



18398 - Hidden in Plain Sight? Unraveling the Potential Merger Histories of Ultra-Massive White Dwarfs in the Initial-Final Mass Relation

Cycle: 34, 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) HYADES-WD1	COS/FUV	2	13-Aug-2026 11:00:16.0	yes
02	(1) HYADES-WD1	COS/FUV	2	13-Aug-2026 11:00:17.0	yes
03	(2) ALPHAPER-WD1	COS/FUV COS/NUV	1	13-Aug-2026 11:00:18.0	yes
04	(3) ALPHAPER-WD2	COS/FUV COS/NUV	1	13-Aug-2026 11:00:19.0	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>
05	(4) ALPHAPER-WD5	COS/FUV COS/NUV	1	13-Aug-2026 11:00:20.0	yes

7 Total Orbits Used

ABSTRACT

The initial-final mass relation (IFMR) is fundamental to stellar astrophysics, linking a star's birth mass to its white dwarf (WD) remnant with broad implications for Galactic chemical enrichment, star formation histories, and the boundary between WD to neutron star formation. While the IFMR has been extensively studied, its high-mass end remains sparsely populated and poorly constrained, largely owing to the rarity of ultra-massive WDs ($M > 1.1$ Msun). This uncertainty is further compounded by binary evolution, since mergers are expected to be a dominant channel for producing ultra-massive WDs. Distinguishing between WDs formed through single-star evolution versus those via a binary merger is challenging, where optical spectroscopy alone cannot always rule out a merger origin. Here, we request 7 orbits of HST/COS far-UV spectroscopy to search for carbon features in four ultra-massive WDs that anchor the high-mass end of the IFMR. If carbon features are detected, they will provide strong evidence that some of the WDs currently anchoring this regime are merger remnants rather than single-star products, motivating a recalibration of the IFMR. If carbon is not detected, these observations will strengthen the case that these systems are consistent with single-star evolution and therefore remain robust calibrators of the high-mass end. In either outcome, this program delivers a direct empirical constraint on the least well constrained end of a fundamental relation in stellar astrophysics, where HST is the only instrument capable of obtaining the far-UV spectroscopy required.

