18092 - Connecting stellar mergers to peculiar stellar behavior with a Rosetta Stone young merger remnant

Cycle: 33, Proposal Category: GO

(UV Initiative)

(Availability Mode: SUPPORTED)

INVESTIGATORS

Name	*Institution*
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VISITS

Visit	*Targets used in Visit*	*Configurations used in Visit*	*Orbits Used*	*Last Orbit Planner Run*	*OP Current with Visit?*
01	(1) TYC25977351	STIS/CCD STIS/NUV-MAMA	1	29-Jan-2026 16:00:15.0	yes
02	(1) TYC25977351	COS/FUV COS/NUV	3	29-Jan-2026 16:00:17.0	yes

Visit	*Targets used in Visit*	*Configurations used in Visit*	*Orbits Used*	*Last Orbit Planner Run*	*OP Current with Visit?*
03	(1) TYC25977351	COS/FUV COS/NUV	2	29-Jan-2026 16:00:18.0	yes
04	(1) TYC25977351	COS/FUV COS/NUV	2	29-Jan-2026 16:00:18.0	yes
05	(1) TYC25977351	COS/FUV COS/NUV	3	29-Jan-2026 16:00:19.0	yes
06	(1) TYC25977351	COS/FUV COS/NUV	3	29-Jan-2026 16:00:20.0	yes

14 Total Orbits Used

ABSTRACT

Binary and multi-star systems make up over 1/3 of the star systems in the Galaxy, with some ending with the complete engulfment of one star by another. The latter process is observed only in a few cases because the engulfment happens quickly, but is a likely outcome for a sizable fraction of the all binary systems. Current models of stellar mergers suggest that the merger remnant puffs up to large radius, carries additional angular momentum, and leadis to the formation of a convective zone and active dynamon. Over time, the star contracts, spinning up further and leading to the formation of a rapidly rotating star with significant stellar activity. The mergence of a convective zone may lead to the generation of a strong magnetic field. Magnetic fields may drive
magnetorotational accretion of surrounding material, slow down rotation via magnetic breaking, and power jets -- all of which transport angular momentum from the merger remnant. Therefore, it remains unclear whether these systems evolve to become a rapid rotators.

TYC 2597-735-1 was recently identified as a stellar merger remnant, whose collision occurred a few thousand years ago. It sits in an observationally rare category - one whose merger was old enough to emerge from its dusty aftermath, yet recent enough to still exhibit signs of a stellar merger. Our program will use HST/COS FUV and HST/STIS NUV spectroscopy to obtain a complete UV (1150 - 3000 {\AA}) spectrum at low- to moderate-resolution of TYC 2597 to disentangle the physical processes (magnetic activity, accretion, and outflows), probed using UV hot gas lines, warm circumstellar H2 features, and the UV accretion continuum, that shape its final state.

OBSERVING DESCRIPTION

We request a Small GO program, comprised of 14 orbits total, to observe TYC 2597-735-1 (TYC 2597) using COS G130M(1291), G160M(1577), and STIS G230L spectroscopic modes. We request the following exposure times and orbits, which assume 2250 seconds of science exposure and 740 seconds of slew/settle time per orbit:
COS G130M, CENWAVE=1291: 5 orbits
COS G160M, CENWAVE=1577: 8 orbits
STIS G230L, NUV-MAMA, 52" x 0.2": 1 orbit

HST/COS exposure times are calculated using signal-to-noise (SN) of 10 for hot gas chromospheric and accretion lines (e.g, C III, C IV, Si IV) and the brightest H2 fluorescence lines (based on the expected Lya flux from TYC 2597, estimated from its Ha flux). The COS grating positions were chosen to maximize coverage of hot gas accretion lines (C III 1175, LyA 1216 (wings), Si IV 1402, C IV 1548, He II 1640) and warm molecular disk (H2 Lyman-Werner electronic emission (1160 - 1620 Angstroms).

HST/STIS exposure times were calculated by assuming a SN = 20 at 2000 Angstroms, the lowest flux region in TYC 2597's NUV spectrum. We require high SN across the NUV-optical bandpass to accurately model the accretion shock continuum and mass accretion rates. The STIS NUV observations (1800 - 3000 Angstroms) provides simultaneous access to the peak accretion shock continuum emission through where the star's photospheric continuum begins to dominate the continuum emission.

Exposure times were estimated for each instrument using a normalized UV spectrum of a pre-main sequence star (RECX-11) and re-scaling the spectrum to TYC 2597's FUV magnitude (20.5 AB). TYC 2597 has a distance of 1.93 kpc (GaiaDR2), an effective temperature of T = 5850 K, and an observed radial velocity ~8.7 km/s. TYC 2597 is at a high galactic latitude (+39.4 degrees above the galactic plane). IRSA extinction maps show E(B-V) = 0.04 +/- 0.02 for a 3' radius around TYC, strongly suggesting that absorption by interstellar dust and hydrogen will not play a significant role in attenuating our FUV observations (A(V) ~ 0.13, assuming R(V) = 3.1).

