



# 15703 - Determining the Cooling Curve of the Unique Extreme Amplitude Dwarf Nova V386 Ser Containing an Accreting, Pulsating White Dwarf.

Cycle: 26, Proposal Category: GO

(UV Initiative)

(Availability Mode: AVAILABLE)

## INVESTIGATORS

<i>Name</i>	<i>Institution</i>	<i>E-Mail</i>
<b>Prof. Paula Szkody (PI) (Contact)</b>	<b>University of Washington</b>	<b>szkody@astro.washington.edu</b>
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Dr. Stella Kafka (CoI)	American Association Of Variable Star Observers	skafka@aavso.org

## 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) V-V386-SER	COS/FUV COS/NUV	2	30-Jul-2019 18:00:17.0	yes
02	(1) V-V386-SER	S/C	1	30-Jul-2019 18:00:18.0	yes
03	(2) V-V386-SER-SAFE	COS/FUV COS/NUV	2	30-Jul-2019 18:00:19.0	yes
11	(1) V-V386-SER	COS/FUV COS/NUV	2	30-Jul-2019 18:00:20.0	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>
12	(1) V-V386-SER	S/C	1	30-Jul-2019 18:00:20.0	yes
13	(3) V-V386-SER-SAFE-2	COS/FUV COS/NUV	2	30-Jul-2019 18:00:21.0	yes

10 Total Orbits Used

### **ABSTRACT**

V386 Ser is a relatively rare close binary containing a well-studied (at quiescence) accreting, pulsating white dwarf that underwent its first known extreme amplitude dwarf nova outburst in January, 2019, and we request a short COS observation to measure the temperature of the white dwarf as soon as possible after the outburst. Since 2004, it has been pulsating at a period of 609 sec, which is known to be a triplet with a spacing indicating a puzzling extremely slow rotation for an accreting white dwarf. The only other pulsating white dwarf that went into a superoutburst and has been followed up with HST is GW Lib. That data revealed an unusually long and non-monotonic cooling time as well as changing modes of pulsation during its decline. However, the monitoring of GW Lib only started 3 yrs past its outburst. V386 Ser presents the unique opportunity to obtain the optimum measurement of the heating within a few months of the outburst when the accretion disk has dissipated enough to view the white dwarf. Obtaining this measurement in the UV with COS will constrain the cooling curve (hence the amount of accretion that took place) and how possible spinup from this accretion impacts the pulsation structure in the interior versus atmospheric rotation.

### **OBSERVING DESCRIPTION**

We will use COS with the G140L grating to obtain time-tag spectra during 2 HST orbits of the pulsating white dwarf in the close binary V386 Ser. In January, 2019, V386 Ser underwent its first dwarf nova outburst since its discovery in 2002. Our goal is to obtain a temperature as soon as possible now that the system has faded back toward quiescence and we can view how much the white dwarf has been heated by the outburst. A quiescent very low resolution spectrum was obtained by HST using the SBC on June 30, 2005 when STIS was out of service ( Program 10233, observation J84E02021). Since we want to cover as much of the Far UV as possible, we will use the new 800 central wavelength. Target acquisition will be done using the ACQ/IMAGE in the NUV. The time-tag data will be used to search for the quiescent pulsation period of 608 sec or longer periods such as those evident in GW Lib after its outburst. The time-tag spectra will also allow removing the orbital motion of the white dwarf in order to obtain the best value for the white dwarf rotation from the Doppler broadened UV absorption lines of Si and C.

