



17412 - Dynamical Masses of the Coldest Brown Dwarfs

Cycle: 31, Proposal Category: GO

(Availability Mode: SUPPORTED)

INVESTIGATORS

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Dr. Mark S. Marley (CoI)	University of Arizona
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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) WISEJ014656.66+423410.0	ACS/WFC	1	11-Jul-2024 15:00:17.0	yes
02	(2) WISEJ090649.35+473538.5	ACS/WFC	1	11-Jul-2024 15:00:18.0	yes
03	(3) CFBDSIRJ145829+101343	ACS/WFC	1	11-Jul-2024 15:00:18.0	yes
53	(3) CFBDSIRJ145829+101343	ACS/WFC	1	11-Jul-2024 15:00:19.0	yes
04	(4) WISEPCJ201546.27+664645.1	ACS/WFC	1	11-Jul-2024 15:00:19.0	yes
54	(4) WISEPCJ201546.27+664645.1	ACS/WFC	1	11-Jul-2024 15:00:19.0	yes

6 Total Orbits Used

ABSTRACT

On the cusp of the JWST era, we are still lacking mass measurements for the coldest brown dwarfs, even though mass is crucial for testing substellar models. We propose a 3-year orbit monitoring program to obtain the first sample of dynamical masses at temperatures of 400-800 K. With projected separations of only 1-3 AU, our targets are among the tightest and faintest substellar visual binaries ever found, discovered at the extreme limits of existing facilities. Resolved astrometry, combined with existing parallax data, is needed to measure their orbits, and only HST can deliver the high-precision monitoring required. These systems, composed entirely of T8-Y0 dwarfs, are likely to be the only such binaries amenable to direct mass measurements within the decade.

OBSERVING DESCRIPTION

The goal of our observations is to obtain precise relative astrometry (~ 3 -5 mas) for four brown dwarf binaries. Our data spanning 3 cycles will allow us to determine their orbits and thereby measure their dynamical masses. ACS/WFC offers a finer pixel scale than WFC3/IR and better sensitivity than WFC3/UVIS, both of which (high SNR, and better deblending of our tight 0.07"-0.11" binaries) are key to achieving our science goals.

We use a standard 3-position dither sequence to guard against cosmic rays and to sample different parts of the detector in case our target lands on a bad pixel in a single pointing. We set the exposure times to fill the time available in each visit, which will yield SNR of ~ 30 for our faintest target (WISE0146, J=20.7) and will still be far from saturating any other of our sources in F850LP (the brightest is J=16.9).

Proposal 17412 - WISE0146 (01) - Dynamical Masses of the Coldest Brown Dwarfs

Thu Jul 11 19:00:20 GMT 2024

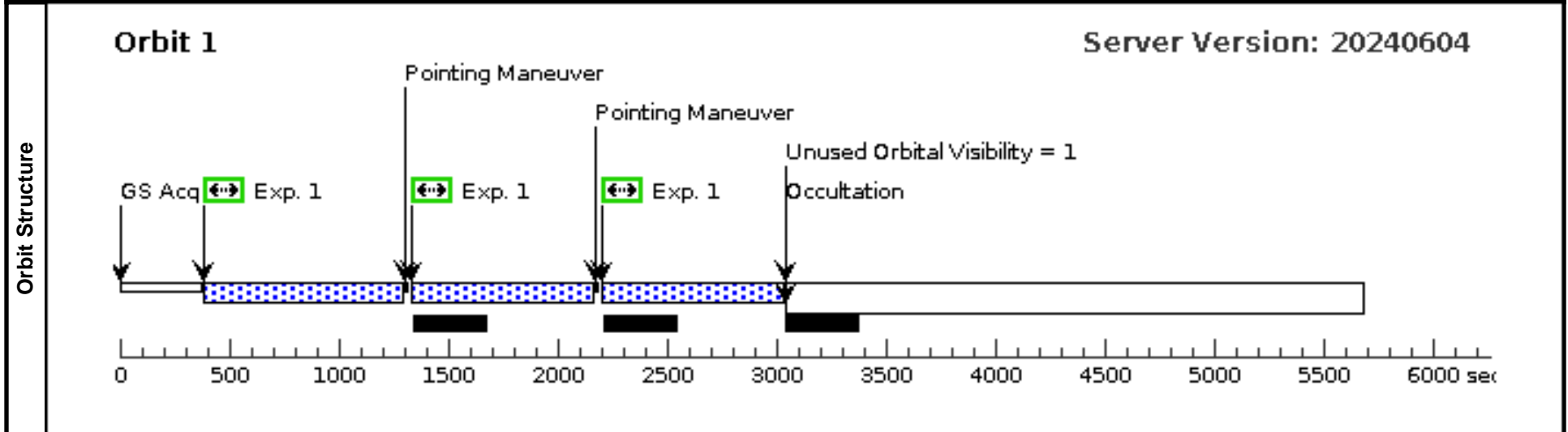
Visit	Proposal 17412, WISE0146 (01), completed		
	Diagnostic Status: No Diagnostics		
	Scientific Instruments: ACS/WFC		
	Special Requirements: AFTER 26-JUN-2024:00:00:00		

