17785 - Anchoring the Diversity of Cold Worlds With HST Spectra

Cycle: 32, Proposal Category: GO

(Availability Mode: SUPPORTED)

INVESTIGATORS

Name	*Institution*
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Dan Caselden (CoI)	American Museum of Natural History

VISITS

Visit	*Targets used in Visit*	*Configurations used in Visit*	*Orbits Used*	*Last Orbit Planner Run*	*OP Current with Visit?*
01	(1) W0503-5648	WFC3/IR	1	22-Apr-2026 12:00:13.0	yes
02	(2) W1935-1546	WFC3/IR	1	22-Apr-2026 12:00:14.0	yes
03	(1) W0503-5648	WFC3/IR	2	22-Apr-2026 12:00:14.0	yes
04	(2) W1935-1546	WFC3/IR	5	22-Apr-2026 12:00:15.0	yes

9 Total Orbits Used

ABSTRACT

Using cold brown dwarfs to understand Jupiter-like atmospheres hinges on defining and explaining their diverse properties. As such a recently accepted JWST cycle-1 GO proposal used the parallax sample of the reddest/faintest brown dwarfs to define 12 sources that share a common mid

infrared color -- an excellent proxy for temperature -- but show meaningfully different Spitzer [4.5] micron absolute magnitudes. Each source is to be followed up with JWST NIRSPEC G395H high resolution (R~2700) spectra as well as MIR F1000W, F1280W, and F1800W photometry to measure bolometric luminosities and differentiate what causes the sample diversity in the mid-infrared. However two of the 12 sources in this legacy JWST proposal lack NIR information therefore can not be maximized for their scientific output. For this HST proposal we request 9 orbits to obtain WFC3 Grism spectra for 2 cold brown dwarfs that are already slated to be definitional for cold world science.

OBSERVING DESCRIPTION

This program will obtain a low-resolution near-infrared spectrum of two Y dwarfs: W1935- 1546 and W0503-5648. We will use the WFC3 G141 grism, which has a resolving power of 130 over the 1.1-1.7 micron wavelength range. In order to wavelength calibrate the slitless grism images, direct images of the field in the F125W filter will be obtained. The WFC3 grism observations are slitless and therefore roll angle constraints must be placed on the observations in order to avoid contamination of the target by other sources in the field. To ensure we are able to find a suitable roll angle free of contamination from nearby sources, we will also require a pre-image of the field around both targets. Given the J band magnitude of W1935-1546 and W0503-5648 at 23.93+/-0.33 and 22.54+/-| 0.09 mag respectively, we require one orbit each to obtain a pre-image for analysis before the spectrum can be taken.

Based on published data of HST Y dwarfs as well as modeling of cold brown dwarf spectra, we require a minimum S/N of ~30 - 50 for the G141 grism observation. This S/N will allow for a high precision spectral retrieval that can be used in tandem with the soon to be acquired JWST data. We will use 4 dither positions for both the direct F125W images and the G141 grism observations. We used a model Y0 template with the HST WFC3 exposure time calculator to conclude that W0503-5648 requires 2 orbits and W1935-1546 requires 5 orbits to achieve the required S/N.
In all we request 3 orbits for W0503-5648, 6 orbits for W1935-1546 or 9 orbits in total to complete the program.

Visit

Proposal 17785, W0503 Pre-Image (01), completed

Wed Apr 22 16:00:16 GMT 2026

Diagnostic Status: No Diagnostics

Scientific Instruments: WFC3/IR

Special Requirements: (none)

Patterns

#	Primary Pattern		Secondary Pattern	Exposures
(1)	Pattern Type=WFC3-IR-DITHER-BOX-MIN Purpose=DITHER Number Of Points=4 Point Spacing=0.572 Line Spacing=0.365	Coordinate Frame=POS-TARG Pattern Orientation=18.528 Angle Between Sides=74.653 Center Pattern=false		(1)

