14239 - Direct Imaging of Galactic Winds in Extreme Starburst Galaxies

Cycle: 23, 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) SDSSJ1107+0417	WFC3/UVIS	5	24-Jul-2015 22:53:43.0	yes
02	(2) SDSSJ1341-0321	WFC3/UVIS	5	24-Jul-2015 22:53:46.0	yes

10 Total Orbits Used

ABSTRACT

Without strong feedback and efficient quenching of star formation, it is impossible for numerical simulations to reproduce a realistic galaxy population. To understand how this feedback process works, a crucial parameter that observations can constrain is the mass ejected in galactic winds. Unfortunately, there are order-of-magnitude uncertainties associated with estimates of mass outflow rates, particularly for winds that are detected via blueshifted absorption lines towards distant star-forming galaxies. This is primarily because the geometry and spatial extent of the wind cannot be

measured directly and the inferred mass outflow rate scales as r_wind^2. One promising technique is to search for extended emission associated with resonantly scattered line photons from the wind. In practice, this is quite difficult to do with ground-based observations, which lack the required sensitivity and spatial resolution. Here we propose to use the unique medium-band imaging capabilities of HST to directly image the winds associated with two massive galaxies at z=0.6 that have recently experienced a feedback-limited starburst and are known to exhibit high-velocity, galactic scale outflows. We will measure (or place robust limits on) the geometry and spatial extent of these galactic winds as traced by resonantly scattered Mg II photons. This provides a unique opportunity to measure the mass outflow rate and energetics of these powerful winds and to quantify their role in the quenching of star formation.

OBSERVING DESCRIPTION

We are proposing to measure the morphology and spatial extent of the galactic winds in two extremely compact starburst galaxies at z = 0.46 and z = 0.66 using WFC3 imaging. We will trace low ionization gas in the wind using resonance emission from Mg II 2800 A which will be at wavelengths of ~4100 and ~4650 A in the observed frame.

We are using the F410M and F467M filters to isolate the wind emission. Both filters are well centered on the line and span the range of velocities we expect to observe. Assuming that the wind has a shell-like geometry and spatial extent of 6 kpc, we expect the peak surface brightness to be 5e-18 erg/s/cm^2/A/arcsec^2. In our medium band filters, we will reach S/N~8-10 in a 3 x 3 pixel area centered on the brightest part of the shell in 4 orbits.

A major concern in our medium-band Mg II imaging is contamination by faint stellar light. We are helped by the fact that our galaxies have very compact light distributions. However, since they are the products of recent major mergers, faint extended tidal features are also present. In order to subtract the stellar light from the filter containing Mg II we are obtaining single-orbit off-band images in F390W. The F390W images will be combined with existing F475W and F814W images to model and remove the continuum in the on-band filter.

In the inner regions of the galaxy the major source of stellar light will be the wings of the PSF. Hence it will be important for the on- and off-band images to be taken at the same epoch and telescope role angle. For this reason we have opted to place all 5 orbits associated with an individual target in a single visit. We are using a box-dither to obtain optimal PSF sampling of our target.

Due to the low background in our F390W, F410M, and F467M images CTE is a concern. The spatial extent of the outflow is expected to be small (< 200 pixels). We have therefore opted to place the targets close to the readout axis at the UVIS2-C1K1C-CTE position. In addition, we have

added post flashes to our exposures to achieve a background of ~12 electrons. While there are some warnings generated about our background being too low, these automated calculations use a low zodiacal background. We have set the post-flash values based on ETC calculations using the actual zodiacal background of the target.

We have constrained the orientations to prevent scatted light from bright stars near the edge of the chip. (We only care about +/-400 pixels form the target, so figure 8 ghosts are not a concern.) For Vist 1 (J1107), the orient constraints drastically reduced the visibility. For that reason we shotened the orbit duration slightly to free up some new visibility windows in November.

Visit

Proposal 14239, J1107 Visit (01), implementation Sat Jul 25 02:53:47 GMT 2015

Diagnostic Status: Warning

Scientific Instruments: WFC3/UVIS

Special Requirements: ORIENT 1D TO 10 D; ORIENT 230D TO 275 D; ORIENT 285D TO 360 D

Diagnostics

(J1107 F390W (01.001)) Warning (Form): FLASH level may be too low for this exposure or a short subexposure. See extended explanation in the diagnostic browser

(J1107 F410M-1 (01.002)) Warning (Form): FLASH level may be too low for this exposure or a short subexposure. See extended explanation in the diagnostic browser

(J1107 F410M-2 (01.003)) Warning (Form): FLASH level may be too low for this exposure or a short subexposure. See extended explanation in the diagnostic browser

