Hartebeesthoek (Hh) Station Report - TOG Meeting - May 2017

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 a linear encoder is to be added to the focussing mechanism. Thereafter we will embark on a campaign to establish whether active focussing can improve the K-band performance. K-band observations continue to suggest that the pointing model may need further refinement, possibly including replacement of the main antenna shaft encoders.

We have suitable components available to implement continuous calibration at L-band, but 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 returned to a fully operational state shortly after the last TOG meeting after the repair of a serious wind-induced motor/gearbox failure.

The 15 m antenna remains equipped with a dual-polarisation cryogenic co-axial S/X receiver and is used mainly to support routine geodetic VLBI observations, thereby freeing up more observing time on the 26 m antenna. This antenna also continues to be used occasionally for Doppler tracking of spacecraft, including the RadioAstron satellite.

Continuous calibration was implemented at S- and X-band on this antenna early in 2016, but the X-band implementation has subsequently failed requiring a re-design which is due to be implemented shortly.

VGOS telescope

Construction of the concrete tower structure for the new 13.2 m VGOS capable antenna has now been completed. Delivery of various components of the antenna itself by MT Mechatronics and its Chinese sub-contractor occurred during April, and on-site assembly of the antenna superstructure has now commenced.

EVN Session III – Oct/Nov 2016

This session was reasonably busy with 15 experiments scheduled, of which 12 were user experiments, comprising some 90% of the 90.75 hours (40.5 hours C-band, 37.25 hours L-band and 13 hours K-band) of recording time and over 94% of the 47.45 Tbytes of recorded data. The average filling factor of the disk-packs was less than 69% because of the two large packs involved and the need to send to two different correlator destinations. Parts of the network monitoring experiments were also recorded on the new Flexbuf in parallel for testing purposes.

Some 22 minutes of data was lost during the session due to two separate antenna drive issues related to an encoder jump and a faulty limit interlock cable. There was also the usual significant RFI at L-band.

EVN Session I – Feb/Mar 2017

This session was more average with 16 experiments scheduled, of which 11 were user experiments, comprising some 84% of the 64.5 hours (23.5 hours L-band, 17.75 hours C-band and 23.25 hours K-band) of recording time and over 91% of the 31.61 Tbytes of recorded data. The entire session was recorded on the new Flexbuf with the subsequent electronic shipment (to both correlators) being completed within 19 days of the end of the session. No disk packs were shipped at all.

Only 6 minutes of data was lost during the session due to a power interruption. However there was the usual significant RFI at L-band.

e-VLBI / Connectivity

Over the period September 2016 to April 2017 Hartebeesthoek participated in 7 e-VLBI sessions, of which 6 were at C-band, and the other at L-band comprising roughly 73.8 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 directly from the FiLa10Gin the DBBC2.

Out of Session experiments

Additionally the Hartebeesthoek 26 m supported a total of 5 out-of-session RadioAstron imaging observations as part of the EVN.

Hartebeesthoek, as part the RadioAstron survey program, also participated in some 112 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. Additionally we tracked the RadioAstron spacecraft itself at X-band on five occasions with the 26 m and/or 15 m in preparation for future experiments designed to measure the gravitational redshift of its onboard hydrogen maser frequency standard.

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 fully operational and is used as the main frequency standard for the 15 m VLBI system thus allowing us to offset the two telescopes in frequency when required. Our original EFOS-A maser (EFOS-6) is still operational 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+/C) & Flexbuf Recorders

A new 144TB Flexbuf system has been commissioned at Hartebeesthoek, with funds donated to JIVE for the purchase of a matching unit. As of February 2017 this system has been adopted as the primary recorder (in VDIF format) for EVN use. 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) provides an off-line electronic data shipment capability and 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 v105_1 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. PFB firmware v16 is also available for testing purposes. Both units are equipped with SSD internal disks which should 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 v105_1/v105E_2 & PFB v16 running on Windows XP; FiLa10G v3.3.2
Mark5B+ version: jive5ab 2.8.1-o running on Debian 4.0 "etch", kernel 2.6.18-6-i386
Mark5C version: jive5ab 2.8.1-o running on Debian 7.x "wheezy", kernel 3.2.0-4-amd64
Flexbuf version: jive5ab 2.8.1-o running on Debian 8.x "jessie", kernel 3.16.0-4-amd64

Disks

No further disk packs have been purchased over this period, with the 2016/7 allocation also being diverted to the purchase of the new Flexbuf infrastructure. We will probably look at using the 2017/8 allocation to double the capacity of the local Flexbuf to match the one at JIVE and use the existing 4 TB disks to upgrade some older SATA packs with smaller disks.

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.

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23 May 2017