



17157 - Observing the Overlooked Double Lyman-alpha Transit of HD 189733 b to Break Mass Loss Rate Degeneracies

Cycle: 30, Proposal Category: GO

(UV Initiative)

(Availability Mode: SUPPORTED)

INVESTIGATORS

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VISITS

<i>Visit</i>	<i>Targets used in Visit</i>	<i>Configurations used in Visit</i>	<i>Orbits Used</i>	<i>Last Orbit Planner Run</i>	<i>OP Current with Visit?</i>
01	(1) HD-189733 WAVE	STIS/CCD STIS/FUV-MAMA	2	17-Nov-2022 10:00:20.0	yes
02	(1) HD-189733 WAVE	STIS/CCD STIS/FUV-MAMA	5	17-Nov-2022 10:00:22.0	yes
03	(1) HD-189733 WAVE	STIS/CCD STIS/FUV-MAMA	2	17-Nov-2022 10:00:23.0	yes

<i>Visit</i>	<i>Targets used in Visit</i>	<i>Configurations used in Visit</i>	<i>Orbits Used</i>	<i>Last Orbit Planner Run</i>	<i>OP Current with Visit?</i>
04	(1) HD-189733 WAVE	STIS/CCD STIS/FUV-MAMA	5	17-Nov-2022 10:00:25.0	yes

14 Total Orbits Used

ABSTRACT

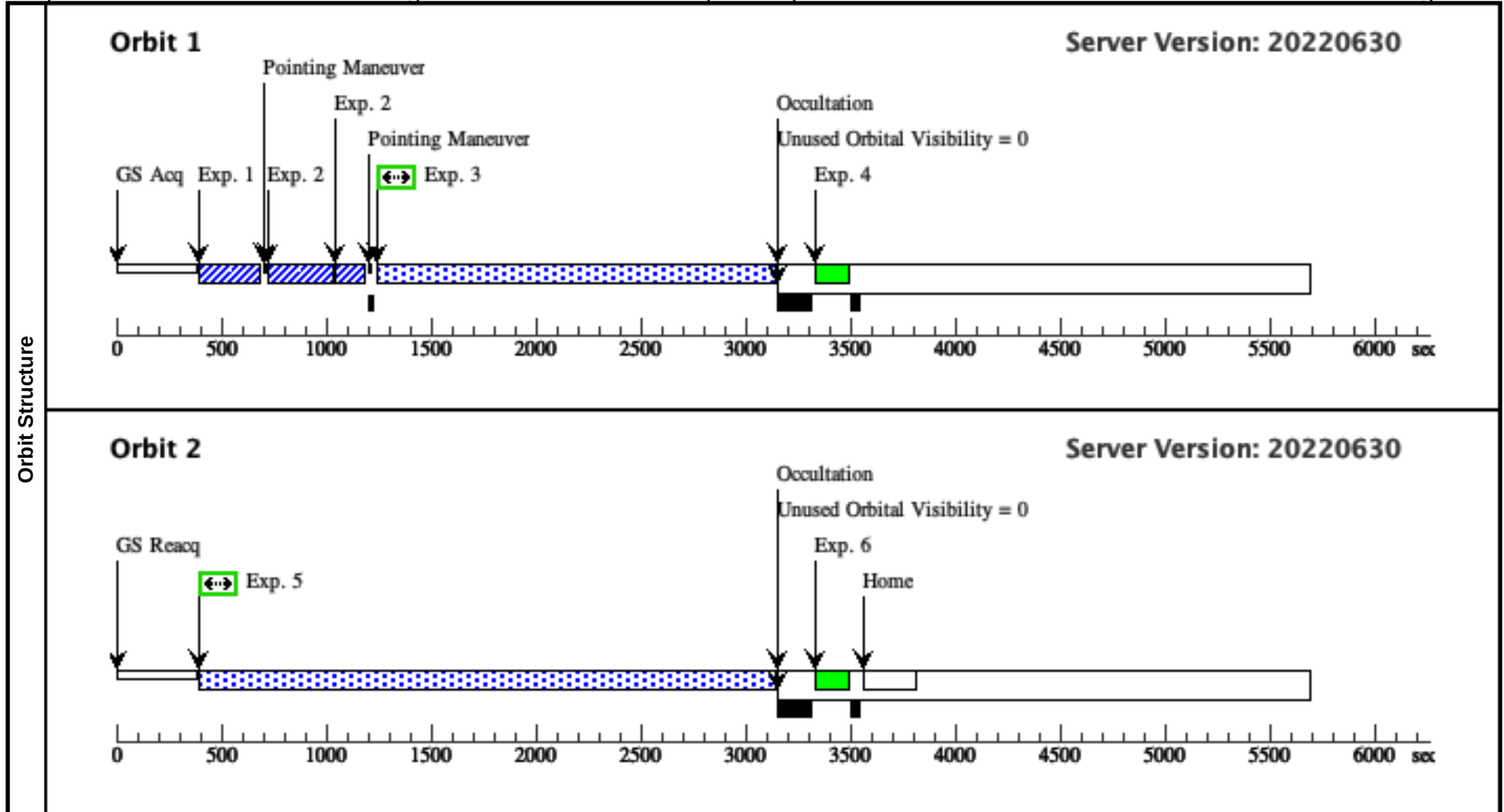
Lyman-alpha transits provide a window into atmospheric escape, a process that has observably shaped the exoplanet population. However, mass loss estimates from these observations are highly model dependent. A recently predicted feature of hot Jupiter transits could begin dismantling this model dependence: the delayed transit of the outflow tail. These transits have been hiding in plain sight, just slightly beyond the primary transits sampled by past Lyman-alpha transit observations. Critically, the plasma causing this delayed transit will have reached ionization equilibrium. Knowing the plasma's ionization state eliminates a confounding factor from the interpretation of the transit signal, enabling a stronger link between the observations and the rate and efficiency of the planet's mass loss. This program will observe the delayed transit from the outflow tail of HD 189733 b, a planet with a well-established primary Lyman-alpha transit. The outcome will be an improved measurement of HD 189733 b's mass loss rate and efficiency, with broader implications for mass loss across the population of exoplanets.