Visit

Proposal 18092, STIS NUV G230L (01), implementation Thu Jan 29 21:00:20 GMT 2026

Diagnostic Status: No Diagnostics

Scientific Instruments: STIS/NUV-MAMA, STIS/CCD

Special Requirements: (none)

Comments: Orbit 1 (out of 1)

Fixed Targets

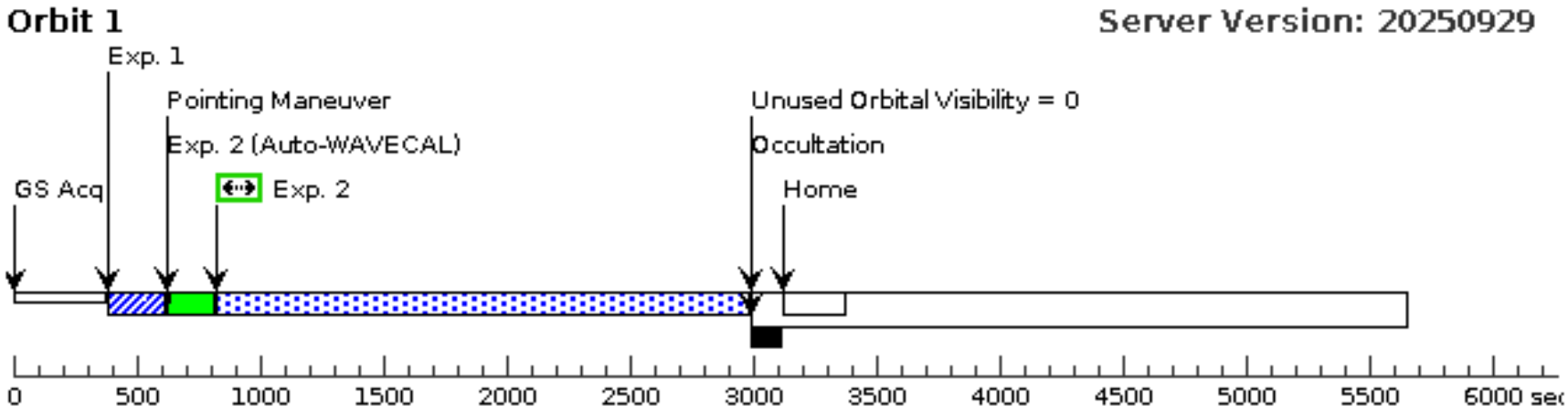
#	Name	Target Coordinates	Targ. Coord. Corrections	Fluxes	Miscellaneous
(1)	TYC25977351	RA: 16 48 37.4122 (252.1558842d) Dec: +35 12 9.44 (35.20262d) Equinox: J2000	Proper Motion RA: -2.854 mas/yr Proper Motion Dec: 2.012 mas/yr Epoch of Position: 2000	V=11.13 20.5 (FUV), 15.4 (NUV), 11.71 (B), 10.95 (G), 9.98 (J)	Reference Frame: ICRS

Comments:
Category=STAR
Description=[ACCRETION DISK, CIRCUMSTELLAR MATTER, F0-F2, F3-F9, WIND]
Extended=NO

Exposures

#	Label (ETC Run)	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time (Total)/[Actual Dur.]	Orbit
1	Orbit 1: Target ACQ (STIS.ta.2026227)	(1) TYC25977351	STIS/CCD, ACQ, F28X50LP	MIRROR				0.1 Secs (0.1 Secs) *[==>]*	 ***[1]***
2	Orbit 1: NUV spectrum (STIS.sp.2026225)	(1) TYC25977351	STIS/NUV-MAMA, ACCUM, 52X0.2	G230L 2376 A				2143 Secs (2143 Secs) *[==>]*	 ***[1]***

Orbit Structure



Visit

Proposal 18092, COS FUV G130M Visit 1 (02), implementation Thu Jan 29 21:00:20 GMT 2026

Diagnostic Status: Warning

Scientific Instruments: COS/FUV, COS/NUV

Special Requirements: (none)

Comments: Orbits 1 - 3 (out of 5)

Diagnostics

(COS FUV G130M Visit 1 (02)) Warning (Orbit Planner): INEFFICIENT ORDERING OF FP-POS POSITIONS

