



## 14157 - Testing Model Atmospheres with the Coldest Known Brown Dwarf

Cycle: 23, Proposal Category: GO

(Availability Mode: SUPPORTED)

### INVESTIGATORS

<i>Name</i>	<i>Institution</i>	<i>E-Mail</i>
<b>Prof. Kevin Luhman (PI) (Contact)</b>	<b>The Pennsylvania State University</b>	<b>kluhman@astro.psu.edu</b>
Mr. Taran Esplin (CoI)	The Pennsylvania State University	tle918@psu.edu

### 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) WISE0855-0714	WFC3/IR	2	04-Mar-2016 21:01:57.0	yes
02	(1) WISE0855-0714	WFC3/IR	2	04-Mar-2016 21:01:59.0	yes
03	(1) WISE0855-0714	WFC3/IR	2	04-Mar-2016 21:02:00.0	yes
04	(1) WISE0855-0714	WFC3/IR	2	04-Mar-2016 21:02:01.0	yes
05	(1) WISE0855-0714	WFC3/IR	2	04-Mar-2016 21:02:02.0	yes
06	(1) WISE0855-0714	WFC3/IR	2	04-Mar-2016 21:02:04.0	yes
07	(1) WISE0855-0714	ACS/WFC	2	04-Mar-2016 21:02:05.0	yes
08	(1) WISE0855-0714	ACS/WFC	2	04-Mar-2016 21:02:06.0	yes
09	(1) WISE0855-0714	ACS/WFC	2	04-Mar-2016 21:02:07.0	yes

18 Total Orbits Used

### ABSTRACT

Last year, we discovered a brown dwarf, WISE 0855-0714, that has a distance of 2.3 pc and a temperature of ~250 K, making it the 4th closest neighbor of the Sun and the coldest known brown dwarf. Because of its extreme proximity and temperature, it represents an unparalleled laboratory for studying planet-like atmospheres in an unexplored temperature regime. In Cycle 22, we obtained images of WISE 0855-0714 in the single most sensitive band of WFC3 for brown dwarfs (F110W) to assess the feasibility of spectroscopy and multi-band photometry, and to begin using it to test the colors predicted by model atmospheres. We have detected WISE 0855-0714 in those data, and the resulting photometry indicates that it is too faint for spectroscopy, but that photometry in additional HST bands is feasible. Therefore, we propose to observe WISE 0855-0714 with ACS and WFC3 in three bands that are well-suited for testing and discriminating between competing models of very cold atmospheres.

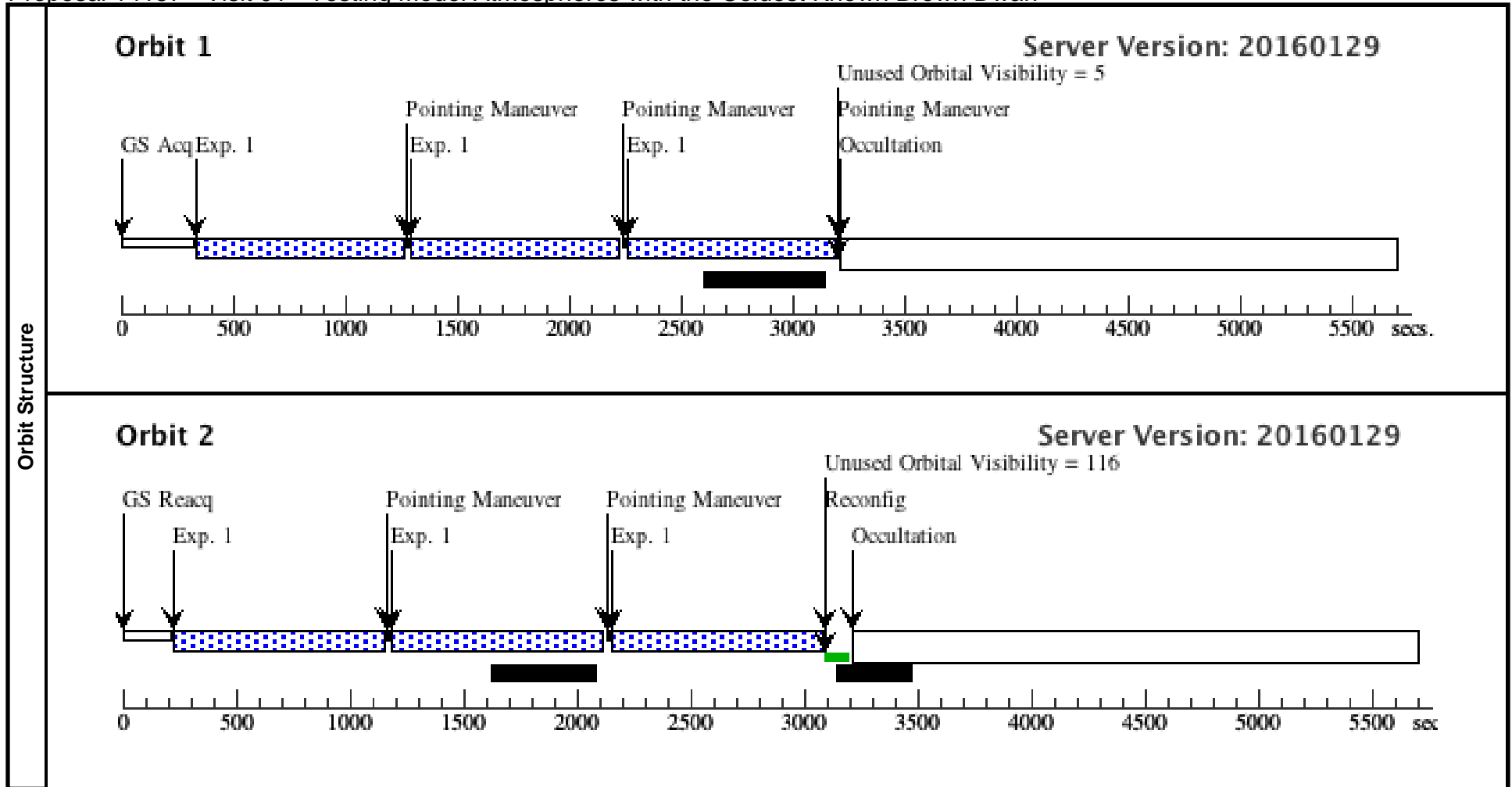
### **OBSERVING DESCRIPTION**

This program consists of WFC3/IR and ACS/WFC images in F105W, F127M, and F850LP of a single faint point source during 18 orbits (6 orbits per filter). The observations have been designed to maximize the total exposure time, optimize the spatial resolution, and provide sufficient flexibility for scheduling. For each of the three filters, the images will be obtained through three identical two-orbit visits. In each orbit, one exposure (SPARS100, NSAMP=10, 900 sec for WFC3; 810 sec for ACS) will be collected at each position in a three-point dither pattern. In each visit, the dither patterns in the two orbits will be offset from each other by 3.5 pixels along the x-axis of the array. The target will be observed at the IR and WFC1-1K apertures for WFC3 and ACS, respectively.

