



Pointing Calibration and Correction

S.B. Luthcke*, T.A. Williams, Chreston Martin

*Code 698, Planetary Geodynamics Laboratory
NASA Goddard Space Flight Center

ICESat Science Team Meeting
Boulder, CO
March 25-26, 2008



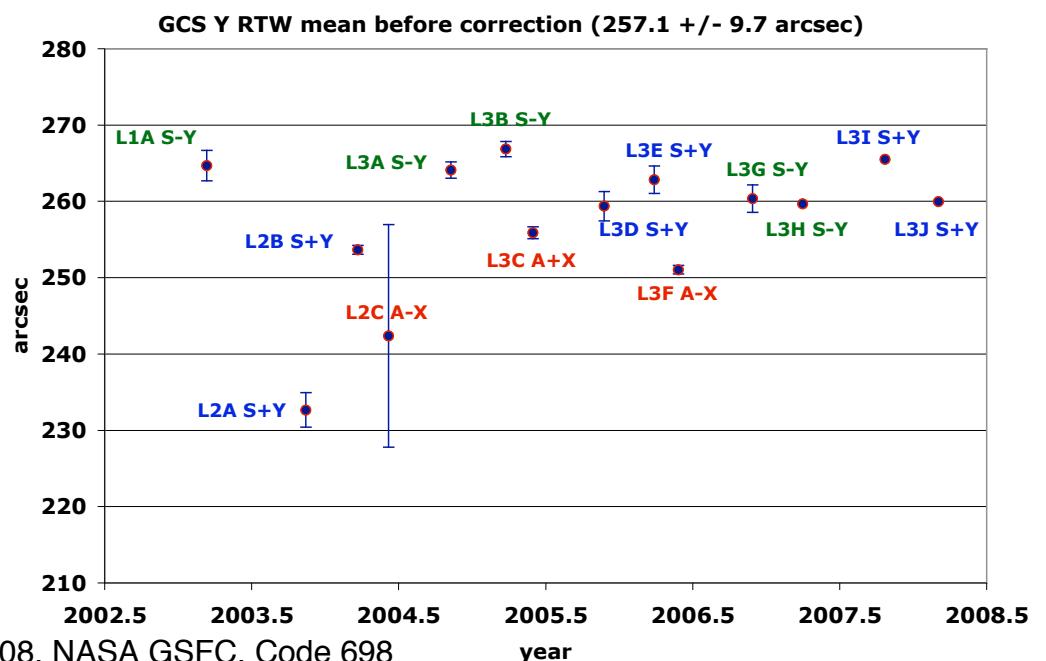
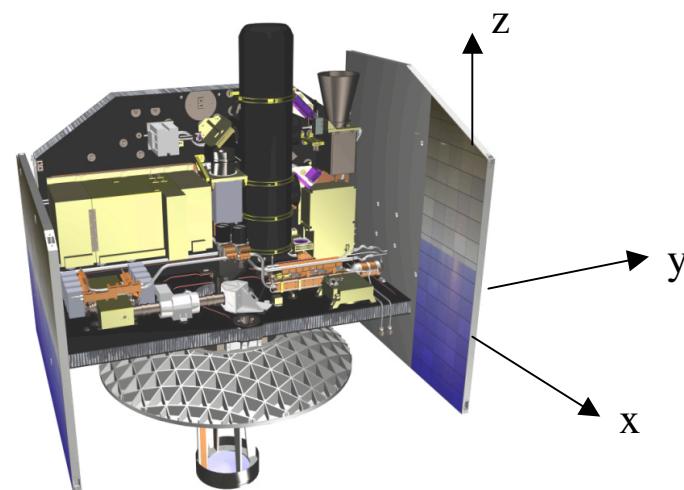
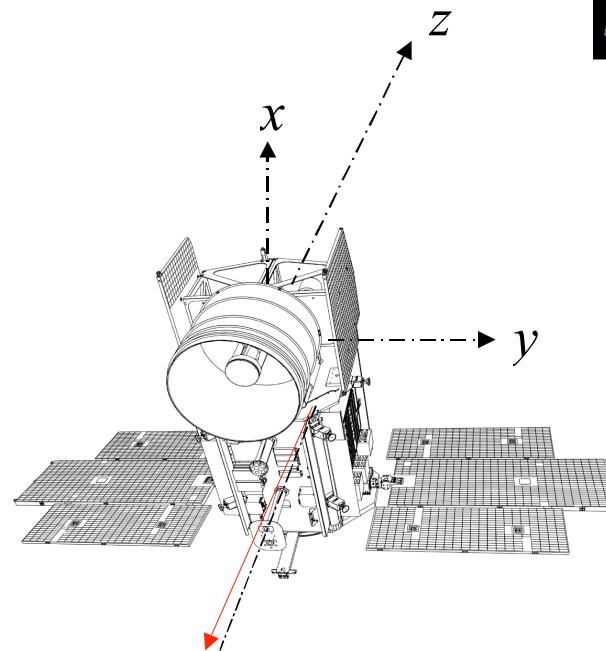
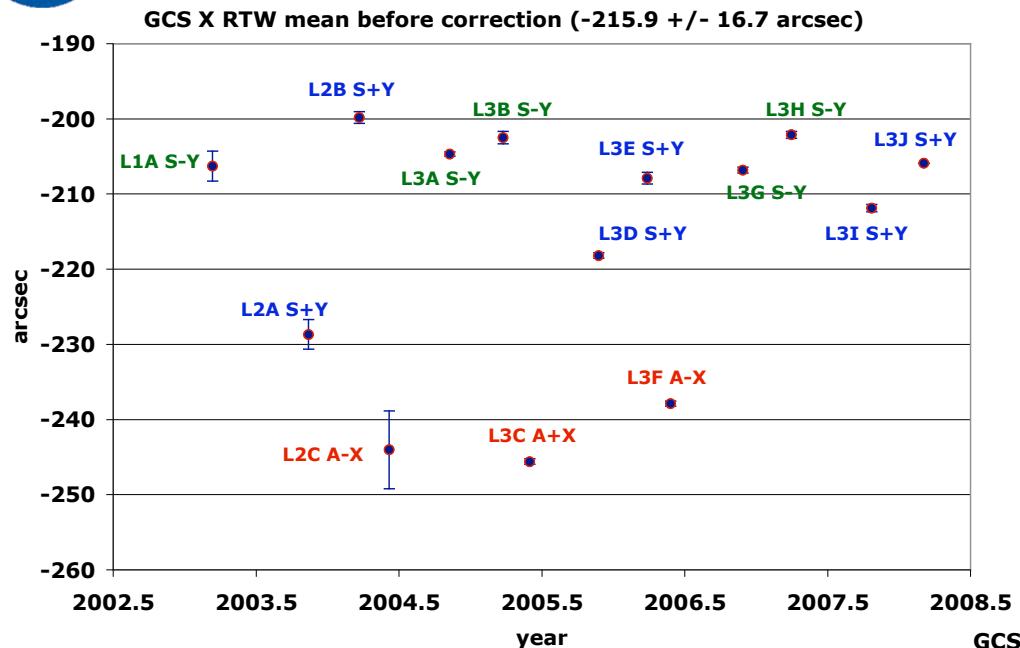
Overview



- Summary of range residual analysis calibration, validation and correction. Focus on pointing.
 - Need to correct sizable observation period pointing biases, trends and orbital variation that is changing in time - largest error source in rel. 128-328 data.
- Pointing calibration and correction from:
 - Scan Maneuver calibrations
 - Short period, 8-day, crossovers
- Initial validation from:
 - *J. Dimarzio* xovers
 - *C. Martin* local pointing calibrations
 - *T. Urban* ocean analysis
- Initial calibrations and corrections completed for all observations periods, except:
 - L1B... refining calibrations and corrections
 - L2C ... beginning analysis
 - L3J ... currently working on
- *New Round-The-World scans that do not interfere with Greenland and Antarctica.....Preliminary analysis demonstrates they are performing well.*



