13876 - HST Observations of Astrophysically Important Visual Binaries

Cycle: 22, Proposal Category: GO

(UV Initiative)

(Availability Mode: AVAILABLE)

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?*
02	(2) MU-CAS	WFC3/UVIS	1	15-Jul-2014 21:09:06.0	yes

Visit	*Targets used in Visit*	*Configurations used in Visit*	*Orbits Used*	*Last Orbit Planner Run*	*OP Current with Visit?*
04	(4) WD1818+126 (5) WD1818-REF1 (6) WD1818-REF2 (7) WD1818-REF3 (8) WD1818-REF4 (9) WD1818-REF5 (10) WD1818-REF6 (11) WD1818-REF7	FGS	1	15-Jul-2014 21:09:08.0	yes
05	(12) G107-70 (13) G107-69 (14) G107-70-REF2 (15) G107-70-REF3 (16) G107-70-REF4 (17) G107-70-REF6 (18) G107-70-REF7 (19) G107-70-REF9	FGS	1	15-Jul-2014 21:09:10.0	yes

3 Total Orbits Used

ABSTRACT

We propose to continue our long-term program of astrometry of close visual binaries, with the primary goal of determining purely dynamical masses for 3 important main-sequence stars and 9 white dwarfs (WDs). A secondary aim is to set limits on third bodies in the systems down to planetary mass. Three of our targets are naked-eye stars with much fainter companions that are extremely difficult to image from the ground. Our other 2 targets are double WDs, whose small separations and faintness likewise make them difficult to measure using ground-based techniques. Observations have been completed for a 3rd double WD.

The bright stars, to be imaged with WFC3, are: (1) Procyon (P = 40.83 yr), containing a bright F star and a much fainter WD companion. 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 WDs. (2) Sirius (P = 50.14 yr), an A-type star also having a faint WD companion, Sirius B, the nearest and brightest of all WDs. (3) Mu Cas (P = 21.08 yr), a nearby metal-deficient G dwarf for which accurate masses will lead to the stars' helium contents, with cosmological implications.

The faint double WDs, to be observed with FGS, are: (1) G 107-70 (P = 18.84 yr), and (2) WD 1818+126 (P = 12.19 yr). Our astrometry of these systems will add 4 accurate masses to the handful of WD masses that are directly known from dynamical measurements. The FGS measurements will also provide precise parallaxes for the systems, a necessary ingredient in the mass determinations.

OBSERVING DESCRIPTION

This is the Cycle 22 continuation of a program in which we are determining the orbits of visual binaries. The targets for Cycle 22 are mu Cas, WD 1818+126, and G 107-70

We have been observing WD 1818+126 and G 107-70 with FGS, and this part of the program will continue as before, with 1 orbit of POS mode observations of the target and reference stars made for both of these target fields.

Mu Cas will be observed with WFC3/UVIS. We will use 1.5-sec exposures in F225W, which will not be saturated. These will be followed at each dither position with a 265-sec exposure, which will be well exposed for the cool dM companion.

Visit

Proposal 13876, Mu Cas (02), implementation Wed Jul 16 01:09:12 GMT 2014

Diagnostic Status: No Diagnostics

Scientific Instruments: WFC3/UVIS

Special Requirements: GYRO MODE 3GOBAD; SCHED 40%; ORIENT 54.1D TO 109.5 D; ORIENT 14.3D TO 19.5 D; BETWEEN 06-JAN-2015 AND 20-MAR-2015

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

Patterns

#	Primary Pattern		Secondary Pattern	Exposures
(1)	Pattern Type=WFC3-UVIS-DITHER-BOX Purpose=DITHER Number Of Points=4 Point Spacing=0.173 Line Spacing=0.112	Coordinate Frame=POS-TARG Pattern Orientation=23.884 Angle Between Sides=81.785 Center Pattern=true		(1-2), (3-4)

