13796 - Understanding New Structures Ejected from Recurrent Nova T Pyx

Cycle: 22, Proposal Category: GO

(Availability Mode: SUPPORTED)

INVESTIGATORS

Name	*Institution*	*E-Mail*
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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	(2) NOVA-PYX-1890-ICRS	WFC3/UVIS	3	01-Jul-2014 21:07:29.0	yes
02	(2) NOVA-PYX-1890-ICRS	STIS/CCD	4	01-Jul-2014 21:07:33.0	yes
03	(2) NOVA-PYX-1890-ICRS CCDFLAT	STIS/CCD	4	01-Jul-2014 21:07:38.0	yes

11 Total Orbits Used

ABSTRACT

Recurrent nova T Pyxidis has recognized, major scientific significance but is a rapidly and surprisingly changing object, now fading quickly. Since its 2011 outburst (the first since 1966 but sixth since 1890), T Pyx has been the target of multispectral observation, including 60 HST orbits by several groups. Our group's HST observations of T Pyx not only have produced a reliable, geometrically determined distance to T Pyx and mapped the ejecta from pre-2011 outbursts, but have also revealed several new and unprecendented structures from the latest outburst, on scales of tenths of an arcsecond. With observations from GO program 13400, we parsimoniously determined the geometry and kinematics of these several new structures, but issues remain. A pair of jet-like spots frame the central ring-like disk structure, but based on simple assumptions have been ejected at

an angle unaligned with the ring. We need another epoch of imaging to determine the proper motion of these spots to settle whether their kinematics are simple, or might instead suffer acceleration, deceleration or unaligned motion. More broadly, additional HST data are needed to determine the nature and origin the three morphological structures that are evident in our previous HST images, and to uncover their relationship to the distinct kinematic components of the ejecta inferred from ground-based monitoring. We request minimal visits of WFC3+STIS to establish a third epoch to rule out or verify competing hypotheses. The requested observations have implications for the ejection and shaping of remnants in nova explosions, binary stellar evolution, and the generation of shocks and gamma-rays in novae.

OBSERVING DESCRIPTION

This proposal consists of two visits to perform WFC3 narrow-band imaging (Visit 01) and STIS spectroscopy (Visit 02) on the rapidly-evolving and fading remnant of the 2011 outburst of recurrent Nova T Pyx. The rapid evolution and fading of features seen in atomic emission lines, combined with key roll angles needed for the spectral slit positions require us to execute these observations as quickly as possible in July 2014.

This second version of the Phase II .apt file includes the preliminary/default plan for the final eight orbits of STIS spectroscopy that were awarded to us, distributed across Visit 02 (four orbits of G430L) and Visit 03 (four orbits of G750L). As soon as we receive the data from our WFC3 F502N & F657N imaging from Visit 01 (scheduling within 07--14 July 2014), we will use the resulting brightness and spatial information in refining this plan for the STIS spectroscopic visits. The most likely change to the default spectroscopic observing plan presented here would be to shift all of the orbits of both visits to one grating, either G430L or G750L.

As described in the Phase I proposal and the visit descriptions here, we are striking a compromise between repeating the ideal slit PA from GO 13400 Visit 05 [which had PA_APER=95.64, PA_V3=320.99, and PA_U3=140.99; see e.g. exposure oc7p05010] and scheduling the visit as early as possible in July 2014. We hope that it is possible to schedule Visits 02 & 03 before July 26th, and at the smallest PA_U3 possible. The chosen maximum roll angle requirement, STIS-ALONG-SLIT dither pattern and total exposure times in each orbit have been carefully chosen to allow a free and open schedule between now and 26-July-2014 23:59.

Visit

Proposal 13796, Visit 01: 3 orbits of WFC3 F502N, F657N imaging (01), scheduled Wed Jul 02 01:07:40 GMT 2014

Diagnostic Status: No Diagnostics

Scientific Instruments: WFC3/UVIS

Special Requirements: BEFORE 31-AUG-2014:00:00:00

Comments: The purpose of Visit 01 is to take images of the highly variable and unpredictable recurrent nova T Pyx. This visit should be timed as soon as possible in early July of 2014, to provide intensity and orientation information for determining the exposure time balance between G430L and G750L gratings in the STIS spectroscopic visit (Visit 02) to follow in mid- to late July 2014. The July timing of the spectroscopy in Visit 02 is necessary to match the jet axis and to duplicate Cycle 21 spectra. This imaging visit requires three orbits, for a total of ~2600 seconds in F502N ([O III]) and ~5400 seconds in F657N (Ha+[N II]).

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)	NOVA-PYX-1890-ICRS Alt Name1: T-PYX	RA: 09 04 41.5000 (136.1729167d) Dec: -32 22 47.50 (-32.37986d) Equinox: J2000		V=15.5+/-1	Reference Frame: ICRS

Comments: This object was generated by the targetselector and retrieved from the SIMBAD database. The coordinates from SIMBAD appear to be the best available.

Exposures

#	Label	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time (Total)/[Actual Dur.]	Orbit
1	Exp 01: 2400 second F502N integration in first orbit	(2) NOVA-PYX-1890-ICRS	WFC3/UVIS, ACCUM, UVIS2-C1K1C-SUB	F502N	FLASH=10		Pattern 1, Exps 1-1 in Visit 01: 3 orbits of WFC3 F502N, F657N imaging (01) (1)	655 Secs (2620 Secs) *[==>(Pattern 1)]* *[==>(Pattern 2)]* *[==>(Pattern 3)]* *[==>(Pattern 4)]*	***[1]***
2	Exp 02: 2756 sec F657N exposure in second orbit	(2) NOVA-PYX-1890-ICRS	WFC3/UVIS, ACCUM, UVIS2-C1K1C-SUB	F657N	FLASH=8		Pattern 1, Exps 2-2 in Visit 01: 3 orbits of WFC3 F502N, F657N imaging (01) (1)	680 Secs (2720 Secs) *[==>(Pattern 1)]* *[==>(Pattern 2)]* *[==>(Pattern 3)]* *[==>(Pattern 4)]*	***[2]***
3	Exp 03: 2756 sec F657N exposure in third orbit	(2) NOVA-PYX-1890-ICRS	WFC3/UVIS, ACCUM, UVIS2-C1K1C-SUB	F657N	FLASH=8		Pattern 1, Exps 3-3 in Visit 01: 3 orbits of WFC3 F502N, F657N imaging (01) (1)	680 Secs (2720 Secs) *[==>(Pattern 1)]* *[==>(Pattern 2)]* *[==>(Pattern 3)]* *[==>(Pattern 4)]*	***[3]***

