

New Pointing Equations for VLBA Antennas
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VLBA TEST MEMO NO. 34

I have gathered all of the good pointing data from March and April (plus May 7) into a large file from which new pointing equations and gains have been derived for most VLBA antennas and most frequencies. All antennas except SC are included. This memo gives the pointing results. The new (postfit) values here should be installed in the system and used for future observations. I have the detailed plots and data if anyone wants to see them.

For the 50/90 cm pointing position, use that listed for 50cm. Note that there is often a large difference between these two. This is well above the noise and probably indicates some problem.

We have ongoing problems with the ellipsoids at PT, KP, and LA. The ellipsoids need to be pinned - they keep moving. We have been trying to do this at KP but have been having all kinds of problems with communications, FRM etc. I will try to get new values for the 4/13 cm system at these sites soon.

Collimation offsets in parenthesis are calculated values based on changing the old values by the same amount as the 1cm values were changed. These need to be remeasured soon.

Possible long term changes can be checked by comparing these results with VLBA Test Memos 22, 23, 25 and some more recent mail messages and documents giving new equations. In most cases changes in terms that are not highly correlated are small. There is a continuing tilt at Pie Town which has amounted to about 0.4 arcminutes to the west and about 0.7 arcminutes to the south since the Fall of 1988 (3.5 years). Other sites have changed by smaller amounts, some by less than the measurement errors.

VLBA_PT

Item		90cm	50cm	20cm	13cm	13cm _{max}	6cm	4cm	4cm _{max}	2cm	1cm	7mm
Collimation offsets:												
Postfit average offset:	Az:	4.92	4.63	1.12	-0.85	----	1.03	-1.24	(-0.09)	1.31	-0.12	(-1.93)
(arc min)	El:	3.76	8.86	-3.09	-0.67	----	-0.02	-2.86	(-5.74)	0.08	0.24	(-1.55)

POINTING FIT RESULTS from band: 1cm
 (All in arcmin except az. enc.)

ITEM	Screen item	Old Value	Wt.	Change	New Value
1: West Tilt	EWTILT	0.62	1.	0.03	0.65
2: North Tilt	NSTILT	-0.52	1.	-0.23	-0.75
4: Azimuth Encoder	AZ ENC	-179D18'56"	1.	0.00	-179D18'56"
5: Sag	ELCENC	-1.43	1.	-0.34	-1.77
7: Azimuth Cos(2*Az)	FLEXC	0.28	1.	-0.11	0.17
8: Azimuth Sin(2*Az)	FLEXS	0.46	1.	-0.05	0.41
9: Elev. Cos(2*Az)	ELQUADC	0.09	1.	-0.03	0.06
10: Elev. Sin(2*Az)	ELQUADS	0.16	1.	-0.02	0.14
11: Axis Non-perp.	PERP	0.00	0.	0.00	0.00
12: Az. Encoder - Cos.	AZCENC	0.04	1.	-0.03	0.01
13: Az. Encoder - Sin.	AZCENS	-0.08	1.	0.04	-0.04
14: El. Encoder - Sin.	ELCENS	0.52	1.	-1.08	-0.56
El. Encoder - Cos. is same as sag.					

VLBA~~LA~~

Item		90cm	50cm	20cm	13cm	13cmsx	6cm	4cm	4cmsx	2cm	1cm	7mm
Collimation offsets:												
Postfit average offset:	Az:	4.70	4.00	0.73	1.00	----	0.68	0.63	----	0.40	0.57	(0.17)
(arc min)	El:	6.05	-0.20	2.94	2.47	----	1.23	2.23	----	1.34	1.43	(1.45)

POINTING FIT RESULTS from band: 1cm
(All in arcmin except az. enc.)

