13694 - UV spectra of the icy Saturnian satellites: Understanding exogenic processes and NH3 in the system

Cycle: 22, Proposal Category: GO

(UV Initiative)

(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) MIMAS-LEADING	STIS/CCD STIS/NUV-MAMA	1	21-Jan-2015 21:08:53.0	yes
02	(2) MIMAS-TRAILING	STIS/CCD STIS/NUV-MAMA	1	21-Jan-2015 21:08:55.0	yes
03	(3) ENCELADUS	STIS/CCD STIS/NUV-MAMA	1	21-Jan-2015 21:08:56.0	yes
04	(4) DIONE-LEADING	STIS/CCD STIS/NUV-MAMA	1	21-Jan-2015 21:08:58.0	yes
05	(5) DIONE-TRAILING	STIS/CCD STIS/NUV-MAMA	1	21-Jan-2015 21:08:59.0	yes

Visit	*Targets used in Visit*	*Configurations used in Visit*	*Orbits Used*	*Last Orbit Planner Run*	*OP Current with Visit?*
06	(6) RHEA-LEADING	STIS/CCD STIS/NUV-MAMA	1	21-Jan-2015 21:09:00.0	yes
07	(7) RHEA-TRAILING	STIS/CCD STIS/NUV-MAMA	1	21-Jan-2015 21:09:01.0	yes

7 Total Orbits Used

ABSTRACT

Existing data from Cassini and HST inform us that the icy satellites of Saturn exhibit unidentified UV absorptions - an overall reddish slope in the ~200-400 nm range, with additional spectral features superimposed. We are unable to solve these mysteries surrounding the source(s) of these absorptions using Cassini datasets due to a gap in spectral coverage in the 190-350 nm range (broadband coverage is available to wavelengths as short as 260 nm). HST/STIS data are critical to understanding the spectra of these moons, and to resolving the sources and processes that cause the absorptions. We suspect that ammonia, with its distinctive and strong absorption near 200 nm, plays a role in the spectra of these moons, which has implications for geologic activity. These observations will provide the first-ever NUV observations of Mimas, improved coverage on Enceladus, and the first-ever STIS observations on Dione and Rhea. We base our observation strategy and estimated SNRs on existing high-quality STIS spectra of Tethys (from program 7316).

OBSERVING DESCRIPTION

Based on the existing spectra of the icy Saturnian satellites, we propose to measure the leading and trailing hemispheres of Mimas, Dione and Rhea, along with measuring Enceladus (either leading or trailing hemisphere) to understand UV-visible spectral shapes on these bodies and put together the story of compositional variations from one body to the next. Mimas has never been observed by STIS or FOS for UV spectral information, so this is sincerely needed. Enceladus has been measured with STIS using the 52x0.5 slit; however we can improve the quality of this spectrum by using the 52x0.2 slit to reduce background noise and improve SNR. Existing STIS datasets of Tethys are of good quality so we do not request time for that satellite. Dione and Rhea have never been measured by STIS, and the increased spectral coverage will be extremely valuable, to help refine what species are present at these moons that appear to be significantly different in spectral character from Tethys and the other moons. This suite of observations will result in observations of Enceladus, Mimas, Dione and Rhea of the quality of the existing Tethys observations, so that we have a good set of composite spectra to analyze as a set and investigate system-wide processes.

We plan to optimize the observations to get the best-possible SNR toward the shorter wavelengths (near 180 nm), to aim for overlap with UVIS. The existing good-quality Tethys G230L spectra (program 7316) used the 52x0.2 slit with an exposure time of 2400 sec, and resulted in an SNR at 200 nm of ~10, increasing to ~895 at 300 nm, binning up 16 spectral elements. For these data, we do not require the highest spectral resolution, so could bin even more spectral pixels to increase SNR further. Thus, we estimate that we can achieve SNR values of this scale for the other satellites, using exposure times of ~2400 sec, keeping in mind that Mimas and Enceladus are smaller than Tethys (we can use the 52x0.1 slit for these objects) and we also expect that the scattered light will be more of an issue for these targets. Dione and Rhea have lower albedos but are larger bodies (we will use the 52x0.2 for Dione and the 52x0.5 slit for Rhea). For each satellite, we will supplement the G230L data with a single 60 sec G430L exposure, providing high SNR at longer wavelengths. We have used the STIS ETC to check exposure times and SNRs and we have determined that these exposure times and slit widths accommodate the MAMA count rate restrictions for bright objects, and do not saturate the CCD at the longer wavelengths in the passband, where the satellites are brighter.

