JET PROPULSION LABORATORY **SIRTF IPF REPORT**

JPL ID01P118
October 12, 2003

SIRTF INSTRUMENT POINTING FRAME KALMAN FILTER EXECUTION SUMMARY

IPF RUN NUMBER: 01P118
REPORT TYPE: IOC EXECUTION (PRECOARSE)

PRIME FRAME: MIPS_70um_fine_center (118)
INFERRED FRAMES: (119) (120) (124) (127)

IPF TEAM

Autonomy and Control Section (345)
Jet Propulsion Laboratory
California Institute of Technology
4800 Oak Grove Drive
Pasadena, CA 91109

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1 IPF EXECUTION SUMMARY

This report summarizes the SIRTF Instrument Pointing Frame (IPF) Kalman Filter execution associated with run file: RN01P118. In particular, this Focal Point Survey calibrates the instrument: MIPS_70um_fine_center (118), as part of the IOC Precoarse Survey. The main calibration results from the IPF filter execution have been documented in IF01P118 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 3 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.

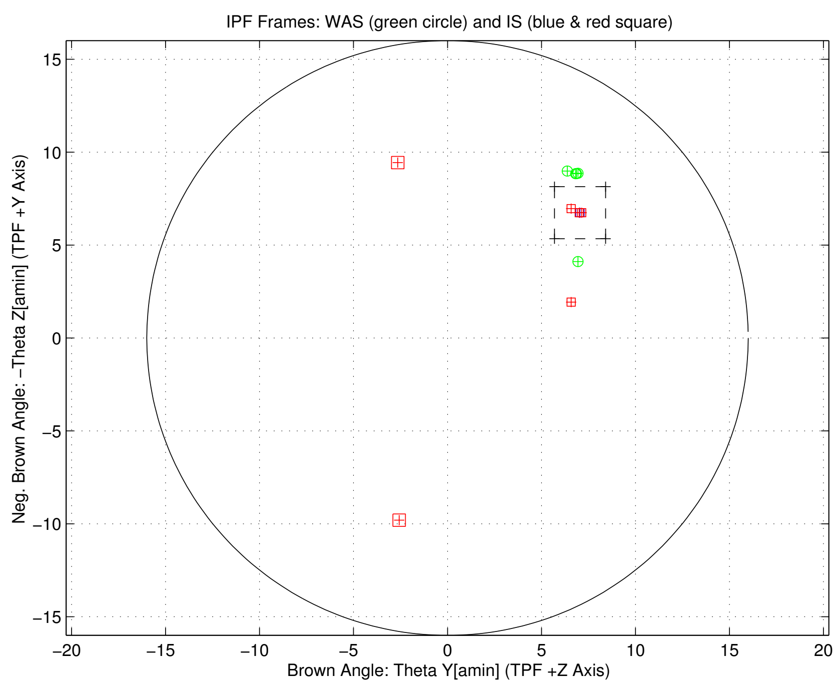

Figure 1.1: A-priori and a-posteriori IPF frames

RAW	FINAL (After Editing)
AA01P118	AA01P118
AS01P118	AS01P118
CA01P118	CA01P118
CB01P118	CB01P118
CS01P118	CS01P118

Table 1.1: IPF filter input files

EXECUTION CONFIGURATION ITEM	CURRENT STATUS
IPF Filter Version Used	IPF.V2.0.0C
Frame Table Version Used	BodyFrames_FTU_07f
Scan-Mirror Employed?	YES
IPF Filter Mode	LITE-MODE(3):FLT
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	55
LS Residual Sigma Scale	7.96655989E-001
Total Number of Maneuvers	9

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
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	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	
0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	

Table 1.3: IPF filter execution mask vector assignment

FOCAL PLANE SURVEY ANALYSIS: IOC Precoarse Survey.
INSTRUMENT NAME: MIPS_70um_fine_center NF: 118

`PIX2RADW: 2.47365083E-005[rad/pixel] = 5.1023E+000[arcsec/pixel]`
`PIX2RADV: 2.47365083E-005[rad/pixel] = 5.1023E+000[arcsec/pixel]`

FRAME	DESCRIPTION	IPF[1]	SF[2]	TOTAL	REQ
118(P)	MIPS_70um_fine_center	2.0525	0.0855	2.0543	1.12
119(I)	MIPS_70um_fine_FOV1	2.0525	0.0855	2.0543	N/A
120(I)	MIPS_70um_fine_FOV2	2.0525	0.0855	2.0543	N/A
124(I)	MIPS_70um_fine_FOV3	2.0525	0.0855	2.0543	N/A
127(I)	MIPS_70um_fine_FOV4	2.0525	0.0855	2.0543	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	121.5982	1.7891	1.4240	arcsec
W-Axis	11.5980	1.5462	1.2729	arcsec
V-Axis	121.0438	0.9002	0.6384	arcsec
Radial	23.8322	0.3507	0.2791	pixels
W-Axis	2.2731	0.3030	0.2495	pixels
V-Axis	23.7235	0.1764	0.1251	pixels

Table 1.5: 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: 0.796656. 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 0.0471 arcseconds, given that ARW = 100 $\mu deg/\sqrt{hr}$, with 277 second Maneuver time (max), and 9 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_07f					
NF	NAME	WAS	IS	CHANGE	UNIT
118	theta_Y	+6.859000	+7.051500	+0.192500	arcmin
118	theta_Z	-8.847000	-6.743181	+2.103819	arcmin
118	angle	-0.000000	+0.000071	+0.000071	deg
119	theta_Y	+6.942000	+7.136538	+0.194538	arcmin
119	theta_Z	-8.861000	-6.743181	+2.117819	arcmin
119	angle	-0.000000	+0.000071	+0.000071	deg
120	theta_Y	+6.941000	+6.575276	-0.365724	arcmin
120	theta_Z	-4.117000	-1.928390	+2.188610	arcmin
120	angle	+0.000000	+0.000071	+0.000071	deg
124	theta_Y	+6.372000	+6.575289	+0.203289	arcmin
124	theta_Z	-8.981000	-6.962036	+2.018964	arcmin
124	angle	-0.000000	+0.000071	+0.000071	deg
127	theta_Y	+6.818000	+7.008981	+0.190981	arcmin
127	theta_Z	-8.840000	-6.743181	+2.096819	arcmin
127	angle	+0.000000	+0.000071	+0.000071	deg

Table 1.6: IPF Brown angle summary

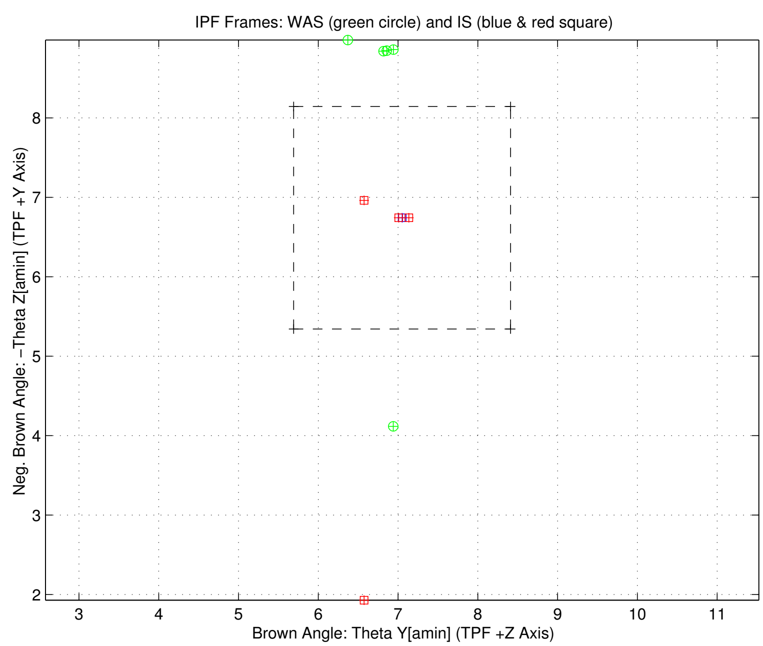

Figure 1.2: A-priori and a-posteriori IPF frames (ZOOMED)

2 IPF INPUT FILE HISTORY

WAS	SIZE	IS	SIZE	REMOVED	PATCHED
AA01P118	UNCHANGED	AA01P118	UNCHANGED	0	0
CA01P118	UNCHANGED	CA01P118	UNCHANGED	0	N/A
CB01P118	UNCHANGED	CB01P118	UNCHANGED	0	N/A

Table 2.1: IPF input file editing status

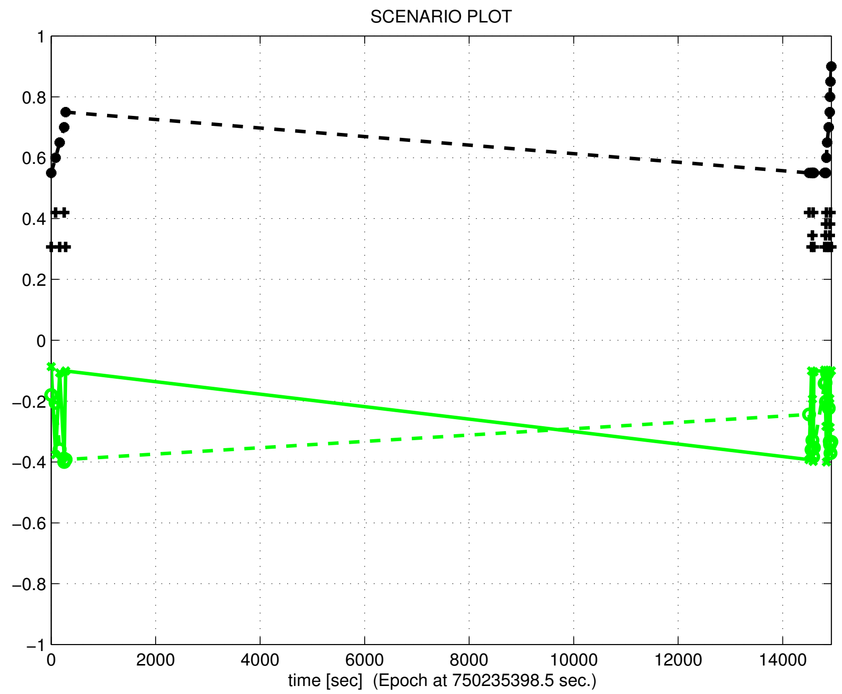

Figure 2.1: Scenario Plot

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
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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
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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	KF innovations with (o) and w/o (+) attitude corrections (PCRS)
Figure 3.21	Histograms of PCRS a-posteriori residuals (or innovations)
Figure 3.22	A-Posteriori Science Centroid Prediction Error Quiver (Att. Cor.)
Figure 3.23	Normalized A-Posteriori Science Centroid Prediction Errors
Figure 3.24	A-Posteriori PCRS Prediction Errors Quiver (Att. Cor.)
Figure 3.25	Normalized A-Posteriori PCRS Prediction Errors
Figure 3.26	W-axis KF innovations and 1-sigma bound
Figure 3.27	V-axis KF innovations and 1-sigma bound
Figure 3.28	Array plot with (solid) and w/o (dashed) optical distortion corrections
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Figure 3.30	Optical Distortion Plot: constant plate scales (x5 magnification)
Figure 3.31	Optical Distortion Plot: linear plate scale (x5 magnification)
Figure 3.32	Optical Distortion Plot: gamma terms (x5 magnification)
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Figure 3.38	Systematic error attributed to gyro drift bias (equiv. angle in (W,V) coords)
Figure 3.39	Systematic error attributed to gyro drift bias (equiv. angle in Body frame)

Table 3.2: Table of figures II (IPF run)

