16721 - The Angular Momentum Architecture of Long-Period Giant Planets and Brown Dwarf Companions

Cycle: 29, 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) GL229-B	WFC3/IR	6	28-Jul-2021 18:00:30.0	yes
02	(2) 2M2236+4751	WFC3/IR	1	28-Jul-2021 18:00:34.0	yes
04	(2) 2M2236+4751	WFC3/IR	1	28-Jul-2021 18:00:35.0	yes
05	(2) 2M2236+4751	WFC3/IR	1	28-Jul-2021 18:00:36.0	yes
06	(2) 2M2236+4751	WFC3/IR	1	28-Jul-2021 18:00:37.0	yes
07	(2) 2M2236+4751	WFC3/IR	1	28-Jul-2021 18:00:38.0	yes
08	(2) 2M2236+4751	WFC3/IR	1	28-Jul-2021 18:00:39.0	yes

Visit	*Targets used in Visit*	*Configurations used in Visit*	*Orbits Used*	*Last Orbit Planner Run*	*OP Current with Visit?*
03	(3) CD-35-2722	WFC3/IR	6	28-Jul-2021 18:02:20.0	yes

18 Total Orbits Used

ABSTRACT

The origin of giant planets and brown dwarfs discovered with direct imaging at wide separations (>10 AU) is challenging to establish because multiple formation and migration mechanisms are possible. The goal of this program is to determine the angular momentum architecture of systems hosting imaged substellar companions to constrain their formation and evolutionary history. We propose WFC3/IR time-series observations of three substellar companions spanning 10-60 Mjup to search for rotationally modulated photometric variability. Rotation periods will be combined with projected rotational velocities (vsini values) and orbit monitoring efforts from the ground to assess the geometric alignment between the orbital angular momentum vector and both the stellar and companion spin axes. Mutual alignment would point to a disk-based origin while misalignment will indicate an alternative route or dynamical evolution. To date, only a single obliquity angle has been measured for a substellar companion; we aim to broaden this to a larger sample, paving the way for similar studies of lower-mass planets at longer wavelengths with JWST.

OBSERVING DESCRIPTION

The science goal of this program is to measure the rotation periods of three substellar companions with time-series WFC3 imaging (for one object) and grism spectroscopy (for the other two). The relative amplitude, wavelength-dependency, and possible phase shifts of the variability provide information about cloud structure and dynamics in these low-mass companions.

Detailed observing description:

The companions are separated by 3-8" from their hosts, have contrasts of dJ=5.7-10 mag, and apparent J-band magnitudes between 13.6-20.0 mag. The host stars range from J=5.1 to 10.0 mag.

For CD-35 2722 B and Gl 229 B, we empoy the G141 grism to disperse their 1.1-1.7 um spectra and capture more flux than a broadband filter. This will also provide spectra covering the water absorption band and enables the opportunity to search for wavelength-dependent variability, a signature of mid-altitude clouds. The contrast between 2M2236+4751 A and b is much higher (dJ=10 mag) and the companion is fainter, so the F125W filter is preferred.

The 256x256 subarray (~30"x30" field of view) will be read out to eliminate the need for in-orbit buffer dumps and improve duty cycle.

The 2M2236+4751 observations will comprise consecutive exposures throughout each orbit in imaging mode followed by a reorientation of the telescope by ~30 deg in adjacent orbits to facilitate PSF roll subtraction.

For CD-35 2722 B and Gl 229 B, we will obtain a single image in F132N immediately at the start of each orbit to determine the location of the companion in the grism data. This is also useful for wavelength calibration. For these two targets, the telescope roll angle should be oriented so that the grism dispersion direction is orthogonal to the binary PA.

The six orbit allocations for each target should be carried out consecutively in one block to maximize uninterrupted coverage.

To minimize flat-fielding errors, each target will be positioned at the same location on the detector for each orbit. As a result there will be no dithering for these observations.

This program requires roll constraints for the G141 observations to maximize the separation between the dispersion of the host and companion spectra (25-45 deg or 225-245 deg for Gl 229 B, and 97-117 deg or 277-297 deg for CD-35 2722 B). All six orbits for each target must also be acquired back-to-back to obtain one continuous 8.5 hour light curve (except during parts of the orbit when the target is out of view). For 2M2236, to facilitate PSF roll subtraction, adjacent orbits should be oriented with roll angles of about +/-20-40 deg from the original configuration while also avoiding diffraction spikes.

Visit

Proposal 16721, Visit 1: Gl 229 B (01) Wed Jul 28 22:02:23 GMT 2021

Diagnostic Status: No Diagnostics

Scientific Instruments: WFC3/IR

Special Requirements: ORIENT 296D TO 316 D; ORIENT 116D TO 136 D

Comments: +/- 20 deg tolerance in Orient

Fixed Targets

#	Name	Target Coordinates	Targ. Coord. Corrections	Fluxes	Miscellaneous
(1)	GL229-B	RA: 06 10 34.6800 (92.6445000d)	Proper Motion RA: -135.7 mas/yr	V=(?)	Reference Frame: SIMBAD
		Dec: -21 51 58.78 (-21.86633d)	Proper Motion Dec: -719.2 mas/yr	J=14.2	
		Equinox: J2000	Epoch of Position: 2000.0		

Comments: The spectral type of the science target (Gl 229 B) is ~T7. The coordinates and magnitudes listed here are for the companion Gl 229 B, which is located 6.2 arcsec from its host at a PA of 171 deg. The J2000 coordinates for the host star (M1 spectral type) are RA=06:10:34.615, Dec=-21:51:52.66. The host star magnitudes are: V=8.1, J=5.1, H=4.4.
Category=STAR
Description=[BROWN DWARF]
Extended=NO

Exposures

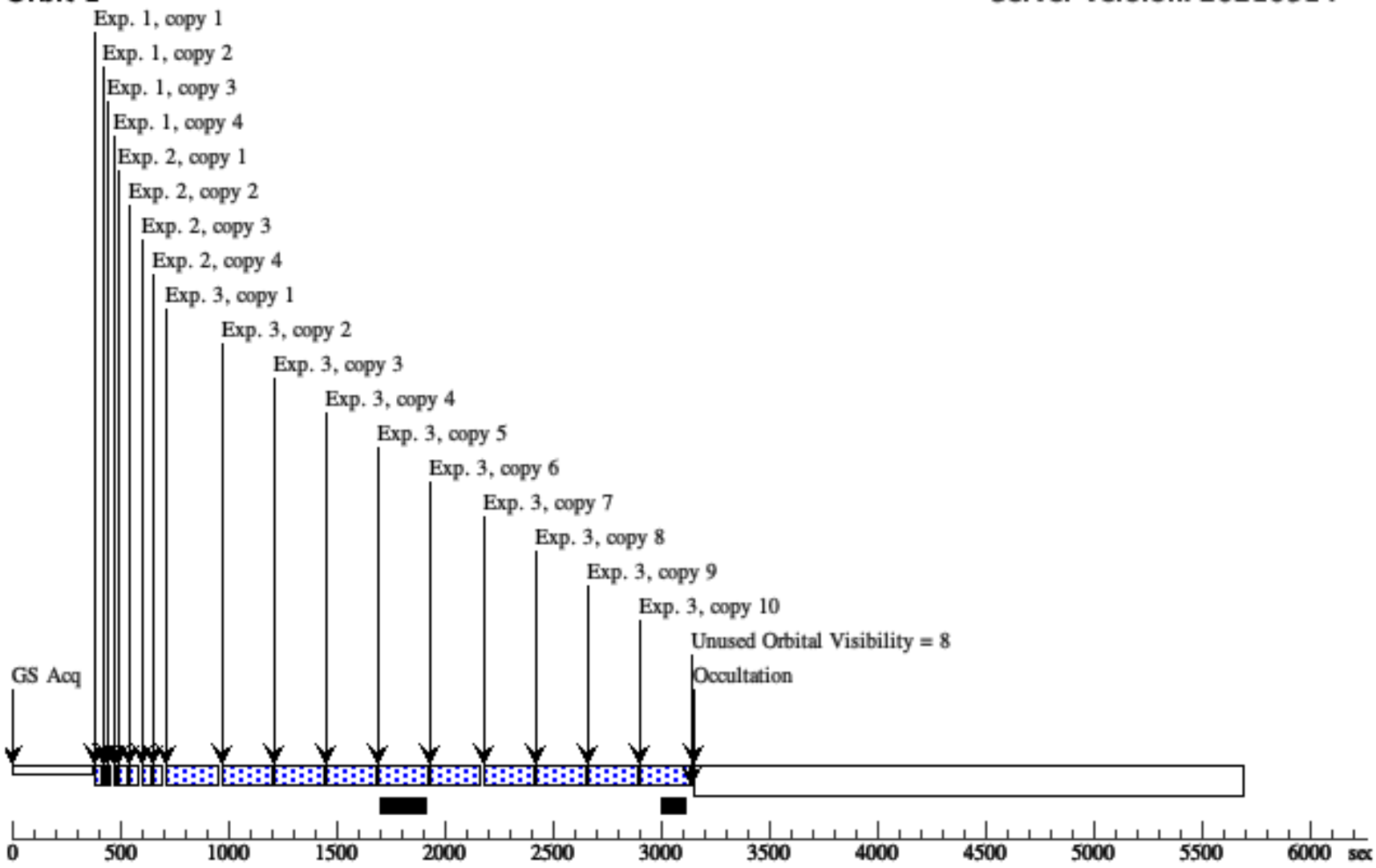
#	Label	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time (Total)/[Actual Dur.]	Orbit
1	Orbit 1: Image in F132N (shallow)	(1) GL229-B	WFC3/IR, MULTIACCUM, GRISM256	F132N	SAMP-SEQ=RAPID; NSAMP=15			4.167225 Secs X 4 (16.669 Secs) *[==>(Copy 1)]* *[==>(Copy 2)]* *[==>(Copy 3)]* *[==>(Copy 4)]*	***[1]***
2	Orbit 1: Image in F132N (deep)	(1) GL229-B	WFC3/IR, MULTIACCUM, GRISM256	F132N	SAMP-SEQ=SPARS10; NSAMP=6			37.01025 Secs X 4 (148.041 Secs) *[==>(Copy 1)]* *[==>(Copy 2)]* *[==>(Copy 3)]* *[==>(Copy 4)]*	***[1]***
Comments: Image in F132N for wavelength calibration									
3	Orbit 1: G141 spectrum	(1) GL229-B	WFC3/IR, MULTIACCUM, GRISM256	G141	SAMP-SEQ=SPARS25; NSAMP=11			223.738205 Secs X 10 (2237.382 Secs) *[==>(Copy 1)]* *[==>(Copy 2)]* *[==>(Copy 3)]* *[==>(Copy 4)]* *[==>(Copy 5)]* *[==>(Copy 6)]* *[==>(Copy 7)]* *[==>(Copy 8)]* *[==>(Copy 9)]* *[==>(Copy 10)]*	***[1]***
4	Orbit 2: Image in F132N (shallow)	(1) GL229-B	WFC3/IR, MULTIACCUM, GRISM256	F132N	SAMP-SEQ=RAPID; NSAMP=15			4.167225 Secs X 4 (16.669 Secs) *[==>(Copy 1)]* *[==>(Copy 2)]* *[==>(Copy 3)]* *[==>(Copy 4)]*	***[2]***
5	Orbit 2: Image in F132N (deep)	(1) GL229-B	WFC3/IR, MULTIACCUM, GRISM256	F132N	SAMP-SEQ=SPARS10; NSAMP=6			37.01025 Secs X 3 (111.031 Secs) *[==>(Copy 1)]* *[==>(Copy 2)]* *[==>(Copy 3)]*	***[2]***
Comments: Image in F132N for wavelength calibration									

