



15967 - Constraining the Stellar Astrophysics Powering Cosmic Reionization: Spectral Templates of Extremely Low-metallicity Main-sequence O-stars

Cycle: 27, Proposal Category: GO

(UV Initiative)

(Availability Mode: SUPPORTED)

INVESTIGATORS

<i>Name</i>	<i>Institution</i>	<i>E-Mail</i>
Dr. John Chisholm (PI) (Contact)	University of California - Santa Cruz	jochisho@ucsc.edu
Dr. Kristen B W McQuinn (CoI)	Rutgers the State University of New Jersey	kristen.mcquinn@rutgers.edu
Dr. Danielle Berg (CoI)	The Ohio State University	berg.249@osu.edu

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) WLM	COS/FUV COS/NUV	3	11-Nov-2019 14:00:17.0	yes
02	(1) WLM	COS/FUV COS/NUV	3	11-Nov-2019 14:00:18.0	yes
03	(1) WLM	COS/FUV COS/NUV	3	11-Nov-2019 14:00:19.0	yes
04	(3) SEXTANS-A	COS/FUV COS/NUV	4	11-Nov-2019 14:00:20.0	yes
05	(3) SEXTANS-A	COS/FUV COS/NUV	5	11-Nov-2019 14:00:21.0	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>
06	(3) SEXTANS-A	COS/FUV COS/NUV	5	11-Nov-2019 14:00:22.0	yes
07	(2) LEO-P	COS/FUV COS/NUV	4	11-Nov-2019 14:00:23.0	yes
08	(2) LEO-P	COS/FUV COS/NUV	4	11-Nov-2019 14:00:24.0	yes
09	(2) LEO-P	COS/FUV COS/NUV	5	11-Nov-2019 14:00:25.0	yes
10	(2) LEO-P	COS/FUV COS/NUV	5	11-Nov-2019 14:00:26.0	yes
11	(2) LEO-P	COS/FUV COS/NUV	5	11-Nov-2019 14:00:27.0	yes
12	(2) LEO-P	COS/FUV COS/NUV	3	11-Nov-2019 14:00:28.0	yes

49 Total Orbits Used

ABSTRACT

Massive stars are thought to have contributed to the reionization of the early universe, however very little is known about the stellar astrophysics of the extremely low-metallicity massive stars that produced the requisite ionizing photons. Crucially, the photospheric opacities and stellar wind mass-loss rates have not been observationally determined below SMC metallicities (0.2 solar). This leaves estimates of the intrinsic number of ionizing photons produced by low-metallicity massive stars largely unconstrained. Consequently, high-redshift observations with JWST will be unable to distinguish between models that power reionization with stars or active galactic nuclei, unless the stellar physics is determined. Here, we propose 49 orbits of HST/COS far-ultraviolet moderate resolution spectroscopy with G130M and G160M of the three known extremely low-metallicity (3-10% solar) main-sequence stars in dwarf galaxies around the Milky Way. The close proximity of these galaxies enables observations of single O-stars to determine the stellar wind mass-loss rates and the photospheric compositions, mainly the iron abundance which is the chief O-star opacity source. As the only known isolated main-sequence O-stars at these metallicities, these observations will be suitable for inclusion in stellar libraries and test stellar astrophysical theory at extremely low-metallicities. These 49 orbits will complement the planned ULLYSES by extending the observations to lower metallicities than currently planned. In total, these observations will provide the first, and possibly only, direct constraints on the stellar

OBSERVING DESCRIPTION

Here we plan observations of three very low-metallicity, main-sequence O-stars in the local universe with the Cosmic Origins Spectrograph. We will utilize both the G130M and G160M configuration to get continuous coverage of important stellar wind and photospheric features to determine the mass-loss rates and abundances of the lowest metallicity known single O-stars to constrain their output of ionizing photons.

We have checked target coordinates using GAIA DR2. GAIA has an astrometric error less than 0.1". There were slight pointing offsets and we have tightened our coordinate constraints to account for this.

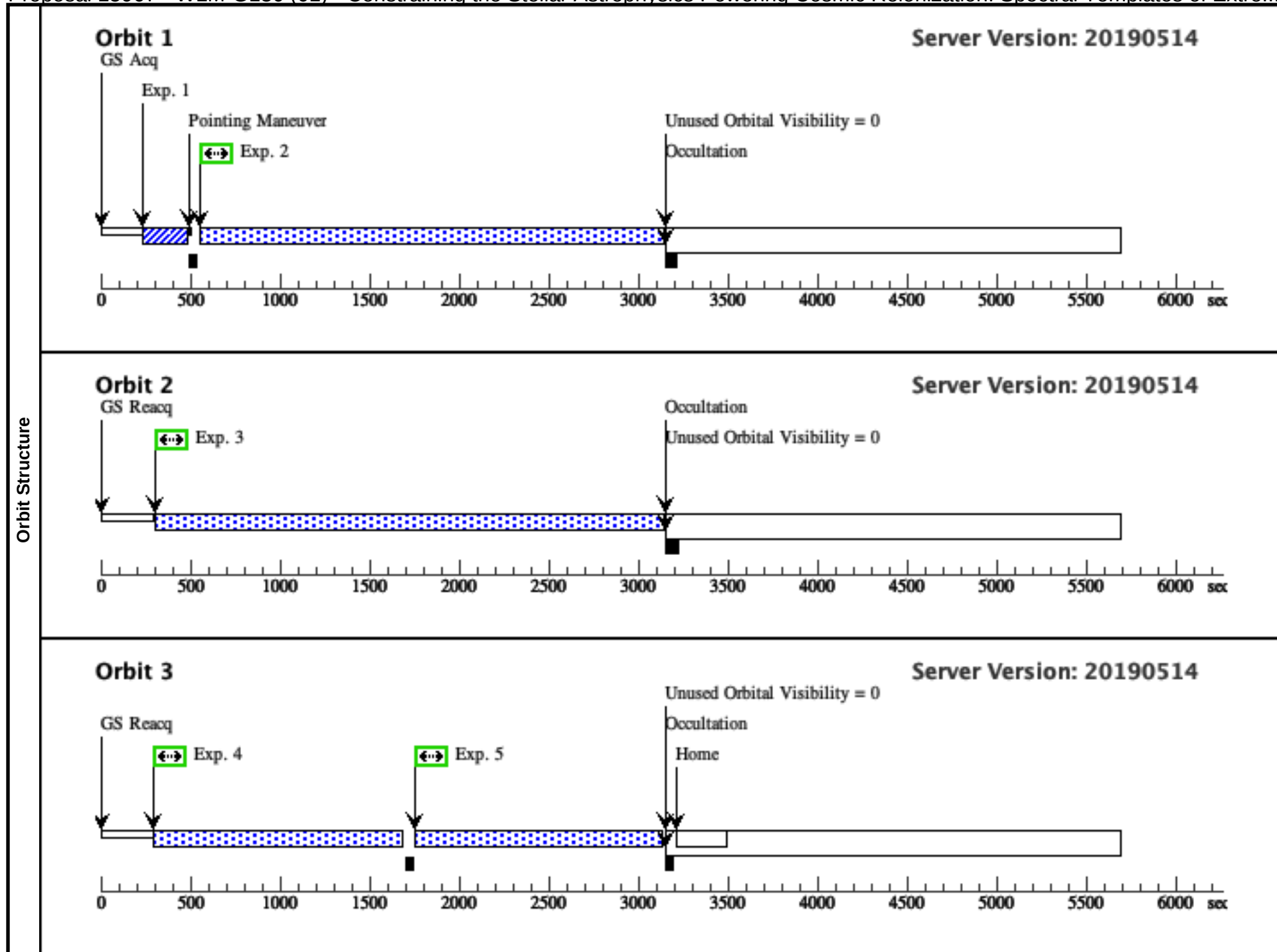
We estimate exposure times using the V-band magnitude, observed interstellar reddening, point sources, and model fits for the SED shape. We have tested various O3 through O7 stellar templates in the COS ETC and confirm that the templates conservatively estimate the required exposure times. We use these estimates for the acquisition and exposure times. These extrapolations are conservative estimates on the total FUV flux. When available, we have compared to the observed FUV fluxes to confirm that these are conservative estimate.

We will use Mirror A for the acquisition. All of the acquisitions satisfy the GALEX safety standards. We organize the observations into visits of at most 5 orbits, to aid schedulability.

We use the G130M grating with the 1291 central wavelength. This covers the N V 1240, O V 1371, and Si IV 1400 stellar wind profiles. The G130M configuration only uses FP = 3, 4 configurations to satisfy the COS2025 restrictions. We then use the G160M grating with the 1600 central wavelength. This configuration covers the Fe V 1428, S V 1500, C IV 1550, He II 1640, Fe IV 1717, N IV 1719, and N III 1750 stellar wind and photospheric profiles. We use FP = All for the G160M observations to extend the possible wavelength coverage.

Proposal 15967 - WLM-G130 (01) - Constraining the Stellar Astrophysics Powering Cosmic Reionization: Spectral Templates of Extre...

Visit	Proposal 15967, WLM-G130 (01), implementation										Mon Nov 11 19:00:29 GMT 2019
	Diagnostic Status: No Diagnostics										
	Scientific Instruments: COS/FUV, COS/NUV										
	Special Requirements: (none)										
Fixed Targets	#	Name	Target Coordinates	Targ. Coord. Corrections			Fluxes		Miscellaneous		
	(1)	WLM	RA: 00 02 0.5333 (.5022221d) Dec: -15 29 52.41 (-15.49789d) Equinox: J2000				V=20.36		Reference Frame: ICRS		
	Comments: Category=EXT-STAR Description=[MAIN SEQUENCE O] 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.137 0785)	(1) WLM	COS/NUV, ACQ/IMAGE, PSA	MIRRORA				15 Secs (15 Secs)		
									[==>]		[1]
	2	(COS.sp.136 5365)	(1) WLM	COS/FUV, TIME-TAG, PSA	G130M 1291 A	FLASH=YES; SEGMENT=BOTH; BUFFER-TIME=46 84; FP-POS=3			2421 Secs (2421 Secs)		
									[==>]		[1]
	3	(COS.sp.136 5365)	(1) WLM	COS/FUV, TIME-TAG, PSA	G130M 1291 A	FLASH=YES; SEGMENT=BOTH; BUFFER-TIME=46 84; FP-POS=3			2790 Secs (2790 Secs)		
									[==>]		[2]
	4	(COS.sp.136 5365)	(1) WLM	COS/FUV, TIME-TAG, PSA	G130M 1291 A	BUFFER-TIME=46 84; FLASH=YES; SEGMENT=BOTH; FP-POS=4			1334 Secs (1334 Secs)		
									[==>]		[3]
	5	(COS.sp.136 5365)	(1) WLM	COS/FUV, TIME-TAG, PSA	G130M 1291 A	BUFFER-TIME=46 84; FLASH=YES; SEGMENT=BOTH; FP-POS=4			1335 Secs (1335 Secs)		
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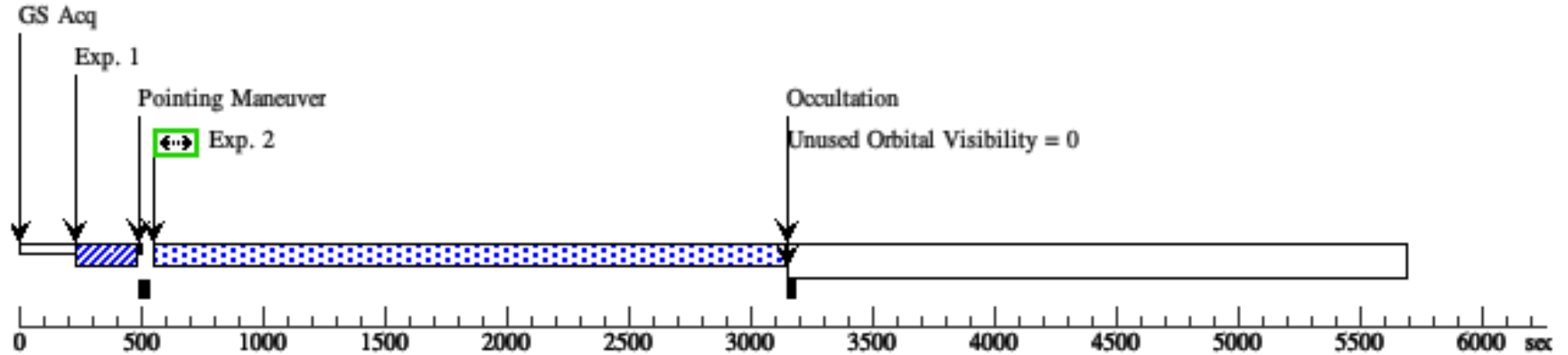


Proposal 15967 - WLM-G160-visit1 (02) - Constraining the Stellar Astrophysics Powering Cosmic Reionization: Spectral Templates of ...

