14791 - Assessing the dependency of the fine structure constant on gravity using hot DA white dwarfs

Cycle: 24, Proposal Category: GO

(Availability Mode: RESTRICTED)

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?*
A0	(1) WD2211-495 NONE WAVE	STIS/CCD STIS/FUV-MAMA	2	07-Sep-2016 18:36:36.0	yes
C0	(3) WD0621-376 NONE WAVE	STIS/CCD STIS/FUV-MAMA	4	07-Sep-2016 18:36:38.0	yes
D0	(4) WD0455-282 NONE	STIS/CCD STIS/FUV-MAMA	3	07-Sep-2016 18:36:40.0	yes
D1	(4) WD0455-282 WAVE	STIS/CCD STIS/FUV-MAMA	3	07-Sep-2016 18:36:41.0	yes

12 Total Orbits Used

ABSTRACT

Variation of fundamental constants is a common theme of many theories of quantum gravity and Grand Unification. Using spectra obtained with the Hubble Space Telescope, it has been shown by Berengut et al. (2013), and Bagdonaite et al. (2014), that it is possible to place strong constraints on gravitational variations of the fine structure constant (alpha), and the proton to electron mass ratio (mu) in white dwarf stars.

As part of the UV initiative, we propose to observe four hot DA white dwarf stars using STIS with the E140H grating, totalling 12 orbits. These four stars have been chosen so as to have a wide range of masses, allowing a full exploration of the compactness parameter space (M/R). We will measure several absorption features of Fe V and Ni V, and extract any potential variation in alpha in a manner similar to Berengut et al. (2013).

This proposal will be a significant advance in the effort to detect gravitational variations in alpha. A confirmed detection of alpha variation would have extensive consequences for fundamental physics, cosmology, and would also signal the breakdown of Einstein's Equivalence principle, and hence, general relativity. Furthermore, a null detection would also allow strong limits to be placed on any potential alpha variation in a strong

gravitational field.

OBSERVING DESCRIPTION

FUV MAMA Echelle spectra of three White Dwarf stars will be observed with the E140H grating, with settings 1307 & 1416.

Visit A0
star: WD2211-495
Target acquisition using the 50CCD aperture
Orbit 1
E140H spectrum with cen. wave. setting 1307 using the 0."2x0."2 slit
During earth block: GO wavecal exposures with cen. wave. setting 1307 using the 0."2x0."09 slit
Orbit 2
E140H spectrum with cen. wave. setting 1416 using the 0."2x0."2 slit
During earth block: GO wavecal exposures with cen. wave. setting 1416 using the 0."2x0."09 slit

Visit C0
star: WD0621-376 (REJ0623-371)
Target acquisition using the 50CCD aperture
Orbit 1&2
E140H spectrum with cen. wave. setting 1307 using the 0."2x0."2 slit
During earth blocks: GO wavecal exposures with cen. wave. setting 1307 using the 0."2x0."09 slit
Orbit 3&4
E140H spectrum with cen. wave. setting 1416 using the 0."2x0."2 slit
During earth blocks: GO wavecal exposures with cen. wave. setting 1416 using the 0."2x0."09 slit

Visit D0
star: WD0455-28

Target acquisition using the 50CCD aperture
Orbit 1, 2, 3:
E140H spectrum with cen. wave. setting 1307 using the 0."2x0."2 slit
During earth blocks: GO wavecal exposures with cen. wave. setting 1307 using the 0."2x0."09 slit

Visit D1
star: WD0455-28
Target acquisition using the 50CCD aperture
Orbit 1, 2, 3:
E140H spectrum with cen. wave. setting 1416 using the 0."2x0."2 slit
During earth blocks: GO wavecal exposures with cen. wave. setting 1416 using the 0."2x0."09 slit

Visit

Proposal 14791, Visit A0, implementation Wed Sep 07 22:36:41 GMT 2016

Diagnostic Status: No Diagnostics

Scientific Instruments: STIS/CCD, STIS/FUV-MAMA

Special Requirements: (none)

