



10760 - Black Hole X-ray Novae in M31

Cycle: 14, 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) M31-BH1	ACS/WFC	2	21-May-2007 18:00:24.0	yes
02	(2) M31-BH2	ACS/WFC	2	21-May-2007 18:00:30.0	yes
03	(3) M31-BH3	ACS/WFC	2	21-May-2007 18:00:35.0	yes
04	(4) M31-BH4	ACS/WFC	2	21-May-2007 18:00:44.0	yes
05	(5) M31-BH5	ACS/WFC	2	21-May-2007 18:00:48.0	yes
06	(1) M31-BH1	ACS/WFC	2	21-May-2007 18:00:52.0	yes
07	(2) M31-BH2	ACS/WFC	2	21-May-2007 18:00:57.0	yes
08	(3) M31-BH3	ACS/WFC	2	21-May-2007 18:01:01.0	yes
09	(4) M31-BH4	WFPC2	4	21-May-2007 18:01:06.0	yes

20 Total Orbits Used

ABSTRACT

We have been carrying out a Chandra (GO+GTO) and HST (GO) program to find Black Hole X-ray Nova (BHXN) and their optical counterparts in M31 for several years. To date we have found >2 dozen BHXN and 3 HST optical counterparts for these BHXN. Our results suggest a rather high ratio of BH to neutron star (NS) binaries, or a high duty cycle for the BHXN. We propose to continue this program, with the goal of determining the orbital period distribution and duty cycles of these BHXN. Current results yield 3 orbital periods and 2 upper limits. Our proposed observations will ~double the total number of periods and therefore yield sufficient numbers to make a first approximation of the orbital period distribution. The orbital period distribution is the fundamental observable parameter any binary stellar evolution models must match, and the duty cycle is very poorly known but directly influences the binary lifetime. M31 is the only galaxy in which this extra-galactic study of BHXN is feasible.

OBSERVING DESCRIPTION

We will use the ACS camera to obtain images of active Black Hole X-ray Novae (BHXNe) in M31. These BHXNe will be identified on Chandra-ACIS observations obtained approximately 1 month prior to each HST observation. We will therefore be splitting up our 20 HST orbits into 10 visits (two orbits per visit). The current plan will use the first 5 observations to detect the optical counterparts of 5 BHXNe and the last 5 observations to revisit those 5 BHXN counterparts to ensure that they were optical transients. This plan may be slightly altered over the course of the program depending on when and where the BHXNe are detected.

REAL TIME JUSTIFICATION

These observations will be scheduled during the full CXO AO7 program, which runs during HST C14 and C15.

Our first 5 two-orbit visits must be performed at intervals of one per month (or a longer interval) in order to find a counterpart for a new BHXN with each observation. Our preliminary studies indicate that about one new BHXN activates each month. We will obtain the 5 HST exposures during the available observing windows in February, June, July, August and October 2006. The CXO exposures would precede each of these by 1 month.

We have scheduled all the other 5 HST observations required to confirm the optical counterparts to the BHXNe during the first available observing

window for M31 during HST C15 (January 2007). The science exposures and visibility period must be determined accurately and updated using suitable software for Cycle 15.

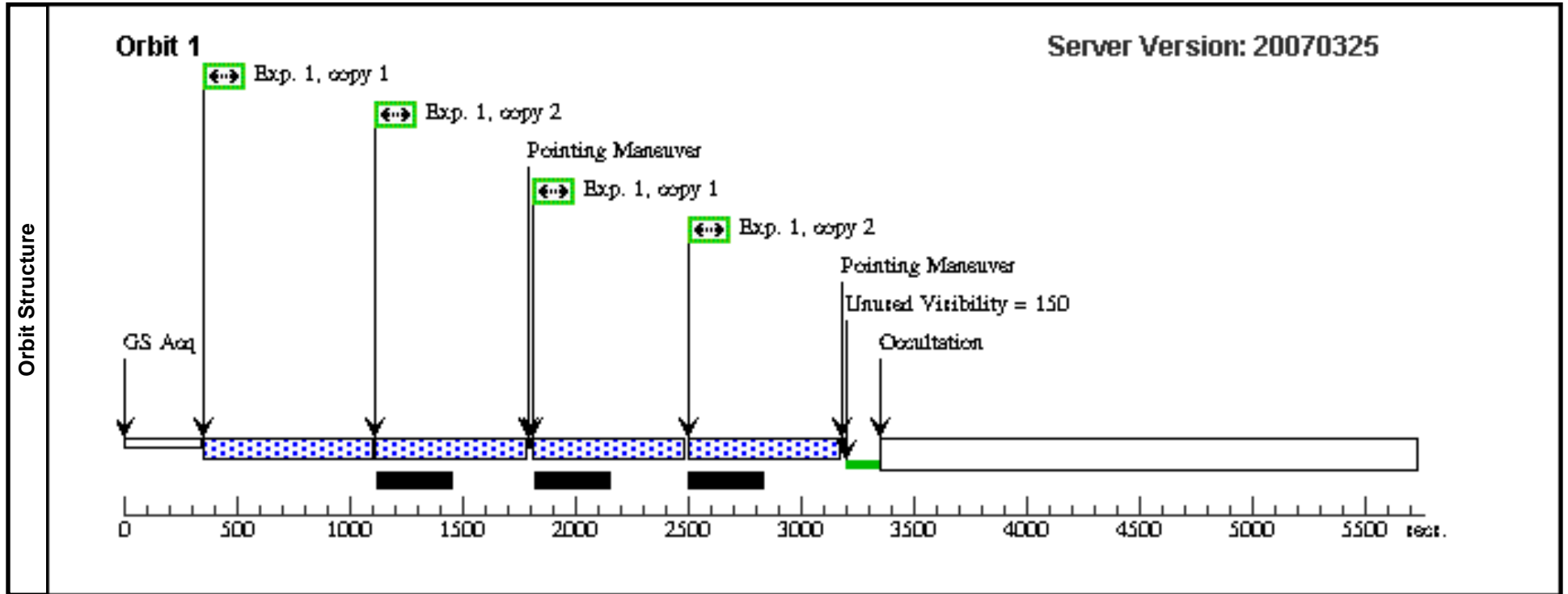
ADDITIONAL COMMENTS

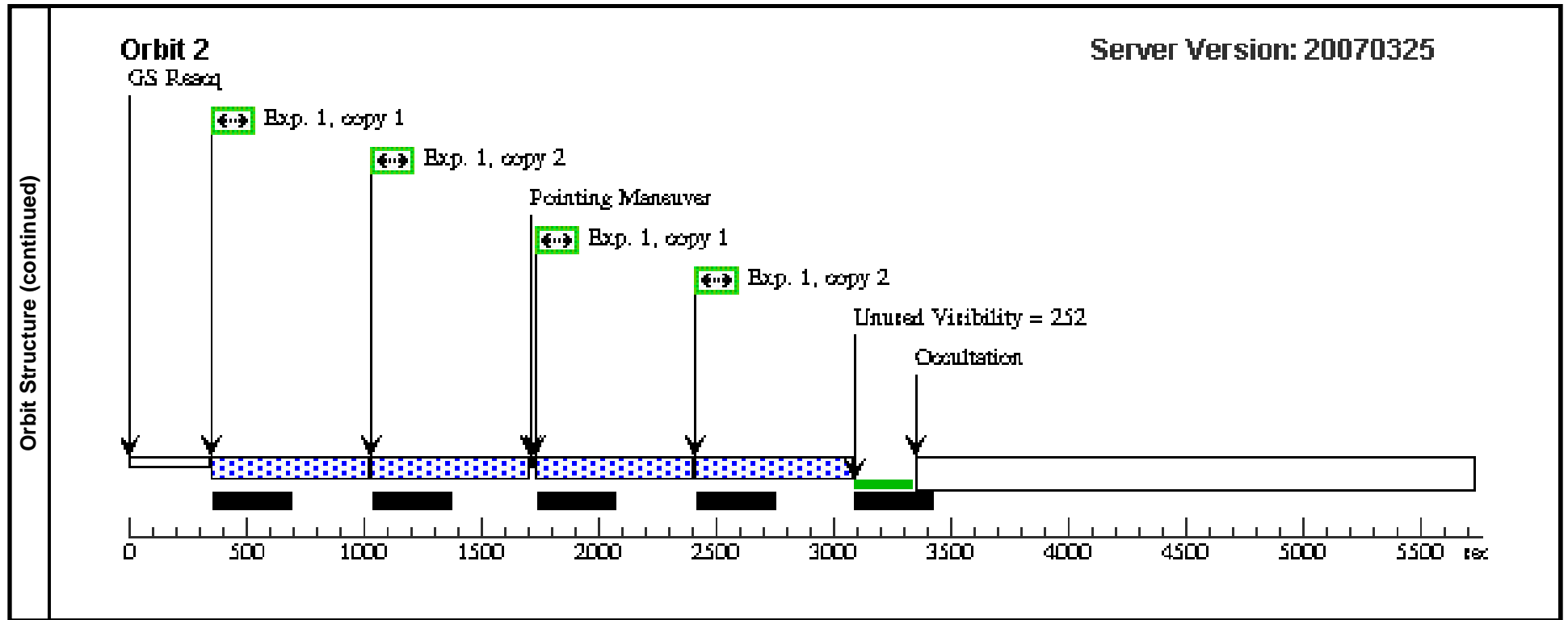
As we will not know the exact location of our target until a Chandra observation is completed, we cannot provide final coordinates for our objects until about 3 weeks prior to each observation. As a result, we have currently supplied the coordinates of the nucleus of M31 as a hold position, to be corrected to the final position when we detect the BHXN. These detections will be within 1 degree of the M31 nucleus.

