



# 17723 - The first UV investigation of a massive stripped-envelope core-collapse progenitor at high metallicity: The WO star WR 102

Cycle: 32, Proposal Category: GO

(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) V-V3893-SGR	COS/FUV COS/NUV	4	29-Aug-2025 00:00:15.0	yes
10	(1) V-V3893-SGR	COS/FUV COS/NUV	2	29-Aug-2025 00:00:16.0	yes
02	(1) V-V3893-SGR	COS/FUV COS/NUV	4	29-Aug-2025 00:00:16.0	yes
20	(1) V-V3893-SGR	COS/FUV COS/NUV	4	29-Aug-2025 00:00:17.0	yes
03	(1) V-V3893-SGR	COS/FUV COS/NUV	4	29-Aug-2025 00:00:17.0	yes

18 Total Orbits Used

## **ABSTRACT**

The WO-type Wolf-Rayet stars of the oxygen sequence represent the final stage in the life of a massive star. These stars offer a unique window to the evolutionary stages right before going supernovae and collapsing into black holes (BHs). A WO star is dominated by a strong stellar wind that further strips its outer layers. This large mass loss ultimately determines how much mass is left for a BH to form. Given the discrepancy between observed BH masses and final masses from stellar evolution, determining the wind structure and mass-loss rate is paramount.

Moreover, the evolution of these stars and their winds is poorly constrained: whether some WO stars will undergo a stripped-envelope supernova (SNIbc) is currently under debate. Optical analyses exist but cannot reveal the whole picture: mayor wind drivers and nucleosynthesis indicators can only be observed in the UV. Yet, UV spectra of WO stars at Galactic metallicities are absent. Looking at the most evolved WO star in the Milky Way, WR 102, we propose to obtain pioneering UV data to understand massive, stripped core-collapse progenitors at high metallicity and shed light on the SNIbc puzzle. Being highly evolved and stripped objects, the abundances of WO stars also yield a unique insight into the highly uncertain C-O nuclear reaction rate.

Using stellar atmosphere models with an inherent solution of the hydrodynamic equation, we will further be able to obtain consistent density stratifications for our targets and get a unique handle on the so far uncertain stellar mass. Thereby, we will be able to provide a crucial testbed for the circumstellar environment of highly stripped stars undergoing core collapse.

