16501 - Is main-belt comet 288P a triple system?

Cycle: 28, Proposal Category: GO

(Availability Mode: SUPPORTED)

INVESTIGATORS

Name	*Institution*	*E-Mail*
Dr. Yoonyoung Kim (PI) (ESA Member) (Contact)	**Technische Universitaet Braunschweig**	**yoonyoung.kim@tu-braunschweig.de**
Dr. Jessica Agarwal (CoI) (ESA Member) (Contact)	Technische Universitaet Braunschweig	agarwal@mps.mpg.de
Dr. David Jewitt (CoI) (AdminUSPI)	University of California - Los Angeles	jewitt@ucla.edu
Max Mutchler (CoI) (Contact)	Space Telescope Science Institute	mutchler@stsci.edu
Dr. Harold A. Weaver (CoI)	The Johns Hopkins University Applied Physics Laboratory	hal.weaver@jhuapl.edu
Dr. Stephen M. Larson (CoI)	University of Arizona	slarson@lpl.arizona.edu

VISITS

Visit	*Targets used in Visit*	*Configurations used in Visit*	*Orbits Used*	*Last Orbit Planner Run*	*OP Current with Visit?*
01	(2) 288P-UPDATE3	WFC3/UVIS	2	02-Sep-2021 13:00:52.0	yes
02	(2) 288P-UPDATE3	WFC3/UVIS	2	02-Sep-2021 13:00:53.0	yes
03	(2) 288P-UPDATE3	WFC3/UVIS	2	02-Sep-2021 13:00:54.0	yes

6 Total Orbits Used

ABSTRACT

We request 6 mid-cycle orbits using WFC3 in 2021 June to probe the newly suspected triple nature of main-belt comet 288P. This object is unique. It has wide separation, nearly equal-sized components, and also displays repetitive comet-like activity. 288P is one of only a few known asteroid

binaries whose components can be spatially resolved by WFC3. Archival WFC3 observations obtained two months after the Cycle 28 deadline reveal that 288P is likely triple. That is, the light curve of one of the two main components is best represented as the sum of the lightcurves of two (spatially unresolved) components with different periods. Additional data are needed to confirm the third component. Successful identification of the third component would make 288P the first-ever detected triple asteroid system to exhibit comet-like activity, and provide crucial constraints on asteroid break-up models and on the role of activity-causing ice sublimation. We emphasize that these measurements maximally exploit the capabilities of HST for high resolution imaging. HST is the only telescope able to spatially separate the two main nuclei (maximum separation about 0.1 arcsec) and hence to measure their rotational lightcurves separately. The proposed observations are time-critical to be carried out in 2021 June, which is the last opportunity to spatially separate the two main components before the return of dust activity in fall 2021.

OBSERVING DESCRIPTION

The goal of this program is to measure the time-variability of the brightness of the two components of binary asteroid 288P. We expect that the components will be separated by <0.1arcsec in 2021 September and have a combined brightness of about V=22mag.

All 6 visits should be scheduled as close in time as possible, ideally as 3 pairs of orbits separated each by only one orbit for gyro reset. But distributing the orbits across a time interval of ~24h will also be acceptable (which can be relaxed as needed for scheduling). Hence the timing requirements are as follows:

Visit 1: BETWEEN Sep 27 and Oct 01, GROUP Visits 01, 02, 03 WITHIN 24H

Each visit consists of 8 exposures of ~240s, using a 2-point linear dither pattern to mitigate bad pixels and the C512C sub-frame to minimise read-out time. If the actual orbital visibility is shorter than expected in APT, then the exposure time can be shortened such that all 8 exposures fit into one orbit.

Should the program have to be carried out in 1gyro mode we can shorten the exposure time to adapt to the increased time for guide star acquisition. The target will be at solar elongations >110deg, hence the enlarged solar exclusion zone will not pose a problem.

Visit

Proposal 16501, Visit 01, implementation Thu Sep 02 17:00:55 GMT 2021

Diagnostic Status: Warning

Scientific Instruments: WFC3/UVIS

Special Requirements: BETWEEN 27-SEP-2021:00:00:00 AND 27-SEP-2021:21:45:00; BETWEEN 28-SEP-2021:00:08:00 AND 28-SEP-2021:06:30:00; BETWEEN 28-SEP-2021:08:53:00 AND 29-SEP-2021:15:00:00; BETWEEN 29-SEP-2021:19:00:00 AND 30-SEP-2021:08:00:00; BETWEEN 30-SEP-2021:13:00:00 AND 01-OCT-2021:13:00:00; GROUP 01,02,03 WITHIN 24H

Diagnostics

(Exposure 1 (Pattern 1, Exps 1-1 in Sequence 1-1 Non-Int 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

(Exposure 2 (Pattern 1, Exps 2-2 in Sequence 2-2 Non-Int 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

