17827 - Weywot's rotational light-curve: searching for hints about the origin of small satellites in the trans-Neptunian region

Cycle: 32, Proposal Category: GO

(Availability Mode: SUPPORTED)

INVESTIGATORS

Name	*Institution*
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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) QUAOAR	WFC3/UVIS	1	12-Aug-2024 09:00:39.0	yes
02	(1) QUAOAR	WFC3/UVIS	1	12-Aug-2024 09:00:40.0	yes
03	(1) QUAOAR	WFC3/UVIS	1	12-Aug-2024 09:00:40.0	yes
04	(1) QUAOAR	WFC3/UVIS	1	12-Aug-2024 09:00:41.0	yes
05	(1) QUAOAR	WFC3/UVIS	1	12-Aug-2024 09:00:41.0	yes
06	(1) QUAOAR	WFC3/UVIS	1	12-Aug-2024 09:00:41.0	yes
07	(1) QUAOAR	WFC3/UVIS	1	12-Aug-2024 09:00:42.0	yes

7 Total Orbits Used

ABSTRACT

This is a proposal to obtain the rotational light-curve of Weywot, the satellite of the TNO dwarf planet (50000) Quaoar. The study of trans-Neptunian binary and multiple systems provides valuable information about the formation and evolution of the icy bodies found beyond the orbit of Neptune. This, in turn, reveals the dynamical history of the outer solar system and the formation of planetary building blocks. The Quaoar-Weywot system is especially interesting because recent stellar occultation data shows a much larger satellite than expected and a significant difference in albedos between the primary and the secondary. The goal of this proposal is to obtain the rotational light-curve of Weywot. This will allow us to determine Weywot's rotation period and constrain the three-dimensional shape of the object by providing its rotational phase during two predicted stellar occultations by Weywot