



17466 - Tracing the wobble: astrometric monitoring of the first Y+Y brown dwarf binary

Cycle: 31, Proposal Category: GO
(Availability Mode: SUPPORTED)

INVESTIGATORS

<i>Name</i>	<i>Institution</i>
Dr. Clemence Fontanive (PI) (CSA Member) (Contact)	Universite de Montreal
Dr. Luigi R. Bedin (CoI) (ESA Member)	INAF - Osservatorio Astronomico di Padova
Dr. Loic Albert (CoI) (CSA Member)	Universite de Montreal
Dr. Matthew De Furio (CoI) (AdminUSPI)	University of Texas at Austin

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) WISE0336-0143	WFC3/IR	1	18-Nov-2024 13:00:16.0	yes
02	(1) WISE0336-0143	WFC3/IR	1	18-Nov-2024 13:00:17.0	yes
52	(1) WISE0336-0143	WFC3/IR	1	18-Nov-2024 13:00:18.0	yes

3 Total Orbits Used

ABSTRACT

We propose a comprehensive astrometric follow-up of the first Y+Y brown dwarf binary, WISE 0336-0143 AB, a <1-AU separation and low mass ratio system detected with JWST. We aim to follow the ~50-mas astrometric wobble of the photocentre resulting from the binary orbital motion, by exploiting HST's high astrometric precision with WFC3/IR. Our program will accurately measure the system's proper motion, trigonometric parallax, and orbital configuration, at an unprecedented accuracy of <0.5 mas through absolute astrometric calibrations using Gaia.

Proposal 17466 (STScI Edit Number: 2, Created: Monday, November 18, 2024, 1:00:19PM Eastern Standard Time) - Overview

Capitalising on the three archival HST epochs already available and the recent JWST results, we have a unique opportunity to simultaneously refine the system's distance and to measure the individual components' dynamical masses, by acquiring only four new HST epochs over the next two years. These additional carefully timed datasets are required to demarcate the absolute astrometric displacement of the barycentre and remaining on-sky offsets due to the orbital motion of the binary components around the centre of mass.

This work will be crucial to anchor current and future observed characteristics of the unique WISE 0336-0143 benchmark, significantly contributing to our understanding of its fundamental and binary properties, and an important step forward in the characterisation and atmospheric modelling of Y-temperature giant exoplanets and brown dwarfs. In addition, this program will also pave the way for future investigations of sub-AU binary systems around faint Y dwarfs, and will provide us with an extensive dataset to develop a framework for joint astrometric analyses linking HST, JWST and Gaia data.

OBSERVING DESCRIPTION

This multi-cycle program consists of 2 orbits of WFC3 IR channel imaging in Cycle 31 (and 2 more orbits in C32) for precise astrometric monitoring of a newly discovered Y+Y brown dwarf binary. All orbits are planned as single-orbit visits. We apply large and fractional-pixel dithering patterns to allow both removal of hot pixels and increase the spatial resolution of the datasets. All observations are taken in full frame mode, in order to maximise the number of reference sources in the fields of view.