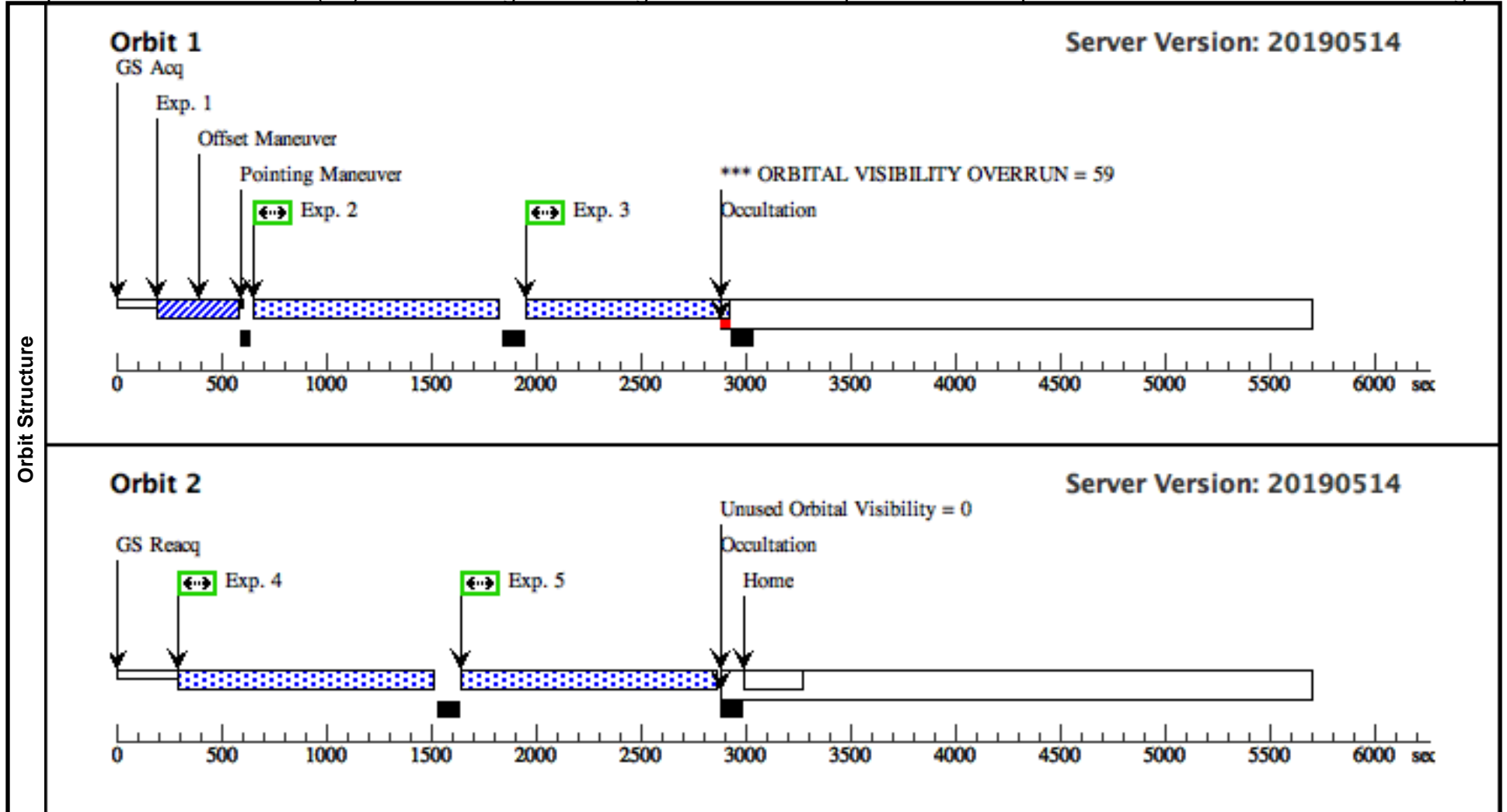
Because the cooling curve of the white dwarf is best determined if we can observe soon after the white dwarf is visible (the disk has decreased its outburst luminosity), the best observation times would be May-June. This is also the time when the optical can be observed from the ground, allowing the ratio of UV/opt amplitude of any pulsations to be determined, which can determine the mode of pulsation.

This is the first outburst since the discovery 19 years ago, so the outburst period is several decades. However, we will determine the precise quiescent optical magnitude within 24 hrs of the HST observation as done in the past for normal dwarf novae. As of March 31, the object is at 17.5 mag, returning to its quiescent value of  $g=19$ .

Proposal 15703 - V386-Ser (01) - Determining the Cooling Curve of the Unique Extreme Amplitude Dwarf Nova V386 Ser Containing ...

