



17099 - Ganymede's water atmosphere in eclipse

Cycle: 30, Proposal Category: GO

(UV Initiative)

(Availability Mode: AVAILABLE)

INVESTIGATORS

<i>Name</i>	<i>Institution</i>
Dr. Lorenz Roth (PI) (ESA Member) (Contact)	Royal Institute of Technology
Dr. Carl Schmidt (CoI) (AdminUSPI)	Boston University
Dr. Joachim Saur (CoI) (ESA Member)	Universitat zu Koeln
Dr. Pippa Molyneux (CoI)	Southwest Research Institute
Dr. Kurt David Retherford (CoI)	Southwest Research Institute
Dr. Nickolay Ivchenko (CoI) (ESA Member)	Royal Institute of Technology

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) GANYMEDE (2) GANYMEDE-ECLIPSE	STIS/FUV-MAMA	2	09-Aug-2024 15:00:17.0	yes
51	(1) GANYMEDE	STIS/CCD STIS/FUV-MAMA	2	09-Aug-2024 15:00:17.0	yes
54	(1) GANYMEDE	STIS/FUV-MAMA	2	09-Aug-2024 15:00:18.0	yes
03	(1) GANYMEDE (2) GANYMEDE-ECLIPSE	STIS/FUV-MAMA	2	09-Aug-2024 15:00:19.0	yes
53	(1) GANYMEDE	STIS/FUV-MAMA	2	09-Aug-2024 15:00:19.0	yes
04	(1) GANYMEDE	STIS/CCD STIS/FUV-MAMA	1	09-Aug-2024 15:00:20.0	yes

<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>
02	(2) GANYMEDE-ECLIPSE (3) IO-ACQ	COS/NUV	2	09-Aug-2024 15:00:21.0	yes

13 Total Orbits Used

ABSTRACT

A recent analysis of HST/STIS images has revealed the presence of water vapor in the atmosphere of Ganymede, the largest moon of Jupiter and in the entire solar system. The derivation of H₂O was through emissions from oxygen, using the relative brightness of far-UV multiplets at 1304 Å and at 1356 Å. The findings constitute the first detection of sublimated H₂O in the outer solar system. This atmosphere likely collapses when Ganymede is eclipsed by Jupiter since surface temperature and sublimation flux are expected to decrease considerably. Here we propose follow-up observations to confirm the detection of H₂O in the atmosphere and characterize the response of the H₂O component to eclipse. For this, we use the successful STIS FUV spectral imaging mode to monitor and map the diagnostic 1304 Å and at 1356 Å emissions from before to after a ~3-hour eclipse passage of Ganymede. During another eclipse occasion, we use COS and the G230L mode to measure OH aurora from dissociative excitation of H₂O for the first time. This visit provides an independent confirmation of the H₂O atmosphere.

Ganymede is a primary target of ESA's JUperiter Icy Moon Explorer (JUICE) and NASA's Europa Clipper mission. An improved understanding of the moon's neutral environment delivers important information for optimal science planning and addressing the habitability goals for these milestone missions.

OBSERVING DESCRIPTION

In visit 1, we use five orbits of STIS FUV-MAMA G140L long-slit spectral imaging for a complete scan of an eclipse passage of Ganymede. With this mode, the OI 1304 Å and OI 1356 Å are imaged simultaneously. The orbits should optimally be aligned such that Ganymede is in sunlight during the first and last orbit and as much time as possible in eclipse during the other three orbits.

In visit 2, we use two contiguous orbits using COS in the NUV-MAMA G230L mode centered at 3000 Å to measure the OH (A-X) band emission in eclipse.

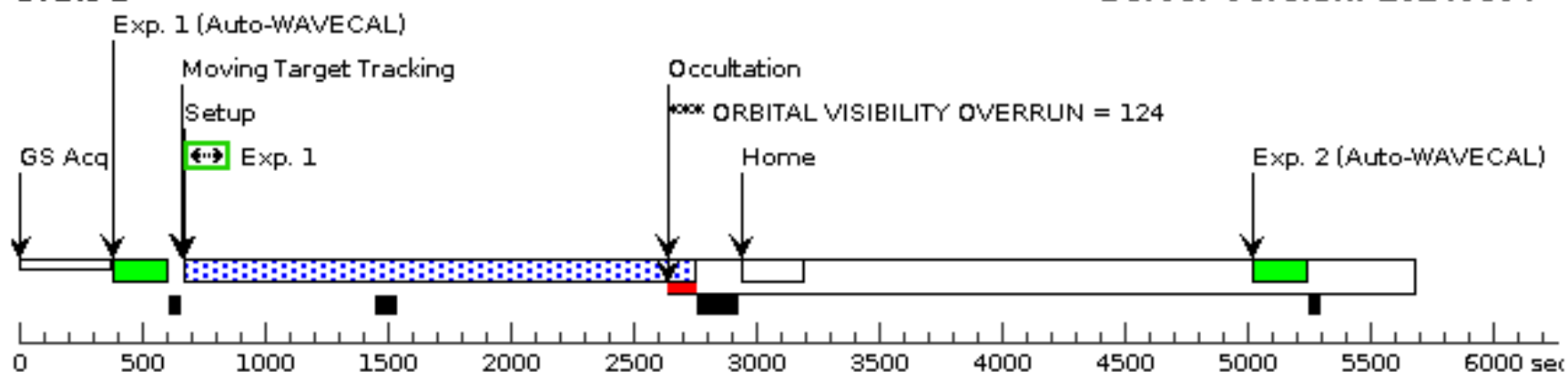
For acquisition, we need to use one of the three other Galilean moon and then sweep to Ganymede (which is eclipsed). After acquisition, we use the remaining time for the science exposures.