Proposal 14157 - Visit 01 - Testing Model Atmospheres with the Coldest Known Brown Dwarf

Sat Mar 05 02:02:08 GMT 2016

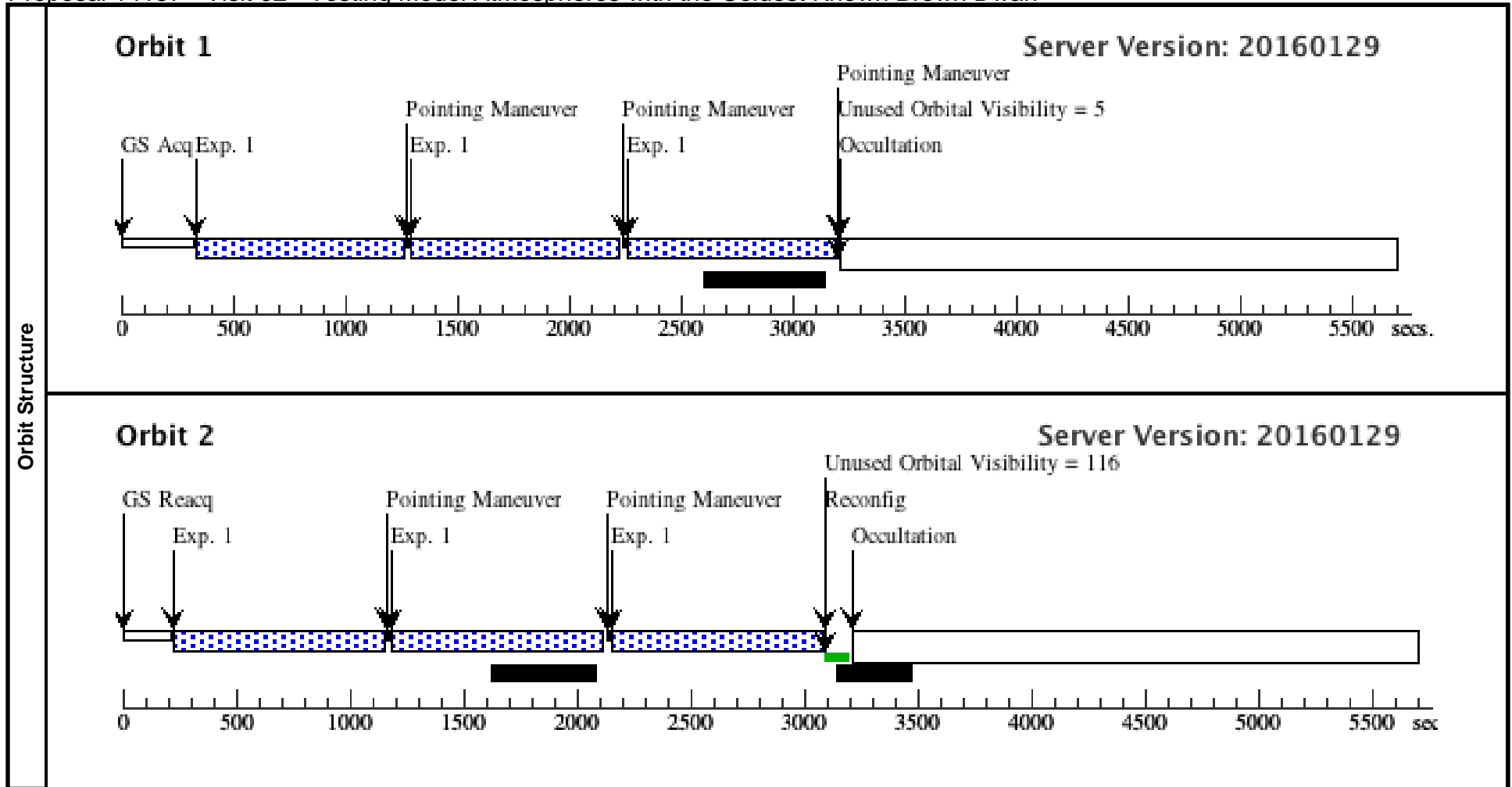
Visit	<b>Proposal 14157, Visit 01, scheduling</b> <b>Diagnostic Status: No Diagnostics</b> Scientific Instruments: WFC3/IR Special Requirements: (none)										
	Patterns	#	Primary Pattern			Secondary Pattern			Exposures		
		(1)	Pattern Type=LINE Purpose=DITHER Number Of Points=2 Point Spacing=0.4725 Line Spacing=	Coordinate Frame=POS-TARG Pattern Orientation=0 Angle Between Sides= Center Pattern=false	Pattern Type=WFC3-IR-DITHER-LINE-3PT Purpose=DITHER Number Of Points=3 Point Spacing=0.605 Line Spacing=	Coordinate Frame=POS-TARG Pattern Orientation=41.788 Angle Between Sides= Center Pattern=false	(1)				
Fixed Targets	#	Name	Target Coordinates		Targ. Coord. Corrections		Fluxes	Miscellaneous			
	(1)	WISE0855-0714	RA: 08 55 7.8289 (133.7826204d) Dec: -07 14 38.75 (-7.24410d) Equinox: J2000	Proper Motion RA: -8.1 arcsec/yr Proper Motion Dec: 0.7 arcsec/yr Parallax: 0.433" Epoch of Position: 2016	V=35	Reference Frame: ICRS					
	<i>Comments: Extended=NO</i>										
Exposures	#	Label	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time (Total)/[Actual Dur.]		Orbit
	1		(1) WISE0855-0714	WFC3/IR, MULTIACCUM, IR	F105W	NSAMP=10; SAMP-SEQ=SPAR S100		Pattern 1, Exps 1-1 i n Visit 01 (1)	902.935198 Secs (5417.611 Secs)		
									[=>(Pattern 1,1)]		
									[=>(Pattern 1,2)]		[1]
									[=>(Pattern 1,3)]		
									[=>(Pattern 2,1)]		
									[=>(Pattern 2,2)]		[2]
									[=>(Pattern 2,3)]		



Proposal 14157 - Visit 02 - Testing Model Atmospheres with the Coldest Known Brown Dwarf

