



14188 - Exometeorology: Characterizing Weather on a Young Free-Floating Planet

Cycle: 23, Proposal Category: GO

(Availability Mode: SUPPORTED)

INVESTIGATORS

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VISITS

<i>Visit</i>	<i>Targets used in Visit</i>	<i>Configurations used in Visit</i>	<i>Orbits Used</i>	<i>Last Orbit Planner Run</i>	<i>OP Current with Visit?</i>
01	(1) PSO318-22	WFC3/IR	5	07-Sep-2016 17:10:43.0	yes

5 Total Orbits Used

ABSTRACT

Variability attributed to cloud structure is a persistent feature for L and T type field brown dwarfs. Directly imaged planets occupy the same temperature regime as L and T type brown dwarfs and are likely to be equally variable. As part of our ongoing NTT SOFI survey for variability in young free-floating planets and low mass brown dwarfs, we detect significant variability in a young, free-floating planetary mass object, likely due to rotational modulation of inhomogeneous cloud cover. This is the first such detection in a bonafide planetary mass object -- here we propose for HST and Spitzer followup to pinpoint the source of the observed variability and determine the rotational period of the object. Due to its low surface gravity, while this object has a late L spectral type, it has an "early/mid T" $T_{\text{eff}} < 1200$ K. We will directly test the effect of low surface gravity on observed variability. If variability matches that found in objects with similar spectral type but higher surface gravity -- i.e. high-level hazes observed in mid L dwarfs by Yang et al. 2015 -- we expect similar variability amplitudes in all bands. If variability is due to inhomogeneous clouds as found in higher gravity T dwarfs with similar T_{eff} (Buenzli et al. 2015, Apai et al. 2013), we expect variability to be strongest in broadband J and H and have lower amplitudes within the 1.4 μm water absorption feature (only observable from space). As ground-based searches for brown dwarf variability only have sensitivities to $>2-3\%$ variability, we require the proven photometric stability of HST and Spitzer (sensitivity down to $<0.5\%$ variability) to be sensitive to small differences between bands.

OBSERVING DESCRIPTION

We are observing a free-floating young planet with WFC3 IR slitless spectroscopy with grism G141 to confirm and characterize time variability found from the ground. With an expected period of 5-20 hours, this target should be observed for 5 consecutive orbits to maximize coverage of as much of a rotational period as possible. At the beginning of each orbit, a direct image is taken for wavelength calibration. This target will be observed simultaneously with Spitzer and thus scheduling must be coordinated.

Orient ranges have been set to avoid background stars at PA~45 degrees.

PRM, July 29, 2016: I tried a full-frame version of the program instead of the 256x256 subarray. Because SPARS25 can be parallel dumped, we get good packing. Do to idiosyncracies of APT and pointing maneuvers for certain apertures, I used GRISM1024 for each of the exposures (both direct imaging and grism). I didn't bother to fill in partial (smaller NSAMP) version of the same exposures to fill the orbits, but the PI should do so in a version to be submitted. Note the total exposure time is longer for both the direct image and the spectra, and as intended, the field of view is much

larger (16 times in area) which may be helpful for extracting comparison star photometry or using the 0th order or 2nd order spectra of the objects for photometry.

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Wed Sep 07 21:10:45 GMT 2016

Visit	Proposal 14188, Visit 01, implementation Diagnostic Status: No Diagnostics Scientific Instruments: WFC3/IR Special Requirements: ORIENT 91D TO 261 D; ORIENT 271D TO 81 D <i>Comments: This 5-orbit visit should be coordinated with simultaneous Spitzer observations (17.6 Spitzer hours awarded, so there is a fairly long range of overlap).</i>					
	Fixed Targets	#	Name	Target Coordinates	Targ. Coord. Corrections	Fluxes
(1)		PSO318-22	RA: 21 14 8.0260 (318.5334417d) Dec: -22 51 35.84 (-22.85996d) Equinox: J2000	Proper Motion RA: 137.3 mas/yr Proper Motion Dec: -138.7 mas/yr Parallax: 0.0407" Epoch of Position: 2000	V=(?) JHKs=16.7, 15.7, 14.7	Reference Frame: ICRS
<i>Comments: Extended=NO</i>						

