



17441 - UV spectroscopy of runaways from thermonuclear supernovae

Cycle: 31, Proposal Category: GO

(UV Initiative)

(Availability Mode: SUPPORTED)

INVESTIGATORS

<i>Name</i>	<i>Institution</i>
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Prof. Boris T. Gaensicke (CoI) (ESA Member)	University of Warwick

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	(2) J0927-6335	COS/FUV COS/NUV	2	21-Jan-2025 13:00:12.0	yes
02	(3) J0546+0836	COS/FUV COS/NUV	2	21-Jan-2025 13:00:13.0	yes
03	(4) J1332-3541	COS/FUV COS/NUV	2	21-Jan-2025 13:00:14.0	yes
05	(4) J1332-3541	COS/FUV COS/NUV	1	21-Jan-2025 13:00:14.0	yes
04	(1) J1235-3752	COS/FUV COS/NUV	5	21-Jan-2025 13:00:15.0	yes

12 Total Orbits Used

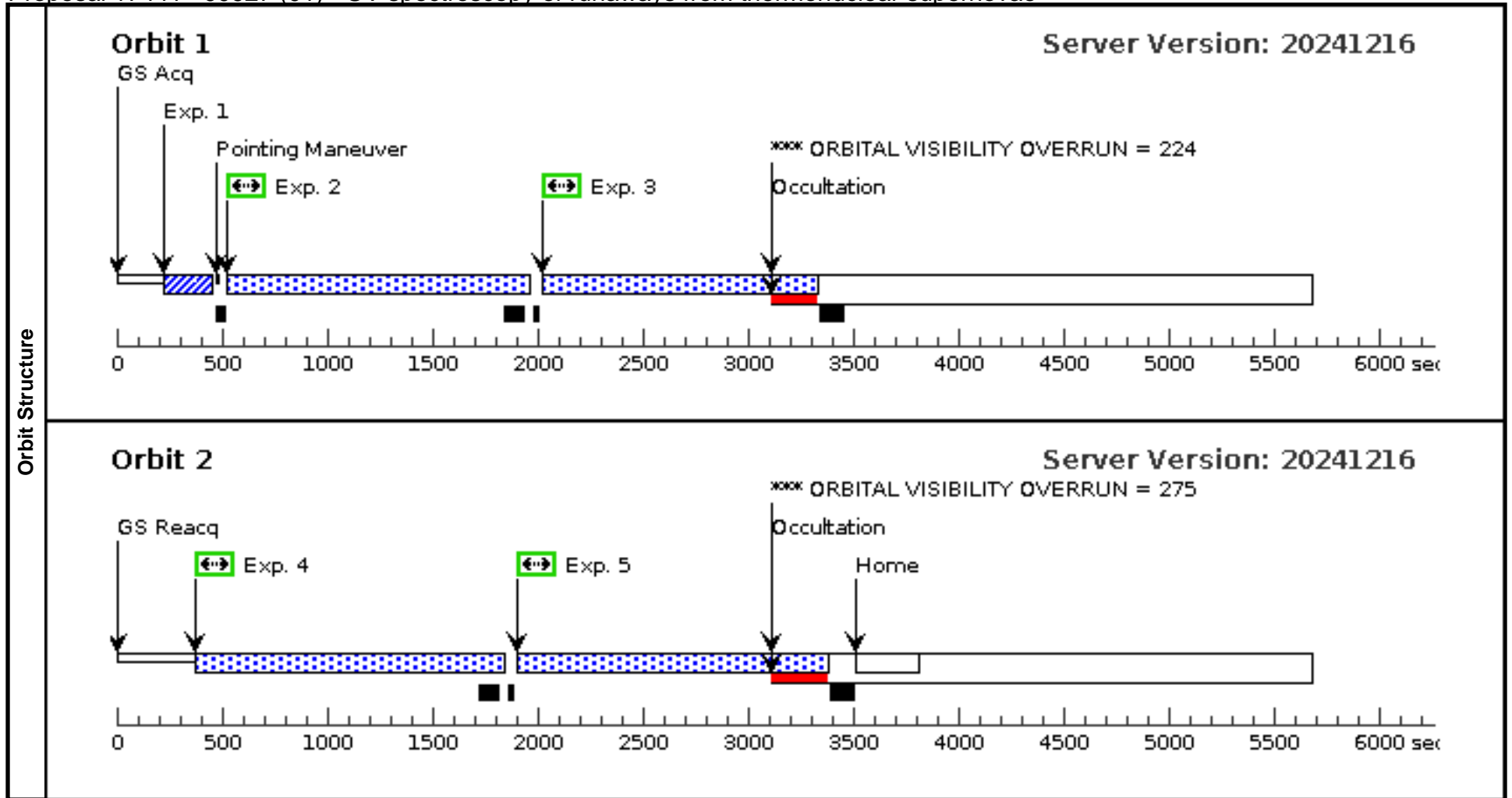
ABSTRACT

We propose COS FUV spectroscopy of four newly-discovered hypervelocity white dwarfs that are runaways from double white dwarf binaries in which one component exploded in a type Ia supernova. Our targets have radial velocities ranging from 1100 to 2300 km/s -- the fastest stellar radial velocities ever measured. They are hot (20,000-140,000 K) and bright in the UV. The primary goal is measurement of their abundance patterns, particularly the abundances of Fe, Si, Mg, and Mn. The surfaces of these stars are predicted to be heavily polluted with supernova ejecta. Abundance measurements will constrain the yields of the supernovae from which these stars were born and the masses of the exploded white dwarfs, both clarifying their formation histories and informing models for their thermal evolution. Optical spectroscopy has shown that their atmospheres consist mostly of carbon and oxygen, but the abundances of most metals can only be measured in the UV at these temperatures.