Patterns

#	Primary Pattern		Secondary Pattern	Exposures
(1)	Pattern Type=WFC3-UVIS-DITHER-BOX Purpose=DITHER Number Of Points=4 Point Spacing=0.173 Line Spacing=0.112	Coordinate Frame=POS-TARG Pattern Orientation=23.884 Angle Between Sides=81.785 Center Pattern=false		(1), (2), (3)

Fixed Targets

#	Name	Target Coordinates	Targ. Coord. Corrections	Fluxes	Miscellaneous
(1)	SDSSJ1107+0417	RA: 11 07 2.8722 (166.7619675d) Dec: +04 17 2.77 (4.28410d) Equinox: J2000	Redshift: 0.46715	V=19+/-0.1	Reference Frame: ICRS

Comments: Extended=YES

Exposures

#	Label (ETC Run)	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time (Total)/[Actual Dur.]	Orbit
1	J1107 F390W (WFC3UVIS.im.732115)	(1) SDSSJ1107+0417	WFC3/UVIS, ACCUM, UVIS2-C1K1C-CTE	F390W	FLASH=4	POS TARG 0,0	Pattern 1, Exps 1-1 in J1107 Visit (01) (1)	615 Secs (2460 Secs) *[==>(Pattern 1)]* *[==>(Pattern 2)]* *[==>(Pattern 3)]* *[==>(Pattern 4)]*	***[1]***
Comments: APT warns that the background is too low, however it assumes a "low" value of the zodiacal light. Using the ETC with the zodiacal light apporiate for the targets RA/DEC, this flash level is adquate									
2	J1107 F410M-1 (WFC3UVIS.im.732110)	(1) SDSSJ1107+0417	WFC3/UVIS, ACCUM, UVIS2-C1K1C-CTE	F410M	FLASH=5	POS TARG 0,0	Pattern 1, Exps 2-2 in J1107 Visit (01) (1)	1418 Secs (5672 Secs) *[==>(Pattern 1)]* *[==>(Pattern 2)]* *[==>(Pattern 3)]* *[==>(Pattern 4)]*	***[2]*** ***[3]***
Comments: APT warns that the background is too low, however it assumes a "low" value of the zodiacal light. Using the ETC with the zodiacal light apporiate for the targets RA/DEC, this flash level is adquate (11.7 e-/pixel)									
3	J1107 F410M-2 (WFPC3UVIS.im.731041)	(1) SDSSJ1107+0417	WFC3/UVIS, ACCUM, UVIS2-C1K1C-CTE	F410M	FLASH=5	POS TARG 0,0	Pattern 1, Exps 3-3 in J1107 Visit (01) (1)	1418 Secs (5672 Secs) *[==>(Pattern 1)]* *[==>(Pattern 2)]* *[==>(Pattern 3)]* *[==>(Pattern 4)]*	***[4]*** ***[5]***
Comments: APT warns that the background is too low, however it assumes a "low" value of the zodiacal light. Using the ETC with the zodiacal light apporiate for the targets RA/DEC, this flash level is adquate (11.7 e-/pixel)									

Orbit Structure

Orbit 1

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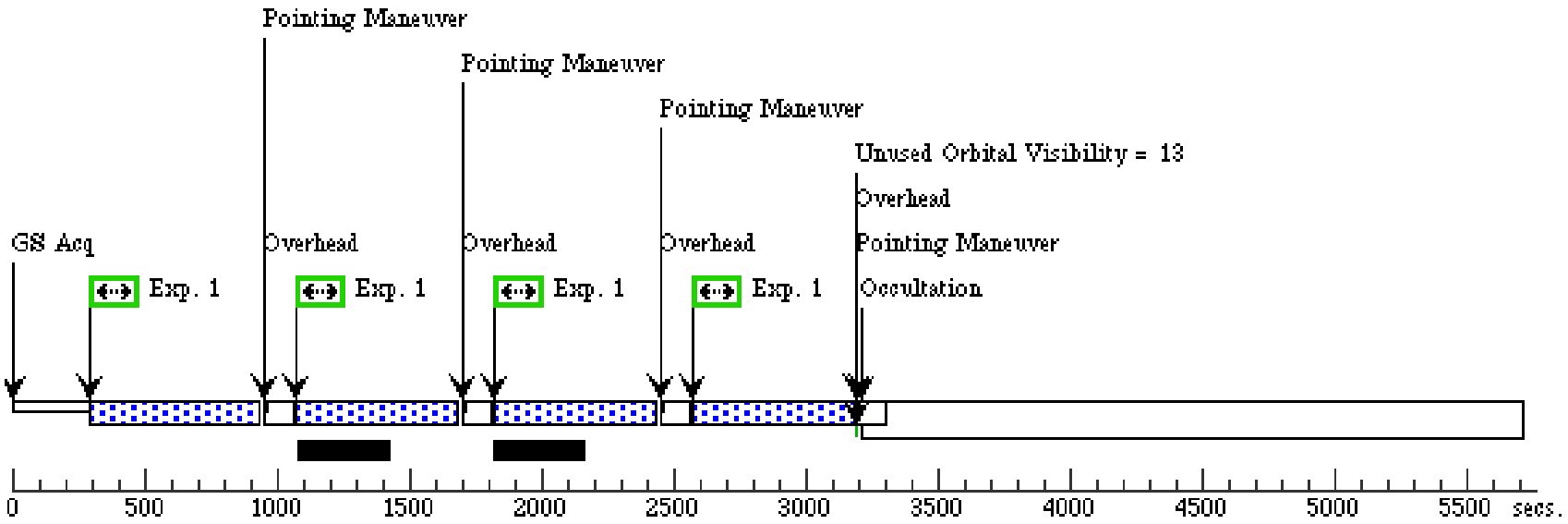

