15846 - He II Emission from Wolf-Rayet Stars: a New Dust Attenuation Measure in Star-forming Galaxies

Cycle: 27, Proposal Category: GO

(Availability Mode: SUPPORTED)

INVESTIGATORS

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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) HE-2-10	STIS/CCD	2	29-Jan-2021 15:00:12.0	yes
02	(2) NGC-3049	STIS/CCD	1	29-Jan-2021 15:00:13.0	yes
03	(3) NGC-3125	STIS/CCD	2	29-Jan-2021 15:00:14.0	yes
04	(4) MRK-33	STIS/CCD	2	29-Jan-2021 15:00:15.0	yes
05	(5) NGC-4214	STIS/CCD	2	29-Jan-2021 15:00:16.0	yes
06	(6) NGC-4670	STIS/CCD	2	29-Jan-2021 15:00:17.0	yes
07	(7) TOL-89	STIS/CCD	1	29-Jan-2021 15:00:17.0	yes
08	(8) TOL-1924-416	STIS/CCD	2	29-Jan-2021 15:00:18.0	yes

14 Total Orbits Used

ABSTRACT

We developed and calibrated a novel technique to measure dust attenuation in star-forming galaxies. The technique utilizes the strong stellar-wind emission lines in Wolf-Rayet stars, which are routinely observed in galaxy spectra locally and up to redshift 3. The He II 1640 and 4686 features are recombination lines whose intrinsic ratio is almost exclusively determined by atomic physics. Therefore it can serve as a stellar dust probe in the same way as the nebular hydrogen-line ratio can be used to measure the reddening of the gas phase. The new technique allows us to study stellar and nebular attenuation in galaxies separately and to test its effects at different stellar age and mass regimes, independently of assumptions on the stellar initial mass function. In this proposal we request co-spatial optical STIS spectroscopy of eight star-forming galaxies with existing archival ultraviolet spectra but lacking co-spatial optical data through matching apertures.The need for high spatial resolution and matching apertures precludes the use of ground-based data. We will use the line ratios of the broad (non-nebular) Wolf-Rayet lines at 1640 and 4686 A to determine the dust attenuation of the most massive stars and compare it to the reddening of the less massive stars, as indicated by the ultraviolet continuum slope, as well as to the gas reddening. This allows us to disentangle the effects of stellar mass, age, and stellar versus nebular reddening in star-forming galaxies.

OBSERVING DESCRIPTION

The eight targeted galaxies have been successfully observed before as part of programs 7513 and 9036 using STIS with the G140L and G230L gratings and the 52x0.2 and 52x0.5 apertures. Therefore the coordinates and acquisition parameters are well known, and the requested observations in G430M and G430L are risk-free. As has been done in both previous programs, we will use an imaging acquisition with the optical long-pass filter. No peak-up will be performed. Typical exposure times are between 20 and 60 s. In Table 1, column 5 we list one archival UV dataset for each galaxy. In all cases, there are additional G140L and (in six cases) G230L spectra.

The available UV spectra permit a safe estimate of the expected fluxes around 4686. The derived values are in column 6 of Table 1. We will collect spectra with the G430M (4706) and G430L (4300) gratings. While the broad W-R 4686 line itself will be easily detected with G430L, we expect some contribution by nebular lines of [Fe III] 4658, [Ar IV] 4711 and [Ar IV] 4740 (Schaerer et al. 1999). This is not an issue at the wavelength of the UV 1640 line, where there are no such lines, but requires more care in the case of the optical 4686 line. These effects can be mitigated by the higher resolution of the G430M grating. Column 8 of Table 1 gives the required exposure times in order to reach S/N = 20 with the G430M grating. This S/N is based on our prior extensive experience with HST spectra of star-forming galaxies.

We will also take short G430L spectra to measure the continuum in combination with the UV spectra. The G430L spectra will also be used to determine the nebular reddening from Ha and Hb. The exposure times for G430L are negligible (300 s or less). All spectra will be cr-split for cosmic-

ray removal.

The total overhead consists of the guide-star acquisition (6 min), target acquisition (7 min), instrument set-up (5 min), and guide-star re-acquisition (4 min), plus a few minutes for data managements. The estimated orbit duration for the eight galaxies is about 54 min. Therefore we can fit the observations for the two gratings into one or two orbits per galaxy.

Visit

Proposal 15846, He-2-10 (01), completed Fri Jan 29 20:00:19 GMT 2021

Diagnostic Status: Warning

Scientific Instruments: STIS/CCD

Special Requirements: ORIENT 129.5D TO 130.5 D; ORIENT 309.5D TO 310.5 D

Diagnostics

(He-2-10 (01)) Warning (Orbit Planner): ORBITAL VISIBILITY OVERRUN

(He-2-10 (01)) Warning (Orbit Planner): STIS EXPOSURE TIME ROUNDED DOWN TO NEAREST 0.1 SECONDS

(He-2-10 (01)) Warning (Orbit Planner): STIS EXPOSURE TIME ROUNDED DOWN TO NEAREST 0.1 SECONDS

(He-2-10 (01)) Warning (Orbit Planner): STIS EXPOSURE TIME ROUNDED DOWN TO NEAREST 0.1 SECONDS

