13610 - Imaging Comet C/2013 A1 (Siding Spring) to Support Risk Assessment for Mars Orbiters during the Close Mars Encounter

Cycle: 21, 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) C2013A1	WFC3/UVIS	1	24-Jan-2014 21:44:21.0	yes
02	(1) C2013A1	WFC3/UVIS	1	24-Jan-2014 21:44:32.0	yes
21	(2) C2013A1-JPL35	WFC3/UVIS	1	24-Jan-2014 21:44:39.0	yes
31	(3) C2013A1-COPY	WFC3/UVIS	1	24-Jan-2014 21:44:48.0	yes

4 Total Orbits Used

ABSTRACT

Newly discovered comet C/Siding Spring passes Mars on October 19, 2014 at a distance of only 134,000 km. Such a close encounter of a dynamically new comet is extremely rare, providing an opportunity for instruments on Mars to observe it around close approach and for studying the interactions between the coma and the Martian atmosphere. However, comet dust also poses a potential risk to NASA's Mars-orbiting spacecraft. We request four HST DD orbits to observe C/Siding Spring in three epochs between October 2013 and March 2014, to characterize the comet's environment. Our goals are to measure the dust activity and its temporal evolution, characterize the coma and tail morphology and colors (to constrain the dust particle size distribution), investigate features or jets near the nucleus, and determine the nucleus' size and rotation state. The proposed studies will provide valuable information about this dynamically new comet and will help in planning future observations (from both Mars- and Earth-based facilities). These studies will provide critical input for assessing the hazards to Mars orbiters. DD time is requested because the potential risks from the dust coma were not fully recognized until after the normal Cycle 21 GO proposal deadlines (when the comet's orbit determination accurately predicted the Mars encounter), and waiting until the normal Cycle 22 will be too late to obtain the necessary data. HST's high angular resolution is essential for the proposed observations as C/Siding Spring is still ~5 AU from the Sun, with a coma only a few arcsec in size.

OBSERVING DESCRIPTION

The total of four orbits are divided into three epochs. The first epoch contains two orbits, separated by 1-2 orbits for a total duration of 4.5-6 hrs, and should be scheduled as early as possible, nominally in the week of October 27 to November 2. The second and third epochs contain one orbit each, to be scheduled between December 15 and 31, 2013 and March 1 and 15, 2014, respectively. The plan for the second and third epochs observations will be refined before the scheduling using the newly available information of the brightness of the comet from the first epoch of observations and future ground-based observations.

For the first epoch of two orbits, we plan to use the same sequence as used for C/ISON observations (GO-13198), given the similar brightness and observing geometry of C/Siding Spring. Specifically, we will use F606W and F438W filters, and two exposure levels for the F606W filter. We will execute a two point dithering pattern with 0.5" offset on both horizontal and vertical directions between the first half and the second half in each orbit to avoid bad pixels affecting our analysis. The exposure times will be 50 s and 272 s for the F606W filter, and 300 s for the F438W filter. Given the small extent of the comet, we plan to use 1k-by-1k subarray mode for this epoch.

The second and the third epochs will nominally have similar sequence. But we will need to update the exposure time later, and probably replace the F606W filter with a narrower F775W filter for less contamination from the gas coma if the comet is bright enough then. We may also switch to larger subarray, e.g., 2k-by-2k, to accomodate the possibly larger angular size of the comet.

Second epoch planning, 12/18/2013

We decided to postpone the second epoch from the nominal end of December to January 21 to capture the orbit plane crossing observing geometry of the comet. Based on scaling with heliocentric and geocentric distance from the first epoch to the second, the brightness of the comet is expected to increase by a factor of ~2.4. To accomodate the expected larger size of the comet, we plan to switch to 2K2C-SUB frame for F606W filter, while keep the C1K1C-SUB frame for F438W filter. We propose to set a roll range of HST as 65-69 to put the comet along the diagonal direction of the FOV to cover the tail as much as possible. For the same reason, we offset the FOV to put the comet center at (500, 500) pixels from the sunward chip corner for F606W filter, and (300, 300) pixels for F438W filter. We also included a 1", 2-point dither for each filter to avoid bad pixels. We also updated the ephemeris of the comet with the most recent JPL orbit solution #35 by using a new target, C2013A1-JPL35.

