17920 - Constraining Composition, Clouds, and Hazes in a Long-Period Giant Planet

Cycle: 32, Proposal Category: GO

(Availability Mode: SUPPORTED)

INVESTIGATORS

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Dr. Armen Tokadjian (CoI)	Jet Propulsion Laboratory

VISITS

Visit	*Targets used in Visit*	*Configurations used in Visit*	*Orbits Used*	*Last Orbit Planner Run*	*OP Current with Visit?*
01	(1) BD+39-3325	WFC3/IR	8	06-Mar-2025 17:00:41.0	yes

8 Total Orbits Used

ABSTRACT

With TSM = 243, TOI-2134 c is by far the best known temperate (Teq < 400 K) planet for transmission spectroscopy with a precise mass constraint, largely because the host star is exceptionally bright (Ks = 6.1). We propose to measure the transmission spectrum of this uniquely important planet between 1.1-1.7 micron with WFC3/G141, where all available JWST observation modes would otherwise saturate. We expect that a WFC3/G141 spectrum of this planet will constrain the planet's NH3 abundance to a precision of 0.6 dex, providing unprecedented constraints on planet formation

and evolution models. If the atmosphere of this temperate planet is cloudy, our data would instead provide the first constraints on water clouds in a planet or brown dwarf outside the Solar System. Finally, if the planetary atmosphere is hazy, this would be the coldest exoplanet for which hazes have been detected, allowing us an opportunity to bridge Solar System haze studies (e.g. in Titan) with the hazes detected in warmer exoplanets. Only WFC3/G141 can enable these exciting advances in exoplanet atmosphere studies, and it can do so in only 8 orbits.

OBSERVING DESCRIPTION

We will observe the transit of TOI-2134c, which lasts roughly 3.5 orbits. We require a full transit duration's worth of baseline, plus an extra orbit at the start of the visit to cover ramp effects, totaling 8 consecutive HST orbits to enable transmission spectroscopy of the target. We will use WFC3/G141 with a similar setup to dozens of exoplanet transit observations in the infrared with HST. We use the spatial scanning mode to extend exposure times, opting for the 512 subarray for improved observational efficiency on this bright source. Using PandExo, we identified the optimal sampling sequence and scan rate, choosing round-trip scans to improve efficiency. The resultant observtions are expected to hit the ~35 ppm noise floor (determined by Stevenson & Fowler) for WFC3/IR spectroscopic observations given the brightness of the host.

We start each orbit sequence with a direct image for wavecal as is standard for WFC3/IR scan spectroscopy, and buffer with additional wavecal reads to ensure that there is a buffer dump exactly at the end of each orbit, maximizing observing efficiency. The remainder of the exposures in the orbit are science exposures. This strategy was adopted previously in GO 13501, which was a WFC3 spatial scan observation of another very bright source HD 97658.

We adopt POS TARG X of -16.5 to roughly center the spectral trace on the detector (same setup as GO 15333 and GO 15255, both of which spatially scan for GRISM512 on similarly (very) bright sources), and POS TARG Y of -24 to capture the full spatially scanned trace on the detector in every image.

Visit

Proposal 17920, TOI-2134c WFC3 (01), implementation Thu Mar 06 22:00:44 GMT 2025

Diagnostic Status: No Diagnostics

Scientific Instruments: WFC3/IR

Special Requirements: SCHED 100%; Period 95.8528722 D AND ZERO-PHASE HJD2459718.969335

Comments: WFC3 IR transit of TOI-2134c. We would like the transit to be scheduled with 8 continuous orbits, which is longer than the typical WFC3 IR spatial scan transit observation because of the unique nature of the target (an exceptionally long-period gas giant with a correspondingly long transit duration).

Fixed Targets

#	Name	Target Coordinates	Targ. Coord. Corrections	Fluxes	Miscellaneous
(1)	BD+39-3325	RA: 18 07 44.4478 (271.9351992d) Dec: +39 04 26.92 (39.07414d) Equinox: J2000	Proper Motion RA: 54.536 mas/yr Proper Motion Dec: -283.050999905754 mas/yr Parallax: 0.0441087" Epoch of Position: 2000	V=8.93	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=[EXTRA-SOLAR PLANET, EXTRA-SOLAR PLANETARY SYSTEM, K III-I, K V-IV]
Extended=NO

Exposures

#	Label	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time (Total)/[Actual Dur.]	Orbit
1	Exposure 1 (Wavecal)	(1) BD+39-3325	WFC3/IR, MULTIACCUM, GRISM512	F130N	SAMP-SEQ=RAPID ; NSAMP=15	PHASE 0.9967180604387424 TO 0.9973701014111778	Sequence 1-3 Non-Int in TOI-2134c WFC3 (01)	12.795405 Secs (12.795 Secs) *[==>]*	 ***[1]***
2	Exposure 2 (Wavecal buffer)	(1) BD+39-3325	WFC3/IR, MULTIACCUM, GRISM512	F130N	SAMP-SEQ=RAPID ; NSAMP=6		Sequence 1-3 Non-Int in TOI-2134c WFC3 (01)	5.118162 Secs (5.118 Secs) *[==>]*	 ***[1]***
3	Exposure 3 (Science)	(1) BD+39-3325	WFC3/IR, MULTIACCUM, GRISM512	G141	SAMP-SEQ=SPARS25; NSAMP=3	POS TARG -16.5,-24; SPATIAL SCAN 0.854369,90.0 Degrees, Round trip	Sequence 1-3 Non-Int in TOI-2134c WFC3 (01)	46.695529 Secs X 12 (1120.693 Secs) *[==>(Copy 1, Forward)]* *[==>(Copy 1, Reverse)]* *[==>(Copy 2, Forward)]* *[==>(Copy 2, Reverse)]* *[==>(Copy 3, Forward)]* *[==>(Copy 3, Reverse)]* *[==>(Copy 4, Forward)]* *[==>(Copy 4, Reverse)]* *[==>(Copy 5, Forward)]* *[==>(Copy 5, Reverse)]* *[==>(Copy 6, Forward)]* *[==>(Copy 6, Reverse)]* *[==>(Copy 7, Forward)]* *[==>(Copy 7, Reverse)]* *[==>(Copy 8, Forward)]* *[==>(Copy 8, Reverse)]* *[==>(Copy 9, Forward)]* *[==>(Copy 9, Reverse)]* *[==>(Copy 10, Forward)]* *[==>(Copy 10, Reverse)]* *[==>(Copy 11, Forward)]* *[==>(Copy 11, Reverse)]* *[==>(Copy 12, Forward)]* *[==>(Copy 12, Reverse)]*	 ***[1]***
4	Exposure 4 (Wavecal)	(1) BD+39-3325	WFC3/IR, MULTIACCUM, GRISM512	F130N	SAMP-SEQ=RAPID ; NSAMP=15		Sequence 4-6 Non-Int in TOI-2134c WFC3 (01)	12.795405 Secs (12.795 Secs) *[==>]*	 ***[2]***
5	Exposure 5 (Wavecal buffer)	(1) BD+39-3325	WFC3/IR, MULTIACCUM, GRISM512	F130N	SAMP-SEQ=RAPID ; NSAMP=6		Sequence 4-6 Non-Int in TOI-2134c WFC3 (01)	5.118162 Secs (5.118 Secs) *[==>]*	 ***[2]***

