11296 - HST Observations of Astrophysically Important Visual Binaries

Cycle: 16, Proposal Category: GO

(Availability Mode: SUPPORTED)

INVESTIGATORS

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VISITS

Visit	*Targets used in Visit*	*Configurations used in Visit*	*Orbits Used*	*Last Orbit Planner Run*	*OP Current with Visit?*
01	(1) PROCYON	WFPC2	1	18-Sep-2007 21:05:36.0	yes
02	(2) MU-CAS	WFPC2	1	18-Sep-2007 21:05:43.0	yes
03	(3) G107-70 (4) G107-69 (5) G107-70-REF2 (6) G107-70-REF3 (8) G107-70-REF6 (9) G107-70-REF7 (10) G107-70-REF9	FGS	1	18-Sep-2007 21:05:50.0	yes

3 Total Orbits Used

ABSTRACT

This is a continuation of a project begun in Cycle 7 and continued up through Cycle 14. The program consists of annual FGS or WFPC2 observations of three visual binary stars that will yield fundamental astrophysical results, once their orbits and masses are determined.

Our targets are the following: (1) Procyon (P = 40.9 yr), for which our first WFPC2 images yielded an extremely accurate angular separation of the bright F star and its much fainter white-dwarf companion. Combined with ground-based astrometry of the bright star, our observation significantly revised downward the derived masses, and brought Procyon A into much better agreement with theoretical evolutionary masses for the first time. With the continued monitoring proposed here, we will obtain masses to an accuracy of better than 1%, providing a testbed for theories of both Sun-like stars and white dwarfs. (2) G 107-70, a close double white dwarf (P = 18.5 yr) that promises to add two accurate masses to the tiny handful of white-dwarf masses that are directly known from dynamical measurements. (3) Mu Cas (P = 20.8 yr), a famous nearby metal-deficient G dwarf for which accurate masses will lead to the stars' helium contents, with cosmological implications. For all three stars, we will also be setting increasingly stringent limits on the presence of planetary-mass bodies in the systems.

OBSERVING DESCRIPTION

In Cycle 15 we will obtain direct images with WFPC2 of Procyon and Mu Cas. The WFPC2 filters have
been chosen appropriately for each target. We will devote one orbit of dithered imaging to each of the two targets.

Visit

Proposal 11296, Visit 01, scheduling Wed Sep 19 01:05:53 GMT 2007

Diagnostic Status: No Diagnostics

Scientific Instruments: WFPC2

Special Requirements: ORIENT 259.8D TO 287.0 D; ORIENT 309.0D TO 336.2 D; BETWEEN 15-OCT-2007:00:00:00 AND 05-DEC-2007:00:00:00

Comments: ORIENT requirement is done so that companion star will not lie near diffraction spikes or bleeding columns from the very bright primary star.

