16073 - Individual component shapes and rotation states in binary main-belt comet 288P

Cycle: 27, 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) 288P	WFC3/UVIS	2	09-Mar-2020 10:00:12.0	yes
02	(1) 288P	WFC3/UVIS	2	09-Mar-2020 10:00:13.0	yes
03	(1) 288P	WFC3/UVIS	2	09-Mar-2020 10:00:14.0	yes

6 Total Orbits Used

ABSTRACT

We request 6 orbits of HST/WFC3 in May 2020 measure the rotation periods, elongation and cross-sections of the components of binary main-belt comet 288P. This will allow us to provide constraints on the formation and evolution of this unusual binary system and for the first time to constrain the bulk density of a main-belt comet. The 288P system is special both because of its unusual orbital properties (wide semi-major axis combined with near-equal component size) and because it is the only confirmed solar system binary showing sublimation-driven activity. At present, it is not clear if such systems are indeed rare, or merely affected by a strong detection bias against them. To better judge this, it is mandatory to understand the formation and past evolution of the system, and a potential interrelation between the activity and the binary formation. To constrain binary formation and evolution models, an accurate knowledge of the masses, shapes and angular momenta of the components is required, which we seek to obtain by the proposed observations. These will allow us measure the individual brightness of the components for a significant fraction of the 16h rotation period reported for the more elongated component. HST is the only telescope able to spatially separate the two components (max. separation about 0.08 arcsec). We did not propose these observations at the time of the regular Cycle 27 deadline because then we had not yet found an orbit solution that would have enabled us to predict the times of maximum component separation with sufficient reliability.

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 about 0.08arcsec in 2020 May and have a combined brightness of about V=22mag. The target will be brightest (21.8mag) on May 04, maximising S/N. Hence an observation as close as possible in time to this date is desirable.

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 a small multiple of 16h (~48h) will also be acceptable. Hence the priorities for scheduling should be as follows:

1. All orbits should be scheduled within about 48h.
2. Scheduling should be as close in time as possible to May 04, but not before Apr-25 and not after May 31 to ensure maximum spatial component separation.
3. If two possible dates exist that have similar distance in time to May 04, the later one is preferable, because the spatial separation will be larger at comparable brightness.

Each visit consists of 8 exposures of 280s, using a 2-point linear dither pattern to mitigate bad pixels and the C515C 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.

The dither pattern and sub-frame are different from those outlined in the proposal, because we trade some comparability to existing date for increased S/N, which is most crucial to reach our science objectives.

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 >100deg, hence the enlarged solar exclusion zone will not pose a problem.

Visit

Proposal 16073, Visit 1 (01) Mon Mar 09 14:00:15 GMT 2020

Diagnostic Status: No Diagnostics

Scientific Instruments: WFC3/UVIS

Special Requirements: BETWEEN 27-APR-2020:00:00:00 AND 18-MAY-2020:00:00:00; GROUP 01,02,03 WITHIN 48H

Comments: The target will be brightest on May 04, hence scheduling as close to this date as possible would maximise S/N and science return.

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)

