



18401 - FUV Spectroscopy of Transiting Exoplanetary Debris Orbiting near the Roche Limit of a White Dwarf

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) ZTF-J1944+4557	COS/FUV COS/NUV	4	18-Aug-2026 14:00:31.0	yes
02	(1) ZTF-J1944+4557	COS/FUV COS/NUV	3	18-Aug-2026 14:00:32.0	yes

7 Total Orbits Used

ABSTRACT

The circumstellar environments of white dwarf stars are often observed to be sites of the ongoing destruction of exoplanetary material. These stars are accreting from tidally disrupted minor planets. The geochemical makeup of these disintegrating objects are encoded within the spectra of these stars, constituting a powerful diagnostic for extracting the bulk composition of exoplanetary bodies. Ultraviolet (UV) spectroscopy is usually necessary to derive the most accurate abundances, especially for hot white dwarfs who emit most of their radiation in the UV, and since the predominant constituents of rocky material, such as iron, oxygen, and silicon, are most densely concentrated in the UV. We propose obtaining far-UV (FUV) spectroscopy with COS over seven consecutive orbits of a white dwarf, ZTF J1944+4557, accreting planetary material that shows transits from the debris repeating every 4.97 hours. This is the second case of transiting debris observed just outside the Roche limit of a white dwarf. In addition to taking an accurate census of the debris chemistry, we will create a time-tagged FUV light curve to search for small dust grains embedded in the disk. We will compare the FUV transit depths against those concurrently observed in the optical to constrain the minimum particle size of the dusty debris. Our proposed observations will place ZTF J1944+4557 into the broader context of the emerging class of white dwarfs showing transiting planetary debris, helping to begin to illuminate possible relationships between the orbital period and eccentricities of debris and dust production mechanisms, namely collisions.

OBSERVING DESCRIPTION

The goal of this HST program is to obtain time-resolved COS far-ultraviolet spectroscopy of the white dwarf ZTF1944+4557 to (1) detect the photospheric metal absorption lines in this wavelength range and (2) to probe for color-dependence of the transit depth. The orbital period of the debris is 4.9704h.

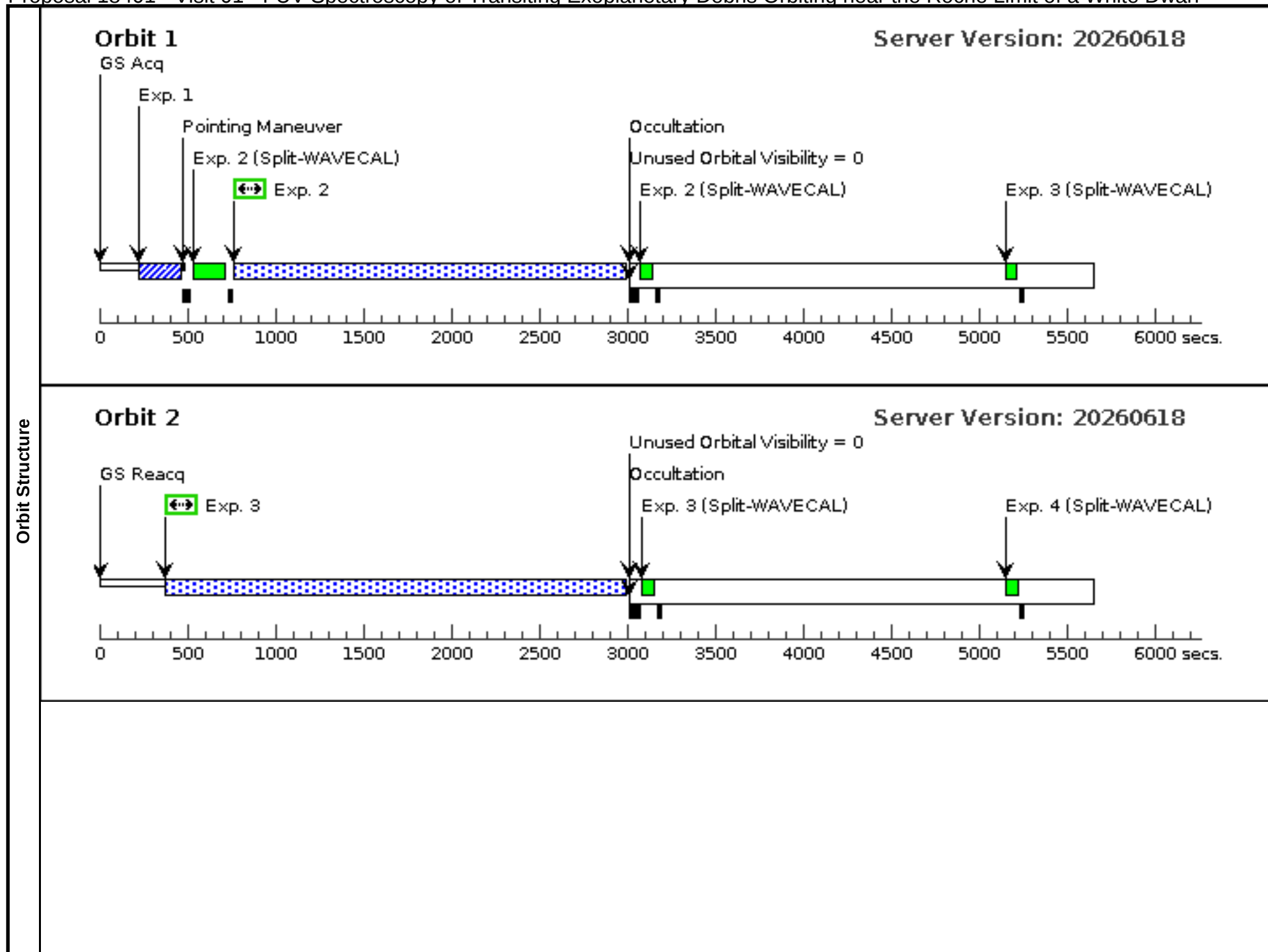
The observations will be collected over two visits, one of four orbits and one of three orbits. We will use the G130M grating in TIME-TAG mode and the primary science aperture (PSA) for both visits. The first visit (four orbits long) will be centered on 1291 Angstrom, while the second (three orbit) visit will be centered on 1222 Angstrom to provide complete coverage of the star's FUV spectrum. This will enhance our first scientific outcome. Splitting our program into two visits will allow us to test for potential variations in the particle size distribution from epoch to epoch.