Fixed Targets

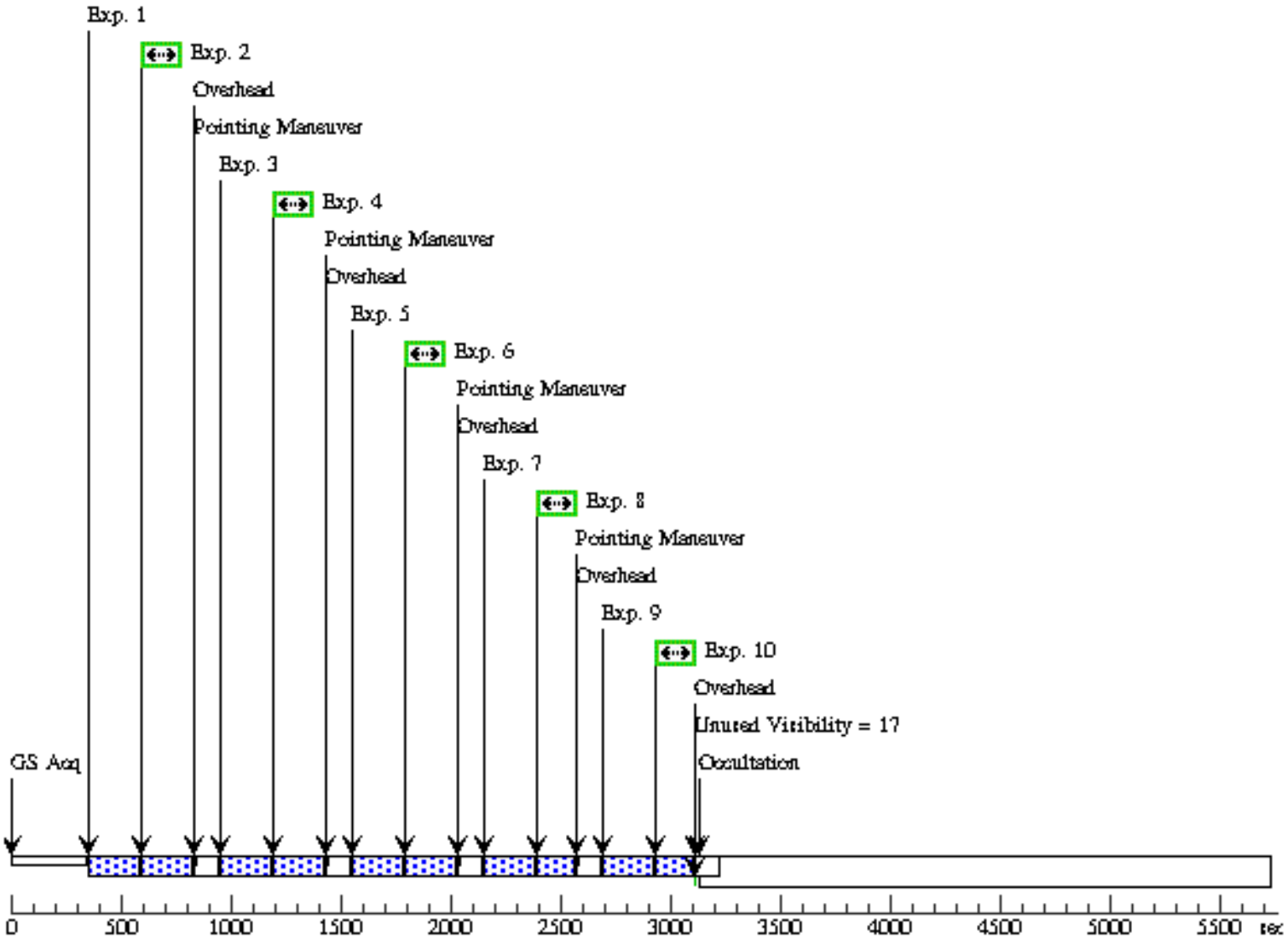
#	Name	Target Coordinates	Targ. Coord. Corrections	Fluxes	Miscellaneous
(1)	PROCYON	RA: 07 39 18.3700 (114.8265417d)	Proper Motion RA: -0.04755s/yr	V=0.36+/-0.0	Reference Frame: ICRS
	Alt Name1: ALPHA-CMI	Dec: +05 13 35.50 (5.22653d)	Proper Motion Dec: -1.0229"/yr	B-V = 0.42	
	Alt Name2: HR2943	Equinox: J2000	Parallax: 0.283"		
			Epoch of Position: 1995.18		

Comments: Coords are for center of gravity of binary. Accuracy confirmed by 2000 Nov 28 WFPC2 observations. 6/14/06: updated to ICRS system using galex website.

Exposures

#	Label	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time/[Actual Dur.]	Orbit
1	10	(1) PROCYON	WFPC2, IMAGE, PC1	F218W	ATD-GAIN=15	POS TARG 0,0		0.11 Secs	
								[==>]	***[1]***
2	20	(1) PROCYON	WFPC2, IMAGE, PC1	F218W	ATD-GAIN=15; CLOCKS=YES	SAME POS AS 1		200.0 Secs	
								[==>]	***[1]***
3	30	(1) PROCYON	WFPC2, IMAGE, PC1	F218W	ATD-GAIN=15	POS TARG -0.659,-0.659		0.11 Secs	
								[==>]	***[1]***
4	40	(1) PROCYON	WFPC2, IMAGE, PC1	F218W	ATD-GAIN=15; CLOCKS=YES	SAME POS AS 3		200.0 Secs	
								[==>]	***[1]***
5	50	(1) PROCYON	WFPC2, IMAGE, PC1	F218W	ATD-GAIN=15	POS TARG -0.421,-0.375		0.11 Secs	
								[==>]	***[1]***
6	60	(1) PROCYON	WFPC2, IMAGE, PC1	F218W	ATD-GAIN=15; CLOCKS=YES	SAME POS AS 5		200.0 Secs	
								[==>]	***[1]***
7	70	(1) PROCYON	WFPC2, IMAGE, PC1	F218W	ATD-GAIN=15	POS TARG -0.318,-0.477		0.11 Secs	
								[==>]	***[1]***
8	80	(1) PROCYON	WFPC2, IMAGE, PC1	F218W	ATD-GAIN=15; CLOCKS=YES	SAME POS AS 7		200.0 Secs	
								[==>160.0 Secs]	***[1]***
9	90	(1) PROCYON	WFPC2, IMAGE, PC1	F218W	ATD-GAIN=15	POS TARG -0.568,-0.273		0.11 Secs	
								[==>]	***[1]***
10	100	(1) PROCYON	WFPC2, IMAGE, PC1	F218W	ATD-GAIN=15; CLOCKS=YES	SAME POS AS 9		160.0 Secs	
								[==>]	***[1]***

