

VLBA Gains and System Temperatures from March and April Data
13 May 1992
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VLBA TEST MEMO NO. 33

These results are from all pointing data taken during March and April (and May 7) 1992. Much of the data has been edited to remove bad days etc. There are still a few cases where the Tsys was different on different days. See the notes for some of the problems.

The atmosphere temperatures are not very reliable because they are the result of fitting of data from many days during which the opacity changed considerably. Eventually a scheme for determining shorter term values should be devised.

Saint Croix pointing has begun but we are a long way from having good numbers at more than one or two frequencies.

The results presented here can be compared with those of VLBA Test Memo 25 to look for changes. In most, but not all, cases the receivers are the same and the results should be the same.

Note that the differences between 13cm and 13cmsx are purely the result of the focus change (the focus is optimized for 4cm in the dual frequency position. We should probably make some attempt to bias the focus for 4/13cm to the low side to improve 13 cm performance.

VLBA_PT

Item		90cm	50cm	20cm	13cm	13cmsx	6cm	4cm	4cmsx	2cm	1cm
Points used for gains:	RCP:	37	42	61	63	150	68	283	214	71	402
	LCP:	37	41	62	62	163	67	275	146	71	385
Frequency in MHz (last point):		327.	611.	1655.	2262.	2262.	4998.	8418.	8418.	15068.	22228.
Expected beam size (arc min):		126.07	67.47	24.91	18.22	18.22	8.25	4.90	4.90	2.74	1.85
Cal Temperature (K):	RCP:	8.70	10.00	2.70	2.42	2.42	2.89	3.52	3.52	1.90	7.82
(Last point)	LCP:	8.65	10.30	2.59	2.62	2.62	3.07	3.96	3.96	1.66	10.03
Zenith system temp. (K):	RCP:	99.8	163.2	31.9	36.2	38.1	44.2	44.4	54.6	63.1	114.5
	LCP:	118.2	166.3	31.4	41.8	43.4	50.2	44.3	53.3	60.9	120.7
Zenith Atmosphere Temp. (K):	RCP:	2.7*	2.7*	2.7*	2.7*	2.7*	2.9	2.1	4.9	4.7	30.0
* => assumed value used.	LCP:	2.7*	2.7*	2.7*	2.7*	2.7*	3.2	2.2	4.7	5.6	30.4
Uncorrected Gain (K/Jy):	RCP:	0.052	0.047	0.101	0.089	0.074	0.110	0.114	0.082	0.091	0.109
* => assumed value used.	LCP:	0.057	0.052	0.096	0.106	0.089	0.120	0.112	0.081	0.099	0.111
Opacity Corr. Gain (K/Jy):	RCP:	0.053	0.048	0.102	0.090	0.075	0.112	0.115	0.084	0.093	0.129
* => assumed value used.	LCP:	0.058	0.053	0.097	0.108	0.090	0.122	0.113	0.083	0.102	0.132
Efficiency (Opa. Corr.):	RCP:	0.30	0.27	0.57	0.51	0.42	0.63	0.65	0.47	0.52	0.72
* => assumed value used.	LCP:	0.33	0.30	0.55	0.60	0.51	0.69	0.64	0.46	0.57	0.74
Zenith system temp. (Jy):	RCP:	1882.	3419.	312.	400.	510.	396.	387.	648.	678.	891.
* => based on assumed gain.	LCP:	2041.	3165.	322.	388.	480.	410.	390.	645.	597.	918.

- 1.) There have been a variety of problems with the 4/13 cm system because of the ellipsoids moving. The numbers here should be treated with suspicion. Two different gains were seen on different days and the above values are an average. On the better days, the gain was about 0.11.
- 2.) On some occasions, the 50 and 90 cm system temperatures were much higher than normal for reasons that I don't know. These data have been edited out before the above gains were determined.
- 3.) Comparison with Test Memo 25 shows that 1 cm has improved while 13 and 4 cm systems have degraded, especially in the dual frequency mode. However the dual frequency data may be bad anyway.

