



16751 - Spatial and Temporal Variations in the Physical Conditions of Clouds Shocked by the Vela Supernova Remnant

Cycle: 29, Proposal Category: GO

(UV Initiative)

(Availability Mode: SUPPORTED)

INVESTIGATORS

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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) HD-71336	STIS/CCD STIS/FUV-MAMA	1	04-May-2022 16:00:13.0	yes
02	(2) HD-72088 WAVE	STIS/CCD STIS/FUV-MAMA	3	04-May-2022 16:00:15.0	yes
03	(3) HD-72089 WAVE	STIS/CCD STIS/FUV-MAMA	1	04-May-2022 16:00:16.0	yes
04	(6) HD-72350 WAVE	STIS/CCD STIS/FUV-MAMA	1	04-May-2022 16:00:16.0	yes
05	(7) HD-72537 WAVE	STIS/CCD STIS/FUV-MAMA	1	04-May-2022 16:00:17.0	yes
06	(8) HD-72648 WAVE	STIS/CCD STIS/FUV-MAMA	1	04-May-2022 16:00:18.0	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>
07	(4) HD-72127A (5) HD-72127B WAVE	STIS/CCD STIS/FUV-MAMA	4	04-May-2022 16:00:19.0	yes

12 Total Orbits Used

ABSTRACT

The Vela supernova remnant (SNR) is an ideal laboratory for studying the physical processes associated with SNR evolution in a highly inhomogeneous interstellar medium (ISM). Previous UV and optical absorption-line studies have revealed the remarkable nature of the highly disturbed interstellar gas interacting with the Vela SNR. The most noteworthy features are (1) the high positive and negative velocity absorption components seen in numerous directions, (2) the strong absorption from excited fine-structure levels of neutral carbon detected in low and high velocity gas, and (3) the many different absorption components that exhibit significant ongoing temporal variations. However, our understanding of the cloud-shock interactions taking place in the Vela region is far from complete. Here, we propose the first large-scale systematic investigation of shocked gas in the Vela SNR to employ the high resolution, high sensitivity, and extensive wavelength coverage provided by HST/STIS. We will observe eight stars clustered along a ridge of high pressure gas near the western edge of the northern X-ray bright region in the Vela SNR. The high resolution and broad wavelength coverage of the STIS spectra will allow us to examine the radial velocities, gas densities, thermal pressures, ionization fractions, and dust depletions in individual clouds along each line of sight. Five of our targets have archival STIS and/or GHRS observations, which will allow us to determine how the physical conditions have changed over time. The result will be the most comprehensive analysis to date of spatial and temporal variations in the physical conditions of clouds shocked by the Vela SNR.

OBSERVING DESCRIPTION

We plan to obtain high-resolution ($\sim 2.5\text{-}3.7$ km/s), moderately high S/N ratio ($\sim 30\text{-}60$) far-UV STIS spectra of eight stars probing a ridge of high-pressure gas associated with the Vela Supernova Remnant. Three of our targets have existing high-resolution STIS spectra in the MAST archive and these archival data will be incorporated into our analysis. The purpose of our research program is to evaluate the physical conditions (i.e., the densities, pressures, ionization states, and depletion levels) along each of the multiple sight lines to explore how the conditions change (1) as a function of velocity along the line of sight, (2) as a function of position on the sky, and (3) as a function of time. The targets selected for our investigation are known to exhibit significant absorption from excited fine-structure levels of neutral carbon. Many of our targets also exhibit high-velocity interstellar absorption components (from both low and high ionization atomic species) and several exhibit time-variable components. All of

our targets have Gaia DR2 distances that place them behind the Vela SNR (which is at a distance of ~ 290 pc).

Our observations will be obtained using the STIS FUV MAMA detector and E140H grating. Two central wavelength settings (at 1307 Å and 1598 Å) will provide wavelength coverage in the range 1206-1699 Å, with a gap between 1408 Å and 1497 Å. The broad wavelength coverage is necessary so that our observations cover all of the relevant C I multiplets, which we will use to derive quantitative measurements of thermal pressure. By carefully analyzing the absorption features arising from all of the various C I multiplets, from the strongest multiplets (i.e., 1277, 1328, 1560, and 1656) to the weakest (e.g., 1270 and 1276), we will be able to obtain accurate determinations of thermal pressure over a wide range of C I column density. Moreover, since the pattern of transitions from the three fine-structure levels varies within each multiplet, it is necessary to observe many different multiplets in order to disentangle the complex velocity structure within each J level.

The spectra we obtain will include many additional absorption features that will allow us to more fully characterize the physical conditions along the various lines of sight. Absorption from excited fine-structure levels of O I and Si II will provide information on the densities and temperatures in the neutral and partially ionized gas components that exhibit these features. Strong to moderately strong transitions of Al II, Fe II, and Ni II that fall within our wavelength coverage will yield information on the depletion characteristics of the different velocity components. Finally, absorption features from the highly-ionized species C IV, Si IV, and N V will provide crucial information on the state of the shocks permeating the Vela SNR.