ADDITIONAL COMMENTS

The last epoch, visit 31, is ON HOLD and will be optimized later using the newly available information about the evolution of the comet.

Visit

Proposal 13610, Visit 01, completed Sat Jan 25 02:44:58 GMT 2014

Diagnostic Status: No Diagnostics

Scientific Instruments: WFC3/UVIS

Special Requirements: BETWEEN 27-OCT-2013:00:00:00 AND 09-NOV-2013:00:00:00

Solar System Targets

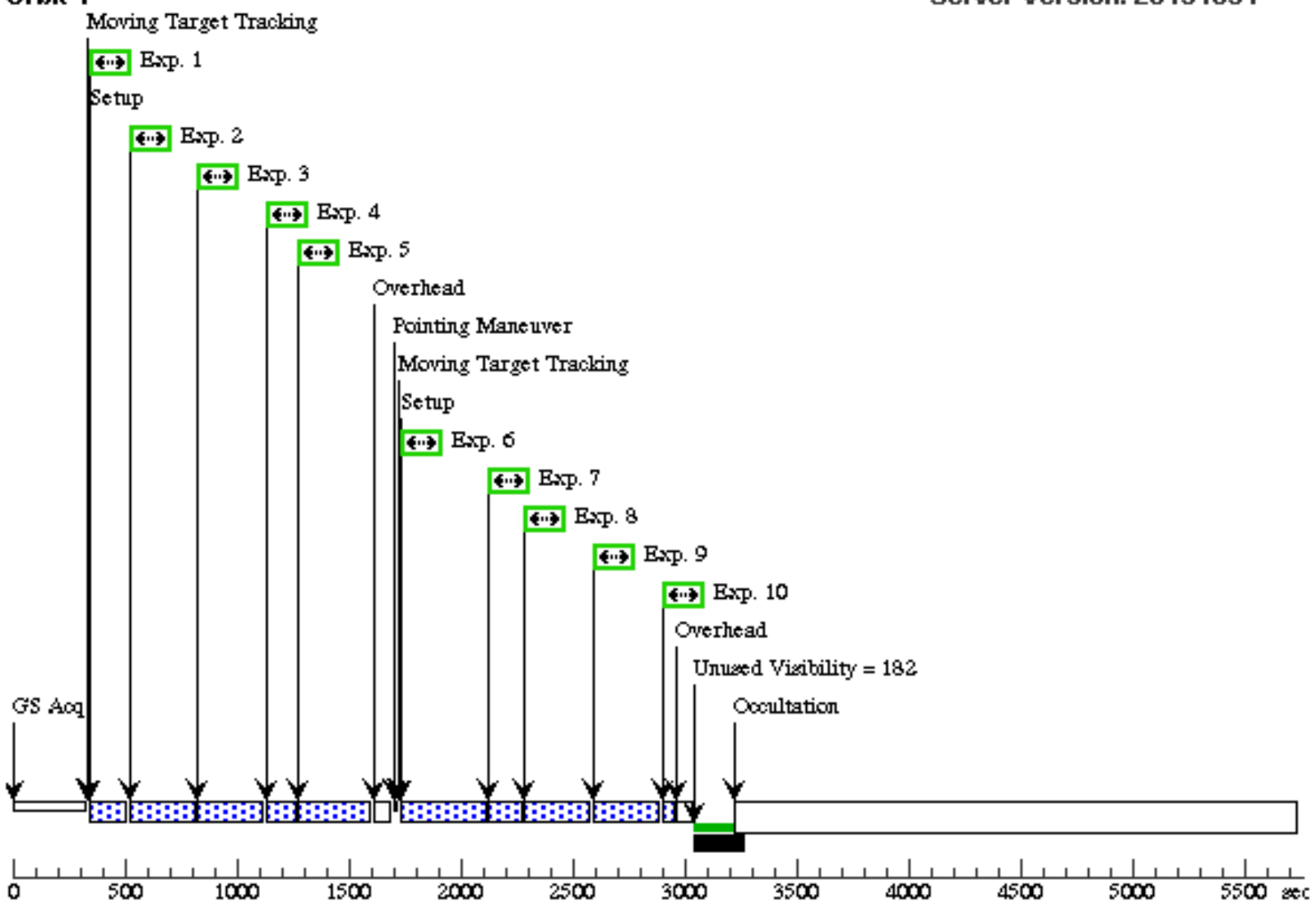
#	Name	Level 1	Level 2	Level 3	Window	Ephem Center
(1)	C2013A1	TYPE=COMET,Q=1.3994729144165 51,E=1.000441510580912,I=129.0231 581865663,O=300.9664722950736,W =2.42938109781337,T=25-OCT-2014:11:51:11,TTimeScale=TDB,EQ UINOX=J2000,EPOCH=11-MAR-2013,EpochTimeScale=TDB				EARTH