Visit

Proposal 13694, Visit 01, implementation Thu Jan 22 02:09:02 GMT 2015

Diagnostic Status: No Diagnostics

Scientific Instruments: STIS/CCD, STIS/NUV-MAMA

Special Requirements: (none)

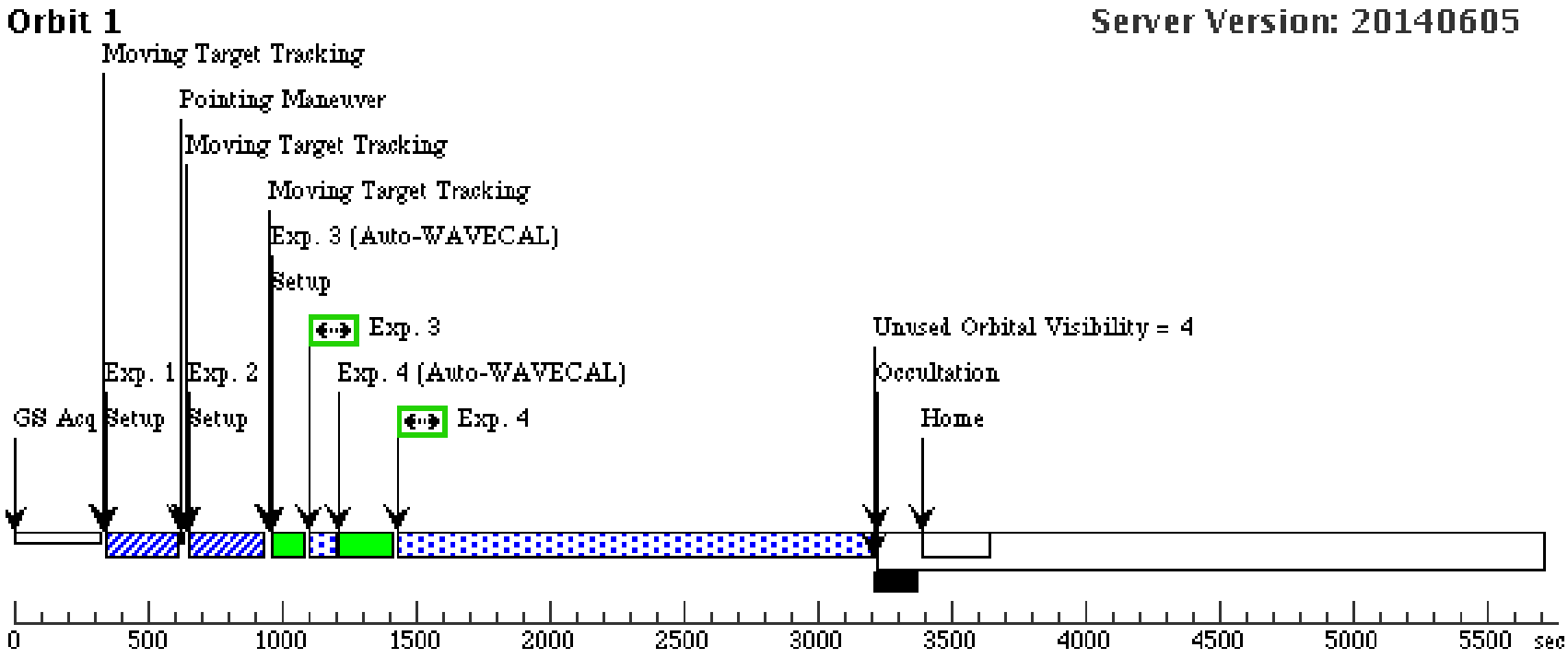
Solar System Targets

#	Name	Level 1	Level 2	Level 3	Window	Ephem Center
(1)	MIMAS-LEADING	STD=SATURN	STD=MIMAS		SEP OF MIMAS-LEADING SATURN FROM EARTH GT 19.0", SEP OF MIMAS-LEADING RHEA FROM EARTH GT 10", SEP OF MIMAS-LEADING TITAN FROM EARTH GT 10", CML OF MIMAS-LEADING FROM EARTH BETWEEN 70 110	EARTH

Exposures

#	Label (ETC Run)	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time (Total)/[Actual Dur.]	Orbit
1		(1) MIMAS-LEADING	STIS/CCD, ACQ, F28X50LP	MIRROR	ACQTYPE=POINT			.5 Secs (0.5 Secs) *[==>]*	 ***[1]***
2		(1) MIMAS-LEADING	STIS/CCD, ACQ/PEAK, 52X0.1	MIRROR				.5 Secs (0.5 Secs) *[==>]*	 ***[1]***
3		(1) MIMAS-LEADING	STIS/CCD, ACCUM, 52X0.1	G430L 4300 A	CR-SPLIT=NO			60 Secs (60 Secs) *[==>]*	 ***[1]***
4	(STIS.sp.622658)	(1) MIMAS-LEADING	STIS/NUV-MAMA, ACCUM, 52X0.1	G230L 2376 A				1760 Secs (1760 Secs) *[==>]*	 ***[1]***