OBSERVING DESCRIPTION

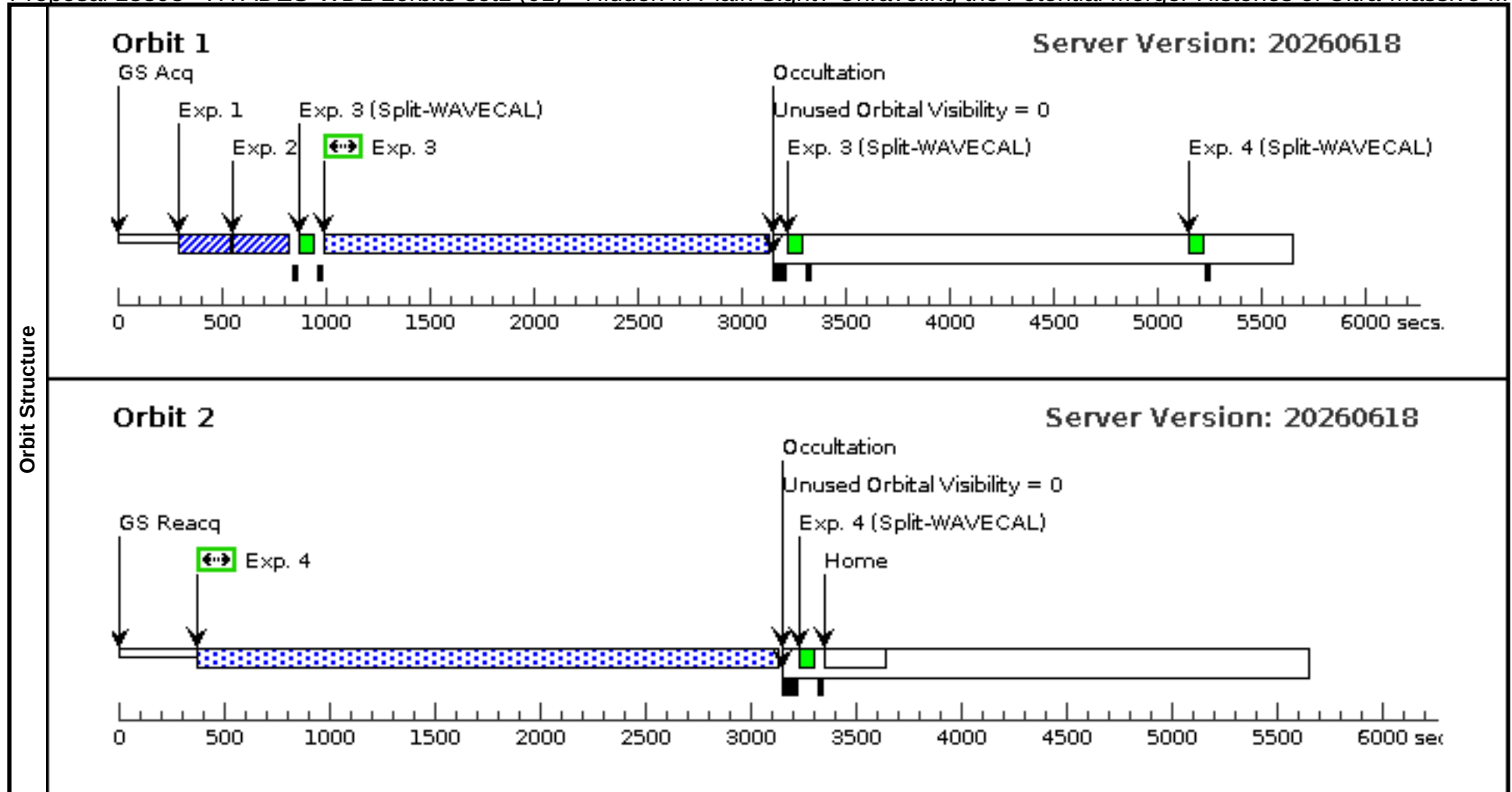
This proposal will obtain UV spectra for four ultramassive white dwarfs in star clusters that currently anchor the high-mass end of the white dwarf initial-final mass relation. These measurements will allow us to search for carbon features (e.g., C III), which would indicate potential evidence for a merger history.

Observations will be obtained in the G130M grism and a central wavelength of 1291 Å, using the FP-POS 3 and 4 positions.

The impacts of reduced gyro operations on this program would primarily be reduced schedulability due to the smaller field of regard.

