16492 - SOFIA and HST Multi-wavelength Study of the Symbiotic Mira HM Sge

Cycle: 28, Proposal Category: GO/DD

(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) HM-SGE	WFC3/UVIS	2	24-Feb-2021 11:00:17.0	yes
02	(1) HM-SGE (2) HM-SGE-N (3) HM-SGE-S	COS/FUV COS/NUV	2	24-Feb-2021 11:00:21.0	yes

4 Total Orbits Used

ABSTRACT

To showcase the capabilities of evolved-star science using the instrument modes of SOFIA and the Hubble Space Telescope (HST), we propose to use FORCAST and EXES aboard SOFIA, and WFC3 and COS aboard HST to probe the quickly-evolving symbiotic system HM Sge. We will use SOFIA to probe the dust and the kinematics of the dense circum-stellar material, and HST to map the gas in the inner nebula and probe the shocked emission. These observations will provide a public dataset that can be used to anchor future observations of HM Sge, a post-outburst symbiotic Mira that displays a wide and diverse range of active astrophysical phenomena. The observations will also demonstrate the possibilities for future

observations of other evolved-star systems.

OBSERVING DESCRIPTION

With WFC3 we are targeting the F502N([O iii]), F656N(Halpha), and F658N([N ii]) filters with three short exposures to image the inner nebula around the symbiotic system, and then a longer exposure (also F658N;[N ii]) that will saturate at the core, but that will capture the morphology of the more extended surrounding nebula.

We will also do three pointings with COS, one on the central system, and two on the previously identified shocked regions to the North and South. For each of these pointing we will use the G140L/800 and G230L/2950 gratings.

Visit

Proposal 16492, WFC3 (01), implementation Wed Feb 24 16:00:22 GMT 2021

Diagnostic Status: Warning

Scientific Instruments: WFC3/UVIS

Special Requirements: (none)

Diagnostics

(H_alpha short 1 (01.001)) Warning (Form): FLASH level may be too high for this exposure or a long subexposure. See extended explanation in the diagnostic browser

(N_II short 1 (01.002)) Warning (Form): FLASH level may be too high for this exposure or a long subexposure. See extended explanation in the diagnostic browser

(O_III short 1 (01.003)) Warning (Form): FLASH level may be too high for this exposure or a long subexposure. See extended explanation in the diagnostic browser

(N_II long 1 (01.004)) Warning (Form): FLASH level may be too high for this exposure or a long subexposure. See extended explanation in the diagnostic browser

Patterns

#	Primary Pattern		Secondary Pattern	Exposures
(1)	Pattern Type=WFC3-UVIS-DITHER-BOX Purpose=DITHER Number Of Points=4 Point Spacing=0.173 Line Spacing=0.112	Coordinate Frame=POS-TARG Pattern Orientation=23.884 Angle Between Sides=81.785 Center Pattern=false		(4)
(2)	Pattern Type=SPIRAL Purpose=DITHER Number Of Points=4 Point Spacing=0.145 Line Spacing=	Coordinate Frame=POS-TARG Pattern Orientation=46.86 Angle Between Sides= Center Pattern=false		(1), (2), (3)