Patterns

#	Primary Pattern		Secondary Pattern	Exposures
(1)	Pattern Type=WFC3-UVIS-DITHER-LINE Purpose=DITHER Number Of Points=2 Point Spacing=0.145 Line Spacing=	Coordinate Frame=POS-TARG Pattern Orientation=46.84 Angle Between Sides= Center Pattern=false		(1), (2)

Solar System Targets

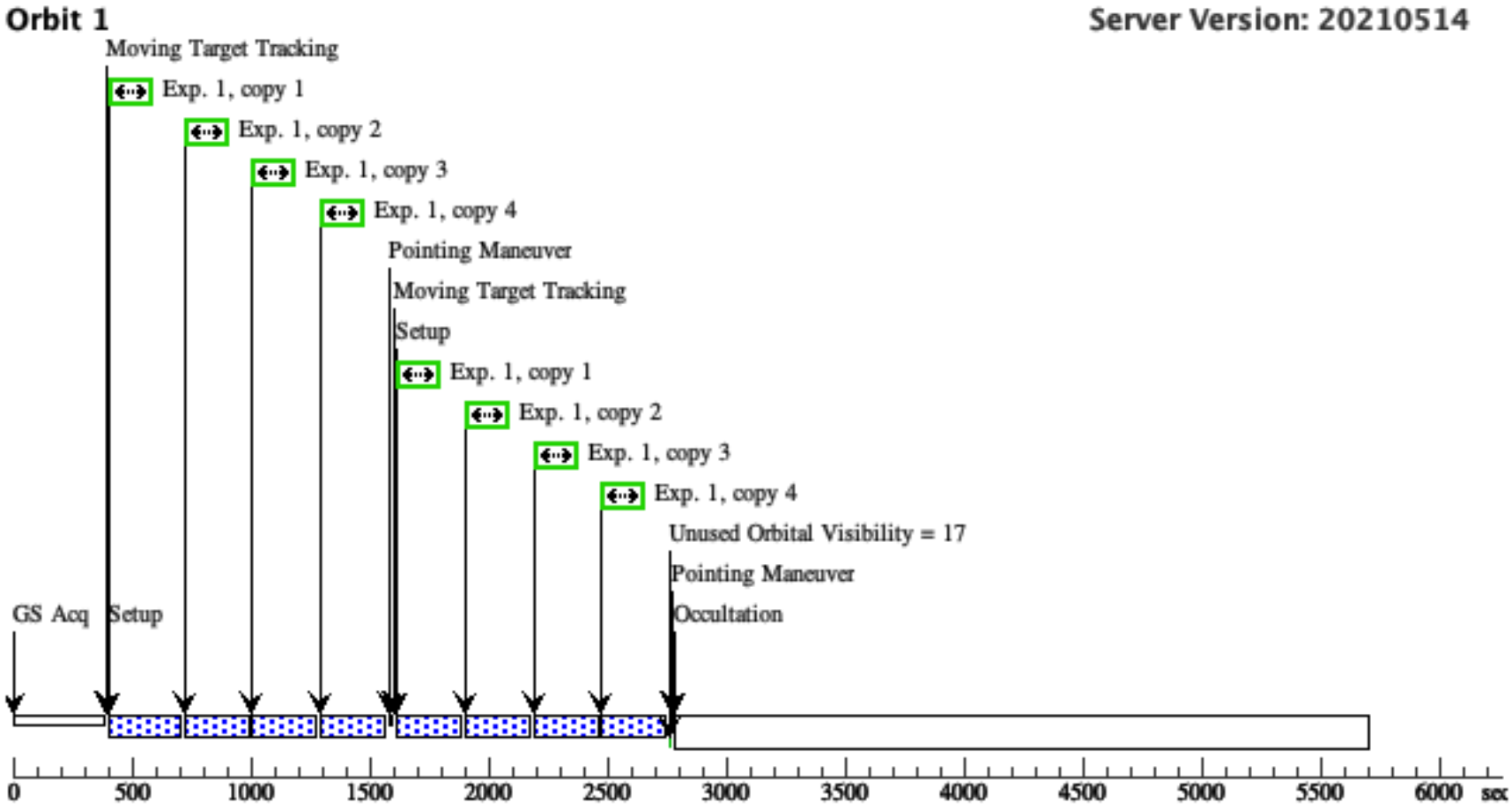
#	Name	Level 1	Level 2	Level 3	Window	Ephem Center
(2)	288P-UPDATE3	TYPE=ASTEROID,A=3.04931670684 5886,E=0.2011145348983784,I=3.240 027217147757 ,O=83.18987601023933,W=281.05319 96557008,M=359.7694035685469,EQ UINOX=J2000,EPOCH=07-NOV- 2016:00:00:00,EpochTimeScale=TDB				EARTH