Tue Jul 30 22:00:22 GMT 2019

<b>Visit</b>	<p><b>Proposal 15703, V386-Ser (01), failed</b></p> <p><b>Diagnostic Status: Warning</b></p> <p>Scientific Instruments: COS/FUV, COS/NUV</p> <p>Special Requirements: ORIENT 190D TO 88 D; AFTER 02 BY 2 D TO 4 D; BEFORE 15-JUN-2019:00:00:00; Period 1 D AND ZERO-PHASE HJD2457083.417; VISIBILITY INTERVAL 48 M</p> <p><i>Comments: This should be scheduled during the evening - Baltimore time. Offset flags need to be cleared during the work day. The PHASE requirement will enforce this. ORIENT is to avoid the possibility of a nearby object landing near the COS Bright Object Aperture.</i></p>									
	<p>(V386-Ser (01)) Warning (Orbit Planner): ORBITAL VISIBILITY OVERRUN</p>									
<b>Diagnosics</b>										
<b>Fixed Targets</b>	<b>#</b>	<b>Name</b>	<b>Target Coordinates</b>	<b>Targ. Coord. Corrections</b>	<b>Fluxes</b>	<b>Miscellaneous</b>				
	(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=18.9+/-1.0	Reference Frame: ICRS				
<p><i>Comments: This object was generated by the targetselector and retrieved from the SIMBAD database. This object was generated by the targetselector and retrieved from the SIMBAD database.</i></p> <p>Category=STAR Description=[DWARF NOVA, INTERACTING BINARY, PULSATING VARIABLE] Extended=NO</p>										
<b>Exposures</b>	<b>#</b>	<b>Label (ETC Run)</b>	<b>Target</b>	<b>Config,Mode,Aperture</b>	<b>Spectral Els.</b>	<b>Opt. Params.</b>	<b>Special Reqs.</b>	<b>Groups</b>	<b>Exp. Time (Total)/[Actual Dur.]</b>	<b>Orbit</b>
	1	V386-Ser A CQ/IMAGE (COS.ta.134 8079)	(1) V-V386-SER	COS/NUV, ACQ/IMAGE, PSA	MIRRORB		PHASE 0 TO 0.5; USE OFFSET 01SA FE		50 Secs (50 Secs) [==>]	[1]
	2	V386-SER F P-1 (COS.sp.132 4684)	(1) V-V386-SER	COS/FUV, TIME-TAG, PSA	G140L 800 A	BUFFER-TIME=10 51; FP-POS=1; FLASH=YES	USE OFFSET 01SA FE		1161 Secs (975 Secs) [==>975.0 Secs ]	[1]
	3	V386-SER F P-2 (COS.sp.132 4684)	(1) V-V386-SER	COS/FUV, TIME-TAG, PSA	G140L 800 A	BUFFER-TIME=99 0; FP-POS=2; FLASH=YES	USE OFFSET 01SA FE		1100 Secs (914 Secs) [==>914.0 Secs ]	[1]
	4	V386-SER F P-3 (COS.sp.132 4684)	(1) V-V386-SER	COS/FUV, TIME-TAG, PSA	G140L 800 A	BUFFER-TIME=12 25; FP-POS=3; FLASH=YES	USE OFFSET 01SA FE		1335 Secs (1166 Secs) [==>1166.0 Secs ]	[2]
	5	V386-SER F P-4 (COS.sp.132 4684)	(1) V-V386-SER	COS/FUV, TIME-TAG, PSA	G140L 800 A	BUFFER-TIME=12 26; FP-POS=4; FLASH=YES	USE OFFSET 01SA FE		1336 Secs (1167 Secs) [==>1167.0 Secs ]	[2]