Patterns	#	Primary Pattern	Secondary Pattern	Exposures
	(1)	Pattern Type=ACS-WFC-DITHER-LINE Purpose=DITHER Number Of Points=3 Point Spacing=3.034 Line Spacing=	Coordinate Frame=POS-TARG Pattern Orientation=85.29 Angle Between Sides= Center Pattern=false	

Fixed Targets	#	Name	Target Coordinates	Targ. Coord. Corrections	Fluxes	Miscellaneous
	(1)	WISEJ014656.66+423410.0	RA: 01 46 56.2824 (26.7345100d) Dec: +42 34 9.66 (42.56935d) Equinox: J2000	Proper Motion RA: -0.452 arcsec/yr Proper Motion Dec: -0.033 arcsec/yr Parallax: 0.052" Epoch of Position: 2020.542	V=(?) J = 20.69	Reference Frame: ICRS

*Comments: Astrometry measured from je4o01010_drz.fits;
 Proper motion and parallax from 2021ApJS..253....7K
 Category=STAR
 Description=[BROWN DWARF, T]
 Extended=NO*

Exposures	#	Label	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time (Total)/[Actual Dur.]	Orbit
	1		(1) WISEJ014656.66+423410.0	ACS/WFC, ACCUM, WFC1-CTE	F850LP				Pattern 1, Exps 1-1 in WISE0146 (01) (1)	708 Secs (2124 Secs) [=>(Pattern 1)] [=>(Pattern 2)] [=>(Pattern 3)]



Proposal 17412 - WISE0906 (02) - Dynamical Masses of the Coldest Brown Dwarfs

Thu Jul 11 19:00:20 GMT 2024

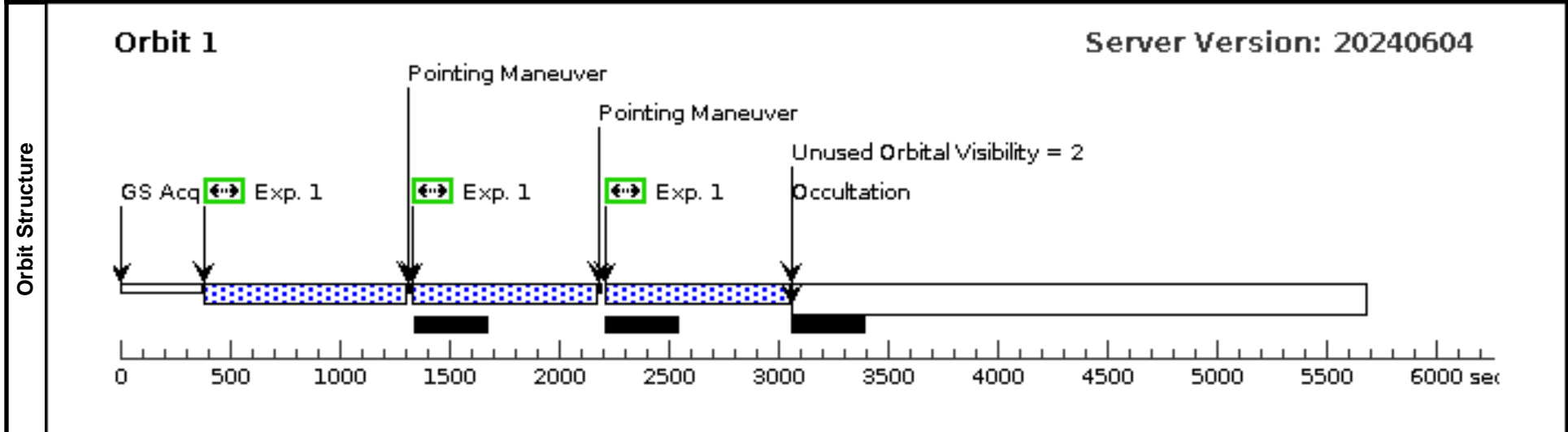
Visit	Proposal 17412, WISE0906 (02), scheduling		
	Diagnostic Status: No Diagnostics		
	Scientific Instruments: ACS/WFC		
	Special Requirements: AFTER 30-MAY-2024:00:00:00		