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#	Label	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time (Total)/[Actual Dur.]	Orbit	
Exposures	1	(1) PSO318-22	WFC3/IR, MULTIACCUM, GRISM1024	F127M	NSAMP=3; SAMP-SEQ=SPAR S25		Sequence 1-3 Non-Int in Visit 01	52.933321 Secs (52.933 Secs) [==>]	[1]	
	<i>Comments: short exposure to determine target position in grism aperture.</i>									
	2	(1) PSO318-22	WFC3/IR, MULTIACCUM, GRISM1024	G141	NSAMP=12; SAMP-SEQ=SPAR S25		Sequence 1-3 Non-Int in Visit 01	277.937956 Secs X 9 (2501.442 Secs) [==>(Copy 1)] [==>(Copy 2)] [==>(Copy 3)] [==>(Copy 4)] [==>(Copy 5)] [==>(Copy 6)] [==>(Copy 7)] [==>(Copy 8)] [==>(Copy 9)]	[1]	
	<i>Comments: science exposures for variability monitoring</i>									
	3	(1) PSO318-22	WFC3/IR, MULTIACCUM, GRISM1024	G141	NSAMP=3; SAMP-SEQ=SPAR S25		Sequence 1-3 Non-Int in Visit 01	52.933321 Secs (52.933 Secs) [==>]	[1]	
	<i>Comments: science exposures for variability monitoring</i>									
	4	(1) PSO318-22	WFC3/IR, MULTIACCUM, GRISM1024	F127M	NSAMP=3; SAMP-SEQ=SPAR S25		Sequence 4-6 Non-Int in Visit 01	52.933321 Secs (52.933 Secs) [==>]	[2]	
	<i>Comments: short exposure to determine target position in grism aperture.</i>									
5	(1) PSO318-22	WFC3/IR, MULTIACCUM, GRISM1024	G141	NSAMP=12; SAMP-SEQ=SPAR S25		Sequence 4-6 Non-Int in Visit 01	277.937956 Secs X 9 (2501.442 Secs) [==>(Copy 1)] [==>(Copy 2)] [==>(Copy 3)] [==>(Copy 4)] [==>(Copy 5)] [==>(Copy 6)] [==>(Copy 7)] [==>(Copy 8)] [==>(Copy 9)]	[2]		
<i>Comments: science exposures for variability monitoring</i>										
6	(1) PSO318-22	WFC3/IR, MULTIACCUM, GRISM1024	G141	NSAMP=7; SAMP-SEQ=SPAR S25		Sequence 4-6 Non-Int in Visit 01	152.935381 Secs (152.935 Secs) [==>]	[2]		
<i>Comments: science exposures for variability monitoring</i>										
7	(1) PSO318-22	WFC3/IR, MULTIACCUM, GRISM1024	F127M	NSAMP=3; SAMP-SEQ=SPAR S25		Sequence 7-9 Non-Int in Visit 01	52.933321 Secs (52.933 Secs) [==>]	[3]		
<i>Comments: short exposure to determine target position in grism aperture.</i>										