VLBA_KP

Item		90cm	50cm	20cm	13cm	13cmsx	6cm	4cm	4cmsx	2cm	1cm
Points used for gains:	RCP:	24	35	39	15	40	31	36	----	51	212
	LCP:	24	35	38	15	80	31	35	----	51	267
Frequency in MHz (last point):		327.	611.	1655.	2262.	2262.	4998.	8418.	8418.	15068.	22228.
Expected beam size (arc min):		126.07	67.47	24.91	18.22	18.22	8.25	4.90	4.90	2.74	1.85
Cal Temperature (K):	RCP:	9.00	10.20	3.07	1.42	1.42	2.63	3.71	----	2.95	23.38
(Last point)	LCP:	9.00	10.20	3.06	1.52	1.52	2.37	3.48	----	2.70	23.97
Zenith system temp. (K):	RCP:	163.7	288.6	32.8	43.7	47.1	42.2	32.5	----	49.1	96.7
	LCP:	149.3	299.0	32.8	44.9	46.2	42.2	34.0	----	59.4	97.8
Zenith Atmosphere Temp. (K):	RCP:	2.7*	2.7*	2.7*	2.7*	2.7*	5.0	2.8	----	5.1	17.6
* => assumed value used.	LCP:	2.7*	2.7*	2.7*	2.7*	2.7*	4.9	2.5	----	4.8	19.9
Uncorrected Gain (K/Jy):	RCP:	0.061	0.097	0.089	0.074	0.059	0.126	0.114	----	0.113	0.090
* => assumed value used.	LCP:	0.061	0.101	0.094	0.074	0.062	0.120	0.116	----	0.105	0.091
Opacity Corr. Gain (K/Jy):	RCP:	0.062	0.099	0.090	0.075	0.060	0.129	0.115	----	0.116	0.100
* => assumed value used.	LCP:	0.062	0.103	0.095	0.075	0.062	0.123	0.118	----	0.108	0.102
Efficiency (Opa. Corr.)	RCP:	0.35	0.55	0.51	0.42	0.34	0.73	0.65	----	0.65	0.56
* => assumed value used.	LCP:	0.35	0.58	0.54	0.42	0.35	0.69	0.66	----	0.60	0.57
Zenith system temp. (Jy):	RCP:	2660.	2930.	362.	580.	781.	327.	282.	----	424.	970.
* => based on assumed gain.	LCP:	2396.	2912.	344.	602.	741.	342.	288.	----	552.	961.

- 1.) Again, problems with the ellipsoids have prevented good values for 4/13 cm from being obtained.
- 2.) At 90 cm, gains of about 0.04 and about 0.075 were seen on different days. The reason for the change has not yet been checked.
- 3.) At 50 cm, the gains cover a range of 0.09 to 0.12.
- 4.) The performance of the 13cm system seems especially poor. Comparison with Memo 25 shows serious degradation. Something is probably wrong.

