16463 - Active Asteroid P/2020 O1

Cycle: 28, 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) P2020-O1	WFC3/UVIS	1	06-Jul-2021 11:00:17.0	yes
02	(1) P2020-O1	WFC3/UVIS	1	06-Jul-2021 11:00:17.0	yes
03	(2) P2020-O1-V3	WFC3/UVIS	2	06-Jul-2021 11:00:18.0	yes
04	(2) P2020-O1-V3	WFC3/UVIS	1	06-Jul-2021 11:00:19.0	yes

5 Total Orbits Used

ABSTRACT

Exploratory observations of newly discovered active asteroid P/2020 O1 show evidence for protracted mass-loss and very low velocity ejection, consistent with prolonged sublimation of ice as the driving mechanism. We request mid-Cycle time in order to refine the analysis of P/2020 O1

using data from a variety of observational geometries, coupled with a sophisticated Monte Carlo dust dynamics model. Observations at high resolution and at a range of times and geometries are needed to definitively determine the mass loss mechanism. If water ice sublimation is confirmed, P/2020 O1 would be the icy asteroid with the smallest semimajor axis (highest temperature), setting new bounds on the distribution of ice in the asteroid belt.

OBSERVING DESCRIPTION

Our basic observing strategy is to take multiple long exposures (348 s) using WFC3 and a wide bandpass filter F350LP for maximum sensitivity. The F350LP filter provides a 1.6x higher count rate for a target with a solar-type spectrum, so we plan to use it. We also plan to dither the exposures to mitigate the effects from bad pixels, cosmic rays, and the inter-chip gap. The apparent rates of motion are easily within Hubbles tracking capabilities. These rates are also slow enough to keep a single pair of guide stars within the FGS pickles for an entire visibility window. The current 1-sigma ephemeris uncertainty of P/2020 O1 is about 4 arcsec and grows with time. However, we will improve the ephemeris iteratively, with each successive visit refining the orbit to get ready for the next. As a result, ephemeris errors will be negligible compared to the WFC3 field-of-view of 162 x 162 arcsec, so that ephemeris issues are of no concern to this observation. We understand that we may have essentially no control over the spacecraft roll angle, which means we will not be able to optimize the orientation of the dust tail on the CCD (i.e., to orient the tail along the longest dimension of the detector). However, the field-of-view of the camera is large enough that we should obtain excellent data on a portion of the tail, no matter what spacecraft roll angle is used. We request 5 orbits to characterize the progression of activity in P/2020 O1. The temporal distribution of the orbits is determined in part by the movement of the target into the 54 degree 4 Sun-exclusion zone of HST and in part by the changing heliocentric distance of the object. Visit 1 is one orbit as early as possible in late November/early December, to bridge the gap from the last observations in September. Visit 2 is one orbit late in 2020 December, close to the entry of P/2020 O1 into the Sun-exclusion zone on UT December 25. The heliocentric distance will be about 2.50 AU and the angle of the Earth above the orbital plane is near the maximum 1.9 degrees, providing the best perspective on the spatial distribution of dust and strong leverage for the dust dynamics models. Visit 3 is one orbit in 2021 July, as close as possible to the emergence of P/2020 O1 from the Sun-exclusion zone on UT 2021 July 6. The heliocentric distance is 2.75 AU and the angle from the orbit plane -1.6 degrees, again providing strong constraint on the dust models. Visit 4 is one orbit in 2021 August, about one month following Visit 3. Visit 5 is one orbit in 2021 September, about one month following Visit 4. With heliocentric distance 2.80 AU, we will sample the target similar to its 2.96 AU aphelion from an out-of-plane angle 0 degrees. Depending on the status of the activity, this is likely to provide our best constraint on the bare nucleus. Visits 1 and 2, together with existing ToO observations from September, will provide coverage of the dust development over 4 months following the 2020 May perihelion. If P/2020 O1 continues to be active in 2021, then Visits 3, 4 and 5 will extend the sampling of the activity for a full year. If activity should shut down before the summer, these visits will sample the evolution of the largest particles already ejected, expected to

linger near the nucleus. These observations will provide powerful constraints on large particle ejection from P/2020 O1. Previously, large particles in comets have been studied mainly using thermal wavelengths, offering angular resolution 100 times poorer than HST. The dates of each visit are not critical at the level of a week to 10 days. The proposed scheduling will bridge the gap to observations to be proposed for Cycle 29.