Proposal 10760 - Visit 01 - Black Hole X-ray Novae in M31

Mon May 21 17:01:09 GMT 2007

Visit	Proposal 10760, Visit 01, completed Diagnostic Status: No Diagnostics Scientific Instruments: ACS/WFC Special Requirements: BETWEEN 08-FEB-2006:12:00:00 AND 14-FEB-2006:11:59:00									
	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=20.67 Angle Between Sides=69.05 Center Pattern=false					(1)	
Fixed Targets	#	Name	Target Coordinates	Targ. Coord. Corrections		Fluxes	Miscellaneous			
	(1)	M31-BH1	RA: 00 42 52.4000 (10.7183333d) Dec: +41 16 49.20 (41.28033d) Equinox: J2000			V=25.0+/-5.0	Coordinate Source: Chandra Observation			
Exposures	#	Label	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time/[Actual Dur.]	Orbit
	1	BH1-on	(1) M31-BH1	ACS/WFC, ACCUM, WFC	F435W	GAIN=2; CR-SPLIT=NO		Pattern 1-1 (1)	545.0 Secs X 2 [==>(Pattern 1, Copy 1)] [==>(Pattern 1, Copy 2)] [==>(Pattern 2, Copy 1)] [==>(Pattern 2, Copy 2)] [==>(Pattern 3, Copy 1)] [==>(Pattern 3, Copy 2)] [==>(Pattern 4, Copy 1)] [==>(Pattern 4, Copy 2)]	[1] [2]