Orbit Structure

Orbit 1

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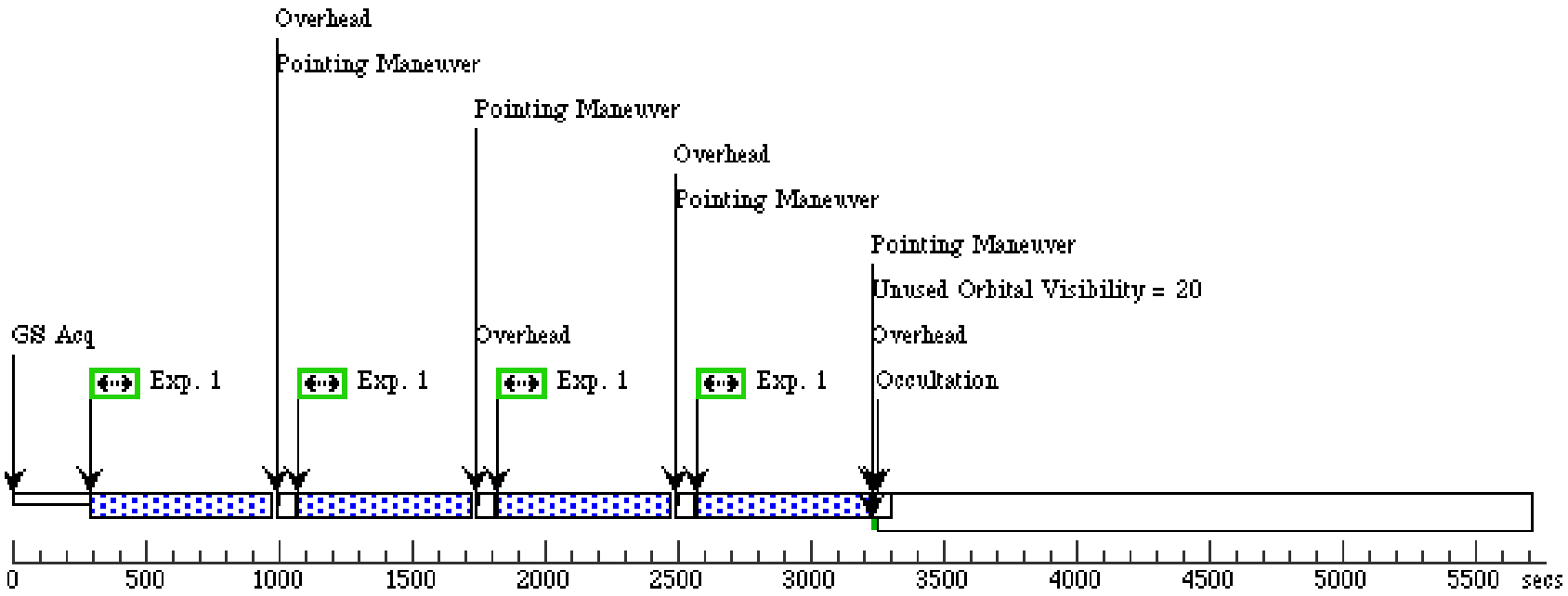

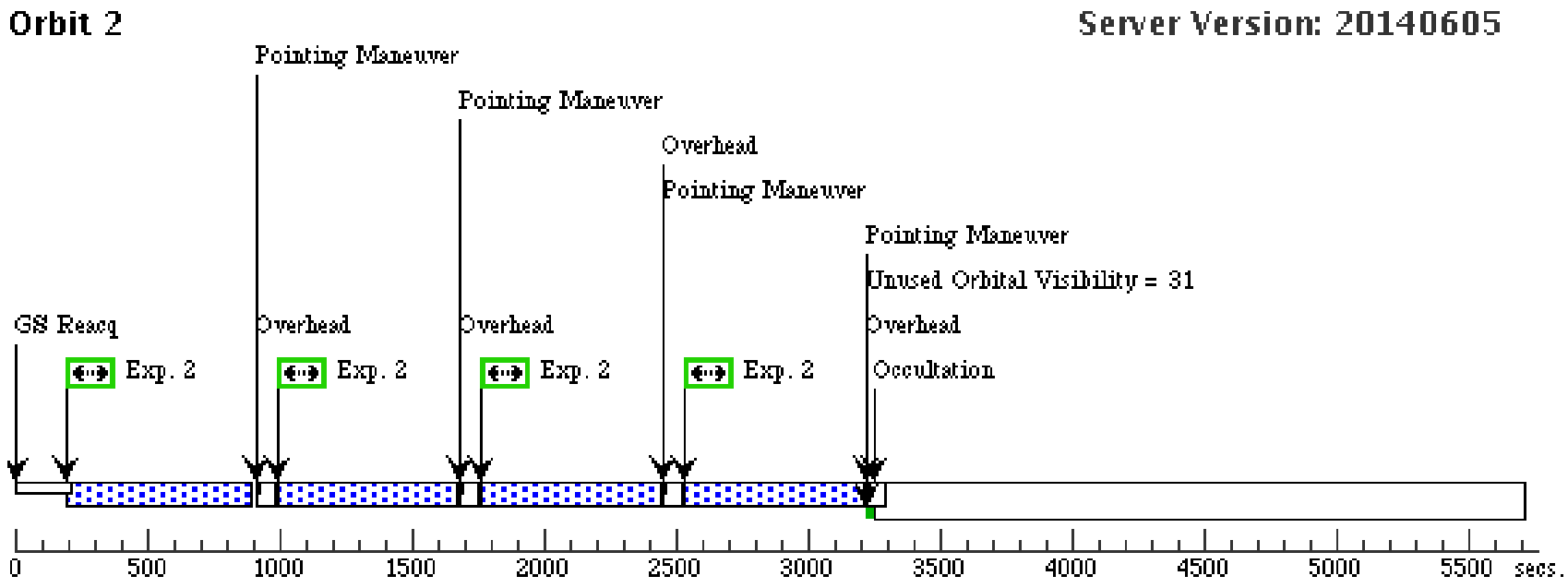
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Pointing Maneuver
Overhead
Pointing Maneuver
Pointing Maneuver
Unused Orbital Visibility = 31
GS Reacq
Overhead
Overhead
Overhead
Exp. 2
Exp. 2
Exp. 2
Exp. 2
Occultation
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4500
5000
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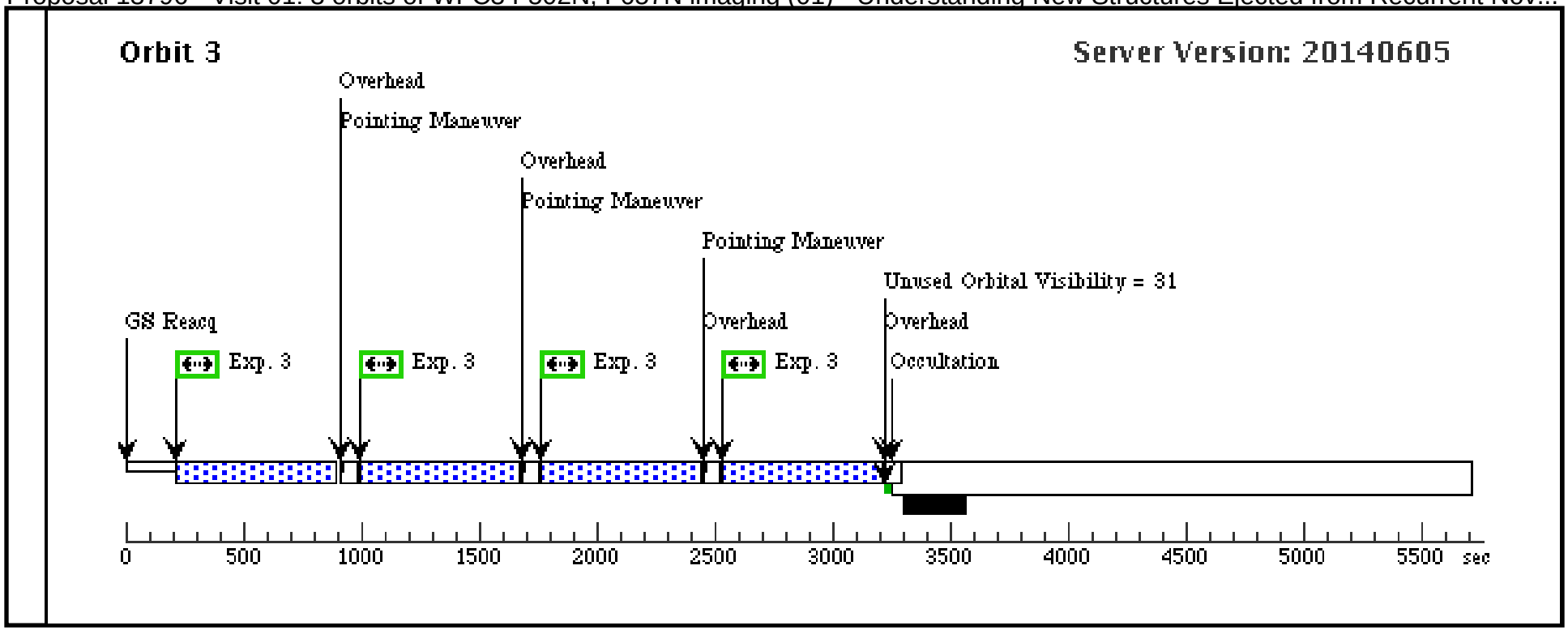
secs.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Overhead
Pointing Maneuver
Overhead
Pointing Maneuver
Pointing Maneuver
Unused Orbital Visibility = 31
GS Reacq
Exp. 3
Exp. 3
Exp. 3
Overhead
Exp. 3
Overhead
Occultation
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500
1000
1500
2000
2500
3000
3500
4000
4500
5000
5500
sec

