



10581 - Imaging a Proto-cluster at $z=2.3$: The Morphology-Density Relation at High Redshift

Cycle: 14, Proposal Category: GO
(Availability Mode: SUPPORTED)

INVESTIGATORS

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VISITS

<i>Visit</i>	<i>Targets</i>	<i>Configurations</i>	<i>Orbits Used</i>	<i>Last Orbit Planner Run</i>	<i>OP Current with Visit?</i>
01	(2) HS1700-NW	ACS/WFC	5	30-Aug-2005 14:02:42.0	yes
02	(4) HS1700-SW	ACS/WFC	5	30-Aug-2005 14:03:00.0	yes
03	(1) HS1700-NE	ACS/WFC	5	30-Aug-2005 14:03:16.0	yes
04	(3) HS1700-SE	ACS/WFC	5	30-Aug-2005 14:03:32.0	yes

20 Total Orbits Used

ABSTRACT

We propose deep ACS/WFC imaging in the HS1700+643 field, which contains a significant galaxy over-density at $z=2.30\pm 0.015$. This structure is the largest and most robustly established cluster-sized over-density at $z>1.5$. We have spectroscopically confirmed 100 $z\sim 2$ star-forming galaxies in this field and find significant differences in their stellar populations as a function of large-scale environment. Here we propose to measure the detailed morphological properties of this sample, to determine if the universal morphology-density relationship observed in the low-redshift universe is already in place in and around a forming proto-cluster region at high redshift. As well as providing a unique window into galaxy formation through studies of the $z=2.3$ proto-cluster, the HS1700+643 field has an extensive wealth of complementary data to recommend it. We will combine the new ACS observations with existing multi-wavelength imaging ranging from 0.3--8.0 microns, optical and near-IR spectroscopy, and narrow band imaging of $z=2.3$ H-alpha emitters, to understand the evolving properties of a complete and unbiased sample of high-redshift galaxies.

OBSERVING DESCRIPTION

We are proposing four adjacent ACS pointings in the HS1700+643 field, which will provide roughly contiguous coverage over a 6.5×6.5 arcmin-squared region. Figure 3 of our Phase I proposal indicates the locations of the proposed ACS pointings at a nominal PA=0 degrees, though we are not requiring "ORIENT" to be fixed. Also indicated in Figure 3 are the locations of the 100 UV-selected spectroscopically-confirmed $z\sim 2$ galaxies described in this proposal. Objects at $z=2.30\pm 0.015$ are highlighted. Though not indicated in this figure, the number of additional UV-selected $z\sim 2$ photometric candidates without redshifts is a factor of four higher. In four ACS pointings, we can cover ~ 80 UV-selected spectroscopically-confirmed $z\sim 2$ galaxies, along with an additional ~ 300 photometric candidates. Additionally, we will cover ~ 50 H-alpha narrow-band-selected objects that are candidate proto-cluster members at $z=2.3$, and ~ 50 J-K_s-selected objects that are most likely massive galaxies at $z\geq 2$. The precise set of galaxies covered by the pointings will vary as a function of ORIENT, but regardless of the orientation of the detector in each pointing, we will be able to cover roughly the same total number of objects, including all of the spectroscopically-confirmed proto-cluster galaxies.

Because we are primarily interested in detailed morphology, our proposed observations emphasize depth over color information. In fact, the majority of the target galaxies already have extensive and deep color information from 0.3-8.0 micron. We are therefore proposing ACS/WFC exposures in the F814W filter for maximum instrumental throughput. The median redshift for the galaxies of primary interest is $\langle z \rangle = 2.3$, so that the F814W filter corresponds to rest-frame 2500 angstrom light.

Proposal 10581 - Overview

We have estimated the required exposure times as follows: our primary spectroscopic sample covers the magnitude range of $AB(6900)=22.0-25.5$, with an average of $AB(6900)=24.3$. For typical rest-frame UV colors, this corresponds to $AB(8140)=22.1-25.4$ with an average of $AB(8140)=24.2$. Using the ACS Exposure Time Calculator and assuming typical half-light radii of 0.25 arcsec, we find that in 10000 seconds we achieve $S/N=30$ detections of the faintest objects in our sample, with a corresponding $S/N>5$ per 2×2 -pixel resolution element. This guarantees that any structure resolved by HST/ACS will be significantly detected for even our faintest targets. Most of the complementary sample of J-K_s-selected objects have F814W magnitudes comparable to those of the faintest of the UV-selected objects, providing further justification for the deep exposures. To put the proposed exposure times in context, we calculate that 10000 seconds in F814W is slightly deeper than the sum of the F606W and F775W data obtained by the GOODS survey. We have in fact spectroscopically confirmed a significant number (~ 200) of UV-selected $z\sim 2$ galaxies in the GOODS-N field, with a similar range of rest-frame UV luminosities to that of the proposed HS1700+643 sample. By stacking the GOODS-N F606W and F775W exposures and inspecting a set of $z\sim 2$ galaxies with a representative range of magnitudes, we determine that we will be able to measure detailed morphological properties for all the objects in our HS1700+643 sample with the proposed exposure times.

We have been awarded 20 orbits, or 5 orbits for each of 4 pointings. For each pointing, we have planned a single 5-orbit visit. In each orbit of a visit, we will perform the ACS-WFC-DITHER-BOX pattern, with the default offsets and orientation. Each position of the 4-point dither pattern will have an exposure of $\sim 600-630$ seconds, yielding a total integration time of $\sim 2400-2500$ seconds per dither pattern. With 5 orbits in each pointing, and therefore 5 dither sequences, we will obtain a total integration time of $\sim 12000-12500$ seconds per pointing. The dithering should allow for cosmic ray rejection, though we will not completely cover the inter-chip gap.

The declination of our field is +64 degrees, which corresponds to a visibility period of 60 minutes in 3-gyro mode. Assuming typical ACS values for guide-star acquisition, small dithers, and instrument overhead, we find ~ 2900 seconds available per orbit for science integration, so our proposed strategy should be feasible.

