11160 - Escape fraction and stellar populations in a highly magnified Lyman-Break Galaxy

Cycle: 16, Proposal Category: GO

(Availability Mode: SUPPORTED)

INVESTIGATORS

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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) COSMICEYE	WFPC2	1	17-Jan-2008 23:00:02.0	yes
02	(1) COSMICEYE	WFPC2	1	17-Jan-2008 23:00:04.0	yes
03	(1) COSMICEYE	WFPC2	1	17-Jan-2008 23:00:06.0	yes

Visit	*Targets used in Visit*	*Configurations used in Visit*	*Orbits Used*	*Last Orbit Planner Run*	*OP Current with Visit?*
04	(1) COSMICEYE	WFPC2	1	17-Jan-2008 23:00:07.0	yes
05	(1) COSMICEYE	WFPC2	1	17-Jan-2008 23:00:08.0	yes
06	(1) COSMICEYE	WFPC2	1	17-Jan-2008 23:00:09.0	yes
07	(1) COSMICEYE	WFPC2	1	17-Jan-2008 23:00:11.0	yes
08	(1) COSMICEYE	NIC2	1	17-Jan-2008 23:00:17.0	yes

8 Total Orbits Used

ABSTRACT

Understanding how star-forming galaxies contribute to cosmic reionization is one of the frontiers of observational cosmology. A key ingredient in this issue is measuring the escape fraction of Lyman-continuum photons in high redshift galaxies (z>3). Gravitationally lensed Lyman-break galaxies (LBGs) act as important laboratories for studying the resolved physical properties at sub-kpc scales with high signal-to-noise. Correlating the local escape fraction with physical parameters derived from stellar population modeling (such as the star formation rate, age and reddening) will offer new insights into understanding the physical processes involved with the production of ionizing photons.

We propose here follow-up observations of the "Cosmic Eye", a remarkable, highly magnified (x 30), Lyman-break galaxy at z~3.07 using WFPC2 and NICMOS. Deep ultraviolet WFPC2 imaging will provide a detailed study of variations in the escape fraction, while WFPC2 and NICMOS/NIC2 imaging will complement the current broad-band detections to allow a precise modeling of the spatially-dependent spectral energy distribution. This will allow the first comprehensive analysis between the escape fraction, the local SED and the dynamics of a distant galaxy.

OBSERVING DESCRIPTION

The first objective of our program requires very deep imaging in the F336W (U) band, using the Wide Field Planetary Camera.
From the LRIS spectrum obtained on several parts of the arc and the average f1500/f900 value recently derived by Shapley et al. (2006) in their

sample of LBGs, we estimate the surface brightness of the Cosmic Eye to be U~24 mag arcsec-2 (AB). Using the Exposure Time Calculator of WFPC2, and taking into account the visibility of the Cosmic Eye (52 min. per orbit) and the overheads ~12 min, we evaluated that a signal-to-noise sigma~4 is achievable in 6 orbits (14.4 ks). Multiple WFPC2/F336W exposures will be used in ACCUM mode, using a dithering pattern to eliminate detector artifacts and provide an adequate sampling of the PSF.

In order to correlate the measured escape fraction with the physical properties (star formation rate, age, reddening) in each region of the arc, we require additional observations with WFPC2 and NICMOS. Using the exposure time calculator and the previous visibility and overhead estimates, 1 orbit integration with WFPC2 will reach ~30 sigma in the F814W filters, matching the depth of our current F606W snapshot image. Multiple exposures will be taken in each filter, using a DITHER-BOX dithering pattern to provide an accurate subsampling of the PSF and eliminate detector artifacts.

We propose to use the NIC2 channel on NICMOS for the observations in the F110W and F160W band, since the Cosmic Eye is easily covered by the size of this camera, and the high resolution is critical for the purpose of this project. Based on the observed integrated colors in the SDSS and NIRC/K images, as well as the LRIS spectrum, we estimate total AB magnitudes of I~19.8 J~19.3 and H~19.1 for the combined arcs, with a surface area of ~0.7 arcsec2. According to the NICMOS Exposure Time Calculator, and based on the photometric estimates given above, a signal-to-noise per pixel sigma~30-40 is reachable in a single HST orbit. A dithering pattern with multiple exposures will ensure removal of dead or non-calibrated pixels on the detectors, improve the sampling of the PSF in the F110W filter, as well as prevent post-SAA cosmic ray persistance.

