JET PROPULSION LABORATORY **SIRTF IPF REPORT**

JPL ID201107
November 20, 2003

SIRTF INSTRUMENT POINTING FRAME KALMAN FILTER EXECUTION SUMMARY

IPF RUN NUMBER: 201107
REPORT TYPE: IOC EXECUTION (COARSE)

PRIME FRAME: MIPS_70um_center (107)
INFERRED FRAMES: (108) (111) (112) (115) (116)

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1 IPF EXECUTION SUMMARY

This report summarizes the SIRTF Instrument Pointing Frame (IPF) Kalman Filter execution associated with run file: RN201107. In particular, this Focal Point Survey calibrates the instrument: MIPS_70um_center (107), as part of the IOC Coarse Survey. The main calibration results from the IPF filter execution have been documented in IF201107 typically stored in the mission archive DOM collection IPF_IF. This report only summarizes the main aspects of the run, and does not substitute for the full information contained in the IF file.

Section 1 summarizes the filter execution results. The filter configurations are tabulated in Table 1.2 and the mask vector assignments are tabulated in Table 1.3. A total of 17 state parameters are estimated in this run. The overall End-to-End pointing performances are tabulated in Table 1.4. The prediction residuals throughout the estimation processes are tabulated in Table 1.5. Section 3 summarizes resulting plots, a mini summary of the IF IPF output file, and the execution log. Section 4 captures the user comments that are specific to this particular run.

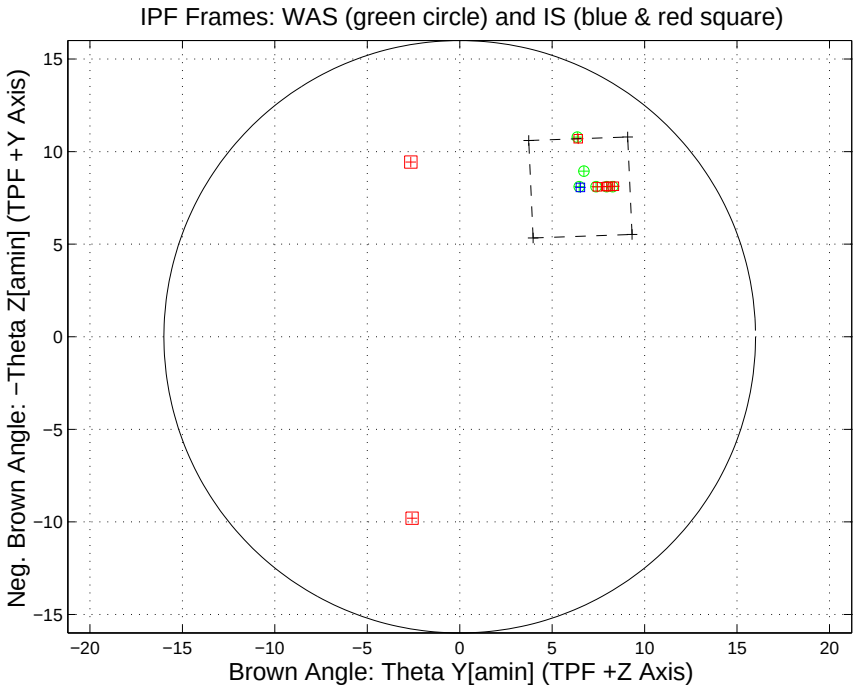

Figure 1.1: A-priori and a-posteriori IPF frames

RAW	FINAL (After Editing)
AA201107	AA201107
AS201107	AS201107
CA201107	CA201107
CB002118	CB002118
CS201107	CS201107

Table 1.1: IPF filter input files

EXECUTION CONFIGURATION ITEM	CURRENT STATUS
IPF Filter Version Used	IPF.V3.0.0B
Frame Table Version Used	BodyFrames_FTU_13Aa
Scan-Mirror Employed?	YES
IPF Filter Mode	LITE-MODE(2):STA
SLIT-MODE Operation	DISABLED
Kalman Filter Operation	ENABLED
Least-Squares Data Analysis	ENABLED
IBAD Screening	ENABLED
User-Specified Data Editing	DISABLED
Total Number of Iterations	30
LS Residual Sigma Scale	8.61257001E-001
Total Number of Maneuvers	11

Table 1.2: IPF filter execution configuration

Con. Plate Scale			Γ Dependent				Γ^2 Dependent				Linear Plate Scale						Mirror	
a_{00}	b_{00}	c_{00}	a_{10}	b_{10}	c_{10}	d_{10}	a_{20}	b_{20}	c_{20}	d_{20}	a_{01}	b_{01}	c_{01}	d_{01}	e_{01}	f_{01}	α	β
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19
1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1
IPF (T)			Alignment R									Gyro Drift Bias						
θ_1	θ_2	θ_3	a_{rx}	a_{ry}	a_{rz}	b_{rx}	b_{ry}	b_{rz}	c_{rx}	c_{ry}	c_{rz}	b_{gx}	b_{gy}	b_{gz}	c_{gx}	c_{gy}	c_{gz}	
20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	
1	1	1	1	1	1	1	1	1	1	1	1	0	0	0	0	0	0	

Table 1.3: IPF filter execution mask vector assignment

FOCAL PLANE SURVEY ANALYSIS: IOC Coarse Survey.
INSTRUMENT NAME: MIPS_70um_center NF: 107
PIX2RADW: 4.79044679E-005[rad/pixel] = 9.8810E+000[arcsec/pixel]
PIX2RADV: 4.87929385E-005[rad/pixel] = 1.0064E+001[arcsec/pixel]

FRAME	DESCRIPTION	IPF[1]	SF[2]	TOTAL	REQ
107(P)	MIPS_70um_center	0.4823	0.0855	0.4898	2.65
108(I)	MIPS_70um_minusY_edge	0.8783	0.0855	0.8825	N/A
111(I)	MIPS_70um_default_small_FOV1	1.0727	0.0855	1.0761	N/A
112(I)	MIPS_70um_default_small_FOV2	0.4167	0.0855	0.4254	N/A
115(I)	MIPS_70um_default_large_FOV1	0.8219	0.0855	0.8263	N/A
116(I)	MIPS_SED_7	0.7604	0.0855	0.7652	N/A

Table 1.4: IPF calibration error summary ([arcsec], 1-sigma, radial)

RMS METRIC	A PRIORI[3]	A POSTERIORI[3]	ATT. CORRECTED[4]	UNITS
Radial	5.2434	3.4787	3.4935	arcsec
W-Axis	3.8912	2.8154	2.8189	arcsec
V-Axis	3.5145	2.0432	2.0637	arcsec
Radial	0.5263	0.3499	0.3513	pixels
W-Axis	0.3938	0.2849	0.2853	pixels
V-Axis	0.3492	0.2030	0.2050	pixels

Table 1.5: Science measurement prediction error summary (1-sigma)

[1]IPF filter removes systematic pointing errors due to: thermomechanical alignment drift (Body to TPF), gyro bias and bias drift, centroiding error, attitude error, and optical distortion. IPF SIGMA presented here is "Scaled" by the Least Squares Scale factor. The Least Squares Scale Factor was: 0.861257. It is assumed that the gyro Angle Random Walk contribution is captured with the Least Squares scaling. The gyro ARW contribution can be approximately calculated as 0.0701 arcseconds, given that ARW = 100 $\mu deg/\sqrt{hr}$, with 7.509658e+002 second Maneuver time (max), and 11 independent Maneuvers.

[2]Gyro Scale Factor(GSF) assumes 95 ppm error over 0.250 degree maneuver.

[3]This can be interpreted as estimate of "pixel to sky" pointing reconstruction error if no science data is used.

[4]This can be interpreted as estimate of achieved S/I centroiding error

IPF BROWN ANGLE SUMMARY					
FRAME TABLE USED: BodyFrames_FTU_13Aa					
NF	NAME	WAS	IS	CHANGE	UNIT
107	theta_Y	+6.465320	+6.528026	+0.062706	arcmin
107	theta_Z	-8.103026	-8.064382	+0.038644	arcmin
107	angle	-2.285674	-2.270991	+0.014683	deg
108	theta_Y	+6.358283	+6.411991	+0.053708	arcmin
108	theta_Z	-10.784699	-10.695708	+0.088990	arcmin
108	angle	-2.285674	-2.270991	+0.014683	deg
111	theta_Y	+8.276800	+8.367911	+0.091111	arcmin
111	theta_Z	-8.103000	-8.129461	-0.026461	arcmin
111	angle	-2.285700	-2.270991	+0.014709	deg
112	theta_Y	+7.371100	+7.447969	+0.076869	arcmin
112	theta_Z	-8.103000	-8.096921	+0.006079	arcmin
112	angle	-2.285700	-2.270991	+0.014709	deg
115	theta_Y	+7.947500	+8.033387	+0.085887	arcmin
115	theta_Z	-8.103000	-8.117628	-0.014628	arcmin
115	angle	-2.285700	-2.270991	+0.014709	deg
116	theta_Y	+6.714264	+7.949756	+1.235492	arcmin
116	theta_Z	-8.948537	-8.114670	+0.833866	arcmin
116	angle	+0.000049	-2.270991	-2.271040	deg

Table 1.6: IPF Brown angle summary

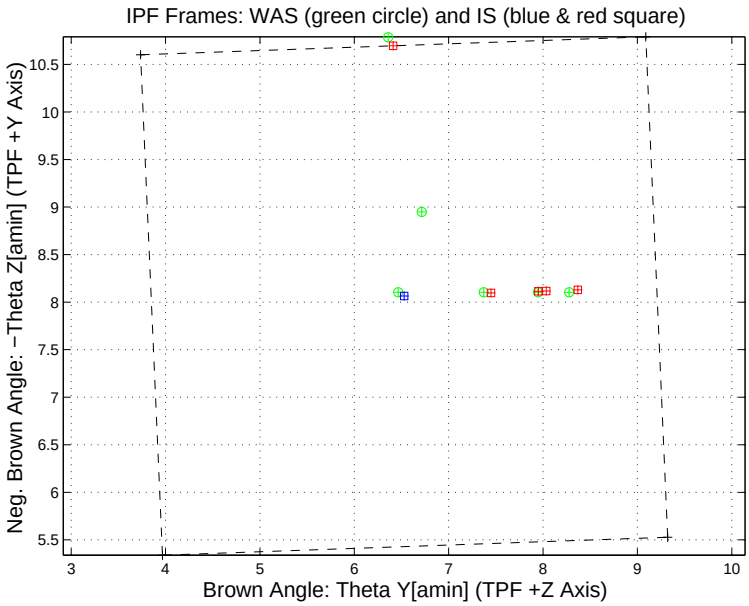

Figure 1.2: A-priori and a-posteriori IPF frames (ZOOMED)

2 IPF INPUT FILE HISTORY

WAS	SIZE	IS	SIZE	REMOVED	PATCHED
AA201107	UNCHANGED	AA201107	UNCHANGED	0	0
CA201107	UNCHANGED	CA201107	UNCHANGED	0	N/A
CB002118	UNCHANGED	CB002118	UNCHANGED	0	N/A

Table 2.1: IPF input file editing status

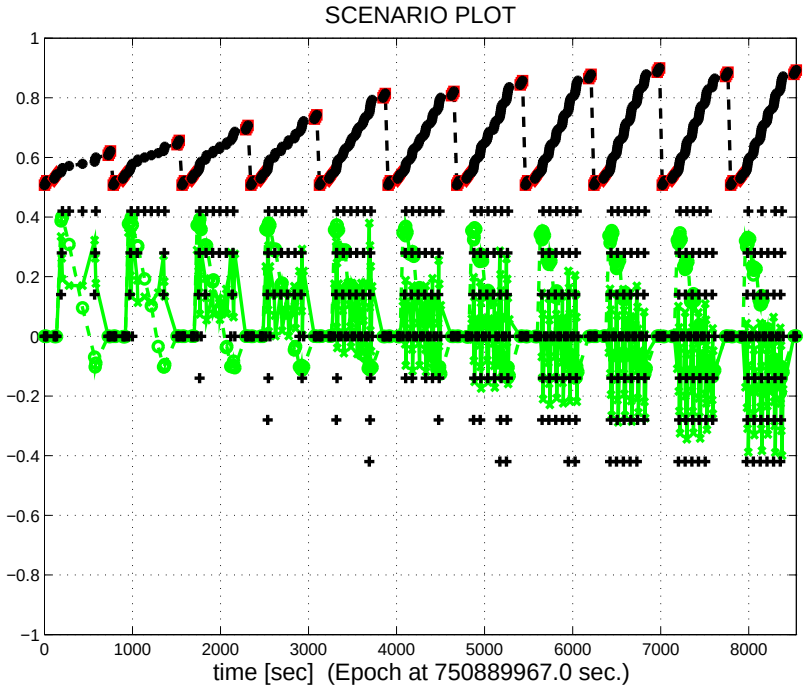

Figure 2.1: Scenario Plot

3 IPF EXECUTION RESULTS

3.1 IPF EXECUTION OUTPUT PLOTS

This subsection summarizes the IPF filter results. As shown in Table 3.1, the output plots are segmented to three groups: predicted performance, post-run results and IPF trending plots.

FIGURE NO.	DESCRIPTION
Predicted performance prior to IPF run	
Figure 3.1	Meas. and a-priori predicts in TPF coords
Figure 3.2	Meas. and a-priori predicts in Oriented Pixel Coords including rectangular array boundary approximation
Figure 3.3	A-Priori Prediction Error Quiver Plot in Oriented Pixel Coords including rectangular array boundary approximation
Figure 3.4	A-priori prediction error
Figure 3.5	Oriented Pixel Coords of measurements and a-priori predicts (PCRS only)
Figure 3.6	Oriented Pixel Coords of measurements and a-priori predicts (Zoomed, PCRS only)
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Figure 3.8	A-priori PCRS prediction error
IPF filter performance (post run results)	
Figure 3.9	IPF execution convergence, chart 1: (top) normalized residual error vs. iteration number and (bottom) norm of effective parameter corrections
Figure 3.10	IPF execution convergence, chart 2: parameter correction size vs. iteration number
Figure 3.11	Parameter uncertainty convergence: square-root of diagonal elements of covariance matrix vs. maneuver number
Figure 3.12	IPF parameter symbol table
Figure 3.13	KF parameter error sigma plot (a-priori-dashed, a-posteriori-solid). Includes true parameter errors (FLUTE runs only)
Figure 3.14	LS parameter error sigma plot. Includes true parameter errors (FLUTE runs only)
Figure 3.15	KF and LS parameter errors sigma plot (Figure 3.13 & Figure 3.14 combined)
Figure 3.16	Measurements and a-posteriori predicts in Oriented Pixel Coords including rectangular array boundaries (a-priori-dashed, a-posteriori-solid)
Figure 3.17	Attitude corrected meas. and a-posteriori predicts in Oriented Pixel Coords including rectangular array boundaries (a-priori-dashed, a-posteriori-solid)

Table 3.1: Table of figures I (IPF run)

FIGURE NO.	DESCRIPTION
IPF filter performance (post run results) - CONTINUE	
Figure 3.18	KF innovations with (o) and w/o (+) attitude corrections
Figure 3.19	Histograms of science a-posteriori residuals (or innovations)
Figure 3.20	A-Posteriori Science Centroid Prediction Error Quiver (Att. Cor.)
Figure 3.21	Normalized A-Posteriori Science Centroid Prediction Errors
Figure 3.22	KF innovations with (o) and w/o (+) attitude corrections (PCRS)
Figure 3.23	Histograms of PCRS a-posteriori residuals (or innovations)
Figure 3.24	A-posteriori PCRS Prediction Summary
Figure 3.25	A-posteriori PCRS Prediction (PCRS 1 Only)
Figure 3.26	A-posteriori PCRS Prediction (PCRS 2 Only)
Figure 3.27	A-Posteriori PCRS Prediction Errors Quiver (Att. Cor.)
Figure 3.28	Normalized A-Posteriori PCRS Prediction Errors
Figure 3.29	W-axis KF innovations and 1-sigma bound
Figure 3.30	V-axis KF innovations and 1-sigma bound
Figure 3.31	Array plot with (solid) and w/o (dashed) optical distortion corrections
Figure 3.32	Optical Distortion Plot: total (x5 magnification)
Figure 3.33	Optical Distortion Plot: constant plate scales (x5 magnification)
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Figure 3.36	Scan Mirror Chops
Figure 3.37	IPF Frame Reconstruction
Figure 3.38	Center Pixel Reconstruction
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Figure 3.39	Estimated attitude corrections (Body frame)
Figure 3.40	Estimated attitude error sigma plot (Body frame)
Figure 3.41	Systematic error attributed to thermo-mechanical boresight drift (equiv. angle in (W,V) coords)
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Figure 3.43	Systematic error attributed to gyro drift bias (equiv. rate in (W,V) coords)
Figure 3.44	Systematic error attributed to gyro drift bias (equiv. angle in (W,V) coords)
Figure 3.45	Systematic error attributed to gyro drift bias (equiv. angle in Body frame)

Table 3.2: Table of figures II (IPF run)