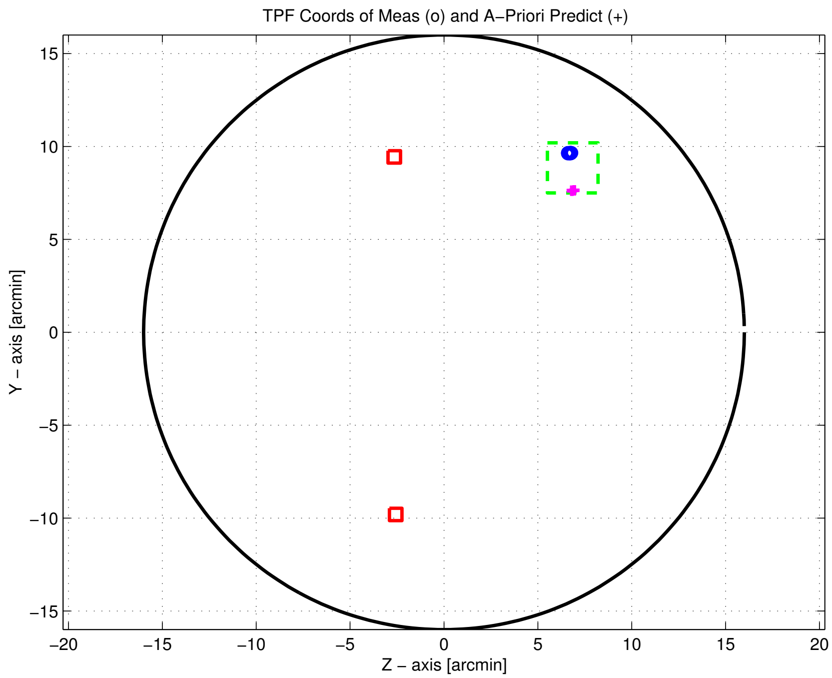

Figure 3.1: TPF coords of measurements and a-priori predicts

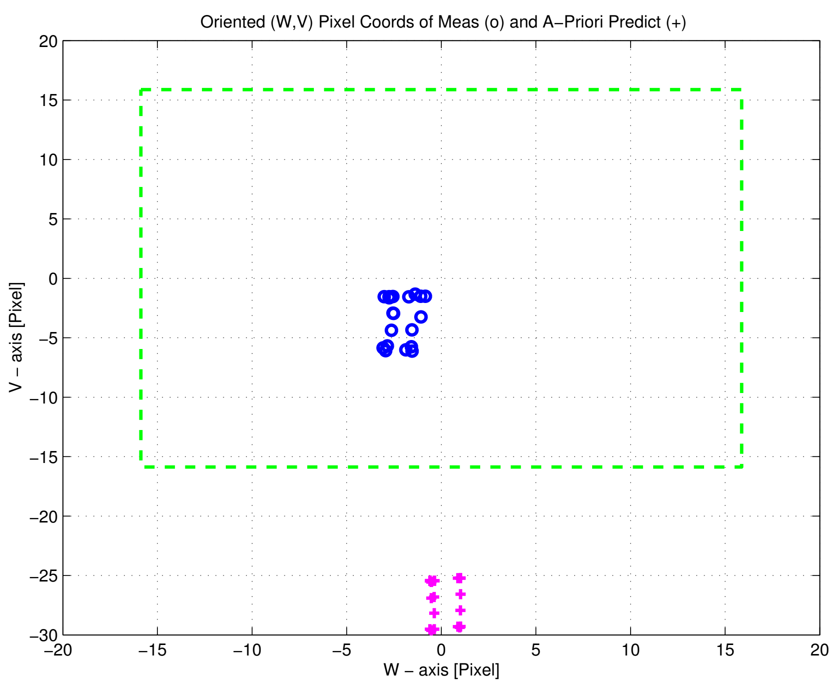

Figure 3.2: Oriented Pixel Coords of measurements and a-priori predicts

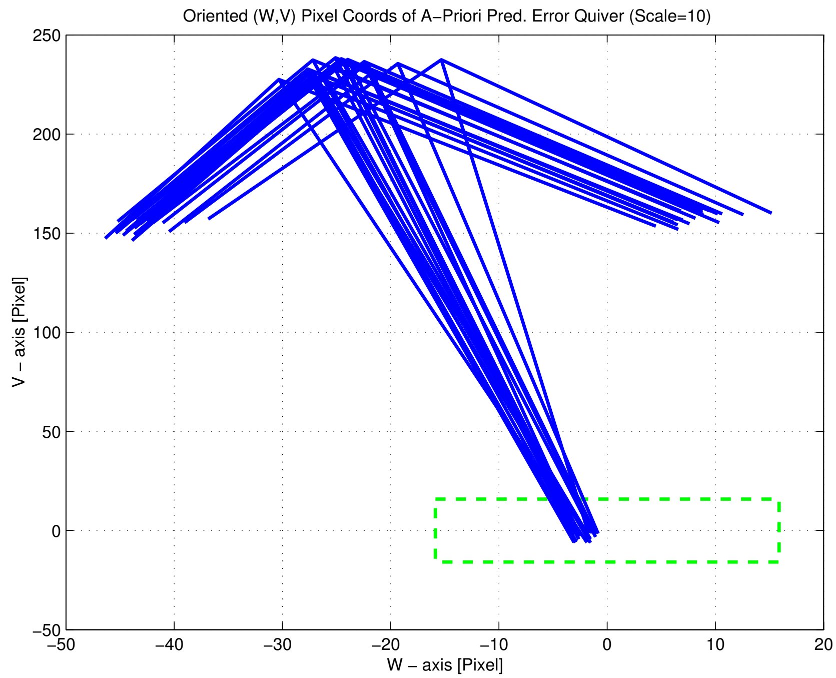

Figure 3.3: Oriented (W,V) Pixel Coords of A-Priori Prediction Error Quiver Plot

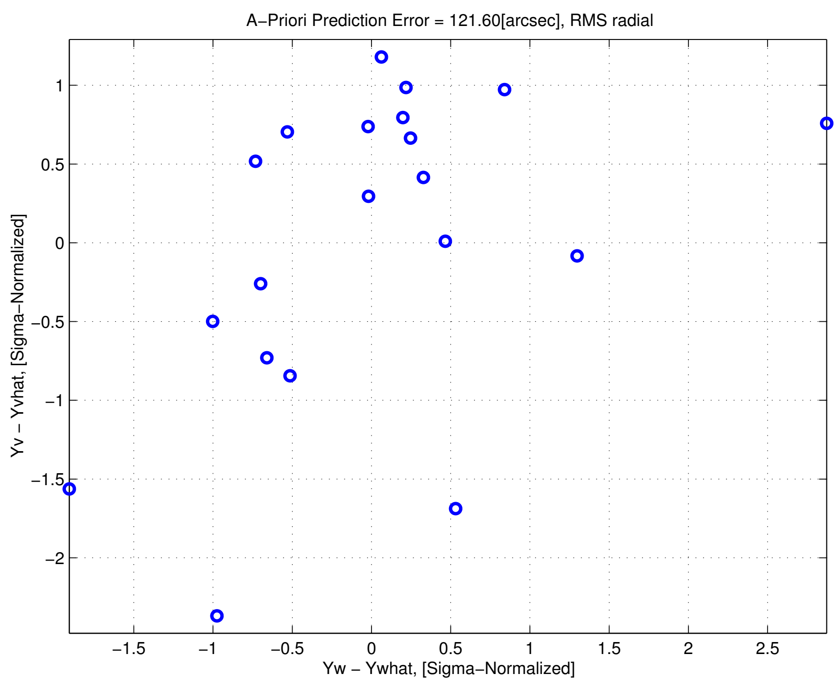

Figure 3.4: A-priori prediction error (Science Centroids)

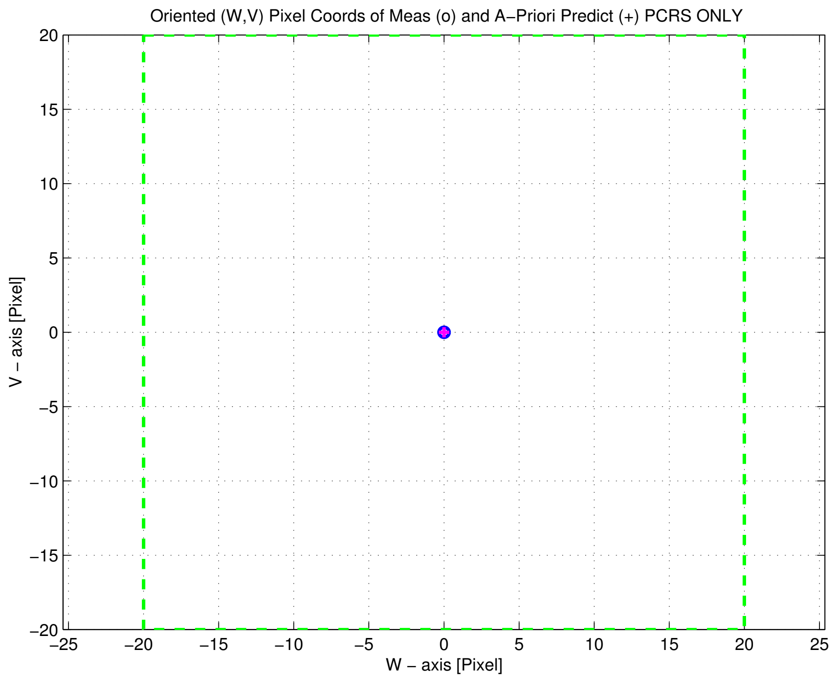

Figure 3.5: Oriented Pixel Coords of measurements and a-priori predicts (PCRS only)

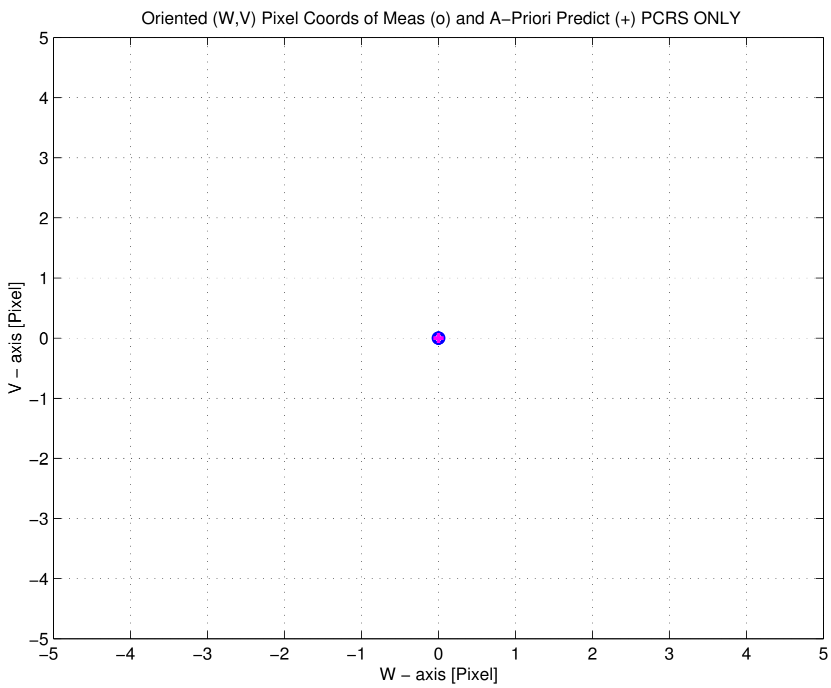

Figure 3.6: Oriented Pixel Coords of measurements and a-priori predicts (Zoomed, PCRS only)

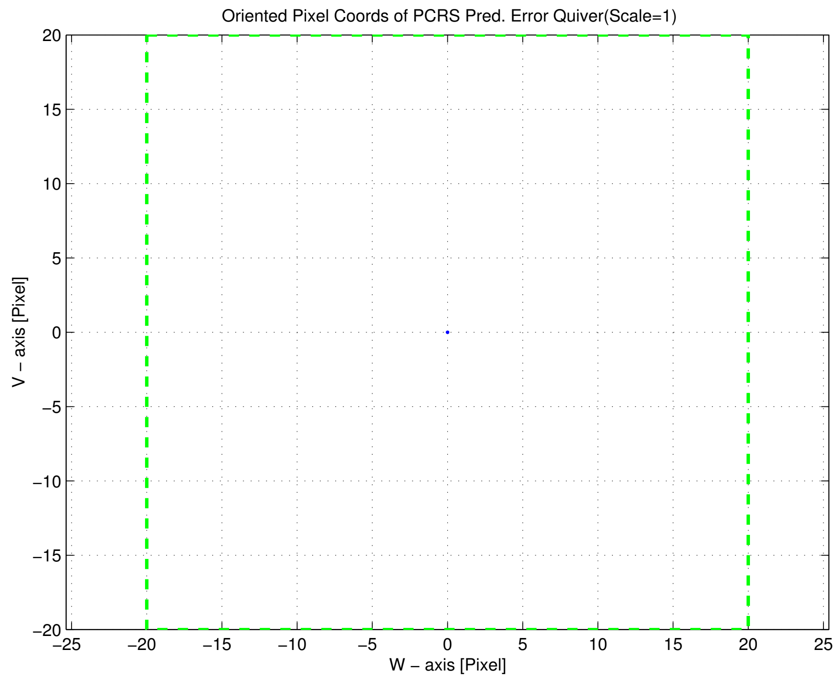

Figure 3.7: Oriented (W,V) Pixel Coords of A-Priori PCRS Prediction Error Quiver Plot