OBSERVING DESCRIPTION

We will conduct all observations with STIS G140M/1222, a configuration with extensive heritage that limits contamination by geocoronal Ly α airglow. HD 189733 has already been extensively observed in Ly α with this mode. To measure the tail transit, we will stagger two five-orbit visits. To guard against evolution in the out-of-transit Ly α flux between these sets, we will conduct two-orbit pre-transit visits approximately 24 or 48~h (again, timing limited by SAA passages) ahead of each 5-orbit transit visit.

Proposal 17157 - Visit 01 - Observing the Overlooked Double Lyman-alpha Transit of HD 189733 b to Break Mass Loss Rate Degener...

Visit	Proposal 17157, Visit 01, implementation										Thu Nov 17 15:00:26 GMT 2022
	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)	HD-189733	RA: 20 00 43.7092 (300.1821217d) Dec: +22 42 35.07 (22.70974d) Equinox: J2000	Proper Motion RA: -3.208339784864691 mas/yr Proper Motion Dec: -250.32333085817578 mas/yr Parallax: 0.05056684941372739" Epoch of Position: 2016.0		V=7.648		Reference Frame: ICRS			
	Comments:										
	Category=STAR Description=[EXTRA-SOLAR PLANET, EXTRA-SOLAR PLANETARY SYSTEM, K V-IV] Extended=NO										
Exposures	#	Label (ETC Run)	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time (Total)/[Actual Dur.]		Orbit
	1	(STIS.ta.181 0029)	(1) HD-189733	STIS/CCD, ACQ, F25ND3	MIRROR				1.0 Secs (1 Secs)		
									[==>]		[1]
	2	(STIS.ta.181 0033)	(1) HD-189733	STIS/CCD, ACQ/PEAK, 0.2X0.05ND	MIRROR				1.0 Secs (1 Secs)		
									[==>]		[1]
	3	(STIS.sp.18 10025)	(1) HD-189733	STIS/FUV-MAMA, TIME-TAG, 52X0.5	G140M 1222 A	BUFFER-TIME=45 10;			1500 Secs (1700 Secs)		
							WAVECAL=NO		[==>1700.0 Secs]		[1]
	4		WAVE	STIS/FUV-MAMA, ACCUM, 52X0.1	G140M 1222 A				[==>]		[1]
	5	(STIS.sp.18 10025)	(1) HD-189733	STIS/FUV-MAMA, TIME-TAG, 52X0.5	G140M 1222 A	BUFFER-TIME=45 10;			2000 Secs (2689 Secs)		
							WAVECAL=NO		[==>2689.0 Secs]		[2]
	6		WAVE	STIS/FUV-MAMA, ACCUM, 52X0.1	G140M 1222 A				[==>]		[2]