VLBA_LA

Item		90cm	50cm	20cm	13cm	13cmsx	6cm	4cm	4cmsx	2cm	1cm
Points used for gains:	RCP:	55	62	73	75	67	85	325	181	71	151
	LCP:	53	62	58	39	89	85	325	181	61	151
Frequency in MHz (last point):		327.	611.	1655.	2262.	2262.	4998.	8418.	8418.	15068.	22237.
Expected beam size (arc min):		126.07	67.47	24.91	18.22	18.22	8.25	4.90	4.90	2.74	1.85
Cal Temperature (K):	RCP:	8.90	5.70	3.60	0.92	0.92	3.43	3.72	3.72	3.73	7.26
(Last point)	LCP:	9.30	5.70	3.69	1.28	1.28	3.40	3.82	3.82	3.96	7.41
Zenith system temp. (K):	RCP:	205.2	229.1	25.5	37.0	37.4	47.1	34.8	41.1	80.0	91.0
	LCP:	191.7	204.8	31.8	47.3	47.8	43.5	39.8	45.6	73.1	92.4
Zenith Atmosphere Temp. (K):	RCP:	2.7*	2.7*	2.7*	2.7*	2.7*	4.6	2.2	2.2	7.0	19.9
* => assumed value used.	LCP:	2.7*	2.7*	2.7*	2.7*	2.7*	4.1	2.3	2.3	6.2	19.9
Uncorrected Gain (K/Jy):	RCP:	0.062	0.063	0.077	0.077	0.066	0.136	0.107	0.087	0.146	0.081
* => assumed value used.	LCP:	0.066	0.069	0.105	0.097	0.079	0.127	0.111	0.091	0.128	0.079
Opacity Corr. Gain (K/Jy):	RCP:	0.063	0.064	0.078	0.079	0.067	0.139	0.108	0.088	0.152	0.090
* => assumed value used.	LCP:	0.067	0.070	0.107	0.098	0.080	0.130	0.113	0.092	0.133	0.087
Efficiency (Opa. Corr.)	RCP:	0.35	0.36	0.44	0.44	0.37	0.78	0.61	0.49	0.85	0.50
* => assumed value used.	LCP:	0.38	0.39	0.60	0.55	0.45	0.73	0.63	0.52	0.75	0.49
Zenith system temp. (Jy):	RCP:	3261.	3590.	326.	471.	563.	339.	322.	468.	528.	1014.
* => based on assumed gain.	LCP:	2841.	2925.	298.	483.	598.	335.	353.	494.	551.	1060.

- 1.) The 20cm gain measurements contained more deviant values than was typical at other stations. This might be due to RFI which has been something of a problem at this site.
- 2.) The 13cm gains showed two different values. For RCP these were about 0.072 and 0.082. LCP is noisier but scaled in a similar manner.
- 3.) The 6cm zenith Tsys seems to have risen by about 4 degrees during the March-April time period. The cause is unknown.
- 4.) The 13cm performance is fairly poor.

VLBA_FD

Item		90cm	50cm	20cm	13cm	13cmsx	6cm	4cm	4cmsx	2cm	1cm
Points used for gains:	RCP:	44	51	53	44	118	35	380	168	----	385
	LCP:	45	52	51	44	121	35	383	170	----	388
Frequency in MHz (last point):		327.	611.	1655.	2262.	2262.	4998.	8418.	8418.	15068.	22228.
Expected beam size (arc min):		126.07	67.47	24.91	18.22	18.22	8.25	4.90	4.90	2.74	1.85
Cal Temperature (K): (Last point)	RCP:	9.50	5.60	3.34	2.82	2.82	3.34	3.89	3.89	----	8.02
	LCP:	8.30	6.00	3.43	2.00	2.00	3.26	3.81	3.81	----	7.71
Zenith system temp. (K):	RCP:	220.1	211.8	25.7	32.8	31.7	35.8	29.1	35.3	----	64.9
	LCP:	210.0	219.1	26.9	32.9	31.4	39.7	28.8	35.5	----	61.0
Zenith Atmosphere Temp. (K): * => assumed value used.	RCP:	2.7*	2.7*	2.7*	2.7*	2.7*	2.7*	2.4	3.9	----	19.1
	LCP:	2.7*	2.7*	2.7*	2.7*	2.7*	2.7*	2.3	3.7	----	19.9
Uncorrected Gain (K/Jy): * => assumed value used.	RCP:	0.092	0.055	0.091	0.085	0.069	0.109	0.114	0.101	----	0.057
	LCP:	0.089	0.061	0.094	0.091	0.073	0.115	0.108	0.098	----	0.058
Opacity Corr. Gain (K/Jy): * => assumed value used.	RCP:	0.093	0.055	0.092	0.086	0.070	0.111	0.115	0.103	----	0.063
	LCP:	0.090	0.062	0.095	0.092	0.074	0.118	0.109	0.100	----	0.064
Efficiency (Opa. Corr.) * => assumed value used.	RCP:	0.52	0.31	0.52	0.48	0.39	0.62	0.65	0.58	----	0.36
	LCP:	0.51	0.35	0.53	0.52	0.42	0.66	0.61	0.56	----	0.36
Zenith system temp. (Jy): * => based on assumed gain.	RCP:	2366.	3820.	278.	380.	453.	323.	253.	342.	----	1027.
	LCP:	2330.	3545.	283.	357.	425.	338.	264.	356.	----	952.