Orbit Structure



Visit

Proposal 13694, Visit 02, implementation Thu Jan 22 02:09:02 GMT 2015

Diagnostic Status: No Diagnostics

Scientific Instruments: STIS/CCD, STIS/NUV-MAMA

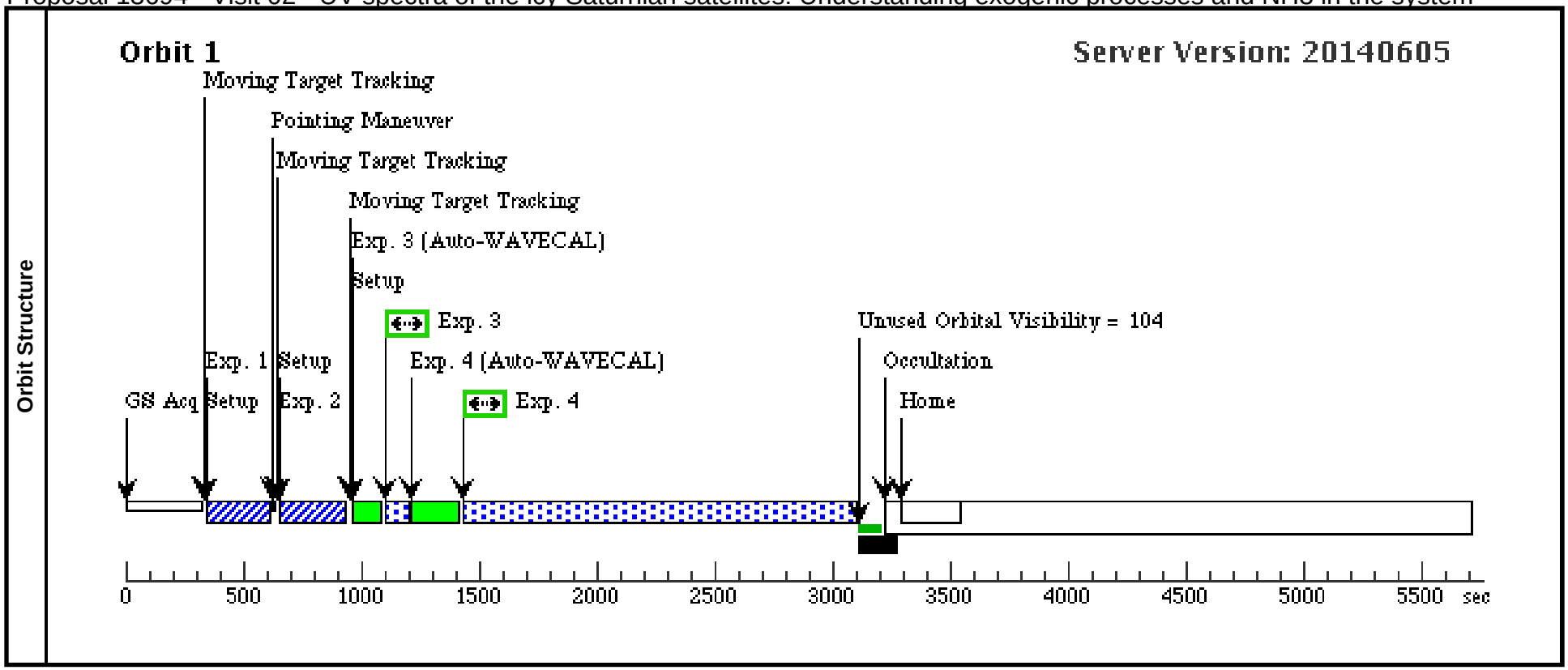
Special Requirements: (none)

Solar System Targets

#	Name	Level 1	Level 2	Level 3	Window	Ephem Center
(2)	MIMAS-TRAILING	STD=SATURN	STD=MIMAS		SEP OF MIMAS-TRAILING SATURN FROM EARTH GT 18.0", SEP OF MIMAS-TRAILING RHEA FROM EARTH GT 10", SEP OF MIMAS-TRAILING TITAN FROM EARTH GT 10", CML OF MIMAS-TRAILING FROM EARTH BETWEEN 250 290	EARTH

Exposures

#	Label (ETC Run)	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time (Total)/[Actual Dur.]	Orbit
1		(2) MIMAS-TRAILING	STIS/CCD, ACQ, F28X50LP	MIRROR	ACQTYPE=POINT			.5 Secs (0.5 Secs) *[==>]*	 ***[1]***
2		(2) MIMAS-TRAILING	STIS/CCD, ACQ/PEAK, 52X0.1	MIRROR				.5 Secs (0.5 Secs) *[==>]*	 ***[1]***
3		(2) MIMAS-TRAILING	STIS/CCD, ACCUM, 52X0.1	G430L 4300 A	CR-SPLIT=NO			60 Secs (60 Secs) *[==>]*	 ***[1]***
4	(STIS.sp.622658)	(2) MIMAS-TRAILING	STIS/NUV-MAMA, ACCUM, 52X0.1	G230L 2376 A				1660 Secs (1660 Secs) *[==>]*	 ***[1]***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Pointing Maneuver
Moving Target Tracking
Moving Target Tracking
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Setup
Exp. 3
Unused Orbital Visibility = 104
Exp. 1
Setup
Exp. 4 (Auto-WAVECAL)
Occultation
GS Acq
Setup
Exp. 2
Exp. 4
Home
0
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1000
1500
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2500
3000
3500
4000
4500
5000
5500
sec