Patterns	#	Primary Pattern	Secondary Pattern	Exposures
	(1)	Pattern Type=ACS-WFC-DITHER-LINE Purpose=DITHER Number Of Points=3 Point Spacing=3.034 Line Spacing=	Coordinate Frame=POS-TARG Pattern Orientation=85.29 Angle Between Sides= Center Pattern=false	

Fixed Targets	#	Name	Target Coordinates	Targ. Coord. Corrections	Fluxes	Miscellaneous
	(2)	WISEJ090649.35+473538.5	RA: 09 06 48.7872 (136.7032800d) Dec: +47 35 31.06 (47.59196d) Equinox: J2000	Proper Motion RA: -0.551 arcsec/yr Proper Motion Dec: -0.714 arcsec/yr Parallax: 0.047" Epoch of Position: 2020.951	V=(?) J = 17.87	Reference Frame: ICRS

*Comments: Astrometry measured from je4o03010_drz.fits;
Proper motion and parallax from 2021ApJS..253....7K
Category=STAR
Description=[BROWN DWARF, T]
Extended=NO*

Exposures	#	Label	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time (Total)/[Actual Dur.]	Orbit
	1		(2) WISEJ090649.35+473538.5	ACS/WFC, ACCUM, WFC1-CTE	F850LP				Pattern 1, Exps 1-1 in WISE0906 (02) (1)	712 Secs (2136 Secs) [=>(Pattern 1)] [=>(Pattern 2)] [=>(Pattern 3)]



Proposal 17412 - CFBDSIR1458 (03) - Dynamical Masses of the Coldest Brown Dwarfs

Thu Jul 11 19:00:20 GMT 2024

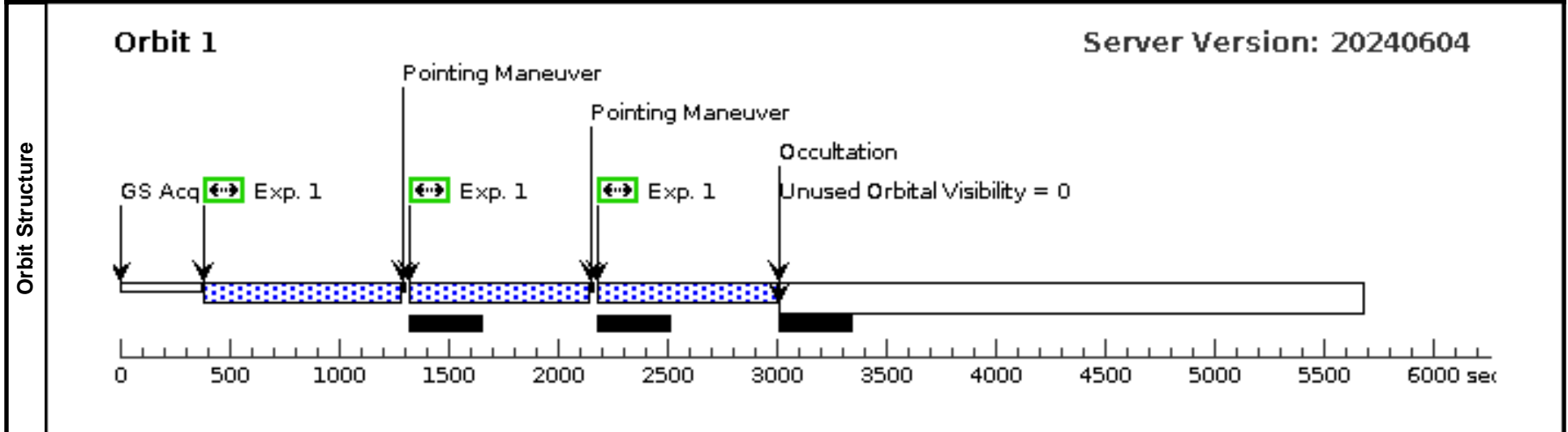
Visit	Proposal 17412, CFBDSIR1458 (03), completed		
	Diagnostic Status: No Diagnostics		
	Scientific Instruments: ACS/WFC		
	Special Requirements: AFTER 16-MAY-2024:00:00:00		