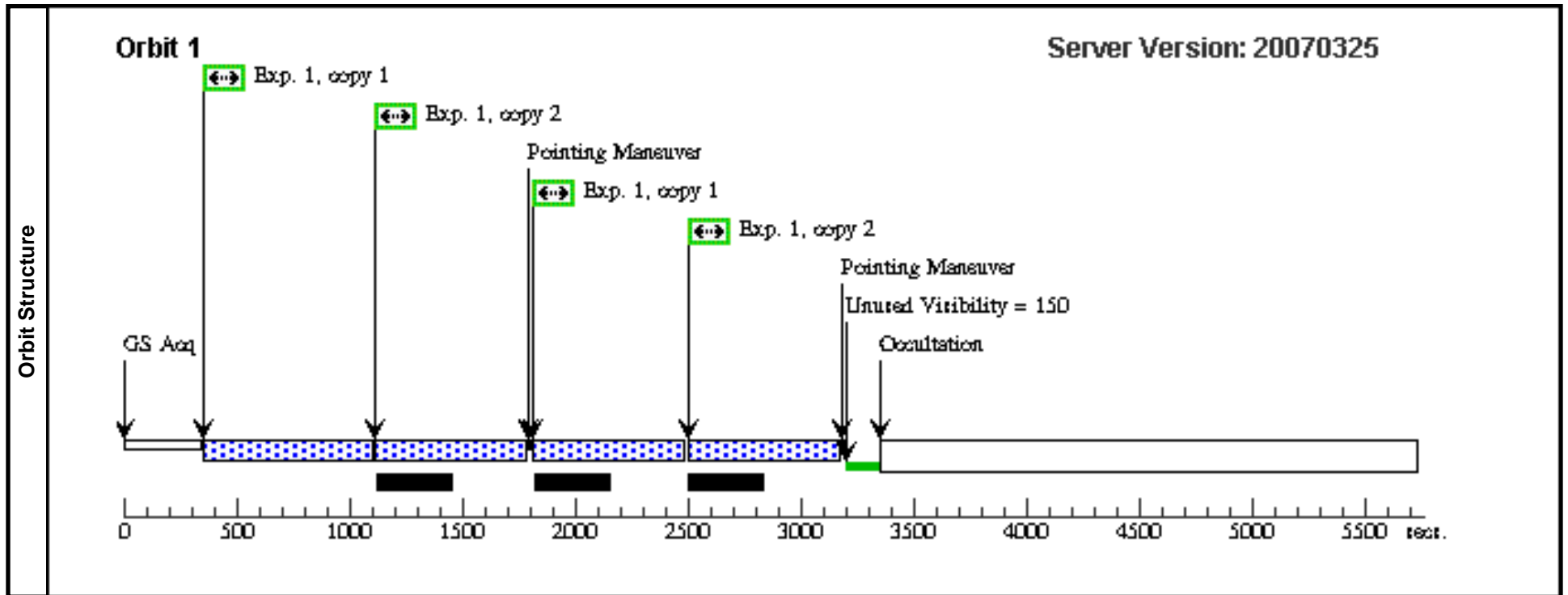


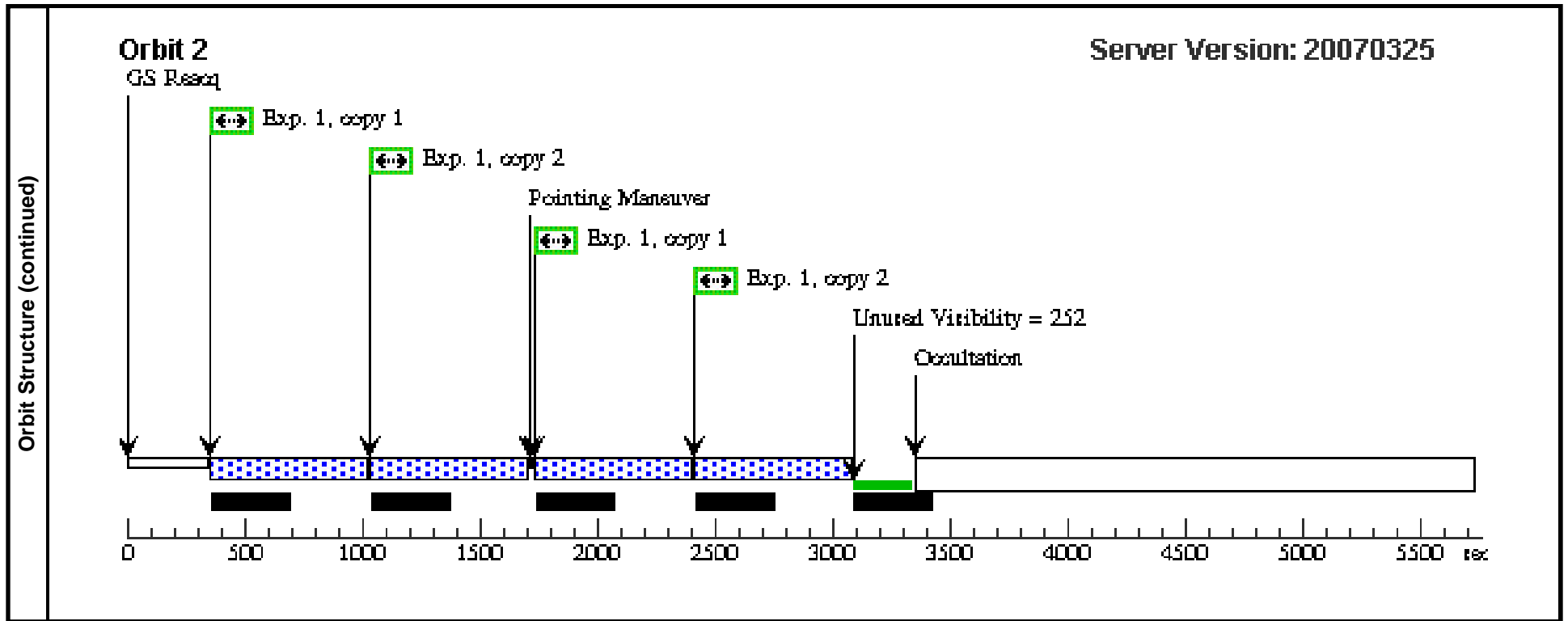


Proposal 10760 - Visit 02 - Black Hole X-ray Novae in M31

Mon May 21 17:01:10 GMT 2007

Visit	Proposal 10760, Visit 02, completed Diagnostic Status: No Diagnostics Scientific Instruments: ACS/WFC Special Requirements: BETWEEN 05-JUL-2006:00:00:00 AND 17-JUL-2006:00:00:00 Comments: <i>It is our preference to have the visit execute as early as possible in the window.</i>										
	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=20.67 Angle Between Sides=69.05 Center Pattern=false				(1)	
Fixed Targets	#	Name	Target Coordinates			Targ. Coord. Corrections		Fluxes	Miscellaneous		
	(2)	M31-BH2	RA: 00 42 33.8790 (10.6411625d) Dec: +41 23 31.11 (41.39198d) Equinox: J2000					V=25.0+/-5.0	Coordinate Source: Chandra Observation		
Exposures	#	Label	Target	Config,Mode,Aperture		Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time/[Actual Dur.]	Orbit
	1	BH2-on	(2) M31-BH2	ACS/WFC, ACCUM, WFC		F435W	GAIN=2;		Pattern 1-1 (1)	545.0 Secs X 2	
							CR-SPLIT=NO			[==>(Pattern 1, Copy 1)] [==>(Pattern 1, Copy 2)] [==>(Pattern 2, Copy 1)] [==>(Pattern 2, Copy 2)]	[1]
										[==>(Pattern 3, Copy 1)] [==>(Pattern 3, Copy 2)] [==>(Pattern 4, Copy 1)] [==>(Pattern 4, Copy 2)]	[2]