Proposal 17099 - STIS FUV visit (01) - Ganymede's water atmosphere in eclipse

Visit	Proposal 17099, STIS FUV visit (01), failed										Fri Aug 09 19:00:21 GMT 2024	
	Diagnostic Status: Warning											
	Scientific Instruments: STIS/FUV-MAMA											
	Special Requirements: BETWEEN 30-OCT-2022:09:38:00 AND 30-OCT-2022:10:38:00											
	Comments: Will execute during Oct 30 eclipse											
Diagnostics	(STIS FUV visit (01)) Warning (Form): A target acquisition should probably be performed before doing spectroscopy or coronagraphy with STIS or COS.											
	(STIS FUV visit (01)) Warning (Orbit Planner): ORBITAL VISIBILITY OVERRUN											
	(STIS FUV visit (01)) Warning (Orbit Planner): ORBITAL VISIBILITY OVERRUN											
	(Eclipse 1 (01.001)) Warning (Form): Sensitive exposures should have an ETC run number provided.											
	(Eclipse 2 (01.002)) Warning (Form): Sensitive exposures should have an ETC run number provided.											
	(STIS FUV visit (01)) Informational (Form): The Visit Planner and Spike may produce different schedulability results.											
Solar System Targets	#	Name	Level 1	Level 2	Level 3	Window	Ephem Center					
	(1)	GANYMEDE	STD=JUPITER	STD=GANYMEDE		NOT OCC OF GANYMEDE BY JUPITER FROM EARTH	EARTH					
	Comments: Description=Ganymede near or in eclipse Extended=YES											
	(2)	GANYMEDE-ECLIPSE	STD=JUPITER	STD=GANYMEDE		NOT OCC OF GANYMEDE-ECLIPSE BY JUPITER FROM EARTH, ECL U FULL OF GANYMEDE BY JUPITER FROM EARTH	EARTH					
Comments: Description=Ganymede near or in eclipse Extended=YES												
Exposures	#	Label	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time (Total)/[Actual Dur.]		Orbit	
	1	Eclipse 1	(1) GANYMEDE	STIS/FUV-MAMA, TIME-TAG, 6X6	G140L 1425 A	BUFFER-TIME=75 0			2300 Secs (2030 Secs) [>=>2030.0 Secs]		[1]	
	Comments: 6"x6" aperture is being used to enable a blind pointing on Ganymede.											
	2	Eclipse 2	(2) GANYMEDE-ECLIPSE	STIS/FUV-MAMA, TIME-TAG, 6X6	G140L 1425 A	BUFFER-TIME=75 0			2300 Secs (2320 Secs) [>=>2320 Secs]		[2]	