Proposal 16463 - Visit 01 - Active Asteroid P/2020 O1

Visit

Proposal 16463, Visit 01, completed Tue Jul 06 15:00:19 GMT 2021

Diagnostic Status: Warning

Scientific Instruments: WFC3/UVIS

Special Requirements: BETWEEN 23-NOV-2020:06:00:00 AND 26-NOV-2020:12:00:00; BETWEEN 27-NOV-2020:00:00:00 AND 02-DEC-2020:00:00:00

Diagnostics

(Visit 01) Warning (Orbit Planner): ORBITAL VISIBILITY OVERRUN

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

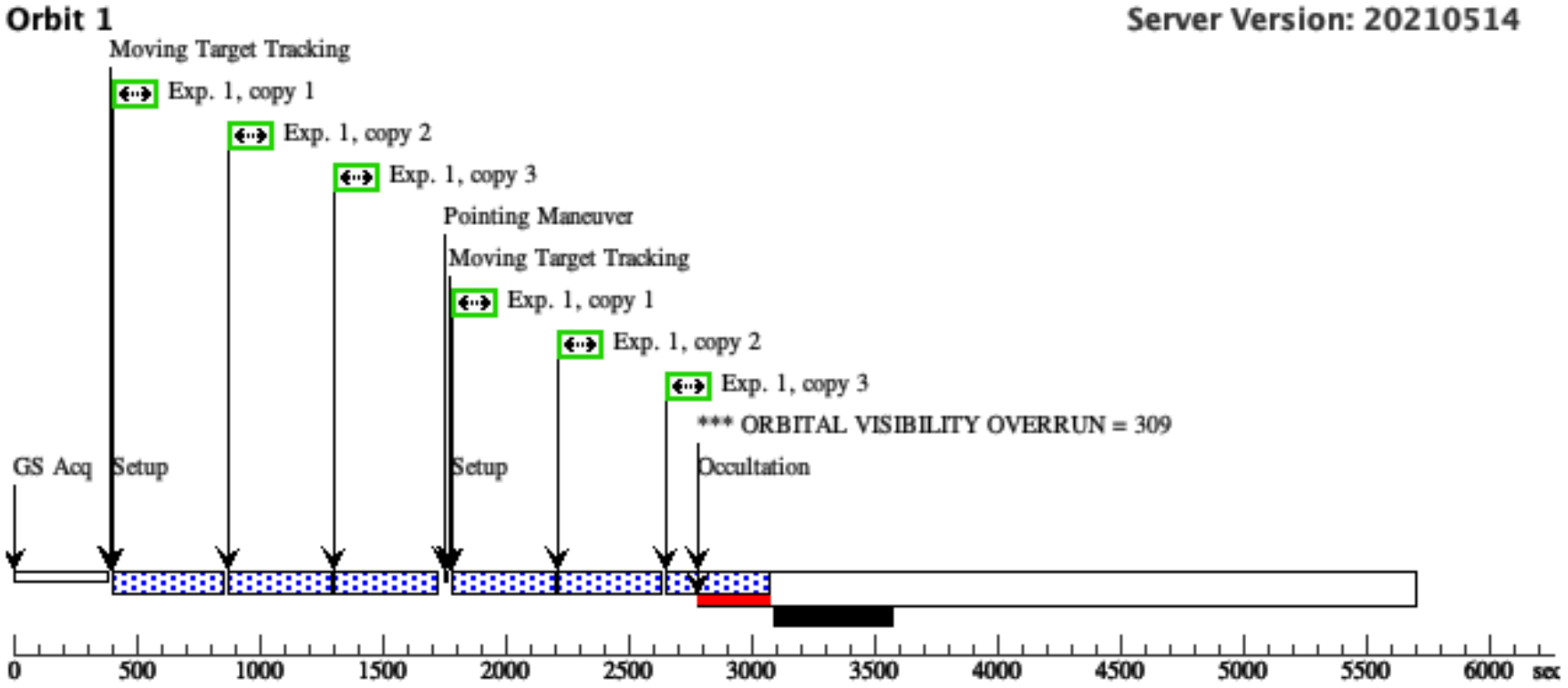
#	Name	Level 1	Level 2	Level 3	Window	Ephem Center
(1)	P2020-O1	TYPE=COMET,Q=2.329339261954623,E=0.1198591438297583,I=5.22346273219021,O=175.9889902558661,W=104.8273219832331,T=03-MAY-2020:18:25:03,TTimeScale=TDB,EQUINOX=J2000,EPOCH=28-JUL-2020:00:00:00,EpochTimeScale=TDB				EARTH