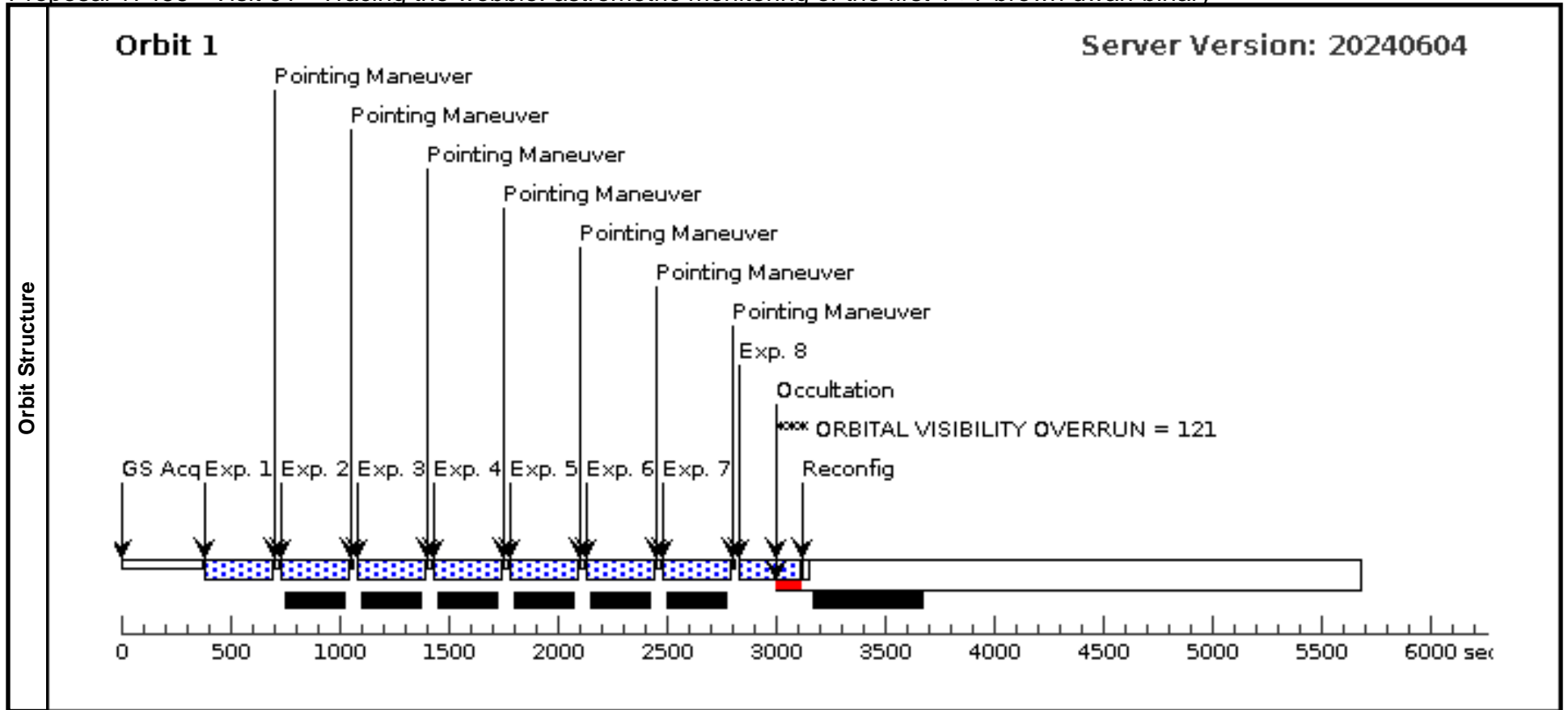
Following the strategy from GO 16229 for the same target, we will acquire 2 F105W exposures and a set of 6 F160W images. The F105W images will be placed in the middle of the sequences, to avoid problems associated with contaminating scattered Earthlight at low limb angles at those wavelengths. We will use 278 s exposures in MULTIACCUM mode, with suitable sampling times and sequence to maximise to total exposure times.

We request specific time constraints for each visit, in order to optimise our science results in the derivation of the system's parallax, proper motion, and orbital motion. Based on phases of the year already covered by existing HST datasets for this system, and the allowed visibility windows in Cycle 31, we propose to obtain our 2 visits around early/mid Dec 2023 and late Jun/mid Aug 2024. With these new epochs, we will be able to start separating offsets from the barycentric motion from additional perturbations due to the binary, enabling the derivation of preliminary constraints for the orbit. We will then determine the optimal timing for the last two epochs in Cycle 32, based on remaining degeneracies in the derived solutions.

Proposal 17466 - Visit 01 - Tracing the wobble: astrometric monitoring of the first Y+Y brown dwarf binary

