10863 - Magnifying the High-z Universe with the Bullet Cluster 1E0657-56

Cycle: 15, Proposal Category: GO

(Availability Mode: SUPPORTED)

INVESTIGATORS

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VISITS

Visit	*Targets*	*Configurations*	*Orbits Used*	*Last Orbit Planner Run*	*OP Current with Visit?*
01	(1) 1E0657-56	ACS/WFC	4	02-Jun-2006 21:03:34.0	yes
02	(1) 1E0657-56	ACS/WFC	5	02-Jun-2006 21:03:43.0	yes

9 Total Orbits Used

ABSTRACT

We propose to use the bullet cluster 1E0657-56 (z=0.296) as a gravitational telescope to conduct a pencil beam survey of the galaxy population to z=7. The cluster 1E0657-56, one of the hottest and most X-ray luminous clusters known, is a highly efficient lens with critical curves comparable in

size to Abell 1689. The proposed observations will yield a high-fidelity strong+weak lensing map of the cluster core, enabling identification of lensed, high-redshift sources and also providing a precision measurement of the cluster mass (good to 5% within 350 kpc). The mass measurement will also serve as a key input for numerical simulations designed to reconstruct the dynamical history of the cluster merger and provide a new constraint on the dark matter self-interaction cross-section. In the cluster core the requested imaging will reach (de-magnified) magnitudes comparable to the Hubble Ultra Deep Field for lensed sources, but with 2+ magnitudes of magnification facilitating spectroscopic follow-up.

OBSERVING DESCRIPTION

The goals of this program are to conduct a pencil-beam survey of high-z galaxies using 1E0657 as a gravitational telescope to probe to fainter magnitudes than would otherwise be possible, and to derive a detailed strong lensing map for the cluster core. The resolution of HST/ACS is critical to this program both for identification of counter-images that are used to refine the strong lensing map, and for identification of the high-z, lensed galaxies that are the focus of this program.

Required area: Our program can be achieved with one ACS pointing covering the core of 1E0657. For the requested central pointing location all the arcs and multiple images associated with the cluster core (including two red arcs near the ICM peak) will lie within the ACS field of view for arbitrary roll angle.

Required Filters: We require two filters, F850LP and F775W, for identification of counter images and constraining the redshifts of the high-z sources. F850LP is chosen rather than F814W because use of the redder band enables detection of
background sources to z~7, which can have colors F814W-F850LP>2. For the bluer band we select F775W rather than F814W to provide a more extended color baseline when identifying counter-images of lower redshift sources.

Required Depth: We will be observing for 5 orbits in F850LP and 4 in F775W. Our target sensitifity for this program is F850LP=25 mag per sq. arcsec (AB, 5 sigma) for typical arcs (equivalent to 26.2 mag 5-sigma detection for galaxies with r=0.3"), which we consider an optimal tradeoff between depth and practicality. At this limiting magnitude we would detect two images of the Kneib et al. arc at z~7,
which is magnified by a factor of 25. We require comparable depth in F775W for color identification of counter images when constructing the strong

lensing map. For star forming galaxies at z=2-6, F850LP-F775W~0-0.3 (AB0, and z>5 candidates are usually selected via F775W-F850LP>0.9. To enable comparable dropout selection in this work down to F850LP=26.2, we set the limiting magnitude to F775W=26.9 (3 sigma).

To calculate the exposure times we assumed that the area for a typical arclet is equivalent to a circle of diameter 0.7" -- consistent with observed arclets in 1E0657 -- and require S/N=3 for 3x3 pixel resolution elements. For these requirements and the desired limiting surface brightness, the ACS ETC indicates nominal exposure times of 14 ks in F850LP and 9 ks in F775W. These estimates are also consistent with the Kneib et al. study, for which the authors had 5 orbits in F850LP.