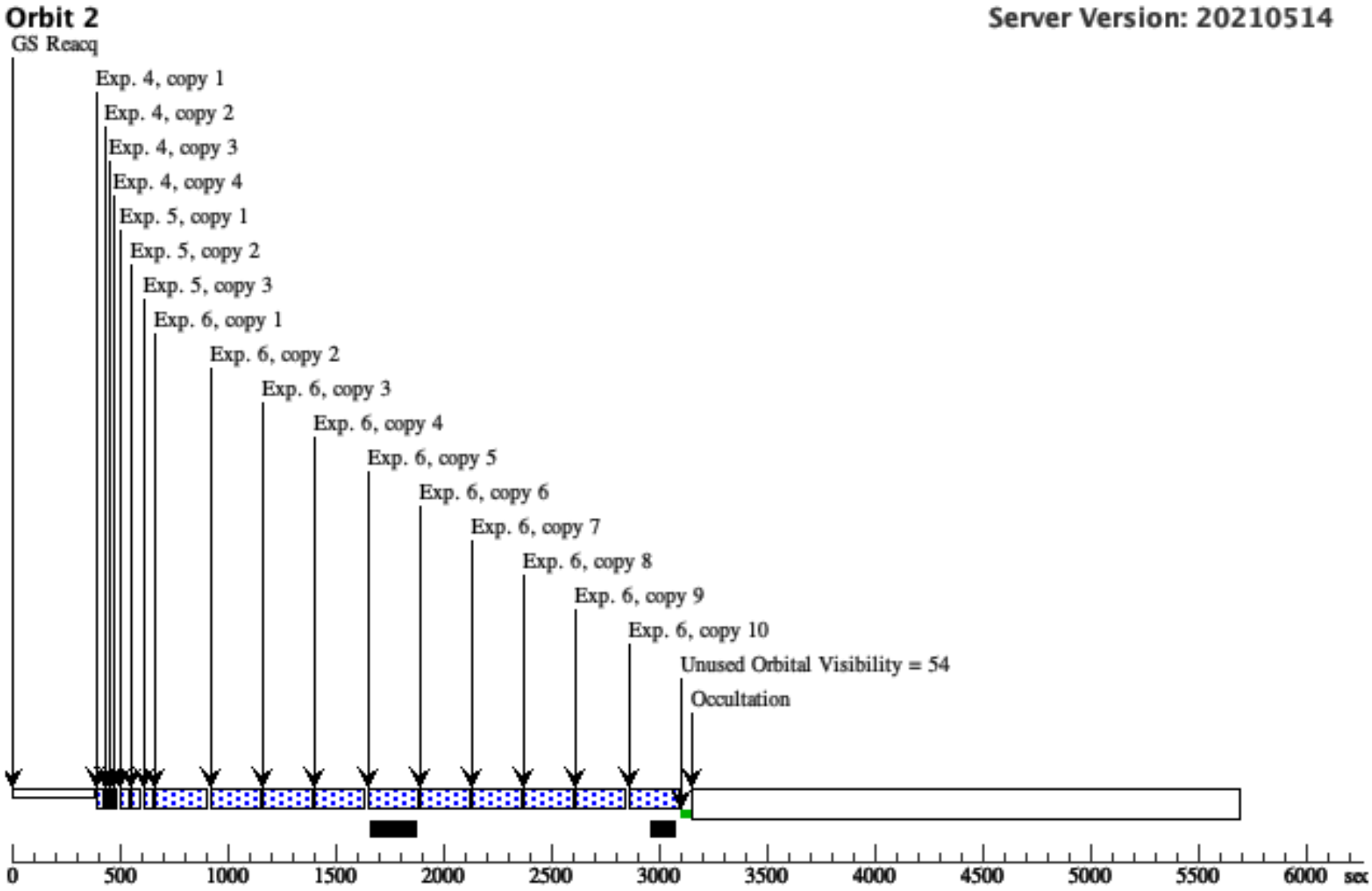
6	Orbit 2: G141 spectrum	(1) GL229-B	WFC3/IR, MULTIACCUM, GRISM256	G141	SAMP-SEQ=SPARS25; NSAMP=11	223.738205 Secs X 10 (2237.382 Secs) *[==>(Copy 1)]* *[==>(Copy 2)]* *[==>(Copy 3)]* *[==>(Copy 4)]* *[==>(Copy 5)]* *[==>(Copy 6)]* *[==>(Copy 7)]* *[==>(Copy 8)]* *[==>(Copy 9)]* *[==>(Copy 10)]*	***[2]***
7	Orbit 3: Image in F132N (shallow)	(1) GL229-B	WFC3/IR, MULTIACCUM, GRISM256	F132N	SAMP-SEQ=RAPID; NSAMP=15	4.167225 Secs X 4 (16.669 Secs) *[==>(Copy 1)]* *[==>(Copy 2)]* *[==>(Copy 3)]* *[==>(Copy 4)]*	***[3]***
8	Orbit 3: Image in F132N (deep)	(1) GL229-B	WFC3/IR, MULTIACCUM, GRISM256	F132N	SAMP-SEQ=SPARS10; NSAMP=6	37.01025 Secs X 3 (111.031 Secs) *[==>(Copy 1)]* *[==>(Copy 2)]* *[==>(Copy 3)]*	***[3]***
Comments: Image in F132N for wavelength calibration							
9	Orbit 3: G141 spectrum	(1) GL229-B	WFC3/IR, MULTIACCUM, GRISM256	G141	SAMP-SEQ=SPARS25; NSAMP=11	223.738205 Secs X 10 (2237.382 Secs) *[==>(Copy 1)]* *[==>(Copy 2)]* *[==>(Copy 3)]* *[==>(Copy 4)]* *[==>(Copy 5)]* *[==>(Copy 6)]* *[==>(Copy 7)]* *[==>(Copy 8)]* *[==>(Copy 9)]* *[==>(Copy 10)]*	***[3]***
10	Orbit 4: Image in F132N (shallow)	(1) GL229-B	WFC3/IR, MULTIACCUM, GRISM256	F132N	SAMP-SEQ=RAPID; NSAMP=15	4.167225 Secs X 4 (16.669 Secs) *[==>(Copy 1)]* *[==>(Copy 2)]* *[==>(Copy 3)]* *[==>(Copy 4)]*	***[4]***
11	Orbit 4: Image in F132N (deep)	(1) GL229-B	WFC3/IR, MULTIACCUM, GRISM256	F132N	SAMP-SEQ=SPARS10; NSAMP=6	37.01025 Secs X 3 (111.031 Secs) *[==>(Copy 1)]* *[==>(Copy 2)]* *[==>(Copy 3)]*	***[4]***
Comments: Image in F132N for wavelength calibration							

12	Orbit 4: G141 spectrum	(1) GL229-B	WFC3/IR, MULTIACCUM, GRISM256	G141	SAMP-SEQ=SPARS25; NSAMP=11	223.738205 Secs X 10 (2237.382 Secs) *[==>(Copy 1)]* *[==>(Copy 2)]* *[==>(Copy 3)]* *[==>(Copy 4)]* *[==>(Copy 5)]* *[==>(Copy 6)]* *[==>(Copy 7)]* *[==>(Copy 8)]* *[==>(Copy 9)]* *[==>(Copy 10)]*	***[4]***
13	Orbit 5: Image in F132N (shallow)	(1) GL229-B	WFC3/IR, MULTIACCUM, GRISM256	F132N	SAMP-SEQ=RAPID; NSAMP=15	4.167225 Secs X 4 (16.669 Secs) *[==>(Copy 1)]* *[==>(Copy 2)]* *[==>(Copy 3)]* *[==>(Copy 4)]*	***[5]***
14	Orbit 5: Image in F132N (deep)	(1) GL229-B	WFC3/IR, MULTIACCUM, GRISM256	F132N	SAMP-SEQ=SPARS10; NSAMP=6	37.01025 Secs X 3 (111.031 Secs) *[==>(Copy 1)]* *[==>(Copy 2)]* *[==>(Copy 3)]*	***[5]***
Comments: Image in F132N for wavelength calibration							
15	Orbit 5: G141 spectrum	(1) GL229-B	WFC3/IR, MULTIACCUM, GRISM256	G141	SAMP-SEQ=SPARS25; NSAMP=11	223.738205 Secs X 10 (2237.382 Secs) *[==>(Copy 1)]* *[==>(Copy 2)]* *[==>(Copy 3)]* *[==>(Copy 4)]* *[==>(Copy 5)]* *[==>(Copy 6)]* *[==>(Copy 7)]* *[==>(Copy 8)]* *[==>(Copy 9)]* *[==>(Copy 10)]*	***[5]***
16	Orbit 6: Image in F132N (shallow)	(1) GL229-B	WFC3/IR, MULTIACCUM, GRISM256	F132N	SAMP-SEQ=RAPID; NSAMP=15	4.167225 Secs X 4 (16.669 Secs) *[==>(Copy 1)]* *[==>(Copy 2)]* *[==>(Copy 3)]* *[==>(Copy 4)]*	***[6]***
17	Orbit 6: Image in F132N (deep)	(1) GL229-B	WFC3/IR, MULTIACCUM, GRISM256	F132N	SAMP-SEQ=SPARS10; NSAMP=6	37.01025 Secs X 3 (111.031 Secs) *[==>(Copy 1)]* *[==>(Copy 2)]* *[==>(Copy 3)]*	***[6]***
Comments: Image in F132N for wavelength calibration							

	18	Orbit 6: G14 1 spectrum	(1) GL229-B	WFC3/IR, MULTIACCUM, GRISM256	G141	SAMP-SEQ=SPARS 25; NSAMP=11	223.738205 Secs X 10 (2237.382 Secs) *[==>(Copy 1)]* *[==>(Copy 2)]* *[==>(Copy 3)]* *[==>(Copy 4)]* *[==>(Copy 5)]* *[==>(Copy 6)]* *[==>(Copy 7)]* *[==>(Copy 8)]* *[==>(Copy 9)]* *[==>(Copy 10)]*	***[6]***