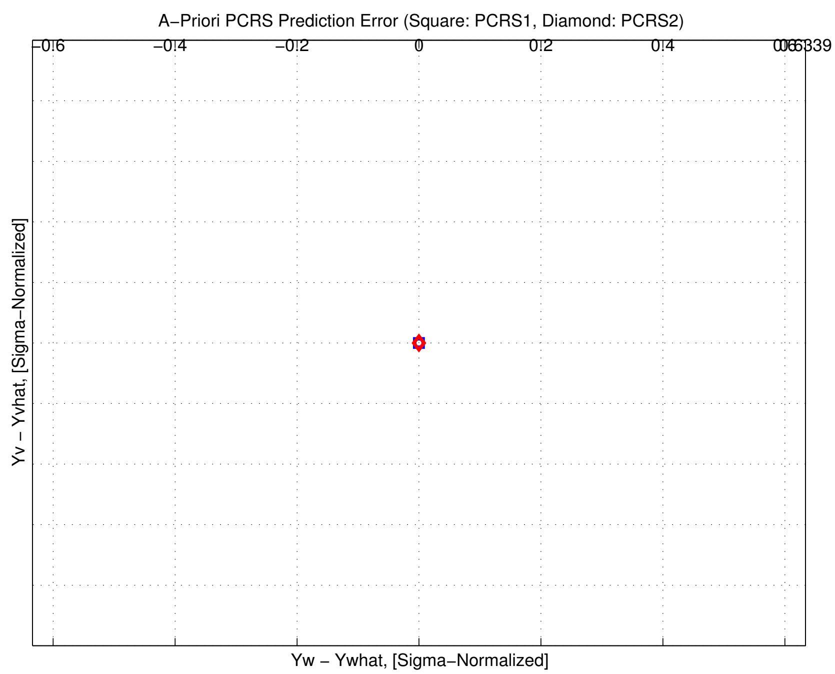

Figure 3.8: A-priori PCRS prediction error

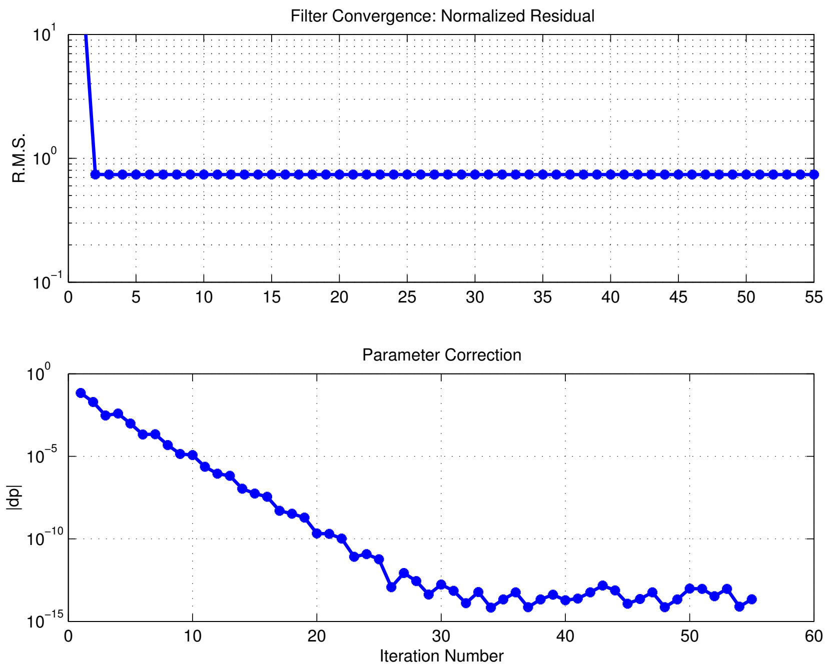

Figure 3.9: IPF execution convergence, chart 1

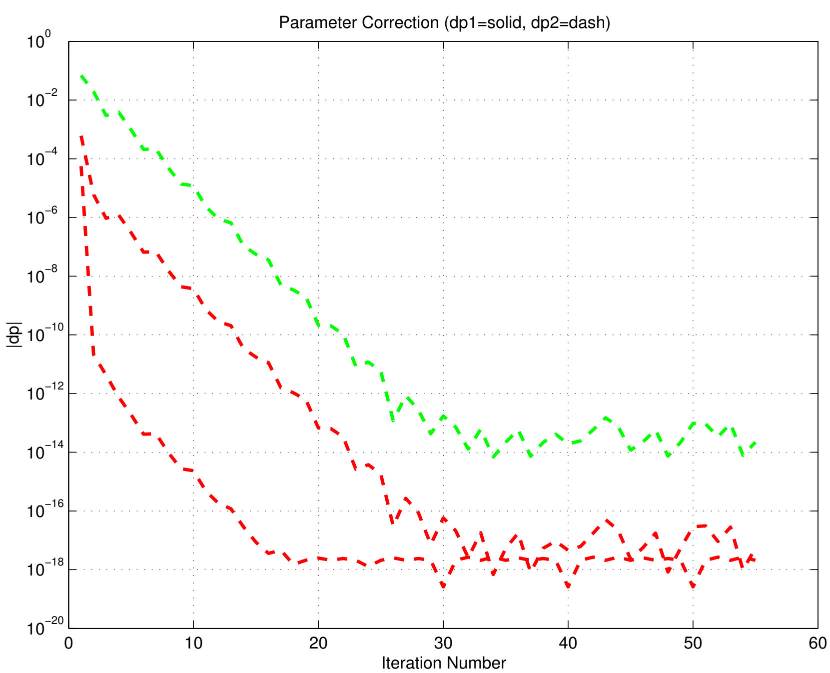

Figure 3.10: IPF execution convergence, chart 2

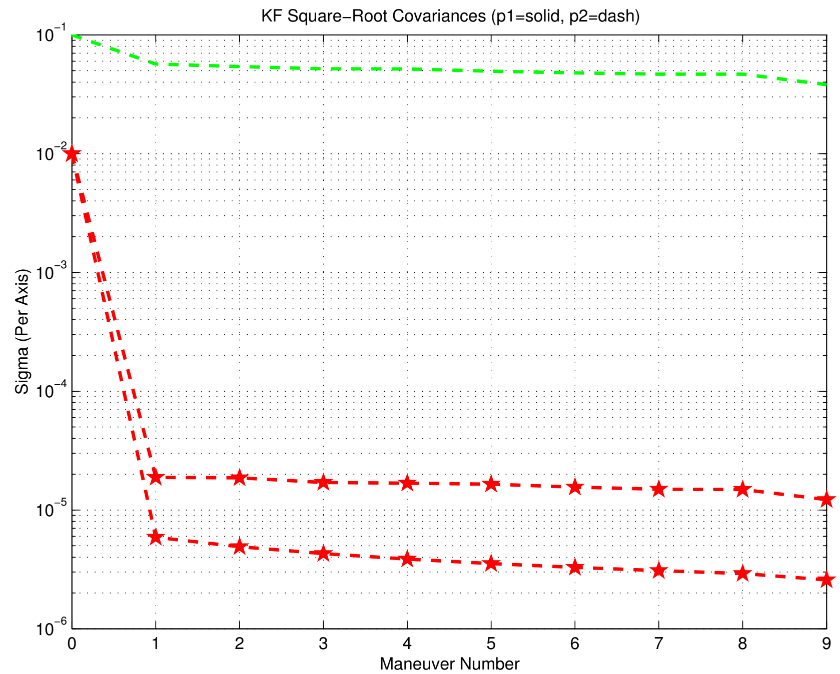

Figure 3.11: Parameter uncertainty convergence

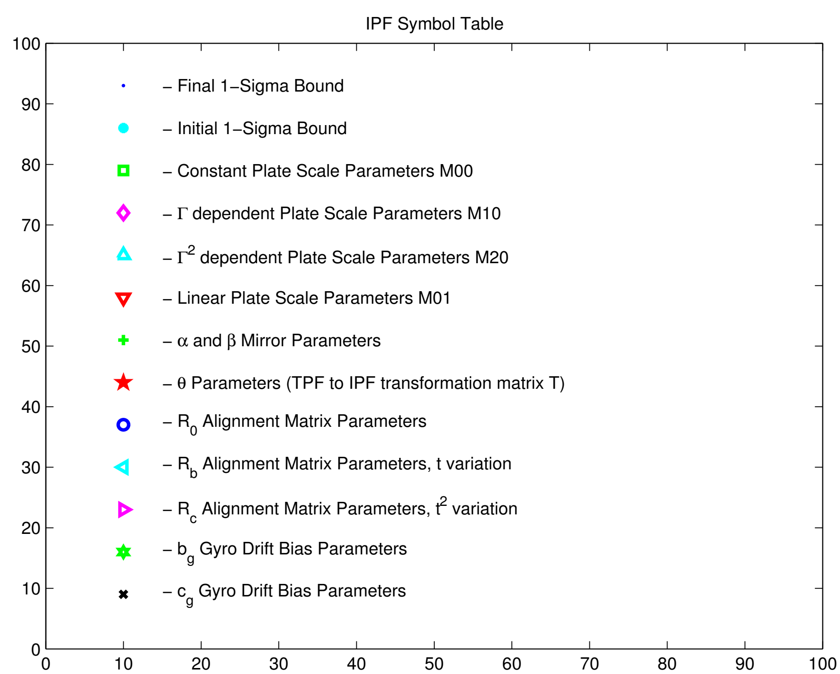

Figure 3.12: IPF parameter symbol table

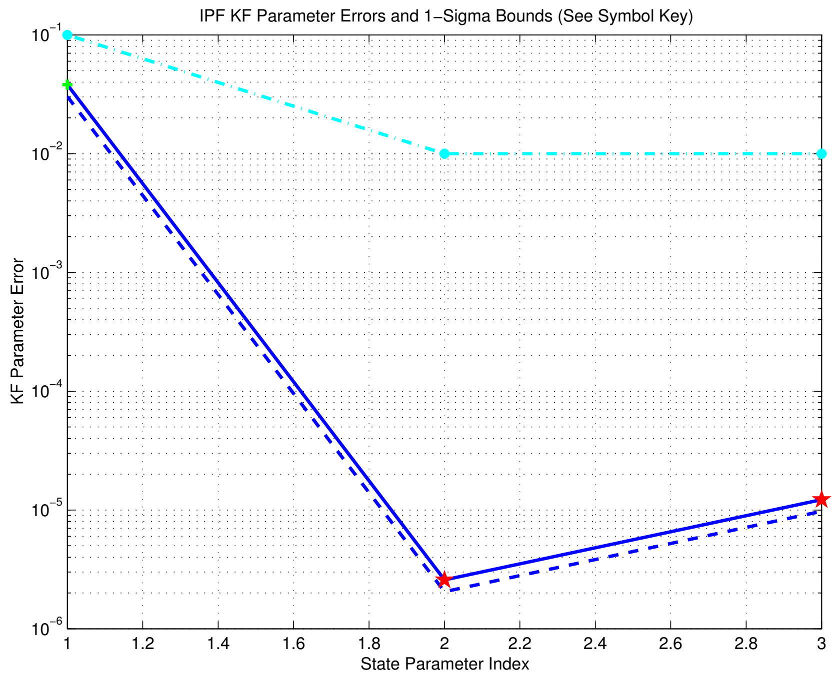

Figure 3.13: KF parameter error sigma plots

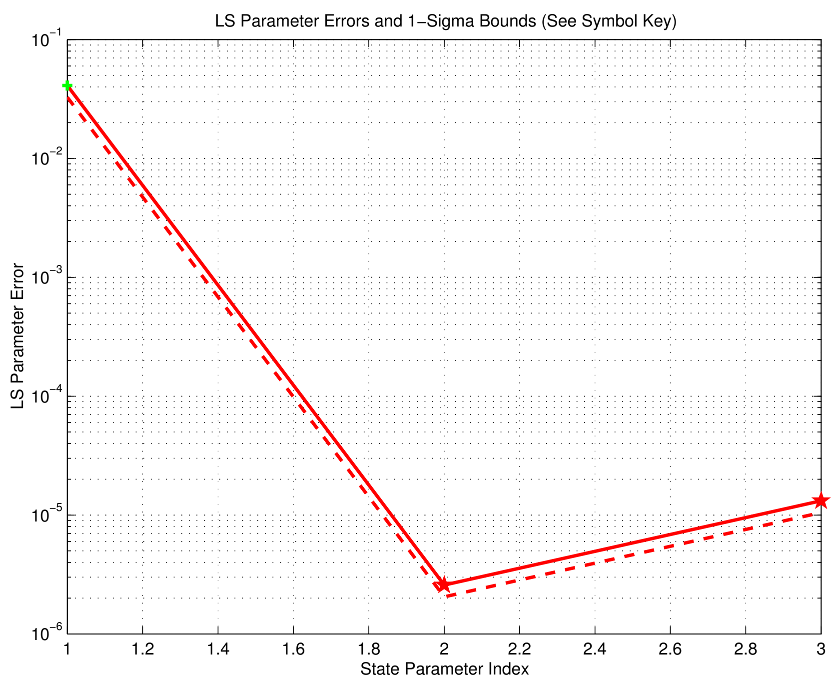

Figure 3.14: LS parameter error sigma plot

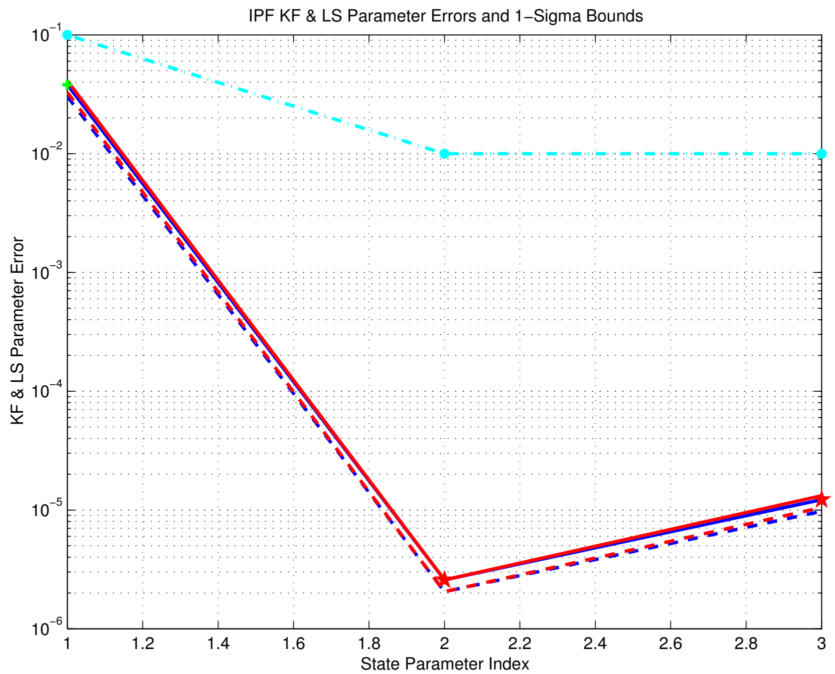

Figure 3.15: KF and LS parameter error sigma plot

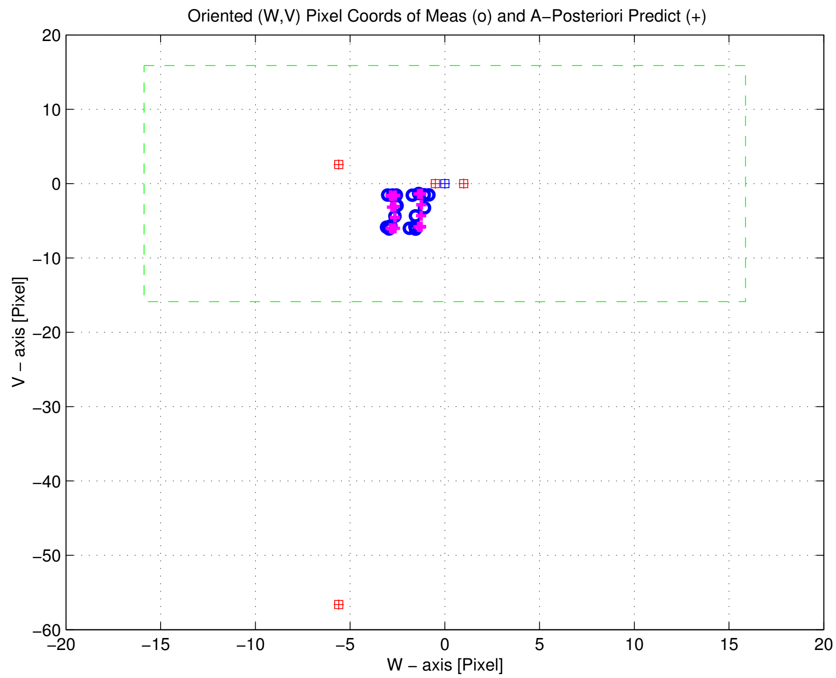

Figure 3.16: Oriented Pixel Coords of meas. and a-posteriori predicts

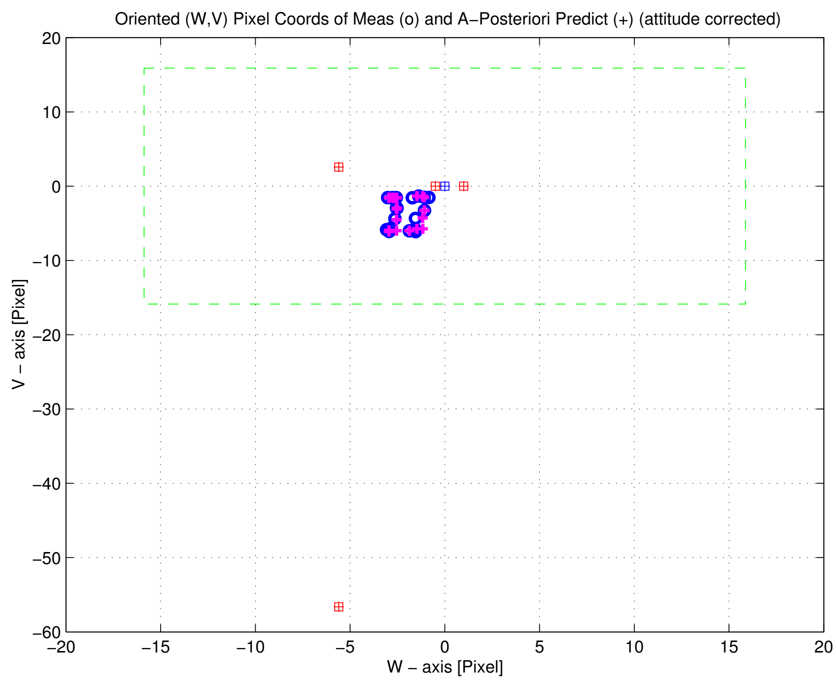

Figure 3.17: Oriented Pixel Coords of meas. and a-posteriori predicts (attitude corrected)