Comments: Solution reference: JPL #23, data arc 2012-10-04 to 2013-09-29

Exposures

#	Label	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time (Total)/[Actual Dur.]	Orbit
1		(1) C2013A1	WFC3/UVIS, ACCUM, UVIS2-C1K1C-SUB	F606W	CR-SPLIT=NO; FLASH=10			50 Secs (50 Secs)	
								[==>]	***[1]***
2		(1) C2013A1	WFC3/UVIS, ACCUM, UVIS2-C1K1C-SUB	F606W	CR-SPLIT=NO			220 Secs (220 Secs)	
								[==>]	***[1]***
3		(1) C2013A1	WFC3/UVIS, ACCUM, UVIS2-C1K1C-SUB	F606W	CR-SPLIT=NO			220 Secs (220 Secs)	
								[==>]	***[1]***
4		(1) C2013A1	WFC3/UVIS, ACCUM, UVIS2-C1K1C-SUB	F606W	CR-SPLIT=NO; FLASH=10			50 Secs (50 Secs)	
								[==>]	***[1]***
5		(1) C2013A1	WFC3/UVIS, ACCUM, UVIS2-C1K1C-SUB	F438W	CR-SPLIT=NO; FLASH=9			300 Secs (300 Secs)	
								[==>]	***[1]***
6		(1) C2013A1	WFC3/UVIS, ACCUM, UVIS2-C1K1C-SUB	F438W	CR-SPLIT=NO; FLASH=9	POS TARG 0.5,0.5		300 Secs (300 Secs)	
								[==>]	***[1]***
7		(1) C2013A1	WFC3/UVIS, ACCUM, UVIS2-C1K1C-SUB	F606W	CR-SPLIT=NO; FLASH=10	SAME POS AS 6		50 Secs (50 Secs)	
								[==>]	***[1]***
8		(1) C2013A1	WFC3/UVIS, ACCUM, UVIS2-C1K1C-SUB	F606W	CR-SPLIT=NO	SAME POS AS 6		220 Secs (220 Secs)	
								[==>]	***[1]***
9		(1) C2013A1	WFC3/UVIS, ACCUM, UVIS2-C1K1C-SUB	F606W	CR-SPLIT=NO	SAME POS AS 6		220 Secs (220 Secs)	
								[==>]	***[1]***
10		(1) C2013A1	WFC3/UVIS, ACCUM, UVIS2-C1K1C-SUB	F606W	CR-SPLIT=NO; FLASH=10	SAME POS AS 6		50 Secs (50 Secs)	
								[==>]	***[1]***