Visit

Proposal 13796, Visit 02: 4 orbits of STIS CCD G430L spectra (02), implementation Wed Jul 02 01:07:41 GMT 2014

Diagnostic Status: No Diagnostics

Scientific Instruments: STIS/CCD

Special Requirements: ORIENT 140.99D TO 162.99 D; BETWEEN 21-JUL-2014 AND 01-SEP-2014:00:00:00

Comments: The purpose of Visit 02 is to take STIS CCD G430L spectra of the highly variable and unpredictable recurrent nova T Pyx. It has been separated from the STIS CCD G750L spectra in Visit 03 to keep the visit orbit requests for each below the requested 5 orbit limit. Visits 02 and 03 are critically timed to occur when the STIS slit corresponds as best as possible to the major principal axis of the jet-like knots seen in the nova remnant and to match as closely as possible G430L spectra taken during GO 13400 Visit 05 [which had PA_APER=95.64, PA_V3=320.99, and PA_U3=140.99; see e.g. exposure oc7p05010]. Hence this visit must be executed as early as possible in July 2014. The MaxOrient=162.99 degrees condition specficied in this visit is a balance between minimizing the PA change from GO 13400, but opening the scheduling window as late as 26-July-2014. If the F657N and F502N imaging from Visit 01 reveal dramatic fading since the last imaging in September 2013, we are prepared to shift all of the allotted eight orbits across both visits into a single grating---either G430L or G750L.

Patterns

#	Primary Pattern		Secondary Pattern	Exposures
(4)	Pattern Type=STIS-ALONG-SLIT	Coordinate Frame=POS-TARG		(3), (4), (5), (6)
	Purpose=DITHER	Pattern Orientation=90.0		
	Number Of Points=4	Angle Between Sides=		
	Point Spacing=0.5078	Center Pattern=false		
	Line Spacing=			

Fixed Targets

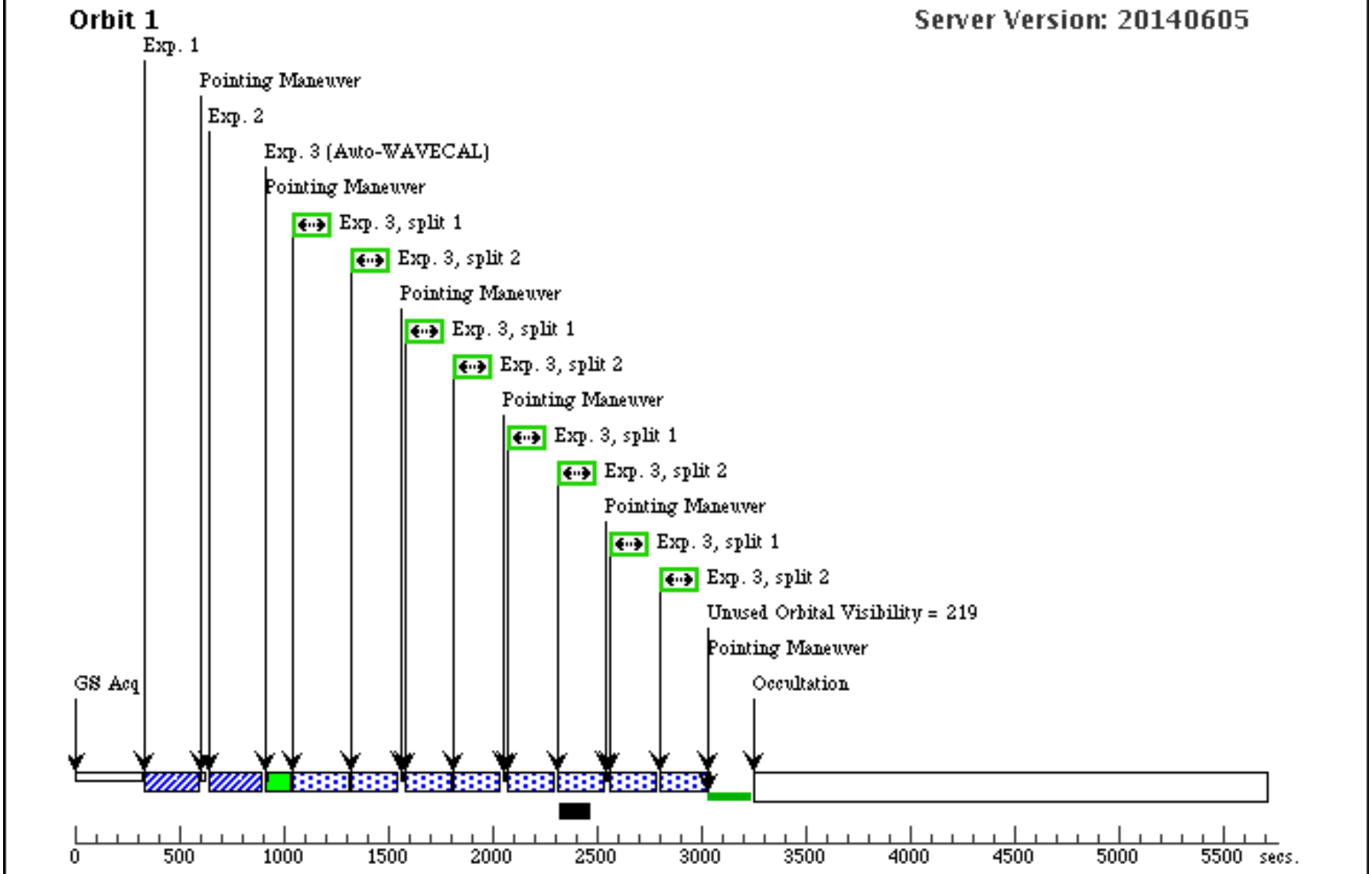
#	Name	Target Coordinates	Targ. Coord. Corrections	Fluxes	Miscellaneous
(2)	NOVA-PYX-1890-ICRS	RA: 09 04 41.5000 (136.1729167d)		V=15.5+/-1	Reference Frame: ICRS
	Alt Name1: T-PYX	Dec: -32 22 47.50 (-32.37986d)			
		Equinox: J2000			

