

**MASSACHUSETTS INSTITUTE OF TECHNOLOGY
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March 5, 2012

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To: UVLBI Group
From: Geoff Crew
Subject: Comparison of DBE1 and RDBE-H in NZ2 and NZ3

Attached is a summary plot set of two scans made and (briefly) analyzed Thursday (with lots of help from various folks on the path to this point) that answer the question posed at the last meeting:

Question: Does the DBE1/Mark5B/RDBE/Mark5C combination correlate equivalently in both of the Nyquist zones we need to use in the upcoming experiment.

Answer: Yes.

The six plots are the two scans (LSB/Nq2 and USB/Nq3) analyzed with vlbi0 (with an ignorant pilot on a short sample), the H/W correlator (which correlated 8s, note hdw in the plot title) and with DiFX (correlating 10s, note DiFX in the title). There **are** issues, but they appear equally in both zones.

Issues/Comments:

- 1] Notice that there are two 180 sign flips on 2 of the channels.
Russ assures me that this has been there all along in the DBE1.
(The sign flips in the RDBE have been much more thoroughly analyzed and are not present in the IF1 we use here. See http://www.haystack.mit.edu/tech/vlbi/mark5/mark5_memos/093.pdf for more details.)
Mike removed these with a manual pcal for both the H/W and S/W correlator.
- 2] vlbi0 (run with defaults, but specifying LSB/USB in the cat file) produces the double peaks, shows the sign flips and the a phase slope. If you're doing this in the field, you should expect similar results.
- 3] There is a 5% disagreement on amplitude H/W v DiFX.
- 4] The input signals to the DBE1 and RDBE were not at the optimal input levels but well within acceptable limits.

I need to review some of the cabling and do a bit more testing today, but the current setup should be available for operator testing all of next week.

