Activities at Sejong Station

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Abstract The Sejong station is a part of the SGOC (Space Geodetic Observation Center) which belongs to the NGII (National Geographic Information Institute). This report will briefly describe the Sejong S/X system issues that we need to improve, establishment of a server cluster for S/W correlation, and installation of the ARGO-M (mobile SLR system, 40 cm in diameter) which is developed by KASI (Korea Astronomy and Space Science Institute) at the Sejong station. Construction of the Korea VLBI Network KVNG (Korea VLBI Network for Geodesy) is currently underway.

Keywords Sejong station, NGII, KASI, ARGO-M

1 General Information

Sejong is located about 120 km south of Seoul at longitude 127°18′12″, latitude 36°31′12″ and 153 meters high in the middle of Sejong city, which serves as a new administrative capital. Sejong station has a VLBI antenna, is an IGS station (SEJN), has four pillars for co-location, is a mobile SLR system (40 cm in diameter), has an MWR (Microwave Water vapor Radiometer), and does astrometric surveying by optics (theodolite).

A considerable change is the installation of the SLR system at Sejong station. KASI (Korea Astronomy Space and Science Institute) developed the 40-cm SLR system and installed it near Sejong station. VLBI, GNSS, and the SLR system are directly measured by electronic distance measuring instruments. There are about 195 meters in distance between the VLBI and SLR systems and about 130 meters in distance between the GNSS and SLR systems.

2 VLBI Observation Activities in 2015

Sejong station started to join IVS regular sessions in September 2014. The Sejong antenna participated in only five sessions in 2014. In 2015, 50 sessions (40 R1, two T2, two APSG, and two AOV) were observed. As for local sessions, Sejong and the KVN (Korea VLBI network, KASI) carried out ten sessions for a performance test.

There are known issues to improve in the Sejong system. One issue is that the DC component sometimes appears in X-band. The NGII and KASI tried to correct this issue by measuring at the Sejong site. However, we could not find and correct this issue. The other issue is quite high SEFDs due to the cooling ability in the cooling box. As you can see in Figure 2, the SEFDs of both X and S are 15,000 Jy and 4,500 Jy respectively. Figure 3 shows S/X feeds in the antenna. It is not the dual one but the individual S and X feeds. Figure 4 shows that eleven cables are connected on the side of the cooling chamber. These cables cause higher physical temperatures inside.