Fixed Targets

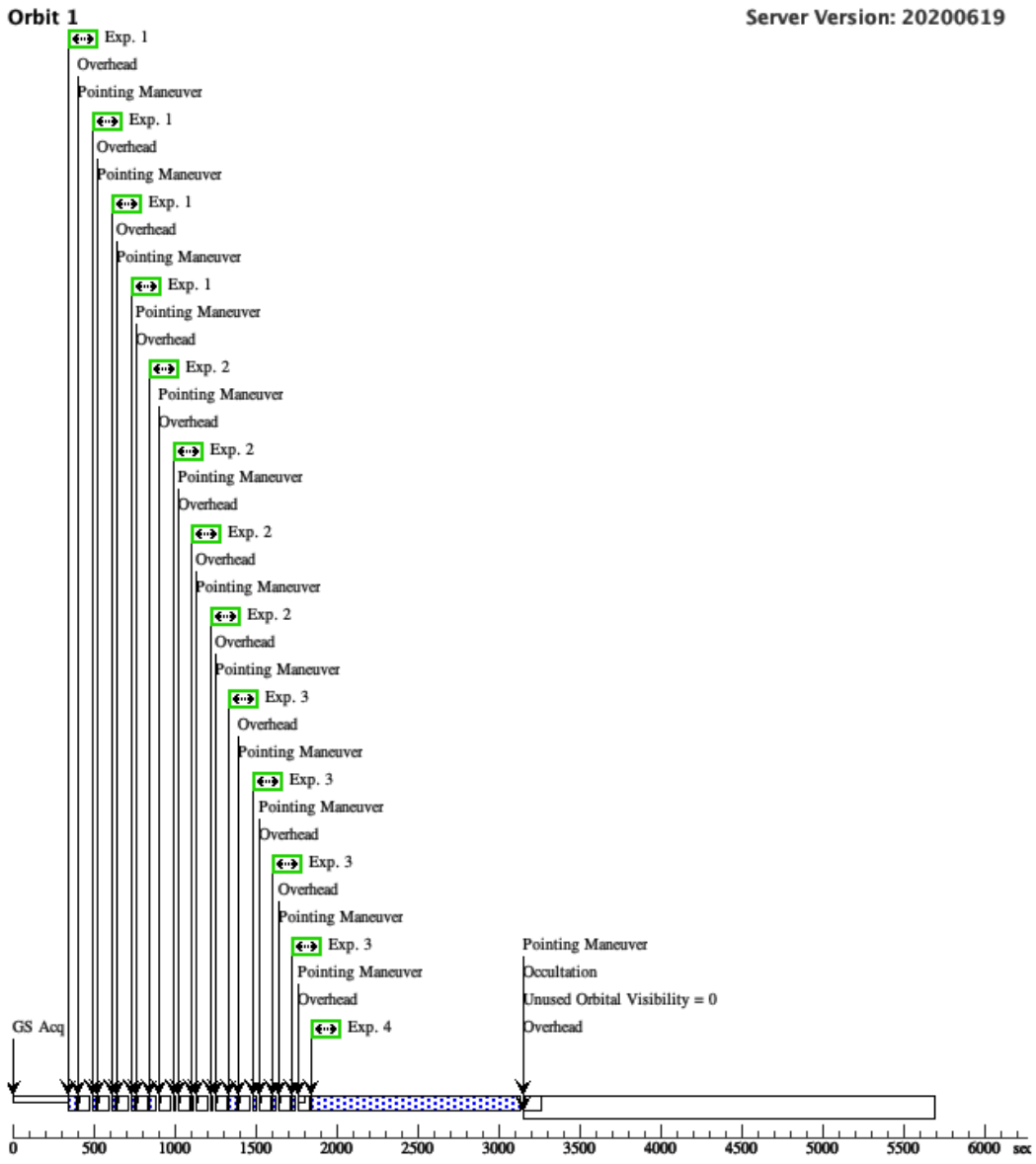
#	Name	Target Coordinates	Targ. Coord. Corrections	Fluxes	Miscellaneous
(1)	HM-SGE	RA: 19 41 57.0760 (295.4878167d) Dec: +16 44 39.86 (16.74441d) Equinox: J2000	Proper Motion RA: 3.003 mas/yr Proper Motion Dec: -10.131 mas/yr Epoch of Position: 2000.0	V=11.1	Reference Frame: ICRS

