10125 - Where is the Wind in 1H0707-495?

Cycle: 13, Proposal Category: GO

(Availability Mode: SUPPORTED)

INVESTIGATORS

Name	*Institution*	*E-Mail*
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VISITS

Visit	*Targets*	*Configurations*	*Orbits Used*	*Last Orbit Planner Run*	*OP Current with Visit?*
01	(1) 1H0707-495	ACS/SBC	1	07-Nov-2005 21:01:01.0	yes
02	(1) 1H0707-495	ACS/SBC	1	07-Nov-2005 21:01:07.0	yes
03	(1) 1H0707-495	ACS/SBC	1	07-Nov-2005 21:01:10.0	yes

3 Total Orbits Used

ABSTRACT

We propose three observations using HST STIS of the narrow-line Seyfert 1 galaxy 1H 0707-495 to be coordinated with already-approved deep exposures using FUSE. A previous HST observation of 1H 0707-495 revealed strongly blueshifted high-ionization lines, suggesting an origin in an outflowing wind. Detailed photoionization modeling reveals that the wind line fluxes and ratios are consistent with two

solutions: a high-density, high-column solution, originating close to the central engine, and a low-density, low-column solution, located much further out. These two locations, interestingly, correspond to those predicted by two different physical models for winds in AGNs. We can differentiate between these models by observing emission line variability on two time scales, and examining relative variability of OVI obtained by FUSE and CIV and other lines obtained by HST. We will also look for profile variability, constrain velocity ionization stratification through a detailed study of the profiles, and investigate metallicity, which has been suggested to be high in NLS1s. This program, requiring only a modest amount of time, is expected to make significant contributions to our understanding of outflows in AGN, and the structure, origin and metallicity of the broad-line region.

OBSERVING DESCRIPTION

Introduction

We plan three observations of 1H0707-495 using HST ACS SBC in spectroscopic mode to be conducted simultaneously with three already-approved deep FUSE observations. The FUSE observations are highly time constrained by the observing constraints of the satellite (see below). The goal to look for variability in flux and profile in the OVI line observed with FUSE, and principally the flux in the FUV

spectrum observed using the HST ACS.

Our approach to the data analysis will be to compare the spectra from individual epochs of observation to the high SNR combined spectrum from all three observations. We will search for line flux and possibly profile variability, refine photoionization models presented in Leighly 2004 (ApJ 611, 125), and construct a radially-stratified photoionization model, if warranted by the emission-line profiles.

Coordination with FUSE

The HST observations should be coordinated with three already-approved FUSE monitoring observations. The FUSE observations are highly time constrained for the following reason. After the loss of two of the reaction wheels, FUSE is limited in the area of the sky that it can observe at any particular time. 1H0707-495 is a good target for FUSE because its high latitude means that it is more accessible than other objects. 1H0707-495 will be available to FUSE for three periods each 11--18 days in length between December 2004 to April 2005 (Table 1). Our science goals require that we observe the target on two different time scales. For the shorter time scale, we will observe the object at the beginning and the end of one of the longer periods; these two observations will be separated by more than three days. For the longer time scale, we will observe the object once during one of

the other periods; thus it will be separated from the other two observations by 2--4 months. Our preference would be to do the two observations during the 2005 April window, as it is one of the longer periods of visibility, and do the third observation during the 2004 December window, to maximize the long interval.

Each of the FUSE observations is 50 ks in length. FUSE observes with about 30% efficiency; this means that each observation will require almost two days of exposure. Each HST observation, comprised of one orbit, should be conducted any time within that two-day interval.

Table 1 -- FUSE Observing Intervals

Start	End	Duration (days)	
2004:12:01:07:57:11	2004:12:12:08:57:52	11	<==
2005:01:27:13:32:17	2005:02:15:06:00:00	18.7	
2005:03:24:12:00:00	2005:04:11:21:32:59	18.4	<==

(the <== mark the preferred windows).

Details of Observations

The primary science goal of these observations is to see whether the

CIV flux changes between the observations. Therefore, it is essential to have good wavelength calibration and an understanding of any potential systematic uncertainties.