- 1.) On April 15, the system temperatures were especially high at 13cm (about 85K), 6cm (about 230K) and 1cm (about 450K). Other frequencies were ok. I have no idea what happened. These data are not included in the above averages at 13 and 1cm. At 6cm, the bad data remained in for the main analysis so I have substituted values from just the march data.
- 2.) The 13cm Tsys decreased by about 8K between mid March and early April. I don't know why. The above numbers are an average. The most recent zenith Tsys for 13 cm is about 26K. The gains also changed from about 0.10 to about 0.08. This combination suggests that the cals changed.
- 3.) The opacity corrected 1 cm gains show a pronounced elevation dependence. However, both the gain and the system temperature at this site are low compared to other sites while the Tsys(Jy) is similar. If the cal values are too low, the gains and Tsys would be low and the derived atmosphere temperature would be low go the opacity corrections would not be correct, possibly explaining the gain vs. elevation, or at least some of it.
- 4.)

VLBA_NL

Item		90cm	50cm	20cm	13cm	13cm _{max}	6cm	4cm	4cm _{max}	2cm	1cm
Points used for gains:	RCP:	21	32	43	54	179	58	266	262	-----	333
	LCP:	20	30	43	54	161	58	266	262	-----	352
Frequency in MHz (last point):		327.	611.	1655.	2262.	2262.	4998.	8418.	8418.	-----	22237.
Expected beam size (arc min):		126.07	67.47	24.91	18.22	18.22	8.25	4.90	4.90	-----	1.85
Cal Temperature (K): (Last point)	RCP:	8.50	5.20	1.74	1.02	1.02	3.47	4.03	4.03	-----	10.38
	LCP:	8.50	5.50	1.84	1.12	1.12	3.79	4.08	4.08	-----	9.52
Zenith system temp. (K):	RCP:	164.1	168.1	27.2	39.2	38.8	43.7	43.1	48.5	-----	107.6
	LCP:	158.0	193.3	28.8	43.1	43.2	38.9	45.7	50.7	-----	113.6
Zenith Atmosphere Temp. (K): * => assumed value used.	RCP:	2.7*	2.7*	2.7*	2.7*	2.7*	4.8	3.3	4.1	-----	40.6
	LCP:	2.7*	2.7*	2.7*	2.7*	2.7*	4.0	3.5	4.2	-----	39.9
Uncorrected Gain (K/Jy): * => assumed value used.	RCP:	0.065	0.041	0.078	0.078	0.065	0.112	0.098	0.096	-----	0.080
	LCP:	0.065	0.055	0.083	0.085	0.073	0.091	0.101	0.099	-----	0.080
Opacity Corr. Gain (K/Jy): * => assumed value used.	RCP:	0.066	0.042	0.079	0.079	0.066	0.115	0.100	0.098	-----	0.098
	LCP:	0.066	0.055	0.084	0.086	0.074	0.093	0.103	0.101	-----	0.099
Efficiency (Opa. Corr.) * => assumed value used.	RCP:	0.37	0.23	0.44	0.44	0.37	0.65	0.56	0.55	-----	0.55
	LCP:	0.37	0.31	0.47	0.48	0.41	0.52	0.58	0.57	-----	0.56
Zenith system temp. (Jy): * => based on assumed gain.	RCP:	2490.	4044.	346.	496.	586.	380.	431.	494.	-----	1094.
	LCP:	2399.	3486.	343.	500.	586.	418.	442.	503.	-----	1144.

