17792 - STIS Analysis of the metal-poor r-element-rich star TYC 3814-1598-1

Cycle: 32, Proposal Category: GO

(Availability Mode: SUPPORTED)

INVESTIGATORS

Name	*Institution*
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Dr. Christopher Evans (CoI) (ESA Member) (AdminUSPI)	Space Telescope Science Institute - ESA - JWST

VISITS

Visit	*Targets used in Visit*	*Configurations used in Visit*	*Orbits Used*	*Last Orbit Planner Run*	*OP Current with Visit?*
01	(1) TYC-3814-1598-1	STIS/CCD STIS/NUV-MAMA	3	11-Mar-2025 12:00:14.0	yes
02	(1) TYC-3814-1598-1	STIS/CCD STIS/NUV-MAMA	3	11-Mar-2025 12:00:15.0	yes
03	(1) TYC-3814-1598-1	STIS/CCD STIS/NUV-MAMA	3	11-Mar-2025 12:00:15.0	yes
04	(1) TYC-3814-1598-1	STIS/CCD STIS/NUV-MAMA	3	11-Mar-2025 12:00:17.0	yes
05	(1) TYC-3814-1598-1	STIS/CCD STIS/NUV-MAMA	1	11-Mar-2025 12:00:17.0	yes

13 Total Orbits Used

ABSTRACT

The formation site of rapid neutron-capture ('r-process') elements is still uncertain. The two most accepted mechanisms are magneto-rotational MHD-jet supernovae and neutron-star mergers, with the latter channel confirmed by observations of the kilonova counterpart of the gravitational-wave event GW170817. However, predictions from the latest nucleosynthesis models argue that neutron-star mergers cannot be the main contributor to r-process enrichment, and we require further empirical constraints on the r-process abundance pattern from early nucleosynthesis in the Galaxy.

Here we propose STIS E230M echelle spectroscopy of TYC~3814-1598-1, a metal-poor ([Fe/H]~-3.0), actinide-enriched ([Eu/Fe] > 1.3) star that will provide new observational constraints on r-process enrichment. The STIS observations will provide the first abundance determinations for at least seven elements for this star, as well as much improved abundances for more than ten other heavy elements that have better diagnostics in the space ultraviolet than from optical spectroscopy. As the brightest known star of this rare class, the proposed analysis of TYC~3814-1598-1 will be a benchmark case for the abundance pattern of the so-called 'actinide boost' stars and provide much needed constraints on galactic chemical-evolution models.

OBSERVING DESCRIPTION

The spectra should be acquired with the E230M grating of the STIS echelle spectrograph and the 0.2" 0.2" slit for a resolving power R = 30,000. The E230M setting c2707 spectra provide complete high-resolution coverage of the stellar spectrum in the interval 2300 - 3111 \AA.

The observation was organized into groups of 3-orbits visits to minimize overheads allowing some scheduling flexibility. Each group is divited into 4 exposure: Orbit 1 ACQ and SCIENCE, Orbists 2 and 3, SCIENCE. To acount for the 13 orbits we also included the 5th visit that has a single orbit, Orbit 1 ACQ and SCIENCE.

The coordenates and propermotion are taken from Gaia DR3.

Visit

Proposal 17792, V1 (01), implementation Tue Mar 11 16:00:18 GMT 2025

Diagnostic Status: No Diagnostics

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

Special Requirements: PCS MODE FINE

Comments: Each visit should contain three orbits.

Fixed Targets

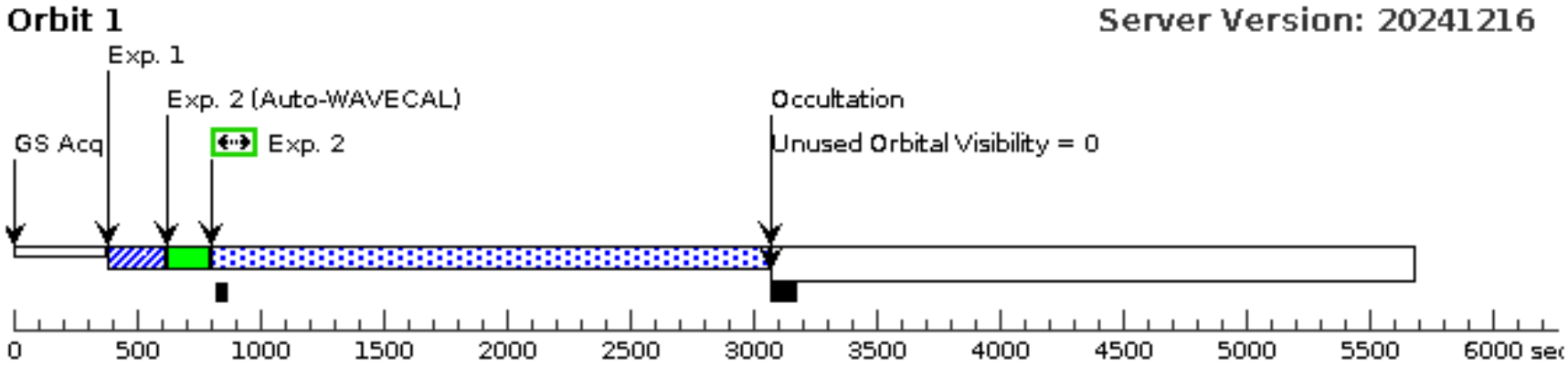
#	Name	Target Coordinates	Targ. Coord. Corrections	Fluxes	Miscellaneous
(1)	TYC-3814-1598-1 Alt Name1: GAIADR3828438619475671936 Alt Name2: 2MASSJ09544277+5246414	RA: 09 54 42.7402 (148.6780842d) Dec: +52 46 41.13 (52.77809d) Equinox: J2000	Proper Motion RA: -17.9173 mas/yr Proper Motion Dec: -26.8062 mas/yr Parallax: 0.3179" Epoch of Position: 2016	V=10.1	Reference Frame: ICRS

