10509 - The Cluster Lens SDSS 1004+4112: Constraining World Models With its Multiply-Imaged Quasar and Galaxies

Cycle: 14, Proposal Category: GO

(Availability Mode: SUPPORTED)

INVESTIGATORS

Name	*Institution*	*E-Mail*
Prof. Christopher S. Kochanek (PI)	**The Ohio State University Research Foundation**	**ckochanek@astronomy.ohio-state.edu**
Dr. Masamune Oguri (CoI)	Princeton University	oguri@astro.princeton.edu
Mr. Eran O. Ofek (CoI)	Tel Aviv University - Wise Observatory	eran@wise.tau.ac.il
Ms. Keren Sharon (CoI) (Contact)	Tel Aviv University - Wise Observatory	kerens@wise.tau.ac.il
Prof. Dan Maoz (CoI)	Tel Aviv University - Wise Observatory	dani@wise.tau.ac.il
Dr. Thomas J. Broadhurst (CoI)	Tel Aviv University - Wise Observatory	tjb@wise.tau.ac.il
Dr. Naohisa Inada (CoI)	University of Tokyo, Institute of Astronomy	inada@ioa.s.u-tokyo.ac.jp
Prof. Yasushi Suto (CoI)	University of Tokyo, Institute of Astronomy	suto@phys.s.u-tokyo.ac.jp

VISITS

Visit	*Targets*	*Configurations*	*Orbits Used*	*Last Orbit Planner Run*	*OP Current with Visit?*
05	(1) SDSS1004+4112	ACS/WFC	5	20-Jun-2005 11:21:04.0	yes
06	(1) SDSS1004+4112	ACS/WFC	5	20-Jun-2005 11:21:11.0	yes

10 Total Orbits Used

ABSTRACT

We will use deep ACS imaging of the giant (15 arcsec) four-image z_s=1.734 lensed quasar SDSS 1004+4112, and its z_l=0.68 lensing galaxy cluster, to identify many additional multiply-imaged background galaxies. Combining the existing single orbit ACS I-band image with ground based data, we have definitely identified two multiply imaged galaxies with estimated redshifts of 2.6 and 4.3, about 15 probable images of background galaxies, and a point source in the core of the central cD galaxy, which is likely to be the faint, fifth image of the quasar. The new data will provide accurate photometric redshifts, confirm that the candidate fifth image has the same spectral energy distribution as the other quasar images, allow secure identification of additional multiply-lensed galaxies for improving the mass model, and permit identification of faint cluster members. Due to the high lens redshift and the broad redshift distribution of the lensed background sources, we should be able to use the source-redshift scaling of the Einstein radius that depends on (d_ls/d_os), to derive a direct, geometric estimate of Omega_Lambda. The deeper images will also allow a weak lensing analysis to extend the mass distribution to larger radii. Unlike any other cluster lenses, the time delay between the lensed quasar images (already measured for the A--B images, and measurable for the others over the next few years), breaks the so-called kappa-degeneracies that complicate weak-lensing analyses.

OBSERVING DESCRIPTION

Our objective is to approximately double the depth of the existing ACS/WFC imaging data for SDSS1004+4112, and to obtain a new B-band image to a comparable S/N. To this end, we will supplement the 1 existing orbit of F814W data and the 1 scheduled orbit of F555W data with 2 more orbits of F814W, 3 more orbits of F555W data, and 5 orbits of F435W data. Using both our existing data and the new ACS data, we estimate that this will let us detect ~27.5 mag galaxies with S/N=10, with the precise limits depending on galaxy colors. We will use standard CR splits and dithering patterns. This depth is then well matched to that of clusters imaged by us and successfully used for this purpose.

The slight, subpixel, degradation in image quality expected in two-gyro model will be of no consequence for these WF data.
Since we have no special scheduling constraints, the more limited scheduling opportunities in two-gyro mode will also not affect this program.