The target acquisition will be performed via COS/NUV ACQ IMAGE exposures designed to achieve $S/N=40$, as estimated using the ETC and MIRRORA.

For the ETC simulation of the COS TIME-TAG spectrophotometry, we used a white dwarf model spectrum computed with the parameters from Bhattarcharjee et al. 2025 (PASP 137, 4202), i.e. $T_{\text{eff}}=20790$ K, $\log g=8.27$, and $\log(\text{Ca/He})=-8.00$, and we scaled all other elements to Bulk Earth abundances. We use the Gaia DR3 G-band Vega magnitude $G=19.36$ mag.

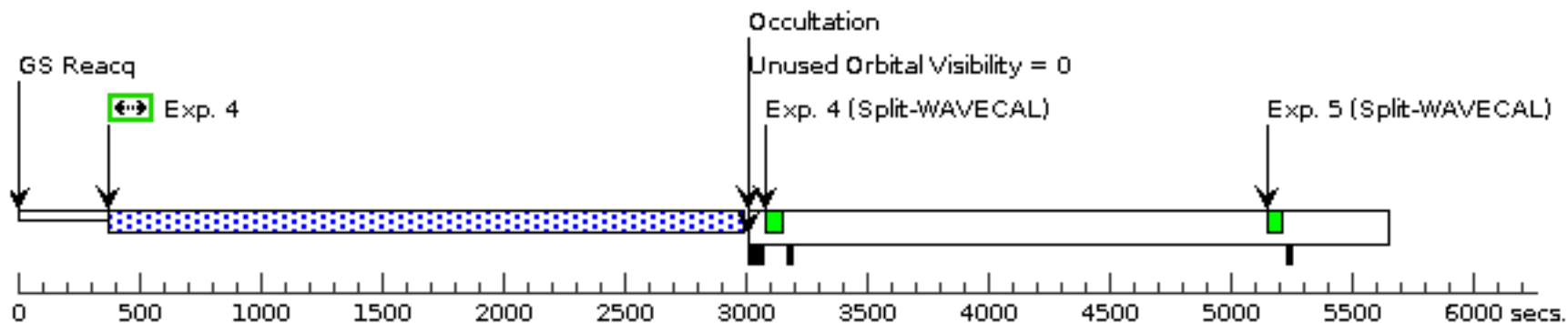
Proposal 18401 - Visit 01 - FUV Spectroscopy of Transiting Exoplanetary Debris Orbiting near the Roche Limit of a White Dwarf

