13802 - Characterizing the Sun's 4th Closest Neighbor and the Coldest Known Brown Dwarf

Cycle: 22, Proposal Category: GO

(Availability Mode: SUPPORTED)

INVESTIGATORS

Name	*Institution*	*E-Mail*
Prof. Kevin Luhman (PI) (Contact)	**The Pennsylvania State University**	**kluhman@astro.psu.edu**

VISITS

Visit	*Targets used in Visit*	*Configurations used in Visit*	*Orbits Used*	*Last Orbit Planner Run*	*OP Current with Visit?*
01	(1) WISE0855-0714	WFC3/IR	2	13-Mar-2015 21:02:53.0	yes
02	(1) WISE0855-0714	WFC3/IR	2	13-Mar-2015 21:02:55.0	yes
03	(1) WISE0855-0714	WFC3/IR	2	13-Mar-2015 21:02:56.0	yes
04	(1) WISE0855-0714	WFC3/IR	2	13-Mar-2015 21:02:57.0	yes

8 Total Orbits Used

ABSTRACT

I have conducted a search for high proper motion brown dwarfs using multi-epoch all-sky mid-infrared images from the WISE satellite. Through this work, I have discovered an object with a parallactic distance of 2.2 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 unparallaled laboratory for studying planet-like atmospheres in an unexplored temperature regime. I propose to obtain deep near-IR images of this object in the single most sensitive band of WFC3 in order to 1) test the predicted near- to mid-IR colors of the coldest brown dwarfs, 2) assess the feasibility of more detailed observations through multi-band photometry and spectroscopy, 3) improve the accuracy of its parallax measurement, and 4) better constrain its multiplicity.

OBSERVING DESCRIPTION

This program consists of WFC3/IR images in F110W of a single faint point source during six orbits. The observations have been designed to maximize the total exposure time, optimize the spatial resolution, and provide sufficient flexibility for scheduling. The images will be obtained through three identical two-orbit visits. In each orbit, one exposure (SPARS100, NSAMP=10, 900 sec) will be collected at each position in a three-point dither pattern (WFC3-IR-DITHER-LINE-3PT). In each visit, the dither patterns in the two orbits will be offset by 3.5 pixels along the x-axis of the array.

Proposal 13802 - Visit 01 - Characterizing the Sun's 4th Closest Neighbor and the Coldest Known Brown Dwarf

Visit

Proposal 13802, Visit 01, completed Sat Mar 14 01:02:58 GMT 2015

Diagnostic Status: No Diagnostics

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)