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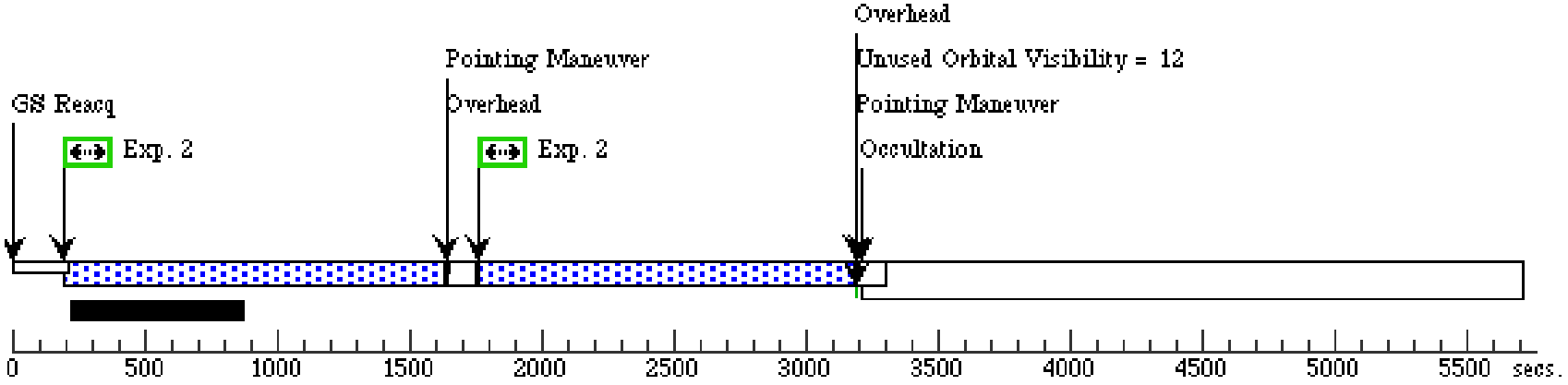
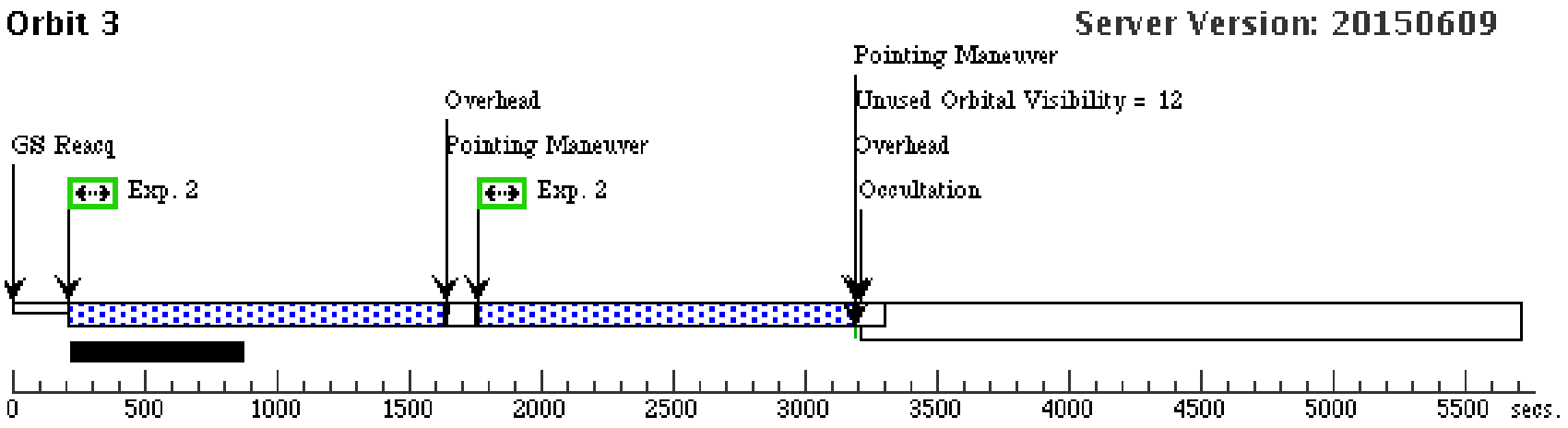
Server Version: 20150609




