16755 - From Supernova Progenitors to Ionizing Radiation - HST/COS Spectroscopy of Stripped Helium Stars

Cycle: 29, 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) LMC-OBS45578-835	COS/FUV COS/NUV	2	14-Mar-2022 02:00:18.0	yes
02	(2) LMC-OBS45461-2273	COS/FUV COS/NUV	2	14-Mar-2022 02:00:19.0	yes
03	(3) LMC-OBS45516-4349	COS/FUV COS/NUV	3	14-Mar-2022 02:00:20.0	yes

Visit	*Targets used in Visit*	*Configurations used in Visit*	*Orbits Used*	*Last Orbit Planner Run*	*OP Current with Visit?*
04	(4) LMC-OBS45446-206	COS/FUV COS/NUV	3	14-Mar-2022 02:00:21.0	yes
05	(5) SMC-OBS40427-981	COS/FUV COS/NUV	1	14-Mar-2022 02:00:22.0	yes
R5	(5) SMC-OBS40427-981	COS/FUV COS/NUV	1	14-Mar-2022 02:00:23.0	yes
06	(6) SMC-OBS40416-6198	COS/FUV COS/NUV	3	14-Mar-2022 02:00:24.0	yes
07	(7) SMC-OBS40454-4332	COS/FUV COS/NUV	3	14-Mar-2022 02:00:25.0	yes

18 Total Orbits Used

ABSTRACT

Binary population synthesis models predict that ~30% of massive stars will have their hydrogen envelopes removed via interaction with a binary companion. The resulting ``stripped" helium cores are relatively long-lived, hot, compact, and emit extreme ultraviolet radiation. As a result, they represent a critical piece in our understanding of the ionizing radiation from stellar populations as well as the nature of supernova and gravitational wave progenitors. However, despite their importance and predicted ubiquity, observations have remained elusive. This is now changing. Using UV maps of the Magellanic Clouds, a sample of candidate systems has been identified. Optical spectroscopy reveals stars with temperatures in excess of 60,000 K, but luminosities intermediate between Wolf-Rayet and subdwarf stars. A lack of strong emission line features indicates their mass loss rates must be more than an order of magnitude lower than previously assumed based on extrapolations from higher luminosity stars. Here, we propose to obtain HST/COS spectra of a sample of 7 of these helium stars in the Magellanic Clouds. UV observations are necessary to measure their mass loss and wind parameters, and this sample was chosen to allow the first observational constraints of these parameters as a function of both luminosity and metallicity. Precise mass loss parameters will have a large impact on the stellar radii, ionizing radiation, and final surface composition of stripped helium stars. These HST/COS observations will therefore provide vital constraints for models of binary evolution, impacting our understanding of supernova progenitors, gravitational wave sources, and ionizing radiation.

OBSERVING DESCRIPTION

This program will obtain UV spectra for 7 targets in the LMC/SMC that are newly discovered intermediate mass stripped helium star candididates. These are hot stars that are more luminous than subdwarfs, but lack the wind emission lines of Wolf-Rayet stars. The goal is to obtain UV spectra that can be modeled to constrain their wind parameters and other physical properties. Spectra will be obtained in the FUV with the G140L grism and a center wavelength of 800 AA, providing continuous wavelength coverage between ~900-1950 AA. We use the maximum exposure time avalible in between 1-3 orbits allocated per star, using all four FP positions for each target.

The impacts of a reduced gyro operations on this program would primarily be reduced schedualability due to the smaller field of regard, as well as possible impacts of roll angle constraints when avoiding placement of bright field objects in the second COS aperture. Slightly longer acquisition times would have only a small effect on the S/N of our observations.

Visit

Proposal 16755, LMC-OBS45578-835-COS (01), scheduling Mon Mar 14 06:00:26 GMT 2022

Diagnostic Status: No Diagnostics

Scientific Instruments: COS/FUV, COS/NUV

Special Requirements: (none)

Fixed Targets

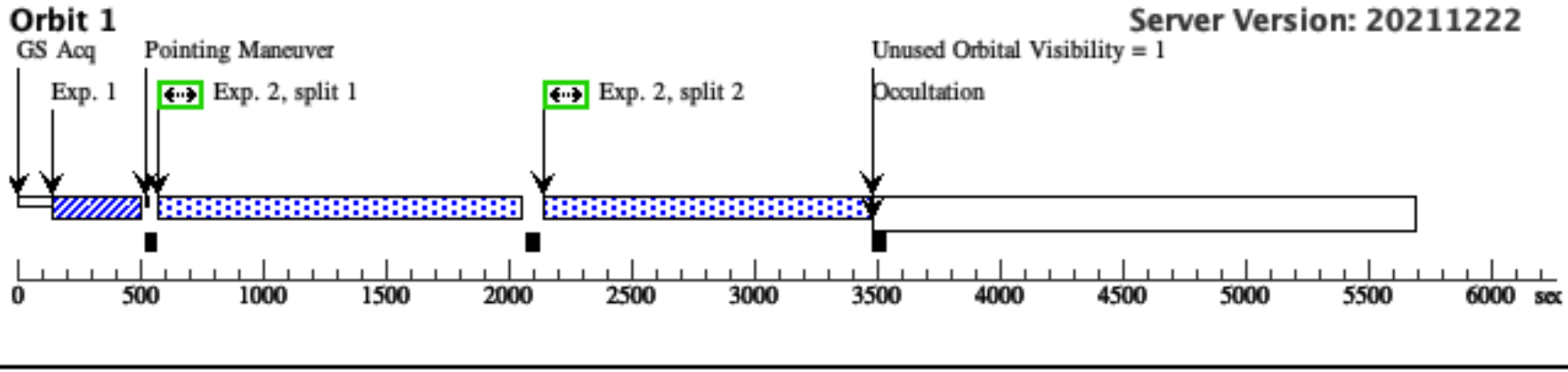
#	Name	Target Coordinates	Targ. Coord. Corrections	Fluxes	Miscellaneous
(1)	LMC-OBS45578-835	RA: 05 04 46.7041 (76.1946004d) Dec: -69 02 24.98 (-69.04027d) Equinox: J2000		V=18.553+/-0.055 UVW2: 17.30 mag (AB), UVM2: 17.56 mag (AB)	Reference Frame: ICRS

