14921 - Atmospheric escape from a mini-Neptune

Cycle: 24, Proposal Category: GO

(UV Initiative)

(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) HD-3167 WAVE	STIS/CCD STIS/FUV-MAMA	5	23-Jun-2017 21:00:31.0	yes

5 Total Orbits Used

ABSTRACT

The transition between rocky and volatile/gas-rich planets is one of the main open questions in exoplanetary research. Population studies show that this transition is not smooth, but rocky super-Earths and gas-rich mini-Neptunes with masses within 7-15 Earth masses should co-exist. Atmospheric escape is surmised to control this transition, causing some planets to lose their atmospheres to space while others retain most of their volatiles and gas. The HD 3167 planetary system, hosting two transiting close-in planets, has been identified from K2 photometry in August 2016. Through a large collaborative effort, we recently pinned down the planetary masses, revealing a duo of super-Earths: one rocky planet (b) and one volatile/gas-rich `mini-Neptune' (planet c). Thanks to its bright host star (V=8.9), this system is poised to become a benchmark target for studies of super-Earth evolution and atmospheres. HD 3167c, in particular, is the mini-Neptune transiting the brightest host star, providing a unique opportunity to access, for the first time, the atmospheric properties of this mysterious class of low-mass, low-density exoplanets. We propose 5 HST orbits to cover one transit of planet c and measure the stellar H I Lyman-alpha emission line. We hope to detect a signature from an extended exosphere escaping the planet. This has never been observed for an exoplanet below 10 Earth masses and would prove that exoplanets in this mass regime can host hydrogen envelopes. A negative result will allow us to assess the far- and extreme-UV environment of both exoplanets, which is critical for planning optimal follow-up strategies.

OBSERVING DESCRIPTION

We will observe HD3167 throughout one visit comprised of 5 consecutive HST orbits. The observations target the transit of planet HD3167c in front of its host star. Transits of HD3167c occur every 29.85 days and last 5.15 hours. The visit has been scheduled such that the first two orbits are observed before transit, the third orbit covers transit ingress, and the fourth and fifth orbits are fully observed during transit. This configuration is essential to obtain a solid pre-transit measurement. We have set a phase constraint on the ACQ exposure such that the visit starts between 4.0 and 3.33 hours before transit ingress, and observations end before transit egress.

Visit

Proposal 14921, Visit 01, implementation Sat Jun 24 01:00:33 GMT 2017

Diagnostic Status: Warning

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

Special Requirements: SCHED 100%; Period 29.8454 D AND ZERO-PHASE HJD2457394.9788

Diagnostics

(Visit 01) Warning (Orbit Planner): ORBITAL VISIBILITY OVERRUN
(Visit 01) Warning (Orbit Planner): ORBITAL VISIBILITY OVERRUN
(Visit 01) Warning (Orbit Planner): ORBITAL VISIBILITY OVERRUN
(Visit 01) Warning (Orbit Planner): ORBITAL VISIBILITY OVERRUN
(Visit 01) Warning (Orbit Planner): ORBITAL VISIBILITY OVERRUN

Fixed Targets

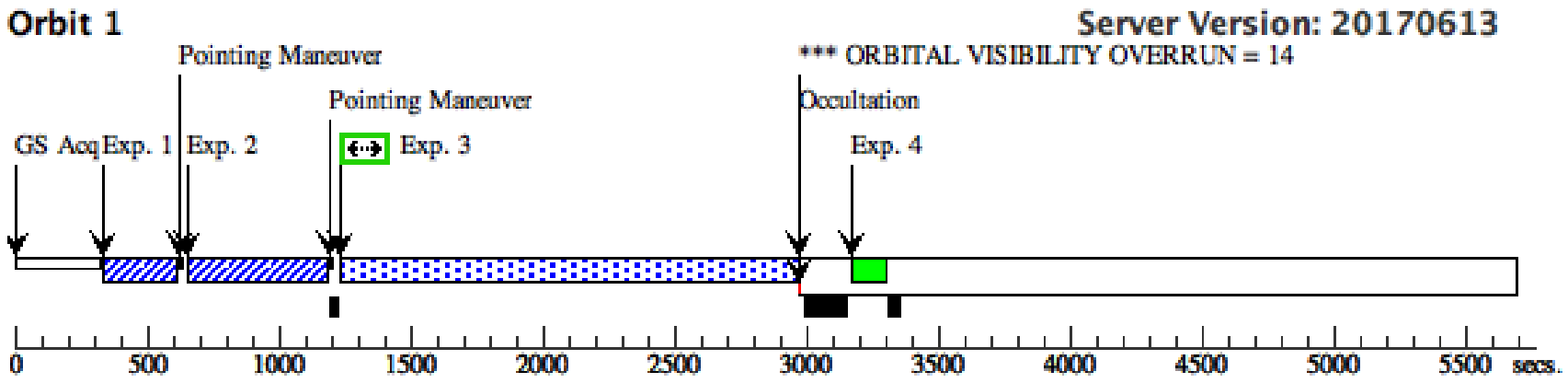
#	Name	Target Coordinates	Targ. Coord. Corrections	Fluxes	Miscellaneous
(1)	HD-3167	RA: 00 34 57.6317 (8.7401321d) Dec: +04 22 50.68 (4.38074d) Equinox: J2000	Proper Motion RA: 107.58 mas/yr Proper Motion Dec: -173.14 mas/yr Epoch of Position: 2015 Radial Velocity: 19.528 km/sec	V=8.94+/-0.01 B = 9.77 +/- 0.02, R = 8.4 +/- 0.02, I = 8.1 +/- 0.02, J = 7.548 +/- 0.03, H = 7.203 +/- 0.04, K = 7.066 +/- 0.02	Reference Frame: ICRS