Visit	Proposal 18401, Visit 01										Tue Aug 18 18:00:32 GMT 2026	
	Diagnostic Status: No Diagnostics											
	Scientific Instruments: COS/FUV, COS/NUV											
	Special Requirements: BETWEEN 01-MAY-2027:00:00:00 AND 01-NOV-2027:00:00:00											
Fixed Targets	#	Name	Target Coordinates			Targ. Coord. Corrections		Fluxes		Miscellaneous		
	(1)	ZTF-J1944+4557	RA: 19 44 31.9200 (296.1330000d)			Proper Motion RA: -2.219 mas/yr		V=19.3		Reference Frame: ICRS		
		Alt Name1: GAIA-DR3-2080201713998110336	Dec: +45 57 53.13 (45.96476d)			Proper Motion Dec: -10.963 mas/yr		Gaia G=19.36				
			Equinox: J2000			Parallax: 0.0023201"						
						Epoch of Position: 2000						
	Comments: This object was generated by the targetselector and retrieved from the SIMBAD database.											
	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=[CIRCUMSTELLAR MATTER, 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	(2366659)	(1) ZTF-J1944+4557	COS/NUV, ACQ/IMAGE, PSA		MIRRORA				11.4 Secs (11.4 Secs)		
										[==>]		[1]
	2	(2366660)	(1) ZTF-J1944+4557	COS/FUV, TIME-TAG, PSA		G130M 1291 A	LIFETIME-POS=LP 7; BUFFER-TIME=50 75; FP-POS=3			1900 Secs (2177 Secs)		
										[==>2177.0 Secs]		[1]
	3	(2366283)	(1) ZTF-J1944+4557	COS/FUV, TIME-TAG, PSA		G130M 1291 A	BUFFER-TIME=50 75; LIFETIME-POS=L P7; FP-POS=3			2200 Secs (2571 Secs)		
										[==>2571.0 Secs]		[2]
	4	(2366283)	(1) ZTF-J1944+4557	COS/FUV, TIME-TAG, PSA		G130M 1291 A	BUFFER-TIME=50 75; LIFETIME-POS=L P7; FP-POS=4			2200 Secs (2571 Secs)		
										[==>2571.0 Secs]		[3]
	5	(2366283)	(1) ZTF-J1944+4557	COS/FUV, TIME-TAG, PSA		G130M 1291 A	BUFFER-TIME=50 75; LIFETIME-POS=L P7; FP-POS=4			2200 Secs (2571 Secs)		
									[==>2571.0 Secs]		[4]	



