JET PROPULSION LABORATORY **SIRTF IPF REPORT**

JPL ID01M095
October 17, 2003

SIRTF INSTRUMENT POINTING FRAME KALMAN FILTER EXECUTION SUMMARY

IPF RUN NUMBER: 01M095
REPORT TYPE: IOC EXECUTION (MULTI-RUN)

PRIME FRAME: MIPS_24um_center (95)
INFERRED FRAMES: (96) (99) (100) (103) (104)

IPF TEAM

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1 IPF MULTI-RUN SUMMARY

This report summarizes the SIRTF Instrument Pointing Frame (IPF) Kalman Filter execution. This document captures the results generated by a multi-run execution with the MR run number specified as: MR01M095. This multi-run execution merges 2 previously executed IPF runs of the instrument: MIPS_24um_center (95), for the purpose of improving estimation accuracy. The main multi-run calibration results have been documented in MF01M095 typically stored in the mission archive DOM collection IPF_MF. This report only summarizes the main aspects of the run, and does not substitute for the full information contained in the MF file.

Section 1 summarizes the multi-run merge results. The merge configurations are tabulated in Table 1.1. The overall End-to-End pointing performances are tabulated in Table 1.4. Section 2 summarizes resulting plots, a mini summary of the MF Multi-Run output file, and the execution log. Section 3 captures the user comments that are specific to this particular run.

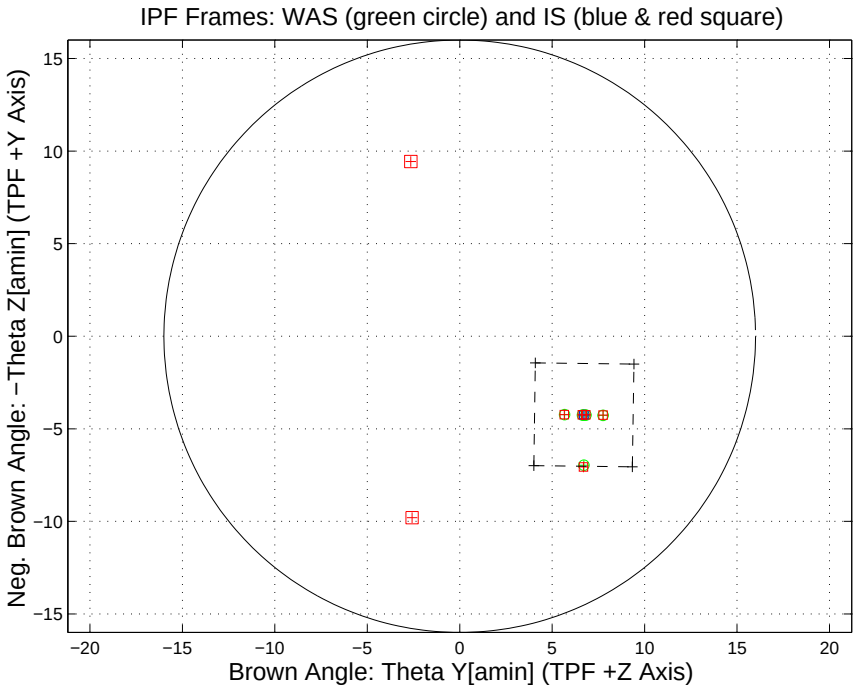

Figure 1.1: A-priori and a-posteriori IPF frames

EXECUTION CONFIGURATION ITEM	CURRENT STATUS
IPF Filter Version Used	IPF.V2.0.0D
Frame Table Version Used	BodyFrames_SPC_08a
IPF Filter Mode	NORMAL-MODE(0)
LS Residual Sigma Scale	9.88732266E-001
Merge Data Set #1	001095
Merge Data Set #2	101095

Table 1.1: IPF filter execution configuration

	BROWN ANGLES AND SIGMAS [arcmin, arcmin, deg]					
RUN#	$-\theta_y$	$-\theta_z$	θ_x	σ_y	σ_z	σ_x
001095	+6.718185	+4.247276	+0.638444	0.001223	0.001103	0.012693
101095	+6.714552	+4.245573	+0.643100	0.000987	0.000823	0.009863
01M095	+6.716105	+4.246060	+0.637930	0.000783	0.000667	0.007892

Table 1.2: Merge performance chart

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

Table 1.3: IPF filter execution mask vector assignment

FOCAL PLANE SURVEY ANALYSIS: MULTI-RUN
INSTRUMENT NAME: MIPS_24um_center NF: 95
`PIX2RADW: 1.20874169E-005[rad/pixel] = 2.4932E+000[arcsec/pixel]`
`PIX2RADV: 1.20874169E-005[rad/pixel] = 2.4932E+000[arcsec/pixel]`

FRAME	DESCRIPTION	IPF[1]	SF[2]	TOTAL	REQ
095(P)	MIPS_24um_center	0.0617	0.0855	0.1054	0.14
096(I)	MIPS_24um_plusY_edge	0.0790	0.0855	0.1164	N/A
099(I)	MIPS_24um_small_FOV1	0.0622	0.0855	0.1058	N/A
100(I)	MIPS_24um_small_FOV2	0.0621	0.0855	0.1057	N/A
103(I)	MIPS_24um_large_FOV1	0.0617	0.0855	0.1054	N/A
104(I)	MIPS_24um_large_FOV2	0.0617	0.0855	0.1054	N/A

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

[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: 0.988732. It is assumed that the Gyro Angle Random Walk (GARW) contribution is captured with the Least Squares scaling. The GARW contribution can be approximately 0.0753 arcseconds, given that ARW = $100\mu deg/\sqrt{hr}$, with 5.518000e+002 second Maneuver (max), and 7 Maneuvers.

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

IPF BROWN ANGLE SUMMARY						
	WAS			IS		
Frame Number	theta_Y (arcmin)	theta_Z (arcmin)	angle (deg)	theta_Y (arcmin)	theta_Z (arcmin)	angle (deg)
095	+6.724001	+4.258239	+0.577299	+6.716105	+4.246060	+0.637930
096	+6.721218	+6.970374	+0.577299	+6.695190	+7.060913	+0.637930
099	+7.758095	+4.277861	+0.577299	+7.756798	+4.259313	+0.637930
100	+5.669225	+4.238226	+0.577299	+5.659609	+4.234140	+0.637930
103	+6.827410	+4.260201	+0.577299	+6.819955	+4.247316	+0.637930
104	+6.641274	+4.256670	+0.577299	+6.633060	+4.245067	+0.637930

Table 1.5: IPF Brown angle summary

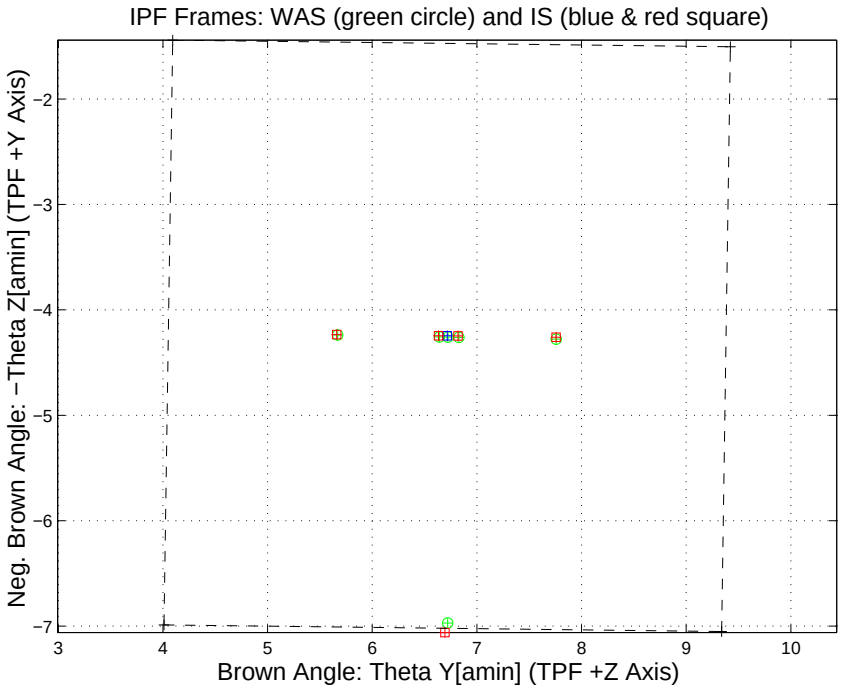

Figure 1.2: A-priori and a-posteriori IPF frames (ZOOMED)