Visit

Proposal 13694, Visit 03, implementation Thu Jan 22 02:09:03 GMT 2015

Diagnostic Status: No Diagnostics

Scientific Instruments: STIS/CCD, STIS/NUV-MAMA

Special Requirements: (none)

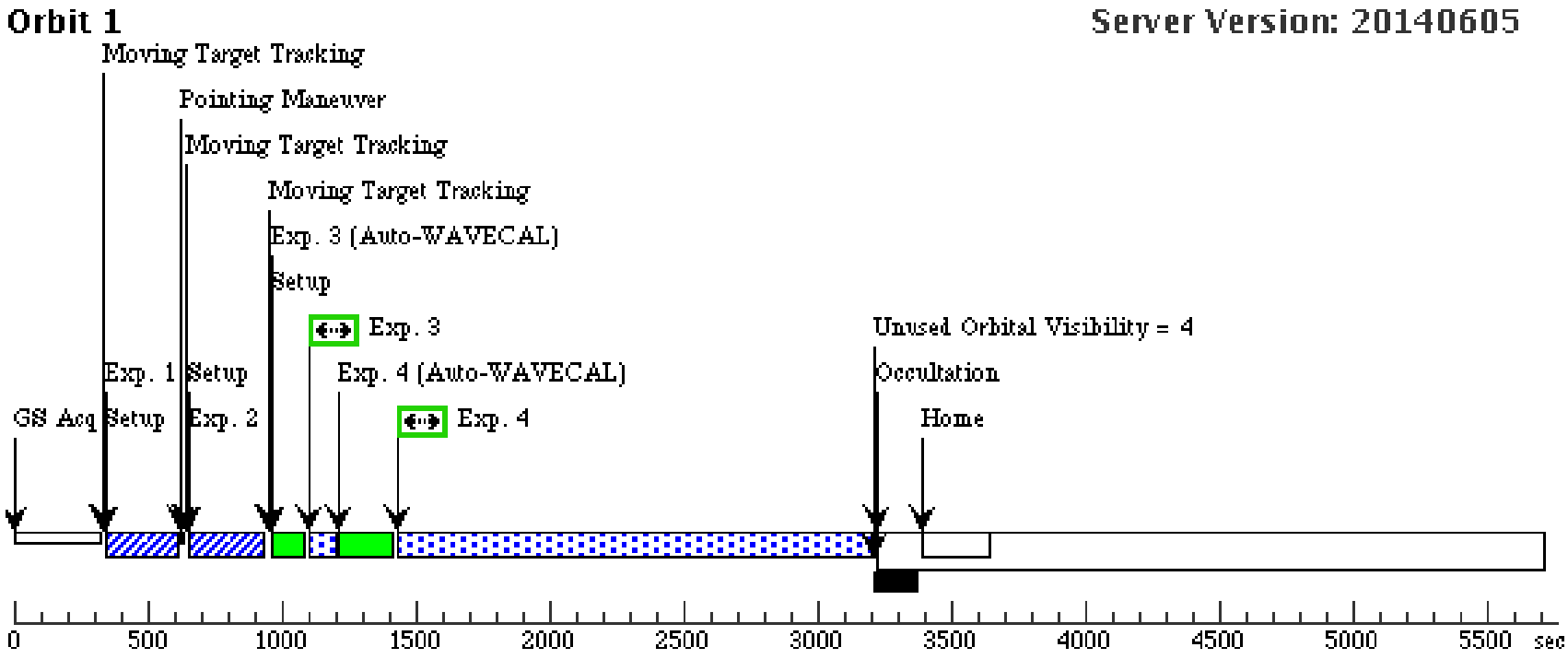
Solar System Targets

#	Name	Level 1	Level 2	Level 3	Window	Ephem Center
(3)	ENCELADUS	STD=SATURN	STD=ENCELADUS		SEP OF ENCELADUS SATURN FROM EARTH GT 26.5", SEP OF ENCELADUS RHEA FROM EARTH GT 10", SEP OF ENCELADUS TITAN FROM EARTH GT 10"	EARTH

Exposures

#	Label (ETC Run)	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time (Total)/[Actual Dur.]	Orbit
1		(3) ENCELADUS	STIS/CCD, ACQ, F28X50LP	MIRROR	ACQTYPE=POINT			.5 Secs (0.5 Secs)	
								[==>]	***[1]***
2		(3) ENCELADUS	STIS/CCD, ACQ/PEAK, 52X0.1	MIRROR				.5 Secs (0.5 Secs)	
								[==>]	***[1]***
3		(3) ENCELADUS	STIS/CCD, ACCUM, 52X0.1	G430L 4300 A	CR-SPLIT=NO			60 Secs (60 Secs)	
								[==>]	***[1]***
4	(STIS.sp.62 2658)	(3) ENCELADUS	STIS/NUV-MAMA, ACCUM, 52X0.1	G230L 2376 A				1760 Secs (1760 Secs)	
								[==>]	***[1]***

