15197 - Rotation Periods and Cloud Dynamics of Directly Imaged Exoplanets

Cycle: 25, 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	(3) 2MASS-J12560215-1257217	WFC3/IR	6	27-Jul-2017 16:00:52.0	yes
07	(2) ROXS42B	WFC3/IR	6	27-Jul-2017 16:02:35.0	yes
13	(1) GSC-06214-00210	WFC3/IR	6	27-Jul-2017 16:04:28.0	yes

18 Total Orbits Used

ABSTRACT

Precision photometric monitoring of brown dwarfs has shown that variability spanning a broad range of amplitudes (0.1-30%) is extremely common in the infrared. These periodic changes are likely caused by rotationally-modulated features produced by heterogeneous coverage of condensate clouds. Time series spectroscopy is an especially informative tool; by simultaneously probing a range of wavelengths, pressure levels, and evolving phases, this method has opened a new window into the atmospheric structure and dynamics of ultracool atmospheres. Recent observations of young

brown dwarfs and planetary-mass objects indicate that high-amplitude (~10%) variability may be even more common at low surface gravities. We propose to obtain the first-ever rotational phase maps for three directly imaged exoplanets with time series WFC3/IR spectroscopy to measure the rotation, cloud structure, and atmospheric dynamics of young (2-300 Myr) giant planets. In addition, by combining projected rotational velocities from high-resolution near-infrared spectroscopy of these planets, these spectroscopic light curves will also be used to determine the first obliquity angle of an imaged exoplanet.

OBSERVING DESCRIPTION

The science goal of this program is to measure the rotation periods of three planetary-mass companions with time-series WFC3/grism spectroscopy. The relative amplitude, wavelength-dependency, and possible phase shifts of the variability provide informaion about cloud structure and dynamics in these low-mass companions.

Detailed observing description:

The companions are separated by 1.2-8" from their hosts and are of comparable brightness (apparent H-band magnitudes between 15.6-15.9 mag).

Immediately at the start of each orbit we will obtain a single image in F132N band to determine the location of the companion in the grism data. This is also useful for wavelength calibration.

The primary science observations will be carried out with WFC3 G141 grism to sample the 1.1-1.7 um spectral region. The 256x256 subarry will be used.

The telescope roll angle should be oriented so that the grism dispersion direction is orthogonal to the binary PA.

The six orbit allocations for each target should be carried out consecutively in one block to maximize uninterrupted coverage.

To minimize flat-fielding errors, each target will be positioned at the same location on the detector for each orbit. As a result there will be no dithering for these observations.

Visit

Proposal 15197, Visit 1: VHS1256 (01), implementation Thu Jul 27 20:04:33 GMT 2017

Diagnostic Status: No Diagnostics

Scientific Instruments: WFC3/IR

Special Requirements: PCS MODE FINE; ORIENT 143.1D TO 203.1 D; ORIENT 323.1D TO 360 D; ORIENT 0.01D TO 23.1 D

Comments: +/- 30 deg tolerance on Orient.

Fixed Targets

#	Name	Target Coordinates	Targ. Coord. Corrections	Fluxes	Miscellaneous
(3)	2MASS-J12560215-1257217	RA: 12 56 1.8330 (194.0076375d)	Proper Motion RA: -268 mas/yr	V=(?)	Reference Frame: ICRS
		Dec: -12 57 27.69 (-12.95769d)	Proper Motion Dec: -188 mas/yr	J=16.7,	
		Equinox: J2000	Epoch of Position: 2000.0	H=15.6	

Comments: The spectral type of the science target (VHS1256b) is ~L7, so its spectrum is very red. The coordinates and magnitudes listed here are for the companion VHS1256 b, which is located 8 arcsec from its host. The coordinates for the host star (M7.5 spectral type) are RA=12:56:02.151, Dec=-12:57:21.71. The host star magnitudes are: V=17.76, J=11.0, H=10.5.
Extended=NO

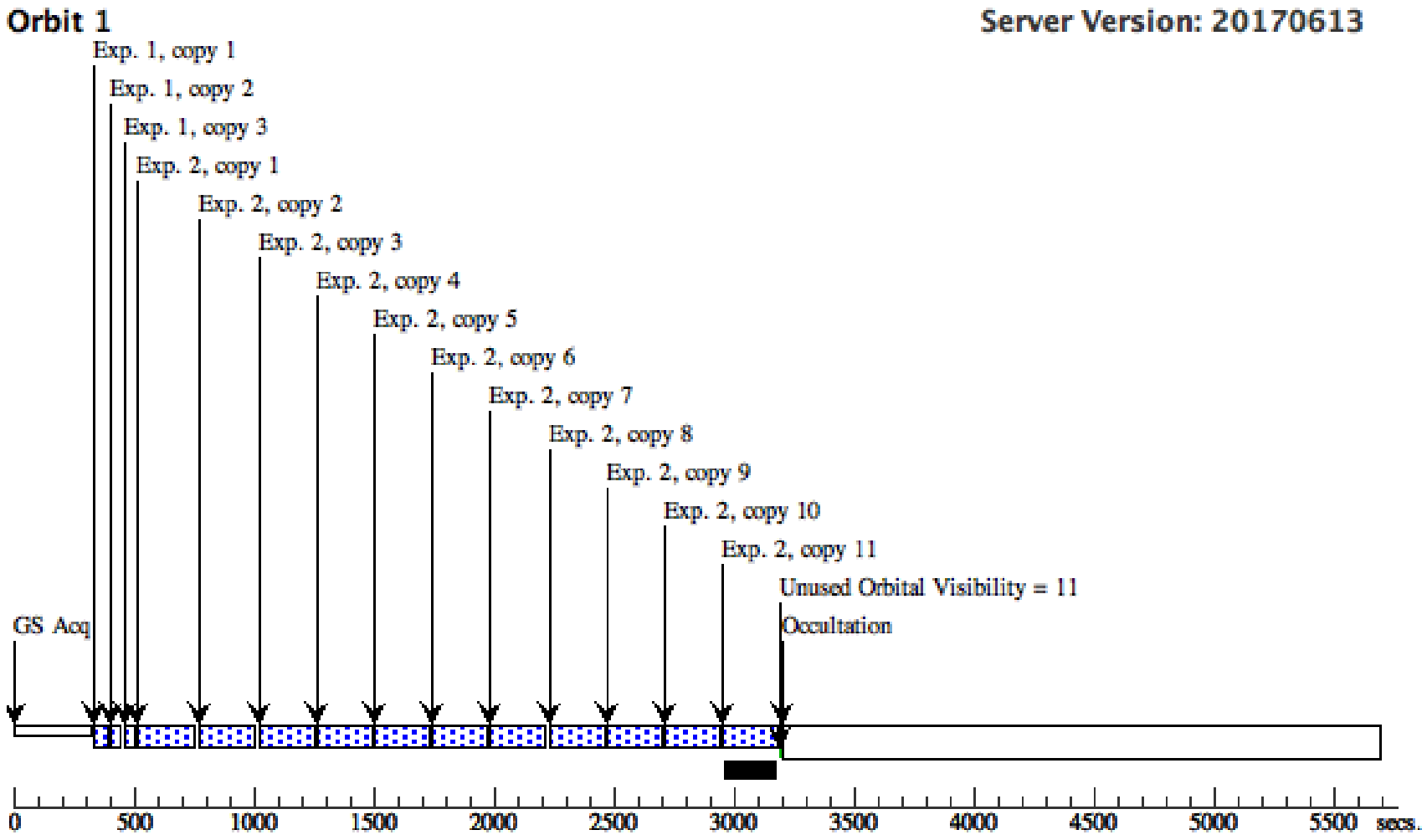
Exposures

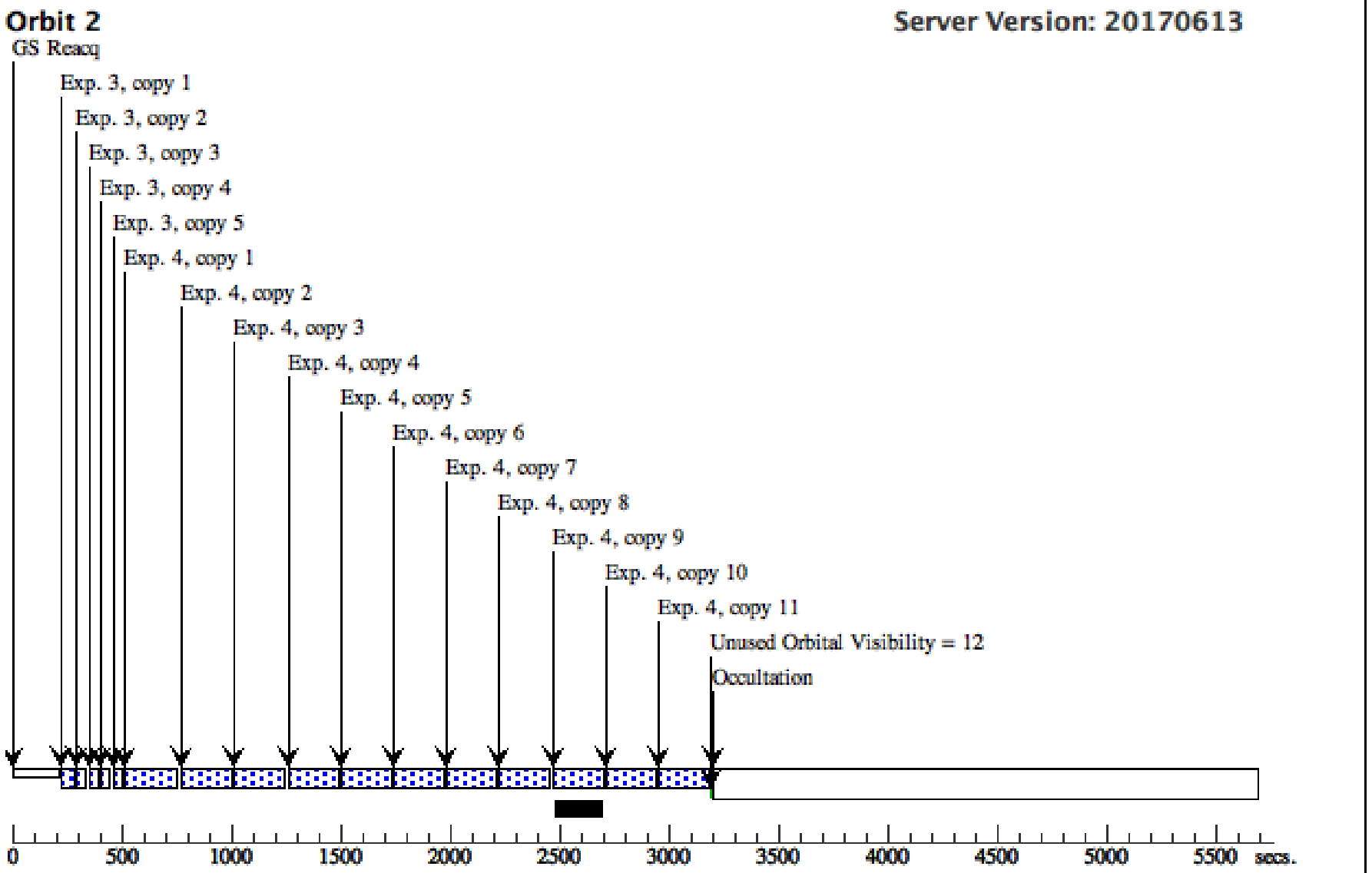
#	Label	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time (Total)/[Actual Dur.]	Orbit
1	Orbit 1: Image in F132N	(3) 2MASS-J12560215-1257217	WFC3/IR, MULTIACCUM, GRISM256	F132N	SAMP-SEQ=SPARS10; NSAMP=6			37.01025 Secs X 3 (111.031 Secs)	
								[==>(Copy 1)] *[==>(Copy 2)]* *[==>(Copy 3)]*	***[1]***
Comments: Image in F132N for wavelength calibration.									
2	Orbit 1: G141 spectrum	(3) 2MASS-J12560215-1257217	WFC3/IR, MULTIACCUM, GRISM256	G141	SAMP-SEQ=SPARS25; NSAMP=11			223.738205 Secs X 11 (2461.12 Secs)	
								[==>(Copy 1)] *[==>(Copy 2)]* *[==>(Copy 3)]* *[==>(Copy 4)]* *[==>(Copy 5)]* *[==>(Copy 6)]* *[==>(Copy 7)]* *[==>(Copy 8)]* *[==>(Copy 9)]* *[==>(Copy 10)]* *[==>(Copy 11)]*	***[1]***
3	Orbit 2: Image in F132N	(3) 2MASS-J12560215-1257217	WFC3/IR, MULTIACCUM, GRISM256	F132N	SAMP-SEQ=SPARS10; NSAMP=6			37.01025 Secs X 5 (185.051 Secs)	
								[==>(Copy 1)] *[==>(Copy 2)]* *[==>(Copy 3)]* *[==>(Copy 4)]* *[==>(Copy 5)]*	***[2]***
Comments: Image in F132N for wavelength calibration.									
4	Orbit 2: G141 spectrum	(3) 2MASS-J12560215-1257217	WFC3/IR, MULTIACCUM, GRISM256	G141	SAMP-SEQ=SPARS25; NSAMP=11			223.738205 Secs X 11 (2461.12 Secs)	
								[==>(Copy 1)] *[==>(Copy 2)]* *[==>(Copy 3)]* *[==>(Copy 4)]* *[==>(Copy 5)]* *[==>(Copy 6)]* *[==>(Copy 7)]* *[==>(Copy 8)]* *[==>(Copy 9)]* *[==>(Copy 10)]* *[==>(Copy 11)]*	***[2]***

