17282 - Ultraviolet Photometry of TRAPPIST-1 during the next JWST Observing Window

Cycle: 30, Proposal Category: GO

(UV Initiative)

(Availability Mode: SUPPORTED)

INVESTIGATORS

Name	*Institution*	*E-Mail*
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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) TRAPPIST-1	WFC3/UVIS	3	09-Feb-2023 19:00:15.0	yes
03	(1) TRAPPIST-1	WFC3/UVIS	3	09-Feb-2023 19:00:17.0	yes
05	(1) TRAPPIST-1	WFC3/UVIS	3	09-Feb-2023 19:00:18.0	yes
02	(1) TRAPPIST-1	ACS/SBC	2	09-Feb-2023 19:00:19.0	yes
04	(1) TRAPPIST-1	ACS/SBC	2	09-Feb-2023 19:00:19.0	yes
06	(1) TRAPPIST-1	ACS/SBC	2	09-Feb-2023 19:00:20.0	yes

15 Total Orbits Used

ABSTRACT

With the successful launch of JWST, the atmospheres of rocky exoplanets are finally within reach. The exemplary host star is TRAPPIST-1, orbited by seven Earth-sized planets. Here we seek to obtain time-series ultraviolet photometry of TRAPPIST-1 during the next JWST observing window, providing vital information for interpreting ongoing JWST transit and eclipse spectroscopy.

The TRAPPIST-1 planets experience a radically different ultraviolet flux than the Earth, changing photochemical reaction rates of key molecules and biomarkers such as ozone. Detailed knowledge of the stellar ultraviolet SED is required to correctly interpret upcoming JWST spectroscopy to characterize the atmospheres and potential habitability of the planets. A large investment of HST spectroscopy time into TRAPPIST-1 has returned only low signal detections of a few stellar emission lines, and essentially no constraints on the ultraviolet variability. Here, we will use ultraviolet photometry, which provides high-quality data in multiple bands with much less HST time.

We will observe TRAPPIST-1 three times in five ultraviolet bands. In the NUV, we will characterize the as-yet unconstrained continuum flux that is a key driver of atmospheric chemistry, and measure the 2800A Mg II lines to diagnose the chromospheric structure. In the FUV, we will observe the C IV 1550A doublet to estimate the strength of the total FUV flux. These observations will provide a contemporaneous ultraviolet dataset for each JWST observation and the first constraints on the ultraviolet variability of TRAPPIST-1. Photometric measurements from the observations will be made available as a MAST High Level Science Product.

OBSERVING DESCRIPTION

The aim is to obtain ultraviolet photometry of TRAPPIST-1 during the next window where both JWST and HST can observe TRAPPIST-1. The expected return is a single flux meaurement in each filter per visit, not an in-visit light curve.

Three two-vist blocks are requested. The two visits in each block should be scheduled on the same day, ideally one right after the other. The three blocks should be spread across the June 1st - July 23rd window as evenly as possible (I've separated them by a nominal 7 days in the phase two but ideally this should be longer).

If scheduling allows, timing one or more of the visits to be simultaneous with a JWST observation of TRAPPIST-1 would provide enhanced science, but is not a requirement.

Each two-visit block consists of one visit with WFC3-UVIS and one with ACS-SBC.

The WFC visits contain three orbits, each with 2x F225W exposure, 1x F275W exposure and 1x F280N exposure. The W filters probe the NUV continuum and the N filter measures the strength of the Mg II 2800A lines. We expect the F275W and F280N observations to return S/N 10-20 per visit. The expected F225W flux is basically unconstrained and its measurement (or an upper limit) will be a key result of this program.

The ACS visits contain one orbit each of the F150LP and F165LP filters. When subtracted, these will measure the strength of the C IV 1550A lines. We predict S/N 10-20 in each filter, although this is somewhat uncertain due to the low quality of existing COS spectra.

Visit

Proposal 17282, WFC3-1 (01), implementation Fri Feb 10 00:00:20 GMT 2023

Diagnostic Status: No Diagnostics

Scientific Instruments: WFC3/UVIS

Special Requirements: BETWEEN 01-JUN-2023:00:00:00 AND 23-JUL-2023:00:00:00

Fixed Targets

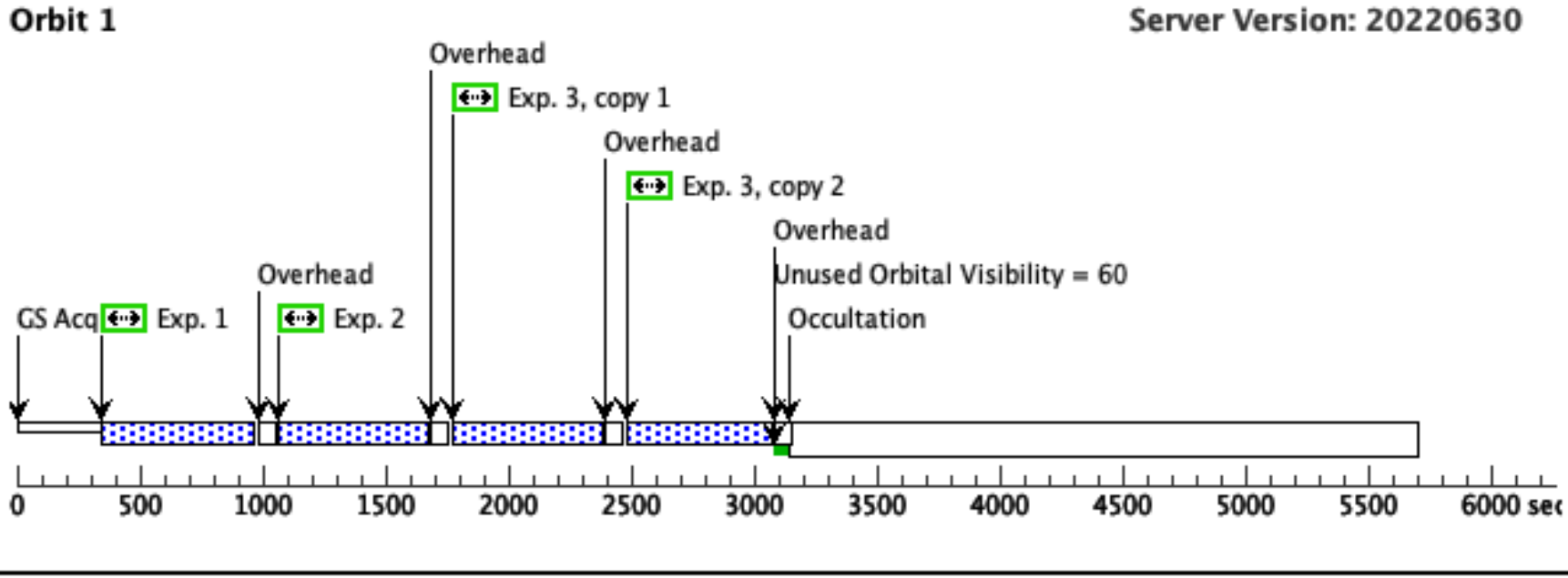
#	Name	Target Coordinates	Targ. Coord. Corrections	Fluxes	Miscellaneous
(1)	TRAPPIST-1	RA: 23 06 30.3341 (346.6263921d) Dec: -05 02 36.46 (-5.04346d) Equinox: J2000	Epoch of Position: 2015.5	V=18.798	Reference Frame: SIMBAD

