10604 - The Formation History of the M81 Spheroid

Cycle: 14, Proposal Category: GO

(Availability Mode: SUPPORTED)

INVESTIGATORS

Name	*Institution*	*E-Mail*
Dr. Ata Sarajedini (PI)	**University of Florida**	**ata@fig.astro.ufl.edu**
Dr. Rupali Chandar (CoI) (Contact)	Space Telescope Science Institute	rupali@stsci.edu
Dr. Patrick R. Durrell (CoI)	Youngstown State University	pdurrell@astro.psu.edu

VISITS

Visit	*Targets*	*Configurations*	*Orbits Used*	*Last Orbit Planner Run*	*OP Current with Visit?*
01	ANY (1) M81-HALO-FLD1	ACS/WFC WFPC2	4	20-Jun-2005 11:56:58.0	yes
02	ANY (1) M81-HALO-FLD1	ACS/WFC WFPC2	5	20-Jun-2005 11:57:12.0	yes
03	ANY (1) M81-HALO-FLD1	ACS/WFC WFPC2	5	20-Jun-2005 11:57:20.0	yes

14 Total Orbits Used

ABSTRACT

Spheroidal stellar populations (elliptical galaxies, bulges, and halos) contain a significant fraction of all stars and metals in the local universe. The mechanisms responsible for their formation are ultimately the ones which governed galaxy formation during early epochs. To begin understanding

the M81 spheroid, we are currently studying the globular cluster population using HST/WFPC2 multiband imaging and ground based optical spectroscopy. To complete this effort, we propose to use ACS/WFC to obtain deep (I, V-I) color magnitude diagrams (to the horizontal branch) of two fields in M81 - one dominated by thick disk stars and the other halo stars. These observations will provide tight constraints on the formation timescales and chemical enrichment history of the field star population. Combined with results on the globular clusters, we will reconstruct the early formation history of M81, and compare with those found for other nearby, massive galaxies. Because M81 is the earliest type spiral galaxy (Sab) available for such a detailed study, it provides a unique opportunity to probe the connection between elliptical halos and lower mass spiral spheroids.

OBSERVING DESCRIPTION

We will use the ACS/WFC to obtain deep V-I color magnitude diagrams of the halo of M81, the closest (3.6 Mpc) early-type (Sab) spiral galaxy. Since M81 has two close interacting companions (M82 and NGC 3077), we have carefully chosen our target field to avoid the HI bridges and other interaction material. Basen on the M81 structural analysis performed by Tikhonov et al. (2004), we have selected a halo field which is outside of the radius found by their analysis. We will use the F606W and F814W filters to make color magnitude diagrams, due to the additional sensitivity of the F606W filter over F555W. These filters have previous observations of Galactic globular clusters with the ACS/WFC which can be used for calibration.

Based on previous work, we need to achieve a minimum S/N of 10 for stars in the red clump (M_V=0). Assuming the Cepheid distance modulus of 27.8 and A_V=0.2 for M81, we need to reach V=28 and I=27. In addition to stars in the red clump, we are interested in the morphology of horizontal branch stars. Because these are bluer (hotter) than red clump stars, additional time in the F814W filter relative to that in the F606W is required. Therefore, we observe the M81 halo field for 5 orbits in F606W, and 9 total orbits in F814W. The F814W orbits will be broken into 2 separate visits or 4 and 5 orbit durations.

In addition to the primary ACS/WFC primary observations, coordinated parallels with WFPC2 were approved. These will be taken with the same filters. We have specified a range of possible spacecraft roll angles in order to optimize the location of the coordinated WFPC2 parallels. Our range of orientations is schedulable, and has been chosen to sample a somewhat more distant M81 halo field, so that we can explore metallicity gradients.

Visit

Proposal 10604, Visit 01 Mon Jun 20 15:57:24 GMT 2005

Diagnostic Status: No Diagnostics

Scientific Instruments: ACS/WFC, WFPC2

Special Requirements: PCS MODE FINE; SCHED 70%; ORIENT 340.0D TO 359.9 D; ORIENT 0.0D TO 20.0 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)

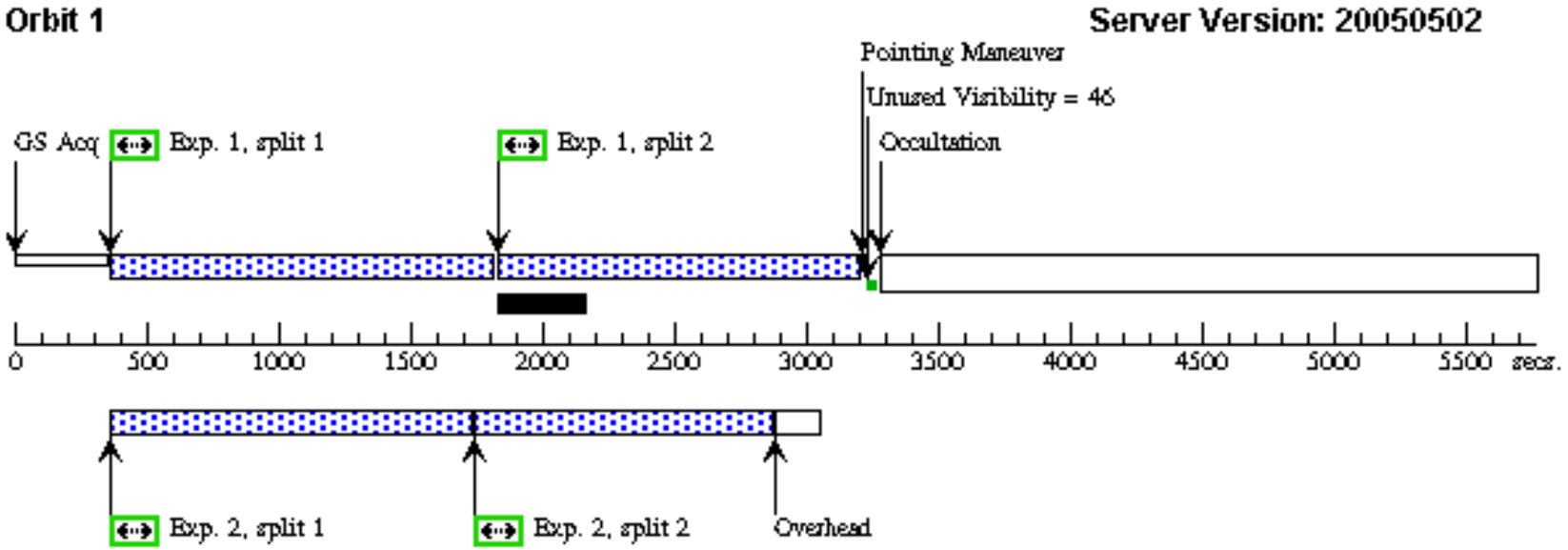
Fixed Targets

#	Name	Target Coordinates	Targ. Coord. Corrections	Fluxes	Miscellaneous
(1)	M81-HALO-FLD1	RA: 09 53 3.2000 (148.2633333d) Dec: +68 52 3.60 (68.86767d) Equinox: J2000 Plate Id: (?)		V=28.0	Coordinate Source: GUIDE_STAR_CATALOG

