



16199 - Exploiting the fortunate Jupiter transit geometry to probe Ganymede's and Callisto's atmospheres

Cycle: 28, 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. Kurt David Retherford (CoI) (AdminUSPI)	Southwest Research Institute
Dr. Joachim Saur (CoI) (ESA Member)	Universitat zu Koeln
Dr. Tracy M Becker (CoI)	Southwest Research Institute
Dr. Jens Hoeijmakers (CoI) (ESA Member)	Lund University
Dr. Pippa Molyneux (CoI)	Southwest Research Institute

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-TRANSIT	STIS/FUV-MAMA	2	03-Jul-2024 10:00:35.0	yes
03	(3) GANYMEDE-TRANSIT-COPY	STIS/FUV-MAMA	1	03-Jul-2024 10:00:36.0	yes
04	(3) GANYMEDE-TRANSIT-COPY	STIS/FUV-MAMA	1	03-Jul-2024 10:00:37.0	yes
02	(2) CALLISTO-TRANSIT	STIS/FUV-MAMA	2	03-Jul-2024 10:00:38.0	yes
52	(4) CALLISTO-TRANSIT2	STIS/FUV-MAMA	2	03-Jul-2024 10:00:38.0	yes

8 Total Orbits Used

ABSTRACT

Ganymede and Callisto are primary targets of ESA's JUpiter Icy Moon Explorer (JUICE) and NASA's Europa Clipper mission: Callisto will be visited with a total of about 20 flybys. Ganymede will be the first planetary moon to be orbited by a spacecraft (JUICE). Today, the atmospheres of the two icy moons are only loosely constrained by observations. Oxygen, the dominant atmospheric species, is observable only through faint electron-excited emissions, complicating derivation of reliable neutral gas abundances or distribution due to poorly constrained electron properties. STIS spectral imaging has recently proven to be a sensitive tool for investigating Io and Europa while in transit of Jupiter: Atmospheres and plume abundances are probed through extinction of the bright Jupiter Ly-alpha background - independently of electron properties. The observing geometry now during HST Cycle 28 provides optimal conditions to also observe Ganymede and Callisto in transit of Jupiter. Both moons have long (>3.5 h) transits near the Ly-alpha-bright equator of the planet, a condition that is fulfilled only every ~6 years. We propose to observe Ganymede and Callisto during one transit of Jupiter each with two consecutive HST orbits. The observations will provide the most precise measurements of the H atmospheres and the first ever spatially resolved constraints on atmospheric H₂O - from sublimation or outgassing - for the two largest moons of Jupiter. The transit geometry provides the unique opportunity to measure hemispheric differences in the atmospheres, which likely arise from the moons' surface volatile distributions as known via albedo dichotomies between the trailing and leading sides.