Visit

Proposal 10509, Visit 05 Mon Jun 20 15:21:14 GMT 2005

Diagnostic Status: No Diagnostics

Scientific Instruments: ACS/WFC

Special Requirements: (none)

Patterns

#	Primary Pattern		Secondary Pattern	Exposures
(1)	Pattern Type=ACS-WFC-DITHER-LINE Purpose=DITHER Number Of Points=3 Point Spacing=3.011 Line Spacing=	Coordinate Frame=POS-TARG Pattern Orientation=85.3 Angle Between Sides= Center Pattern=false		(1)
(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)

Fixed Targets

#	Name	Target Coordinates	Targ. Coord. Corrections	Fluxes	Miscellaneous
(1)	SDSS1004+4112	RA: 10 04 34.1900 (151.1424583d) Dec: +41 12 44.00 (41.21222d) Equinox: J2000 Plate Id: (?)		V=18.5+/-0.5	Coordinate Source: HST_IMAGE

Comments: Magnitude is that of brightest quasar image. Lens galaxy is r=20.5 (g~22.5) and the lensed arcs are i~24. Coordinates derived from HST image agree with SDSS coordinates to better than one arcsec

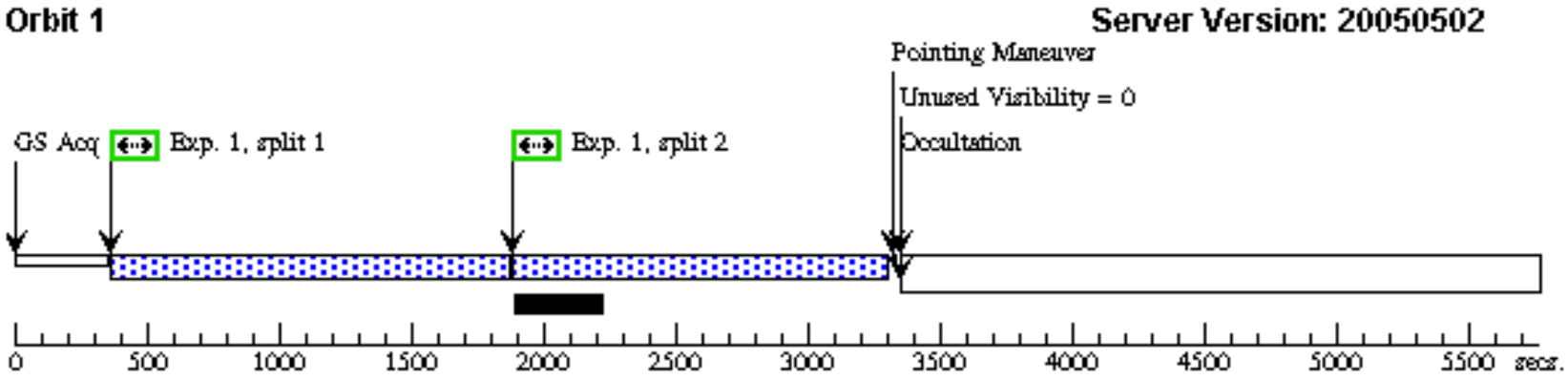
Exposures

#	Label	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time/[Actual Dur.]	Orbit
1		(1) SDSS1004+4112	ACS/WFC, ACCUM, WFC1	F555W			Pattern 1-1 (1)	2200.0 Secs	
								[==>1303.0 Secs (Pattern 1, Split 1)] *[==>1303.0 Secs (Pattern 1, Split 2)]*	***[1]***
								[==>1344.0 Secs (Pattern 2, Split 1)] *[==>1344.0 Secs (Pattern 2, Split 2)]*	***[2]***
								[==>1342.0 Secs (Pattern 3, Split 1)] *[==>1342.0 Secs (Pattern 3, Split 2)]*	***[3]***