Fixed Targets

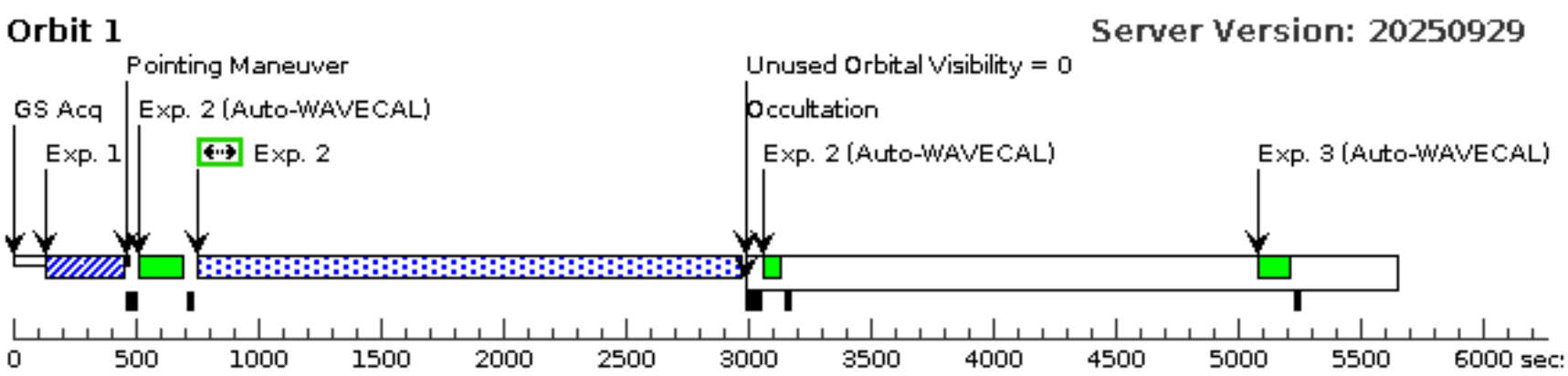
#	Name	Target Coordinates	Targ. Coord. Corrections	Fluxes	Miscellaneous
(1)	TYC25977351	RA: 16 48 37.4122 (252.1558842d) Dec: +35 12 9.44 (35.20262d) Equinox: J2000	Proper Motion RA: -2.854 mas/yr Proper Motion Dec: 2.012 mas/yr Epoch of Position: 2000	V=11.13 20.5 (FUV), 15.4 (NUV), 11.71 (B), 10.95 (G), 9.98 (J)	Reference Frame: ICRS

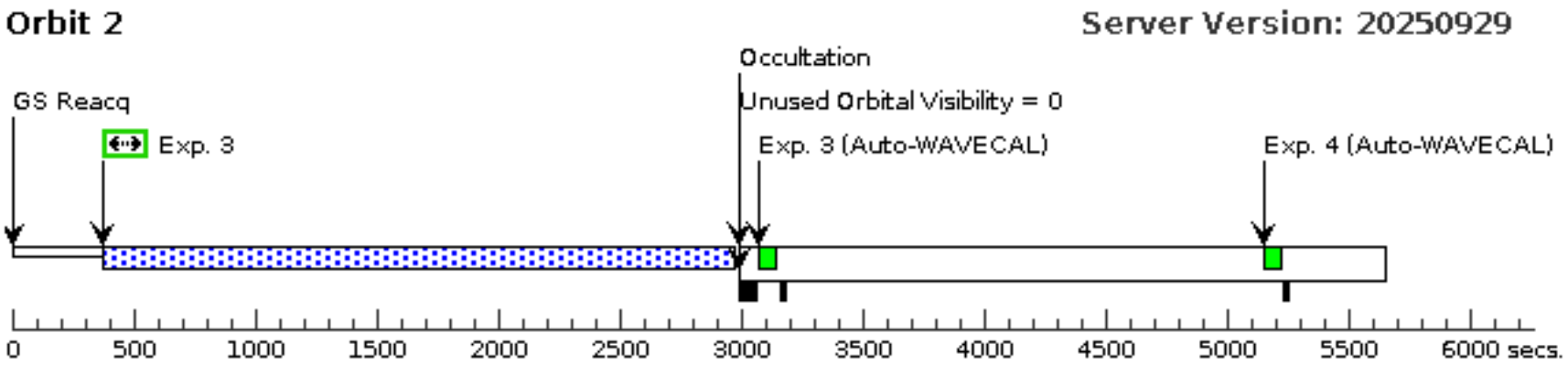
Comments:
Category=STAR
Description=[ACCRETION DISK, CIRCUMSTELLAR MATTER, F0-F2, F3-F9, WIND]
Extended=NO