2 IPF MULTI-RUN RESULTS

2.1 IPF MULTI-RUN OUTPUT PLOTS

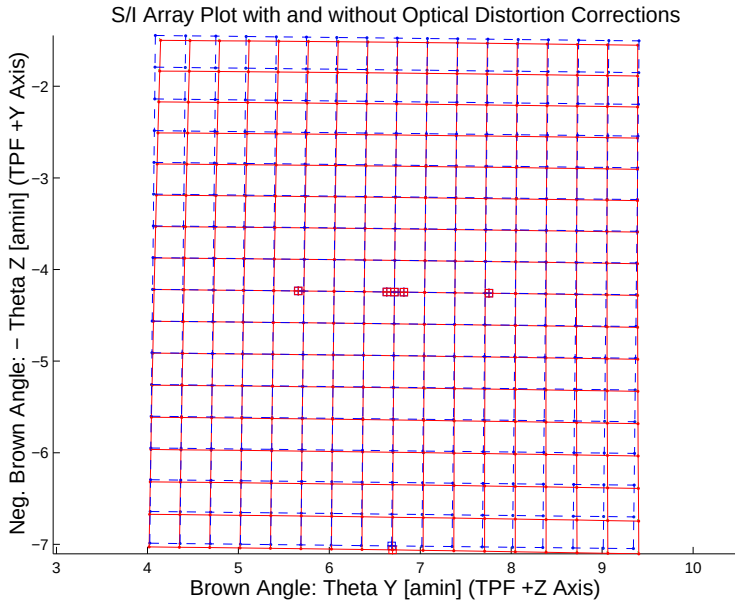

Figure 2.1: Array plot with (solid) and w/o (dashed) optical distortion corrections