- 1.) There seems to be a significant gain vs. elevation dependence at 50cm which seems strange. It is in the sense that the gain is higher at low elevations.
- 2.) The 13cm performance seems fairly poor.
- 3.) The 2cm system has not had initial pointing and focus determined yet.
- 4.) This site has the worst 4cm and 6cm sensitivities.

VLBA_OV

Item		90cm	50cm	20cm	13cm	13cmsx	6cm	4cm	4cmsx	2cm	1cm
Points used for gains:	RCP:	----	----	50	----	----	43	293	----	----	297
	LCP:	----	----	51	----	----	43	293	----	----	294
Frequency in MHz (last point):		315.	622.	1655.	2262.	----	4998.	8418.	----	15068.	22228.
Expected beam size (arc min):		130.87	66.28	24.91	18.22	----	8.25	4.90	----	2.74	1.85
Cal Temperature (K):	RCP:	----	----	2.81	----	----	1.09	3.42	----	----	11.90
(Last point)	LCP:	----	----	2.81	----	----	1.20	3.69	----	----	17.20
Zenith system temp. (K):	RCP:	----	----	33.4	----	----	30.3	39.5	----	----	160.5
	LCP:	----	----	37.1	----	----	32.8	34.3	----	----	167.5
Zenith Atmosphere Temp. (K):	RCP:	----	----	2.7*	----	----	5.4	2.8	----	----	22.4
* => assumed value used.	LCP:	----	----	2.7*	----	----	5.7	2.5	----	----	25.5
Uncorrected Gain (K/Jy):	RCP:	----	----	0.079	----	----	0.102	0.110	----	----	0.068
* => assumed value used.	LCP:	----	----	0.097	----	----	0.107	0.099	----	----	0.086
Opacity Corr. Gain (K/Jy):	RCP:	----	----	0.080	----	----	0.105	0.112	----	----	0.076
* => assumed value used.	LCP:	----	----	0.099	----	----	0.110	0.100	----	----	0.098
Efficiency (Opa. Corr.)	RCP:	----	----	0.45	----	----	0.59	0.63	----	----	0.43
* => assumed value used.	LCP:	----	----	0.55	----	----	0.62	0.56	----	----	0.55
Zenith system temp. (Jy):	RCP:	----	----	415.	----	----	288.	354.	----	----	2111.
* => based on assumed gain.	LCP:	----	----	376.	----	----	297.	343.	----	----	1713.

- 1.) At 1cm on 3 April, the Ts started reasonably low for one observation, and then jumped to about 300K for the rest of the time. The pointing remained fine. The gain was very low - about 0.014. I have no idea what the problem was and it did not occur again.
- 2.) The cables to the 90/50 cm receiver were damaged by the FRM and were not repaired during this period. No good data were obtained.
- 3.) Note that the 1cm sensitivity is much worse than at any other site. There used to be some other sites which also had fairly poor performance but those have mostly been fixed. This site now clearly stands out as the worst at this frequency.
- 4.) This site has the worst sensitivity at 20cm although it is not worse by a large margin.