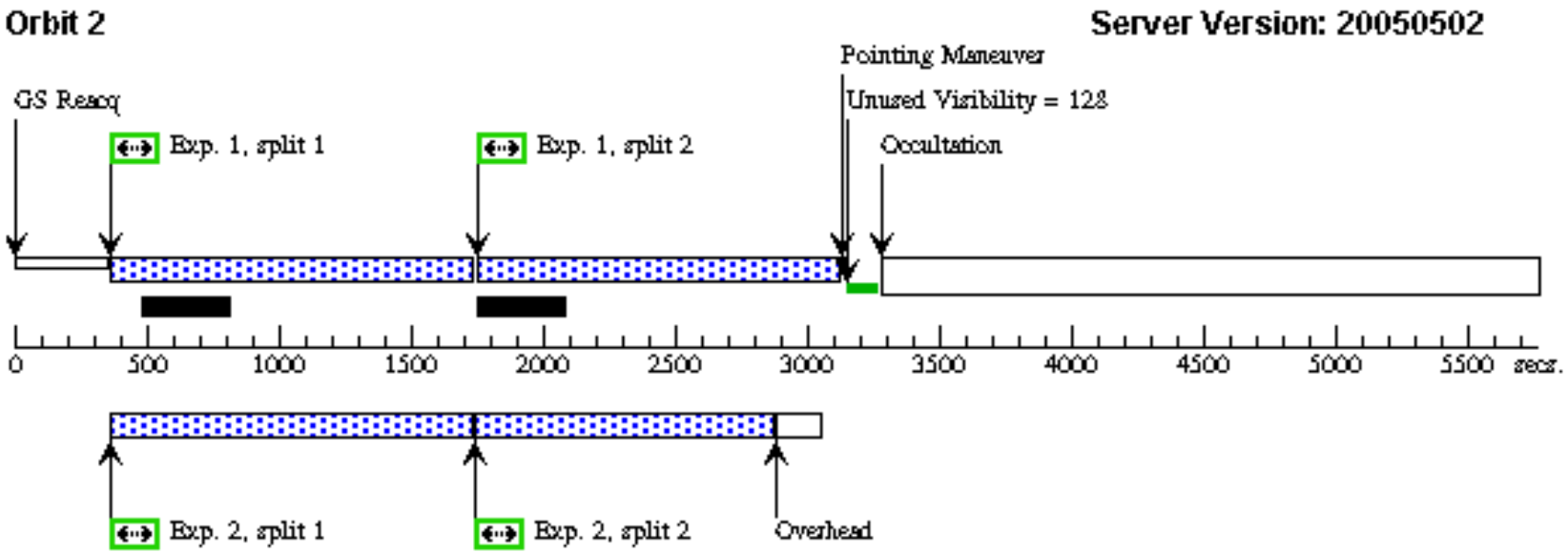
Exposures

#	Label	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time/[Actual Dur.]	Orbit
1	Prime_ACS	(1) M81-HALO-FLD1	ACS/WFC, ACCUM, WFC-FIX	F814W	CR-SPLIT=2	POS TARG 0,0	Pattern 1-2 (1)	2494.0 Secs	
							Prime + Parallel Group 1-2	*[==>(Pattern 1, Split 1)]* *[==>(Pattern 1, Split 2)]*	***[1]***
								[==>(Pattern 2, Split 1)] *[==>(Pattern 2, Split 2)]*	***[2]***
								[==>(Pattern 3, Split 1)] *[==>(Pattern 3, Split 2)]*	***[3]***
								[==>(Pattern 4, Split 1)] *[==>(Pattern 4, Split 2)]*	***[4]***
2	CPAR_WFPC2	ANY	WFPC2, IMAGE, WFALL-FIX	F814W			Pattern 1-2 (1)	2200.0 Secs	
							Prime + Parallel Group 1-2	*[==>(Pattern 1, Split 1)]* *[==>(Pattern 1, Split 2)]*	***[1]***
								[==>(Pattern 2, Split 1)] *[==>(Pattern 2, Split 2)]*	***[2]***
								[==>(Pattern 3, Split 1)] *[==>(Pattern 3, Split 2)]*	***[3]***
								[==>(Pattern 4, Split 1)] *[==>(Pattern 4, Split 2)]*	***[4]***