in July 2025. This is a unique opportunity not presented in the foreseeable future for any other TNO dwarf planet satellite. The combination of these data will provide important constraints for the formation scenario of Weywot and will inform about the formation mechanisms of similar systems.

OBSERVING DESCRIPTION

We are using the WFC3 instrument with the UVIS2 detector (full array), and the F606W filter for a total of 7 orbits. These orbits are roughly evenly spaced between 1.5 and 1.9 days.

Each orbit in APT uses a 4-point box dither with the WFC3-UVIS-DITHER-BOX pattern and 352 seconds per exposure. This time exceeds the 348-second threshold to avoid overheads from a serial buffer dump.

Each orbit is sequence after the previous one within the above indicated time spam.

Visit

Proposal 17827, Visit 01 Mon Aug 12 13:00:42 GMT 2024

Diagnostic Status: Warning

Scientific Instruments: WFC3/UVIS

Special Requirements: BETWEEN 30-JUN-2025:00:00:00 AND 13-JUL-2025:00:00:00

Diagnostics

(Exposure 1 (Pattern 1, Exps 1-1 in Visit 01)) Warning (Form): FLASH level may be too low for this exposure or a short subexposure. See extended explanation in the diagnostic browser

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

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)

Solar System Targets

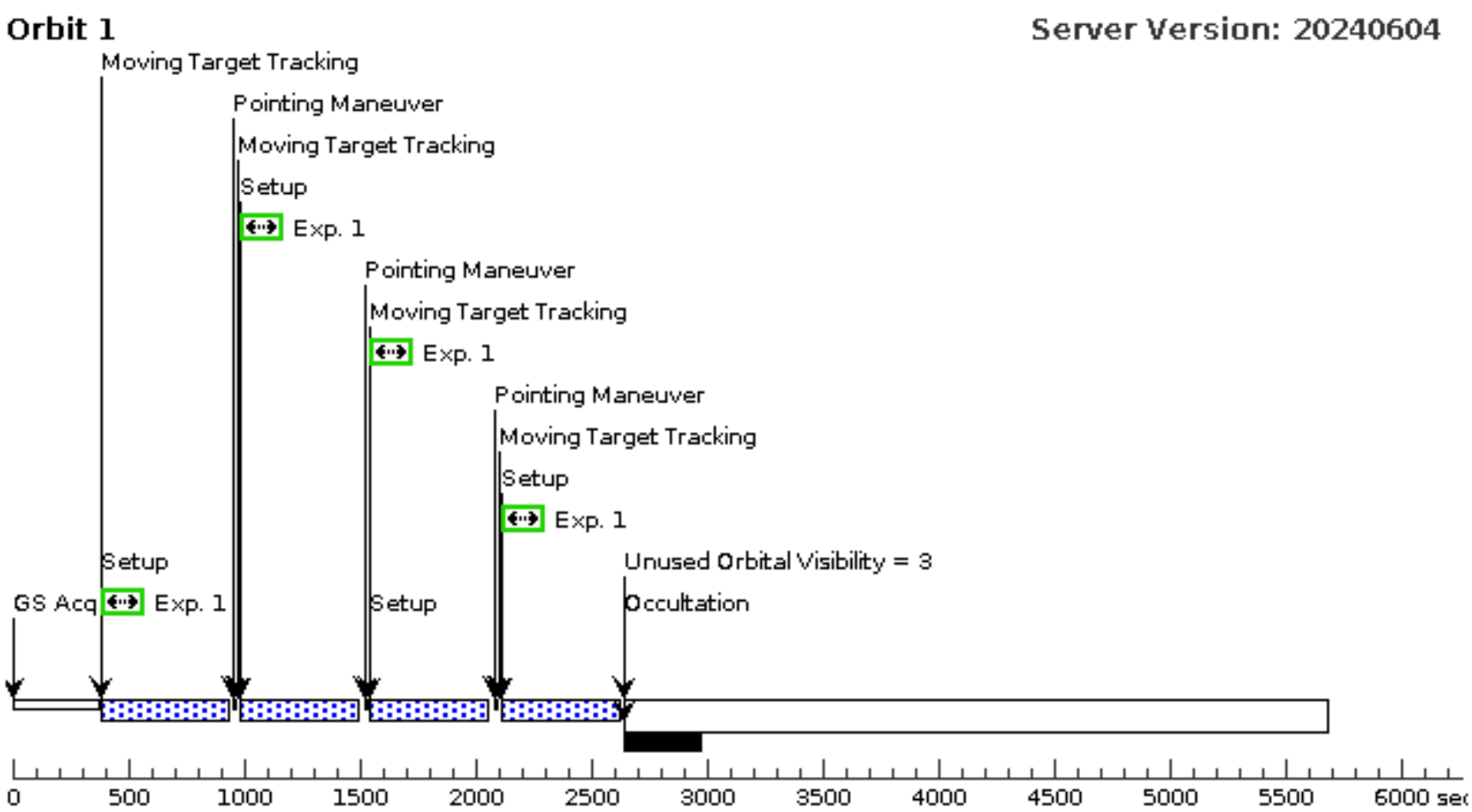
#	Name	Level 1	Level 2	Level 3	Window	Ephem Center
(1)	QUAOAR	TYPE=ASTEROID,A=43.2037307416 1458,E=0.03753824088264753,I=7.99 5050907129574 ,O=189.0123433459229,W=162.21048 42103545,M=276.2958152838288,EQ UINOX=J2000,EPOCH=06-JUL-2012:00:00:00,EpochTimeScale=TDB				EARTH

