10901 - UV-Luminous Globular Clusters in NGC 1399

Cycle: 15, Proposal Category: GO

(Availability Mode: SUPPORTED)

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VISITS

Visit	*Targets used in Visit*	*Configurations used in Visit*	*Orbits Used*	*Last Orbit Planner Run*	*OP Current with Visit?*
01	(1) NGC-1399-FIELD-1	ACS/SBC WFPC2	5	17-Jan-2008 15:38:17.0	yes
02	(2) NGC-1399-FIELD-2	ACS/SBC WFPC2	5	17-Jan-2008 15:38:32.0	yes

Visit	*Targets used in Visit*	*Configurations used in Visit*	*Orbits Used*	*Last Orbit Planner Run*	*OP Current with Visit?*
03	(3) NGC-1399-FIELD-3	ACS/SBC WFPC2	5	17-Jan-2008 15:38:44.0	yes

15 Total Orbits Used

ABSTRACT

Ultraviolet observations have revealed remarkable diversity among old stellar populations in globular clusters and E/S0 galaxies. We recently discovered with HST/STIS that globular clusters in the giant elliptical galaxy M87 have the most heavily populated hot horizontal branches of any stellar systems yet studied. Their far-UV/optical colors are up to 1 mag bluer than any Milky Way globular cluster and approach the theoretical limits for production of hot-HB stars in old stellar populations. The differences among the metal-poor clusters are particularly interesting, because it is thought that these objects reflect the earliest stages of galaxy formation at high redshifts.
Here we propose deep ACS far-UV imaging of a second gE galaxy, NGC 1399, with a cluster system that is well-studied at longer wavelengths, to determine whether it shares characteristics with M87. These observations bear on aspects of advanced stellar evolution, on the histories of globular clusters in different environments, and on the interpretation of the "ultraviolet upturn" phenomenon in elliptical galaxies and its value as a population probe in distant galaxies.

OBSERVING DESCRIPTION

We are planning deep ACS/SBC Far-UV MAMA imaging observations of globular clusters in 3 fields near the center of the gE galaxy NGC 1399. The brightest clusters have V ~ 20.4, implying estimated m_1500 ~ 21-25 (STMAGS) for the top 3 magnitudes of the V-band luminosity function. We have chosen fields from existing HST archival images from which we can obtain auxiliary optical and NIR colors for the clusters. These are well correlated with abundances as estimated from ground-based spectroscopy of absorption line features. The exact placement of the MAMA imaging field within the pre-existing HST fields is adjusted to optimize the number of clusters included. We estimate that there are 25-35 brighter clusters per MAMA field (34x31 arcsec). This implies that 3 fields will suffice to meet our goal of at least 75 detected clusters. The clusters are essentially point sources at SBC resolution.

The feasibility of this program has been established by our earlier program on M87 (GO-8643), which employed the STIS/Far-UV MAMA detector. The ACS Far-UV MAMA has comparable performance characteristics. NGC 1399 is only slightly more distant than M87 (0.4 mag in distance modulus).

We estimate that the total exposure time with the far-UV MAMA in each field should be approximately 8000 secs. We have based our estimates on the ACS Imaging Exposure Time Calculator. Other than the faintness

of the sources, the most important technical consideration is the dayglow sky background. Because the sources of interest are hot, with T_e > 16000 K, it is important to extend the bandwidth of our images as far to the blue as possible without including geocoronal Lyman-alpha or [O I]. We have chosen the F140LP filter as the best compromise for this purpose. It is sufficiently resistant to the dayglow that observations do not have to be restricted to shadow time.

We estimate that a standard integration time of 8000 seconds with F140LP will yield far-UV fluxes at S/N ~ 32 for m_1500 = 22 and S/N ~ 8 for m_1500 = 24. If we conservatively assume that we obtain 2000 seconds of exposure per orbit, a 8000 second exposure implies 4 orbits of far-UV exposure time per field.

Archival ACS exposures show that there are two field stars near the galaxy center that are moderately bright in the optical bands. We have checked the available UV imaging of NGC 1399 from the Ultraviolet Imaging Telescope and GALEX. Neither star is detectable on these fairly deep far-UV frames, so there is no danger of overexposure with the SBC/MAMA.

It is also important to obtain visible-band HRC CCD imaging of the same fields during the same visits in order to verify pointing, provide astrometry, and provide flux normalization for our targets at approximately the same spatial resolution as our F140LP exposures. We are planning 2000 sec exposures in HRC/F555W, which should yield S/N ~

20 at V = 25.

A full exposure sequence would then require 5 orbits per field, for 15 orbits total. All exposures will be broken into 4 sub-exposures using the standard DITHER-BOX offset pattern in order to suppress response variations, cosmetic defects, and the effects of cosmic rays.

Visit

Proposal 10901, Visit 01, implementation Thu Jan 17 20:38:49 GMT 2008

Diagnostic Status: No Diagnostics

Scientific Instruments: ACS/SBC, WFPC2

Special Requirements: (none)

Patterns

#	Primary Pattern		Secondary Pattern	Exposures
(1)	Pattern Type=WFPC2-BOX Purpose=DITHER Number Of Points=4 Point Spacing=0.559017 Line Spacing=0.559017	Coordinate Frame=POS-TARG Pattern Orientation=26.56505 Angle Between Sides=143.1301 Center Pattern=false		(5)
(2)	Pattern Type=ACS-SBC-DITHER-BOX Purpose=DITHER Number Of Points=4 Point Spacing=0.179 Line Spacing=0.116	Coordinate Frame=POS-TARG Pattern Orientation=20.02 Angle Between Sides=63.65 Center Pattern=false		(1), (2), (3), (4)

Fixed Targets

#	Name	Target Coordinates	Targ. Coord. Corrections	Fluxes	Miscellaneous
(1)	NGC-1399-FIELD-1	RA: 03 38 32.1700 (54.6340417d) Dec: -35 27 8.60 (-35.45239d) Equinox: J2000		V=22	Reference Frame: ICRS

Comments: Coordinates have been converted to ICRS at mean epoch 1992.