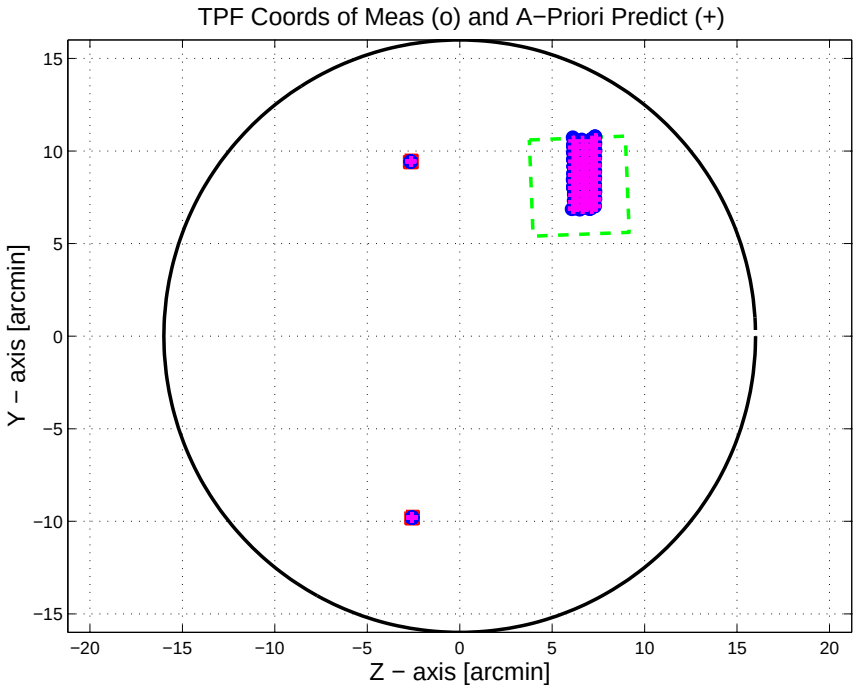

Figure 3.1: TPF coords of measurements and a-priori predicts

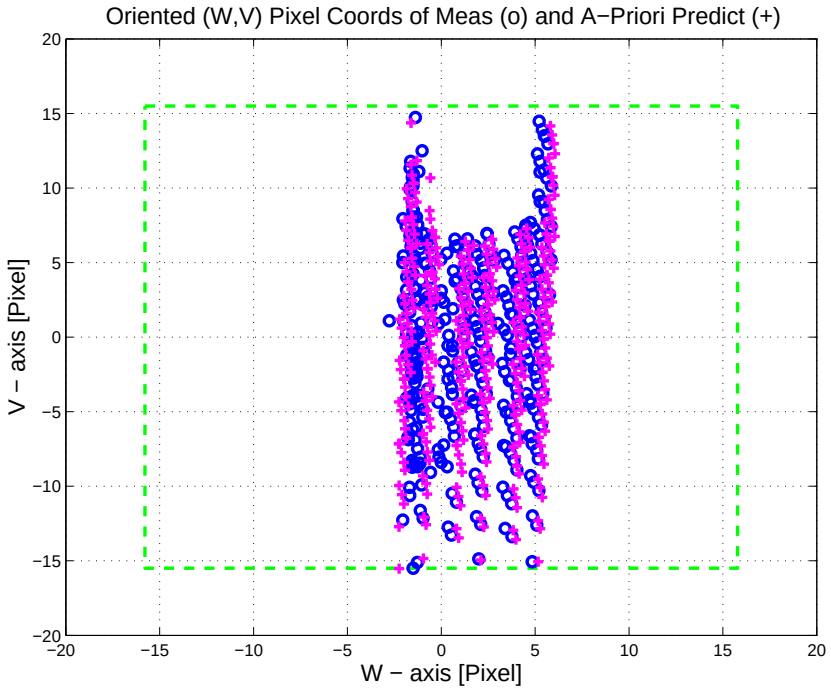

Figure 3.2: Oriented Pixel Coords of measurements and a-priori predicts

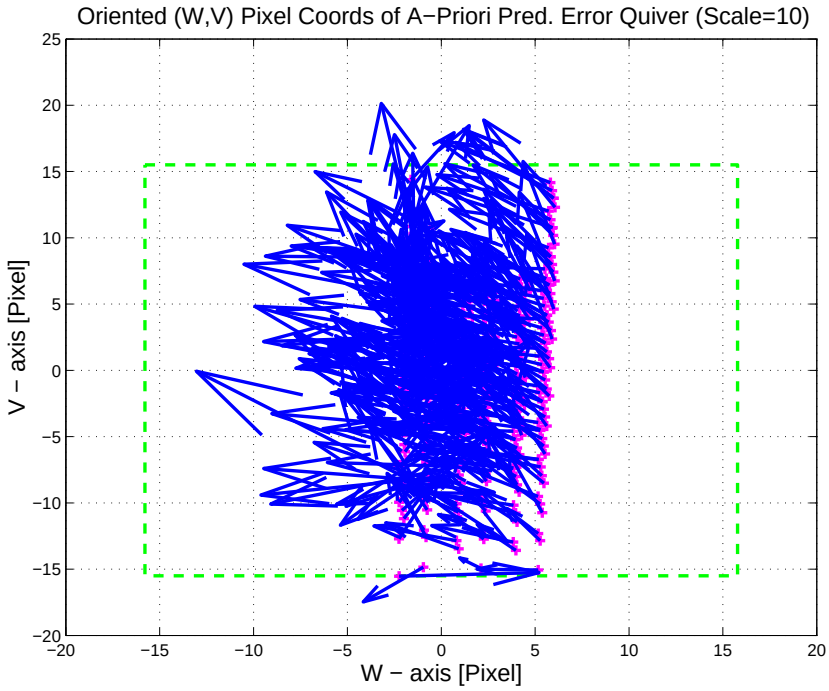

Figure 3.3: Oriented (W,V) Pixel Coords of A-Priori Prediction Error Quiver Plot

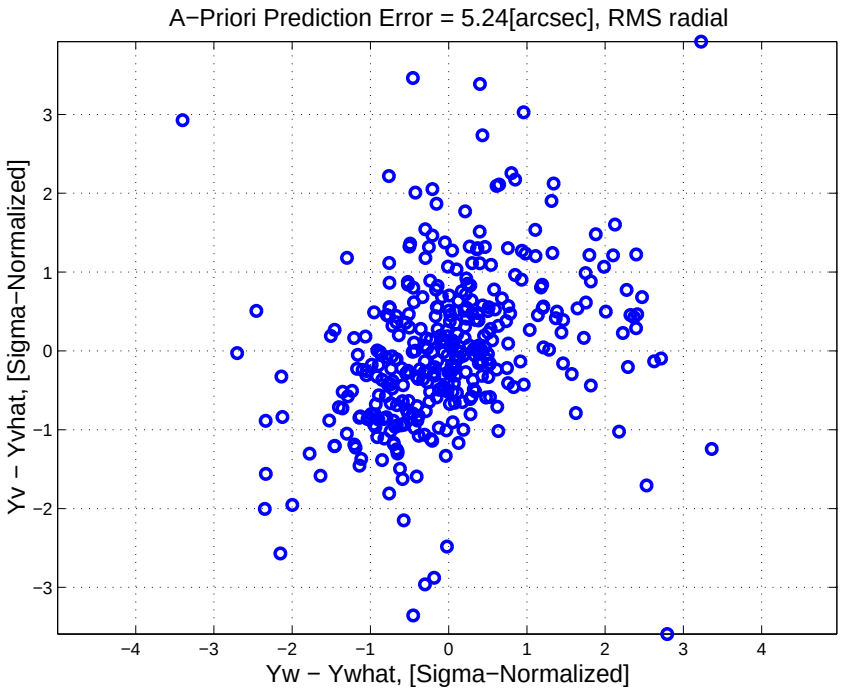

Figure 3.4: A-priori prediction error (Science Centroids)

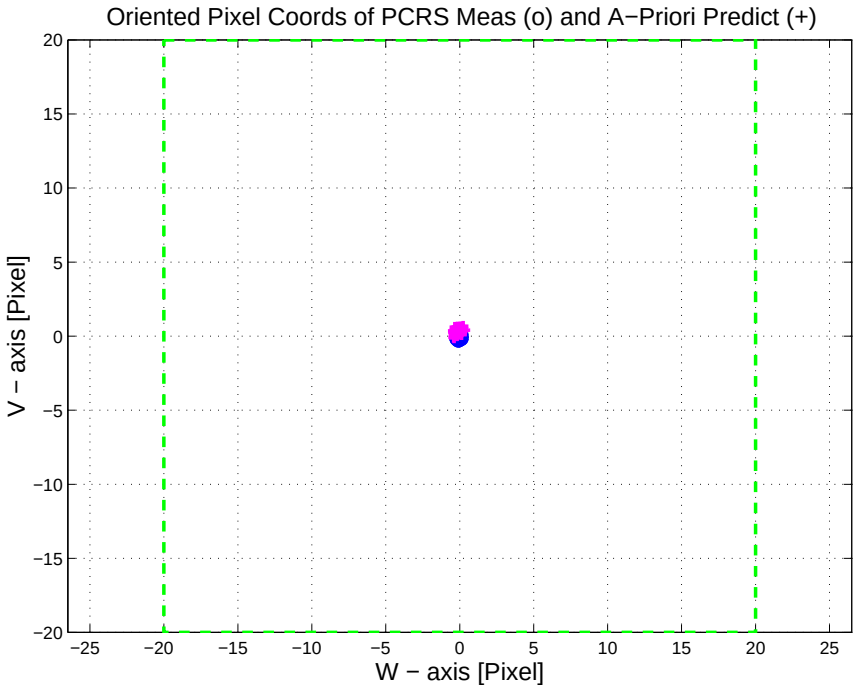

Figure 3.5: Oriented Pixel Coords of measurements and a-priori predicts (PCRS only)

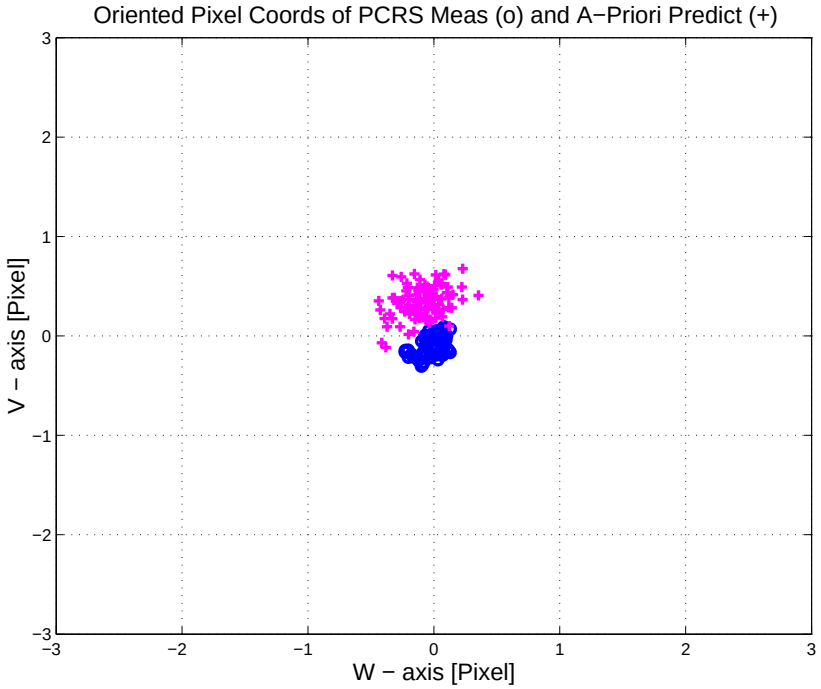

Figure 3.6: Oriented Pixel Coords of measurements and a-priori predicts (Zoomed, PCRS only)

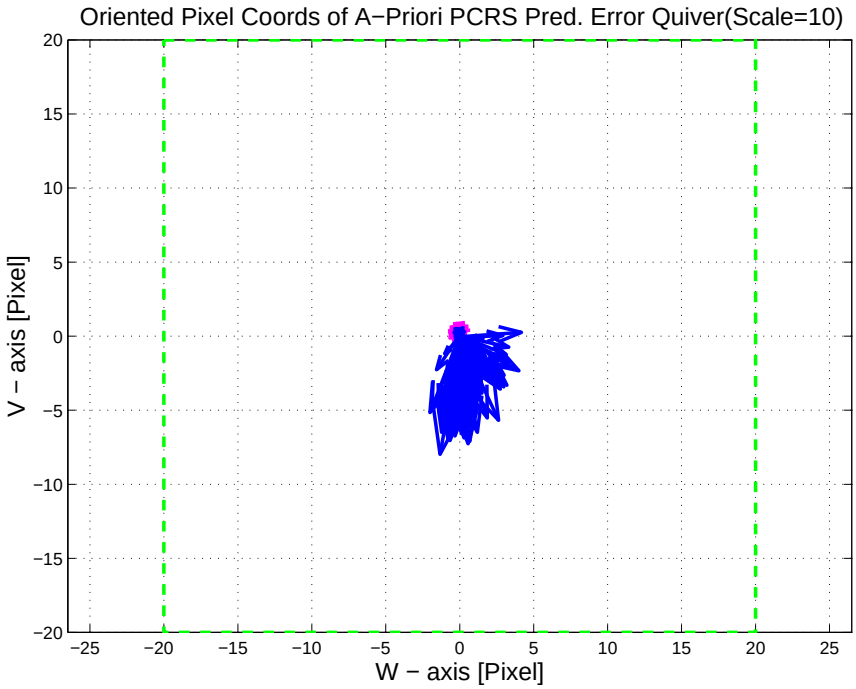

Figure 3.7: Oriented (W,V) Pixel Coords of A-Priori PCRS Prediction Error Quiver Plot