To obtain good wavelength calibration, it is essential that the position of the zeroth order image be known. Therefore, we choose to make a short direct imaging SBC observation at the beginning of each visit. Bright object limit constraints are a concern here. We use the ACS Imaging ETC, using the merged observed Cycle 7 HST STIS FUV and NUV spectra as input. We find that we cannot use the clear filter (F115LP) because the bright object limits are violated by about a factor of two. F150LP gives an acceptable rate (30.5 c/s in the brightest pixel); however, we worry about variability of the object so deem that filter also unacceptable. We finally conclude that only the Lyalpha filter (F122M) predicts an acceptably conservative rate of 5.2 counts/second in brightest pixel. This is a factor of 10 lower than the local bright object limit maximum. The source count rate is 48.8 counts/s and the background rate is 6.6 counts/s, so there will be no problem in identifying the position of the source. The predicted count rate in the entire detector is 9,036 counts/s, much smaller than the acceptable global count rate of 80,000 counts/s. A 180 second observation should give us a well exposed image. Note that there is no obviously UV-bright object in the 32x32 arcsec field of view around 1H0707-495 in the DSS.

To ameliorate any systematic uncertainty, we use a AC-SBC-DITHER-BOX

to sample the spectrum on four different places on the detector. We use box sides of 1 and 1.5 arcseconds, box orientation of 20 degrees, and box side angle of 60 degrees.

The spectra obtained at each of the four points of the box are 623 second in exposure time. Using the ACS SBC Spectroscopic ETC with the Cycle 7 HST STIS spectrum as input we find that the count rate in the brightest pixel is 4.6 count/s, far below the bright object limit. In 623 seconds, we obtain 2866 photons in the brightest pixel, so we are far from the full-well capacity of the detector (65,523 counts). In each of these four spectra, the ACS spectroscopic ETC predicts a signal-to-noise of between 80 and 120 between 1250 and 1700 Angstroms.

Visit

Proposal 10125, Visit 01 Tue Nov 08 02:01:12 GMT 2005

Diagnostic Status: No Diagnostics

Scientific Instruments: ACS/SBC

Special Requirements: (none)

Comments: This observation should be coordinated with the first of the three FUSE observations. The FUSE observation should span a time period of about 2 days. The HST observation should be done at some time during the FUSE observation.
Ideally, that first FUSE observation will be done sometime during the first window that the target is available to FUSE: 2004:12:01:07:57:11 2004:12:12:08:57:52.

Patterns

#	Primary Pattern		Secondary Pattern	Exposures
(1)	Pattern Type=BOX	Coordinate Frame=POS-TARG		(2)
	Purpose=DITHER	Pattern Orientation=20		
	Number Of Points=4	Angle Between Sides=60		
	Point Spacing=1.5	Center Pattern=true		
	Line Spacing=1			

