13468 - HST Observations of Astrophysically Important Visual Binaries

Cycle: 21, 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?*
01	(1) PROCYON	WFC3/UVIS	1	16-Sep-2013 21:12:34.0	yes
02	(2) MU-CAS	WFC3/UVIS	1	16-Sep-2013 21:12:55.0	yes
03	(3) SIRIUS	WFC3/UVIS	1	16-Sep-2013 21:13:16.0	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	16-Sep-2013 21:13:30.0	yes

4 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 21 continuation of a program in which we are determining the orbits of visual binaries. The targets for Cycle 21 are Procyon, mu Cas, Sirius, and WD 1818+126.

We have been observing WD 1818+126 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 each of these target fields.

Procyon, mu Cas, and Sirius will be observed with WFC3/UVIS. For the two very bright stars, Procyon and Sirius, we will use the long-wavelength F953N filter to reduce the signal. Since even with this filter Procyon A and Sirius A would saturate in the minimum WFC3 exposure, we will let them saturate and use the diffraction spikes to centroid the bright components. For Procyon there will be a series of dithered 38-sec exposures, which will provide good unsaturated exposures for Procyon B at the same telescope pointing. For Sirius there will be a series of 6- and 12-sec dithered exposures.

For mu Cas, 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 13468, Procyon (01), implementation Tue Sep 17 01:13:39 GMT 2013

Diagnostic Status: No Diagnostics

Scientific Instruments: WFC3/UVIS

Special Requirements: GYRO MODE 3GOBAD; SCHED 40%; ORIENT 293.3D TO 9.7 D; ORIENT 252.5D TO 279.7 D; BETWEEN 09-SEP-2014 AND 29-NOV-2014

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

Fixed Targets

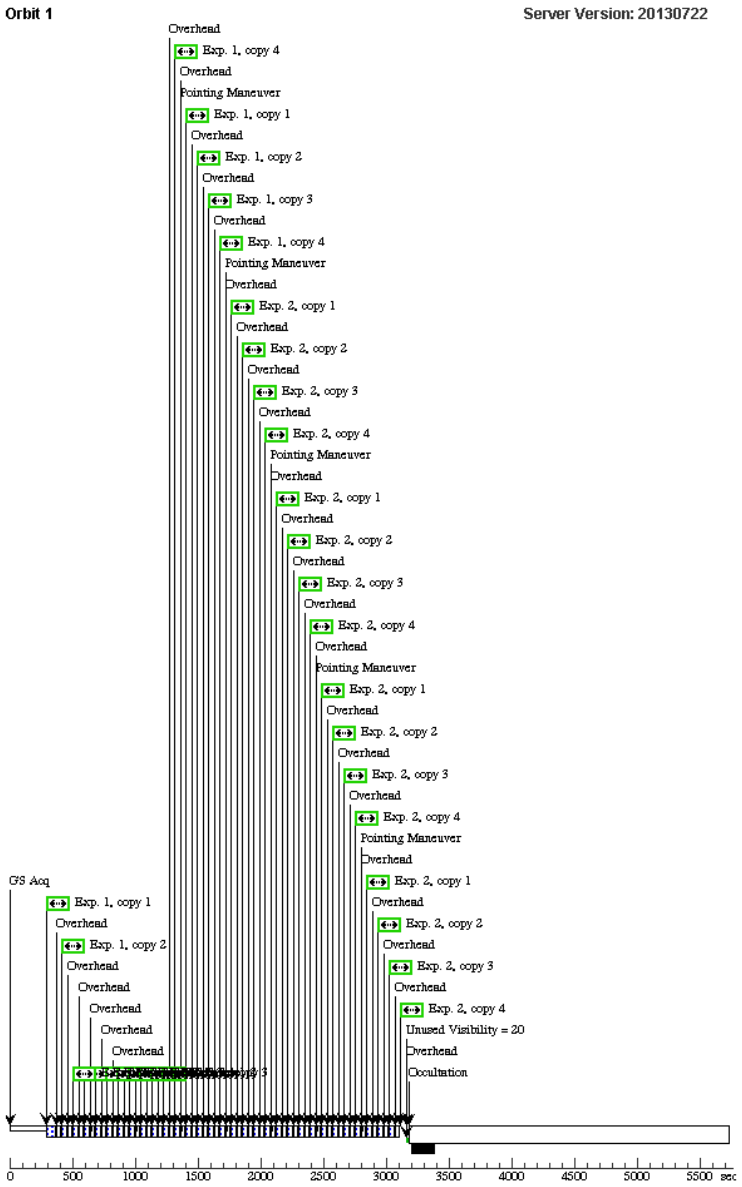
#	Name	Target Coordinates	Targ. Coord. Corrections	Fluxes	Miscellaneous
(1)	PROCYON Alt Name1: ALPHA-CMI Alt Name2: HR2943	RA: 07 39 18.3700 (114.8265417d) Dec: +05 13 35.50 (5.22653d) Equinox: J2000	Proper Motion RA: -0.04755 sec of time/yr Proper Motion Dec: -1.0229 arcsec/yr Parallax: 0.283" Epoch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