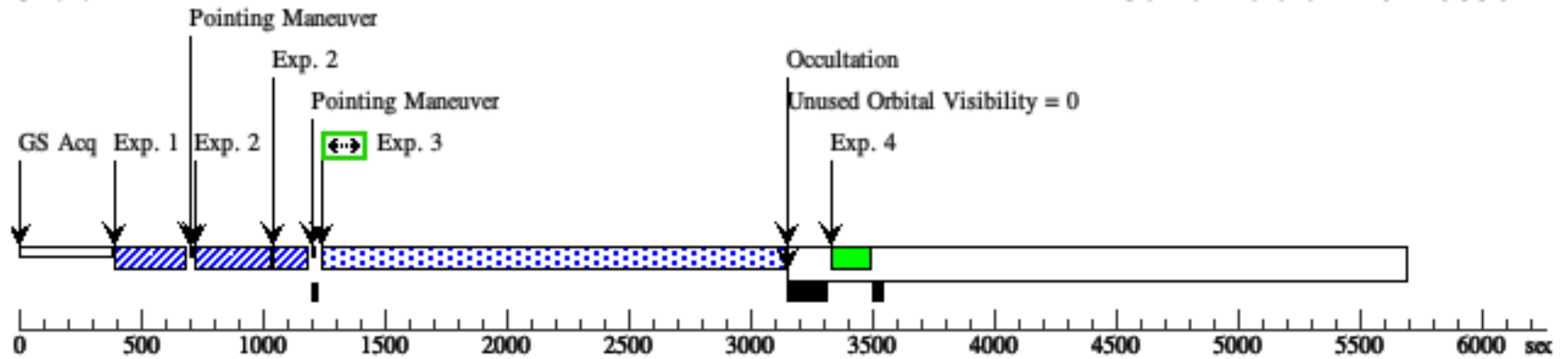


Proposal 17157 - Visit 02 - Observing the Overlooked Double Lyman-alpha Transit of HD 189733 b to Break Mass Loss Rate Degener...

Visit	Proposal 17157, Visit 02, implementation								Thu Nov 17 15:00:26 GMT 2022		
	Diagnostic Status: No Diagnostics										
	Scientific Instruments: STIS/CCD, STIS/FUV-MAMA										
	Special Requirements: AFTER 01 BY 0.5 D TO 1.5 D; Period 2.21857519 D AND ZERO-PHASE HJD2454403.677711										
Fixed Targets	#	Name	Target Coordinates	Targ. Coord. Corrections		Fluxes		Miscellaneous			
	(1)	HD-189733	RA: 20 00 43.7092 (300.1821217d) Dec: +22 42 35.07 (22.70974d) Equinox: J2000	Proper Motion RA: -3.208339784864691 mas/yr Proper Motion Dec: -250.32333085817578 mas/yr Parallax: 0.05056684941372739" Epoch of Position: 2016.0		V=7.648		Reference Frame: ICRS			
	Comments: Category=STAR Description=[EXTRA-SOLAR PLANET, EXTRA-SOLAR PLANETARY SYSTEM, K V-IV] Extended=NO										
Exposures	#	Label (ETC Run)	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time (Total)/[Actual Dur.]		Orbit
	1	(STIS.ta.181 0029)	(1) HD-189733	STIS/CCD, ACQ, F25ND3	MIRROR		PHASE 0.05634246 725710477 TO 0.093 90411209517462		1.0 Secs (1 Secs) [==>]		[1]
	2	(STIS.ta.181 0033)	(1) HD-189733	STIS/CCD, ACQ/PEAK, 0.2X0.05ND	MIRROR				1.0 Secs (1 Secs) [==>]		[1]
	3	(STIS.sp.18 10025)	(1) HD-189733	STIS/FUV-MAMA, TIME-TAG, 52X0.5	G140M 1222 A	BUFFER-TIME=45 10; WAVECAL=NO			1500 Secs (1700 Secs) [==>1700.0 Secs]		[1]
	4		WAVE	STIS/FUV-MAMA, ACCUM, 52X0.1	G140M 1222 A				[==>]		[1]
	5	(STIS.sp.18 10025)	(1) HD-189733	STIS/FUV-MAMA, TIME-TAG, 52X0.5	G140M 1222 A	BUFFER-TIME=45 10; WAVECAL=NO			2000 Secs (2689 Secs) [==>2689.0 Secs]		[2]
	6		WAVE	STIS/FUV-MAMA, ACCUM, 52X0.1	G140M 1222 A				[==>]		[2]
	7	(STIS.sp.18 10025)	(1) HD-189733	STIS/FUV-MAMA, TIME-TAG, 52X0.5	G140M 1222 A	BUFFER-TIME=45 10; WAVECAL=NO			2000 Secs (2689 Secs) [==>2689.0 Secs]		[3]
	8		WAVE	STIS/FUV-MAMA, ACCUM, 52X0.1	G140M 1222 A				[==>]		[3]
	9	(STIS.sp.18 10025)	(1) HD-189733	STIS/FUV-MAMA, TIME-TAG, 52X0.5	G140M 1222 A	BUFFER-TIME=45 10; WAVECAL=NO			2000 Secs (2689 Secs) [==>2689.0 Secs]		[4]
	10		WAVE	STIS/FUV-MAMA, ACCUM, 52X0.1	G140M 1222 A				[==>]		[4]
	11	(STIS.sp.18 10025)	(1) HD-189733	STIS/FUV-MAMA, TIME-TAG, 52X0.5	G140M 1222 A	BUFFER-TIME=45 10; WAVECAL=NO			2000 Secs (2689 Secs) [==>2689.0 Secs]		[5]
	12		WAVE	STIS/FUV-MAMA, ACCUM, 52X0.1	G140M 1222 A				[==>]		[5]