Comments: Description=active asteroid
Extended=YES

Exposures

#	Label	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time (Total)/[Actual Dur.]	Orbit
1		(1) P2020-O1	WFC3/UVIS, ACCUM, UVIS2-2K2C-SUB	F350LP			Sequence 1-1 Non-Int in Visit 01 Pattern 1, Exps 1-1 in Sequence 1-1 Non-Int in Visit 01 (1)	260 Secs X 3 (1560 Secs) *[==>(Pattern 1, Copy 1)]* *[==>(Pattern 1, Copy 2)]* *[==>(Pattern 1, Copy 3)]* *[==>(Pattern 2, Copy 1)]* *[==>(Pattern 2, Copy 2)]* *[==>(Pattern 2, Copy 3)]*	***[1]***

Orbit Structure



Visit

Proposal 16463, Visit 02, completed Tue Jul 06 15:00:20 GMT 2021

Diagnostic Status: Warning

Scientific Instruments: WFC3/UVIS

Special Requirements: BETWEEN 21-DEC-2020:00:00:00 AND 28-DEC-2020:00:00:00

Diagnostics

(Visit 02) Warning (Orbit Planner): ORBITAL VISIBILITY OVERRUN

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

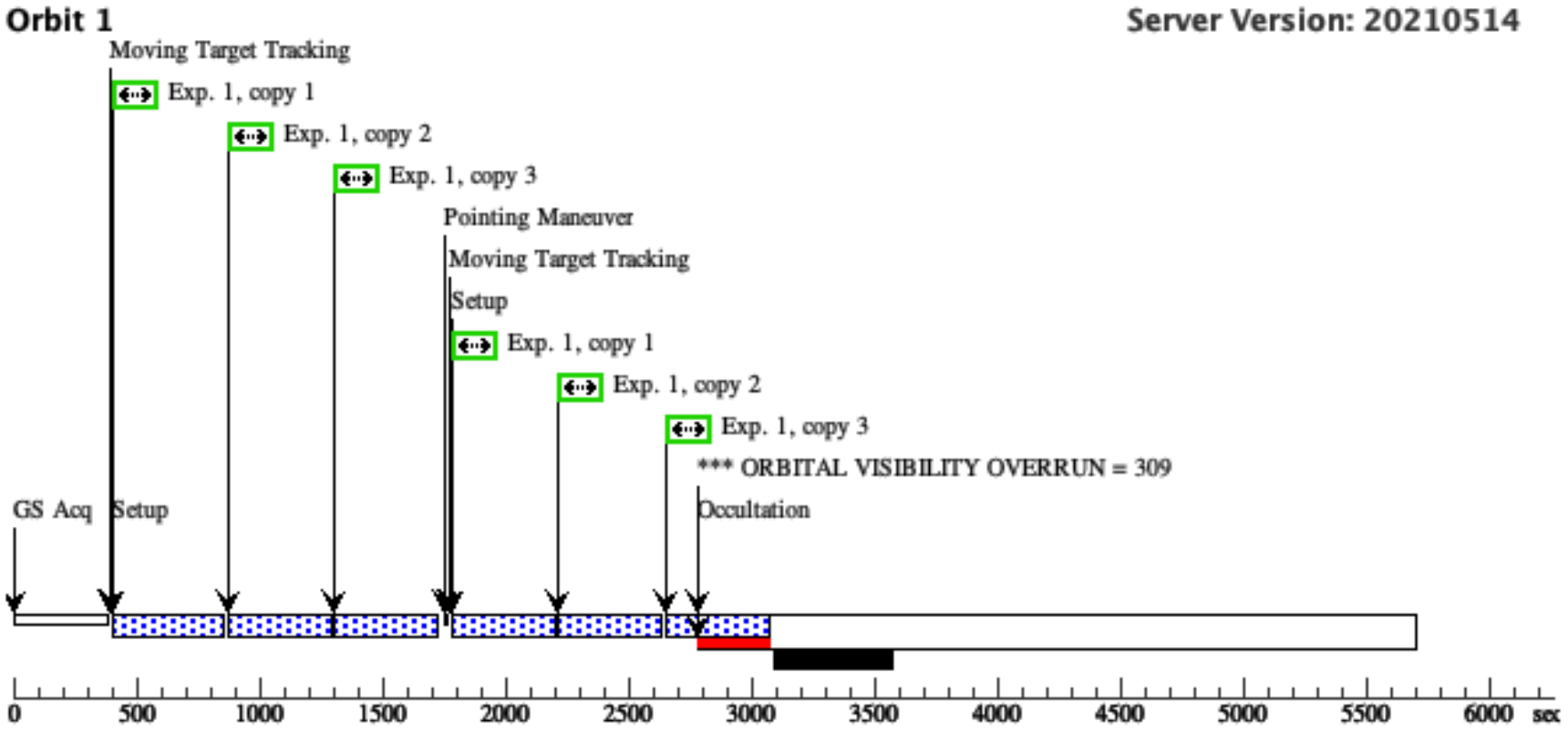
