14184 - A Local Benchmark for High-Redshift Feedback

Cycle: 23, Proposal Category: GO

(UV Initiative)

(Availability Mode: SUPPORTED)

INVESTIGATORS

Name	*Institution*	*E-Mail*
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Prof. Sylvain Veilleux (CoI)	University of Maryland	veilleux@astro.umd.edu

VISITS

Visit	*Targets used in Visit*	*Configurations used in Visit*	*Orbits Used*	*Last Orbit Planner Run*	*OP Current with Visit?*
01	(1) 2MASX-J05210136-2521450	STIS/CCD STIS/NUV-MAMA	4	14-Jul-2015 21:22:32.0	yes
02	(1) 2MASX-J05210136-2521450	STIS/CCD STIS/NUV-MAMA	4	14-Jul-2015 21:22:35.0	yes

8 Total Orbits Used

ABSTRACT

Galactic winds are crucial channels of star formation and AGN feedback at the peak epochs of star formation and black hole activity. However, rest-frame NUV observations of z=1-2 winds, which employ resonant metal lines, are constrained by sensitivity and generally have no spatial resolution. We recently discovered spatially-resolved metal resonant line emission and absorption in a nearby wind in the rest frame optical. We propose to use STIS to observe the same resonant lines used at high z (in the rest-frame NUV, 2600-2800 A) but in a low z wind for the first time. We will use the detailed, 100 pc spatial information that this provides and combine with our current data to uncover the structure and mass loss rates of these winds, and ultimately to provide leverage for understanding the same absorption line signatures at high redshift.

OBSERVING DESCRIPTION

We will use the G230L grating with STIS/MAMA in ACCUM mode to observe the key observed wavelength range 2690-2925 A at a resolution of R~1000 and a slit width of 0."5. This configuration balances several competing needs. The first is for appropriate coverage of all of the diagnostic lines (MgII 2796, 2803 A, FeII 2586, 2600 A and FeII* 2612, 2626, 2632), which we observe in one central wavelength with this grating. This setting will also catch a weaker set of FeII lines near 2300 A. Moderate velocity resolution is also necessary to allow separation of absorption and emission and adjacent lines and for resolved velocity modeling. G230L has a velocity resolution of 300 km/s at the primary wavelengths of interest (2700-2900 A observed frame), which will satisfy these needs; it is a typical resolution used when probing these transitions at high a. The moderate slit width (0."5) will slightly increase the wings of the instrumental spectral profile but should not affect the most important derived line quantities. Finally, we need high sensitivity to detect extended emission along the slit; choosing G230L (vs. G230M), a moderate slit width (0."5) and the MAMA detector (with its lower dark current vs. the CCD) dramatically improves our sensitivity.

COS and STIS provide similar sensitivities in the NUV, but STIS has the clear advantage of spatial resolution. By choosing a long slit (25" x 0."5) we will be able to separate emission from the nuclear point sources and the extended emission to better model the wind's structure. We orient the slit along the line connecting the nucleus with the brightest off-nuclear point source (0."5 to the SE), which also intersects the region of highest off-nuclear diffuse UV flux, the highest resonant line emission flux in NaI D, and the region of highest NaI D absorption equivalent width. This will simultaneously provide two bright background sources for probing absorption and the brightest location of resonant emission, as well as the best location for comparing with NaI D absorption.

The same slit orientation was used to make shallower observations of F05189-2524 using other STIS grating configurations which missed the lines of interest here and had generally lower spectral resolution. However, we will combine those data with these to better model the continuum and emission lines in this source, including other possible wind tracers (like Ly-alpha).

We will acquire the target using a simple ACQ exposure, since the nuclear point source is the optically brightest source in the nucleus.