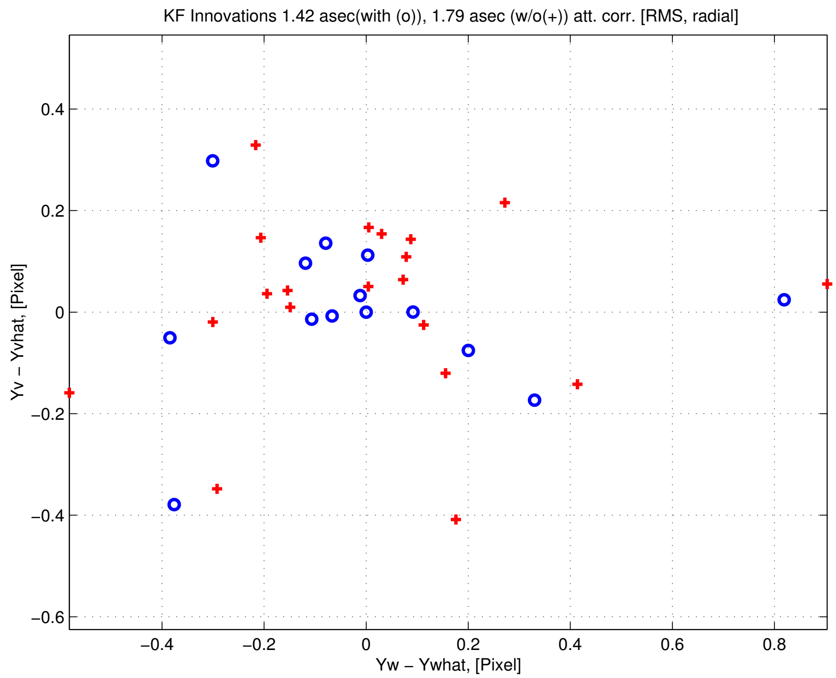

Figure 3.18: KF innovations with (o) and w/o (+) attitude corrections

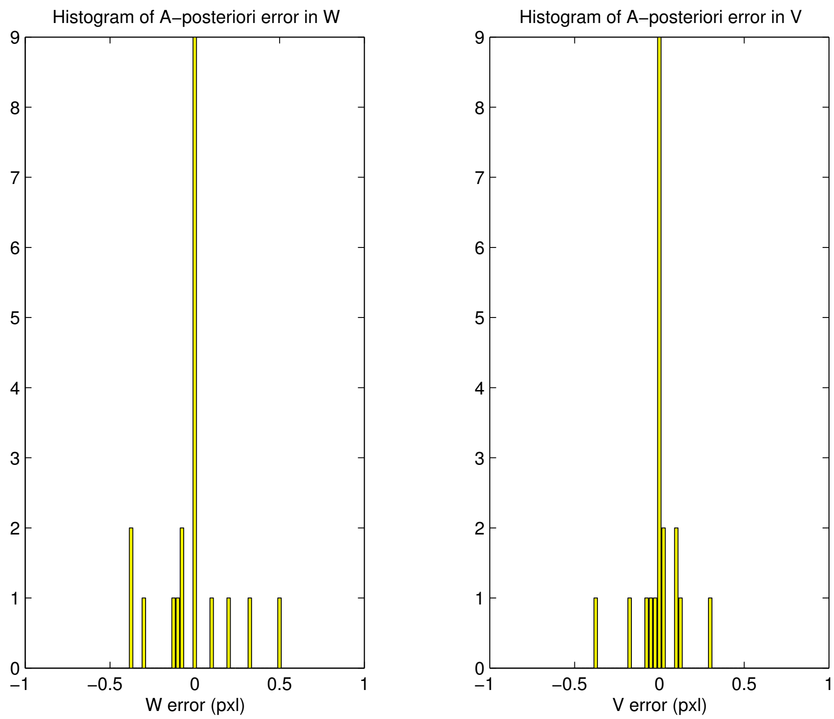

Figure 3.19: Histograms of science a-posteriori residuals (or innovations)

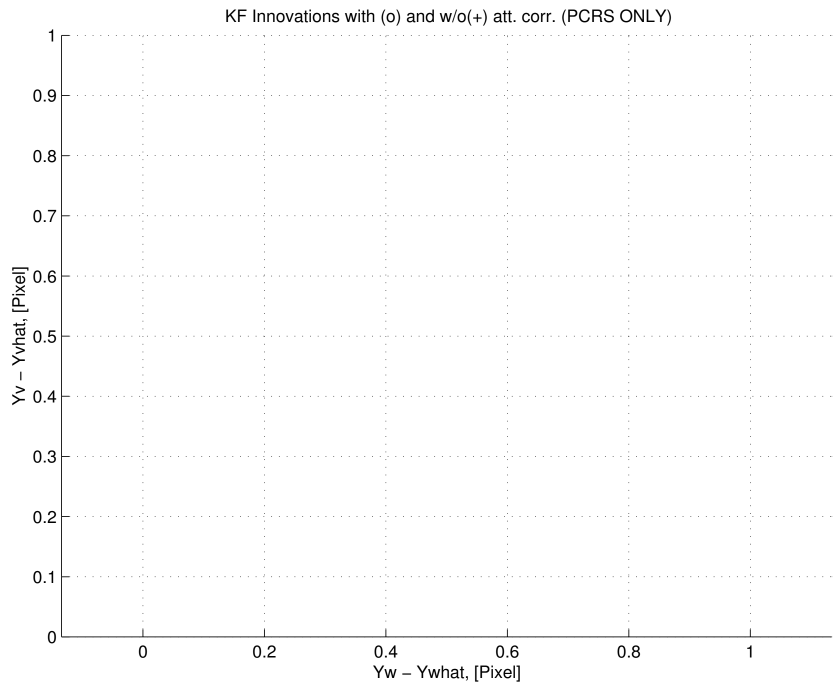

Figure 3.20: KF innovations with (o) and w/o (+) attitude corrections (PCRS)

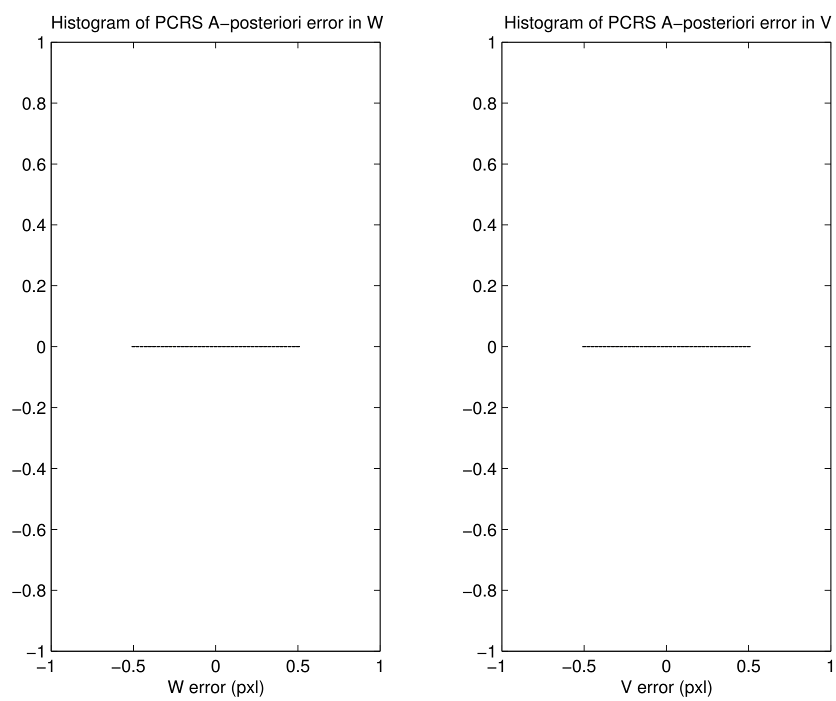

Figure 3.21: Histograms of PCRS a-posteriori residuals (or innovations)

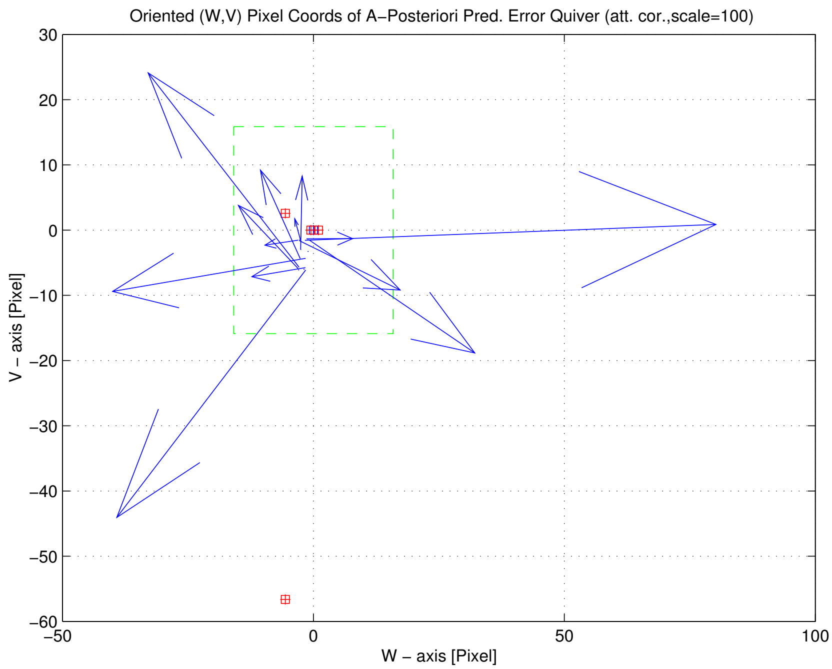

Figure 3.22: A-Posteriori Science Centroid Prediction Error Quiver (Att. Cor.)

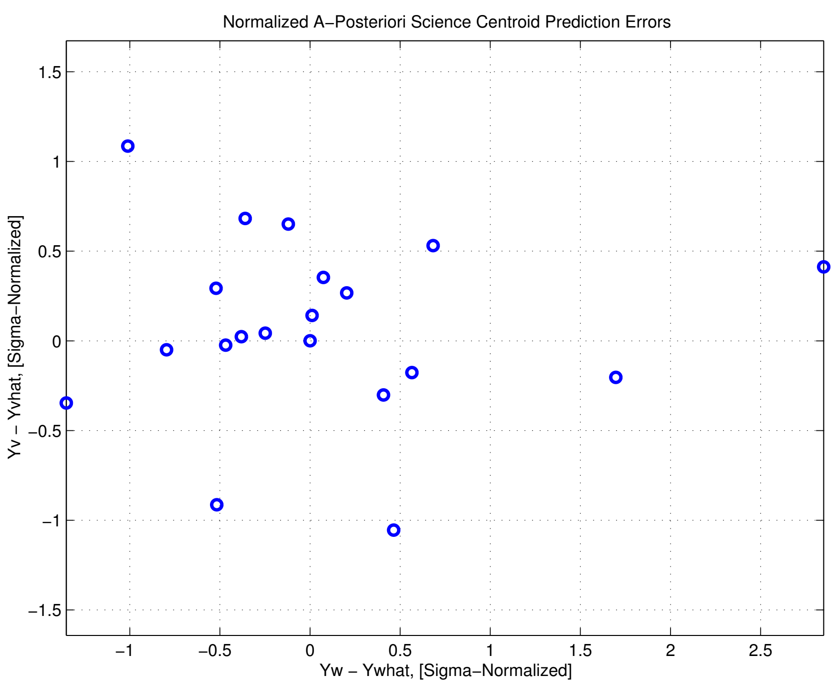

Figure 3.23: Normalized A-Posteriori Science Centroid Prediction Errors

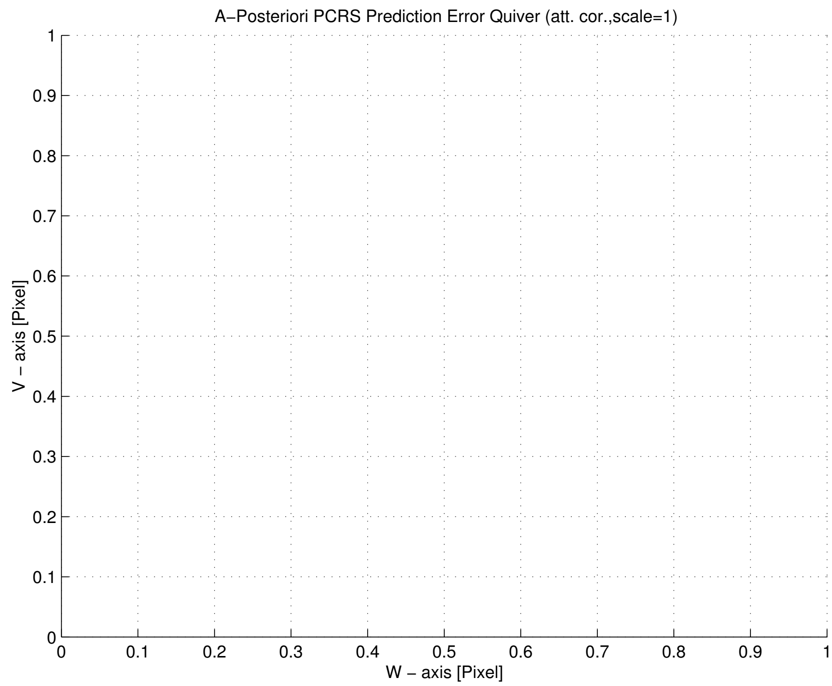

Figure 3.24: A-Posteriori PCRS Prediction Errors Quiver (Att. Cor.)

