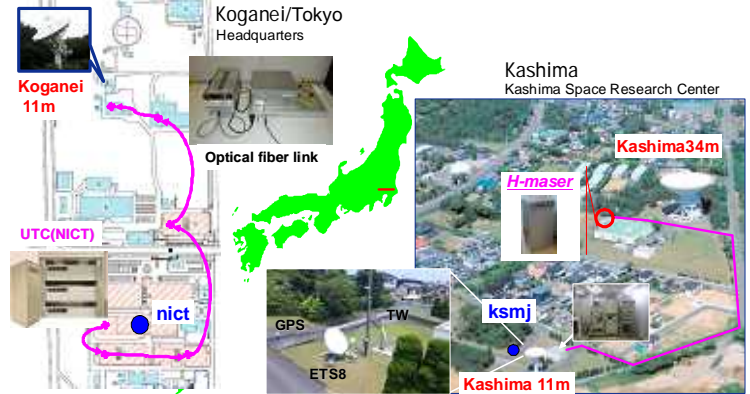
Advantages:

- could not consider the sensitivity of the compact-compact antenna baseline
- short integration time and increase the number of scan
- cancel the effects of the large antenna's problems (gravitational and thermal deformation)



Intercomparison between VLBI and Other Techniques

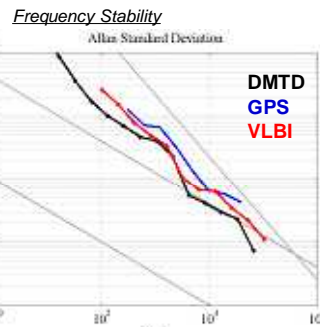
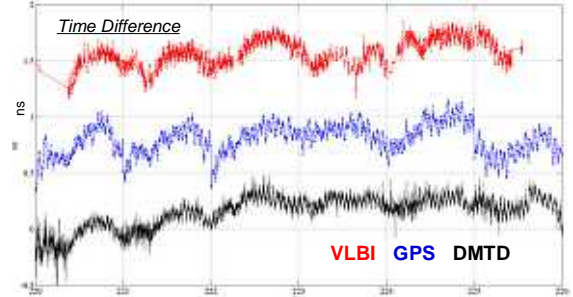
NICT has several T&F transfer techniques other than VLBI such as using GPS and telecommunication satellites at NICT Koganei Headquarters and Kashima Space Research Center.



to show the capability of the current VLBI system
Intercomparison between VLBI and other techniques

Kashima 34m - Kashima 11m baseline

VLBI (multi channel sampling), GPS Carrier Phase, DMTD(Dual Mixer Time Difference)

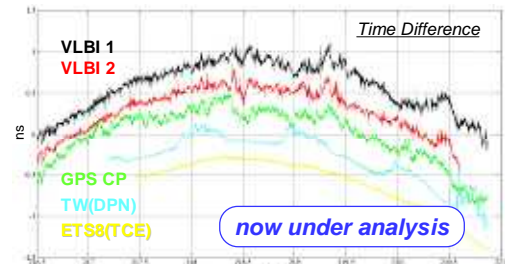


Summary

- Time differences VLBI vs. GPS and DMTD
Good agreement : ± 500 ps
- VLBI is more stable than GPS same baseline and same period over 10^3 averaging time
- VLBI stability : follows a $1/\tau$

Latest Observation

Kashima - Koganei baseline
VLBI 1(multi channel sampling), VLBI 2(wide band sampling), GPS Carrier Phase, TWSTFT (DPN: Dual Pseudo random Noises), ETS8 (TCE: Time Comparison Equipment)



now under analysis

About ETS8(TCE), please see the poster: AP-9 Nakagawa et al., "TIME AND FREQUENCY TRANSFER EXPERIMENTS BETWEEN TWO EARTH-BASED CLOCKS USING ETS-VIII SATELLITE"

References

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- H. Takiguchi et al., VLBI MEASUREMENTS FOR TIME AND FREQUENCY TRANSFER, AT F 2008 Proc., 2008.
- H. Takiguchi et al., Evaluation of the new approach to improving compact-compact antenna baseline in VLBI, JGU 2009 Abstract, D107-005, 2009.
- H. Takiguchi et al., Comparison Study of VLBI and GPS Carrier Phase Frequency Transfer - Part II -, IVS NICT-TDC News, No.30, 26-29, 2009.