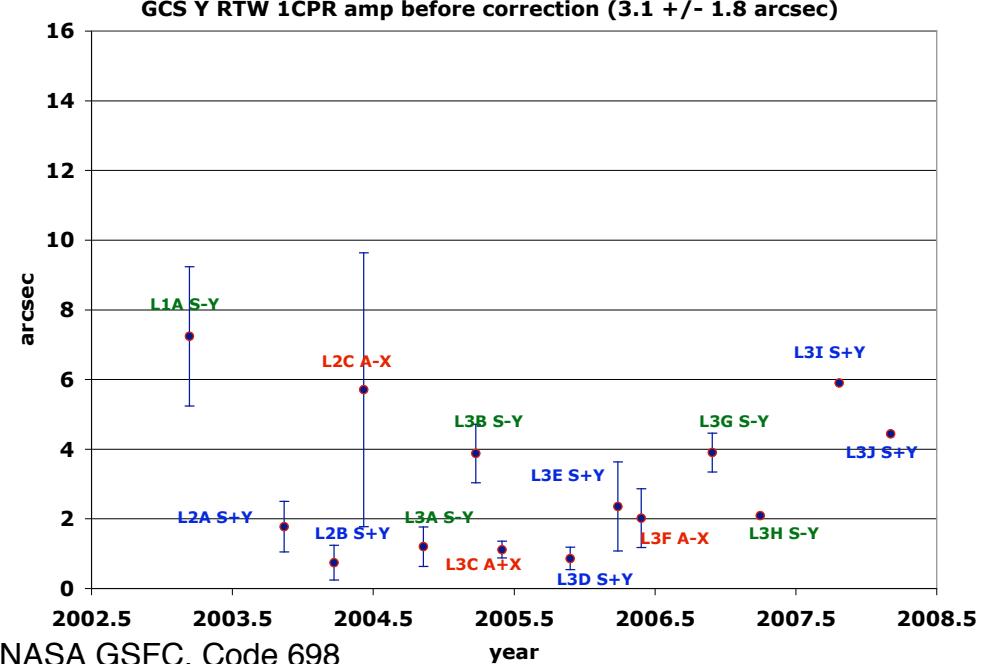
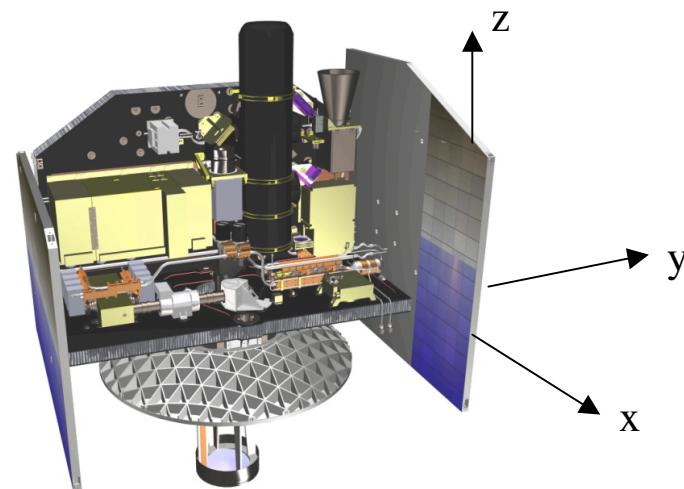
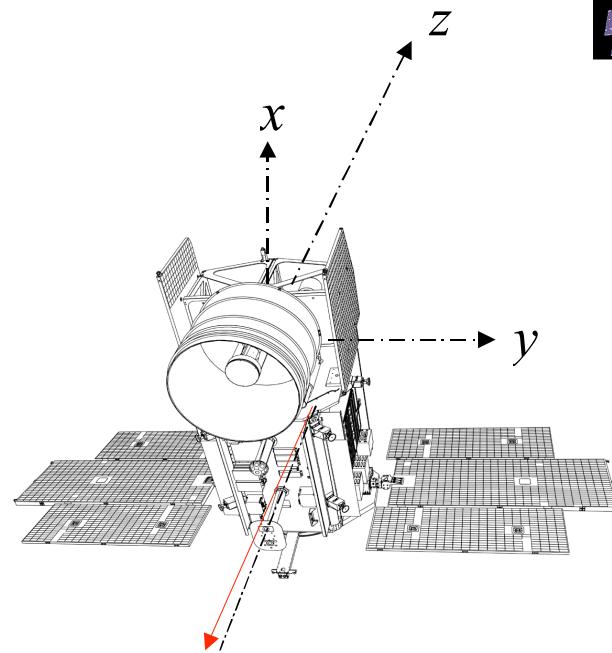
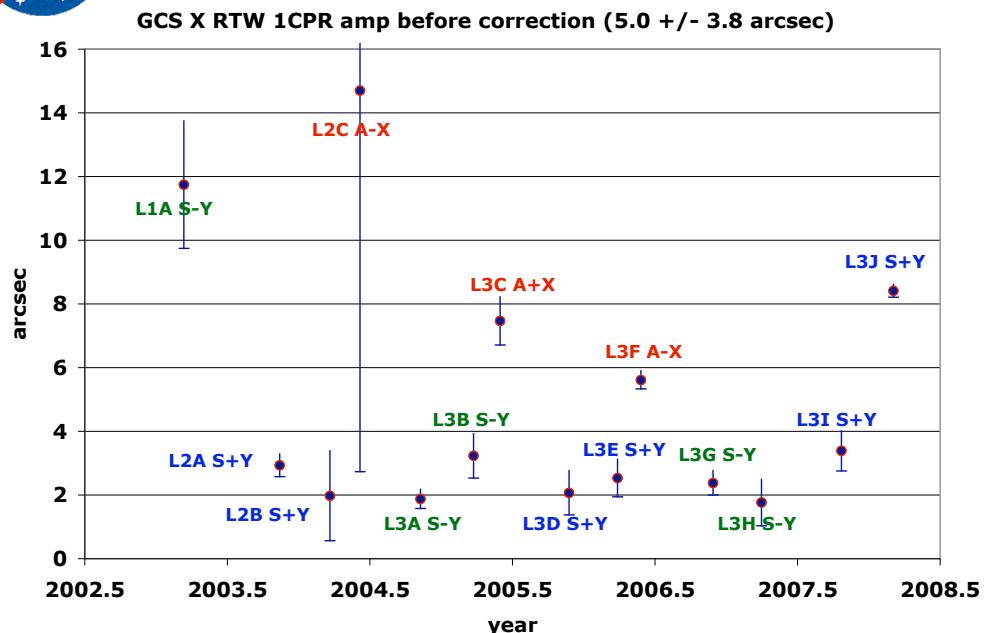
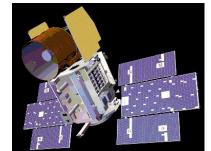
Initial Pointing Bias Calibration



Luthcke et al. 2008, NASA GSFC, Code 698



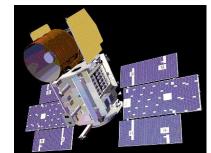
RTWS 1CPR amp. before corrections



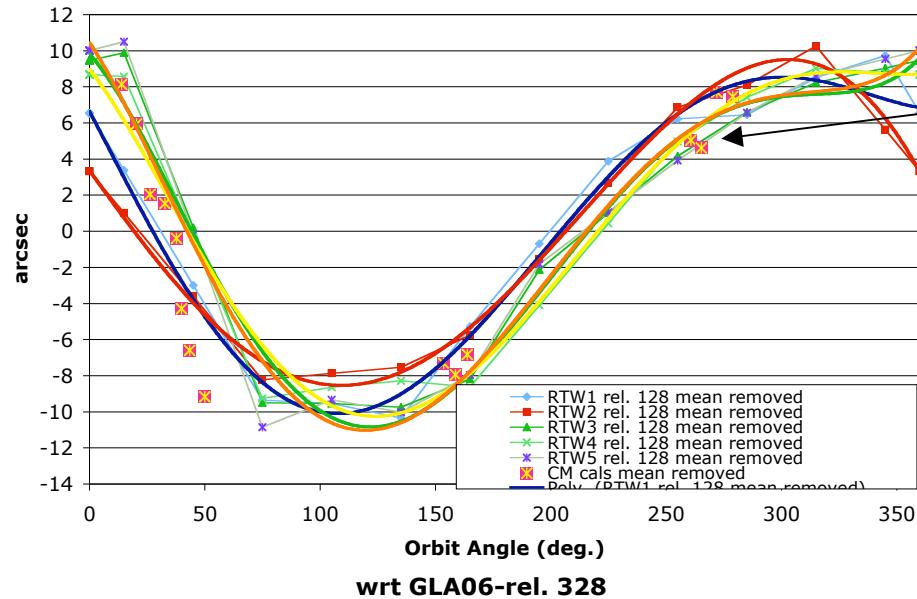
Luthcke et al. 2008, NASA GSFC, Code 698