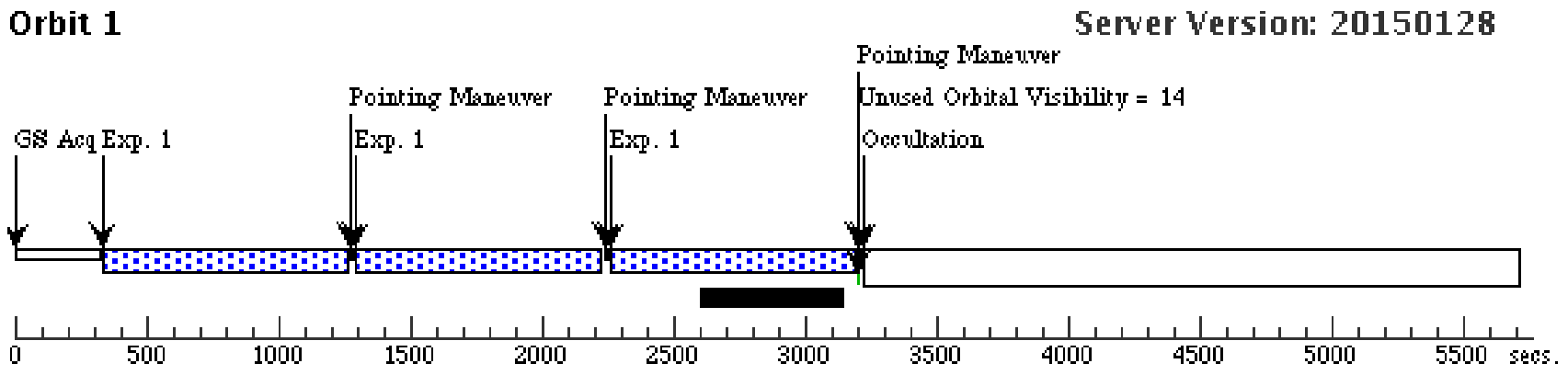
Fixed Targets

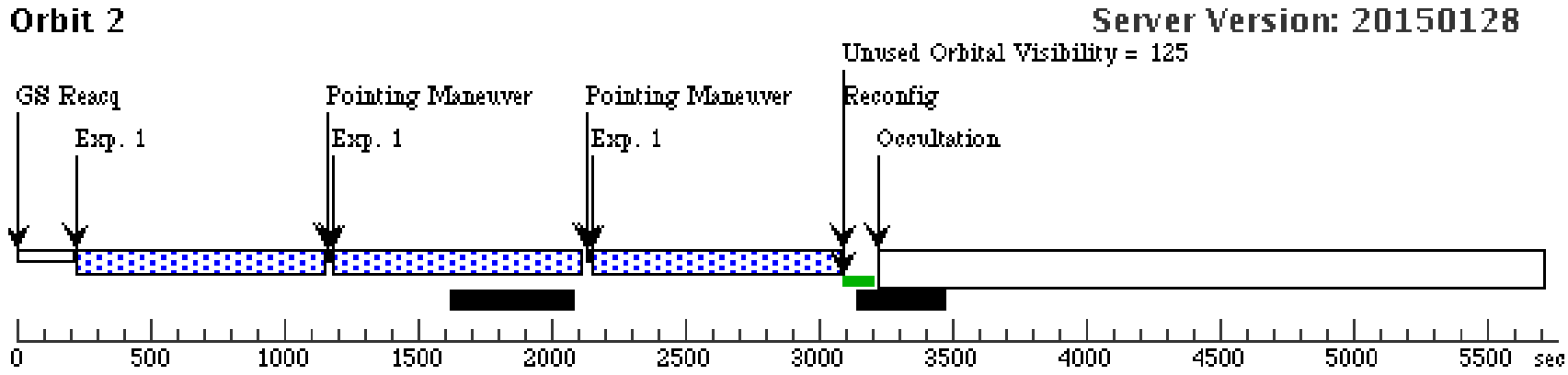
#	Name	Target Coordinates	Targ. Coord. Corrections	Fluxes	Miscellaneous
(1)	WISE0855-0714	RA: 08 55 8.9000 (133.7870833d) Dec: -07 14 40.02 (-7.24445d) Equinox: J2000	Proper Motion RA: -8.06 arcsec/yr Proper Motion Dec: 0.69 arcsec/yr Parallax: 0.455" Epoch of Position: 2014.052	V=35	Reference Frame: ICRS

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	F110W	NSAMP=10; SAMP-SEQ=SPARS100		Pattern 1, Exps 1-1 in Visit 01 (1)	902.935198 Secs (5417.611 Secs)	
								[==>(Pattern 1,1)] *[==>(Pattern 1,2)]* *[==>(Pattern 1,3)]*	***[1]***
								[==>(Pattern 2,1)] *[==>(Pattern 2,2)]* *[==>(Pattern 2,3)]*	***[2]***

Orbit Structure





Visit

Proposal 13802, Visit 02, completed Sat Mar 14 01:02:58 GMT 2015

Diagnostic Status: No Diagnostics

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)