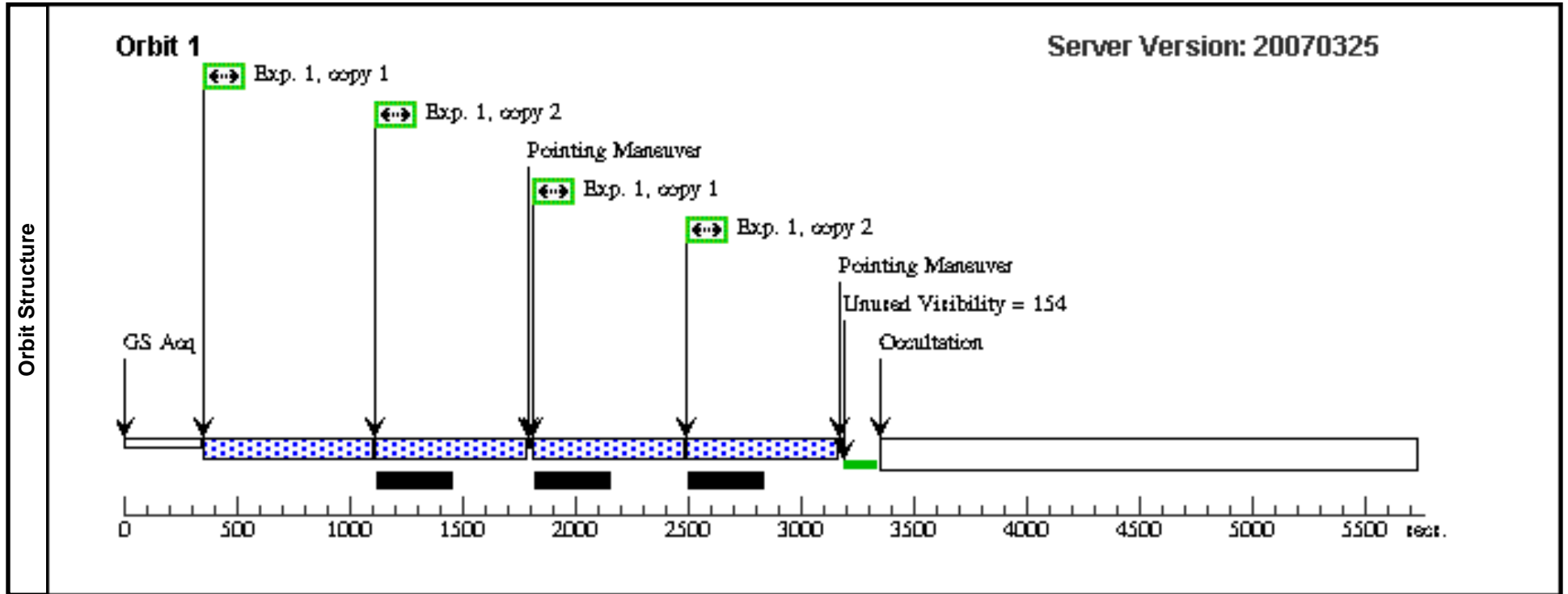


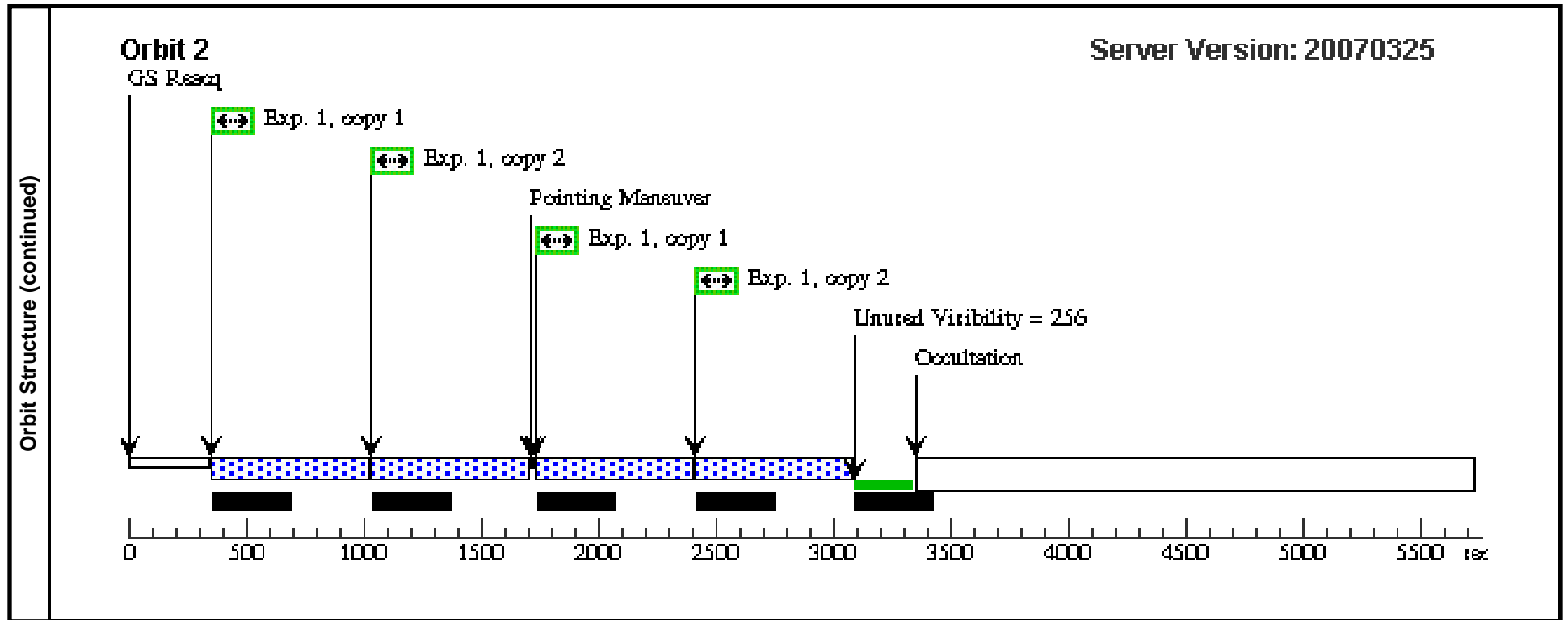


Proposal 10760 - Visit 03 - Black Hole X-ray Novae in M31

Mon May 21 17:01:11 GMT 2007

Visit	Proposal 10760, Visit 03, completed Diagnostic Status: No Diagnostics Scientific Instruments: ACS/WFC Special Requirements: BETWEEN 09-JUL-2006:12:00:00 AND 16-JUL-2006:11:59:00 Comments: <i>It is our preference to have the visit execute as early as possible in its window.</i>									
	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=20.67 Angle Between Sides=69.05 Center Pattern=false					(1)		
Fixed Targets	#	Name	Target Coordinates	Targ. Coord. Corrections	Fluxes	Miscellaneous				
	(3)	M31-BH3	RA: 00 42 51.1710 (10.7132125d) Dec: +41 19 17.92 (41.32164d) Equinox: J2000		V=25.0+/-5.0	Coordinate Source: Chandra Observation				
Exposures	#	Label	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time/[Actual Dur.]	Orbit
	1	BH3-on	(3) M31-BH3	ACS/WFC, ACCUM, WFC	F435W	GAIN=2;		Pattern 1-1 (1)	544.0 Secs X 2	
						CR-SPLIT=NO			[==>(Pattern 1, Copy 1)] [==>(Pattern 1, Copy 2)] [==>(Pattern 2, Copy 1)] [==>(Pattern 2, Copy 2)]	[1]
									[==>(Pattern 3, Copy 1)] [==>(Pattern 3, Copy 2)] [==>(Pattern 4, Copy 1)] [==>(Pattern 4, Copy 2)]	[2]

