15973 - Distant Comet C/2017 K2

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) C2017K2	WFC3/UVIS	1	10-Aug-2020 10:00:15.0	yes
02	(2) C2017K2-V2	WFC3/UVIS	1	10-Aug-2020 10:00:16.0	yes
03	(3) C2017K2-V3	WFC3/UVIS	1	10-Aug-2020 10:00:16.0	yes
04	(4) C2017K2-V4	WFC3/UVIS	1	10-Aug-2020 10:00:17.0	yes
05	(5) C2017K2-V5	WFC3/UVIS	1	10-Aug-2020 10:00:17.0	yes

5 Total Orbits Used

ABSTRACT

Extraordinary long-period comet C/2017 K2 offers our best opportunity to study the rise of activity in a body entering the solar system from Oort cloud distances. Active initially at 26 AU, the comet is now near 12 AU and about to cross the critical distance for the onset of crystallization in amorphous ice. It is far too cold for any aspect of the activity to be driven by normal sublimation processes in the presumed dominant volatile, water ice. We seek HST observations 1) to measure the 3D morphology of the coma and to search for jet activity associated with crystallization 2) to photometrically isolate the nucleus from its massive coma background and so to estimate its size and 3) to contribute to a unique record of cometary development from the largest distances. Already bright beyond Saturn, K2 will cross both the crystallization zone (10 AU) and the water ice sublimation zone (5 AU) on its way to perihelion at 1.8 AU in late 2022. It is predicted to exceed naked-eye visibility and will be suited to increasingly intense astronomical study using the full range of techniques and wavelengths. It offers a unique opportunity to understand the degree to which comets evolve even before entry into the terrestrial planet region where they are more normally studied.

OBSERVING DESCRIPTION

We request 5 visits with WFC3 to study K2 crossing the crystallization zone. Observations of this unique target will be the first to test for the role of crystallization in any comet. WFC3/UVIS and the F350LP filter provide maximum sensitivity to faint and structured emission. In each orbit, we will obtain 6 images each of 260s duration, with a dither between groups of three to reject hot pixels and cosmic ray hits. Combination of the images allows the elimination of essential all cosmic ray tracks that otherwise would compromise the measurements. In order to optimally extract information about the dust coma of K2, we plan measurements as follows.

Visit 1 is scheduled as early as possible to assess the initial state of the comet, and will permit comparisons with existing imaging data. Visit 2 observes the comet as the Earth crosses its orbit plane from north to south. This in-plane geometry provides special sensitivity to the largest particles, whose low ejection speeds confine them to the cometary orbit plane, giving a line-line tail or trail appearance. The thickness of this line is a direct measure of the ejection speed, and a primary constraint on the ejection mechanism. Visit 3 is timed to image K2 from the largest angle below the orbital plane. This provides the best perspective on the distribution of material in the plane, and we expect to detect the first fan-like tail in K2 owing to ongoing mass-loss. New material from crystallization activity will reveal itself by its spatial distribution in the plane (c.f. Finson & Probstein 1968). Visit 4 again records the comet from its orbital plane but as the Earth moves from south to north. Comparison with Visit 2 will allow us to assess changes in the intervening 6 months from exactly the same viewing angle. In this time K2 moves from rH = 10.2 AU to 8.9 AU, prime distance for activity driven by crystallization. Final Visit 5 occurs from the maximum angle above the orbital plane, providing a stereo view when compared with Visit 3. This combination of times and angles will give us maximum leverage in the application of our dust dynamics model, needed to extract fundamental parameters of the coma.

Our observing strategy is to take WFC3 exposures using a wide bandpass filter (F350LP) for maximum sensitivity. The predicted brightness of a 9 km nucleus at 12 AU is V = 22 which, without the coma, would be an easy measurement. However, given the presence of the massive coma, the nucleus cannot be isolated without the fine resolution and PSF stability of HST needed to disentangle the nucleus from the coma. The apparent rates of non-sidereal motion remain easily within Hubble's tracking capabilities and also slow enough to keep a single pair of guide stars within the FGS pickles for an entire visibility window. The ephemeris uncertainty of K2 is negligible because it is a long-observed object. Ephemeris issues are of no concern to this proposal. We understand that we will have essentially no control over the spacecraft roll angle, which means we will not be able to optimize the orientation of any dust tail on the CCD (i.e., to orient a 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 no matter what spacecraft roll angle is used.

