



13303 - The Structure of MgII Absorbing Galaxies at $z=2-5$: Linking CGM Physics and Stellar Morphology During Galaxy Assembly

Cycle: 21, 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) BR0004-6224	WFC3/IR	3	11-Jul-2013 13:47:39.0	yes
02	(2) BR0305-4957	WFC3/IR	3	11-Jul-2013 13:47:56.0	yes
03	(3) BR0016-3544	WFC3/IR	3	11-Jul-2013 13:48:11.0	yes
04	(4) BR2346-3729	WFC3/IR	3	11-Jul-2013 13:48:24.0	yes
05	(5) SDSS1616+0501	WFC3/IR	3	11-Jul-2013 13:48:41.0	yes
06	(6) SDSS0203+0012	WFC3/IR	3	11-Jul-2013 13:48:54.0	yes
07	(7) SDSS1411+1217	WFC3/IR	3	11-Jul-2013 13:49:07.0	yes
08	(8) SDSS1030+0524	WFC3/IR	3	11-Jul-2013 13:49:20.0	yes
09	(9) SDSS1306+0356	WFC3/IR	3	11-Jul-2013 13:49:33.0	yes

27 Total Orbits Used

ABSTRACT

Using Magellan/FIRE, we have completed the first infrared survey for MgII absorption systems in the $z > 2$ universe. At $z < 0.5$, such MgII absorbers are almost universally associated with $\sim L^*$ galaxies. Morphological studies of these host galaxies indicate that MgII traces inflowing gas accretion and outflowing galactic winds in the circum-galactic medium (CGM); both processes are critical to the regulated growth of stellar mass. We propose a deep WFC3 imaging survey toward 9 of our survey sightlines hosting 44 MgII absorbers to investigate the morphology-absorber connection in a unique sample spanning $2 < z < 5$. Only HST is capable of delivering the deep, spatially resolved rest-frame optical imaging needed to measure morphological parameters and orientations of these galaxies, connecting our work directly to what has been achieved in the local universe.

OBSERVING DESCRIPTION

Our program requires a single observing setup, incorporating the F160W IR filter to capture rest frame optical emission from the MgII host sample galaxies (or rest frame near-UV for the highest redshift examples). Our observing strategy is modeled after the similar WFC3 survey of Law et al. (2012), who studied the rest frame optical properties of galaxies selected generally from the field, over a similar redshift range. However we employ a slightly different, customized dithering pattern.

Each of the 9 fields is scheduled for one visit consisting of 3 orbits. Our primary targets of interest are faint galaxies ($H_{AB}=23-25$ magnitudes) that are typically located within ~ 15 arcseconds of a bright background quasar ($H_{AB}=19$).

We are not interested in photometry for the quasar itself, but given our long integrations (7835 seconds/field, split into 650 second SPARS50 ramps), we are concerned about saturation and persistence from the QSO which is by construction near the science targets. Accordingly we designed a specialized dither pattern to mitigate the effects that saturation and persistence would have on our ability to identify galaxies at small angular separation.

The dither pattern consists of three pointings on a spiral pattern (effectively an "L"), separated by 16 arcseconds. This ensures that any persistence image from the saturated QSO is placed $> 15''$ away from the new position of the QSO at the start of each orbit. At each of these three locations, we perform a 2.5 pixel, 4-point box subpattern dither to sample the PSF. Our choice of 2.5 pixels provides full PSF sampling, and just exceeds the minimum recommended dithering distance of 2 pixels to recover operability from hot pixels. The 16" dithers between orbits will span clustered artifacts on the detector.

Our SPARS50 x 14 or 15 exposures were chosen to pack a self contained 4-pont sample of the PSF in each orbit. Also, this provides exposures long enough to be background-dominated even for a 14 read ramp, yet short enough to avoid deep saturation (we hope) for most of our QSOs. We anticipate saturation in the central few pixels in some cases but hope to avoid saturation in the PSF wings.

ADDITIONAL COMMENTS

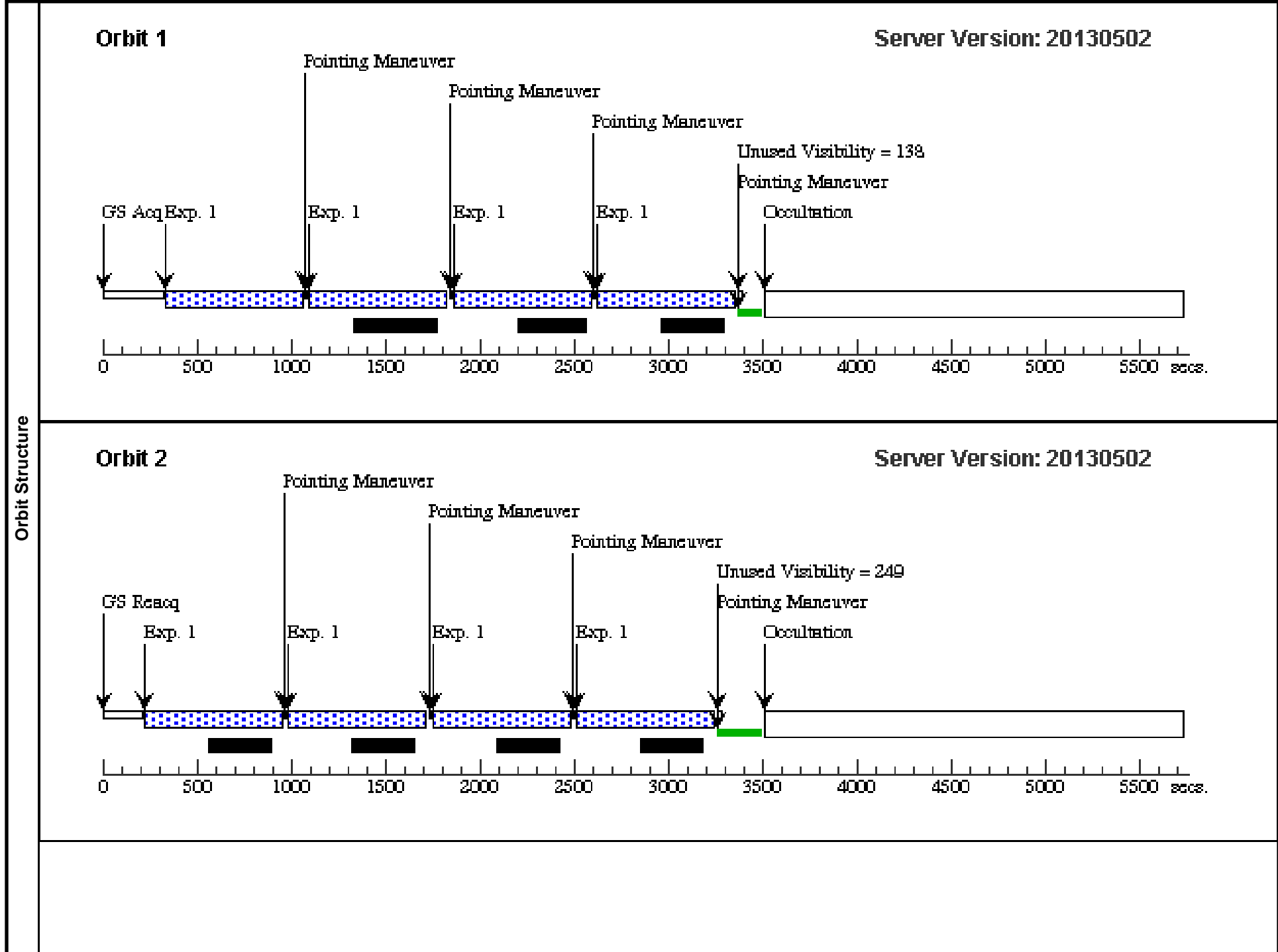
Please note that for several of our targets, most notably numbers 6, 7, 8 and 9, there will be no flux from the quasar at optical wavelengths - they are at very high redshift and therefore only visible in the IR. This is why there is no target in the finding chart crosshairs for several examples. However we have verified independently that the pointings are all correct using our own IR images.

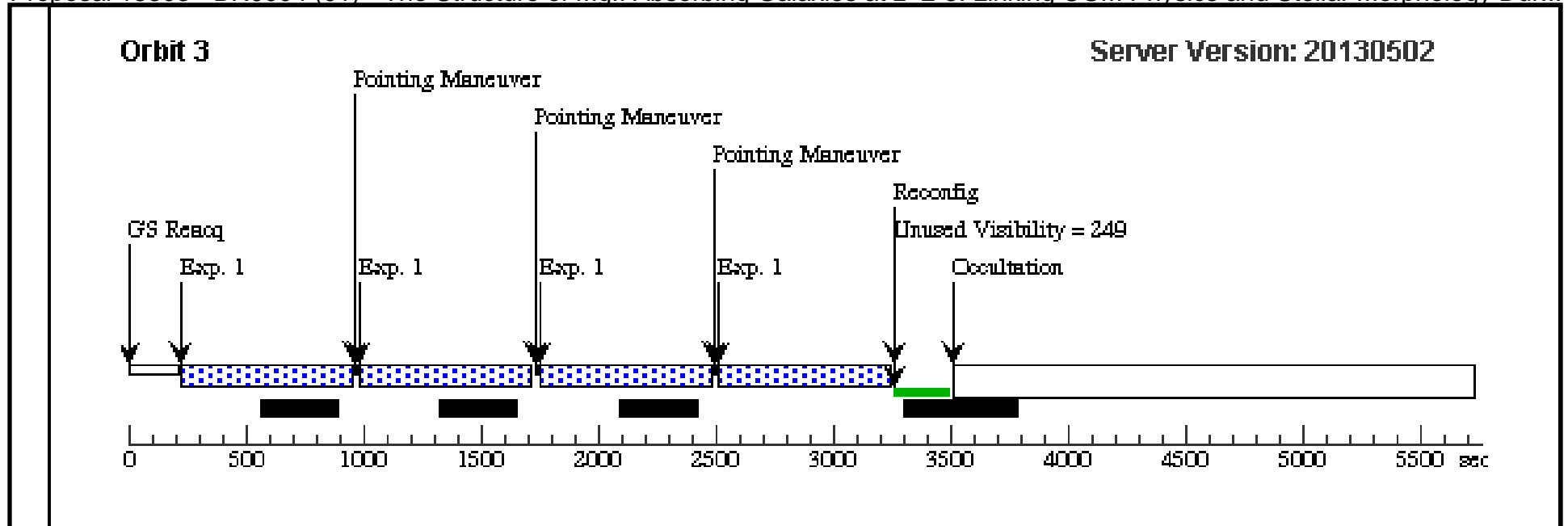
Also, the science fields are centered around known quasars which constitute the "targets," but the actual sources of interest are faint galaxies near the quasar on the sky - not the quasar itself (see the Observing Description for details).

