

## hartebeesthoek (Hh) Station Report - TOG Meeting - January 2014

### 26m telescope (Hh):

The 26m telescope remains fully operational and work has commenced on a new K-band cryogenic receiver following unprecedented VLBI demand for the ambient test receiver. We hope to have this operational at least by Session II if not earlier.

Although the new encoder for the subreflector tilt was installed previously, the motor controller still needs to be upgraded to make use of this higher precision readout. This upgrade is aimed at developing a better pointing model and improving pointing performance, a necessity for proper K-band operation.

### 15m telescope (Ht):

The 15m antenna has a cryogenic S/X receiver and is now used operationally to support routine geodetic VLBI using it's own independent DBBC and Mark5B+ recorder, thereby freeing up more observing time on the 26m antenna. For more information on the 15m telescope see

[http://www.hartrao.ac.za/hh15m\\_factsfile.html](http://www.hartrao.ac.za/hh15m_factsfile.html).

### Session II - May/Jun 2013:

This session was relatively quiet with only 11 experiments scheduled, of which 6 were user experiments, comprising some 86% of the 55 hours (31 hours C-band, 19 hours L-band and 5 hours K-band) of recording time and some 92% of the 17.59 Tbytes of recorded data. The average filling factor of the disk-packs was around 98%. We shipped 1.85 Tbytes (ie. 11%) of the user data (from one experiment) electronically to the Bonn correlator. Additionally some 1.48 Tbytes of parallel test data from our DBBC was shipped to JIVE.

Some 180 minutes of data (ie. ~5.4%) was possibly lost, due to clock jumps occurring during scans - a problem that was later revealed to be due to poor synchronisation of the VSI4 sampler unit in the analogue Mark4 terminal. There was significant RFI at L-band during the session.

### Session III - Oct/Nov 2013:

This session, the first using our DBBC as a production facility, was also quiet with only 14 experiments scheduled, of which 7 were user experiments, comprising some 72% of the 60 hours (6 hours K-band, 20 hours C-band, 26 hours L-band and 8 hours X-band) of recording time and some 79% of the 13.96 Tbytes of recorded data. The average filling factor of the disk-packs used was around 99%. Additionally some 2.63 Tbytes of data was streamed to JIVE from the DBBC in e-VLBI mode for the first time.

Only 17 minutes of data (ie. ~0.5%) from one experiment was lost, due to a faulty northern limit switch. There was the usual significant RFI at L-band during the session and some minor RFI at X-band too.

### e-VLBI / Connectivity:

Over the period May 2013 to January 2014 Hartebeesthoek participated in a total of 11 e-VLBI sessions (including 5 ad-hoc Targets of Opportunity), 8 at C-band,

2 at L-band and 1 at K-band, comprising roughly 102 hours of user data. The dedicated layer-2 2Gbps 'light-path' connection direct to JIVE was used without incident throughout.

#### Out of Session experiments:

Additionally Hartebeesthoek supported 3 out-of-session RadioAstron imaging observations, 1 under the auspices of the LBA and 2 as part of the EVN (and roughly 80 ~1 hour RadioAstron survey observations), in addition to the 5 ad-hoc e-VLBI experiments mentioned above. Both antennas also participated in the MEX/Phobos fly-by PRIDE observation in December 2013 and the 15m has been used extensively for VEX scintillation experiments as well.

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

Our one Mark5B and two Mark5B+ recorders enable us to record all three of VLBI backends (two on the 26m and one on the 15m) simultaneously. All three of the recorders have now been switched to using jive5ab for production recording. In addition we now have a Mark5C recorder (on loan from the University of Tasmania in support of collaboration with the AuScope array) facilitating off-line electronic shipment of data. We also have the parts necessary to upgrade one Mark5B+ into a Mark5C in future if so required.

A "Harrobox" on loan from JIVE is currently also installed on site.

#### Disks:

Components sufficient to assemble four new 16TB disk-packs were purchased for addition to the EVN pool and will be available for use in the next EVN session.

#### Mark5 Terminal:

The Mark5 rack has now been officially retired (apart from the 5MHz distributor and VLBI delay calibrator ground unit modules) but still continues to function reasonably well, apart from a minor fault in the IF distributor affecting total power measurements.

#### DBBC Terminals:

The two DBBC units (HB1 and HB2) are now being used in DDC mode as the primary VLBI terminals on the 15m and 26m antenna respectively, with full Field System support. The FILA10G on the 26m antenna (in HB2) was used in a 4Gbps e-VLBI demonstration but has since been disconnected as it lead to synchronisation issues on pass through of the VSI-H outputs of the DBBC to a Mark5B+. The PFB mode of the same DBBC has now also been calibrated and was used to support the same 4Gbps demonstration experiment.

#### Frequency Standards:

HartRAO continued to operate on our T4Science iMaser-3000 (iMaser-72) during both sessions. Our EFOS-C (EFOS-28) maser is again fully operational and is used as the frequency standard for the 15m VLBI terminal thus allowing us to offset the two antennas in frequency if required. Our original EFOS-A maser (EFOS-6) remains operational and we also have a Vremya VCH-314 two-channel

precision frequency comparator to allow intercomparison of the three masers.

Receivers:

There have been no changes to our receiver complement since the last TOG meeting.

Other Software:

Field System: FS 9.11.4 running on FS Linux 8 (Debian "lenny") kernel 2.6.26-2  
DBBC versions: DDC v104\_2 / PFB v14 running on Windows XP  
Mark5B version: jive5ab 2.4.4 running on Debian "etch" kernel 2.6.18-6  
Mark5B+ version: jive5ab 2.4.4 running on Debian "etch" kernel 2.6.18-6  
Mark5C version: jive5ab 'head' running on Debian "lenny" kernel 2.6.26-2

Spares:

Currently available VLBI-related spare parts at HarRAO (after some were sold to UTas) are:

- o A spare 2m VSI-H interface cable.
- o A Conduant 10GigE mezzanine board suitable for upgrading a Mark5B+ into a Mark5C.

Other used parts from recent upgrades or obtained from obsolete equipment at Haystack are:

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

J.F.H. Quick  
15 January 2014