Fixed Targets

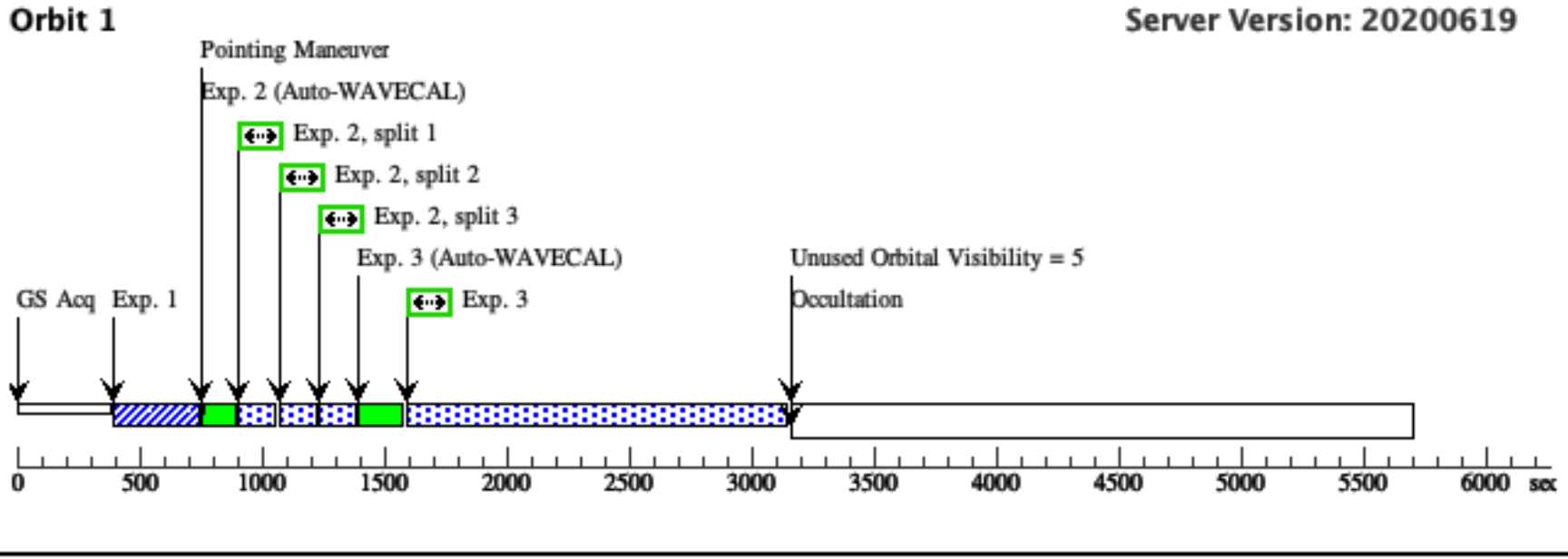
#	Name	Target Coordinates	Targ. Coord. Corrections	Fluxes	Miscellaneous
(1)	HE-2-10	RA: 08 36 15.1300 (129.0630417d) Dec: -26 24 33.70 (-26.40936d) Equinox: J2000		V=11.1 F(4700) = 1e-15	Reference Frame: ICRS

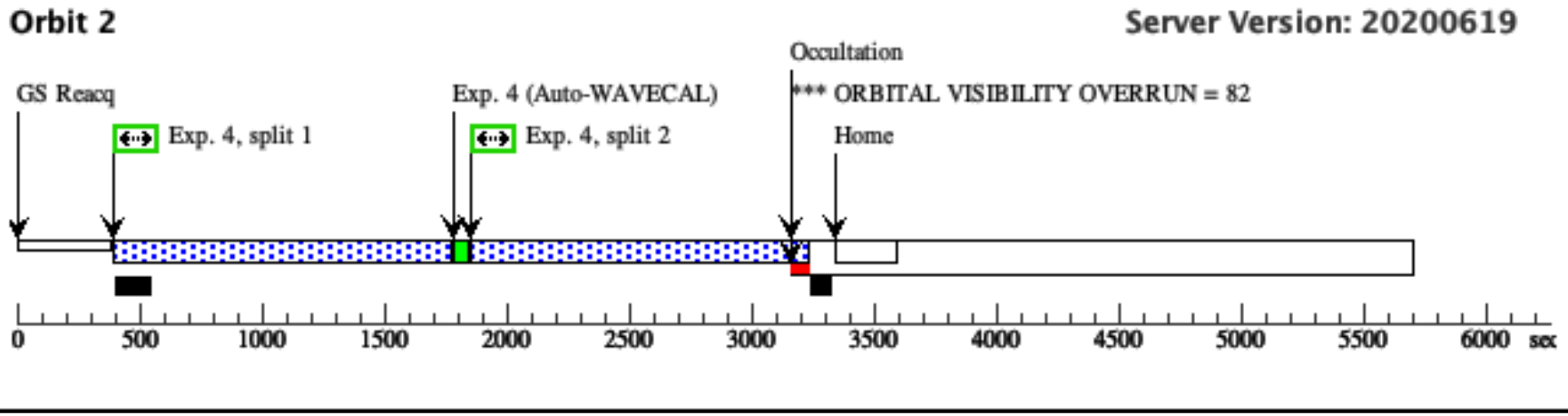
Comments: This object was generated by the targetselector and retrieved from the NED database.
Category=GALAXY
Description=[STAR FORMING REGION]
Extended=NO

Exposures

#	Label	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time (Total)/[Actual Dur.]	Orbit
1		(1) HE-2-10	STIS/CCD, ACQ, F28X50LP	MIRROR	ACQTYPE=POINT			30 Secs (30 Secs) *[==>]*	***[1]***
2		(1) HE-2-10	STIS/CCD, ACCUM, 52X0.2	G430L 4300 A	CR-SPLIT=3			350 Secs (350 Secs) *[==>(Split 1)]* *[==>(Split 2)]* *[==>(Split 3)]*	***[1]***
3		(1) HE-2-10	STIS/CCD, ACCUM, 52X0.2	G430M 4706 A	CR-SPLIT=NO			1515 Secs (1515 Secs) *[==>]*	***[1]***
4		(1) HE-2-10	STIS/CCD, ACCUM, 52X0.2	G430M 4706 A	CR-SPLIT=2			2680 Secs (2680 Secs) *[==>(Split 1)]* *[==>(Split 2)]*	***[2]***