Visit

Proposal 10863, Visit 01 Sat Jun 03 01:03:47 GMT 2006

Diagnostic Status: No Diagnostics

Scientific Instruments: ACS/WFC

Special Requirements: ORIENT 275.0D TO 300.0 D; GROUP 01,02 WITHIN 14.0D

Patterns

#	Primary Pattern		Secondary Pattern		Exposures
(1)	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=true	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)

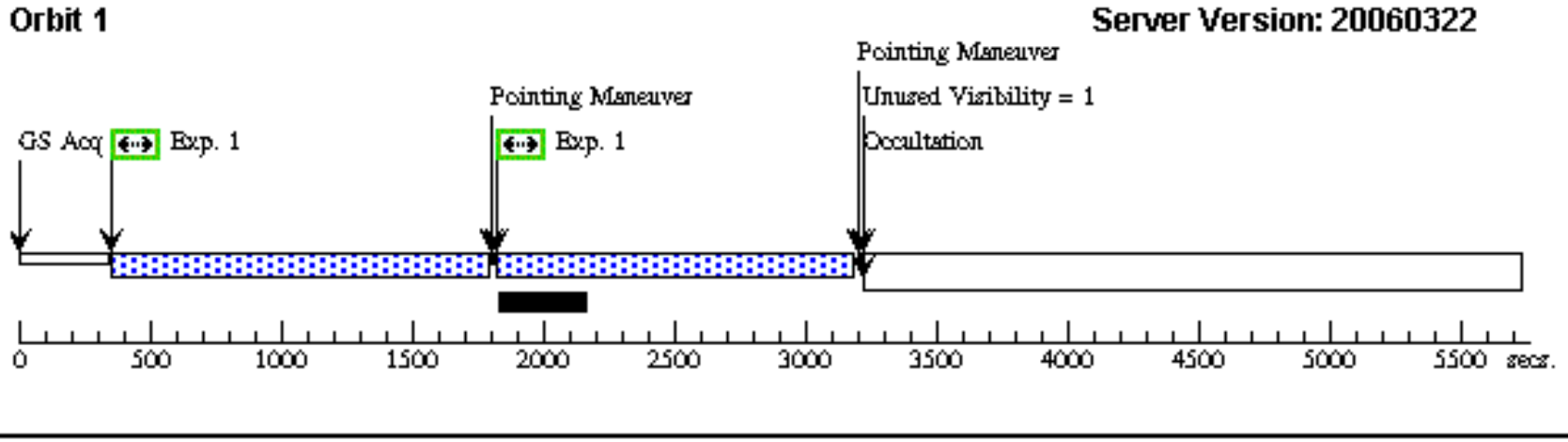
Fixed Targets

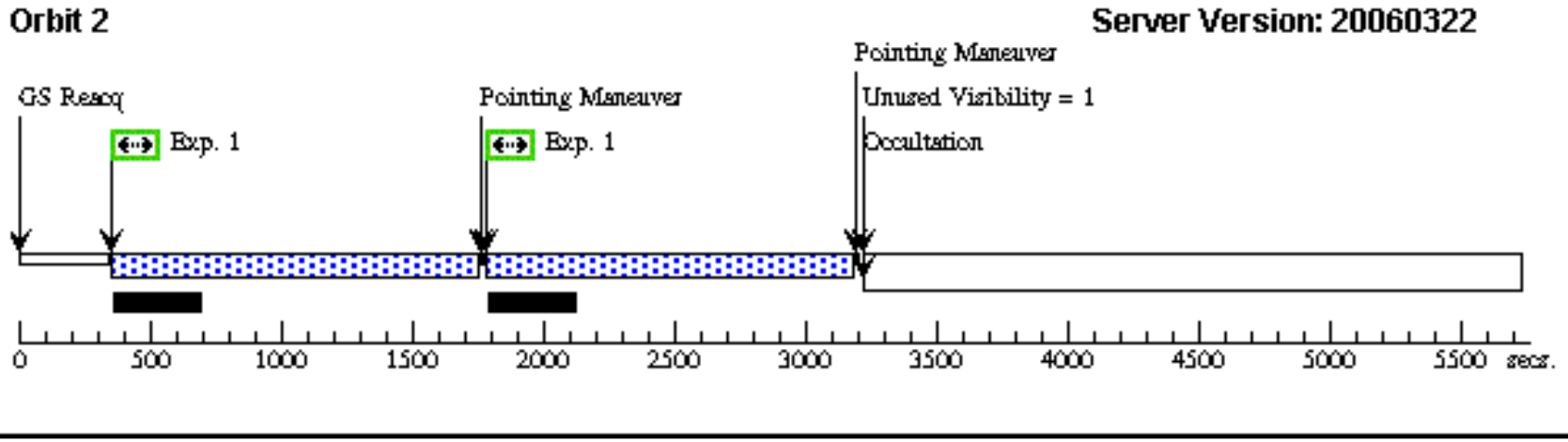
#	Name	Target Coordinates	Targ. Coord. Corrections	Fluxes	Miscellaneous
(1)	1E0657-56	RA: 06 58 34.0000 (104.6416667d) Dec: -55 57 5.00 (-55.95139d) Equinox: J2000		V=25.0	Reference Frame: ICRS