Comments: Description=Quaoar Extended=NO

Exposures

#	Label	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time (Total)/[Actual Dur.]	Orbit
1		(1) QUAOAR	WFC3/UVIS, ACCUM, UVIS2-2K2C-SUB	F606W			Pattern 1, Exps 1-1 in Visit 01 (1)	352 Secs (1408 Secs) *[==>(Pattern 1)]* *[==>(Pattern 2)]* *[==>(Pattern 3)]* *[==>(Pattern 4)]*	***[1]***

Orbit Structure



Visit

Proposal 17827, Visit 02 Mon Aug 12 13:00:42 GMT 2024

Diagnostic Status: Warning

Scientific Instruments: WFC3/UVIS

Special Requirements: AFTER_01 BY 1.5 D TO 1.9 D

Diagnostics

(Exposure 1 (Pattern 1, Exps 1-1 in Visit 02)) Warning (Form): FLASH level may be too low for this exposure or a short subexposure. See extended explanation in the diagnostic browser

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

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)

Solar System Targets

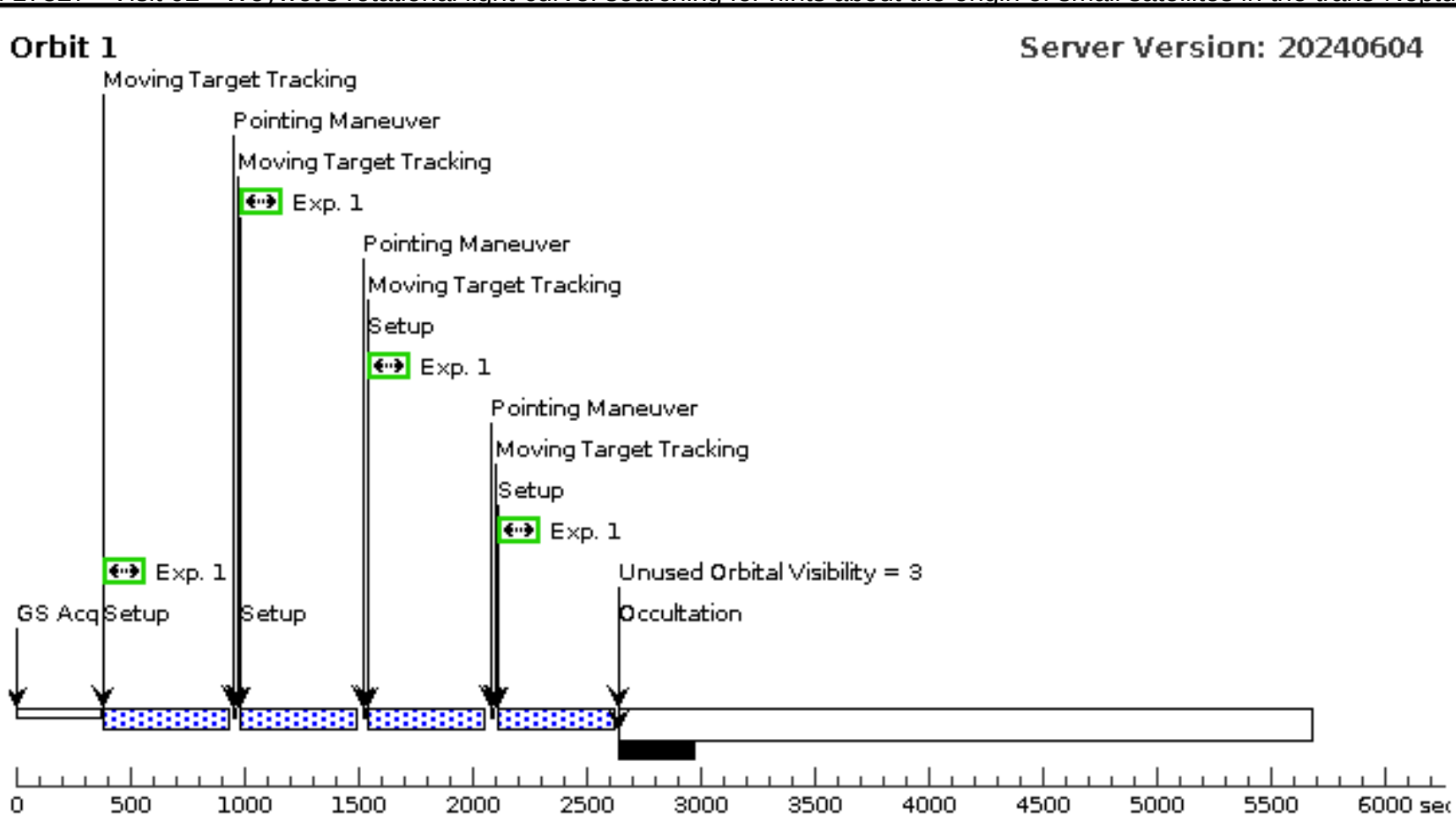
#	Name	Level 1	Level 2	Level 3	Window	Ephem Center
(1)	QUAOAR	TYPE=ASTEROID,A=43.203730741614 58,E=0.037538240882647 53,I=7.995050907129574 ,O=189.0123433459229,W=162.2104842103545,M=276.2958152838288,EQUINOX=J2000,EPOCH=06-JUL-2012:00:00:00,EpochTimeScale=TDB				EARTH

Comments: Description=Quaoar Extended=NO

Exposures

#	Label	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time (Total)/[Actual Dur.]	Orbit
1		(1) QUAOAR	WFC3/UVIS, ACCUM, UVIS2-2K2C-SUB	F606W			Pattern 1, Exps 1-1 in Visit 02 (1)	352 Secs (1408 Secs) *[==>(Pattern 1)]* *[==>(Pattern 2)]* *[==>(Pattern 3)]* *[==>(Pattern 4)]*	***[1]***

Orbit Structure



Visit

Proposal 17827, Visit 03 Mon Aug 12 13:00:42 GMT 2024

Diagnostic Status: Warning

Scientific Instruments: WFC3/UVIS

Special Requirements: AFTER_02 BY 1.5 D TO 1.9 D

Diagnostics

(Exposure 1 (Pattern 1, Exps 1-1 in Visit 03)) Warning (Form): FLASH level may be too low for this exposure or a short subexposure. See extended explanation in the diagnostic browser

(Visit 03) Informational (Form): The Visit Planner and Spike may produce different schedulability results.

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)