1. National Geographic Information Institute
2. Korea Astronomy Space and Science Institute

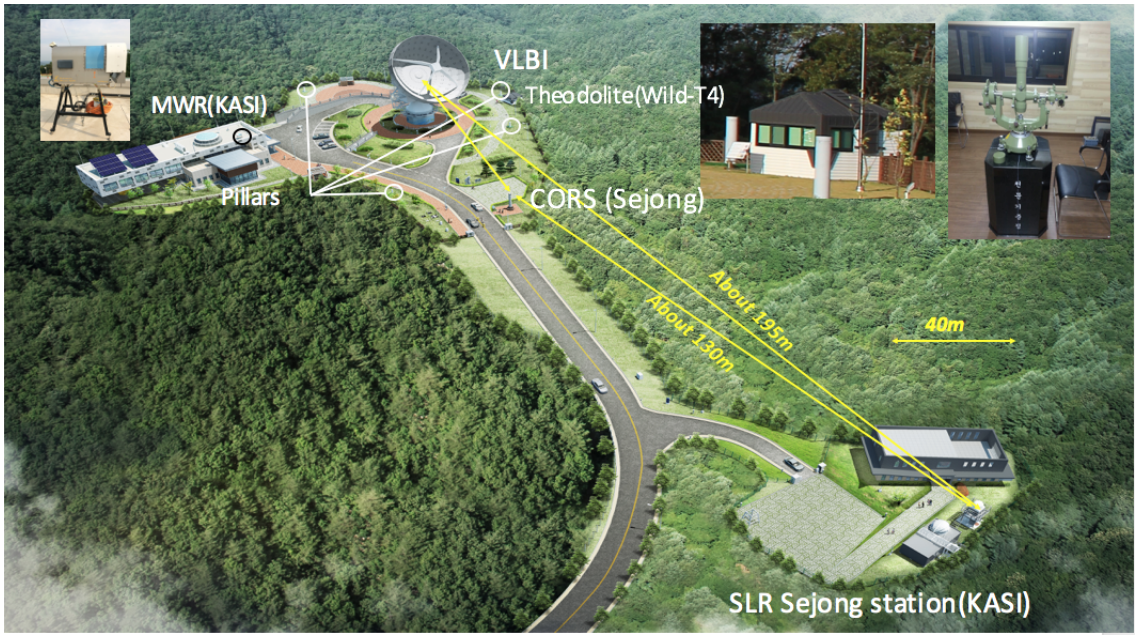

Fig. 1 Site layout and equipment at the Sejong station (KASI's newly installed SLR station in October 2015).

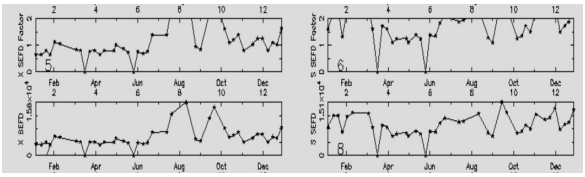

Fig. 2 A captured image of station performance on the IVS Web site for the Sejong antenna.

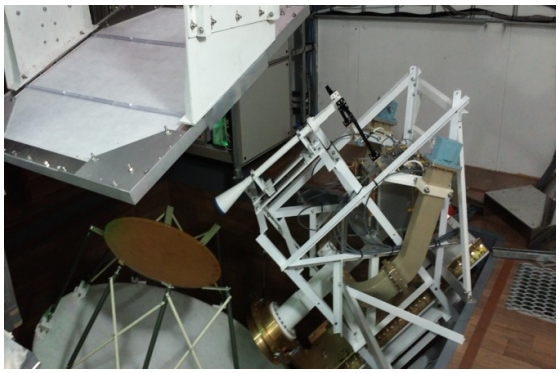

Fig. 3 Sejong S/X feed system.

Fig. 4 LNA cooling chamber. Inside the chamber, LNAs for S/X, a cabling system for calibration, and mode switch cables (Hot/Cold/Sky) are installed.

3 Status of Korea VLBI Network for Geodesy

The Sejong station is preparing for the local Korean VLBI network with high frequencies (22 GHz and 43 GHz). The purpose is for the co-utilization of geodesy and astrometry. There are four VLBI sites (Sejong, Ulsan, Tamna, and Yonsei) in Korea. KVN (Korea VLBI Network: Ulsan, Tamna, and Yousei) began VLBI observations in 2007. They have K (22 GHz), Q (43 GHz), W (86 GHz), and D (129 GHz) receiver systems with a 21-meter main dish. Among

the receivers, K- and Q-band are the same as in the Sejong VLBI system. In 2015, Sejong and KVN carried out a fringe test. We received fringes for both K- and Q-bands.

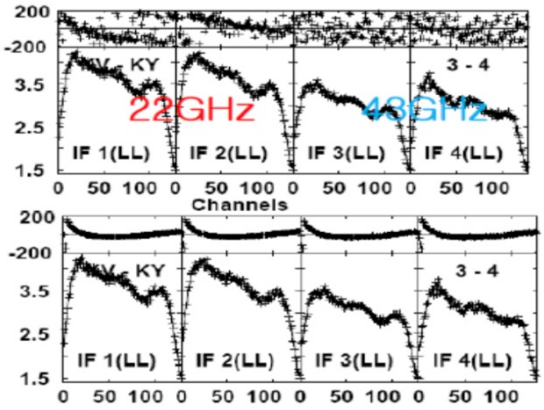

Fig. 5 Phase arranging results in both K- and Q-band.