Exposures

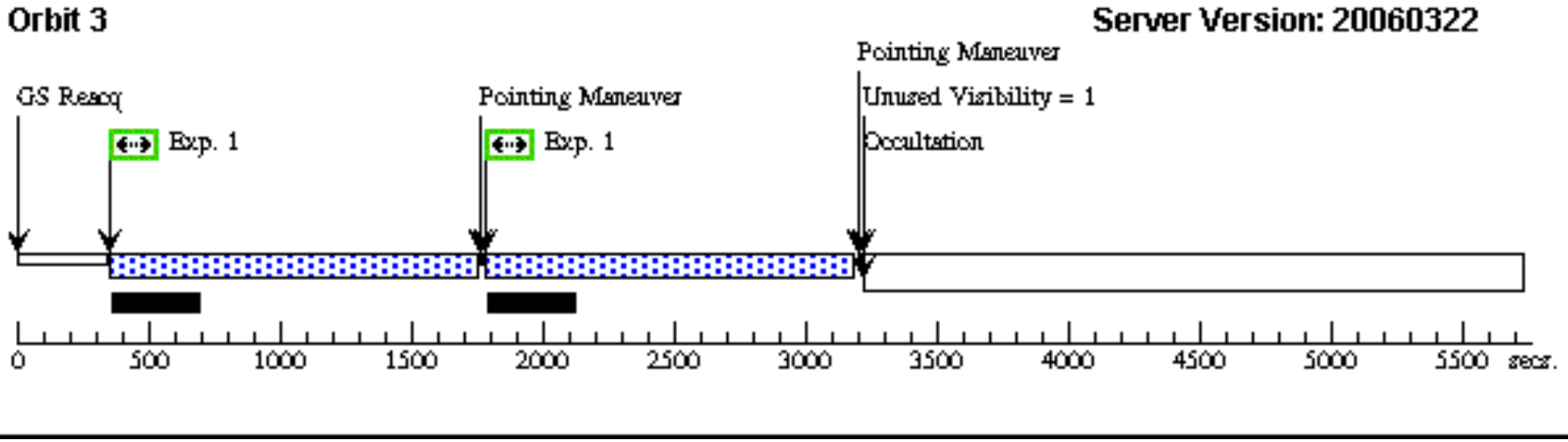
#	Label	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time/[Actual Dur.]	Orbit
1	F775W Main Loop	(1) 1E0657-56	ACS/WFC, ACCUM, WFC	F775W	CR-SPLIT=NO		Pattern 1-1 (1)	1200.0 Secs	
								[==>1236.0 Secs (Pattern 1,1)] *[==>1236.0 Secs (Pattern 1,2)]*	***[1]***
								[==>1275.0 Secs (Pattern 1,3)] *[==>1275.0 Secs (Pattern 1,4)]*	***[2]***
								[==>1277.0 Secs (Pattern 2,1)] *[==>1277.0 Secs (Pattern 2,2)]*	***[3]***
								[==>1287.0 Secs (Pattern 2,3)] *[==>1287.0 Secs (Pattern 2,4)]*	***[4]***