Visit	Proposal 15967, WLM-G160-visit1 (02), implementation								Mon Nov 11 19:00:29 GMT 2019	
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	Scientific Instruments: COS/FUV, COS/NUV									
	Special Requirements: (none)									
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	(1)	WLM	RA: 00 02 0.5333 (.5022221d) Dec: -15 29 52.41 (-15.49789d) Equinox: J2000			V=20.36		Reference Frame: ICRS		
	Comments: Category=EXT-STAR Description=[MAIN SEQUENCE O] 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.137 0785)	(1) WLM	COS/NUV, ACQ/IMAGE, PSA	MIRRORA				15 Secs (15 Secs)	
									[==>]	[1]
	2	(COS.sp.136 5397)	(1) WLM	COS/FUV, TIME-TAG, PSA	G160M 1600 A	FLASH=YES; SEGMENT=BOTH; BUFFER-TIME=17 355; FP-POS=1			2374 Secs (2374 Secs)	
									[==>]	[1]
	3	(COS.sp.136 5397)	(1) WLM	COS/FUV, TIME-TAG, PSA	G160M 1600 A	FLASH=YES; SEGMENT=BOTH; BUFFER-TIME=17 355; FP-POS=2			2790 Secs (2790 Secs)	
									[==>]	[2]
	4	(COS.sp.136 5397)	(1) WLM	COS/FUV, TIME-TAG, PSA	G160M 1600 A	BUFFER-TIME=17 355; FLASH=YES; SEGMENT=BOTH; FP-POS=3			1343 Secs (1343 Secs)	
									[==>]	[3]
	5	(COS.sp.136 5397)	(1) WLM	COS/FUV, TIME-TAG, PSA	G160M 1600 A	BUFFER-TIME=17 355; FLASH=YES; SEGMENT=BOTH; FP-POS=4			1342 Secs (1342 Secs)	
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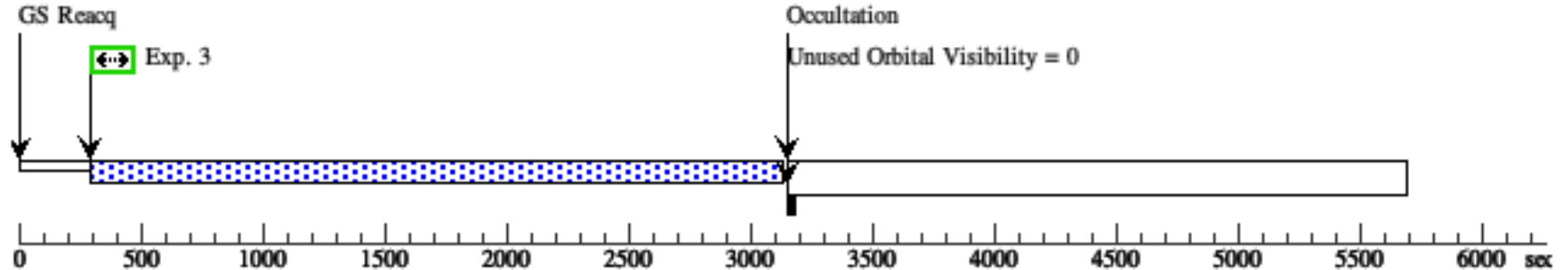
Orbit 1

Server Version: 20190514



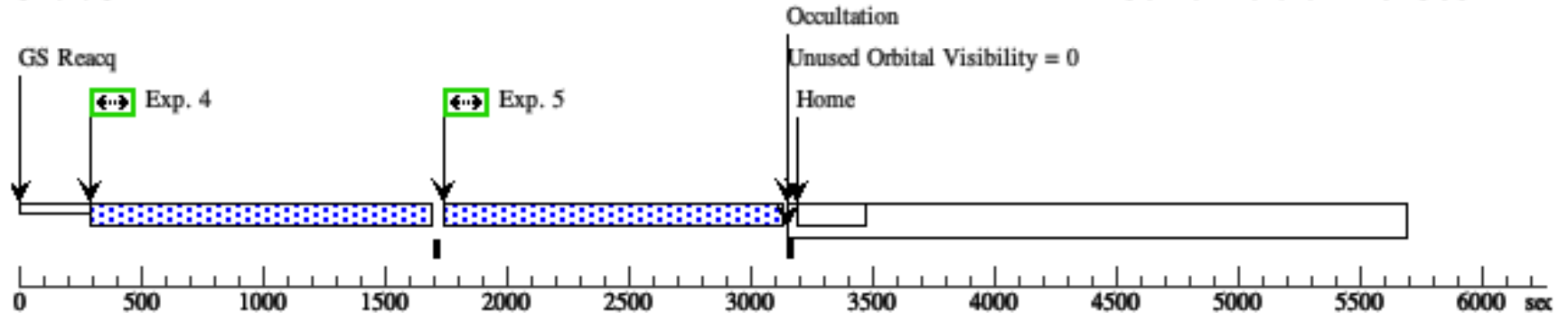
Orbit 2

Server Version: 20190514



Orbit 3

Server Version: 20190514

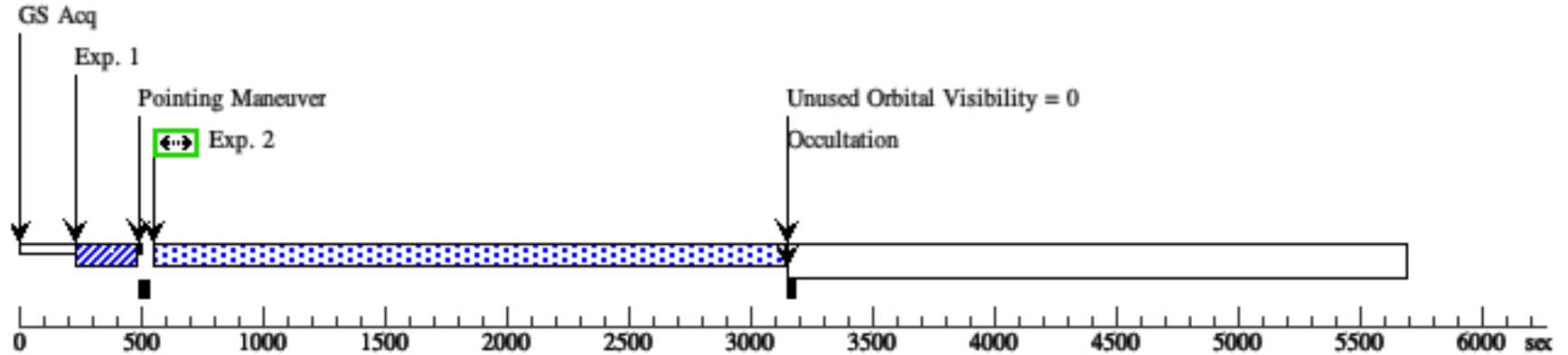


Proposal 15967 - WLM-G160-visit2 (03) - Constraining the Stellar Astrophysics Powering Cosmic Reionization: Spectral Templates of ...

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	Scientific Instruments: COS/FUV, COS/NUV											
	Special Requirements: (none)											
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	(1)	WLM	RA: 00 02 0.5333 (.5022221d) Dec: -15 29 52.41 (-15.49789d) Equinox: J2000			V=20.36		Reference Frame: ICRS				
	Comments: Category=EXT-STAR Description=[MAIN SEQUENCE O] 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.137 0785)	(1) WLM	COS/NUV, ACQ/IMAGE, PSA	MIRRORA				15 Secs (15 Secs)			
									[==>]		[1]	
	2	(COS.sp.136 5397)	(1) WLM	COS/FUV, TIME-TAG, PSA	G160M 1600 A	FLASH=YES; SEGMENT=BOTH; BUFFER-TIME=17 355; FP-POS=1				2374 Secs (2374 Secs)		
									[==>]		[1]	
	3	(COS.sp.136 5397)	(1) WLM	COS/FUV, TIME-TAG, PSA	G160M 1600 A	FLASH=YES; SEGMENT=BOTH; BUFFER-TIME=17 355; FP-POS=2				2790 Secs (2790 Secs)		
									[==>]		[2]	
	4	(COS.sp.136 5397)	(1) WLM	COS/FUV, TIME-TAG, PSA	G160M 1600 A	BUFFER-TIME=17 355; FLASH=YES; SEGMENT=BOTH; FP-POS=3				1343 Secs (1343 Secs)		
									[==>]		[3]	
	5	(COS.sp.136 5397)	(1) WLM	COS/FUV, TIME-TAG, PSA	G160M 1600 A	BUFFER-TIME=17 355; FLASH=YES; SEGMENT=BOTH; FP-POS=4				1342 Secs (1342 Secs)		
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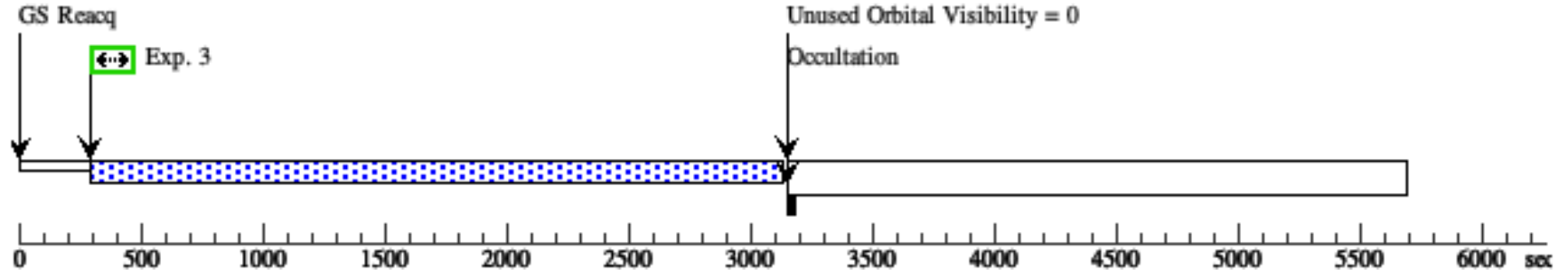
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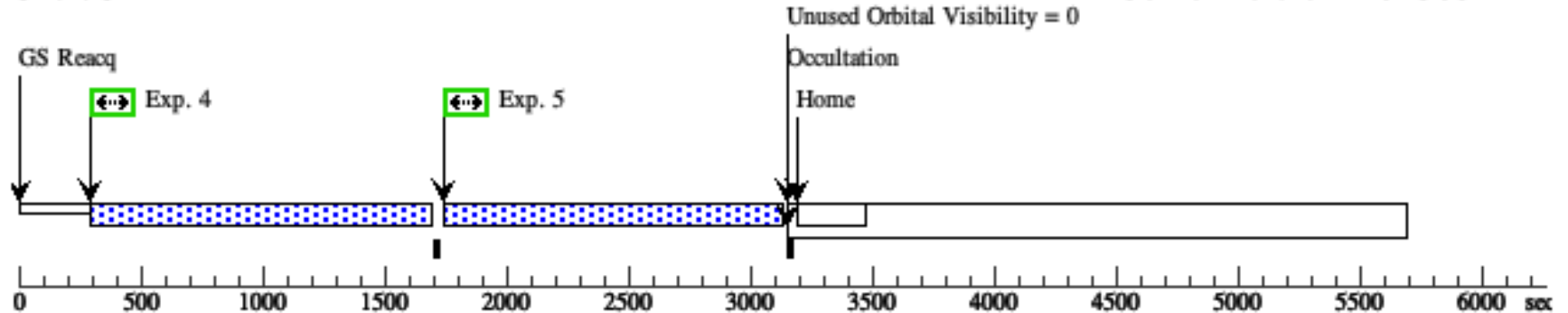
Orbit 2

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Orbit 3

Server Version: 20190514

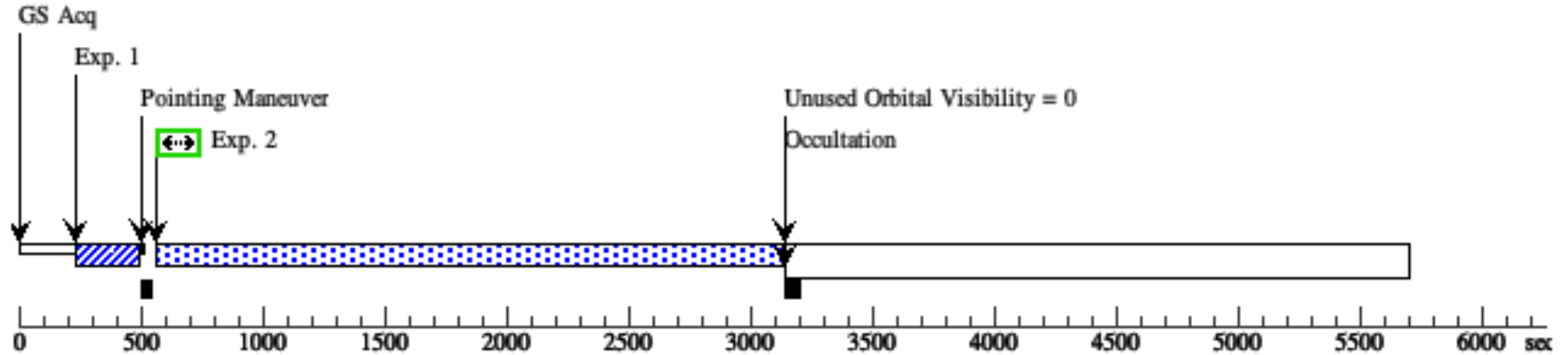


Proposal 15967 - Sextans-A-G130M (04) - Constraining the Stellar Astrophysics Powering Cosmic Reionization: Spectral Templates o...