Orbit Structure



Visit

Proposal 11296, Visit 02, scheduling Wed Sep 19 01:05:54 GMT 2007

Diagnostic Status: No Diagnostics

Scientific Instruments: WFPC2

Special Requirements: ORIENT 72.0D TO 130.0 D; ORIENT 162.0D TO 220.0 D; ORIENT 252.0D TO 310.0 D; ORIENT 342.0D TO 40.0 D; BETWEEN 25-SEP-2007:00:00:00 AND 01-DEC-2007:00:00:00

Comments: ORIENT requirement is done so that companion star will not lie near diffraction spikes of primary star.

Fixed Targets

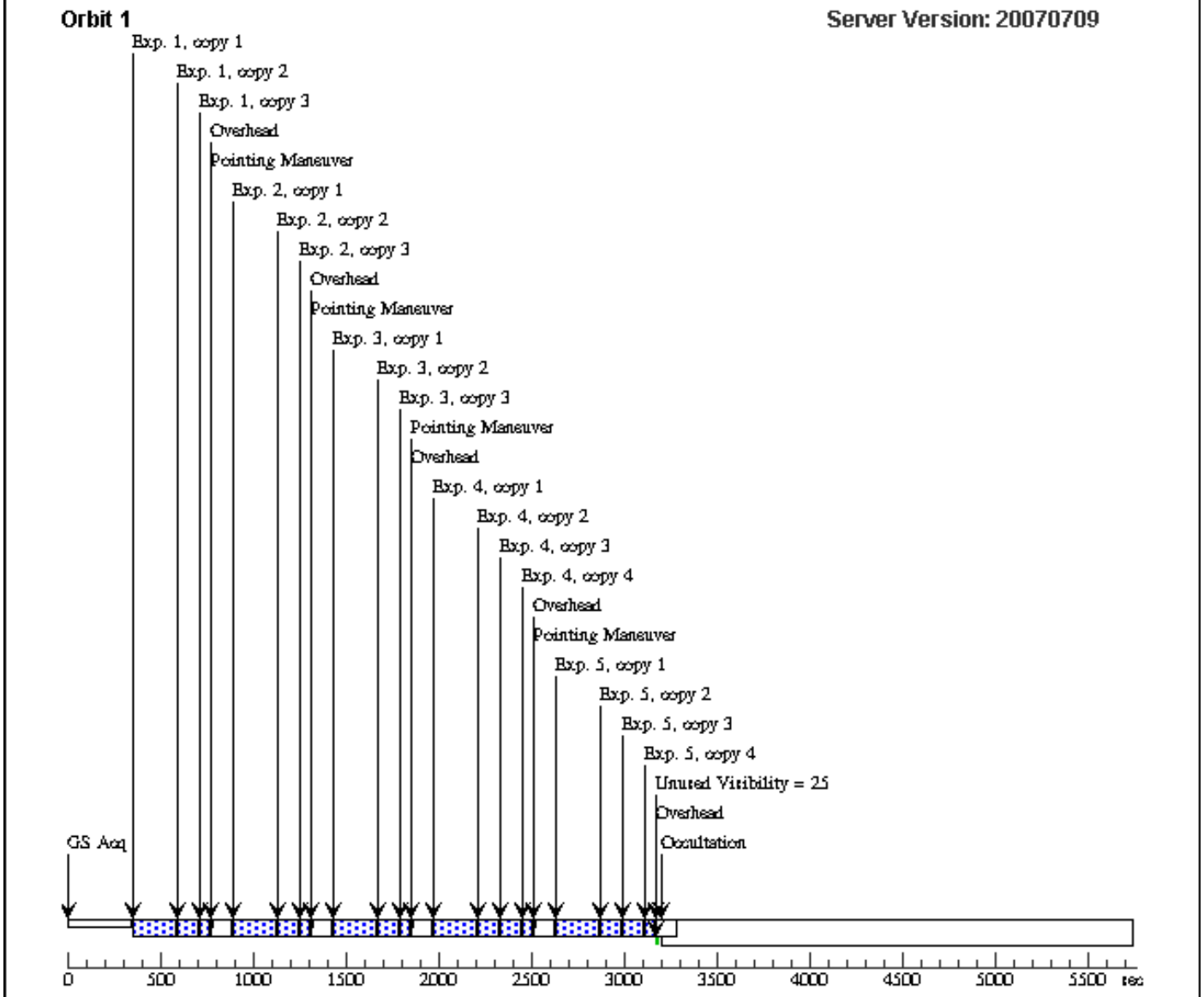
#	Name	Target Coordinates	Targ. Coord. Corrections	Fluxes	Miscellaneous
(2)	MU-CAS	RA: 01 08 16.3700 (17.0682083d)	Proper Motion RA: 0.3972s/yr	V=5.15+/-0.0	Reference Frame: ICRS
	Alt Name1: HR321	Dec: +54 55 13.20 (54.92033d)	Proper Motion Dec: -1.596"/yr	B-V = 0.70	
	Alt Name2: HD6582	Equinox: J2000	Parallax: 0.134"		
			Epoch of Position: 2000.0		

