15129 - Completing Kepler's Mission to Determine the Frequency of Earth-like Planets

Cycle: 25, Proposal Category: GO

(Availability Mode: AVAILABLE)

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) KEPLER-62	WFC3/UVIS	18	16-Nov-2017 14:01:24.0	yes

18 Total Orbits Used

ABSTRACT

The primary goal of NASA's Kepler mission is to estimate the frequency of Earth-sized planets orbiting in the habitable zone (HZ) of Sun-like stars (so called eta-Earth). Analysis of four years of Kepler data reveals an unprecedented population of more than 4400 planet candidates orbiting 3400

stars, however only a small subset of these (~13 planets) fall into the regime of near-Earth-sized and in the HZ of a solar-type star. By accounting properly for detection biases that limit the catalog completeness and reliability we can turn an observed population into an intrinsic population and achieve Kepler's prime mission goal. Our team have shown that uncertainties in HZ occurrence rates for solar-type stars for all analyses to date are dominated by systematic uncertainties. The robustness of the 13 high-value Earth-like planet candidates is questionable due to their long periods and small transit depths - the Kepler team estimate that perhaps 50% of these are real planets. The proposed HST observations provide a pilot study to measure the photometric time series of the high-value, temperate terrestrial planet candidate Kepler-62f in order to confirm that it is not a false alarm. Long-duration high-precision observations from HST of this kind have not been attempted before and therefore we opt to waive the proprietary period of data collected during this pilot study. Successful confirmation will pave the way for a future large program to examine all of the Kepler G dwarf habitable Earth-sized planets and drastically improve the accuracy of eta-Earth estimates.

OBSERVING DESCRIPTION

Using HST, recover the long period, P=267 day, transiting super-Earth size planet, Kepler-62f that was originally detected by Kepler. The science goal requires 19 uninterrupted HST orbits in a SINGLE visit using the WFC3/UVIS F350LP filter of the planet host ,Kepler-62 (K2V; V=14.1). Due to the long orbital period there are two opportunities during the Cycle 25 observing window to observe a transit of Kepler-62f (we are requesting observations for one of the two). We seek high precision, continuous photometric coverage in order to recover the shallow (470 ppm) transit event lasting ~8 hours. Observations are planned to achieve high throughput via spatial scanning and provide orbit-to-orbit stability. Kepler-62 is positioned in the sub-array in order to accomodate without overlap the DeltaV=1.1 comparison stellar target 2MASS: 18524855+4521022 to aid in understanding the data systematics. With the transit event constraints and uninterrupted 19 orbit visit, the scheduling for this program will be challenging, but 19-orbits contiguously has been observed before in program 13467 (visit 25). We will accept SAA impacted orbits in science. Schedulability = 100% special requirement is enabled.

Visit

Proposal 15129, Visit 01, implementation Thu Nov 16 19:01:36 GMT 2017

Diagnostic Status: Warning

Scientific Instruments: WFC3/UVIS

Special Requirements: SCHED 100%; ORIENT 28D TO 28 D; Period 267.282 D AND ZERO-PHASE HJD2455422.720

Comments: Scheduling Requirements: Visit 1 requires19 non-interrupt HST orbits. There are only two transit events during cycle 25.
We accept science observations during SAA.
We desire comparison stellar target 2MASS: 18524855+4521022 (Delta mag = 1.1; Separation = 25 arcsec) to also be observable on 1024x1024 subarray to aid in understanding the data systematics.

Diagnostics

(Visit 01) Warning (Orbit Planner): LONG SU LIKELY TO INTERSECT THE SAA

(Exposure 3 (Visit 01)) Warning (Form): FLASH level may be too low for this exposure or a short subexposure. See extended explanation in the diagnostic browser

(Exposure 4 (Visit 01)) Warning (Form): FLASH level may be too low for this exposure or a short subexposure. See extended explanation in the diagnostic browser

(Exposure 5 (Visit 01)) Warning (Form): FLASH level may be too low for this exposure or a short subexposure. See extended explanation in the diagnostic browser

(Exposure 6 (Visit 01)) Warning (Form): FLASH level may be too low for this exposure or a short subexposure. See extended explanation in the diagnostic browser

(Exposure 7 (Visit 01)) Warning (Form): FLASH level may be too low for this exposure or a short subexposure. See extended explanation in the diagnostic browser

(Exposure 8 (Visit 01)) Warning (Form): FLASH level may be too low for this exposure or a short subexposure. See extended explanation in the diagnostic browser

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(Exposure 11 (Visit 01)) Warning (Form): FLASH level may be too low for this exposure or a short subexposure. See extended explanation in the diagnostic browser

(Exposure 12 (Visit 01)) Warning (Form): FLASH level may be too low for this exposure or a short subexposure. See extended explanation in the diagnostic browser

Fixed Targets

#	Name	Target Coordinates	Targ. Coord. Corrections	Fluxes	Miscellaneous
(1)	KEPLER-62	RA: 18 52 51.0590 (283.2127458d)	Proper Motion RA: -11.1 mas/yr	V=14.1+/-0.1	Reference Frame: ICRS
	Alt Name1: 2MASS-J18525105+4520595	Dec: +45 20 59.51 (45.34986d)	Proper Motion Dec: -29.3 mas/yr	J=12.256,	
		Equinox: J2000	Epoch of Position: 2000.0	K=11.659	

Comments: This object was generated by the targetselector and retrieved from the SIMBAD database.
Extended=NO

Exposures

#	Label	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time (Total)/[Actual Dur.]	Orbit
1		(1) KEPLER-62	WFC3/UVIS, ACCUM, UVIS2-M1K1C-SUB	F555W	FLASH=12.0	POS TARG 6.3,-14.3; PHASE 0.997256 TO 0.997755; GSPAIR N2EP000667F2N2F2000852F1		6 Secs (6 Secs) *[==>]*	 ***[1]***
2		(1) KEPLER-62	WFC3/UVIS, ACCUM, UVIS2-M1K1C-SUB	F814W	FLASH=12.0	POS TARG 6.3,-14.3		8 Secs (8 Secs) *[==>]*	 ***[1]***
3		(1) KEPLER-62	WFC3/UVIS, ACCUM, UVIS2-M1K1C-SUB	F350LP		POS TARG 6.3,-14.3; SPATIAL SCAN 0.0438,90.0 Degrees,Round trip		137 Secs X 5 (1370 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)]*	 ***[1]***
4		(1) KEPLER-62	WFC3/UVIS, ACCUM, UVIS2-M1K1C-SUB	F350LP		POS TARG 6.3,-14.3; SPATIAL SCAN 0.0438,90.0 Degrees,Forward		137 Secs (137 Secs) *[==>]*	 ***[2]***
5		(1) KEPLER-62	WFC3/UVIS, ACCUM, UVIS2-M1K1C-SUB	F350LP		POS TARG 6.3,-14.3; SPATIAL SCAN 0.0438,90.0 Degrees,Round trip; SAA CONTOUR 02		137 Secs X 5 (1370 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)]*	 ***[2]***
6		(1) KEPLER-62	WFC3/UVIS, ACCUM, UVIS2-M1K1C-SUB	F350LP		POS TARG 6.3,-14.3; SPATIAL SCAN 0.0438,90.0 Degrees,Forward; SAA CONTOUR 02		137 Secs (137 Secs) *[==>]*	 ***[3]***

	7	(1) KEPLER-62	WFC3/UVIS, ACCUM, UVIS2-M1K1C-SUB	F350LP	POS TARG 6.3,-14.3; SPATIAL SCAN 0.0 438,90.0 Degrees,Round trip; SAA CONTOUR 02	137 Secs X 16 (4384 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)]*	***[3]***
						[==>(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)]*	***[4]***
						[==>(Copy 12, Forward)] *[==>(Copy 12, Reverse)]* *[==>(Copy 13, Forward)]* *[==>(Copy 13, Reverse)]* *[==>(Copy 14, Forward)]* *[==>(Copy 14, Reverse)]* *[==>(Copy 15, Forward)]* *[==>(Copy 15, Reverse)]* *[==>(Copy 16, Forward)]* *[==>(Copy 16, Reverse)]*	***[5]***
	8	(1) KEPLER-62	WFC3/UVIS, ACCUM, UVIS2-M1K1C-SUB	F350LP	POS TARG 6.3,-14.3; SPATIAL SCAN 0.0 438,90.0 Degrees,Forward; SAA CONTOUR 02	137 Secs (137 Secs)	
						[==>]	***[5]***

	9	(1) KEPLER-62	WFC3/UVIS, ACCUM, UVIS2-M1K1C-SUB	F350LP	POS TARG 6.3,-14.3; SPATIAL SCAN 0.0 438,90.0 Degrees,Round trip; SAA CONTOUR 02	137 Secs X 48 (13152 Secs)	
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						[==>(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]***
						[==>(Copy 13, Forward)] *[==>(Copy 13, Reverse)]* *[==>(Copy 14, Forward)]* *[==>(Copy 14, Reverse)]* *[==>(Copy 15, Forward)]* *[==>(Copy 15, Reverse)]* *[==>(Copy 16, Forward)]* *[==>(Copy 16, Reverse)]* *[==>(Copy 17, Forward)]* *[==>(Copy 17, Reverse)]* *[==>(Copy 18, Forward)]* *[==>(Copy 18, Reverse)]*	***[8]***

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		[==>(Copy 25, Forward)] *[==>(Copy 25, Reverse)]* *[==>(Copy 26, Forward)]* *[==>(Copy 26, Reverse)]* *[==>(Copy 27, Forward)]* *[==>(Copy 27, Reverse)]* *[==>(Copy 28, Forward)]* *[==>(Copy 28, Reverse)]* *[==>(Copy 29, Forward)]* *[==>(Copy 29, Reverse)]* *[==>(Copy 30, Forward)]* *[==>(Copy 30, Reverse)]*	***[10]***
		[==>(Copy 31, Forward)] *[==>(Copy 31, Reverse)]* *[==>(Copy 32, Forward)]* *[==>(Copy 32, Reverse)]* *[==>(Copy 33, Forward)]* *[==>(Copy 33, Reverse)]* *[==>(Copy 34, Forward)]* *[==>(Copy 34, Reverse)]* *[==>(Copy 35, Forward)]* *[==>(Copy 35, Reverse)]* *[==>(Copy 36, Forward)]* *[==>(Copy 36, Reverse)]*	***[11]***

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		[==>(Copy 43, Forward)] *[==>(Copy 43, Reverse)]* *[==>(Copy 44, Forward)]* *[==>(Copy 44, Reverse)]* *[==>(Copy 45, Forward)]* *[==>(Copy 45, Reverse)]* *[==>(Copy 46, Forward)]* *[==>(Copy 46, Reverse)]* *[==>(Copy 47, Forward)]* *[==>(Copy 47, Reverse)]* *[==>(Copy 48, Forward)]* *[==>(Copy 48, Reverse)]*	***[13]***