For the faintest stars in our program (HD 71336, HD 72088, HD 72089, and HD 72648), the 0.2x0.2 arcsec entrance slit will be used, which will provide a velocity resolution of ~ 3.7 km/s. The use of this relatively wide slit has two advantages. No pickup observation is required to place the target on the slit, meaning that more of the orbital visibility period can be used for science exposures. And, the higher throughput from the wider slit will yield higher S/N ratios in the resulting spectra for these fainter targets. For two of the brighter stars (HD 72350 and HD 72537), the 0.2x0.09 arcsec slit is required so that the total count rate per image is below the bright limit for the FUV MAMA. This narrower slit will yield a somewhat higher velocity resolution of ~ 2.8 km/s. For the binary pair (HD 72127AB), which consists of a bright ($V=5.19$) primary and a much fainter ($V=6.98$) secondary separated by 4.65 arcsec, a neutral density filter (0.2x0.05ND) will need to be employed for both targets (since the two stars are separated by less than 5 arcsec).

The exposure time calculations are based on the need for peak S/N values in the range 30-60, which will yield 1-sigma equivalent width uncertainties of ~ 0.5 -1.0 mÅ for weak lines with small intrinsic widths. This level of precision is required for our derivations of thermal pressures from C I and O I fine-structure excitations since the results can be sensitive to small changes in the relative populations. All of our targets (except HD 72127B) have previously been observed by the IUE satellite. Thus, we used the archival IUE spectrum (preferably obtained with the large aperture) as the input

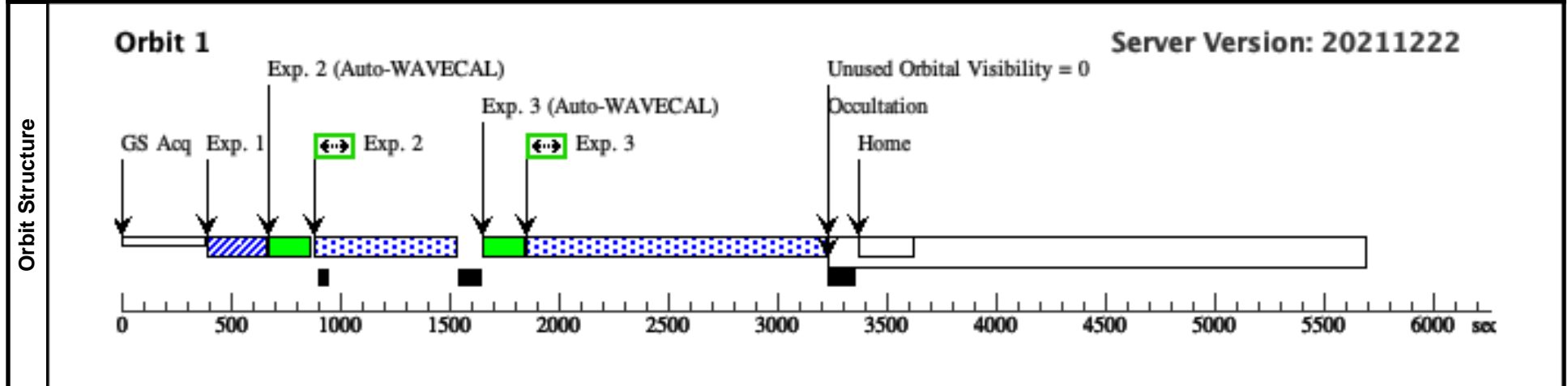
spectrum for the ETC calculations. For HD 72537, the only available IUE spectrum was obtained with the small aperture, which has been known to underestimate the true flux of the star. To correct the flux for this target, we matched the IUE spectrum to the overlapping portion of the available FUSE spectrum of this star. Since HD 72127B was not observed with IUE, we based the ETC calculations for this target on a synthetic spectrum derived from the spectral type (B2.5 V), V magnitude, and reddening ($E(B-V)=0.04$), assuming an average Galactic extinction curve. However, we checked that the flux in the synthetic spectrum matches available UV observations of this star taken with the GHRS (see Wallerstein et al. 1995, ApJ, 455, 590).

With (absolute) declinations in the range 43-45 degrees, the visibility period for our targets is 54 minutes per orbit. In cases where we are using narrow slits (0.2x0.09 or 0.2x0.05ND), the targets will be acquired with an ACQ followed by an ACQ/PEAK. For all of our targets (except the binary pair), the visits have been structured so that each star has its own visit. Each target (except HD 72127B) will be observed with both central wavelength settings of the E140H grating. We can achieve the required S/N at both settings in one orbit each for HD 71336, HD 72089, HD 72350, HD 72537, and HD 72648, and in three orbits for HD 72088. Both components of the binary pair will be observed in one 4-orbit visit so that we can take advantage of a small angle maneuver to move from the primary to the secondary. A pickup will be performed after acquiring the primary and after moving to the secondary. While HD 72127A will be observed with both central wavelength settings, HD 72127B will be observed with the setting at 1307 Å only. Due to the increased exposure time caused by the neutral density filter, it will not be feasible to obtain high quality data at both settings toward HD 72127B with the number of orbits allocated. This will not affect our science program, however. The purpose of observing the binary pair is to examine small scale structure primarily in the C I absorption profiles. There will still be many C I multiplets available with just the setting at 1307 Å.

