17102 - Anchoring CNO with an Extremely Metal Deficient Galaxy

Cycle: 30, Proposal Category: GO

(UV Initiative)

(Availability Mode: SUPPORTED)

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) LEO-P	COS/FUV COS/NUV	4	14-Jul-2022 14:00:30.0	yes
02	(1) LEO-P	COS/FUV COS/NUV	4	14-Jul-2022 14:00:31.0	yes
03	(1) LEO-P	COS/FUV COS/NUV	4	14-Jul-2022 14:00:32.0	yes
04	(1) LEO-P	COS/FUV COS/NUV	4	14-Jul-2022 14:00:32.0	yes

16 Total Orbits Used

ABSTRACT

While oxygen and nitrogen have been widely observed in spiral and dwarf galaxies, the study of the next most abundant element, carbon, remains relatively unexplored, especially for the lowest metallicities relevant for high-z galaxies. Carbon has no strong collisionally-excited emission lines in the optical, however, by observing the CIII] 1907,1909 and OIII] 1661,1666 emission lines in the UV, we can obtain a very secure measurement of the C/O ratio in HII regions. Recent campaigns have been successfully using this method to measure C/O abundances in dwarf galaxies using HST/COS, however, extremely metal poor galaxies (XMPs; 12+log(O/H) < 7.3 or < 3% solar) are notoriously rare and have challengingly faint emission, and so no significant measurements of C/O yet exist for the most metal-poor nearby galaxies.

The recent discovery of unexpectedly strong ultraviolet OIII] 1666 and rare NIII] 1750 emission from the HST/COS G160M spectrum of nearby XMP galaxy, Leo P (12+log(O/H)=7.17), reveals a unique opportunity to measure the CNO abundances in a chemically-young, high-ionization galaxy with exceptionally bright emission. We propose HST/COS G140L observations of Leo P to simultaneously measure the C, N, and O abundance in the most metal-poor XMP to date. These observations will allow us to (1) anchor the C/O and C/N relationships by extending the low-metallicity baseline, (2) explore the potential continuity in C/O versus O/H from dwarf galaxies to DLAs, (3) test the proposed link between C and N production, and (4) help constrain rest-frame UV emission-line diagnostics in chemically-young systems in preparation for the distant galaxies that will be observed with JWST.

OBSERVING DESCRIPTION

In order to anchor the poorly constrained low-metallicity regime of the C/O-O/H relationship, we will use HST/COS spectroscopic measurements of the OIII] 1661,1666 and CIII] 1907,1909 emission lines of the extremely metal-deficient Leo P galaxy. This data will provide a crucial constraint on the C/O relationship in metal-poor dwarf galaxies, which yields important information on the time evolution and nucleosynthetic origins of these elements, and will provide an important template for early galaxy evolution. The most efficient observing strategy for these observations is to use the G140L grating on COS with the 1280 central wavelength setting, which allows simultaneous observations of all the necessary UV emission lines within Segment A. We have excellent input coordinates centered on the NUV surface brightness peak of the O-star Leo P from previous HST/COS observations, allowing us to utilize the time-efficient ACQ/IMAGE mode for target acquisition. Note that while the resolution of COS spectra is degraded for non-point sources, we have demonstrated in Berg+19 that the OIII] doublet is easily resolved and the CIII] doublet can be deblended in G140L spectra (allowing for an estimate of the CIII] electron density), even for targets with extended nebular emission that fills the COS aperture. We split our awarded 16 orbits up into 4 visits based on the updated COS guidelines to reduce observation failures.

Visit

Proposal 17102, G185M (01) Thu Jul 14 18:00:33 GMT 2022

Diagnostic Status: Warning

Scientific Instruments: COS/FUV, COS/NUV

Special Requirements: (none)

Diagnostics

(Exposure 2 (G185M (01))) Warning (Form): COS FUV PSA science exposures with extended targets have special calibration limitations. See "Errors and Warnings" for more details.

Fixed Targets

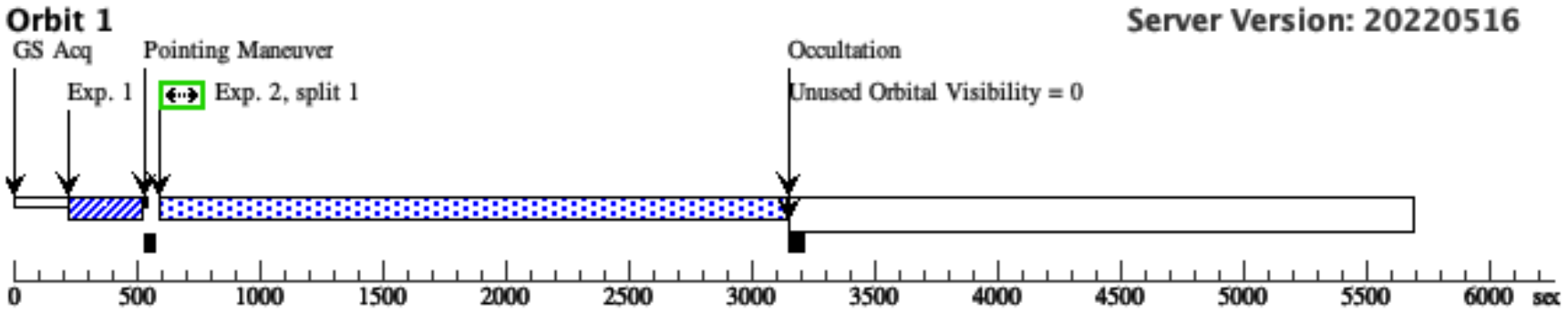
#	Name	Target Coordinates	Targ. Coord. Corrections	Fluxes	Miscellaneous
(1)	LEO-P	RA: 10 21 45.1217 (155.4380071d) Dec: +18 05 16.93 (18.08804d) Equinox: J2000		V=21.51 Galex NUV: 18.81	Reference Frame: ICRS

