

Hartebeesthoek (Hh) Station Report - TOG Meeting - November 2020

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 in the near future, involving a few months of down time.

Ongoing work to improve high-frequency performance by way of gain and focus curve measurements at K-band suggest that the sub-reflector may not be properly centred and displaces laterally under gravitational load. Mechanical measurements to confirm this are envisaged next. If confirmed, we may need to look at installing a full hexapod positioner (and a more accurate subreflector) in future. A new problem developed with the Declination shaft encoder in early October 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 ongoing. We are still investigating what would be needed for the remaining receivers.

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 more observing time on the 26 m antenna.

Continuous calibration is available at both S- and X-band on this antenna but has not yet been 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 completed, most of the work is waiting on the equipping of the antenna with a suitable wideband receiver, VGOS-capable backend etc. Funding for such equipment has now been secured and orders have either been placed or are currently being negotiated. We would hope to complete commissioning by late 2021. In the interim we are working on a single polarisation cryogenic broad X-band receiver from components already on-hand to enable us to evaluate the gain and to allow development of a suitable pointing model.

EVN Session II – May/June 2020

This session was relatively quiet with 20 experiments scheduled, of which only 15 were user experiments, comprising some 85% of the 92.35 hours (9.75 hours X-band, 12.75 hours methanol, 17.5 hours K-band, 34.85 hours L-band and 17.5 hours C-band) of recording time but over 89% of

the 41.59 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 the session but there was also the usual significant RFI at L-band.

EVN Session III – Oct/Nov 2020

This session, of which electronic shipping is still ongoing as of the date of this report, was more average with 22 experiments scheduled, of which 18 were user experiments, comprising 91% of the 138.31 hours (12.4 hours X-band, 59.86 hours K-band, 15.67 hours C-band and 50.38 hours L-band) of recording time and over 89% of the 67.89 Tbytes of recorded data. The entire session was recorded on our Flexbuf which remained below 40% of maximum capacity.

Unfortunately over 4,6 hours of data was lost due to problems caused by a new intermittent fault in the Declination encoder that materialised one week before the session started. There was also the usual significant RFI at L-band.

e-VLBI / Connectivity

Over the period May to October 2020 Hartebeesthoek participated in 4 e-VLBI sessions, of which 3 were at L-band and the other at C-band comprising roughly 60.6 hours of user data. The dedicated layer-2 'light-path' connection direct to JIVE was used without incident throughout., but we lost almost 11 hours due to a cooling fan failure in the DBBC2. All of the L-band sessions were run at 1 Gbps and the C-band session at 2 Gbps directly from the FiLa10G in the DBBC2.

Out of Session experiments

Additionally the Hartebeesthoek 26 m supported 2 out-of-session recorded targets-of-opportunity as part of the EVN.

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 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 last year, there are currently no further upgrades planned. However a second Flexbuf system for geodetic use with the 15 m is in the process of being commissioned. 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 if required.

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.

An order for a fully VGOS-capable DBBC3 unit has been placed with HAT-Lab, for delivery in early 2021, which will be deployed on the new VGOS antenna, together with the Mark6 recorder above.

Software

Field System: FS 9.13.2 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 over this period. The source of future funding for purchasing media remains unclear as we have no guaranteed capital funds but rely on unpredictable special grants.

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
19 November 2020