Fixed Targets

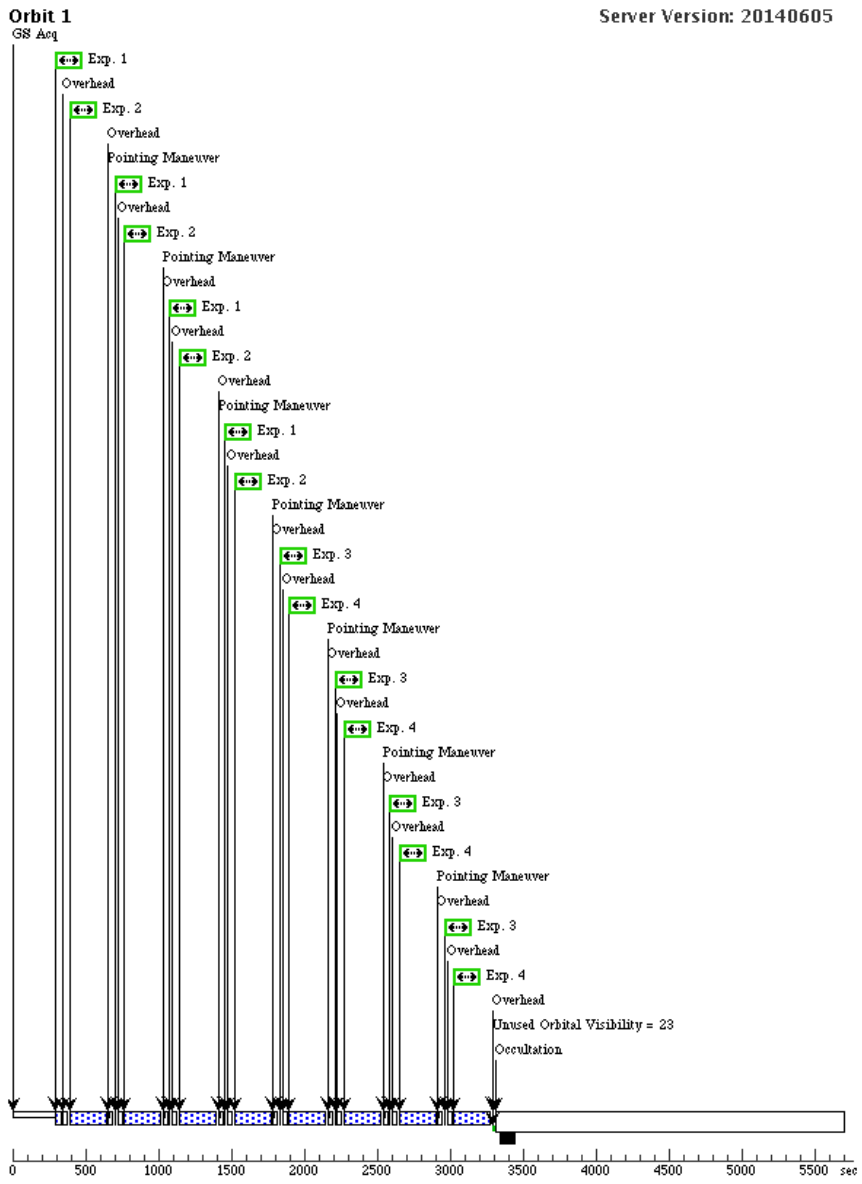
#	Name	Target Coordinates	Targ. Coord. Corrections	Fluxes	Miscellaneous
(2)	MU-CAS Alt Name1: HR321 Alt Name2: HD6582	RA: 01 08 16.3700 (17.0682083d) Dec: +54 55 13.20 (54.92033d) Equinox: J2000	Proper Motion RA: 0.3972 sec of time/yr Proper Motion Dec: -1.596 arcsec/yr Parallax: 0.134" Epoch of Position: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

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 (Total)/[Actual Dur.]	Orbit
1		(2) MU-CAS	WFC3/UVIS, ACCUM, UVIS2-C512C-SUB	F225W	CR-SPLIT=NO; FLASH=12; BLADE=A		Pattern 1, Exps 1-2 in Mu Cas (02) (1)	1.5 Secs (6 Secs) *[==>(Pattern 1)]* *[==>(Pattern 2)]* *[==>(Pattern 3)]* *[==>(Pattern 4)]*	 ***[1]***
2		(2) MU-CAS	WFC3/UVIS, ACCUM, UVIS2-C512C-SUB	F225W	CR-SPLIT=NO; FLASH=12		Pattern 1, Exps 1-2 in Mu Cas (02) (1)	255 Secs (1020 Secs) *[==>(Pattern 1)]* *[==>(Pattern 2)]* *[==>(Pattern 3)]* *[==>(Pattern 4)]*	 ***[1]***
3		(2) MU-CAS	WFC3/UVIS, ACCUM, UVIS2-C512C-SUB	F225W	CR-SPLIT=NO; FLASH=12; BLADE=A		Pattern 1, Exps 3-4 in Mu Cas (02) (1)	1.5 Secs (6 Secs) *[==>(Pattern 1)]* *[==>(Pattern 2)]* *[==>(Pattern 3)]* *[==>(Pattern 4)]*	 ***[1]***
4		(2) MU-CAS	WFC3/UVIS, ACCUM, UVIS2-C512C-SUB	F225W	CR-SPLIT=NO; FLASH=12		Pattern 1, Exps 3-4 in Mu Cas (02) (1)	255 Secs (1020 Secs) *[==>(Pattern 1)]* *[==>(Pattern 2)]* *[==>(Pattern 3)]* *[==>(Pattern 4)]*	 ***[1]***

