14498 - Comet P/2010 V1 as a Natural Disintegration Laboratory

Cycle: 23, 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) P2010-V-C-OFFSET	WFC3/UVIS	1	24-Mar-2016 21:12:35.0	yes
02	(1) P2010-V-C-OFFSET	WFC3/UVIS	1	24-Mar-2016 21:12:36.0	yes
03	(1) P2010-V-C-OFFSET	WFC3/UVIS	1	24-Mar-2016 21:12:37.0	yes
04	(1) P2010-V-C-OFFSET	WFC3/UVIS	1	24-Mar-2016 21:12:38.0	yes
05	(1) P2010-V-C-OFFSET	WFC3/UVIS	1	24-Mar-2016 21:12:39.0	yes

5 Total Orbits Used

ABSTRACT

We propose mid-cycle observations of short-period comet P/2010 V1, currently undergoing a spectacular disintegration. Observations already obtained under GO 14474 reveal multiple fragments undergoing rapid evolution, and motivate the additinal high resolution, time-resolved images proposed here. Science objectives are to determine the nature and cause of the breakup by studying the dynamics, and the photometric and morphological evolution of this body. Results will provide key constraints on existing breakup and disintegration models. Our HST data will constitute by far the best observational dataset ever obtained, with unprecedented spatial and temporal resolution.

OBSERVING DESCRIPTION

Our basic observing strategy is to take multiple long exposures (348-400 sec) using WFC3 and a wide bandpass filter (F350LP) for maximum sensitivity. We use F350LP because experience in previous HST programs shows that the F350LP count rate is 1.6 times higher for a target with a solar-type spectrum than other commonly used broadband filters (e.g. F606W). We also plan to dither the exposures to mitigate the effects from bad pixels, cosmic rays, and the inter-chip gap. The WFC3 Exposure Time Calculator indicates that, for a point source, solar-type spectrum, a signal-to-noise ratio of 6 is reached in 348 s at V = 26.5 in the F350LP filter (ETC request ID WFC3UVIS.im.765972; optimal extraction yields SNR=13). For example, on UT 2016 March 24, when heliocentric distance R = 1.57 AU, geocentric distance 0.78 AU and phase angle 31 deg, magnitude V = 26.5 corresponds to an object radius 30 m (geometric albedo 0.04 and C-type asteroid phase function assumed). These are upper limits to the point source thresholds because at least some of the fragments are embedded in their own dust comae. However, it is clear that HST offers unprecedented sensitivity to faint fragments. Our observations have the following main objectives, both of which build upon the unprecedented dataset we are acquiring under GO 14474. Five HST orbits, consecutive or as nearly consecutive as possible, will allow us to examine rotationally modulated brightness variations. Five orbits with HST will provide a timebase from which the best possible constraints on the importance of rotation can be obtained. The apparent rates of motion relative to sidereal are easily within Hubble|'s tracking capabilities. The rate of motion is also slow enough to keep a single pair of guide stars within the FGS pickles for an entire visibility window. The ephemeris uncertainties on the main components of P/2010 V1 (e.g. A, B, C, D) are sub-arcsecond. We will position the field so that D and the fragement-rich field in Figure (2) are well-placed but, because of the increasing separation of the components, will have to sacrifice the western-most component A. We understand that we will have essentially no control over the spacecraft roll angle.

We request 5 mid-cycle orbits within the April 1-15 window. Under GO 14474 we have schedule HST observations on January 26-28, February 11-

13 and March 24. The March 24 observation is timed to coincide with the passage of Earth through the orbital plane of V1, providing a unique and projection-free determination of the out-of-plane velocity of the fragments, Unfortunately, because many fragments are likely aligned very closely with the plane, we expect substantial overlap and confusion with dust on this date and, for many fragments, the best astrometry will come only from the 2-week timebase separating the January and Febuary observations.

