



16207 - Photochemistry in TESS's first habitable zone terrestrial planet, TOI-700 d

Cycle: 28, 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) UCAC3-49-21611	COS/FUV COS/NUV	2	08-Jan-2021 14:00:17.0	yes
02	(1) UCAC3-49-21611	COS/FUV COS/NUV	2	08-Jan-2021 14:00:18.0	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>
03	(1) UCAC3-49-21611	COS/FUV COS/NUV	3	08-Jan-2021 14:00:19.0	yes
04	(1) UCAC3-49-21611	COS/FUV COS/NUV	4	08-Jan-2021 14:00:20.0	yes
05	(1) UCAC3-49-21611	STIS/CCD STIS/NUV-MAMA	2	08-Jan-2021 14:00:22.0	yes
06	(1) UCAC3-49-21611	STIS/CCD STIS/NUV-MAMA	3	08-Jan-2021 14:00:23.0	yes

16 Total Orbits Used

ABSTRACT

Recently, the TESS spacecraft uncovered an exciting three-planet system that included its first habitable zone terrestrial planet, TOI-700 d. This system orbits an M2V dwarf located 31 pc away from Earth. Previous studies of the TOI-700 system have not included photochemistry, but photochemistry can strongly impact planetary atmospheric composition, habitability, and observable spectral features. A critical input for accurate photochemical modeling of this system is the UV spectrum of the host star, TOI-700. Measured UV spectra of exoplanet host stars have been heavily used for a diverse range of modeling efforts and are a critical in-demand need of the exoplanet community. We will measure the UV spectrum of TOI-700 (1150-5000 Å), use it to update previous modeling efforts of possible atmospheres and spectra of TOI-700 d, and make the spectrum available to the community. This will result in the first self-consistent model atmospheres for TOI-700 d using a 3-D climate model with clouds and atmospheric dynamics coupled to a photochemical and spectral model. We will be able to put this new analysis into the context of previous works considering climatically and photochemically self-consistent atmospheres and spectra of potentially habitable M dwarf planets. TOI-700 will be the earliest M dwarf for which such a study has been performed for a specific known planet and will thus provide a useful point of comparison against potentially habitable worlds around later M dwarfs, including TRAPPIST-1 (M8V). The stellar UV spectrum we measure will also be able to be used in future works considering the atmospheres and spectral features of all planets in the TOI-700 system.

OBSERVING DESCRIPTION

We will obtain a ~1150-5500 Å spectrum of the M2 dwarf TOI-700 (d=31 pc) with the COS and STIS instruments over 15 orbits. The modes used are COS G140L (1121-2148 Å; 10 orbits), STIS G230L (1570-3180 Å; 5 orbits), and STIS G430L (2900-5700 Å; short exposure at the end

Proposal 16207 (STScI Edit Number: 2, Created: Friday, January 8, 2021 at 2:00:24 PM Eastern Standard Time) - Overview

