

Observatorio Astronómico Nacional – Yebes

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Abstract

This report updates the description and details of the OAN facilities as an IVS network station. The construction of the new 40-meter radiotelescope has progressed substantially, after the main parabolic reflector and subreflector have been lifted on top of the concrete tower. Completed construction in 2005 will allow the installation of a new S/X band receiver, in order to restart the geodetic VLBI observations in 2006. The institute staff is also involved in technical developments, and scientific research in geodesy, astrometry and astrophysics.



Figure 1. Erection of the new 40 meter radiotelescope of OAN at Yebes (Guadalajara, Spain).

1. General Information: The OAN Facilities

The Observatorio Astronómico Nacional (OAN) of Spain, which is a department of the Instituto Geográfico Nacional (IGN, Ministerio de Fomento), operates a 14 meter radiotelescope at Yebes (Guadalajara, Spain). This facility is a network station of the IVS, and has participated regularly in the geodetic VLBI campaigns to study the tectonic plate motions in Europe, Earth rotation, and pole motion.

The VLBI equipment has been constantly upgraded (including a Mark 5A unit), and is fully operational. The institute is currently involved in the construction of a new 40 meter radiotelescope

(see Fig. 1) which is expected to be available for geodetic VLBI observations in 2006. Progress can be followed at the web address (in Spanish):

<http://www.oan.es/ign/home/astronomia/instalaciones/telescopios/40m/40m.html>

2. OAN Staff Working in VLBI Projects

Table 1 lists the OAN staff which are involved in VLBI studies, some of which can be found at the telescope (CAY) address. The associated members of IVS are indicated with an asterisk. Contact information is provided at the URL:

<http://www.oan.es/investigacion/astronomia/vlbi.shtml>

The VLBI activities are also supported by other staff like receiver engineers, computer managers, secretaries and students.

Table 1. Staff in the OAN VLBI group (Email: vlbitech@oan.es).

Name	Background	Role	Dedication	Address
Rafael Bachiller	Astronomer	Director of OAN	10%	OAN
Alberto Barcia	Engineer	Chief engineer	10%	CAY
Francisco Colomer*	Astronomer	VLBI Project coordinator	30%	OAN
Jean-Francois Desmurs	Astronomer	Scientist (Astrophysics)	10%	OAN
Jesús Gómez-González*	Astronomer	General Subdirector for Geodesy and Geophysics	10%	IGN
José Antonio López-Fdez	Engineer	CAY site manager	20%	CAY
Maria Rioja*	Astronomer	Scientist (Astrometry)	50%	OAN
Pablo de Vicente*	Astronomer	VLBI Technical coordinator	30%	CAY

3. Status of the Geodetic VLBI Activities at OAN

The main contribution of OAN to IVS is the realization of geodetic VLBI observations: the OAN 14-m radio telescope at Yebes has however not participated in any VLBI campaigns in 2004 due to the failure of the very old telescope control computer (HP1000).

Therefore most of the activities focused on the construction of the new 40-m radiotelescope. The configuration of the VLBI receivers was fully designed and the construction of the different elements started. The system consists of several mirrors, called auxiliary, that direct the beam from the nasmyth mirrors to the receivers. Up to seven frequency bands can be supported: S, X, C, Ku, 22 GHz and 30 GHz. This configuration allows simultaneous observations with at least two receivers.

Up to the moment, three receivers have been designed. All of them are based on cryogenically cooled HEMT amplifiers with simultaneous double circular polarisation. The construction of the optical configuration of the VLBI receivers will be finished by the end of March 2005 (Fig. 2). For simultaneous observation with the S and X receivers, a parabolic and a dichroic mirrors have been constructed and tested. An elliptical reflector has been constructed for the 22 GHz optics.

The movement of these mirrors is remotely controlled and the selection between receivers will be done in terms of seconds. The horns and polarizers for the three receivers have been constructed and tested in an anechoic chamber. The 22 GHz receiver, including the cryostat (Fig. 3), is fully constructed and presents very low noise (less than 18 K from 21 to 24 GHz). The S and X receivers are fully designed and most parts of their components are already in our laboratories.