Visit	Proposal 16751, Visit 01, completed				
	Diagnostic Status: No Diagnostics				
	Scientific Instruments: STIS/CCD, STIS/FUV-MAMA				
	Special Requirements: (none)				

Fixed Targets	#	Name	Target Coordinates	Targ. Coord. Corrections	Fluxes	Miscellaneous
	(1)	HD-71336	RA: 08 25 6.9832 (126.2790967d) Dec: -43 21 52.64 (-43.36462d) Equinox: J2000	Proper Motion RA: -0.009598 arcsec/yr Proper Motion Dec: 0.009283 arcsec/yr Parallax: 0.0014873" Epoch of Position: 2000.0	V=7.99 F(1350) = 3.2E-11, F(1510) = 2.5E-11	Reference Frame: ICRS
	<i>Comments:</i>					
	Category=STAR Description=[B3-B5 III-I, B3-B5 V-IV]					

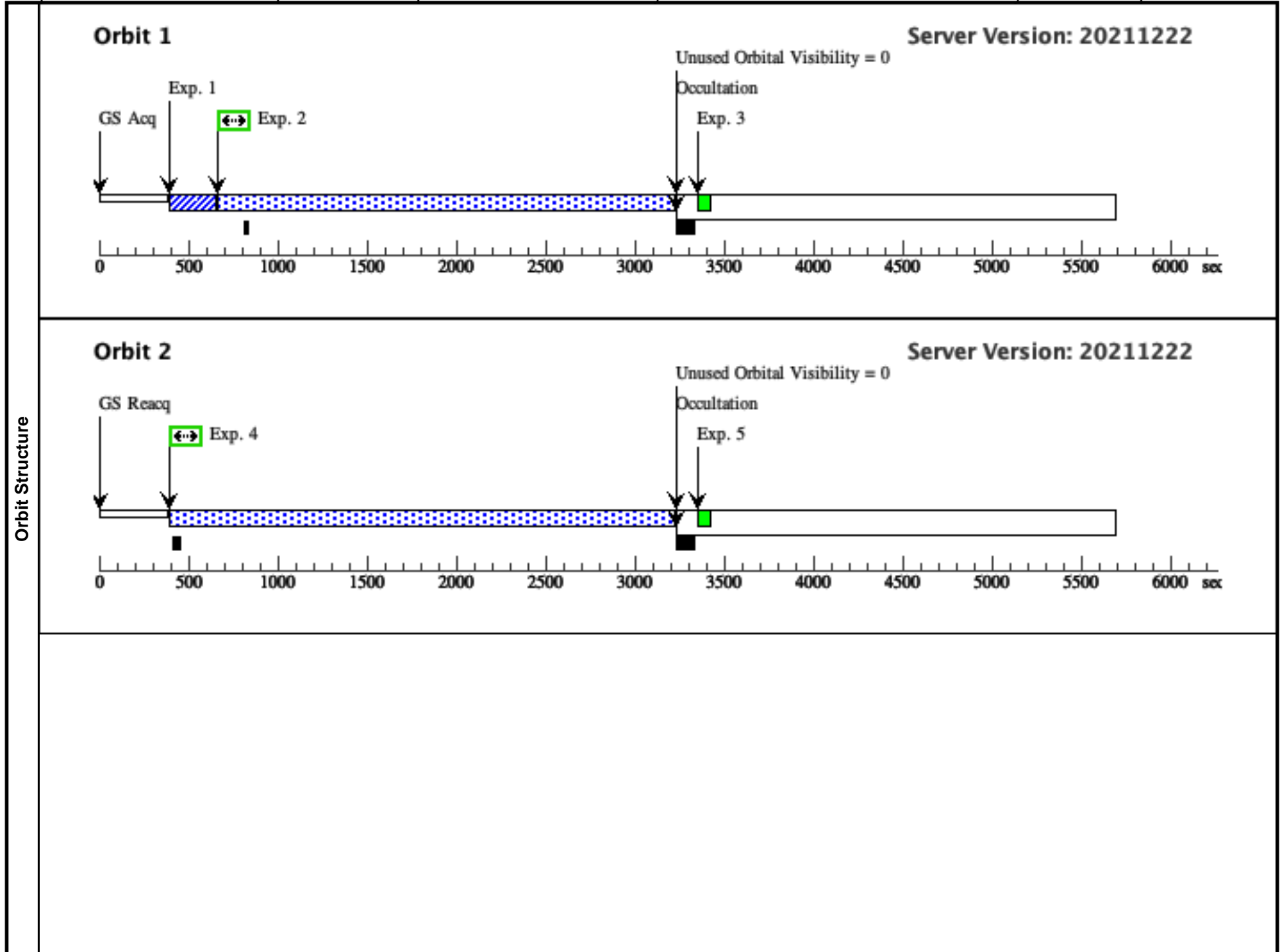
Exposures	#	Label (ETC Run)	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time (Total)/[Actual Dur.]	Orbit
	1	(STIS.ta.152 7453)	(1) HD-71336	STIS/CCD, ACQ, F28X500III	MIRROR				0,4 Secs (0,4 Secs)	
	2	(STIS.sp.15 27457)	(1) HD-71336	STIS/FUV-MAMA, ACCUM, 0.2X0.2	E140H 1307 A				632 Secs (632 Secs)	[1]
	3	(STIS.sp.15 27458)	(1) HD-71336	STIS/FUV-MAMA, ACCUM, 0.2X0.2	E140H 1562 A				1350 Secs (1350 Secs)	[1]