Orbit Structure

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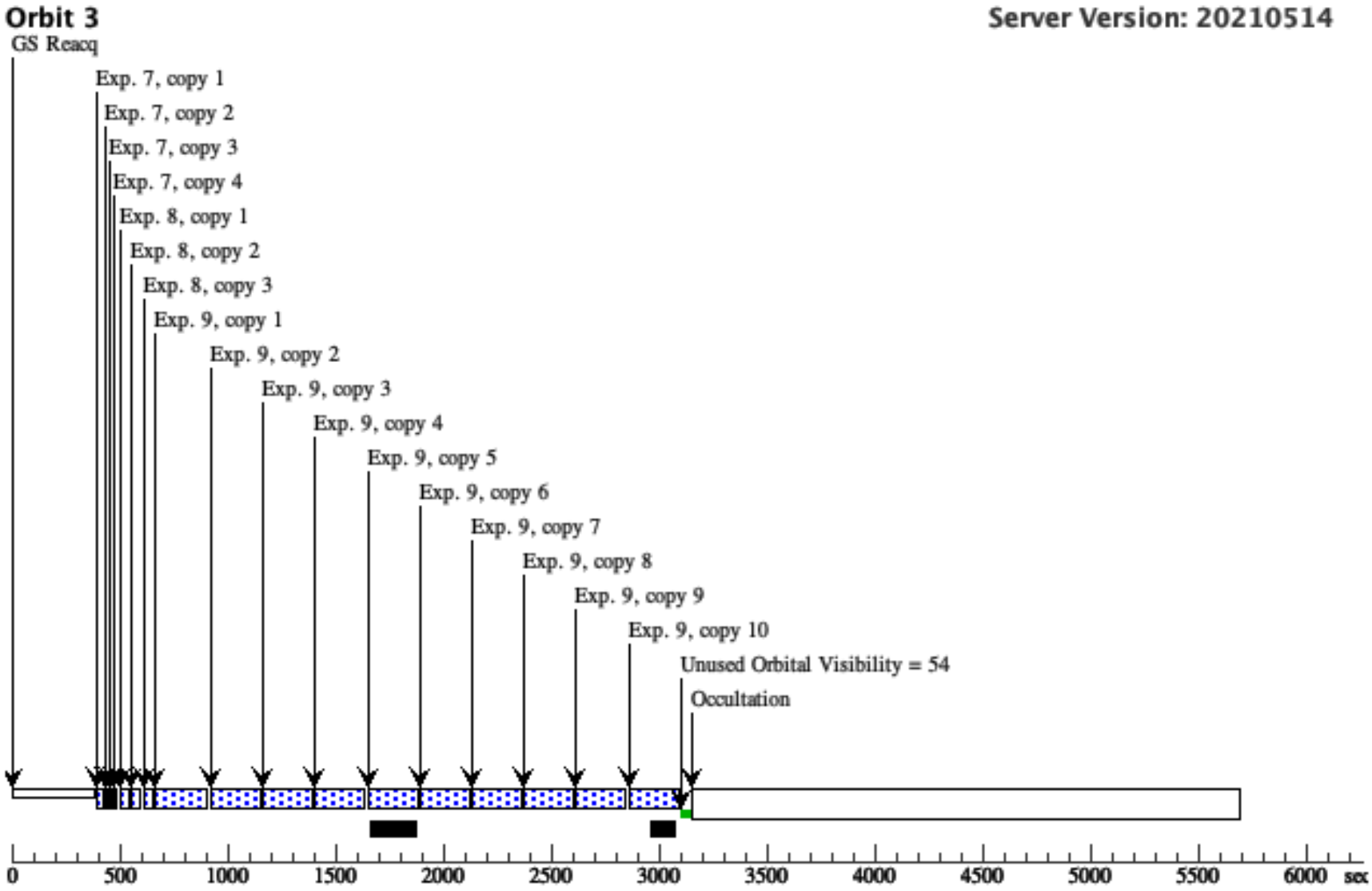
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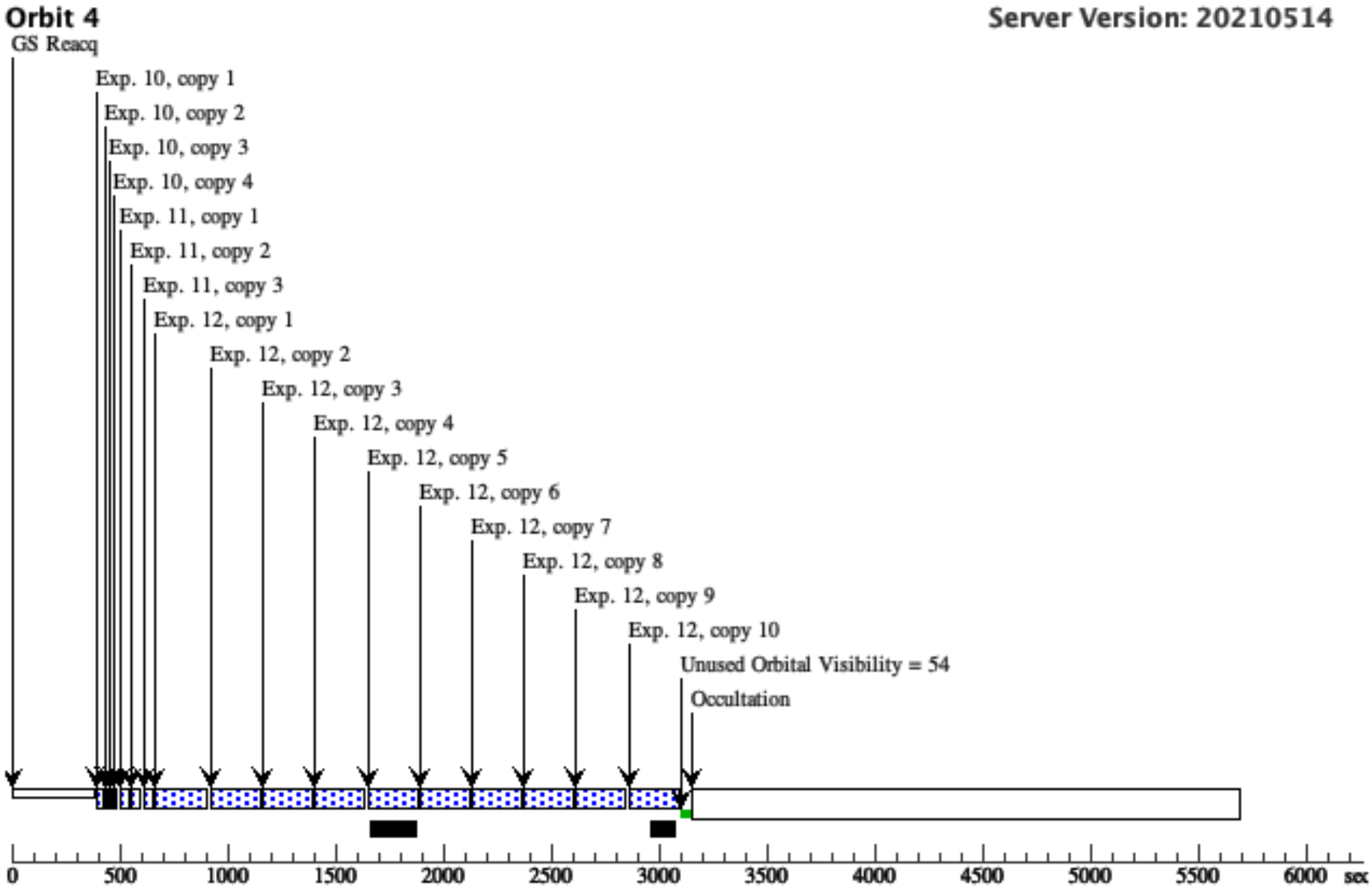
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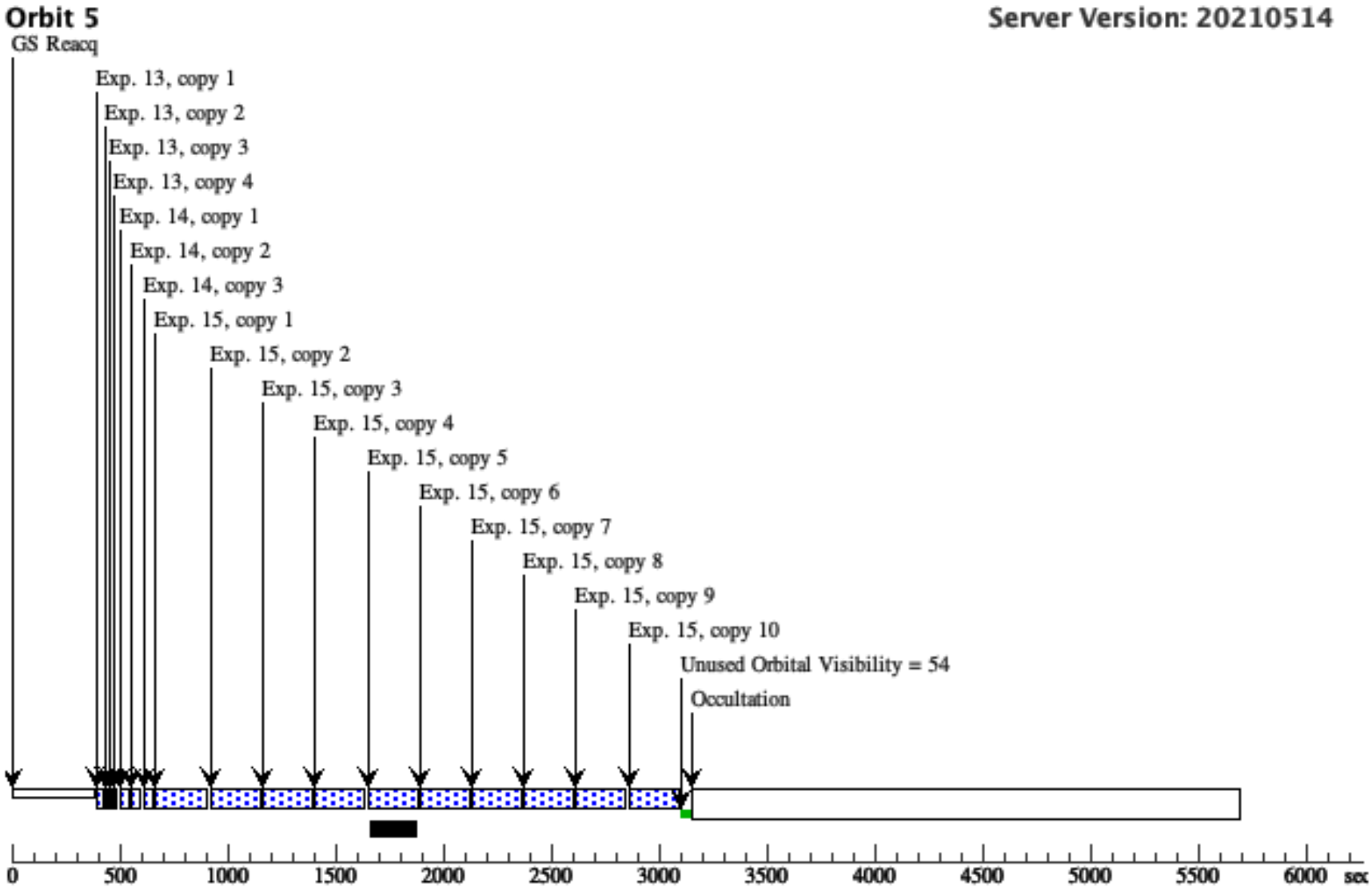
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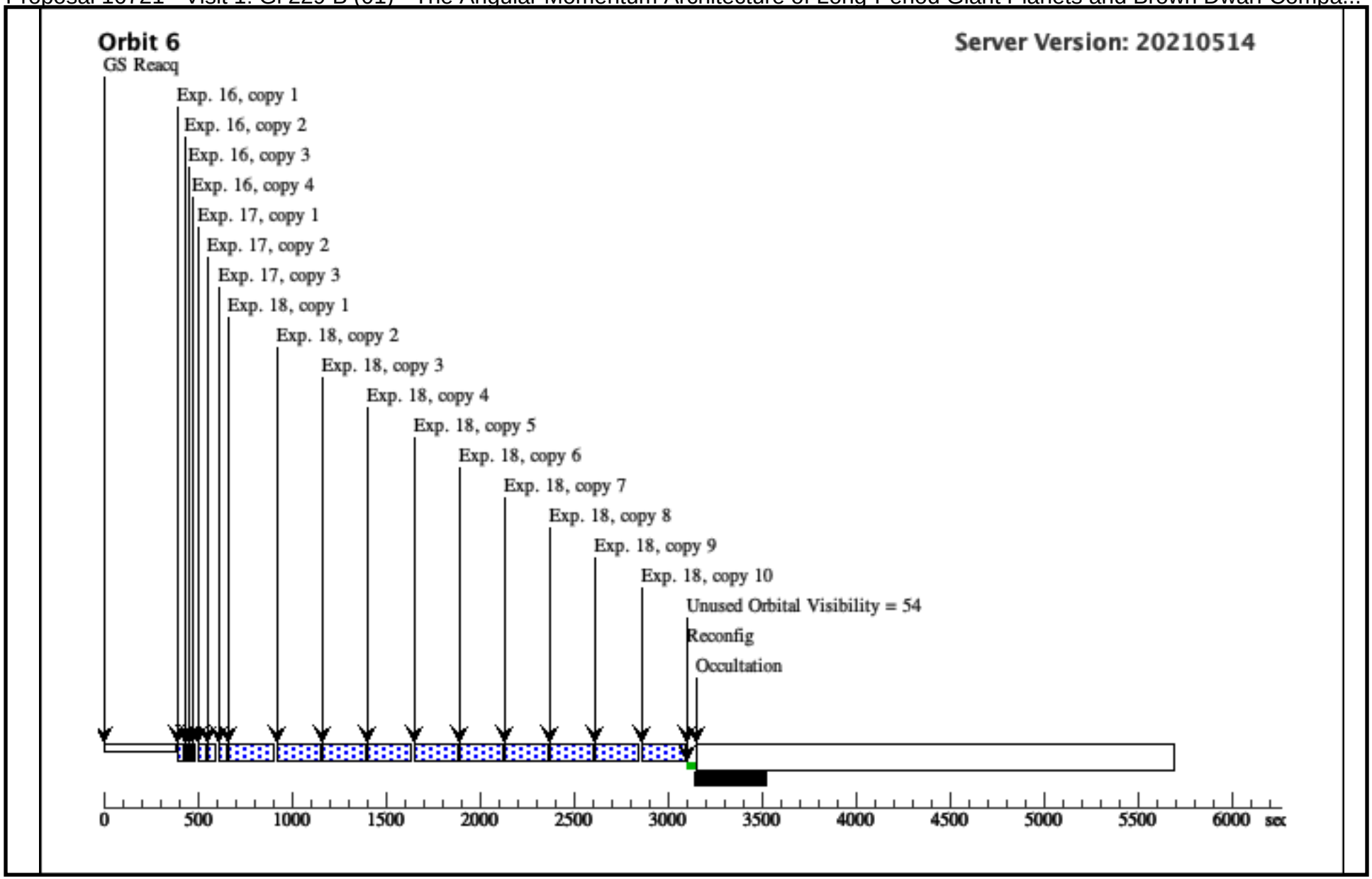
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Unused Orbital Visibility = 54
Reconfig
Occultation
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1500
2000
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3000
3500
4000
4500
5000
5500
6000
sec

Visit

Proposal 16721, Visit 2a: 2M2236+4751 b (02) Wed Jul 28 22:02:24 GMT 2021

Diagnostic Status: No Diagnostics

Scientific Instruments: WFC3/IR

Special Requirements: ORIENT 240D TO 300 D; ORIENT 330D TO 30 D; ORIENT 60D TO 120 D; ORIENT 150D TO 210 D

Comments: Adjacent orbits should be oriented with roll angles of about +/-20-40 deg from the original configuration while also avoiding diffraction spikes.

Fixed Targets

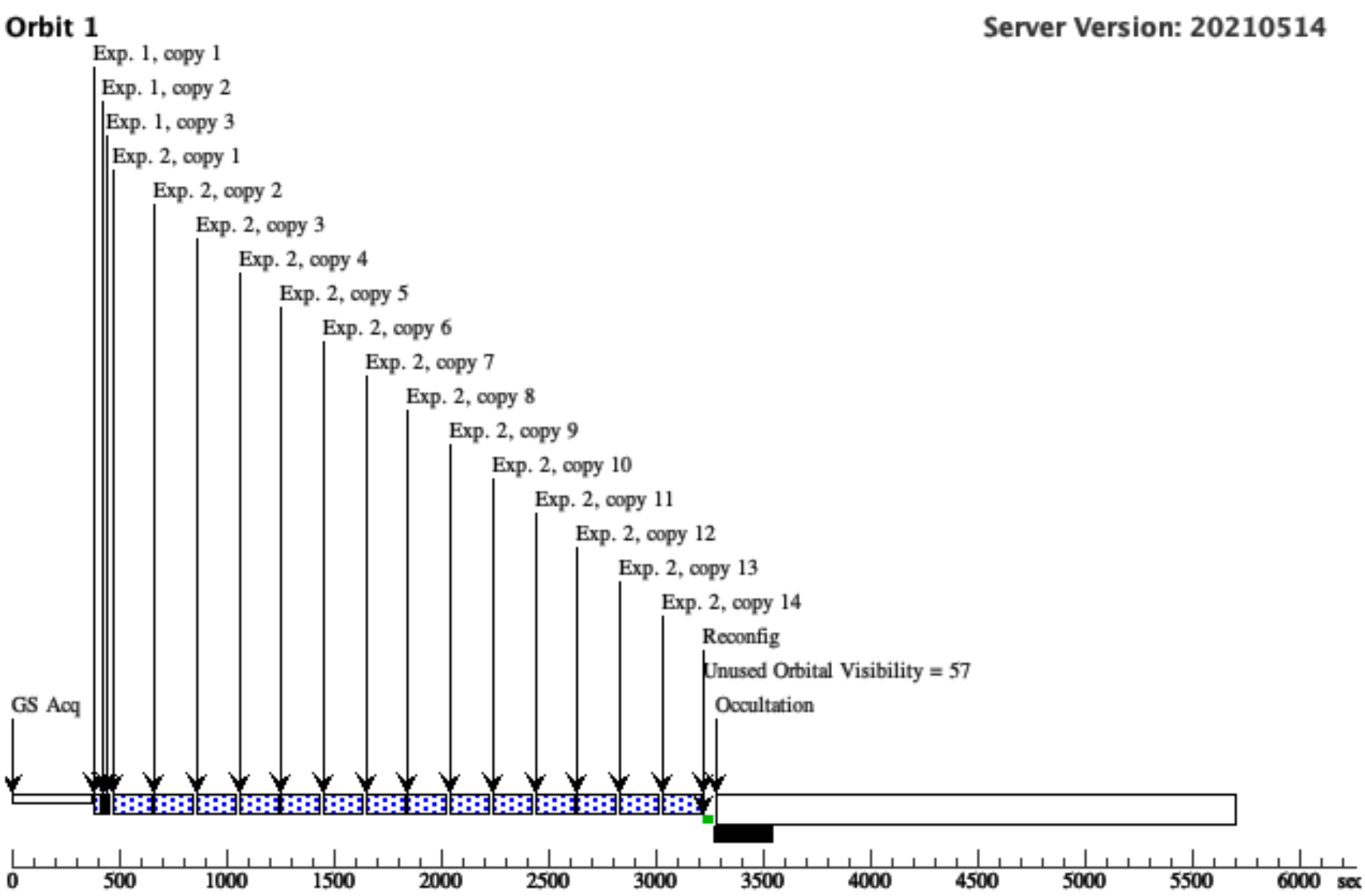
#	Name	Target Coordinates	Targ. Coord. Corrections	Fluxes	Miscellaneous
(2)	2M2236+4751 Alt Name1: 2MASSJ22362452+4751425	RA: 22 36 24.5260 (339.1021917d) Dec: +47 51 42.53 (47.86181d) Equinox: J2000	Proper Motion RA: 62.7 mas/yr Proper Motion Dec: -30.5 mas/yr Epoch of Position: 2000.0	V=(?) J=20.0	Reference Frame: SIMBAD