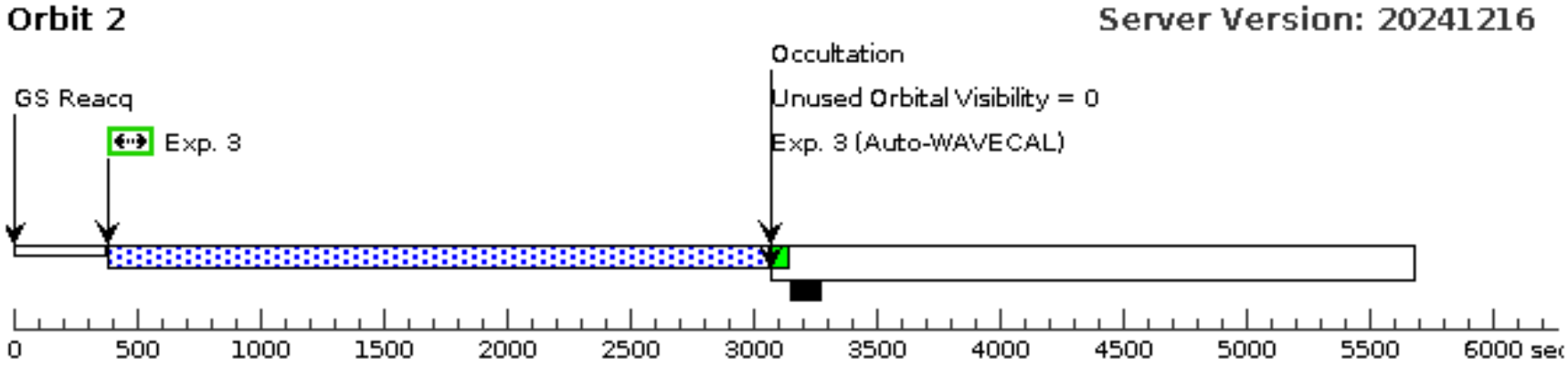
Comments: This object was generated by the targetselector and retrieved from the SIMBAD database. SIMBAD listed proper motion for this target. When retrieving targets with PM from SIMBAD, APT requests the coordinates be calculated with an epoch of the year 2000. Do not modify this epoch. Always review coordinates using the Target Confirmation tool, which graphically displays the PM.
Category=STAR
Description=[K III-I, POPULATION II]