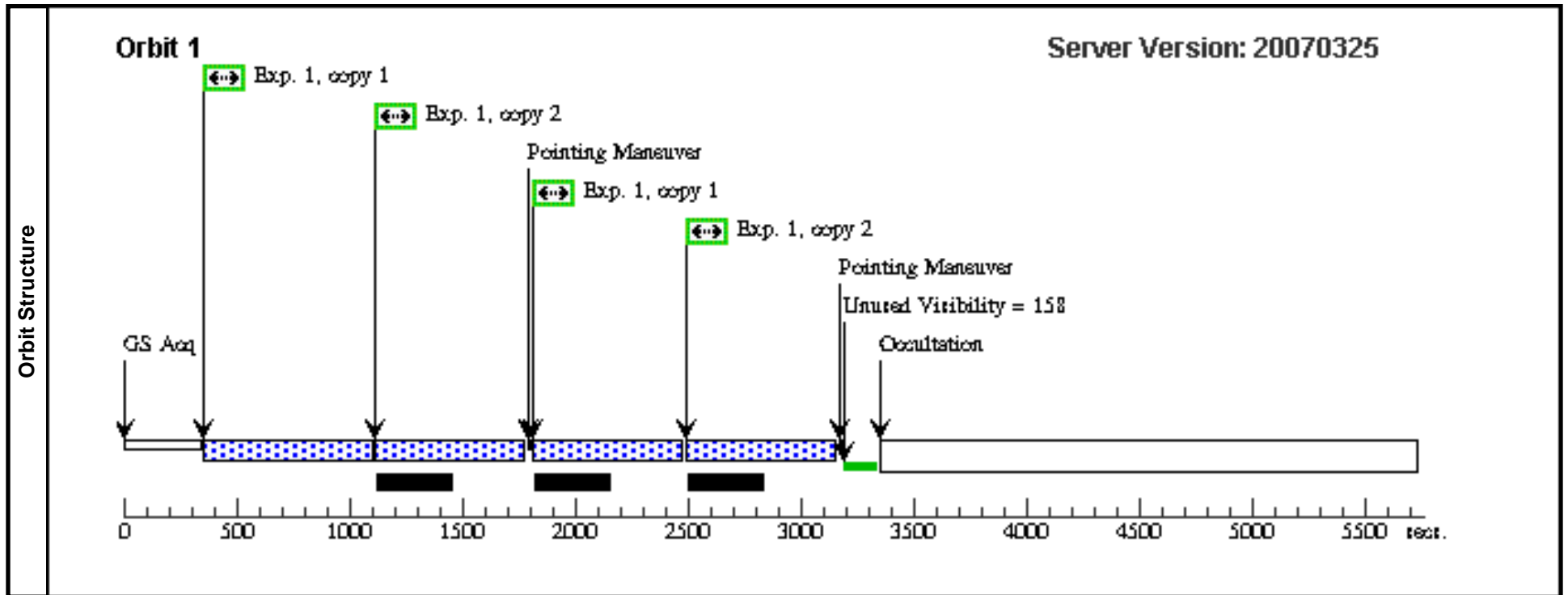


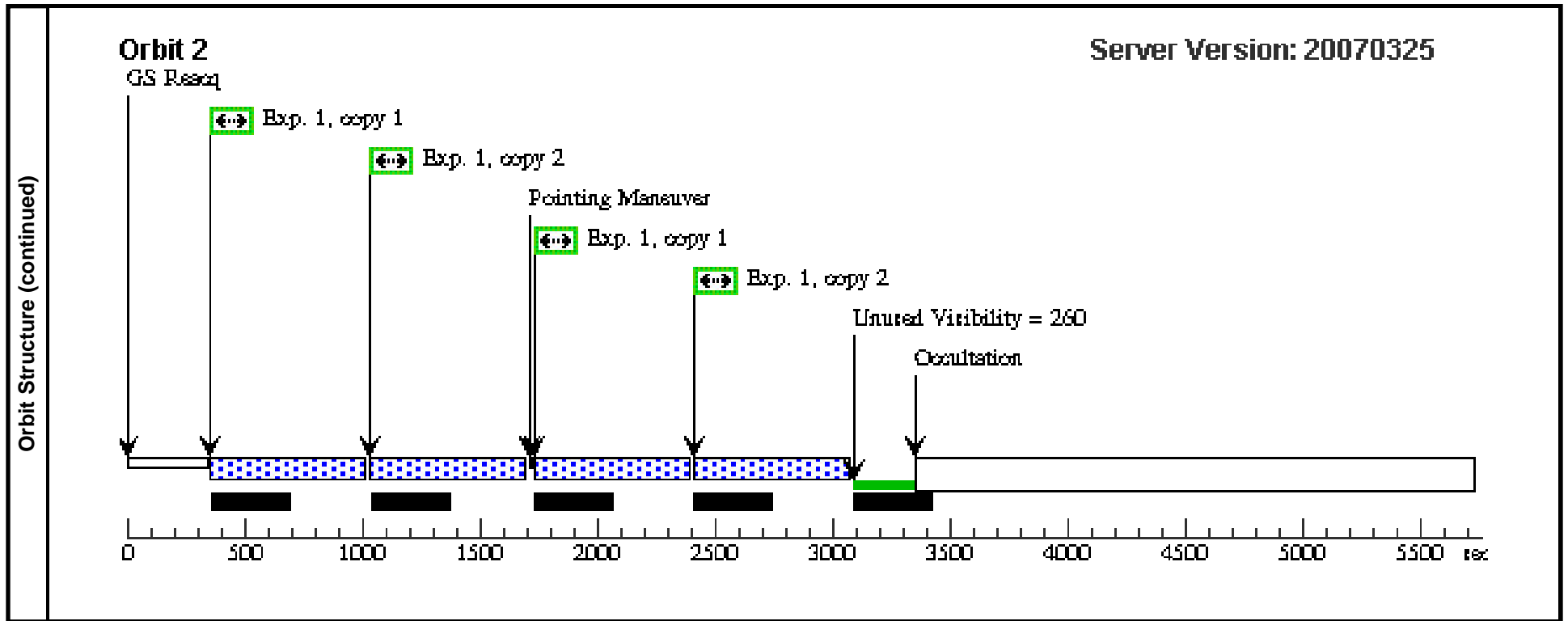


Proposal 10760 - Visit 04 - Black Hole X-ray Novae in M31

Mon May 21 17:01:12 GMT 2007

Visit	Proposal 10760, Visit 04, completed Diagnostic Status: No Diagnostics Scientific Instruments: ACS/WFC Special Requirements: BETWEEN 27-AUG-2006:12:00:00 AND 03-SEP-2006:11:59:00 Comments: Please schedule this visits as early as possible in its window.									
	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=20.67 Angle Between Sides=69.05 Center Pattern=false					(1)		
Fixed Targets	#	Name	Target Coordinates	Targ. Coord. Corrections		Fluxes	Miscellaneous			
	(4)	M31-BH4	RA: 00 42 16.0590 (10.5669125d) Dec: +41 19 26.07 (41.32391d) Equinox: J2000			V=25.0+/-5.0	Coordinate Source: Chandra observation			
Exposures	#	Label	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time/[Actual Dur.]	Orbit
	1	BH4-on	(4) M31-BH4	ACS/WFC, ACCUM, WFC	F435W	GAIN=2;		Pattern 1-1 (1)	543.0 Secs X 2	
						CR-SPLIT=NO			[==>(Pattern 1, Copy 1)]	[1]
									[==>(Pattern 1, Copy 2)]	
								[==>(Pattern 2, Copy 1)]	[2]	
								[==>(Pattern 2, Copy 2)]		
								[==>(Pattern 3, Copy 1)]		
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								[==>(Pattern 4, Copy 1)]		
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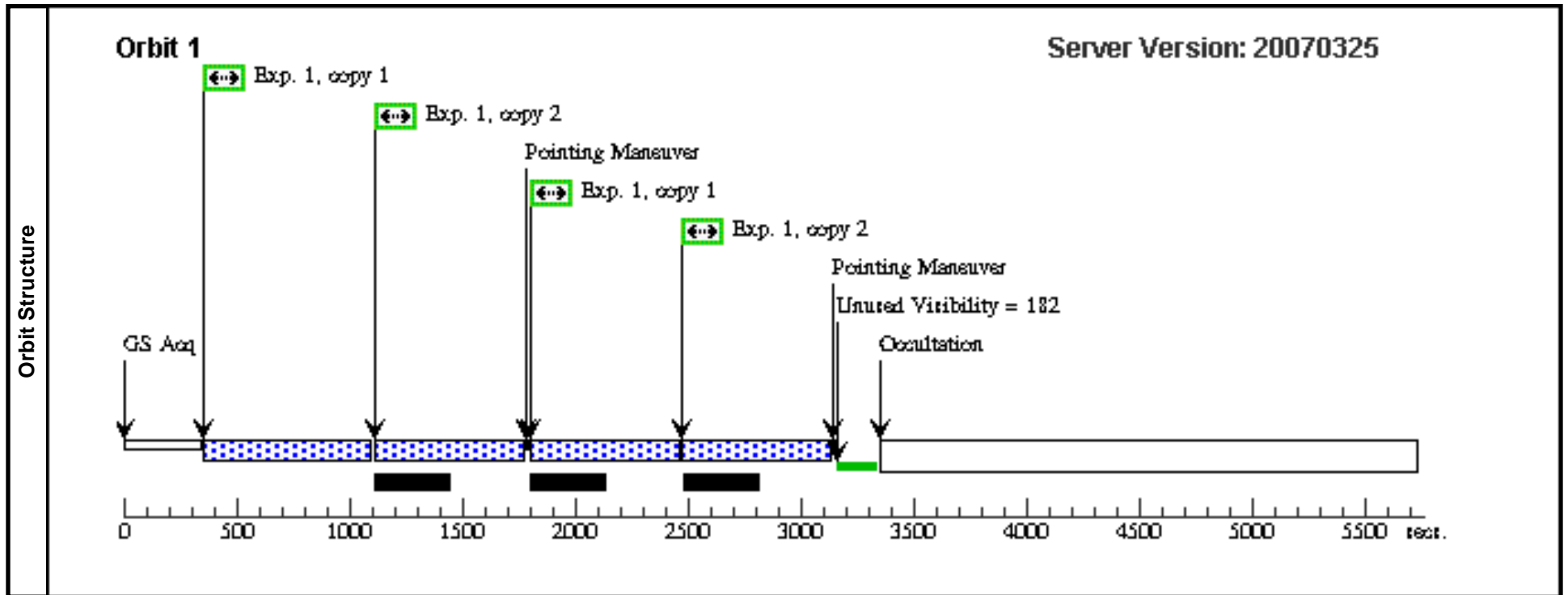


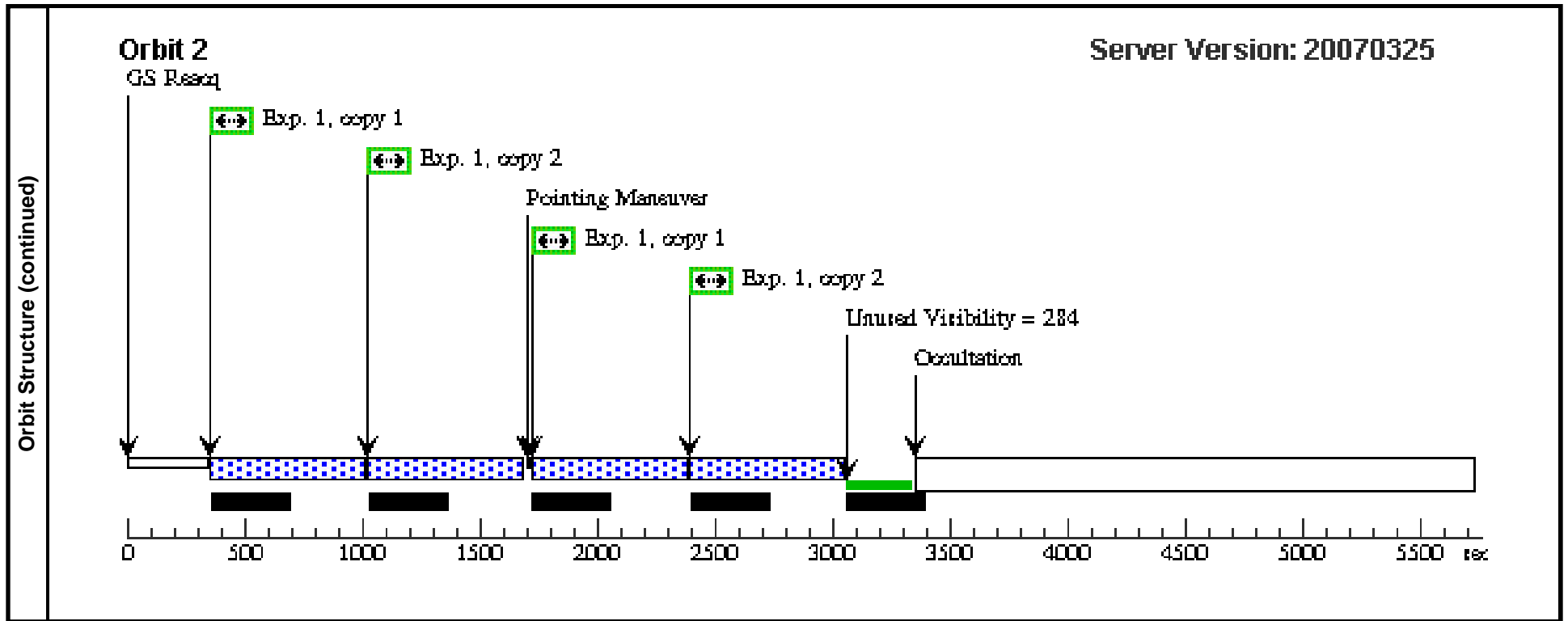


Proposal 10760 - Visit 05 - Black Hole X-ray Novae in M31

Mon May 21 17:01:12 GMT 2007

Visit	Proposal 10760, Visit 05, completed Diagnostic Status: No Diagnostics Scientific Instruments: ACS/WFC Special Requirements: BETWEEN 23-OCT-2006:12:00:00 AND 25-OCT-2006:11:59:00 Comments: <i>Please schedule as late as possible in the window.</i>									
	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=20.67 Angle Between Sides=69.05 Center Pattern=false					(1)		
Fixed Targets	#	Name	Target Coordinates	Targ. Coord. Corrections	Fluxes	Miscellaneous				
	(5)	M31-BH5	RA: 00 42 17.3310 (10.5722125d) Dec: +41 15 36.84 (41.26023d) Equinox: J2000		V=25.0+/-5.0	Coordinate Source: Chandra Observation				
Exposures	#	Label	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time/[Actual Dur.]	Orbit
	1	BH5-on	(5) M31-BH5	ACS/WFC, ACCUM, WFC	F435W	GAIN=2;		Pattern 1-1 (1)	537.0 Secs X 2	
						CR-SPLIT=NO			[==>(Pattern 1, Copy 1)] [==>(Pattern 1, Copy 2)] [==>(Pattern 2, Copy 1)] [==>(Pattern 2, Copy 2)]	[1]
									[==>(Pattern 3, Copy 1)] [==>(Pattern 3, Copy 2)] [==>(Pattern 4, Copy 1)] [==>(Pattern 4, Copy 2)]	[2]

