16046 - Understanding the Instability Strip of Accreting Pulsating White Dwarfs: Followup to a Recent COS Result

Cycle: 27, Proposal Category: GO

(UV Initiative)

(Availability Mode: AVAILABLE)

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) V-V386-SER	COS/FUV COS/NUV	3	11-Feb-2020 17:00:16.0	yes
1B	(2) TARGET01-SAFE-TARGET	COS/FUV COS/NUV	3	11-Feb-2020 17:00:18.0	yes
1A	(1) V-V386-SER	S/C	1	11-Feb-2020 17:00:19.0	yes

7 Total Orbits Used

ABSTRACT

Analysis of August, 2019 COS time-tag ultraviolet spectra shows great promise for confirmation of the physical properties defining the observed wide instability strip for pulsating white dwarfs in close binaries accreting material from their companions. The dwarf nova V386 Ser containing a pulsating white dwarf underwent its first rare large amplitude outburst in January 2019. The August UV spectra 7 months after this outburst implies a large He abundance from a white dwarf ~5000K hotter than at quiescence, with a pulsation period 6 times shorter than its quiescent one. Both the temperature and period fit with a mode driven by a He enriched composition, exactly what is predicted as the cause of the wide instability strip. For the first time, the observations match theoretical predictions! We propose to monitor the cooling during the next 6 months to further constrain the HeII and H/HeI convection zones in pulsating white dwarfs. This information is unique to the few white dwarf pulsators that undergo dwarf nova outbursts, as their heating and cooling only takes months-few years (versus millions of years in single white dwarf pulsators), presenting a rare opportunity to track how a deepening convection zone begins to drive pulsation modes with longer periods. Unfortunately, the January outburst missed the normal Cycle 26 deadline and the August observation (a Cycle 26 mid proposal) took place too late for results to provide a strong case for the Cycle 27 deadline. Due to the decades long recurrence time between outbursts in dwarf novae with pulsating white dwarfs, this is likely the last object HST can follow from outburst to quiescence.

OBSERVING DESCRIPTION

We will use COS with the G140L grating (setting 800) in time-tag mode for 3 consecutive HST orbits.
This same configuration was used for the 2 orbits in our August 2019 observation which provided a useful spectrum with coverage between 900-1900A and detection of 3% amplitude pulsations. The AAVSO shows the system is currently at 18.5 magnitude, about one-half magnitude above quiescence and a half-magnitude fainter than the previous Aug observation. The 3 orbits will provide an adequate spectrum for determining the temperature which is expected to be somewhat cooler than the 20,000K determined in August. To maximize the determination of pulsations, the orbits should be consecutive. To maximize the cooling rate, the observations should be conducted as soon as possible within the window when the object is observable from the ground (Feb-March). Target acquisition will be done using the ACQ/IMAGE in the NUV.

This is the first outburst since the discovery 19 years ago, meaning the outburst recurrence time is several decades. However, we will determine the precise quiescent magnitude within 24 hrs of the HST observation as done in the past.

While the science is optimized if the observations take place as soon as possible (before the object cools to its quiescent temperature), if reduced gyros impact the observation windows, the observations can be made
up to August 2020 when it will no longer be visible from the ground.

Visit

Proposal 16046, Visit 01, implementation Tue Feb 11 22:00:19 GMT 2020

Diagnostic Status: No Diagnostics

Scientific Instruments: COS/FUV, COS/NUV

Special Requirements: ORIENT 115D TO 355 D; AFTER 1A BY 3 D TO 5 D

Comments: This should be scheduled in evening-local time. Flags need to be cleared during the work day.

