



14877 - Confirmation and characterization of an exosphere around the super Earth 55 Cnc e

Cycle: 24, Proposal Category: GO

(UV Initiative)

(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) -RHO-CNC	COS/FUV COS/NUV	5	20-Dec-2016 21:08:00.0	yes
02	(1) -RHO-CNC	COS/FUV COS/NUV	5	20-Dec-2016 21:08:04.0	yes

10 Total Orbits Used

ABSTRACT

The super-Earth 55 Cnc e transits an extremely bright star ($V=6$) at a very short separation ($a=0.016$ au). Transit spectroscopy of the planet in the ultraviolet detected no significant amounts of hydrogen or water, while optical and infrared observations suggest it could either have no atmosphere, or be surrounded by a heavyweight metal-rich envelope. Located within a carbon-rich system, 55 Cnc e might indeed be a 'Super-Venus' with a carbon-dioxide atmosphere that could expand under the strong stellar irradiation. Our recent observation of the transit at far UV wavelengths with HST/COS may bring a new and decisive insight in favor of this scenario. Indeed, we detect a significant absorption signature of ionized carbon during and after the optical transit of 55 Cnc e. However, while this could represent the first clear detection of an exosphere around a super Earth, it relies on a single visit and previous experience demonstrates the importance of repeatability. Furthermore, a single visit is not enough to fully interpret the dynamics of the putative carbon exosphere. With two independent visits of five orbits each, a Mid-Cycle program is the perfect opportunity to assess the repeatability of this absorption, and characterize an envelope of carbon around 55 Cnc e. For the foreseeable future, the Hubble Space Telescope provides our only option to observe the transit of this super Earth at UV wavelengths, and indeed represents a unique possibility to characterize the atmosphere of this small planet, its composition, and its evolution.

OBSERVING DESCRIPTION

This program consists in 2 visits of 5 HST orbits each (total of 10 HST orbits), dedicated to the observations of the transits of the exoplanet 55 Cancri e in front of their host-star. The aim is to confirm a signature detected in the frame of Visit 2 in GO#14094, and this program will thus use the same instrumental settings. The scheduling will be slightly different however, because this new program has one more orbit per visit, and we need to obtain a good baseline by measuring the stellar flux farther from the planet transit.

