



13732 - Detecting dark matter substructure with narrow line lensing

Cycle: 22, Proposal Category: GO

(Availability Mode: SUPPORTED)

INVESTIGATORS

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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) HE0435-1223	WFC3/IR	1	05-Aug-2014 21:03:04.0	yes
02	(2) HS0810+2554	WFC3/IR	1	05-Aug-2014 21:03:06.0	yes
03	(3) RXJ0911+0551	WFC3/IR	2	05-Aug-2014 21:03:07.0	yes
04	(4) SDSSJ1330+1810	WFC3/IR	2	05-Aug-2014 21:03:09.0	yes
05	(5) WFI2026-4536	WFC3/IR	2	05-Aug-2014 21:03:10.0	yes
06	(6) WFI2033-4723	WFC3/IR	2	05-Aug-2014 21:03:11.0	yes

10 Total Orbits Used

ABSTRACT

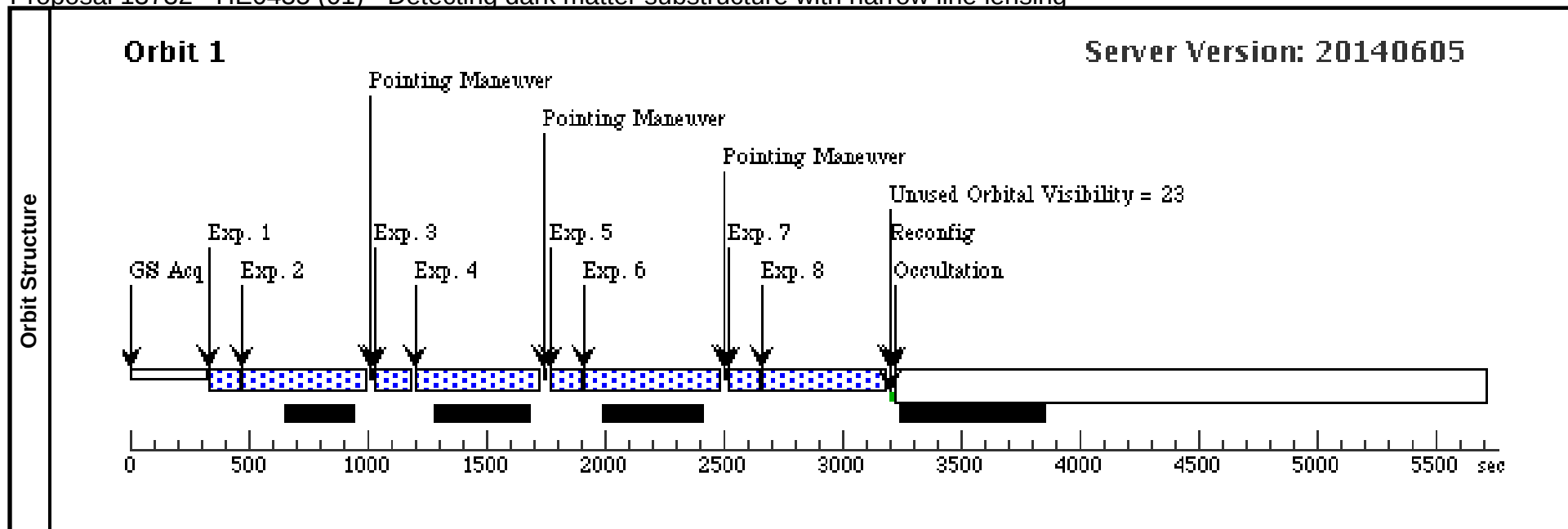
The abundance of low mass halos is one of the key predictions of LCDM and remains at apparent odds with observations of luminous structure. Strong gravitational lensing provides a straightforward means of testing this theory as it enables the detection of dark matter subhalos at cosmological distances, without requiring the structure to contain any baryons at all. The fluxes of strongly lensed, parsec scale sources in particular, are excellent probes as they are extremely sensitive to the presence of low mass subhalos, while still being extended enough to remain unaffected by microlensing by stars which is a dominant contaminant for smaller sources. Traditionally this field has been limited to the analysis of the small number of strongly lensed, radio-loud quasars. Quasar narrow-line emission offers an alternative to radio. It is also parsec scale and microlensing free, but has the benefit of detectable in a much larger sample of systems. This proposal will combine milliarcsecond astrometry, and percent level photometry attainable with WFC3 IR grism, in order to measure spatially resolved narrow line lensing in six new systems, which cannot be studied from the ground. We have demonstrated that data of this quality can be used to detect subhalos as small as a million solar masses. This proposal will double the sample of systems which can be used to detect dark, low mass substructure using flux ratio anomalies.

OBSERVING DESCRIPTION

We will use the same procedure as was used in GLASS and 3D HST: First we take a short exposure using either F105W or F140, and then a longer grism exposure with G102 or G141 respectively. We dither on a sub-pixel pattern to obtain better spatial resolution after data reduction.