Mon Nov 18 18:00:19 GMT 2024

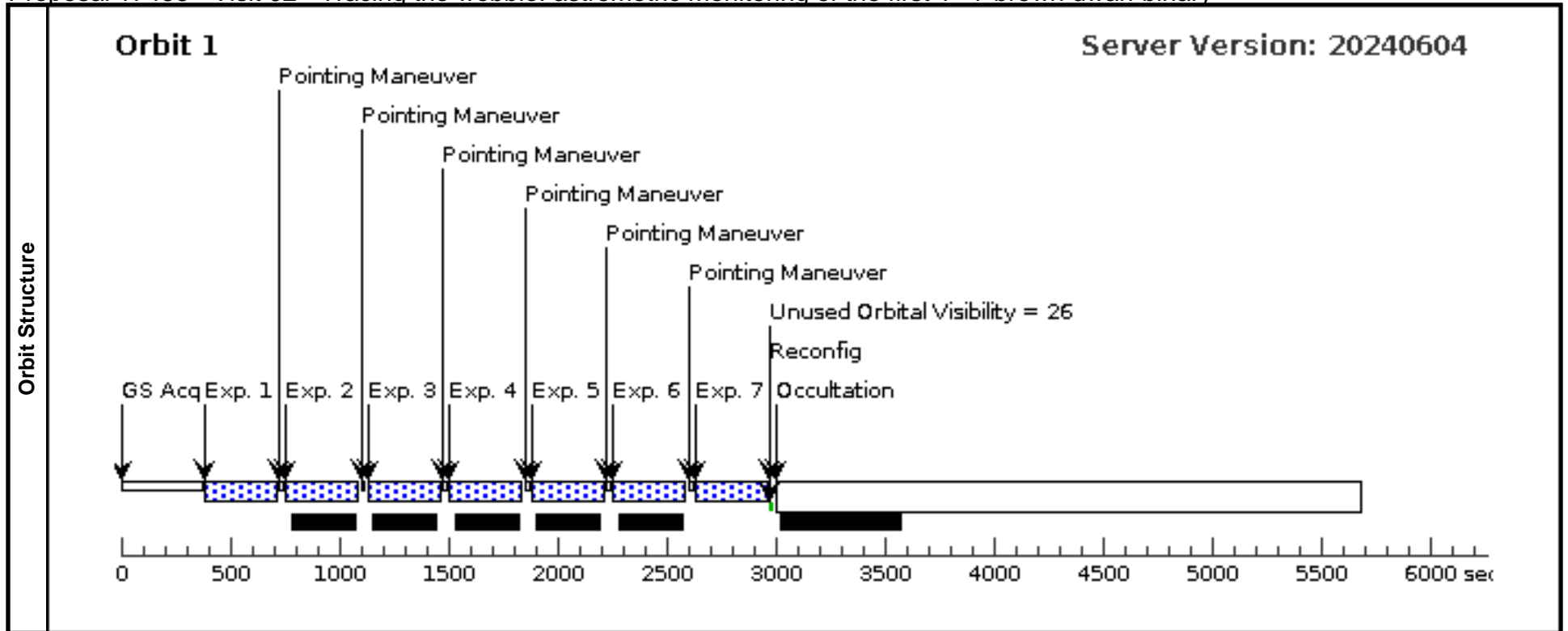
Visit	Proposal 17466, Visit 01, completed Diagnostic Status: Warning Scientific Instruments: WFC3/IR Special Requirements: BETWEEN 19-NOV-2023:00:00:00 AND 16-DEC-2023:00:00:00																																																																																										
Diagnostics	(Visit 01) Warning (Orbit Planner): ORBITAL VISIBILITY OVERRUN																																																																																										
Fixed Targets	<table border="1"> <thead> <tr> <th>#</th> <th>Name</th> <th>Target Coordinates</th> <th>Targ. Coord. Corrections</th> <th>Fluxes</th> <th>Miscellaneous</th> </tr> </thead> <tbody> <tr> <td>(1)</td> <td>WISE0336-0143</td> <td>RA: 03 36 5.0062 (54.0208592d) Dec: -01 43 55.80 (-1.73217d) Equinox: J2000</td> <td>Proper Motion RA: -257.8 mas/yr Proper Motion Dec: -1212.3 mas/yr Epoch of Position: 2014.0</td> <td>V=(?) H=22</td> <td>Reference Frame: ICRS</td> </tr> </tbody> </table> <p><i>Comments:</i> Category=STAR Description=[BROWN DWARF]</p>	#	Name	Target Coordinates	Targ. Coord. Corrections	Fluxes	Miscellaneous	(1)	WISE0336-0143	RA: 03 36 5.0062 (54.0208592d) Dec: -01 43 55.80 (-1.73217d) Equinox: J2000	Proper Motion RA: -257.8 mas/yr Proper Motion Dec: -1212.3 mas/yr Epoch of Position: 2014.0	V=(?) H=22	Reference Frame: ICRS																																																																														
#	Name	Target Coordinates	Targ. Coord. Corrections	Fluxes	Miscellaneous																																																																																						
(1)	WISE0336-0143	RA: 03 36 5.0062 (54.0208592d) Dec: -01 43 55.80 (-1.73217d) Equinox: J2000	Proper Motion RA: -257.8 mas/yr Proper Motion Dec: -1212.3 mas/yr Epoch of Position: 2014.0	V=(?) H=22	Reference Frame: ICRS																																																																																						
Exposures	<table border="1"> <thead> <tr> <th>#</th> <th>Label</th> <th>Target</th> <th>Config,Mode,Aperture</th> <th>Spectral Els.</th> <th>Opt. Params.</th> <th>Special Reqs.</th> <th>Groups</th> <th>Exp. Time (Total)/[Actual Dur.]</th> <th>Orbit</th> </tr> </thead> <tbody> <tr> <td>1</td> <td>(1) WISE0336-0143</td> <td>WISE0336-0143</td> <td>WFC3/IR, MULTIACCUM, IR</td> <td>F160W</td> <td>NSAMP=12; SAMP-SEQ=SPAR S25</td> <td>POS TARG 7.34,7.30</td> <td>Sequence 1-8 Non-Int in Visit 01</td> <td>277.937956 Secs (277.938 Secs) [==>]</td> <td>[1]</td> </tr> <tr> <td>2</td> <td>(1) WISE0336-0143</td> <td>WISE0336-0143</td> <td>WFC3/IR, MULTIACCUM, IR</td> <td>F160W</td> <td>NSAMP=12; SAMP-SEQ=SPAR S25</td> <td>POS TARG -5.34,-1.73</td> <td>Sequence 1-8 Non-Int in Visit 01</td> <td>277.937956 Secs (277.938 