



## 16044 - Polarimetry of New Interstellar Comet 2I/Borisov

Cycle: 27, Proposal Category: GO

(Availability Mode: SUPPORTED)

### INVESTIGATORS

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### VISITS

<i>Visit</i>	<i>Targets used in Visit</i>	<i>Configurations used in Visit</i>	<i>Orbits Used</i>	<i>Last Orbit Planner Run</i>	<i>OP Current with Visit?</i>
01	(1) BORISOV	ACS/WFC	1	19-May-2020 11:00:16.0	yes
02	(1) BORISOV	ACS/WFC	1	19-May-2020 11:00:18.0	yes
03	(2) BORISOV-VISIT3	ACS/WFC	1	19-May-2020 11:00:19.0	yes
04	(3) BORISOV-VISIT4-5	ACS/WFC	1	19-May-2020 11:00:20.0	yes
05	(3) BORISOV-VISIT4-5	ACS/WFC	1	19-May-2020 11:00:21.0	yes
06	(4) BORISOV-VISIT6	ACS/WFC	2	19-May-2020 11:00:22.0	yes
07	(5) BORISOV-VISIT7	ACS/WFC	2	19-May-2020 11:00:23.0	yes
08	(6) BORISOV-VISIT8	ACS/WFC	2	19-May-2020 11:00:24.0	yes
09	(7) BORISOV-VISIT9	ACS/WFC	2	19-May-2020 11:00:25.0	yes
10	(8) BORISOV-VISIT9-OFFSET	ACS/WFC	2	19-May-2020 11:00:26.0	yes
11	(9) BORISOV-VISIT11	ACS/WFC	1	19-May-2020 11:00:27.0	yes
12	(10) BORISOV-VISIT11-OFFSET	ACS/WFC	1	19-May-2020 11:00:27.0	yes

17 Total Orbits Used

## **ABSTRACT**

2I/Borisov is the first comet discovered in the solar system identified to be of likely extrasolar origin, and provides an exceptionally rare opportunity to characterize the material properties of a planetesimal from another planetary system. Its cometary activity coupled with its fortuitously nearby and well-timed trajectory, which presents phase angles as high as 28 deg, makes it a compelling target for detailed polarimetric characterization of its dust properties. High resolution imaging polarimetry has previously revealed varied polarized structures within the comas of solar system comets, including positively polarized jets and negatively polarized circumnucleus halos. Such features reflect spatial variation in their dust size and structure, and thus trace the material evolution of the dust under solar irradiation following their release from the nucleus. This project will use HST/ACS imaging polarimetry to spatially map the phase angle and wavelength dependence of dust polarization over 2I/Borisov's coma and inner tail. This data, together with advanced light scattering models, will provide a detailed qualitative and quantitative physical characterization of the dust from an interstellar comet. These results will enable a direct comparison with solar system comets previously characterized by similar methods, and more generally, a comparison between our solar system and its formation and evolutionary processes, with those of another planetary system. 2I/Borisov was discovered well after the HST Cycle 27 GO deadline, and the observing window will have closed before Cycle 28, thus requiring a Mid-Cycle proposal for these observations.

## **OBSERVING DESCRIPTION**

We request 15 orbits to conduct polarimetric observations of 2I/Borisov from 2019 November to 2020 May. The phase angle of the comet will vary from a high of 28 deg in 2019 December down to 12 deg in 2020 May. The requested orbits are necessary to provide sufficient S/N to generate high resolution maps of polarization phase functions, and thus spatial variations in dust grain properties, over the coma and inner tail of the comet. The exact timing of these orbits is not critical to meet the science objectives, provided they are well distributed over the range of phase angles, particularly over the 15-25 deg phase angles typical of polarization inversion for cometary dust grains. Additionally, a pair of epochs in 2019 November and 2020 January at similar phase angles will particularly aid the isolation of physical evolution in coma/tail properties from the viewing geometry effects of a varying phase angle targeted by the other observations.

We will obtain (1) F475W + Clear images, and (2) polarimetry with F606W and F775W on filter wheel 1, and POL0V, POL60V, and POL120V (0 deg, 60 deg, 120 deg visual polarizers) on filter wheel 2, for a total of  $1+2 \times 3=7$  distinct combinations. Each combination will be used with 2-point dithering within an orbit or pair of nearby orbits, to facilitate the removal of cosmic rays, background stars, and detector defects. To mitigate the

substantial overhead cost of many short exposures, not all combinations will be used in every orbit or orbit pair. F606W and F775W are selected for their relative dearth of notable emission bands, while still providing a sufficiently wide baseline to measure wavelength dependence.

The F475W exposures cover the major emission bands of many gaseous species (typically dominated by C<sub>2</sub>), and will be used to trace the spatial distribution of these gases over the comet by comparing them with the nearly emission-free F775W data, and to correct for any dilution of dust polarization in the F606W band. Hines & Levasseur-Regourd (2016; P&SS, 123, 41) was hindered by significant C<sub>2</sub> contamination in their F606W polarimetry of C/2012 S1 (ISON) 1 au from the Sun, which our approach seeks to mitigate. We additionally note that optical spectra of 2I/Borisov has not yet shown clear evidence of C<sub>2</sub> emission as close as 2.4 au from the Sun (Opitom et al. 2019; arXiv:1910.09078), and such emission may not ever become significant, as the comet will remain beyond 2.0 au throughout its apparition. We will, however, continue to monitor published spectroscopy over the observation period for changes, including for any other significant contaminants.

We understand that we have no control of the rolling angle of HST. However, our objectives require only coverage of the coma and inner tail, which, according to recent observations in 2019 September, is about 10-20" in angular size (MPEC 2019-R106). 2I/Borisov will be ~40% closer to the Earth during its closest approach, corresponding to an angular size of ~40", which should still easily fit onto the 2k WFC sub-array (~70" wide with polarizer).

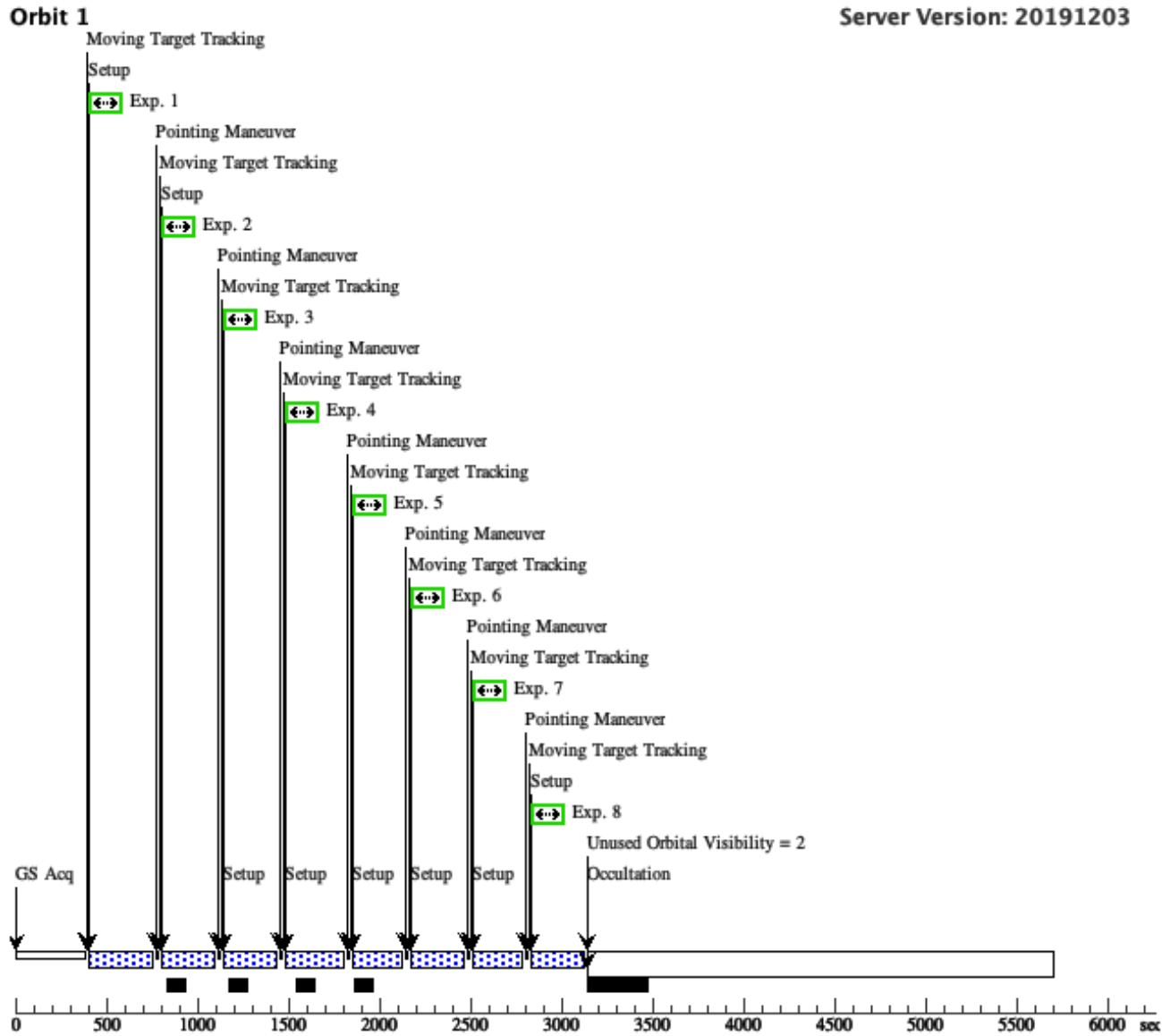
We also request moving object support. The maximum apparent motion rate of 2I/Borisov is 130 arcsec/hr (in late 2019 November), which is well within the tracking capability of HST. As of early 2019 November, the formal ephemeris uncertainties computed by JPL fall well within the field of the WFC sub-array throughout the observation period. The orbit continues to be refined, with regular updates from the Minor Planet Center (MPC). We will work with MPC to incorporate new astrometry to ensure that the comet remains observable by HST.