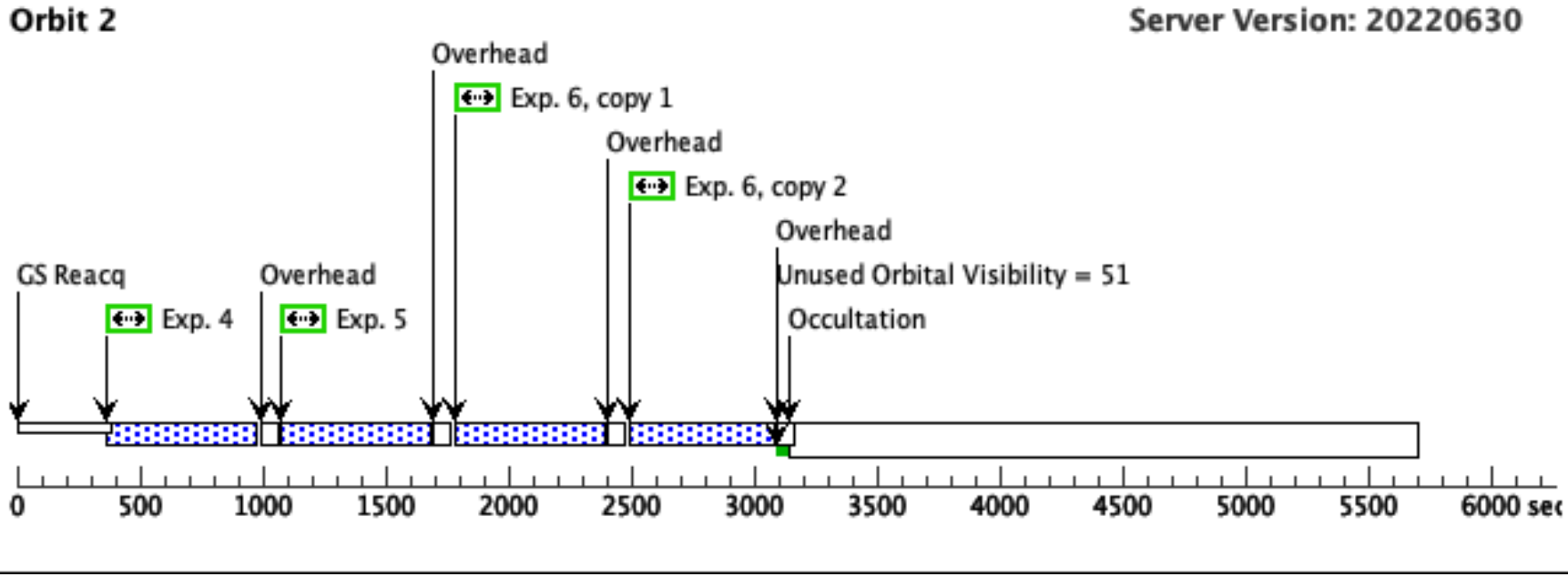
Comments:
Category=EXT-STAR
Description=[LATE-TYPE DEGENERATE]