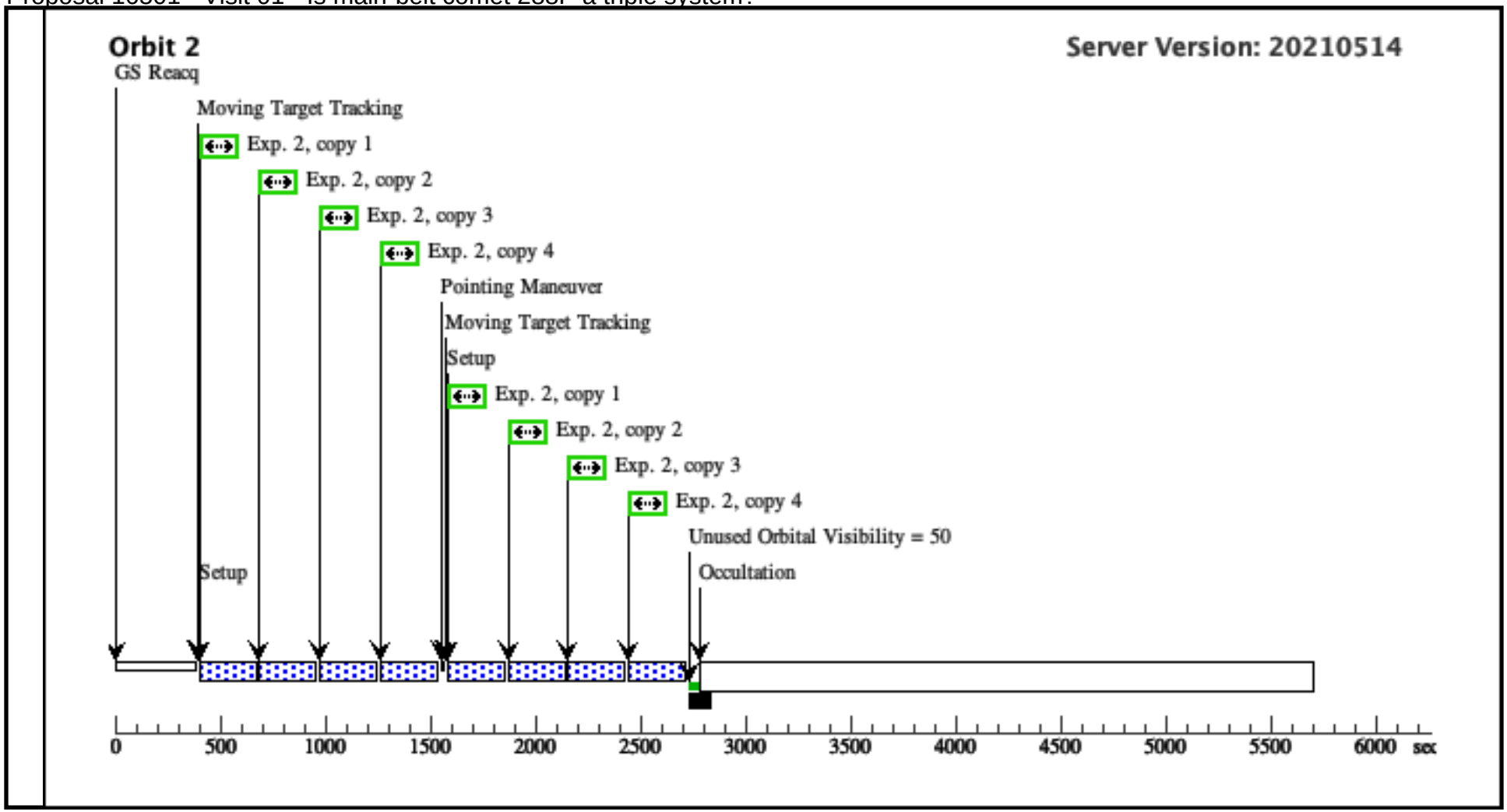
Comments: Description=binary asteroid
Extended=NO

Exposures

#	Label	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time (Total)/[Actual Dur.]	Orbit
1		(2) 288P-UPDATE3	WFC3/UVIS, ACCUM, UVIS2-C512C-SUB	F606W			Sequence 1-1 Non-In t in Visit 01 Pattern 1, Exps 1-1 i n Sequence 1-1 Non- Int in Visit 01 (1)	237 Secs X 4 (1896 Secs) *[==>(Pattern 1, Copy 1)]* *[==>(Pattern 1, Copy 2)]* *[==>(Pattern 1, Copy 3)]* *[==>(Pattern 1, Copy 4)]* *[==>(Pattern 2, Copy 1)]* *[==>(Pattern 2, Copy 2)]* *[==>(Pattern 2, Copy 3)]* *[==>(Pattern 2, Copy 4)]*	***[1]***
2		(2) 288P-UPDATE3	WFC3/UVIS, ACCUM, UVIS2-C512C-SUB	F606W			Sequence 2-2 Non-In t in Visit 01 Pattern 1, Exps 2-2 i n Sequence 2-2 Non- Int in Visit 01 (1)	237 Secs X 4 (1896 Secs) *[==>(Pattern 1, Copy 1)]* *[==>(Pattern 1, Copy 2)]* *[==>(Pattern 1, Copy 3)]* *[==>(Pattern 1, Copy 4)]* *[==>(Pattern 2, Copy 1)]* *[==>(Pattern 2, Copy 2)]* *[==>(Pattern 2, Copy 3)]* *[==>(Pattern 2, Copy 4)]*	***[2]***