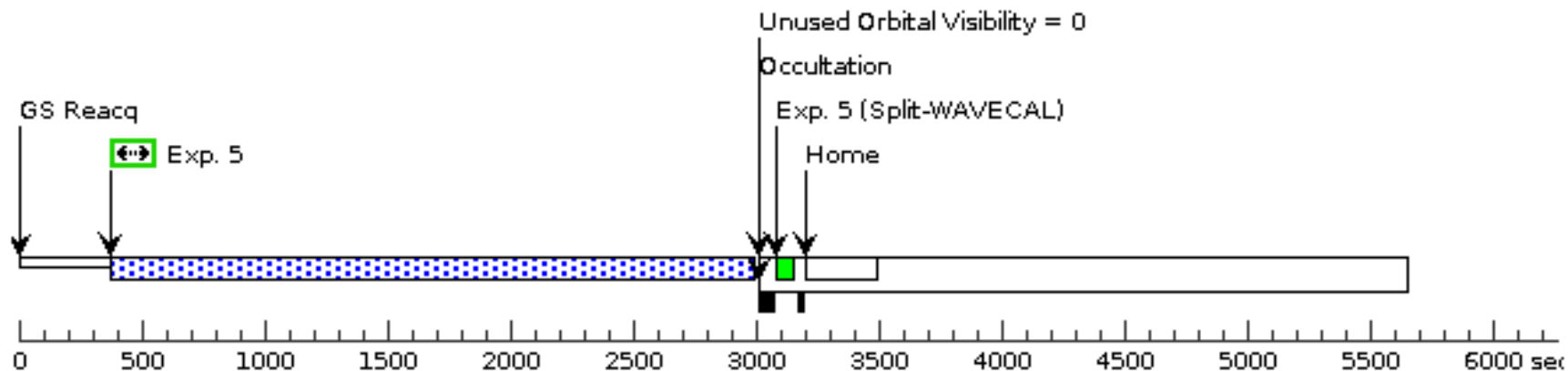
Orbit 3

Server Version: 20260618



Orbit 4

Server Version: 20260618

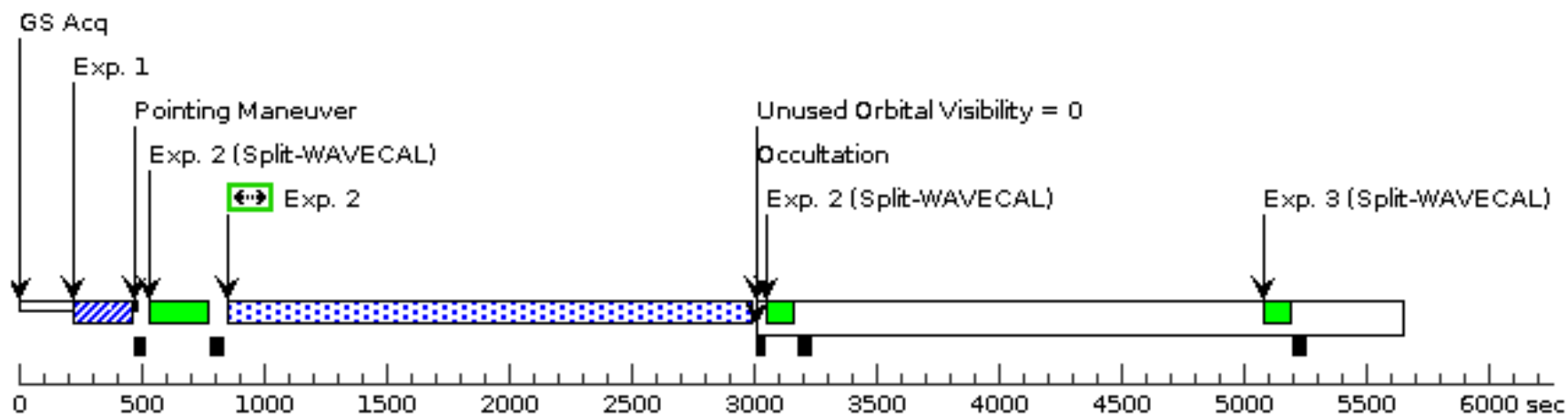


Proposal 18401 - Visit 02 - FUV Spectroscopy of Transiting Exoplanetary Debris Orbiting near the Roche Limit of a White Dwarf

Visit	Proposal 18401, Visit 02										Tue Aug 18 18:00:33 GMT 2026	
	Diagnostic Status: No Diagnostics											
	Scientific Instruments: COS/FUV, COS/NUV											
	Special Requirements: BETWEEN 01-MAY-2027:00:00:00 AND 01-NOV-2027:00:00:00											
Fixed Targets	#	Name	Target Coordinates		Targ. Coord. Corrections		Fluxes		Miscellaneous			
	(1)	ZTF-J1944+4557	RA: 19 44 31.9200 (296.1330000d)		Proper Motion RA: -2.219 mas/yr		V=19.3		Reference Frame: ICRS			
		Alt Name1: GAIA-DR3-2080201713998110336	Dec: +45 57 53.13 (45.96476d)		Proper Motion Dec: -10.963 mas/yr		Gaia G=19.36					
			Equinox: J2000		Parallax: 0.0023201"							
					Epoch of Position: 2000							
	Comments: This object was generated by the targetselector and retrieved from the SIMBAD database.											
	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=[CIRCUMSTELLAR MATTER, 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	(2366659)	(1) ZTF-J1944+4557	COS/NUV, ACQ/IMAGE, PSA		MIRRORA				11.4 Secs (11.4 Secs)		
										[==>]		[1]
	2	(2366661)	(1) ZTF-J1944+4557	COS/FUV, TIME-TAG, PSA		G130M 1222 A	LIFETIME-POS=LP 7; FP-POS=1; BUFFER-TIME=10 633			2200 Secs (2091 Secs)		
										[==>2091.0 Secs]		[1]
	3	(2366294)	(1) ZTF-J1944+4557	COS/FUV, TIME-TAG, PSA		G130M 1222 A	LIFETIME-POS=LP 7; FP-POS=2; BUFFER-TIME=10 633			2200 Secs (2571 Secs)		
										[==>2571.0 Secs]		[2]
	4	(2366294)	(1) ZTF-J1944+4557	COS/FUV, TIME-TAG, PSA		G130M 1222 A	LIFETIME-POS=LP 7; FP-POS=3; BUFFER-TIME=10 633			2200 Secs (2571 Secs)		
										[==>2571.0 Secs]		[3]

Orbit 1

Server Version: 20260618



Orbit 2

Server Version: 20260618