Orbit Structure





Visit

Proposal 15846, NGC-3049 (02), completed Fri Jan 29 20:00:19 GMT 2021

Diagnostic Status: No Diagnostics

Scientific Instruments: STIS/CCD

Special Requirements: ORIENT 266.5D TO 267.5 D; ORIENT 86.5D TO 87.5 D

Fixed Targets

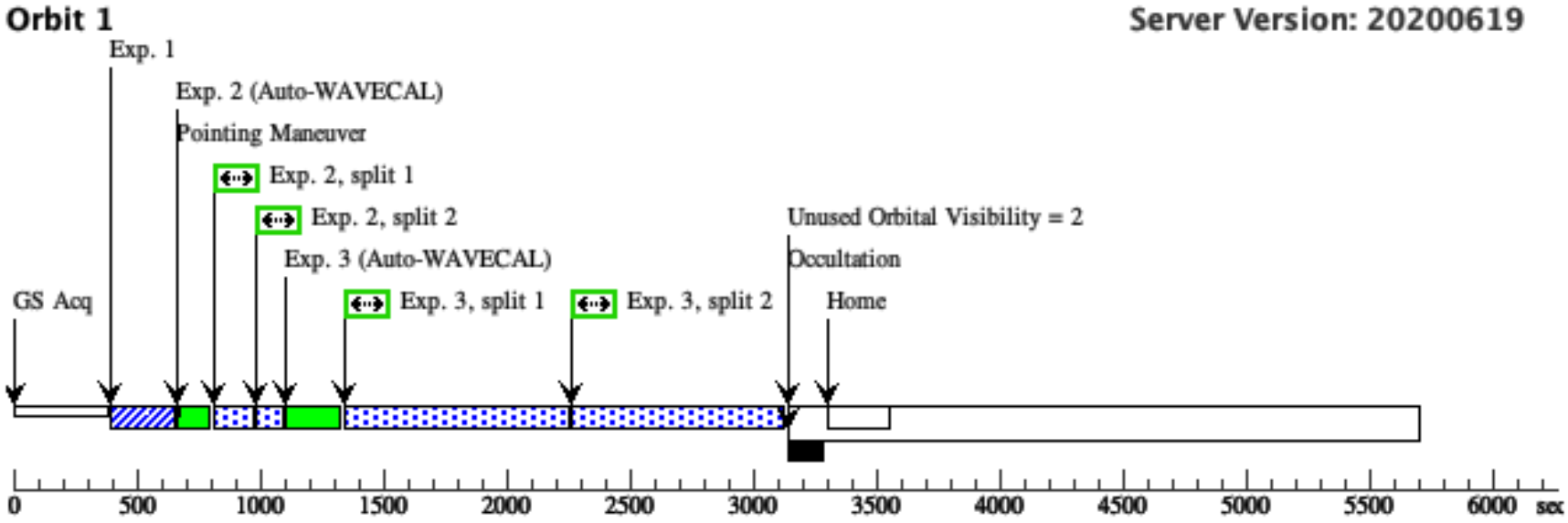
#	Name	Target Coordinates	Targ. Coord. Corrections	Fluxes	Miscellaneous
(2)	NGC-3049	RA: 09 54 49.4000 (148.7058333d) Dec: +09 16 15.90 (9.27108d) Equinox: J2000		V=12.5 F(4700) = 4e-15	Reference Frame: ICRS

Comments: This object was generated by the targetselector and retrieved from the SIMBAD database.
Category=GALAXY
Description=[STAR FORMING REGION]
Extended=NO

Exposures

#	Label	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time (Total)/[Actual Dur.]	Orbit
1		(2) NGC-3049	STIS/CCD, ACQ, F28X50LP	MIRROR	ACQTYPE=POINT			8 Secs (8 Secs) *[==>]*	*[1]*
2		(2) NGC-3049	STIS/CCD, ACCUM, 52X0.5	G430L 4300 A	CR-SPLIT=2			150 Secs (150 Secs) *[==>(Split 1)]* *[==>(Split 2)]*	*[1]*
3		(2) NGC-3049	STIS/CCD, ACCUM, 52X0.5	G430M 4706 A	CR-SPLIT=2			1650 Secs (1650 Secs) *[==>(Split 1)]* *[==>(Split 2)]*	*[1]*

Orbit Structure



Visit

Proposal 15846, NGC-3125 (03), completed Fri Jan 29 20:00:19 GMT 2021

Diagnostic Status: Warning

Scientific Instruments: STIS/CCD

Special Requirements: SCHED 60%; ORIENT 166.8D TO 167.8 D; ORIENT 346.8D TO 347.8 D

Diagnostics

(NGC-3125 (03)) Warning (Orbit Planner): ORBITAL VISIBILITY OVERRUN

(NGC-3125 (03)) Warning (Orbit Planner): ORBITAL VISIBILITY OVERRUN

Fixed Targets

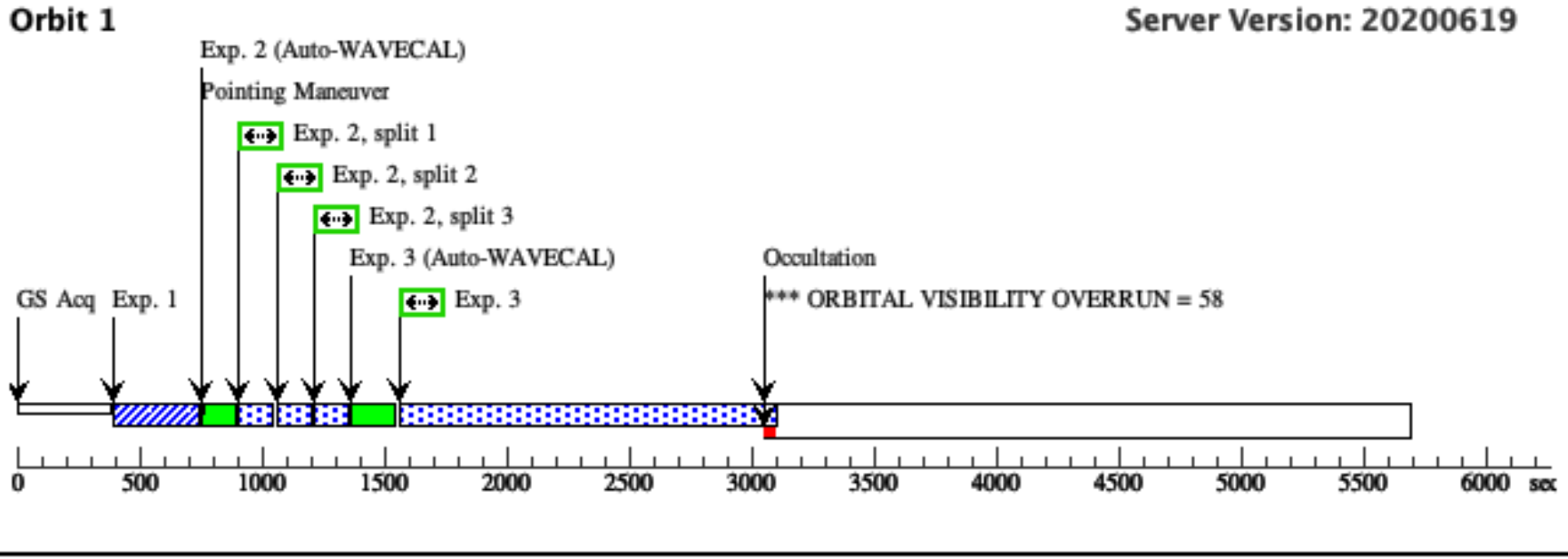
#	Name	Target Coordinates	Targ. Coord. Corrections	Fluxes	Miscellaneous
(3)	NGC-3125	RA: 10 06 33.2900 (151.6387083d)		V=13.0	Reference Frame: ICRS
		Dec: -29 56 6.80 (-29.93522d)		F(4700) = 6e-16	
		Equinox: J2000			

