18115 - HD 96670: A pilot study to characterise low luminosity stripped stars around bright O stars

Cycle: 33, Proposal Category: GO

(Availability Mode: SUPPORTED)

INVESTIGATORS

Name	*Institution*
Dr. Koushik Sen (PI) (Contact)	**University of Arizona**
Dr. Yael Naze (CoI) (ESA Member) (CoPI)	Universite de Liege
Dr. Nikolay Britavskiy (CoI) (ESA Member)	Universite de Liege
Prof. Gregor Rauw (CoI) (ESA Member)	Universite de Liege
Prof. Mathieu Renzo (CoI) (AdminUSPI)	University of Arizona

VISITS

Visit	*Targets used in Visit*	*Configurations used in Visit*	*Orbits Used*	*Last Orbit Planner Run*	*OP Current with Visit?*
01	(1) HD-96670	STIS/CCD STIS/FUV-MAMA	3	20-May-2026 14:00:14.0	yes
03	(1) HD-96670	STIS/CCD STIS/FUV-MAMA	3	20-May-2026 14:00:15.0	yes
02	(1) HD-96670	STIS/CCD STIS/FUV-MAMA	3	20-May-2026 14:00:15.0	yes

9 Total Orbits Used

ABSTRACT

Massive stars stripped of their hydrogen-rich envelopes are one of the most common products of binary interaction. They are the progenitors of stripped-envelope supernovae and binary compact object mergers. Uncertain assumptions in binary mass transfer, including the efficiency of mass and angular momentum transfer, affect our understanding of stripped-envelope supernovae and gravitational wave merger progenitors. Without empirical constraints from stripped stars, parameter-space degeneracies are likely to persist despite the anticipated growth in data in the coming decade. Observationally, only a few stripped stars have been detected because the light from their much brighter B- or O-star companions dominates the spectral signature. Recent simulations indicate that high-quality FUV spectra from HST/STIS are ideal for identifying low-luminosity stripped stars with O-star companions. We propose a pilot study requiring only six orbits to characterise the first discovered stripped star+O star binary, HD 96670, in the Milky Way. We will cross-correlate model spectra of stripped stars with the observed spectrum to derive the radial velocities of the stripped star. Combined with the O-star radial velocity curve from the literature, we will provide the first dynamical mass estimate for a stripped star+O star binary. This project will pave the way for more extensive programs to identify populations of stripped star+O star binaries with luminosity contrasts down to 1%. We demonstrate how our analysis of HD 96670 will serve as a cornerstone for providing robust empirical constraints on mass and angular momentum transfer efficiency in massive binary evolution.

OBSERVING DESCRIPTION

We request 2 epochs of high-resolution R ~ 45800 spectra (using the FUV-MAMA detector and the E140M echelle grating) of HD96670 (1144 - 1710 Angstrom) at a signal-to-noise ratio SNR ~ 120 at 1425 Angstrom (global SNR ~ 170 for 2 epochs). For the E140M grating with a 0.2 x 0.06 aperture, a Pickles O9 star spectrum with V = 7.43 and E(B - V) = 0.483 (Gomez et al. 2021), the exposure time required to reach an SNR of 120 at 1425 Angstrom is ~ 5208 s or ~ 87 min, accounting for the minimum buffer time of 99 s (count rate > 20000/s). The target visibility is 52 min per orbit (APT). The total overhead is calculated as the sum of the initial acquisition overhead (6 min) + target acquisition overhead (6 min) + first scientific exposure in MAMA (8 min) ~ 20 min. This allows for 52-20 ~ 32 mins of science exposure time per orbit. As such, 88/32 ~ 3 orbits are required per epoch to reach SNR ~ 120.

Visit

Proposal 18115, Epoch 1 (01), failed Wed May 20 18:00:16 GMT 2026

Diagnostic Status: No Diagnostics

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

Special Requirements: Period 5.28387625 D AND ZERO-PHASE HJD2460064.890

Fixed Targets

#	Name	Target Coordinates	Targ. Coord. Corrections	Fluxes	Miscellaneous
(1)	HD-96670	RA: 11 07 13.9343 (166.8080596d) Dec: -59 52 23.18 (-59.87311d) Equinox: J2000	Proper Motion RA: -6.748 mas/yr Proper Motion Dec: 1.693 mas/yr Parallax: 3.11E-4" Epoch of Position: 2000 Radial Velocity: -9.00 km/sec	V=7.43 U 6.86, B 7.60, R 8.38, G 7.35, J 7.056, H 7.07, K 7.00	Reference Frame: ICRS