Fixed Targets

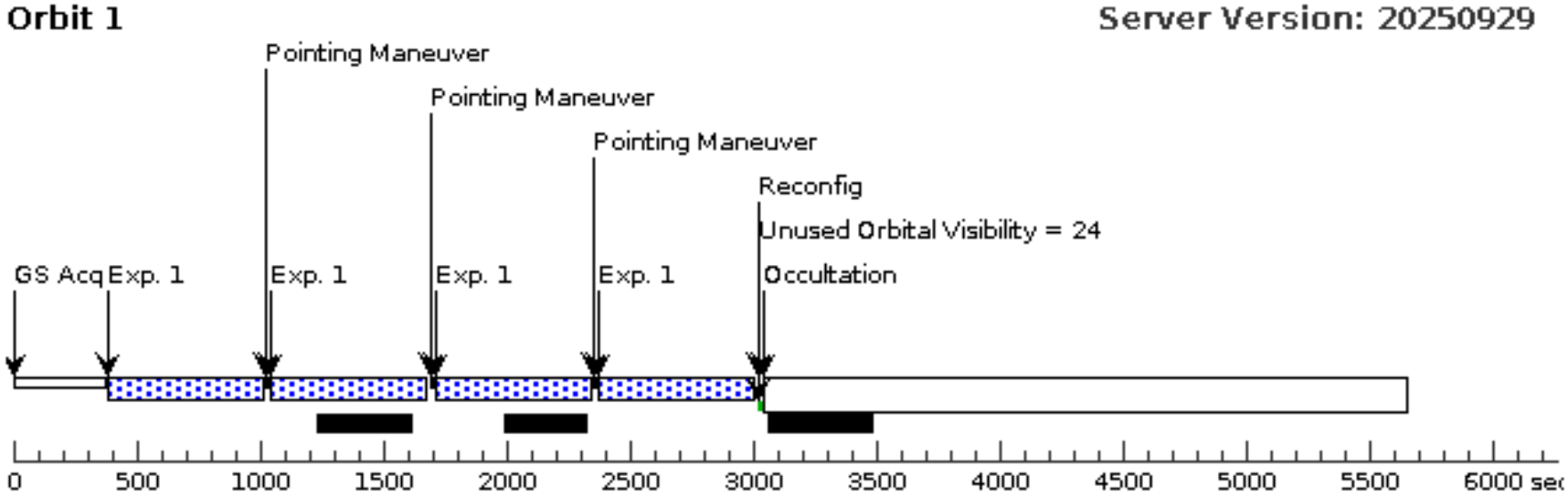
#	Name	Target Coordinates	Targ. Coord. Corrections	Fluxes	Miscellaneous
(1)	W0503-5648	RA: 05 03 6.9359 (75.7788996d) Dec: -56 48 29.44 (-56.80818d) Equinox: J2000	Proper Motion RA: 759.2 mas/yr Proper Motion Dec: 288.2 mas/yr Parallax: 0.0983" Epoch of Position: 2022.6969	V=(?) J=22.54	Reference Frame: ICRS

Comments:
Category=STAR
Description=[BROWN DWARF]

Exposures

#	Label	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time (Total)/[Actual Dur.]	Orbit
1	W0503 F125W Image	(1) W0503-5648	WFC3/IR, MULTIACCUM, GRISM1024	F125W	NSAMP=13; SAMP-SEQ=SPARS50		Pattern 1, Exps 1-1 in W0503 Pre-Image (01) (1)	602.937703 Secs (2411.751 Secs) *[==>(Pattern 1)]* *[==>(Pattern 2)]* *[==>(Pattern 3)]* *[==>(Pattern 4)]*	***[1]***

Orbit Structure



Visit

Proposal 17785, W1935 Pre-Image (02), completed Wed Apr 22 16:00:16 GMT 2026

Diagnostic Status: Warning

Scientific Instruments: WFC3/IR

Special Requirements: (none)

Diagnostics

(W1935 Pre-Image (02)) Warning (Orbit Planner): ORBITAL VISIBILITY OVERRUN

Patterns

#	Primary Pattern		Secondary Pattern	Exposures
(1)	Pattern Type=WFC3-IR-DITHER-BOX-MIN Purpose=DITHER Number Of Points=4 Point Spacing=0.572 Line Spacing=0.365	Coordinate Frame=POS-TARG Pattern Orientation=18.528 Angle Between Sides=74.653 Center Pattern=false		(1)