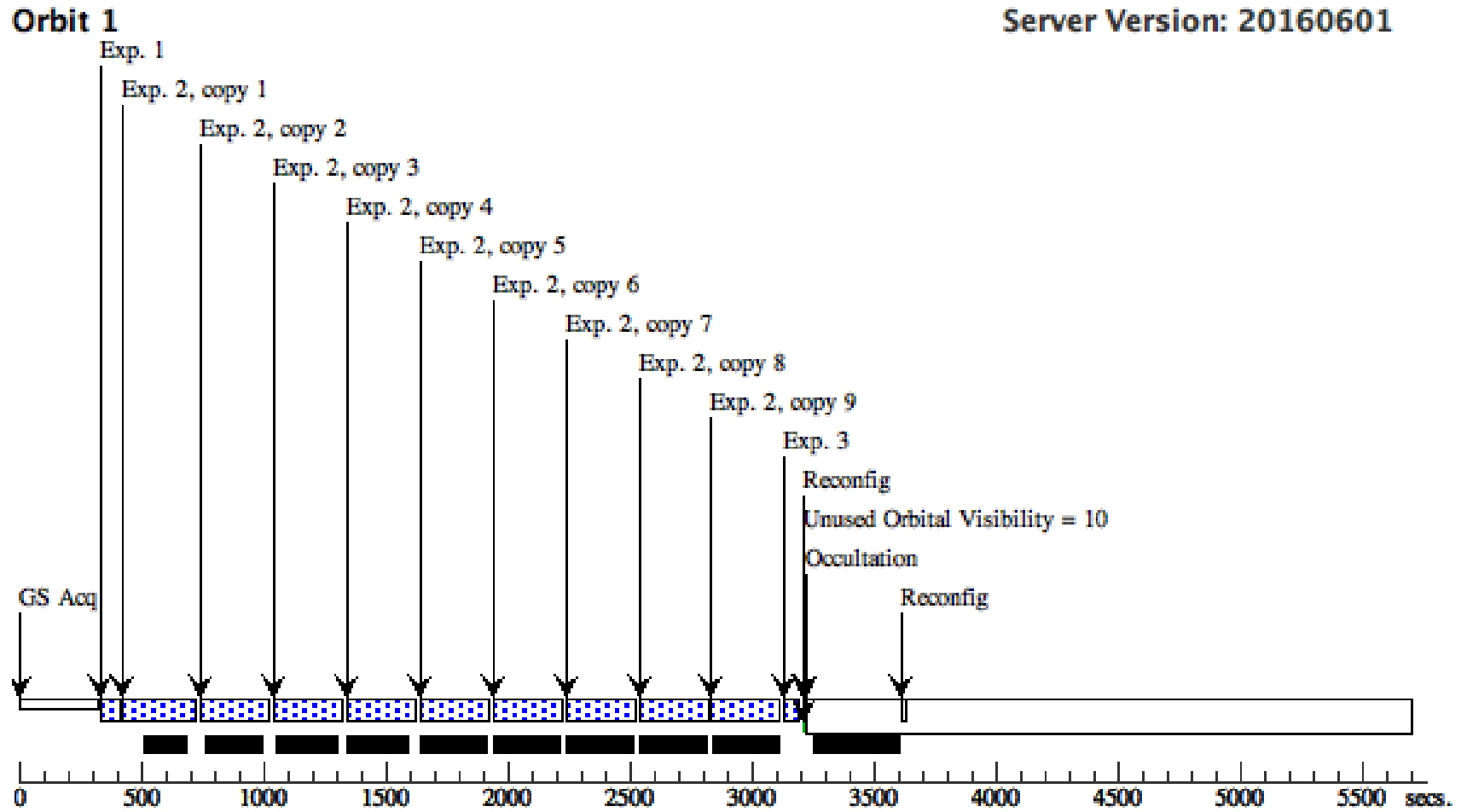
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8	(1) PSO318-22	WFC3/IR, MULTIACCUM, GRISM1024	G141	NSAMP=12; SAMP-SEQ=SPAR S25	Sequence 7-9 Non-Int in Visit 01	277.937956 Secs X 9 (2501.442 Secs) [==>(Copy 1)] [==>(Copy 2)] [==>(Copy 3)] [==>(Copy 4)] [==>(Copy 5)] [==>(Copy 6)] [==>(Copy 7)] [==>(Copy 8)] [==>(Copy 9)]	[3]
<i>Comments: science exposures for variability monitoring</i>							
9	(1) PSO318-22	WFC3/IR, MULTIACCUM, GRISM1024	G141	NSAMP=7; SAMP-SEQ=SPAR S25	Sequence 7-9 Non-Int in Visit 01	152.935381 Secs (152.935 Secs) [==>]	[3]
<i>Comments: science exposures for variability monitoring</i>							
10	(1) PSO318-22	WFC3/IR, MULTIACCUM, GRISM1024	F127M	NSAMP=3; SAMP-SEQ=SPAR S25	Sequence 10-12 Non-Int in Visit 01	52.933321 Secs (52.933 Secs) [==>]	[4]
<i>Comments: short exposure to determine target position in grism aperture.</i>							
11	(1) PSO318-22	WFC3/IR, MULTIACCUM, GRISM1024	G141	NSAMP=12; SAMP-SEQ=SPAR S25	Sequence 10-12 Non-Int in Visit 01	277.937956 Secs X 9 (2501.442 Secs) [==>(Copy 1)] [==>(Copy 2)] [==>(Copy 3)] [==>(Copy 4)] [==>(Copy 5)] [==>(Copy 6)] [==>(Copy 7)] [==>(Copy 8)] [==>(Copy 9)]	[4]
<i>Comments: science exposures for variability monitoring</i>							
12	(1) PSO318-22	WFC3/IR, MULTIACCUM, GRISM1024	G141	NSAMP=7; SAMP-SEQ=SPAR S25	Sequence 10-12 Non-Int in Visit 01	152.935381 Secs (152.935 Secs) [==>]	[4]
<i>Comments: science exposures for variability monitoring</i>							
13	(1) PSO318-22	WFC3/IR, MULTIACCUM, GRISM1024	F127M	NSAMP=3; SAMP-SEQ=SPAR S25	Sequence 13-15 Non-Int in Visit 01	52.933321 Secs (52.933 Secs) [==>]	[5]
<i>Comments: short exposure to determine target position in grism aperture.</i>							

