15430 - Atmopsheric Escape from the Closest Super-Earth at High Spectral Resolution

Cycle: 25, Proposal Category: GO

(UV Initiative)

(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) HD-219134 WAVE	STIS/CCD STIS/FUV-MAMA	4	05-Dec-2017 20:01:19.0	yes
02	(1) HD-219134 WAVE	STIS/CCD STIS/FUV-MAMA	4	05-Dec-2017 20:01:22.0	yes

8 Total Orbits Used

ABSTRACT

The super-Earth HD 219134b has the brightest (V=5.6) and closest (6.5 pc) known host star of any transiting exoplanet. The planet density is compatible with a rocky composition containing a large amount of volatile species (i.e., H2O). Under high stellar irradiation, the planet is likely losing a fraction of its atmosphere and water photodissociation could give rise to an extended cloud of hydrogen. For larger planets, this cloud can be detected as a blueshifted absorption in the stellar H I Lyman-alpha line. So far, no spectral signature of an atmosphere (escaping or not) has been convincingly detected on a super-Earth. Our recent STIS/FUV observation revealed a *redshifted* H I Lya transit signature of 8.2+/-1.9%. While scenarios with a redshifted atmospheric signature exist, the mandatory first step is to rule out stellar variability that could have mimicked a transit signature. This is straightfoward to do with new transit observations. Confirming this H detection is primordial, as it will be a smoking gun for the presence of water vapor in the lower atmosphere. Furthermore, we have established HD 219134 as the brightest Lyman-alpha source among all measured transiting exoplanet host stars, making it possible to use the high-resolution (R=114,000) echelle grating E140H for transit observation. We obtained a first E140H spectrum of the star, revealing strong emission lines of O I and C II in addition to H I Lyman-alpha. This enables the simultaneous search for hydrogen, oxygen, and carbon in the upper extended atmosphere of the planet. Finding these elements escaping from a super-Earth will bring exciting constraints on the nature of the elusive lower atmosphere.

OBSERVING DESCRIPTION

We are going to observe the UV transit of the brightest (V=5.6) and closest (6 pc) known transiting planet, which is a super-Earth. The star is a K2 dwarf. We are observing with the E140H echelle grating two transits of the planet HD219134b with two HST visits of 4 HST orbits each. Observations of this target were already done with the same settings (E140H echelle grating) during cycle 23 (Proposal id 14461).

Visit

Proposal 15430, Visit 01 Wed Dec 06 01:01:23 GMT 2017

Diagnostic Status: No Diagnostics

Scientific Instruments: STIS/CCD, STIS/FUV-MAMA

Special Requirements: SCHED 100%; Period 3.092926 D AND ZERO-PHASE HJD2457463.82884

Fixed Targets

#	Name	Target Coordinates	Targ. Coord. Corrections	Fluxes	Miscellaneous
(1)	HD-219134	RA: 23 13 16.9763 (348.3207346d)	Proper Motion RA: 2075.07 mas/yr	V=5.57+/-0.009	Reference Frame: ICRS
	Alt Name1: HR-8832	Dec: +57 10 6.08 (57.16836d)	Proper Motion Dec: 295.45 mas/yr	U=7.460,	
		Equinox: J2000	Parallax: 0.15276"	B=6.560	
			Epoch of Position: 2000		

Comments:
Category=STAR
Description=[EXTRA-SOLAR PLANETARY SYSTEM, K V-IV]
Extended=NO