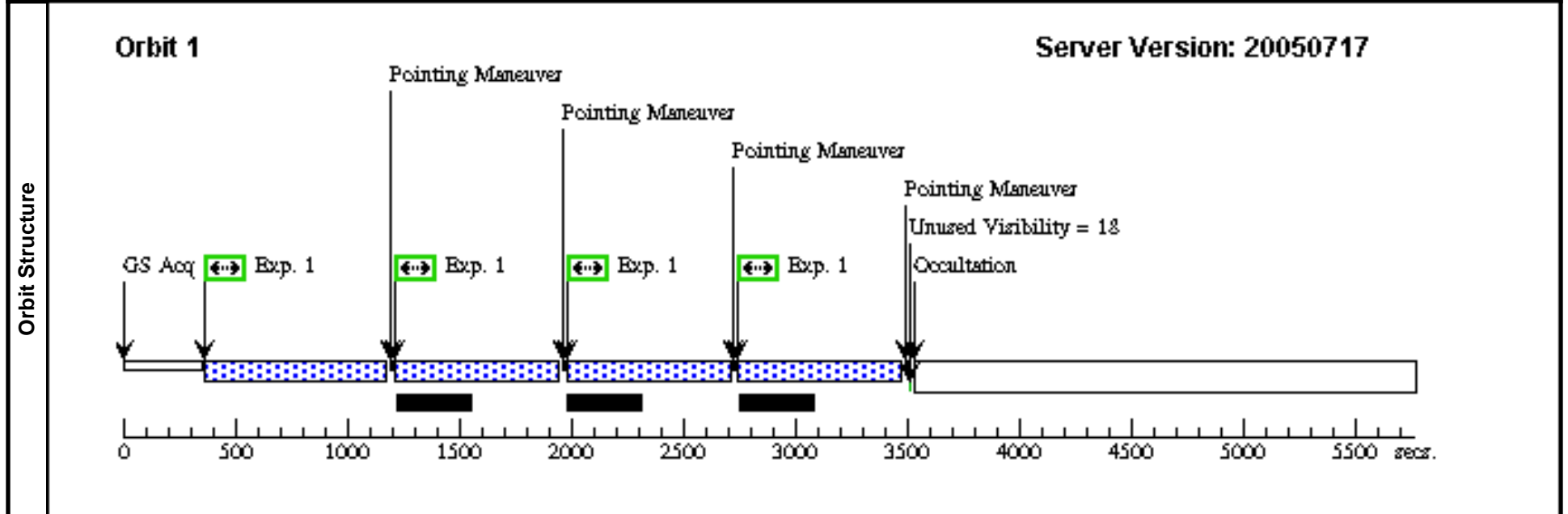
Proposal 10581 - Visit 01 - Imaging a Proto-cluster at z=2.3: The Morphology-Density Relation at High Redshift