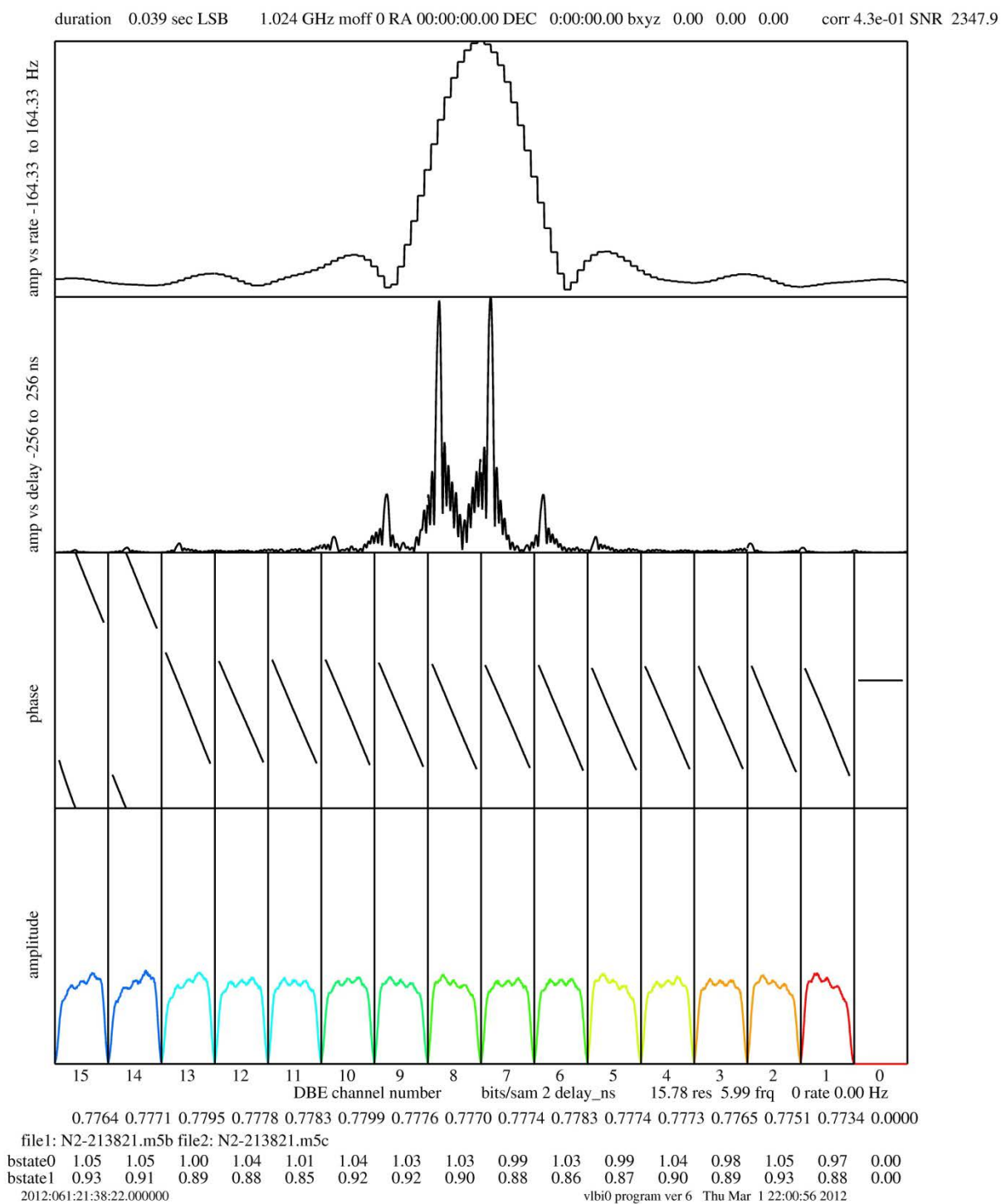


Figure 1. Scan 061-2138: Nyquist zone 2 (LSB), vlbi0 correlator.