	6	Exposure 6 ((1) BD+39-3325 Science)	WFC3/IR, MULTIACCUM, GRISM512	G141	SAMP-SEQ=SPARS 25; NSAMP=3	POS TARG -16.5,-2 4; SPATIAL SCAN 0.8 54369,90.0 Degrees, Round trip	Sequence 4-6 Non-In t in TOI-2134c WFC 3 (01)	46.695529 Secs X 12 (1120.693 Sec s) *[==>(Copy 1, Forward)]* *[==>(Copy 1, Reverse)]* *[==>(Copy 2, Forward)]* *[==>(Copy 2, Reverse)]* *[==>(Copy 3, Forward)]* *[==>(Copy 3, Reverse)]* *[==>(Copy 4, Forward)]* *[==>(Copy 4, Reverse)]* *[==>(Copy 5, Forward)]* *[==>(Copy 5, Reverse)]* *[==>(Copy 6, Forward)]* *[==>(Copy 6, Reverse)]* *[==>(Copy 7, Forward)]* *[==>(Copy 7, Reverse)]* *[==>(Copy 8, Forward)]* *[==>(Copy 8, Reverse)]* *[==>(Copy 9, Forward)]* *[==>(Copy 9, Reverse)]* *[==>(Copy 10, Forward)]* *[==>(Copy 10, Reverse)]* *[==>(Copy 11, Forward)]* *[==>(Copy 11, Reverse)]* *[==>(Copy 12, Forward)]* *[==>(Copy 12, Reverse)]*	***[2]***
	7	Exposure 7 ((1) BD+39-3325 Wavecal)	WFC3/IR, MULTIACCUM, GRISM512	F130N	SAMP-SEQ=RAPID ; NSAMP=15		Sequence 7-9 Non-In t in TOI-2134c WFC 3 (01)	12.795405 Secs (12.795 Secs) *[==>]*	***[3]***
	8	Exposure 8 ((1) BD+39-3325 Wavecal buf fer)	WFC3/IR, MULTIACCUM, GRISM512	F130N	SAMP-SEQ=RAPID ; NSAMP=6		Sequence 7-9 Non-In t in TOI-2134c WFC 3 (01)	5.118162 Secs (5.118 Secs) *[==>]*	***[3]***

	9	Exposure 9 (Science)	(1) BD+39-3325	WFC3/IR, MULTIACCUM, GRISM512	G141	SAMP-SEQ=SPARS 25; NSAMP=3	POS TARG -16.5,-2 4; SPATIAL SCAN 0.8 54369,90.0 Degrees, Round trip	Sequence 7-9 Non-In t in TOI-2134c WFC 3 (01)	46.695529 Secs X 13 (1214.084 Sec s) *[==>(Copy 1, Forward)]* *[==>(Copy 1, Reverse)]* *[==>(Copy 2, Forward)]* *[==>(Copy 2, Reverse)]* *[==>(Copy 3, Forward)]* *[==>(Copy 3, Reverse)]* *[==>(Copy 4, Forward)]* *[==>(Copy 4, Reverse)]* *[==>(Copy 5, Forward)]* *[==>(Copy 5, Reverse)]* *[==>(Copy 6, Forward)]* *[==>(Copy 6, Reverse)]* *[==>(Copy 7, Forward)]* *[==>(Copy 7, Reverse)]* *[==>(Copy 8, Forward)]* *[==>(Copy 8, Reverse)]* *[==>(Copy 9, Forward)]* *[==>(Copy 9, Reverse)]* *[==>(Copy 10, Forward)]* *[==>(Copy 10, Reverse)]* *[==>(Copy 11, Forward)]* *[==>(Copy 11, Reverse)]* *[==>(Copy 12, Forward)]* *[==>(Copy 12, Reverse)]* *[==>(Copy 13, Forward)]* *[==>(Copy 13, Reverse)]*	***[3]***
	10	Exposure 10 (Wavecal)	(1) BD+39-3325	WFC3/IR, MULTIACCUM, GRISM512	F130N	SAMP-SEQ=RAPID ; NSAMP=15		Sequence 10-12 Non -Int in TOI-2134c W FC3 (01)	12.795405 Secs (12.795 Secs) *[==>]*	***[4]***
	11	Exposure 11 (Wavecal bu ffer)	(1) BD+39-3325	WFC3/IR, MULTIACCUM, GRISM512	F130N	SAMP-SEQ=RAPID ; NSAMP=6		Sequence 10-12 Non -Int in TOI-2134c W FC3 (01)	5.118162 Secs (5.118 Secs) *[==>]*	***[4]***