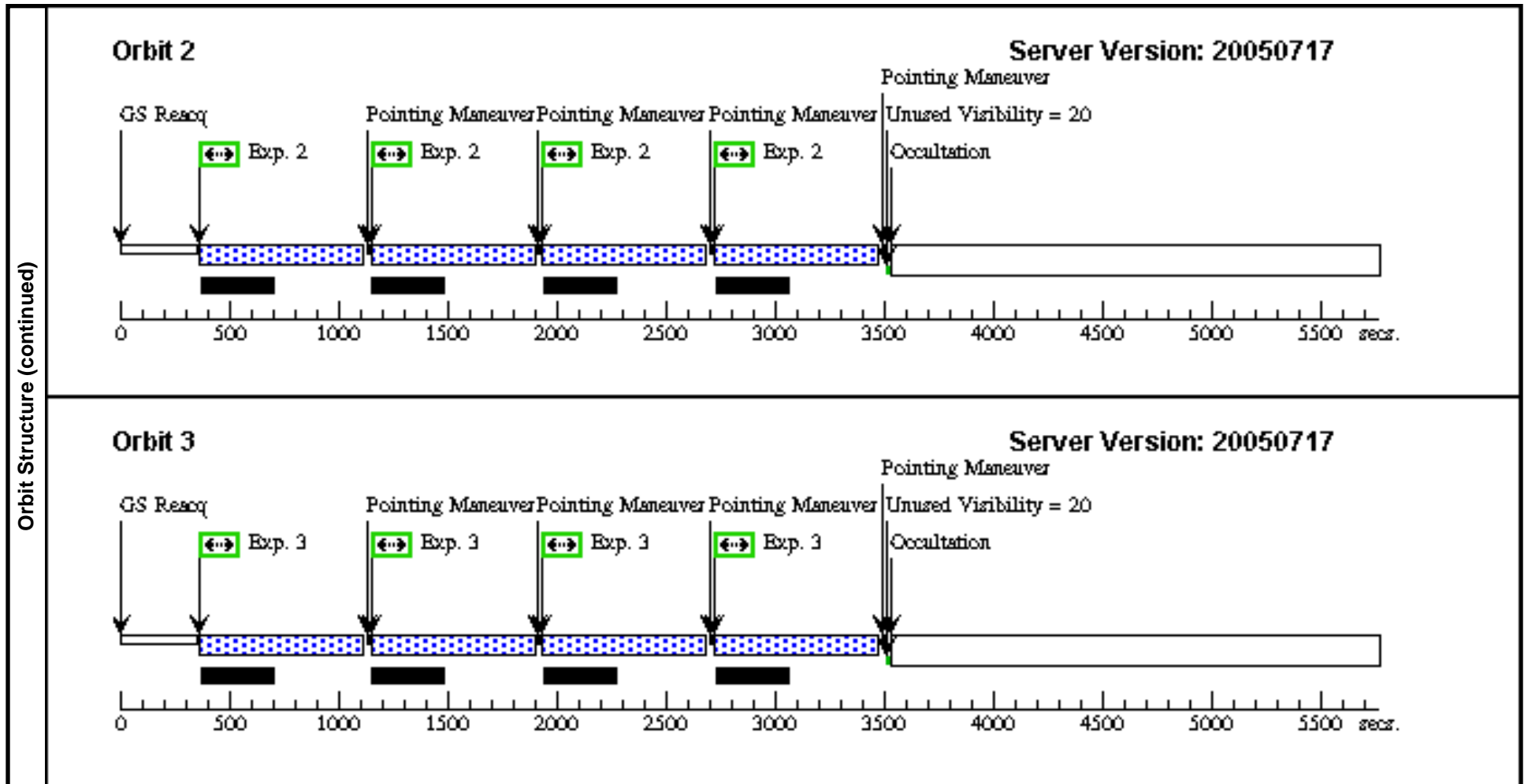
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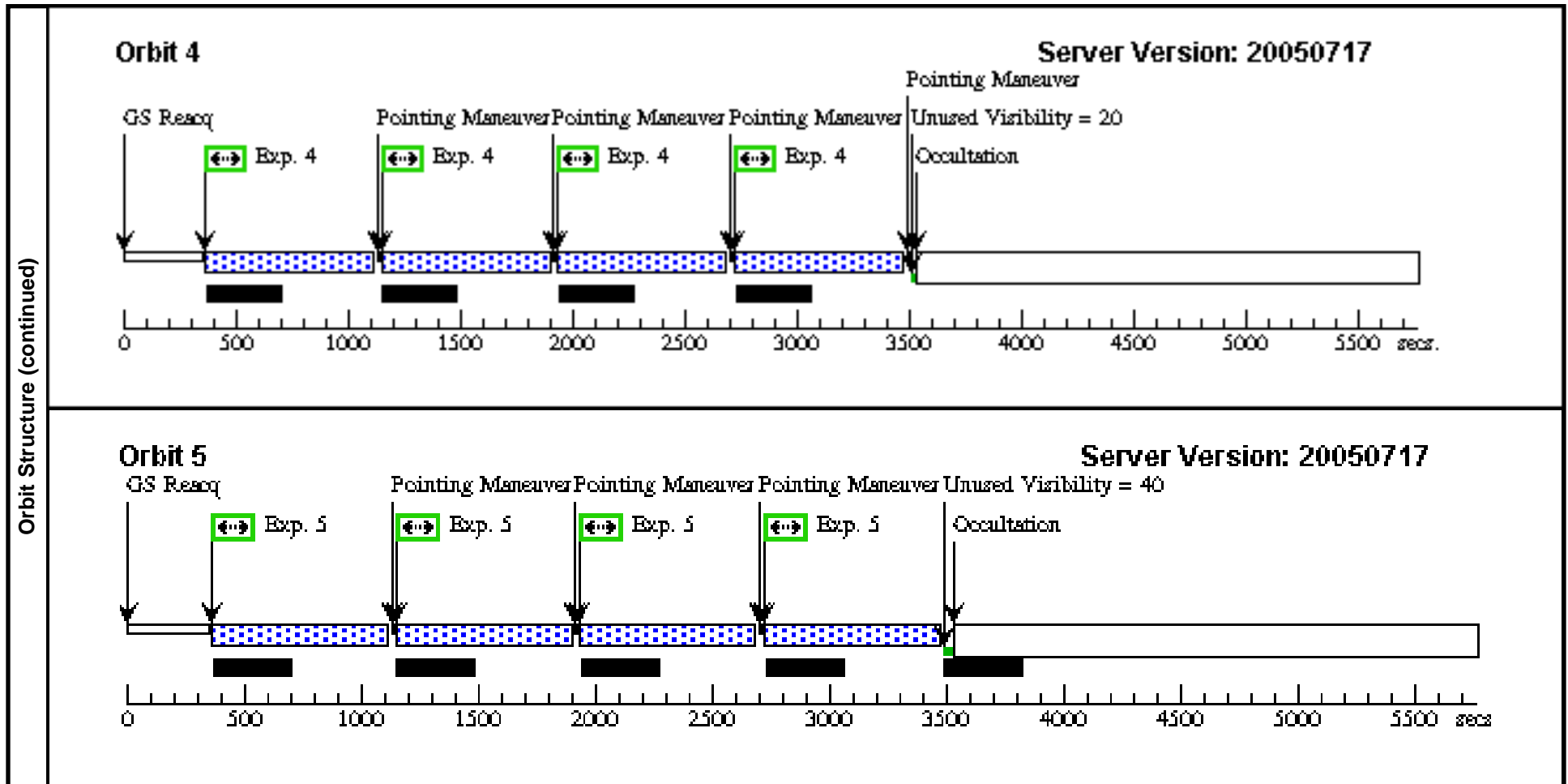
Visit	Proposal 10581, Visit 01 Diagnostic Status: No Diagnostics Scientific Instruments: ACS/WFC Special Requirements: ORIENT 340.0D TO 20.0 D; ORIENT 70.0D TO 110.0 D; ORIENT 160.0D TO 200.0 D; ORIENT 250.0D TO 290.0 D									
	Patterns	#	Primary Pattern			Secondary Pattern			Exposures	
		(1)	Pattern Type=ACS-WFC-DITHER-BOX Purpose=DITHER Number Of Points=4 Point Spacing=0.265 Line Spacing=0.187	Coordinate Frame=POS-TARG Pattern Orientation=20.7 Angle Between Sides=69.1 Center Pattern=false					(1), (2), (3), (4), (5)	
Fixed Targets	#	Name	Target Coordinates	Targ. Coord. Corrections		Fluxes	Miscellaneous			
	(2)	HS1700-NW	RA: 17 00 45.2000 (255.1883333d) Dec: +64 15 6.70 (64.25186d) Equinox: J2000 Plate Id: 01H3			V=26.0	Coordinate Source: GUIDE_STAR_CATALOG			
Exposures	#	Label	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time/[Actual Dur.]	Orbit
	1		(2) HS1700-NW	ACS/WFC, ACCUM, WFCENTER	F814W	CR-SPLIT=NO		Pattern 1-1 (1)	610.0 Secs	
									[==>(Pattern 1)] [==>(Pattern 2)] [==>(Pattern 3)] [==>(Pattern 4)]	[1]
	2		(2) HS1700-NW	ACS/WFC, ACCUM, WFCENTER	F814W	CR-SPLIT=NO		Pattern 2-2 (1)	630.0 Secs	
									[==>(Pattern 1)] [==>(Pattern 2)] [==>(Pattern 3)] [==>(Pattern 4)]	[2]
3		(2) HS1700-NW	ACS/WFC, ACCUM, WFCENTER	F814W	CR-SPLIT=NO		Pattern 3-3 (1)	630.0 Secs		
								[==>(Pattern 1)] [==>(Pattern 2)] [==>(Pattern 3)] [==>(Pattern 4)]	[3]	
4		(2) HS1700-NW	ACS/WFC, ACCUM, WFCENTER	F814W	CR-SPLIT=NO		Pattern 4-4 (1)	630.0 Secs		
								[==>(Pattern 1)] [==>(Pattern 2)] [==>(Pattern 3)] [==>(Pattern 4)]	[4]	