Mk4/hdw. fourfit 3.7 rev 660

3C273.wapflu, 061-2138_LOW, ST
SMTOL - SMTOR, fgroup U, pol LL

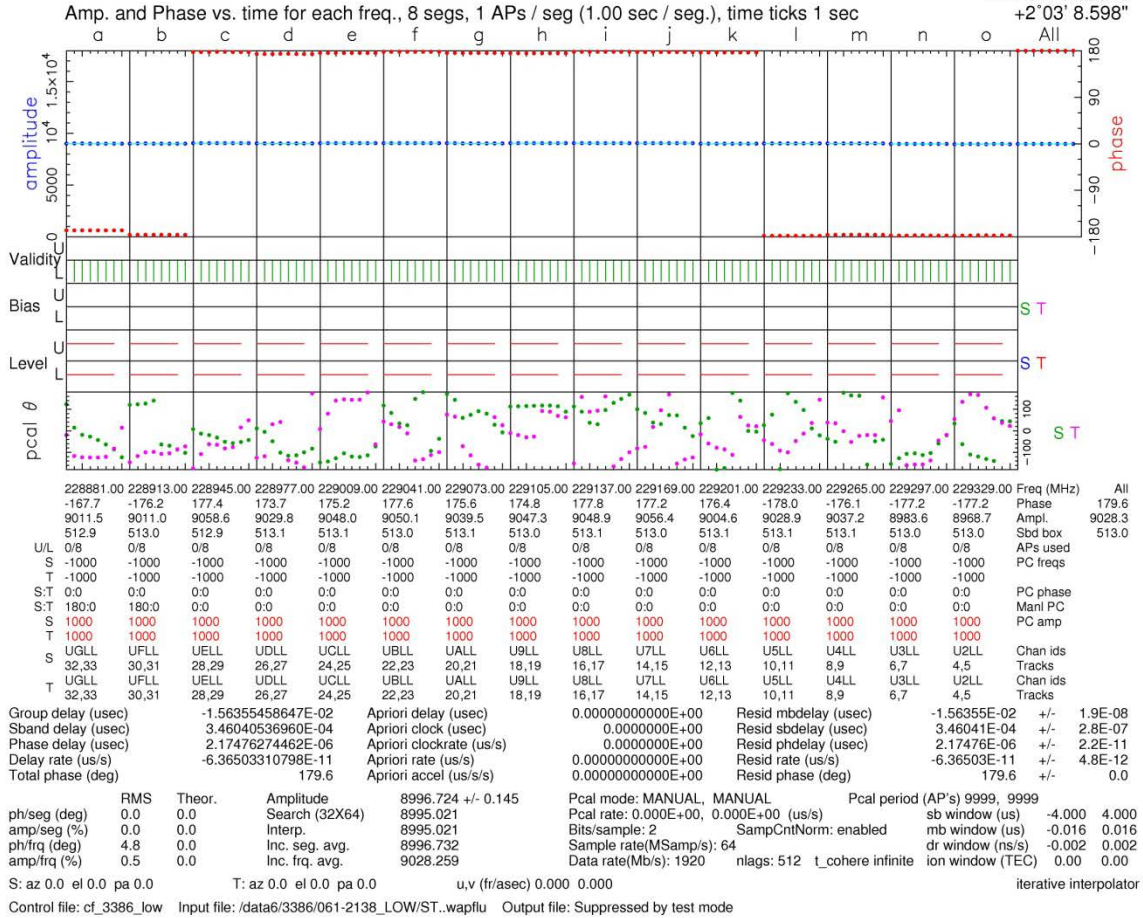
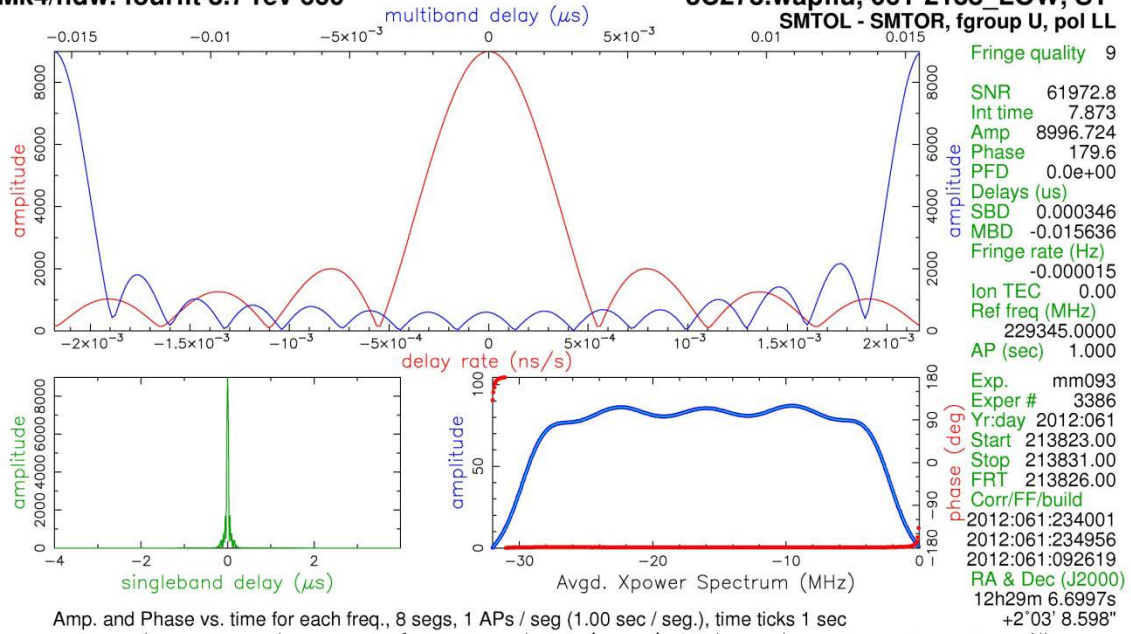


Figure 2. Scan 061-2138: Nyquist zone 2 (LSB), MkIV correlator.
(Manual phase cal was used--the phase cal shown is noise.)