Exposures

#	Label (ETC Run)	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time (Total)/[Actual Dur.]	Orbit
1	ACQ (STIS.ta.757128)	(1) HD-219134	STIS/CCD, ACQ, F28X50OIII	MIRROR		PHASE 0.971 TO 0.979	Sequence 1-4 Non-Int in Visit 01	3 Secs (3 Secs) *[==>]*	***[1]***
2	ACQ/PEAK (STIS.sp.757130)	(1) HD-219134	STIS/CCD, ACQ/PEAK, 52X0.05	G430L 4300 A			Sequence 1-4 Non-Int in Visit 01	1 Secs (1 Secs) *[==>]*	***[1]***
3	SCI E140H (STIS.sp.1035659)	(1) HD-219134	STIS/FUV-MAMA, TIME-TAG, 0.2X0.2	E140H 1271 A	BUFFER-TIME=900; WAVECAL=NO		Sequence 1-4 Non-Int in Visit 01	1792 Secs (1785 Secs) *[==>1785.0 Secs]*	***[1]***
	Comments: Using previous spectrum obtained with proposal 14461, the count rate for the entire detector in 2127s is ~180 counts/s. The maximum buffer time should thus be 2x10^6 / 180 ~ 11,000s. Because of other chromospheric emission in the range of the echelle grism, we consider a factor of 10x as a margin, so we keep on using our "classic" 900-s buffer time setting.								
4	GO-WAVE CAL E140H	WAVE	STIS/FUV-MAMA, ACCUM, 0.2X0.2	E140H 1271 A			Sequence 1-4 Non-Int in Visit 01	*[==>]*	***[1]***
5	ACQ/PEAK (STIS.sp.757130)	(1) HD-219134	STIS/CCD, ACQ/PEAK, 52X0.05	G430L 4300 A			Sequence 5-7 Non-Int in Visit 01	1 Secs (1 Secs) *[==>]*	***[2]***