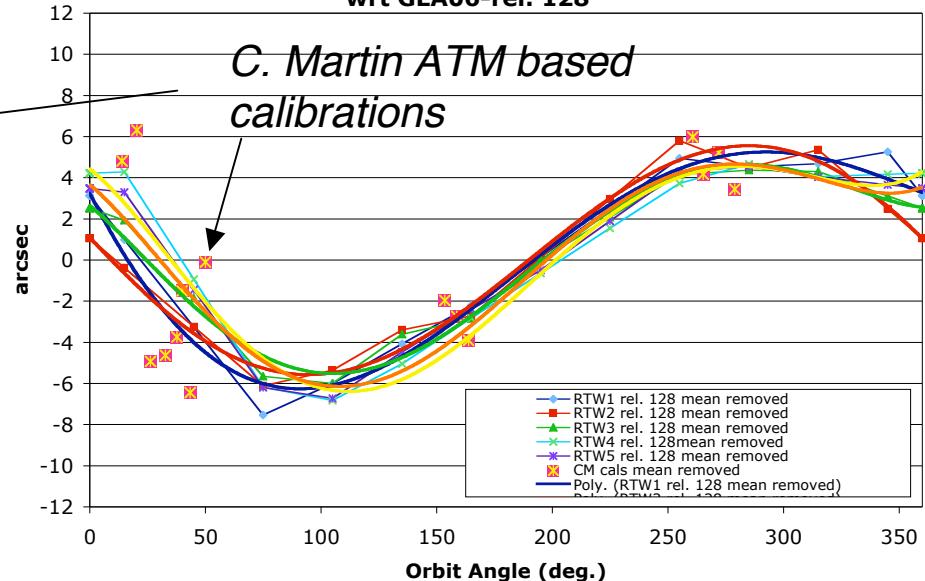
L3G SM Validation/Calibration



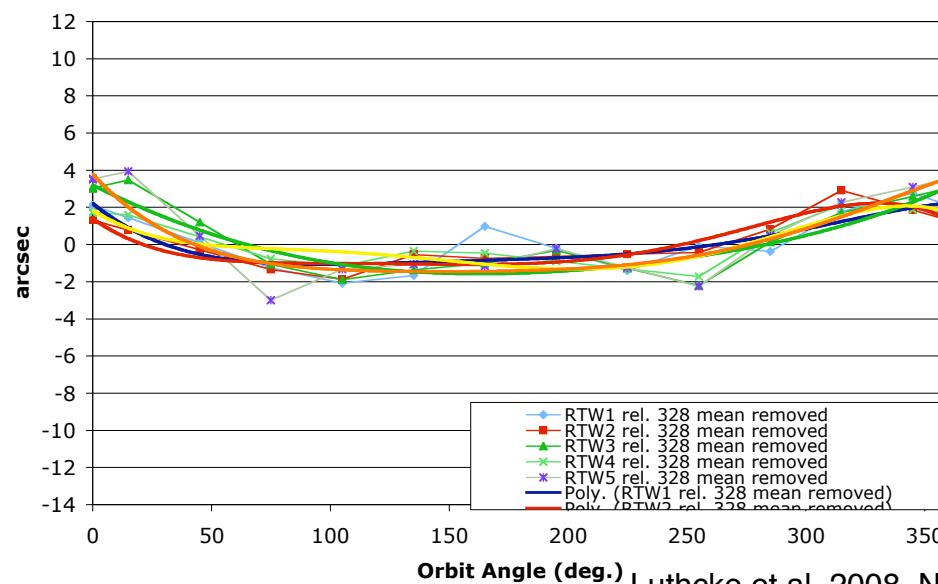
L3G Pointing Orbital Variation Calibration (about GCS X)
wrt GLA06-rel. 128



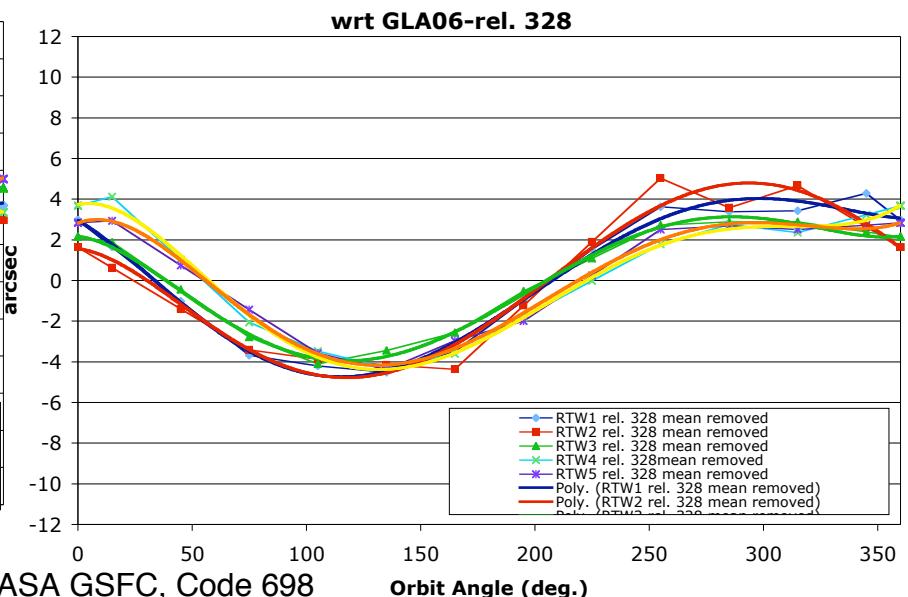
L3G Pointing Orbital Variation Calibration (about GCS Y)
wrt GLA06-rel. 128



wrt GLA06-rel. 328



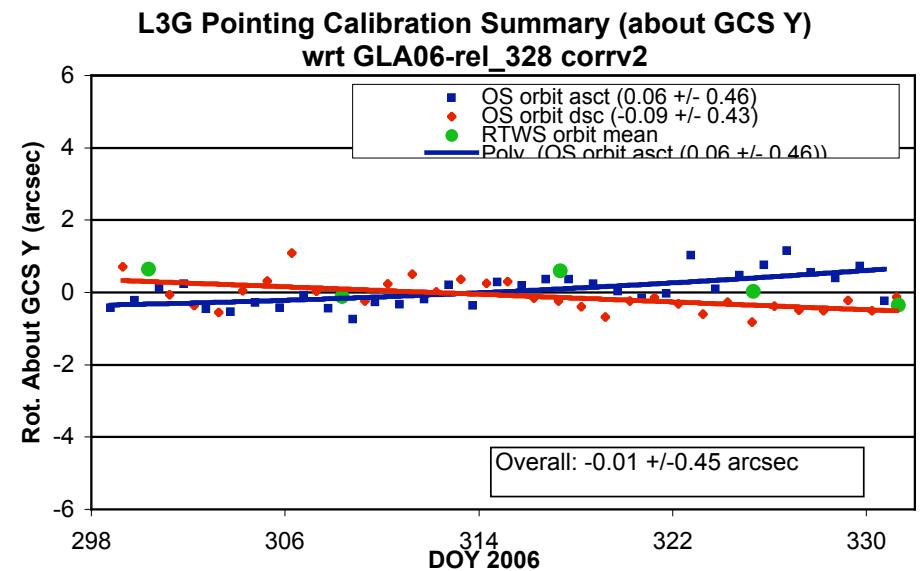
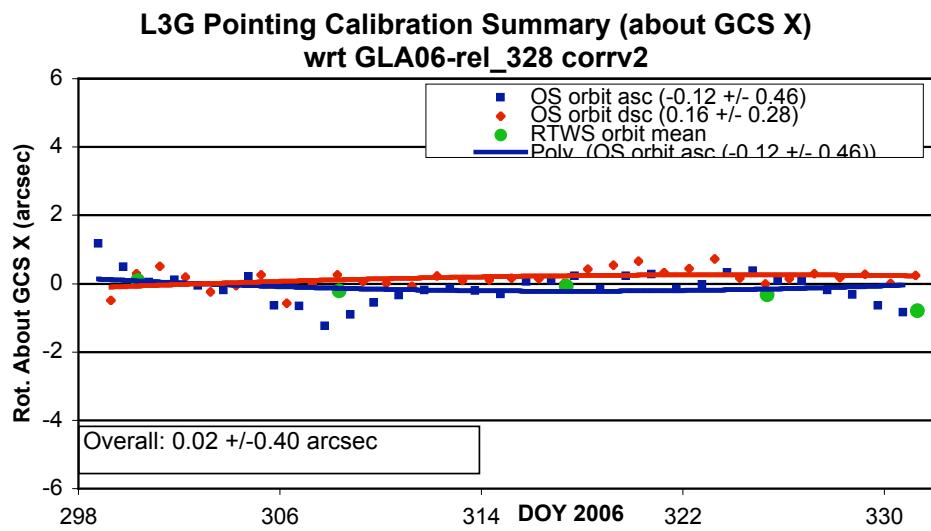
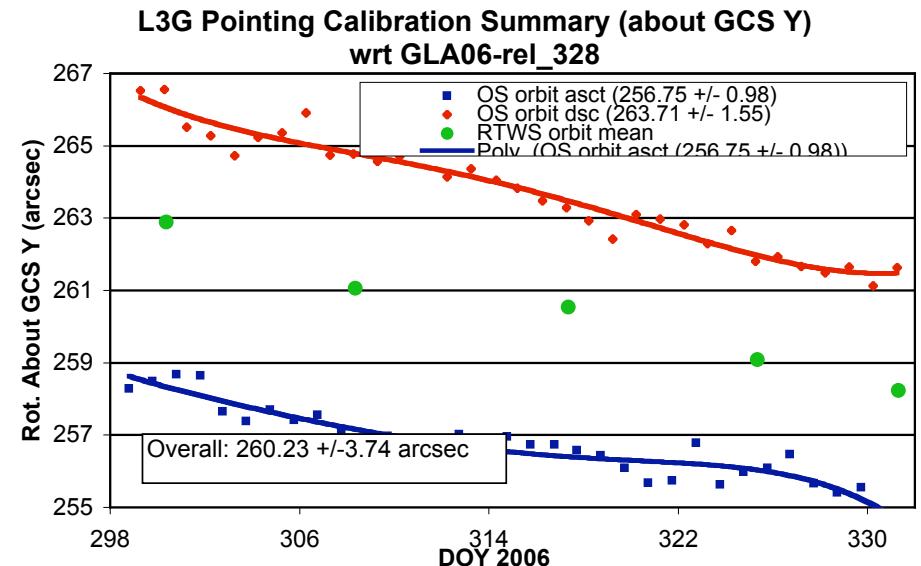
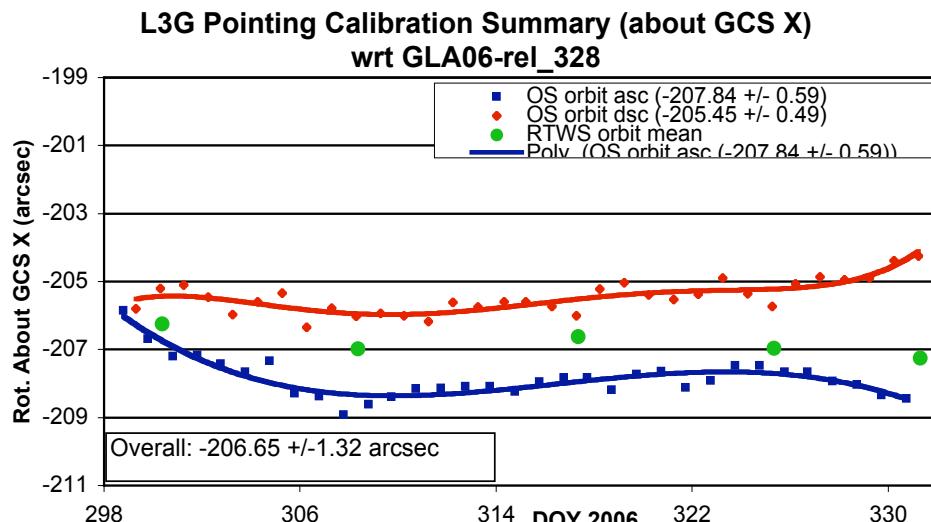
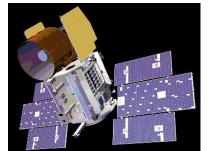
wrt GLA06-rel. 328