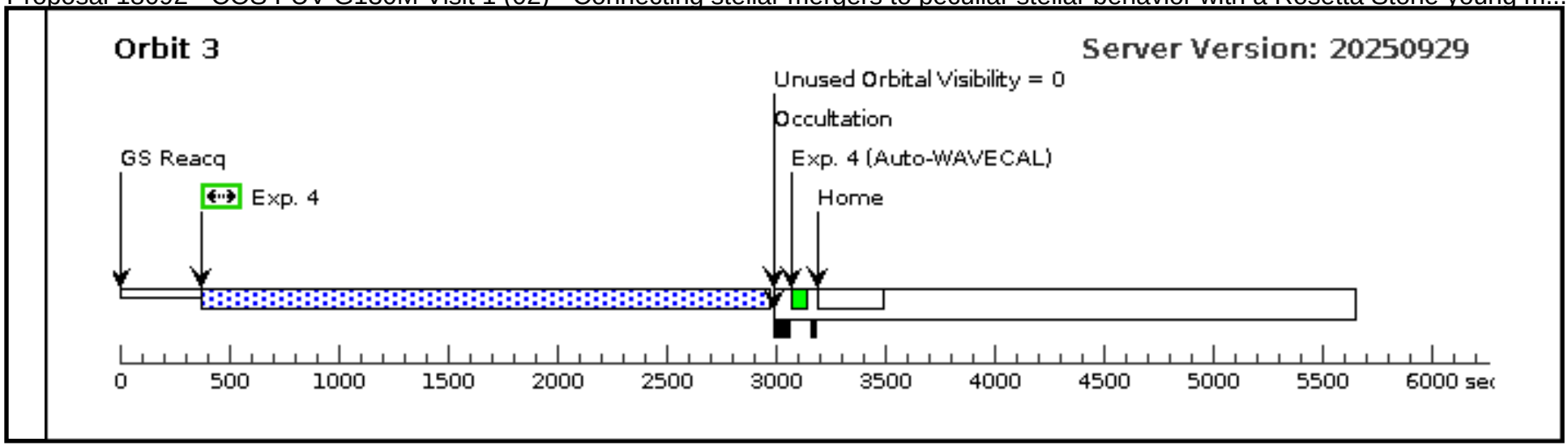
Exposures

#	Label (ETC Run)	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time (Total)/[Actual Dur.]	Orbit
1	Orbit 1: Target ACQ (COS.ta.2026231)	(1) TYC25977351	COS/NUV, ACQ/IMAGE, PSA	MIRRORB				5 Secs (5 Secs) *[==>]*	***[1]***
2	Orbit 1: FUV spectrum (G130) (COS.sp.2026236)	(1) TYC25977351	COS/FUV, TIME-TAG, PSA	G130M 1291 A	BUFFER-TIME=4160; FP-POS=4			2172 Secs (2172 Secs) *[==>]*	***[1]***
3	Orbit 2: FUV spectrum (G130) (COS.sp.2026236)	(1) TYC25977351	COS/FUV, TIME-TAG, PSA	G130M 1291 A	BUFFER-TIME=4160; FP-POS=3			2552 Secs (2552 Secs) *[==>]*	***[2]***
4	Orbit 3: FUV spectrum (G130) (COS.sp.2026236)	(1) TYC25977351	COS/FUV, TIME-TAG, PSA	G130M 1291 A	BUFFER-TIME=4160; FP-POS=4			2552 Secs (2552 Secs) *[==>]*	***[3]***

Orbit Structure



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4000
4500
5000
5500
6000 sec

Visit

Proposal 18092, COS FUV G130M Visit 2 (03), implementation Thu Jan 29 21:00:20 GMT 2026

Diagnostic Status: No Diagnostics

Scientific Instruments: COS/FUV, COS/NUV

Special Requirements: (none)

Comments: Orbits 4 - 5 (out of 5)

Fixed Targets

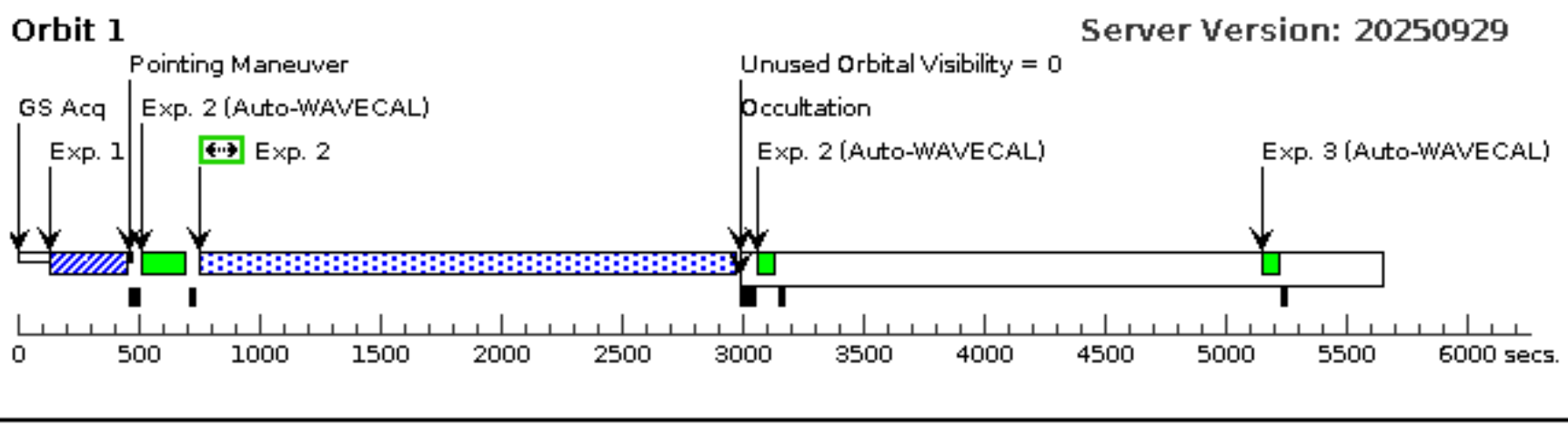
#	Name	Target Coordinates	Targ. Coord. Corrections	Fluxes	Miscellaneous
(1)	TYC25977351	RA: 16 48 37.4122 (252.1558842d) Dec: +35 12 9.44 (35.20262d) Equinox: J2000	Proper Motion RA: -2.854 mas/yr Proper Motion Dec: 2.012 mas/yr Epoch of Position: 2000	V=11.13 20.5 (FUV), 15.4 (NUV), 11.71 (B), 10.95 (G), 9.98 (J)	Reference Frame: ICRS