Visit

Proposal 14498, Visit 01

Fri Mar 25 01:12:41 GMT 2016

Diagnostic Status: No Diagnostics

Scientific Instruments: WFC3/UVIS

Special Requirements: BETWEEN 01-APR-2016:00:00:00 AND 14-APR-2016:00:00:00; SEQ 01,02,03,04,05 WITHIN 1 D

Solar System Targets

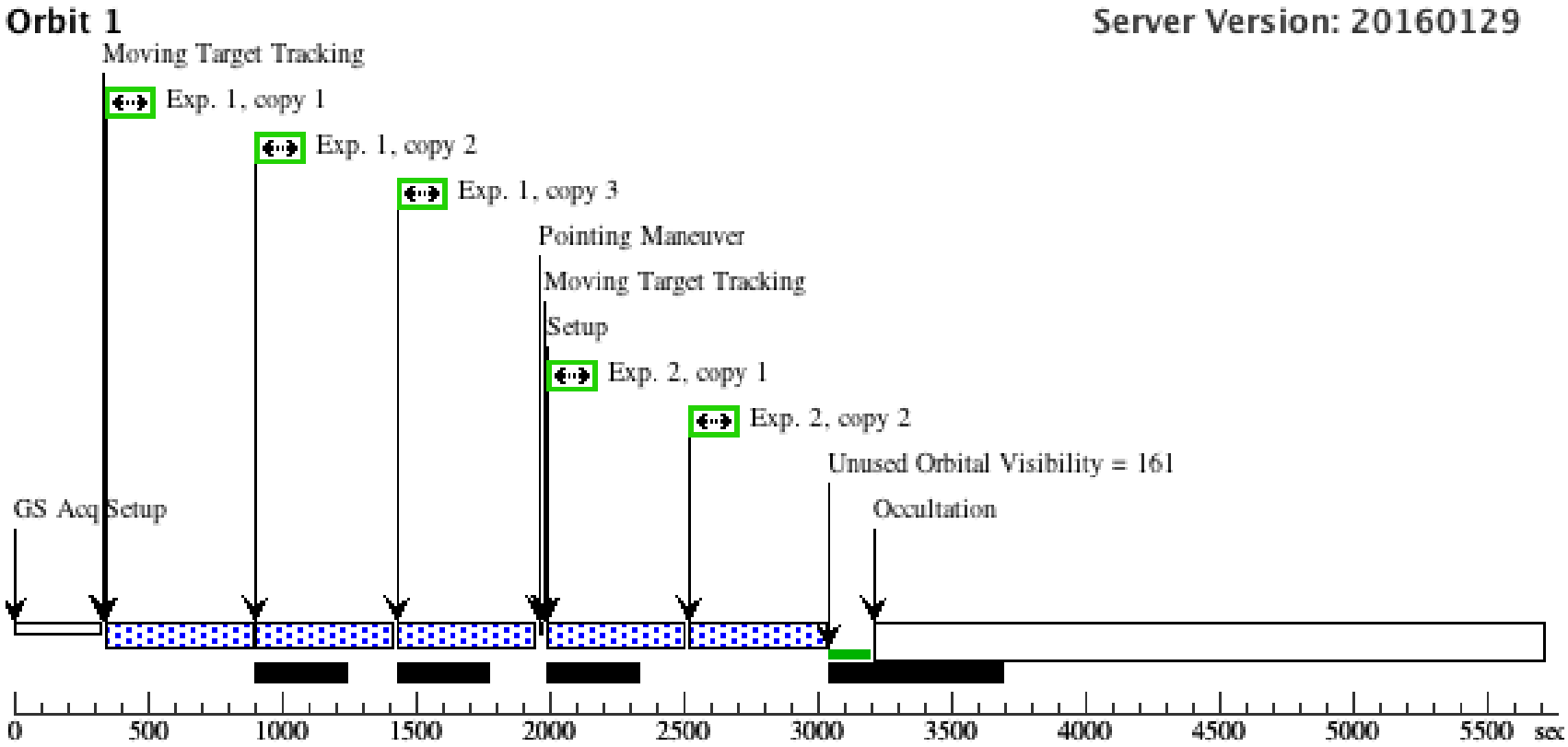
#	Name	Level 1	Level 2	Level 3	Window	Ephem Center
(1)	P2010-V-C-OFFSET	TYPE=COMET,Q=1.573112870680267E+00,E=4.905480395391478E-01,I=9.387268291468491E+00,O=3.782156311741634E+00,W=1.524172097988438E+02,T=17-MAR-2016:05:02:50,TTimeScale=TDB,EQUINOX=J2000,EPOCH=12-APR-2016:00:00:00,EpochTimeScale=TDB	TYPE=POS_ANGLE,RAD=64.8,ANG=289.8,REF=NORTH			EARTH