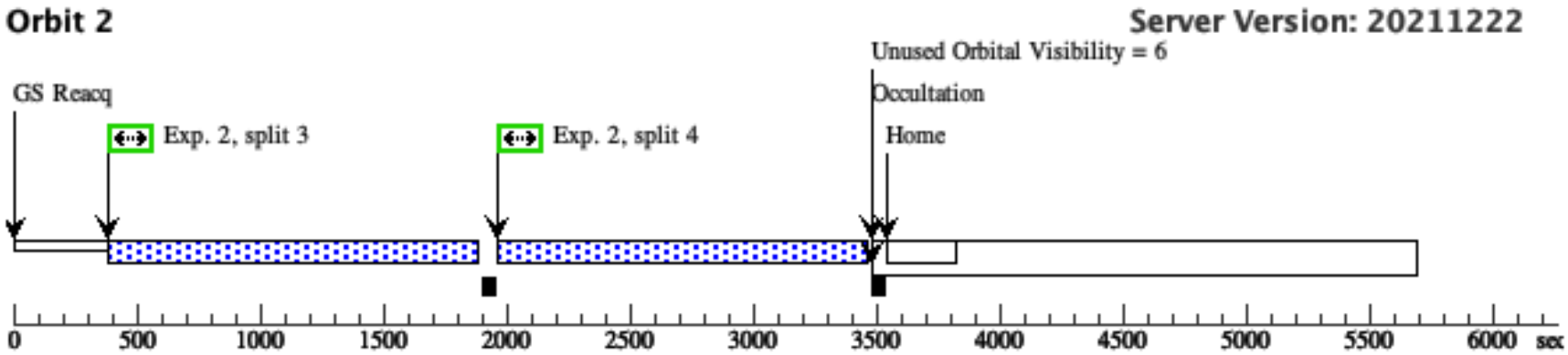
Comments:
Category=EXT-STAR
Description=[COMPOSITE SPECTRAL TYPE, SDO, WOLF RAYET]
Extended=NO

Exposures

#	Label (ETC Run)	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time (Total)/[Actual Dur.]	Orbit
1	LMC-OBS45578-835-ACQ/IMAGE (COS.ta.1529142)	(1) LMC-OBS45578-835	COS/NUV, ACQ/IMAGE, PSA	MIRRORB				28 Secs (28 Secs) *[==>]*	 ***[1]***
2	LMC-OBS45578-835-FPALL (COS.sp.1529151)	(1) LMC-OBS45578-835	COS/FUV, TIME-TAG, PSA	G140L 800 A	SEGMENT=A; FLASH=YES; FP-POS=ALL; BUFFER-TIME=3476			1276 Secs (5442 Secs) *[==>(Split 1)]* *[==>(Split 2)]* *[==>1445 Secs (Split 3)]* *[==>1445 Secs (Split 4)]*	 ***[1]*** ***[2]***

Orbit Structure





Visit

Proposal 16755, LMC-OBS45461-2273-COS (02), scheduling Mon Mar 14 06:00:26 GMT 2022

Diagnostic Status: No Diagnostics

Scientific Instruments: COS/FUV, COS/NUV

Special Requirements: (none)

Fixed Targets

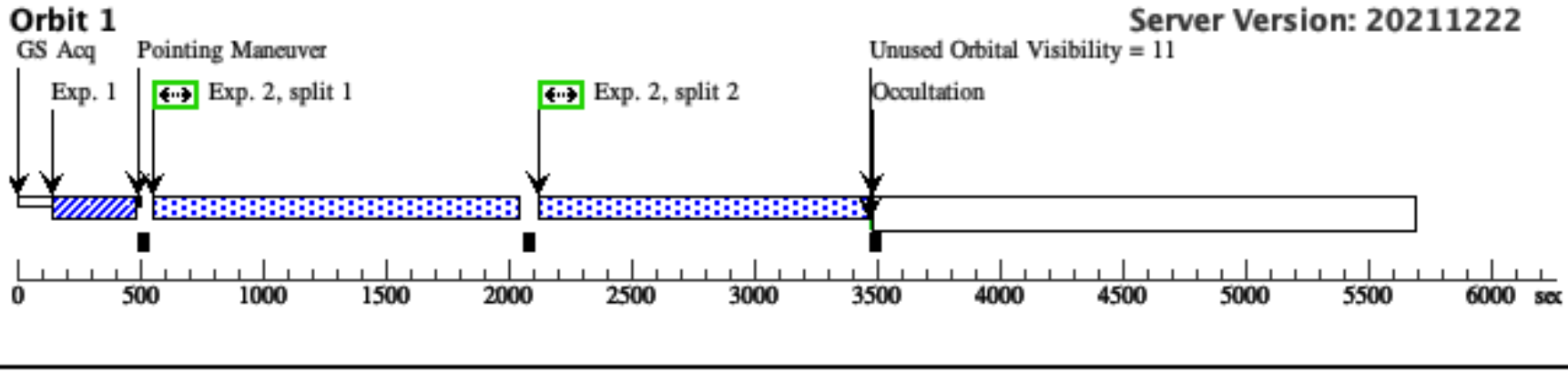
#	Name	Target Coordinates	Targ. Coord. Corrections	Fluxes	Miscellaneous
(2)	LMC-OBS45461-2273	RA: 05 08 49.3860 (77.2057750d) Dec: -69 05 29.99 (-69.09166d) Equinox: J2000		V=18.318+/-0.049 UVW2: 17.73 mag (AB), UVM2: 17.80 mag (AB)	Reference Frame: ICRS

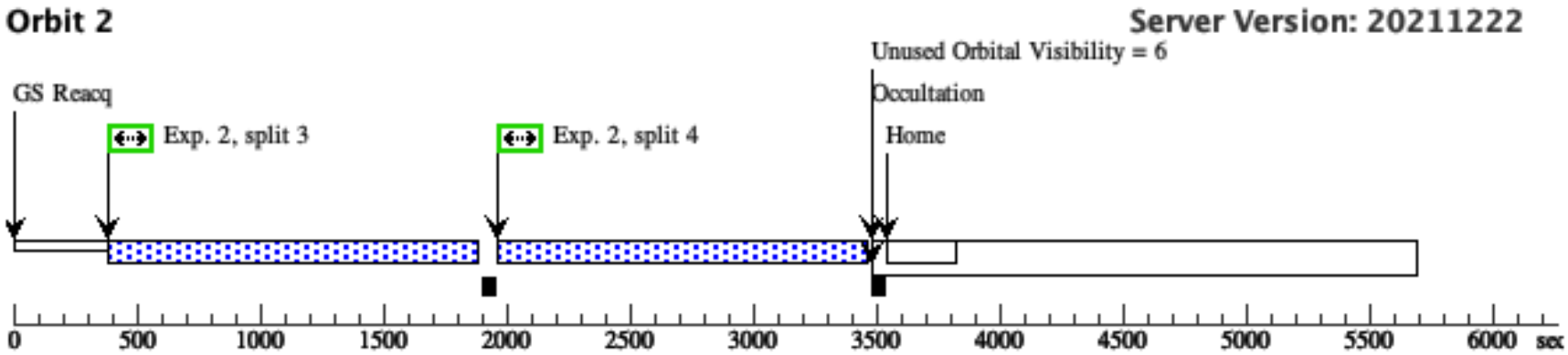
Comments:
Category=EXT-STAR
Description=[COMPOSITE SPECTRAL TYPE, SDO, WOLF RAYET]
Extended=NO