Visit	Proposal 15967, Sextans-A-G130M (04), implementation										Mon Nov 11 19:00:29 GMT 2019	
	Diagnostic Status: No Diagnostics											
	Scientific Instruments: COS/FUV, COS/NUV											
	Special Requirements: (none)											
Fixed Targets	#	Name		Target Coordinates		Targ. Coord. Corrections		Fluxes		Miscellaneous		
	(3)	SEXTANS-A		RA: 10 10 58.1866 (152.7424442d) Dec: -04 43 18.45 (-4.72179d) Equinox: J2000				V=20.803		Reference Frame: ICRS		
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Exposures	#	Label (ETC Run)	Target	Config,Mode,Aperture		Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time (Total)/[Actual Dur.]		Orbit
	1	(COS.ta.137 0782)	(3) SEXTANS-A	COS/NUV, ACQ/IMAGE, PSA		MIRRORA				20 Secs (20 Secs)		
										[==>]		[1]
	2	(COS.sp.136 5415)	(3) SEXTANS-A	COS/FUV, TIME-TAG, PSA		G130M 1291 A	FP-POS=3; SEGMENT=BOTH; FLASH=YES; BUFFER-TIME=48 85			2397 Secs (2397 Secs)		
										[==>]		[1]
	3	(COS.sp.136 5415)	(3) SEXTANS-A	COS/FUV, TIME-TAG, PSA		G130M 1291 A	FP-POS=3; SEGMENT=BOTH; FLASH=YES; BUFFER-TIME=48 85			2776 Secs (2776 Secs)		
										[==>]		[2]
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										[==>]		[3]
	5	(COS.sp.136 5415)	(3) SEXTANS-A	COS/FUV, TIME-TAG, PSA		G130M 1291 A	FP-POS=4; SEGMENT=BOTH; FLASH=YES; BUFFER-TIME=48 85			2776 Secs (2776 Secs)		
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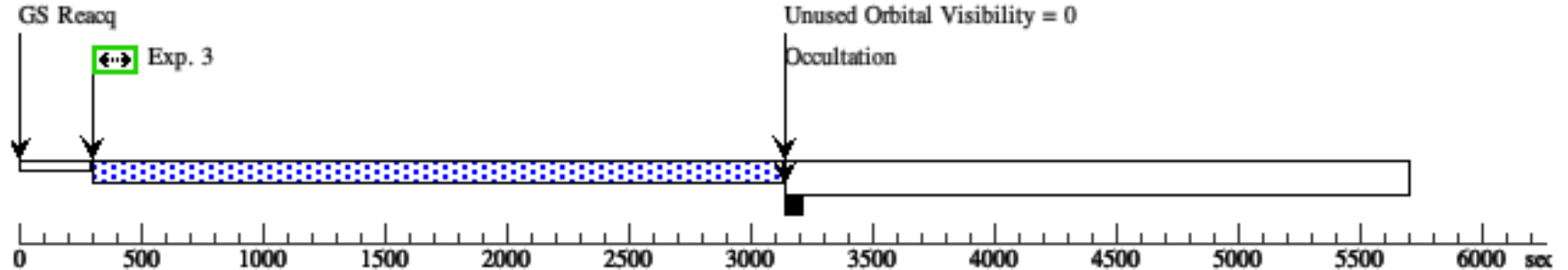
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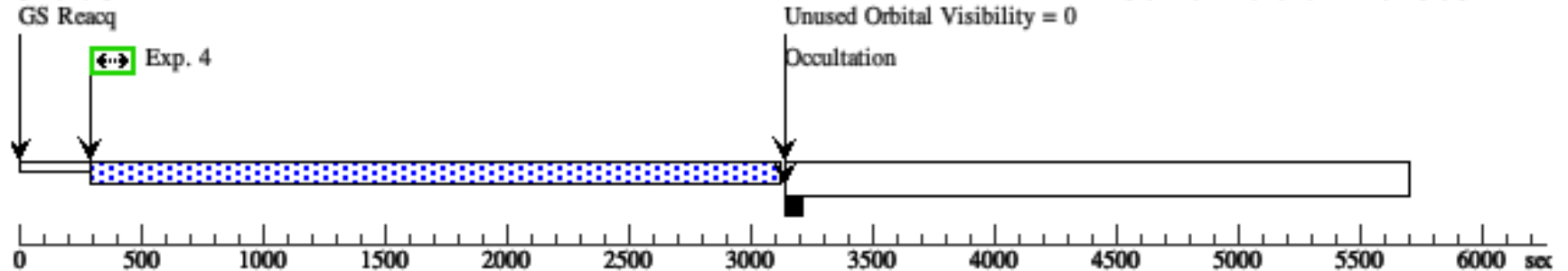
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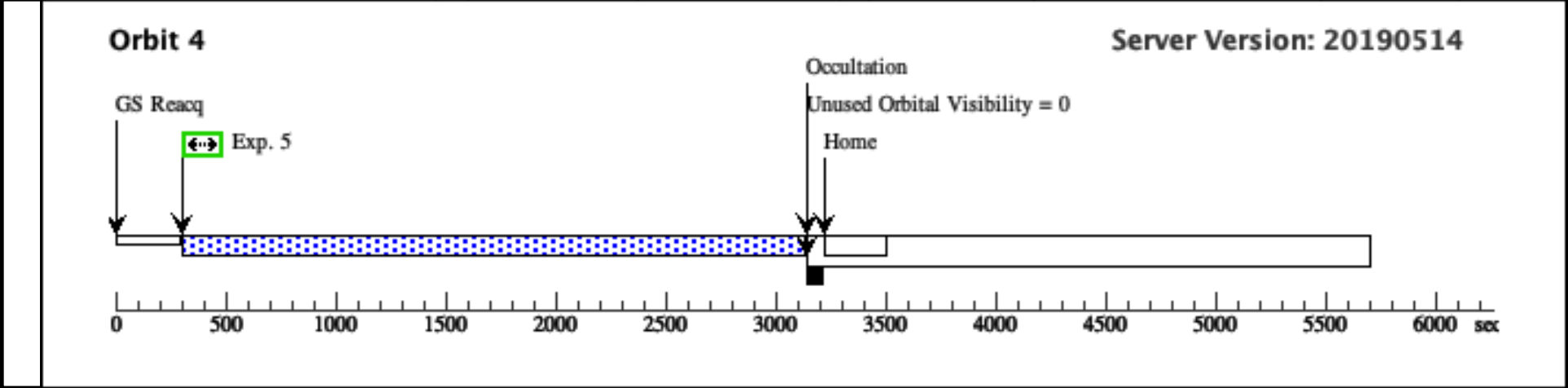
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Orbit 3

Server Version: 20190514



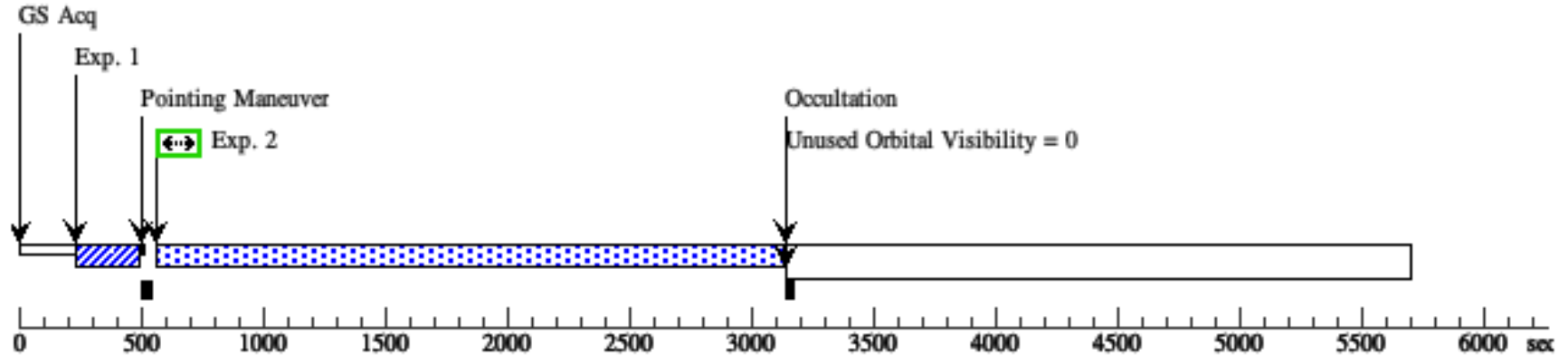


Proposal 15967 - Sextans-A-G160M-visit1 (05) - Constraining the Stellar Astrophysics Powering Cosmic Reionization: Spectral Templ...

Visit	Proposal 15967, Sextans-A-G160M-visit1 (05), implementation										Mon Nov 11 19:00:29 GMT 2019
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	Scientific Instruments: COS/FUV, COS/NUV										
	Special Requirements: (none)										
Fixed Targets	#	Name	Target Coordinates		Targ. Coord. Corrections		Fluxes		Miscellaneous		
	(3)	SEXTANS-A	RA: 10 10 58.1866 (152.7424442d) Dec: -04 43 18.45 (-4.72179d) Equinox: J2000				V=20.803		Reference Frame: ICRS		
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Exposures	#	Label (ETC Run)	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time (Total)/[Actual Dur.]		Orbit
	1	(COS.ta.137 0782)	(3) SEXTANS-A	COS/NUV, ACQ/IMAGE, PSA	MIRRORA				20 Secs (20 Secs)		
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	2	(COS.sp.136 5420)	(3) SEXTANS-A	COS/FUV, TIME-TAG, PSA	G160M 1600 A	FP-POS=1; SEGMENT=BOTH; FLASH=YES; BUFFER-TIME=18 228			2350 Secs (2350 Secs)		
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	3	(COS.sp.136 5420)	(3) SEXTANS-A	COS/FUV, TIME-TAG, PSA	G160M 1600 A	FP-POS=2; SEGMENT=BOTH; FLASH=YES; BUFFER-TIME=18 228			2776 Secs (2776 Secs)		
									[==>]		[2]
	4	(COS.sp.136 5420)	(3) SEXTANS-A	COS/FUV, TIME-TAG, PSA	G160M 1600 A	FP-POS=3; SEGMENT=BOTH; FLASH=YES; BUFFER-TIME=18 228			2776 Secs (2776 Secs)		
									[==>]		[3]
	5	(COS.sp.136 5420)	(3) SEXTANS-A	COS/FUV, TIME-TAG, PSA	G160M 1600 A	FP-POS=4; SEGMENT=BOTH; FLASH=YES; BUFFER-TIME=18 228			2776 Secs (2776 Secs)		
									[==>]		[4]
	6	(COS.sp.136 5420)	(3) SEXTANS-A	COS/FUV, TIME-TAG, PSA	G160M 1600 A	FP-POS=4; SEGMENT=BOTH; FLASH=YES; BUFFER-TIME=18 228			2776 Secs (2776 Secs)		
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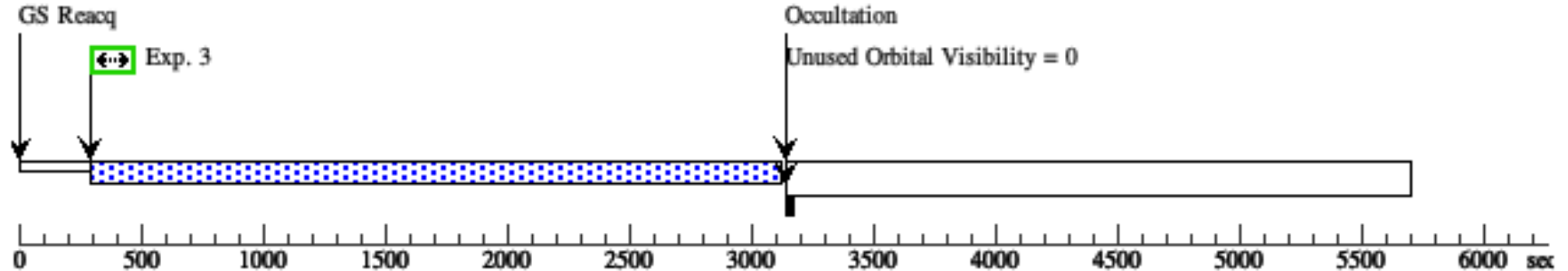
Orbit 1