Fixed Targets

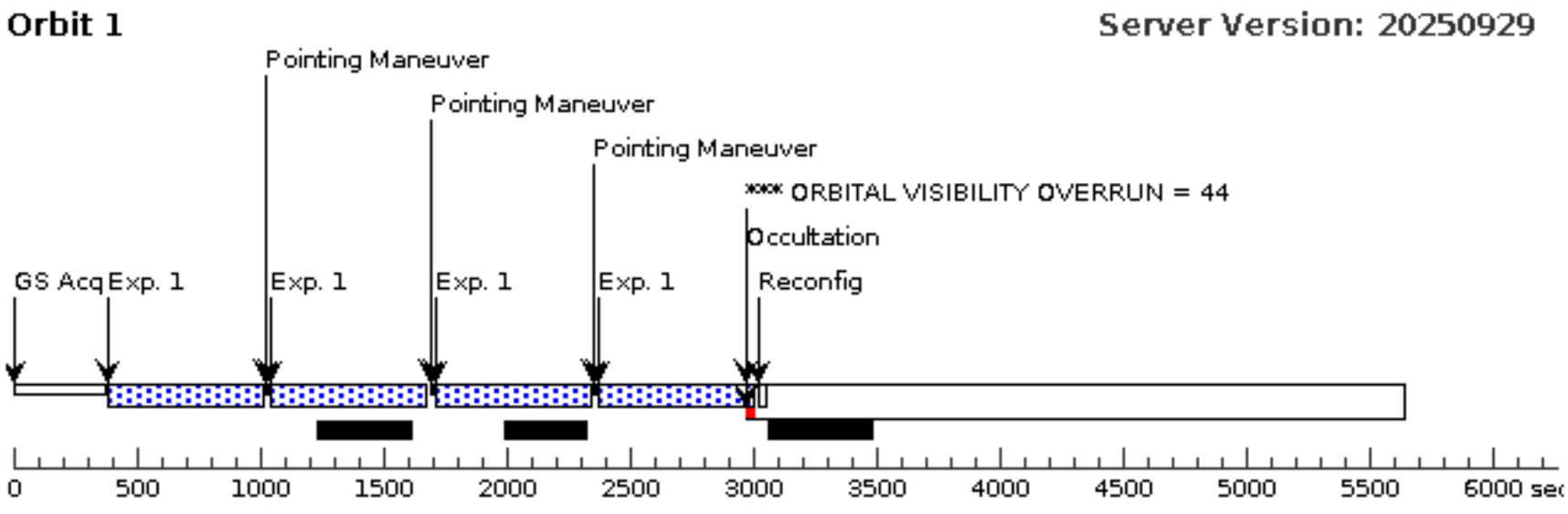
#	Name	Target Coordinates	Targ. Coord. Corrections	Fluxes	Miscellaneous
(2)	W1935-1546	RA: 19 35 18.7380 (293.8280750d) Dec: -15 46 20.33 (-15.77231d) Equinox: J2000	Proper Motion RA: 290.2 mas/yr Proper Motion Dec: 43.1 mas/yr Parallax: 0.0693" Epoch of Position: 2022.7168	V=(?) J=23.93	Reference Frame: ICRS

Comments:
Category=STAR
Description=[BROWN DWARF]

Exposures

#	Label	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time (Total)/[Actual Dur.]	Orbit
1	W1935 F125W Image	(2) W1935-1546	WFC3/IR, MULTIACCUM, GRISM1024	F125W	NSAMP=13; SAMP-SEQ=SPARS50		Pattern 1, Exps 1-1 in W1935 Pre-Image (02) (1)	602.937703 Secs (2411.751 Secs) *[==>(Pattern 1)]* *[==>(Pattern 2)]* *[==>(Pattern 3)]* *[==>(Pattern 4)]*	***[1]***

Orbit Structure



Visit

Proposal 17785, G141 Grism for W0503 (03), completed Wed Apr 22 16:00:16 GMT 2026

Diagnostic Status: Warning

Scientific Instruments: WFC3/IR

Special Requirements: SCHED 100%; ORIENT 15D TO 25 D; ORIENT 195D TO 205 D; AFTER 01 BY 60.0 D TO 365.0 D; ON HOLD FOR 01

On Hold Comments: Pre-image of W0503 is required to determine roll angle for G141 spectroscopic observations. 60 days allows for the determination of this angle and an update to the Phase II.

