13198 - The First Pre-Perihelion Nucleus Size Measurement of a Sungrazing Comet, C/2012 S1 (ISON)

Cycle: 20, Proposal Category: GO/DD

(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) ISON	WFC3/UVIS	1	26-Mar-2013 21:03:46.0	yes
02	(1) ISON	WFC3/UVIS	1	26-Mar-2013 21:03:56.0	yes
03	(1) ISON	WFC3/UVIS	1	26-Mar-2013 21:04:04.0	yes

3 Total Orbits Used

ABSTRACT

Comet ISON (C/2012 S1), potentially on its first sojourn into the inner-solar system, will pass within two solar radii of the Sun's surface at perihelion. It presents us with a unique opportunity to study the properties of an Oort Cloud comet and to characterize evolutionary changes in the nucleus as it experiences the extraordinary and rapid change in its thermal and dynamical environment. Measuring the pre-perihelion size of the nucleus is fundamental to characterizing these changes. We propose to measure the nuclear size of Comet ISON as early as possible, particularly before the onset of water sublimation in early summer. An early nuclear size measurement enables or enhances the science returns of many future observations of this comet, and improves our predictions for its survivability and possible outcomes from the perihelion passage, greatly benefiting observation planning. Potentially contemporaneous observations with Herschel Space Telescope allow for the measurement of the nuclear albedo, further strengthening our proposed observations.

OBSERVING DESCRIPTION

The goal of this observation is to measure the size of the nucleus of Comet C/2012 S1 (ISON) before its activity is expected to dramatically increase when water sublimation is turned on at ~3 AU heliocentric distance in this fall. A small geocentric distance is essential for the goal. Since the geocentric distance of this comet is currently increasing until after it enters the HST exclusion zone in mid May until early October, we need to execute the observations as early as possible.

We plan to use three orbits to image the comet with identical sequences. For each orbit, we will primarily use the F606W filter to image the comet, and also take images through the F438W filter to determine the color of the nucleus and coma. We will include two exposure levels for the F606W filter, 50 sec and 274 sec. For the F438W filter, we will use one exposure level of 300 sec. To avoid bad pixels and cosmic rays, we will both take multiple long exposures at the same pointing and use two-point dither. We plan to use a 1k-by-1k subarray (UVIS2-C1K1C-SUB) to reduce the instrument overhead and eliminate any issues associated with dumping the data buffer. In addition, in order to mitigate the possible CTE loss for the exposures through F438W filter due to the faint sky and possibly faint comet at this wavelength, we will use post flash value of 6 to add background to about 12 e-.

The imaging sequence of each single orbit is:

50s F606W
272s F606W x2 copies

50s F606W
300s F438W
Dither to a 2nd location
300s F438W
50s F606W
272s F606W x2 copies
502 F606W

The purpose of imaging the comet three times in three separate orbits is to bracket the photometric range of the nucleus in a full rotation to avoid potential bias in the size determination. Since the rotational period is completely unknown, we need to separate the three orbits based on the statistical characteristics of the rotational periods of all comets previously measured. The best strategy is to execute the second orbit 3-6 hrs (2-4 orbits) after the first orbit, and execute the third orbit 12-24 hrs (8-16 orbits) after the second orbit. The exact timing is not critical here, as long as the two separations are not nearly commensurable.