Visit

Proposal 11160, Visit 01, implementation Fri Jan 18 04:00:21 GMT 2008

Diagnostic Status: No Diagnostics

Scientific Instruments: WFPC2

Special Requirements: GROUP 01,02,03,04,05,06 WITHIN 30.0D

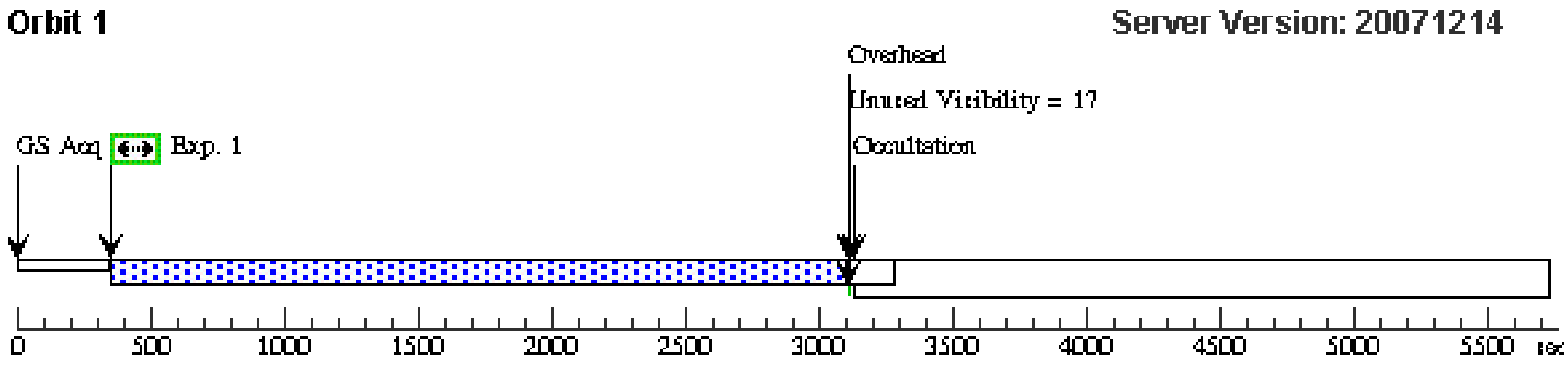
Fixed Targets

#	Name	Target Coordinates	Targ. Coord. Corrections	Fluxes	Miscellaneous
(1)	COSMICEYE	RA: 21 35 12.7340 (323.8030583d) Dec: -01 01 43.94 (-1.02887d) Equinox: J2000		V=20.3+/-0.1 U=24.0 +/- 0.2 mag.arcsec-2 I(814) = 19.8 +/- 0.1 J (110) =19.3 +/- 0.1 H(160)=19.1 +/- 0.1 surface=0.7 arcsec2	Reference Frame: ICRS

Exposures

#	Label	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time/[Actual Dur.]	Orbit
1		(1) COSMICEYE	WFPC2, IMAGE, WFALL	F336W	CR-SPLIT=NO			2600.0 Secs *[==>]*	*[1]*

Orbit Structure



Visit

Proposal 11160, Visit 02, implementation Fri Jan 18 04:00:22 GMT 2008

Diagnostic Status: No Diagnostics

Scientific Instruments: WFPC2

Special Requirements: (none)

