

## **Hartebeesthoek (Hh) Station Report - TOG Meeting - February 2022**

### **26 m telescope**

The 26 m telescope remains fully operational with its full complement of receivers, though the L-band receiver is currently on the ground being refurbished. 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 no repair is currently envisaged.

A problem developed with the Declination shaft encoder in October 2020 requiring an emergency replacement with older model. 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.

Continuous calibration is available at L-band and has been in use since 2020 Session I. Although we have suitable components available to implement continuous calibration at S-band, this has stalled due to staff constraints from the current pandemic. Purchasing of components for a C-band and Methanol implementation is still ongoing. We are still investigating what would be needed for the remaining receivers. No new receivers are presently envisaged.

Beam pattern measurements are still 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 observing time on the 26 m antenna.

Continuous calibration is available at both S- and X-band on this antenna but is not 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. Funding for all outstanding parts has been secured and an order has been placed with Yebes for the receiver. We would now hope to complete commissioning only by mid 2023 due to pandemic-related delays. In the interim all work on a single polarisation cryogenic broad X-band receiver to be built from components already on-hand has also stalled.

### **EVN Session II – May/June 2021**

This session was relatively quiet with only 17 experiments scheduled, of which 14 were user experiments, comprising some 93.9% of the 148.05 hours (68.90 hours L-band, 28.75 hours K-band and 50.40 hours C-band) of recording time and 93.2% of the 76.21 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 three weeks of the session's end.

About 2 minutes of data was lost to brief power interruptions and there was the usual significant RFI at L-band.

### **EVN Session III – Oct/Nov 2021**

This session was reasonably average with 22 experiments scheduled, of which 17 were user experiments, comprising some 91.2% of the 165.38 hours (25.16 hours C-band, 101.94 hours L-band, 10.40 hours M-band, 19.13 hours X-band and 8.75 hours K-band) of recording time and 90.3% of the 77.32 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 one week of the session's end.

Some 17 minutes of data was lost to an antenna drive problem and two wind-stows. There was the usual significant RFI at L-band.

### **e-VLBI / Connectivity**

Over the period May 2021 to January 2022 Hartebeesthoek participated in 7 routine e-VLBI sessions, of which 2 were at C-band and 5 were at L-band comprising roughly 89.3 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 7 out-of-session EVN experiments from a single proposal over this period of which 6 were disk-based and the other was an ad-hoc e-VLBI session.

### **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 current working conditions prevent its installation. 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**

Following an upgrade of our Flexbuf system to 258TB in 2019, there are still no definite plans for further upgrade. However a second 306TB Flexbuf system for geodetic use with the 15 m is now operational and provides a backup. 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. However both DBBC2 terminals are in need of a power distribution upgrade which HAT-Lab has now supplied for us to fit locally in due course. As a result the V107 beta firmware does not run stably, particularly on unit HB1 which is used on the 15 m antenna.

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 10.0.0 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. We must still engage with SARA0 on how their 1000TB commitment is to be realised in terms of funding 72 x 14 TB etc.

## **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

5 February 2022