Diagnostics

(G141 Grism for W0503 (03)) Warning (Orbit Planner): ORBITAL VISIBILITY OVERRUN

(G141 Grism for W0503 (03)) Warning (Orbit Planner): ORBITAL VISIBILITY OVERRUN

Patterns

#	Primary Pattern		Secondary Pattern	Exposures
(2)	Pattern Type=LINE	Coordinate Frame=POS-TARG		(2), (4)
	Purpose=DITHER	Pattern Orientation=0		
	Number Of Points=2	Angle Between Sides=		
	Point Spacing=0.572	Center Pattern=false		
	Line Spacing=			

Fixed Targets

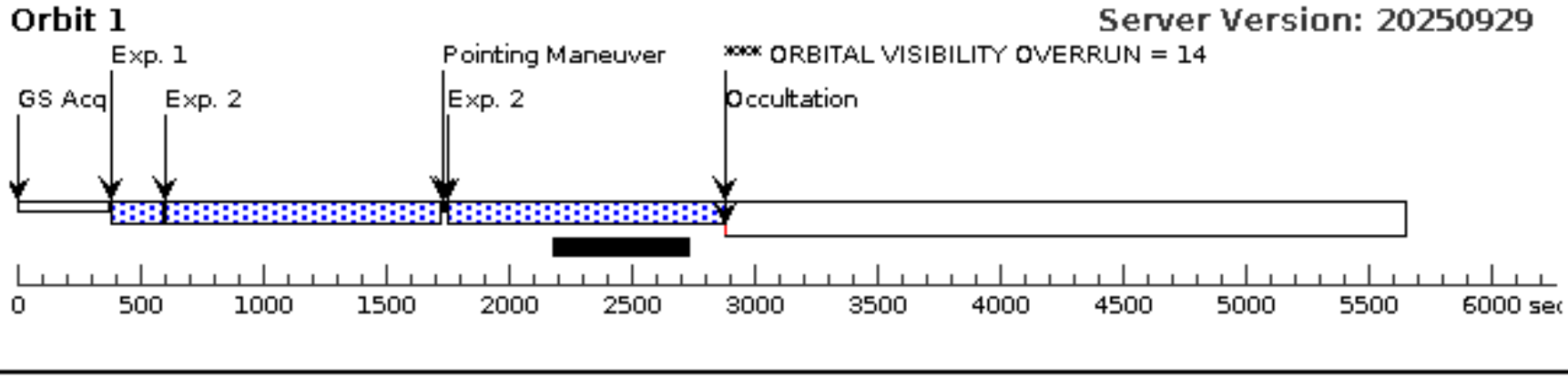
#	Name	Target Coordinates	Targ. Coord. Corrections	Fluxes	Miscellaneous
(1)	W0503-5648	RA: 05 03 6.9359 (75.7788996d)	Proper Motion RA: 759.2 mas/yr	V=(?)	Reference Frame: ICRS
		Dec: -56 48 29.44 (-56.80818d)	Proper Motion Dec: 288.2 mas/yr	J=22.54	
		Equinox: J2000	Parallax: 0.0983"		
			Epoch of Position: 2022.6969		

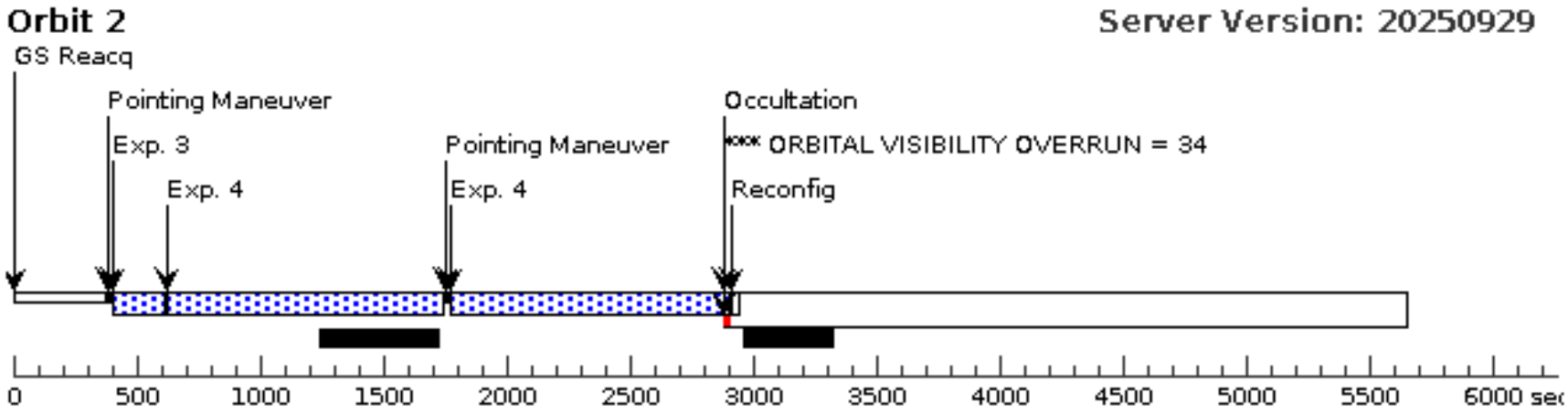
Comments:
Category=STAR
Description=[BROWN DWARF]