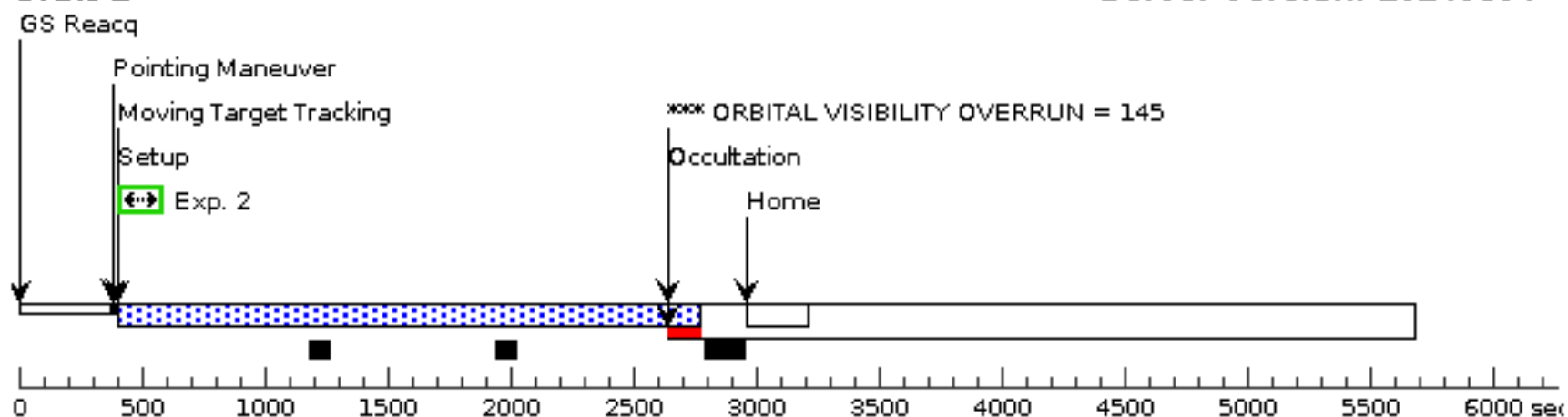
Orbit 1

Server Version: 20240604



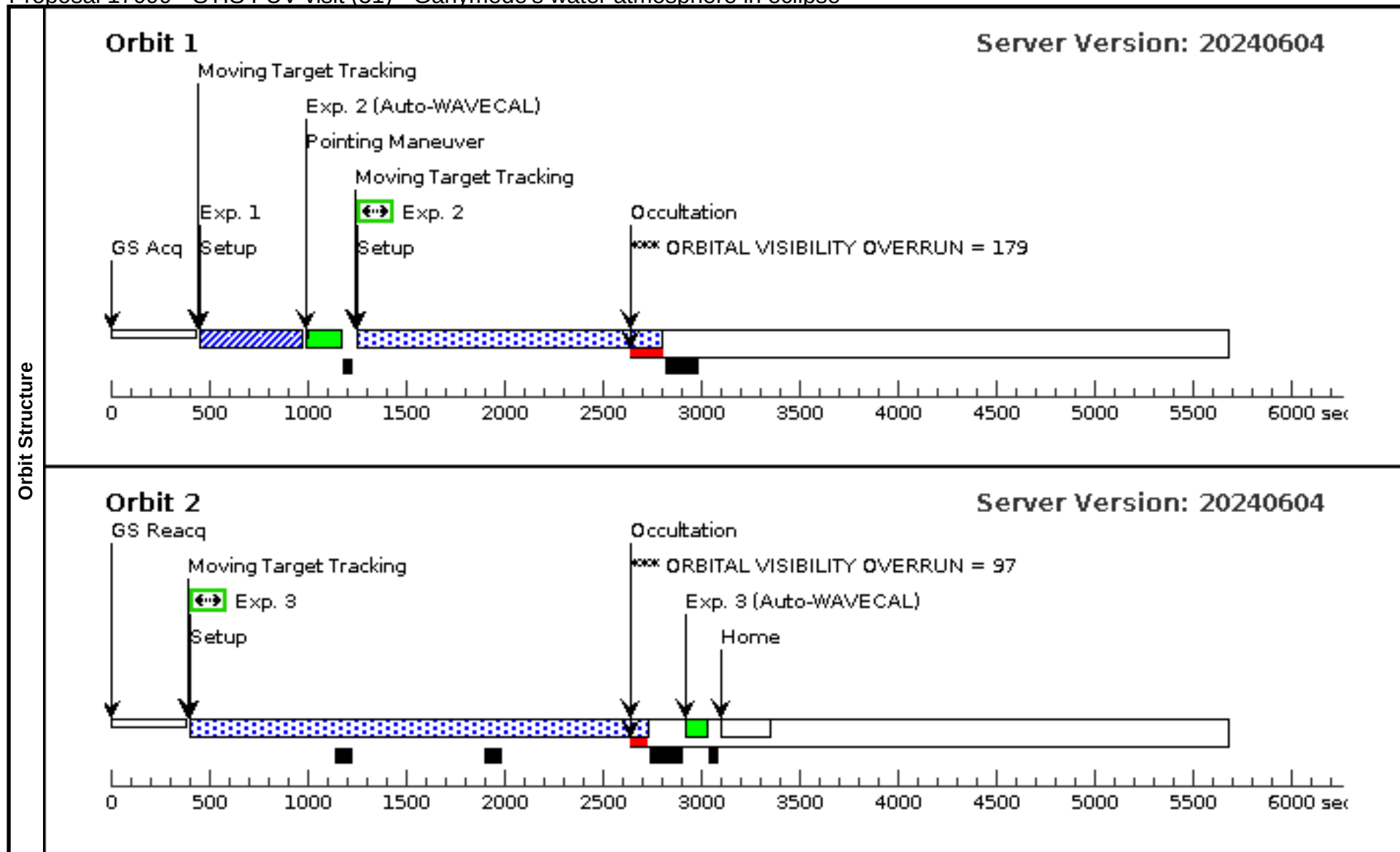
Orbit 2

Server Version: 20240604



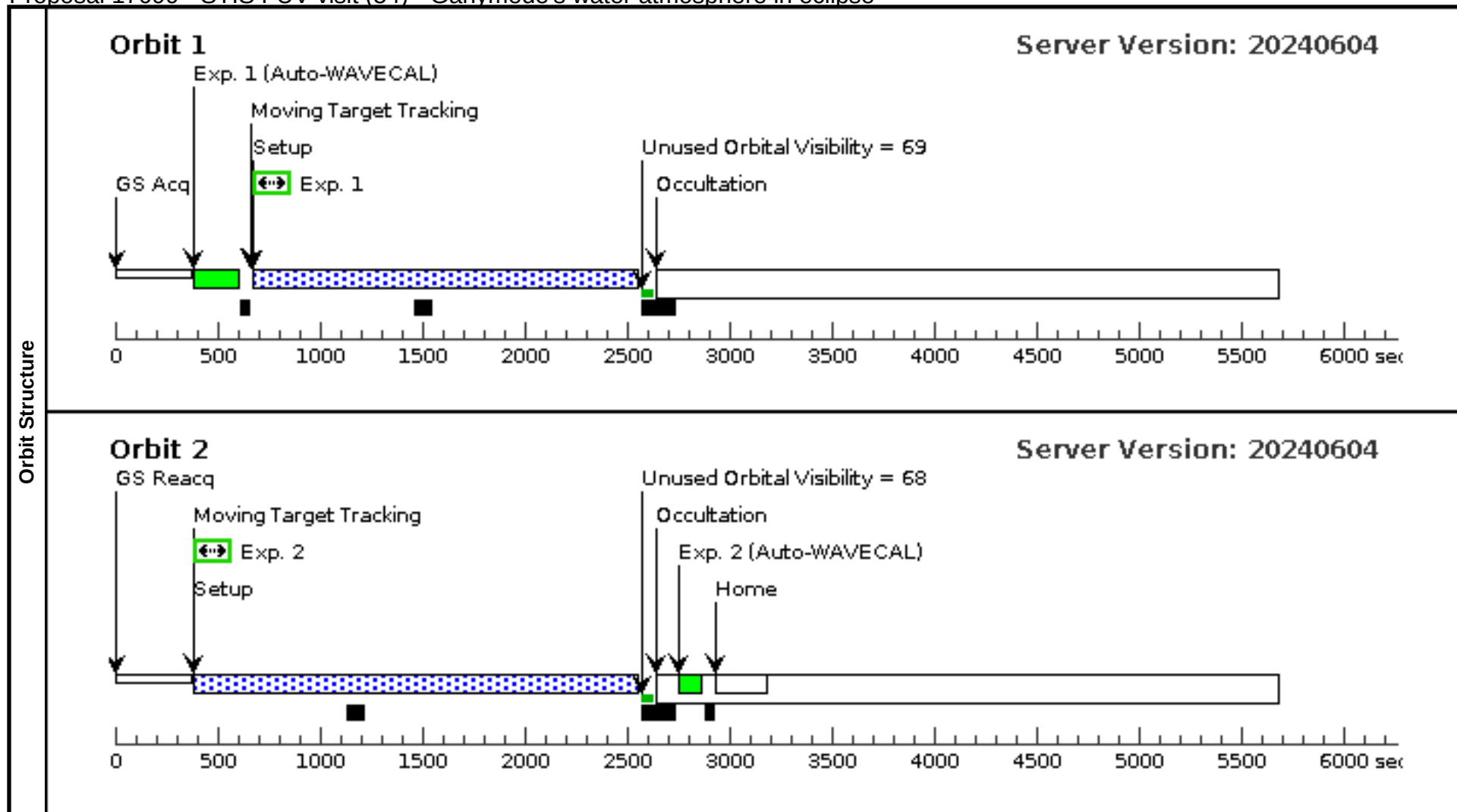
Proposal 17099 - STIS FUV visit (51) - Ganymede's water atmosphere in eclipse