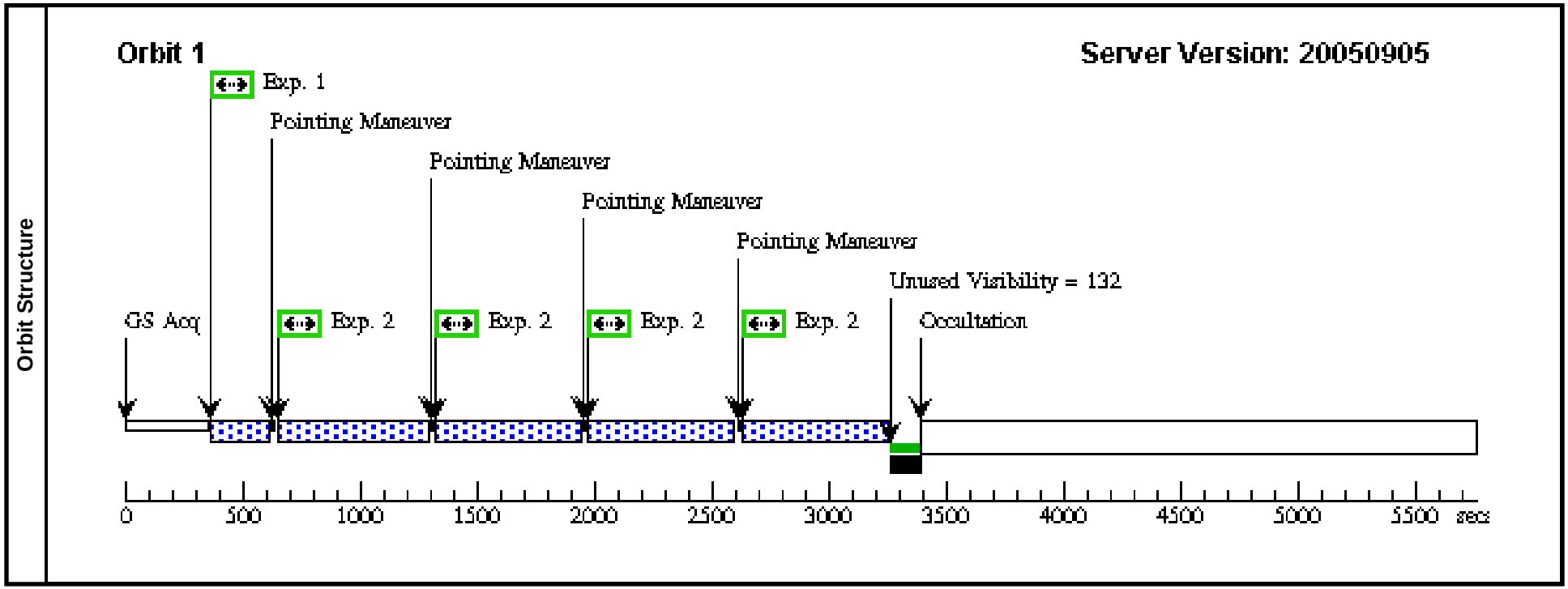
Fixed Targets

#	Name	Target Coordinates	Targ. Coord. Corrections	Fluxes	Miscellaneous
(1)	1H0707-495	RA: 07 08 41.4700 (107.1727917d) Dec: -49 33 5.80 (-49.55161d) Equinox: J2000 Plate Id: 019B		V=15.7 B-V=0.32, U-B=-0.71, F-CONT(2500)=7.4E-15, F-CONT(1400)=1.4E-14, F-LINE(1264)=2.4E-14, F-LINE(2914)=3.0E-15	Coordinate Source: GSC_SURVEY_PLATE

Comments: F-CONT(2500), F-CONT(1400) are the observed flux in the continuum from previous STIS observation in 1999 in erg/cm^2/s/Angstrom.
F-LINE(1264) is the difference in the peak flux of the Lyalpha line, which is the brightest line in the FUV, and the continuum under the line.
F-LINE(2914) is the difference in the peak flux in the MgII line, which is the brightest line in the NUV, and the continuum under the line.

Exposures

#	Label	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time/[Actual Dur.]	Orbit
1		(1) 1H0707-495	ACS/SBC, ACCUM, SBC	F122M				180.0 Secs	
								[==>]	***[1]***
2		(1) 1H0707-495	ACS/SBC, ACCUM, SBC	PR130L			Pattern 2-2 (1)	593.0 Secs	
								[==>(Pattern 1)] *[==>(Pattern 2)]* *[==>(Pattern 3)]* *[==>(Pattern 4)]*	***[1]***


Orbit Structure
Orbit 1
Server Version: 20050905
Exp. 1
Pointing Maneuver
Pointing Maneuver
Pointing Maneuver
Pointing Maneuver
Unused Visibility = 132
GS Acq
Exp. 2
Exp. 2
Exp. 2
Exp. 2
Occultation
0
500
1000
1500
2000
2500
3000
3500
4000
4500
5000
5500
sec

Visit

Proposal 10125, Visit 02 Tue Nov 08 02:01:13 GMT 2005

Diagnostic Status: No Diagnostics

Scientific Instruments: ACS/SBC

Special Requirements: (none)

Comments: This observation should be coordinated with the second of the three FUSE observations. The FUSE observation should span a time period of about 2 days. The HST observation should be done at some time during the FUSE observation. Ideally, that second FUSE observation will be done sometime near the beginning of the third window that the target is available to FUSE: 2005:03:24:12:00:00 2005:04:11:21:32:59.

Patterns

#	Primary Pattern		Secondary Pattern	Exposures
(1)	Pattern Type=BOX	Coordinate Frame=POS-TARG		(2)
	Purpose=DITHER	Pattern Orientation=20		
	Number Of Points=4	Angle Between Sides=60		
	Point Spacing=1.5	Center Pattern=true		
	Line Spacing=1			

Fixed Targets

#	Name	Target Coordinates	Targ. Coord. Corrections	Fluxes	Miscellaneous
(1)	1H0707-495	RA: 07 08 41.4700 (107.1727917d) Dec: -49 33 5.80 (-49.55161d) Equinox: J2000 Plate Id: 019B		V=15.7 B-V=0.32, U-B=-0.71, F-CONT(2500)=7.4E-15, F-CONT(1400)=1.4E-14, F-LINE(1264)=2.4E-14, F-LINE(2914)=3.0E-15	Coordinate Source: GSC_SURVEY_PLATE

