13712 - Target of Opportunity Observation of an Episodic Storm on Uranus

Cycle: 22, Proposal Category: GO

(Availability Mode: SUPPORTED)

INVESTIGATORS

Name	*Institution*	*E-Mail*
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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) URANUS-OUTBREAK-TOO	WFC3/UVIS	1	06-Oct-2014 21:04:37.0	yes
02	(1) URANUS-OUTBREAK-TOO	WFC3/UVIS	1	06-Oct-2014 21:04:39.0	yes
03	(1) URANUS-OUTBREAK-TOO	WFC3/UVIS	1	06-Oct-2014 21:04:42.0	yes

3 Total Orbits Used

ABSTRACT

We propose a TOO observation of Uranus to capture the formation process of a dark anticyclonic vortex during an episodic convective storm. The planet Uranus continues to exhibit increased atmospheric activity after the 2007 equinox, likely in response to extreme insolation change (Hammel et al. 2005, Icarus 175, 284, Sromovsky et al. 2009, Icarus 203, 265, Sromovsky et al. 2007, Icarus 192, 558, Sromovsky et al. 2012, Icarus 220, 6). We hypothesize that Uranian dark spots emerge from an episodic outburst, and predict that such a spot will form in the near future. The historical record

makes references to such discrete structures (both bright and dark) on Uranus during previous equinoctial apparitions (Alexander 1965; the last equinox occurred in 1965). Furthermore, northern high-latitudes are now coming into view after 40+ years of winter darkness, exhibiting unusual activities (Sromovsky et al. 2012, Icarus 220, 694). Our TOO will be triggered by amateur observations; the best amateur facilities are now able to resolve the disk of Uranus and detect such activity if it is very large or has very high contrast. Amateurs also have access to a great many nights of telescope time. If a discrete cloud feature on Uranus is reported through these networked professional and amateur ground-based observations, we propose to obtain follow-up images with Hubble's WFC3. The proposed TOO images will permit determination of detailed structure of the feature at visible wavelengths, and provide vertical and horizontal constraints on the feature's scattering properties. Hubble is the only facility that can provide such information at visible wavelengths.

All WFC3 exposures have CR-SPLIT=NO to reduce overhead. POS-TARG offsets for quad filter WFC3 exposures have been specified to place target approximately 20 arcseconds closer to center of array relative to "optimal" aperture locations. This places the planet approximately 10 arcseconds towards the center of the array relative to the "QUAD-FIX" fiducial points. This has been done to reduce telescope move magnitudes (between different quads), while still leaving a 512 x 512 pixel area around the target outside of the quad filter vignetted regions.

OBSERVING DESCRIPTION

We request three orbits of WFC3 imaging to obtain disk-resolved images of an anomalous feature on Uranus. The three orbits will be timed such that all 360-degree of longitudes are captured in the shortest time possible allowed within applicable scheduling constraints. We use an identical set of filters for all three orbits to obtain a consistent coverage across longitudes. We use the following filters; the strong methane absorption band near 889 nm as well its neighboring continuum at 937 nm; the intermediate methane absorption band at 727 nm and the corresponding continuum at 750 nm; weak methane absorption band at 619nm; filters corresponding to Stromgren b (467 nm) and y (547 nm) filters used for long-term brightness monitoring; and the F658N filter similar to one that showed maximum contrast for the Uranus dark spot in C15. In general, we will not dither due to short exposure times (dithering imposes a 2.5-min penalty for splitting the exposure, and dithering several exposures could require a 5.6-min buffer readout). If there is time remaining in an orbit in Phase II planning, we will dither additional F845M and F924N exposures to increase S/N and better sample the point spread function in this filter as done in our 2011 TOO observations. We will use sub-arrays to avoid the need for buffer readouts during our planned visits. Comparisons with images at nearby wavelengths will permit identification of artifacts and cosmic rays.

Visit

Proposal 13712, Visit 01, scheduling Tue Oct 07 01:04:43 GMT 2014

Diagnostic Status: Warning

Scientific Instruments: WFC3/UVIS

Special Requirements: BETWEEN 13-OCT-2014:00:00:00 AND 19-OCT-2014:00:00:00; ON HOLD ; TOO RESPONSE TIME 21.0D; VISIBILITY INTERVAL 50.0 M

On Hold Comments: For Target of Opportunity (Non-Disruptive)

Diagnostics

(FQ619N A (01.005)) Warning (Form): POS TARG & PATTERN should be used carefully with ACS ramp or WFC3 quad filters as central wavelengths & transmission efficiencies vary within the apertures.