	12	Exposure 12 (Science)	(1) BD+39-3325	WFC3/IR, MULTIACCUM, GRISM512	G141	SAMP-SEQ=SPARS25; NSAMP=3	POS TARG -16.5,-24; SPATIAL SCAN 0.854369,90.0 Degrees, Round trip	Sequence 10-12 Non-Int in TOI-2134c WFC3 (01)	46.695529 Secs X 13 (1214.084 Secs) *[==>(Copy 1, Forward)]* *[==>(Copy 1, Reverse)]* *[==>(Copy 2, Forward)]* *[==>(Copy 2, Reverse)]* *[==>(Copy 3, Forward)]* *[==>(Copy 3, Reverse)]* *[==>(Copy 4, Forward)]* *[==>(Copy 4, Reverse)]* *[==>(Copy 5, Forward)]* *[==>(Copy 5, Reverse)]* *[==>(Copy 6, Forward)]* *[==>(Copy 6, Reverse)]* *[==>(Copy 7, Forward)]* *[==>(Copy 7, Reverse)]* *[==>(Copy 8, Forward)]* *[==>(Copy 8, Reverse)]* *[==>(Copy 9, Forward)]* *[==>(Copy 9, Reverse)]* *[==>(Copy 10, Forward)]* *[==>(Copy 10, Reverse)]* *[==>(Copy 11, Forward)]* *[==>(Copy 11, Reverse)]* *[==>(Copy 12, Forward)]* *[==>(Copy 12, Reverse)]* *[==>(Copy 13, Forward)]* *[==>(Copy 13, Reverse)]*	***[4]***
	13	Exposure 13 (Wavecal)	(1) BD+39-3325	WFC3/IR, MULTIACCUM, GRISM512	F130N	SAMP-SEQ=RAPID; NSAMP=15	NEW OBSET	Sequence 13-15 Non-Int in TOI-2134c WFC3 (01)	12.795405 Secs (12.795 Secs) *[==>]*	***[5]***
	14	Exposure 14 (Wavecal buffer)	(1) BD+39-3325	WFC3/IR, MULTIACCUM, GRISM512	F130N	SAMP-SEQ=RAPID; NSAMP=6		Sequence 13-15 Non-Int in TOI-2134c WFC3 (01)	5.118162 Secs (5.118 Secs) *[==>]*	***[5]***

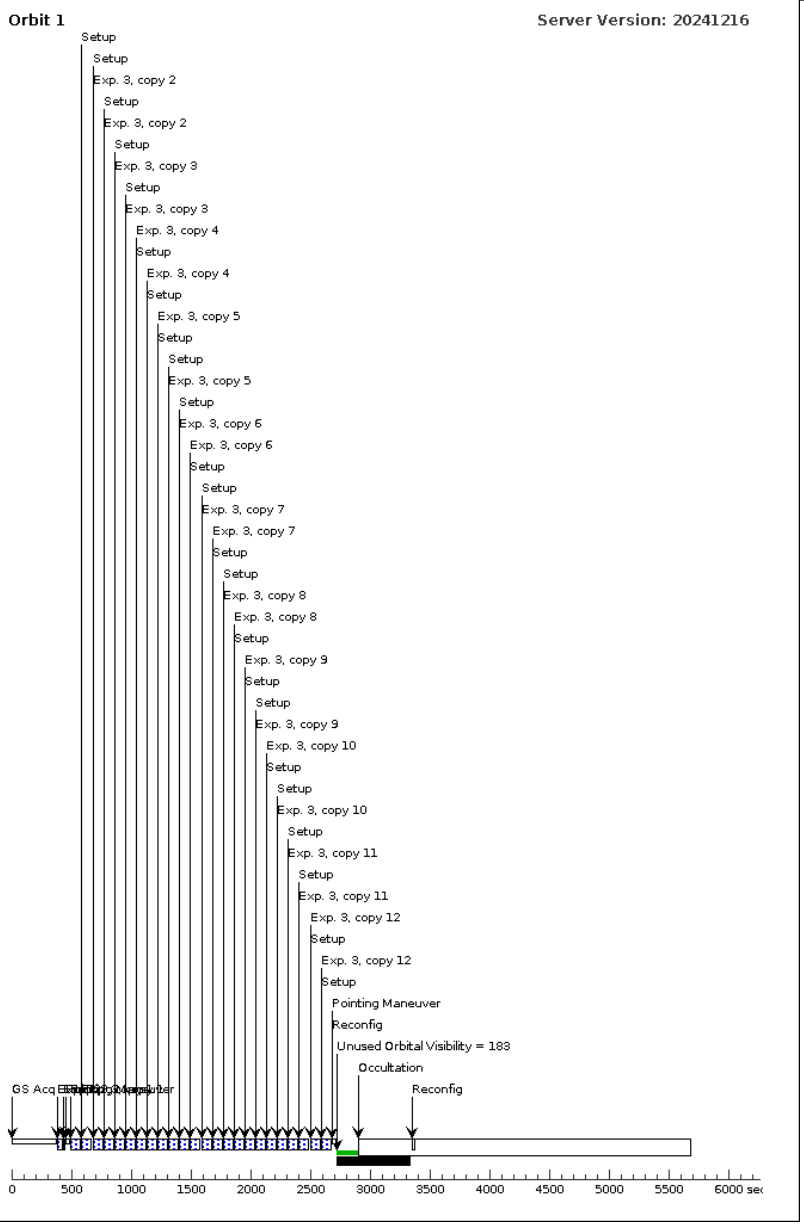
	15	Exposure 15 (Science)	(1) BD+39-3325	WFC3/IR, MULTIACCUM, GRISM512	G141	SAMP-SEQ=SPARS25; NSAMP=3	POS TARG -16.5,-24; SPATIAL SCAN 0.854369,90.0 Degrees, Round trip	Sequence 13-15 Non-Int in TOI-2134c WFC3 (01)	46.695529 Secs X 13 (1214.084 Secs) *[==>(Copy 1, Forward)]* *[==>(Copy 1, Reverse)]* *[==>(Copy 2, Forward)]* *[==>(Copy 2, Reverse)]* *[==>(Copy 3, Forward)]* *[==>(Copy 3, Reverse)]* *[==>(Copy 4, Forward)]* *[==>(Copy 4, Reverse)]* *[==>(Copy 5, Forward)]* *[==>(Copy 5, Reverse)]* *[==>(Copy 6, Forward)]* *[==>(Copy 6, Reverse)]* *[==>(Copy 7, Forward)]* *[==>(Copy 7, Reverse)]* *[==>(Copy 8, Forward)]* *[==>(Copy 8, Reverse)]* *[==>(Copy 9, Forward)]* *[==>(Copy 9, Reverse)]* *[==>(Copy 10, Forward)]* *[==>(Copy 10, Reverse)]* *[==>(Copy 11, Forward)]* *[==>(Copy 11, Reverse)]* *[==>(Copy 12, Forward)]* *[==>(Copy 12, Reverse)]* *[==>(Copy 13, Forward)]* *[==>(Copy 13, Reverse)]*	 ***[5]***
	16	Exposure 16 (Wavecal)	(1) BD+39-3325	WFC3/IR, MULTIACCUM, GRISM512	F130N	SAMP-SEQ=RAPID; NSAMP=15		Sequence 16-18 Non-Int in TOI-2134c WFC3 (01)	12.795405 Secs (12.795 Secs) *[==>]*	 ***[6]***
	17	Exposure 17 (Wavecal buffer)	(1) BD+39-3325	WFC3/IR, MULTIACCUM, GRISM512	F130N	SAMP-SEQ=RAPID; NSAMP=6		Sequence 16-18 Non-Int in TOI-2134c WFC3 (01)	5.118162 Secs (5.118 Secs) *[==>]*	 ***[6]***