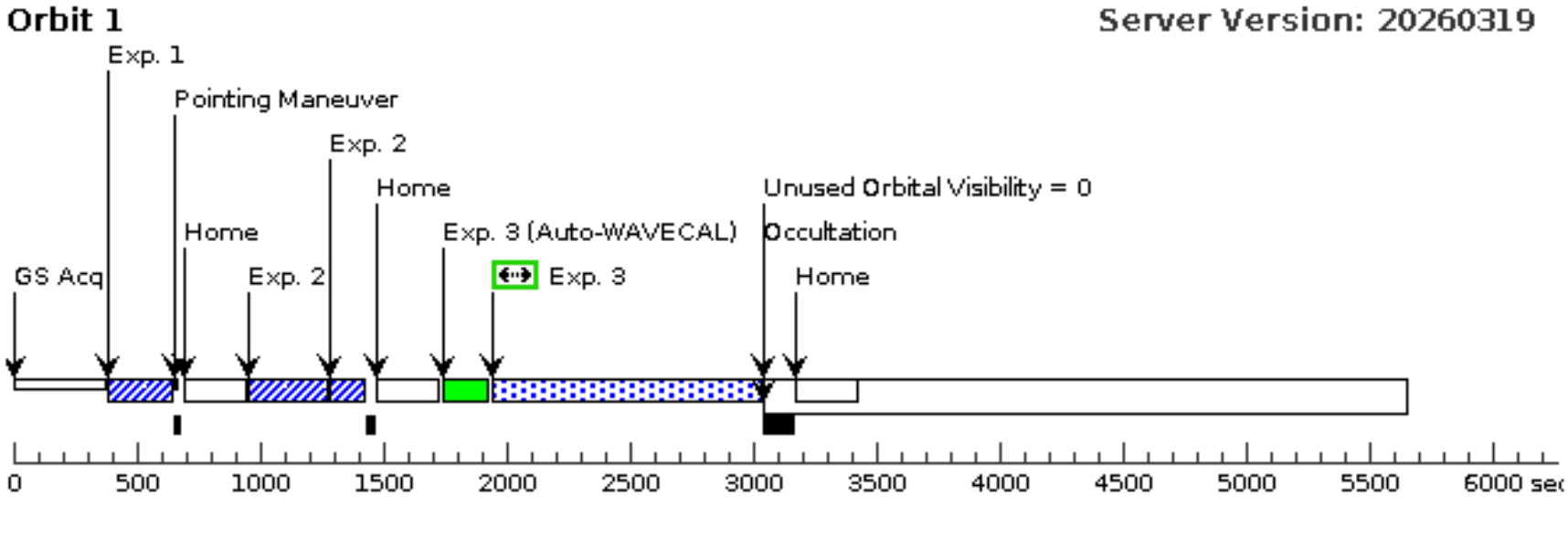
Comments: This object was generated by the targetselector and retrieved from the SIMBAD database.