Fixed Targets

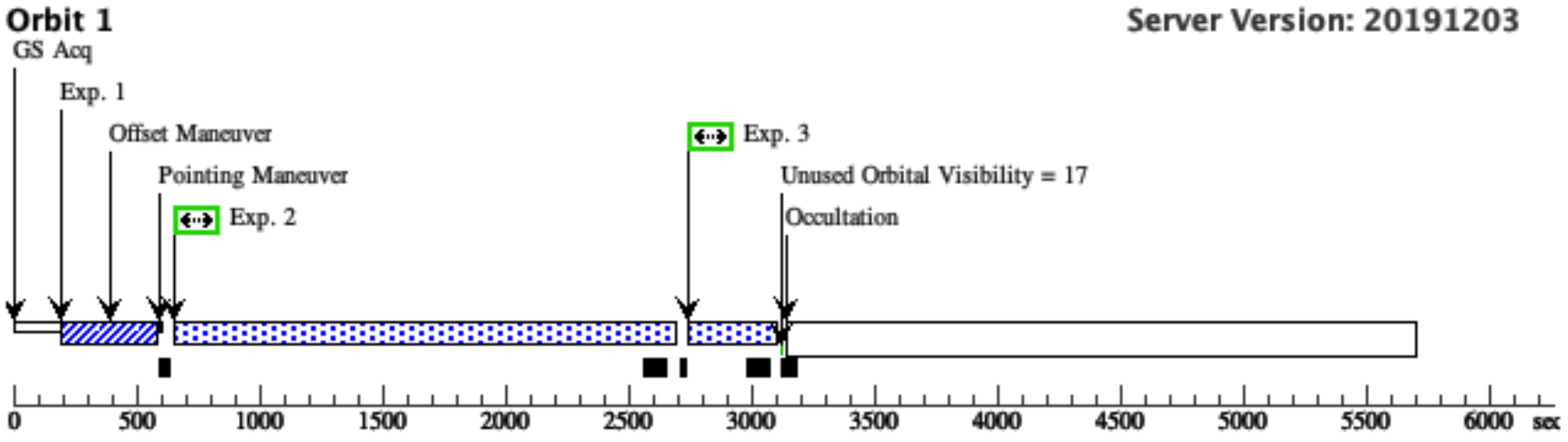
#	Name	Target Coordinates	Targ. Coord. Corrections	Fluxes	Miscellaneous
(1)	V-V386-SER	RA: 16 10 33.6206 (242.6400858d) Dec: -01 02 23.51 (-1.03986d) Equinox: J2000	Proper Motion RA: -5.34554702006616E-4 sec of time/yr Proper Motion Dec: -0.01910200003294449 arcsec/yr Parallax: 0.00415" Epoch of Position: 2015.5	V=18.5+/-0.5	Reference Frame: ICRS

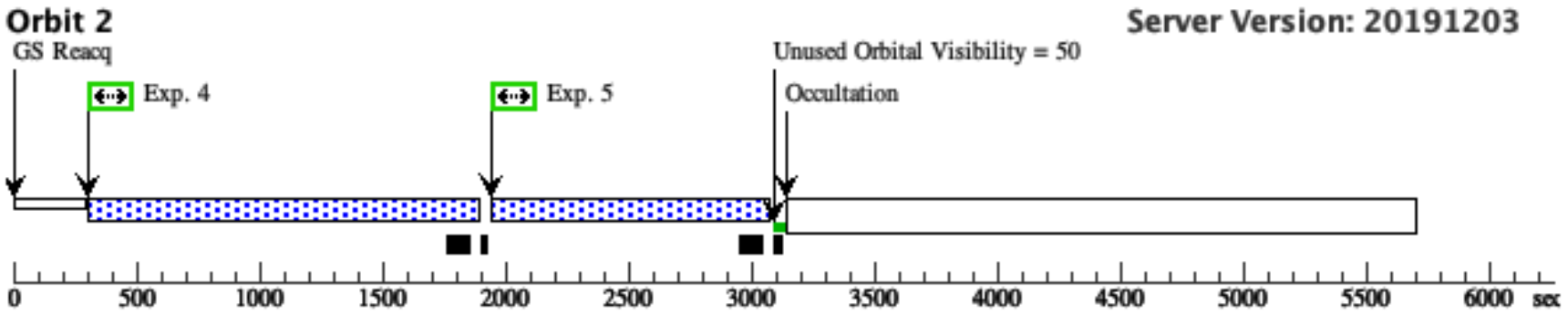
Comments: This object was generated by the targetselector and retrieved from the SIMBAD database.
Category=STAR
Description=[DWARF NOVA, INTERACTING BINARY, PULSATING VARIABLE]
Extended=NO