Proposal 15973 - Visit 01 - Distant Comet C/2017 K2

Visit

Proposal 15973, Visit 01, completed Mon Aug 10 14:00:18 GMT 2020

Diagnostic Status: No Diagnostics

Scientific Instruments: WFC3/UVIS

Special Requirements: BETWEEN 16-SEP-2019:00:00:00 AND 28-OCT-2019:00:00:00

Patterns

#	Primary Pattern		Secondary Pattern	Exposures
(3)	Pattern Type=LINE	Coordinate Frame=POS-TARG		(1)
	Purpose=DITHER	Pattern Orientation=45		
	Number Of Points=2	Angle Between Sides=		
	Point Spacing=1	Center Pattern=false		
	Line Spacing=			

Solar System Targets

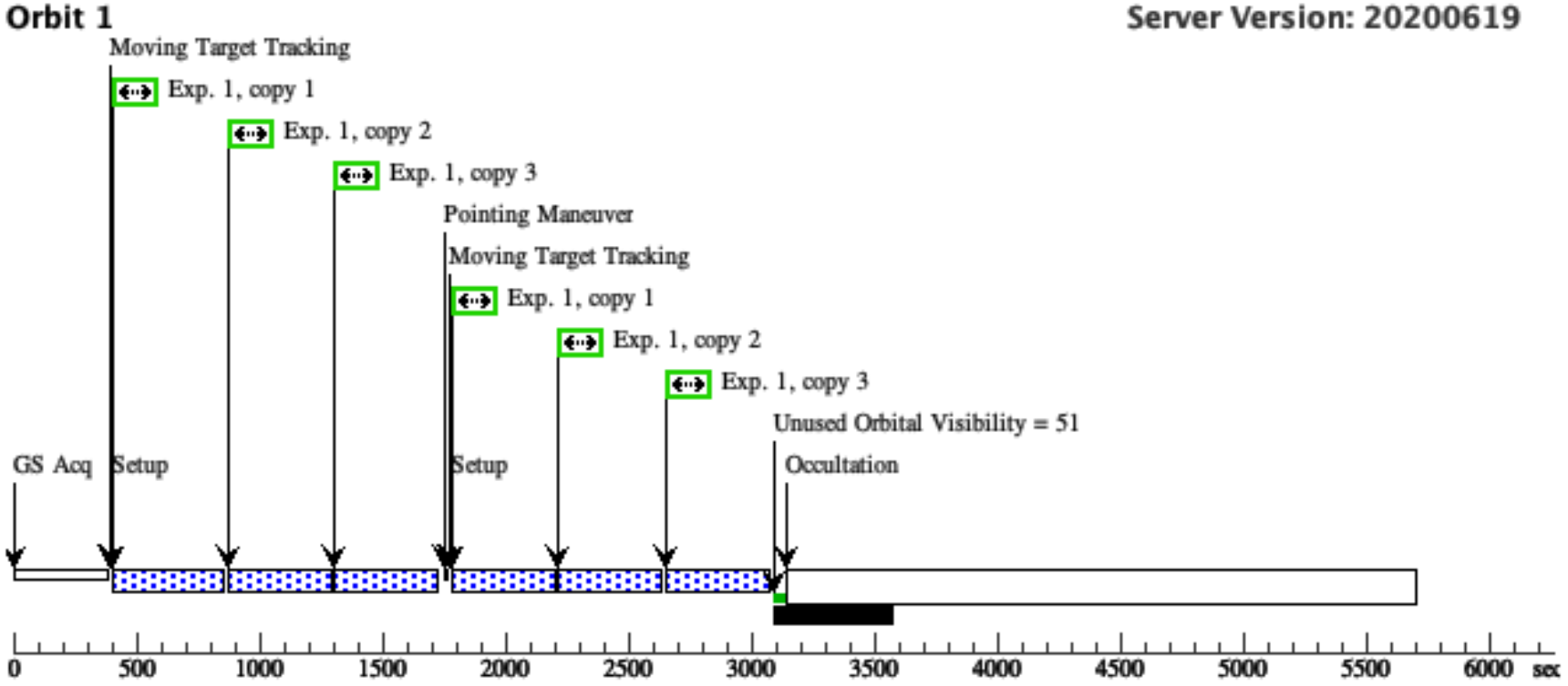
#	Name	Level 1	Level 2	Level 3	Window	Ephem Center
(1)	C2017K2	TYPE=COMET,Q=1.808218882175621,E=1.000358260337378,I=87.54744458634227,O=88.23491101383877,W=236.0474261597543,T=20-DEC-2022:23:34:34,TTimeScale=TDB,EQUINOX=J2000,EPOCH=24-APR-2018:00:00:00,EpochTimeScale=TDB				EARTH