Solar System Targets

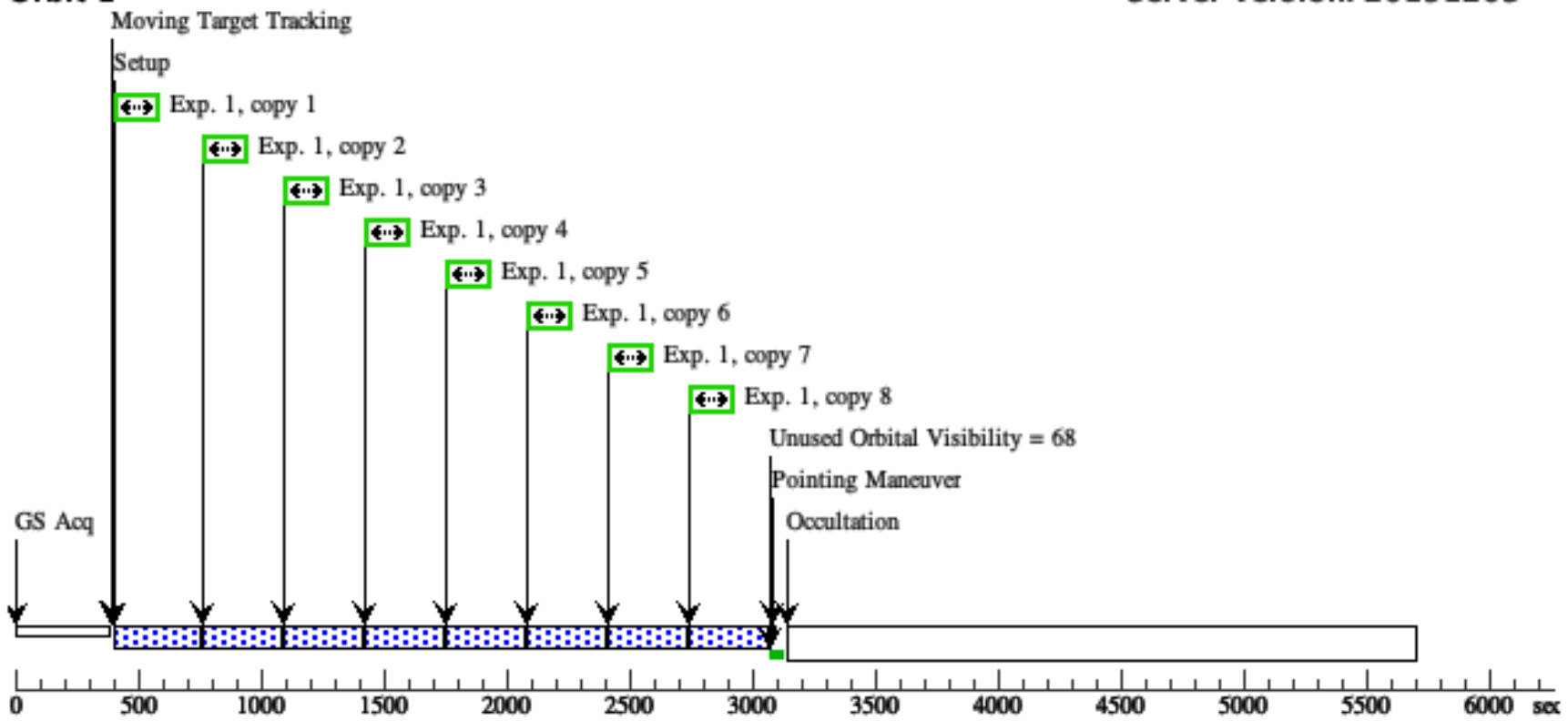
#	Name	Level 1	Level 2	Level 3	Window	Ephem Center
(1)	288P	TYPE=ASTEROID,A=3.04716762972 7458,E=0.2011952883437459,I=3.240 682641168021 ,O=83.19068811025544,W=281.25292 59614446,M=188.6246594824991,EQ UINOX=J2000,EPOCH=29-APR-2014:00:00:00,EpochTimeScale=TDB				EARTH

