17737 - Seasonal dependence of Uranus' upper atmosphere: Tapping 26 years of HST Ly-alpha observations

Cycle: 32, Proposal Category: GO

(UV Initiative)

(Availability Mode: SUPPORTED)

INVESTIGATORS

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Dr. Henrik Melin (CoI) (ESA Member)	Northumbria University
Mr. Sushen Pravin Joshi (CoI) (ESA Member)	Royal Institute of Technology

VISITS

Visit	*Targets used in Visit*	*Configurations used in Visit*	*Orbits Used*	*Last Orbit Planner Run*	*OP Current with Visit?*
01	(1) URANUS	STIS/FUV-MAMA	4	04-Oct-2024 09:00:31.0	yes
02	(1) URANUS	STIS/FUV-MAMA	4	04-Oct-2024 09:00:33.0	yes

8 Total Orbits Used

ABSTRACT

The upper atmospheres of giant planets play key role in various processes such as solar wind interaction, atmospheric escape, magnetosphere-ionosphere coupling, and interaction with ring particles. Voyager2 revealed a largely extended upper atmosphere of Uranus, devoid of hydrocarbons -

unique among the solar system's giant planets. It is not yet well understood how the upper atmosphere varies seasonally and Uranus' orbital period of 84 years makes it generally difficult to obtain observational evidence for seasonal changes. However, IR monitoring of ionospheric H3+ emissions suggest a decrease in temperature of the ionized upper atmosphere since 1992. The abundance of H, H2 and H3+ in the upper atmosphere are strongly coupled and indeed HST Ly-alpha observations before (1998) and close to equinox (2011) revealed a similar trend with shrinking and decreasing emissions.
Imaging the H Ly-alpha emissions from Uranus with STIS now in cycle 32 - more than a decade after equinox - offers the unique possibility to test the puzzling cooling trend. The new STIS Ly-alpha images together with the archived STIS images will determine if Uranus' neutral upper atmosphere is indeed undergoing continuous cooling. Additional STIS G140M slit spectra provide precise measurements of Raman shifted features for a characterization of the H2 component. With only 8 orbits in 2024 this program will complete a unique archive of FUV data on the only ice giant planet with Ly-alpha emission signal observable from Earth and inform a possible large Uranus Orbiter and Probe mission as recommended by the NASA decadal survey.

OBSERVING DESCRIPTION

The idea is to take different kind of imaging and spectral observations combined in one visit to compare the signals and calibrate archival observations of similar type (but never simultanously taken).
First we want a global image of only Lyman-alpha emissions through slit-less spectral imaging with G140L and the FUV-MAMA
Then we take a long-slit spectrum to get Raman-shifted Lyman-alpha photons longward of the Lyman-alpha line.
And finally, we take an image pair with the clear filter (FUV-MAMA) and the S25SRF2 filter. The difference of these two should also give a Lyman-alpha image but with some uncertainty from the throughput dependncy. For our two visits these filter pairs can be calibrated for the first time with the G140L Lyman-alpha image.

We do not do acquisitions for the spectral observations. For the slitless exposure exact pointing is not required at all. For the long-slit exposures with the 0.5 arcec slit, even with an offset of up to 1 arcec along x the slit will still intersect with a good fraction of the Uranus' 3.6 arcsec wide disk.

One of the visits should optimally happen simultaneously to the observations by JWST from program 5073.

Proposal 17737 - Visit 01 - Seasonal dependence of Uranus' upper atmosphere: Tapping 26 years of HST Ly-alpha observations

Visit

Proposal 17737, Visit 01, completed

Fri Oct 04 13:00:33 GMT 2024

Diagnostic Status: Warning

Scientific Instruments: STIS/FUV-MAMA

Special Requirements: BETWEEN 02-OCT-2024:02:00:00 AND 02-OCT-2024:10:00:00

Diagnostics

(Visit 01) Warning (Form): A target acquisition should probably be performed before doing spectroscopy or coronography with STIS or COS.

(Visit 01) Informational (Form): The Visit Planner and Spike may produce different schedulability results.