Comments: The quoted photometry is for the companion, which is red and has a spectral type of late-L. The K7 host star photometry is as follows: V=12.8, J=10.0, H=9.3. The companion is located 3.7" from the host at a PA of 135 deg.
Category=STAR
Description=[BROWN DWARF]
Extended=NO

Exposures

#	Label	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time (Total)/[Actual Dur.]	Orbit
1	Orbit 1: Image in F125W (shallow)	(2) 2M2236+4751	WFC3/IR, MULTIACCUM, IRSUB256	F125W	SAMP-SEQ=RAPID; NSAMP=15			4.167225 Secs X 3 (12.502 Secs) *[==>(Copy 1)]* *[==>(Copy 2)]* *[==>(Copy 3)]*	 ***[1]***
2	Orbit 1: Image in F125W (science)	(2) 2M2236+4751	WFC3/IR, MULTIACCUM, IRSUB256	F125W	SAMP-SEQ=SPARS25; NSAMP=9			179.046127 Secs X 14 (2506.646 Secs) *[==>(Copy 1)]* *[==>(Copy 2)]* *[==>(Copy 3)]* *[==>(Copy 4)]* *[==>(Copy 5)]* *[==>(Copy 6)]* *[==>(Copy 7)]* *[==>(Copy 8)]* *[==>(Copy 9)]* *[==>(Copy 10)]* *[==>(Copy 11)]* *[==>(Copy 12)]* *[==>(Copy 13)]* *[==>(Copy 14)]*	 ***[1]***

Orbit Structure



Visit

Proposal 16721, Visit 2b: 2M2236+4751 b (04) Wed Jul 28 22:02:24 GMT 2021

Diagnostic Status: No Diagnostics

Scientific Instruments: WFC3/IR

Special Requirements: ORIENT 25D TO 35D FROM 02; AFTER 02 BY 0.5 Orbits TO 1.5 Orbits

Comments: Adjacent orbits should be oriented with roll angles of about +/-20-40 deg from the original configuration while also avoiding diffraction spikes.

Fixed Targets

#	Name	Target Coordinates	Targ. Coord. Corrections	Fluxes	Miscellaneous
(2)	2M2236+4751	RA: 22 36 24.5260 (339.1021917d)	Proper Motion RA: 62.7 mas/yr	V=(?)	Reference Frame: SIMBAD
	Alt Name1: 2MASSJ22362452+4751425	Dec: +47 51 42.53 (47.86181d)	Proper Motion Dec: -30.5 mas/yr	J=20.0	
		Equinox: J2000	Epoch of Position: 2000.0		

Comments: The quoted photometry is for the companion, which is red and has a spectral type of late-L. The K7 host star photometry is as follows: V=12.8, J=10.0, H=9.3. The companion is located 3.7" from the host at a PA of 135 deg.
Category=STAR
Description=[BROWN DWARF]
Extended=NO

Exposures

#	Label	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time (Total)/[Actual Dur.]	Orbit
1	Orbit 1: Image in F125W (shallow)	(2) 2M2236+4751	WFC3/IR, MULTIACCUM, IRSUB256	F125W	SAMP-SEQ=RAPID; NSAMP=15			4.167225 Secs X 3 (12.502 Secs)	
								[==>(Copy 1)]	***[1]***
								[==>(Copy 2)]	
								[==>(Copy 3)]	
2	Orbit 1: Image in F125W (science)	(2) 2M2236+4751	WFC3/IR, MULTIACCUM, IRSUB256	F125W	SAMP-SEQ=SPARS25; NSAMP=9			179.046127 Secs X 14 (2506.646 Secs)	
								[==>(Copy 1)]	***[1]***
								[==>(Copy 2)]	
								[==>(Copy 3)]	
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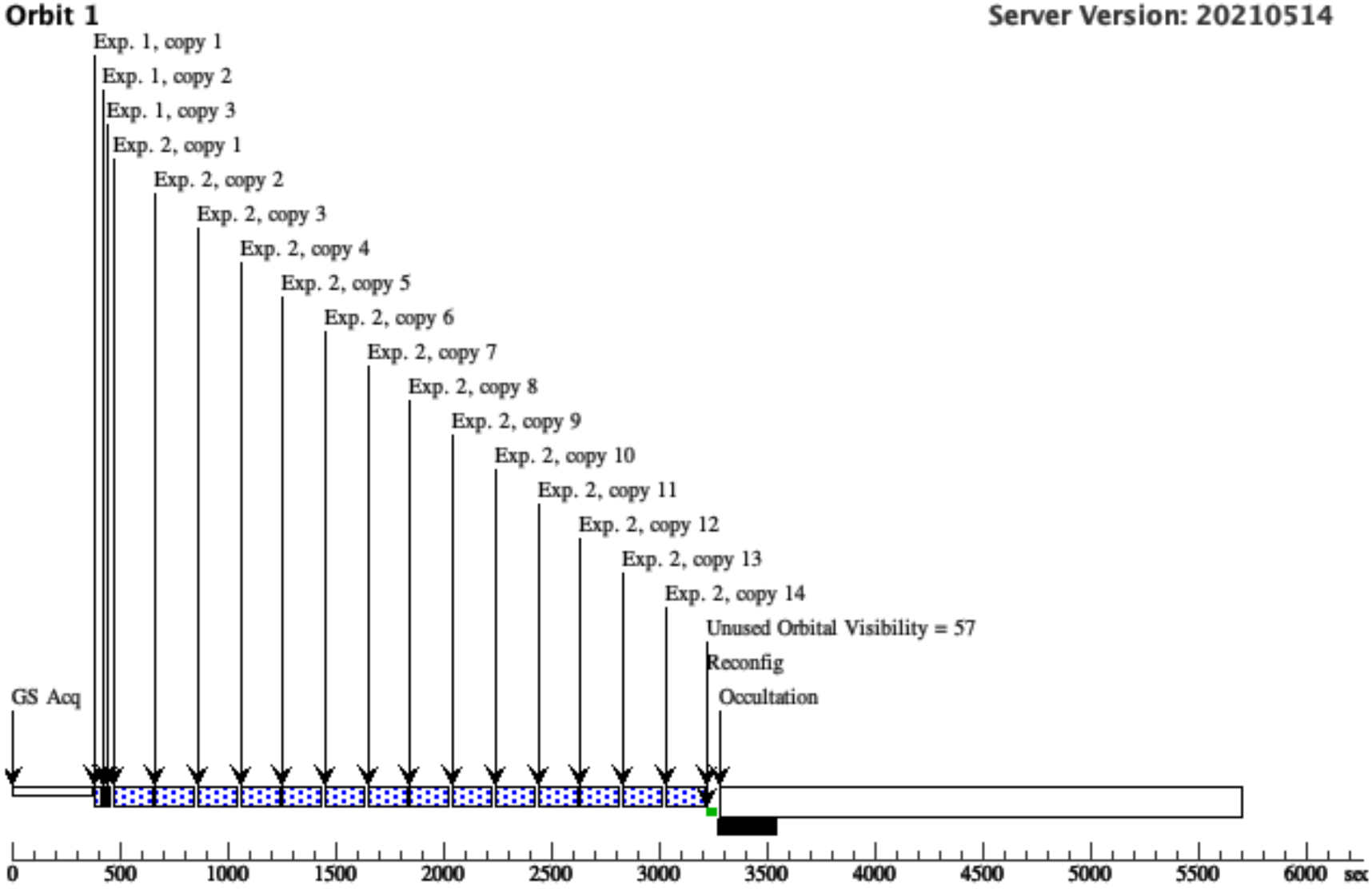
Orbit Structure



Visit

Proposal 16721, Visit 2c: 2M2236+4751 b (05) Wed Jul 28 22:02:24 GMT 2021

Diagnostic Status: No Diagnostics

Scientific Instruments: WFC3/IR

Special Requirements: SAME ORIENT AS 02; AFTER 04 BY 0.5 Orbits TO 1.5 Orbits

Comments: Adjacent orbits should be oriented with roll angles of about +/-20-40 deg from the original configuration while also avoiding diffraction spikes.

Fixed Targets

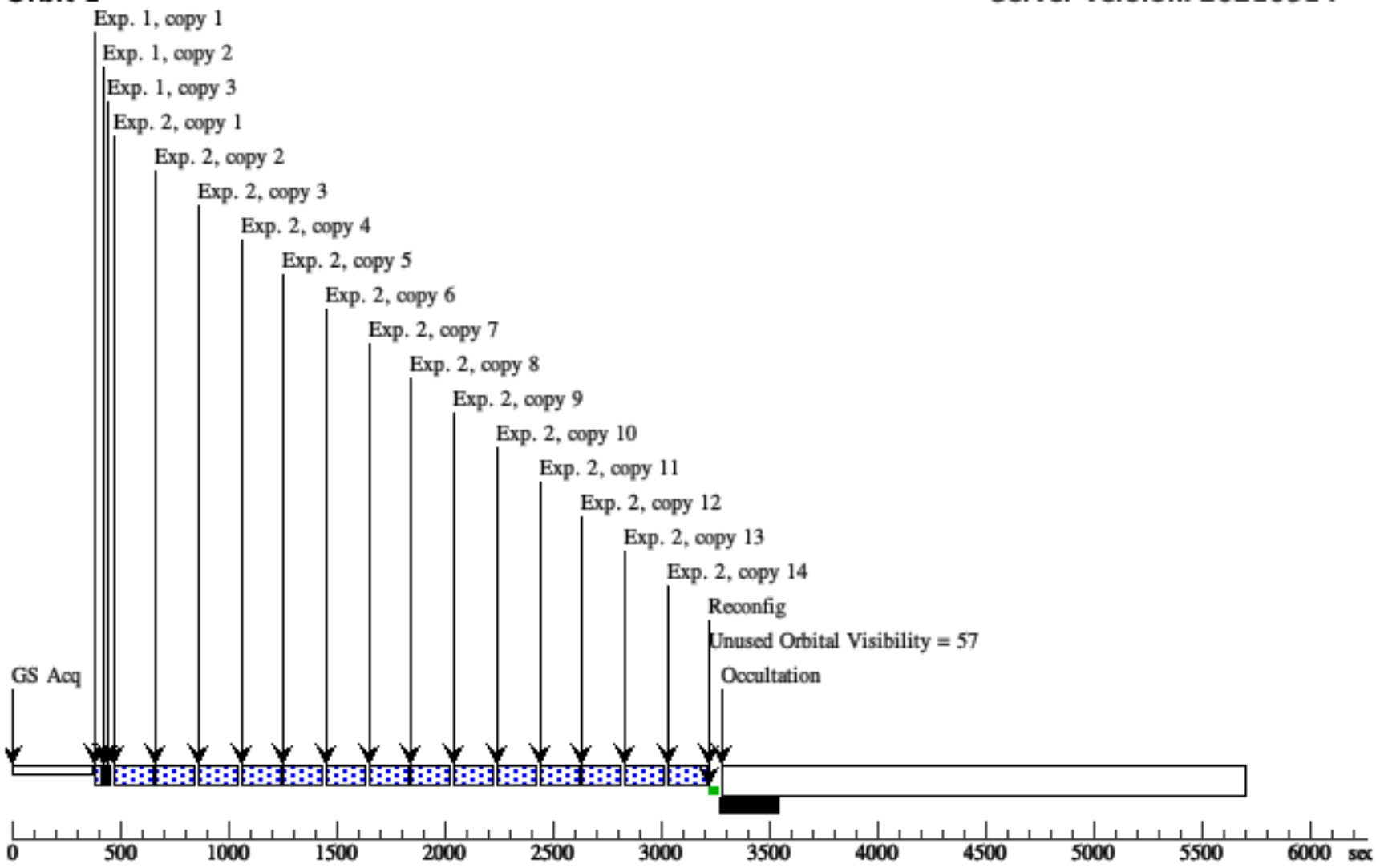
#	Name	Target Coordinates	Targ. Coord. Corrections	Fluxes	Miscellaneous
(2)	2M2236+4751 Alt Name1: 2MASSJ22362452+4751425	RA: 22 36 24.5260 (339.1021917d) Dec: +47 51 42.53 (47.86181d) Equinox: J2000	Proper Motion RA: 62.7 mas/yr Proper Motion Dec: -30.5 mas/yr Epoch of Position: 2000.0	V=(?) J=20.0	Reference Frame: SIMBAD

Comments: The quoted photometry is for the companion, which is red and has a spectral type of late-L. The K7 host star photometry is as follows: V=12.8, J=10.0, H=9.3. The companion is located 3.7" from the host at a PA of 135 deg.
Category=STAR
Description=[BROWN DWARF]
Extended=NO

Exposures

#	Label	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time (Total)/[Actual Dur.]	Orbit
1	Orbit 1: Image in F125W (shallow)	(2) 2M2236+4751	WFC3/IR, MULTIACCUM, IRSUB256	F125W	SAMP-SEQ=RAPID; NSAMP=15			4.167225 Secs X 3 (12.502 Secs) *[==>(Copy 1)]* *[==>(Copy 2)]* *[==>(Copy 3)]*	 ***[1]***
2	Orbit 1: Image in F125W (science)	(2) 2M2236+4751	WFC3/IR, MULTIACCUM, IRSUB256	F125W	SAMP-SEQ=SPARS25; NSAMP=9			179.046127 Secs X 14 (2506.646 Secs) *[==>(Copy 1)]* *[==>(Copy 2)]* *[==>(Copy 3)]* *[==>(Copy 4)]* *[==>(Copy 5)]* *[==>(Copy 6)]* *[==>(Copy 7)]* *[==>(Copy 8)]* *[==>(Copy 9)]* *[==>(Copy 10)]* *[==>(Copy 11)]* *[==>(Copy 12)]* *[==>(Copy 13)]* *[==>(Copy 14)]*	 ***[1]***

Orbit Structure



Visit

Proposal 16721, Visit 2d: 2M2236+4751 b (06) Wed Jul 28 22:02:24 GMT 2021

Diagnostic Status: No Diagnostics

Scientific Instruments: WFC3/IR

Special Requirements: SAME ORIENT AS 04; AFTER 05 BY 0.5 Orbits TO 1.5 Orbits

Comments: Adjacent orbits should be oriented with roll angles of about +/-20-40 deg from the original configuration while also avoiding diffraction spikes.