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 (Total)/[Actual Dur.]	Orbit
1		(1) PROCYON	WFC3/UVIS, ACCUM, UVIS2-C512C-SUB	F953N	CR-SPLIT=NO	GS ACQ SCENARIO BASE1B3	Pattern 1, Exps 1-1 in Procyon (01) (1)	36 Secs X 4 (576 Secs) *[==>(Pattern 1, Copy 1)]* *[==>(Pattern 1, Copy 2)]* *[==>(Pattern 1, Copy 3)]* *[==>(Pattern 1, Copy 4)]* *[==>(Pattern 2, Copy 1)]* *[==>(Pattern 2, Copy 2)]* *[==>(Pattern 2, Copy 3)]* *[==>(Pattern 2, Copy 4)]* *[==>(Pattern 3, Copy 1)]* *[==>(Pattern 3, Copy 2)]* *[==>(Pattern 3, Copy 3)]* *[==>(Pattern 3, Copy 4)]* *[==>(Pattern 4, Copy 1)]* *[==>(Pattern 4, Copy 2)]* *[==>(Pattern 4, Copy 3)]* *[==>(Pattern 4, Copy 4)]*	***[1]***
2		(1) PROCYON	WFC3/UVIS, ACCUM, UVIS2-C512C-SUB	F953N	CR-SPLIT=NO		Pattern 1, Exps 2-2 in Procyon (01) (1)	36 Secs X 4 (576 Secs) *[==>(Pattern 1, Copy 1)]* *[==>(Pattern 1, Copy 2)]* *[==>(Pattern 1, Copy 3)]* *[==>(Pattern 1, Copy 4)]* *[==>(Pattern 2, Copy 1)]* *[==>(Pattern 2, Copy 2)]* *[==>(Pattern 2, Copy 3)]* *[==>(Pattern 2, Copy 4)]* *[==>(Pattern 3, Copy 1)]* *[==>(Pattern 3, Copy 2)]* *[==>(Pattern 3, Copy 3)]* *[==>(Pattern 3, Copy 4)]* *[==>(Pattern 4, Copy 1)]* *[==>(Pattern 4, Copy 2)]* *[==>(Pattern 4, Copy 3)]* *[==>(Pattern 4, Copy 4)]*	***[1]***

Orbit Structure



Visit

Proposal 13468, Mu Cas (02), implementation Tue Sep 17 01:13:42 GMT 2013

Diagnostic Status: No Diagnostics

Scientific Instruments: WFC3/UVIS

Special Requirements: GYRO MODE 3GOBAD; SCHED 40%; ORIENT 60.1D TO 114.5 D; ORIENT 150.1D TO 155.3 D; BETWEEN 25-OCT-2013 AND 25-DEC-2013