ITEM	Screen item	Old Value	Wt.	Change	New Value
1: West Tilt	EWTILT	0.14	1.	0.01	0.15
2: North Tilt	NSTILT	0.15	1.	-0.01	0.14
4: Azimuth Encoder	AZ ENC	-180D01'26"	1.	-0.17	-180D01'36"
5: Sag	ELCENC	-1.75	1.	0.34	-1.41
7: Azimuth Cos(2*Az)	FLEXC	0.38	1.	-0.08	0.30
8: Azimuth Sin(2*Az)	FLEXS	0.09	1.	-0.06	0.03
9: Elev. Cos(2*Az)	ELQUADC	0.09	1.	-0.05	0.04
10: Elev. Sin(2*Az)	ELQUADS	0.11	1.	-0.13	-0.02
11: Axis Non-perp.	PERP	0.00	0.	0.00	0.00
12: Az. Encoder - Cos.	AZCENC	-0.08	1.	-0.01	-0.09
13: Az. Encoder - Sin.	AZCENS	-0.08	1.	0.03	-0.05
14: El. Encoder - Sin.	ELCENS	0.06	1.	0.08	0.14
El. Encoder - Cos. is same as sag.					

*** The ellipsoid has been moved and sources weren't in the beam on the first test. Totally new 4cmsx values are needed.

VLBA_{LA}

Item		90cm	50cm	20cm	13cm	13cmsx	6cm	4cm	4cmsx	2cm	1cm	7mm
Postfit average offset:	Az:	4.73	6.17	0.76	0.19	-----	1.12	-0.51	(-0.36)	1.36	0.39	(1.35)
(arc min)	El:	-0.99	-1.00	-5.21	-4.01	-----	-3.51	-4.58	(-1.05)	-4.26	-3.49	(-4.75)

POINTING FIT RESULTS from band: 1cm
(All in arcmin except az. enc.)

ITEM	Screen item	Old Value	Wt.	Change	New Value
1: West Tilt	EWTILT	0.03	1.	0.02	0.05
2: North Tilt	NSTILT	0.23	1.	0.06	0.29
4: Azimuth Encoder	AZ ENC	179D42'52"	1.	-0.04	179D42'50"
5: Sag	ELCENC	-1.23	1.	-0.20	-1.43
7: Azimuth Cos(2*Az)	FLEXC	0.16	1.	-0.01	0.15
8: Azimuth Sin(2*Az)	FLEXS	-0.07	1.	-0.05	-0.12
9: Elev. Cos(2*Az)	ELQUADC	0.04	1.	0.02	0.06
10: Elev. Sin(2*Az)	ELQUADS	0.05	1.	-0.05	0.00
11: Axis Non-perp.	PERP	0.00	0.	0.00	0.00
12: Az. Encoder - Cos.	AZCENC	-0.02	1.	-0.06	-0.08
13: Az. Encoder - Sin.	AZCENS	0.00	1.	-0.05	-0.05
14: El. Encoder - Sin.	ELCENS	0.33	1.	-0.60	-0.27
El. Encoder - Cos. is same as sag.					

VLBA_FD

Item		90cm	50cm	20cm	13cm	13cmsx	6cm	4cm	4cmsx	2cm	1cm
Collimation offsets:											
Postfit average offset:	Az:	5.20	6.46	0.57	-0.68	-0.70	-1.38	-0.05	-1.19	----	-1.55
	El:	2.55	4.75	-3.30	-4.96	-5.04	-3.73	-4.71	-4.83	----	-4.40

POINTING FIT RESULTS from band: 1cm
(All in arcmin except az. enc.)

ITEM	Screen item	Old Value	Wt.	Change	New Value
1: West Tilt	EWTILT	0.13	1.	0.08	0.21
2: North Tilt	NSTILT	0.12	1.	0.01	0.13
4: Azimuth Encoder	AZ ENC	-179D16'52"	1.	-0.15	-179D17'01"
5: Sag	ELCENC	-1.44	1.	0.18	-1.26
7: Azimuth Cos(2*Az)	FLEXC	0.04	1.	0.04	0.08
8: Azimuth Sin(2*Az)	FLEXS	-0.04	1.	0.01	-0.03
9: Elev. Cos(2*Az)	ELQUADC	0.03	1.	0.03	0.06
10: Elev. Sin(2*Az)	ELQUADS	-0.01	1.	0.00	-0.01
11: Axis Non-perp.	PERP	0.00	0.	0.00	0.00
12: Az. Encoder - Cos.	AZCENC	-0.05	1.	0.05	0.00
13: Az. Encoder - Sin.	AZCENS	0.01	1.	0.02	0.03
14: El. Encoder - Sin.	ELCENS	0.39	1.	0.08	0.47
El. Encoder - Cos. is same as sag.					