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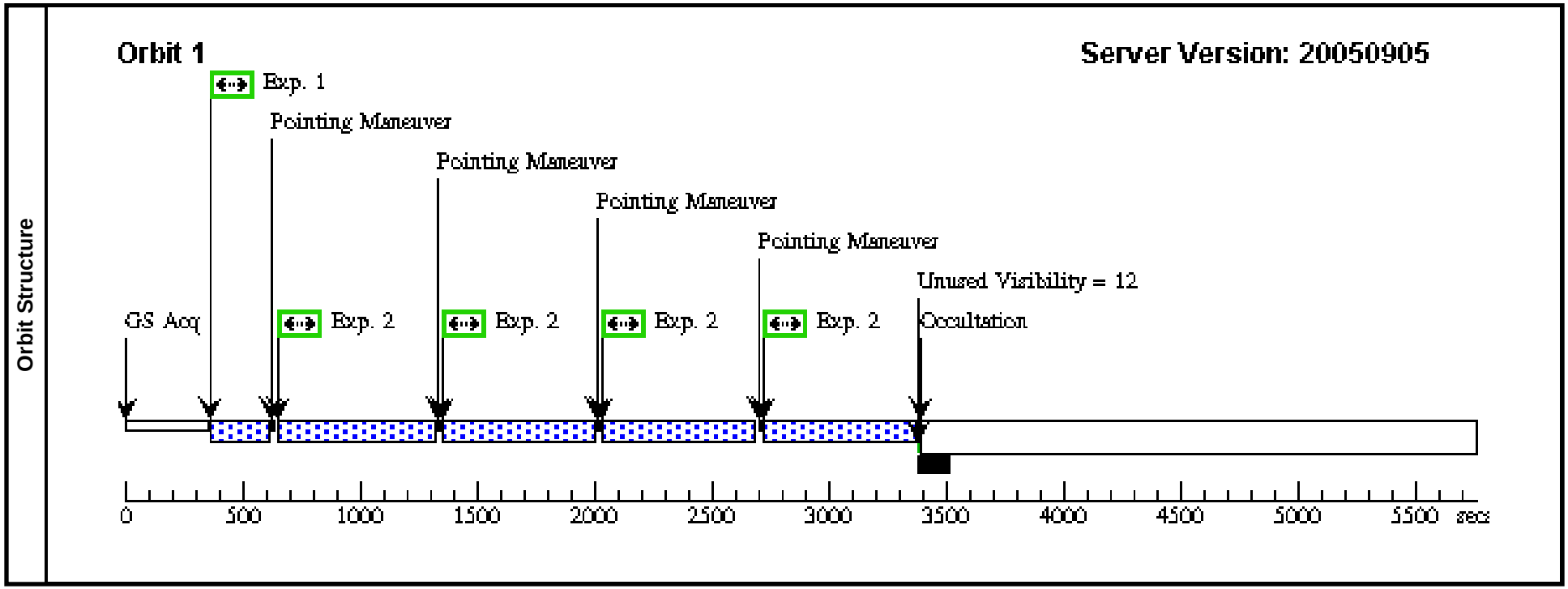
Exposures

#	Label	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time/[Actual Dur.]	Orbit
1		(1) 1H0707-495	ACS/SBC, ACCUM, SBC	F122M				180.0 Secs	
								[==>]	***[1]***
2		(1) 1H0707-495	ACS/SBC, ACCUM, SBC	PR130L			Pattern 2-2 (1)	623.0 Secs	
								[==>(Pattern 1)] *[==>(Pattern 2)]* *[==>(Pattern 3)]* *[==>(Pattern 4)]*	***[1]***


Orbit Structure
Orbit 1
Server Version: 20050905
Exp. 1
Pointing Maneuver
Pointing Maneuver
Pointing Maneuver
Pointing Maneuver
Unused Visibility = 12
GS Acq
Exp. 2
Exp. 2
Exp. 2
Exp. 2
Occultation
0
500
1000
1500
2000
2500
3000
3500
4000
4500
5000
5500
sec

Visit

Proposal 10125, Visit 03 Tue Nov 08 02:01:14 GMT 2005

Diagnostic Status: No Diagnostics

Scientific Instruments: ACS/SBC

Special Requirements: AFTER 02 BY 3 D TO 11 D

Comments: This observation should be coordinated with the third of the three FUSE observations. The FUSE observation should span a time period of about 2 days. The HST observation should be done at some time during the FUSE observation.
Ideally, that third FUSE observation will be done sometime during the third window that the target is available to FUSE:2005:03:24:12:00:00 2005:04:11:21:32:59.