Visit

Proposal 13198, Visit 01, implementation Wed Mar 27 01:04:12 GMT 2013

Diagnostic Status: No Diagnostics

Scientific Instruments: WFC3/UVIS

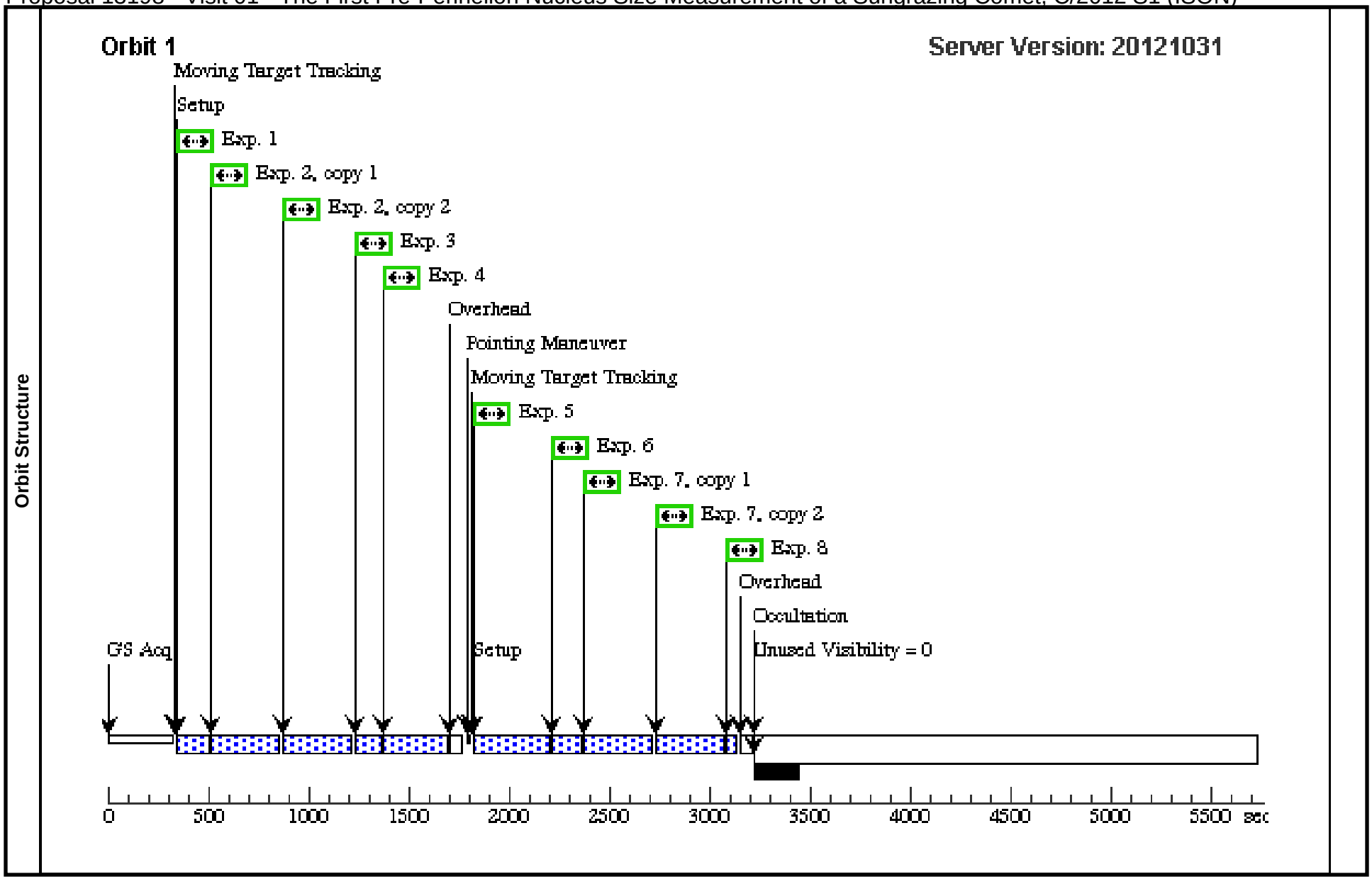
Special Requirements: (none)

Solar System Targets

#	Name	Level 1	Level 2	Level 3	Window	Ephem Center
(1)	ISON	TYPE=COMET,Q=0.012502588348629 41,E=1.000004161371302,I=61.85935281653595,O=295.7375188569599,W=345.5090969848318,T=28-NOV-2013:18:42:46,TTimeScale=UTC,EQUINOX=J2000,EPOCH=07-JAN-2013:00:00:00,EpochTimeScale=TDB				EARTH