6	SCI E140H (STIS.sp.1035648)	(1) HD-219134	STIS/FUV-MAMA, TIME-TAG, 0.2X0.2	E140H 1271 A	BUFFER-TIME=900; WAVECAL=NO		Sequence 5-7 Non-Int in Visit 01	2147 Secs (2136 Secs) *[==>2136.0 Secs]*	***[2]***
	Comments: Using previous spectrum obtained with proposal 14461, the count rate for the entire detector in 2127s is ~180 counts/s. The maximum buffer time should thus be 2x10^6 / 180 ~ 11,000s. Because of other chromospheric emission in the range of the echelle grism, we consider a factor of 10x as a margin, so we keep on using our "classic" 900-s buffer time setting.								
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8	ACQ/PEAK (STIS.sp.757130)	(1) HD-219134	STIS/CCD, ACQ/PEAK, 52X0.05	G430L 4300 A			Sequence 8-10 Non-Int in Visit 01	1 Secs (1 Secs) *[==>]*	***[3]***
9	SCI E140H (STIS.sp.1035648)	(1) HD-219134	STIS/FUV-MAMA, TIME-TAG, 0.2X0.2	E140H 1271 A	BUFFER-TIME=900; WAVECAL=NO		Sequence 8-10 Non-Int in Visit 01	2147 Secs (2136 Secs) *[==>2136.0 Secs]*	***[3]***
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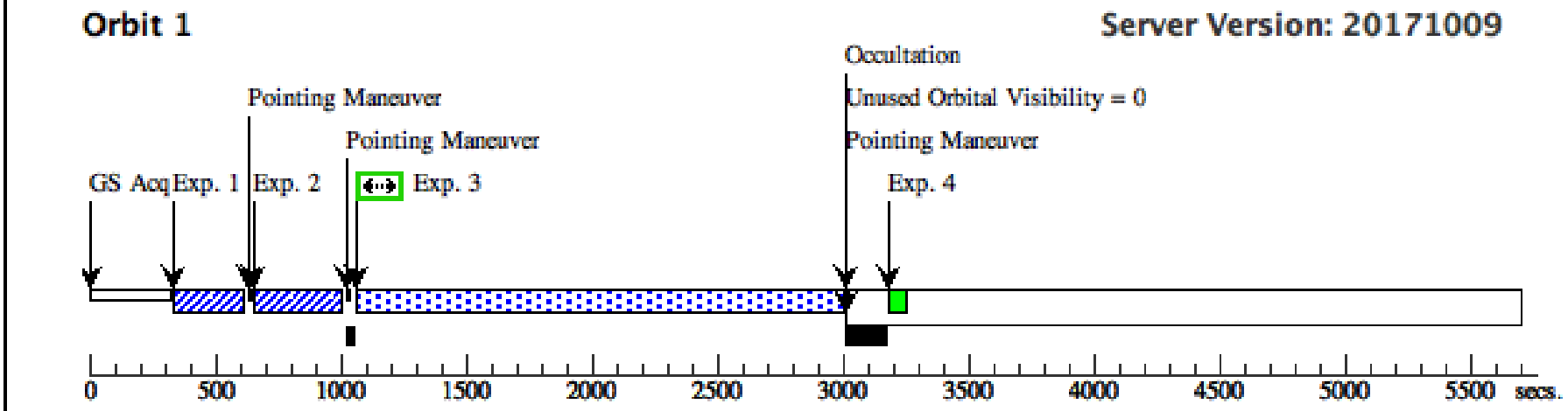
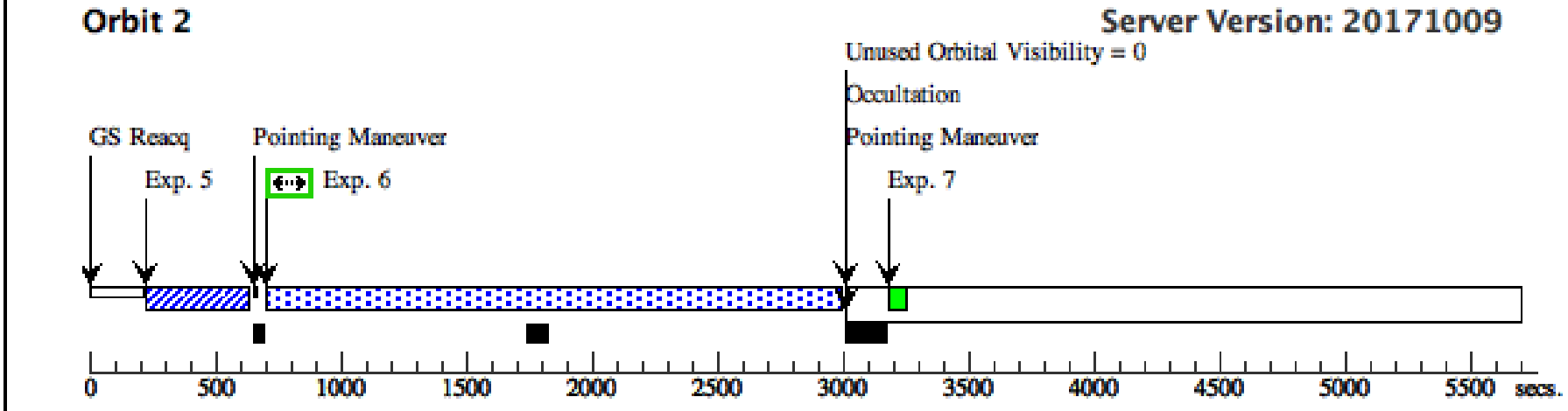
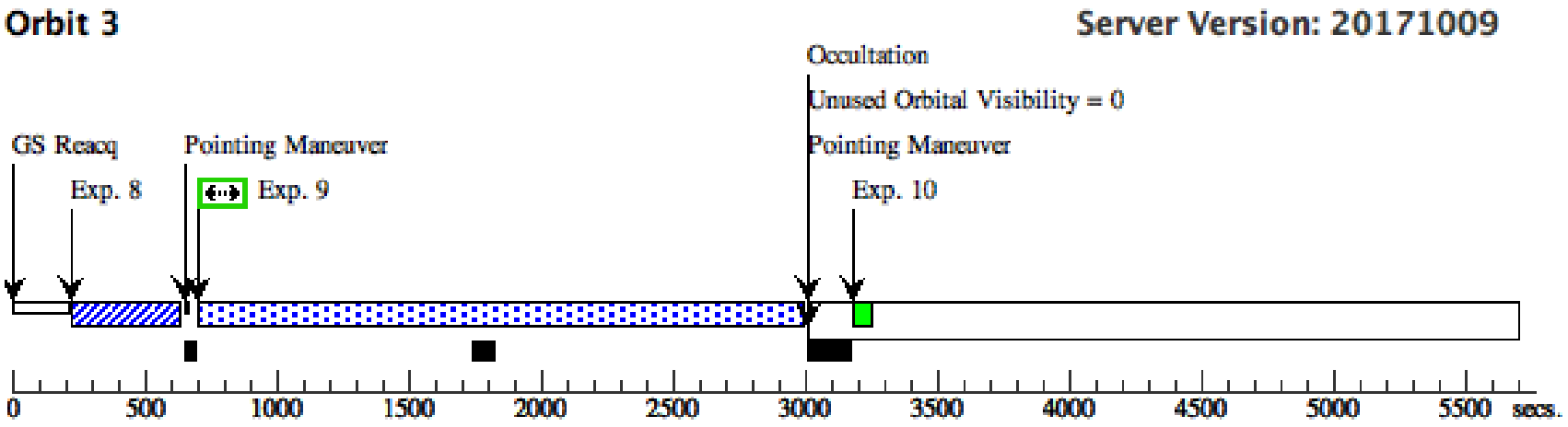
Orbit Structure