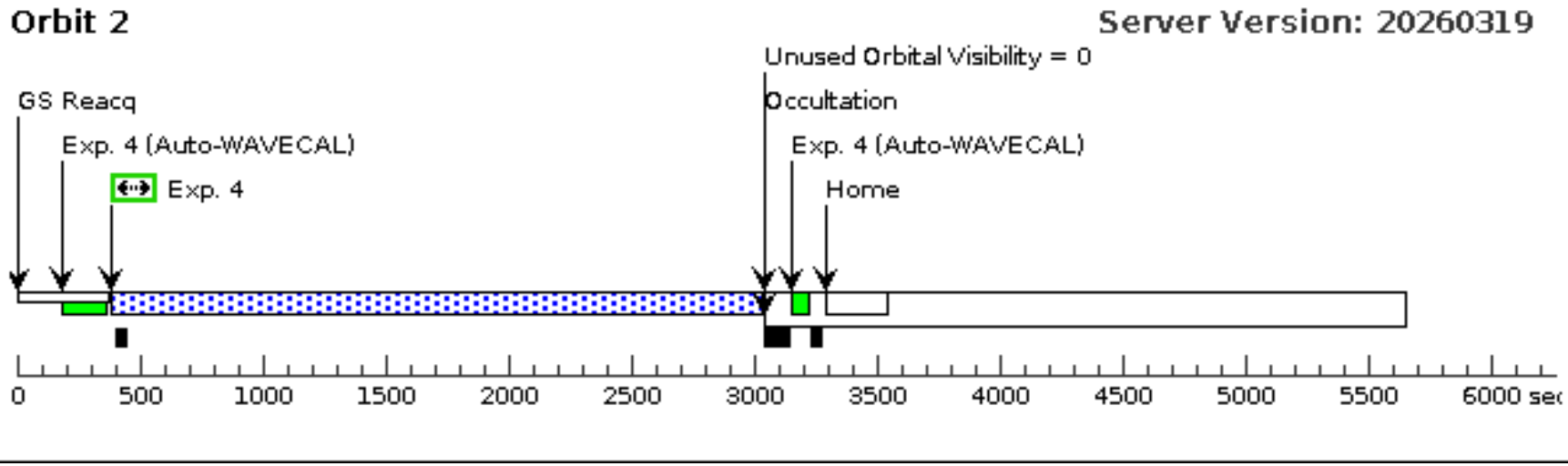
SIMBAD listed proper motion for this target. When retrieving targets with PM from SIMBAD, APT requests the coordinates be calculated with an epoch of the year 2000. Do not modify this epoch. Always review coordinates using the Target Confirmation tool, which graphically displays the PM.
Category=STAR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