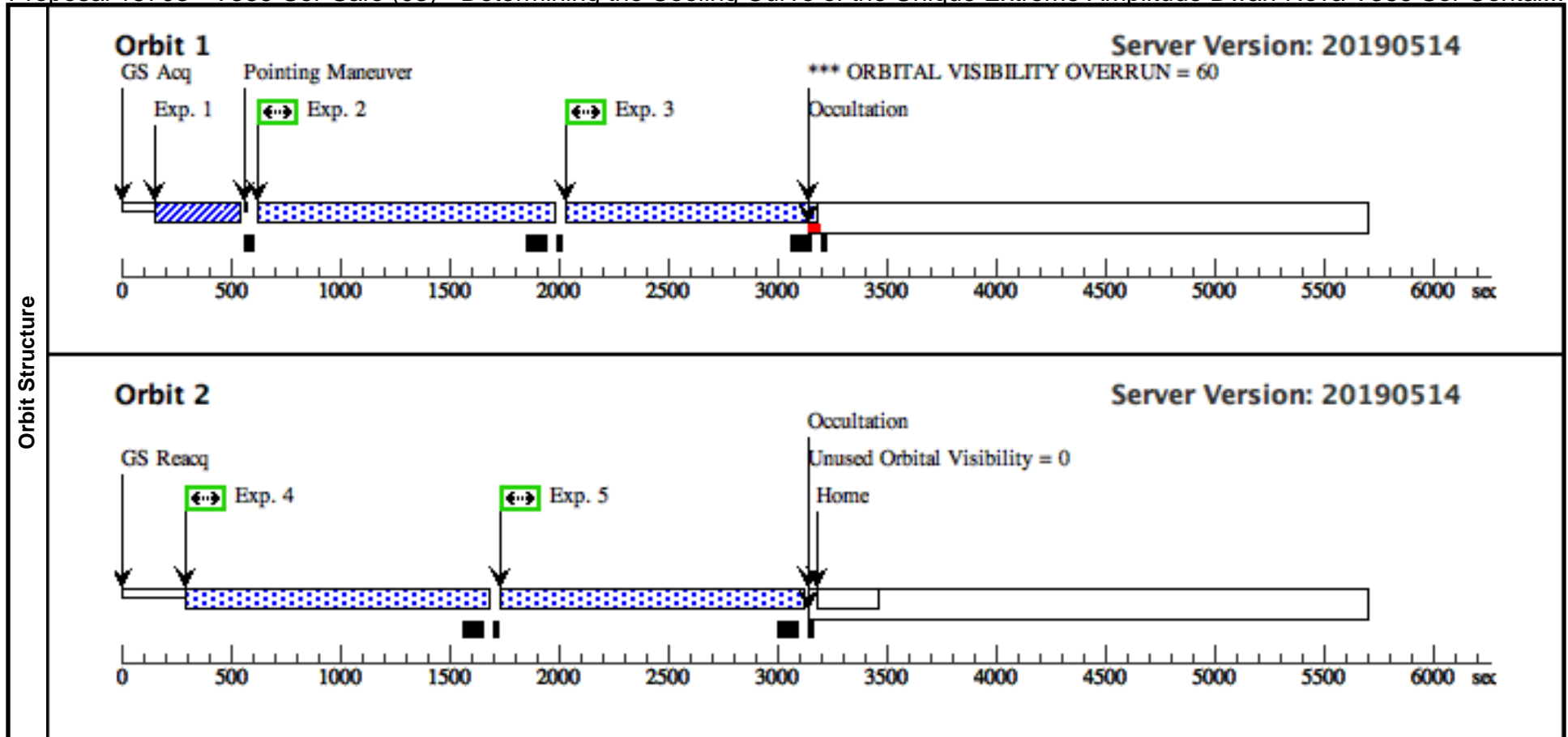


<b>Visit</b>	<p><b>Proposal 15703, Visit 02, completed</b></p> <p><b>Diagnostic Status: No Diagnostics</b></p> <p>Scientific Instruments: S/C</p> <p>Special Requirements: Period 7 D AND ZERO-PHASE HJD2457082.5</p> <p><i>Comments: This visit allocates and sets up the safe position offset slot for visit 01 which will use that slot. This S/C visit should go earlier in the week while visit 01 will be at least 3 days later. The PHASE requirement will ensure that the visit is scheduled on a Monday.</i></p>																									
	<table border="1"> <thead> <tr> <th>#</th> <th>Name</th> <th>Target Coordinates</th> <th>Targ. Coord. Corrections</th> <th>Fluxes</th> <th>Miscellaneous</th> </tr> </thead> <tbody> <tr> <td>(1)</td> <td>V-V386-SER</td> <td>RA: 16 10 33.6206 (242.6400858d) Dec: -01 02 23.51 (-1.03986d) Equinox: J2000</td> <td>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</td> <td>V=18.9+/-1.0</td> <td>Reference Frame: ICRS</td> </tr> </tbody> </table> <p><i>Comments: This object was generated by the targetselector and retrieved from the SIMBAD database. This object was generated by the targetselector and retrieved from the SIMBAD database.</i></p> <p>Category=STAR Description=[DWARF NOVA, INTERACTING BINARY, PULSATING VARIABLE] Extended=NO</p>						#	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=18.9+/-1.0	Reference Frame: ICRS								
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<b>Exposures</b>	<p><b>Orbit 1</b> <span style="float: right;"><b>Server Version: 20190514</b></span></p> <p>Exp. 1</p> <p>GS Acq Unused Orbital Visibility = 2804</p> <p>Occultation</p> <p>0 500 1000 1500 2000 2500 3000 3500 4000 4500 5000 5500 6000 sec</p>																									
	<b>Orbit Structure</b>																									

Proposal 15703 - V386-Ser-Safe (03) - Determining the Cooling Curve of the Unique Extreme Amplitude Dwarf Nova V386 Ser Contai...