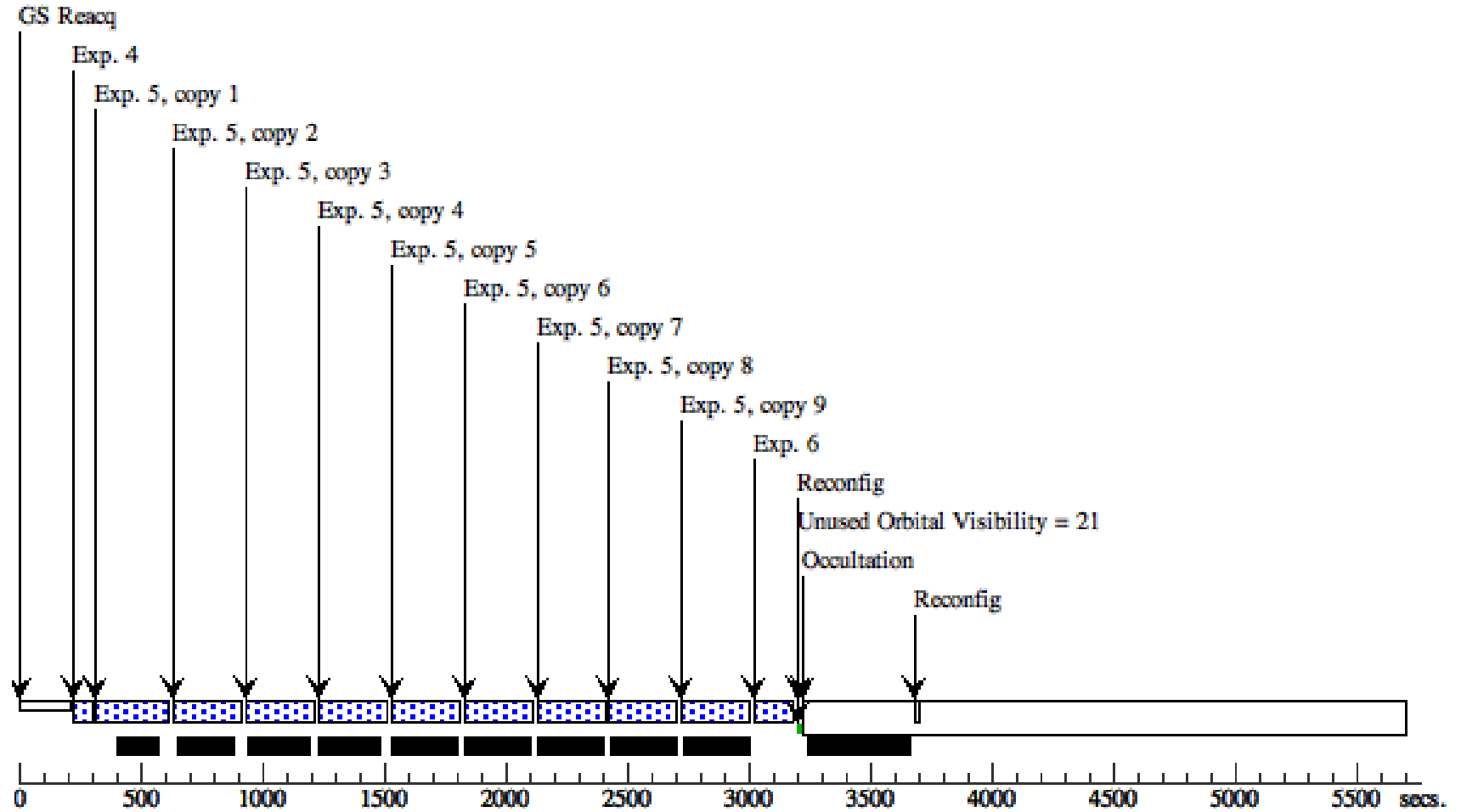
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14	(1) PSO318-22	WFC3/IR, MULTIACCUM, GRISM1024	G141	NSAMP=12; SAMP-SEQ=SPAR S25	Sequence 13-15 Non -Int in Visit 01	277.937956 Secs X 9 (2501.442 Secs)	[==>(Copy 1)] [==>(Copy 2)] [==>(Copy 3)] [==>(Copy 4)] [==>(Copy 5)] [==>(Copy 6)] [==>(Copy 7)] [==>(Copy 8)] [==>(Copy 9)]	[5]
<i>Comments: science exposures for variability monitoring</i>								
15	(1) PSO318-22	WFC3/IR, MULTIACCUM, GRISM1024	G141	NSAMP=7; SAMP-SEQ=SPAR S25	Sequence 13-15 Non -Int in Visit 01	152.935381 Secs (152.935 Secs)	[==>]	[5]
<i>Comments: science exposures for variability monitoring</i>								