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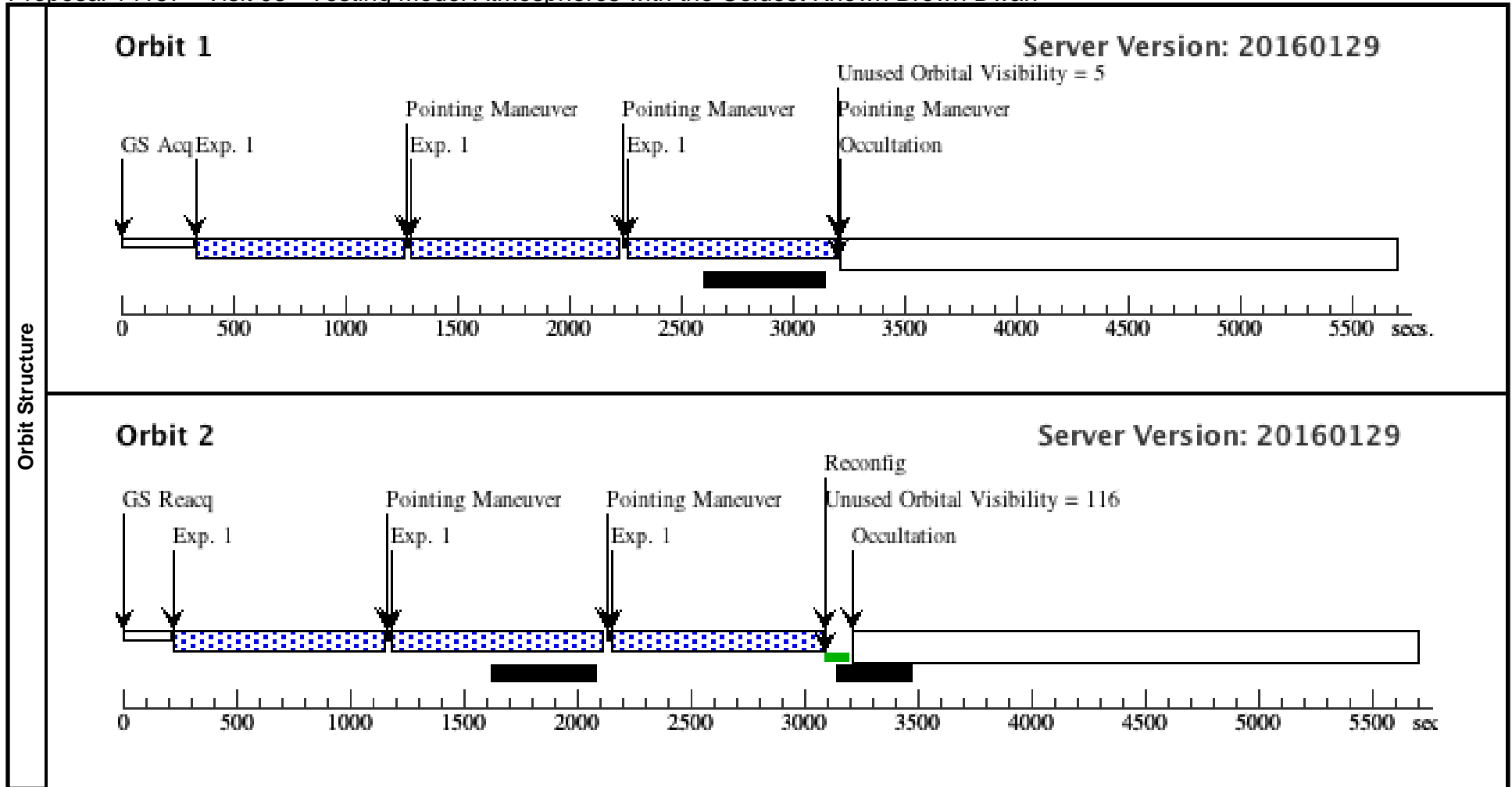
Visit	<b>Proposal 14157, Visit 02, scheduling</b> <b>Diagnostic Status: No Diagnostics</b> Scientific Instruments: WFC3/IR Special Requirements: (none)										
	Patterns	#	Primary Pattern			Secondary Pattern			Exposures		
		(1)	Pattern Type=LINE Purpose=DITHER Number Of Points=2 Point Spacing=0.4725 Line Spacing=	Coordinate Frame=POS-TARG Pattern Orientation=0 Angle Between Sides= Center Pattern=false	Pattern Type=WFC3-IR-DITHER-LINE-3PT Purpose=DITHER Number Of Points=3 Point Spacing=0.605 Line Spacing=	Coordinate Frame=POS-TARG Pattern Orientation=41.788 Angle Between Sides= Center Pattern=false	(1)				
Fixed Targets	#	Name	Target Coordinates	Targ. Coord. Corrections		Fluxes	Miscellaneous				
	(1)	WISE0855-0714	RA: 08 55 7.8289 (133.7826204d) Dec: -07 14 38.75 (-7.24410d) Equinox: J2000	Proper Motion RA: -8.1 arcsec/yr Proper Motion Dec: 0.7 arcsec/yr Parallax: 0.433" Epoch of Position: 2016	V=35	Reference Frame: ICRS					
	<i>Comments: Extended=NO</i>										
Exposures	#	Label	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time (Total)/[Actual Dur.]		Orbit
	1		(1) WISE0855-0714	WFC3/IR, MULTIACCUM, IR	F105W	NSAMP=10; SAMP-SEQ=SPAR S100		Pattern 1, Exps 1-1 i n Visit 02 (1)	902.935198 Secs (5417.611 Secs)		
									[==(Pattern 1,1)]		[1]
									[==(Pattern 1,2)]		
									[==(Pattern 1,3)]		
									[==(Pattern 2,1)]		
									[==(Pattern 2,2)]		[2]
									[==(Pattern 2,3)]		



Proposal 14157 - Visit 03 - Testing Model Atmospheres with the Coldest Known Brown Dwarf