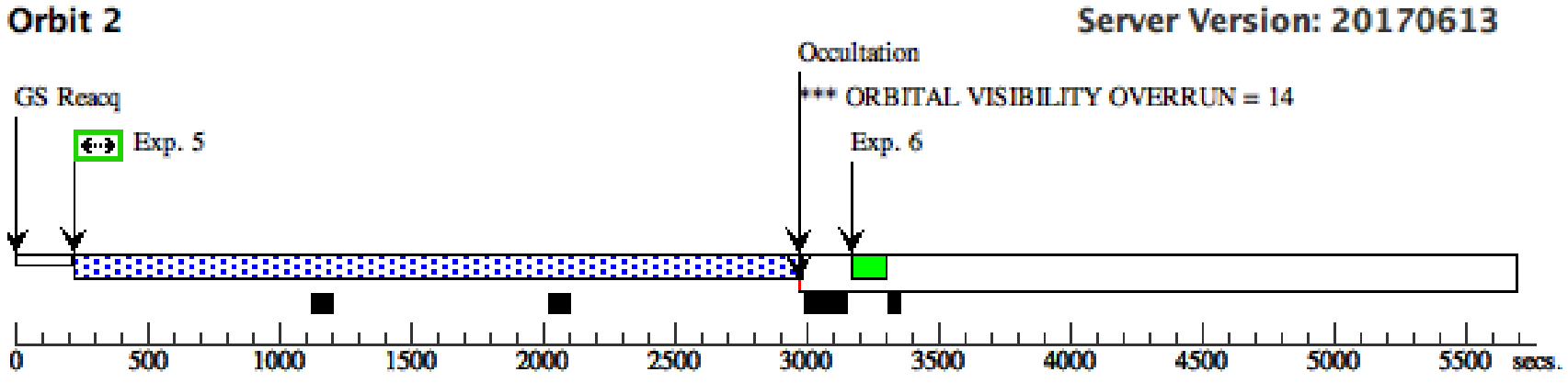
Comments: The coordinates were taken from GAIA DR1. We have verified them against HIPPARCOS coordinates, finding excellent agreement (differences < 0.002 arcsec).