Mk4/DiFX fourfit 3.7 rev 662

3C273.wapyio, 061-2138_LOW, ST
SMTOL - SMTOR, fgroup B, pol LL

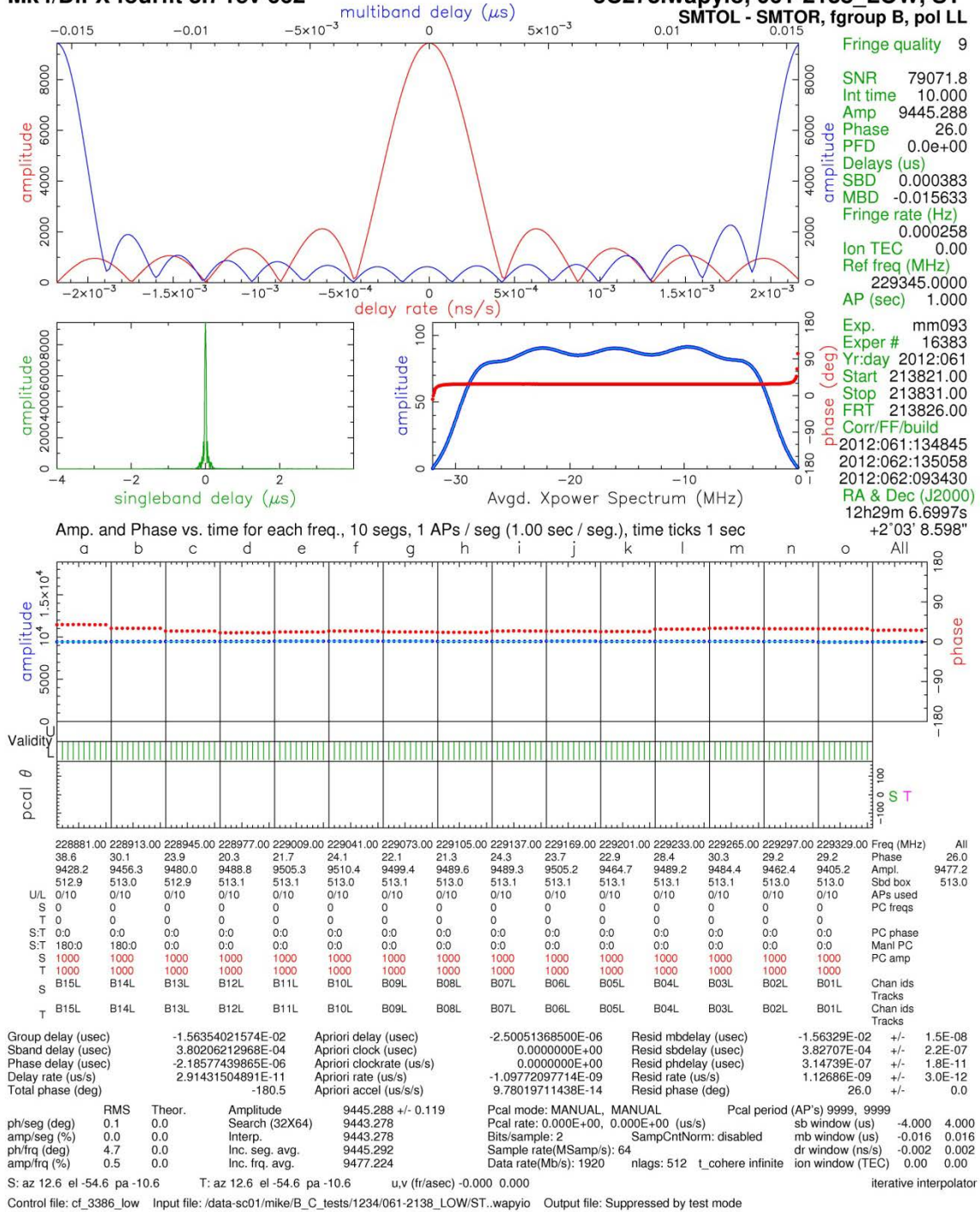


Figure 3. Scan 061-2138: Nyquist zone 2 (LSB), DiFX correlator.