Orbit Structure



Visit

Proposal 13610, Visit 02, completed Sat Jan 25 02:45:00 GMT 2014

Diagnostic Status: No Diagnostics

Scientific Instruments: WFC3/UVIS

Special Requirements: AFTER_01 BY 0.9_Orbits TO 2.1_Orbits

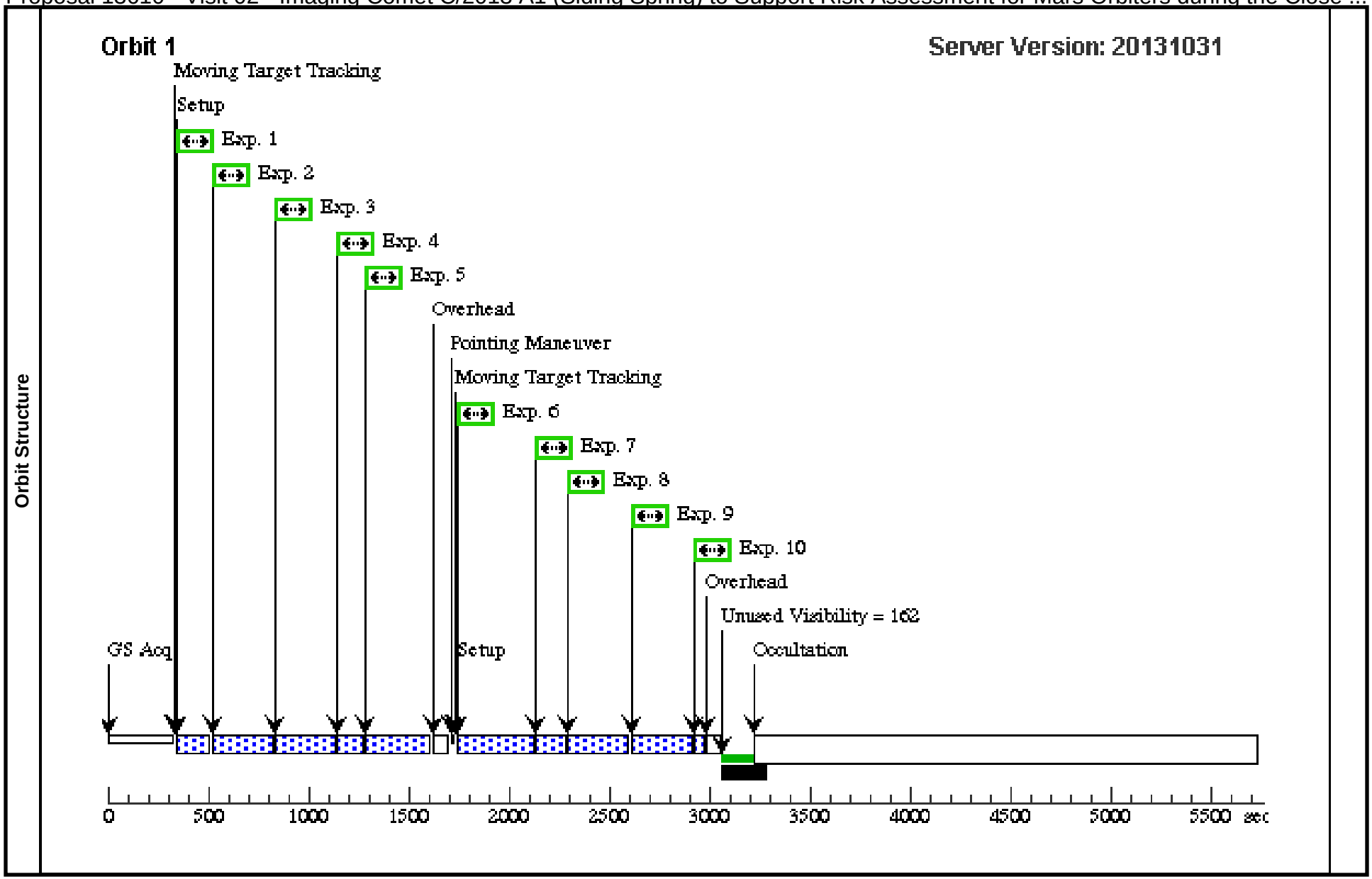
Solar System Targets

#	Name	Level 1	Level 2	Level 3	Window	Ephem Center
(1)	C2013A1	TYPE=COMET,Q=1.3994729144165 51,E=1.000441510580912,I=129.0231 581865663,O=300.9664722950736,W =2.42938109781337,T=25-OCT-2014:11:51:11,TTimeScale=TDB,EQ UINOX=J2000,EPOCH=11-MAR-2013,EpochTimeScale=TDB				EARTH