Solar System Targets

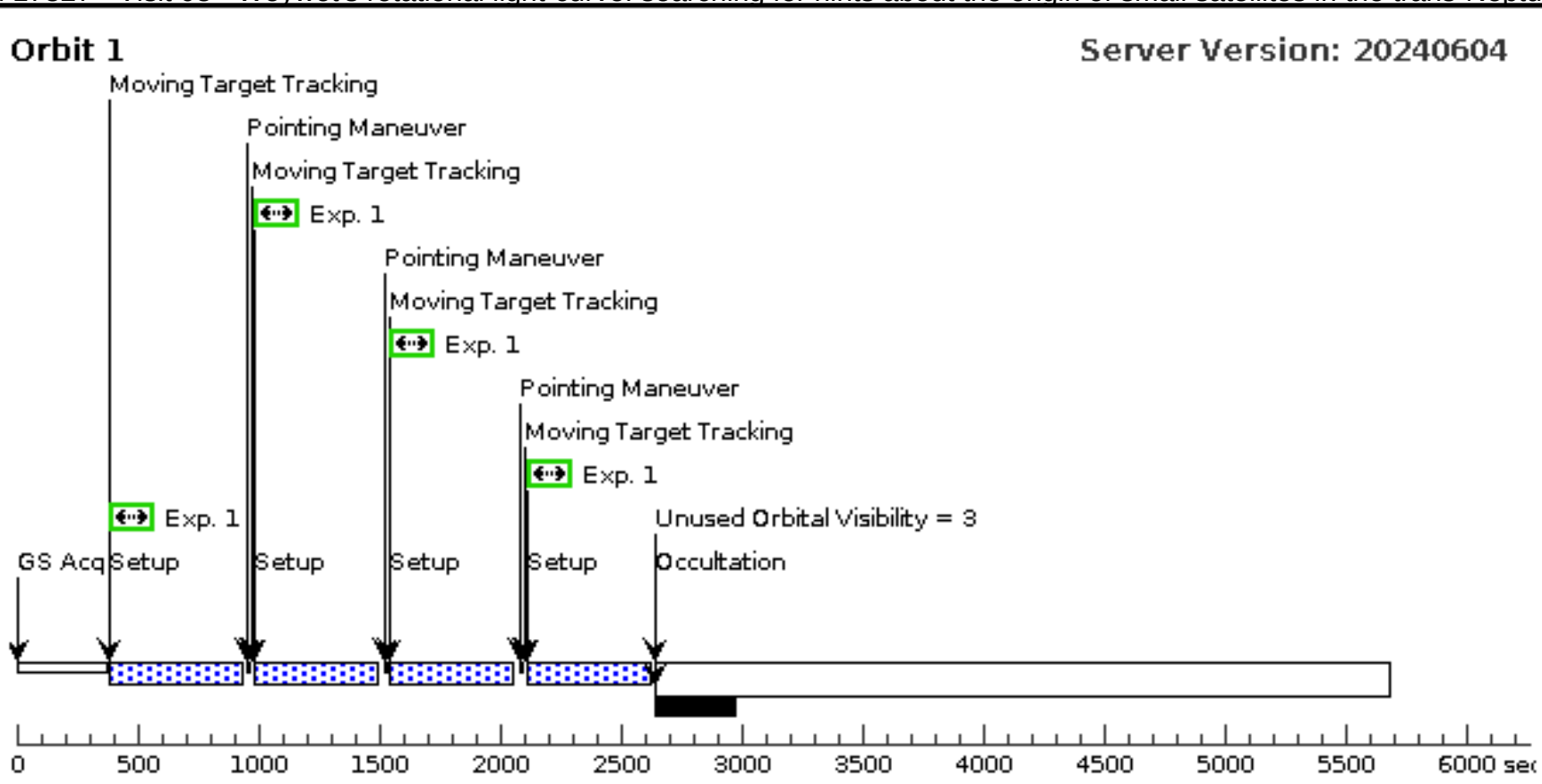
#	Name	Level 1	Level 2	Level 3	Window	Ephem Center
(1)	QUAOAR	TYPE=ASTEROID,A=43.2037307416 1458,E=0.03753824088264753,I=7.99 5050907129574 ,O=189.0123433459229,W=162.21048 42103545,M=276.2958152838288,EQ UINOX=J2000,EPOCH=06-JUL-2012:00:00:00,EpochTimeScale=TDB				EARTH

Comments: Description=Quaoar Extended=NO

Exposures

#	Label	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time (Total)/[Actual Dur.]	Orbit
1		(1) QUAOAR	WFC3/UVIS, ACCUM, UVIS2-2K2C-SUB	F606W			Pattern 1, Exps 1-1 in Visit 03 (1)	352 Secs (1408 Secs) *[==>(Pattern 1)]* *[==>(Pattern 2)]* *[==>(Pattern 3)]* *[==>(Pattern 4)]*	***[1]***

Orbit Structure



Visit

Proposal 17827, Visit 04 Mon Aug 12 13:00:42 GMT 2024

Diagnostic Status: Warning

Scientific Instruments: WFC3/UVIS

Special Requirements: AFTER_03 BY 1.5 D TO 1.8 D

Diagnostics

(Exposure 1 (Pattern 1, Exps 1-1 in Visit 04)) Warning (Form): FLASH level may be too low for this exposure or a short subexposure. See extended explanation in the diagnostic browser

(Visit 04) Informational (Form): The Visit Planner and Spike may produce different schedulability results.

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)