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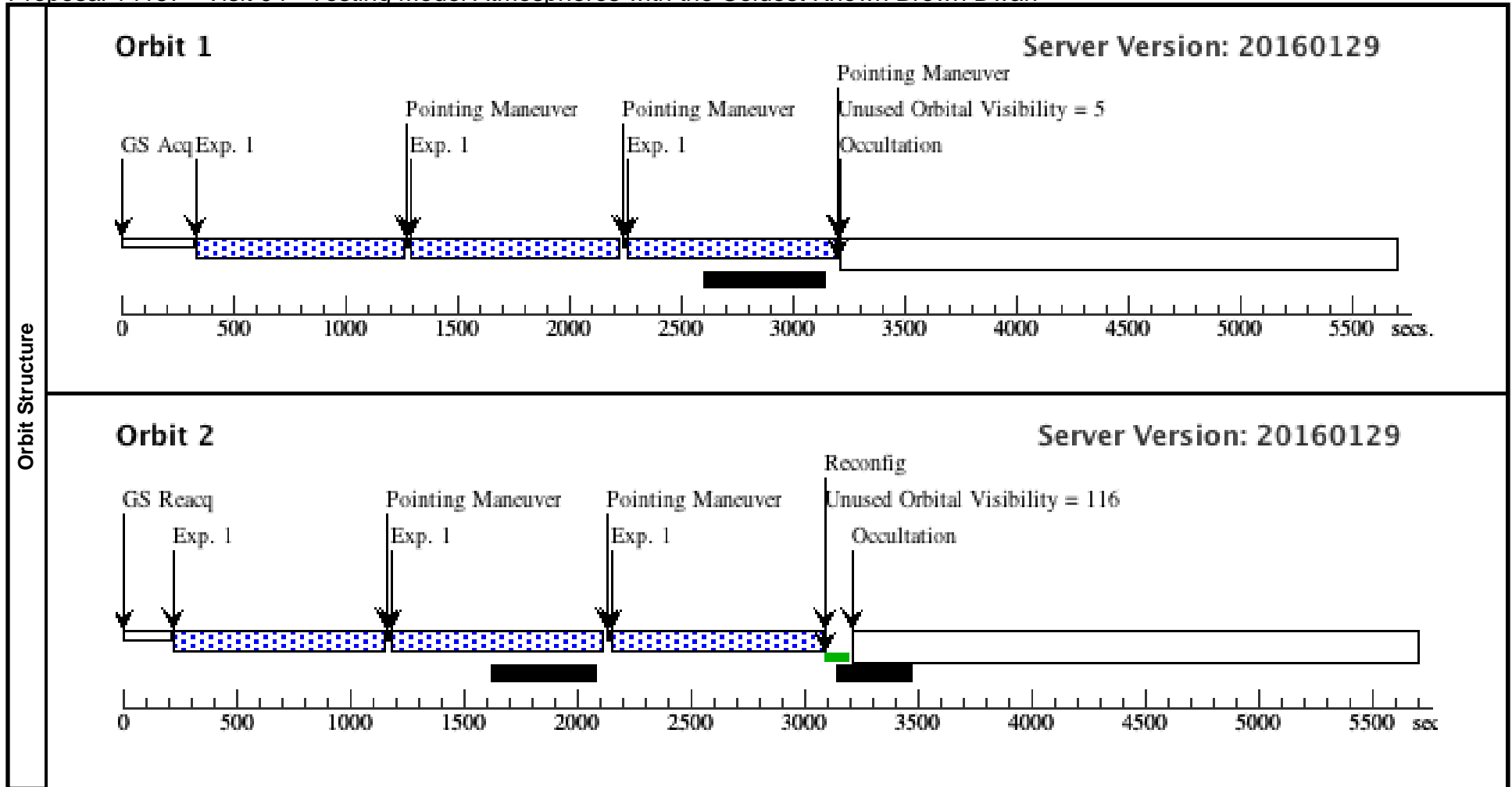
Visit	<b>Proposal 14157, Visit 03, scheduling</b> <b>Diagnostic Status: No Diagnostics</b> Scientific Instruments: WFC3/IR Special Requirements: (none)									
	Patterns	#	Primary Pattern			Secondary Pattern			Exposures	
		(1)	Pattern Type=LINE Purpose=DITHER Number Of Points=2 Point Spacing=0.4725 Line Spacing=	Coordinate Frame=POS-TARG Pattern Orientation=0 Angle Between Sides= Center Pattern=false	Pattern Type=WFC3-IR-DITHER- LINE-3PT Purpose=DITHER Number Of Points=3 Point Spacing=0.605 Line Spacing=	Coordinate Frame=POS-TARG Pattern Orientation=41.788 Angle Between Sides= Center Pattern=false	(1)			
Fixed Targets	#	Name	Target Coordinates	Targ. Coord. Corrections	Fluxes	Miscellaneous				
	(1)	WISE0855-0714	RA: 08 55 7.8289 (133.7826204d) Dec: -07 14 38.75 (-7.24410d) Equinox: J2000	Proper Motion RA: -8.1 arcsec/yr Proper Motion Dec: 0.7 arcsec/yr Parallax: 0.433" Epoch of Position: 2016	V=35	Reference Frame: ICRS				
	<i>Comments: Extended=NO</i>									
Exposures	#	Label	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time (Total)/[Actual Dur.]	Orbit
	1		(1) WISE0855-0714	WFC3/IR, MULTIACCUM, IR	F105W	NSAMP=10; SAMP-SEQ=SPAR S100		Pattern 1, Exps 1-1 i n Visit 03 (1)	902.935198 Secs (5417.611 Secs)	
								[==>(Pattern 1,1)]		
								[==>(Pattern 1,2)]		[1]
								[==>(Pattern 1,3)]		
								[==>(Pattern 2,1)]		
								[==>(Pattern 2,2)]		[2]
								[==>(Pattern 2,3)]		



Proposal 14157 - Visit 04 - Testing Model Atmospheres with the Coldest Known Brown Dwarf