Proposal 16044 - Visit 01 - Polarimetry of New Interstellar Comet 2I/Borisov

Tue May 19 15:00:28 GMT 2020

Visit	<b>Proposal 16044, Visit 01, completed</b> <b>Diagnostic Status: No Diagnostics</b> Scientific Instruments: ACS/WFC Special Requirements: BETWEEN 25-NOV-2019:00:00:00 AND 26-NOV-2019:00:00:00									
	Solar System Targets	#	Name	Level 1	Level 2	Level 3	Window	Ephem Center		
	(1)	BORISOV	TYPE=COMET,Q=2.0065685762835 42,E=3.356615336479035,I=44.05126 537510564 .O=308.1483826038324,W=209.12463 06195056,T=08-DEC- 2019:13:20:06,TimeScale=TDB,EQ UINOX=J2000,EPOCH=25-SEP- 2019:00:00:00,EpochTimeScale=TDB, A1=0.,A2=2.581266021729E-7,A3=0.					EARTH		
	Comments: Description=C/2019 Q4 (Borisov) Extended=YES									
Exposures	#	Label	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time (Total)/[Actual Dur.]	Orbit
	1		(1) BORISOV	ACS/WFC, ACCUM, WFC	F475W POL0V		POS TARG -0.4,0	Sequence 1-3 Non-Int in Visit 01	143 Secs (143 Secs) [==>]	[1]
	2		(1) BORISOV	ACS/WFC, ACCUM, WFC	F475W POL60V		POS TARG -0.4,0	Sequence 1-3 Non-Int in Visit 01	143 Secs (143 Secs) [==>]	[1]
	3		(1) BORISOV	ACS/WFC, ACCUM, WFC	F475W POL120V		POS TARG -0.4,0	Sequence 1-3 Non-Int in Visit 01	143 Secs (143 Secs) [==>]	[1]
	4		(1) BORISOV	ACS/WFC, ACCUM, WFC	F606W POL0V		POS TARG -0.4,0	Sequence 4-8 Non-Int in Visit 01	143 Secs (143 Secs) [==>]	[1]
	5		(1) BORISOV	ACS/WFC, ACCUM, WFC	F606W POL0V		POS TARG 0,0.4	Sequence 4-8 Non-Int in Visit 01	143 Secs (143 Secs) [==>]	[1]
	6		(1) BORISOV	ACS/WFC, ACCUM, WFC	F606W POL60V		POS TARG -0.4,0	Sequence 4-8 Non-Int in Visit 01	143 Secs (143 Secs) [==>]	[1]
	7		(1) BORISOV	ACS/WFC, ACCUM, WFC	F606W POL60V		POS TARG 0,0.4	Sequence 4-8 Non-Int in Visit 01	143 Secs (143 Secs) [==>]	[1]
	8		(1) BORISOV	ACS/WFC, ACCUM, WFC	F606W POL120V		POS TARG -0.4,0	Sequence 4-8 Non-Int in Visit 01	143 Secs (143 Secs) [==>]	[1]

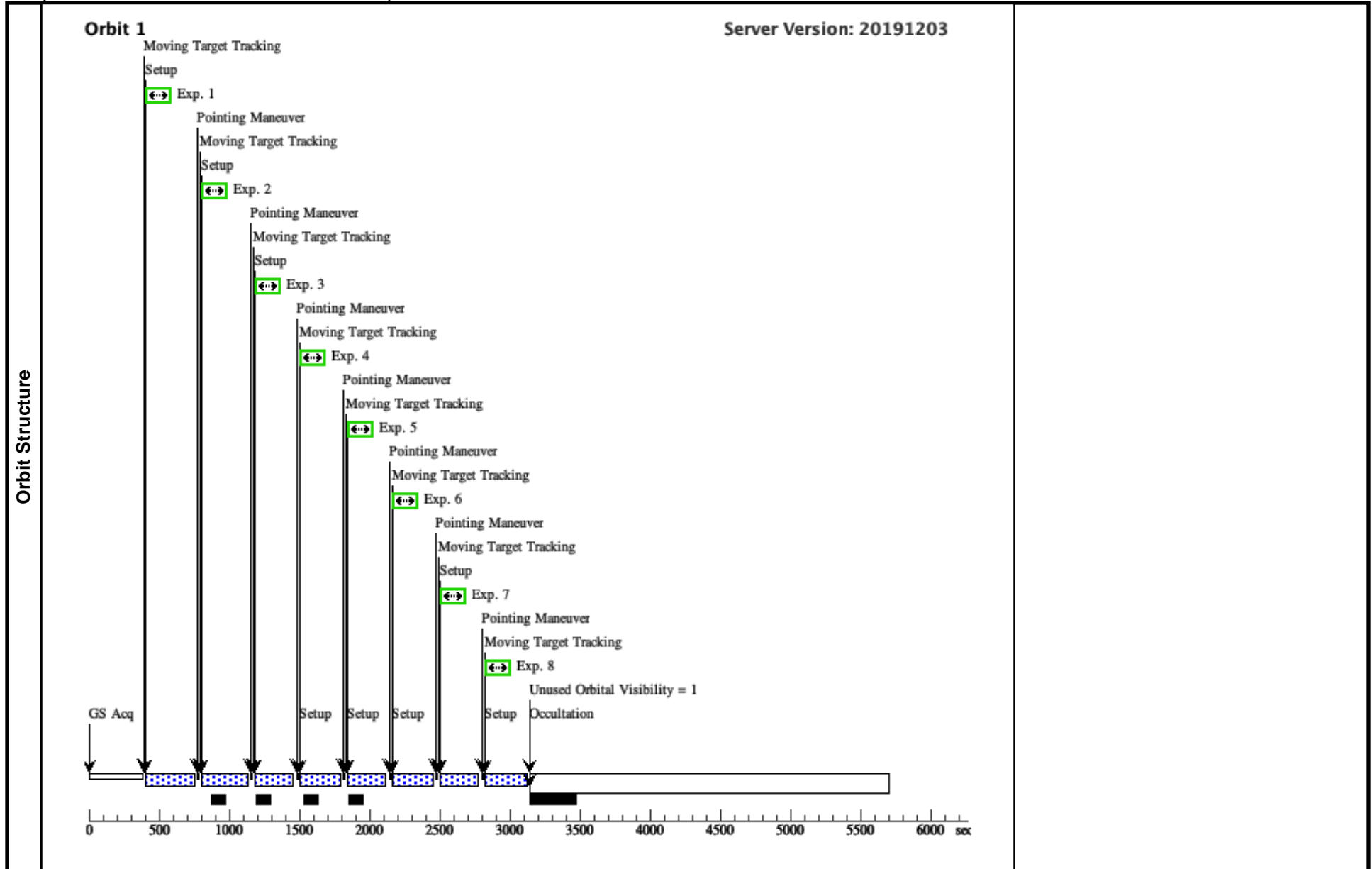
Orbit Structure



Proposal 16044 - Visit 02 - Polarimetry of New Interstellar Comet 2I/Borisov

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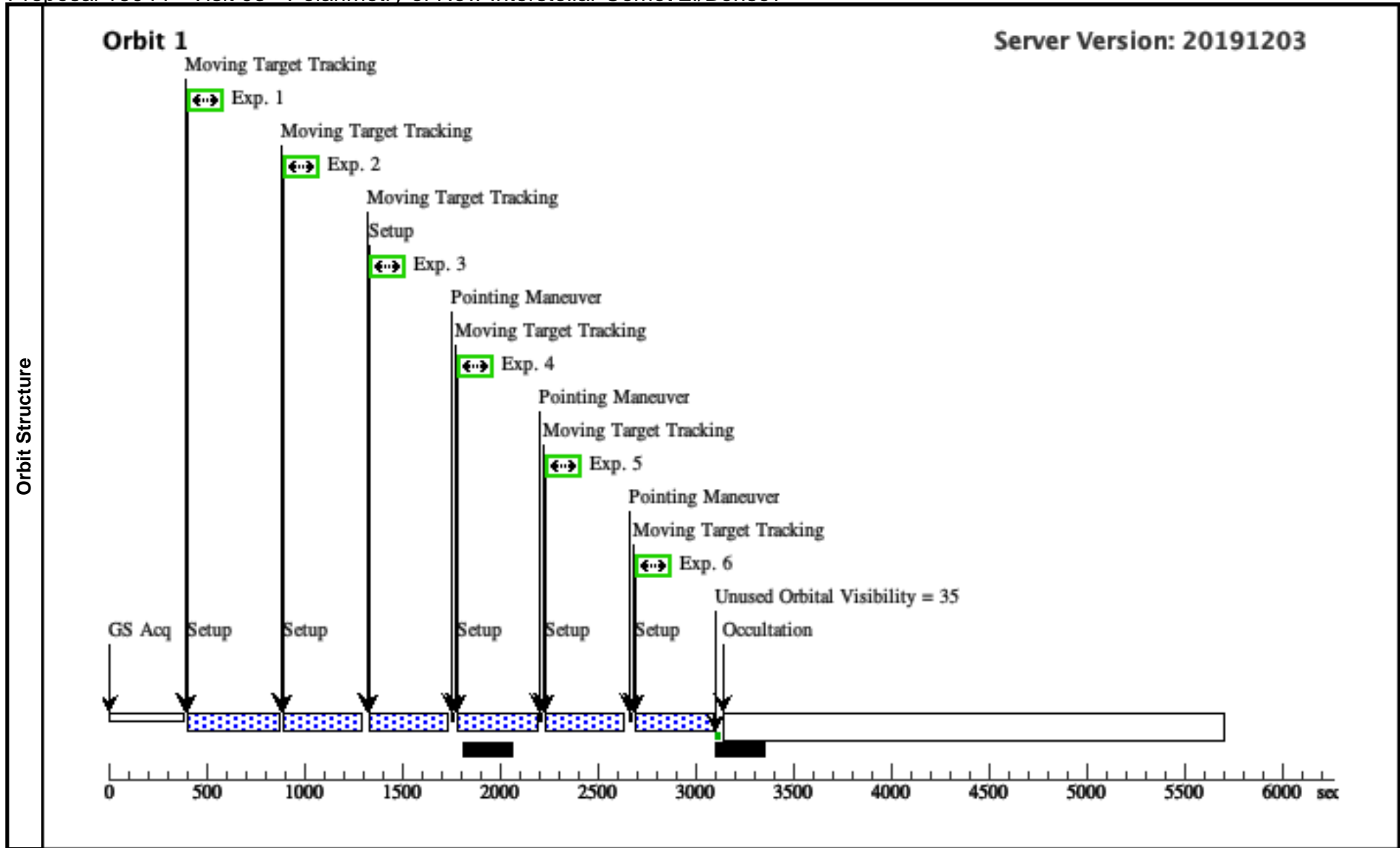
Visit	<b>Proposal 16044, Visit 02, completed</b> <b>Diagnostic Status: No Diagnostics</b> Scientific Instruments: ACS/WFC Special Requirements: GROUP 02,01 WITHIN 0.5D									
	Solar System Targets	#	Name	Level 1	Level 2	Level 3	Window	Ephem Center		
	(1)	BORISOV	TYPE=COMET,Q=2.0065685762835 42,E=3.356615336479035,I=44.05126 537510564 ,O=308.1483826038324,W=209.12463 06195056,T=08-DEC- 2019:13:20:06,TTimeScale=TDB,EQ UINOX=J2000,EPOCH=25-SEP- 2019:00:00:00,EpochTimeScale=TDB, A1=0.,A2=2.581266021729E-7,A3=0.					EARTH		
	<i>Comments: Description=C/2019 Q4 (Borisov)</i> <i>Extended=YES</i>									
Exposures	#	Label	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time (Total)/[Actual Dur.]	Orbit
	1		(1) BORISOV	ACS/WFC, ACCUM, WFC	F606W		POS TARG 0,0,4		143 Secs (143 Secs)	
					POL120V				[==>]	[1]
	2		(1) BORISOV	ACS/WFC, ACCUM, WFC	F775W		POS TARG -0,4,0	Sequence 2-7 Non-Int in Visit 02	143 Secs (143 Secs)	
					POL0V				[==>]	[1]
	3		(1) BORISOV	ACS/WFC, ACCUM, WFC	F775W		POS TARG 0,0,4	Sequence 2-7 Non-Int in Visit 02	143 Secs (143 Secs)	
					POL0V				[==>]	[1]
	4		(1) BORISOV	ACS/WFC, ACCUM, WFC	F775W		POS TARG -0,4,0	Sequence 2-7 Non-Int in Visit 02	143 Secs (143 Secs)	
					POL60V				[==>]	[1]
5		(1) BORISOV	ACS/WFC, ACCUM, WFC	F775W		POS TARG 0,0,4	Sequence 2-7 Non-Int in Visit 02	143 Secs (143 Secs)		
				POL60V				[==>]	[1]	
6		(1) BORISOV	ACS/WFC, ACCUM, WFC	F775W		POS TARG -0,4,0	Sequence 2-7 Non-Int in Visit 02	143 Secs (143 Secs)		
				POL120V				[==>]	[1]	
7		(1) BORISOV	ACS/WFC, ACCUM, WFC	F775W		POS TARG 0,0,4	Sequence 2-7 Non-Int in Visit 02	143 Secs (143 Secs)		
				POL120V				[==>]	[1]	
8		(1) BORISOV	ACS/WFC, ACCUM, WFC1B-2K	F475W		POS TARG 0,0,4		110 Secs (110 Secs)		
								[==>]	[1]	