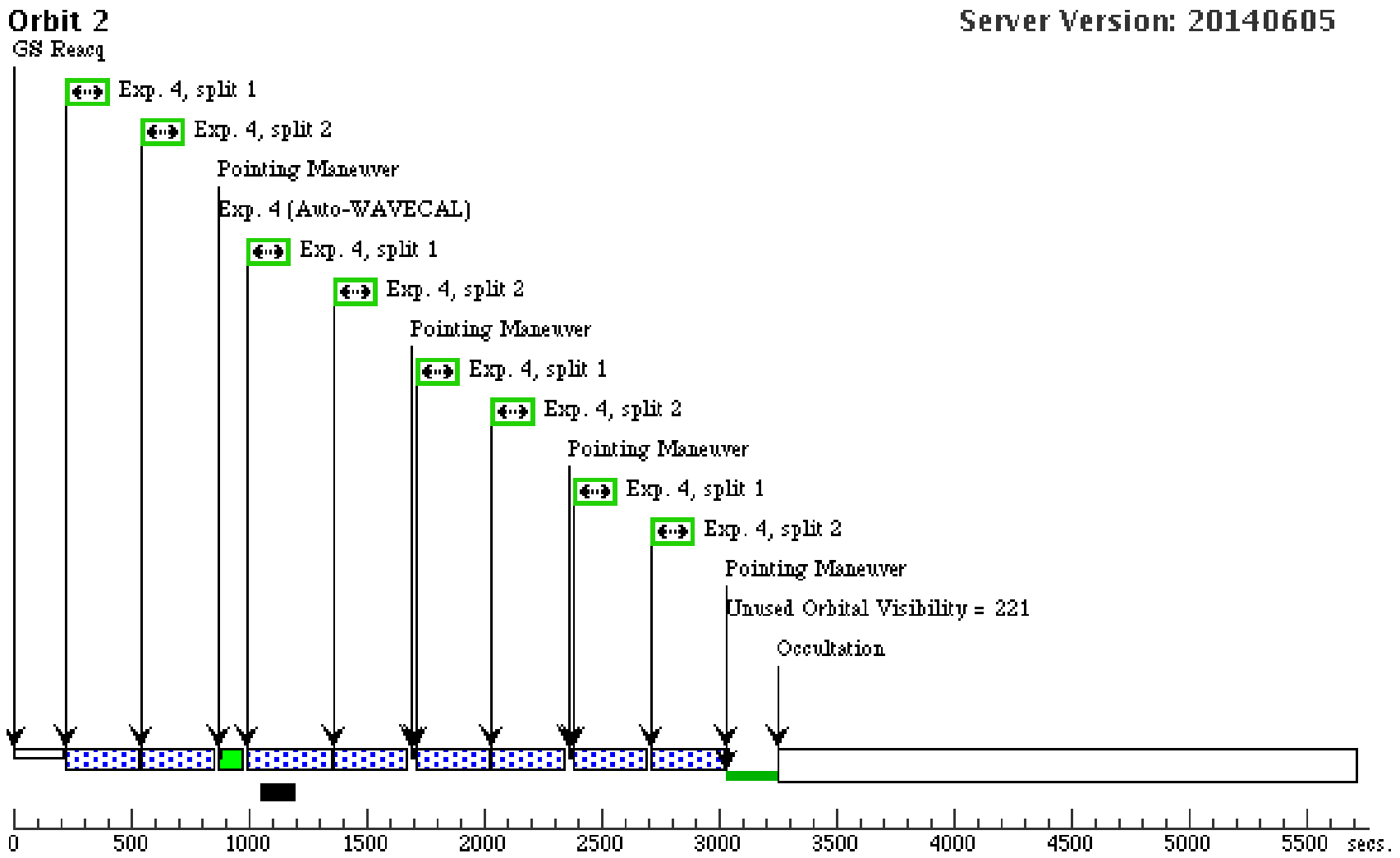
Comments: This object was generated by the targetselector and retrieved from the SIMBAD database. The coordinates from SIMBAD appear to be the best available.

Exposures

#	Label (ETC Run)	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time (Total)/[Actual Dur.]	Orbit
1	TPyx-ACQ (508839)	(2) NOVA-PYX-1890-ICRS	STIS/CCD, ACQ, 50CCD	MIRROR	CHECKBOX=5; ACQTYPE=DIFFUSE; DIFFUSE-CENTER=FLUX-CENTROID			3 Secs (3 Secs) *[==>]*	***[1]***
2	TPyx-PEAK (508842)	(2) NOVA-PYX-1890-ICRS	STIS/CCD, ACQ/PEAK, 52X0.1E1	MIRROR				3 Secs (3 Secs) *[==>]*	***[1]***
3	Orbit 1 G430L	(2) NOVA-PYX-1890-ICRS	STIS/CCD, ACCUM, 52X2E1	G430L 4300 A	CR-SPLIT=2		Pattern 4, Exps 3-3 in Visit 02: 4 orbits of STIS CCD G430L spectra (02) (4)	378 Secs (1512 Secs) *[==>(Pattern 1, Split 1)]* *[==>(Pattern 1, Split 2)]* *[==>(Pattern 2, Split 1)]* *[==>(Pattern 2, Split 2)]* *[==>(Pattern 3, Split 1)]* *[==>(Pattern 3, Split 2)]* *[==>(Pattern 4, Split 1)]* *[==>(Pattern 4, Split 2)]*	***[1]***
4	Orbit 2 G430L	(2) NOVA-PYX-1890-ICRS	STIS/CCD, ACCUM, 52X2E1	G430L 4300 A	CR-SPLIT=2		Pattern 4, Exps 4-4 in Visit 02: 4 orbits of STIS CCD G430L spectra (02) (4)	558 Secs (2232 Secs) *[==>(Pattern 1, Split 1)]* *[==>(Pattern 1, Split 2)]* *[==>(Pattern 2, Split 1)]* *[==>(Pattern 2, Split 2)]* *[==>(Pattern 3, Split 1)]* *[==>(Pattern 3, Split 2)]* *[==>(Pattern 4, Split 1)]* *[==>(Pattern 4, Split 2)]*	***[2]***
5	Orbit 3 G430L	(2) NOVA-PYX-1890-ICRS	STIS/CCD, ACCUM, 52X2E1	G430L 4300 A	CR-SPLIT=2		Pattern 4, Exps 5-5 in Visit 02: 4 orbits of STIS CCD G430L spectra (02) (4)	552 Secs (2208 Secs) *[==>(Pattern 1, Split 1)]* *[==>(Pattern 1, Split 2)]* *[==>(Pattern 2, Split 1)]* *[==>(Pattern 2, Split 2)]* *[==>(Pattern 3, Split 1)]* *[==>(Pattern 3, Split 2)]* *[==>(Pattern 4, Split 1)]* *[==>(Pattern 4, Split 2)]*	***[3]***
6	Orbit 4 G430L	(2) NOVA-PYX-1890-ICRS	STIS/CCD, ACCUM, 52X2E1	G430L 4300 A	CR-SPLIT=2		Pattern 4, Exps 6-6 in Visit 02: 4 orbits of STIS CCD G430L spectra (02) (4)	544 Secs (2176 Secs) *[==>(Pattern 1, Split 1)]* *[==>(Pattern 1, Split 2)]* *[==>(Pattern 2, Split 1)]* *[==>(Pattern 2, Split 2)]* *[==>(Pattern 3, Split 1)]* *[==>(Pattern 3, Split 2)]* *[==>(Pattern 4, Split 1)]* *[==>(Pattern 4, Split 2)]*	***[4]***