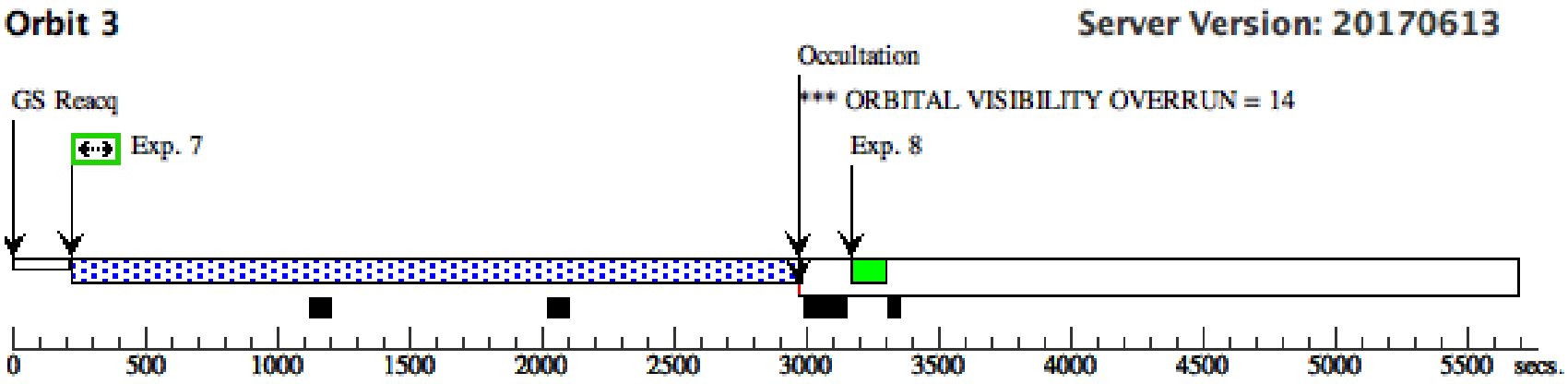
Exposures

#	Label (ETC Run)	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time (Total)/[Actual Dur.]	Orbit
1	(STIS.ta.912546)	(1) HD-3167	STIS/CCD, ACQ, F28X50OII	MIRROR		PHASE 0.990600 TO 0.99325255	Sequence 1-4 Non-Int in Visit 01	5 Secs (5 Secs) *[==>]*	*[1]*
2	(STIS.sp.912588)	(1) HD-3167	STIS/CCD, ACQ/PEAK, 52X0.05D1	G430L 4300 A			Sequence 1-4 Non-Int in Visit 01	12 Secs (12 Secs) *[==>]*	*[1]*
3	(STIS.sp.912653)	(1) HD-3167	STIS/FUV-MAMA, TIME-TAG, 52X0.05D1	G140M 1222 A	BUFFER-TIME=900; WAVECAL=NO		Sequence 1-4 Non-Int in Visit 01	1659 Secs (1593 Secs) *[==>1593.0 Secs]*	*[1]*
4		WAVE	STIS/FUV-MAMA, ACCUM, 52X0.05	G140M 1222 A			Sequence 1-4 Non-Int in Visit 01	*[==>]*	*[1]*
5	(STIS.sp.912653)	(1) HD-3167	STIS/FUV-MAMA, TIME-TAG, 52X0.05D1	G140M 1222 A	BUFFER-TIME=900		Sequence 5-6 Non-Int in Visit 01	2740 Secs (2740 Secs) *[==>]*	*[2]*
6		WAVE	STIS/FUV-MAMA, ACCUM, 52X0.05	G140M 1222 A			Sequence 5-6 Non-Int in Visit 01	*[==>]*	*[2]*
7	(STIS.sp.912653)	(1) HD-3167	STIS/FUV-MAMA, TIME-TAG, 52X0.05D1	G140M 1222 A	BUFFER-TIME=900		Sequence 7-8 Non-Int in Visit 01	2740 Secs (2740 Secs) *[==>]*	*[3]*
8		WAVE	STIS/FUV-MAMA, ACCUM, 52X0.05	G140M 1222 A			Sequence 7-8 Non-Int in Visit 01	*[==>]*	*[3]*
9	(STIS.sp.912653)	(1) HD-3167	STIS/FUV-MAMA, TIME-TAG, 52X0.05D1	G140M 1222 A	BUFFER-TIME=900		Sequence 9-10 Non-Int in Visit 01	2740 Secs (2740 Secs) *[==>]*	*[4]*
10		WAVE	STIS/FUV-MAMA, ACCUM, 52X0.05	G140M 1222 A			Sequence 9-10 Non-Int in Visit 01	*[==>]*	*[4]*
11	(STIS.sp.912653)	(1) HD-3167	STIS/FUV-MAMA, TIME-TAG, 52X0.05D1	G140M 1222 A	BUFFER-TIME=900		Sequence 11-12 Non-Int in Visit 01	2740 Secs (2740 Secs) *[==>]*	*[5]*
12		WAVE	STIS/FUV-MAMA, ACCUM, 52X0.05	G140M 1222 A			Sequence 11-12 Non-Int in Visit 01	*[==>]*	*[5]*