Orbit Structure

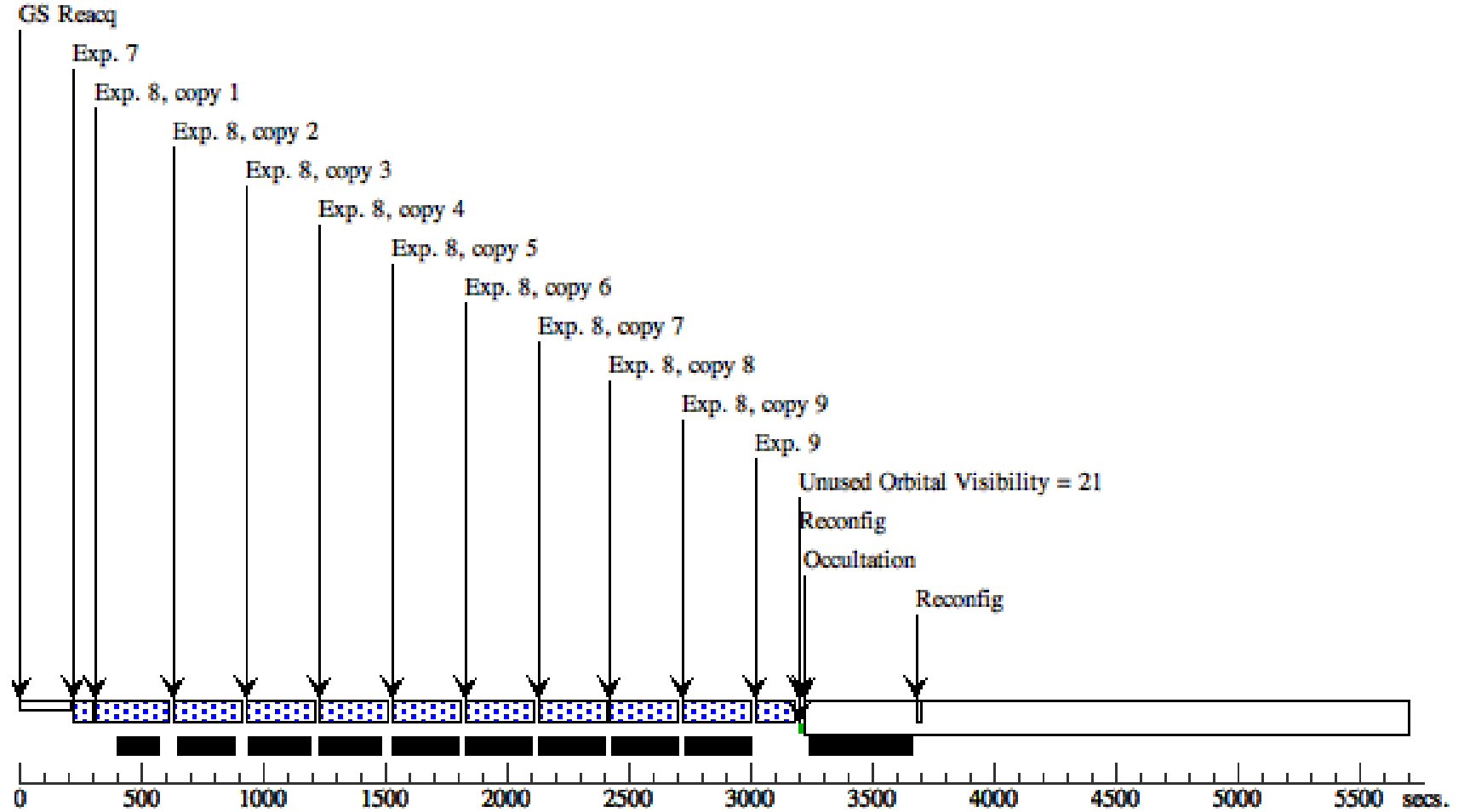


Orbit 2



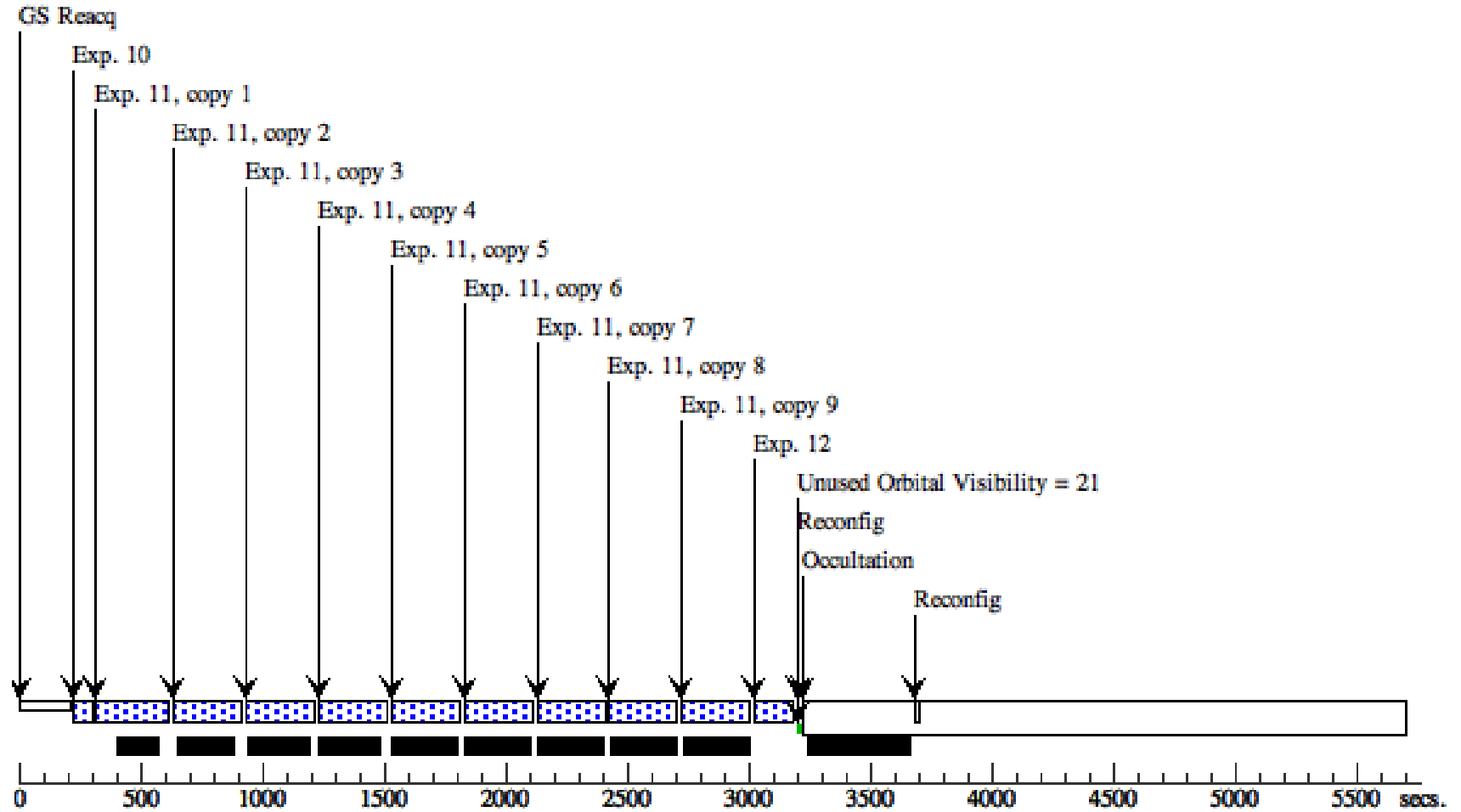
Orbit 3

Server Version: 20160601



Orbit 4

Server Version: 20160601



Orbit 5