Proposal 10581 - Visit 01 - Imaging a Proto-cluster at z=2.3: The Morphology-Density Relation at High Redshift

Exposures (continued)	#	Label	Target	Config, Mode, Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time/[Actual Dur.]	Orbit
	5	(2) HS1700-NW	ACS/WFC, ACCUM, WFCENTER	F814W	CR-SPLIT=NO	Pattern 5-5 (1)	630.0 Secs [=>(Pattern 1)] [=>(Pattern 2)] [=>(Pattern 3)] [=>(Pattern 4)]	[5]		







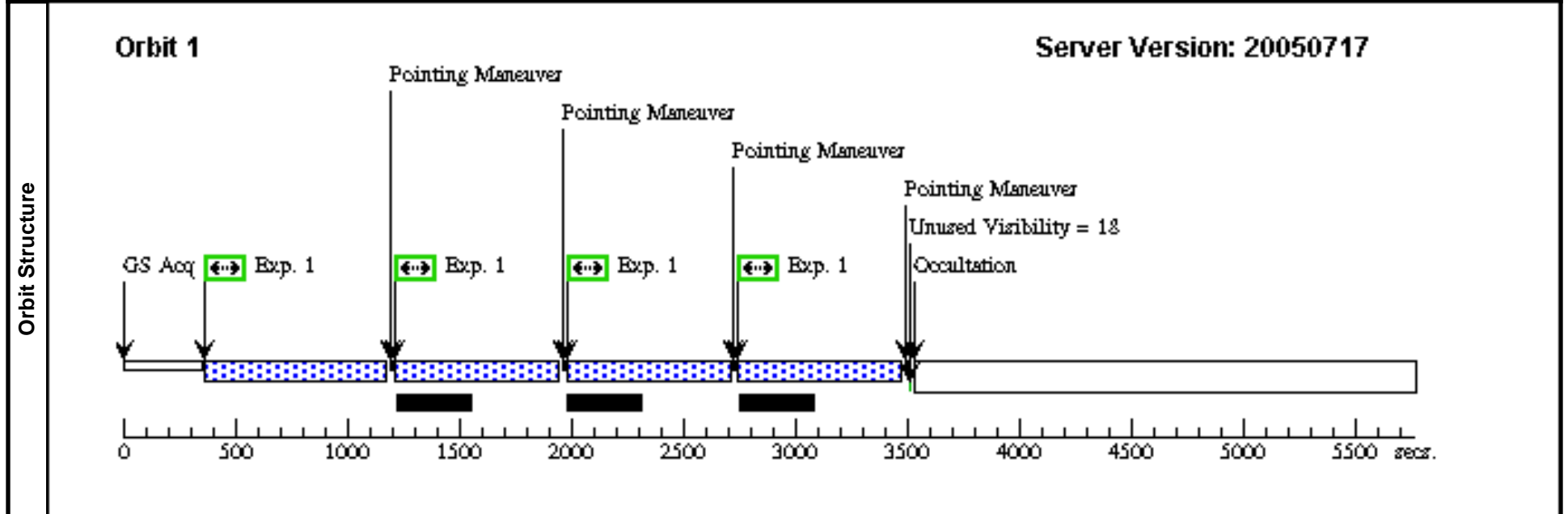
Proposal 10581 - Visit 02 - Imaging a Proto-cluster at z=2.3: The Morphology-Density Relation at High Redshift