Comments: Coordinate accuracy confirmed by 2000-01 WFPC2 observations. 6/14/06: updated to ICRS system using galex website.

Exposures

#	Label	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time/[Actual Dur.]	Orbit
1	1	(2) MU-CAS	WFPC2, IMAGE, PC1	F953N	ATD-GAIN=15; CLOCKS=YES	POS TARG 0,0		1.0 Secs X 3 *[==>(Copy 1)]* *[==>(Copy 2)]* *[==>(Copy 3)]*	***[1]***
2	2	(2) MU-CAS	WFPC2, IMAGE, PC1	F953N	ATD-GAIN=15; CLOCKS=YES	POS TARG -0.659,-0.659		1.0 Secs X 3 *[==>(Copy 1)]* *[==>(Copy 2)]* *[==>(Copy 3)]*	***[1]***
3	3	(2) MU-CAS	WFPC2, IMAGE, PC1	F953N	ATD-GAIN=15; CLOCKS=YES	POS TARG -0.318,-0.477		1.0 Secs X 3 *[==>(Copy 1)]* *[==>(Copy 2)]* *[==>(Copy 3)]*	***[1]***
4	4	(2) MU-CAS	WFPC2, IMAGE, PC1	F953N	ATD-GAIN=15; CLOCKS=YES	POS TARG -0.568,-0.273		1.0 Secs X 4 *[==>(Copy 1)]* *[==>(Copy 2)]* *[==>(Copy 3)]* *[==>(Copy 4)]*	***[1]***
Comments: Here we take one extra exposure to use up the orbit									
5	5	(2) MU-CAS	WFPC2, IMAGE, PC1	F953N	ATD-GAIN=15; CLOCKS=YES	POS TARG -0.421,-0.375		1.0 Secs X 4 *[==>(Copy 1)]* *[==>(Copy 2)]* *[==>(Copy 3)]* *[==>(Copy 4)]*	***[1]***
Comments: Here we take one extra exposure to use up the orbit									

Orbit Structure



Visit

Proposal 11296, Visit 03, implementation Wed Sep 19 01:05:55 GMT 2007

Diagnostic Status: No Diagnostics

Scientific Instruments: FGS

Special Requirements: PCS MODE FINE; ORIENT 266.0D TO 275.0 D; BETWEEN 10-OCT-2007:00:00:00 AND 16-NOV-2007:00:00:00

