Robledo Station Report

EVN TOG Meeting, June 2015
Robledo, Spain

1. Hardware and software status.

1.1. DSN digital backend.

The DSN VLBI digital backend -DSN VLBI Processor (DVP)- was declared operational on April 2014. Since then the DVP is successfully supporting JPL VLBI projects using the JPL software correlator. The DVP does not use the NASA Field System application to configure the terminal and carry out the observations. A schedule processor has been developed to generate DVP scripts from VEX schedules. Currently it records VDIF format (multi-channels data threads, 16 bytes legacy headers) on a Mark5C recorder with SDK 9.2. The DVP schedule processor (script builder) does not support yet Mark5 continuous recording. DVP recording script needs to be manually edited for continuous recording.

Efforts are under way to test the DVP within international VLBI networks. Fringes were already demonstrated with the EVN and the VERA Japanese networks. Certain issues related with the DSN VDIF format were addressed at the DiFX software correlator and, since last reported, fringes have been demonstrated with Bonn and Haystack DiFX based software correlators (Fig. 1 and 2). Recently RadioAstron ASC correlator was also able to correlate DVP VDIF data (Fig. 3).

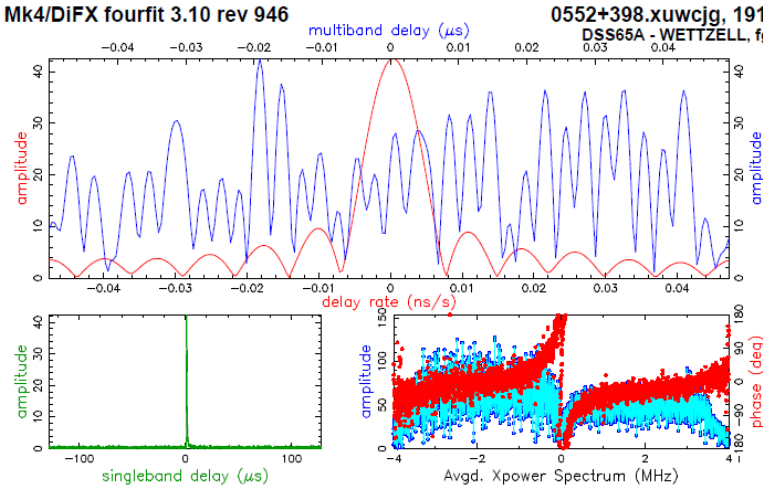

Figure 1. First demonstration of Robledo DVP fringes for the International VLBI Services/ Space Geodesy Program (IVS/SGP) project with Bonn DiFX based software correlator. Fringes shown are for the DSS65A-Wettzell (Germany) baseline during the Europe-129 observation performed on DOY 190 (2014). DSS-65A is the Robledo 34m antenna used for Geodesy support.

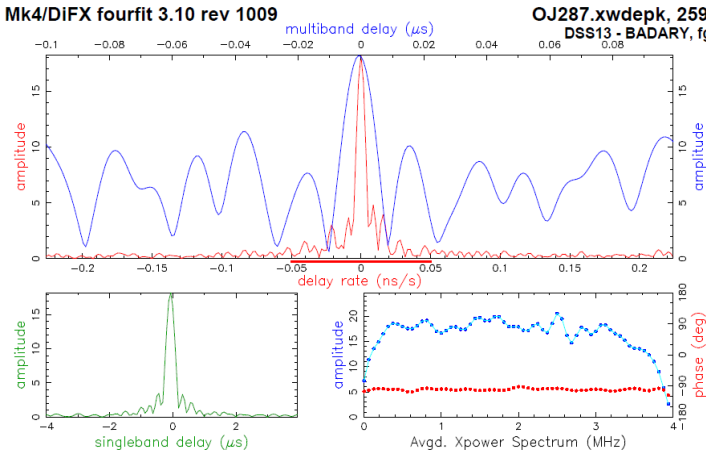

Figure 2. First demonstration of Goldstone DVP fringes for IVS project produced with Haystack DiFX based software correlator. Fringes shown are for the DSS13 -Badary (Russia) baseline during the T-2099 observation performed on DOY 259 (2014). DSS-13 is the Goldstone R&D 34m antenna.