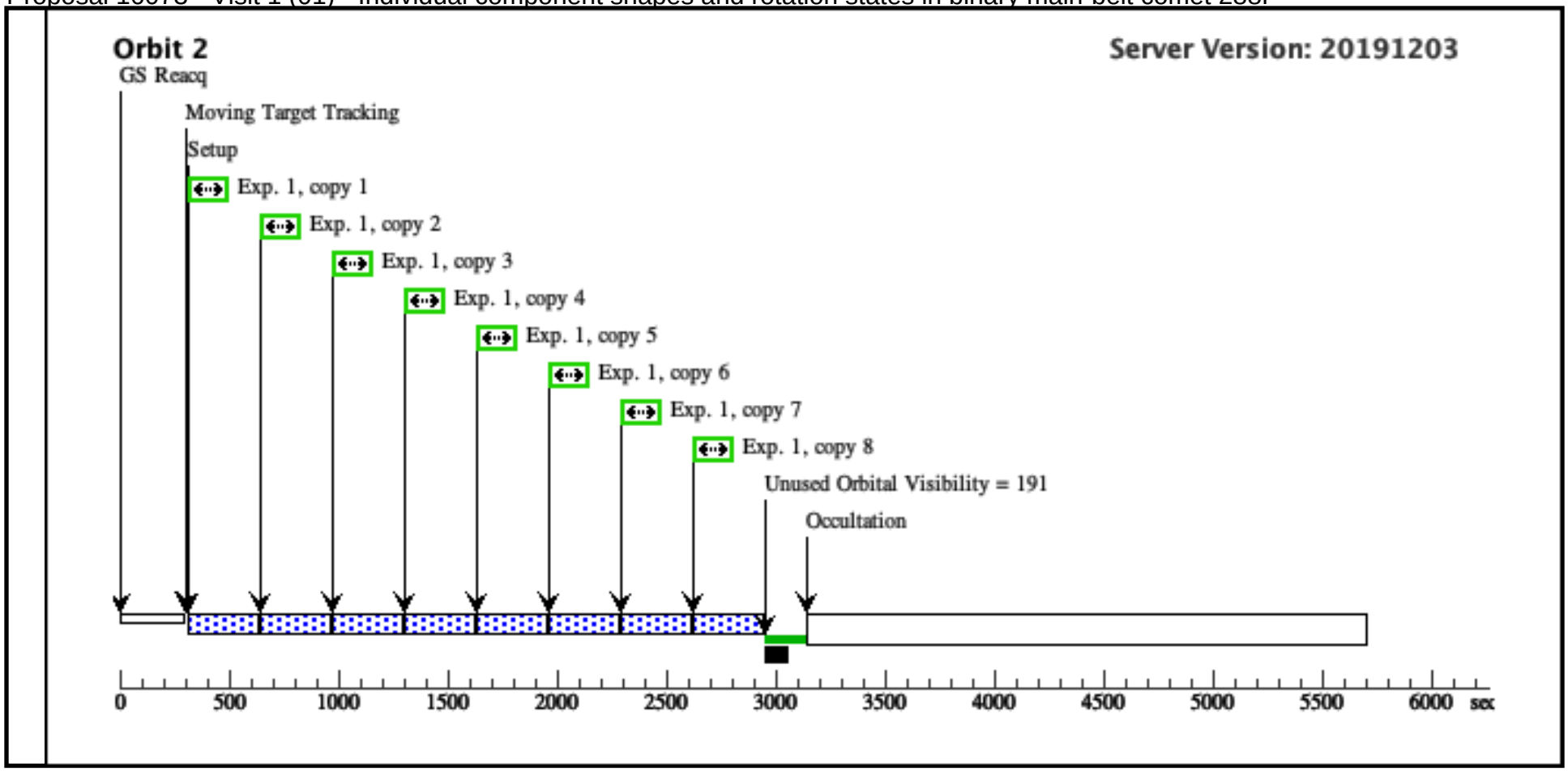
Comments: Description=Binary asteroid

Exposures

#	Label	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time (Total)/[Actual Dur.]	Orbit
1		(1) 288P	WFC3/UVIS, ACCUM, UVIS2-C512C-SUB	F606W			Pattern 1, Exps 1-1 in Visit 1 (01) (1)	280 Secs X 8 (4480 Secs)	
								[==>(Pattern 1, Copy 1)]	***[1]***
								[==>(Pattern 1, Copy 2)]	
								[==>(Pattern 1, Copy 3)]	
								[==>(Pattern 1, Copy 4)]	
								[==>(Pattern 1, Copy 5)]	
								[==>(Pattern 1, Copy 6)]	
								[==>(Pattern 1, Copy 7)]	
								[==>(Pattern 1, Copy 8)]	
								[==>(Pattern 2, Copy 1)]	***[2]***
								[==>(Pattern 2, Copy 2)]	
								[==>(Pattern 2, Copy 3)]	
								[==>(Pattern 2, Copy 4)]	
								[==>(Pattern 2, Copy 5)]	
								[==>(Pattern 2, Copy 6)]	
								[==>(Pattern 2, Copy 7)]	
								[==>(Pattern 2, Copy 8)]	