4 Preparations to Build Sejong Correlator

In order to operate a correlator in Sejong, we constructed a server cluster system with 100 TB of data storage. DiFX and K5 correlation software was installed. Sejong took charge of the AOV004 and AOV005 sessions; however, imperfect fringes were detected during the correlation process, and progress in solving the problem was slow. Thankfully, Shanghai observatory and GSI took over the AOV data for Sejong. We will keep looking into solving the problems. The results will be reported to the AOV board and the IVS when they are finished.

5 Development of Broadband Feed for VGOS by KASI

Normally, feedhorn specification depends on the antenna optic system. It is assumed that the optic system is the same as the VGOS antenna. Here are the feedhorn specifications that we made: a. Operation frequency bandwidth: 2–14 GHz; b. 10 dB bandwidth: 60–90 degrees; c. Input return loss: less than −10 dB; d. Isolation: less than −30 dB; e. Possibility of receiving linear dual polarization; and f. Input impedence: 50 Ohm. As for the results, almost all frequencies' (all except 2 GHz) 10 dB bandwidth levels are satisfied. The specified input return loss and isolation levels are satisfied. KASI will compensate for the failure to satisfy the 10 dB bandwidth level at 2 GHz that appeared during the test.

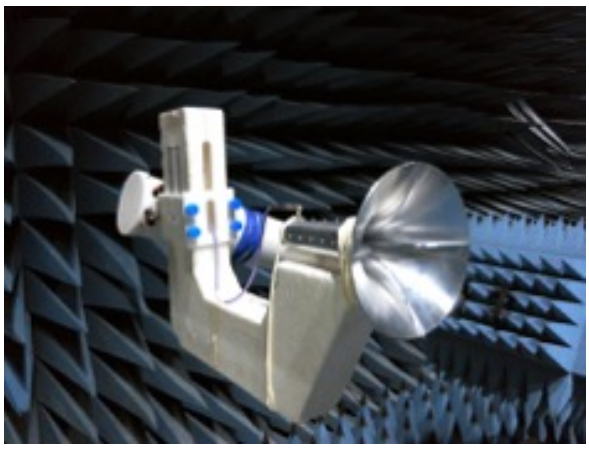

Fig. 6 Far-field pattern measurement setup.

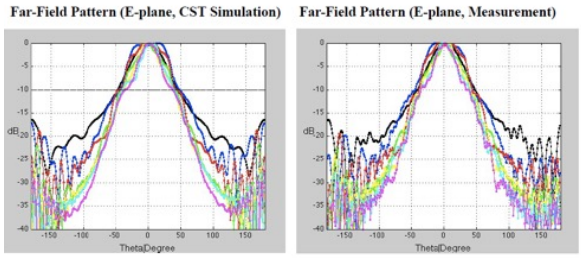

Fig. 7 Comparison for far-field pattern between the simulation and the measured results (Left: Simulation results; Right: Measured results).

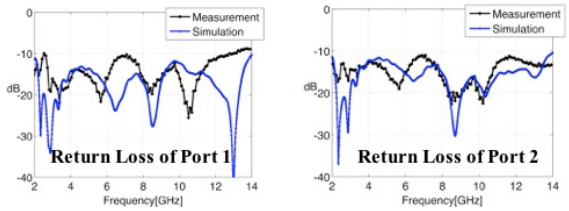

Fig. 8 Comparison for return losses between the simulation and the measured results (Left: Port 1; Right: Port 2).

6 Future Plans

The sessions and the amount of IVS participation of the Sejong station in 2016 will be similar to the 2015 Sejong annual observation schedule. As for the Korea local VLBI network project in 2016, the upgrade for relevant equipment and software development will progress. To operate the correlator properly, the Sejong station will keep solving whatever problems the Sejong correlator may have. Over the next few years, the Sejong station hopes to become an IVS Correlator.