Orbit Structure



Visit

Proposal 13876, WD1818+126 (04), implementation Wed Jul 16 01:09:12 GMT 2014

Diagnostic Status: Warning

Scientific Instruments: FGS

Special Requirements: SCHED 70%; ORIENT 284D TO 286 D; BETWEEN 01-MAR-2015 AND 07-MAR-2015

Diagnostics

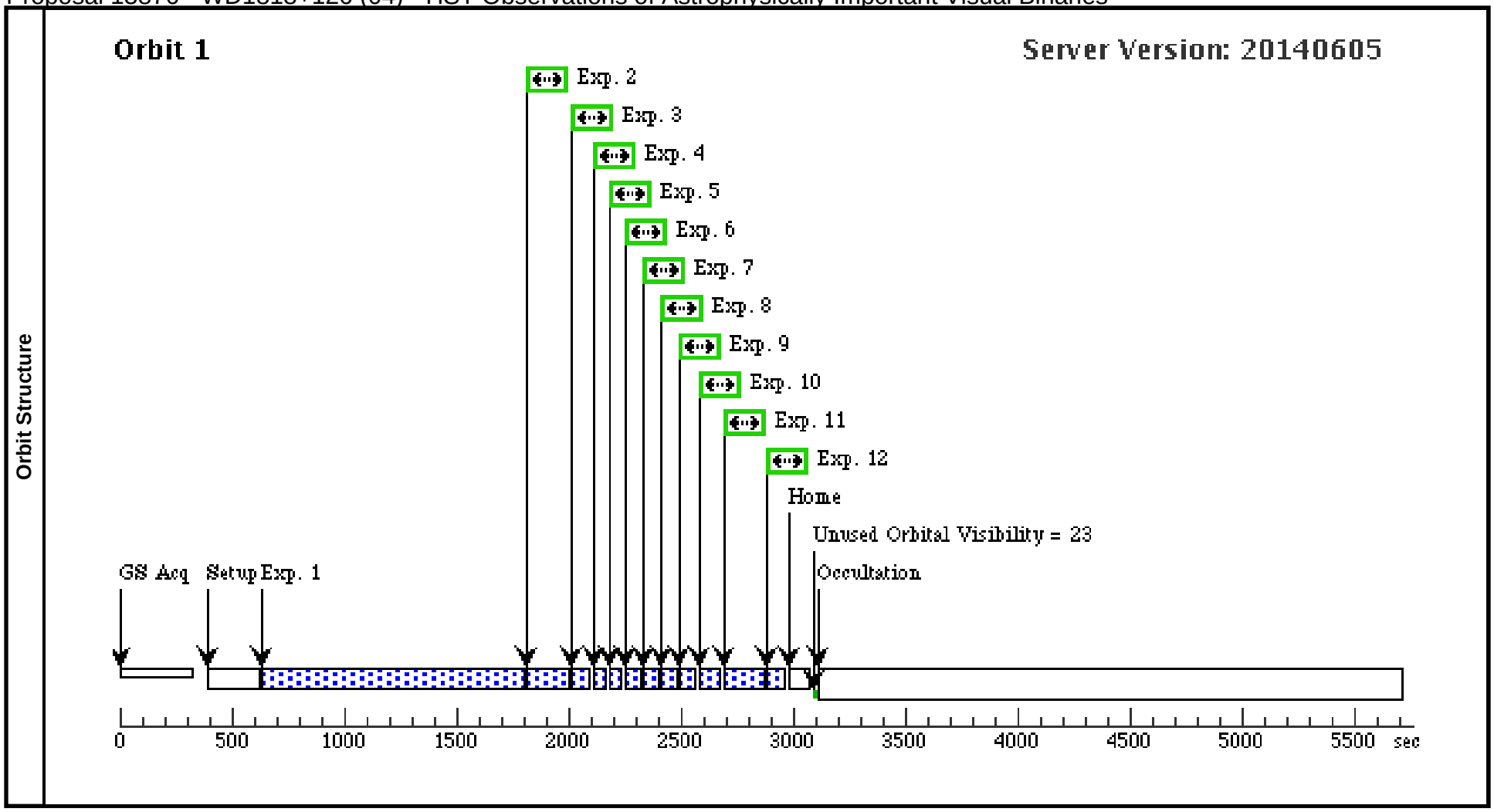
(WD1818+126 (04)) Warning (Orbit Planner): SHORT FGS SCAN LENGTH MAY SIGNAL PROBLEMS

