13400 - The Surprising Ejecta Geometry of Recurrent Nova T Pyx

Cycle: 21, 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) NOVA-PYX-1890	WFC3/UVIS	3	18-Sep-2013 21:11:09.0	yes
05	(2) NOVA-PYX-1890-ICRS	STIS/CCD	3	18-Sep-2013 21:11:23.0	yes
07	(2) NOVA-PYX-1890-ICRS	WFC3/UVIS	1	18-Sep-2013 21:11:35.0	yes
08	(2) NOVA-PYX-1890-ICRS	STIS/CCD	5	18-Sep-2013 21:11:51.0	yes
09	(2) NOVA-PYX-1890-ICRS	WFC3/UVIS	2	18-Sep-2013 21:12:06.0	yes

14 Total Orbits Used

ABSTRACT

Given the striking appearance of the old remnant that surrounds T Pyxidis (T Pyx), and the rapid pace at which this binary is currently evolving, T Pyx is one of the most stunning and interesting recurrent novae (RNe). But it is also one of the most disobedient, with the rate of mass transfer, the mass of the white dwarf, and the speed of the eruptions all inconsistent with standard expectations. In 2011, T Pyx experienced its first eruption in 45 years, providing observers with the long-awaited opportunity to determine the detailed properties of a T Pyx explosion and to test ideas about how these events might have led to T Pyx's unusual state. Our Cycle 20 HST observations of the light echo from the old remnant and direct line emission

from the young remnant from 2011 provided one of several surprises: much of the old and young ejecta form a disk or ring inclined with respect to the plane of the sky. The 2011 ejecta also contain multiple kinematic components. But our Cycle 20 observations did not cover enough position angles, or span a long enough time baseline, to enable us to fully disentangle the spatial and velocity structure of the young remnant. In Cycle 21, we propose to take advantage of the unique moment in time when the young remnant is both large enough and bright enough for the spatial extent, expansion, and velocity structure to be clearly mapped. This research has implications for our understanding of the mass expelled in the 2011 eruption of T Pyx, the shaping of nova remnants, and the potential influence of nova eruptions on binary stellar evolution and the production of type Ia supernovae.

OBSERVING DESCRIPTION

The purpose of the current version of this Phase II proposal is to execute the three-orbit Visit 1 as soon as possible but before June 28, 2013 if at all possible according to the APT in order to be consistent with the following. We are taking images and spectra of the recurrent nova T Pyx, a highly variable and unpredictable target. These consist of two sets of images (Visits 1 and 4); the first one (Visit 1) which must be taken as soon as possible, since the [Ne V] (F343N) emission nebula is fading rapidly. The second and third visits (Visits 2 and 3) are timed to occur when the STIS slit corresponds to the principal axes of the nebula so as to allow us to define the velocity field, hence must be executed in July and October 2013. Depending on the outcome of each Visit, we might be forced to change exposure times on subsequent Visits, for which a new APT file will be submitted if necessary. The specific timings and adaptive nature of our observations are spelled out in our Phase I proposal, which specify non-disruptive TOO observations.

Visit

Proposal 13400, T Pyx 1st images (01), completed Thu Sep 19 01:12:15 GMT 2013

Diagnostic Status: No Diagnostics

Scientific Instruments: WFC3/UVIS

Special Requirements: BEFORE 31-JUL-2013:00:00:00

Comments: The [Ne V] (F343N) emission nebula from T Pyx is fading rapidly so Visit 1 must be scheduled as soon as possible and certainly before the end of July 2013. It would be highly preferable if Visit 1 could be scheduled sufficiently in advance of Visit 2 in case exposure times need to be adjusted for Visit 2. This strategy was described in our Phase i proposal in connection with our non-disruptive TOO request. The goal of this Visit 1 is to acquire two dithered images of the T Pyx nebula, on in [Ne V] (F343N) requiring two orbits, and [O III] (F502N) requiring one orbit.

Patterns

#	Primary Pattern		Secondary Pattern	Exposures
(2)	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)

Fixed Targets

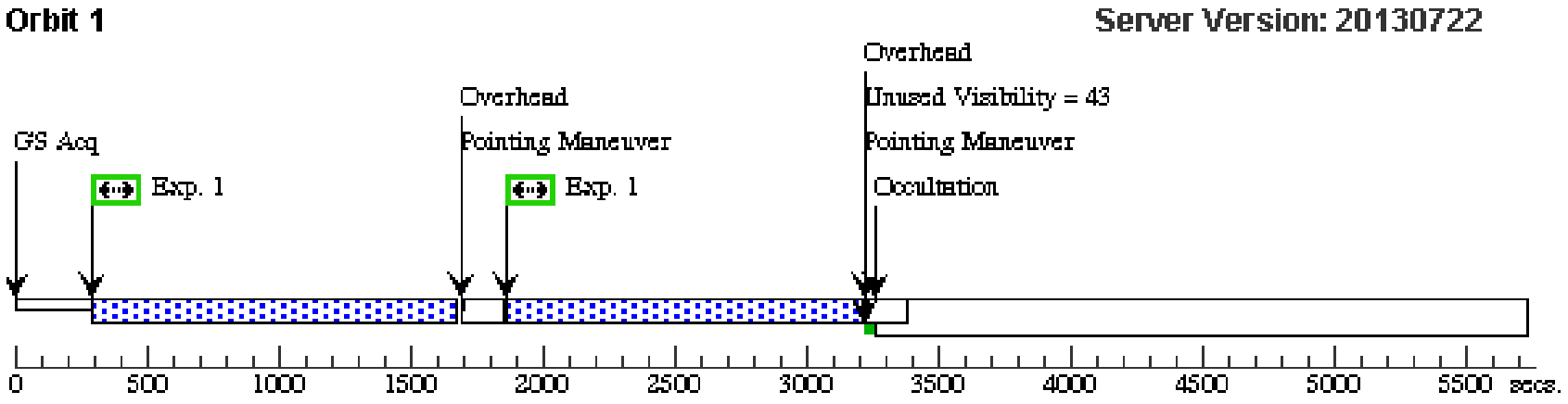
#	Name	Target Coordinates	Targ. Coord. Corrections	Fluxes	Miscellaneous
(1)	NOVA-PYX-1890	RA: 09 04 41.5000 (136.1729167d) Dec: -32 22 47.50 (-32.37986d) Equinox: J2000		V=15.5+/-1	Reference Frame: SIMBAD