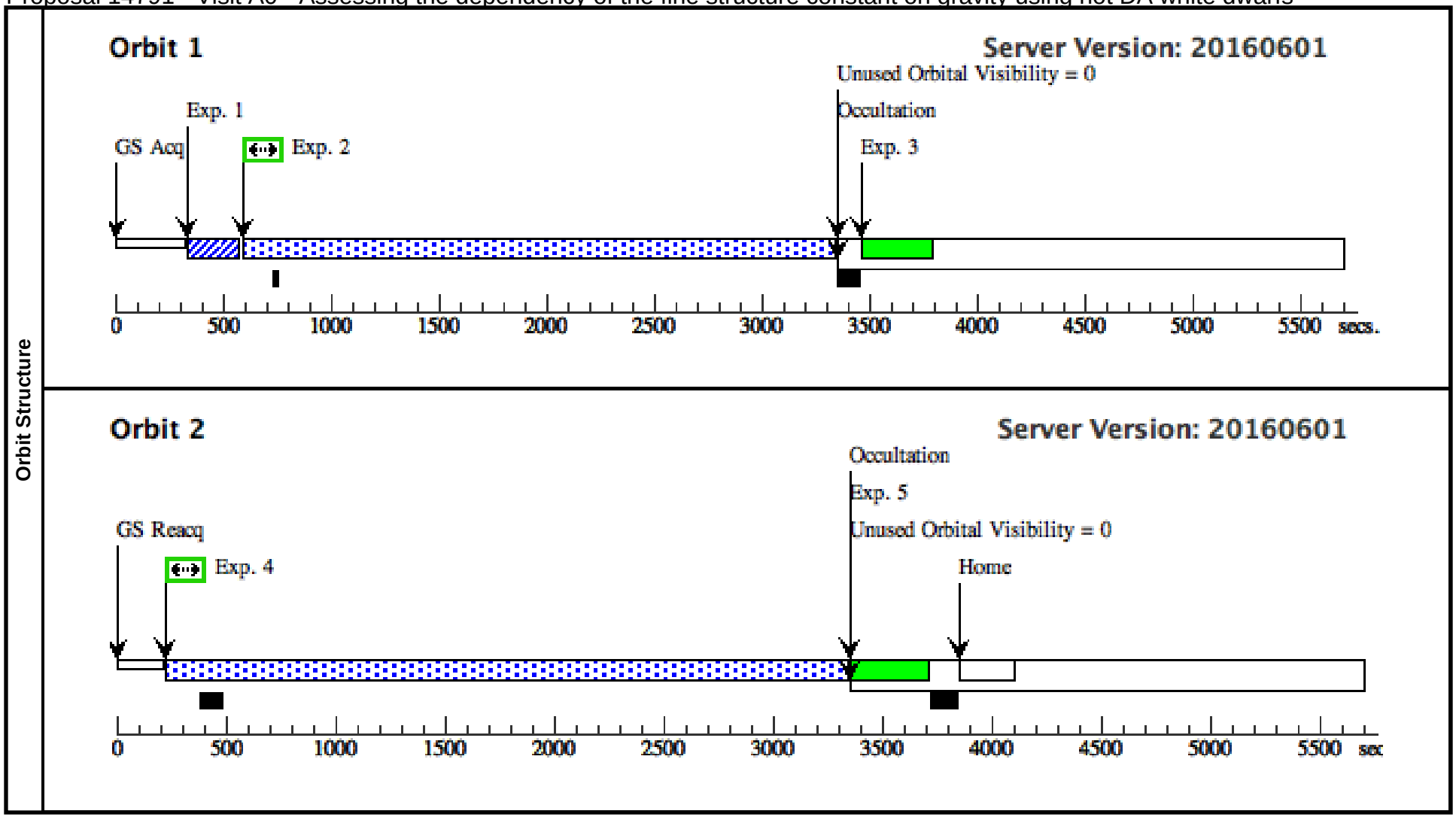
Fixed Targets

#	Name	Target Coordinates	Targ. Coord. Corrections	Fluxes	Miscellaneous
(1)	WD2211-495	RA: 22 14 11.9140 (333.5496417d) Dec: -49 19 27.26 (-49.32424d) Equinox: J2000	Proper Motion RA: +7.8 mas/yr Proper Motion Dec: -66.2 mas/yr Parallax: 0." Epoch of Position: 2000 Radial Velocity: 0. km/sec	V=11.57 IUE fluxes: 1.4E-11 @ 130 nm, 1.1E-11 @ 140nm	Reference Frame: ICRS

Comments: ICRS coordinates and proper motions from SIMBAD; verified against 2MASS coordinates (epoch 1999.65)

Exposures

#	Label (ETC Run)	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time (Total)/[Actual Dur.]	Orbit
1	(STIS.ta.826539)	(1) WD2211-495	STIS/CCD, ACQ, 50CCD	MIRROR				0.1 Secs (0.1 Secs) *[==>]*	 ***[1]***
Comments: time to saturation 0.5s; SNR= 220									
2	(STIS.sp.824841)	(1) WD2211-495	STIS/FUV-MAMA, ACCUM, 0.2X0.2	E140H 1307 A	WAVECAL=NO		Sequence 2-3 Non-Int in Visit A0	2610 Secs (2610 Secs) *[==>]*	 ***[1]***
3		NONE	STIS/FUV-MAMA, ACCUM, 0.2X0.09	E140H 1307 A	LAMP=LINE	QESIPARM TARG TYPE HITM2	Sequence 2-3 Non-Int in Visit A0	300 Secs (300 Secs) *[==>]*	 ***[1]***
4	(STIS.sp.825371)	(1) WD2211-495	STIS/FUV-MAMA, ACCUM, 0.2X0.2	E140H 1416 A	WAVECAL=NO		Sequence 4-5 Non-Int in Visit A0	2966 Secs (2966 Secs) *[==>]*	 ***[2]***
5		WAVE	STIS/FUV-MAMA, ACCUM, 0.2X0.09	E140H 1416 A			Sequence 4-5 Non-Int in Visit A0	300 Secs (300 Secs) *[==>]*	 ***[2]***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Exp. 2
Exp. 3
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secs.
Orbit 2
Server Version: 20160601
Occultation
Exp. 5
GS Reacq
Unused Orbital Visibility = 0
Exp. 4
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5500
sec