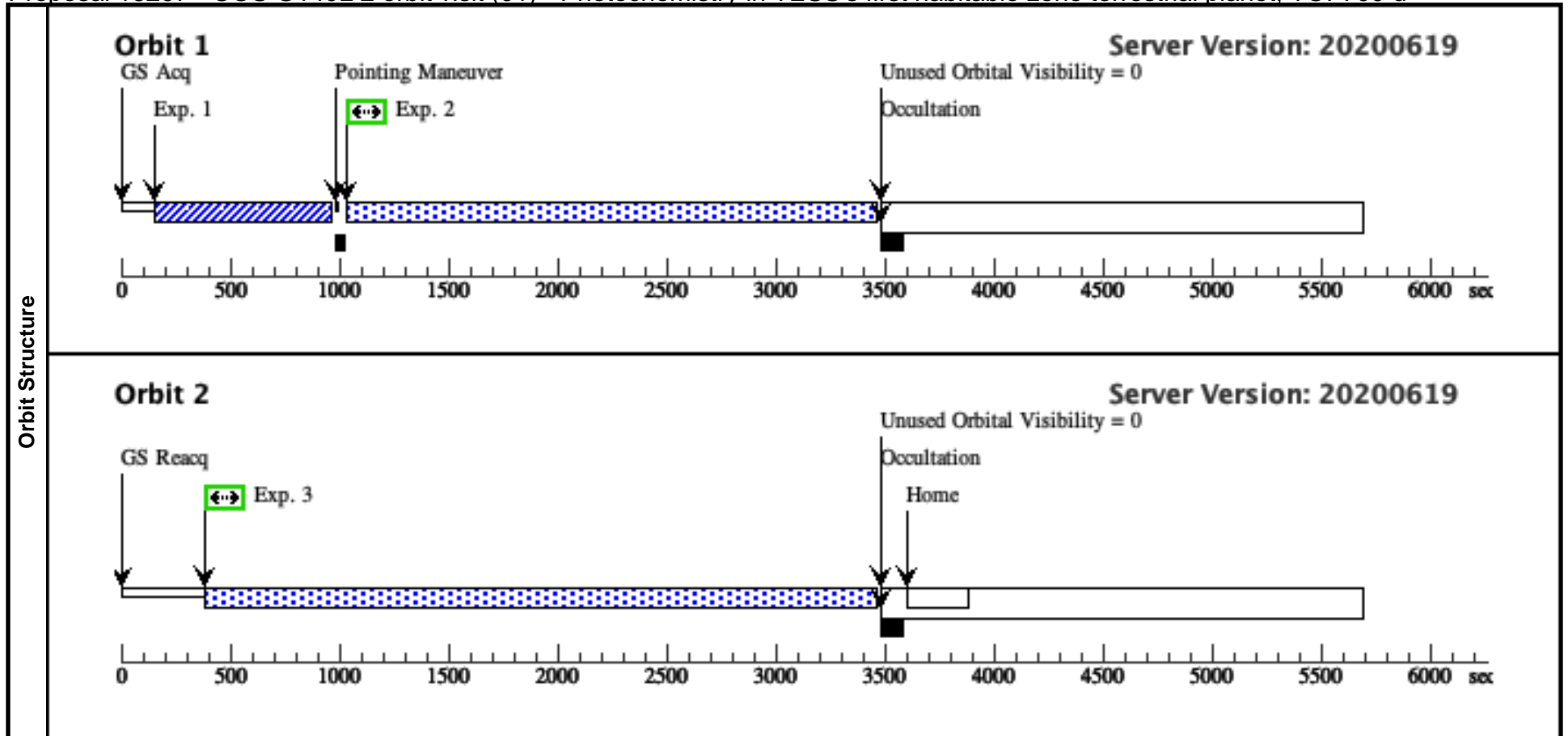
of one of the STIS G230L orbits). All UV MAMA exposures will use TIME-TAG mode to identify any flares. For both STIS gratings, we will use the 52"x0.2" slit, the minimum recommended slit width for accurate absolute flux calibration. For the COS target acquisition, we will forgo the time-intensive ACQ/SEARCH exposure because our target's coordinates are very precise (Gaia DR2). We have constrained our observations to take place within a period of 2 weeks to minimize the effects of stellar variability on the spectrum.

Impact of reduced-gyro operations: low. This program has no orientation constraints, no spatial scans, and lots of orbital visibility in the visit planner. The only constraint we impose that could make scheduling difficult in reduced-gyro mode is that all our visits take place within a period of 2 weeks. This constraint could be relaxed in the event of reduced-gyro operations with only a moderate impact on the science goals.

Proposal 16207 - COS G140L 2 orbit visit (01) - Photochemistry in TESS's first habitable zone terrestrial planet, TOI-700 d