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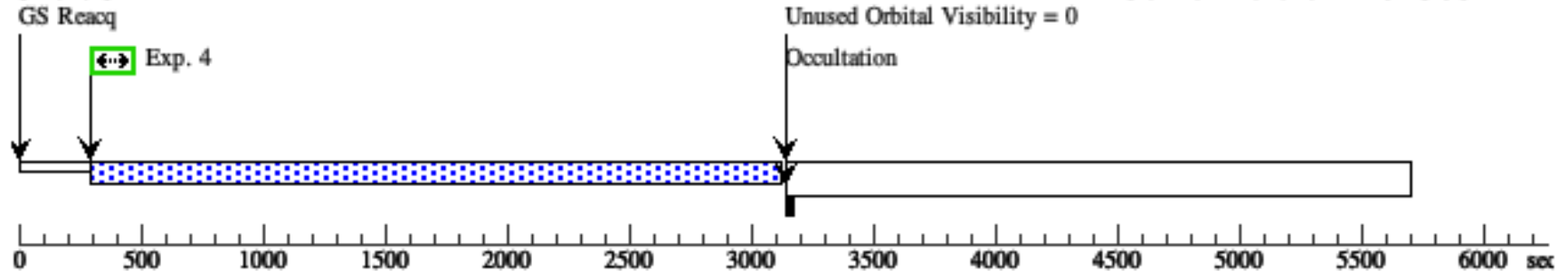
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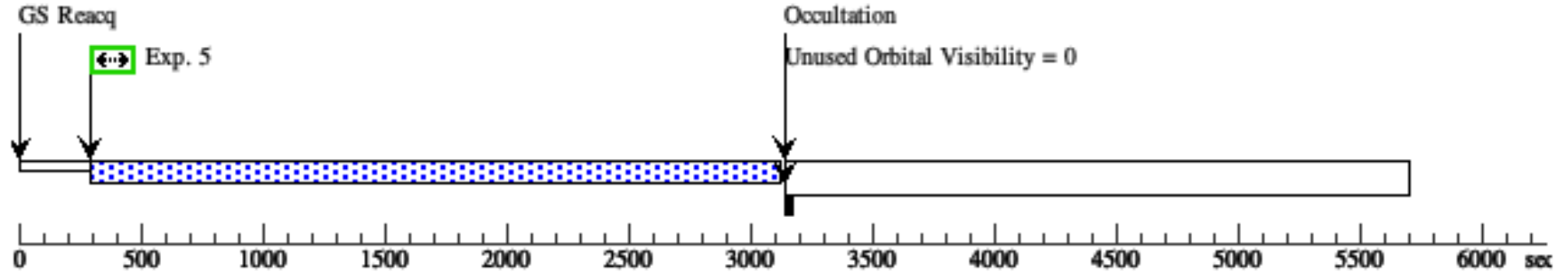
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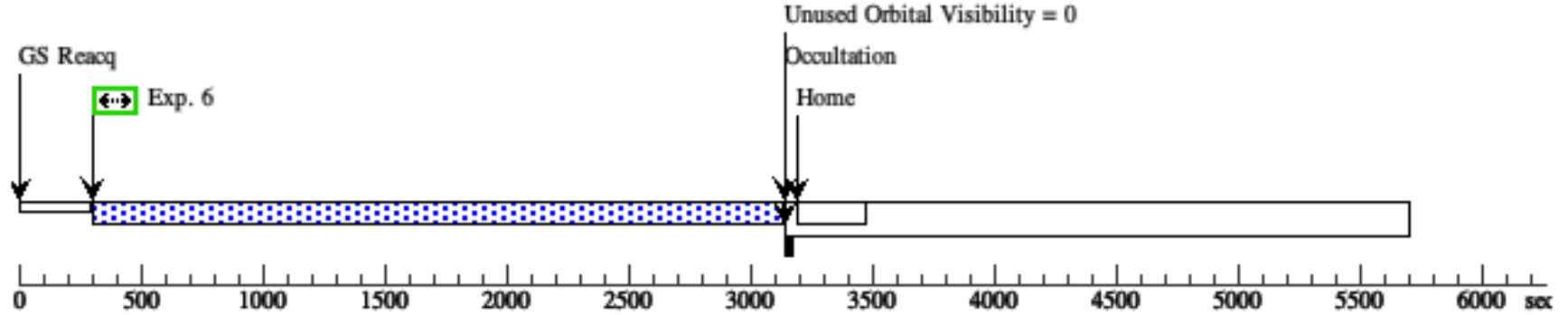
Orbit 4

Server Version: 20190514



Orbit 5

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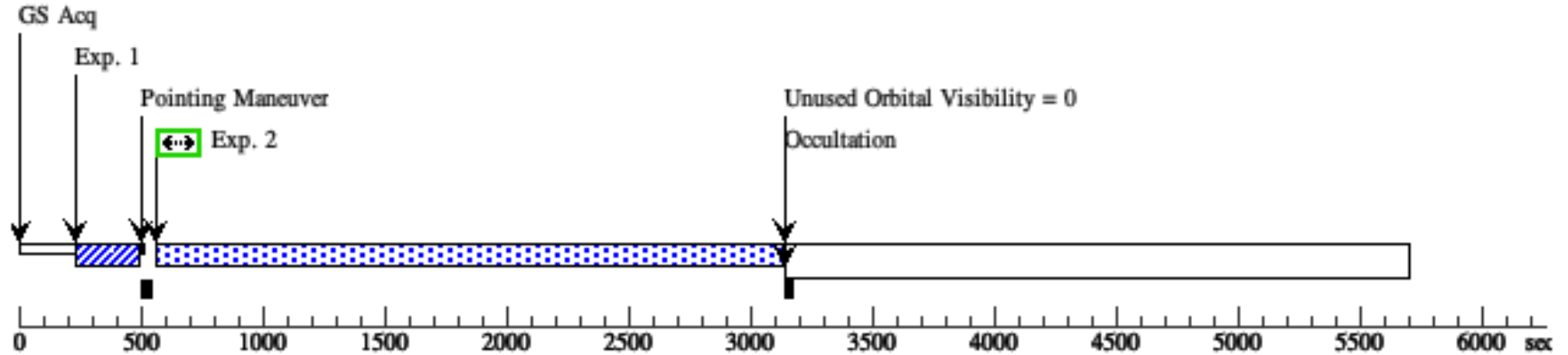


Proposal 15967 - Sextans-A-G160M-visit2 (06) - Constraining the Stellar Astrophysics Powering Cosmic Reionization: Spectral Templ...

Visit	Proposal 15967, Sextans-A-G160M-visit2 (06), implementation										Mon Nov 11 19:00:29 GMT 2019
	Diagnostic Status: No Diagnostics										
	Scientific Instruments: COS/FUV, COS/NUV										
	Special Requirements: (none)										
Fixed Targets	#	Name	Target Coordinates		Targ. Coord. Corrections		Fluxes		Miscellaneous		
	(3)	SEXTANS-A	RA: 10 10 58.1866 (152.7424442d) Dec: -04 43 18.45 (-4.72179d) Equinox: J2000				V=20.803		Reference Frame: ICRS		
	Comments: Category=EXT-STAR Description=[MAIN SEQUENCE O] 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.137 0782)	(3) SEXTANS-A	COS/NUV, ACQ/IMAGE, PSA	MIRRORA				20 Secs (20 Secs)		
									[==>]		[1]
	2	(COS.sp.136 5420)	(3) SEXTANS-A	COS/FUV, TIME-TAG, PSA	G160M 1600 A	FP-POS=1; SEGMENT=BOTH; FLASH=YES; BUFFER-TIME=18 228			2350 Secs (2350 Secs)		
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	3	(COS.sp.136 5420)	(3) SEXTANS-A	COS/FUV, TIME-TAG, PSA	G160M 1600 A	FP-POS=2; SEGMENT=BOTH; FLASH=YES; BUFFER-TIME=18 228			2776 Secs (2776 Secs)		
									[==>]		[2]
	4	(COS.sp.136 5420)	(3) SEXTANS-A	COS/FUV, TIME-TAG, PSA	G160M 1600 A	FP-POS=3; SEGMENT=BOTH; FLASH=YES; BUFFER-TIME=18 228			2776 Secs (2776 Secs)		
									[==>]		[3]
	5	(COS.sp.136 5420)	(3) SEXTANS-A	COS/FUV, TIME-TAG, PSA	G160M 1600 A	FP-POS=4; SEGMENT=BOTH; FLASH=YES; BUFFER-TIME=18 228			2776 Secs (2776 Secs)		
									[==>]		[4]
	6	(COS.sp.136 5420)	(3) SEXTANS-A	COS/FUV, TIME-TAG, PSA	G160M 1600 A	FP-POS=4; SEGMENT=BOTH; FLASH=YES; BUFFER-TIME=18 228			2776 Secs (2776 Secs)		
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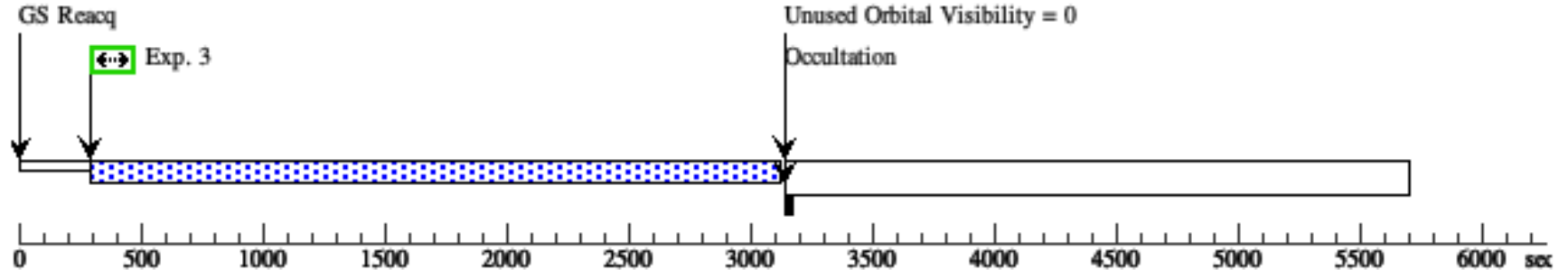
Orbit 1

