



17213 - UV spectroscopy of the next interstellar object 3I

Cycle: 30, Proposal Category: GO

(UV Initiative)

(Availability Mode: SUPPORTED)

INVESTIGATORS

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Mikołaj Sabat (CoI) (ESA Member)	Uniwersytet Jagiellonski

VISITS

<i>Visit</i>	<i>Targets used in Visit</i>	<i>Configurations used in Visit</i>	<i>Orbits Used</i>	<i>Last Orbit Planner Run</i>	<i>OP Current with Visit?</i>
01	(1) 3I	COS/FUV COS/NUV STIS/CCD STIS/FUV-MAMA STIS/NUV-MAMA	4	10-Jun-2024 16:00:18.0	yes
02	(1) 3I	COS/FUV COS/NUV STIS/CCD STIS/FUV-MAMA STIS/NUV-MAMA	4	10-Jun-2024 16:00:19.0	yes

<i>Visit</i>	<i>Targets used in Visit</i>	<i>Configurations used in Visit</i>	<i>Orbits Used</i>	<i>Last Orbit Planner Run</i>	<i>OP Current with Visit?</i>
03	(1) 3I	COS/FUV COS/NUV STIS/CCD STIS/FUV-MAMA STIS/NUV-MAMA	4	10-Jun-2024 16:00:21.0	yes
04	(1) 3I	COS/FUV COS/NUV STIS/CCD STIS/FUV-MAMA STIS/NUV-MAMA	4	10-Jun-2024 16:00:22.0	yes

16 Total Orbits Used

ABSTRACT

The discovery of the first interstellar minor bodies 1I/'Oumuamua and 2I/Borisov has opened a new era for planetary science investigations. 'Oumuamua shows that escapees from other planetary systems may significantly differ from the minor bodies that we know from our own Solar System while 2I/Borisov is similar to Solar System comets. Recognizing the importance of spectroscopic characterization in the UV, we propose a combined COS and STIS study of the yet unknown interstellar minor body 3I to quantify its gaseous emissions. Hubble is uniquely suited to this proposal given that currently it is the only facility that provides sensitive spectroscopy in UV.

OBSERVING DESCRIPTION

This is a Target-of-Opportunity program to obtain STIS and COS spectroscopy of the next interstellar object passing through the Solar System. The program will be activated upon the discovery of a new minor body on a hyperbolic orbit (an inbound barycentric eccentricity greater than 1.0) consistent with interstellar origin. Our team will be instantly notified of such an event by a dedicated rapid-response alerting software, which analyzes publicly available astrometric data of newly discovered objects (the NEOCP and PCCP services) in search of hyperbolic orbits.

Given that the target has not been discovered yet, its magnitude, spectrum, and type (point source, diffuse?) are all unknown at this time. For the purpose of acquisition exposure time estimation we assumed a point source with a solar-type spectrum (consistent with the first-known interstellar interloper 'Oumuamua) and $V=20.0$ mag. These information will be updated after the target has been discovered based on zero-proprietary-period

Proposal 17213 (STScI Edit Number: 1, Created: Monday, June 10, 2024 at 3:00:23 PM Eastern Standard Time) - Overview

WFC3 imaging data of the same target from a disruptive ToO program GO 17224 (PI D. Jewitt) and early ground-based imaging data from VLT and Gemini secured by our team. Similarly, we will be able to determine the impact of reduced-gyro operations on our program only after the target has been discovered and its preliminary orbit established.

To ensure a high accuracy of the target coordinates needed for an initial target acquisition (better than 2 arcsec), updated orbital data will be provided shortly before observations. At that point we will address the safety of our target and fields with respect to the appropriate count rate limits of COS and STIS/MAMA, and inspect acquisition fields to ensure clean background.

The program consists of 4 visits, each having a duration of 4 orbits. The design of all the visits is nearly identical, with the only varying parameter being FP-POS applicable to COS science exposures. The sequence in each visit is as follows:

Orbit 1:

STIS/CCD ACQ (MIRROR, F28X50LP)
STIS/FUV-MAMA ACCUM (E140H, 0.2x0.2 arcsec)

Orbit 2:

COS/NUV ACQ/IMAGE (MIRRORA, PSA)
COS/FUV ACCUM (G130M, PSA)

Orbit 3:

STIS/CCD ACQ/PEAK (MIRROR, 52x0.1 arcsec)
STIS/NUV-MAMA ACCUM (G230L, 52x0.1 arcsec)

Orbit 4:

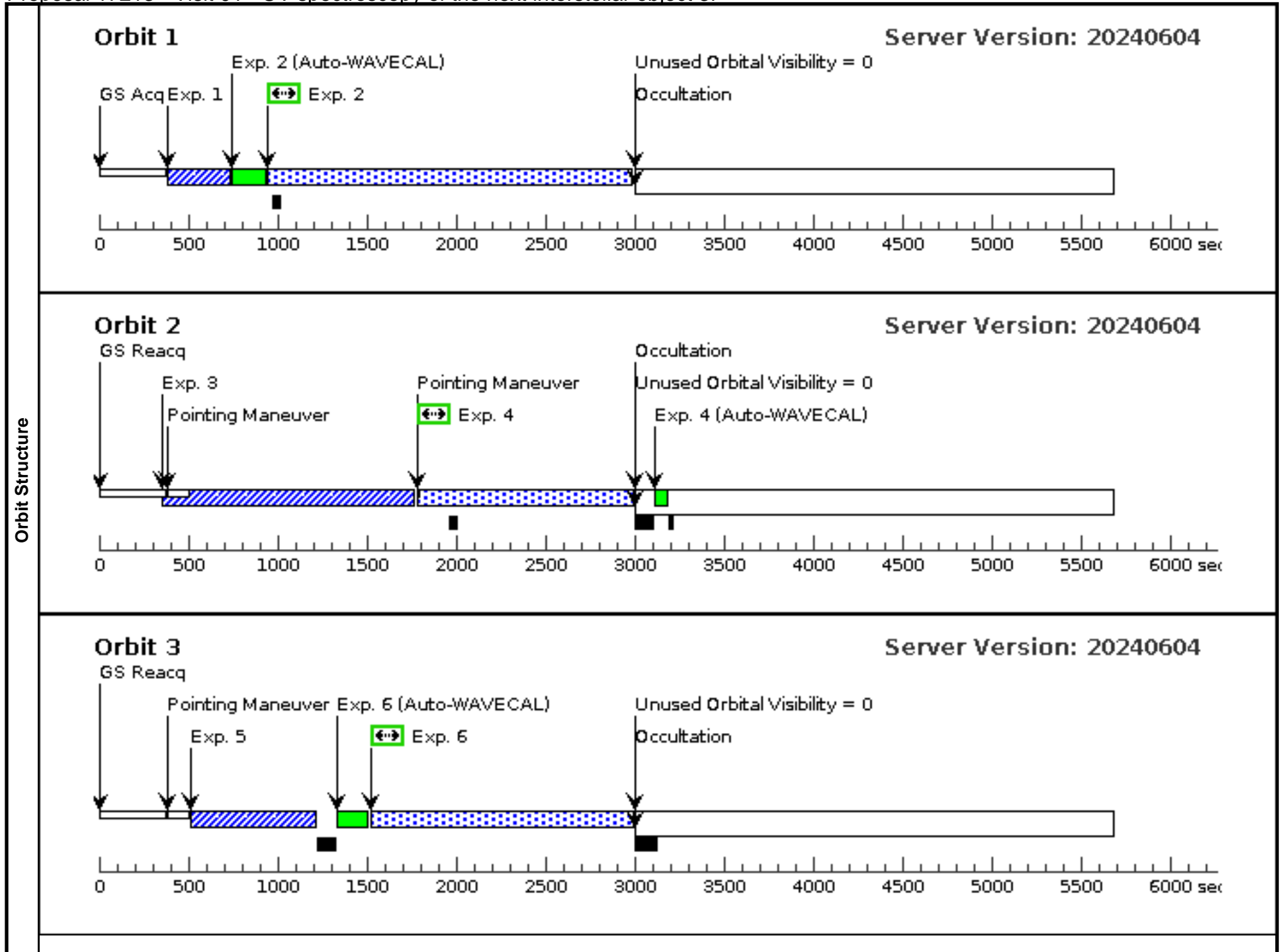
COS/NUV ACQ/IMAGE (MIRRORA, PSA)
COS/FUV ACCUM (G160M, PSA)