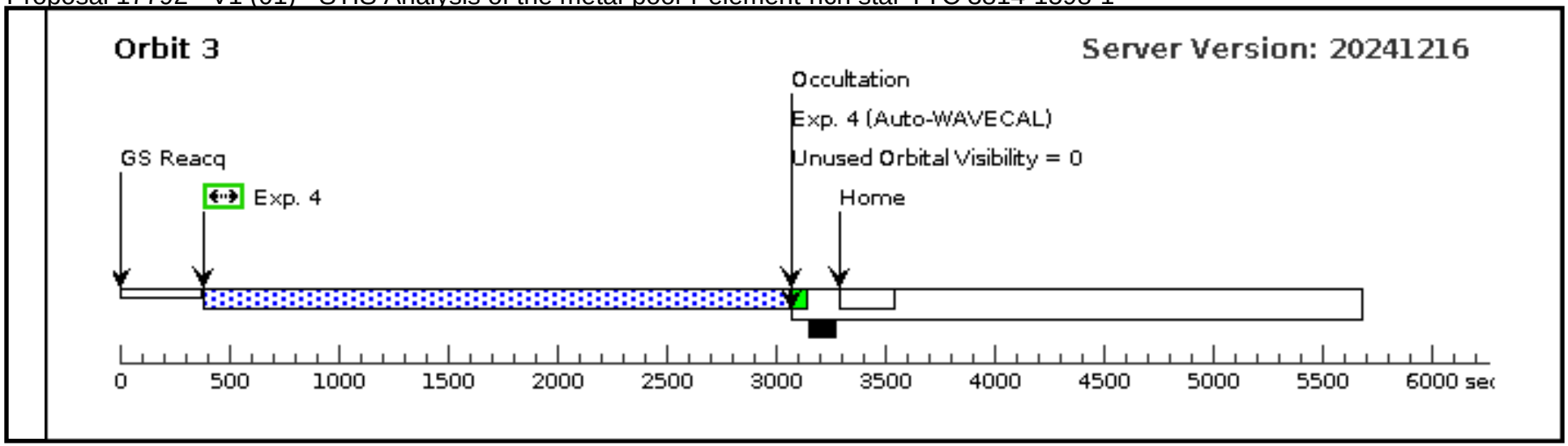
Exposures

#	Label (ETC Run)	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time (Total)/[Actual Dur.]	Orbit
1	exp0 (STIS.im.1954936)	(1) TYC-3814-1598-1	STIS/CCD, ACQ, F28X50LP	MIRROR				0.1 Secs (0.1 Secs) *[==>]*	***[1]***
2	exp1 (STIS.sp.1931798)	(1) TYC-3814-1598-1	STIS/NUV-MAMA, ACCUM, 0.2X0.2	E230M 2707 A				1801 Secs (2245 Secs) *[==>2245.0 Secs]*	***[1]***
3	exp2 (STIS.sp.1931799)	(1) TYC-3814-1598-1	STIS/NUV-MAMA, ACCUM, 0.2X0.2	E230M 2707 A				2668 Secs (2668 Secs) *[==>2668.0 Secs]*	***[2]***
4	exp3 (STIS.sp.1931799)	(1) TYC-3814-1598-1	STIS/NUV-MAMA, ACCUM, 0.2X0.2	E230M 2707 A				2668 Secs (2668 Secs) *[==>]*	***[3]***

Orbit Structure






Orbit 3
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Occultation
Exp. 4 (Auto-WAVECAL)
Unused Orbital Visibility = 0
GS Reacq
Exp. 4
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2000
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4000
4500
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5500
6000 sec

Visit

Proposal 17792, V2 (02), implementation Tue Mar 11 16:00:18 GMT 2025

Diagnostic Status: No Diagnostics

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

Special Requirements: PCS MODE FINE

Comments: Each visit should contain three orbits.

Fixed Targets

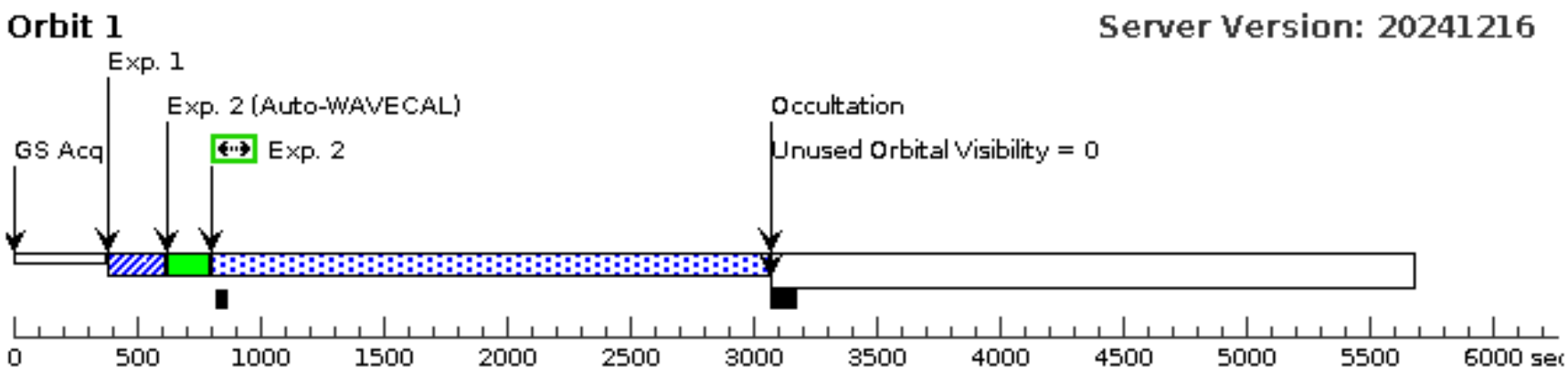
#	Name	Target Coordinates	Targ. Coord. Corrections	Fluxes	Miscellaneous
(1)	TYC-3814-1598-1 Alt Name1: GAIADR3828438619475671936 Alt Name2: 2MASSJ09544277+5246414	RA: 09 54 42.7402 (148.6780842d) Dec: +52 46 41.13 (52.77809d) Equinox: J2000	Proper Motion RA: -17.9173 mas/yr Proper Motion Dec: -26.8062 mas/yr Parallax: 0.3179" Epoch of Position: 2016	V=10.1	Reference Frame: ICRS