Comments: Description=distant comet
Extended=YES

Exposures

#	Label	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time (Total)/[Actual Dur.]	Orbit
1		(1) C2017K2	WFC3/UVIS, ACCUM, UVIS2-2K2C-SUB	F350LP	CR-SPLIT=NO		Pattern 3, Exps 1-1 in Visit 01 (3)	260 Secs X 3 (1560 Secs)	
								[==>(Pattern 1, Copy 1)]	***[1]***
								[==>(Pattern 1, Copy 2)]	
								[==>(Pattern 1, Copy 3)]	
								[==>(Pattern 2, Copy 1)]	
								[==>(Pattern 2, Copy 2)]	
								[==>(Pattern 2, Copy 3)]	

Orbit Structure



Visit

Proposal 15973, Visit 02, completed Mon Aug 10 14:00:18 GMT 2020

Diagnostic Status: No Diagnostics

Scientific Instruments: WFC3/UVIS

Special Requirements: BETWEEN 17-DEC-2019:00:00:00 AND 22-DEC-2019:17:00:00

Patterns

#	Primary Pattern		Secondary Pattern	Exposures
(3)	Pattern Type=LINE	Coordinate Frame=POS-TARG		(1)
	Purpose=DITHER	Pattern Orientation=45		
	Number Of Points=2	Angle Between Sides=		
	Point Spacing=1	Center Pattern=false		
	Line Spacing=			

