16448 - Confirming a tentative detection of an atmosphere around a potentially rocky planet

Cycle: 28, Proposal Category: GO

(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) L-98-59	WFC3/IR	4	01-Dec-2020 18:00:51.0	yes
02	(1) L-98-59	WFC3/IR	4	01-Dec-2020 18:01:19.0	yes

8 Total Orbits Used

ABSTRACT

We are moving from an era of exoplanet discovery into an era of exoplanet characterization, but small (R < 1.5 Rearth), potentially-rocky planets orbiting bright, nearby stars that are suitable for atmospheric characterization studies are relatively scarce. Amongst these candidates for atmospheric characterization is L 98-59 c. This 1.35 Rearth planet is one of three known to orbit the bright (H = 7.4), nearby (10.6 pc), M3V star L 98-59. HST/WFC3 observed a transit of L 98-59 c earlier this year. These data revealed the first tentative signs of a atmosphere on a predominantly rocky exoplanet. However, this detection was of fairly low signal-to-noise, and independent analyses did not yield wholly consistent results. Here we propose to observe two additional transits of L 98-59 c using the same instrument setup as the archival data. With these new data, the significance of the atmospheric features, if supported, would be increased by greater than 5-sigma. Moreover, these new data will provide sufficient signal to measure the chemical composition of the atmosphere. With the robust detection of an atmosphere, L 98-59 c will become a touchstone exoplanet for atmospheric studies and a key planet for demonstrating the precision of JWST.

OBSERVING DESCRIPTION

The program will obtain time series spectroscopy of L 98-59 c. We will use WFC3's G141 grism and the 512x512 subarray. We will cover 2 transits of the planet. Each transit is covered by a single visit, and each visit consists of four sequential orbits to obtain quasi-continuous coverage of the transits. The actual planet transits will occur in the third orbit of each visit, with two pre-transit orbits and one post-transit orbit. We will use the first orbit of each visit in our construction of the out-of-transit baseline flux if instrument systematics allow. Each orbit begins with a direct image of the target with the F130N filter for wavelength calibration. The remainder of each orbit will consist of MULTIACCUM exposures with the NSAMP = 4, SPARS25 readout pattern. To keep the fluence near 30,000 photoelectrons, we will use spatial scan mode with a 0.496 arcsec/sec scan rate, yielding a total scan height of 285.3 pixels), as recommended by Pandexo. To maximize the duty cycle of the observations (~60%), we will alternate between forward and reverse scanning along the detector.

Visit

Proposal 16448, planet c transit 1/2 (01) Tue Dec 01 23:01:22 GMT 2020

Diagnostic Status: No Diagnostics

Scientific Instruments: WFC3/IR

Special Requirements: Period 3.6906219 D AND ZERO-PHASE HJD2458367.2755

Fixed Targets

#	Name	Target Coordinates	Targ. Coord. Corrections	Fluxes	Miscellaneous
(1)	L-98-59	RA: 08 18 7.8865 (124.5328604d) Dec: -68 18 52.08 (-68.31447d) Equinox: J2000	Proper Motion RA: 0.017097678098934456 sec of time/yr Proper Motion Dec: -0.34046999996917293 arcsec/yr Epoch of Position: 2015.5	V=11.685	Reference Frame: SIMBAD

Comments: This object was generated by the targetselector and retrieved from the SIMBAD database.
Category=EXT-STAR
Description=[EXTRA-SOLAR PLANET, M V-IV]