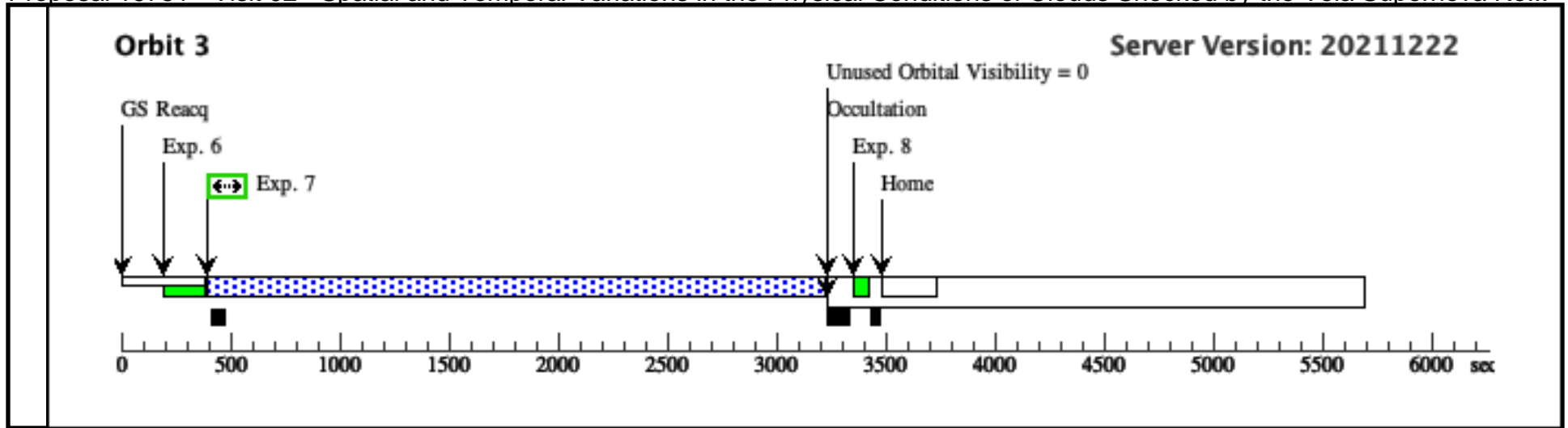


Proposal 16751 - Visit 02 - Spatial and Temporal Variations in the Physical Conditions of Clouds Shocked by the Vela Supernova Re...

Wed May 04 20:00:20 GMT 2022

Visit	Proposal 16751, Visit 02, scheduling Diagnostic Status: No Diagnostics Scientific Instruments: STIS/CCD, STIS/FUV-MAMA Special Requirements: (none)									
	Fixed Targets	#	Name	Target Coordinates	Targ. Coord. Corrections	Fluxes	Miscellaneous			
		(2)	HD-72088	RA: 08 29 12.6384 (127.3026600d) Dec: -44 53 5.52 (-44.88487d) Equinox: J2000	Proper Motion RA: -0.004765 arcsec/yr Proper Motion Dec: 0.004103 arcsec/yr Parallax: 0.0010863" Epoch of Position: 2000.0	V=9.07 F(1350) = 9.4E-12, F(1510) = 7.2E-12	Reference Frame: ICRS			
	<i>Comments:</i> Category=STAR Description=[B3-B5 III-I, B3-B5 V-IV]									
Exposures	#	Label (ETC Run)	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time (Total)/[Actual Dur.]	Orbit
	1	(STIS.ta.152 7460)	(2) HD-72088	STIS/CCD, ACQ, F28X500II	MIRROR				0.4 Secs (0.4 Secs)	
									[==>]	[1]
	2	(STIS.sp.17 47436)	(2) HD-72088	STIS/FUV-MAMA, ACCUM, 0.2X0.2	E140H 1598 A	WAVECAL=NO			2422 Secs (2422 Secs)	
									[==>]	[1]
	3		WAVE	STIS/FUV-MAMA, ACCUM, 0.2X0.2	E140H 1598 A				[==>]	[1]
	4	(STIS.sp.17 47437)	(2) HD-72088	STIS/FUV-MAMA, ACCUM, 0.2X0.2	E140H 1598 A				2816 Secs (2816 Secs)	
									[==>]	[2]
	5		WAVE	STIS/FUV-MAMA, ACCUM, 0.2X0.2	E140H 1598 A				[==>]	[2]
6		WAVE	STIS/FUV-MAMA, ACCUM, 0.2X0.2	E140H 1307 A				[==>]	[3]	
7	(STIS.sp.15 27783)	(2) HD-72088	STIS/FUV-MAMA, ACCUM, 0.2X0.2	E140H 1307 A				2816 Secs (2816 Secs)		
								[==>]	[3]	
8		WAVE	STIS/FUV-MAMA, ACCUM, 0.2X0.2	E140H 1307 A				[==>]	[3]	