Secs) [==>]</td> <td>[1]</td> </tr> <tr> <td>3</td> <td>(1) WISE0336-0143</td> <td>WISE0336-0143</td> <td>WFC3/IR, MULTIACCUM, IR</td> <td>F160W</td> <td>NSAMP=12; SAMP-SEQ=SPAR S25</td> <td>POS TARG -7.24,-7.16</td> <td>Sequence 1-8 Non-Int in Visit 01</td> <td>277.937956 Secs (277.938 Secs) [==>]</td> <td>[1]</td> </tr> <tr> <td>4</td> <td>(1) WISE0336-0143</td> <td>WISE0336-0143</td> <td>WFC3/IR, MULTIACCUM, IR</td> <td>F105W</td> <td>NSAMP=12; SAMP-SEQ=SPAR S25</td> <td>POS TARG 3.69,-3.57</td> <td>Sequence 1-8 Non-Int in Visit 01</td> <td>277.937956 Secs (277.938 Secs) [==>]</td> <td>[1]</td> </tr> <tr> <td>5</td> <td>(1) WISE0336-0143</td> <td>WISE0336-0143</td> <td>WFC3/IR, MULTIACCUM, IR</td> <td>F105W</td> <td>NSAMP=12; SAMP-SEQ=SPAR S25</td> <td>POS TARG -3.59,3.65</td> <td>Sequence 1-8 Non-Int in Visit 01</td> <td>277.937956 Secs (277.938 Secs) [==>]</td> <td>[1]</td> </tr> <tr> <td>6</td> <td>(1) WISE0336-0143</td> <td>WISE0336-0143</td> <td>WFC3/IR, MULTIACCUM, IR</td> <td>F160W</td> <td>NSAMP=12; SAMP-SEQ=SPAR S25</td> <td>POS TARG -1.69,-5.45</td> <td>Sequence 1-8 Non-Int in Visit 01</td> <td>277.937956 Secs (277.938 Secs) [==>]</td> <td>[1]</td> </tr> <tr> <td>7</td> <td>(1) WISE0336-0143</td> <td>WISE0336-0143</td> <td>WFC3/IR, MULTIACCUM, IR</td> <td>F160W</td> <td>NSAMP=12; SAMP-SEQ=SPAR S25</td> <td>POS TARG 1.83,5.50</td> <td>Sequence 1-8 Non-Int in Visit 01</td> <td>277.937956 Secs (277.938 Secs) [==>]</td> <td>[1]</td> </tr> <tr> <td>8</td> <td>(1) WISE0336-0143</td> <td>WISE0336-0143</td> <td>WFC3/IR, MULTIACCUM, IR</td> <td>F160W</td> <td>NSAMP=11; SAMP-SEQ=SPAR S25</td> <td>POS TARG 5.52,1.89</td> <td>Sequence 1-8 Non-Int in Visit 01</td> <td>252.937441 Secs (252.937 Secs) [==>]</td> <td>[1]</td> </tr> </tbody> </table>	#	Label	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time (Total)/[Actual Dur.]	Orbit	1	(1) WISE0336-0143	WISE0336-0143	WFC3/IR, MULTIACCUM, IR	F160W	NSAMP=12; SAMP-SEQ=SPAR S25	POS TARG 7.34,7.30	Sequence 1-8 Non-Int in Visit 01	277.937956 Secs (277.938 Secs) [==>]	[1]	2	(1) WISE0336-0143	WISE0336-0143	WFC3/IR, MULTIACCUM, IR	F160W	NSAMP=12; SAMP-SEQ=SPAR S25	POS TARG -5.34,-1.73	Sequence 1-8 Non-Int in Visit 01	277.937956 Secs (277.938 Secs) [==>]	[1]	3	(1) WISE0336-0143	WISE0336-0143	WFC3/IR, MULTIACCUM, IR	F160W	NSAMP=12; SAMP-SEQ=SPAR S25	POS TARG -7.24,-7.16	Sequence 1-8 Non-Int in Visit 01	277.937956 Secs (277.938 Secs) [==>]	[1]	4	(1) WISE0336-0143	WISE0336-0143	WFC3/IR, MULTIACCUM, IR	F105W	NSAMP=12; SAMP-SEQ=SPAR S25	POS TARG 3.69,-3.57	Sequence 1-8 Non-Int in Visit 01	277.937956 Secs (277.938 Secs) [==>]	[1]	5	(1) WISE0336-0143	WISE0336-0143	WFC3/IR, MULTIACCUM, IR	F105W	NSAMP=12; SAMP-SEQ=SPAR S25	POS TARG -3.59,3.65	Sequence 1-8 Non-Int in Visit 01	277.937956 Secs (277.938 Secs) [==>]	[1]	6	(1) WISE0336-0143	WISE0336-0143	WFC3/IR, MULTIACCUM, IR	F160W	NSAMP=12; SAMP-SEQ=SPAR