Proposal 16044 - Visit 03 - Polarimetry of New Interstellar Comet 2I/Borisov

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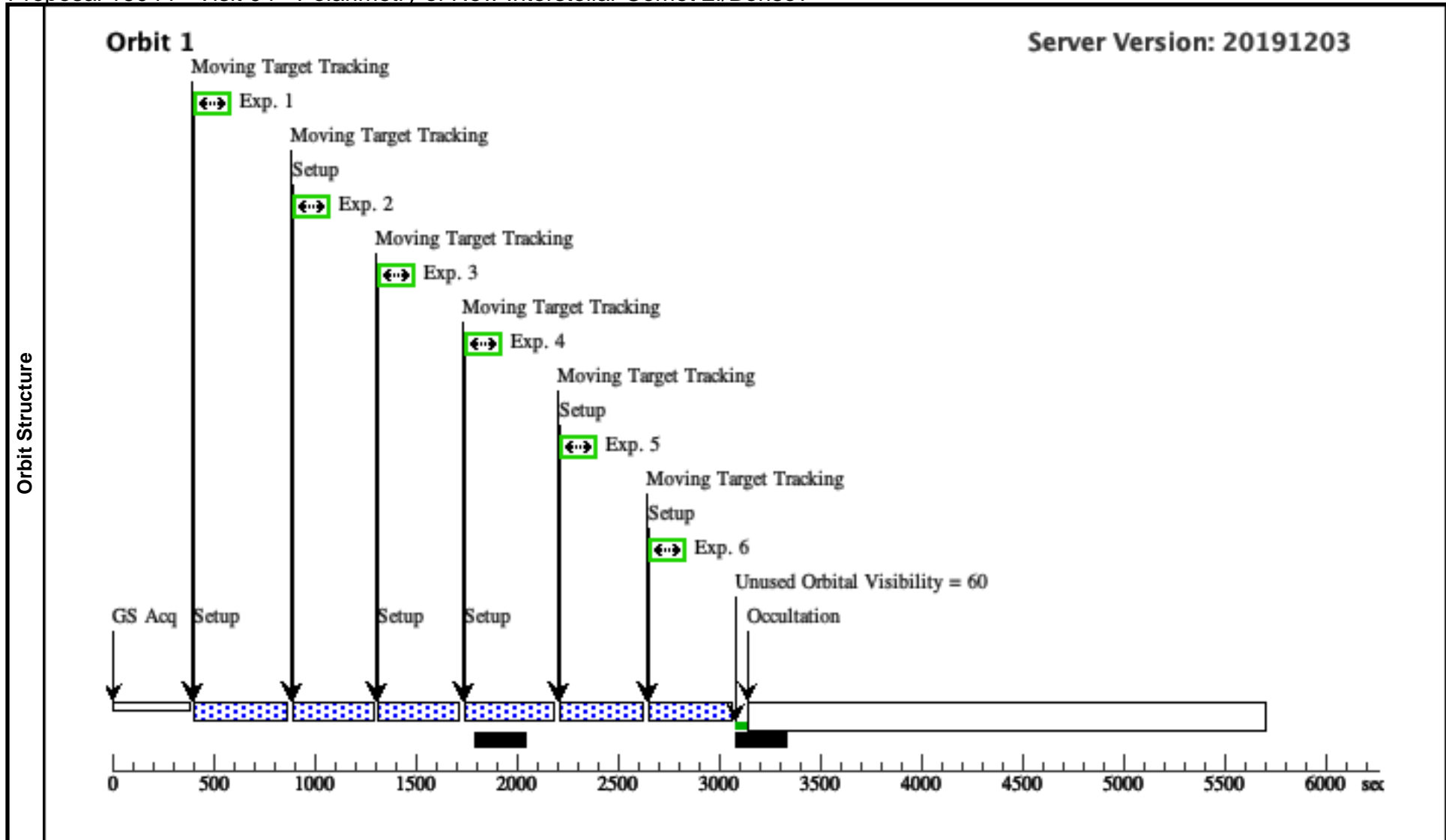
Visit	Proposal 16044, Visit 03, completed Diagnostic Status: No Diagnostics Scientific Instruments: ACS/WFC Special Requirements: BETWEEN 13-DEC-2019:00:00:00 AND 20-DEC-2019:00:00:00									
	Solar System Targets	#	Name	Level 1	Level 2	Level 3	Window	Ephem Center		
	(2)	BORISOV-VISIT3	TYPE=COMET,Q=2.0066316719435 12,E=3.357186641306118,I=44.05177 560961525 .O=308.1489574182682,W=209.12373 39804854,T=08-DEC- 2019:13:15:25,TimeScale=TDB,EQ UINOX=J2000,EPOCH=20-DEC- 2019:00:00:00,EpochTimeScale=TDB					EARTH	Comments: Description=C/2019 Q4 (Borisov) Extended=YES	
Exposures	#	Label	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time (Total)/[Actual Dur.]	Orbit
	1		(2) BORISOV-VISIT3	ACS/WFC, ACCUM, WFC	F606W POL0V		POS TARG 0,0	Sequence 1-6 Non-Int in Visit 03	260 Secs (260 Secs) [==>]	[1]
	2		(2) BORISOV-VISIT3	ACS/WFC, ACCUM, WFC	F606W POL60V		POS TARG 0,0; NEW ALIGNMENT	Sequence 1-6 Non-Int in Visit 03	260 Secs (260 Secs) [==>]	[1]
	3		(2) BORISOV-VISIT3	ACS/WFC, ACCUM, WFC	F606W POL120V		POS TARG 0,0; NEW ALIGNMENT	Sequence 1-6 Non-Int in Visit 03	260 Secs (260 Secs) [==>]	[1]
	4		(2) BORISOV-VISIT3	ACS/WFC, ACCUM, WFC	F606W POL0V		POS TARG 0.4,0.4	Sequence 1-6 Non-Int in Visit 03	260 Secs (260 Secs) [==>]	[1]
	5		(2) BORISOV-VISIT3	ACS/WFC, ACCUM, WFC	F606W POL60V		POS TARG 0.4,0.4	Sequence 1-6 Non-Int in Visit 03	260 Secs (260 Secs) [==>]	[1]
	6		(2) BORISOV-VISIT3	ACS/WFC, ACCUM, WFC	F606W POL120V		POS TARG 0.4,0.4	Sequence 1-6 Non-Int in Visit 03	260 Secs (260 Secs) [==>]	[1]