OBSERVING DESCRIPTION

We will obtain 11 orbits of HST/COS medium-resolution FUV spectroscopy of four hot, inflated WDs. The three brightest objects, with FUV = 17.9, 18.0, and 18.2 mag, will be observed for two orbits each, while the faintest target, with FUV = 19.5 mag, will be observed for 5 orbits. The FUV magnitudes are measured from GALEX for two targets and estimated based on the effective temperature and optical SED for the other two. The extinction is low ($E(B-V) < 0.2$), and the expected FUV magnitudes are well-constrained. None of the targets have nearby bright UV sources that would risk damaging the detector.

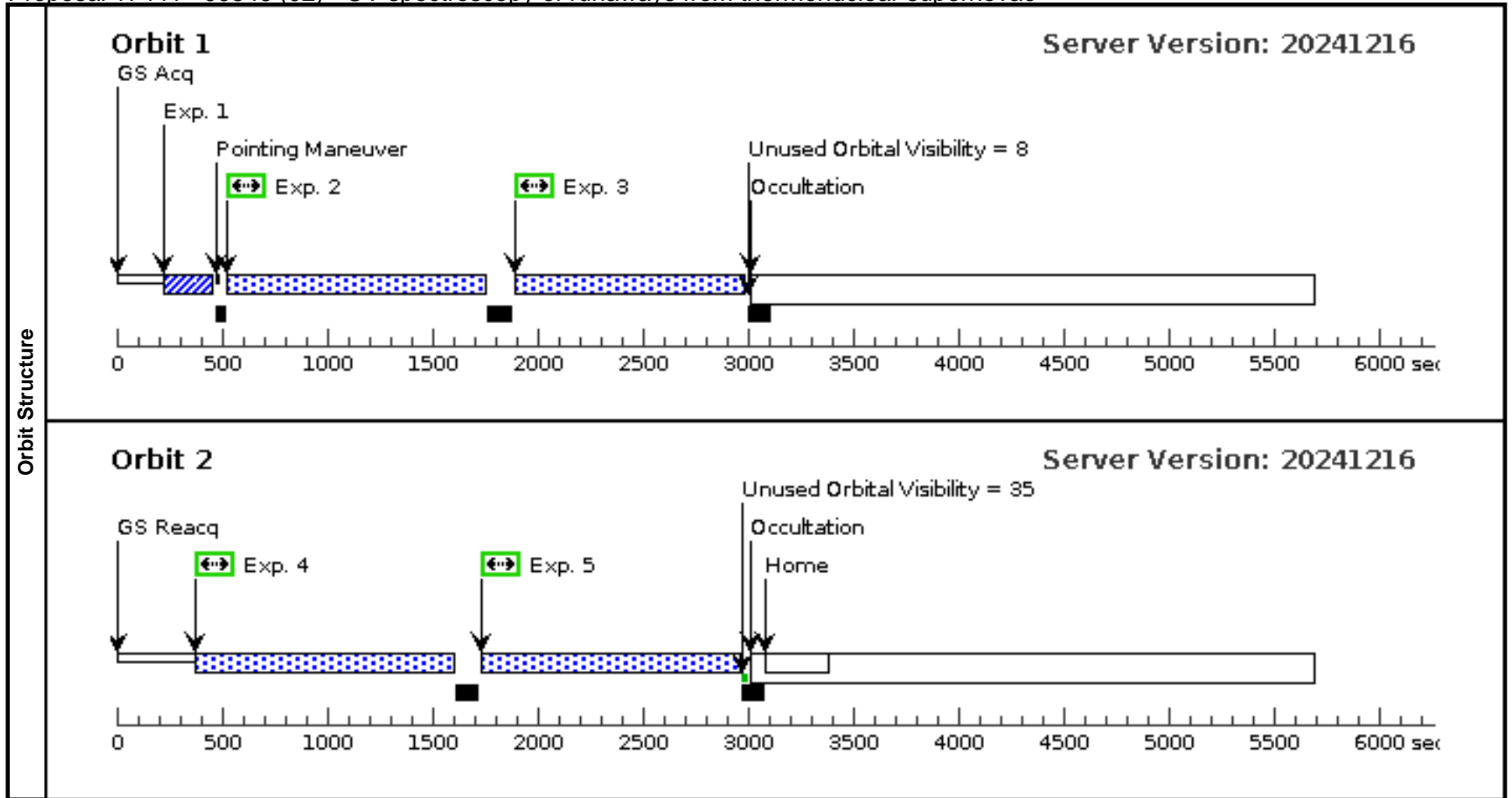
We will acquire each target using the NUV channel with an ACQ/IMAG sequence, and then switch to the FUV channel, using the G140L grating with the 1105 AA central wavelength, spanning 1130-2000 AA. Detailed modeling of the photospheric abundances (particularly Fe, Si, Mg, and Mn), requires a signal-to-noise ratio ~ 30 . Using the COS ETC with model spectra generated for our targets based on their optical spectra and broadband SEDs, and accounting for the targets' individual visibility windows and instrumental overheads, we find that we can achieve SNR = 26-33 at 1300 AA in one orbit each for the 3 brightest targets, and SNR = 20 in 5 orbits for the faintest target.