S25	POS TARG -1.69,-5.45	Sequence 1-8 Non-Int in Visit 01	277.937956 Secs (277.938 Secs) [==>]	[1]	7	(1) WISE0336-0143	WISE0336-0143	WFC3/IR, MULTIACCUM, IR	F160W	NSAMP=12; SAMP-SEQ=SPAR S25	POS TARG 1.83,5.50	Sequence 1-8 Non-Int in Visit 01	277.937956 Secs (277.938 Secs) [==>]	[1]	8	(1) WISE0336-0143	WISE0336-0143	WFC3/IR, MULTIACCUM, IR	F160W	NSAMP=11; SAMP-SEQ=SPAR S25	POS TARG 5.52,1.89	Sequence 1-8 Non-Int in Visit 01	252.937441 Secs (252.937 Secs) [==>]	[1]
#	Label	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time (Total)/[Actual Dur.]	Orbit																																																																																		
1	(1) WISE0336-0143	WISE0336-0143	WFC3/IR, MULTIACCUM, IR	F160W	NSAMP=12; SAMP-SEQ=SPAR S25	POS TARG 7.34,7.30	Sequence 1-8 Non-Int in Visit 01	277.937956 Secs (277.938 Secs) [==>]	[1]																																																																																		
2	(1) WISE0336-0143	WISE0336-0143	WFC3/IR, MULTIACCUM, IR	F160W	NSAMP=12; SAMP-SEQ=SPAR S25	POS TARG -5.34,-1.73	Sequence 1-8 Non-Int in Visit 01	277.937956 Secs (277.938 Secs) [==>]	[1]																																																																																		
3	(1) WISE0336-0143	WISE0336-0143	WFC3/IR, MULTIACCUM, IR	F160W	NSAMP=12; SAMP-SEQ=SPAR S25	POS TARG -7.24,-7.16	Sequence 1-8 Non-Int in Visit 01	277.937956 Secs (277.938 Secs) [==>]	[1]																																																																																		
4	(1) WISE0336-0143	WISE0336-0143	WFC3/IR, MULTIACCUM, IR	F105W	NSAMP=12; SAMP-SEQ=SPAR S25	POS TARG 3.69,-3.57	Sequence 1-8 Non-Int in Visit 01	277.937956 Secs (277.938 Secs) [==>]	[1]																																																																																		
5	(1) WISE0336-0143	WISE0336-0143	WFC3/IR, MULTIACCUM, IR	F105W	NSAMP=12; SAMP-SEQ=SPAR S25	POS TARG -3.59,3.65	Sequence 1-8 Non-Int in Visit 01	277.937956 Secs (277.938 Secs) [==>]	[1]																																																																																		
6	(1) WISE0336-0143	WISE0336-0143	WFC3/IR, MULTIACCUM, IR	F160W	NSAMP=12; SAMP-SEQ=SPAR S25	POS TARG -1.69,-5.45	Sequence 1-8 Non-Int in Visit 01	277.937956 Secs (277.938 Secs) [==>]	[1]																																																																																		
7	(1) WISE0336-0143	WISE0336-0143	WFC3/IR, MULTIACCUM, IR	F160W	NSAMP=12; SAMP-SEQ=SPAR S25	POS TARG 1.83,5.50	Sequence 1-8 Non-Int in Visit 01	277.937956 Secs (277.938 Secs) [==>]	[1]																																																																																		
8	(1) WISE0336-0143	WISE0336-0143	WFC3/IR, MULTIACCUM, IR	F160W	NSAMP=11; SAMP-SEQ=SPAR S25	POS TARG 5.52,1.89	Sequence 1-8 Non-Int in Visit 01	252.937441 Secs (252.937 Secs) [==>]	[1]																																																																																		