Visit

Proposal 14791, Visit C0, implementation Wed Sep 07 22:36:42 GMT 2016

Diagnostic Status: No Diagnostics

Scientific Instruments: STIS/CCD, STIS/FUV-MAMA

Special Requirements: (none)

Fixed Targets

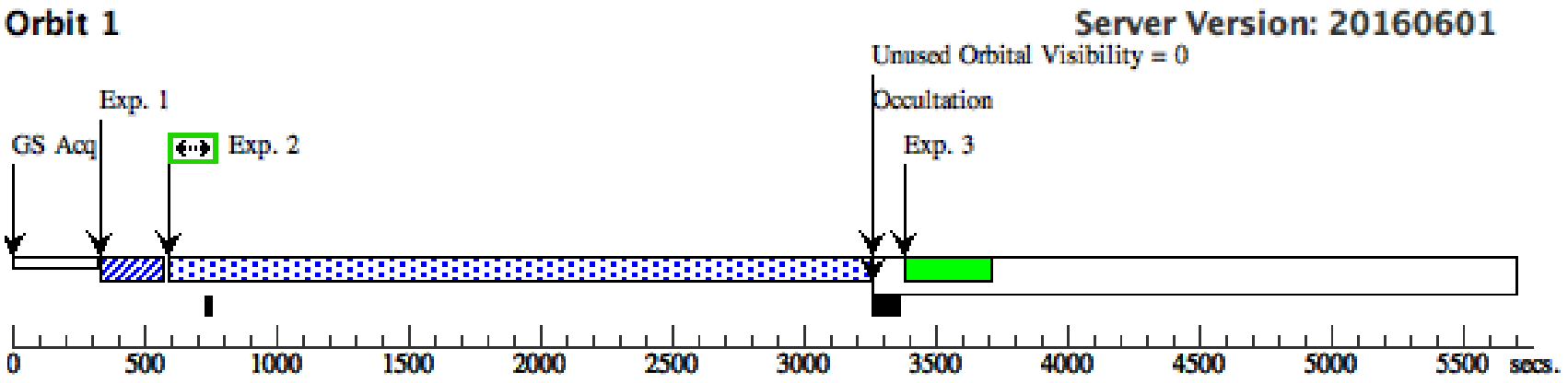
#	Name	Target Coordinates	Targ. Coord. Corrections	Fluxes	Miscellaneous
(3)	WD0621-376	RA: 06 23 12.6080 (95.8025333d)	Proper Motion RA: +64.7 mas/yr	V=12.42	Reference Frame: ICRS
	Alt Name1: REJ0623-374	Dec: -37 41 27.96 (-37.69110d)	Proper Motion Dec: -3.7 mas/yr	IUE fluxes: 9E-12 @ 130 nm,	
		Equinox: J2000	Parallax: 0."	7E-12 @ 140nm	
			Epoch of Position: 2000		
			Radial Velocity: 0. km/sec		

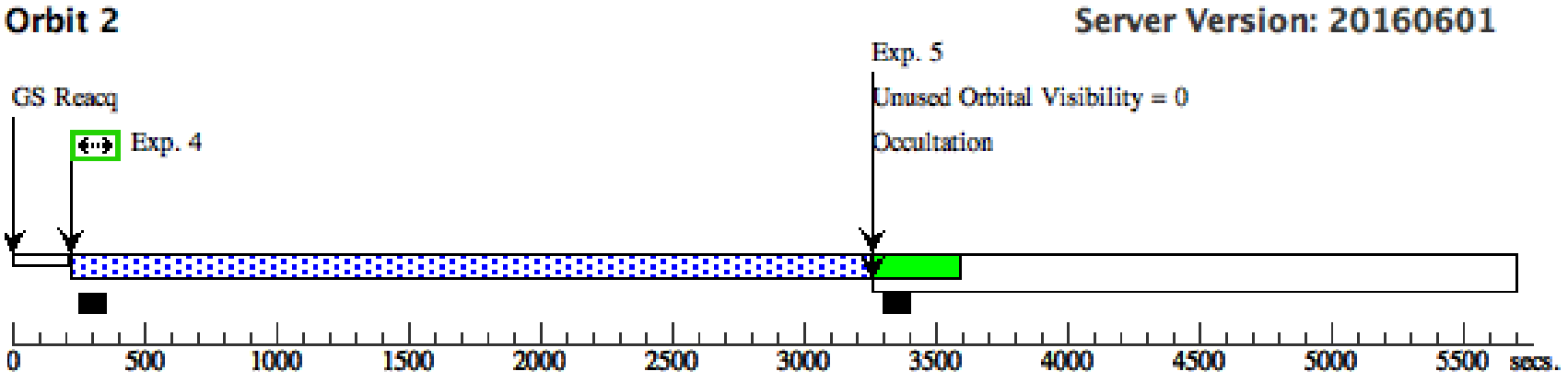
Comments: ICRS coordinates and proper motions from SIMBAD; verified against 2MASS coordinates (epoch 1999.88)