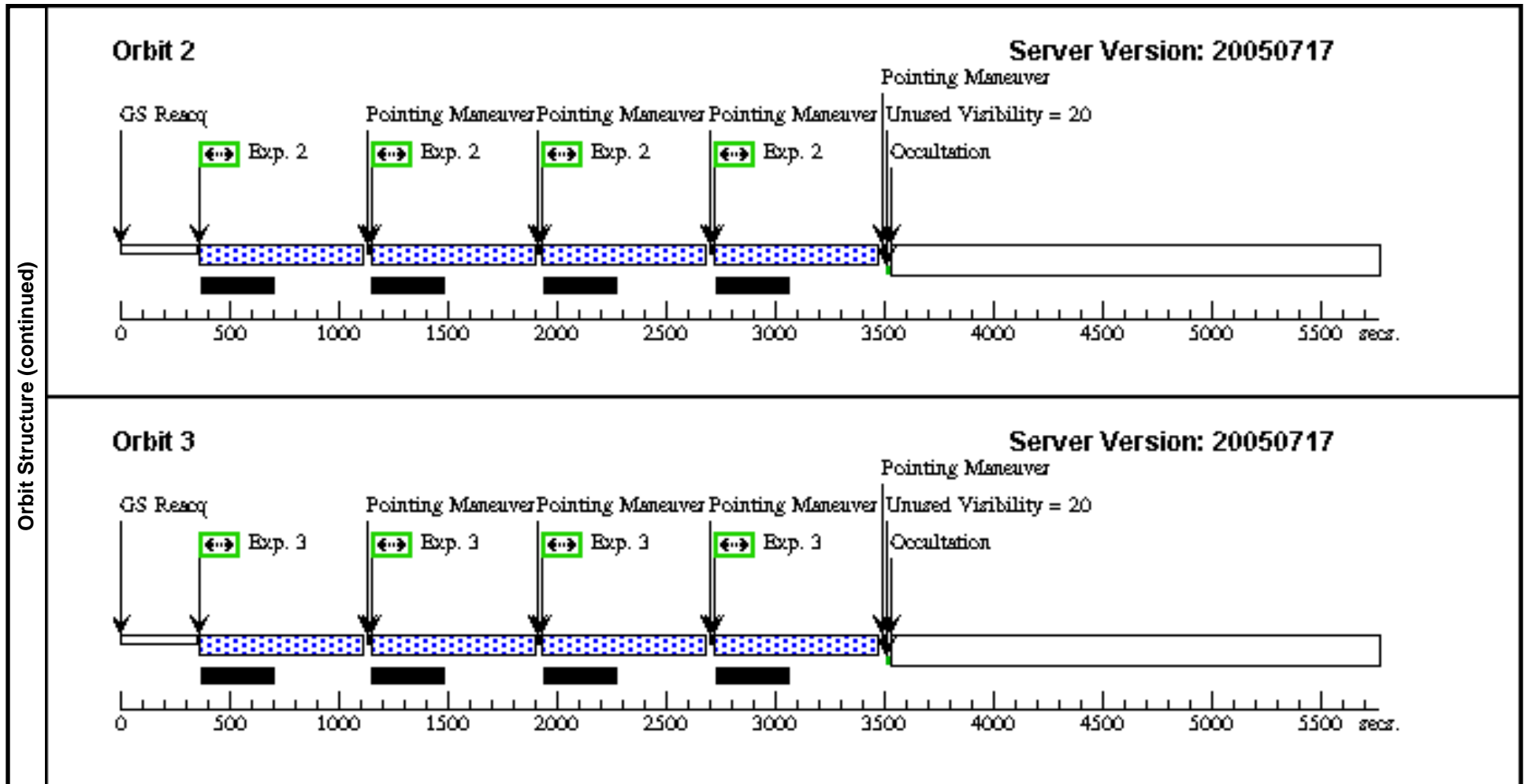
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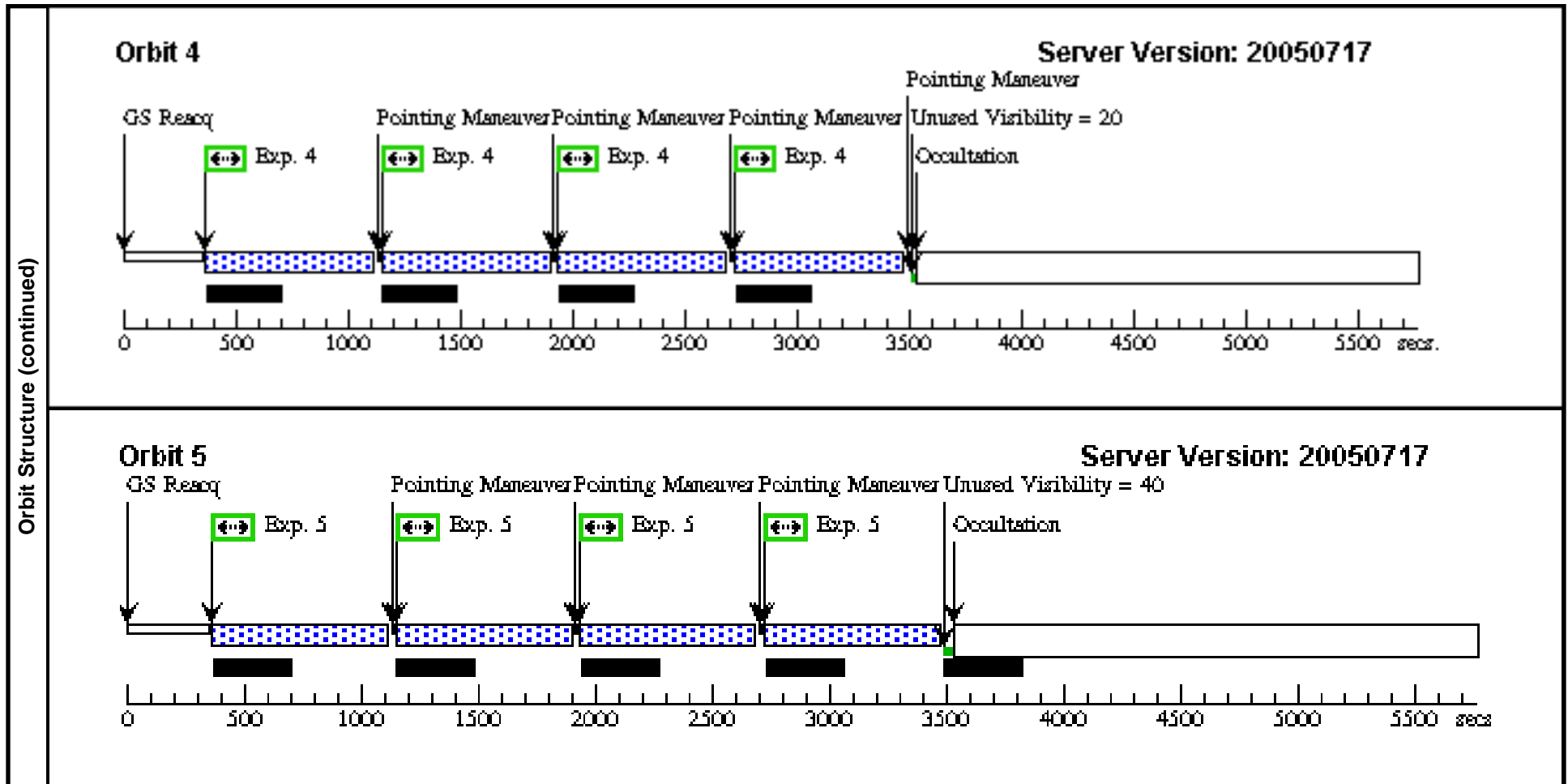
Visit	Proposal 10581, Visit 02 Diagnostic Status: No Diagnostics Scientific Instruments: ACS/WFC Special Requirements: ORIENT 340.0D TO 20.0 D; ORIENT 70.0D TO 110.0 D; ORIENT 160.0D TO 200.0 D; ORIENT 250.0D TO 290.0 D									
	Patterns	#	Primary Pattern			Secondary Pattern			Exposures	
		(1)	Pattern Type=ACS-WFC-DITHER-BOX Purpose=DITHER Number Of Points=4 Point Spacing=0.265 Line Spacing=0.187	Coordinate Frame=POS-TARG Pattern Orientation=20.7 Angle Between Sides=69.1 Center Pattern=false					(1), (2), (3), (4), (5)	
Fixed Targets	#	Name	Target Coordinates		Targ. Coord. Corrections		Fluxes	Miscellaneous		
	(4)	HS1700-SW	RA: 17 00 54.3000 (255.2262500d) Dec: +64 11 13.30 (64.18703d) Equinox: J2000 Plate Id: 01H3			V=26.0	Coordinate Source: GUIDE_STAR_CATALOG			
Exposures	#	Label	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time/[Actual Dur.]	Orbit
	1		(4) HS1700-SW	ACS/WFC, ACCUM, WFCENTER	F814W	CR-SPLIT=NO		Pattern 1-1 (1)	610.0 Secs	
									[==>(Pattern 1)] [==>(Pattern 2)] [==>(Pattern 3)] [==>(Pattern 4)]	[1]
	2		(4) HS1700-SW	ACS/WFC, ACCUM, WFCENTER	F814W	CR-SPLIT=NO		Pattern 2-2 (1)	630.0 Secs	
									[==>(Pattern 1)] [==>(Pattern 2)] [==>(Pattern 3)] [==>(Pattern 4)]	[2]
3		(4) HS1700-SW	ACS/WFC, ACCUM, WFCENTER	F814W	CR-SPLIT=NO		Pattern 3-3 (1)	630.0 Secs		
								[==>(Pattern 1)] [==>(Pattern 2)] [==>(Pattern 3)] [==>(Pattern 4)]	[3]	
4		(4) HS1700-SW	ACS/WFC, ACCUM, WFCENTER	F814W	CR-SPLIT=NO		Pattern 4-4 (1)	630.0 Secs		
								[==>(Pattern 1)] [==>(Pattern 2)] [==>(Pattern 3)] [==>(Pattern 4)]	[4]	