Visit	Proposal 17099, STIS FUV visit (51), failed							Fri Aug 09 19:00:21 GMT 2024		
	Diagnostic Status: Warning									
	Scientific Instruments: STIS/CCD, STIS/FUV-MAMA									
	Special Requirements: BETWEEN 03-SEP-2023:14:25:00 AND 03-SEP-2023:15:40:00									
Comments: HOPR repeat of visit 1										
Diagnostics	(STIS FUV visit (51)) Warning (Orbit Planner): GS ACQ SCENARIO REQUESTED INCONSISTENT WITH VISIT GYRO MODE									
	(STIS FUV visit (51)) Warning (Orbit Planner): ORBITAL VISIBILITY OVERRUN									
	(STIS FUV visit (51)) Warning (Orbit Planner): ORBITAL VISIBILITY OVERRUN									
	(Acquisition (51.001) special requirements) Warning (Form): The specified GS Acq Scenario is not in the current list of valid scenarios.									
	(Eclipse 1 (51.002)) Warning (Form): Sensitive exposures should have an ETC run number provided.									
	(Eclipse 2 (51.003)) Warning (Form): Sensitive exposures should have an ETC run number provided.									
Solar System Targets	(STIS FUV visit (51)) Informational (Form): The Visit Planner and Spike may produce different schedulability results.									
	#	Name	Level 1	Level 2	Level 3	Window	Ephem Center			
	(1)	GANYMEDE	STD=JUPITER	STD=GANYMEDE		NOT OCC OF GANYMEDE BY JUPITER FROM EARTH	EARTH			
	Comments: Description=Ganymede near or in eclipse Extended=YES									
Exposures	#	Label	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time (Total)/[Actual Dur.]	Orbit
	1	Acquisition	(1) GANYMEDE	STIS/CCD, ACQ, F28X50LP	MIRROR	CHECKBOX=35; ACQTYPE=DIFFUSE; DIFFUSE-CENTER=GEOMETRIC-CENTER	GS ACQ SCENARIO BASE1BR		0.3 Secs (0.3 Secs) [==>]	[1]
	2	Eclipse 1	(1) GANYMEDE	STIS/FUV-MAMA, TIME-TAG, 52X2D1	G140L 1425 A	BUFFER-TIME=75 0			1700 Secs (1500 Secs) [==>1500.0 Secs]	[1]
	Comments: 6"x6" aperture is being used to enable a blind pointing on Ganymede.									
	3	Eclipse 2	(1) GANYMEDE	STIS/FUV-MAMA, TIME-TAG, 52X2D1	G140L 1425 A	BUFFER-TIME=75 0			2000 Secs (2313 Secs) [==>2313.0 Secs]	[2]



