15473 - WFC3-UVIS Eclipse Observation of WASP-43b: Helping James Webb See Through the Clouds

Cycle: 25, Proposal Category: GO

(JWST Initative)

(Availability Mode: AVAILABLE)

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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) WASP-43	WFC3/UVIS	4	10-Apr-2019 11:00:27.0	yes

4 Total Orbits Used

ABSTRACT

Observations of hot Jupiters have shown that aerosols (i.e. clouds/hazes) exist in their atmospheres, but their location and composition is not generally well known. WASP-43b is poised to become the most well characterized hot Jupiter to date, including several confirmed JWST GTO and ERS phase curve observations. However, previous observations of WASP-43b indicate that aerosol formation in its atmosphere could introduce degeneracy or spurious detections of gas phase chemistry - a major constrain on planet formation theories. In addition, optical reflectivity from these aerosols may be a dominant source of emission to constrain the total energy budget of this planet. Our proposed HST-UVIS observations will constrain the aerosol distribution and composition of WASP-43b, as well as provide essential context for interpreting the upcoming JWST-GTO and JWST-ERS results.

OBSERVING DESCRIPTION

We consulted with the STScI WFC3 instrument team for instrumental capabilities and calibration tests. STScI ISR 2017-06 details several calibration observations that reconstructed the stellar flux to <1% predicted by the WFC3-UVIS ETC at STScI. In particular, we will be using "the round trip" scan observations (scan forward, then scan back) to mitigate the unconstrained drift in the scan process; a "round trip" scan returns the detector and FGS to the same location at the beginning of every image.

We chose the F350LP filter because it minimized contribution from H2 scattering, maximizing the contrast between the cloudy and the cloudless atmosphere, and thus the SNR on the aerosol composition. We expect negligible thermal contribution. Moreover, any such thermal contribution is expeted to be anti-correlated with the reflected-light contributions and, therfore, distinguishable.

The details of our WFC3-UVIS instrument configuration are as follows. Because the WASP-43 is moderately bright (Vmag = 12.4), we will operate in spatial scan mode with a scan rate of 0.15 arcsec s^-1 perpendicular to the read direction -- for 93.1 seconds or 360 pixels -- located 100 rows (YPOS: 6.08) from the readout edge of the detector. This will result in a maximum pixel brightness of <12,500 DN (30,000 e), with minimum read noise contribution. The total scan length will be 360 pixels, which affords the use of the 512x512 sub-array mode -- with an additional 75 pixels before and after the scan. We consulted the STScI WFC3 team for geometric parameters to maximize stability of the observation along the detector's

physical rows. APT 25.4.4 determined that our observations will contain 19 frames per orbit (10 forward scan and 9 reverse scan) -- culminating in over 75 frames for the entire program. Using STScI's WFC3-UVIS ETC, we expected an SNR~7800 per frame -- coinciding with a photometric precision per frame of 128 ppm.

Visit

Proposal 15473, WASP43 UVIS (01), implementation Wed Apr 10 15:00:31 GMT 2019

Diagnostic Status: No Diagnostics

Scientific Instruments: WFC3/UVIS

Special Requirements: SCHED 100%; ORIENT 100D TO 80 D; Period 0.813473978 D AND ZERO-PHASE HJD2455528.868634

Fixed Targets

#	Name	Target Coordinates	Targ. Coord. Corrections	Fluxes	Miscellaneous
(1)	WASP-43	RA: 10 19 38.0080 (154.9083667d) Dec: -09 48 22.59 (-9.80628d) Equinox: J2000		V=12.4	Reference Frame: SIMBAD

Comments: This object was generated by the targetselector and retrieved from the SIMBAD database.
Category=STAR
Description=[EXTRA-SOLAR PLANET, EXTRA-SOLAR PLANETARY SYSTEM, K V-IV]
Extended=NO