Proposal 17466 - Visit 02 - Tracing the wobble: astrometric monitoring of the first Y+Y brown dwarf binary

Mon Nov 18 18:00:19 GMT 2024

Visit	Proposal 17466, Visit 02, completed Diagnostic Status: No Diagnostics Scientific Instruments: WFC3/IR Special Requirements: (none)									
	Fixed Targets	#	Name	Target Coordinates	Targ. Coord. Corrections	Fluxes	Miscellaneous			
	(1)	WISE0336-0143	RA: 03 36 5.0062 (54.0208592d) Dec: -01 43 55.80 (-1.73217d) Equinox: J2000	Proper Motion RA: -257.8 mas/yr Proper Motion Dec: -1212.3 mas/yr Epoch of Position: 2014.0	V=(?) H=22	Reference Frame: ICRS				
	<i>Comments:</i> 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	(1)	WISE0336-0143	WFC3/IR, MULTIACCUM, IR	F160W	NSAMP=13; SAMP-SEQ=SPAR S25	POS TARG 7.34,7.3 0	Sequence 1-7 Non-Int in Visit 02	302.938471 Secs (302.938 Secs) [==>]	[1]
	2	(1)	WISE0336-0143	WFC3/IR, MULTIACCUM, IR	F160W	NSAMP=13; SAMP-SEQ=SPAR S25	POS TARG -5.34,-1. 73	Sequence 1-7 Non-Int in Visit 02	302.938471 Secs (302.938 Secs) [==>]	[1]
	3	(1)	WISE0336-0143	WFC3/IR, MULTIACCUM, IR	F160W	NSAMP=13; SAMP-SEQ=SPAR S25	POS TARG -7.24,-7. 16	Sequence 1-7 Non-Int in Visit 02	302.938471 Secs (302.938 Secs) [==>]	[1]
	4	(1)	WISE0336-0143	WFC3/IR, MULTIACCUM, IR	F105W	NSAMP=13; SAMP-SEQ=SPAR S25	POS TARG 3.69,-3. 57	Sequence 1-7 Non-Int in Visit 02	302.938471 Secs (302.938 Secs) [==>]	[1]
	5	(1)	WISE0336-0143	WFC3/IR, MULTIACCUM, IR	F105W	NSAMP=13; SAMP-SEQ=SPAR S25	POS TARG -3.59,3. 65	Sequence 1-7 Non-Int in Visit 02	302.938471 Secs (302.938 Secs) [==>]	[1]
	6	(1)	WISE0336-0143	WFC3/IR, MULTIACCUM, IR	F160W	NSAMP=13; SAMP-SEQ=SPAR S25	POS TARG -1.69,-5. 45	Sequence 1-7 Non-Int in Visit 02	302.938471 Secs (302.938 Secs) [==>]	[1]
	7	(1)	WISE0336-0143	WFC3/IR, MULTIACCUM, IR	F160W	NSAMP=13; SAMP-SEQ=SPAR S25	POS TARG 1.83,5.5 0	Sequence 1-7 Non-Int in Visit 02	302.938471 Secs (302.938 Secs) [==>]	[1]