Tue Jul 30 22:00:22 GMT 2019

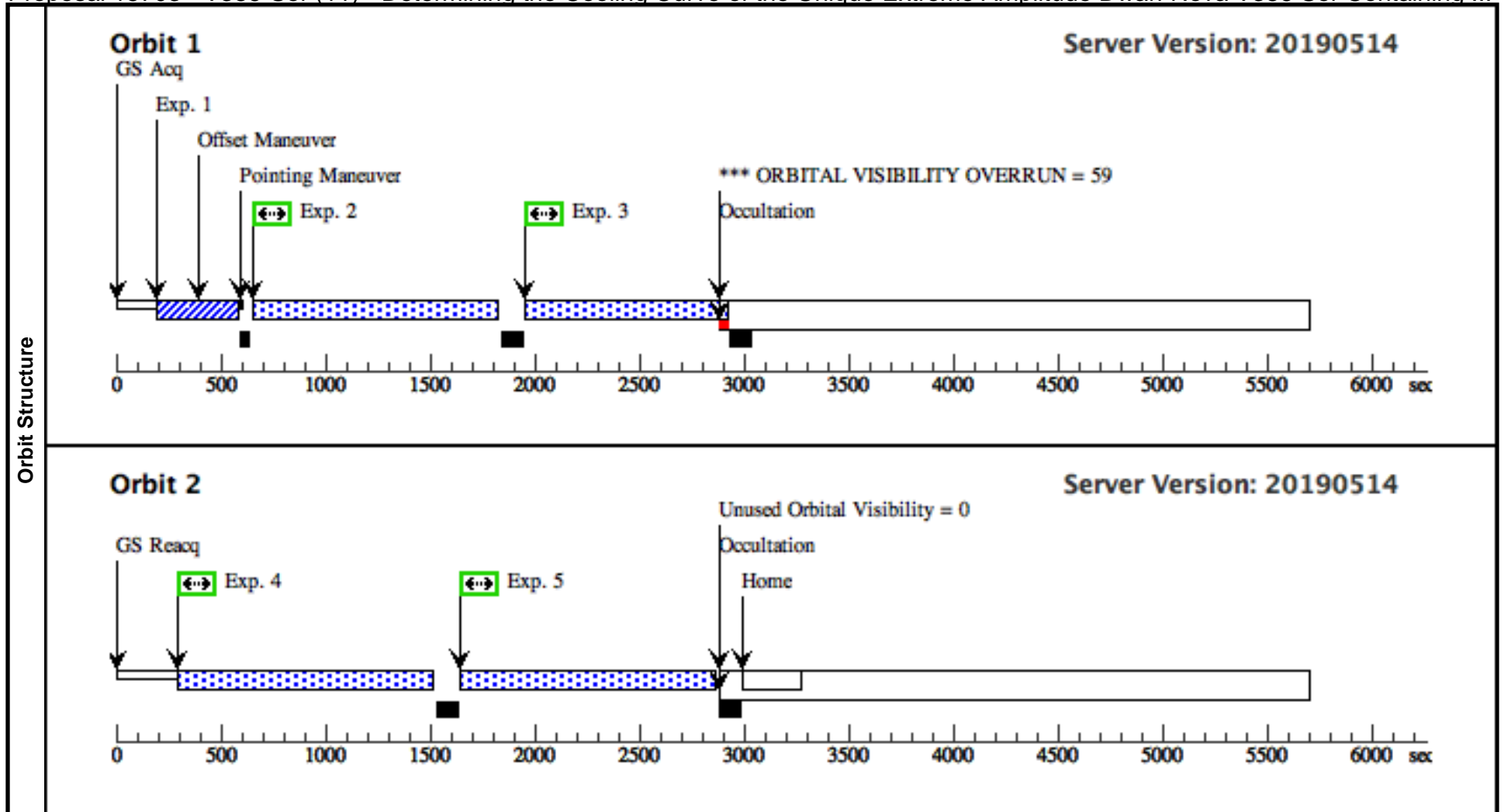
<b>Visit</b>	<p><b>Proposal 15703, V386-Ser-Safe (03), withdrawn</b></p> <p><b>Diagnostic Status: Warning</b></p> <p>Scientific Instruments: COS/FUV, COS/NUV</p> <p>Special Requirements: ORIENT 190D TO 88 D</p> <p><i>Comments: This visit is for BOP checking the safe target only and should not execute onboard HST.</i></p>									
	<p><b>Diagnosics</b></p> <p>(V386-Ser-Safe (03)) Warning (Orbit Planner): ORBITAL VISIBILITY OVERRUN</p>									
<b>Fixed Targets</b>	<b>#</b>	<b>Name</b>	<b>Target Coordinates</b>	<b>Targ. Coord. Corrections</b>	<b>Fluxes</b>	<b>Miscellaneous</b>				
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(2)	V-V386-SER-SAFE	Offset from V-V386-SER RA Offset: 0.0 Secs Dec Offset: 9.75 Arcsec			V=16.5+/-0.5	Offset Position (V-V386-SER-SAFE)				
<p><i>Comments:</i></p> <p><i>Category=UNIDENTIFIED</i></p> <p><i>Description=[BLANK FIELD]</i></p> <p><i>Extended=NO</i></p>										
<b>Exposures</b>	<b>#</b>	<b>Label (ETC Run)</b>	<b>Target</b>	<b>Config,Mode,Aperture</b>	<b>Spectral Els.</b>	<b>Opt. Params.</b>	<b>Special Reqs.</b>	<b>Groups</b>	<b>Exp. Time (Total)/[Actual Dur.]</b>	<b>Orbit</b>
	1	V386-Ser A CQ/IMAGE (COS.ta.134 8079)	(2) V-V386-SER-SA FE	COS/NUV, ACQ/IMAGE, PSA	MIRRORB				50 Secs (50 Secs) [==>]	[1]
	2	V386-SER F P-1 (COS.sp.132 4684)	(2) V-V386-SER-SA FE	COS/FUV, TIME-TAG, PSA	G140L 800 A	BUFFER-TIME=10 51; FP-POS=1; FLASH=YES			1161 Secs (1161 Secs) [==>]	[1]
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	5	V386-SER F P-4 (COS.sp.132 4684)	(2) V-V386-SER-SA FE	COS/FUV, TIME-TAG, PSA	G140L 800 A	BUFFER-TIME=12 26; FP-POS=4; FLASH=YES			1336 Secs (1336 Secs) [==>]	[2]