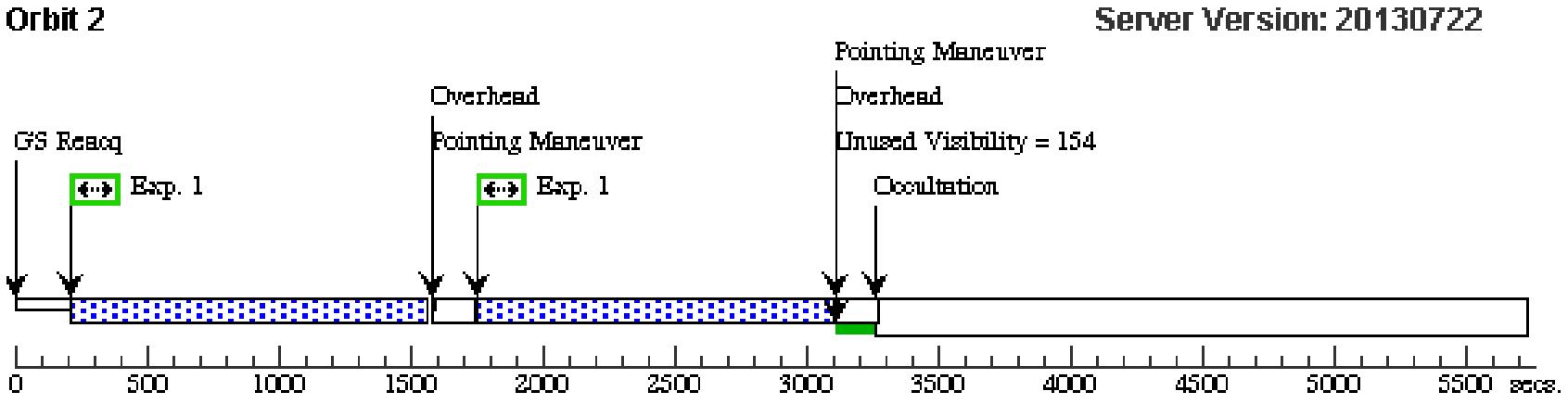
Comments: This object was generated by the targetselector and retrieved from the SIMBAD database. The coordinates from SIMBAD appear to be the best available.

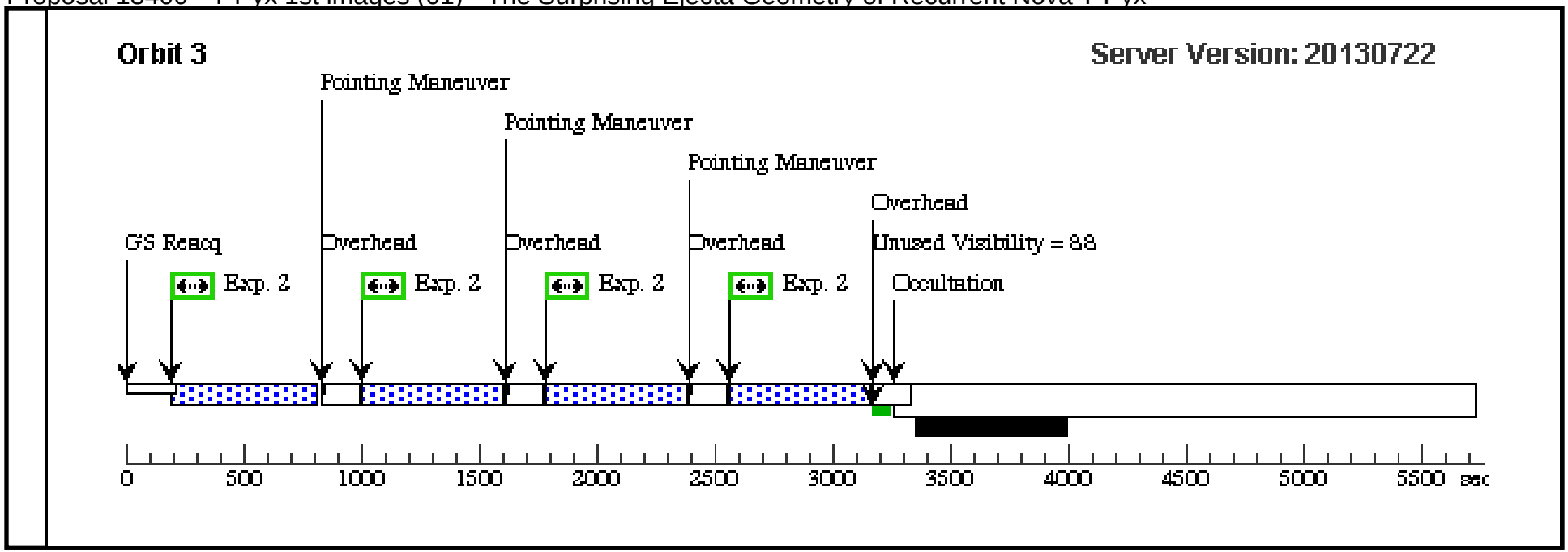
Exposures

#	Label	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time (Total)/[Actual Dur.]	Orbit
1		(1) NOVA-PYX-1890	WFC3/UVIS, ACCUM, UVIS2-2K2C-SUB	F343N	FLASH=10		Pattern 2, Exps 1-1 in T Pyx 1st images (01) (2)	1350 Secs (5400 Secs)	
								[==>(Pattern 1)] *[==>(Pattern 2)]*	***[1]***
								[==>(Pattern 3)] *[==>(Pattern 4)]*	***[2]***
2		(1) NOVA-PYX-1890	WFC3/UVIS, ACCUM, UVIS2-2K2C-SUB	F502N	FLASH=10		Pattern 2, Exps 2-2 in T Pyx 1st images (01) (2)	600 Secs (2400 Secs)	
								[==>(Pattern 1)] *[==>(Pattern 2)]* *[==>(Pattern 3)]* *[==>(Pattern 4)]*	***[3]***

Orbit Structure






Orbit 3
Server Version: 20130722
Pointing Maneuver
Pointing Maneuver
Pointing Maneuver
Overhead
GS Reacq
Overhead
Overhead
Overhead
Unused Visibility = 88
Exp. 2
Exp. 2
Exp. 2
Exp. 2
Occultation
0
500
1000
1500
2000
2500
3000
3500
4000
4500
5000
5500
sec

Visit

Proposal 13400, T Pyx 1st spectra (05), completed Thu Sep 19 01:12:17 GMT 2013

Diagnostic Status: No Diagnostics

Scientific Instruments: STIS/CCD

Special Requirements: ORIENT 138D TO 142 D; AFTER 01 BY 7 D TO 45 D

Comments: The purpose of this Visit 05 is to take spectra of the highly variable and unpredictable recurrent nova T Pyx. Visit 05 is timed to occur when the STIS slit corresponds to the major principal axis of the nebula so as to allow us to define the velocity field, hence must be executed in late-June/early-July 2013. The goal of this Visit 05 is to acquire a spectrum in G430L offset to the less noisy portion of the detector, composed of 8 subexposures.