Proposal 13303 - BR0004 (01) - The Structure of Mqll Absorbing Galaxies at z=2-5: Linking CGM Physics and Stellar Morphology Dur...

Thu Jul 11 17:49:42 GMT 2013

Visit	Proposal 13303, BR0004 (01) Diagnostic Status: No Diagnostics Scientific Instruments: WFC3/IR Special Requirements: (none)									
	Patterns	#	Primary Pattern			Secondary Pattern			Exposures	
		(4)	Pattern Type=SPIRAL Purpose=DITHER Number Of Points=3 Point Spacing=16 Line Spacing=	Coordinate Frame=POS-TARG Pattern Orientation=41.788 Angle Between Sides= Center Pattern=true	Pattern Type=WFC3-IR-DITHER-BOX-MIN Purpose=DITHER Number Of Points=4 Point Spacing=0.338 Line Spacing=0.303	Coordinate Frame=POS-TARG Pattern Orientation=0 Angle Between Sides=90 Center Pattern=false	(1)			
Fixed Targets	#	Name	Target Coordinates	Targ. Coord. Corrections	Fluxes	Miscellaneous				
	(1)	BR0004-6224	RA: 00 06 51.7000 (1.7154167d) Dec: -62 08 3.70 (-62.13436d) Equinox: J2000		V=18.29	Reference Frame: ICRS				
	<i>Comments: This object was generated by the targetselector and retrieved from the SIMBAD database.</i>									
Exposures	#	Label	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time (Total)/[Actual Dur.]	Orbit
	1		(1) BR0004-6224	WFC3/IR, MULTIACCUM, IR	F160W	NSAMP=15; SAMP-SEQ=SPAR S50		Pattern 4, Exps 1-1 i n BR0004 (01) (4)	702.938605 Secs (8435.263 Secs)	
									[=>(Pattern 1,1)] [=>(Pattern 1,2)] [=>(Pattern 1,3)] [=>(Pattern 1,4)]	[1]
									[=>(Pattern 2,1)] [=>(Pattern 2,2)] [=>(Pattern 2,3)] [=>(Pattern 2,4)]	[2]
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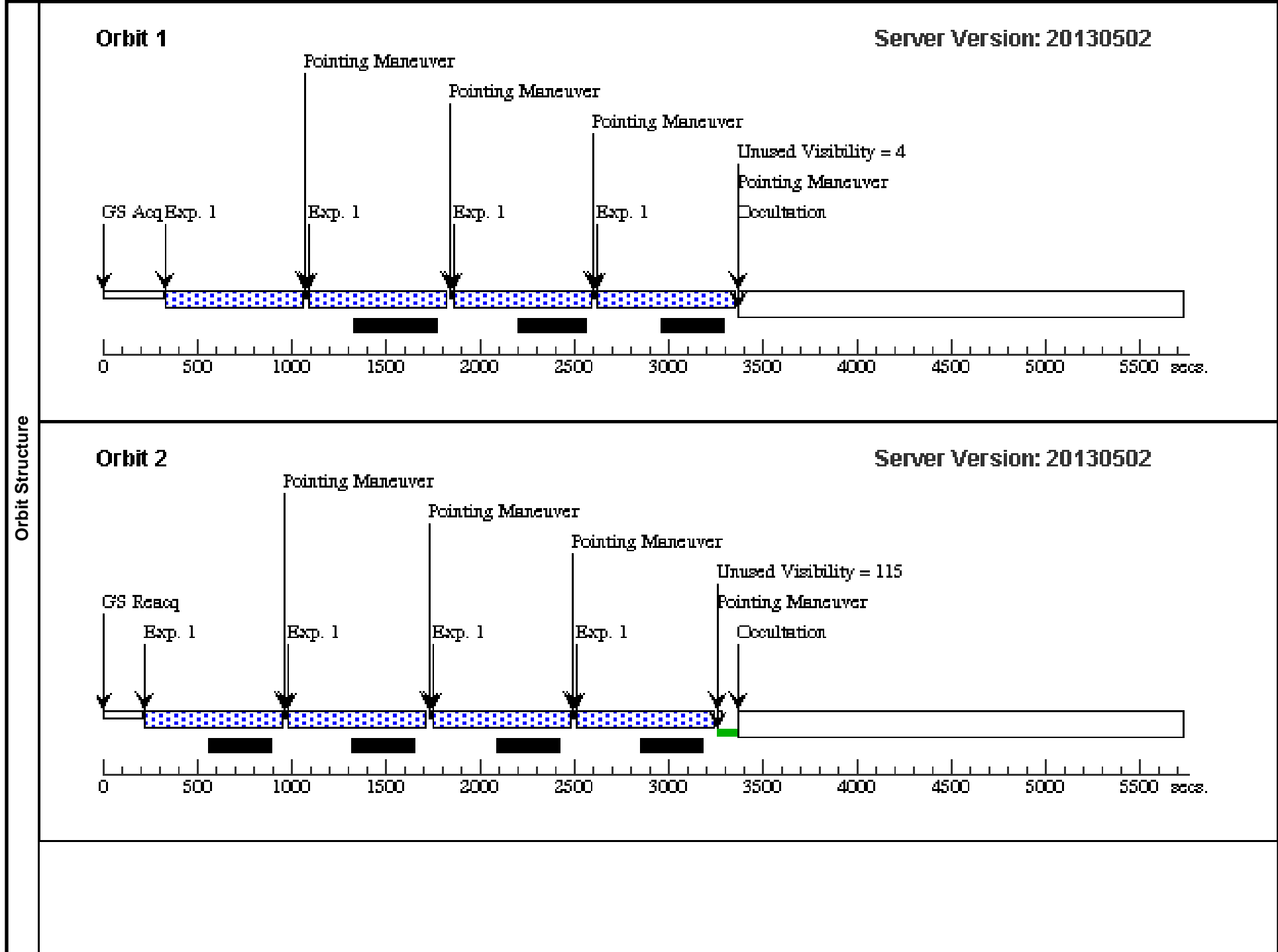


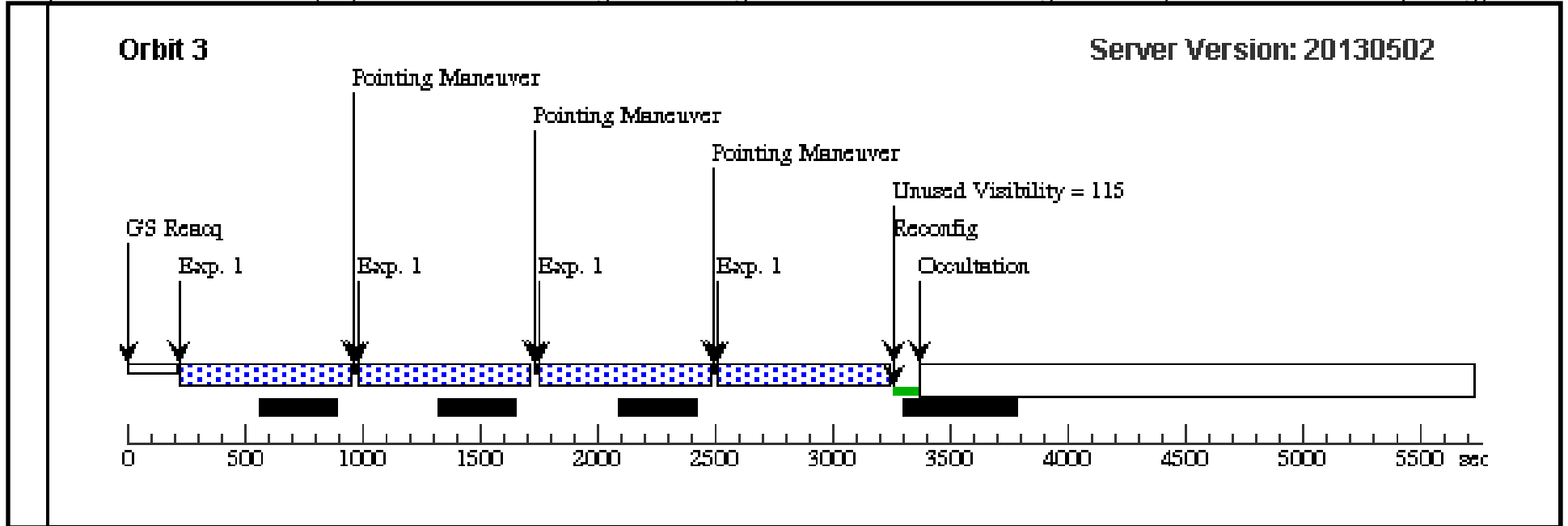


Proposal 13303 - BR0305 (02) - The Structure of Mqll Absorbing Galaxies at z=2-5: Linking CGM Physics and Stellar Morphology Dur...