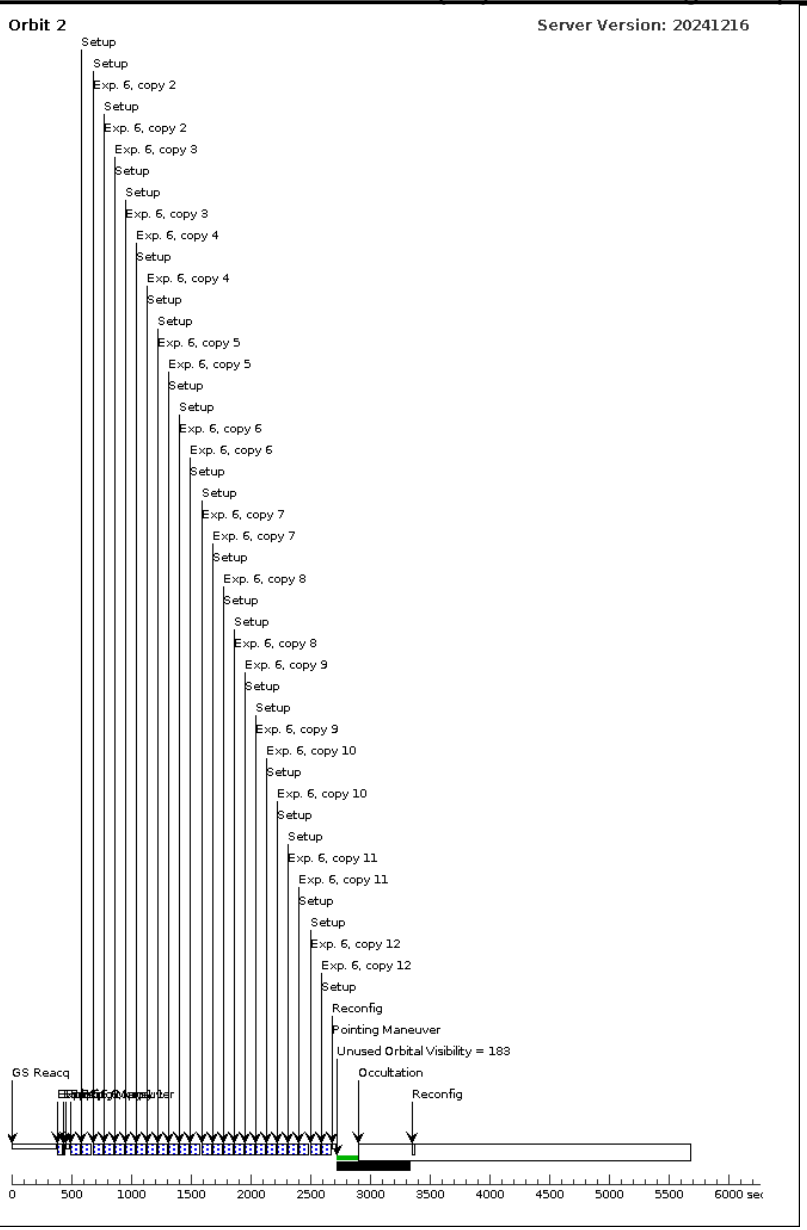
	18	Exposure 18 (Science)	(1) BD+39-3325	WFC3/IR, MULTIACCUM, GRISM512	G141	SAMP-SEQ=SPARS25; NSAMP=3	POS TARG -16.5,-24; SPATIAL SCAN 0.854369,90.0 Degrees, Round trip	Sequence 16-18 Non-Int in TOI-2134c WFC3 (01)	46.695529 Secs X 13 (1214.084 Secs) *[==>(Copy 1, Forward)]* *[==>(Copy 1, Reverse)]* *[==>(Copy 2, Forward)]* *[==>(Copy 2, Reverse)]* *[==>(Copy 3, Forward)]* *[==>(Copy 3, Reverse)]* *[==>(Copy 4, Forward)]* *[==>(Copy 4, Reverse)]* *[==>(Copy 5, Forward)]* *[==>(Copy 5, Reverse)]* *[==>(Copy 6, Forward)]* *[==>(Copy 6, Reverse)]* *[==>(Copy 7, Forward)]* *[==>(Copy 7, Reverse)]* *[==>(Copy 8, Forward)]* *[==>(Copy 8, Reverse)]* *[==>(Copy 9, Forward)]* *[==>(Copy 9, Reverse)]* *[==>(Copy 10, Forward)]* *[==>(Copy 10, Reverse)]* *[==>(Copy 11, Forward)]* *[==>(Copy 11, Reverse)]* *[==>(Copy 12, Forward)]* *[==>(Copy 12, Reverse)]* *[==>(Copy 13, Forward)]* *[==>(Copy 13, Reverse)]*	***[6]***
	19	Exposure 16 (Wavecal)	(1) BD+39-3325	WFC3/IR, MULTIACCUM, GRISM512	F130N	SAMP-SEQ=RAPID; NSAMP=15		Sequence 19-21 Non-Int in TOI-2134c WFC3 (01)	12.795405 Secs (12.795 Secs) *[==>]*	***[7]***
	20	Exposure 17 (Wavecal buffer)	(1) BD+39-3325	WFC3/IR, MULTIACCUM, GRISM512	F130N	SAMP-SEQ=RAPID; NSAMP=6		Sequence 19-21 Non-Int in TOI-2134c WFC3 (01)	5.118162 Secs (5.118 Secs) *[==>]*	***[7]***