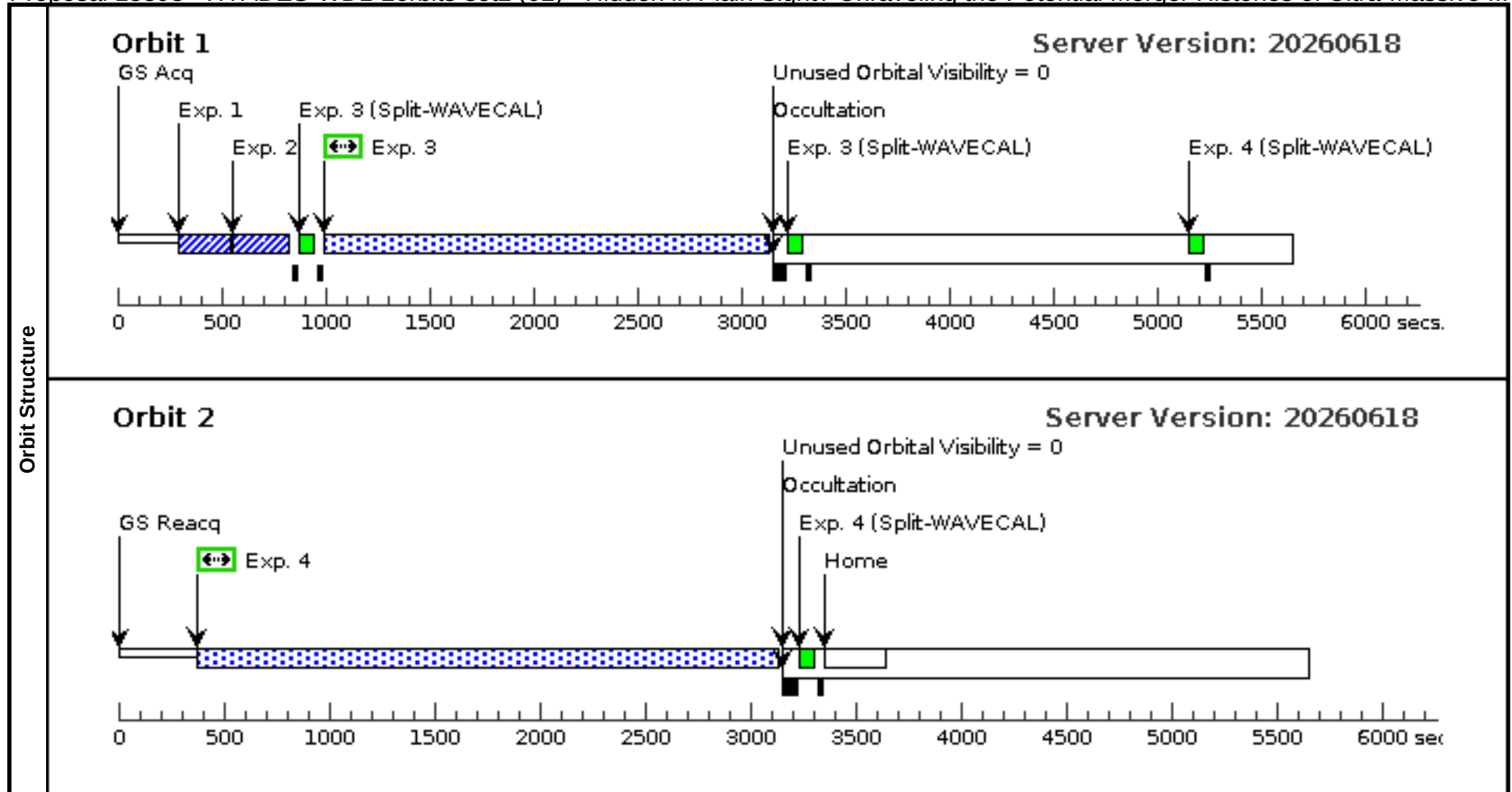
Proposal 18398 - HYADES-WD1-2orbits-set1 (01) - Hidden in Plain Sight? Unraveling the Potential Merger Histories of Ultra-Massive ...

Visit	Proposal 18398, HYADES-WD1-2orbits-set1 (01)								Thu Aug 13 15:00:20 GMT 2026	
	Diagnostic Status: No Diagnostics									
	Scientific Instruments: COS/FUV									
	Special Requirements: (none)									
Fixed Targets	#	Name	Target Coordinates	Targ. Coord. Corrections	Fluxes	Miscellaneous				
	(1)	HYADES-WD1	RA: 02 38 36.4186 (39.6517442d) Dec: +76 42 18.76 (76.70521d) Equinox: J2000	Proper Motion RA: 46.363 mas/yr Proper Motion Dec: -26.491 mas/yr Epoch of Position: 2016	V=19.17	Reference Frame: ICRS				
	Comments: Category=STAR Description=[DA] Extended=NO									
Exposures	#	Label (ETC Run)	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time (Total)/[Actual Dur.]	Orbit
	1	HYADES-WD1-Acq (COS.sa.236 4375)	(1) HYADES-WD1	COS/FUV, ACQ/PEAKXD, PSA	G130M 1291 A	LIFETIME-POS=LP 7			23.5 Secs (23.5 Secs) [==>]	 [1]
	2	HYADES-WD1-Acq (COS.sa.236 4375)	(1) HYADES-WD1	COS/FUV, ACQ/PEAKD, PSA	G130M 1291 A	NUM-POS=5; STEP-SIZE=0.9; CENTER=FLUX-W T-FLR; LIFETIME-POS=L P7			23.5 Secs (23.5 Secs) [==>]	 [1]
	3	HYADES-WD1-Science (COS.sp.236 4373)	(1) HYADES-WD1	COS/FUV, TIME-TAG, PSA	G130M 1291 A	FP-POS=3; BUFFER-TIME=44 45; LIFETIME-POS=L P7			1905 Secs (2088 Secs) [==>2088.0 Secs]	 [1]
	4	HYADES-WD1-Science (COS.sp.236 4373)	(1) HYADES-WD1	COS/FUV, TIME-TAG, PSA	G130M 1291 A	FP-POS=4; BUFFER-TIME=44 45; LIFETIME-POS=L P7			1905 Secs (2712 Secs) [==>2712.0 Secs]	 [2]