(FQ889N A (01.006)) Warning (Form): POS TARG & PATTERN should be used carefully with ACS ramp or WFC3 quad filters as central wavelengths & transmission efficiencies vary within the apertures.

(FQ750N B (01.007)) Warning (Form): POS TARG & PATTERN should be used carefully with ACS ramp or WFC3 quad filters as central wavelengths & transmission efficiencies vary within the apertures.

(FQ937N B (01.008)) Warning (Form): POS TARG & PATTERN should be used carefully with ACS ramp or WFC3 quad filters as central wavelengths & transmission efficiencies vary within the apertures.

(FQ727N D (01.009)) Warning (Form): POS TARG & PATTERN should be used carefully with ACS ramp or WFC3 quad filters as central wavelengths & transmission efficiencies vary within the apertures.

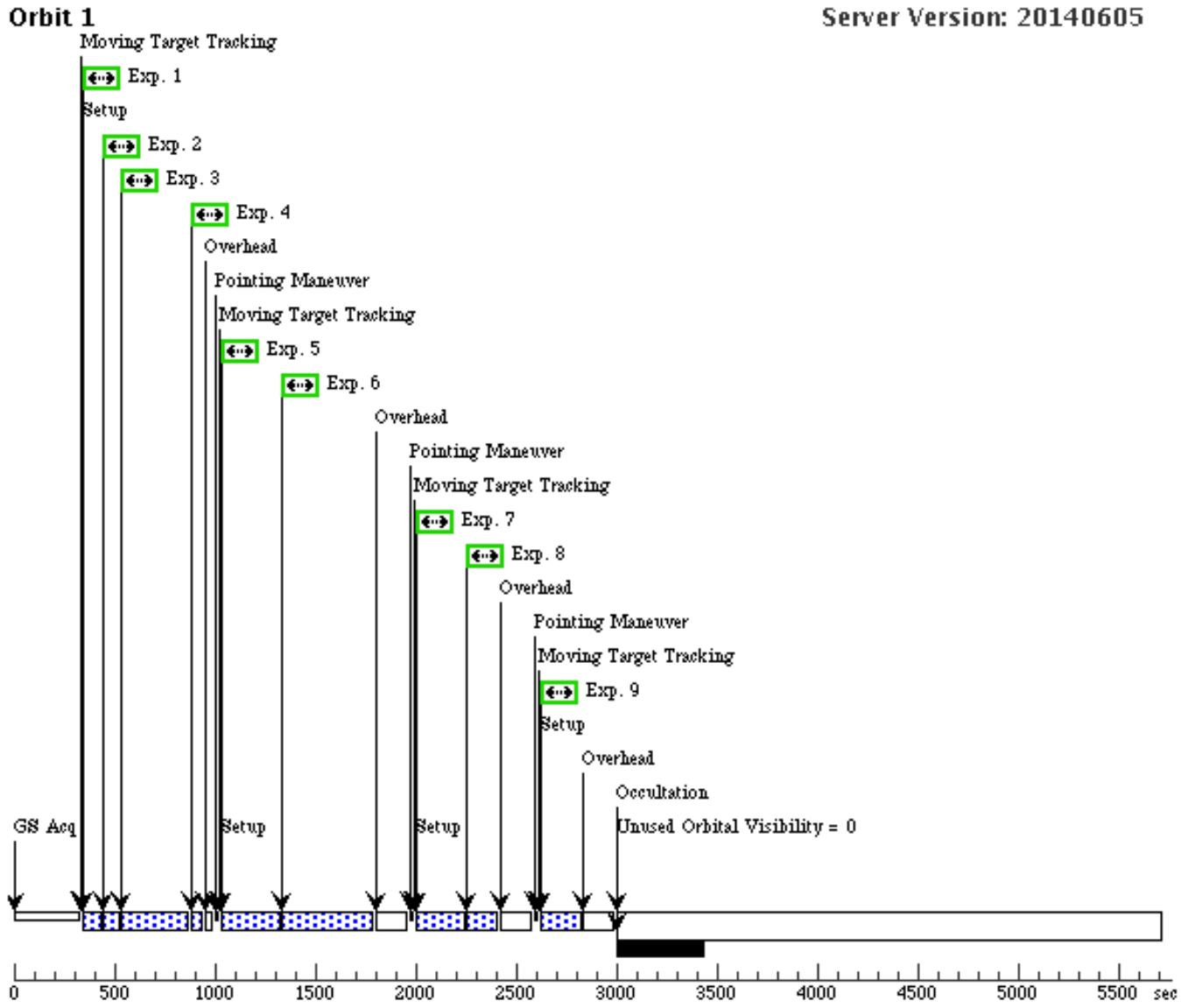
Solar System Targets

#	Name	Level 1	Level 2	Level 3	Window	Ephem Center
(1)	URANUS-OUTBREAK-TOO	STD=URANUS				EARTH

Exposures

#	Label	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time (Total)/[Actual Dur.]	Orbit
1	F467M	(1) URANUS-OUTBREAK-TOO	WFC3/UVIS, ACCUM, UVIS2-M512C-SUB	F467M	CR-SPLIT=NO	GS ACQ SCENARIO BASE1B3	Sequence 1-9 Non-Int in Visit 01	16 Secs (16 Secs)	
								[==>]	***[1]***
2	F547M	(1) URANUS-OUTBREAK-TOO	WFC3/UVIS, ACCUM, UVIS2-M512C-SUB	F547M	CR-SPLIT=NO		Sequence 1-9 Non-Int in Visit 01	6 Secs (6 Secs)	
								[==>]	***[1]***
3	F658N	(1) URANUS-OUTBREAK-TOO	WFC3/UVIS, ACCUM, UVIS2-M512C-SUB	F658N	CR-SPLIT=NO		Sequence 1-9 Non-Int in Visit 01	270 Secs (270 Secs)	
								[==>]	***[1]***