Proposal 16044 - Visit 04 - Polarimetry of New Interstellar Comet 2I/Borisov

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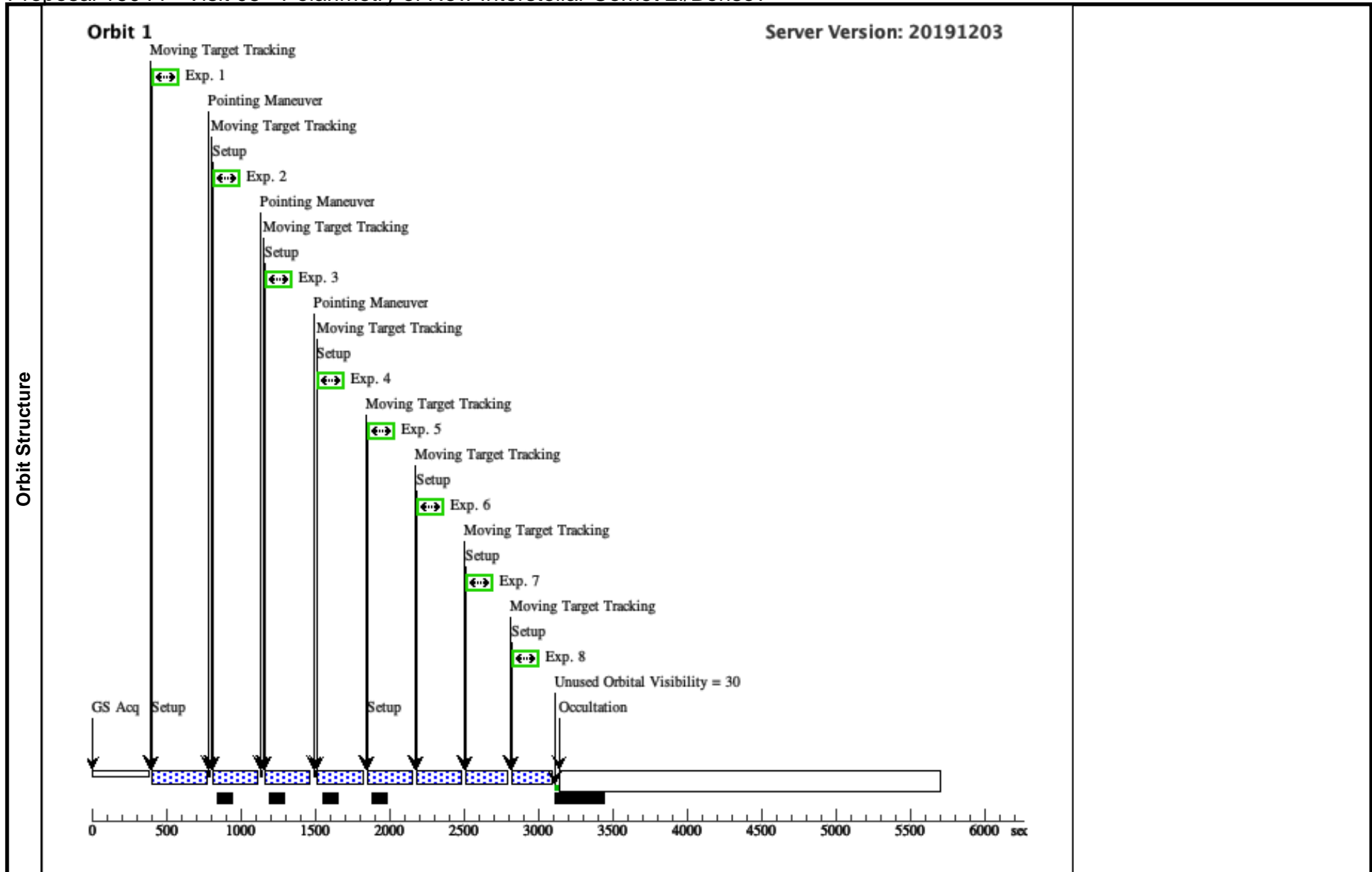
Visit	<b>Proposal 16044, Visit 04, completed</b> <b>Diagnostic Status: No Diagnostics</b> Scientific Instruments: ACS/WFC Special Requirements: BETWEEN 06-JAN-2020:00:00:00 AND 08-JAN-2020:00:00:00									
	Solar System Targets	#	Name	Level 1	Level 2	Level 3	Window	Ephem Center		
	(3)	BORISOV-VISIT4-5	TYPE=COMET,Q=2.0066469198896 02,E=3.357489316443313,I=44.05247 152804048 .O=308.1494484383344,W=209.12238 57291233,T=08-DEC- 2019:13:12:54,TimeScale=TDB,EQ UINOX=J2000,EPOCH=20-DEC- 2019:00:00:00,EpochTimeScale=TDB, A1=2.001994848251E- 8,A2=1.551358127594E-7,A3=- 7.238847255707E-8					EARTH		
	<i>Comments: Description=C/2019 Q4 (Borisov)</i> <i>Extended=YES</i>									
Exposures	#	Label	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time (Total)/[Actual Dur.]	Orbit
	1		(3) BORISOV-VISI T4-5	ACS/WFC, ACCUM, WFC	F475W POL0V		POS TARG 0,0; NEW ALIGNMENT	Sequence 1-6 Non-Int in Visit 04	253 Secs (253 Secs) [==>]	[1]
	2		(3) BORISOV-VISI T4-5	ACS/WFC, ACCUM, WFC	F475W POL60V		POS TARG 0,0; NEW ALIGNMENT	Sequence 1-6 Non-Int in Visit 04	253 Secs (253 Secs) [==>]	[1]
	3		(3) BORISOV-VISI T4-5	ACS/WFC, ACCUM, WFC	F475W POL120V		POS TARG 0,0; NEW ALIGNMENT	Sequence 1-6 Non-Int in Visit 04	253 Secs (253 Secs) [==>]	[1]
	4		(3) BORISOV-VISI T4-5	ACS/WFC, ACCUM, WFC	F775W POL0V		POS TARG 0,0; NEW ALIGNMENT	Sequence 1-6 Non-Int in Visit 04	270 Secs (270 Secs) [==>]	[1]
	5		(3) BORISOV-VISI T4-5	ACS/WFC, ACCUM, WFC	F775W POL60V		POS TARG 0,0; NEW ALIGNMENT	Sequence 1-6 Non-Int in Visit 04	270 Secs (270 Secs) [==>]	[1]
	6		(3) BORISOV-VISI T4-5	ACS/WFC, ACCUM, WFC	F775W POL120V		POS TARG 0,0; NEW ALIGNMENT	Sequence 1-6 Non-Int in Visit 04	270 Secs (270 Secs) [==>]	[1]



Proposal 16044 - Visit 05 - Polarimetry of New Interstellar Comet 2I/Borisov

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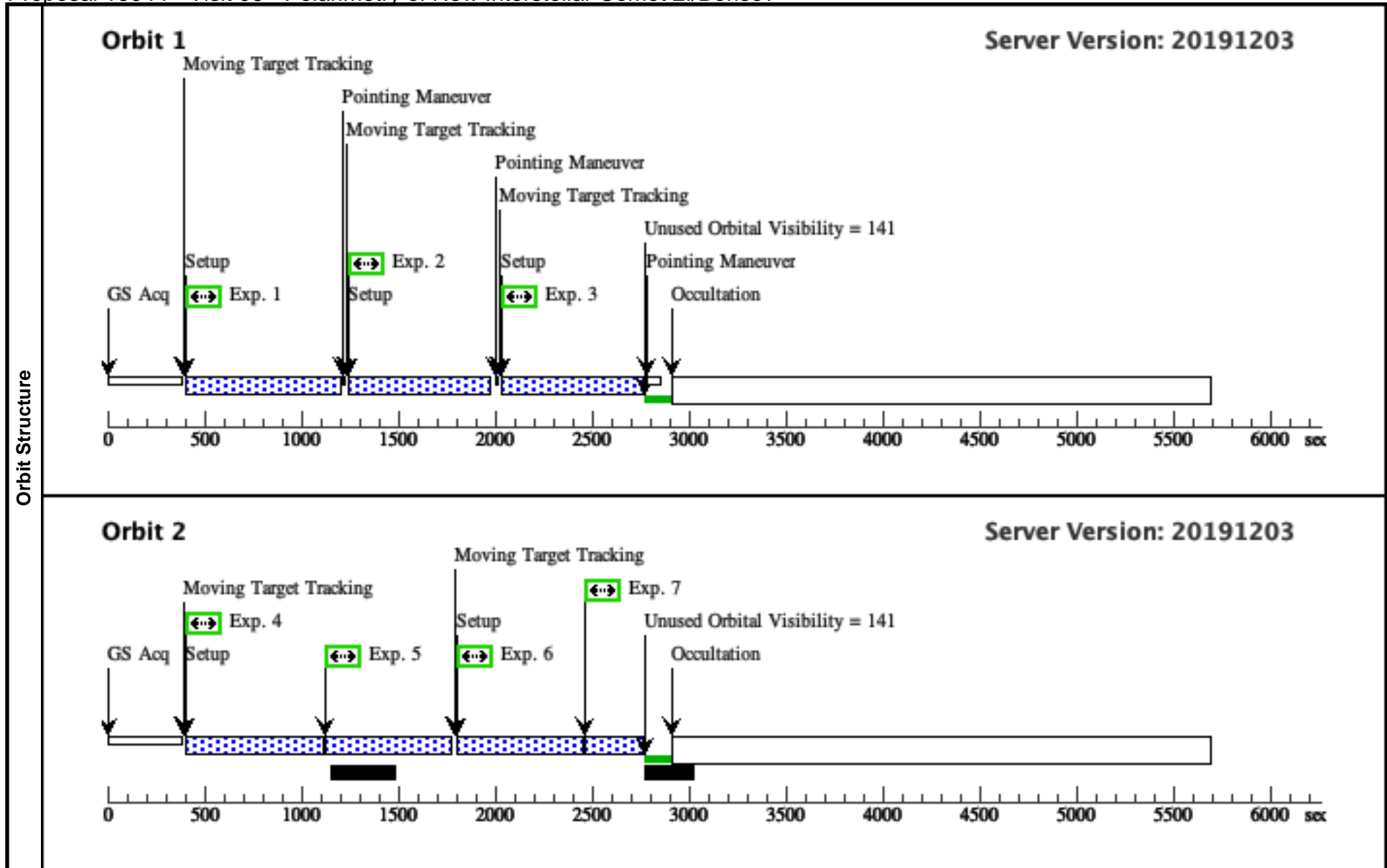
Visit		<b>Proposal 16044, Visit 05, completed</b> <b>Diagnostic Status: No Diagnostics</b> Scientific Instruments: ACS/WFC Special Requirements: ORIENT 0D TO 2D FROM 04; GROUP 05,04 WITHIN 0.5D								
Solar System Targets	#	Name	Level 1	Level 2	Level 3	Window	Ephem Center			
		(3)	BORISOV-VISIT4-5	TYPE=COMET,Q=2.0066469198896 02,E=3.357489316443313,I=44.05247 152804048 .O=308.1494484383344,W=209.12238 57291233,T=08-DEC- 2019:13:12:54,TTimeScale=TDB,EQ UINOX=J2000,EPOCH=20-DEC- 2019:00:00:00,EpochTimeScale=TDB, A1=2.001994848251E- 8,A2=1.551358127594E-7,A3=- 7.238847255707E-8				EARTH		
	Comments: Description=C/2019 Q4 (Borisov) Extended=YES									
Exposures	#	Label	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time (Total)/[Actual Dur.]	Orbit
	1	(3) BORISOV-VISI T4-5	(3) BORISOV-VISI T4-5	ACS/WFC, ACCUM, WFC	F606W POL0V		POS TARG 0.4,0.4; NEW ALIGNMENT	Sequence 1-8 Non-Int in Visit 05	155 Secs (155 Secs) [==>]	[1]
	2	(3) BORISOV-VISI T4-5	(3) BORISOV-VISI T4-5	ACS/WFC, ACCUM, WFC	F606W POL60V		POS TARG 0.4,0.4; NEW ALIGNMENT	Sequence 1-8 Non-Int in Visit 05	155 Secs (155 Secs) [==>]	[1]
	3	(3) BORISOV-VISI T4-5	(3) BORISOV-VISI T4-5	ACS/WFC, ACCUM, WFC	F606W POL120V		POS TARG 0.4,0.4; NEW ALIGNMENT	Sequence 1-8 Non-Int in Visit 05	155 Secs (155 Secs) [==>]	[1]
	4	(3) BORISOV-VISI T4-5	(3) BORISOV-VISI T4-5	ACS/WFC, ACCUM, WFC	F606W POL0V		POS TARG 0.0; NEW ALIGNMENT	Sequence 1-8 Non-Int in Visit 05	155 Secs (155 Secs) [==>]	[1]
	5	(3) BORISOV-VISI T4-5	(3) BORISOV-VISI T4-5	ACS/WFC, ACCUM, WFC	F606W POL60V		POS TARG 0.0; NEW ALIGNMENT	Sequence 1-8 Non-Int in Visit 05	155 Secs (155 Secs) [==>]	[1]
	6	(3) BORISOV-VISI T4-5	(3) BORISOV-VISI T4-5	ACS/WFC, ACCUM, WFC	F606W POL120V		POS TARG 0.0; NEW ALIGNMENT	Sequence 1-8 Non-Int in Visit 05	155 Secs (155 Secs) [==>]	[1]
	7	(3) BORISOV-VISI T4-5	(3) BORISOV-VISI T4-5	ACS/WFC, ACCUM, WFC1B-2K	F475W		POS TARG 0.0; NEW ALIGNMENT	Sequence 1-8 Non-Int in Visit 05	88 Secs (88 Secs) [==>]	[1]
	8	(3) BORISOV-VISI T4-5	(3) BORISOV-VISI T4-5	ACS/WFC, ACCUM, WFC1B-2K	F475W		POS TARG 0.0; NEW ALIGNMENT	Sequence 1-8 Non-Int in Visit 05	143 Secs (143 Secs) [==>]	[1]