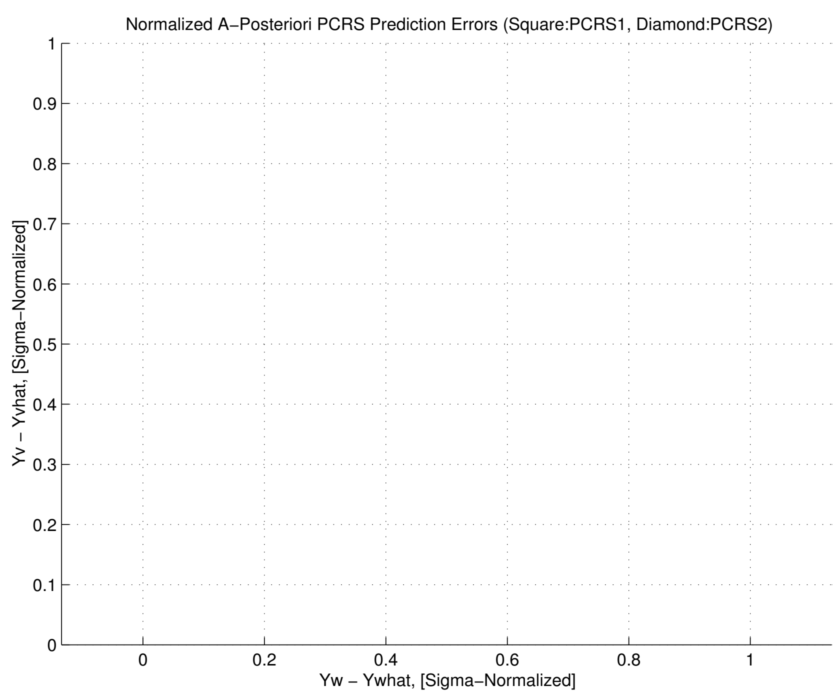

Figure 3.25: Normalized A-Posteriori PCRS Prediction Errors

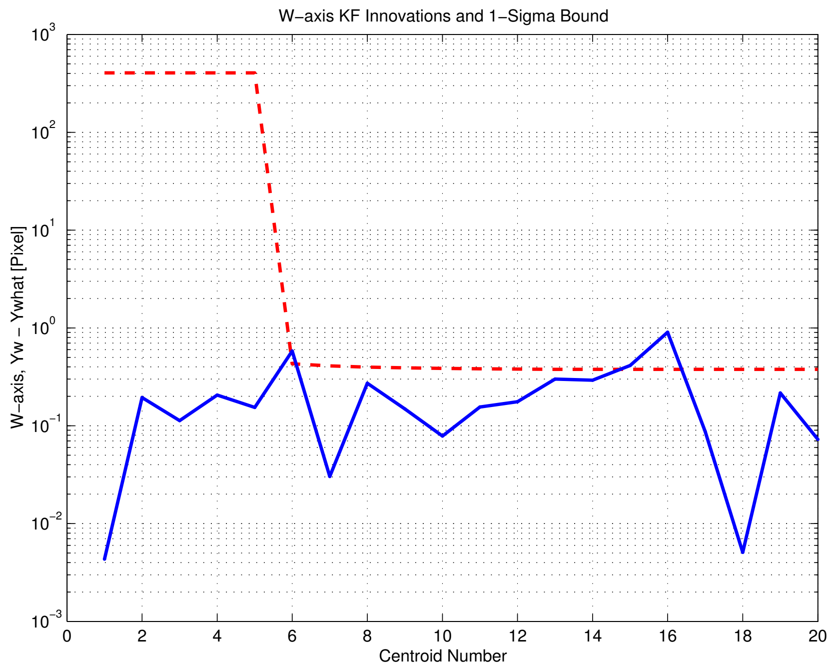

Figure 3.26: W-axis KF innovations and 1-sigma bound

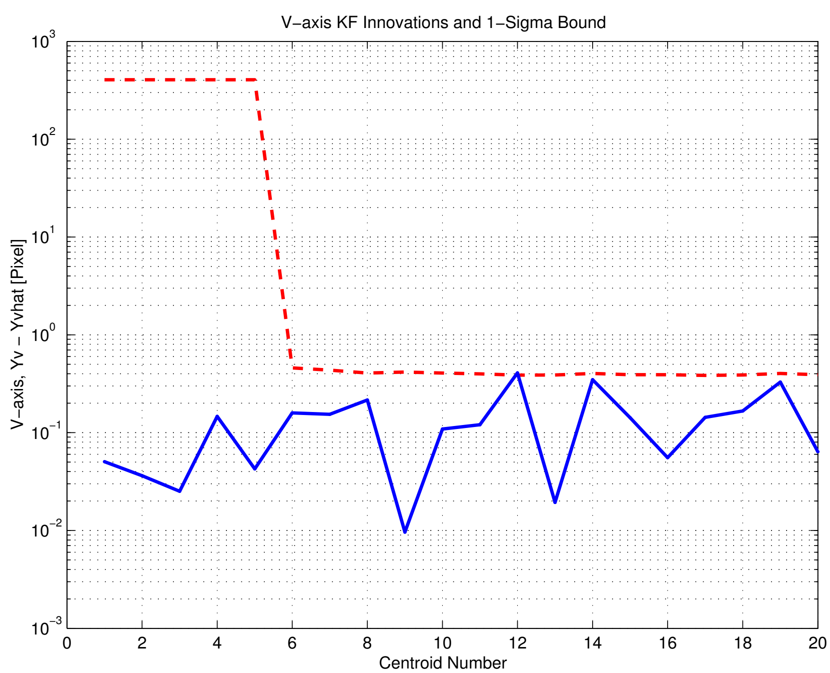

Figure 3.27: V-axis KF innovations and 1-sigma bound

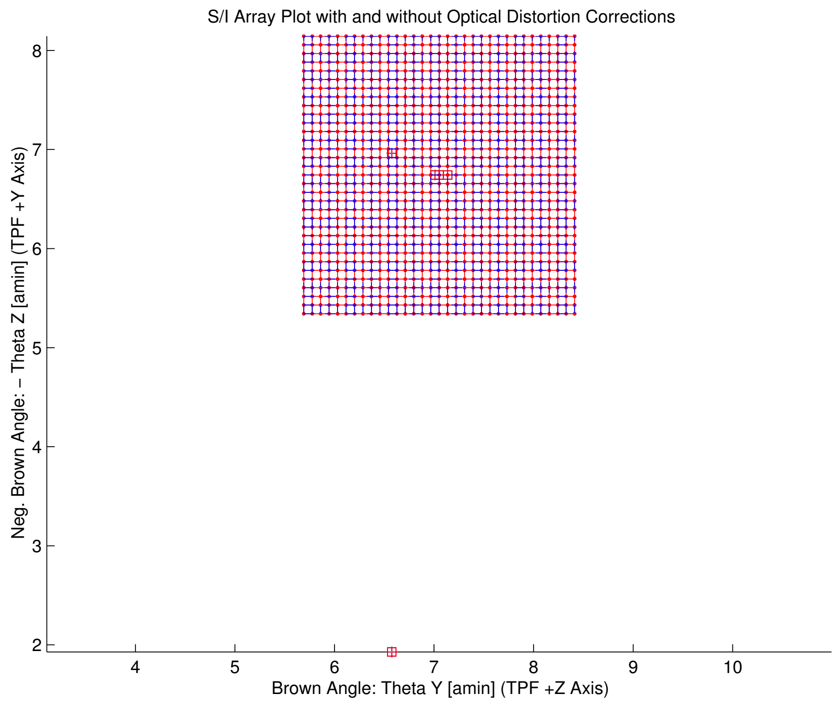

Figure 3.28: Array plot with (solid) and w/o (dashed) optical distortion corrections

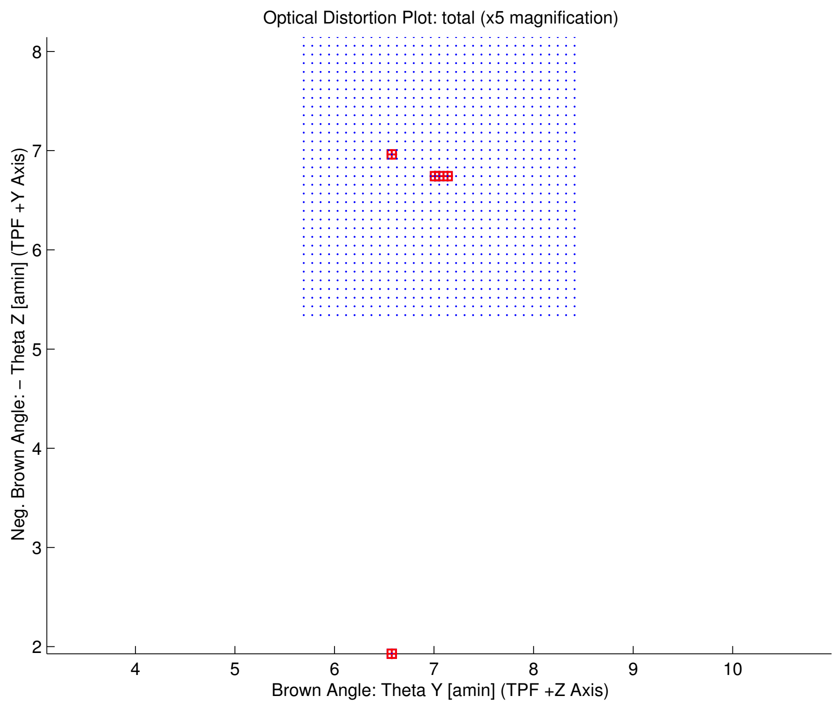

Figure 3.29: Optical Distortion Plot: total (x5 magnification)

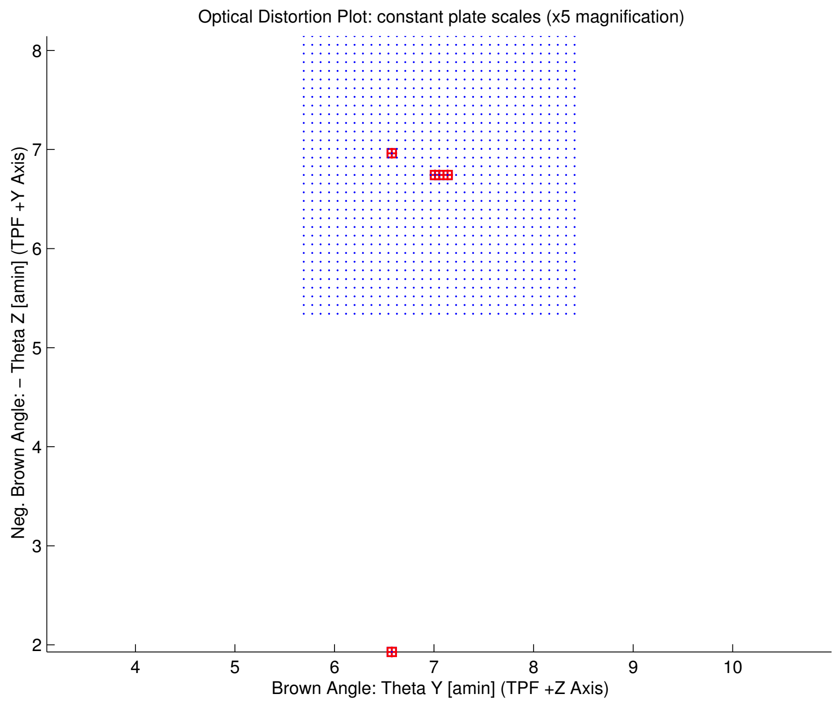

Figure 3.30: Optical Distortion Plot: constant plate scales (x5 magnification)

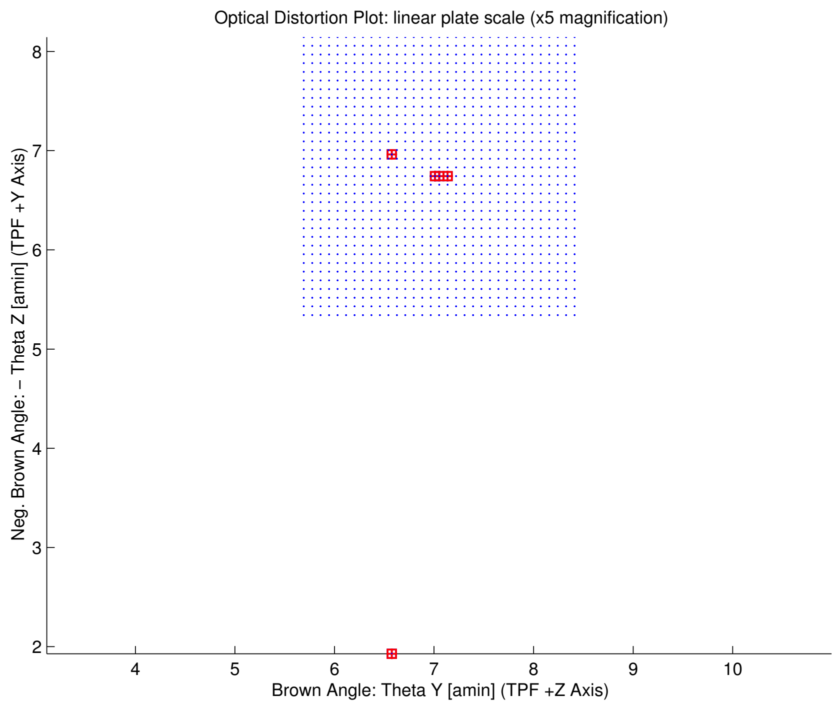

Figure 3.31: Optical Distortion Plot: linear plate scale (x5 magnification)

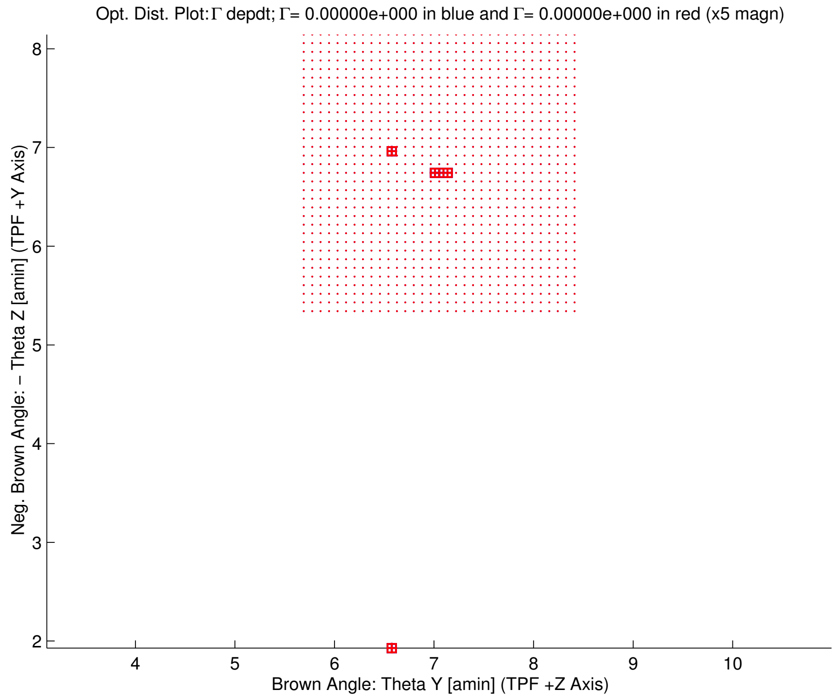

Figure 3.32: Optical Distortion Plot: gamma terms (x5 magnification)