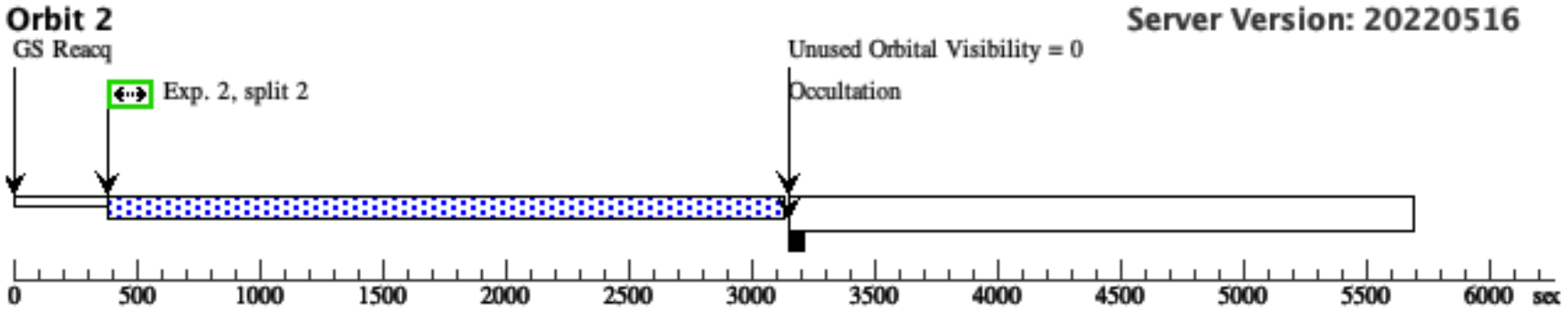
Comments:
Category=GALAXY
Description=[DWARF COMPACT]
Extended=YES