	10	(1) KEPLER-62	WFC3/UVIS, ACCUM, UVIS2-M1K1C-SUB	F350LP	POS TARG 6.3,-14.3; SPATIAL SCAN 0.0 438,90.0 Degrees,Round trip; SAA CONTOUR 02; NEW OBSET FULL ACQ; GSPAIR N2EP0006 67F2N2F2000852F1	137 Secs X 17 (4658 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)]*	***[14]***
						[==>(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)]*	***[15]***
						[==>(Copy 12, Reverse)] *[==>(Copy 13, Forward)]* *[==>(Copy 13, Reverse)]* *[==>(Copy 14, Forward)]* *[==>(Copy 14, Reverse)]* *[==>(Copy 15, Forward)]* *[==>(Copy 15, Reverse)]* *[==>(Copy 16, Forward)]* *[==>(Copy 16, Reverse)]* *[==>(Copy 17, Forward)]* *[==>(Copy 17, Reverse)]*	***[16]***
	11	(1) KEPLER-62	WFC3/UVIS, ACCUM, UVIS2-M1K1C-SUB	F350LP	POS TARG 6.3,-14.3; SPATIAL SCAN 0.0 438,90.0 Degrees,Forward; SAA CONTOUR 02	137 Secs (137 Secs)	
						[==>]	***[16]***

	12	(1) KEPLER-62	WFC3/UVIS, ACCUM, UVIS2-M1K1C-SUB	F350LP	POS TARG 6.3,-14.3; SPATIAL SCAN 0.0 438,90.0 Degrees,Round trip; SAA CONTOUR 02	137 Secs X 9 (2466 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)]*	 ***[17]*** ***[18]***

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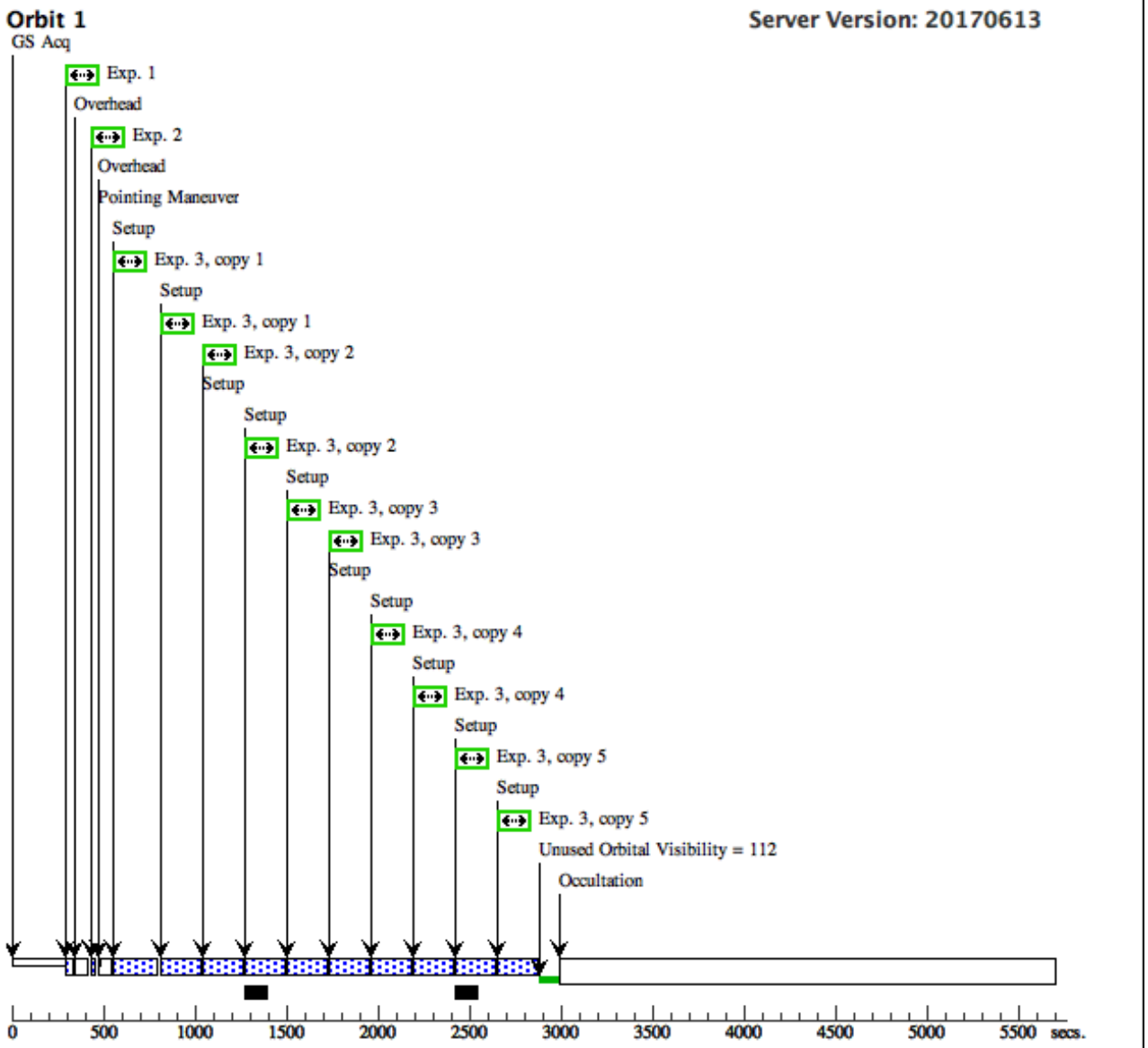