Proposal 17099 - STIS FUV visit (54) - Ganymede's water atmosphere in eclipse

Visit	Proposal 17099, STIS FUV visit (54), implementation										Fri Aug 09 19:00:21 GMT 2024
	Diagnostic Status: Warning										
	Scientific Instruments: STIS/FUV-MAMA										
	Special Requirements: BETWEEN 17-SEP-2024:12:00:00 AND 17-SEP-2024:13:00:00										
Comments: HOPR repeat of visit 51											
Diagnostics	(STIS FUV visit (54)) Warning (Form): A target acquisition should probably be performed before doing spectroscopy or coronagraphy with STIS or COS.										
	(Eclipse 1 (54.001)) Warning (Form): Sensitive exposures should have an ETC run number provided.										
	(Eclipse 2 (54.002)) Warning (Form): Sensitive exposures should have an ETC run number provided.										
	(STIS FUV visit (54)) Informational (Form): The Visit Planner and Spike may produce different schedulability results.										
Solar System Targets	#	Name	Level 1	Level 2	Level 3	Window	Ephem Center				
	(1)	GANYMEDE	STD=JUPITER	STD=GANYMEDE		NOT OCC OF GANYMEDE BY JUPITER FROM EARTH	EARTH				
	Comments: Description=Ganymede near or in eclipse										
	Extended=YES										
Exposures	#	Label	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time (Total)/[Actual Dur.]	Orbit	
	1	Eclipse 1	(1) GANYMEDE	STIS/FUV-MAMA, TIME-TAG, 52X2D1	G140L 1425 A	BUFFER-TIME=75 0			1830 Secs (1830 Secs)		
										[==>]	[1]
	Comments: 6"x6" aperture is being used to enable a blind pointing on Ganymede.										
	2	Eclipse 2	(1) GANYMEDE	STIS/FUV-MAMA, TIME-TAG, 52X2D1	G140L 1425 A	BUFFER-TIME=75 0			2160 Secs (2160 Secs)		
									[==>]	[2]	

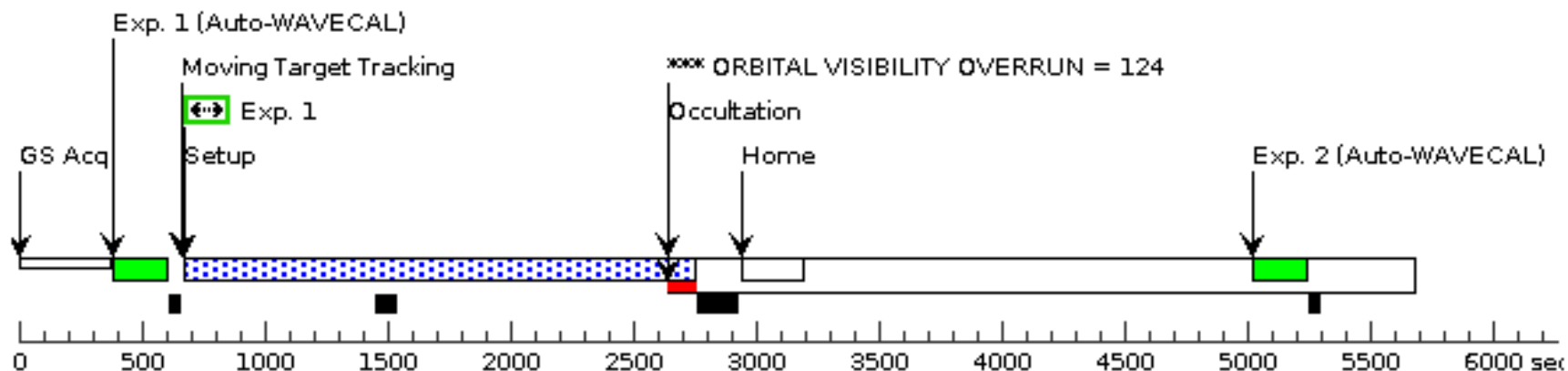


Proposal 17099 - STIS FUV visit (03) - Ganymede's water atmosphere in eclipse

Visit	Proposal 17099, STIS FUV visit (03), failed										Fri Aug 09 19:00:22 GMT 2024	
	Diagnostic Status: Warning											
	Scientific Instruments: STIS/FUV-MAMA											
	Special Requirements: BETWEEN 13-NOV-2022:18:00:00 AND 13-NOV-2022:19:00:00											
	Comments: Will execute during Nov 13 eclipse											
Diagnostics	(STIS FUV visit (03)) Warning (Form): A target acquisition should probably be performed before doing spectroscopy or coronagraphy with STIS or COS.											
	(STIS FUV visit (03)) Warning (Orbit Planner): ORBITAL VISIBILITY OVERRUN											
	(STIS FUV visit (03)) Warning (Orbit Planner): ORBITAL VISIBILITY OVERRUN											
	(Eclipse 1 (03.001)) Warning (Form): Sensitive exposures should have an ETC run number provided.											
	(Eclipse 2 (03.002)) Warning (Form): Sensitive exposures should have an ETC run number provided.											
	(STIS FUV visit (03)) Informational (Form): The Visit Planner and Spike may produce different schedulability results.											
Solar System Targets	#	Name	Level 1	Level 2	Level 3	Window	Ephem Center					
	(1)	GANYMEDE	STD=JUPITER	STD=GANYMEDE		NOT OCC OF GANYMEDE BY JUPITER FROM EARTH	EARTH					
	Comments: Description=Ganymede near or in eclipse Extended=YES											
	(2)	GANYMEDE-ECLIPSE	STD=JUPITER	STD=GANYMEDE		NOT OCC OF GANYMEDE-ECLIPSE BY JUPITER FROM EARTH, ECL U FULL OF GANYMEDE BY JUPITER FROM EARTH	EARTH					
Comments: Description=Ganymede near or in eclipse Extended=YES												
Exposures	#	Label	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time (Total)/[Actual Dur.]		Orbit	
	1	Eclipse 1	(1) GANYMEDE	STIS/FUV-MAMA, TIME-TAG, 6X6	G140L 1425 A	BUFFER-TIME=75 0			2300 Secs (2030 Secs) [>=>2030.0 Secs]		[1]	
	Comments: 6"x6" aperture is being used to enable a blind pointing on Ganymede.											
	2	Eclipse 2	(2) GANYMEDE-ECLIPSE	STIS/FUV-MAMA, TIME-TAG, 6X6	G140L 1425 A	BUFFER-TIME=75 0			2300 Secs (2320 Secs) [>=>2320 Secs]		[2]	