Patterns

#	Primary Pattern		Secondary Pattern	Exposures
(3)	Pattern Type=STIS-ALONG-SLIT	Coordinate Frame=POS-TARG		(3)
	Purpose=DITHER	Pattern Orientation=90.0		
	Number Of Points=4	Angle Between Sides=		
	Point Spacing=0.5	Center Pattern=false		
	Line Spacing=			

Fixed Targets

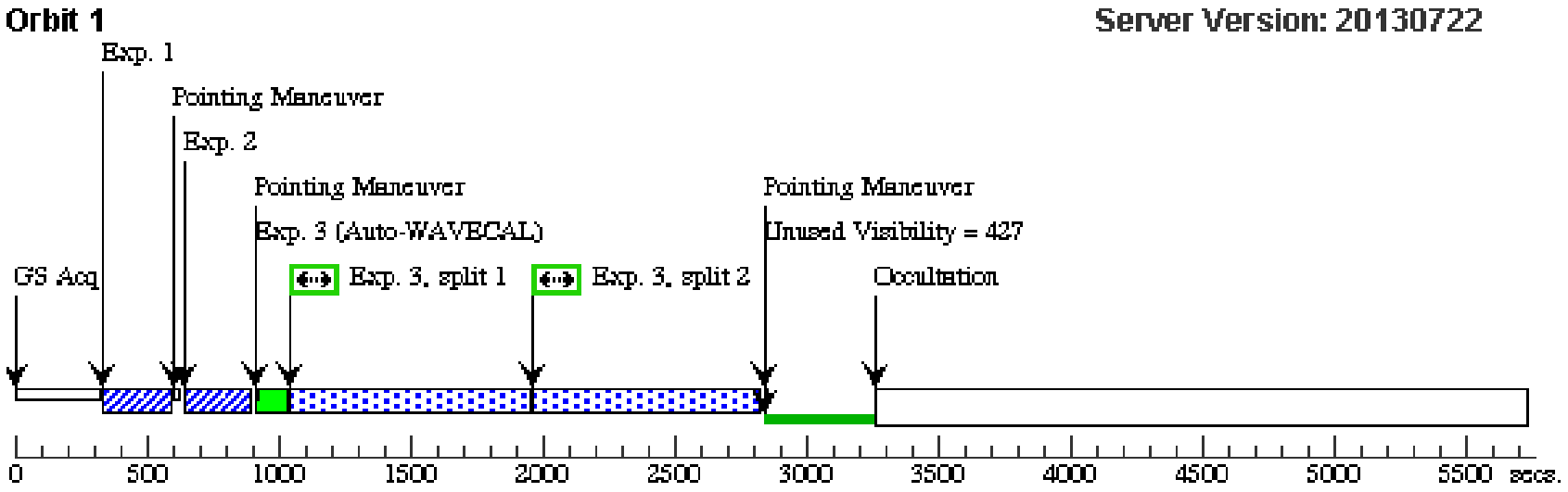
#	Name	Target Coordinates	Targ. Coord. Corrections	Fluxes	Miscellaneous
(2)	NOVA-PYX-1890-ICRS	RA: 09 04 41.5000 (136.1729167d)		V=15.5+/-1	Reference Frame: ICRS
		Dec: -32 22 47.50 (-32.37986d)			
		Equinox: J2000			

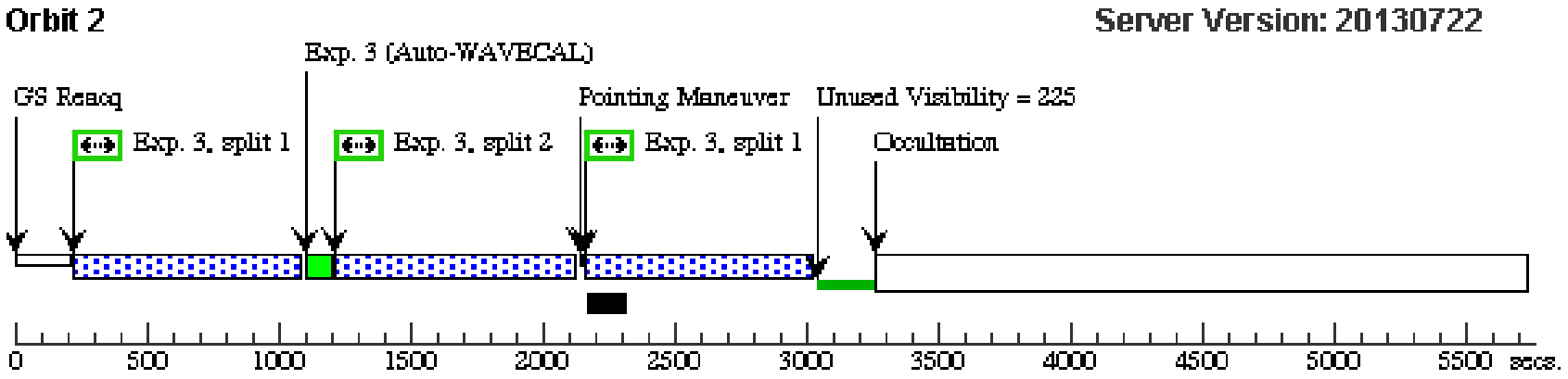
Comments: This object was generated by the targetselector and retrieved from the SIMBAD database. The coordinates from SIMBAD appear to be the best available.

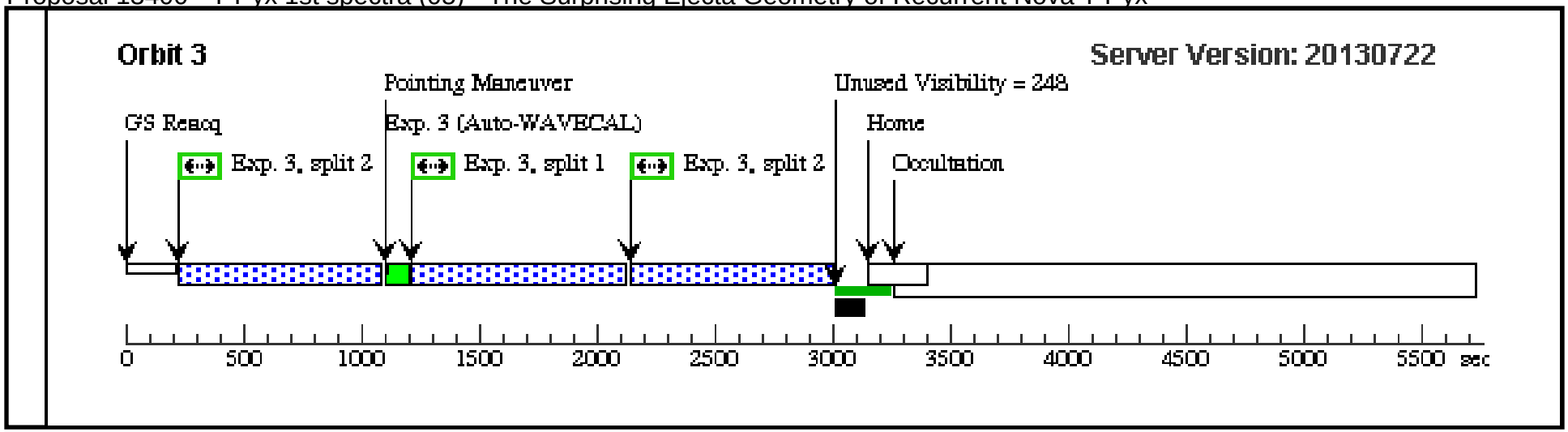
Exposures

#	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		(2) NOVA-PYX-1890-ICRS	STIS/CCD, ACCUM, 52X2E1	G430L 4300 A	CR-SPLIT=2		Pattern 3, Exps 3-3 in T Pyx 1st spectra (05) (3)	1656 Secs (6624 Secs)	
								[==>(Pattern 1, Split 1)]	***[1]***
								[==>(Pattern 1, Split 2)]	
								[==>(Pattern 2, Split 1)]	
								[==>(Pattern 2, Split 2)]	***[2]***
								[==>(Pattern 3, Split 1)]	
								[==>(Pattern 3, Split 2)]	
								[==>(Pattern 4, Split 1)]	***[3]***
								[==>(Pattern 4, Split 2)]	