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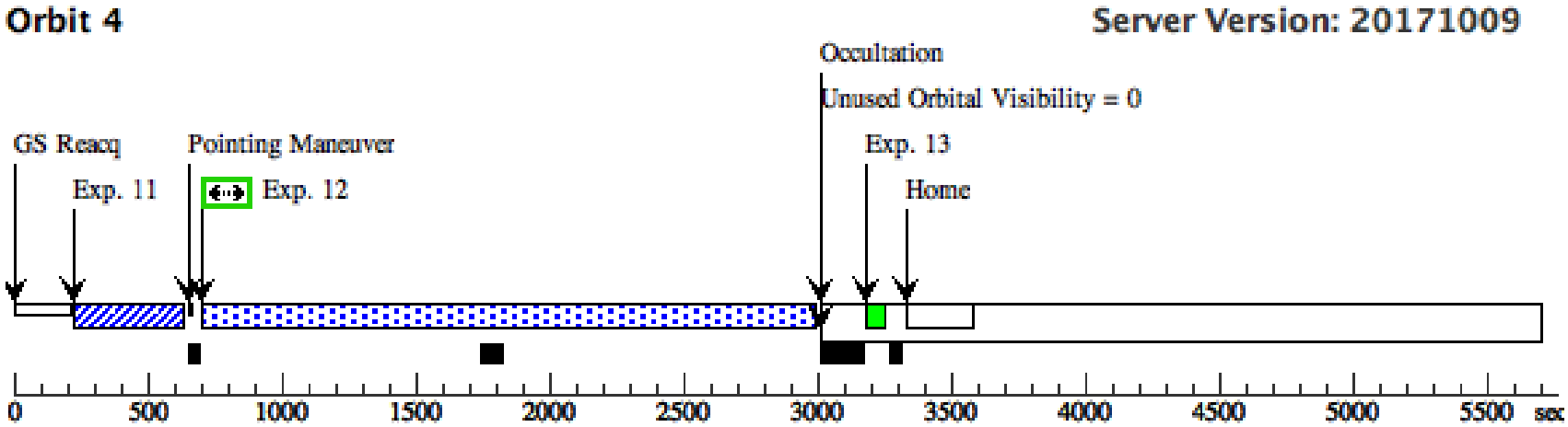
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Visit