Exposures

#	Label	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time (Total)/[Actual Dur.]	Orbit
1	F125W Direct Image for W0503	(1) W0503-5648	WFC3/IR, MULTIACCUM, GRISM1024	F125W	NSAMP=8; SAMP-SEQ=SPARS25			177.935896 Secs (177.936 Secs) *[==>]*	*[1]*
2		(1) W0503-5648	WFC3/IR, MULTIACCUM, GRISM1024	G141	SAMP-SEQ=SPARS100; NSAMP=12		Pattern 2, Exps 2-2 in G141 Grism for W0503 (03) (2)	1102.935844 Secs (2205.872 Secs) *[==>(Pattern 1)]* *[==>(Pattern 2)]*	*[1]*
3	F125W Direct Image for W0503	(1) W0503-5648	WFC3/IR, MULTIACCUM, GRISM1024	F125W	NSAMP=8; SAMP-SEQ=SPARS25	POS TARG 0.542,0.182		177.935896 Secs (177.936 Secs) *[==>]*	*[2]*
4		(1) W0503-5648	WFC3/IR, MULTIACCUM, GRISM1024	G141	SAMP-SEQ=SPARS100; NSAMP=12	POS TARG 0.542,0.182	Pattern 2, Exps 4-4 in G141 Grism for W0503 (03) (2)	1102.935844 Secs (2205.872 Secs) *[==>(Pattern 1)]* *[==>(Pattern 2)]*	*[2]*

Orbit Structure





Visit

Proposal 17785, G141 Grism for W1935 (04), implementation Wed Apr 22 16:00:16 GMT 2026

Diagnostic Status: No Diagnostics

Scientific Instruments: WFC3/IR

Special Requirements: SCHED 100%; ORIENT 85D TO 95 D; ORIENT 265D TO 275 D; AFTER 02 BY 60.0 D TO 365.0 D; ON HOLD FOR 02

On Hold Comments: Pre-image of W1935 is required to determine roll angle for G141 spectroscopic observations. 60 days allows for the determination of this angle and an update to the Phase II.

Patterns

#	Primary Pattern		Secondary Pattern	Exposures
(2)	Pattern Type=LINE	Coordinate Frame=POS-TARG		(2), (4), (6), (8), (10)
	Purpose=DITHER	Pattern Orientation=0		
	Number Of Points=2	Angle Between Sides=		
	Point Spacing=0.572	Center Pattern=false		
	Line Spacing=			

Fixed Targets

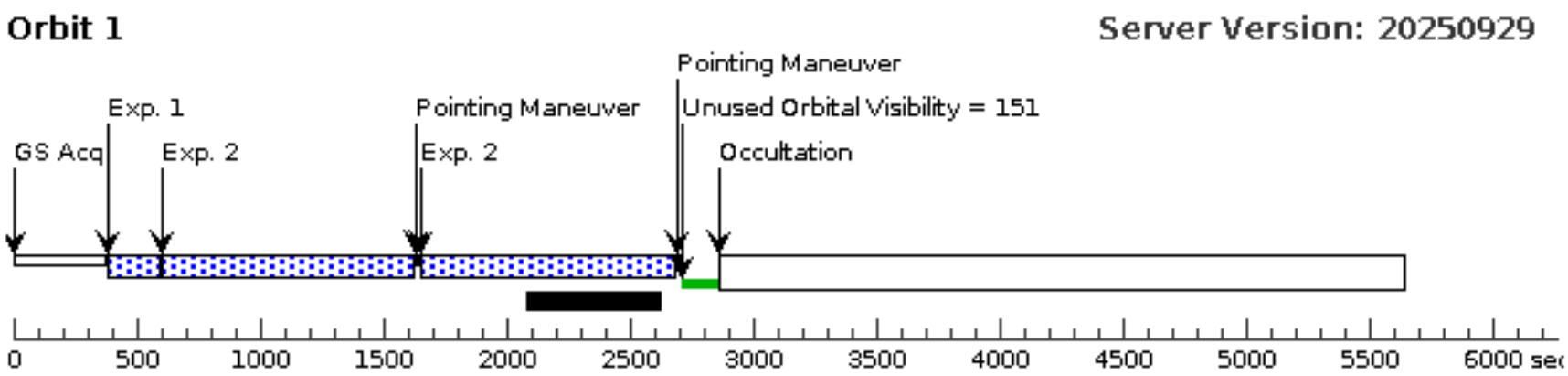
#	Name	Target Coordinates	Targ. Coord. Corrections	Fluxes	Miscellaneous
(2)	W1935-1546	RA: 19 35 18.7380 (293.8280750d)	Proper Motion RA: 290.2 mas/yr	V=(?)	Reference Frame: ICRS
		Dec: -15 46 20.33 (-15.77231d)	Proper Motion Dec: 43.1 mas/yr	J=23.93	
		Equinox: J2000	Parallax: 0.0693"		
			Epoch of Position: 2022.7168		