Comments: Extended=YES

Exposures

#	Label	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time (Total)/[Actual Dur.]	Orbit
1		(1) P2010-V-C-OFFSET	WFC3/UVIS, ACCUM, UVIS-CENTER	F350LP	CR-SPLIT=NO		Sequence 1-2 Non-Int in Visit 01	400 Secs X 3 (1200 Secs)	
								[==>(Copy 1)]	***[1]***
								[==>(Copy 2)]	
								[==>(Copy 3)]	
2		(1) P2010-V-C-OFFSET	WFC3/UVIS, ACCUM, UVIS-CENTER	F350LP	CR-SPLIT=NO	POS TARG 0.2,2.0	Sequence 1-2 Non-Int in Visit 01	400 Secs X 2 (800 Secs)	
								[==>(Copy 1)]	***[1]***
								[==>(Copy 2)]	

Orbit Structure



Visit

Proposal 14498, Visit 02

Fri Mar 25 01:12:41 GMT 2016

Diagnostic Status: No Diagnostics

Scientific Instruments: WFC3/UVIS

Special Requirements: BETWEEN 01-APR-2016:00:00:00 AND 14-APR-2016:00:00:00

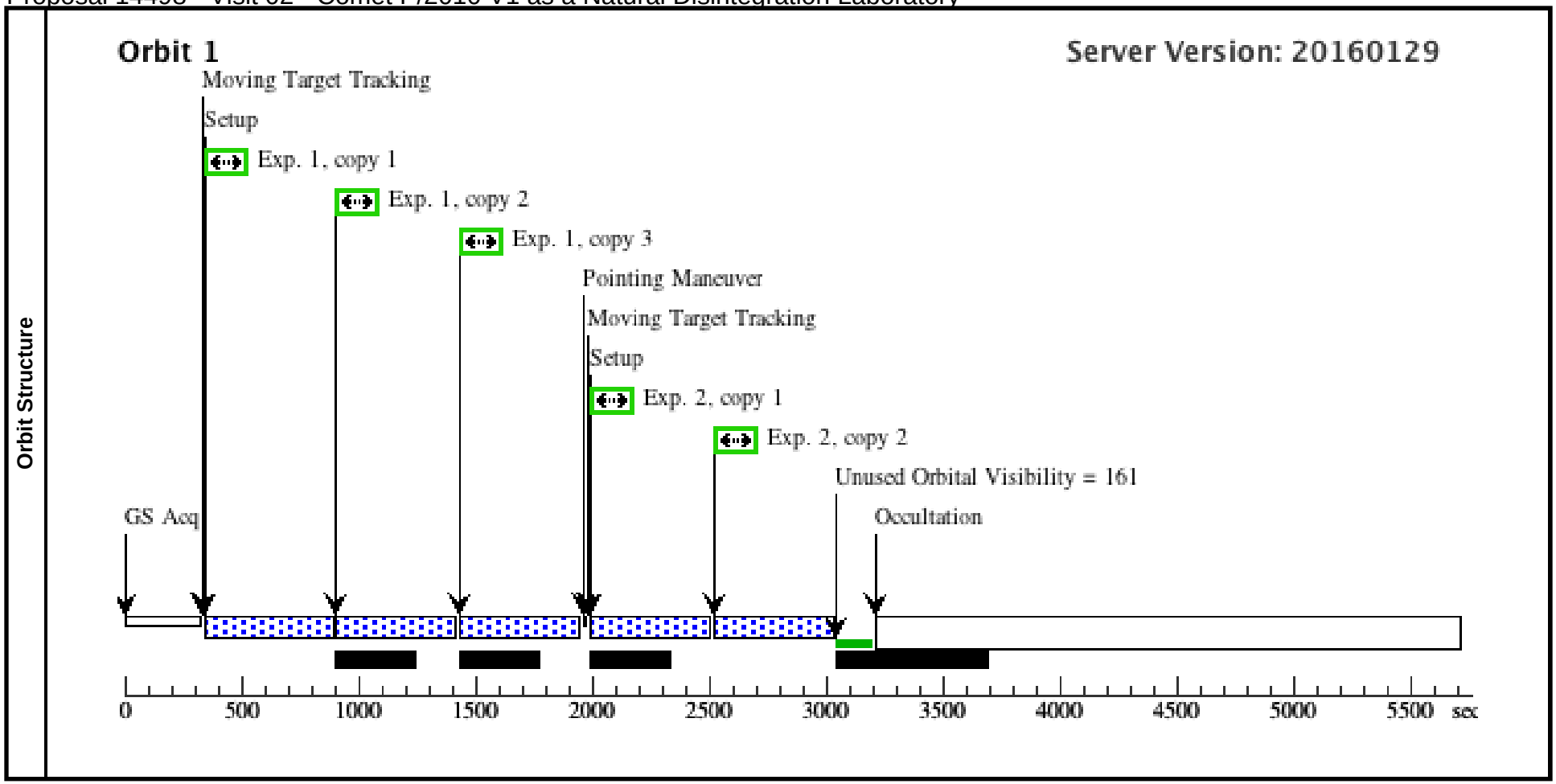
Solar System Targets

#	Name	Level 1	Level 2	Level 3	Window	Ephem Center
(1)	P2010-V-C-OFFSET	TYPE=COMET,Q=1.573112870680267E+00,E=4.905480395391478E-01,I=9.387268291468491E+00,O=3.782156311741634E+00,W=1.524172097988438E+02,T=17-MAR-2016:05:02:50,TTimeScale=TDB,EQUINOX=J2000,EPOCH=12-APR-2016:00:00:00,EpochTimeScale=TDB	