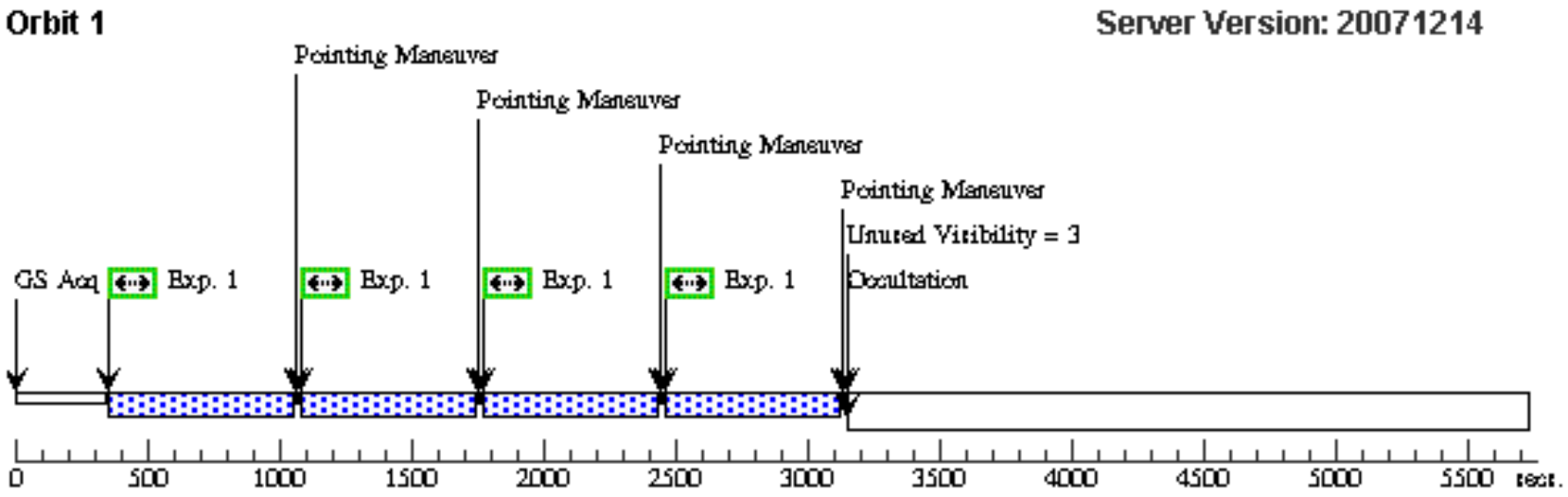
Exposures

#	Label	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time/[Actual Dur.]	Orbit
1	NGC 1399 Field 1	(1) NGC-1399-FIELD-1	ACS/SBC, ACCUM, SBC-FIX	F140LP			Pattern 1-1 (2)	630.0 Secs	
								[==>(Pattern 1)] *[==>(Pattern 2)]* *[==>(Pattern 3)]* *[==>(Pattern 4)]*	***[1]***
2	NGC 1399 Field 1	(1) NGC-1399-FIELD-1	ACS/SBC, ACCUM, SBC-FIX	F140LP			Pattern 2-2 (2)	630.0 Secs	
								[==>(Pattern 1)] *[==>(Pattern 2)]* *[==>(Pattern 3)]* *[==>(Pattern 4)]*	***[2]***
3	NGC 1399 Field 1	(1) NGC-1399-FIELD-1	ACS/SBC, ACCUM, SBC-FIX	F140LP			Pattern 3-3 (2)	630.0 Secs	
								[==>(Pattern 1)] *[==>(Pattern 2)]* *[==>(Pattern 3)]* *[==>(Pattern 4)]*	***[3]***

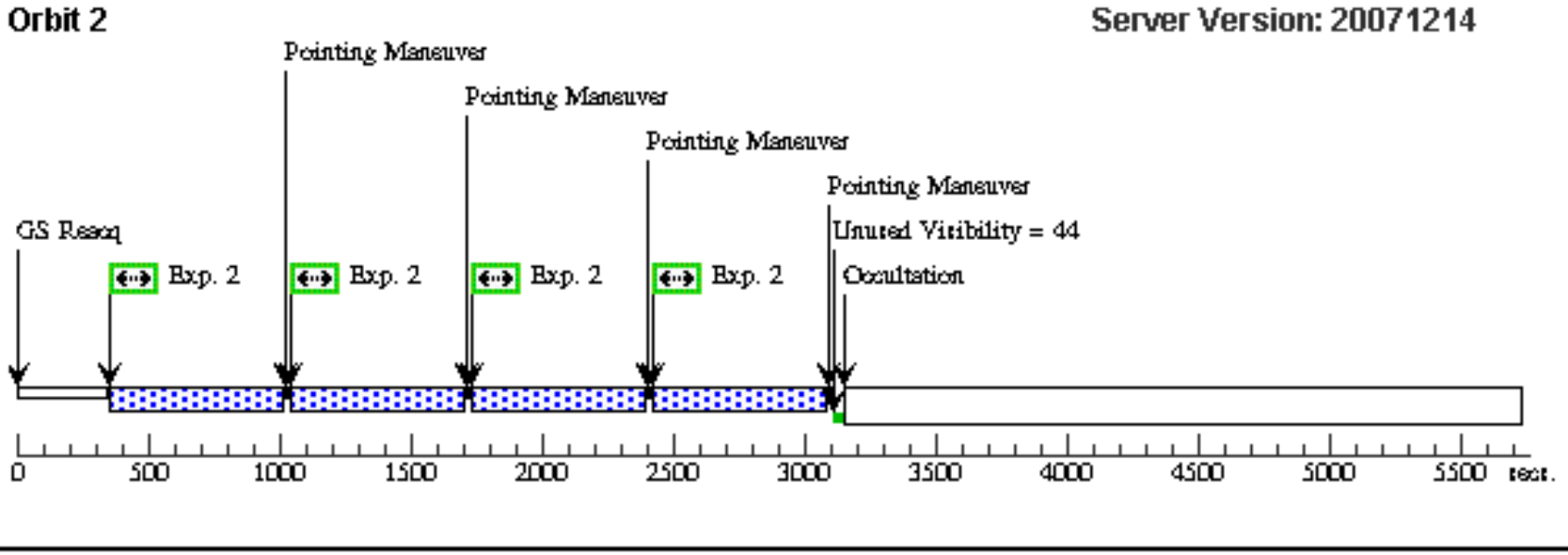
Exposures (continued)