### **OBSERVING DESCRIPTION**

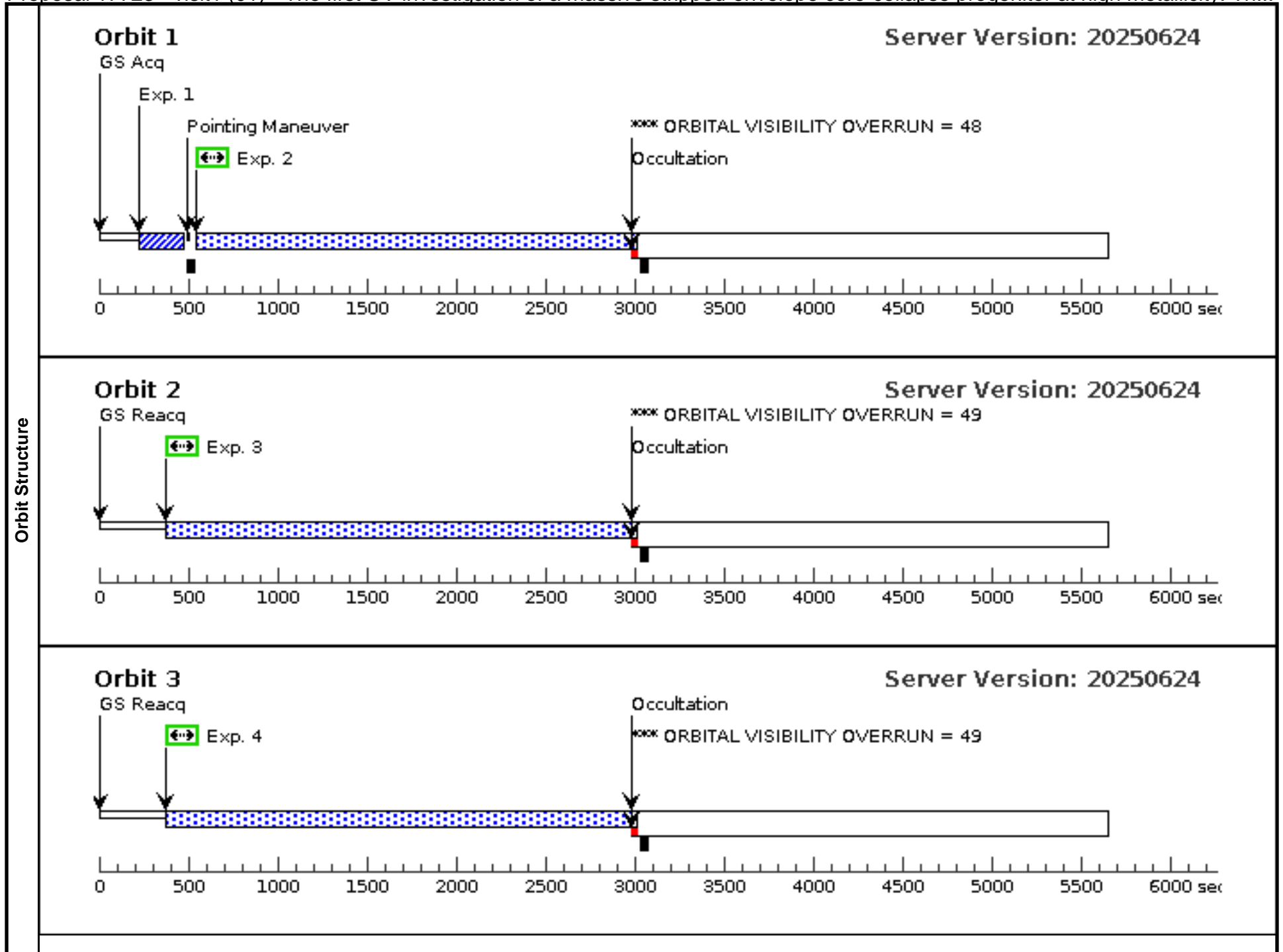
The spectra of WR102 (V-V3893-SGR) will be obtained using the COS G140L (800 Angstrom) grating. As this specific grating has a pass band of 913-1940 Angstrom, the FUV range of the spectrum is well covered and without gaps. The FUV range is crucial for our target star since prominent wind features in the spectra, along with P Cygni profiles, are paramount to break parameter ambiguity resulting often from optical spectra of Wolf-Rayet stars. More specifically, expectedly strong lines like O VI 1371 Angstrom and CIV 1548-50 Angstrom are of particular importance for wind parameter and abundance determinations in our analyses.