Orbit Structure

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Exp. 4 (Auto-WAVECAL)
Exp. 4, split 1
Exp. 4, split 2
Pointing Maneuver
Exp. 4, split 1
Exp. 4, split 2
Pointing Maneuver
Exp. 4, split 1
Exp. 4, split 2
Pointing Maneuver
Unused Orbital Visibility = 221
Occultation
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3500
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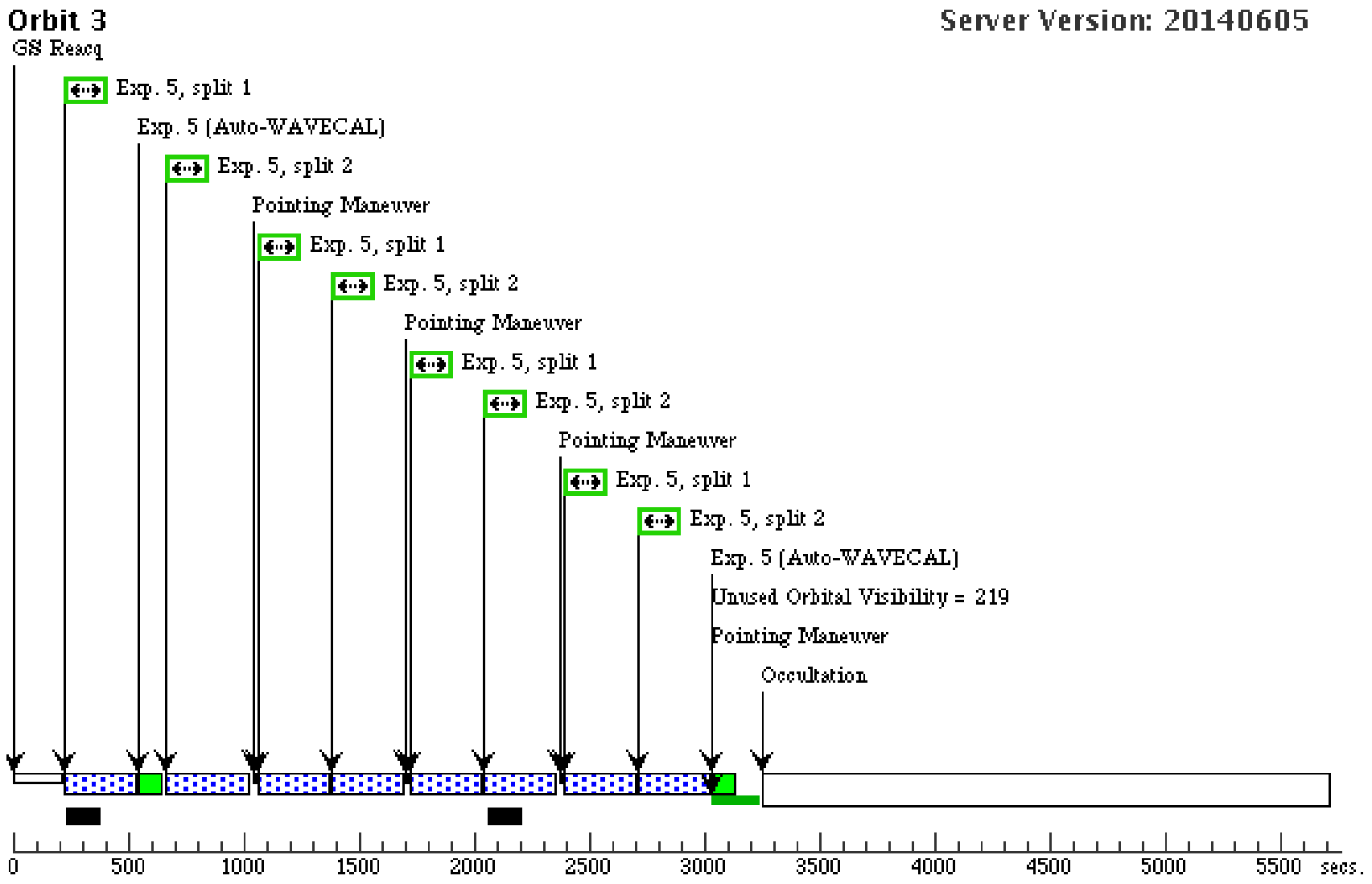
4500
5000
5500
secs.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Pointing Maneuver
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Exp. 5, split 2
Pointing Maneuver
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Exp. 5, split 2
Exp. 5 (Auto-WAVECAL)
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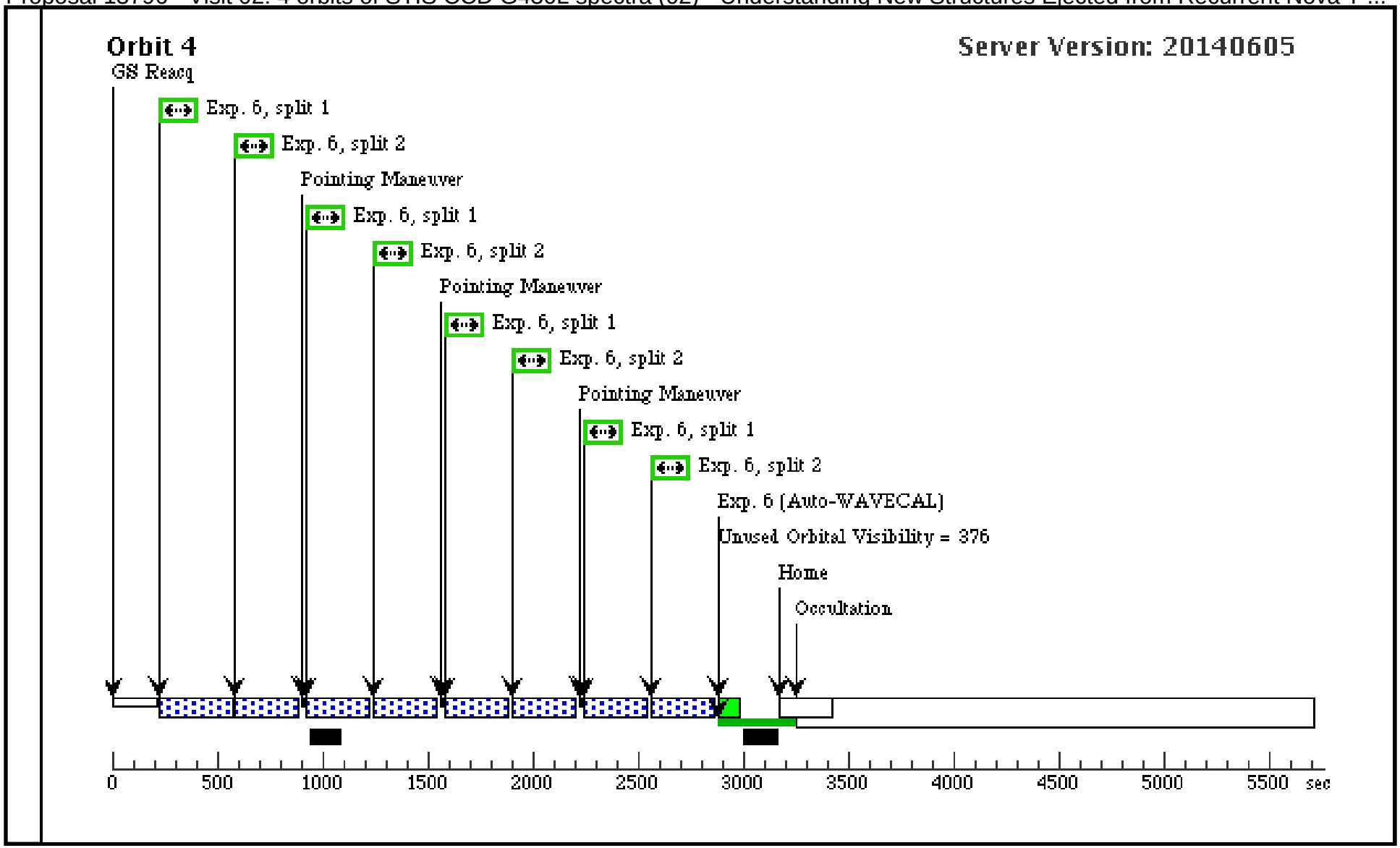
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Exp. 6, split 1
Exp. 6, split 2
Pointing Maneuver
Exp. 6, split 1
Exp. 6, split 2
Pointing Maneuver
Exp. 6, split 1
Exp. 6, split 2
Exp. 6 (Auto-WAVECAL)
Unused Orbital Visibility = 376
Home
Occultation
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500
1000
1500
2000
2500
3000
3500
4000
4500
5000
5500
sec