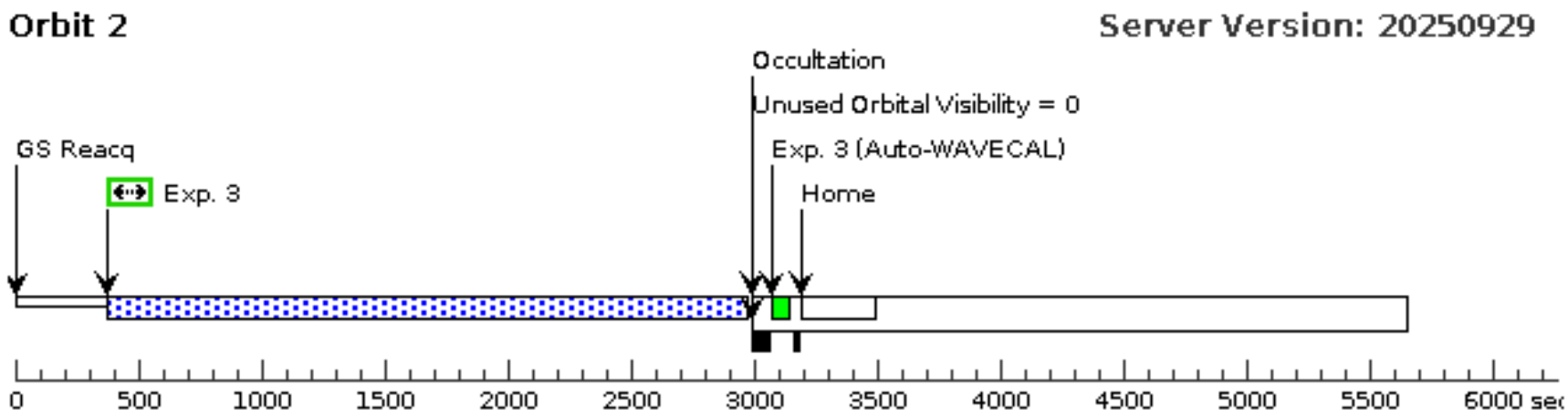
Comments:
Category=STAR
Description=[ACCRETION DISK, CIRCUMSTELLAR MATTER, F0-F2, F3-F9, WIND]
Extended=NO

Exposures

#	Label (ETC Run)	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time (Total)/[Actual Dur.]	Orbit
1	Orbit 1: Target ACQ (COS.ta.2026231)	(1) TYC25977351	COS/NUV, ACQ/IMAGE, PSA	MIRRORB				5 Secs (5 Secs) *[==>]*	*[1]*
2	Orbit 1: FUV spectrum (G130) (COS.sp.2026236)	(1) TYC25977351	COS/FUV, TIME-TAG, PSA	G130M 1291 A	BUFFER-TIME=4160; FP-POS=3			2172 Secs (2172 Secs) *[==>]*	*[1]*
3	Orbit 2: FUV spectrum (G130) (COS.sp.2026236)	(1) TYC25977351	COS/FUV, TIME-TAG, PSA	G130M 1291 A	BUFFER-TIME=4160; FP-POS=4			2552 Secs (2552 Secs) *[==>]*	*[2]*

Orbit Structure





Visit

Proposal 18092, COS FUV G160M Visit 1 (04), implementation Thu Jan 29 21:00:20 GMT 2026

Diagnostic Status: Warning

Scientific Instruments: COS/FUV, COS/NUV

Special Requirements: (none)

Comments: Orbits 1 - 2 (out of 8)

Diagnostics

(COS FUV G160M Visit 1 (04)) 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