Luthcke et al. 2008, NASA GSFC, Code 698

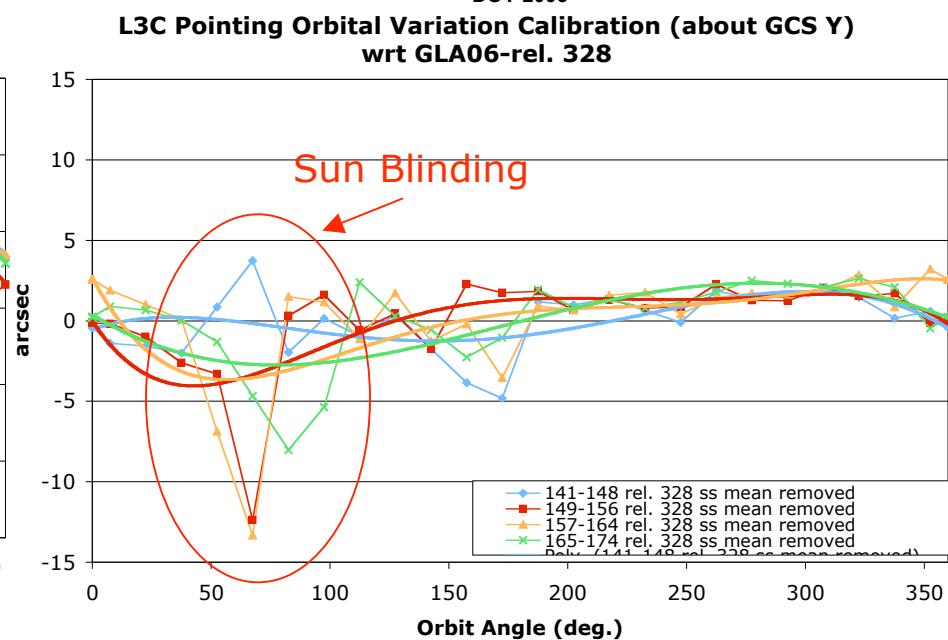
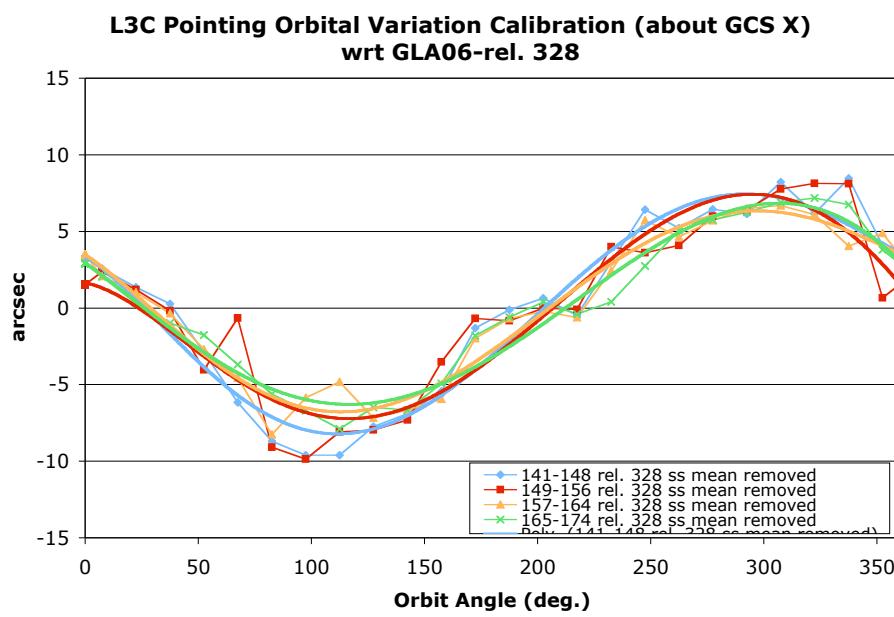
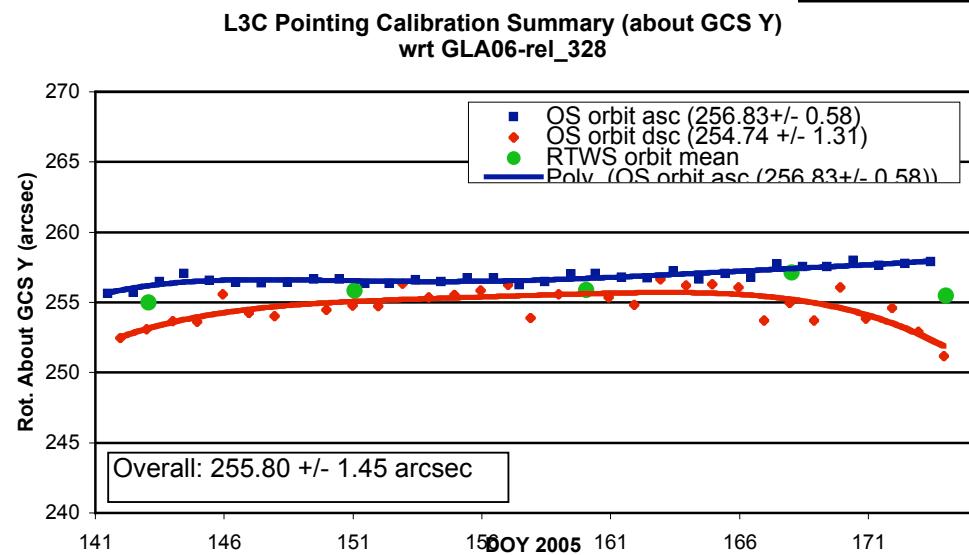
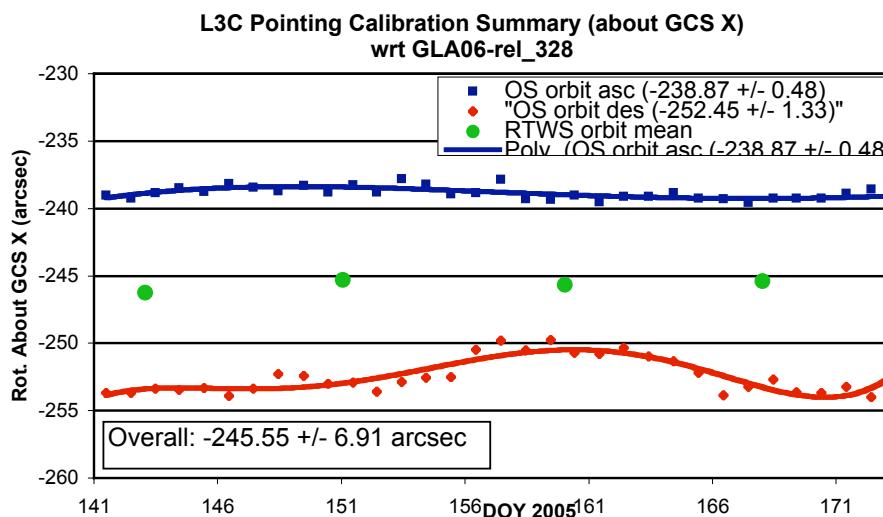
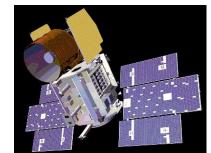