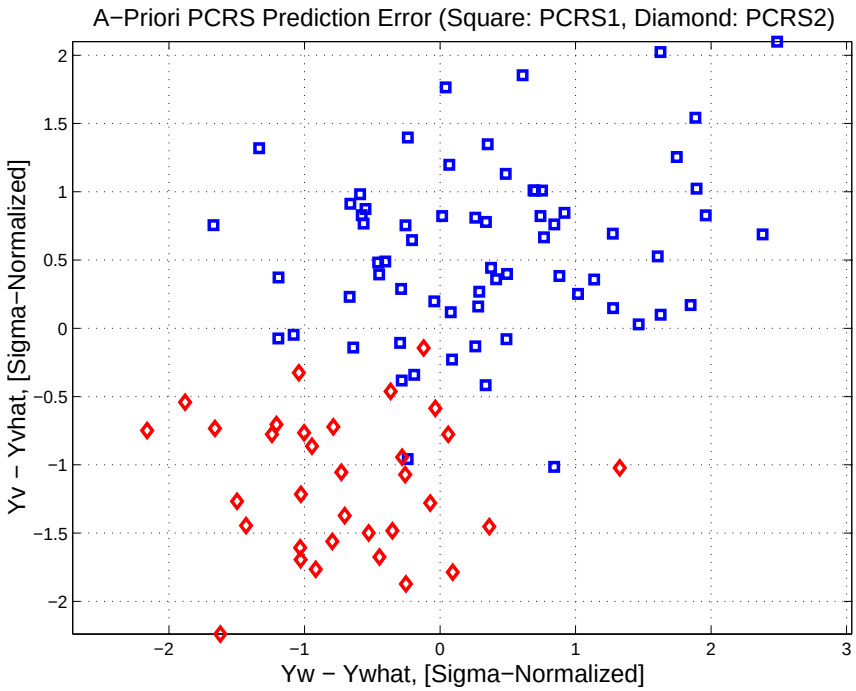

Figure 3.8: A-priori PCRS prediction error

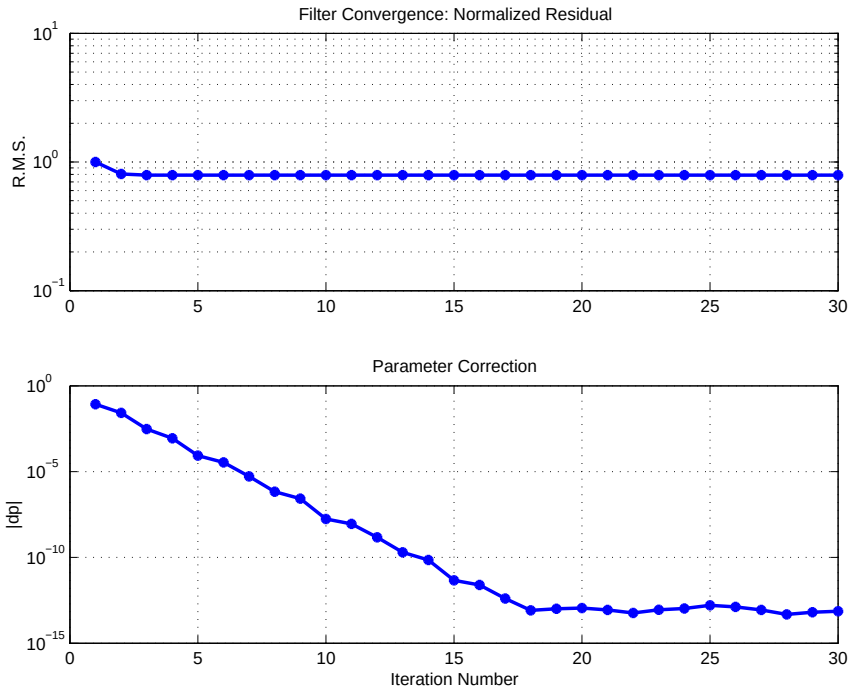

Figure 3.9: IPF execution convergence, chart 1

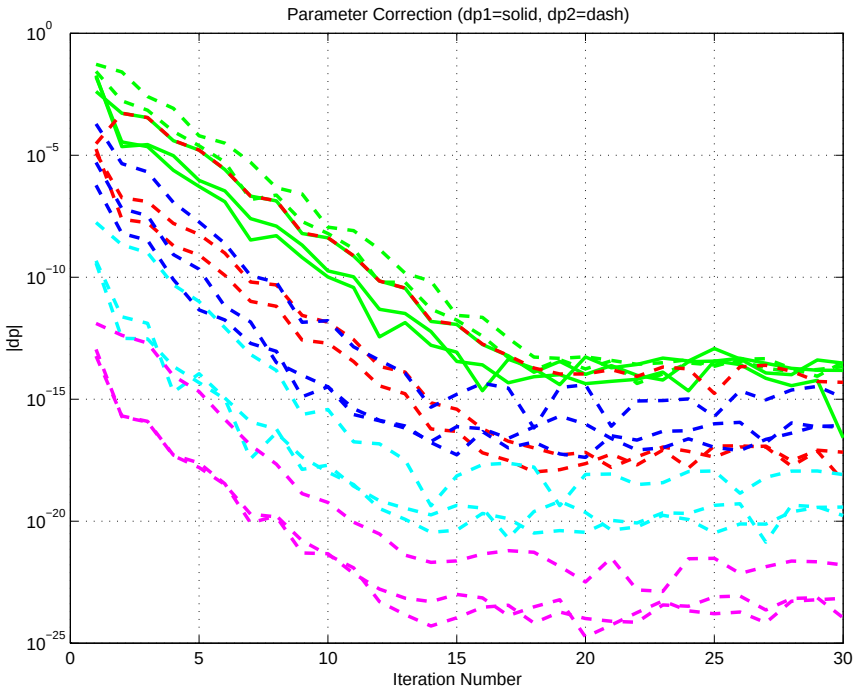

Figure 3.10: IPF execution convergence, chart 2

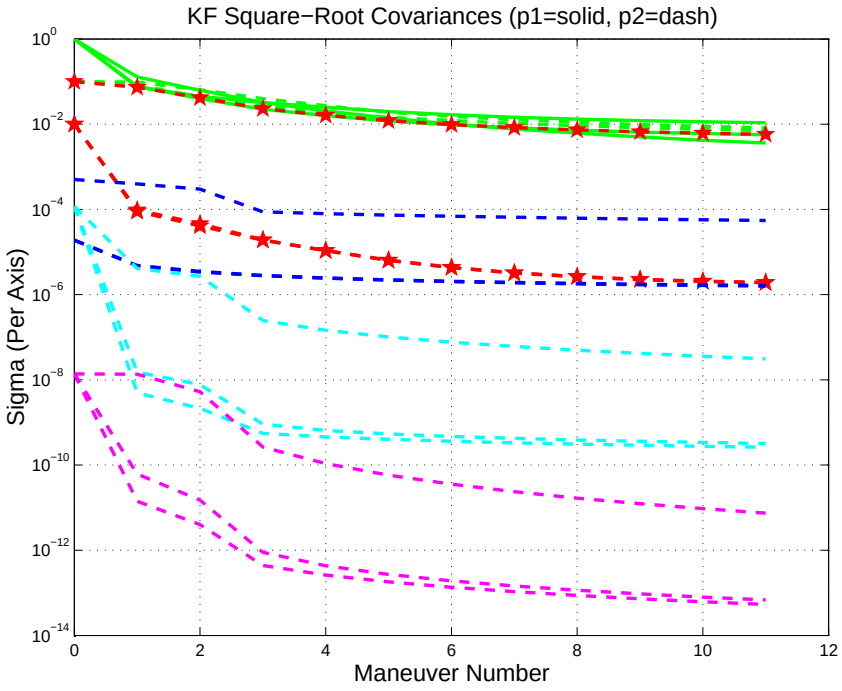

Figure 3.11: Parameter uncertainty convergence

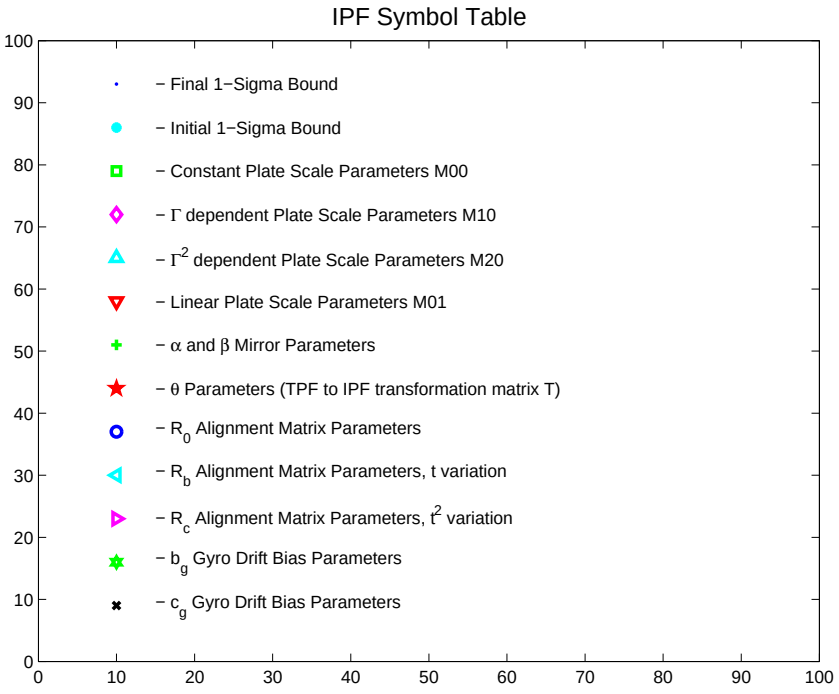

Figure 3.12: IPF parameter symbol table

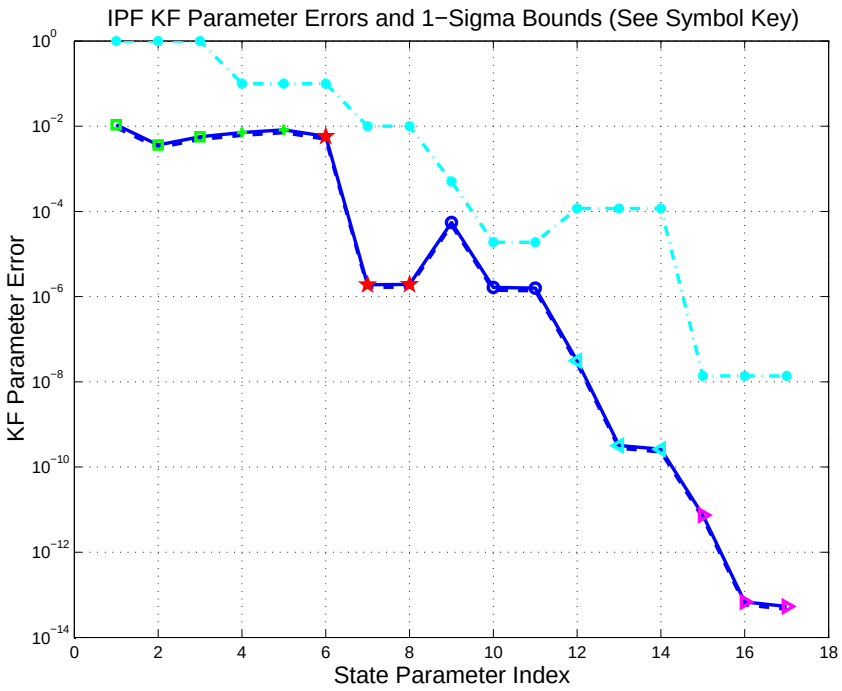

Figure 3.13: KF parameter error sigma plots

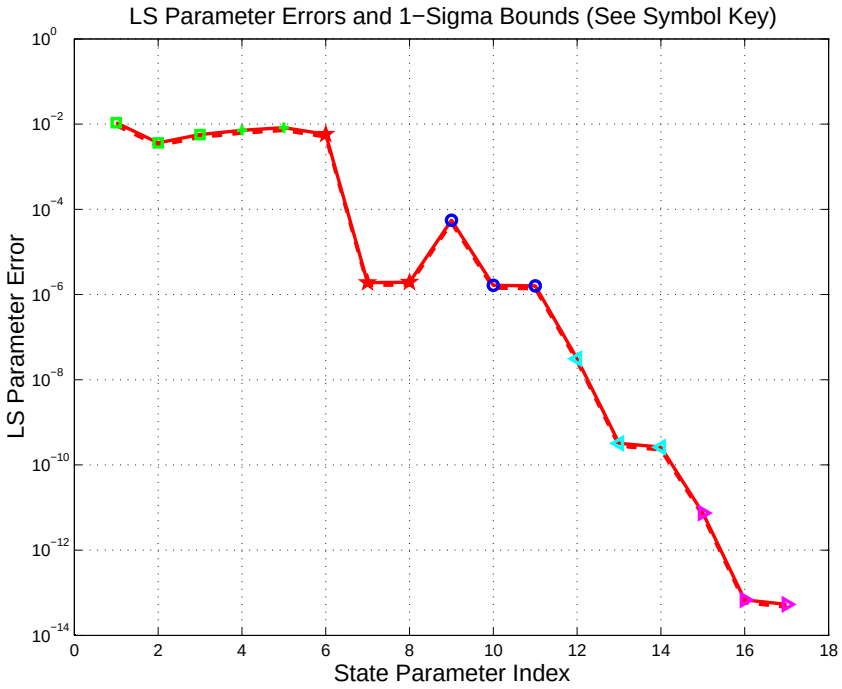

Figure 3.14: LS parameter error sigma plot

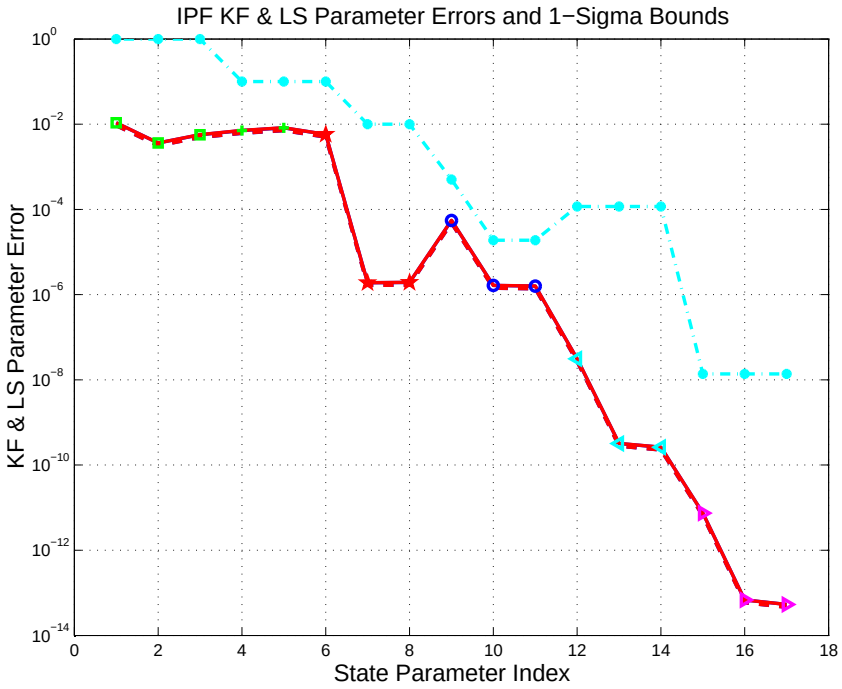

Figure 3.15: KF and LS parameter error sigma plot

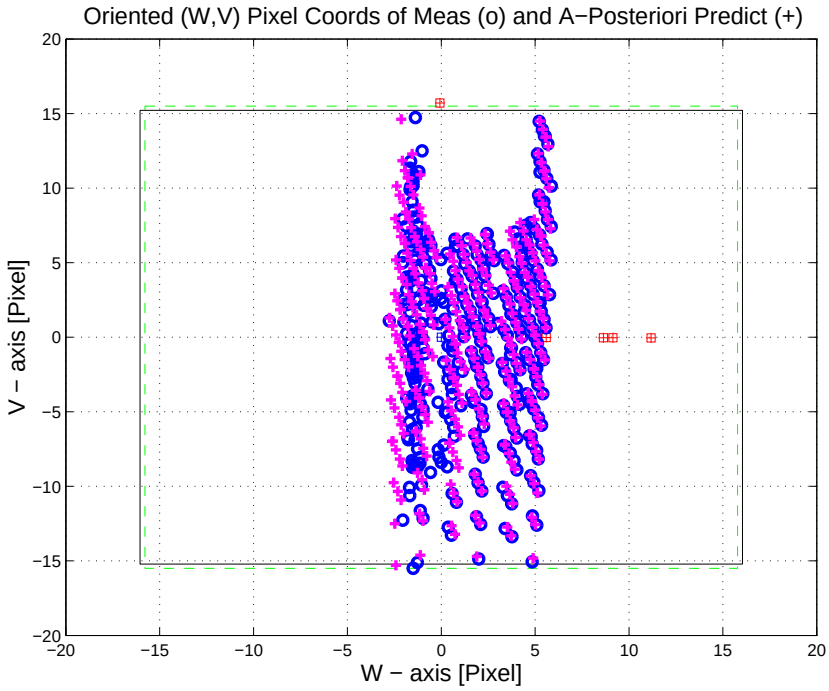

Figure 3.16: Oriented Pixel Coords of meas. and a-posteriori predicts

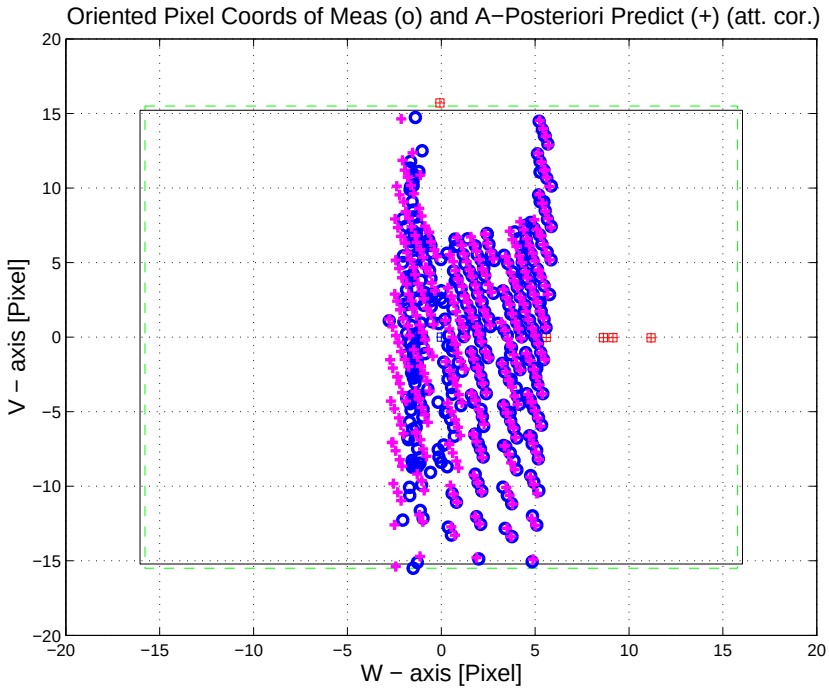

Figure 3.17: Oriented Pixel Coords of meas. and a-posteriori predicts (attitude corrected)

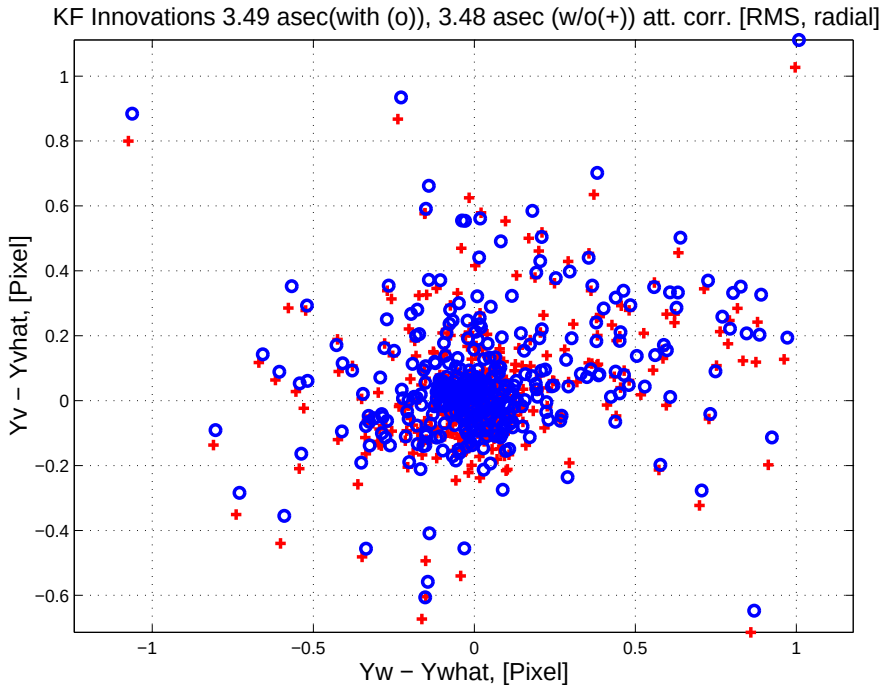

Figure 3.18: KF innovations with (o) and w/o (+) attitude corrections

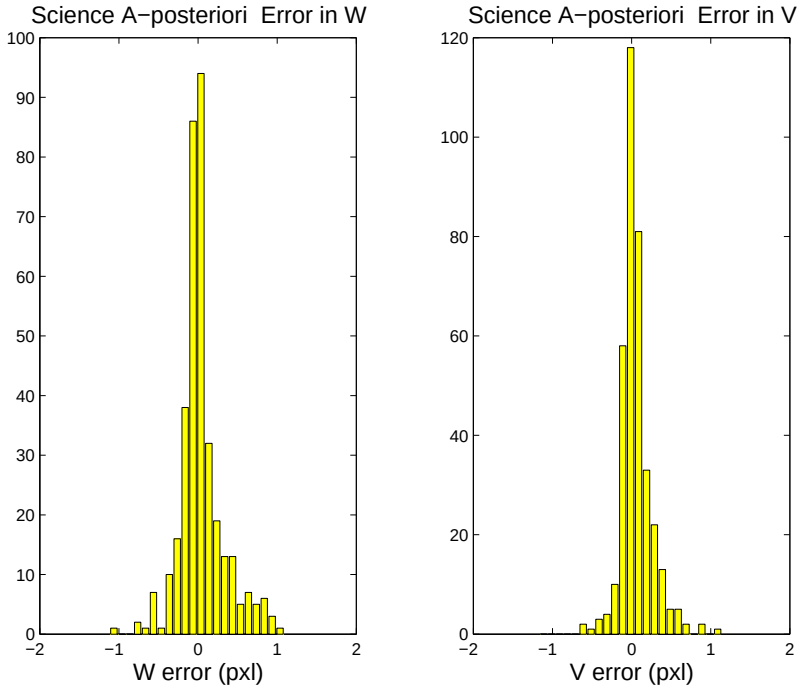

Figure 3.19: Histograms of science a-posteriori residuals (or innovations)

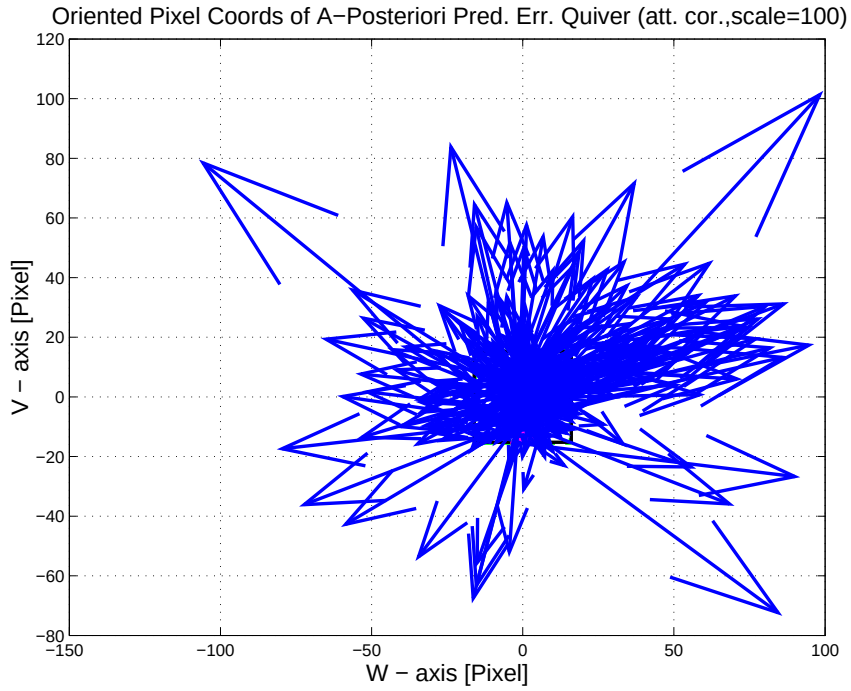

Figure 3.20: A-Posteriori Science Centroid Prediction Error Quiver (Att. Cor.)

