



## 10615 - Timing Studies of the X-ray Binary Populations in Globular Clusters

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	(1) NGC362	ACS/WFC	5	20-Jun-2005 12:42:17.0	yes
02	(2) NGC5904	ACS/WFC	5	20-Jun-2005 12:42:46.0	yes
03	(3) NGC6121	ACS/WFC	5	20-Jun-2005 12:43:12.0	yes
04	(4) NGC6341	ACS/WFC	5	20-Jun-2005 12:43:37.0	yes
05	(5) NGC6541	ACS/WFC	5	20-Jun-2005 12:44:03.0	yes

25 Total Orbits Used

**ABSTRACT**

Close binaries are fundamental to the dynamical stability and evolution of globular clusters, but large populations have been extremely difficult to identify. Chandra X-ray images provide a revolutionary resource, revealing a few to dozens of low-luminosity X-ray sources in every cluster deeply examined; our own Chandra programs uniformly study these ubiquitous X-ray sources (close binaries and their progeny) in a dozen clusters. We have obtained multicolor, single-epoch, ACS images, from which to obtain initial optical counterparts, especially CVs (the dominant population in most clusters), BY Dra's, and qLMXBs. As HST capability for follow-on, confirming, spectra of our multicolor-selected counterparts is now severely curtailed, we propose an ACS time-series imaging program that will yield equivalent follow-on information for 5 of our clusters. The proposed ACS time-series data with 6 min resolution and 8 hr time-span, will: provide variability information to secure our suggested multicolor identifications; allow secure classifications of the various X-ray subpopulations (e.g., CVs vs. BY Dra's); yield quality lightcurves, whose shape will help test the notion that magnetic CVs are more common in globular clusters than the field; and, provide interesting constraints on the period distributions of cluster X-ray binaries.

**OBSERVING DESCRIPTION**

ACS B-band time series images (typically 6 exposures of about 340s each per orbit) will be taken during 5 orbits in each of 5 globular clusters observed previously with Chandra and HST. Dithers are used to improve data quality and fill the ACS chip gaps.

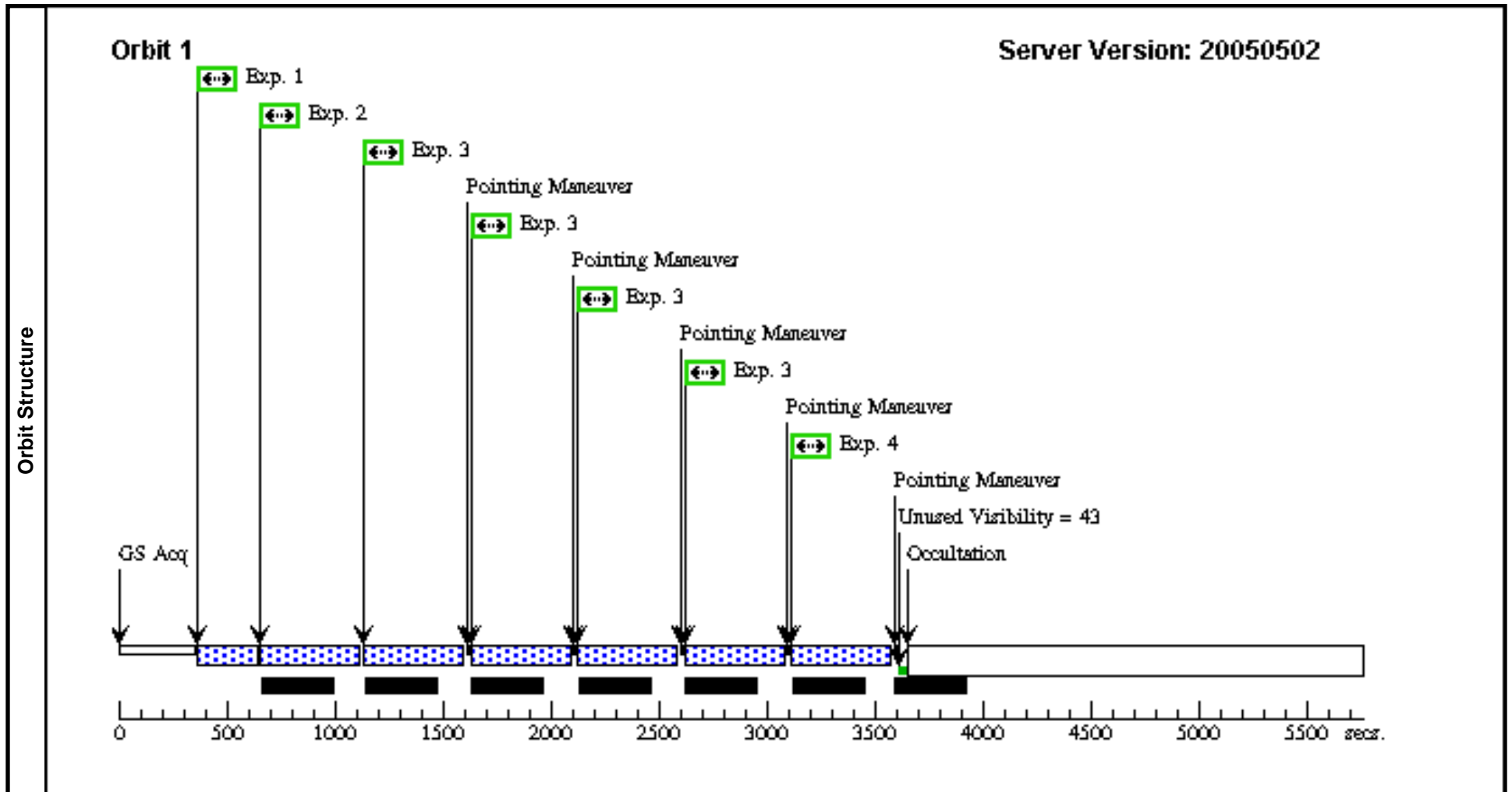
Proposal 10615 - Visit 01 - Timing Studies of the X-ray Binary Populations in Globular Clusters

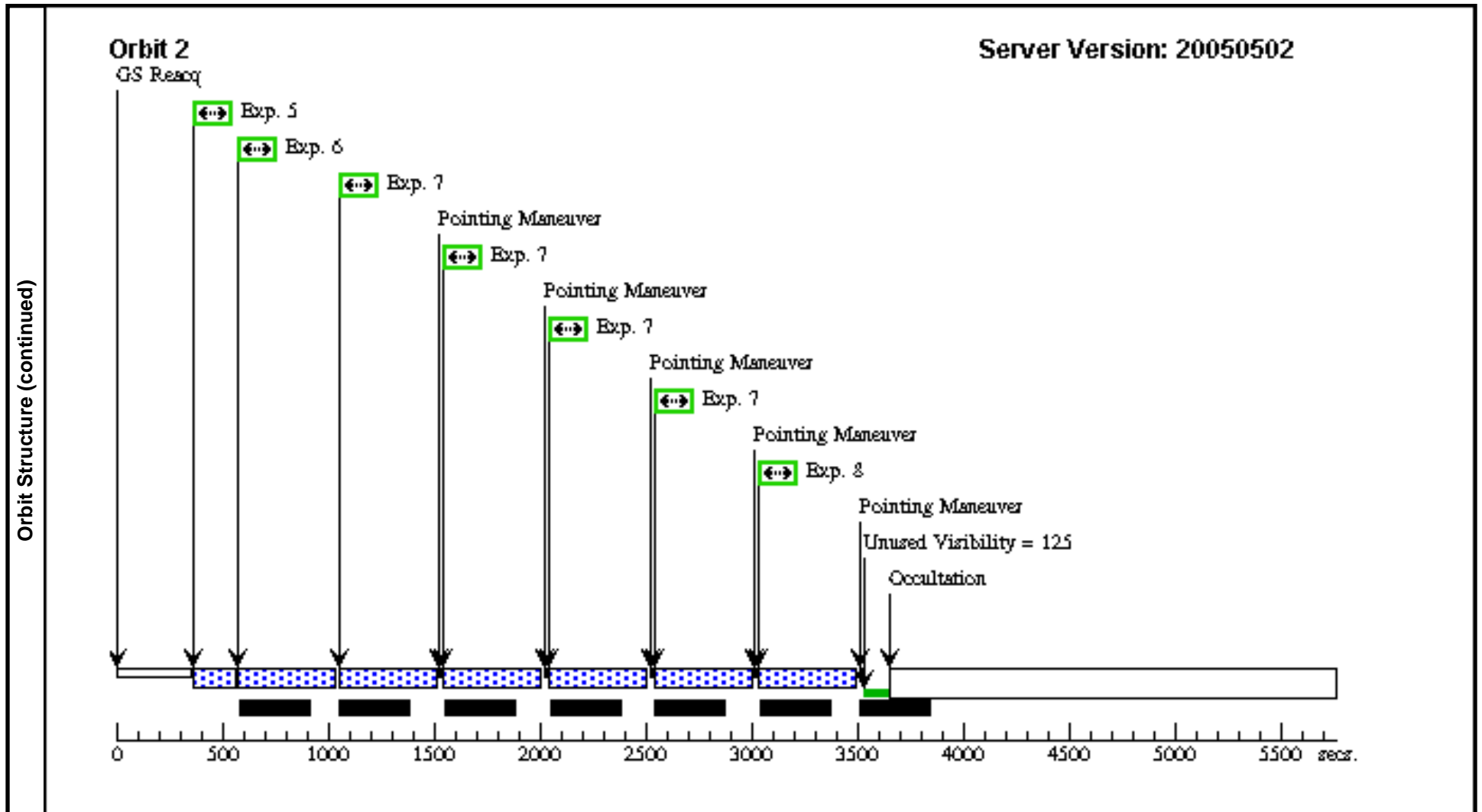
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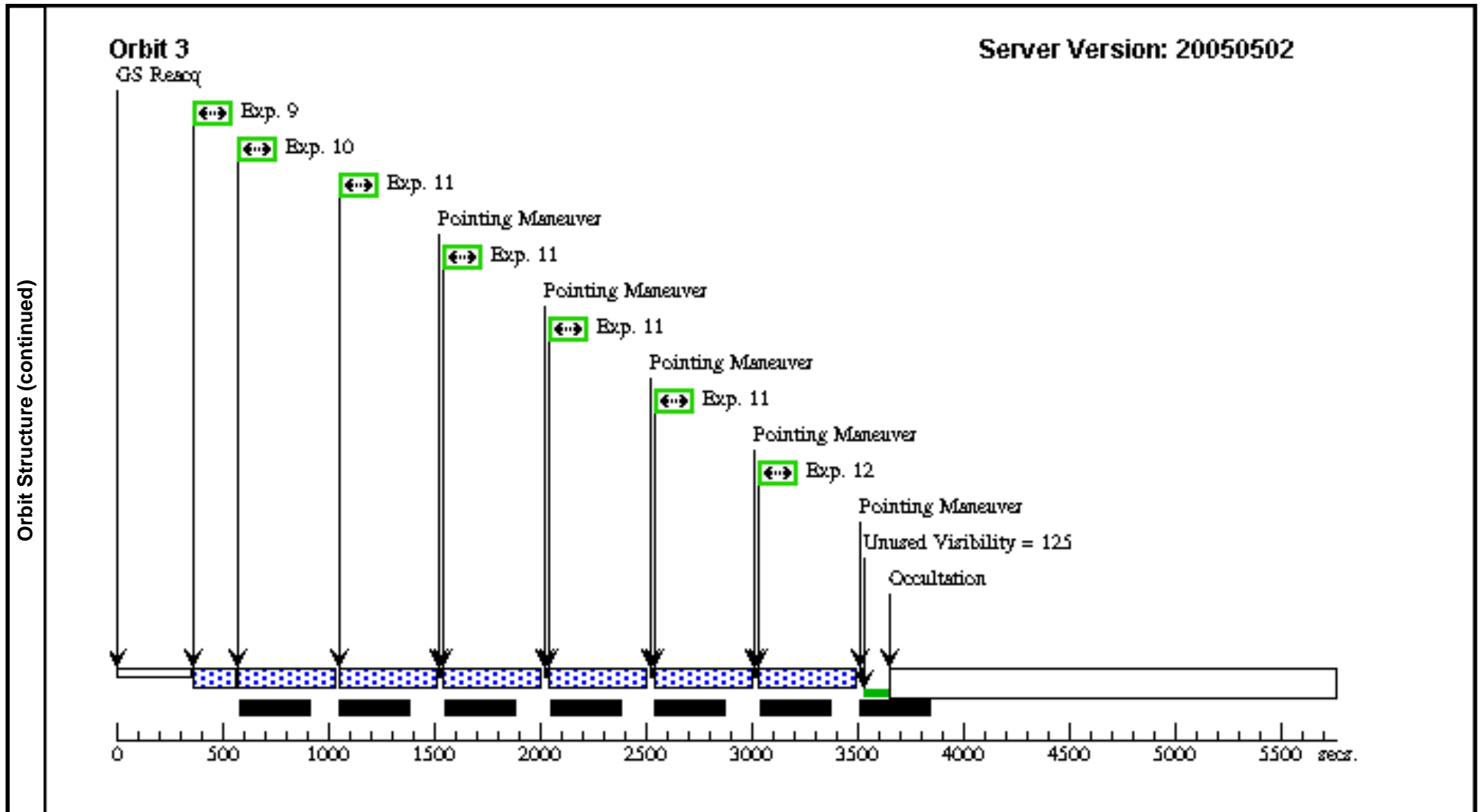
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Fixed Targets	#	Name	Target Coordinates	Targ. Coord. Corrections	Fluxes	Miscellaneous				
	(1)	NGC362	RA: 01 03 14.3000 (15.8095833d) Dec: -70 50 54.00 (-70.84833d) Equinox: J2000 Plate Id: (?)		V=20.0	Coordinate Source: IMAGE_TIED_TO_GSC_FRAME				
Exposures	#	Label	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time/[Actual Dur.]	Orbit
	1		(1) NGC362	ACS/WFC, ACCUM, WFC1	F435W	CR-SPLIT=NO			70.0 Secs [==>]	[1]
	2		(1) NGC362	ACS/WFC, ACCUM, WFC1	F435W	CR-SPLIT=NO			340.0 Secs [==>]	[1]
	3		(1) NGC362	ACS/WFC, ACCUM, WFC1	F435W	CR-SPLIT=NO		Pattern 3-3 (1)	340.0 Secs [==>(Pattern 1)] [==>(Pattern 2)] [==>(Pattern 3)] [==>(Pattern 4)]	[1]
	4		(1) NGC362	ACS/WFC, ACCUM, WFC1	F435W	CR-SPLIT=NO	SAME POS AS 8		340.0 Secs [==>]	[1]
	5		(1) NGC362	ACS/WFC, ACCUM, WFC1	F435W	CR-SPLIT=NO	SAME POS AS 1		70.0 Secs [==>]	[2]
	6		(1) NGC362	ACS/WFC, ACCUM, WFC1	F435W	CR-SPLIT=NO	SAME POS AS 1		340.0 Secs [==>]	[2]
	7		(1) NGC362	ACS/WFC, ACCUM, WFC1	F435W	CR-SPLIT=NO		Pattern 7-7 (1)	340.0 Secs [==>(Pattern 1)] [==>(Pattern 2)] [==>(Pattern 3)] [==>(Pattern 4)]	[2]