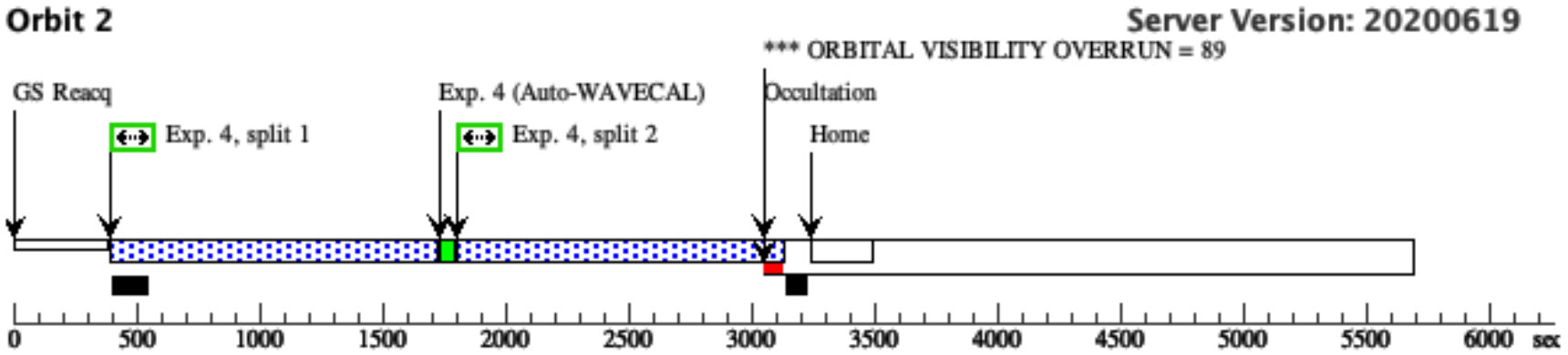
Comments: This object was generated by the targetselector and retrieved from the NED database.
Category=GALAXY
Description=[STAR FORMING REGION]
Extended=NO

Exposures

#	Label	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time (Total)/[Actual Dur.]	Orbit
1		(3) NGC-3125	STIS/CCD, ACQ, F28X50LP	MIRROR	ACQTYPE=POINT			30 Secs (30 Secs)	
								[==>]	***[1]***
2		(3) NGC-3125	STIS/CCD, ACCUM, 52X0.2	G430L	CR-SPLIT=3			350 Secs (316.8 Secs)	
				4300 A				*[==>105.6 Secs (Split 1)]*	***[1]***
								[==>105.6 Secs (Split 2)]	
								[==>105.6 Secs (Split 3)]	
3		(3) NGC-3125	STIS/CCD, ACCUM, 52X0.2	G430M	CR-SPLIT=NO			1515 Secs (1504 Secs)	
				4706 A				*[==>1504.0 Secs]*	***[1]***
4		(3) NGC-3125	STIS/CCD, ACCUM, 52X0.2	G430M	CR-SPLIT=2			2680 Secs (2580 Secs)	
				4706 A				*[==>1290.0 Secs (Split 1)]*	***[2]***
								[==>1290.0 Secs (Split 2)]	

Orbit Structure





Visit

Proposal 15846, Mrk-33 (04), implementation Fri Jan 29 20:00:19 GMT 2021

Diagnostic Status: No Diagnostics

Scientific Instruments: STIS/CCD

Special Requirements: SCHED 50%; ORIENT 12.2D TO 13.2 D; ORIENT 192.2D TO 193.2 D

Fixed Targets

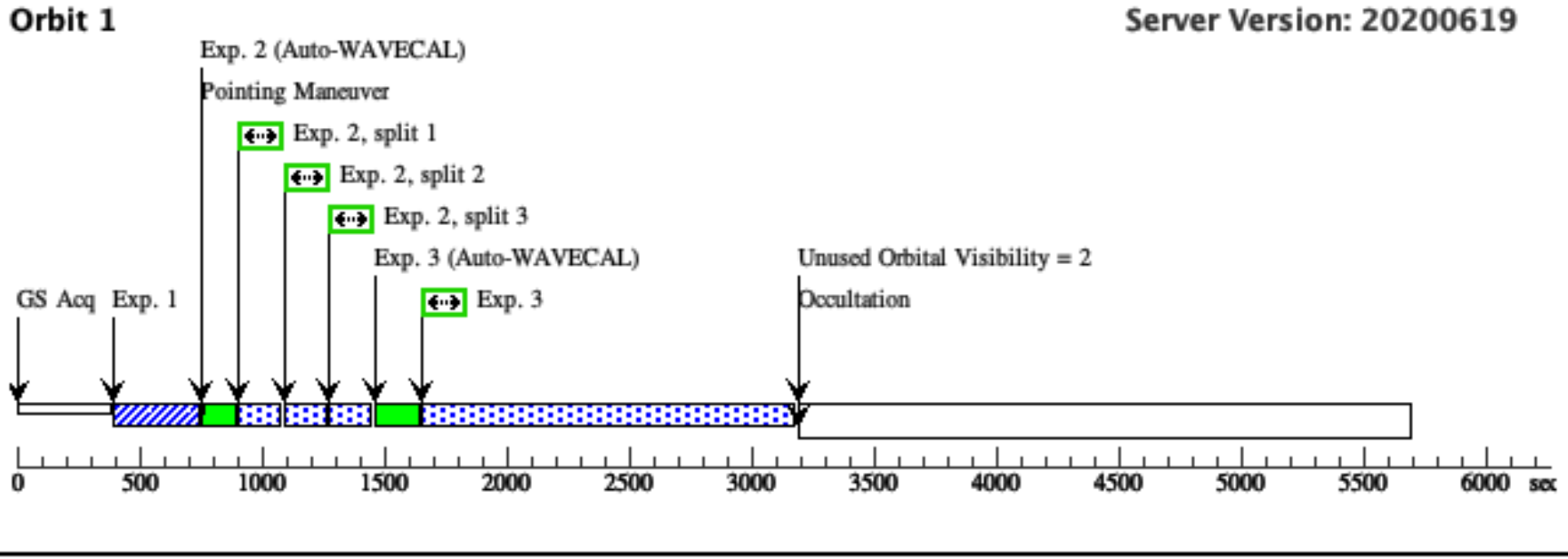
#	Name	Target Coordinates	Targ. Coord. Corrections	Fluxes	Miscellaneous
(4)	MRK-33	RA: 10 32 31.8800 (158.1328333d) Dec: +54 24 2.20 (54.40061d) Equinox: J2000		V=13.1 F(4700) = 8e-16	Reference Frame: ICRS