Proposal 17441 - J0546 (02) - UV spectroscopy of runaways from thermonuclear supernovae

Tue Jan 21 18:00:16 GMT 2025

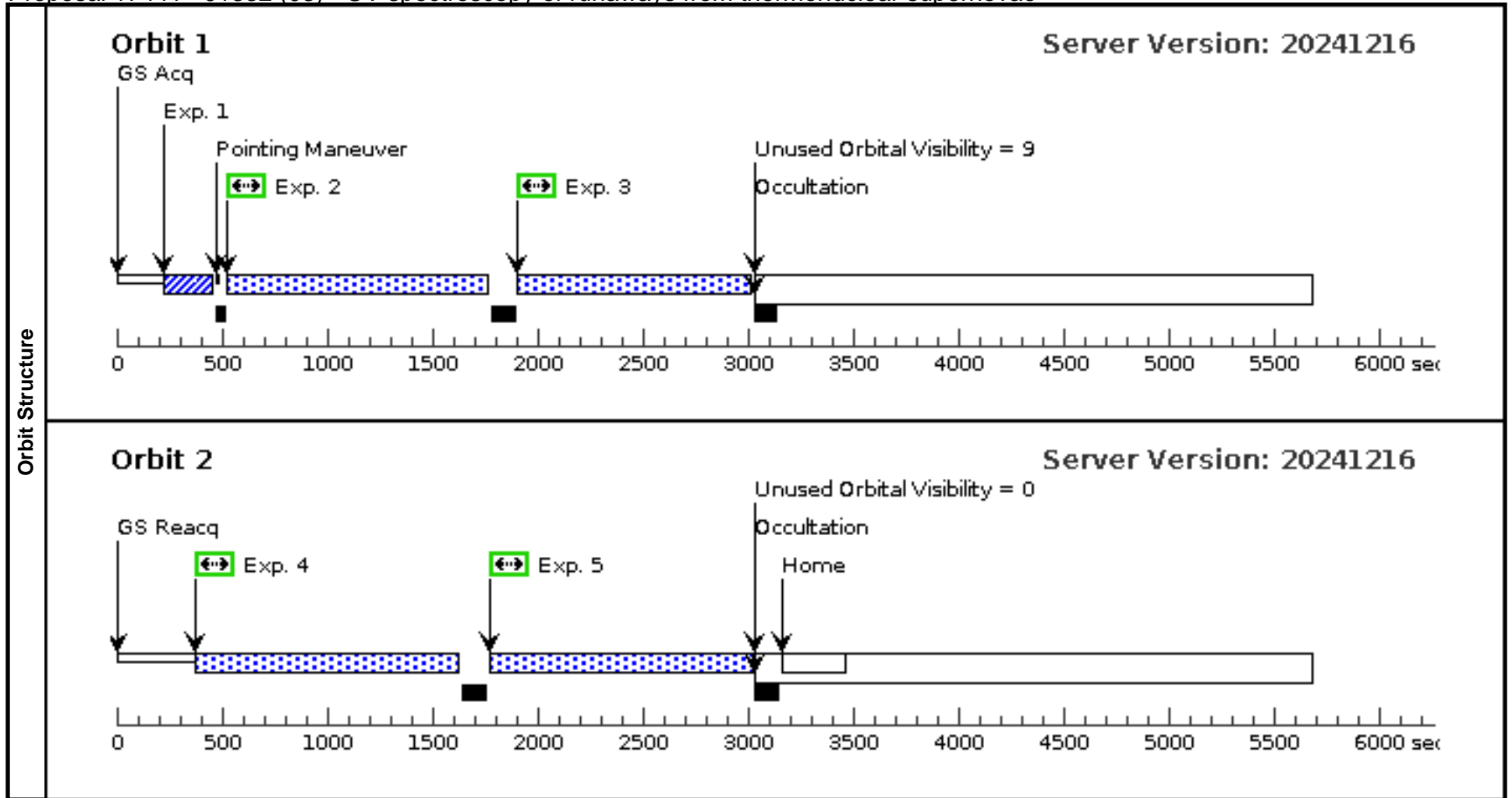
Visit	Proposal 17441, J0546 (02), completed Diagnostic Status: No Diagnostics Scientific Instruments: COS/FUV, COS/NUV Special Requirements: (none)									
	Fixed Targets	#	Name	Target Coordinates	Targ. Coord. Corrections	Fluxes	Miscellaneous			
	(3)	J0546+0836	RA: 05 46 17.6000 (86.5733333d) Dec: +08 36 6.65 (8.60185d) Equinox: J2000	Proper Motion RA: -12.51 mas/yr Proper Motion Dec: -75.03 mas/yr Epoch of Position: 2016.0	V=19.0+/-0.1 NUV = 18.4, FUV = 18.2	Reference Frame: ICRS				
	<i>Comments:</i> Category=STAR Description=[SDO] Extended=NO									
Exposures	#	Label (ETC Run)	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time (Total)/[Actual Dur.]	Orbit
	1	(COS.ta.188 9951)	(3) J0546+0836	COS/NUV, ACQ/IMAGE, PSA	MIRRORA				10 Secs (10 Secs) [==>]	[1]
	2	(COS.sp.189 0179)	(3) J0546+0836	COS/FUV, TIME-TAG, PSA	G140L 1105 A	BUFFER-TIME=10 10; FP-POS=1			1120 Secs (1042 Secs) [==>1042.0 Secs]	[1]
	3	(COS.sp.189 0179)	(3) J0546+0836	COS/FUV, TIME-TAG, PSA	G140L 1105 A	BUFFER-TIME=10 82; FP-POS=2			1120 Secs (1042 Secs) [==>1042.0 Secs]	[1]
	4	(COS.sp.189 0179)	(3) J0546+0836	COS/FUV, TIME-TAG, PSA	G140L 1105 A	BUFFER-TIME=11 77; FP-POS=3			1287 Secs (1175 Secs) [==>1175.0 Secs]	[2]
	5	(COS.sp.189 0179)	(3) J0546+0836	COS/FUV, TIME-TAG, PSA	G140L 1105 A	BUFFER-TIME=12 49; FP-POS=4			1287 Secs (1175 Secs) [==>1175.0 Secs]	[2]



Proposal 17441 - J1332 (03) - UV spectroscopy of runaways from thermonuclear supernovae