5	Orbit 3: Image in F132N	(3) 2MASS-J12560215-1257217	WFC3/IR, MULTIACCUM, GRISM256	F132N	SAMP-SEQ=SPARS10; NSAMP=6	37.01025 Secs X 5 (185.051 Secs)		
						[==>(Copy 1)] *[==>(Copy 2)]* *[==>(Copy 3)]* *[==>(Copy 4)]* *[==>(Copy 5)]*	***[3]***	
Comments: Image in F132N for wavelength calibration.								
6	Orbit 3: G141 spectrum	(3) 2MASS-J12560215-1257217	WFC3/IR, MULTIACCUM, GRISM256	G141	SAMP-SEQ=SPARS25; NSAMP=11	223.738205 Secs X 11 (2461.12 Secs)		
						[==>(Copy 1)] *[==>(Copy 2)]* *[==>(Copy 3)]* *[==>(Copy 4)]* *[==>(Copy 5)]* *[==>(Copy 6)]* *[==>(Copy 7)]* *[==>(Copy 8)]* *[==>(Copy 9)]* *[==>(Copy 10)]* *[==>(Copy 11)]*	***[3]***	
7	Orbit 4: Image in F132N	(3) 2MASS-J12560215-1257217	WFC3/IR, MULTIACCUM, GRISM256	F132N	SAMP-SEQ=SPARS10; NSAMP=6	37.01025 Secs X 5 (185.051 Secs)		
						[==>(Copy 1)] *[==>(Copy 2)]* *[==>(Copy 3)]* *[==>(Copy 4)]* *[==>(Copy 5)]*	***[4]***	
Comments: Image in F132N for wavelength calibration.								
8	Orbit 4: G141 spectrum	(3) 2MASS-J12560215-1257217	WFC3/IR, MULTIACCUM, GRISM256	G141	SAMP-SEQ=SPARS25; NSAMP=11	223.738205 Secs X 11 (2461.12 Secs)		
						[==>(Copy 1)] *[==>(Copy 2)]* *[==>(Copy 3)]* *[==>(Copy 4)]* *[==>(Copy 5)]* *[==>(Copy 6)]* *[==>(Copy 7)]* *[==>(Copy 8)]* *[==>(Copy 9)]* *[==>(Copy 10)]* *[==>(Copy 11)]*	***[4]***	

	9	Orbit 5: Image in F132N	(3) 2MASS-J12560215-1257217	WFC3/IR, MULTIACCUM, GRISM256	F132N	SAMP-SEQ=SPARS10; NSAMP=6	37.01025 Secs X 5 (185.051 Secs) *[==>(Copy 1)]* *[==>(Copy 2)]* *[==>(Copy 3)]* *[==>(Copy 4)]* *[==>(Copy 5)]*	***[5]***
	Comments: Image in F132N for wavelength calibration.							
	10	Orbit 5: G141 spectrum	(3) 2MASS-J12560215-1257217	WFC3/IR, MULTIACCUM, GRISM256	G141	SAMP-SEQ=SPARS25; NSAMP=11	223.738205 Secs X 11 (2461.12 Secs) *[==>(Copy 1)]* *[==>(Copy 2)]* *[==>(Copy 3)]* *[==>(Copy 4)]* *[==>(Copy 5)]* *[==>(Copy 6)]* *[==>(Copy 7)]* *[==>(Copy 8)]* *[==>(Copy 9)]* *[==>(Copy 10)]* *[==>(Copy 11)]*	***[5]***
	11	Orbit 6: Image in F132N	(3) 2MASS-J12560215-1257217	WFC3/IR, MULTIACCUM, GRISM256	F132N	SAMP-SEQ=SPARS10; NSAMP=6	37.01025 Secs X 5 (185.051 Secs) *[==>(Copy 1)]* *[==>(Copy 2)]* *[==>(Copy 3)]* *[==>(Copy 4)]* *[==>(Copy 5)]*	***[6]***
	Comments: Image in F132N for wavelength calibration.							
	12	Orbit 6: G141 spectrum	(3) 2MASS-J12560215-1257217	WFC3/IR, MULTIACCUM, GRISM256	G141	SAMP-SEQ=SPARS25; NSAMP=11	223.738205 Secs X 11 (2461.12 Secs) *[==>(Copy 1)]* *[==>(Copy 2)]* *[==>(Copy 3)]* *[==>(Copy 4)]* *[==>(Copy 5)]* *[==>(Copy 6)]* *[==>(Copy 7)]* *[==>(Copy 8)]* *[==>(Copy 9)]* *[==>(Copy 10)]* *[==>(Copy 11)]*	***[6]***