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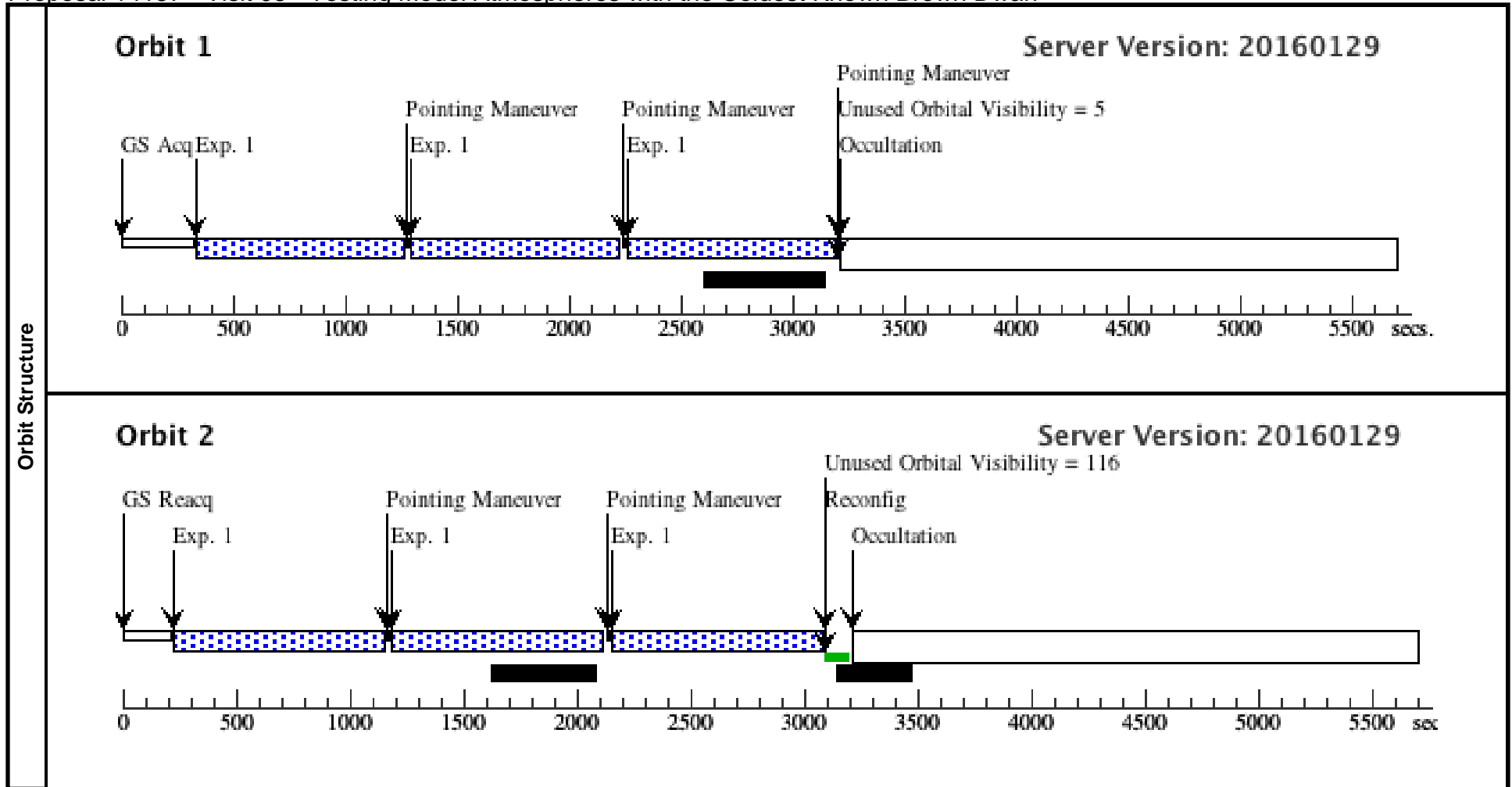
Visit	<b>Proposal 14157, Visit 04, scheduling</b> <b>Diagnostic Status: No Diagnostics</b> Scientific Instruments: WFC3/IR Special Requirements: (none)									
	Patterns	#	Primary Pattern			Secondary Pattern			Exposures	
		(1)	Pattern Type=LINE Purpose=DITHER Number Of Points=2 Point Spacing=0.4725 Line Spacing=	Coordinate Frame=POS-TARG Pattern Orientation=0 Angle Between Sides= Center Pattern=false	Pattern Type=WFC3-IR-DITHER- LINE-3PT Purpose=DITHER Number Of Points=3 Point Spacing=0.605 Line Spacing=	Coordinate Frame=POS-TARG Pattern Orientation=41.788 Angle Between Sides= Center Pattern=false	(1)			
Fixed Targets	#	Name	Target Coordinates	Targ. Coord. Corrections		Fluxes	Miscellaneous			
	(1)	WISE0855-0714	RA: 08 55 7.8289 (133.7826204d) Dec: -07 14 38.75 (-7.24410d) Equinox: J2000	Proper Motion RA: -8.1 arcsec/yr Proper Motion Dec: 0.7 arcsec/yr Parallax: 0.433" Epoch of Position: 2016	V=35	Reference Frame: ICRS				
	<i>Comments: Extended=NO</i>									
Exposures	#	Label	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time (Total)/[Actual Dur.]	Orbit
	1		(1) WISE0855-0714	WFC3/IR, MULTIACCUM, IR	F127M	NSAMP=10; SAMP-SEQ=SPAR S100		Pattern 1, Exps 1-1 i n Visit 04 (1)	902.935198 Secs (5417.611 Secs) [==>(Pattern 1,1)] [==>(Pattern 1,2)] [==>(Pattern 1,3)] [==>(Pattern 2,1)] [==>(Pattern 2,2)] [==>(Pattern 2,3)]	[1]    [2]



Proposal 14157 - Visit 05 - Testing Model Atmospheres with the Coldest Known Brown Dwarf