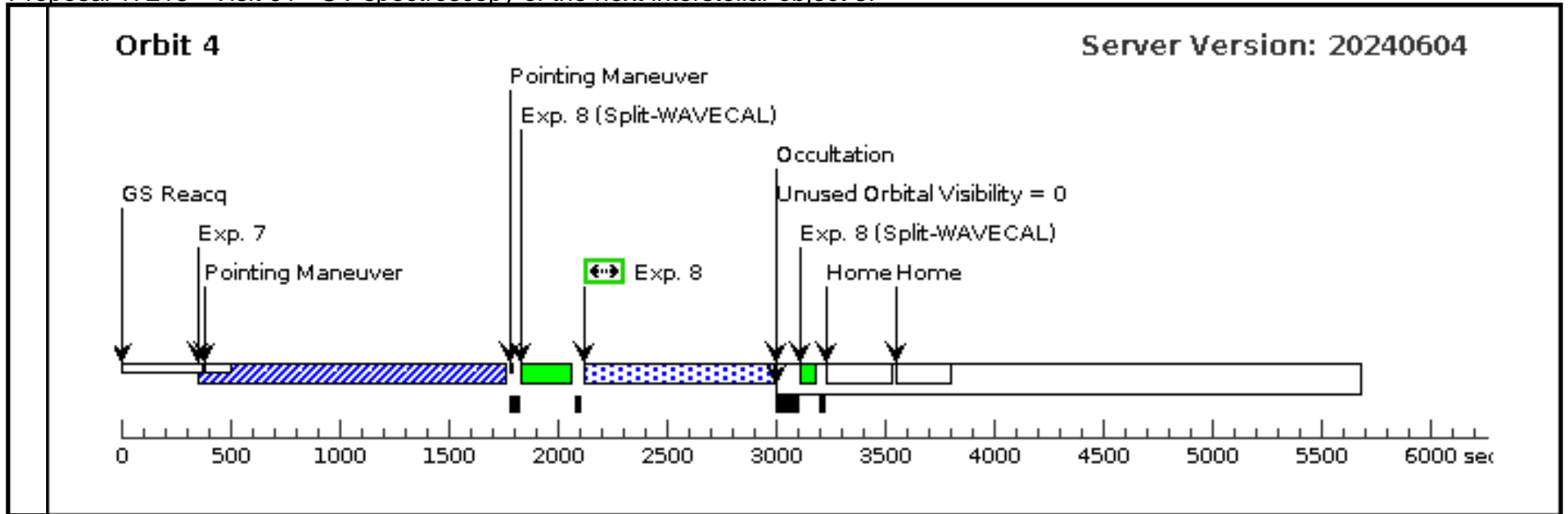
The order of the exposures is primarily dictated by the desire to minimize target acquisition overheads. The visits should be scheduled as close in time as possible.