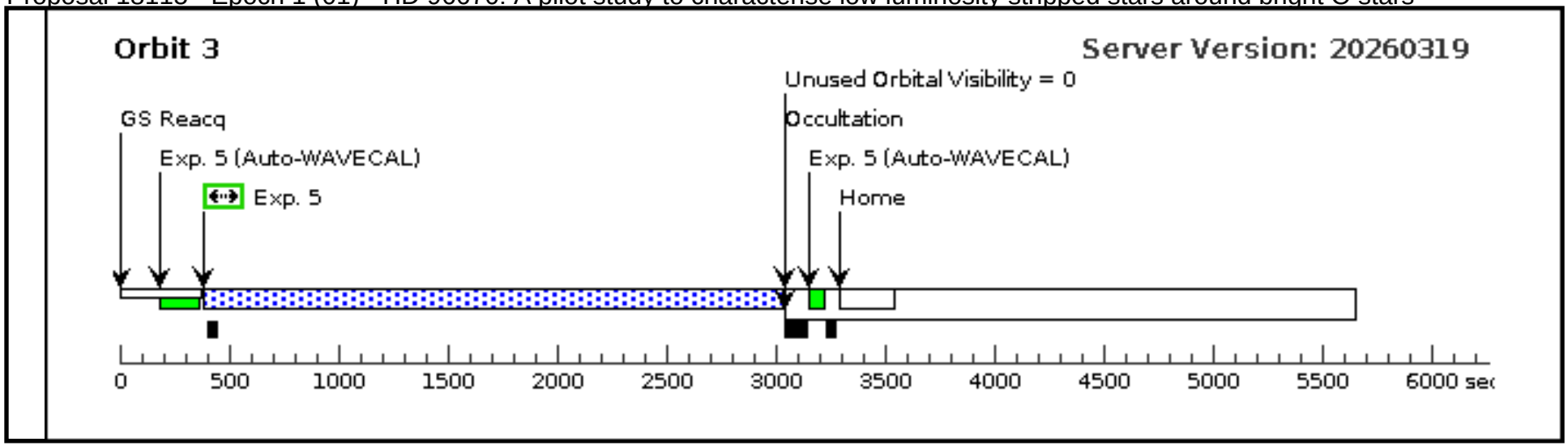
Exposures

#	Label (ETC Run)	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time (Total)/[Actual Dur.]	Orbit
1	Target ACQ (STIS.ta.2022924)	(1) HD-96670	STIS/CCD, ACQ, F28X50OII	MIRROR		PHASE 0.15 TO 0.35		1 Secs (1 Secs) *[==>]*	*[1]*
2	Target ACQ /PEAK (STIS.sp.2022941)	(1) HD-96670	STIS/CCD, ACQ/PEAK, 0.2X0.06	G430L 4300 A		PHASE 0.15 TO 0.35		1 Secs (1 Secs) *[==>]*	*[1]*
3	SC EXP 1 (2022589)	(1) HD-96670	STIS/FUV-MAMA, ACCUM, 0.2X0.06	E140M 1425 A		PHASE 0.15 TO 0.35		1074 Secs (1074 Secs) *[==>]*	*[1]*
4	SC EXP 2 (2022589)	(1) HD-96670	STIS/FUV-MAMA, ACCUM, 0.2X0.06	E140M 1425 A		PHASE 0.15 TO 0.35		2634 Secs (2634 Secs) *[==>]*	*[2]*
5	SC EXP 3 (2022589)	(1) HD-96670	STIS/FUV-MAMA, ACCUM, 0.2X0.06	E140M 1425 A		PHASE 0.15 TO 0.35		2634 Secs (2634 Secs) *[==>]*	*[3]*

Orbit Structure






Orbit 3
Server Version: 20260319
Unused Orbital Visibility = 0
GS Reacq
Occultation
Exp. 5 (Auto-WAVECAL)
Exp. 5 (Auto-WAVECAL)
Exp. 5
Home
0
500
1000
1500
2000
2500
3000
3500
4000
4500
5000
5500
6000 sec

Visit

Proposal 18115, Epoch 1 repeat of visit 01 (03), implementation Wed May 20 18:00:16 GMT 2026

Diagnostic Status: No Diagnostics

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

Special Requirements: Period 5.28387625 D AND ZERO-PHASE HJD2460064.890

Fixed Targets

#	Name	Target Coordinates	Targ. Coord. Corrections	Fluxes	Miscellaneous
(1)	HD-96670	RA: 11 07 13.9343 (166.8080596d) Dec: -59 52 23.18 (-59.87311d) Equinox: J2000	Proper Motion RA: -6.748 mas/yr Proper Motion Dec: 1.693 mas/yr Parallax: 3.11E-4" Epoch of Position: 2000 Radial Velocity: -9.00 km/sec	V=7.43 U 6.86, B 7.60, R 8.38, G 7.35, J 7.056, H 7.07, K 7.00	Reference Frame: ICRS

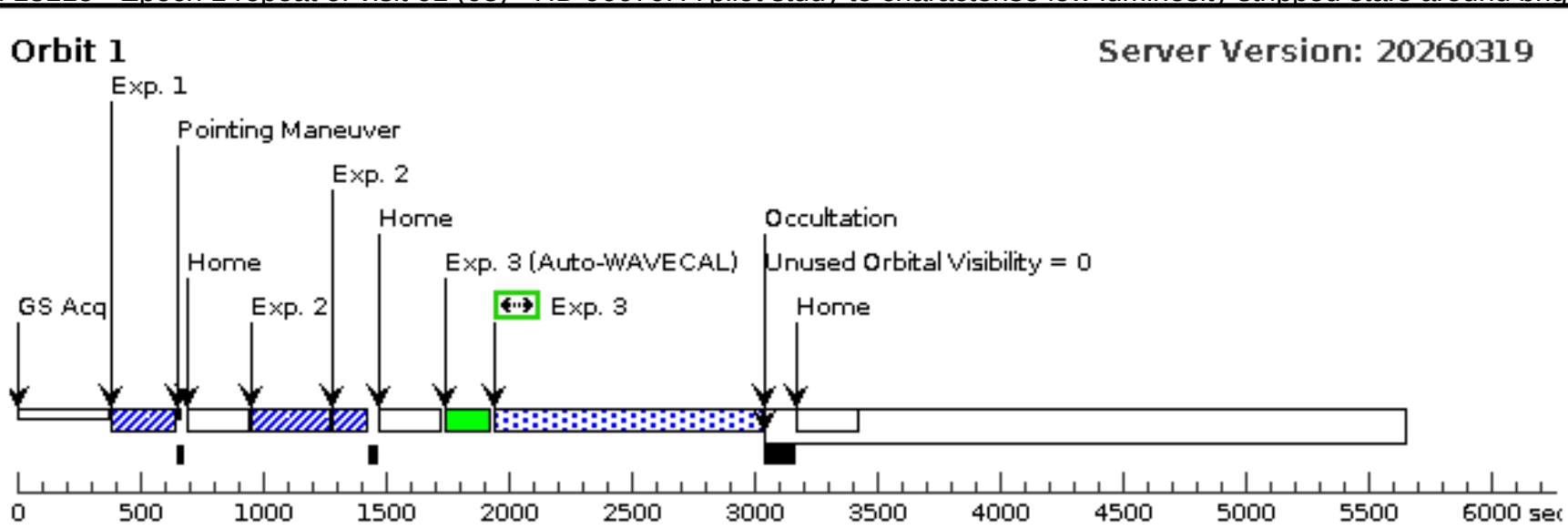
Comments: This object was generated by the targetselector and retrieved from the SIMBAD database.