Fixed Targets

#	Name	Target Coordinates	Targ. Coord. Corrections	Fluxes	Miscellaneous
(2)	2M2236+4751	RA: 22 36 24.5260 (339.1021917d)	Proper Motion RA: 62.7 mas/yr	V=(?)	Reference Frame: SIMBAD
	Alt Name1: 2MASSJ22362452+4751425	Dec: +47 51 42.53 (47.86181d)	Proper Motion Dec: -30.5 mas/yr	J=20.0	
		Equinox: J2000	Epoch of Position: 2000.0		

Comments: The quoted photometry is for the companion, which is red and has a spectral type of late-L. The K7 host star photometry is as follows: V=12.8, J=10.0, H=9.3. The companion is located 3.7" from the host at a PA of 135 deg.
Category=STAR
Description=[BROWN DWARF]
Extended=NO

Exposures

#	Label	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time (Total)/[Actual Dur.]	Orbit
1	Orbit 1: Image in F125W (shallow)	(2) 2M2236+4751	WFC3/IR, MULTIACCUM, IRSUB256	F125W	SAMP-SEQ=RAPID; NSAMP=15			4.167225 Secs X 3 (12.502 Secs)	
								[==>(Copy 1)]	***[1]***
								[==>(Copy 2)]	
								[==>(Copy 3)]	
2	Orbit 1: Image in F125W (science)	(2) 2M2236+4751	WFC3/IR, MULTIACCUM, IRSUB256	F125W	SAMP-SEQ=SPARS25; NSAMP=9			179.046127 Secs X 14 (2506.646 Secs)	
								[==>(Copy 1)]	***[1]***
								[==>(Copy 2)]	
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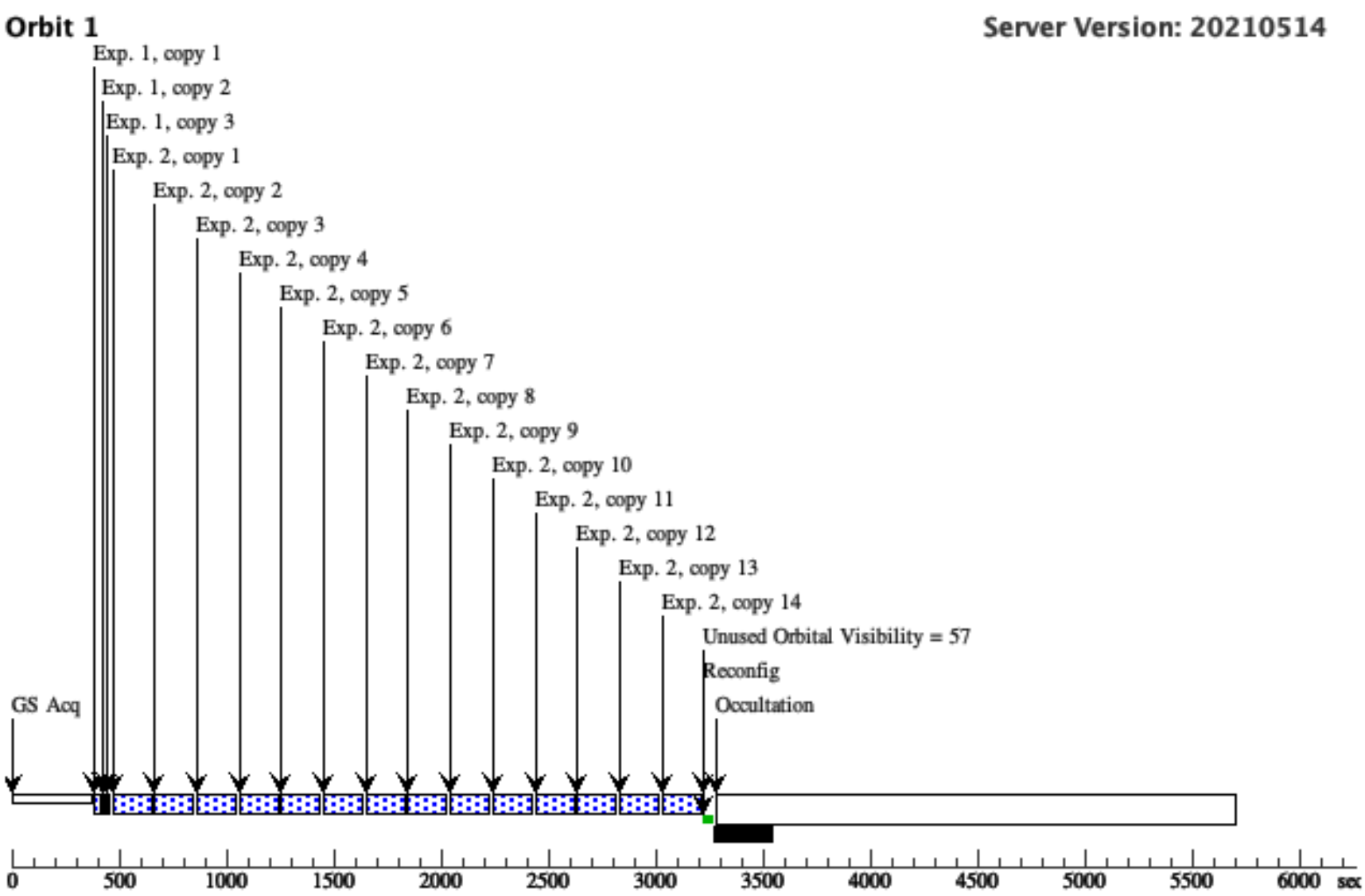
Orbit Structure



Visit

Proposal 16721, Visit 2e: 2M2236+4751 b (07) Wed Jul 28 22:02:24 GMT 2021

Diagnostic Status: No Diagnostics

Scientific Instruments: WFC3/IR

Special Requirements: SAME ORIENT AS 02; AFTER 06 BY 0.5 Orbits TO 1.5 Orbits

Comments: Adjacent orbits should be oriented with roll angles of about +/-20-40 deg from the original configuration while also avoiding diffraction spikes.

Fixed Targets

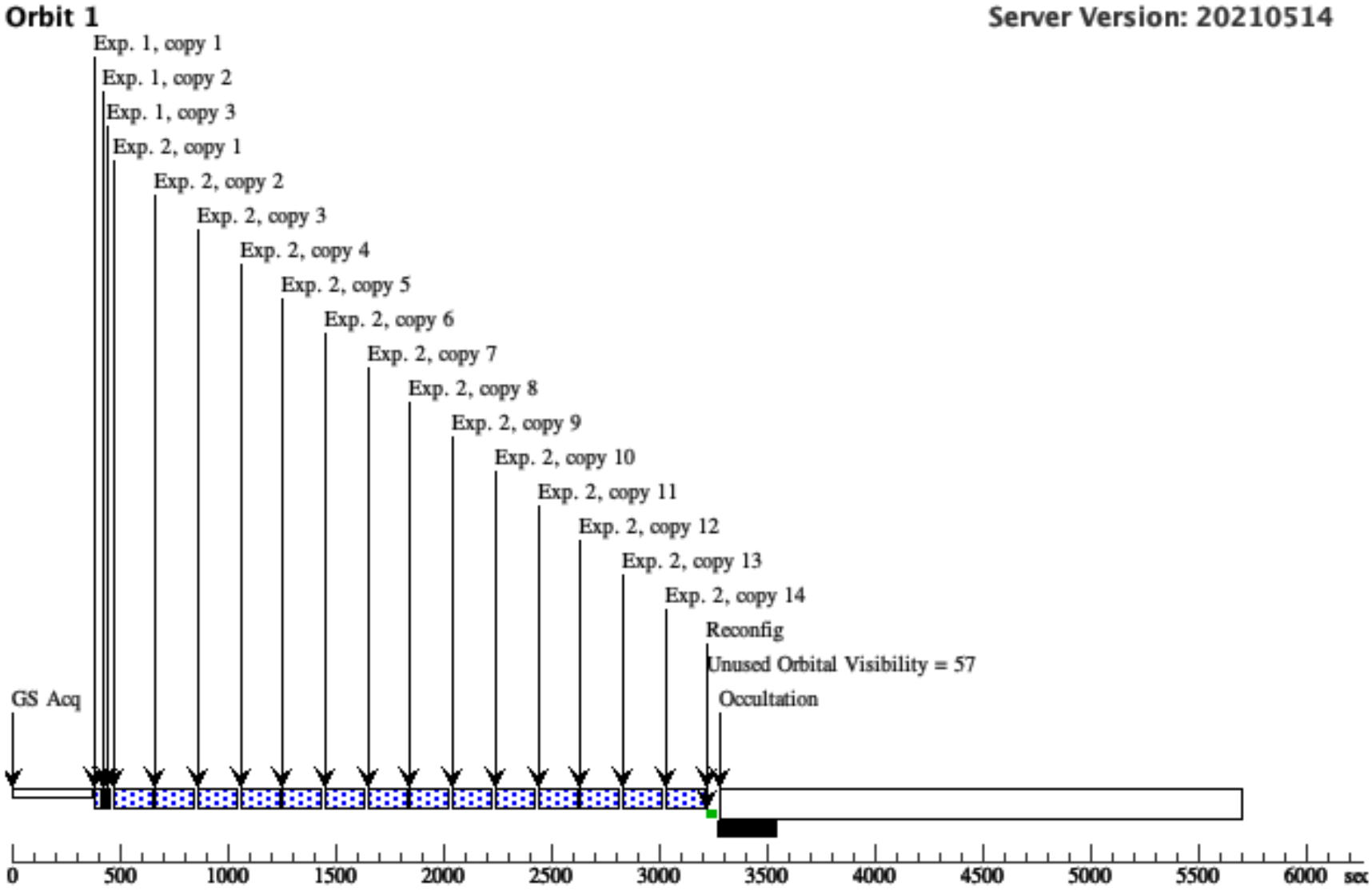
#	Name	Target Coordinates	Targ. Coord. Corrections	Fluxes	Miscellaneous
(2)	2M2236+4751 Alt Name1: 2MASSJ22362452+4751425	RA: 22 36 24.5260 (339.1021917d) Dec: +47 51 42.53 (47.86181d) Equinox: J2000	Proper Motion RA: 62.7 mas/yr Proper Motion Dec: -30.5 mas/yr Epoch of Position: 2000.0	V=(?) J=20.0	Reference Frame: SIMBAD

Comments: The quoted photometry is for the companion, which is red and has a spectral type of late-L. The K7 host star photometry is as follows: V=12.8, J=10.0, H=9.3. The companion is located 3.7" from the host at a PA of 135 deg.
Category=STAR
Description=[BROWN DWARF]
Extended=NO

Exposures

#	Label	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time (Total)/[Actual Dur.]	Orbit
1	Orbit 1: Image in F125W (shallow)	(2) 2M2236+4751	WFC3/IR, MULTIACCUM, IRSUB256	F125W	SAMP-SEQ=RAPID; NSAMP=15			4.167225 Secs X 3 (12.502 Secs) *[==>(Copy 1)]* *[==>(Copy 2)]* *[==>(Copy 3)]*	 ***[1]***
2	Orbit 1: Image in F125W (science)	(2) 2M2236+4751	WFC3/IR, MULTIACCUM, IRSUB256	F125W	SAMP-SEQ=SPARS25; NSAMP=9			179.046127 Secs X 14 (2506.646 Secs) *[==>(Copy 1)]* *[==>(Copy 2)]* *[==>(Copy 3)]* *[==>(Copy 4)]* *[==>(Copy 5)]* *[==>(Copy 6)]* *[==>(Copy 7)]* *[==>(Copy 8)]* *[==>(Copy 9)]* *[==>(Copy 10)]* *[==>(Copy 11)]* *[==>(Copy 12)]* *[==>(Copy 13)]* *[==>(Copy 14)]*	 ***[1]***

Orbit Structure



Visit

Proposal 16721, Visit 2f: 2M2236+4751 b (08) Wed Jul 28 22:02:24 GMT 2021

Diagnostic Status: No Diagnostics

Scientific Instruments: WFC3/IR

Special Requirements: SAME ORIENT AS 04; AFTER 07 BY 0.5 Orbits TO 1.5 Orbits

Comments: Adjacent orbits should be oriented with roll angles of about +/-20-40 deg from the original configuration while also avoiding diffraction spikes.