Exposures

#	Label (ETC Run)	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time (Total)/[Actual Dur.]	Orbit
1	LMC-OBS45461-2273-ACQ/IMAGE (COS.ta.1530160)	(2) LMC-OBS45461-2273	COS/NUV, ACQ/IMAGE, PSA	MIRRORB				16 Secs (16 Secs) *[==>]*	 ***[1]***
2	LMC-OBS45461-2273-FPALL (COS.sp.1530179)	(2) LMC-OBS45461-2273	COS/FUV, TIME-TAG, PSA	G140L 800 A	BUFFER-TIME=3865; FLASH=YES; SEGMENT=A; FP-POS=ALL			1288 Secs (5466 Secs) *[==>(Split 1)]* *[==>(Split 2)]* *[==>1445.0 Secs (Split 3)]* *[==>1445.0 Secs (Split 4)]*	 ***[1]*** ***[2]***

Orbit Structure





Visit

Proposal 16755, LMC-OBS45516-4349-COS (03), scheduling Mon Mar 14 06:00:26 GMT 2022

Diagnostic Status: No Diagnostics

Scientific Instruments: COS/FUV, COS/NUV

Special Requirements: (none)

Fixed Targets

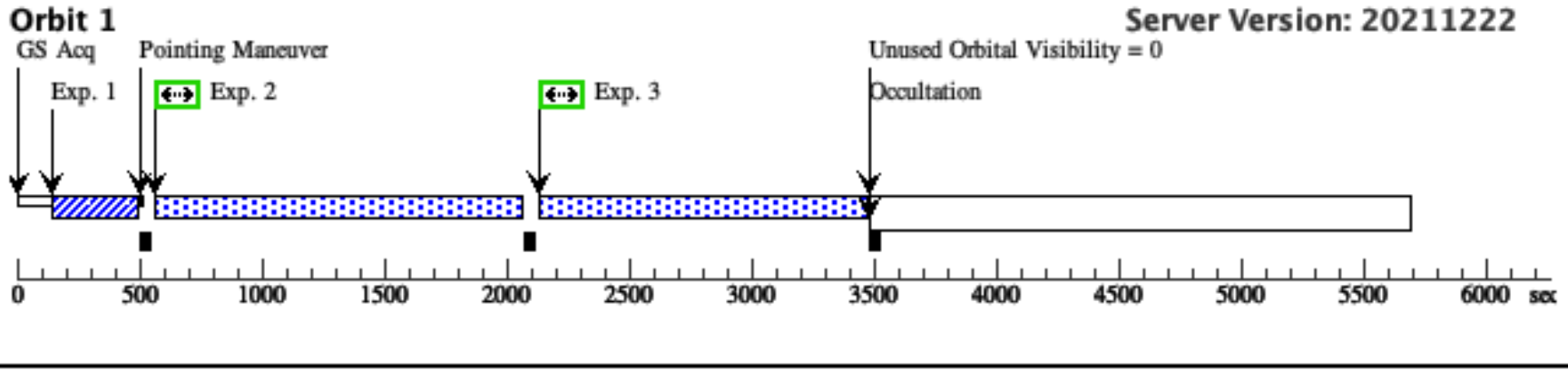
#	Name	Target Coordinates	Targ. Coord. Corrections	Fluxes	Miscellaneous
(3)	LMC-OBS45516-4349	RA: 05 28 1.0799 (82.0044996d) Dec: -69 59 49.09 (-69.99697d) Equinox: J2000		V=18.668+/-0.191 UVW2: 17.86 mag (AB), UVM2: 17.97 mag (AB)	Reference Frame: ICRS

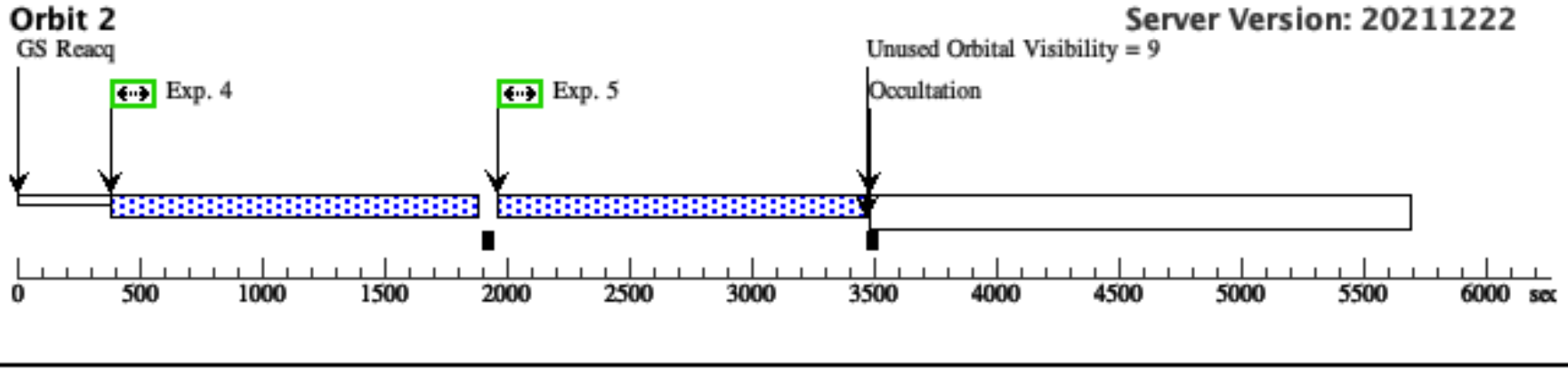
Comments:
Category=EXT-STAR
Description=[COMPOSITE SPECTRAL TYPE, SDO, WOLF RAYET]
Extended=NO