Server Version: 20190514



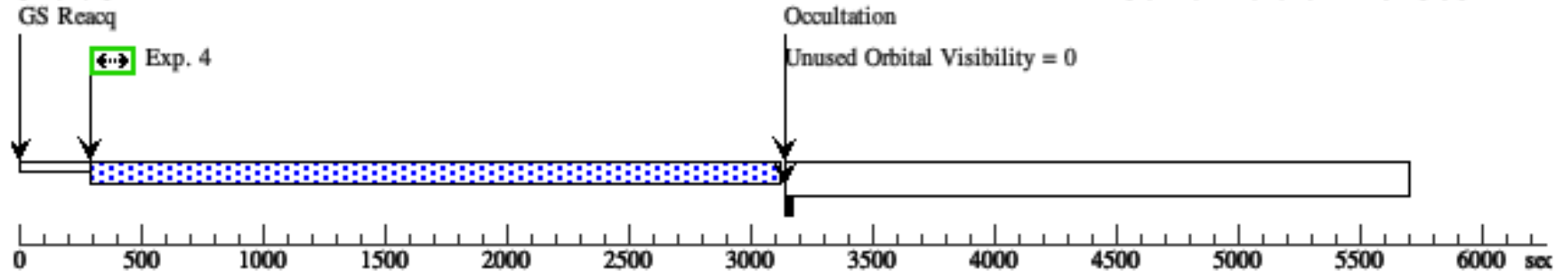
Orbit 2

Server Version: 20190514



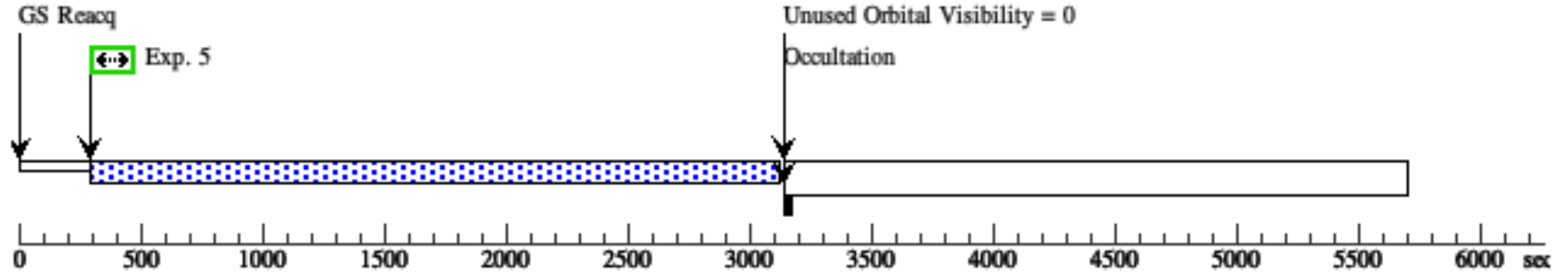
Orbit 3

Server Version: 20190514



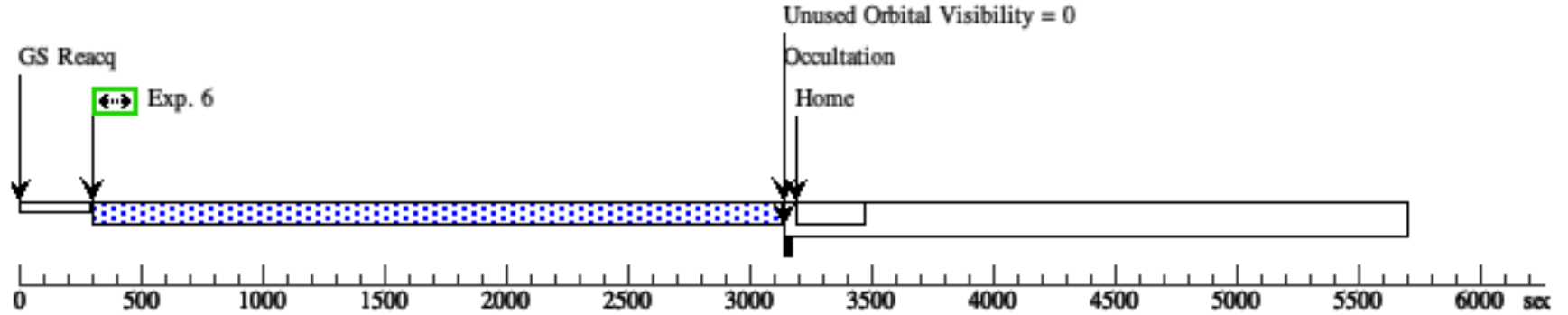
Orbit 4

Server Version: 20190514



Orbit 5

Server Version: 20190514

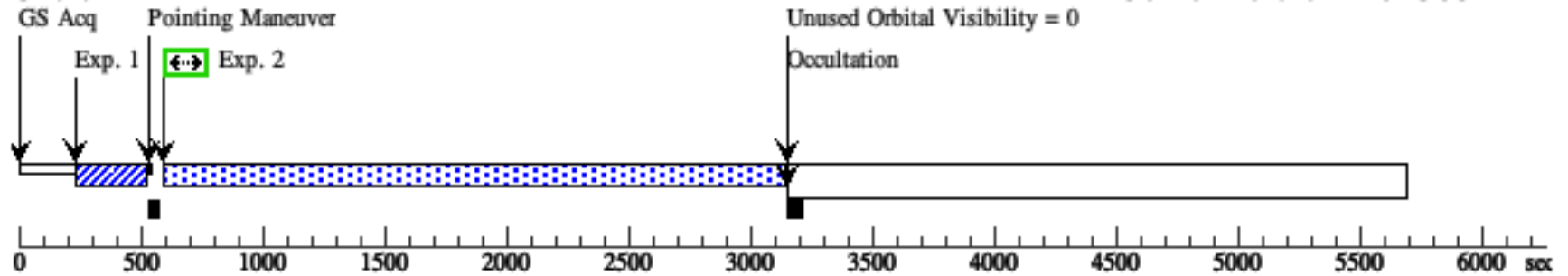


Proposal 15967 - Leo-P-G130M-visit1 (07) - Constraining the Stellar Astrophysics Powering Cosmic Reionization: Spectral Templates ...

Visit	Proposal 15967, Leo-P-G130M-visit1 (07), implementation									Mon Nov 11 19:00:30 GMT 2019
	Diagnostic Status: No Diagnostics									
	Scientific Instruments: COS/FUV, COS/NUV									
	Special Requirements: (none)									
Fixed Targets	#	Name	Target Coordinates	Targ. Coord. Corrections		Fluxes		Miscellaneous		
	(2)	LEO-P	RA: 10 21 45.1217 (155.4380071d) Dec: +18 05 16.93 (18.08804d) Equinox: J2000			V=21.51 Galex NUV: 18.81		Reference Frame: ICRS		
	Comments: Category=EXT-STAR Description=[MAIN SEQUENCE O] 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.137 0780)	(2) LEO-P	COS/NUV, ACQ/IMAGE, PSA	MIRRORA				35 Secs (35 Secs)	
									[==>]	[1]
	Comments: The GSC II BOT flags this, but the GALEX BOT determines that it reaches saftey standards.									
	2	(COS.sp.136 5469)	(2) LEO-P	COS/FUV, TIME-TAG, PSA	G130M 1291 A	FP-POS=3; SEGMENT=BOTH; FLASH=YES; BUFFER-TIME=50 74			2381 Secs (2381 Secs)	
									[==>]	[1]
	3	(COS.sp.136 5415)	(2) LEO-P	COS/FUV, TIME-TAG, PSA	G130M 1291 A	FP-POS=3; SEGMENT=BOTH; FLASH=YES; BUFFER-TIME=50 74			2790 Secs (2790 Secs)	
									[==>]	[2]
	4	(COS.sp.136 5415)	(2) LEO-P	COS/FUV, TIME-TAG, PSA	G130M 1291 A	FP-POS=4; SEGMENT=BOTH; FLASH=YES; BUFFER-TIME=50 74			2790 Secs (2790 Secs)	
									[==>]	[3]
5	(COS.sp.136 5415)	(2) LEO-P	COS/FUV, TIME-TAG, PSA	G130M 1291 A	FP-POS=4; SEGMENT=BOTH; FLASH=YES; BUFFER-TIME=50 74			2790 Secs (2790 Secs)		
								[==>]	[4]	

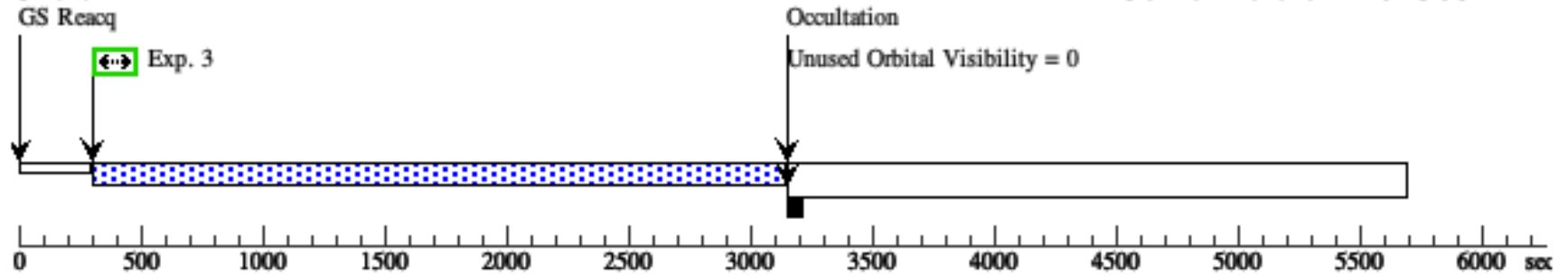
Orbit 1

Server Version: 20190514



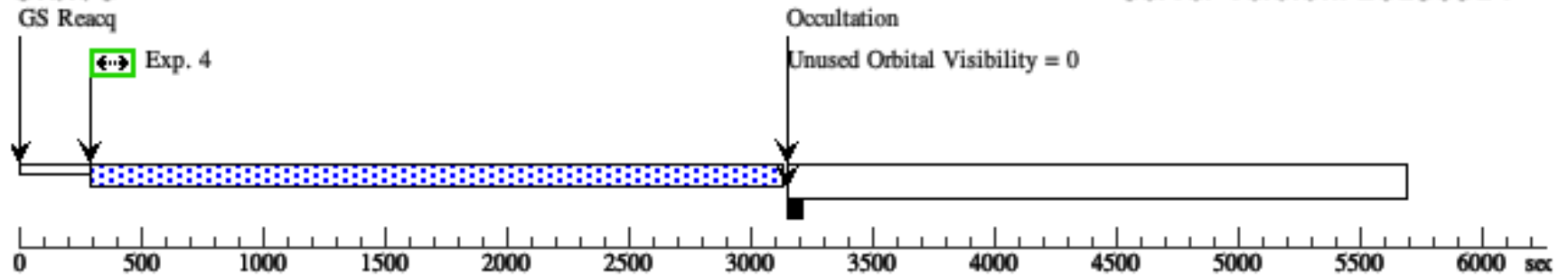
Orbit 2

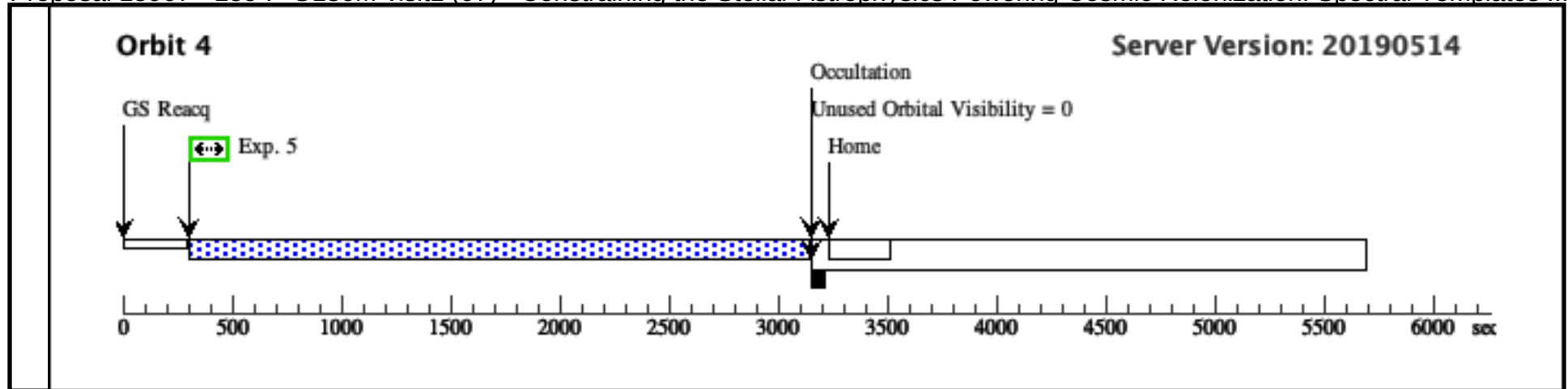
Server Version: 20190514



Orbit 3

Server Version: 20190514



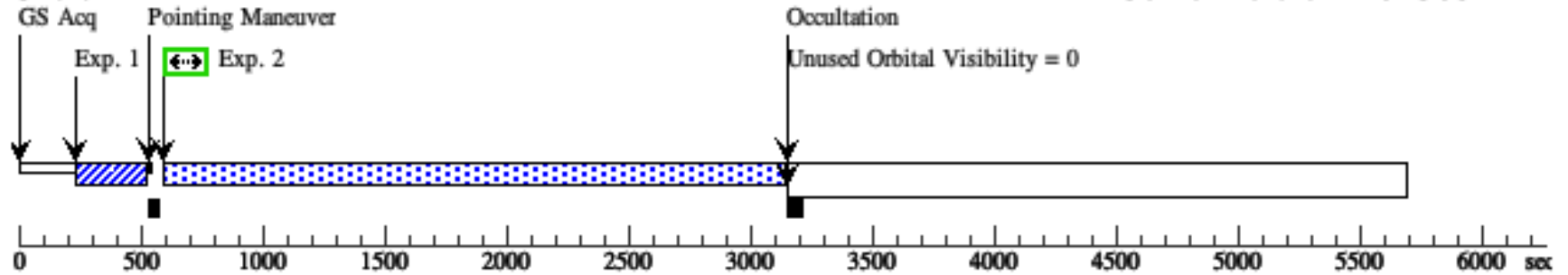


Proposal 15967 - Leo-P-G130M-visit2 (08) - Constraining the Stellar Astrophysics Powering Cosmic Reionization: Spectral Templates ...

Visit	Proposal 15967, Leo-P-G130M-visit2 (08), implementation									Mon Nov 11 19:00:30 GMT 2019
	Diagnostic Status: No Diagnostics									
	Scientific Instruments: COS/FUV, COS/NUV									
	Special Requirements: (none)									
Fixed Targets	#	Name	Target Coordinates	Targ. Coord. Corrections		Fluxes		Miscellaneous		
	(2)	LEO-P	RA: 10 21 45.1217 (155.4380071d) Dec: +18 05 16.93 (18.08804d) Equinox: J2000			V=21.51 Galex NUV: 18.81		Reference Frame: ICRS		
	Comments: Category=EXT-STAR Description=[MAIN SEQUENCE O] 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.137 0780)	(2) LEO-P	COS/NUV, ACQ/IMAGE, PSA	MIRRORA				35 Secs (35 Secs)	
									[==>]	[1]
	Comments: The GSC II BOT flags this, but the GALEX BOT determines that it reaches saftey standards.									
	2	(COS.sp.136 5469)	(2) LEO-P	COS/FUV, TIME-TAG, PSA	G130M 1291 A	FP-POS=3; SEGMENT=BOTH; FLASH=YES; BUFFER-TIME=50 74			2381 Secs (2381 Secs)	
									[==>]	[1]
	3	(COS.sp.136 5415)	(2) LEO-P	COS/FUV, TIME-TAG, PSA	G130M 1291 A	FP-POS=3; SEGMENT=BOTH; FLASH=YES; BUFFER-TIME=50 74			2790 Secs (2790 Secs)	
									[==>]	[2]
	4	(COS.sp.136 5415)	(2) LEO-P	COS/FUV, TIME-TAG, PSA	G130M 1291 A	FP-POS=4; SEGMENT=BOTH; FLASH=YES; BUFFER-TIME=50 74			2790 Secs (2790 Secs)	
									[==>]	[3]
5	(COS.sp.136 5415)	(2) LEO-P	COS/FUV, TIME-TAG, PSA	G130M 1291 A	FP-POS=4; SEGMENT=BOTH; FLASH=YES; BUFFER-TIME=50 74			2790 Secs (2790 Secs)		
								[==>]	[4]	

