

Hartebeesthoek (Hh) Station Report - TOG Meeting - January 2023

26 m telescope

The 26 m telescope remains fully 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 is effected. Unfortunately any thoughts of a pre-emptive replacement have been quashed by SRAO Head Office as being “not worth doing”.

A further problem developed with the Declination shaft encoder in November 2020 (during an e-VLBI) 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.

Continuous calibration is now available at L-band and C-band and has been in use since 2020 Session I and 2022 Session II respectively. Although we have suitable components available to implement continuous calibration at S-band, this was stalled due to staff constraints from the current pandemic but will now be revisited. Purchasing of components for a K-band and Methanol implementation is still ongoing. No new receivers are presently envisaged for this antenna.

Beam pattern measurements are stalled due to lack of manpower.

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.

Continuous calibration is available at both S- and X-band on this antenna but is seldom activated as the antenna is mainly used for geodetic observations.

13.2 m (VGOS) telescope

The construction phase of the new 13.2 m VGOS capable antenna has long been completed. Although commissioning of some subsystems has been done, most of the work is waiting on the equipping of the antenna with a suitable wideband receiver. All outstanding parts have finally been procured following extensive Covid-related delays and construction of the new receiver has now commenced at Yebes. We would now hope to complete commissioning by early 2024 . In the interim the single polarisation cryogenic broad X-band receiver has been built from components already on-hand but has not yet been installed.

EVN Session I – Feb/Mar 2022

This session was relatively busy with 29 experiments scheduled, of which 27 were user experiments, comprising some 97.1% of the 184.16 hours (108.66 hours L-band and 75.5 hours C-band) of recording time and 97.2% of the 93.54 Tbytes of recorded data. The entire session was

recorded smoothly on our Flexbuf but the subsequent electronic shipment to JIVE over the e-VLBI lightpath was only completed over a month after the session's end due to a flaky local flylead.

Only 1 minute of data was lost to a brief power interruption. There was the usual significant RFI at L-band.

EVN Session II – May/June 2022

This session was reasonably average with 25 experiments scheduled, of which 22 were user experiments, comprising some 95.6% of the 140.45 hours (77.25 hours L-band and 63.2 hours C-band) of recording time and 94.2% of the 99.58 Tbytes of recorded data. The entire session was recorded smoothly on our Flexbuf with the subsequent electronic shipment to JIVE over the e-VLBI lightpath being completed within two weeks of the session's end.

No data was lost during this session, but there was the usual significant RFI at L-band.

EVN Session III – Oct/Nov 2022

This session was relatively busy with 30 experiments scheduled, of which 26 were user experiments, comprising some 93.0% of the 152.82 hours (67.4 hours C-band, 54.66 hours C-band, 12.16 hours of X-band and 18.6 hours K-band) of recording time and 88.9% of the 95.74 Tbytes of recorded data. The entire session has been recorded smoothly on our Flexbuf but with the subsequent electronic shipment to JIVE over the e-VLBI lightpath only completed a month after the end of the session, in part due to a delayed start.

About 5 minutes of data was been lost to brief power interruptions and a windstow. There was the usual significant RFI at L-band and the Tsys was elevated at times by water leaking into the feed.

e-VLBI / Connectivity

Over the period February to December 2022, Hartebeesthoek participated in 9 routine e-VLBI sessions, of which 6 were at C-band and 3 were at L-band comprising roughly 117 hours of user data. The dedicated layer-2 'light-path' connection direct to JIVE was used without incident throughout., but about 6 hours were lost due to the Declination encoder failure. 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 3 out-of-session EVN experiments from a single proposal over this period which were all disk-based, being electronically shipped shortly after the experiment in each case.

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

Funding has recently been secured to purchase a second Flexbuf for EVN use this financial year, though we may not have sufficient funds to fully populate it and to supply a matching unit to JIVE until later in the calendar year. 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. An older Mark5B recorder is also available for shipping purposes. 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 in progress in support of FS 10.1 development.

Unfortunately we do not have funds for another DBBC3 at this time.

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 other disk packs or Flexbuf storage 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
17 January 2023