Thu Jul 11 17:49:45 GMT 2013

Visit	Proposal 13303, BR0305 (02) Diagnostic Status: No Diagnostics Scientific Instruments: WFC3/IR Special Requirements: (none)									
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		(3)	Pattern Type=SPIRAL Purpose=DITHER Number Of Points=3 Point Spacing=16 Line Spacing=	Coordinate Frame=POS-TARG Pattern Orientation=221.788 Angle Between Sides= Center Pattern=true	Pattern Type=WFC3-IR-DITHER-BOX-MIN Purpose=DITHER Number Of Points=4 Point Spacing=0.338 Line Spacing=0.303	Coordinate Frame=POS-TARG Pattern Orientation=0 Angle Between Sides=90 Center Pattern=false	(1)			
Fixed Targets	#	Name	Target Coordinates	Targ. Coord. Corrections	Fluxes	Miscellaneous				
	(2)	BR0305-4957	RA: 03 07 22.9400 (46.8455833d) Dec: -49 45 48.80 (-49.76356d) Equinox: J2000		V=18.76	Reference Frame: ICRS				
	<i>Comments: This object was generated by the targetselector and retrieved from the SIMBAD database.</i>									
Exposures	#	Label	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time (Total)/[Actual Dur.]	Orbit
	1		(2) BR0305-4957	WFC3/IR, MULTIACCUM, IR	F160W	NSAMP=15; SAMP-SEQ=SPAR S50		Pattern 3, Exps 1-1 i n BR0305 (02) (3)	702.938605 Secs (8435.263 Secs) [==>(Pattern 1,1)] [==>(Pattern 1,2)] [==>(Pattern 1,3)] [==>(Pattern 1,4)]	[1]
								[==>(Pattern 2,1)] [==>(Pattern 2,2)] [==>(Pattern 2,3)] [==>(Pattern 2,4)]	[2]	
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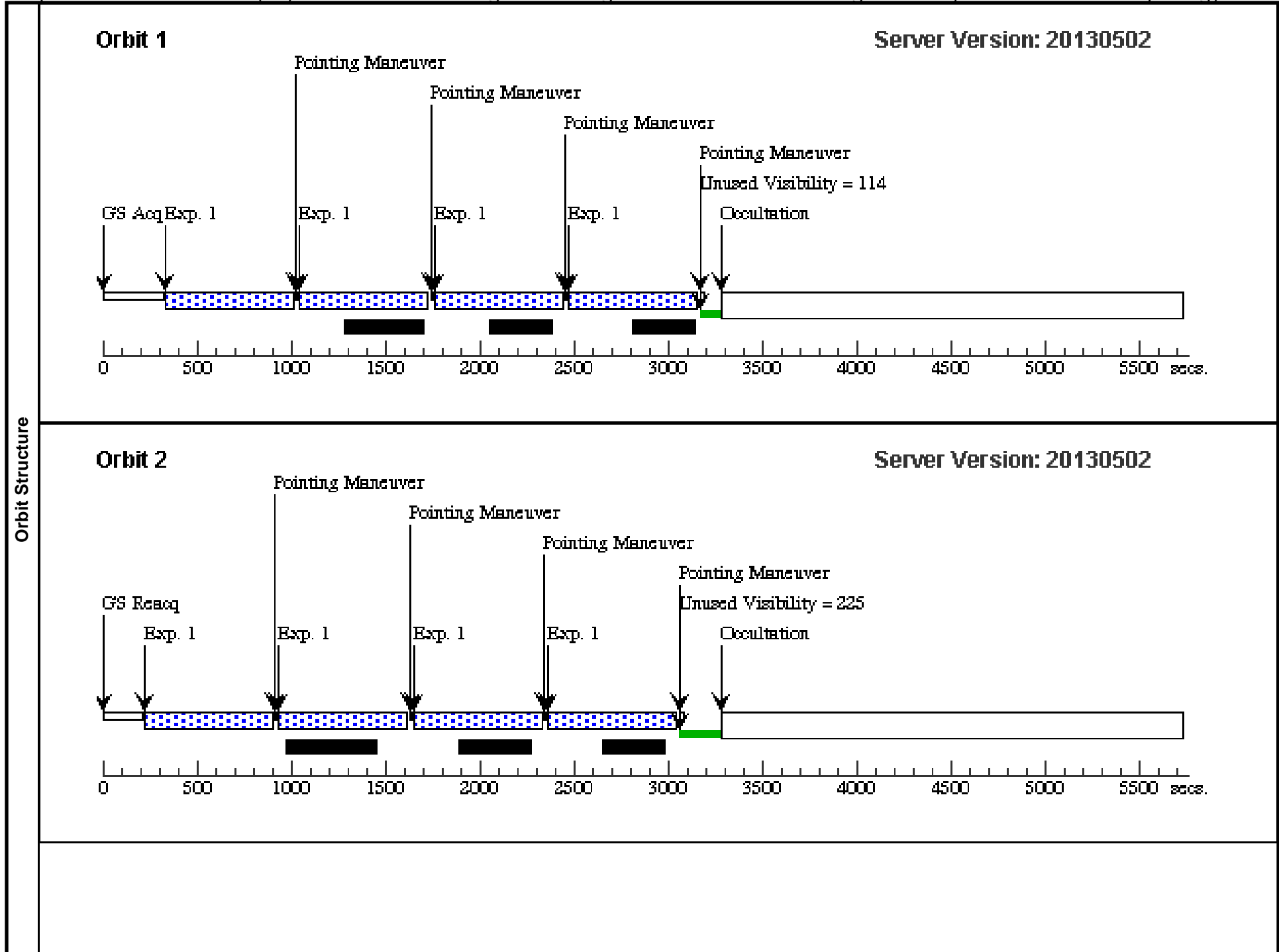


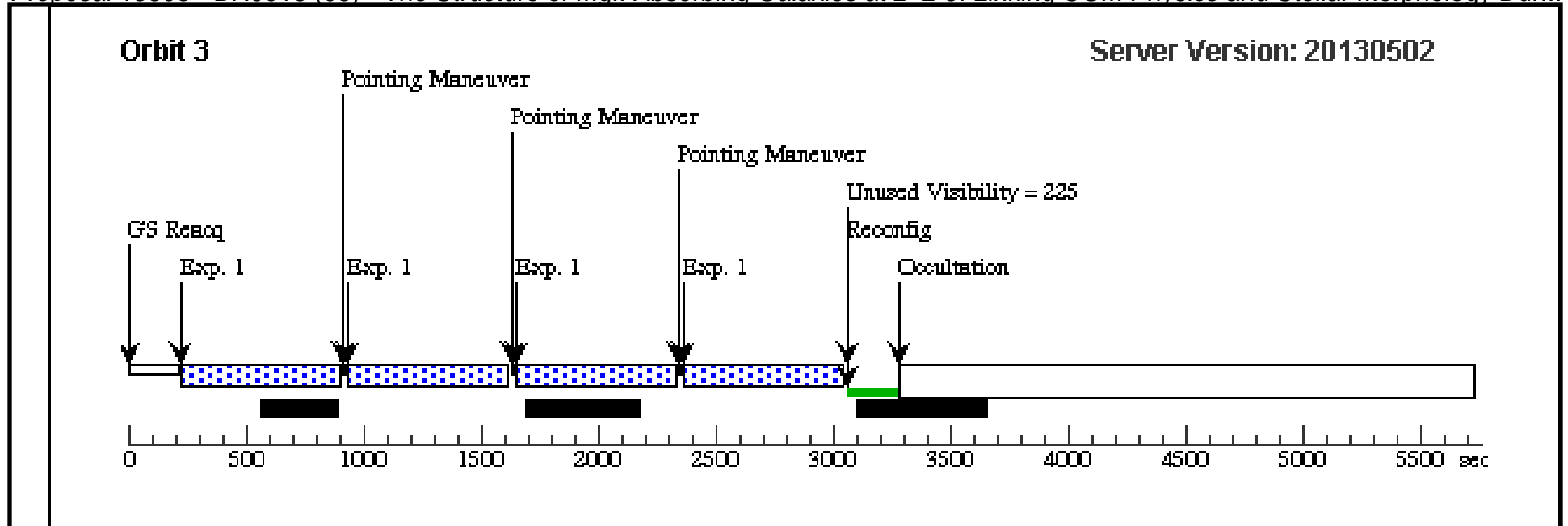


Proposal 13303 - BR0016 (03) - The Structure of Mqll Absorbing Galaxies at z=2-5: Linking CGM Physics and Stellar Morphology Dur...

