18344 - Unraveling The Time-Variable XUV Environment of a Young and Evolving Planetary System

Cycle: 34, Proposal Category: GO

(UV Initiative)

(Availability Mode: SUPPORTED)

INVESTIGATORS

Name	*Institution*
Dr. Matthew Michael Murphy (PI) (Contact)	**Michigan State University**
Dr. Adina Feinstein (CoI) (CoPI)	Michigan State University
Darryl Seligman (CoI)	Michigan State University
Dr. Benjamin Rackham (CoI)	Massachusetts Institute of Technology
Dr. Saugata Barat (CoI)	University of Texas at Austin
Prof. Kevin France (CoI)	University of Colorado at Boulder
Dr. Luis Welbanks (CoI)	Arizona State University
Sydney Petz (CoI)	Michigan State University
Dr. Girish M. Duvvuri (CoI)	Vanderbilt University
Dr. Matthew Conor Nixon (CoI)	Arizona State University

VISITS

Visit	*Targets used in Visit*	*Configurations used in Visit*	*Orbits Used*	*Last Orbit Planner Run*	*OP Current with Visit?*
01	(1) V-V1298-TAU	COS/FUV COS/NUV	3	27-Aug-2026 10:00:18.0	yes
02	(1) V-V1298-TAU	COS/FUV COS/NUV	3	27-Aug-2026 10:00:20.0	yes

Visit	*Targets used in Visit*	*Configurations used in Visit*	*Orbits Used*	*Last Orbit Planner Run*	*OP Current with Visit?*
03	(1) V-V1298-TAU	COS/FUV COS/NUV	3	27-Aug-2026 10:00:21.0	yes

9 Total Orbits Used

ABSTRACT

Stellar X-ray and UV (XUV) irradiation is believed to sculpt short-period exoplanets through photoevaporation. In the Solar System, such atmospheric escape varies along with the Sun's 11-year activity cycle. The atmospheric evolution of young exoplanets may therefore be linked to their host stars' activity cycles, which are likely shorter than the Sun's. V1298 Tau, a 23 Myr multi-planet system with the only confirmed detections of atmospheric escape from young exoplanets, presents an ideal laboratory for revealing this star--planet connection. A series of detections and non-detections of escape in this system hint at variable escape and a 1.5 year stellar activity cycle, and upcoming JWST observations will search for more. We request simultaneous joint observations with HST/COS (primary, 9 orbits) and XMM-Newton (72 ks) to measure the XUV flux of V1298 Tau at the same times and activity phases of ongoing JWST escape measurements. Our data will unravel why atmospheric escape appears time-variable in this benchmark system, and provide a critical missing link between exoplanet atmospheric evolution and their host star's activity cycle.

OBSERVING DESCRIPTION

Our program consists of three visits with identical observing setups. Each visit consists of four exposures (one target acquisition and three spectroscopic science exposures) across three orbits.

We will collect HST/COS G130M spectra of the exoplanet host star V1298 Tau. Such measurements have previously been made successfully for this target (HST GO 16163), and we follow the same instrument setup.

Exposure times were vetted using the online ETC. Our target was previously observed using the same instrument configuration as our program as well as other similar configurations. We downloaded the observed COS spectrum, which is presented in Duvvuri et al. (2023), and used it as input to the ETC. The exposure durations that maximized signal-to-noise ratio (SNR) would exceed the orbit visibility window and overlap with occultation, so for each exposure we instead opted for the maximum time that avoided overlap as determined by the APT Orbit Planner. The exposure times listed for each exposure reflect these adjusted values. We verified these times would still achieve acceptable SNR using the ETC. The buffer times follow the ETC recommendations.

The primary science goal is to measure the time-variable XUV flux of the exoplanet host star V1298 Tau. These observations are complementary to ongoing JWST observations studying atmospheric escape from several planets in this system. As such, we aim to measure the stellar flux contemporaneously with these JWST observations. These data must be taken as close in time as possible, otherwise the stellar flux cannot be connected to planetary atmospheric escape due to unknown time variability. Visit 1 should be scheduled as close in time as possible to the first observation of JWST GO 11831, which is curretly planned for September 7, 2026. There are abundant visibility windows from September 2026 into the beginning of Cycle 34 in November 2026. We therefore request this visit be scheduled as soon as possible after the start of Cycle 34.