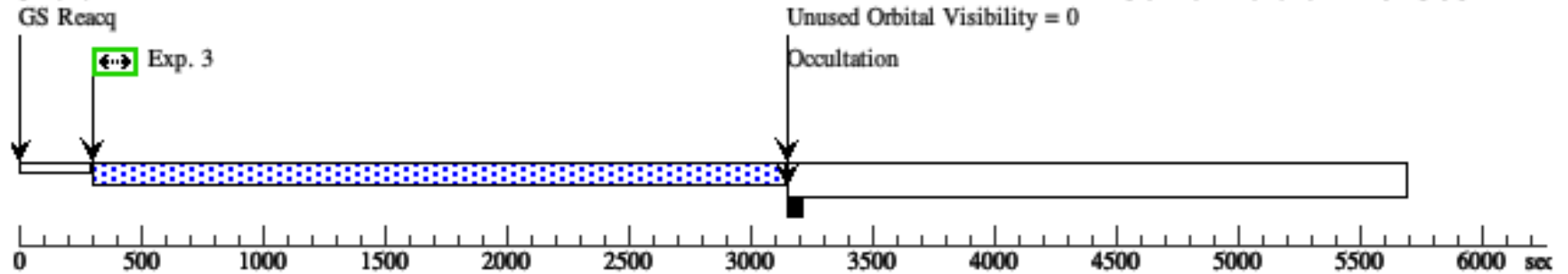
Orbit 1

Server Version: 20190514



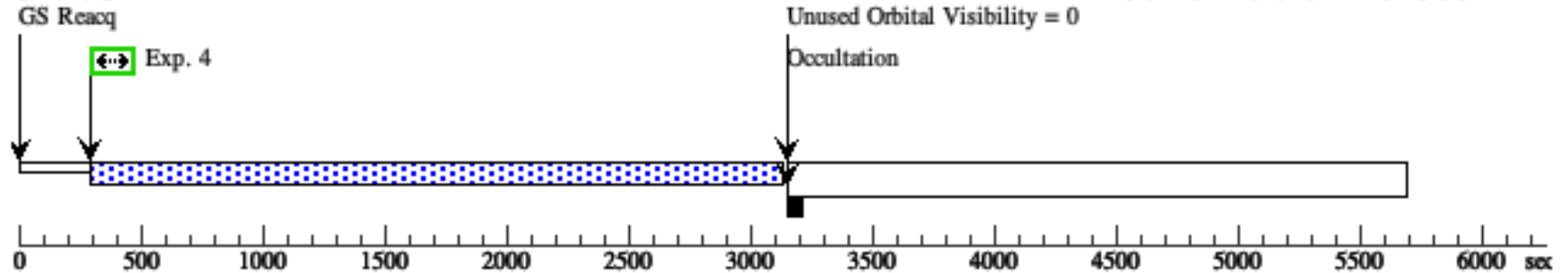
Orbit 2

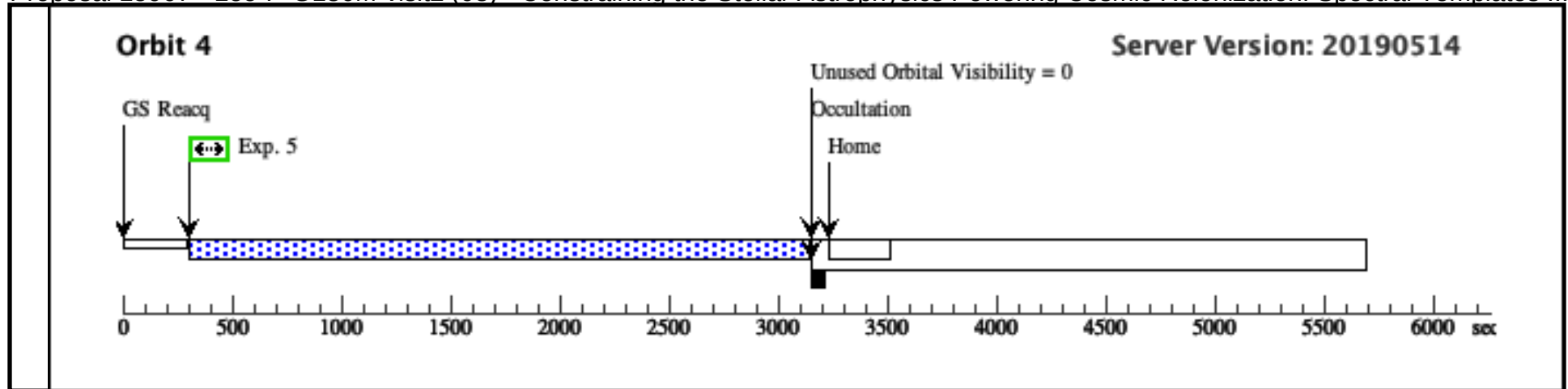
Server Version: 20190514



Orbit 3

Server Version: 20190514



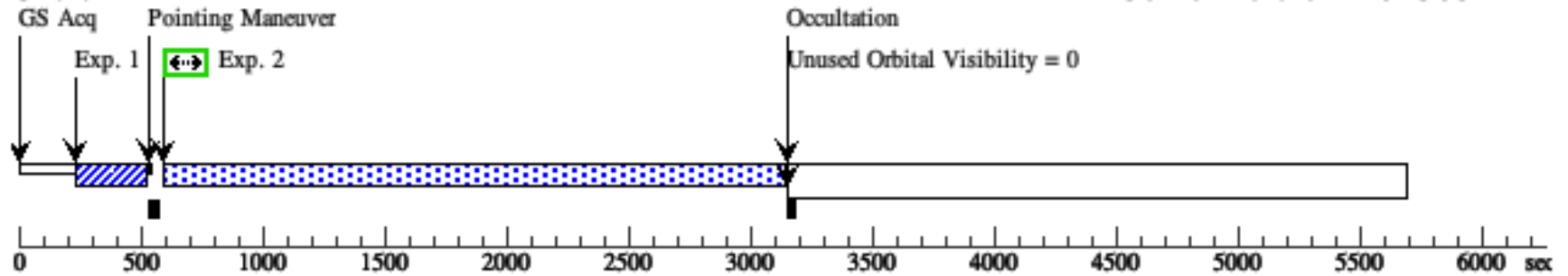


Proposal 15967 - Leo-P-G160M-visit1 (09) - Constraining the Stellar Astrophysics Powering Cosmic Reionization: Spectral Templates ...

Visit	Proposal 15967, Leo-P-G160M-visit1 (09), implementation								Mon Nov 11 19:00:30 GMT 2019	
	Diagnostic Status: No Diagnostics									
	Scientific Instruments: COS/FUV, COS/NUV									
	Special Requirements: (none)									
Fixed Targets	#	Name	Target Coordinates	Targ. Coord. Corrections		Fluxes		Miscellaneous		
	(2)	LEO-P	RA: 10 21 45.1217 (155.4380071d) Dec: +18 05 16.93 (18.08804d) Equinox: J2000			V=21.51 Galex NUV: 18.81		Reference Frame: ICRS		
	Comments: Category=EXT-STAR Description=[MAIN SEQUENCE O] 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.137 0780)	(2) LEO-P	COS/NUV, ACQ/IMAGE, PSA	MIRRORA				35 Secs (35 Secs)	
									[==>]	[1]
	Comments: The GSC II BOT flags this, but the GALEX BOT determines that it reaches saftey standards.									
	2	(COS.sp.139 0812)	(2) LEO-P	COS/FUV, TIME-TAG, PSA	G160M 1600 A	FP-POS=1; SEGMENT=BOTH; FLASH=YES; BUFFER-TIME=19 381			2334 Secs (2334 Secs)	
									[==>]	[1]
	3	(COS.sp.139 0812)	(2) LEO-P	COS/FUV, TIME-TAG, PSA	G160M 1600 A	FP-POS=2; SEGMENT=BOTH; FLASH=YES; BUFFER-TIME=19 381			2790 Secs (2790 Secs)	
									[==>]	[2]
	4	(COS.sp.139 0812)	(2) LEO-P	COS/FUV, TIME-TAG, PSA	G160M 1600 A	FP-POS=3; SEGMENT=BOTH; FLASH=YES; BUFFER-TIME=19 381			2790 Secs (2790 Secs)	
									[==>]	[3]
	5	(COS.sp.139 0812)	(2) LEO-P	COS/FUV, TIME-TAG, PSA	G160M 1600 A	FP-POS=4; SEGMENT=BOTH; FLASH=YES; BUFFER-TIME=19 381			2790 Secs (2790 Secs)	
									[==>]	[4]
	6	(COS.sp.139 0812)	(2) LEO-P	COS/FUV, TIME-TAG, PSA	G160M 1600 A	FP-POS=4; SEGMENT=BOTH; FLASH=YES; BUFFER-TIME=19 381			2790 Secs (2790 Secs)	
									[==>]	[5]