Orbit Structure




Orbit 2
Server Version: 20210514
GS Reacq
Moving Target Tracking
Exp. 2, copy 1
Exp. 2, copy 2
Exp. 2, copy 3
Exp. 2, copy 4
Pointing Maneuver
Moving Target Tracking
Setup
Exp. 2, copy 1
Exp. 2, copy 2
Exp. 2, copy 3
Exp. 2, copy 4
Unused Orbital Visibility = 50
Occultation
Setup
0
500
1000
1500
2000
2500
3000
3500
4000
4500
5000
5500
6000
sec

Visit

Proposal 16501, Visit 02, implementation Thu Sep 02 17:00:55 GMT 2021

Diagnostic Status: Warning

Scientific Instruments: WFC3/UVIS

Special Requirements: BETWEEN 27-SEP-2021:00:00:00 AND 27-SEP-2021:21:45:00; BETWEEN 28-SEP-2021:00:08:00 AND 28-SEP-2021:06:30:00; BETWEEN 28-SEP-2021:08:53:00 AND 29-SEP-2021:15:00:00; BETWEEN 29-SEP-2021:19:00:00 AND 30-SEP-2021:08:00:00; BETWEEN 30-SEP-2021:13:00:00 AND 01-OCT-2021:13:00:00

Diagnostics

(Exposure 1 (Pattern 1, Exps 1-1 in Sequence 1-1 Non-Int 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

(Exposure 2 (Pattern 1, Exps 2-2 in Sequence 2-2 Non-Int 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

Patterns

#	Primary Pattern		Secondary Pattern	Exposures
(1)	Pattern Type=WFC3-UVIS-DITHER-LINE Purpose=DITHER Number Of Points=2 Point Spacing=0.145 Line Spacing=	Coordinate Frame=POS-TARG Pattern Orientation=46.84 Angle Between Sides= Center Pattern=false		(1), (2)

Solar System Targets

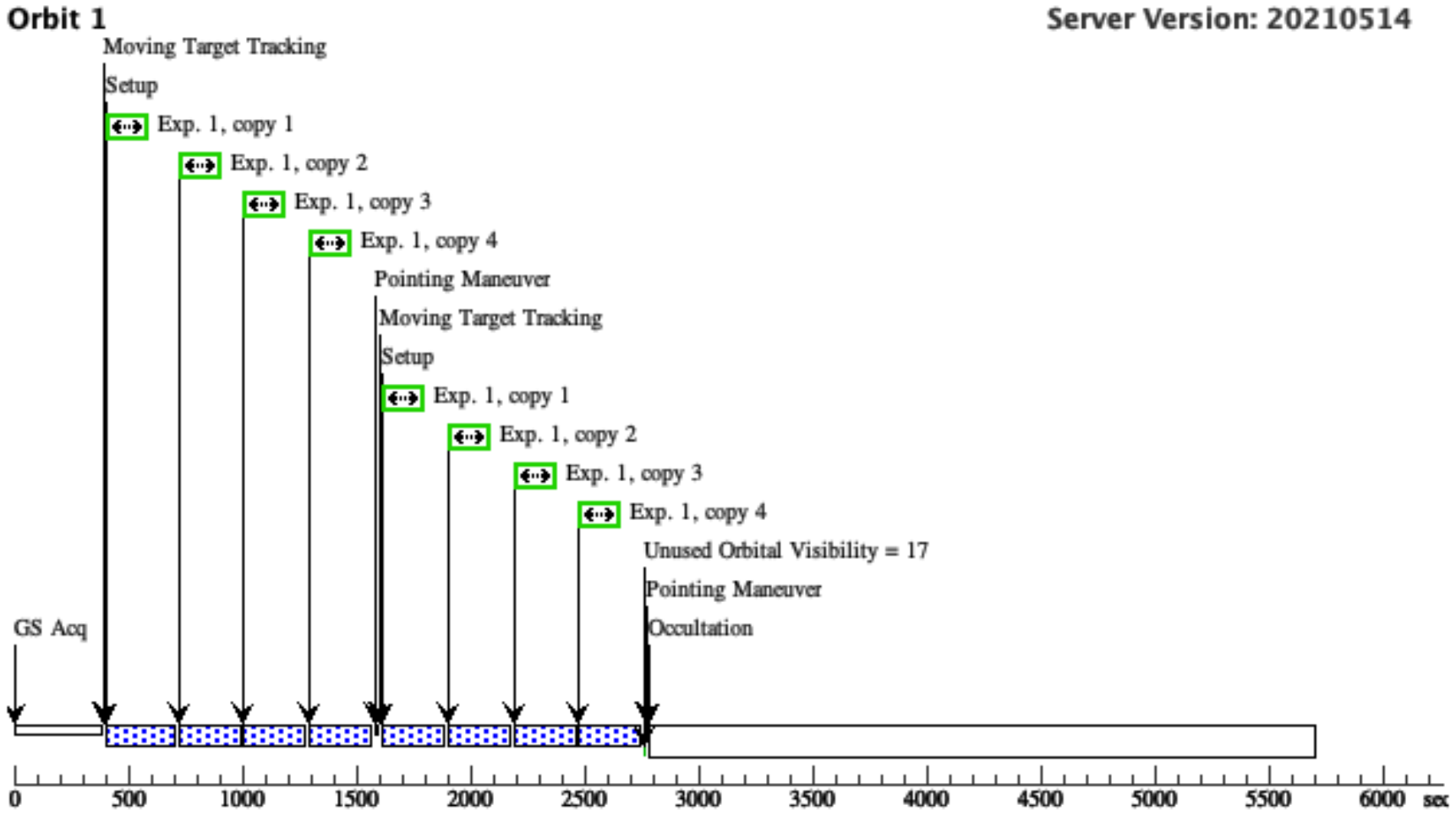
#	Name	Level 1	Level 2	Level 3	Window	Ephem Center
(2)	288P-UPDATE3	TYPE=ASTEROID,A=3.04931670684 5886,E=0.2011145348983784,I=3.240 027217147757 ,O=83.18987601023933,W=281.05319 96557008,M=359.7694035685469,EQ UINOX=J2000,EPOCH=07-NOV- 2016:00:00:00,EpochTimeScale=TDB				EARTH