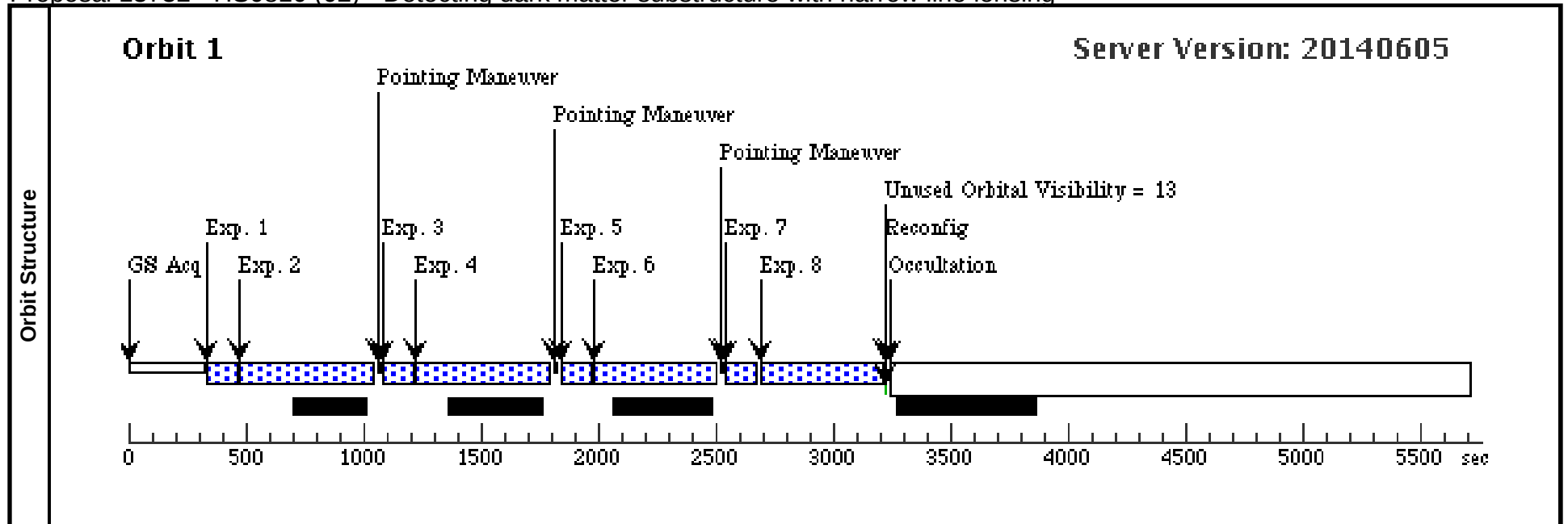
Proposal 13732 - HE0435 (01) - Detecting dark matter substructure with narrow line lensing

Visit	Proposal 13732, HE0435 (01), implementation									Wed Aug 06 01:03:13 GMT 2014	
	Diagnostic Status: No Diagnostics										
	Scientific Instruments: WFC3/IR										
	Special Requirements: ORIENT 283D TO 283 D										
Fixed Targets	#	Name	Target Coordinates		Targ. Coord. Corrections		Fluxes		Miscellaneous		
	(1)	HE0435-1223	RA: 04 38 14.7600 (69.5615000d) Dec: -12 17 14.00 (-12.28722d) Equinox: J2000				V=18		Reference Frame: ICRS		
Exposures	#	Label	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time (Total)/[Actual Dur.]		Orbit
	1	F140W	(1) HE0435-1223	WFC3/IR, MULTIACCUM, GRISM1024	F140W	NSAMP=8; SAMP-SEQ=STEP2 5		Sequence 1-2 Non-Int in HE0435 (01)	99.231256 Secs (99.231 Secs) [==>]		[1]
	2	G141	(1) HE0435-1223	WFC3/IR, MULTIACCUM, GRISM1024	G141	NSAMP=11; SAMP-SEQ=SPAR S50		Sequence 1-2 Non-Int in HE0435 (01)	502.936801 Secs (502.937 Secs) [==>]		[1]
	3	F140W Dither 1	(1) HE0435-1223	WFC3/IR, MULTIACCUM, GRISM1024	F140W	NSAMP=9; SAMP-SEQ=STEP2 5	POS TARG 1.355,4.063	Sequence 3-4 Non-Int in HE0435 (01)	124.231771 Secs (124.232 Secs) [==>]		[1]
	4	G141 Dither 1	(1) HE0435-1223	WFC3/IR, MULTIACCUM, GRISM1024	G141	NSAMP=11; SAMP-SEQ=SPAR S50	POS TARG 1.355,4.063	Sequence 3-4 Non-Int in HE0435 (01)	502.936801 Secs (502.937 Secs) [==>]		[1]
	5	F140W Dither 2	(1) HE0435-1223	WFC3/IR, MULTIACCUM, GRISM1024	F140W	NSAMP=8; SAMP-SEQ=STEP2 5	POS TARG 0.881,-3.64	Sequence 5-6 Non-Int in HE0435 (01)	99.231256 Secs (99.231 Secs) [==>]		[1]
	6	G141 Dither 2	(1) HE0435-1223	WFC3/IR, MULTIACCUM, GRISM1024	G141	NSAMP=12; SAMP-SEQ=SPAR S50	POS TARG 0.881,-3.64	Sequence 5-6 Non-Int in HE0435 (01)	552.937252 Secs (552.937 Secs) [==>]		[1]
	7	F140W Dither 3	(1) HE0435-1223	WFC3/IR, MULTIACCUM, GRISM1024	F140W	NSAMP=8; SAMP-SEQ=STEP2 5	POS TARG -0.474,-6.49	Sequence 7-8 Non-Int in HE0435 (01)	99.231256 Secs (99.231 Secs) [==>]		[1]
	8	G141 Dither 3	(1) HE0435-1223	WFC3/IR, MULTIACCUM, GRISM1024	G141	NSAMP=11; SAMP-SEQ=SPAR S50	POS TARG -0.474,-6.49	Sequence 7-8 Non-Int in HE0435 (01)	502.936801 Secs (502.937 Secs) [==>]		[1]