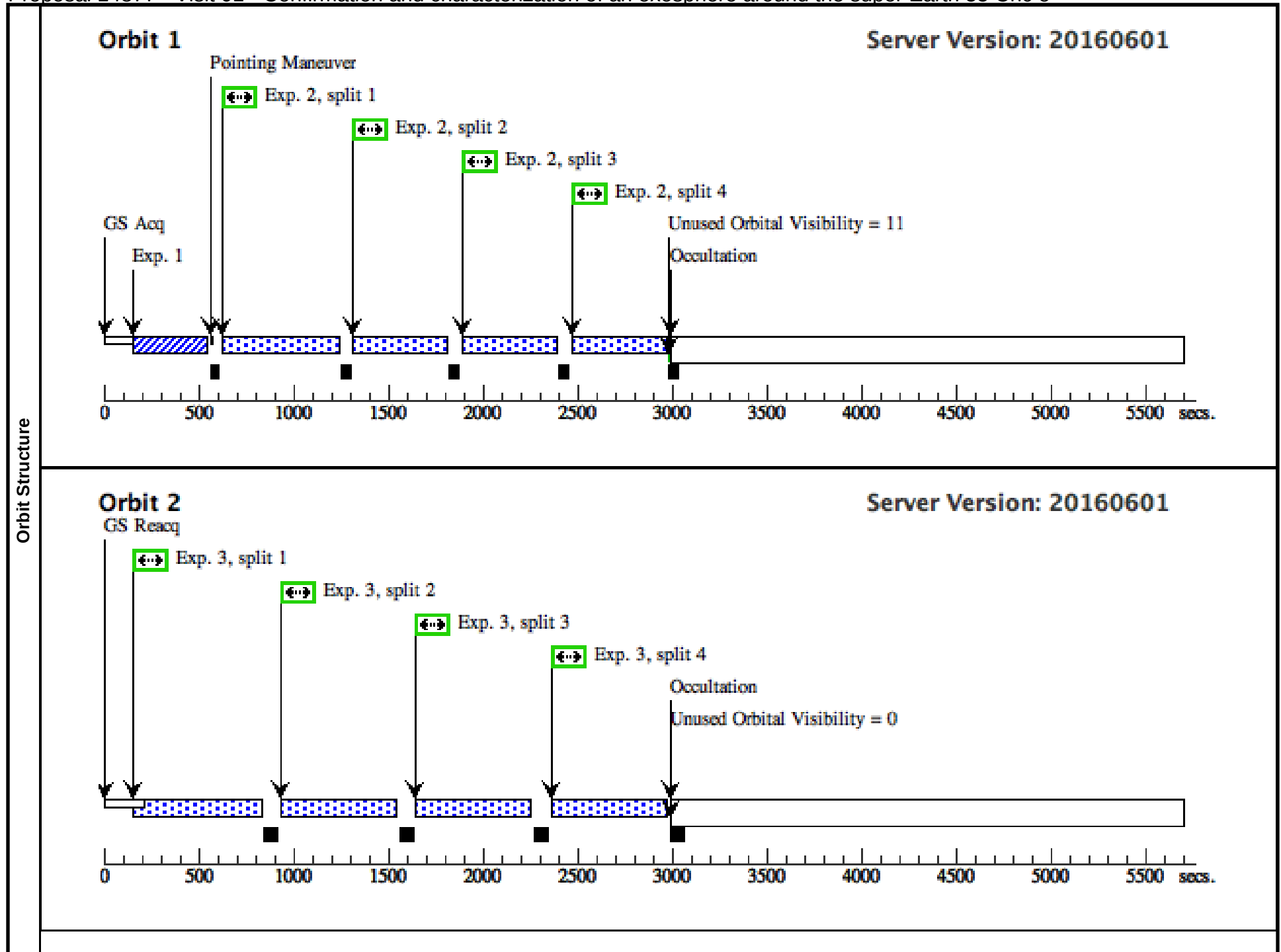
The transits of the targeted planet 55 Cancri 'e' occur every 17.7 hours and last for about 1.5 hours. The timing requirements for both visits are set as phase constraints on the first ACQ exposure of the first orbit.

Proposal 14877 - Visit 01 - Confirmation and characterization of an exosphere around the super Earth 55 Cnc e

Visit	Proposal 14877, Visit 01, implementation					Wed Dec 21 02:08:05 GMT 2016
	Diagnostic Status: Warning					
	Scientific Instruments: COS/FUV, COS/NUV					
	Special Requirements: SCHED 100%; Period 0.736543 D AND ZERO-PHASE HJD2455733.008					
Diagnostics	(Visit 01) Warning (Orbit Planner): INEFFICIENT ORDERING OF FP-POS POSITIONS					
	(Visit 01) Warning (Orbit Planner): INEFFICIENT ORDERING OF FP-POS POSITIONS					
	(Visit 01) Warning (Orbit Planner): INEFFICIENT ORDERING OF FP-POS POSITIONS					
	(Visit 01) Warning (Orbit Planner): INEFFICIENT ORDERING OF FP-POS POSITIONS					
Fixed Targets	#	Name	Target Coordinates	Targ. Coord. Corrections	Fluxes	Miscellaneous
	(1)	-RHO-CNC	RA: 08 52 35.8109 (133.1492121d)	Proper Motion RA: -485.80 mas/yr	V=5.95	Reference Frame: ICRS
		Alt Name1: HR3522	Dec: +28 19 50.95 (28.33082d)	Proper Motion Dec: -234.05 mas/yr	U=7.45,	
		Alt Name2: GJ324A	Equinox: J2000	Parallax: 0.08103"	B=6.82,	
				Epoch of Position: 2000	R=5.4,	
				Radial Velocity: 27.36 km/sec	I=5.0,	
					J=4.59,	
					H=4.14,	
					K=4.015	
		Comments: This star is in a double system (common proper motions) with 55 Cancri B (GJ 324B), a much fainter (V=13) M4 dwarf that is 1.4-arcmin away. It also 4.6-arcmin away from the similarly bright (V=6.3) star 53 Cancri (BO Cancri)				
	Extended=NO					