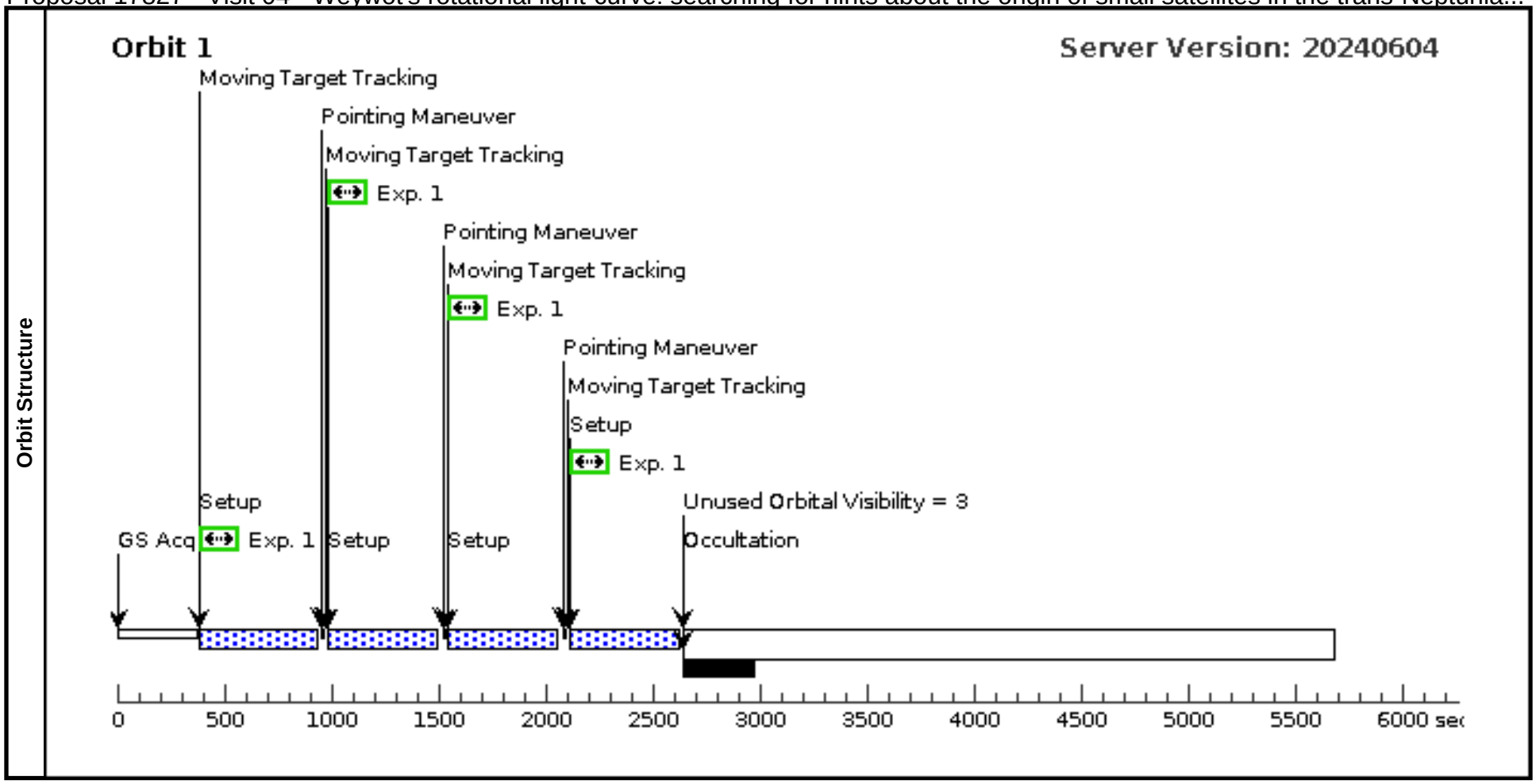
Solar System Targets

#	Name	Level 1	Level 2	Level 3	Window	Ephem Center
(1)	QUAOAR	TYPE=ASTEROID,A=43.2037307416 1458,E=0.03753824088264753,I=7.99 5050907129574 ,O=189.0123433459229,W=162.21048 42103545,M=276.2958152838288,EQ UINOX=J2000,EPOCH=06-JUL-2012:00:00:00,EpochTimeScale=TDB				EARTH

Comments: Description=Quaoar Extended=NO

Exposures

#	Label	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time (Total)/[Actual Dur.]	Orbit
1		(1) QUAOAR	WFC3/UVIS, ACCUM, UVIS2-2K2C-SUB	F606W			Pattern 1, Exps 1-1 in Visit 04 (1)	352 Secs (1408 Secs) *[==>(Pattern 1)]* *[==>(Pattern 2)]* *[==>(Pattern 3)]* *[==>(Pattern 4)]*	***[1]***


Orbit Structure
Orbit 1
Server Version: 20240604
Moving Target Tracking
Pointing Maneuver
Moving Target Tracking
Exp. 1
Pointing Maneuver
Moving Target Tracking
Exp. 1
Pointing Maneuver
Moving Target Tracking
Setup
Exp. 1
Setup
Unused Orbital Visibility = 3
GS Acq
Exp. 1
Setup
Setup
Occultation
0
500
1000
1500
2000
2500
3000
3500
4000
4500
5000
5500
6000 sec

Visit

Proposal 17827, Visit 05 Mon Aug 12 13:00:42 GMT 2024

Diagnostic Status: Warning

Scientific Instruments: WFC3/UVIS

Special Requirements: AFTER_04 BY 1.5 D TO 1.9 D

Diagnostics

(Exposure 1 (Pattern 1, Exps 1-1 in Visit 05)) Warning (Form): FLASH level may be too low for this exposure or a short subexposure. See extended explanation in the diagnostic browser

(Visit 05) Informational (Form): The Visit Planner and Spike may produce different schedulability results.