Proposal 15703 - V386-Ser (11) - Determining the Cooling Curve of the Unique Extreme Amplitude Dwarf Nova V386 Ser Containing ...

Tue Jul 30 22:00:22 GMT 2019

<b>Visit</b>	<b>Proposal 15703, V386-Ser (11), implementation</b> <b>Diagnostic Status: Warning</b> Scientific Instruments: COS/FUV, COS/NUV Special Requirements: ORIENT 210D TO 100 D; AFTER 12 BY 2 D TO 14 D; BETWEEN 05-AUG-2019:00:00:00 AND 10-AUG-2019:00:00:00; BETWEEN 12-AUG-2019:00:00:00 AND 17-AUG-2019:00:00:00; BETWEEN 19-AUG-2019:00:00:00 AND 24-AUG-2019:00:00:00; Period 1 D AND ZERO-PHASE HJD2457083.417; VISIBILITY INTERVAL 48 M <i>Comments: This should be scheduled during the evening - Baltimore time. Offset flags need to be cleared during the work day. The PHASE requirement will enforce this. ORIENT is to avoid the possibility of a nearby object landing near the COS Bright Object Aperture.</i>																																																																				
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<b>Visit</b>	<b>Proposal 15703, Visit 12, implementation</b> <b>Diagnostic Status: No Diagnostics</b> Scientific Instruments: S/C Special Requirements: Period 7 D AND ZERO-PHASE HJD2457082.5 <i>Comments: This visit allocates and sets 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 at least 3 days later. The PHASE requirement will ensure that the visit is scheduled on a Monday.</i>																								
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Proposal 15703 - V386-Ser-Safe-2 (13) - Determining the Cooling Curve of the Unique Extreme Amplitude Dwarf Nova V386 Ser Cont...

Tue Jul 30 22:00:22 GMT 2019

<b>Visit</b>	<p><b>Proposal 15703, V386-Ser-Safe-2 (13), withdrawn</b></p> <p><b>Diagnostic Status: Warning</b></p> <p>Scientific Instruments: COS/FUV, COS/NUV</p> <p>Special Requirements: ORIENT 210D TO 100 D</p> <p><i>Comments: This visit is for BOP checking the safe target only and should not execute onboard HST.</i></p>																																																																					
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