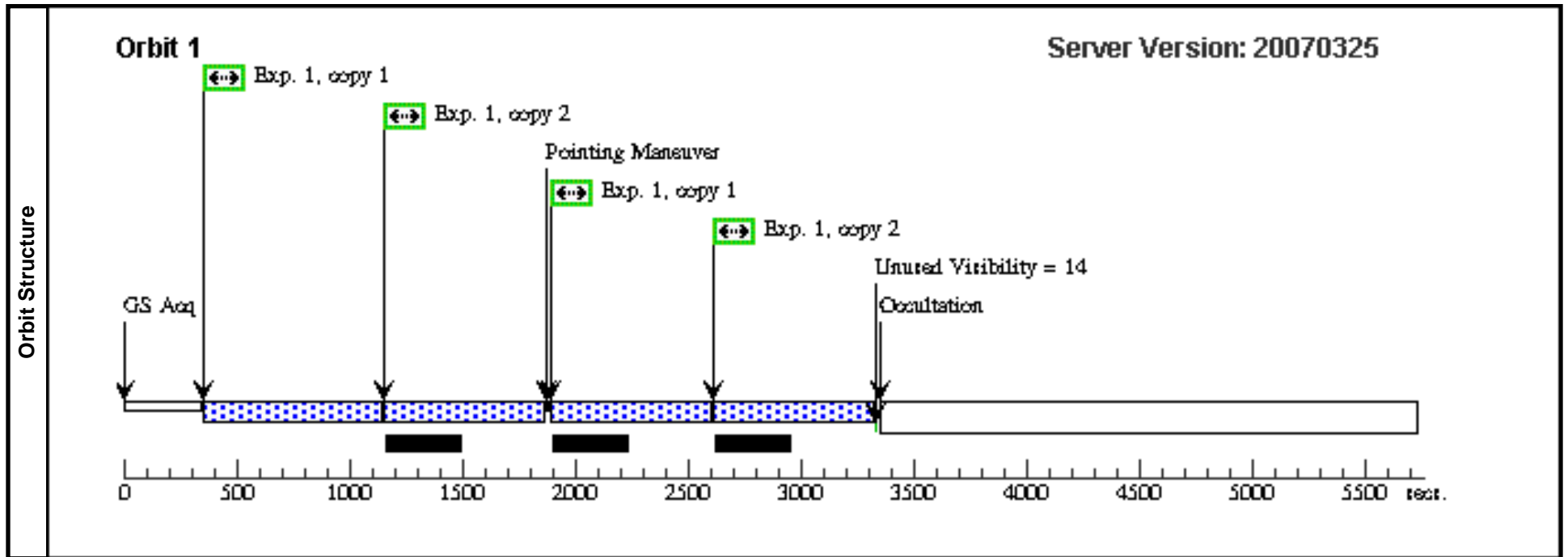


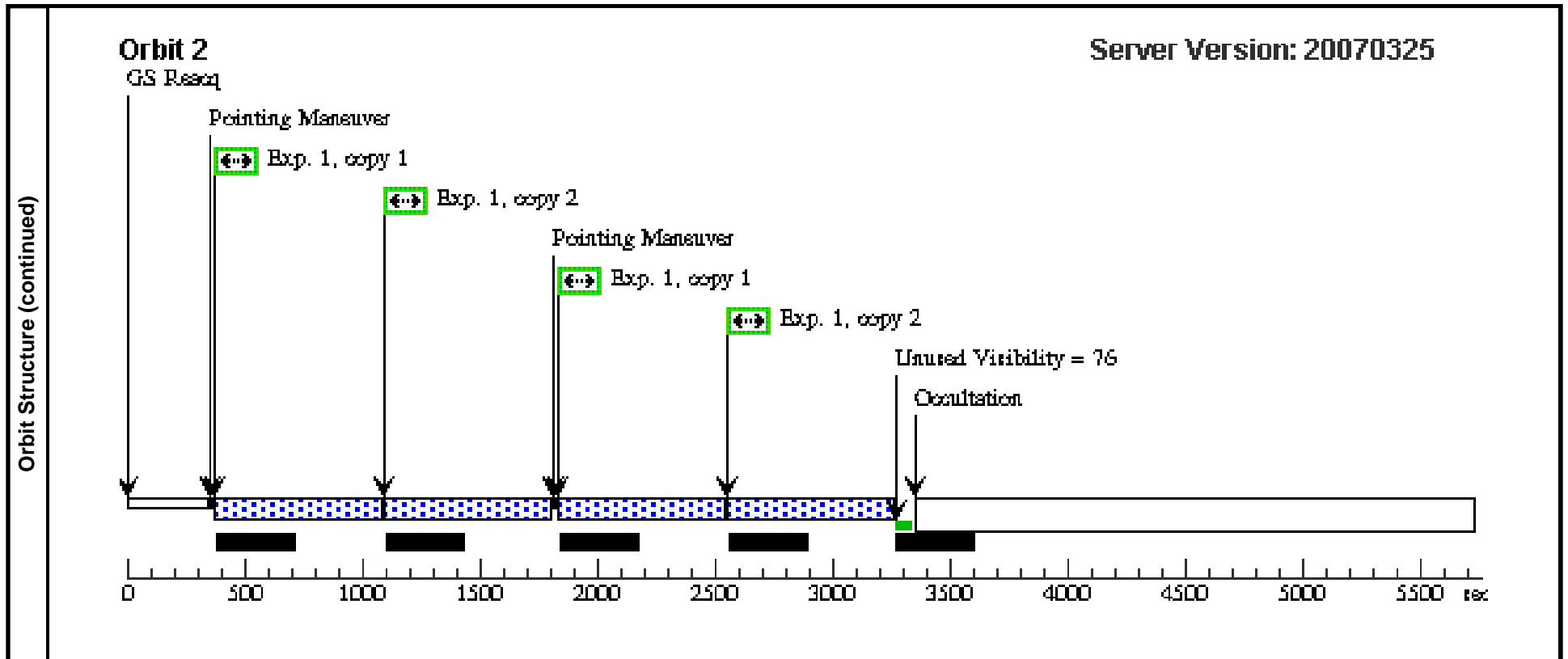


Proposal 10760 - Visit 06 - Black Hole X-ray Novae in M31

Mon May 21 17:01:13 GMT 2007

Visit	Proposal 10760, Visit 06, completed Diagnostic Status: No Diagnostics Scientific Instruments: ACS/WFC Special Requirements: BETWEEN 07-JAN-2007:12:00:00 AND 13-JAN-2007:11:59:00									
	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=20.67 Angle Between Sides=69.05 Center Pattern=false					(1)		
Fixed Targets	#	Name	Target Coordinates	Targ. Coord. Corrections	Fluxes	Miscellaneous				
	(1)	M31-BH1	RA: 00 42 52.4000 (10.7183333d) Dec: +41 16 49.20 (41.28033d) Equinox: J2000		V=25.0+/-5.0	Coordinate Source: Chandra Observation				
Exposures	#	Label	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time/[Actual Dur.]	Orbit
	1	BH1-off	(1) M31-BH1	ACS/WFC, ACCUM, WFC	F435W	GAIN=2;		Pattern 1-1 (1)	584.0 Secs X 2	
						CR-SPLIT=NO			[==>(Pattern 1, Copy 1)]	
									[==>(Pattern 1, Copy 2)]	[1]
									[==>(Pattern 2, Copy 1)]	
								[==>(Pattern 2, Copy 2)]		
								[==>(Pattern 3, Copy 1)]		
								[==>(Pattern 3, Copy 2)]		
								[==>(Pattern 4, Copy 1)]	[2]	
								[==>(Pattern 4, Copy 2)]		
<i>Comments: Check schedulability of this orbit.</i>										