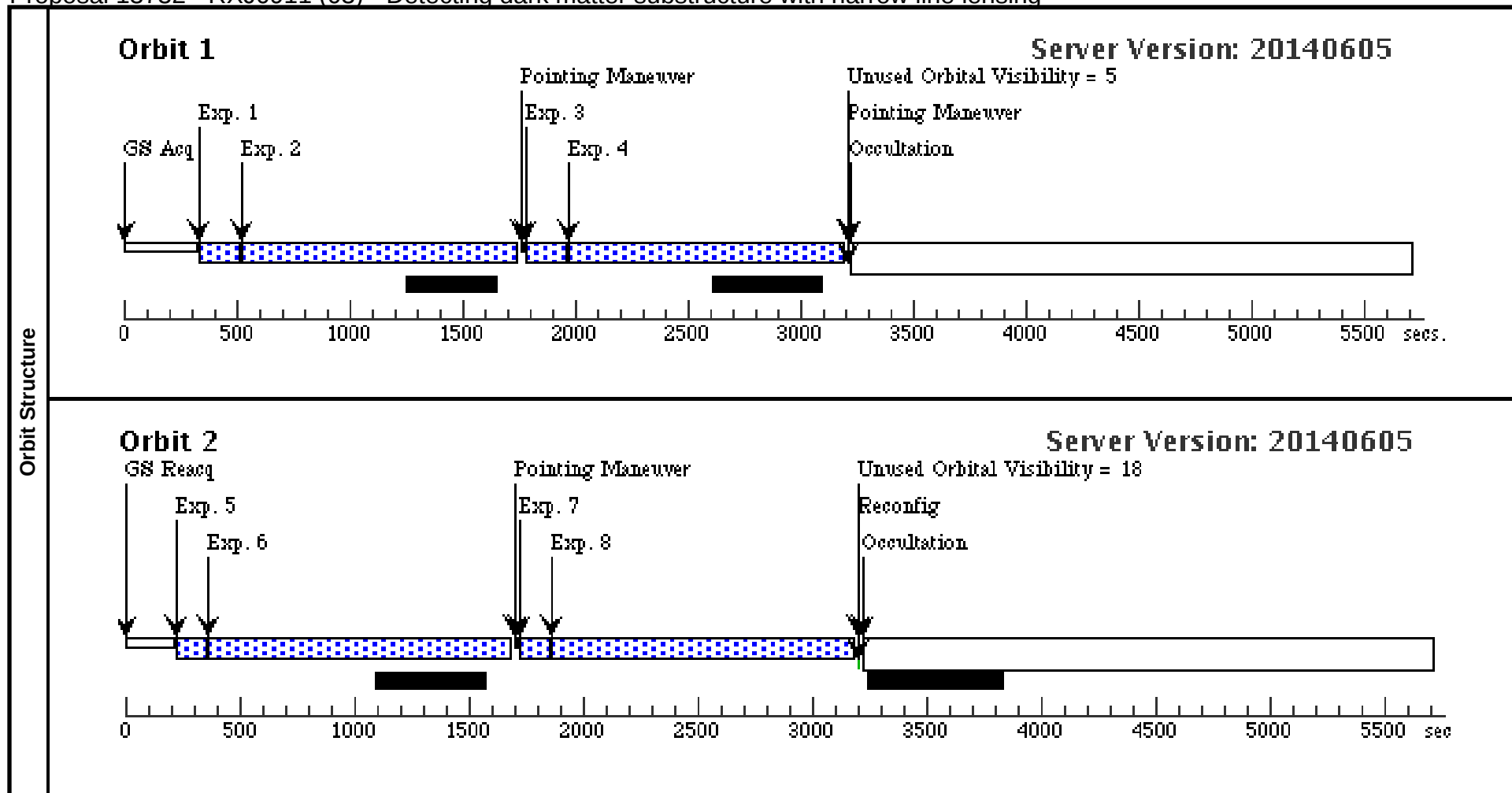
Proposal 13732 - HS0810 (02) - Detecting dark matter substructure with narrow line lensing