L3G SM Validation/Calibration



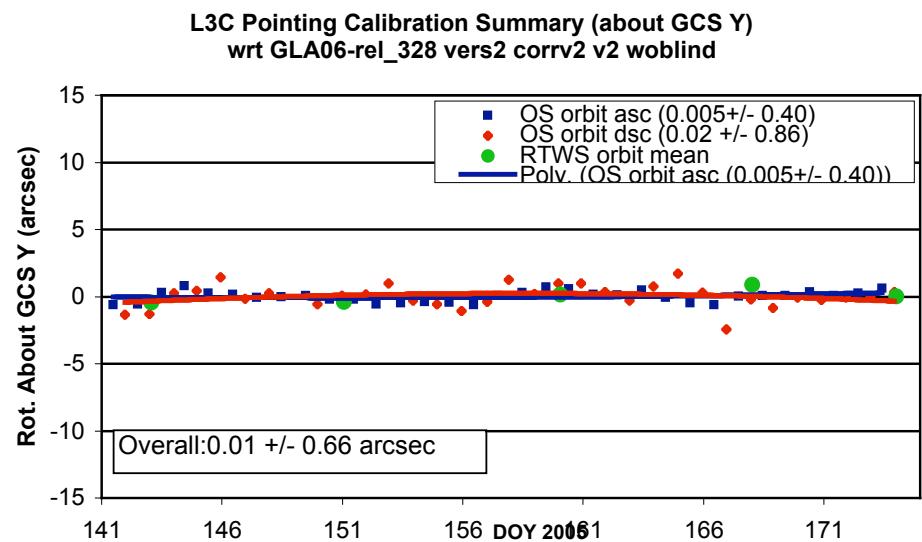
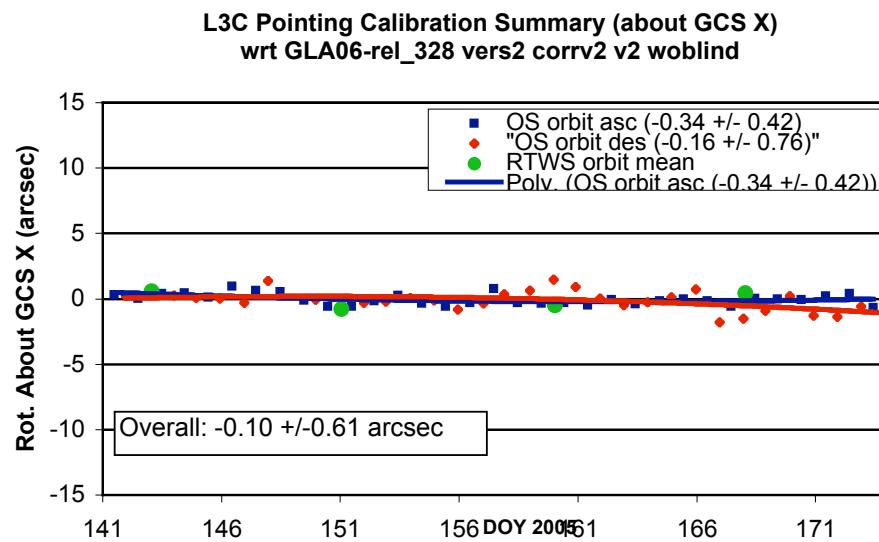
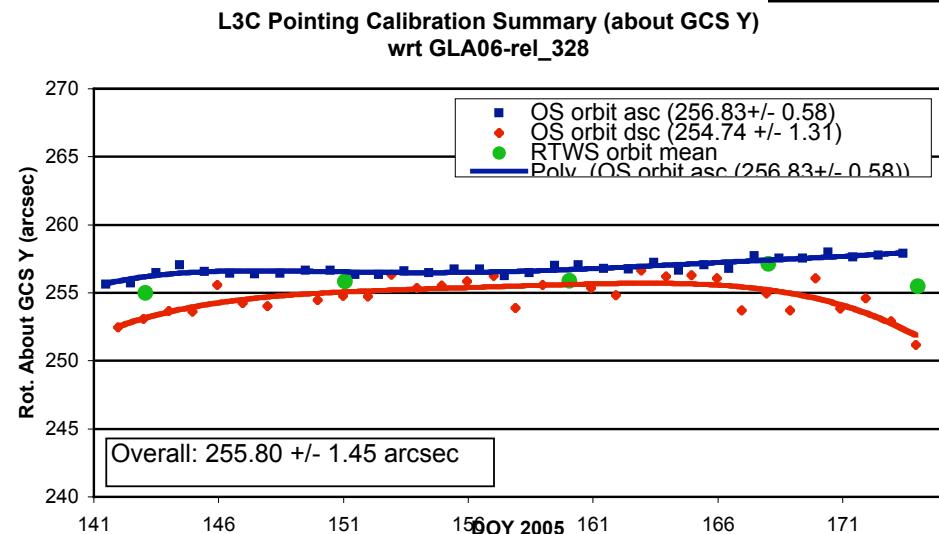
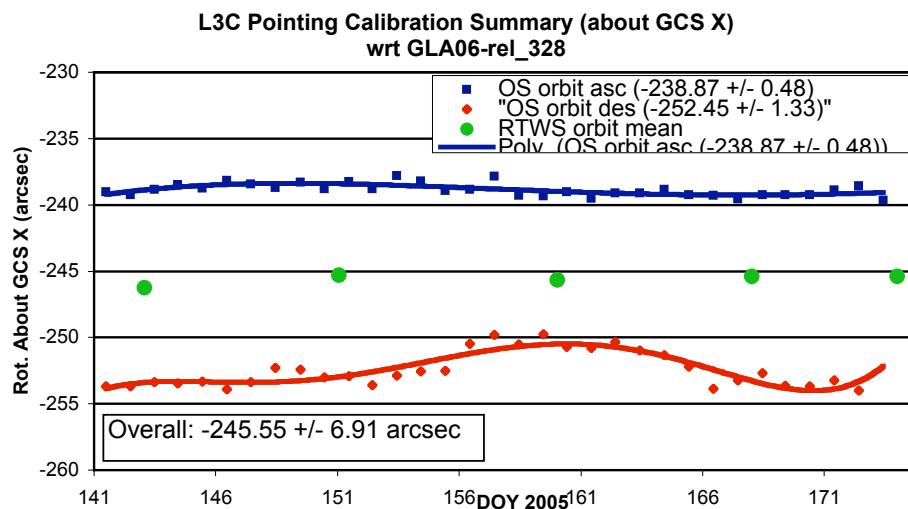
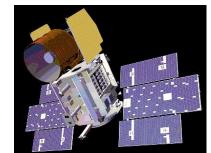


L3C SM Validation/Calibration



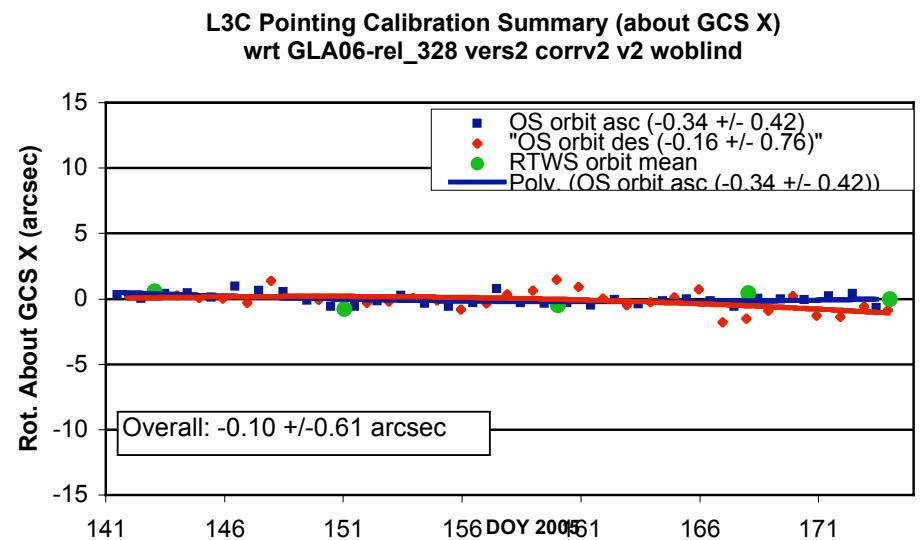
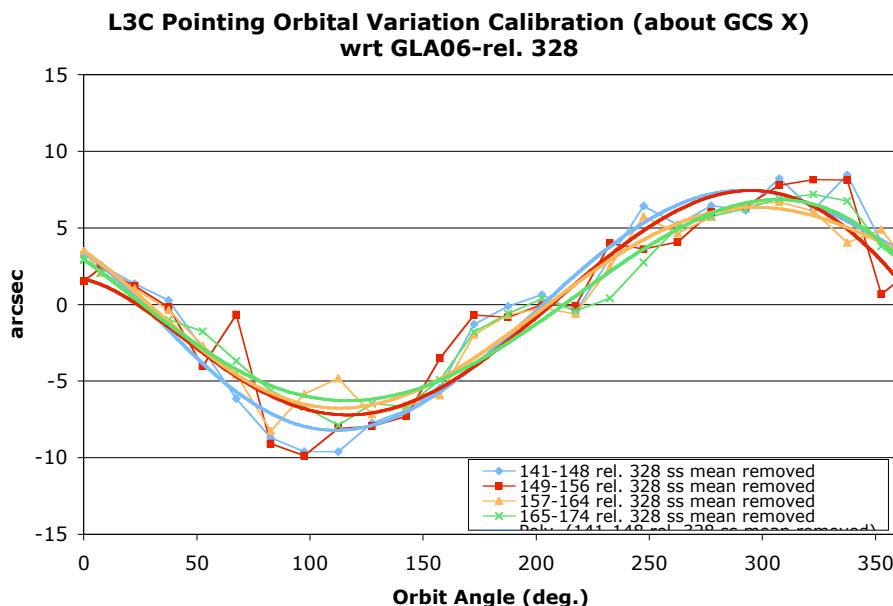
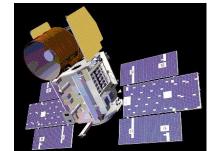