Comments: Solution reference: JPL #23, data arc 2012-10-04 to 2013-09-29

Exposures

#	Label	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time (Total)/[Actual Dur.]	Orbit
1		(1) C2013A1	WFC3/UVIS, ACCUM, UVIS2-C1K1C-SUB	F606W	CR-SPLIT=NO; FLASH=10			50 Secs (50 Secs)	
								[==>]	***[1]***
2		(1) C2013A1	WFC3/UVIS, ACCUM, UVIS2-C1K1C-SUB	F606W	CR-SPLIT=NO			225 Secs (225 Secs)	
								[==>]	***[1]***
3		(1) C2013A1	WFC3/UVIS, ACCUM, UVIS2-C1K1C-SUB	F606W	CR-SPLIT=NO			225 Secs (225 Secs)	
								[==>]	***[1]***
4		(1) C2013A1	WFC3/UVIS, ACCUM, UVIS2-C1K1C-SUB	F606W	CR-SPLIT=NO; FLASH=10			50 Secs (50 Secs)	
								[==>]	***[1]***
5		(1) C2013A1	WFC3/UVIS, ACCUM, UVIS2-C1K1C-SUB	F438W	CR-SPLIT=NO; FLASH=9			300 Secs (300 Secs)	
								[==>]	***[1]***
6		(1) C2013A1	WFC3/UVIS, ACCUM, UVIS2-C1K1C-SUB	F438W	CR-SPLIT=NO; FLASH=9	POS TARG 0.5,0.5		300 Secs (300 Secs)	
								[==>]	***[1]***
7		(1) C2013A1	WFC3/UVIS, ACCUM, UVIS2-C1K1C-SUB	F606W	CR-SPLIT=NO; FLASH=10	SAME POS AS 6		50 Secs (50 Secs)	
								[==>]	***[1]***
8		(1) C2013A1	WFC3/UVIS, ACCUM, UVIS2-C1K1C-SUB	F606W	CR-SPLIT=NO	SAME POS AS 6		225 Secs (225 Secs)	
								[==>]	***[1]***
9		(1) C2013A1	WFC3/UVIS, ACCUM, UVIS2-C1K1C-SUB	F606W	CR-SPLIT=NO	SAME POS AS 6		225 Secs (225 Secs)	
								[==>]	***[1]***
10		(1) C2013A1	WFC3/UVIS, ACCUM, UVIS2-C1K1C-SUB	F606W	CR-SPLIT=NO; FLASH=10	SAME POS AS 6		50 Secs (50 Secs)	
								[==>]	***[1]***


Orbit 1
Server Version: 20131031
Orbit Structure
Moving Target Tracking
Setup
Exp. 1
Exp. 2
Exp. 3
Exp. 4
Exp. 5
Overhead
Pointing Maneuver
Moving Target Tracking
Exp. 6
Exp. 7
Exp. 8
Exp. 9
Exp. 10
Overhead
Unused Visibility = 162
GS Acq
Setup
Occultation
0
500
1000
1500
2000
2500
3000
3500
4000
4500
5000
5500
sec

Visit

Proposal 13610, Visit 21, completed Sat Jan 25 02:45:01 GMT 2014

Diagnostic Status: No Diagnostics

Scientific Instruments: WFC3/UVIS

Special Requirements: ORIENT 65D TO 69 D; BETWEEN 20-JAN-2014:20:00:00 AND 21-JAN-2014:20:00:00

Solar System Targets

#	Name	Level 1	Level 2	Level 3	Window	Ephem Center
(2)	C2013A1-JPL35	TYPE=COMET,Q=1.399258352456117,E=1.000543709462318,I=129.0248840897145,O=300.970049823124,W=2.43082528025856,T=25-OCT-2014:10:15:53,TTimeScale=TDB,EQUINOX=J2000,EPOCH=14-MAY-2013,EpochTimeScale=TDB				EARTH