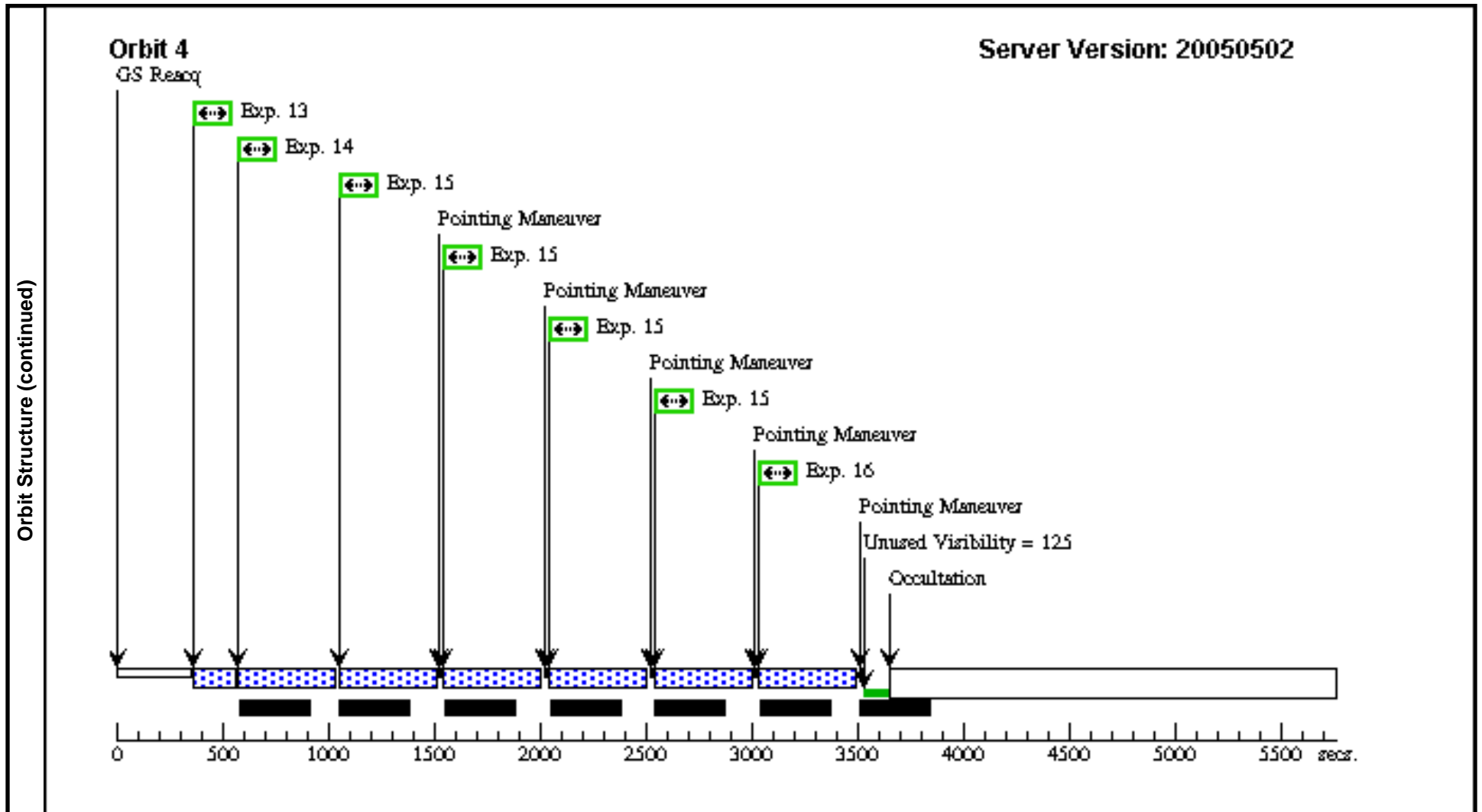
Proposal 10615 - Visit 01 - Timing Studies of the X-ray Binary Populations in Globular Clusters

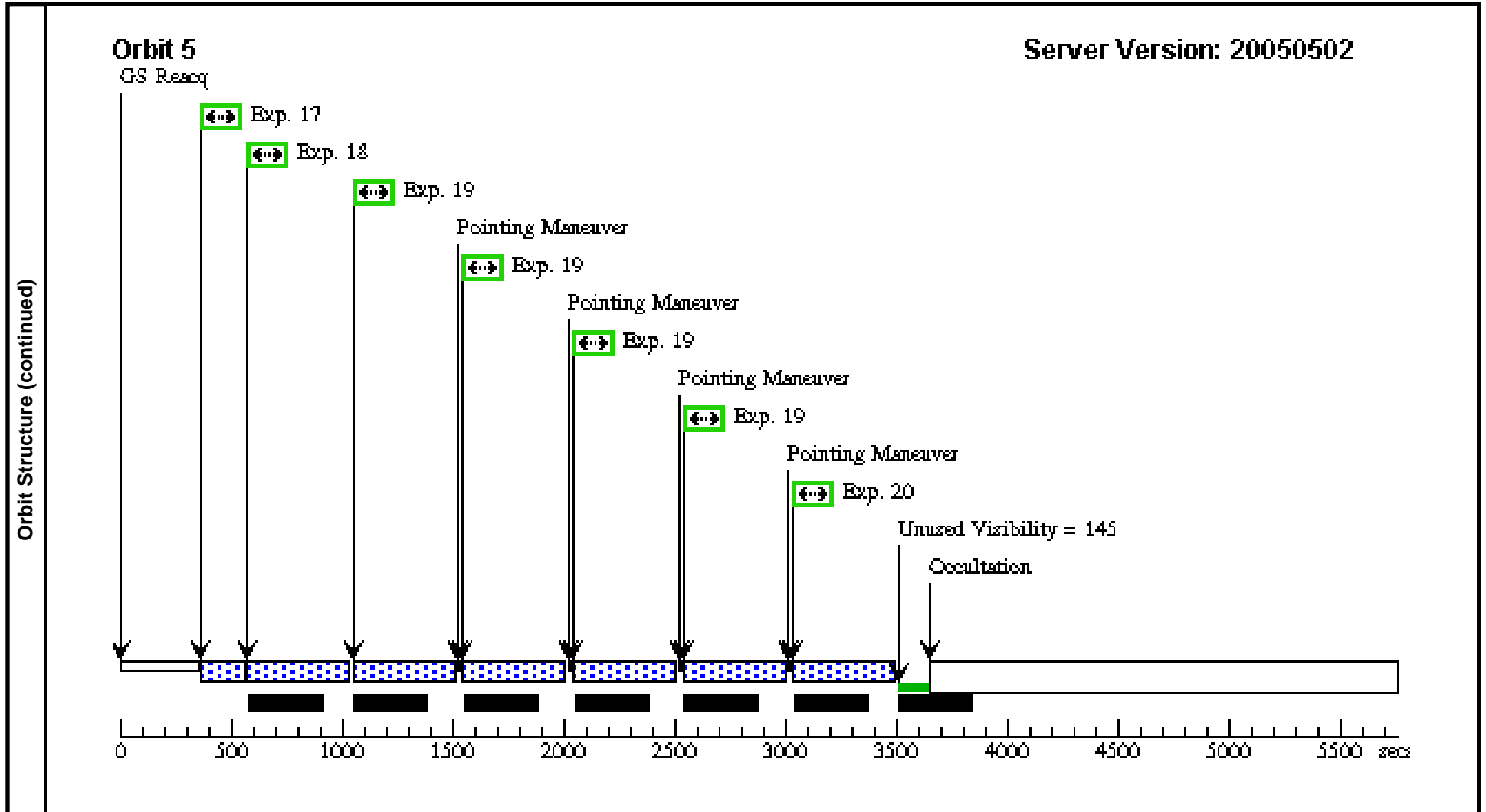
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Exposures (continued)	8	(1) NGC362	ACS/WFC, ACCUM, WFC1	F435W	CR-SPLIT=NO	POS TARG -0.124,0 .138		340.0 Secs [==>]	[2]
	9	(1) NGC362	ACS/WFC, ACCUM, WFC1	F435W	CR-SPLIT=NO	SAME POS AS 1		70.0 Secs [==>]	[3]
	10	(1) NGC362	ACS/WFC, ACCUM, WFC1	F435W	CR-SPLIT=NO	SAME POS AS 1		340.0 Secs [==>]	[3]
	11	(1) NGC362	ACS/WFC, ACCUM, WFC1	F435W	CR-SPLIT=NO		Pattern 11-11 (1)	340.0 Secs [==>(Pattern 1)] [==>(Pattern 2)] [==>(Pattern 3)] [==>(Pattern 4)]	[3]
	12	(1) NGC362	ACS/WFC, ACCUM, WFC1	F435W	CR-SPLIT=NO	SAME POS AS 8		340.0 Secs [==>]	[3]
	13	(1) NGC362	ACS/WFC, ACCUM, WFC1	F435W	CR-SPLIT=NO	SAME POS AS 1		70.0 Secs [==>]	[4]
	14	(1) NGC362	ACS/WFC, ACCUM, WFC1	F435W	CR-SPLIT=NO	SAME POS AS 1		340.0 Secs [==>]	[4]
	15	(1) NGC362	ACS/WFC, ACCUM, WFC1	F435W	CR-SPLIT=NO		Pattern 15-15 (1)	340.0 Secs [==>(Pattern 1)] [==>(Pattern 2)] [==>(Pattern 3)] [==>(Pattern 4)]	[4]
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	17	(1) NGC362	ACS/WFC, ACCUM, WFC1	F435W	CR-SPLIT=NO	SAME POS AS 1		70.0 Secs [==>]	[5]
	18	(1) NGC362	ACS/WFC, ACCUM, WFC1	F435W	CR-SPLIT=NO	SAME POS AS 1		340.0 Secs [==>]	[5]
	19	(1) NGC362	ACS/WFC, ACCUM, WFC1	F435W	CR-SPLIT=NO		Pattern 19-19 (1)	340.0 Secs [==>(Pattern 1)] [==>(Pattern 2)] [==>(Pattern 3)] [==>(Pattern 4)]	[5]
	20	(1) NGC362	ACS/WFC, ACCUM, WFC1	F435W	CR-SPLIT=NO	SAME POS AS 8		340.0 Secs [==>]	[5]