L3C SM Validation/Calibration

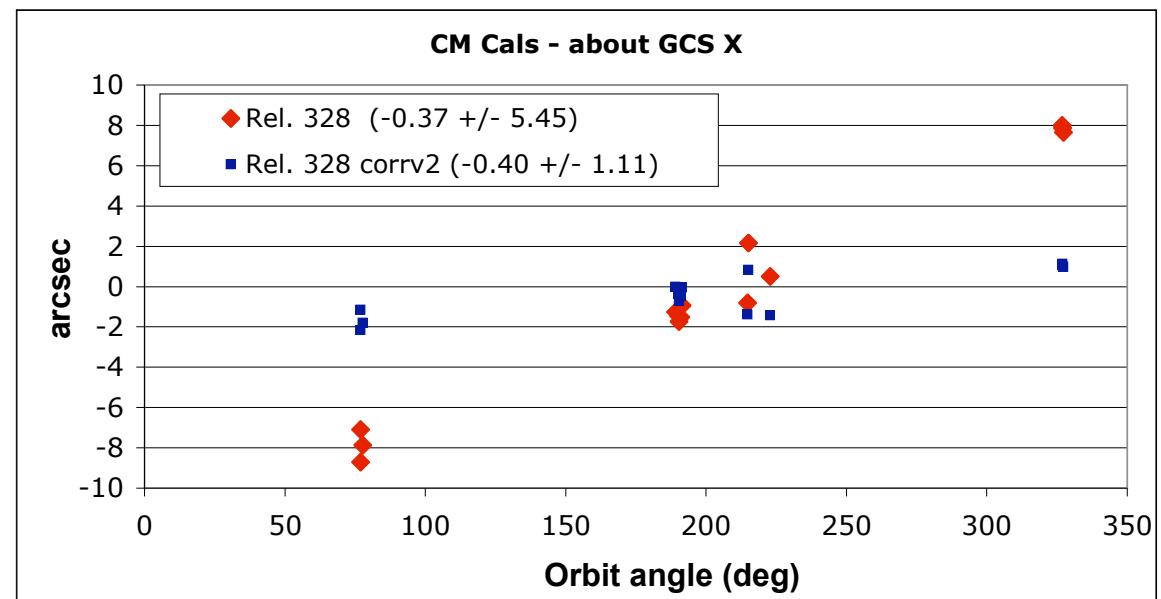




L3C SM Validation/Calibration

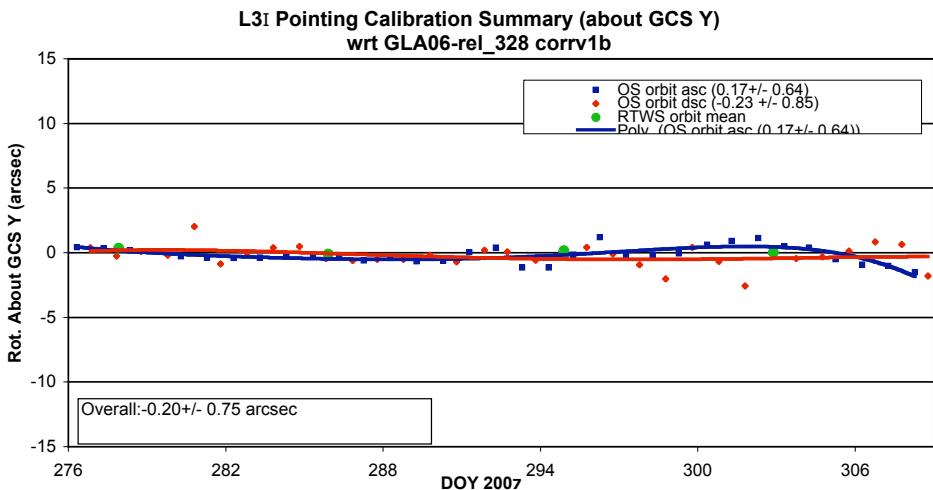
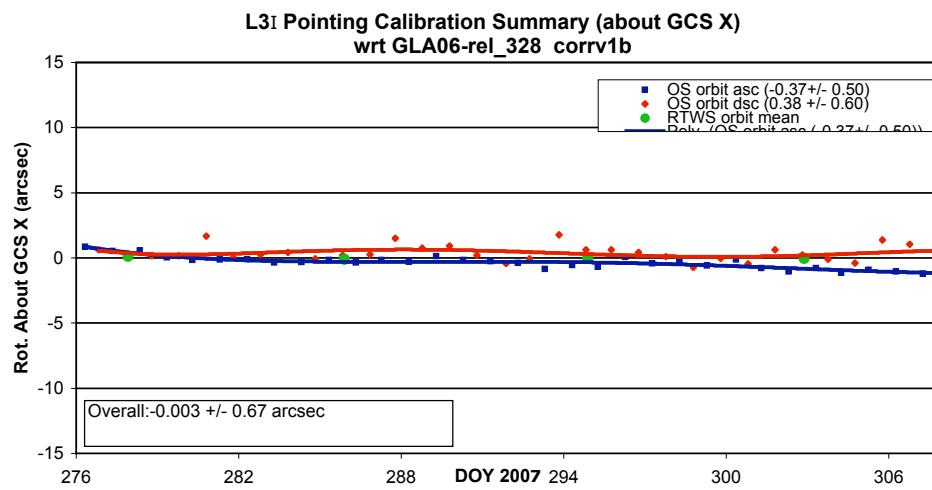
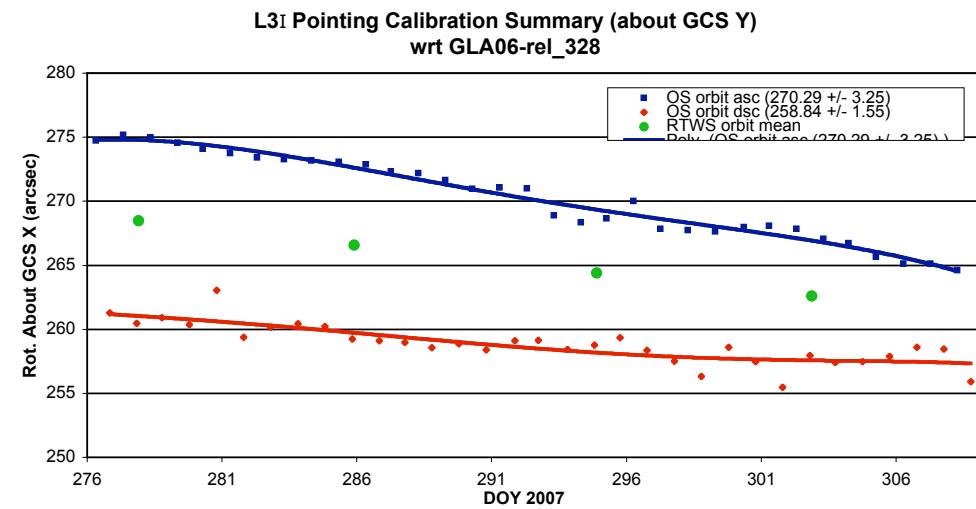
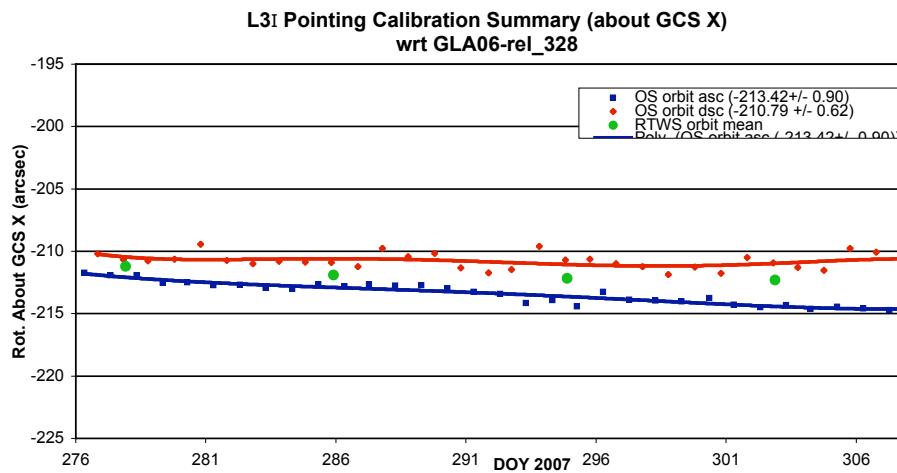
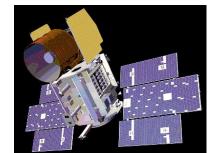