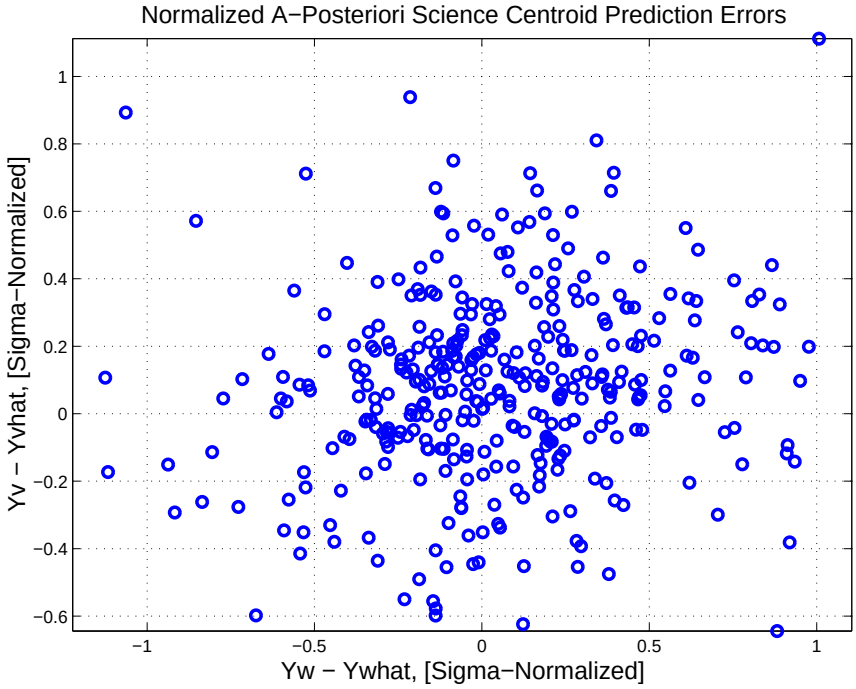

Figure 3.21: Normalized A-Posteriori Science Centroid Prediction Errors

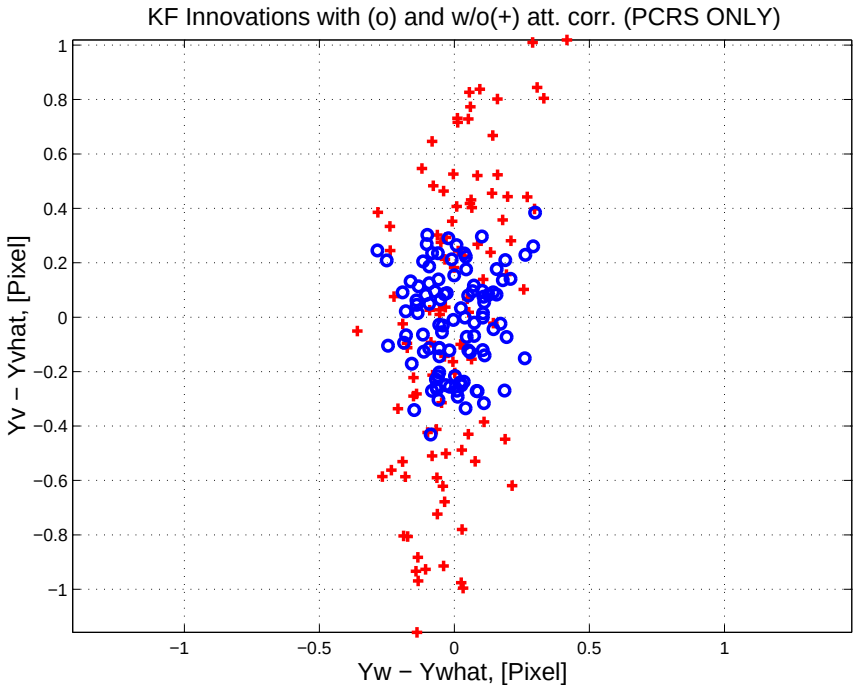

Figure 3.22: KF innovations with (o) and w/o (+) attitude corrections (PCRS)

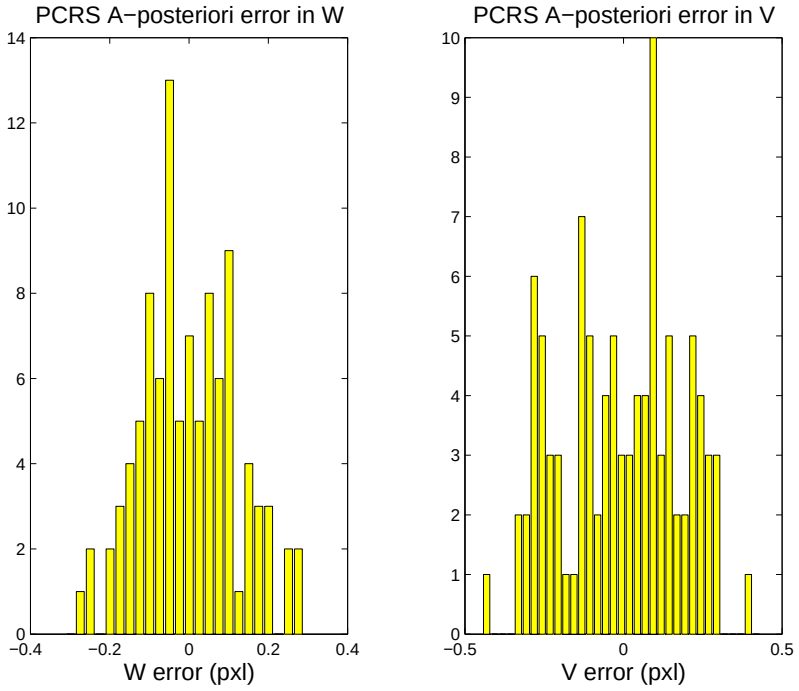

Figure 3.23: Histograms of PCRS a-posteriori residuals (or innovations)

IPF PCRS SUMMARY						
PCRS 1 (Total of 66 centroids)						
RMS	**MEAN**		**SIGMA**			
METRIC	APOST.	ATT. COR.	APOST.	ATT. COR.	STAT. CONF.	UNITS
Radial	0.0895	0.0892	0.5451	0.1851	0.0228	arcsec
W-axis	-0.0041	-0.0004	0.1570	0.1282	0.0158	arcsec
V-axis	0.0894	0.0891	0.5220	0.1336	0.0164	arcsec
PCRS 2 (Total of 33 centroids)						
METRIC	APOST.	ATT. COR.	APOST.	ATT. COR.	STAT. CONF.	UNITS
Radial	0.2087	0.2089	0.5167	0.1409	0.0245	arcsec
W-axis	-0.0025	0.0012	0.1290	0.1074	0.0187	arcsec
V-axis	-0.2086	-0.2089	0.5003	0.0911	0.0159	arcsec
Combined (Total of 99 centroids)						
METRIC	APOST.	ATT. COR.	APOST.	ATT. COR.	STAT. CONF.	UNITS
Radial	0.0106	0.0102	0.5539	0.2218	0.0223	arcsec
W-axis	-0.0036	0.0001	0.1482	0.1217	0.0122	arcsec
V-axis	-0.0100	-0.0102	0.5337	0.1855	0.0186	arcsec

Table 3.3: PCRS measurement prediction error summary

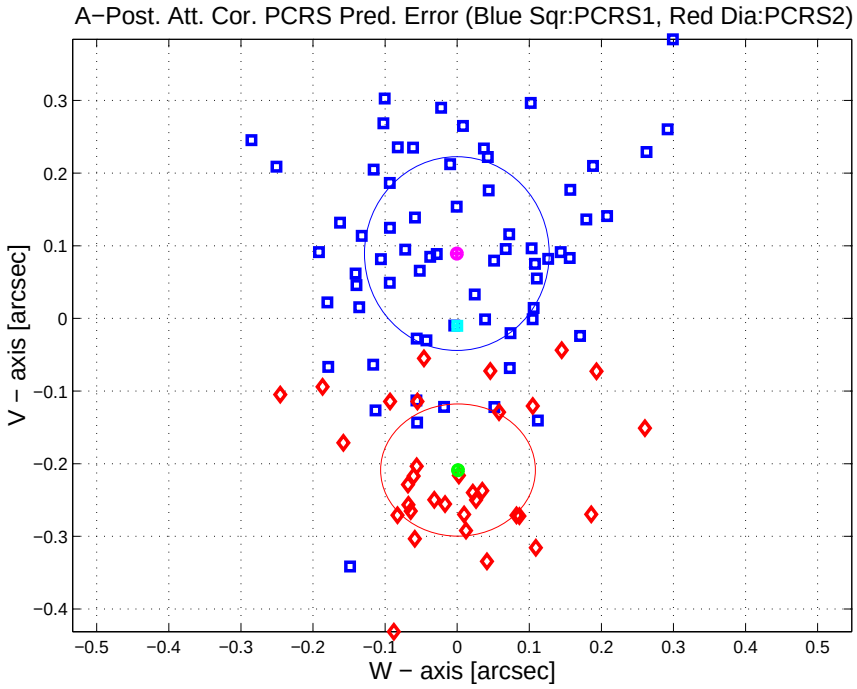

Figure 3.24: A-posteriori PCRS Prediction Summary

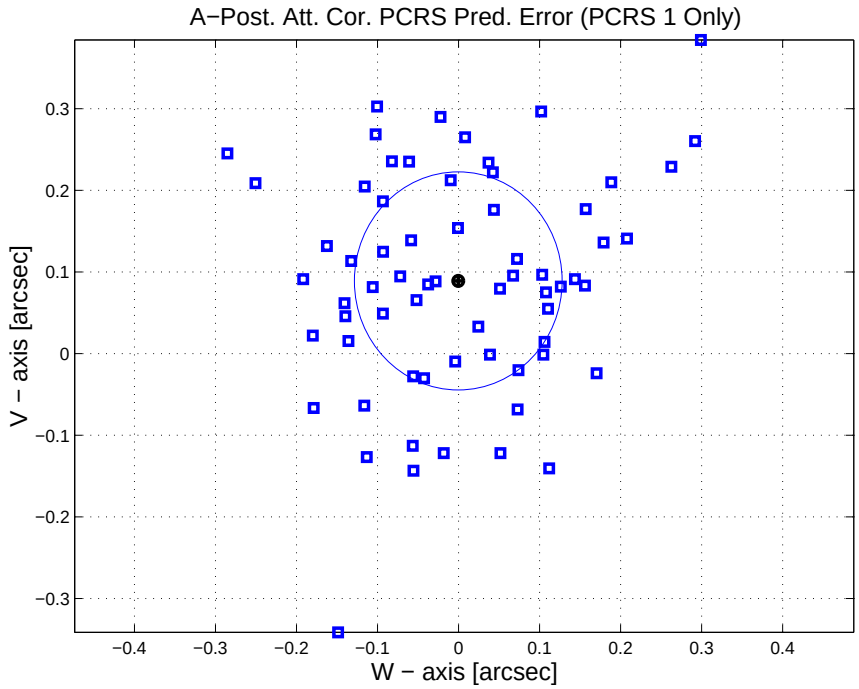

Figure 3.25: A-posteriori PCRS Prediction (PCRS 1 Only)

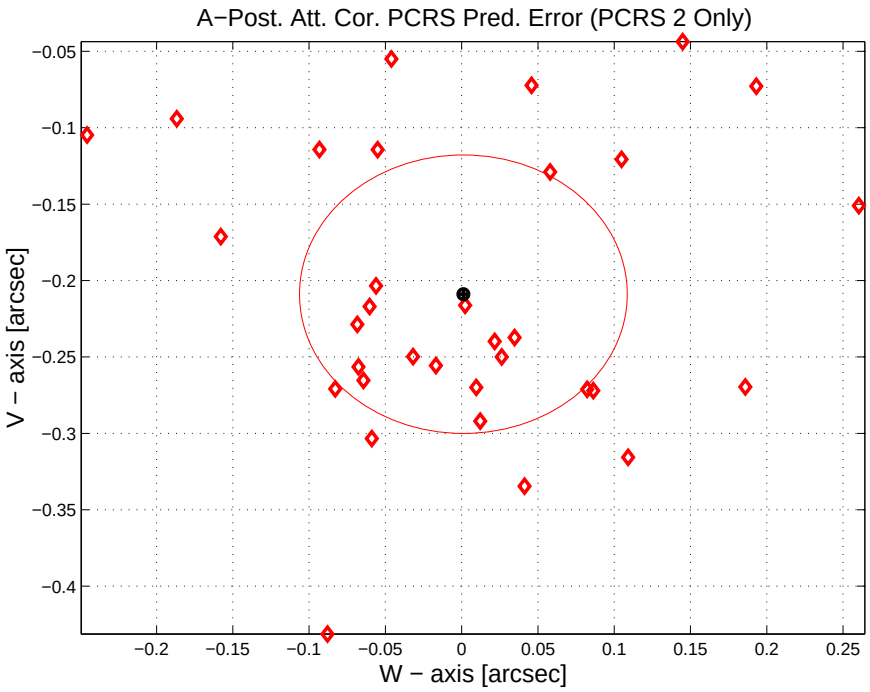

Figure 3.26: A-posteriori PCRS Prediction (PCRS 2 Only)

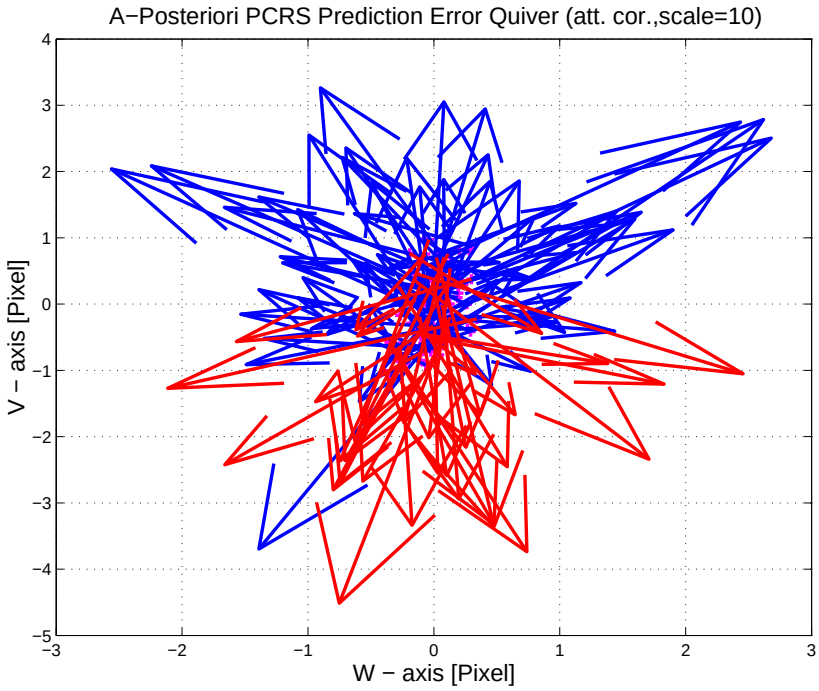

Figure 3.27: A-Posteriori PCRS Prediction Errors Quiver (Att. Cor.)