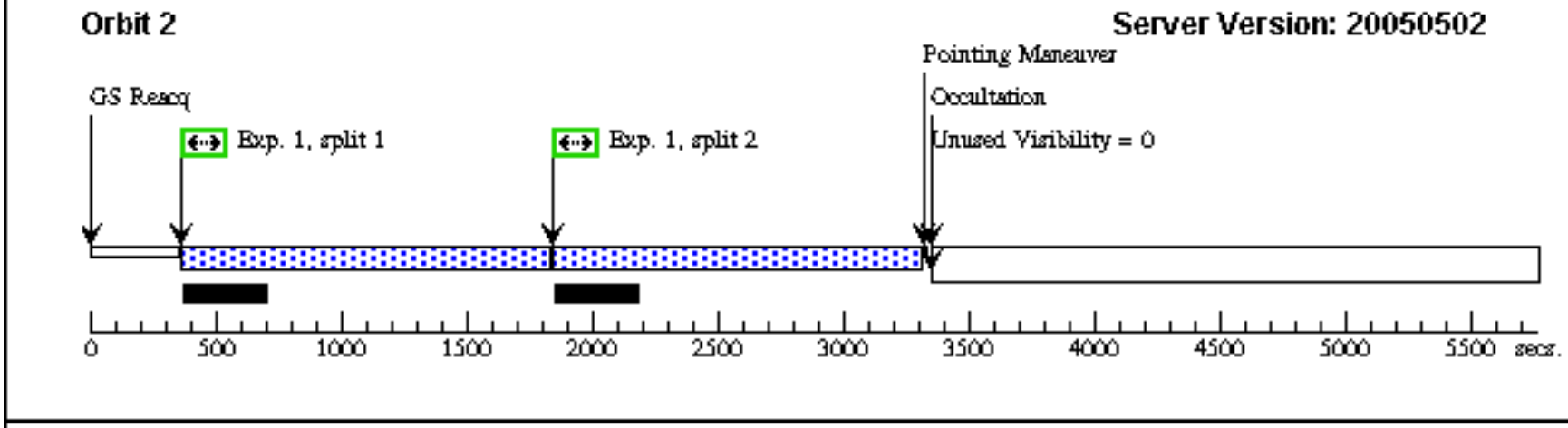
Exposures (continued)

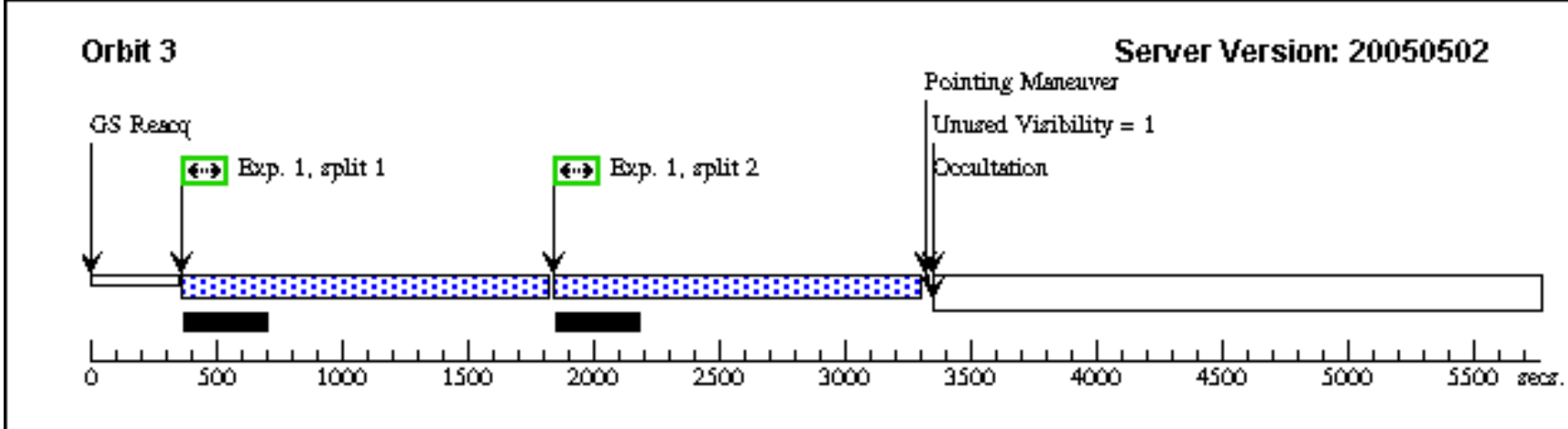
#	Label	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time/[Actual Dur.]	Orbit
2		(1) SDSS1004+4112	ACS/WFC, ACCUM, WFC1	F814W			Pattern 2-2 (2)	2200.0 Secs	
								[==>1324.0 Secs (Pattern 1, Split 1)] *[==>1324.0 Secs (Pattern 1, Split 2)]*	***[4]***
								[==>1356.0 Secs (Pattern 2, Split 1)] *[==>1356.0 Secs (Pattern 2, Split 2)]*	***[5]***

