

VLBI Measurements for Frequency Transfer

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National Institute of Information and Communications Technology (NICT) has conducted a wide range of the research in time scales and reference frames. Time and frequency transfer techniques and the VLBI (Very Long Baseline Interferometry) technique are the important fields among them. As the combination of these two techniques, we are investigating the time and frequency transfer method using VLBI (Very Long Baseline Interferometry) technique. We expect that this technique will open up a new way to a better time transfer than those using GPS (Global Positioning System) signal or telecommunication satellites. In this study, we introduce the activity dealing with the development VLBI frequency transfer technique.

To develop VLBI frequency transfer, we are doing two things. First, we are developing a compact VLBI system named MARBLE (Multiple Antenna Radio-Interferometry of Baseline Length). As a main feature of MARBLE a 1.65m dish, which can be transported by a single person, has to be mentioned. In the future, we are planning to deploy it at global time and frequency laboratories. Secondly, we are evaluating the ability of VLBI frequency transfer by comparison with GPS carrier phase frequency transfer at the Kashima-Koganei baseline. Results showed VLBI is more stable than GPS [1]. Also, we compared VLBI and GPS using data from the International VLBI Service for Geodesy and Astrometry (IVS) and the International GNSS Service (IGS) for the same purpose. The results of the VLBI frequency transfer show that the stability follows a $1/\tau$ law very closely and it's surpassing the stability of atomic fountain at 10^3 seconds or longer. And that shows the stability has reached about 2×10^{-11} (20ps) at 1 sec. These results show that geodetic VLBI technique has the potential for precise frequency transfer [2].

Based on these findings, we will discuss the VLBI frequency transfer in detail. Additionally, we will show the results of the experiment that used the first prototype of MARBLE.

References

[1] Takiguchi et al, Proc. EFTF2008, 2008.

[2] Takiguchi et al, IVS NICT-TDC News, No.29, 23-27, 2008.