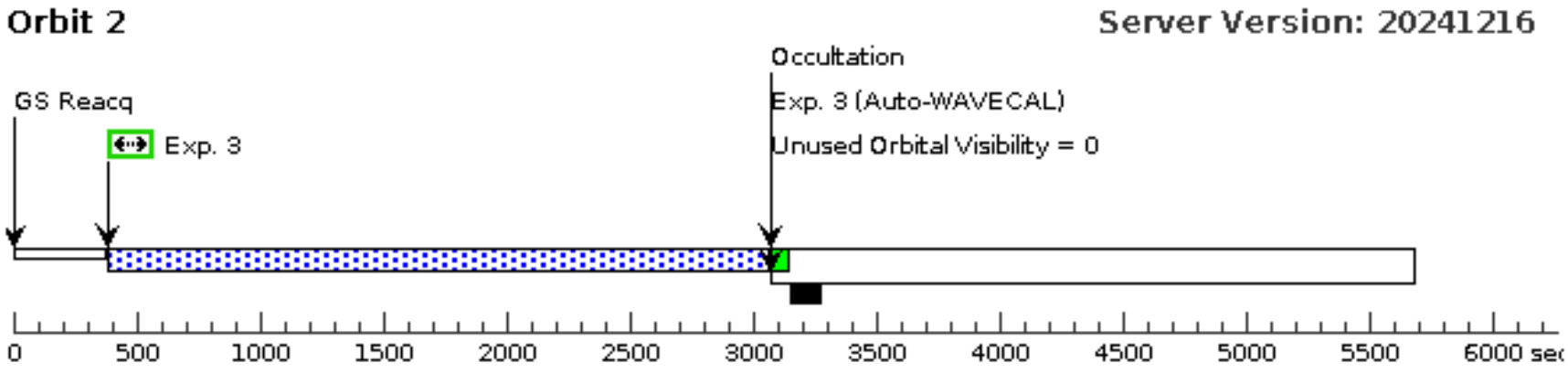
Comments: This object was generated by the targetselector and retrieved from the SIMBAD database. SIMBAD listed proper motion for this target. When retrieving targets with PM from SIMBAD, APT requests the coordinates be calculated with an epoch of the year 2000. Do not modify this epoch. Always review coordinates using the Target Confirmation tool, which graphically displays the PM.
Category=STAR
Description=[K III-I, POPULATION II]

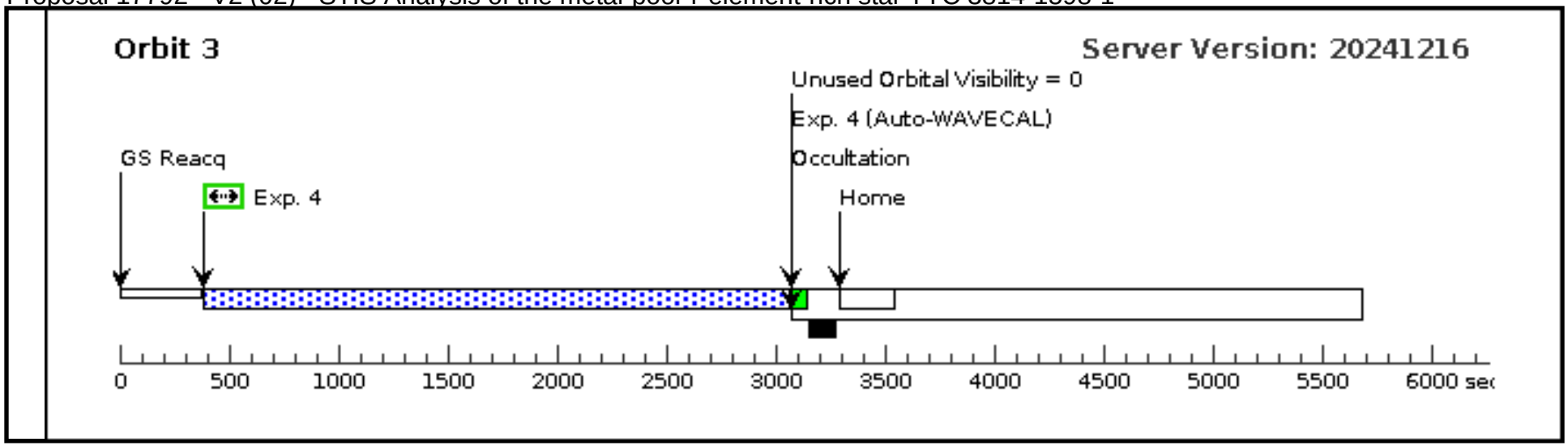
Exposures

#	Label (ETC Run)	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time (Total)/[Actual Dur.]	Orbit
1	exp0 (STIS.im.1954936)	(1) TYC-3814-1598-1	STIS/CCD, ACQ, F28X50LP	MIRROR				0.1 Secs (0.1 Secs) *[==>]*	***[1]***
2	exp1 (STIS.sp.1931798)	(1) TYC-3814-1598-1	STIS/NUV-MAMA, ACCUM, 0.2X0.2	E230M 2707 A				1801 Secs (2245 Secs) *[==>2245.0 Secs]*	***[1]***
3	exp2 (STIS.sp.1931799)	(1) TYC-3814-1598-1	STIS/NUV-MAMA, ACCUM, 0.2X0.2	E230M 2707 A				2668 Secs (2668 Secs) *[==>2668.0 Secs]*	***[2]***
4	exp3 (STIS.sp.1931799)	(1) TYC-3814-1598-1	STIS/NUV-MAMA, ACCUM, 0.2X0.2	E230M 2707 A				2668 Secs (2668 Secs) *[==>]*	***[3]***