Exposures

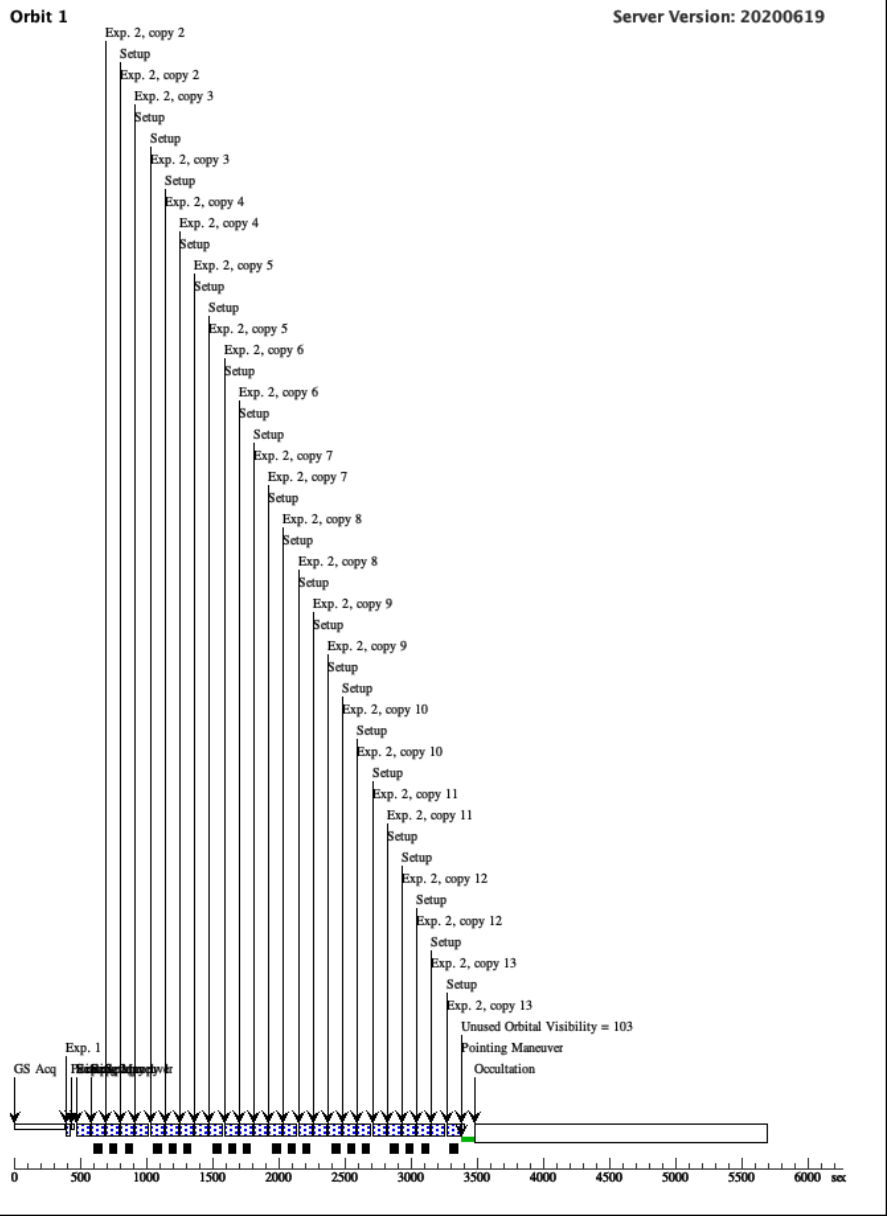
#	Label	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time (Total)/[Actual Dur.]	Orbit
1		(1) L-98-59	WFC3/IR, MULTIACCUM, GRISM512	F130N	NSAMP=2; SAMP-SEQ=RAPID	PHASE 0.957474625598 TO 0.961237933067	Sequence 1-2 Non-Int in planet c transit 1/2 (01)	1.706054 Secs (1.706 Secs) *[==>]*	***[1]***
2		(1) L-98-59	WFC3/IR, MULTIACCUM, GRISM512	G141	NSAMP=4; SAMP-SEQ=SPARS25	POS TARG null,-21; SPATIAL SCAN 0.496,90.0 Degrees,Round trip	Sequence 1-2 Non-Int in planet c transit 1/2 (01)	69.61678 Secs X 13 (1810.036 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)]* *[==>(Copy 10, Forward)]* *[==>(Copy 10, Reverse)]* *[==>(Copy 11, Forward)]* *[==>(Copy 11, Reverse)]* *[==>(Copy 12, Forward)]* *[==>(Copy 12, Reverse)]* *[==>(Copy 13, Forward)]* *[==>(Copy 13, Reverse)]*	***[1]***
3		(1) L-98-59	WFC3/IR, MULTIACCUM, GRISM512	F130N	NSAMP=2; SAMP-SEQ=RAPID		Sequence 3-4 Non-Int in planet c transit 1/2 (01)	1.706054 Secs (1.706 Secs) *[==>]*	***[2]***