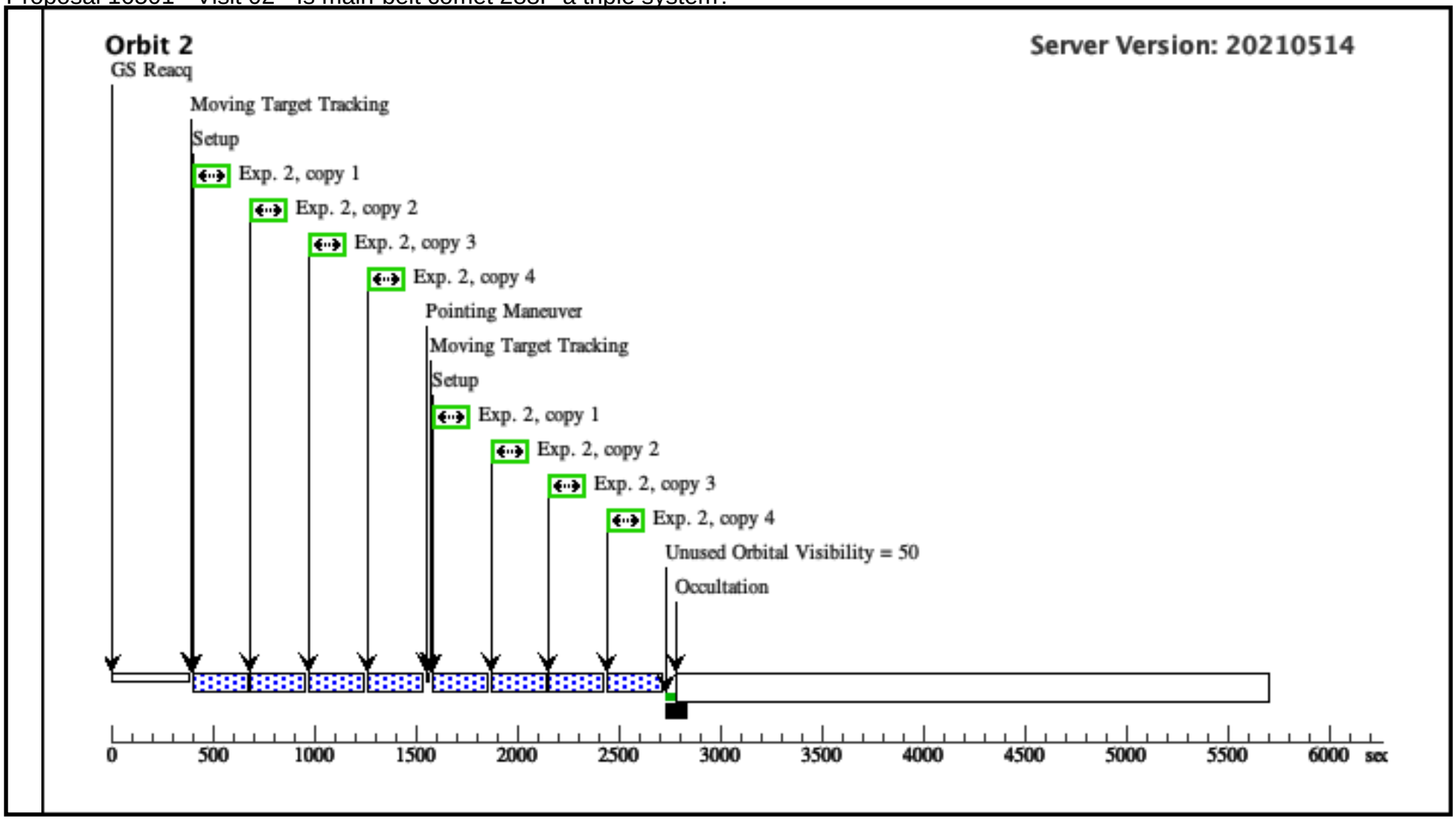
Comments: Description=binary asteroid
Extended=NO