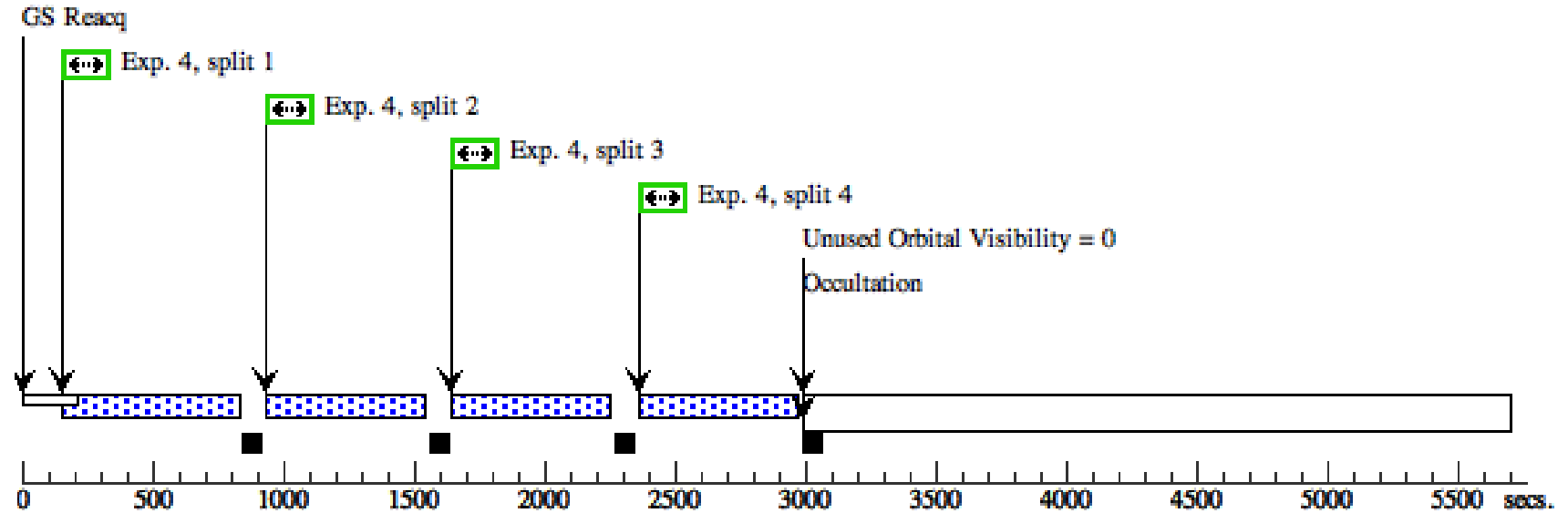
Proposal 14877 - Visit 01 - Confirmation and characterization of an exosphere around the super Earth 55 Cnc e