Fixed Targets

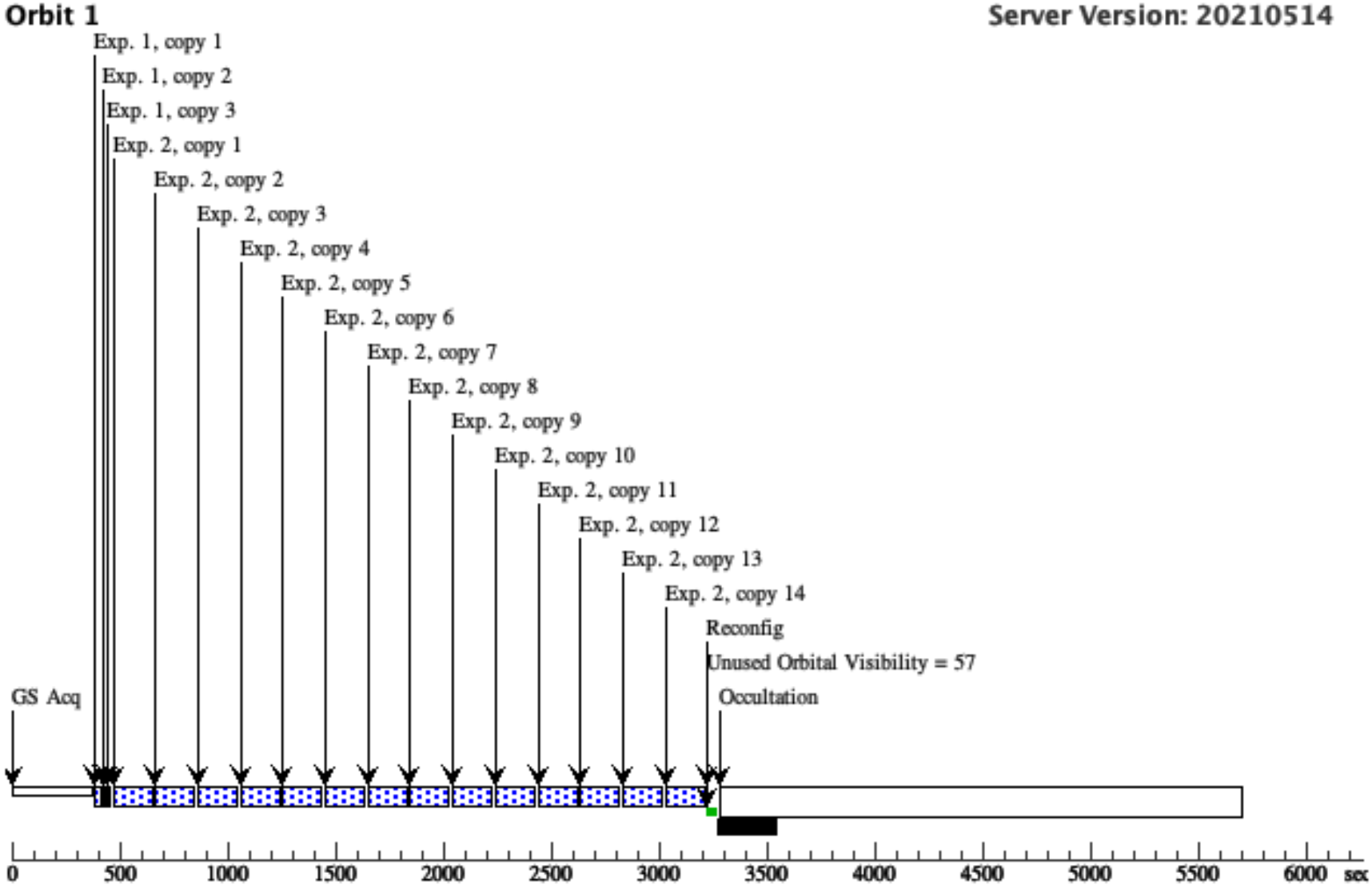
#	Name	Target Coordinates	Targ. Coord. Corrections	Fluxes	Miscellaneous
(2)	2M2236+4751 Alt Name1: 2MASSJ22362452+4751425	RA: 22 36 24.5260 (339.1021917d) Dec: +47 51 42.53 (47.86181d) Equinox: J2000	Proper Motion RA: 62.7 mas/yr Proper Motion Dec: -30.5 mas/yr Epoch of Position: 2000.0	V=(?) J=20.0	Reference Frame: SIMBAD

Comments: The quoted photometry is for the companion, which is red and has a spectral type of late-L. The K7 host star photometry is as follows: V=12.8, J=10.0, H=9.3. The companion is located 3.7" from the host at a PA of 135 deg.
Category=STAR
Description=[BROWN DWARF]
Extended=NO

Exposures

#	Label	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time (Total)/[Actual Dur.]	Orbit
1	Orbit 1: Image in F125W (shallow)	(2) 2M2236+4751	WFC3/IR, MULTIACCUM, IRSUB256	F125W	SAMP-SEQ=RAPID; NSAMP=15			4.167225 Secs X 3 (12.502 Secs) *[==>(Copy 1)]* *[==>(Copy 2)]* *[==>(Copy 3)]*	 ***[1]***
2	Orbit 1: Image in F125W (science)	(2) 2M2236+4751	WFC3/IR, MULTIACCUM, IRSUB256	F125W	SAMP-SEQ=SPARS25; NSAMP=9			179.046127 Secs X 14 (2506.646 Secs) *[==>(Copy 1)]* *[==>(Copy 2)]* *[==>(Copy 3)]* *[==>(Copy 4)]* *[==>(Copy 5)]* *[==>(Copy 6)]* *[==>(Copy 7)]* *[==>(Copy 8)]* *[==>(Copy 9)]* *[==>(Copy 10)]* *[==>(Copy 11)]* *[==>(Copy 12)]* *[==>(Copy 13)]* *[==>(Copy 14)]*	 ***[1]***

Orbit Structure



Visit

Proposal 16721, Visit 3: CD-35 2722 B (03) Wed Jul 28 22:02:24 GMT 2021

Diagnostic Status: No Diagnostics

Scientific Instruments: WFC3/IR

Special Requirements: ORIENT 8D TO 28 D; ORIENT 188D TO 208 D

Comments: +/- 10 deg tolerance in Orient

Fixed Targets

#	Name	Target Coordinates	Targ. Coord. Corrections	Fluxes	Miscellaneous
(3)	CD-35-2722	RA: 06 09 19.2080 (92.3300333d)	Proper Motion RA: -3.6 mas/yr	V=(?)	Reference Frame: SIMBAD
		Dec: -35 49 31.07 (-35.82530d)	Proper Motion Dec: -56.1 mas/yr	J=13.6	
		Equinox: J2000	Epoch of Position: 2000.0		

Comments: The quoted photometry is for the companion, which is red and has a spectral type of L4. The M1 host star photometry is as follows: V=11.1, J=7.9, H=7.3. The companion is located 3.1" from the host at a PA of 243 deg.
Category=STAR
Description=[BROWN DWARF]
Extended=NO

Exposures

#	Label	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time (Total)/[Actual Dur.]	Orbit
1	Orbit 1: Image in F132N (shallow)	(3) CD-35-2722	WFC3/IR, MULTIACCUM, GRISM256	F132N	SAMP-SEQ=RAPID; NSAMP=15			4.167225 Secs X 2 (8.334 Secs) *[==>(Copy 1)]* *[==>(Copy 2)]*	***[1]***
Comments: Image in F132N for wavelength calibration									
2	Orbit 1: Image in F132N (deep)	(3) CD-35-2722	WFC3/IR, MULTIACCUM, GRISM256	F132N	SAMP-SEQ=SPARS10; NSAMP=5			29.663763 Secs X 4 (118.655 Secs) *[==>(Copy 1)]* *[==>(Copy 2)]* *[==>(Copy 3)]* *[==>(Copy 4)]*	***[1]***
3	Orbit 1: G141 spectrum	(3) CD-35-2722	WFC3/IR, MULTIACCUM, GRISM256	G141	SAMP-SEQ=SPARS10; NSAMP=15			103.128633 Secs X 21 (2165.701 Secs) *[==>(Copy 1)]* *[==>(Copy 2)]* *[==>(Copy 3)]* *[==>(Copy 4)]* *[==>(Copy 5)]* *[==>(Copy 6)]* *[==>(Copy 7)]* *[==>(Copy 8)]* *[==>(Copy 9)]* *[==>(Copy 10)]* *[==>(Copy 11)]* *[==>(Copy 12)]* *[==>(Copy 13)]* *[==>(Copy 14)]* *[==>(Copy 15)]* *[==>(Copy 16)]* *[==>(Copy 17)]* *[==>(Copy 18)]* *[==>(Copy 19)]* *[==>(Copy 20)]* *[==>(Copy 21)]*	***[1]***
4	Orbit 2: Image in F132N (shallow)	(3) CD-35-2722	WFC3/IR, MULTIACCUM, GRISM256	F132N	SAMP-SEQ=RAPID; NSAMP=15			4.167225 Secs X 2 (8.334 Secs) *[==>(Copy 1)]* *[==>(Copy 2)]*	***[2]***
Comments: Image in F132N for wavelength calibration									
5	Orbit 2: Image in F132N (deep)	(3) CD-35-2722	WFC3/IR, MULTIACCUM, GRISM256	F132N	SAMP-SEQ=SPARS10; NSAMP=5			29.663763 Secs X 3 (88.991 Secs) *[==>(Copy 1)]* *[==>(Copy 2)]* *[==>(Copy 3)]*	***[2]***

6	Orbit 2: G141 spectrum	(3) CD-35-2722	WFC3/IR, MULTIACCUM, GRISM256	G141	SAMP-SEQ=SPARS10; NSAMP=15	103.128633 Secs X 21 (2165.701 Secs) *[==>(Copy 1)]* *[==>(Copy 2)]* *[==>(Copy 3)]* *[==>(Copy 4)]* *[==>(Copy 5)]* *[==>(Copy 6)]* *[==>(Copy 7)]* *[==>(Copy 8)]* *[==>(Copy 9)]* *[==>(Copy 10)]* *[==>(Copy 11)]* *[==>(Copy 12)]* *[==>(Copy 13)]* *[==>(Copy 14)]* *[==>(Copy 15)]* *[==>(Copy 16)]* *[==>(Copy 17)]* *[==>(Copy 18)]* *[==>(Copy 19)]* *[==>(Copy 20)]* *[==>(Copy 21)]*	***[2]***
7	Orbit 3: Image in F132N (shallow)	(3) CD-35-2722	WFC3/IR, MULTIACCUM, GRISM256	F132N	SAMP-SEQ=RAPID; NSAMP=15	4.167225 Secs X 2 (8.334 Secs) *[==>(Copy 1)]* *[==>(Copy 2)]*	***[3]***
Comments: Image in F132N for wavelength calibration							
8	Orbit 3: Image in F132N (deep)	(3) CD-35-2722	WFC3/IR, MULTIACCUM, GRISM256	F132N	SAMP-SEQ=SPARS10; NSAMP=5	29.663763 Secs X 3 (88.991 Secs) *[==>(Copy 1)]* *[==>(Copy 2)]* *[==>(Copy 3)]*	***[3]***