Exposures

#	Label	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time (Total)/[Actual Dur.]	Orbit
1		(2) 288P-UPDATE3	WFC3/UVIS, ACCUM, UVIS2-C512C-SUB	F606W			Sequence 1-1 Non-In t in Visit 02 Pattern 1, Exps 1-1 i n Sequence 1-1 Non-Int in Visit 02 (1)	237 Secs X 4 (1896 Secs) *[==>(Pattern 1, Copy 1)]* *[==>(Pattern 1, Copy 2)]* *[==>(Pattern 1, Copy 3)]* *[==>(Pattern 1, Copy 4)]* *[==>(Pattern 2, Copy 1)]* *[==>(Pattern 2, Copy 2)]* *[==>(Pattern 2, Copy 3)]* *[==>(Pattern 2, Copy 4)]*	***[1]***
2		(2) 288P-UPDATE3	WFC3/UVIS, ACCUM, UVIS2-C512C-SUB	F606W			Sequence 2-2 Non-In t in Visit 02 Pattern 1, Exps 2-2 i n Sequence 2-2 Non-Int in Visit 02 (1)	237 Secs X 4 (1896 Secs) *[==>(Pattern 1, Copy 1)]* *[==>(Pattern 1, Copy 2)]* *[==>(Pattern 1, Copy 3)]* *[==>(Pattern 1, Copy 4)]* *[==>(Pattern 2, Copy 1)]* *[==>(Pattern 2, Copy 2)]* *[==>(Pattern 2, Copy 3)]* *[==>(Pattern 2, Copy 4)]*	***[2]***

Orbit Structure




Orbit 2
Server Version: 20210514
GS Reacq
Moving Target Tracking
Setup
Exp. 2, copy 1
Exp. 2, copy 2
Exp. 2, copy 3
Exp. 2, copy 4
Pointing Maneuver
Moving Target Tracking
Setup
Exp. 2, copy 1
Exp. 2, copy 2
Exp. 2, copy 3
Exp. 2, copy 4
Unused Orbital Visibility = 50
Occultation
0
500
1000
1500
2000
2500
3000
3500
4000
4500
5000
5500
6000
sec

Visit

Proposal 16501, Visit 03, implementation Thu Sep 02 17:00:55 GMT 2021

Diagnostic Status: Warning

Scientific Instruments: WFC3/UVIS

Special Requirements: BETWEEN 27-SEP-2021:00:00:00 AND 27-SEP-2021:21:45:00; BETWEEN 28-SEP-2021:00:08:00 AND 28-SEP-2021:06:30:00; BETWEEN 28-SEP-2021:08:53:00 AND 29-SEP-2021:15:00:00; BETWEEN 29-SEP-2021:19:00:00 AND 30-SEP-2021:08:00:00; BETWEEN 30-SEP-2021:13:00:00 AND 01-OCT-2021:13:00:00

Diagnostics

(Exposure 1 (Pattern 1, Exps 1-1 in Sequence 1-1 Non-Int 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

(Exposure 2 (Pattern 1, Exps 2-2 in Sequence 2-2 Non-Int 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

Patterns

#	Primary Pattern		Secondary Pattern	Exposures
(1)	Pattern Type=WFC3-UVIS-DITHER-LINE Purpose=DITHER Number Of Points=2 Point Spacing=0.145 Line Spacing=	Coordinate Frame=POS-TARG Pattern Orientation=46.84 Angle Between Sides= Center Pattern=false		(1), (2)