Orbit 3
Server Version: 20150609
Pointing Maneuver
Unused Orbital Visibility = 12
Overhead
Occultation
GS Reacq
Pointing Maneuver
Overhead
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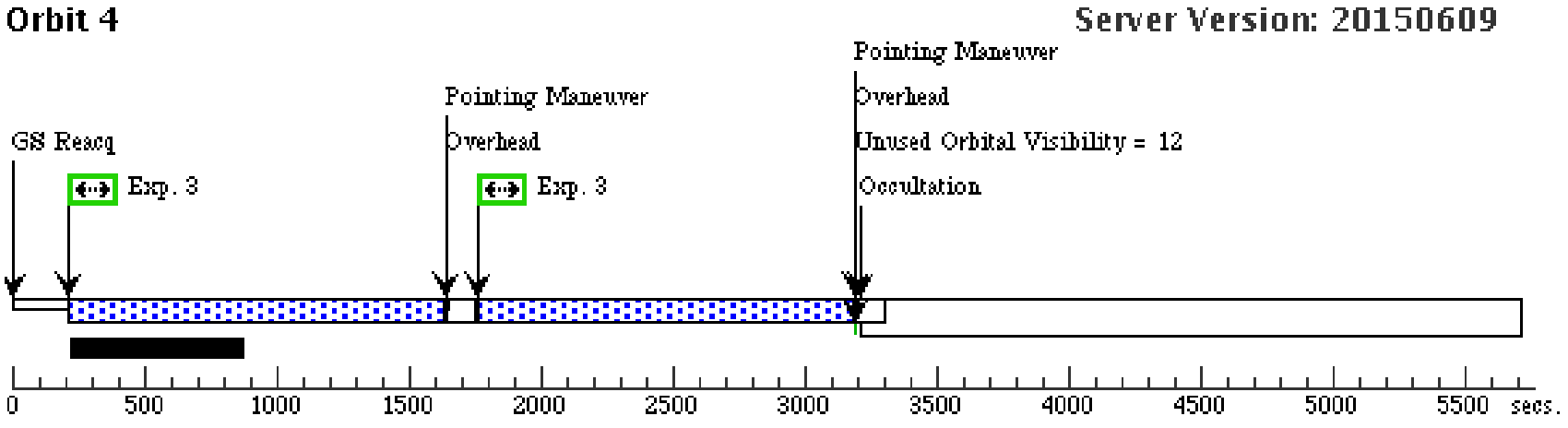
3500
4000
4500
5000
5500
secs.