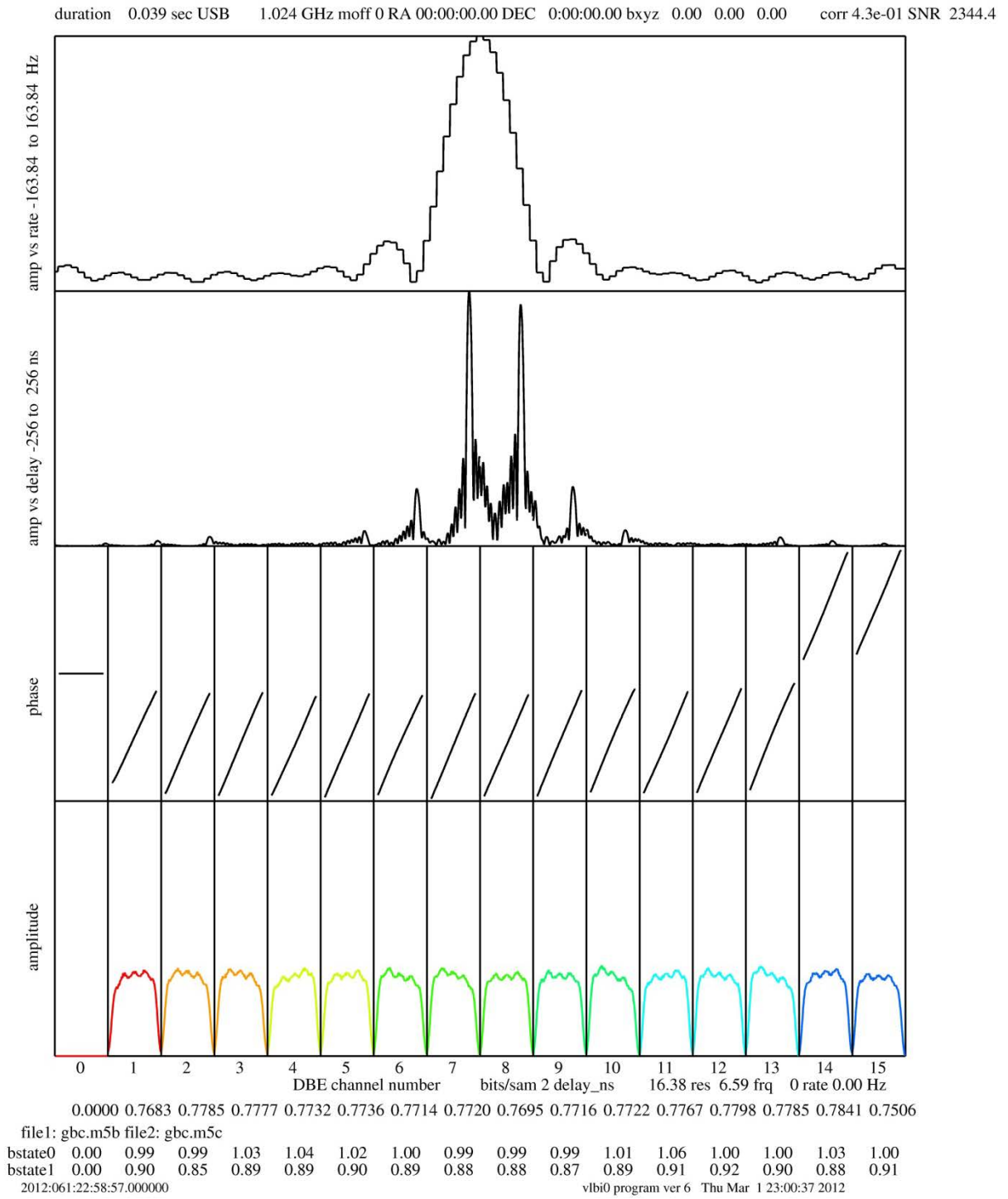
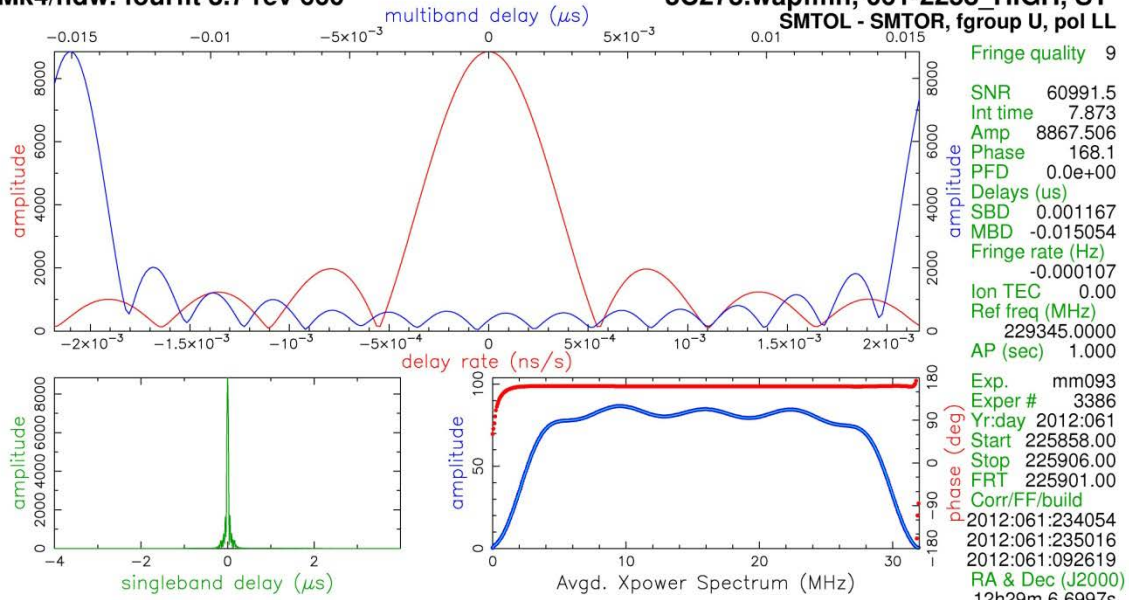


Figure 4. Scan 061-2258: Nyquist zone 3 (USB), vlbi0 correlator.