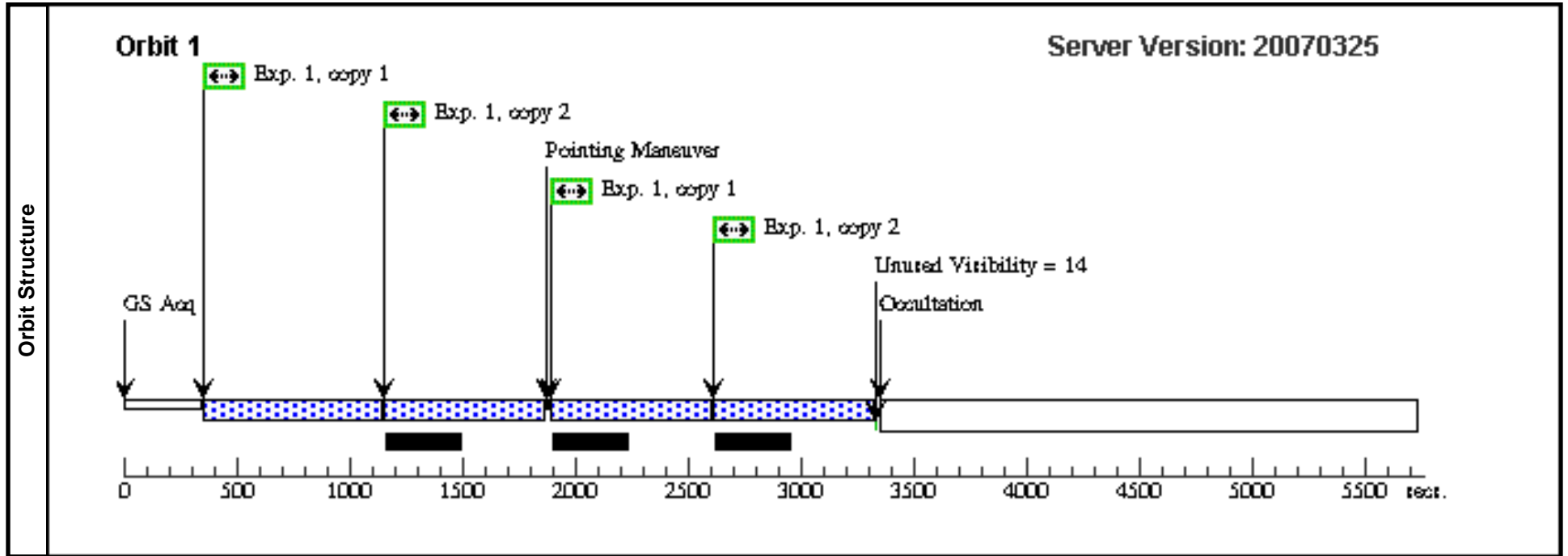


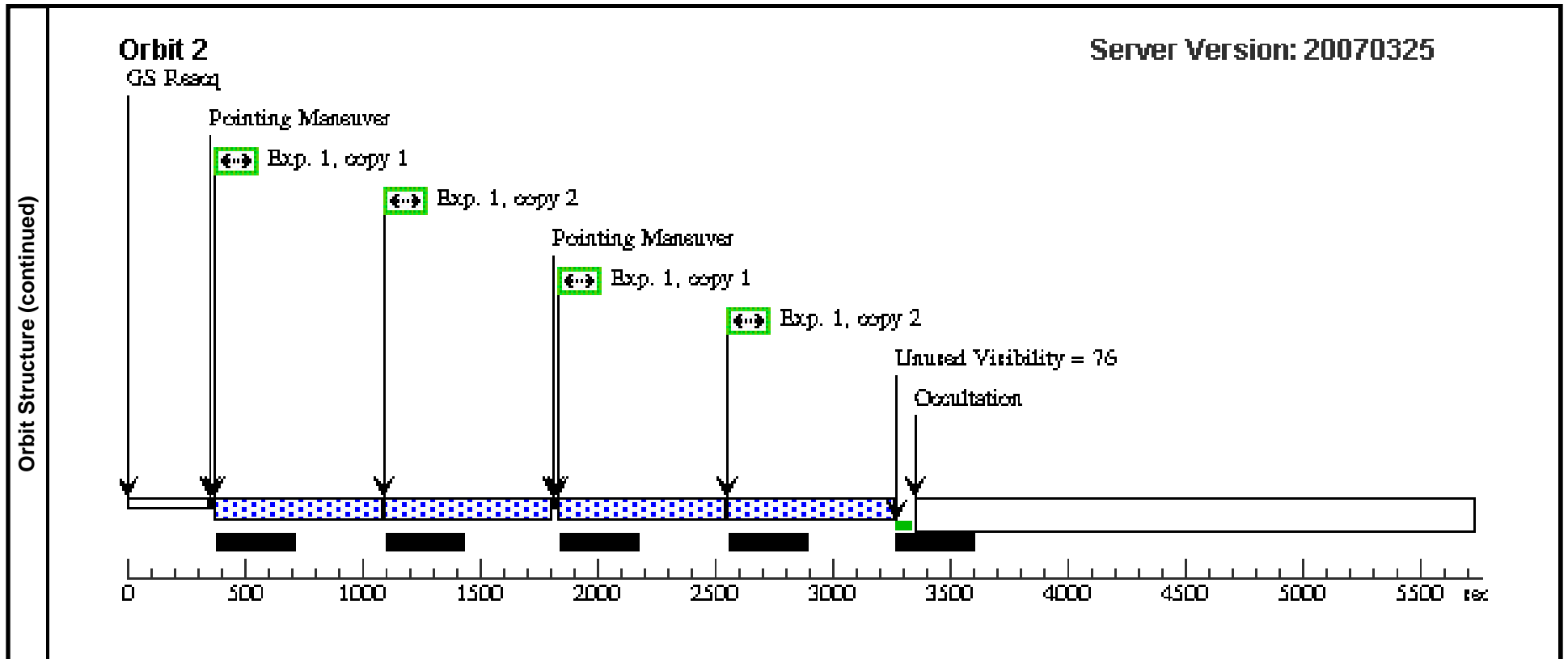


Proposal 10760 - Visit 07 - Black Hole X-ray Novae in M31

Mon May 21 17:01:14 GMT 2007

Visit	Proposal 10760, Visit 07, completed Diagnostic Status: No Diagnostics Scientific Instruments: ACS/WFC Special Requirements: BETWEEN 07-JAN-2007:12:00:00 AND 13-JAN-2007:11:59:00									
	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=20.67 Angle Between Sides=69.05 Center Pattern=false					(1)	
Fixed Targets	#	Name	Target Coordinates	Targ. Coord. Corrections		Fluxes	Miscellaneous			
	(2)	M31-BH2	RA: 00 42 33.8790 (10.6411625d) Dec: +41 23 31.11 (41.39198d) Equinox: J2000			V=25.0+/-5.0	Coordinate Source: Chandra Observation			
Exposures	#	Label	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time/[Actual Dur.]	Orbit
	1	BH2-off	(2) M31-BH2	ACS/WFC, ACCUM, WFC	F435W	GAIN=2; CR-SPLIT=NO			Pattern 1-1 (1)	584.0 Secs X 2 [==>(Pattern 1, Copy 1)] [==>(Pattern 1, Copy 2)] [==>(Pattern 2, Copy 1)] [==>(Pattern 2, Copy 2)] [==>(Pattern 3, Copy 1)] [==>(Pattern 3, Copy 2)] [==>(Pattern 4, Copy 1)] [==>(Pattern 4, Copy 2)]