Proposal 10581 - Visit 02 - Imaging a Proto-cluster at z=2.3: The Morphology-Density Relation at High Redshift

Exposures (continued)	#	Label	Target	Config, Mode, Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time/[Actual Dur.]	Orbit
	5	(4) HS1700-SW	ACS/WFC, ACCUM, WFCENTER	F814W	CR-SPLIT=NO	Pattern 5-5 (1)	630.0 Secs [==>(Pattern 1)] [==>(Pattern 2)] [==>(Pattern 3)] [==>(Pattern 4)]	[5]		







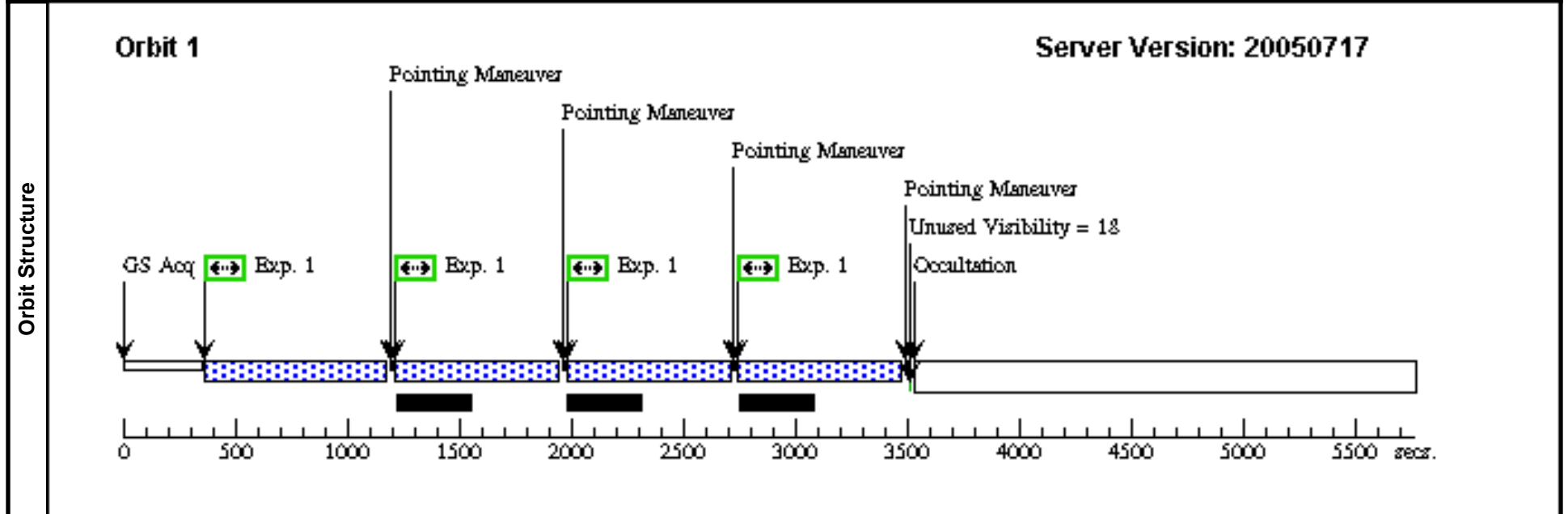
Proposal 10581 - Visit 03 - Imaging a Proto-cluster at z=2.3: The Morphology-Density Relation at High Redshift