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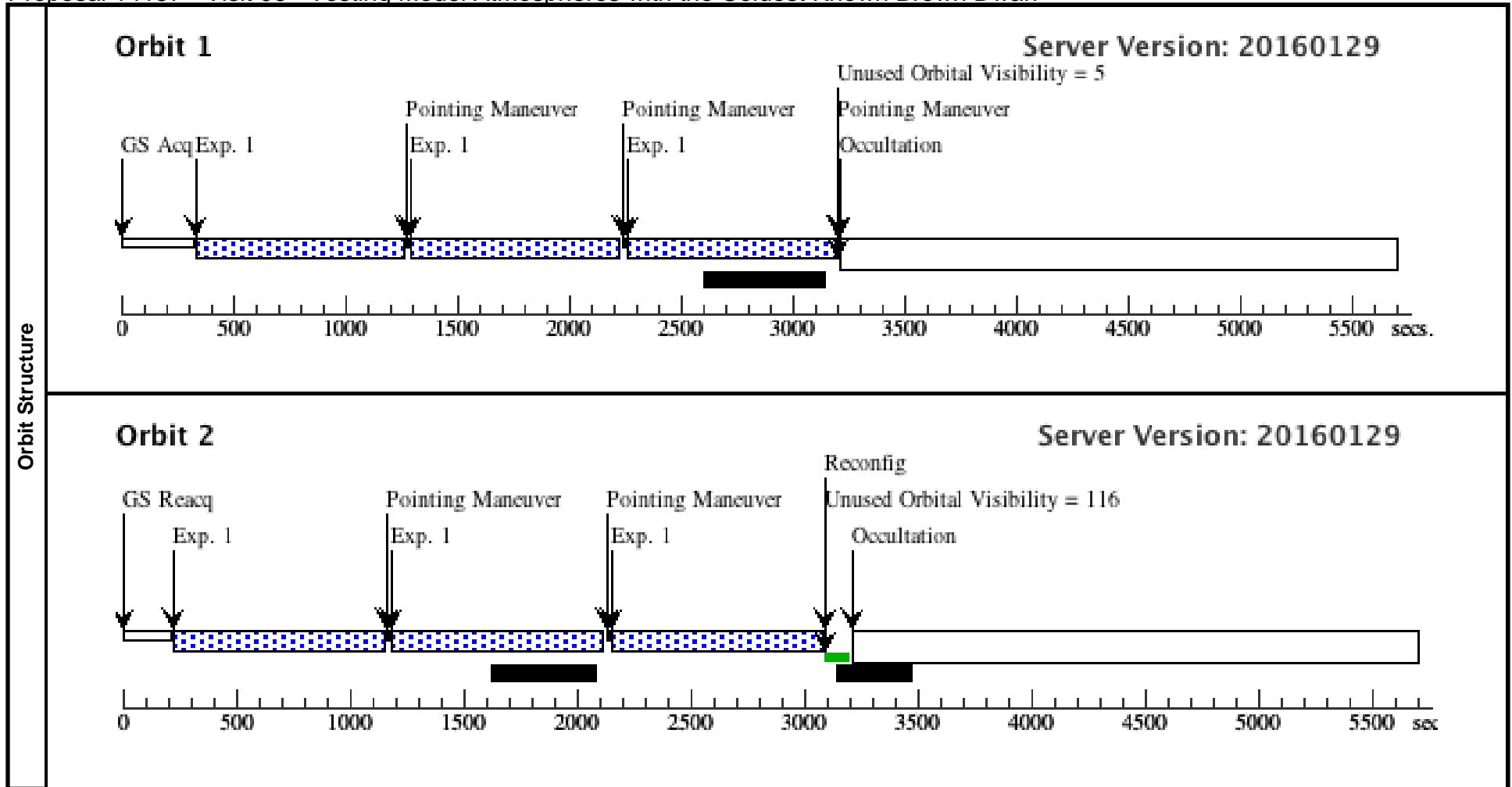
Visit	<b>Proposal 14157, Visit 05, scheduling</b> <b>Diagnostic Status: No Diagnostics</b> Scientific Instruments: WFC3/IR Special Requirements: (none)									
	Patterns	#	Primary Pattern			Secondary Pattern			Exposures	
		(1)	Pattern Type=LINE Purpose=DITHER Number Of Points=2 Point Spacing=0.4725 Line Spacing=	Coordinate Frame=POS-TARG Pattern Orientation=0 Angle Between Sides= Center Pattern=false	Pattern Type=WFC3-IR-DITHER-LINE-3PT Purpose=DITHER Number Of Points=3 Point Spacing=0.605 Line Spacing=	Coordinate Frame=POS-TARG Pattern Orientation=41.788 Angle Between Sides= Center Pattern=false	(1)			
Fixed Targets	#	Name	Target Coordinates	Targ. Coord. Corrections		Fluxes	Miscellaneous			
	(1)	WISE0855-0714	RA: 08 55 7.8289 (133.7826204d) Dec: -07 14 38.75 (-7.24410d) Equinox: J2000	Proper Motion RA: -8.1 arcsec/yr Proper Motion Dec: 0.7 arcsec/yr Parallax: 0.433" Epoch of Position: 2016	V=35	Reference Frame: ICRS				
	<i>Comments: Extended=NO</i>									
Exposures	#	Label	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time (Total)/[Actual Dur.]	Orbit
	1		(1) WISE0855-0714	WFC3/IR, MULTIACCUM, IR	F127M	NSAMP=10; SAMP-SEQ=SPAR S100		Pattern 1, Exps 1-1 i n Visit 05 (1)	902.935198 Secs (5417.611 Secs)	
								[==>(Pattern 1,1)]		
								[==>(Pattern 1,2)]		[1]
								[==>(Pattern 1,3)]		
								[==>(Pattern 2,1)]		
								[==>(Pattern 2,2)]		[2]
								[==>(Pattern 2,3)]		



Proposal 14157 - Visit 06 - Testing Model Atmospheres with the Coldest Known Brown Dwarf