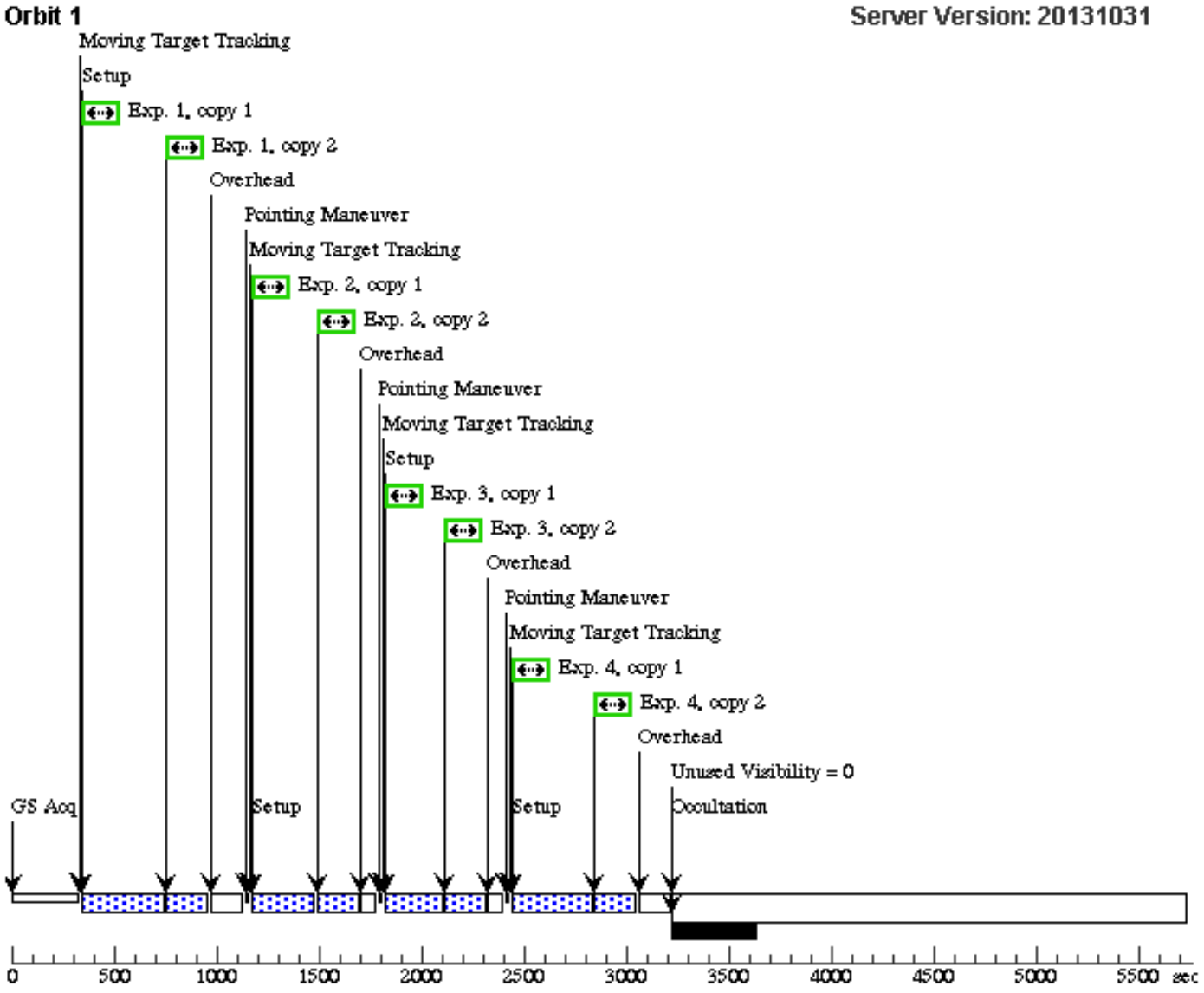
Comments: Solution reference: JPL #35, data arc 2012-10-04 to 2013-12-13

Ephemeris Uncertainty: 1.302 Secs

Exposures

#	Label	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time (Total)/[Actual Dur.]	Orbit
1		(2) C2013A1-JPL35	WFC3/UVIS, ACCUM, UVIS2-2K2C-SUB	F606W	CR-SPLIT=NO	POS TARG 29.5,30.5		207 Secs X 2 (414 Secs) *[==>(Copy 1)]* *[==>(Copy 2)]*	***[1]***
2		(2) C2013A1-JPL35	WFC3/UVIS, ACCUM, UVIS2-C1K1C-SUB	F438W	CR-SPLIT=NO; FLASH=9	POS TARG 7.5,8.5		200 Secs X 2 (400 Secs) *[==>(Copy 1)]* *[==>(Copy 2)]*	***[1]***
3		(2) C2013A1-JPL35	WFC3/UVIS, ACCUM, UVIS2-C1K1C-SUB	F438W	CR-SPLIT=NO; FLASH=9	POS TARG 8.5,7.5		200 Secs X 2 (400 Secs) *[==>(Copy 1)]* *[==>(Copy 2)]*	***[1]***
4		(2) C2013A1-JPL35	WFC3/UVIS, ACCUM, UVIS2-2K2C-SUB	F606W	CR-SPLIT=NO	POS TARG 30.5,29.5		207 Secs X 2 (414 Secs) *[==>(Copy 1)]* *[==>(Copy 2)]*	***[1]***