Solar System Targets

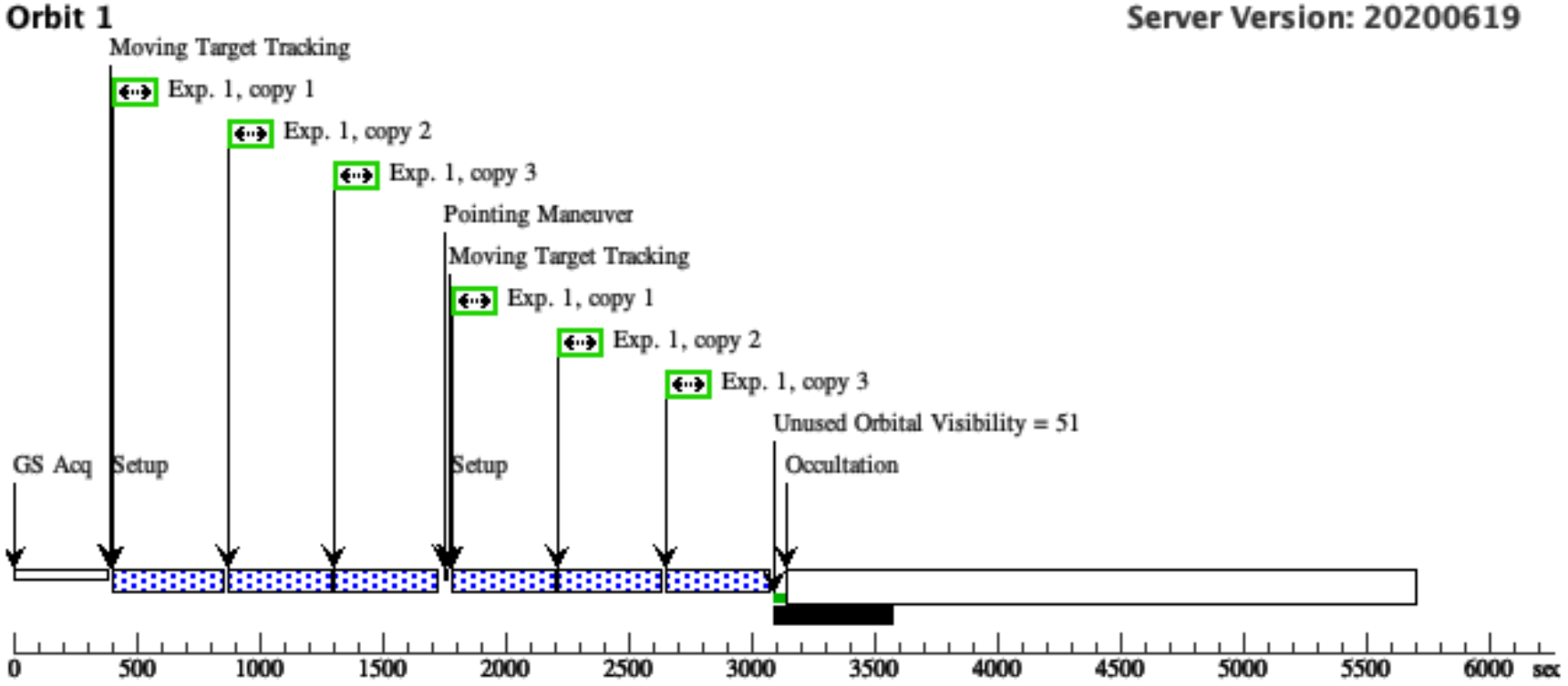
#	Name	Level 1	Level 2	Level 3	Window	Ephem Center
(2)	C2017K2-V2	TYPE=COMET,Q=1.806744822544937,E=1.000357930157462,I=87.54491480043235,O=88.25182687379407,W=236.0649075500748,T=20-DEC-2022:19:19:53,TTimeScale=TDB,EQUINOX=J2000,EPOCH=14-AUG-2018:00:00:00,EpochTimeScale=TDB				EARTH

Comments: Description=distant comet
Extended=YES

Exposures

#	Label	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time (Total)/[Actual Dur.]	Orbit
1		(2) C2017K2-V2	WFC3/UVIS, ACCUM, UVIS2-2K2C-SUB	F350LP	CR-SPLIT=NO		Pattern 3, Exps 1-1 in Visit 02 (3)	260 Secs X 3 (1560 Secs)	
								[==>(Pattern 1, Copy 1)]	***[1]***
								[==>(Pattern 1, Copy 2)]	
								[==>(Pattern 1, Copy 3)]	
								[==>(Pattern 2, Copy 1)]	
								[==>(Pattern 2, Copy 2)]	
								[==>(Pattern 2, Copy 3)]	

Orbit Structure



Visit

Proposal 15973, Visit 03, completed Mon Aug 10 14:00:18 GMT 2020

Diagnostic Status: No Diagnostics

Scientific Instruments: WFC3/UVIS

Special Requirements: BETWEEN 14-MAR-2020:00:00:00 AND 14-MAR-2020:21:00:00; BETWEEN 15-MAR-2020:02:00:00 AND 20-MAR-2020:05:00:00; BETWEEN 20-MAR-2020:14:00:00 AND 22-MAR-2020:21:00:00; BETWEEN 24-MAR-2020:02:00:00 AND 26-MAR-2020:05:00:00; BETWEEN 27-MAR-2020:02:00:00 AND 27-MAR-2020:17:00:00; BETWEEN 28-MAR-2020:13:00:00 AND 29-MAR-2020:23:00:00; BETWEEN 30-MAR-2020:10:00:00 AND 03-APR-2020:00:00:00

Patterns

#	Primary Pattern		Secondary Pattern	Exposures
(3)	Pattern Type=LINE	Coordinate Frame=POS-TARG		(1)
	Purpose=DITHER	Pattern Orientation=45		
	Number Of Points=2	Angle Between Sides=		
	Point Spacing=1	Center Pattern=false		
	Line Spacing=			