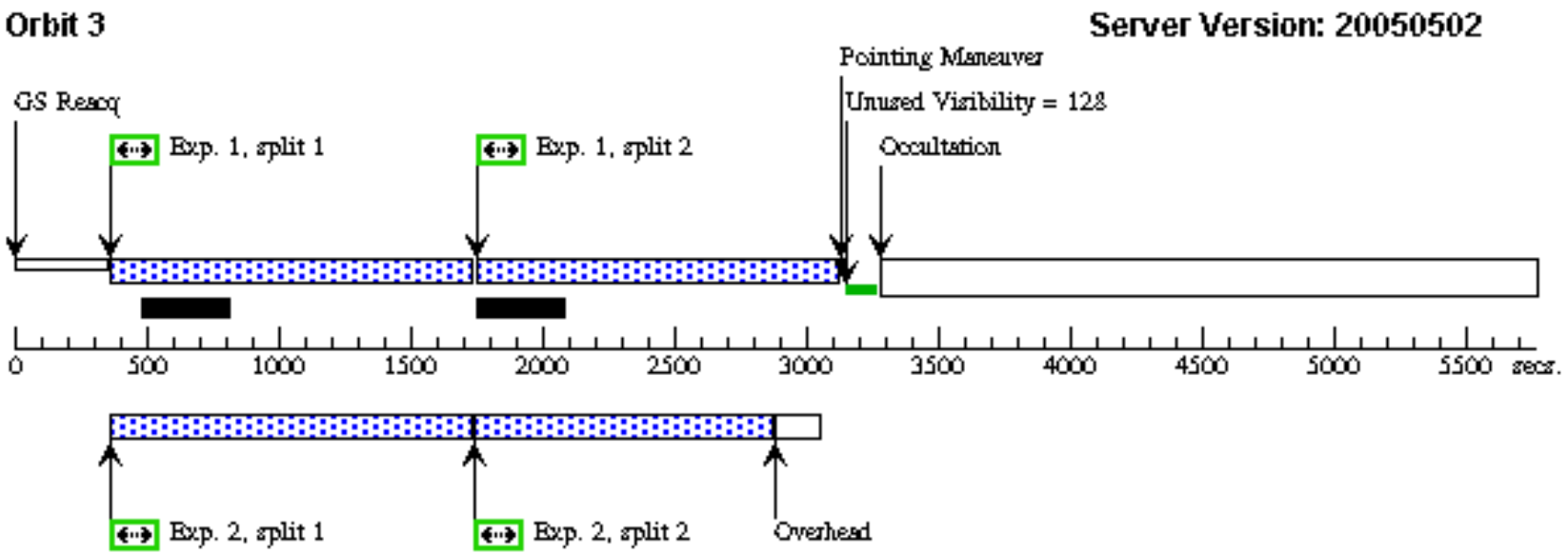
Orbit Structure



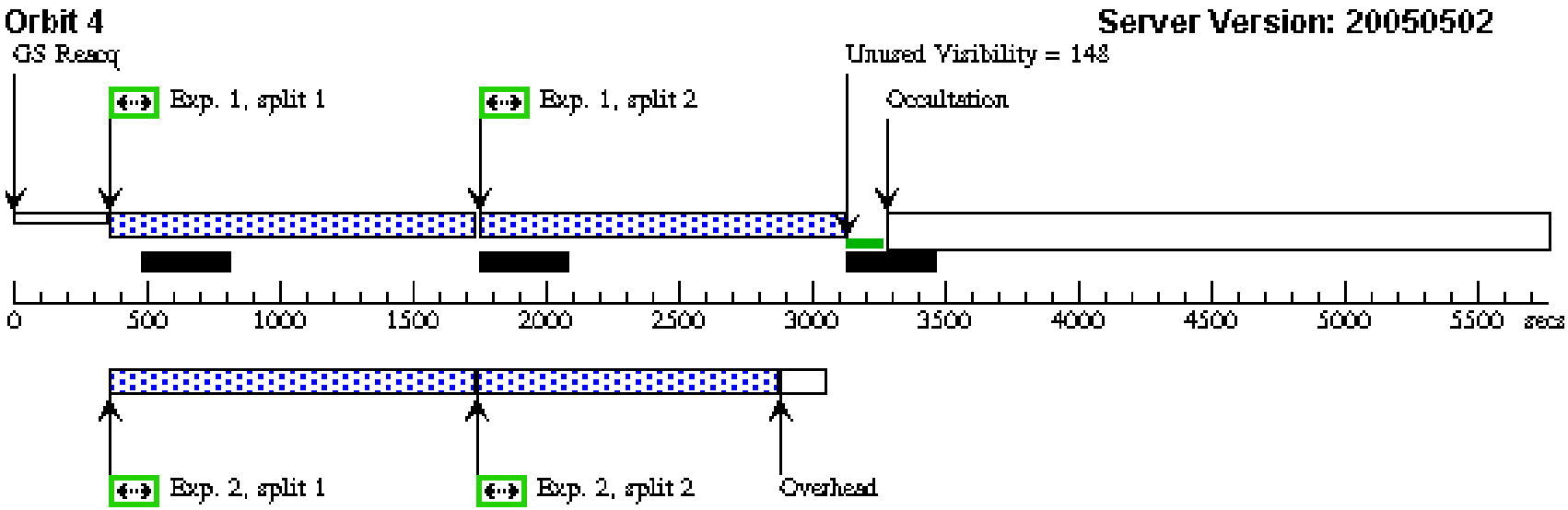
Orbit Structure (continued)



Orbit Structure (continued)



Orbit Structure (continued)



Visit

Proposal 10604, Visit 02 Mon Jun 20 15:57:28 GMT 2005

Diagnostic Status: No Diagnostics

Scientific Instruments: ACS/WFC, WFPC2

Special Requirements: PCS MODE FINE; SCHED 70%; SAME ORIENT AS 01

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)

Fixed Targets

#	Name	Target Coordinates	Targ. Coord. Corrections	Fluxes	Miscellaneous
(1)	M81-HALO-FLD1	RA: 09 53 3.2000 (148.2633333d) Dec: +68 52 3.60 (68.86767d) Equinox: J2000 Plate Id: (?)		V=28.0	Coordinate Source: GUIDE_STAR_CATALOG