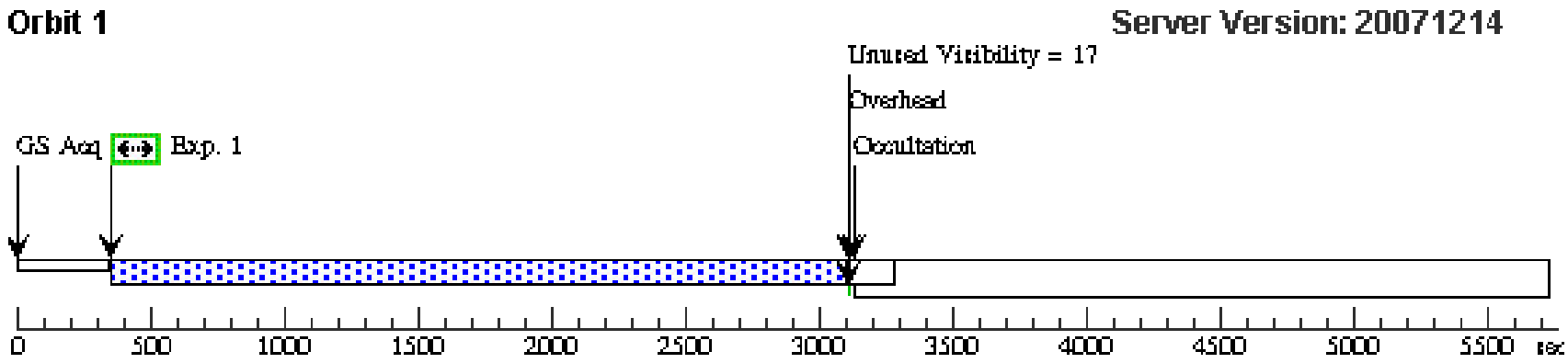
Fixed Targets

#	Name	Target Coordinates	Targ. Coord. Corrections	Fluxes	Miscellaneous
(1)	COSMICEYE	RA: 21 35 12.7340 (323.8030583d) Dec: -01 01 43.94 (-1.02887d) Equinox: J2000		V=20.3+/-0.1 U=24.0 +/- 0.2 mag.arcsec-2 I(814) = 19.8 +/- 0.1 J (110) =19.3 +/- 0.1 H(160)=19.1 +/- 0.1 surface=0.7 arcsec2	Reference Frame: ICRS

Exposures

#	Label	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time/[Actual Dur.]	Orbit
1		(1) COSMICEYE	WFPC2, IMAGE, WFALL	F336W	CR-SPLIT=NO	POS TARG 1.0,1.0		2600.0 Secs *[==>]*	*[1]*

Orbit Structure



Visit

Proposal 11160, Visit 03, implementation Fri Jan 18 04:00:22 GMT 2008

Diagnostic Status: No Diagnostics

Scientific Instruments: WFPC2

Special Requirements: (none)

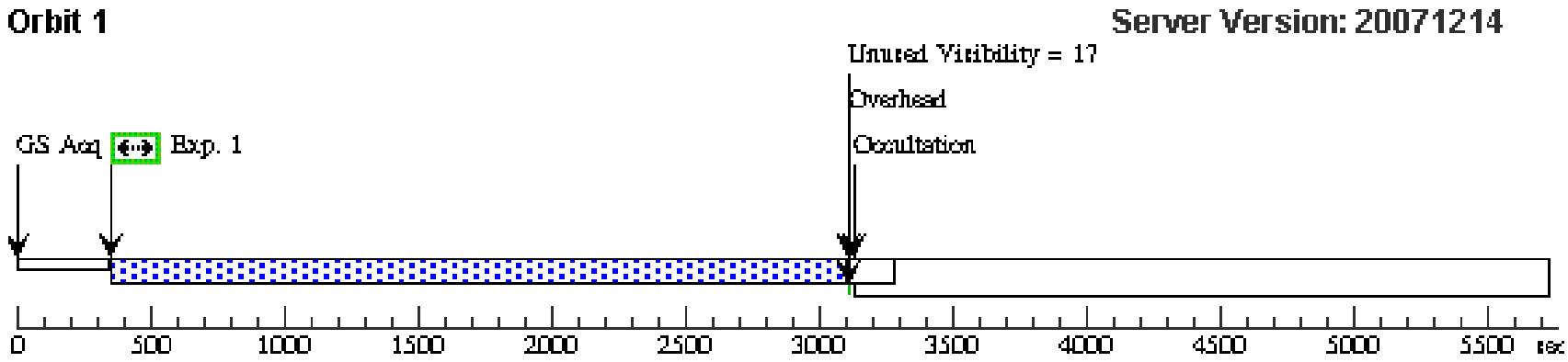
Fixed Targets

#	Name	Target Coordinates	Targ. Coord. Corrections	Fluxes	Miscellaneous
(1)	COSMICEYE	RA: 21 35 12.7340 (323.8030583d) Dec: -01 01 43.94 (-1.02887d) Equinox: J2000		V=20.3+/-0.1 U=24.0 +/- 0.2 mag.arcsec-2 I(814) = 19.8 +/- 0.1 J (110) =19.3 +/- 0.1 H(160)=19.1 +/- 0.1 surface=0.7 arcsec2	Reference Frame: ICRS