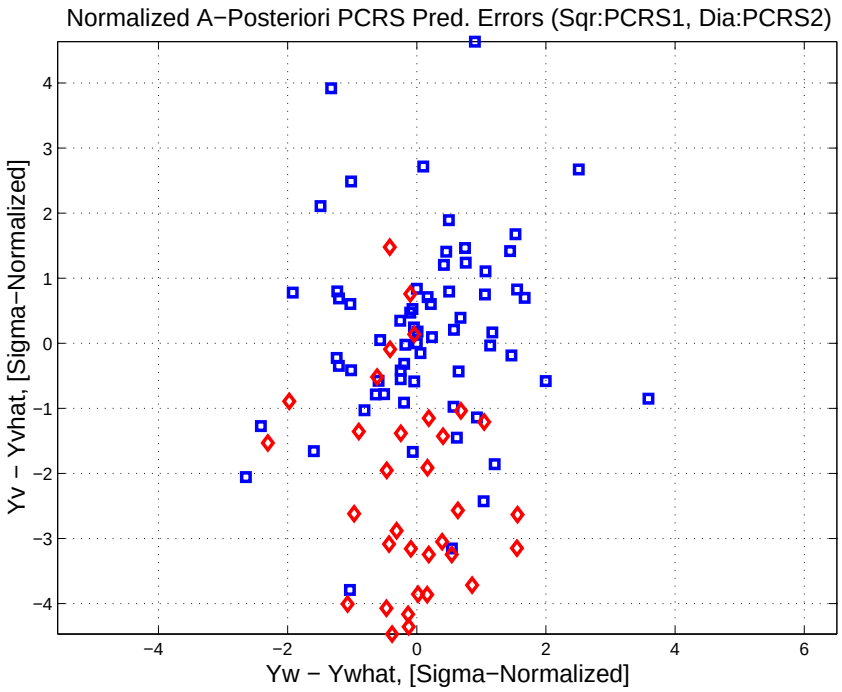

Figure 3.28: Normalized A-Posteriori PCRS Prediction Errors

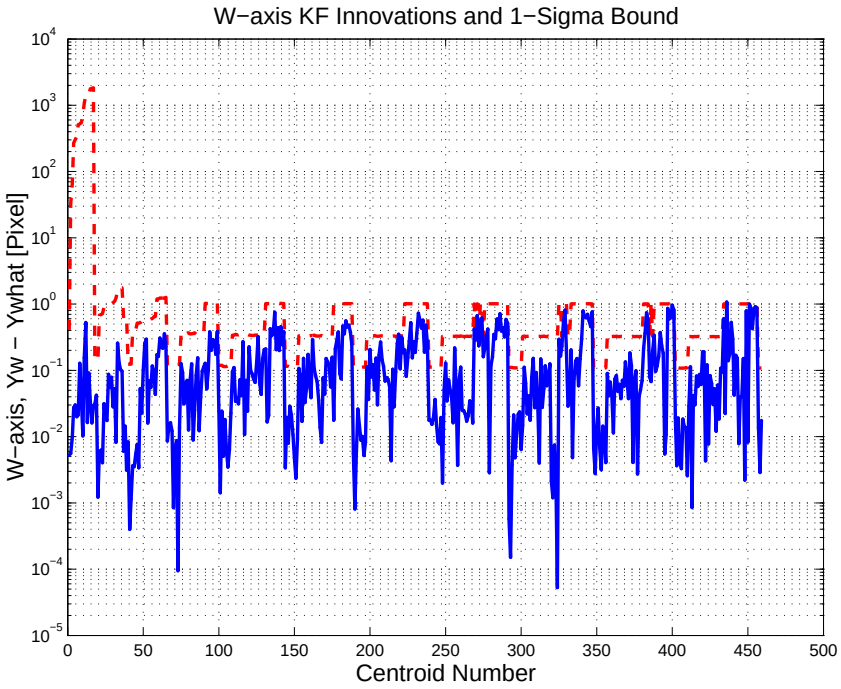

Figure 3.29: W-axis KF innovations and 1-sigma bound

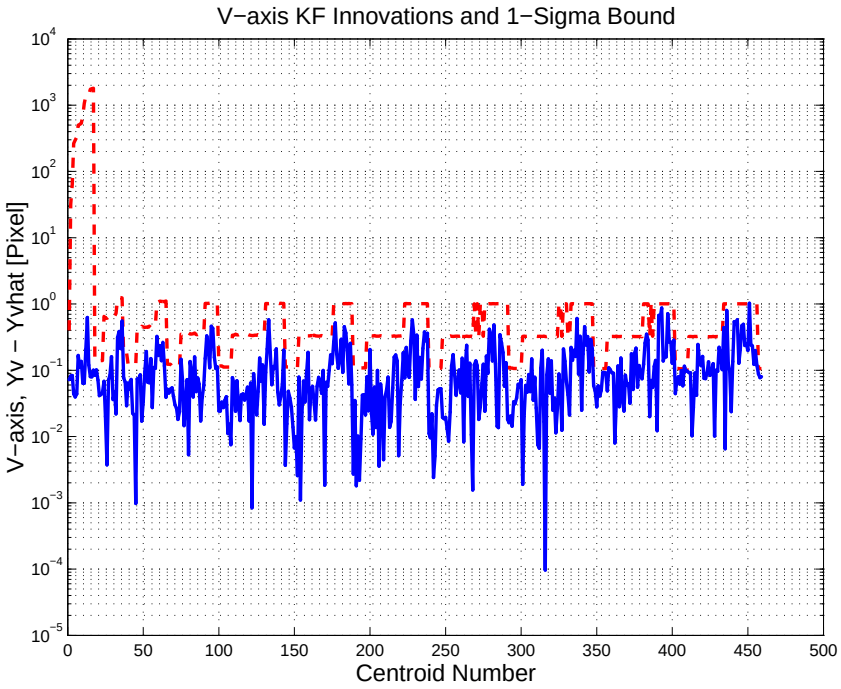

Figure 3.30: V-axis KF innovations and 1-sigma bound

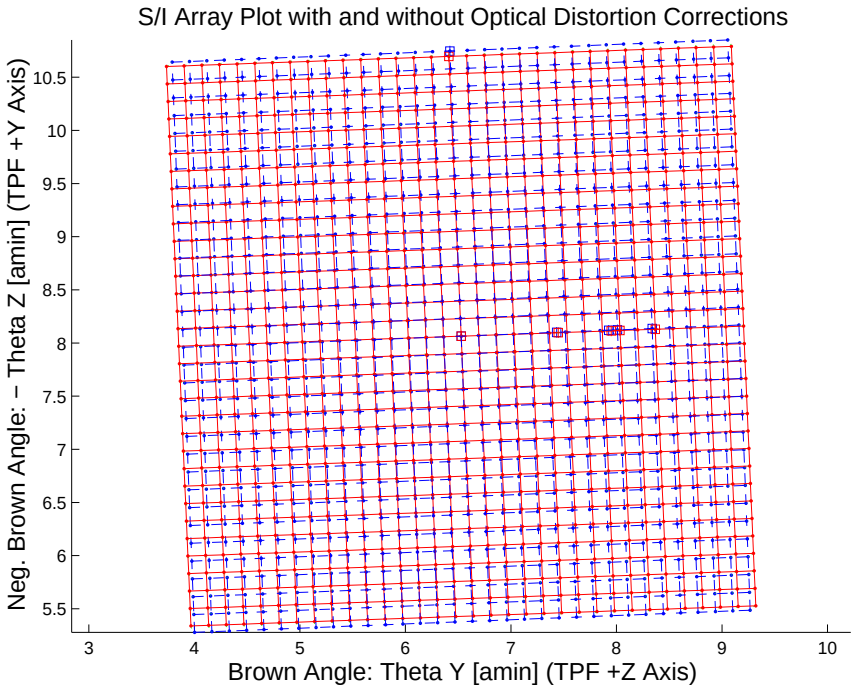

Figure 3.31: Array plot with (solid) and w/o (dashed) optical distortion corrections

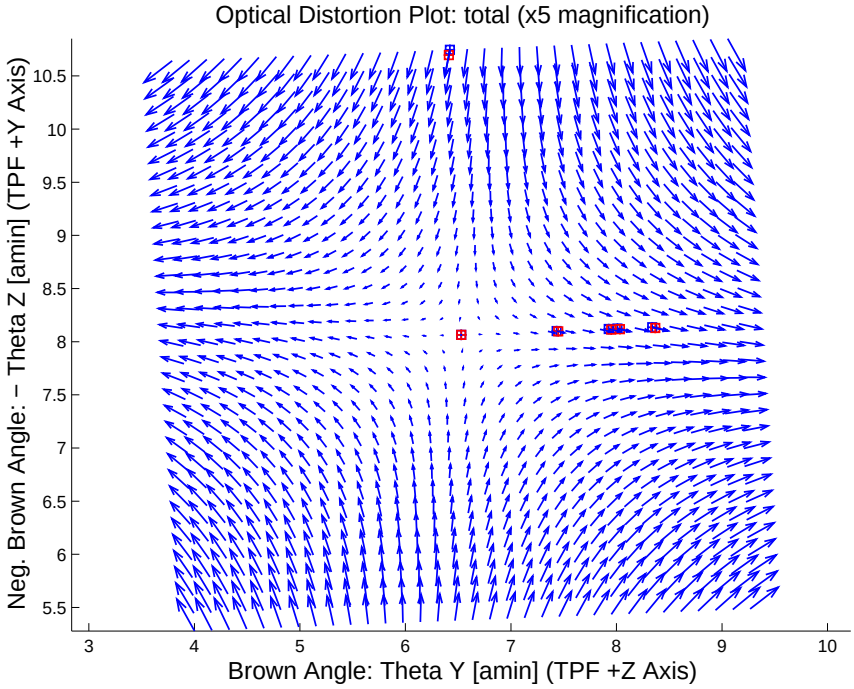

Figure 3.32: Optical Distortion Plot: total (x5 magnification)

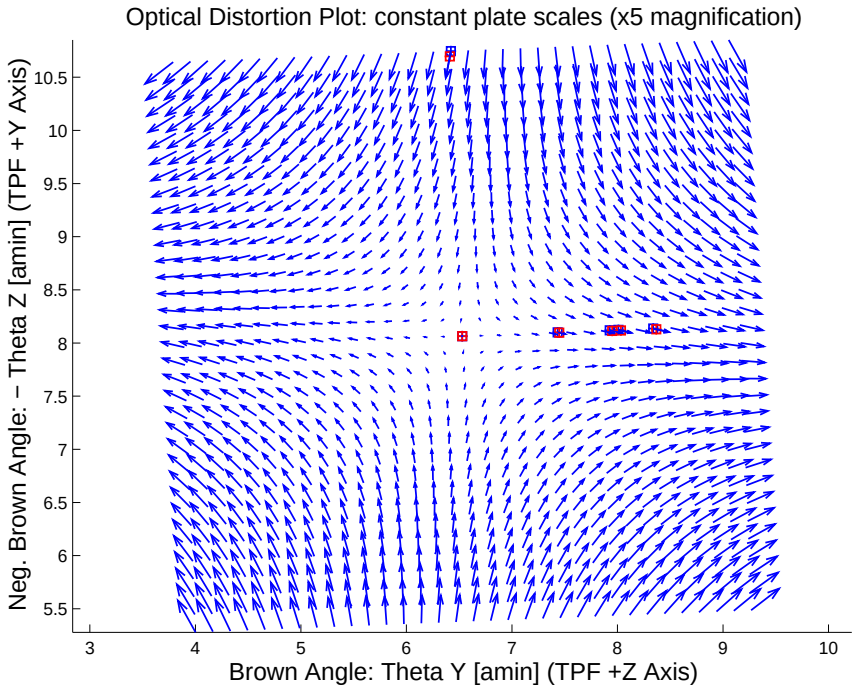

Figure 3.33: Optical Distortion Plot: constant plate scales (x5 magnification)

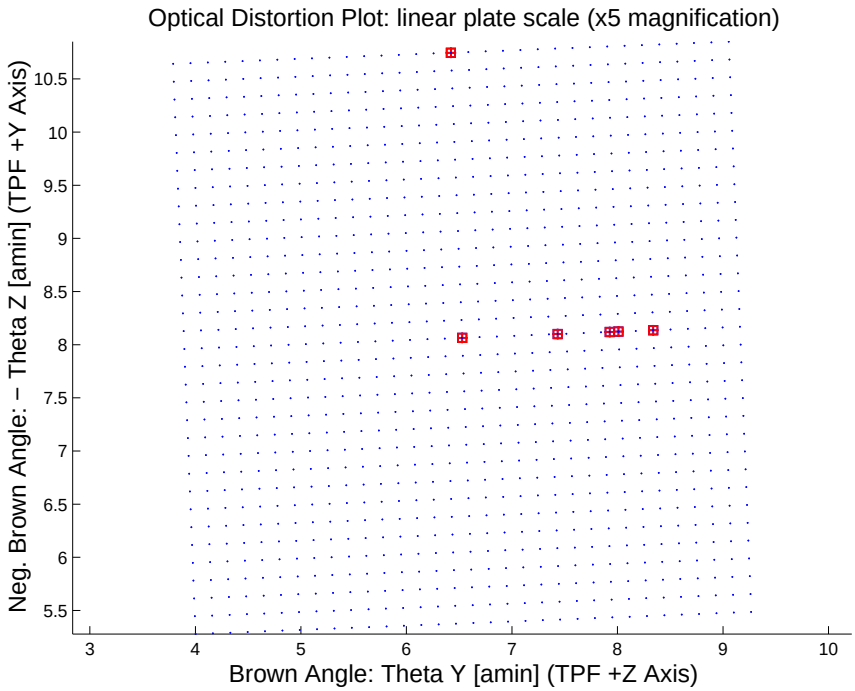

Figure 3.34: Optical Distortion Plot: linear plate scale (x5 magnification)

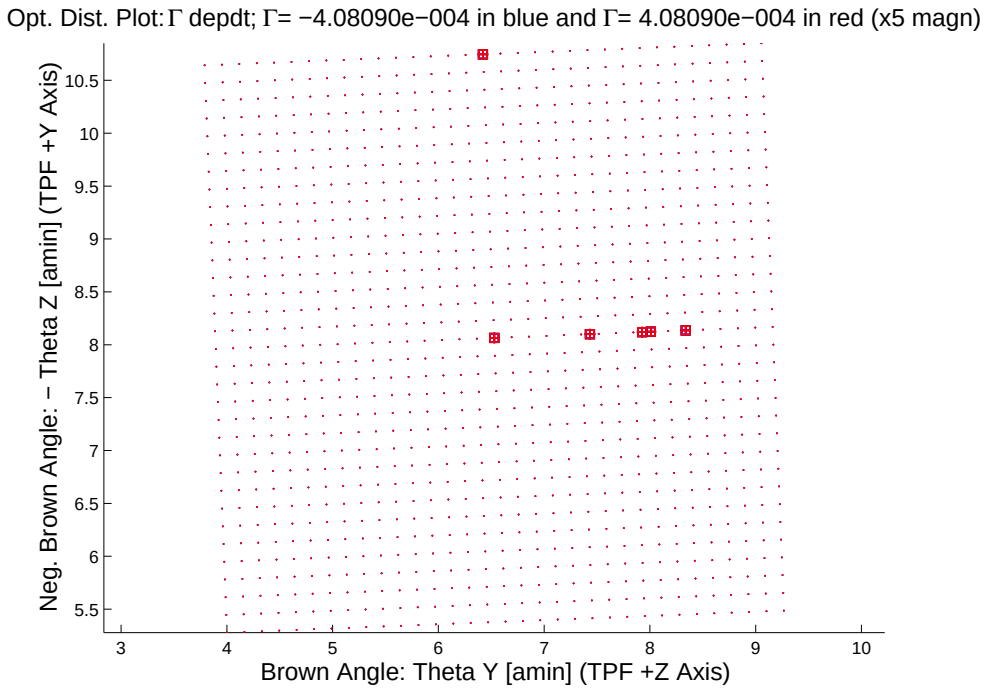

Figure 3.35: Optical Distortion Plot: gamma terms (x5 magnification)