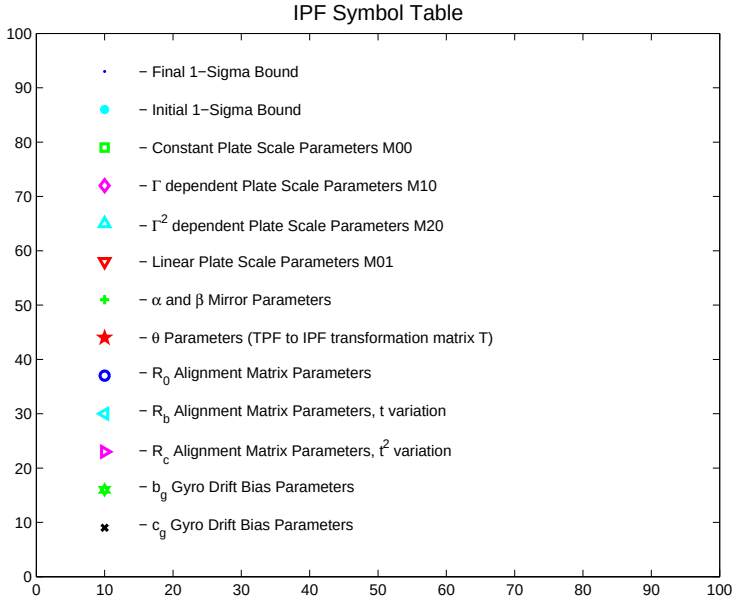

Figure 2.2: IPF parameter symbol table

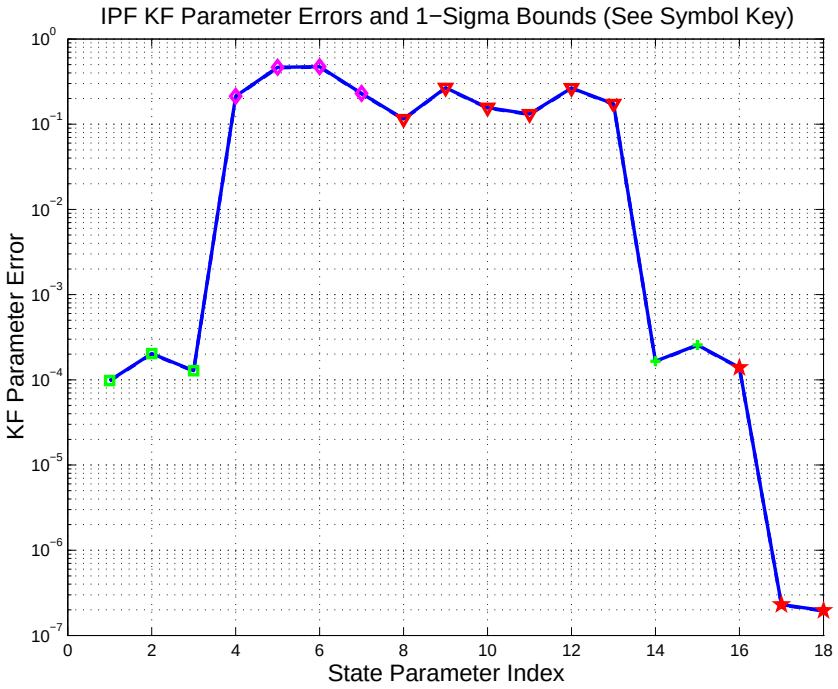

Figure 2.3: KF parameter error sigma plots

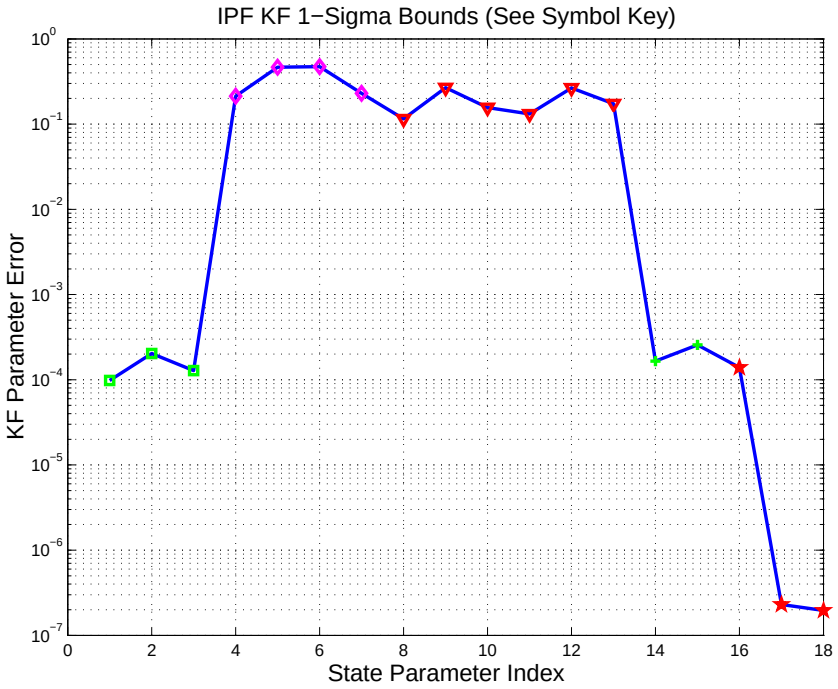

Figure 2.4: KF parameter error 1-sigma bound

2.2 IPF MULTI-RUN OUTPUT DATA (MF MINI FILE)

```
OUTPUT FILE NAME: MF01M095mini.dat   DATE: 17-Oct-2003   TIME: 17:53
INSTRUMENT NAME:  MIPS_24um_center   NF: 95
IPF FILTER VERSION: IPF.V2.0.0D       SW RELEASE DATE: August 1, 2003
FRAME TABLE USED: BodyFrames_SPC_08a
-------------------------------------------------------------------------------
--------------------------- IPF BROWN ANGLE SUMMARY ---------------------------
-------------------------------------------------------------------------------
         ------------ WAS ------------           ------------ IS -------------
Frame    theta_Y     theta_Z     angle           theta_Y     theta_Z     angle
Number   (arcmin)    (arcmin)    (deg)           (arcmin)    (arcmin)    (deg)
------  ---------------------------------       ---------------------------------
 095     +6.724001  +4.258239   +0.577299        +6.716105  +4.246060   +0.637930
 096     +6.721218  +6.970374   +0.577299        +6.695190  +7.060913   +0.637930
 099     +7.758095  +4.277861   +0.577299        +7.756798  +4.259313   +0.637930
 100     +5.669225  +4.238226   +0.577299        +5.659609  +4.234140   +0.637930
 103     +6.827410  +4.260201   +0.577299        +6.819955  +4.247316   +0.637930
 104     +6.641274  +4.256670   +0.577299        +6.633060  +4.245067   +0.637930
-------------------------------------------------------------------------------
OFFSET           NF          Delta_CW          Delta_CV
  0              95            +0.000            +0.000     pixels
OFFSET FRAME NAME: MIPS_24um_center
Brown Angle       theta_Y(arcmin)  theta_Z(arcmin)  angle(deg)
WAS(FTB)            +6.724001        +4.258239       +0.577299
IS (EST)            +6.716105        +4.246060       +0.637930
dT_EST              -0.007896        -0.012179       +0.060630
T_sSIGMA            +0.000783        +0.000667       +0.007892
dT_EST/T_sSIGMA    -10.090075       -18.272687       +7.682093
-------------------------------------------------------------------------
OFFSET           NF          Delta_CW          Delta_CV
  1              96            +0.000           -64.000     pixels
OFFSET FRAME NAME: MIPS_24um_plusY_edge
Brown Angle       theta_Y(arcmin)  theta_Z(arcmin)  angle(deg)
WAS(FTB)            +6.721218        +6.970374       +0.577299
IS (EST)            +6.695190        +7.060913       +0.637930
dT_EST              -0.026029        +0.090538       +0.060630
T_sSIGMA            +0.001000        +0.000855       +0.007892
dT_EST/T_sSIGMA    -26.025853       +105.867737       +7.682099
-------------------------------------------------------------------------
OFFSET           NF          Delta_CW          Delta_CV
  2              99           +25.000            +0.000     pixels
OFFSET FRAME NAME: MIPS_24um_small_FOV1
Brown Angle       theta_Y(arcmin)  theta_Z(arcmin)  angle(deg)
WAS(FTB)            +7.758095        +4.277861       +0.577299
IS (EST)            +7.756798        +4.259313       +0.637930
dT_EST              -0.001297        -0.018548       +0.060630
T_sSIGMA            +0.000791        +0.000672       +0.007892
dT_EST/T_sSIGMA     -1.640336       -27.619402       +7.682093
-------------------------------------------------------------------------
OFFSET           NF          Delta_CW          Delta_CV
  3             100           -25.500            +0.000     pixels
OFFSET FRAME NAME: MIPS_24um_small_FOV2
Brown Angle       theta_Y(arcmin)  theta_Z(arcmin)  angle(deg)
WAS(FTB)            +5.669225        +4.238226       +0.577299
IS (EST)            +5.659609        +4.234140       +0.637930
dT_EST              -0.009616        -0.004085       +0.060630
T_sSIGMA            +0.000779        +0.000682       +0.007892
dT_EST/T_sSIGMA    -12.345581        -5.993294       +7.682093
-------------------------------------------------------------------------
OFFSET           NF          Delta_CW          Delta_CV
  4             103            +2.500            +0.000     pixels
OFFSET FRAME NAME: MIPS_24um_large_FOV1
Brown Angle       theta_Y(arcmin)  theta_Z(arcmin)  angle(deg)
WAS(FTB)            +6.827410        +4.260201       +0.577299
IS (EST)            +6.819955        +4.247316       +0.637930
```

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dT_EST              -0.007455        -0.012886       +0.060630
T_sSIGMA            +0.000783        +0.000666       +0.007892
dT_EST/T_sSIGMA     -9.519303       -19.352528       +7.682093
-----------------------------------------------------------------
OFFSET           NF          Delta_CW          Delta_CV
  5             104            -2.000            +0.000     pixels
OFFSET FRAME NAME: MIPS_24um_large_FOV2
Brown Angle       theta_Y(arcmin)  theta_Z(arcmin)  angle(deg)
WAS(FTB)            +6.641274        +4.256670       +0.577299
IS (EST)            +6.633060        +4.245067       +0.637930
dT_EST              -0.008214        -0.011603       +0.060630
T_sSIGMA            +0.000782        +0.000667       +0.007892
dT_EST/T_sSIGMA    -10.502263       -17.390375       +7.682093
-----------------------------------------------------------------
-------------------------------------------------------------------------------
-------------------------------------------------------------------------------
VARNAME             MEAN                     SIGMA                SCALED_SIGMA
a00        -4.8253305544525868E-004 +9.793406775053576O-005 +9.6830572702274431E-005
b00        -2.9493161287727894E-004 +2.0296517315945419E-004 +2.0067821552871966E-004
c00        -8.8253429497406777E-004 +1.2814375124170629E-004 +1.2669986150845174E-004
a10        +5.1004878770414130E+000 +2.1295459226909860E-001 +2.1055507651864441E-001
b10        +2.3839869927419173E+000 +4.6604359997255490E-001 +4.6079234454473383E-001
c10        +9.5182814899047958E+000 +4.7165591356911174E-001 +4.6634142008322427E-001
d10        -1.3544133408884651E+000 +2.2977310111249083E-001 +2.2718407887410949E-001
a01        +7.7743759567265034E+000 +1.1535718529305300E-001 +1.1405737118672481E-001
b01        +3.5729494144581802E+000 +2.6785216667298667E-001 +2.6483407964383748E-001
c01        -1.5969553074868037E+001 +1.5622575174441755E-001 +1.5446544149262650E-001
d01        -2.3844513597816790E+000 +1.3159218103229339E-001 +1.3010943530862004E-001
e01        -1.9885266764026291E+001 +2.6600165498044909E-001 +2.6300441902525579E-001
f01        +2.5152036788821652E+000 +1.7354175029698110E-001 +1.7158632797543383E-001
del_alpha  -1.1569375888531642E-004 +1.6538118393060602E-004 +1.6351771270210679E-004
beta       +9.6249851890792215E-001 +2.5661614747257716E-004 +2.5372466492167153E-004
del_theta1 -8.9703126474420616E-006 +1.3931870545382967E-004 +1.3774889930639087E-004
del_theta2 +6.0905981295996651E-007 +2.3023278310579026E-007 +2.2763858129287443E-007
del_theta3 +3.4693340240780274E-007 +1.9609546738084116E-007 +1.9388591576911344E-007
-------------------------------------------------------------------------------
LSQF RESIDUAL SIGMA SCALE =         +9.8873226576197959E-001
-------------------------------------------------------------------------------
-------------------------------------------------------------------------------------------------------------
-------------------------------------------------------------------------------------------------------------
                    a_mirror(1)               a_mirror(2)               a_mirror(3)
a_mirror_ipf   +0.0000000000000000E+000  +1.2253741231958116E-002  +9.9992492009441403E-001
a_mirror_tpf   -1.9522483437843499E-003  +1.1224876476781491E-003  +9.9999746437072756E-001
beta                beta_0                    beta                      beta_total
               +2.8047410000000001E-006  +9.6249851890792215E-001  +2.6995590584203247E-006
-------------------------------------------------------------------------------------------------------------
qT              qT(1)                     qT(2)                     qT(3)                     qT(4)
FrmTbl:    +5.0372558129468097E-003 -9.8107368935810191E-004 -6.1440075534372396E-004 +9.9998664294079498E-001
Estim:     +5.5663503708387090E-003 -9.8024034448415242E-004 -6.1211659772710057E-004 +9.9998383996226992E-001
DelTheta        deltheta(1)               deltheta(2)               deltheta(3)
           +1.0582067314484421E-003 +2.3324697472668774E-006 +3.5194874774434236E-006       [rad]
EulAngT         theta(1)                  theta(2)                  theta(3)                  [rad]
Mean       +1.1133972162952586E-002 -1.9536357393625014E-003 -1.2351288053021321E-003
SigmaT     +1.3931870545382967E-004 +2.3023278310579026E-007 +1.9609546738084116E-007
-------------------------------------------------------------------------------------------------------------
Initial Gyro Bias         Bg0(1)                    Bg0(2)                    Bg0(3)
                   +3.700694719555O310E-007 +1.7281990949413739E-007 -3.4789076153174392E-007
Gyro Bias Correction      Bg(1)                     Bg(2)                     Bg(3)
                   +1.4588501599232332E-006 -2.3082906003562955E-009 +7.1164400698708779E-010
Total Gyro Bias           BgT(1)                    BgT(2)                    BgT(3)
                   +1.8289196318787363E-006 +1.7051161889378110E-007 -3.4717911752475681E-007