Orbit Structure




Orbit 2
Server Version: 20191203
GS Reacq
Moving Target Tracking
Setup
Exp. 1, copy 1
Exp. 1, copy 2
Exp. 1, copy 3
Exp. 1, copy 4
Exp. 1, copy 5
Exp. 1, copy 6
Exp. 1, copy 7
Exp. 1, copy 8
Unused Orbital Visibility = 191
Occultation
0
500
1000
1500
2000
2500
3000
3500
4000
4500
5000
5500
6000
sec

Visit

Proposal 16073, Visit 2 (02) Mon Mar 09 14:00:15 GMT 2020

Diagnostic Status: No Diagnostics

Scientific Instruments: WFC3/UVIS

Special Requirements: BETWEEN 27-APR-2020:00:00:00 AND 18-MAY-2020:00:00:00; GROUP 02,01,03 WITHIN 48H

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)

Solar System Targets

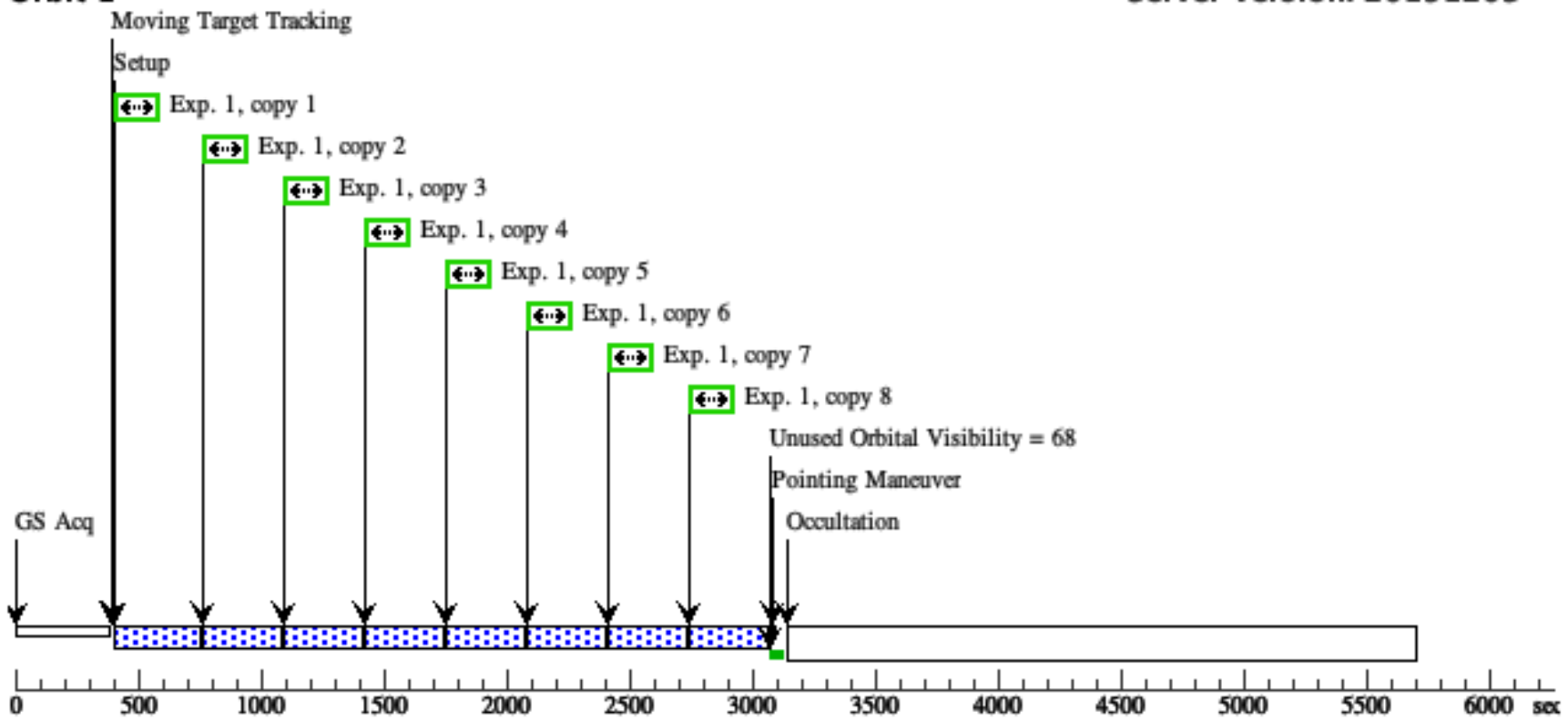
#	Name	Level 1	Level 2	Level 3	Window	Ephem Center
(1)	288P	TYPE=ASTEROID,A=3.04716762972 7458,E=0.2011952883437459,I=3.240 682641168021 ,O=83.19068811025544,W=281.25292 59614446,M=188.6246594824991,EQ UINOX=J2000,EPOCH=29-APR- 2014:00:00:00,EpochTimeScale=TDB				EARTH