Solar System Targets

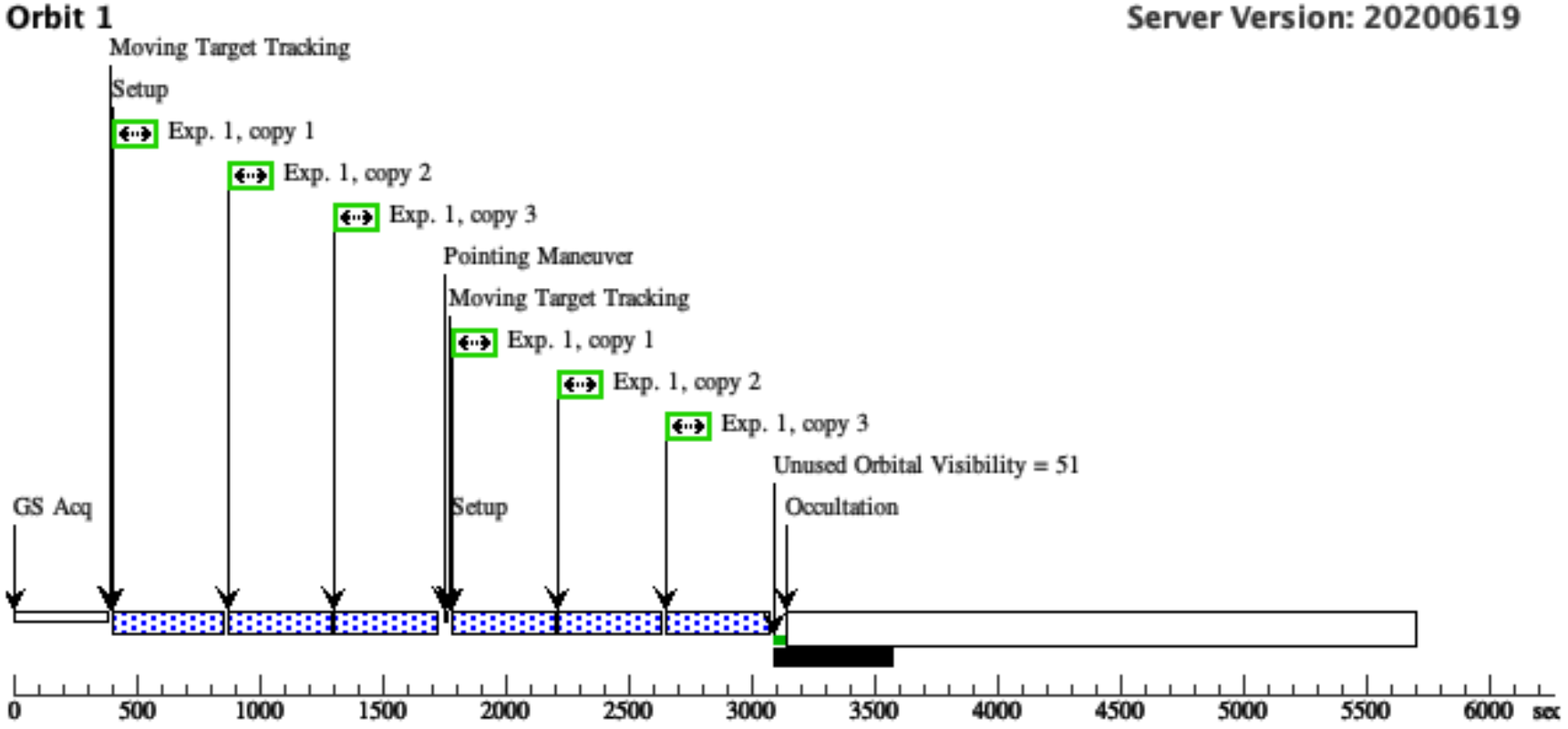
#	Name	Level 1	Level 2	Level 3	Window	Ephem Center
(3)	C2017K2-V3	TYPE=COMET,Q=1.8064280859243 8,E=1.000361158009129,I=87.544650 43083408 ,O=88.25348410391007,W=236.06859 24553383,T=20-DEC-2022:18:17:48,TTimeScale=TDB,EQ UINOX=J2000,EPOCH=06-SEP-2018:00:00:00,EpochTimeScale=TDB				EARTH