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)

Solar System Targets

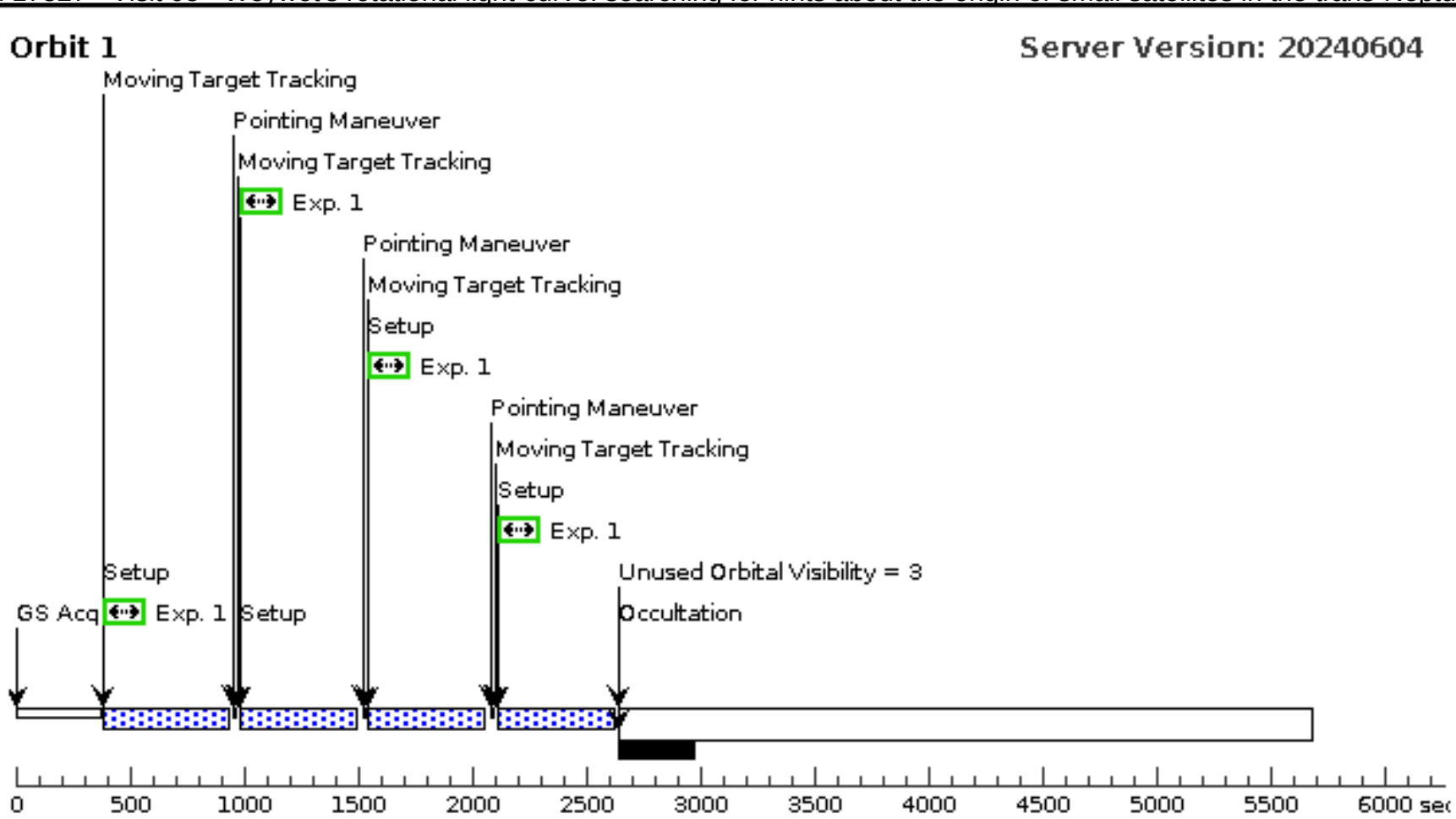
#	Name	Level 1	Level 2	Level 3	Window	Ephem Center
(1)	QUAOAR	TYPE=ASTEROID,A=43.2037307416 1458,E=0.03753824088264753,I=7.99 5050907129574 ,O=189.0123433459229,W=162.21048 42103545,M=276.2958152838288,EQ UINOX=J2000,EPOCH=06-JUL-2012:00:00:00,EpochTimeScale=TDB				EARTH

Comments: Description=Quaoar Extended=NO

Exposures

#	Label	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time (Total)/[Actual Dur.]	Orbit
1		(1) QUAOAR	WFC3/UVIS, ACCUM, UVIS2-2K2C-SUB	F606W			Pattern 1, Exps 1-1 in Visit 05 (1)	352 Secs (1408 Secs) *[==>(Pattern 1)]* *[==>(Pattern 2)]* *[==>(Pattern 3)]* *[==>(Pattern 4)]*	***[1]***

Orbit Structure



Visit

Proposal 17827, Visit 06 Mon Aug 12 13:00:43 GMT 2024

Diagnostic Status: Warning

Scientific Instruments: WFC3/UVIS

Special Requirements: AFTER_05 BY 1.5 D TO 1.9 D

Diagnostics

(Exposure 1 (Pattern 1, Exps 1-1 in Visit 06)) Warning (Form): FLASH level may be too low for this exposure or a short subexposure. See extended explanation in the diagnostic browser

(Visit 06) Informational (Form): The Visit Planner and Spike may produce different schedulability results.