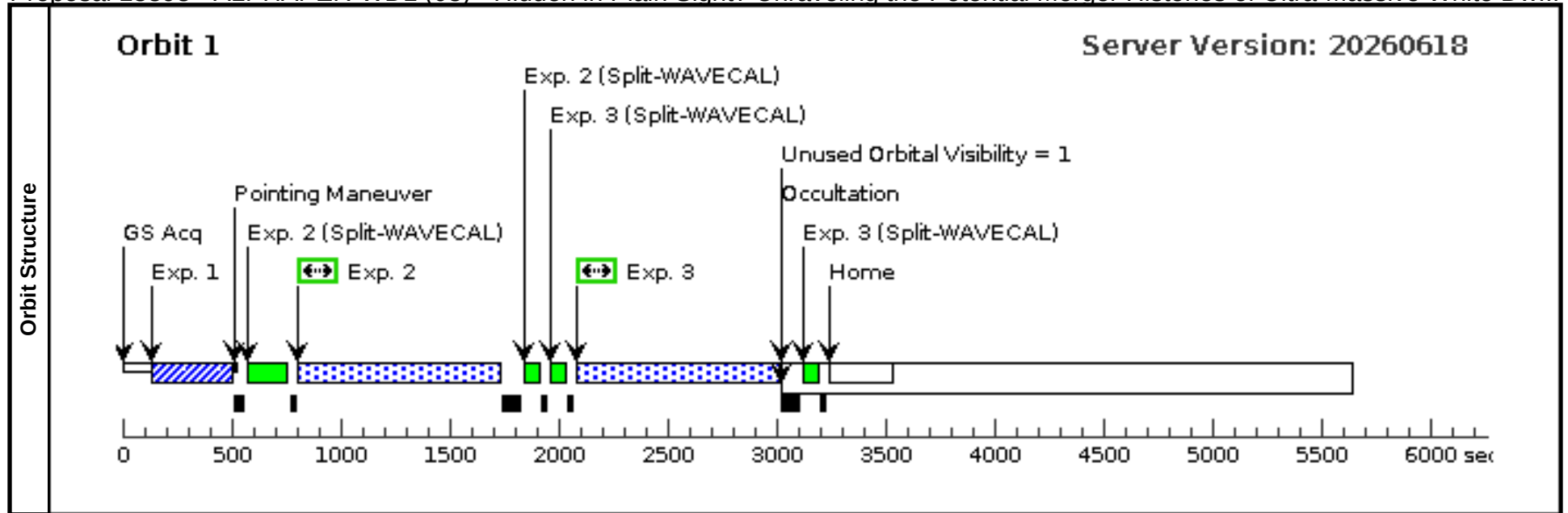
Proposal 18398 - HYADES-WD1-2orbits-set2 (02) - Hidden in Plain Sight? Unraveling the Potential Merger Histories of Ultra-Massive ...