Fri Jan 08 19:00:24 GMT 2021

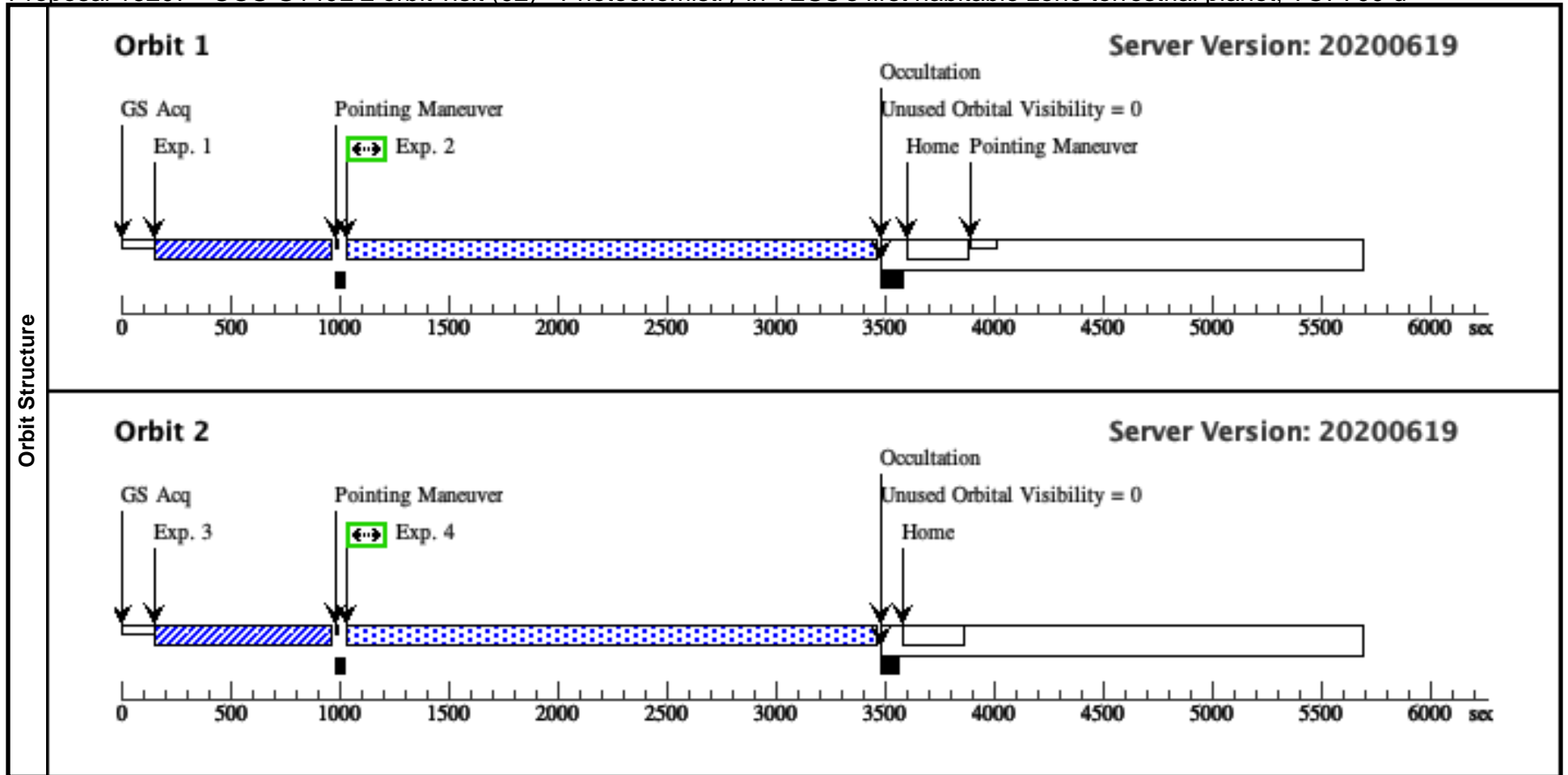
Visit	Proposal 16207, COS G140L 2 orbit visit (01), scheduled Diagnostic Status: No Diagnostics Scientific Instruments: COS/FUV, COS/NUV Special Requirements: GROUP 01,02,03,04,05,06 WITHIN 14D									
	Fixed Targets	#	Name	Target Coordinates	Targ. Coord. Corrections	Fluxes	Miscellaneous			
		(1)	UCAC3-49-21611	RA: 06 28 22.9720 (97.0957167d) Dec: -65 34 43.01 (-65.57861d) Equinox: J2000	Proper Motion RA: -0.016568132424273217 sec of time/yr Proper Motion Dec: 0.161805 arcsec/yr Epoch of Position: 2015.5 Radial Velocity: -5.76 km/sec	V=13.08+/-0.02	Reference Frame: ICRS			
	<i>Comments: This object was generated by the targetselector and retrieved from the SIMBAD database.</i> Category=STAR Description=[EXTRA-SOLAR PLANETARY SYSTEM, M 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	(COS.ta.144 6479)	(1) UCAC3-49-21611	COS/NUV, ACQ/IMAGE, PSA	MIRRORB				258 Secs (258 Secs)	
								[==>]	[1]	
	2	(COS.sp.144 5496)	(1) UCAC3-49-21611	COS/FUV, TIME-TAG, PSA	G140L 1280 A	BUFFER-TIME=22 61;			2261 Secs (2261 Secs)	
						FP-POS=1		[==>]	[1]	
	3	(COS.sp.144 5496)	(1) UCAC3-49-21611	COS/FUV, TIME-TAG, PSA	G140L 1280 A	BUFFER-TIME=30 30;			3030 Secs (3030 Secs)	
						FP-POS=2		[==>]	[2]	



Proposal 16207 - COS G140L 2 orbit visit (02) - Photochemistry in TESS's first habitable zone terrestrial planet, TOI-700 d