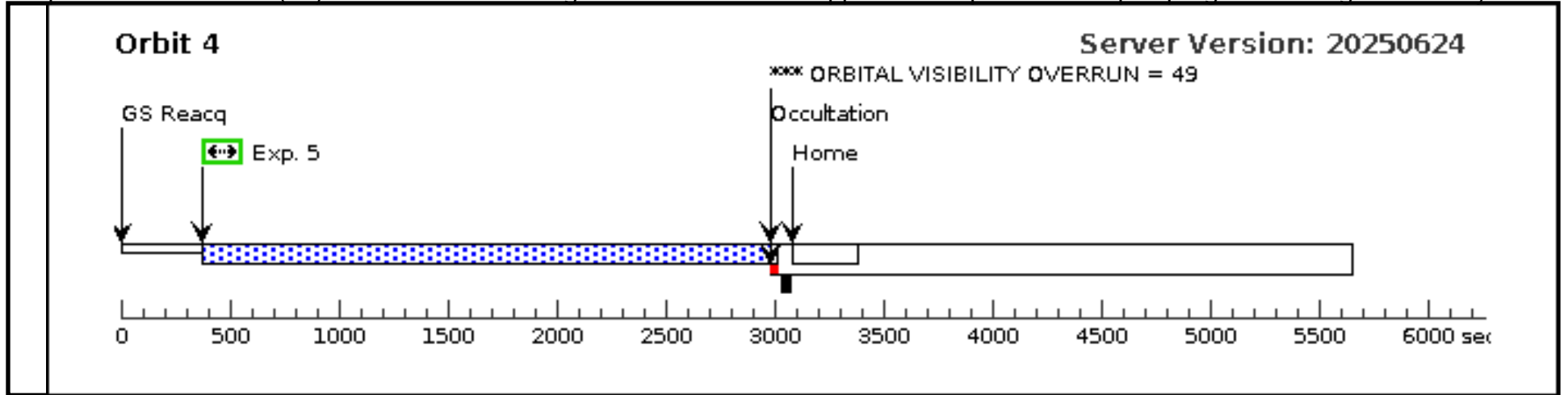
As WR102 is quite reddened, with an  $E(B-V) = 1.26$  (Tramper et al. 2015), the FUV regime of this star requires more exposure time than its visual magnitude of 14.20 suggests. Hence, the total of 12 orbits is necessary for our requirements. A total science exposure time of 30,078s ensures an SNR of 13.3 at 1480 Angstrom, this latter value being chosen to avoid the SNR estimate being heavily influenced by strong spectral lines. In addition, this science exposure time ensures an SNR between 10 and 11 around wavelengths around 1320 Angstrom.