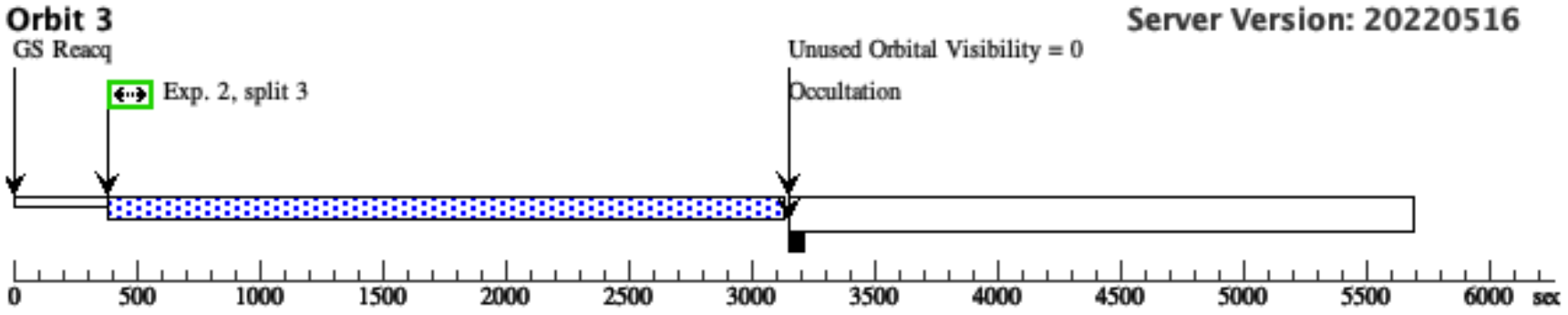
Exposures

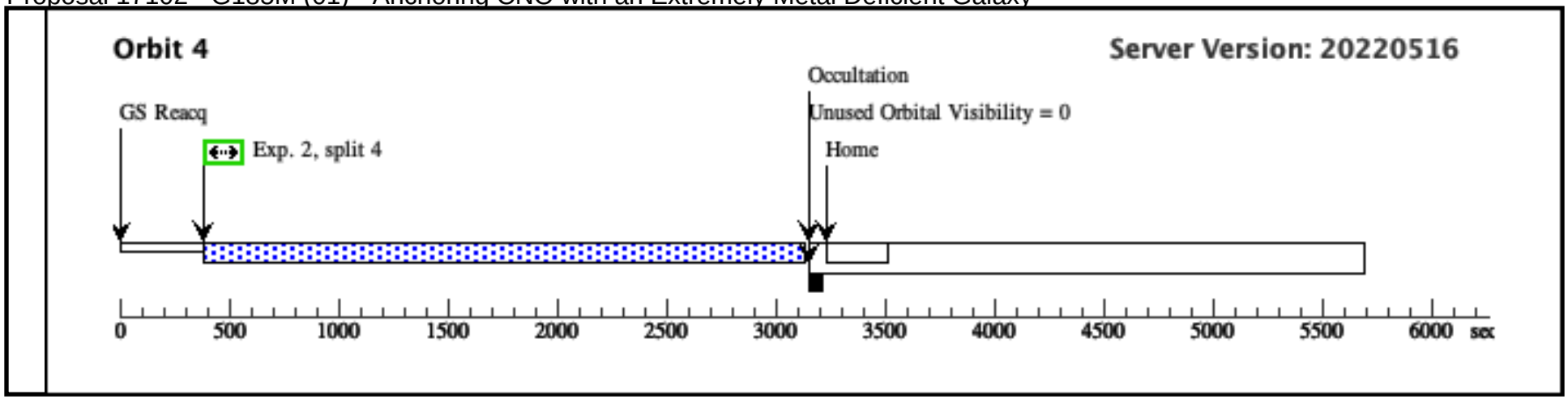
#	Label (ETC Run)	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time (Total)/[Actual Dur.]	Orbit
1	G140L-1 (COS.ta.1370780)	(1) LEO-P	COS/NUV, ACQ/IMAGE, PSA	MIRRORA				35 Secs (35 Secs)	
								[==>]	***[1]***
Comments: The GSC II BOT flags this, but the GALEX BOT determines that it reaches saftey standards.									
2	(COS.sp.1365469)	(1) LEO-P	COS/FUV, TIME-TAG, PSA	G140L 1280 A	FP-POS=ALL; SEGMENT=BOTH; FLASH=YES; BUFFER-TIME=5074			2381 Secs (10474 Secs) *[==>2374.0 Secs (Split 1)]* *[==>2700.0 Secs (Split 2)]* *[==>2700.0 Secs (Split 3)]* *[==>2700.0 Secs (Split 4)]*	 ***[1]*** ***[2]*** ***[3]*** ***[4]***

Orbit Structure








Orbit 4
Server Version: 20220516
Occultation
GS Reacq
Unused Orbital Visibility = 0
Exp. 2, split 4
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Visit

Proposal 17102, G185M (02) Thu Jul 14 18:00:33 GMT 2022

Diagnostic Status: Warning

Scientific Instruments: COS/FUV, COS/NUV

Special Requirements: (none)

Diagnostics

(Exposure 2 (G185M (02))) Warning (Form): COS FUV PSA science exposures with extended targets have special calibration limitations. See "Errors and Warnings" for more details.

Fixed Targets

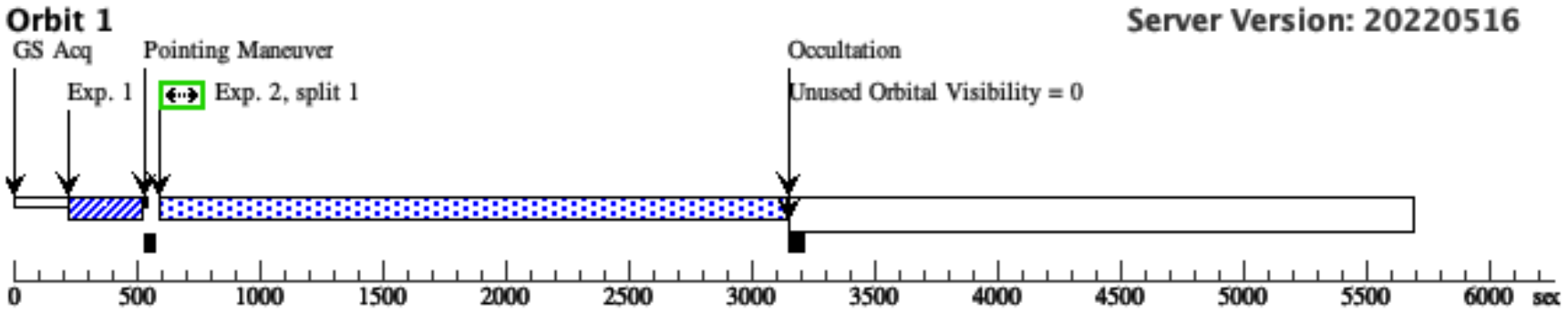
#	Name	Target Coordinates	Targ. Coord. Corrections	Fluxes	Miscellaneous
(1)	LEO-P	RA: 10 21 45.1217 (155.4380071d) Dec: +18 05 16.93 (18.08804d) Equinox: J2000		V=21.51 Galex NUV: 18.81	Reference Frame: ICRS