Proposal 16044 - Visit 06 - Polarimetry of New Interstellar Comet 2I/Borisov

Tue May 19 15:00:28 GMT 2020

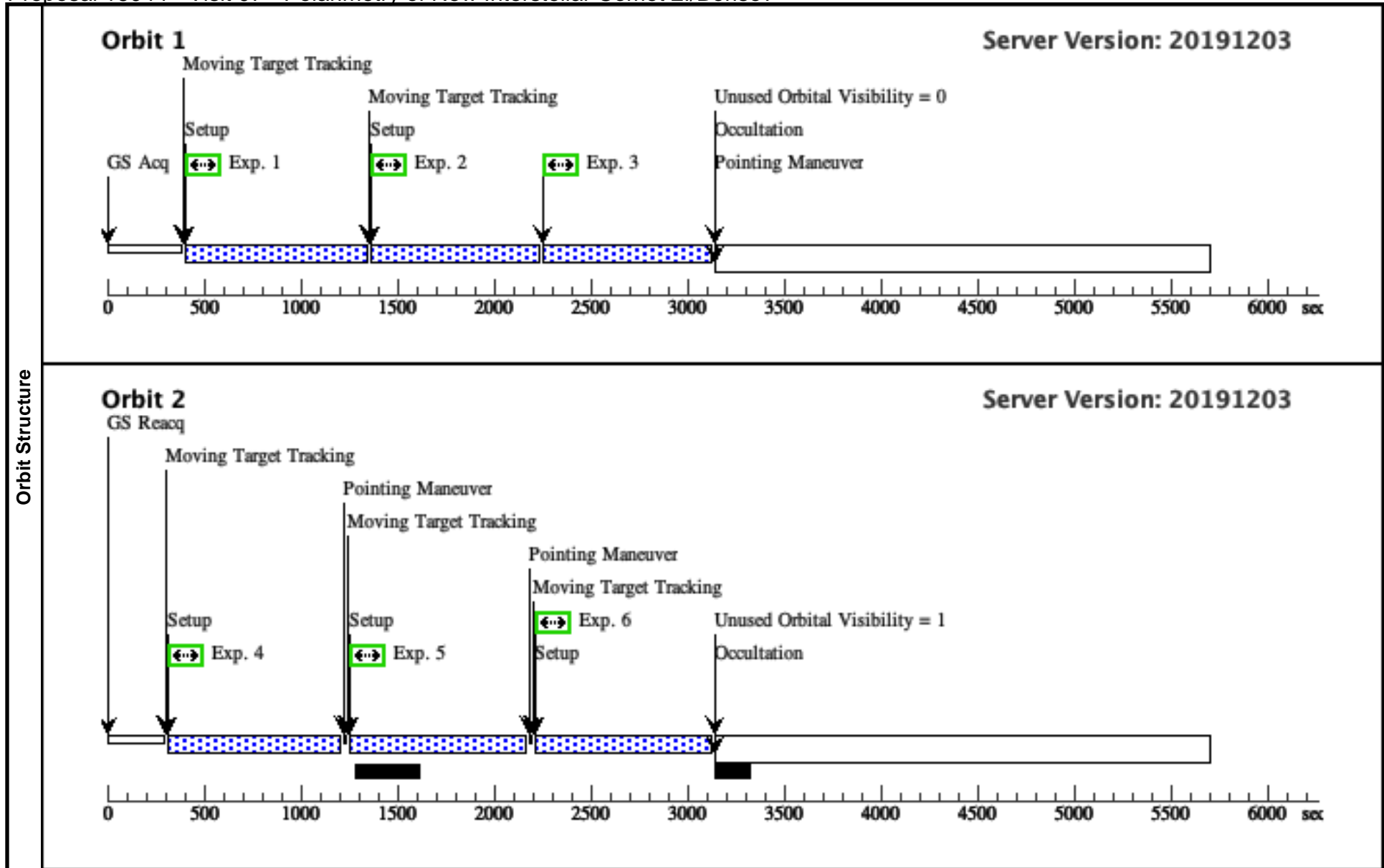
Visit	<b>Proposal 16044, Visit 06, completed</b> <b>Diagnostic Status: No Diagnostics</b> Scientific Instruments: ACS/WFC Special Requirements: SCHED 100%; ORIENT 282.5D TO 290 D; BETWEEN 28-JAN-2020:00:00:00 AND 30-JAN-2020:00:00:00									
	Solar System Targets	#	Name	Level 1	Level 2	Level 3	Window	Ephem Center		
	(4)	BORISOV-VISIT6	TYPE=COMET,Q=2.0066154765591 97,E=3.357057274677898,I=44.05348 671638512 .O=308.1499528970442,W=209.12439 7765598,T=08-DEC- 2019:13:18:12,TimeScale=TDB,EQ UINOX=J2000,EPOCH=05-JAN- 2020:00:00:00,EpochTimeScale=TDB, A1=-4.111801624298E-8,A2=- 2.939796209335E-8,A3=- 1.149449539185E-7					EARTH		
	<i>Comments: Description=C/2019 Q4 (Borisov)</i> <i>Extended=YES</i>									
Exposures	#	Label	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time (Total)/[Actual Dur.]	Orbit
	1		(4) BORISOV-VISI T6	ACS/WFC, ACCUM, WFC	F606W POL0V		POS TARG 0,0,4	Sequence 1-3 Non-Int in Visit 06	590 Secs (590 Secs) [==>]	[1]
	2		(4) BORISOV-VISI T6	ACS/WFC, ACCUM, WFC	F606W POL60V		POS TARG 0.4,0.4	Sequence 1-3 Non-Int in Visit 06	590 Secs (590 Secs) [==>]	[1]
	3		(4) BORISOV-VISI T6	ACS/WFC, ACCUM, WFC	F606W POL120V		POS TARG -0.4,0.4	Sequence 1-3 Non-Int in Visit 06	590 Secs (590 Secs) [==>]	[1]
	4		(4) BORISOV-VISI T6	ACS/WFC, ACCUM, WFC	F606W POL120V		POS TARG 0,0; NEW OBSSET FULL ACQ; NEW ALIGNMENT	Sequence 4-7 Non-Int in Visit 06	505 Secs (505 Secs) [==>]	[2]
	5		(4) BORISOV-VISI T6	ACS/WFC, ACCUM, WFC	F606W POL60V		POS TARG 0,0	Sequence 4-7 Non-Int in Visit 06	505 Secs (505 Secs) [==>]	[2]
	6		(4) BORISOV-VISI T6	ACS/WFC, ACCUM, WFC	F606W POL0V		POS TARG 0,0; NEW ALIGNMENT	Sequence 4-7 Non-Int in Visit 06	505 Secs (505 Secs) [==>]	[2]
	7		(4) BORISOV-VISI T6	ACS/WFC, ACCUM, WFC1B-2K	F606W			Sequence 4-7 Non-Int in Visit 06	128 Secs (128 Secs) [==>]	[2]