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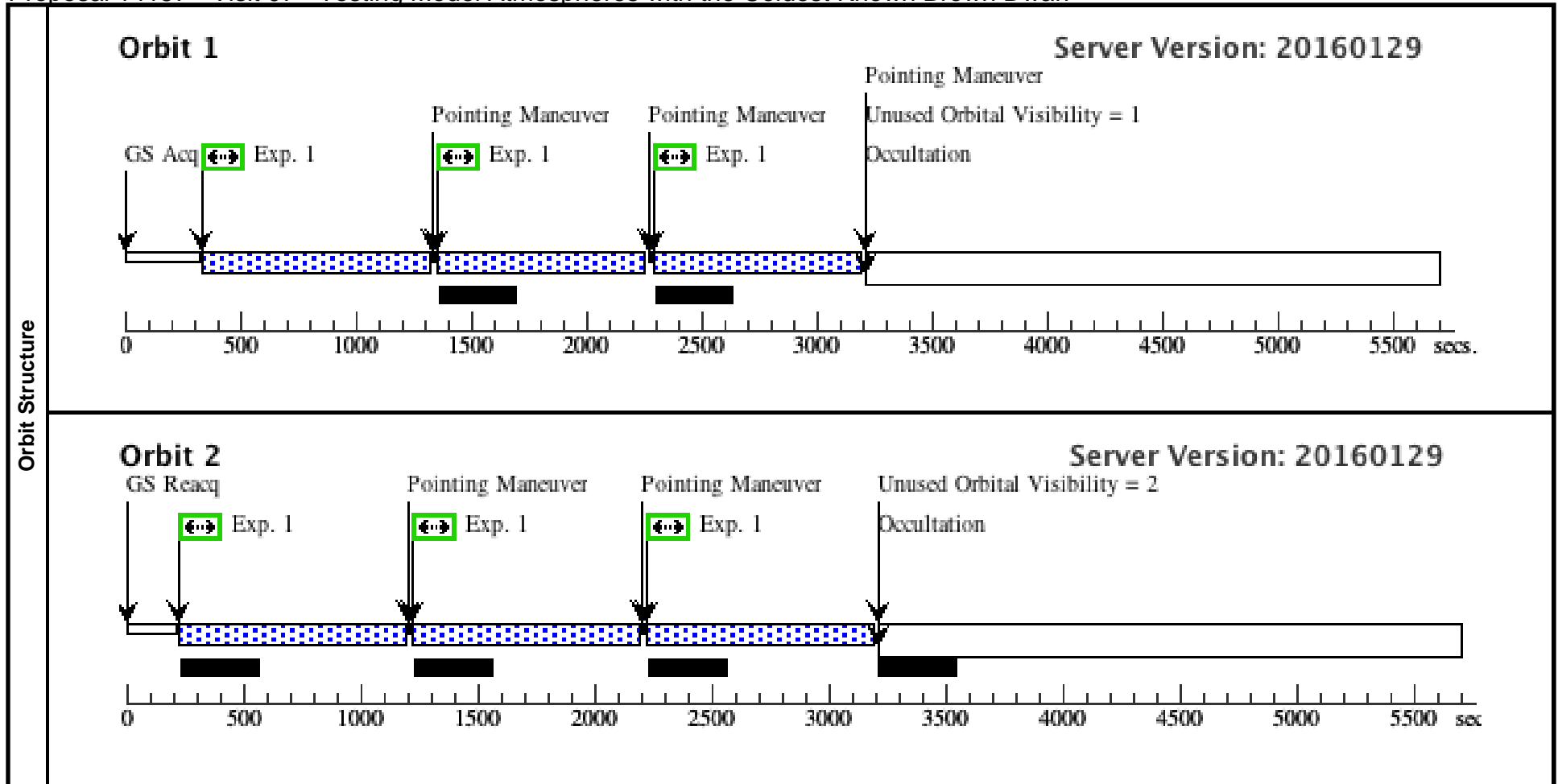
Visit	<b>Proposal 14157, Visit 06, scheduling</b> <b>Diagnostic Status: No Diagnostics</b> Scientific Instruments: WFC3/IR Special Requirements: (none)									
	Patterns	#	Primary Pattern			Secondary Pattern			Exposures	
		(1)	Pattern Type=LINE Purpose=DITHER Number Of Points=2 Point Spacing=0.4725 Line Spacing=	Coordinate Frame=POS-TARG Pattern Orientation=0 Angle Between Sides= Center Pattern=false	Pattern Type=WFC3-IR-DITHER-LINE-3PT Purpose=DITHER Number Of Points=3 Point Spacing=0.605 Line Spacing=	Coordinate Frame=POS-TARG Pattern Orientation=41.788 Angle Between Sides= Center Pattern=false	(1)			
Fixed Targets	#	Name	Target Coordinates	Targ. Coord. Corrections	Fluxes	Miscellaneous				
	(1)	WISE0855-0714	RA: 08 55 7.8289 (133.7826204d) Dec: -07 14 38.75 (-7.24410d) Equinox: J2000	Proper Motion RA: -8.1 arcsec/yr Proper Motion Dec: 0.7 arcsec/yr Parallax: 0.433" Epoch of Position: 2016	V=35	Reference Frame: ICRS				
	<i>Comments: Extended=NO</i>									
Exposures	#	Label	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time (Total)/[Actual Dur.]	Orbit
	1		(1) WISE0855-0714	WFC3/IR, MULTIACCUM, IR	F127M	NSAMP=10; SAMP-SEQ=SPAR S100		Pattern 1, Exps 1-1 i n Visit 06 (1)	902.935198 Secs (5417.611 Secs)	
								[==>(Pattern 1,1)]		
								[==>(Pattern 1,2)]		[1]
								[==>(Pattern 1,3)]		
								[==>(Pattern 2,1)]		
								[==>(Pattern 2,2)]		[2]
								[==>(Pattern 2,3)]		



Proposal 14157 - Visit 07 - Testing Model Atmospheres with the Coldest Known Brown Dwarf

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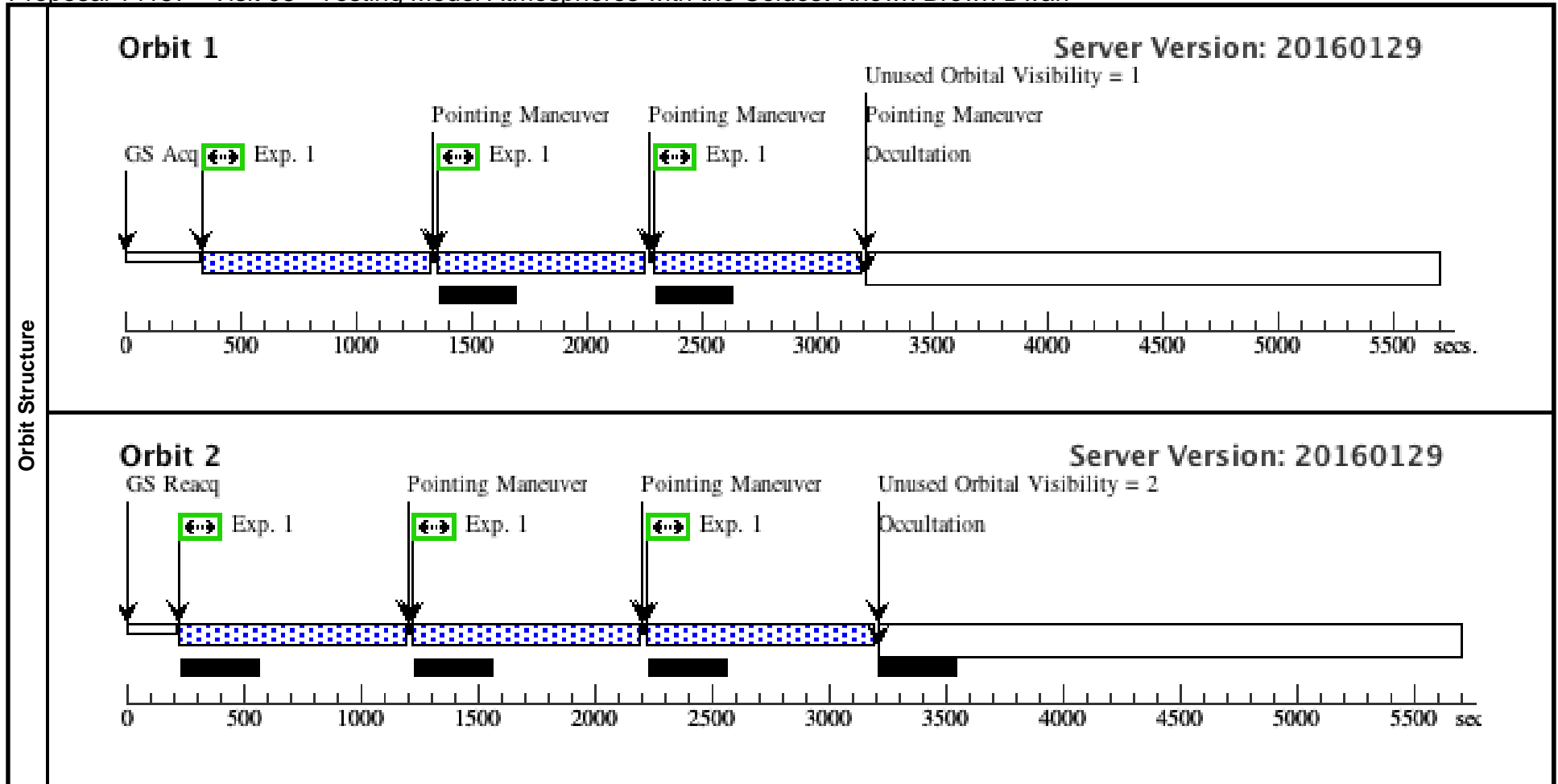
Visit	<b>Proposal 14157, Visit 07, implementation</b> <b>Diagnostic Status: No Diagnostics</b> Scientific Instruments: ACS/WFC Special Requirements: (none)									
	Patterns	#	Primary Pattern	Secondary Pattern	Exposures					
	(2)	Pattern Type=LINE Purpose=DITHER Number Of Points=2 Point Spacing=0.1726 Line Spacing=	Coordinate Frame=POS-TARG Pattern Orientation=0 Angle Between Sides= Center Pattern=false	Pattern Type=ACS-WFC-DITHER-LINE Purpose=DITHER Number Of Points=3 Point Spacing=0.170 Line Spacing=	(1)					
Fixed Targets	#	Name	Target Coordinates	Targ. Coord. Corrections	Fluxes	Miscellaneous				
	(1)	WISE0855-0714	RA: 08 55 7.8289 (133.7826204d) Dec: -07 14 38.75 (-7.24410d) Equinox: J2000	Proper Motion RA: -8.1 arcsec/yr Proper Motion Dec: 0.7 arcsec/yr Parallax: 0.433" Epoch of Position: 2016	V=35	Reference Frame: ICRS				
	<i>Comments: Extended=NO</i>									
Exposures	#	Label	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time (Total)/[Actual Dur.]	Orbit
	1		(1) WISE0855-0714	ACS/WFC, ACCUM, WFC1-CTE	F850LP			Pattern 2, Exps 1-1 i n Visit 07 (2)	810 Secs (4878 Secs)	
									[==>781.0 Secs (Pattern 1,1)]	
									[==>781.0 Secs (Pattern 1,2)]	[1]
									[==>781.0 Secs (Pattern 1,3)]	
									[==>845.0 Secs (Pattern 2,1)]	
									[==>845.0 Secs (Pattern 2,2)]	[2]
									[==>845.0 Secs (Pattern 2,3)]	