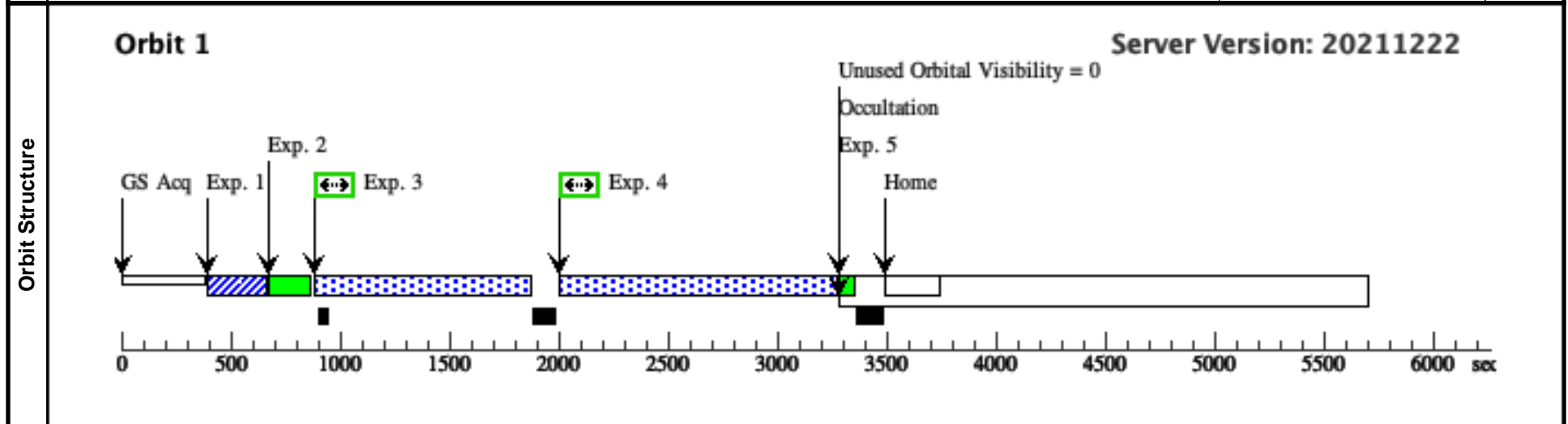




Visit	Proposal 16751, Visit 03, scheduling				
	Diagnostic Status: No Diagnostics				
	Scientific Instruments: STIS/CCD, STIS/FUV-MAMA				
	Special Requirements: (none)				

Fixed Targets	#	Name	Target Coordinates	Targ. Coord. Corrections	Fluxes	Miscellaneous
	(3)	HD-72089	RA: 08 29 6.9713 (127.2790471d) Dec: -45 33 26.96 (-45.55749d) Equinox: J2000	Proper Motion RA: -0.009312 arcsec/yr Proper Motion Dec: 0.0011861 arcsec/yr Parallax: 0.0015632" Epoch of Position: 2000.0	V=8.02+/-0.01 F(1350) = 2.4E-11, F(1510) = 1.8E-11	Reference Frame: ICRS
	<i>Comments:</i>					
	<i>Category=STAR</i>					
	<i>Description=[B3-B5 III-I]</i>					

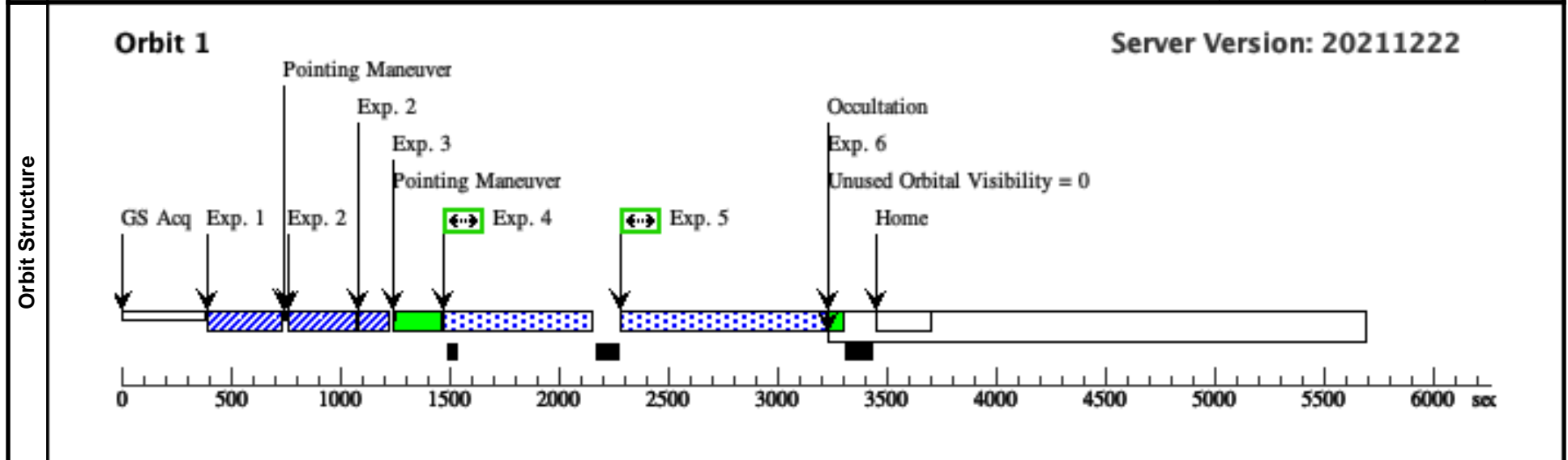
Exposures	#	Label (ETC Run)	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time (Total)/[Actual Dur.]	Orbit
	1	(STIS.ta.152 7467)	(3) HD-72089	STIS/CCD, ACQ, F28X50OIII	MIRROR				0,4 Secs (0,4 Secs)	
	2		WAVE	STIS/FUV-MAMA, ACCUM, 0.2X0.2	E140H 1307 A				[==>]	[1]
	3	(STIS.sp.17 20698)	(3) HD-72089	STIS/FUV-MAMA, ACCUM, 0.2X0.2	E140H 1307 A	WAVECAL=NO			981 Secs (981 Secs)	
	4	(STIS.sp.17 47438)	(3) HD-72089	STIS/FUV-MAMA, ACCUM, 0.2X0.2	E140H 1598 A				1135 Secs (1135 Secs)	
	5		WAVE	STIS/FUV-MAMA, ACCUM, 0.2X0.2	E140H 1598 A				[==>]	[1]