4	F845M	(1) URANUS-OUTBREAK-TOO	WFC3/UVIS, ACCUM, UVIS2-M512C-SUB	F845M	CR-SPLIT=NO		Sequence 1-9 Non-Int in Visit 01	35 Secs (35 Secs)	
								[==>]	***[1]***
5	FQ619N A	(1) URANUS-OUTBREAK-TOO	WFC3/UVIS, ACCUM, UVIS-QUAD-SUB	FQ619N	CR-SPLIT=NO	POS TARG +15,-15	Sequence 1-9 Non-Int in Visit 01	100 Secs (100 Secs)	
								[==>]	***[1]***
6	FQ889N A	(1) URANUS-OUTBREAK-TOO	WFC3/UVIS, ACCUM, UVIS-QUAD-SUB	FQ889N	CR-SPLIT=NO	POS TARG +15,-15	Sequence 1-9 Non-Int in Visit 01	446 Secs (446 Secs)	
								[==>]	***[1]***
7	FQ750N B	(1) URANUS-OUTBREAK-TOO	WFC3/UVIS, ACCUM, UVIS-QUAD-SUB	FQ750N	CR-SPLIT=NO	POS TARG -15,-15	Sequence 1-9 Non-Int in Visit 01	60 Secs (60 Secs)	
								[==>]	***[1]***
8	FQ937N B	(1) URANUS-OUTBREAK-TOO	WFC3/UVIS, ACCUM, UVIS-QUAD-SUB	FQ937N	CR-SPLIT=NO	POS TARG -15,-15	Sequence 1-9 Non-Int in Visit 01	140 Secs (140 Secs)	
								[==>]	***[1]***
9	FQ727N D	(1) URANUS-OUTBREAK-TOO	WFC3/UVIS, ACCUM, UVIS-QUAD-SUB	FQ727N	CR-SPLIT=NO	POS TARG -15,+15	Sequence 1-9 Non-Int in Visit 01	180 Secs (180 Secs)	
								[==>]	***[1]***

Orbit Structure



Visit

Proposal 13712, Visit 02, scheduling Tue Oct 07 01:04:44 GMT 2014

Diagnostic Status: Warning

Scientific Instruments: WFC3/UVIS

Special Requirements: AFTER 01 BY 4.75 H TO 6.75 H; ON HOLD ; TOO RESPONSE TIME 21.0D; VISIBILITY INTERVAL 50.0 M

On Hold Comments: For Target of Opportunity (Non-Disruptive)

Diagnostics

(FQ619N A (02.005)) Warning (Form): POS TARG & PATTERN should be used carefully with ACS ramp or WFC3 quad filters as central wavelengths & transmission efficiencies vary within the apertures.