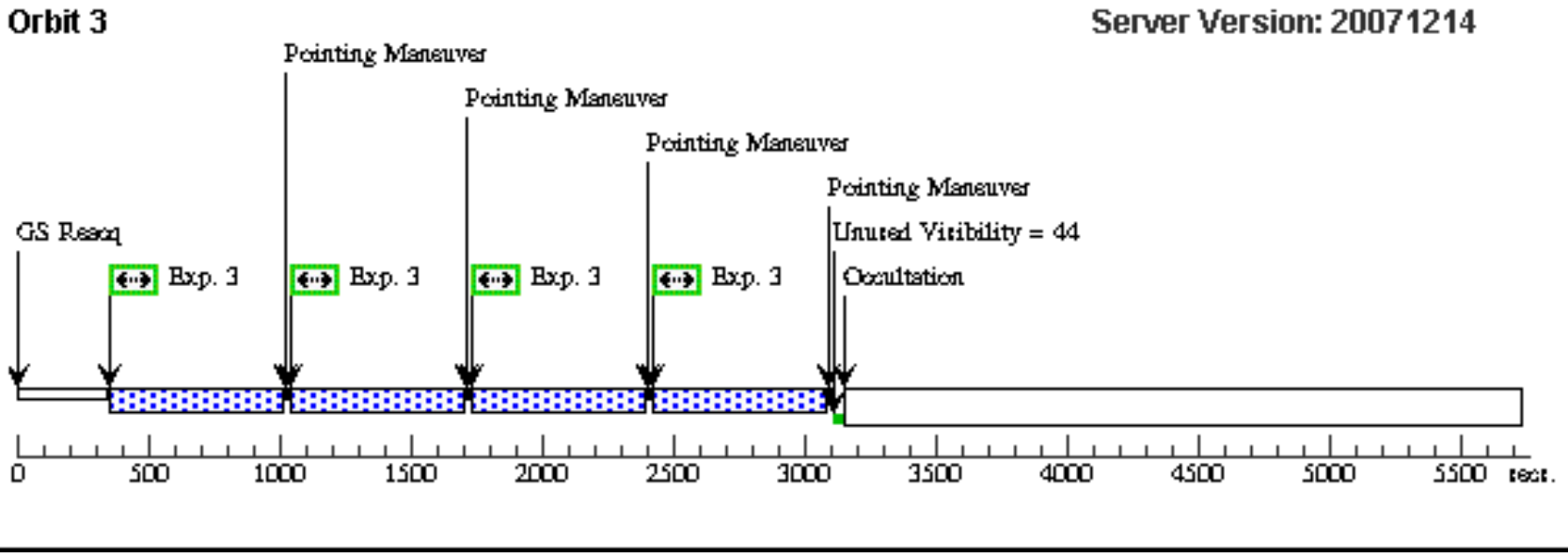
#	Label	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time/[Actual Dur.]	Orbit
4	NGC 1399 Field 1	(1) NGC-1399-FIELD-1	ACS/SBC, ACCUM, SBC-FIX	F140LP			Pattern 4-4 (2)	630.0 Secs	
								[==>(Pattern 1)] *[==>(Pattern 2)]* *[==>(Pattern 3)]* *[==>(Pattern 4)]*	***[4]***
5		(1) NGC-1399-FIELD-1	WFPC2, IMAGE, PC1-FIX	F555W			Pattern 5-5 (1)	615.0 Secs	
								[==>400.0 Secs (Pattern 1)] *[==>400.0 Secs (Pattern 2)]* *[==>400.0 Secs (Pattern 3)]* *[==>400.0 Secs (Pattern 4)]*	***[5]***

Orbit Structure



Orbit Structure (continued)





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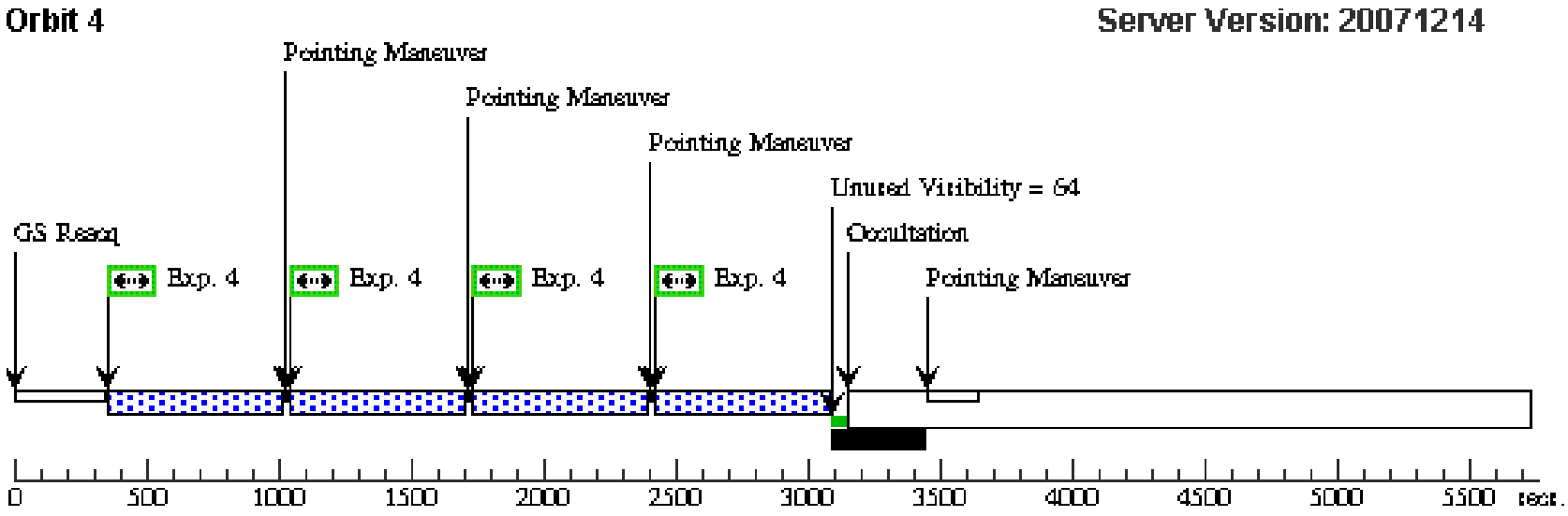
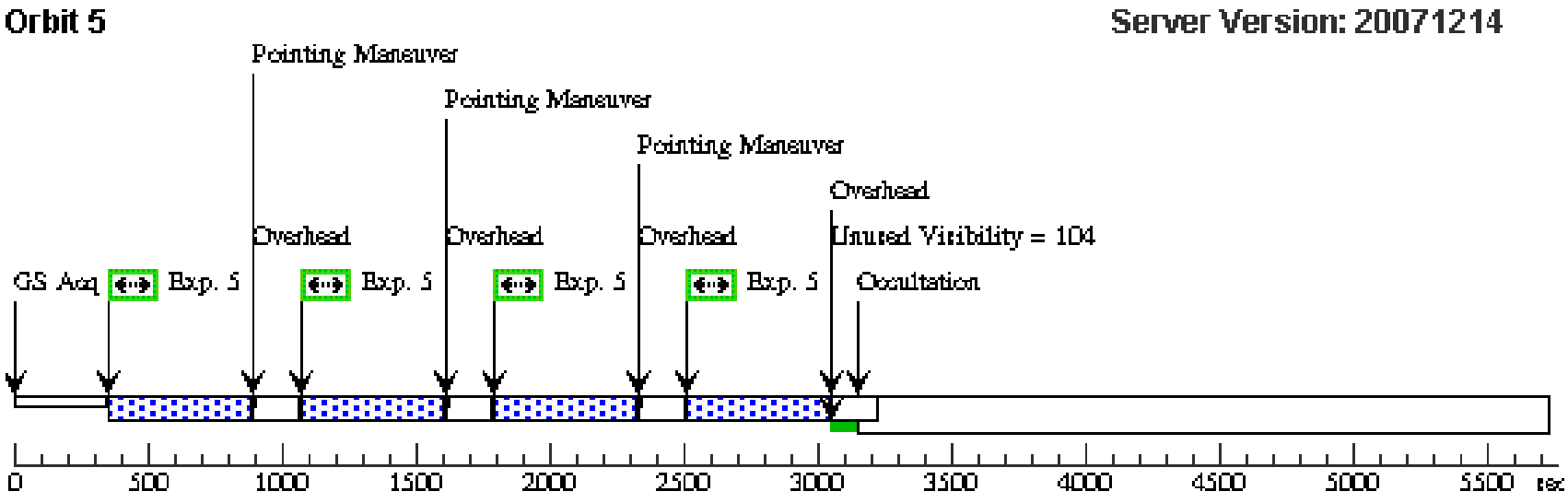