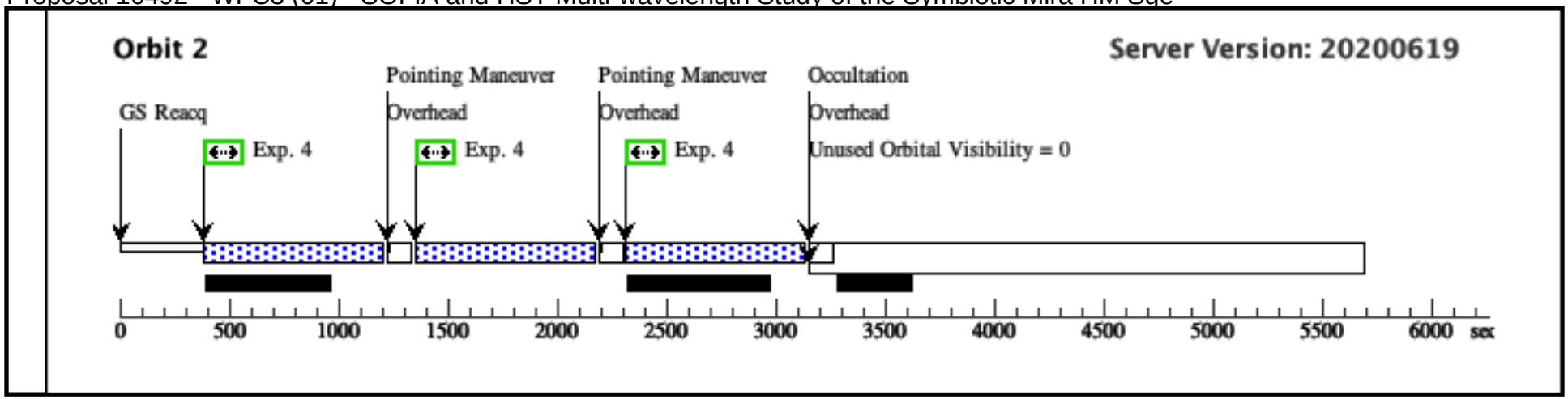
Comments: Co-ordinates and proper motions from SIMBAD, which uses GAIA DR2.
V magnitude as listed in SIMBAD ; however AAVSO data shows that V varies between 11.5 and 12.5.
Category=STAR
Description=[AGB STAR, SYMBIOTIC STAR]
Extended=YES

Exposures

#	Label	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time (Total)/[Actual Dur.]	Orbit
1	H_alpha short 1	(1) HM-SGE	WFC3/UVIS, ACCUM, UVIS2-C1K1C-SUB	F656N	FLASH=20		Pattern 2, Exps 1-1 in WFC3 (01) (2)	17 Secs (68 Secs) *[==>(Pattern 1)]* *[==>(Pattern 2)]* *[==>(Pattern 3)]* *[==>(Pattern 4)]*	 ***[1]***
2	N_II short 1	(1) HM-SGE	WFC3/UVIS, ACCUM, UVIS2-C1K1C-SUB	F658N	FLASH=20		Pattern 2, Exps 2-2 in WFC3 (01) (2)	15 Secs (60 Secs) *[==>(Pattern 1)]* *[==>(Pattern 2)]* *[==>(Pattern 3)]* *[==>(Pattern 4)]*	 ***[1]***
3	O_III short 1	(1) HM-SGE	WFC3/UVIS, ACCUM, UVIS2-C1K1C-SUB	F502N	FLASH=20		Pattern 2, Exps 3-3 in WFC3 (01) (2)	20 Secs (80 Secs) *[==>(Pattern 1)]* *[==>(Pattern 2)]* *[==>(Pattern 3)]* *[==>(Pattern 4)]*	 ***[1]***
4	N_II long 1	(1) HM-SGE	WFC3/UVIS, ACCUM, UVIS	F658N	FLASH=18	POS TARG 0,-50	Pattern 1, Exps 4-4 in WFC3 (01) (1)	828 Secs (3755 Secs) *[==>1275.0 Secs (Pattern 1)]* *[==>827.0 Secs (Pattern 2)]* *[==>827.0 Secs (Pattern 3)]* *[==>826.0 Secs (Pattern 4)]*	 ***[1]*** ***[2]***