The first observations with these three receivers are scheduled after summer 2005. The instrument will start operations for the IVS at S/X bands in 2006.

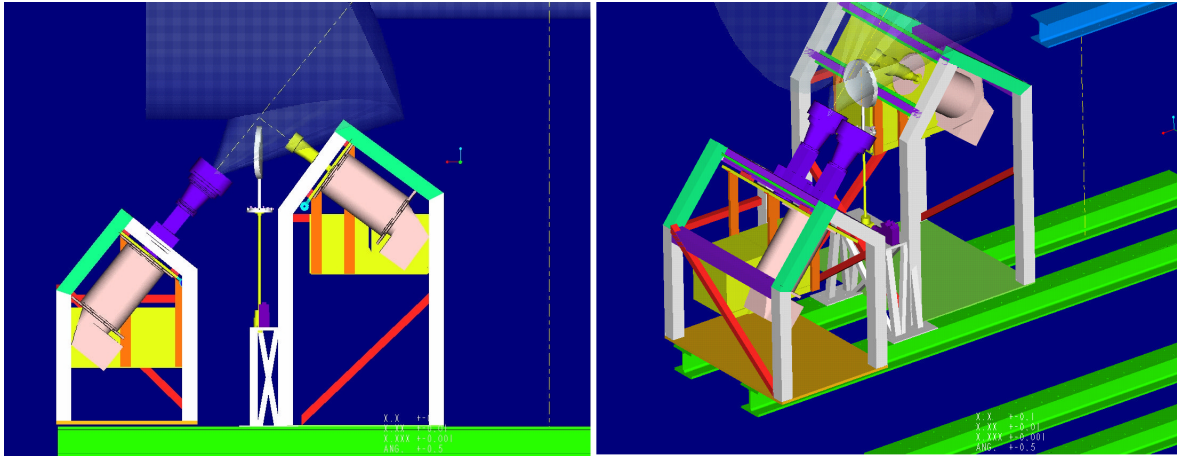


Figure 2. Optical configuration of the 40 meter radiotelescope S/X bands.



Figure 3. Cryostat of the 40-m telescope 22 GHz VLBI receiver.

The OAN group performs high precision astrophysical VLBI studies of maser emission towards late-type stars, which will not be discussed here. However we point out the case of high precision astrometric studies applied to the joint determination of proper motion of H₂O masers and distances to emitting stars, with the analysis of multiple VLBI campaigns in the course of 1 year, at 22 GHz (Rioja et al. 2004). The development of new observational and analysis strategies will allow the extension of this work to higher frequencies, to study “bona fide” proper motions of SiO masers at 43 and 86 GHz.

Also, the new Japanese interferometer, VERA, with its innovative dual-beam system will make possible the extension of these absolute astrometric studies to higher frequencies (Honma et al. 2004).

4. Future Plans

The construction of the new 40 meter radiotelescope at Yebes is progressing well. The erection of the main reflector was carried out in December 2004. This telescope is expected to be operational at S/X bands in mid 2006. Other frequencies of operation will be 4-7 GHz, 10-15 GHz, 21-24 GHz (first light receiver), 30-32 GHz, 40-50 GHz, and 72-116 GHz.

On the other hand, measurements of absolute gravimetry at the 14-m telescope building have been performed. A project of construction of a building is being finalized, which will allow the installation of permanent equipment for constant gravity monitoring. The Yebes site will become a fundamental geodetic station after collocation of three geodetic techniques (VLBI, GPS and gravimetry) is achieved in 2005. More information at the web site (in Spanish):

<http://www.ign.es/ign/home/geodesia/gravimetria.htm>

Finally, we expect to connect the Yebes site to GEANT (the high speed transeuropean data network) by the end of 2005.

References

- [1] M. Honma et al (incl M. Rioja): “VERA Observation of the W49N H₂O Maser Outburst in 2003 October”. Publications of the Astronomical Society of Japan, Vol.56, No.3, pp. L15-L18, 2004.
- [2] M.J. Rioja, R. Cesaroni, L. Moscadelli: “Astrophysical applications of precision astrometry”. Proceedings of the 7th EVN Symposium, held in Toledo (Spain), 2004. (see <http://www.oan.es/evn2004/>).