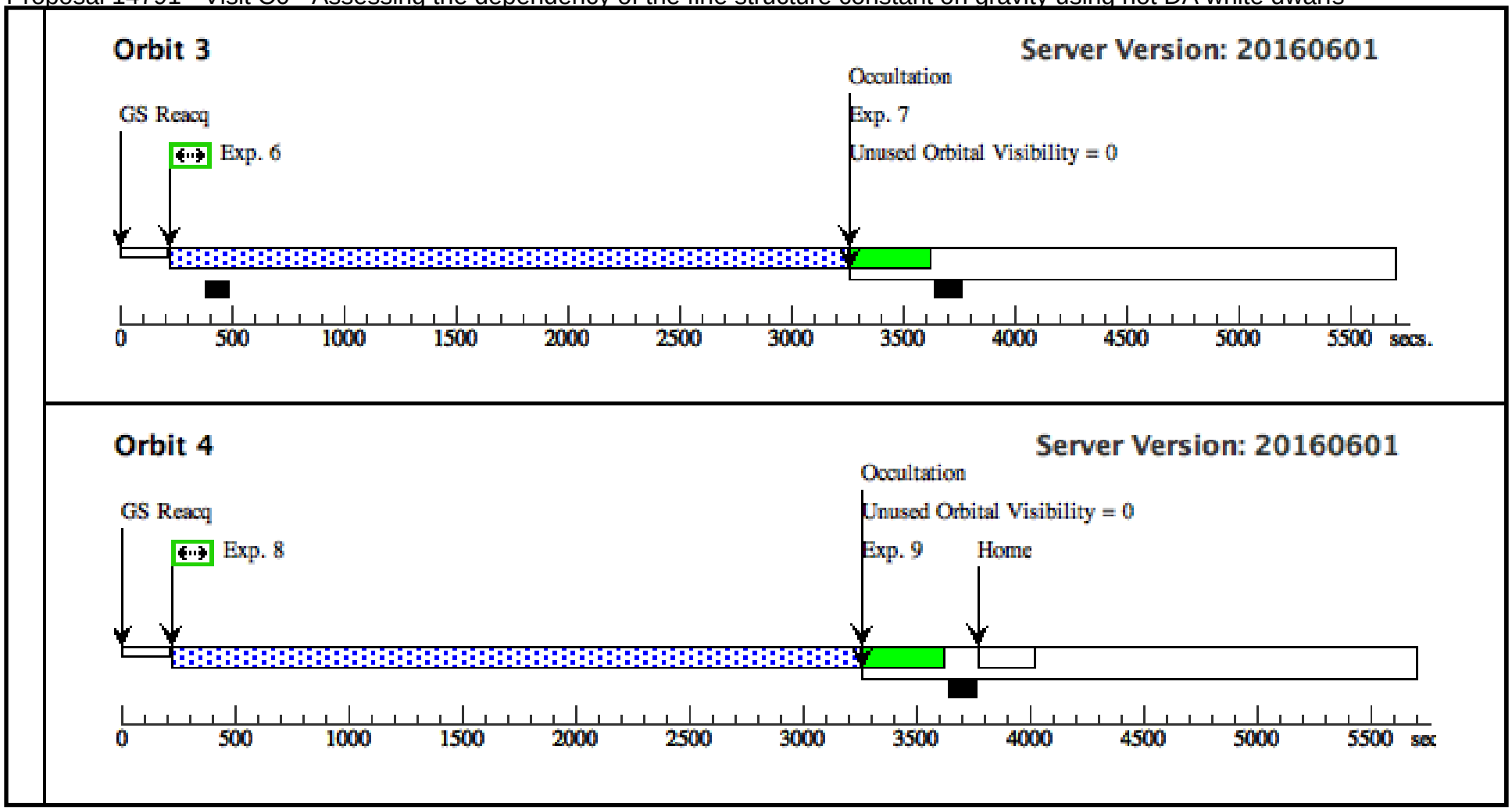
Exposures

#	Label (ETC Run)	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time (Total)/[Actual Dur.]	Orbit
1	(STIS.ta.826540)	(3) WD0621-376	STIS/CCD, ACQ, 50CCD	MIRROR				0.1 Secs (0.1 Secs)	
								[==>]	***[1]***
Comments: time to saturation 1.0s; SNR= 148									
2	(STIS.sp.824879)	(3) WD0621-376	STIS/FUV-MAMA, ACCUM, 0.2X0.2	E140H 1307 A	WAVECAL=NO		Sequence 2-3 Non-Int in Visit C0	2525 Secs (2525 Secs)	
								[==>]	***[1]***
3		NONE	STIS/FUV-MAMA, ACCUM, 0.2X0.09	E140H 1307 A	LAMP=LINE	QESIPARM TARG TYPE HITM2	Sequence 2-3 Non-Int in Visit C0	300 Secs (300 Secs)	
								[==>]	***[1]***
4	(STIS.sp.824879)	(3) WD0621-376	STIS/FUV-MAMA, ACCUM, 0.2X0.2	E140H 1307 A	WAVECAL=NO		Sequence 4-5 Non-Int in Visit C0	3002 Secs (3002 Secs)	
								[==>]	***[2]***
5		NONE	STIS/FUV-MAMA, ACCUM, 0.2X0.09	E140H 1307 A	LAMP=LINE	QESIPARM TARG TYPE HITM2	Sequence 4-5 Non-Int in Visit C0	300 Secs (300 Secs)	
								[==>]	***[2]***
6	(STIS.sp.825370)	(3) WD0621-376	STIS/FUV-MAMA, ACCUM, 0.2X0.2	E140H 1416 A	WAVECAL=NO		Sequence 6-7 Non-Int in Visit C0	2881 Secs (2881 Secs)	
								[==>]	***[3]***
7		WAVE	STIS/FUV-MAMA, ACCUM, 0.2X0.09	E140H 1416 A			Sequence 6-7 Non-Int in Visit C0	300 Secs (300 Secs)	