Proposal 17213 - Visit 01 - UV spectroscopy of the next interstellar object 3I

Mon Jun 10 20:00:23 GMT 2024

Visit	Proposal 17213, Visit 01, implementation Diagnostic Status: Warning Scientific Instruments: STIS/NUV-MAMA, STIS/CCD, COS/FUV, STIS/FUV-MAMA, COS/NUV Special Requirements: ON HOLD ; TOO RESPONSE TIME 21.0D <i>On Hold Comments: Visit awaiting discovery of a suitable target</i>																																																																																																			
Diagnostics	(Visit 01) Warning (Orbit Planner): COS ACCUM EXCEEDS 900s (Exposure 2 (Visit 01)) Warning (Form): Sensitive exposures should have an ETC run number provided. (Exposure 3 (Visit 01)) Warning (Form): Sensitive exposures should have an ETC run number provided. (Exposure 4 (Visit 01)) Warning (Form): Sensitive exposures should have an ETC run number provided. (Exposure 6 (Visit 01)) Warning (Form): Sensitive exposures should have an ETC run number provided. (Exposure 7 (Visit 01)) Warning (Form): Sensitive exposures should have an ETC run number provided. (Exposure 8 (Visit 01)) Warning (Form): Sensitive exposures should have an ETC run number provided.																																																																																																			
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	#	Label	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time (Total)/[Actual Dur.]	Orbit																																																																																										
	1		(1) 3I	STIS/CCD, ACQ, F28X50LP	MIRROR	ACQTYPE=POINT			30 Secs (30 Secs) [==>]	[1]																																																																																										
	2		(1) 3I	STIS/FUV-MAMA, ACCUM, 0.2X0.2	E140H 1234 A				2152 Secs (2028 Secs) [==>2028.0 Secs]	[1]																																																																																										
	3		(1) 3I	COS/NUV, ACQ/IMAGE, PSA	MIRRORA				600 Secs (600 Secs) [==>]	[2]																																																																																										
	4		(1) 3I	COS/FUV, ACCUM, PSA	G130M 1291 A	FP-POS=3			1289 Secs (1034 Secs) [==>1034.0 Secs]	[2]																																																																																										
	5		(1) 3I	STIS/CCD, ACQ/PEAK, 52X0.1	MIRROR				30 Secs (30 Secs) [==>]	[3]																																																																																										
	6		(1) 3I	STIS/NUV-MAMA, ACCUM, 52X0.1	G230L 2376 A				1712 Secs (1456 Secs) [==>1456.0 Secs]	[3]																																																																																										
	7		(1) 3I	COS/NUV, ACQ/IMAGE, PSA	MIRRORA				600 Secs (600 Secs) [==>]	[4]																																																																																										
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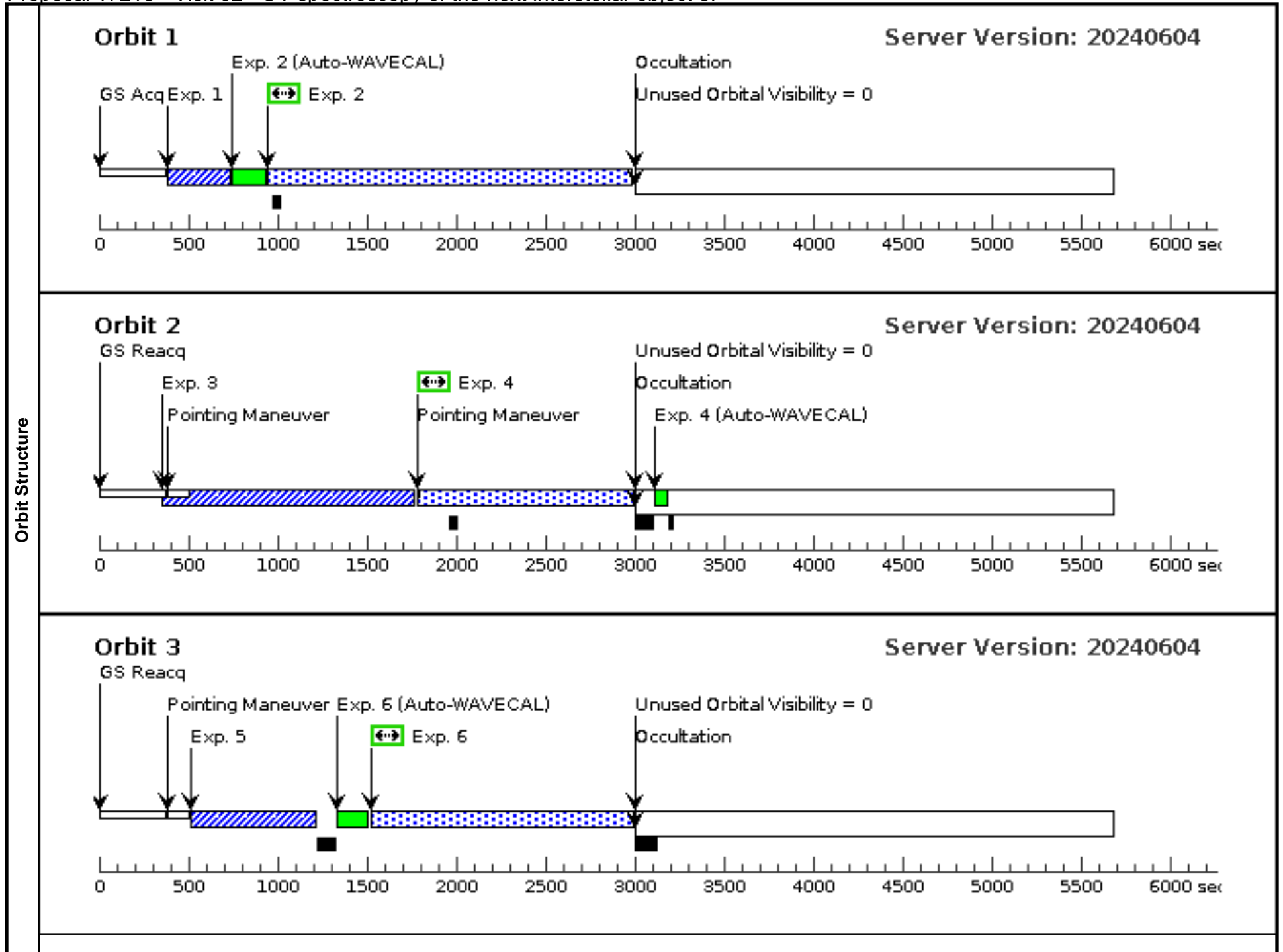