Thu Jul 11 17:49:46 GMT 2013

Visit	Proposal 13303, BR0016 (03) Diagnostic Status: No Diagnostics Scientific Instruments: WFC3/IR Special Requirements: (none)									
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		(3)	Pattern Type=SPIRAL Purpose=DITHER Number Of Points=3 Point Spacing=16 Line Spacing=	Coordinate Frame=POS-TARG Pattern Orientation=221.788 Angle Between Sides= Center Pattern=true	Pattern Type=WFC3-IR-DITHER-BOX-MIN Purpose=DITHER Number Of Points=4 Point Spacing=0.338 Line Spacing=0.303	Coordinate Frame=POS-TARG Pattern Orientation=0 Angle Between Sides=90 Center Pattern=false	(1)			
Fixed Targets	#	Name	Target Coordinates	Targ. Coord. Corrections	Fluxes	Miscellaneous				
	(3)	BR0016-3544	RA: 00 18 37.8700 (4.6577917d) Dec: -35 27 40.30 (-35.46119d) Equinox: J2000		V=18.43	Reference Frame: ICRS				
	<i>Comments: This object was generated by the targetselector and retrieved from the SIMBAD database.</i>									
Exposures	#	Label	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time (Total)/[Actual Dur.]	Orbit
	1		(3) BR0016-3544	WFC3/IR, MULTIACCUM, IR	F160W	NSAMP=14; SAMP-SEQ=SPAR S50		Pattern 3, Exps 1-1 i n BR0016 (03) (3)	652.938154 Secs (7835.258 Secs)	
									[=>(Pattern 1,1)] [=>(Pattern 1,2)] [=>(Pattern 1,3)] [=>(Pattern 1,4)]	[1]
									[=>(Pattern 2,1)] [=>(Pattern 2,2)] [=>(Pattern 2,3)] [=>(Pattern 2,4)]	[2]
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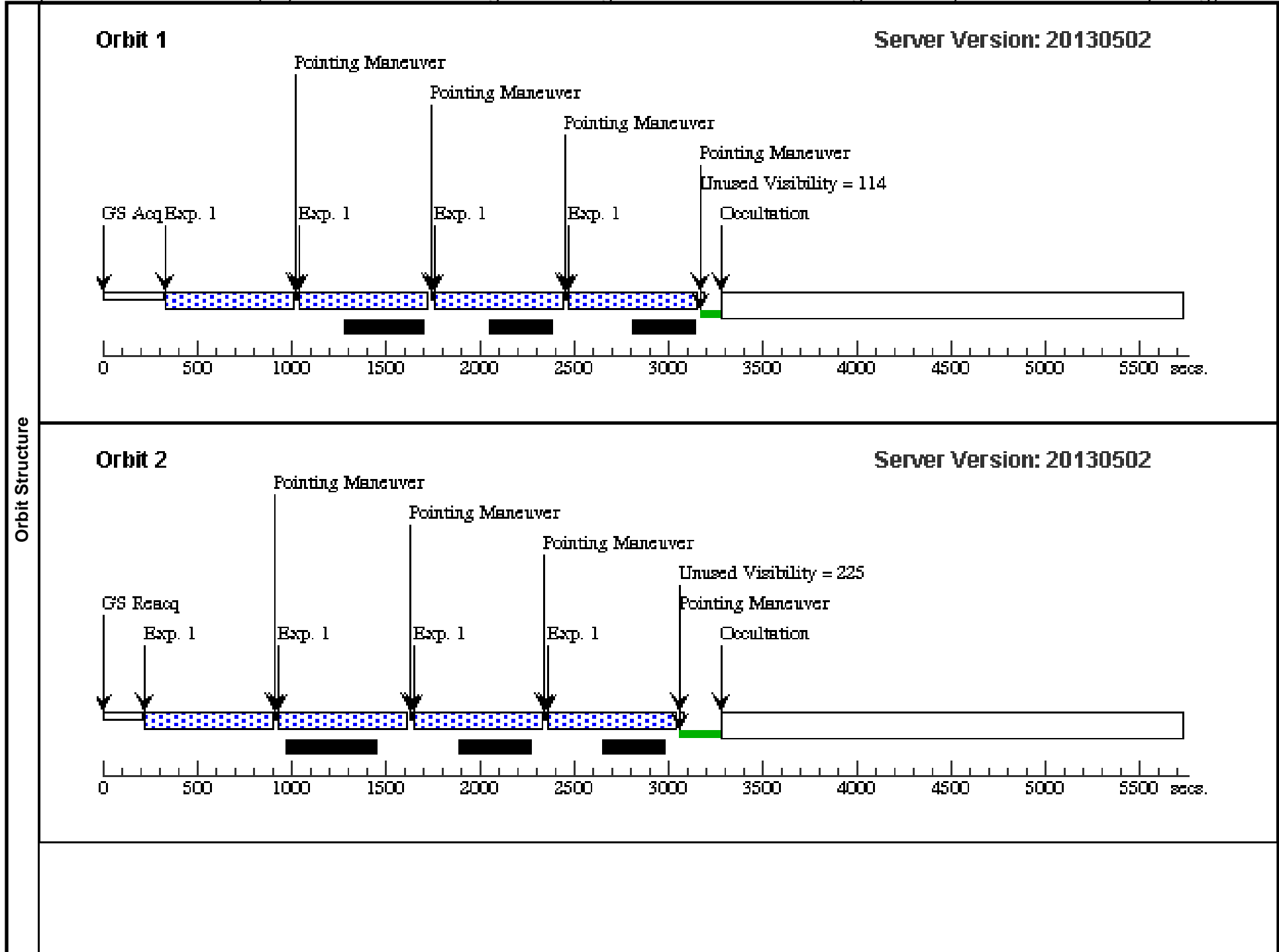


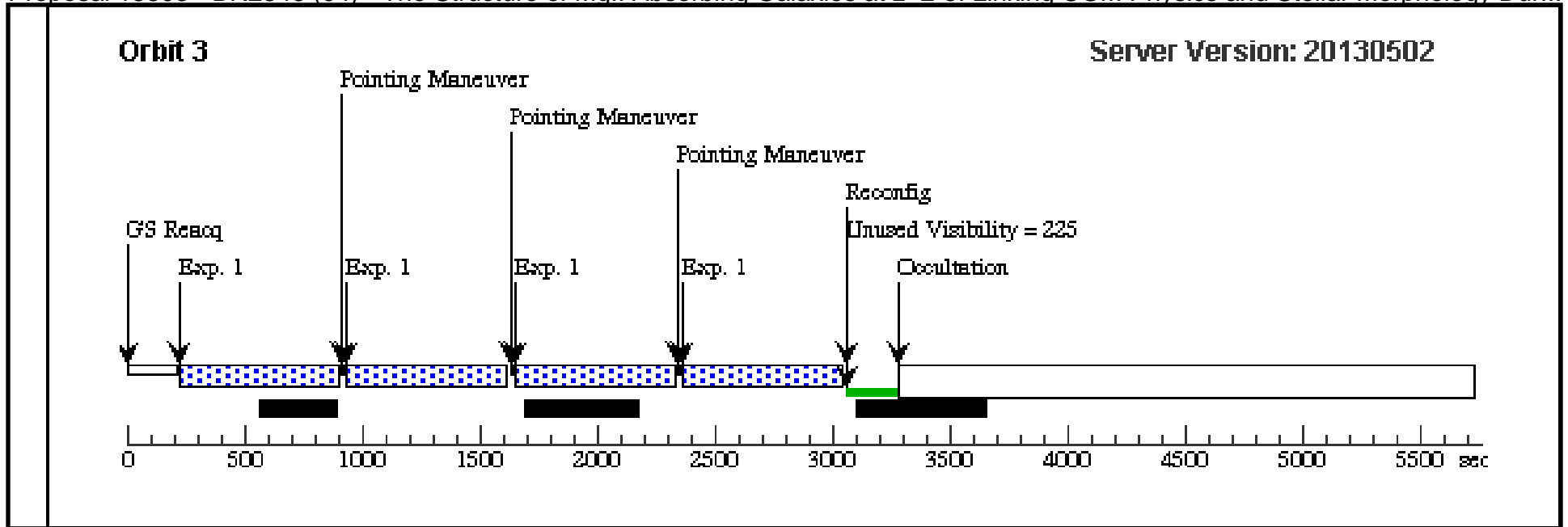


Proposal 13303 - BR2346 (04) - The Structure of Mqll Absorbing Galaxies at z=2-5: Linking CGM Physics and Stellar Morphology Dur...