Visit	Proposal 16751, Visit 04, scheduling				
	Diagnostic Status: No Diagnostics				
	Scientific Instruments: STIS/CCD, STIS/FUV-MAMA				
	Special Requirements: (none)				

Fixed Targets	#	Name	Target Coordinates	Targ. Coord. Corrections	Fluxes	Miscellaneous
	(6)	HD-72350	RA: 08 30 39.2292 (127.6634550d) Dec: -44 44 14.34 (-44.73732d) Equinox: J2000	Proper Motion RA: -0.010840 arcsec/yr Proper Motion Dec: 0.005377 arcsec/yr Parallax: 0.0017598" Epoch of Position: 2000.0	V=6.29 F(1350) = 7.4E-11, F(1510) = 6.3E-11	Reference Frame: ICRS
	<i>Comments:</i>					
	Category=STAR Description=[B3-B5 V-IV]					

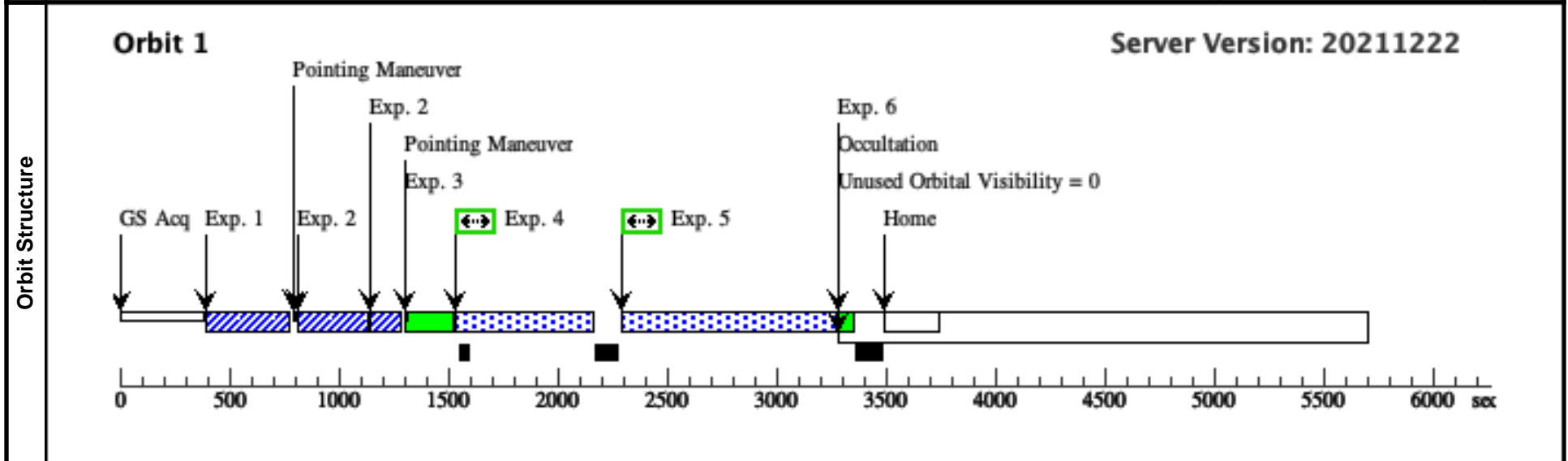
Exposures	#	Label (ETC Run)	Target	Config, Mode, Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time (Total)/[Actual Dur.]	Orbit
	1	(STIS.ta.152 7633)	(6) HD-72350	STIS/CCD, ACQ, F25ND5	MIRROR				12.0 Secs (12 Secs)	[1]
	2	(STIS.ta.152 7636)	(6) HD-72350	STIS/CCD, ACQ/PEAK, 0.3X0.05ND	MIRROR				0.6 Secs (0.6 Secs)	[1]
	3		WAVE	STIS/FUV-MAMA, ACCUM, 0.2X0.09	E140H 1307 A				[==>]	[1]
	4	(STIS.sp.17 20700)	(6) HD-72350	STIS/FUV-MAMA, ACCUM, 0.2X0.09	E140H 1307 A	WAVECAL=NO			670 Secs (670 Secs)	[1]
	5	(STIS.sp.17 47439)	(6) HD-72350	STIS/FUV-MAMA, ACCUM, 0.2X0.09	E140H 1598 A				806 Secs (806 Secs)	[1]
	6		WAVE	STIS/FUV-MAMA, ACCUM, 0.2X0.09	E140H 1598 A				[==>]	[1]