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)

Solar System Targets

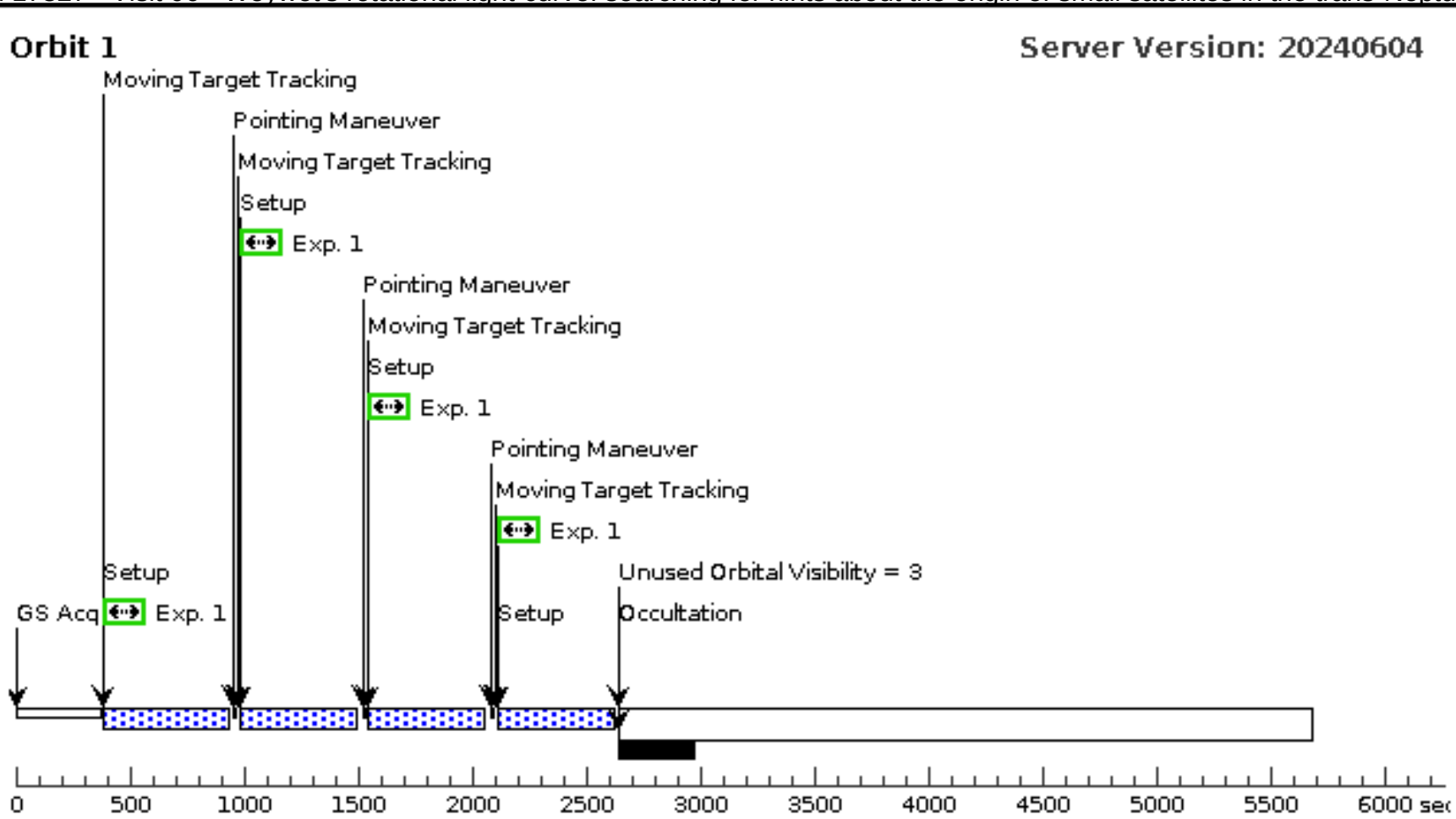
#	Name	Level 1	Level 2	Level 3	Window	Ephem Center
(1)	QUAOAR	TYPE=ASTEROID,A=43.2037307416 1458,E=0.03753824088264753,I=7.99 5050907129574 ,O=189.0123433459229,W=162.21048 42103545,M=276.2958152838288,EQ UINOX=J2000,EPOCH=06-JUL-2012:00:00:00,EpochTimeScale=TDB				EARTH

Comments: Description=Quaoar Extended=NO

Exposures

#	Label	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time (Total)/[Actual Dur.]	Orbit
1		(1) QUAOAR	WFC3/UVIS, ACCUM, UVIS2-2K2C-SUB	F606W			Pattern 1, Exps 1-1 in Visit 06 (1)	352 Secs (1408 Secs) *[==>(Pattern 1)]* *[==>(Pattern 2)]* *[==>(Pattern 3)]* *[==>(Pattern 4)]*	***[1]***

Orbit Structure



Visit

Proposal 17827, Visit 07 Mon Aug 12 13:00:43 GMT 2024

Diagnostic Status: Warning

Scientific Instruments: WFC3/UVIS

Special Requirements: AFTER_06 BY 1.5 D TO 1.9 D

Diagnostics

(Exposure 1 (Pattern 1, Exps 1-1 in Visit 07)) Warning (Form): FLASH level may be too low for this exposure or a short subexposure. See extended explanation in the diagnostic browser

(Visit 07) Informational (Form): The Visit Planner and Spike may produce different schedulability results.