21	Exposure 18 (Science)	(1) BD+39-3325	WFC3/IR, MULTIACCUM, GRISM512	G141	SAMP-SEQ=SPARS25; NSAMP=3	POS TARG -16.5,-24; SPATIAL SCAN 0.8 54369,90.0 Degrees, Round trip	Sequence 19-21 Non-Int in TOI-2134c WFC3 (01)	46.695529 Secs X 12 (1120.693 Secs)	
								[==>(Copy 1, Forward)] *[==>(Copy 1, Reverse)]* *[==>(Copy 2, Forward)]* *[==>(Copy 2, Reverse)]* *[==>(Copy 3, Forward)]* *[==>(Copy 3, Reverse)]* *[==>(Copy 4, Forward)]* *[==>(Copy 4, Reverse)]* *[==>(Copy 5, Forward)]* *[==>(Copy 5, Reverse)]* *[==>(Copy 6, Forward)]* *[==>(Copy 6, Reverse)]* *[==>(Copy 7, Forward)]* *[==>(Copy 7, Reverse)]* *[==>(Copy 8, Forward)]* *[==>(Copy 8, Reverse)]* *[==>(Copy 9, Forward)]* *[==>(Copy 9, Reverse)]* *[==>(Copy 10, Forward)]* *[==>(Copy 10, Reverse)]* *[==>(Copy 11, Forward)]* *[==>(Copy 11, Reverse)]* *[==>(Copy 12, Forward)]* *[==>(Copy 12, Reverse)]*	***[7]***
22	Exposure 16 (Wavecal)	(1) BD+39-3325	WFC3/IR, MULTIACCUM, GRISM512	F130N	SAMP-SEQ=RAPID; NSAMP=15		Sequence 22-24 Non-Int in TOI-2134c WFC3 (01)	12.795405 Secs (12.795 Secs)	
								[==>]	***[8]***
23	Exposure 17 (Wavecal buffer)	(1) BD+39-3325	WFC3/IR, MULTIACCUM, GRISM512	F130N	SAMP-SEQ=RAPID; NSAMP=6		Sequence 22-24 Non-Int in TOI-2134c WFC3 (01)	5.118162 Secs (5.118 Secs)	
								[==>]	***[8]***

	24	Exposure 18 (Science)	(1) BD+39-3325	WFC3/IR, MULTIACCUM, GRISM512	G141	SAMP-SEQ=SPARS25; NSAMP=3	POS TARG -16.5,-24; SPATIAL SCAN 0.854369,90.0 Degrees, Round trip	Sequence 22-24 Non-Int in TOI-2134c WFC3 (01)	46.695529 Secs X 12 (1120.693 Secs) *[==>(Copy 1, Forward)]* *[==>(Copy 1, Reverse)]* *[==>(Copy 2, Forward)]* *[==>(Copy 2, Reverse)]* *[==>(Copy 3, Forward)]* *[==>(Copy 3, Reverse)]* *[==>(Copy 4, Forward)]* *[==>(Copy 4, Reverse)]* *[==>(Copy 5, Forward)]* *[==>(Copy 5, Reverse)]* *[==>(Copy 6, Forward)]* *[==>(Copy 6, Reverse)]* *[==>(Copy 7, Forward)]* *[==>(Copy 7, Reverse)]* *[==>(Copy 8, Forward)]* *[==>(Copy 8, Reverse)]* *[==>(Copy 9, Forward)]* *[==>(Copy 9, Reverse)]* *[==>(Copy 10, Forward)]* *[==>(Copy 10, Reverse)]* *[==>(Copy 11, Forward)]* *[==>(Copy 11, Reverse)]* *[==>(Copy 12, Forward)]* *[==>(Copy 12, Reverse)]*	***[8]***