Thu Jul 11 17:49:48 GMT 2013

Visit	Proposal 13303, BR2346 (04) Diagnostic Status: No Diagnostics Scientific Instruments: WFC3/IR Special Requirements: (none)									
	Patterns	#	Primary Pattern			Secondary Pattern			Exposures	
		(3)	Pattern Type=SPIRAL Purpose=DITHER Number Of Points=3 Point Spacing=16 Line Spacing=	Coordinate Frame=POS-TARG Pattern Orientation=221.788 Angle Between Sides= Center Pattern=true	Pattern Type=WFC3-IR-DITHER-BOX-MIN Purpose=DITHER Number Of Points=4 Point Spacing=0.338 Line Spacing=0.303	Coordinate Frame=POS-TARG Pattern Orientation=0 Angle Between Sides=90 Center Pattern=false	(1)			
Fixed Targets	#	Name	Target Coordinates	Targ. Coord. Corrections	Fluxes	Miscellaneous				
	(4)	BR2346-3729	RA: 23 49 13.7600 (357.3073333d) Dec: -37 12 58.90 (-37.21636d) Equinox: J2000		V=18.69	Reference Frame: ICRS				
	<i>Comments: This object was generated by the targetselector and retrieved from the SIMBAD database.</i>									
Exposures	#	Label	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time (Total)/[Actual Dur.]	Orbit
	1		(4) BR2346-3729	WFC3/IR, MULTIACCUM, IR	F160W	NSAMP=14; SAMP-SEQ=SPAR S50		Pattern 3, Exps 1-1 i n BR2346 (04) (3)	652.938154 Secs (7835.258 Secs) [==>(Pattern 1,1)] [==>(Pattern 1,2)] [==>(Pattern 1,3)] [==>(Pattern 1,4)]	[1]
								[==>(Pattern 2,1)] [==>(Pattern 2,2)] [==>(Pattern 2,3)] [==>(Pattern 2,4)]	[2]	
								[==>(Pattern 3,1)] [==>(Pattern 3,2)] [==>(Pattern 3,3)] [==>(Pattern 3,4)]	[3]	

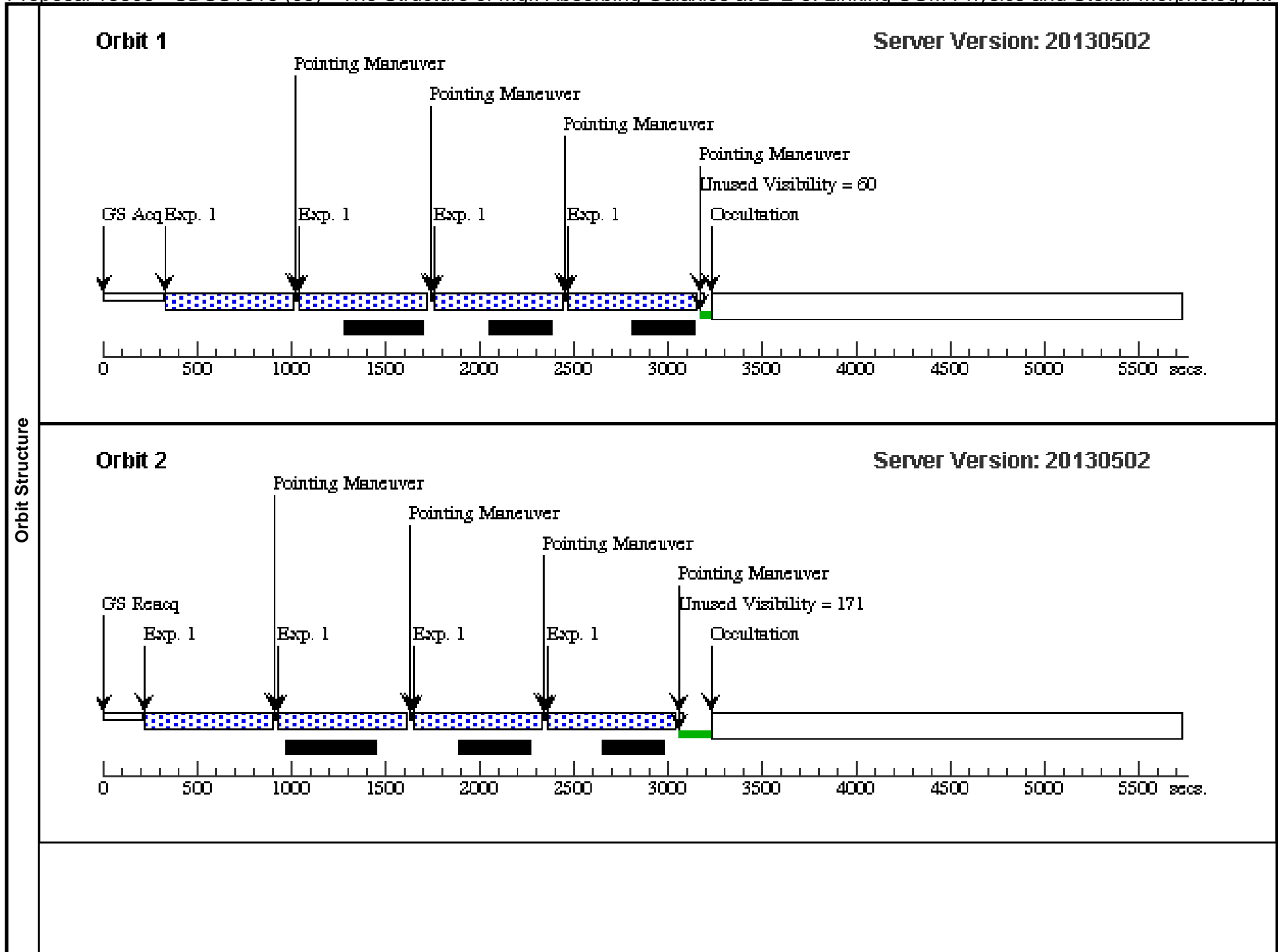


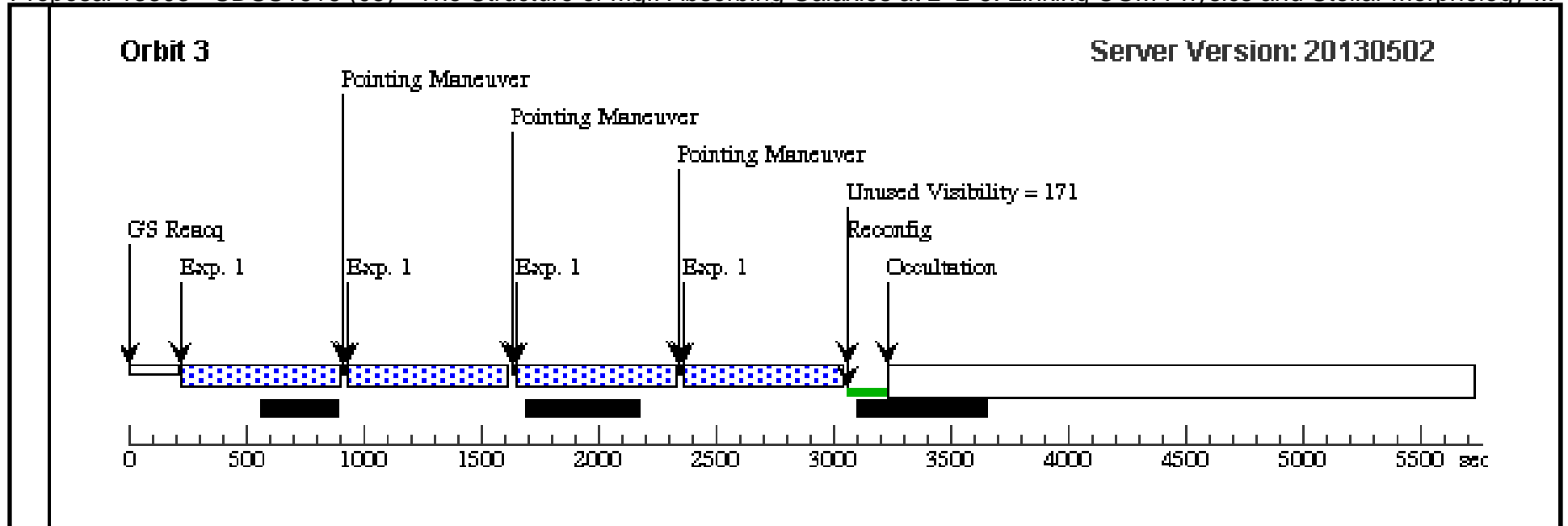


Proposal 13303 - SDSS1616 (05) - The Structure of MgII Absorbing Galaxies at z=2-5: Linking CGM Physics and Stellar Morphology ...

