Hartebeesthoek (Hh) Station Report - TOG Meeting - October 2018

26 m telescope

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

A new variable-speed controller for the subreflector focus positioner making use of a linear encoder system has been installed and is currently being commissioned. Thereafter we will embark on a campaign to establish whether active focussing can improve the K-band performance. K-band observations suggest that the pointing model may need further refinement, and the main antenna shaft encoders continue to show serious signs of ageing and will need replacement soon.

We have suitable components available to implement continuous calibration at L-band, which we are now starting to work on, but we are still investigating what would be needed for other receivers.

Beam pattern measurements have unfortunately 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 was first implemented at S- and X-band on this antenna in early 2016, but the X-band implementation failed requiring a re-design. The re-implementation had logic errors that were finally fixed during a recent maintenance window and final testing/integration is under way, prior to trial integration on the 26 m antenna.

Recent tests reveal that the v106 DDC firmware implements continuous calibration consistently across all 4 installed Core2 boards such that it can also be used in geodetic mode. Previously the inconsistent behaviour of v105_1 firmware prevented such usage.

VGOS telescope

Acceptance testing of the new 13.2 m VGOS capable antenna has now been completed and the antenna formally handed over to the observatory. Unfortunately an application for funding to equip the antenna with a suitable wideband receiver and VGOS-capable backend etc. was not successful. In the interim we are looking at putting together a cryogenic X-band test receiver from components already on-hand to evaluate the gain and pointing whilst we explore other funding possibilities.

EVN Session I – Feb/Mar 2018

This session was relatively busy for Hartebeesthoek with 22 experiments scheduled, of which 18 were user experiments, comprising some 89% of the 148.69 hours (43.25 hours L-band, 46.11 hours 6.7 GHz Methanol, 38.83 hours C-band and 20 hours K-band) of recording time and over 94% of the 57.42 TBytes of recorded data. The entire session was recorded on our local Flexbuf with the subsequent electronic shipment to JIVE going very smoothly over the e-VLBI lightpath, being completed within 3 weeks of session's end.

About 2 hours and 50 minutes of data was lost during the session, almost all due to the antenna getting stuck in a maladjusted northern final limit over a weekend and otherwise due to a glitch in

the subreflector positioner and an operator error. There was the usual significant RFI at L-band.

EVN Session II – Jun/Jul 2017

This session was equally busy with 22 experiments scheduled, of which 17 were user experiments, comprising some 93% of the 201.31 hours (16.83 hours C-band, 37.49 hours L-band, 85.83 hours S/X-band and 61.16 hours K-band) of recording time and over 94.5% of the 56.16 TBytes of recorded data. The entire session was recorded on our Flexbuf with electronic shipment to JIVE within 4 weeks of session's end. The sudden step up in recording time and data volume appears to be mainly due to the inclusion of some day-long astrometric experiments.

About 5 hours and 30 minutes of data was lost during the session, due to a 'jive5ab' software glitch on the Flexbuf in the early hours of a weekend morning. There was also the usual significant RFI at L-band.

e-VLBI / Connectivity

Over the period March to September 2018 Hartebeesthoek participated in 5 e-VLBI sessions, of which 3 were at L-band and 2 were at C-band, comprising roughly 51.25 hours of user data. The dedicated layer-2 'light-path' connection direct to JIVE was used without incident throughout – the only minor data loss was due to a declination encoder problem. All of the sessions were transmitted directly from the FiLa10G in the DBBC2.

Out of Session experiments

Additionally the Hartebeesthoek 26 m supported a total of 8 out-of-session RadioAstron imaging observations of which 6 were formally as part of the EVN.

Hartebeesthoek, as part the now defunct RadioAstron survey program, also participated in some 48 segments (ranging from 20 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 Hartebeesthoek 26 m continued to operate on our T4Science iMaser-3000 (iMaser-72) during this period. Our backup EFOS-C (EFOS-28) maser remains operational (though there are minor issues with its heater control circuitry) and was in use as the main frequency standard for the 15 m VLBI system until very recently thereby allowing us to offset the two telescopes in frequency when required. The sequential failure of our two backup clocks at the start of September has left us currently very exposed and we are urgently attending to this issue. Our original EFOS-A maser (EFOS-6) is still running but is no longer considered reliable. A Vremya VCH-314 two-channel precision frequency comparator is available to allow intercomparison of the three masers.

Mark5(B/B+/C) & Flexbuf Recorders

Since February 2017 our 105 TB capacity Flexbuf system has been adopted as the primary recorder (in VDIF format) for EVN use. Unfortunately is it no longer able to hold two sessions' worth of data at current recording rates and urgently needs to be upgraded. We also have two Mark5B+ recorders set up to record the two VLBI backends (on the 26m and 15m in Mark5B format) independently. In addition a Mark5C recorder (on long-term loan from the University of Tasmania in support of collaboration with the AuScope array) and an older Mark5B recorder provide an off-line electronic data shipment capability. The former can also be used to record 2 or 4 Gbps VDIF

data from either telescope via the built-in FiLa10G's. We have the parts necessary to upgrade one of the Mark5B+'s into a second Mark5C in future should that prove necessary.

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 v105E_2 allowing up to 2 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.

Software

Field System: FS 9.11.19 running on FS Linux 8 (Debian 5.0.x "lenny"), kernel 2.6.26-2-i386
DBBC versions: DDC v106/v105E_2 & PFB v16 running on Windows XP; FiLa10G v3.3.2
Mark5B/B+ version: jive5ab 2.9.0 running on Debian 4.0 "etch", kernel 2.6.18-6-i386
Mark5C version: jive5ab 2.9.0 running on Debian 7.x "wheezy", kernel 3.2.0-4-amd64
Flexbuf version: jive5ab 2.9.0 running on Debian 8.x "jessie", kernel 3.16.0-4-amd64

Disks

No further disk packs have been purchased over this period. We will look at using the 2017/8 and 2018/9 allocations to upgrade the local Flexbuf with 10 TB disks and use the existing 4 TB disks to upgrade some older SATA packs which have smaller disks. However with the observatory having been taken over by SARAO, the sourcing of the funds required is no longer within our direct control.

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.

J.F.H.Quick
28 September 2018