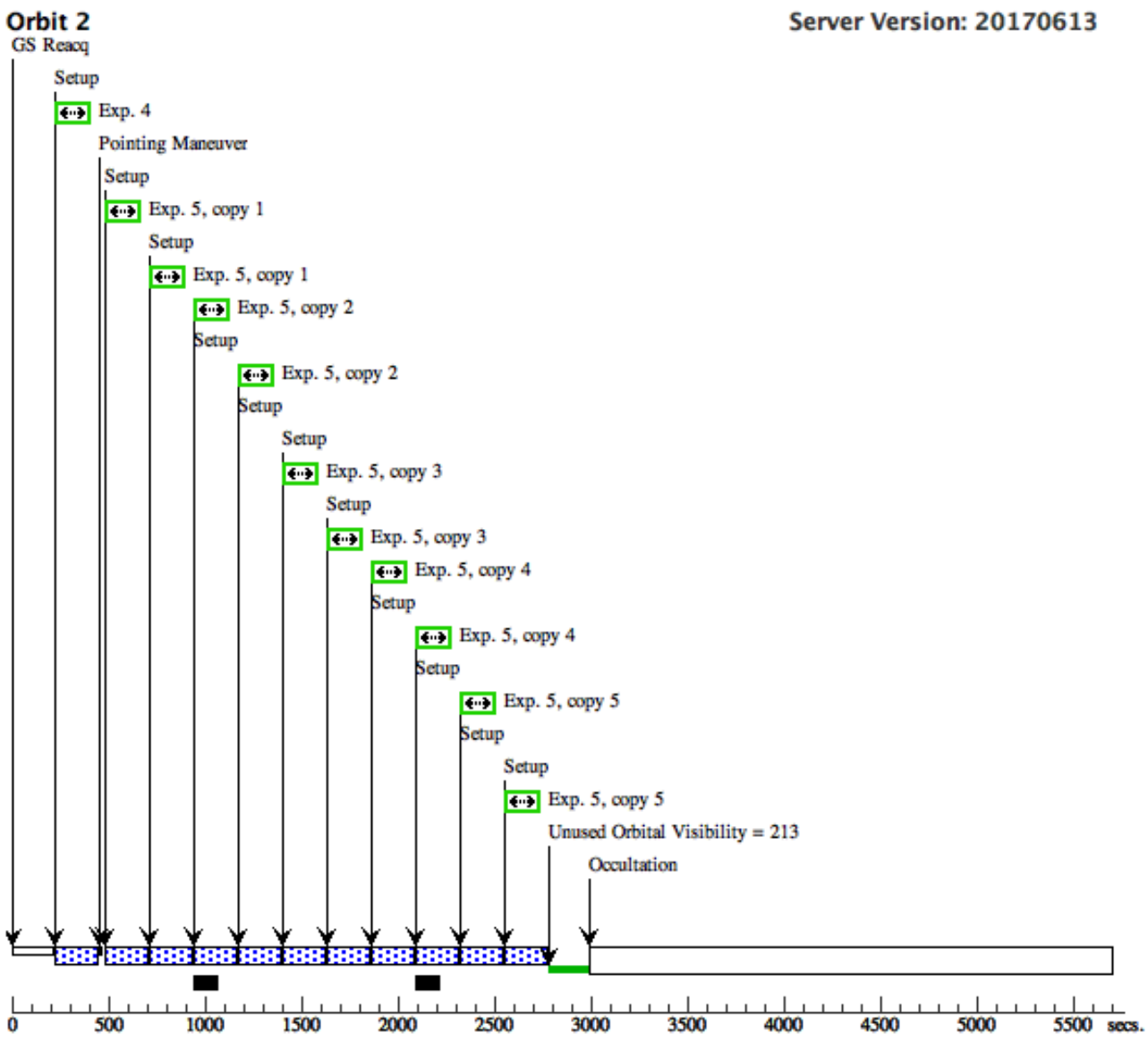
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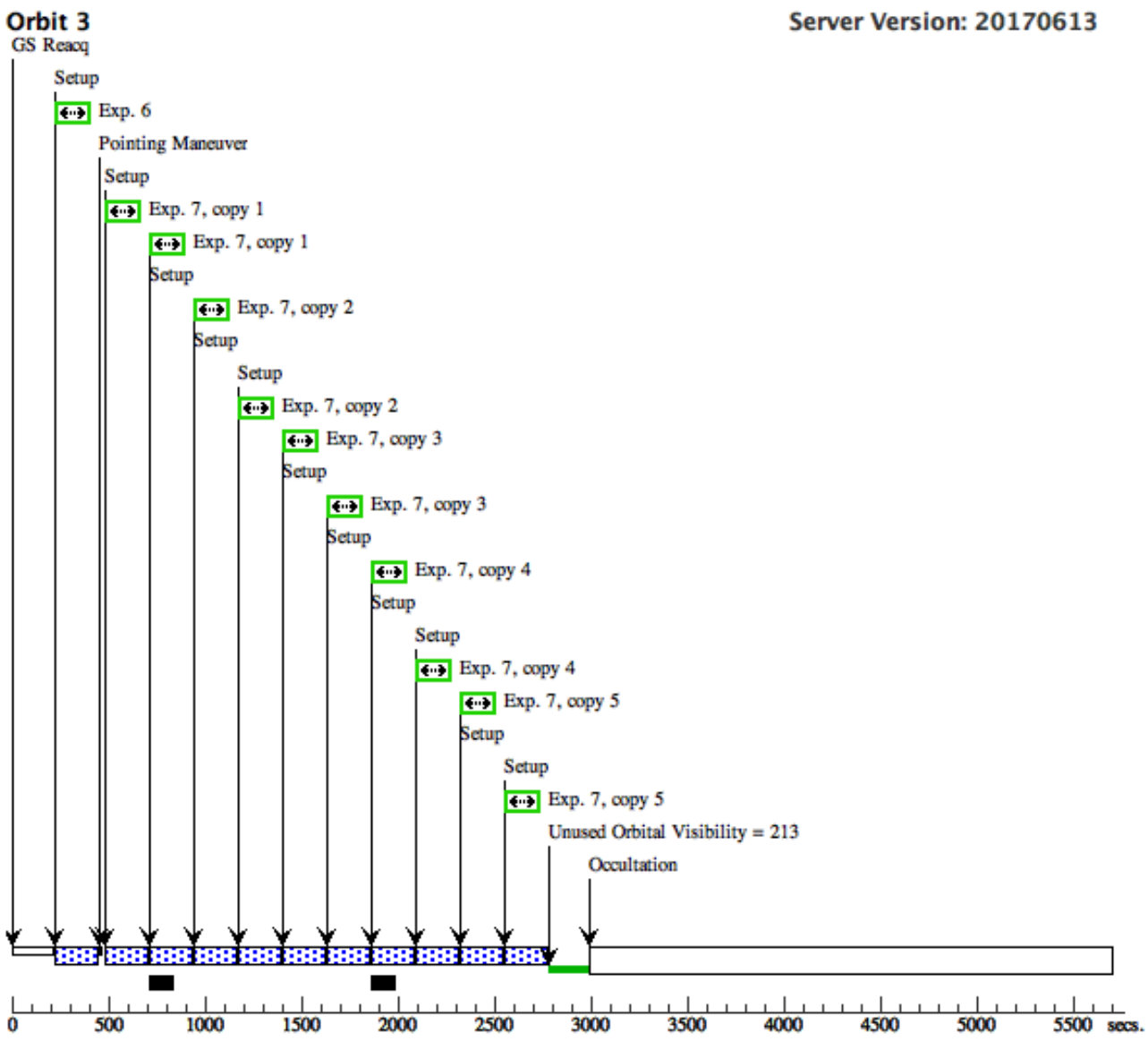
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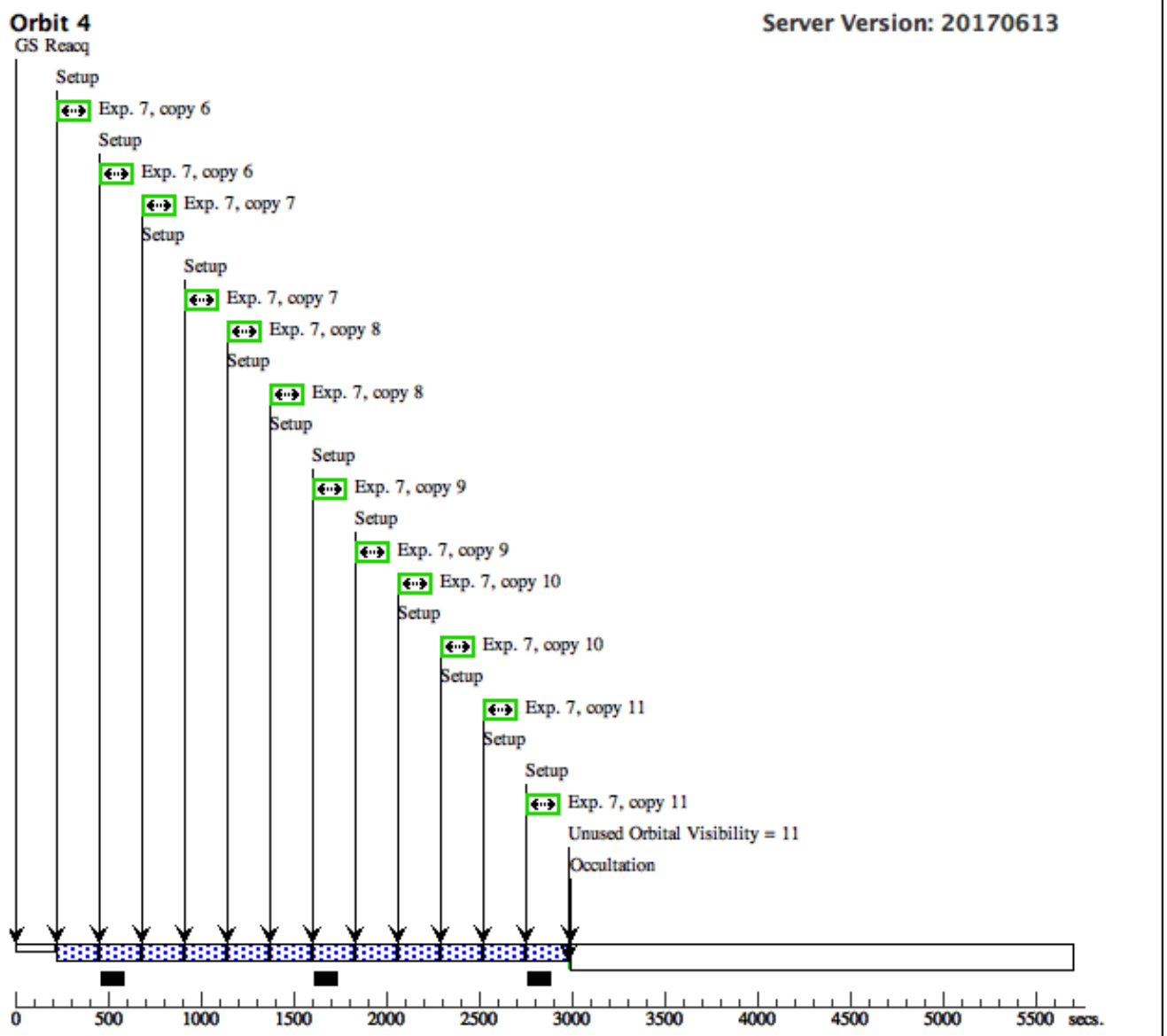