Orbit Structure






Orbit 3
Server Version: 20130722
Pointing Maneuver
Unused Visibility = 248
GS Reacq
Exp. 3 (Auto-WAVECAL)
Home
Exp. 3, split 2
Exp. 3, split 1
Exp. 3, split 2
Occultation
0
500
1000
1500
2000
2500
3000
3500
4000
4500
5000
5500
sec

Visit

Proposal 13400, T Pyx 1st images supplement (07), completed Thu Sep 19 01:12:19 GMT 2013

Diagnostic Status: No Diagnostics

Scientific Instruments: WFC3/UVIS

Special Requirements: BETWEEN 14-JUL-2013:00:00:00 AND 19-JUL-2013:00:00:00

Comments: The [He II] (F469N) emission nebula from T Pyx is fading rapidly so Visit 7 must be scheduled as soon and certainly before the end of July 2013. The purpose of Visit 7 is to supplement information obtained on the longer Visit 1 and spectroscopic Visit 5 to aid in their interpretation. It requires one orbit, mainly on [He II] (F459N) plus to a lesser extent on [Ne V] (F343N) and on [O III] (F502N).

Patterns

#	Primary Pattern		Secondary Pattern	Exposures
(2)	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		(3)
(4)	Pattern Type=WFC3-UVIS-DITHER-LINE-3PT Purpose=DITHER Number Of Points=3 Point Spacing=0.135 Line Spacing=	Coordinate Frame=POS-TARG Pattern Orientation=46.84 Angle Between Sides= Center Pattern=false		(1), (2)

Fixed Targets

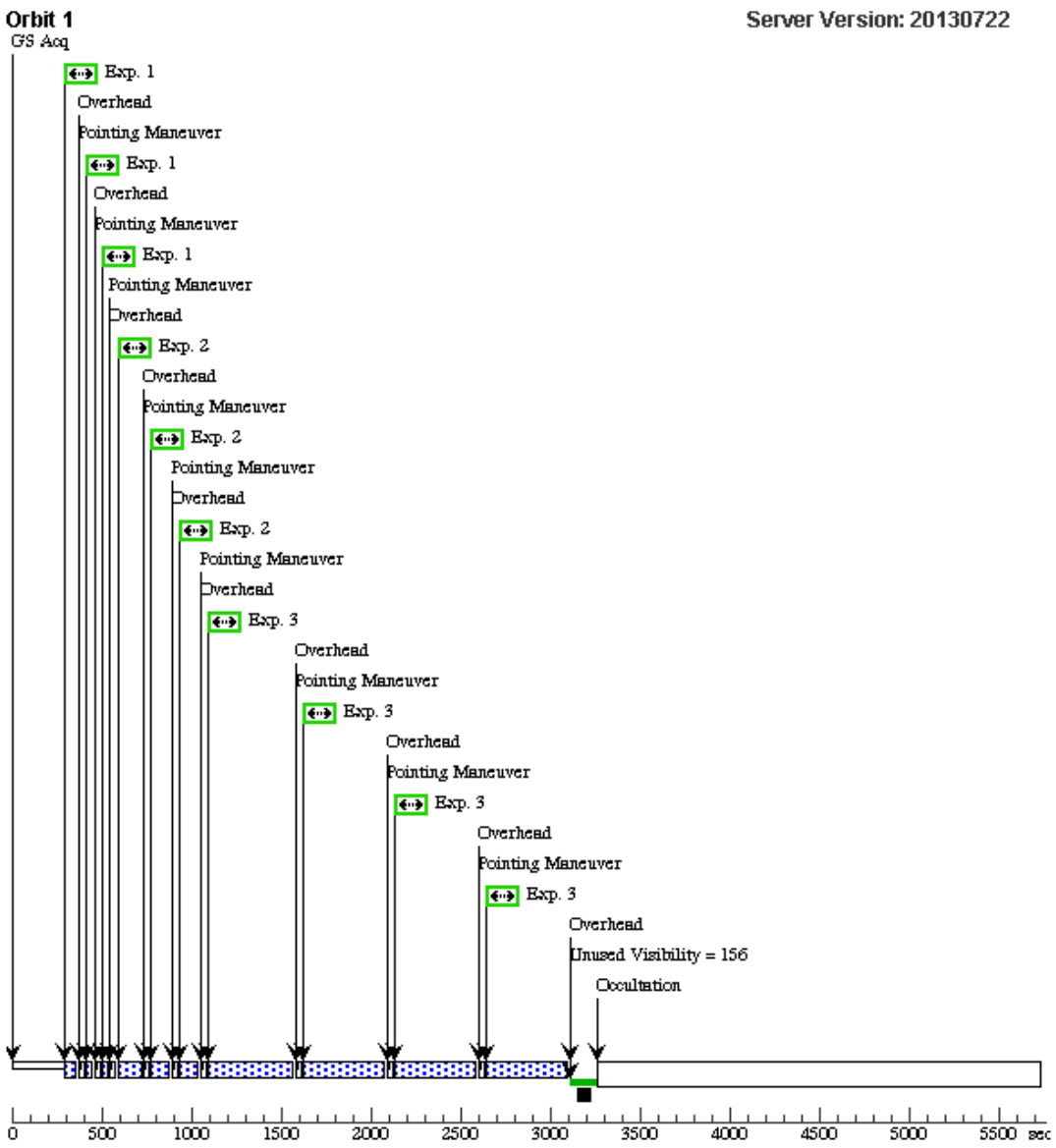
#	Name	Target Coordinates	Targ. Coord. Corrections	Fluxes	Miscellaneous
(2)	NOVA-PYX-1890-ICRS	RA: 09 04 41.5000 (136.1729167d) Dec: -32 22 47.50 (-32.37986d) Equinox: J2000		V=15.5+/-1	Reference Frame: ICRS