Exposures

#	Label	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time/[Actual Dur.]	Orbit
1		(1) COSMICEYE	WFPC2, IMAGE, WFALL	F336W	CR-SPLIT=NO	POS TARG 0.0,1.0		2600.0 Secs *[==>]*	*[1]*

Orbit Structure



Visit

Proposal 11160, Visit 04, implementation Fri Jan 18 04:00:22 GMT 2008

Diagnostic Status: No Diagnostics

Scientific Instruments: WFPC2

Special Requirements: (none)

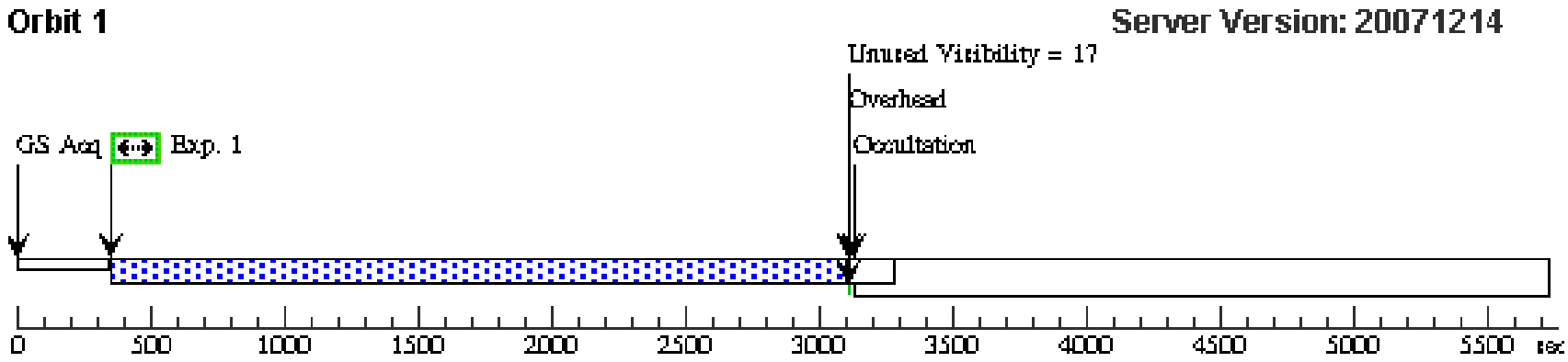
Fixed Targets

#	Name	Target Coordinates	Targ. Coord. Corrections	Fluxes	Miscellaneous
(1)	COSMICEYE	RA: 21 35 12.7340 (323.8030583d) Dec: -01 01 43.94 (-1.02887d) Equinox: J2000		V=20.3+/-0.1 U=24.0 +/- 0.2 mag.arcsec-2 I(814) = 19.8 +/- 0.1 J (110) =19.3 +/- 0.1 H(160)=19.1 +/- 0.1 surface=0.7 arcsec2	Reference Frame: ICRS

Exposures

#	Label	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time/[Actual Dur.]	Orbit
1		(1) COSMICEYE	WFPC2, IMAGE, WFALL	F336W	CR-SPLIT=NO	POS TARG -1.0,0.0		2600.0 Secs *[==>]*	*[1]*

Orbit Structure



Visit

Proposal 11160, Visit 05, implementation Fri Jan 18 04:00:23 GMT 2008

Diagnostic Status: No Diagnostics

Scientific Instruments: WFPC2

Special Requirements: (none)