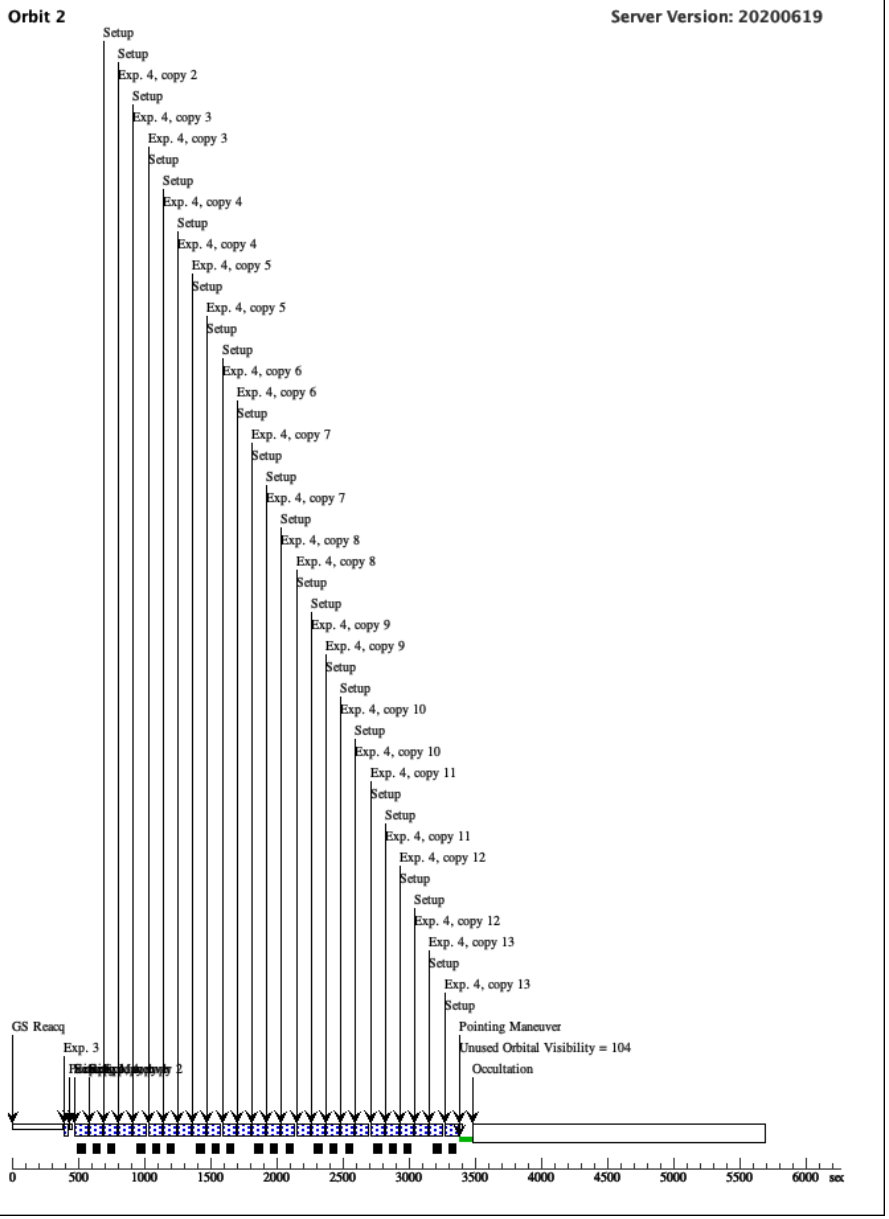
	4	(1) L-98-59	WFC3/IR, MULTIACCUM, GRISM512	G141	NSAMP=4; SAMP-SEQ=SPARS25	POS TARG null,-21; SPATIAL SCAN 0.496,90.0 Degrees,Round trip	Sequence 3-4 Non-Int in planet c transit 1/2 (01)	69.61678 Secs X 13 (1810.036 Secs) *[==>(Copy 1, Forward)]* *[==>(Copy 1, Reverse)]* *[==>(Copy 2, Forward)]* *[==>(Copy 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)]* *[==>(Copy 10, Forward)]* *[==>(Copy 10, Reverse)]* *[==>(Copy 11, Forward)]* *[==>(Copy 11, Reverse)]* *[==>(Copy 12, Forward)]* *[==>(Copy 12, Reverse)]* *[==>(Copy 13, Forward)]* *[==>(Copy 13, Reverse)]*	***[2]***
	5	(1) L-98-59	WFC3/IR, MULTIACCUM, GRISM512	F130N	NSAMP=2; SAMP-SEQ=RAPID		Sequence 5-6 Non-Int in planet c transit 1/2 (01)	1.706054 Secs (1.706 Secs) *[==>]*	***[3]***

	6	(1) L-98-59	WFC3/IR, MULTIACCUM, GRISM512	G141	NSAMP=4; SAMP-SEQ=SPARS25	POS TARG null,-21; SPATIAL SCAN 0.496,90.0 Degrees,Round trip	Sequence 5-6 Non-Int in planet c transit 1/2 (01)	69.61678 Secs X 13 (1810.036 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)]* *[==>(Copy 10, Forward)]* *[==>(Copy 10, Reverse)]* *[==>(Copy 11, Forward)]* *[==>(Copy 11, Reverse)]* *[==>(Copy 12, Forward)]* *[==>(Copy 12, Reverse)]* *[==>(Copy 13, Forward)]* *[==>(Copy 13, Reverse)]*	***[3]***
	7	(1) L-98-59	WFC3/IR, MULTIACCUM, GRISM512	F130N	NSAMP=2; SAMP-SEQ=RAPID		Sequence 7-8 Non-Int in planet c transit 1/2 (01)	1.706054 Secs (1.706 Secs) *[==>]*	***[4]***