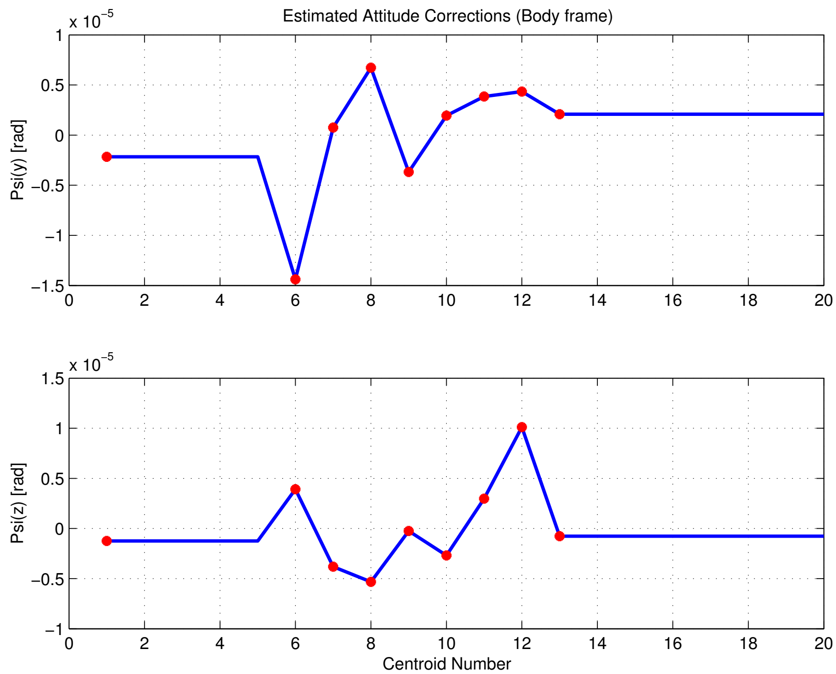

Figure 3.33: Estimated attitude corrections (Body frame)

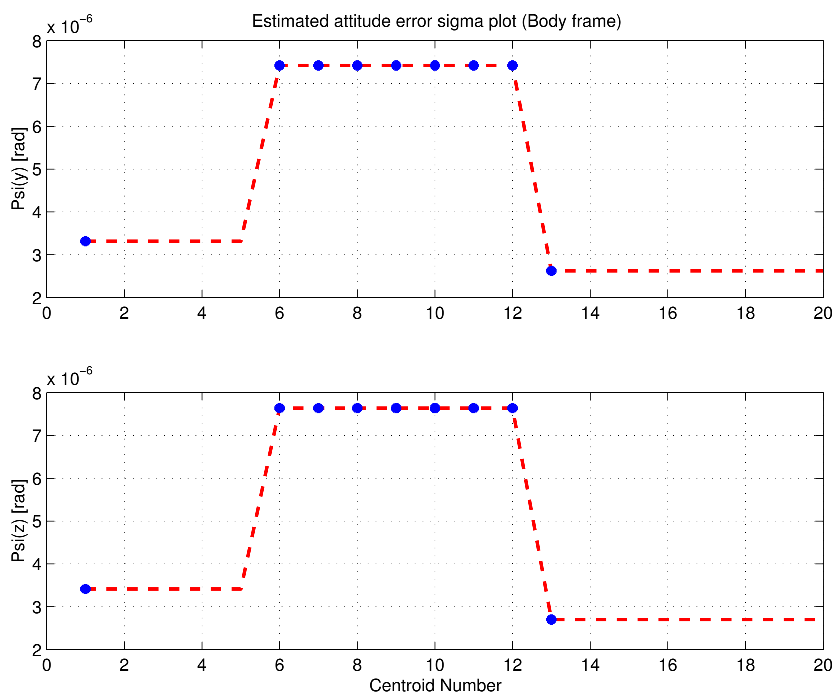

Figure 3.34: Estimated attitude error sigma plot (Body frame)

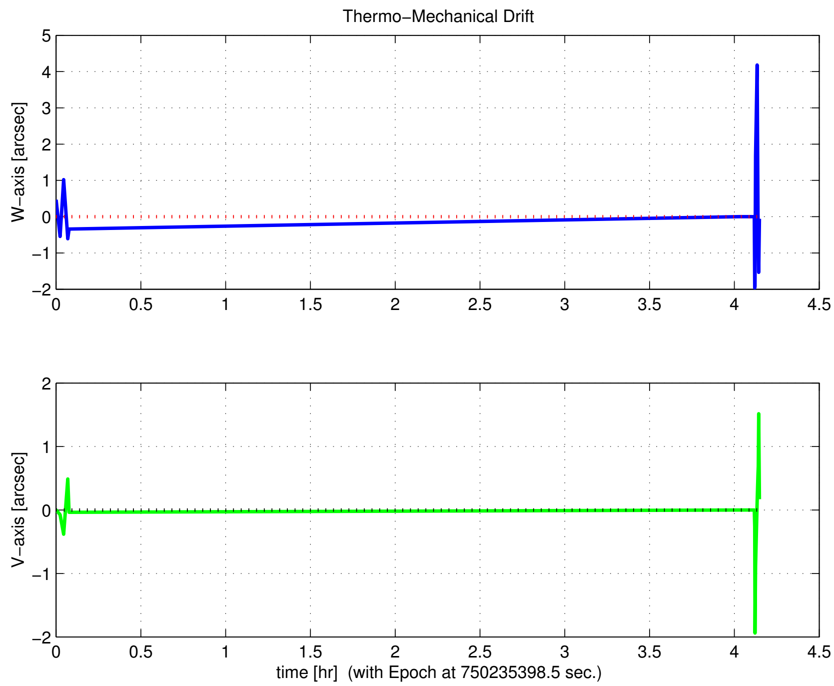

Figure 3.35: Thermo-mechanical boresight drift (equiv. angle in (W,V) coords)

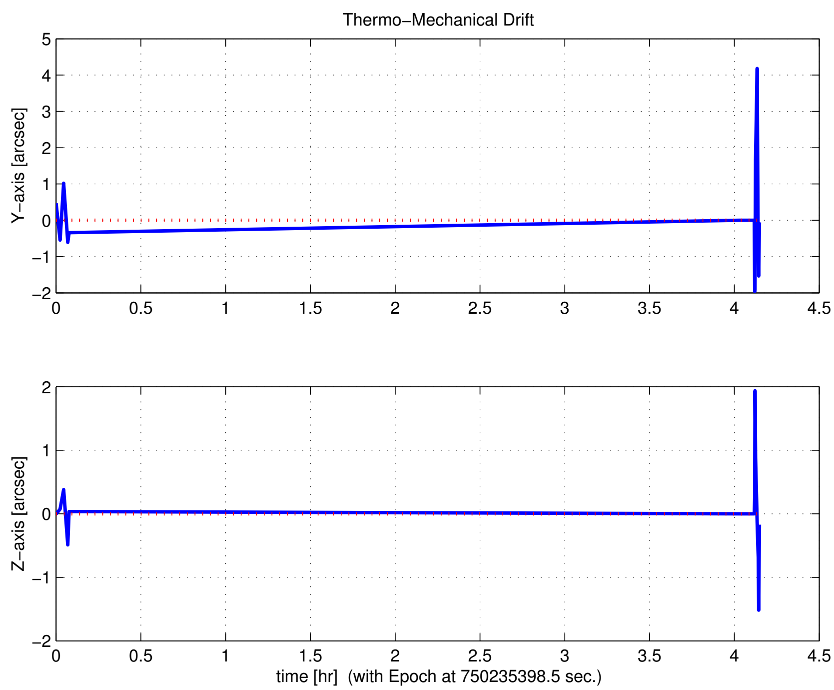

Figure 3.36: Thermo-mechanical boresight drift (equiv. angle in Body frame)

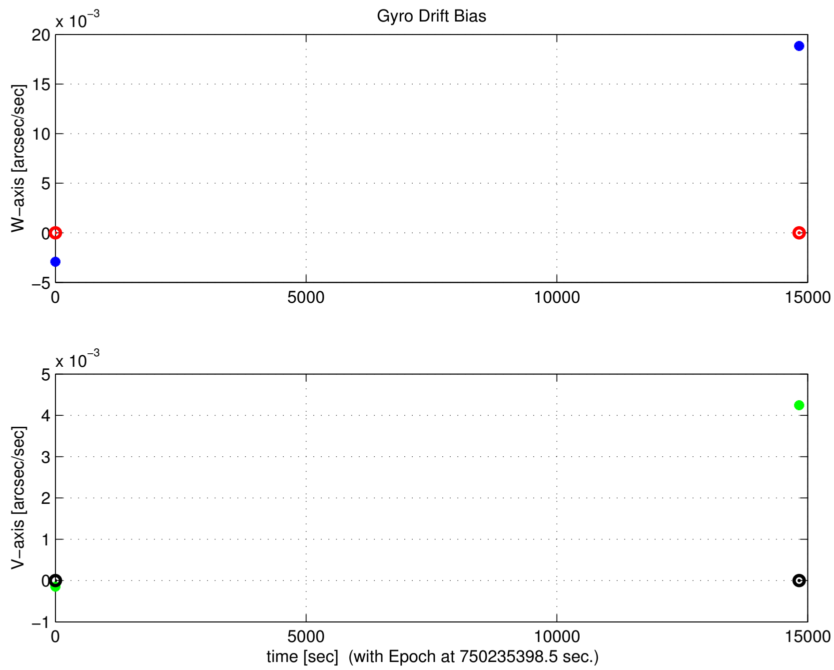

Figure 3.37: Gyro drift bias contribution (equiv. rate in (W,V) coords)

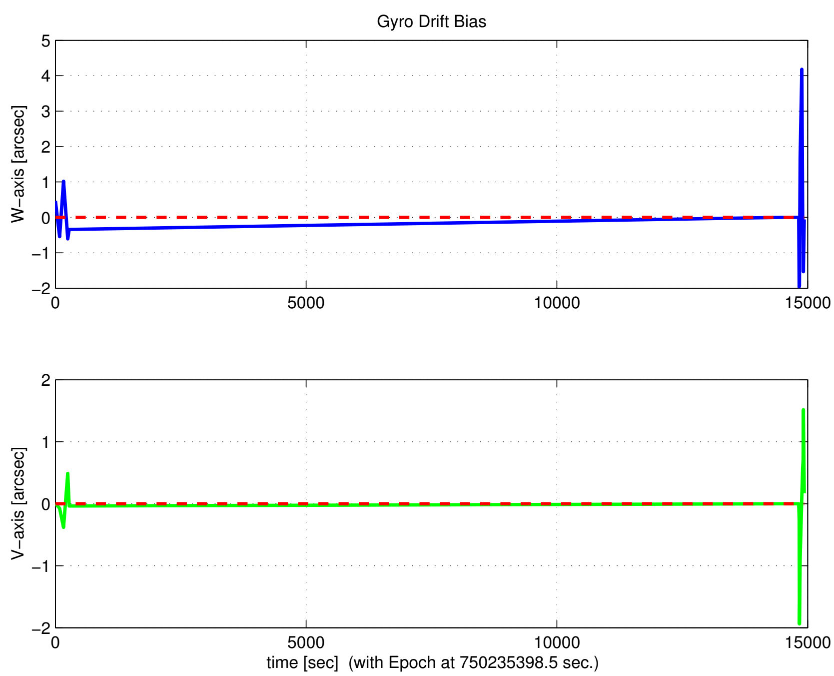

Figure 3.38: Gyro drift bias contribution (equiv. angle in (W,V) coords)

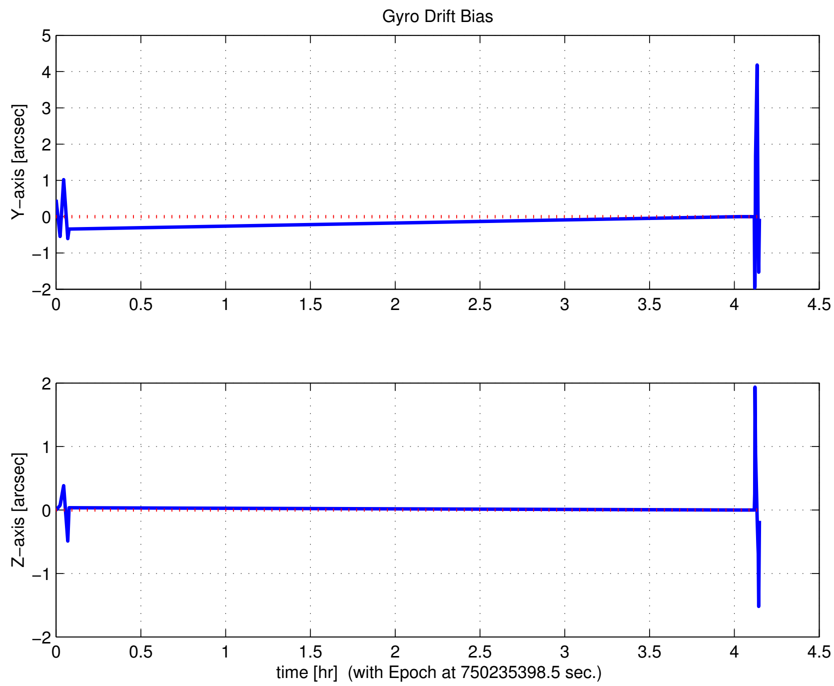

Figure 3.39: Gyro drift bias contribution (equiv. angle in Body frame)