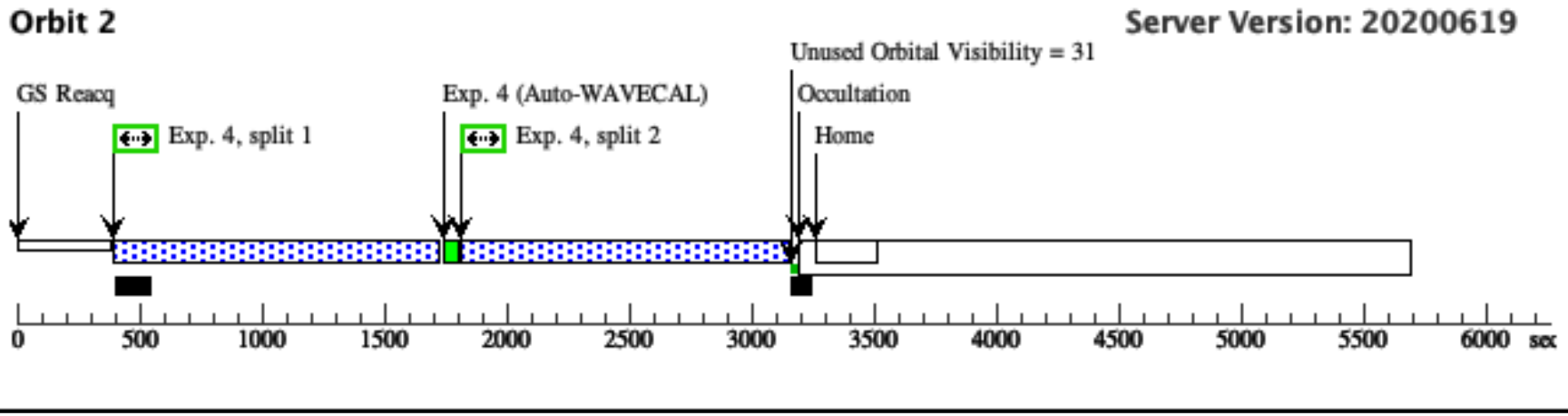
Comments: This object was generated by the targetselector and retrieved from the SIMBAD database.
Category=GALAXY
Description=[STAR FORMING REGION]
Extended=NO

Exposures

#	Label	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time (Total)/[Actual Dur.]	Orbit
1		(4) MRK-33	STIS/CCD, ACQ, F28X50LP	MIRROR	ACQTYPE=POINT			30 Secs (30 Secs) *[==>]*	***[1]***
2		(4) MRK-33	STIS/CCD, ACCUM, 52X0.2	G430L 4300 A	CR-SPLIT=3			500 Secs (412.8 Secs) *[==>137.6 Secs (Split 1)]* *[==>137.6 Secs (Split 2)]* *[==>137.6 Secs (Split 3)]*	***[1]***
3		(4) MRK-33	STIS/CCD, ACCUM, 52X0.2	G430M 4706 A	CR-SPLIT=NO			1515 Secs (1486 Secs) *[==>1486.0 Secs]*	***[1]***
4		(4) MRK-33	STIS/CCD, ACCUM, 52X0.2	G430M 4706 A	CR-SPLIT=2			2850 Secs (2598 Secs) *[==>1299.0 Secs (Split 1)]* *[==>1299.0 Secs (Split 2)]*	***[2]***

Orbit Structure





Visit

Proposal 15846, NGC-4214 (05), completed Fri Jan 29 20:00:19 GMT 2021

Diagnostic Status: Warning

Scientific Instruments: STIS/CCD

Special Requirements: ORIENT 220.5D TO 221.5 D; ORIENT 40.5D TO 41.5 D

Diagnostics

(NGC-4214 (05)) Warning (Orbit Planner): ORBITAL VISIBILITY OVERRUN

(NGC-4214 (05)) Warning (Orbit Planner): STIS EXPOSURE TIME ROUNDED DOWN TO NEAREST 0.1 SECONDS

(NGC-4214 (05)) Warning (Orbit Planner): STIS EXPOSURE TIME ROUNDED DOWN TO NEAREST 0.1 SECONDS

(NGC-4214 (05)) Warning (Orbit Planner): STIS EXPOSURE TIME ROUNDED DOWN TO NEAREST 0.1 SECONDS