Visit	Proposal 13732, HS0810 (02), implementation									Wed Aug 06 01:03:13 GMT 2014	
	Diagnostic Status: No Diagnostics										
	Scientific Instruments: WFC3/IR										
	Special Requirements: ORIENT 108D TO 108 D										
Fixed Targets	#	Name	Target Coordinates		Targ. Coord. Corrections		Fluxes		Miscellaneous		
	(2)	HS0810+2554	RA: 08 13 31.2500 (123.3802083d) Dec: +25 45 3.24 (25.75090d) Equinox: J2000				V=17		Reference Frame: ICRS		
Exposures	#	Label	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time (Total)/[Actual Dur.]		Orbit
	1	F140W	(2) HS0810+2554	WFC3/IR, MULTIACCUM, GRISM1024	F140W	NSAMP=8; SAMP-SEQ=STEP2 5	GS ACQ SCENARI O BASE1B3	Sequence 1-2 Non-Int in HS0810 (02)	99.231256 Secs (99.231 Secs) [==>]		[1]
	2	G141	(2) HS0810+2554	WFC3/IR, MULTIACCUM, GRISM1024	G141	NSAMP=12; SAMP-SEQ=SPAR S50		Sequence 1-2 Non-Int in HS0810 (02)	552.937252 Secs (552.937 Secs) [==>]		[1]
	3	F140W Dither 1	(2) HS0810+2554	WFC3/IR, MULTIACCUM, GRISM1024	F140W	NSAMP=8; SAMP-SEQ=STEP2 5	POS TARG 1.355,4. 063	Sequence 3-4 Non-Int in HS0810 (02)	99.231256 Secs (99.231 Secs) [==>]		[1]
	4	G141 Dither 1	(2) HS0810+2554	WFC3/IR, MULTIACCUM, GRISM1024	G141	NSAMP=12; SAMP-SEQ=SPAR S50	POS TARG 1.355,4. 063	Sequence 3-4 Non-Int in HS0810 (02)	552.937252 Secs (552.937 Secs) [==>]		[1]
	5	F140W Dither 2	(2) HS0810+2554	WFC3/IR, MULTIACCUM, GRISM1024	F140W	NSAMP=8; SAMP-SEQ=STEP2 5	POS TARG 0.881,-3 .64	Sequence 5-6 Non-Int in HS0810 (02)	99.231256 Secs (99.231 Secs) [==>]		[1]
	6	G141 Dither 2	(2) HS0810+2554	WFC3/IR, MULTIACCUM, GRISM1024	G141	NSAMP=11; SAMP-SEQ=SPAR S50	POS TARG 0.881,-3 .64	Sequence 5-6 Non-Int in HS0810 (02)	502.936801 Secs (502.937 Secs) [==>]		[1]
	7	F140W Dither 3	(2) HS0810+2554	WFC3/IR, MULTIACCUM, GRISM1024	F140W	NSAMP=8; SAMP-SEQ=STEP2 5	POS TARG -0.474,- 6.49	Sequence 7-8 Non-Int in HS0810 (02)	99.231256 Secs (99.231 Secs) [==>]		[1]
	8	G141 Dither 3	(2) HS0810+2554	WFC3/IR, MULTIACCUM, GRISM1024	G141	NSAMP=11; SAMP-SEQ=SPAR S50	POS TARG -0.474,- 6.49	Sequence 7-8 Non-Int in HS0810 (02)	502.936801 Secs (502.937 Secs) [==>]		[1]