Orbit Structure

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Exp. 3, copy 3
Exp. 3, copy 4
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Exp. 4, copy 3
Exp. 4, copy 4
Exp. 4, copy 5
Exp. 4, copy 6
Exp. 4, copy 7
Exp. 4, copy 8
Exp. 4, copy 9
Exp. 4, copy 10
Exp. 4, copy 11
Unused Orbital Visibility = 12
Occultation
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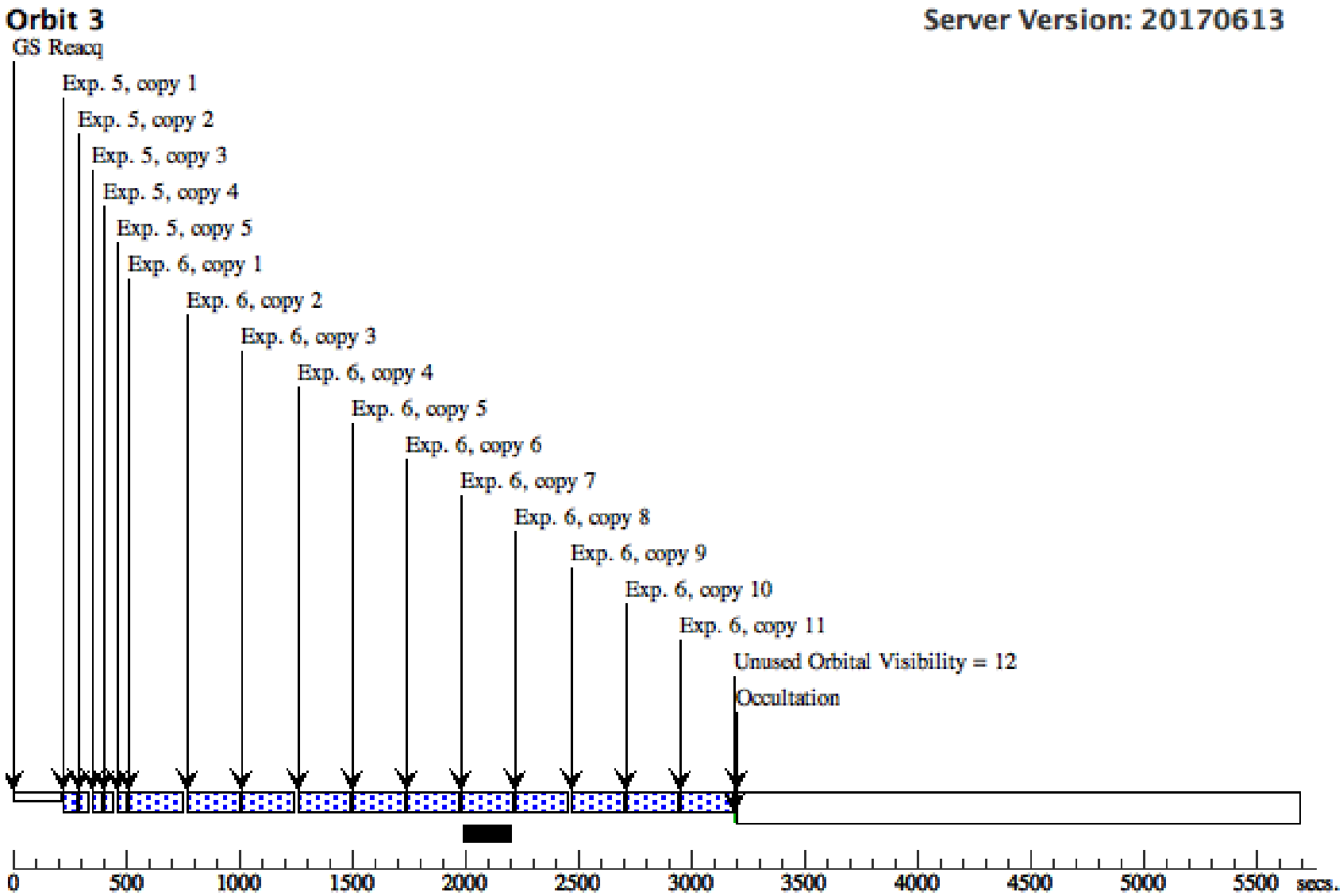
1000
1500
2000
2500
3000
3500
4000
4500
5000
5500
secs.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Server Version: 20170613
GS Reacq
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Exp. 5, copy 3
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Exp. 6, copy 5
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Exp. 6, copy 7
Exp. 6, copy 8
Exp. 6, copy 9
Exp. 6, copy 10
Exp. 6, copy 11
Unused Orbital Visibility = 12
Occultation
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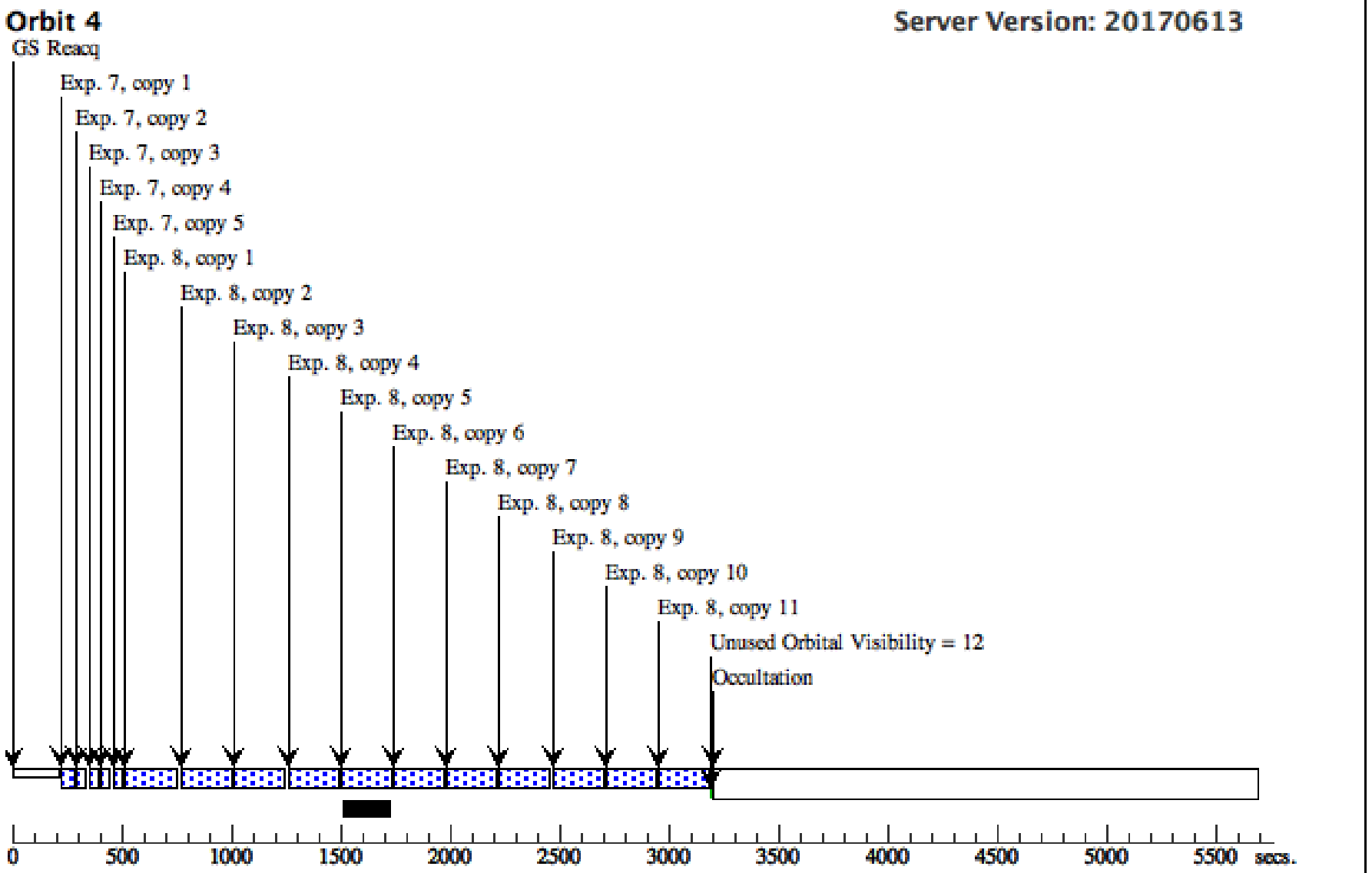
secs.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GS Reacq
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5000
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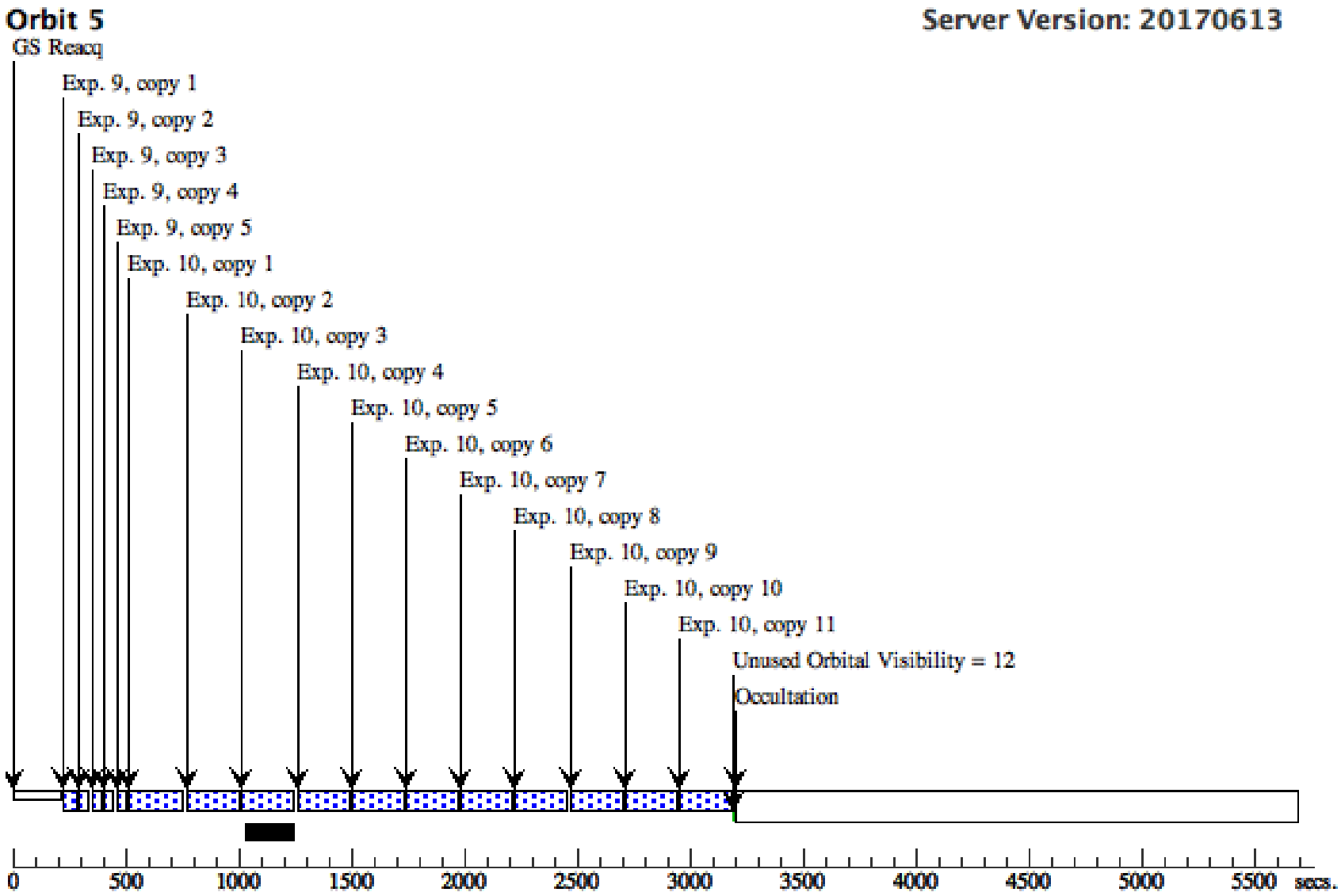
secs.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Server Version: 20170613
GS Reacq
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Exp. 9, copy 2
Exp. 9, copy 3
Exp. 9, copy 4
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Exp. 10, copy 6
Exp. 10, copy 7
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Exp. 10, copy 11
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3500
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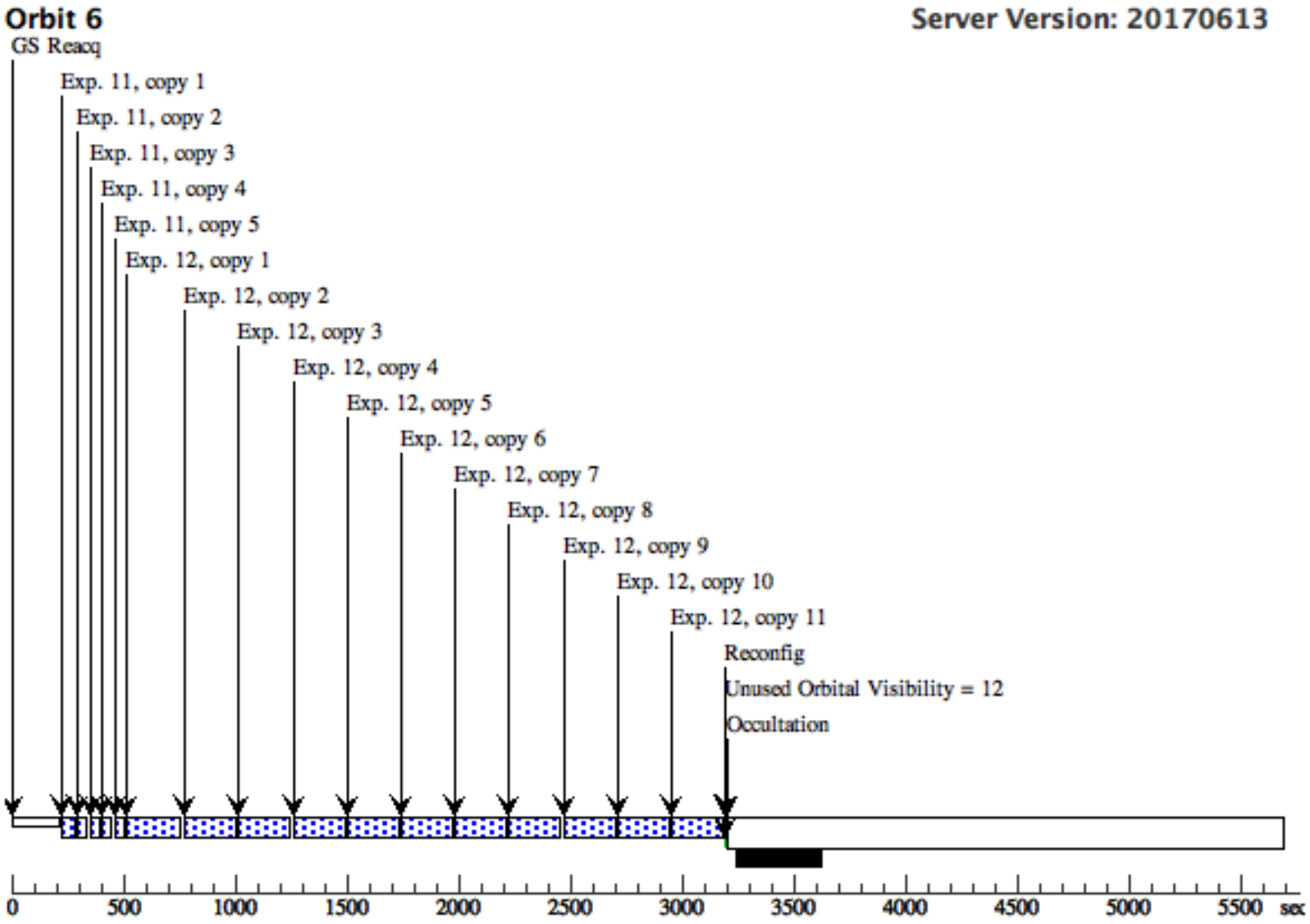
secs.


Orbit 6
Server Version: 20170613
GS Reacq
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Exp. 11, copy 2
Exp. 11, copy 3
Exp. 11, copy 4
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Exp. 12, copy 5
Exp. 12, copy 6
Exp. 12, copy 7
Exp. 12, copy 8
Exp. 12, copy 9
Exp. 12, copy 10
Exp. 12, copy 11
Reconfig
Unused Orbital Visibility = 12
Occultation
0
500
1000
1500
2000
2500
3000
3500
4000
4500
5000
5500
sec

Visit

Proposal 15197, Visit 2: ROXs42B (07), implementation Thu Jul 27 20:04:33 GMT 2017

Diagnostic Status: No Diagnostics

Scientific Instruments: WFC3/IR

Special Requirements: PCS MODE FINE; ORIENT 255D TO 258 D

Comments: Orient constrained by availablility of guide stars

Fixed Targets

#	Name	Target Coordinates	Targ. Coord. Corrections	Fluxes	Miscellaneous
(2)	ROXS42B	RA: 16 31 15.0160 (247.8125667d)	Proper Motion RA: -9 mas/yr	V=(?)	Reference Frame: ICRS
		Dec: -24 32 43.70 (-24.54547d)	Proper Motion Dec: -15 mas/yr	J=17.0,	
		Equinox: J2000	Epoch of Position: 2000.0	H=15.9	

Comments: The quoted photometry is for the companion, which is red and has a spectral type of L1. The M0 host star photometry is as follows: R=13.6, J=9.9, H=9.0. It is located 1.2" from the companion at a PA of 270 deg.
Extended=NO

Exposures

#	Label	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time (Total)/[Actual Dur.]	Orbit
1	Orbit 1: Image in F132N (shallow)	(2) ROXS42B	WFC3/IR, MULTIACCUM, GRISM256	F132N	SAMP-SEQ=RAPID; NSAMP=15	GS ACQ SCENARIO BASE1B3		4.167225 Secs X 2 (8.334 Secs) *[==>(Copy 1)]* *[==>(Copy 2)]*	***[1]***
	Comments: Image in F132N for wavelength calibration.								
2	Orbit 1: Image in F132N (deep)	(2) ROXS42B	WFC3/IR, MULTIACCUM, GRISM256	F132N	SAMP-SEQ=SPARS10; NSAMP=5			29.663763 Secs X 2 (59.328 Secs) *[==>(Copy 1)]* *[==>(Copy 2)]*	***[1]***
	Comments: Image in F132N for wavelength calibration.								
3	Orbit 1: G141 spectrum	(2) ROXS42B	WFC3/IR, MULTIACCUM, GRISM256	G141	SAMP-SEQ=SPARS10; NSAMP=15			103.128633 Secs X 21 (2165.701 Secs) *[==>(Copy 1)]* *[==>(Copy 2)]* *[==>(Copy 3)]* *[==>(Copy 4)]* *[==>(Copy 5)]* *[==>(Copy 6)]* *[==>(Copy 7)]* *[==>(Copy 8)]* *[==>(Copy 9)]* *[==>(Copy 10)]* *[==>(Copy 11)]* *[==>(Copy 12)]* *[==>(Copy 13)]* *[==>(Copy 14)]* *[==>(Copy 15)]* *[==>(Copy 16)]* *[==>(Copy 17)]* *[==>(Copy 18)]* *[==>(Copy 19)]* *[==>(Copy 20)]* *[==>(Copy 21)]*	***[1]***
4	Orbit 2: Image in F132N (shallow)	(2) ROXS42B	WFC3/IR, MULTIACCUM, GRISM256	F132N	SAMP-SEQ=RAPID; NSAMP=15			4.167225 Secs X 2 (8.334 Secs) *[==>(Copy 1)]* *[==>(Copy 2)]*	***[2]***
	Comments: Image in F132N for wavelength calibration.								
5	Orbit 2: Image in F132N (deep)	(2) ROXS42B	WFC3/IR, MULTIACCUM, GRISM256	F132N	SAMP-SEQ=SPARS10; NSAMP=5			29.663763 Secs X 2 (59.328 Secs) *[==>(Copy 1)]* *[==>(Copy 2)]*	***[2]***
	Comments: Image in F132N for wavelength calibration.								