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<b>Visit</b>	<b>Proposal 17723, visit1 (01), failed</b> <b>Diagnostic Status: Warning</b> Scientific Instruments: COS/FUV, COS/NUV Special Requirements: (none)																																																																				
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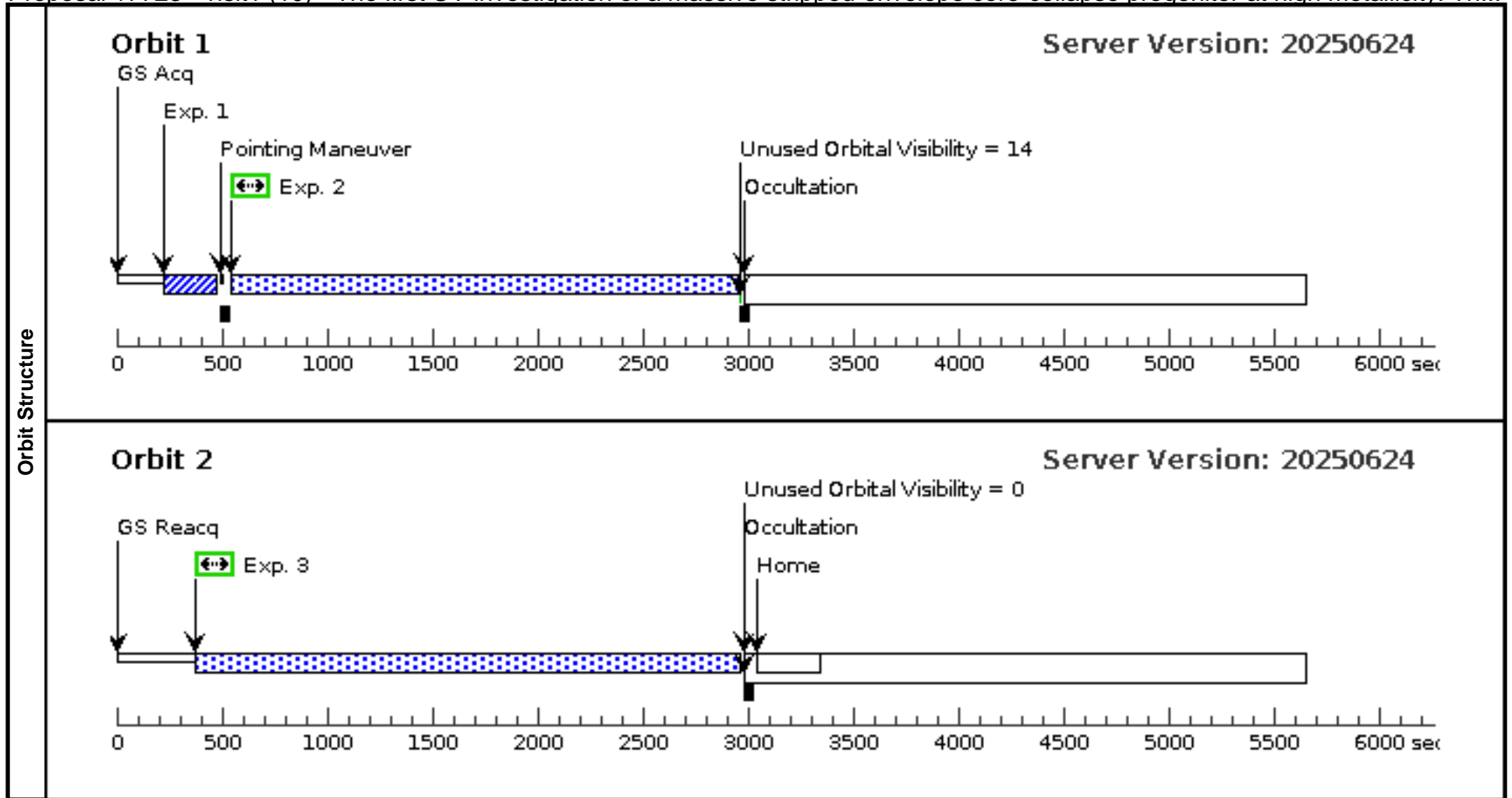