Visit 2 should be scheduled as close in time as possible to the second observation of JWST GO 11831, currently planned for January 23, 2027. The visit planner lists no possible simultaneous HST windows. The earliest and closest possible window is around the end of July 2027 or the start of August 2027. We request this visit be scheduled as early as possible during this window.

Visit 3 is meant to measure the stellar flux at an analogous phase in the star's activity cycle as previous atmospheric escape observations, assuming a hypothesized stellar activity cycle. The optimal times for this is July - September 2027. However, this overlaps with the possible window for Visit 2. Having two of our visits stacked directly on top of each other hampers our ability to probe time variability. The minimum useful cadence for our science is approximately one month. Therefore, we request Visit 3 be scheduled around this analogous activity phase, so long as it is one month after Visit 2 executes.

Visit

Proposal 18344, Visit 01, implementation Thu Aug 27 14:00:21 GMT 2026

Diagnostic Status: Warning

Scientific Instruments: COS/FUV, COS/NUV

Special Requirements: SCHED 100%; BETWEEN 08-SEP-2026:18:15:00 AND 08-SEP-2026:19:15:00

Comments: Visit contemporaneous or as close as possible with Obs.1 of JWST GO 11831, which will execute on either September 7, 2026 or October 1, 2026.

Diagnostics

(Visit 01) Warning (Form): For the best data quality, it is generally required to use all four FP-POS positions at a given COS cenwave (or 2 positions for certain exception cases). See extended explanation in the diagnostic browser.

Fixed Targets

#	Name	Target Coordinates	Targ. Coord. Corrections	Fluxes	Miscellaneous
(1)	V-V1298-TAU	RA: 04 05 19.5910 (61.3316292d) Dec: +20 09 25.56 (20.15710d) Equinox: J2000	Proper Motion RA: 5.412668 mas/yr Proper Motion Dec: -16.051627 mas/yr Parallax: 0.0092577" Epoch of Position: 2016	V=10.115+/-0.009 Sloan u=14.97, g=14.617, r=14.19, J=8.687	Reference Frame: ICRS

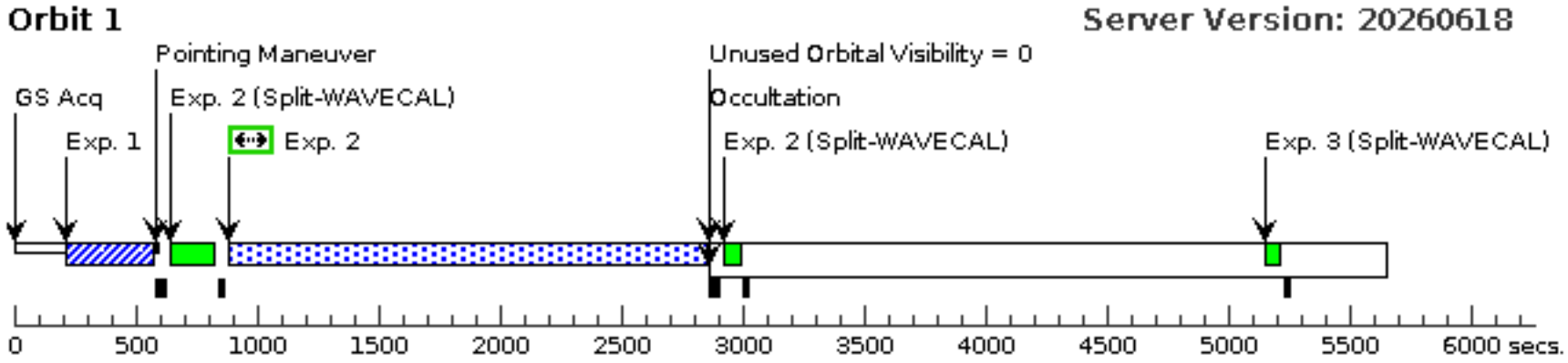
Comments: This object was generated by the targetselector and retrieved from the SIMBAD database.