Orbit Structure (continued)



Visit

Proposal 10901, Visit 02, implementation Thu Jan 17 20:38:51 GMT 2008

Diagnostic Status: No Diagnostics

Scientific Instruments: ACS/SBC, WFPC2

Special Requirements: (none)

Patterns

#	Primary Pattern		Secondary Pattern	Exposures
(1)	Pattern Type=WFPC2-BOX Purpose=DITHER Number Of Points=4 Point Spacing=0.559017 Line Spacing=0.559017	Coordinate Frame=POS-TARG Pattern Orientation=26.56505 Angle Between Sides=143.1301 Center Pattern=false		(5)
(2)	Pattern Type=ACS-SBC-DITHER-BOX Purpose=DITHER Number Of Points=4 Point Spacing=0.179 Line Spacing=0.116	Coordinate Frame=POS-TARG Pattern Orientation=20.02 Angle Between Sides=63.65 Center Pattern=false		(1), (2), (3), (4)

Fixed Targets

#	Name	Target Coordinates	Targ. Coord. Corrections	Fluxes	Miscellaneous
(2)	NGC-1399-FIELD-2	RA: 03 38 28.6200 (54.6192500d) Dec: -35 27 2.60 (-35.45072d) Equinox: J2000		V=22	Reference Frame: ICRS

Comments: Coordinates have been converted to ICRS at mean epoch 1992.

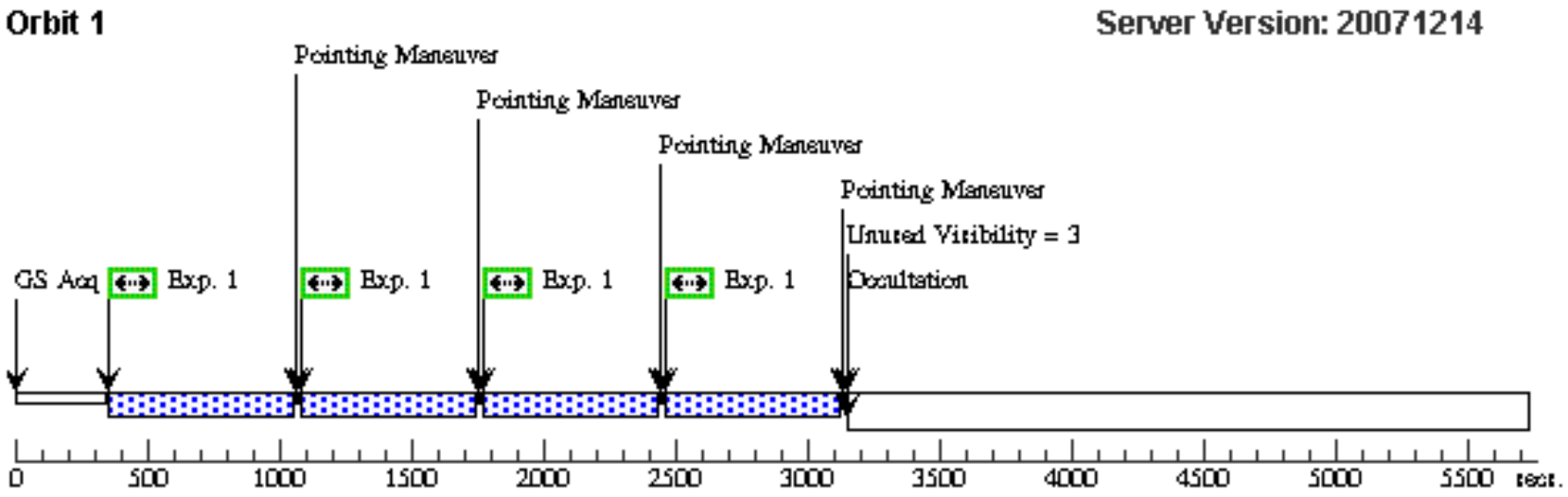
Exposures

#	Label	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time/[Actual Dur.]	Orbit
1	NGC 1399 Field 2	(2) NGC-1399-FIELD-2	ACS/SBC, ACCUM, SBC-FIX	F140LP			Pattern 1-1 (2)	630.0 Secs	
								[==>(Pattern 1)] *[==>(Pattern 2)]* *[==>(Pattern 3)]* *[==>(Pattern 4)]*	***[1]***
2	NGC 1399 Field 2	(2) NGC-1399-FIELD-2	ACS/SBC, ACCUM, SBC-FIX	F140LP			Pattern 2-2 (2)	630.0 Secs	
								[==>(Pattern 1)] *[==>(Pattern 2)]* *[==>(Pattern 3)]* *[==>(Pattern 4)]*	***[2]***
3	NGC 1399 Field 2	(2) NGC-1399-FIELD-2	ACS/SBC, ACCUM, SBC-FIX	F140LP			Pattern 3-3 (2)	630.0 Secs	
								[==>(Pattern 1)] *[==>(Pattern 2)]* *[==>(Pattern 3)]* *[==>(Pattern 4)]*	***[3]***