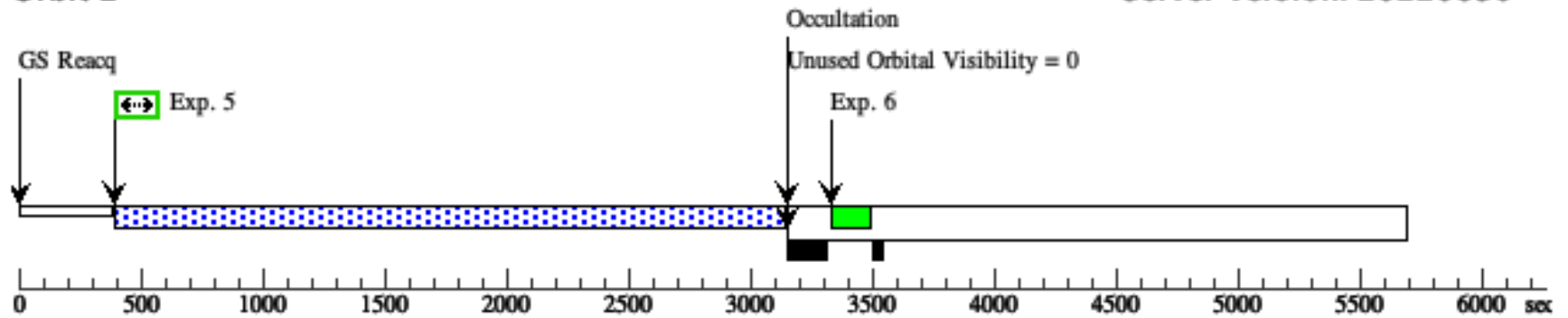
Orbit 1

Server Version: 20220630



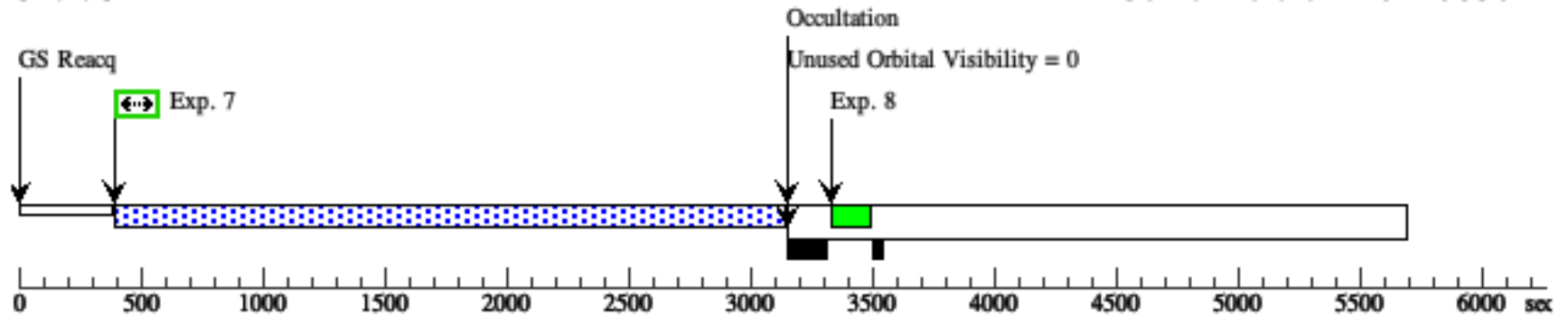
Orbit 2

Server Version: 20220630