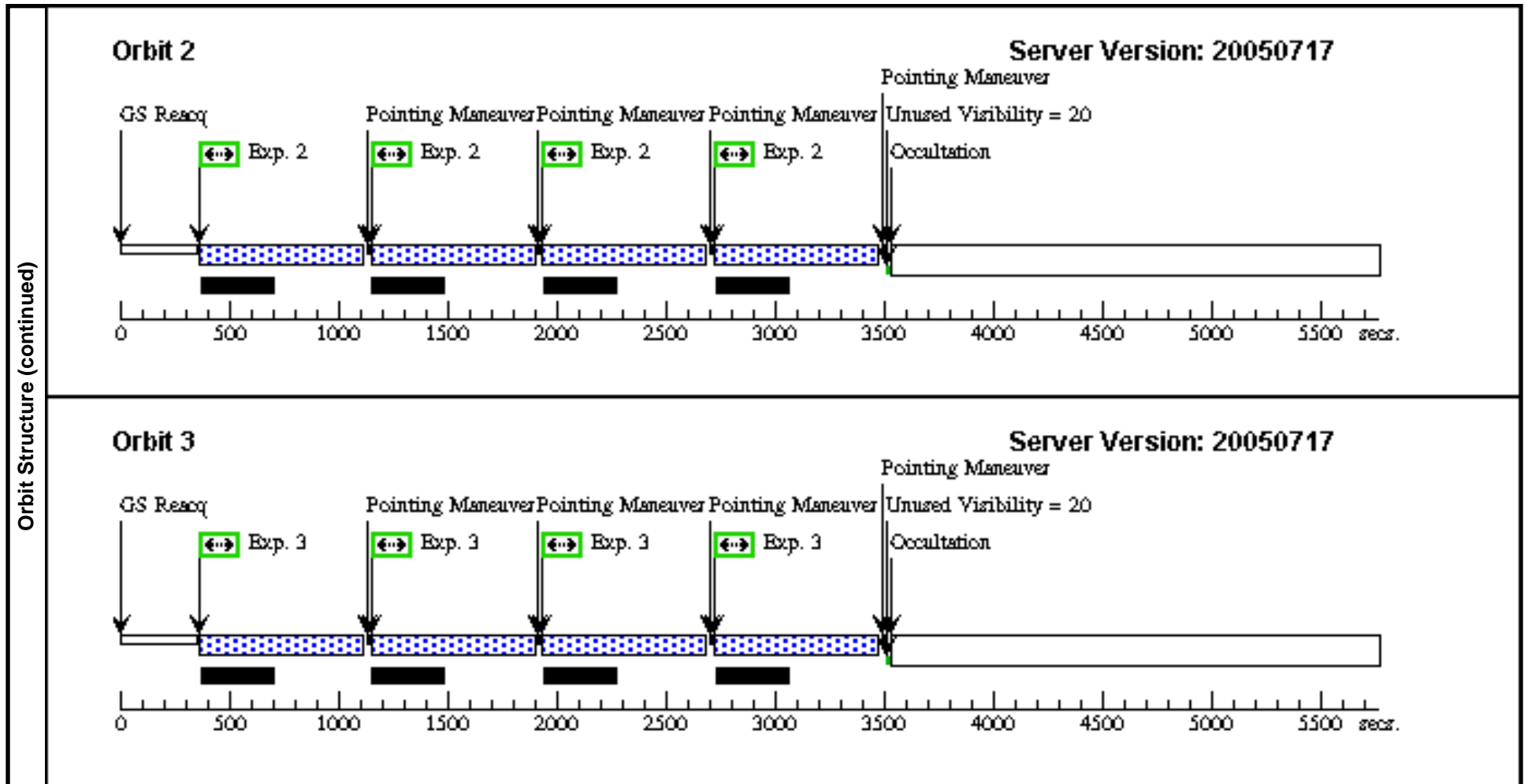
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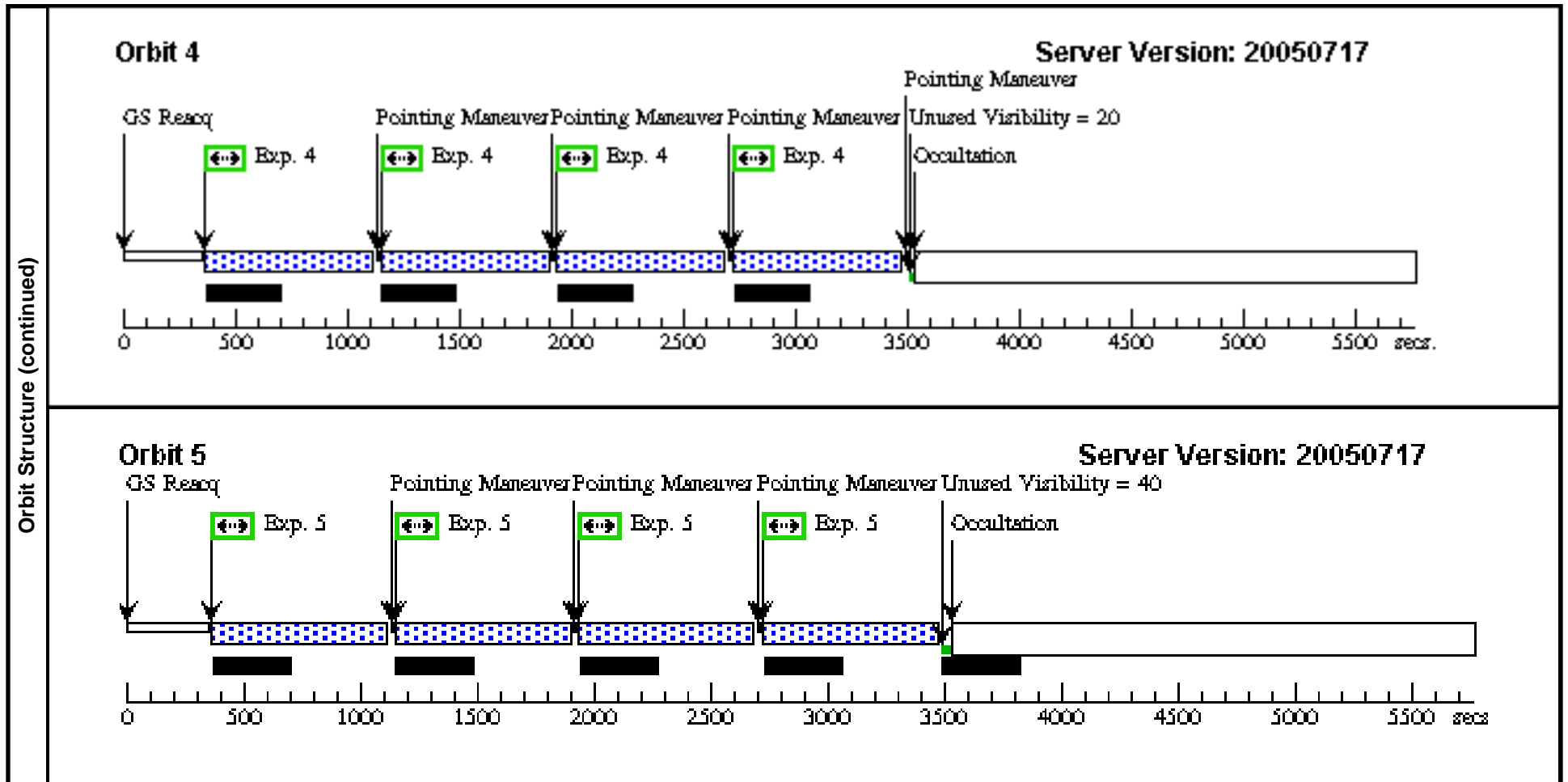
Visit	Proposal 10581, Visit 03 Diagnostic Status: No Diagnostics Scientific Instruments: ACS/WFC Special Requirements: ORIENT 340.0D TO 20.0 D; ORIENT 70.0D TO 110.0 D; ORIENT 160.0D TO 200.0 D; ORIENT 250.0D TO 290.0 D									
	Patterns	#	Primary Pattern			Secondary Pattern			Exposures	
		(1)	Pattern Type=ACS-WFC-DITHER-BOX Purpose=DITHER Number Of Points=4 Point Spacing=0.265 Line Spacing=0.187	Coordinate Frame=POS-TARG Pattern Orientation=20.7 Angle Between Sides=69.1 Center Pattern=false					(1), (2), (3), (4), (5)	
Fixed Targets	#	Name	Target Coordinates	Targ. Coord. Corrections	Fluxes	Miscellaneous				
	(1)	HS1700-NE	RA: 17 01 16.3000 (255.3179167d) Dec: +64 14 54.70 (64.24853d) Equinox: J2000 Plate Id: 01H3		V=26.0	Coordinate Source: GUIDE_STAR_CATALOG				
Exposures	#	Label	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time/[Actual Dur.]	Orbit
	1		(1) HS1700-NE	ACS/WFC, ACCUM, WFCENTER	F814W	CR-SPLIT=NO		Pattern 1-1 (1)	610.0 Secs	
									[==>(Pattern 1)] [==>(Pattern 2)] [==>(Pattern 3)] [==>(Pattern 4)]	[1]
	2		(1) HS1700-NE	ACS/WFC, ACCUM, WFCENTER	F814W	CR-SPLIT=NO		Pattern 2-2 (1)	630.0 Secs	
									[==>(Pattern 1)] [==>(Pattern 2)] [==>(Pattern 3)] [==>(Pattern 4)]	[2]
3		(1) HS1700-NE	ACS/WFC, ACCUM, WFCENTER	F814W	CR-SPLIT=NO		Pattern 3-3 (1)	630.0 Secs		
								[==>(Pattern 1)] [==>(Pattern 2)] [==>(Pattern 3)] [==>(Pattern 4)]	[3]	
4		(1) HS1700-NE	ACS/WFC, ACCUM, WFCENTER	F814W	CR-SPLIT=NO		Pattern 4-4 (1)	630.0 Secs		
								[==>(Pattern 1)] [==>(Pattern 2)] [==>(Pattern 3)] [==>(Pattern 4)]	[4]	