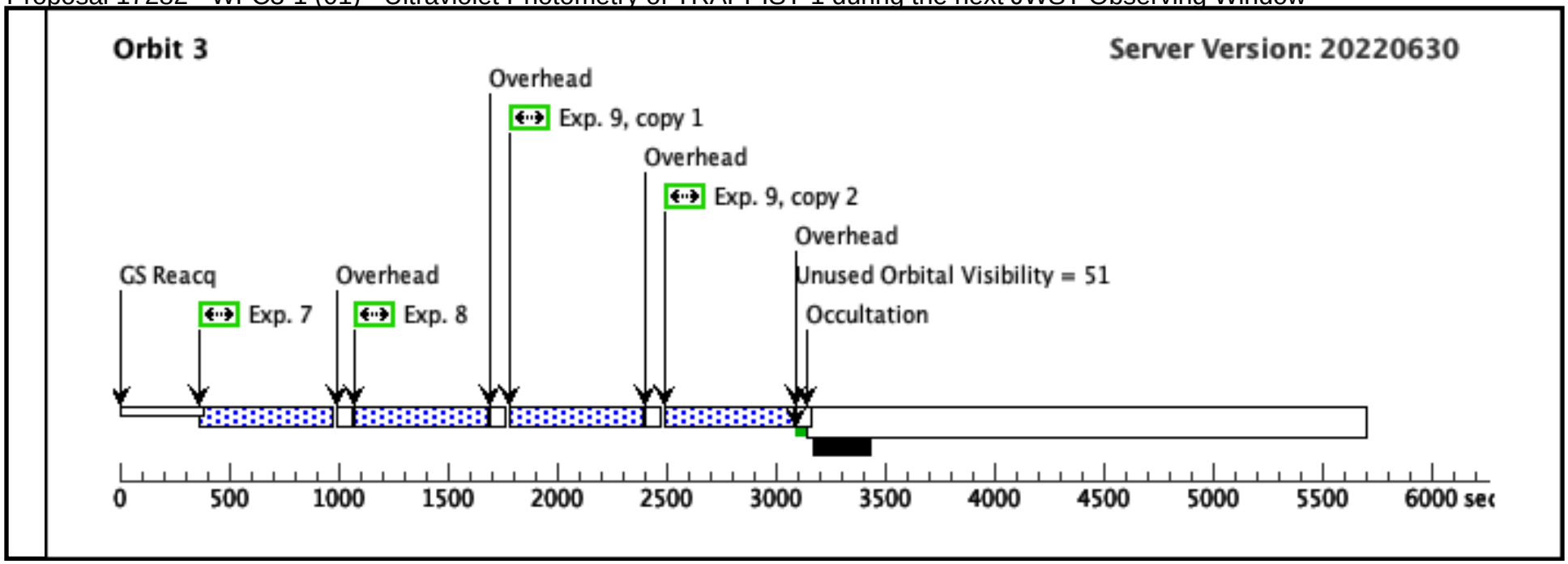
Exposures

#	Label (ETC Run)	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time (Total)/[Actual Dur.]	Orbit
1	(WFC3UVIS.im.1837462)	(1) TRAPPIST-1	WFC3/UVIS, ACCUM, UVIS2-C1K1C-SUB	F275W	FLASH=20			590 Secs (590 Secs) *[==>]*	***[1]***
2	(WFC3UVIS.im.1837463)	(1) TRAPPIST-1	WFC3/UVIS, ACCUM, UVIS2-C1K1C-SUB	F280N	FLASH=20			590 Secs (590 Secs) *[==>]*	***[1]***
3	(WFC3UVIS.im.1837462)	(1) TRAPPIST-1	WFC3/UVIS, ACCUM, UVIS2-C1K1C-SUB	F225W	FLASH=20			590 Secs X 2 (1180 Secs) *[==>(Copy 1)]* *[==>(Copy 2)]*	***[1]***
4	(WFC3UVIS.im.1837463)	(1) TRAPPIST-1	WFC3/UVIS, ACCUM, UVIS2-C1K1C-SUB	F275W	FLASH=20			590 Secs (590 Secs) *[==>]*	***[2]***
5	(WFC3UVIS.im.1837464)	(1) TRAPPIST-1	WFC3/UVIS, ACCUM, UVIS2-C1K1C-SUB	F280N	FLASH=20			590 Secs (590 Secs) *[==>]*	***[2]***
6	(WFC3UVIS.im.1837464)	(1) TRAPPIST-1	WFC3/UVIS, ACCUM, UVIS2-C1K1C-SUB	F225W	FLASH=20			590 Secs X 2 (1180 Secs) *[==>(Copy 1)]* *[==>(Copy 2)]*	***[2]***
7	(WFC3UVIS.im.1837463)	(1) TRAPPIST-1	WFC3/UVIS, ACCUM, UVIS2-C1K1C-SUB	F275W	FLASH=20			590 Secs (590 Secs) *[==>]*	***[3]***
8	(WFC3UVIS.im.1837464)	(1) TRAPPIST-1	WFC3/UVIS, ACCUM, UVIS2-C1K1C-SUB	F280N	FLASH=20			590 Secs (590 Secs) *[==>]*	***[3]***
9	(WFC3UVIS.im.1837464)	(1) TRAPPIST-1	WFC3/UVIS, ACCUM, UVIS2-C1K1C-SUB	F225W	FLASH=20			590 Secs X 2 (1180 Secs) *[==>(Copy 1)]* *[==>(Copy 2)]*	***[3]***

Orbit Structure



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Overhead
Exp. 9, copy 2
Overhead
GS Reacq
Overhead
Unused Orbital Visibility = 51
Exp. 7
Exp. 8
Occultation
0
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Visit

Proposal 17282, WFC3-2 (03) Fri Feb 10 00:00:20 GMT 2023

Diagnostic Status: No Diagnostics

Scientific Instruments: WFC3/UVIS

Special Requirements: AFTER_02 BY 7 D TO 100 D; BETWEEN 01-JUN-2023:00:00:00 AND 23-JUL-2023:00:00:00

Fixed Targets

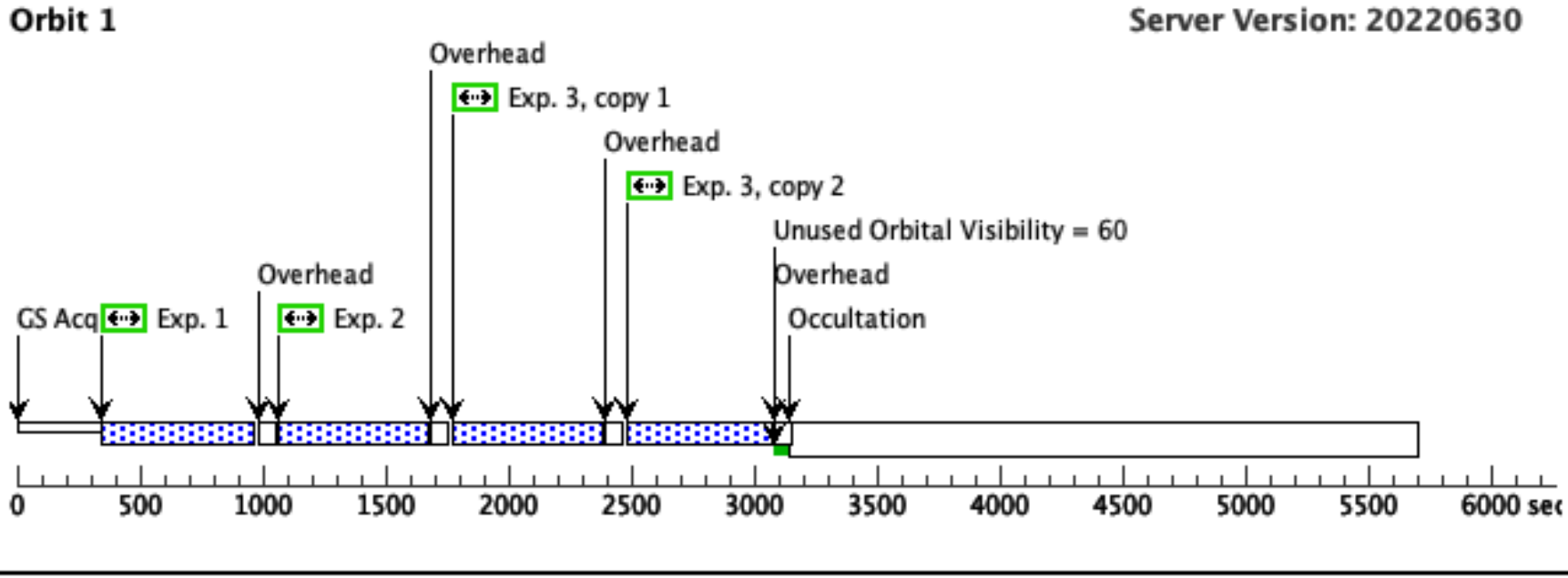
#	Name	Target Coordinates	Targ. Coord. Corrections	Fluxes	Miscellaneous
(1)	TRAPPIST-1	RA: 23 06 30.3341 (346.6263921d) Dec: -05 02 36.46 (-5.04346d) Equinox: J2000	Epoch of Position: 2015.5	V=18.798	Reference Frame: SIMBAD