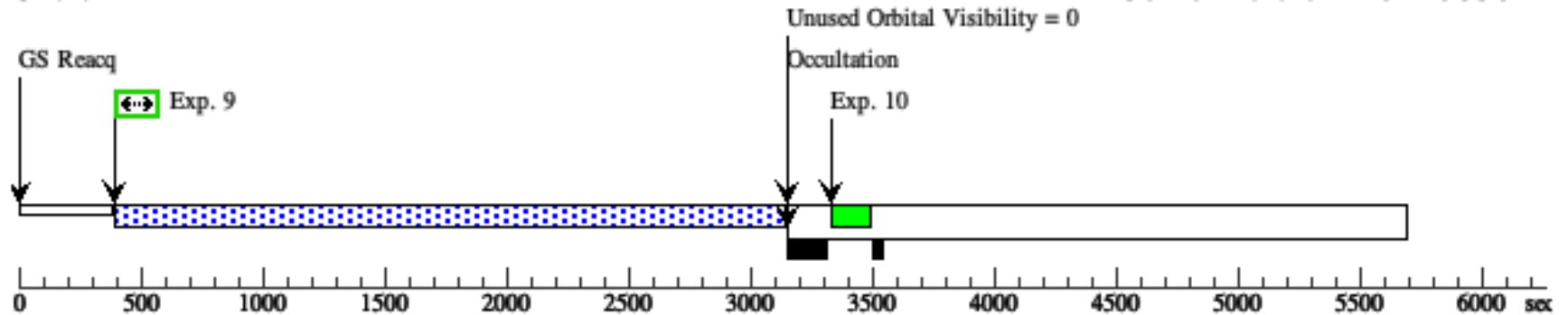
Orbit 3

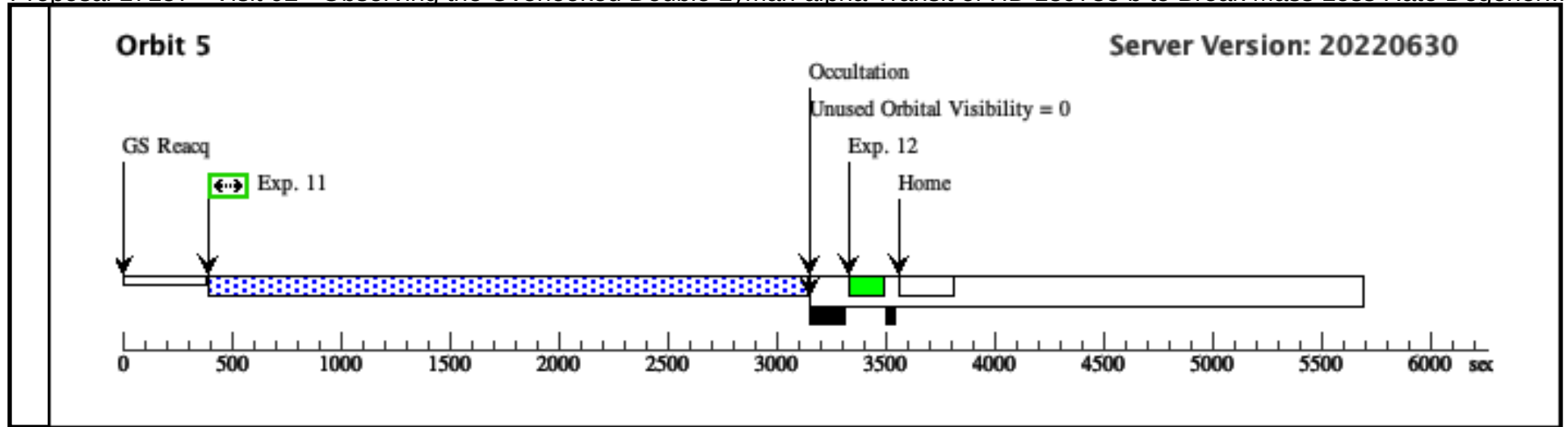
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Orbit 4