TYPE=POS_ANGLE,RAD=64.8,ANG=289.8,REF=NORTH			EARTH

Comments: Extended=YES

Exposures

#	Label	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time (Total)/[Actual Dur.]	Orbit
1		(1) P2010-V-C-OFFSET	WFC3/UVIS, ACCUM, UVIS-CENTER	F350LP	CR-SPLIT=NO		Sequence 1-2 Non-Int in Visit 02	400 Secs X 3 (1200 Secs)	
								[==>(Copy 1)]	***[1]***
								[==>(Copy 2)]	
								[==>(Copy 3)]	
2		(1) P2010-V-C-OFFSET	WFC3/UVIS, ACCUM, UVIS-CENTER	F350LP	CR-SPLIT=NO	POS TARG 0.2,2.0	Sequence 1-2 Non-Int in Visit 02	400 Secs X 2 (800 Secs)	
								[==>(Copy 1)]	***[1]***
								[==>(Copy 2)]	


Orbit Structure
Orbit 1
Server Version: 20160129
Moving Target Tracking
Setup
Exp. 1, copy 1
Exp. 1, copy 2
Exp. 1, copy 3
Pointing Maneuver
Moving Target Tracking
Setup
Exp. 2, copy 1
Exp. 2, copy 2
Unused Orbital Visibility = 161
GS Acq
Occultation
0
500
1000
1500
2000
2500
3000
3500
4000
4500
5000
5500
sec