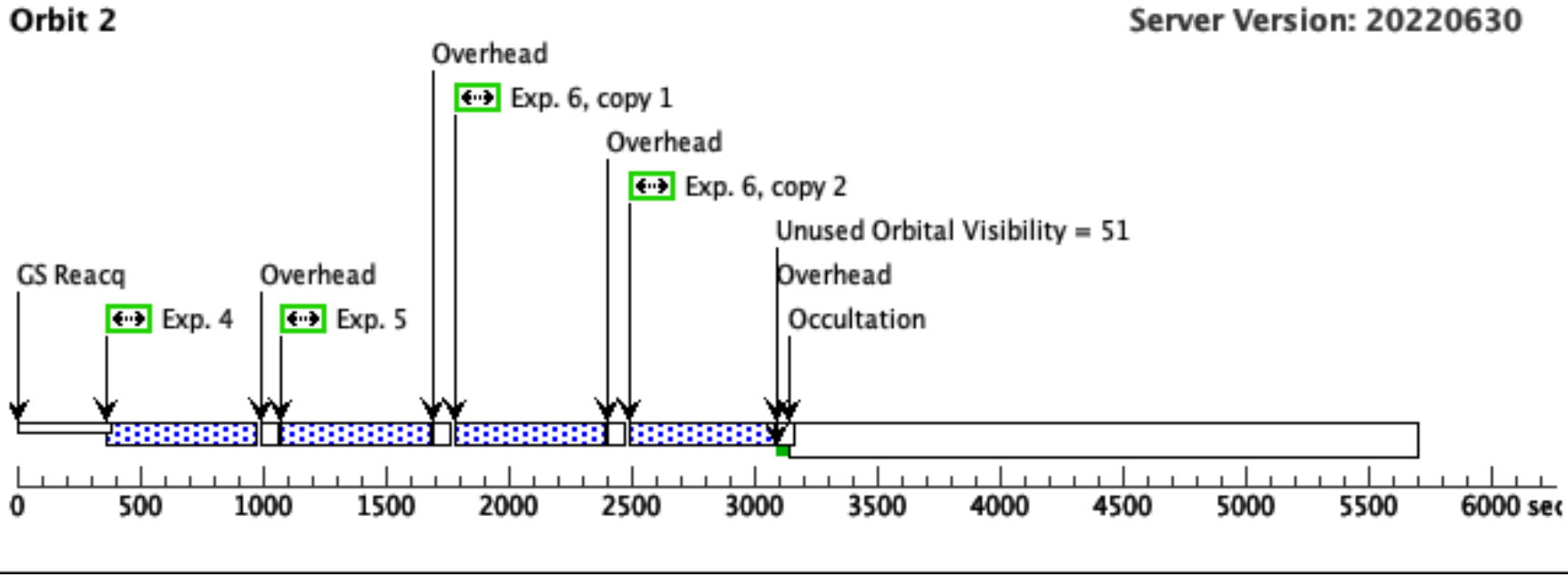
Comments:
Category=EXT-STAR
Description=[LATE-TYPE DEGENERATE]