	8	(1) L-98-59	WFC3/IR, MULTIACCUM, GRISM512	G141	NSAMP=4; SAMP-SEQ=SPARS25	POS TARG null,-21; SPATIAL SCAN 0.496,90.0 Degrees,Round trip	Sequence 7-8 Non-Int in planet c transit 1/2 (01)	69.61678 Secs X 13 (1810.036 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)]* *[==>(Copy 10, Forward)]* *[==>(Copy 10, Reverse)]* *[==>(Copy 11, Forward)]* *[==>(Copy 11, Reverse)]* *[==>(Copy 12, Forward)]* *[==>(Copy 12, Reverse)]* *[==>(Copy 13, Forward)]* *[==>(Copy 13, Reverse)]*	***[4]***

Orbit Structure

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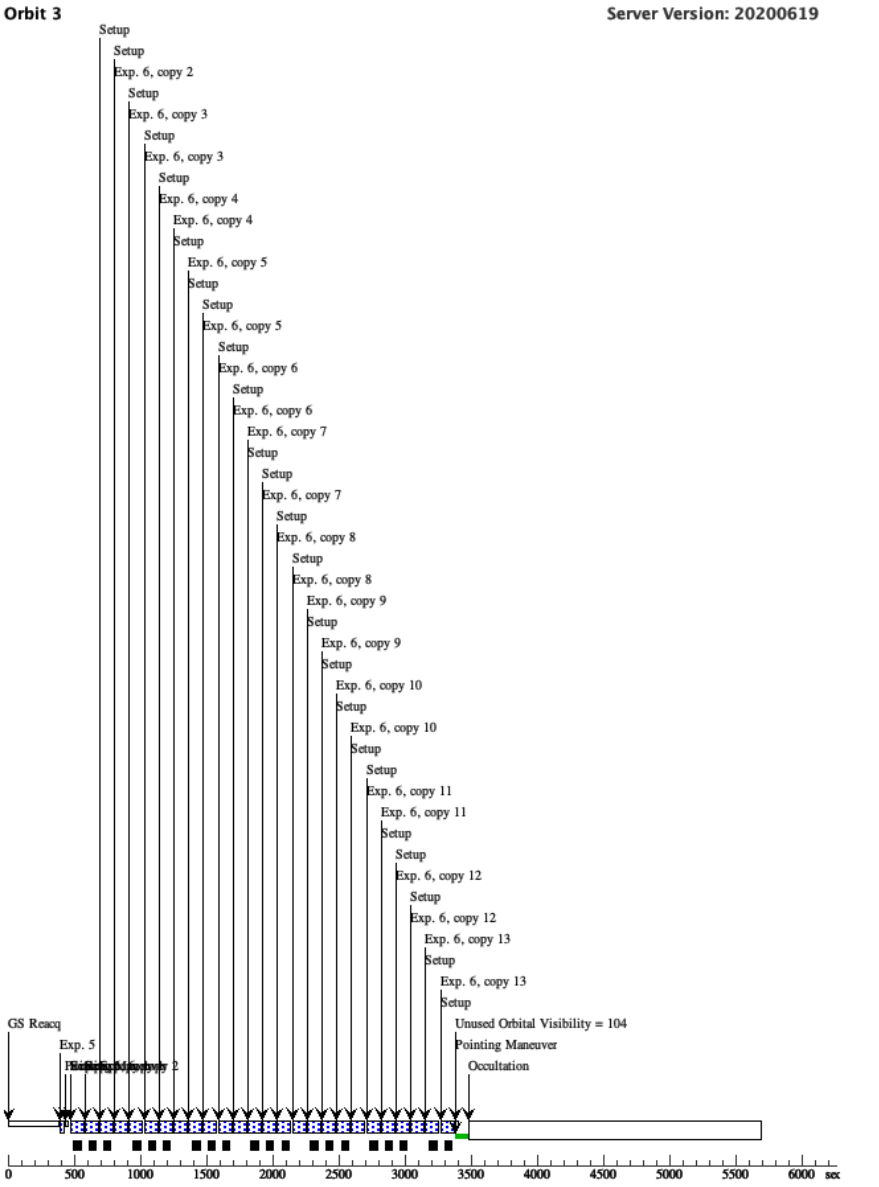
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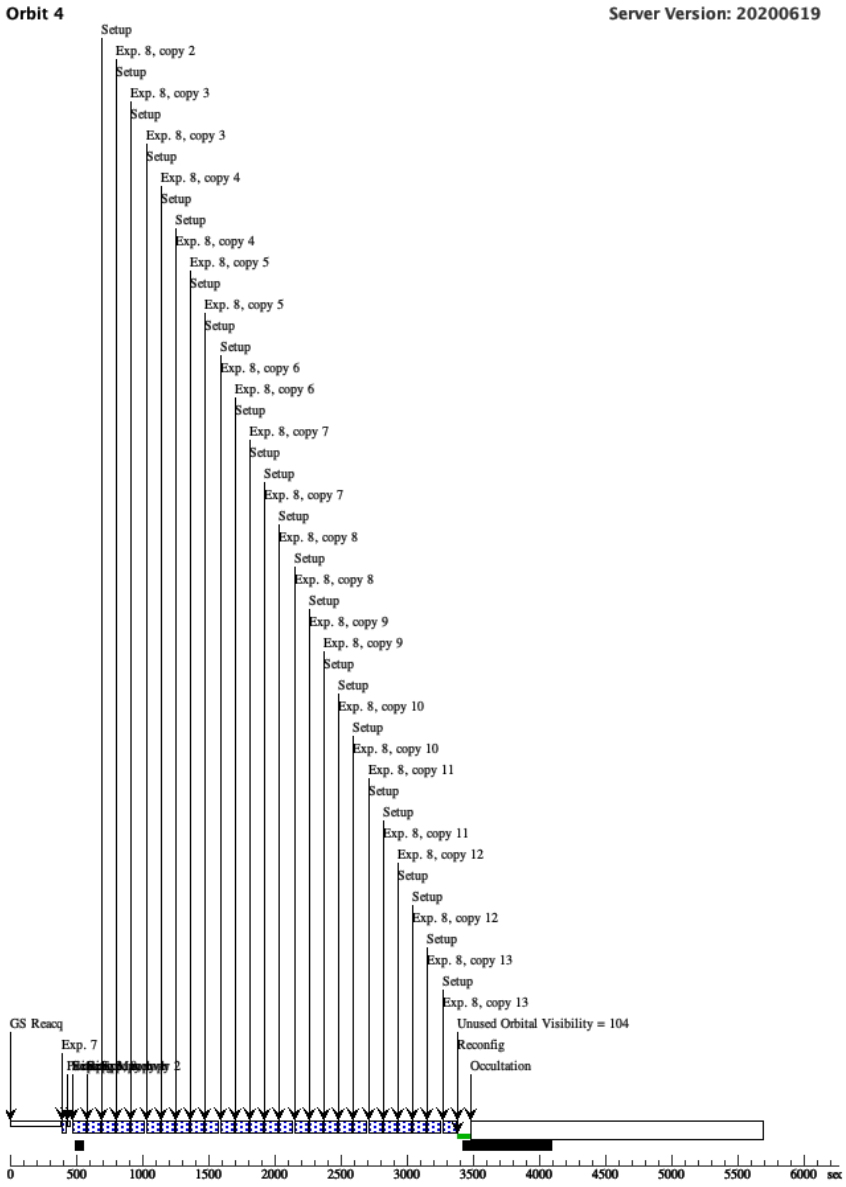
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GS Reacq
Exp. 7
Unused Orbital Visibility = 104
Reconfig
Occultation
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Visit