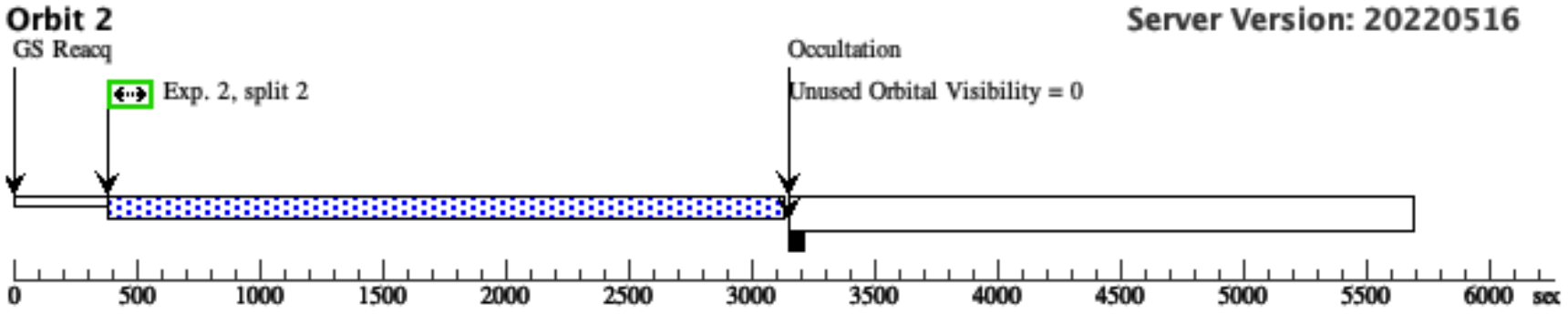
Comments:
Category=GALAXY
Description=[DWARF COMPACT]
Extended=YES