Patterns	#	Primary Pattern	Secondary Pattern	Exposures
	(1)	Pattern Type=ACS-WFC-DITHER-LINE Purpose=DITHER Number Of Points=3 Point Spacing=3.034 Line Spacing=	Coordinate Frame=POS-TARG Pattern Orientation=85.29 Angle Between Sides= Center Pattern=false	

Fixed Targets	#	Name	Target Coordinates	Targ. Coord. Corrections	Fluxes	Miscellaneous
	(3)	CFBDSIRJ145829+101343	RA: 14 58 29.4888 (224.6228700d) Dec: +10 13 37.96 (10.22721d) Equinox: J2000	Proper Motion RA: 0.174 arcsec/yr Proper Motion Dec: -0.380 arcsec/yr Parallax: 0.031" Epoch of Position: 2020.489	V=(?) J = 19.66	Reference Frame: ICRS

*Comments: Astrometry measured from je4o05010_drz.fits;
 Proper motion and parallax from 2012ApJS..201...19D
 Category=STAR
 Description=[BROWN DWARF, T]
 Extended=NO*

Exposures	#	Label	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time (Total)/[Actual Dur.]	Orbit
	1		(3) CFBDSIRJ145829+101343	ACS/WFC, ACCUM, WFC1-CTE	F850LP				Pattern 1, Exps 1-1 in CFBDSIR1458 (03) (1)	697 Secs (2091 Secs) [=>(Pattern 1)] [=>(Pattern 2)] [=>(Pattern 3)]



Proposal 17412 - CFBDSIR1458 (53) - Dynamical Masses of the Coldest Brown Dwarfs

Thu Jul 11 19:00:20 GMT 2024

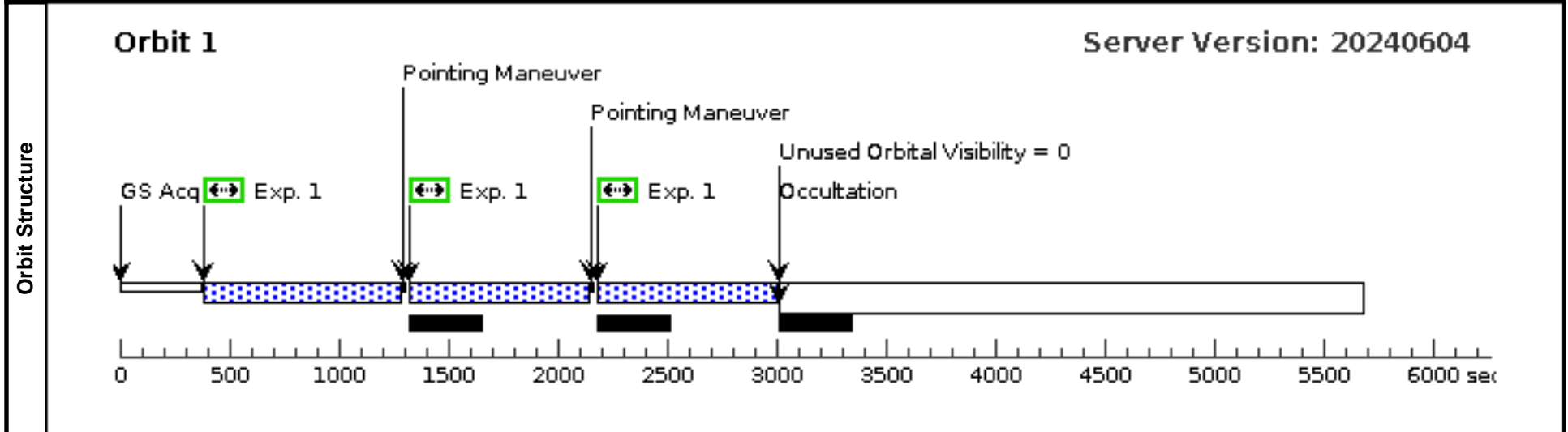
Visit	Proposal 17412, CFBDSIR1458 (53) Diagnostic Status: No Diagnostics Scientific Instruments: ACS/WFC Special Requirements: AFTER 16-MAY-2024:00:00:00		
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Patterns	#	Primary Pattern	Secondary Pattern	Exposures
	(1)	Pattern Type=ACS-WFC-DITHER-LINE Purpose=DITHER Number Of Points=3 Point Spacing=3.034 Line Spacing=	Coordinate Frame=POS-TARG Pattern Orientation=85.29 Angle Between Sides= Center Pattern=false	