VLBA_NL

Item		90cm	50cm	20cm	13cm	13cmsx	6cm	4cm	4cmsx	2cm	1cm	7mm
Collimation offsets:												
Postfit average offset:	Az:	1.94	2.70	1.55	-2.09	-1.75	-0.09	-1.39	-2.07	----	-1.37	(-1.37)
	El:	1.86	-7.74	-3.91	-1.75	-1.67	-0.11	-3.78	-1.24	----	-0.54	(-0.54)

POINTING FIT RESULTS from band: 1cm
(All in arcmin except az. enc.)

ITEM	Screen item	Old Value	Wt.	Change	New Value
1: West Tilt	EWTILT	0.02	1.	0.02	0.04
2: North Tilt	NSTILT	0.23	1.	-0.07	0.16
4: Azimuth Encoder	AZ ENC	179D44'56"	1.	-0.09	179D44'50"
5: Sag	ELCENC	-2.27	1.	0.15	-2.12
7: Azimuth Cos(2*Az)	FLEXC	0.00	1.	0.04	0.04
8: Azimuth Sin(2*Az)	FLEXS	-0.18	1.	0.03	-0.15
9: Elev. Cos(2*Az)	ELQUADC	0.03	1.	0.00	0.03
10: Elev. Sin(2*Az)	ELQUADS	-0.02	1.	-0.04	-0.06
11: Axis Non-perp.	PERP	0.00	0.	0.00	0.00
12: Az. Encoder - Cos.	AZCENC	-0.08	1.	0.10	0.02
13: Az. Encoder - Sin.	AZCENS	-0.25	1.	0.07	-0.18
14: El. Encoder - Sin.	ELCENS	-0.06	1.	-0.14	-0.20
El. Encoder - Cos. is same as sag.					

***** The 2 cm system needs initial values.

VLBA_V

Item		90cm	50cm	20cm	13cm	13cmsx	6cm	4cm	4cmsx	2cm	1cm
Collimation offsets:											
Postfit average offset:	Az:	----	----	1.46	----	----	-0.18	1.37	(1.37)	----	-0.19
(arc min)	El:	----	----	-6.34	----	----	-7.98	-8.09	(-8.09)	----	-8.44

POINTING FIT RESULTS from band: 1cm
(All in arcmin except az. enc.)

ITEM	Screen item	Old Value	Wt.	Change	New Value
1: West Tilt	EWTILT	0.19	1.	0.02	0.21
2: North Tilt	NSTILT	-0.11	1.	0.02	-0.09
4: Azimuth Encoder	AZ ENC	178D15'31"	1.	-0.25	178D15'16"
5: Sag	ELCENC	-1.52	1.	0.15	-1.37
7: Azimuth Cos(2*Az)	FLEXC	0.00	1.	0.07	0.07
8: Azimuth Sin(2*Az)	FLEXS	0.08	1.	-0.05	0.03
9: Elev. Cos(2*Az)	ELQUADC	-0.02	1.	0.02	0.00
10: Elev. Sin(2*Az)	ELQUADS	0.04	1.	-0.01	0.03
11: Axis Non-perp.	PERP	0.00	0.	0.00	0.00
12: Az. Encoder - Cos.	AZCENC	0.01	1.	-0.01	0.00
13: Az. Encoder - Sin.	AZCENS	0.07	1.	-0.06	0.01
14: El. Encoder - Sin.	ELCENS	-0.03	1.	0.12	0.09
El. Encoder - Cos. is same as sag.					