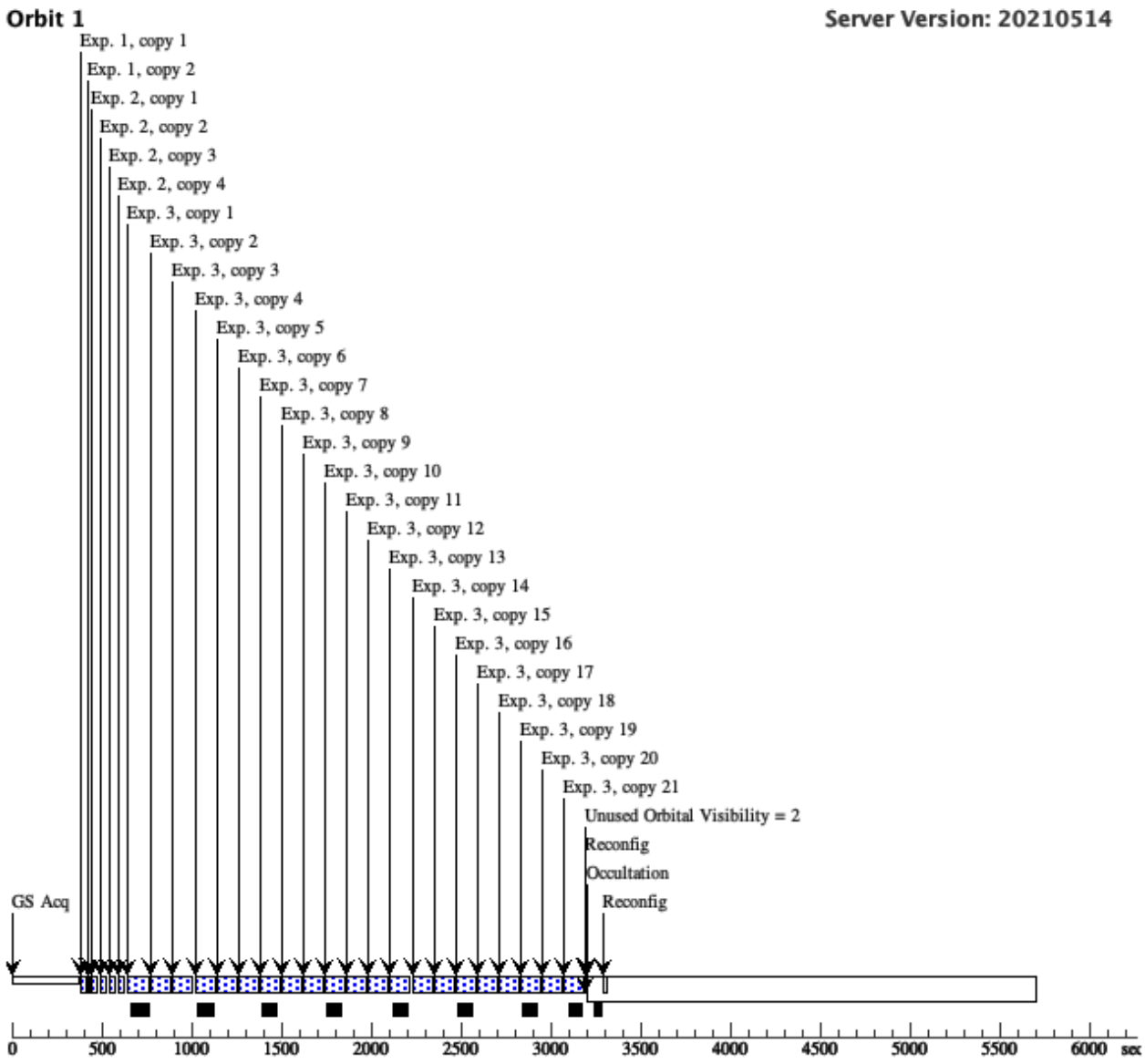
	9	Orbit 3: G141 spectrum	(3) CD-35-2722	WFC3/IR, MULTIACCUM, GRISM256	G141	SAMP-SEQ=SPARS10; NSAMP=15	103.128633 Secs X 21 (2165.701 Secs) *[==>(Copy 1)]* *[==>(Copy 2)]* *[==>(Copy 3)]* *[==>(Copy 4)]* *[==>(Copy 5)]* *[==>(Copy 6)]* *[==>(Copy 7)]* *[==>(Copy 8)]* *[==>(Copy 9)]* *[==>(Copy 10)]* *[==>(Copy 11)]* *[==>(Copy 12)]* *[==>(Copy 13)]* *[==>(Copy 14)]* *[==>(Copy 15)]* *[==>(Copy 16)]* *[==>(Copy 17)]* *[==>(Copy 18)]* *[==>(Copy 19)]* *[==>(Copy 20)]* *[==>(Copy 21)]*	***[3]***
	10	Orbit 4: Image in F132N (shallow)	(3) CD-35-2722	WFC3/IR, MULTIACCUM, GRISM256	F132N	SAMP-SEQ=RAPID; NSAMP=15	4.167225 Secs X 2 (8.334 Secs) *[==>(Copy 1)]* *[==>(Copy 2)]*	***[4]***
	Comments: Image in F132N for wavelength calibration							
	11	Orbit 4: Image in F132N (deep)	(3) CD-35-2722	WFC3/IR, MULTIACCUM, GRISM256	F132N	SAMP-SEQ=SPARS10; NSAMP=5	29.663763 Secs X 3 (88.991 Secs) *[==>(Copy 1)]* *[==>(Copy 2)]* *[==>(Copy 3)]*	***[4]***

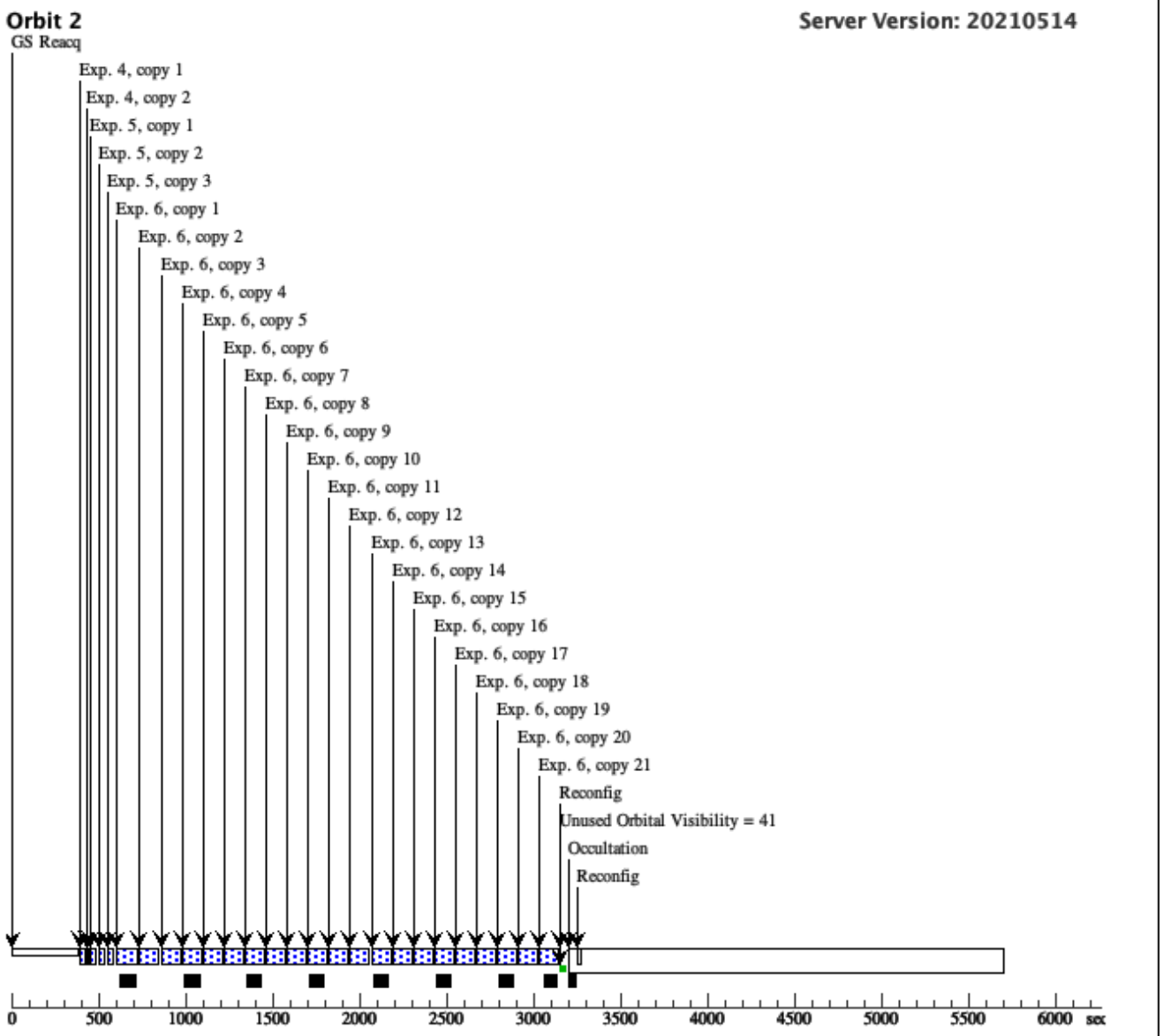
12	Orbit 4: G141 spectrum	(3) CD-35-2722	WFC3/IR, MULTIACCUM, GRISM256	G141	SAMP-SEQ=SPARS10; NSAMP=15	103.128633 Secs X 21 (2165.701 Secs)		
						[==>(Copy 1)] *[==>(Copy 2)]* *[==>(Copy 3)]* *[==>(Copy 4)]* *[==>(Copy 5)]* *[==>(Copy 6)]* *[==>(Copy 7)]* *[==>(Copy 8)]* *[==>(Copy 9)]* *[==>(Copy 10)]* *[==>(Copy 11)]* *[==>(Copy 12)]* *[==>(Copy 13)]* *[==>(Copy 14)]* *[==>(Copy 15)]* *[==>(Copy 16)]* *[==>(Copy 17)]* *[==>(Copy 18)]* *[==>(Copy 19)]* *[==>(Copy 20)]* *[==>(Copy 21)]*	***[4]***
13	Orbit 5: Image in F132N (shallow)	(3) CD-35-2722	WFC3/IR, MULTIACCUM, GRISM256	F132N	SAMP-SEQ=RAPID; NSAMP=15	4.167225 Secs X 2 (8.334 Secs)		
						[==>(Copy 1)] *[==>(Copy 2)]*	***[5]***
Comments: Image in F132N for wavelength calibration								
14	Orbit 5: Image in F132N (deep)	(3) CD-35-2722	WFC3/IR, MULTIACCUM, GRISM256	F132N	SAMP-SEQ=SPARS10; NSAMP=5	29.663763 Secs X 3 (88.991 Secs)		
						[==>(Copy 1)] *[==>(Copy 2)]* *[==>(Copy 3)]*	***[5]***

15	Orbit 5: G141 spectrum	(3) CD-35-2722	WFC3/IR, MULTIACCUM, GRISM256	G141	SAMP-SEQ=SPARS10; NSAMP=15	103.128633 Secs X 21 (2165.701 Secs) *[==>(Copy 1)]* *[==>(Copy 2)]* *[==>(Copy 3)]* *[==>(Copy 4)]* *[==>(Copy 5)]* *[==>(Copy 6)]* *[==>(Copy 7)]* *[==>(Copy 8)]* *[==>(Copy 9)]* *[==>(Copy 10)]* *[==>(Copy 11)]* *[==>(Copy 12)]* *[==>(Copy 13)]* *[==>(Copy 14)]* *[==>(Copy 15)]* *[==>(Copy 16)]* *[==>(Copy 17)]* *[==>(Copy 18)]* *[==>(Copy 19)]* *[==>(Copy 20)]* *[==>(Copy 21)]*	***[5]***
16	Orbit 6: Image in F132N (shallow)	(3) CD-35-2722	WFC3/IR, MULTIACCUM, GRISM256	F132N	SAMP-SEQ=RAPID; NSAMP=15	4.167225 Secs X 2 (8.334 Secs) *[==>(Copy 1)]* *[==>(Copy 2)]*	***[6]***
Comments: Image in F132N for wavelength calibration								
17	Orbit 6: Image in F132N (deep)	(3) CD-35-2722	WFC3/IR, MULTIACCUM, GRISM256	F132N	SAMP-SEQ=SPARS10; NSAMP=5	29.663763 Secs X 3 (88.991 Secs) *[==>(Copy 1)]* *[==>(Copy 2)]* *[==>(Copy 3)]*	***[6]***	

	18	Orbit 6: G14 (3) CD-35-2722 1 spectrum	WFC3/IR, MULTIACCUM, GRISM256	G141	SAMP-SEQ=SPARS 10; NSAMP=15	103.128633 Secs X 21 (2165.701 Secs) *[==>(Copy 1)]* *[==>(Copy 2)]* *[==>(Copy 3)]* *[==>(Copy 4)]* *[==>(Copy 5)]* *[==>(Copy 6)]* *[==>(Copy 7)]* *[==>(Copy 8)]* *[==>(Copy 9)]* *[==>(Copy 10)]* *[==>(Copy 11)]* *[==>(Copy 12)]* *[==>(Copy 13)]* *[==>(Copy 14)]* *[==>(Copy 15)]* *[==>(Copy 16)]* *[==>(Copy 17)]* *[==>(Copy 18)]* *[==>(Copy 19)]* *[==>(Copy 20)]* *[==>(Copy 21)]*	 ***[6]***

