

Argentinean-German Geodetic Observatory

AGGO-VLBI Network Station Report

Christian Kristukat¹, Federico Salguero², Martin García², José Vera², Augusto Cassino², Alfredo Pasquaré², Hayo Hase¹

Abstract The Argentinean-German Geodetic Observatory (AGGO) contributed to observation programs of the IVS. The last two years have been characterized by preventive as well as spontaneously necessary repairs. A new antenna control room was put into operation, and, in the course of this, the VLBI hardware had to be moved and a large part of the antenna's cabling was renewed. Significant improvements have been made in system monitoring and operational automation.

1 General Information

The Argentinean-German Geodetic Observatory (AGGO) is a joint effort of the Argentinean National Scientific and Technical Research Council (CONICET) and the German Federal Agency of Cartography and Geodesy (BKG) to support the Global Geodetic Observing System (GGOS) by contributing a geodetic fundamental station located in South America [1].

The observatory is situated within a natural reserve between the metropolitan area of Buenos Aires and the city of La Plata, adjacent to the Argentinean Institute of Radio Astronomy (IAR).

The project is based on the bilateral scientific-technical cooperation between Argentina and Germany. The agreement of cooperation between both partners was renewed in October 2022. It provides a

1. Bundesamt für Kartographie und Geodäsie (BKG)
2. Consejo Nacional de Investigaciones Científicas y Técnicas (CONICET)

AGGO Network Station

IVS 2023+2024 Biennial Report

base for an at least 10 year period of further cooperation and commitment to operate AGGO jointly. Germany via BKG provides, maintains, and renews the measuring equipment; CONICET provides the infrastructure. The operation is carried out jointly by staff from BKG and CONICET and completed by operators from the Ministry of Defense of Argentina.

2 Component Description

Table 1 lists the most important parameters of the VLBI components.

Table 1 The VLBI reference point and the primary VLBI equipment at AGGO.

Parameter	Value
DOMES No.	41596S002
CDP No.	7641 (axis intersection)
Four-char code	AGGV
IVS two-char id	Ag
approx. longitude	W 58.51398
approx. latitude	S 34.8739
approx. height	35.8 m
Diameter	6 m
Optics	primary focus, offset
Slew speed (°/s)	Az. 6 / El. 3
Data acquisition	DBBC2
Data recorder	Flexbuff with 2TB capacity
Max. ETransfer bandwidth	400 Mbps
FS-version	10.2 (2024)
webcam: https://www.aggo-conicet.gob.ar/liveview.php	

Table 2 AGGO staff linked to VLBI.

Name	Background	Tasks	E-mail
Federico Salguero	Electronic engineer	VLBI hardware	fsalguero@aggo-conicet.gob.ar
Martin García	Electronic engineer	VLBI hard- and software	mgarcia@aggo-conicet.gob.ar
José Vera	Electronic engineer	VLBI software and system administrator	jvera@aggo-conicet.gob.ar
Alfredo Pasquare	Electronic engineer	time and frequency lab, GNSS	apasquare@aggo-conicet.gob.ar
Augusto Cassino	Electrical engineer	head of infrastructure and construction	acassino@aggo-conicet.gob.ar
Hayo Hase	Geodesist	head of operations	hayo.hase@bkg.bund.de
Christian Kristukat	Physicist	VLBI support	christian.kristukat@bkg.bund.de
Six operators	Soldiers	VLBI operation	

3 Staff

The current VLBI staff situation is given in Table 2. There have been no changes during the last two years. The current size of the staff and its interdisciplinarity perfectly meet the requirements of daily VLBI operations and maintenance tasks.

Some of the military operators changed during the last two years, and the training and education of new operators has been an ongoing process. Changes to the software infrastructure or to the operation processes required permanent training.

4 Current Status

The past two years have been highly labor-intensive, primarily due to work on antenna hardware, which led to reduced data production because of multiple downtime periods. The antenna has reached almost 30 years of lifetime, and in 2023 more and more antenna failures were observed that could be identified as malfunctions of particular components. At the same time, many of those components were discontinued, leaving only the remaining parts from stock available as replacements. All necessary repairs were successfully carried out by station staff, including the replacement of encoders, motors, servo drive electronics, and RF components, among the most important ones. Finally, at the time of writing this report, the antenna is in better condition than it has been at any point in the past two years.

In addition to addressing hardware issues, significant effort was invested in improving system monitoring and automation. The Field System was upgraded to version 10.2 in 2024, which had the benefit of getting a modern Linux environment running on 64 bit

hardware. At AGGO, the Field System runs on virtual hardware without any inconveniences, hosted on the flexbuff data recording server. All communication with peripherals is carried out via Ethernet.

4.1 Monitoring and Automation

InfluxDB and Grafana were introduced to collect and visualize various types of data, including:

- meteorological data
- receiver parameters, such as the housing temperatures, cryogenic temperatures, vacuum pressure, peltier cooling current, functioning of the local oscillators, and S/X band power levels
- parameters obtained by the antenna control unit (ACU): encoder positions, rates, ACU errors, and warnings.

Python is used to retrieve information from sensors or subsystems and upload it to the Influx database with a resolution of less than one second. Python-based web applications were developed to process and present the monitored information through clear and simple user interfaces, allowing operators to access all relevant information for their surveillance tasks, even on mobile devices. Another web application was designed to manage session preparation, including pointing, gather the necessary information for the START message, and send it. The application injects commands into the Field System and reads information from the log or the shared memory. A Telegram bot is used to alert operators and staff of system errors and to provide remote control for operations and session transfer.