Orbit Structure

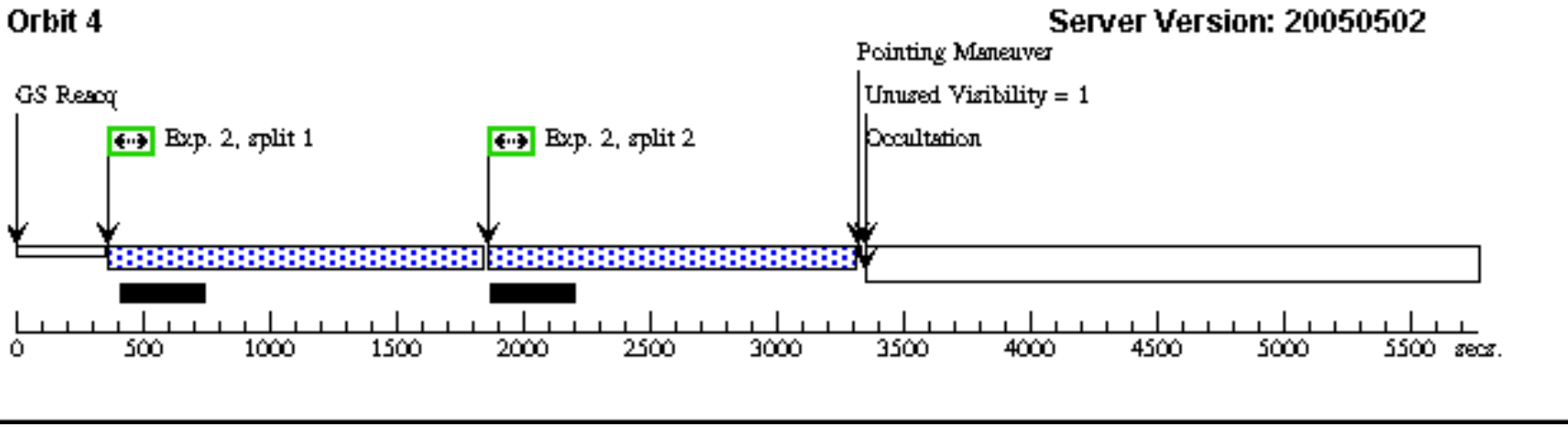


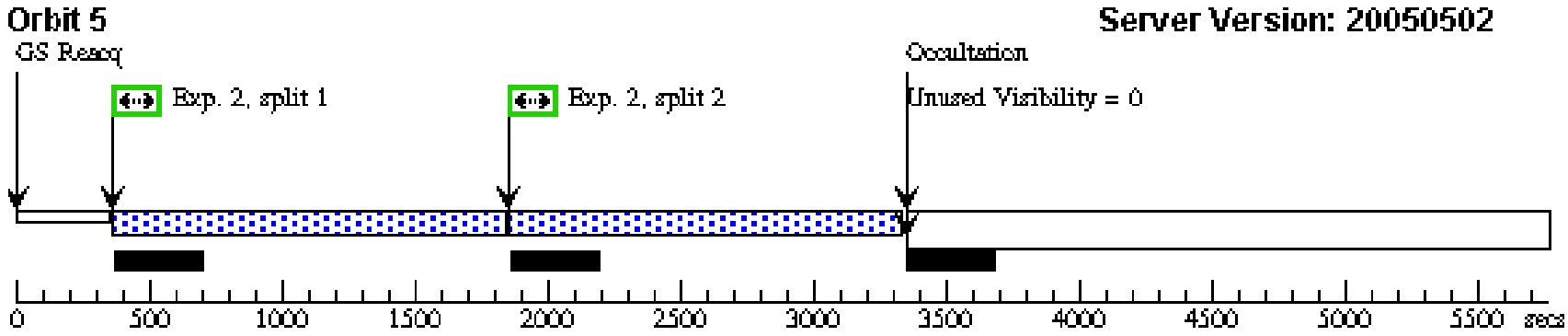
Orbit Structure (continued)





Orbit Structure (continued)





Visit

Proposal 10509, Visit 06 Mon Jun 20 15:21:17 GMT 2005

Diagnostic Status: No Diagnostics

Scientific Instruments: ACS/WFC

Special Requirements: (none)