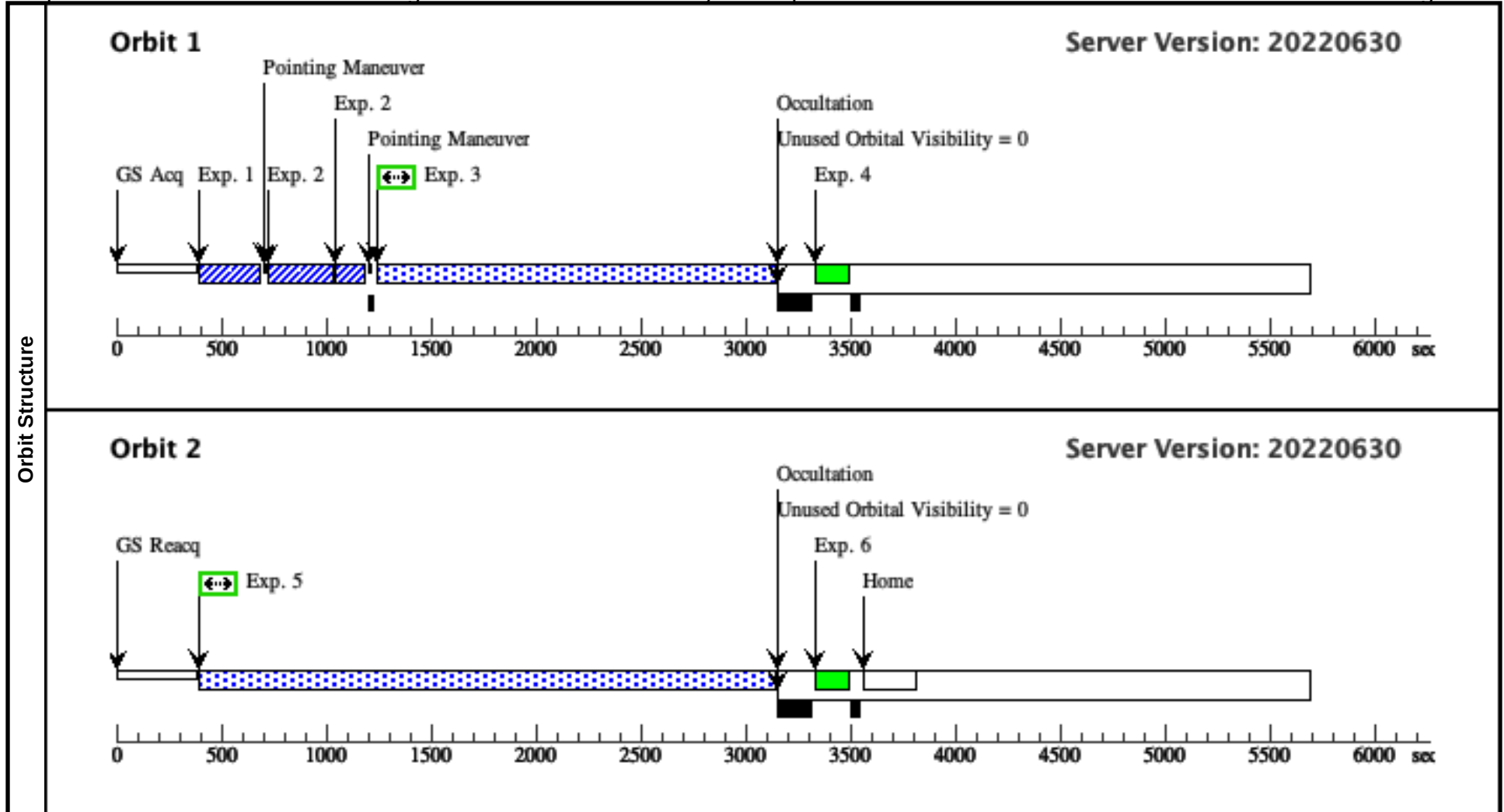
Server Version: 20220630





Proposal 17157 - Visit 03 - Observing the Overlooked Double Lyman-alpha Transit of HD 189733 b to Break Mass Loss Rate Degener...

Visit	Proposal 17157, Visit 03, implementation										Thu Nov 17 15:00:26 GMT 2022
	Diagnostic Status: No Diagnostics										
	Scientific Instruments: STIS/CCD, STIS/FUV-MAMA										
	Special Requirements: AFTER 02 BY 0.5 D TO 1.5 D										
Fixed Targets	#	Name	Target Coordinates	Targ. Coord. Corrections		Fluxes		Miscellaneous			
	(1)	HD-189733	RA: 20 00 43.7092 (300.1821217d) Dec: +22 42 35.07 (22.70974d) Equinox: J2000	Proper Motion RA: -3.208339784864691 mas/yr Proper Motion Dec: -250.32333085817578 mas/yr Parallax: 0.05056684941372739" Epoch of Position: 2016.0		V=7.648		Reference Frame: ICRS			
	Comments:										
	Category=STAR Description=[EXTRA-SOLAR PLANET, EXTRA-SOLAR PLANETARY SYSTEM, K V-IV] Extended=NO										
Exposures	#	Label (ETC Run)	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time (Total)/[Actual Dur.]		Orbit
	1	(STIS.ta.181 0029)	(1) HD-189733	STIS/CCD, ACQ, F25ND3	MIRROR				1.0 Secs (1 Secs) [==>]		[1]
	2	(STIS.ta.181 0033)	(1) HD-189733	STIS/CCD, ACQ/PEAK, 0.2X0.05ND	MIRROR				1.0 Secs (1 Secs) [==>]		[1]
	3	(STIS.sp.18 10025)	(1) HD-189733	STIS/FUV-MAMA, TIME-TAG, 52X0.5	G140M 1222 A	BUFFER-TIME=45 10;			1500 Secs (1700 Secs) [==>1700.0 Secs]		[1]
	4		WAVE	STIS/FUV-MAMA, ACCUM, 52X0.1	G140M 1222 A				[==>]		[1]
	5	(STIS.sp.18 10025)	(1) HD-189733	STIS/FUV-MAMA, TIME-TAG, 52X0.5	G140M 1222 A	BUFFER-TIME=45 10;			2000 Secs (2689 Secs) [==>2689.0 Secs]		[2]
	6		WAVE	STIS/FUV-MAMA, ACCUM, 52X0.1	G140M 1222 A				[==>]		[2]