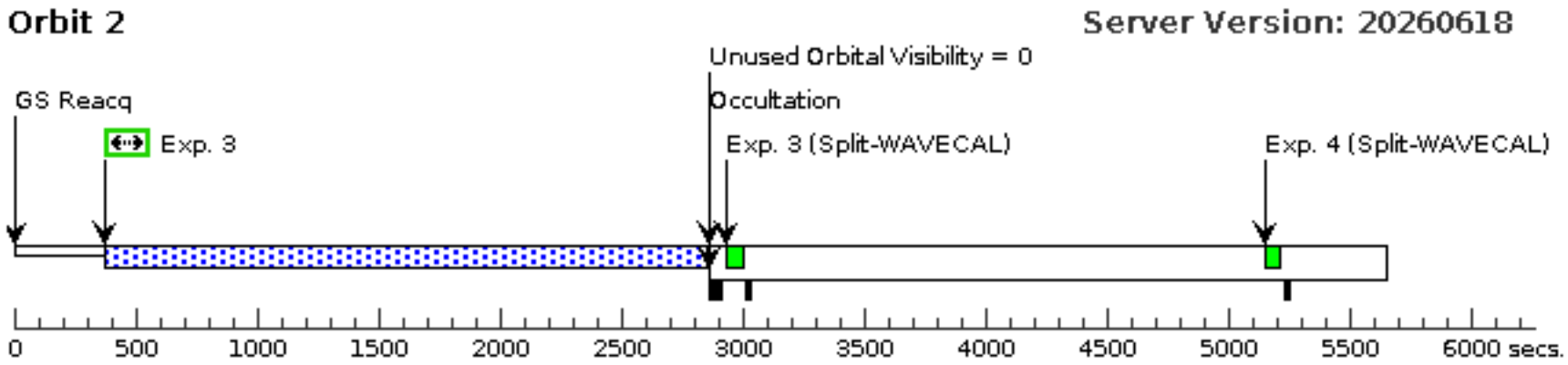
SIMBAD listed proper motion for this target. When retrieving targets with PM from SIMBAD, APT requests the coordinates be calculated with an epoch of the year 2000. Do not modify this epoch. Always review coordinates using the Target Confirmation tool, which graphically displays the PM.
Category=STAR
Description=[EXTRA-SOLAR PLANETARY SYSTEM, T TAURI STAR]
Extended=NO