Exposures

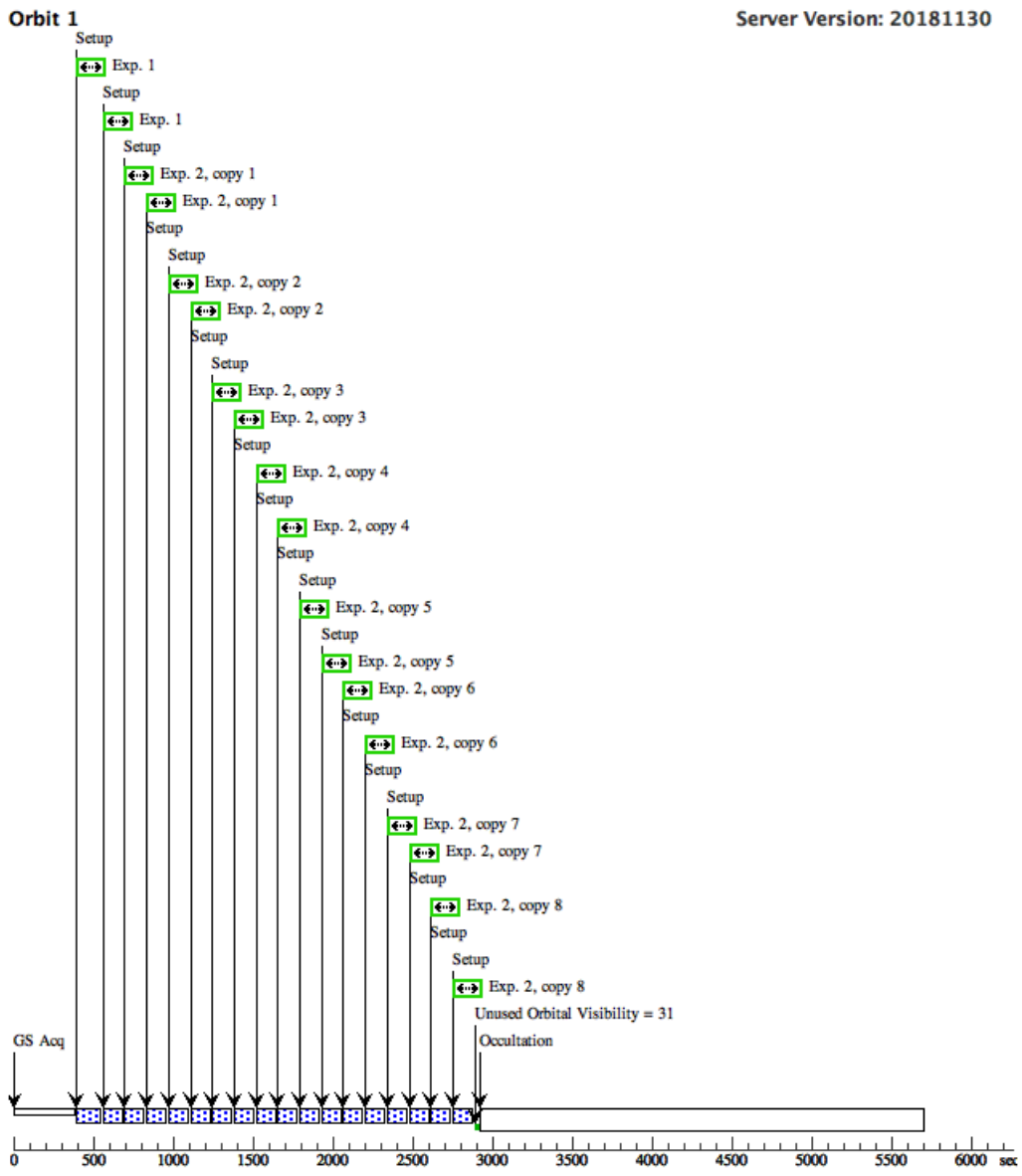
#	Label (ETC Run)	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time (Total)/[Actual Dur.]	Orbit
1	(1166501)	(1) WASP-43	WFC3/UVIS, ACCUM, UVIS2	F350LP	FLASH=6; BIN=NONE; CR-SPLIT=NO; SIZEAXIS1=974; SIZEAXIS2=400; CENTERAXIS1=490; CENTERAXIS2=201	POS TARG -73.18,-37.54; SPATIAL SCAN 0.2258,3.7702 Degrees, Round trip; PHASE 0.306956 TO 0.324040; GS ACQ SCENARIO BASE1BE	Sequence 1-2 Non-Int in WASP43 UVIS (01)	82 Secs (164 Secs) *[==>(Forward)]* *[==>(Reverse)]*	***[1]***
2		(1) WASP-43	WFC3/UVIS, ACCUM, UVIS2	F350LP	FLASH=6; BIN=NONE; CR-SPLIT=NO; CENTERAXIS1=490; CENTERAXIS2=201; SIZEAXIS1=974; SIZEAXIS2=400	POS TARG -73.18,-37.54; SPATIAL SCAN 0.2258,3.7702 Degrees, Round trip	Sequence 1-2 Non-Int in WASP43 UVIS (01)	82 Secs X 8 (1312 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)]*	***[1]***