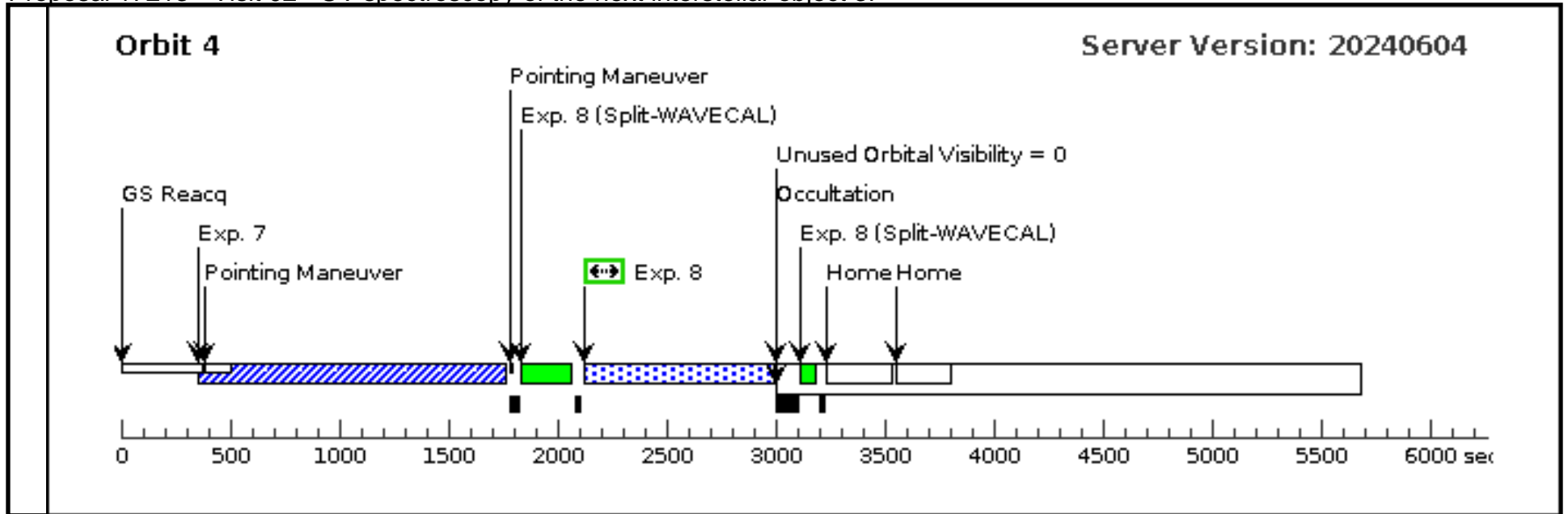


Proposal 17213 - Visit 02 - UV spectroscopy of the next interstellar object 3I

Mon Jun 10 20:00:23 GMT 2024

Visit	Proposal 17213, Visit 02, implementation Diagnostic Status: Warning Scientific Instruments: STIS/NUV-MAMA, STIS/CCD, COS/FUV, STIS/FUV-MAMA, COS/NUV Special Requirements: ON HOLD ; TOO RESPONSE TIME 21.0D <i>On Hold Comments: Visit awaiting discovery of a suitable target</i>									
	(Visit 02) Warning (Orbit Planner): COS ACCUM EXCEEDS 900s (Exposure 2 (Visit 02)) Warning (Form): Sensitive exposures should have an ETC run number provided. (Exposure 3 (Visit 02)) Warning (Form): Sensitive exposures should have an ETC run number provided. (Exposure 4 (Visit 02)) Warning (Form): Sensitive exposures should have an ETC run number provided. (Exposure 6 (Visit 02)) Warning (Form): Sensitive exposures should have an ETC run number provided. (Exposure 7 (Visit 02)) Warning (Form): Sensitive exposures should have an ETC run number provided. (Exposure 8 (Visit 02)) Warning (Form): Sensitive exposures should have an ETC run number provided.									
Diagnostics										
Generic Targets	#	Name	Criteria	Description						
	(1)	3I	Next interstellar object	ASTEROID COMET OTHER						
Exposures	#	Label	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time (Total)/[Actual Dur.]	Orbit
	1		(1) 3I	STIS/CCD, ACQ, F28X50LP	MIRROR	ACQTYPE=POINT			30 Secs (30 Secs) [==>]	[1]
	2		(1) 3I	STIS/FUV-MAMA, ACCUM, 0.2X0.2	E140H 1234 A				2152 Secs (2028 Secs) [==>2028.0 Secs]	[1]
	3		(1) 3I	COS/NUV, ACQ/IMAGE, PSA	MIRRORA				600 Secs (600 Secs) [==>]	[2]
	4		(1) 3I	COS/FUV, ACCUM, PSA	G130M 1291 A	FP-POS=3			1289 Secs (1034 Secs) [==>1034.0 Secs]	[2]
	5		(1) 3I	STIS/CCD, ACQ/PEAK, 52X0.1	MIRROR				30 Secs (30 Secs) [==>]	[3]
	6		(1) 3I	STIS/NUV-MAMA, ACCUM, 52X0.1	G230L 2376 A				1712 Secs (1456 Secs) [==>1456.0 Secs]	[3]
	7		(1) 3I	COS/NUV, ACQ/IMAGE, PSA	MIRRORA				600 Secs (600 Secs) [==>]	[4]
	8		(1) 3I	COS/FUV, ACCUM, PSA	G160M 1623 A	FP-POS=2			1062 Secs (807 Secs) [==>807.0 Secs]	[4]