The primary goals are to maximize the signal-to-noise ratio (S/N) in the resonant emission and absorption lines. The proposed 8 orbits will achieve S/N~20 per resel in the off-nuclear point source and significantly better in the nuclear point source. This signal-to-noise ratio will allow us to accurately characterize both the absorption and emission lines; lower S/N in absorption lines can result in underestimated column densities. The

NUV flux in the nucleus of F05189-2524 has been directly measured using WFC3/F225W. The nuclear point source flux density is 4 x 10^-16 erg/s/cm^2/A at 2372 A. The brightest off-nuclear point source is 5x fainter. F05189-2524 is an optional nonstellar source template in the STIS ETC, so we use this as our model and add the FeII 2626 A emission line (which we assume to have a 1 A equivalent width for these nuclear sources, comparable to observations).

The threshold for measuring the extended resonant emission is the primary driver behind the number of requested orbits. The extended resonant line emission varies little with position (at ground-based resolution), so we can bin along the slit to maximize signal-to-noise. If the equivalent width rises with radial distance as in NaI D, we calculate that in the region of extended NUV continuum emission to the NW of the nucleus, integrating along the slit by 1."0 will yield S/N~10, which is appropriate for characterization of the emission line profile.

We need only two visits and a single instrument configuration. The only scheduling restriction for these observations is the required range of position angles of the long slit, which are necessary to intersect the four areas of interest in the galaxy nucleus, and the constraint of the same position angle for all observations so that the extended emission is from the same regions of the galaxy.

Visit

Proposal 14184, Visit 01 Wed Jul 15 01:22:36 GMT 2015

Diagnostic Status: No Diagnostics

Scientific Instruments: STIS/CCD, STIS/NUV-MAMA

Special Requirements: ORIENT 155D TO 185 D; ORIENT 335D TO 5 D

Comments: The position angle of the slit (length) East of North needs to be in the range (110 to 140) or (290 to 320). The corresponding ORIENT ranges were calculated by adding 45 degrees to these values.

Patterns

#	Primary Pattern		Secondary Pattern	Exposures
(1)	Pattern Type=STIS-ALONG-SLIT	Coordinate Frame=POS-TARG		(3)
	Purpose=DITHER	Pattern Orientation=90.0		
	Number Of Points=3	Angle Between Sides=		
	Point Spacing=0.5	Center Pattern=false		
	Line Spacing=			

Fixed Targets

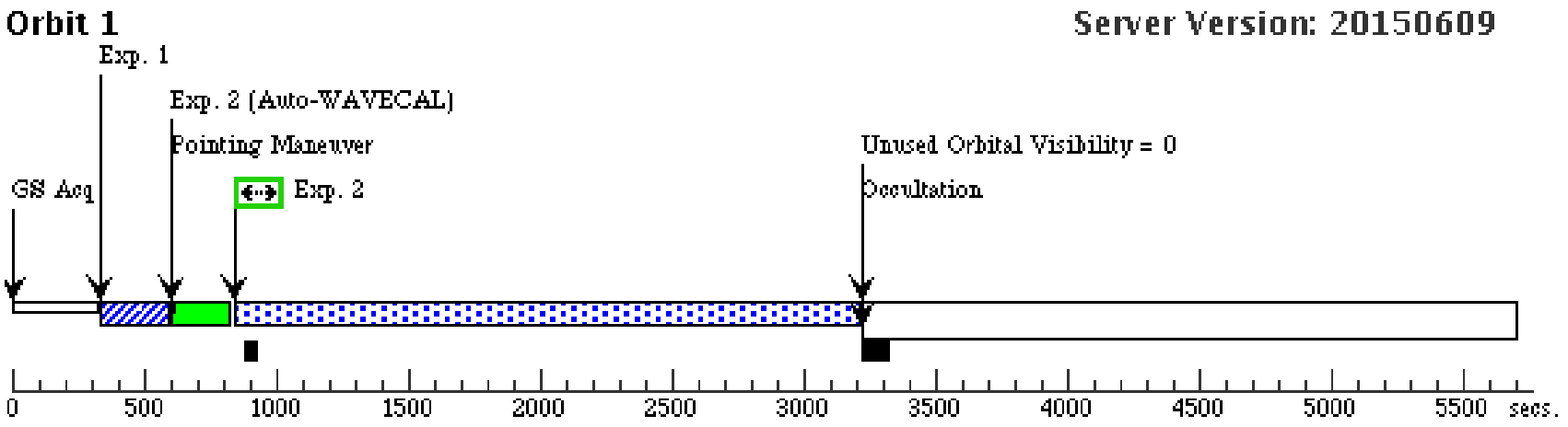
#	Name	Target Coordinates	Targ. Coord. Corrections	Fluxes	Miscellaneous
(1)	2MASX-J05210136-2521450 Alt Name1: F05189-2524	RA: 05 21 1.3880 (80.2557833d) Dec: -25 21 45.10 (-25.36253d) Equinox: J2000	Proper Motion RA: 0.0 Proper Motion Dec: 0.0 Parallax: 0.0" Redshift: 0.043	V=15.0 V mag is for total galaxy; flux of nuclear point source used for tar get acquisition is ~1% of total ga laxy flux. F225W ABmag of nuc lear point source is ~19.1.	Reference Frame: ICRS