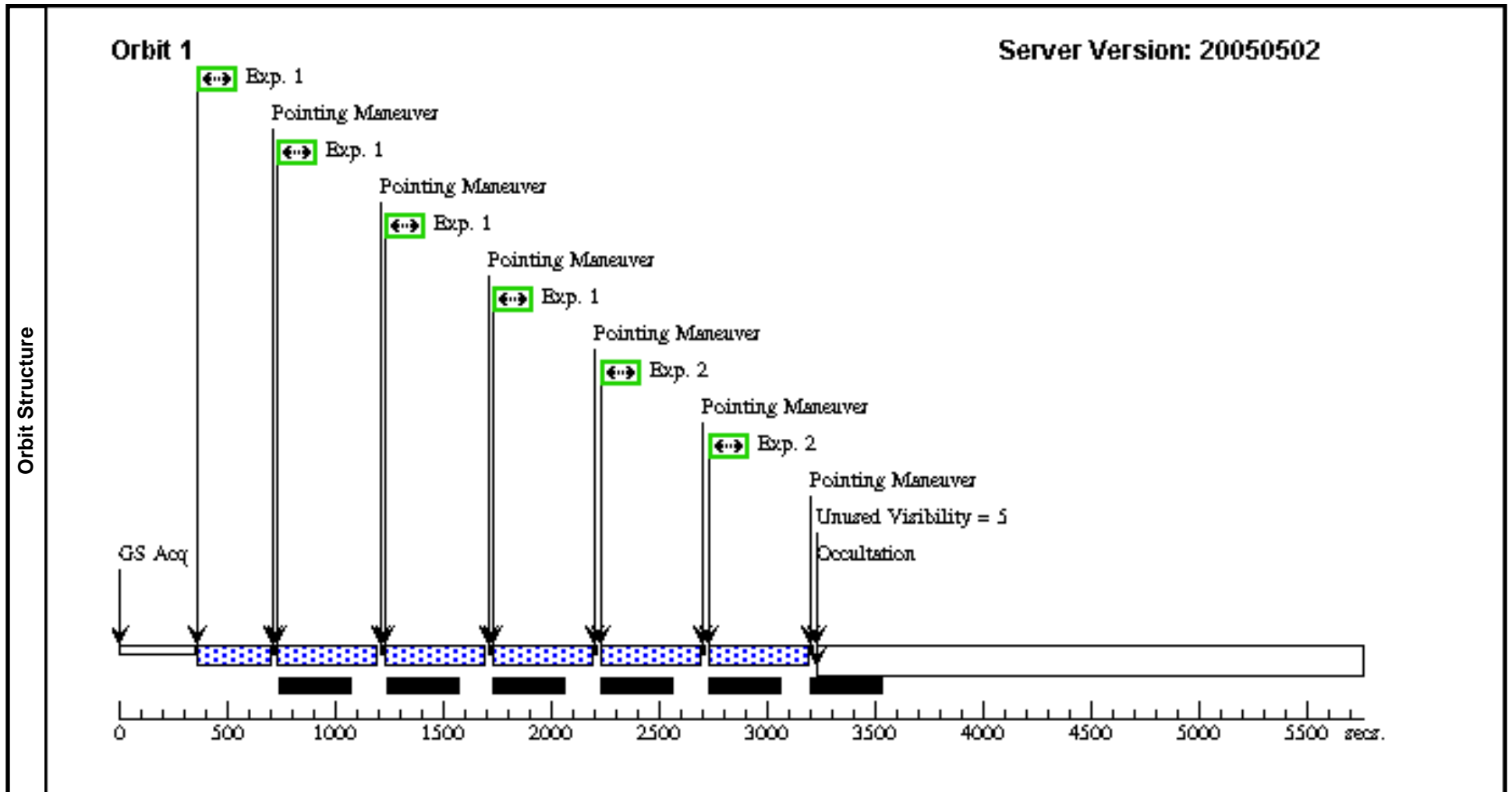
Proposal 10615 - Visit 02 - Timing Studies of the X-ray Binary Populations in Globular Clusters

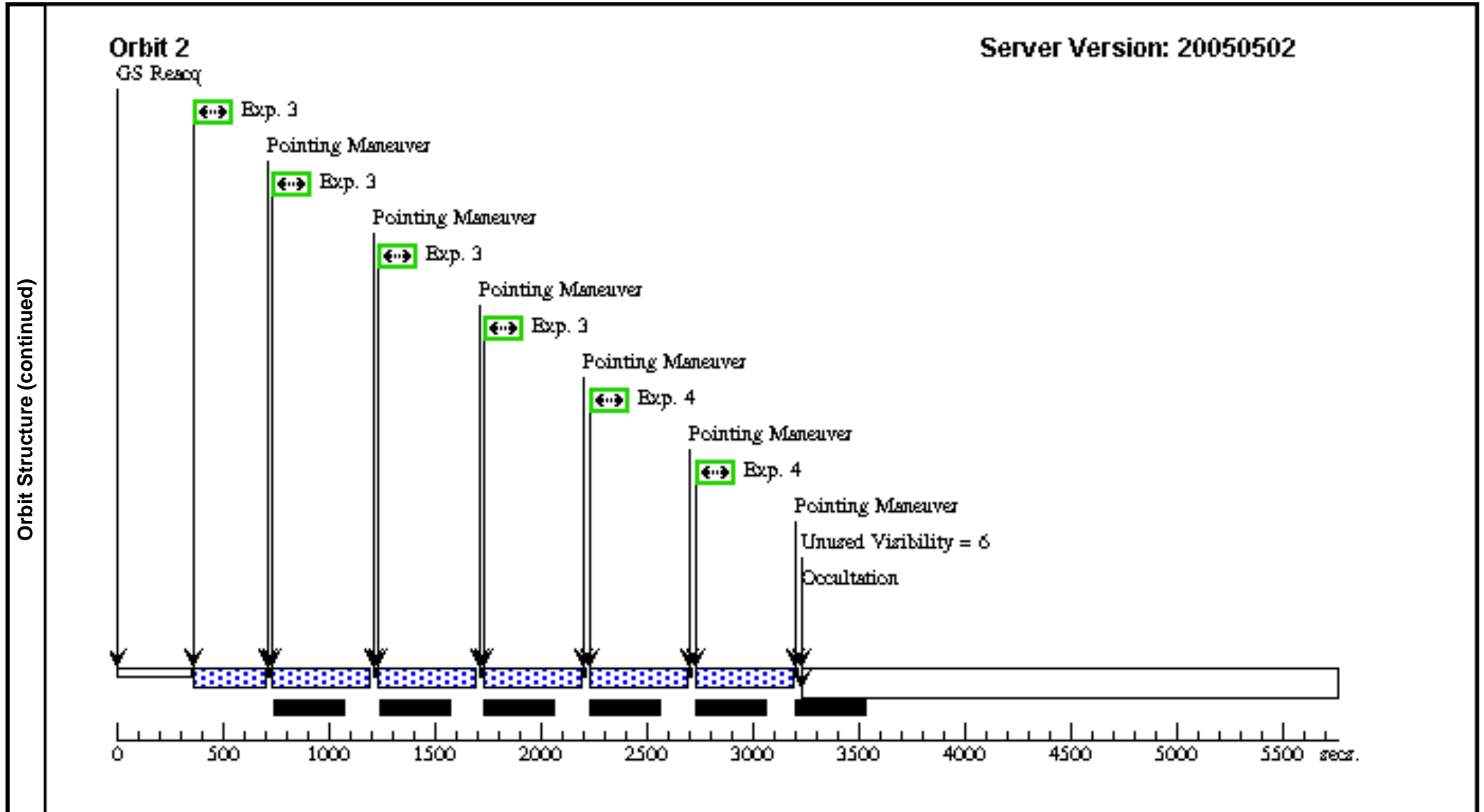
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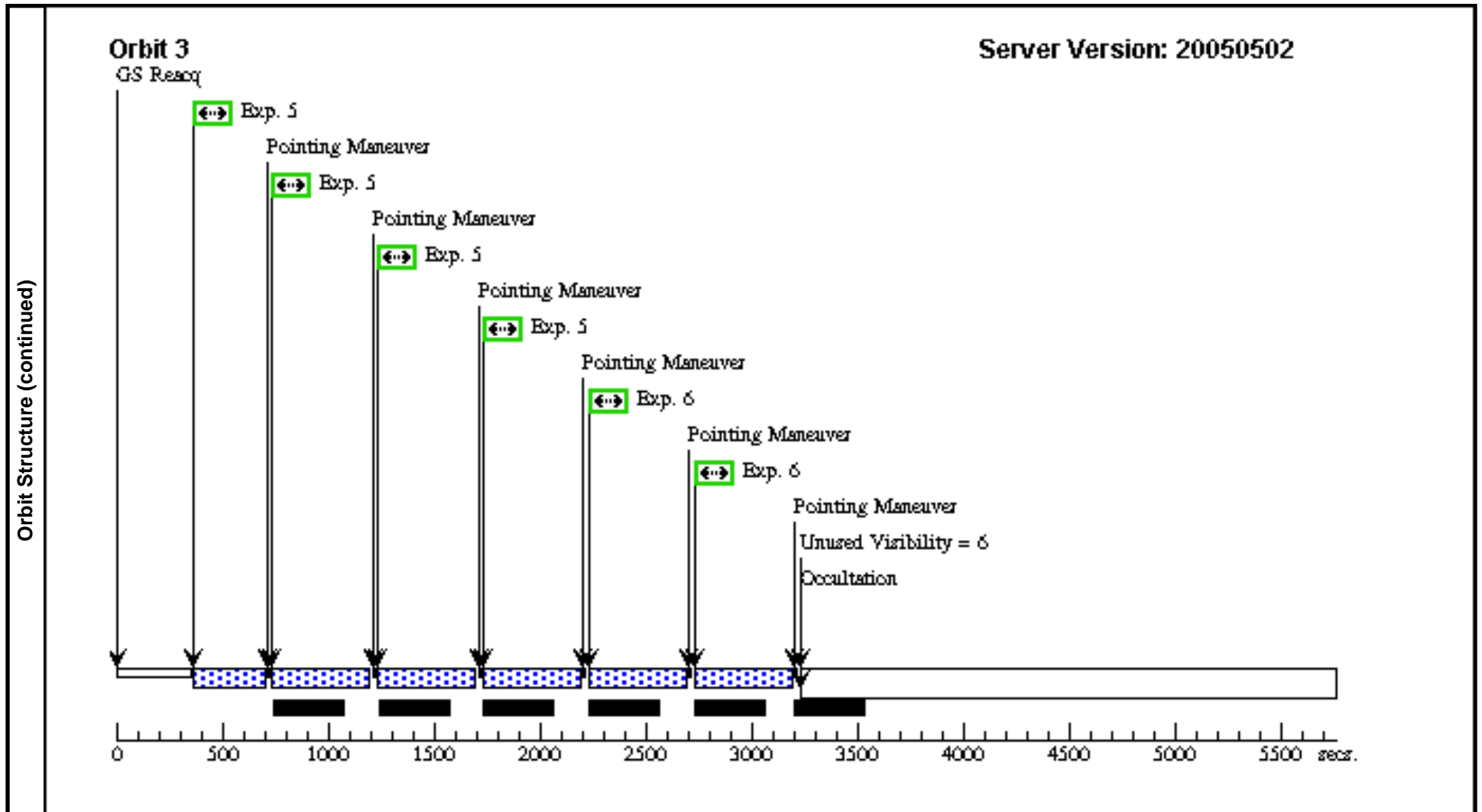
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Fixed Targets	#	Name	Target Coordinates	Targ. Coord. Corrections	Fluxes	Miscellaneous				
	(2)	NGC5904	RA: 15 18 33.8000 (229.6408333d) Dec: +02 04 58.00 (2.08278d) Equinox: J2000 Plate Id: (?)		V=20.0	Coordinate Source: IMAGE_TIED_TO_GSC_FRAME				
Exposures	#	Label	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time/[Actual Dur.]	Orbit
	1		(2) NGC5904	ACS/WFC, ACCUM, WFC	F435W	CR-SPLIT=NO		Pattern 1-1 (1)	200.0 Secs [==>130.0 Secs (Pattern 1)] [==>340.0 Secs (Pattern 2)] [==>340.0 Secs (Pattern 3)] [==>340.0 Secs (Pattern 4)]	[1]
	2		(2) NGC5904	ACS/WFC, ACCUM, WFC	F435W	CR-SPLIT=NO	POS TARG 0.248,3.001	Pattern 2-2 (2)	340.0 Secs [==>(Pattern 1)] [==>(Pattern 2)]	[1]
	3		(2) NGC5904	ACS/WFC, ACCUM, WFC	F435W	CR-SPLIT=NO	POS TARG 0.248,3.001	Pattern 3-3 (1)	340.0 Secs [==>215.0 Secs (Pattern 1)] [==>340.0 Secs (Pattern 2)] [==>340.0 Secs (Pattern 3)] [==>340.0 Secs (Pattern 4)]	[2]