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

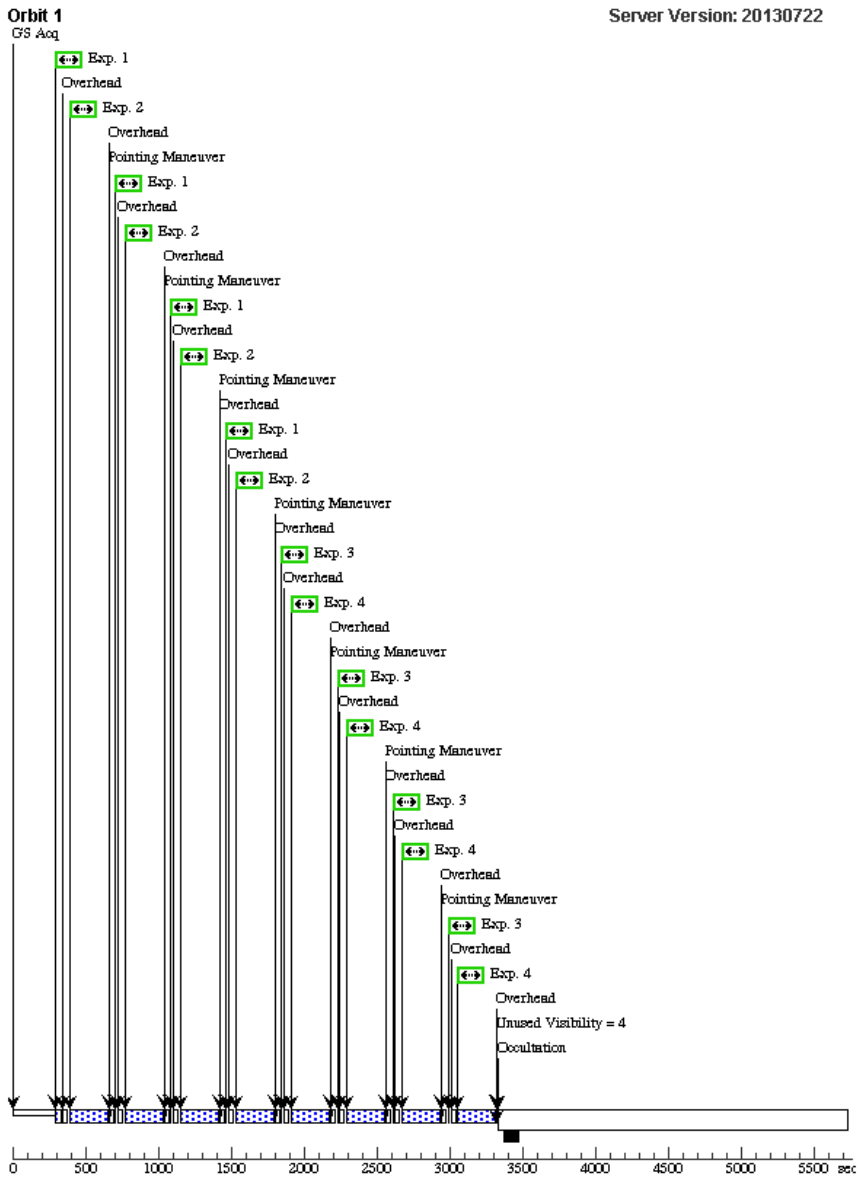
#	Name	Target Coordinates	Targ. Coord. Corrections	Fluxes	Miscellaneous
(2)	MU-CAS Alt Name1: HR321 Alt Name2: HD6582	RA: 01 08 16.3700 (17.0682083d) Dec: +54 55 13.20 (54.92033d) Equinox: J2000	Proper Motion RA: 0.3972 sec of time/yr Proper Motion Dec: -1.596 arcsec/yr Parallax: 0.134" Epoch of Position: 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)	270 Secs (1036 Secs) *[==>259.0 Secs (Pattern 1)]* *[==>259.0 Secs (Pattern 2)]* *[==>259.0 Secs (Pattern 3)]* *[==>259.0 Secs (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)	270 Secs (1036 Secs) *[==>259.0 Secs (Pattern 1)]* *[==>259.0 Secs (Pattern 2)]* *[==>259.0 Secs (Pattern 3)]* *[==>259.0 Secs (Pattern 4)]*	***[1]***