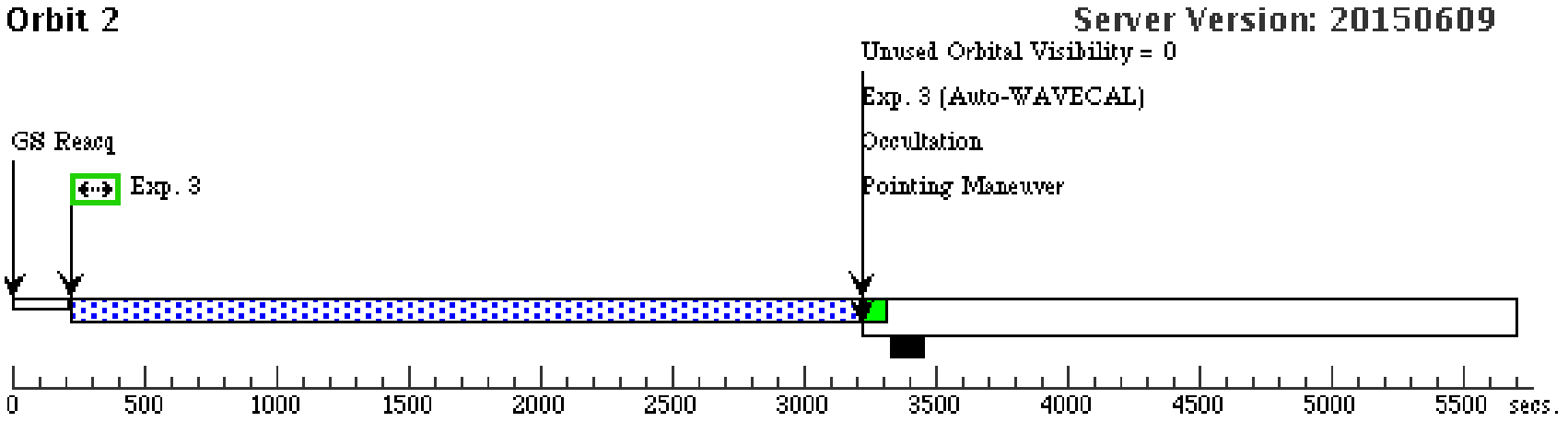
Comments: Coordinates are from HLA-processed F814W image, with astrometry refined using GSC2 stars according to HLA header.