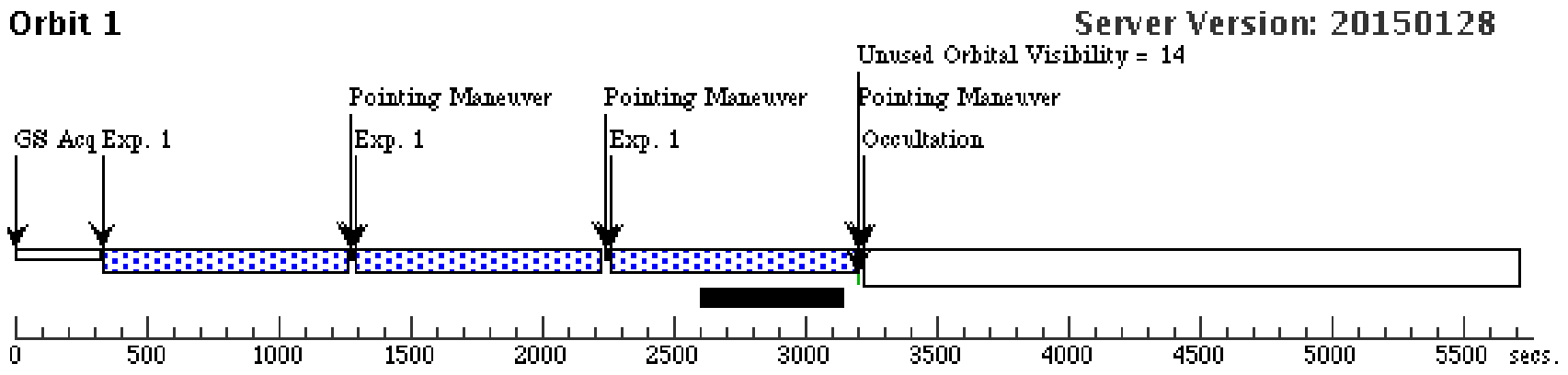
Fixed Targets

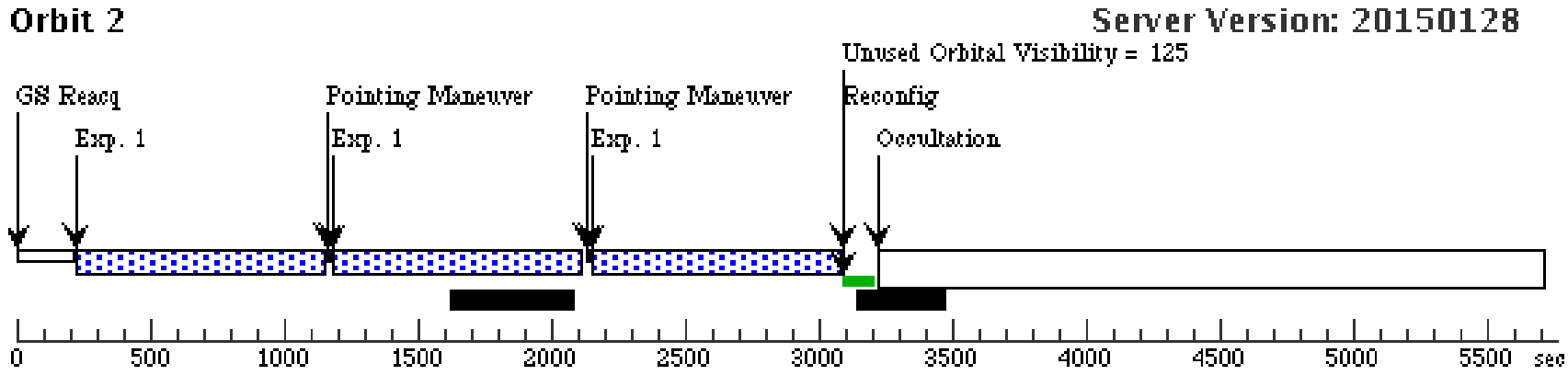
#	Name	Target Coordinates	Targ. Coord. Corrections	Fluxes	Miscellaneous
(1)	WISE0855-0714	RA: 08 55 8.9000 (133.7870833d) Dec: -07 14 40.02 (-7.24445d) Equinox: J2000	Proper Motion RA: -8.06 arcsec/yr Proper Motion Dec: 0.69 arcsec/yr Parallax: 0.455" Epoch of Position: 2014.052	V=35	Reference Frame: ICRS

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	F110W	NSAMP=10; SAMP-SEQ=SPARS100		Pattern 1, Exps 1-1 in Visit 02 (1)	902.935198 Secs (5417.611 Secs)	
								[==>(Pattern 1,1)] *[==>(Pattern 1,2)]* *[==>(Pattern 1,3)]*	***[1]***
								[==>(Pattern 2,1)] *[==>(Pattern 2,2)]* *[==>(Pattern 2,3)]*	***[2]***

Orbit Structure





Proposal 13802 - Visit 03 - Characterizing the Sun's 4th Closest Neighbor and the Coldest Known Brown Dwarf

Visit

Proposal 13802, Visit 03, failed Sat Mar 14 01:02:58 GMT 2015

Diagnostic Status: No Diagnostics

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)