Solar System Targets

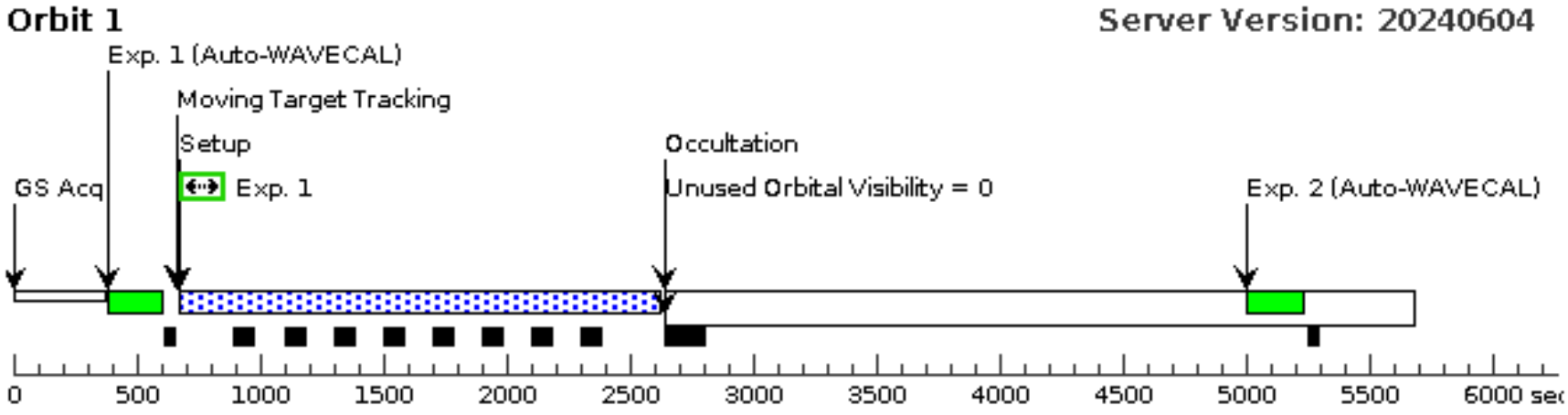
#	Name	Level 1	Level 2	Level 3	Window	Ephem Center
(1)	URANUS	STD=URANUS				EARTH

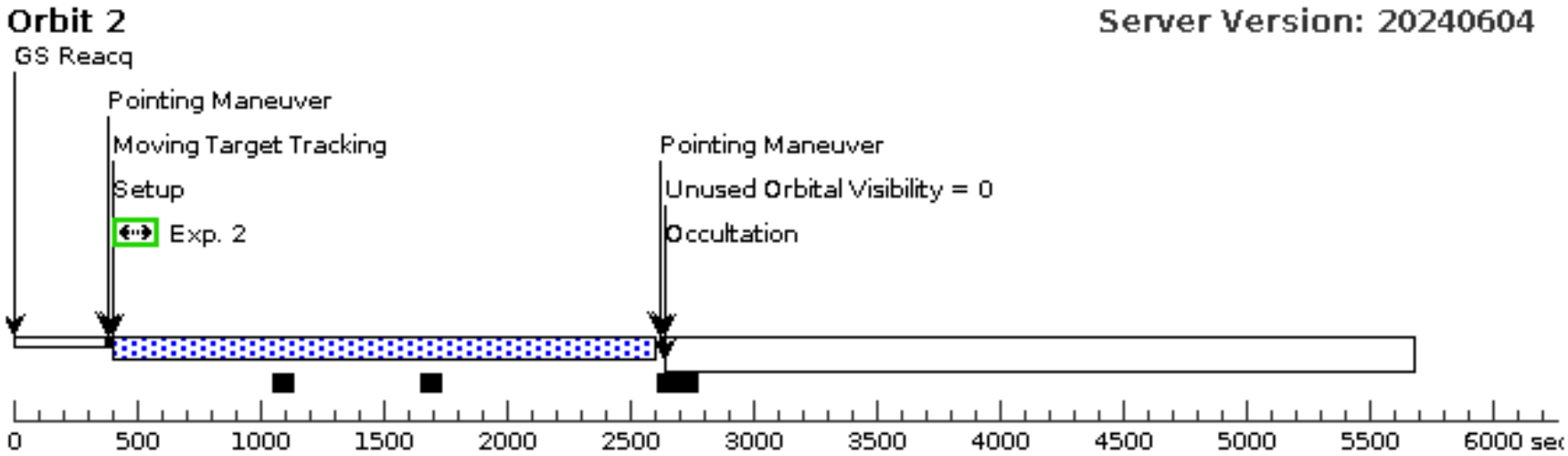
Comments: Description=Planet Uranus
Extended=YES