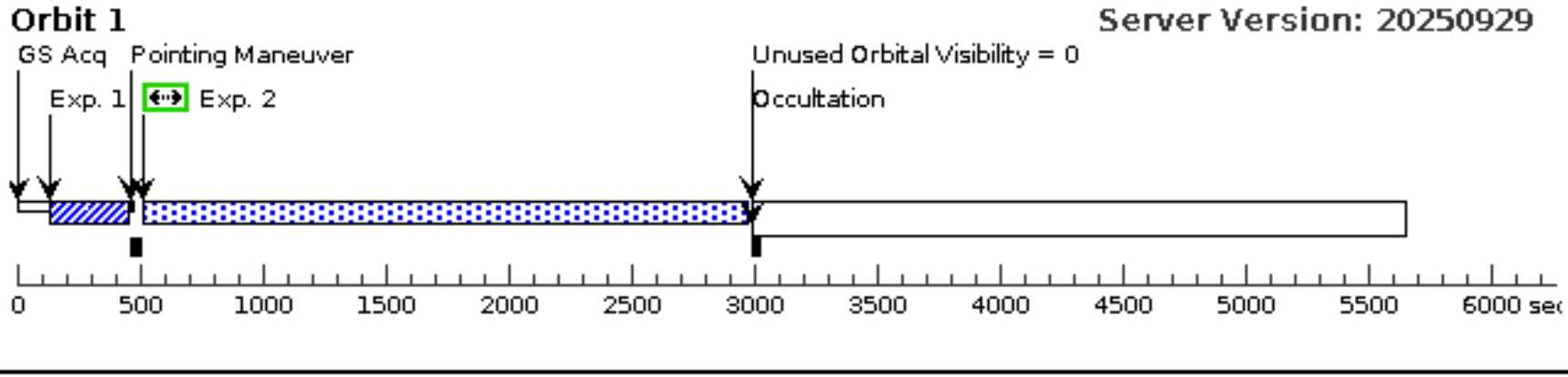
#	Name	Target Coordinates	Targ. Coord. Corrections	Fluxes	Miscellaneous
(1)	TYC25977351	RA: 16 48 37.4122 (252.1558842d) Dec: +35 12 9.44 (35.20262d) Equinox: J2000	Proper Motion RA: -2.854 mas/yr Proper Motion Dec: 2.012 mas/yr Epoch of Position: 2000	V=11.13 20.5 (FUV), 15.4 (NUV), 11.71 (B), 10.95 (G), 9.98 (J)	Reference Frame: ICRS

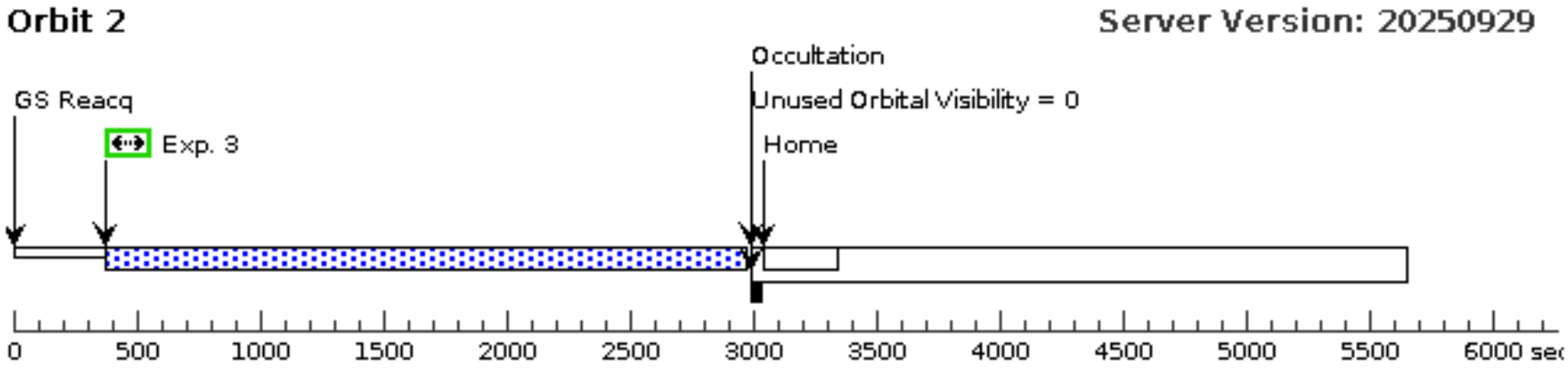
Comments:
Category=STAR
Description=[ACCRETION DISK, CIRCUMSTELLAR MATTER, F0-F2, F3-F9, WIND]
Extended=NO

Exposures

#	Label (ETC Run)	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time (Total)/[Actual Dur.]	Orbit
1	Orbit 1: Target ACQ (COS.ta.2026231)	(1) TYC25977351	COS/NUV, ACQ/IMAGE, PSA	MIRRORB				5 Secs (5 Secs) *[==>]*	***[1]***
2	Orbit 1: FUV spectrum (G160) (COS.sp.2026238)	(1) TYC25977351	COS/FUV, TIME-TAG, PSA	G160M 1577 A	BUFFER-TIME=10300; FP-POS=1			2243 Secs (2243 Secs) *[==>]*	***[1]***
3	Orbit 2: FUV spectrum (G160) (COS.sp.2026238)	(1) TYC25977351	COS/FUV, TIME-TAG, PSA	G160M 1577 A	BUFFER-TIME=10300; FP-POS=2			2548 Secs (2548 Secs) *[==>]*	***[2]***

Orbit Structure





Visit

Proposal 18092, COS FUV G160M Visit 2 (05), implementation Thu Jan 29 21:00:20 GMT 2026

Diagnostic Status: Warning

Scientific Instruments: COS/FUV, COS/NUV

Special Requirements: (none)

Comments: Orbits 3 - 5 (out of 8)

Diagnostics

(COS FUV G160M Visit 2 (05)) 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