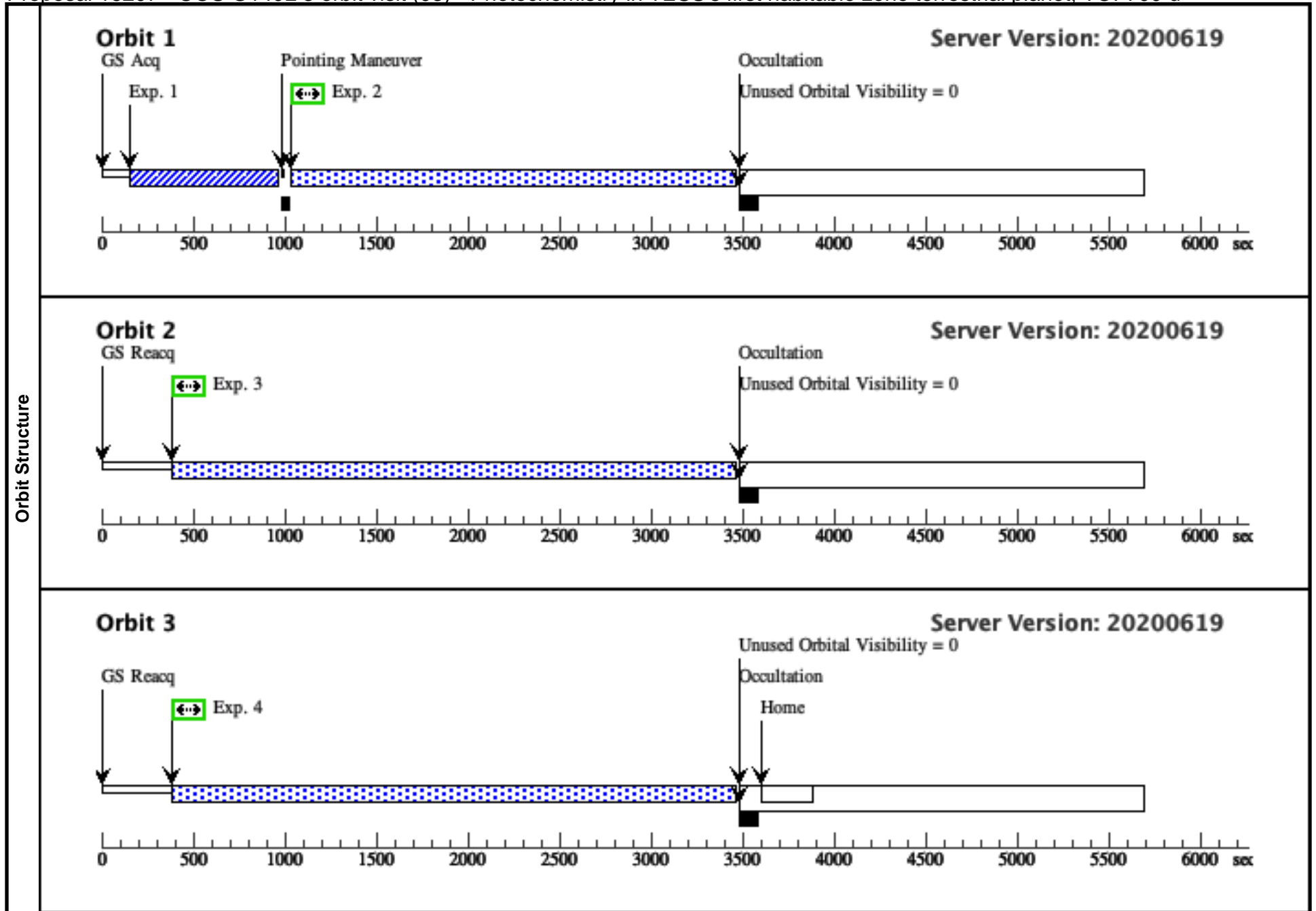
Fri Jan 08 19:00:24 GMT 2021

Visit	Proposal 16207, COS G140L 2 orbit visit (02), implementation Diagnostic Status: No Diagnostics Scientific Instruments: COS/FUV, COS/NUV Special Requirements: (none)									
	Fixed Targets	#	Name	Target Coordinates	Targ. Coord. Corrections	Fluxes	Miscellaneous			
		(1)	UCAC3-49-21611	RA: 06 28 22.9720 (97.0957167d) Dec: -65 34 43.01 (-65.57861d) Equinox: J2000	Proper Motion RA: -0.016568132424273217 sec of time/yr Proper Motion Dec: 0.161805 arcsec/yr Epoch of Position: 2015.5 Radial Velocity: -5.76 km/sec	V=13.08+/-0.02	Reference Frame: ICRS			
	<i>Comments: This object was generated by the targetselector and retrieved from the SIMBAD database.</i> Category=STAR Description=[EXTRA-SOLAR PLANETARY SYSTEM, M 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	(COS.ta.144 6479)	(1) UCAC3-49-21611	COS/NUV, ACQ/IMAGE, PSA	MIRRORB			Sequence 1-2 Non-Int in COS G140L 2 orbit visit (02)	258 Secs (258 Secs) [==>]	[1]
	2	(COS.sp.144 5496)	(1) UCAC3-49-21611	COS/FUV, TIME-TAG, PSA	G140L 1280 A	BUFFER-TIME=22 61; FP-POS=3		Sequence 1-2 Non-Int in COS G140L 2 orbit visit (02)	2261 Secs (2261 Secs) [==>]	[1]
	3	(COS.ta.144 6479)	(1) UCAC3-49-21611	COS/NUV, ACQ/IMAGE, PSA	MIRRORB		NEW OBSET FULL ACQ	Sequence 3-4 Non-Int in COS G140L 2 orbit visit (02)	258 Secs (258 Secs) [==>]	[2]
	4	(COS.sp.144 5496)	(1) UCAC3-49-21611	COS/FUV, TIME-TAG, PSA	G140L 1280 A	BUFFER-TIME=30 30; FP-POS=4		Sequence 3-4 Non-Int in COS G140L 2 orbit visit (02)	2261 Secs (2261 Secs) [==>]	[2]



Proposal 16207 - COS G140L 3 orbit visit (03) - Photochemistry in TESS's first habitable zone terrestrial planet, TOI-700 d