								[==>]	***[3]***
8	(STIS.sp.825370)	(3) WD0621-376	STIS/FUV-MAMA, ACCUM, 0.2X0.2	E140H 1416 A	WAVECAL=NO		Sequence 8-9 Non-Int in Visit C0	3002 Secs (3002 Secs)	
								[==>]	***[4]***
9		WAVE	STIS/FUV-MAMA, ACCUM, 0.2X0.09	E140H 1416 A			Sequence 8-9 Non-Int in Visit C0	300 Secs (300 Secs)	
								[==>]	***[4]***

Orbit Structure



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Orbit 4
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GS Reacq
Unused Orbital Visibility = 0
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sec

Visit

Proposal 14791, Visit D0, implementation Wed Sep 07 22:36:42 GMT 2016

Diagnostic Status: No Diagnostics

Scientific Instruments: STIS/CCD, STIS/FUV-MAMA

Special Requirements: (none)

Fixed Targets

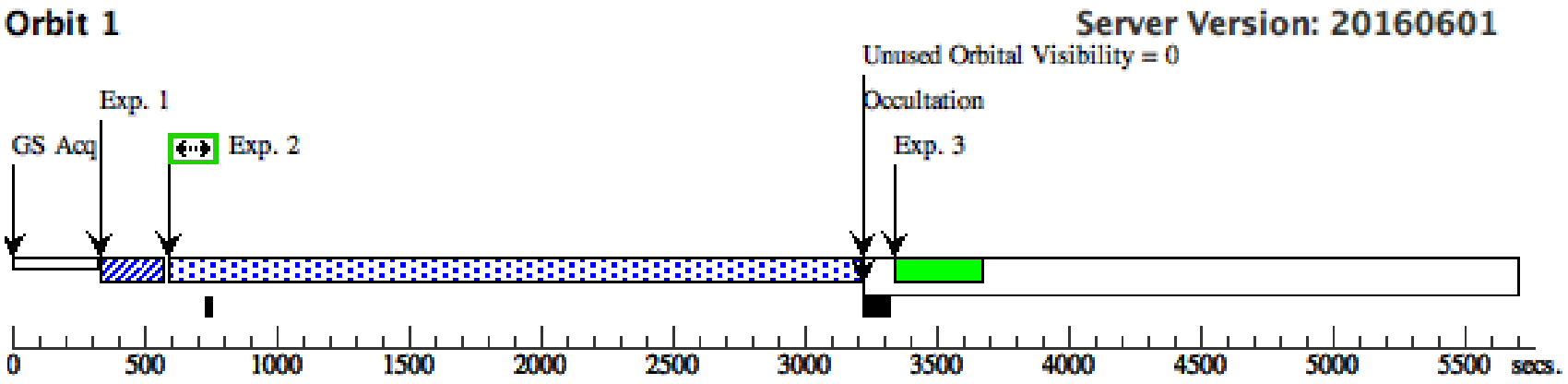
#	Name	Target Coordinates	Targ. Coord. Corrections	Fluxes	Miscellaneous
(4)	WD0455-282	RA: 04 57 13.3180 (74.3054917d) Dec: -28 07 52.74 (-28.13132d) Equinox: J2000	Proper Motion RA: +52.5 mas/yr Proper Motion Dec: +10.2 mas/yr Parallax: 0." Epoch of Position: 2000 Radial Velocity: 0. km/sec	V=13.92 IUE fluxes: 1.6E-12 @ 130 nm, 1.2E-12 @ 140nm	Reference Frame: ICRS