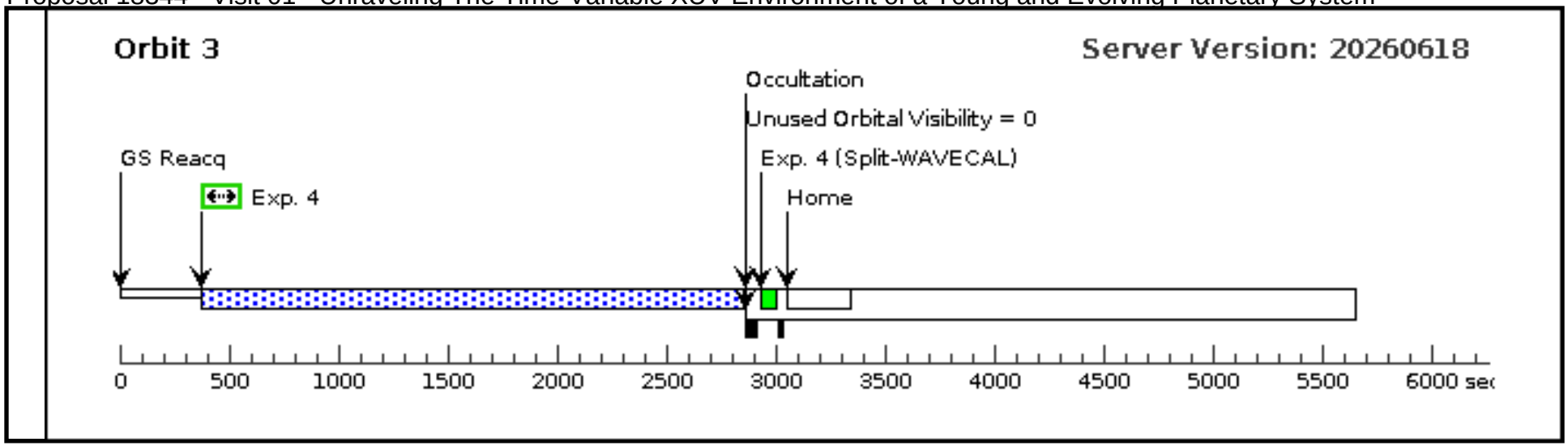
Exposures

#	Label (ETC Run)	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time (Total)/[Actual Dur.]	Orbit
1	(COS.ta.2364917)	(1) V-V1298-TAU	COS/NUV, ACQ/IMAGE, BOA	MIRRORA				67.9 Secs (67.9 Secs) *[==>]*	 ***[1]***
2	(COS.sp.2364996)	(1) V-V1298-TAU	COS/FUV, TIME-TAG, PSA	G130M 1291 A	BUFFER-TIME=5867; FP-POS=4; LIFETIME-POS=LP7			1917 Secs (1917 Secs) *[==>]*	 ***[1]***
3	(COS.sp.2364997)	(1) V-V1298-TAU	COS/FUV, TIME-TAG, PSA	G130M 1291 A	BUFFER-TIME=5867; FP-POS=4; LIFETIME-POS=LP7			2424 Secs (2424 Secs) *[==>]*	 ***[2]***
4	(COS.sp.2364997)	(1) V-V1298-TAU	COS/FUV, TIME-TAG, PSA	G130M 1291 A	BUFFER-TIME=5867; FP-POS=4; LIFETIME-POS=LP7			2424 Secs (2424 Secs) *[==>]*	 ***[3]***

Orbit Structure






Orbit 3
Server Version: 20260618
Occultation
Unused Orbital Visibility = 0
GS Reacq
Exp. 4 (Split-WAVECAL)
Exp. 4
Home
0
500
1000
1500
2000
2500
3000
3500
4000
4500
5000
5500
6000 sec

Visit

Proposal 18344, Visit 02, implementation Thu Aug 27 14:00:21 GMT 2026

Diagnostic Status: Warning

Scientific Instruments: COS/FUV, COS/NUV

Special Requirements: SCHED 100%; BETWEEN 15-DEC-2026:00:00:00 AND 01-AUG-2027:23:59:59

Comments: Visit close in time as possible to Obs.2 of JWST GO 11831, currently scheduled for January 23, 2027

Diagnostics

(Visit 02) Warning (Form): For the best data quality, it is generally required to use all four FP-POS positions at a given COS cenwave (or 2 positions for certain exception cases). See extended explanation in the diagnostic browser.

Fixed Targets

#	Name	Target Coordinates	Targ. Coord. Corrections	Fluxes	Miscellaneous
(1)	V-V1298-TAU	RA: 04 05 19.5910 (61.3316292d) Dec: +20 09 25.56 (20.15710d) Equinox: J2000	Proper Motion RA: 5.412668 mas/yr Proper Motion Dec: -16.051627 mas/yr Parallax: 0.0092577" Epoch of Position: 2016	V=10.115+/-0.009 Sloan u=14.97, g=14.617, r=14.19, J=8.687	Reference Frame: ICRS