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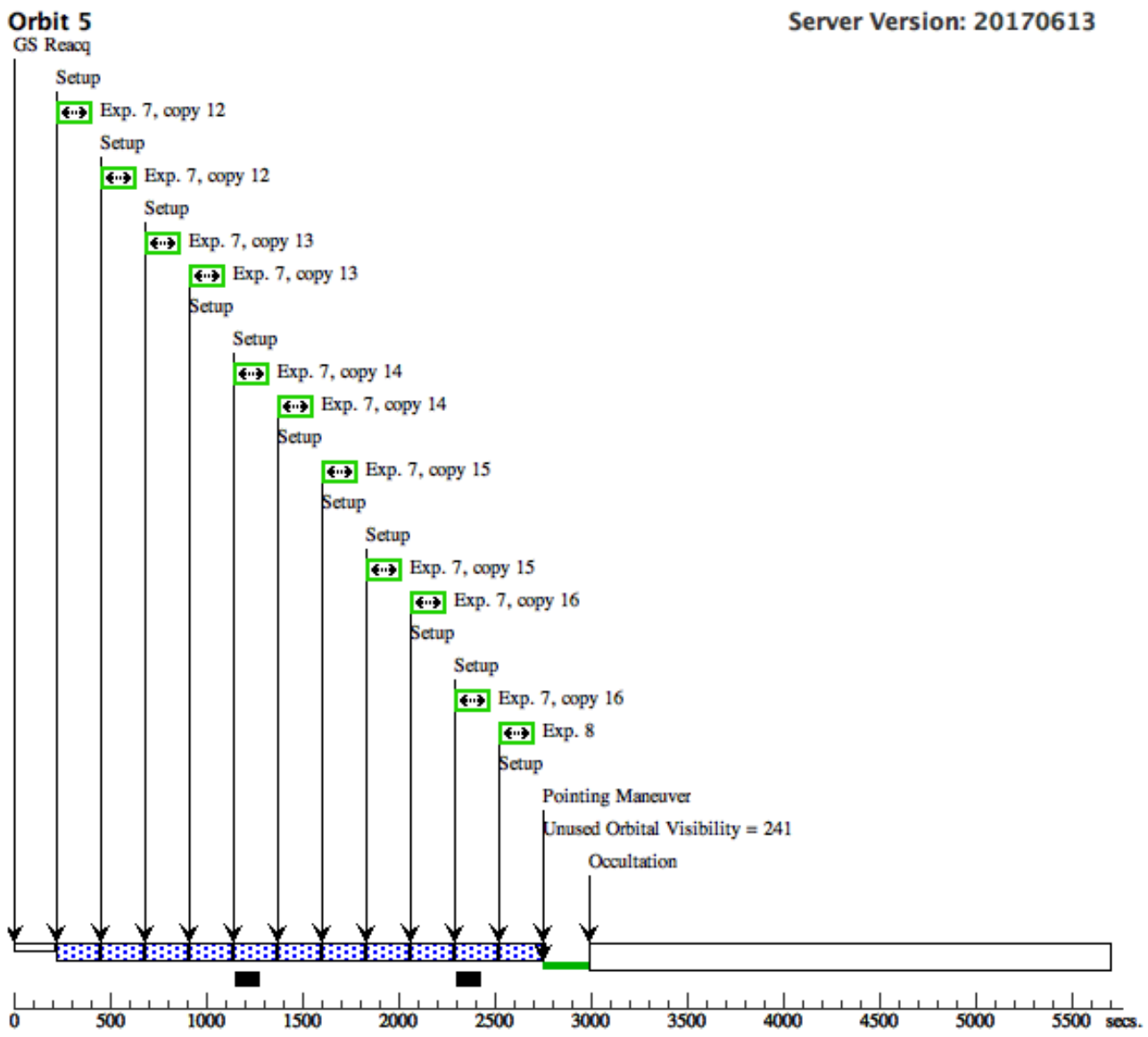
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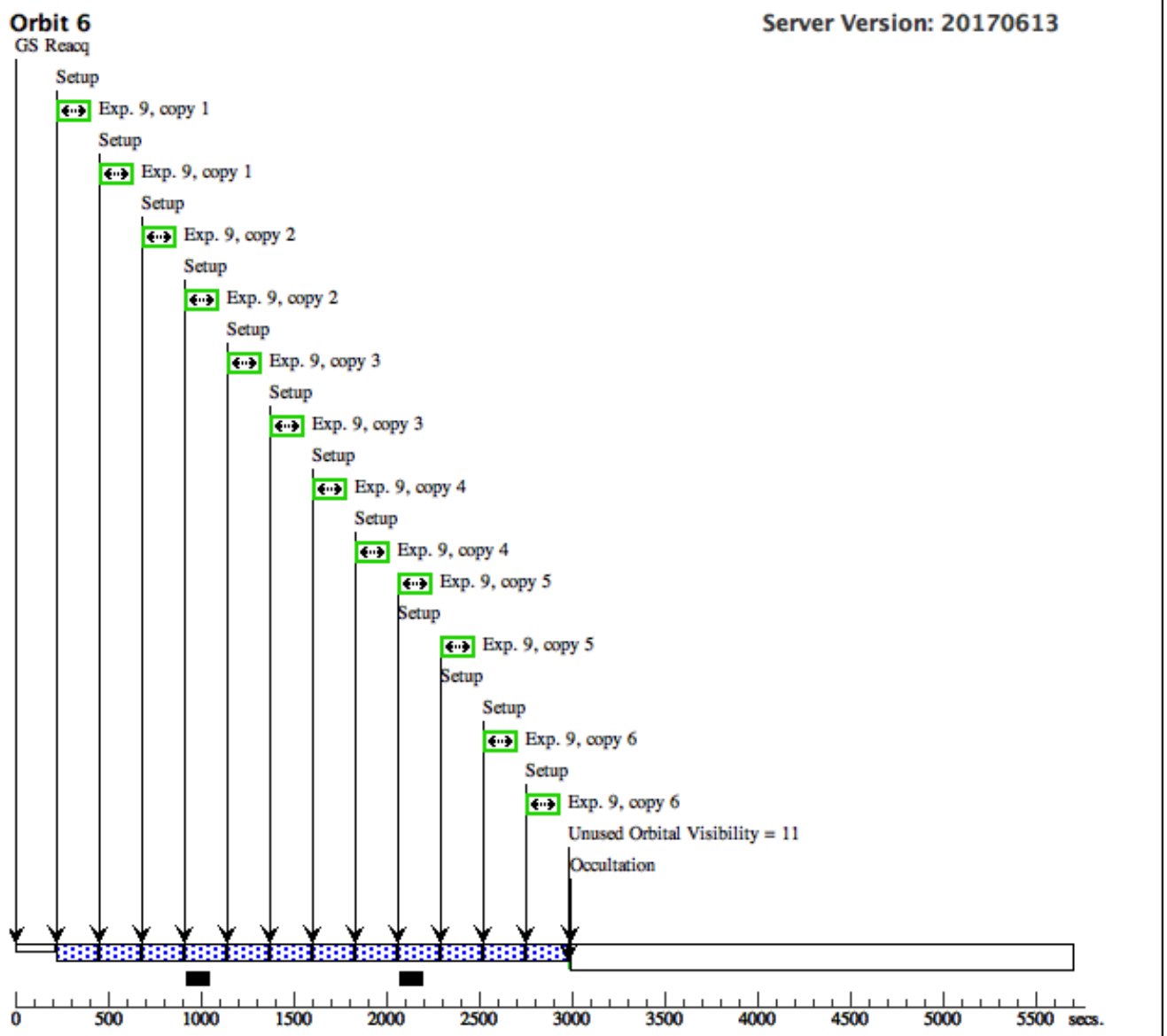