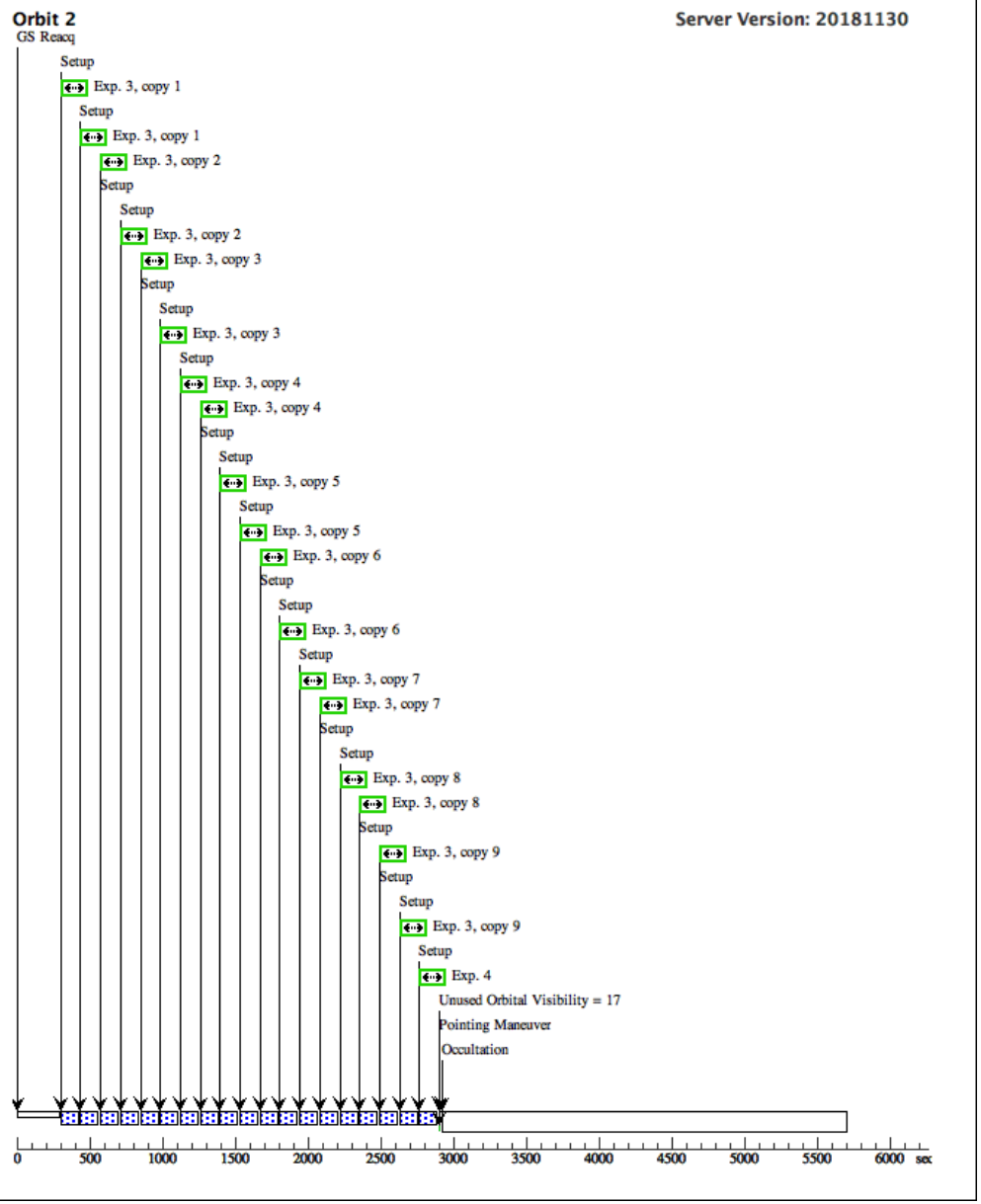
3	(1) WASP-43	WFC3/UVIS, ACCUM, UVIS2	F350LP	FLASH=6; BIN=NONE; CR-SPLIT=NO; CENTERAXIS1=490; CENTERAXIS2=201; SIZEAXIS1=974; SIZEAXIS2=400	POS TARG -73.18,-37.54; SPATIAL SCAN 0.2258,3.7702 Degrees, Round trip	Sequence 3-4 Non-Int in WASP43 UVIS (01)	82 Secs X 9 (1476 Secs) *[==>(Copy 1, Forward)]* *[==>(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)]*	***[2]***
4	(1) WASP-43	WFC3/UVIS, ACCUM, UVIS2	F350LP	FLASH=6; BIN=NONE; CR-SPLIT=NO; CENTERAXIS1=490; CENTERAXIS2=201; SIZEAXIS1=974; SIZEAXIS2=400	POS TARG -73.18,-37.54; SPATIAL SCAN 0.2258,3.7702 Degrees, Forward	Sequence 3-4 Non-Int in WASP43 UVIS (01)	82 Secs (82 Secs) *[==>]*	***[2]***