Visit

Proposal 14498, Visit 03

Fri Mar 25 01:12:41 GMT 2016

Diagnostic Status: No Diagnostics

Scientific Instruments: WFC3/UVIS

Special Requirements: BETWEEN 01-APR-2016:00:00:00 AND 14-APR-2016:00:00:00

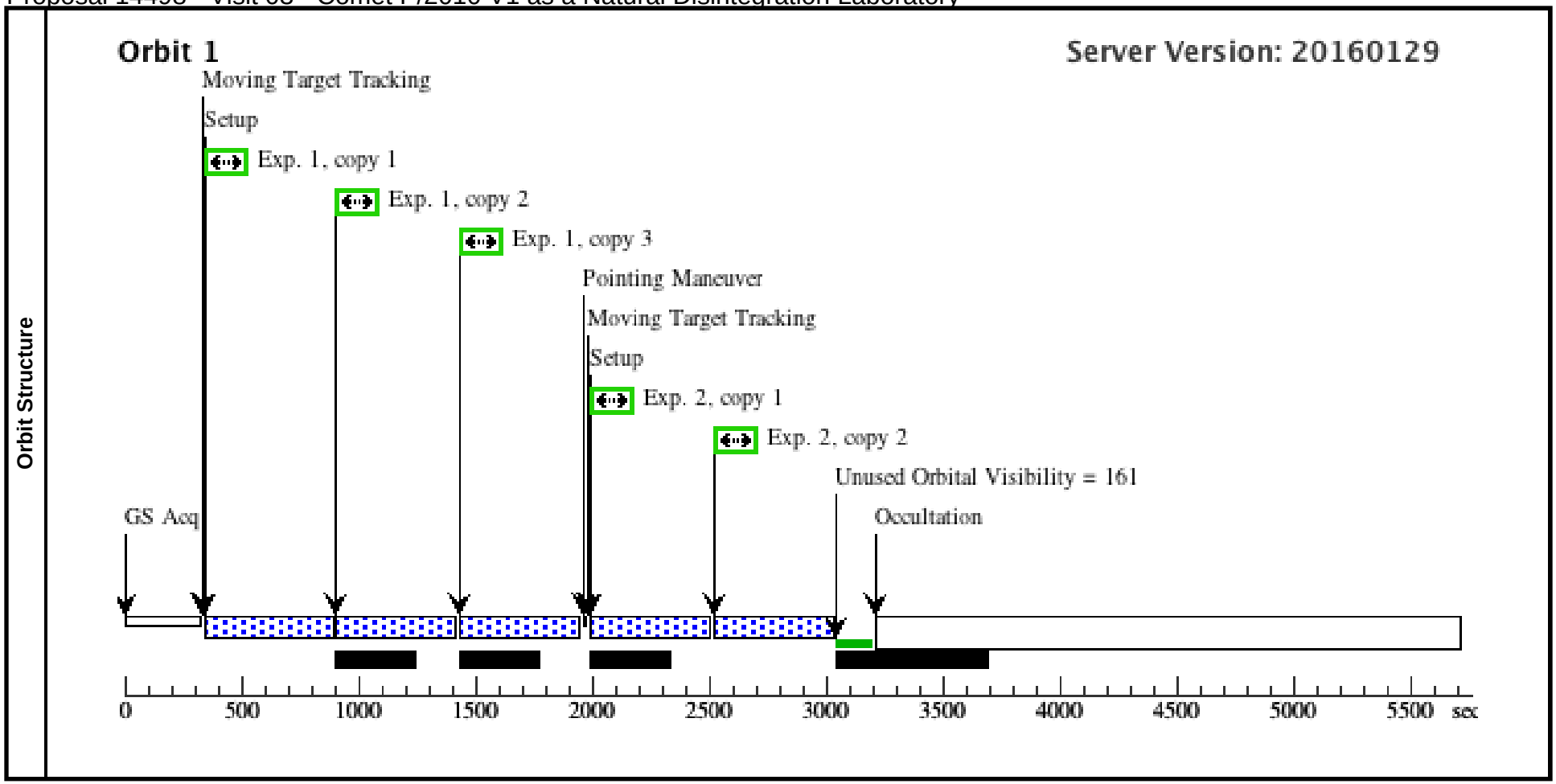
Solar System Targets

#	Name	Level 1	Level 2	Level 3	Window	Ephem Center
(1)	P2010-V-C-OFFSET	TYPE=COMET,Q=1.573112870680267E+00,E=4.905480395391478E-01,I=9.387268291468491E+00,O=3.782156311741634E+00,W=1.524172097988438E+02,T=17-MAR-2016:05:02:50,TTimeScale=TDB,EQUINOX=J2000,EPOCH=12-APR-2016:00:00:00,EpochTimeScale=TDB	TYPE=POS_ANGLE,RAD=64.8,ANG=289.8,REF=NORTH			EARTH

Comments: Extended=YES

Exposures

#	Label	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time (Total)/[Actual Dur.]	Orbit
1		(1) P2010-V-C-OFFSET	WFC3/UVIS, ACCUM, UVIS-CENTER	F350LP	CR-SPLIT=NO		Sequence 1-2 Non-Int in Visit 03	400 Secs X 3 (1200 Secs)	
								[==>(Copy 1)]	***[1]***
								[==>(Copy 2)]	
								[==>(Copy 3)]	
2		(1) P2010-V-C-OFFSET	WFC3/UVIS, ACCUM, UVIS-CENTER	F350LP	CR-SPLIT=NO	POS TARG 0.2,2.0	Sequence 1-2 Non-Int in Visit 03	400 Secs X 2 (800 Secs)	
								[==>(Copy 1)]	***[1]***
								[==>(Copy 2)]	