Comments: Description=distant comet
Extended=YES

Exposures

#	Label	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time (Total)/[Actual Dur.]	Orbit
1		(3) C2017K2-V3	WFC3/UVIS, ACCUM, UVIS2-2K2C-SUB	F350LP	CR-SPLIT=NO		Pattern 3, Exps 1-1 in Visit 03 (3)	260 Secs X 3 (1560 Secs)	
								[==>(Pattern 1, Copy 1)]	***[1]***
								[==>(Pattern 1, Copy 2)]	
								[==>(Pattern 1, Copy 3)]	
								[==>(Pattern 2, Copy 1)]	
								[==>(Pattern 2, Copy 2)]	
								[==>(Pattern 2, Copy 3)]	

Orbit Structure



Visit

Proposal 15973, Visit 04, completed Mon Aug 10 14:00:18 GMT 2020

Diagnostic Status: No Diagnostics

Scientific Instruments: WFC3/UVIS

Special Requirements: BETWEEN 17-JUN-2020:15:00:00 AND 20-JUN-2020:15:00:00; BETWEEN 21-JUN-2020:15:00:00 AND 23-JUN-2020:14:00:00

Patterns

#	Primary Pattern		Secondary Pattern	Exposures
(3)	Pattern Type=LINE	Coordinate Frame=POS-TARG		(1)
	Purpose=DITHER	Pattern Orientation=45		
	Number Of Points=2	Angle Between Sides=		
	Point Spacing=1	Center Pattern=false		
	Line Spacing=			

Solar System Targets

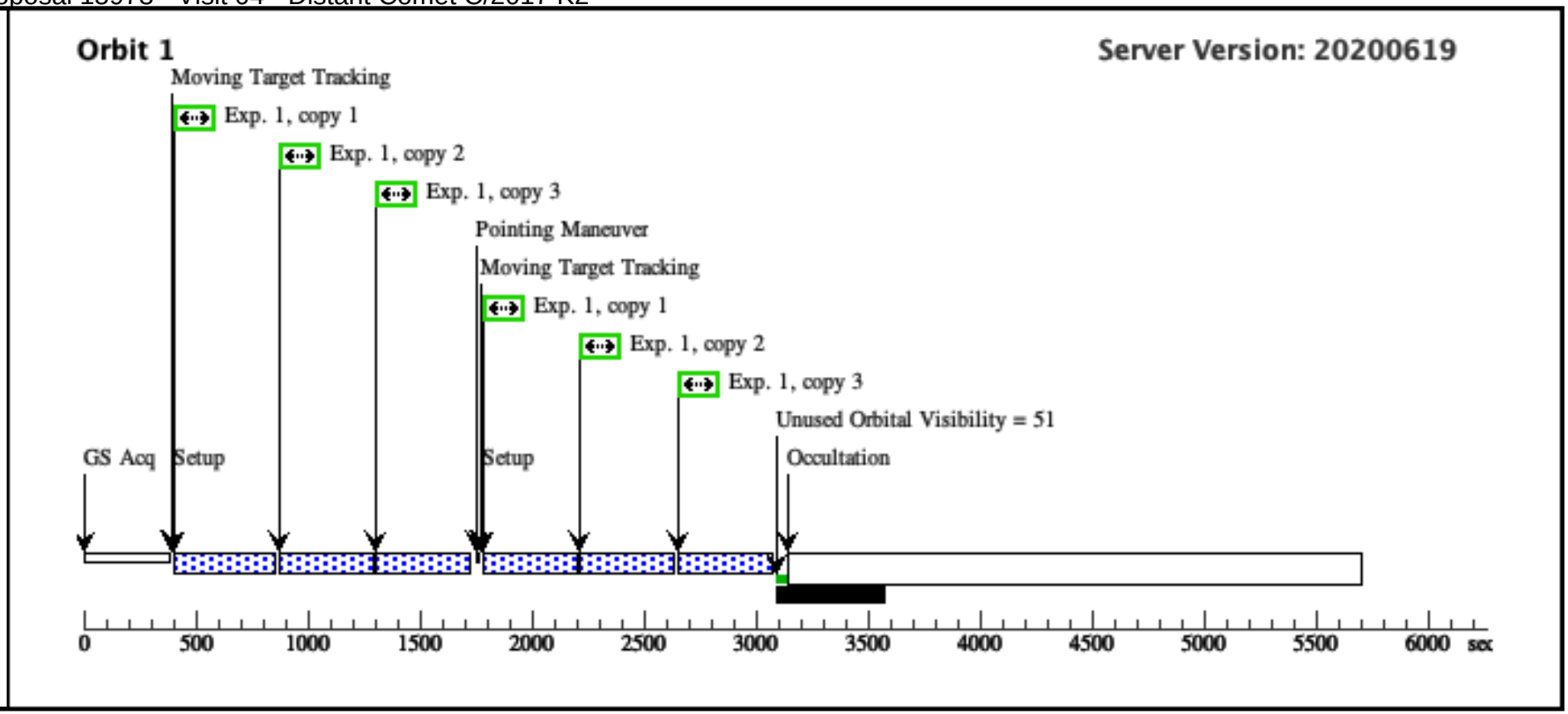
#	Name	Level 1	Level 2	Level 3	Window	Ephem Center
(4)	C2017K2-V4	TYPE=COMET,Q=1.805556561985431,E=1.000363079426984,I=87.54398267530995,O=88.25737988381947,W=236.0793389386575,T=20-DEC-2022:15:44:07,TTimeScale=TDB,EQUINOX=J2000,EPOCH=20-NOV-2018:00:00:00,EpochTimeScale=TDB				EARTH