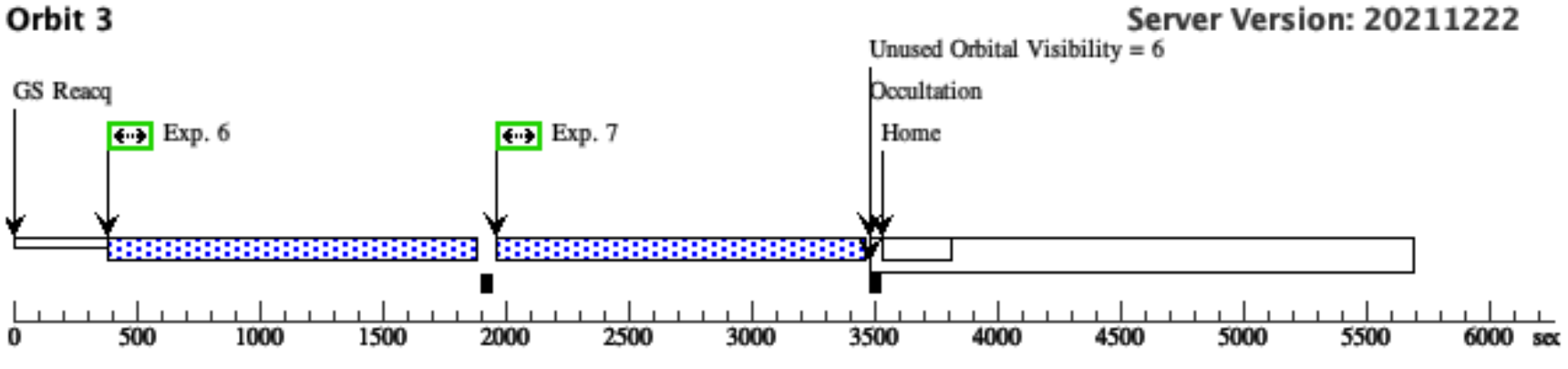
Exposures

#	Label (ETC Run)	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time (Total)/[Actual Dur.]	Orbit
1	LMC-OBS45516-4349-ACQ/IMAGE (COS.ta.1530164)	(3) LMC-OBS45516-4349	COS/NUV, ACQ/IMAGE, PSA	MIRRORB				20 Secs (20 Secs) *[==>]*	***[1]***
2	LMC-OBS45516-4349-FP1 (COS.sp.1530193)	(3) LMC-OBS45516-4349	COS/FUV, TIME-TAG, PSA	G140L 800 A	BUFFER-TIME=4425; FLASH=YES; FP-POS=1; SEGMENT=A			1291 Secs (1291 Secs) *[==>]*	***[1]***
3	LMC-OBS45516-4349-FP1 (COS.sp.1530193)	(3) LMC-OBS45516-4349	COS/FUV, TIME-TAG, PSA	G140L 800 A	BUFFER-TIME=4425; FLASH=YES; FP-POS=1; SEGMENT=A			1291 Secs (1291 Secs) *[==>]*	***[1]***
4	LMC-OBS45516-4349-FP2 (COS.sp.1530193)	(3) LMC-OBS45516-4349	COS/FUV, TIME-TAG, PSA	G140L 800 A	BUFFER-TIME=4425; FLASH=YES; FP-POS=2; SEGMENT=A			1450 Secs (1450 Secs) *[==>]*	***[2]***
5	LMC-OBS45516-4349-FP2 (COS.sp.1530193)	(3) LMC-OBS45516-4349	COS/FUV, TIME-TAG, PSA	G140L 800 A	BUFFER-TIME=4425; FLASH=YES; FP-POS=2; SEGMENT=A			1450 Secs (1450 Secs) *[==>]*	***[2]***
6	LMC-OBS45516-4349-FP3 (COS.sp.1530193)	(3) LMC-OBS45516-4349	COS/FUV, TIME-TAG, PSA	G140L 800 A	BUFFER-TIME=4425; FLASH=YES; FP-POS=3; SEGMENT=A			1450 Secs (1450 Secs) *[==>]*	***[3]***
7	LMC-OBS45516-4349-FP4 (COS.sp.1530193)	(3) LMC-OBS45516-4349	COS/FUV, TIME-TAG, PSA	G140L 800 A	BUFFER-TIME=4425; FLASH=YES; FP-POS=4; SEGMENT=A			1450 Secs (1450 Secs) *[==>]*	***[3]***

Orbit Structure







Visit

Proposal 16755, LMC-OBS45446-206-COS (04), scheduling Mon Mar 14 06:00:26 GMT 2022

Diagnostic Status: No Diagnostics

Scientific Instruments: COS/FUV, COS/NUV

Special Requirements: (none)

Fixed Targets

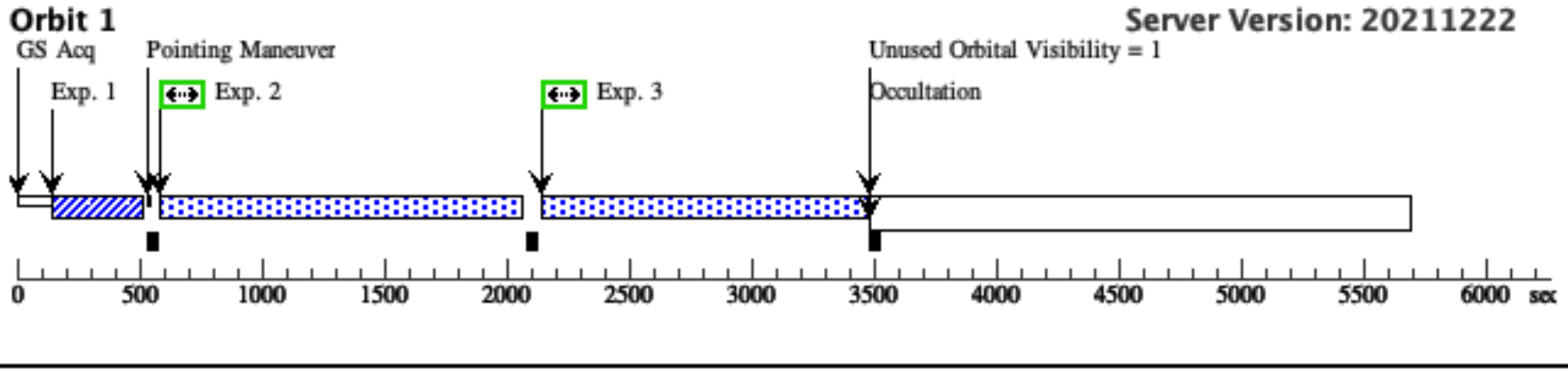
#	Name	Target Coordinates	Targ. Coord. Corrections	Fluxes	Miscellaneous
(4)	LMC-OBS45446-206	RA: 05 47 28.0113 (86.8667138d) Dec: -69 06 7.76 (-69.10216d) Equinox: J2000		V=19.46+/-0.088 UVW2: 18.16 mag (AB), UVM2: 18.27 mag (AB)	Reference Frame: ICRS