Orbit Structure
Orbit 1
Server Version: 20160129
Moving Target Tracking
Setup
Exp. 1, copy 1
Exp. 1, copy 2
Exp. 1, copy 3
Pointing Maneuver
Moving Target Tracking
Setup
Exp. 2, copy 1
Exp. 2, copy 2
Unused Orbital Visibility = 161
GS Acq
Occultation
0
500
1000
1500
2000
2500
3000
3500
4000
4500
5000
5500
sec

Visit

Proposal 14498, Visit 04

Fri Mar 25 01:12:41 GMT 2016

Diagnostic Status: No Diagnostics

Scientific Instruments: WFC3/UVIS

Special Requirements: BETWEEN 01-APR-2016:00:00:00 AND 14-APR-2016:00:00:00

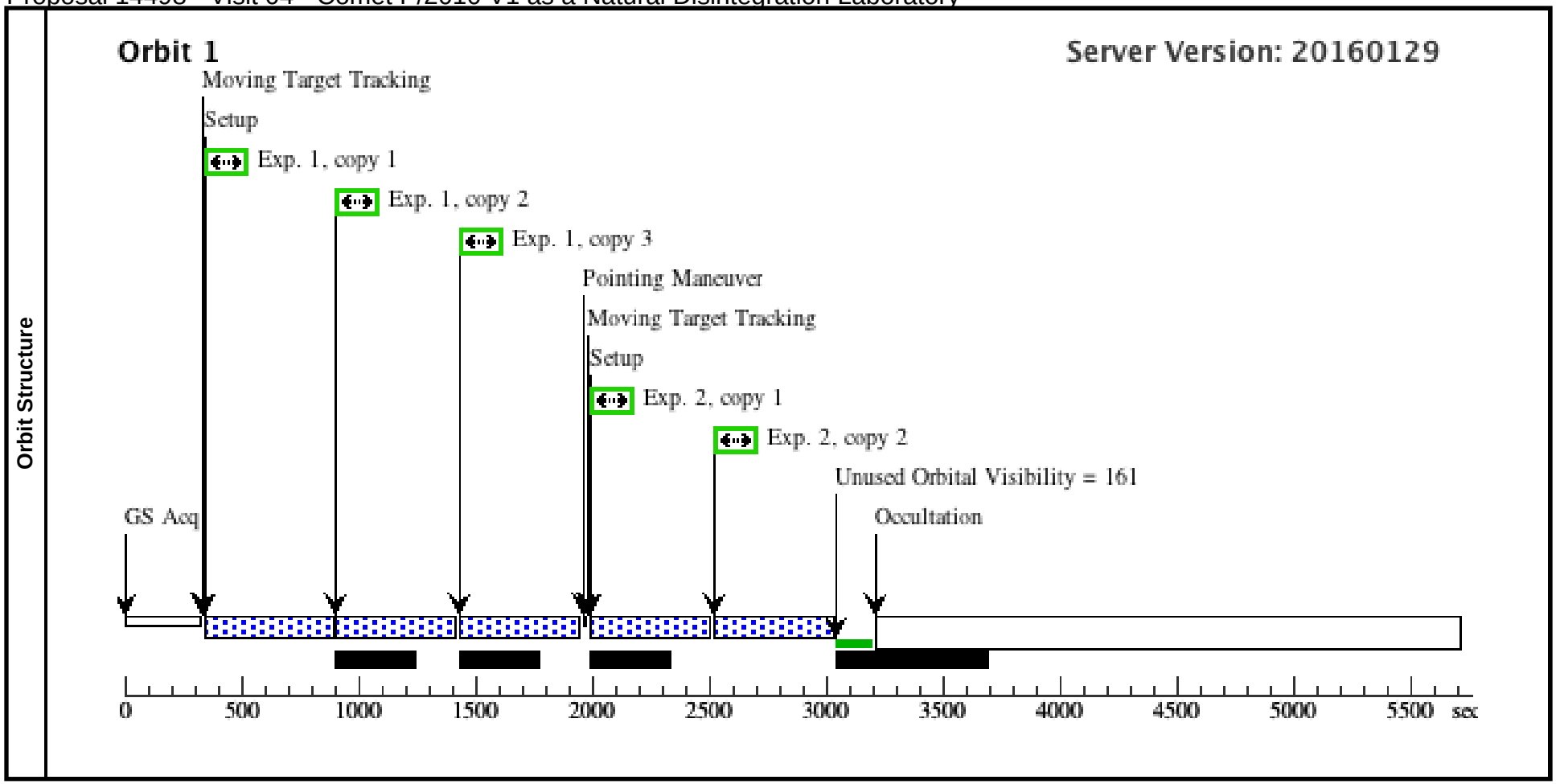
Solar System Targets

#	Name	Level 1	Level 2	Level 3	Window	Ephem Center
(1)	P2010-V-C-OFFSET	TYPE=COMET,Q=1.573112870680267E+00,E=4.905480395391478E-01,I=9.387268291468491E+00,O=3.782156311741634E+00,W=1.524172097988438E+02,T=17-MAR-2016:05:02:50,TTimeScale=TDB,EQUINOX=J2000,EPOCH=12-APR-2016:00:00:00,EpochTimeScale=TDB	TYPE=POS_ANGLE,RAD=64.8,ANG=289.8,REF=NORTH			EARTH

Comments: Extended=YES

Exposures

#	Label	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time (Total)/[Actual Dur.]	Orbit
1		(1) P2010-V-C-OFFSET	WFC3/UVIS, ACCUM, UVIS-CENTER	F350LP	CR-SPLIT=NO		Sequence 1-2 Non-Int in Visit 04	400 Secs X 3 (1200 Secs) *[==>(Copy 1)]* *[==>(Copy 2)]* *[==>(Copy 3)]*	***[1]***
2		(1) P2010-V-C-OFFSET	WFC3/UVIS, ACCUM, UVIS-CENTER	F350LP	CR-SPLIT=NO	POS TARG 0.2,2.0	Sequence 1-2 Non-Int in Visit 04	400 Secs X 2 (800 Secs) *[==>(Copy 1)]* *[==>(Copy 2)]*	***[1]***