Proposal 16044 - Visit 07 - Polarimetry of New Interstellar Comet 2I/Borisov

Tue May 19 15:00:28 GMT 2020

Visit	<b>Proposal 16044, Visit 07, completed</b> <b>Diagnostic Status: No Diagnostics</b> Scientific Instruments: ACS/WFC Special Requirements: BETWEEN 02-MAR-2020:18:45:00 AND 02-MAR-2020:23:00:00									
	#	Name	Level 1	Level 2	Level 3	Window	Ephem Center			
Solar System Targets	(5)	BORISOV-VISIT7	TYPE=COMET,Q=2.0066154765591 97,E=3.357057274677898,I=44.05348 671638512 .O=308.1499528970442,W=209.12439 7765598,T=08-DEC- 2019:13:18:12,TimeScale=TDB,EQ UINOX=J2000,EPOCH=05-JAN- 2020:00:00:00,EpochTimeScale=TDB, A1=-4.111801624298E-8,A2=- 2.939796209335E-8,A3=- 1.149449539185E-7					EARTH		
	Comments: Description=C/2019 Q4 (Borisov) Extended=YES									
Exposures	#	Label	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time (Total)/[Actual Dur.]	Orbit
	1		(5) BORISOV-VISI T7	ACS/WFC, ACCUM, WFC	F606W POL120V		POS TARG 0,0; NEW ALIGNMENT	Sequence 1-3 Non-Int in Visit 07	730 Secs (730 Secs) [==>]	[1]
	2		(5) BORISOV-VISI T7	ACS/WFC, ACCUM, WFC	F606W POL60V		POS TARG 0,0; NEW ALIGNMENT	Sequence 1-3 Non-Int in Visit 07	730 Secs (730 Secs) [==>]	[1]
	3		(5) BORISOV-VISI T7	ACS/WFC, ACCUM, WFC	F606W POL0V		POS TARG 0,0	Sequence 1-3 Non-Int in Visit 07	730 Secs (730 Secs) [==>]	[1]
	4		(5) BORISOV-VISI T7	ACS/WFC, ACCUM, WFC	F606W POL0V		POS TARG -0.4,0.4; NEW ALIGNMENT	Sequence 4-6 Non-Int in Visit 07	769 Secs (769 Secs) [==>]	[2]
	5		(5) BORISOV-VISI T7	ACS/WFC, ACCUM, WFC	F606W POL60V		POS TARG 0.4,0; NEW ALIGNMENT	Sequence 4-6 Non-Int in Visit 07	769 Secs (769 Secs) [==>]	[2]
	6		(5) BORISOV-VISI T7	ACS/WFC, ACCUM, WFC	F606W POL120V		POS TARG -0.4,-0.4 ; NEW ALIGNMENT	Sequence 4-6 Non-Int in Visit 07	769 Secs (769 Secs) [==>]	[2]



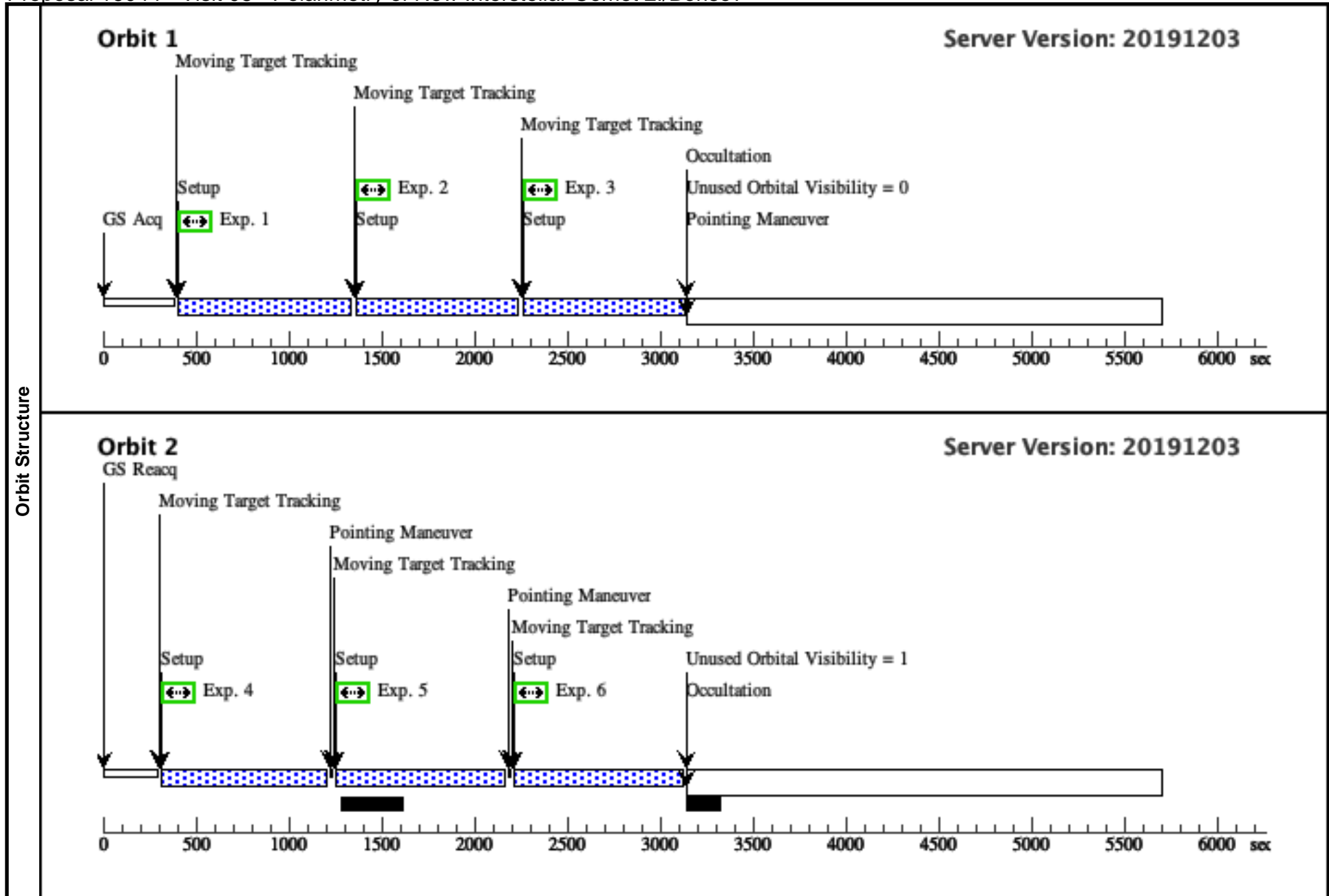
Proposal 16044 - Visit 08 - Polarimetry of New Interstellar Comet 2I/Borisov

Tue May 19 15:00:28 GMT 2020

<b>Visit</b>	<b>Proposal 16044, Visit 08, completed</b> <b>Diagnostic Status: No Diagnostics</b> Scientific Instruments: ACS/WFC Special Requirements: BETWEEN 01-APR-2020:22:00:00 AND 02-APR-2020:02:00:00; BETWEEN 03-APR-2020:02:00:00 AND 03-APR-2020:09:00:00; BETWEEN 04-APR-2020:05:00:00 AND 04-APR-2020:09:00:00					

<b>Solar System Targets</b>	#	Name	Level 1	Level 2	Level 3	Window	Ephem Center
	(6)	BORISOV-VISIT8	TYPE=COMET,Q=2.0066154765591 97,E=3.357057274677898,I=44.05348 671638512 ,O=308.1499528970442,W=209.12439 7765598,T=08-DEC- 2019:13:18:12,TTimeScale=TDB,EQ UINOX=J2000,EPOCH=05-JAN- 2020:00:00:00,EpochTimeScale=TDB, A1=-4.111801624298E-8,A2=- 2.939796209335E-8,A3=- 1.149449539185E-7				
Comments: Description=C/2019 Q4 (Borisov) Extended=YES							