#	Name	Level 1	Level 2	Level 3	Window	Ephem Center
(1)	P2020-O1	TYPE=COMET,Q=2.329339261954623,E=0.1198591438297583,I=5.22346273219021,O=175.9889902558661,W=104.8273219832331,T=03-MAY-2020:18:25:03,TTimeScale=TDB,EQUINOX=J2000,EPOCH=28-JUL-2020:00:00:00,EpochTimeScale=TDB				EARTH

Comments: Description=active asteroid
Extended=YES

Exposures

#	Label	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time (Total)/[Actual Dur.]	Orbit
1		(1) P2020-O1	WFC3/UVIS, ACCUM, UVIS2-2K2C-SUB	F350LP			Sequence 1-1 Non-Int in Visit 02 Pattern 1, Exps 1-1 in Sequence 1-1 Non-Int in Visit 02 (1)	260 Secs X 3 (1560 Secs) *[==>(Pattern 1, Copy 1)]* *[==>(Pattern 1, Copy 2)]* *[==>(Pattern 1, Copy 3)]* *[==>(Pattern 2, Copy 1)]* *[==>(Pattern 2, Copy 2)]* *[==>(Pattern 2, Copy 3)]*	***[1]***

Orbit Structure



Visit

Proposal 16463, Visit 03, implementation Tue Jul 06 15:00:20 GMT 2021

Diagnostic Status: Warning

Scientific Instruments: WFC3/UVIS

Special Requirements: BETWEEN 07-JUL-2021:06:00:00 AND 23-JUL-2021:03:00:00; BETWEEN 23-JUL-2021:17:30:00 AND 26-JUL-2021:00:00:00