Tue Jan 21 18:00:16 GMT 2025

Visit	Proposal 17441, J1332 (03), failed Diagnostic Status: No Diagnostics Scientific Instruments: COS/FUV, COS/NUV Special Requirements: (none)									
	Fixed Targets	#	Name	Target Coordinates	Targ. Coord. Corrections	Fluxes	Miscellaneous			
	(4)	J1332-3541	RA: 13 32 57.9800 (203.2415833d) Dec: -35 41 10.68 (-35.68630d) Equinox: J2000	Proper Motion RA: -139.2 mas/yr Proper Motion Dec: 69.37 mas/yr Epoch of Position: 2016.0	V=19.4+/-0.1 NUV = 18.23, FUV = 17.94	Reference Frame: ICRS				
	<i>Comments:</i> Category=STAR Description=[SDO] Extended=NO									
Exposures	#	Label (ETC Run)	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time (Total)/[Actual Dur.]	Orbit
	1	(COS.ta.188 9951)	(4) J1332-3541	COS/NUV, ACQ/IMAGE, PSA	MIRRORA				10 Secs (10 Secs) [==>]	[1]
	2	(COS.sp.189 0180)	(4) J1332-3541	COS/FUV, TIME-TAG, PSA	G140L 1105 A	BUFFER-TIME=10 32; FP-POS=1			1142 Secs (1056 Secs) [==>1056.0 Secs]	[1]
	3	(COS.sp.189 0180)	(4) J1332-3541	COS/FUV, TIME-TAG, PSA	G140L 1105 A	BUFFER-TIME=11 00; FP-POS=2			1142 Secs (1056 Secs) [==>1056.0 Secs]	[1]
	4	(COS.sp.189 0180)	(4) J1332-3541	COS/FUV, TIME-TAG, PSA	G140L 1105 A	BUFFER-TIME=11 90; FP-POS=3			1309 Secs (1202 Secs) [==>1202.0 Secs]	[2]
	5	(COS.sp.189 0180)	(4) J1332-3541	COS/FUV, TIME-TAG, PSA	G140L 1105 A	BUFFER-TIME=11 90; FP-POS=4			1309 Secs (1202 Secs) [==>1202.0 Secs]	[2]