Fixed Targets

#	Name	Target Coordinates	Targ. Coord. Corrections	Fluxes	Miscellaneous
(4)	WD1818+126	RA: 18 20 30.8800 (275.1286667d) Dec: +12 39 17.70 (12.65492d) Equinox: J2000	Proper Motion RA: 0.007 sec of time/yr Proper Motion Dec: 0.271 arcsec/yr Parallax: 0" Epoch of Position: 2000.0	V=16.06+/-0.1	Reference Frame: HST CYCLE 10 PROPOSAL
Comments: maximum parallax factor occurs Sep 29 and March 29					
(5)	WD1818-REF1 Alt Name1: GSC1018.02189	RA: 18 20 23.6700 (275.0986250d) Dec: +12 39 43.80 (12.66217d) Equinox: J2000	Parallax: 0"	V=13.22+/-0.2	Reference Frame: ICRS
(6)	WD1818-REF2 Alt Name1: GSC1018.02278	RA: 18 20 26.3600 (275.1098333d) Dec: +12 39 25.20 (12.65700d) Equinox: J2000	Parallax: 0"	V=12.7+/-0.2	Reference Frame: ICRS
(7)	WD1818-REF3 Alt Name1: GSC1018.01251	RA: 18 20 31.9700 (275.1332083d) Dec: +12 38 48.12 (12.64670d) Equinox: J2000	Parallax: 0"	V=12.97+/-0.2	Reference Frame: ICRS
(8)	WD1818-REF4 Alt Name1: N020230030828	RA: 18 20 33.8600 (275.1410833d) Dec: +12 39 5.56 (12.65154d) Equinox: J2000	Parallax: 0"	V=14.23+/-0.2	Reference Frame: ICRS
Comments: position and magnitude from GSC2, using Kriss & Stys color transformations.					
(9)	WD1818-REF5 Alt Name1: N020230030566	RA: 18 20 35.3400 (275.1472500d) Dec: +12 38 50.74 (12.64743d) Equinox: J2000	Parallax: 0"	V=14.49+/-0.2	Reference Frame: ICRS
Comments: position and magnitude from GSC2, using Kriss & Stys color transformations					
(10)	WD1818-REF6 Alt Name1: N020230031910	RA: 18 20 33.6100 (275.1400417d) Dec: +12 40 16.29 (12.67119d) Equinox: J2000	Parallax: 0"	V=14.43+/-0.3	Reference Frame: ICRS
Comments: position and magnitude from GSC2, using Kriss & Stys color transformation					
(11)	WD1818-REF7 Alt Name1: N020230031978	RA: 18 20 29.4800 (275.1228333d) Dec: +12 40 21.03 (12.67251d) Equinox: J2000	Parallax: 0"	V=15.01+/-0.2	Reference Frame: ICRS
Comments: position and magnitude from GSC2, color transformation using Kriss & Stys					