Proposal 14157 - Visit 08 - Testing Model Atmospheres with the Coldest Known Brown Dwarf

Sat Mar 05 02:02:09 GMT 2016

Visit	<b>Proposal 14157, Visit 08, implementation</b> <b>Diagnostic Status: No Diagnostics</b> Scientific Instruments: ACS/WFC Special Requirements: (none)									
	Patterns	#	Primary Pattern	Secondary Pattern	Exposures					
	(2)	Pattern Type=LINE Purpose=DITHER Number Of Points=2 Point Spacing=0.1726 Line Spacing=	Coordinate Frame=POS-TARG Pattern Orientation=0 Angle Between Sides= Center Pattern=false	Pattern Type=ACS-WFC-DITHER-LINE Purpose=DITHER Number Of Points=3 Point Spacing=0.170 Line Spacing=	(1)					
Fixed Targets	#	Name	Target Coordinates	Targ. Coord. Corrections	Fluxes	Miscellaneous				
	(1)	WISE0855-0714	RA: 08 55 7.8289 (133.7826204d) Dec: -07 14 38.75 (-7.24410d) Equinox: J2000	Proper Motion RA: -8.1 arcsec/yr Proper Motion Dec: 0.7 arcsec/yr Parallax: 0.433" Epoch of Position: 2016	V=35	Reference Frame: ICRS				
	<i>Comments: Extended=NO</i>									
Exposures	#	Label	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time (Total)/[Actual Dur.]	Orbit
	1		(1) WISE0855-0714	ACS/WFC, ACCUM, WFC1-CTE	F850LP			Pattern 2, Exps 1-1 i n Visit 08 (2)	810 Secs (4878 Secs)	
									[==>781.0 Secs (Pattern 1,1)]	
									[==>781.0 Secs (Pattern 1,2)]	[1]
									[==>781.0 Secs (Pattern 1,3)]	
									[==>845.0 Secs (Pattern 2,1)]	
									[==>845.0 Secs (Pattern 2,2)]	[2]
									[==>845.0 Secs (Pattern 2,3)]	



Proposal 14157 - Visit 09 - Testing Model Atmospheres with the Coldest Known Brown Dwarf

Sat Mar 05 02:02:09 GMT 2016

Visit	<b>Proposal 14157, Visit 09, implementation</b> <b>Diagnostic Status: No Diagnostics</b> Scientific Instruments: ACS/WFC Special Requirements: (none)									
	Patterns	#	Primary Pattern	Secondary Pattern	Exposures					
		(2)	Pattern Type=LINE Purpose=DITHER Number Of Points=2 Point Spacing=0.1726 Line Spacing=	Coordinate Frame=POS-TARG Pattern Orientation=0 Angle Between Sides= Center Pattern=false	Pattern Type=ACS-WFC-DITHER-LINE Purpose=DITHER Number Of Points=3 Point Spacing=0.170 Line Spacing=	Coordinate Frame=POS-TARG Pattern Orientation=47.23 Angle Between Sides= Center Pattern=false	(1)			
Fixed Targets	#	Name	Target Coordinates	Targ. Coord. Corrections	Fluxes	Miscellaneous				
	(1)	WISE0855-0714	RA: 08 55 7.8289 (133.7826204d) Dec: -07 14 38.75 (-7.24410d) Equinox: J2000	Proper Motion RA: -8.1 arcsec/yr Proper Motion Dec: 0.7 arcsec/yr Parallax: 0.433" Epoch of Position: 2016	V=35	Reference Frame: ICRS				
	<i>Comments: Extended=NO</i>									
Exposures	#	Label	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time (Total)/[Actual Dur.]	Orbit
	1		(1) WISE0855-0714	ACS/WFC, ACCUM, WFC1-CTE	F850LP				Pattern 2, Exps 1-1 i n Visit 09 (2)	810 Secs (4878 Secs) [==>781.0 Secs (Pattern 1,1)] [==>781.0 Secs (Pattern 1,2)] [==>781.0 Secs (Pattern 1,3)] [==>845.0 Secs (Pattern 2,1)] [==>845.0 Secs (Pattern 2,2)] [==>845.0 Secs (Pattern 2,3)]