Fixed Targets

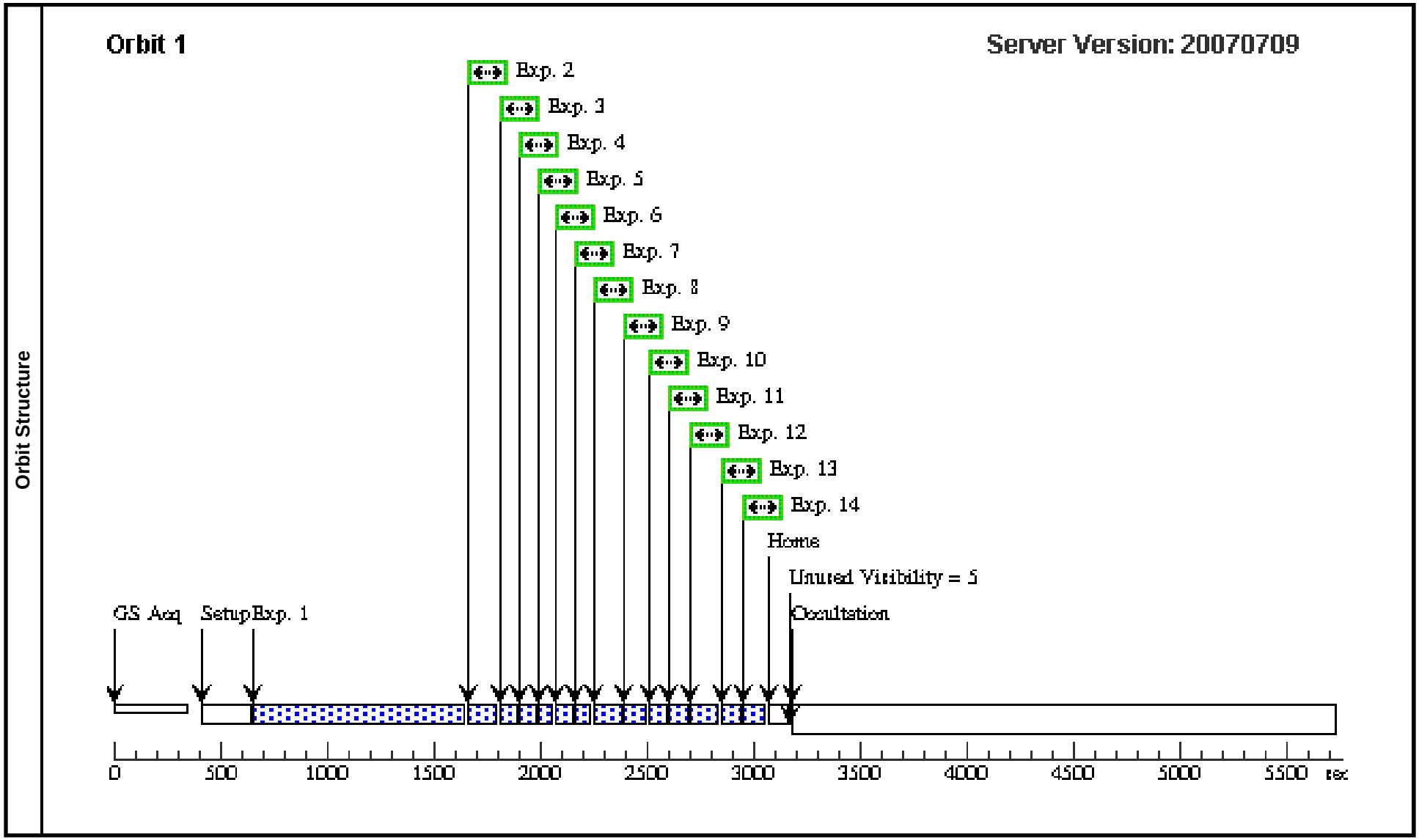
#	Name	Target Coordinates	Targ. Coord. Corrections	Fluxes	Miscellaneous
(3)	G107-70 Alt Name1: GSC3409.01958	RA: 07 30 47.2300 (112.6967917d) Dec: +48 10 26.60 (48.17406d) Equinox: J2000	Proper Motion RA: -0.022s/yr Proper Motion Dec: -1.271"/yr Parallax: 0.09" Epoch of Position: 2000.0	V=15.5+/-0.0 B-V = 0.99	Reference Frame: ICRS
Comments: Double Degenerate binary system					
(4)	G107-69 Alt Name1: GSC3409.00415	RA: 07 30 42.5700 (112.6773750d) Dec: +48 11 58.80 (48.19967d) Equinox: J2000	Proper Motion RA: -0.022s/yr Proper Motion Dec: -1.271"/yr Parallax: 0.09" Epoch of Position: 2000.0	V=13.6+/-0.1	Reference Frame: ICRS
Comments: This is a common-proper-motion companion to G107-70					
(5)	G107-70-REF2 Alt Name1: GSC3409.01754	RA: 07 30 26.6900 (112.6112083d) Dec: +48 11 1.64 (48.18379d) Equinox: J2000	Parallax: 0.0" Epoch of Position:	V=13.3+/-0.1	Reference Frame: ICRS
(6)	G107-70-REF3 Alt Name1: GSC3409.01706	RA: 07 31 9.7700 (112.7907083d) Dec: +48 10 27.41 (48.17428d) Equinox: J2000	Parallax: 0.0" Epoch of Position:	V=14.3+/-0.1	Reference Frame: ICRS
(8)	G107-70-REF6 Alt Name1: GSC3409.02253	RA: 07 30 34.9200 (112.6455000d) Dec: +48 10 31.22 (48.17534d) Equinox: J2000	Parallax: 0.0" Epoch of Position:	V=14.3+/-0.1	Reference Frame: ICRS
(9)	G107-70-REF7 Alt Name1: GSC3409.01670	RA: 07 31 0.3100 (112.7512917d) Dec: +48 10 16.07 (48.17113d) Equinox: J2000	Parallax: 0.0" Epoch of Position:	V=14.9+/-0.1	Reference Frame: ICRS
(10)	G107-70-REF9 Alt Name1: GSC3409.02395	RA: 07 30 15.0300 (112.5626250d) Dec: +48 10 19.67 (48.17213d) Equinox: J2000	Parallax: 0.0" Epoch of Position:	V=12.9+/-0.1	Reference Frame: ICRS