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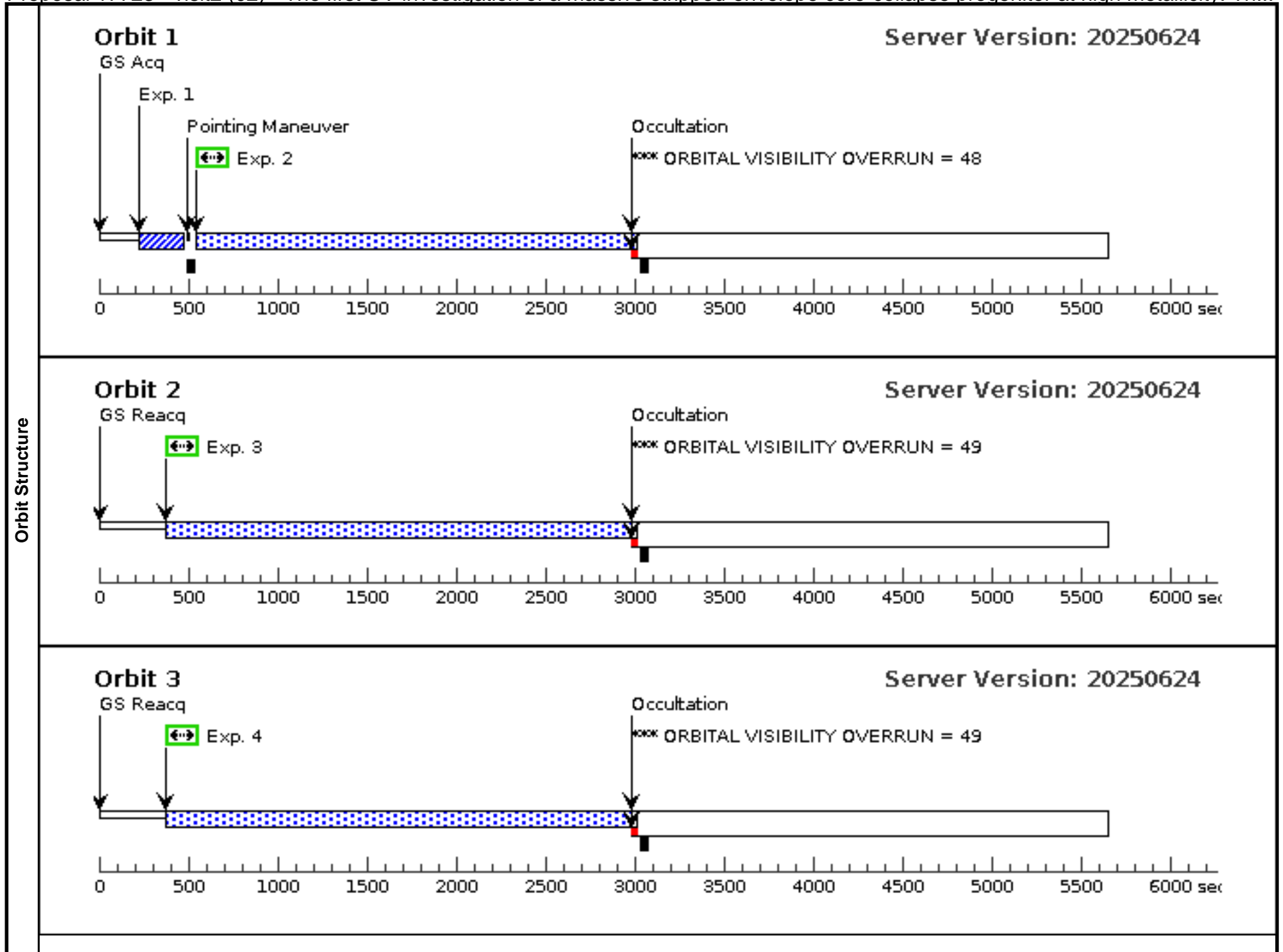
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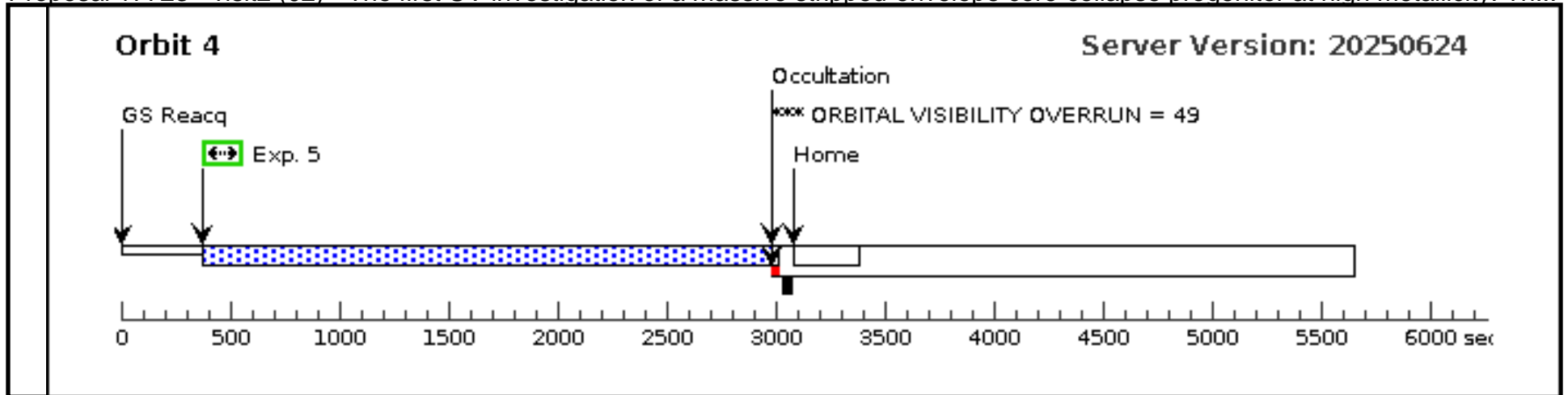