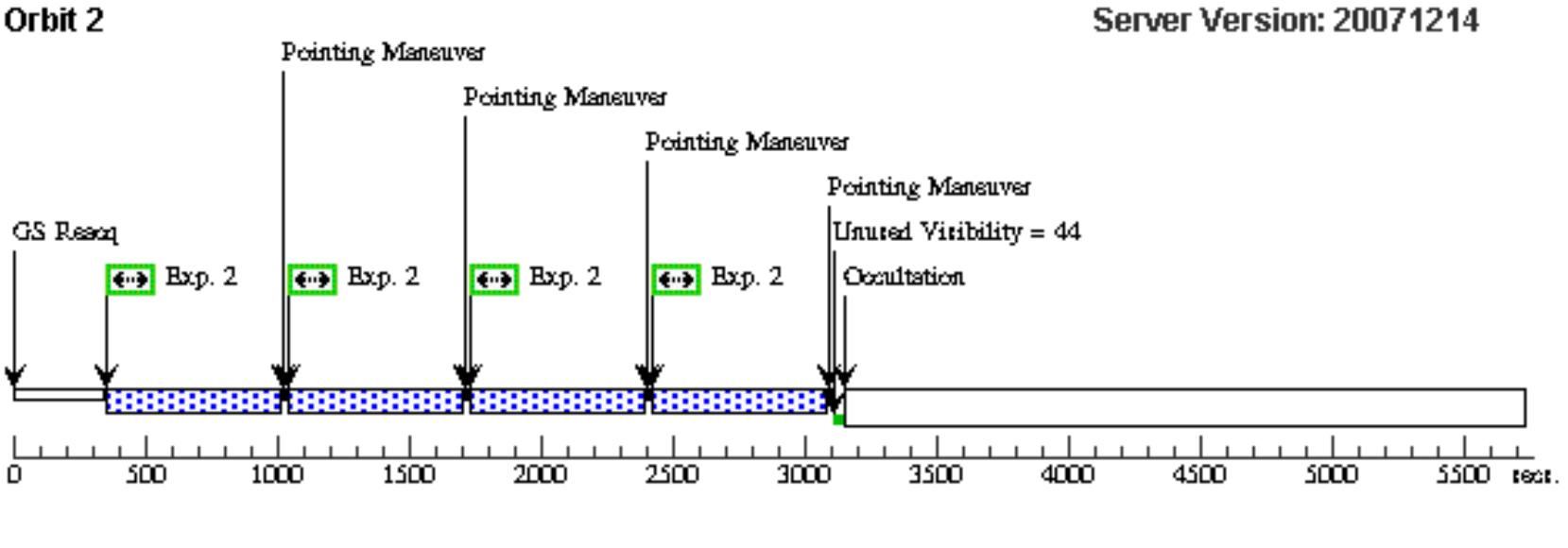
Exposures (continued)

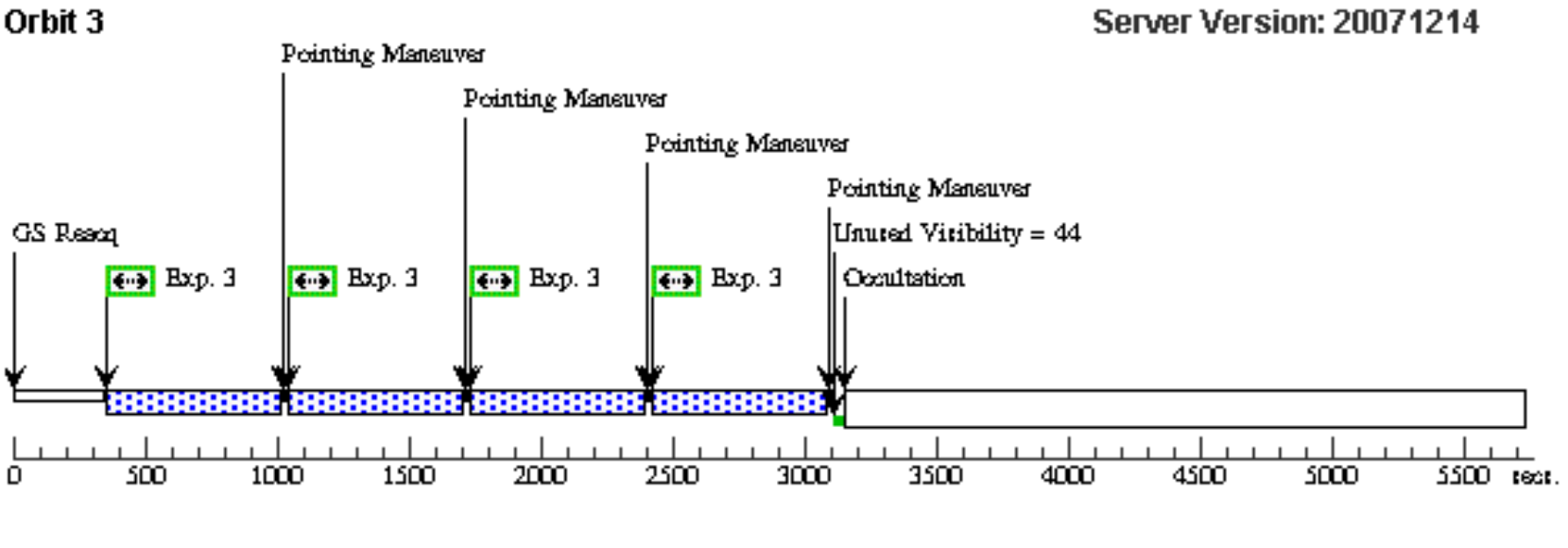
#	Label	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time/[Actual Dur.]	Orbit
4	NGC 1399 Field 2	(2) NGC-1399-FIELD-2	ACS/SBC, ACCUM, SBC-FIX	F140LP			Pattern 4-4 (2)	630.0 Secs	
								[==>(Pattern 1)] *[==>(Pattern 2)]* *[==>(Pattern 3)]* *[==>(Pattern 4)]*	***[4]***
5	NGC 1399 Field 2	(2) NGC-1399-FIELD-2	WFPC2, IMAGE, PC1-FIX	F555W			Pattern 5-5 (1)	615.0 Secs	
								[==>400.0 Secs (Pattern 1)] *[==>400.0 Secs (Pattern 2)]* *[==>400.0 Secs (Pattern 3)]* *[==>400.0 Secs (Pattern 4)]*	***[5]***

Orbit Structure



Orbit Structure (continued)