Thu Jul 11 17:49:50 GMT 2013

Visit	Proposal 13303, SDSS1616 (05) Diagnostic Status: No Diagnostics Scientific Instruments: WFC3/IR Special Requirements: (none)									
	Patterns	#	Primary Pattern			Secondary Pattern			Exposures	
		(3)	Pattern Type=SPIRAL Purpose=DITHER Number Of Points=3 Point Spacing=16 Line Spacing=	Coordinate Frame=POS-TARG Pattern Orientation=221.788 Angle Between Sides= Center Pattern=true	Pattern Type=WFC3-IR-DITHER-BOX-MIN Purpose=DITHER Number Of Points=4 Point Spacing=0.338 Line Spacing=0.303	Coordinate Frame=POS-TARG Pattern Orientation=0 Angle Between Sides=90 Center Pattern=false	(1)			
Fixed Targets	#	Name	Target Coordinates	Targ. Coord. Corrections	Fluxes	Miscellaneous				
	(5)	SDSS1616+0501	RA: 16 16 22.1050 (244.0921042d) Dec: +05 01 27.75 (5.02438d) Equinox: J2000		V=0	Reference Frame: ICRS				
	<i>Comments: This object was generated by the targetselector and retrieved from the SIMBAD database.</i>									
Exposures	#	Label	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time (Total)/[Actual Dur.]	Orbit
	1		(5) SDSS1616+0501	WFC3/IR, MULTIACCUM, IR	F160W	NSAMP=14; SAMP-SEQ=SPAR S50		Pattern 3, Exps 1-1 i n SDSS1616 (05) (3)	652.938154 Secs (7835.258 Secs) [==>(Pattern 1,1)] [==>(Pattern 1,2)] [==>(Pattern 1,3)] [==>(Pattern 1,4)]	[1]
								[==>(Pattern 2,1)] [==>(Pattern 2,2)] [==>(Pattern 2,3)] [==>(Pattern 2,4)]	[2]	
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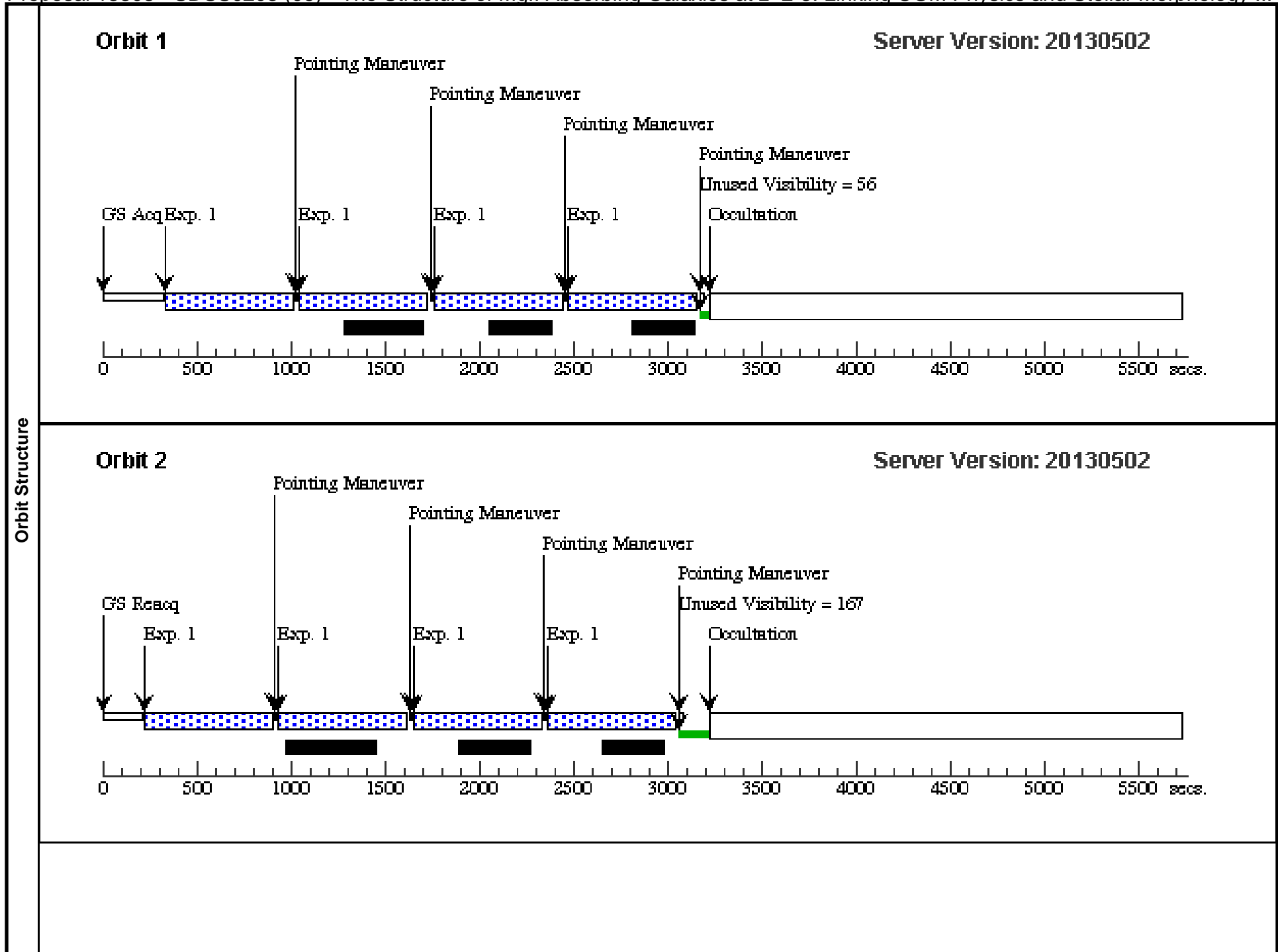


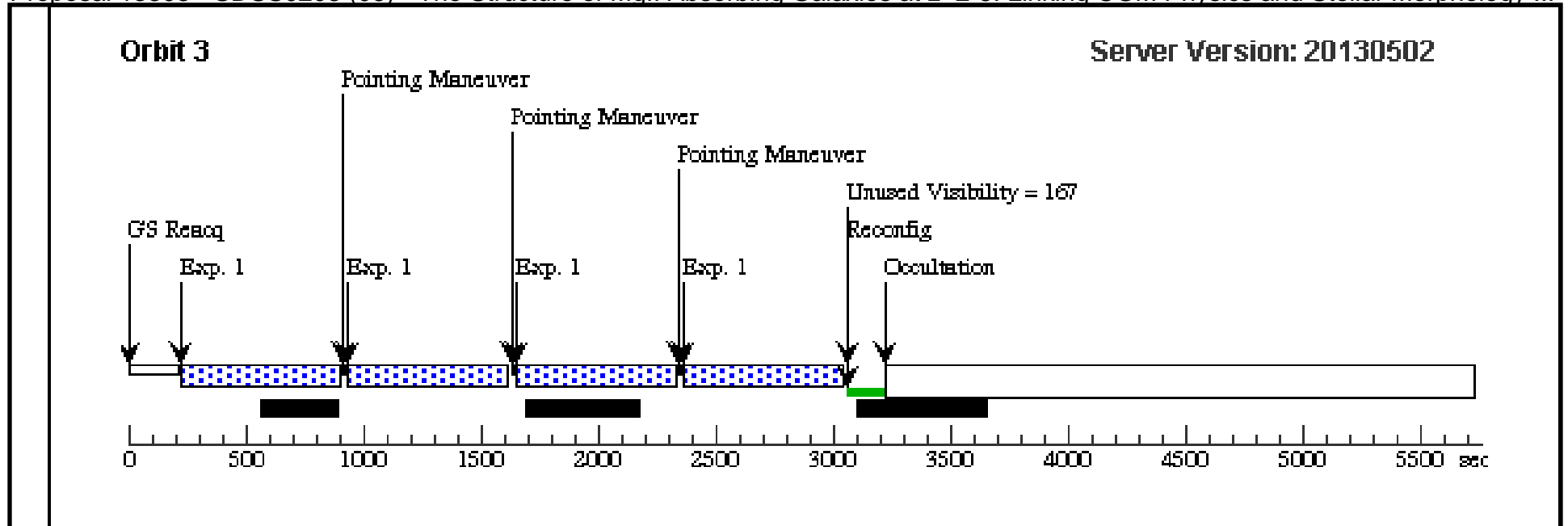


Proposal 13303 - SDSS0203 (06) - The Structure of MgII Absorbing Galaxies at z=2-5: Linking CGM Physics and Stellar Morphology ...