Exposures

#	Label	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time/[Actual Dur.]	Orbit
1	10	(3) G107-70	FGS, TRANS, 1	F583W	SCANS=13; STEP-SIZE=0.8	POS TARG 0,10	Sequence 1-14 Non-Int	725.0 Secs *[==>]*	 ***[1]***
2	20	(3) G107-70	FGS, POS, 1	F583W	FES-TIME=0.4	SAME POS AS 1	Sequence 1-14 Non-Int	7.0 Secs *[==>]*	 ***[1]***
3	30	(4) G107-69	FGS, POS, 1	F583W		SAME POS AS 1	Sequence 1-14 Non-Int	7.0 Secs *[==>]*	 ***[1]***
4	40	(5) G107-70-REF2	FGS, POS, 1	F583W		SAME POS AS 1	Sequence 1-14 Non-Int	7.0 Secs *[==>]*	 ***[1]***

Exposures (continued)

#	Label	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time/[Actual Dur.]	Orbit
5	50	(10) G107-70-REF9	FGS, POS, 1	F583W		SAME POS AS 1	Sequence 1-14 Non-Int	7.0 Secs	
								[==>]	***[1]***
6	60	(8) G107-70-REF6	FGS, POS, 1	F583W		SAME POS AS 1	Sequence 1-14 Non-Int	7.0 Secs	
								[==>]	***[1]***
7	70	(4) G107-69	FGS, POS, 1	F583W		SAME POS AS 1	Sequence 1-14 Non-Int	7.0 Secs	
								[==>]	***[1]***
8	80	(3) G107-70	FGS, POS, 1	F583W	FES-TIME=0.4	SAME POS AS 1	Sequence 1-14 Non-Int	7.0 Secs	
								[==>]	***[1]***
9	110	(9) G107-70-REF7	FGS, POS, 1	F583W		SAME POS AS 1	Sequence 1-14 Non-Int	7.0 Secs	
								[==>]	***[1]***
10	120	(6) G107-70-REF3	FGS, POS, 1	F583W		SAME POS AS 1	Sequence 1-14 Non-Int	7.0 Secs	
								[==>]	***[1]***
11	130	(4) G107-69	FGS, POS, 1	F583W		SAME POS AS 1	Sequence 1-14 Non-Int	7.0 Secs	
								[==>]	***[1]***
12	140	(3) G107-70	FGS, POS, 1	F583W	FES-TIME=0.4	SAME POS AS 1	Sequence 1-14 Non-Int	7.0 Secs	
								[==>]	***[1]***
13	150	(8) G107-70-REF6	FGS, POS, 1	F583W		SAME POS AS 1	Sequence 1-14 Non-Int	7.0 Secs	
								[==>]	***[1]***
14	160	(6) G107-70-REF3	FGS, POS, 1	F583W		SAME POS AS 1	Sequence 1-14 Non-Int	7.0 Secs	
								[==>]	***[1]***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Exp. 3
Exp. 4
Exp. 5
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Exp. 7
Exp. 8
Exp. 9
Exp. 10
Exp. 11
Exp. 12
Exp. 13
Exp. 14
Home
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GS Acq
Setup
Exp. 1
Occultation
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