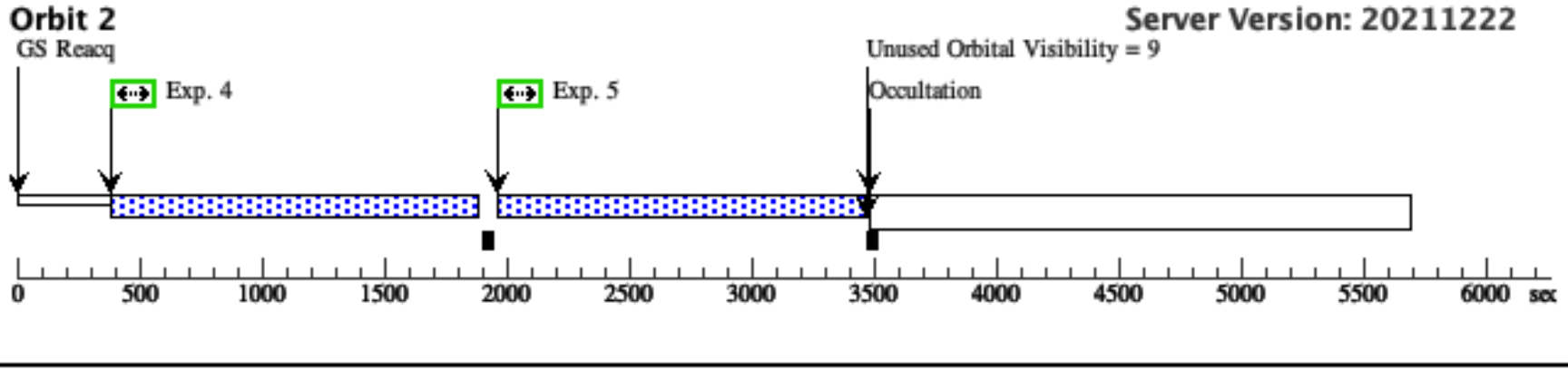
Comments:
Category=EXT-STAR
Description=[COMPOSITE SPECTRAL TYPE, SDO, WOLF RAYET]
Extended=NO

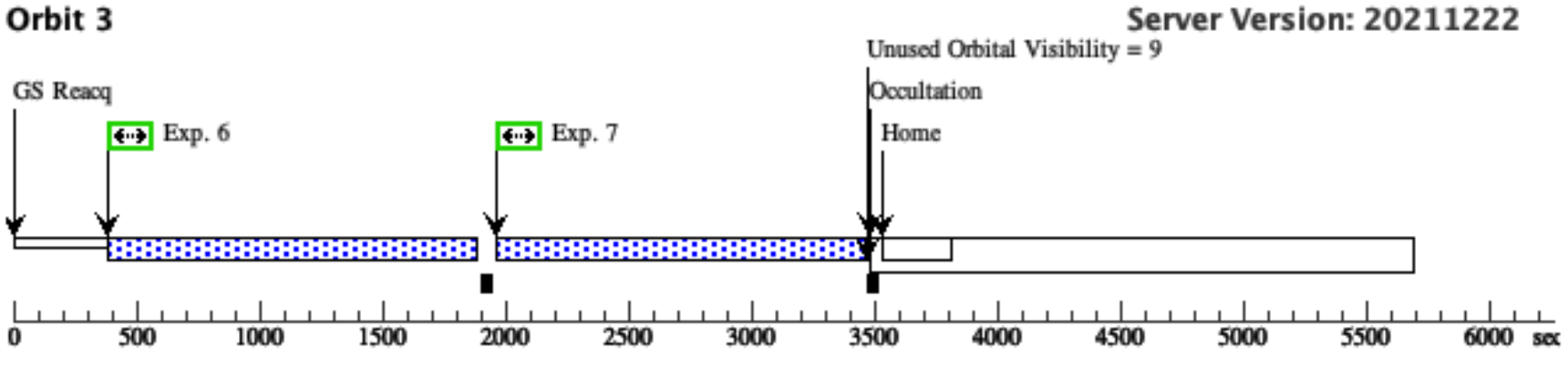
Exposures

#	Label (ETC Run)	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time (Total)/[Actual Dur.]	Orbit
1	LMC-OBS45446-206-ACQ/IMAGE (COS.ta.1530169)	(4) LMC-OBS45446-206	COS/NUV, ACQ/IMAGE, PSA	MIRRORB				32 Secs (32 Secs) *[==>]*	***[1]***
2	OBS45446-206-FP1 (COS.sp.1530194)	(4) LMC-OBS45446-206	COS/FUV, TIME-TAG, PSA	G140L 800 A	BUFFER-TIME=5364; FLASH=YES; FP-POS=1; SEGMENT=A			1277 Secs (1277 Secs) *[==>]*	***[1]***
3	OBS45446-206-FP2 (COS.sp.1530194)	(4) LMC-OBS45446-206	COS/FUV, TIME-TAG, PSA	G140L 800 A	BUFFER-TIME=5364; FLASH=YES; FP-POS=2; SEGMENT=A			1277 Secs (1277 Secs) *[==>]*	***[1]***
4	OBS45446-206-FP3 (COS.sp.1530194)	(4) LMC-OBS45446-206	COS/FUV, TIME-TAG, PSA	G140L 800 A	BUFFER-TIME=5364; FLASH=YES; FP-POS=3; SEGMENT=A			1450 Secs (1450 Secs) *[==>]*	***[2]***
5	OBS45446-206-FP3 (COS.sp.1530194)	(4) LMC-OBS45446-206	COS/FUV, TIME-TAG, PSA	G140L 800 A	BUFFER-TIME=5364; FLASH=YES; FP-POS=3; SEGMENT=A			1450 Secs (1450 Secs) *[==>]*	***[2]***
6	OBS45446-206-FP4 (COS.sp.1530194)	(4) LMC-OBS45446-206	COS/FUV, TIME-TAG, PSA	G140L 800 A	BUFFER-TIME=5364; FLASH=YES; FP-POS=4; SEGMENT=A			1450 Secs (1450 Secs) *[==>]*	***[3]***
7	OBS45446-206-FP4 (COS.sp.1530194)	(4) LMC-OBS45446-206	COS/FUV, TIME-TAG, PSA	G140L 800 A	BUFFER-TIME=5364; FLASH=YES; FP-POS=4; SEGMENT=A			1450 Secs (1450 Secs) *[==>]*	***[3]***

Orbit Structure







Visit

Proposal 16755, SMC-OBS40427-981-COS (05), failed Mon Mar 14 06:00:26 GMT 2022

Diagnostic Status: No Diagnostics

Scientific Instruments: COS/FUV, COS/NUV

Special Requirements: (none)