Orbit Structure




Orbit 2
Server Version: 20200619
GS Reacq
Pointing Maneuver
Overhead
Pointing Maneuver
Overhead
Occultation
Overhead
Exp. 4
Exp. 4
Exp. 4
Unused Orbital Visibility = 0
0
500
1000
1500
2000
2500
3000
3500
4000
4500
5000
5500
6000
sec

Visit

Proposal 16492, COS (02), implementation Wed Feb 24 16:00:22 GMT 2021

Diagnostic Status: Warning

Scientific Instruments: COS/FUV, COS/NUV

Special Requirements: (none)

Comments: The input spectrum used for all ETC calculations is one constructed from IUE observations obtained on October 20, 1992, SWP46012 and LWP24119.

ACQ/IMAGE: The continuum from the central source is expected to be the main contributor to the flux for the NUV acquisition, and therefore a point source is assumed for the calculation. The line emission, however, is likely to be distributed, and we have increased the S/N to 40 to examine the spatial extent of this emitting region.

Spectroscopy: We are mainly interested in the line emission from compact, but extended sources. The total flux has been measured by IUE. In the spectroscopy ETC calculations, we are assuming a point source to be conservative for Bright Object Protection.

Diagnostics

(COS (02)) Warning (Form): If the target position is not known to 0.4" (or better), an ACQ/SEARCH should precede the ACQ/IMAGE.

(COS (02)) Warning (Orbit Planner): INEFFICIENT ORDERING OF FP-POS POSITIONS

(COS (02)) Warning (Orbit Planner): INEFFICIENT ORDERING OF FP-POS POSITIONS

(G140L/800 HM Sge (02.002)) Warning (Form): COS FUV PSA science exposures with extended targets have special calibration limitations. See "Errors and Warnings" for more details.

(G140L/800 HM Sge North (02.003)) Warning (Form): COS FUV PSA science exposures with extended targets have special calibration limitations. See "Errors and Warnings" for more details.

(G140L/800 HM Sge South (02.004)) Warning (Form): COS FUV PSA science exposures with extended targets have special calibration limitations. See "Errors and Warnings" for more details.