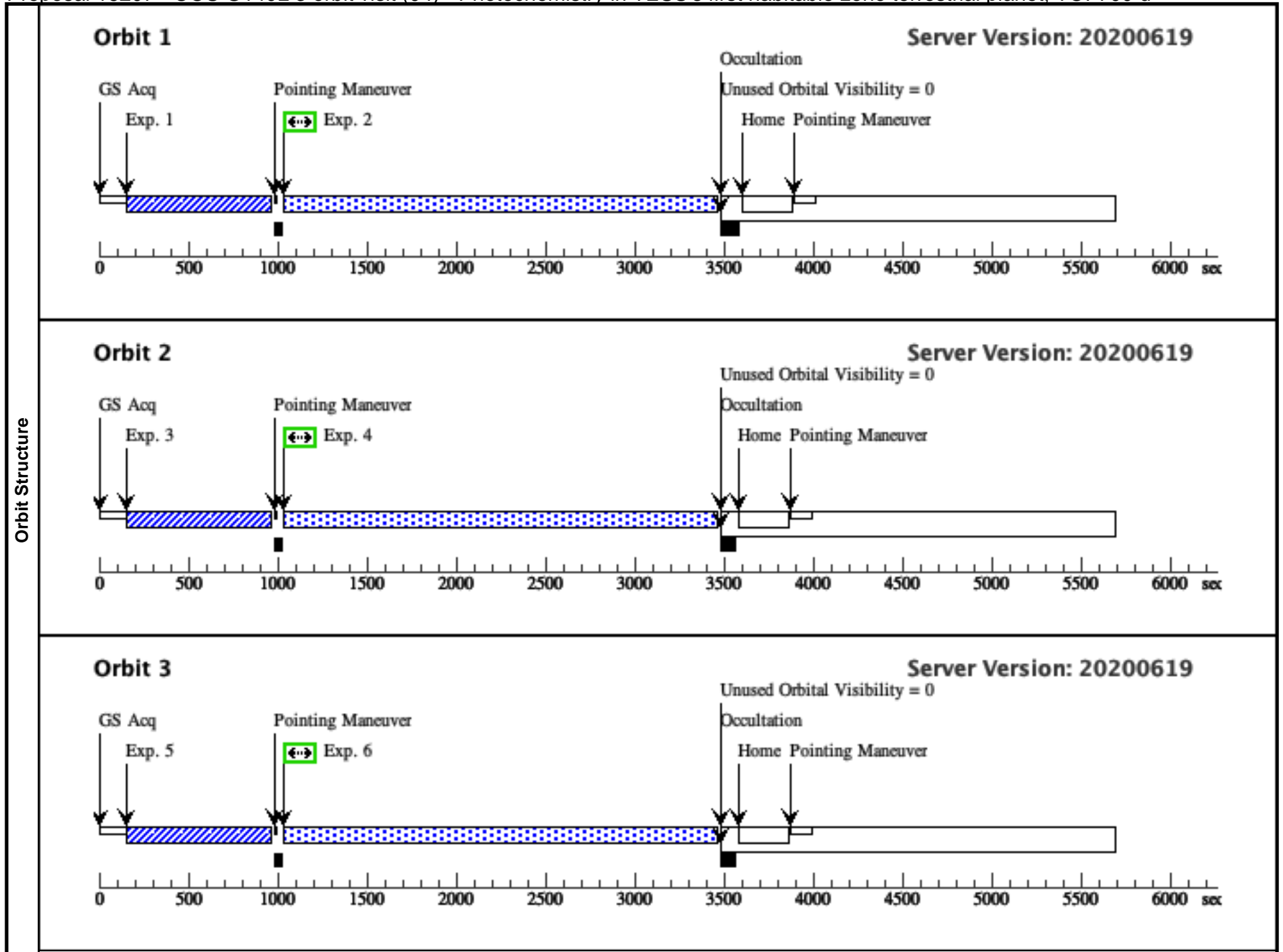
Visit		Proposal 16207, COS G140L 3 orbit visit (03), scheduled Fri Jan 08 19:00:24 GMT 2021								
		Diagnostic Status: No Diagnostics Scientific Instruments: COS/FUV, COS/NUV Special Requirements: (none)								
Fixed Targets	#	Name	Target Coordinates	Targ. Coord. Corrections	Fluxes	Miscellaneous				
	(1)	UCAC3-49-21611	RA: 06 28 22.9720 (97.0957167d) Dec: -65 34 43.01 (-65.57861d) Equinox: J2000	Proper Motion RA: -0.016568132424273217 sec of time/yr Proper Motion Dec: 0.161805 arcsec/yr Epoch of Position: 2015.5 Radial Velocity: -5.76 km/sec	V=13.08+/-0.02	Reference Frame: ICRS				
		<i>Comments: This object was generated by the targetselector and retrieved from the SIMBAD database.</i> Category=STAR Description=[EXTRA-SOLAR PLANETARY SYSTEM, M 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	(COS.ta.144 6479)	(1) UCAC3-49-21611	COS/NUV, ACQ/IMAGE, PSA	MIRRORB				258 Secs (258 Secs)	
									[==>]	[1]
	2	(COS.sp.144 5496)	(1) UCAC3-49-21611	COS/FUV, TIME-TAG, PSA	G140L 1280 A	BUFFER-TIME=22 61; FP-POS=1			2261 Secs (2261 Secs)	
									[==>]	[1]
3	(COS.sp.144 5496)	(1) UCAC3-49-21611	COS/FUV, TIME-TAG, PSA	G140L 1280 A	BUFFER-TIME=30 30; FP-POS=2			3030 Secs (3030 Secs)		
								[==>]	[2]	
4	(COS.sp.144 5496)	(1) UCAC3-49-21611	COS/FUV, TIME-TAG, PSA	G140L 1280 A	BUFFER-TIME=30 30; FP-POS=3			3030 Secs (3030 Secs)		
								[==>]	[3]	