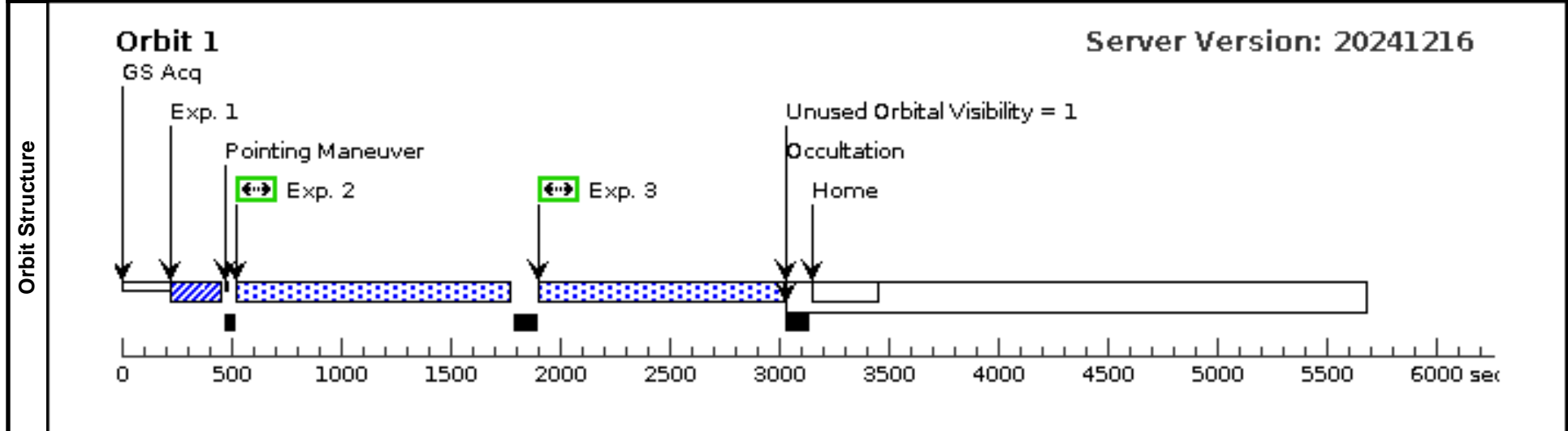


Visit	Proposal 17441, J1332 (05) Diagnostic Status: Warning Scientific Instruments: COS/FUV, COS/NUV Special Requirements: (none)
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Diagnostics	(J1332 (05)) Warning (Form): For the best data quality, it is generally required to use all four FP-POS positions when observing at a given COS cenwave.
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#	Name	Target Coordinates	Targ. Coord. Corrections	Fluxes	Miscellaneous
(4)	J1332-3541	RA: 13 32 57.9800 (203.2415833d) Dec: -35 41 10.68 (-35.68630d) Equinox: J2000	Proper Motion RA: -139.2 mas/yr Proper Motion Dec: 69.37 mas/yr Epoch of Position: 2016.0	V=19.4+/-0.1 NUV = 18.23, FUV = 17.94	Reference Frame: ICRS
<i>Comments:</i> Category=STAR Description=[SDO] Extended=NO					

#	Label (ETC Run)	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time (Total)/[Actual Dur.]	Orbit
1	(COS.ta.188 9951)	(4) J1332-3541	COS/NUV, ACQ/IMAGE, PSA	MIRRORA				10 Secs (10 Secs) [==>]	[1]
2	(COS.sp.189 0180)	(4) J1332-3541	COS/FUV, TIME-TAG, PSA	G140L 1105 A	BUFFER-TIME=11 90; FP-POS=3			1309 Secs (1065 Secs) [==>1065.0 Secs]	[1]
3	(COS.sp.189 0180)	(4) J1332-3541	COS/FUV, TIME-TAG, PSA	G140L 1105 A	BUFFER-TIME=11 90; FP-POS=4			1309 Secs (1065 Secs) [==>1065.0 Secs]	[1]



Proposal 17441 - J1235 (04) - UV spectroscopy of runaways from thermonuclear supernovae

Tue Jan 21 18:00:16 GMT 2025

Visit	Proposal 17441, J1235 (04), completed Diagnostic Status: Warning Scientific Instruments: COS/FUV, COS/NUV Special Requirements: (none)									