Orbit Structure

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Reconfig
Pointing Maneuver
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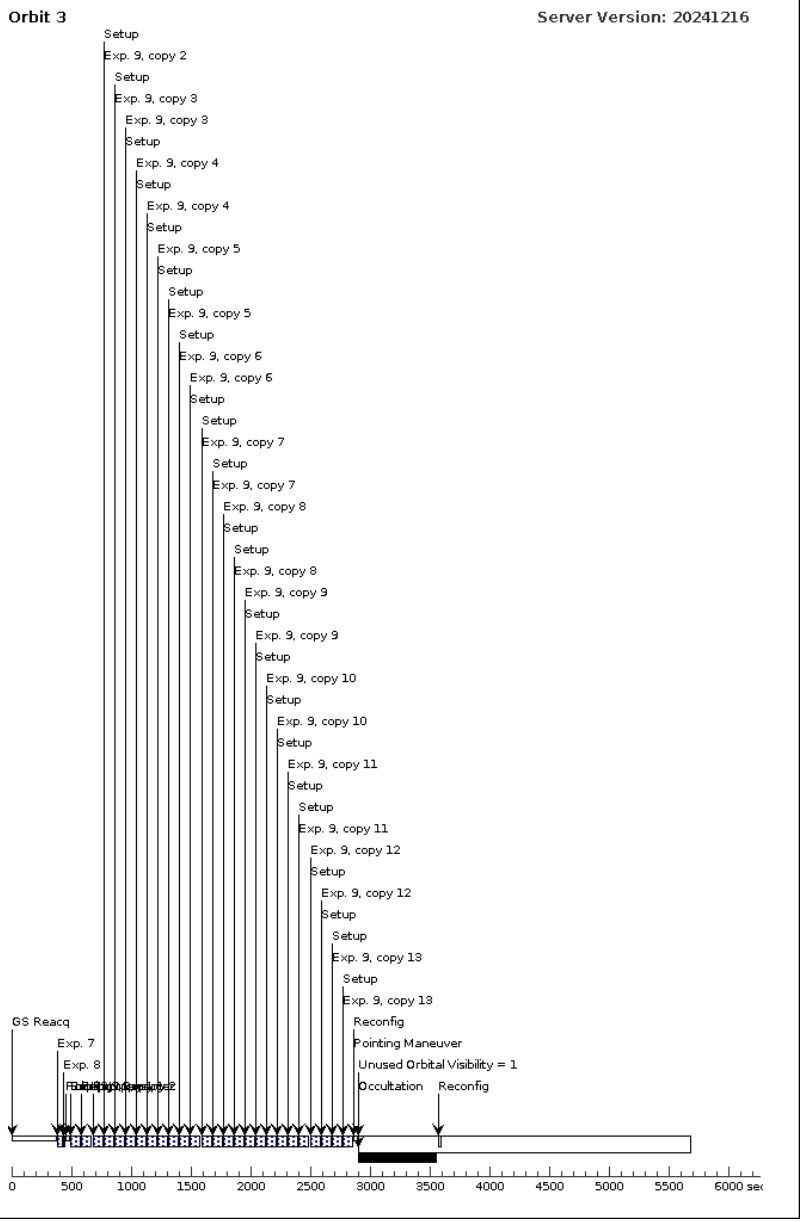
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GS Reacq
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Reconfig
Pointing Maneuver
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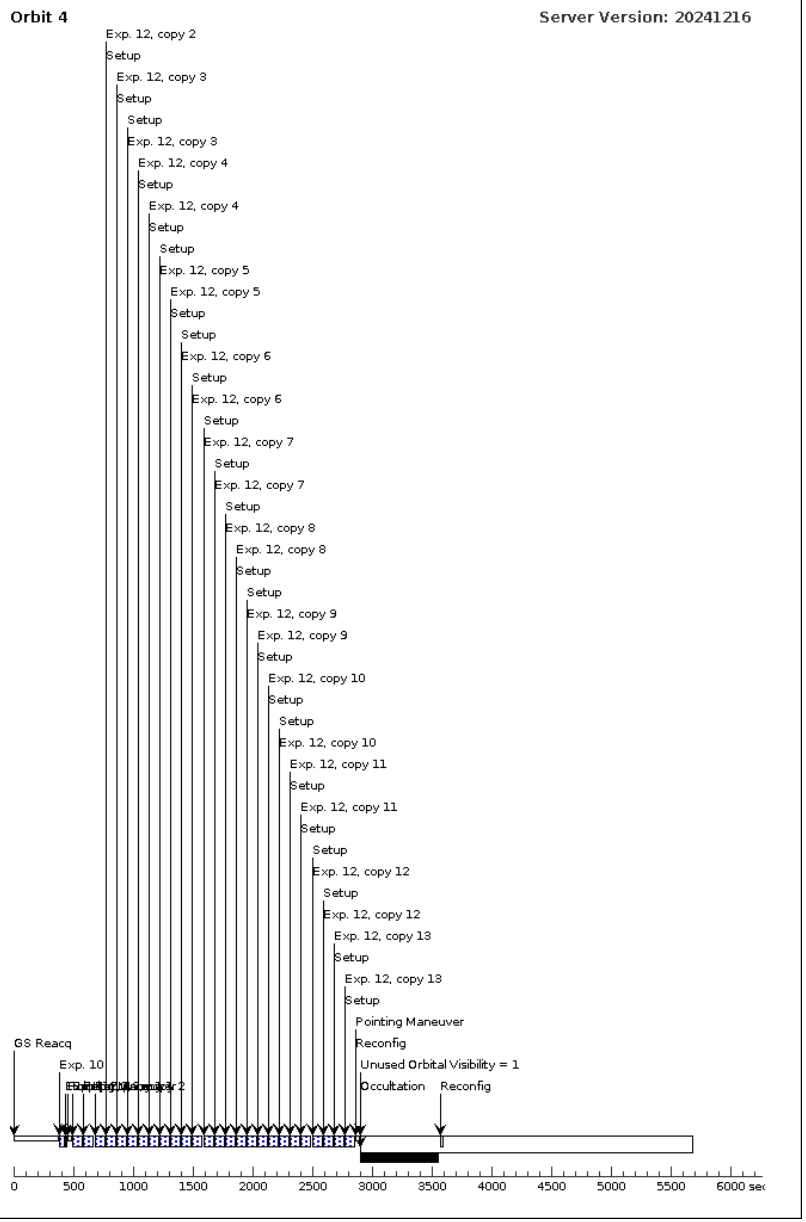
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Pointing Maneuver
Reconfig
GS Reacq
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Unused Orbital Visibility = 1
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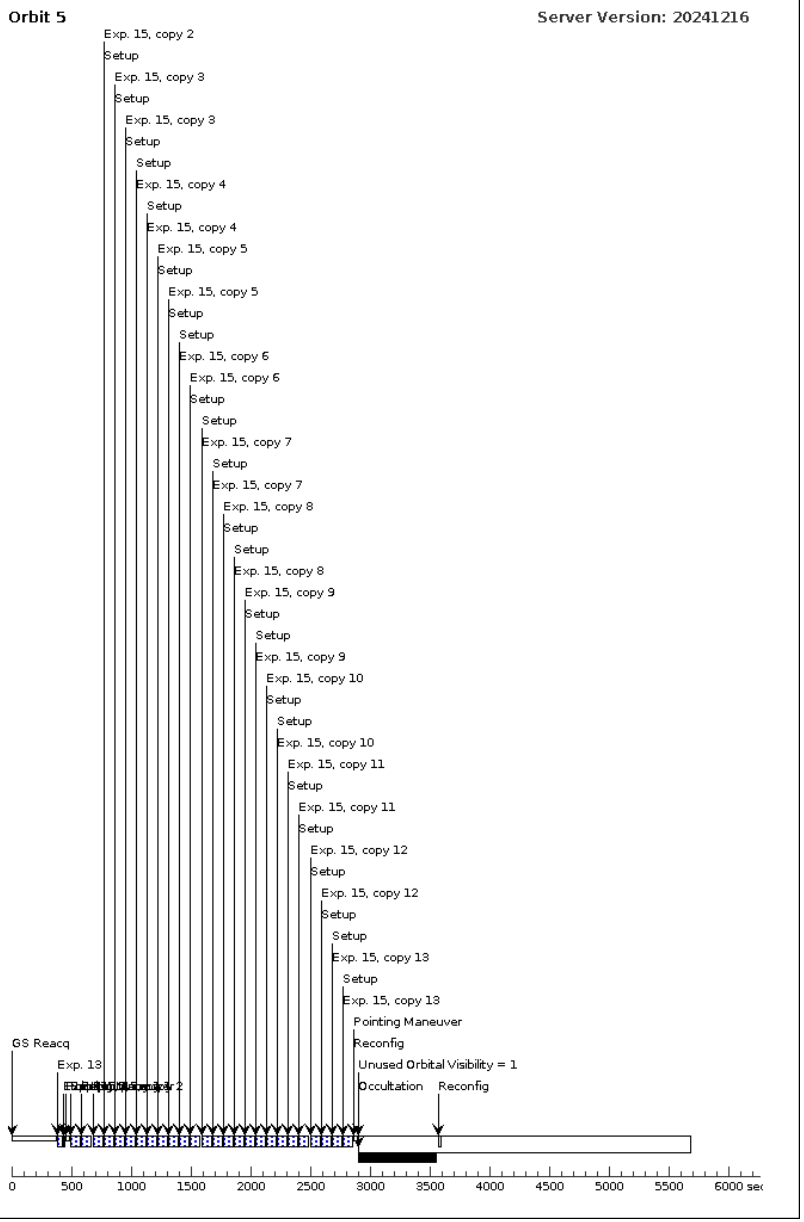