Proposal 15430, Visit 02

Wed Dec 06 01:01:24 GMT 2017

Diagnostic Status: No Diagnostics

Scientific Instruments: STIS/CCD, STIS/FUV-MAMA

Special Requirements: SCHED 100%; Period 3.092926 D AND ZERO-PHASE HJD2457463.82884

Fixed Targets

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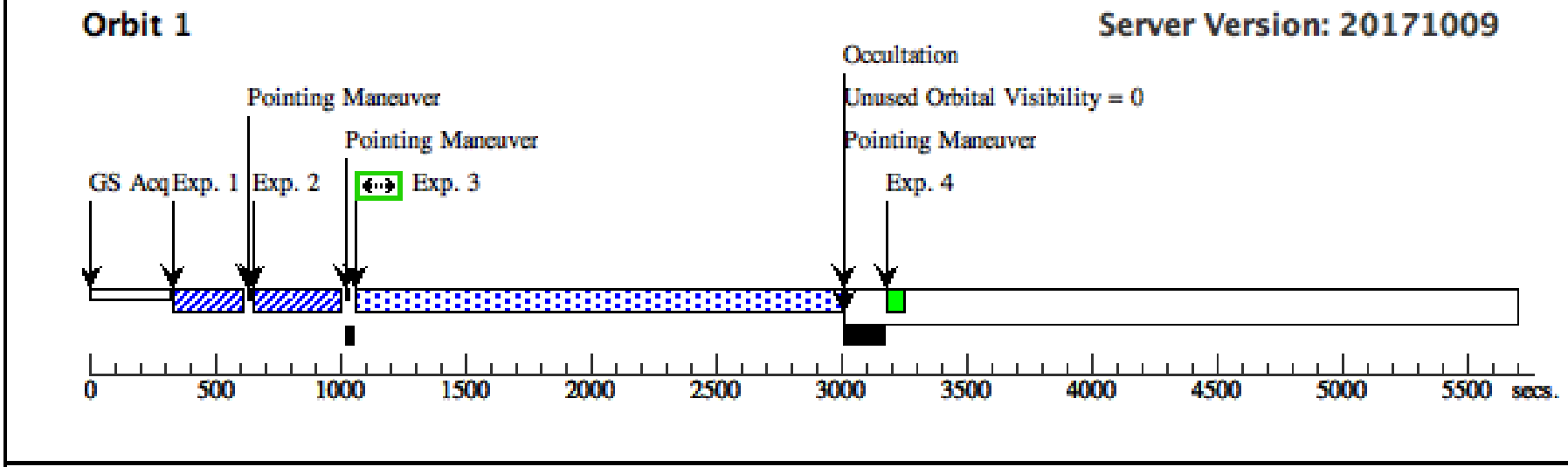
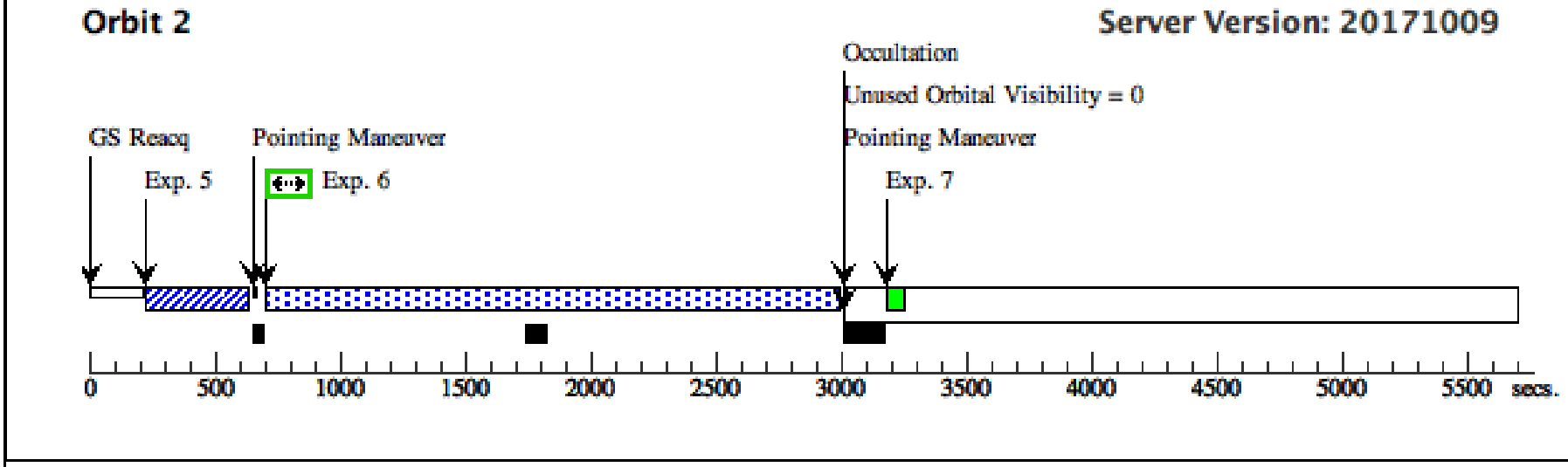
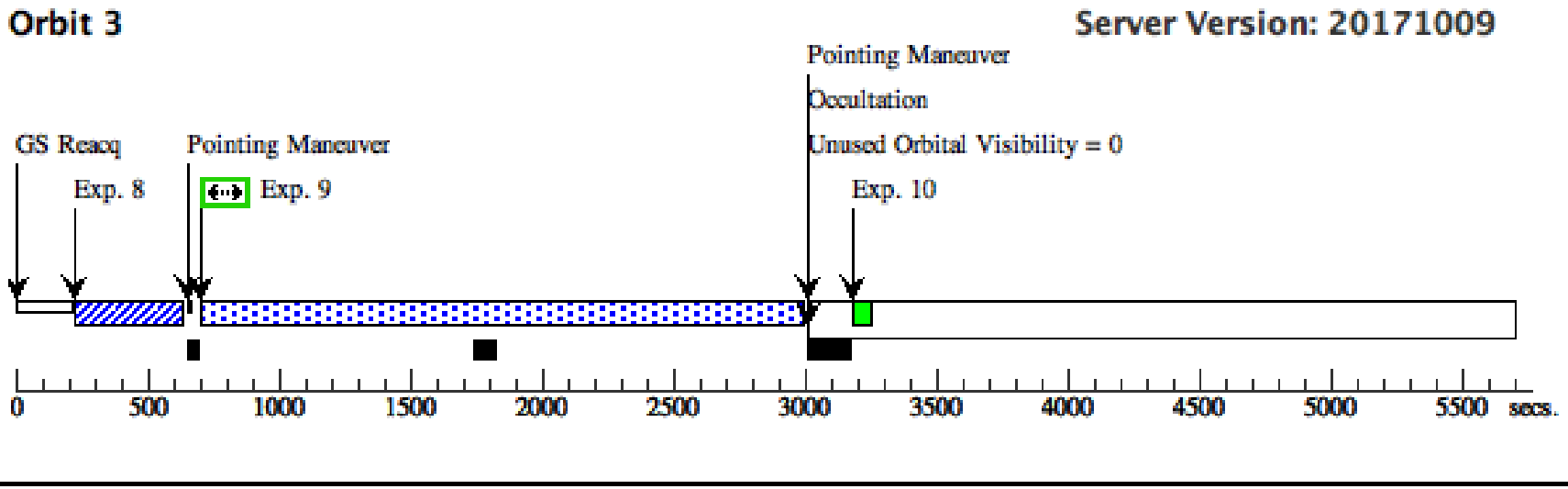
Orbit Structure