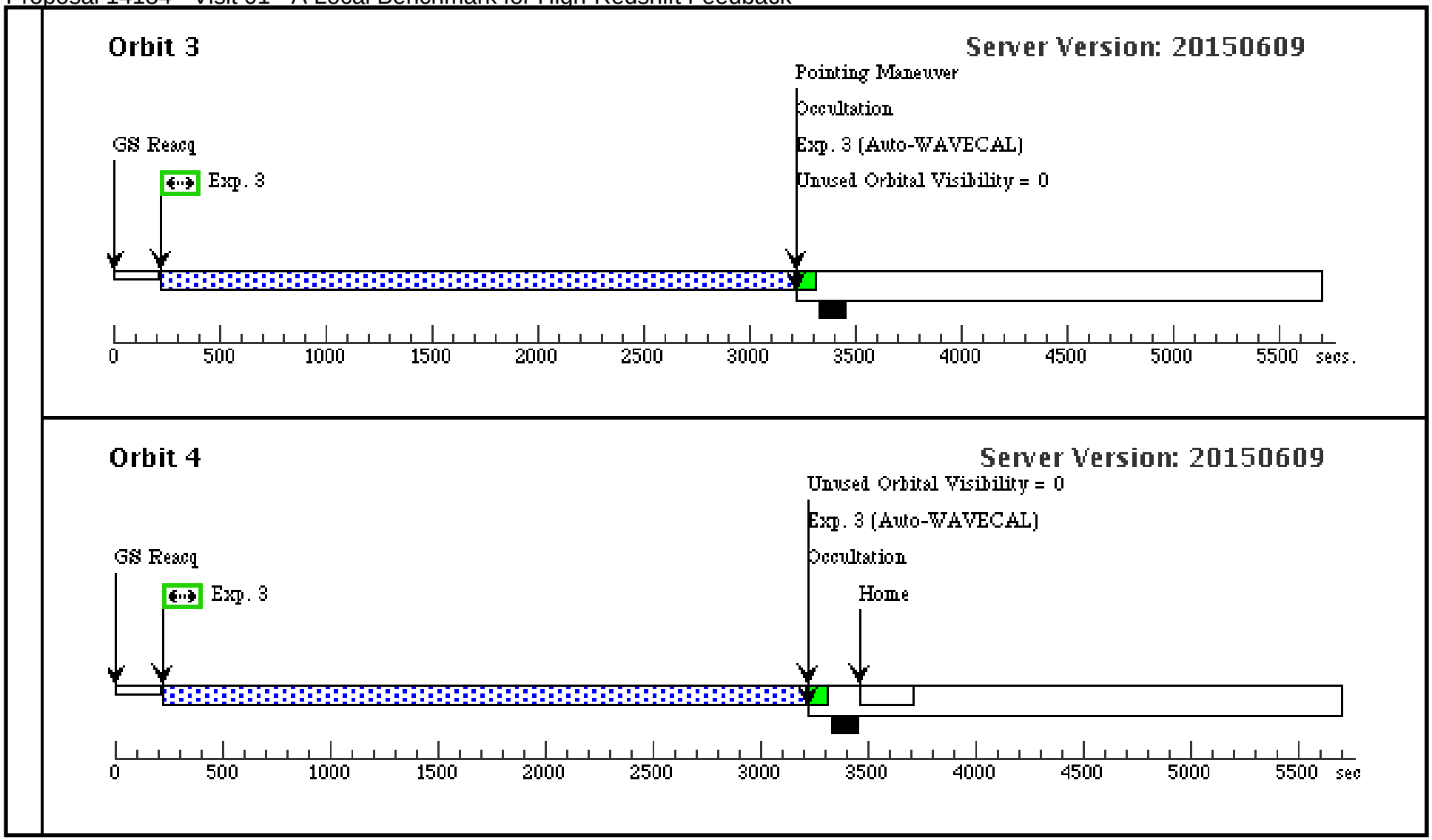
Exposures

#	Label (ETC Run)	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time (Total)/[Actual Dur.]	Orbit
1		(1) 2MASX-J05210136-2521450	STIS/CCD, ACQ, F28X50LP	MIRROR	ACQTYPE=POINT			8 Secs (8 Secs)	
								[==>]	***[1]***
Comments: This acquisition exposure is identical to the acquisition performed for the STIS observations for proposal ID 8190.									
2	(718168)	(1) 2MASX-J05210136-2521450	STIS/NUV-MAMA, ACCUM, 52X0.5	G230L 2376 A				1800 Secs (2337 Secs)	
								[==>2337.0 Secs]	***[1]***
Comments: ETC is for nuclear point source based on F225W imaging (see magnitudes in target description).									
3	(718168)	(1) 2MASX-J05210136-2521450	STIS/NUV-MAMA, ACCUM, 52X0.5	G230L 2376 A			Pattern 1, Exps 3-3 i n Visit 01 (1)	2280 Secs (8891 Secs)	
								[==>2979.0 Secs (Pattern 1)]	***[2]***
								[==>2956.0 Secs (Pattern 2)]	***[3]***
								[==>2956.0 Secs (Pattern 3)]	***[4]***

Orbit Structure



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Pointing Maneuver
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Exp. 3 (Auto-WAVECAL)
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GS Reacq
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500
1000
1500
2000
2500
3000
3500
4000
4500
5000
5500
secs.
Orbit 4
Server Version: 20150609
Unused Orbital Visibility = 0
Exp. 3 (Auto-WAVECAL)
Occultation
Home
GS Reacq
Exp. 3
0
500
1000
1500
2000
2500
3000
3500
4000
4500
5000
5500
sec