	5	(1) WASP-43	WFC3/UVIS, ACCUM, UVIS2	F350LP	FLASH=6; BIN=NONE; CR-SPLIT=NO; CENTERAXIS1=490; CENTERAXIS2=201; SIZEAXIS1=974; SIZEAXIS2=400	POS TARG -73.18,-37.54; SPATIAL SCAN 0.2 258,3.7702 Degrees, Round trip	Sequence 5-6 Non-Int in WASP43 UVIS (01)	82 Secs X 9 (1476 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)]*	***[3]***
	6	(1) WASP-43	WFC3/UVIS, ACCUM, UVIS2	F350LP	FLASH=6; BIN=NONE; CR-SPLIT=NO; CENTERAXIS1=490; CENTERAXIS2=201; SIZEAXIS1=974; SIZEAXIS2=400	POS TARG -73.18,-37.54; SPATIAL SCAN 0.2 258,3.7702 Degrees, Forward	Sequence 5-6 Non-Int in WASP43 UVIS (01)	82 Secs (82 Secs) *[==>]*	***[3]***

	7	(1) WASP-43	WFC3/UVIS, ACCUM, UVIS2	F350LP	FLASH=6; BIN=NONE; CR-SPLIT=NO; CENTERAXIS1=490; CENTERAXIS2=201; SIZEAXIS1=974; SIZEAXIS2=400	POS TARG -73.18,-37.54; SPATIAL SCAN 0.2 258,3.7702 Degrees, Round trip	Sequence 7-8 Non-Int in WASP43 UVIS (01)	82 Secs X 9 (1476 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)]*	***[4]***
	8	(1) WASP-43	WFC3/UVIS, ACCUM, UVIS2	F350LP	FLASH=6; BIN=NONE; CR-SPLIT=NO; CENTERAXIS1=490; CENTERAXIS2=201; SIZEAXIS1=974; SIZEAXIS2=400	POS TARG -73.18,-37.54; SPATIAL SCAN 0.2 258,3.7702 Degrees, Forward	Sequence 7-8 Non-Int in WASP43 UVIS (01)	82 Secs (82 Secs) *[==>]*	***[4]***