Fixed Targets

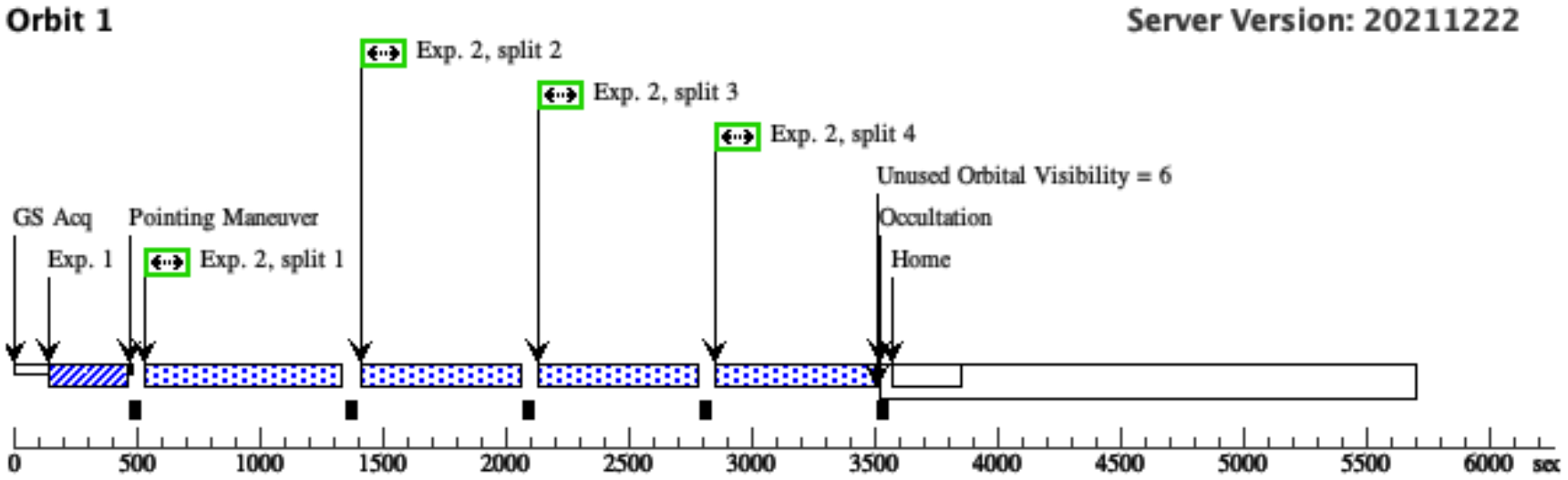
#	Name	Target Coordinates	Targ. Coord. Corrections	Fluxes	Miscellaneous
(5)	SMC-OBS40427-981	RA: 01 00 59.6811 (15.2486712d) Dec: -72 37 13.98 (-72.62055d) Equinox: J2000		V=17.430+/-0.041 UVW2: 16.18 mag (AB), UVM2: 16.26 mag (AB)	Reference Frame: ICRS

Comments:
Category=EXT-STAR
Description=[COMPOSITE SPECTRAL TYPE, SDO, WOLF RAYET]
Extended=NO

Exposures

#	Label (ETC Run)	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time (Total)/[Actual Dur.]	Orbit
1	SMC-OBS40427-981-ACQ/IMAGE (COS.ta.1528840)	(5) SMC-OBS40427-981	COS/NUV, ACQ/IMAGE, PSA	MIRRORB				6 Secs (6 Secs) *[==>]*	*[1]*
2	SMC-OBS40427-981-FPALL (COS.sp.1530192)	(5) SMC-OBS40427-981	COS/FUV, TIME-TAG, PSA	G140L 800 A	BUFFER-TIME=2212; FLASH=YES; FP-POS=ALL; SEGMENT=A			598 Secs (2392 Secs) *[==>(Split 1)]* *[==>(Split 2)]* *[==>(Split 3)]* *[==>(Split 4)]*	*[1]*

Orbit Structure



Visit

Proposal 16755, SMC-OBS40427-981-COS (R5) Mon Mar 14 06:00:26 GMT 2022

Diagnostic Status: No Diagnostics

Scientific Instruments: COS/FUV, COS/NUV

Special Requirements: (none)

Fixed Targets

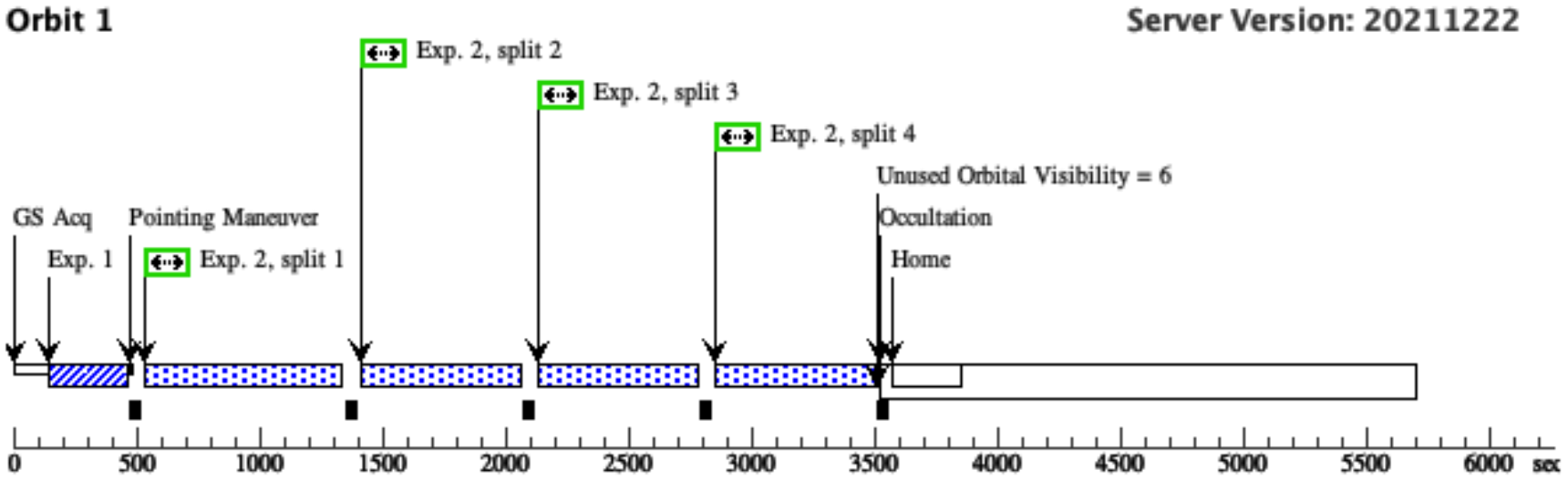
#	Name	Target Coordinates	Targ. Coord. Corrections	Fluxes	Miscellaneous
(5)	SMC-OBS40427-981	RA: 01 00 59.6811 (15.2486712d) Dec: -72 37 13.98 (-72.62055d) Equinox: J2000		V=17.430+/-0.041 UVW2: 16.18 mag (AB), UVM2: 16.26 mag (AB)	Reference Frame: ICRS