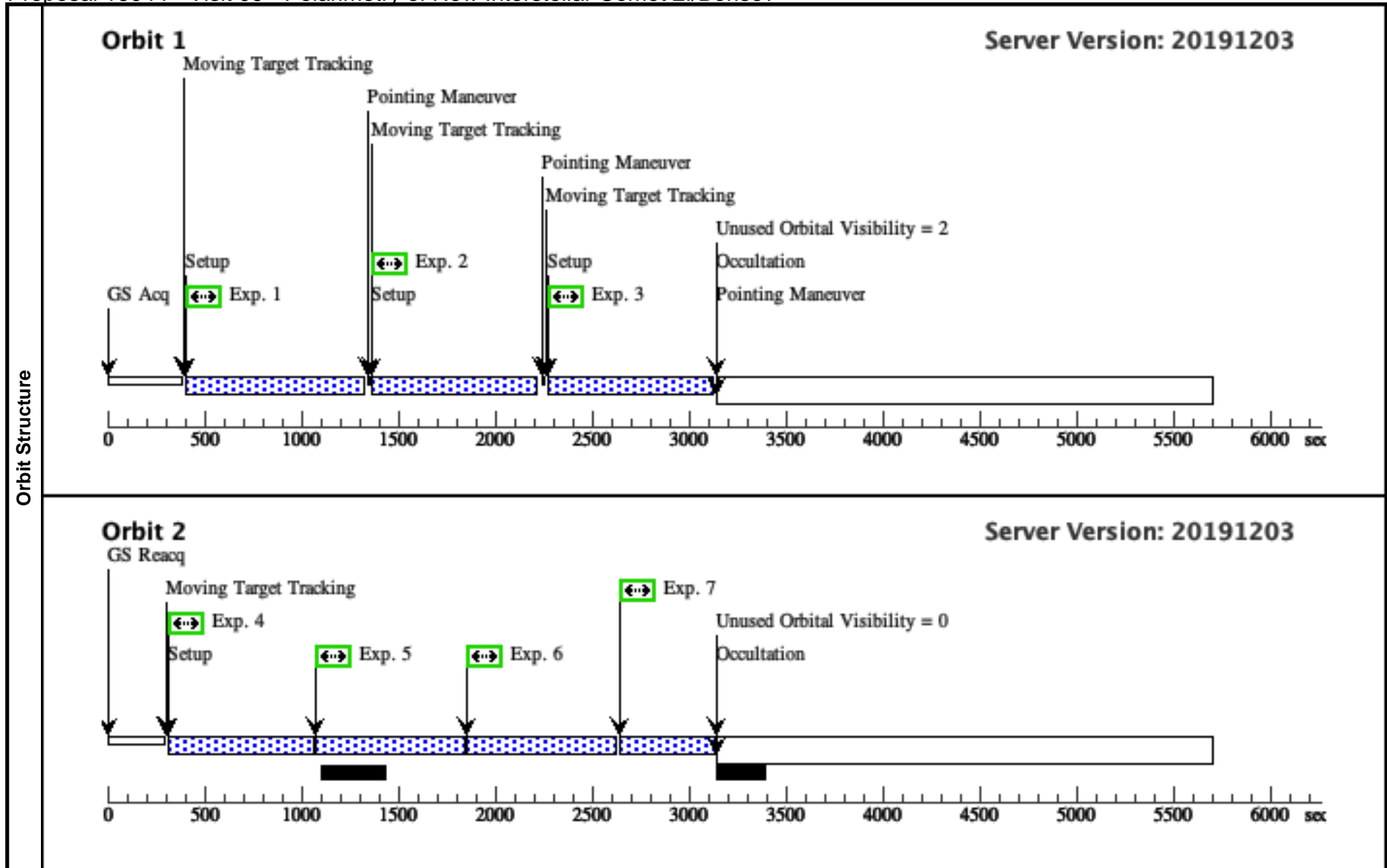
<b>Exposures</b>	#	Label	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time (Total)/[Actual Dur.]	Orbit
	1		(6) BORISOV-VISIT8	ACS/WFC, ACCUM, WFC	F606W POL120V		POS TARG 0,0; NEW ALIGNMENT	Sequence 1-3 Non-Int in Visit 08	725 Secs (725 Secs) [==>]	[1]
	2		(6) BORISOV-VISIT8	ACS/WFC, ACCUM, WFC	F606W POL60V		POS TARG 0,0; NEW ALIGNMENT	Sequence 1-3 Non-Int in Visit 08	725 Secs (725 Secs) [==>]	[1]
	3		(6) BORISOV-VISIT8	ACS/WFC, ACCUM, WFC	F606W POL0V		POS TARG 0,0; NEW ALIGNMENT	Sequence 1-3 Non-Int in Visit 08	725 Secs (725 Secs) [==>]	[1]
	4		(6) BORISOV-VISIT8	ACS/WFC, ACCUM, WFC	F606W POL0V		POS TARG -0.4,0.4; NEW ALIGNMENT	Sequence 4-6 Non-Int in Visit 08	769 Secs (769 Secs) [==>]	[2]
	5		(6) BORISOV-VISIT8	ACS/WFC, ACCUM, WFC	F606W POL60V		POS TARG -0.4,0; NEW ALIGNMENT	Sequence 4-6 Non-Int in Visit 08	769 Secs (769 Secs) [==>]	[2]
	6		(6) BORISOV-VISIT8	ACS/WFC, ACCUM, WFC	F606W POL120V		POS TARG 0.4,-0.4; NEW ALIGNMENT	Sequence 4-6 Non-Int in Visit 08	769 Secs (769 Secs) [==>]	[2]



Proposal 16044 - Visit 09 - Polarimetry of New Interstellar Comet 2I/Borisov

Tue May 19 15:00:29 GMT 2020

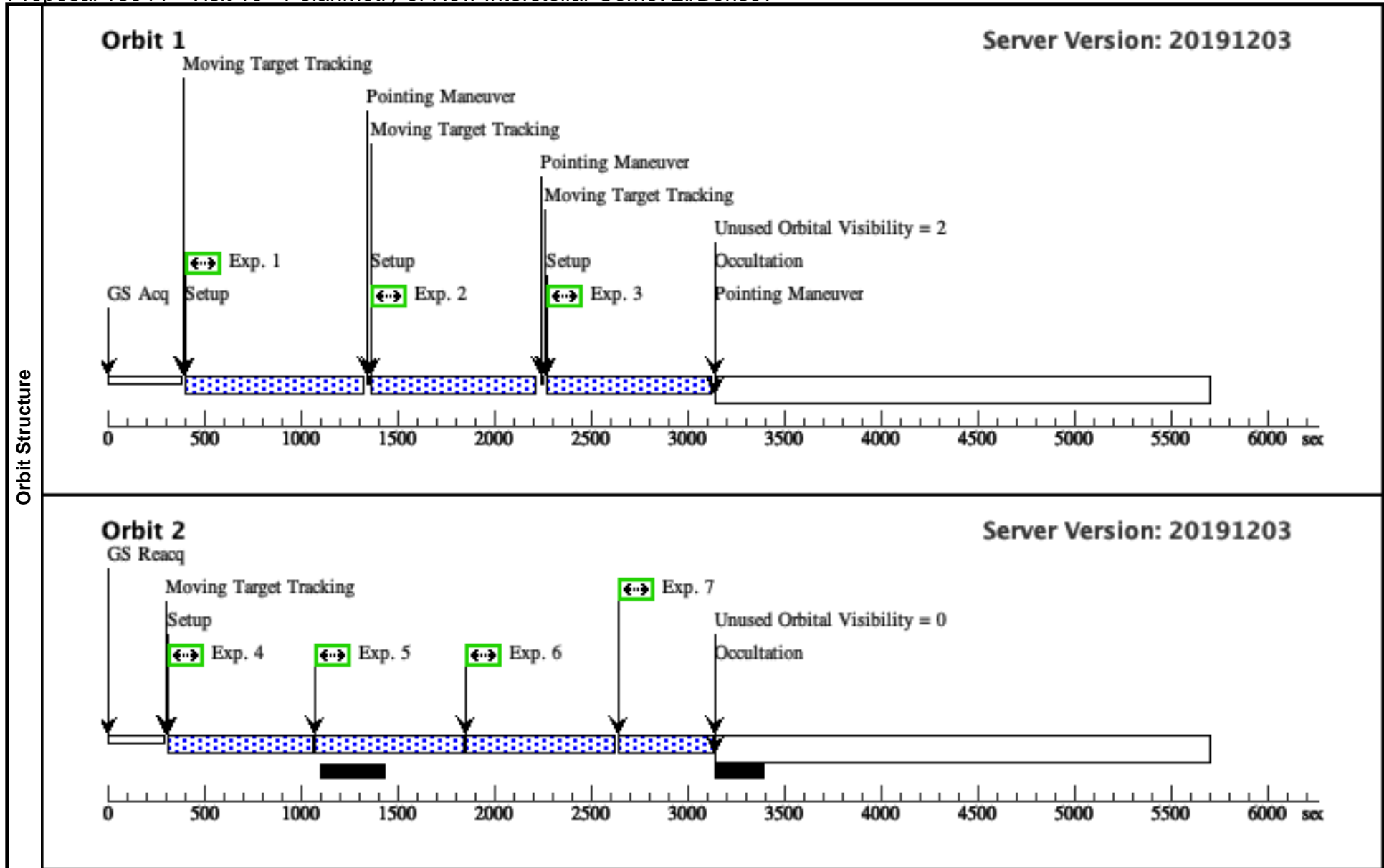
Visit	<b>Proposal 16044, Visit 09, completed</b> <b>Diagnostic Status: No Diagnostics</b> Scientific Instruments: ACS/WFC Special Requirements: BETWEEN 05-MAY-2020:07:00:00 AND 05-MAY-2020:12:00:00; BETWEEN 08-MAY-2020:07:00:00 AND 08-MAY-2020:13:00:00; BETWEEN 09-MAY-2020:00:00:00 AND 09-MAY-2020:06:00:00; BETWEEN 09-MAY-2020:11:30:00 AND 09-MAY-2020:14:30:00; BETWEEN 10-MAY-2020:06:00:00 AND 10-MAY-2020:12:30:00									
	Solar System Targets	#	Name	Level 1	Level 2	Level 3	Window	Ephem Center		
		(7)	BORISOV-VISIT9	TYPE=COMET,Q=2.0066240085872 65,E=3.356191268153205,I=44.05262 620283894 ,O=308.1489154698829,W=209.12460 56235187,T=08-DEC- 2019:13:04:38,TimeScale=TDB,EQ UINOX=J2000,EPOCH=31-JUL- 2020:00:00:00,EpochTimeScale=TDB, R0=2.808 ,DT=0. ,A1=7.312064170837E-8,A2=- 3.252092599869E-8,A3=0. ,ALN=0.1112620426,NM=2.15,NN=5. 093,NK=4.6142,AMRAT=0.					EARTH	
	Comments: Description=C/2019 Q4 (Borisov) Extended=YES									
Exposures	#	Label	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time (Total)/[Actual Dur.]	Orbit
	1		(7) BORISOV-VISIT9	ACS/WFC, ACCUM, WFC	F606W POL0V		POS TARG 0,0	Sequence 1-3 Non-Int in Visit 09	711 Secs (711 Secs) [==>]	[1]
	2		(7) BORISOV-VISIT9	ACS/WFC, ACCUM, WFC	F606W POL60V		POS TARG .4,0	Sequence 1-3 Non-Int in Visit 09	711 Secs (711 Secs) [==>]	[1]
	3		(7) BORISOV-VISIT9	ACS/WFC, ACCUM, WFC	F606W POL120V		POS TARG 0,0,4	Sequence 1-3 Non-Int in Visit 09	711 Secs (711 Secs) [==>]	[1]
	4		(7) BORISOV-VISIT9	ACS/WFC, ACCUM, WFC	F606W POL120V		POS TARG 0,0	Sequence 4-7 Non-Int in Visit 09	626 Secs (626 Secs) [==>]	[2]
	5		(7) BORISOV-VISIT9	ACS/WFC, ACCUM, WFC	F606W POL60V		POS TARG 0,0	Sequence 4-7 Non-Int in Visit 09	626 Secs (626 Secs) [==>]	[2]
	6		(7) BORISOV-VISIT9	ACS/WFC, ACCUM, WFC	F606W POL0V		POS TARG 0,0	Sequence 4-7 Non-Int in Visit 09	626 Secs (626 Secs) [==>]	[2]
	7		(7) BORISOV-VISIT9	ACS/WFC, ACCUM, WFC1B-2K	F775W		POS TARG 0,0	Sequence 4-7 Non-Int in Visit 09	282 Secs (282 Secs) [==>]	[2]



