

VLBI application for Frequency Transfer and Development of GALA-V System (III)

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NICT is developing the frequency comparison technology using the VLBI as one of the remote frequency comparison technologies. The small broadband VLBI station, which is an important element of this project (Gala-V), is semi-compliant with the specification of the broadband geodetic VLBI system VGOS (VLBI2010 Global Observing System) specifications. Many VLBI observation stations compliant with the VGOS are under development several countries as an international standard specification for the next generation geodetic VLBI. Our Gala-V system is aimed for the comparison of the frequency standard, but of course this is useful for the geodetic observations too.

[broadband feeding development for large diameter antenna]

Most of the VGOS VLBI stations under development are adopting the special optical system so called ring-focus, That is because of wider beam width characteristic of wide frequency band (2-14GHz) feed, currently available. The receiver feed, that has sensitivity about 3 octaves of frequency, has generally wide beam angle, and therefore, existing Cassegrain reflector antenna is difficult to use it. We have been developing a new broadband feed for our 34m antenna. The first test feed become ready and it was mounted on the 34m diameter modified Cassegrain parabola in the end of 2013, and successfully we observed 6.7GHz, and 12.2 GHz emission line of the Methanol maser simultaneously.

[Zero redundant frequency array - Direct Sampler]

The Gala-V system, which is under the development at NICT, is designed to use four bands of the 1 GHz bandwidth with intervals of zero redundancy in the 2-14 GHz frequency range. This enables a fine delay resolution function without uncertainty (Ambiguity), and the precision of delay measurement could be improved by a one order higher than conventional.

In addition to a conventional analog frequency conversion method, we are experimentally adopting a method to acquire specific frequency band with a digital filter with a direct sampler, which acquires data without frequency conversion via a high-speed sampler. If a direct sampling method is established, system components and cost necessary for the system are simplified and reduced.

[development of the broadband signal composition technology]

The VGOS system is targeting to achieve high precision delay measurements by synthesizing 2-14 GHz broadband signal coherently. A new data processing software, which enables estimation of nonlinear phase change caused by the ionosphere and derivation of precise delay from the super broadband signal, and broadband stable phase calibration system are required.

Keywords: VLBI, VGOS, Frequency Comparison