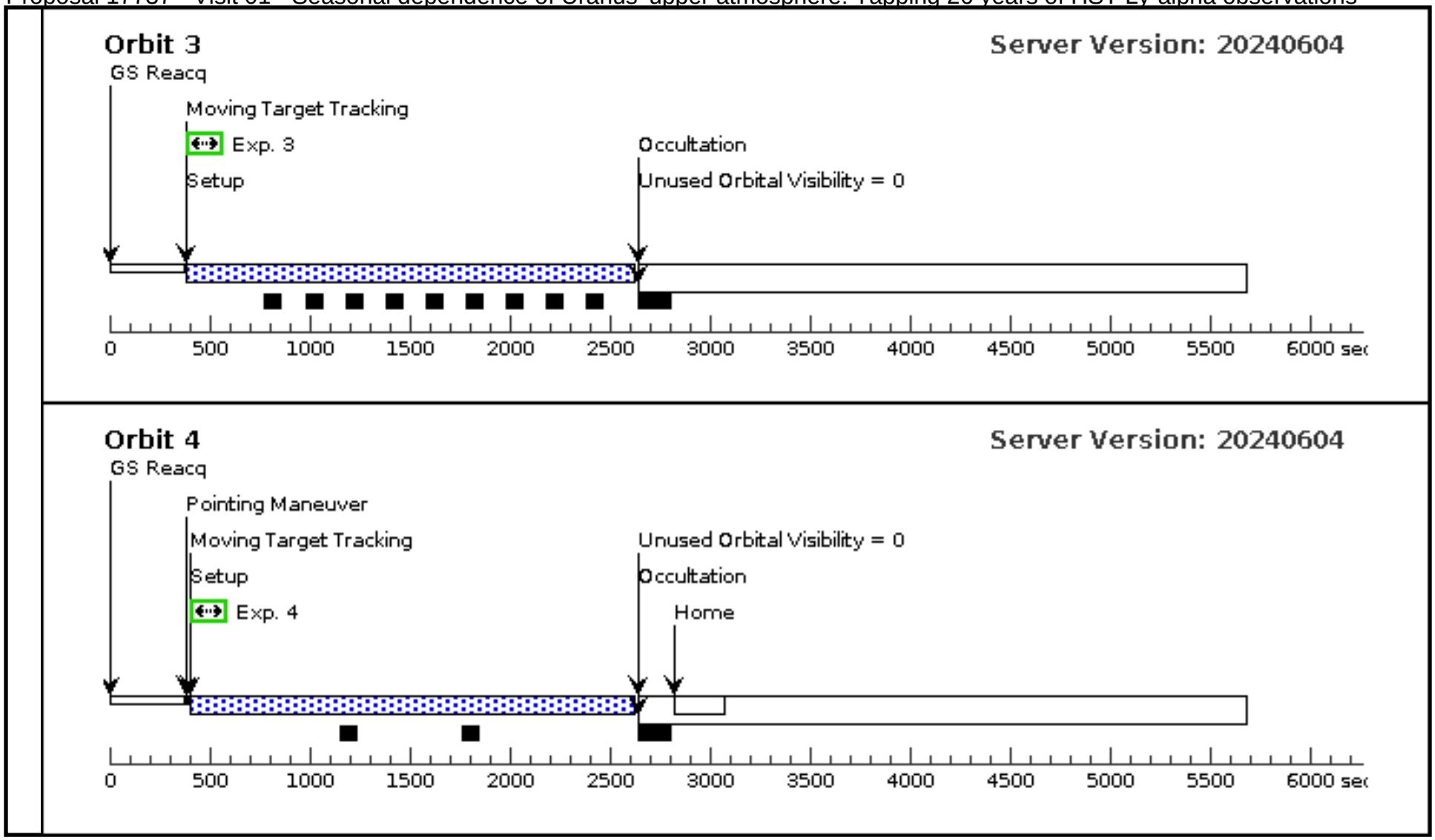
Exposures

#	Label (ETC Run)	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time (Total)/[Actual Dur.]	Orbit
1	Spectral Lyman-alpha (189449)	(1) URANUS	STIS/FUV-MAMA, TIME-TAG, 25MAMAD1	G140L 1425 A	BUFFER-TIME=2000			2100 Secs (1917 Secs)	
								[==>1917.0 Secs]	***[1]***
2	Spectral Raman (189449)	(1) URANUS	STIS/FUV-MAMA, TIME-TAG, 52X0.5D1	G140M 1272 A	BUFFER-TIME=600			2100 Secs (2134 Secs)	
								[==>2134.0 Secs]	***[2]***
3	Clear image (189449)	(1) URANUS	STIS/FUV-MAMA, TIME-TAG, 25MAMA	MIRROR	BUFFER-TIME=2000			2100 Secs (2037 Secs)	
								[==>2037.0 Secs]	***[3]***
4	Filter image (189449)	(1) URANUS	STIS/FUV-MAMA, TIME-TAG, F25SRF2	MIRROR	BUFFER-TIME=600			2100 Secs (2056 Secs)	
								[==>2056.0 Secs]	***[4]***

Orbit Structure



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5000
5500
6000 sec
Orbit 4