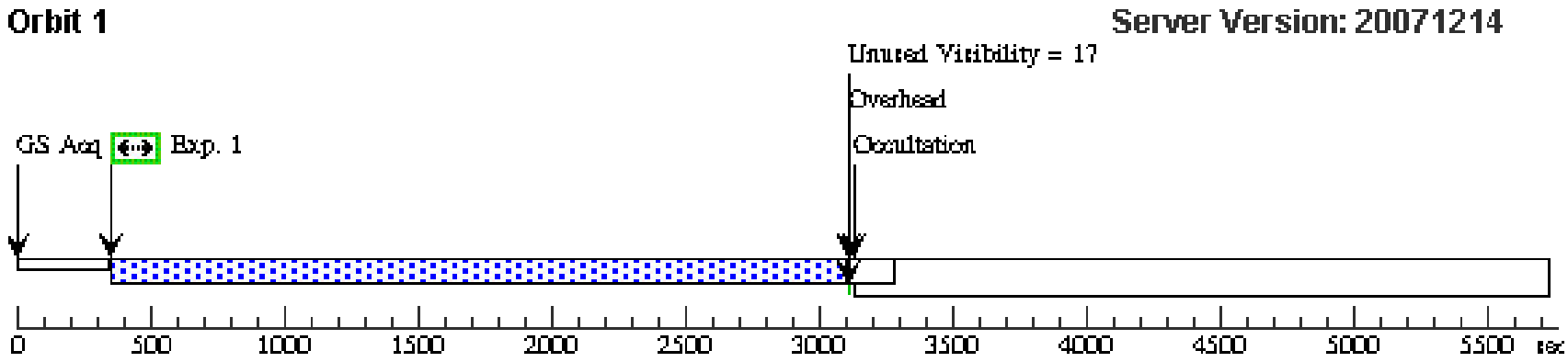
Fixed Targets

#	Name	Target Coordinates	Targ. Coord. Corrections	Fluxes	Miscellaneous
(1)	COSMICEYE	RA: 21 35 12.7340 (323.8030583d) Dec: -01 01 43.94 (-1.02887d) Equinox: J2000		V=20.3+/-0.1 U=24.0 +/- 0.2 mag.arcsec-2 I(814) = 19.8 +/- 0.1 J (110) =19.3 +/- 0.1 H(160)=19.1 +/- 0.1 surface=0.7 arcsec2	Reference Frame: ICRS

Exposures

#	Label	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time/[Actual Dur.]	Orbit
1		(1) COSMICEYE	WFPC2, IMAGE, WFALL	F336W	CR-SPLIT=NO	POS TARG -1.0,-1.0		2600.0 Secs *[==>]*	*[1]*

Orbit Structure



Visit

Proposal 11160, Visit 06, implementation Fri Jan 18 04:00:23 GMT 2008

Diagnostic Status: No Diagnostics

Scientific Instruments: WFPC2

Special Requirements: (none)