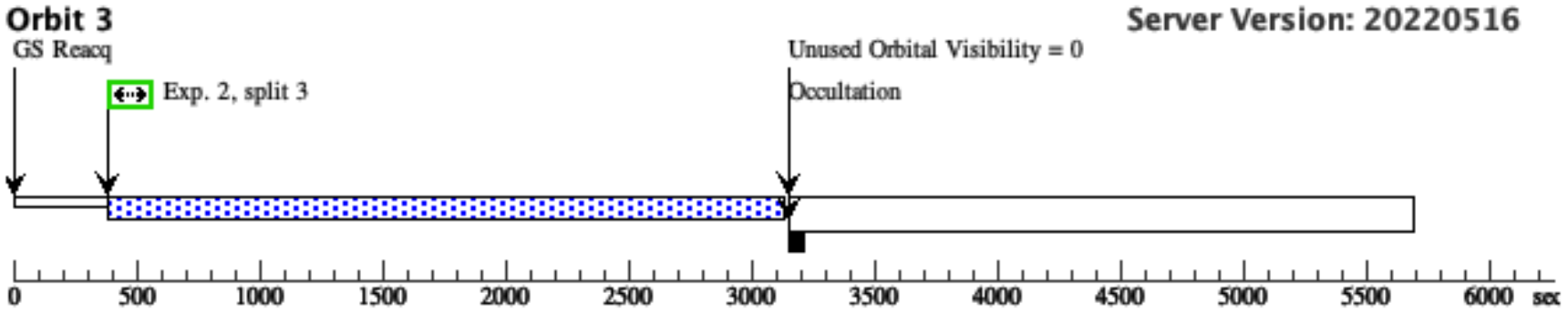
Exposures

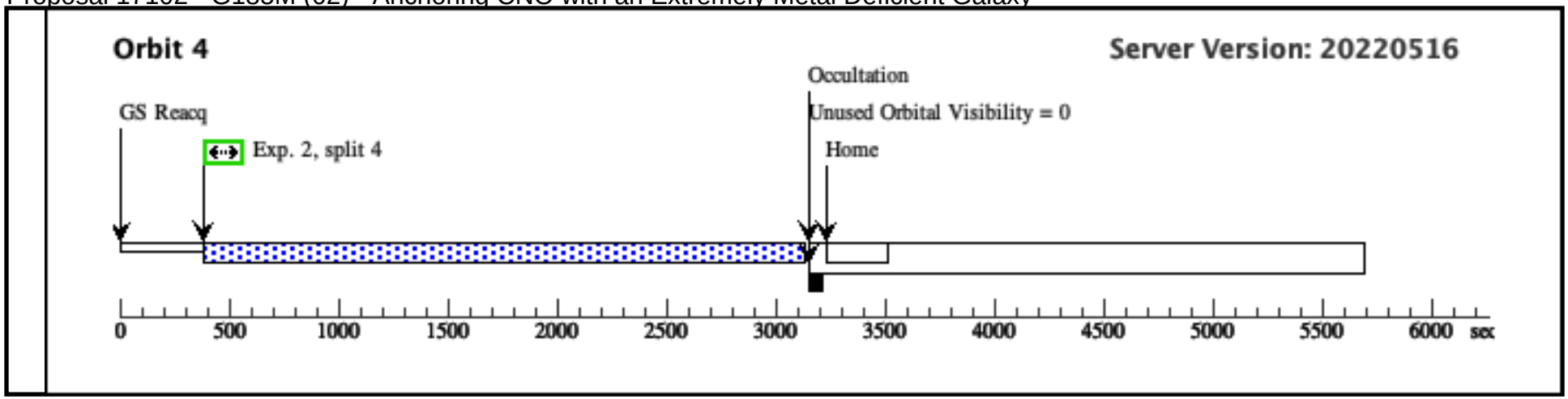
#	Label (ETC Run)	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time (Total)/[Actual Dur.]	Orbit
1	G140L-1 (COS.ta.1370780)	(1) LEO-P	COS/NUV, ACQ/IMAGE, PSA	MIRRORA				35 Secs (35 Secs)	
								[==>]	***[1]***
Comments: The GSC II BOT flags this, but the GALEX BOT determines that it reaches saftey standards.									
2	(COS.sp.1365469)	(1) LEO-P	COS/FUV, TIME-TAG, PSA	G140L 1280 A	FP-POS=ALL; SEGMENT=BOTH; FLASH=YES; BUFFER-TIME=5074			2381 Secs (10474 Secs) *[==>2374.0 Secs (Split 1)]* *[==>2700.0 Secs (Split 2)]* *[==>2700.0 Secs (Split 3)]* *[==>2700.0 Secs (Split 4)]*	 ***[1]*** ***[2]*** ***[3]*** ***[4]***

Orbit Structure








Orbit 4
Server Version: 20220516
Occultation
GS Reacq
Unused Orbital Visibility = 0
Exp. 2, split 4
Home
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Visit

Proposal 17102, G185M (03) Thu Jul 14 18:00:33 GMT 2022

Diagnostic Status: Warning

Scientific Instruments: COS/FUV, COS/NUV

Special Requirements: (none)

Diagnostics

(Exposure 2 (G185M (03))) Warning (Form): COS FUV PSA science exposures with extended targets have special calibration limitations. See "Errors and Warnings" for more details.

Fixed Targets

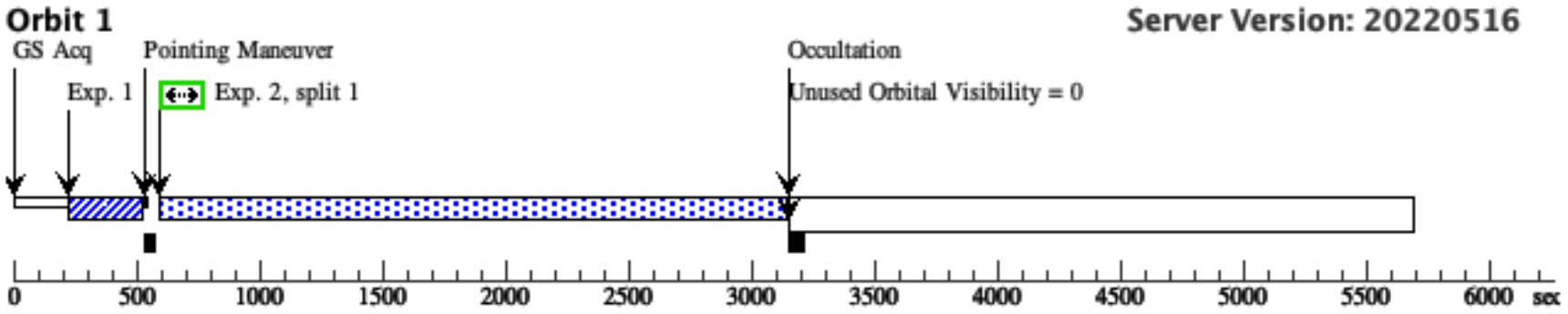
#	Name	Target Coordinates	Targ. Coord. Corrections	Fluxes	Miscellaneous
(1)	LEO-P	RA: 10 21 45.1217 (155.4380071d) Dec: +18 05 16.93 (18.08804d) Equinox: J2000		V=21.51 Galex NUV: 18.81	Reference Frame: ICRS

