

Bonn DiFX correlator report to the TOG January 2011

Correlator status and operations

In Bonn all VLBI observations are now processed using the **DiFX software correlator**. DiFX (Distributed FX correlator) was developed at Swinburne University in Melbourne, Australia by Adam Deller (and collaborators), and adapted to the VLBA operational environment by Walter Brisken and NRAO staff.

The MK IV correlator broke early December 2010 and was declared broken beyond repair after one day of fruitless attempts to fix it. The geodetic correlation had to be changed over to the DiFX correlator in a hurry. The pre-release of DiFX version 2.0¹ has been used for the correlation. It can extract phase-cal information and also has an interface to the MK IV data format, both of which are very important for geodetic operation.

Quick summary:

- Since December both astronomical and geodetic observations are correlated with the DiFX trunk version (2.0). Correlation with the older 1.5.3 version is still possible.
- 14 Mark 5s can be used for playback from disk modules. In addition data can be played back from presently 5 big RAID systems. This setup allows correlation of significantly more than 20 stations in parallel.
- All Mark 5s can playback all flavours of Mark 5 data (A/B/C).
- All Mark 5 systems have been upgraded to SDK 9 under kernel 2.6.18 (Debian etch). Big disks (> 1 TB) can be played back.
- One Mark 5 was upgraded to OpenSuSE 11.1 and SDK9 and it seems to work reliably. The advantage of OpenSuSE is that it can easily be installed and maintained. (The correlator cluster is also running under OpenSuSE). The aim is a seamless integration of the Mark 5s into the cluster including auto-installation and supervision via the cluster appliance.
- On all Mark 5s (A/B/C) the fuse-based access to Mark 5 modules was changed to the native mode which Walter Brisken has implemented. This makes the Mark 5s part of the correlator cluster; they become “datastream nodes”.
- The Mark5A and Domino programs have been replaced by NRAO's mk5daemon. It offers much of the functionality needed like:
 - reading the directory of each received disk module. This verifies the module content by opening every file on the module and reading its start and stop time. The resulting file is also used for the correlation.
 - resetting the streamstor card
 - rebooting the Mark 5
 - conditioning a module
- An Infiniband 20 Gb/s connection between the Mark 5s and the cluster is under test.
- eVLBI data are stored on normal disk RAIDS without the need to copy them to a module.
- Data is archived in raw format and FITS. The latter is made available to the PIs.
- The correlation is driven with simple command line calls and/or batch files starting from the observe vex file and an auxiliary input file. In addition directory listings (see above) from the modules or of directories on the RAIDS are used for controlling the correlation. Correlation via GUI is under development.
- Data throughput and CPU usage of Mark 5s is monitored. The cluster usage is monitored via a webinterface.

Capabilities

The **Bonn DiFX implementation** is significantly more powerful and flexible than the previous MK IV hardware correlator. The capabilities of the DiFX software correlator can be found at <http://www.mpifr->

¹astro-ph/0702141: DiFX: A software correlator for very long baseline interferometry using multi-processor computing environments

bonn.mpg.de/div/vlbicor/correlator_e.html

Recent highlights are:

- Phase-cal extraction of all tones in a sub-band simultaneously
- Interface to MK IV data format for full access to geodetic analysis software and Haystack fringe fitting program.
- Pulsar correlation with optional correlation and output of all bins

Operations

Correlation is much faster with the DiFX correlator compared to the MK IV. The daytimes are mostly used for development work and tests. Disk turnaround is presently slowed down to a little more than one session. Due to the purchase of new big disks and SATA modules a shortage of disk space has not been caused by this delay.

Shipment of disks with less than 4 TB is avoided in favour of the new big disks.

Technical developments

A module with 16 TB of cheap disks is under test. (Conduant lists only one kind of expensive 2 TB “Enterprise Grade” disks as certified for their modules).

The VLBI equipment for the APEX telescope has been prepared and will be shipped now. A test observation at 1 mm wavelength is planned for the end of March.

(For more info on technical developments see the DBBC report)