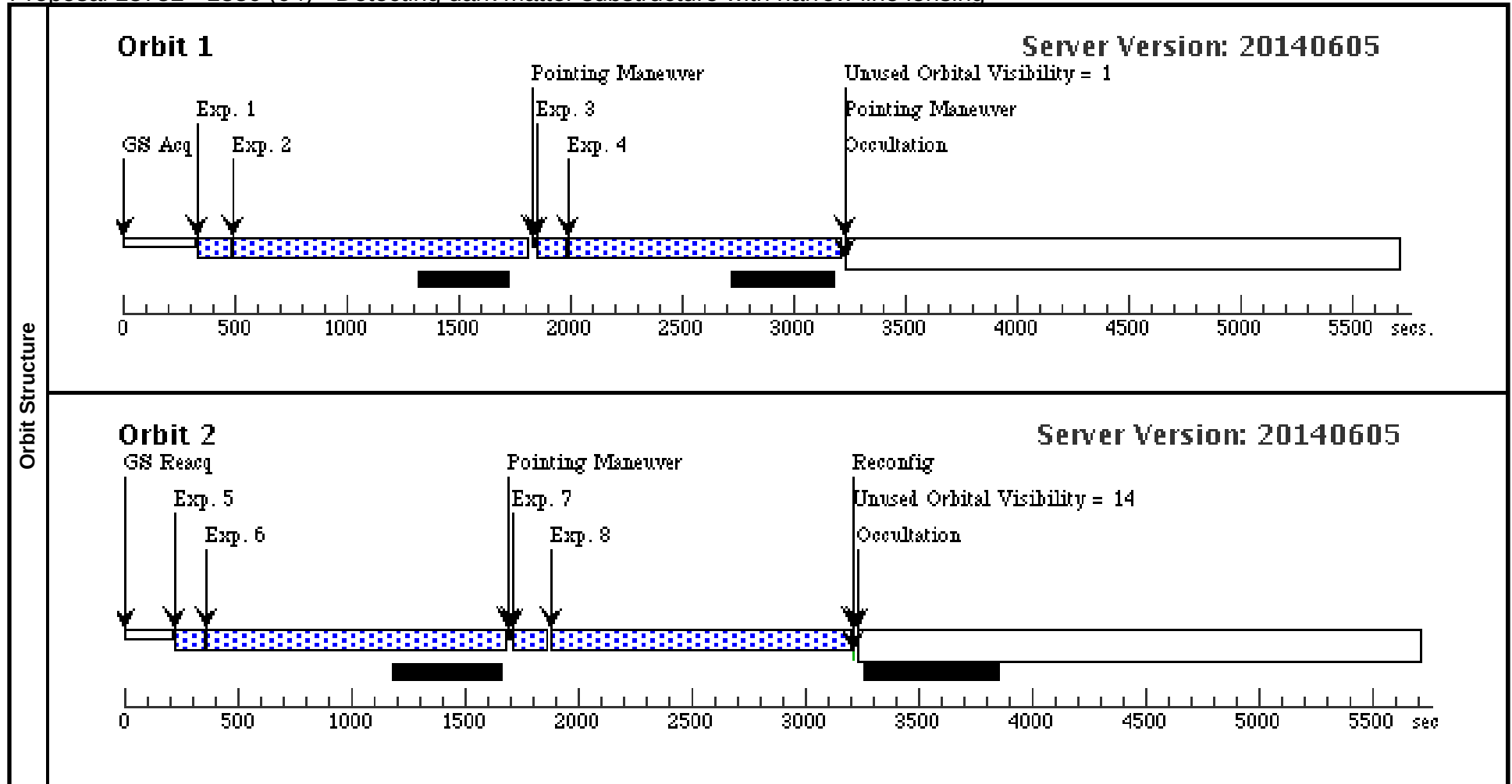
Proposal 13732 - RXJ0911 (03) - Detecting dark matter substructure with narrow line lensing

Visit	Proposal 13732, RXJ0911 (03), implementation									Wed Aug 06 01:03:13 GMT 2014		
	Diagnostic Status: No Diagnostics											
	Scientific Instruments: WFC3/IR											
	Special Requirements: ORIENT 118D TO 118 D											
Fixed Targets	#	Name		Target Coordinates		Targ. Coord. Corrections		Fluxes		Miscellaneous		
	(3)	RXJ0911+0551		RA: 09 11 27.6200 (137.8650833d) Dec: +05 50 54.00 (5.84833d) Equinox: J2000				V=18		Reference Frame: ICRS		
Exposures	#	Label	Target	Config,Mode,Aperture		Spectral Els.	Opt. Params.		Special Reqs.	Groups	Exp. Time (Total)/[Actual Dur.]	Orbit
	1	F140W	(3) RXJ0911+0551	WFC3/IR, MULTIACCUM, GRISM1024		F140W	NSAMP=10; SAMP-SEQ=STEP2 5			Sequence 1-2 Non-Int in RXJ0911 (03)	149.232286 Secs (149.232 Secs) [==>]	[1]
	2	G141	(3) RXJ0911+0551	WFC3/IR, MULTIACCUM, GRISM1024		G141	NSAMP=13; SAMP-SEQ=SPAR S100			Sequence 1-2 Non-Int in RXJ0911 (03)	1202.936167 Secs (1202.936 Secs) [==>]	[1]
	3	F140W Dither 1	(3) RXJ0911+0551	WFC3/IR, MULTIACCUM, GRISM1024		F140W	NSAMP=10; SAMP-SEQ=STEP2 5		POS TARG 1.355,4.063	Sequence 3-4 Non-Int in RXJ0911 (03)	149.232286 Secs (149.232 Secs) [==>]	[1]
	4	G141 Dither 1	(3) RXJ0911+0551	WFC3/IR, MULTIACCUM, GRISM1024		G141	NSAMP=13; SAMP-SEQ=SPAR S100		POS TARG 1.355,4.063	Sequence 3-4 Non-Int in RXJ0911 (03)	1202.936167 Secs (1202.936 Secs) [==>]	[1]
	5	F140W Dither 2	(3) RXJ0911+0551	WFC3/IR, MULTIACCUM, GRISM1024		F140W	NSAMP=8; SAMP-SEQ=STEP2 5		POS TARG 0.881,-4.853	Sequence 5-6 Non-Int in RXJ0911 (03)	99.231256 Secs (99.231 Secs) [==>]	[2]
	6	G141 Dither 2	(3) RXJ0911+0551	WFC3/IR, MULTIACCUM, GRISM1024		G141	NSAMP=14; SAMP-SEQ=SPAR S100		POS TARG 0.881,-4.853	Sequence 5-6 Non-Int in RXJ0911 (03)	1302.93649 Secs (1302.936 Secs) [==>]	[2]
	7	F140W Dither 3	(3) RXJ0911+0551	WFC3/IR, MULTIACCUM, GRISM1024		F140W	NSAMP=8; SAMP-SEQ=STEP2 5		POS TARG -0.474,-7.703	Sequence 7-8 Non-Int in RXJ0911 (03)	99.231256 Secs (99.231 Secs) [==>]	[2]
	8	G141 Dither 3	(3) RXJ0911+0551	WFC3/IR, MULTIACCUM, GRISM1024		G141	NSAMP=14; SAMP-SEQ=SPAR S100		POS TARG -0.474,-7.703	Sequence 7-8 Non-Int in RXJ0911 (03)	1302.93649 Secs (1302.936 Secs) [==>]	[2]