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 (ETC Run)	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time (Total)/[Actual Dur.]	Orbit
1	(518981)	(2) NOVA-PYX-1890-ICRS	WFC3/UVIS, ACCUM, UVIS2-C512C-SUB	F343N	FLASH=6		Pattern 4, Exps 1-1 in T Pyx 1st images supplement (07) (4)	30 Secs (90 Secs) *[==>(Pattern 1)]* *[==>(Pattern 2)]* *[==>(Pattern 3)]*	***[1]***
2	(518981)	(2) NOVA-PYX-1890-ICRS	WFC3/UVIS, ACCUM, UVIS2-C512C-SUB	F502N	FLASH=6		Pattern 4, Exps 2-2 in T Pyx 1st images supplement (07) (4)	100 Secs (300 Secs) *[==>(Pattern 1)]* *[==>(Pattern 2)]* *[==>(Pattern 3)]*	***[1]***
3	(518981)	(2) NOVA-PYX-1890-ICRS	WFC3/UVIS, ACCUM, UVIS2-C512C-SUB	F469N	FLASH=6		Pattern 2, Exps 3-3 in T Pyx 1st images supplement (07) (2)	455 Secs (1820 Secs) *[==>(Pattern 1)]* *[==>(Pattern 2)]* *[==>(Pattern 3)]* *[==>(Pattern 4)]*	***[1]***

Orbit Structure



Visit

Proposal 13400, T Pyx 2nd spectra (08), scheduled Thu Sep 19 01:12:20 GMT 2013

Diagnostic Status: No Diagnostics

Scientific Instruments: STIS/CCD

Special Requirements: ORIENT 225D TO 235 D; BEFORE 01-OCT-2013:00:00:00

Comments: The purpose of this Visit 08 is to take spectra of the highly variable and unpredictable recurrent nova T Pyx. Visit 08 must be timed to occur when the STIS slit corresponds to the minor principal axis of the nebula (ORIENT=230) so as to allow us to define the velocity field, hence must be executed in mid-September 2013. In Visit 08 and 09 some precaution is taken for the source increasing in brightness by a few magnitudes by including a series of shorter exposures corresponding to longer exposure sequences.

Patterns

#	Primary Pattern		Secondary Pattern	Exposures
(3)	Pattern Type=STIS-ALONG-SLIT	Coordinate Frame=POS-TARG		(3), (4)
	Purpose=DITHER	Pattern Orientation=90.0		
	Number Of Points=4	Angle Between Sides=		
	Point Spacing=0.5	Center Pattern=false		
	Line Spacing=			

Fixed Targets

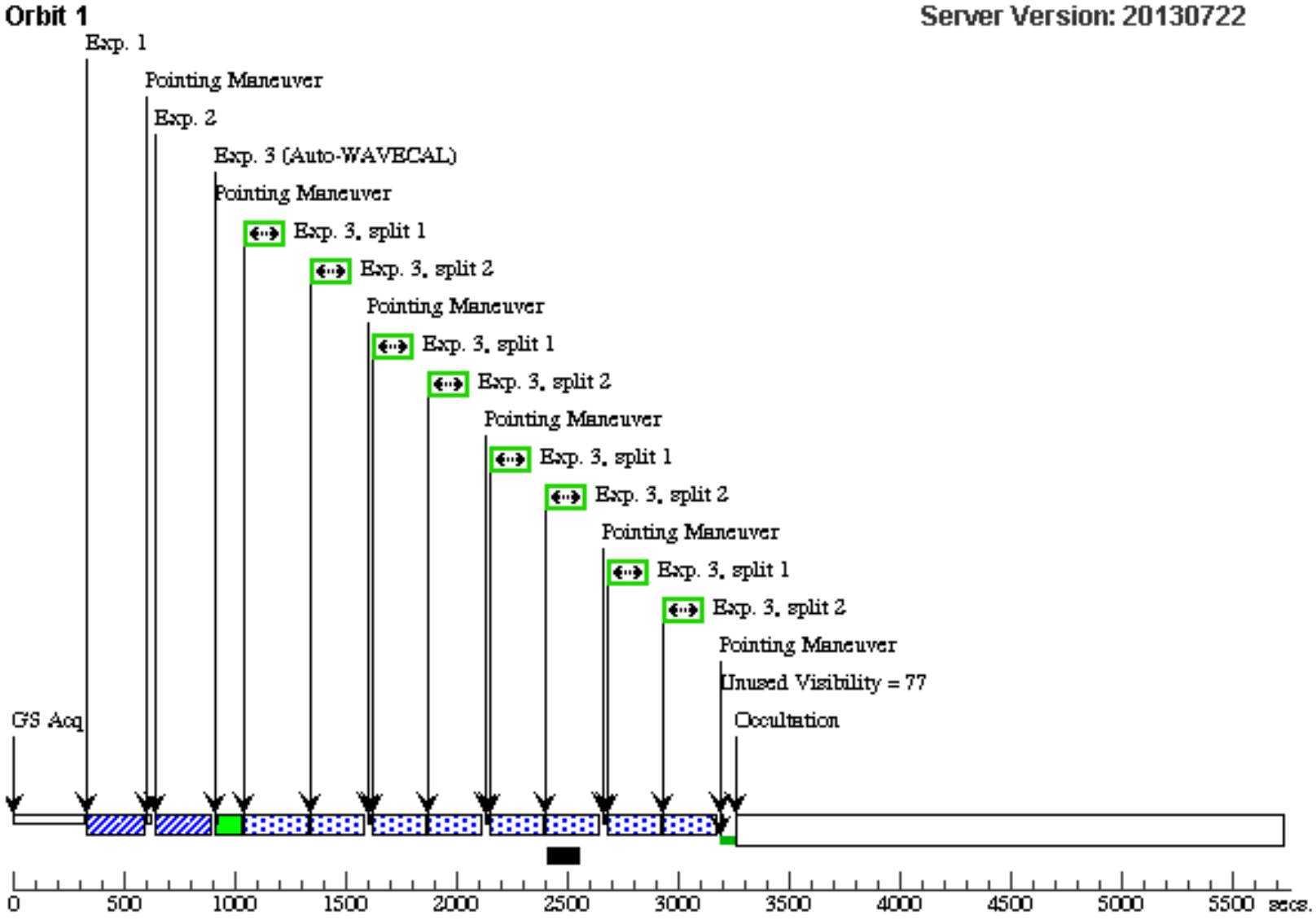
#	Name	Target Coordinates	Targ. Coord. Corrections	Fluxes	Miscellaneous
(2)	NOVA-PYX-1890-ICRS	RA: 09 04 41.5000 (136.1729167d)		V=15.5+/-1	Reference Frame: ICRS
		Dec: -32 22 47.50 (-32.37986d)			
		Equinox: J2000			