6	Orbit 2: G141 spectrum	(2) ROXS42B	WFC3/IR, MULTIACCUM, GRISM256	G141	SAMP-SEQ=SPARS10; NSAMP=15	103.128633 Secs X 22 (2268.83 Secs) *[==>(Copy 1)]* *[==>(Copy 2)]* *[==>(Copy 3)]* *[==>(Copy 4)]* *[==>(Copy 5)]* *[==>(Copy 6)]* *[==>(Copy 7)]* *[==>(Copy 8)]* *[==>(Copy 9)]* *[==>(Copy 10)]* *[==>(Copy 11)]* *[==>(Copy 12)]* *[==>(Copy 13)]* *[==>(Copy 14)]* *[==>(Copy 15)]* *[==>(Copy 16)]* *[==>(Copy 17)]* *[==>(Copy 18)]* *[==>(Copy 19)]* *[==>(Copy 20)]* *[==>(Copy 21)]* *[==>(Copy 22)]*	***[2]***
7	Orbit 3: Image in F132N (shallow)	(2) ROXS42B	WFC3/IR, MULTIACCUM, GRISM256	F132N	SAMP-SEQ=RAPID; NSAMP=15	4.167225 Secs X 2 (8.334 Secs) *[==>(Copy 1)]* *[==>(Copy 2)]*	***[3]***
Comments: Image in F132N for wavelength calibration.							
8	Orbit 3: Image in F132N (deep)	(2) ROXS42B	WFC3/IR, MULTIACCUM, GRISM256	F132N	SAMP-SEQ=SPARS10; NSAMP=5	29.663763 Secs X 2 (59.328 Secs) *[==>(Copy 1)]* *[==>(Copy 2)]*	***[3]***
Comments: Image in F132N for wavelength calibration.							

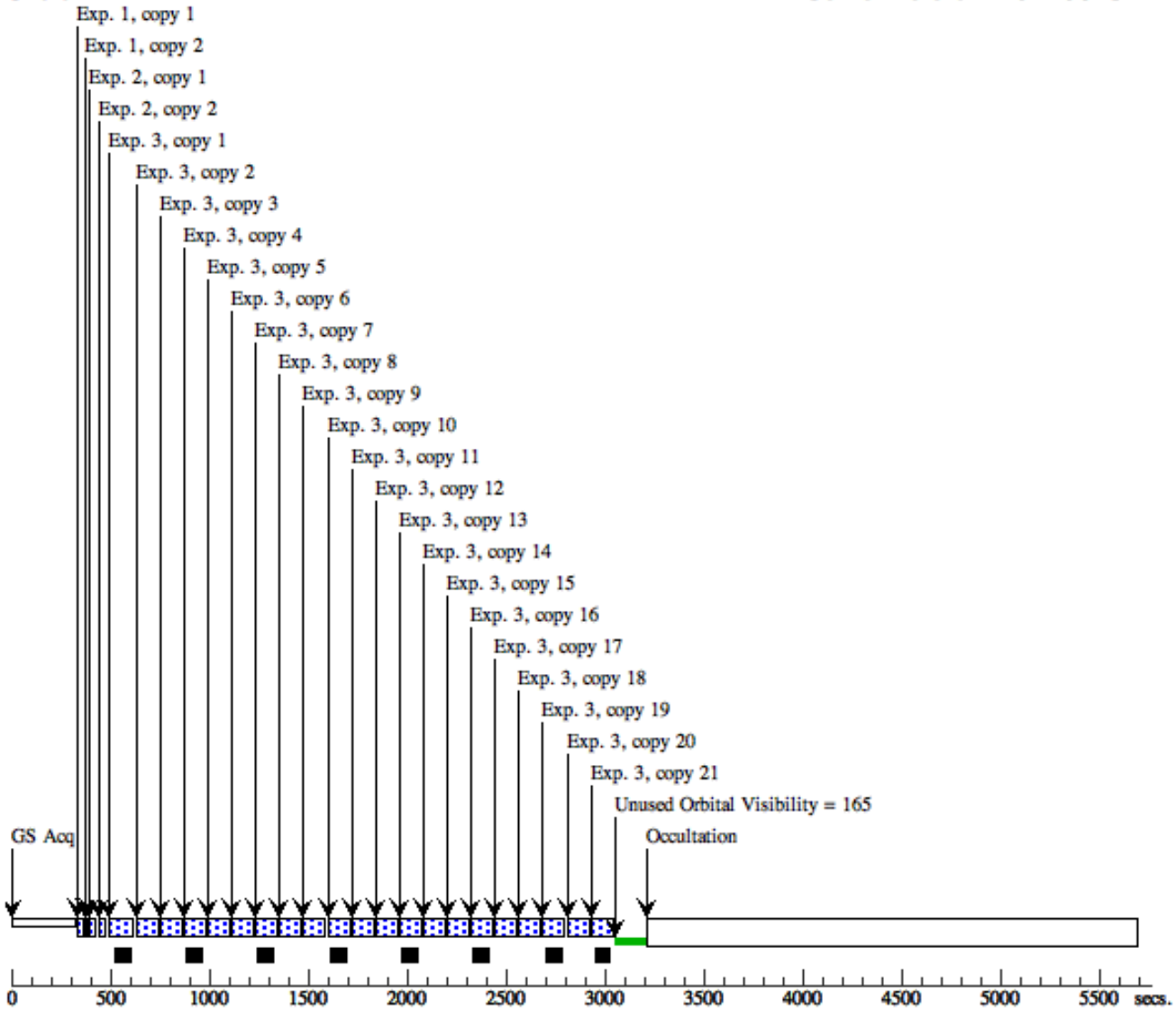
9	Orbit 3: G141 spectrum	(2) ROXS42B	WFC3/IR, MULTIACCUM, GRISM256	G141	SAMP-SEQ=SPARS10; NSAMP=15	103.128633 Secs X 22 (2268.83 Secs) *[==>(Copy 1)]* *[==>(Copy 2)]* *[==>(Copy 3)]* *[==>(Copy 4)]* *[==>(Copy 5)]* *[==>(Copy 6)]* *[==>(Copy 7)]* *[==>(Copy 8)]* *[==>(Copy 9)]* *[==>(Copy 10)]* *[==>(Copy 11)]* *[==>(Copy 12)]* *[==>(Copy 13)]* *[==>(Copy 14)]* *[==>(Copy 15)]* *[==>(Copy 16)]* *[==>(Copy 17)]* *[==>(Copy 18)]* *[==>(Copy 19)]* *[==>(Copy 20)]* *[==>(Copy 21)]* *[==>(Copy 22)]*	***[3]***
10	Orbit 4: Image in F132N (shallow)	(2) ROXS42B	WFC3/IR, MULTIACCUM, GRISM256	F132N	SAMP-SEQ=RAPID; NSAMP=15	4.167225 Secs X 2 (8.334 Secs) *[==>(Copy 1)]* *[==>(Copy 2)]*	***[4]***
Comments: Image in F132N for wavelength calibration.							
11	Orbit 4: Image in F132N (deep)	(2) ROXS42B	WFC3/IR, MULTIACCUM, GRISM256	F132N	SAMP-SEQ=SPARS10; NSAMP=5	29.663763 Secs X 2 (59.328 Secs) *[==>(Copy 1)]* *[==>(Copy 2)]*	***[4]***
Comments: Image in F132N for wavelength calibration.							

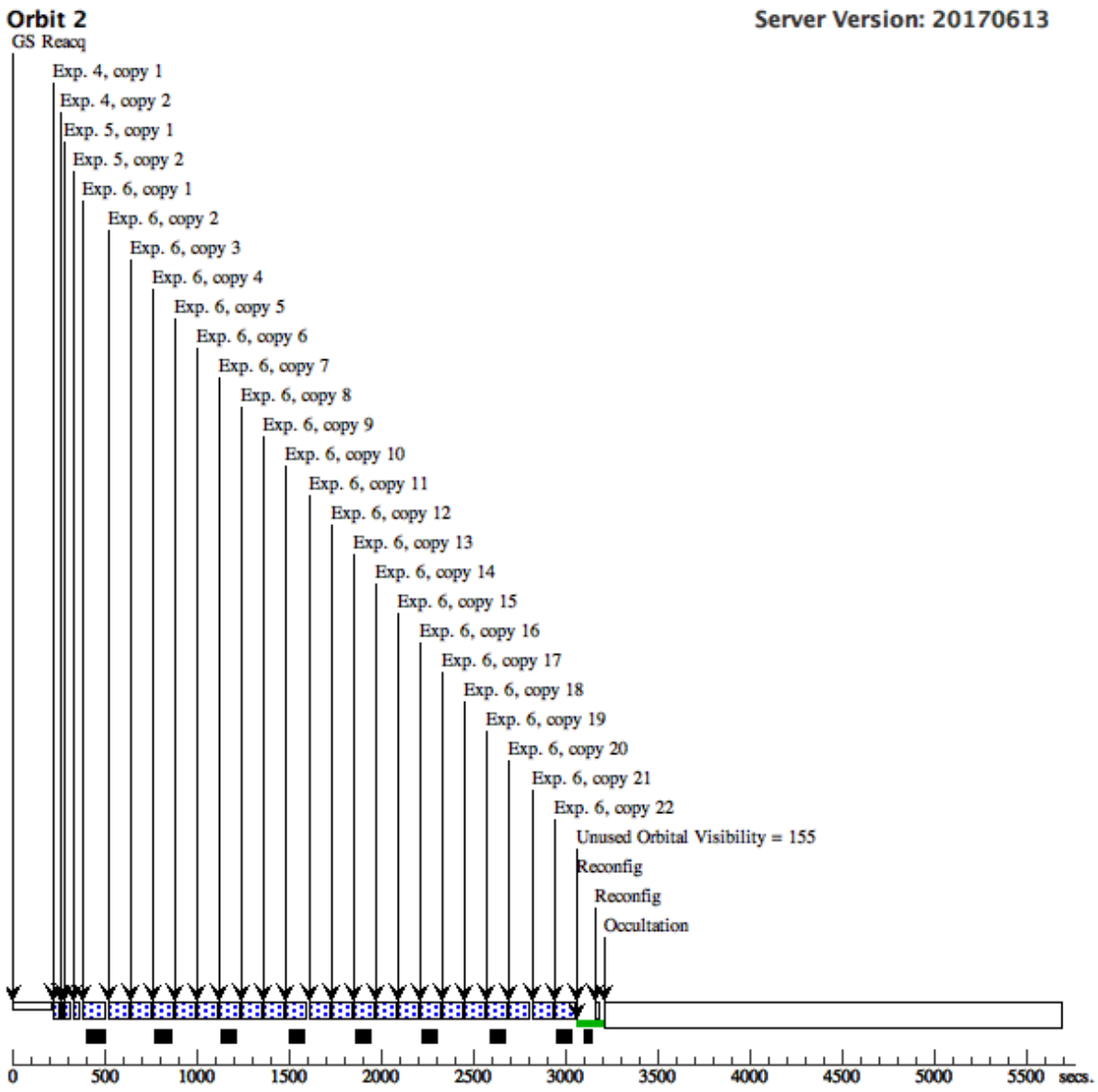
12	Orbit 4: G141 spectrum	(2) ROXS42B	WFC3/IR, MULTIACCUM, GRISM256	G141	SAMP-SEQ=SPARS10; NSAMP=15	103.128633 Secs X 22 (2268.83 Secs) *[==>(Copy 1)]* *[==>(Copy 2)]* *[==>(Copy 3)]* *[==>(Copy 4)]* *[==>(Copy 5)]* *[==>(Copy 6)]* *[==>(Copy 7)]* *[==>(Copy 8)]* *[==>(Copy 9)]* *[==>(Copy 10)]* *[==>(Copy 11)]* *[==>(Copy 12)]* *[==>(Copy 13)]* *[==>(Copy 14)]* *[==>(Copy 15)]* *[==>(Copy 16)]* *[==>(Copy 17)]* *[==>(Copy 18)]* *[==>(Copy 19)]* *[==>(Copy 20)]* *[==>(Copy 21)]* *[==>(Copy 22)]*	***[4]***
13	Orbit 5: Image in F132N (shallow)	(2) ROXS42B	WFC3/IR, MULTIACCUM, GRISM256	F132N	SAMP-SEQ=RAPID; NSAMP=15	4.167225 Secs X 2 (8.334 Secs) *[==>(Copy 1)]* *[==>(Copy 2)]*	***[5]***
Comments: Image in F132N for wavelength calibration.							
14	Orbit 5: Image in F132N (deep)	(2) ROXS42B	WFC3/IR, MULTIACCUM, GRISM256	F132N	SAMP-SEQ=SPARS10; NSAMP=5	29.663763 Secs X 2 (59.328 Secs) *[==>(Copy 1)]* *[==>(Copy 2)]*	***[5]***
Comments: Image in F132N for wavelength calibration.							

15	Orbit 5: G141 spectrum	(2) ROXS42B	WFC3/IR, MULTIACCUM, GRISM256	G141	SAMP-SEQ=SPARS10; NSAMP=15	103.128633 Secs X 22 (2268.83 Secs) *[==>(Copy 1)]* *[==>(Copy 2)]* *[==>(Copy 3)]* *[==>(Copy 4)]* *[==>(Copy 5)]* *[==>(Copy 6)]* *[==>(Copy 7)]* *[==>(Copy 8)]* *[==>(Copy 9)]* *[==>(Copy 10)]* *[==>(Copy 11)]* *[==>(Copy 12)]* *[==>(Copy 13)]* *[==>(Copy 14)]* *[==>(Copy 15)]* *[==>(Copy 16)]* *[==>(Copy 17)]* *[==>(Copy 18)]* *[==>(Copy 19)]* *[==>(Copy 20)]* *[==>(Copy 21)]* *[==>(Copy 22)]*	***[5]***
16	Orbit 6: Image in F132N (shallow)	(2) ROXS42B	WFC3/IR, MULTIACCUM, GRISM256	F132N	SAMP-SEQ=RAPID; NSAMP=15	4.167225 Secs X 2 (8.334 Secs) *[==>(Copy 1)]* *[==>(Copy 2)]*	***[6]***
Comments: Image in F132N for wavelength calibration.							
17	Orbit 6: Image in F132N (deep)	(2) ROXS42B	WFC3/IR, MULTIACCUM, GRISM256	F132N	SAMP-SEQ=SPARS10; NSAMP=5	29.663763 Secs X 2 (59.328 Secs) *[==>(Copy 1)]* *[==>(Copy 2)]*	***[6]***
Comments: Image in F132N for wavelength calibration.							