Exposures

#	Label	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time/[Actual Dur.]	Orbit
1		(1) ISON	WFC3/UVIS, ACCUM, UVIS2-C1K1C-SUB	F606W	CR-SPLIT=NO			50 Secs *[==>]*	 ***[1]***
2		(1) ISON	WFC3/UVIS, ACCUM, UVIS2-C1K1C-SUB	F606W	CR-SPLIT=NO			272 Secs X 2 *[==>(Copy 1)]* *[==>(Copy 2)]*	 ***[1]***
3		(1) ISON	WFC3/UVIS, ACCUM, UVIS2-C1K1C-SUB	F606W	CR-SPLIT=NO			50 Secs *[==>]*	 ***[1]***
4		(1) ISON	WFC3/UVIS, ACCUM, UVIS2-C1K1C-SUB	F438W	CR-SPLIT=NO; FLASH=6			300 Secs *[==>]*	 ***[1]***
5		(1) ISON	WFC3/UVIS, ACCUM, UVIS2-C1K1C-SUB	F438W	CR-SPLIT=NO; FLASH=6	POS TARG 0.4,0.4		300 Secs *[==>]*	 ***[1]***
6		(1) ISON	WFC3/UVIS, ACCUM, UVIS2-C1K1C-SUB	F606W	CR-SPLIT=NO	SAME POS AS 5		50 Secs *[==>]*	 ***[1]***
7		(1) ISON	WFC3/UVIS, ACCUM, UVIS2-C1K1C-SUB	F606W	CR-SPLIT=NO	SAME POS AS 5		272 Secs X 2 *[==>(Copy 1)]* *[==>(Copy 2)]*	 ***[1]***
8		(1) ISON	WFC3/UVIS, ACCUM, UVIS2-C1K1C-SUB	F606W	CR-SPLIT=NO	SAME POS AS 5		50 Secs *[==>]*	 ***[1]***


Orbit Structure
Orbit 1
Server Version: 20121031
Moving Target Tracking
Setup
Exp. 1
Exp. 2, copy 1
Exp. 2, copy 2
Exp. 3
Exp. 4
Overhead
Pointing Maneuver
Moving Target Tracking
Exp. 5
Exp. 6
Exp. 7, copy 1
Exp. 7, copy 2
Exp. 8
Overhead
Occultation
Unused Visibility = 0
GS Acq
Setup
0
500
1000
1500
2000
2500
3000
3500
4000
4500
5000
5500
sec