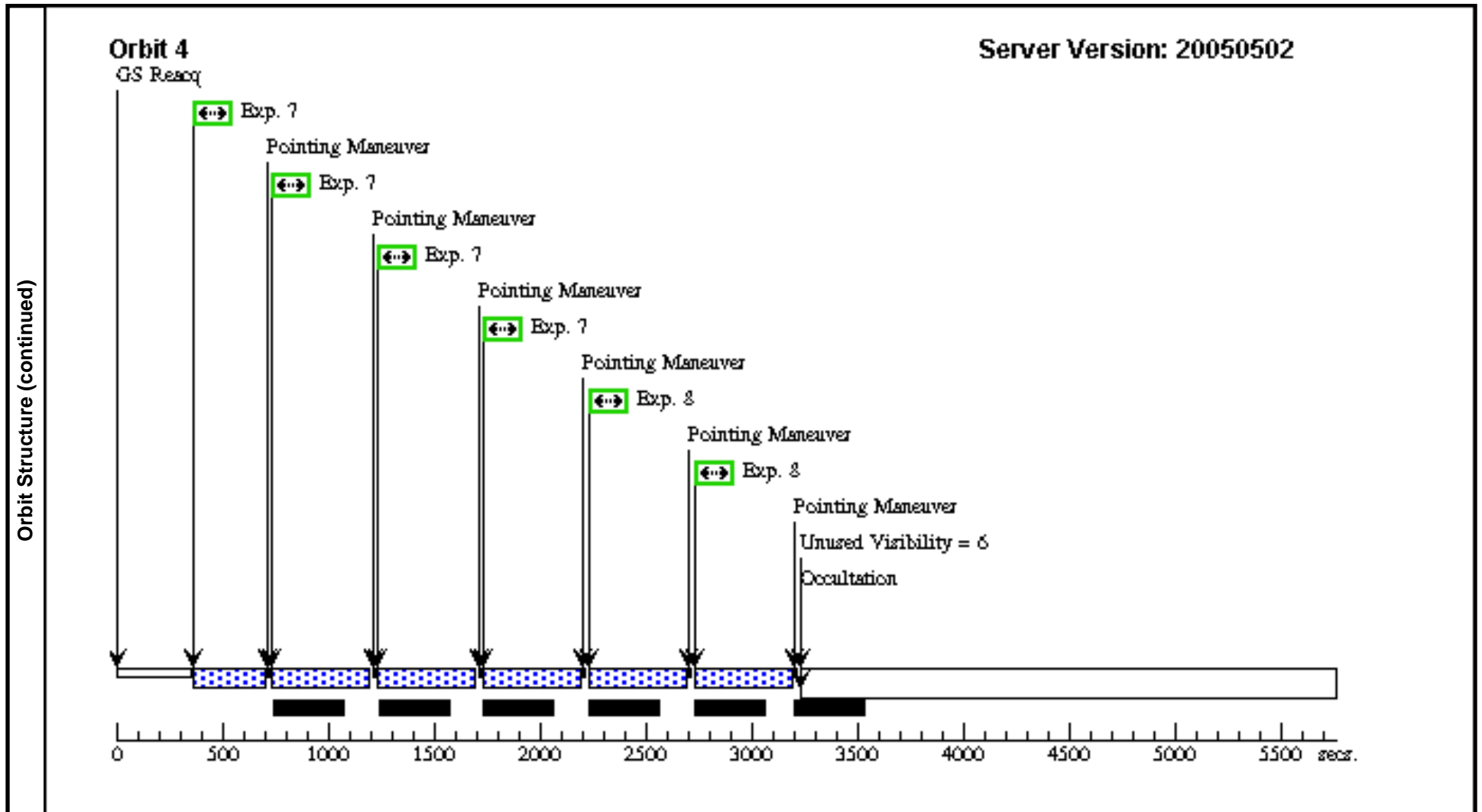
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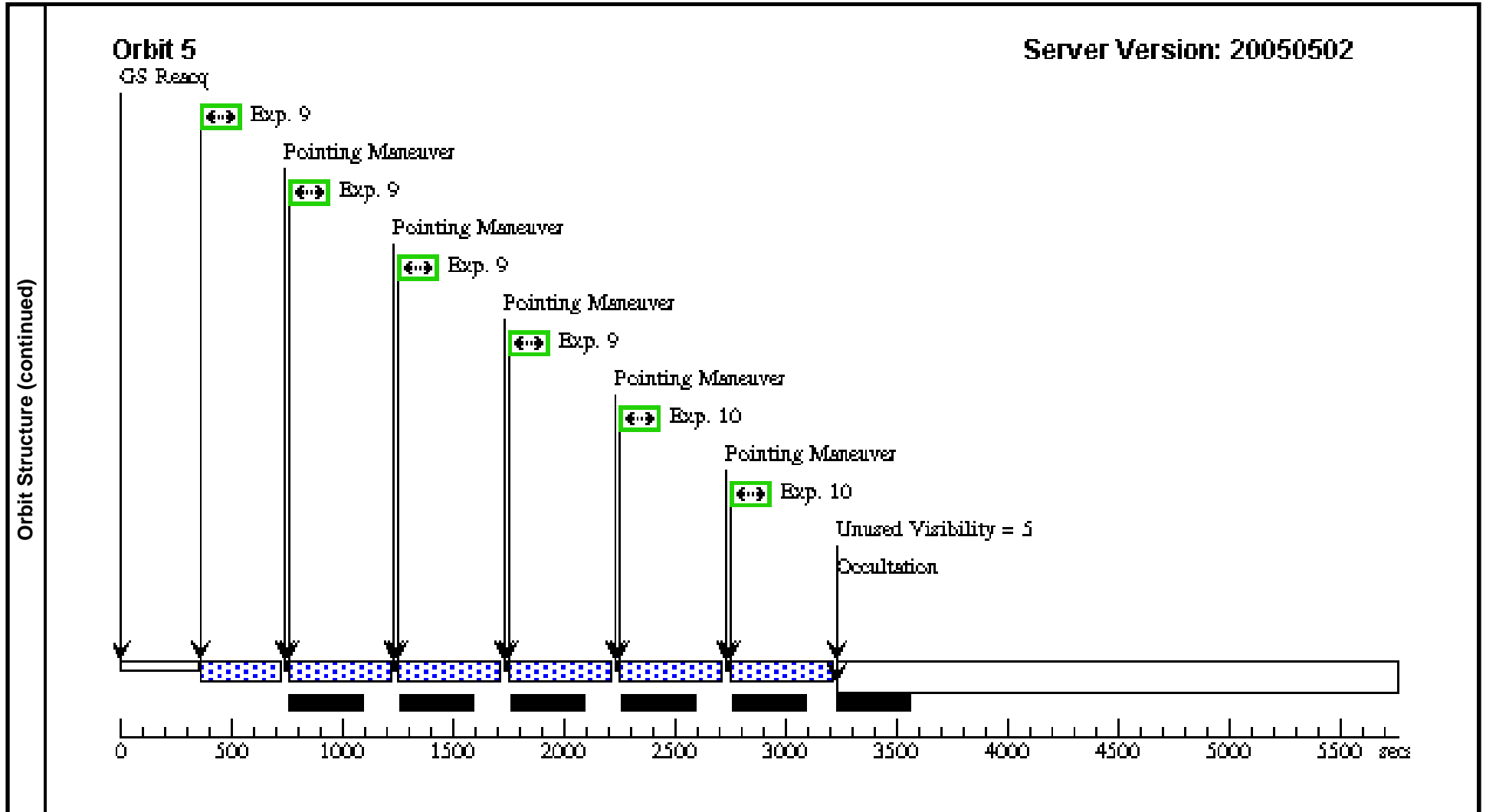
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Exposures (continued)	4	(2) NGC5904	ACS/WFC, ACCUM, WFC	F435W	CR-SPLIT=NO	POS TARG 0,0	Pattern 4-4 (2)	340.0 Secs [==>(Pattern 1)] [==>(Pattern 2)]	[2]
	5	(2) NGC5904	ACS/WFC, ACCUM, WFC	F435W	CR-SPLIT=NO		Pattern 5-5 (1)	340.0 Secs [==>215.0 Secs (Pattern 1)] [==>340.0 Secs (Pattern 2)] [==>340.0 Secs (Pattern 3)] [==>340.0 Secs (Pattern 4)]	[3]
	6	(2) NGC5904	ACS/WFC, ACCUM, WFC	F435W	CR-SPLIT=NO	POS TARG 0.248,3.001	Pattern 6-6 (2)	340.0 Secs [==>(Pattern 1)] [==>(Pattern 2)]	[3]
	7	(2) NGC5904	ACS/WFC, ACCUM, WFC	F435W	CR-SPLIT=NO	POS TARG 0.248,3.001	Pattern 7-7 (1)	340.0 Secs [==>215.0 Secs (Pattern 1)] [==>340.0 Secs (Pattern 2)] [==>340.0 Secs (Pattern 3)] [==>340.0 Secs (Pattern 4)]	[4]
	8	(2) NGC5904	ACS/WFC, ACCUM, WFC	F435W	CR-SPLIT=NO	POS TARG 0,0	Pattern 8-8 (2)	340.0 Secs [==>(Pattern 1)] [==>(Pattern 2)]	[4]
	9	(2) NGC5904	ACS/WFC, ACCUM, WFC	F435W	CR-SPLIT=NO		Pattern 9-9 (1)	340.0 Secs [==>240.0 Secs (Pattern 1)] [==>340.0 Secs (Pattern 2)] [==>340.0 Secs (Pattern 3)] [==>340.0 Secs (Pattern 4)]	[5]
	10	(2) NGC5904	ACS/WFC, ACCUM, WFC	F435W	CR-SPLIT=NO	POS TARG 0.248,3.001	Pattern 10-10 (2)	340.0 Secs [==>(Pattern 1)] [==>(Pattern 2)]	[5]