Orbit Structure



Visit

Proposal 13694, Visit 04, implementation Thu Jan 22 02:09:03 GMT 2015

Diagnostic Status: No Diagnostics

Scientific Instruments: STIS/CCD, STIS/NUV-MAMA

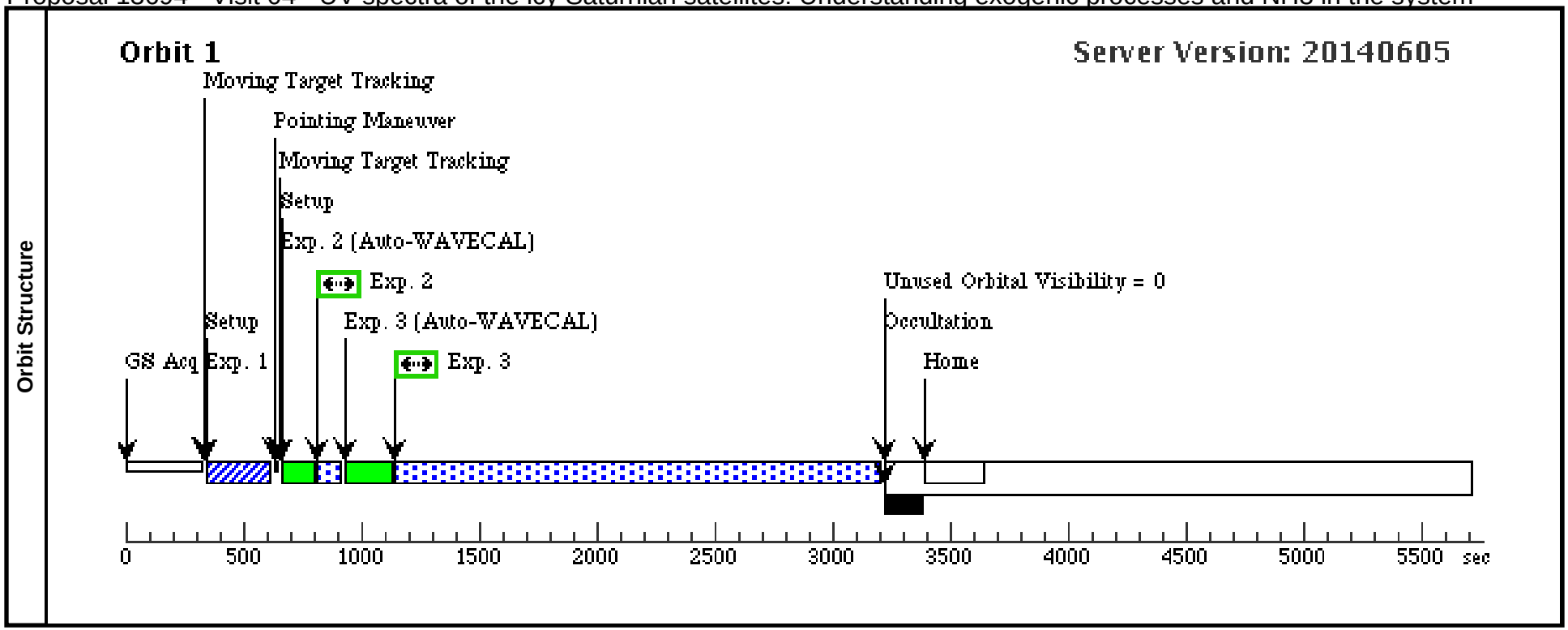
Special Requirements: (none)

Solar System Targets

#	Name	Level 1	Level 2	Level 3	Window	Ephem Center
(4)	DIONE-LEADING	STD=SATURN	STD=DIONE		SEP OF DIONE-LEADING SATURN FROM EARTH GT 45", SEP OF DIONE-LEADING RHEA FROM EARTH GT 10", SEP OF DIONE-LEADING TITAN FROM EARTH GT 10", CML OF DIONE-LEADING FROM EARTH BETWEEN 70 110	EARTH

Exposures

#	Label (ETC Run)	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time (Total)/[Actual Dur.]	Orbit
1		(4) DIONE-LEADING	STIS/CCD, ACQ, F28X50LP	MIRROR	ACQTYPE=DIFFUSE; CHECKBOX=3.0; DIFFUSE-CENTER=GEOMETRIC-CENTER			.5 Secs (0.5 Secs) *[==>]*	***[1]***
2		(4) DIONE-LEADING	STIS/CCD, ACCUM, 52X0.2	G430L 4300 A	CR-SPLIT=NO			60 Secs (60 Secs) *[==>]*	***[1]***
3	(STIS.sp.622662)	(4) DIONE-LEADING	STIS/NUV-MAMA, ACCUM, 52X0.2	G230L 2376 A				2051 Secs (2051 Secs) *[==>]*	***[1]***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Pointing Maneuver
Moving Target Tracking
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Exp. 2
Unused Orbital Visibility = 0
Setup
Exp. 3 (Auto-WAVECAL)
Occultation
GS Acq
Exp. 1
Exp. 3
Home
0
500
1000
1500
2000
2500
3000
3500
4000
4500
5000
5500
sec