Visit	Proposal 18398, HYADES-WD1-2orbits-set2 (02)								Thu Aug 13 15:00:20 GMT 2026	
	Diagnostic Status: No Diagnostics									
	Scientific Instruments: COS/FUV									
	Special Requirements: (none)									
Fixed Targets	#	Name	Target Coordinates	Targ. Coord. Corrections	Fluxes	Miscellaneous				
	(1)	HYADES-WD1	RA: 02 38 36.4186 (39.6517442d) Dec: +76 42 18.76 (76.70521d) Equinox: J2000	Proper Motion RA: 46.363 mas/yr Proper Motion Dec: -26.491 mas/yr Epoch of Position: 2016	V=19.17	Reference Frame: ICRS				
	Comments: Category=STAR Description=[DA] Extended=NO									
Exposures	#	Label (ETC Run)	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time (Total)/[Actual Dur.]	Orbit
	1	HYADES-WD1-Acq (COS.sa.236 4375)	(1) HYADES-WD1	COS/FUV, ACQ/PEAKXD, PSA	G130M 1291 A	LIFETIME-POS=LP 7			23.5 Secs (23.5 Secs) [==>]	 [1]
	2	HYADES-WD1-Acq (COS.sa.236 4375)	(1) HYADES-WD1	COS/FUV, ACQ/PEAKD, PSA	G130M 1291 A	NUM-POS=5; STEP-SIZE=0.9; CENTER=FLUX-W T-FLR; LIFETIME-POS=L P7			23.5 Secs (23.5 Secs) [==>]	 [1]
	3	HYADES-WD1-Science (COS.sp.236 4373)	(1) HYADES-WD1	COS/FUV, TIME-TAG, PSA	G130M 1291 A	FP-POS=3; BUFFER-TIME=44 45; LIFETIME-POS=L P7			1905 Secs (2088 Secs) [==>2088.0 Secs]	 [1]
	4	HYADES-WD1-Science (COS.sp.236 4373)	(1) HYADES-WD1	COS/FUV, TIME-TAG, PSA	G130M 1291 A	FP-POS=4; BUFFER-TIME=44 45; LIFETIME-POS=L P7			1905 Secs (2712 Secs) [==>2712.0 Secs]	 [2]



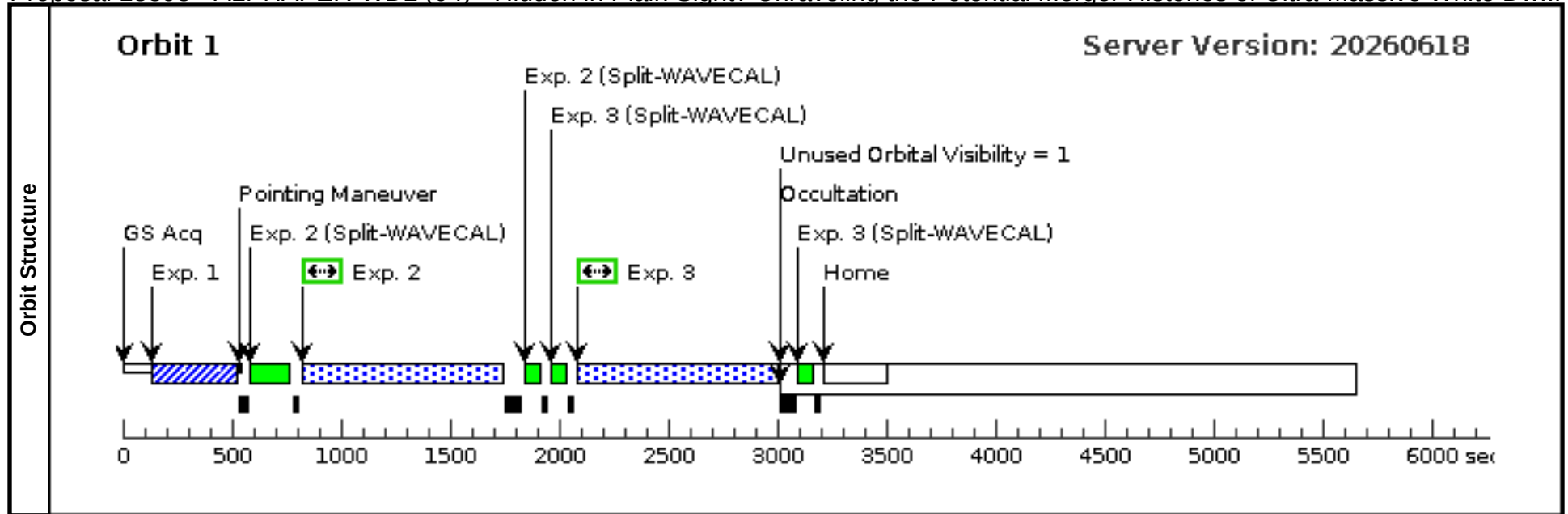
Proposal 18398 - ALPHAPER-WD1 (03) - Hidden in Plain Sight? Unraveling the Potential Merger Histories of Ultra-Massive White Dw...