Server Version: 20240604
GS Reacq
Pointing Maneuver
Moving Target Tracking
Setup
Exp. 4
Unused Orbital Visibility = 0
Occultation
Home
0
500
1000
1500
2000
2500
3000
3500
4000
4500
5000
5500
6000 sec

Visit

Proposal 17737, Visit 02, implementation Fri Oct 04 13:00:34 GMT 2024

Diagnostic Status: Warning

Scientific Instruments: STIS/FUV-MAMA

Special Requirements: BETWEEN 24-OCT-2024:13:30:00 AND 24-OCT-2024:14:30:00

Diagnostics

(Visit 02) Warning (Form): A target acquisition should probably be performed before doing spectroscopy or coronography with STIS or COS.

(Visit 02) Warning (Orbit Planner): SAME POS MAY NOT BE APPROPRIATE

(Visit 02) Informational (Form): The Visit Planner and Spike may produce different schedulability results.

Solar System Targets

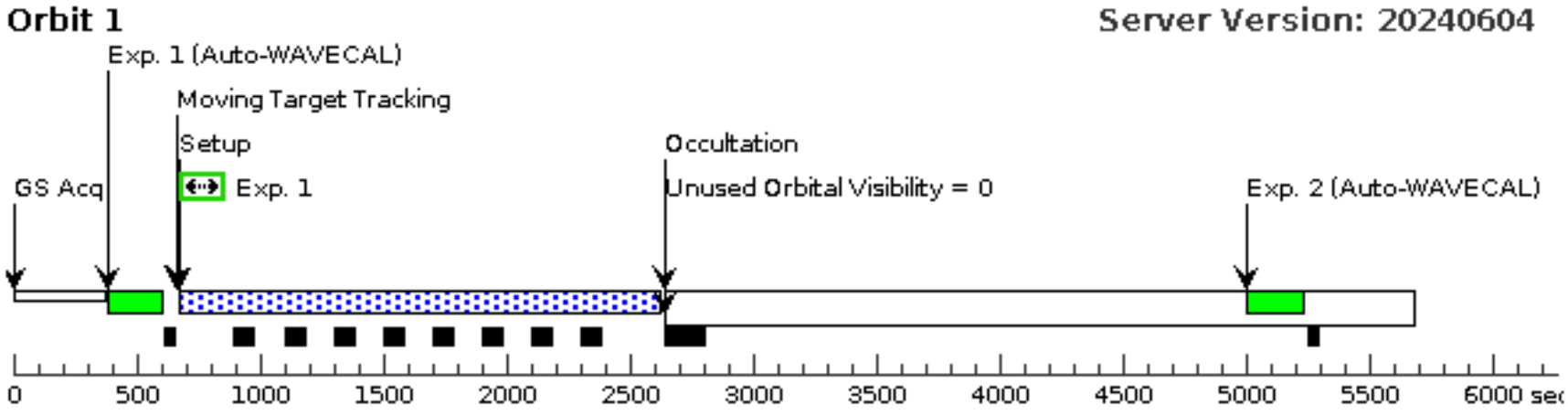
#	Name	Level 1	Level 2	Level 3	Window	Ephem Center
(1)	URANUS	STD=URANUS				EARTH