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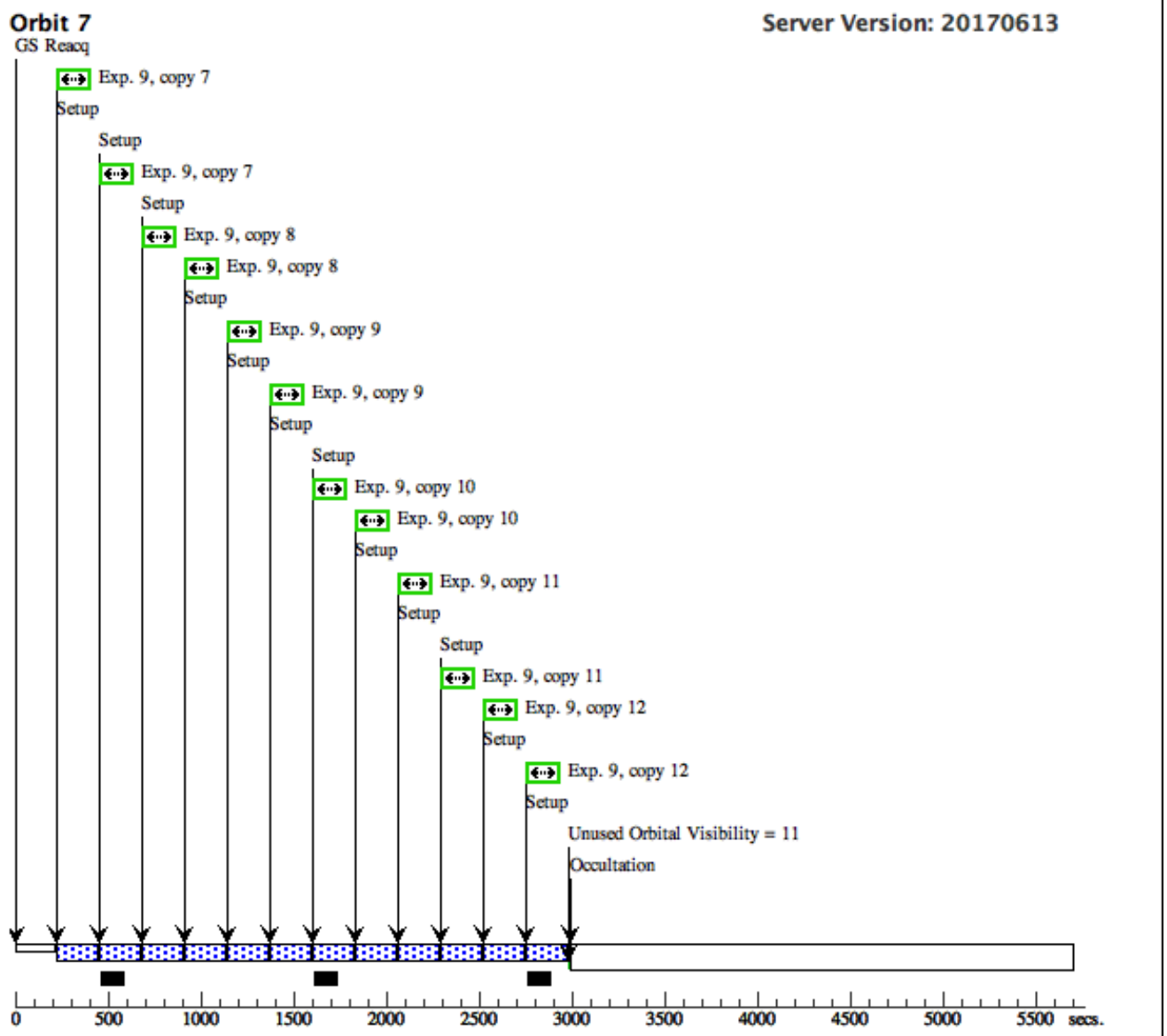
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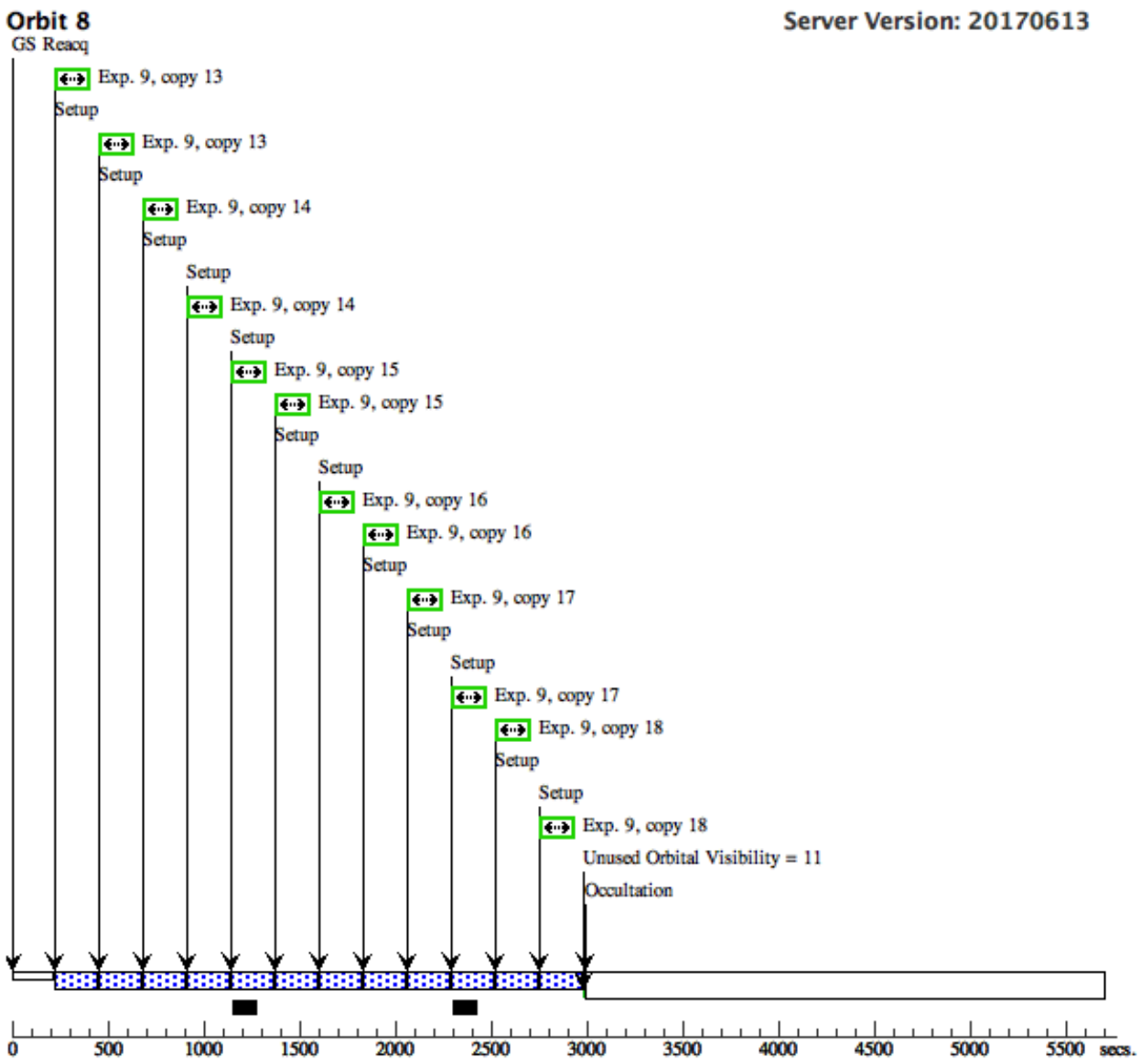
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