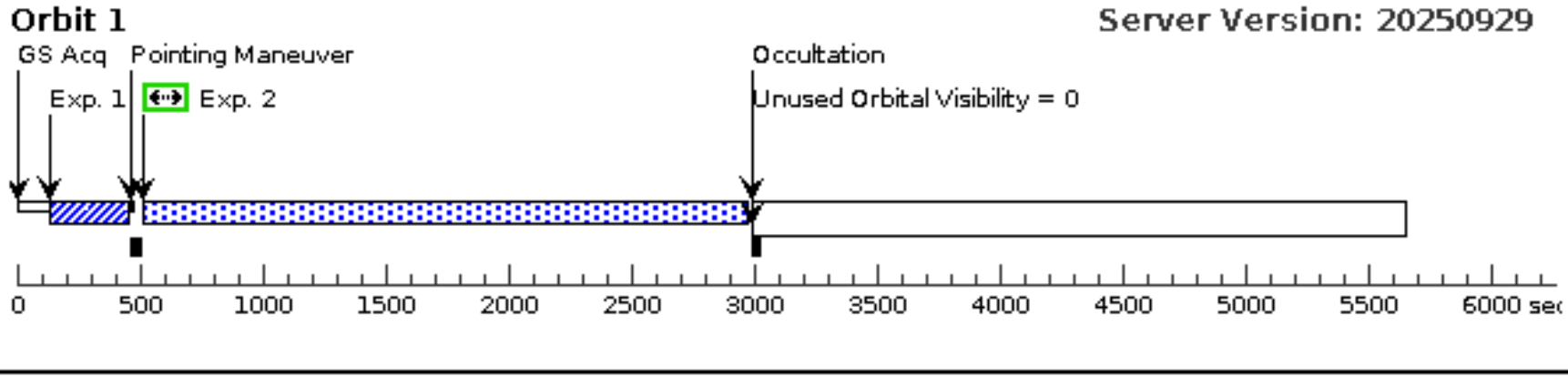
#	Name	Target Coordinates	Targ. Coord. Corrections	Fluxes	Miscellaneous
(1)	TYC25977351	RA: 16 48 37.4122 (252.1558842d) Dec: +35 12 9.44 (35.20262d) Equinox: J2000	Proper Motion RA: -2.854 mas/yr Proper Motion Dec: 2.012 mas/yr Epoch of Position: 2000	V=11.13 20.5 (FUV), 15.4 (NUV), 11.71 (B), 10.95 (G), 9.98 (J)	Reference Frame: ICRS

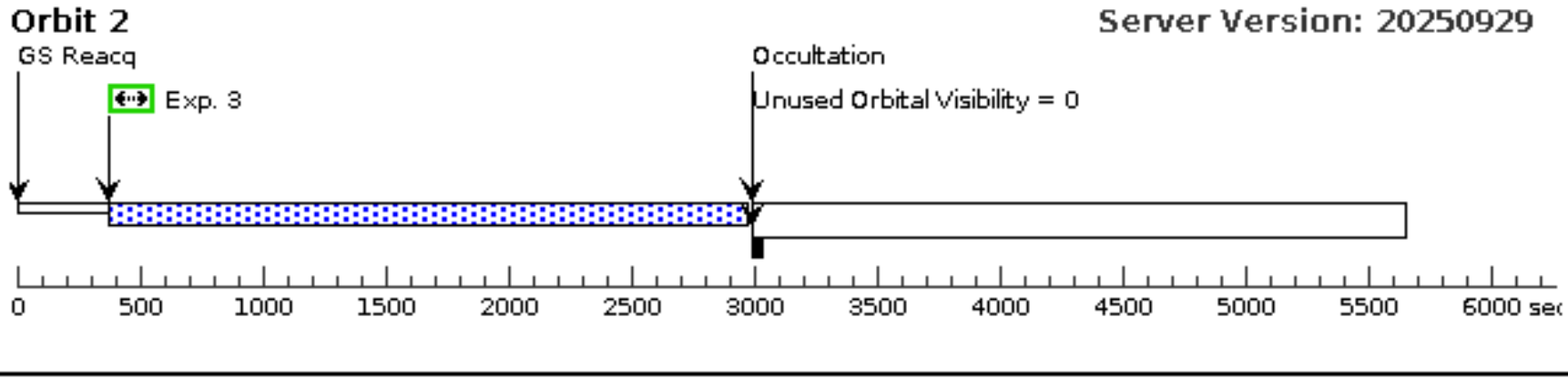
Comments:
Category=STAR
Description=[ACCRETION DISK, CIRCUMSTELLAR MATTER, F0-F2, F3-F9, WIND]
Extended=NO