	18	Orbit 6: G14 (2) ROXS42B 1 spectrum	WFC3/IR, MULTIACCUM, GRISM256	G141	SAMP-SEQ=SPARS 10; NSAMP=15	103.128633 Secs X 22 (2268.83 Secs) *[==>(Copy 1)]* *[==>(Copy 2)]* *[==>(Copy 3)]* *[==>(Copy 4)]* *[==>(Copy 5)]* *[==>(Copy 6)]* *[==>(Copy 7)]* *[==>(Copy 8)]* *[==>(Copy 9)]* *[==>(Copy 10)]* *[==>(Copy 11)]* *[==>(Copy 12)]* *[==>(Copy 13)]* *[==>(Copy 14)]* *[==>(Copy 15)]* *[==>(Copy 16)]* *[==>(Copy 17)]* *[==>(Copy 18)]* *[==>(Copy 19)]* *[==>(Copy 20)]* *[==>(Copy 21)]* *[==>(Copy 22)]*	***[6]***

Orbit Structure

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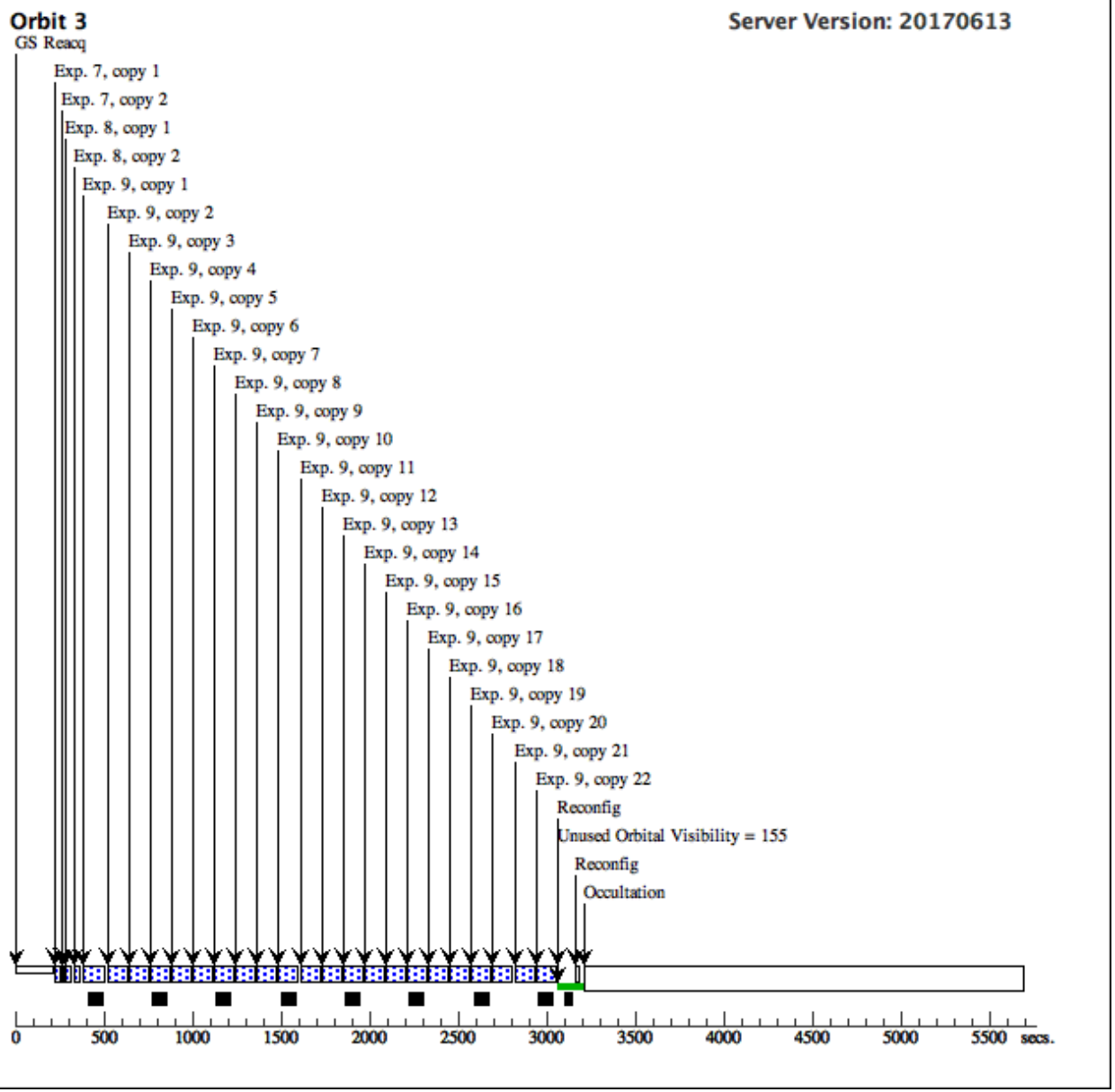
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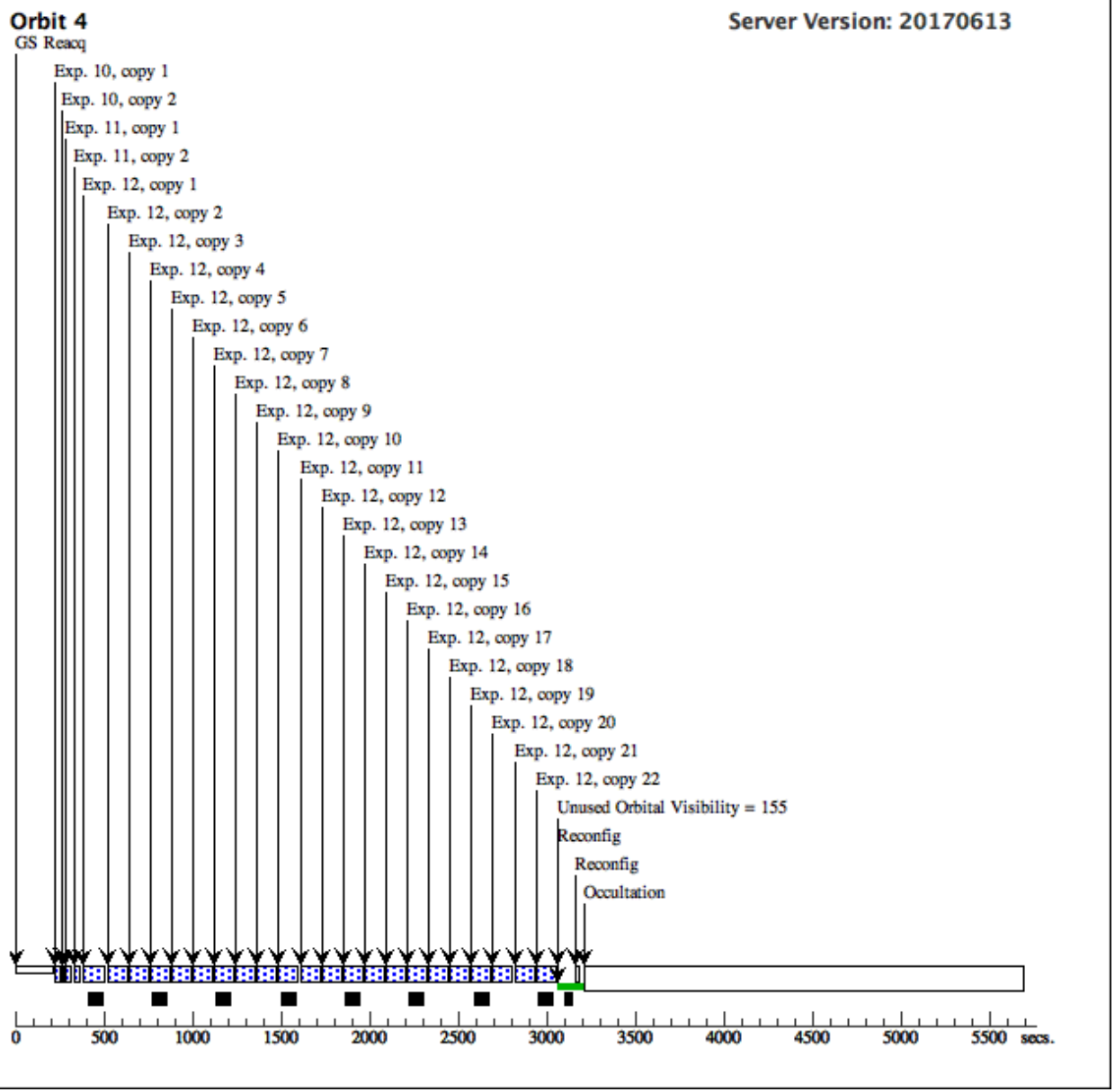
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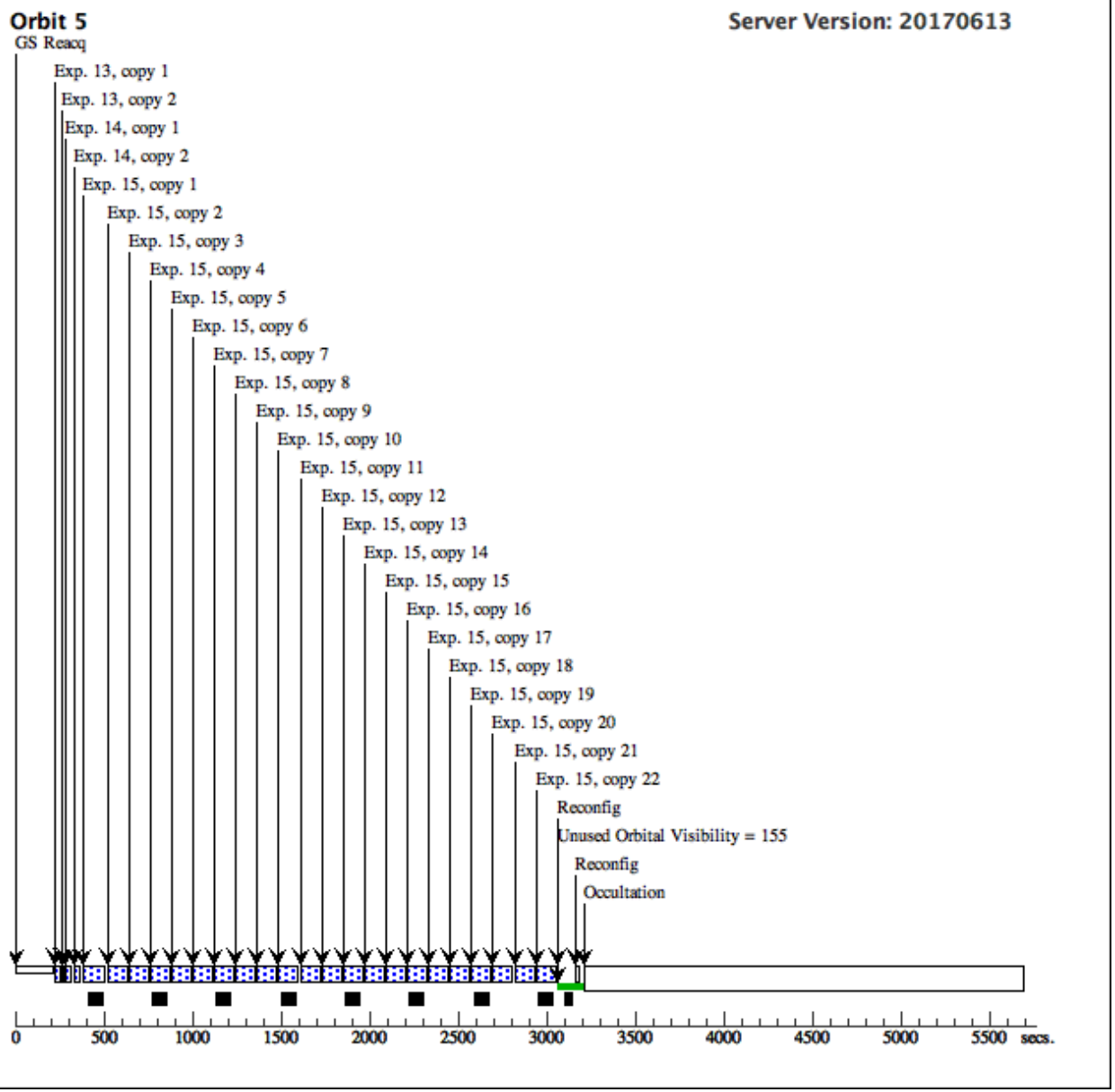
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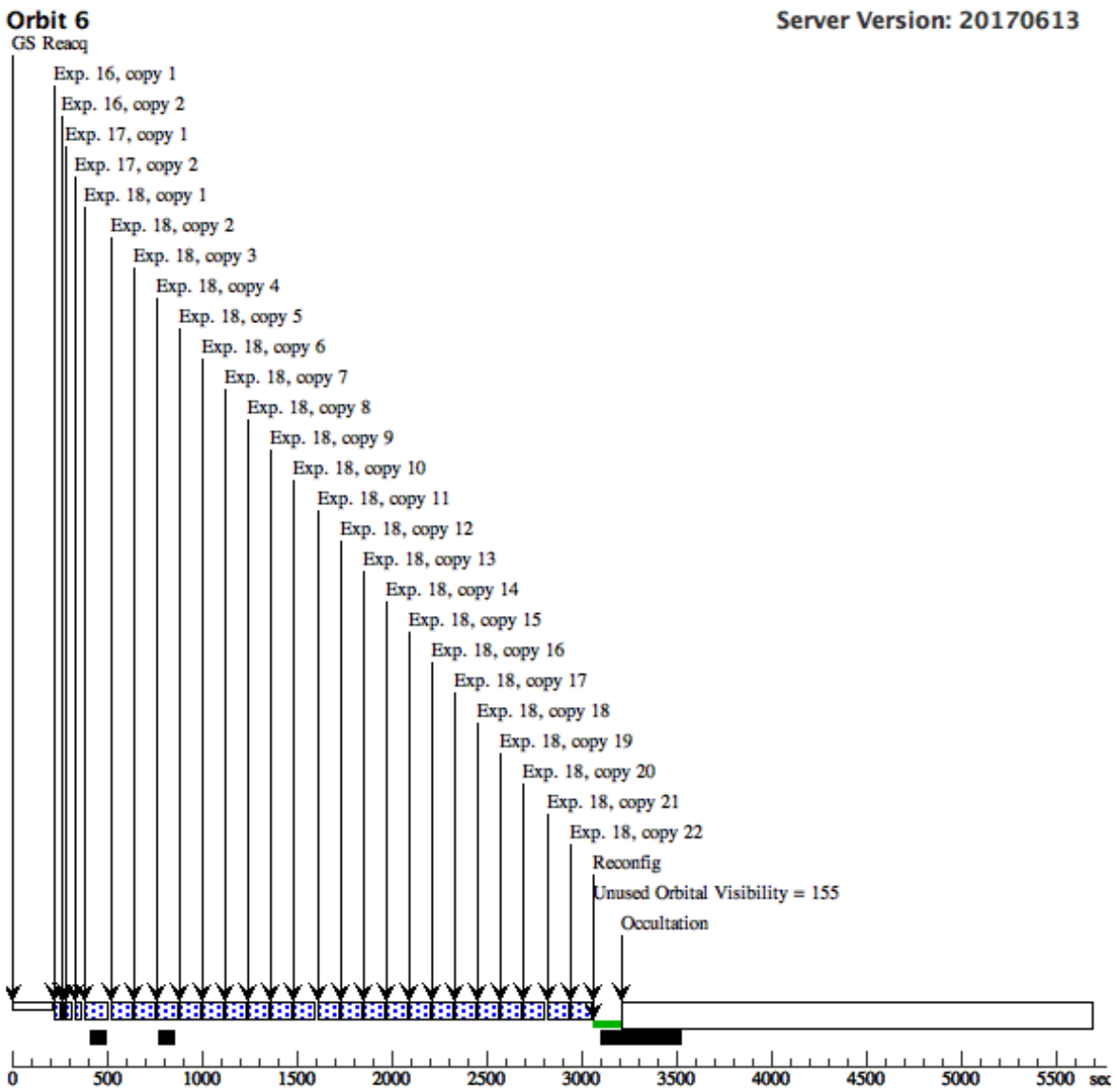
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Exp. 18, copy 22
Reconfig
Unused Orbital Visibility = 155
Occultation
0
500
1000
1500
2000
2500
3000
3500
4000
4500
5000
5500
sec