Visit

Proposal 13796, Visit 03: 4 orbits of STIS CCD G750L spectra (03), implementation Wed Jul 02 01:07:41 GMT 2014

Diagnostic Status: No Diagnostics

Scientific Instruments: STIS/CCD

Special Requirements: ORIENT 140.99D TO 162.99 D; BETWEEN 21-JUL-2014 AND 01-SEP-2014:00:00:00

Comments: The purpose of Visit 03 is to take STIS CCD G750L spectra of the highly variable and unpredictable recurrent nova T Pyx. It has been separated from the STIS CCD G430L spectra in Visit 02 to keep the visit orbit requests for each below the requested 5 orbit limit. Visits 02 and 03 are critically timed to occur when the STIS slit corresponds as best as possible to the major principal axis of the jet-like knots seen in the nova remnant and to match as closely as possible G430L spectra taken during GO 13400 Visit 05 [which had PA_APER=95.64, PA_V3=320.99, and PA_U3=140.99; see e.g. exposure oc7p05010]. Hence this visit must be executed as early as possible in July 2014. The MaxOrient=162.99 degrees condition specficied in this visit is a balance between minimizing the PA change from GO 13400, but opening the scheduling window as late as 26-July-2014 23:59. If the F657N and F502N imaging from Visit 01 reveal dramatic fading since the last imaging in September 2013, we are prepared to shift all of the allotted eight orbits across both visits into a single grating---either G430L or G750L.

Patterns

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(4)	Pattern Type=STIS-ALONG-SLIT	Coordinate Frame=POS-TARG		(3), (4), (5), (6)
	Purpose=DITHER	Pattern Orientation=90.0		
	Number Of Points=4	Angle Between Sides=		
	Point Spacing=0.5078	Center Pattern=false		
	Line Spacing=			

Fixed Targets

#	Name	Target Coordinates	Targ. Coord. Corrections	Fluxes	Miscellaneous
(2)	NOVA-PYX-1890-ICRS	RA: 09 04 41.5000 (136.1729167d)		V=15.5+/-1	Reference Frame: ICRS
	Alt Name1: T-PYX	Dec: -32 22 47.50 (-32.37986d)			
		Equinox: J2000			

Comments: This object was generated by the targetselector and retrieved from the SIMBAD database. The coordinates from SIMBAD appear to be the best available.

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#	Label (ETC Run)	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time (Total)/[Actual Dur.]	Orbit
1	TPyx-ACQ (508839)	(2) NOVA-PYX-1890-ICRS	STIS/CCD, ACQ, 50CCD	MIRROR	CHECKBOX=5; ACQTYPE=DIFFUSE; DIFFUSE-CENTER=FLUX-CENTROID			3 Secs (3 Secs) *[==>]*	***[1]***
2	TPyx-PEAK (508842)	(2) NOVA-PYX-1890-ICRS	STIS/CCD, ACQ/PEAK, 52X0.1E1	MIRROR				3 Secs (3 Secs) *[==>]*	***[1]***
3	Orbit 1 G750L	(2) NOVA-PYX-1890-ICRS	STIS/CCD, ACCUM, 52X2E1	G750L 7751 A	CR-SPLIT=2		Pattern 4, Exps 3-3 in Visit 03: 4 orbits of STIS CCD G750L spectra (03) (4)	373 Secs (1492 Secs) *[==>(Pattern 1, Split 1)]* *[==>(Pattern 1, Split 2)]* *[==>(Pattern 2, Split 1)]* *[==>(Pattern 2, Split 2)]* *[==>(Pattern 3, Split 1)]* *[==>(Pattern 3, Split 2)]* *[==>(Pattern 4, Split 1)]* *[==>(Pattern 4, Split 2)]*	***[1]***
4	Orbit 2 G750L	(2) NOVA-PYX-1890-ICRS	STIS/CCD, ACCUM, 52X2E1	G750L 7751 A	CR-SPLIT=2		Pattern 4, Exps 4-4 in Visit 03: 4 orbits of STIS CCD G750L spectra (03) (4)	558 Secs (2232 Secs) *[==>(Pattern 1, Split 1)]* *[==>(Pattern 1, Split 2)]* *[==>(Pattern 2, Split 1)]* *[==>(Pattern 2, Split 2)]* *[==>(Pattern 3, Split 1)]* *[==>(Pattern 3, Split 2)]* *[==>(Pattern 4, Split 1)]* *[==>(Pattern 4, Split 2)]*	***[2]***
5	Orbit 3 G750L	(2) NOVA-PYX-1890-ICRS	STIS/CCD, ACCUM, 52X2E1	G750L 7751 A	CR-SPLIT=2		Pattern 4, Exps 5-5 in Visit 03: 4 orbits of STIS CCD G750L spectra (03) (4)	552 Secs (2208 Secs) *[==>(Pattern 1, Split 1)]* *[==>(Pattern 1, Split 2)]* *[==>(Pattern 2, Split 1)]* *[==>(Pattern 2, Split 2)]* *[==>(Pattern 3, Split 1)]* *[==>(Pattern 3, Split 2)]* *[==>(Pattern 4, Split 1)]* *[==>(Pattern 4, Split 2)]*	***[3]***
6	Orbit 4 G750L	(2) NOVA-PYX-1890-ICRS	STIS/CCD, ACCUM, 52X2E1	G750L 7751 A	CR-SPLIT=2		Pattern 4, Exps 6-6 in Visit 03: 4 orbits of STIS CCD G750L spectra (03) (4)	543 Secs (2172 Secs) *[==>(Pattern 1, Split 1)]* *[==>(Pattern 1, Split 2)]* *[==>(Pattern 2, Split 1)]* *[==>(Pattern 2, Split 2)]* *[==>(Pattern 3, Split 1)]* *[==>(Pattern 3, Split 2)]* *[==>(Pattern 4, Split 1)]* *[==>(Pattern 4, Split 2)]*	***[4]***