Fixed Targets	#	Name	Target Coordinates	Targ. Coord. Corrections	Fluxes	Miscellaneous
	(3)	CFBDSIRJ145829+101343	RA: 14 58 29.4888 (224.6228700d) Dec: +10 13 37.96 (10.22721d) Equinox: J2000	Proper Motion RA: 0.174 arcsec/yr Proper Motion Dec: -0.380 arcsec/yr Parallax: 0.031" Epoch of Position: 2020.489	V=(?) J = 19.66	Reference Frame: ICRS

*Comments: Astrometry measured from je4o05010_drz.fits;
 Proper motion and parallax from 2012ApJS..201...19D
 Category=STAR
 Description=[BROWN DWARF, T]
 Extended=NO*

Exposures	#	Label	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time (Total)/[Actual Dur.]	Orbit
	1		(3) CFBDSIRJ145829+101343	ACS/WFC, ACCUM, WFC1-CTE	F850LP				Pattern 1, Exps 1-1 in CFBDSIR1458 (53) (1)	697 Secs (2091 Secs) [=>(Pattern 1)] [=>(Pattern 2)] [=>(Pattern 3)]



Proposal 17412 - WISE2015 (04) - Dynamical Masses of the Coldest Brown Dwarfs

Thu Jul 11 19:00:20 GMT 2024

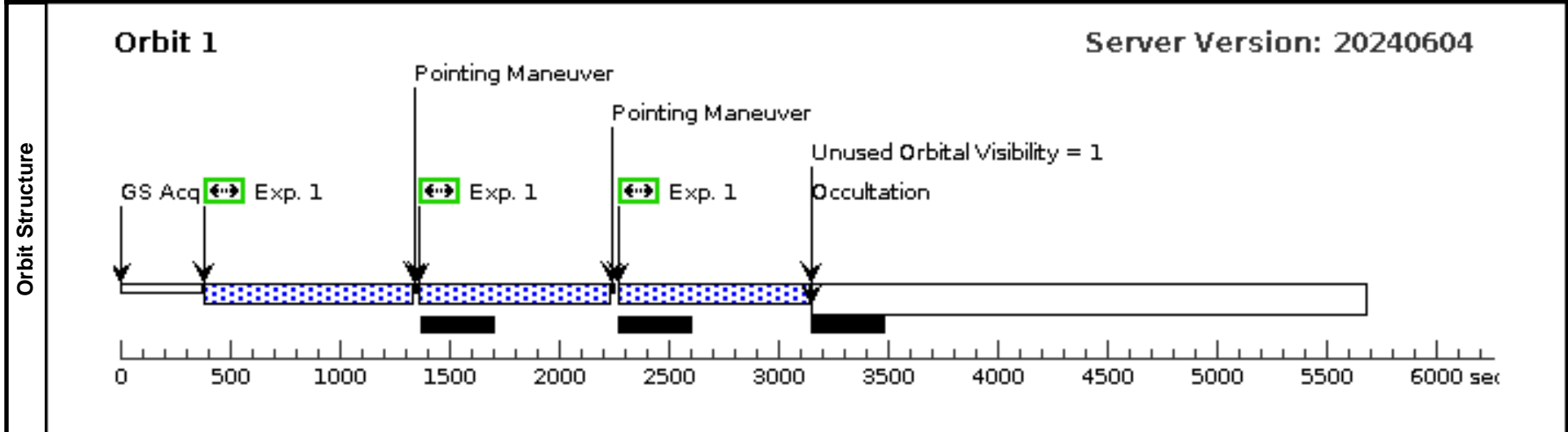
Visit	Proposal 17412, WISE2015 (04), failed		
	Diagnostic Status: No Diagnostics		
	Scientific Instruments: ACS/WFC		
	Special Requirements: AFTER 07-MAY-2024:00:00:00		