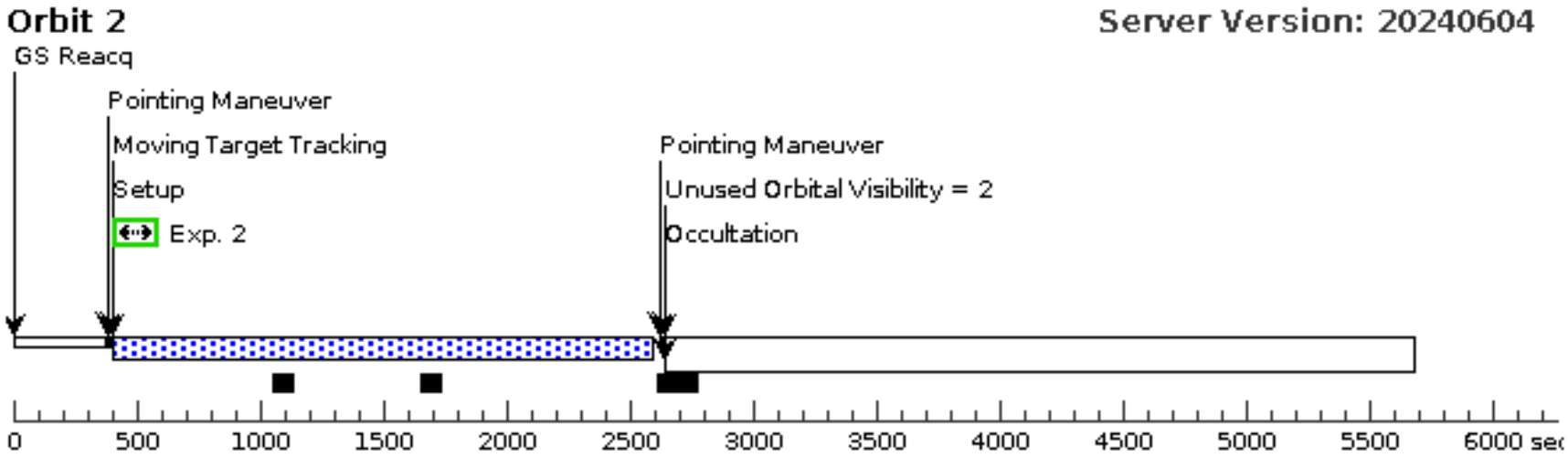
Comments: Description=Planet Uranus
Extended=YES