Diagnostics

(Visit 03) Warning (Orbit Planner): ORBITAL VISIBILITY OVERRUN

(Visit 03) Warning (Orbit Planner): ORBITAL VISIBILITY OVERRUN

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

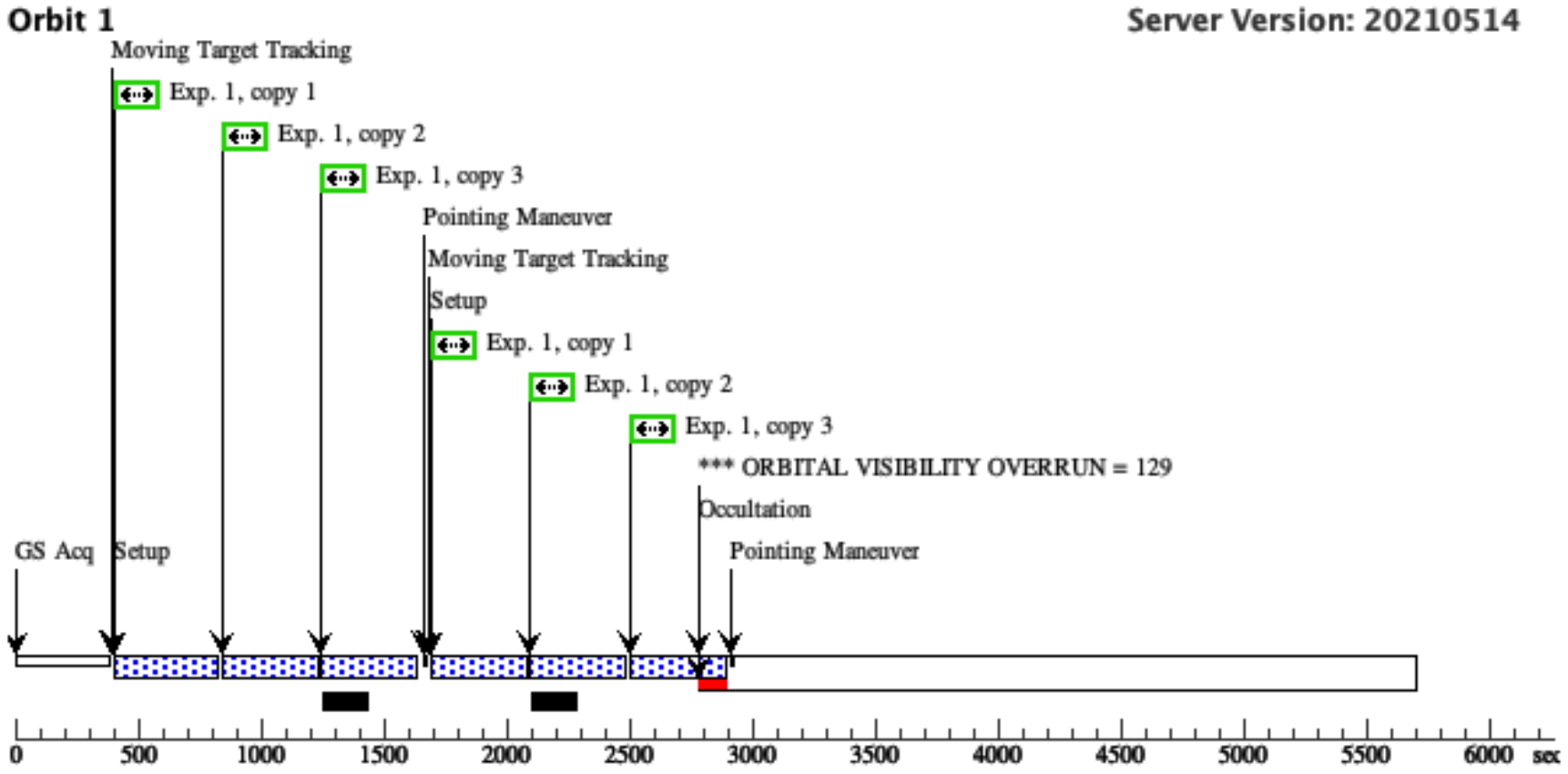
#	Name	Level 1	Level 2	Level 3	Window	Ephem Center
(2)	P2020-O1-V3	TYPE=COMET,Q=2.329334434263673,E=0.1198571503419016,I=5.223476693804598,O=175.9886843766403,W=104.827482351413,T=03-MAY-2020:18:24:37,TTimeScale=TDB,EQUINOX=J2000,EPOCH=29-JUL-2020:00:00:00,EpochTimeScale=TDB				EARTH