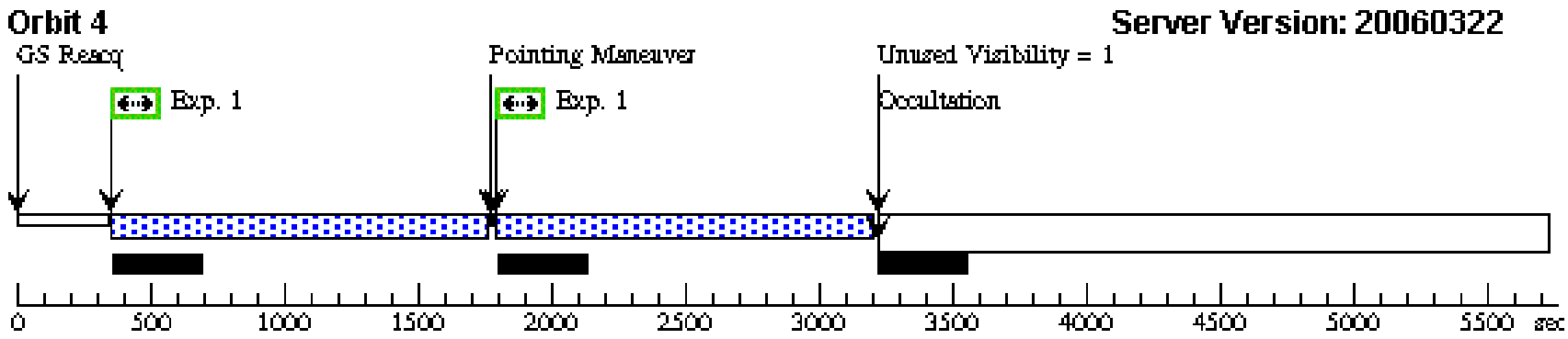
Orbit Structure





Orbit Structure (continued)





Visit

Proposal 10863, Visit 02 Sat Jun 03 01:03:48 GMT 2006

Diagnostic Status: No Diagnostics

Scientific Instruments: ACS/WFC

Special Requirements: SAME ORIENT AS 01

Patterns

#	Primary Pattern		Secondary Pattern		Exposures
(1)	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=true	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)
(4)	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)