Mk4/hdw. fourfit 3.7 rev 660

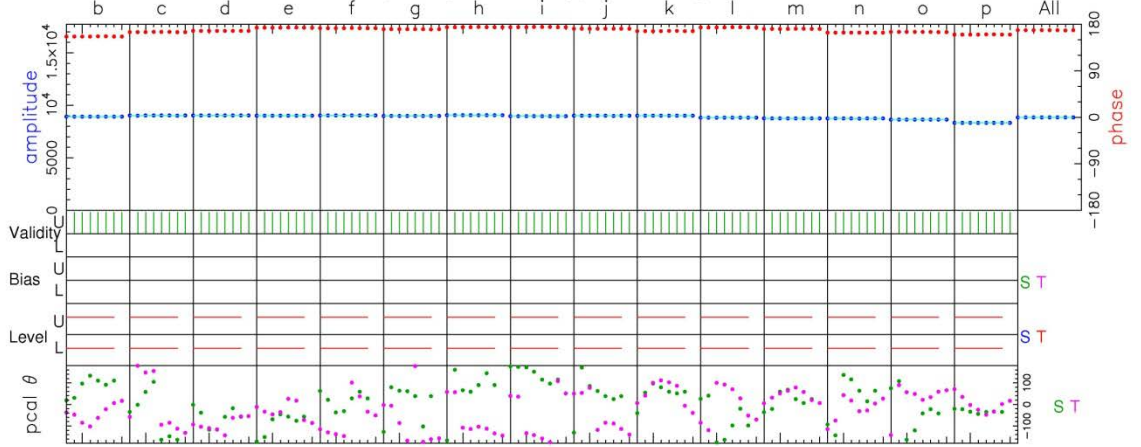
3C273.wapfmh, 061-2258_HIGH, ST

SMTOL - SMTOR, fgroup U, pol LL



Fringe quality 9
SNR 60991.5
Int time 7.873
Amp 8867.506
Phase 168.1
PFD 0.0e+00
Delays (us)
SBD 0.001167
MBD -0.015054
Fringe rate (Hz)
-0.000107
Ion TEC 0.00
Ref freq (MHz)
229345.0000
AP (sec) 1.000
Exp. mm093
Exper # 3386
Yr:day 2012:061
Start 225858.00
Stop 225906.00
FRT 225901.00
Corr/FF/build
2012:061:234054
2012:061:235016
2012:061:092619
RA & Dec (J2000)
12h29m 6.6997s
+2° 03' 8.598"

Amp. and Phase vs. time for each freq., 8 segs, 1 APs / seg (1.00 sec / seg.), time ticks 1 sec