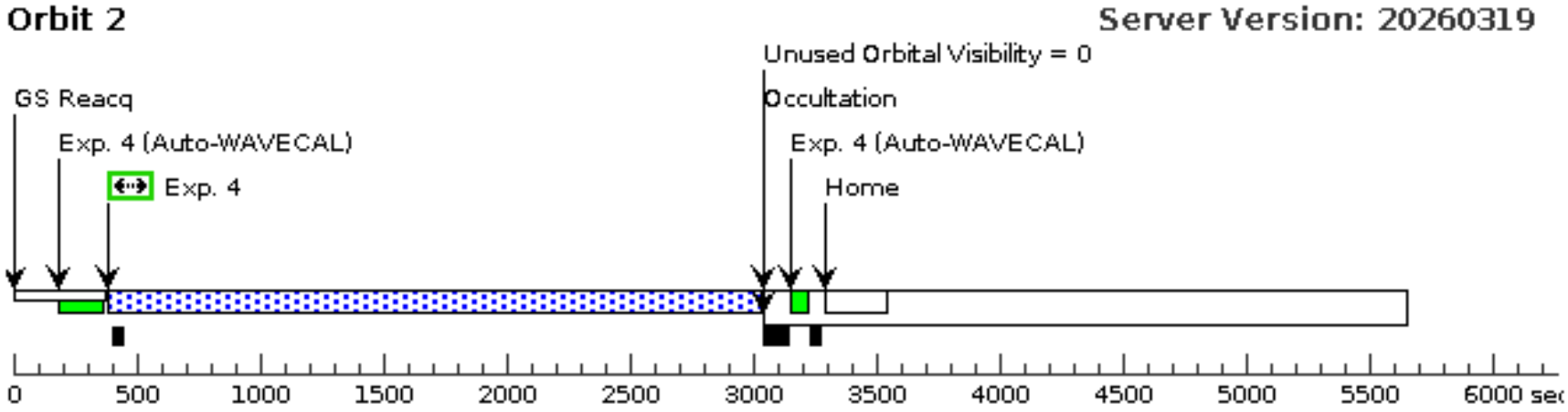
SIMBAD listed proper motion for this target. When retrieving targets with PM from SIMBAD, APT requests the coordinates be calculated with an epoch of the year 2000. Do not modify this epoch. Always review coordinates using the Target Confirmation tool, which graphically displays the PM.
Category=STAR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