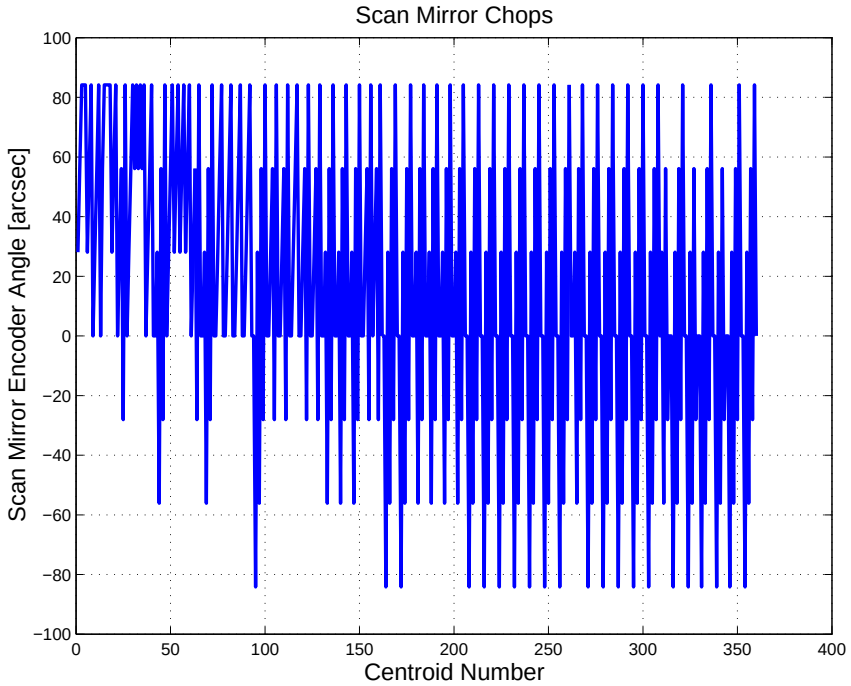

Figure 3.36: Scan Mirror Chops

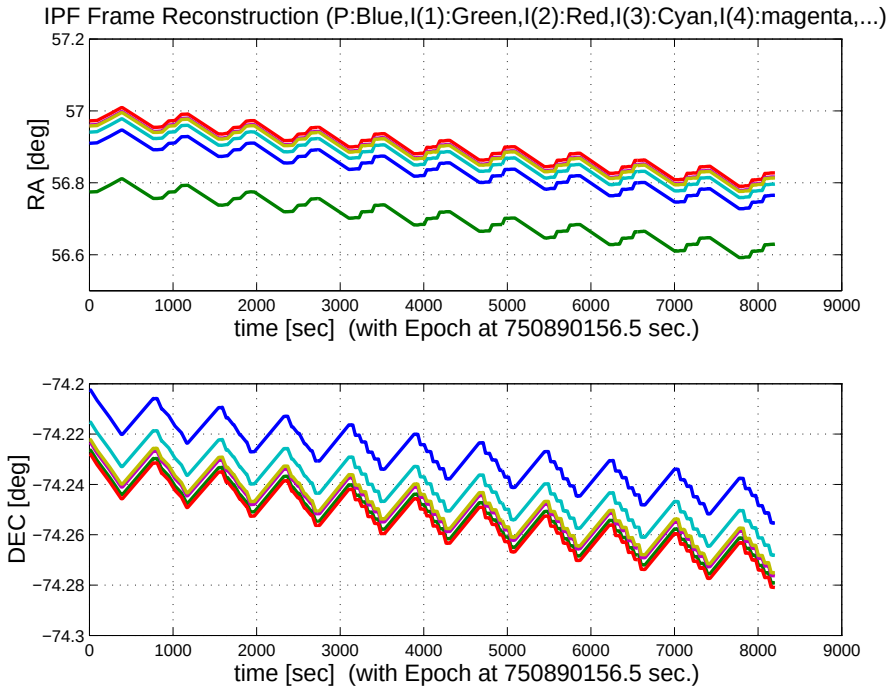

Figure 3.37: IPF Frame Reconstruction

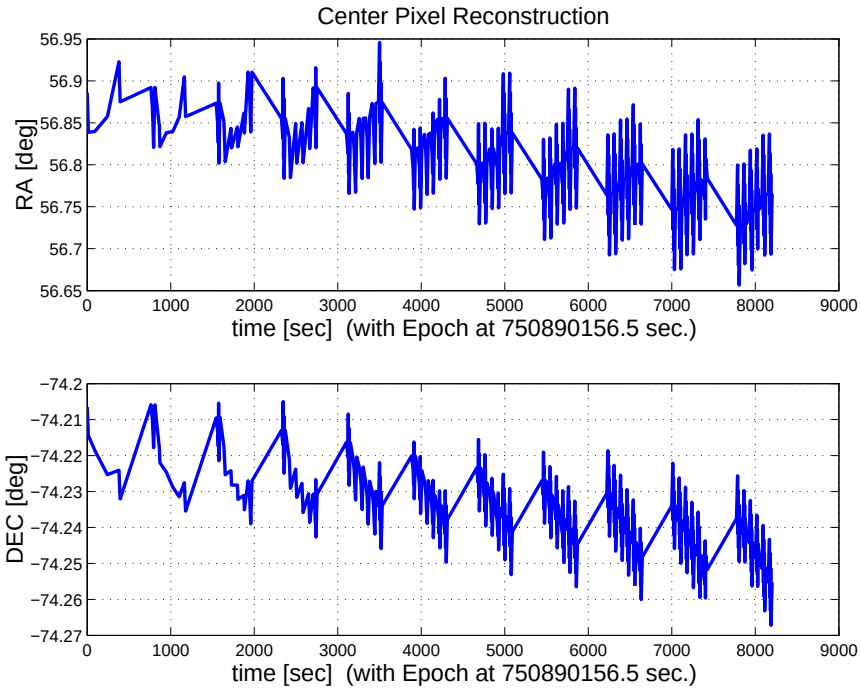

Figure 3.38: Center Pixel Reconstruction

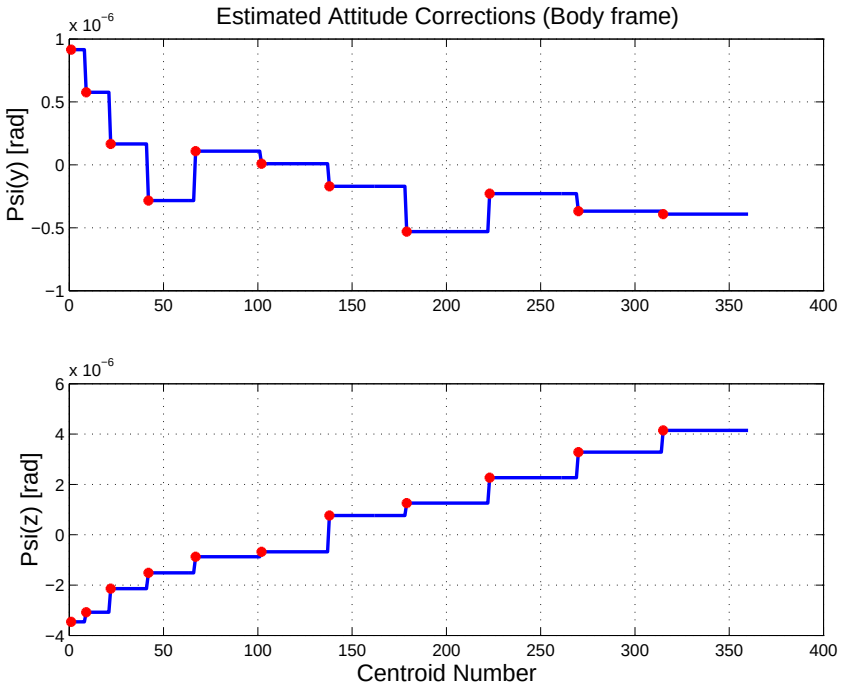

Figure 3.39: Estimated attitude corrections (Body frame)

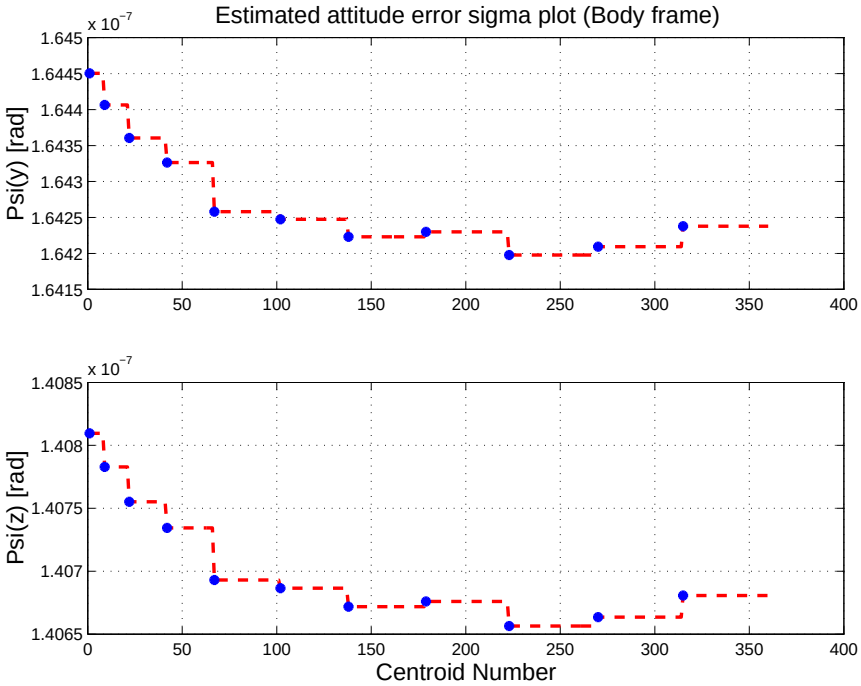

Figure 3.40: Estimated attitude error sigma plot (Body frame)

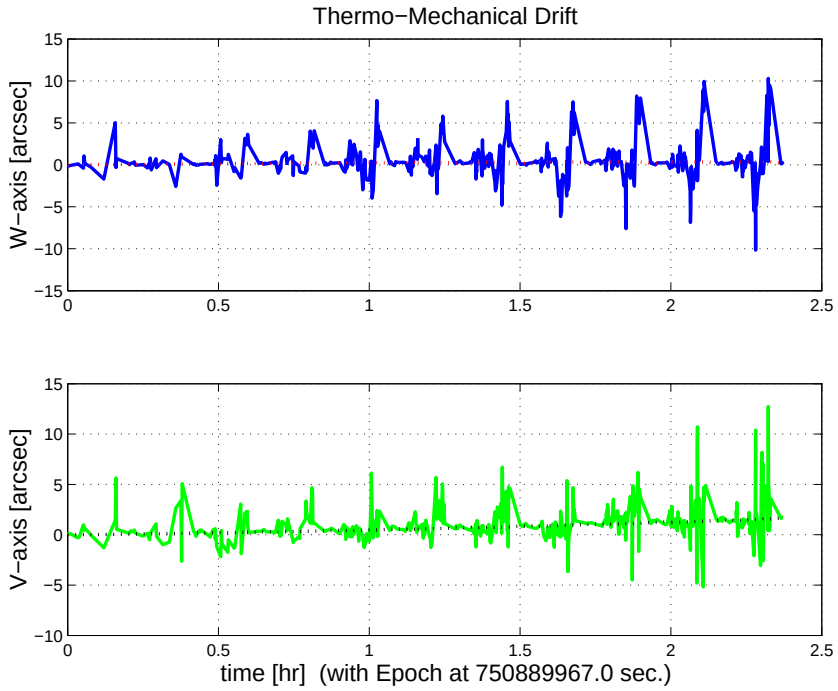

Figure 3.41: Thermo-mechanical boresight drift (equiv. angle in (W,V) coords)

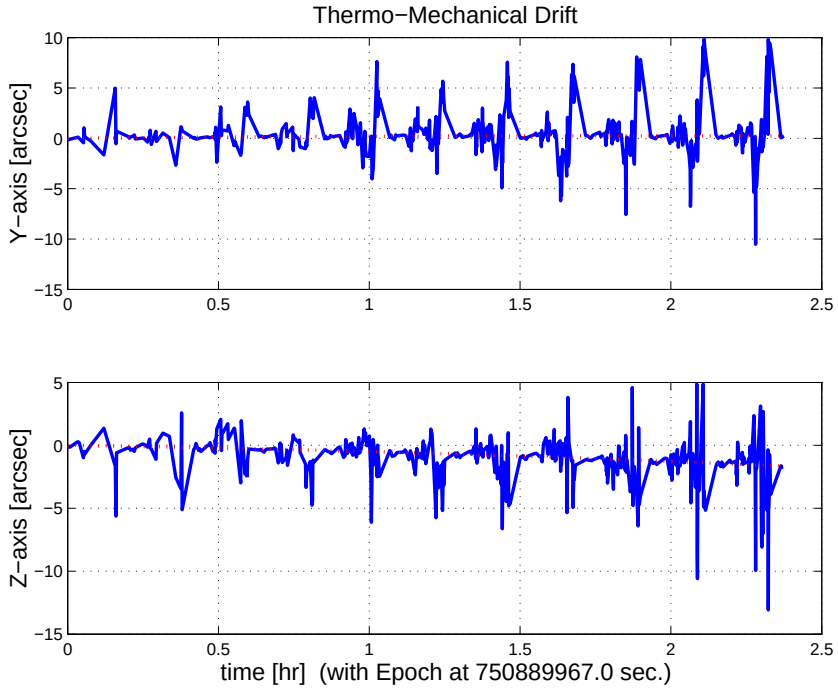

Figure 3.42: Thermo-mechanical boresight drift (equiv. angle in Body frame)

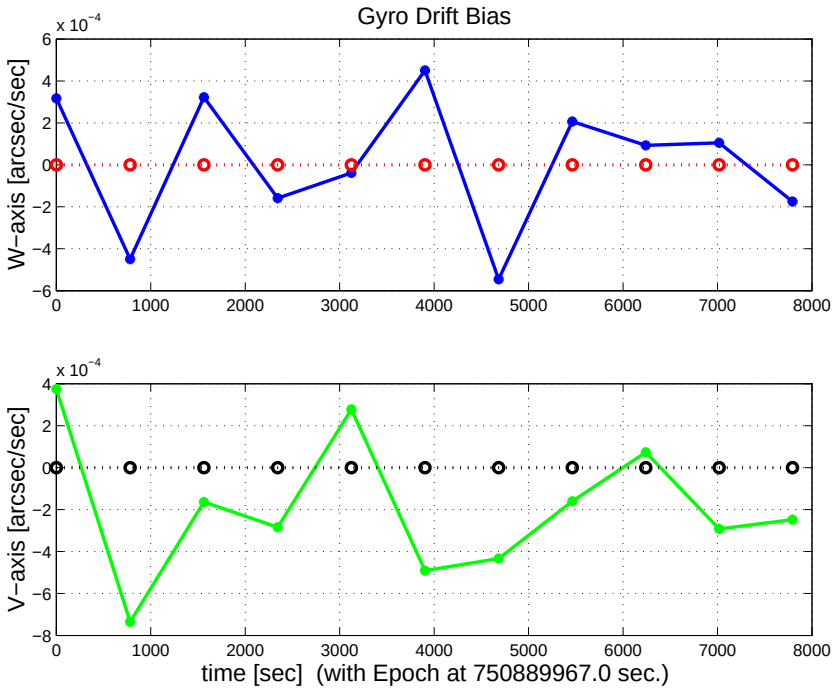

Figure 3.43: Gyro drift bias contribution (equiv. rate in (W,V) coords)

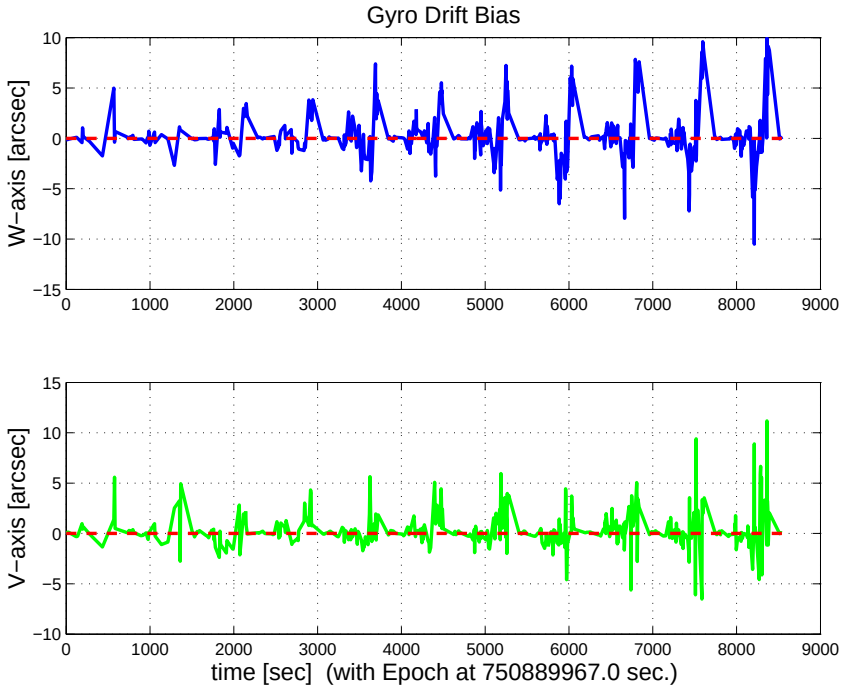

Figure 3.44: Gyro drift bias contribution (equiv. angle in (W,V) coords)

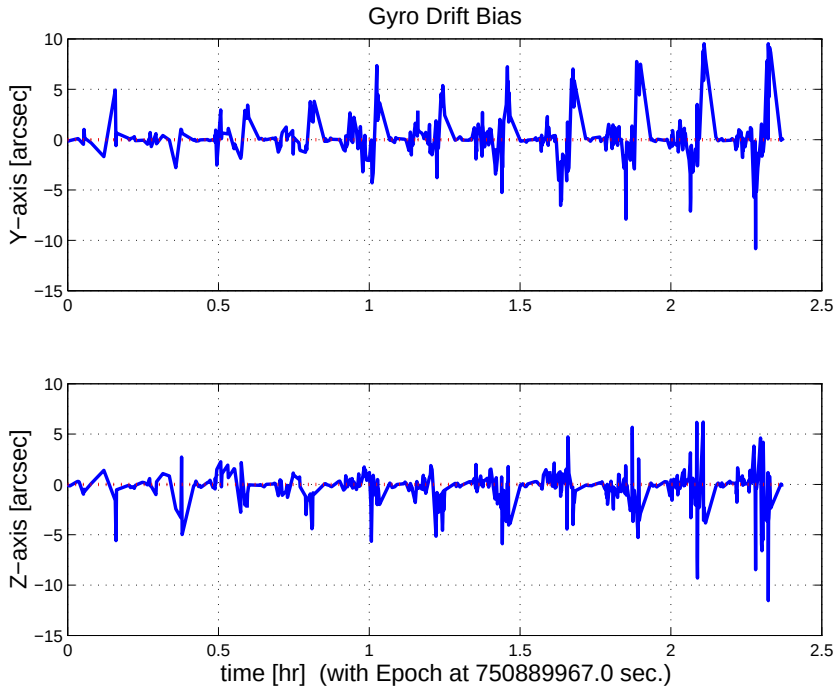

Figure 3.45: Gyro drift bias contribution (equiv. angle in Body frame)