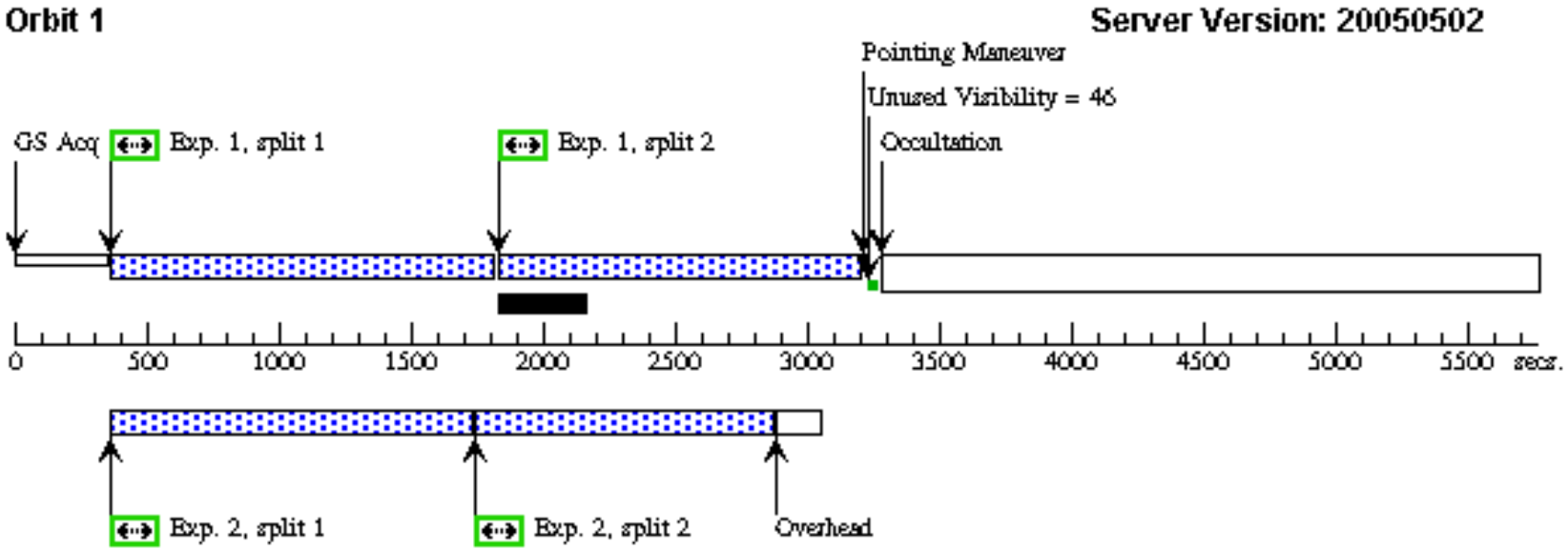
Exposures

#	Label	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time/[Actual Dur.]	Orbit
1	Prime_ACS	(1) M81-HALO-FLD1	ACS/WFC, ACCUM, WFC-FIX	F606W	CR-SPLIT=2	POS TARG 0,0	Pattern 1-2 (1) Prime + Parallel Group 1-2	2494.0 Secs *[==>(Pattern 1, Split 1)]* *[==>(Pattern 1, Split 2)]*	***[1]***
								[==>(Pattern 2, Split 1)] *[==>(Pattern 2, Split 2)]*	***[2]***
								[==>(Pattern 3, Split 1)] *[==>(Pattern 3, Split 2)]*	***[3]***
								[==>(Pattern 4, Split 1)] *[==>(Pattern 4, Split 2)]*	***[4]***
2	CPAR_WFPC2	ANY	WFPC2, IMAGE, WFALL-FIX	F606W			Pattern 1-2 (1) Prime + Parallel Group 1-2	2200.0 Secs *[==>(Pattern 1, Split 1)]* *[==>(Pattern 1, Split 2)]*	***[1]***
								[==>(Pattern 2, Split 1)] *[==>(Pattern 2, Split 2)]*	***[2]***
								[==>(Pattern 3, Split 1)] *[==>(Pattern 3, Split 2)]*	***[3]***
								[==>(Pattern 4, Split 1)] *[==>(Pattern 4, Split 2)]*	***[4]***
3	Prime_ACS	(1) M81-HALO-FLD1	ACS/WFC, ACCUM, WFC-FIX	F606W	CR-SPLIT=2	POS TARG 0,0.125	Prime + Parallel Group 3-4	2494.0 Secs *[==>(Split 1)]* *[==>(Split 2)]*	***[5]***

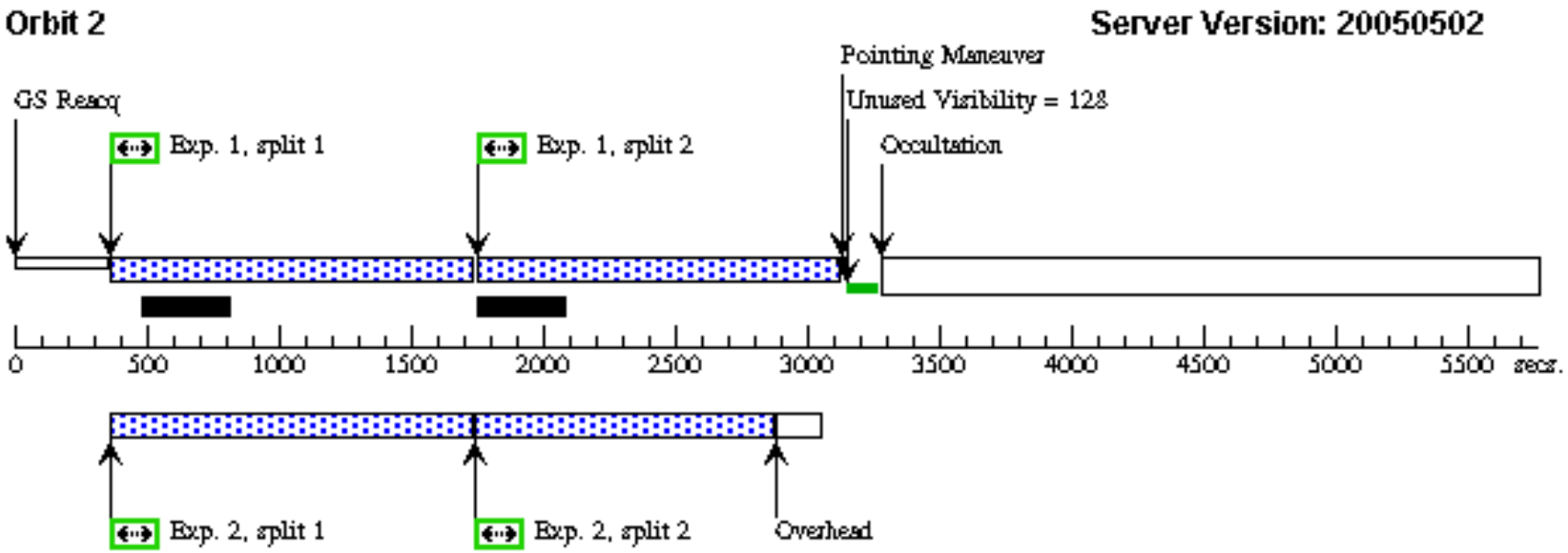
Exposures (continued)

#	Label	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time/[Actual Dur.]	Orbit
4	CPAR_WFPC2	ANY	WFPC2, IMAGE, WFALL-FIX	F606W			Prime + Parallel Group 3-4	2200.0 Secs *[==>(Split 1)]* *[==>(Split 2)]*	*[5]*