VLBA_BR

Item		90cm	50cm	20cm	13cm	13cmsx	6cm	4cm	4cmsx	2cm	1cm
Points used for gains:	RCP:	64	83	57	----	----	68	509	----	----	438
	LCP:	66	70	55	----	----	68	519	----	----	434
Frequency in MHz (last point):		327.	611.	1655.	2262.	----	4998.	8418.	----	15068.	22228.
Expected beam size (arc min):		126.07	67.47	24.91	18.22	----	8.25	4.90	----	2.74	1.85
Cal Temperature (K):	RCP:	7.20	4.00	2.87	----	----	1.86	3.78	----	----	3.53
(Last point)	LCP:	7.10	4.00	2.64	----	----	1.79	3.80	----	----	3.72
Zenith system temp. (K):	RCP:	215.1	165.9	28.9	----	----	34.2	35.6	----	----	105.7
	LCP:	227.0	181.2	27.8	----	----	34.4	39.2	----	----	98.7
Zenith Atmosphere Temp. (K):	RCP:	2.7*	2.7*	2.7*	----	----	4.9	3.2	----	----	24.4
* => assumed value used.	LCP:	2.7*	2.7*	2.7*	----	----	4.7	3.4	----	----	22.8
Uncorrected Gain (K/Jy):	RCP:	0.057	0.038	0.090	----	----	0.115	0.102	----	----	0.074
* => assumed value used.	LCP:	0.057	0.044	0.090	----	----	0.110	0.110	----	----	0.072
Opacity Corr. Gain (K/Jy):	RCP:	0.058	0.039	0.092	----	----	0.118	0.103	----	----	0.084
* => assumed value used.	LCP:	0.058	0.045	0.092	----	----	0.113	0.112	----	----	0.081
Efficiency (Opa. Corr.)	RCP:	0.33	0.22	0.52	----	----	0.66	0.58	----	----	0.47
* => assumed value used.	LCP:	0.33	0.25	0.51	----	----	0.63	0.63	----	----	0.46
Zenith system temp. (Jy):	RCP:	3708.	4247.	315.	----	----	289.	345.	----	----	1256.
* => based on assumed gain.	LCP:	3905.	4030.	303.	----	----	306.	351.	----	----	1211.

- 1.) There is a curvature in the azimuth pointing as a function of elevation apparent in both the 4cm and 1cm data that cannot be taken out by the pointing equation. The peak errors due to this curvature are about 8 arcseconds.

VLBA_HN

Item		90cm	50cm	20cm	13cm	13cm _{max}	6cm	4cm	4cm _{max}	2cm	1cm
Points used for gains:	RCP:	25	----	27	25	----	255	63	----	----	65
	LCP:	24	----	30	25	----	256	63	----	----	66
Frequency in MHz (last point):		327.	611.	1655.	2262.	----	4998.	8418.	----	15068.	22232.
Expected beam size (arc min):		126.07	67.47	24.91	18.22	----	8.25	4.90	----	2.74	1.85
Cal Temperature (K):	RCP:	5.77	4.69	1.83	1.20	----	1.40	2.59	----	----	11.42
(Last point)	LCP:	6.04	----	1.75	1.48	----	1.30	2.77	----	----	11.44
Zenith system temp. (K):	RCP:	124.0	----	29.8	44.4	----	32.4	31.1	----	----	81.3
	LCP:	130.8	----	30.8	53.2	----	36.0	32.9	----	----	81.5
Zenith Atmosphere Temp. (K):	RCP:	2.7*	2.7*	2.7*	2.7*	----	4.6	2.3	----	----	17.1
* => assumed value used.	LCP:	2.7*	----	2.7*	2.7*	----	4.4	2.4	----	----	17.3
Uncorrected Gain (K/Jy):	RCP:	0.058	----	0.085	0.082	----	0.108	0.082	----	----	0.070
* => assumed value used.	LCP:	0.058	----	0.083	0.095	----	0.108	0.086	----	----	0.069
Opacity Corr. Gain (K/Jy):	RCP:	0.059	----	0.086	0.083	----	0.110	0.083	----	----	0.076
* => assumed value used.	LCP:	0.059	----	0.084	0.096	----	0.111	0.087	----	----	0.076
Efficiency (Opa. Corr.):	RCP:	0.33	----	0.48	0.46	----	0.62	0.47	----	----	0.43
* => assumed value used.	LCP:	0.33	----	0.47	0.54	----	0.62	0.49	----	----	0.43
Zenith system temp. (Jy):	RCP:	2099.	----	348.	537.	----	295.	375.	----	----	1065.
* => based on assumed gain.	LCP:	2216.	----	365.	551.	----	326.	381.	----	----	1072.

- 1.) The 50cm filter has not been installed.
- 2.) 2cm and 4/13cm need initial focus and colimation offsets (I thought we had some, but there does not seem to be and good pointing data.
- 3.) The 13cm performance is poor.