Solar System Targets

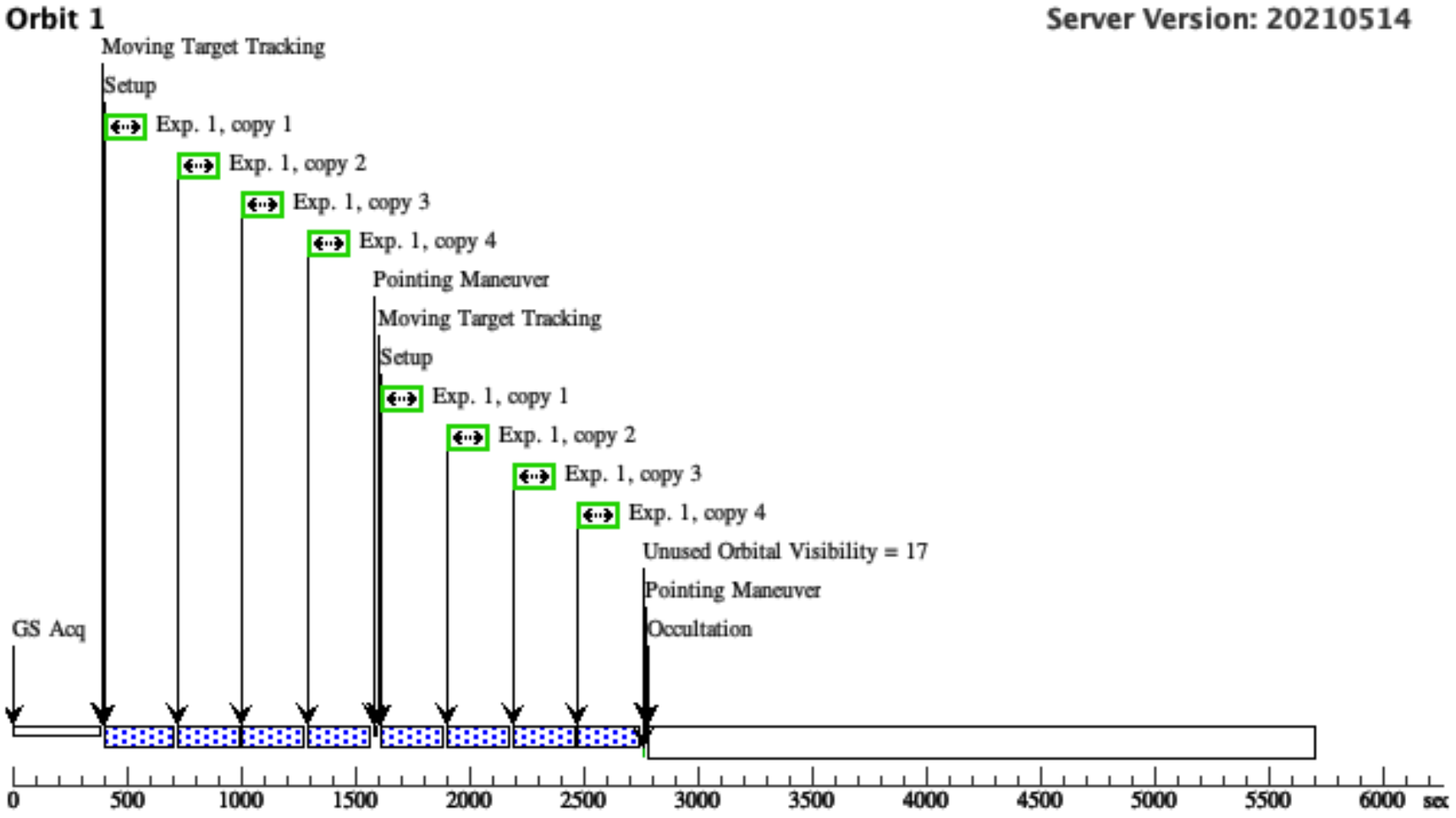
#	Name	Level 1	Level 2	Level 3	Window	Ephem Center
(2)	288P-UPDATE3	TYPE=ASTEROID,A=3.04931670684 5886,E=0.2011145348983784,I=3.240 027217147757 ,O=83.18987601023933,W=281.05319 96557008,M=359.7694035685469,EQ UINOX=J2000,EPOCH=07-NOV-2016:00:00:00,EpochTimeScale=TDB				EARTH