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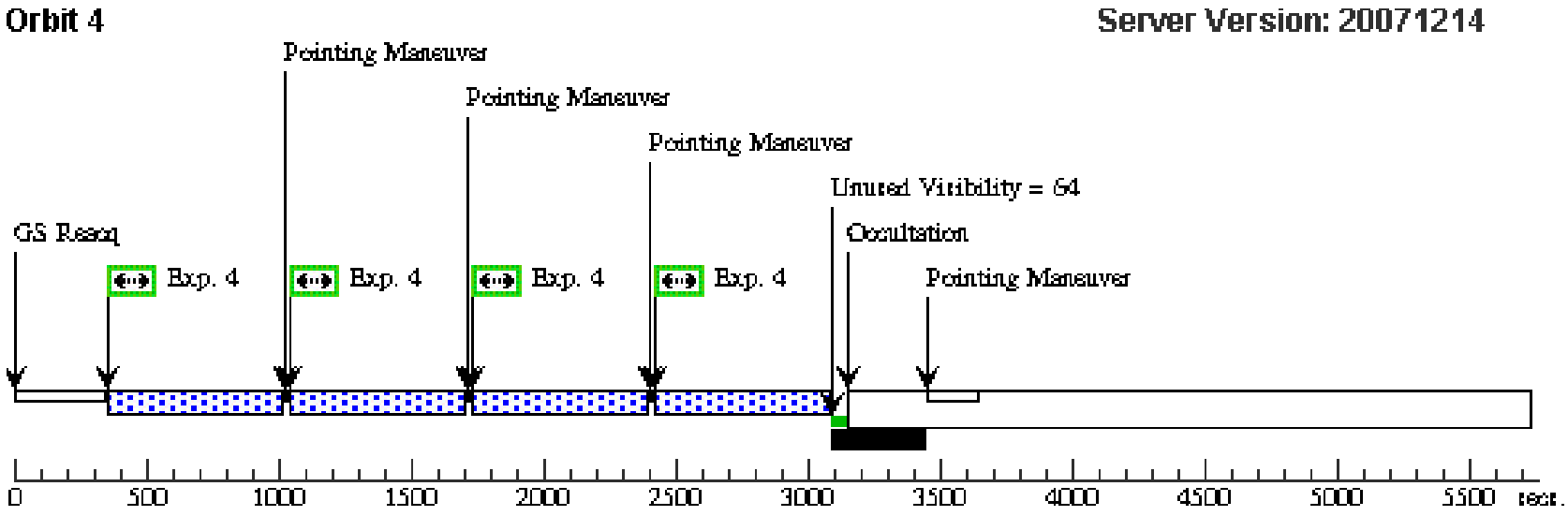
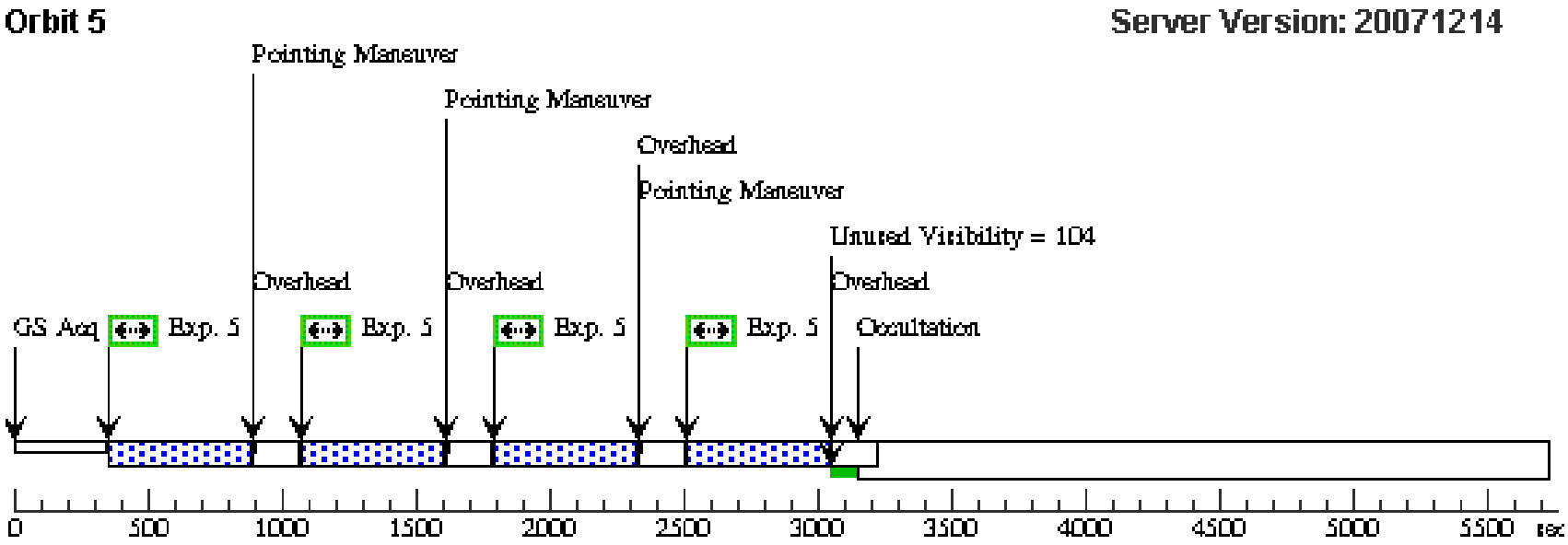


Orbit Structure (continued)



Visit

Proposal 10901, Visit 03, implementation Thu Jan 17 20:38:52 GMT 2008

Diagnostic Status: No Diagnostics

Scientific Instruments: ACS/SBC, WFPC2

Special Requirements: (none)

Patterns

#	Primary Pattern		Secondary Pattern	Exposures
(1)	Pattern Type=WFPC2-BOX Purpose=DITHER Number Of Points=4 Point Spacing=0.559017 Line Spacing=0.559017	Coordinate Frame=POS-TARG Pattern Orientation=26.56505 Angle Between Sides=143.1301 Center Pattern=false		(5)
(2)	Pattern Type=ACS-SBC-DITHER-BOX Purpose=DITHER Number Of Points=4 Point Spacing=0.179 Line Spacing=0.116	Coordinate Frame=POS-TARG Pattern Orientation=20.02 Angle Between Sides=63.65 Center Pattern=false		(1), (2), (3), (4)

Fixed Targets

#	Name	Target Coordinates	Targ. Coord. Corrections	Fluxes	Miscellaneous
(3)	NGC-1399-FIELD-3	RA: 03 38 30.2000 (54.6258333d) Dec: -35 26 42.90 (-35.44525d) Equinox: J2000		V=22	Reference Frame: ICRS

Comments: Coordinates have been converted to ICRS at mean epoch 1992.

