

Metsähovi Radio Observatory Network Station 2014 Annual Report

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Abstract In 2014, Metsähovi Radio Observatory, together with the Finnish Geodetic Institute, have observed six IVS sessions: three T2 and three EUROPE sessions.

1 General Information

Aalto University Metsähovi Radio Observatory and Finnish Geodetic Institute (FGI) are two separate institutes which together form the Metsähovi IVS Network Station. Metsähovi Radio Observatory operates a 13.7-meter radio telescope on the premises of Aalto University at Metsähovi, Kylmälä, Finland about 35 km from the university campus. The Metsähovi Fundamental Geodetic Station of FGI is in the same area, near Metsähovi Radio Observatory.

2 Component Description

The Metsähovi Radio Observatory has been operational since 1974. The telescope was upgraded in 1992-1994. The radome was replaced with a new one, and new surface panels were installed. Metsähovi, together with FGI, began observing IVS T2 and EUROPE sessions in 2004. Approximately six to eight sessions are observed per year. The surface accuracy of the present

telescope is 0.1 mm (rms). The speed of the Metsähovi antenna is 1.2 degrees per second.

Metsähovi is known for its long-term quasar monitoring. Astronomical VLBI observations are carried out with the 22 and 43 GHz receivers. The geodetic VLBI receiver of Metsähovi uses right circular polarization and 8.15—8.65 and 2.21—2.35 GHz frequency bands.

2.1 Metsähovi Fundamental Station

FGI is running the Metsähovi Fundamental Station. It is a part of the IAG GGOS Core station network. The instrumentation includes geodetic VLBI (in cooperation with Aalto University), Satellite Laser Ranging (SLR), DORIS, and GNSS equipment and absolute and superconducting gravimeters.

Currently, instrumentation is being renewed based on special funding from the Ministry of Agriculture and Forestry. During this year, a new dome for SLR was constructed. The installation of a new SLR telescope and other equipment is expected to be installed within the next year.

At the start of 2015, the Finnish Geodetic Institute will become a part of the National Land Survey of Finland (NLS) as the Finnish Geospatial Research Institute (the abbreviation remaining FGI). The construction of a new radio telescope for GeoVLBI observations will be realized, if the project is funded by NLS.

1. Aalto University Metsähovi Radio Observatory

2. Finnish Geodetic Institute



Fig. 1 Metsähovi Radio Observatory (photo by Merja Tornikoski).

Table 1 Staff at Metsähovi Radio Observatory and at FGI involved in geodetic observations during 2014.

Staff at Metsähovi Radio Observatory		
Name	Title	Responsibility
Ph.D., Lic.(tech.) Juha Kallunki	Technical staff manager	VLBI equipment
M.Sc.(tech.) Ari Mujunen	Laboratory engineer	VLBI equipment
D.Sc.(tech.) Minttu Uunila	Post-doctoral researcher, IVS on-site technical contact	VLBI observations, VLBI equipment
M.Sc.(tech.) Petri Kirves	Operations engineer	Receivers
Staff at Finnish Geodetic Institute		
Name	Title	Responsibility
Prof. Markku Poutanen	Head of the Department of Geodesy and Geodynamics	Metsähovi research station
Ph.D. Nataliya Zubko	Senior research scientist	IVS observations, analysis
M.Sc. Veikko Saaranen	Special research scientist	IVS observations operations
M.Sc. Ulla Kallio	Senior research scientist	Local ties measurements
Ph.D. Diego Meschini	Research scientist	Correlation research
Ph.D. Jyri Näränen	Special research scientist	Metsähovi infrastructure

3 Staff

FGI is responsible for the geodetic VLBI observations and is the owner of the S/X receiver. The radio telescope is owned and operated by the Aalto University, and an annual agreement is made on its use for geodetic VLBI sessions. It is not possible to increase the number of annual geodetic sessions (currently six to eight) because the telescope is mainly used for astronomical observations. Operation during the geo-VLBI sessions and technical questions are handled jointly; all other technical work, telescope maintenance, and maintenance of instrumentation are done by the personnel of the radio telescope.