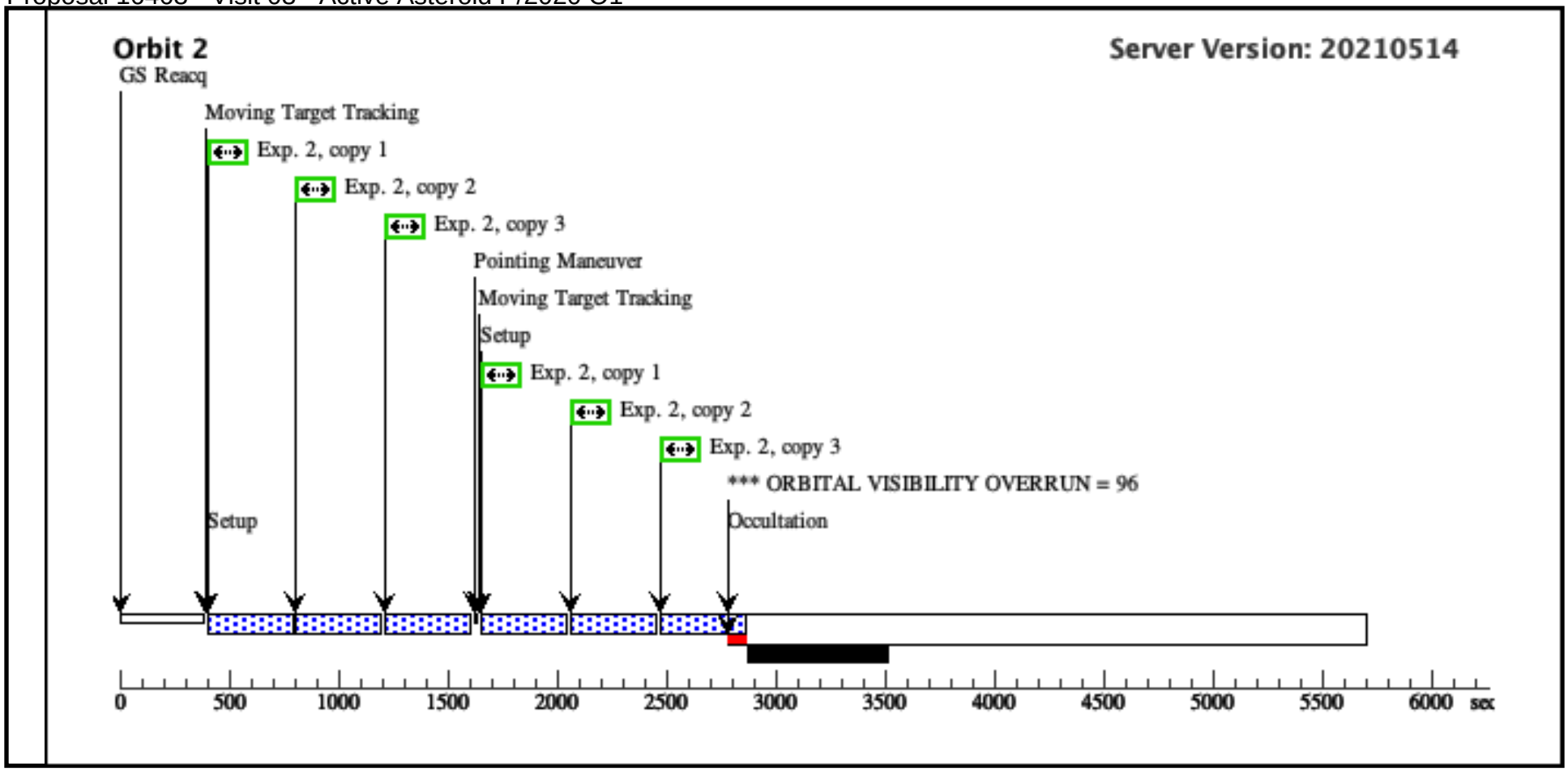
Comments: Description=active asteroid
Extended=YES