	229361.00	229393.00	229425.00	229457.00	229489.00	229521.00	229553.00	229585.00	229617.00	229649.00	229681.00	229713.00	229745.00	229777.00	229809.00	Freq (MHz)	All
	156.0	164.6	166.8	173.1	172.2	170.1	174.2	174.2	171.0	166.5	173.6	170.8	163.5	164.7	159.9	Phase	168.1
	8929.8	9039.1	9039.6	9032.5	9047.7	9012.8	9088.4	8971.2	9025.1	9031.6	8834.2	8773.3	8758.7	8654.3	8353.9	Ampl.	8906.2
	513.3	513.2	513.1	513.2	513.1	513.2	513.1	513.2	513.1	513.1	513.2	513.1	513.1	513.1	513.1	Sbd box	513.1
U/L	8/0	8/0	8/0	8/0	8/0	8/0	8/0	8/0	8/0	8/0	8/0	8/0	8/0	8/0	8/0	AP's used	
S	2000	2000	2000	2000	2000	2000	2000	2000	2000	2000	2000	2000	2000	2000	2000	PC freqs	
T	2000	2000	2000	2000	2000	2000	2000	2000	2000	2000	2000	2000	2000	2000	2000		
S:T	0:0	0:0	0:0	0:0	0:0	0:0	0:0	0:0	0:0	0:0	0:0	0:0	0:0	0:0	0:0	PC phase	
S:T	0:0	0:0	0:0	0:0	0:0	0:0	0:0	0:0	0:0	0:0	0:0	0:0	0:0	180:0	180:0	Manl PC	
S	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	PC amp	
T	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000		
S	U2HU	U3HU	U4HU	U5HU	U6HU	U7HU	U8HU	U9HU	UAHU	UBHU	UCHU	UDHU	UEHU	UFHU	UGHU	Chan ids	
	4,5	6,7	8,9	10,11	12,13	14,15	16,17	18,19	20,21	22,23	24,25	26,27	28,29	30,31	32,33	Tracks	
T	U2HU	U3HU	U4HU	U5HU	U6HU	U7HU	U8HU	U9HU	UAHU	UBHU	UCHU	UDHU	UEHU	UFHU	UGHU	Chan ids	
	4,5	6,7	8,9	10,11	12,13	14,15	16,17	18,19	20,21	22,23	24,25	26,27	28,29	30,31	32,33	Tracks	
Group delay (usec)			-1.50543760802E-02			Apriori delay (usec)			0.0000000000E+00			Resid mbdelay (usec)			-1.50544E-02	+/-	1.9E-08
Sband delay (usec)			1.16716268317E-03			Apriori clock (usec)			0.00000000E+00			Resid sbdelay (usec)			1.16716E-03	+/-	2.8E-07
Phase delay (usec)			2.03637958016E-06			Apriori clockrate (us/s)			0.00000000E+00			Resid phdelay (usec)			2.03638E-06	+/-	2.3E-11
Delay rate (us/s)			-4.67450633548E-10			Apriori rate (us/s)			0.0000000000E+00			Resid rate (us/s)			-4.67451E-10	+/-	4.9E-12
Total phase (deg)			168.1			Apriori accel (us/s/s)			0.0000000000E+00			Resid phase (deg)			168.1	+/-	0.0
		RMS	Theor.	Amplitude		8867.507 +/- 0.145			Pcal mode: MANUAL	MANUAL		Pcal period (AP's)	9999	9999			
ph/seg (deg)	0.1	0.0		Search (32X64)		8830.645			Pcal rate: 0.000E+00, 0.000E+00 (us/s)			sb window (us)			-4.000	4.000	
amp/seg (%)	0.0	0.0		Interp.		8830.645			Bits/sample: 2	SampCntNorm: enabled		mb window (us)			-0.016	0.016	
ph/frq (deg)	5.3	0.0		Inc. seg. avg.		8867.518			Sample rate(MSamp/s): 64			dr window (ns/s)			-0.002	0.002	
amp/frq (%)	2.2	0.0		Inc. frq. avg.		8906.151			Data rate(Mb/s): 1920	nlags: 512	t_cohere infinite	ion window (TEC)			0.00	0.00	
S: az 0.0 el 0.0 pa 0.0				T: az 0.0 el 0.0 pa 0.0			u,v (fr/asec)	0.000	0.000								iterative interpolator
Control file: cf_3386_high				Input file: /data6/3386/061-2258_HIGH/ST..wapfmh					Output file: Suppressed by test mode								

Figure 5. Scan 061-2258: Nyquist zone 3 (USB), MkIV correlator.
(Manual phase cal was used--the phase cal shown is noise.)