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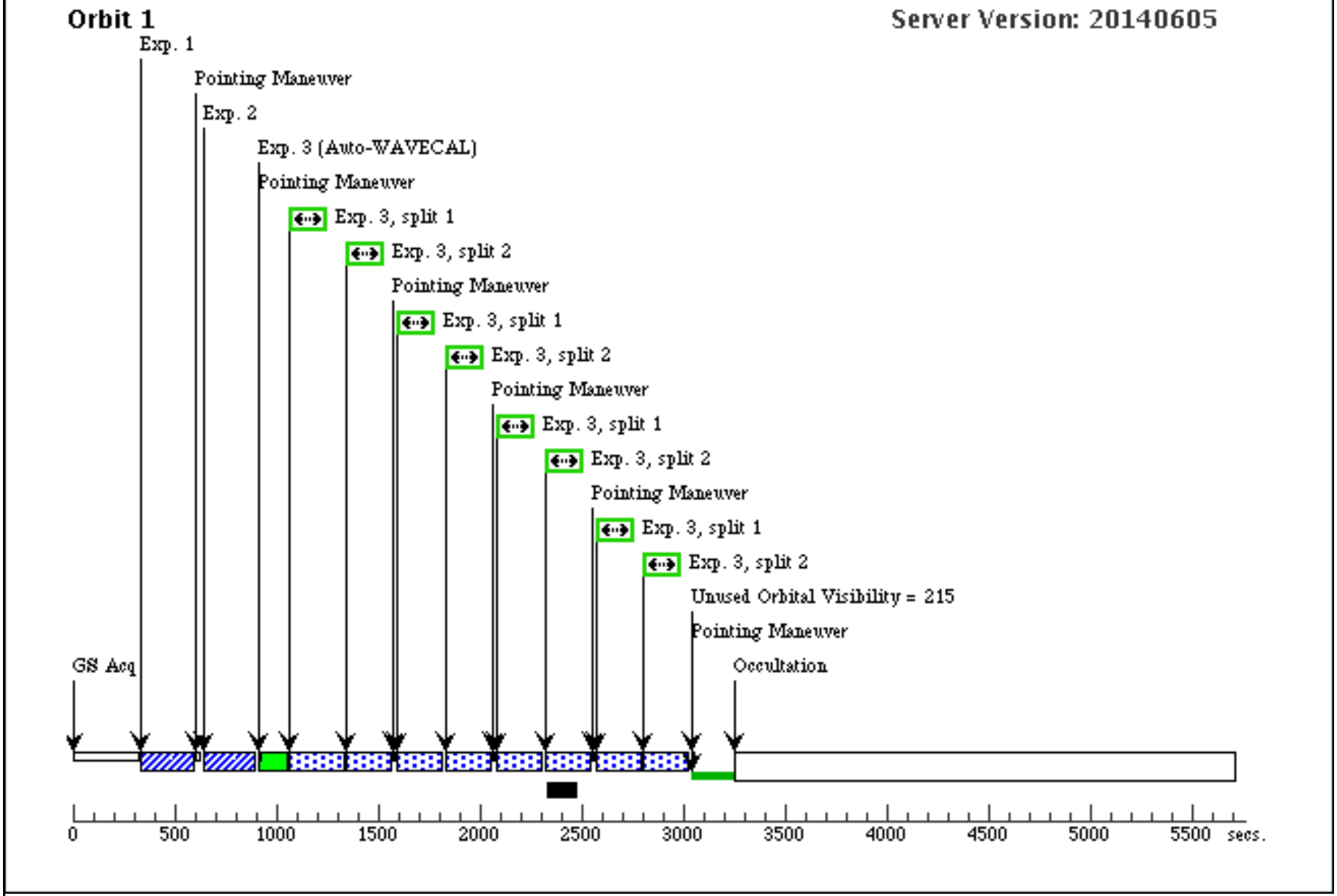
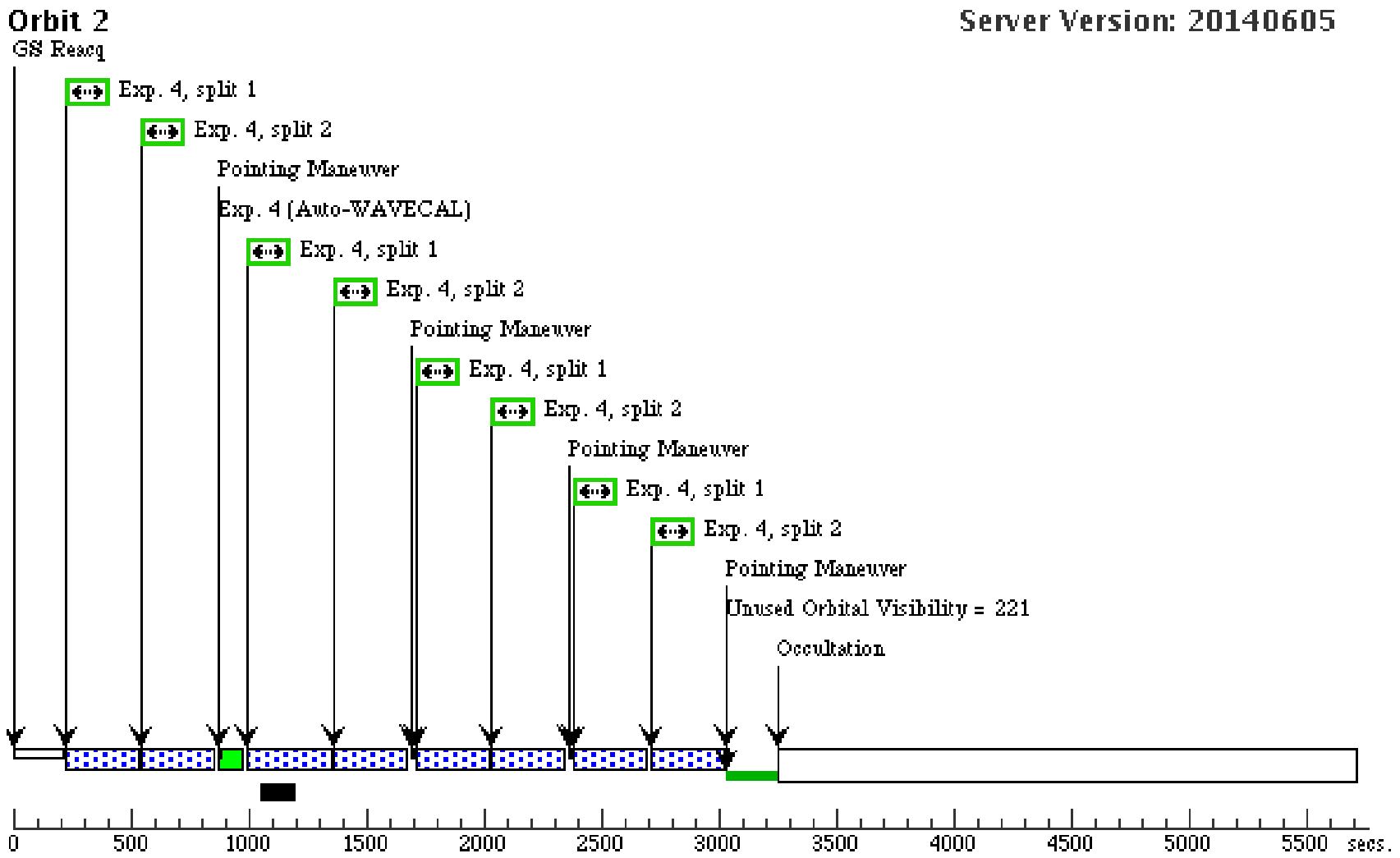
Orbit Structure