Exposures

#	Label	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time (Total)/[Actual Dur.]	Orbit
1	1	(4) WD1818+126	FGS, TRANS, 1	F583W	STEP-SIZE=0.4; SCANS=20	POS TARG 0.0,0.0; GS ACQ SCENARIO BASE1B3	Sequence 1-12 Non-Int in WD1818+126 (04)	830.0 Secs (830 Secs)	
								[==>]	***[1]***
2	2	(4) WD1818+126	FGS, POS, 1	F583W		SAME POS AS 1	Sequence 1-12 Non-Int in WD1818+126 (04)	10.0 Secs (10 Secs)	
								[==>]	***[1]***
3	3	(5) WD1818-REF1	FGS, POS, 1	F583W		SAME POS AS 1	Sequence 1-12 Non-Int in WD1818+126 (04)	10.0 Secs (10 Secs)	
								[==>]	***[1]***
4	4	(6) WD1818-REF2	FGS, POS, 1	F583W		SAME POS AS 1	Sequence 1-12 Non-Int in WD1818+126 (04)	10.0 Secs (10 Secs)	
								[==>]	***[1]***
5	5	(7) WD1818-REF3	FGS, POS, 1	F583W		SAME POS AS 1	Sequence 1-12 Non-Int in WD1818+126 (04)	10.0 Secs (10 Secs)	
								[==>]	***[1]***
6	6	(8) WD1818-REF4	FGS, POS, 1	F583W		SAME POS AS 1	Sequence 1-12 Non-Int in WD1818+126 (04)	10.0 Secs (10 Secs)	
								[==>]	***[1]***
7	7	(9) WD1818-REF5	FGS, POS, 1	F583W		SAME POS AS 1	Sequence 1-12 Non-Int in WD1818+126 (04)	10.0 Secs (10 Secs)	
								[==>]	***[1]***
8	8	(6) WD1818-REF2	FGS, POS, 1	F583W		SAME POS AS 1	Sequence 1-12 Non-Int in WD1818+126 (04)	10.0 Secs (10 Secs)	
								[==>]	***[1]***
9	9	(10) WD1818-REF6	FGS, POS, 1	F583W		SAME POS AS 1	Sequence 1-12 Non-Int in WD1818+126 (04)	10.0 Secs (10 Secs)	
								[==>]	***[1]***
10	10	(11) WD1818-REF7	FGS, POS, 1	F583W		SAME POS AS 1	Sequence 1-12 Non-Int in WD1818+126 (04)	10.0 Secs (10 Secs)	
								[==>]	***[1]***
11	11	(4) WD1818+126	FGS, POS, 1	F583W		SAME POS AS 1	Sequence 1-12 Non-Int in WD1818+126 (04)	10.0 Secs (10 Secs)	
								[==>]	***[1]***
12	12	(5) WD1818-REF1	FGS, POS, 1	F583W		SAME POS AS 1	Sequence 1-12 Non-Int in WD1818+126 (04)	10.0 Secs (10 Secs)	
								[==>]	***[1]***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Exp. 5
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Exp. 7
Exp. 8
Exp. 9
Exp. 10
Exp. 11
Exp. 12
Home
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Occultation
GS Acq
Setup
Exp. 1
0
500
1000
1500
2000
2500
3000
3500
4000
4500
5000
5500
sec

Visit

Proposal 13876, G107-70 (05) Wed Jul 16 01:09:12 GMT 2014

Diagnostic Status: No Diagnostics

Scientific Instruments: FGS

Special Requirements: GYRO MODE 3GOBAD; ORIENT 95.0D TO 96.0 D; BETWEEN 01-APR-2015 AND 20-APR-2015