Visit	Proposal 18398, ALPHAPER-WD1 (03)										Thu Aug 13 15:00:20 GMT 2026			
	Diagnostic Status: Warning													
	Scientific Instruments: COS/FUV, COS/NUV													
	Special Requirements: (none)													
Diagnostics	(ALPHAPER-WD1 (03)) Warning (Orbit Planner): COS EXPOSURE TIME ROUNDED DOWN TO NEAREST 0.1 SECONDS													
Fixed Targets	#	Name	Target Coordinates		Targ. Coord. Corrections		Fluxes		Miscellaneous					
	(2)	ALPHAPER-WD1	RA: 02 58 43.3094 (44.6804558d)		Proper Motion RA: 26.828 mas/yr		V=17.04		Reference Frame: ICRS					
			Dec: +50 20 52.02 (50.34778d)		Proper Motion Dec: -24.163 mas/yr									
			Equinox: J2000		Epoch of Position: 2016									
	Comments: Category=STAR Description=[DA] Extended=NO													
Exposures	#	Label (ETC Run)	Target	Config,Mode,Aperture		Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time (Total)/[Actual Dur.]		Orbit		
	1	ALPHAPER -WD1-Acq (COS.ta.236 4101)	(2) ALPHAPER-WD 1	COS/NUV, ACQ/IMAGE, PSA		MIRRORB				31.2 Secs (31.2 Secs)				
										[==>]		[1]		
	2	ALPHAPER -WD1-Scien ce (COS.sp.236 4102)	(2) ALPHAPER-WD 1	COS/FUV, TIME-TAG, PSA		G130M 1291 A	FP-POS=3; BUFFER-TIME=11 98; LIFETIME-POS=L P7			735 Secs (875 Secs)				
										[==>875.0 Secs]		[1]		
	3	ALPHAPER -WD1-Scien ce (COS.sp.236 4102)	(2) ALPHAPER-WD 1	COS/FUV, TIME-TAG, PSA		G130M 1291 A	FP-POS=4; BUFFER-TIME=11 98; LIFETIME-POS=L P7			735 Secs (875 Secs)				
									[==>875.0 Secs]		[1]			



Proposal 18398 - ALPHAPER-WD2 (04) - Hidden in Plain Sight? Unraveling the Potential Merger Histories of Ultra-Massive White Dw...