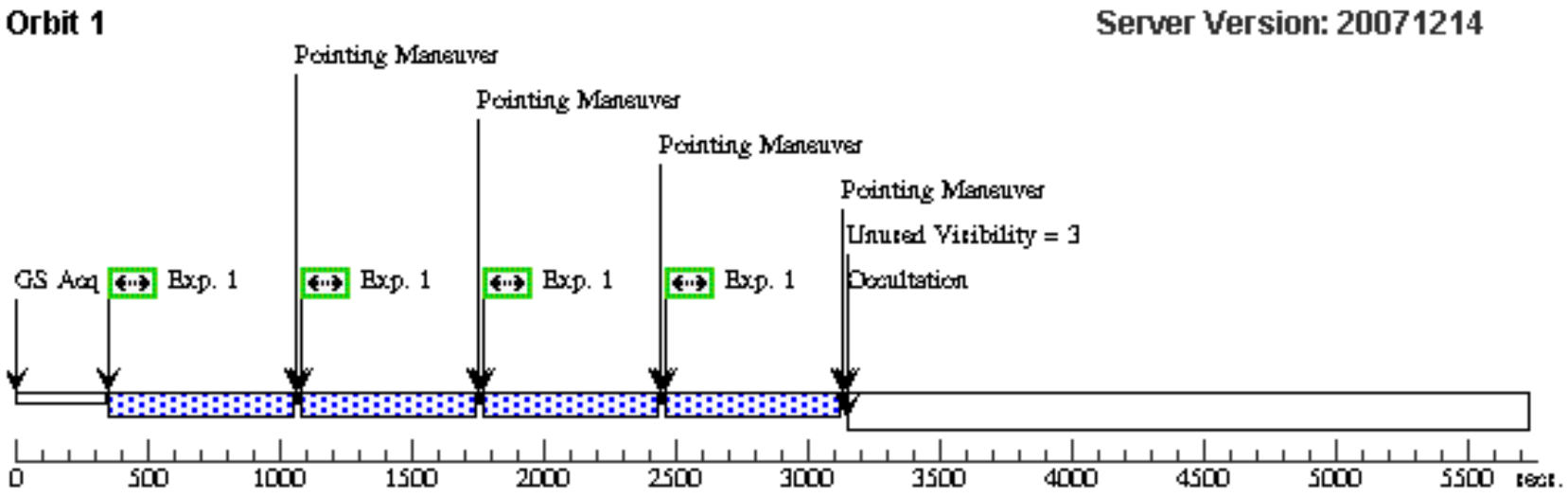
Exposures

#	Label	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time/[Actual Dur.]	Orbit
1	NGC 1399 Field 3	(3) NGC-1399-FIELD-3	ACS/SBC, ACCUM, SBC-FIX	F140LP			Pattern 1-1 (2)	630.0 Secs	
								[==>(Pattern 1)] *[==>(Pattern 2)]* *[==>(Pattern 3)]* *[==>(Pattern 4)]*	***[1]***
2	NGC 1399 Field 3	(3) NGC-1399-FIELD-3	ACS/SBC, ACCUM, SBC-FIX	F140LP			Pattern 2-2 (2)	630.0 Secs	
								[==>(Pattern 1)] *[==>(Pattern 2)]* *[==>(Pattern 3)]* *[==>(Pattern 4)]*	***[2]***
3	NGC 1399 Field 3	(3) NGC-1399-FIELD-3	ACS/SBC, ACCUM, SBC-FIX	F140LP			Pattern 3-3 (2)	630.0 Secs	
								[==>(Pattern 1)] *[==>(Pattern 2)]* *[==>(Pattern 3)]* *[==>(Pattern 4)]*	***[3]***

Exposures (continued)

#	Label	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time/[Actual Dur.]	Orbit
4	NGC 1399 Field 3	(3) NGC-1399-FIELD-3	ACS/SBC, ACCUM, SBC-FIX	F140LP			Pattern 4-4 (2)	630.0 Secs	
								[==>(Pattern 1)] *[==>(Pattern 2)]* *[==>(Pattern 3)]* *[==>(Pattern 4)]*	***[4]***
5	NGC 1399 Field 3	(3) NGC-1399-FIELD-3	WFPC2, IMAGE, PC1-FIX	F555W			Pattern 5-5 (1)	615.0 Secs	
								[==>400.0 Secs (Pattern 1)] *[==>400.0 Secs (Pattern 2)]* *[==>400.0 Secs (Pattern 3)]* *[==>400.0 Secs (Pattern 4)]*	***[5]***

Orbit Structure



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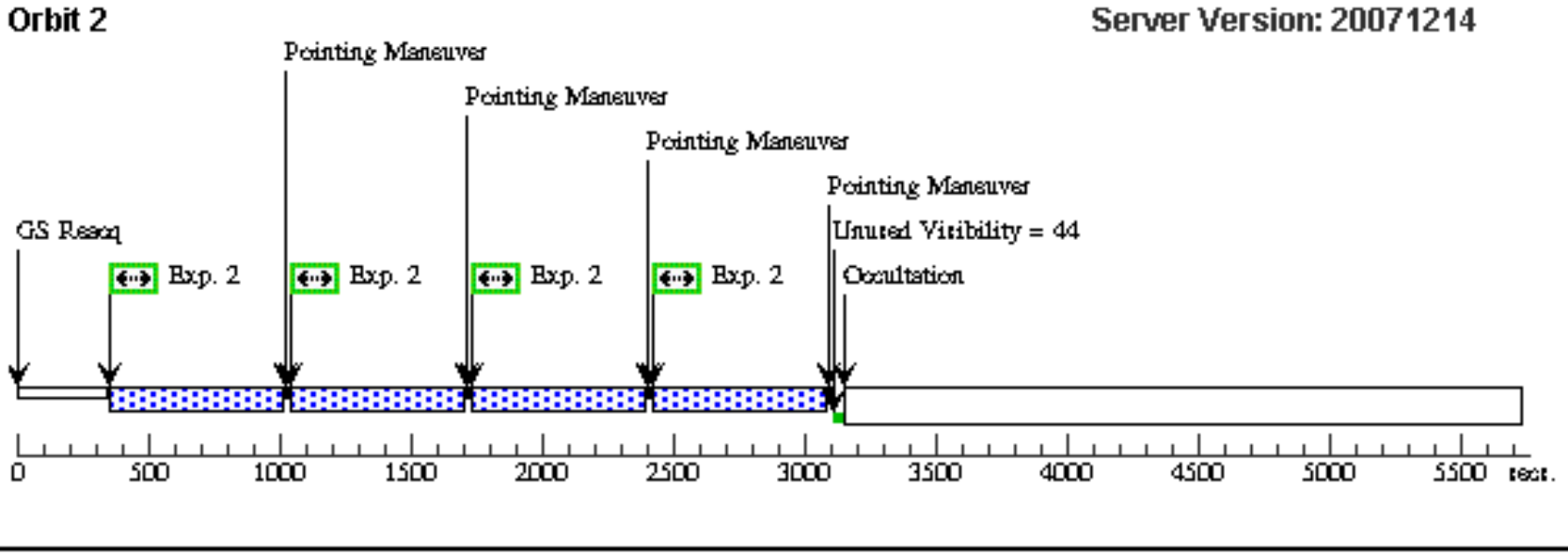