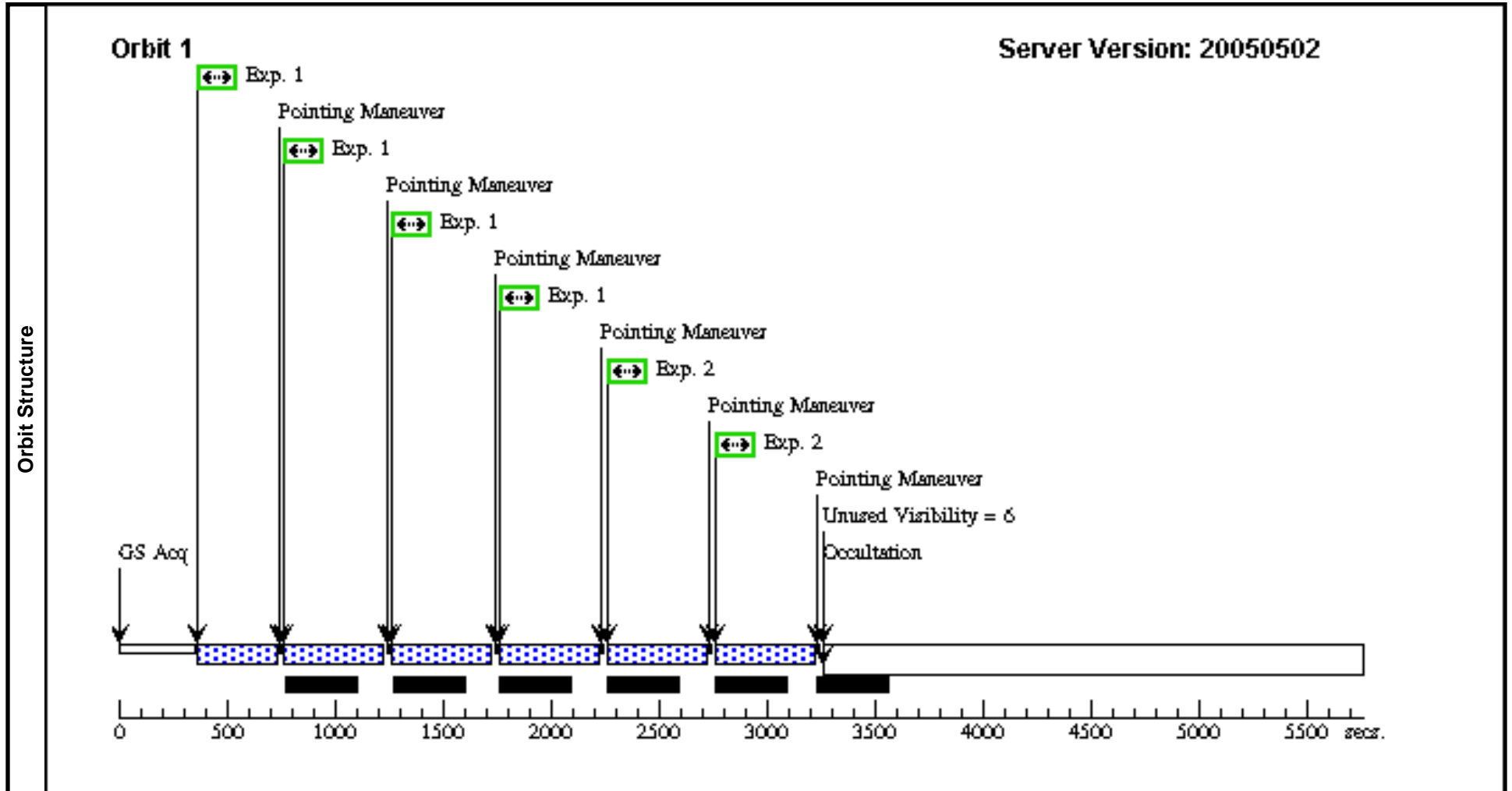
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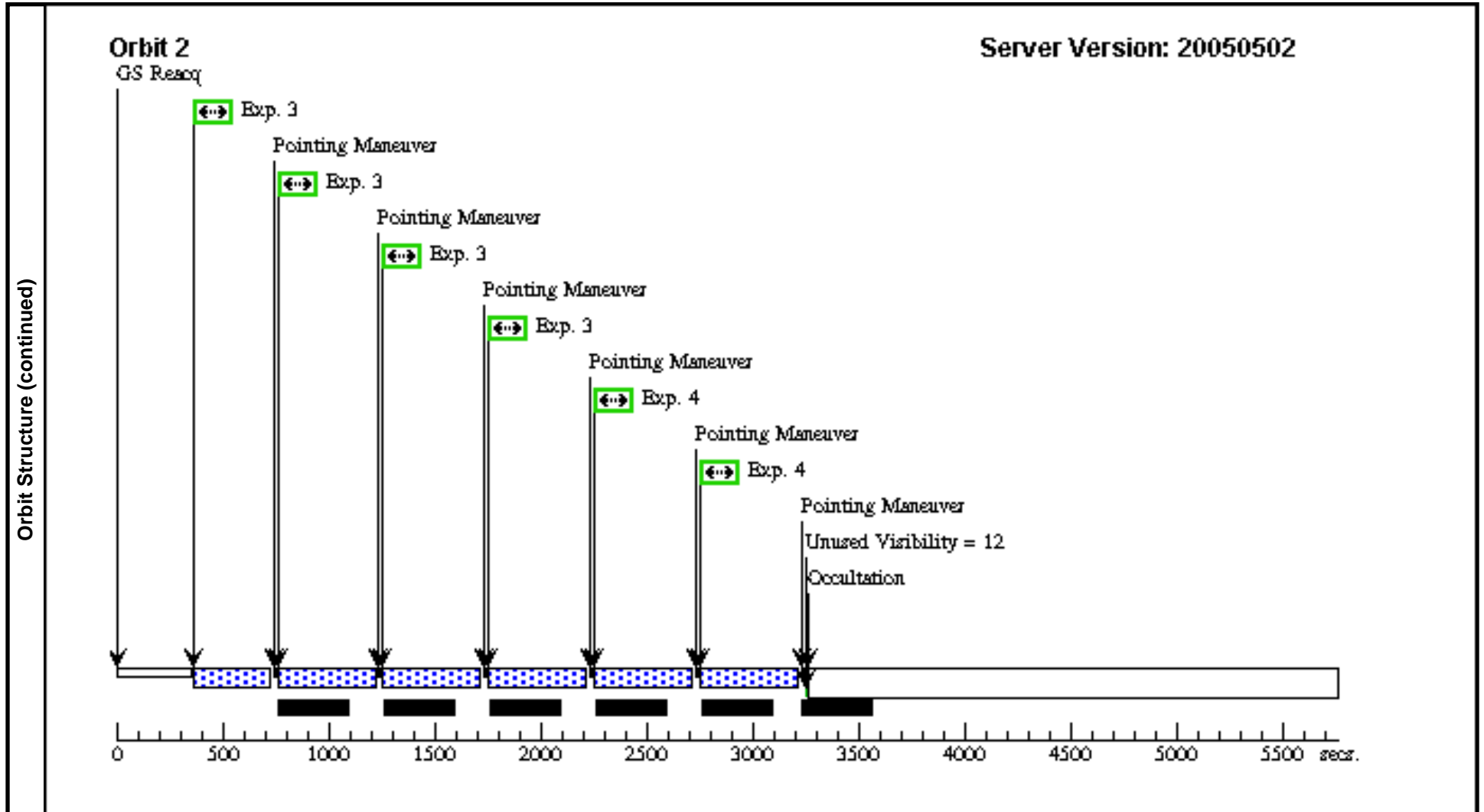
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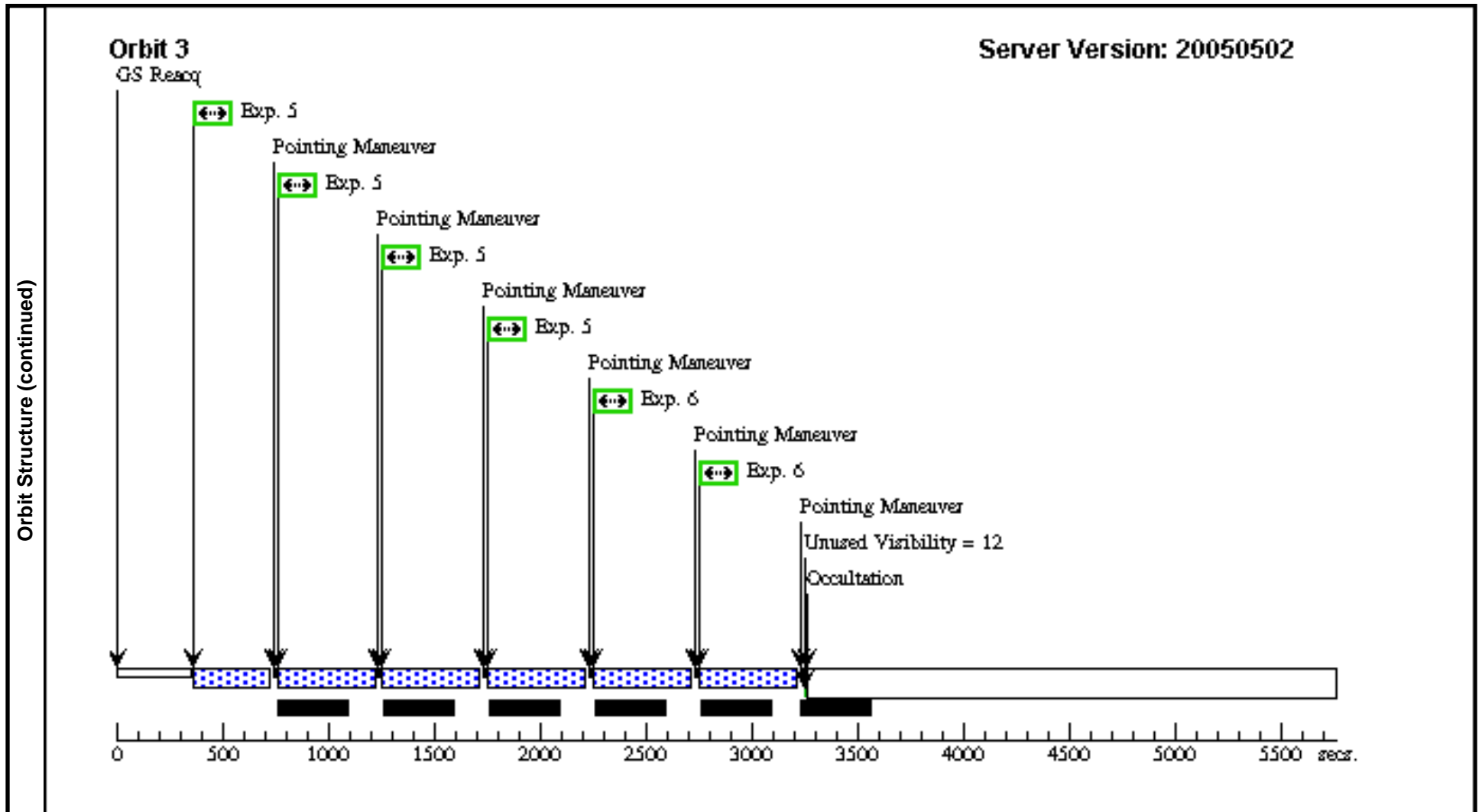
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Fixed Targets	#	Name	Target Coordinates	Targ. Coord. Corrections	Fluxes	Miscellaneous				
	(3)	NGC6121	RA: 16 23 33.1800 (245.8882500d) Dec: -26 31 1.90 (-26.51719d) Equinox: J2000 Plate Id: (?)		V=20.0	Coordinate Source: GSC_SURVEY_PLATE				
Exposures	#	Label	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time/[Actual Dur.]	Orbit
	1		(3) NGC6121	ACS/WFC, ACCUM, WFCENTER	F435W	CR-SPLIT=NO		Pattern 1-1 (1)	200.0 Secs [==>160.0 Secs (Pattern 1)] [==>340.0 Secs (Pattern 2)] [==>340.0 Secs (Pattern 3)] [==>340.0 Secs (Pattern 4)]	[1]
	2		(3) NGC6121	ACS/WFC, ACCUM, WFCENTER	F435W	CR-SPLIT=NO	POS TARG 0.248,3.001	Pattern 2-2 (2)	340.0 Secs [==>340.0 Secs (Pattern 1)] [==>340.0 Secs (Pattern 2)]	[1]
	3		(3) NGC6121	ACS/WFC, ACCUM, WFCENTER	F435W	CR-SPLIT=NO	POS TARG 0.248,3.001	Pattern 3-3 (1)	340.0 Secs [==>240.0 Secs (Pattern 1)] [==>340.0 Secs (Pattern 2)] [==>340.0 Secs (Pattern 3)] [==>340.0 Secs (Pattern 4)]	[2]