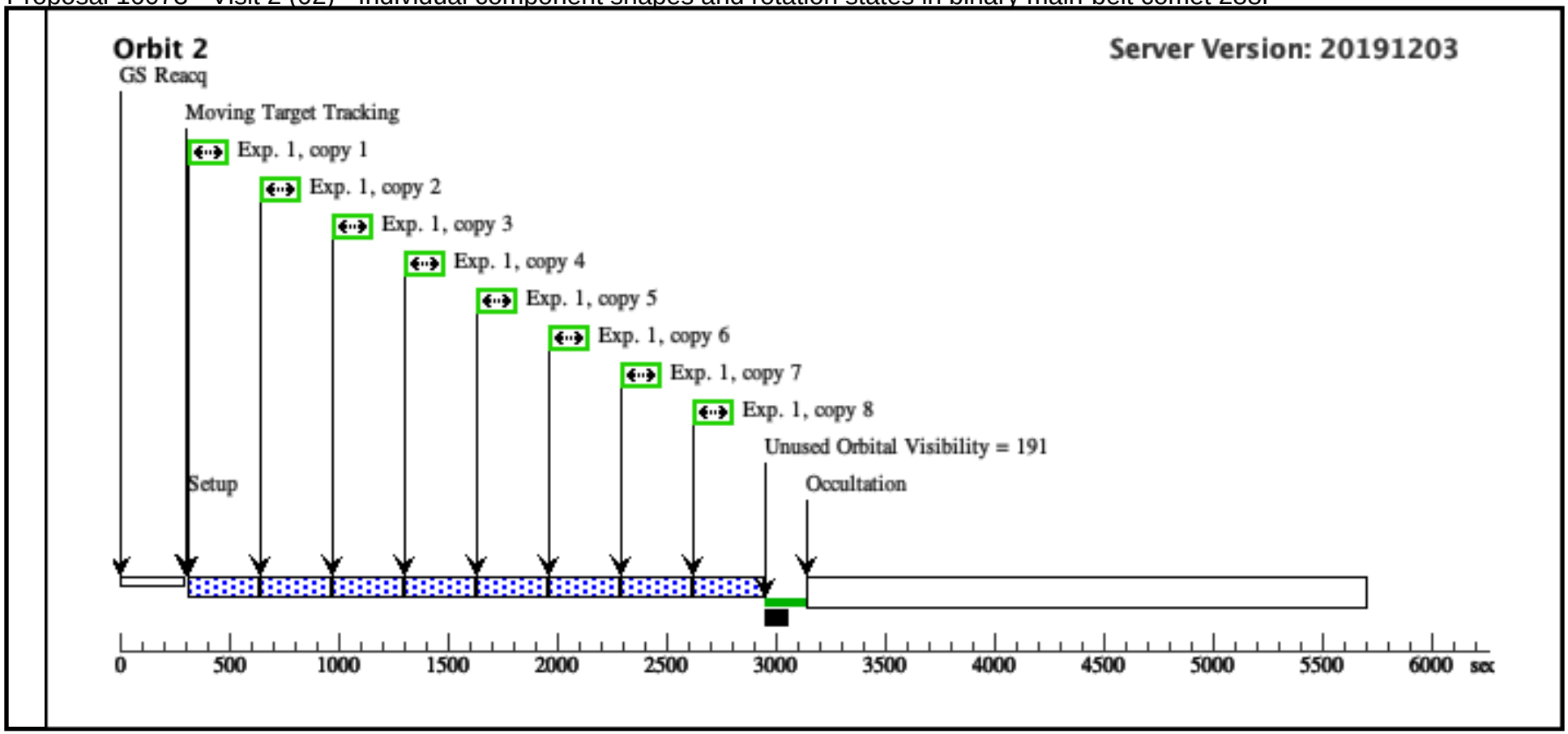
Comments: Description=Binary asteroid

Exposures

#	Label	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time (Total)/[Actual Dur.]	Orbit
1		(1) 288P	WFC3/UVIS, ACCUM, UVIS2-C512C-SUB	F606W			Pattern 1, Exps 1-1 in Visit 2 (02) (1)	280 Secs X 8 (4480 Secs)	
								[==>(Pattern 1, Copy 1)]	***[1]***
								[==>(Pattern 1, Copy 2)]	
								[==>(Pattern 1, Copy 3)]	
								[==>(Pattern 1, Copy 4)]	
								[==>(Pattern 1, Copy 5)]	
								[==>(Pattern 1, Copy 6)]	
								[==>(Pattern 1, Copy 7)]	
								[==>(Pattern 1, Copy 8)]	
								[==>(Pattern 2, Copy 1)]	***[2]***
								[==>(Pattern 2, Copy 2)]	
								[==>(Pattern 2, Copy 3)]	
								[==>(Pattern 2, Copy 4)]	
								[==>(Pattern 2, Copy 5)]	
								[==>(Pattern 2, Copy 6)]	
								[==>(Pattern 2, Copy 7)]	
								[==>(Pattern 2, Copy 8)]	

Orbit Structure




Orbit 2
Server Version: 20191203
GS Reacq
Moving Target Tracking
Exp. 1, copy 1
Exp. 1, copy 2
Exp. 1, copy 3
Exp. 1, copy 4
Exp. 1, copy 5
Exp. 1, copy 6
Exp. 1, copy 7
Exp. 1, copy 8
Unused Orbital Visibility = 191
Occultation
Setup
0
500
1000
1500
2000
2500
3000
3500
4000
4500
5000
5500
6000
sec

Visit

Proposal 16073, Visit 3 (03) Mon Mar 09 14:00:15 GMT 2020

Diagnostic Status: No Diagnostics

Scientific Instruments: WFC3/UVIS

Special Requirements: BETWEEN 27-APR-2020:00:00:00 AND 18-MAY-2020:00:00:00; GROUP 03,01,02 WITHIN 48H

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)