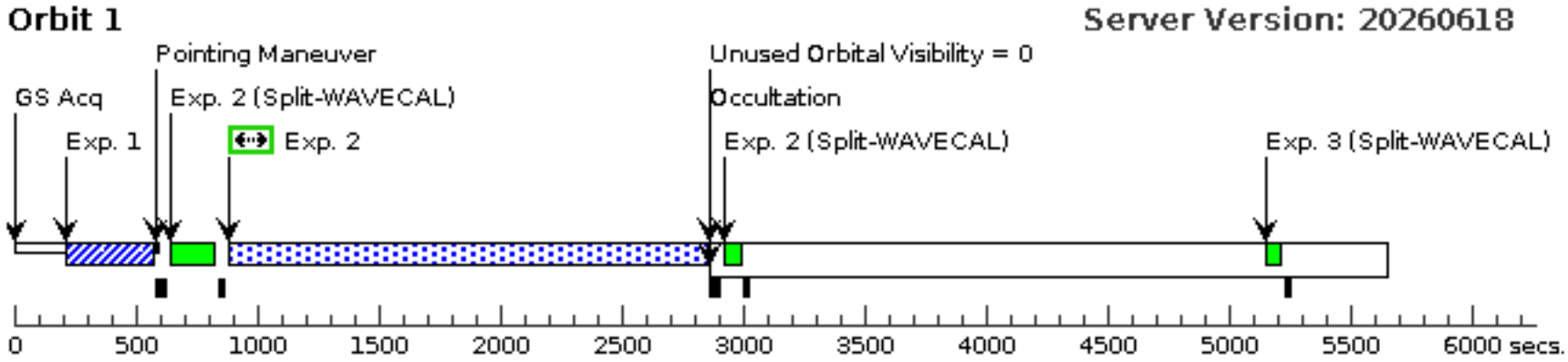
Comments: This object was generated by the targetselector and retrieved from the SIMBAD database.

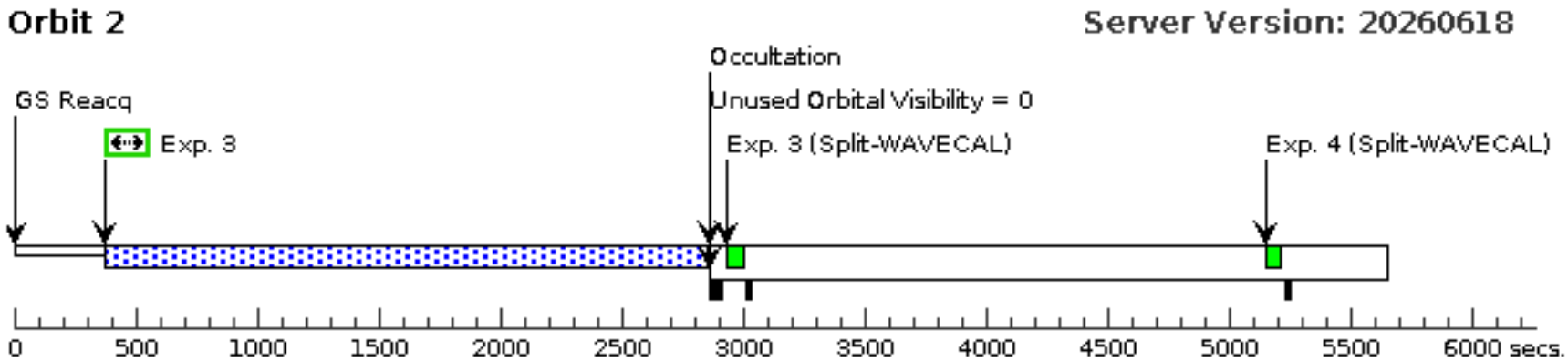
SIMBAD listed proper motion for this target. When retrieving targets with PM from SIMBAD, APT requests the coordinates be calculated with an epoch of the year 2000. Do not modify this epoch. Always review coordinates using the Target Confirmation tool, which graphically displays the PM.
Category=STAR
Description=[EXTRA-SOLAR PLANETARY SYSTEM, T TAURI STAR]
Extended=NO