(FQ889N A (02.006)) Warning (Form): POS TARG & PATTERN should be used carefully with ACS ramp or WFC3 quad filters as central wavelengths & transmission efficiencies vary within the apertures.

(FQ750N B (02.007)) Warning (Form): POS TARG & PATTERN should be used carefully with ACS ramp or WFC3 quad filters as central wavelengths & transmission efficiencies vary within the apertures.

(FQ937N B (02.008)) Warning (Form): POS TARG & PATTERN should be used carefully with ACS ramp or WFC3 quad filters as central wavelengths & transmission efficiencies vary within the apertures.

(FQ727N D (02.009)) Warning (Form): POS TARG & PATTERN should be used carefully with ACS ramp or WFC3 quad filters as central wavelengths & transmission efficiencies vary within the apertures.

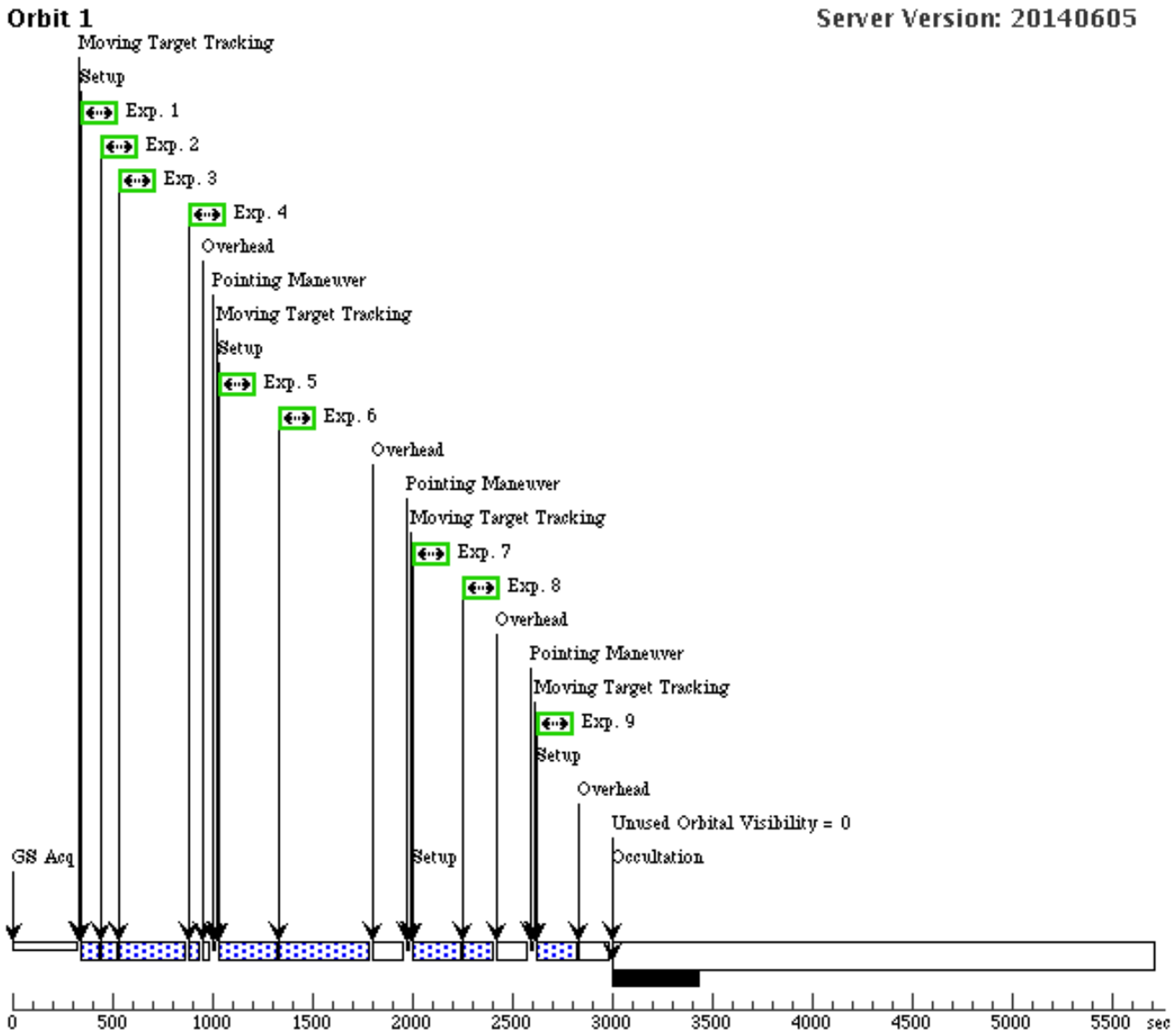
Solar System Targets

#	Name	Level 1	Level 2	Level 3	Window	Ephem Center
(1)	URANUS-OUTBREAK-TOO	STD=URANUS				EARTH

Exposures

#	Label	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time (Total)/[Actual Dur.]	Orbit
1	F467M	(1) URANUS-OUTBREAK-TOO	WFC3/UVIS, ACCUM, UVIS2-M512C-SUB	F467M	CR-SPLIT=NO	GS ACQ SCENARIO BASE1B3	Sequence 1-9 Non-Int in Visit 02	16 Secs (16 Secs)	
								[==>]	***[1]***
2	F547M	(1) URANUS-OUTBREAK-TOO	WFC3/UVIS, ACCUM, UVIS2-M512C-SUB	F547M	CR-SPLIT=NO		Sequence 1-9 Non-Int in Visit 02	6 Secs (6 Secs)	
								[==>]	***[1]***
3	F658N	(1) URANUS-OUTBREAK-TOO	WFC3/UVIS, ACCUM, UVIS2-M512C-SUB	F658N	CR-SPLIT=NO		Sequence 1-9 Non-Int in Visit 02	270 Secs (270 Secs)	
								[==>]	***[1]***
4	F845M	(1) URANUS-OUTBREAK-TOO	WFC3/UVIS, ACCUM, UVIS2-M512C-SUB	F845M	CR-SPLIT=NO		Sequence 1-9 Non-Int in Visit 02	35 Secs (35 Secs)	