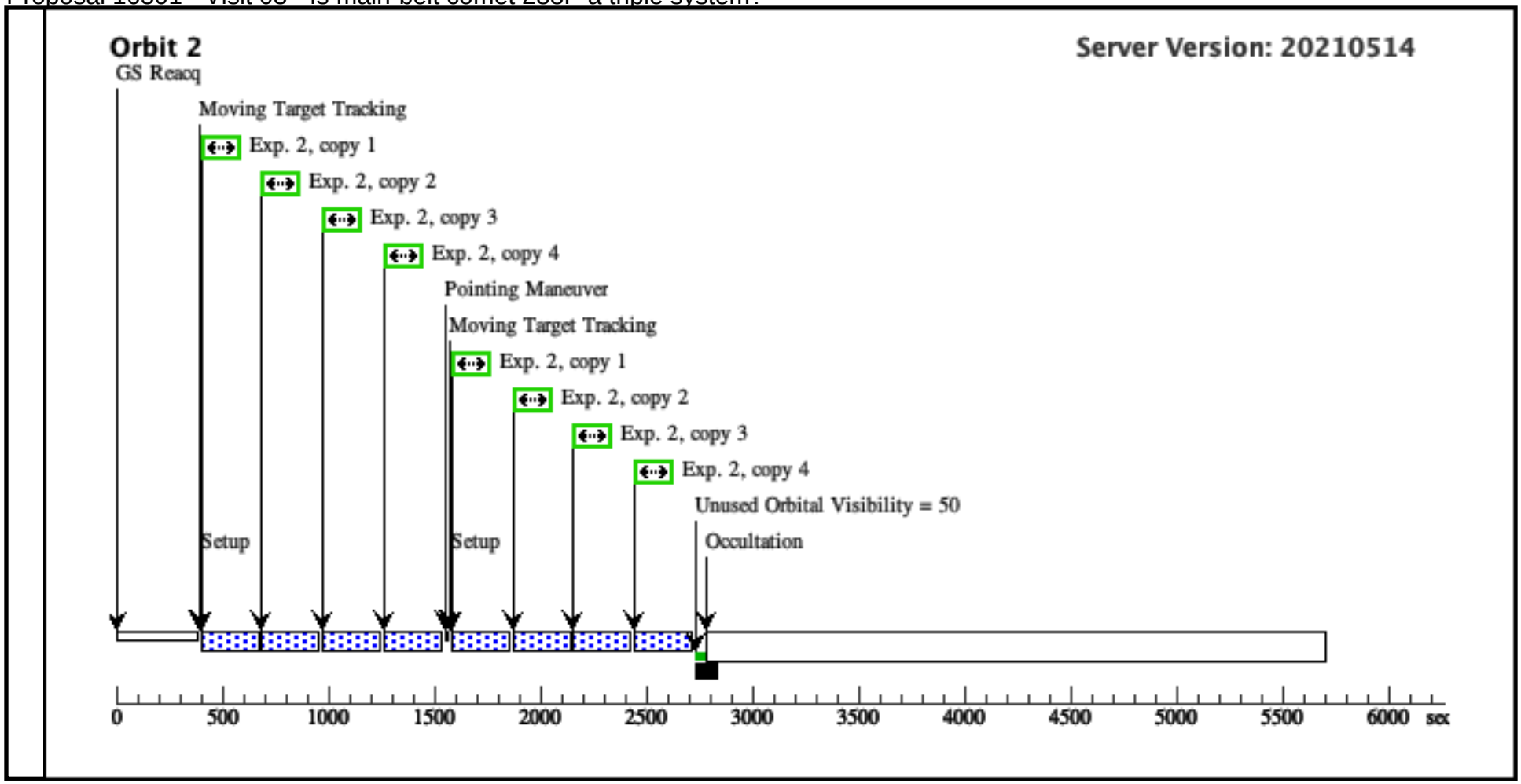
Comments: Description=binary asteroid
Extended=NO

Exposures

#	Label	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time (Total)/[Actual Dur.]	Orbit
1		(2) 288P-UPDATE3	WFC3/UVIS, ACCUM, UVIS2-C512C-SUB	F606W			Sequence 1-1 Non-Int in Visit 03 Pattern 1, Exps 1-1 in Sequence 1-1 Non-Int in Visit 03 (1)	237 Secs X 4 (1896 Secs) *[==>(Pattern 1, Copy 1)]* *[==>(Pattern 1, Copy 2)]* *[==>(Pattern 1, Copy 3)]* *[==>(Pattern 1, Copy 4)]* *[==>(Pattern 2, Copy 1)]* *[==>(Pattern 2, Copy 2)]* *[==>(Pattern 2, Copy 3)]* *[==>(Pattern 2, Copy 4)]*	***[1]***
2		(2) 288P-UPDATE3	WFC3/UVIS, ACCUM, UVIS2-C512C-SUB	F606W			Sequence 2-2 Non-Int in Visit 03 Pattern 1, Exps 2-2 in Sequence 2-2 Non-Int in Visit 03 (1)	237 Secs X 4 (1896 Secs) *[==>(Pattern 1, Copy 1)]* *[==>(Pattern 1, Copy 2)]* *[==>(Pattern 1, Copy 3)]* *[==>(Pattern 1, Copy 4)]* *[==>(Pattern 2, Copy 1)]* *[==>(Pattern 2, Copy 2)]* *[==>(Pattern 2, Copy 3)]* *[==>(Pattern 2, Copy 4)]*	***[2]***

Orbit Structure




Orbit 2
Server Version: 20210514
GS Reacq
Moving Target Tracking
Exp. 2, copy 1
Exp. 2, copy 2
Exp. 2, copy 3
Exp. 2, copy 4
Pointing Maneuver
Moving Target Tracking
Exp. 2, copy 1
Exp. 2, copy 2
Exp. 2, copy 3
Exp. 2, copy 4
Unused Orbital Visibility = 50
Setup
Setup
Occultation
0
500
1000
1500
2000
2500
3000
3500
4000
4500
5000
5500
6000
sec