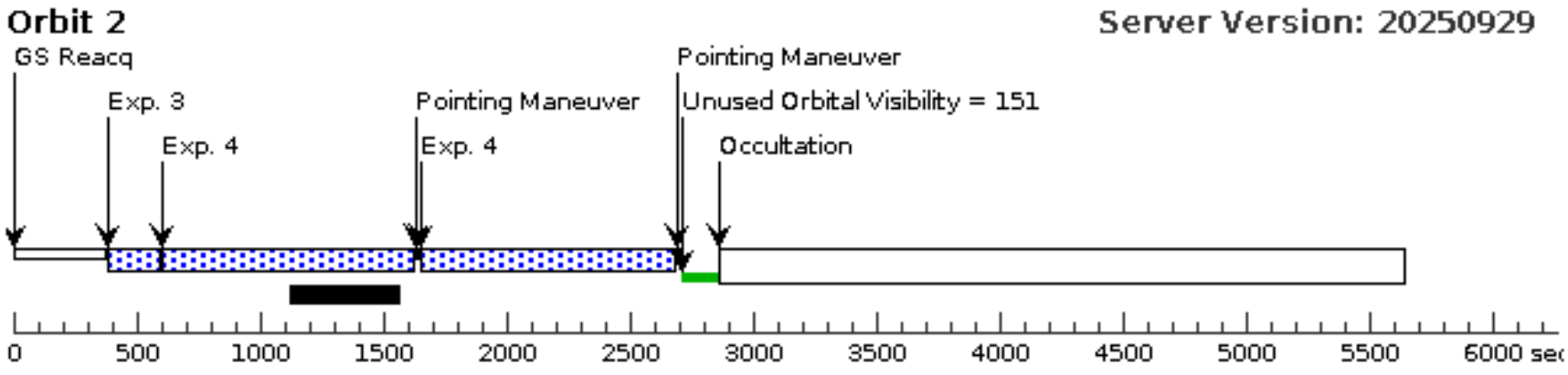
Comments:
Category=STAR
Description=[BROWN DWARF]