								[==>]	***[1]***
5	FQ619N A	(1) URANUS-OUTBREAK-TOO	WFC3/UVIS, ACCUM, UVIS-QUAD-SUB	FQ619N	CR-SPLIT=NO	POS TARG +15,-15	Sequence 1-9 Non-Int in Visit 02	100 Secs (100 Secs)	
								[==>]	***[1]***
6	FQ889N A	(1) URANUS-OUTBREAK-TOO	WFC3/UVIS, ACCUM, UVIS-QUAD-SUB	FQ889N	CR-SPLIT=NO	POS TARG +15,-15	Sequence 1-9 Non-Int in Visit 02	446 Secs (446 Secs)	
								[==>]	***[1]***
7	FQ750N B	(1) URANUS-OUTBREAK-TOO	WFC3/UVIS, ACCUM, UVIS-QUAD-SUB	FQ750N	CR-SPLIT=NO	POS TARG -15,-15	Sequence 1-9 Non-Int in Visit 02	60 Secs (60 Secs)	
								[==>]	***[1]***
8	FQ937N B	(1) URANUS-OUTBREAK-TOO	WFC3/UVIS, ACCUM, UVIS-QUAD-SUB	FQ937N	CR-SPLIT=NO	POS TARG -15,-15	Sequence 1-9 Non-Int in Visit 02	140 Secs (140 Secs)	
								[==>]	***[1]***
9	FQ727N D	(1) URANUS-OUTBREAK-TOO	WFC3/UVIS, ACCUM, UVIS-QUAD-SUB	FQ727N	CR-SPLIT=NO	POS TARG -15,+15	Sequence 1-9 Non-Int in Visit 02	180 Secs (180 Secs)	
								[==>]	***[1]***

Orbit Structure



Visit

Proposal 13712, Visit 03, scheduling Tue Oct 07 01:04:44 GMT 2014

Diagnostic Status: Warning

Scientific Instruments: WFC3/UVIS

Special Requirements: AFTER 01 BY 10.5 H TO 12.5 H; ON HOLD ; TOO RESPONSE TIME 21.0D; VISIBILITY INTERVAL 50.0 M

On Hold Comments: For Target of Opportunity (Non-Disruptive) -- Visit 3 is to happen 4 Uranus rotations (between 68 and 71 hours) after Visit 1

Diagnostics

(FQ619N A (03.005)) Warning (Form): POS TARG & PATTERN should be used carefully with ACS ramp or WFC3 quad filters as central wavelengths & transmission efficiencies vary within the apertures.