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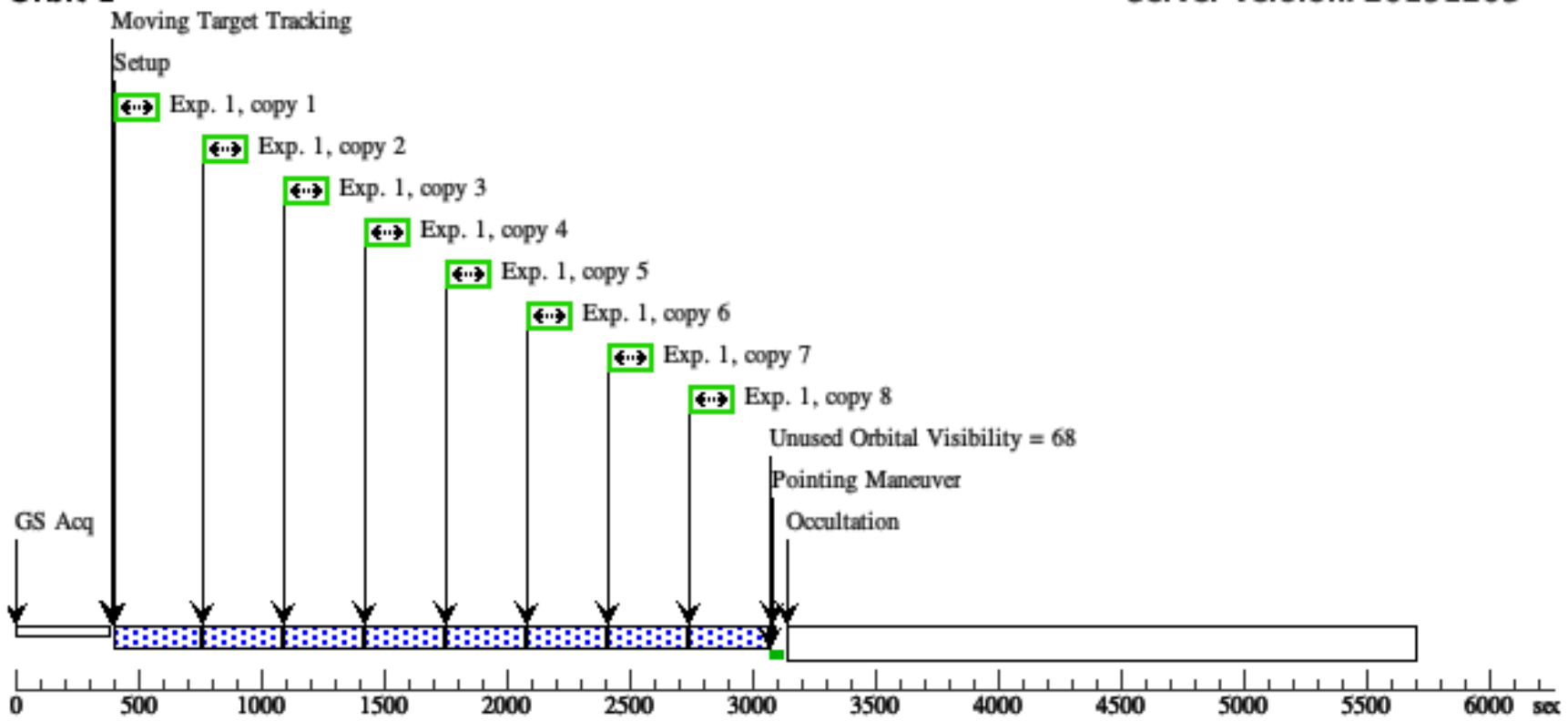