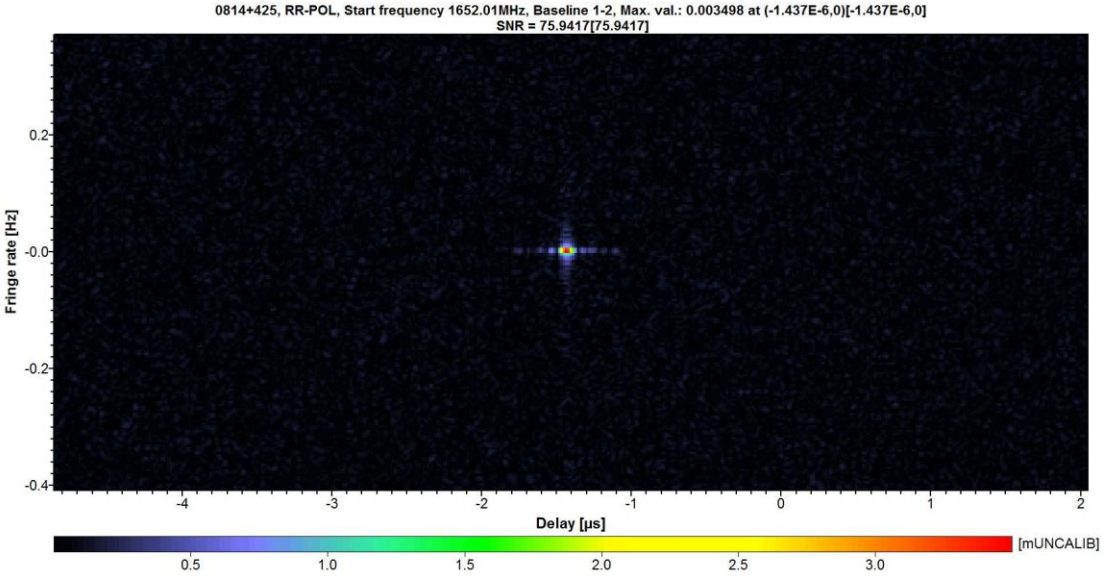

Figure 3. First demonstration of Robledo DVP fringes with the RadioAstron Astro Space Correlator. Fringes shown are for the baseline DSS63-Kalyazin(Russia) for an L-band observation performed in December, 2014. DSS-63 is the Robledo 70m antenna used to support Radio Astronomy single dish and VLBI observations.

Robledo has supported the EVN observations performed during last observing session in 2014 and first observing session in 2015 with the DVP as the only backend. Actions have been already initiated for the decommissioning of the VLBI MarkIV DAT in a near future.

1.2. DSS-63 (70m) K-band receiver status.

Only K-LCP polarization operational. K-RCP polarization system temperature is very high. It is suspected the K-RCP path at the Post-amp & Calibration assembly unit. Lately it has been noticed a considerable drop in the signal level at both polarizations. Further troubleshooting is required.

1.3. DSS-63 (70m) L-band receiver status.

Operational. All DSN 70m antennas L-band receivers have been upgraded from 90 MHz bandwidth (1625-1715MHz sky frequency) to 500 MHz (1400-1900MHz sky frequency). The upgrade took place at just one of the LNAs, replacing the refrigerated RF filter installed before the LNA. The spare LNA has not been modified yet.

1.4. DSS-54 (34m) Q-band receiver status.

Operational. Host Country group is extensively using it to perform single dish spectroscopy observations.