Exposures	#	Label (ETC Run)	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time (Total)/[Actual Dur.]	Orbit
	1	ACQ/Image (COS.ta.848 720)	(1) -RHO-CNC	COS/NUV, ACQ/IMAGE, BOA	MIRRORA		PHASE 0.737 TO 0. 754	Sequence 1-2 Non-In t in Visit 01	80 Secs (80 Secs) [==>]	[1]
	Comments: We compared the counts for the brightest pixel in the acquisition image of GO#14094, and the value predicted for similar settings with the ETC but the GALEX magnitude (12.93 in NUV band). There is a ratio of about 7.5 between the actual count (lower) and the predicted count. Then, we used the ETC with the GALEX magnitude and mirror A to find that an exposure time of 80s is required to obtain a predicted count of 3230 for the brightest pixel, which should correspond to a true count of 430 and a SNR of 55 (assuming the ratio of 7.5 between the predicted and true counts)									
	2	SCI (COS.sp.715 790)	(1) -RHO-CNC	COS/FUV, TIME-TAG, PSA	G130M 1291 A	FLASH=YES; FP-POS=ALL; BUFFER-TIME=10 00		Sequence 1-2 Non-In t in Visit 01	535 Secs (1772 Secs) [==>443.0 Secs (Split 1)] [==>443.0 Secs (Split 2)] [==>443.0 Secs (Split 3)] [==>443.0 Secs (Split 4)]	[1]
	Comments: In the ETC run, the strength of the stellar Lyman-alpha line has been set to an extremely conservative value, and the airglow as set to its higher value, in order to calculate the buffer-time. We use the same settings as in Visit 2 of GO#14094, which was successfully obtained.									
	3	SCI (COS.sp.715 790)	(1) -RHO-CNC	COS/FUV, TIME-TAG, PSA	G130M 1291 A	FLASH=YES; FP-POS=ALL; BUFFER-TIME=10 00		Sequence 3-3 Non-In t in Visit 01	535 Secs (2248 Secs) [==>562.0 Secs (Split 1)] [==>562.0 Secs (Split 2)] [==>562.0 Secs (Split 3)] [==>562.0 Secs (Split 4)]	[2]
	Comments: In the ETC run, the strength of the stellar Lyman-alpha line has been set to an extremely conservative value, and the airglow as set to its higher value, in order to calculate the buffer-time.									
Exposures	4	SCI (COS.sp.715 790)	(1) -RHO-CNC	COS/FUV, TIME-TAG, PSA	G130M 1291 A	FLASH=YES; FP-POS=ALL; BUFFER-TIME=10 00		Sequence 4-4 Non-In t in Visit 01	535 Secs (2248 Secs) [==>562.0 Secs (Split 1)] [==>562.0 Secs (Split 2)] [==>562.0 Secs (Split 3)] [==>562.0 Secs (Split 4)]	[3]
	Comments: In the ETC run, the strength of the stellar Lyman-alpha line has been set to an extremely conservative value, and the airglow as set to its higher value, in order to calculate the buffer-time.									
	5	SCI (COS.sp.715 790)	(1) -RHO-CNC	COS/FUV, TIME-TAG, PSA	G130M 1291 A	FLASH=YES; FP-POS=ALL; BUFFER-TIME=10 00		Sequence 5-5 Non-In t in Visit 01	535 Secs (2248 Secs) [==>562.0 Secs (Split 1)] [==>562.0 Secs (Split 2)] [==>562.0 Secs (Split 3)] [==>562.0 Secs (Split 4)]	[4]
	Comments: In the ETC run, the strength of the stellar Lyman-alpha line has been set to an extremely conservative value, and the airglow as set to its higher value, in order to calculate the buffer-time.									
	6	SCI (COS.sp.715 790)	(1) -RHO-CNC	COS/FUV, TIME-TAG, PSA	G130M 1291 A	FLASH=YES; FP-POS=ALL; BUFFER-TIME=10 00		Sequence 6-6 Non-In t in Visit 01	535 Secs (2248 Secs) [==>562.0 Secs (Split 1)] [==>562.0 Secs (Split 2)] [==>562.0 Secs (Split 3)] [==>562.0 Secs (Split 4)]	[5]
	Comments: In the ETC run, the strength of the stellar Lyman-alpha line has been set to an extremely conservative value, and the airglow as set to its higher value, in order to calculate the buffer-time.									