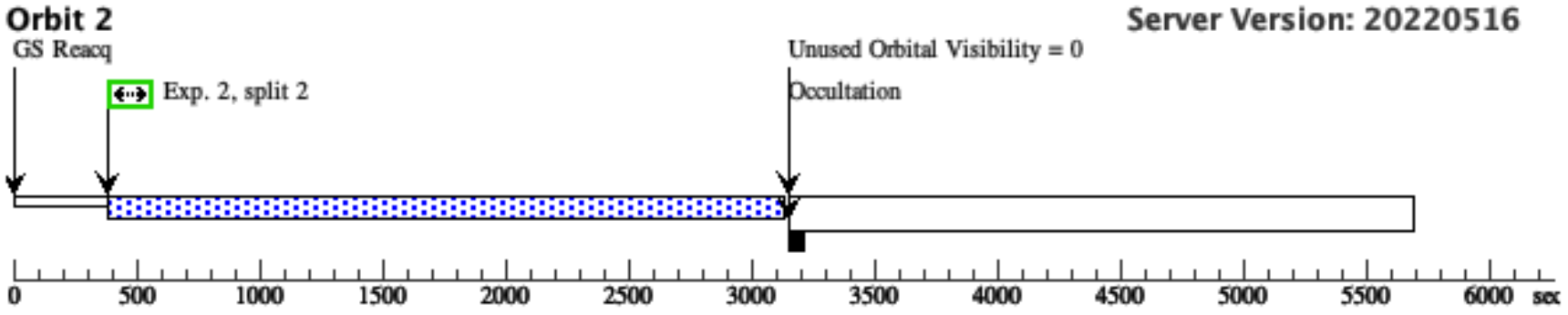
Comments:
Category=GALAXY
Description=[DWARF COMPACT]
Extended=YES

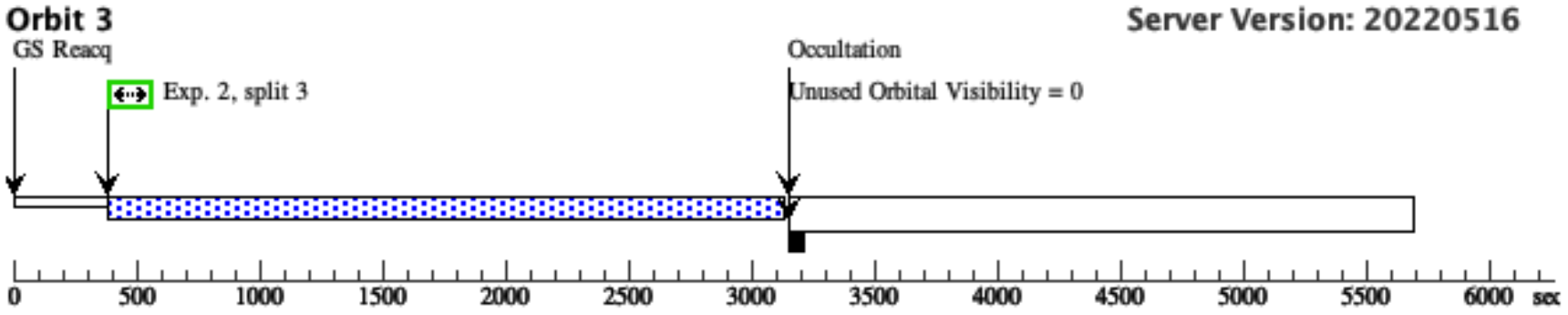
Exposures

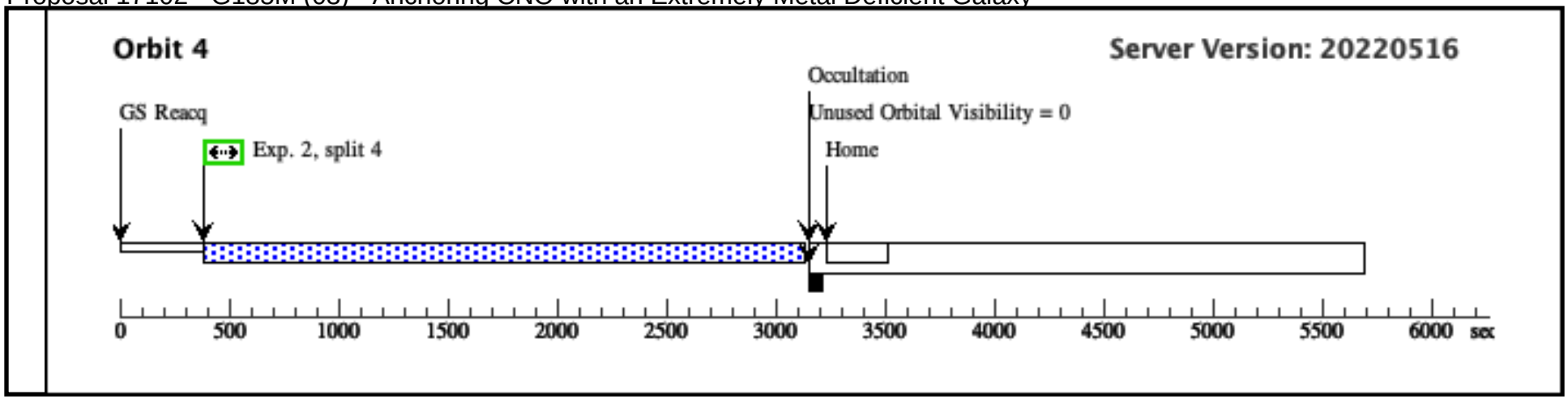
#	Label (ETC Run)	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time (Total)/[Actual Dur.]	Orbit
1	G140L-1 (COS.ta.1370780)	(1) LEO-P	COS/NUV, ACQ/IMAGE, PSA	MIRRORA				35 Secs (35 Secs)	
								[==>]	***[1]***
Comments: The GSC II BOT flags this, but the GALEX BOT determines that it reaches saftey standards.									
2	(COS.sp.1365469)	(1) LEO-P	COS/FUV, TIME-TAG, PSA	G140L 1280 A	FP-POS=ALL; SEGMENT=BOTH; FLASH=YES; BUFFER-TIME=5074			2381 Secs (10474 Secs) *[==>2374.0 Secs (Split 1)]* *[==>2700.0 Secs (Split 2)]* *[==>2700.0 Secs (Split 3)]* *[==>2700.0 Secs (Split 4)]*	 ***[1]*** ***[2]*** ***[3]*** ***[4]***