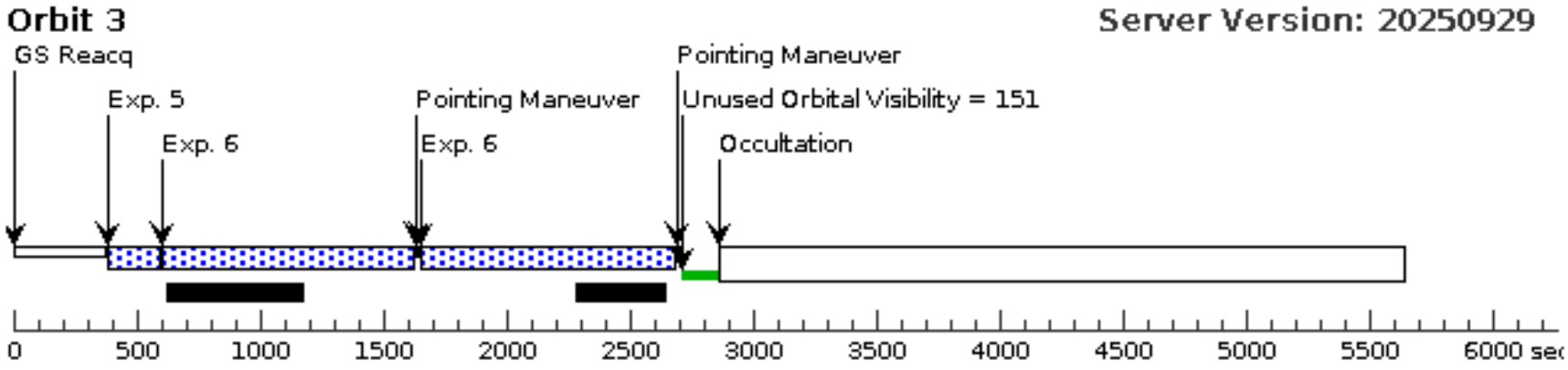
Exposures

#	Label	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time (Total)/[Actual Dur.]	Orbit
1	F125W Direct Image for W1935	(2) W1935-1546	WFC3/IR, MULTIACCUM, GRISM1024	F125W	NSAMP=8; SAMP-SEQ=SPARS25			177.935896 Secs (177.936 Secs) *[==>]*	***[1]***
2		(2) W1935-1546	WFC3/IR, MULTIACCUM, GRISM1024	G141	SAMP-SEQ=SPARS100; NSAMP=11		Pattern 2, Exps 2-2 in G141 Grism for W1935 (04) (2)	1002.935521 Secs (2005.871 Secs) *[==>(Pattern 1)]* *[==>(Pattern 2)]*	***[1]***
3	F125W Direct Image for W1935	(2) W1935-1546	WFC3/IR, MULTIACCUM, GRISM1024	F125W	NSAMP=8; SAMP-SEQ=SPARS25	POS TARG 0.542,0.182		177.935896 Secs (177.936 Secs) *[==>]*	***[2]***
4		(2) W1935-1546	WFC3/IR, MULTIACCUM, GRISM1024	G141	SAMP-SEQ=SPARS100; NSAMP=11	POS TARG 0.542,0.182	Pattern 2, Exps 4-4 in G141 Grism for W1935 (04) (2)	1002.935521 Secs (2005.871 Secs) *[==>(Pattern 1)]* *[==>(Pattern 2)]*	***[2]***
5	F125W Direct Image for W1935	(2) W1935-1546	WFC3/IR, MULTIACCUM, GRISM1024	F125W	NSAMP=8; SAMP-SEQ=SPARS25	POS TARG 0.542,0.182		177.935896 Secs (177.936 Secs) *[==>]*	***[3]***
6		(2) W1935-1546	WFC3/IR, MULTIACCUM, GRISM1024	G141	SAMP-SEQ=SPARS100; NSAMP=11	POS TARG 0.542,0.182	Pattern 2, Exps 6-6 in G141 Grism for W1935 (04) (2)	1002.935521 Secs (2005.871 Secs) *[==>(Pattern 1)]* *[==>(Pattern 2)]*	***[3]***
7	F125W Direct Image for W1935	(2) W1935-1546	WFC3/IR, MULTIACCUM, GRISM1024	F125W	NSAMP=8; SAMP-SEQ=SPARS25	POS TARG 0.542,0.182		177.935896 Secs (177.936 Secs) *[==>]*	***[4]***
8		(2) W1935-1546	WFC3/IR, MULTIACCUM, GRISM1024	G141	SAMP-SEQ=SPARS100; NSAMP=11	POS TARG 0.542,0.182	Pattern 2, Exps 8-8 in G141 Grism for W1935 (04) (2)	1002.935521 Secs (2005.871 Secs) *[==>(Pattern 1)]* *[==>(Pattern 2)]*	***[4]***
9	F125W Direct Image for W1935	(2) W1935-1546	WFC3/IR, MULTIACCUM, GRISM1024	F125W	NSAMP=8; SAMP-SEQ=SPARS25	POS TARG 0.542,0.182		177.935896 Secs (177.936 Secs) *[==>]*	***[5]***
10		(2) W1935-1546	WFC3/IR, MULTIACCUM, GRISM1024	G141	SAMP-SEQ=SPARS100; NSAMP=11	POS TARG 0.542,0.182	Pattern 2, Exps 10-10 in G141 Grism for W1935 (04) (2)	1002.935521 Secs (2005.871 Secs) *[==>(Pattern 1)]* *[==>(Pattern 2)]*	***[5]***