Proposal 16044 - Visit 10 - Polarimetry of New Interstellar Comet 2I/Borisov

Tue May 19 15:00:29 GMT 2020

Visit	<b>Proposal 16044, Visit 10, failed</b> <b>Diagnostic Status: No Diagnostics</b> Scientific Instruments: ACS/WFC Special Requirements: BETWEEN 08-MAY-2020:07:00:00 AND 08-MAY-2020:13:00:00; BETWEEN 09-MAY-2020:00:00:00 AND 09-MAY-2020:06:00:00; BETWEEN 09-MAY-2020:11:30:00 AND 09-MAY-2020:14:30:00; BETWEEN 10-MAY-2020:06:00:00 AND 10-MAY-2020:12:30:00; GROUP 10,09 WITHIN 0.5D									
	#	Name	Level 1	Level 2	Level 3	Window	Ephem Center			
Solar System Targets	(8)	BORISOV-VISIT9-OFFSET	TYPE=COMET,Q=2.0066240085872 65,E=3.356191268153205,I=44.05262 620283894 ,O=308.1489154698829,W=209.12460 56235187,T=08-DEC- 2019:13:04:38,TTIMEscale=TDB,EQ UINOX=J2000,EPOCH=31-JUL- 2020:00:00:00,EpochTimeScale=TDB, R0=2.808 ,DT=0. ,A1=7.312064170837E-8,A2=- 3.252092599869E-8,A3=0. ,ALN=0.1112620426,NM=2.15,NN=5. 093,NK=4.6142,AMRAT=0.	TYPE=POS_ANGLE,RAD=,8,ANG= 135,REF=NORTH			EARTH			
	Comments: Description=C/2019 Q4 (Borisov) Extended=YES									
Exposures	#	Label	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time (Total)/[Actual Dur.]	Orbit
	1		(8) BORISOV-VISIT9-OFFSET	ACS/WFC, ACCUM, WFC	F606W POL0V		POS TARG 0,0	Sequence 1-3 Non-Int in Visit 10	711 Secs (711 Secs) [==>]	[1]
	2		(8) BORISOV-VISIT9-OFFSET	ACS/WFC, ACCUM, WFC	F606W POL60V		POS TARG 0,.4	Sequence 1-3 Non-Int in Visit 10	711 Secs (711 Secs) [==>]	[1]
	3		(8) BORISOV-VISIT9-OFFSET	ACS/WFC, ACCUM, WFC	F606W POL120V		POS TARG .4,0	Sequence 1-3 Non-Int in Visit 10	711 Secs (711 Secs) [==>]	[1]
	4		(8) BORISOV-VISIT9-OFFSET	ACS/WFC, ACCUM, WFC	F606W POL120V		POS TARG 0,0	Sequence 4-7 Non-Int in Visit 10	626 Secs (626 Secs) [==>]	[2]
	5		(8) BORISOV-VISIT9-OFFSET	ACS/WFC, ACCUM, WFC	F606W POL60V		POS TARG 0,0	Sequence 4-7 Non-Int in Visit 10	626 Secs (626 Secs) [==>]	[2]
	6		(8) BORISOV-VISIT9-OFFSET	ACS/WFC, ACCUM, WFC	F606W POL0V		POS TARG 0,0	Sequence 4-7 Non-Int in Visit 10	626 Secs (626 Secs) [==>]	[2]
	7		(8) BORISOV-VISIT9-OFFSET	ACS/WFC, ACCUM, WFC1B-2K	F775W		POS TARG 0,0	Sequence 4-7 Non-Int in Visit 10	282 Secs (282 Secs) [==>]	[2]



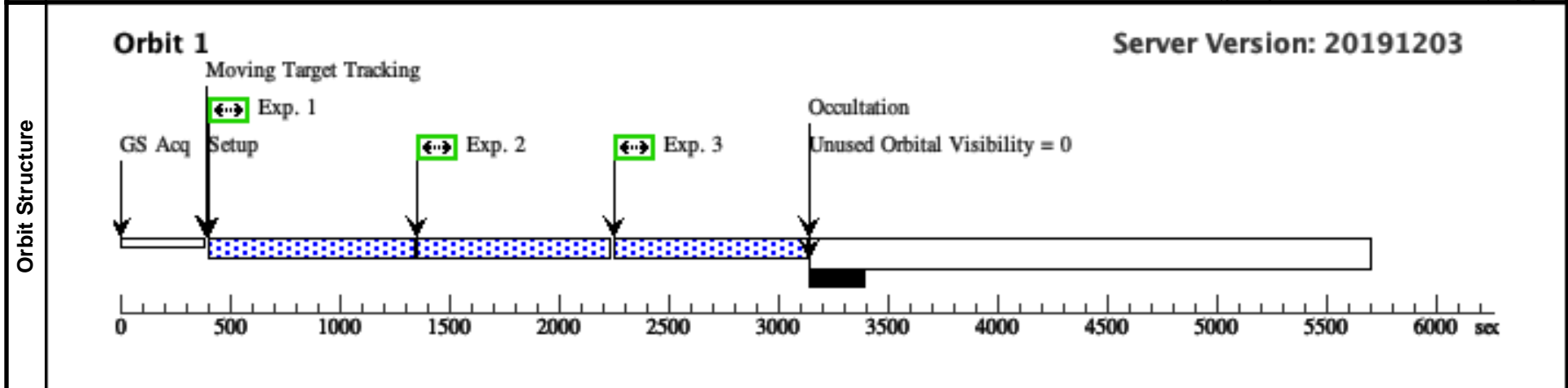
Proposal 16044 - Visit 11 - Polarimetry of New Interstellar Comet 2I/Borisov

Tue May 19 15:00:29 GMT 2020

<b>Visit</b>	<b>Proposal 16044, Visit 11, implementation</b>					
	<b>Diagnostic Status: No Diagnostics</b> Scientific Instruments: ACS/WFC Special Requirements: BETWEEN 15-JUN-2020:13:30:00 AND 15-JUN-2020:14:30:00; BETWEEN 15-JUN-2020:17:00:00 AND 16-JUN-2020:05:00:00; BETWEEN 16-JUN-2020:10:30:00 AND 16-JUN-2020:12:30:00					

<b>Solar System Targets</b>	#	Name	Level 1	Level 2	Level 3	Window	Ephem Center
	(9)	BORISOV-VISIT11	TYPE=COMET,Q=2.0066240085872 65,E=3.356191268153205,I=44.05262 620283894 ,O=308.1489154698829,W=209.12460 56235187,T=08-DEC- 2019:13:04:38,TTTimeScale=TDB,EQ UINOX=J2000,EPOCH=31-JUL- 2020:00:00:00,EpochTimeScale=TDB, R0=2.808 ,DT=0. ,A1=7.312064170837E-8,A2=- 3.252092599869E-8,A3=0. ,ALN=0.1112620426,NM=2.15,NN=5. 093,NK=4.6142,AMRAT=0.				
<i>Comments: Description=C/2019 Q4 (Borisov)</i> <i>Extended=YES</i>							

<b>Exposures</b>	#	Label	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time (Total)/[Actual Dur.]	Orbit
	1	(9) BORISOV-VISIT11	(9) BORISOV-VISIT11	ACS/WFC, ACCUM, WFC	F606W POL0V		POS TARG 0,0	Sequence 1-3 Non-Int in Visit 11	735 Secs (735 Secs)	[1]
2	(9) BORISOV-VISIT11	(9) BORISOV-VISIT11	ACS/WFC, ACCUM, WFC	F606W POL60V		POS TARG 0,0	Sequence 1-3 Non-Int in Visit 11	735 Secs (735 Secs)	[1]	
3	(9) BORISOV-VISIT11	(9) BORISOV-VISIT11	ACS/WFC, ACCUM, WFC	F606W POL120V		POS TARG 0,0	Sequence 1-3 Non-Int in Visit 11	735 Secs (735 Secs)	[1]	



Proposal 16044 - Visit 12 - Polarimetry of New Interstellar Comet 2I/Borisov

Tue May 19 15:00:29 GMT 2020

<b>Visit</b>	<b>Proposal 16044, Visit 12, implementation</b>					
	<b>Diagnostic Status: No Diagnostics</b> Scientific Instruments: ACS/WFC Special Requirements: BETWEEN 15-JUN-2020:13:30:00 AND 15-JUN-2020:14:30:00; BETWEEN 15-JUN-2020:17:00:00 AND 16-JUN-2020:05:00:00; BETWEEN 16-JUN-2020:10:30:00 AND 16-JUN-2020:12:30:00; GROUP 12,11 WITHIN 0.5D					

<b>Solar System Targets</b>	#	Name	Level 1	Level 2	Level 3	Window	Ephem Center
	(10)	BORISOV-VISIT11-OFFSET	TYPE=COMET,Q=2.0066240085872 65,E=3.356191268153205,I=44.05262 620283894 ,O=308.1489154698829,W=209.12460 56235187,T=08-DEC-2019:13:04:38,TTTimeScale=TDB,EQ UINOX=J2000,EPOCH=31-JUL-2020:00:00:00,EpochTimeScale=TDB, R0=2.808 ,DT=0. ,A1=7.312064170837E-8,A2=-3.252092599869E-8,A3=0. ,ALN=0.1112620426,NM=2.15,NN=5.093,NK=4.6142,AMRAT=0.	TYPE=POS_ANGLE,RAD=.8,ANG=135,REF=NORTH			
Comments: Description=C/2019 Q4 (Borisov) Extended=YES							

<b>Exposures</b>	#	Label	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time (Total)/[Actual Dur.]	Orbit
	1	(10) BORISOV-VISIT11-OFFSET	ACS/WFC, ACCUM, WFC	F606W		POS TARG 0,0	Sequence 1-3 Non-Int in Visit 12	735 Secs (735 Secs)	[1]	
2	(10) BORISOV-VISIT11-OFFSET	ACS/WFC, ACCUM, WFC	F606W		POS TARG 0,0	Sequence 1-3 Non-Int in Visit 12	735 Secs (735 Secs)	[1]		
3	(10) BORISOV-VISIT11-OFFSET	ACS/WFC, ACCUM, WFC	F606W		POS TARG 0,0	Sequence 1-3 Non-Int in Visit 12	735 Secs (735 Secs)	[1]		