Comments: Description=distant comet
Extended=YES

Exposures

#	Label	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time (Total)/[Actual Dur.]	Orbit
1		(4) C2017K2-V4	WFC3/UVIS, ACCUM, UVIS2-2K2C-SUB	F350LP	CR-SPLIT=NO		Sequence 1-1 Non-Int in Visit 04	260 Secs X 3 (1560 Secs)	
							Pattern 3, Exps 1-1 in Sequence 1-1 Non-Int in Visit 04 (3)	*[==>(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 15973, Visit 05, implementation Mon Aug 10 14:00:18 GMT 2020

Diagnostic Status: No Diagnostics

Scientific Instruments: WFC3/UVIS

Special Requirements: BETWEEN 12-SEP-2020:08:00:00 AND 22-SEP-2020:00:00:00; BETWEEN 25-SEP-2020:15:00:00 AND 30-SEP-2020:09:00:00

Patterns

#	Primary Pattern		Secondary Pattern	Exposures
(3)	Pattern Type=LINE	Coordinate Frame=POS-TARG		(1)
	Purpose=DITHER	Pattern Orientation=45		
	Number Of Points=2	Angle Between Sides=		
	Point Spacing=1	Center Pattern=false		
	Line Spacing=			

Solar System Targets

#	Name	Level 1	Level 2	Level 3	Window	Ephem Center
(5)	C2017K2-V5	TYPE=COMET,Q=1.8043869734348 5,E=1.000368117470132,I=87.542081 01109985 ,O=88.26729169229563,W=236.09384 28193913,T=20-DEC-2022:12:21:34,TTimeScale=TDB,EQ UINOX=J2000,EPOCH=09-MAR-2019:00:00:00,EpochTimeScale=TDB				EARTH

Comments: Description=distant comet
Extended=YES

Exposures

#	Label	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time (Total)/[Actual Dur.]	Orbit
1		(5) C2017K2-V5	WFC3/UVIS, ACCUM, UVIS2-2K2C-SUB	F350LP	CR-SPLIT=NO		Sequence 1-1 Non-In t in Visit 05 Pattern 3, Exps 1-1 i n Sequence 1-1 Non-Int in Visit 05 (3)	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