Orbit Structure








Orbit 4
Server Version: 20220516
Occultation
GS Reacq
Unused Orbital Visibility = 0
Exp. 2, split 4
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sec

Visit

Proposal 17102, G185M (04) Thu Jul 14 18:00:33 GMT 2022

Diagnostic Status: Warning

Scientific Instruments: COS/FUV, COS/NUV

Special Requirements: (none)

Diagnostics

(Exposure 2 (G185M (04))) Warning (Form): COS FUV PSA science exposures with extended targets have special calibration limitations. See "Errors and Warnings" for more details.

Fixed Targets

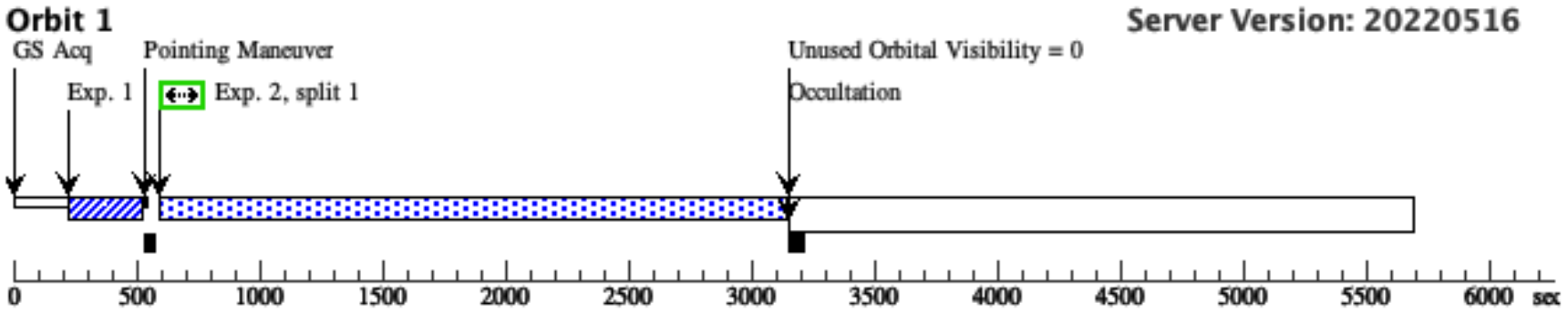
#	Name	Target Coordinates	Targ. Coord. Corrections	Fluxes	Miscellaneous
(1)	LEO-P	RA: 10 21 45.1217 (155.4380071d) Dec: +18 05 16.93 (18.08804d) Equinox: J2000		V=21.51 Galex NUV: 18.81	Reference Frame: ICRS

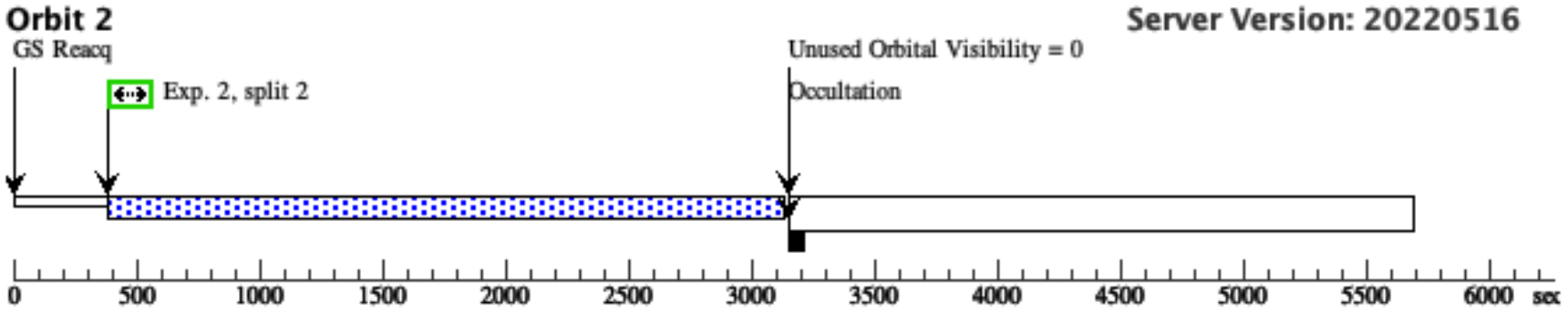
Comments:
Category=GALAXY
Description=[DWARF COMPACT]
Extended=YES