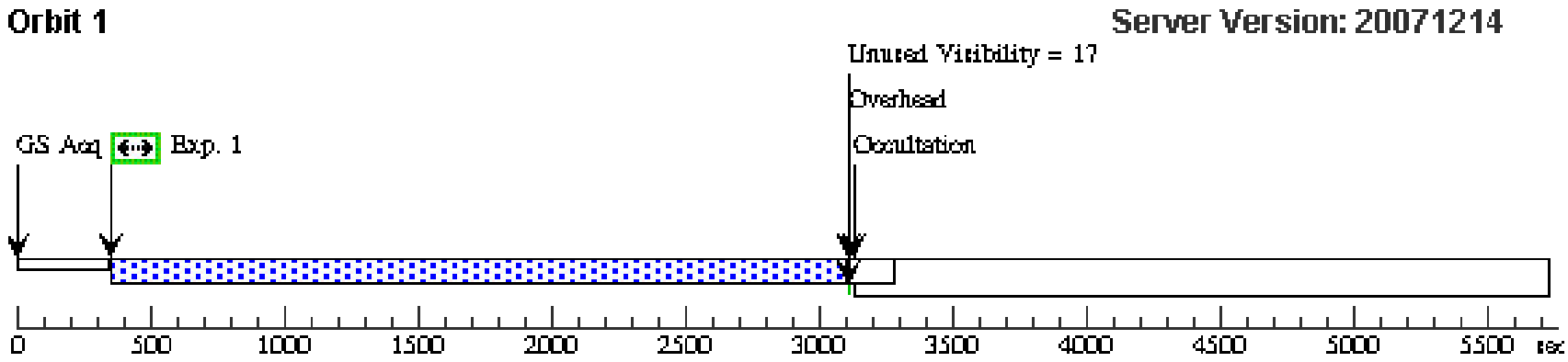
Fixed Targets

#	Name	Target Coordinates	Targ. Coord. Corrections	Fluxes	Miscellaneous
(1)	COSMICEYE	RA: 21 35 12.7340 (323.8030583d) Dec: -01 01 43.94 (-1.02887d) Equinox: J2000		V=20.3+/-0.1 U=24.0 +/- 0.2 mag.arcsec-2 I(814) = 19.8 +/- 0.1 J (110) =19.3 +/- 0.1 H(160)=19.1 +/- 0.1 surface=0.7 arcsec2	Reference Frame: ICRS

Exposures

#	Label	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time/[Actual Dur.]	Orbit
1		(1) COSMICEYE	WFPC2, IMAGE, WFALL	F336W	CR-SPLIT=NO	POS TARG 1.0,-1.0		2600.0 Secs *[==>]*	*[1]*

Orbit Structure



Visit

Proposal 11160, Visit 07, implementation Fri Jan 18 04:00:24 GMT 2008

Diagnostic Status: No Diagnostics

Scientific Instruments: WFPC2

Special Requirements: (none)

Patterns

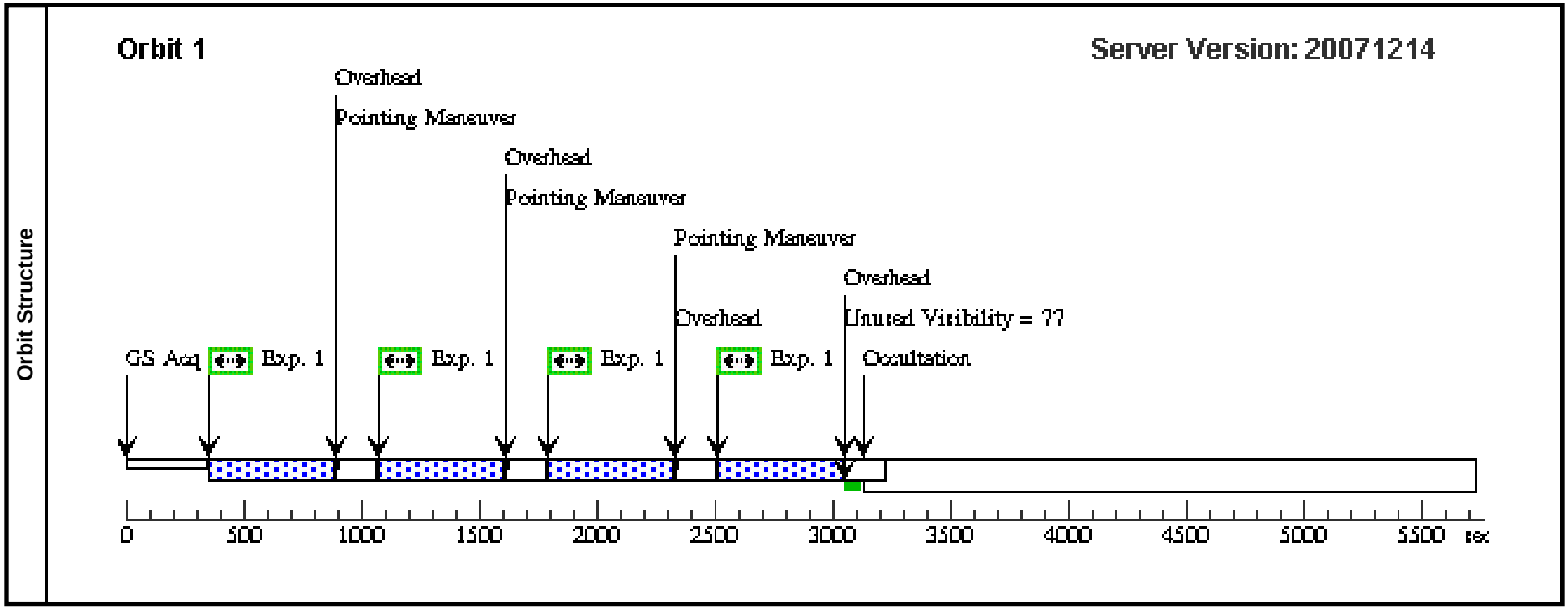
#	Primary Pattern		Secondary Pattern	Exposures
(1)	Pattern Type=WFPC2-BOX	Coordinate Frame=POS-TARG		(1)
	Purpose=DITHER	Pattern Orientation=26.56505		
	Number Of Points=4	Angle Between Sides=143.1301		
	Point Spacing=0.559017	Center Pattern=false		
	Line Spacing=0.559017			

