Hartebeesthoek (Hh) Station Report - TOG Meeting – June 2024

26 m telescope

The 26 m telescope remains operational with its full complement of receivers. However there is a bearing failure at the west end of the Declination shaft that needs to be replaced, which would involve several months of down time. We are still waiting for SARAO to take any action on this. Should the matching bearing on the east end of the shaft also disintegrate, 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 working on installind a new encoder on the Hour Angle shaft so as to free up an better resolution encoder 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. However ti should be noted that the lefetime of a self-supporting aingle-piece fibreglass-composite dish such as this is completely unknown and any failure is likely to be catastrophic in nature.

13.2 m (VGOS) telescope

The construction phase of the new 13.2 m VGOS capable antenna has long been completed. Following the installation of a broadband VGOS receiver in February, commisioning work has been ongoing and is expected to be completed soon. We would hope to have this antenna fully operational by early 2025.

EVN Session I – Feb/Mar 2024

This session was extremely busy with 36 experiments scheduled, of which 30 were user experiments, comprising some 93.6% of the 217.81 hours (41.78 hours X-band, 64.03 hours C-band, 76.05 hours L-band and 35.95 hours K-band) of recording time and 90.0% of the 140.58 Tbytes of recorded data. The session was recorded on our new Flexbuf which was still dropping some packets at the highest data rate for reasons unknown. The subsequent electronic shipment to JIVE was only completed after the next session had just started due to a lack of storage space at the correlator.

There was no detected data loss, but the usual significant RFI at L-band was still evident.

EVN Session II – May/Jun 2024

This session was, in contrast, relatively quiet with only 21 experiments scheduled, of which 16 were user experiments, comprising only 85.2% of the 101.15 hours (54.15 hours L-band, 26 hours C-band, 6 hours X-band, 9 hours K-band, and 6 hours S-band) of recording time and 87.1% of the

52.17 Tbytes of recorded data. The session was recorded on our new Flexbuf which was still dropping some packets at the highest data rate for reasons unknown. The subsequent electronic shipment to JIVE over the e-VLBI lightpath only started just before the session ended.

There was no data loss during the session, only the usual significant RFI at L-band. However the entire session was run using our backup maser after tje primary maser lost lock just prior due to backup power problems.

e-VLBI / Connectivity

Over the period November 2023 to May 2024, Hartebeesthoek participated in 6 routine e-VLBI sessions, of which 5 were at C-band and 1 was at L-band comprising roughly 68.7 hours of user data, including two ToO making use of the “extra day”. 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 session at 1 Gbps directly from the FiLa10G embedded in the DBBC2.

Out of Session experiments

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

Frequency Standards

The Hartebeesthoek 26 m continued to operate on our T4Science iMaser-3000 (iMaser-72) during this period, except as noted above. 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 have secured funds to supply a matching unit to JIVE within the next month or two. 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 and have been retro-fitted with a power distribution upgrade from HAT-Lab allowing more stable operation with the v107 beta 3 firmware.

We also have 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 now mostly complete.

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 10.2.0 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 3.1.0 running on Debian 8.x "jessie", kernel 3.16.0-4-amd64

Disks

No disks have been purchased for the EVN over this period but funds are now available to do so.

Spares

Currently available VLBI-related (mostly 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.
An old Mark5B recorder (with a failed motherboard).

J.F.H.Quick
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