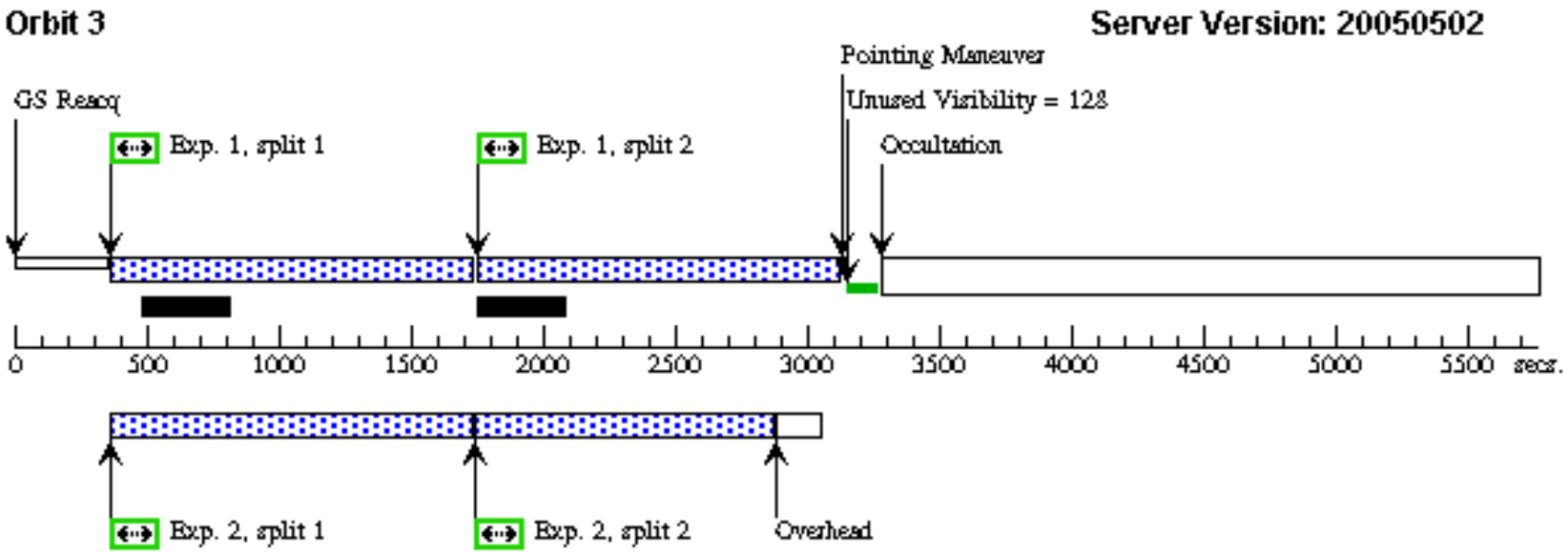
Orbit Structure



Orbit Structure (continued)



Orbit Structure (continued)



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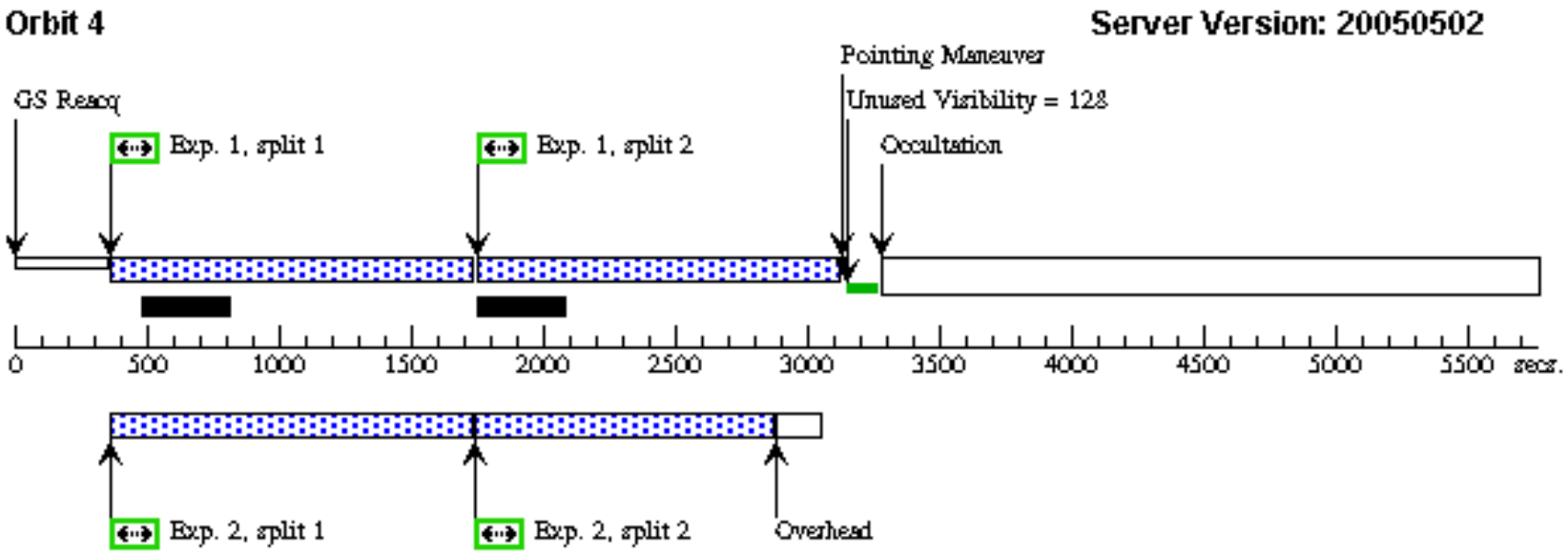