Orbit Structure



Visit

Proposal 13610, Visit 31, implementation Sat Jan 25 02:45:03 GMT 2014

Diagnostic Status: No Diagnostics

Scientific Instruments: WFC3/UVIS

Special Requirements: BETWEEN 01-MAR-2014:00:00:00 AND 12-MAR-2014:00:00:00; ON HOLD

On Hold Comments: We will finalize the sequence based on the first three orbits of observations and updated conditions from ground-based observers before the actual scheduling.

Solar System Targets

#	Name	Level 1	Level 2	Level 3	Window	Ephem Center
(3)	C2013A1-COPY	TYPE=COMET,Q=1.3994729144165 51,E=1.000441510580912,I=129.0231 581865663,O=300.9664722950736,W =2.42938109781337,T=25-OCT-2014:11:51:11,TTimeScale=TDB,EQ UINOX=J2000,EPOCH=11-MAR-2013,EpochTimeScale=TDB				EARTH

Comments: Solution reference: JPL #23, data arc 2012-10-04 to 2013-09-29

Exposures

#	Label	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time (Total)/[Actual Dur.]	Orbit
1		(3) C2013A1-COPY	WFC3/UVIS, ACCUM, UVIS2-C1K1C-SUB	F606W	CR-SPLIT=NO; FLASH=10			50 Secs (50 Secs) *[==>]*	*[1]*
2		(3) C2013A1-COPY	WFC3/UVIS, ACCUM, UVIS2-C1K1C-SUB	F606W	CR-SPLIT=NO			265 Secs (265 Secs) *[==>]*	*[1]*
3		(3) C2013A1-COPY	WFC3/UVIS, ACCUM, UVIS2-C1K1C-SUB	F606W	CR-SPLIT=NO			265 Secs (265 Secs) *[==>]*	*[1]*
4		(3) C2013A1-COPY	WFC3/UVIS, ACCUM, UVIS2-C1K1C-SUB	F606W	CR-SPLIT=NO; FLASH=10			50 Secs (50 Secs) *[==>]*	*[1]*
5		(3) C2013A1-COPY	WFC3/UVIS, ACCUM, UVIS2-C1K1C-SUB	F438W	CR-SPLIT=NO; FLASH=9			300 Secs (300 Secs) *[==>]*	*[1]*
6		(3) C2013A1-COPY	WFC3/UVIS, ACCUM, UVIS2-C1K1C-SUB	F438W	CR-SPLIT=NO; FLASH=9	POS TARG 0.5,0.5		300 Secs (300 Secs) *[==>]*	*[1]*
7		(3) C2013A1-COPY	WFC3/UVIS, ACCUM, UVIS2-C1K1C-SUB	F606W	CR-SPLIT=NO; FLASH=10	SAME POS AS 6		50 Secs (50 Secs) *[==>]*	*[1]*
8		(3) C2013A1-COPY	WFC3/UVIS, ACCUM, UVIS2-C1K1C-SUB	F606W	CR-SPLIT=NO	SAME POS AS 6		265 Secs (265 Secs) *[==>]*	*[1]*
9		(3) C2013A1-COPY	WFC3/UVIS, ACCUM, UVIS2-C1K1C-SUB	F606W	CR-SPLIT=NO	SAME POS AS 6		265 Secs (265 Secs) *[==>]*	*[1]*
10		(3) C2013A1-COPY	WFC3/UVIS, ACCUM, UVIS2-C1K1C-SUB	F606W	CR-SPLIT=NO; FLASH=10	SAME POS AS 6		50 Secs (50 Secs) *[==>]*	*[1]*

Orbit Structure