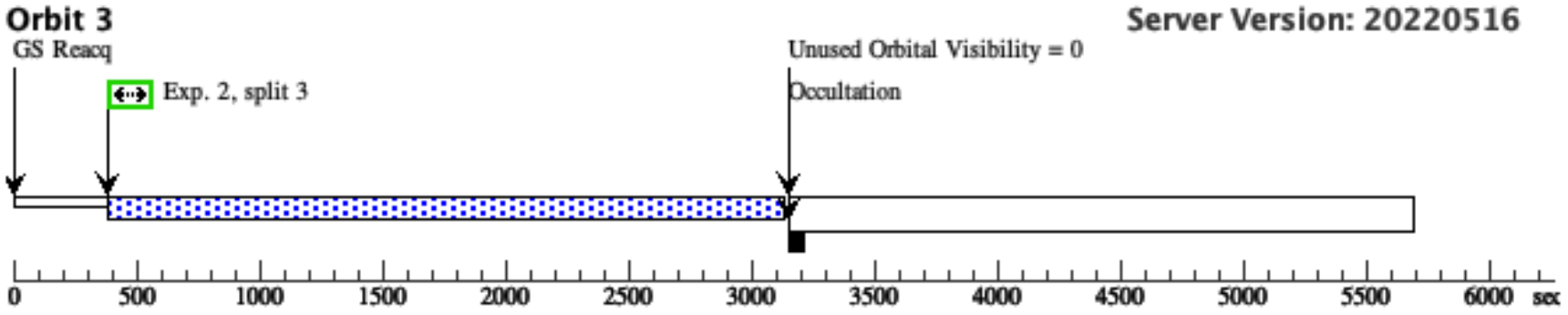
Exposures

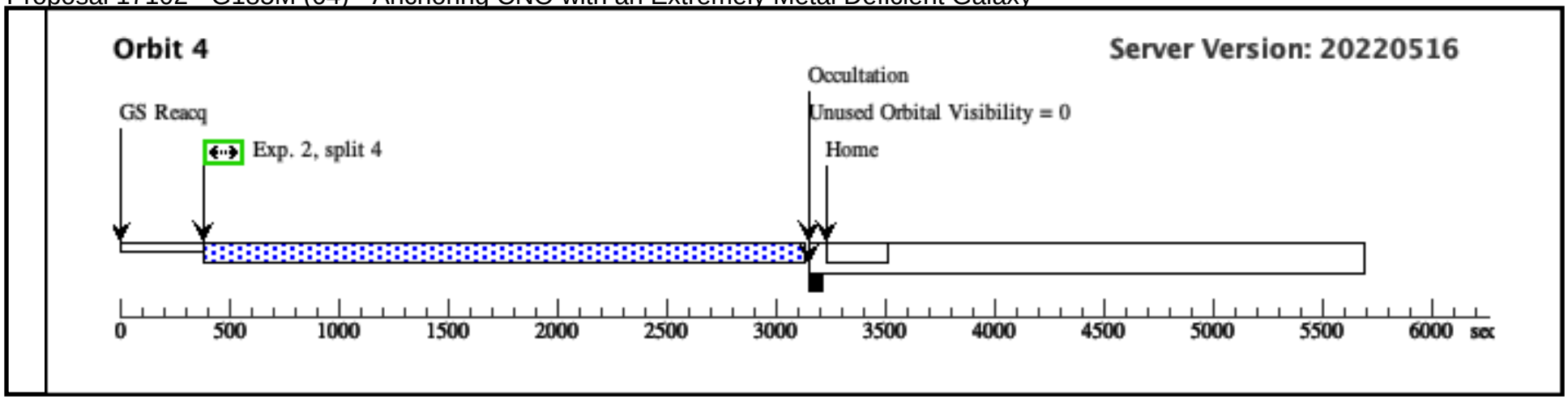
#	Label (ETC Run)	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time (Total)/[Actual Dur.]	Orbit
1	G140L-1 (COS.ta.1370780)	(1) LEO-P	COS/NUV, ACQ/IMAGE, PSA	MIRRORA				35 Secs (35 Secs)	
								[==>]	***[1]***
Comments: The GSC II BOT flags this, but the GALEX BOT determines that it reaches saftey standards.									
2	(COS.sp.1365469)	(1) LEO-P	COS/FUV, TIME-TAG, PSA	G140L 1280 A	FP-POS=ALL; SEGMENT=BOTH; FLASH=YES; BUFFER-TIME=5074			2381 Secs (10474 Secs) *[==>2374.0 Secs (Split 1)]* *[==>2700.0 Secs (Split 2)]* *[==>2700.0 Secs (Split 3)]* *[==>2700.0 Secs (Split 4)]*	 ***[1]*** ***[2]*** ***[3]*** ***[4]***

Orbit Structure





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Server Version: 20220516
Occultation
GS Reacq
Unused Orbital Visibility = 0
Exp. 2, split 4
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sec