2. Calibration.

a. DVP data calibration. Field system calibration capabilities have not yet being replaced for the DVP digital backend. Antabfs files are not yet being provided for the EVN observations. Continuous calibration scheme is currently being tested with the DVP.

b. DSS-63 K-band calibration. Currently there is no ambient load available so calibrations are performed using the noise diode. Noise diode calibration is regularly checked using the ground.

c. DSS-63 K-band pointing. K-band pointing models need to be improved. This task has been included in the incoming August 3rd- 14th Depot Level Maintenance DSS-63 antenna downtime.

d. DSS-63 L-band beam-shape measurement. EVN has requested to provide DSS-63 beam-shapes at L-band and low antenna elevations for calibrating off-axis detections in wide field observations. Several preliminary raster scans were performed in DEC/XDEC using different sources and antenna elevations. Lack of available antenna time has avoided to continue this task.

3. Immediate and Future Plans.

DSS-63 Robledo 70m antenna downtime in August 3rd – August 14th 2015 for Depot Level Maintenance tasks. The 5 week downtime for AZ track regrouting planned for February 2016 that could have impacted the first EVN observing session has been cancelled.

The old DSN K-band broadband receiver (18-26.5GHz, with only 70MHz baseband bandwidth per polarization) is currently being upgraded from three to four IF channels with a goal of 10 GHz instantaneous usable bandwidth at each polarization (17-27GHz), and beam switching capability for single dish spectroscopy. The actual downconverter (MMS) will be replaced by a design from the EE Department at Caltech that will down convert the IF channels into 1GHz wide USB and LSB (or into 2 GHz wide in-phase/quadrature-phase) analog data channels. It will also allow selecting linear or circular polarization. Phase I of the receiver (only 21-23GHz and 23-25GHz frequency ranges) has been installed in Canberra 70 m antenna (DSS-43) and is currently in commissioning phase. Goldstone and Madrid receivers will be upgraded depending on available budget.

DSN L-band receiver upgrade to 1.4-1.9 GHz bandwidth: the original L-band feed is band-limited and does not allow the usage of the whole available bandwidth. The design of a replacement corrugated feed is already complete and ready to be implemented. The development of an orthomode/turnstile junction (that will provide L-band dual polarization) and the bandwidth upgrade of the spare LNA will be deferred. The lower edge of the band is hard-limited by the actual waveguide cut-off so participation in 21cm observations will be limited. On the other hand the DSN is considering the upgrade to broader L-band bandwidths, using feeds similar to the wide-band Eleven feed (Chalmers) or the Circular Quadruple-ridge flared horn (Caltech).

Robledo e-VLBI activities: 300 Mbps connection from Robledo to the Spanish Research and Educational Network (RedIRIS) has not yet being upgraded to 1 Gbps.

4. Recent Robledo support to EVN observations.

Robledo has supported the EVN observations performed during 2014 and 2015 with the new DSN digital backend (DVP).

Out of session EVN observations, 2014: Robledo participated in following observation in K-band:

```
DOY START BOT  EOT  END  FACILITY  USER   ACTIVITY
360 2140 2310 0420 0450 DSS-63 EGS EVN GL042-A (K-band)
```

Out of session EVN observations, 2015: Robledo participated in following observations in L and K bands, correlated at Bonn (B) and JIVE (J) correlators:

```
DOY START BOT  EOT  END  FACILITY  USER   ACTIVITY
003 2030 2200 0350 0420 DSS-63 EGS EVN GL041A (K-band; B)
010 2030 2200 0320 0350 DSS-63 EGS EVN RG10A (L-band; B)
020 1950 2120 0245 0315 DSS-63 EGS EVN GL042B (L-band; B)
028 1955 2125 0210 0240 DSS-63 EGS EVN RG10B (L-band; B)
029 1600 1730 1900 1930 DSS-63 EGS EVN GA035B (K-band; J)
```

During EVN session#1 2015 Robledo participated in following observations in L-band, correlated at JIVE (J) correlator:

DOY	START	BOT	EOT	END	FACILITY	USER	ACTIVITY
059	1705	1835	0010	0040	DSS-63	EGS	EVN EP092A (L-band, J)
060	1950	2120	0005	0035	DSS-63	EGS	EVN EG078C (L-band, J)

Best regards,

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