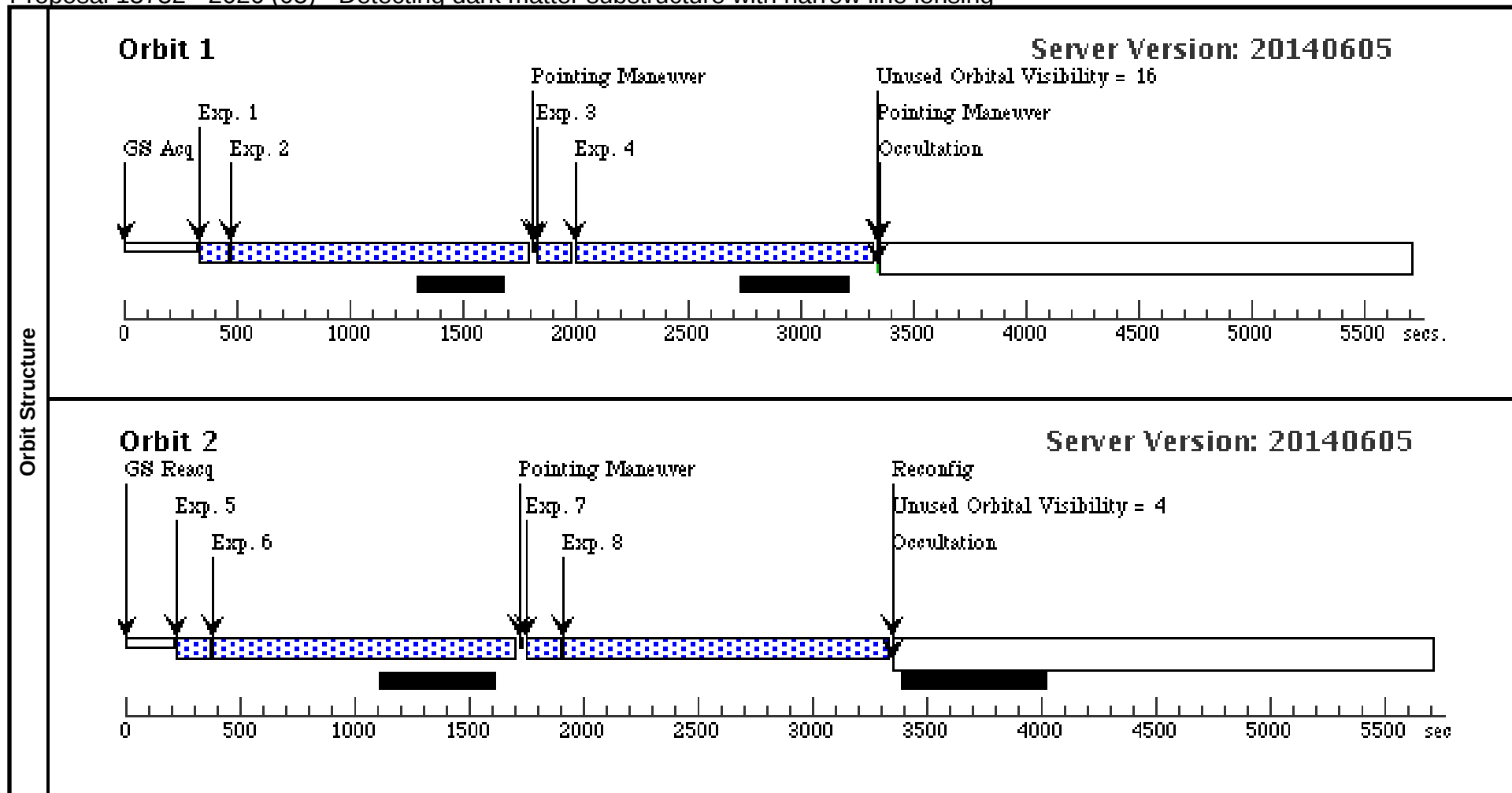
Proposal 13732 - 1330 (04) - Detecting dark matter substructure with narrow line lensing