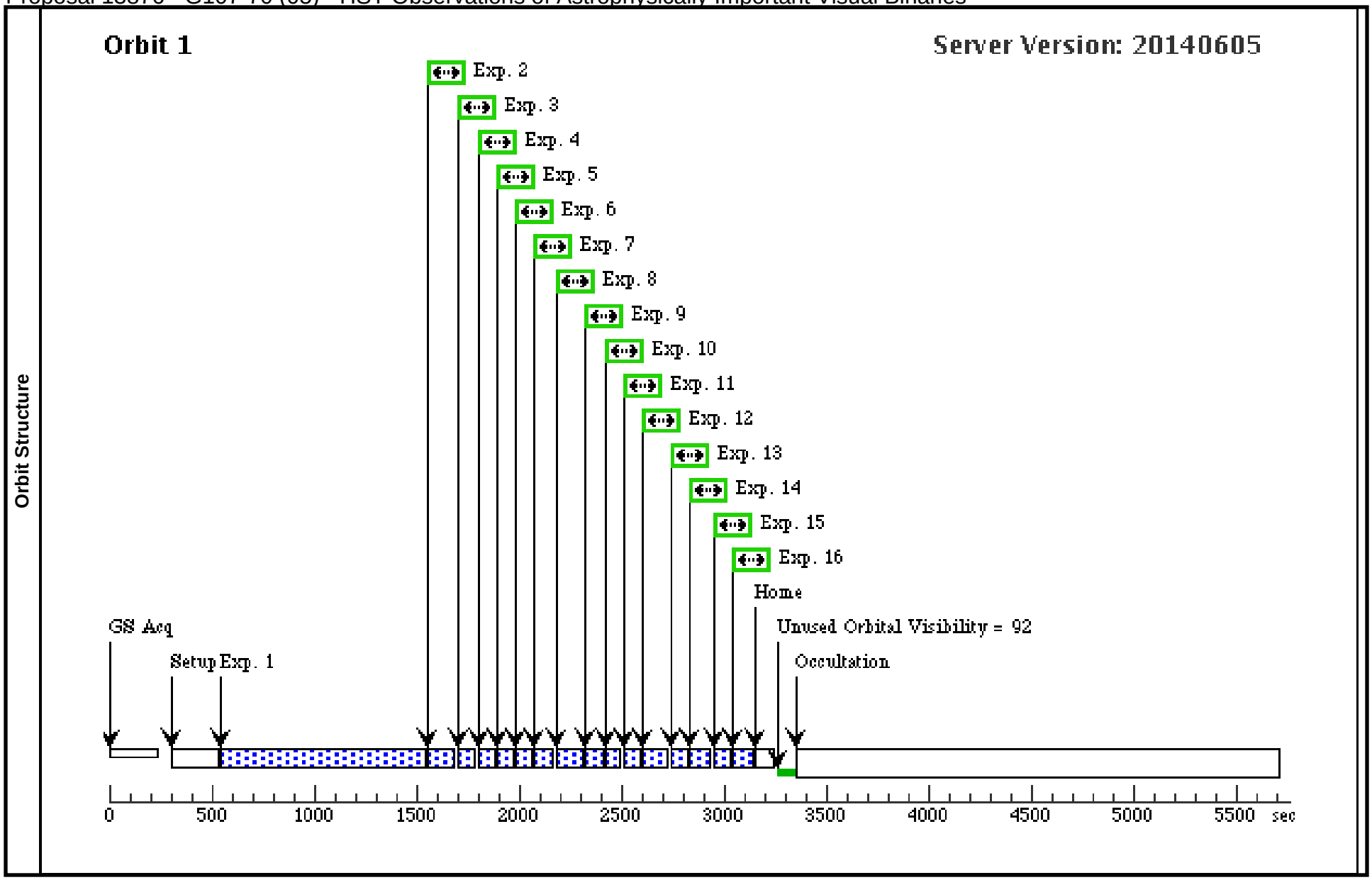
Comments: Maximum parallax factors April 10, October 11. This ORIENT can schedule up to April 6, and results in a favorable projection of the G107-70 components (PA ~ 272 degrees) in the FGS frame.

Fixed Targets

#	Name	Target Coordinates	Targ. Coord. Corrections	Fluxes	Miscellaneous
(12)	G107-70	RA: 07 30 47.2300 (112.6967917d) Dec: +48 10 26.60 (48.17406d) Equinox: J2000	Proper Motion RA: -0.022 sec of time/yr Proper Motion Dec: -1.271 arcsec/yr Parallax: 0.09" Epoch of Position: 2000.0	V=15.5+/-0.1	Reference Frame: ICRS
Comments: double degenerate binary system, separation ~0.6"					
(13)	G107-69	RA: 07 30 42.5700 (112.6773750d) Dec: +48 11 58.80 (48.19967d) Equinox: J2000	Proper Motion RA: -0.022 sec of time/yr Proper Motion Dec: -1.272 arcsec/yr Parallax: 0.09" Epoch of Position: 2000	V=13.6+/-0.1	Reference Frame: ICRS
Comments: CPM companion to G107-70, ~1 arcmin distant					
(14)	G107-70-REF2	RA: 07 30 26.6900 (112.6112083d) Dec: +48 11 1.64 (48.18379d) Equinox: J2000		V=13.3+/-0.1	Reference Frame: ICRS
(15)	G107-70-REF3	RA: 07 31 9.7700 (112.7907083d) Dec: +48 10 27.41 (48.17428d) Equinox: J2000		V=14.3+/-0.1	Reference Frame: ICRS
(16)	G107-70-REF4	RA: 07 30 57.1700 (112.7382083d) Dec: +48 08 36.71 (48.14353d) Equinox: J2000		V=12.2+/-0.1	Reference Frame: ICRS
(17)	G107-70-REF6	RA: 07 30 34.9200 (112.6455000d) Dec: +48 10 31.22 (48.17534d) Equinox: J2000		V=14.3+/-0.1	Reference Frame: ICRS
(18)	G107-70-REF7	RA: 07 31 0.3100 (112.7512917d) Dec: +48 10 16.07 (48.17113d) Equinox: J2000		V=14.9	Reference Frame: ICRS
(19)	G107-70-REF9	RA: 07 30 15.0300 (112.5626250d) Dec: +48 10 19.67 (48.17213d) Equinox: J2000		V=12.9	Reference Frame: ICRS