Fixed Targets

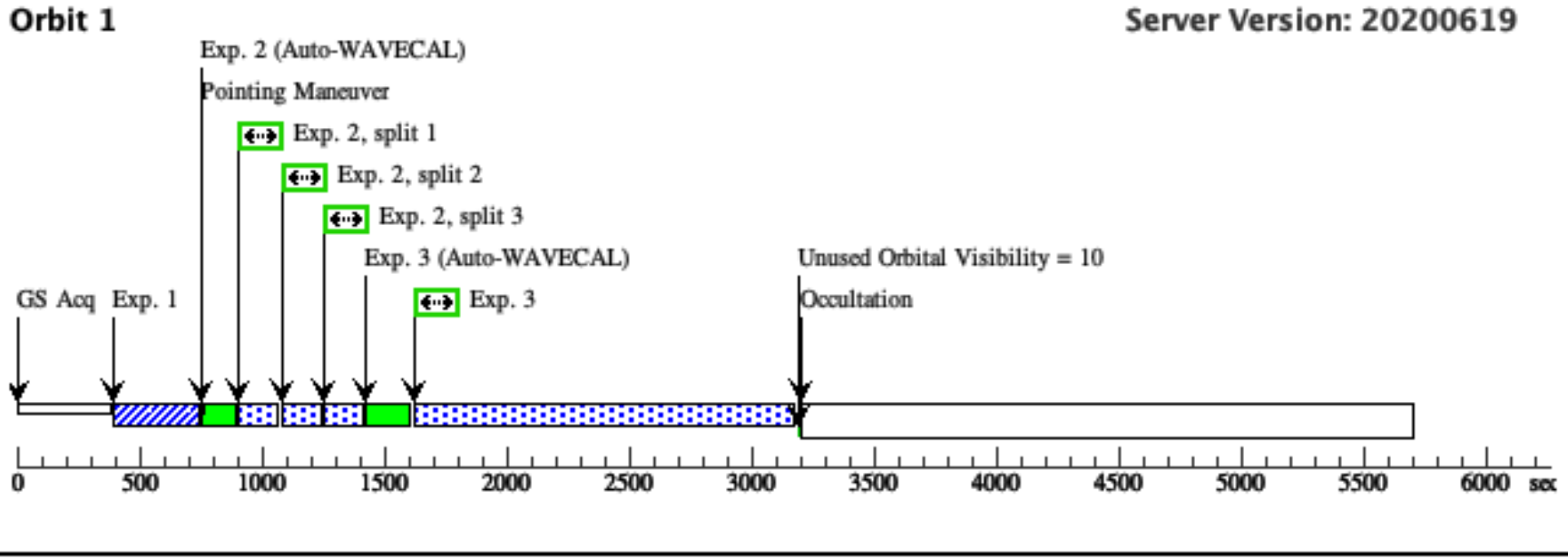
#	Name	Target Coordinates	Targ. Coord. Corrections	Fluxes	Miscellaneous
(5)	NGC-4214	RA: 12 15 39.4500 (183.9143750d) Dec: +36 19 34.80 (36.32633d) Equinox: J2000		V=10.2 F(4700) = 1e-15	Reference Frame: ICRS

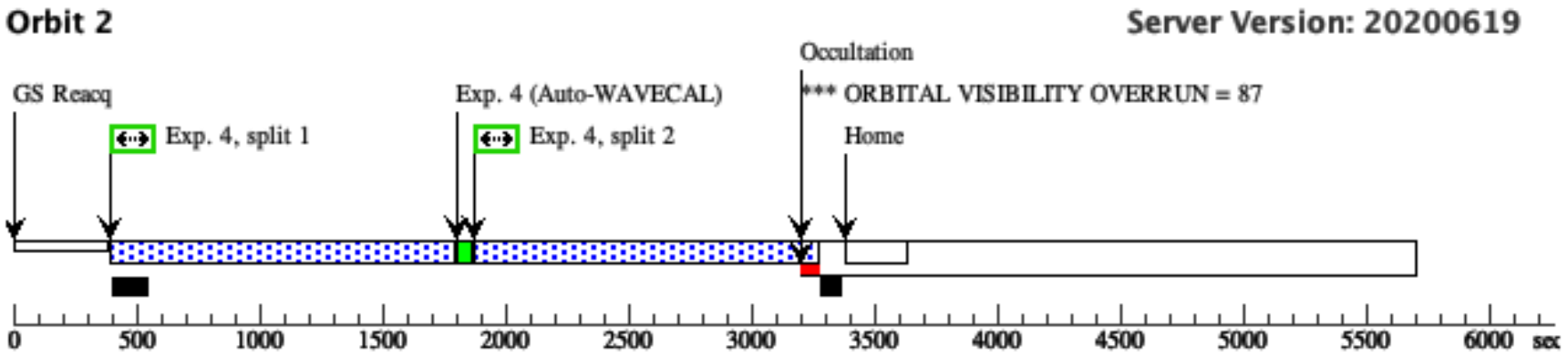
Comments: This object was generated by the targetselector and retrieved from the NED database.
Category=GALAXY
Description=[STAR FORMING REGION]
Extended=NO

Exposures

#	Label	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time (Total)/[Actual Dur.]	Orbit
1		(5) NGC-4214	STIS/CCD, ACQ, F28X50LP	MIRROR	ACQTYPE=POINT			30 Secs (30 Secs) *[==>]*	*[1]*
2		(5) NGC-4214	STIS/CCD, ACCUM, 52X0.2	G430L 4300 A	CR-SPLIT=3			380 Secs (380 Secs) *[==>(Split 1)]* *[==>(Split 2)]* *[==>(Split 3)]*	*[1]*
3		(5) NGC-4214	STIS/CCD, ACCUM, 52X0.2	G430M 4706 A	CR-SPLIT=NO			1515 Secs (1515 Secs) *[==>]*	*[1]*
4		(5) NGC-4214	STIS/CCD, ACCUM, 52X0.2	G430M 4706 A	CR-SPLIT=2			2720 Secs (2720 Secs) *[==>(Split 1)]* *[==>(Split 2)]*	*[2]*

Orbit Structure





Visit

Proposal 15846, NGC-4670 (06), scheduled Fri Jan 29 20:00:19 GMT 2021

Diagnostic Status: Warning

Scientific Instruments: STIS/CCD

Special Requirements: SCHED 50%; ORIENT 89.5D TO 90.5 D; ORIENT 268.5D TO 270.5 D

