

Current Status of Development of Compact VLBI System with 1-m class Antenna for Providing over 10km Baseline Calibration

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We are developing a compact VLBI system with 1m-class antenna in order to provide reference baseline lengths for calibration baselines. The calibration baselines are used to validate surveying instruments such as GPS and EDM and maintained by the Geographical Survey Institute (GSI). The long (10km) calibration baseline is examined only by GPS receiver at present. Therefore, to examine the 10km calibration baseline by another technique is required. VLBI technique can give an independent measurement to examine the long calibration baseline. Our concept of this VLBI system is using a pair of very small antennas combined with a large aperture antenna. Time delay between small antennas is directly undetectable due to their low sensitivity. However their time delay can be obtained from delays observed with a large antenna and the baseline vector between small antennas can be measured. We named this project MARBLE (Multiple Antenna Radio-interferometry for Baseline Length Evaluation) based on the measuring concept.

We have started the development of a small antenna for the MARBLE project since 2006. A quad-ridge horn antenna (QRHA) that covers 2-18GHz will be used as a feed of the small antenna. Wide-band RF signals received by the QRHA are filtered to S and X bands by a diplexer and led to a VLBI backend. The QRHA was measured in an anechoic chamber to get antenna pattern and to evaluate performance. The small antenna of paraboloidal reflector was designed using the measured antenna pattern of QRHA. The QRHA has been installed at a main focus point of CARAVAN2400 (paraboloidal reflector of 2.4m diameter) for the performance evaluation since November, 2007. A fringe test was carried out on December 5, 2007, and got fringes successfully for both S and X bands. The QRHA antenna pattern, the result of the fringe test and outlook of the small antenna design will be presented in this presentation.