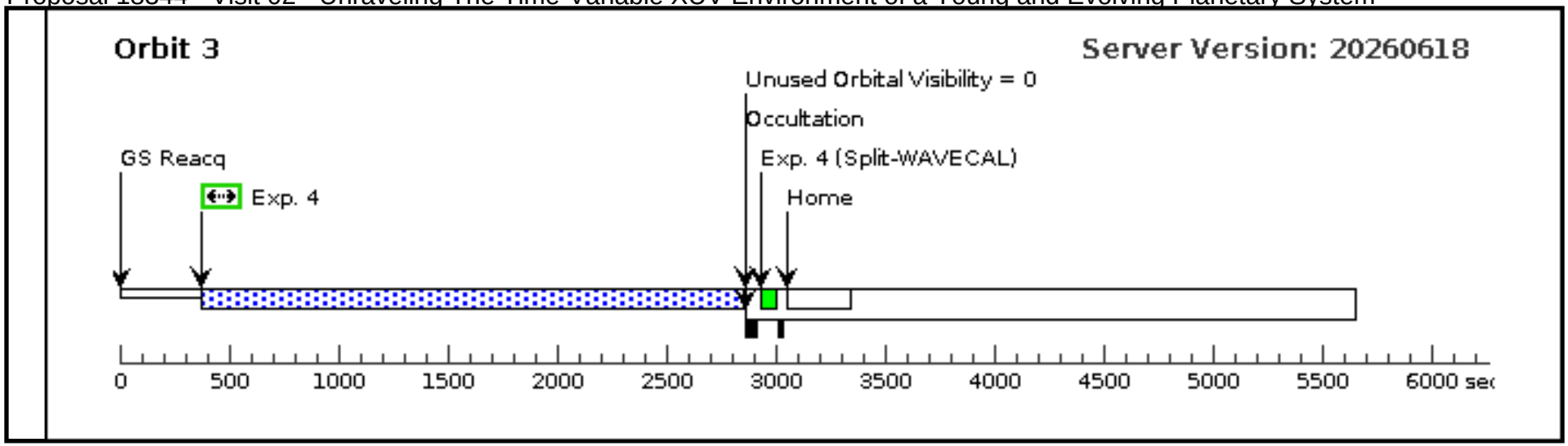
Exposures

#	Label (ETC Run)	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time (Total)/[Actual Dur.]	Orbit
1	(COS.ta.2364917)	(1) V-V1298-TAU	COS/NUV, ACQ/IMAGE, BOA	MIRRORA				67.9 Secs (67.9 Secs) *[==>]*	*[1]*
2	(COS.sp.2364996)	(1) V-V1298-TAU	COS/FUV, TIME-TAG, PSA	G130M 1291 A	BUFFER-TIME=5867; FP-POS=4; LIFETIME-POS=LP7			1917 Secs (1917 Secs) *[==>]*	*[1]*
3	(COS.sp.2364997)	(1) V-V1298-TAU	COS/FUV, TIME-TAG, PSA	G130M 1291 A	BUFFER-TIME=5867; FP-POS=4; LIFETIME-POS=LP7			2424 Secs (2424 Secs) *[==>]*	*[2]*
4	(COS.sp.2364997)	(1) V-V1298-TAU	COS/FUV, TIME-TAG, PSA	G130M 1291 A	BUFFER-TIME=5867; FP-POS=4; LIFETIME-POS=LP7			2424 Secs (2424 Secs) *[==>]*	*[3]*

Orbit Structure






Orbit 3
Server Version: 20260618
Unused Orbital Visibility = 0
Occultation
GS Reacq
Exp. 4
Exp. 4 (Split-WAVECAL)
Home
0
500
1000
1500
2000
2500
3000
3500
4000
4500
5000
5500
6000 sec

Visit

Proposal 18344, Visit 03, implementation Thu Aug 27 14:00:22 GMT 2026

Diagnostic Status: Warning

Scientific Instruments: COS/FUV, COS/NUV

Special Requirements: SCHED 100%; AFTER 02 BY 28 D TO 90 D; BETWEEN 01-JUL-2027:00:00:00 AND 31-DEC-2027:00:00:00

Diagnostics

(Visit 03) Warning (Form): For the best data quality, it is generally required to use all four FP-POS positions at a given COS cenwave (or 2 positions for certain exception cases). See extended explanation in the diagnostic browser.