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)
                   +2.3043024642430984E-010 -1.9507735802366981E-013 +7.3841218185067421E-013
Total Gyro Bias Rate       CgT(1)                    CgT(2)                    CgT(3)
                   +2.3043024642430984E-010 -1.9507735802366981E-013 +7.3841218185067421E-013
```

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--------------------------------------------------------------------------------------------------------------
--------------------------------------------------------------------------------------------------------------
OFFSET           NF          Delta_CW          Delta_CV
  1              96            +0.000           -64.000     pixels
OFFSET FRAME NAME: MIPS_24um_plusY_edge
qT               qT(1)                    qT(2)                    qT(3)                    qT(4)
WAS(FTB)  +5.0368688350518696E-003 -9.8265590121642096E-004 -1.0088615259627000E-003 +9.9998632317554204E-001
IS (EST)  +5.5659517308697557E-003 -9.7947717279747910E-004 -1.0215305487940567E-003 +9.9998350850458306E-001

DelTheta        deltheta(1)              deltheta(2)              deltheta(3)
Units             rad                      rad                      rad
          +1.0581483141594327E-003 +7.3057311106767740E-006 -2.6411351305142378E-005
EulAngT         theta(1)                 theta(2)                 theta(3)                 [rad]
Mean      +1.1133972162952588E-002 -1.9475516912192130E-003 -2.0539361891690742E-003
sSigmaT   +1.3774878618770452E-004 +2.9092115618903295E-007 +2.4876748805844746E-007
SigmaT    +1.3931859104602658E-004 +2.9423653527158915E-007 +2.5160247791320082E-007
--------------------------------------------------------------------------------------------------------------
--------------------------------------------------------------------------------------------------------------
OFFSET           NF          Delta_CW          Delta_CV
  2              99            +25.000            +0.000     pixels
OFFSET FRAME NAME: MIPS_24um_small_FOV1
qT               qT(1)                    qT(2)                    qT(3)                    qT(4)
WAS(FTB)  +5.0371586372862228E-003 -1.1314889056829706E-003 -6.1649671362086034E-004 +9.9998648325740958E-001
IS (EST)  +5.5662538280227556E-003 -1.1316112973882814E-003 -6.1320141015468827E-004 +9.9998367999594084E-001

DelTheta        deltheta(1)              deltheta(2)              deltheta(3)
Units             rad                      rad                      rad
          +1.0582119777805318E-003 +4.3159255284674422E-007 +5.3911928948160442E-006
EulAngT         theta(1)                 theta(2)                 theta(3)                 [rad]
Mean      +1.1133972162952586E-002 -2.2563611041655062E-003 -1.2389839477663328E-003
sSigmaT   +1.3774889027810922E-004 +2.2998403775518255E-007 +1.9534389688256881E-007
SigmaT    +1.3931869632266043E-004 +2.3260496872522140E-007 +1.9757006385548110E-007
--------------------------------------------------------------------------------------------------------------
--------------------------------------------------------------------------------------------------------------
OFFSET           NF          Delta_CW          Delta_CV
  3             100            -25.500            +0.000     pixels
OFFSET FRAME NAME: MIPS_24um_small_FOV2
qT               qT(1)                    qT(2)                    qT(3)                    qT(4)
WAS(FTB)  +5.0373539303327245E-003 -8.2765014547835373E-004 -6.1226286617559059E-004 +9.9998678251004891E-001
IS (EST)  +5.5664474678460609E-003 -8.2657205344854325E-004 -6.1123845851204588E-004 +9.9998397878604794E-001

DelTheta        deltheta(1)              deltheta(2)              deltheta(3)
Units             rad                      rad                      rad
          +1.0582017617050228E-003 +2.8091103601302430E-006 +1.1601713309629840E-006
EulAngT         theta(1)                 theta(2)                 theta(3)                 [rad]
Mean      +1.1133972162952588E-002 -1.6463135116627575E-003 -1.2316614518055418E-003
sSigmaT   +1.3774889552074660E-004 +2.2658134322843569E-007 +1.9829121541218992E-007
SigmaT    +1.3931870162504366E-004 +2.2916349660523903E-007 +2.0055097044837936E-007
--------------------------------------------------------------------------------------------------------------
--------------------------------------------------------------------------------------------------------------
OFFSET           NF          Delta_CW          Delta_CV
  4             103            +2.500            +0.000     pixels
OFFSET FRAME NAME: MIPS_24um_large_FOV1
qT               qT(1)                    qT(2)                    qT(3)                    qT(4)
WAS(FTB)  +5.0372461391393897E-003 -9.9611521251996506E-004 -6.1461035168427895E-004 +9.9998662799056104E-001
IS (EST)  +5.5663407785030115E-003 -9.9534554975494287E-004 -6.1221510359754845E-004 +9.9998382503430583E-001

DelTheta        deltheta(1)              deltheta(2)              deltheta(3)
Units             rad                      rad                      rad
          +1.0582072462594651E-003 +2.2062545029205239E-006 +3.7263221219868335E-006
EulAngT         theta(1)                 theta(2)                 theta(3)                 [rad]
Mean      +1.1133972162952588E-002 -1.9838446056394850E-003 -1.2354940126701715E-003
sSigmaT   +1.3774889897415137E-004 +2.2781054000971324E-007 +1.9368888980096833E-007
SigmaT    +1.3931870511780392E-004 +2.3040670148874736E-007 +1.9589619607659858E-007
--------------------------------------------------------------------------------------------------------------
--------------------------------------------------------------------------------------------------------------
OFFSET           NF          Delta_CW          Delta_CV
  5             104            -2.000            +0.000     pixels
```

```
OFFSET FRAME NAME: MIPS_24um_large_FOV2
qT              qT(1)                    qT(2)                    qT(3)                    qT(4)
WAS(FTB)  +5.037263544991320 5E-003 -9.6904047066332906E-004 -6.1423307818932811E-004 +9.9998665473808712E-001
IS (EST)  +5.5663580350760822E-003 -9.6816128275258821E-004 -6.1203938908990785E-004 +9.9998385173448789E-001

DelTheta        deltheta(1)              deltheta(2)              deltheta(3)
Units             rad                      rad                      rad
         +1.0582063222269523E-003 +2.4232223440087804E-006 +3.3508735068383909E-006
EulAngT         theta(1)                 theta(2)                 theta(3)                 [rad]
Mean      +1.1133972162952586E-002 -1.9294788337173435E-003 -1.2348398885060872E-003
sSigmaT   +1.3774889948134827E-004 +2.2750690215103552E-007 +1.9408007099345179E-007
SigmaT    +1.3931870563078092E-004 +2.3009960332962768E-007 +1.9629183522587018E-007
-------------------------------------------------------------------------------------------------------------
-------------------------------------------------------------------------------------------------------------
              q(1)                     q(2)                     q(3)                     q(4)
PCRS1A: +5.3377191730804340E-007 +3.7444181445836429E-004 -1.4255121007937610E-003 +9.9999891385355677E-001
PCRS2A: -5.2784857378083422E-007 +3.8463011681657313E-004 +1.3723523317471205E-003 +9.9999898435372037E-001
-------------------------------------------------------------------------------
**********  CS-FILE PARAMETERS:  **********  **********  AS-FILE PARAMETERS:  **********
Row (01) PIX2RADX: +1.2087416876100000E-005  Row (1) TASTART:   +7.5024450039074707E+008
Row (02) PIX2RADY: +1.2595908372599999E-005  Row (2) TASTOP:    +7.5025000029077756E+008
Row (03) CX0:      +6.4500000000000000E+001  Row (3) S/C TIME:  +7.5023110219073486E+008
Row (04) CY0:      +6.4500000000000000E+001  Row (4) QR1:       +7.0861761923879385E-004
Row (05) BETA0:    +2.8047410000000001E-006  Row (5) QR2:       +1.2695450568571687E-003
Row (06) GAMMA_E0: +2.0070000000000000E+003  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 = 1.208741687610E-005[rad/pixel]
XPIXSIZE = 2.4932[arcsec]
PIX2RADY = 1.259590837260E-005[rad/pixel]
YPIXSIZE = 2.5981[arcsec]
CX0 = 64.5[pixel] = 160.81[arcsec]
CY0 = 64.5[pixel] = 167.58[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 |
-----------------------------------------------------------
```