Orbit Structure






Orbit 3
Server Version: 20241216
Unused Orbital Visibility = 0
Exp. 4 (Auto-WAVECAL)
Occultation
GS Reacq
Exp. 4
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5500
6000 sec

Visit

Proposal 17792, V3 (03), implementation Tue Mar 11 16:00:18 GMT 2025

Diagnostic Status: No Diagnostics

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

Special Requirements: PCS MODE FINE

Comments: Each visit should contain three orbits.

Fixed Targets

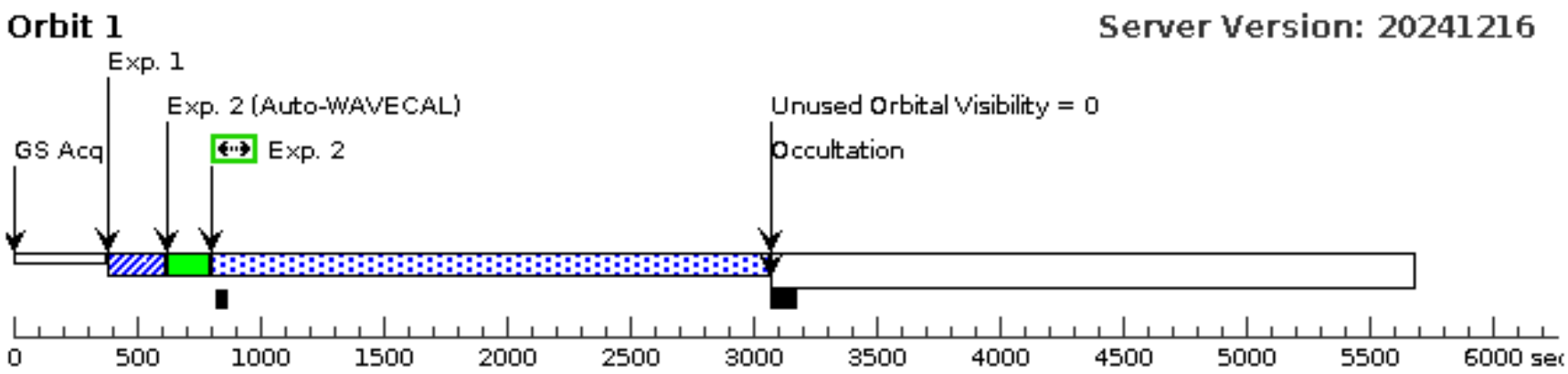
#	Name	Target Coordinates	Targ. Coord. Corrections	Fluxes	Miscellaneous
(1)	TYC-3814-1598-1 Alt Name1: GAIADR3828438619475671936 Alt Name2: 2MASSJ09544277+5246414	RA: 09 54 42.7402 (148.6780842d) Dec: +52 46 41.13 (52.77809d) Equinox: J2000	Proper Motion RA: -17.9173 mas/yr Proper Motion Dec: -26.8062 mas/yr Parallax: 0.3179" Epoch of Position: 2016	V=10.1	Reference Frame: ICRS

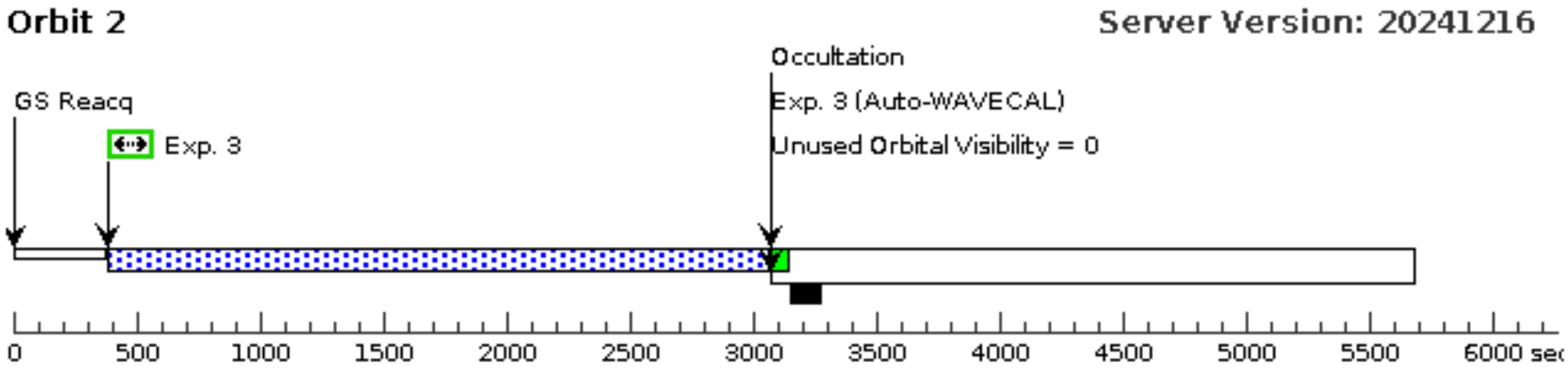
Comments: This object was generated by the targetselector and retrieved from the SIMBAD database. SIMBAD listed proper motion for this target. When retrieving targets with PM from SIMBAD, APT requests the coordinates be calculated with an epoch of the year 2000. Do not modify this epoch. Always review coordinates using the Target Confirmation tool, which graphically displays the PM.
Category=STAR
Description=[K III-I, POPULATION II]