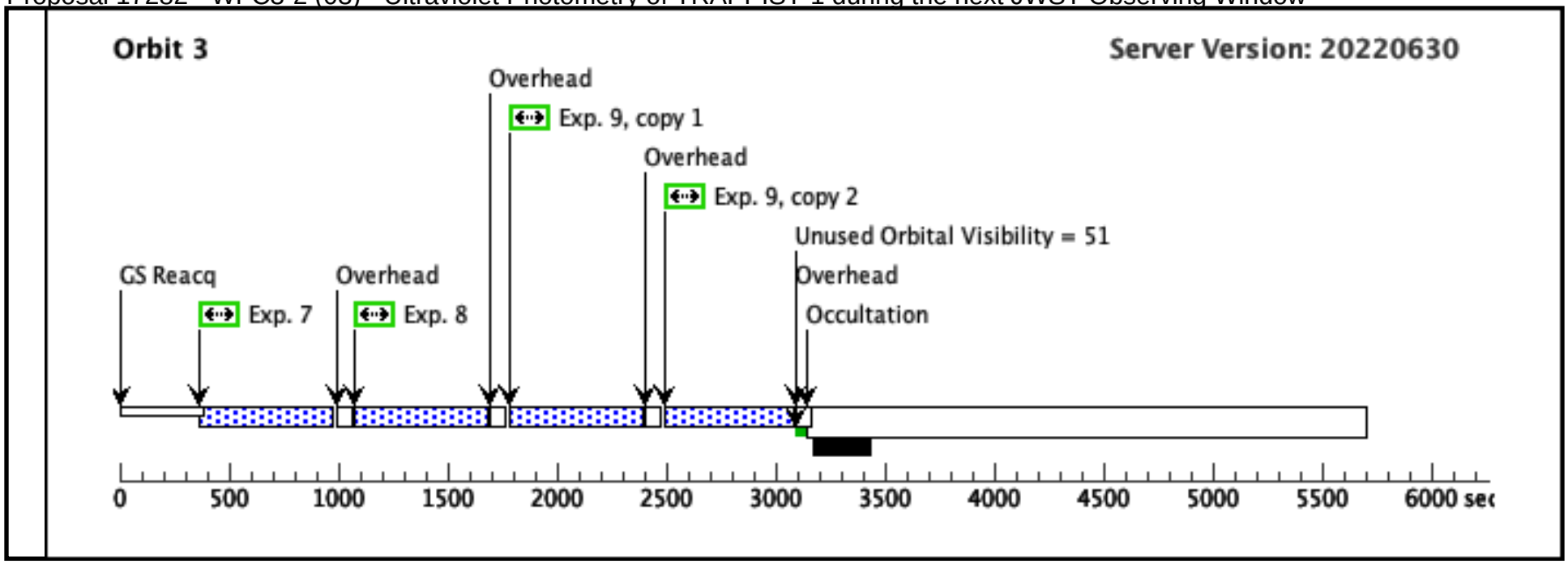
Exposures

#	Label (ETC Run)	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time (Total)/[Actual Dur.]	Orbit
1	(WFC3UVIS.im.1837462)	(1) TRAPPIST-1	WFC3/UVIS, ACCUM, UVIS2-C1K1C-SUB	F275W	FLASH=20			590 Secs (590 Secs) *[==>]*	***[1]***
2	(WFC3UVIS.im.1837463)	(1) TRAPPIST-1	WFC3/UVIS, ACCUM, UVIS2-C1K1C-SUB	F280N	FLASH=20			590 Secs (590 Secs) *[==>]*	***[1]***
3	(WFC3UVIS.im.1837462)	(1) TRAPPIST-1	WFC3/UVIS, ACCUM, UVIS2-C1K1C-SUB	F225W	FLASH=20			590 Secs X 2 (1180 Secs) *[==>(Copy 1)]* *[==>(Copy 2)]*	***[1]***
4	(WFC3UVIS.im.1837463)	(1) TRAPPIST-1	WFC3/UVIS, ACCUM, UVIS2-C1K1C-SUB	F275W	FLASH=20			590 Secs (590 Secs) *[==>]*	***[2]***
5	(WFC3UVIS.im.1837464)	(1) TRAPPIST-1	WFC3/UVIS, ACCUM, UVIS2-C1K1C-SUB	F280N	FLASH=20			590 Secs (590 Secs) *[==>]*	***[2]***
6	(WFC3UVIS.im.1837464)	(1) TRAPPIST-1	WFC3/UVIS, ACCUM, UVIS2-C1K1C-SUB	F225W	FLASH=20			590 Secs X 2 (1180 Secs) *[==>(Copy 1)]* *[==>(Copy 2)]*	***[2]***
7	(WFC3UVIS.im.1837463)	(1) TRAPPIST-1	WFC3/UVIS, ACCUM, UVIS2-C1K1C-SUB	F275W	FLASH=20			590 Secs (590 Secs) *[==>]*	***[3]***
8	(WFC3UVIS.im.1837464)	(1) TRAPPIST-1	WFC3/UVIS, ACCUM, UVIS2-C1K1C-SUB	F280N	FLASH=20			590 Secs (590 Secs) *[==>]*	***[3]***
9	(WFC3UVIS.im.1837464)	(1) TRAPPIST-1	WFC3/UVIS, ACCUM, UVIS2-C1K1C-SUB	F225W	FLASH=20			590 Secs X 2 (1180 Secs) *[==>(Copy 1)]* *[==>(Copy 2)]*	***[3]***

Orbit Structure



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Exp. 9, copy 2
Unused Orbital Visibility = 51
GS Reacq
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Overhead
Exp. 7
Exp. 8
Occultation
0
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Visit

Proposal 17282, WFC3-3 (05) Fri Feb 10 00:00:20 GMT 2023

Diagnostic Status: No Diagnostics

Scientific Instruments: WFC3/UVIS

Special Requirements: AFTER_04 BY 7 D TO 100 D; BETWEEN 01-JUN-2023:00:00:00 AND 23-JUL-2023:00:00:00

Fixed Targets

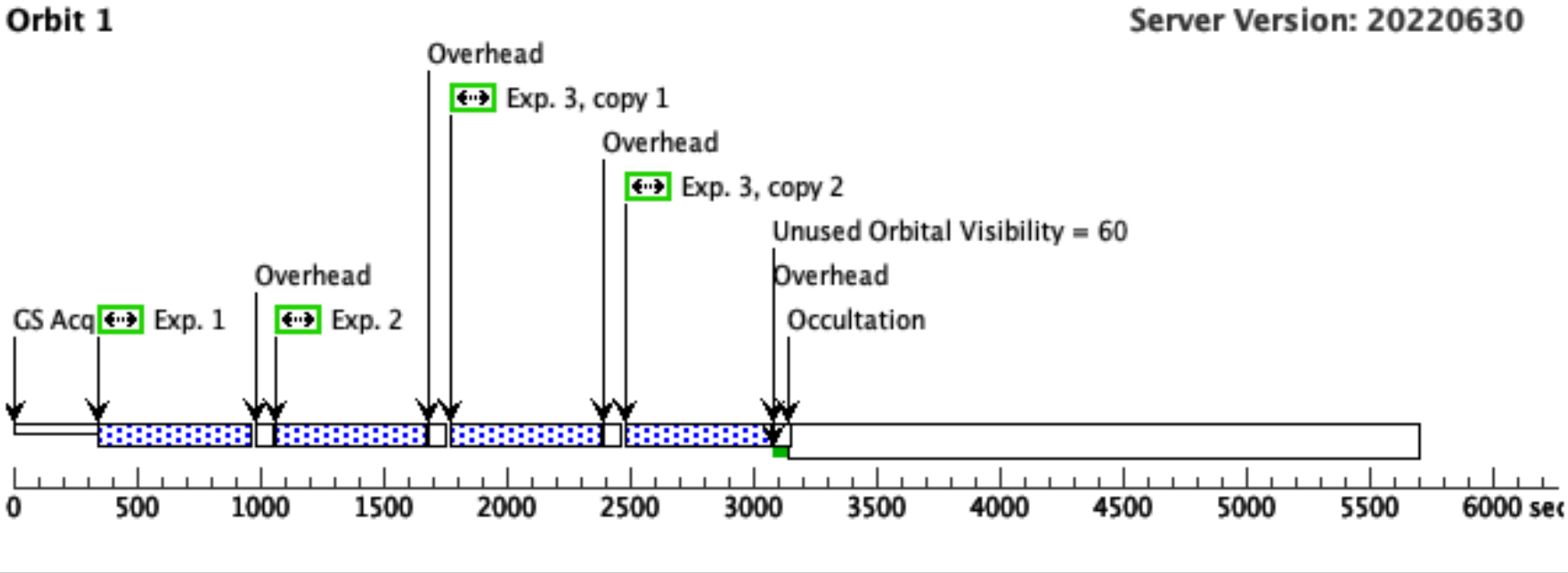
#	Name	Target Coordinates	Targ. Coord. Corrections	Fluxes	Miscellaneous
(1)	TRAPPIST-1	RA: 23 06 30.3341 (346.6263921d) Dec: -05 02 36.46 (-5.04346d) Equinox: J2000	Epoch of Position: 2015.5	V=18.798	Reference Frame: SIMBAD