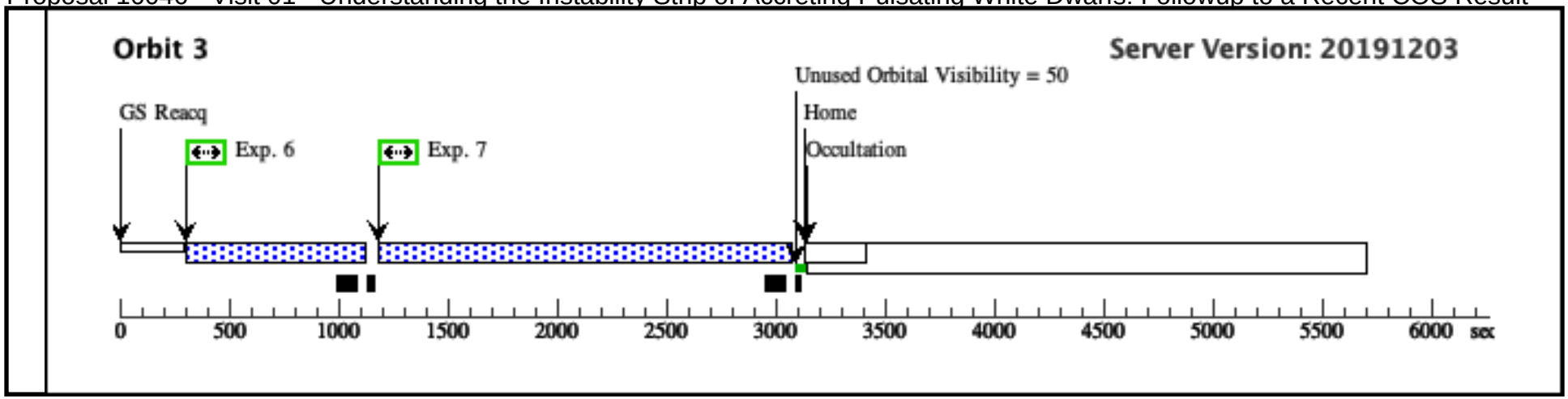
Exposures

#	Label (ETC Run)	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time (Total)/[Actual Dur.]	Orbit
1	V386-Ser ACQ/IMAGE (COS.ta.1348079)	(1) V-V386-SER	COS/NUV, ACQ/IMAGE, PSA	MIRRORB		USE OFFSET V1AS AF		50 Secs (50 Secs) *[==>]*	*[1]*
2	V386-Ser P1 (COS.sp.1392253)	(1) V-V386-SER	COS/FUV, TIME-TAG, PSA	G140L 800 A	BUFFER-TIME=1730; FP-POS=1; FLASH=YES	USE OFFSET V1AS AF		1841 Secs (1841 Secs) *[==>]*	*[1]*
3	V386-Ser P2 (COS.sp.1392253)	(1) V-V386-SER	COS/FUV, TIME-TAG, PSA	G140L 800 A	BUFFER-TIME=200; FP-POS=2; FLASH=YES	USE OFFSET V1AS AF		310 Secs (310 Secs) *[==>]*	*[1]*
4	V386-Ser P2 (COS.sp.1392253)	(1) V-V386-SER	COS/FUV, TIME-TAG, PSA	G140L 800 A	BUFFER-TIME=1430; FP-POS=2; FLASH=YES	USE OFFSET V1AS AF		1541 Secs (1541 Secs) *[==>]*	*[2]*
5	V386-Ser P3 (COS.sp.1392253)	(1) V-V386-SER	COS/FUV, TIME-TAG, PSA	G140L 800 A	BUFFER-TIME=970; FP-POS=3; FLASH=YES	USE OFFSET V1AS AF		1080 Secs (1080 Secs) *[==>]*	*[2]*
6	V386-Ser P3 (COS.sp.1392253)	(1) V-V386-SER	COS/FUV, TIME-TAG, PSA	G140L 800 A	BUFFER-TIME=660; FP-POS=3; FLASH=YES	USE OFFSET V1AS AF		771 Secs (771 Secs) *[==>]*	*[3]*
7	V386-Ser-P4 (COS.sp.1392253)	(1) V-V386-SER	COS/FUV, TIME-TAG, PSA	G140L 800 A	BUFFER-TIME=1730; FP-POS=4; FLASH=YES	USE OFFSET V1AS AF		1840 Secs (1840 Secs) *[==>]*	*[3]*

Orbit Structure






Orbit 3
Server Version: 20191203
Unused Orbital Visibility = 50
GS Reacq
Home
Exp. 6
Exp. 7
Occultation
0
500
1000
1500
2000
2500
3000
3500
4000
4500
5000
5500
6000
sec

Visit

Proposal 16046, SCIENCETARGET-BOP-ONLY (1B), implementation Tue Feb 11 22:00:19 GMT 2020

Diagnostic Status: No Diagnostics

Scientific Instruments: COS/FUV, COS/NUV

Special Requirements: ORIENT 115D TO 355 D

Comments: This visit is for BOP checking the safetarget only and should not execute onboard HST.