Orbit Structure
Orbit 1
Server Version: 20160129
Moving Target Tracking
Setup
Exp. 1, copy 1
Exp. 1, copy 2
Exp. 1, copy 3
Pointing Maneuver
Moving Target Tracking
Setup
Exp. 2, copy 1
Exp. 2, copy 2
Unused Orbital Visibility = 161
GS Acq
Occultation
0
500
1000
1500
2000
2500
3000
3500
4000
4500
5000
5500
sec

Visit

Proposal 14498, Visit 05

Fri Mar 25 01:12:41 GMT 2016

Diagnostic Status: No Diagnostics

Scientific Instruments: WFC3/UVIS

Special Requirements: BETWEEN 01-APR-2016:00:00:00 AND 14-APR-2016:00:00:00

Solar System Targets

#	Name	Level 1	Level 2	Level 3	Window	Ephem Center
(1)	P2010-V-C-OFFSET	TYPE=COMET,Q=1.573112870680267E+00,E=4.905480395391478E-01,I=9.387268291468491E+00,O=3.782156311741634E+00,W=1.524172097988438E+02,T=17-MAR-2016:05:02:50,TTimeScale=TDB,EQUINOX=J2000,EPOCH=12-APR-2016:00:00:00,EpochTimeScale=TDB	TYPE=POS_ANGLE,RAD=64.8,ANG=289.8,REF=NORTH			EARTH

Comments: Extended=YES

Exposures

#	Label	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time (Total)/[Actual Dur.]	Orbit
1		(1) P2010-V-C-OFFSET	WFC3/UVIS, ACCUM, UVIS-CENTER	F350LP	CR-SPLIT=NO		Sequence 1-2 Non-Int in Visit 05	400 Secs X 3 (1200 Secs) *[==>(Copy 1)]* *[==>(Copy 2)]* *[==>(Copy 3)]*	***[1]***
2		(1) P2010-V-C-OFFSET	WFC3/UVIS, ACCUM, UVIS-CENTER	F350LP	CR-SPLIT=NO	POS TARG 0.2,2.0	Sequence 1-2 Non-Int in Visit 05	400 Secs X 2 (800 Secs) *[==>(Copy 1)]* *[==>(Copy 2)]*	***[1]***

Orbit Structure