3.2 IPF OUTPUT DATA (IF MINI FILE)

```
OUTPUT FILE NAME: IFmini201107.dat   DATE: 20-Nov-2003   TIME: 17:37
INSTRUMENT NAME:  MIPS_70um_center   NF: 107
IPF FILTER VERSION: IPF.V3.0.0B       SW RELEASE DATE: November 3, 2003
FRAME TABLE USED: BodyFrames_FTU_13Aa
-------------------------------------------------------------------------------
--------------------------- IPF BROWN ANGLE SUMMARY ---------------------------
-------------------------------------------------------------------------------
         ------------ WAS ------------           ------------ IS -------------
Frame    theta_Y     theta_Z     angle           theta_Y     theta_Z     angle
Number   (arcmin)    (arcmin)    (deg)           (arcmin)    (arcmin)    (deg)
------  ---------------------------------       ---------------------------------
 107     +6.465320  -8.103026   -2.285674        +6.528026  -8.064382   -2.270991
 108     +6.358283 -10.784699   -2.285674        +6.411991 -10.695708   -2.270991
 111     +8.276800  -8.103000   -2.285700        +8.367911  -8.129461   -2.270991
 112     +7.371100  -8.103000   -2.285700        +7.447969  -8.096921   -2.270991
 115     +7.947500  -8.103000   -2.285700        +8.033387  -8.117628   -2.270991
 116     +6.714264  -8.948537   +0.000049        +7.949756  -8.114670   -2.270991
-------------------------------------------------------------------------------
OFFSET           NF          Delta_CW          Delta_CV
  0             107            +0.000            +0.000     pixels
OFFSET FRAME NAME: MIPS_70um_center
Brown Angle       theta_Y(arcmin)  theta_Z(arcmin)  angle(deg)
WAS(FTB)            +6.465320        -8.103026       -2.285674
IS (EST)            +6.528026        -8.064382       -2.270991
dT_EST              +0.062706        +0.038644       +0.014683
T_sSIGMA            +0.005633        +0.005734       +0.284804
dT_EST/T_sSIGMA    +11.131487        +6.739941       +0.051555
-------------------------------------------------------------------------
OFFSET           NF          Delta_CW          Delta_CV
  1             108            +0.000           +16.000     pixels
OFFSET FRAME NAME: MIPS_70um_minusY_edge
Brown Angle       theta_Y(arcmin)  theta_Z(arcmin)  angle(deg)
WAS(FTB)            +6.358283       -10.784699       -2.285674
IS (EST)            +6.411991       -10.695708       -2.270991
dT_EST              +0.053708        +0.088990       +0.014683
T_sSIGMA            +0.010247        +0.010455       +0.284804
dT_EST/T_sSIGMA     +5.241573        +8.511550       +0.051555
-------------------------------------------------------------------------
OFFSET           NF          Delta_CW          Delta_CV
  2             111           +11.000            +0.000     pixels
OFFSET FRAME NAME: MIPS_70um_default_small_FOV1
Brown Angle       theta_Y(arcmin)  theta_Z(arcmin)  angle(deg)
WAS(FTB)            +8.276800        -8.103000       -2.285700
IS (EST)            +8.367911        -8.129461       -2.270991
dT_EST              +0.091111        -0.026461       +0.014709
T_sSIGMA            +0.012541        +0.012742       +0.284804
dT_EST/T_sSIGMA     +7.265263        -2.076596       +0.051647
-------------------------------------------------------------------------
OFFSET           NF          Delta_CW          Delta_CV
  3             112            +5.500            +0.000     pixels
OFFSET FRAME NAME: MIPS_70um_default_small_FOV2
Brown Angle       theta_Y(arcmin)  theta_Z(arcmin)  angle(deg)
WAS(FTB)            +7.371100        -8.103000       -2.285700
IS (EST)            +7.447969        -8.096921       -2.270991
dT_EST              +0.076869        +0.006079       +0.014709
T_sSIGMA            +0.004853        +0.004968       +0.284804
dT_EST/T_sSIGMA    +15.839152        +1.223527       +0.051647
-------------------------------------------------------------------------
OFFSET           NF          Delta_CW          Delta_CV
  4             115            +9.000            +0.000     pixels
OFFSET FRAME NAME: MIPS_70um_default_large_FOV1
Brown Angle       theta_Y(arcmin)  theta_Z(arcmin)  angle(deg)
WAS(FTB)            +7.947500        -8.103000       -2.285700
IS (EST)            +8.033387        -8.117628       -2.270991
```

```
dT_EST              +0.085887        -0.014628       +0.014709
T_sSIGMA            +0.009603        +0.009768       +0.284804
dT_EST/T_sSIGMA     +8.943299        -1.497508       +0.051647
-------------------------------------------------------------------
OFFSET           NF          Delta_CW          Delta_CV
  5             116            +8.500            +0.000     pixels
OFFSET FRAME NAME: MIPS_SED_7
Brown Angle       theta_Y(arcmin)  theta_Z(arcmin)  angle(deg)
WAS(FTB)            +6.714264        -8.948537       +0.000049
IS (EST)            +7.949756        -8.114670       -2.270991
dT_EST              +1.235492        +0.833866       -2.271040
T_sSIGMA            +0.008882        +0.009039       +0.284804
dT_EST/T_sSIGMA    +139.093510       +92.253667       -7.974044
-------------------------------------------------------------------
-------------------------------------------------------------------------------------
-------------------------------------------------------------------------------------
VARNAME             MEAN                     SIGMA                SCALED_SIGMA
a00         +1.6285513394659976E-002 +1.0796001688278604E-002 +9.2981320332141664E-003
b00         -1.8611821370918331E-002 +3.6157352055518456E-003 +3.1140772583301054E-003
c00         -4.3495221556585587E-003 +5.6573449271450239E-003 +4.8724279236766399E-003
del_alpha   +2.1563805428781446E-014 +7.0946638888572493E-003 +6.1103289416389187E-003
beta        +9.7445951425150379E-001 +8.1987258104733521E-003 +7.0612100007977300E-003
del_theta1 -4.8719708822808627E-015 +5.7715260594826470E-003 +4.9707672232462011E-003
del_theta2 +4.4860982468955882E-019 +1.9025983135275073E-006 +1.6386261169777652E-006
del_theta3 +6.7194329612295595E-018 +1.9364965818747260E-006 +1.6678212379022063E-006
del_arx     +1.1532794563395463E-015 +5.5091517164885316E-005 +4.7447954835478081E-005
del_ary     -8.5362028278042763E-017 +1.6388625053729985E-006 +1.4114818058788226E-006
del_arz     +6.9989591277793990E-017 +1.5890263804128387E-006 +1.3685600943709013E-006
brx         -1.8537128950432671E-008 +3.1068926810108658E-008 +2.6758330718334619E-008
bry         +3.7936941765165937E-010 +3.2083638570453214E-010 +2.7632258325587817E-010
brz         -4.6810531410300872E-010 +2.6154843935416894E-010 +2.2526042440661505E-010
crx         +1.4776897478851962E-012 +7.4316007238419144E-012 +6.4005181495511532E-012
cry         -5.8116521247054800E-014 +6.7931039914873738E-014 +5.8506083689094891E-014
crz         -1.0933796838535734E-013 +5.3335286599002835E-014 +4.5935388965831065E-014
-------------------------------------------------------------------------------------
LSQF RESIDUAL SIGMA SCALE =         +8.6125700066435718E-001
-------------------------------------------------------------------------------------
-----------------------------------------------------------------------------------------------------------
-----------------------------------------------------------------------------------------------------------
                    a_mirror(1)               a_mirror(2)               a_mirror(3)
a_mirror_ipf   +0.0000000000000000E+000  +2.8426260487745662E-002  +9.9959589220578671E-001
a_mirror_tpf   -2.0540711721332623E-003  +6.8009178241101725E-002  +9.9768258101792584E-001
beta                beta_0                    beta                      beta_total
               +2.8047410000000001E-006  +9.7445951425150379E-001  +2.7331065524612770E-006
-----------------------------------------------------------------------------------------------------------
qT               qT(1)                     qT(2)                     qT(3)                     qT(4)
FrmTbl:    -1.9943813499221301E-002 -9.6366071810333903E-004 +1.1595470044329500E-003 +9.9979996554904504E-001
Estim:     -1.9815699824280417E-002 -9.7251913035883509E-004 +1.1538703312603887E-003 +9.9980251091416739E-001
DelTheta         deltheta(1)               deltheta(2)               deltheta(3)
           +2.5624624691542784E-004 -1.7777521289144618E-005 -1.1959513311808932E-005       [rad]
EulAngT          theta(1)                  theta(2)                  theta(3)                  [rad]
Mean       -3.9636266147876575E-002 -1.8989257818774470E-003 +2.3458335841805055E-003
SigmaT     +5.7715260594826470E-003 +1.9025983135275073E-006 +1.9364965818747260E-006
-----------------------------------------------------------------------------------------------------------
qR               qR(1)                     qR(2)                     qR(3)                     qR(4)
ASFILE:    +7.0019613485783339E-004 +1.2696074554696679E-003 -1.6132958990056068E-004 +9.9999892711639404E-001
Estim:     +7.9750489236589438E-004 +1.2692946741419224E-003 -1.5892717113867954E-004 +9.9999886380892011E-001
DelThetaR        delthetaR(1)              delthetaR(2)              delthetaR(3)
           +1.9461139605695738E-004 -5.9113096415754763E-007 +5.0522803544516358E-006       [rad]
EulAngR          angR(1)                   angR(2)                   angR(3)                   [rad]
Mean       +1.5946103366657734E-003 +2.5388426817991756E-003 -3.1583046683690530E-004
SigmaR     +5.5091517164885316E-005 +1.6388625053729985E-006 +1.5890263804128387E-006
-----------------------------------------------------------------------------------------------------------
Initial Gyro Bias         Bg0(1)                    Bg0(2)                    Bg0(3)
                   +0.0000000000000000E+000 +0.0000000000000000E+000 +0.0000000000000000E+000
Gyro Bias Correction      Bg(1)                     Bg(2)                     Bg(3)
                   +0.0000000000000000E+000 +0.0000000000000000E+000 +0.0000000000000000E+000
Total Gyro Bias           BgT(1)                    BgT(2)                    BgT(3)
```

```
                +0.0000000000000000E+000 +0.0000000000000000E+000 +0.0000000000000000E+000

Initial Gyro Bias Rate     Cg0(1)                   Cg0(2)                   Cg0(3)
                +0.0000000000000000E+000 +0.0000000000000000E+000 +0.0000000000000000E+000
Gyro Bias Rate Correction  Cg(1)                    Cg(2)                    Cg(3)
                +0.0000000000000000E+000 +0.0000000000000000E+000 +0.0000000000000000E+000
Total Gyro Bias Rate       CgT(1)                   CgT(2)                   CgT(3)
                +0.0000000000000000E+000 +0.0000000000000000E+000 +0.0000000000000000E+000
-------------------------------------------------------------------------------------------------------------
-------------------------------------------------------------------------------------------------------------
OFFSET           NF          Delta_CW          Delta_CV
  1             108            +0.000           +16.000     pixels
OFFSET FRAME NAME: MIPS_70um_minusY_edge
qT               qT(1)                    qT(2)                    qT(3)                    qT(4)
WAS(FTB)  -1.994346082634792OE-002 -9.558745809239649 7E-004 +1.5498129478758314E-003 +9.9979945126704295E-001
IS (EST)  -1.9815352742601194E-002 -9.632295130045588 8E-004 +1.5368400631436650E-003 +9.9980201145387371E-001

DelTheta        deltheta(1)              deltheta(2)              deltheta(3)
Units             rad                      rad                      rad
          +2.5621949700715724E-004 -1.4578265045769979E-005 -2.6488645652636716E-005
EulAngT         theta(1)                 theta(2)                 theta(3)                 [rad]
Mean      -3.9636266147876575E-002 -1.8651726347154217E-003 +3.1112554692305098E-003
sSigmaT   +4.9707657343348952E-003 +2.9806102138571753E-006 +3.0413034273975531E-006
SigmaT    +5.7715243307172445E-003 +3.4607674730748074E-006 +3.5312379754841466E-006
-------------------------------------------------------------------------------------------------------------
-------------------------------------------------------------------------------------------------------------
OFFSET           NF          Delta_CW          Delta_CV
  2             111            +11.000            +0.000     pixels
OFFSET FRAME NAME: MIPS_70um_default_small_FOV1
qT               qT(1)                    qT(2)                    qT(3)                    qT(4)
WAS(FTB)  -1.9943725968805691E-002 -1.2270772015423093E-003 +1.1542878003233397E-003 +9.9979968478475556E-001
IS (EST)  -1.9815368529964298E-002 -1.2402542631921756E-003 +1.1580305113446860E-003 +9.9980221639318201E-001

DelTheta        deltheta(1)              deltheta(2)              deltheta(3)
Units             rad                      rad                      rad
          +2.5674311001372131E-004 -2.6789093109876133E-005 +6.6340309001212623E-006
EulAngT         theta(1)                 theta(2)                 theta(3)                 [rad]
Mean      -3.9636266147876575E-002 -2.4341267234472197E-003 +2.3647643439543282E-003
sSigmaT   +4.9707672147831549E-003 +3.6479338251087396E-006 +3.7066378993860960E-006
SigmaT    +5.7715260496562582E-003 +4.2355926538707881E-006 +4.3037535793925232E-006
-------------------------------------------------------------------------------------------------------------
-------------------------------------------------------------------------------------------------------------
OFFSET           NF          Delta_CW          Delta_CV
  3             112            +5.500            +0.000     pixels
OFFSET FRAME NAME: MIPS_70um_default_small_FOV2
qT               qT(1)                    qT(2)                    qT(3)                    qT(4)
WAS(FTB)  -1.9943884174298491E-002 -1.0953748607054996E-003 +1.1569153256015096E-003 +9.9979983155874053E-001
IS (EST)  -1.9815534987819062E-002 -1.1063867170430157E-003 +1.1559504297386104E-003 +9.9980237260179716E-001

DelTheta        deltheta(1)              deltheta(2)              deltheta(3)
Units             rad                      rad                      rad
          +2.5672078349313180E-004 -2.2271887102253283E-005 -2.6585631551222342E-006
EulAngT         theta(1)                 theta(2)                 theta(3)                 [rad]
Mean      -3.9636266147876575E-002 -2.1665262719462366E-003 +2.3552989592583919E-003
sSigmaT   +4.9707673972156970E-003 +1.4117041372132959E-006 +1.4451621404792354E-006
SigmaT    +5.7715262614775175E-003 +1.6391206528647481E-006 +1.6779685266586687E-006
-------------------------------------------------------------------------------------------------------------
-------------------------------------------------------------------------------------------------------------
OFFSET           NF          Delta_CW          Delta_CV
  4             115            +9.000            +0.000     pixels
OFFSET FRAME NAME: MIPS_70um_default_large_FOV1
qT               qT(1)                    qT(2)                    qT(3)                    qT(4)
WAS(FTB)  -1.9943783530175202E-002 -1.1791920533528101E-003 +1.1552431345124802E-003 +9.9979974015694906E-001
IS (EST)  -1.9815429247690978E-002 -1.1915751615550099E-003 +1.1572741199746129E-003 +9.9980227526695264E-001

DelTheta        deltheta(1)              deltheta(2)              deltheta(3)
Units             rad                      rad                      rad
          +2.5673441458001160E-004 -2.5133267937344168E-005 +3.2554331187564816E-006
```

```
EulAngT         theta(1)                 theta(2)                 theta(3)                 [rad]
Mean      -3.9636266147876575E-002 -2.3368174752416374E-003 +2.3613223847703531E-003
sSigmaT   +4.9707673223588498E-003 +2.7935369549708264E-006 +2.8415397816787741E-006
SigmaT    +5.7715261745617105E-003 +3.2435579075884961E-006 +3.2992936829388497E-006
-------------------------------------------------------------------------------------------------------------
-------------------------------------------------------------------------------------------------------------
OFFSET           NF          Delta_CW          Delta_CV
  5             116            +8.500            +0.000     pixels
OFFSET FRAME NAME: MIPS_SED_7
qT               qT(1)                    qT(2)                    qT(3)                    qT(4)
WAS(FTB)  +1.697396651882820 2E-006 -9.765485668859711 5E-004 +1.3015113355285702E-003 +9.9999867620825311E-001
IS (EST)  -1.9815444393623156E-002 -1.1794053849835905E-003 +1.1570850217860968E-003 +9.9980228961563866E-001

DelTheta        deltheta(1)              deltheta(2)              deltheta(3)
Units             rad                      rad                      rad
          -3.9637592707743495E-002 -3.5939021777598633E-004 -2.4256097975835440E-004
EulAngT         theta(1)                 theta(2)                 theta(3)                 [rad]
Mean      -3.9636266147876568E-002 -2.3124901618164118E-003 +2.3604618951730532E-003
sSigmaT   +4.9707673418890987E-003 +2.5838010242459954E-006 +2.6292929674069836E-006
SigmaT    +5.7715261972381571E-003 +3.0000348586460262E-006 +3.0528552631546649E-006
-------------------------------------------------------------------------------------------------------------
-------------------------------------------------------------------------------------------------------------
              q(1)                     q(2)                     q(3)                     q(4)
PCRS1A: +5.3371888965461637E-007 +3.7444233778550031E-004 -1.4253684912431913E-003 +9.9999891405806784E-001
PCRS2A: -5.2779261998836216E-007 +3.8462959425181312E-004 +1.3722087221825403E-003 +9.9999898455099423E-001
-----------------------------------------------------------------------------------------
********** CS-FILE PARAMETERS: ********** ********** AS-FILE PARAMETERS: **********
Row (01) PIX2RADX: +4.7904467948999998E-005  Row (1) TASTART:   +7.5088900029074097E+008
Row (02) PIX2RADY: +4.8792938470999998E-005  Row (2) TASTOP:    +7.5089899969074094E+008
Row (03) CX0:      +1.6500000000000000E+001  Row (3) S/C TIME:  +7.5088810549076843E+008
Row (04) CY0:      +1.6500000000000000E+001  Row (4) QR1:       +7.0019613485783339E-004
Row (05) BETA0:    +2.8047410000000001E-006  Row (5) QR2:       +1.2696074554696679E-003
Row (06) GAMMA_E0: +2.0070000000000000E+003  Row (6) QR3:       -1.6132958990056068E-004
Row (07) D11:      -1.0000000000000000E+000  Row (7) QR4:       +9.9999892711639404E-001
Row (08) D12:      +0.0000000000000000E+000
Row (09) D21:      +0.0000000000000000E+000
Row (10) D22:      -1.0000000000000000E+000
Row (11) DG:       -1.0000000000000000E+000
-----------------------------------------------------------------------------------------
---------------------------------------------------------
INITIAL STA-TO-PCRS ALIGNMENT (R) KNOWLEDGE (1-SIGMA)
    SIGMA(X)        SIGMA(Y)         SIGMA(Z)
1.03875511E+001  3.90072739E-001  3.90593874E-001  [arcsec]
---------------------------------------------------------
PIX2RADX = 4.790446794900E-005[rad/pixel]
XPIXSIZE = 9.8810[arcsec]
PIX2RADY = 4.879293847100E-005[rad/pixel]
YPIXSIZE = 10.0643[arcsec]
CX0 = 16.5[pixel] = 163.04[arcsec]
CY0 = 16.5[pixel] = 166.06[arcsec]
---------------------------------------------------------
NOMINAL BETA0 = 2.804741000000E-006[rad/encoder unit]
ENCODER UNIT SIZE = 0.58[arcsec]
GAMMA_E0 = 2007.00[encoder unit] = 1161.09[arcsec]
---------------------------------------------------------
                | -1 | +0 |
FLIP MATRIX D = |----|----|   and   DG = -1
                | +0 | -1 |
---------------------------------------------------------
```