Visit

Proposal 15197, Visit 3: GSC6214-210 (13), implementation Thu Jul 27 20:04:34 GMT 2017

Diagnostic Status: No Diagnostics

Scientific Instruments: WFC3/IR

Special Requirements: PCS MODE FINE; ORIENT 120.9D TO 140.9 D; ORIENT 300.9D TO 320.9 D

Comments: +/- 10 deg tolerance on Orient.

Fixed Targets

#	Name	Target Coordinates	Targ. Coord. Corrections	Fluxes	Miscellaneous
(1)	GSC-06214-00210	RA: 16 21 54.6680 (245.4777833d)	Proper Motion RA: -19 mas/yr	V=(?)	Reference Frame: ICRS
		Dec: -20 43 9.15 (-20.71921d)	Proper Motion Dec: -32 mas/yr	J=16.3,	
		Equinox: J2000	Epoch of Position: 2000.0	H=15.6	

Comments: The quoted photometry is for the companion, which is red and has a spectral type of M9.5. The K7 host star photometry is as follows: R=11.9, J=10.0, H=9.3. It is located 2.2" from the companion at a PA of 175.9 deg.
Extended=NO

Exposures

#	Label	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time (Total)/[Actual Dur.]	Orbit
1	Orbit 1: Image in F132N (shallow)	(1) GSC-06214-00210	WFC3/IR, MULTIACCUM, GRISM256	F132N	SAMP-SEQ=RAPID; NSAMP=15			4.167225 Secs X 2 (8.334 Secs) *[==>(Copy 1)]* *[==>(Copy 2)]*	***[1]***
Comments: Image in F132N for wavelength calibration.									
2	Orbit 1: Image in F132N (deep)	(1) GSC-06214-00210	WFC3/IR, MULTIACCUM, GRISM256	F132N	SAMP-SEQ=SPARS10; NSAMP=5			29.663763 Secs X 2 (59.328 Secs) *[==>(Copy 1)]* *[==>(Copy 2)]*	***[1]***
Comments: Image in F132N for wavelength calibration.									
3	Orbit 1: G141 spectrum	(1) GSC-06214-00210	WFC3/IR, MULTIACCUM, GRISM256	G141	SAMP-SEQ=SPARS10; NSAMP=15			103.128633 Secs X 22 (2268.83 Secs) *[==>(Copy 1)]* *[==>(Copy 2)]* *[==>(Copy 3)]* *[==>(Copy 4)]* *[==>(Copy 5)]* *[==>(Copy 6)]* *[==>(Copy 7)]* *[==>(Copy 8)]* *[==>(Copy 9)]* *[==>(Copy 10)]* *[==>(Copy 11)]* *[==>(Copy 12)]* *[==>(Copy 13)]* *[==>(Copy 14)]* *[==>(Copy 15)]* *[==>(Copy 16)]* *[==>(Copy 17)]* *[==>(Copy 18)]* *[==>(Copy 19)]* *[==>(Copy 20)]* *[==>(Copy 21)]* *[==>(Copy 22)]*	***[1]***
4	Orbit 2: Image in F132N (shallow)	(1) GSC-06214-00210	WFC3/IR, MULTIACCUM, GRISM256	F132N	SAMP-SEQ=RAPID; NSAMP=15			4.167225 Secs X 2 (8.334 Secs) *[==>(Copy 1)]* *[==>(Copy 2)]*	***[2]***
Comments: Image in F132N for wavelength calibration.									
5	Orbit 2: Image in F132N (deep)	(1) GSC-06214-00210	WFC3/IR, MULTIACCUM, GRISM256	F132N	SAMP-SEQ=SPARS10; NSAMP=5			29.663763 Secs X 2 (59.328 Secs) *[==>(Copy 1)]* *[==>(Copy 2)]*	***[2]***
Comments: Image in F132N for wavelength calibration.									

6	Orbit 2: G141 spectrum	(1) GSC-06214-0021 0	WFC3/IR, MULTIACCUM, GRISM256	G141	SAMP-SEQ=SPARS10; NSAMP=15	103.128633 Secs X 23 (2371.959 Secs) *[==>(Copy 1)]* *[==>(Copy 2)]* *[==>(Copy 3)]* *[==>(Copy 4)]* *[==>(Copy 5)]* *[==>(Copy 6)]* *[==>(Copy 7)]* *[==>(Copy 8)]* *[==>(Copy 9)]* *[==>(Copy 10)]* *[==>(Copy 11)]* *[==>(Copy 12)]* *[==>(Copy 13)]* *[==>(Copy 14)]* *[==>(Copy 15)]* *[==>(Copy 16)]* *[==>(Copy 17)]* *[==>(Copy 18)]* *[==>(Copy 19)]* *[==>(Copy 20)]* *[==>(Copy 21)]* *[==>(Copy 22)]* *[==>(Copy 23)]*	***[2]***
7	Orbit 3: Image in F132N (shallow)	(1) GSC-06214-0021 0	WFC3/IR, MULTIACCUM, GRISM256	F132N	SAMP-SEQ=RAPID; NSAMP=15	4.167225 Secs X 2 (8.334 Secs) *[==>(Copy 1)]* *[==>(Copy 2)]*	***[3]***
Comments: Image in F132N for wavelength calibration.								
8	Orbit 3: Image in F132N (deep)	(1) GSC-06214-0021 0	WFC3/IR, MULTIACCUM, GRISM256	F132N	SAMP-SEQ=SPARS10; NSAMP=5	29.663763 Secs X 2 (59.328 Secs) *[==>(Copy 1)]* *[==>(Copy 2)]*	***[3]***
Comments: Image in F132N for wavelength calibration.								

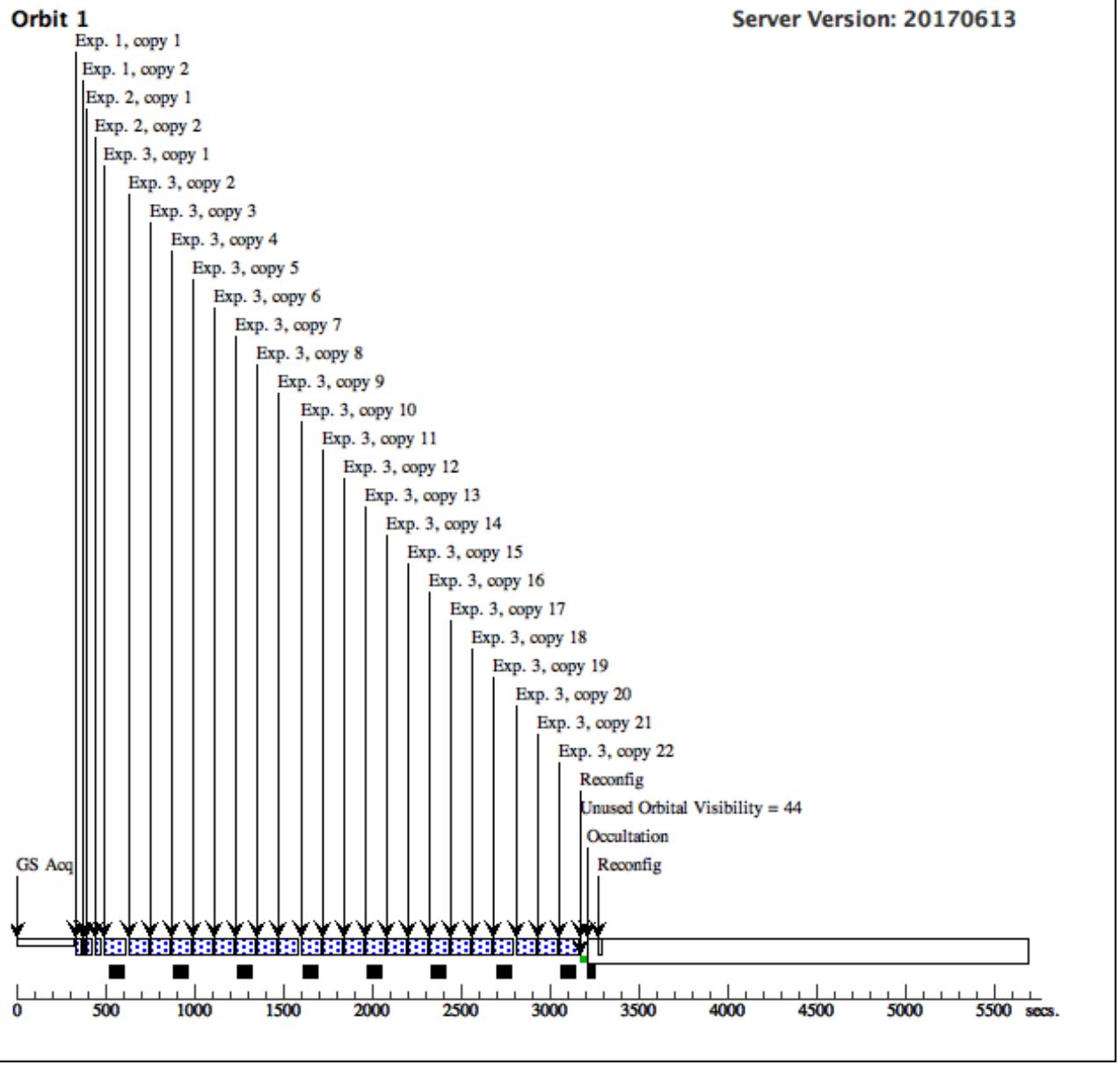
9	Orbit 3: G141 spectrum	(1) GSC-06214-0021 0	WFC3/IR, MULTIACCUM, GRISM256	G141	SAMP-SEQ=SPARS10; NSAMP=15	103.128633 Secs X 23 (2371.959 Secs) *[==>(Copy 1)]* *[==>(Copy 2)]* *[==>(Copy 3)]* *[==>(Copy 4)]* *[==>(Copy 5)]* *[==>(Copy 6)]* *[==>(Copy 7)]* *[==>(Copy 8)]* *[==>(Copy 9)]* *[==>(Copy 10)]* *[==>(Copy 11)]* *[==>(Copy 12)]* *[==>(Copy 13)]* *[==>(Copy 14)]* *[==>(Copy 15)]* *[==>(Copy 16)]* *[==>(Copy 17)]* *[==>(Copy 18)]* *[==>(Copy 19)]* *[==>(Copy 20)]* *[==>(Copy 21)]* *[==>(Copy 22)]* *[==>(Copy 23)]*	***[3]***
10	Orbit 4: Image in F132N (shallow)	(1) GSC-06214-0021 0	WFC3/IR, MULTIACCUM, GRISM256	F132N	SAMP-SEQ=RAPID; NSAMP=15	4.167225 Secs X 2 (8.334 Secs) *[==>(Copy 1)]* *[==>(Copy 2)]*	***[4]***
Comments: Image in F132N for wavelength calibration.								
11	Orbit 4: Image in F132N (deep)	(1) GSC-06214-0021 0	WFC3/IR, MULTIACCUM, GRISM256	F132N	SAMP-SEQ=SPARS10; NSAMP=5	29.663763 Secs X 2 (59.328 Secs) *[==>(Copy 1)]* *[==>(Copy 2)]*	***[4]***
Comments: Image in F132N for wavelength calibration.								