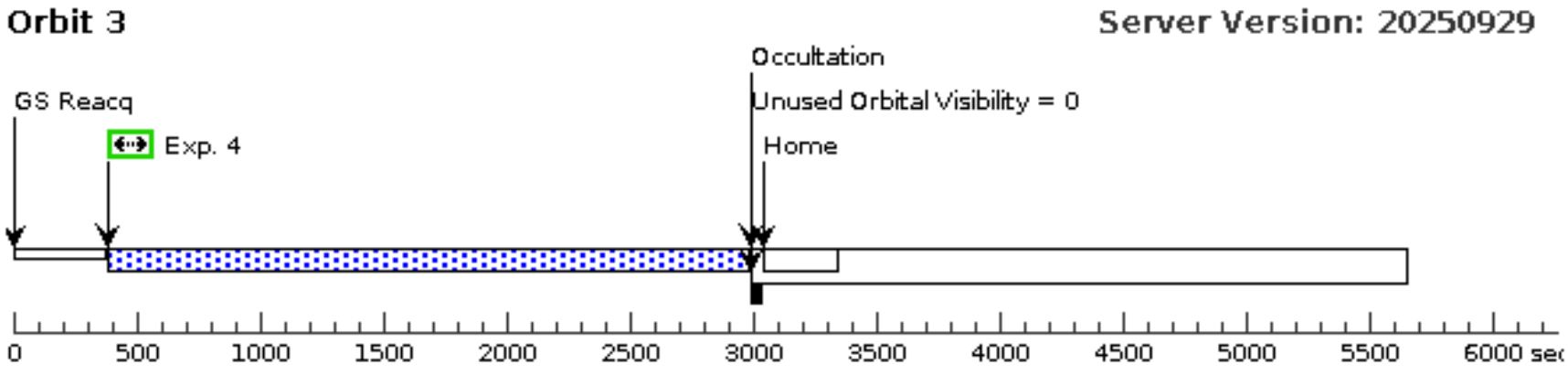
Exposures

#	Label (ETC Run)	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time (Total)/[Actual Dur.]	Orbit
1	Orbit 1: Target ACQ (COS.ta.2026231)	(1) TYC25977351	COS/NUV, ACQ/IMAGE, PSA	MIRRORB				5 Secs (5 Secs) *[==>]*	***[1]***
2	Orbit 1: FUV spectrum (G160) (COS.sp.2026238)	(1) TYC25977351	COS/FUV, TIME-TAG, PSA	G160M 1577 A	BUFFER-TIME=10300; FP-POS=3			2243 Secs (2243 Secs) *[==>]*	***[1]***
3	Orbit 2: FUV spectrum (G160) (COS.sp.2026238)	(1) TYC25977351	COS/FUV, TIME-TAG, PSA	G160M 1577 A	BUFFER-TIME=10300; FP-POS=4			2548 Secs (2548 Secs) *[==>]*	***[2]***
4	Orbit 3: FUV spectrum (G160) (COS.sp.2026238)	(1) TYC25977351	COS/FUV, TIME-TAG, PSA	G160M 1577 A	BUFFER-TIME=10300; FP-POS=4			2548 Secs (2548 Secs) *[==>]*	***[3]***

Orbit Structure







Visit

Proposal 18092, COS FUV G160M Visit 3 (06), implementation Thu Jan 29 21:00:20 GMT 2026

Diagnostic Status: Warning

Scientific Instruments: COS/FUV, COS/NUV

Special Requirements: (none)

Comments: Orbits 6 - 8 (out of 8)

Diagnostics

(COS FUV G160M Visit 3 (06)) 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)	TYC25977351	RA: 16 48 37.4122 (252.1558842d) Dec: +35 12 9.44 (35.20262d) Equinox: J2000	Proper Motion RA: -2.854 mas/yr Proper Motion Dec: 2.012 mas/yr Epoch of Position: 2000	V=11.13 20.5 (FUV), 15.4 (NUV), 11.71 (B), 10.95 (G), 9.98 (J)	Reference Frame: ICRS

Comments:
Category=STAR
Description=[ACCRETION DISK, CIRCUMSTELLAR MATTER, F0-F2, F3-F9, WIND]
Extended=NO

Exposures

#	Label (ETC Run)	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time (Total)/[Actual Dur.]	Orbit
1	Orbit 1: Target ACQ (COS.ta.2026231)	(1) TYC25977351	COS/NUV, ACQ/IMAGE, PSA	MIRRORB				5 Secs (5 Secs) *[==>]*	***[1]***
2	Orbit 1: FUV spectrum (G160) (COS.sp.2026238)	(1) TYC25977351	COS/FUV, TIME-TAG, PSA	G160M 1577 A	BUFFER-TIME=10300; FP-POS=1			2243 Secs (2243 Secs) *[==>]*	***[1]***
3	Orbit 2: FUV spectrum (G160) (COS.sp.2026238)	(1) TYC25977351	COS/FUV, TIME-TAG, PSA	G160M 1577 A	BUFFER-TIME=10300; FP-POS=2			2548 Secs (2548 Secs) *[==>]*	***[2]***
4	Orbit 3: FUV spectrum (G160) (COS.sp.2026238)	(1) TYC25977351	COS/FUV, TIME-TAG, PSA	G160M 1577 A	BUFFER-TIME=10300; FP-POS=3			2548 Secs (2548 Secs) *[==>]*	***[3]***

Orbit Structure