Orbit 4
Server Version: 20150609
Pointing Maneuver
Overhead
Unused Orbital Visibility = 12
Occultation
Pointing Maneuver
Overhead
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Exp. 3
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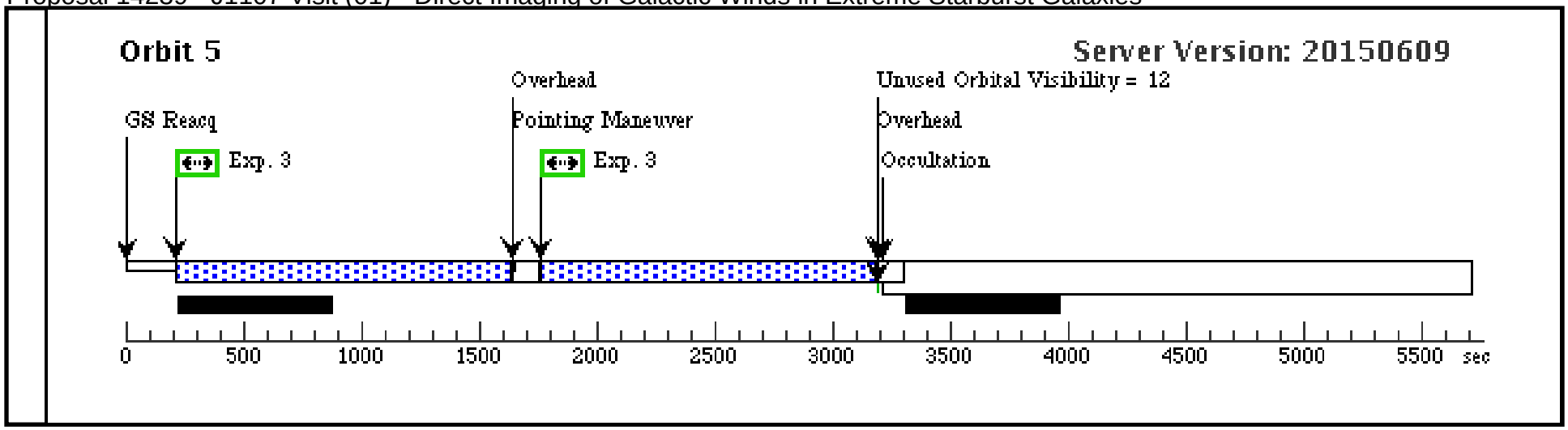
secs.


Orbit 5
Server Version: 20150609
GS Reacq
Exp. 3
Overhead
Pointing Maneuver
Exp. 3
Unused Orbital Visibility = 12
Overhead
Occultation
0
500
1000
1500
2000
2500
3000
3500
4000
4500
5000
5500
sec

Visit

Proposal 14239, J1341 Visit (02), implementation Sat Jul 25 02:53:48 GMT 2015

Diagnostic Status: Warning

Scientific Instruments: WFC3/UVIS

Special Requirements: ORIENT 100D TO 150 D; ORIENT 215D TO 240 D

Diagnostics

(J1341 F390W (02.001)) Warning (Form): FLASH level may be too low for this exposure or a short subexposure. See extended explanation in the diagnostic browser

(J1341 F467M-1 (02.002)) Warning (Form): FLASH level may be too low for this exposure or a short subexposure. See extended explanation in the diagnostic browser

(J1341 F467M-2 (02.003)) Warning (Form): FLASH level may be too low for this exposure or a short subexposure. See extended explanation in the diagnostic browser

Patterns

#	Primary Pattern		Secondary Pattern	Exposures
(1)	Pattern Type=WFC3-UVIS-DITHER-BOX Purpose=DITHER Number Of Points=4 Point Spacing=0.173 Line Spacing=0.112	Coordinate Frame=POS-TARG Pattern Orientation=23.884 Angle Between Sides=81.785 Center Pattern=false		(1), (2), (3)