2.3 IPF MULTI-RUN EXECUTION LOG

```
***********************************************
*****          MULTI_RUN LOG FILE           *****
***********************************************

-----------------------------------------------
MULTI-RUN-LOG FILE NAME:  LG01M095.dat
```

```
INSTRUMENT TYPE:              MIPS_24um_center
MULTI-RUN EXECUTION DATE: 17-Oct-2003    TIME: 17:53
-------------------------------------------------


-------------------------------------------------------
MT001095 FILE LOADED!
q_T    = +5.5708354382570388E-003 -9.8054664932168962E-004 -6.1228736020785908E-004 +9.9998381458150465E-001
SigmaT = +2.0989446877712882E-004 +3.3714631802295598E-007 +3.0387325754805143E-007
Sigma Scale = +1.0554797110858032E+000

-------------------------------------------------------
MT101095 FILE LOADED!
q_T    = +5.6114657829231702E-003 -9.8004174764065909E-004 -6.1200280515191882E-004 +9.9998358807657761E-001
SigmaT = +1.9014622197686758E-004 +3.1721724760892415E-007 +2.6428140677021008E-007
Sigma Scale = +9.0531257929934594E-001

-------------------------------------------------------

-----------------------------------------------------------------
Conditioning Number for LSQ Filter was:  +4.1069844590985063E+006
-----------------------------------------------------------------

Merged q_T    = +5.5663503708387090E-003 -9.8024034448415242E-004 -6.1211659772710057E-004 +9.9998383996226992E-001
Merged SigmaT = +1.3931870545382967E-004 +2.3023278310579026E-007 +1.9609546738084116E-007
Merged Sigma Scale = +9.8873226576197959E-001

********** Sigma T Ratios for Multi-Run ************
DATA#1 Expected:     1.41421 1.41421 1.41421
DATA#1 Calculated:   1.50658 1.46437 1.54962
-------------------------------------------------
DATA#2 Expected:     1.41421 1.41421 1.41421
DATA#2 Calculated:   1.36483 1.37781 1.34772
-------------------------------------------------


Merging LG Files!


**********************************************************************
IPF EXECUTION-LOG FILE NAME:  LG001095.dat
INSTRUMENT TYPE:              MIPS_24um_center
IPF FILTER EXECUTION DATE:    17-Oct-2003    TIME: 16:48
IPF FILTER VERSION USED:      IPF.V2.0.0D
**********************************************************************

------------------- Loading & Preparing Input Files -------------------
AAFILE:  AA001095 Loaded!        AAFILE dimension = 61340 X 21
ASFILE:  AS001095 Loaded!
CAFILE:  CA003095 Loaded!        CAFILE dimension = 227 X 15
CBFILE:  CB002095 Loaded!        CBFILE dimension = 63 X 15
CCFILE:  CC001095 Created!       CCFILE dimension = 290 X 19
CSFILE:  CS003095 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  1  1  1  1  0  0  0  0  1  1  1  1  1  1 ]
mask2 = [ 1  1  1  1  1  1  1  1  0  0  0  0  0  0  1  1  1  1  1  1 ]
-----------------------------------------------------------------------

---------------  Selected Initial Gyro Bias Parameters  ---------------
User Entered 1 : Use AFILE database - from S/C filter
IPF Linearized Using Following Nominal Gyro Bias Estimates
bg0 = [+3.8798614809820720E-007 +1.7442596345063063E-007 -3.4433065820849146E-007 ]
cg0 = [+0.0000000000000000E+000 +0.0000000000000000E+000 +0.0000000000000000E+000 ]
```

```
--------------------------------------------------------------------------

---------------  Gyro Pre-Processor Run Completed  --------------------
     AGFILE CREATED:  AG001095.m     ACFILE CREATED:  AC001095.m
--------------------------------------------------------------------------
Total Gyro Preprocessor Execution Time: 29 seconds

FRAME TABLE ENTRIES FOR PCRS LOADED TO TPCRS
q_PCRS4 = [ +5.3377191730804340E-007     q_PCRS5 = [ +7.3379987833742897E-007
            +3.7444181445836429E-004                 +5.2236196154513707E-004
            -1.4255121007937610E-003                 -1.4047712280184723E-003
            +9.9999891385355677E-001 ];              +9.9999887687698918E-001 ];
q_PCRS8 = [ -5.2784857378083422E-007     q_PCRS9 = [ -7.1963421681856818E-007
            +3.8463011681657313E-004                 +5.3239763239987400E-004
            +1.3723523317471205E-003                 +1.3516841804518383E-003
            +9.9999898435372037E-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) = 1.0000000000000000E+002
p1(05)  = b10  = +0.0000000000000000E+000  Sigma_initial(05,05) = 1.0000000000000000E+002
p1(06)  = c10  = +0.0000000000000000E+000  Sigma_initial(06,06) = 1.0000000000000000E+002
p1(07)  = d10  = +0.0000000000000000E+000  Sigma_initial(07,07) = 1.0000000000000000E+002
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) = 1.0000000000000000E+004
p1(13)  = b01  = +0.0000000000000000E+000  Sigma_initial(13,13) = 1.0000000000000000E+004
p1(14)  = c01  = +0.0000000000000000E+000  Sigma_initial(14,14) = 1.0000000000000000E+004
p1(15)  = d01  = +0.0000000000000000E+000  Sigma_initial(15,15) = 1.0000000000000000E+004
p1(16)  = e01  = +0.0000000000000000E+000  Sigma_initial(16,16) = 1.0000000000000000E+004
p1(17)  = f01  = +0.0000000000000000E+000  Sigma_initial(17,17) = 1.0000000000000000E+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  = +5.0372558129468141E-003  Sigma_initial(20,20) = 1.0000000000000001E-001
p2f(06) = qT2  = -9.8107368935810278E-004  Sigma_initial(21,21) = 1.0000000000000000E-002
p2f(07) = aT3  = -6.1440075534372450E-004  Sigma_initial(22,22) = 1.0000000000000000E-002
p2f(08) = qT4  = +9.9998664294079587E-001
p2f(09) = qR1  = +7.0782797411084175E-004  Sigma_initial(23,23) = 2.2855533686591019E-004
p2f(10) = qR2  = +1.2707553105428815E-003  Sigma_initial(24,24) = 1.0447116979821692E-005
p2f(11) = qR3  = -1.6110119759105146E-004  Sigma_initial(25,25) = 1.0463687644985126E-005
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) = 2.4585125629856917E-004
p2f(20) = bgy  = +0.0000000000000000E+000  Sigma_initial(33,33) = 2.4585125629856917E-004
p2f(21) = bgz  = +0.0000000000000000E+000  Sigma_initial(34,34) = 2.4585125629856917E-004
p2f(22) = cgx  = +0.0000000000000000E+000  Sigma_initial(35,35) = 6.0442840223584758E-008
p2f(23) = cgy  = +0.0000000000000000E+000  Sigma_initial(36,36) = 6.0442840223584758E-008
p2f(24) = cgz  = +0.0000000000000000E+000  Sigma_initial(37,37) = 6.0442840223584758E-008
------------------------------------------------------------------------------------------

--------------------   IPF KALMAN FILTER STARTED  ---------------------
Iteration#001: |dp|= +2.923388906087E+001   RMS(|Res|)=+1.263420341113E-005
Iteration#002: |dp|= +3.858069924280E-002   RMS(|Res|)=+3.458261468810E-006
Iteration#003: |dp|= +8.135580395357E-003   RMS(|Res|)=+1.857705116763E-006
Iteration#004: |dp|= +3.720174933893E-003   RMS(|Res|)=+1.837909443886E-006
Iteration#005: |dp|= +4.026198439453E-005   RMS(|Res|)=+1.835089495760E-006
```

```
Iteration#006: |dp|= +3.572071580738E-004   RMS(|Res|)=+1.835513614107E-006