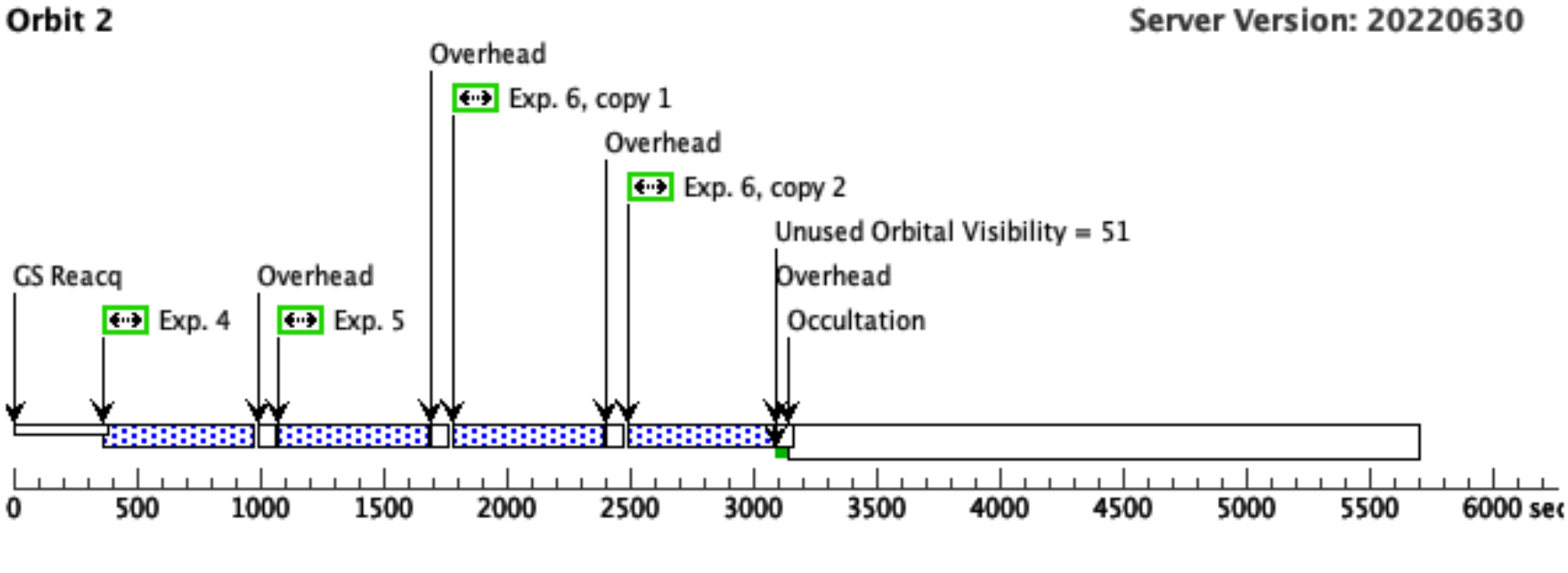
Comments:
Category=EXT-STAR
Description=[LATE-TYPE DEGENERATE]