Visit

Proposal 13694, Visit 05, implementation Thu Jan 22 02:09:03 GMT 2015

Diagnostic Status: No Diagnostics

Scientific Instruments: STIS/CCD, STIS/NUV-MAMA

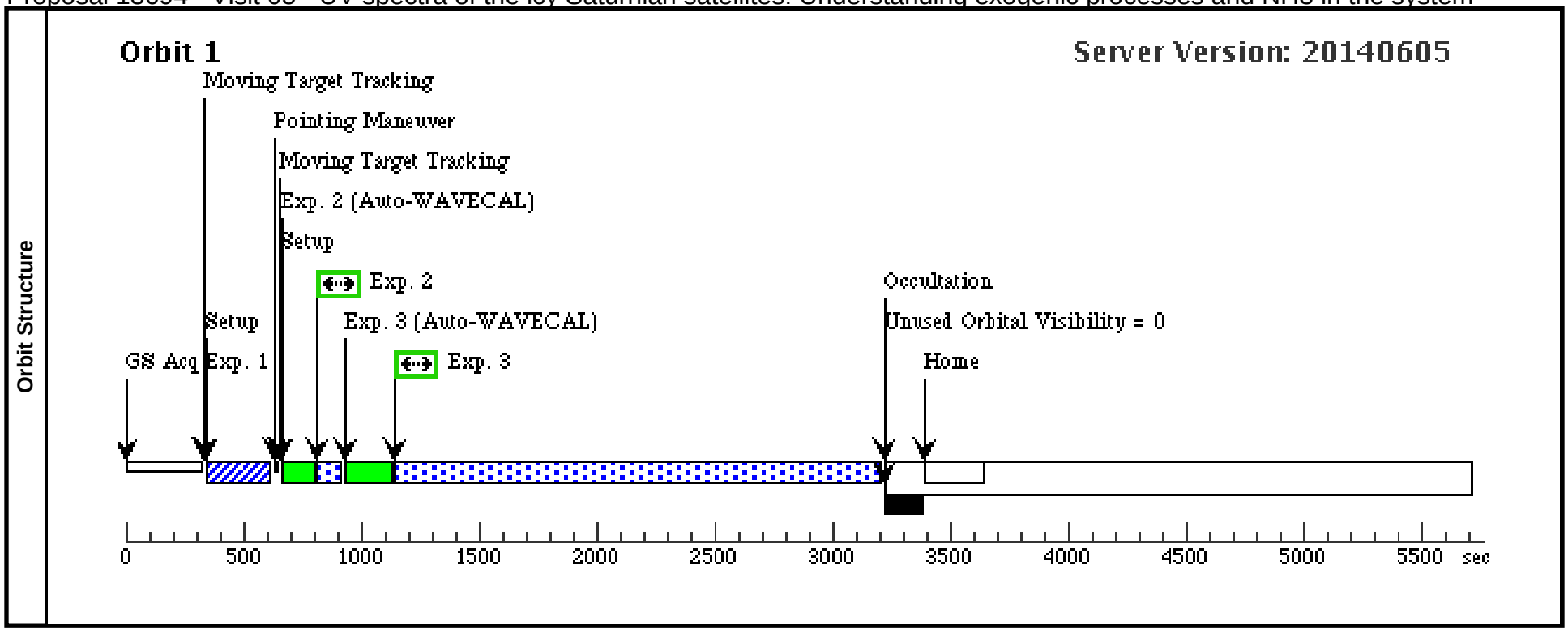
Special Requirements: (none)

Solar System Targets

#	Name	Level 1	Level 2	Level 3	Window	Ephem Center
(5)	DIONE-TRAILING	STD=SATURN	STD=DIONE		SEP OF DIONE-TRAILING SATURN FROM EARTH GT 45", SEP OF DIONE-TRAILING RHEA FROM EARTH GT 10", SEP OF DIONE-TRAILING TITAN FROM EARTH GT 10", CML OF DIONE-TRAILING FROM EARTH BETWEEN 250 290	EARTH

Exposures

#	Label (ETC Run)	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time (Total)/[Actual Dur.]	Orbit
1		(5) DIONE-TRAILING	STIS/CCD, ACQ, F28X50LP	MIRROR	ACQTYPE=DIFFUSE; CHECKBOX=3.0; DIFFUSE-CENTER=GEOMETRIC-CENTER			.5 Secs (0.5 Secs) *[==>]*	***[1]***
2		(5) DIONE-TRAILING	STIS/CCD, ACCUM, 52X0.2	G430L 4300 A	CR-SPLIT=NO			60 Secs (60 Secs) *[==>]*	***[1]***
3	(STIS.sp.622662)	(5) DIONE-TRAILING	STIS/NUV-MAMA, ACCUM, 52X0.2	G230L 2376 A				2051 Secs (2051 Secs) *[==>]*	***[1]***


Orbit Structure
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Pointing Maneuver
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Setup
Exp. 2
Occultation
Setup
Exp. 3 (Auto-WAVECAL)
Unused Orbital Visibility = 0
GS Acq
Exp. 1
Exp. 3
Home
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Visit