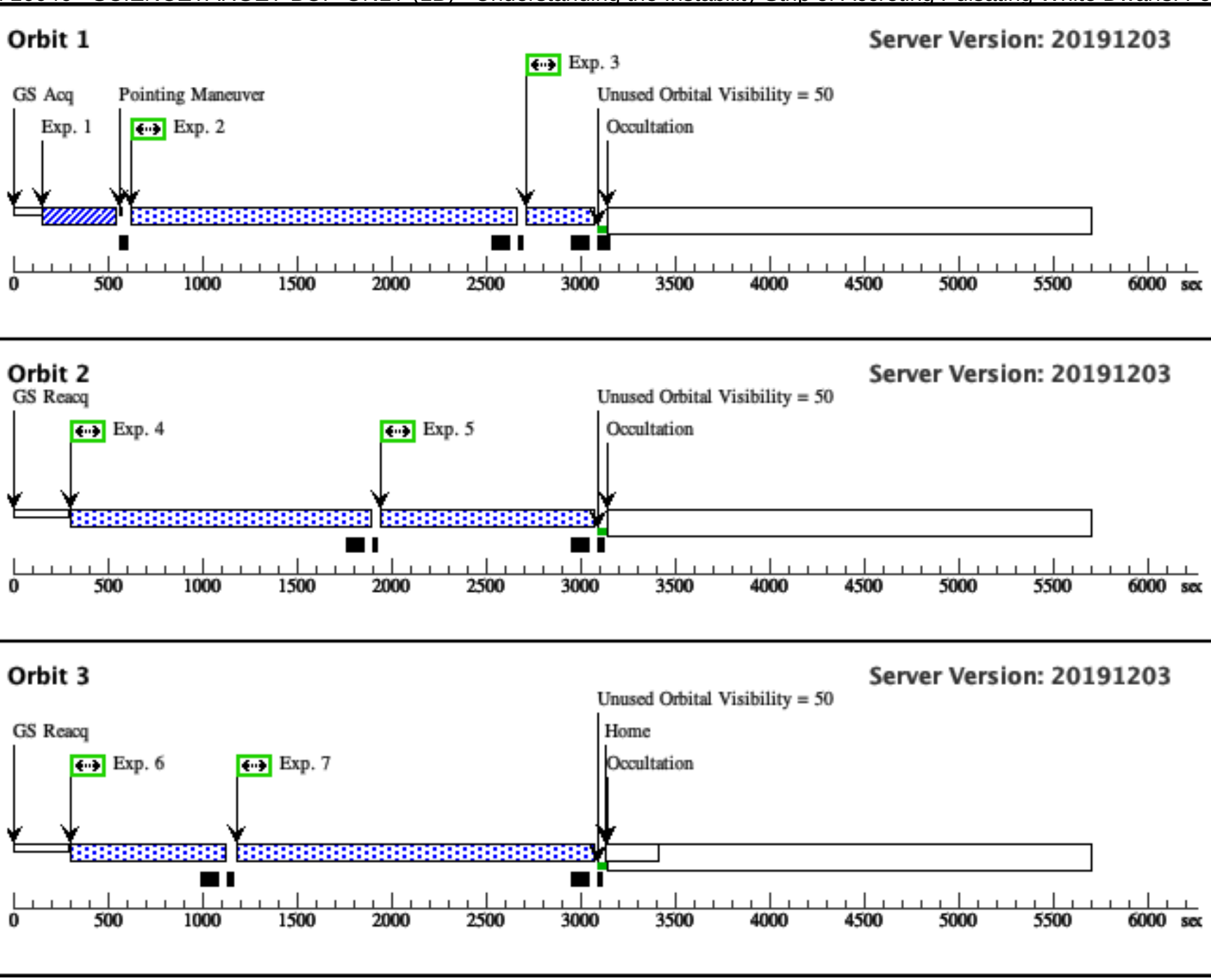
Fixed Targets

#	Name	Target Coordinates	Targ. Coord. Corrections	Fluxes	Miscellaneous
(1)	V-V386-SER	RA: 16 10 33.6206 (242.6400858d) Dec: -01 02 23.51 (-1.03986d) Equinox: J2000	Proper Motion RA: -5.34554702006616E-4 sec of time/yr Proper Motion Dec: -0.01910200003294449 arcsec/yr Parallax: 0.00415" Epoch of Position: 2015.5	V=18.5+/-0.5	Reference Frame: ICRS
Comments: This object was generated by the targetselector and retrieved from the SIMBAD database. *Category=STAR* *Description=[DWARF NOVA, INTERACTING BINARY, PULSATING VARIABLE]* *Extended=NO*					
(2)	TARGET01-SAFE-TARGET	Offset from V-V386-SER RA Offset: -0.64 Secs Dec Offset: 1.678 Arcsec		V=18.5+/-0.5	Offset Position (TARGET01-SAFE-TARGET)
Comments: This object was generated by the targetselector and retrieved from the SIMBAD database. Ths target is a blank piece of sky which is the bright object safe pointing and is 9.794 arcseconds away at a PA 279.9 degrees from V-V386-SER. *Category=UNIDENTIFIED* *Description=[BLANK FIELD]* *Extended=NO*					