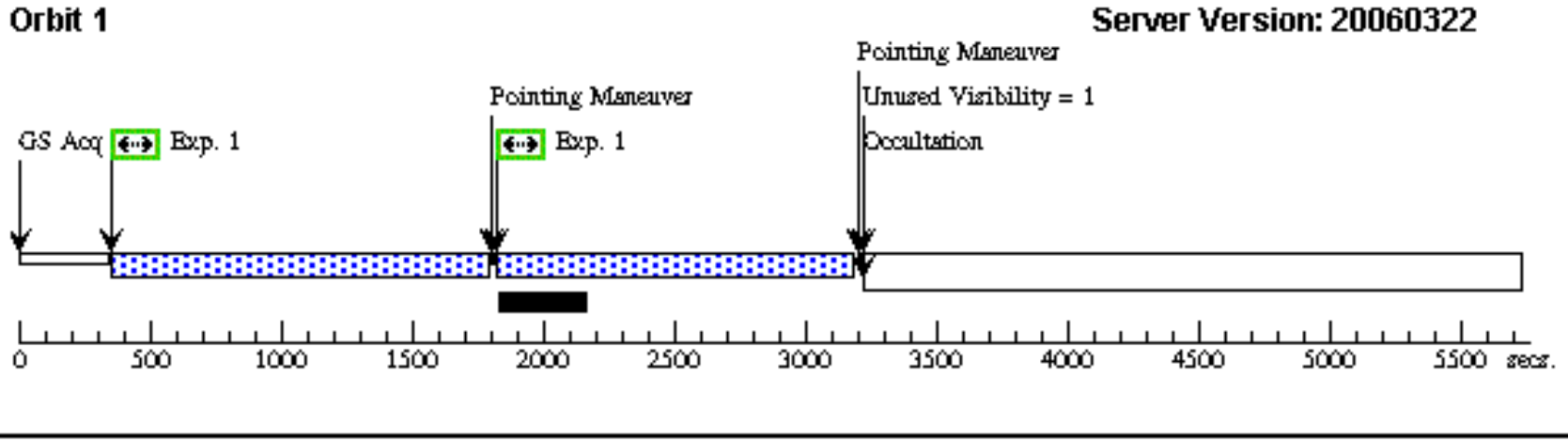
Fixed Targets

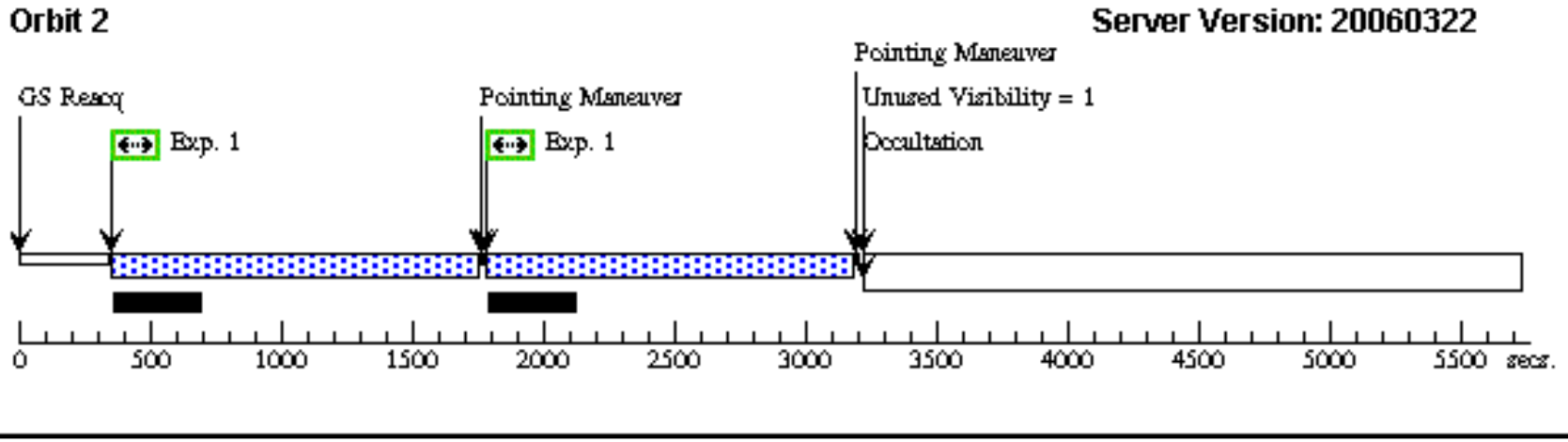
#	Name	Target Coordinates	Targ. Coord. Corrections	Fluxes	Miscellaneous
(1)	1E0657-56	RA: 06 58 34.0000 (104.6416667d) Dec: -55 57 5.00 (-55.95139d) Equinox: J2000		V=25.0	Reference Frame: ICRS