Orbit Structure



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GS Reacq
Exp. 5
Exp. 6
Pointing Maneuver
Exp. 6
Pointing Maneuver
Unused Orbital Visibility = 151
Occultation
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500
1000
1500
2000
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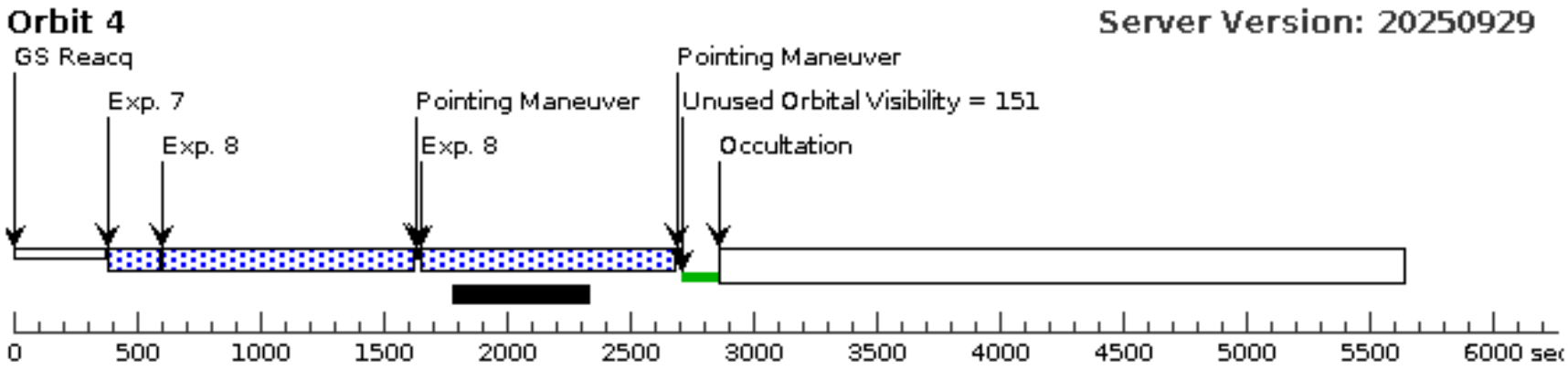
3000
3500
4000
4500
5000
5500
6000 sec


Orbit 4
Server Version: 20250929
GS Reacq
Exp. 7
Exp. 8
Pointing Maneuver
Exp. 8
Pointing Maneuver
Unused Orbital Visibility = 151
Occultation
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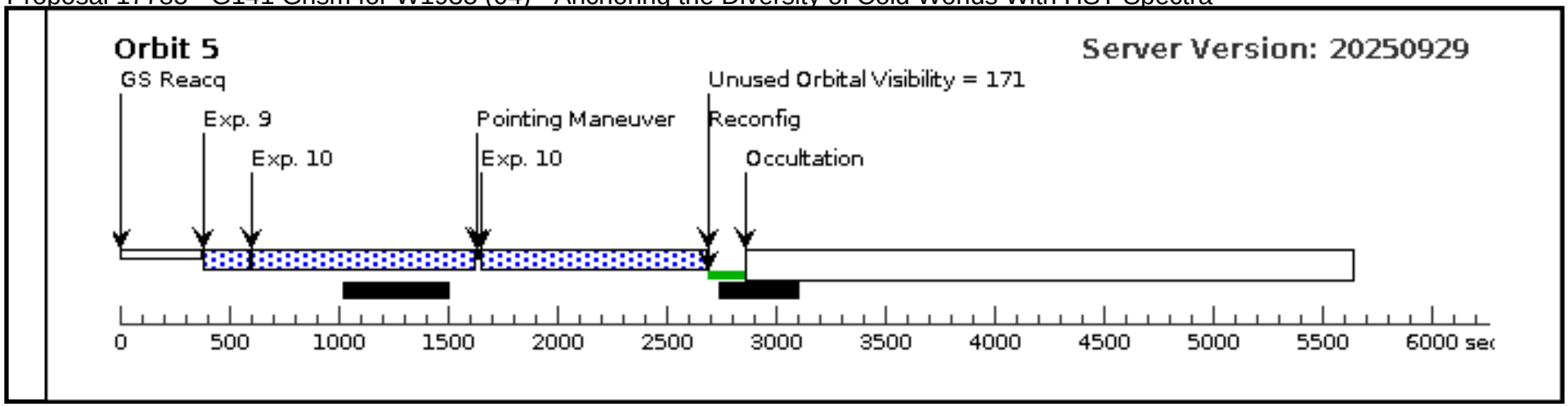
6000 sec


Orbit 5
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GS Reacq
Exp. 9
Exp. 10
Pointing Maneuver
Exp. 10
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Reconfig
Occultation
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500
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5000
5500
6000 sec