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Pointing Maneuver
Reconfig
GS Reacq
Exp. 13
Unused Orbital Visibility = 1
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Reconfig
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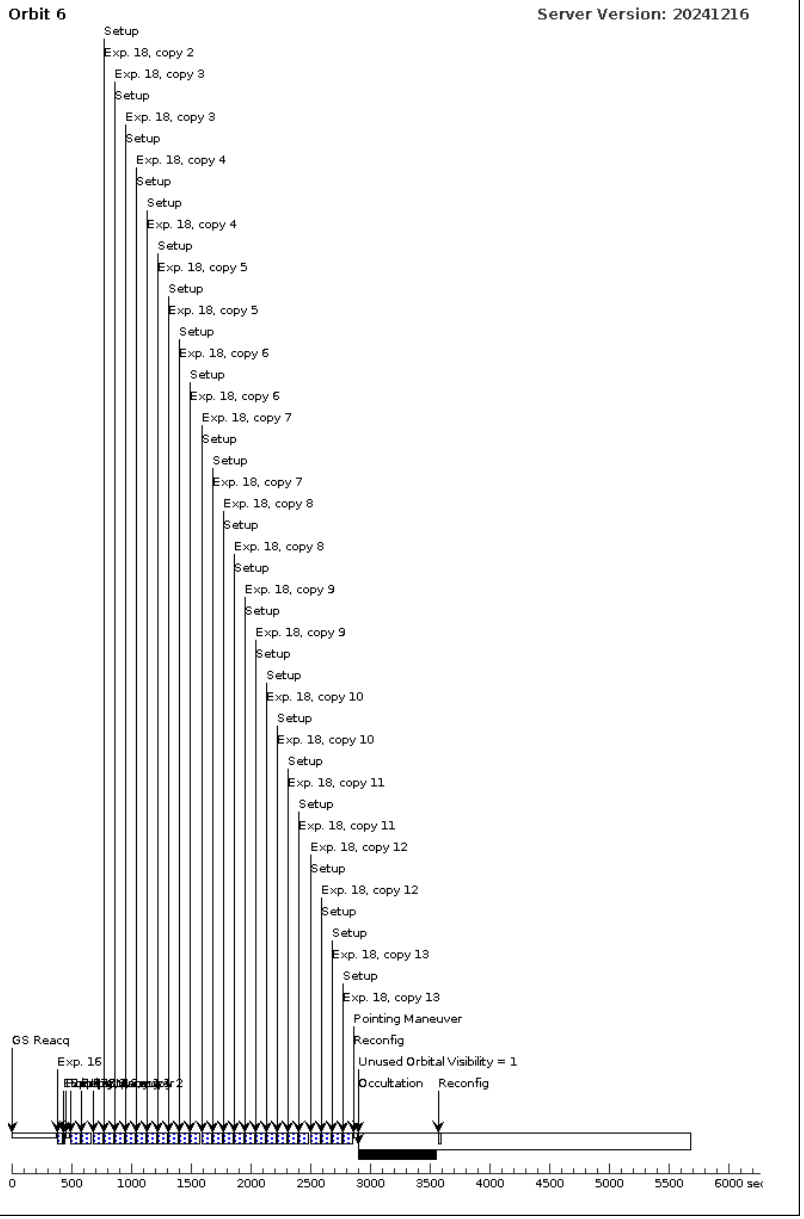
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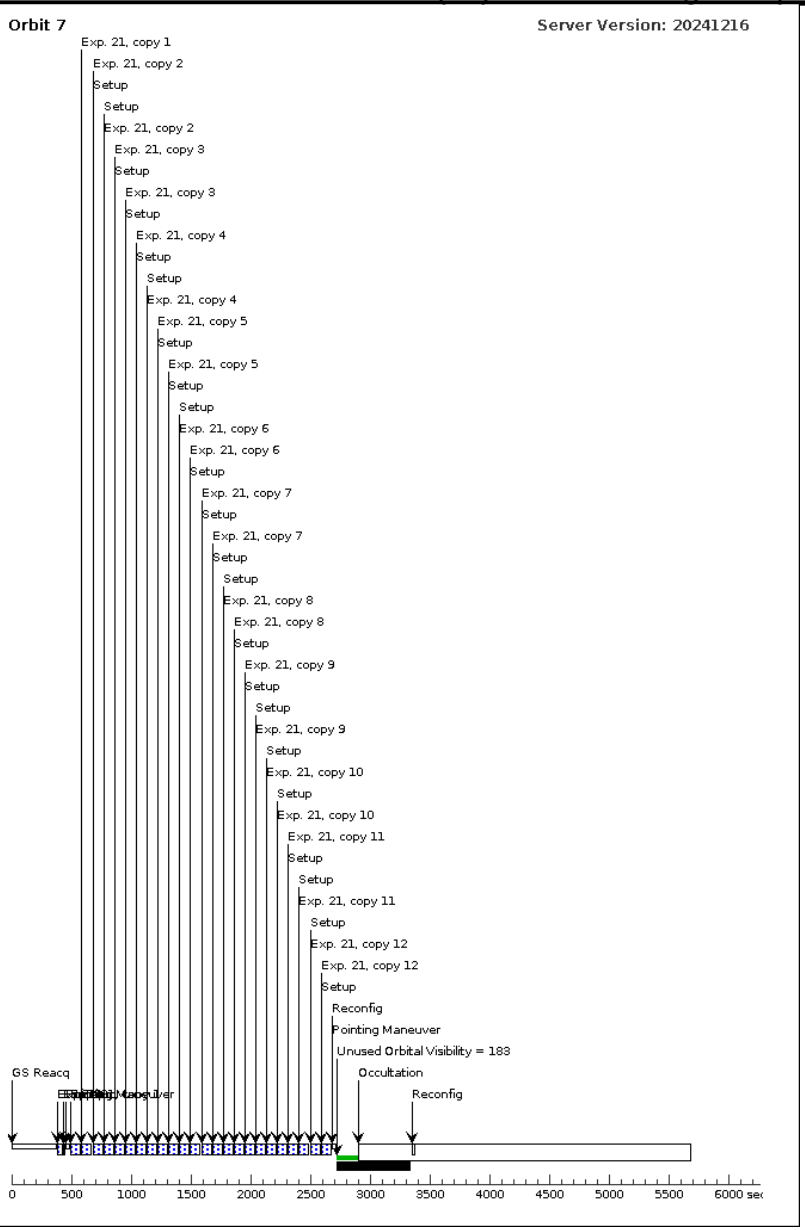
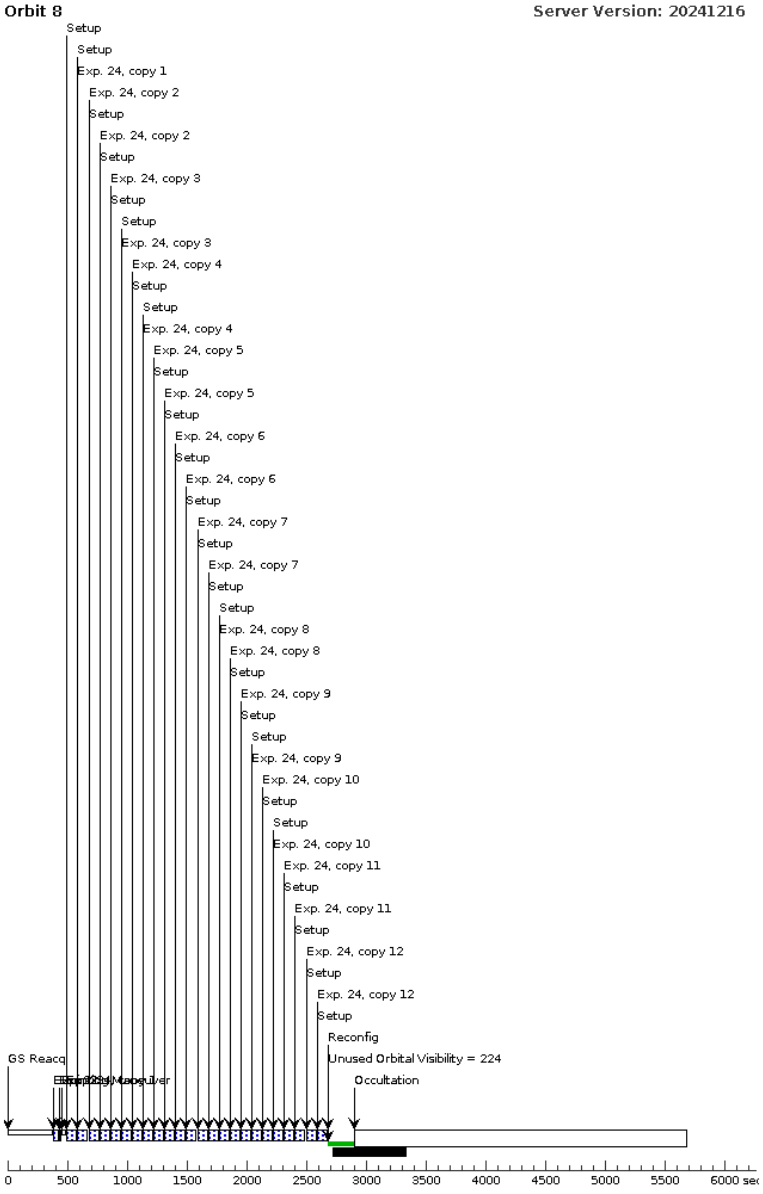
Setup
Exp. 18, copy 13
Pointing Maneuver
Reconfig
Unused Orbital Visibility = 1
GS Reacq
Exp. 16
Occultation
Reconfig
0
500
1000
1500
2000
2500
3000
3500
4000
4500
5000
5500
6000 sec