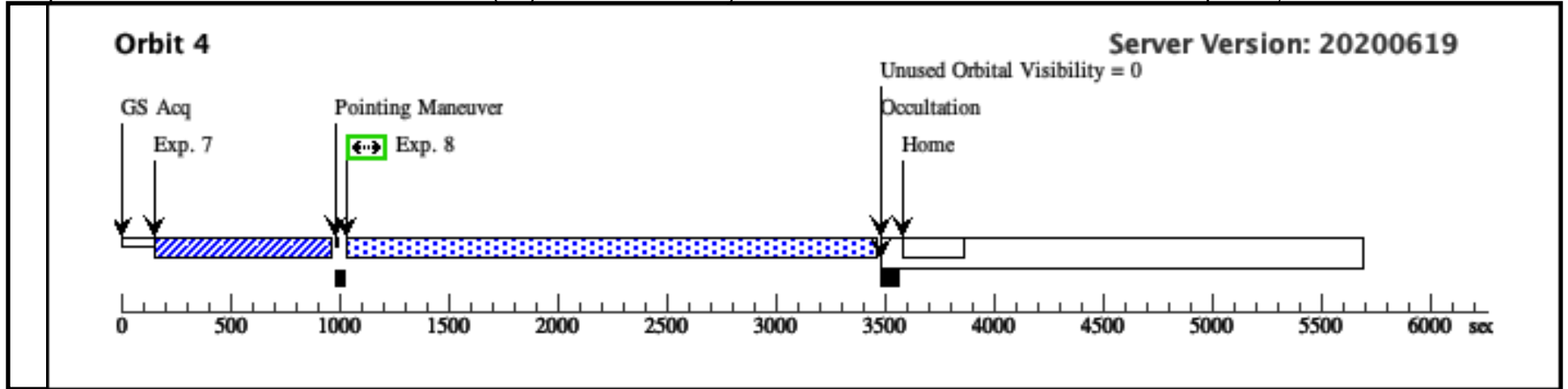


Proposal 16207 - COS G140L 3 orbit visit (04) - Photochemistry in TESS's first habitable zone terrestrial planet, TOI-700 d