C. Martin Calibrations →



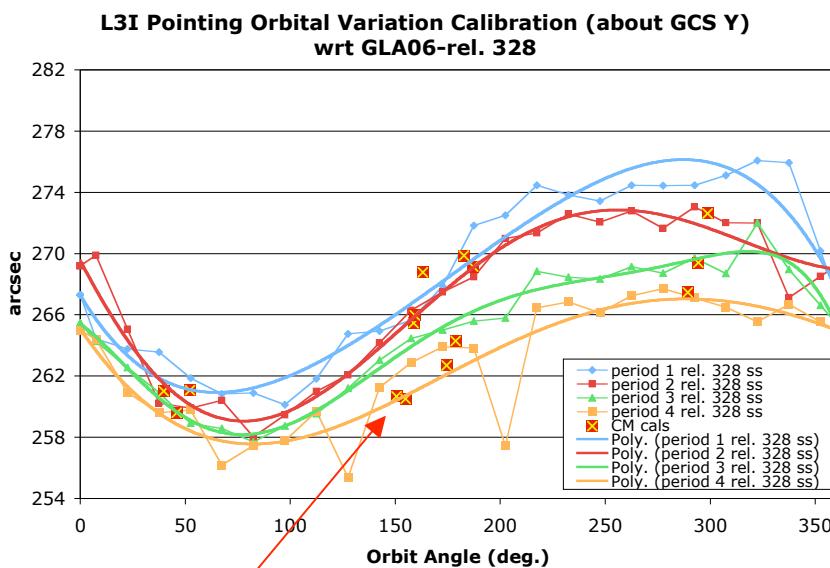


L3I SM Validation/Calibration

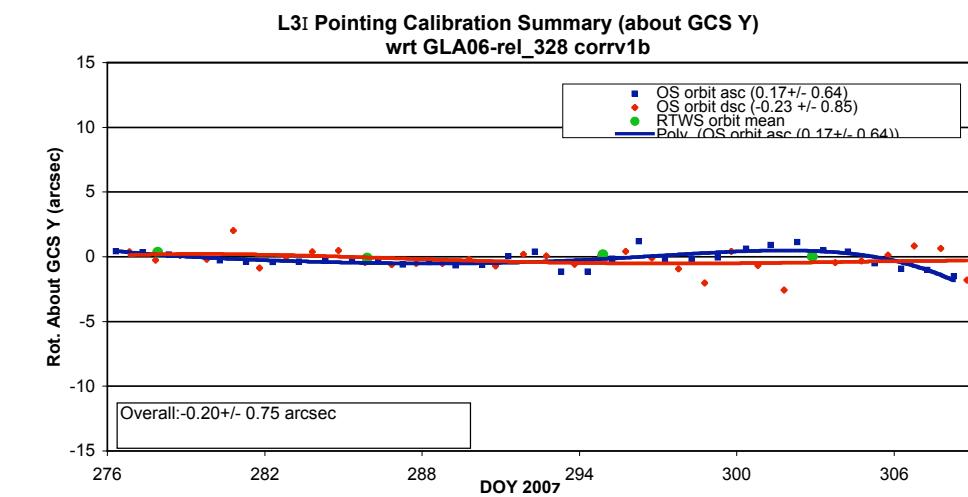
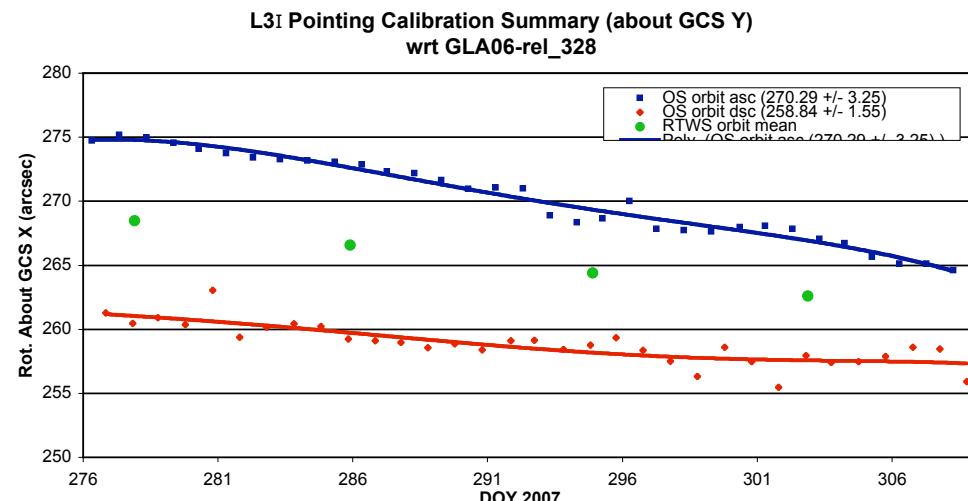
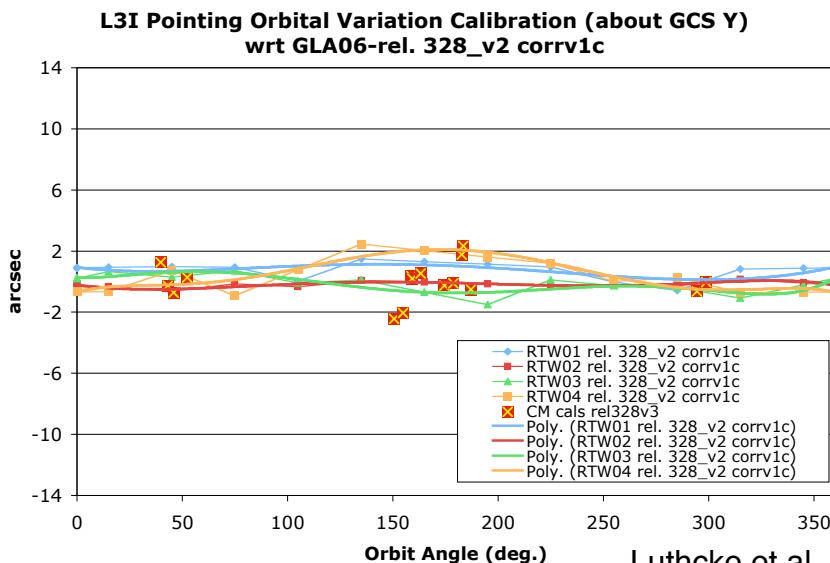




L3C SM Validation/Calibration

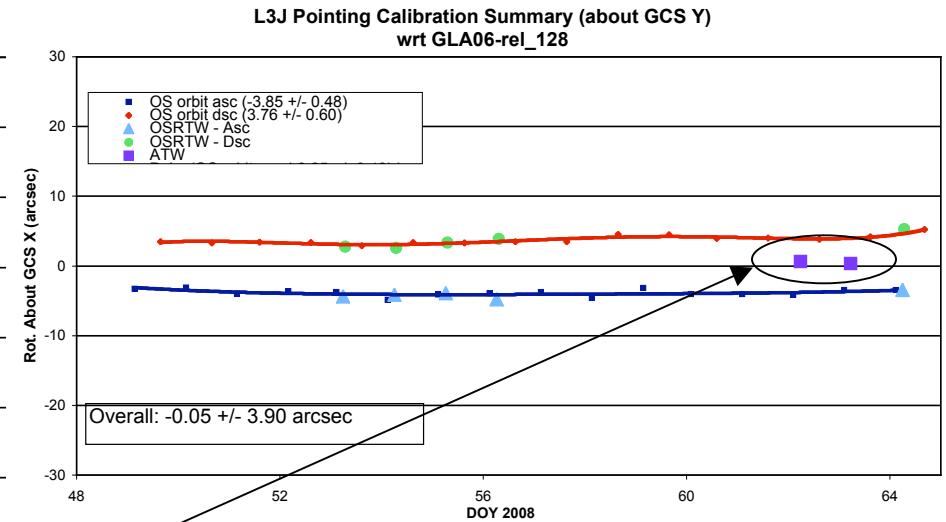
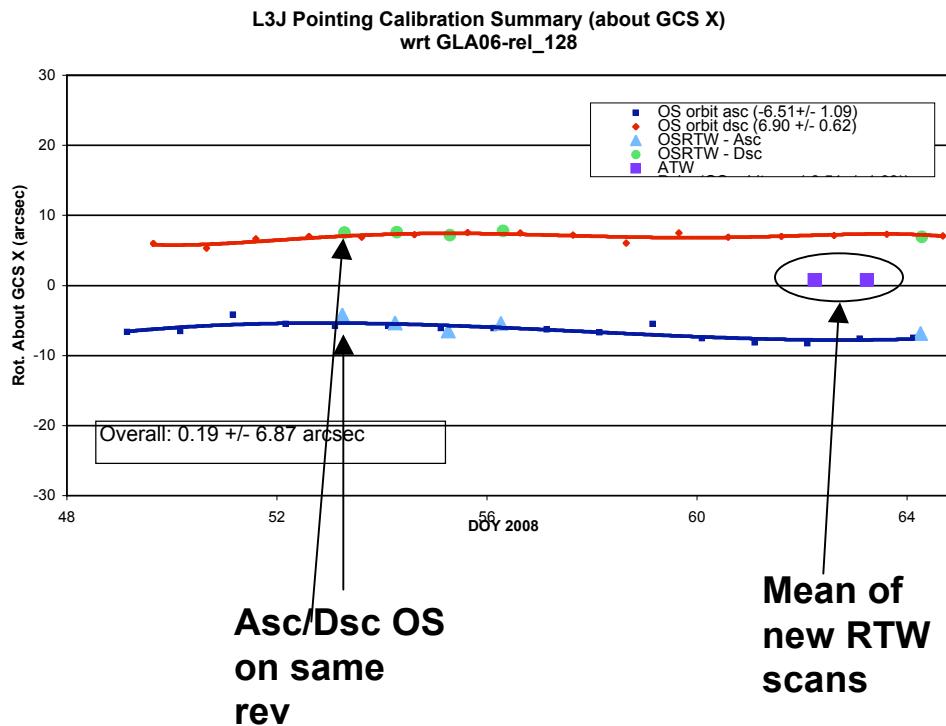
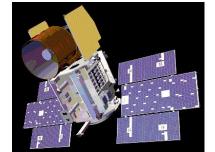


C. Martin Calibrations





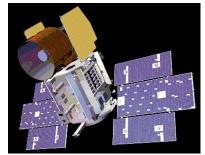
L3J SM Initial Rel.128 Calibrations



Both the Dsc/Asc OSs on the same rev and the new RTW scans appear to be performing as expected...