Proposal 16448, planet c transit 2/2 (02) Tue Dec 01 23:01:23 GMT 2020

Diagnostic Status: No Diagnostics

Scientific Instruments: WFC3/IR

Special Requirements: Period 3.6906219 D AND ZERO-PHASE HJD2458367.2755

Fixed Targets

#	Name	Target Coordinates	Targ. Coord. Corrections	Fluxes	Miscellaneous
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Comments: This object was generated by the targetselector and retrieved from the SIMBAD database.
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Exposures

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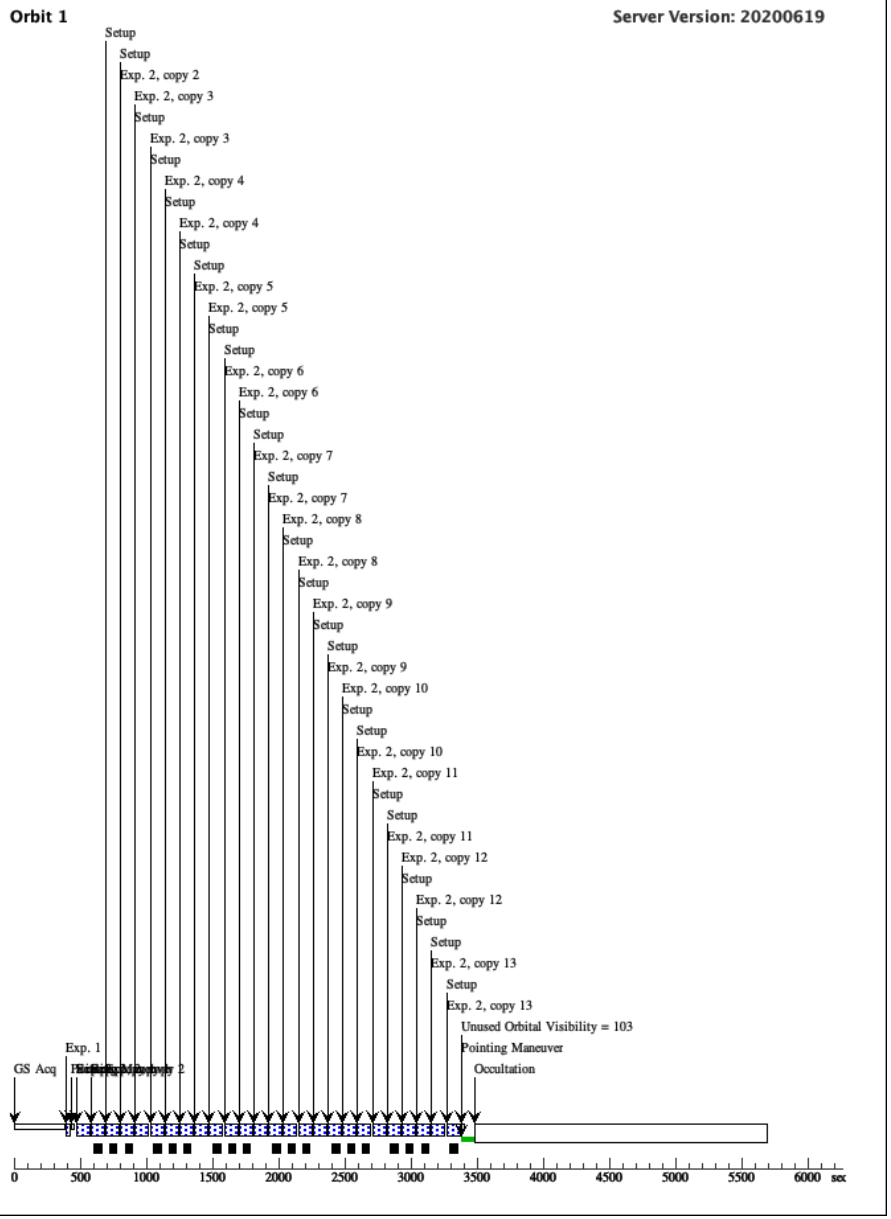
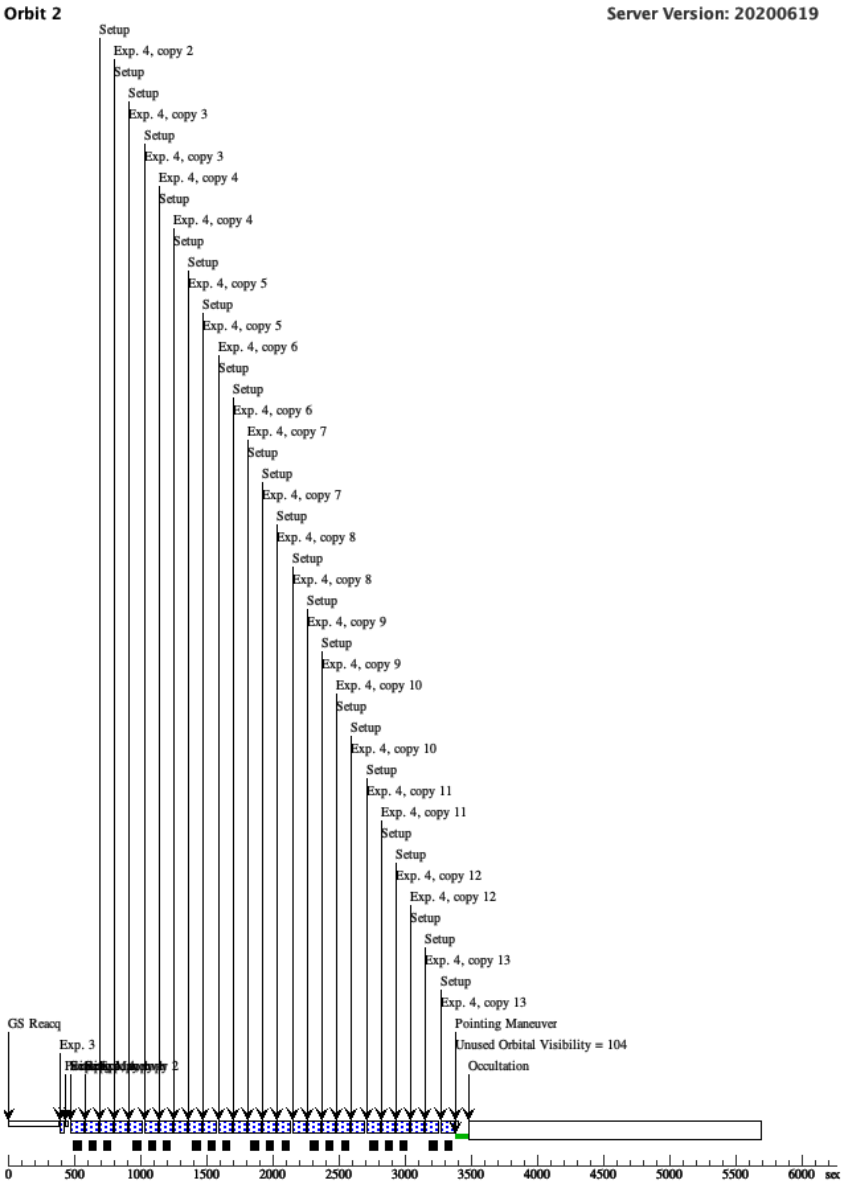
	7	(1) L-98-59	WFC3/IR, MULTIACCUM, GRISM512	F130N	NSAMP=2; SAMP-SEQ=RAPID		Sequence 7-8 Non-Int in planet c transit 2/2 (02)	1.706054 Secs (1.706 Secs) *[==>]*	***[4]***