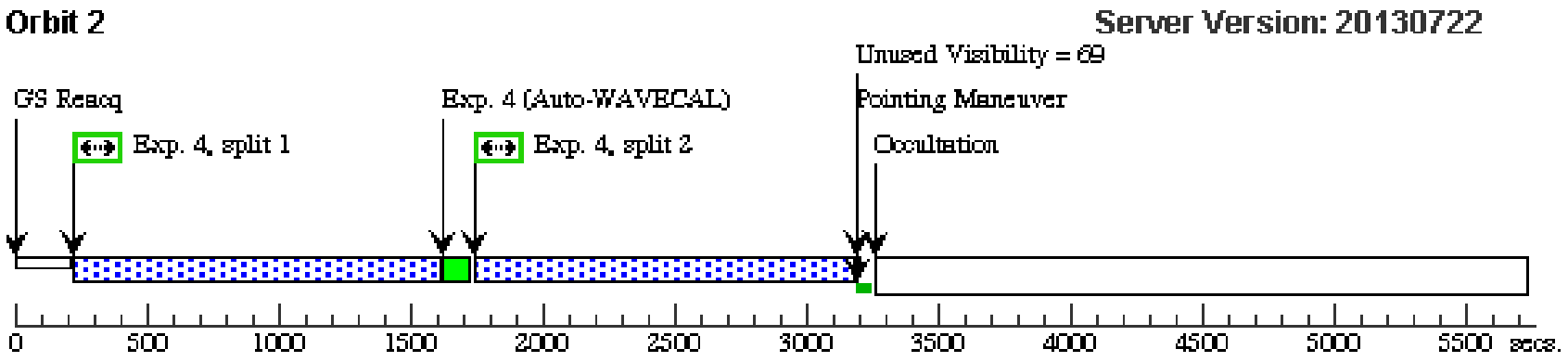
Comments: This object was generated by the targetselector and retrieved from the SIMBAD database. The coordinates from SIMBAD appear to be the best available.

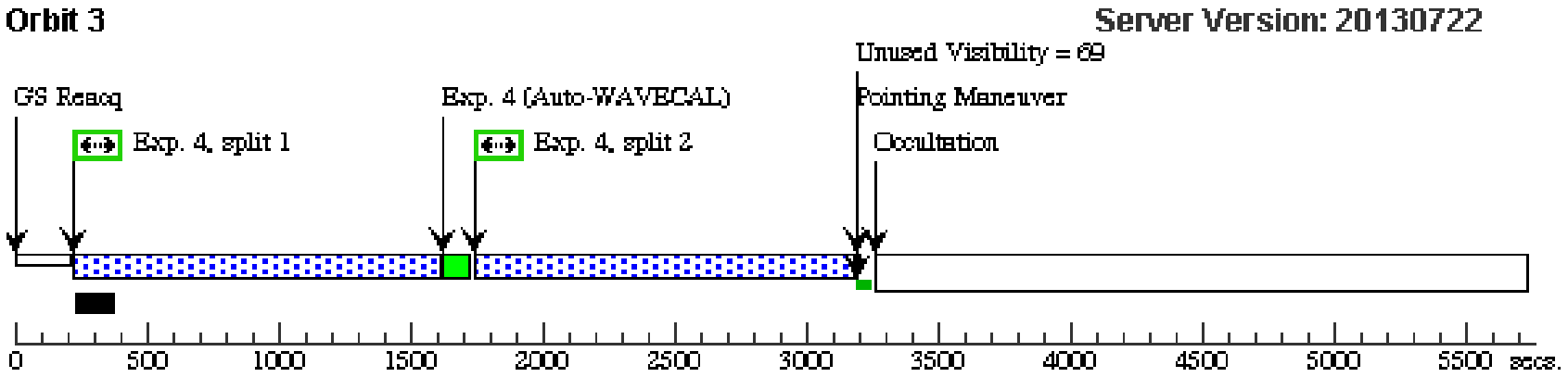
Exposures

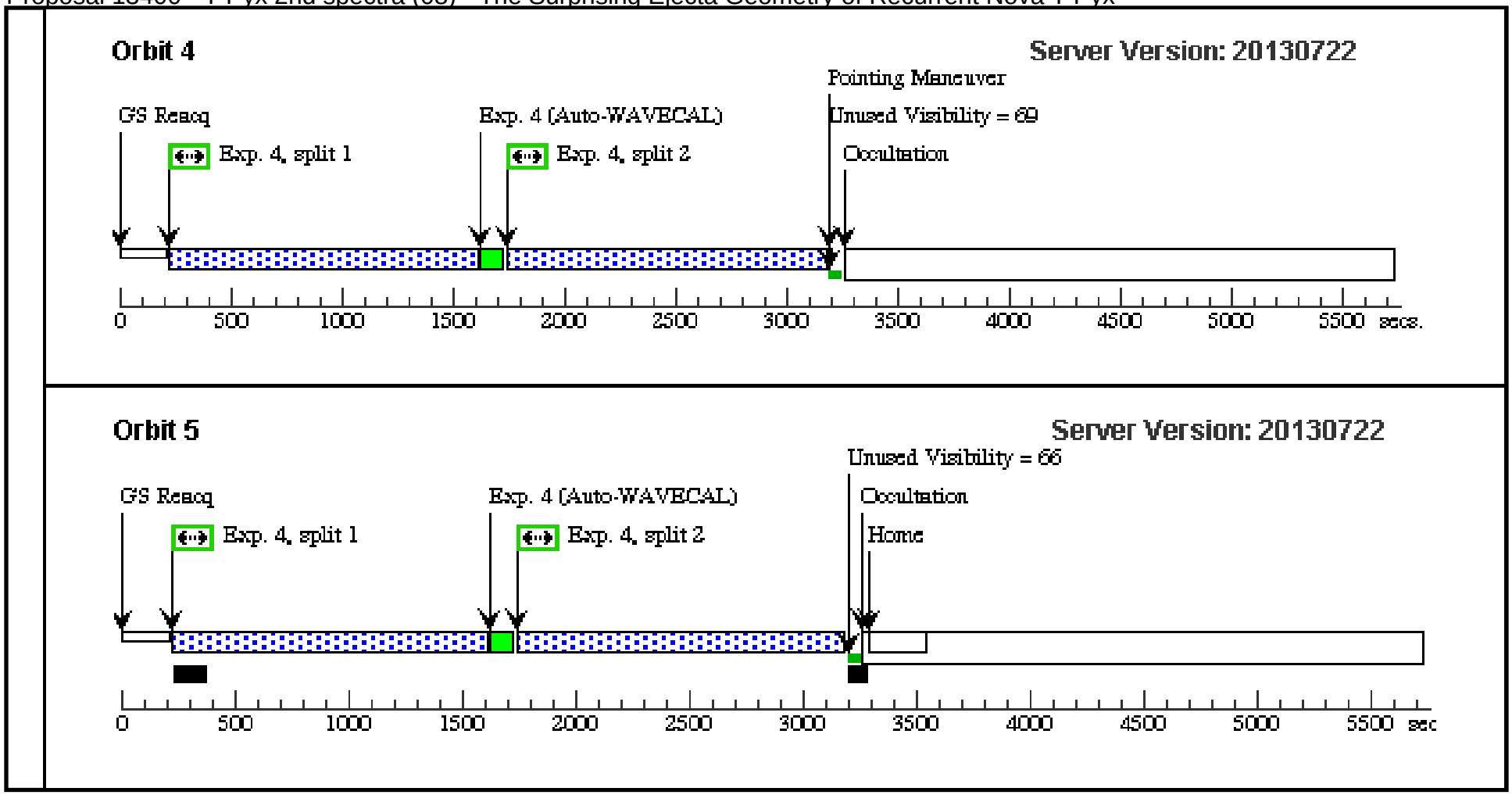
#	Label (ETC Run)	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time (Total)/[Actual Dur.]	Orbit
1	TPyx-ACQ (508839)	(2) NOVA-PYX-1890-ICRS	STIS/CCD, ACQ, 50CCD	MIRROR	CHECKBOX=5; ACQTYPE=DIFFUSE; DIFFUSE-CENTER=FLUX-CENTROID			3 Secs (3 Secs)	
								[==>]	***[1]***
2	TPyx-PEAK (508842)	(2) NOVA-PYX-1890-ICRS	STIS/CCD, ACQ/PEAK, 52X0.1E1	MIRROR				3 Secs (3 Secs)	
								[==>]	***[1]***
3		(2) NOVA-PYX-1890-ICRS	STIS/CCD, ACCUM, 52X2E1	G430L 4300 A	CR-SPLIT=2		Pattern 3, Exps 3-3 in T Pyx 2nd spectra (08) (3)	415 Secs (1660 Secs)	
								[==>(Pattern 1, Split 1)]	***[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		(2) NOVA-PYX-1890-ICRS	STIS/CCD, ACCUM, 52X2E1	G430L 4300 A	CR-SPLIT=2		Pattern 3, Exps 4-4 in T Pyx 2nd spectra (08) (3)	2710 Secs (10840 Secs)	
								[==>(Pattern 1, Split 1)]	***[2]***
								[==>(Pattern 1, Split 2)]	
								[==>(Pattern 2, Split 1)]	***[3]***
								[==>(Pattern 2, Split 2)]	
								[==>(Pattern 3, Split 1)]	***[4]***
								[==>(Pattern 3, Split 2)]	
								[==>(Pattern 4, Split 1)]	***[5]***
								[==>(Pattern 4, Split 2)]	