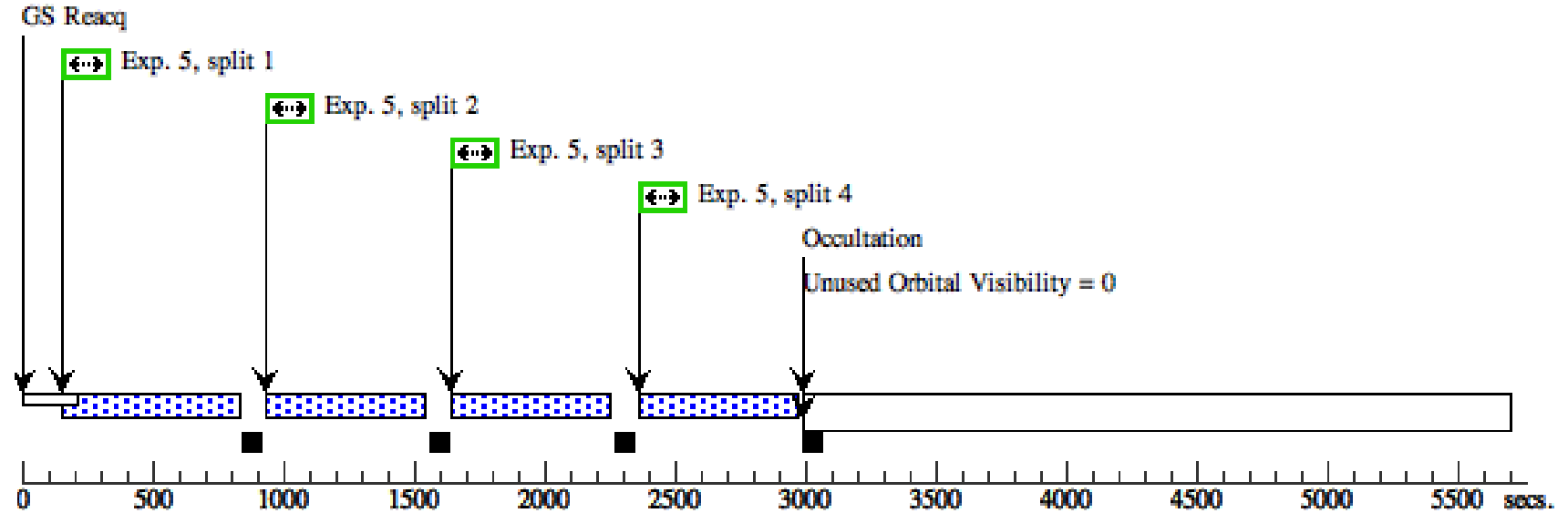
Orbit 3

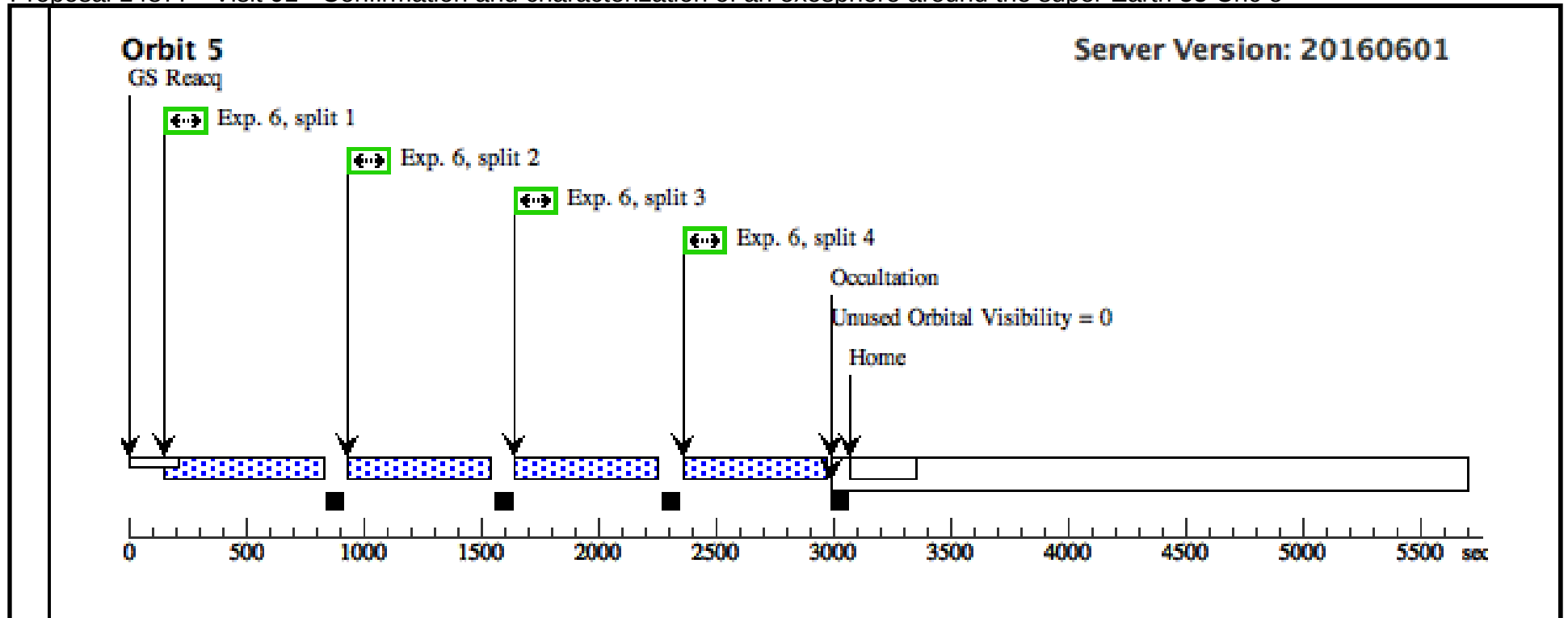
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Orbit 4