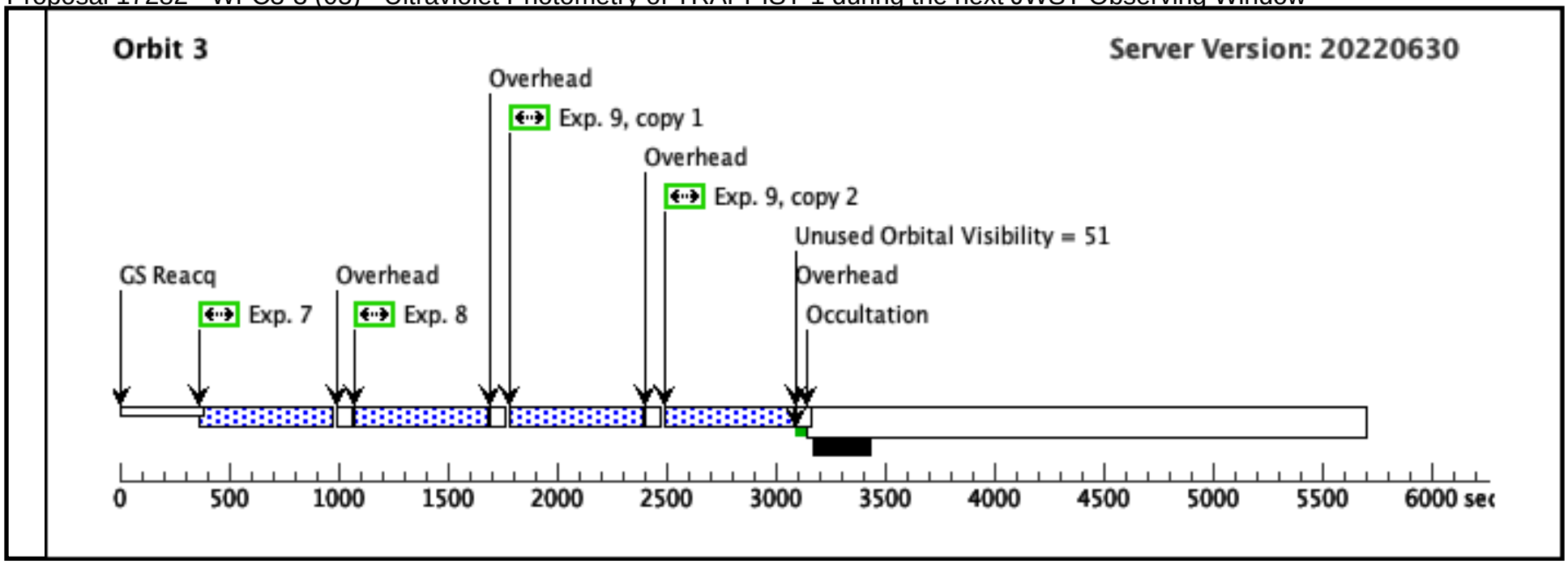
Exposures

#	Label (ETC Run)	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time (Total)/[Actual Dur.]	Orbit
1	(WFC3UVIS.im.1837462)	(1) TRAPPIST-1	WFC3/UVIS, ACCUM, UVIS2-C1K1C-SUB	F275W	FLASH=20			590 Secs (590 Secs) *[==>]*	***[1]***
2	(WFC3UVIS.im.1837463)	(1) TRAPPIST-1	WFC3/UVIS, ACCUM, UVIS2-C1K1C-SUB	F280N	FLASH=20			590 Secs (590 Secs) *[==>]*	***[1]***
3	(WFC3UVIS.im.1837462)	(1) TRAPPIST-1	WFC3/UVIS, ACCUM, UVIS2-C1K1C-SUB	F225W	FLASH=20			590 Secs X 2 (1180 Secs) *[==>(Copy 1)]* *[==>(Copy 2)]*	***[1]***
4	(WFC3UVIS.im.1837463)	(1) TRAPPIST-1	WFC3/UVIS, ACCUM, UVIS2-C1K1C-SUB	F275W	FLASH=20			590 Secs (590 Secs) *[==>]*	***[2]***
5	(WFC3UVIS.im.1837464)	(1) TRAPPIST-1	WFC3/UVIS, ACCUM, UVIS2-C1K1C-SUB	F280N	FLASH=20			590 Secs (590 Secs) *[==>]*	***[2]***
6	(WFC3UVIS.im.1837464)	(1) TRAPPIST-1	WFC3/UVIS, ACCUM, UVIS2-C1K1C-SUB	F225W	FLASH=20			590 Secs X 2 (1180 Secs) *[==>(Copy 1)]* *[==>(Copy 2)]*	***[2]***
7	(WFC3UVIS.im.1837463)	(1) TRAPPIST-1	WFC3/UVIS, ACCUM, UVIS2-C1K1C-SUB	F275W	FLASH=20			590 Secs (590 Secs) *[==>]*	***[3]***
8	(WFC3UVIS.im.1837464)	(1) TRAPPIST-1	WFC3/UVIS, ACCUM, UVIS2-C1K1C-SUB	F280N	FLASH=20			590 Secs (590 Secs) *[==>]*	***[3]***
9	(WFC3UVIS.im.1837464)	(1) TRAPPIST-1	WFC3/UVIS, ACCUM, UVIS2-C1K1C-SUB	F225W	FLASH=20			590 Secs X 2 (1180 Secs) *[==>(Copy 1)]* *[==>(Copy 2)]*	***[3]***

Orbit Structure



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Exp. 9, copy 2
Unused Orbital Visibility = 51
GS Reacq
Overhead
Overhead
Exp. 7
Exp. 8
Occultation
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Visit

Proposal 17282, ACS-1 (02), implementation Fri Feb 10 00:00:21 GMT 2023

Diagnostic Status: No Diagnostics

Scientific Instruments: ACS/SBC

Special Requirements: AFTER_01 BY 0 D TO 1 D

Fixed Targets

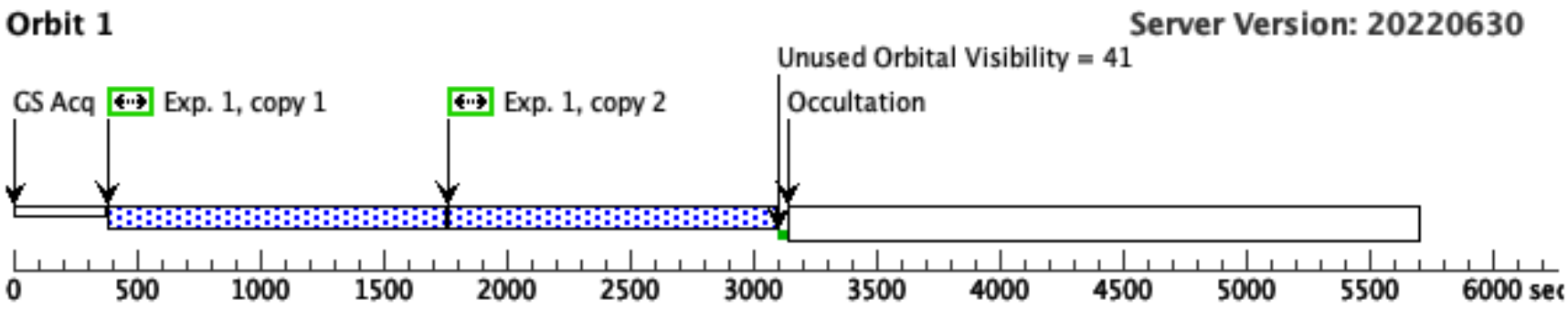
#	Name	Target Coordinates	Targ. Coord. Corrections	Fluxes	Miscellaneous
(1)	TRAPPIST-1	RA: 23 06 30.3341 (346.6263921d) Dec: -05 02 36.46 (-5.04346d) Equinox: J2000	Epoch of Position: 2015.5	V=18.798	Reference Frame: SIMBAD

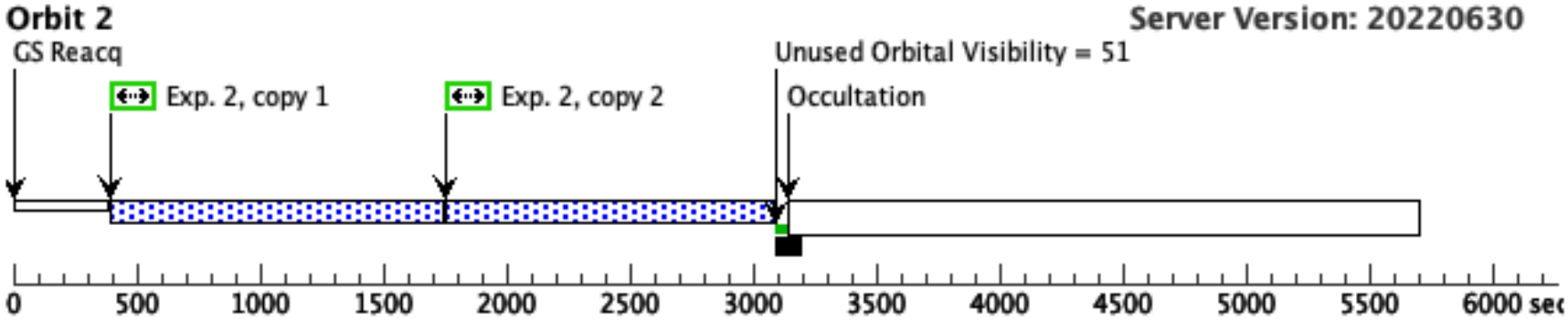
Comments:
Category=EXT-STAR
Description=[LATE-TYPE DEGENERATE]

Exposures

#	Label (ETC Run)	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time (Total)/[Actual Dur.]	Orbit
1	(ACS.im.18 37465)	(1) TRAPPIST-1	ACS/SBC, ACCUM, SBC	F150LP		POS TARG 1,1		1300 Secs X 2 (2600 Secs) *[==>(Copy 1)]* *[==>(Copy 2)]*	*[1]*
2	(ACS.im.18 37466)	(1) TRAPPIST-1	ACS/SBC, ACCUM, SBC	F165LP		POS TARG 1,1		1300 Secs X 2 (2600 Secs) *[==>(Copy 1)]* *[==>(Copy 2)]*	*[2]*