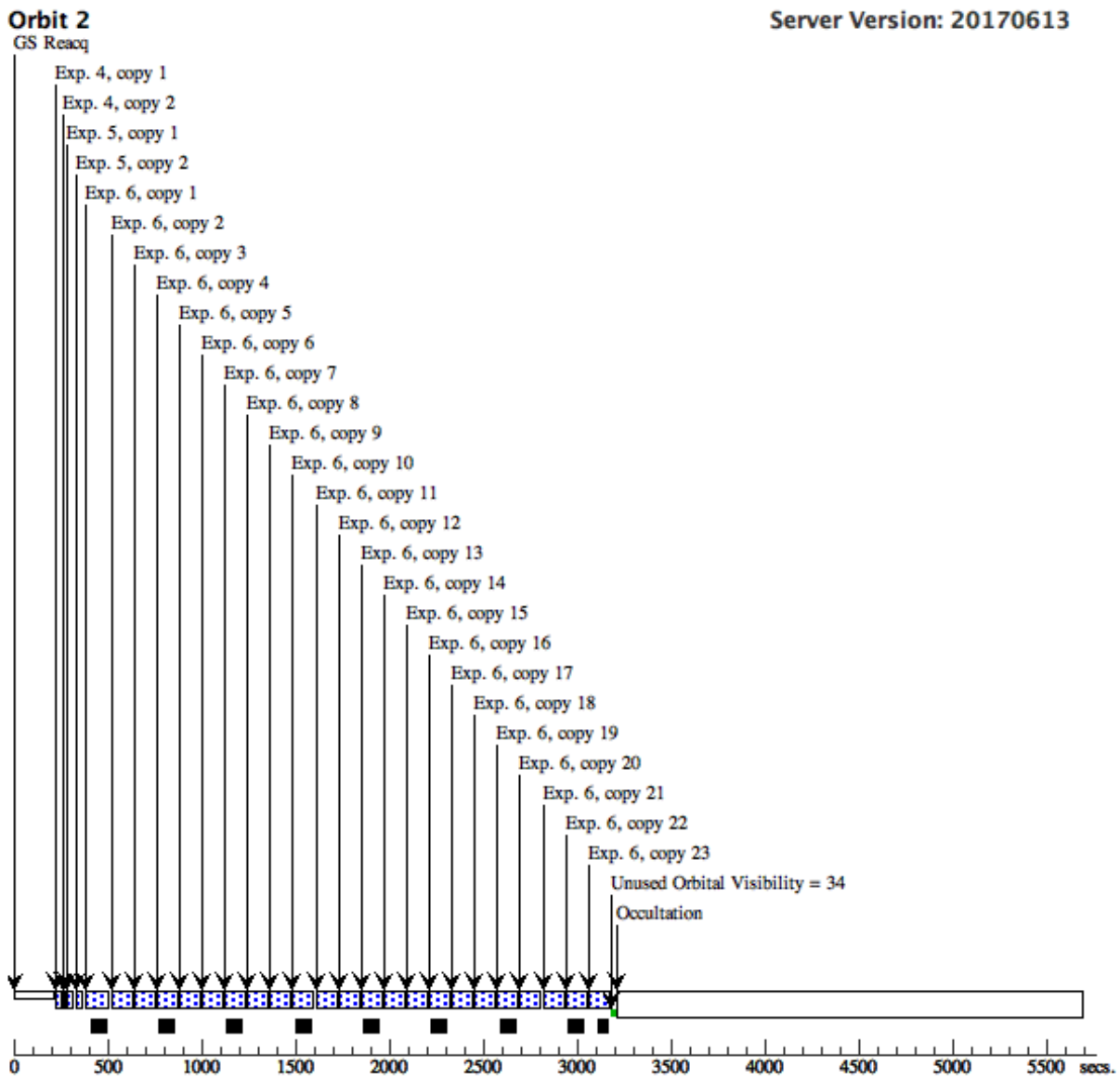
12	Orbit 4: G141 spectrum	(1) GSC-06214-0021 0	WFC3/IR, MULTIACCUM, GRISM256	G141	SAMP-SEQ=SPARS10; NSAMP=15	103.128633 Secs X 23 (2371.959 Secs) *[==>(Copy 1)]* *[==>(Copy 2)]* *[==>(Copy 3)]* *[==>(Copy 4)]* *[==>(Copy 5)]* *[==>(Copy 6)]* *[==>(Copy 7)]* *[==>(Copy 8)]* *[==>(Copy 9)]* *[==>(Copy 10)]* *[==>(Copy 11)]* *[==>(Copy 12)]* *[==>(Copy 13)]* *[==>(Copy 14)]* *[==>(Copy 15)]* *[==>(Copy 16)]* *[==>(Copy 17)]* *[==>(Copy 18)]* *[==>(Copy 19)]* *[==>(Copy 20)]* *[==>(Copy 21)]* *[==>(Copy 22)]* *[==>(Copy 23)]*	***[4]***
13	Orbit 5: Image in F132N (shallow)	(1) GSC-06214-0021 0	WFC3/IR, MULTIACCUM, GRISM256	F132N	SAMP-SEQ=RAPID; NSAMP=15	4.167225 Secs X 2 (8.334 Secs) *[==>(Copy 1)]* *[==>(Copy 2)]*	***[5]***
Comments: Image in F132N for wavelength calibration.								
14	Orbit 5: Image in F132N (deep)	(1) GSC-06214-0021 0	WFC3/IR, MULTIACCUM, GRISM256	F132N	SAMP-SEQ=SPARS10; NSAMP=5	29.663763 Secs X 2 (59.328 Secs) *[==>(Copy 1)]* *[==>(Copy 2)]*	***[5]***
Comments: Image in F132N for wavelength calibration.								

15	Orbit 5: G141 spectrum	(1) GSC-06214-0021 0	WFC3/IR, MULTIACCUM, GRISM256	G141	SAMP-SEQ=SPARS10; NSAMP=15	103.128633 Secs X 23 (2371.959 Secs) *[==>(Copy 1)]* *[==>(Copy 2)]* *[==>(Copy 3)]* *[==>(Copy 4)]* *[==>(Copy 5)]* *[==>(Copy 6)]* *[==>(Copy 7)]* *[==>(Copy 8)]* *[==>(Copy 9)]* *[==>(Copy 10)]* *[==>(Copy 11)]* *[==>(Copy 12)]* *[==>(Copy 13)]* *[==>(Copy 14)]* *[==>(Copy 15)]* *[==>(Copy 16)]* *[==>(Copy 17)]* *[==>(Copy 18)]* *[==>(Copy 19)]* *[==>(Copy 20)]* *[==>(Copy 21)]* *[==>(Copy 22)]* *[==>(Copy 23)]*	***[5]***
16	Orbit 6: Image in F132N (shallow)	(1) GSC-06214-0021 0	WFC3/IR, MULTIACCUM, GRISM256	F132N	SAMP-SEQ=RAPID; NSAMP=15	4.167225 Secs X 2 (8.334 Secs) *[==>(Copy 1)]* *[==>(Copy 2)]*	***[6]***
Comments: Image in F132N for wavelength calibration.								
17	Orbit 6: Image in F132N (deep)	(1) GSC-06214-0021 0	WFC3/IR, MULTIACCUM, GRISM256	F132N	SAMP-SEQ=SPARS10; NSAMP=5	29.663763 Secs X 2 (59.328 Secs) *[==>(Copy 1)]* *[==>(Copy 2)]*	***[6]***
Comments: Image in F132N for wavelength calibration.								

	18	Orbit 6: G141 spectrum	(1) GSC-06214-0021 0	WFC3/IR, MULTIACCUM, GRISM256	G141	SAMP-SEQ=SPARS10; NSAMP=15	103.128633 Secs X 23 (2371.959 Secs) *[==>(Copy 1)]* *[==>(Copy 2)]* *[==>(Copy 3)]* *[==>(Copy 4)]* *[==>(Copy 5)]* *[==>(Copy 6)]* *[==>(Copy 7)]* *[==>(Copy 8)]* *[==>(Copy 9)]* *[==>(Copy 10)]* *[==>(Copy 11)]* *[==>(Copy 12)]* *[==>(Copy 13)]* *[==>(Copy 14)]* *[==>(Copy 15)]* *[==>(Copy 16)]* *[==>(Copy 17)]* *[==>(Copy 18)]* *[==>(Copy 19)]* *[==>(Copy 20)]* *[==>(Copy 21)]* *[==>(Copy 22)]* *[==>(Copy 23)]*	 ***[6]***