Exposures

#	Label (ETC Run)	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time (Total)/[Actual Dur.]	Orbit
1	V386-Ser ACQ/IMAGE (COS.ta.1348079)	(2) TARGET01-SAFE-TARGET	COS/NUV, ACQ/IMAGE, PSA	MIRRORB				50 Secs (50 Secs) *[==>]*	***[1]***
2	V386-Ser P1 (COS.sp.1392253)	(2) TARGET01-SAFE-TARGET	COS/FUV, TIME-TAG, PSA	G140L 800 A	BUFFER-TIME=1730; FP-POS=1; FLASH=YES			1841 Secs (1841 Secs) *[==>]*	***[1]***
3	V386-Ser P2 (COS.sp.1392253)	(2) TARGET01-SAFE-TARGET	COS/FUV, TIME-TAG, PSA	G140L 800 A	BUFFER-TIME=200; FP-POS=2; FLASH=YES			310 Secs (310 Secs) *[==>]*	***[1]***
4	V386-Ser P2 (COS.sp.1392253)	(2) TARGET01-SAFE-TARGET	COS/FUV, TIME-TAG, PSA	G140L 800 A	BUFFER-TIME=1430; FP-POS=2; FLASH=YES			1541 Secs (1541 Secs) *[==>]*	***[2]***
5	V386-Ser P3 (COS.sp.1392253)	(2) TARGET01-SAFE-TARGET	COS/FUV, TIME-TAG, PSA	G140L 800 A	BUFFER-TIME=970; FP-POS=3; FLASH=YES			1080 Secs (1080 Secs) *[==>]*	***[2]***
6	V386-Ser P3 (COS.sp.1392253)	(2) TARGET01-SAFE-TARGET	COS/FUV, TIME-TAG, PSA	G140L 800 A	BUFFER-TIME=660; FP-POS=3; FLASH=YES			771 Secs (771 Secs) *[==>]*	***[3]***
7	V386-Ser-P4 (COS.sp.1392253)	(2) TARGET01-SAFE-TARGET	COS/FUV, TIME-TAG, PSA	G140L 800 A	BUFFER-TIME=1730; FP-POS=4; FLASH=YES			1840 Secs (1840 Secs) *[==>]*	***[3]***

Orbit Structure



Visit

Proposal 16046, Visit 1A, implementation Tue Feb 11 22:00:20 GMT 2020

Diagnostic Status: No Diagnostics

Scientific Instruments: S/C

Special Requirements: ORIENT 115D TO 355 D

Comments: This visit allocates and set up the safe position offset slot for visit 01 which will use that slot. This S/C visit should go earlier in the week while Visit 01 will be atleast 3 days later. The S/C visit will contain only 1 exposure. Note: weekends are to be avoided since the CS must clear the target within 24 hours of HST execution.

Fixed Targets

#	Name	Target Coordinates	Targ. Coord. Corrections	Fluxes	Miscellaneous
(1)	V-V386-SER	RA: 16 10 33.6206 (242.6400858d) Dec: -01 02 23.51 (-1.03986d) Equinox: J2000	Proper Motion RA: -5.34554702006616E-4 sec of time/yr Proper Motion Dec: -0.01910200003294449 arcsec/yr Parallax: 0.00415" Epoch of Position: 2015.5	V=18.5+/-0.5	Reference Frame: ICRS

Comments: This object was generated by the targetselector and retrieved from the SIMBAD database.
Category=STAR
Description=[DWARF NOVA, INTERACTING BINARY, PULSATING VARIABLE]
Extended=NO

Exposures

#	Label	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time (Total)/[Actual Dur.]	Orbit
1		(1) V-V386-SER	S/C, DATA, V1			POS TARG 232.723, -237.515; SAVE OFFSET V1 ASAF; SPEC COM INSTR ECSLOTSET; QESIPARM ANGLE 279.9; QESIPARM DIST 9.794		5 Secs (5 Secs) *[==>]*	*[1]*

Orbit Structure