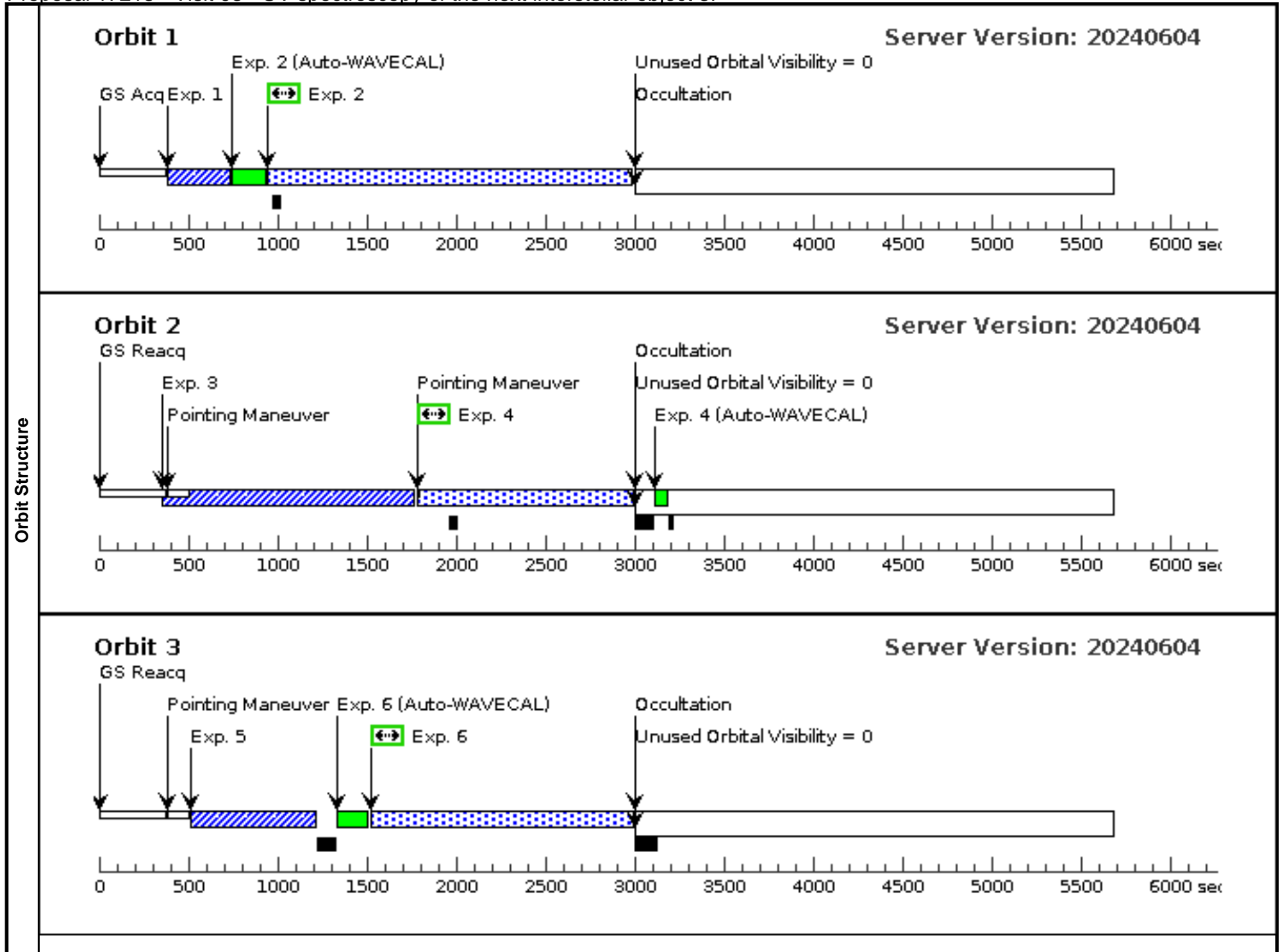


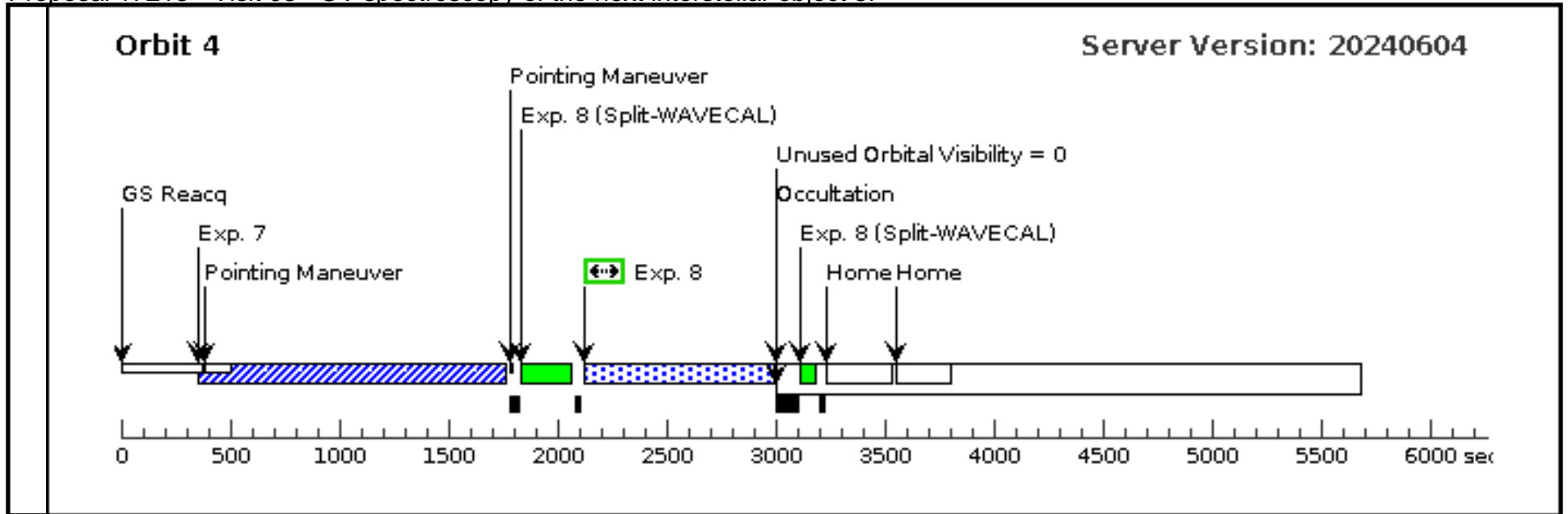


Proposal 17213 - Visit 03 - UV spectroscopy of the next interstellar object 3I

Mon Jun 10 20:00:23 GMT 2024

Visit	Proposal 17213, Visit 03, implementation Diagnostic Status: Warning Scientific Instruments: STIS/NUV-MAMA, STIS/CCD, COS/FUV, STIS/FUV-MAMA, COS/NUV Special Requirements: ON HOLD ; TOO RESPONSE TIME 21.0D <i>On Hold Comments: Visit awaiting discovery of a suitable target</i>									
	(Visit 03) Warning (Orbit Planner): COS ACCUM EXCEEDS 900s (Exposure 2 (Visit 03)) Warning (Form): Sensitive exposures should have an ETC run number provided. (Exposure 3 (Visit 03)) Warning (Form): Sensitive exposures should have an ETC run number provided. (Exposure 4 (Visit 03)) Warning (Form): Sensitive exposures should have an ETC run number provided. (Exposure 6 (Visit 03)) Warning (Form): Sensitive exposures should have an ETC run number provided. (Exposure 7 (Visit 03)) Warning (Form): Sensitive exposures should have an ETC run number provided. (Exposure 8 (Visit 03)) Warning (Form): Sensitive exposures should have an ETC run number provided.									
Diagnosics										
Generic Targets	#	Name	Criteria	Description						
	(1)	3I	Next interstellar object	ASTEROID COMET OTHER						
Exposures	#	Label	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time (Total)/[Actual Dur.]	Orbit