Thu Jul 11 17:49:51 GMT 2013

Visit	Proposal 13303, SDSS0203 (06) Diagnostic Status: No Diagnostics Scientific Instruments: WFC3/IR Special Requirements: (none)									
	Patterns	#	Primary Pattern			Secondary Pattern			Exposures	
		(4)	Pattern Type=SPIRAL Purpose=DITHER Number Of Points=3 Point Spacing=16 Line Spacing=	Coordinate Frame=POS-TARG Pattern Orientation=41.788 Angle Between Sides= Center Pattern=true	Pattern Type=WFC3-IR-DITHER-BOX-MIN Purpose=DITHER Number Of Points=4 Point Spacing=0.338 Line Spacing=0.303	Coordinate Frame=POS-TARG Pattern Orientation=0 Angle Between Sides=90 Center Pattern=false	(1)			
Fixed Targets	#	Name	Target Coordinates	Targ. Coord. Corrections	Fluxes	Miscellaneous				
	(6)	SDSS0203+0012	RA: 02 03 32.3800 (30.8849167d) Dec: +00 12 29.20 (.20811d) Equinox: J2000		V=0	Reference Frame: ICRS				
	<i>Comments: This object was generated by the targetselector and retrieved from the SIMBAD database.</i>									
Exposures	#	Label	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time (Total)/[Actual Dur.]	Orbit
	1		(6) SDSS0203+0012	WFC3/IR, MULTIACCUM, IR	F160W	NSAMP=14; SAMP-SEQ=SPAR S50		Pattern 4, Exps 1-1 i n SDSS0203 (06) (4)	652.938154 Secs (7835.258 Secs) [==>(Pattern 1,1)] [==>(Pattern 1,2)] [==>(Pattern 1,3)] [==>(Pattern 1,4)]	[1]
								[==>(Pattern 2,1)] [==>(Pattern 2,2)] [==>(Pattern 2,3)] [==>(Pattern 2,4)]	[2]	
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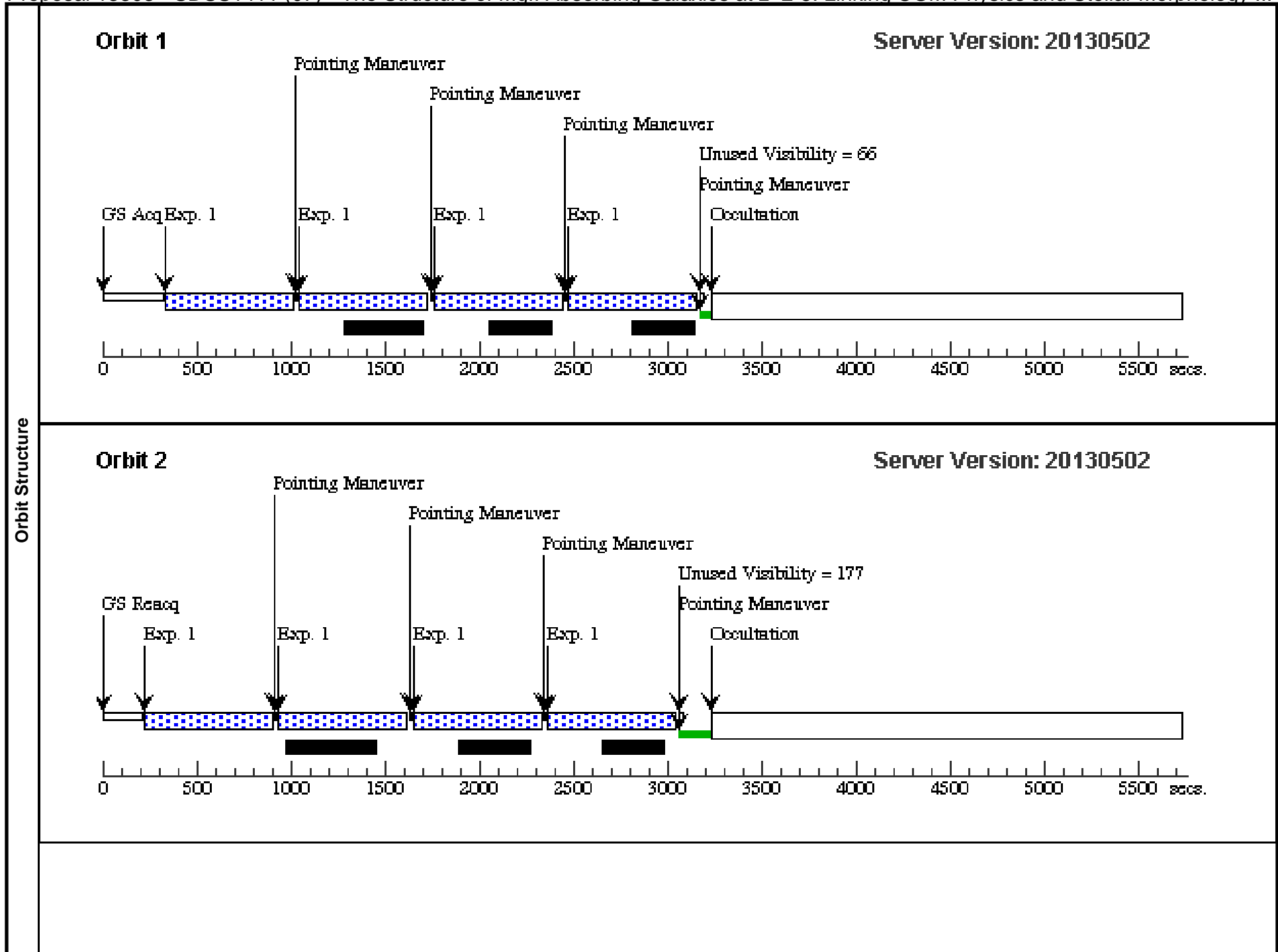


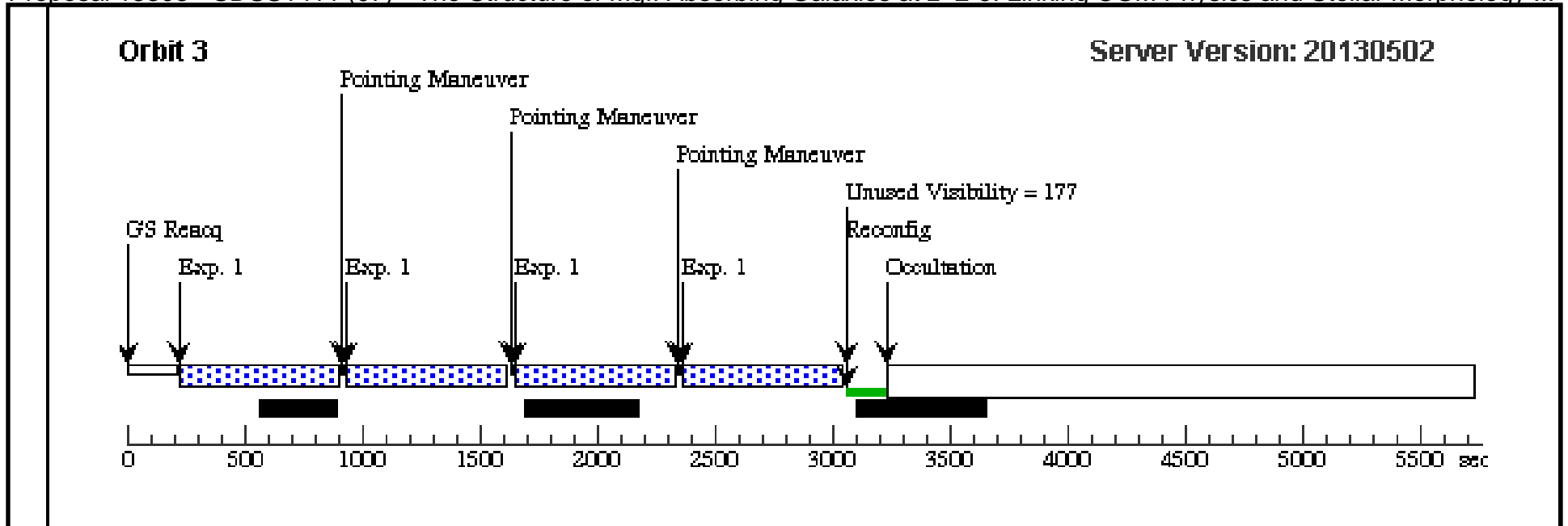


Proposal 13303 - SDSS1411 (07) - The Structure of MgII Absorbing Galaxies at z=2-5: Linking CGM Physics and Stellar Morphology ...

Thu Jul 11 17:49:52 GMT 2013

Visit	Proposal 13303, SDSS1411 (07) Diagnostic Status: No Diagnostics Scientific Instruments: WFC3/IR Special Requirements: (none)									
	Patterns	#	Primary Pattern				Secondary Pattern			
(4)		Pattern Type=SPIRAL Purpose=DITHER Number Of Points=3 Point Spacing=16 Line Spacing=	Coordinate Frame=POS-TARG Pattern Orientation=41.788 Angle Between Sides= Center Pattern=true	Pattern Type=WFC3-IR-DITHER-BOX-MIN Purpose=DITHER Number Of Points=4 Point Spacing=0.338 Line Spacing=0.303	Coordinate Frame=POS-TARG Pattern Orientation=0 Angle Between Sides=90 Center Pattern=false	(1)				
Fixed Targets	#	Name	Target Coordinates	Targ. Coord. Corrections	Fluxes	Miscellaneous				
	(7)	SDSS1411+1217	RA: 14 11 11.2900 (212.7970417d) Dec: +12 17 37.40 (12.29372d) Equinox: J2000		V=0	Reference Frame: ICRS				
<i>Comments: This object was generated by the targetselector and retrieved from the SIMBAD database.</i>										
Exposures	#	Label	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time (Total)/[Actual Dur.]	Orbit
	1	(7) SDSS1411+1217	WFC3/IR, MULTIACCUM, IR	F160W	NSAMP=14; SAMP-SEQ=SPAR S50		Pattern 4, Exps 1-1 i n SDSS1411 (07) (4)	652.938154 Secs (7835.258 Secs)		
								[==>(Pattern 1,1)] [==>(Pattern 1,2)] [==>(Pattern 1,3)] [==>(Pattern 1,4)]	[1]	
								[==>(Pattern 2,1)] [==>(Pattern 2,2)] [==>(Pattern 2,3)] [==>(Pattern 2,4)]	[2]	
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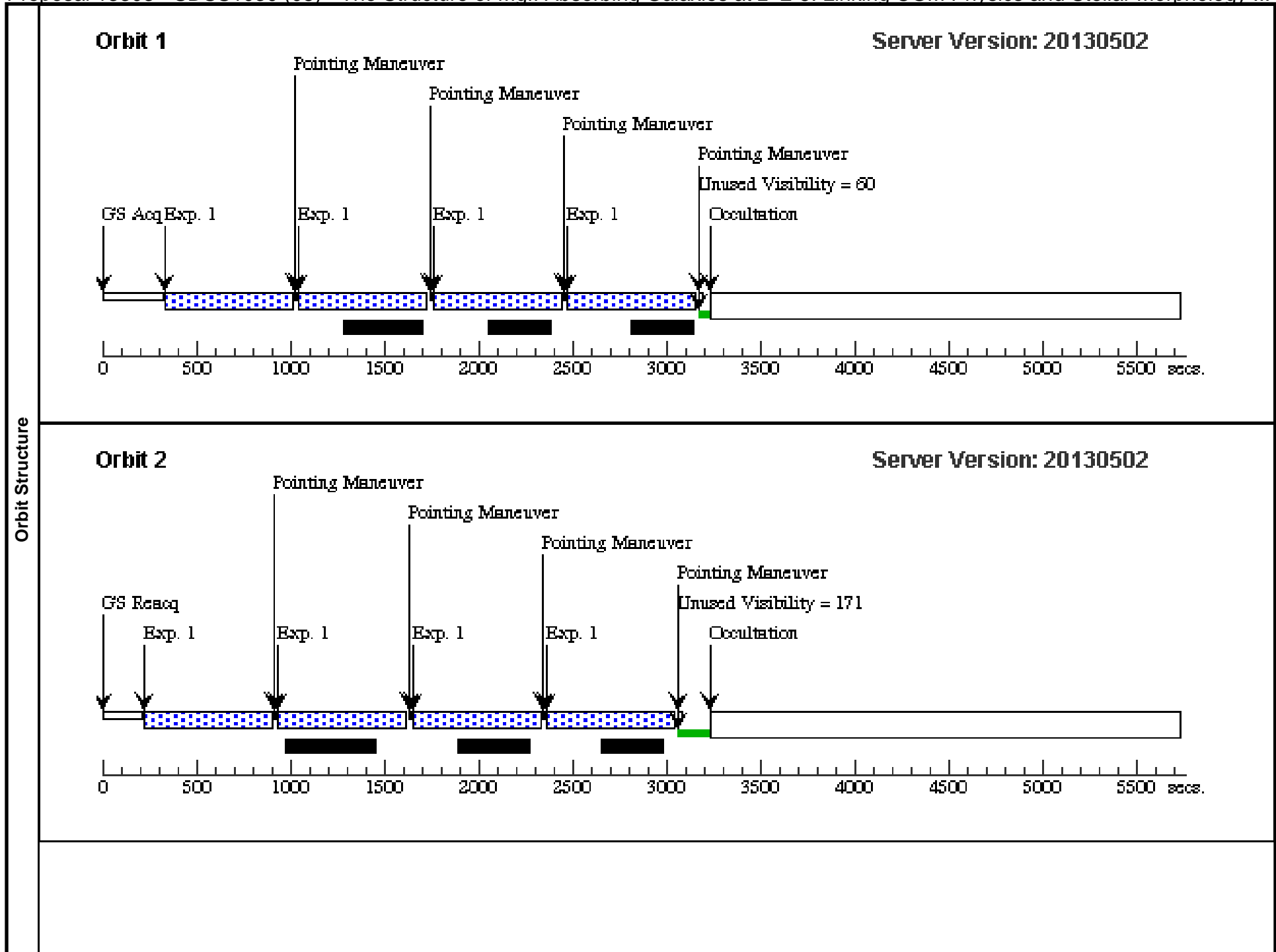