Orbit Structure

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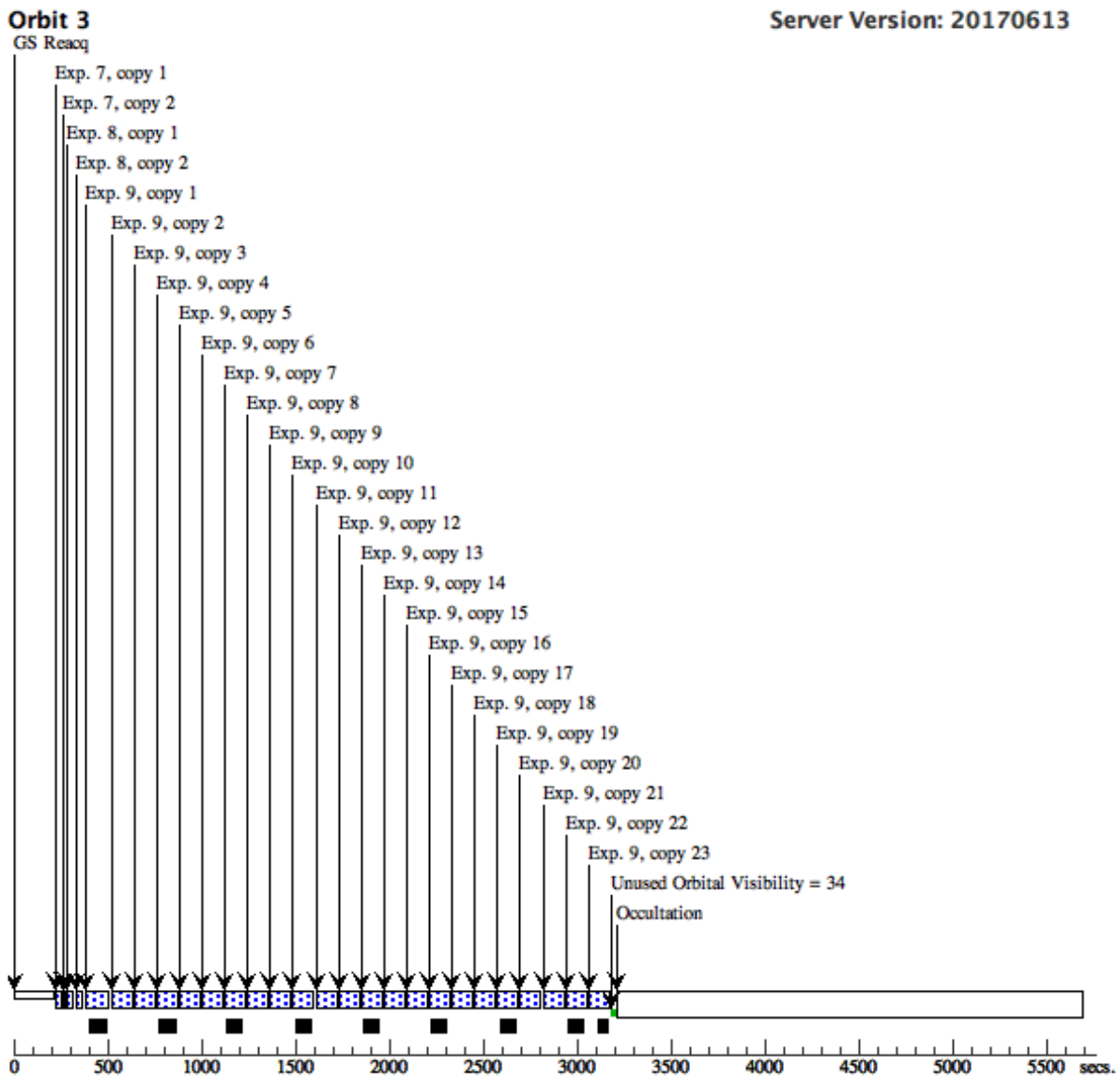
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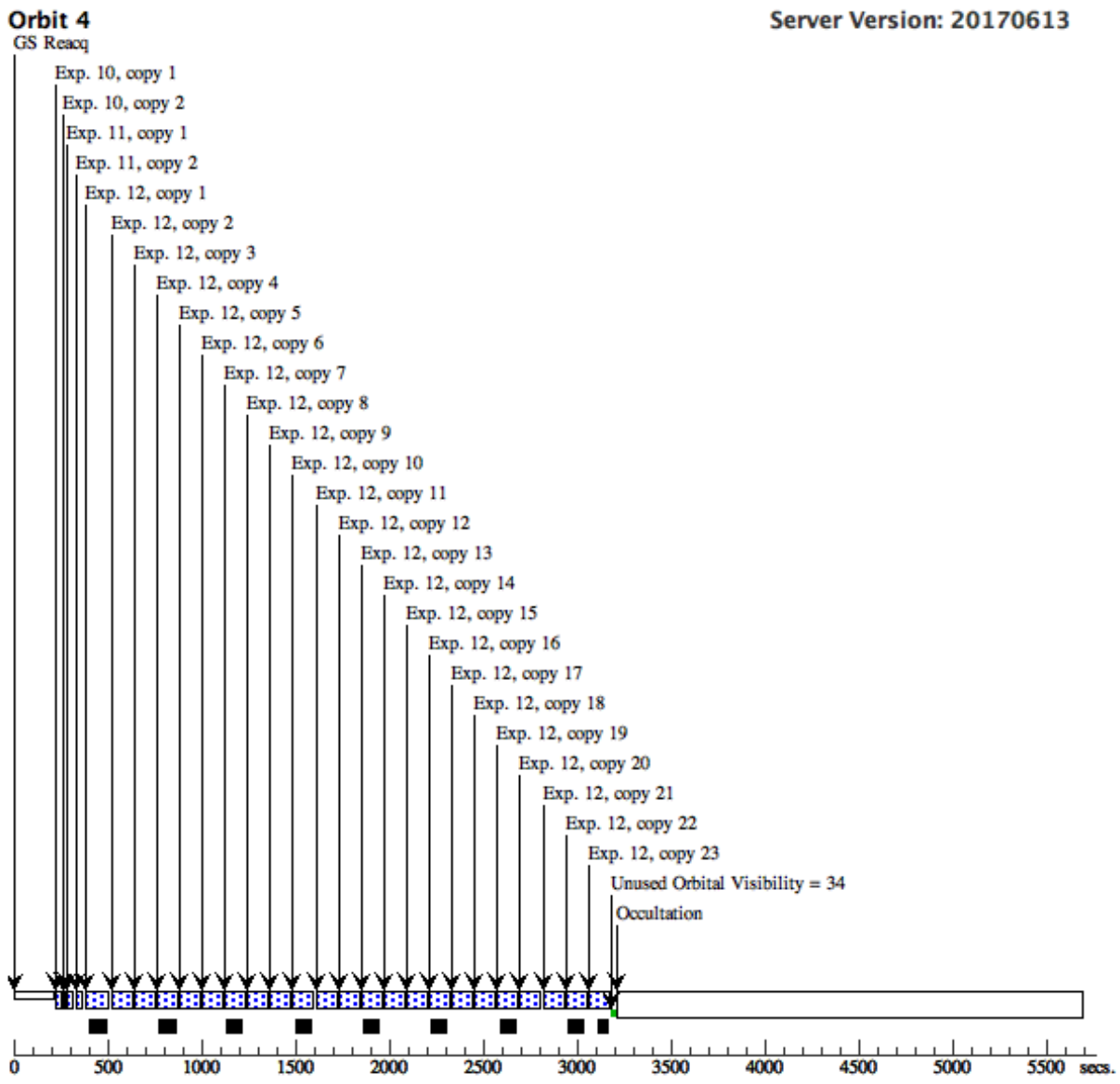
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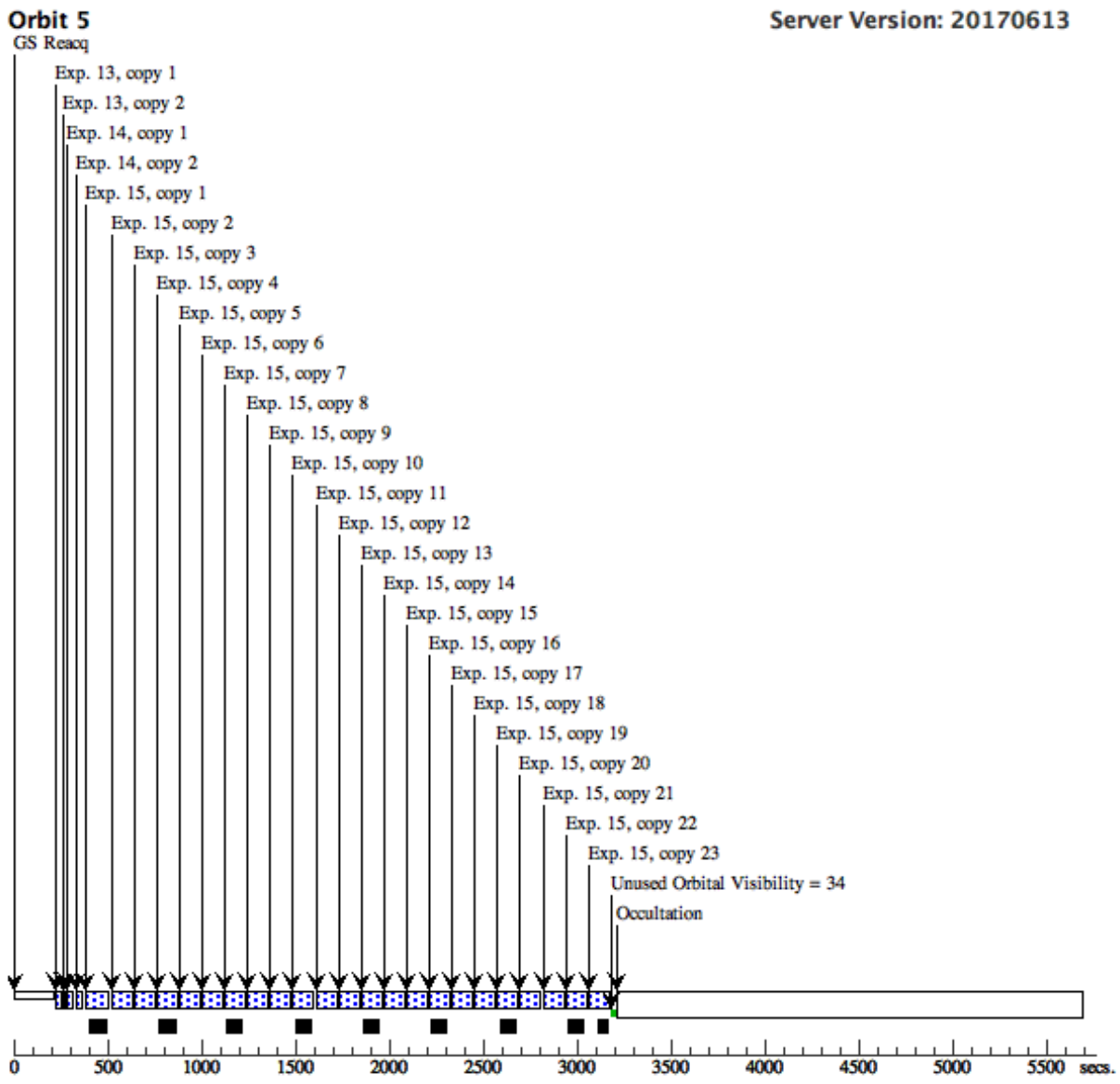
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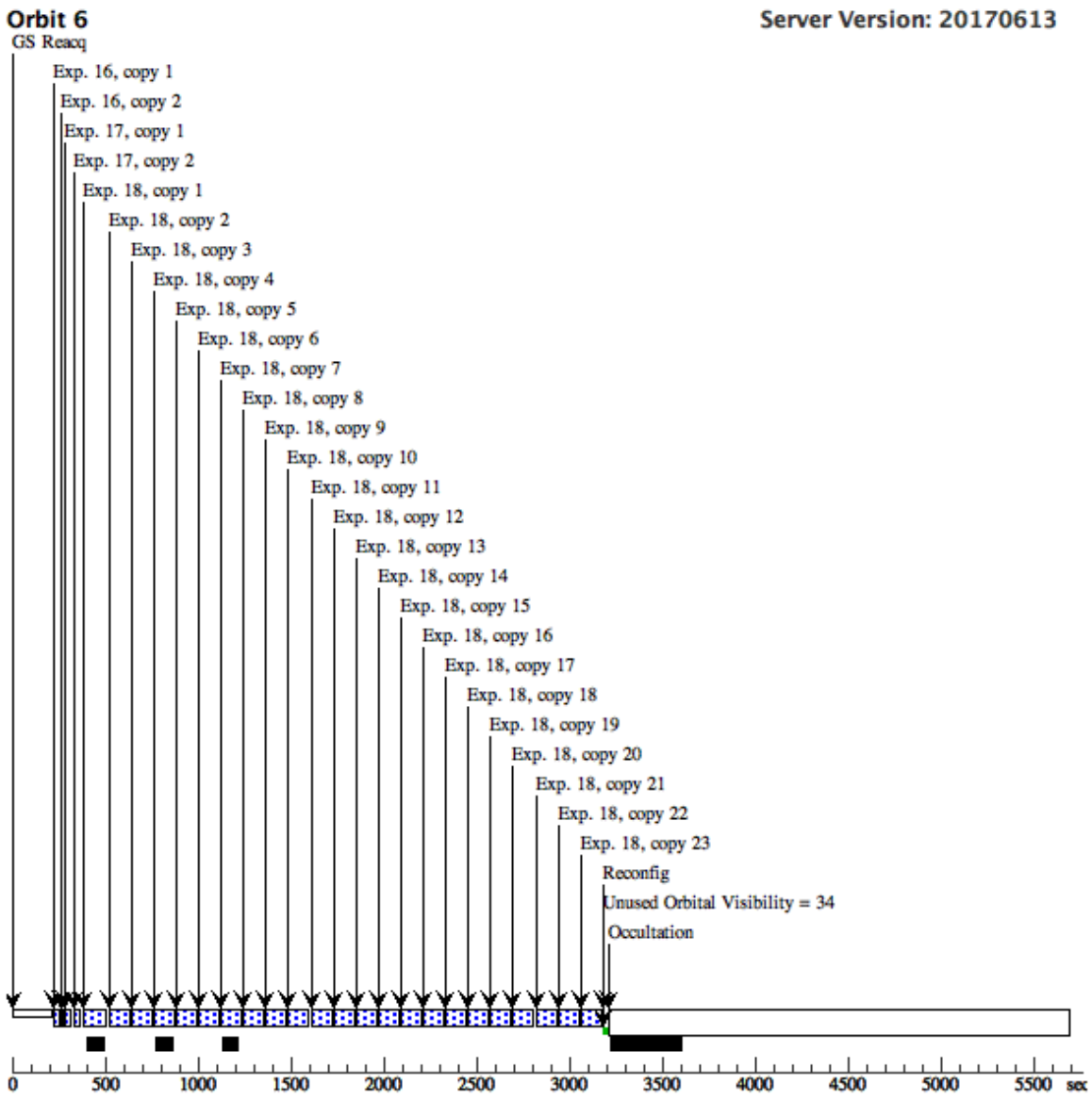
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