Fri Jan 08 19:00:24 GMT 2021

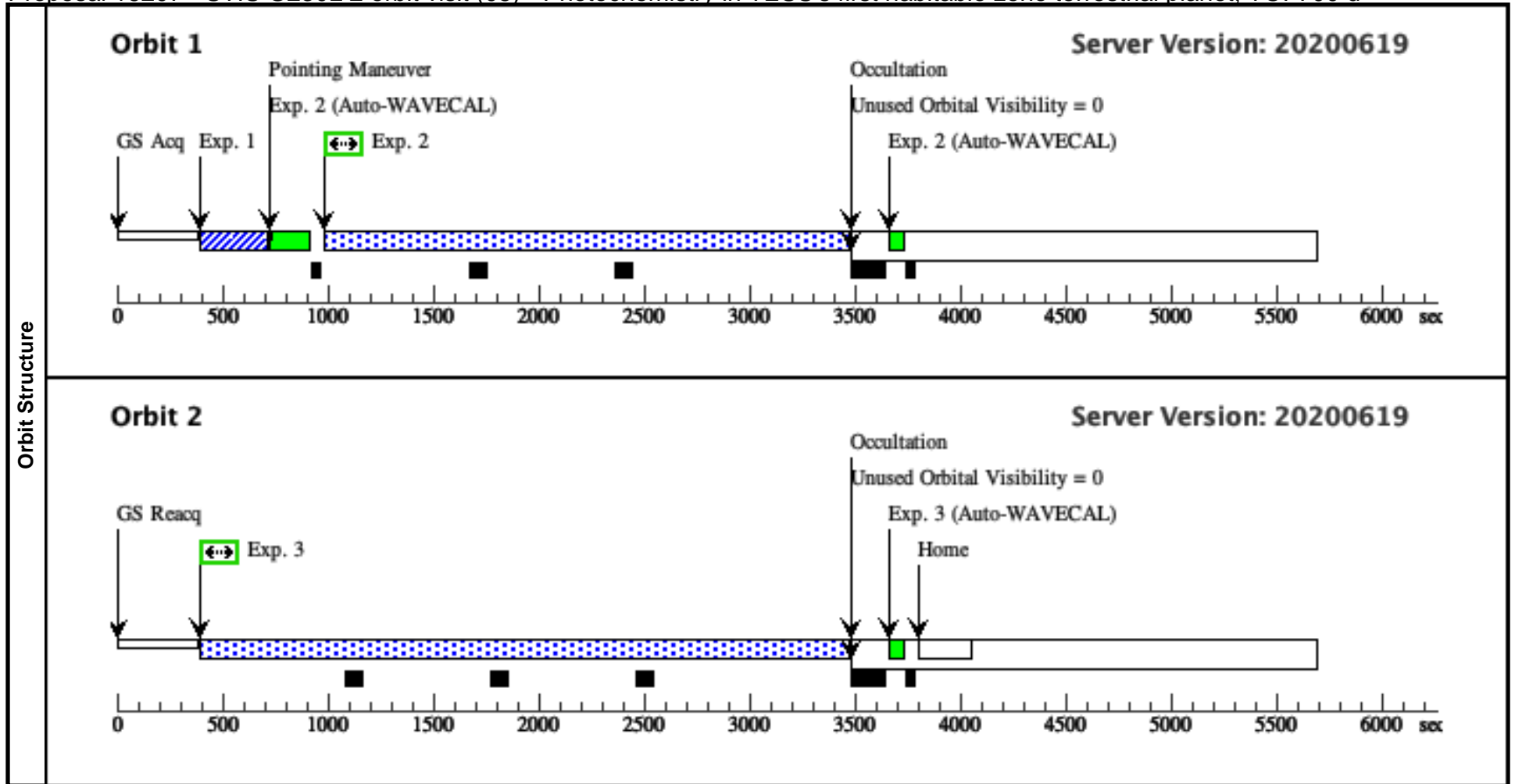
Visit	Proposal 16207, COS G140L 3 orbit visit (04), implementation Diagnostic Status: No Diagnostics Scientific Instruments: COS/FUV, COS/NUV Special Requirements: (none)									
	Fixed Targets	#	Name	Target Coordinates	Targ. Coord. Corrections	Fluxes	Miscellaneous			
		(1)	UCAC3-49-21611	RA: 06 28 22.9720 (97.0957167d) Dec: -65 34 43.01 (-65.57861d) Equinox: J2000	Proper Motion RA: -0.016568132424273217 sec of time/yr Proper Motion Dec: 0.161805 arcsec/yr Epoch of Position: 2015.5 Radial Velocity: -5.76 km/sec	V=13.08+/-0.02	Reference Frame: ICRS			
	Comments: This object was generated by the targetselector and retrieved from the SIMBAD database. Category=STAR Description=[EXTRA-SOLAR PLANETARY SYSTEM, M 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	(COS.ta.144 6479)	(1) UCAC3-49-21611	COS/NUV, ACQ/IMAGE, PSA	MIRRORB			Sequence 1-2 Non-Int in COS G140L 3 orbit visit (04)	258 Secs (258 Secs) [==>]	[1]
	2	(COS.sp.144 5496)	(1) UCAC3-49-21611	COS/FUV, TIME-TAG, PSA	G140L 1280 A	BUFFER-TIME=22 61; FP-POS=2		Sequence 1-2 Non-Int in COS G140L 3 orbit visit (04)	2261 Secs (2261 Secs) [==>]	[1]
	3	(COS.ta.144 6479)	(1) UCAC3-49-21611	COS/NUV, ACQ/IMAGE, PSA	MIRRORB		NEW OBSET FULL ACQ	Sequence 3-4 Non-Int in COS G140L 3 orbit visit (04)	258 Secs (258 Secs) [==>]	[2]
	4	(COS.sp.144 5496)	(1) UCAC3-49-21611	COS/FUV, TIME-TAG, PSA	G140L 1280 A	BUFFER-TIME=30 30; FP-POS=3		Sequence 3-4 Non-Int in COS G140L 3 orbit visit (04)	2261 Secs (2261 Secs) [==>]	[2]
	5	(COS.ta.144 6479)	(1) UCAC3-49-21611	COS/NUV, ACQ/IMAGE, PSA	MIRRORB		NEW OBSET FULL ACQ	Sequence 5-6 Non-Int in COS G140L 3 orbit visit (04)	258 Secs (258 Secs) [==>]	[3]
	6	(COS.sp.144 5496)	(1) UCAC3-49-21611	COS/FUV, TIME-TAG, PSA	G140L 1280 A	BUFFER-TIME=30 30; FP-POS=4		Sequence 5-6 Non-Int in COS G140L 3 orbit visit (04)	2261 Secs (2261 Secs) [==>]	[3]
	7	(COS.ta.144 6479)	(1) UCAC3-49-21611	COS/NUV, ACQ/IMAGE, PSA	MIRRORB		NEW OBSET FULL ACQ	Sequence 7-8 Non-Int in COS G140L 3 orbit visit (04)	258 Secs (258 Secs) [==>]	[4]
	8	(COS.sp.144 5496)	(1) UCAC3-49-21611	COS/FUV, TIME-TAG, PSA	G140L 1280 A	BUFFER-TIME=30 30; FP-POS=4		Sequence 7-8 Non-Int in COS G140L 3 orbit visit (04)	2261 Secs (2261 Secs) [==>]	[4]