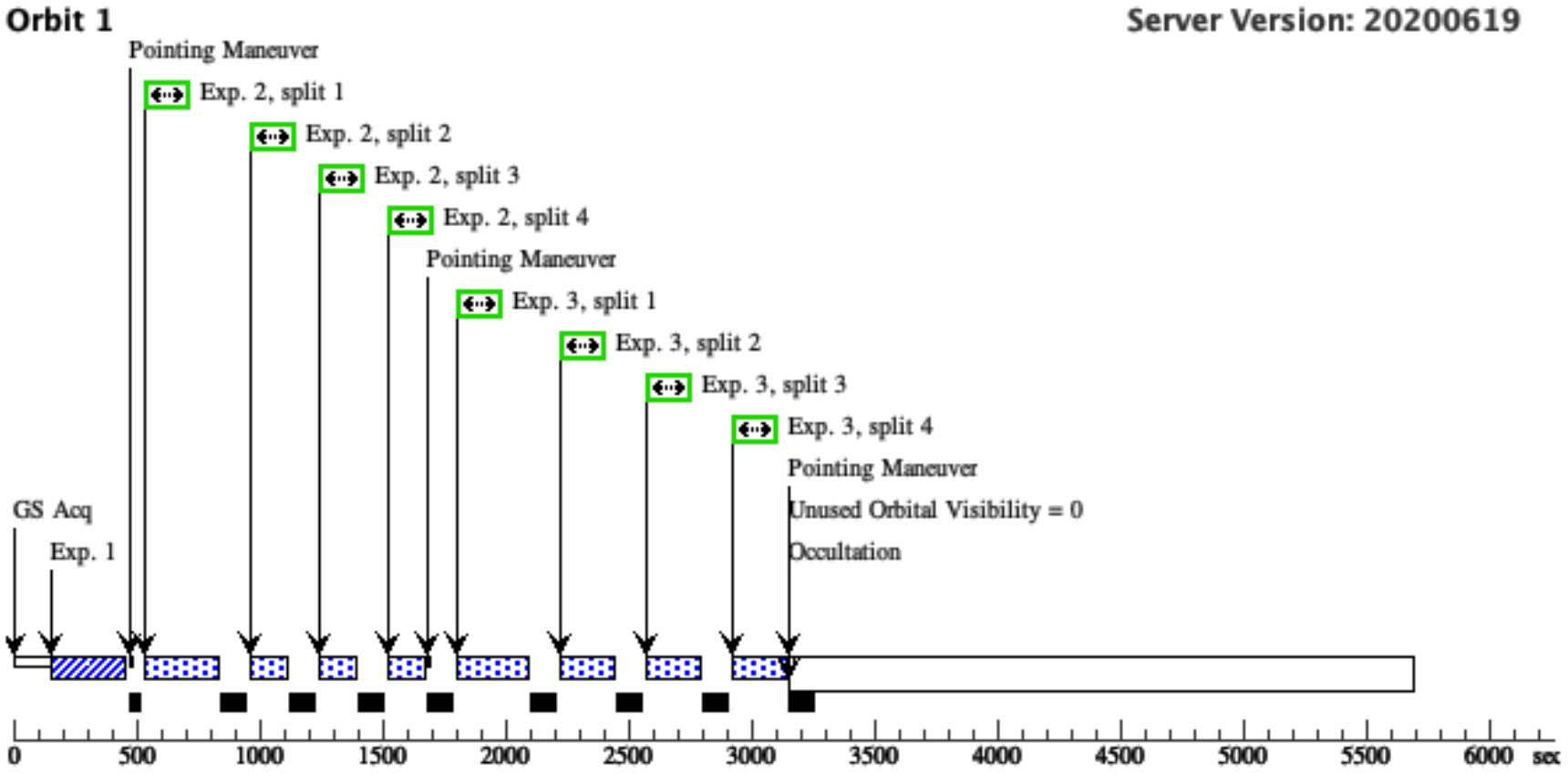
Fixed Targets

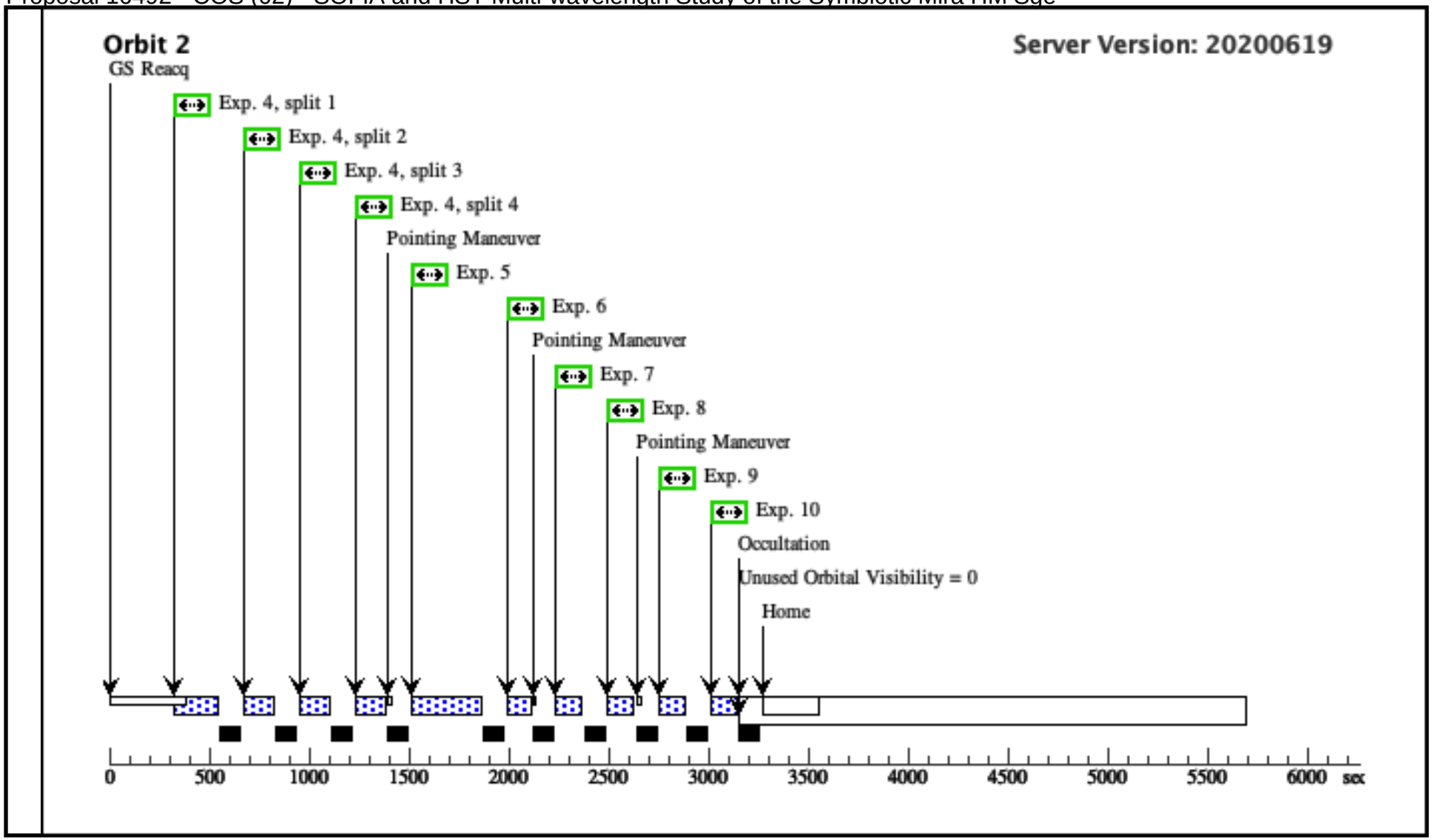
#	Name	Target Coordinates	Targ. Coord. Corrections	Fluxes	Miscellaneous
(1)	HM-SGE	RA: 19 41 57.0760 (295.4878167d) Dec: +16 44 39.86 (16.74441d) Equinox: J2000	Proper Motion RA: 3.003 mas/yr Proper Motion Dec: -10.131 mas/yr Epoch of Position: 2000.0	V=11.1	Reference Frame: ICRS
		Comments: Co-ordinates and proper motions from SIMBAD, which uses GAIA DR2. *V magnitude as listed in SIMBAD ; however AAVSO data shows that V varies between 11.5 and 12.5.* *Category=STAR* *Description=[AGB STAR, SYMBIOTIC STAR]* *Extended=YES*			
(2)	HM-SGE-N	Offset from HM-SGE RA Offset: -8.88889E-4 Degrees Dec Offset: 3.5 Arcsec		V=35	Offset Position (HM-SGE-N)
		Comments: *Category=STAR* *Description=[EMISSION LINE NEBULA]* *Extended=YES*			
(3)	HM-SGE-S	Offset from HM-SGE RA Offset: 0.00138889 Degrees Dec Offset: -2.5 Arcsec		V=35	Offset Position (HM-SGE-S)
		Comments: *Category=STAR* *Description=[EMISSION LINE NEBULA]* *Extended=YES*			