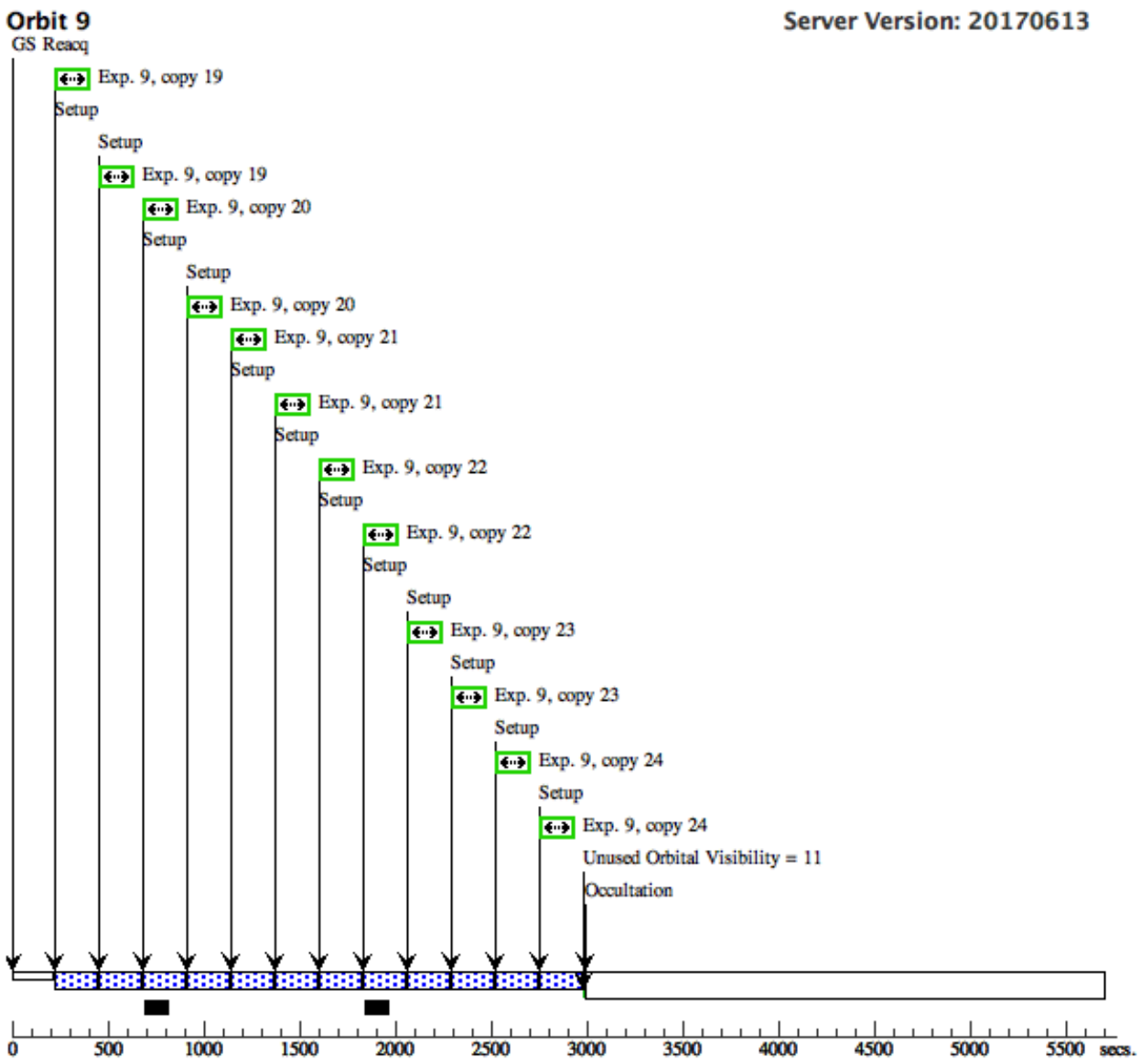
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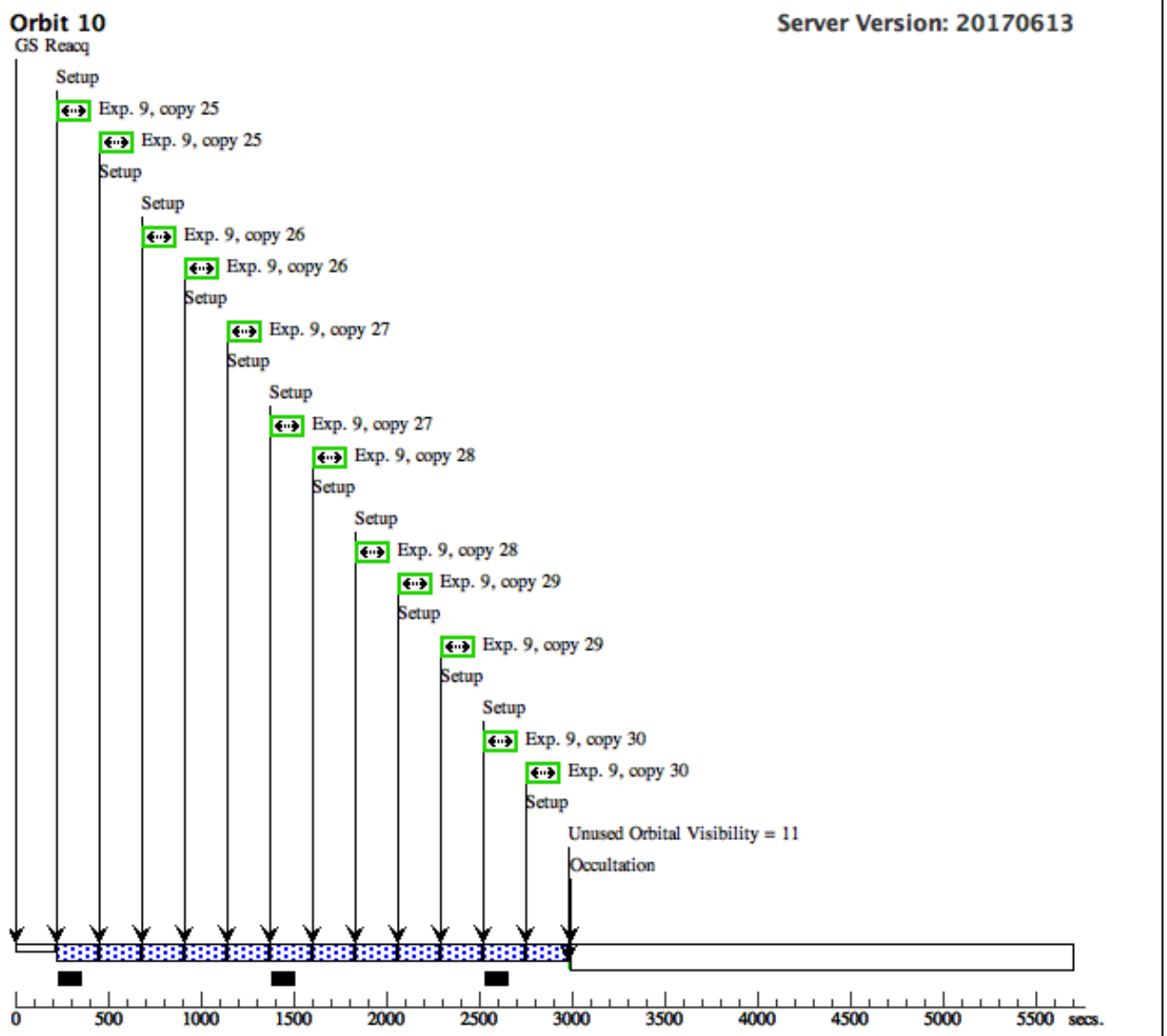
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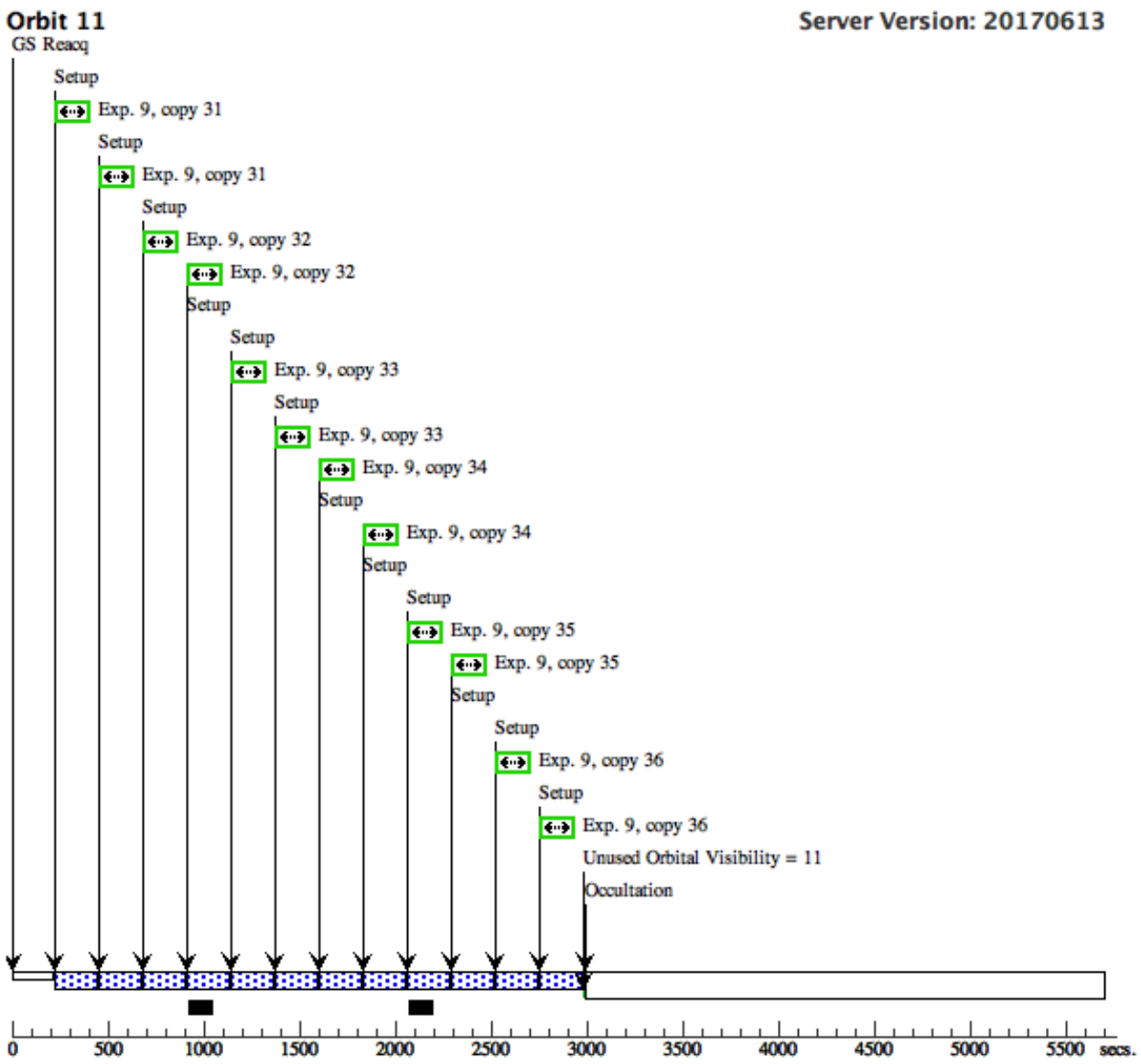