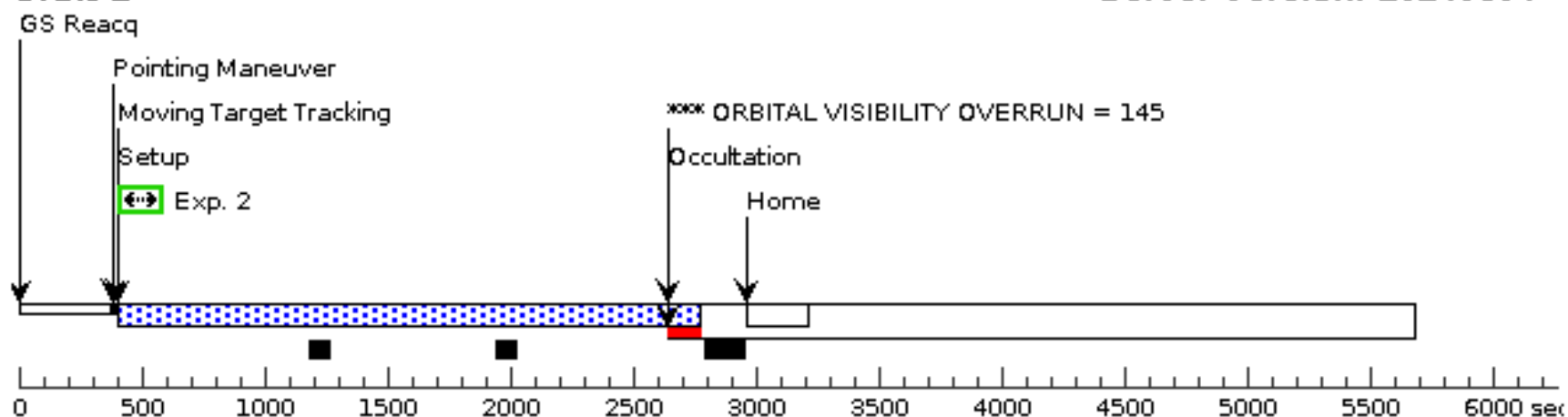
Orbit 1

Server Version: 20240604



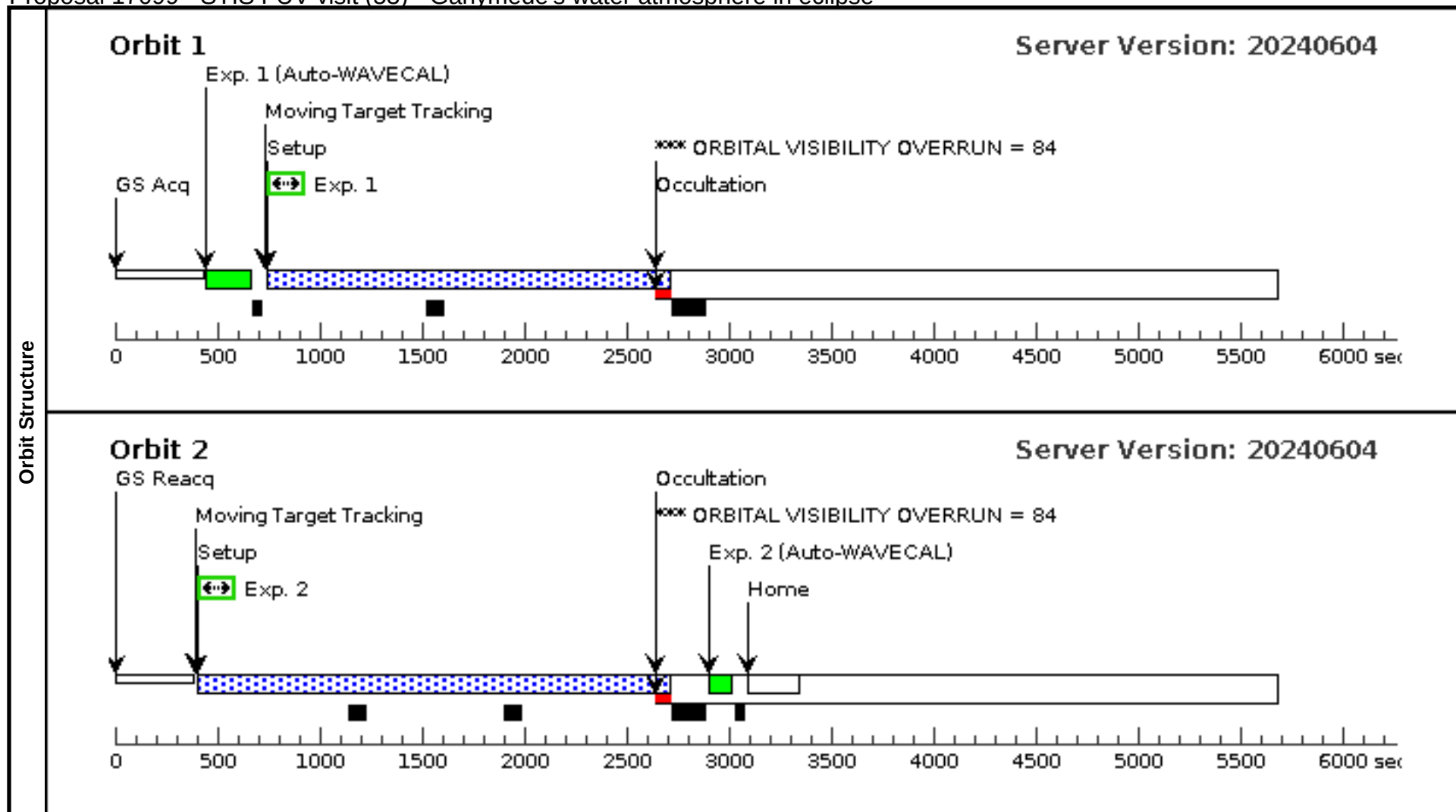
Orbit 2

Server Version: 20240604



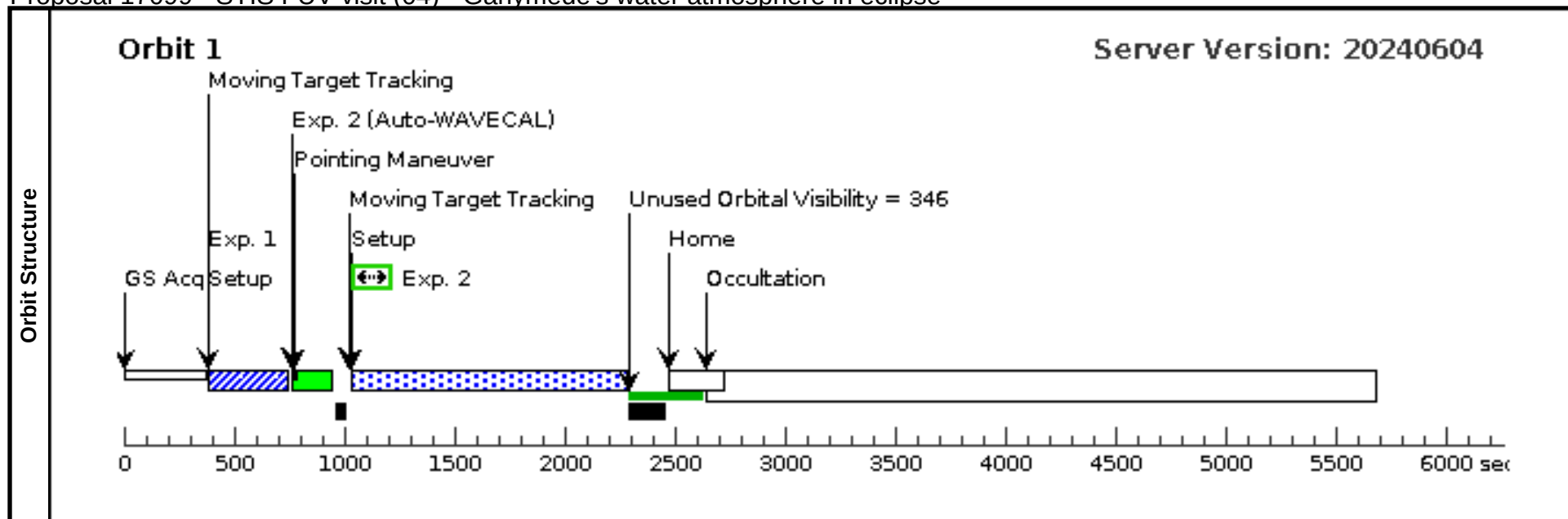
Proposal 17099 - STIS FUV visit (53) - Ganymede's water atmosphere in eclipse

Visit	Proposal 17099, STIS FUV visit (53), completed										Fri Aug 09 19:00:22 GMT 2024	
	Diagnostic Status: Warning											
	Scientific Instruments: STIS/FUV-MAMA											
	Special Requirements: BETWEEN 27-DEC-2023:07:45:00 AND 27-DEC-2023:08:45:00											
Comments: HOPR repeat of visit 03.												
Diagnostics	(STIS FUV visit (53)) Warning (Form): A target acquisition should probably be performed before doing spectroscopy or coronagraphy with STIS or COS.											
	(STIS FUV visit (53)) Warning (Orbit Planner): GS ACQ SCENARIO REQUESTED INCONSISTENT WITH VISIT GYRO MODE											
	(STIS FUV visit (53)) Warning (Orbit Planner): INVALID GS ACQ SCENARIO SPECIAL REQUIREMENT											
	(STIS FUV visit (53)) Warning (Orbit Planner): ORBITAL VISIBILITY OVERRUN											
	(STIS FUV visit (53)) Warning (Orbit Planner): ORBITAL VISIBILITY OVERRUN											
	(Eclipse 1 (53.001)) Warning (Form): Sensitive exposures should have an ETC run number provided.											