Metsähovi Radio Observatory personnel working with IVS observations are listed in Table 1. Dr. Uunila is in charge of all (IVS, EVN, and GMVA) VLBI observations at Metsähovi. The preparation, operation of IVS observations, and submission of data are provided by staff from FGI. The personnel engaged in the work are listed in Table 1.

4 Current Status and Activities

4.1 IVS Sessions

Metsähovi, together with FGI, has observed six IVS sessions (three T2 and three EUROPE sessions) in 2014. In EUR127 there was RFI on X-band channels. This might have been caused by the fact that we had to use a signal generator to produce the LO, which was broken in the receiver. The Mark 5B also had to be rebooted, and there were some non-detections. In EUR128 there were no problems. In EUR130 there were antenna slewing problems during the scan recording (see also the Technical Activities Section). The T2 sessions (T2097, T2098, and T2099) are not yet correlated, and there were no known problems.

4.2 Research Visits

Dr. Uunila visited the Goddard Space Flight Center (GSFC) VLBI group in order to collaborate with local group members on a comparison of the VieVS analysis software package developed by the Vienna University of Technology and the Solve package developed by the GSFC VLBI group.

4.3 Technical Activities

DBBC boards were repaired in Bonn in January by M. Wunderlich. The LO of the X-band receiver was repaired in January at Metsähovi. A new 8 TB disk-module was assembled and tested in October.

Throughout the year we experienced slewing problems with the antenna. These will be fixed in January 2015, when the old antenna control software version will be replaced with a new one and the azimuth limits will be changed from 0—360 to -90—450 degrees.

4.4 Data Analysis

Geodetic data analysis at Metsähovi is done by Dr. Uunila. The analysis focuses on the IVS-INT01 sessions.

Data analysis at FGI is performed by Dr. Zubko. The project of source structure study and its influence on estimated geodetic VLBI parameters has been continued in cooperation with Dr. Rastorgueva-Foi from University of Tasmania. The latest results on this research were presented at the EGU meeting this year. Dr. Meschini is responsible for correlation.

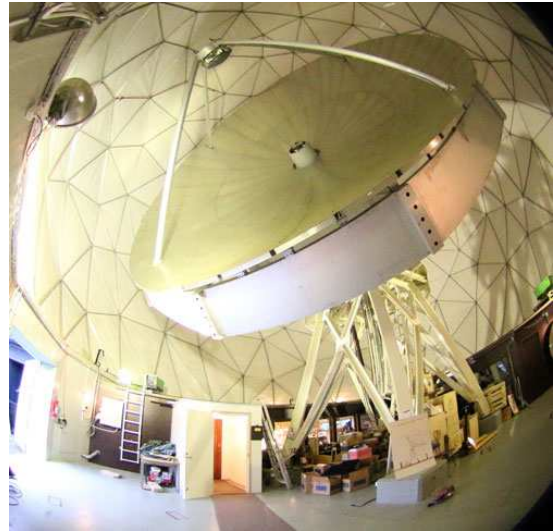


Fig. 2 Metsähovi radio telescope (Photo by Merja Tornikoski).

4.5 Local Tie Measurements

The local tie measurements between the co-located instruments at Metsähovi are provided by Ulla Kallio. A local tie between IGS station METS and the VLBI antenna reference point was regularly performed with kinematic GPS measurements during the geo-VLBI campaigns beginning in 2008. Testing shows that a millimeter level accuracy can be achieved in local tie vector determination with the kinematic GPS method.

4.6 Laser Scanning of Telescope Dish

During the summer, the telescope dish was scanned with a FARO Focus 3D terrestrial laser scanner established on the position of the secondary mirror to study dish deformation (Figure 3). This experimental work



Fig. 3 Laser scanning of antenna dish. The scanner is in place of the secondary mirror.

was performed by Antero Kukko, Harri Kaartinen, Ulla Kallio, and Henry Rönnerberg. The preliminary results show that the data is suitable for the focal length estimation, but not accurate enough for a detailed surface deformation analysis. To get more precise results the scanning will be repeated next year with another scanner.

5 Future Plans

In 2015 Metsähovi is scheduled to participate in seven IVS sessions: three EUROPE sessions and four T2 sessions. The antenna control software will be updated in January 2015.