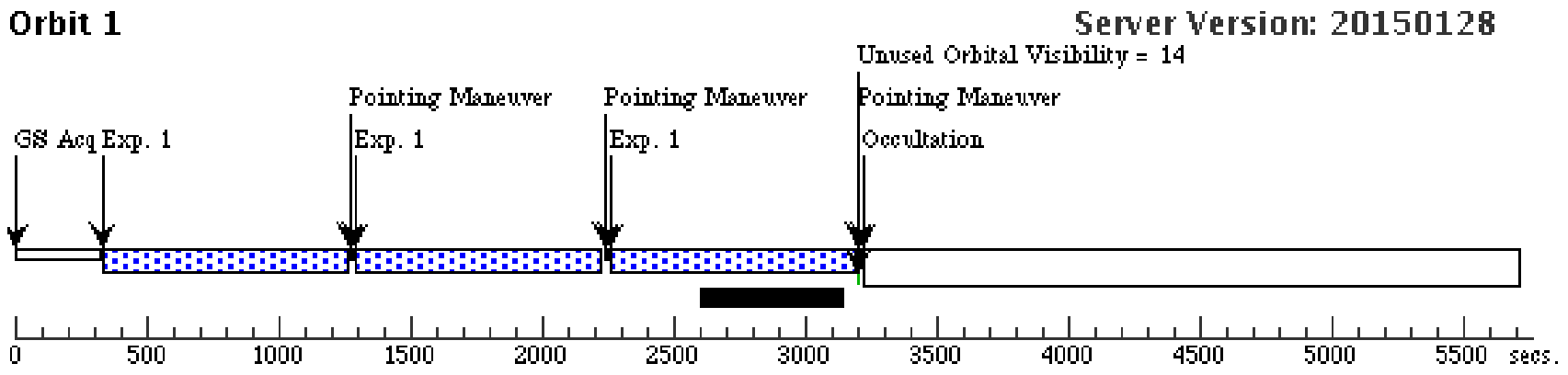
Fixed Targets

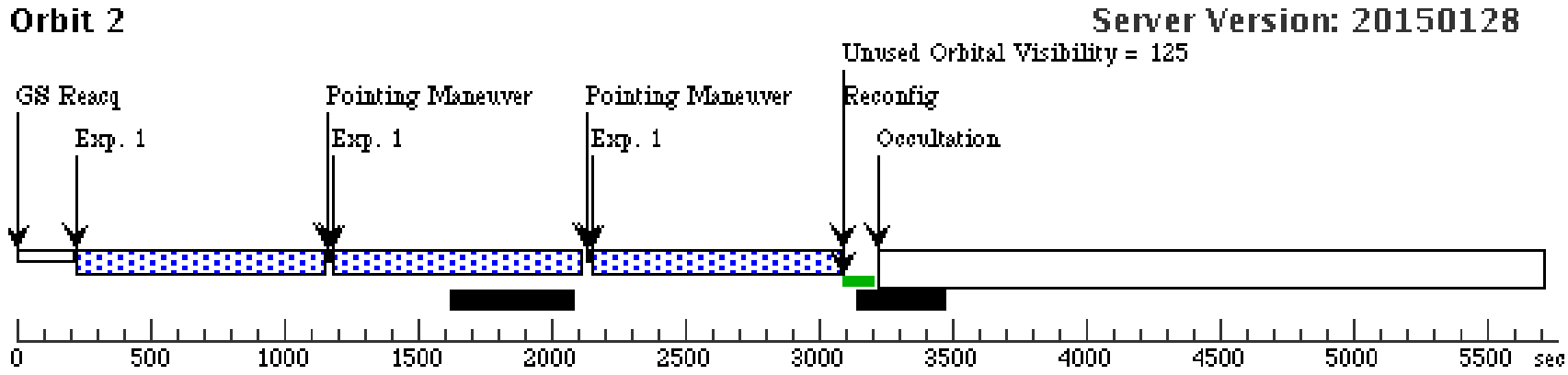
#	Name	Target Coordinates	Targ. Coord. Corrections	Fluxes	Miscellaneous
(1)	WISE0855-0714	RA: 08 55 8.9000 (133.7870833d) Dec: -07 14 40.02 (-7.24445d) Equinox: J2000	Proper Motion RA: -8.06 arcsec/yr Proper Motion Dec: 0.69 arcsec/yr Parallax: 0.455" Epoch of Position: 2014.052	V=35	Reference Frame: ICRS

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	F110W	NSAMP=10; SAMP-SEQ=SPARS100		Pattern 1, Exps 1-1 in Visit 03 (1)	902.935198 Secs (5417.611 Secs)	
								[==>(Pattern 1,1)] *[==>(Pattern 1,2)]* *[==>(Pattern 1,3)]*	***[1]***
								[==>(Pattern 2,1)] *[==>(Pattern 2,2)]* *[==>(Pattern 2,3)]*	***[2]***

Orbit Structure





Visit

Proposal 13802, Visit 04 Sat Mar 14 01:02:59 GMT 2015

Diagnostic Status: No Diagnostics

Scientific Instruments: WFC3/IR

Special Requirements: (none)

Patterns

#	Primary Pattern		Secondary Pattern		Exposures
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Fixed Targets

#	Name	Target Coordinates	Targ. Coord. Corrections	Fluxes	Miscellaneous
(1)	WISE0855-0714	RA: 08 55 8.9000 (133.7870833d) Dec: -07 14 40.02 (-7.24445d) Equinox: J2000	Proper Motion RA: -8.06 arcsec/yr Proper Motion Dec: 0.69 arcsec/yr Parallax: 0.455" Epoch of Position: 2014.052	V=35	Reference Frame: ICRS

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	F110W	NSAMP=10; SAMP-SEQ=SPARS100		Pattern 1, Exps 1-1 in Visit 04 (1)	902.935198 Secs (5417.611 Secs)	
								[==>(Pattern 1,1)] *[==>(Pattern 1,2)]* *[==>(Pattern 1,3)]*	***[1]***
								[==>(Pattern 2,1)] *[==>(Pattern 2,2)]* *[==>(Pattern 2,3)]*	***[2]***

Orbit Structure