Visit

Proposal 14184, Visit 02 Wed Jul 15 01:22:37 GMT 2015

Diagnostic Status: No Diagnostics

Scientific Instruments: STIS/CCD, STIS/NUV-MAMA

Special Requirements: SAME ORIENT AS 01

Patterns

#	Primary Pattern		Secondary Pattern	Exposures
(1)	Pattern Type=STIS-ALONG-SLIT	Coordinate Frame=POS-TARG		(3)
	Purpose=DITHER	Pattern Orientation=90.0		
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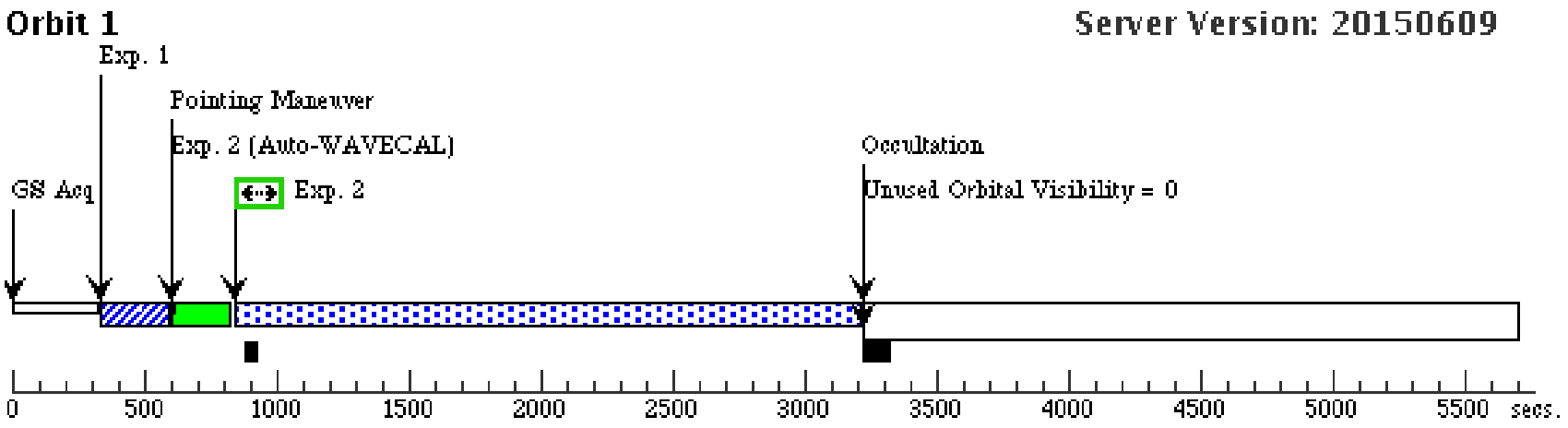