Server Version: 20160601



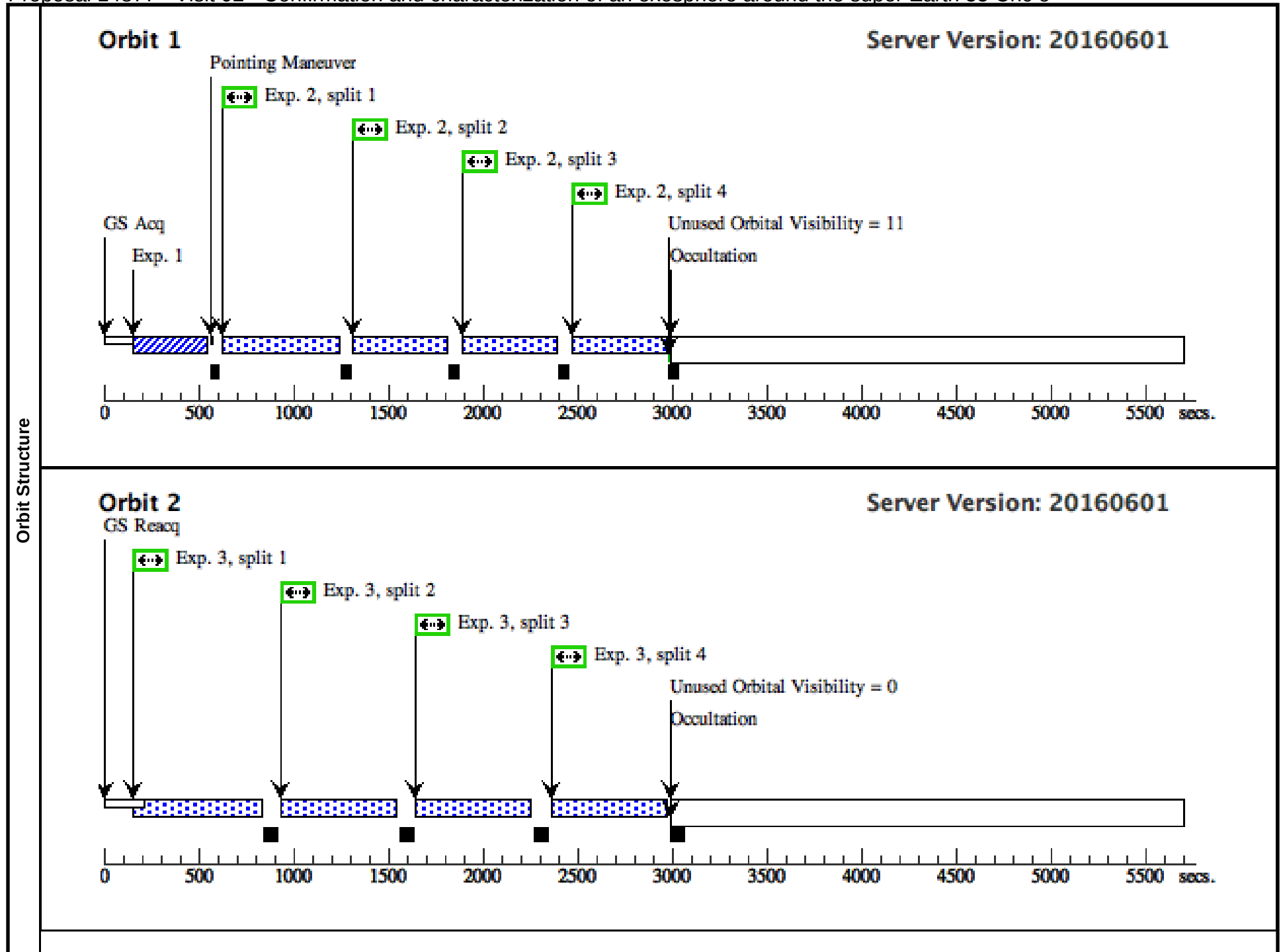


Proposal 14877 - Visit 02 - Confirmation and characterization of an exosphere around the super Earth 55 Cnc e