Exposures

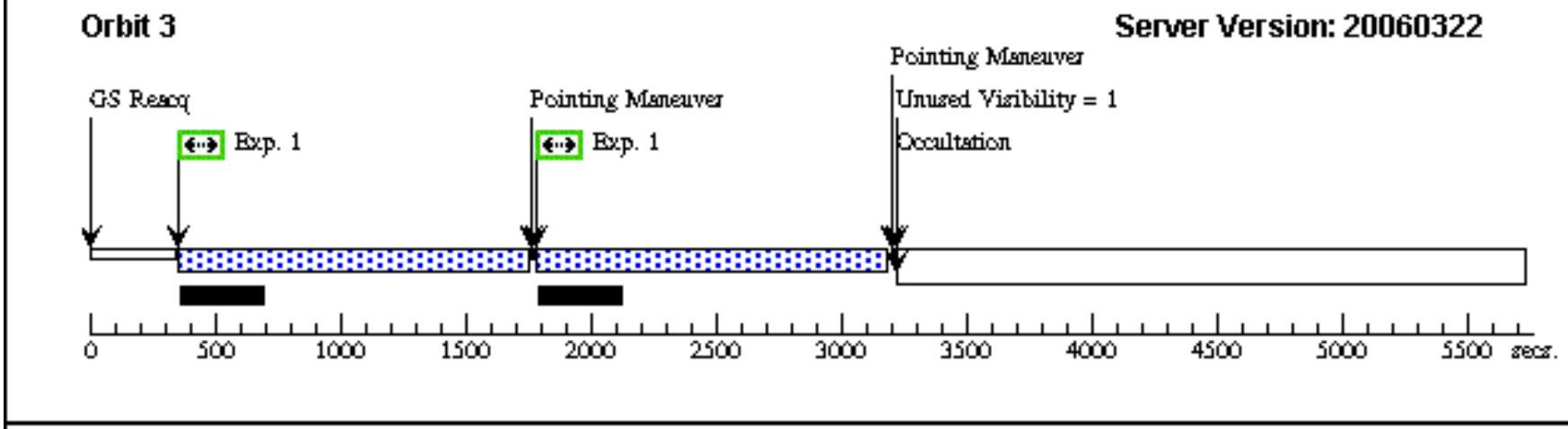
#	Label	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time/[Actual Dur.]	Orbit
1	F850LP	(1) 1E0657-56	ACS/WFC, ACCUM, WFC	F850LP	CR-SPLIT=NO		Pattern 1-1 (1)	1200.0 Secs	
								[==>1236.0 Secs (Pattern 1,1)] *[==>1236.0 Secs (Pattern 1,2)]*	***[1]***
								[==>1275.0 Secs (Pattern 1,3)] *[==>1275.0 Secs (Pattern 1,4)]*	***[2]***
								[==>1277.0 Secs (Pattern 2,1)] *[==>1277.0 Secs (Pattern 2,2)]*	***[3]***
								[==>1274.0 Secs (Pattern 2,3)] *[==>1274.0 Secs (Pattern 2,4)]*	***[4]***
2	F850LP	(1) 1E0657-56	ACS/WFC, ACCUM, WFC	F850LP	CR-SPLIT=NO	POS TARG 0.494,5.968	Pattern 2-2 (4)	1200.0 Secs	
								[==>1285.0 Secs (Pattern 1)] *[==>1285.0 Secs (Pattern 2)]*	***[5]***

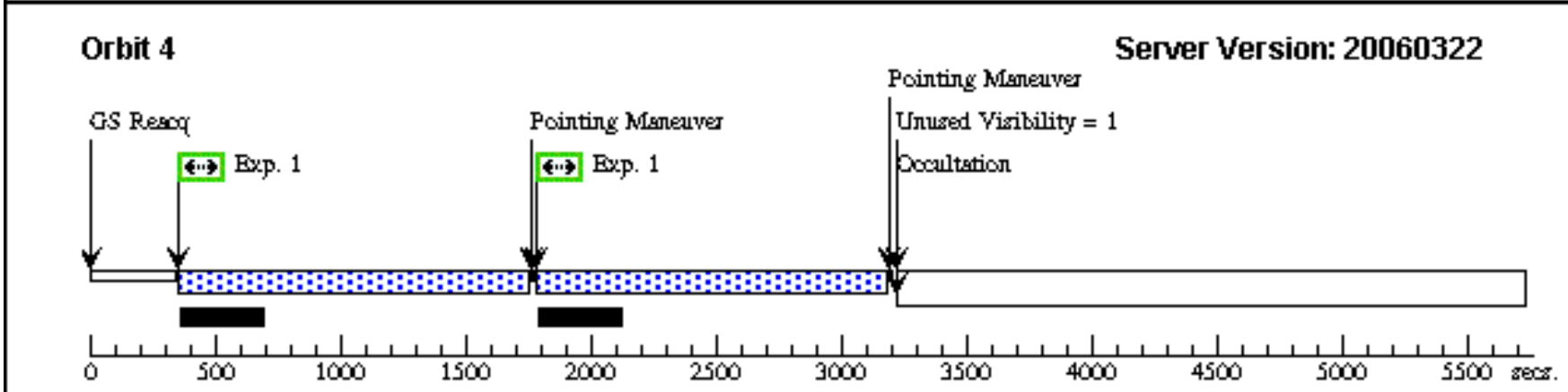
Orbit Structure





Orbit Structure (continued)





Orbit Structure (continued)