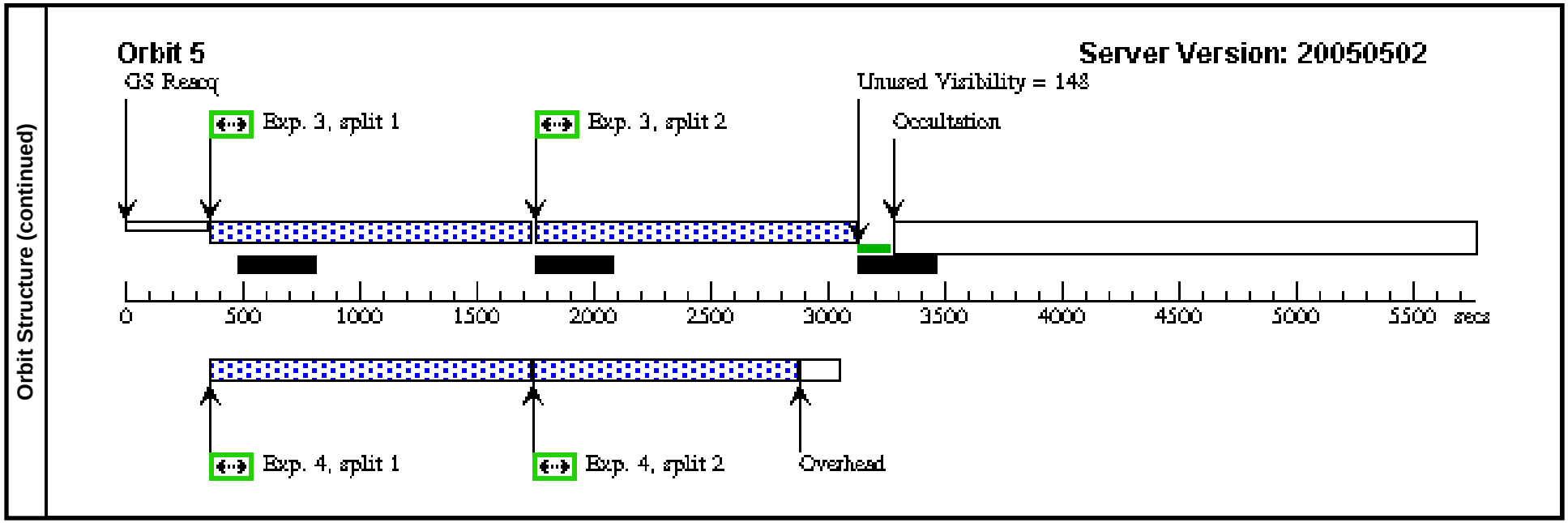
Orbit Structure (continued)
Orbit 5
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GS Reacq
Exp. 3, split 1
Exp. 3, split 2
Unused Visibility = 148
Occultation
0
500
1000
1500
2000
2500
3000
3500
4000
4500
5000
5500
secs
Exp. 4, split 1
Exp. 4, split 2
Overhead

Visit

Proposal 10604, Visit 03 Mon Jun 20 15:57:33 GMT 2005

Diagnostic Status: No Diagnostics

Scientific Instruments: ACS/WFC, WFPC2

Special Requirements: PCS MODE FINE; SCHED 70%; SAME ORIENT AS 01

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)

Fixed Targets

#	Name	Target Coordinates	Targ. Coord. Corrections	Fluxes	Miscellaneous
(1)	M81-HALO-FLD1	RA: 09 53 3.2000 (148.2633333d) Dec: +68 52 3.60 (68.86767d) Equinox: J2000 Plate Id: (?)		V=28.0	Coordinate Source: GUIDE_STAR_CATALOG