Visit	Proposal 14877, Visit 02, implementation					Wed Dec 21 02:08:06 GMT 2016
	Diagnostic Status: Warning					
	Scientific Instruments: COS/FUV, COS/NUV					
	Special Requirements: SCHED 100%; Period 0.736543 D AND ZERO-PHASE HJD2455733.008					
Diagnostics	(Visit 02) Warning (Orbit Planner): INEFFICIENT ORDERING OF FP-POS POSITIONS					
	(Visit 02) Warning (Orbit Planner): INEFFICIENT ORDERING OF FP-POS POSITIONS					
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Fixed Targets	#	Name	Target Coordinates	Targ. Coord. Corrections	Fluxes	Miscellaneous
	(1)	-RHO-CNC	RA: 08 52 35.8109 (133.1492121d)	Proper Motion RA: -485.80 mas/yr	V=5.95	Reference Frame: ICRS
		Alt Name1: HR3522	Dec: +28 19 50.95 (28.33082d)	Proper Motion Dec: -234.05 mas/yr	U=7.45,	
		Alt Name2: GJ324A	Equinox: J2000	Parallax: 0.08103"	B=6.82,	
				Epoch of Position: 2000	R=5.4,	
				Radial Velocity: 27.36 km/sec	I=5.0,	
					J=4.59,	
					H=4.14,	
					K=4.015	
		Comments: This star is in a double system (common proper motions) with 55 Cancri B (GJ 324B), a much fainter (V=13) M4 dwarf that is 1.4-arcmin away. It also 4.6-arcmin away from the similarly bright (V=6.3) star 53 Cancri (BO Cancri)				
	Extended=NO					

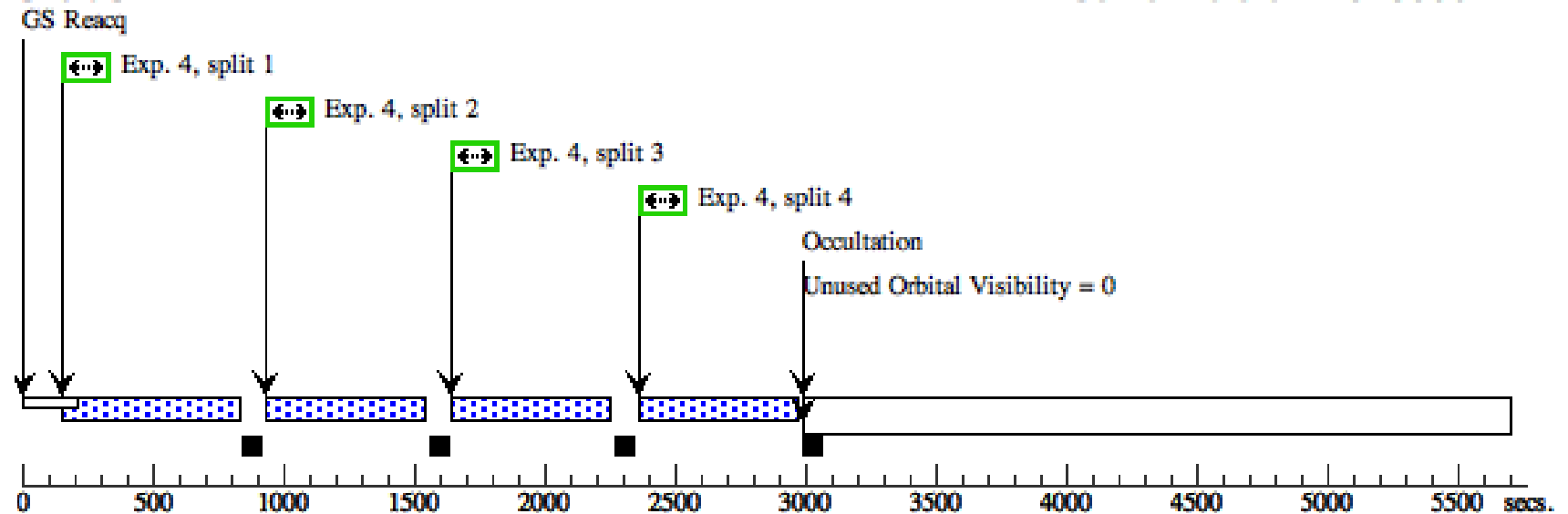
Proposal 14877 - Visit 02 - Confirmation and characterization of an exosphere around the super Earth 55 Cnc e