Patterns	#	Primary Pattern	Secondary Pattern	Exposures
	(1)	Pattern Type=ACS-WFC-DITHER-LINE Purpose=DITHER Number Of Points=3 Point Spacing=3.034 Line Spacing=	Coordinate Frame=POS-TARG Pattern Orientation=85.29 Angle Between Sides= Center Pattern=false	

Fixed Targets	#	Name	Target Coordinates	Targ. Coord. Corrections	Fluxes	Miscellaneous
	(4)	WISEPCJ201546.27+664645.1	RA: 20 15 46.5384 (303.9439100d) Dec: +66 46 48.90 (66.78025d) Equinox: J2000	Proper Motion RA: 0.290 arcsec/yr Proper Motion Dec: 0.430 arcsec/yr Parallax: 0.0396" Epoch of Position: 2020.435	V=(?) J = 16.91	Reference Frame: ICRS

*Comments: Astrometry measured from je4o09010_drz.fits;
 Proper motion and parallax from 2021ApJS..253....7K
 Category=STAR
 Description=[BROWN DWARF, T]
 Extended=NO*

Exposures	#	Label	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time (Total)/[Actual Dur.]	Orbit
	1		(4) WISEPCJ201546.27+664645.1	ACS/WFC, ACCUM, WFC1-CTE	F850LP				Pattern 1, Exps 1-1 in WISE2015 (04) (1)	742 Secs (2226 Secs) [=>(Pattern 1)] [=>(Pattern 2)] [=>(Pattern 3)]



Proposal 17412 - WISE2015 (54) - Dynamical Masses of the Coldest Brown Dwarfs

Thu Jul 11 19:00:20 GMT 2024

Visit	Proposal 17412, WISE2015 (54), implementation		
	Diagnostic Status: No Diagnostics		
	Scientific Instruments: ACS/WFC		
	Special Requirements: AFTER 07-MAY-2024:00:00:00		

Patterns	#	Primary Pattern	Secondary Pattern	Exposures
	(1)	Pattern Type=ACS-WFC-DITHER-LINE Purpose=DITHER Number Of Points=3 Point Spacing=3.034 Line Spacing=	Coordinate Frame=POS-TARG Pattern Orientation=85.29 Angle Between Sides= Center Pattern=false	

Fixed Targets	#	Name	Target Coordinates	Targ. Coord. Corrections	Fluxes	Miscellaneous
	(4)	WISEPCJ201546.27+664645.1	RA: 20 15 46.5384 (303.9439100d) Dec: +66 46 48.90 (66.78025d) Equinox: J2000	Proper Motion RA: 0.290 arcsec/yr Proper Motion Dec: 0.430 arcsec/yr Parallax: 0.0396" Epoch of Position: 2020.435	V=(?) J = 16.91	Reference Frame: ICRS

*Comments: Astrometry measured from je4o09010_drz.fits;
 Proper motion and parallax from 2021ApJS..253....7K
 Category=STAR
 Description=[BROWN DWARF, T]
 Extended=NO*

Exposures	#	Label	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time (Total)/[Actual Dur.]	Orbit
	1		(4) WISEPCJ201546.27+664645.1	ACS/WFC, ACCUM, WFC1-CTE	F850LP				Pattern 1, Exps 1-1 in WISE2015 (54) (1)	742 Secs (2226 Secs) [=>(Pattern 1)] [=>(Pattern 2)] [=>(Pattern 3)]