Orbit Structure



Visit

Proposal 13468, Sirius (03), implementation Tue Sep 17 01:13:44 GMT 2013

Diagnostic Status: No Diagnostics

Scientific Instruments: WFC3/UVIS

Special Requirements: GYRO MODE 3GOBAD; ORIENT 83.4D TO 165.8 D; ORIENT 42.6D TO 75.8 D; BETWEEN 20-MAR-2014 AND 20-MAY-2014

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

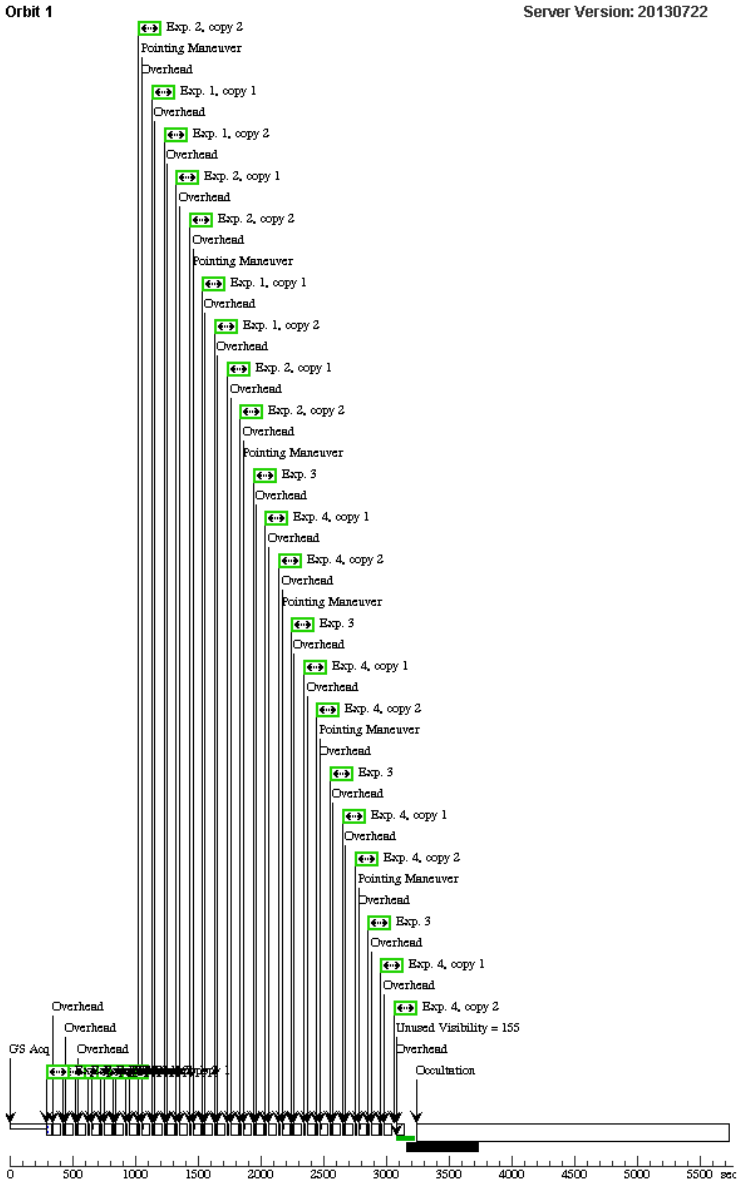
#	Name	Target Coordinates	Targ. Coord. Corrections	Fluxes	Miscellaneous
(3)	SIRIUS Alt Name1: ALPHA-CMA Alt Name2: HR2491	RA: 06 45 8.6300 (101.2859583d) Dec: -16 43 7.40 (-16.71872d) Equinox: J2000	Proper Motion RA: -0.038011 sec of time/yr Proper Motion Dec: -1.22308 arcsec/yr Parallax: 0.379" Epoch of Position: 2008.007	V=-1.47	Reference Frame: ICRS