	1		(1) 3I	STIS/CCD, ACQ, F28X50LP	MIRROR	ACQTYPE=POINT			30 Secs (30 Secs) [==>]	[1]
	2		(1) 3I	STIS/FUV-MAMA, ACCUM, 0.2X0.2	E140H 1234 A				2152 Secs (2028 Secs) [==>2028.0 Secs]	[1]
	3		(1) 3I	COS/NUV, ACQ/IMAGE, PSA	MIRRORA				600 Secs (600 Secs) [==>]	[2]
	4		(1) 3I	COS/FUV, ACCUM, PSA	G130M 1291 A	FP-POS=4			1289 Secs (1034 Secs) [==>1034.0 Secs]	[2]
	5		(1) 3I	STIS/CCD, ACQ/PEAK, 52X0.1	MIRROR				30 Secs (30 Secs) [==>]	[3]
	6		(1) 3I	STIS/NUV-MAMA, ACCUM, 52X0.1	G230L 2376 A				1712 Secs (1456 Secs) [==>1456.0 Secs]	[3]
	7		(1) 3I	COS/NUV, ACQ/IMAGE, PSA	MIRRORA				600 Secs (600 Secs) [==>]	[4]
	8		(1) 3I	COS/FUV, ACCUM, PSA	G160M 1623 A	FP-POS=3			1062 Secs (807 Secs) [==>807.0 Secs]	[4]





Proposal 17213 - Visit 04 - UV spectroscopy of the next interstellar object 3I

Mon Jun 10 20:00:23 GMT 2024

Visit	Proposal 17213, Visit 04, implementation Diagnostic Status: Warning Scientific Instruments: STIS/NUV-MAMA, STIS/CCD, COS/FUV, STIS/FUV-MAMA, COS/NUV Special Requirements: ON HOLD ; TOO RESPONSE TIME 21.0D <i>On Hold Comments: Visit awaiting discovery of a suitable target</i>									
	(Visit 04) Warning (Orbit Planner): COS ACCUM EXCEEDS 900s (Exposure 2 (Visit 04)) Warning (Form): Sensitive exposures should have an ETC run number provided. (Exposure 3 (Visit 04)) Warning (Form): Sensitive exposures should have an ETC