Diagnostics

(NGC-4670 (06)) Warning (Orbit Planner): ORBITAL VISIBILITY OVERRUN

Fixed Targets

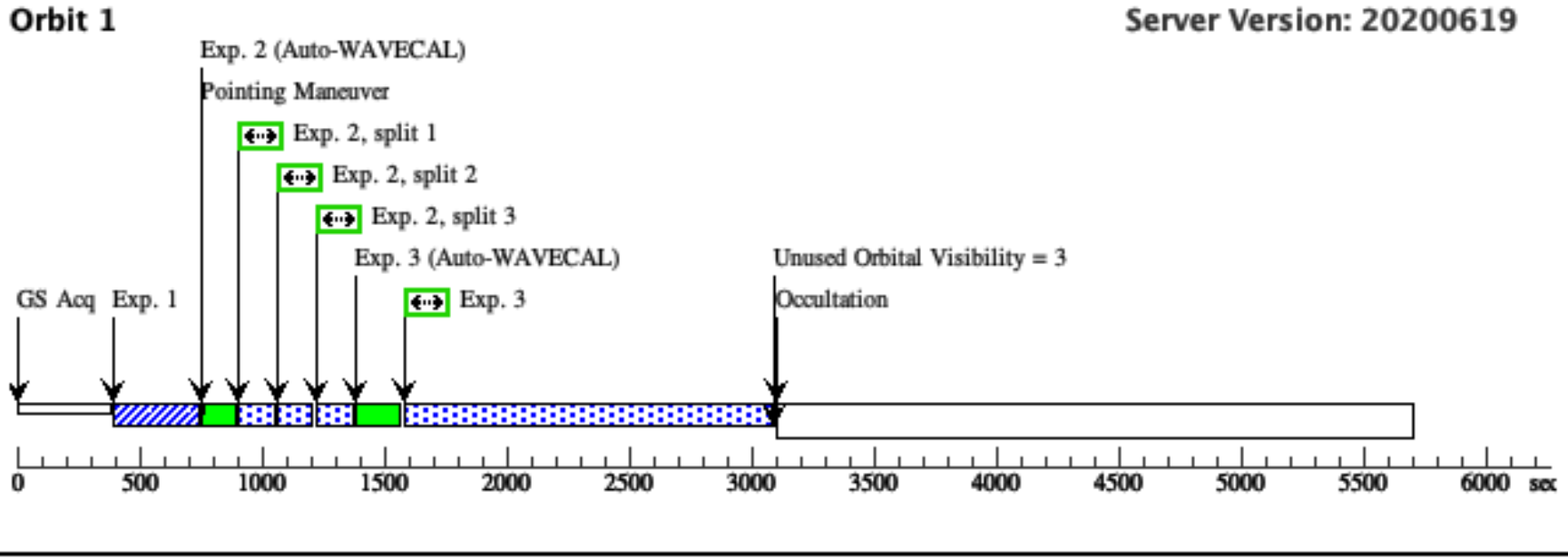
#	Name	Target Coordinates	Targ. Coord. Corrections	Fluxes	Miscellaneous
(6)	NGC-4670	RA: 12 45 17.4400 (191.3226667d) Dec: +27 07 31.80 (27.12550d) Equinox: J2000		V=12.2 F(4700) = 9e-16	Reference Frame: ICRS

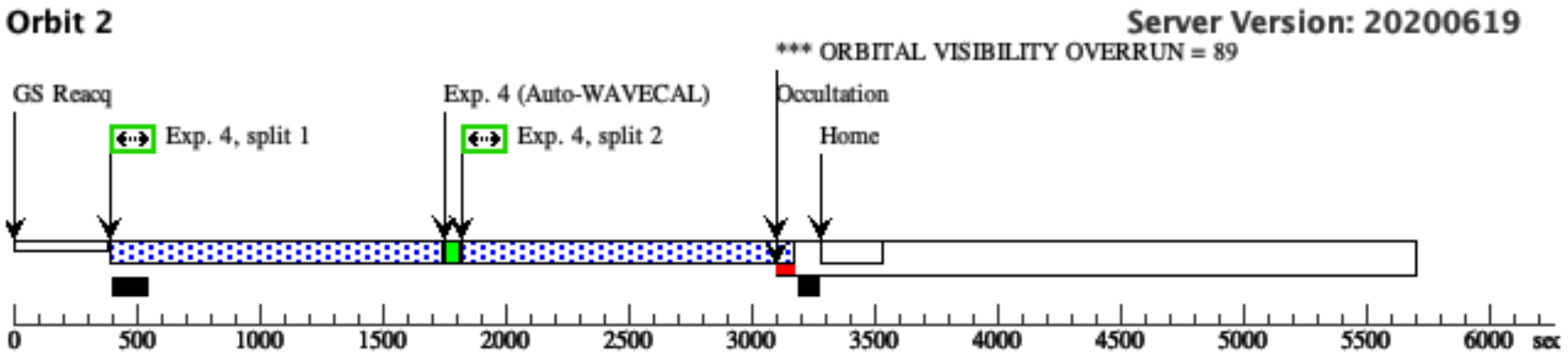
Comments: This object was generated by the targetselector and retrieved from the SIMBAD database.
Category=GALAXY
Description=[STAR FORMING REGION]
Extended=NO

Exposures

#	Label	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time (Total)/[Actual Dur.]	Orbit
1		(6) NGC-4670	STIS/CCD, ACQ, F28X50LP	MIRROR	ACQTYPE=POINT	GS ACQ SCENARIO BASE1BE		30 Secs (30 Secs) *[==>]*	***[1]***
2		(6) NGC-4670	STIS/CCD, ACCUM, 52X0.2	G430L 4300 A	CR-SPLIT=3			380 Secs (337.8 Secs) *[==>112.6 Secs (Split 1)]* *[==>112.6 Secs (Split 2)]* *[==>112.6 Secs (Split 3)]*	***[1]***
3		(6) NGC-4670	STIS/CCD, ACCUM, 52X0.2	G430M 4706 A	CR-SPLIT=NO			1480 Secs (1466 Secs) *[==>1466.0 Secs]*	***[1]***
4		(6) NGC-4670	STIS/CCD, ACCUM, 52X0.2	G430M 4706 A	CR-SPLIT=2			2680 Secs (2624 Secs) *[==>1312.0 Secs (Split 1)]* *[==>1312.0 Secs (Split 2)]*	***[2]***