Orbit Structure

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Exp. 3, copy 5
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Exp. 3, copy 8
Exp. 3, copy 8
Setup
Exp. 3, copy 9
Setup
Setup
Exp. 3, copy 9
Setup
Exp. 4
Unused Orbital Visibility = 17
Pointing Maneuver
Occultation
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2000
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3500
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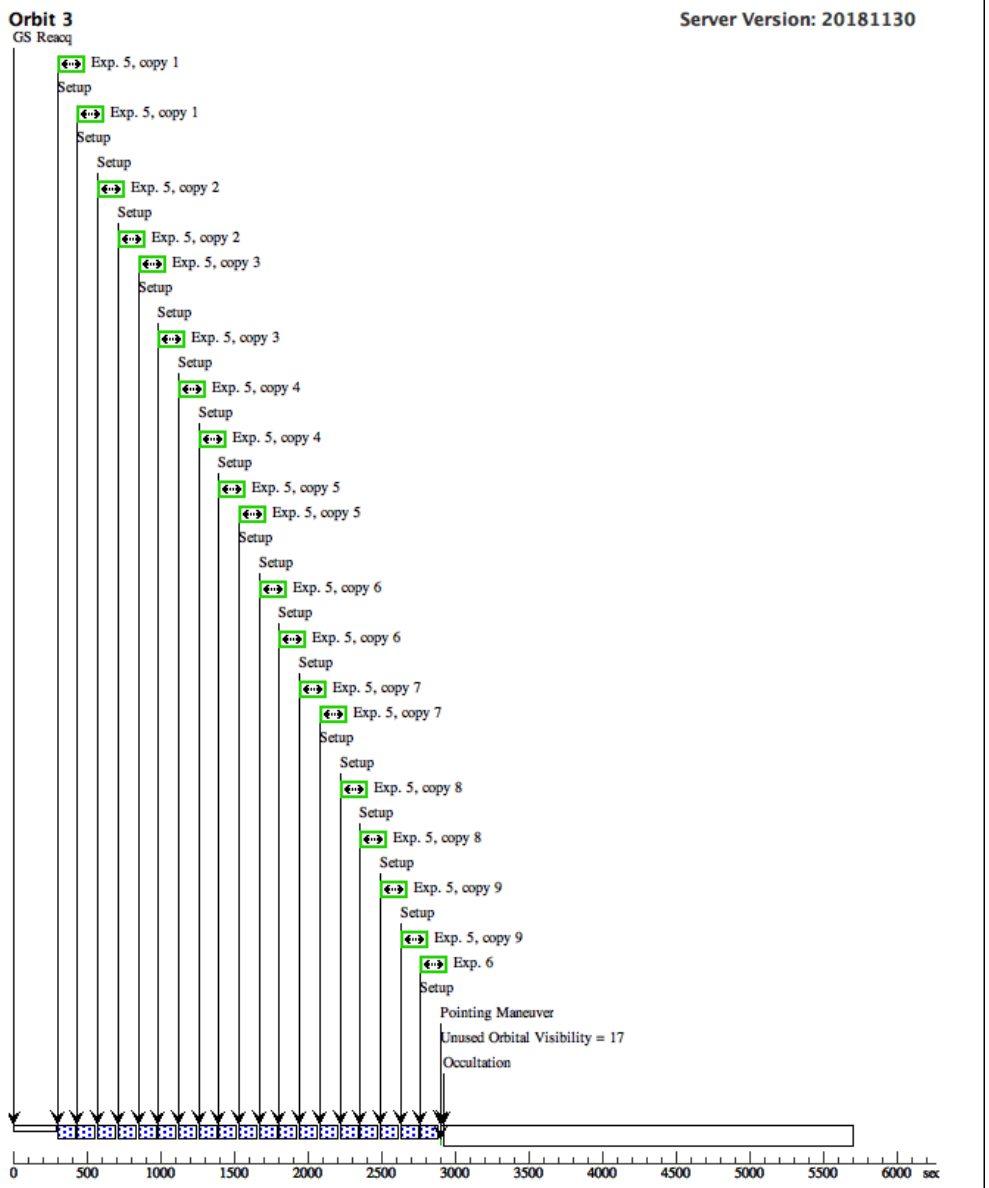
sec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Server Version: 20181130
GS Reacq
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Exp. 5, copy 3
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Exp. 5, copy 8
