

## **Hartebeesthoek (Hh) Station Report - TOG Meeting - February 2016**

### **26 m telescope**

The 26 m telescope remains fully operational with its full complement of receivers.

Control of the subreflector tilt is now done using a shaft encoder and the pointing model has been updated, though not much change was found. Hopefully the pointing will now be more repeatable and we now intend to embark on a campaign to establish whether active focussing can assist with K-band performance.

### **15 m telescope**

The 15 m antenna is equipped with a cryogenic S/X receiver and is used mainly to support the majority of routine geodetic VLBI sessions, thereby freeing up more observing time on the 26 m antenna. This antenna has also proved to be very useful for doppler tracking of spacecraft.

### **VGOS telescope**

The tender for a new 13m VGOS capable antenna has been awarded to MT Mechatronics for completion in mid-2017. Site preparation at a new spot to the NE of the current compound is now mostly complete and a tender for the concrete tower structure will be advertised shortly. Several site infrastructure components have already been delivered in the interim.

### **EVN Session III – Oct/Nov 2015**

This session was extremely quiet with only 8 experiments scheduled, of which 6 were user experiments, comprising some 88% of the 44.2 hours (25.0 hours L-band and 19.2 hours C-band) of recording time and over 95% of the 19.0 Tbytes of recorded data. The average filling factor of the disk-pack was only 59% because only 1 large 32TB pack was used.

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

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

Over the period July 2015 to January 2016 Hartebeesthoek participated in 5 e-VLBI sessions, 2 at C-band and 3 at L-band (of which one was a target of opportunity) comprising roughly 53.5 hours of user data. The dedicated layer-2 'light-path' connection direct to JIVE was used without incident throughout. A test run of e-VLBI at 2 Gbps has also been completed successfully.

### **Out of Session experiments**

Additionally the Hartebeesthoek 26 m supported a total of 3 out-of-session Radioastron imaging observations, 2 as part of the EVN and 1 with the LBA. The 15 m continued to be used extensively (for 101 hours) in support of Doppler tracking of the VEX and Rosetta spacecraft over this period.

Hartebeesthoek, as part the RadioAstron survey program, participated in some 82 segments (typically 40 minutes to 1 hour in duration) over this period with the majority involving switching from C-band to either L-band or K-band on-the-fly mid-segment.

## Frequency Standards

The HartRAO 26 m continued to operate on our T4Science iMaser-3000 (iMaser-72) during this period. Our EFOS-C (EFOS-28) maser is also operational and is used as the frequency standard for the 15 m VLBI terminal thus allowing us to offset them in frequency if required. Our original EFOS-A maser (EFOS-6) now only runs intermittently. A Vremya VCH-314 two-channel precision frequency comparator is available to allow intercomparison of the three masers.

## Mark5(B/B+/C) Recorders

Our old Mark5B recorder is currently non-functional – we suspect a motherboard fault. The other two newer Mark5B+ recorders enable us to record both the main VLBI backends (on the 26m and 15m) simultaneously. In addition one Mark5C recorder (on loan from the University of Tasmania to support collaboration with the AuScope array) provides an off-line electronic data shipment capability and can be used to record 2Gbps VDIF data from either telescope via FiLa10G's. We have the parts necessary to upgrade one Mark5B+ into a second Mark5C in future should that prove necessary. In addition the JIVE Harrobox on site has now been converted into a mini FlexBuff for test purposes by the addition of four 4 TB disk drives..

## Mark5 Terminal

The original Mark5 acquisition rack has been retired from active duty and continues accumulating a collection of faults which would need rectification before it could be reliably used for observations again. We no longer have a working spare video converter - the unit we have lacks a functional synthesizer/divider module (and probably has several other faults).

## 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 V105\_1/V105E\_1 allowing 2 Gbps operation. Both are also equipped with an internal FiLa10G though this is usually only cabled for test purposes. The PFB firmware on HB2 has been upgraded to v15 to facilitate evaluation of test FS support. Both units have also been upgraded to SSD internal OS disks which should facilitate a Window/Linux dual-boot capability.

## Software

Field System: FS 9.11.8 running on FS Linux 8 (Debian "lenny") kernel 2.6.26-u-i386

DBBC versions: DDC v105\_1 / PFB v15 running on Windows XP; FiLa10G v3.3.1

Mark5B+ version: jive5ab 2.7.1 running on Debian "etch" kernel 2.6.18-6-i386

Mark5C version: jive5ab 2.7.1 running on Debian "wheezy" kernel 3.2.0-4-amd64

## Disks

No further diskpacks have been purchased over this period, but we expect to be able to purchase three 32TB disk packs (for 2015/16) by financial year end.

## 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+ into a Mark5C.

Used parts from recent upgrades or harvested from obsolete equipment at Haystack are:

- A used Mark5A I/O board with its related external interface.
- Various used boards from a Mark4 formatter (after conversion to a VSI4 sampler unit).
- A used Mark4 IF Distributor unit master control board.
- Several used Mark4 "MAT" ASCII transceiver boards (all faulty).
- Assorted used Mark4 Video Converter unit sub-modules (some faulty).

### **Development of other African Antennas for VLBI**

The AVN project (2 input / 2 Core2 board) DBBC2 and associated Mark5B+ recorder intended for use in Ghana have now, after checkout at Hartebeesthoek, been shipped to the SKA office in Cape Town in preparation for deployment later this year.

J.F.H.Quick

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