4.2 Replacement of Elevation Encoder

The implementation of continuous monitoring of all system parameters made it easier to investigate the causes of the increasingly frequent antenna stops in 2023. In the second half of the year, the elevation encoder could be identified as the source of those problems. The replacement of the encoder with the only spare left was straightforward. The stow position was used to lock the antenna in elevation, and the new encoder was installed and rotated until the reading matched the angular stow position. The operation was completed within a single day, allowing observations to resume without significant delay.

4.3 Design and Procurement of a New Receiver

The previously mentioned issue with discontinued components also applies to the cryogenic parts of the receiver (CTI), especially to the cold head. Given that many of the other components of the receiver are the same age as the entire antenna, it was decided to purchase not only new cryogenic parts, but a new receiver with the complete RF and IF signal chain as a plug-in replacement for the current one. The new cryogenic cooling system will provide greater cooling power, which is especially advantageous during the summer months when high temperatures frequently caused failures in the old system. The new receiver is expected to be delivered and installed by mid-2025.

4.4 Relocation of VLBI Hardware to a New Control Room

A planned overhaul action for 2024 was the relocation of the VLBI hardware from the container where it has been since the arrival of the observatory in Argentina to a new control room (see Figure 1) located in the main building of AGGO. For this task the original manufacturer of the antenna was contracted. This measure also included the installation of new cables between the control room and the base of the antenna, as well as the replacement of the hybrid cables which run through the drag chains of the antenna. A new junction box was in-



Fig. 1 The new control room at AGGO, giving view to the 6-m primary focus offset radio telescope for VLBI observations.

stalled at the base of the antenna for the transition between the hybrid cable and the underground cables (see Figure 2).



Fig. 2 The new junction box at the base of the antenna (left). The new hybrid cables in the azimuth drag chain (right).

After the completion of this overhaul task, several weeks were spent on optimization, with special focus on the quality of the signal lines (encoders, motor encoders, and other sensors). Significant improvements were achieved by working on the shielding of the entire installation. Unfortunately, various components began to fail, ultimately requiring the replacement of two servo motors and two ACU power modules. Moreover, it was recognized that the azimuth position encoder was close to failing and that it has to be replaced urgently. In summary, these activities involved an in-depth investigation of the entire system's hardware, leading to a substantial increase in the VLBI staff's understanding of its overall operation.

4.5 Sessions

AGGO participated in R1, CRD, OHG, and T2P sessions. As previously mentioned, ageing hardware led to multiple planned and unplanned downtimes. Figure 3

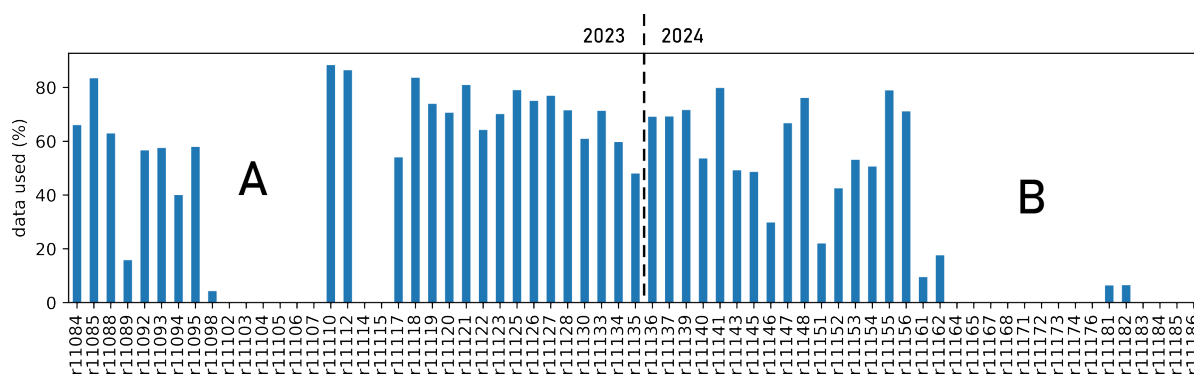


Fig. 3 The R1 data yield as a measure of the overall performance of AGGO.

shows the AGGO performance in terms of the used observations from correlation for all R1 sessions in the years 2023–2024. Individual dips in the performance curve correspond mostly to antenna stops during sessions for various reasons. The lack of data during period A was primarily caused by an issue in the X-band signal chain, which went undetected for an extended period. The correlator reported a lack of data in the X-band. After a thorough investigation, it was determined that the local oscillator of the X-band had experienced temporary failures. Once replaced, the X-band data returned to normal. Period B began with a crash of the DBBC hard drive, followed by challenges in restoring it. After that, in September, the antenna overhaul mentioned earlier commenced, and it took until early 2025 to fully restore the system to optimal operating conditions.

5 Future Plans

A number of important issues will take place during the coming years:

- Installation of the new receiver mid-2025
- Replacement of the discontinued position encoders of both axes by compatible devices
- Preparation of the bidding for the installation of a new VGOS compatible antenna at AGGO.

The last item remains dependent on a few ultimate administrative steps that still need to be completed. At the planned location of the new antenna, in the backyard of AGGO, tall trees are present, which may not be removed or cut. While this serves as an effective measure against interference from ground-based RF sources, it also makes a high elevation axis necessary, posing a challenge for the design and construction of the base (tower) of the antenna.

Acknowledgements

The authors acknowledge the support received from the Argentinean Ministry of Defense with the provision of operators and are especially grateful to its coordinator Dr. Anibal Aguirre.

References

1. H. Hase et al., “Moving from TIGO to AGGO”, in International VLBI Service for Geodesy and Astrometry 2015+2016 Biennial Report, edited by K. D. Baver, D. Behrend, and K. L. Armstrong, NASA/TP-2017-219021, pp. 43–47, 2017.