Exposures

#	Label (ETC Run)	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time (Total)/[Actual Dur.]	Orbit
1	ACQ_HMSGE (COS.ta.1478462)	(1) HM-SGE	COS/NUV, ACQ/IMAGE, PSA	MIRRORB				5 Secs (5 Secs) *[==>]*	***[1]***
Comments: The input spectrum used for the ETC calculation was constructed from IUE observations obtained on October 20, 1992, SWP46012 and LWP24119. The continuum from the central source is expected to be the main contributor to the flux, and therefore a point source is assumed for the calculation. The line emission, however, is likely to be distributed, and we have increased the S/N to 40 to examine the spatial extent of this emitting region.									
2	G140L/800 HM Sge (COS.sp.1478501)	(1) HM-SGE	COS/FUV, TIME-TAG, PSA	G140L 800 A	FP-POS=ALL; BUFFER-TIME=100			100 Secs (400 Secs) *[==>(Split 1)]* *[==>(Split 2)]* *[==>(Split 3)]* *[==>(Split 4)]*	***[1]***
3	G140L/800 HM Sge North (COS.sp.1478501)	(2) HM-SGE-N	COS/FUV, TIME-TAG, PSA	G140L 800 A	FP-POS=ALL; BUFFER-TIME=169			169 Secs (676 Secs) *[==>(Split 1)]* *[==>(Split 2)]* *[==>(Split 3)]* *[==>(Split 4)]*	***[1]***
4	G140L/800 HM Sge South (COS.sp.1478501)	(3) HM-SGE-S	COS/FUV, TIME-TAG, PSA	G140L 800 A	FP-POS=ALL; BUFFER-TIME=100			100 Secs (400 Secs) *[==>(Split 1)]* *[==>(Split 2)]* *[==>(Split 3)]* *[==>(Split 4)]*	***[2]***
5	G230L/2950 HM Sge FP POS 1 (COS.sp.1478506)	(1) HM-SGE	COS/NUV, TIME-TAG, PSA	G230L 2950 A	FP-POS=1; BUFFER-TIME=100			100 Secs (100 Secs) *[==>]*	***[2]***
6	G230L/2950 HM Sge FP POS 2 (COS.sp.1478506)	(1) HM-SGE	COS/NUV, TIME-TAG, PSA	G230L 2950 A	FP-POS=2; BUFFER-TIME=100			100 Secs (100 Secs) *[==>]*	***[2]***
7	G230L/2950 HM Sge North FPPOS 2 (COS.sp.1478506)	(2) HM-SGE-N	COS/NUV, TIME-TAG, PSA	G230L 2950 A	FP-POS=2; BUFFER-TIME=117			117 Secs (117 Secs) *[==>]*	***[2]***
8	G230L/2950 HM Sge North FPPOS 3 (COS.sp.1478506)	(2) HM-SGE-N	COS/NUV, TIME-TAG, PSA	G230L 2950 A	FP-POS=3; BUFFER-TIME=116			116 Secs (116 Secs) *[==>]*	***[2]***
9	G230L/2950 HM Sge South FPPOS 3 (COS.sp.1478506)	(3) HM-SGE-S	COS/NUV, TIME-TAG, PSA	G230L 2950 A	FP-POS=3; BUFFER-TIME=115			115 Secs (115 Secs) *[==>]*	***[2]***
10	G230L/2950 HM Sge South FPPOS 4 (COS.sp.1478506)	(3) HM-SGE-S	COS/NUV, TIME-TAG, PSA	G230L 2950 A	FP-POS=4; BUFFER-TIME=115			115 Secs (115 Secs) *[==>]*	***[2]***

Orbit Structure




Orbit 2
Server Version: 20200619
GS Reacq
Exp. 4, split 1
Exp. 4, split 2
Exp. 4, split 3
Exp. 4, split 4
Pointing Maneuver
Exp. 5
Exp. 6
Pointing Maneuver
Exp. 7
Exp. 8
Pointing Maneuver
Exp. 9
Exp. 10
Occultation
Unused Orbital Visibility = 0
Home
0
500
1000
1500
2000
2500
3000
3500
4000
4500
5000
5500
6000
sec