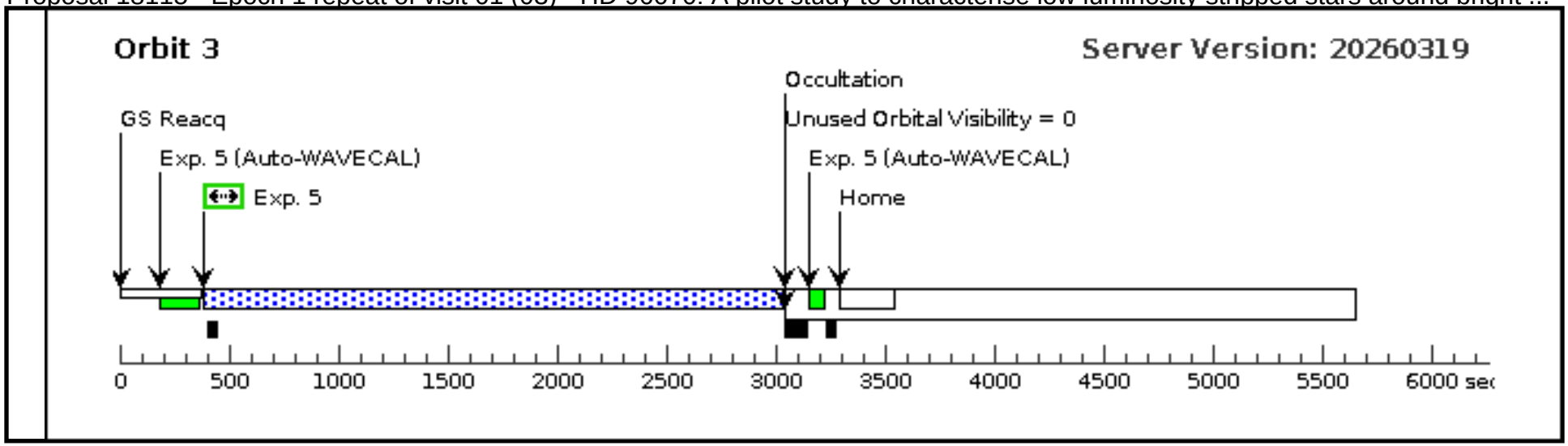
Exposures

#	Label (ETC Run)	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time (Total)/[Actual Dur.]	Orbit
1	Target ACQ (STIS.ta.2022924)	(1) HD-96670	STIS/CCD, ACQ, F28X50OII	MIRROR		PHASE 0.15 TO 0.35		1 Secs (1 Secs) *[==>]*	***[1]***
2	Target ACQ /PEAK (STIS.sp.2022941)	(1) HD-96670	STIS/CCD, ACQ/PEAK, 0.2X0.06	G430L 4300 A		PHASE 0.15 TO 0.35		1 Secs (1 Secs) *[==>]*	***[1]***
3	SC EXP 1 (2022589)	(1) HD-96670	STIS/FUV-MAMA, ACCUM, 0.2X0.06	E140M 1425 A		PHASE 0.15 TO 0.35		1074 Secs (1074 Secs) *[==>]*	***[1]***
4	SC EXP 2 (2022589)	(1) HD-96670	STIS/FUV-MAMA, ACCUM, 0.2X0.06	E140M 1425 A		PHASE 0.15 TO 0.35		2634 Secs (2634 Secs) *[==>]*	***[2]***
5	SC EXP 3 (2022589)	(1) HD-96670	STIS/FUV-MAMA, ACCUM, 0.2X0.06	E140M 1425 A		PHASE 0.15 TO 0.35		2634 Secs (2634 Secs) *[==>]*	***[3]***

Orbit Structure






Orbit 3
Server Version: 20260319
Occultation
GS Reacq
Unused Orbital Visibility = 0
Exp. 5 (Auto-WAVECAL)
Exp. 5 (Auto-WAVECAL)
Exp. 5
Home
0
500
1000
1500
2000
2500
3000
3500
4000
4500
5000
5500
6000 sec

Visit

Proposal 18115, Epoch 2 (02), scheduling Wed May 20 18:00:16 GMT 2026

Diagnostic Status: No Diagnostics

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

Special Requirements: Period 5.28387625 D AND ZERO-PHASE HJD2460064.890

Fixed Targets

#	Name	Target Coordinates	Targ. Coord. Corrections	Fluxes	Miscellaneous
(1)	HD-96670	RA: 11 07 13.9343 (166.8080596d) Dec: -59 52 23.18 (-59.87311d) Equinox: J2000	Proper Motion RA: -6.748 mas/yr Proper Motion Dec: 1.693 mas/yr Parallax: 3.11E-4" Epoch of Position: 2000 Radial Velocity: -9.00 km/sec	V=7.43 U 6.86, B 7.60, R 8.38, G 7.35, J 7.056, H 7.07, K 7.00	Reference Frame: ICRS