Visit	Proposal 18398, ALPHAPER-WD2 (04)										Thu Aug 13 15:00:20 GMT 2026			
	Diagnostic Status: Warning													
	Scientific Instruments: COS/FUV, COS/NUV													
	Special Requirements: (none)													
Diagnostics	(ALPHAPER-WD2 (04)) Warning (Orbit Planner): COS EXPOSURE TIME ROUNDED DOWN TO NEAREST 0.1 SECONDS													
Fixed Targets	#	Name	Target Coordinates			Targ. Coord. Corrections		Fluxes		Miscellaneous				
	(3)	ALPHAPER-WD2	RA: 03 56 58.0087 (59.2417029d)			Proper Motion RA: 22.356 mas/yr		V=17.41		Reference Frame: ICRS				
			Dec: +45 01 11.15 (45.01976d)			Proper Motion Dec: -30.505 mas/yr								
			Equinox: J2000			Epoch of Position: 2016								
	Comments: Category=STAR Description=[DA] Extended=NO													
Exposures	#	Label (ETC Run)	Target	Config,Mode,Aperture		Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time (Total)/[Actual Dur.]		Orbit		
	1	ALPHAPER -WD2-Acq 2 (COS.ta.236 4369)	(3) ALPHAPER-WD 2	COS/NUV, ACQ/IMAGE, PSA		MIRRORB				39.4 Secs (39.4 Secs)				
										[==>]		[1]		
	2	ALPHAPER -WD2-Scien ce (COS.sp.236 4367)	(3) ALPHAPER-WD 2	COS/FUV, TIME-TAG, PSA		G130M 1291 A	FP-POS=3; BUFFER-TIME=14 15; LIFETIME-POS=L P7			705 Secs (864 Secs)				
										[==>864.0 Secs]		[1]		
	3	ALPHAPER -WD2-Scien ce (COS.sp.236 4367)	(3) ALPHAPER-WD 2	COS/FUV, TIME-TAG, PSA		G130M 1291 A	FP-POS=4; BUFFER-TIME=14 15; LIFETIME-POS=L P7			705 Secs (864 Secs)				
										[==>864.0 Secs]		[1]		



Proposal 18398 - ALPHAPER-WD5 (05) - Hidden in Plain Sight? Unraveling the Potential Merger Histories of Ultra-Massive White Dw...

Visit	Proposal 18398, ALPHAPER-WD5 (05)										Thu Aug 13 15:00:20 GMT 2026										
	Diagnostic Status: No Diagnostics																				
	Scientific Instruments: COS/FUV, COS/NUV																				
	Special Requirements: (none)																				
Fixed Targets	#	Name		Target Coordinates				Targ. Coord. Corrections				Fluxes				Miscellaneous					
	(4)	ALPHAPER-WD5		RA: 22 28 14.7816 (337.0615900d) Dec: +45 34 34.33 (45.57620d) Equinox: J2000				Proper Motion RA: 22.356 mas/yr Proper Motion Dec: -30.505 mas/yr Epoch of Position: 2016				V=17.41				Reference Frame: ICRS					
	Comments: Category=STAR Description=[DA] Extended=NO																				
Exposures	#	Label (ETC Run)	Target	Config,Mode,Aperture				Spectral Els.		Opt. Params.		Special Reqs.		Groups		Exp. Time (Total)/[Actual Dur.]				Orbit	
	1	ALPHAPER (4) ALPHAPER-WD5-Acq 5 (COS.ta.236 4371)	(4) ALPHAPER-WD5	COS/NUV, ACQ/IMAGE, PSA				MIRRORB								39.2 Secs (39.2 Secs)					
														[==>]				[1]			
	2	ALPHAPER (4) ALPHAPER-WD5-Scien 5 ce (COS.sp.236 4370)	(4) ALPHAPER-WD5	COS/FUV, TIME-TAG, PSA				G130M 1291 A		FP-POS=3; BUFFER-TIME=14 01; LIFETIME-POS=L P7						705 Secs (864 Secs)					
														[==>864.0 Secs]				[1]			
	3	ALPHAPER (4) ALPHAPER-WD5-Scien 5 ce (COS.sp.236 4370)	(4) ALPHAPER-WD5	COS/FUV, TIME-TAG, PSA				G130M 1291 A		FP-POS=4; BUFFER-TIME=14 01; LIFETIME-POS=L P7						705 Secs (864 Secs)					
															[==>864.0 Secs]				[1]		
Orbit Structure	Orbit 1 Server Version: 20260618																				