3.2 IPF OUTPUT DATA (IF MINI FILE)

```
OUTPUT FILE NAME: IFmini01P118.dat   DATE: 12-Oct-2003   TIME: 17:09
INSTRUMENT NAME:  MIPS_70um_fine_center   NF: 118
IPF FILTER VERSION: IPF.V2.0.0C       SW RELEASE DATE: August 1, 2003
FRAME TABLE USED: BodyFrames_FTU_07f
--------------------------------------------------------------------------------
---------------------------- IPF BROWN ANGLE SUMMARY ----------------------------
--------------------------------------------------------------------------------
         ------------ WAS ------------          ------------ IS -------------
Frame    theta_Y     theta_Z     angle          theta_Y     theta_Z     angle
Number   (arcmin)    (arcmin)    (deg)          (arcmin)    (arcmin)    (deg)
------  --------------------------------       --------------------------------
 118     +6.859000  -8.847000   -0.000000       +7.051500  -6.743181   +0.000071
 119     +6.942000  -8.861000   -0.000000       +7.136538  -6.743181   +0.000071
 120     +6.941000  -4.117000   +0.000000       +6.575276  -1.928390   +0.000071
 124     +6.372000  -8.981000   -0.000000       +6.575289  -6.962036   +0.000071
 127     +6.818000  -8.840000   +0.000000       +7.008981  -6.743181   +0.000071
--------------------------------------------------------------------------------
OFFSET           NF          Delta_CW         Delta_CV
  0             118            +0.000           +0.000     pixels
OFFSET FRAME NAME: MIPS_70um_fine_center
Brown Angle       theta_Y(arcmin)  theta_Z(arcmin)  angle(deg)
WAS(FTB)            +6.859000        -8.847000       -0.000000
IS (EST)            +7.051500        -6.743181       +0.000071
dT_EST              +0.192500        +2.103819       +0.000071
T_sSIGMA            +0.007051        +0.033473     +999.999999
dT_EST/T_sSIGMA    +27.300794       +62.850716     +999.999999
------------------------------------------------------------------
OFFSET           NF          Delta_CW         Delta_CV
  1             119            +1.000           +0.000     pixels
OFFSET FRAME NAME: MIPS_70um_fine_FOV1
Brown Angle       theta_Y(arcmin)  theta_Z(arcmin)  angle(deg)
WAS(FTB)            +6.942000        -8.861000       -0.000000
IS (EST)            +7.136538        -6.743181       +0.000071
dT_EST              +0.194538        +2.117819       +0.000071
T_sSIGMA            +0.007051        +0.033473     +999.999999
dT_EST/T_sSIGMA    +27.589806       +63.268963     +999.999999
------------------------------------------------------------------
OFFSET           NF          Delta_CW         Delta_CV
  2             120            -5.600          -55.000     pixels
OFFSET FRAME NAME: MIPS_70um_fine_FOV2
Brown Angle       theta_Y(arcmin)  theta_Z(arcmin)  angle(deg)
WAS(FTB)            +6.941000        -4.117000       +0.000000
IS (EST)            +6.575276        -1.928390       +0.000071
dT_EST              -0.365724        +2.188610       +0.000071
T_sSIGMA            +0.007051        +0.033473     +999.999999
dT_EST/T_sSIGMA    -51.867816       +65.383810     +999.999999
------------------------------------------------------------------
OFFSET           NF          Delta_CW         Delta_CV
  3             124            -5.600           +2.500     pixels
OFFSET FRAME NAME: MIPS_70um_fine_FOV3
Brown Angle       theta_Y(arcmin)  theta_Z(arcmin)  angle(deg)
WAS(FTB)            +6.372000        -8.981000       -0.000000
IS (EST)            +6.575289        -6.962036       +0.000071
dT_EST              +0.203289        +2.018964       +0.000071
T_sSIGMA            +0.007051        +0.033473     +999.999999
dT_EST/T_sSIGMA    +28.830812       +60.315711     +999.999999
------------------------------------------------------------------
OFFSET           NF          Delta_CW         Delta_CV
  4             127            -0.500           +0.000     pixels
OFFSET FRAME NAME: MIPS_70um_fine_FOV4
```

```
Brown Angle       theta_Y(arcmin)  theta_Z(arcmin)  angle(deg)
WAS(FTB)            +6.818000       -8.840000       +0.000000
IS (EST)            +7.008981       -6.743181       +0.000071
dT_EST              +0.190981       +2.096819       +0.000071
T_sSIGMA            +0.007051       +0.033473     +999.999999
dT_EST/T_sSIGMA    +27.085376      +62.641592     +999.999999
-------------------------------------------------------------------
-------------------------------------------------------------------------------------
-------------------------------------------------------------------------------------
VARNAME             MEAN                     SIGMA                SCALED_SIGMA
beta        +1.0809326727231776E+000 +3.8020159921398455E-002 +3.0288988096351641E-002
del_theta2 -2.0815834678774431E-018 +2.5746094122165560E-006 +2.0510780070520498E-006
del_theta3 -5.3838472918667397E-018 +1.2222312034211477E-005 +9.7369780789841062E-006
-------------------------------------------------------------------------------------
LSQF RESIDUAL SIGMA SCALE =         +7.9665598879568189E-001
-------------------------------------------------------------------------------------
------------------------------------------------------------------------------------------------------------
------------------------------------------------------------------------------------------------------------
beta               beta_0                    beta                       beta_total
              +2.8047410000000001E-006  +1.0809326727231776E+000  +3.0317361854262778E-006
------------------------------------------------------------------------------------------------------------
qT                qT(1)                    qT(2)                    qT(3)                    qT(4)
FrmTbl:    +1.2836566686785979E-006 -9.9760012028013629E-004 +1.2867429956649658E-003 +9.9999867454152913E-001
Estim:     +1.6249886197225981E-006 -1.0255978600816954E-003 +9.8075593318555534E-004 +9.9999899313158735E-001
DelTheta        deltheta(1)              deltheta(2)              deltheta(3)
           +1.7239129071485307E-008 -5.5996431063919813E-005 -6.1197475311842336E-004       [rad]
EulAngT         theta(1)                 theta(2)                 theta(3)                 [rad]
Mean       +1.2382541993943780E-006 -2.0511982806868958E-003 +1.9615119424885642E-003
SigmaT     +9.9999000000000000E+004 +2.5746094122165560E-006 +1.2222312034211477E-005
------------------------------------------------------------------------------------------------------------
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             119           +1.000           +0.000     pixels
OFFSET FRAME NAME: MIPS_70um_fine_FOV1
qT                qT(1)                    qT(2)                    qT(3)                    qT(4)
WAS(FTB)   +1.3012459624148111E-006 -1.0096719622185043E-003 +1.2887791948094824E-003 +9.9999865980361324E-001
IS (EST)   +1.6371188266522766E-006 -1.0379661017172396E-003 +9.8075591301223595E-004 +9.9999898037024559E-001

DelTheta        deltheta(1)              deltheta(2)              deltheta(3)
Units             rad                      rad                      rad
           -5.7599289274345969E-009 -5.6589227650100990E-005 -6.1604717868311756E-004
EulAngT         theta(1)                 theta(2)                 theta(3)                 [rad]
Mean       +1.2382541993943780E-006 -2.0759347890218320E-003 +1.9615119118584130E-003
sSigmaT    +2.4085883938350812E-010 +2.0510780070520503E-006 +9.7369780760051032E-006
SigmaT     +3.0233732347586873E-010 +2.5746094122165564E-006 +1.2222312030472093E-005
------------------------------------------------------------------------------------------------------------
------------------------------------------------------------------------------------------------------------
OFFSET           NF         Delta_CW         Delta_CV
  2             120           -5.600          -55.000     pixels
OFFSET FRAME NAME: MIPS_70um_fine_FOV2
```

```
qT              qT(1)                   qT(2)                   qT(3)                   qT(4)
WAS(FTB)  +6.0449825951069261E-007 -1.0095271757136512E-003 +5.9879303662630152E-004 +9.9999931115047058E-001
IS (EST)  +8.8735294407346057E-007 -9.5633475530512658E-004 +2.8047347927950860E-004 +9.9999950337871457E-001

DelTheta        deltheta(1)             deltheta(2)             deltheta(3)
Units             rad                     rad                     rad
          -4.7157506102252036E-008 +1.0638442249194010E-004 -6.3663955592391534E-004
EulAngT         theta(1)                theta(2)                theta(3)                [rad]
Mean      +1.2382541993943780E-006 -1.9126702246848527E-003 +5.6094603824197013E-004
sSigmaT   +3.1735142411016739E-009 +2.0510759966067813E-006 +9.7369779853186760E-006
SigmaT    +3.9835440713866072E-009 +2.5746068886112650E-006 +1.2222311916638230E-005
------------------------------------------------------------------------------------------------------------
------------------------------------------------------------------------------------------------------------
OFFSET          NF          Delta_CW          Delta_CV
  3             124          -5.600            +2.500     pixels
OFFSET FRAME NAME: MIPS_70um_fine_FOV3
qT              qT(1)                   qT(2)                   qT(3)                   qT(4)
WAS(FTB)  +1.2105772857918672E-006 -9.2676890949311853E-004 +1.3062325685908875E-003 +9.9999871742637714E-001
IS (EST)  +1.5875006737397027E-006 -9.5633569193538139E-004 +1.0125870809633470E-003 +9.9999903004299351E-001

DelTheta        deltheta(1)             deltheta(2)             deltheta(3)
Units             rad                     rad                     rad
          +1.4968447200856792E-007 -5.9134563858897636E-005 -5.8729167888981219E-004
EulAngT         theta(1)                theta(2)                theta(3)                [rad]
Mean      +1.2382541993943780E-006 -1.9126739098228956E-003 +2.0251742499112400E-003
sSigmaT   +1.3551200055457569E-009 +2.0510780028485281E-006 +9.7369779855718220E-006
SigmaT    +1.7010102536156346E-009 +2.5746094069400981E-006 +1.2222311916955991E-005
------------------------------------------------------------------------------------------------------------
------------------------------------------------------------------------------------------------------------
OFFSET          NF          Delta_CW          Delta_CV
  4             127          -0.500            +0.000     pixels
OFFSET FRAME NAME: MIPS_70um_fine_FOV4
qT              qT(1)                   qT(2)                   qT(3)                   qT(4)
WAS(FTB)  +1.2749739579667491E-006 -9.9163692118734836E-004 +1.2857248959092255E-003 +9.9999868178217266E-001
IS (EST)  +1.6189235160214323E-006 -1.0194137392040262E-003 +9.8075594321595416E-004 +9.9999899945489312E-001

DelTheta        deltheta(1)             deltheta(2)             deltheta(3)
Units             rad                     rad                     rad
          +2.8576203192364212E-008 -5.5554588749272964E-005 -6.0993854003545589E-004
EulAngT         theta(1)                theta(2)                theta(3)                [rad]
Mean      +1.2382541993943780E-006 -2.0388300265175357E-003 +1.9615119578036389E-003
sSigmaT   +1.2042941971938137E-010 +2.0510780070520503E-006 +9.7369780782393575E-006
SigmaT    +1.5116866177261345E-010 +2.5746094122165564E-006 +1.2222312033276634E-005
------------------------------------------------------------------------------------------------------------
------------------------------------------------------------------------------------------------------------
              q(1)                    q(2)                    q(3)                    q(4)
PCRS1A: +5.3376441636293240E-007 +3.7444188848489133E-004 -1.4254917867010713E-003 +9.9999891388248685E-001
PCRS2A: -5.2784065890448333E-007 +3.8463004289789228E-004 +1.3723320176524409E-003 +9.9999898438162671E-001
--------------------------------------------------------------------------------------
**********  CS-FILE PARAMETERS:  **********  **********  AS-FILE PARAMETERS:  **********
Row (01) PIX2RADX: +2.4736508339999999E-005  Row (1) TASTART:   +7.5023400039077759E+008
Row (02) PIX2RADY: +2.5464808057000000E-005  Row (2) TASTOP:    +7.5025100029079282E+008
Row (03) CX0:      +1.6500000000000000E+001  Row (3) S/C TIME:  +7.5023110219073486E+008
Row (04) CY0:      +1.6500000000000000E+001  Row (4) QR1:       +7.0861761923879385E-004
Row (05) BETA0:    +2.8047410000000001E-006  Row (5) QR2:       +1.2695450568571687E-003
Row (06) GAMMA_E0: +8.7500000000000000E+002  Row (6) QR3:       -1.6060027701314539E-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)
3.72482062E+000  3.96855444E-001  3.97055348E-001  [arcsec]
-----------------------------------------------------------
PIX2RADX = 2.473650834000E-005[rad/pixel]
XPIXSIZE = 5.1023[arcsec]
PIX2RADY = 2.546480805700E-005[rad/pixel]
YPIXSIZE = 5.2525[arcsec]
CX0 = 16.5[pixel] = 84.19[arcsec]
CY0 = 16.5[pixel] = 86.67[arcsec]
-----------------------------------------------------------
NOMINAL BETA0 = 2.804741000000E-006[rad/encoder unit]
ENCODER UNIT SIZE = 0.58[arcsec]
GAMMA_E0 = 875.00[encoder unit] = 506.20[arcsec]
-----------------------------------------------------------
                | -1 | +0 |
FLIP MATRIX D = |----|----|   and   DG = -1
                | +0 | +1 |
-----------------------------------------------------------
```