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Exp. 4 (Auto-WAVECAL)
Exp. 4, split 1
Exp. 4, split 2
Pointing Maneuver
Exp. 4, split 1
Exp. 4, split 2
Pointing Maneuver
Exp. 4, split 1
Exp. 4, split 2
Pointing Maneuver
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Occultation
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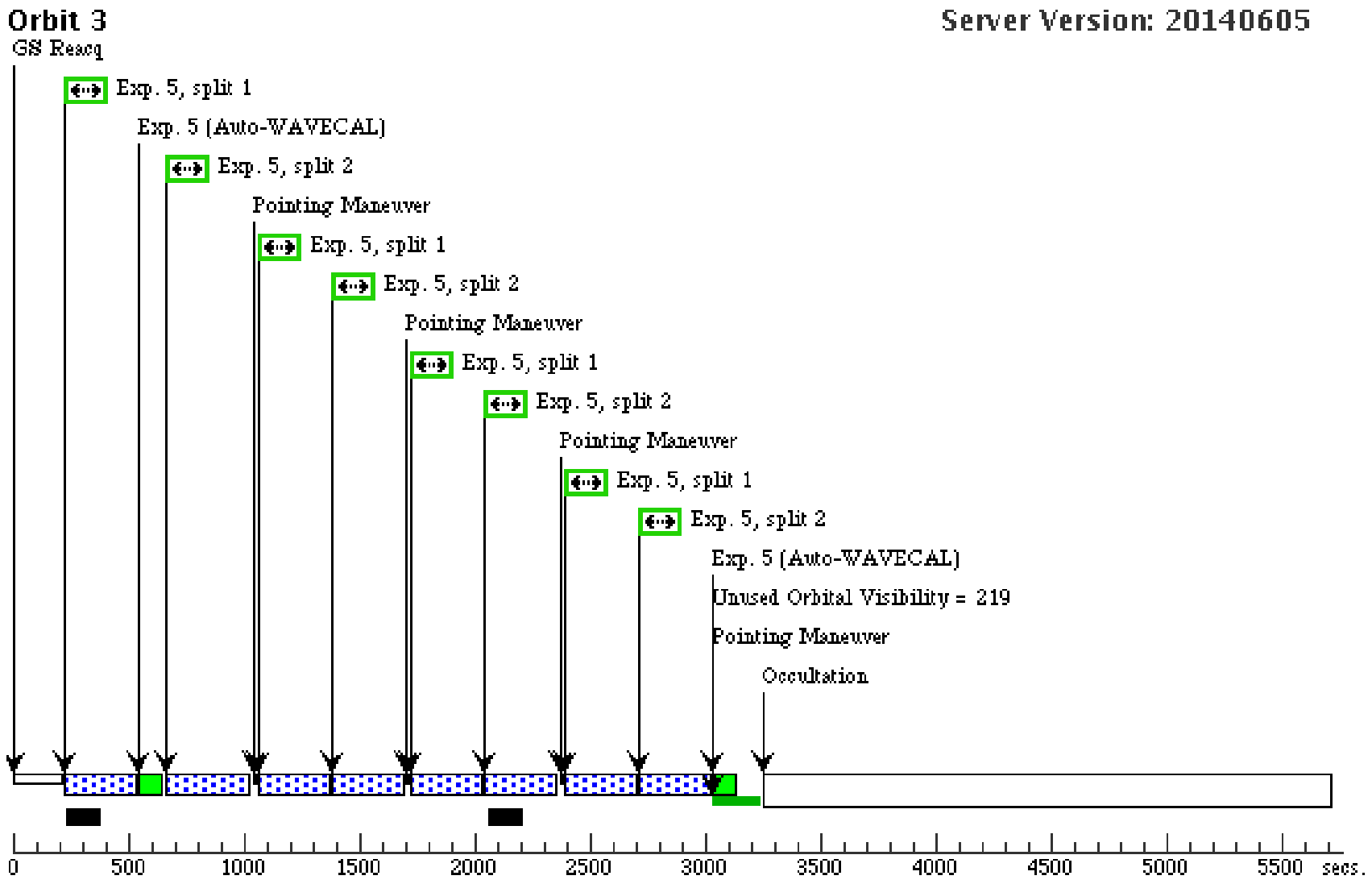
5500
secs.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Exp. 5 (Auto-WAVECAL)
Exp. 5, split 2
Pointing Maneuver
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Exp. 5, split 1
Exp. 5, split 2
Pointing Maneuver
Exp. 5, split 1
Exp. 5, split 2
Exp. 5 (Auto-WAVECAL)
Unused Orbital Visibility = 219
Pointing Maneuver
Occultation
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3500
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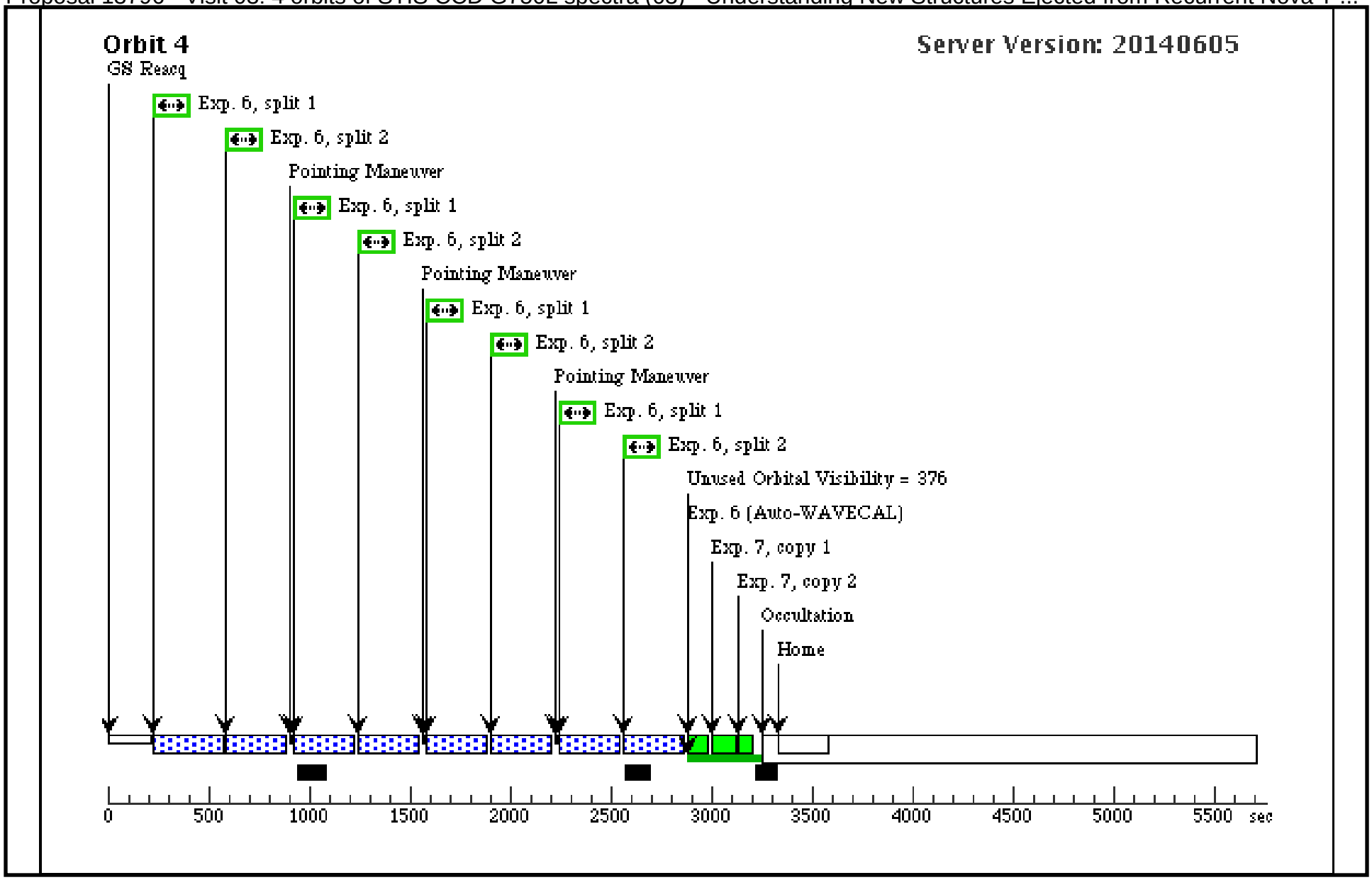
secs.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Pointing Maneuver
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Exp. 6, split 2
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Unused Orbital Visibility = 376
Exp. 6 (Auto-WAVECAL)
Exp. 7, copy 1
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Occultation
Home
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