Visit	Proposal 13732, 1330 (04), implementation Wed Aug 06 01:03:13 GMT 2014									
	Diagnostic Status: No Diagnostics Scientific Instruments: WFC3/IR Special Requirements: ORIENT 95D TO 95 D									
Fixed Targets	#	Name	Target Coordinates	Targ. Coord. Corrections	Fluxes	Miscellaneous				
	(4)	SDSSJ1330+1810	RA: 13 30 18.6400 (202.5776667d) Dec: +18 10 32.10 (18.17558d) Equinox: J2000		V=18	Reference Frame: ICRS				
Exposures	#	Label	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time (Total)/[Actual Dur.]	Orbit
	1	F105	(4) SDSSJ1330+1810	WFC3/IR, MULTIACCUM, GRISM1024	F105W	NSAMP=9; SAMP-SEQ=STEP25		Sequence 1-2 Non-Int in 1330 (04)	124.231771 Secs (124.232 Secs) [==>]	[1]
	2	G102	(4) SDSSJ1330+1810	WFC3/IR, MULTIACCUM, GRISM1024	G102	NSAMP=14; SAMP-SEQ=SPARS100		Sequence 1-2 Non-Int in 1330 (04)	1302.93649 Secs (1302.936 Secs) [==>]	[1]
	3	F105W Dither 1	(4) SDSSJ1330+1810	WFC3/IR, MULTIACCUM, GRISM1024	F105W	NSAMP=8; SAMP-SEQ=STEP25	POS TARG 1.355,4.063	Sequence 3-4 Non-Int in 1330 (04)	99.231256 Secs (99.231 Secs) [==>]	[1]
	4	G102 Dither 1	(4) SDSSJ1330+1810	WFC3/IR, MULTIACCUM, GRISM1024	G102	NSAMP=13; SAMP-SEQ=SPARS100	POS TARG 1.355,4.063	Sequence 3-4 Non-Int in 1330 (04)	1202.936167 Secs (1202.936 Secs) [==>]	[1]
	5	F105W Dither 2	(4) SDSSJ1330+1810	WFC3/IR, MULTIACCUM, GRISM1024	F105W	NSAMP=8; SAMP-SEQ=STEP25	POS TARG 0.881,-3.64	Sequence 5-6 Non-Int in 1330 (04)	99.231256 Secs (99.231 Secs) [==>]	[2]
	6	G102 Dither 2	(4) SDSSJ1330+1810	WFC3/IR, MULTIACCUM, GRISM1024	G102	NSAMP=14; SAMP-SEQ=SPARS100	POS TARG 0.881,-3.64	Sequence 5-6 Non-Int in 1330 (04)	1302.93649 Secs (1302.936 Secs) [==>]	[2]
	7	F105W Dither 3	(4) SDSSJ1330+1810	WFC3/IR, MULTIACCUM, GRISM1024	F105W	NSAMP=9; SAMP-SEQ=STEP25	POS TARG -0.474,-6.49	Sequence 7-8 Non-Int in 1330 (04)	124.231771 Secs (124.232 Secs) [==>]	[2]
	8	G102 Dither 3	(4) SDSSJ1330+1810	WFC3/IR, MULTIACCUM, GRISM1024	G102	NSAMP=14; SAMP-SEQ=SPARS100	POS TARG -0.474,-6.49	Sequence 7-8 Non-Int in 1330 (04)	1302.93649 Secs (1302.936 Secs) [==>]	[2]



Proposal 13732 - 2026 (05) - Detecting dark matter substructure with narrow line lensing

Visit	Proposal 13732, 2026 (05), implementation Wed Aug 06 01:03:13 GMT 2014									
	Diagnostic Status: No Diagnostics Scientific Instruments: WFC3/IR Special Requirements: ORIENT 55D TO 55 D									
Fixed Targets	#	Name	Target Coordinates	Targ. Coord. Corrections	Fluxes	Miscellaneous				
	(5)	WFI2026-4536	RA: 20 26 10.4300 (306.5434583d) Dec: -45 36 26.80 (-45.60744d) Equinox: J2000		V=17	Reference Frame: ICRS				
Exposures	#	Label	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time (Total)/[Actual Dur.]	Orbit
	1	F140W	(5) WFI2026-4536	WFC3/IR, MULTIACCUM, GRISM1024	F140W	NSAMP=8; SAMP-SEQ=STEP2 5		Sequence 1-2 Non-Int in 2026 (05)	99.231256 Secs (99.231 Secs) [==>]	[1]
	2	G141	(5) WFI2026-4536	WFC3/IR, MULTIACCUM, GRISM1024	G141	NSAMP=14; SAMP-SEQ=SPAR S100		Sequence 1-2 Non-Int in 2026 (05)	1302.93649 Secs (1302.936 Secs) [==>]	[1]
	3	F140W Dither 1	(5) WFI2026-4536	WFC3/IR, MULTIACCUM, GRISM1024	F140W	NSAMP=9; SAMP-SEQ=STEP2 5	POS TARG 1.355,4.063	Sequence 3-4 Non-Int in 2026 (05)	124.231771 Secs (124.232 Secs) [==>]	[1]
	4	G141 Dither 1	(5) WFI2026-4536	WFC3/IR, MULTIACCUM, GRISM1024	G141	NSAMP=14; SAMP-SEQ=SPAR S100	POS TARG 1.355,4.063	Sequence 3-4 Non-Int in 2026 (05)	1302.93649 Secs (1302.936 Secs) [==>]	[1]
	5	F140W Dither 2	(5) WFI2026-4536	WFC3/IR, MULTIACCUM, GRISM1024	F140W	NSAMP=9; SAMP-SEQ=STEP2 5	POS TARG 0.881,-3.64	Sequence 5-6 Non-Int in 2026 (05)	124.231771 Secs (124.232 Secs) [==>]	[2]
	6	G141 Dither 2	(5) WFI2026-4536	WFC3/IR, MULTIACCUM, GRISM1024	G141	NSAMP=14; SAMP-SEQ=SPAR S100	POS TARG 0.881,-3.64	Sequence 5-6 Non-Int in 2026 (05)	1302.93649 Secs (1302.936 Secs) [==>]	[2]
	7	F140W Dither 3	(5) WFI2026-4536	WFC3/IR, MULTIACCUM, GRISM1024	F140W	NSAMP=9; SAMP-SEQ=STEP2 5	POS TARG -0.474,-6.49	Sequence 7-8 Non-Int in 2026 (05)	124.231771 Secs (124.232 Secs) [==>]	[2]
	8	G141 Dither 3	(5) WFI2026-4536	WFC3/IR, MULTIACCUM, GRISM1024	G141	NSAMP=15; SAMP-SEQ=SPAR S100	POS TARG -0.474,-6.49	Sequence 7-8 Non-Int in 2026 (05)	1402.936813 Secs (1402.937 Secs) [==>]	[2]