Mk4/DiFX fourfit 3.7 rev 662

3C273.wapyip, 061-2258_HIGH, ST
SMTOL - SMTOR, fgroup B, pol LL

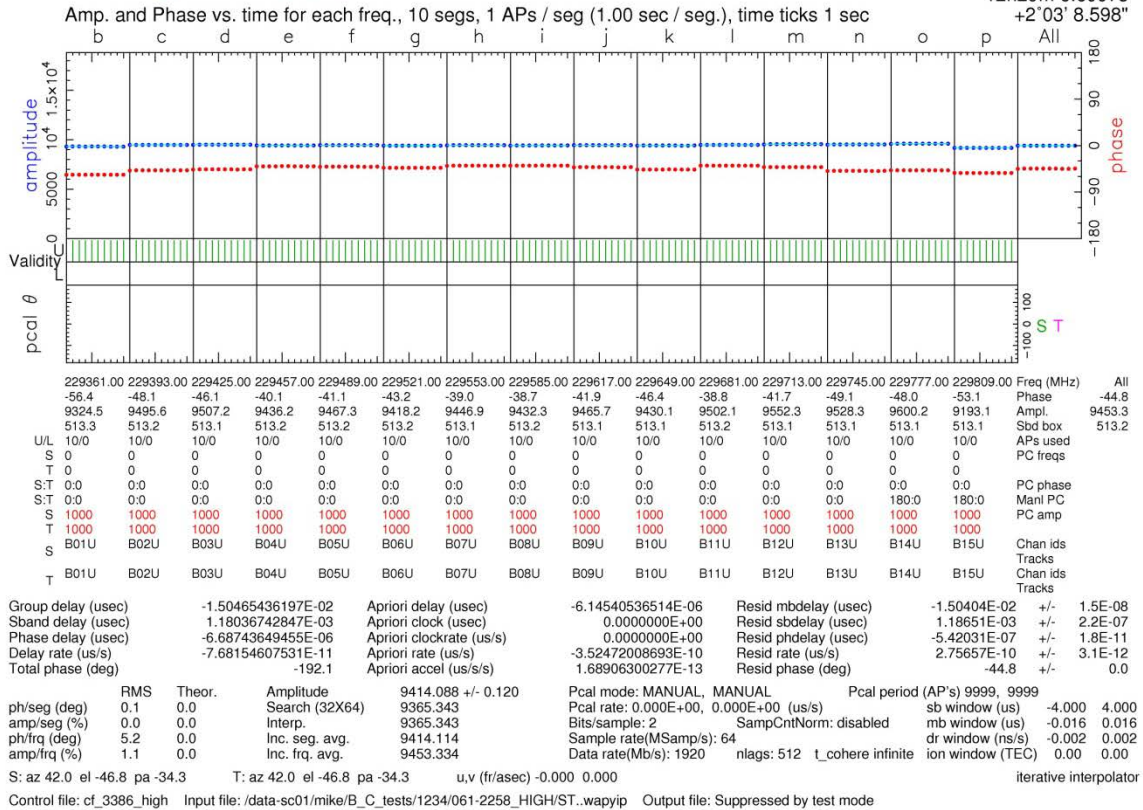
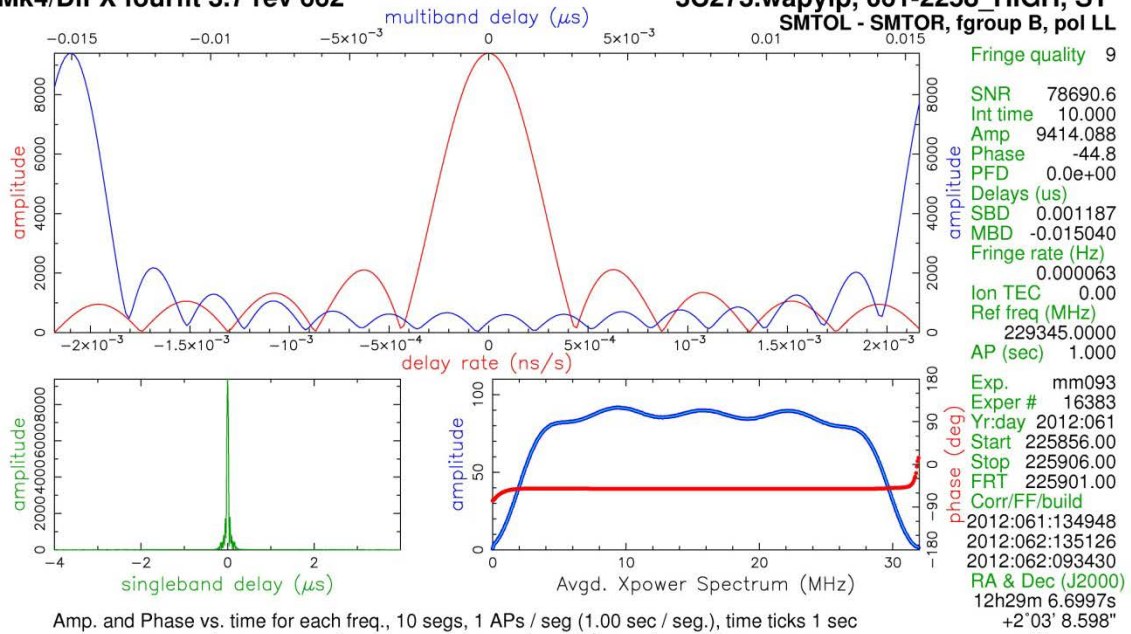


Figure 6. Scan 061-2258: Nyquist zone 3 (USB), DiFX correlator.