Robledo Station Report

EVN TOG Meeting, May 2017
Ventspils International Radio Astronomy Center – VIRAC, Latvia

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 and non-DSN VLBI users. 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, firmware 16.45.

To improve our support to the EVN, IVS and other non-DSN users a new delivery of the DVP software is currently being developed and tested (V.2.4.3). This upgrade includes:

1. DSN VDIF format modification: 32-bytes headers for all external users. Legacy headers still available.
2. DSN VDIF format modification: possibility to record ONLY 4, 8 or 16 complex channels, decreasing recording data rate for certain configurations (Table 1). Maximum data rate is 2048Mbps.
3. DSN VDIF format modification: possibility to use 64MHz complex channels (or 32MHz usb/lsb channels) for 2Gbps recordings (Fig. 1).
4. DSN VDIF format modification: added 1 bit channel sampling.
5. Mark5C upgraded to SDK 9.4: allows to use >16TB SATA disk modules.
6. Mark5C upgraded from Debian Linux 6.0.7 32-bit to Debian Linux 7.10 64-bit.
7. DVP control computer upgraded from Debian Linux 6.0.7 64-bit to Debian Linux 8.4 64-bit.
8. Includes antenna status and weather data in experiment logs.
9. More reliable calculation of total power in 2-bit sampled channels.
10. Several bug fixes for overall robustness.

Several issues with this new DVP delivery (V.2.4.3) were found during EVN session III 2016 that affected our whole participation in the session. DSN has officially came back to previous operational version (AV.1.0.1) to support the EVN and external VLBI users during 2017 until the new delivery is improved by the end of 2017. Current operational version has some limitations: limited to use <=16TB SATA disk modules, it does not properly switch between banks during recording, limited to use a maximum 16MHz bandwidth for real channels, and records always 32 real channels regardless of the experiment configuration.

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

Operational. Pending to confirm fringes detection by the correlators after summer 2016 repair.

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

Operational. All DSN 70m antennas L-band receivers at least one of the LNAs have been upgraded from 90 MHz bandwidth (1625-1715MHz sky frequency) to 500 MHz (1400-1900MHz sky frequency). 2048Mbps observations and 21cm observations have been supported using the modified LNA (LNA2 for Robledo). L-band polarization was configured for RCP. Pending to confirm fringes detection by the correlators.

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

Operational. Pending to confirm fringes detection by the correlators after summer 2016 repair.

2. Calibration.

a. **DVP data calibration.** *Continuous calibration scheme* regularly used for L, S, X and Ka-bands (32 GHz). A noise diode with 3-6% of Tsys noise is modulated at 10 Hz, the EVN software correlator has been modified to extract continuous calibration from the Robledo data using this non-standard modulation frequency.

b. **DSS-63 K-band calibration.** During summer 2016 K-band ambient load was installed and its control repaired allowing non-linear Zenith Calibrations before the observations. Linear calibrations performed with a power meter during the observations. K-band noise diode is too noisy for continuous calibration.

c. **DSS-54 Q-band calibration.** Non-linear Zenith Calibrations performed before the observations. Linear calibrations performed with a power meter during the observations. Q-band noise diode is too noisy for continuous calibration.

3. Immediate and Future Plans.

DSS-63 Robledo 70m antenna will be stopped for most of next year 2018 (weeks 9-43, both included) for major maintenance works, including shimming and AZ track epoxy grouting to finish the remaining three AZ segments, antenna controller upgrade and elevation bearing installation.

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. It could be upgraded to 1 Gbps for testing purposes during one month a year.

4. Recent Robledo support to EVN observations.

Robledo has supported the EVN observations performed during 2016 and 2017 with the DSN digital backend (DVP).

During EVN session III 2016 and Out-of-Session Robledo has participated with DSS-63 antenna in following L-band, X-band and K-band observations, correlated at JIVE (J) and Bonn (B) correlators:

```
DOY START BOT  EOT  END   FACILITY  USER   ACTIVITY
282 2155 2325 0455 0525 DSS-63 EGS EVN GG081A B-M5
291 2135 2305 0420 0450 DSS-63 EGS EVN GG081B B-M5
302 2055 2225 0815 0845 DSS-63 EGS EA058A/EM124 J-M5
303 2230 0000 0600 0630 DSS-63 EGS EM123B J-M5
304 2045 2215 0900 0930 DSS-63 EGS GS038B J-M5
305 2200 2330 0130 0200 DSS-63 EGS EK036B J-M5
307 0330 0500 0730 0800 DSS-63 EGS EG092C J-M5
308 0410 0540 0730 0800 DSS-63 EGS EM122B J-M5
312 2150 2320 0720 0750 DSS-63 EGS EP099C J-M5
320 0020 0150 0255 0325 DSS-63 EGS EVN-GA038
```

Supports performed using the DVP with V.2.4.3 and locally developed non-TDN connection blocks for 70m antenna. Mark5 modules, logs and feedback reports were sent to Bonn and JIVE correlators. **All supports failed due to several problems found with DVP V.2.4.3 version.**

During EVN session I 2017 and Out-of-Session Robledo has participated with DSS-63 and DSS-54 antennas in following L-band, K-band and Q-band observations, correlated at JIVE (J) and Bonn (B) correlators:

```
DOY START BOT  EOT  END   FACILITY  USER   ACTIVITY
039 2255 2340 0015 0045 DSS-54 EGS EVN-DEVEL Q-BAND (testing)
044 2125 2210 0435 0505 DSS-54 EGS EVN-DEVEL Q-BAND (testing)
053 2130 2215 0200 0230 DSS-54 EGS EVN-DEVEL Q-BAND (testing)
054 1850 2020 2120 2150 DSS-63 EGS EVN-EP103A 0054
055 1945 2115 2330 0000 DSS-63 EGS EVN-EM127A 0055
056 1810 1940 2200 2230 DSS-63 EGS EVN-N17L1 0056
057 2100 2230 0330 0400 DSS-63 EGS EVN-EP102 0057
067 0200 0330 0730 0800 DSS-63 EGS GG081C/EC057B
067 1730 1900 2345 0015 DSS-63 EGS EVN-GG081E/F
068 2130 2300 0030 0100 DSS-63 EGS EVN-GG081J
068 2305 2350 0200 0230 DSS-54 EGS EVN-DEVEL Q-BAND (testing)
072 1920 2050 0200 0230 DSS-54 EGS EVN-GA032D Q-BND
079 1945 2115 0040 0110 DSS-54 EGS EVN-GR039 Q-BND
```

Supports performed using the DVP with AV.1.0.1 and locally developed non-TDN connection blocks for 70m and BWG antennas. Mark5 modules, logs and feedback reports were sent to Bonn and JIVE correlators. **All supports were successful apart** from support on DOY 054 that was affected by a problem with NTB blocks (DR M109853, 56 min lost) and support on DOY 067 that was affected by a problem with DSS-63 antenna after "Follow the Sun" test (DR M109865, 240 min lost).

Best regards,

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