Visit	Proposal 16751, Visit 05, scheduling				
	Diagnostic Status: No Diagnostics				
	Scientific Instruments: STIS/CCD, STIS/FUV-MAMA				
	Special Requirements: (none)				

Fixed Targets	#	Name	Target Coordinates	Targ. Coord. Corrections	Fluxes	Miscellaneous
	(7)	HD-72537	RA: 08 31 36.6957 (127.9028988d) Dec: -45 47 5.19 (-45.78477d) Equinox: J2000	Proper Motion RA: -0.013217 arcsec/yr Proper Motion Dec: 0.001681 arcsec/yr Parallax: 0.0030349" Epoch of Position: 2000.0	V=6.98+/-0.01 F(1350) = 4.8E-11, F(1510) = 3.6E-11	Reference Frame: ICRS
	<i>Comments:</i>					
	Category=STAR Description=[B3-B5 V-IV]					

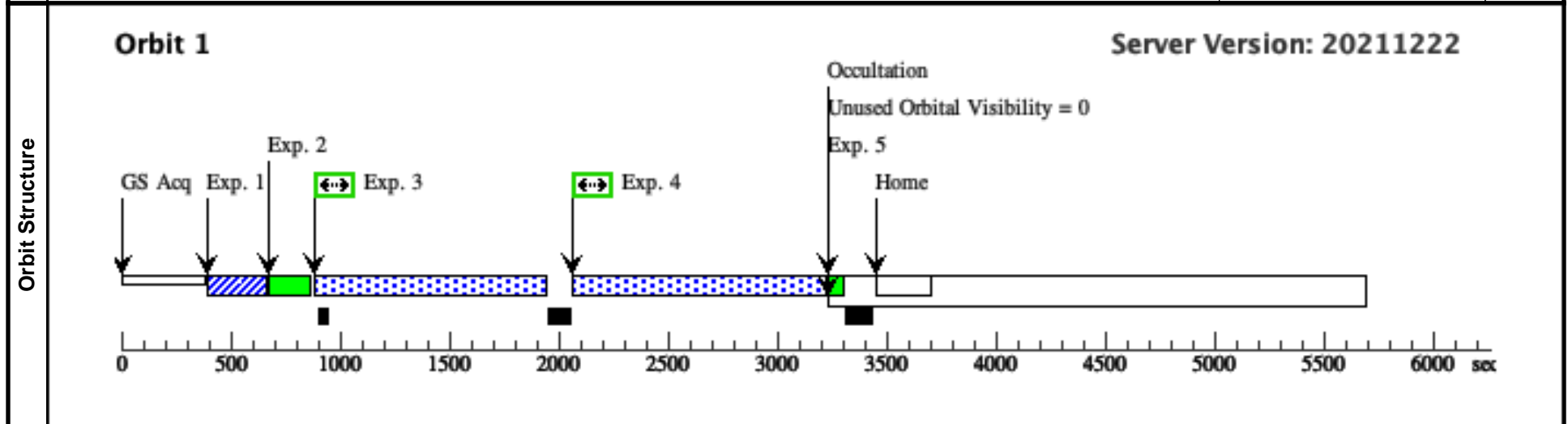
Exposures	#	Label (ETC Run)	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time (Total)/[Actual Dur.]	Orbit
	1	(STIS.ta.152 7670)	(7) HD-72537	STIS/CCD, ACQ, F25ND5	MIRROR				24.0 Secs (24 Secs)	[1]
	2	(STIS.ta.152 7676)	(7) HD-72537	STIS/CCD, ACQ/PEAK, 0.3X0.05ND	MIRROR				1.2 Secs (1.2 Secs)	[1]
	3		WAVE	STIS/FUV-MAMA, ACCUM, 0.2X0.09	E140H 1307 A				[==>]	[1]
	4	(STIS.sp.17 20701)	(7) HD-72537	STIS/FUV-MAMA, ACCUM, 0.2X0.09	E140H 1307 A	WAVECAL=NO			616 Secs (616 Secs)	[1]
	5	(STIS.sp.17 47440)	(7) HD-72537	STIS/FUV-MAMA, ACCUM, 0.2X0.09	E140H 1598 A				846 Secs (846 Secs)	[1]
	6		WAVE	STIS/FUV-MAMA, ACCUM, 0.2X0.09	E140H 1598 A				[==>]	[1]



Visit	Proposal 16751, Visit 06, scheduling				
	Diagnostic Status: No Diagnostics				
	Scientific Instruments: STIS/CCD, STIS/FUV-MAMA				
	Special Requirements: (none)				

Fixed Targets	#	Name	Target Coordinates	Targ. Coord. Corrections	Fluxes	Miscellaneous
	(8)	HD-72648	RA: 08 32 18.9895 (128.0791229d) Dec: -43 55 53.36 (-43.93149d) Equinox: J2000	Proper Motion RA: -0.005948 arcsec/yr Proper Motion Dec: 0.005275 arcsec/yr Parallax: 0.0007843" Epoch of Position: 2000.0	V=7.62 F(1350) = 2.1E-11, F(1510) = 1.6E-11	Reference Frame: ICRS
	<i>Comments:</i>					
	Category=STAR Description=[B0-B2 III-I]					