Visit

Proposal 13198, Visit 02, implementation Wed Mar 27 01:04:14 GMT 2013

Diagnostic Status: No Diagnostics

Scientific Instruments: WFC3/UVIS

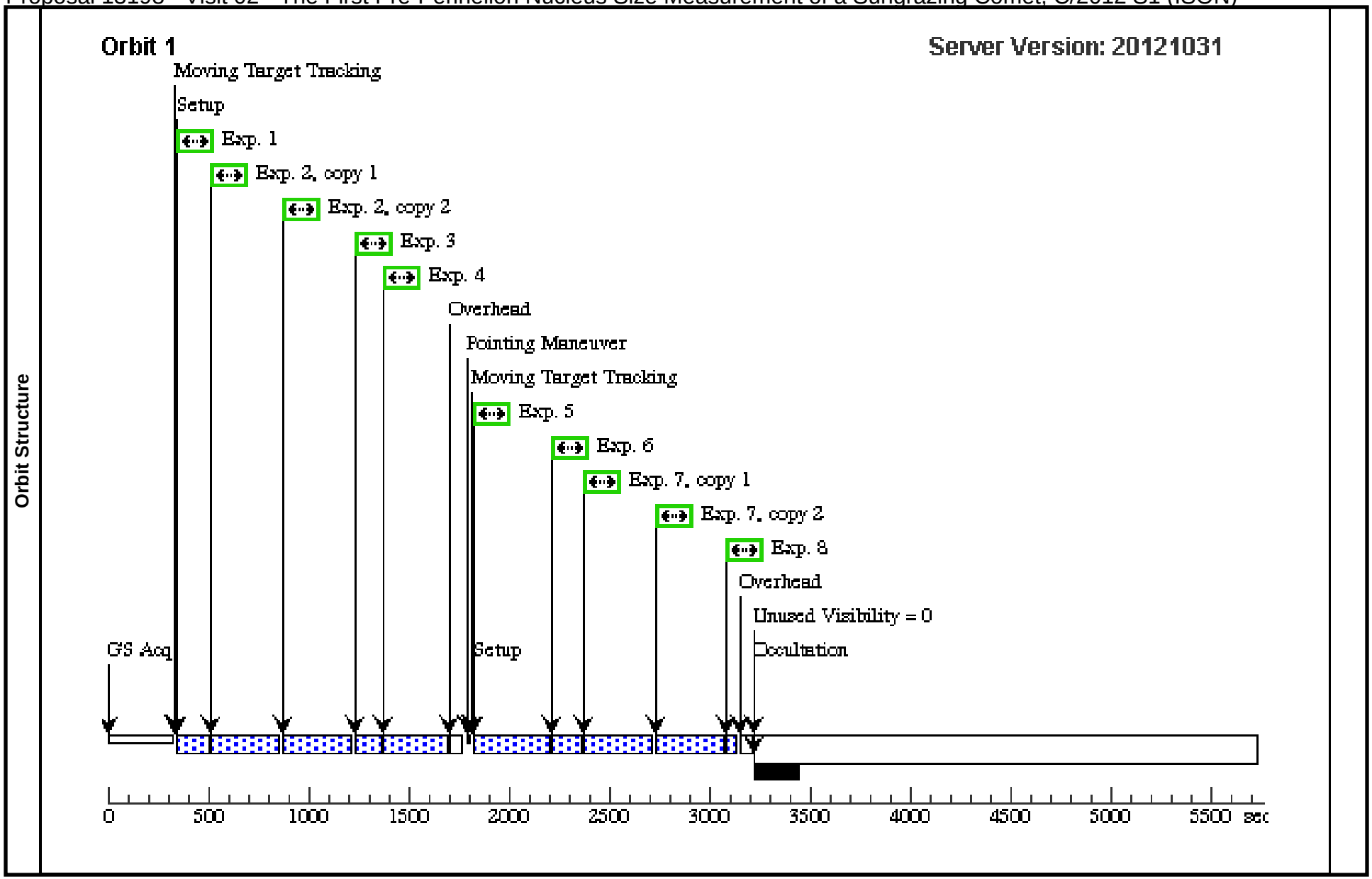
Special Requirements: AFTER 01 BY 2 Orbits TO 4 Orbits

Solar System Targets

#	Name	Level 1	Level 2	Level 3	Window	Ephem Center
(1)	ISON	TYPE=COMET,Q=0.0125025883486 2941,E=1.000004161371302,I=61.859 35281653595,O=295.7375188569599, W=345.5090969848318,T=28-NOV-2013:18:42:46,TTimeScale=UTC,EQ UINOX=J2000,EPOCH=07-JAN-2013:00:00:00,EpochTimeScale=TDB				EARTH

Exposures

#	Label	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time/[Actual Dur.]	Orbit
1		(1) ISON	WFC3/UVIS, ACCUM, UVIS2-C1K1C-SUB	F606W	CR-SPLIT=NO			50 Secs *[==>]*	 ***[1]***
2		(1) ISON	WFC3/UVIS, ACCUM, UVIS2-C1K1C-SUB	F606W	CR-SPLIT=NO			272 Secs X 2 *[==>(Copy 1)]* *[==>(Copy 2)]*	 ***[1]***
3		(1) ISON	WFC3/UVIS, ACCUM, UVIS2-C1K1C-SUB	F606W	CR-SPLIT=NO			50 Secs *[==>]*	 ***[1]***
4		(1) ISON	WFC3/UVIS, ACCUM, UVIS2-C1K1C-SUB	F438W	CR-SPLIT=NO; FLASH=6			300 Secs *[==>]*	 ***[1]***
5		(1) ISON	WFC3/UVIS, ACCUM, UVIS2-C1K1C-SUB	F438W	CR-SPLIT=NO; FLASH=6	POS TARG 0.4,0.4		300 Secs *[==>]*	 ***[1]***
6		(1) ISON	WFC3/UVIS, ACCUM, UVIS2-C1K1C-SUB	F606W	CR-SPLIT=NO	SAME POS AS 5		50 Secs *[==>]*	 ***[1]***
7		(1) ISON	WFC3/UVIS, ACCUM, UVIS2-C1K1C-SUB	F606W	CR-SPLIT=NO	SAME POS AS 5		272 Secs X 2 *[==>(Copy 1)]* *[==>(Copy 2)]*	 ***[1]***
8		(1) ISON	WFC3/UVIS, ACCUM, UVIS2-C1K1C-SUB	F606W	CR-SPLIT=NO	SAME POS AS 5		50 Secs *[==>]*	 ***[1]***