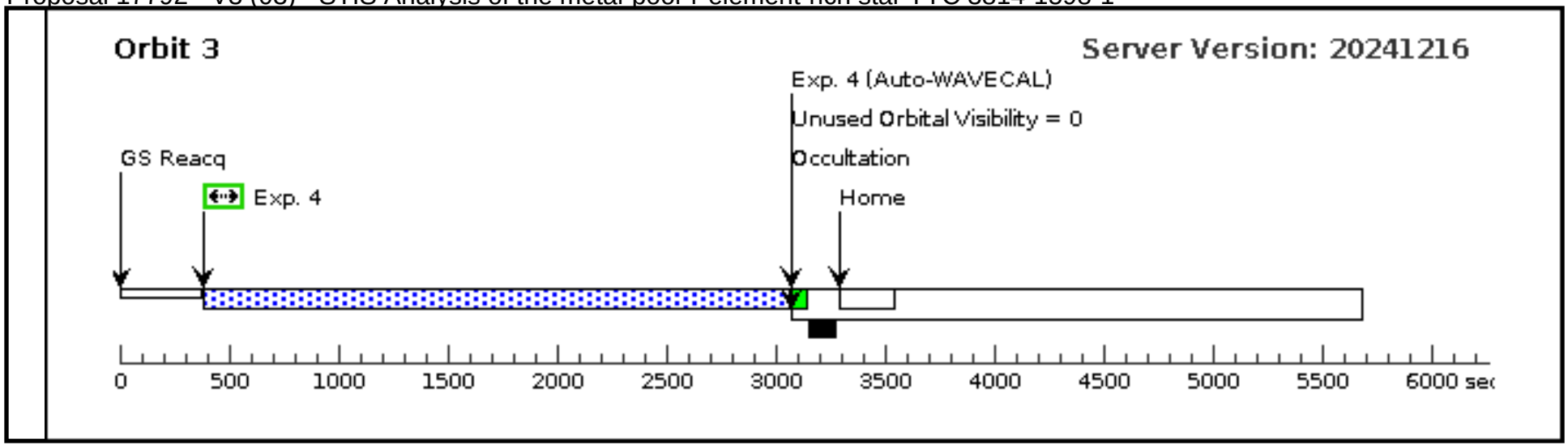
Exposures

#	Label (ETC Run)	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time (Total)/[Actual Dur.]	Orbit
1	exp0 (STIS.im.1954936)	(1) TYC-3814-1598-1	STIS/CCD, ACQ, F28X50LP	MIRROR				0.1 Secs (0.1 Secs) *[==>]*	***[1]***
2	exp1 (STIS.sp.1931798)	(1) TYC-3814-1598-1	STIS/NUV-MAMA, ACCUM, 0.2X0.2	E230M 2707 A				1801 Secs (2245 Secs) *[==>2245.0 Secs]*	***[1]***
3	exp2 (STIS.sp.1931799)	(1) TYC-3814-1598-1	STIS/NUV-MAMA, ACCUM, 0.2X0.2	E230M 2707 A				2668 Secs (2668 Secs) *[==>2668.0 Secs]*	***[2]***
4	exp3 (STIS.sp.1931799)	(1) TYC-3814-1598-1	STIS/NUV-MAMA, ACCUM, 0.2X0.2	E230M 2707 A				2668 Secs (2668 Secs) *[==>]*	***[3]***

Orbit Structure






Orbit 3
Server Version: 20241216
Exp. 4 (Auto-WAVECAL)
Unused Orbital Visibility = 0
Occultation
GS Reacq
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Visit

Proposal 17792, V4 (04), implementation Tue Mar 11 16:00:18 GMT 2025

Diagnostic Status: No Diagnostics

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

Special Requirements: PCS MODE FINE

Comments: Each visit should contain three orbits.