Fixed Targets

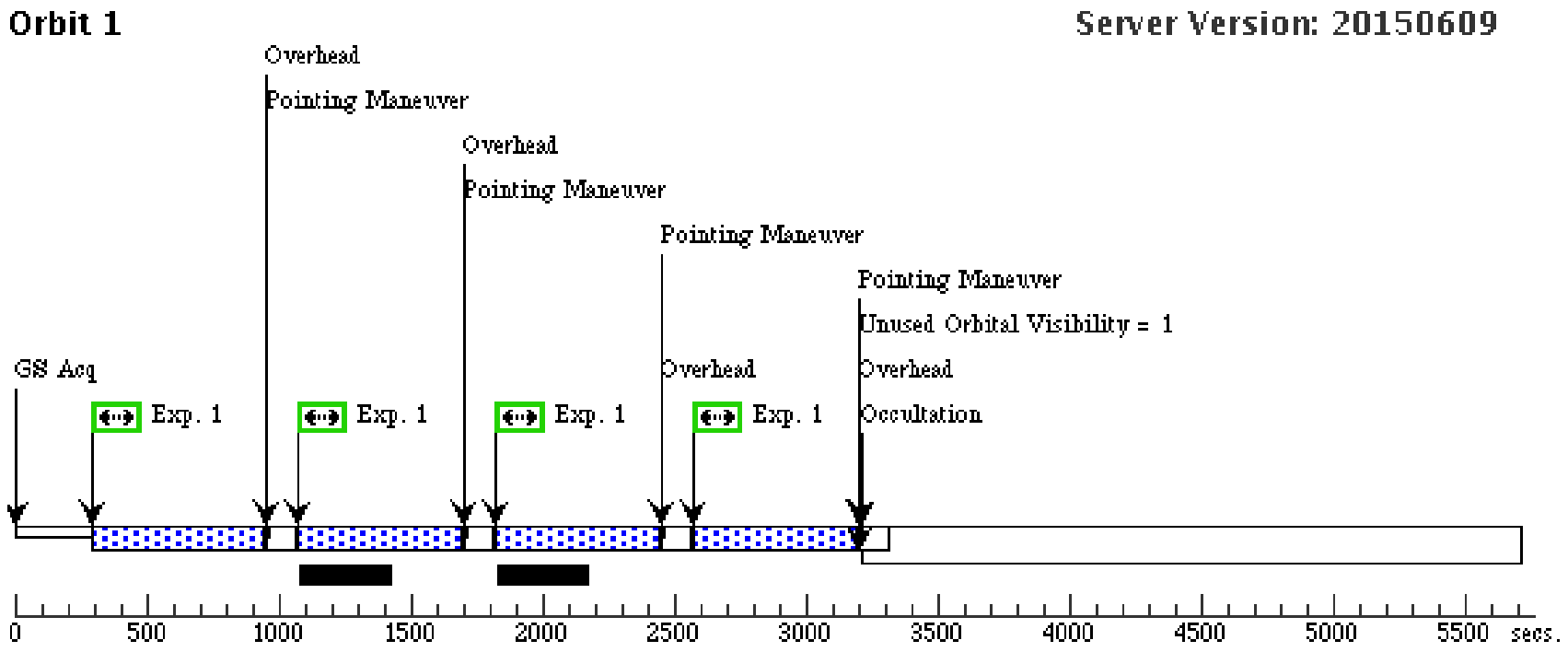
#	Name	Target Coordinates	Targ. Coord. Corrections	Fluxes	Miscellaneous
(2)	SDSSJ1341-0321	RA: 13 41 36.7997 (205.4033321d) Dec: -03 21 25.27 (-3.35702d) Equinox: J2000	Redshift: 0.66188	V=19+/-0.1	Reference Frame: ICRS