Iteration#007: |dp|= +7.484717612068E-005   RMS(|Res|)=+1.835609380301E-006
Iteration#008: |dp|= +1.932631415950E-005   RMS(|Res|)=+1.835601464970E-006
Iteration#009: |dp|= +1.108714693758E-005   RMS(|Res|)=+1.835599066272E-006
Iteration#010: |dp|= +4.007790316182E-007   RMS(|Res|)=+1.835599491009E-006
Iteration#011: |dp|= +9.854353929778E-007   RMS(|Res|)=+1.835599559417E-006
Iteration#012: |dp|= +2.369416479233E-007   RMS(|Res|)=+1.835599511436E-006
Iteration#013: |dp|= +4.669538442751E-008   RMS(|Res|)=+1.835599501356E-006
Iteration#014: |dp|= +3.216327688216E-008   RMS(|Res|)=+1.835599504983E-006
Iteration#015: |dp|= +2.058164015948E-009   RMS(|Res|)=+1.835599506577E-006
Iteration#016: |dp|= +2.678714638851E-009   RMS(|Res|)=+1.835599506494E-006
Iteration#017: |dp|= +7.088286598531E-010   RMS(|Res|)=+1.835599506334E-006
Iteration#018: |dp|= +1.146764322744E-010   RMS(|Res|)=+1.835599506306E-006
Iteration#019: |dp|= +1.173380003192E-010   RMS(|Res|)=+1.835599506319E-006
Iteration#020: |dp|= +8.867601264758E-011   RMS(|Res|)=+1.835599506320E-006
Iteration#021: |dp|= +1.034337608083E-010   RMS(|Res|)=+1.835599506330E-006
Iteration#022: |dp|= +4.294929288901E-011   RMS(|Res|)=+1.835599506319E-006
Iteration#023: |dp|= +5.533254747774E-011   RMS(|Res|)=+1.835599506317E-006
Iteration#024: |dp|= +7.371086871788E-011   RMS(|Res|)=+1.835599506320E-006
Iteration#025: |dp|= +5.640050254276E-011   RMS(|Res|)=+1.835599506324E-006
Iteration#026: |dp|= +9.805338326027E-011   RMS(|Res|)=+1.835599506323E-006
Iteration#027: |dp|= +5.364746679925E-011   RMS(|Res|)=+1.835599506320E-006
Iteration#028: |dp|= +1.250474616073E-010   RMS(|Res|)=+1.835599506326E-006
Iteration#029: |dp|= +6.057809671472E-011   RMS(|Res|)=+1.835599506315E-006
Iteration#030: |dp|= +7.013390751722E-011   RMS(|Res|)=+1.835599506314E-006
IPF Kalman Filter Completed with Error |dp1| + |dp2| = +7.0133907517224141E-011
------------------------------------------------------------------------

-----------------  IPF LEAST SQUARES FILTER STARTED  ------------------
Iteration#001   COND#=+2.241783314396E+009,   |dp|=+2.923244960994E+001
Iteration#002   COND#=+2.241837830694E+009,   |dp|=+2.742962119457E-002
Iteration#003   COND#=+2.241837921822E+009,   |dp|=+1.131932286882E-003
Iteration#004   COND#=+2.241837934419E+009,   |dp|=+2.786972451794E-005
Iteration#005   COND#=+2.241837933467E+009,   |dp|=+3.639443929191E-007
Iteration#006   COND#=+2.241837930999E+009,   |dp|=+4.547957415594E-009
Iteration#007   COND#=+2.241837931670E+009,   |dp|=+1.86347179104 8E-010
Iteration#008   COND#=+2.241837931036E+009,   |dp|=+1.659433592044E-010
Iteration#009   COND#=+2.241837938096E+009,   |dp|=+7.392008244009E-011
Iteration#010   COND#=+2.241837920784E+009,   |dp|=+5.737788159571E-011
Iteration#011   COND#=+2.241837931601E+009,   |dp|=+7.943787703054E-011
Iteration#012   COND#=+2.241837930092E+009,   |dp|=+7.785593879279E-011
Iteration#013   COND#=+2.241837928544E+009,   |dp|=+8.032647097817E-011
Iteration#014   COND#=+2.241837913887E+009,   |dp|=+1.045905604328E-010
Iteration#015   COND#=+2.241837934703E+009,   |dp|=+9.728263571348E-011
Iteration#016   COND#=+2.241837934492E+009,   |dp|=+3.904117803119E-011
Iteration#017   COND#=+2.241837916185E+009,   |dp|=+7.049777087051E-011
Iteration#018   COND#=+2.241837931420E+009,   |dp|=+8.562747042633E-011
Iteration#019   COND#=+2.241837919051E+009,   |dp|=+1.026086601150E-010
Iteration#020   COND#=+2.241837935361E+009,   |dp|=+7.829338403282E-011
Iteration#021   COND#=+2.241837950348E+009,   |dp|=+9.657880804700E-011
Iteration#022   COND#=+2.241837924051E+009,   |dp|=+6.240762424867E-011
Iteration#023   COND#=+2.241837932627E+009,   |dp|=+8.858056834637E-011
Iteration#024   COND#=+2.241837917653E+009,   |dp|=+9.290808205005E-011
Iteration#025   COND#=+2.241837921687E+009,   |dp|=+9.106463191514E-011
Iteration#026   COND#=+2.241837941935E+009,   |dp|=+6.850803194340E-011
Iteration#027   COND#=+2.241837932393E+009,   |dp|=+7.287268794382E-011
Iteration#028   COND#=+2.241837939396E+009,   |dp|=+6.498314953930E-011
Iteration#029   COND#=+2.241837942302E+009,   |dp|=+1.178951062537E-010
Iteration#030   COND#=+2.241837925631E+009,   |dp|=+1.045577717947E-010
IPF Least Squares Filter Completed with Error |dp1| + |dp2| = +1.0455777179468052E-010
------------------------------------------------------------------------
Total Execution Time: 280 seconds




************************************************************************
IPF EXECUTION-LOG FILE NAME:  LG101095.dat
```

```
INSTRUMENT TYPE:              MIPS_24um_center
IPF FILTER EXECUTION DATE:    17-Oct-2003    TIME: 17:22
IPF FILTER VERSION USED:      IPF.V2.0.0D
**********************************************************************

------------------- Loading & Preparing Input Files -------------------
AAFILE:  AA101095 Loaded!        AAFILE dimension = 55000 X 21
ASFILE:  AS101095 Loaded!
CAFILE:  CA105095 Loaded!        CAFILE dimension = 227 X 15
CBFILE:  CB101095 Loaded!        CBFILE dimension = 63 X 15
CCFILE:  CC101095 Created!       CCFILE dimension = 290 X 19
CSFILE:  CS105095 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  1  1  1  1  0  0  0  0  1  1  1  1  1  1 ]
mask2 = [ 1  1  1  1  1  1  1  1  0  0  0  0  0  0  1  1  1  1  1  1 ]
----------------------------------------------------------------------

---------------  Selected Initial Gyro Bias Parameters  ---------------
User Entered 1 : Use AFILE database - from S/C filter
IPF Linearized Using Following Nominal Gyro Bias Estimates
bg0 = [+3.7006947195550310E-007 +1.7281990949413739E-007 -3.4789076153174392E-007 ]
cg0 = [+0.0000000000000000E+000 +0.0000000000000000E+000 +0.0000000000000000E+000 ]
----------------------------------------------------------------------

---------------  Gyro Pre-Processor Run Completed  --------------------
     AGFILE CREATED:  AG101095.m     ACFILE CREATED:  AC101095.m
----------------------------------------------------------------------
Total Gyro Preprocessor Execution Time: 29 seconds

FRAME TABLE ENTRIES FOR PCRS LOADED TO TPCRS
q_PCRS4 = [ +5.3377191730804340E-007     q_PCRS5 = [ +7.3379987833742897E-007
            +3.7444181445836429E-004                 +5.2236196154513707E-004
            -1.4255121007937610E-003                 -1.4047712280184723E-003
            +9.9999891385355677E-001 ];              +9.9999887687698918E-001 ];
q_PCRS8 = [ -5.2784857378083422E-007     q_PCRS9 = [ -7.1963421681856818E-007
            +3.8463011681657313E-004                 +5.3239763239987400E-004
            +1.3723523317471205E-003                 +1.3516841804518383E-003
            +9.9999898435372037E-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) = 1.0000000000000000E+002
p1(05)  = b10  = +0.0000000000000000E+000  Sigma_initial(05,05) = 1.0000000000000000E+002