Proposal 17723 - visit2 (02) - The first UV investigation of a massive stripped-envelope core-collapse progenitor at high metallicity: Th...

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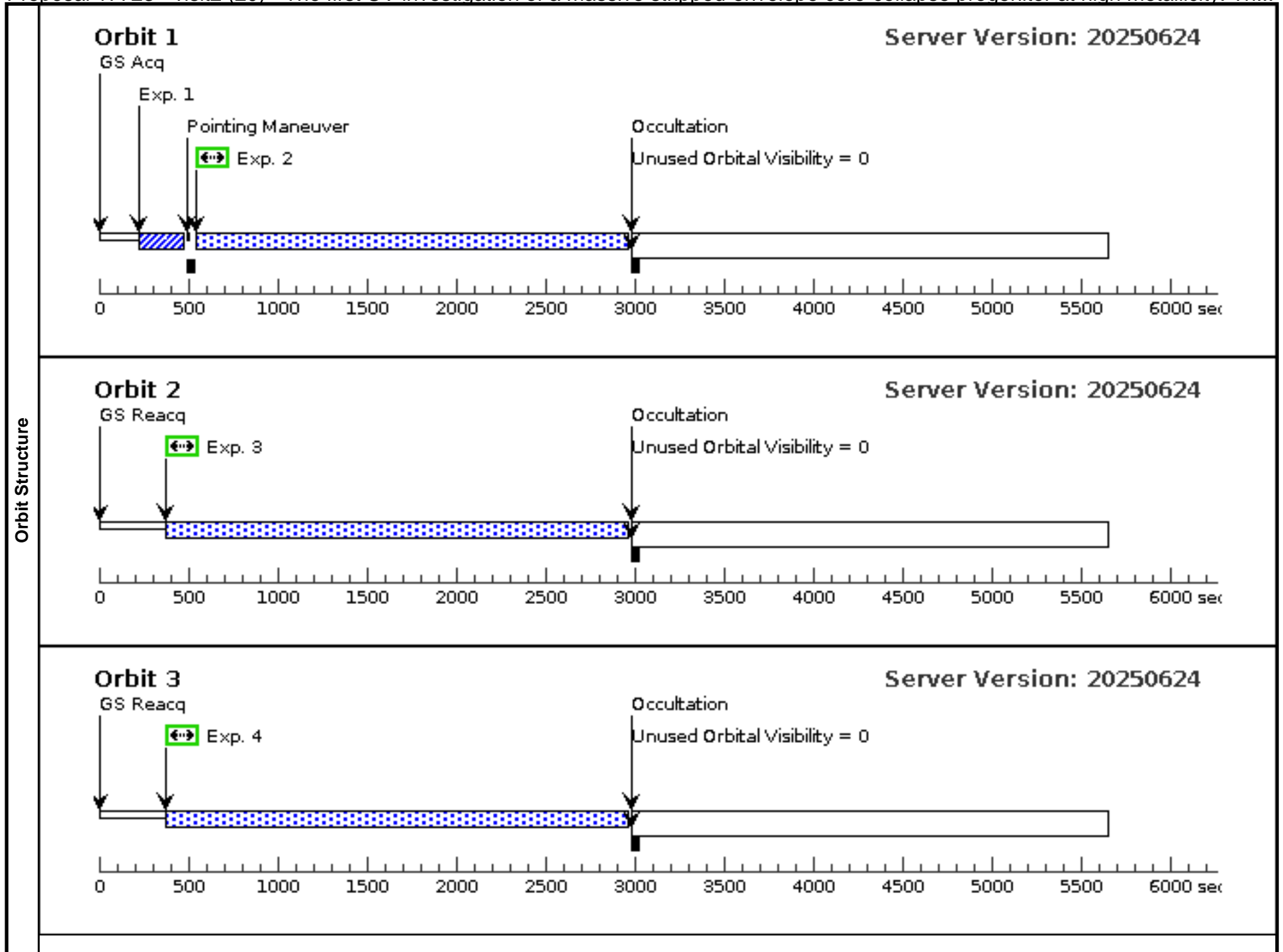