Comments: Coordinates are for center of mass of the Sirius A-B binary, determined from a WFPC2 observation in January 2008 and a WFC3 observation in September 2012..

Exposures

#	Label	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time (Total)/[Actual Dur.]	Orbit
1		(3) SIRIUS	WFC3/UVIS, ACCUM, UVIS2-C1K1C-SUB	F953N	CR-SPLIT=NO; BLADE=A		Pattern 1, Exps 1-2 in Sirius (03) (1)	6 Secs X 2 (48 Secs)	
								[==>(Pattern 1, Copy 1)] *[==>(Pattern 1, Copy 2)]* *[==>(Pattern 2, Copy 1)]* *[==>(Pattern 2, Copy 2)]* *[==>(Pattern 3, Copy 1)]* *[==>(Pattern 3, Copy 2)]* *[==>(Pattern 4, Copy 1)]* *[==>(Pattern 4, Copy 2)]*	***[1]***
2		(3) SIRIUS	WFC3/UVIS, ACCUM, UVIS2-C1K1C-SUB	F953N	CR-SPLIT=NO; BLADE=A		Pattern 1, Exps 1-2 in Sirius (03) (1)	12 Secs X 2 (96 Secs)	
								[==>(Pattern 1, Copy 1)] *[==>(Pattern 1, Copy 2)]* *[==>(Pattern 2, Copy 1)]* *[==>(Pattern 2, Copy 2)]* *[==>(Pattern 3, Copy 1)]* *[==>(Pattern 3, Copy 2)]* *[==>(Pattern 4, Copy 1)]* *[==>(Pattern 4, Copy 2)]*	***[1]***
3		(3) SIRIUS	WFC3/UVIS, ACCUM, UVIS2-C1K1C-SUB	F953N	CR-SPLIT=NO; BLADE=A		Pattern 1, Exps 3-4 in Sirius (03) (1)	6 Secs (24 Secs)	
								[==>(Pattern 1)] *[==>(Pattern 2)]* *[==>(Pattern 3)]* *[==>(Pattern 4)]*	***[1]***
4		(3) SIRIUS	WFC3/UVIS, ACCUM, UVIS2-C1K1C-SUB	F953N	CR-SPLIT=NO; BLADE=A		Pattern 1, Exps 3-4 in Sirius (03) (1)	12 Secs X 2 (96 Secs)	
								[==>(Pattern 1, Copy 1)] *[==>(Pattern 1, Copy 2)]* *[==>(Pattern 2, Copy 1)]* *[==>(Pattern 2, Copy 2)]* *[==>(Pattern 3, Copy 1)]* *[==>(Pattern 3, Copy 2)]* *[==>(Pattern 4, Copy 1)]* *[==>(Pattern 4, Copy 2)]*	***[1]***

Orbit Structure



Visit

Proposal 13468, WD1818+126 (04), scheduled Tue Sep 17 01:13:46 GMT 2013

Diagnostic Status: Warning

Scientific Instruments: FGS

Special Requirements: SCHED 70%; ORIENT 74.0D TO 76.0 D; BETWEEN 20-SEP-2013 AND 15-OCT-2013