p1(06)  = c10  = +0.0000000000000000E+000  Sigma_initial(06,06) = 1.0000000000000000E+002
p1(07)  = d10  = +0.0000000000000000E+000  Sigma_initial(07,07) = 1.0000000000000000E+002
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) = 1.0000000000000000E+004
p1(13)  = b01  = +0.0000000000000000E+000  Sigma_initial(13,13) = 1.0000000000000000E+004
p1(14)  = c01  = +0.0000000000000000E+000  Sigma_initial(14,14) = 1.0000000000000000E+004
p1(15)  = d01  = +0.0000000000000000E+000  Sigma_initial(15,15) = 1.0000000000000000E+004
p1(16)  = e01  = +0.0000000000000000E+000  Sigma_initial(16,16) = 1.0000000000000000E+004
p1(17)  = f01  = +0.0000000000000000E+000  Sigma_initial(17,17) = 1.0000000000000000E+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  = +5.0372558129468141E-003  Sigma_initial(20,20) = 1.0000000000000001E-001
```

```
p2f(06) = qT2  = -9.8107368935810278E-004  Sigma_initial(21,21) = 1.0000000000000000E-002
p2f(07) = aT3  = -6.1440075534372450E-004  Sigma_initial(22,22) = 1.0000000000000000E-002
p2f(08) = qT4  = +9.9998664294079587E-001
p2f(09) = qR1  = +7.0861761923879385E-004  Sigma_initial(23,23) = 1.8058439939781077E-004
p2f(10) = qR2  = +1.2695450568571687E-003  Sigma_initial(24,24) = 1.9240094872549512E-005
p2f(11) = qR3  = -1.6060027701314539E-004  Sigma_initial(25,25) = 1.9249786506380275E-005
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) = 2.4218939210462581E-004
p2f(20) = bgy  = +0.0000000000000000E+000  Sigma_initial(33,33) = 2.4218939210462581E-004
p2f(21) = bgz  = +0.0000000000000000E+000  Sigma_initial(34,34) = 2.4218939210462581E-004
p2f(22) = cgx  = +0.0000000000000000E+000  Sigma_initial(35,35) = 5.8655701648008190E-008
p2f(23) = cgy  = +0.0000000000000000E+000  Sigma_initial(36,36) = 5.8655701648008190E-008
p2f(24) = cgz  = +0.0000000000000000E+000  Sigma_initial(37,37) = 5.8655701648008190E-008
--------------------------------------------------------------------------------

--------------------   IPF KALMAN FILTER STARTED  ----------------------
Iteration#001: |dp|= +2.966076716407E+001   RMS(|Res|)=+1.265415087509E-005
Iteration#002: |dp|= +2.796316773419E-002   RMS(|Res|)=+3.456606243431E-006
Iteration#003: |dp|= +3.162494779683E-003   RMS(|Res|)=+1.582280095041E-006
Iteration#004: |dp|= +1.369966761393E-003   RMS(|Res|)=+1.567360842468E-006
Iteration#005: |dp|= +6.627798211342E-005   RMS(|Res|)=+1.567240479830E-006
Iteration#006: |dp|= +1.537032687073E-004   RMS(|Res|)=+1.567272218916E-006
Iteration#007: |dp|= +4.777985097174E-005   RMS(|Res|)=+1.567290980766E-006
Iteration#008: |dp|= +6.576388142151E-006   RMS(|Res|)=+1.567294687786E-006
Iteration#009: |dp|= +7.554685116238E-006   RMS(|Res|)=+1.567293628780E-006
Iteration#010: |dp|= +1.145412072387E-006   RMS(|Res|)=+1.567292877854E-006
Iteration#011: |dp|= +6.326034598486E-007   RMS(|Res|)=+1.567292810999E-006
Iteration#012: |dp|= +3.035562216614E-007   RMS(|Res|)=+1.567292886075E-006
Iteration#013: |dp|= +1.277894960067E-009   RMS(|Res|)=+1.567292913687E-006
Iteration#014: |dp|= +3.707625674750E-008   RMS(|Res|)=+1.567292911591E-006
Iteration#015: |dp|= +9.649273167272E-009   RMS(|Res|)=+1.567292907658E-006
Iteration#016: |dp|= +2.079610934170E-009   RMS(|Res|)=+1.567292906906E-006
Iteration#017: |dp|= +1.711158844394E-009   RMS(|Res|)=+1.567292907189E-006
Iteration#018: |dp|= +2.308692282719E-010   RMS(|Res|)=+1.567292907360E-006
Iteration#019: |dp|= +1.787751877971E-010   RMS(|Res|)=+1.567292907364E-006
Iteration#020: |dp|= +1.141975856712E-010   RMS(|Res|)=+1.567292907348E-006
Iteration#021: |dp|= +5.025423438211E-011   RMS(|Res|)=+1.567292907340E-006
Iteration#022: |dp|= +6.521105205547E-011   RMS(|Res|)=+1.567292907344E-006
Iteration#023: |dp|= +3.154156733742E-011   RMS(|Res|)=+1.567292907343E-006
Iteration#024: |dp|= +8.533968770825E-011   RMS(|Res|)=+1.567292907345E-006
Iteration#025: |dp|= +9.116059066458E-011   RMS(|Res|)=+1.567292907349E-006
Iteration#026: |dp|= +9.396738991827E-011   RMS(|Res|)=+1.567292907339E-006
Iteration#027: |dp|= +4.053576142808E-011   RMS(|Res|)=+1.567292907345E-006
Iteration#028: |dp|= +5.294394587945E-011   RMS(|Res|)=+1.567292907343E-006
Iteration#029: |dp|= +8.397180313523E-011   RMS(|Res|)=+1.567292907344E-006
Iteration#030: |dp|= +8.304556513363E-011   RMS(|Res|)=+1.567292907340E-006
IPF Kalman Filter Completed with Error |dp1| + |dp2| = +8.3045565133631253E-011
--------------------------------------------------------------------

-----------------  IPF LEAST SQUARES FILTER STARTED  ------------------
Iteration#001   COND#=+1.865228128523E+009,   |dp|=+2.966033505013E+001
Iteration#002   COND#=+1.865165862804E+009,   |dp|=+2.690530470968E-002
Iteration#003   COND#=+1.865166358625E+009,   |dp|=+1.111978573917E-003
Iteration#004   COND#=+1.865166384568E+009,   |dp|=+2.693657217791E-005
Iteration#005   COND#=+1.865166375430E+009,   |dp|=+3.462578791608E-007
Iteration#006   COND#=+1.865166386861E+009,   |dp|=+4.274701315624E-009
Iteration#007   COND#=+1.865166367133E+009,   |dp|=+1.418976248770E-010
Iteration#008   COND#=+1.865166372979E+009,   |dp|=+5.169610212889E-011
Iteration#009   COND#=+1.865166370063E+009,   |dp|=+9.816561791207E-011
Iteration#010   COND#=+1.865166366390E+009,   |dp|=+4.058561471610E-011
Iteration#011   COND#=+1.865166396021E+009,   |dp|=+4.914871502319E-011
Iteration#012   COND#=+1.865166374323E+009,   |dp|=+7.040235036163E-011
```

```
Iteration#013   COND#=+1.865166362226E+009,   |dp|=+8.545258521372E-011
Iteration#014   COND#=+1.865166374577E+009,   |dp|=+3.068233640598E-011
Iteration#015   COND#=+1.865166374874E+009,   |dp|=+3.475220853001E-011
Iteration#016   COND#=+1.865166366324E+009,   |dp|=+8.128910703838E-011
Iteration#017   COND#=+1.865166383814E+009,   |dp|=+1.207103142958E-010
Iteration#018   COND#=+1.865166370287E+009,   |dp|=+6.143941684038E-011
Iteration#019   COND#=+1.865166375572E+009,   |dp|=+4.785183190720E-011
Iteration#020   COND#=+1.865166376234E+009,   |dp|=+5.303033253302E-011
Iteration#021   COND#=+1.865166375698E+009,   |dp|=+1.089775880866E-010
Iteration#022   COND#=+1.865166380422E+009,   |dp|=+6.170340316229E-011
Iteration#023   COND#=+1.865166386334E+009,   |dp|=+6.145685075551E-011
Iteration#024   COND#=+1.865166384013E+009,   |dp|=+4.239936615428E-011
Iteration#025   COND#=+1.865166386009E+009,   |dp|=+6.740113503972E-011
Iteration#026   COND#=+1.865166379487E+009,   |dp|=+6.213971945248E-011
Iteration#027   COND#=+1.865166363695E+009,   |dp|=+5.369696219896E-011
Iteration#028   COND#=+1.865166376929E+009,   |dp|=+6.078358195406E-011
Iteration#029   COND#=+1.865166386700E+009,   |dp|=+1.134911670933E-010
Iteration#030   COND#=+1.865166378579E+009,   |dp|=+1.229907787848E-010
IPF Least Squares Filter Completed with Error |dp1| + |dp2| = +1.2299077878484463E-010
--------------------------------------------------------------------------
Total Execution Time: 184 seconds
```