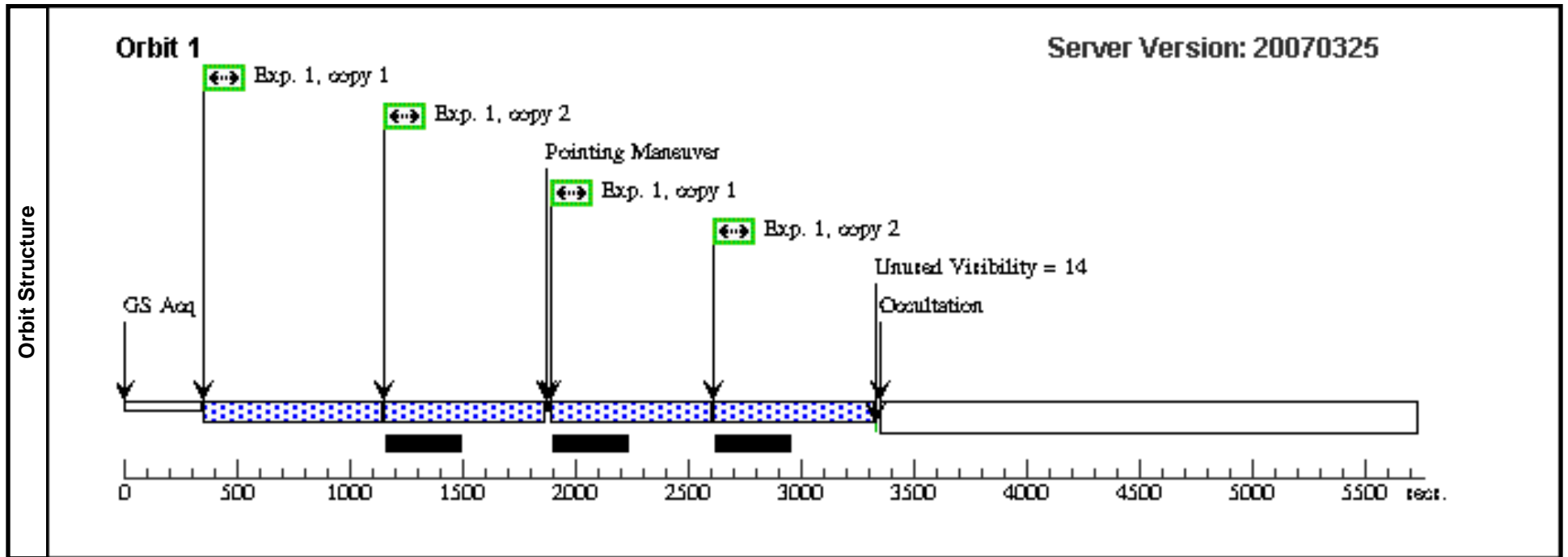


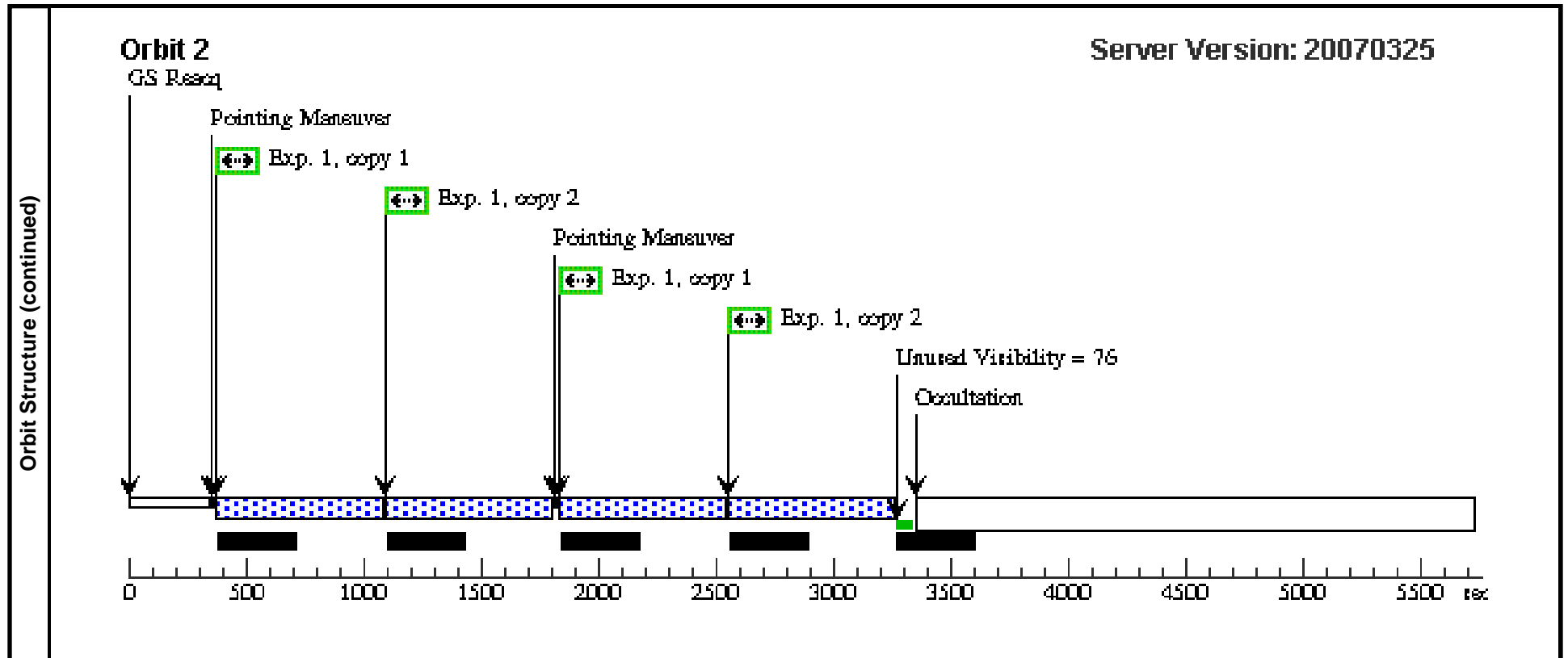


Proposal 10760 - Visit 08 - Black Hole X-ray Novae in M31

Mon May 21 17:01:14 GMT 2007

Visit	Proposal 10760, Visit 08, completed Diagnostic Status: No Diagnostics Scientific Instruments: ACS/WFC Special Requirements: BETWEEN 07-JAN-2007:12:00:00 AND 13-JAN-2007:11:59:00									
	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=20.67 Angle Between Sides=69.05 Center Pattern=false					(1)	
Fixed Targets	#	Name	Target Coordinates	Targ. Coord. Corrections	Fluxes	Miscellaneous				
	(3)	M31-BH3	RA: 00 42 51.1710 (10.7132125d) Dec: +41 19 17.92 (41.32164d) Equinox: J2000		V=25.0+/-5.0	Coordinate Source: Chandra Observation				
Exposures	#	Label	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time/[Actual Dur.]	Orbit
	1	BH3-off	(3) M31-BH3	ACS/WFC, ACCUM, WFC	F435W	GAIN=2; CR-SPLIT=NO			Pattern 1-1 (1)	584.0 Secs X 2 [==>(Pattern 1, Copy 1)] [==>(Pattern 1, Copy 2)] [==>(Pattern 2, Copy 1)] [==>(Pattern 2, Copy 2)] [==>(Pattern 3, Copy 1)] [==>(Pattern 3, Copy 2)] [==>(Pattern 4, Copy 1)] [==>(Pattern 4, Copy 2)]





Proposal 10760 - Visit 09 - Black Hole X-ray Novae in M31

Mon May 21 17:01:15 GMT 2007

Visit	Proposal 10760, Visit 09 Diagnostic Status: No Diagnostics Scientific Instruments: WFPC2 Special Requirements: BETWEEN 28-JUN-2007:00:00:00 AND 13-JUL-2007:11:59:00									
	Patterns	#	Primary Pattern			Secondary Pattern			Exposures	
		(2)	Pattern Type=WFPC2-BOX	Coordinate Frame=POS-TARG						
		Purpose=DITHER	Pattern Orientation=26.57							
		Number Of Points=4	Angle Between Sides=143.13							
		Point Spacing=0.559	Center Pattern=false							
		Line Spacing=0.559								
Fixed Targets	#	Name	Target Coordinates	Targ. Coord. Corrections	Fluxes	Miscellaneous				
	(4)	M31-BH4	RA: 00 42 16.0590 (10.5669125d) Dec: +41 19 26.07 (41.32391d) Equinox: J2000		V=25.0+/-5.0	Coordinate Source: Chandra observation				
Exposures	#	Label	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time/[Actual Dur.]	Orbit
	1	BH4-off	(4) M31-BH4	WFPC2, IMAGE, PC1-FIX	F439W	CR-SPLIT=NO; ATD-GAIN=15		Pattern 1-1 (2)	700.0 Secs X 3	
								[==>700.0 Secs (Pattern 1, Copy 1)]	[1]	
								[==>700.0 Secs (Pattern 1, Copy 2)]		
								[==>700.0 Secs (Pattern 1, Copy 3)]		
								[==>700.0 Secs (Pattern 2, Copy 1)]	[2]	
								[==>700.0 Secs (Pattern 2, Copy 2)]		
								[==>700.0 Secs (Pattern 2, Copy 3)]		
								[==>700.0 Secs (Pattern 3, Copy 1)]	[3]	
								[==>700.0 Secs (Pattern 3, Copy 2)]		
								[==>700.0 Secs (Pattern 3, Copy 3)]		
								[==>700.0 Secs (Pattern 4, Copy 1)]	[4]	
								[==>700.0 Secs (Pattern 4, Copy 2)]		
								[==>700.0 Secs (Pattern 4, Copy 3)]		