Proposal 16207 - STIS G230L 2 orbit visit (05) - Photochemistry in TESS's first habitable zone terrestrial planet, TOI-700 d

Visit		Fri Jan 08 19:00:24 GMT 2021									
Fixed Targets		Proposal 16207, STIS G230L 2 orbit visit (05), scheduled Diagnostic Status: No Diagnostics Scientific Instruments: STIS/NUV-MAMA, STIS/CCD Special Requirements: (none)									
		#	Name	Target Coordinates	Targ. Coord. Corrections		Fluxes		Miscellaneous		
Exposures		(1)	UCAC3-49-21611	RA: 06 28 22.9720 (97.0957167d) Dec: -65 34 43.01 (-65.57861d) Equinox: J2000	Proper Motion RA: -0.016568132424273217 sec of time/yr Proper Motion Dec: 0.161805 arcsec/yr Epoch of Position: 2015.5 Radial Velocity: -5.76 km/sec		V=13.08+/-0.02		Reference Frame: ICRS		
		<i>Comments: This object was generated by the targetselector and retrieved from the SIMBAD database.</i> Category=STAR Description=[EXTRA-SOLAR PLANETARY SYSTEM, M 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.144 4742)	(1) UCAC3-49-21611 1	STIS/CCD, ACQ, F25ND3	MIRROR				7 Secs (7 Secs)	
		[==>]									
		2	(STIS.sp.14 45499)	(1) UCAC3-49-21611 1	STIS/NUV-MAMA, TIME-TAG, 52X0.2	G230L 2376 A	BUFFER-TIME=69 1				2472 Secs (2472 Secs)
[==>]											
3	(STIS.sp.14 45500)	(1) UCAC3-49-21611 1	STIS/NUV-MAMA, TIME-TAG, 52X0.2	G230L 2376 A	BUFFER-TIME=69 1				3066 Secs (3066 Secs)		
[==>]											
[1]											
[1]											
[2]											



Proposal 16207 - STIS G230L 3 orbit visit + G430L (06) - Photochemistry in TESS's first habitable zone terrestrial planet, TOI-700 d

Visit		Proposal 16207, STIS G230L 3 orbit visit + G430L (06), scheduled Fri Jan 08 19:00:24 GMT 2021									
		Diagnostic Status: No Diagnostics Scientific Instruments: STIS/NUV-MAMA, STIS/CCD Special Requirements: (none)									
Fixed Targets	#	Name	Target Coordinates	Targ. Coord. Corrections	Fluxes	Miscellaneous					
	(1)	UCAC3-49-21611	RA: 06 28 22.9720 (97.0957167d) Dec: -65 34 43.01 (-65.57861d) Equinox: J2000	Proper Motion RA: -0.016568132424273217 sec of time/yr Proper Motion Dec: 0.161805 arcsec/yr Epoch of Position: 2015.5 Radial Velocity: -5.76 km/sec	V=13.08+/-0.02	Reference Frame: ICRS					
		<i>Comments: This object was generated by the targetselector and retrieved from the SIMBAD database.</i> Category=STAR Description=[EXTRA-SOLAR PLANETARY SYSTEM, M 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.144 4742)	(1) UCAC3-49-21611	STIS/CCD, ACQ, F25ND3	MIRROR				7 Secs (7 Secs)		
									[==>]	[1]	
	2	(STIS.sp.14 45499)	(1) UCAC3-49-21611	STIS/NUV-MAMA, TIME-TAG, 52X0.2	G230L 2376 A	BUFFER-TIME=69 1			2472 Secs (2472 Secs)		
									[==>]	[1]	
	3	(STIS.sp.14 45500)	(1) UCAC3-49-21611	STIS/NUV-MAMA, TIME-TAG, 52X0.2	G230L 2376 A	BUFFER-TIME=69 1			3066 Secs (3066 Secs)		
									[==>]	[2]	
4	(STIS.sp.14 45500)	(1) UCAC3-49-21611	STIS/NUV-MAMA, TIME-TAG, 52X0.2	G230L 2376 A	BUFFER-TIME=69 1			2251 Secs (2251 Secs)			
								[==>]	[3]		
5	(STIS.sp.14 45501)	(1) UCAC3-49-21611	STIS/CCD, ACCUM, 52X0.2E1	G430L 4300 A	CR-SPLIT=3			300 Secs (300 Secs)			
								[==>(Split 1)]			
								[==>(Split 2)]			
								[==>(Split 3)]	[3]		
		<i>Comments: E1 aperture selected to mitigate charge transfer efficiency issues.</i>									