Proposal 10581 - Visit 03 - Imaging a Proto-cluster at z=2.3: The Morphology-Density Relation at High Redshift

Exposures (continued)	#	Label	Target	Config, Mode, Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time/[Actual Dur.]	Orbit
	5	(1) HS1700-NE	ACS/WFC, ACCUM, WFCENTER	F814W	CR-SPLIT=NO	Pattern 5-5 (1)	630.0 Secs [=>(Pattern 1)] [=>(Pattern 2)] [=>(Pattern 3)] [=>(Pattern 4)]	[5]		







Proposal 10581 - Visit 04 - Imaging a Proto-cluster at z=2.3: The Morphology-Density Relation at High Redshift

Tue Aug 30 18:03:39 GMT 2005

Visit	Proposal 10581, Visit 04 Diagnostic Status: No Diagnostics Scientific Instruments: ACS/WFC Special Requirements: ORIENT 340.0D TO 20.0 D; ORIENT 70.0D TO 110.0 D; ORIENT 160.0D TO 200.0 D; ORIENT 250.0D TO 290.0 D									
	Patterns	#	Primary Pattern			Secondary Pattern			Exposures	
		(1)	Pattern Type=ACS-WFC-DITHER-BOX Purpose=DITHER Number Of Points=4 Point Spacing=0.265 Line Spacing=0.187	Coordinate Frame=POS-TARG Pattern Orientation=20.7 Angle Between Sides=69.1 Center Pattern=false					(1), (2), (3), (4), (5)	
Fixed Targets	#	Name	Target Coordinates	Targ. Coord. Corrections		Fluxes	Miscellaneous			
	(3)	HS1700-SE	RA: 17 01 22.9000 (255.3454167d) Dec: +64 11 16.80 (64.18800d) Equinox: J2000 Plate Id: 01H3			V=26.0	Coordinate Source: GUIDE_STAR_CATALOG			
Exposures	#	Label	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time/[Actual Dur.]	Orbit
	1		(3) HS1700-SE	ACS/WFC, ACCUM, WFCENTER	F814W	CR-SPLIT=NO		Pattern 1-1 (1)	610.0 Secs	
									[==>(Pattern 1)] [==>(Pattern 2)] [==>(Pattern 3)] [==>(Pattern 4)]	[1]
	2		(3) HS1700-SE	ACS/WFC, ACCUM, WFCENTER	F814W	CR-SPLIT=NO		Pattern 2-2 (1)	630.0 Secs	
									[==>(Pattern 1)] [==>(Pattern 2)] [==>(Pattern 3)] [==>(Pattern 4)]	[2]
3		(3) HS1700-SE	ACS/WFC, ACCUM, WFCENTER	F814W	CR-SPLIT=NO		Pattern 3-3 (1)	630.0 Secs		
								[==>(Pattern 1)] [==>(Pattern 2)] [==>(Pattern 3)] [==>(Pattern 4)]	[3]	
4		(3) HS1700-SE	ACS/WFC, ACCUM, WFCENTER	F814W	CR-SPLIT=NO		Pattern 4-4 (1)	630.0 Secs		
								[==>(Pattern 1)] [==>(Pattern 2)] [==>(Pattern 3)] [==>(Pattern 4)]	[4]	

Proposal 10581 - Visit 04 - Imaging a Proto-cluster at z=2.3: The Morphology-Density Relation at High Redshift

Exposures (continued)	#	Label	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time/[Actual Dur.]	Orbit
	5	(3) HS1700-SE	ACS/WFC, ACCUM, WFCENTER	F814W	CR-SPLIT=NO	Pattern 5-5 (1)	630.0 Secs [==>(Pattern 1)] [==>(Pattern 2)] [==>(Pattern 3)] [==>(Pattern 4)]	[5]		