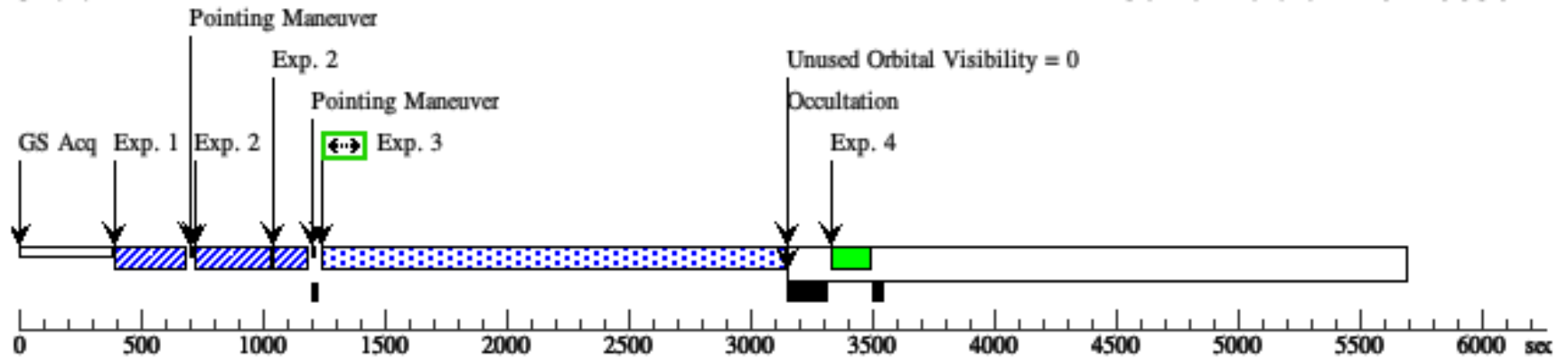


Proposal 17157 - Visit 04 - Observing the Overlooked Double Lyman-alpha Transit of HD 189733 b to Break Mass Loss Rate Degener...

Visit	Proposal 17157, Visit 04, implementation								Thu Nov 17 15:00:26 GMT 2022	
	Diagnostic Status: No Diagnostics									
	Scientific Instruments: STIS/CCD, STIS/FUV-MAMA									
	Special Requirements: AFTER 03 BY 0.5 D TO 1.5 D; Period 2.21857519 D AND ZERO-PHASE HJD2454403.677711									
Fixed Targets	#	Name	Target Coordinates	Targ. Coord. Corrections	Fluxes	Miscellaneous				
	(1)	HD-189733	RA: 20 00 43.7092 (300.1821217d) Dec: +22 42 35.07 (22.70974d) Equinox: J2000	Proper Motion RA: -3.208339784864691 mas/yr Proper Motion Dec: -250.32333085817578 mas/yr Parallax: 0.05056684941372739" Epoch of Position: 2016.0	V=7.648	Reference Frame: ICRS				
	Comments: Category=STAR Description=[EXTRA-SOLAR PLANET, EXTRA-SOLAR PLANETARY SYSTEM, K V-IV] Extended=NO									
Exposures	#	Label (ETC Run)	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time (Total)/[Actual Dur.]	Orbit
	1	(STIS.ta.181 0029)	(1) HD-189733	STIS/CCD, ACQ, F25ND3	MIRROR		PHASE 0.95782194 33707811 TO 0.9953 83588208851		1.0 Secs (1 Secs) [==>]	[1]
	2	(STIS.ta.181 0033)	(1) HD-189733	STIS/CCD, ACQ/PEAK, 0.2X0.05ND	MIRROR				1.0 Secs (1 Secs) [==>]	[1]
	3	(STIS.sp.18 10025)	(1) HD-189733	STIS/FUV-MAMA, TIME-TAG, 52X0.5	G140M 1222 A	BUFFER-TIME=45 10; WAVECAL=NO			1500 Secs (1700 Secs) [==>1700.0 Secs]	[1]
	4		WAVE	STIS/FUV-MAMA, ACCUM, 52X0.1	G140M 1222 A				[==>]	[1]
	5	(STIS.sp.18 10025)	(1) HD-189733	STIS/FUV-MAMA, TIME-TAG, 52X0.5	G140M 1222 A	BUFFER-TIME=45 10; WAVECAL=NO			2000 Secs (2689 Secs) [==>2689.0 Secs]	[2]
	6		WAVE	STIS/FUV-MAMA, ACCUM, 52X0.1	G140M 1222 A				[==>]	[2]
	7	(STIS.sp.18 10025)	(1) HD-189733	STIS/FUV-MAMA, TIME-TAG, 52X0.5	G140M 1222 A	BUFFER-TIME=45 10; WAVECAL=NO			2000 Secs (2689 Secs) [==>2689.0 Secs]	[3]
	8		WAVE	STIS/FUV-MAMA, ACCUM, 52X0.1	G140M 1222 A				[==>]	[3]
	9	(STIS.sp.18 10025)	(1) HD-189733	STIS/FUV-MAMA, TIME-TAG, 52X0.5	G140M 1222 A	BUFFER-TIME=45 10; WAVECAL=NO			2000 Secs (2689 Secs) [==>2689.0 Secs]	[4]
	10		WAVE	STIS/FUV-MAMA, ACCUM, 52X0.1	G140M 1222 A				[==>]	[4]
	11	(STIS.sp.18 10025)	(1) HD-189733	STIS/FUV-MAMA, TIME-TAG, 52X0.5	G140M 1222 A	BUFFER-TIME=45 10; WAVECAL=NO			2000 Secs (2689 Secs) [==>2689.0 Secs]	[5]
	12		WAVE	STIS/FUV-MAMA, ACCUM, 52X0.1	G140M 1222 A				[==>]	[5]