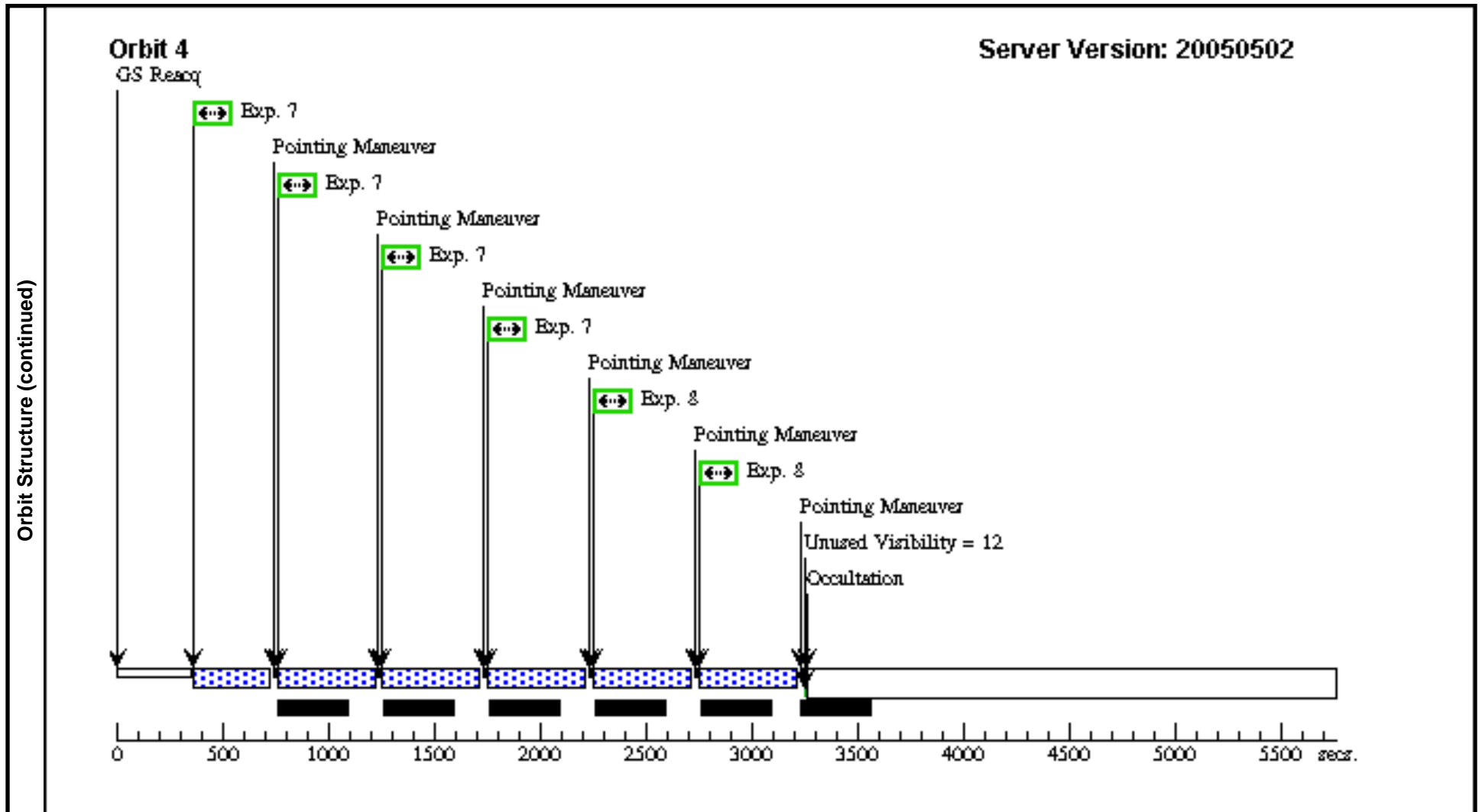
Proposal 10615 - Visit 03 - Timing Studies of the X-ray Binary Populations in Globular Clusters

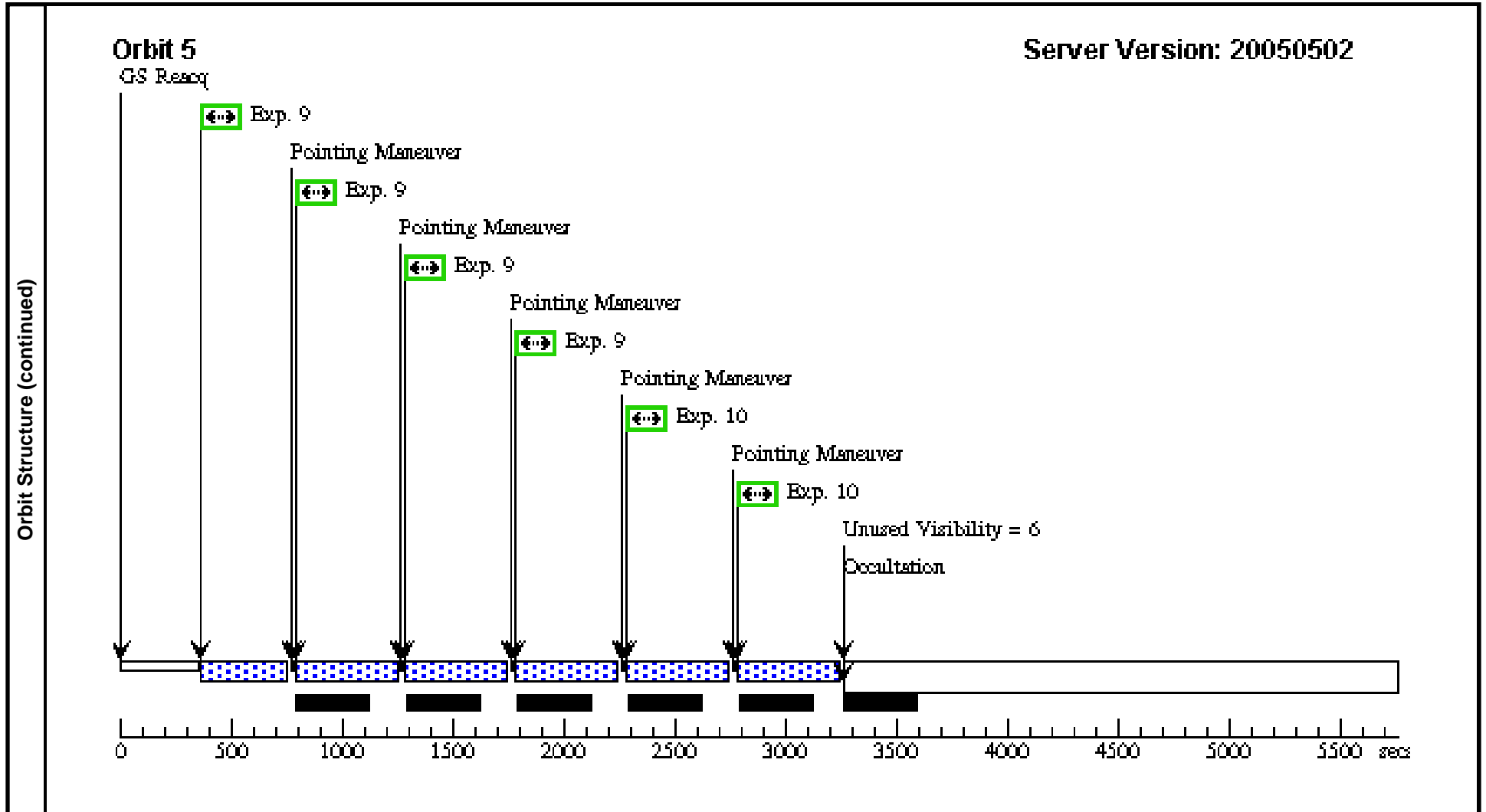
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Exposures (continued)	4	(3) NGC6121	ACS/WFC, ACCUM, WFCENTER	F435W	CR-SPLIT=NO	POS TARG 0,0	Pattern 4-4 (2)	340.0 Secs [==>340.0 Secs (Pattern 1)] [==>340.0 Secs (Pattern 2)]	[2]
	5	(3) NGC6121	ACS/WFC, ACCUM, WFCENTER	F435W	CR-SPLIT=NO		Pattern 5-5 (1)	340.0 Secs [==>240.0 Secs (Pattern 1)] [==>340.0 Secs (Pattern 2)] [==>340.0 Secs (Pattern 3)] [==>340.0 Secs (Pattern 4)]	[3]
	6	(3) NGC6121	ACS/WFC, ACCUM, WFCENTER	F435W	CR-SPLIT=NO	POS TARG 0.248,3.001	Pattern 6-6 (2)	340.0 Secs [==>340.0 Secs (Pattern 1)] [==>340.0 Secs (Pattern 2)]	[3]
	7	(3) NGC6121	ACS/WFC, ACCUM, WFCENTER	F435W	CR-SPLIT=NO	POS TARG 0.248,3.001	Pattern 7-7 (1)	340.0 Secs [==>240.0 Secs (Pattern 1)] [==>340.0 Secs (Pattern 2)] [==>340.0 Secs (Pattern 3)] [==>340.0 Secs (Pattern 4)]	[4]
	8	(3) NGC6121	ACS/WFC, ACCUM, WFCENTER	F435W	CR-SPLIT=NO	POS TARG 0,0	Pattern 8-8 (2)	340.0 Secs [==>340.0 Secs (Pattern 1)] [==>340.0 Secs (Pattern 2)]	[4]
	9	(3) NGC6121	ACS/WFC, ACCUM, WFCENTER	F435W	CR-SPLIT=NO		Pattern 9-9 (1)	340.0 Secs [==>270.0 Secs (Pattern 1)] [==>340.0 Secs (Pattern 2)] [==>340.0 Secs (Pattern 3)] [==>340.0 Secs (Pattern 4)]	[5]
	10	(3) NGC6121	ACS/WFC, ACCUM, WFCENTER	F435W	CR-SPLIT=NO	POS TARG 0.248,3.001	Pattern 10-10 (2)	340.0 Secs [==>340.0 Secs (Pattern 1)] [==>340.0 Secs (Pattern 2)]	[5]