Fixed Targets

#	Name	Target Coordinates	Targ. Coord. Corrections	Fluxes	Miscellaneous
(1)	COSMICEYE	RA: 21 35 12.7340 (323.8030583d) Dec: -01 01 43.94 (-1.02887d) Equinox: J2000		V=20.3+/-0.1 U=24.0 +/- 0.2 mag.arcsec-2 I(814) = 19.8 +/- 0.1 J (110) =19.3 +/- 0.1 H(160)=19.1 +/- 0.1 surface=0.7 arcsec2	Reference Frame: ICRS

Exposures

#	Label	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time/[Actual Dur.]	Orbit
1		(1) COSMICEYE	WFPC2, IMAGE, WFALL	F814W	CR-SPLIT=NO		Pattern 1-1 (1)	400.0 Secs	
								[==>(Pattern 1)]	***[1]***
								[==>(Pattern 2)]	
								[==>(Pattern 3)]	
								[==>(Pattern 4)]	


Orbit Structure
Orbit 1
Server Version: 20071214
Overhead
Pointing Maneuver
Overhead
Pointing Maneuver
Pointing Maneuver
Overhead
Overhead
Unused Visibility = 77
GS Acq
Exp. 1
Exp. 1
Exp. 1
Exp. 1
Occultation
0
500
1000
1500
2000
2500
3000
3500
4000
4500
5000
5500
sec

Visit

Proposal 11160, Visit 08, implementation Fri Jan 18 04:00:24 GMT 2008

Diagnostic Status: No Diagnostics

Scientific Instruments: NIC2

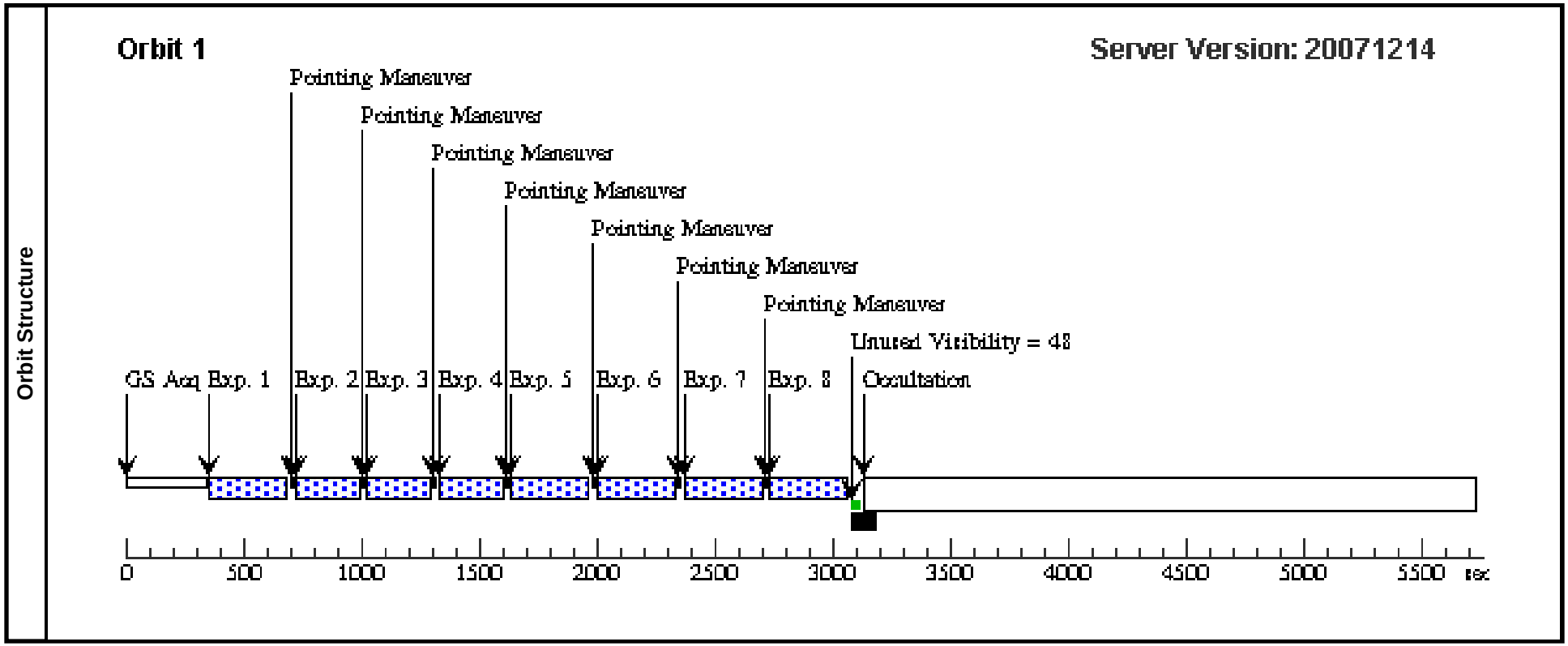
Special Requirements: (none)

