

Geodetic VLBI Experiments on VERA

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VERA(VLBI Exploration of Radio Astrometry) three stations, Mizusawa, Iriki and Ogasawara, were constructed in March 2001. Each station has a 20m diameter antenna, and S/X bands, 22GHz band and 43GHz band VLBI system. One of purposes of the geodetic VLBI observation on VERA is to constrain VERA network itself. 1 or 2 mm precision for the baseline length of 2000km is required. Its precision is necessary to measure 10 micro arc second order annual parallax of radio sources. In VERA, several observation modes are expected. One is a VERA original mode which uses 1Gbit sampling system. New K4 (i.e. DFC2100 and DIR1000) system is equipped in Mizusawa station for domestic VLBI experiments.

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The specifications of S and X bands are as follows,

S band band width 2.2 GHz - 2.4GHz

system noise temperature less than 150K (considering dome loss)

aperture efficiency more than 20%

X band band width 8.1GHz - 9.0 GHz (within 400MHz for one channel)

system noise temperature 150K - 200K

aperture efficiency more than 40%

antenna feed spiral antenna developed by Hosei University

In the geodetic experiments on VERA, several observation modes are expected.

1. VERA original mode

using 1 Gbit sampler, 400MHz continuous band width.

1) S and X dual band observation

2) 2 channels X band observation, ionosphere correction is done by suitable method

2. Domestic experiment

using new K4 system (i.e. using DFC2100 and DIR1000)

3. VLBA applied mode

Using digital filter, 8MHz width, 16 channels, 1bit sampling (data rate is 256Mbps)

This system is not fully compatible with VLBA system. Recoding media differs from Mark IV and band width is limited within 400MHz.

One of purposes of the geodetic observation on VERA is to constrain VERA network itself. 1 or 2 mm precision for the baseline length of 2000km is required. Its precision is necessary to measure 10 micro arc second order annual parallax of radio sources. The measurement of annual parallax is a main target of astrometry in VERA. The VERA network should be also connected with global reference frame with a precision of 1cm order. VERA does not have Mark IIIa or Mark IV backend system which are widely used on international experiments, thus it is difficult to connect VERA network directly with global network. VERA network will be connected with global frame through Tsukuba VLBI station of Geographical Survey Institute, which station operates international geodetic experiments regularly.

In the early stage on planning VERA system, Earth rotation observation was a main target of VERA. But now, routine observation of Earth rotation is not planned in VERA. The Earth orientation parameters (EOP) which are provided by IERS will be used in VERA. We estimated that the accuracy of EOP given by IERS is enough to measure annual parallax of radio sources.

The VERA stations will be also used as tracking stations for RISE/SELENE project which is a Japanese Moon satellite mission to resolve gravity field of the Moon. In the tracking of RISE, a specially designed narrow band backend system will be used. In addition, collocated observation of GPS is in preparation for all VERA stations.