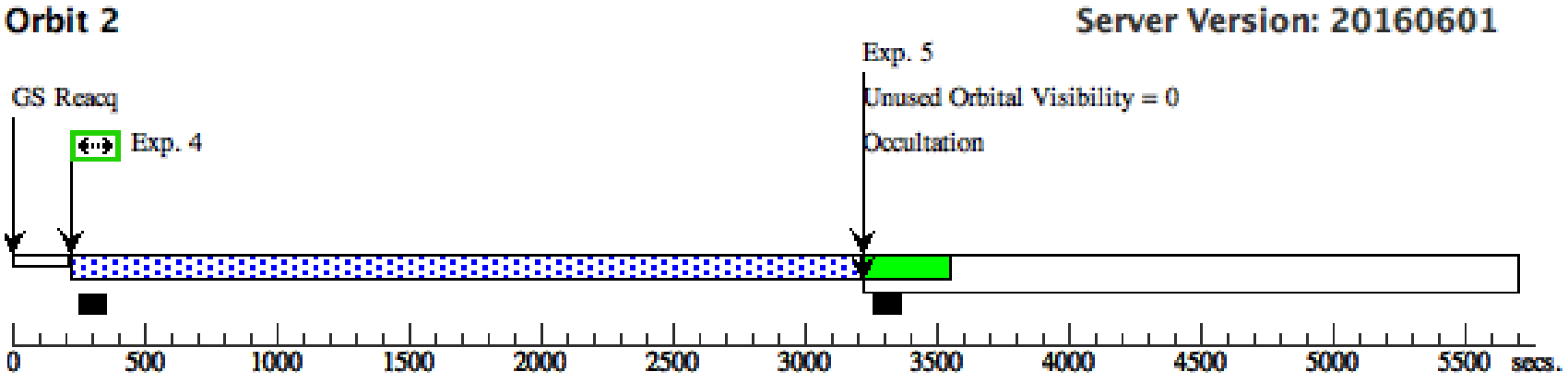
Comments: ICRS coordinates and proper motions from SIMBAD; verified against 2MASS coordinates (epoch 1998.98)

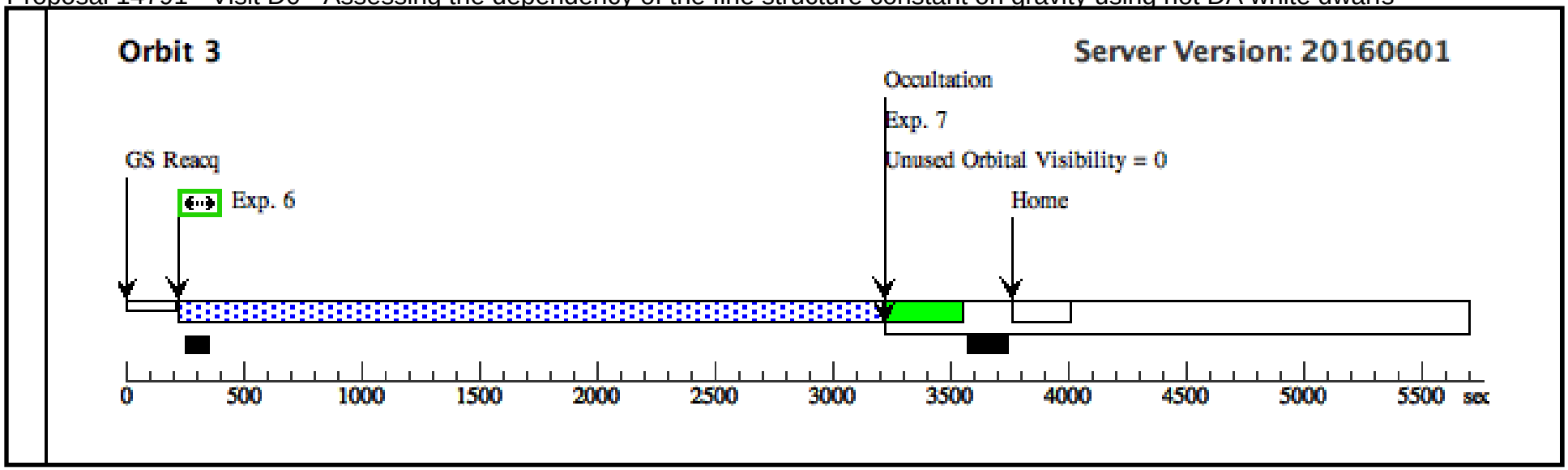
Exposures

#	Label (ETC Run)	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time (Total)/[Actual Dur.]	Orbit
1	(STIS.ta.826541)	(4) WD0455-282	STIS/CCD, ACQ, 50CCD	MIRROR				0.1 Secs (0.1 Secs) *[==>]*	 ***[1]***
Comments: time to saturation 4.0s; SNR= 71									
2	(STIS.sp.824875)	(4) WD0455-282	STIS/FUV-MAMA, ACCUM, 0.2X0.2	E140H 1307 A	WAVECAL=NO		Sequence 2-3 Non-In t in Visit D0	2487 Secs (2487 Secs) *[==>]*	 ***[1]***
3		NONE	STIS/FUV-MAMA, ACCUM, 0.2X0.09	E140H 1307 A	LAMP=LINE	QESIPARM TARG TYPE HITM2	Sequence 2-3 Non-In t in Visit D0	300 Secs (300 Secs) *[==>]*	 ***[1]***
4	(STIS.sp.824875)	(4) WD0455-282	STIS/FUV-MAMA, ACCUM, 0.2X0.2	E140H 1307 A	WAVECAL=NO		Sequence 4-5 Non-In t in Visit D0	2964 Secs (2964 Secs) *[==>]*	 ***[2]***
5		NONE	STIS/FUV-MAMA, ACCUM, 0.2X0.09	E140H 1307 A	LAMP=LINE	QESIPARM TARG TYPE HITM2	Sequence 4-5 Non-In t in Visit D0	300 Secs (300 Secs) *[==>]*	 ***[2]***
6	(STIS.sp.824875)	(4) WD0455-282	STIS/FUV-MAMA, ACCUM, 0.2X0.2	E140H 1307 A	WAVECAL=NO		Sequence 6-7 Non-In t in Visit D0	2964 Secs (2964 Secs) *[==>]*	 ***[3]***
7		NONE	STIS/FUV-MAMA, ACCUM, 0.2X0.09	E140H 1307 A	LAMP=LINE	QESIPARM TARG TYPE HITM2	Sequence 6-7 Non-In t in Visit D0	300 Secs (300 Secs) *[==>]*	 ***[3]***