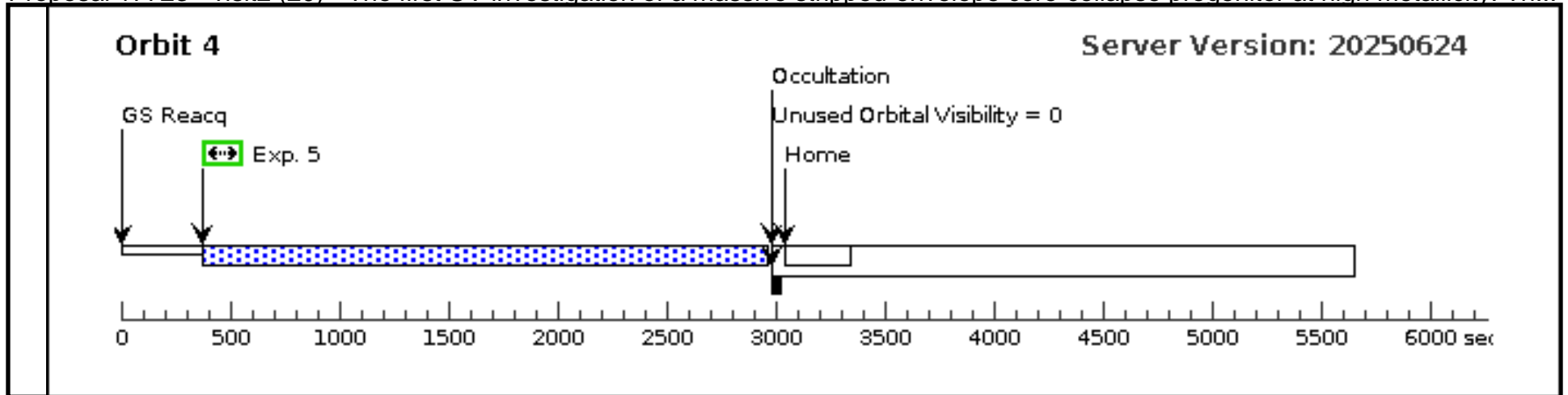


Proposal 17723 - visit2 (20) - The first UV investigation of a massive stripped-envelope core-collapse progenitor at high metallicity: Th...

Fri Aug 29 04:00:18 GMT 2025

Visit	<b>Proposal 17723, visit2 (20)</b> <b>Diagnostic Status: No Diagnostics</b> Scientific Instruments: COS/FUV, COS/NUV Special Requirements: (none)									
	Fixed Targets	#	Name	Target Coordinates	Targ. Coord. Corrections	Fluxes	Miscellaneous			
		(1)	V-V3893-SGR Alt Name1: WR102	RA: 17 45 47.5405 (266.4480854d) Dec: -26 10 26.78 (-26.17411d) Equinox: J2000	Proper Motion RA: 0.76 mas/yr Proper Motion Dec: -0.06 mas/yr Parallax: 0.0003241" Epoch of Position: 2000	V=14.2	Reference Frame: ICRS			
	<i>Comments: This object was generated by the targetselector and retrieved from the SIMBAD database.</i> SIMBAD listed proper motion for this target. When retrieving targets with PM from SIMBAD, APT requests the coordinates be calculated with an epoch of the year 2000. Do not modify this epoch. Always review coordinates using the Target Confirmation tool, which graphically displays the PM. Category=STAR Description=[WOLF RAYET] Extended=NO									
Exposures	#	Label (ETC Run)	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time (Total)/[Actual Dur.]	Orbit
	1	TA (COS.ta.193 0034)	(1) V-V3893-SGR	COS/NUV, ACQ/IMAGE, PSA	MIRRORA				20 Secs (20 Secs) [==>]	[1]
	2	(COS.sp.193 0121)	(1) V-V3893-SGR	COS/FUV, TIME-TAG, PSA	G140L 800 A	BUFFER-TIME=94 03; FP-POS=1			2262 Secs (2214 Secs) [==>2214.0 Secs ]	[1]
	3	(COS.sp.193 0122)	(1) V-V3893-SGR	COS/FUV, TIME-TAG, PSA	G140L 800 A	BUFFER-TIME=94 03; FP-POS=2			2588 Secs (2539 Secs) [==>2539.0 Secs ]	[2]
	4	(COS.sp.193 0122)	(1) V-V3893-SGR	COS/FUV, TIME-TAG, PSA	G140L 800 A	BUFFER-TIME=94 03; FP-POS=3			2588 Secs (2539 Secs) [==>2539.0 Secs ]	[3]
	5	(COS.sp.193 0122)	(1) V-V3893-SGR	COS/FUV, TIME-TAG, PSA	G140L 800 A	BUFFER-TIME=94 03; FP-POS=4			2588 Secs (2539 Secs) [==>2539.0 Secs ]	[4]





Proposal 17723 - visit3 (03) - The first UV investigation of a massive stripped-envelope core-collapse progenitor at high metallicity: Th...

Fri Aug 29 04:00:18 GMT 2025

<b>Visit</b>	<b>Proposal 17723, visit3 (03), completed</b> <b>Diagnostic Status: Warning</b> Scientific Instruments: COS/FUV, COS/NUV Special Requirements: (none)																																																																				
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