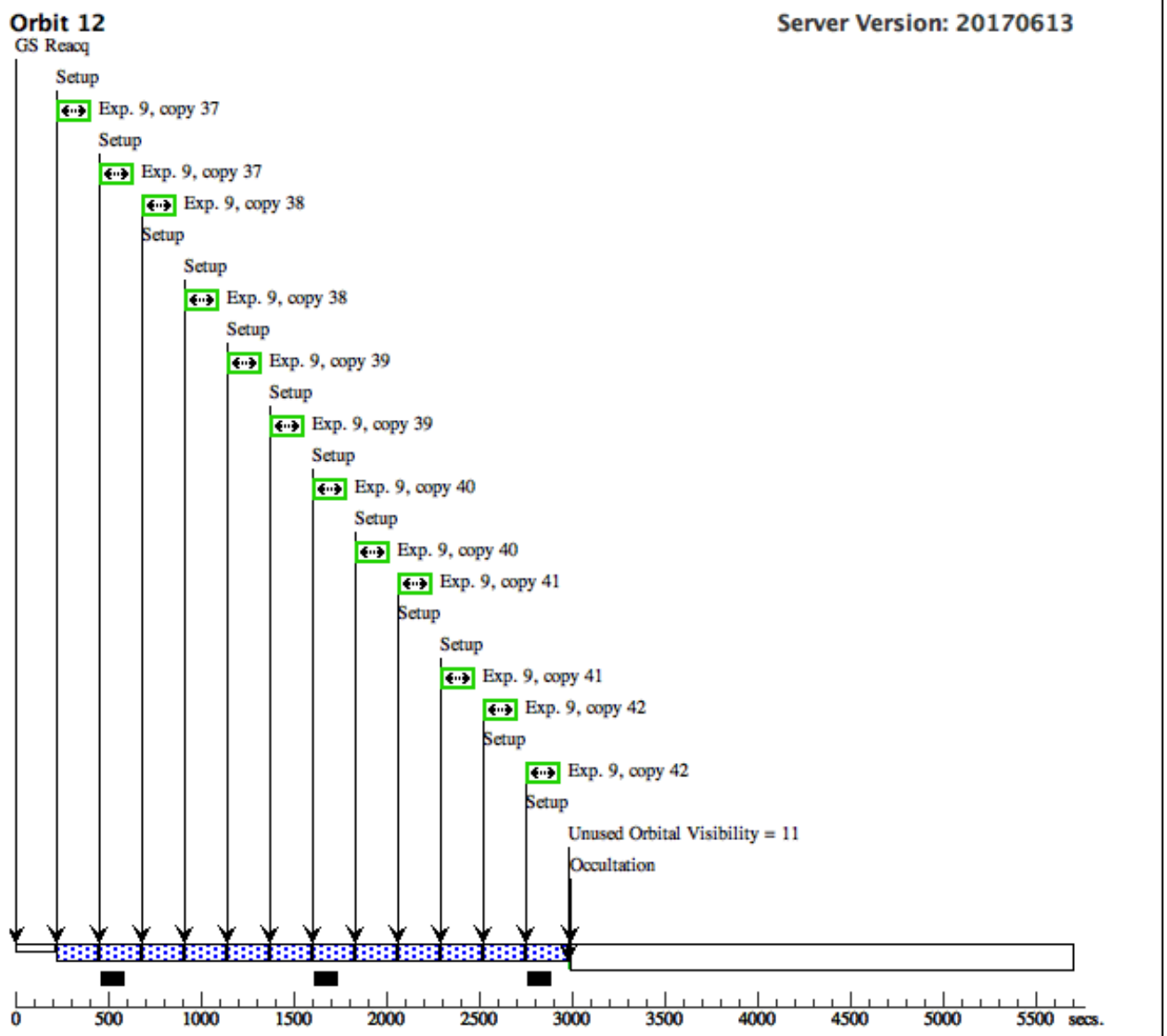
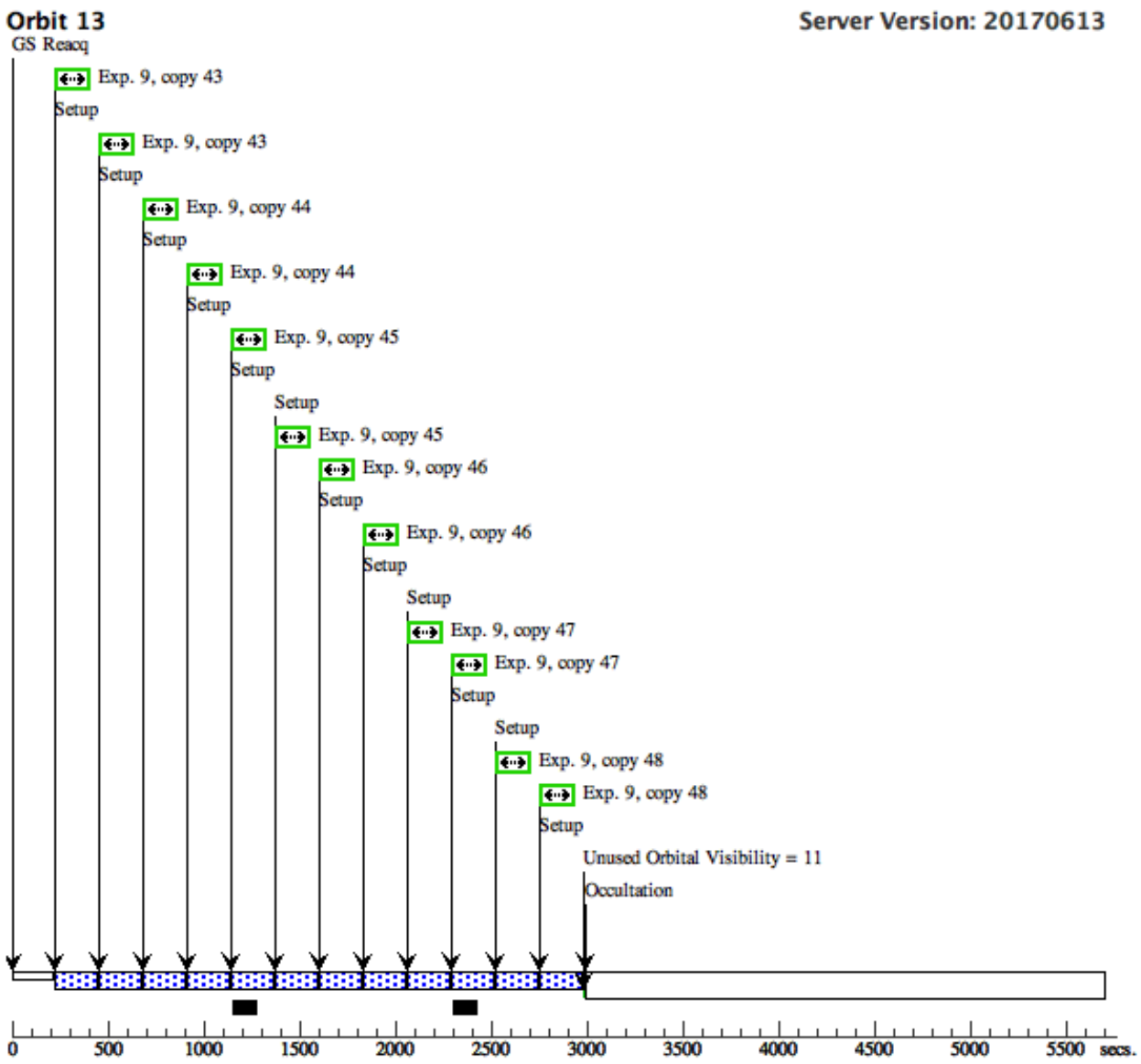
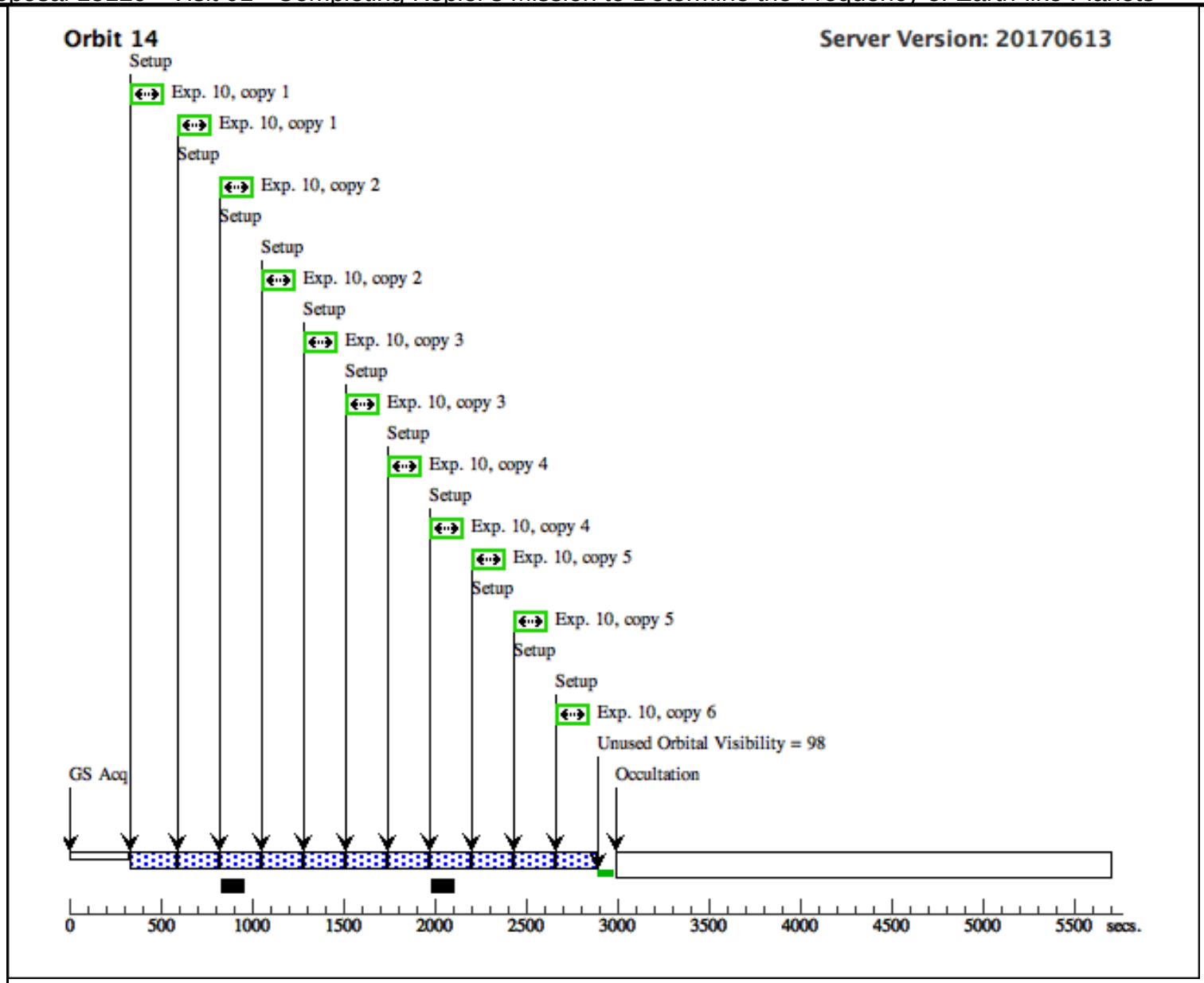
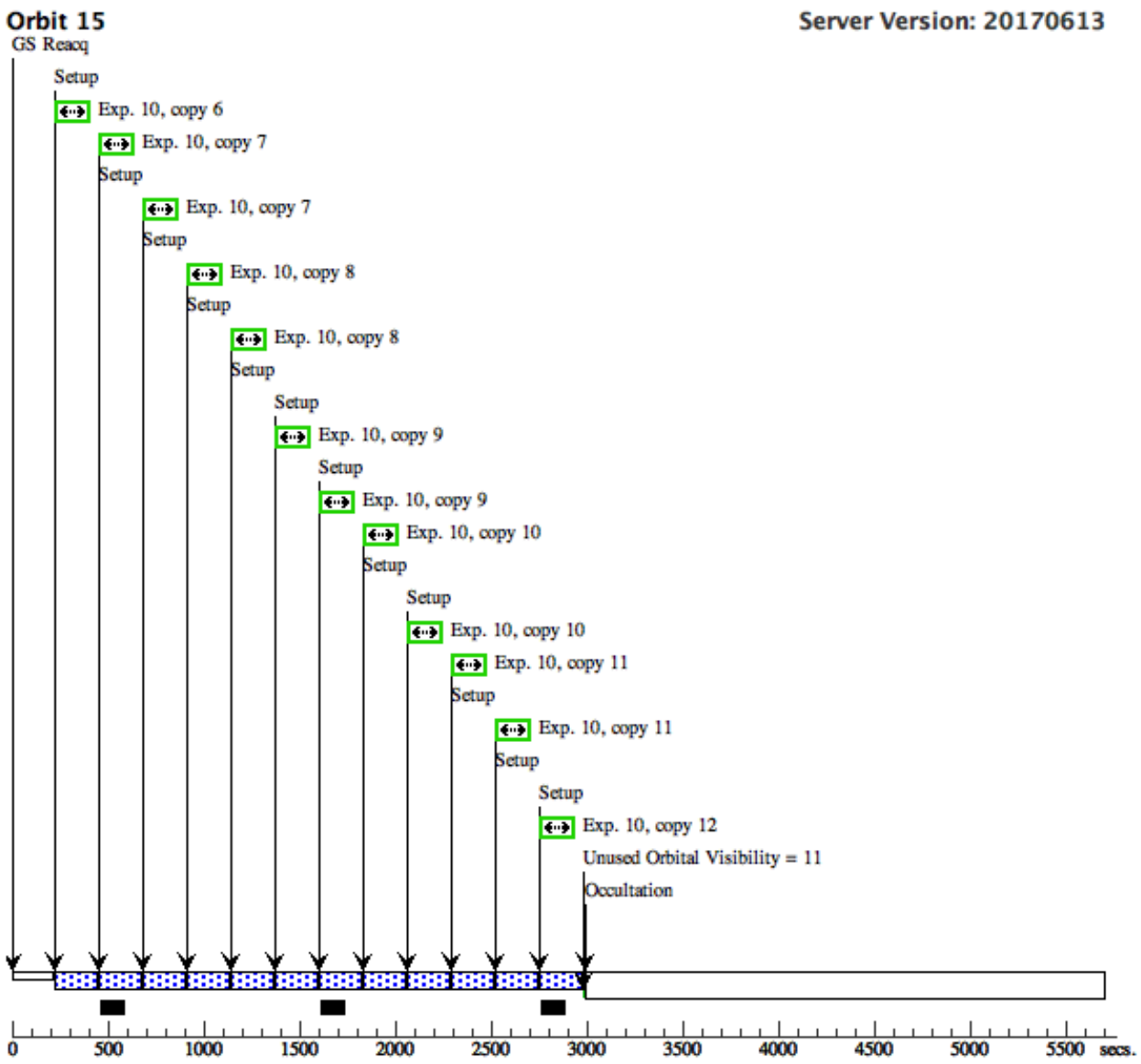
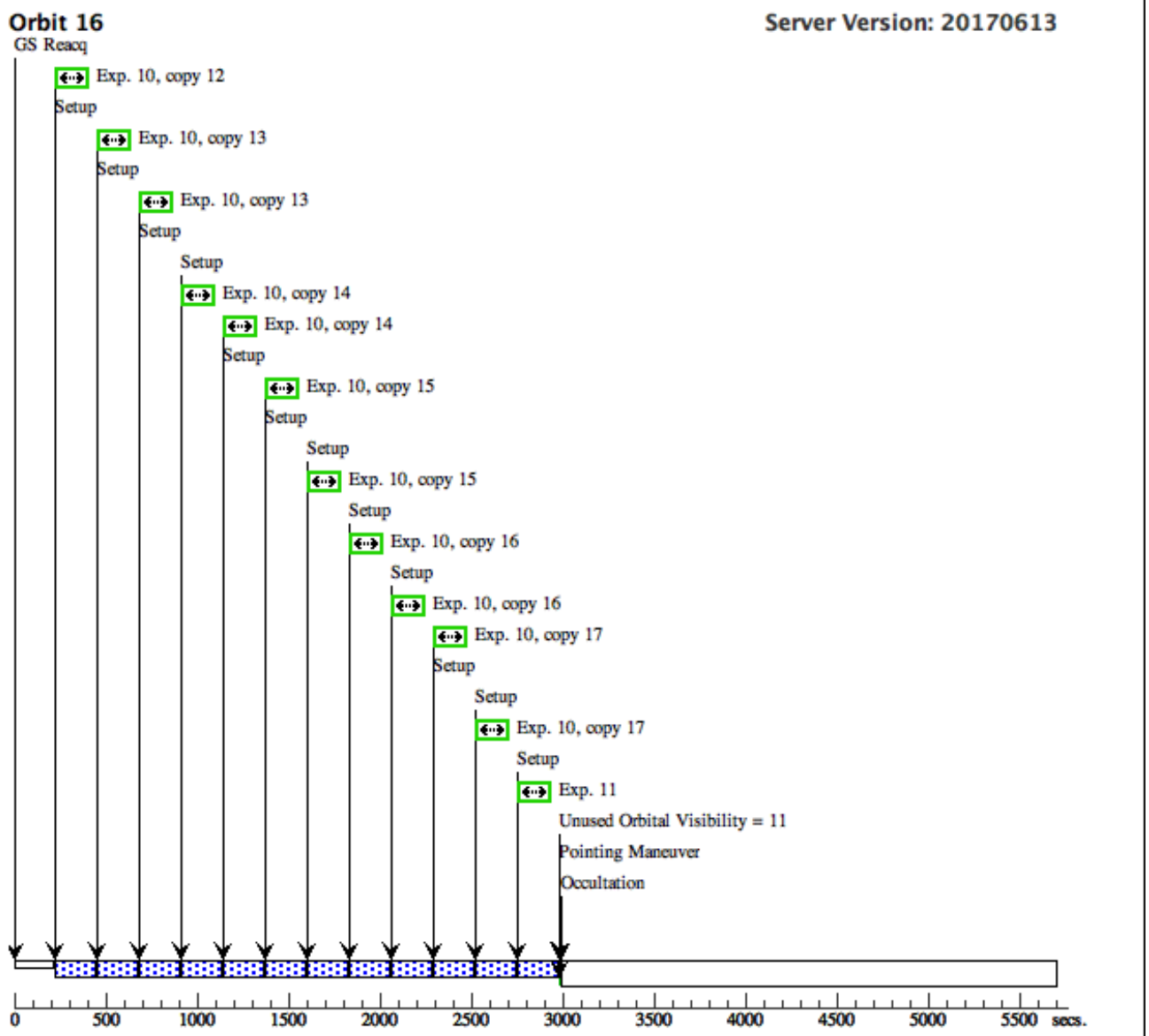