Orbit Structure



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Exp. 6
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4500
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5500
sec

Visit

Proposal 14791, Visit D1, implementation Wed Sep 07 22:36:42 GMT 2016

Diagnostic Status: No Diagnostics

Scientific Instruments: STIS/CCD, STIS/FUV-MAMA

Special Requirements: (none)

Fixed Targets

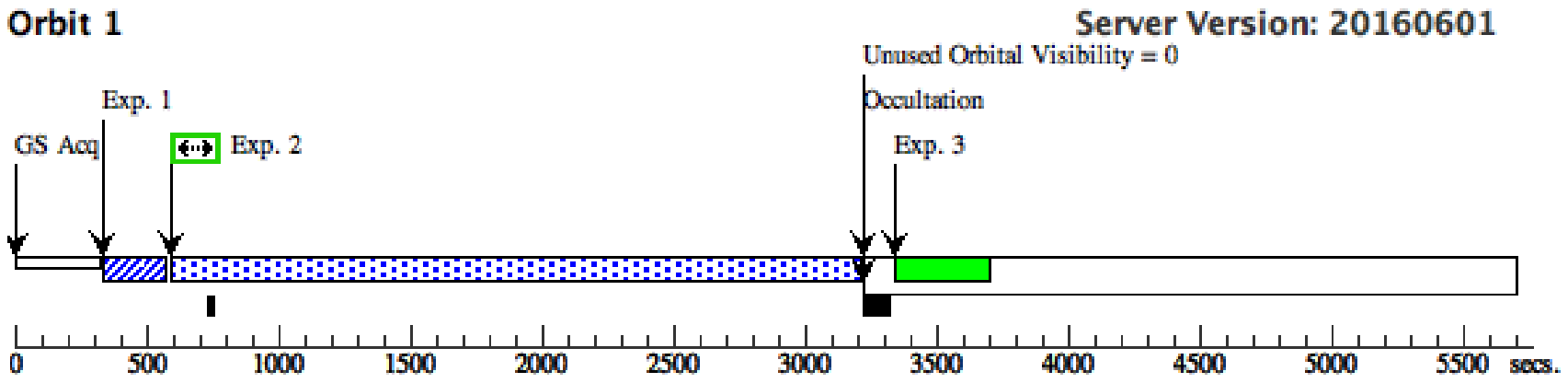
#	Name	Target Coordinates	Targ. Coord. Corrections	Fluxes	Miscellaneous
(4)	WD0455-282	RA: 04 57 13.3180 (74.3054917d) Dec: -28 07 52.74 (-28.13132d) Equinox: J2000	Proper Motion RA: +52.5 mas/yr Proper Motion Dec: +10.2 mas/yr Parallax: 0." Epoch of Position: 2000 Radial Velocity: 0. km/sec	V=13.92 IUE fluxes: 1.6E-12 @ 130 nm, 1.2E-12 @ 140nm	Reference Frame: ICRS

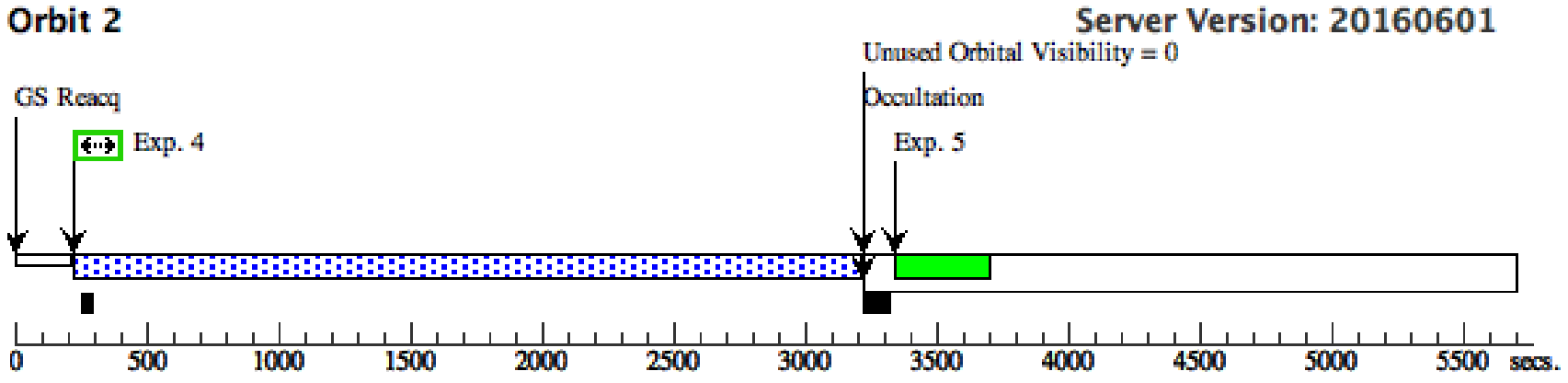
Comments: ICRS coordinates and proper motions from SIMBAD; verified against 2MASS coordinates (epoch 1998.98)