Ice Sheet Xover Summary



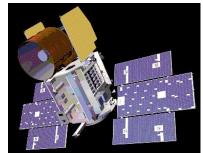
	Antarctica		Greenland	
All in cm	rms	%ΔVar.	rms	%ΔVar.
L2A rel328	13.77		18.12	
	12.48	-17.84	14.29	-35.24
L3A rel22	20.18		25.25	
	19.37	-7.70	22.47	-20.78
L3F rel328	13.74		18.48	
	11.56	-29.24	12.00	-57.84
L3G rel328	10.32		12.83	
	8.60	-30.52	8.99	-50.90
L3H rel328	9.67		13.90	
	8.53	-22.31	9.78	-50.52
L3I rel328	10.87		12.68	
	9.60	-22.08	10.52	-31.15

8-day xover; <0.6 deg. slope

Luthcke et al. 2008, NASA GSFC, Code 698



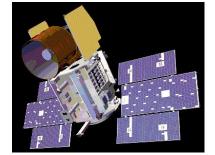
SM Cal./Val. Correction Summary long-arc (~1700 km) estimate



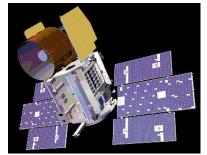
Obs. Period	Date Green -not complete Pink -Sun Blinding	Release cal/val correction	Pointing accuracy (arcsec)	Horizontal accuracy (m)	Vertical Accuracy 0.4° slope (cm)
L1A Sailboat -Y	2/20/03 - 3/21/03	328 corrV	0.27 ± 1.64	0.79 ± 4.77	0.6 ± 3.3
L1B Airplane X	3/21/03 - 3/29/03				
L2A Sailboat Y	9/25/03 - 11/19/03	328 corrV2	0.00 ± 1.30	0.00 ± 3.78	0.0 ± 2.6
L2B Sailboat Y	2/17/04 - 3/21/04	22 corrV2	0.00 ± 1.24	0.00 ± 3.60	0.0 ± 2.5
L2C Airplane -X	5/18/04 - 6/21/04	17	12.96 ± 18.37	37.70 ± 53.43	26.3 ± 37.3
L3A Sailboat -Y	10/3/04 - 11/8/04	22 corrV2	0.00 ± 0.95	0.00 ± 2.75	0.0 ± 1.9
L3B Sailboat -Y	2/17/05 - 3/24/05	542 corrV2	0.02 ± 1.44	0.07 ± 4.20	0.0 ± 2.9
L3C Airplane X	5/20/05 - 6/23/05	328v2 corrV2	0.09 ± 1.52	0.26 ± 4.41	0.2 ± 3.1
L3D Sailboat Y	10/21/05 - 11/24/05	529 corrV2	0.02 ± 0.98	0.07 ± 2.86	0.1 ± 2.0
L3E Sailboat Y	2/22/06 - 3/28/06	537 corrV2	0.00 ± 1.17	0.00 ± 3.41	0.0 ± 2.4
L3F Airplane -X	5/24/06 - 6/26/06	328 corrV1b	0.46 ± 1.88	1.35 ± 5.46	0.9 ± 3.8
L3G Sailboat -Y	10/25/06 - 11/27/06	328 corrV2	0.02 ± 1.16	0.07 ± 3.37	0.1 ± 2.4
L3H Sailboat -Y	3/12/07 - 4/14/07	328 corrV2	0.00 ± 1.48	0.00 ± 4.29	0.0 ± 3.0
L3I Sailboat Y	10/02/07 - 11/05/07	328 corrV1c	0.22 ± 0.68	0.65 ± 1.98	0.5 ± 1.4



Summary



- Initial calibrations and corrections completed for all observations periods, except:
 - L1B... refining calibrations and corrections
 - L2C ... beginning analysis
 - L3J ... currently working on
- *Preliminary analysis of new RTWs suggest they are performing as expected.*
- Evolving algorithms, methodologies and data releases ... important to revisit each of the “older - processed” observation periods
 - Have already reprocessed L3G ... little difference
 - Important to revisit L3A and L3B next...
- Likely we will recalibrate and correct a few more times as data sets and methodologies mature...



Luthcke et al. 2008, NASA GSFC, Code 698



Ocean Scan (OS)

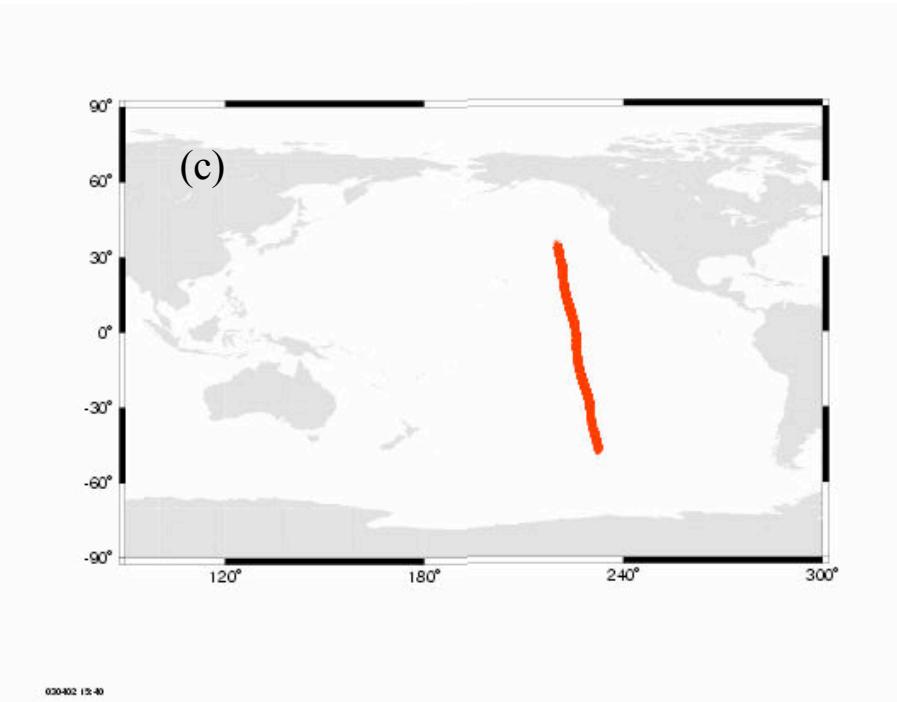
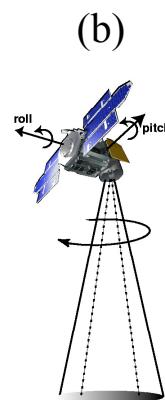
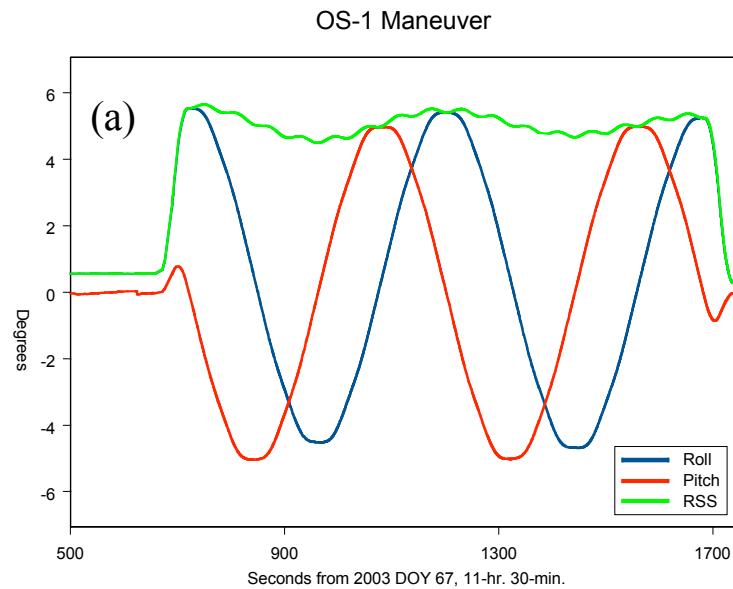
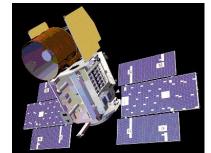
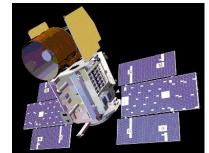


Figure 1. (a) ICESat Ocean Sweep maneuver #1 (OS-1) roll and pitch from nominal attitude profile. (b) cartoon of ocean sweep maneuver. (c) geographic location and extent of OS-1.

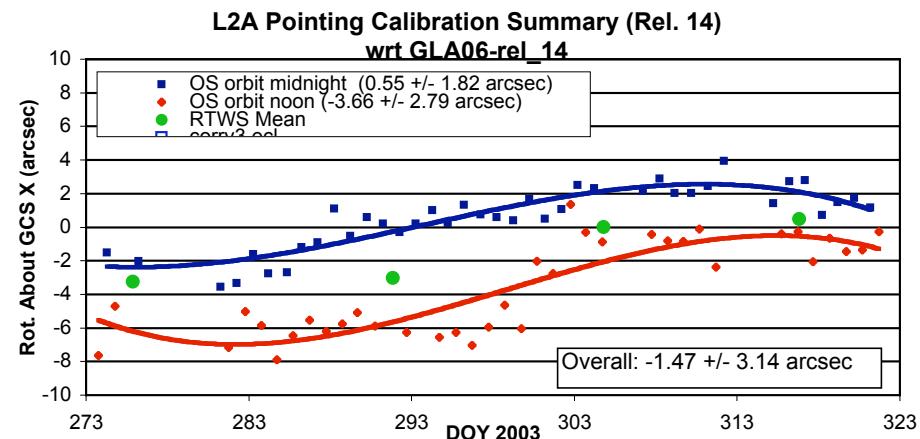


Scan Maneuver Calibrations



Using OSs capture pointing bias trends and orbital variation about both GCS X and Y

L2A GCS X Example



Using RTWSs estimate orbital pointing variation as a step function in orbit angle for both GCS X and Y