	(Eclipse 1 (53.001) special requirements) Warning (Form): The specified GS Acq Scenario is not in the current list of valid scenarios.											
	(Eclipse 2 (53.002)) Warning (Form): Sensitive exposures should have an ETC run number provided.											
	(Eclipse 2 (53.002) special requirements) Warning (Form): The specified GS Acq Scenario is not in the current list of valid scenarios.											
(STIS FUV visit (53)) Informational (Form): The Visit Planner and Spike may produce different schedulability results.												
Solar System Targets	#	Name	Level 1	Level 2	Level 3	Window	Ephem Center					
	(1)	GANYMEDE	STD=JUPITER	STD=GANYMEDE		NOT OCC OF GANYMEDE BY JUPITER FROM EARTH	EARTH					
	Comments: Description=Ganymede near or in eclipse Extended=YES											
Exposures	#	Label	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time (Total)/[Actual Dur.]	Orbit		
	1	Eclipse 1	(1) GANYMEDE	STIS/FUV-MAMA, TIME-TAG, 52X2D1	G140L 1425 A	BUFFER-TIME=75 0	GS ACQ SCENARI O BASE1BR		1920 Secs (1920 Secs)			
									[==>]	[1]		
	Comments: 52 x 2 aperture is being used to enable a blind pointing on Ganymede.											
	2	Eclipse 2	(1) GANYMEDE	STIS/FUV-MAMA, TIME-TAG, 52X2D1	G140L 1425 A	BUFFER-TIME=75 0	GS ACQ SCENARI O BASE1BR		2300 Secs (2300 Secs)			
								[==>]	[2]			