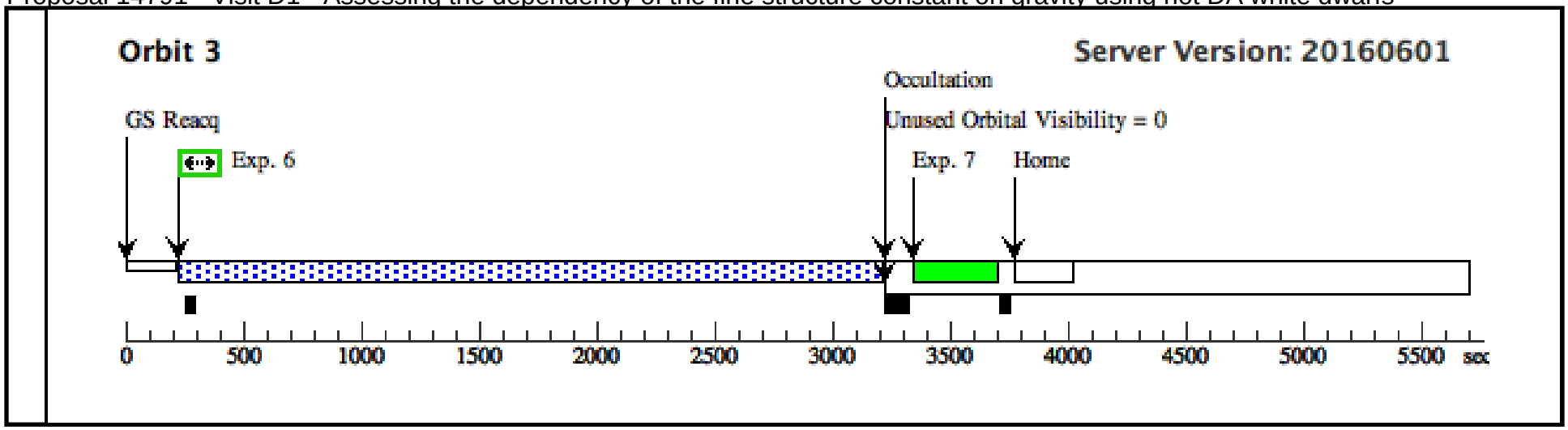
Exposures

#	Label (ETC Run)	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time (Total)/[Actual Dur.]	Orbit
1	(STIS.ta.826541)	(4) WD0455-282	STIS/CCD, ACQ, 50CCD	MIRROR				0.1 Secs (0.1 Secs) *[==>]*	 ***[1]***
Comments: time to saturation 4.0s; SNR= 71									
2	(STIS.sp.825369)	(4) WD0455-282	STIS/FUV-MAMA, ACCUM, 0.2X0.2	E140H 1416 A	WAVECAL=NO		Sequence 2-3 Non-Int in Visit D1	2487 Secs (2487 Secs) *[==>]*	 ***[1]***
3		WAVE	STIS/FUV-MAMA, ACCUM, 0.2X0.09	E140H 1416 A			Sequence 2-3 Non-Int in Visit D1	300 Secs (300 Secs) *[==>]*	 ***[1]***
4	(STIS.sp.825369)	(4) WD0455-282	STIS/FUV-MAMA, ACCUM, 0.2X0.2	E140H 1416 A	WAVECAL=NO		Sequence 4-5 Non-Int in Visit D1	2964 Secs (2964 Secs) *[==>]*	 ***[2]***
5		WAVE	STIS/FUV-MAMA, ACCUM, 0.2X0.09	E140H 1416 A			Sequence 4-5 Non-Int in Visit D1	300 Secs (300 Secs) *[==>]*	 ***[2]***
6	(STIS.sp.825369)	(4) WD0455-282	STIS/FUV-MAMA, ACCUM, 0.2X0.2	E140H 1416 A	WAVECAL=NO		Sequence 6-7 Non-Int in Visit D1	2964 Secs (2964 Secs) *[==>]*	 ***[3]***
7		WAVE	STIS/FUV-MAMA, ACCUM, 0.2X0.09	E140H 1416 A			Sequence 6-7 Non-Int in Visit D1	300 Secs (300 Secs) *[==>]*	 ***[3]***

Orbit Structure



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