Fixed Targets

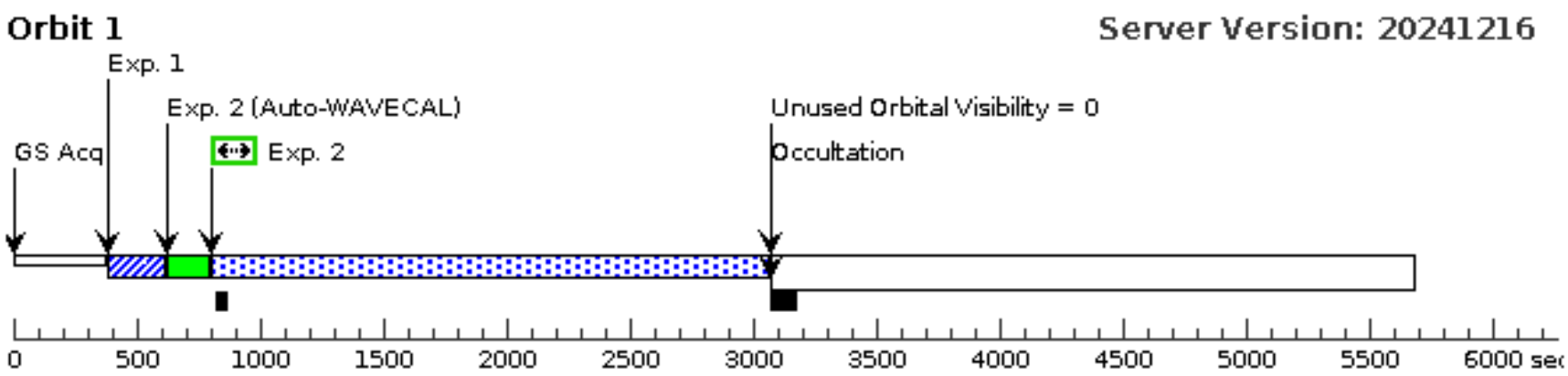
#	Name	Target Coordinates	Targ. Coord. Corrections	Fluxes	Miscellaneous
(1)	TYC-3814-1598-1 Alt Name1: GAIADR3828438619475671936 Alt Name2: 2MASSJ09544277+5246414	RA: 09 54 42.7402 (148.6780842d) Dec: +52 46 41.13 (52.77809d) Equinox: J2000	Proper Motion RA: -17.9173 mas/yr Proper Motion Dec: -26.8062 mas/yr Parallax: 0.3179" Epoch of Position: 2016	V=10.1	Reference Frame: ICRS

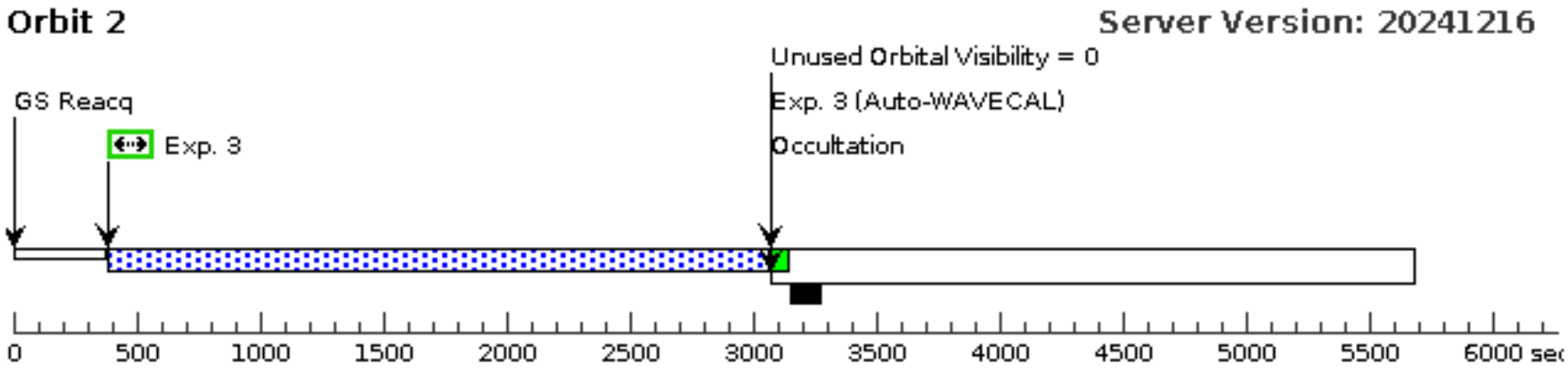
Comments: This object was generated by the targetselector and retrieved from the SIMBAD database. SIMBAD listed proper motion for this target. When retrieving targets with PM from SIMBAD, APT requests the coordinates be calculated with an epoch of the year 2000. Do not modify this epoch. Always review coordinates using the Target Confirmation tool, which graphically displays the PM.
Category=STAR
Description=[K III-I, POPULATION II]