Proposal 17099 - STIS FUV visit (04) - Ganymede's water atmosphere in eclipse

Visit	Proposal 17099, STIS FUV visit (04), completed										Fri Aug 09 19:00:22 GMT 2024	
	Diagnostic Status: Warning											
	Scientific Instruments: STIS/CCD, STIS/FUV-MAMA											
	Special Requirements: BETWEEN 13-NOV-2022:21:00:00 AND 13-NOV-2022:22:00:00											
Comments: Will execute during Nov 13 eclipse												
Diagnostics	(After Eclipse (04.002)) Warning (Form): Sensitive exposures should have an ETC run number provided.											
	(STIS FUV visit (04)) Informational (Form): The Visit Planner and Spike may produce different schedulability results.											
Solar System Targets	#	Name	Level 1	Level 2	Level 3	Window	Ephem Center					
	(1)	GANYMEDE	STD=JUPITER	STD=GANYMEDE		NOT OCC OF GANYMEDE BY JUPITER FROM EARTH	EARTH					
	Comments: Description=Ganymede near or in eclipse											
	Extended=YES											
Exposures	#	Label	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time (Total)/[Actual Dur.]	Orbit		
	1	Acquisition	(1) GANYMEDE	STIS/CCD, ACQ, F28X50LP	MIRROR	CHECKBOX=21;			0.3 Secs (0.3 Secs)			
						ACQTYPE=DIFFUSE;			[==>]		[1]	
						DIFFUSE-CENTER=GEOMETRIC-CENTER						
	2	After Eclipse	(1) GANYMEDE	STIS/FUV-MAMA, TIME-TAG, 52X2	G140L 1425 A	BUFFER-TIME=750			2300 Secs (1200 Secs)			
									[==>1200.0 Secs]		[1]	



Proposal 17099 - COS NUV visit (02) - Ganymede's water atmosphere in eclipse

Visit	Proposal 17099, COS NUV visit (02), completed										Fri Aug 09 19:00:22 GMT 2024	
	Diagnostic Status: Warning											
	Scientific Instruments: COS/NUV											
	Special Requirements: BETWEEN 05-DEC-2022:05:45:00 AND 05-DEC-2022:06:45:00											
Comments: Will execute during Dec 5 eclipse												
Diagnostics	(COS NUV visit (02)) Warning (Orbit Planner): ORBITAL VISIBILITY OVERRUN											
	(COS NUV visit (02)) Informational (Form): The Visit Planner and Spike may produce different schedulability results.											
Solar System Targets	#	Name	Level 1	Level 2	Level 3	Window	Ephem Center					
	(2)	GANYMEDE-ECLIPSE	STD=JUPITER	STD=GANYMEDE		NOT OCC OF GANYMEDE-ECLIPSE BY JUPITER FROM EARTH, ECL U FULL OF GANYMEDE BY JUPITER FROM EARTH	EARTH					
	Comments: Description=Ganymede near or in eclipse Extended=YES											
	(3)	IO-ACQ	STD=JUPITER	STD=IO		NOT OCC OF IO-ACQ BY JUPITER FROM EARTH, SEP OF IO-ACQ EUROPA FROM EARTH GT 10", SEP OF IO-ACQ GANYMEDE FROM EARTH GT 10", SEP OF IO-ACQ CALLISTO FROM EARTH GT 10"	EARTH					
Comments: This target is being used to do the target Acqs Description=Galileian Moon other than Europa for acquisition Extended=YES												
Exposures	#	Label (ETC Run)	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time (Total)/[Actual Dur.]		Orbit	
	1	Acquisition (COS.ta.182 5830)	(3) IO-ACQ	COS/NUV, ACQ/SEARCH, BOA	MIRRORA	SCAN-SIZE=2			30 Secs (30 Secs)			
										[>=>]	[1]	
	Comments: This acquisition mode/setup was used successfully used in program 16211.											
	2	(COS.sp.182 5513)	(2) GANYMEDE-E CLIPSE	COS/NUV, TIME-TAG, PSA	G230L 3000 A	BUFFER-TIME=10 30; FP-POS=1			1130 Secs (1130 Secs)			
										[>=>]	[1]	
	3	(COS.sp.182 5513)	(2) GANYMEDE-E CLIPSE	COS/NUV, TIME-TAG, PSA	G230L 3000 A	BUFFER-TIME=62 6; FP-POS=2			726 Secs (726 Secs)			
										[>=>]	[2]	
	4	(COS.sp.182 5513)	(2) GANYMEDE-E CLIPSE	COS/NUV, TIME-TAG, PSA	G230L 3000 A	BUFFER-TIME=62 6; FP-POS=3			726 Secs (726 Secs)			
										[>=>]	[2]	
5	(COS.sp.182 5513)	(2) GANYMEDE-E CLIPSE	COS/NUV, TIME-TAG, PSA	G230L 3000 A	BUFFER-TIME=62 5; FP-POS=4			725 Secs (725 Secs)				
									[>=>]	[2]		