Orbit 3
Server Version: 20171009
Pointing Maneuver
Occultation
Unused Orbital Visibility = 0
GS Reacq
Pointing Maneuver
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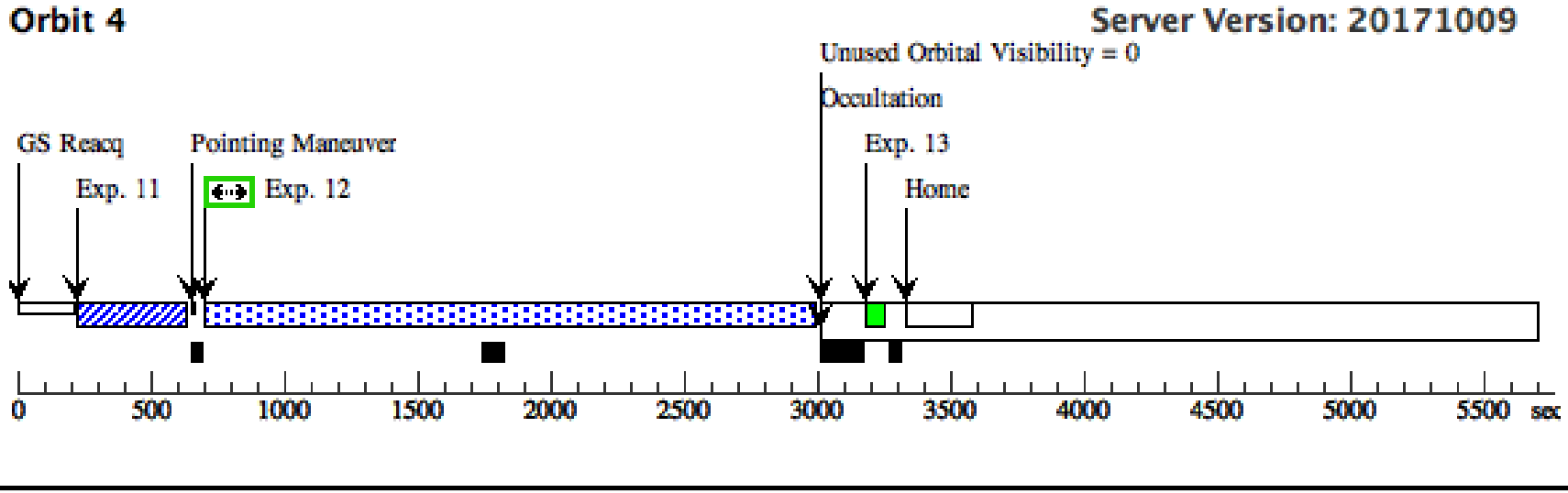
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Exp. 12
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