Diagnostics

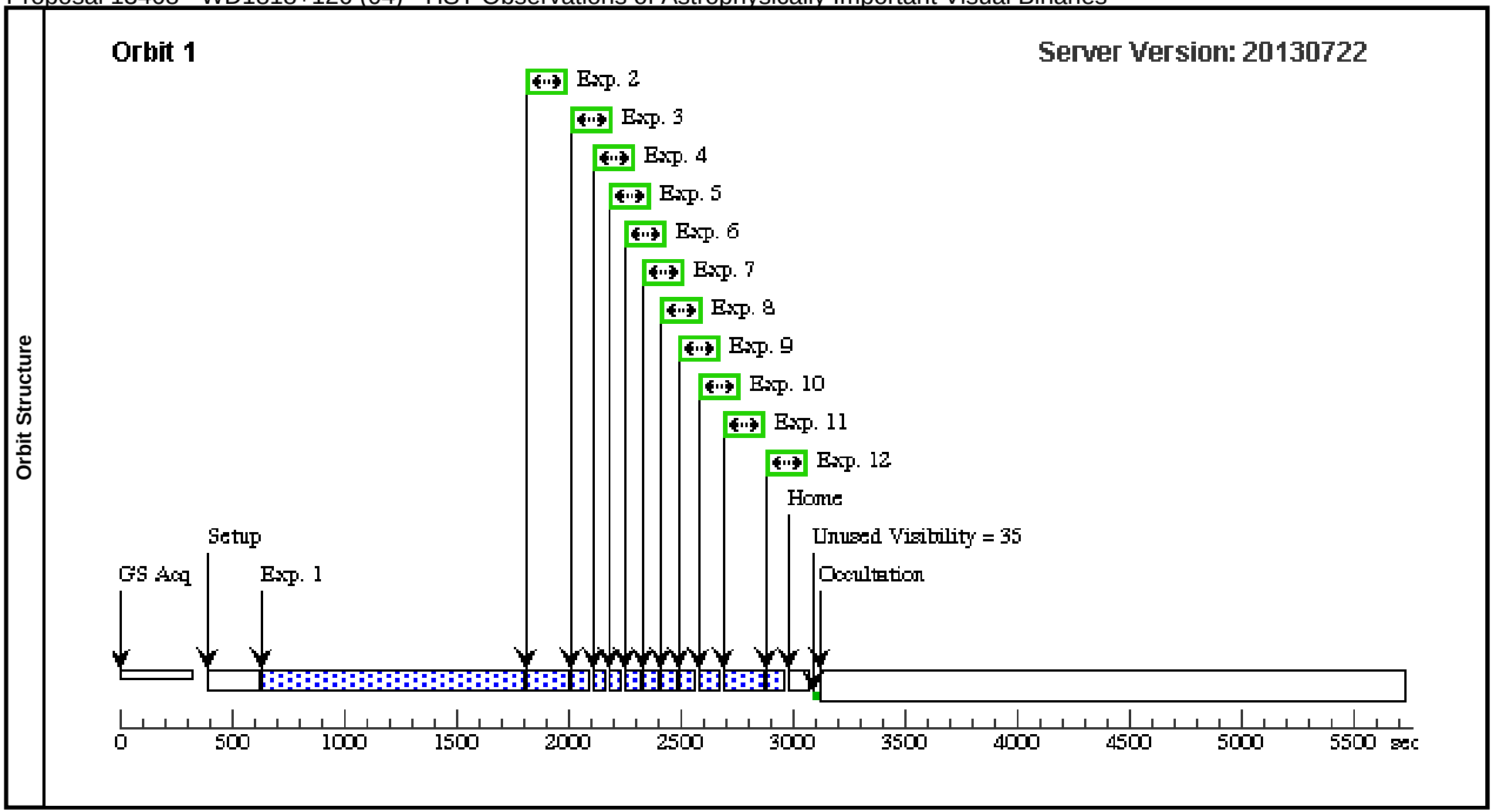
(WD1818+126 (04)) Warning (Orbit Planner): SHORT FGS SCAN LENGTH MAY SIGNAL PROBLEMS

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. 12
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Occultation
Setup
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