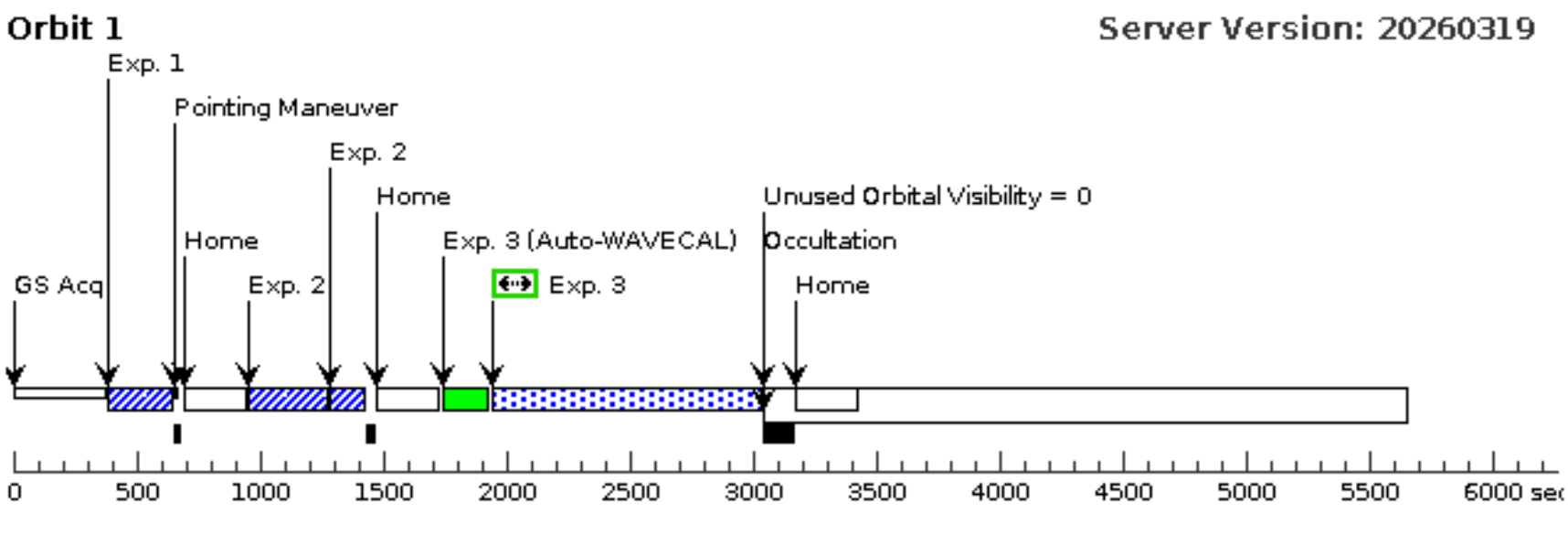
Comments: This object was generated by the targetselector and retrieved from the SIMBAD database.

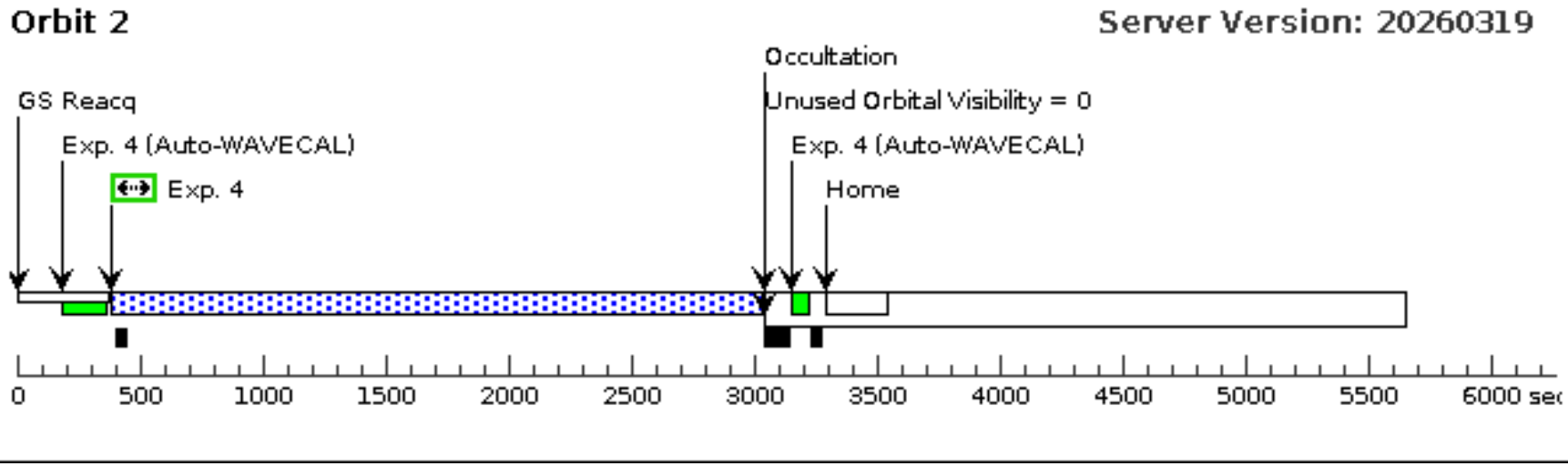
SIMBAD listed proper motion for this target. When retrieving targets with PM from SIMBAD, APT requests the coordinates be calculated with an epoch of the year 2000. Do not modify this epoch. Always review coordinates using the Target Confirmation tool, which graphically displays the PM.
Category=STAR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