Orbit Structure




Orbit 2
Server Version: 20130722
Unused Visibility = 69
GS Reacq
Exp. 4 (Auto-WAVECAL)
Pointing Maneuver
Exp. 4, split 1
Exp. 4, split 2
Occultation
0
500
1000
1500
2000
2500
3000
3500
4000
4500
5000
5500
secs.


Orbit 3
Server Version: 20130722
Unused Visibility = 69
GS Reacq
Exp. 4 (Auto-WAVECAL)
Pointing Maneuver
Exp. 4, split 1
Exp. 4, split 2
Occultation
0
500
1000
1500
2000
2500
3000
3500
4000
4500
5000
5500
secs.


Orbit 4
Server Version: 20130722
Pointing Maneuver
GS Reacq
Exp. 4 (Auto-WAVECAL)
Unused Visibility = 69
Exp. 4, split 1
Exp. 4, split 2
Occultation
0
500
1000
1500
2000
2500
3000
3500
4000
4500
5000
5500
secs.
Orbit 5
Server Version: 20130722
Unused Visibility = 66
GS Reacq
Exp. 4 (Auto-WAVECAL)
Occultation
Exp. 4, split 1
Exp. 4, split 2
Home
0
500
1000
1500
2000
2500
3000
3500
4000
4500
5000
5500
sec

Visit

Proposal 13400, T Pyx 2nd images (09), scheduling Thu Sep 19 01:12:23 GMT 2013

Diagnostic Status: No Diagnostics

Scientific Instruments: WFC3/UVIS

Special Requirements: AFTER 08 BY 10 D TO 20 D; BETWEEN 30-SEP-2013 AND 01-NOV-2013

Comments: The purpose of this Visit 09 is to take images of the highly variable and unpredictable recurrent nova T Pyx. This Visit 09 should be timed soon after Visit 08, which must occur in September 2013. It requires two orbits, on [Ne V] (F343N) and on [O III] (F502N). In Visit 08 and 09 some precaution is taken for the source increasing in brightness by a few magnitudes by including a series of shorter exposures corresponding to longer exposure sequences.

Patterns

#	Primary Pattern		Secondary Pattern	Exposures
(2)	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

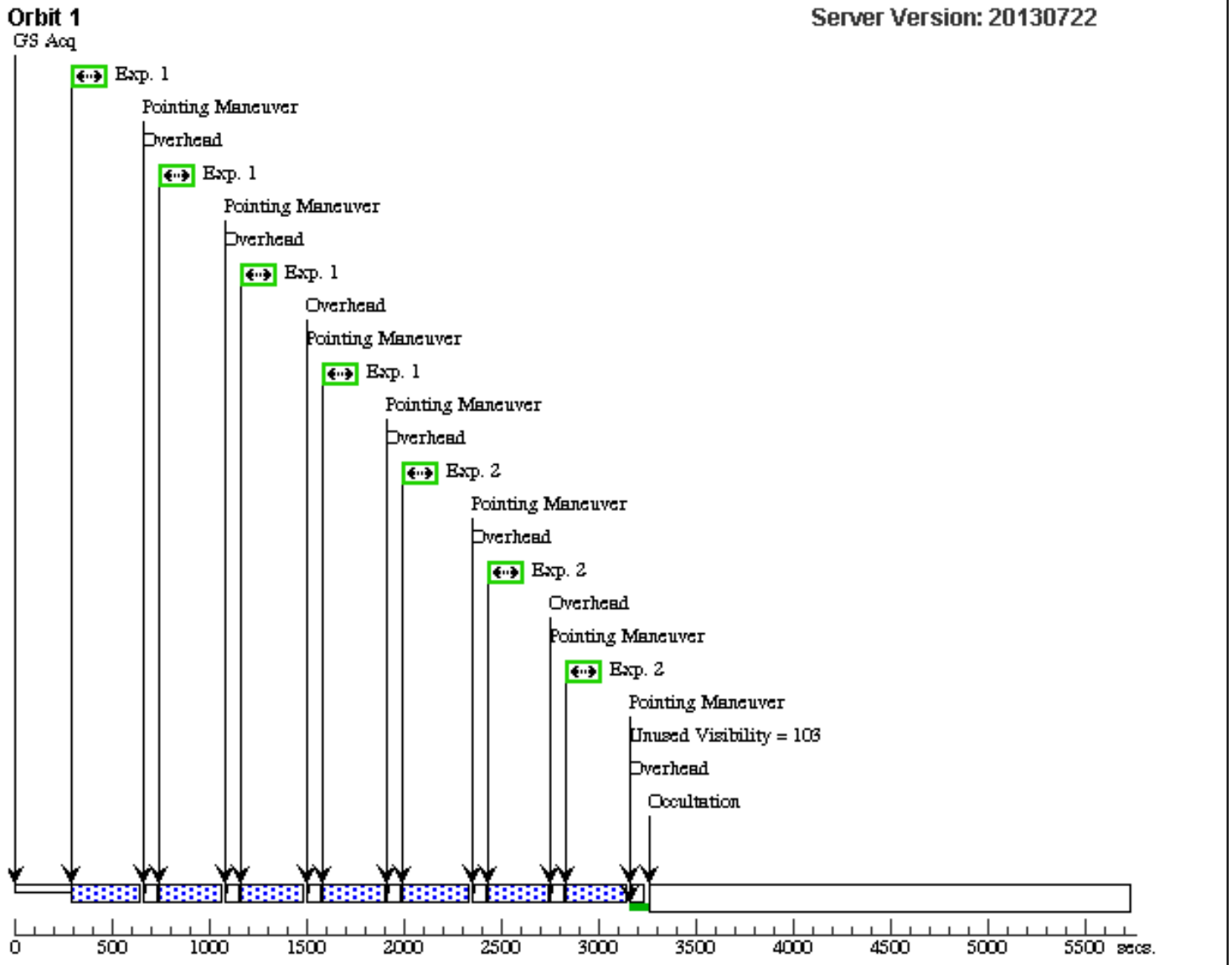
#	Name	Target Coordinates	Targ. Coord. Corrections	Fluxes	Miscellaneous
(2)	NOVA-PYX-1890-ICRS	RA: 09 04 41.5000 (136.1729167d) Dec: -32 22 47.50 (-32.37986d) Equinox: J2000		V=15.5+/-1	Reference Frame: ICRS