Orbit Structure
Orbit 1
Server Version: 20121031
Moving Target Tracking
Setup
Exp. 1
Exp. 2, copy 1
Exp. 2, copy 2
Exp. 3
Exp. 4
Overhead
Pointing Maneuver
Moving Target Tracking
Exp. 5
Exp. 6
Exp. 7, copy 1
Exp. 7, copy 2
Exp. 8
Overhead
Unused Visibility = 0
Occultation
GS Acq
Setup
0
500
1000
1500
2000
2500
3000
3500
4000
4500
5000
5500
sec

Visit

Proposal 13198, Visit 03, implementation Wed Mar 27 01:04:15 GMT 2013

Diagnostic Status: No Diagnostics

Scientific Instruments: WFC3/UVIS

Special Requirements: AFTER 02 BY 8 Orbits TO 16 Orbits

Solar System Targets

#	Name	Level 1	Level 2	Level 3	Window	Ephem Center
(1)	ISON	TYPE=COMET,Q=0.012502588348629 41,E=1.000004161371302,I=61.85935281653595,O=295.7375188569599,W=345.5090969848318,T=28-NOV-2013:18:42:46,TTimeScale=UTC,EQUINOX=J2000,EPOCH=07-JAN-2013:00:00:00,EpochTimeScale=TDB				EARTH

Exposures

#	Label	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time/[Actual Dur.]	Orbit
1		(1) ISON	WFC3/UVIS, ACCUM, UVIS2-C1K1C-SUB	F606W	CR-SPLIT=NO	GS ACQ SCENARIO BASE1B3		50 Secs *[==>]*	 ***[1]***
2		(1) ISON	WFC3/UVIS, ACCUM, UVIS2-C1K1C-SUB	F606W	CR-SPLIT=NO			272 Secs X 2 *[==>(Copy 1)]* *[==>(Copy 2)]*	 ***[1]***
3		(1) ISON	WFC3/UVIS, ACCUM, UVIS2-C1K1C-SUB	F606W	CR-SPLIT=NO			50 Secs *[==>]*	 ***[1]***
4		(1) ISON	WFC3/UVIS, ACCUM, UVIS2-C1K1C-SUB	F438W	CR-SPLIT=NO; FLASH=6			300 Secs *[==>]*	 ***[1]***
5		(1) ISON	WFC3/UVIS, ACCUM, UVIS2-C1K1C-SUB	F438W	CR-SPLIT=NO; FLASH=6	POS TARG 0.4,0.4		300 Secs *[==>]*	 ***[1]***
6		(1) ISON	WFC3/UVIS, ACCUM, UVIS2-C1K1C-SUB	F606W	CR-SPLIT=NO	SAME POS AS 5		50 Secs *[==>]*	 ***[1]***
7		(1) ISON	WFC3/UVIS, ACCUM, UVIS2-C1K1C-SUB	F606W	CR-SPLIT=NO	SAME POS AS 5		272 Secs X 2 *[==>(Copy 1)]* *[==>(Copy 2)]*	 ***[1]***
8		(1) ISON	WFC3/UVIS, ACCUM, UVIS2-C1K1C-SUB	F606W	CR-SPLIT=NO	SAME POS AS 5		50 Secs *[==>]*	 ***[1]***

Orbit Structure