Orbit Structure





Visit

Proposal 15846, Tol-89 (07), completed Fri Jan 29 20:00:19 GMT 2021

Diagnostic Status: No Diagnostics

Scientific Instruments: STIS/CCD

Special Requirements: ORIENT 314D TO 316 D; ORIENT 134D TO 136 D

Fixed Targets

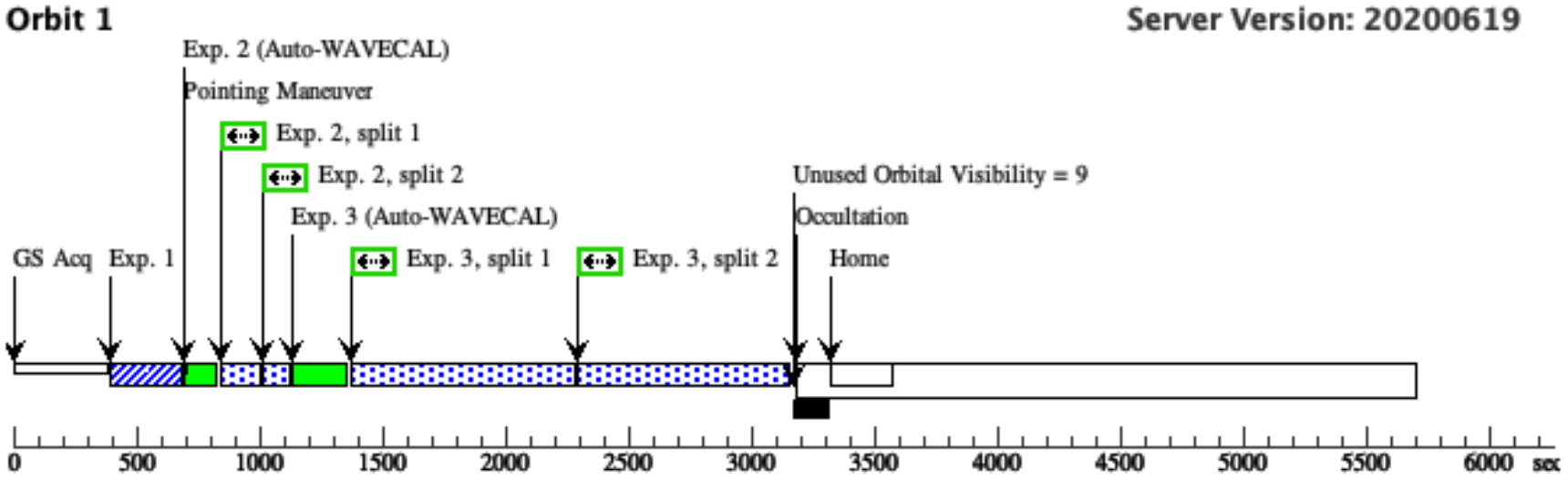
#	Name	Target Coordinates	Targ. Coord. Corrections	Fluxes	Miscellaneous
(7)	TOL-89	RA: 14 01 19.9200 (210.3330000d) Dec: -33 04 10.70 (-33.06964d) Equinox: J2000	Epoch of Position: 2015.5	V=12.0 F(4700) = 2e-15	Reference Frame: ICRS

Comments: This object was generated by the targetselector and retrieved from the SIMBAD database.
Category=GALAXY
Description=[STAR FORMING REGION]
Extended=NO

Exposures

#	Label	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time (Total)/[Actual Dur.]	Orbit
1		(7) TOL-89	STIS/CCD, ACQ, F28X50LP	MIRROR	ACQTYPE=POINT			15 Secs (15 Secs) *[==>]*	*[1]*
2		(7) TOL-89	STIS/CCD, ACCUM, 52X0.5	G430L 4300 A	CR-SPLIT=2			150 Secs (150 Secs) *[==>(Split 1)]* *[==>(Split 2)]*	*[1]*
3		(7) TOL-89	STIS/CCD, ACCUM, 52X0.5	G430M 4706 A	CR-SPLIT=2			1650 Secs (1650 Secs) *[==>(Split 1)]* *[==>(Split 2)]*	*[1]*

Orbit Structure



Visit

Proposal 15846, Tol-1924-416 (08), scheduling Fri Jan 29 20:00:19 GMT 2021

Diagnostic Status: Warning

Scientific Instruments: STIS/CCD

Special Requirements: SCHED 70%; ORIENT 130.5D TO 131.5 D; ORIENT 310.5D TO 311.5 D

Diagnostics

(Tol-1924-416 (08)) Warning (Orbit Planner): ORBITAL VISIBILITY OVERRUN

Fixed Targets

#	Name	Target Coordinates	Targ. Coord. Corrections	Fluxes	Miscellaneous
(8)	TOL-1924-416	RA: 19 27 58.3100 (291.9929583d) Dec: -41 34 29.80 (-41.57494d) Equinox: J2000		V=13.2 F(4700) = 8e-16	Reference Frame: ICRS

Comments: This object was generated by the targetselector and retrieved from the SIMBAD database.
Category=GALAXY
Description=[STAR FORMING REGION]
Extended=NO

Exposures

#	Label	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time (Total)/[Actual Dur.]	Orbit
1		(8) TOL-1924-416	STIS/CCD, ACQ, F28X50LP	MIRROR	ACQTYPE=POINT	GS ACQ SCENARIO BASE1BE		30 Secs (30 Secs) *[==>]*	***[1]***
2		(8) TOL-1924-416	STIS/CCD, ACCUM, 52X0.2	G430L 4300 A	CR-SPLIT=3			380 Secs (253.8 Secs) *[==>84.6 Secs (Split 1)]* *[==>84.6 Secs (Split 2)]* *[==>84.6 Secs (Split 3)]*	***[1]***
3		(8) TOL-1924-416	STIS/CCD, ACCUM, 52X0.2	G430M 4706 A	CR-SPLIT=NO			1560 Secs (1518 Secs) *[==>1518.0 Secs]*	***[1]***
4		(8) TOL-1924-416	STIS/CCD, ACCUM, 52X0.2	G430M 4706 A	CR-SPLIT=2			2760 Secs (2590 Secs) *[==>1295.0 Secs (Split 1)]* *[==>1295.0 Secs (Split 2)]*	***[2]***

Orbit Structure