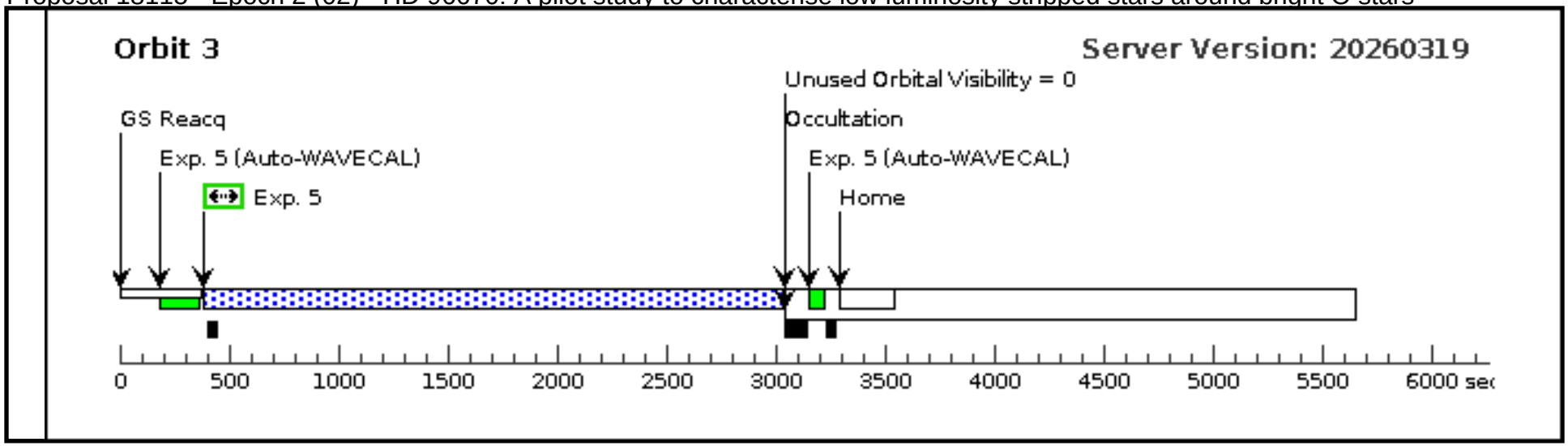
Exposures

#	Label (ETC Run)	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time (Total)/[Actual Dur.]	Orbit
1	Target ACQ (STIS.ta.2022924)	(1) HD-96670	STIS/CCD, ACQ, F28X50OII	MIRROR		PHASE 0.65 TO 0.85		1 Secs (1 Secs) *[==>]*	*[1]*
2	Target ACQ /PEAK (STIS.sp.2022941)	(1) HD-96670	STIS/CCD, ACQ/PEAK, 0.2X0.06	G430L 4300 A		PHASE 0.65 TO 0.85		1 Secs (1 Secs) *[==>]*	*[1]*
3	SC EXP 1 (2022589)	(1) HD-96670	STIS/FUV-MAMA, ACCUM, 0.2X0.06	E140M 1425 A		PHASE 0.65 TO 0.85		1074 Secs (1074 Secs) *[==>]*	*[1]*
4	SC EXP 2 (2022589)	(1) HD-96670	STIS/FUV-MAMA, ACCUM, 0.2X0.06	E140M 1425 A		PHASE 0.65 TO 0.85		2634 Secs (2634 Secs) *[==>]*	*[2]*
5	SC EXP 3 (2022589)	(1) HD-96670	STIS/FUV-MAMA, ACCUM, 0.2X0.06	E140M 1425 A		PHASE 0.65 TO 0.85		2634 Secs (2634 Secs) *[==>]*	*[3]*

Orbit Structure






Orbit 3
Server Version: 20260319
Unused Orbital Visibility = 0
GS Reacq
Occultation
Exp. 5 (Auto-WAVECAL)
Exp. 5 (Auto-WAVECAL)
Exp. 5
Home
0
500
1000
1500
2000
2500
3000
3500
4000
4500
5000
5500
6000 sec