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)

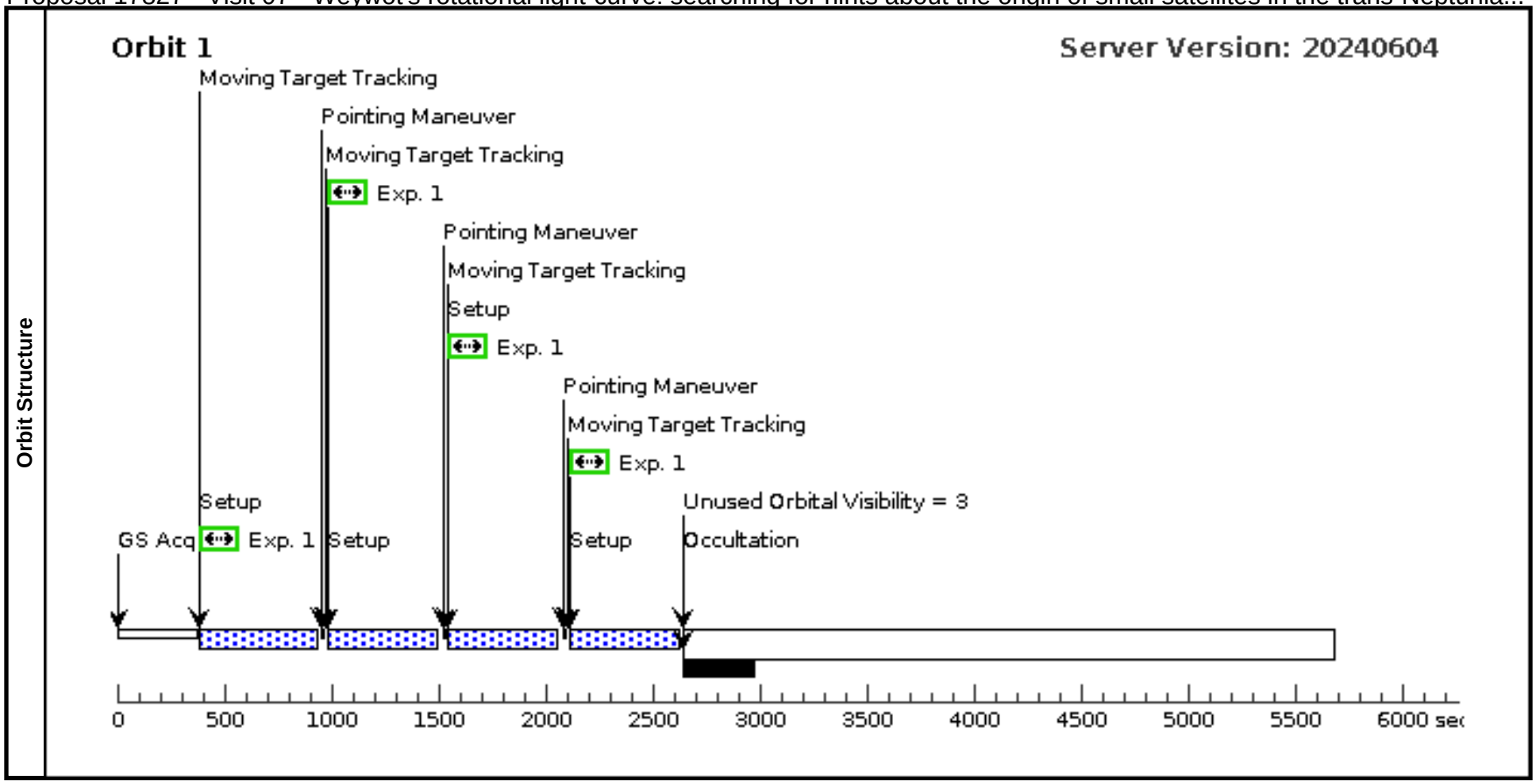
Solar System Targets

#	Name	Level 1	Level 2	Level 3	Window	Ephem Center
(1)	QUAOAR	TYPE=ASTEROID,A=43.2037307416 1458,E=0.03753824088264753,I=7.99 5050907129574 ,O=189.0123433459229,W=162.21048 42103545,M=276.2958152838288,EQ UINOX=J2000,EPOCH=06-JUL-2012:00:00:00,EpochTimeScale=TDB				EARTH

Comments: Description=Quaoar Extended=NO

Exposures

#	Label	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time (Total)/[Actual Dur.]	Orbit
1		(1) QUAOAR	WFC3/UVIS, ACCUM, UVIS2-2K2C-SUB	F606W			Pattern 1, Exps 1-1 in Visit 07 (1)	352 Secs (1408 Secs) *[==>(Pattern 1)]* *[==>(Pattern 2)]* *[==>(Pattern 3)]* *[==>(Pattern 4)]*	***[1]***


Orbit Structure
Orbit 1
Server Version: 20240604
Moving Target Tracking
Pointing Maneuver
Moving Target Tracking
Exp. 1
Pointing Maneuver
Moving Target Tracking
Setup
Exp. 1
Pointing Maneuver
Moving Target Tracking
Exp. 1
Setup
Unused Orbital Visibility = 3
GS Acq
Exp. 1
Setup
Setup
Occultation
0
500
1000
1500
2000
2500
3000
3500
4000
4500
5000
5500
6000 sec