Matera CGS VLBI Station 2021–2022 Report

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Abstract This report presents the status of the Matera VLBI station. An overview of the station and some technical characteristics of the system are also given.

1 General Information

The Matera VLBI station is located at the Italian Space Agency's 'Centro di Geodesia Spaziale G. Colombo' (CGS) near Matera, a small town in the south of Italy. The CGS came into operation in 1983 when the Satellite Laser Ranging SAO-1 System was installed. Fully integrated into the worldwide network, SAO-1 was in continuous operation from 1983 until 2000, providing high precision ranging observations of several satellites. The new Matera Laser Ranging Observatory (MLRO), one of the most advanced Satellite and Lunar Laser Ranging facilities in the world, was installed in 2002, replacing the old SLR system. The CGS also hosted mobile SLR systems MTLRS (Holland/Germany) and TLRS-1 (NASA).

In May 1990, the CGS extended its capabilities to Very Long Baseline Interferometry (VLBI), installing a 20-m radio telescope. Since then, Matera has observed in 1,467 sessions up through December 2022.

In 1991 we started GPS activities, participating in the GIG 91 experiment and installing at Matera a permanent GPS Rogue receiver. In 1994, six TurboRogue SNR 8100 receivers were purchased in order to create the Italian Space Agency GPS fiducial network (IGFN). At the moment 15 stations are part of the IGFN, and all data from these stations, together with 24 other stations in Italy, are archived and made available by the CGS Web server GeoDAF (http://geodaf.mt.asi.it). Six stations are included in the IGS network, while 12 stations are included in the EUREF network.

In 2000, we started activities with an Absolute Gravimeter (FG5 Micro-G Solutions). The gravimeter operates routinely at CGS and is available for external campaigns on request.

Thanks to the co-location of all precise positioning space-based techniques (VLBI, SLR, LLR, and GPS) and the Absolute Gravimeter, CGS is one of the few "fundamental" stations in the world. With the objective of exploiting the maximum integration in the field of Earth observations, in the late 1980s, ASI extended CGS' involvement to include remote sensing activities for present and future missions (ERS-1, ERS-2, X-SAR/SIR-C, SRTM, ENVISAT, and COSMO-SkyMed).

The Matera VLBI antenna is a 20-meter dish with a Cassegrain configuration and an AZ-EL mount. The AZ axis has ± 270 degrees of available motion. The slewing velocity is two deg/sec for both the AZ and the EL axes.

The technical parameters of the Matera VLBI antenna are summarized in Table 1.

The Matera time and frequency system consists of the following frequency sources:

- Cesium beam
- Active H-maser standard
- Passive Maser
- GNSS receiver disciplined by Rubidium.

1. Agenzia Spaziale Italiana
2. e-geos – an ASI/Telespazio company

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Fig. 1 VLBI antenna.

Table 1 Matera antenna technical specification.

Parameter name	Values (S/X)
Input frequencies	2210−2450 MHz 8180−8980 MHz
Noise temperature at dewar flange	<20 K
IF output frequencies	190−430 MHz 100−900 MHz
IF Output Power (300 K at inp. flange)	0.0 dBm to +8.0 dBm
Gain compression	<1 dB at +8 dBm output level
Image rejection	>45 dB within the IF passband
Inter modulation products	At least 30 dB below each of two carriers at an IF output level of 0 dBm per carrier
T_{sys}	55/65 K
SEFD	800/900 Jy

The Active iMaser 3000 H-maser from T4Science is used as a frequency source for VLBI. Specifications for this new maser can be found here: https://www.t4science.ch/products/imaser3000/.

2 Activities during the Past Two Years

In 2021 and 2022 heavy maintenance on the antenna wheels was performed.

In 2022 the azimuth encoder was replaced by a modern one with the same 21 bits of resolution. The replacement was necessary because no spare parts are available for the old model.

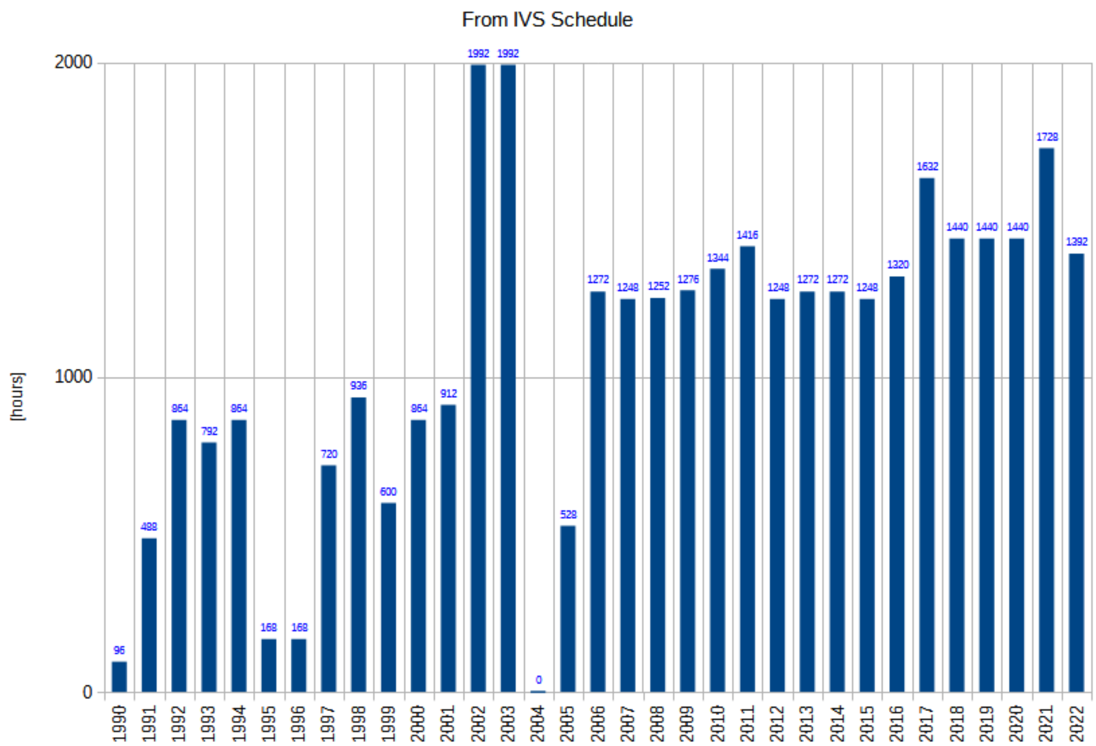

Fig. 2 Observation time.

3 Current Status

Figure 2 shows a summary of the total acquisitions per year, starting in 1990.

In 2004, in order to fix the existing rail problems, a complete rail replacement was planned. In 2005, due to financial difficulties, it was instead decided that only the concrete pedestal under the existing rail would be repaired. From then on, no rail movements were noted [1]–[3].

4 Future Plans

The replacement of the elevation encoder is planned for 2023.

Tuning of the network connection is in progress. The goal is to start electronic transfer of VLBI data at the beginning of 2023.

New VGOS system construction started in 2022; work is in progress.

References

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