(FQ889N A (03.006)) Warning (Form): POS TARG & PATTERN should be used carefully with ACS ramp or WFC3 quad filters as central wavelengths & transmission efficiencies vary within the apertures.

(FQ750N B (03.007)) Warning (Form): POS TARG & PATTERN should be used carefully with ACS ramp or WFC3 quad filters as central wavelengths & transmission efficiencies vary within the apertures.

(FQ937N B (03.008)) Warning (Form): POS TARG & PATTERN should be used carefully with ACS ramp or WFC3 quad filters as central wavelengths & transmission efficiencies vary within the apertures.

(FQ727N D (03.009)) Warning (Form): POS TARG & PATTERN should be used carefully with ACS ramp or WFC3 quad filters as central wavelengths & transmission efficiencies vary within the apertures.

Solar System Targets

#	Name	Level 1	Level 2	Level 3	Window	Ephem Center
(1)	URANUS-OUTBREAK-TOO	STD=URANUS				EARTH

Exposures

#	Label	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time (Total)/[Actual Dur.]	Orbit
1	F467M	(1) URANUS-OUTBREAK-TOO	WFC3/UVIS, ACCUM, UVIS2-M512C-SUB	F467M	CR-SPLIT=NO	GS ACQ SCENARIO BASE1B3	Sequence 1-9 Non-Int in Visit 03	16 Secs (16 Secs)	
								[==>]	***[1]***
2	F547M	(1) URANUS-OUTBREAK-TOO	WFC3/UVIS, ACCUM, UVIS2-M512C-SUB	F547M	CR-SPLIT=NO		Sequence 1-9 Non-Int in Visit 03	6 Secs (6 Secs)	
								[==>]	***[1]***
3	F658N	(1) URANUS-OUTBREAK-TOO	WFC3/UVIS, ACCUM, UVIS2-M512C-SUB	F658N	CR-SPLIT=NO		Sequence 1-9 Non-Int in Visit 03	270 Secs (270 Secs)	
								[==>]	***[1]***
4	F845M	(1) URANUS-OUTBREAK-TOO	WFC3/UVIS, ACCUM, UVIS2-M512C-SUB	F845M	CR-SPLIT=NO		Sequence 1-9 Non-Int in Visit 03	35 Secs (35 Secs)	
								[==>]	***[1]***
5	FQ619N A	(1) URANUS-OUTBREAK-TOO	WFC3/UVIS, ACCUM, UVIS-QUAD-SUB	FQ619N	CR-SPLIT=NO	POS TARG +15,-15	Sequence 1-9 Non-Int in Visit 03	100 Secs (100 Secs)	
								[==>]	***[1]***
6	FQ889N A	(1) URANUS-OUTBREAK-TOO	WFC3/UVIS, ACCUM, UVIS-QUAD-SUB	FQ889N	CR-SPLIT=NO	POS TARG +15,-15	Sequence 1-9 Non-Int in Visit 03	446 Secs (446 Secs)	
								[==>]	***[1]***
7	FQ750N B	(1) URANUS-OUTBREAK-TOO	WFC3/UVIS, ACCUM, UVIS-QUAD-SUB	FQ750N	CR-SPLIT=NO	POS TARG -15,-15	Sequence 1-9 Non-Int in Visit 03	60 Secs (60 Secs)	
								[==>]	***[1]***
8	FQ937N B	(1) URANUS-OUTBREAK-TOO	WFC3/UVIS, ACCUM, UVIS-QUAD-SUB	FQ937N	CR-SPLIT=NO	POS TARG -15,-15	Sequence 1-9 Non-Int in Visit 03	140 Secs (140 Secs)	
								[==>]	***[1]***
9	FQ727N D	(1) URANUS-OUTBREAK-TOO	WFC3/UVIS, ACCUM, UVIS-QUAD-SUB	FQ727N	CR-SPLIT=NO	POS TARG -15,+15	Sequence 1-9 Non-Int in Visit 03	180 Secs (180 Secs)	
								[==>]	***[1]***

Orbit Structure