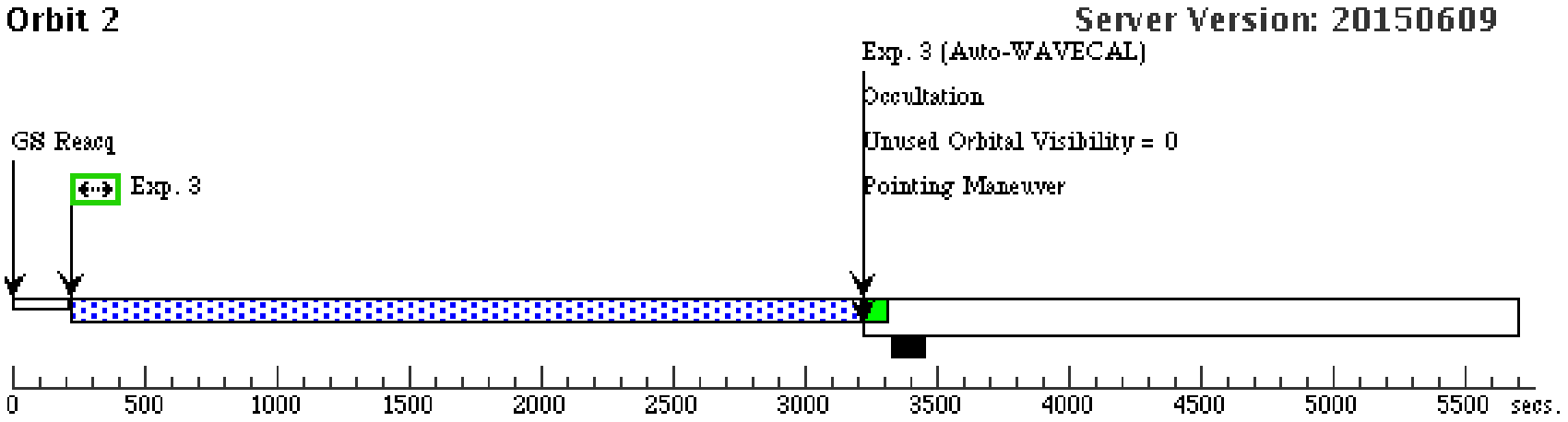
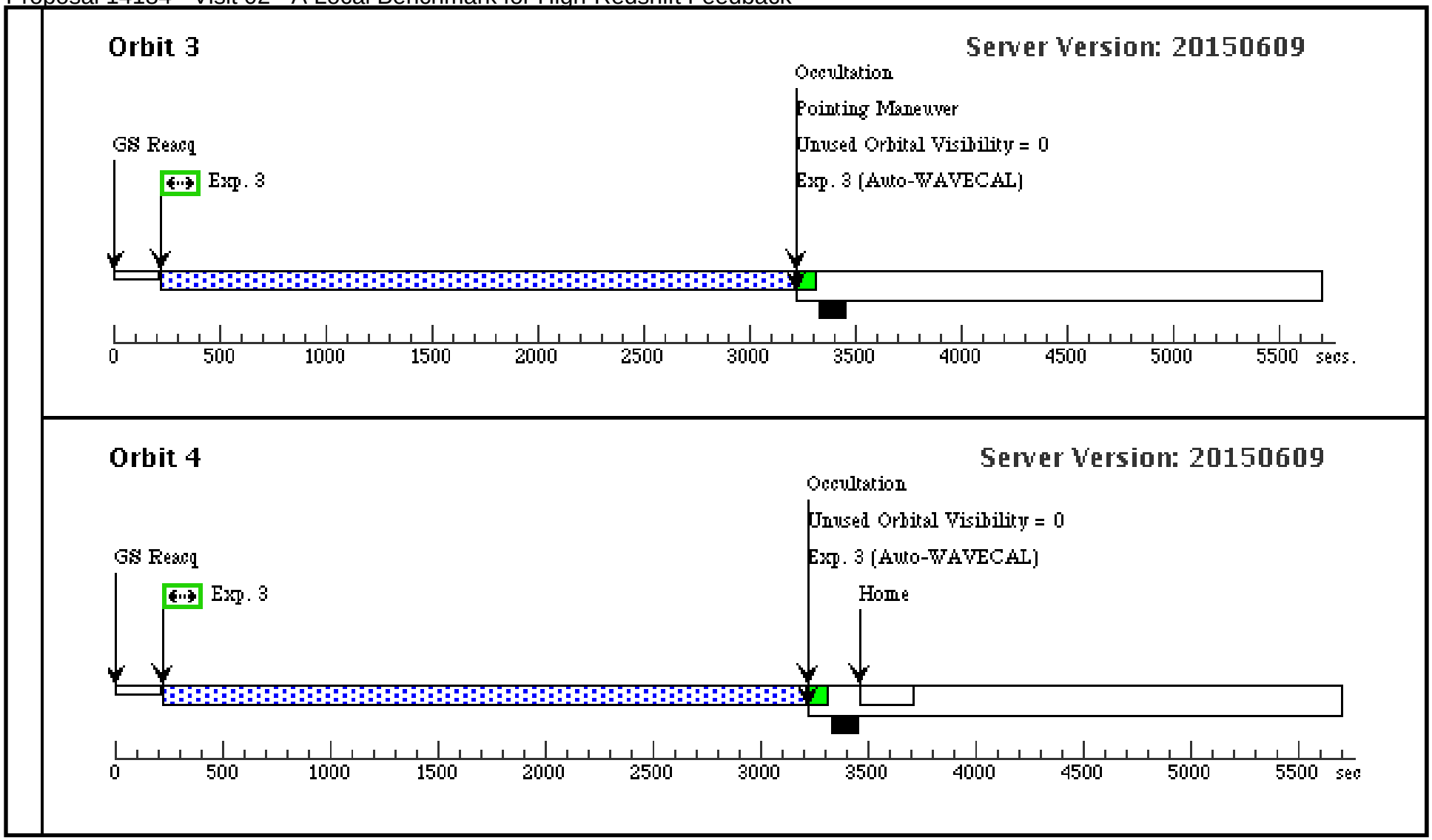
								[==>2337.0 Secs]	***[1]***
Comments: ETC is for nuclear point source based on F225W imaging (see magnitudes in target description).									
3	(718168)	(1) 2MASX-J05210136-2521450	STIS/NUV-MAMA, ACCUM, 52X0.5	G230L 2376 A			Pattern 1, Exps 3-3 i n Visit 02 (1)	2280 Secs (8891 Secs)	
								[==>2979.0 Secs (Pattern 1)]	***[2]***
								[==>2956.0 Secs (Pattern 2)]	***[3]***
								[==>2956.0 Secs (Pattern 3)]	***[4]***

Orbit Structure






Orbit 3
Server Version: 20150609
Occultation
Pointing Maneuver
Unused Orbital Visibility = 0
Exp. 3 (Auto-WAVECAL)
GS Reacq
Exp. 3
0
500
1000
1500
2000
2500
3000
3500
4000
4500
5000
5500
secs.
Orbit 4
Server Version: 20150609
Occultation
Unused Orbital Visibility = 0
Exp. 3 (Auto-WAVECAL)
GS Reacq
Exp. 3
Home
0
500
1000
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sec