Patterns

#	Primary Pattern		Secondary Pattern	Exposures
(1)	Pattern Type=ACS-WFC-DITHER-LINE Purpose=DITHER Number Of Points=3 Point Spacing=3.011 Line Spacing=	Coordinate Frame=POS-TARG Pattern Orientation=85.3 Angle Between Sides= Center Pattern=false		(1)
(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)

Fixed Targets

#	Name	Target Coordinates	Targ. Coord. Corrections	Fluxes	Miscellaneous
(1)	SDSS1004+4112	RA: 10 04 34.1900 (151.1424583d) Dec: +41 12 44.00 (41.21222d) Equinox: J2000 Plate Id: (?)		V=18.5+/-0.5	Coordinate Source: HST_IMAGE

Comments: Magnitude is that of brightest quasar image. Lens galaxy is r=20.5 (g~22.5) and the lensed arcs are i~24. Coordinates derived from HST image agree with SDSS coordinates to better than one arcsec

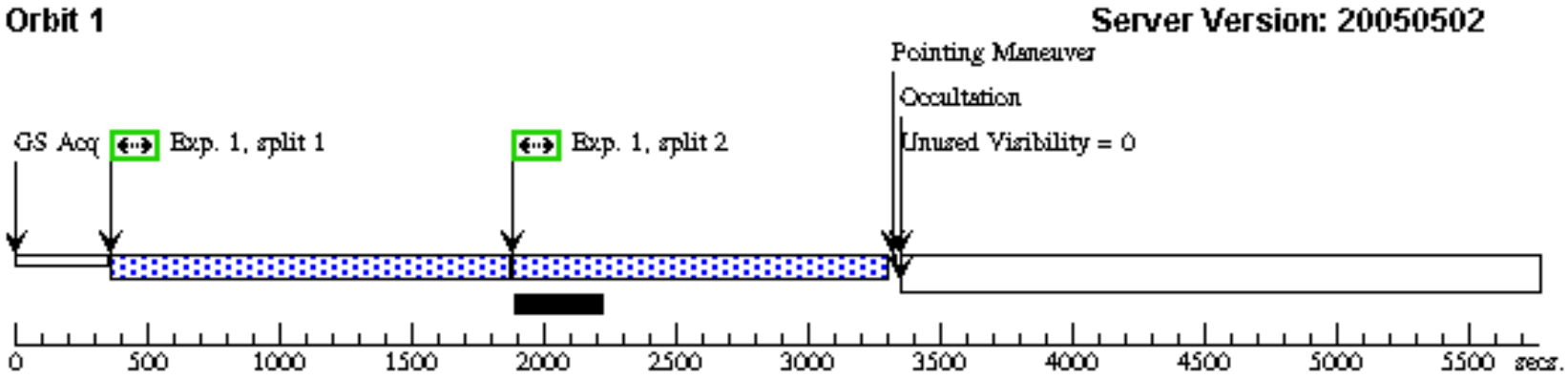
Exposures

#	Label	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time/[Actual Dur.]	Orbit
1		(1) SDSS1004+4112	ACS/WFC, ACCUM, WFC1	F435W			Pattern 1-1 (1)	2200.0 Secs	
								[==>1303.0 Secs (Pattern 1, Split 1)] *[==>1303.0 Secs (Pattern 1, Split 2)]*	***[1]***
								[==>1344.0 Secs (Pattern 2, Split 1)] *[==>1344.0 Secs (Pattern 2, Split 2)]*	***[2]***
								[==>1342.0 Secs (Pattern 3, Split 1)] *[==>1342.0 Secs (Pattern 3, Split 2)]*	***[3]***