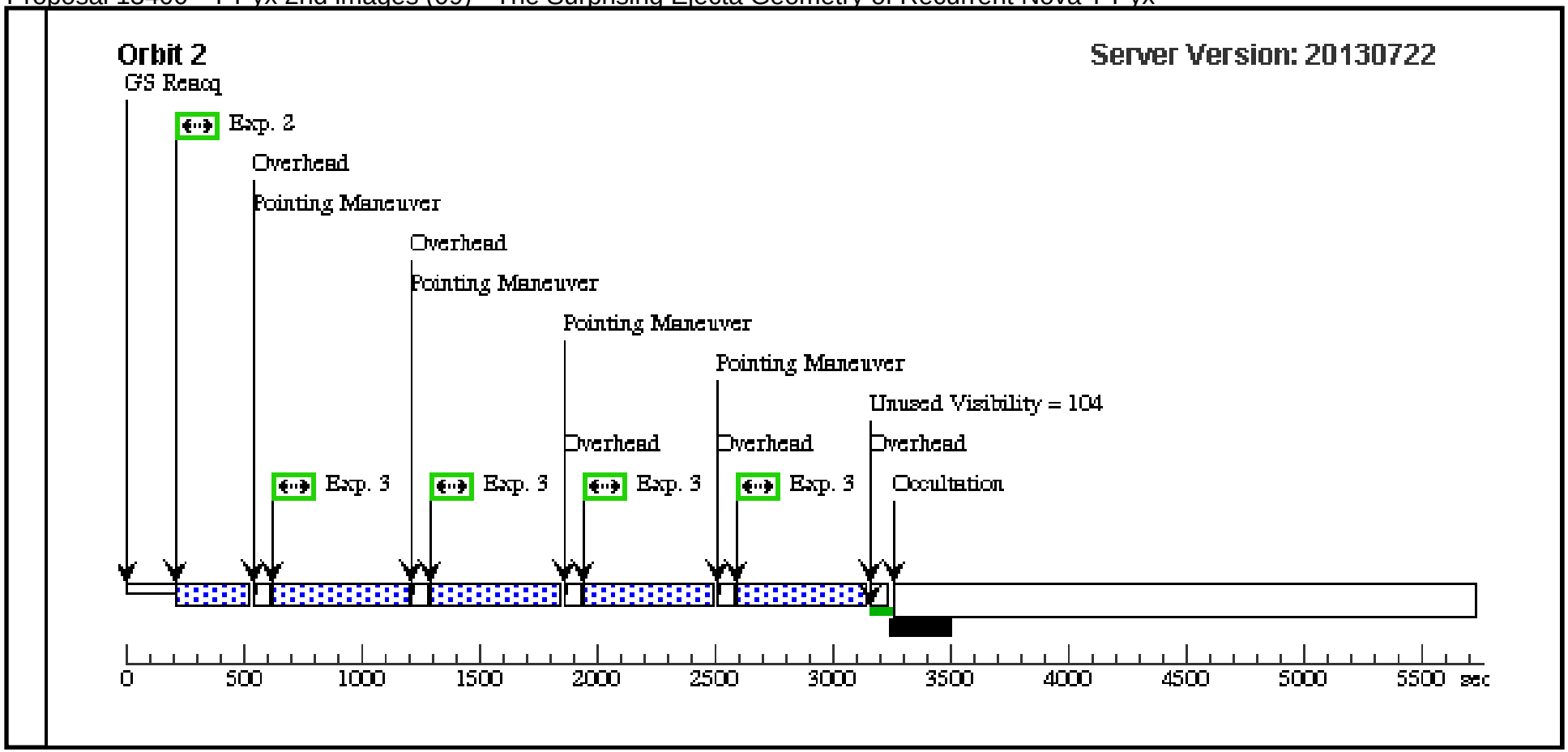
Comments: This object was generated by the targetselector and retrieved from the SIMBAD database. The coordinates from SIMBAD appear to be the best available.

Exposures

#	Label (ETC Run)	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time (Total)/[Actual Dur.]	Orbit
1	(518981)	(2) NOVA-PYX-1890-ICRS	WFC3/UVIS, ACCUM, UVIS2-C1K1C-SUB	F656N	FLASH=10		Pattern 2, Exps 1-1 in T Pyx 2nd images (09) (2)	325 Secs (1300 Secs)	
								[==>(Pattern 1)] *[==>(Pattern 2)]* *[==>(Pattern 3)]* *[==>(Pattern 4)]*	***[1]***
2	(518981)	(2) NOVA-PYX-1890-ICRS	WFC3/UVIS, ACCUM, UVIS2-C1K1C-SUB	F658N	FLASH=10		Pattern 2, Exps 2-2 in T Pyx 2nd images (09) (2)	315 Secs (1260 Secs)	
								[==>(Pattern 1)] *[==>(Pattern 2)]* *[==>(Pattern 3)]*	***[1]***
								[==>(Pattern 4)]	***[2]***
3	(518981)	(2) NOVA-PYX-1890-ICRS	WFC3/UVIS, ACCUM, UVIS2-C1K1C-SUB	F502N	FLASH=10		Pattern 2, Exps 3-3 in T Pyx 2nd images (09) (2)	556 Secs (2224 Secs)	
								[==>(Pattern 1)] *[==>(Pattern 2)]* *[==>(Pattern 3)]* *[==>(Pattern 4)]*	***[2]***

Orbit Structure




Orbit 2
Server Version: 20130722
GS Reacq
Exp. 2
Overhead
Pointing Maneuver
Overhead
Pointing Maneuver
Pointing Maneuver
Pointing Maneuver
Unused Visibility = 104
Overhead
Overhead
Overhead
Exp. 3
Exp. 3
Exp. 3
Exp. 3
Occultation
0
500
1000
1500
2000
2500
3000
3500
4000
4500
5000
5500
sec