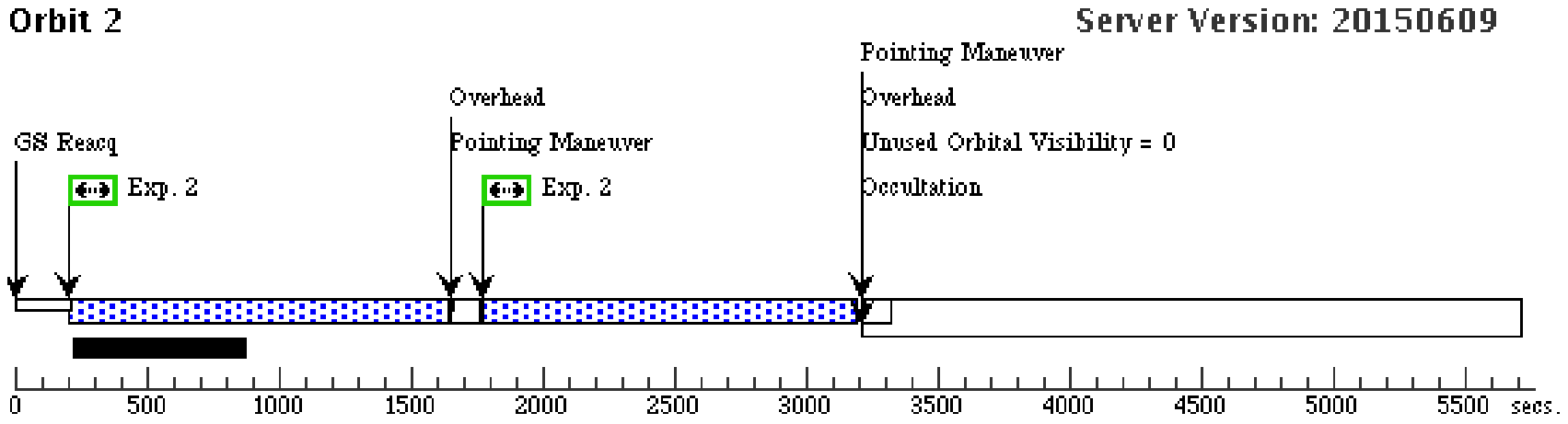
Comments: Extended=YES

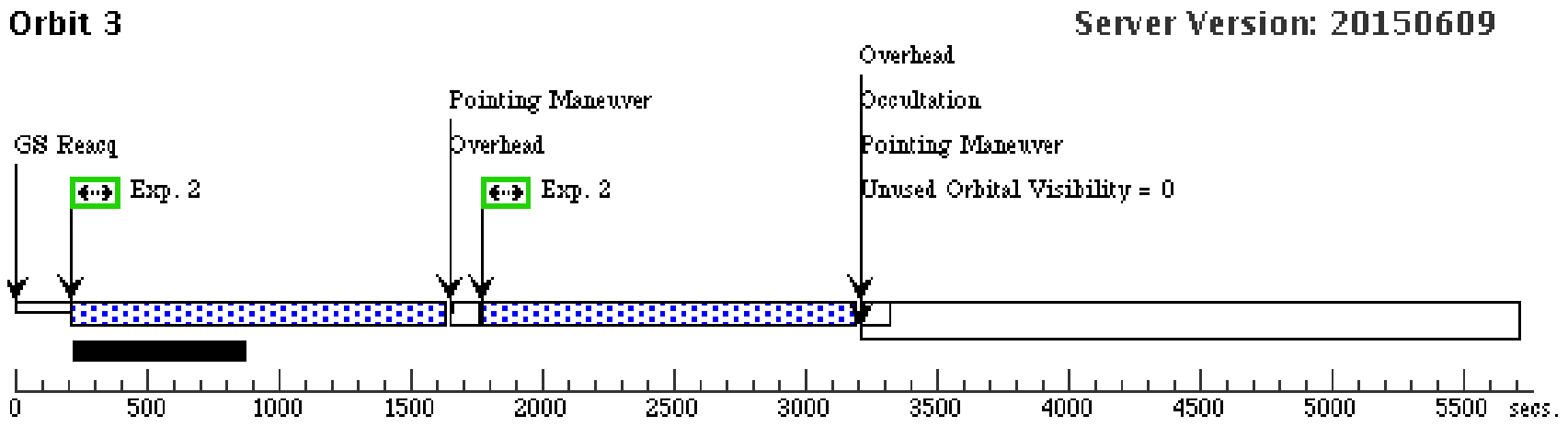
Exposures

#	Label (ETC Run)	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time (Total)/[Actual Dur.]	Orbit
1	J1341 F390W (WFC3UVIS.im.732125)	(2) SDSSJ1341-0321	WFC3/UVIS, ACCUM, UVIS2-C1K1C-CTE	F390W	FLASH=5		Pattern 1, Exps 1-1 in J1341 Visit (02) (1)	618 Secs (2472 Secs) *[==>(Pattern 1)]* *[==>(Pattern 2)]* *[==>(Pattern 3)]* *[==>(Pattern 4)]*	***[1]***
Comments: APT warns that the background is too low, however it assumes a "low" value of the zodiacal light. Using the ETC with the zodiacal light apporiate for the targets RA/DEC, this flash level is adquate									
2	J1341 F467M-1 (WFC3UVIS.im.732132)	(2) SDSSJ1341-0321	WFC3/UVIS, ACCUM, UVIS2-C1K1C-CTE	F467M	FLASH=3		Pattern 1, Exps 2-2 in J1341 Visit (02) (1)	1424 Secs (5696 Secs) *[==>(Pattern 1)]* *[==>(Pattern 2)]* *[==>(Pattern 3)]* *[==>(Pattern 4)]*	***[2]*** ***[3]***
Comments: APT warns that the background is too low, however it assumes a "low" value of the zodiacal light. Using the ETC with the zodiacal light apporiate for the targets RA/DEC, this flash level is adquate									
3	J1341 F467M-2 (WFC3UVIS.im.732132)	(2) SDSSJ1341-0321	WFC3/UVIS, ACCUM, UVIS2-C1K1C-CTE	F467M	FLASH=3		Pattern 1, Exps 3-3 in J1341 Visit (02) (1)	1424 Secs (5696 Secs) *[==>(Pattern 1)]* *[==>(Pattern 2)]* *[==>(Pattern 3)]* *[==>(Pattern 4)]*	***[4]*** ***[5]***
Comments: APT warns that the background is too low, however it assumes a "low" value of the zodiacal light. Using the ETC with the zodiacal light apporiate for the targets RA/DEC, this flash level is adquate									