3.3 IPF EXECUTION LOG

```
*********************************************************************
IPF EXECUTION-LOG FILE NAME:  LG201107.dat
INSTRUMENT TYPE:              MIPS_70um_center
IPF FILTER EXECUTION DATE:    20-Nov-2003    TIME: 17:27
IPF FILTER VERSION USED:      IPF.V3.0.0B
*********************************************************************

------------------- Loading & Preparing Input Files -------------------
AAFILE:  AA201107 Loaded!        AAFILE dimension = 99995 X 21
ASFILE:  AS201107 Loaded!
CAFILE:  CA201107 Loaded!        CAFILE dimension = 360 X 15
CBFILE:  CB002118 Loaded!        CBFILE dimension = 99 X 15
CCFILE:  CC201107 Created!       CCFILE dimension = 459 X 19
CSFILE:  CS201107 Loaded!
Loading Input Files Completed!
---------------------------------------------------------------------

------------------------ Selected Mask Vectors ------------------------
index =   1  2  3  4  5  6  7  8  9 10 11 12 13 14 15 16 17 18 19 20
---------------------------------------------------------------------
mask1 = [ 1  1  1  0  0  0  0  0  0  0  0  0  0  0  0  0  0 ]
mask2 = [ 1  1  1  1  1  1  1  1  1  1  1  1  1  1  0  0  0  0  0  0 ]
---------------------------------------------------------------------

---------------  Selected Initial Gyro Bias Parameters  ---------------
IPF Filter in LITE MODE# 2
IPF LITE MODE WITH UNFILTERED STA QUATERNION!
IPF Linearized Using Following Nominal Gyro Bias Estimates
bg0 = [+0.0000000000000000E+000 +0.0000000000000000E+000 +0.0000000000000000E+000 ]
cg0 = [+0.0000000000000000E+000 +0.0000000000000000E+000 +0.0000000000000000E+000 ]
---------------------------------------------------------------------

---------------  Gyro Pre-Processor Run Completed  --------------------
     AGFILE CREATED:  AG201107.m     ACFILE CREATED:  AC201107.m
---------------------------------------------------------------------
Total Gyro Preprocessor Execution Time: 25 seconds

FRAME TABLE ENTRIES FOR PCRS LOADED TO TPCRS
q_PCRS4 = [ +5.3371888965461637E-007     q_PCRS5 = [ +7.3379987833742897E-007
            +3.7444233778550031E-004                 +5.2236196154513707E-004
            -1.4253684912431913E-003                 -1.4047712280184723E-003
            +9.9999891405806784E-001 ];              +9.9999887687698918E-001 ];
q_PCRS8 = [ -5.2779261998836216E-007     q_PCRS9 = [ -7.1963421681856818E-007
            +3.8462959425181312E-004                 +5.3239763239987400E-004
            +1.3722087221825403E-003                 +1.3516841804518383E-003
            +9.9999898455099423E-001 ];              +9.9999894475050310E-001 ];
---------------------------------------------------------------------------
------ Initial Conditions for State -----  ------   Inital Square-Root Cov (diag)   -----
p1(01)  = a00  = +0.0000000000000000E+000  Sigma_initial(01,01) = 1.0000000000000000E+000
p1(02)  = b00  = +0.0000000000000000E+000  Sigma_initial(02,02) = 1.0000000000000000E+000
p1(03)  = c00  = +0.0000000000000000E+000  Sigma_initial(03,03) = 1.0000000000000000E+000
p1(04)  = a10  = +0.0000000000000000E+000  Sigma_initial(04,04) = 9.9999000000000000E+004
p1(05)  = b10  = +0.0000000000000000E+000  Sigma_initial(05,05) = 9.9999000000000000E+004
p1(06)  = c10  = +0.0000000000000000E+000  Sigma_initial(06,06) = 9.9999000000000000E+004
p1(07)  = d10  = +0.0000000000000000E+000  Sigma_initial(07,07) = 9.9999000000000000E+004
p1(08)  = a20  = +0.0000000000000000E+000  Sigma_initial(08,08) = 9.9999000000000000E+004
p1(09)  = b20  = +0.0000000000000000E+000  Sigma_initial(09,09) = 9.9999000000000000E+004
p1(10)  = c20  = +0.0000000000000000E+000  Sigma_initial(10,10) = 9.9999000000000000E+004
p1(11)  = d20  = +0.0000000000000000E+000  Sigma_initial(11,11) = 9.9999000000000000E+004
p1(12)  = a01  = +0.0000000000000000E+000  Sigma_initial(12,12) = 9.9999000000000000E+004
p1(13)  = b01  = +0.0000000000000000E+000  Sigma_initial(13,13) = 9.9999000000000000E+004
p1(14)  = c01  = +0.0000000000000000E+000  Sigma_initial(14,14) = 9.9999000000000000E+004
p1(15)  = d01  = +0.0000000000000000E+000  Sigma_initial(15,15) = 9.9999000000000000E+004
p1(16)  = e01  = +0.0000000000000000E+000  Sigma_initial(16,16) = 9.9999000000000000E+004
```

```
p1(17)  = f01  = +0.0000000000000000E+000  Sigma_initial(17,17) = 9.9999000000000000E+004
-------------------------------------------------------------------------------------
p2f(01) = am1  = +0.0000000000000000E+000
p2f(02) = am2  = +0.0000000000000000E+000  Sigma_initial(18,18) = 1.0000000000000001E-001
p2f(03) = am3  = +1.0000000000000000E+000
p2f(04) = beta = +1.0000000000000000E+000  Sigma_initial(19,19) = 1.0000000000000001E-001
p2f(05) = qT1  = -1.9943813499221315E-002  Sigma_initial(20,20) = 1.0000000000000001E-001
p2f(06) = qT2  = -9.6366071810333978E-004  Sigma_initial(21,21) = 1.0000000000000000E-002
p2f(07) = aT3  = +1.1595470044329509E-003  Sigma_initial(22,22) = 1.0000000000000000E-002
p2f(08) = qT4  = +9.9979996554904582E-001
p2f(09) = qR1  = +7.0019613485783339E-004  Sigma_initial(23,23) = 5.0360268829562863E-004
p2f(10) = qR2  = +1.2696074554696679E-003  Sigma_initial(24,24) = 1.8911260069207081E-005
p2f(11) = qR3  = -1.6132958990056068E-004  Sigma_initial(25,25) = 1.8936525388250984E-005
p2f(12) = qR4  = +9.9999892711639404E-001
p2f(13) = brx  = +0.0000000000000000E+000  Sigma_initial(26,26) = 1.1710013278346707E-004
p2f(14) = bry  = +0.0000000000000000E+000  Sigma_initial(27,27) = 1.1710013278346707E-004
p2f(15) = brz  = +0.0000000000000000E+000  Sigma_initial(28,28) = 1.1710013278346707E-004
p2f(16) = crx  = +0.0000000000000000E+000  Sigma_initial(29,29) = 1.3712441097905619E-008
p2f(17) = cry  = +0.0000000000000000E+000  Sigma_initial(30,30) = 1.3712441097905619E-008
p2f(18) = crz  = +0.0000000000000000E+000  Sigma_initial(31,31) = 1.3712441097905619E-008
p2f(19) = bgx  = +0.0000000000000000E+000  Sigma_initial(32,32) = 9.9999000000000000E+004
p2f(20) = bgy  = +0.0000000000000000E+000  Sigma_initial(33,33) = 9.9999000000000000E+004
p2f(21) = bgz  = +0.0000000000000000E+000  Sigma_initial(34,34) = 9.9999000000000000E+004
p2f(22) = cgx  = +0.0000000000000000E+000  Sigma_initial(35,35) = 9.9999000000000000E+004
p2f(23) = cgy  = +0.0000000000000000E+000  Sigma_initial(36,36) = 9.9999000000000000E+004
p2f(24) = cgz  = +0.0000000000000000E+000  Sigma_initial(37,37) = 9.9999000000000000E+004
-------------------------------------------------------------------------------------

--------------------   IPF KALMAN FILTER STARTED  ---------------------
Iteration#001: |dp|= +8.484103076476E-002   RMS(|Res|)=+2.867783550923E-005
Iteration#002: |dp|= +2.642261397621E-002   RMS(|Res|)=+1.782464667053E-005
Iteration#003: |dp|= +3.005002362485E-003   RMS(|Res|)=+1.686816045344E-005
Iteration#004: |dp|= +8.826865034730E-004   RMS(|Res|)=+1.687337180816E-005
Iteration#005: |dp|= +8.505001502896E-005   RMS(|Res|)=+1.686292679910E-005
Iteration#006: |dp|= +3.447147180348E-005   RMS(|Res|)=+1.686490001084E-005
Iteration#007: |dp|= +5.303395921140E-006   RMS(|Res|)=+1.686517697511E-005
Iteration#008: |dp|= +6.686879746661E-007   RMS(|Res|)=+1.686508997712E-005
Iteration#009: |dp|= +2.660071124122E-007   RMS(|Res|)=+1.686509221447E-005
Iteration#010: |dp|= +1.748382778097E-008   RMS(|Res|)=+1.686509550986E-005
Iteration#011: |dp|= +9.048895862719E-009   RMS(|Res|)=+1.686509507911E-005
Iteration#012: |dp|= +1.472394234967E-009   RMS(|Res|)=+1.686509501108E-005
Iteration#013: |dp|= +1.965502302932E-010   RMS(|Res|)=+1.686509503576E-005
Iteration#014: |dp|= +7.069249934926E-011   RMS(|Res|)=+1.686509503549E-005
Iteration#015: |dp|= +4.572200808333E-012   RMS(|Res|)=+1.686509503461E-005
Iteration#016: |dp|= +2.468359549398E-012   RMS(|Res|)=+1.686509503472E-005
Iteration#017: |dp|= +3.991370107652E-013   RMS(|Res|)=+1.686509503474E-005
Iteration#018: |dp|= +8.194154955083E-014   RMS(|Res|)=+1.686509503473E-005
Iteration#019: |dp|= +1.005285578972E-013   RMS(|Res|)=+1.686509503474E-005
Iteration#020: |dp|= +1.128473492840E-013   RMS(|Res|)=+1.686509503474E-005
Iteration#021: |dp|= +8.708173543871E-014   RMS(|Res|)=+1.686509503473E-005
Iteration#022: |dp|= +5.737177086562E-014   RMS(|Res|)=+1.686509503473E-005
Iteration#023: |dp|= +8.943653371648E-014   RMS(|Res|)=+1.686509503474E-005
Iteration#024: |dp|= +1.050748561601E-013   RMS(|Res|)=+1.686509503474E-005
Iteration#025: |dp|= +1.624388288775E-013   RMS(|Res|)=+1.686509503474E-005
Iteration#026: |dp|= +1.306470439607E-013   RMS(|Res|)=+1.686509503474E-005
Iteration#027: |dp|= +8.755665718651E-014   RMS(|Res|)=+1.686509503473E-005
Iteration#028: |dp|= +4.788358794031E-014   RMS(|Res|)=+1.686509503474E-005
Iteration#029: |dp|= +6.347138159062E-014   RMS(|Res|)=+1.686509503474E-005
Iteration#030: |dp|= +7.358722798151E-014   RMS(|Res|)=+1.686509503474E-005
IPF Kalman Filter Completed with Error |dp1| + |dp2| = +7.3587227981508961E-014
-----------------------------------------------------------------------

-----------------  IPF LEAST SQUARES FILTER STARTED  ------------------
Iteration#001   COND#=+1.323142996014E+004,   |dp|=+8.546475508128E-002
Iteration#002   COND#=+1.372108296721E+004,   |dp|=+2.733231060482E-002
Iteration#003   COND#=+1.360548309778E+004,   |dp|=+8.090746660733E-004
Iteration#004   COND#=+1.360149919735E+004,   |dp|=+4.667914739663E-005
Iteration#005   COND#=+1.360171622932E+004,   |dp|=+1.421310014687E-006
```

```
Iteration#006   COND#=+1.360170963290E+004,   |dp|=+4.204728697834E-008
Iteration#007   COND#=+1.360170982806E+004,   |dp|=+1.246009973989E-009
Iteration#008   COND#=+1.360170982227E+004,   |dp|=+3.701110535330E-011
Iteration#009   COND#=+1.360170982244E+004,   |dp|=+1.133823640147E-012
Iteration#010   COND#=+1.360170982244E+004,   |dp|=+1.061278336815E-013
Iteration#011   COND#=+1.360170982243E+004,   |dp|=+7.550902434634E-014
Iteration#012   COND#=+1.360170982244E+004,   |dp|=+6.074491058303E-014
Iteration#013   COND#=+1.360170982244E+004,   |dp|=+5.089249245901E-014
Iteration#014   COND#=+1.360170982244E+004,   |dp|=+3.884213395920E-014
Iteration#015   COND#=+1.360170982243E+004,   |dp|=+7.426860503557E-014
Iteration#016   COND#=+1.360170982244E+004,   |dp|=+5.306139994176E-014
Iteration#017   COND#=+1.360170982244E+004,   |dp|=+4.326644364021E-014
Iteration#018   COND#=+1.360170982244E+004,   |dp|=+9.143673949877E-014
Iteration#019   COND#=+1.360170982244E+004,   |dp|=+1.123780507748E-013
Iteration#020   COND#=+1.360170982245E+004,   |dp|=+6.333438229182E-014
Iteration#021   COND#=+1.360170982244E+004,   |dp|=+6.708491279116E-014
Iteration#022   COND#=+1.360170982244E+004,   |dp|=+6.926233446077E-014
Iteration#023   COND#=+1.360170982244E+004,   |dp|=+8.721390978390E-014
Iteration#024   COND#=+1.360170982244E+004,   |dp|=+6.590437492468E-014
Iteration#025   COND#=+1.360170982244E+004,   |dp|=+7.877140495646E-014
Iteration#026   COND#=+1.360170982244E+004,   |dp|=+7.599812228527E-014
Iteration#027   COND#=+1.360170982244E+004,   |dp|=+9.678303266007E-014
Iteration#028   COND#=+1.360170982243E+004,   |dp|=+5.054598653178E-014
Iteration#029   COND#=+1.360170982244E+004,   |dp|=+8.359833600809E-014
Iteration#030   COND#=+1.360170982243E+004,   |dp|=+1.231773524769E-013
IPF Least Squares Filter Completed with Error |dp1| + |dp2| = +1.2317735247692570E-013
---------------------------------------------------------------------
Total Execution Time: 622 seconds
```

4 COMMENTS

Overall the data looked clean, and the filter converged nicely.

1. The run was done in IPF Lite mode 2 (i.e., star tracker based attitude), for robustness, and since the star tracker error is expected to be small compared to the science centroiding errors.
2. There were 11 sandwich maneuvers with 360 science centroids and 99 PCRS measurements. No centroids were removed.
3. We estimated 17 parameters consisting of: 3 constant plate scales, 2 mirror parameters, 3 IPF alignment angles, 3 STA-to-PCRS alignment angles, and 6 STA-to-PCRS thermomechanical drift parameters.
4. The scan mirror parameter estimates (alpha and beta) indicate that the mirror spin axis is tilted by 1.6 degrees with a 0.35 degree confidence and the scan mirror scale factors are off by 2.5 percent with a 1-sigma confidence of about 0.7 percent.
5. Constant plate scales were estimated to about 1.8 percent.
6. For historical interest, the MIPS team constructed the final CA file by merging two separate CA files which were cleaned based on earlier results from unofficial IPF runs.

We recommend updating frames 107, 108, 111, 112, 115 and 116 with the new quaternions listed in the IF file IF201107.dat. This contains adjustments of 3.7 and 2.3 arcseconds in Y and Z, and 0.015 deg in twist (for the prime frame). In our best judgement, this coarse survey is accurate to 0.5 arcsecond which satisfies its coarse survey requirement of 2.65 arcseconds by a good margin.

IPF TEAM CONTACT INFORMATION

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