	(J1235 (04)) Warning (Orbit Planner): INEFFICIENT ORDERING OF FP-POS POSITIONS									
Fixed Targets	#	Name	Target Coordinates	Targ. Coord. Corrections	Fluxes	Miscellaneous				
	(1)	J1235-3752	RA: 12 35 31.8000 (188.8825000d) Dec: -37 52 35.53 (-37.87654d) Equinox: J2000	Proper Motion RA: -20.8043379 mas/yr Proper Motion Dec: 92.87213882 mas/yr Epoch of Position: 2016.0	V=19.0+/-0.1 NUV = 18.89, FUV = 19.49	Reference Frame: ICRS				
Comments: Category=STAR Description=[SDO] Extended=NO										
Exposures	#	Label (ETC Run)	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time (Total)/[Actual Dur.]	Orbit
	1	(COS.ta.188 9977)	(1) J1235-3752	COS/NUV, ACQ/IMAGE, PSA	MIRRORA				13 Secs (13 Secs) [==>]	[1]
	2	(COS.sp.189 0181)	(1) J1235-3752	COS/FUV, TIME-TAG, PSA	G140L 1105 A	BUFFER-TIME=22 73; FP-POS=1			2383 Secs (2306 Secs) [==>2306.0 Secs]	[1]
	3	(COS.sp.189 0181)	(1) J1235-3752	COS/FUV, TIME-TAG, PSA	G140L 1105 A	BUFFER-TIME=27 23; FP-POS=2			2723 Secs (2595 Secs) [==>2595.0 Secs]	[2]
	4	(COS.sp.189 0181)	(1) J1235-3752	COS/FUV, TIME-TAG, PSA	G140L 1105 A	BUFFER-TIME=27 23; FP-POS=3			2723 Secs (2595 Secs) [==>2595.0 Secs]	[3]
	5	(COS.sp.189 0181)	(1) J1235-3752	COS/FUV, TIME-TAG, PSA	G140L 1105 A	BUFFER-TIME=27 23; FP-POS=4			2723 Secs (2595 Secs) [==>2595.0 Secs]	[4]
	6	all_fps (COS.sp.189 0181)	(1) J1235-3752	COS/FUV, TIME-TAG, PSA	G140L 1105 A	BUFFER-TIME=47 7; FP-POS=ALL			587 Secs (1976 Secs) [==>494.0 Secs (Split 1)] [==>494.0 Secs (Split 2)] [==>494.0 Secs (Split 3)] [==>494.0 Secs (Split 4)]	[5]