Orbit Structure

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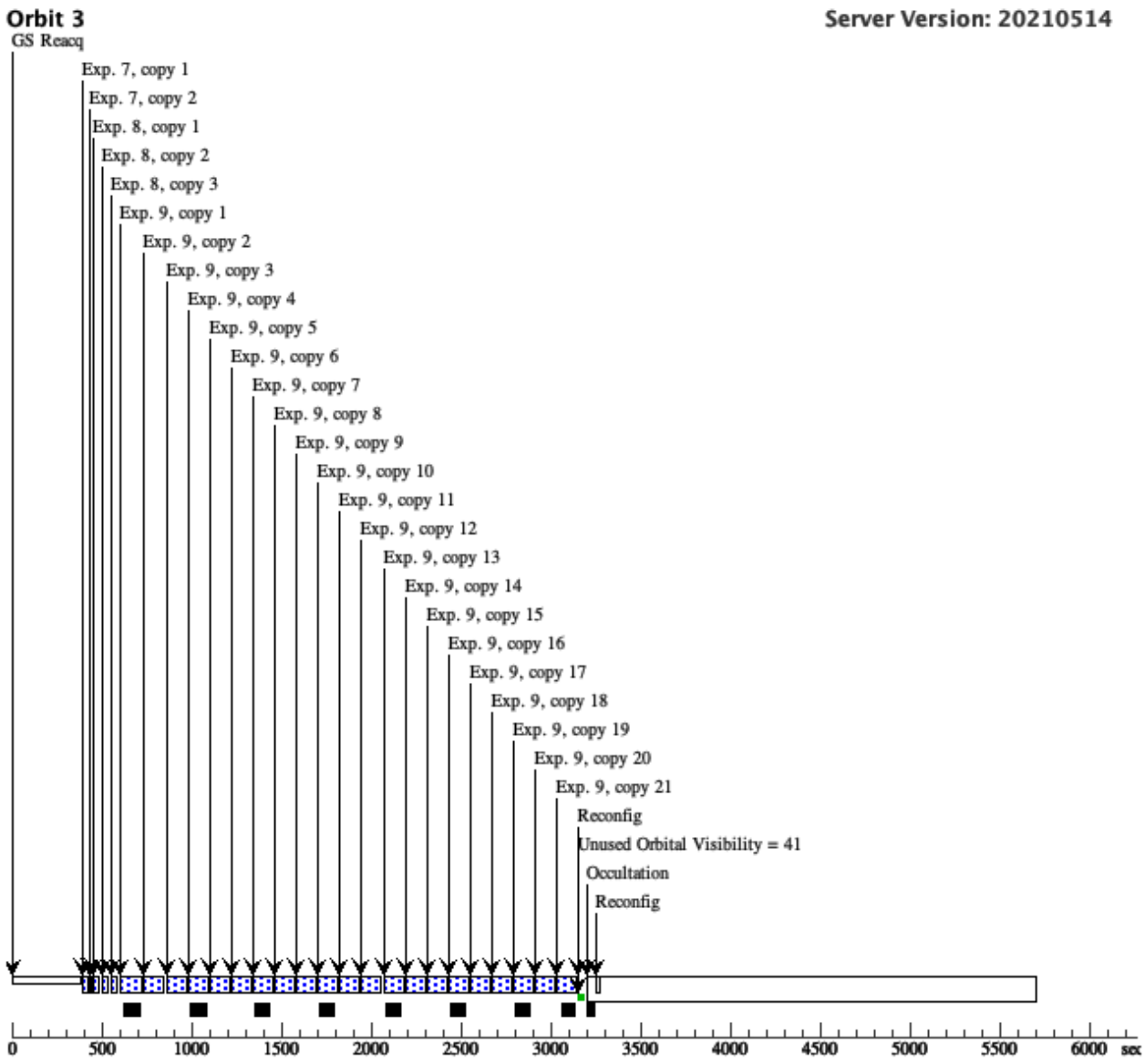
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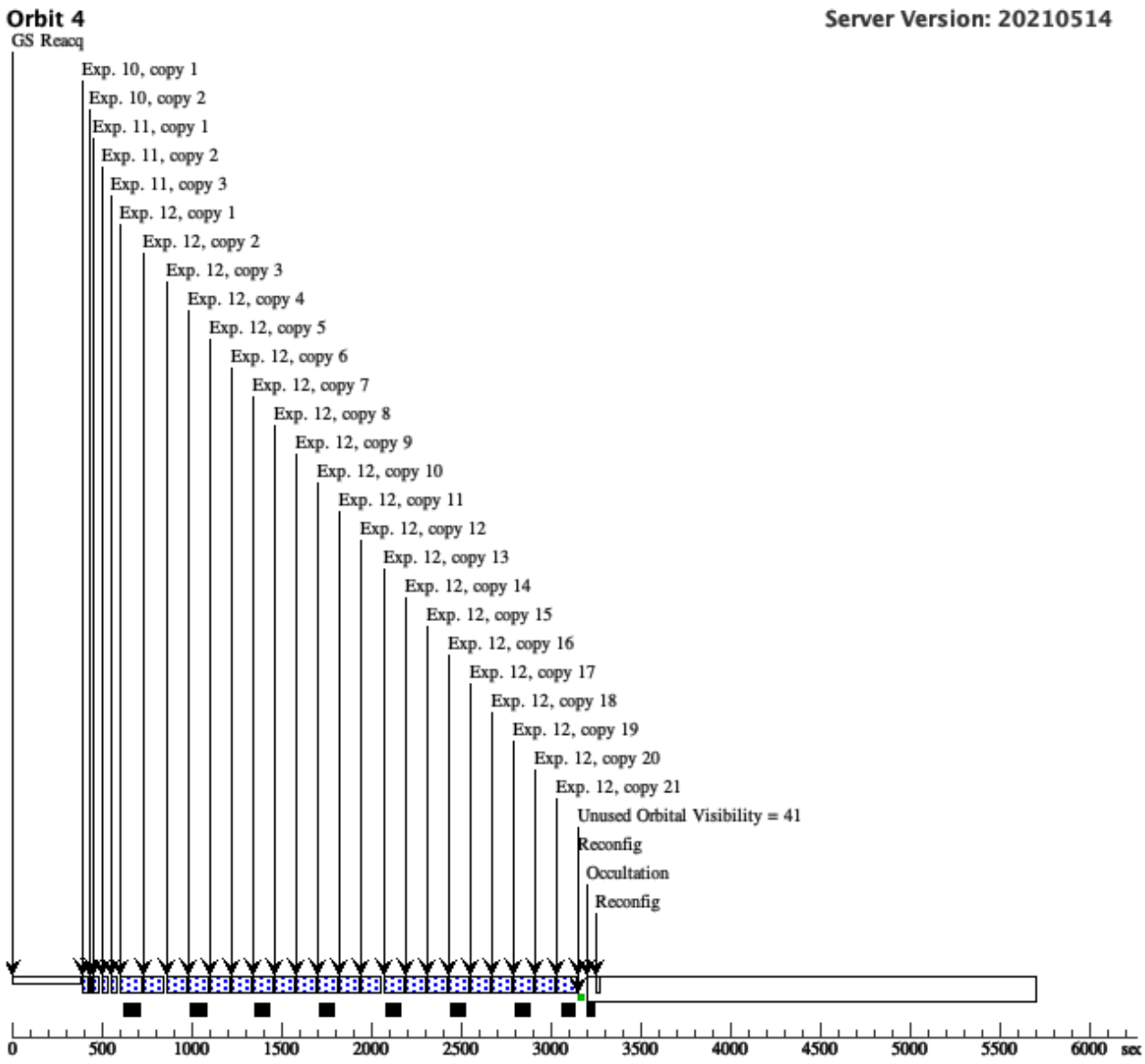
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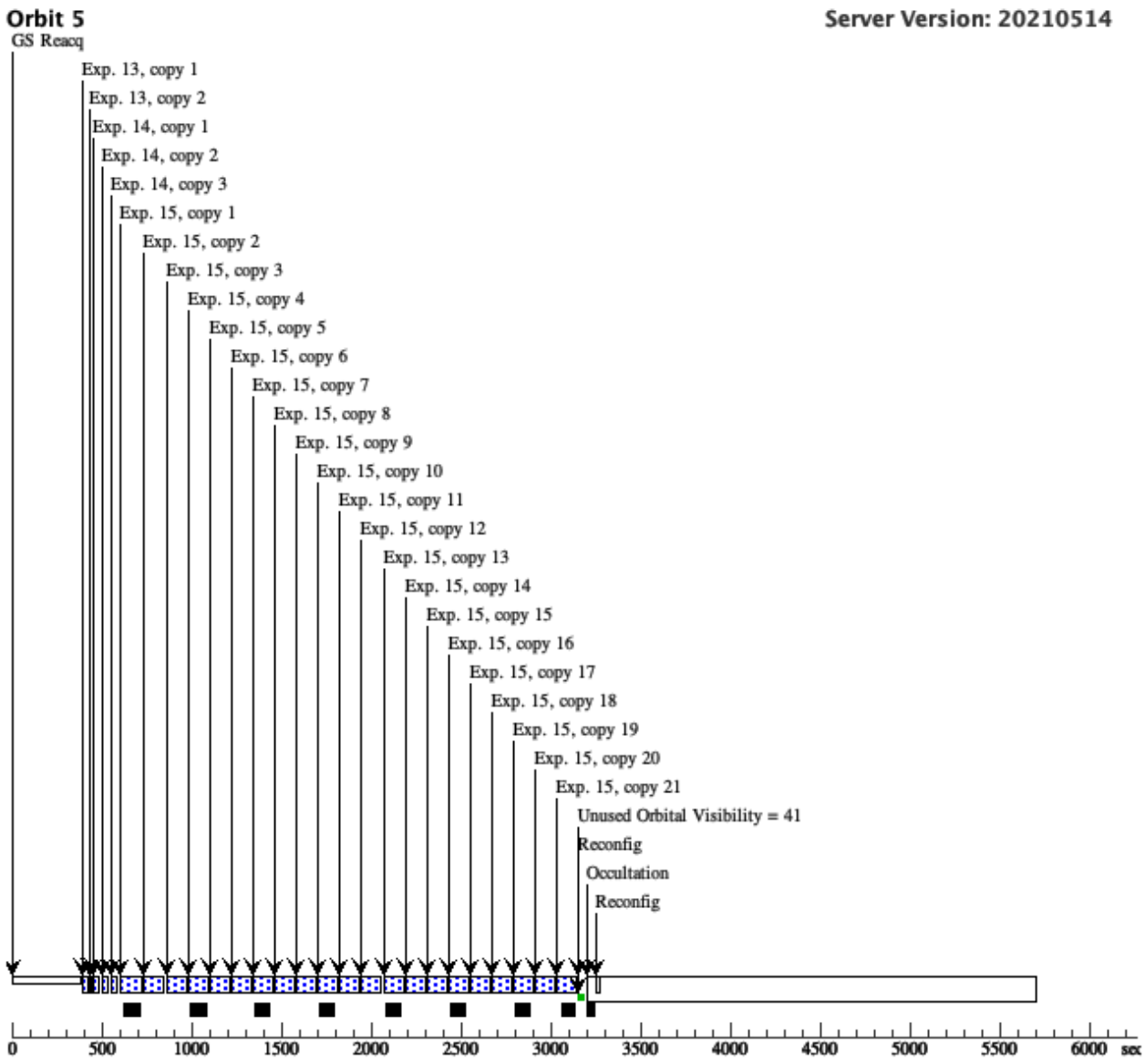
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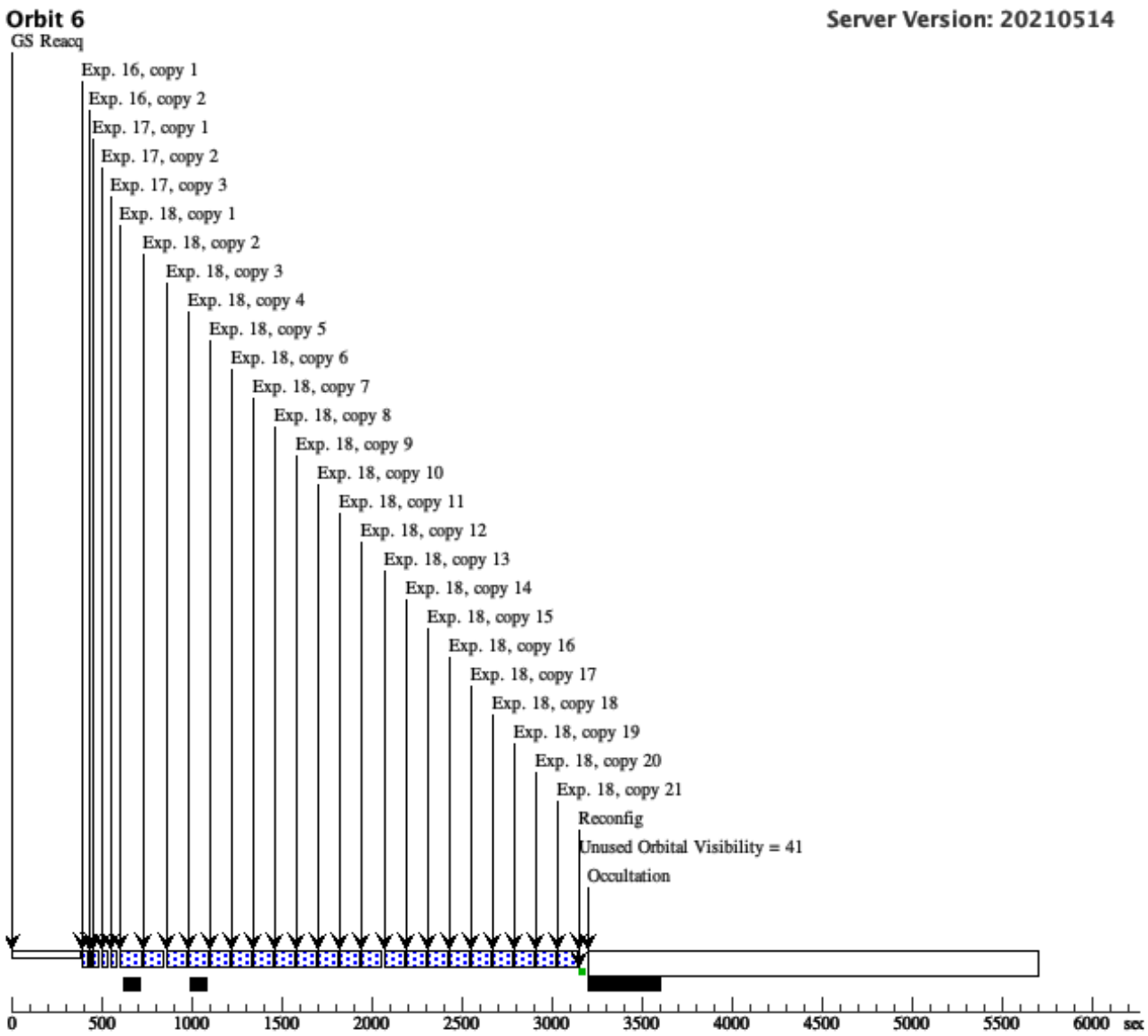
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Exp. 18, copy 4
Exp. 18, copy 5
Exp. 18, copy 6
Exp. 18, copy 7
Exp. 18, copy 8
Exp. 18, copy 9
Exp. 18, copy 10
Exp. 18, copy 11
Exp. 18, copy 12
Exp. 18, copy 13
Exp. 18, copy 14
Exp. 18, copy 15
Exp. 18, copy 16
Exp. 18, copy 17
Exp. 18, copy 18
Exp. 18, copy 19
Exp. 18, copy 20
Exp. 18, copy 21
Reconfig
Unused Orbital Visibility = 41
Occultation
0
500
1000
1500
2000
2500
3000
3500
4000
4500
5000
5500
6000
sec