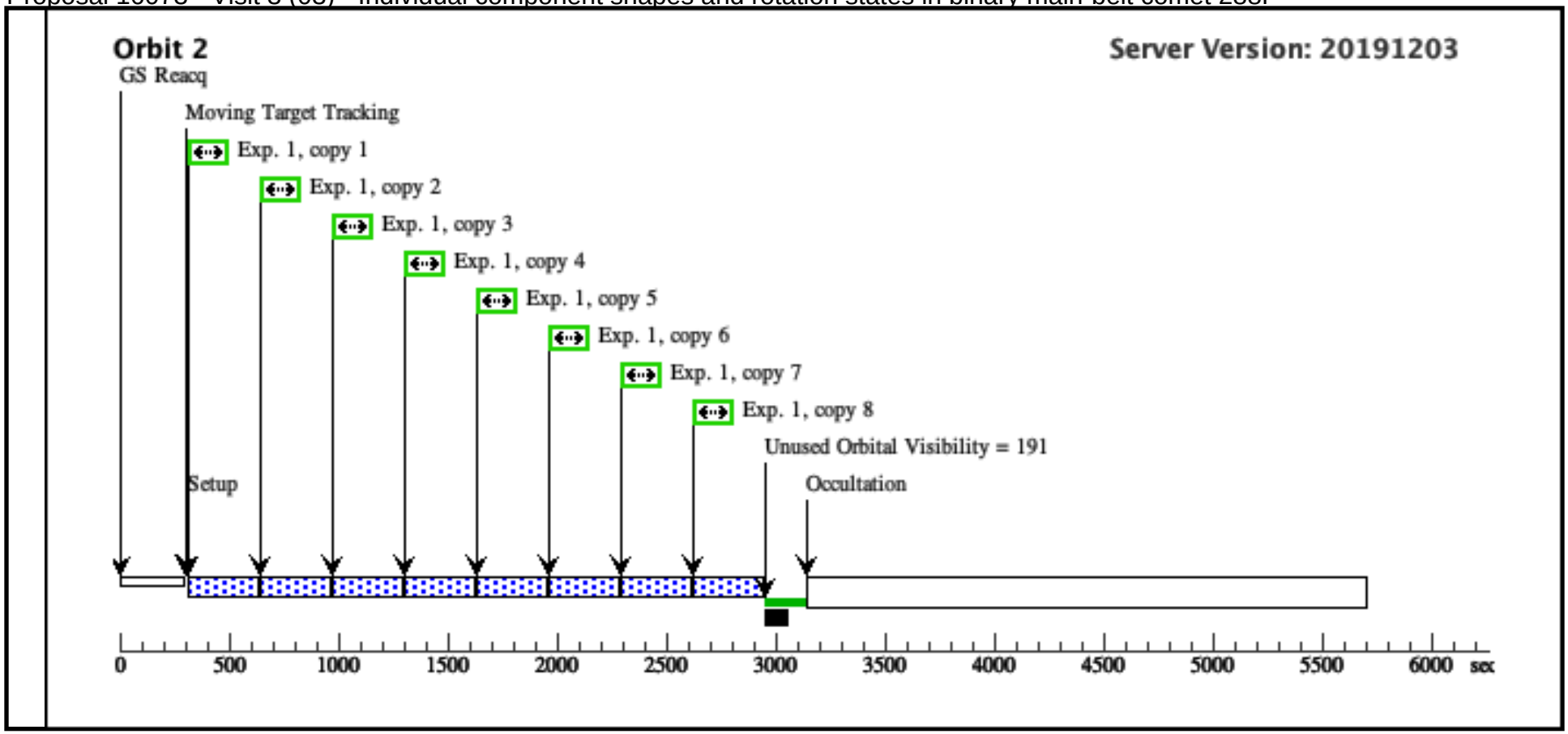
Comments: Description=Binary asteroid