Fixed Targets

#	Name	Target Coordinates	Targ. Coord. Corrections	Fluxes	Miscellaneous
(1)	COSMICEYE	RA: 21 35 12.7340 (323.8030583d) Dec: -01 01 43.94 (-1.02887d) Equinox: J2000		V=20.3+/-0.1 U=24.0 +/- 0.2 mag.arcsec-2 I(814) = 19.8 +/- 0.1 J (110) =19.3 +/- 0.1 H(160)=19.1 +/- 0.1 surface=0.7 arcsec2	Reference Frame: ICRS

Exposures

#	Label	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time/[Actual Dur.]	Orbit
1		(1) COSMICEYE	NIC2, MULTIACCUM, NIC2	F110W	SAMP-SEQ=SPARS64; NSAMP=7			*[==>]*	***[1]***
2		(1) COSMICEYE	NIC2, MULTIACCUM, NIC2	F110W	SAMP-SEQ=SPARS64; NSAMP=6	POS TARG 0.7,1.5		*[==>]*	***[1]***
3		(1) COSMICEYE	NIC2, MULTIACCUM, NIC2	F110W	SAMP-SEQ=SPARS64; NSAMP=6	POS TARG -0.7,-1.5		*[==>]*	***[1]***
4		(1) COSMICEYE	NIC2, MULTIACCUM, NIC2	F110W	SAMP-SEQ=SPARS64; NSAMP=6	POS TARG 1.5,0.7		*[==>]*	***[1]***
5		(1) COSMICEYE	NIC2, MULTIACCUM, NIC2	F160W	SAMP-SEQ=SPARS64; NSAMP=7			*[==>]*	***[1]***
6		(1) COSMICEYE	NIC2, MULTIACCUM, NIC2	F160W	SAMP-SEQ=SPARS64; NSAMP=7	POS TARG 0.7,1.5		*[==>]*	***[1]***
7		(1) COSMICEYE	NIC2, MULTIACCUM, NIC2	F160W	SAMP-SEQ=SPARS64; NSAMP=7	POS TARG -0.7,-1.5		*[==>]*	***[1]***
8		(1) COSMICEYE	NIC2, MULTIACCUM, NIC2	F160W	SAMP-SEQ=SPARS64; NSAMP=7	POS TARG 1.5,0.7		*[==>]*	***[1]***


Orbit Structure
Orbit 1
Server Version: 20071214
Pointing Maneuver
Pointing Maneuver
Pointing Maneuver
Pointing Maneuver
Pointing Maneuver
Pointing Maneuver
Pointing Maneuver
Unused Visibility = 48
GS Acq
Exp. 1
Exp. 2
Exp. 3
Exp. 4
Exp. 5
Exp. 6
Exp. 7
Exp. 8
Occultation
0
500
1000
1500
2000
2500
3000
3500
4000
4500
5000
5500
sec