Proposal 13732 - 2033 (06) - Detecting dark matter substructure with narrow line lensing

Visit	Proposal 13732, 2033 (06), implementation									Wed Aug 06 01:03:14 GMT 2014	
	Diagnostic Status: No Diagnostics										
	Scientific Instruments: WFC3/IR										
	Special Requirements: ORIENT 270D TO 270 D										
Fixed Targets	#	Name	Target Coordinates		Targ. Coord. Corrections		Fluxes		Miscellaneous		
	(6)	WFI2033-4723	RA: 20 33 42.0000 (308.4250000d) Dec: -47 23 43.00 (-47.39528d) Equinox: J2000				V=18		Reference Frame: ICRS		
Exposures	#	Label	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time (Total)/[Actual Dur.]		Orbit
	1	F140W	(6) WFI2033-4723	WFC3/IR, MULTIACCUM, GRISM1024	F140W	NSAMP=9; SAMP-SEQ=STEP2 5		Sequence 1-2 Non-Int in 2033 (06)	124.231771 Secs (124.232 Secs) [==>]		[1]
	2	G141	(6) WFI2033-4723	WFC3/IR, MULTIACCUM, GRISM1024	G141	NSAMP=14; SAMP-SEQ=SPAR S100		Sequence 1-2 Non-Int in 2033 (06)	1302.93649 Secs (1302.936 Secs) [==>]		[1]
	3	F140W Dither 1	(6) WFI2033-4723	WFC3/IR, MULTIACCUM, GRISM1024	F140W	NSAMP=8; SAMP-SEQ=STEP2 5	POS TARG 1.355,4.063	Sequence 3-4 Non-Int in 2033 (06)	99.231256 Secs (99.231 Secs) [==>]		[1]
	4	G141 Dither 1	(6) WFI2033-4723	WFC3/IR, MULTIACCUM, GRISM1024	G141	NSAMP=14; SAMP-SEQ=SPAR S100	POS TARG 1.355,4.063	Sequence 3-4 Non-Int in 2033 (06)	1302.93649 Secs (1302.936 Secs) [==>]		[1]
	5	F140W Dither 2	(6) WFI2033-4723	WFC3/IR, MULTIACCUM, GRISM1024	F140W	NSAMP=9; SAMP-SEQ=STEP2 5	POS TARG 0.881,7.277	Sequence 5-6 Non-Int in 2033 (06)	124.231771 Secs (124.232 Secs) [==>]		[2]
	6	G141 Dither 2	(6) WFI2033-4723	WFC3/IR, MULTIACCUM, GRISM1024	G141	NSAMP=15; SAMP-SEQ=SPAR S100	POS TARG 0.881,7.277	Sequence 5-6 Non-Int in 2033 (06)	1402.936813 Secs (1402.937 Secs) [==>]		[2]
	7	F140W Dither 3	(6) WFI2033-4723	WFC3/IR, MULTIACCUM, GRISM1024	F140W	NSAMP=8; SAMP-SEQ=STEP2 5	POS TARG -0.474,-6.49	Sequence 7-8 Non-Int in 2033 (06)	99.231256 Secs (99.231 Secs) [==>]		[2]
	8	G141 Dither 3	(6) WFI2033-4723	WFC3/IR, MULTIACCUM, GRISM1024	G141	NSAMP=14; SAMP-SEQ=SPAR S100	POS TARG -0.474,-6.49	Sequence 7-8 Non-Int in 2033 (06)	1302.93649 Secs (1302.936 Secs) [==>]		[2]