3.3 IPF EXECUTION LOG

```
***********************************************************************
IPF EXECUTION-LOG FILE NAME:  LG01P118.dat
INSTRUMENT TYPE:              MIPS_70um_fine_center
IPF FILTER EXECUTION DATE:    12-Oct-2003    TIME: 17:08
IPF FILTER VERSION USED:      IPF.V2.0.0C
***********************************************************************

-------------------- Loading & Preparing Input Files -------------------
AAFILE:  AA01P118 Loaded!        AAFILE dimension = 170000 X 21
ASFILE:  AS01P118 Loaded!
CAFILE:  CA01P118 Loaded!        CAFILE dimension = 20 X 15
CBFILE:  CB01P118 Loaded!        CBFILE dimension = 0 X 0
CCFILE:  CC01P118 Created!       CCFILE dimension = 20 X 19
CSFILE:  CS01P118 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 = [ 0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0 ]
mask2 = [ 0  1  0  1  1  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0 ]
-----------------------------------------------------------------------

---------------  Selected Initial Gyro Bias Parameters  ---------------
IPF Filter in LITE MODE# 3
IPF LITE MODE WITH FILTERED 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:  AG01P118.m     ACFILE CREATED:  AC01P118.m
-----------------------------------------------------------------------
Total Gyro Preprocessor Execution Time: 1 seconds
```

```
FRAME TABLE ENTRIES FOR PCRS LOADED TO TPCRS
q_PCRS4 = [ +5.3376441636293240E-007     q_PCRS5 = [ +7.3379987833742897E-007
            +3.7444188848489133E-004                 +5.2236196154513707E-004
            -1.4254917867010713E-003                 -1.4047712280184723E-003
            +9.9999891388248685E-001 ];              +9.9999887687698918E-001 ];
q_PCRS8 = [ -5.2784065890448333E-007     q_PCRS9 = [ -7.1963421681856818E-007
            +3.8463004289789228E-004                 +5.3239763239987400E-004
            +1.3723320176524409E-003                 +1.3516841804518383E-003
            +9.9999898438162671E-001 ];              +9.9999894475050310E-001 ];
--------------------------------------------------------------------------------
------ Initial Conditions for State -----  ------   Inital Square-Root Cov (diag)   -----
p1(01)  = a00  = +0.0000000000000000E+000  Sigma_initial(01,01) = 9.9999000000000000E+004
p1(02)  = b00  = +0.0000000000000000E+000  Sigma_initial(02,02) = 9.9999000000000000E+004
p1(03)  = c00  = +0.0000000000000000E+000  Sigma_initial(03,03) = 9.9999000000000000E+004
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) = 9.9999000000000000E+004
p2f(03) = am3  = +1.0000000000000000E+000
p2f(04) = beta = +1.0000000000000000E+000  Sigma_initial(19,19) = 1.0000000000000001E-001
p2f(05) = qT1  = +1.2836566686785981E-006  Sigma_initial(20,20) = 9.9999000000000000E+004
p2f(06) = qT2  = -9.9760012028013651E-004  Sigma_initial(21,21) = 1.0000000000000000E-002
p2f(07) = aT3  = +1.2867429956649661E-003  Sigma_initial(22,22) = 1.0000000000000000E-002
p2f(08) = qT4  = +9.9999867454152924E-001
p2f(09) = qR1  = +7.0861761923879385E-004  Sigma_initial(23,23) = 9.9999000000000000E+004
p2f(10) = qR2  = +1.2695450568571687E-003  Sigma_initial(24,24) = 9.9999000000000000E+004
p2f(11) = qR3  = -1.6060027701314539E-004  Sigma_initial(25,25) = 9.9999000000000000E+004
p2f(12) = qR4  = +9.9999892711639404E-001
p2f(13) = brx  = +0.0000000000000000E+000  Sigma_initial(26,26) = 9.9999000000000000E+004
p2f(14) = bry  = +0.0000000000000000E+000  Sigma_initial(27,27) = 9.9999000000000000E+004
p2f(15) = brz  = +0.0000000000000000E+000  Sigma_initial(28,28) = 9.9999000000000000E+004
p2f(16) = crx  = +0.0000000000000000E+000  Sigma_initial(29,29) = 9.9999000000000000E+004
p2f(17) = cry  = +0.0000000000000000E+000  Sigma_initial(30,30) = 9.9999000000000000E+004
p2f(18) = crz  = +0.0000000000000000E+000  Sigma_initial(31,31) = 9.9999000000000000E+004
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|= +6.900154523732E-002   RMS(|Res|)=+5.895246352030E-004
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Iteration#004: |dp|= +3.872635902411E-003   RMS(|Res|)=+8.674489200226E-006
Iteration#005: |dp|= +9.703448398852E-004   RMS(|Res|)=+8.673734566842E-006
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Iteration#007: |dp|= +2.157633772408E-004   RMS(|Res|)=+8.673975600144E-006
```

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Iteration#010:  |dp|= +1.193858960682E-005   RMS(|Res|)=+8.673882423737E-006
Iteration#011:  |dp|= +2.322095918984E-006   RMS(|Res|)=+8.673886561998E-006
Iteration#012:  |dp|= +8.852287041263E-007   RMS(|Res|)=+8.673887370555E-006
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Iteration#014:  |dp|= +1.095321263121E-007   RMS(|Res|)=+8.673886833732E-006
Iteration#015:  |dp|= +5.519481962865E-008   RMS(|Res|)=+8.673886795595E-006
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Iteration#019:  |dp|= +1.941251757736E-009   RMS(|Res|)=+8.673886827839E-006
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Iteration#022:  |dp|= +1.044454340148E-010   RMS(|Res|)=+8.673886827161E-006
Iteration#023:  |dp|= +8.315896774132E-012   RMS(|Res|)=+8.673886827197E-006
Iteration#024:  |dp|= +1.181855735555E-011   RMS(|Res|)=+8.673886827195E-006
Iteration#025:  |dp|= +5.800425089949E-012   RMS(|Res|)=+8.673886827198E-006
Iteration#026:  |dp|= +1.190974440987E-013   RMS(|Res|)=+8.673886827195E-006
Iteration#027:  |dp|= +8.579671676368E-013   RMS(|Res|)=+8.673886827194E-006
Iteration#028:  |dp|= +2.774731539154E-013   RMS(|Res|)=+8.673886827194E-006
Iteration#029:  |dp|= +4.238580039356E-014   RMS(|Res|)=+8.673886827194E-006
Iteration#030:  |dp|= +1.718174310426E-013   RMS(|Res|)=+8.673886827194E-006
Iteration#031:  |dp|= +7.127783916964E-014   RMS(|Res|)=+8.673886827195E-006
Iteration#032:  |dp|= +1.286254142211E-014   RMS(|Res|)=+8.673886827192E-006
Iteration#033:  |dp|= +6.026798264222E-014   RMS(|Res|)=+8.673886827194E-006
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Iteration#035:  |dp|= +2.164306136069E-014   RMS(|Res|)=+8.673886827193E-006
Iteration#036:  |dp|= +5.836043726444E-014   RMS(|Res|)=+8.673886827193E-006
Iteration#037:  |dp|= +7.298632526795E-015   RMS(|Res|)=+8.673886827193E-006
Iteration#038:  |dp|= +2.173760382559E-014   RMS(|Res|)=+8.673886827192E-006
Iteration#039:  |dp|= +4.125346009512E-014   RMS(|Res|)=+8.673886827195E-006
Iteration#040:  |dp|= +1.923396392264E-014   RMS(|Res|)=+8.673886827193E-006
Iteration#041:  |dp|= +2.432472712997E-014   RMS(|Res|)=+8.673886827193E-006
Iteration#042:  |dp|= +5.777648595230E-014   RMS(|Res|)=+8.673886827193E-006
Iteration#043:  |dp|= +1.495396774045E-013   RMS(|Res|)=+8.673886827193E-006
Iteration#044:  |dp|= +7.612075368746E-014   RMS(|Res|)=+8.673886827194E-006
Iteration#045:  |dp|= +1.181151570131E-014   RMS(|Res|)=+8.673886827193E-006
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Iteration#047:  |dp|= +5.812863481136E-014   RMS(|Res|)=+8.673886827194E-006
Iteration#048:  |dp|= +7.344169110838E-015   RMS(|Res|)=+8.673886827192E-006
Iteration#049:  |dp|= +2.174562689072E-014   RMS(|Res|)=+8.673886827193E-006
Iteration#050:  |dp|= +9.686479482762E-014   RMS(|Res|)=+8.673886827196E-006
Iteration#051:  |dp|= +9.380474339617E-014   RMS(|Res|)=+8.673886827193E-006
Iteration#052:  |dp|= +3.366751455387E-014   RMS(|Res|)=+8.673886827192E-006
Iteration#053:  |dp|= +9.427420205184E-014   RMS(|Res|)=+8.673886827195E-006
Iteration#054:  |dp|= +7.864586229143E-015   RMS(|Res|)=+8.673886827192E-006
Iteration#055:  |dp|= +2.186033548504E-014   RMS(|Res|)=+8.673886827193E-006
IPF Kalman Filter Completed with Error |dp1| + |dp2| = +2.1860335485039730E-014
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-----------------  IPF LEAST SQUARES FILTER STARTED  ------------------
Iteration#001   COND#=+1.596638431267E+004,   |dp|=+8.066383260201E-002
Iteration#002   COND#=+1.596638974761E+004,   |dp|=+3.022029620782E-007
Iteration#003   COND#=+1.596638974761E+004,   |dp|=+5.449598657605E-014
Iteration#004   COND#=+1.596638974761E+004,   |dp|=+8.781394112817E-014
Iteration#005   COND#=+1.596638974761E+004,   |dp|=+5.445771219386E-014
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Iteration#007   COND#=+1.596638974761E+004,   |dp|=+1.110498543009E-013
Iteration#008   COND#=+1.596638974761E+004,   |dp|=+5.450787669921E-014
Iteration#009   COND#=+1.596638974761E+004,   |dp|=+5.450733207202E-014
Iteration#010   COND#=+1.596638974761E+004,   |dp|=+8.780761628890E-014
Iteration#011   COND#=+1.596638974761E+004,   |dp|=+5.450733207202E-014
Iteration#012   COND#=+1.596638974761E+004,   |dp|=+3.126171035124E-014
```

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Iteration#013   COND#=+1.596638974761E+004,   |dp|=+8.781263382007E-014
Iteration#014   COND#=+1.596638974761E+004,   |dp|=+5.450787669921E-014
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Iteration#016   COND#=+1.596638974761E+004,   |dp|=+1.110493096738E-013
Iteration#017   COND#=+1.596638974761E+004,   |dp|=+5.450733207202E-014
Iteration#018   COND#=+1.596638974761E+004,   |dp|=+9.465942516737E-015
Iteration#019   COND#=+1.596638974761E+004,   |dp|=+9.467634267164E-015
Iteration#020   COND#=+1.596638974761E+004,   |dp|=+9.468178917678E-015
Iteration#021   COND#=+1.596638974761E+004,   |dp|=+1.377360660527E-014
Iteration#022   COND#=+1.596638974761E+004,   |dp|=+8.780985267156E-014
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Iteration#024   COND#=+1.596638974761E+004,   |dp|=+5.450787669921E-014
Iteration#025   COND#=+1.596638974761E+004,   |dp|=+8.780816090811E-014
Iteration#026   COND#=+1.596638974761E+004,   |dp|=+5.450787669921E-014
Iteration#027   COND#=+1.596638974761E+004,   |dp|=+3.126161853301E-014
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Iteration#030   COND#=+1.596638974761E+004,   |dp|=+5.450787669921E-014
Iteration#031   COND#=+1.596638974761E+004,   |dp|=+1.110498542937E-013
Iteration#032   COND#=+1.596638974761E+004,   |dp|=+5.450787669921E-014
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Iteration#034   COND#=+1.596638974761E+004,   |dp|=+9.468178917678E-015
Iteration#035   COND#=+1.596638974761E+004,   |dp|=+9.467634267164E-015
Iteration#036   COND#=+1.596638974761E+004,   |dp|=+1.377351481515E-014
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Iteration#038   COND#=+1.596638974761E+004,   |dp|=+5.450787669921E-014
Iteration#039   COND#=+1.596638974761E+004,   |dp|=+5.450733207202E-014
Iteration#040   COND#=+1.596638974761E+004,   |dp|=+8.780761628890E-014
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Iteration#043   COND#=+1.596638974761E+004,   |dp|=+8.781263382007E-014
Iteration#044   COND#=+1.596638974761E+004,   |dp|=+5.450787669921E-014
Iteration#045   COND#=+1.596638974761E+004,   |dp|=+5.450733207202E-014
Iteration#046   COND#=+1.596638974761E+004,   |dp|=+1.110493096738E-013
Iteration#047   COND#=+1.596638974761E+004,   |dp|=+5.450733207202E-014
Iteration#048   COND#=+1.596638974761E+004,   |dp|=+9.465942516737E-015
Iteration#049   COND#=+1.596638974761E+004,   |dp|=+9.467634267164E-015
Iteration#050   COND#=+1.596638974761E+004,   |dp|=+9.468178917678E-015
Iteration#051   COND#=+1.596638974761E+004,   |dp|=+1.377360660527E-014
Iteration#052   COND#=+1.596638974761E+004,   |dp|=+8.780985267156E-014
Iteration#053   COND#=+1.596638974761E+004,   |dp|=+5.450733207202E-014
Iteration#054   COND#=+1.596638974761E+004,   |dp|=+5.450787669921E-014
Iteration#055   COND#=+1.596638974761E+004,   |dp|=+8.780816090811E-014
IPF Least Squares Filter Completed with Error |dp1| + |dp2| = +8.7808160908114280E-014
--------------------------------------------------------------------------------
Total Execution Time: 47 seconds
```

4 COMMENTS

This Pre-course run should be used for sanity checking, and to make first rough corrections to the focal plane quaternions. Only three parameters were estimated: the frame table quaternion (not including Twist) and the scan mirror scale factor.

(1) Overall the data set ran well and the filter converged properly. No modifications were required to the centroid CA file. The attitude AAfile also looked very clean with tracker and gyro working to spec. We did not have to scale the GCF biases AA file for this run due to a correction made by MIPL to convert arcseconds to radians.

(2) The experiment design did not contain any PCRS measurements, motivating us to run in an IPF Lite mode. Since the systematic error seen earlier in the observer was gone, (indicating the PCS modifications were effective) we used Lite-Mode 3.

(3) There were limitations in the experiment design due to only having positive scan mirror angles. No centroids were even available at the center scan mirror position. This forced us to rely heavily on the accuracy of the plate scales reported to us by MIPS team in calculating the alignment Brown angles, and the scan mirror scale factor.

(4) A fairly large scan mirror scale factor error of 8 percent was found, with an estimation error of about 3 percent.

(5) Errors were dominated by centroiding errors of 1.5 arcseconds (approx .3 pixel with 5 arcsecond pixels). This made us decide not to estimate plate scales or the Twist Brown angle, and to restrict the scan mirror parameters to only the scale factor. Because of this, systematic errors of about 2 arcseconds were not removed, and can be seen from the size and non-Gaussian character of the a-posterior residuals.

(6) There appears to be a discrepancy in the definition of Frame 120 in the provided FFfile and the current frame table BodyFrame_FTU_07f.xls.

We recommend updating frames 118, 119, 120, 124, and 127 with the new quaternions listed in the IF file IF01P118.dat. We realize these recommendations are large, being on the order of two arcminutes. However, our confidence in this change is high since it is many times the estimation accuracy which is on the order of only 12 arcseconds (assuming as much as a 10 percent error in the MIPS plate scales). Disregard accuracies quoted in the Tables which are optimistic due to the lack of PCRS measurements.

The only caveat we have to this conclusion is if there was a gross error in the centroids, plate scales or geometry indicated in CA01P118.m and/or CS01P118.m files provided to the IPF filter. **Because of the size of the corrections, we strongly encourage the MIPS science team to review the integrity of the CA and CS files provided to us, before accepting our above conclusions**.

IPF TEAM CONTACT INFORMATION

IPF Team email		ipf@sirtfweb.jpl.nasa.gov	
David S. Bayard	X4-8208	David.S.Bayard@jpl.nasa.gov	(TEAM LEADER)
Dhemetrio Boussalis	X4-3977	boussali@grover.jpl.nasa.gov	
Paul Brugarolas	X4-9243	Paul.Brugarolas@jpl.nasa.gov	
Bryan H. Kang	X4-0541	Bryan.H.Kang@jpl.nasa.gov	
Edward.C.Wong	X4-3053	Edward.C.Wong@jpl.nasa.gov	(TASK MANAGER)

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