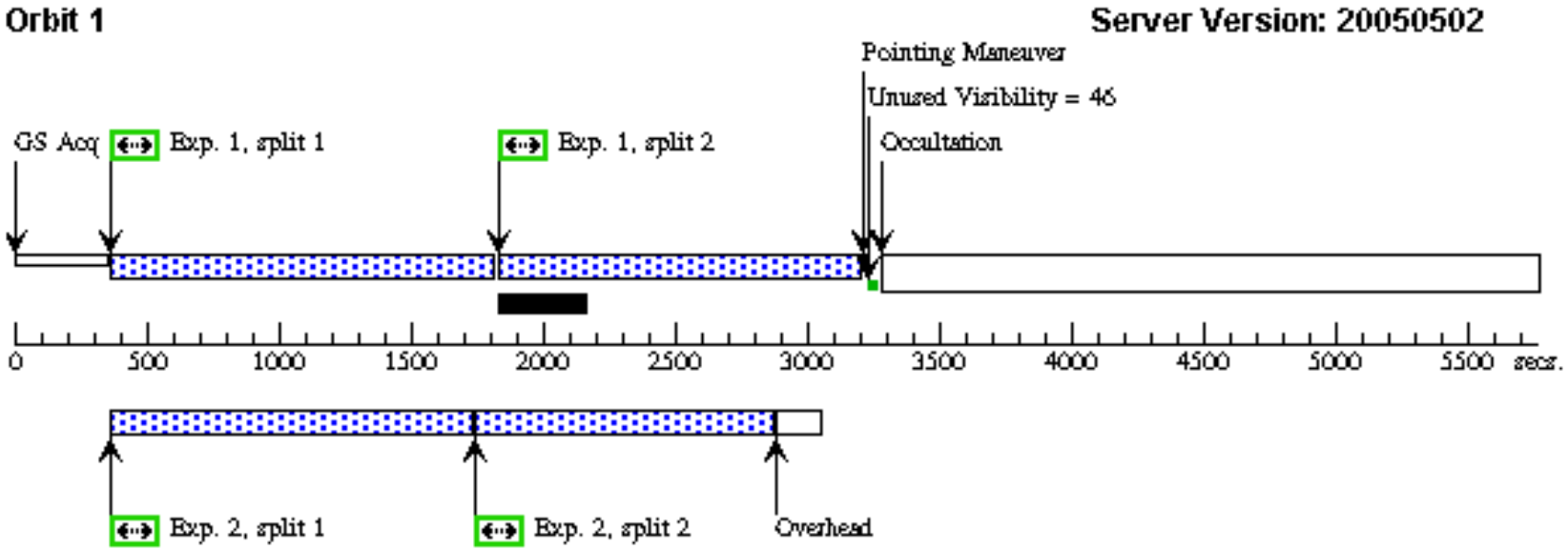
Exposures

#	Label	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time/[Actual Dur.]	Orbit
1	Prime_ACS	(1) M81-HALO-FLD1	ACS/WFC, ACCUM, WFC-FIX	F814W	CR-SPLIT=2	POS TARG 0,0	Pattern 1-2 (1) Prime + Parallel Group 1-2	2494.0 Secs	
								[==>(Pattern 1, Split 1)] *[==>(Pattern 1, Split 2)]*	***[1]***
								[==>(Pattern 2, Split 1)] *[==>(Pattern 2, Split 2)]*	***[2]***
								[==>(Pattern 3, Split 1)] *[==>(Pattern 3, Split 2)]*	***[3]***
								[==>(Pattern 4, Split 1)] *[==>(Pattern 4, Split 2)]*	***[4]***
2	CPAR_WFPC2	ANY	WFPC2, IMAGE, WFALL-FIX	F814W			Pattern 1-2 (1) Prime + Parallel Group 1-2	2200.0 Secs	
								[==>(Pattern 1, Split 1)] *[==>(Pattern 1, Split 2)]*	***[1]***
								[==>(Pattern 2, Split 1)] *[==>(Pattern 2, Split 2)]*	***[2]***
								[==>(Pattern 3, Split 1)] *[==>(Pattern 3, Split 2)]*	***[3]***
								[==>(Pattern 4, Split 1)] *[==>(Pattern 4, Split 2)]*	***[4]***
3	Prime_ACS	(1) M81-HALO-FLD1	ACS/WFC, ACCUM, WFC-FIX	F814W	CR-SPLIT=2	POS TARG 0,0.125	Prime + Parallel Group 3-4	2494.0 Secs	
								[==>(Split 1)] *[==>(Split 2)]*	***[5]***

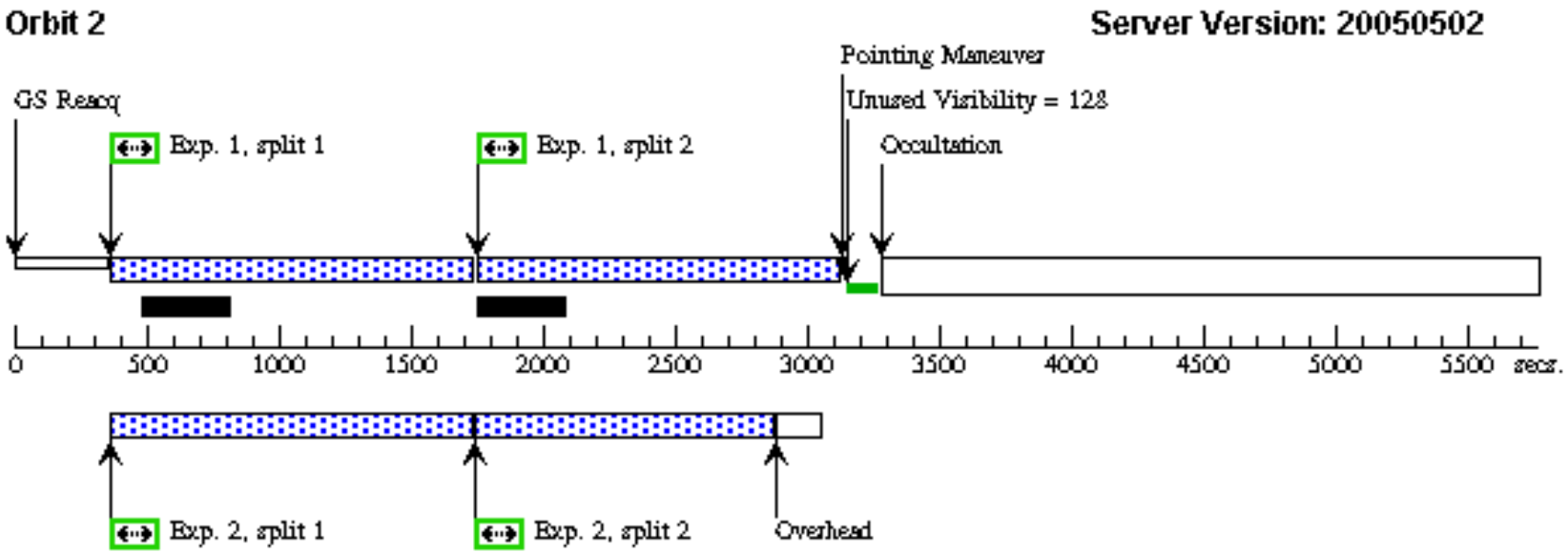
Exposures (continued)

#	Label	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time/[Actual Dur.]	Orbit
4	CPAR_WFP C2	ANY	WFPC2, IMAGE, WFALL-FIX	F814W			Prime + Parallel Group 3-4	2200.0 Secs *[==>(Split 1)]* *[==>(Split 2)]*	*[5]*