Orbit 11
Server Version: 20170613
GS Reacq
Setup
Exp. 9, copy 31
Setup
Exp. 9, copy 31
Setup
Exp. 9, copy 32
Exp. 9, copy 32
Setup
Setup
Exp. 9, copy 33
Setup
Exp. 9, copy 33
Exp. 9, copy 34
Setup
Exp. 9, copy 34
Setup
Setup
Exp. 9, copy 35
Exp. 9, copy 35
Setup
Setup
Exp. 9, copy 36
Setup
Exp. 9, copy 36
Unused Orbital Visibility = 11
Occultation
0
500
1000
1500
2000
2500
3000
3500
4000
4500
5000
5500
secs.

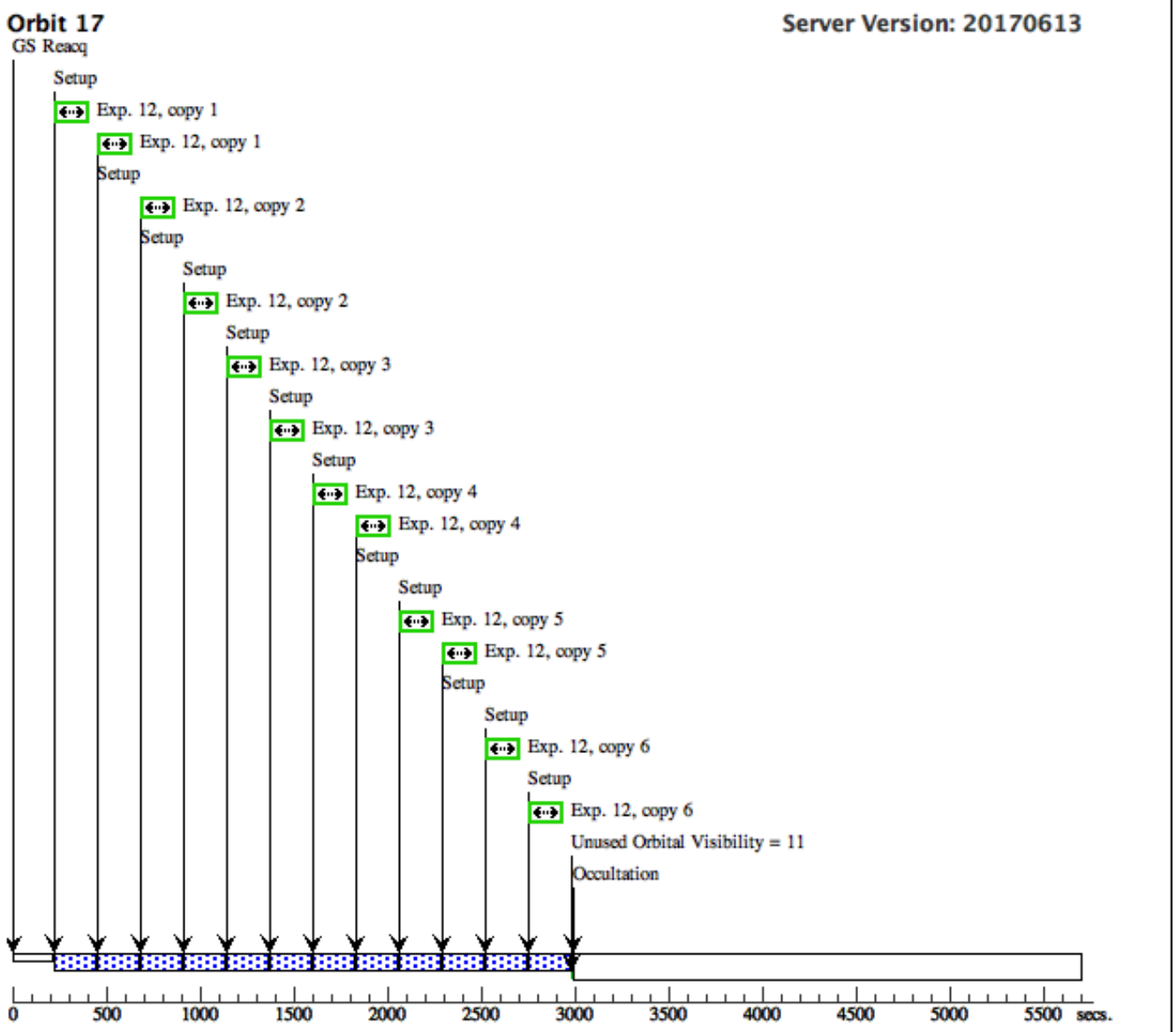

Orbit 12
Server Version: 20170613
GS Reacq
Setup
Exp. 9, copy 37
Setup
Exp. 9, copy 37
Exp. 9, copy 38
Setup
Setup
Exp. 9, copy 38
Setup
Exp. 9, copy 39
Setup
Exp. 9, copy 39
Setup
Exp. 9, copy 40
Setup
Exp. 9, copy 40
Exp. 9, copy 41
Setup
Setup
Exp. 9, copy 41
Exp. 9, copy 42
Setup
Exp. 9, copy 42
Setup
Unused Orbital Visibility = 11
Occultation
0
500
1000
1500
2000
2500
3000
3500
4000
4500
5000
5500
secs.

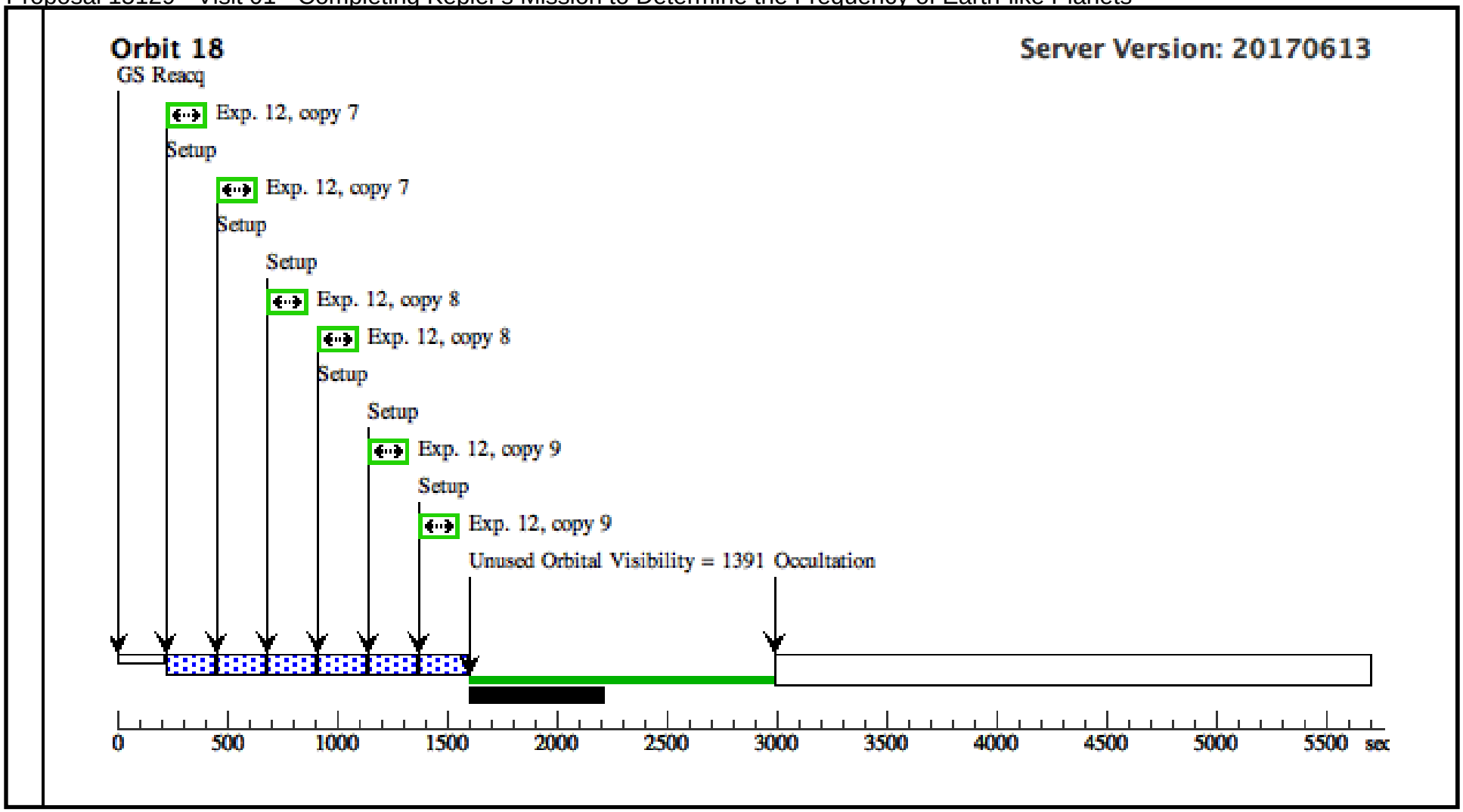

Orbit 13
Server Version: 20170613
GS Reacq
Exp. 9, copy 43
Setup
Exp. 9, copy 43
Setup
Exp. 9, copy 44
Setup
Exp. 9, copy 44
Setup
Exp. 9, copy 45
Setup
Setup
Exp. 9, copy 45
Exp. 9, copy 46
Setup
Exp. 9, copy 46
Setup
Setup
Exp. 9, copy 47
Exp. 9, copy 47
Setup
Setup
Exp. 9, copy 48
Exp. 9, copy 48
Setup
Unused Orbital Visibility = 11
Occultation
0
500
1000
1500
2000
2500
3000
3500
4000
4500
5000
5500
secs.


Orbit 14
Server Version: 20170613
Setup
Exp. 10, copy 1
Exp. 10, copy 1
Setup
Exp. 10, copy 2
Setup
Setup
Exp. 10, copy 2
Setup
Exp. 10, copy 3
Setup
Exp. 10, copy 3
Setup
Exp. 10, copy 4
Setup
Exp. 10, copy 4
Exp. 10, copy 5
Setup
Exp. 10, copy 5
Setup
Setup
Exp. 10, copy 6
Unused Orbital Visibility = 98
GS Acq
Occultation
0
500
1000
1500
2000
2500
3000
3500
4000
4500
5000
5500
secs.


Orbit 15
Server Version: 20170613
GS Reacq
Setup
Exp. 10, copy 6
Exp. 10, copy 7
Setup
Exp. 10, copy 7
Setup
Exp. 10, copy 8
Setup
Exp. 10, copy 8
Setup
Setup
Exp. 10, copy 9
Setup
Exp. 10, copy 9
Exp. 10, copy 10
Setup
Setup
Exp. 10, copy 10
Exp. 10, copy 11
Setup
Exp. 10, copy 11
Setup
Setup
Exp. 10, copy 12
Unused Orbital Visibility = 11
Occultation
0
500
1000
1500
2000
2500
3000
3500
4000
4500
5000
5500
secs.


Orbit 16
Server Version: 20170613
GS Reacq
Exp. 10, copy 12
Setup
Exp. 10, copy 13
Setup
Exp. 10, copy 13
Setup
Setup
Exp. 10, copy 14
Exp. 10, copy 14
Setup
Exp. 10, copy 15
Setup
Setup
Exp. 10, copy 15
Setup
Exp. 10, copy 16
Setup
Exp. 10, copy 16
Exp. 10, copy 17
Setup
Setup
Exp. 10, copy 17
Setup
Exp. 11
Unused Orbital Visibility = 11
Pointing Maneuver
Occultation
0
500
1000
1500
2000
2500
3000
3500
4000
4500
5000
5500
secs.


Orbit 17
Server Version: 20170613
GS Reacq
Setup
Exp. 12, copy 1
Exp. 12, copy 1
Setup
Exp. 12, copy 2
Setup
Setup
Exp. 12, copy 2
Setup
Exp. 12, copy 3
Setup
Exp. 12, copy 3
Setup
Exp. 12, copy 4
Exp. 12, copy 4
Setup
Setup
Exp. 12, copy 5
Exp. 12, copy 5
Setup
Setup
Exp. 12, copy 6
Setup
Exp. 12, copy 6
Unused Orbital Visibility = 11
Occultation
0
500
1000
1500
2000
2500
3000
3500
4000
4500
5000
5500
secs.


Orbit 18
Server Version: 20170613
GS Reacq
Exp. 12, copy 7
Setup
Exp. 12, copy 7
Setup
Setup
Exp. 12, copy 8
Exp. 12, copy 8
Setup
Setup
Exp. 12, copy 9
Setup
Exp. 12, copy 9
Unused Orbital Visibility = 1391
Occultation
0
500
1000
1500
2000
2500
3000
3500
4000
4500
5000
5500
sec