Proposal 17466 - Visit 52 - Tracing the wobble: astrometric monitoring of the first Y+Y brown dwarf binary

Mon Nov 18 18:00:19 GMT 2024

Visit	Proposal 17466, Visit 52					Mon Nov 18 18:00:19 GMT 2024				
	Diagnostic Status: No Diagnostics									
Scientific Instruments: WFC3/IR										
Special Requirements: (none)										
Fixed Targets	#	Name	Target Coordinates	Targ. Coord. Corrections	Fluxes	Miscellaneous				
	(1)	WISE0336-0143	RA: 03 36 5.0062 (54.0208592d) Dec: -01 43 55.80 (-1.73217d) Equinox: J2000	Proper Motion RA: -257.8 mas/yr Proper Motion Dec: -1212.3 mas/yr Epoch of Position: 2014.0	V=(?) H=22	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	(1)	WISE0336-0143	WFC3/IR, MULTIACCUM, IR	F160W	NSAMP=13; SAMP-SEQ=SPAR S25	POS TARG 7.34,7.3 0	Sequence 1-7 Non-Int in Visit 52	302.938471 Secs (302.938 Secs) [==>]	[1]
	2	(1)	WISE0336-0143	WFC3/IR, MULTIACCUM, IR	F160W	NSAMP=13; SAMP-SEQ=SPAR S25	POS TARG -5.34,-1. 73	Sequence 1-7 Non-Int in Visit 52	302.938471 Secs (302.938 Secs) [==>]	[1]
	3	(1)	WISE0336-0143	WFC3/IR, MULTIACCUM, IR	F160W	NSAMP=13; SAMP-SEQ=SPAR S25	POS TARG -7.24,-7. 16	Sequence 1-7 Non-Int in Visit 52	302.938471 Secs (302.938 Secs) [==>]	[1]
	4	(1)	WISE0336-0143	WFC3/IR, MULTIACCUM, IR	F105W	NSAMP=13; SAMP-SEQ=SPAR S25	POS TARG 3.69,-3. 57	Sequence 1-7 Non-Int in Visit 52	302.938471 Secs (302.938 Secs) [==>]	[1]
	5	(1)	WISE0336-0143	WFC3/IR, MULTIACCUM, IR	F105W	NSAMP=13; SAMP-SEQ=SPAR S25	POS TARG -3.59,3. 65	Sequence 1-7 Non-Int in Visit 52	302.938471 Secs (302.938 Secs) [==>]	[1]
	6	(1)	WISE0336-0143	WFC3/IR, MULTIACCUM, IR	F160W	NSAMP=13; SAMP-SEQ=SPAR S25	POS TARG -1.69,-5. 45	Sequence 1-7 Non-Int in Visit 52	302.938471 Secs (302.938 Secs) [==>]	[1]
	7	(1)	WISE0336-0143	WFC3/IR, MULTIACCUM, IR	F160W	NSAMP=13; SAMP-SEQ=SPAR S25	POS TARG 1.83,5.5 0	Sequence 1-7 Non-Int in Visit 52	302.938471 Secs (302.938 Secs) [==>]	[1]