Proposal 13694, Visit 06, implementation Thu Jan 22 02:09:03 GMT 2015

Diagnostic Status: No Diagnostics

Scientific Instruments: STIS/CCD, STIS/NUV-MAMA

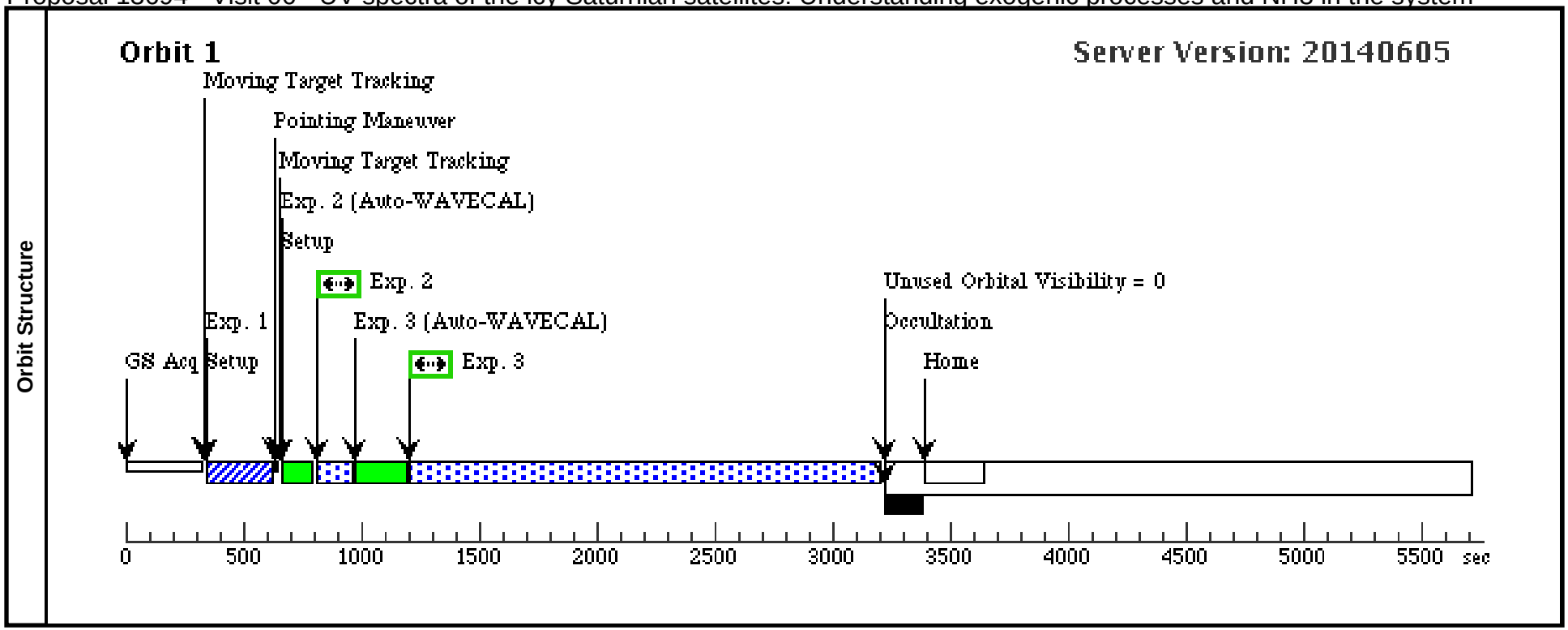
Special Requirements: (none)

Solar System Targets

#	Name	Level 1	Level 2	Level 3	Window	Ephem Center
(6)	RHEA-LEADING	STD=SATURN	STD=RHEA		SEP OF RHEA-LEADING SATURN FROM EARTH GT 45", SEP OF RHEA-LEADING TITAN FROM EARTH GT 10", CML OF RHEA-LEADING FROM EARTH BETWEEN 70 110	EARTH

Exposures

#	Label (ETC Run)	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time (Total)/[Actual Dur.]	Orbit
1		(6) RHEA-LEADING	STIS/CCD, ACQ, F28X50LP	MIRROR	ACQTYPE=DIFFUSE; CHECKBOX=5.0; DIFFUSE-CENTER=GEOMETRIC-CENTER			.5 Secs (0.5 Secs) *[==>]*	***[1]***
2		(6) RHEA-LEADING	STIS/CCD, ACCUM, 52X0.5	G430L 4300 A	CR-SPLIT=NO			60 Secs (60 Secs) *[==>]*	***[1]***
3	(STIS.sp.622661)	(6) RHEA-LEADING	STIS/NUV-MAMA, ACCUM, 52X0.5	G230L 2376 A				1963 Secs (1963 Secs) *[==>]*	***[1]***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Exp. 2
Exp. 1
Exp. 3 (Auto-WAVECAL)
GS Acq
Setup
Exp. 3
Unused Orbital Visibility = 0
Occultation
Home
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Visit