Exposures

#	Label	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time (Total)/[Actual Dur.]	Orbit
1		(1) 288P	WFC3/UVIS, ACCUM, UVIS2-C512C-SUB	F606W			Pattern 1, Exps 1-1 in Visit 3 (03) (1)	280 Secs X 8 (4480 Secs)	
								[==>(Pattern 1, Copy 1)]	***[1]***
								[==>(Pattern 1, Copy 2)]	
								[==>(Pattern 1, Copy 3)]	
								[==>(Pattern 1, Copy 4)]	
								[==>(Pattern 1, Copy 5)]	
								[==>(Pattern 1, Copy 6)]	
								[==>(Pattern 1, Copy 7)]	
								[==>(Pattern 1, Copy 8)]	
								[==>(Pattern 2, Copy 1)]	***[2]***
								[==>(Pattern 2, Copy 2)]	
								[==>(Pattern 2, Copy 3)]	
								[==>(Pattern 2, Copy 4)]	
								[==>(Pattern 2, Copy 5)]	
								[==>(Pattern 2, Copy 6)]	
								[==>(Pattern 2, Copy 7)]	
								[==>(Pattern 2, Copy 8)]	

Orbit Structure




Orbit 2
Server Version: 20191203
GS Reacq
Moving Target Tracking
Exp. 1, copy 1
Exp. 1, copy 2
Exp. 1, copy 3
Exp. 1, copy 4
Exp. 1, copy 5
Exp. 1, copy 6
Exp. 1, copy 7
Exp. 1, copy 8
Unused Orbital Visibility = 191
Occultation
Setup
0
500
1000
1500
2000
2500
3000
3500
4000
4500
5000
5500
6000
sec