Orbit Structure



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Server Version: 20150609
GS Reacq
Exp. 2
Pointing Maneuver
Overhead
Exp. 2
Overhead
Occultation
Pointing Maneuver
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1000
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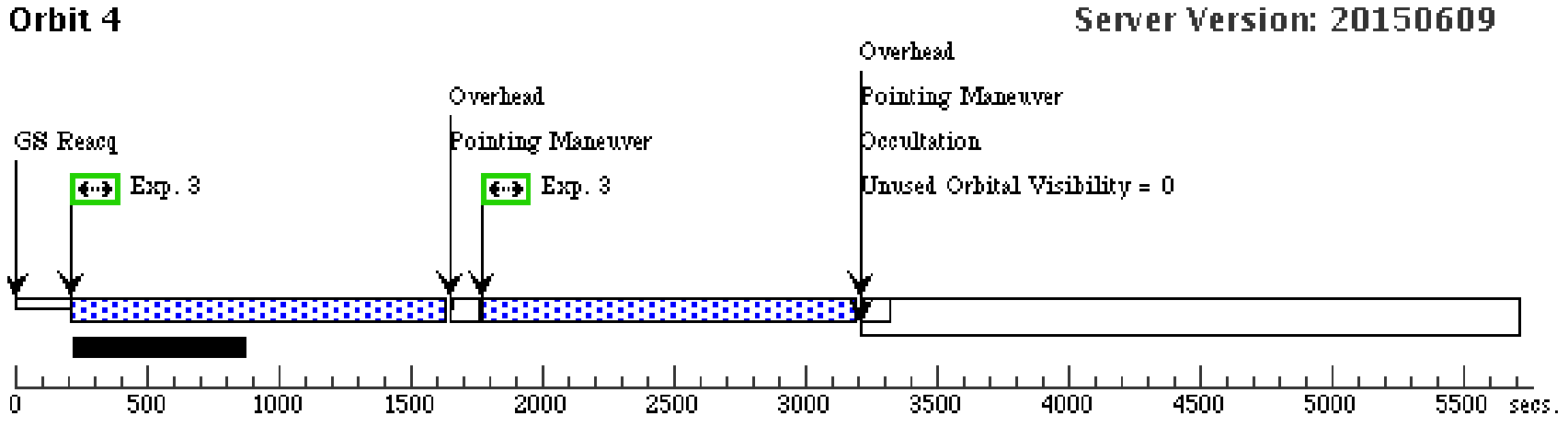
5000
5500
secs.


Orbit 4
Server Version: 20150609
GS Reacq
Exp. 3
Overhead
Pointing Maneuver
Exp. 3
Overhead
Pointing Maneuver
Occultation
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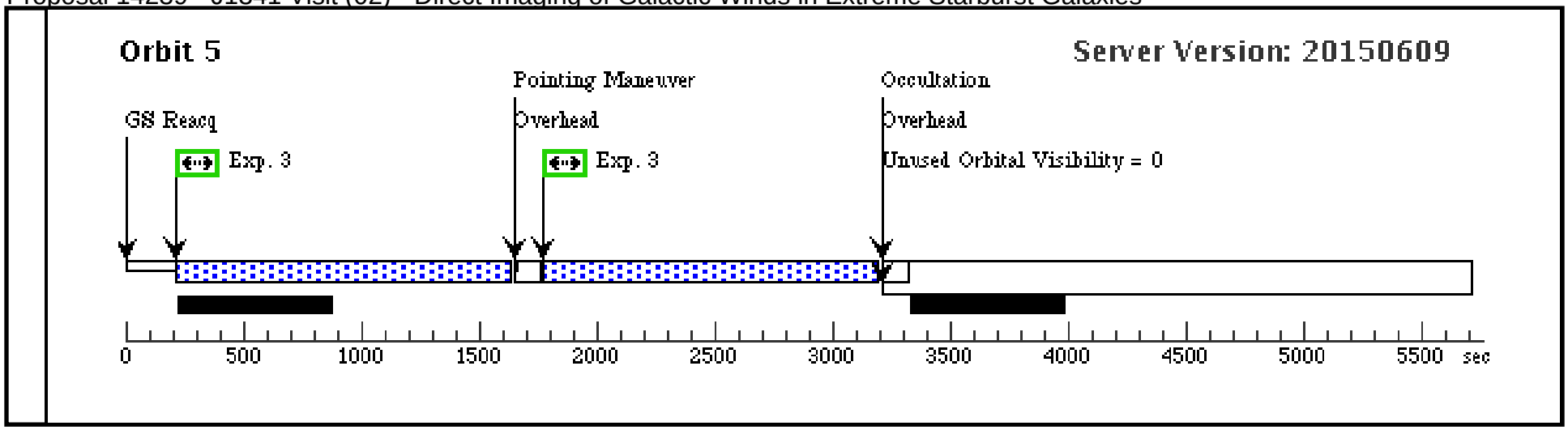
5000
5500
secs.


Orbit 5
Server Version: 20150609
Pointing Maneuver
Occultation
GS Reacq
Overhead
Overhead
Exp. 3
Exp. 3
Unused Orbital Visibility = 0
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1000
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sec