run number provided. (Exposure 4 (Visit 04)) Warning (Form): Sensitive exposures should have an ETC run number provided. (Exposure 6 (Visit 04)) Warning (Form): Sensitive exposures should have an ETC run number provided. (Exposure 7 (Visit 04)) Warning (Form): Sensitive exposures should have an ETC run number provided. (Exposure 8 (Visit 04)) Warning (Form): Sensitive exposures should have an ETC run number provided.									
Diagnostics										
Generic Targets	#	Name	Criteria	Description						
	(1)	3I	Next interstellar object	ASTEROID COMET OTHER						
Exposures	#	Label	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time (Total)/[Actual Dur.]	Orbit
	1		(1) 3I	STIS/CCD, ACQ, F28X50LP	MIRROR	ACQTYPE=POINT			30 Secs (30 Secs) [==>]	[1]
	2		(1) 3I	STIS/FUV-MAMA, ACCUM, 0.2X0.2	E140H 1234 A				2152 Secs (2028 Secs) [==>2028.0 Secs]	[1]
	3		(1) 3I	COS/NUV, ACQ/IMAGE, PSA	MIRRORA				600 Secs (600 Secs) [==>]	[2]
	4		(1) 3I	COS/FUV, ACCUM, PSA	G130M 1291 A	FP-POS=4			1289 Secs (1034 Secs) [==>1034.0 Secs]	[2]
	5		(1) 3I	STIS/CCD, ACQ/PEAK, 52X0.1	MIRROR				30 Secs (30 Secs) [==>]	[3]
	6		(1) 3I	STIS/NUV-MAMA, ACCUM, 52X0.1	G230L 2376 A				1712 Secs (1456 Secs) [==>1456.0 Secs]	[3]
	7		(1) 3I	COS/NUV, ACQ/IMAGE, PSA	MIRRORA				600 Secs (600 Secs) [==>]	[4]
	8		(1) 3I	COS/FUV, ACCUM, PSA	G160M 1623 A	FP-POS=4			1062 Secs (807 Secs) [==>807.0 Secs]	[4]