Exposures	#	Label (ETC Run)	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time (Total)/[Actual Dur.]	Orbit
	1	ACQ/Image (COS.ta.848 720)	(1) -RHO-CNC	COS/NUV, ACQ/IMAGE, BOA	MIRRORA		PHASE 0.779 TO 0. 815	Sequence 1-2 Non-In t in Visit 02	80 Secs (80 Secs) [==>]	[1]
	Comments: See visit #01									
	2	SCI (COS.sp.715 790)	(1) -RHO-CNC	COS/FUV, TIME-TAG, PSA	G130M 1291 A	FLASH=YES; FP-POS=ALL; BUFFER-TIME=10 00		Sequence 1-2 Non-In t in Visit 02	535 Secs (1772 Secs) [==>443.0 Secs (Split 1)] [==>443.0 Secs (Split 2)] [==>443.0 Secs (Split 3)] [==>443.0 Secs (Split 4)]	[1]
	Comments: In the ETC run, the strength of the stellar Lyman-alpha line has been set to an extremely conservative value, and the airglow as set to its higher value, in order to calculate the buffer-time. We use the same settings as in Visit 2 of GO#14094, which was successfully obtained.									
	3	SCI (COS.sp.715 790)	(1) -RHO-CNC	COS/FUV, TIME-TAG, PSA	G130M 1291 A	FLASH=YES; FP-POS=ALL; BUFFER-TIME=10 00		Sequence 3-3 Non-In t in Visit 02	535 Secs (2248 Secs) [==>562.0 Secs (Split 1)] [==>562.0 Secs (Split 2)] [==>562.0 Secs (Split 3)] [==>562.0 Secs (Split 4)]	[2]
	Comments: In the ETC run, the strength of the stellar Lyman-alpha line has been set to an extremely conservative value, and the airglow as set to its higher value, in order to calculate the buffer-time.									
Exposures	4	SCI (COS.sp.715 790)	(1) -RHO-CNC	COS/FUV, TIME-TAG, PSA	G130M 1291 A	FLASH=YES; FP-POS=ALL; BUFFER-TIME=10 00		Sequence 4-4 Non-In t in Visit 02	535 Secs (2248 Secs) [==>562.0 Secs (Split 1)] [==>562.0 Secs (Split 2)] [==>562.0 Secs (Split 3)] [==>562.0 Secs (Split 4)]	[3]
	Comments: In the ETC run, the strength of the stellar Lyman-alpha line has been set to an extremely conservative value, and the airglow as set to its higher value, in order to calculate the buffer-time.									
	5	SCI (COS.sp.715 790)	(1) -RHO-CNC	COS/FUV, TIME-TAG, PSA	G130M 1291 A	FLASH=YES; FP-POS=ALL; BUFFER-TIME=10 00		Sequence 5-5 Non-In t in Visit 02	535 Secs (2248 Secs) [==>562.0 Secs (Split 1)] [==>562.0 Secs (Split 2)] [==>562.0 Secs (Split 3)] [==>562.0 Secs (Split 4)]	[4]
	Comments: In the ETC run, the strength of the stellar Lyman-alpha line has been set to an extremely conservative value, and the airglow as set to its higher value, in order to calculate the buffer-time.									
	6	SCI (COS.sp.715 790)	(1) -RHO-CNC	COS/FUV, TIME-TAG, PSA	G130M 1291 A	FLASH=YES; FP-POS=ALL; BUFFER-TIME=10 00		Sequence 6-6 Non-In t in Visit 02	535 Secs (2248 Secs) [==>562.0 Secs (Split 1)] [==>562.0 Secs (Split 2)] [==>562.0 Secs (Split 3)] [==>562.0 Secs (Split 4)]	[5]
	Comments: In the ETC run, the strength of the stellar Lyman-alpha line has been set to an extremely conservative value, and the airglow as set to its higher value, in order to calculate the buffer-time.									



Orbit 3

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Orbit 4

Server Version: 20160601