Orbit Structure





Visit

Proposal 17282, ACS-2 (04), implementation Fri Feb 10 00:00:21 GMT 2023

Diagnostic Status: No Diagnostics

Scientific Instruments: ACS/SBC

Special Requirements: AFTER_03 BY 0 D TO 1 D

Fixed Targets

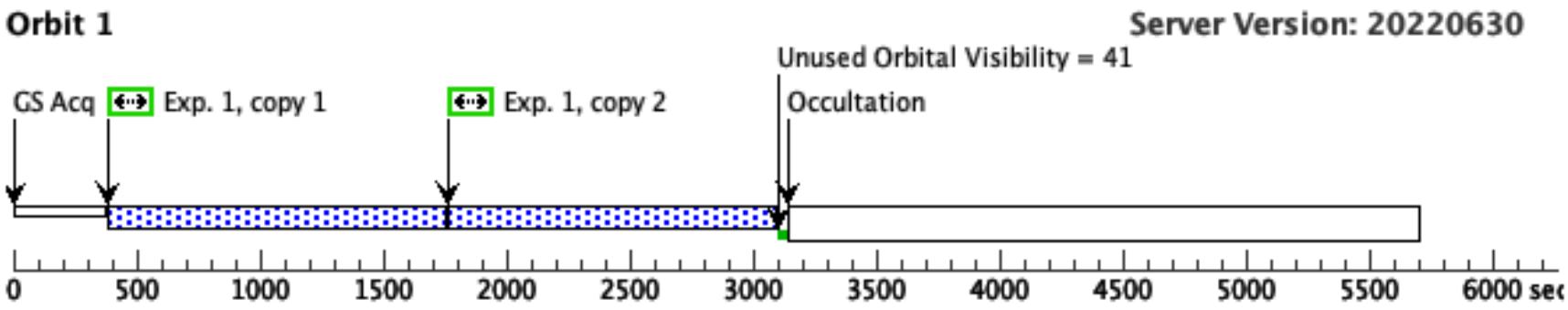
#	Name	Target Coordinates	Targ. Coord. Corrections	Fluxes	Miscellaneous
(1)	TRAPPIST-1	RA: 23 06 30.3341 (346.6263921d) Dec: -05 02 36.46 (-5.04346d) Equinox: J2000	Epoch of Position: 2015.5	V=18.798	Reference Frame: SIMBAD

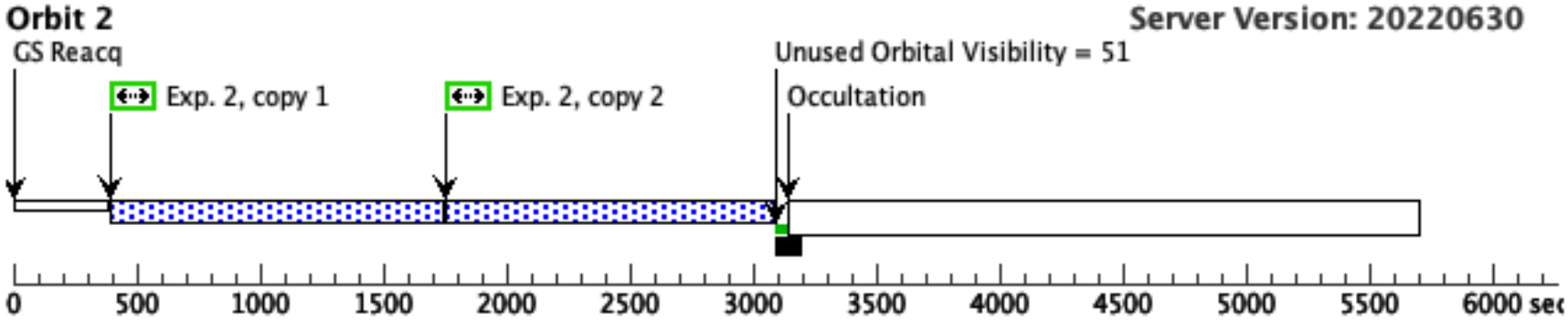
Comments:
Category=EXT-STAR
Description=[LATE-TYPE DEGENERATE]

Exposures

#	Label (ETC Run)	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time (Total)/[Actual Dur.]	Orbit
1	(ACS.im.1837465)	(1) TRAPPIST-1	ACS/SBC, ACCUM, SBC	F150LP		POS TARG 1,1		1300 Secs X 2 (2600 Secs) *[==>(Copy 1)]* *[==>(Copy 2)]*	*[1]*
2	(ACS.im.1837466)	(1) TRAPPIST-1	ACS/SBC, ACCUM, SBC	F165LP		POS TARG 1,1		1300 Secs X 2 (2600 Secs) *[==>(Copy 1)]* *[==>(Copy 2)]*	*[2]*

Orbit Structure





Visit

Proposal 17282, ACS-3 (06), implementation Fri Feb 10 00:00:21 GMT 2023

Diagnostic Status: No Diagnostics

Scientific Instruments: ACS/SBC

Special Requirements: AFTER_05 BY 0 D TO 1 D

Fixed Targets

#	Name	Target Coordinates	Targ. Coord. Corrections	Fluxes	Miscellaneous
(1)	TRAPPIST-1	RA: 23 06 30.3341 (346.6263921d) Dec: -05 02 36.46 (-5.04346d) Equinox: J2000	Epoch of Position: 2015.5	V=18.798	Reference Frame: SIMBAD

Comments:
Category=EXT-STAR
Description=[LATE-TYPE DEGENERATE]

Exposures

#	Label (ETC Run)	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time (Total)/[Actual Dur.]	Orbit
1	(ACS.im.18 37465)	(1) TRAPPIST-1	ACS/SBC, ACCUM, SBC	F150LP		POS TARG 1,1		1300 Secs X 2 (2600 Secs) *[==>(Copy 1)]* *[==>(Copy 2)]*	*[1]*
2	(ACS.im.18 37466)	(1) TRAPPIST-1	ACS/SBC, ACCUM, SBC	F165LP		POS TARG 1,1		1300 Secs X 2 (2600 Secs) *[==>(Copy 1)]* *[==>(Copy 2)]*	*[2]*

Orbit Structure