***** The cables to the 50/90 cm system were damaged. New offsets await a fix.

***** The rotation position for 4/13cm should be the same as for 4cm until the ellipsoid gets there.

VLBA_BR

Item		90cm	50cm	20cm	13cm	13cmsx	6cm	4cm	4cmsx	2cm	1cm
Collimation offsets:											
Postfit average offset:	Az:	3.66	0.77	2.14	----	----	2.71	-1.00	(-1.00)	----	1.29
(arc min)	El:	-0.44	0.18	-1.79	----	----	1.99	-0.84	(-0.84)	----	2.54

POINTING FIT RESULTS from band: 1cm
(All in arcmin except az. enc.)

ITEM	Screen item	Old Value	Wt.	Change	New Value
1: West Tilt	EWTILT	0.03	1.	-0.05	-0.02
2: North Tilt	NSTILT	0.05	1.	-0.05	0.00
4: Azimuth Encoder	AZ ENC	179D53'20"	1.	-0.01	179D53'19"
5: Sag	ELCENC	-1.63	1.	0.33	-1.30
7: Azimuth Cos(2*Az)	FLEXC	0.05	1.	-0.01	0.04
8: Azimuth Sin(2*Az)	FLEXS	0.03	1.	-0.02	0.01
9: Elev. Cos(2*Az)	ELQUADC	0.00	1.	-0.01	-0.01
10: Elev. Sin(2*Az)	ELQUADS	0.04	1.	-0.04	0.00
11: Axis Non-perp.	PERP	0.00	0.	0.00	0.00
12: Az. Encoder - Cos.	AZCENC	0.29	1.	-0.03	0.26
13: Az. Encoder - Sin.	AZCENS	-0.27	1.	0.01	-0.26
14: El. Encoder - Sin.	ELCENS	0.06	1.	0.18	0.24
El. Encoder - Cos. is same as sag.					

***** The rotation position for 4/13cm should be the same as for 4cm until the ellipsoid gets there.

VLBA_HN

Item		90cm	50cm	20cm	13cm	13cmsx	6cm	4cm	4cmsx	2cm	1cm	7mm

Collimation offsets:												
Postfit average offset:	Az:	2.32	-----	-1.20	1.21	-----	1.58	-0.97	(0.95)	(1.12)	1.72	(1.27)
(arc min)	El:	-0.67	-----	-0.23	1.41	-----	-1.21	0.64	(0.28)	(-2.10)	-0.16	(0.95)

POINTING FIT RESULTS from band: 1cm
(All in arcmin except az. enc.)

ITEM	Screen item	Old Value	Wt.	Change	New Value
1: West Tilt	EWILT	-0.03	1.	0.10	0.07
2: North Tilt	NSTILT	0.04	1.	0.04	0.08
4: Azimuth Encoder	AZ ENC	180D11'00"	1.	-0.03	180D10'58"
5: Sag	ELCENC	-1.38	1.	0.13	-1.25
7: Azimuth Cos(2*Az)	FLEXC	-0.32	1.	-0.06	-0.38
8: Azimuth Sin(2*Az)	FLEXS	-0.10	1.	-0.03	-0.13
9: Elev. Cos(2*Az)	ELQUADC	-0.16	1.	0.05	-0.11
10: Elev. Sin(2*Az)	ELQUADS	-0.03	1.	-0.03	-0.06
11: Axis Non-perp.	PERP	0.00	0.	0.00	0.00
12: Az. Encoder - Cos.	AZCENC	-0.11	1.	-0.02	-0.13
13: Az. Encoder - Sin.	AZCENS	0.01	1.	-0.07	-0.06
14: El. Encoder - Sin.	ELCENS	0.13	1.	-0.06	0.07
El. Encoder - Cos. is same as sag.					

***** 50 cm is still missing a filter. The 4/13 cm and 2 cm system still need initial values.