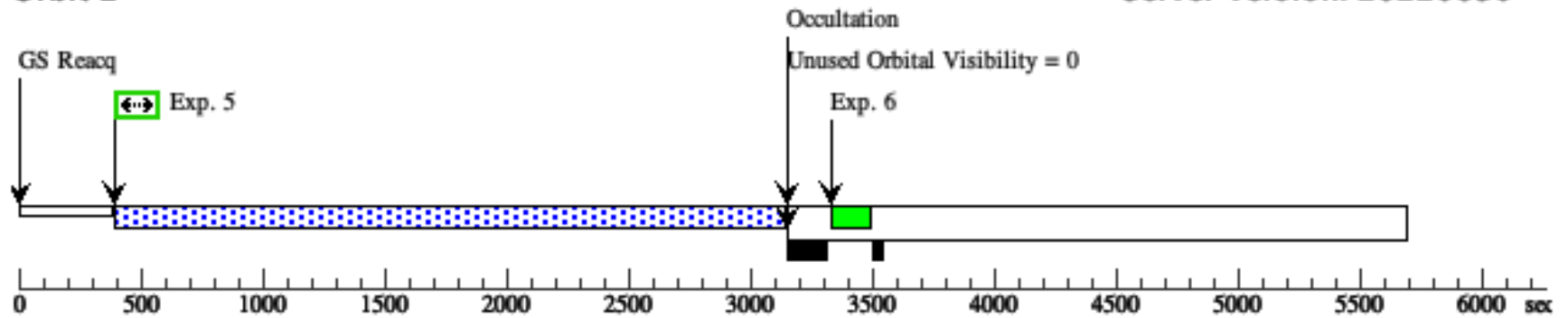
Orbit 1

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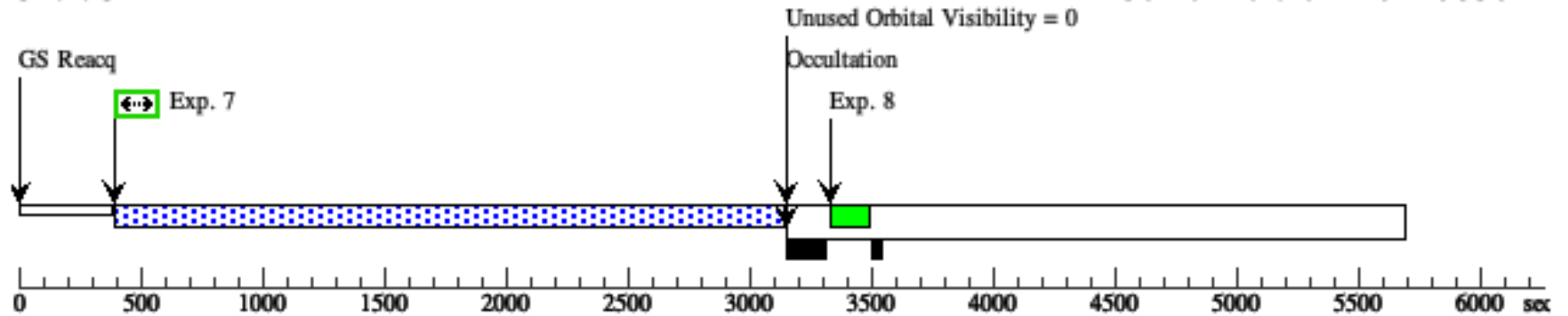
Orbit 2

Server Version: 20220630



Orbit 3

Server Version: 20220630



Orbit 4

Server Version: 20220630