Orbit Structure



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Occultation
GS Reacq
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Exp. 8
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4500
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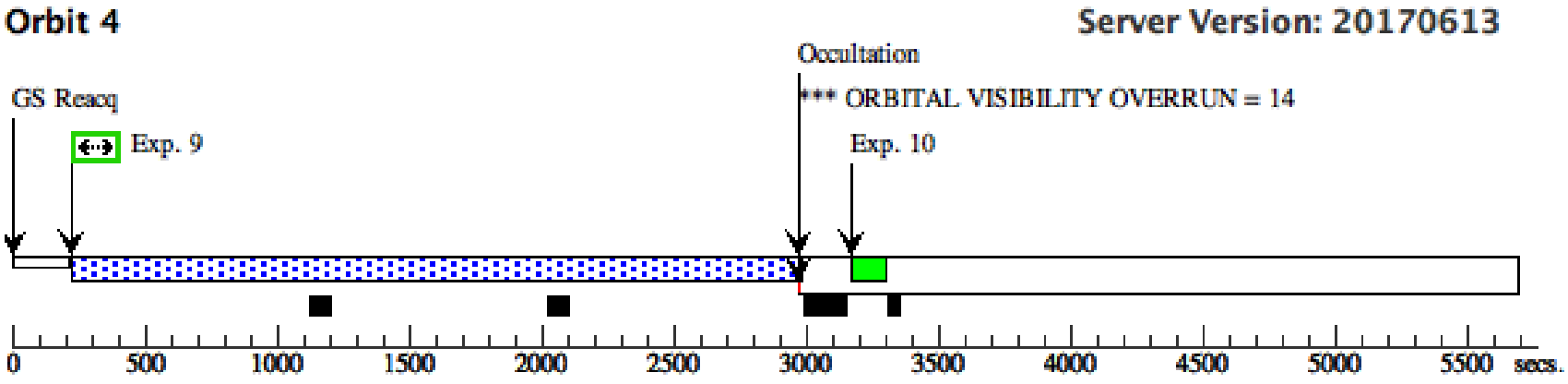
5500
secs.


Orbit 4
Server Version: 20170613
Occultation
GS Reacq
*** ORBITAL VISIBILITY OVERRUN = 14
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Exp. 10
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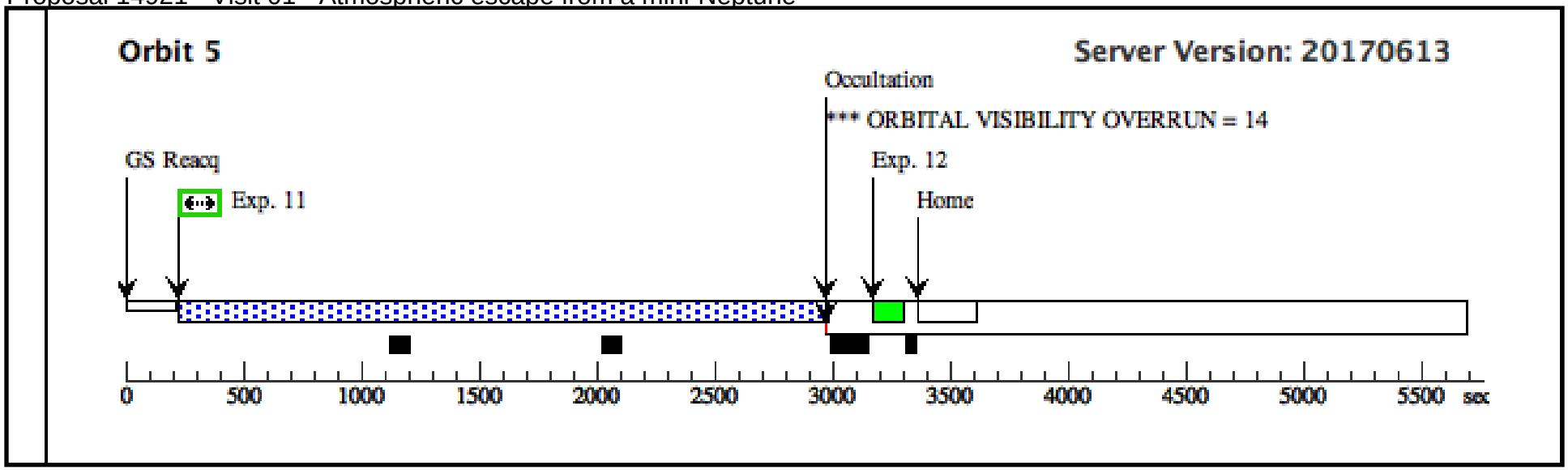
5500
secs.


Orbit 5
Server Version: 20170613
Occultation
*** ORBITAL VISIBILITY OVERRUN = 14
GS Reacq
Exp. 11
Exp. 12
Home
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1500
2000
2500
3000
3500
4000
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5000
5500
sec