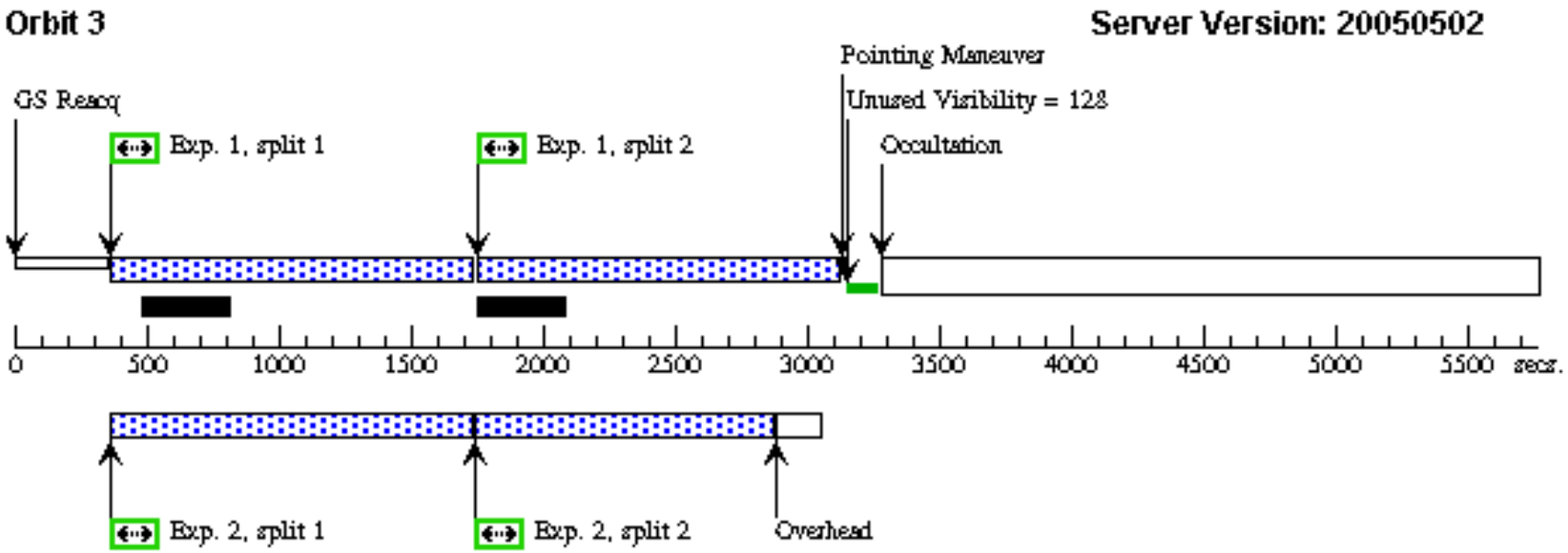
Orbit Structure



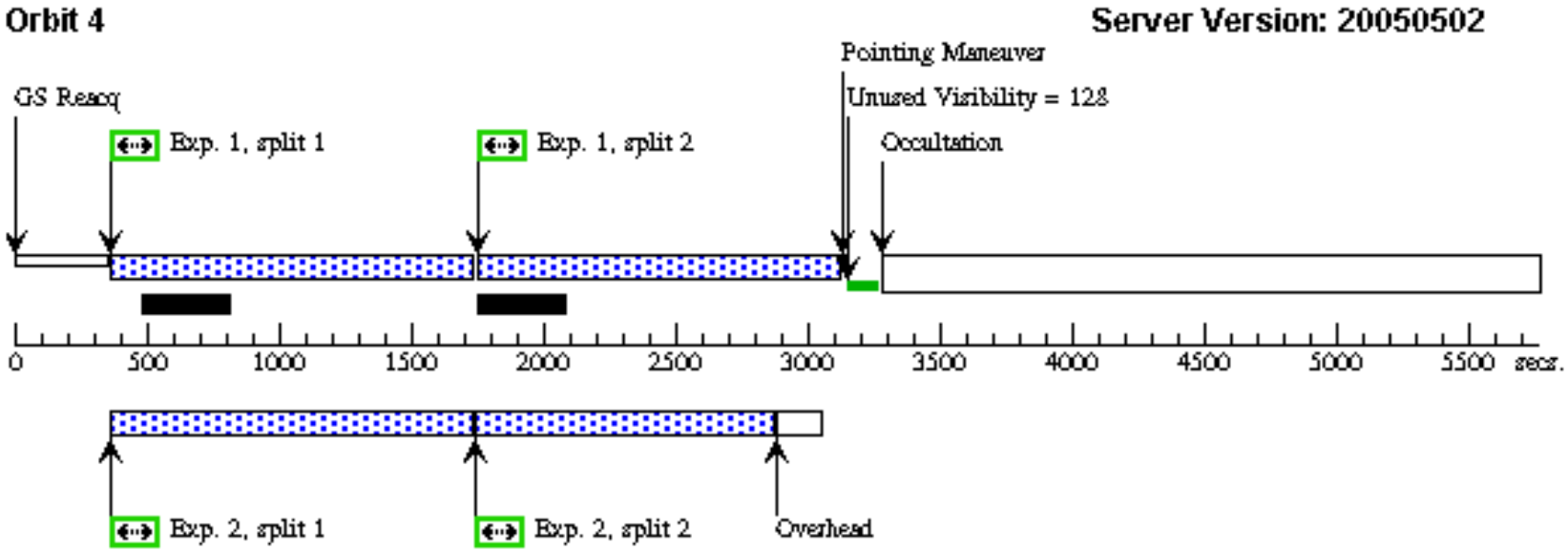
Orbit Structure (continued)

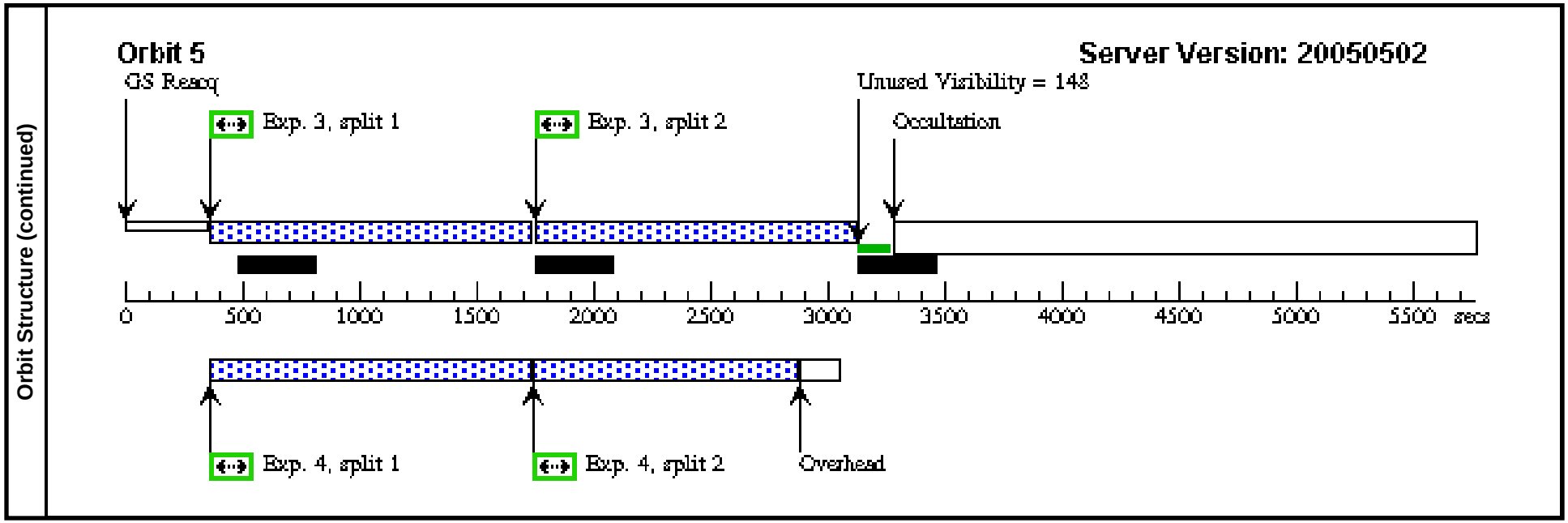


Orbit Structure (continued)



Orbit Structure (continued)




Orbit Structure (continued)
Orbit 5
Server Version: 20050502
GS Reacq
Exp. 3, split 1
Exp. 3, split 2
Unused Visibility = 148
Occultation
0
500
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2000
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3000
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5000
5500
secs
Exp. 4, split 1
Exp. 4, split 2
Overhead