Proposal 13694, Visit 07, implementation Thu Jan 22 02:09:03 GMT 2015

Diagnostic Status: No Diagnostics

Scientific Instruments: STIS/CCD, STIS/NUV-MAMA

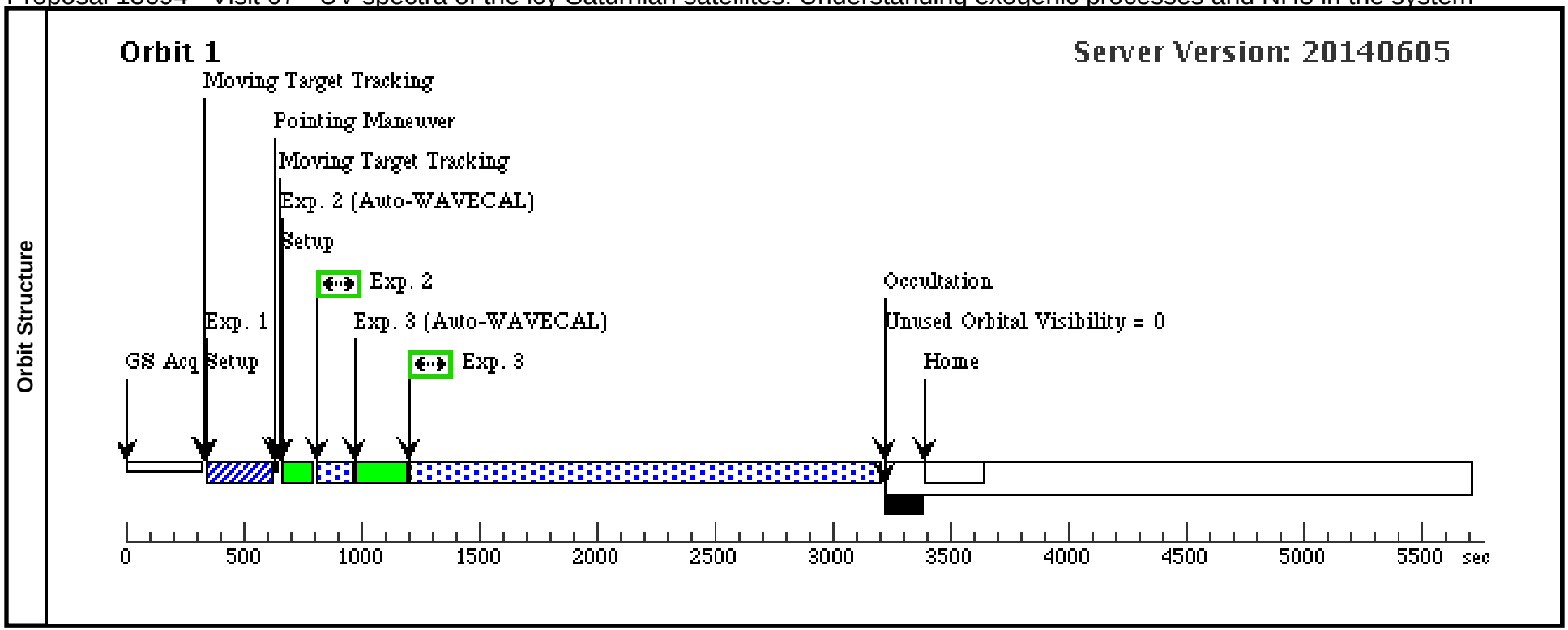
Special Requirements: (none)

Solar System Targets

#	Name	Level 1	Level 2	Level 3	Window	Ephem Center
(7)	RHEA-TRAILING	STD=SATURN	STD=RHEA		SEP OF RHEA-TRAILING SATURN FROM EARTH GT 45", SEP OF RHEA-TRAILING TITAN FROM EARTH GT 10", CML OF RHEA-TRAILING FROM EARTH BETWEEN 250 290	EARTH

Exposures

#	Label (ETC Run)	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time (Total)/[Actual Dur.]	Orbit
1		(7) RHEA-TRAILING	STIS/CCD, ACQ, F28X50LP	MIRROR	ACQTYPE=DIFFUSE; CHECKBOX=5.0; DIFFUSE-CENTER=GEOMETRIC-CENTER			.5 Secs (0.5 Secs) *[==>]*	***[1]***
2		(7) RHEA-TRAILING	STIS/CCD, ACCUM, 52X0.5	G430L 4300 A	CR-SPLIT=NO			60 Secs (60 Secs) *[==>]*	***[1]***
3	(STIS.sp.622661)	(7) RHEA-TRAILING	STIS/NUV-MAMA, ACCUM, 52X0.5	G230L 2376 A				1963 Secs (1963 Secs) *[==>]*	***[1]***


Orbit Structure
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Pointing Maneuver
Moving Target Tracking
Exp. 2 (Auto-WAVECAL)
Setup
Exp. 2
Occultation
Exp. 1
Exp. 3 (Auto-WAVECAL)
Unused Orbital Visibility = 0
GS Acq Setup
Exp. 3
Home
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500
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