Exposures	#	Label (ETC Run)	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time (Total)/[Actual Dur.]	Orbit
	1	(STIS.ta.152 7687)	(8) HD-72648	STIS/CCD, ACQ, F28X50OIII	MIRROR				0,4 Secs (0,4 Secs)	
	2		WAVE	STIS/FUV-MAMA, ACCUM, 0.2X0.2	E140H 1307 A				[==>]	[1]
	3	(STIS.sp.17 20705)	(8) HD-72648	STIS/FUV-MAMA, ACCUM, 0.2X0.2	E140H 1307 A	WAVECAL=NO			1046 Secs (1046 Secs)	
	4	(STIS.sp.17 47441)	(8) HD-72648	STIS/FUV-MAMA, ACCUM, 0.2X0.2	E140H 1598 A				1023 Secs (1023 Secs)	
	5		WAVE	STIS/FUV-MAMA, ACCUM, 0.2X0.2	E140H 1598 A				[==>]	[1]



Proposal 16751 - Visit 07 - Spatial and Temporal Variations in the Physical Conditions of Clouds Shocked by the Vela Supernova Re...

Wed May 04 20:00:21 GMT 2022

Visit	Proposal 16751, Visit 07, scheduling Diagnostic Status: No Diagnostics Scientific Instruments: STIS/CCD, STIS/FUV-MAMA Special Requirements: (none)									
Fixed Targets	#	Name	Target Coordinates	Targ. Coord. Corrections	Fluxes	Miscellaneous				
	(4)	HD-72127A	RA: 08 29 27.4850 (127.3645208d) Dec: -44 43 29.35 (-44.72482d) Equinox: J2000	Proper Motion RA: -0.0045 arcsec/yr Proper Motion Dec: 0.0033 arcsec/yr Epoch of Position: 2000.0	V=5.19+/-0.01 F(1350) = 1.0E-9, F(1510) = 6.2E-10	Reference Frame: ICRS				
<i>Comments:</i> Category=STAR Description=[B0-B2 III-I]										
Fixed Targets	(5)	HD-72127B	RA: 08 29 27.4170 (127.3642375d) Dec: -44 43 24.76 (-44.72354d) Equinox: J2000	Proper Motion RA: -0.006480 arcsec/yr Proper Motion Dec: 0.007339 arcsec/yr Parallax: 0.0019363" Epoch of Position: 2000.0	V=6.976+/-0.010 F(1290) = 1.5E-10, F(1540) = 7.1E-11	Reference Frame: ICRS				
	<i>Comments:</i> Category=STAR Description=[B0-B2 V-IV]									
Exposures	#	Label (ETC Run)	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time (Total)/[Actual Dur.]	Orbit
	1	(STIS.ta.152 7696)	(4) HD-72127A	STIS/CCD, ACQ, F25ND5	MIRROR				6.0 Secs (6 Secs)	
									[==>]	[1]
	2	(STIS.ta.152 7698)	(4) HD-72127A	STIS/CCD, ACQ/PEAK, 0.3X0.05ND	MIRROR				0.2 Secs (0.2 Secs)	
									[==>]	[1]
	3	(STIS.sp.17 20706)	(4) HD-72127A	STIS/FUV-MAMA, ACCUM, 0.2X0.05ND	E140H 1307 A		WAVECAL=NO		1849 Secs (1849 Secs)	
									[==>]	[1]
	4		WAVE	STIS/FUV-MAMA, ACCUM, 0.2X0.09	E140H 1307 A				[==>]	[1]
	5		WAVE	STIS/FUV-MAMA, ACCUM, 0.2X0.09	E140H 1598 A				[==>]	[2]
	6	(STIS.sp.17 47442)	(4) HD-72127A	STIS/FUV-MAMA, ACCUM, 0.2X0.05ND	E140H 1598 A				2786 Secs (2786 Secs)	
									[==>]	[2]
	7		WAVE	STIS/FUV-MAMA, ACCUM, 0.2X0.09	E140H 1598 A				[==>]	[2]
8	(STIS.ta.152 7715)	(5) HD-72127B	STIS/CCD, ACQ/PEAK, 0.3X0.05ND	MIRROR				1.0 Secs (1 Secs)		
								[==>]	[3]	
9	(STIS.sp.17 20707)	(5) HD-72127B	STIS/FUV-MAMA, ACCUM, 0.2X0.05ND	E140H 1307 A				2051 Secs (2051 Secs)		
								[==>]	[3]	
10		WAVE	STIS/FUV-MAMA, ACCUM, 0.2X0.09	E140H 1307 A				[==>]	[3]	
11	(STIS.sp.17 20708)	(5) HD-72127B	STIS/FUV-MAMA, ACCUM, 0.2X0.05ND	E140H 1307 A				2786 Secs (2786 Secs)		
								[==>]	[4]	
12		WAVE	STIS/FUV-MAMA, ACCUM, 0.2X0.09	E140H 1307 A				[==>]	[4]	