Setup
Exp. 5, copy 8
Setup
Exp. 5, copy 9
Setup
Exp. 5, copy 9
Exp. 6
Setup
Pointing Maneuver
Unused Orbital Visibility = 17
Occultation
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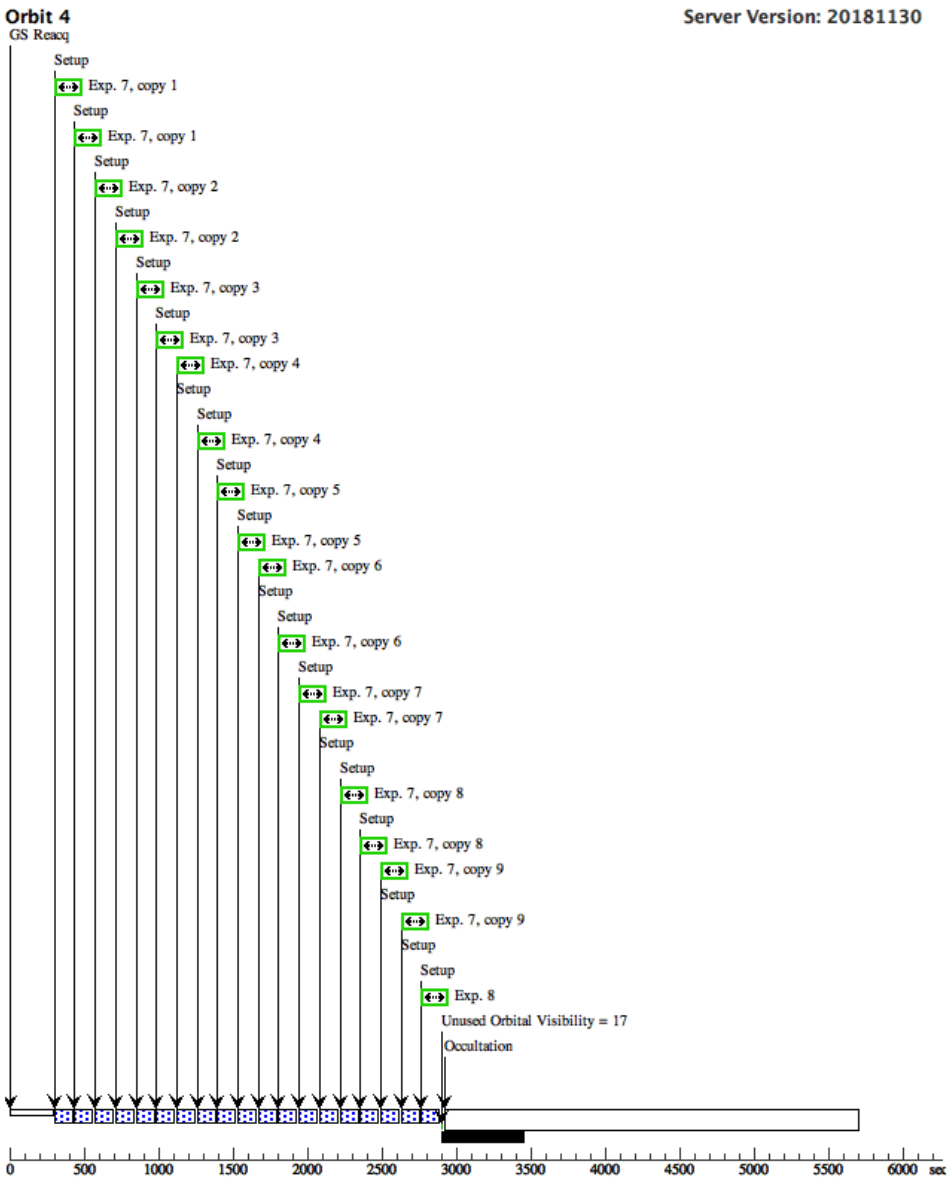
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Server Version: 20181130
GS Reacq
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Exp. 7, copy 8
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Exp. 7, copy 8
Exp. 7, copy 9
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Exp. 7, copy 9
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Setup
Exp. 8
Unused Orbital Visibility = 17
Occultation
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sec