Orbit 7
Server Version: 20241216
Exp. 21, copy 1
Exp. 21, copy 2
Setup
Setup
Exp. 21, copy 2
Exp. 21, copy 3
Setup
Exp. 21, copy 3
Setup
Exp. 21, copy 4
Setup
Setup
Exp. 21, copy 4
Exp. 21, copy 5
Setup
Exp. 21, copy 5
Setup
Setup
Exp. 21, copy 6
Exp. 21, copy 6
Setup
Exp. 21, copy 7
Setup
Exp. 21, copy 7
Setup
Setup
Exp. 21, copy 8
Exp. 21, copy 8
Setup
Exp. 21, copy 9
Setup
Setup
Exp. 21, copy 9
Setup
Exp. 21, copy 10
Setup
Exp. 21, copy 10
Exp. 21, copy 11
Setup
Setup
Exp. 21, copy 11
Setup
Exp. 21, copy 12
Exp. 21, copy 12
Setup
Reconfig
Pointing Maneuver
Unused Orbital Visibility = 183
Occultation
Reconfig
GS Reacq
0
500
1000
1500
2000
2500
3000
3500
4000
4500
5000
5500
6000 sec


Orbit 8
Server Version: 20241216
Setup
Exp. 24, copy 1
Exp. 24, copy 2
Exp. 24, copy 3
Exp. 24, copy 4
Exp. 24, copy 5
Exp. 24, copy 6
Exp. 24, copy 7
Exp. 24, copy 8
Exp. 24, copy 9
Exp. 24, copy 10
Exp. 24, copy 11
Exp. 24, copy 12
Reconfig
Unused Orbital Visibility = 224
Occultation
0
500
1000
1500
2000
2500
3000
3500
4000
4500
5000
5500
6000