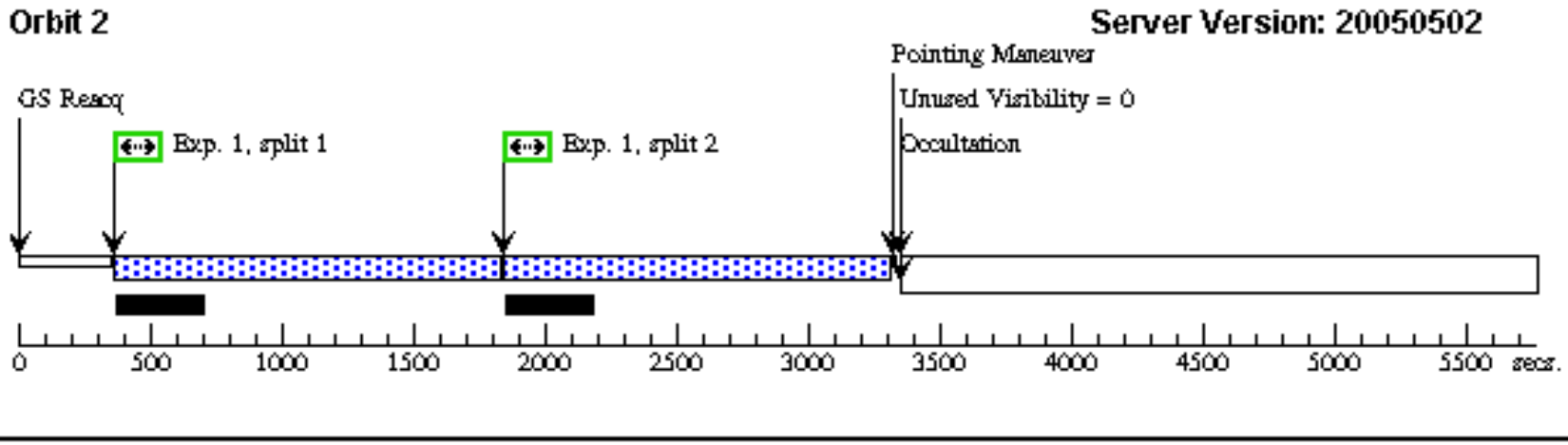
Exposures (continued)

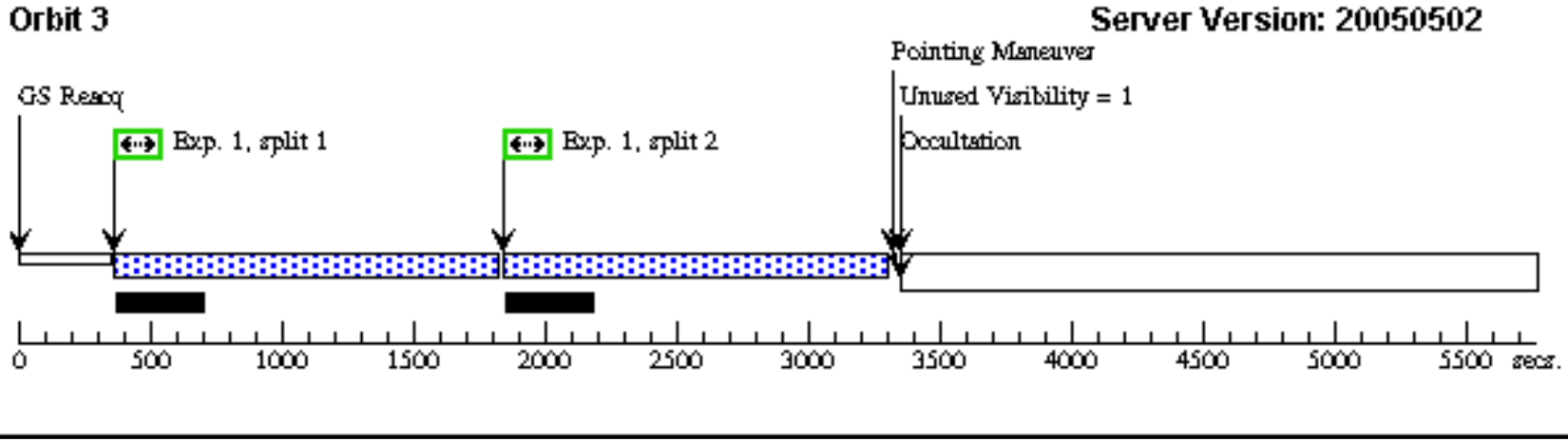
#	Label	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time/[Actual Dur.]	Orbit
2		(1) SDSS1004+4112	ACS/WFC, ACCUM, WFC1	F435W			Pattern 2-2 (2)	2200.0 Secs	
								[==>1344.0 Secs (Pattern 1, Split 1)] *[==>1344.0 Secs (Pattern 1, Split 2)]*	***[4]***
								[==>1356.0 Secs (Pattern 2, Split 1)] *[==>1356.0 Secs (Pattern 2, Split 2)]*	***[5]***

Orbit Structure



Orbit Structure (continued)





Orbit Structure (continued)