	8	(1) L-98-59	WFC3/IR, MULTIACCUM, GRISM512	G141	NSAMP=4; SAMP-SEQ=SPARS25	POS TARG null,-21; SPATIAL SCAN 0.4 96,90.0 Degrees,Round trip	Sequence 7-8 Non-Int in planet c transit 2/2 (02)	69.61678 Secs X 13 (1810.036 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)]* *[==>(Copy 10, Forward)]* *[==>(Copy 10, Reverse)]* *[==>(Copy 11, Forward)]* *[==>(Copy 11, Reverse)]* *[==>(Copy 12, Forward)]* *[==>(Copy 12, Reverse)]* *[==>(Copy 13, Forward)]* *[==>(Copy 13, Reverse)]*	***[4]***

Orbit Structure

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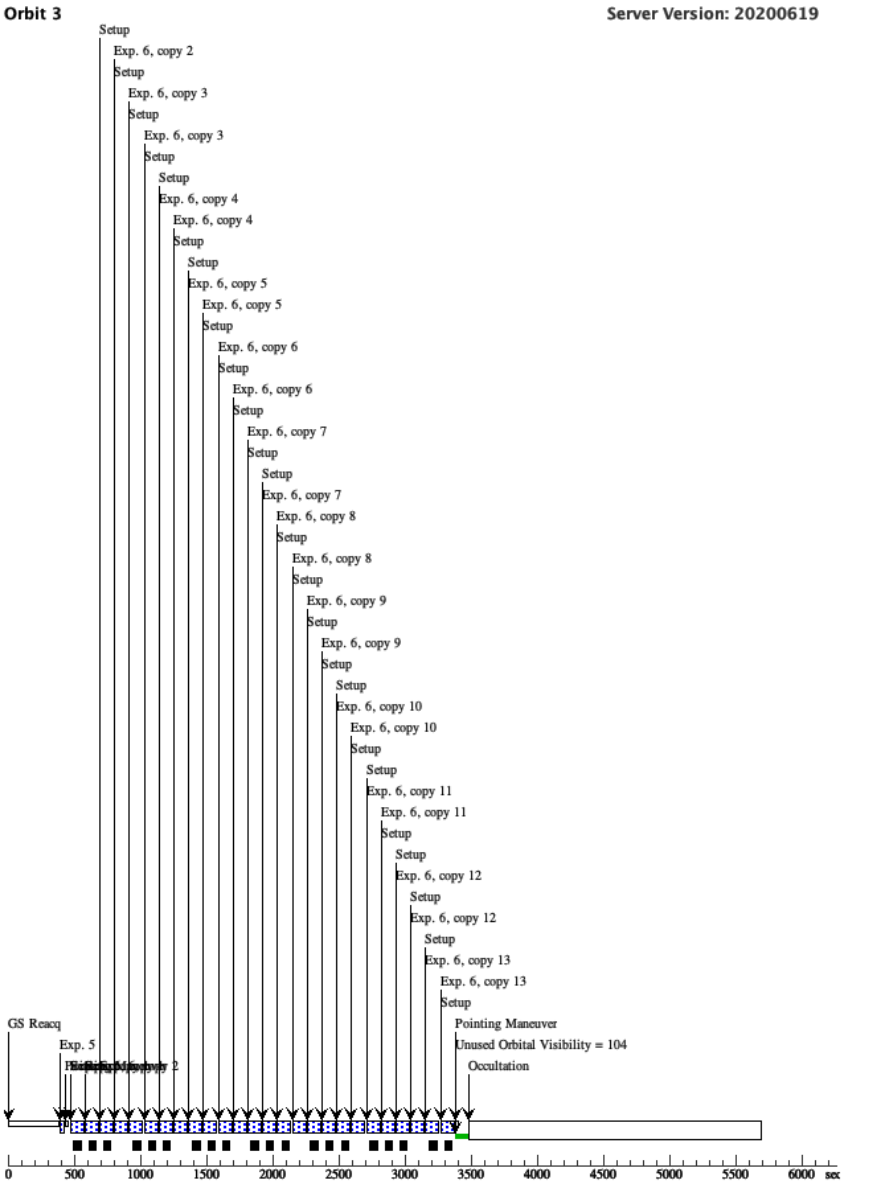