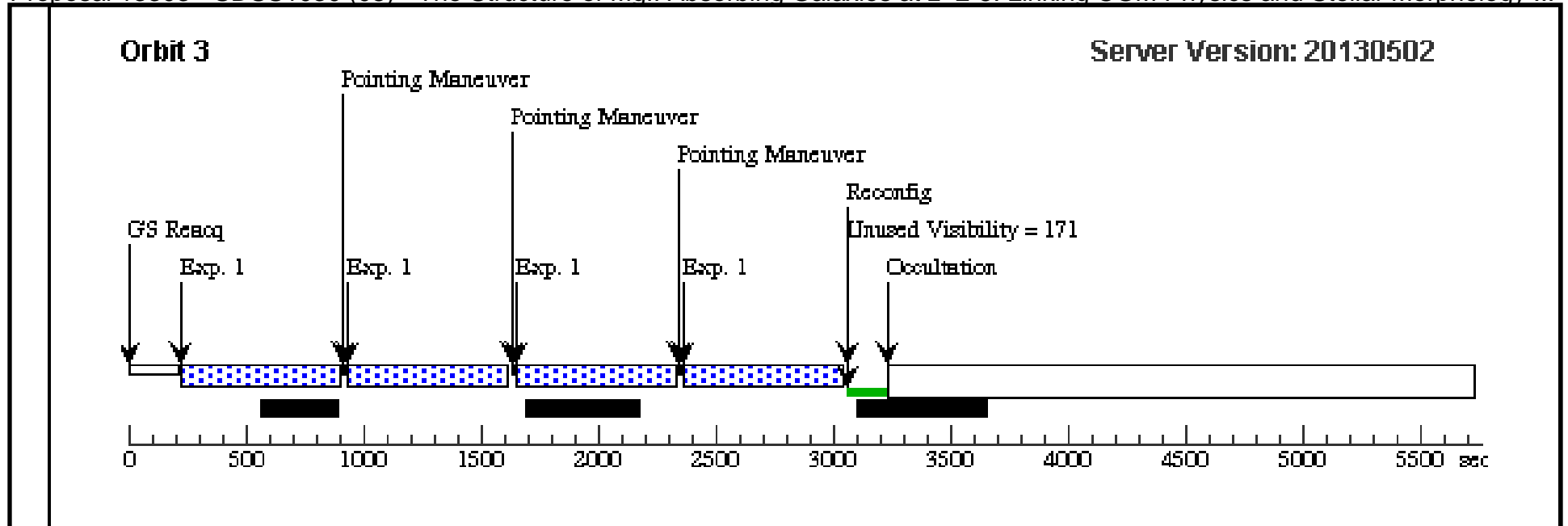


Proposal 13303 - SDSS1030 (08) - The Structure of MgII Absorbing Galaxies at z=2-5: Linking CGM Physics and Stellar Morphology ...

Thu Jul 11 17:49:53 GMT 2013

Visit	Proposal 13303, SDSS1030 (08) Diagnostic Status: No Diagnostics Scientific Instruments: WFC3/IR Special Requirements: (none)									
	Patterns	#	Primary Pattern				Secondary Pattern			
(3)		Pattern Type=SPIRAL Purpose=DITHER Number Of Points=3 Point Spacing=16 Line Spacing=	Coordinate Frame=POS-TARG Pattern Orientation=221.788 Angle Between Sides= Center Pattern=true	Pattern Type=WFC3-IR-DITHER-BOX-MIN Purpose=DITHER Number Of Points=4 Point Spacing=0.338 Line Spacing=0.303	Coordinate Frame=POS-TARG Pattern Orientation=0 Angle Between Sides=90 Center Pattern=false	(1)				
Fixed Targets	#	Name	Target Coordinates	Targ. Coord. Corrections	Fluxes	Miscellaneous				
	(8)	SDSS1030+0524	RA: 10 30 27.1000 (157.6129167d) Dec: +05 24 55.00 (5.41528d) Equinox: J2000		V=20.05	Reference Frame: ICRS				
<i>Comments: This object was generated by the targetselector and retrieved from the SIMBAD database.</i>										
Exposures	#	Label	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time (Total)/[Actual Dur.]	Orbit
	1	(8) SDSS1030+0524	WFC3/IR, MULTIACCUM, IR	F160W	NSAMP=14; SAMP-SEQ=SPAR S50		Pattern 3, Exps 1-1 i n SDSS1030 (08) (3)	652.938154 Secs (7835.258 Secs)		
								[==>(Pattern 1,1)] [==>(Pattern 1,2)] [==>(Pattern 1,3)] [==>(Pattern 1,4)]	[1]	
								[==>(Pattern 2,1)] [==>(Pattern 2,2)] [==>(Pattern 2,3)] [==>(Pattern 2,4)]	[2]	
								[==>(Pattern 3,1)] [==>(Pattern 3,2)] [==>(Pattern 3,3)] [==>(Pattern 3,4)]	[3]	





Proposal 13303 - SDSS1306 (09) - The Structure of MgII Absorbing Galaxies at z=2-5: Linking CGM Physics and Stellar Morphology ...

Thu Jul 11 17:49:54 GMT 2013

Visit	Proposal 13303, SDSS1306 (09) Diagnostic Status: No Diagnostics Scientific Instruments: WFC3/IR Special Requirements: (none) <i>Comments: We have offset the telescope pointing slightly from the coordinates in the Phase I proposal (by ~10" in RA and DEC). This is because there is an H=6 star near the edge of the field and we want to keep this off the detector at all times given our long exposures, in the interest of saturation, scattered light, etc.</i>										
	Patterns	#	Primary Pattern				Secondary Pattern				Exposures
(4)		Pattern Type=SPIRAL Purpose=DITHER Number Of Points=3 Point Spacing=16 Line Spacing=	Coordinate Frame=POS-TARG Pattern Orientation=41.788 Angle Between Sides= Center Pattern=true	Pattern Type=WFC3-IR-DITHER-BOX-MIN Purpose=DITHER Number Of Points=4 Point Spacing=0.338 Line Spacing=0.303	Coordinate Frame=POS-TARG Pattern Orientation=0 Angle Between Sides=90 Center Pattern=false	(1)					
Fixed Targets	#	Name	Target Coordinates		Targ. Coord. Corrections		Fluxes	Miscellaneous			
	(9)	SDSS1306+0356	RA: 13 06 7.2600 (196.5302500d) Dec: +03 56 16.30 (3.93786d) Equinox: J2000				V=22.58	Reference Frame: ICRS			
<i>Comments: This object was generated by the targetselector and retrieved from the SIMBAD database.</i>											
Exposures	#	Label	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time (Total)/[Actual Dur.]		Orbit
	1	(9) SDSS1306+0356	WFC3/IR, MULTIACCUM, IR	F160W	NSAMP=14; SAMP-SEQ=SPAR S50			Pattern 4, Exps 1-1 in SDSS1306 (09) (4)	652.938154 Secs (7835.258 Secs)		
									[=>(Pattern 1,1)]		[1]
									[=>(Pattern 1,2)]		
									[=>(Pattern 1,3)]		
								[=>(Pattern 1,4)]			
								[=>(Pattern 2,1)]			
								[=>(Pattern 2,2)]			
								[=>(Pattern 2,3)]			
								[=>(Pattern 2,4)]		[2]	
								[=>(Pattern 3,1)]			
								[=>(Pattern 3,2)]			
								[=>(Pattern 3,3)]			
								[=>(Pattern 3,4)]		[3]	