Comments:
Category=EXT-STAR
Description=[COMPOSITE SPECTRAL TYPE, SDO, WOLF RAYET]
Extended=NO

Exposures

#	Label (ETC Run)	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time (Total)/[Actual Dur.]	Orbit
1	SMC-OBS40427-981-ACQ/IMAGE (COS.ta.1528840)	(5) SMC-OBS40427-981	COS/NUV, ACQ/IMAGE, PSA	MIRRORB				6 Secs (6 Secs) *[==>]*	*[1]*
2	SMC-OBS40427-981-FPALL (COS.sp.1530192)	(5) SMC-OBS40427-981	COS/FUV, TIME-TAG, PSA	G140L 800 A	BUFFER-TIME=2212; FLASH=YES; FP-POS=ALL; SEGMENT=A			598 Secs (2392 Secs) *[==>(Split 1)]* *[==>(Split 2)]* *[==>(Split 3)]* *[==>(Split 4)]*	*[1]*

Orbit Structure



Visit

Proposal 16755, SMC-OBS40416-6198-COS (06), scheduling Mon Mar 14 06:00:26 GMT 2022

Diagnostic Status: No Diagnostics

Scientific Instruments: COS/FUV, COS/NUV

Special Requirements: (none)

Fixed Targets

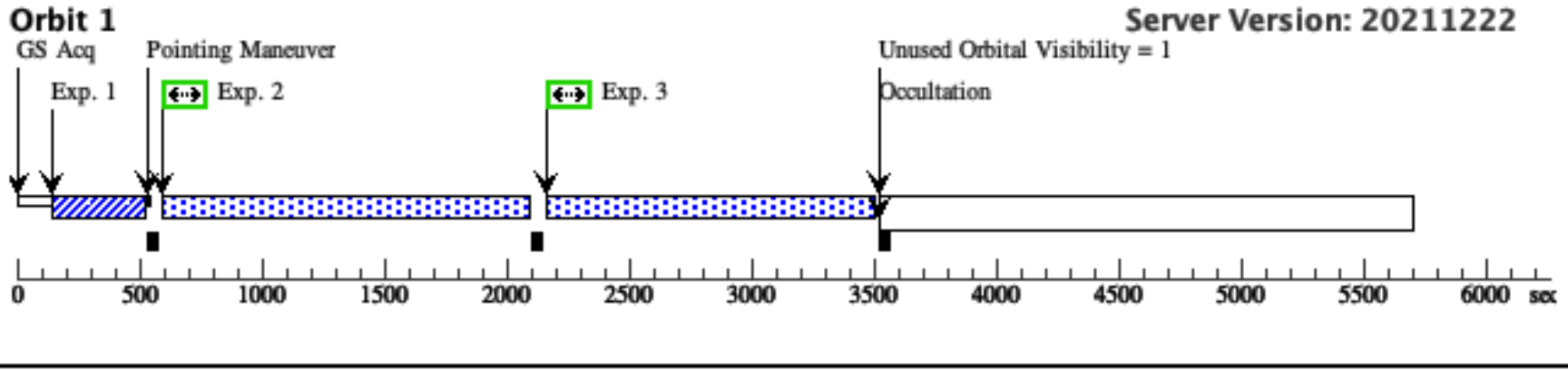
#	Name	Target Coordinates	Targ. Coord. Corrections	Fluxes	Miscellaneous
(6)	SMC-OBS40416-6198	RA: 00 57 1.5268 (14.2563617d) Dec: -72 36 3.48 (-72.60097d) Equinox: J2000		V=18.919+/-0.058 UVW2: 17.94 mag (AB); UVM 2: 17.98 mag (AB)	Reference Frame: ICRS

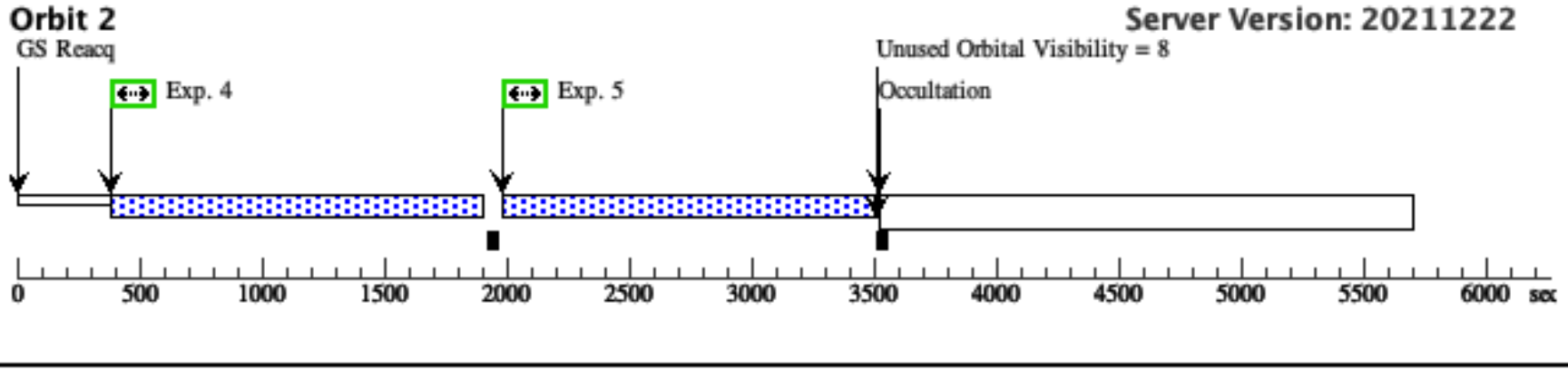
Comments:
Category=EXT-STAR
Description=[COMPOSITE SPECTRAL TYPE, SDO, WOLF RAYET]
Extended=NO