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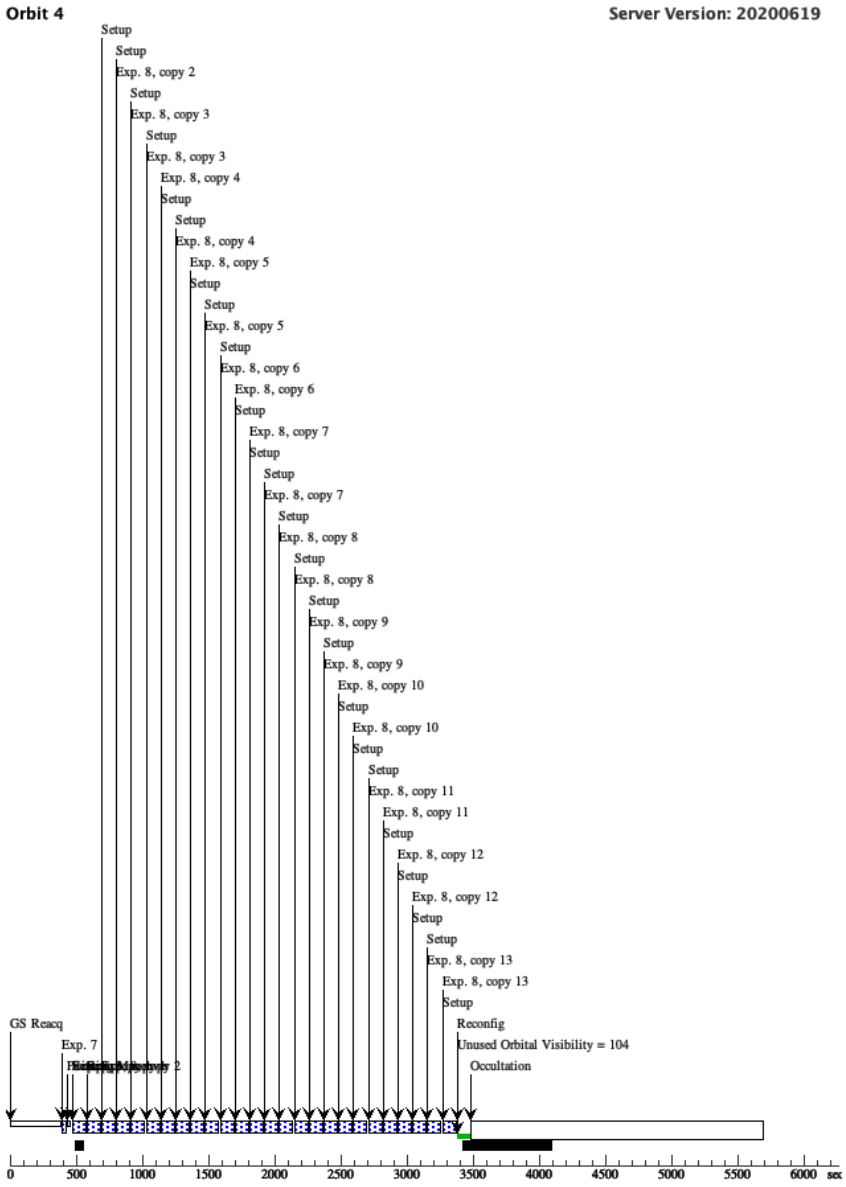
Setup
Exp. 6, copy 12
Setup
Exp. 6, copy 13
Exp. 6, copy 13
Setup
Pointing Maneuver
Unused Orbital Visibility = 104
Occultation
GS Reacq
Exp. 5
0
500
1000
1500
2000
2500
3000
3500
4000
4500
5000
5500
6000
sec


Orbit 4
Server Version: 20200619
Setup
Exp. 8, copy 2
Exp. 8, copy 3
Exp. 8, copy 4
Exp. 8, copy 5
Exp. 8, copy 6
Exp. 8, copy 7
Exp. 8, copy 8
Exp. 8, copy 9
Exp. 8, copy 10
Exp. 8, copy 11
Exp. 8, copy 12
Exp. 8, copy 13
GS Reacq
Exp. 7
Reconfig
Unused Orbital Visibility = 104
Occultation
0
500
1000
1500
2000
2500
3000
3500
4000
4500
5000
5500
6000
sec