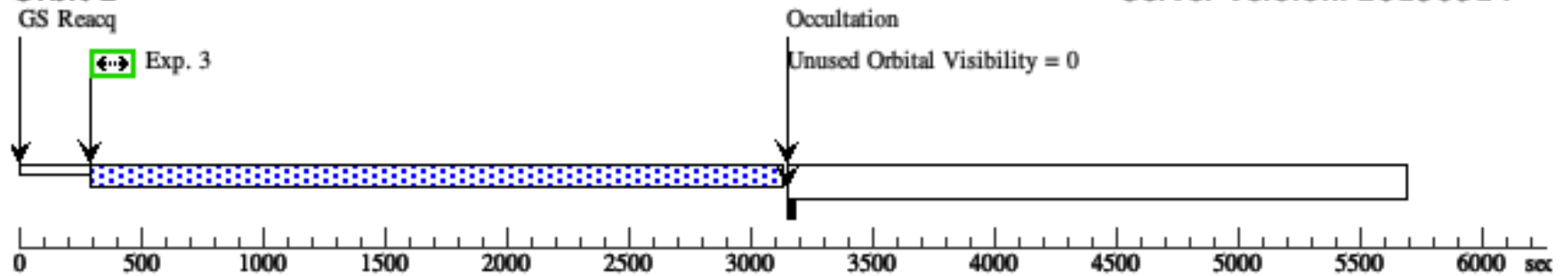
Orbit 1

Server Version: 20190514



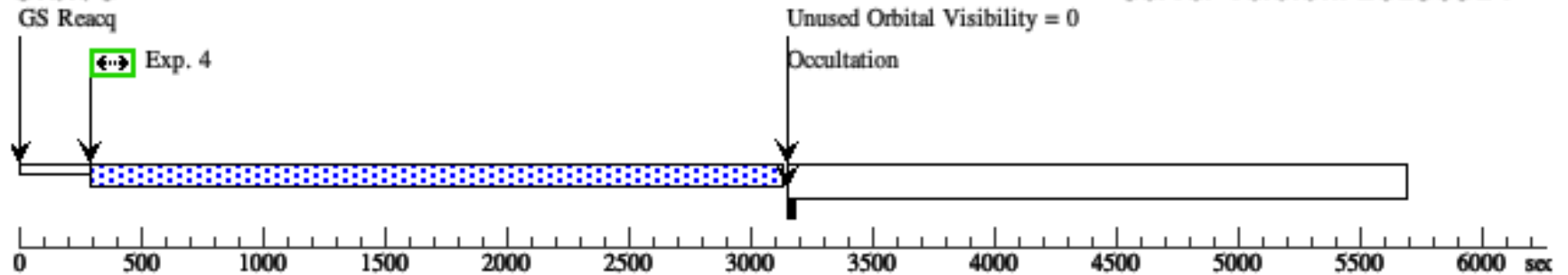
Orbit 2

Server Version: 20190514



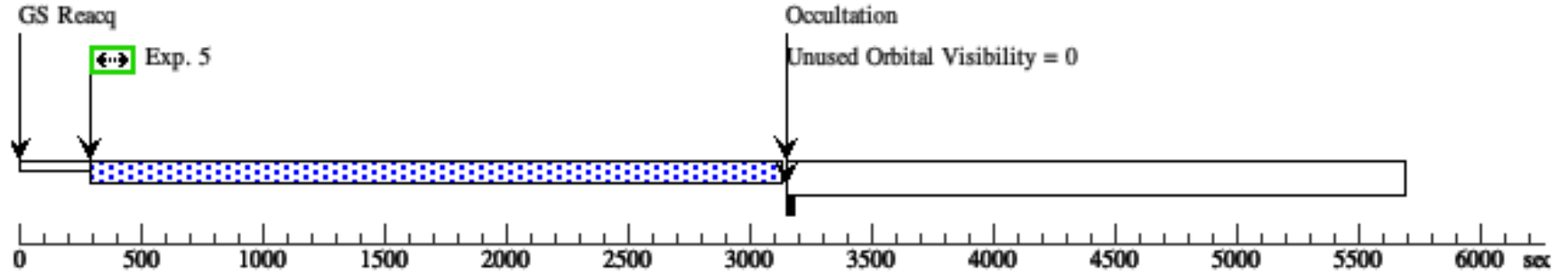
Orbit 3

Server Version: 20190514



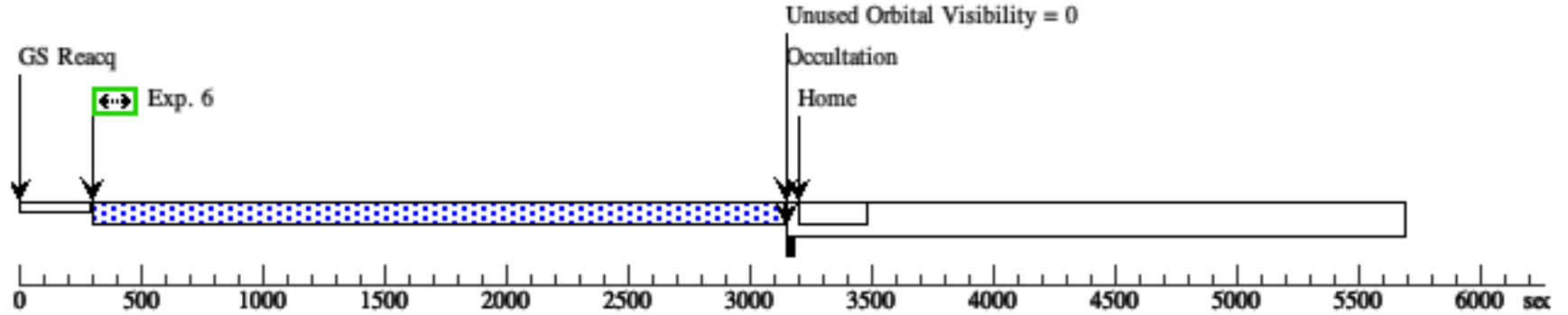
Orbit 4

Server Version: 20190514



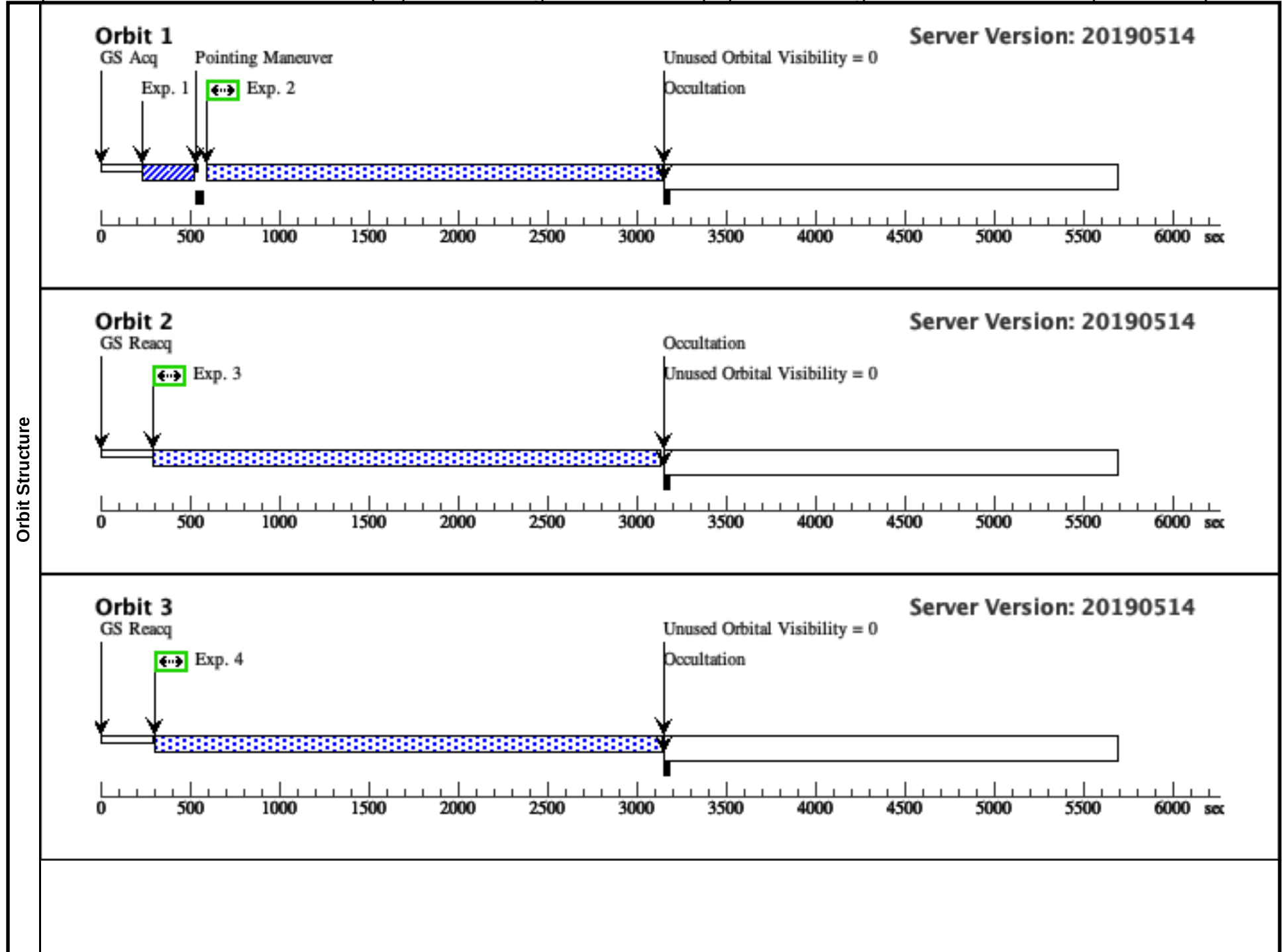
Orbit 5

Server Version: 20190514



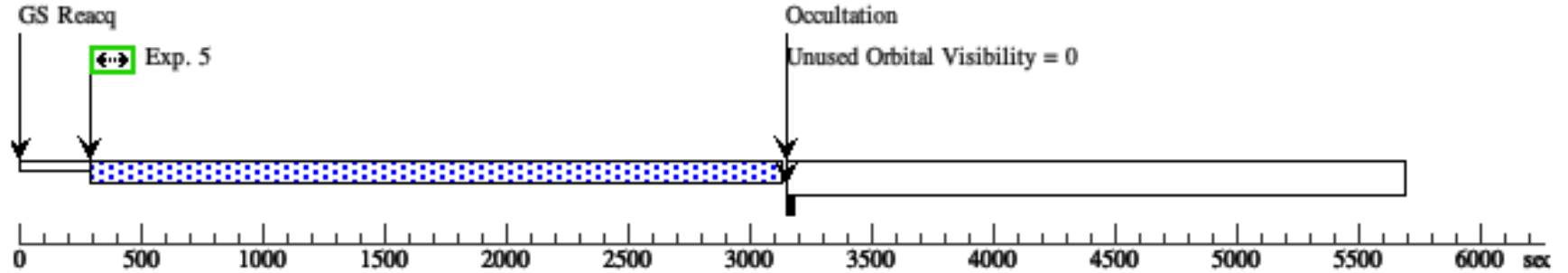
Proposal 15967 - Leo-P-G160M-visit2 (10) - Constraining the Stellar Astrophysics Powering Cosmic Reionization: Spectral Templates ...

Visit	Proposal 15967, Leo-P-G160M-visit2 (10), implementation								Mon Nov 11 19:00:30 GMT 2019	
	Diagnostic Status: No Diagnostics									
	Scientific Instruments: COS/FUV, COS/NUV									
	Special Requirements: (none)									
Fixed Targets	#	Name	Target Coordinates	Targ. Coord. Corrections		Fluxes		Miscellaneous		
	(2)	LEO-P	RA: 10 21 45.1217 (155.4380071d) Dec: +18 05 16.93 (18.08804d) Equinox: J2000			V=21.51 Galex NUV: 18.81		Reference Frame: ICRS		
	Comments: Category=EXT-STAR Description=[MAIN SEQUENCE O] 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.137 0780)	(2) LEO-P	COS/NUV, ACQ/IMAGE, PSA	MIRRORA				35 Secs (35 Secs)	
									[==>]	[1]
	Comments: The GSC II BOT flags this, but the GALEX BOT determines that it reaches saftey standards.									
	2	(COS.sp.139 0812)	(2) LEO-P	COS/FUV, TIME-TAG, PSA	G160M 1600 A	FP-POS=1; SEGMENT=BOTH; FLASH=YES; BUFFER-TIME=19 381			2334 Secs (2334 Secs)	
									[==>]	[1]
	3	(COS.sp.139 0812)	(2) LEO-P	COS/FUV, TIME-TAG, PSA	G160M 1600 A	FP-POS=2; SEGMENT=BOTH; FLASH=YES; BUFFER-TIME=19 381			2790 Secs (2790 Secs)	
									[==>]	[2]
	4	(COS.sp.139 0812)	(2) LEO-P	COS/FUV, TIME-TAG, PSA	G160M 1600 A	FP-POS=2; SEGMENT=BOTH; FLASH=YES; BUFFER-TIME=19 381			2790 Secs (2790 Secs)	
									[==>]	[3]
	5	(COS.sp.139 0812)	(2) LEO-P	COS/FUV, TIME-TAG, PSA	G160M 1600 A	FP-POS=3; SEGMENT=BOTH; FLASH=YES; BUFFER-TIME=19 381			2790 Secs (2790 Secs)	
									[==>]	[4]
	6	(COS.sp.139 0812)	(2) LEO-P	COS/FUV, TIME-TAG, PSA	G160M 1600 A	FP-POS=4; SEGMENT=BOTH; FLASH=YES; BUFFER-TIME=19 381			2790 Secs (2790 Secs)	
									[==>]	[5]



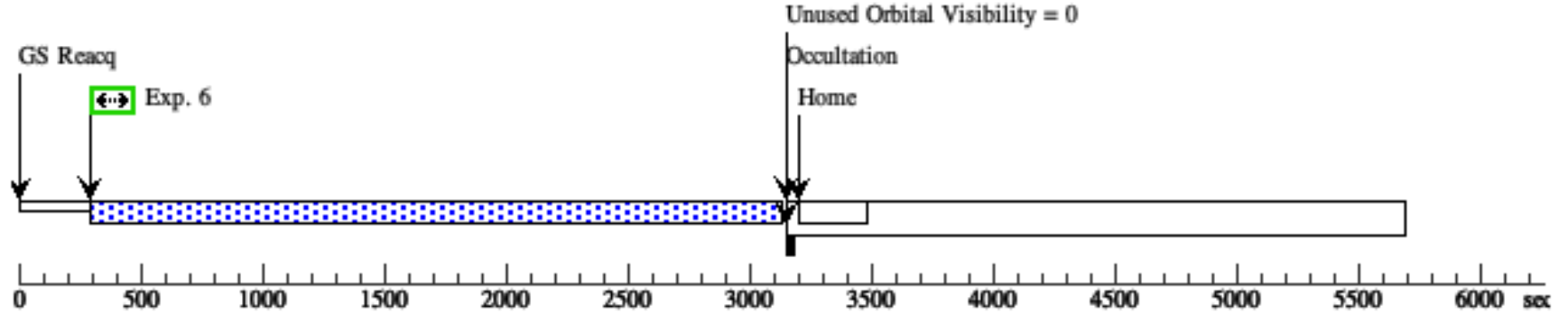
Orbit 4

Server Version: 20190514



Orbit 5

Server Version: 20190514

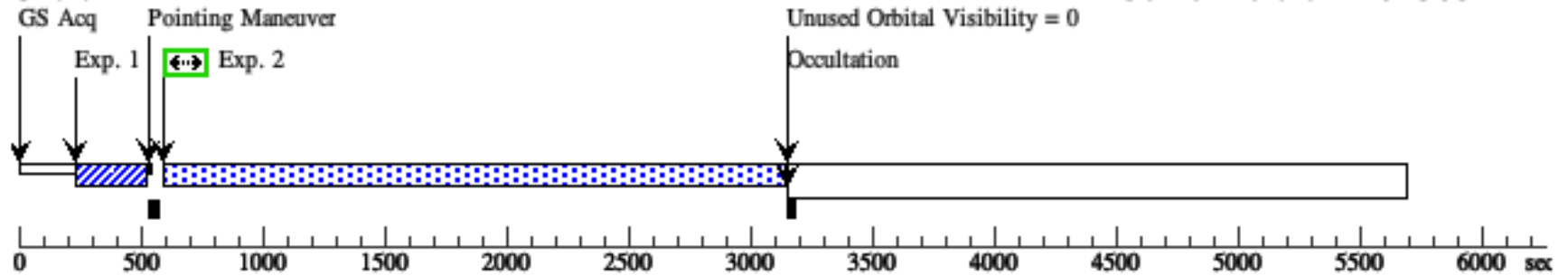


Proposal 15967 - Leo-P-G160M-visit3 (11) - Constraining the Stellar Astrophysics Powering Cosmic Reionization: Spectral Templates ...