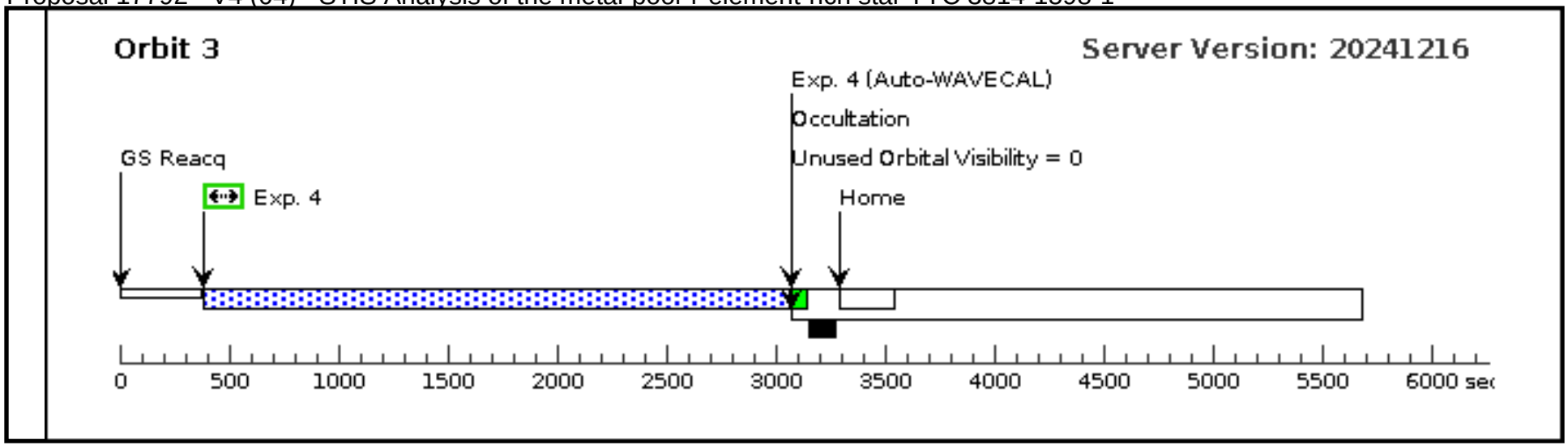
Exposures

#	Label (ETC Run)	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time (Total)/[Actual Dur.]	Orbit
1	exp0 (STIS.im.1954936)	(1) TYC-3814-1598-1	STIS/CCD, ACQ, F28X50LP	MIRROR				0.1 Secs (0.1 Secs) *[==>]*	***[1]***
2	exp1 (STIS.sp.1931798)	(1) TYC-3814-1598-1	STIS/NUV-MAMA, ACCUM, 0.2X0.2	E230M 2707 A				1801 Secs (2245 Secs) *[==>2245.0 Secs]*	***[1]***
3	exp2 (STIS.sp.1931799)	(1) TYC-3814-1598-1	STIS/NUV-MAMA, ACCUM, 0.2X0.2	E230M 2707 A				2668 Secs (2668 Secs) *[==>2668.0 Secs]*	***[2]***
4	exp3 (STIS.sp.1931799)	(1) TYC-3814-1598-1	STIS/NUV-MAMA, ACCUM, 0.2X0.2	E230M 2707 A				2668 Secs (2668 Secs) *[==>]*	***[3]***

Orbit Structure






Orbit 3
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Exp. 4 (Auto-WAVECAL)
Occultation
Unused Orbital Visibility = 0
GS Reacq
Exp. 4
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6000 sec

Visit

Proposal 17792, V5 (05), implementation Tue Mar 11 16:00:18 GMT 2025

Diagnostic Status: No Diagnostics

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

Special Requirements: PCS MODE FINE

Comments: Each visit should contain three orbits.

Fixed Targets

#	Name	Target Coordinates	Targ. Coord. Corrections	Fluxes	Miscellaneous
(1)	TYC-3814-1598-1 Alt Name1: GAIADR3828438619475671936 Alt Name2: 2MASSJ09544277+5246414	RA: 09 54 42.7402 (148.6780842d) Dec: +52 46 41.13 (52.77809d) Equinox: J2000	Proper Motion RA: -17.9173 mas/yr Proper Motion Dec: -26.8062 mas/yr Parallax: 0.3179" Epoch of Position: 2016	V=10.1	Reference Frame: ICRS

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Category=STAR
Description=[K III-I, POPULATION II]

Exposures

#	Label (ETC Run)	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time (Total)/[Actual Dur.]	Orbit
1	exp0 (STIS.im.1954936)	(1) TYC-3814-1598-1	STIS/CCD, ACQ, F28X50LP	MIRROR				0.1 Secs (0.1 Secs) *[==>]*	 ***[1]***
2	exp1 (STIS.sp.1931799)	(1) TYC-3814-1598-1	STIS/NUV-MAMA, ACCUM, 0.2X0.2	E230M 2707 A				2668 Secs (2245 Secs) *[==>2245.0 Secs]*	 ***[1]***

Orbit Structure