Fixed Targets

#	Name	Target Coordinates	Targ. Coord. Corrections	Fluxes	Miscellaneous
(1)	V-V1298-TAU	RA: 04 05 19.5910 (61.3316292d) Dec: +20 09 25.56 (20.15710d) Equinox: J2000	Proper Motion RA: 5.412668 mas/yr Proper Motion Dec: -16.051627 mas/yr Parallax: 0.0092577" Epoch of Position: 2016	V=10.115+/-0.009 Sloan u=14.97, g=14.617, r=14.19, J=8.687	Reference Frame: ICRS

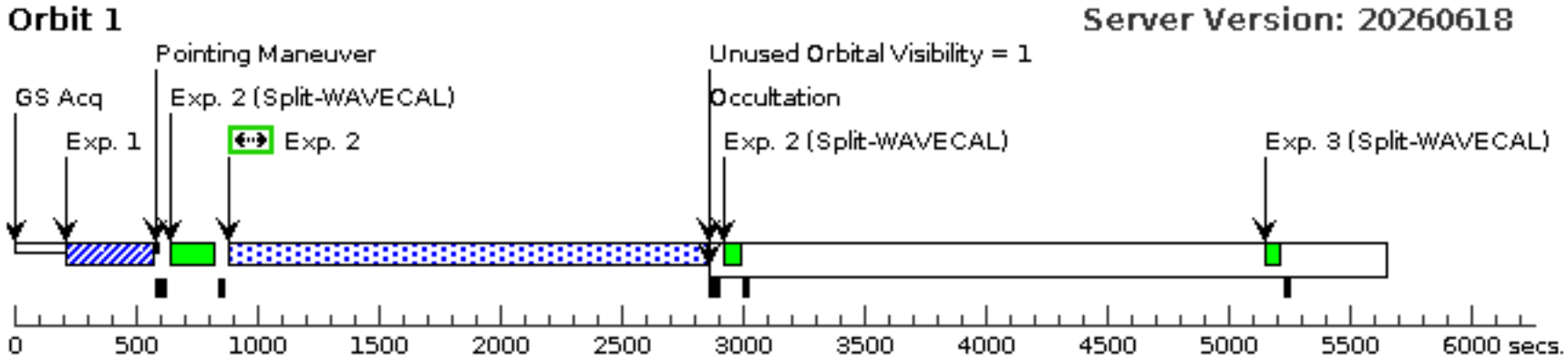
Comments: This object was generated by the targetselector and retrieved from the SIMBAD database.

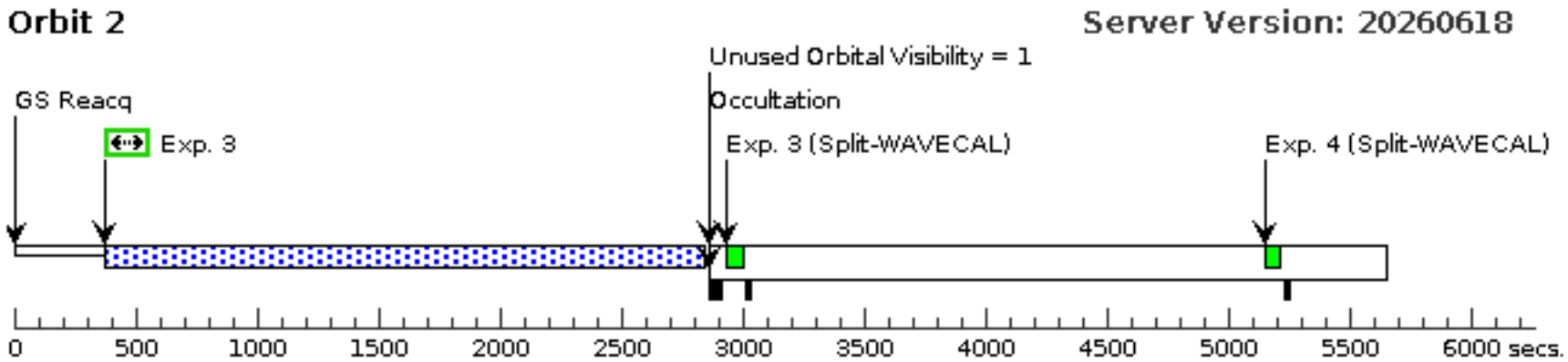
SIMBAD listed proper motion for this target. When retrieving targets with PM from SIMBAD, APT requests the coordinates be calculated with an epoch of the year 2000. Do not modify this epoch. Always review coordinates using the Target Confirmation tool, which graphically displays the PM.
Category=STAR
Description=[EXTRA-SOLAR PLANETARY SYSTEM, T TAURI STAR]
Extended=NO