Exposures

#	Label	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time (Total)/[Actual Dur.]	Orbit
1		(2) P2020-O1-V3	WFC3/UVIS, ACCUM, UVIS2-2K2C-SUB	F350LP			Sequence 1-1 Non-Int in Visit 03 Pattern 1, Exps 1-1 in Sequence 1-1 Non-Int in Visit 03 (1)	230 Secs X 3 (1380 Secs) *[==>(Pattern 1, Copy 1)]* *[==>(Pattern 1, Copy 2)]* *[==>(Pattern 1, Copy 3)]* *[==>(Pattern 2, Copy 1)]* *[==>(Pattern 2, Copy 2)]* *[==>(Pattern 2, Copy 3)]*	***[1]***
2		(2) P2020-O1-V3	WFC3/UVIS, ACCUM, UVIS2-2K2C-SUB	F350LP			Sequence 2-2 Non-Int in Visit 03 Pattern 1, Exps 2-2 in Sequence 2-2 Non-Int in Visit 03 (1)	230 Secs X 3 (1380 Secs) *[==>(Pattern 1, Copy 1)]* *[==>(Pattern 1, Copy 2)]* *[==>(Pattern 1, Copy 3)]* *[==>(Pattern 2, Copy 1)]* *[==>(Pattern 2, Copy 2)]* *[==>(Pattern 2, Copy 3)]*	***[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
Pointing Maneuver
Moving Target Tracking
Setup
Exp. 2, copy 1
Exp. 2, copy 2
Exp. 2, copy 3
*** ORBITAL VISIBILITY OVERRUN = 96
Occultation
Setup
0
500
1000
1500
2000
2500
3000
3500
4000
4500
5000
5500
6000
sec

Visit

Proposal 16463, Visit 04, implementation Tue Jul 06 15:00:20 GMT 2021

Diagnostic Status: Warning

Scientific Instruments: WFC3/UVIS

Special Requirements: BETWEEN 19-JUL-2021:00:00:00 AND 23-JUL-2021:03:00:00; BETWEEN 23-JUL-2021:16:00:00 AND 26-JUL-2021:00:00:00; GROUP 04,03 WITHIN 2.5 Orbits

Diagnostics

(Visit 04) Warning (Orbit Planner): ORBITAL VISIBILITY OVERRUN

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
(2)	P2020-O1-V3	TYPE=COMET,Q=2.3293344342636 73,E=0.1198571503419016,I=5.22347 6693804598 ,O=175.9886843766403,W=104.82748 2351413,T=03-MAY-2020:18:24:37,TTimeScale=TDB,EQ UINOX=J2000,EPOCH=29-JUL-2020:00:00:00,EpochTimeScale=TDB				EARTH

Comments: Description=active asteroid
Extended=YES

Exposures

#	Label	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time (Total)/[Actual Dur.]	Orbit
1		(2) P2020-O1-V3	WFC3/UVIS, ACCUM, UVIS2-2K2C-SUB	F350LP			Sequence 1-1 Non-Int in Visit 04 Pattern 1, Exps 1-1 in Sequence 1-1 Non-Int in Visit 04 (1)	230 Secs X 3 (1380 Secs) *[==>(Pattern 1, Copy 1)]* *[==>(Pattern 1, Copy 2)]* *[==>(Pattern 1, Copy 3)]* *[==>(Pattern 2, Copy 1)]* *[==>(Pattern 2, Copy 2)]* *[==>(Pattern 2, Copy 3)]*	***[1]***

Orbit Structure