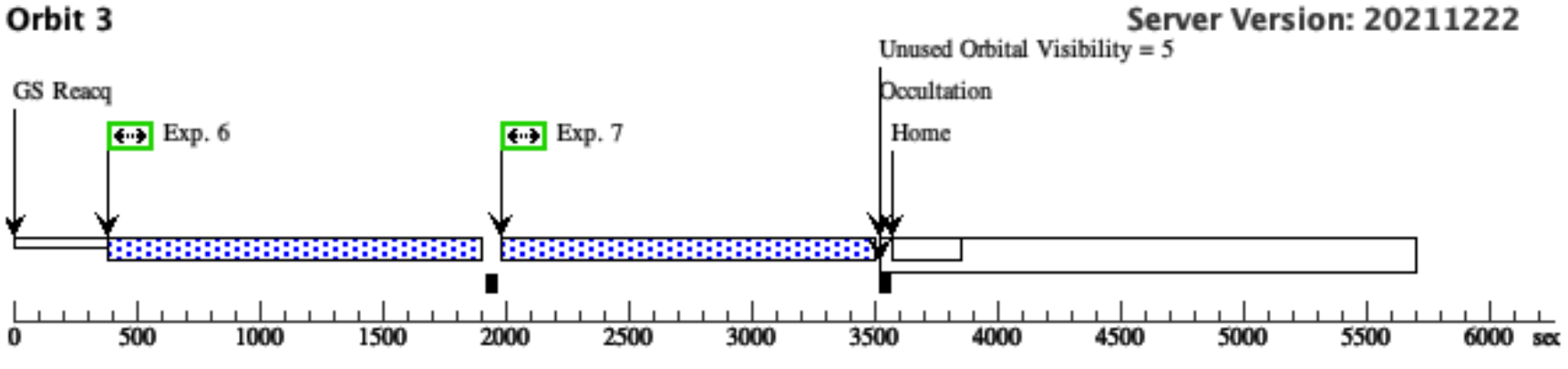
Exposures

#	Label (ETC Run)	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time (Total)/[Actual Dur.]	Orbit
1	SMC-OBS40416-6198-ACQ/IMAGE (COS.ta.1530174)	(6) SMC-OBS40416-6198	COS/NUV, ACQ/IMAGE, PSA	MIRRORB				36 Secs (36 Secs) *[==>]*	*[1]*
2	SMC-OBS40416-6198-FP1 (COS.sp.1530210)	(6) SMC-OBS40416-6198	COS/FUV, TIME-TAG, PSA	G140L 800 A	BUFFER-TIME=4426; FLASH=YES; FP-POS=1; SEGMENT=A			1294 Secs (1294 Secs) *[==>]*	*[1]*
3	SMC-OBS40416-6198-FP1 (COS.sp.1530210)	(6) SMC-OBS40416-6198	COS/FUV, TIME-TAG, PSA	G140L 800 A	BUFFER-TIME=4426; FLASH=YES; FP-POS=1; SEGMENT=A			1294 Secs (1294 Secs) *[==>]*	*[1]*
4	SMC-OBS40416-6198-FP2 (COS.sp.1530210)	(6) SMC-OBS40416-6198	COS/FUV, TIME-TAG, PSA	G140L 800 A	BUFFER-TIME=4426; FLASH=YES; FP-POS=2; SEGMENT=A			1470 Secs (1470 Secs) *[==>]*	*[2]*
5	SMC-OBS40416-6198-FP2 (COS.sp.1530210)	(6) SMC-OBS40416-6198	COS/FUV, TIME-TAG, PSA	G140L 800 A	BUFFER-TIME=4426; FLASH=YES; FP-POS=2; SEGMENT=A			1470 Secs (1470 Secs) *[==>]*	*[2]*
6	SMC-OBS40416-6198-FP3 (COS.sp.1530210)	(6) SMC-OBS40416-6198	COS/FUV, TIME-TAG, PSA	G140L 800 A	BUFFER-TIME=4426; FLASH=YES; FP-POS=3; SEGMENT=A			1470 Secs (1470 Secs) *[==>]*	*[3]*
7	SMC-OBS40416-6198-FP4 (COS.sp.1530210)	(6) SMC-OBS40416-6198	COS/FUV, TIME-TAG, PSA	G140L 800 A	BUFFER-TIME=4426; FLASH=YES; FP-POS=4; SEGMENT=A			1470 Secs (1470 Secs) *[==>]*	*[3]*

Orbit Structure







Visit

Proposal 16755, SMC-OBS40454-4332-COS (07), scheduling Mon Mar 14 06:00:26 GMT 2022

Diagnostic Status: No Diagnostics

Scientific Instruments: COS/FUV, COS/NUV

Special Requirements: (none)

Fixed Targets

#	Name	Target Coordinates	Targ. Coord. Corrections	Fluxes	Miscellaneous
(7)	SMC-OBS40454-4332	RA: 01 04 0.5070 (16.0021125d) Dec: -72 16 43.05 (-72.27863d) Equinox: J2000		V=19.204+/-0.062 UVW2: 17.82 mag (AB), UVM2: 17.88 mag (AB)	Reference Frame: ICRS

Comments:
Category=EXT-STAR
Description=[COMPOSITE SPECTRAL TYPE, SDO, WOLF RAYET]
Extended=NO

Exposures

#	Label (ETC Run)	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time (Total)/[Actual Dur.]	Orbit
1	SMC-obs40454-4332-ACQ/IMAGE (COS.ta.1530176)	(7) SMC-OBS40454-4332	COS/NUV, ACQ/IMAGE, PSA	MIRRORB				28 Secs (28 Secs) *[==>]*	***[1]***
2	SMC-obs40454-4332-FP1 (COS.sp.1530224)	(7) SMC-OBS40454-4332	COS/FUV, TIME-TAG, PSA	G140L 800 A	BUFFER-TIME=5364; FLASH=YES; FP-POS=1; SEGMENT=A			1300 Secs (1300 Secs) *[==>]*	***[1]***
3	SMC-obs40454-4332-FP2 (COS.sp.1530224)	(7) SMC-OBS40454-4332	COS/FUV, TIME-TAG, PSA	G140L 800 A	BUFFER-TIME=5364; FLASH=YES; FP-POS=2; SEGMENT=A			1300 Secs (1300 Secs) *[==>]*	***[1]***
4	SMC-obs40454-4332-FP3 (COS.sp.1530224)	(7) SMC-OBS40454-4332	COS/FUV, TIME-TAG, PSA	G140L 800 A	BUFFER-TIME=5364; FLASH=YES; FP-POS=3; SEGMENT=A			1470 Secs (1470 Secs) *[==>]*	***[2]***
5	SMC-obs40454-4332-FP3 (COS.sp.1530224)	(7) SMC-OBS40454-4332	COS/FUV, TIME-TAG, PSA	G140L 800 A	BUFFER-TIME=5364; FLASH=YES; FP-POS=3; SEGMENT=A			1470 Secs (1470 Secs) *[==>]*	***[2]***
6	SMC-obs40454-4332-FP4 (COS.sp.1530224)	(7) SMC-OBS40454-4332	COS/FUV, TIME-TAG, PSA	G140L 800 A	BUFFER-TIME=5364; FLASH=YES; FP-POS=4; SEGMENT=A			1470 Secs (1470 Secs) *[==>]*	***[3]***
7	SMC-obs40454-4332-FP4 (COS.sp.1530224)	(7) SMC-OBS40454-4332	COS/FUV, TIME-TAG, PSA	G140L 800 A	BUFFER-TIME=5364; FLASH=YES; FP-POS=4; SEGMENT=A			1470 Secs (1470 Secs) *[==>]*	***[3]***

Orbit Structure