3 COMMENTS

The multi-run tool averaged the data nicely. Comments:

1. The run was performed in IPF (Least-Squares) multi-run mode.
2. This multi-run combined 18 total parameters consisting of: 3 constant and 6 linear plate scales,4 Gamma Dependent parameters, 2 mirror parameters and 3 IPF alignment angles.
3. This run was made using BodyFrames_SPC_08a which was a special frame table incorporating the 40 star Stage 2 PAC filter run results.

We recommend updating frames 95, 96, 99, 100, 103 and 104 with the new quaternions listed in the MF file MF01M095.dat. This contains adjustments of 0.47 and 0.73 arcseconds in Y and Z, and .06 deg in twist (for the prime frame). In our best judgment, these frames will be accurate to better than 0.3 arcsecond (disregard the accuracies quoted in the the tables).

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References

[1] D.S. Bayard, B.H. Kang, *SIRTF Instrument Pointing Frame Kalman Filter Algorithm*, JPL D-Document D-24809, September 30, 2003.

[2] B.H. Kang, D.S. Bayard, *SIRTF Instrument Pointing Frame (IPF) Software Description Document and User's Guide*, JPL D-Document D-24808, September 30, 2003.

[3] D.S. Bayard, B.H. Kang, *SIRTF Instrument Pointing Frame (IPF) Kalman Filter Unit Test Report*, JPL D-Document D-24810, September 30, 2003.

[4] *Space Infrared Telescope Facility In-Orbit Checkout and Science Verification Mission Plan*, JPL D-Document D-22622, 674-FE-301 Version 1.4, February 8, 2002.

[5] *Space Infrared Telescope Facility Observatory Description Document*, Lockheed Martin LMMS/P458569, 674-SEIT-300 Version 1.2, November 1, 2002.

[6] *SIRTF Software Interface Specification for Science Centroid INPUT Files (CAFILE, CSFILE)*, JPL SOS-SIS-2002, November 18, 2002.

[7] *SIRTF Software Interface Specification for Inferred Frames Offset INPUT Files (OFILE)*, JPL SOS-SIS-2003, November 18, 2002.

[8] *SIRTF Software Interface Specification for PCRS Centroid INPUT Files (CBFILE)*, JPL SIS-FES-015, November 18, 2002.

[9] *SIRTF Software Interface Specification for Attitude INPUT Files (AFILE, ASFILE)*, JPL SIS-FES-014, January 7, 2002.

[10] *SIRTF Software Interface Specification for IPF Filter Output Files (IFFILE, LGFILE, TARFILE)*, JPL SOS-SIS-2005, November 18, 2002.

[11] R.J. Brown, *Focal Surface to Object Space Field of View Conversion.* Systems Engineering Report SER No. S20447-OPT-051, Ball Aerospace & Technologies Corp., November 23, 1999.