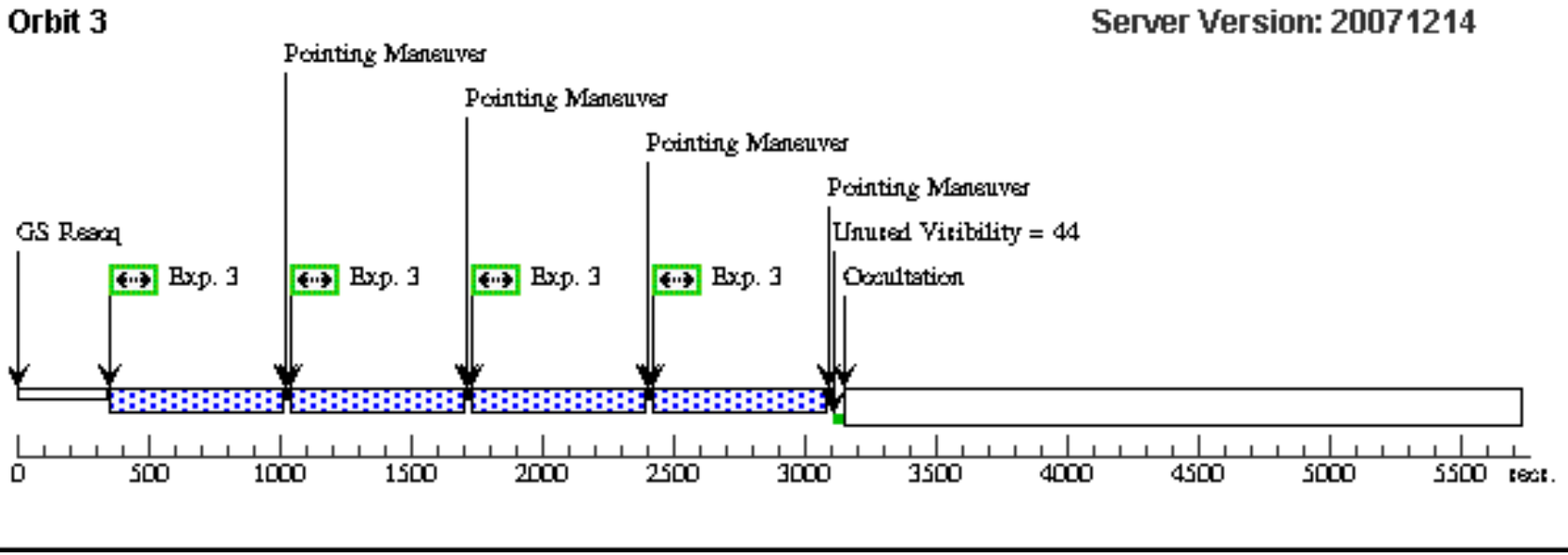

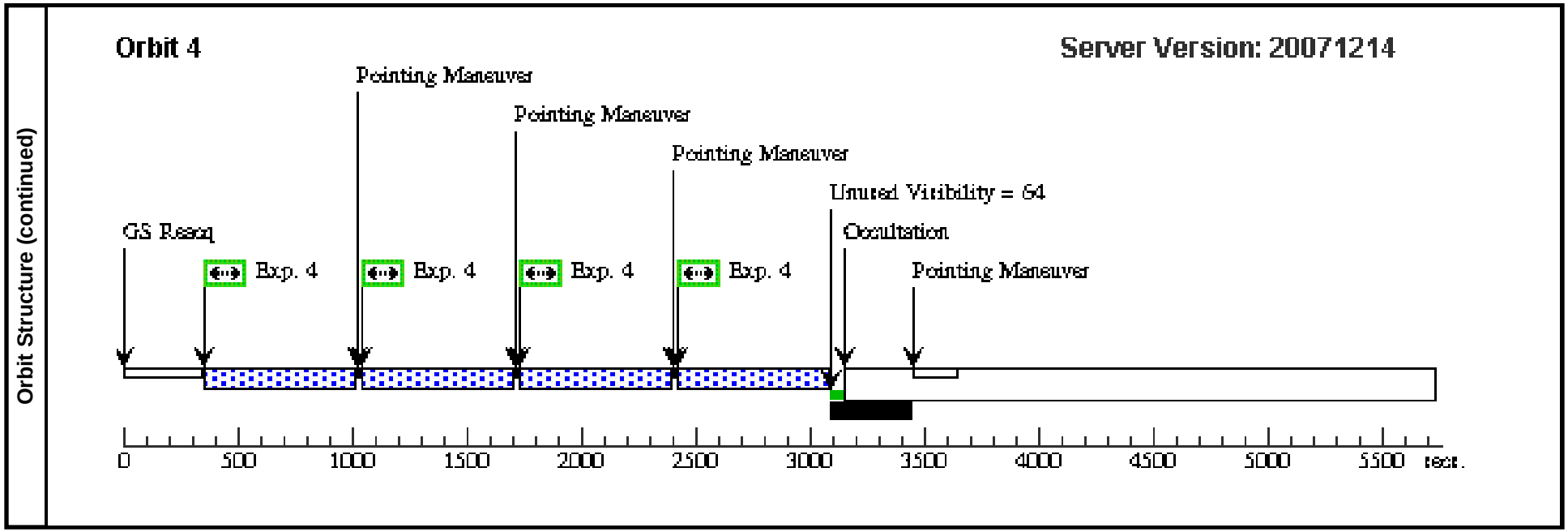
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Orbit 4
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Pointing Maneuver
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Unused Visibility = 64
GS Reacq
Occultation
Exp. 4
Exp. 4
Exp. 4
Exp. 4
Pointing Maneuver
0
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sec.

Orbit Structure (continued)