Visit	Proposal 15967, Leo-P-G160M-visit3 (11), implementation										Mon Nov 11 19:00:30 GMT 2019	
	Diagnostic Status: No Diagnostics											
	Scientific Instruments: COS/FUV, COS/NUV											
	Special Requirements: (none)											
Fixed Targets	#	Name	Target Coordinates	Targ. Coord. Corrections			Fluxes		Miscellaneous			
	(2)	LEO-P	RA: 10 21 45.1217 (155.4380071d) Dec: +18 05 16.93 (18.08804d) Equinox: J2000				V=21.51 Galex NUV: 18.81		Reference Frame: ICRS			
	Comments: Category=EXT-STAR Description=[MAIN SEQUENCE O] 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.137 0780)	(2) LEO-P	COS/NUV, ACQ/IMAGE, PSA	MIRRORA				35 Secs (35 Secs)			
										[==>]	[1]	
	Comments: The GSC II BOT flags this, but the GALEX BOT determines that it reaches saftey standards.											
	2	(COS.sp.139 0812)	(2) LEO-P	COS/FUV, TIME-TAG, PSA	G160M 1600 A	FP-POS=1; SEGMENT=BOTH; FLASH=YES; BUFFER-TIME=19 381				2334 Secs (2334 Secs)		
										[==>]	[1]	
	3	(COS.sp.139 0812)	(2) LEO-P	COS/FUV, TIME-TAG, PSA	G160M 1600 A	FP-POS=2; SEGMENT=BOTH; FLASH=YES; BUFFER-TIME=19 381				2790 Secs (2790 Secs)		
										[==>]	[2]	
	4	(COS.sp.139 0812)	(2) LEO-P	COS/FUV, TIME-TAG, PSA	G160M 1600 A	FP-POS=3; SEGMENT=BOTH; FLASH=YES; BUFFER-TIME=19 381				2790 Secs (2790 Secs)		
										[==>]	[3]	
	5	(COS.sp.139 0812)	(2) LEO-P	COS/FUV, TIME-TAG, PSA	G160M 1600 A	FP-POS=3; SEGMENT=BOTH; FLASH=YES; BUFFER-TIME=19 381				2790 Secs (2790 Secs)		
										[==>]	[4]	
	6	(COS.sp.139 0812)	(2) LEO-P	COS/FUV, TIME-TAG, PSA	G160M 1600 A	FP-POS=4; SEGMENT=BOTH; FLASH=YES; BUFFER-TIME=19 381				2790 Secs (2790 Secs)		
										[==>]	[5]	

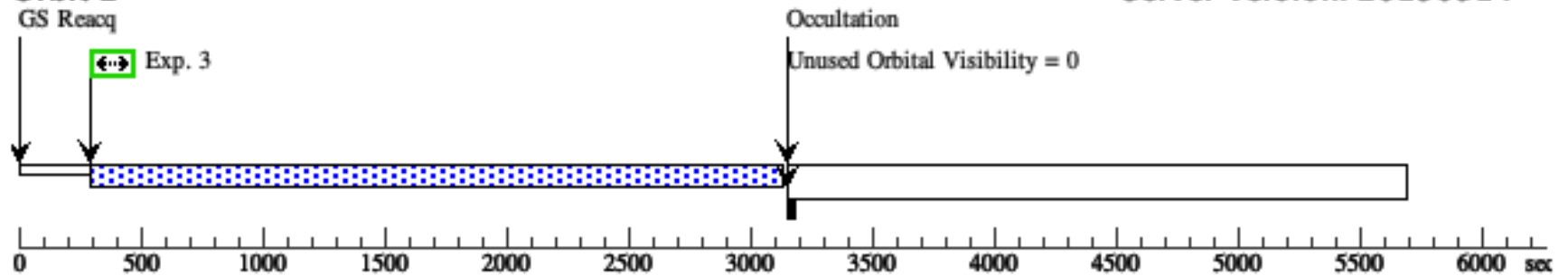
Orbit 1

Server Version: 20190514



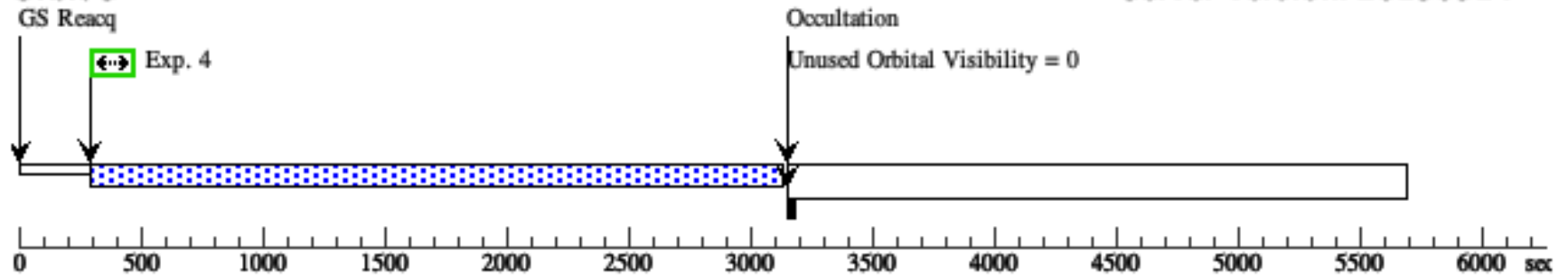
Orbit 2

Server Version: 20190514



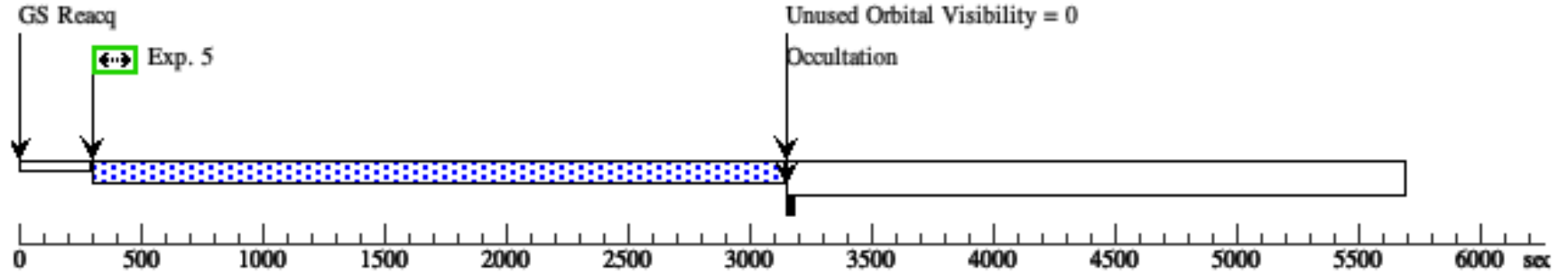
Orbit 3

Server Version: 20190514



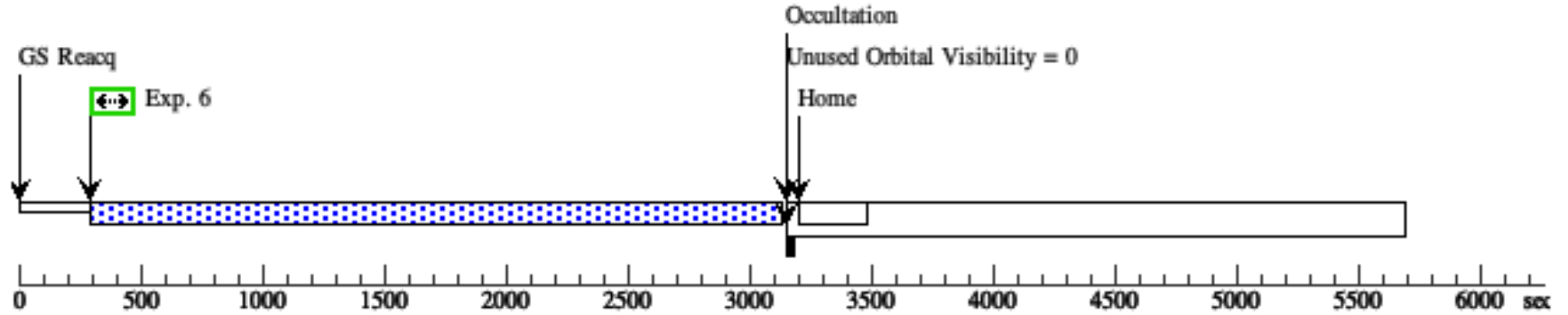
Orbit 4

Server Version: 20190514



Orbit 5

Server Version: 20190514

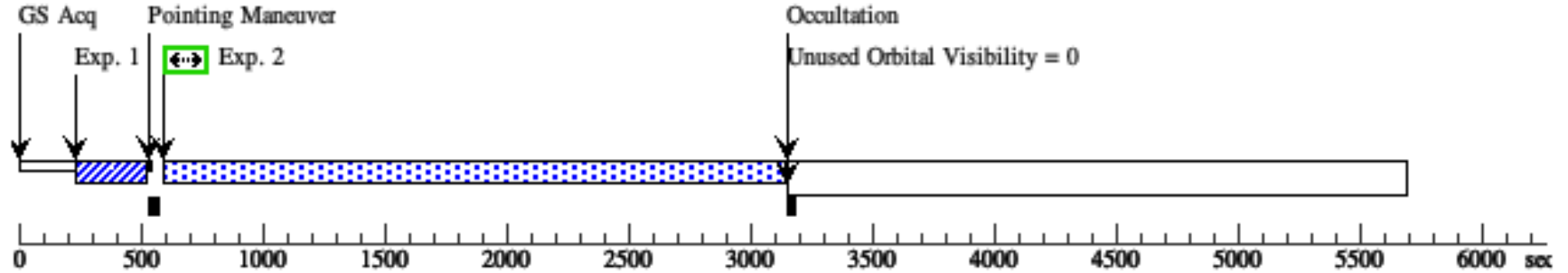


Proposal 15967 - Leo-P-G160M-visit4 (12) - Constraining the Stellar Astrophysics Powering Cosmic Reionization: Spectral Templates ...

Visit	Proposal 15967, Leo-P-G160M-visit4 (12), implementation								Mon Nov 11 19:00:30 GMT 2019	
	Diagnostic Status: No Diagnostics									
	Scientific Instruments: COS/FUV, COS/NUV									
	Special Requirements: (none)									
Fixed Targets	#	Name	Target Coordinates	Targ. Coord. Corrections		Fluxes		Miscellaneous		
	(2)	LEO-P	RA: 10 21 45.1217 (155.4380071d) Dec: +18 05 16.93 (18.08804d) Equinox: J2000			V=21.51 Galex NUV: 18.81		Reference Frame: ICRS		
	Comments: Category=EXT-STAR Description=[MAIN SEQUENCE O] 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.137 0780)	(2) LEO-P	COS/NUV, ACQ/IMAGE, PSA	MIRRORA				35 Secs (35 Secs)	
	[==>]									[1]
	Comments: The GSC II BOT flags this, but the GALEX BOT determines that it reaches saftey standards.									
	2	(COS.sp.139 0812)	(2) LEO-P	COS/FUV, TIME-TAG, PSA	G160M 1600 A	FP-POS=1; SEGMENT=BOTH; FLASH=YES; BUFFER-TIME=19 381			2334 Secs (2334 Secs)	
	[==>]									[1]
	3	(COS.sp.139 0812)	(2) LEO-P	COS/FUV, TIME-TAG, PSA	G160M 1600 A	FP-POS=1; SEGMENT=BOTH; FLASH=YES; BUFFER-TIME=19 381			2790 Secs (2790 Secs)	
	[==>]									[2]
	4	(COS.sp.139 0812)	(2) LEO-P	COS/FUV, TIME-TAG, PSA	G160M 1600 A	FP-POS=1; SEGMENT=BOTH; FLASH=YES; BUFFER-TIME=19 381			2790 Secs (2790 Secs)	
	[==>]									[3]

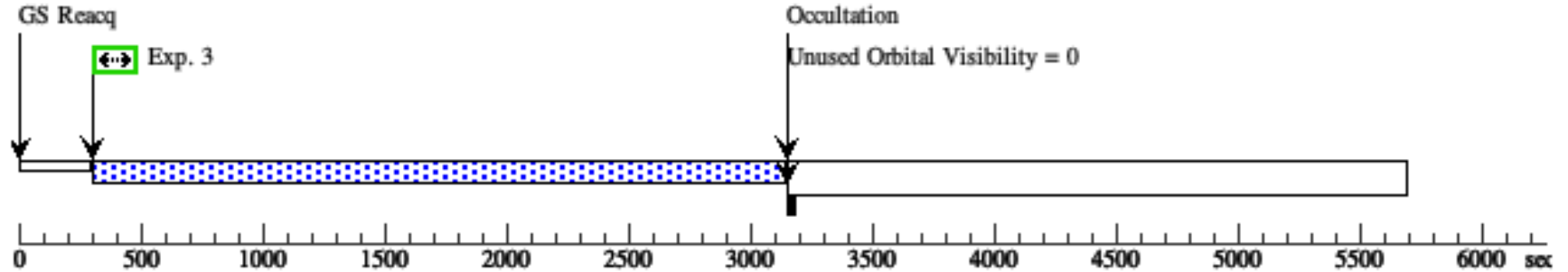
Orbit 1

Server Version: 20190514



Orbit 2

Server Version: 20190514



Orbit 3

Server Version: 20190514