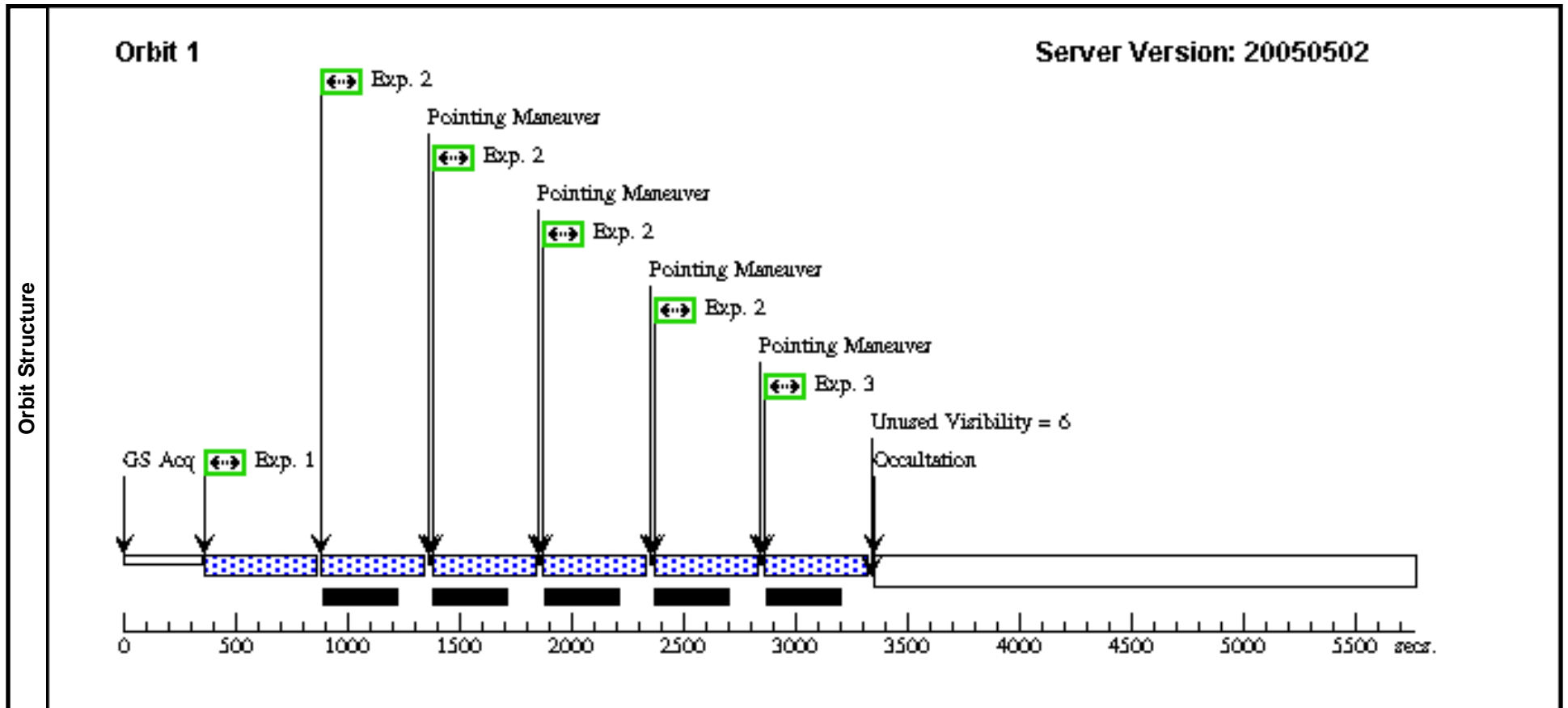
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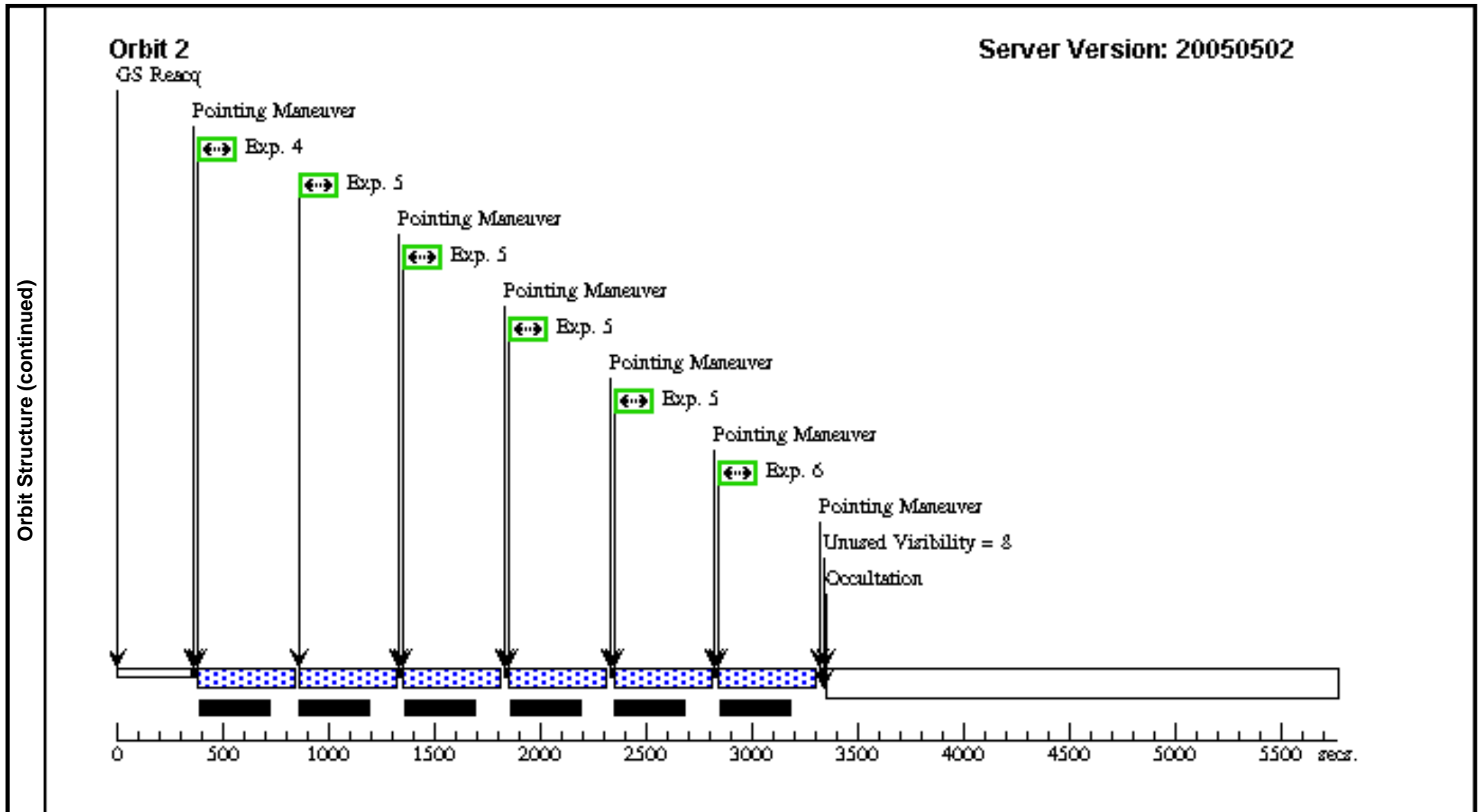
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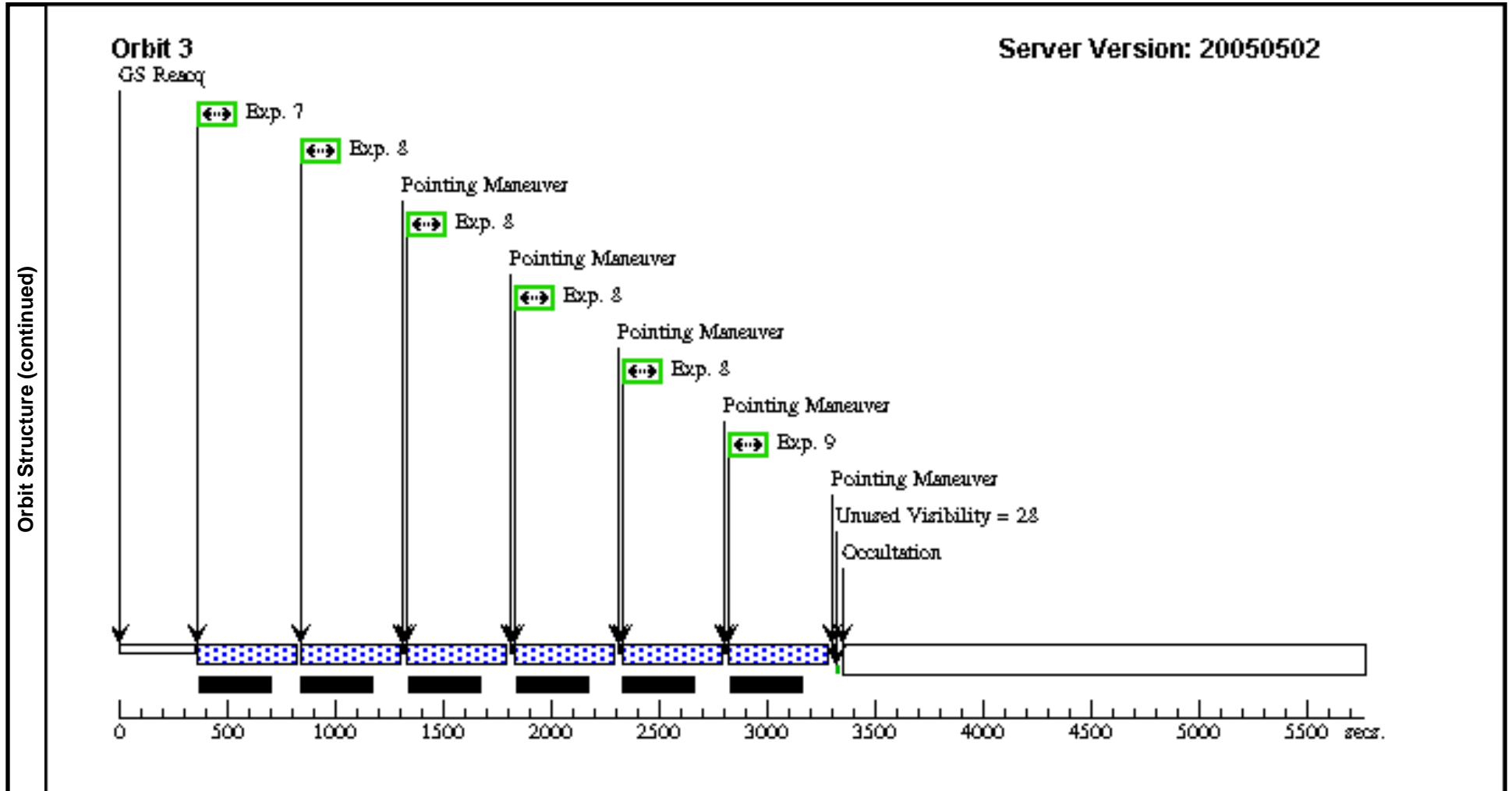
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Fixed Targets	#	Name	Target Coordinates	Targ. Coord. Corrections	Fluxes	Miscellaneous				
	(4)	NGC6341	RA: 17 17 7.3000 (259.2804167d) Dec: +43 08 11.50 (43.13653d) Equinox: J2000 Plate Id: (?)		V=20.0	Coordinate Source: IMAGE_TIED_TO_GSC_FRAME				
Exposures	#	Label	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time/[Actual Dur.]	Orbit
	1		(4) NGC6341	ACS/WFC, ACCUM, WFC1	F435W	CR-SPLIT=NO			300.0 Secs	
									[==>]	[1]
	2		(4) NGC6341	ACS/WFC, ACCUM, WFC1	F435W	CR-SPLIT=NO		Pattern 2-2 (1)	340.0 Secs	
									[==>(Pattern 1)]	
									[==>(Pattern 2)]	
									[==>(Pattern 3)]	[1]
									[==>(Pattern 4)]	
3		(4) NGC6341	ACS/WFC, ACCUM, WFC1	F435W	CR-SPLIT=NO	SAME POS AS 6		340.0 Secs		
								[==>]	[1]	
4		(4) NGC6341	ACS/WFC, ACCUM, WFC1	F435W	CR-SPLIT=NO	SAME POS AS 1		340.0 Secs		
								[==>]	[2]	
5		(4) NGC6341	ACS/WFC, ACCUM, WFC1	F435W	CR-SPLIT=NO		Pattern 5-5 (1)	340.0 Secs		
								[==>(Pattern 1)]		
								[==>(Pattern 2)]		
								[==>(Pattern 3)]	[2]	
								[==>(Pattern 4)]		
6		(4) NGC6341	ACS/WFC, ACCUM, WFC1	F435W	CR-SPLIT=NO	POS TARG -0.124,0 .138		340.0 Secs		
								[==>]	[2]	
7		(4) NGC6341	ACS/WFC, ACCUM, WFC1	F435W	CR-SPLIT=NO	SAME POS AS 1		340.0 Secs		
								[==>]	[3]	

