

Hartebeesthoek (Hh) Station Report - TOG Meeting – December 2023

26 m telescope

The 26 m telescope remains operational with its full complement of receivers. However there is an incipient bearing failure at the west end of the Declination shaft that will require replacement, involving several months of down time. Should the matching bearing on the east end of the shaft fail, we will be unable to operate until such a repair were to be effected.

A problem developed with the Declination shaft encoder in November 2020 requiring an emergency replacement with a lower resolution alternative. Though new higher resolution encoders are in hand and work on adapting the electronic and software interfaces is ongoing, the current shaft end float due to the worn bearing(s) prevents their installation. We are looking to install one on the Hour Angle shaft so as to free up an better encode for use on the Declination shaft.

15 m telescope

The 15 m telescope remains in a fully operational state and is equipped with a dual-polarisation cryogenic co-axial S/X receiver, used mainly to support routine geodetic VLBI observations, thereby freeing up more observing time on the 26 m antenna.

13.2 m (VGOS) telescope

The construction phase of the new 13.2 m VGOS capable antenna has long been completed. Construction of a VGOS-capable receiver is nearing completion at Yebes and we would hope to complete commissioning by early to mid-2024 . In the interim a single polarisation cryogenic X-band test receiver has been built from components already on-hand and is in the process of being installed.

EVN Session I – Feb/Mar 2023

This session was pretty average with 22 experiments scheduled, of which 19 were user experiments, comprising some 94.0% of the 151.9 hours (40.25 hours C-band, 49.0 hours X-band and 62.85 hours L-band) of recording time and 91.6% of the 79.57 Tbytes of recorded data. The entire session was recorded on our Flexbuf without incident but the subsequent electronic shipment to JIVE was delayed significantly by space constraints at the correlator.

There was no reported data loss though the usual significant RFI at L-band was evident.

EVN Session II – May/Jun 2023

This session was relatively quiet with only 17 experiments scheduled, of which 11 were user experiments, comprising some 91.5% of the 140.80 hours (34.0 hours C-band, 51.0 hours K-band, 29.6 hours L-band and 26.2 hours K-band) of recording time and 90.3% of the 84.18 Tbytes of recorded data. The entire session was recorded smoothly on our original Flexbuf with the subsequent electronic shipment to JIVE over the e-VLBI lightpath completed within a week after the session end..

There was no data loss during the session, only the usual significant RFI at L-band.

EVN Session III – Oct/Nov 2023

The current session is relatively busy with 30 experiments scheduled, of which 24 were user experiments, comprising some 92.9% of the 193.16 hours (29.66 hours X-band, 26.8 hours Methanol, 68.1 hours L-band and 68.6 hours C-band) of recording time and 91.1% of the 105.48 Tbytes of recorded data. The session was recorded on our new Flexbuf which was dropping some packets at higher data rates due to incomplete tuning. The subsequent electronic shipment to JIVE was completed just over two weeks after the session ended.

About 1.5 hours of data was lost due to a power-supply failure. The usual significant RFI at L-band was still evident.

e-VLBI / Connectivity

Over the period January to November 2023, Hartebeesthoek participated in 7 routine e-VLBI sessions, of which 6 were at C-band and 1 was at L-band comprising roughly 72 hours of user data. The dedicated layer-2 'light-path' connection direct to JIVE was used without incident throughout. All of the C-band sessions were run at 2 Gbps and the L-band sessions at 1 Gbps directly from the FiLa10G in the DBBC2.

Out of Session experiments

There were 6 out-of-session EVN experiments from a separate proposals over this period of which 4 were disk-based, being electronically shipped shortly after the experiment and the other two were in e-VLBI mode.

Frequency Standards

The Hartebeesthoek 26 m continued to operate on our T4Science iMaser-3000 (iMaser-72) during this period. Our backup EFOS-C (EFOS-28) maser, though still operational, has developed an instability in the internal heaters controller. A replacement controller has been purchased, but still needs to be installed. Our original EFOS-A maser (EFOS-6) no longer operates despite several attempts to resuscitate it. A Vremya VCH-314 two-channel precision frequency comparator is available to allow intercomparison of the three masers.

Flexbuf, Mark5(B/B+/C) and Mark6 Recorders

A second Flexbuf for EVN use, containing 36x 18TB drives, was brought into service just before the Oct/Nov session. We also have funds available to supply a matching unit to JIVE later this financial year, although right at the moment there has been a moratorium placed on such capital expenditure. In addition to the current Flexbufs's, we also have two Mark5B+ recorders set up to record the two VLBI backends (on the 26m and 15m) independently. In addition a Mark5C recorder (on long-term loan from the University of Tasmania in support of collaboration with the AuScope array) provides an off-line electronic data shipment capability and can be used to record 2 or 4 Gbps VDIF data from either telescope via the built-in FiLa10G's. We have the parts necessary to upgrade one of the Mark5B+'s into a second Mark5C in future should that prove to be necessary/useful.

In preparation for VGOS operations, we also have a new Mark6 recorder (complete with an expansion chassis) and four 32 TB Mark6 modules sufficient to run as a temporary Flexbuf.

DBBC Terminals

The two DBBC2 units (HB1 and HB2) continue to be used in DDC mode as the primary VLBI terminals on the 15 m and 26 m antenna respectively, with full Field System support, now running firmware versions v106 and v107 beta 3 allowing up to 4 Gbps operation. Both are also equipped with an internal FiLa10G cabled in pass-through mode, allowing for simultaneous use of the Mark5B+ recorders (but this prevents use of the newer FiLa10G v4.x firmware). PFB firmware v16 is also available for testing purposes. Both units are equipped with SSD internal disks which would facilitate a Window/Linux dual-boot capability. Both DBBC2 terminals have been retro-fitted with a power distribution upgrade from HAT-Lab allowing more stable operation with the v107 beta 3 firmware.

We have taken delivery of a fully VGOS-capable DBBC3 unit (3HT), intended to be deployed on the new VGOS antenna together with the afore-mentioned Mark6 recorder. Check-out and commissioning of this new terminal is continues in support of FS 10.2 development.

We are still in the process of seeking funds for a DBBC3-L2H2 so as to be in line with the EVN technical roadmap's requirements.

Software

Field System: FS 10.1.0 running on FS Linux 8 (Debian 5.0.x "lenny"), kernel 2.6.26-2-i386

DBBC versions: DDC v106/v107(beta) & PFB v16 running on Windows XP; FiLa10G v3.3.2

Mark5B/B+ version: jive5ab 3.0.0 running on Debian 4.0 "etch", kernel 2.6.18-6-i386

Mark5C version: jive5ab 3.0.0 running on Debian 7.x "wheezy", kernel 3.2.0-4-amd64

Flexbuf version: jive5ab 3.0.0 running on Debian 8.x "jessie", kernel 3.16.0-4-amd64

Disks

No disk packs have been purchased for the EVN over this period.

Spares

Currently available VLBI-related (new) spare parts at HartRAO are:

A spare 2 m VSI-H interface cable.

A Conduant 10GigE mezzanine board intended for use in upgrading a Mark5B+ to a Mark5C.

J.F.H.Quick

24 November 2023