Exposures

#	Label	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time (Total)/[Actual Dur.]	Orbit
1		(12) G107-70	FGS, TRANS, 1	F583W	SCANS=15; STEP-SIZE=0.8	POS TARG 0.0,0.0; GS ACQ SCENARIO SINGLE	Sequence 1-16 Non-Int in G107-70 (05)	715.0 Secs (715 Secs)	
								[==>]	***[1]***
2		(12) G107-70	FGS, POS, 1	F583W	FES-TIME=0.4	SAME POS AS 1	Sequence 1-16 Non-Int in G107-70 (05)	7 Secs (7 Secs)	
								[==>]	***[1]***
3		(13) G107-69	FGS, POS, 1	F583W		SAME POS AS 1	Sequence 1-16 Non-Int in G107-70 (05)	7 Secs (7 Secs)	
								[==>]	***[1]***
4		(19) G107-70-REF9	FGS, POS, 1	F583W		SAME POS AS 1	Sequence 1-16 Non-Int in G107-70 (05)	7 Secs (7 Secs)	
								[==>]	***[1]***
5		(16) G107-70-REF4	FGS, POS, 1	F583W		SAME POS AS 1	Sequence 1-16 Non-Int in G107-70 (05)	7 Secs (7 Secs)	
								[==>]	***[1]***
6		(15) G107-70-REF3	FGS, POS, 1	F583W		SAME POS AS 1	Sequence 1-16 Non-Int in G107-70 (05)	7 Secs (7 Secs)	
								[==>]	***[1]***
7		(13) G107-69	FGS, POS, 1	F583W		SAME POS AS 1	Sequence 1-16 Non-Int in G107-70 (05)	7 Secs (7 Secs)	
								[==>]	***[1]***
8		(12) G107-70	FGS, POS, 1	F583W	FES-TIME=0.4	SAME POS AS 1	Sequence 1-16 Non-Int in G107-70 (05)	7 Secs (7 Secs)	
								[==>]	***[1]***
9		(17) G107-70-REF6	FGS, POS, 1	F583W		SAME POS AS 1	Sequence 1-16 Non-Int in G107-70 (05)	7 Secs (7 Secs)	
								[==>]	***[1]***
10		(14) G107-70-REF2	FGS, POS, 1	F583W		SAME POS AS 1	Sequence 1-16 Non-Int in G107-70 (05)	7 Secs (7 Secs)	
								[==>]	***[1]***
11		(16) G107-70-REF4	FGS, POS, 1	F583W		SAME POS AS 1	Sequence 1-16 Non-Int in G107-70 (05)	7 Secs (7 Secs)	
								[==>]	***[1]***
12		(12) G107-70	FGS, POS, 1	F583W	FES-TIME=0.4	SAME POS AS 1	Sequence 1-16 Non-Int in G107-70 (05)	7 Secs (7 Secs)	
								[==>]	***[1]***
13		(13) G107-69	FGS, POS, 1	F583W		SAME POS AS 1	Sequence 1-16 Non-Int in G107-70 (05)	7 Secs (7 Secs)	
								[==>]	***[1]***
14		(18) G107-70-REF7	FGS, POS, 1	F583W		SAME POS AS 1	Sequence 1-16 Non-Int in G107-70 (05)	7 Secs (7 Secs)	
								[==>]	***[1]***
15		(15) G107-70-REF3	FGS, POS, 1	F583W		SAME POS AS 1	Sequence 1-16 Non-Int in G107-70 (05)	7 Secs (7 Secs)	
								[==>]	***[1]***
16		(19) G107-70-REF9	FGS, POS, 1	F583W		SAME POS AS 1	Sequence 1-16 Non-Int in G107-70 (05)	7 Secs (7 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
Exp. 15
Exp. 16
Home
GS Acq
Setup
Exp. 1
Unused Orbital Visibility = 92
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2000
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5500
sec