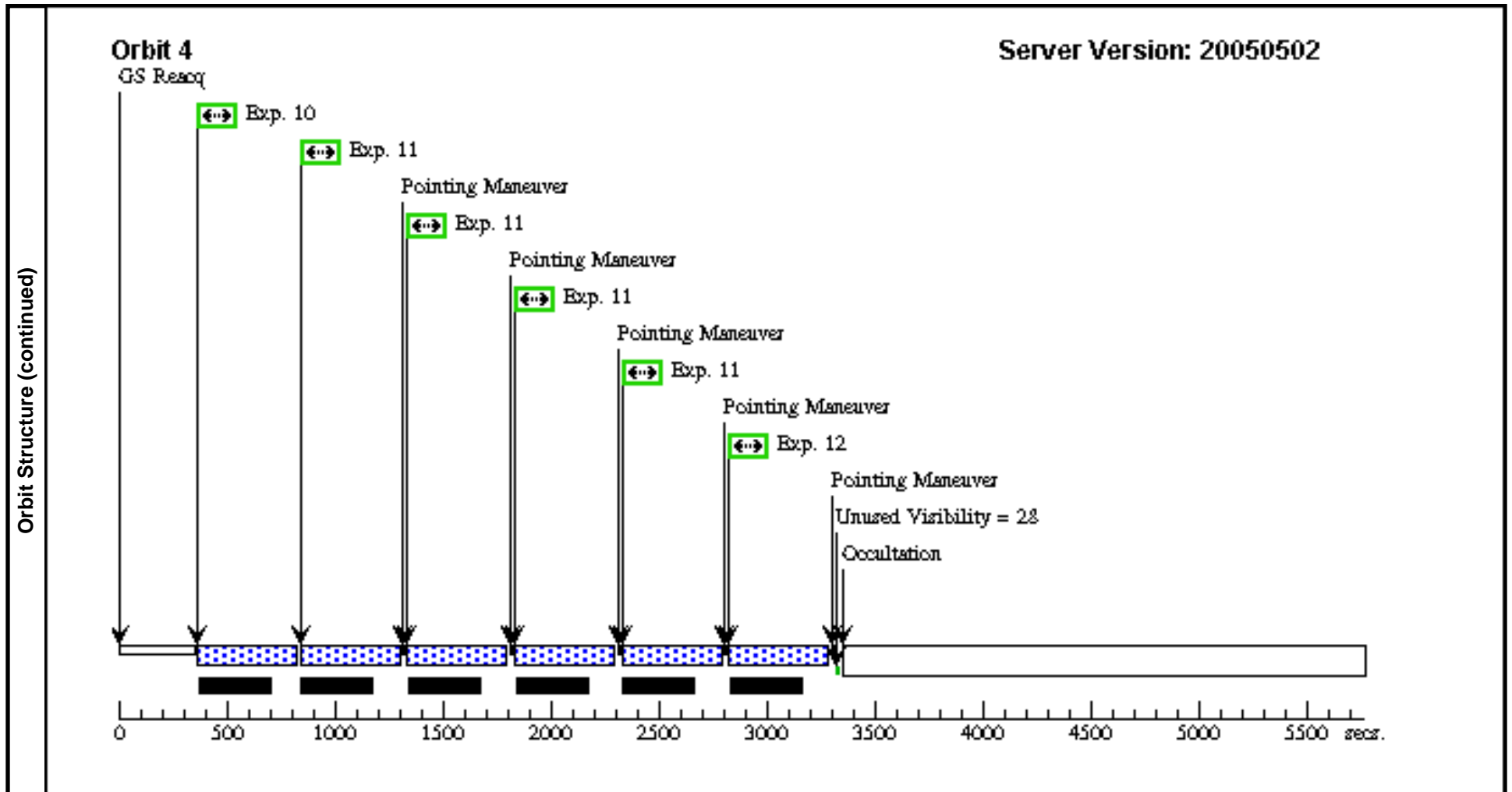
Proposal 10615 - Visit 04 - Timing Studies of the X-ray Binary Populations in Globular Clusters

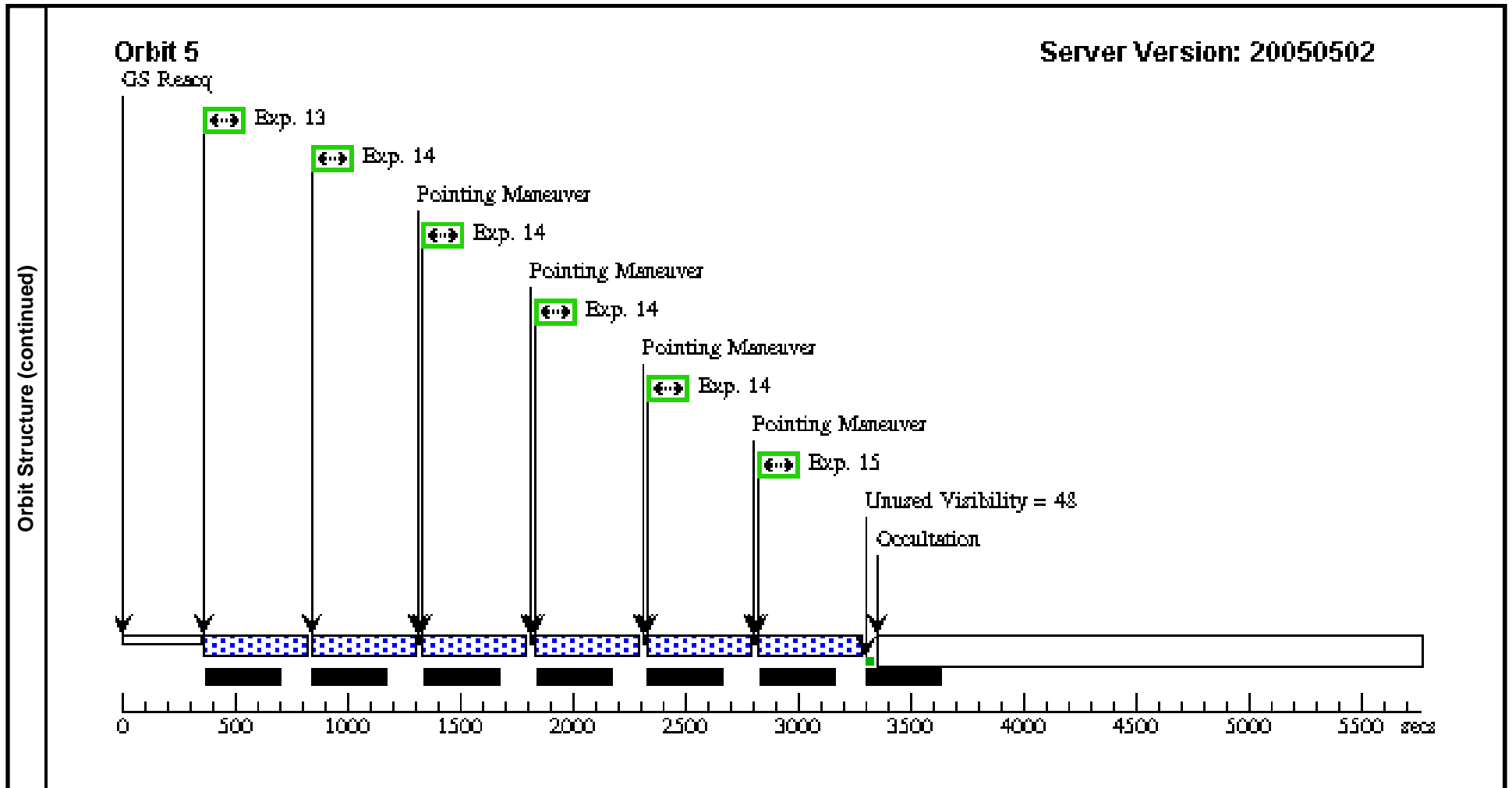
#	Label	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time/[Actual Dur.]	Orbit
Exposures (continued)	8	(4) NGC6341	ACS/WFC, ACCUM, WFC1	F435W	CR-SPLIT=NO		Pattern 8-8 (1)	340.0 Secs [==>(Pattern 1)] [==>(Pattern 2)] [==>(Pattern 3)] [==>(Pattern 4)]	[3]
	9	(4) NGC6341	ACS/WFC, ACCUM, WFC1	F435W	CR-SPLIT=NO	SAME POS AS 6		340.0 Secs [==>]	[3]
	10	(4) NGC6341	ACS/WFC, ACCUM, WFC1	F435W	CR-SPLIT=NO	SAME POS AS 1		340.0 Secs [==>]	[4]
	11	(4) NGC6341	ACS/WFC, ACCUM, WFC1	F435W	CR-SPLIT=NO		Pattern 11-11 (1)	340.0 Secs [==>(Pattern 1)] [==>(Pattern 2)] [==>(Pattern 3)] [==>(Pattern 4)]	[4]
	12	(4) NGC6341	ACS/WFC, ACCUM, WFC1	F435W	CR-SPLIT=NO	SAME POS AS 6		340.0 Secs [==>]	[4]
	13	(4) NGC6341	ACS/WFC, ACCUM, WFC1	F435W	CR-SPLIT=NO	SAME POS AS 1		340.0 Secs [==>]	[5]
	14	(4) NGC6341	ACS/WFC, ACCUM, WFC1	F435W	CR-SPLIT=NO		Pattern 14-14 (1)	340.0 Secs [==>(Pattern 1)] [==>(Pattern 2)] [==>(Pattern 3)] [==>(Pattern 4)]	[5]
	15	(4) NGC6341	ACS/WFC, ACCUM, WFC1	F435W	CR-SPLIT=NO	SAME POS AS 6		340.0 Secs [==>]	[5]











Proposal 10615 - Visit 05 - Timing Studies of the X-ray Binary Populations in Globular Clusters

Mon Jun 20 16:44:38 GMT 2005

Visit	<b>Proposal 10615, Visit 05</b> <b>Diagnostic Status: No Diagnostics</b> Scientific Instruments: ACS/WFC Special Requirements: (none) Comments: NGC 6541									
	#	Primary Pattern	Secondary Pattern	Exposures						
Patterns	(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), (3), (5), (7), (9)						
	(2)	Pattern Type=ACS-WFC-DITHER-LINE Purpose=DITHER Number Of Points=2 Point Spacing=3.011 Line Spacing=	Coordinate Frame=POS-TARG Pattern Orientation=85.3 Angle Between Sides= Center Pattern=false	(2), (4), (6), (8), (10)						
Fixed Targets	#	Name	Target Coordinates	Targ. Coord. Corrections	Fluxes	Miscellaneous				
	(5)	NGC6541	RA: 18 08 4.2000 (272.0175000d) Dec: -43 43 15.00 (-43.72083d) Equinox: J2000 Plate Id: (?)		V=20.0	Coordinate Source: IMAGE_TIED_TO_GSC_FRAME				
Exposures	#	Label	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time/[Actual Dur.]	Orbit
	1		(5) NGC6541	ACS/WFC, ACCUM, WFC	F435W	CR-SPLIT=NO		Pattern 1-1 (1)	200.0 Secs [==>270.0 Secs (Pattern 1)] [==>340.0 Secs (Pattern 2)] [==>340.0 Secs (Pattern 3)] [==>340.0 Secs (Pattern 4)]	[1]
	2		(5) NGC6541	ACS/WFC, ACCUM, WFC	F435W	CR-SPLIT=NO	POS TARG 0.248,3.001	Pattern 2-2 (2)	340.0 Secs [==>(Pattern 1)] [==>(Pattern 2)]	[1]
	3		(5) NGC6541	ACS/WFC, ACCUM, WFC	F435W	CR-SPLIT=NO	POS TARG 0.248,3.001	Pattern 3-3 (1)	340.0 Secs [==>330.0 Secs (Pattern 1)] [==>340.0 Secs (Pattern 2)] [==>340.0 Secs (Pattern 3)] [==>340.0 Secs (Pattern 4)]	[2]

Proposal 10615 - Visit 05 - Timing Studies of the X-ray Binary Populations in Globular Clusters

#	Label	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time/[Actual Dur.]	Orbit
Exposures (continued)	4	(5) NGC6541	ACS/WFC, ACCUM, WFC	F435W	CR-SPLIT=NO	POS TARG 0,0	Pattern 4-4 (2)	340.0 Secs [==>(Pattern 1)] [==>(Pattern 2)]	[2]
	5	(5) NGC6541	ACS/WFC, ACCUM, WFC	F435W	CR-SPLIT=NO		Pattern 5-5 (1)	340.0 Secs [==>330.0 Secs (Pattern 1)] [==>340.0 Secs (Pattern 2)] [==>340.0 Secs (Pattern 3)] [==>340.0 Secs (Pattern 4)]	[3]
	6	(5) NGC6541	ACS/WFC, ACCUM, WFC	F435W	CR-SPLIT=NO	POS TARG 0.248,3.001	Pattern 6-6 (2)	340.0 Secs [==>(Pattern 1)] [==>(Pattern 2)]	[3]
	7	(5) NGC6541	ACS/WFC, ACCUM, WFC	F435W	CR-SPLIT=NO	POS TARG 0.248,3.001	Pattern 7-7 (1)	340.0 Secs [==>330.0 Secs (Pattern 1)] [==>340.0 Secs (Pattern 2)] [==>340.0 Secs (Pattern 3)] [==>340.0 Secs (Pattern 4)]	[4]
	8	(5) NGC6541	ACS/WFC, ACCUM, WFC	F435W	CR-SPLIT=NO	POS TARG 0,0	Pattern 8-8 (2)	340.0 Secs [==>(Pattern 1)] [==>(Pattern 2)]	[4]
	9	(5) NGC6541	ACS/WFC, ACCUM, WFC	F435W	CR-SPLIT=NO		Pattern 9-9 (1)	340.0 Secs [==>330.0 Secs (Pattern 1)] [==>340.0 Secs (Pattern 2)] [==>340.0 Secs (Pattern 3)] [==>340.0 Secs (Pattern 4)]	[5]
	10	(5) NGC6541	ACS/WFC, ACCUM, WFC	F435W	CR-SPLIT=NO	POS TARG 0.248,3.001	Pattern 10-10 (2)	340.0 Secs [==>(Pattern 1)] [==>(Pattern 2)]	[5]