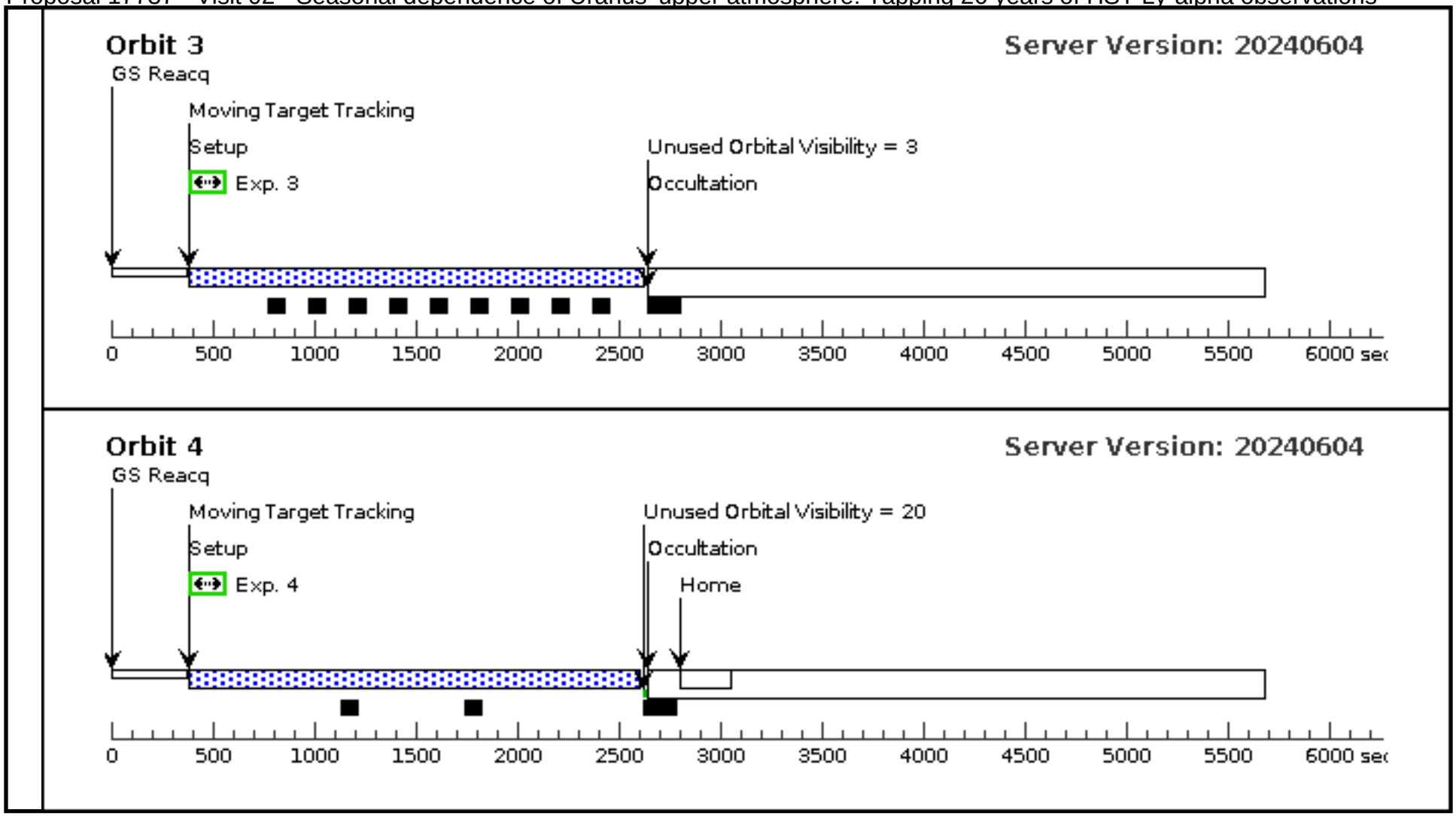
Exposures

#	Label (ETC Run)	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time (Total)/[Actual Dur.]	Orbit
1	Spectral Lyman-alpha (189449)	(1) URANUS	STIS/FUV-MAMA, TIME-TAG, 25MAMA	G140L 1425 A	BUFFER-TIME=2000	POS TARG 3,-2.5		2100 Secs (1917 Secs)	
								[==>1917.0 Secs]	***[1]***
2	Spectral Raman (189449)	(1) URANUS	STIS/FUV-MAMA, TIME-TAG, 52X2	G140M 1272 A	BUFFER-TIME=600	POS TARG 0,-6		2100 Secs (2134 Secs)	
								[==>2134.0 Secs]	***[2]***
3	Clear image (189449)	(1) URANUS	STIS/FUV-MAMA, TIME-TAG, 25MAMA	MIRROR	BUFFER-TIME=2000	POS TARG 3,-4		2100 Secs (2037 Secs)	
								[==>2037.0 Secs]	***[3]***
4	Filter image (189449)	(1) URANUS	STIS/FUV-MAMA, TIME-TAG, F25SRF2	MIRROR	BUFFER-TIME=600	SAME POS AS 3		2100 Secs (2056 Secs)	
								[==>2056.0 Secs]	***[4]***

Orbit Structure



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GS Reacq
Moving Target Tracking
Setup
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Occultation
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5500
6000 sec
Orbit 4
Server Version: 20240604
GS Reacq
Moving Target Tracking
Setup
Exp. 4
Unused Orbital Visibility = 20
Occultation
Home
0
500
1000
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2000
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3000
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6000 sec