Patterns

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(1)	Pattern Type=BOX	Coordinate Frame=POS-TARG		(2)
	Purpose=DITHER	Pattern Orientation=20		
	Number Of Points=4	Angle Between Sides=60		
	Point Spacing=1.5	Center Pattern=true		
	Line Spacing=1			

Fixed Targets

#	Name	Target Coordinates	Targ. Coord. Corrections	Fluxes	Miscellaneous
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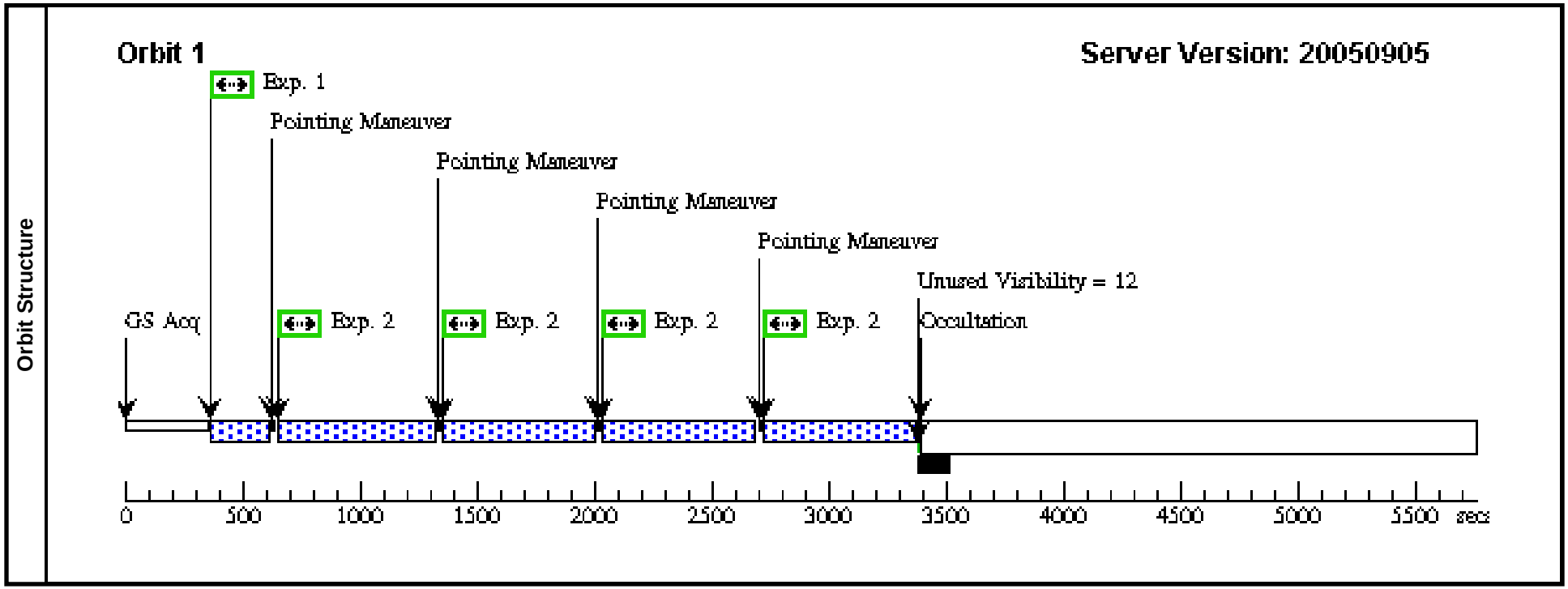
								[==>]	***[1]***
2		(1) 1H0707-495	ACS/SBC, ACCUM, SBC	PR130L			Pattern 2-2 (1)	623.0 Secs	
								[==>(Pattern 1)] *[==>(Pattern 2)]* *[==>(Pattern 3)]* *[==>(Pattern 4)]*	***[1]***


Orbit Structure
Orbit 1
Server Version: 20050905
Exp. 1
Pointing Maneuver
Pointing Maneuver
Pointing Maneuver
Pointing Maneuver
Unused Visibility = 12
GS Acq
Exp. 2
Exp. 2
Exp. 2
Exp. 2
Occultation
0
500
1000
1500
2000
2500
3000
3500
4000
4500
5000
5500
sec