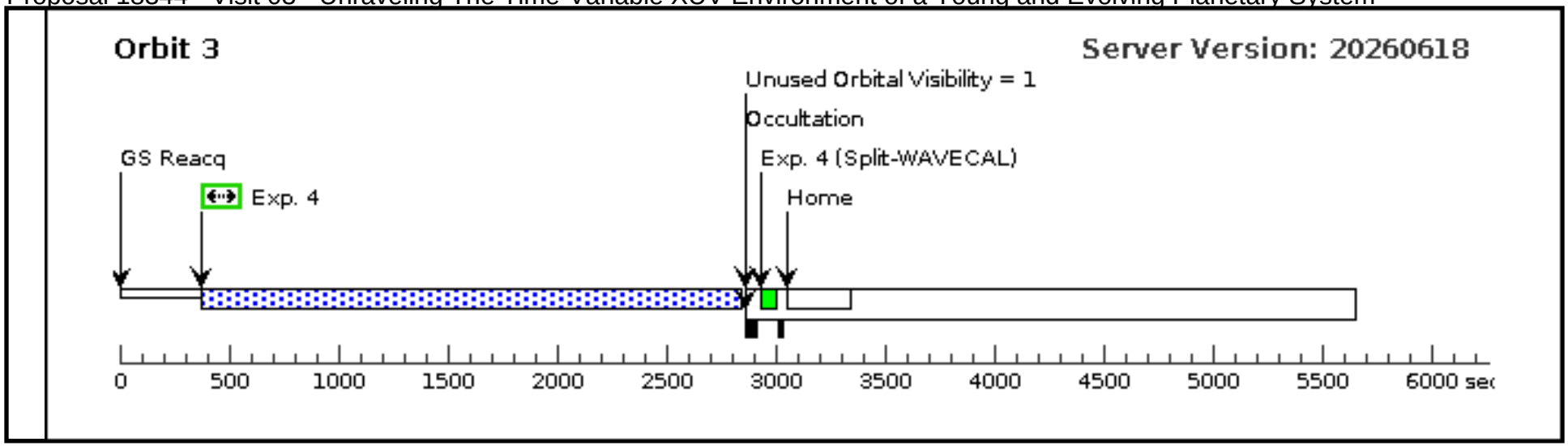
Exposures

#	Label (ETC Run)	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time (Total)/[Actual Dur.]	Orbit
1	(COS.ta.2364917)	(1) V-V1298-TAU	COS/NUV, ACQ/IMAGE, BOA	MIRRORA				67.9 Secs (67.9 Secs) *[==>]*	*[1]*
2	(COS.sp.2364996)	(1) V-V1298-TAU	COS/FUV, TIME-TAG, PSA	G130M 1291 A	BUFFER-TIME=5867; FP-POS=4; LIFETIME-POS=LP7			1916 Secs (1916 Secs) *[==>]*	*[1]*
3	(COS.sp.2364997)	(1) V-V1298-TAU	COS/FUV, TIME-TAG, PSA	G130M 1291 A	BUFFER-TIME=5867; FP-POS=4; LIFETIME-POS=LP7			2423 Secs (2423 Secs) *[==>]*	*[2]*
4	(COS.sp.2364997)	(1) V-V1298-TAU	COS/FUV, TIME-TAG, PSA	G130M 1291 A	BUFFER-TIME=5867; FP-POS=4; LIFETIME-POS=LP7			2423 Secs (2423 Secs) *[==>]*	*[3]*

Orbit Structure






Orbit 3
Server Version: 20260618
Unused Orbital Visibility = 1
Occultation
GS Reacq
Exp. 4
Exp. 4 (Split-WAVECAL)
Home
0
500
1000
1500
2000
2500
3000
3500
4000
4500
5000
5500
6000 sec