OBSERVING DESCRIPTION

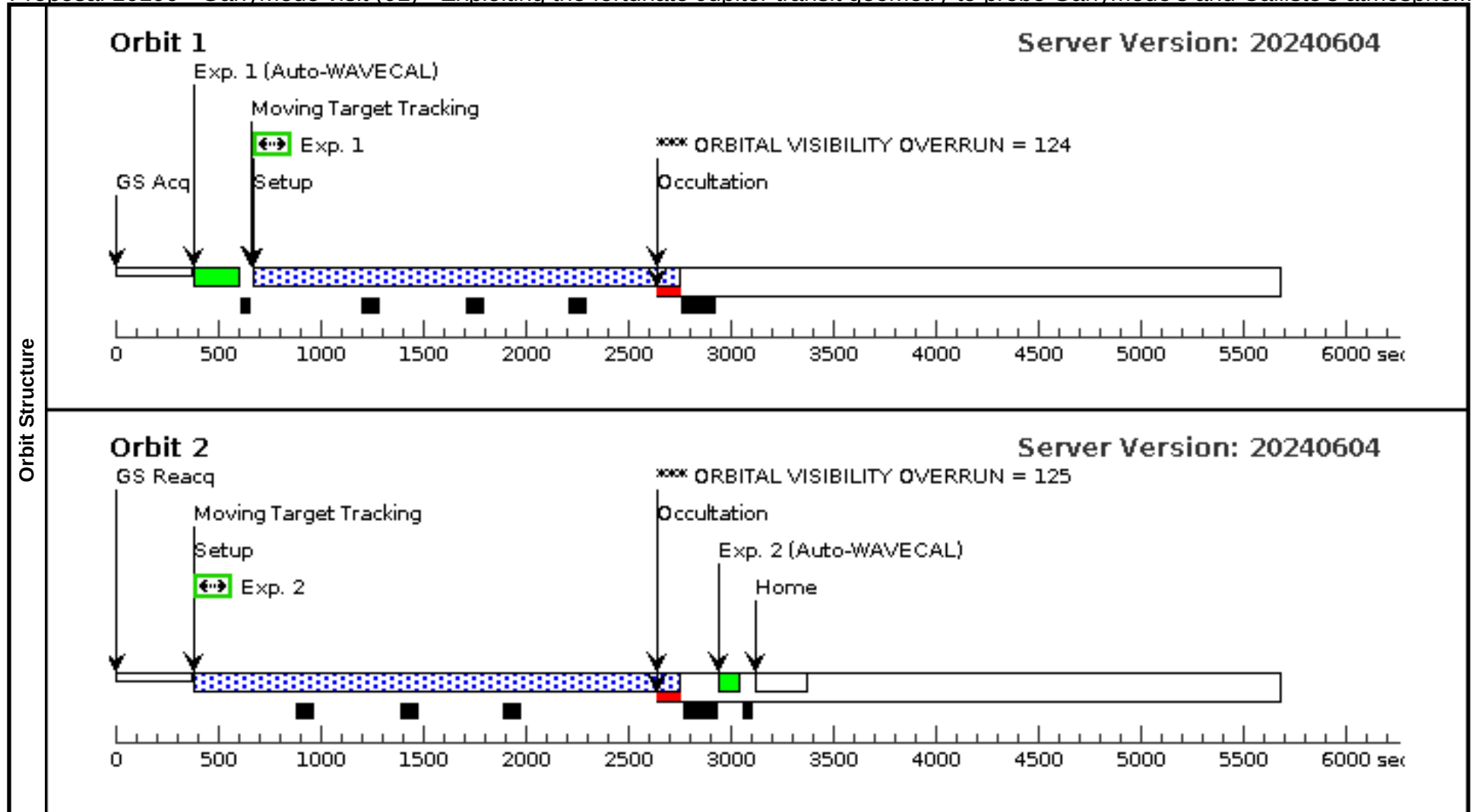
We observe Ganymede and Callisto during one visit per target with two contiguous HST orbits each. We use STIS in the spectral mode with the G140L grating and the unsupported 6"x6" aperture. The use of this aperture is required: Both Ganymede's and Callisto's disks (~1.6" and 1.8") almost fill the widest available slit (2"), preventing a characterization of (a) the several moon radii extended H coronae and (b) the Jovian background.

To minimize the geocorona signal and to maximize the moon size in the apertures the observations are to be taken max 2 month before or after Jupiter opposition on August 20, 2021. The period +/-3 days around opposition is yet excluded to avoid phase angles below 1 deg and thus avoid the shadow of the respective moon on Jupiter to be in the background image.

Target acquisition is omitted to save science exposure time. The pointing accuracy of HST is sufficient to ensure the moons to be within the 6"x6" aperture.

Proposal 16199 - Ganymede visit (01) - Exploiting the fortunate Jupiter transit geometry to probe Ganymede's and Callisto's atmosphe...

Visit	Proposal 16199, Ganymede visit (01), failed										Wed Jul 03 14:00:39 GMT 2024
	Diagnostic Status: Warning										
	Scientific Instruments: STIS/FUV-MAMA										
	Special Requirements: BETWEEN 20-JUN-2021:00:00:00 AND 17-AUG-2021:00:00:00; BETWEEN 06-SEP-2021:01:30:00 AND 06-SEP-2021:02:20:00										
Diagnostics	(Ganymede visit (01)) Warning (Form): A target acquisition should probably be performed before doing spectroscopy or coronagraphy with STIS or COS.										
	(Ganymede visit (01)) Warning (Orbit Planner): ORBITAL VISIBILITY OVERRUN										
	(Ganymede visit (01)) Warning (Orbit Planner): ORBITAL VISIBILITY OVERRUN										
	(Exposure 1 (Ganymede visit (01))) Warning (Form): Sensitive exposures should have an ETC run number provided.										
	(Exposure 2 (Ganymede visit (01))) Warning (Form): Sensitive exposures should have an ETC run number provided.										
	(Ganymede 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-TRANSIT	STD=JUPITER	STD=GANYMEDE		NOT OCC OF GANYMEDE-TRANSIT BY JUPITER FROM EARTH, SEP OF GANYMEDE-TRANSIT IO FROM EARTH GT 10", SEP OF GANYMEDE-TRANSIT EUROPA FROM EARTH GT 10", SEP OF GANYMEDE-TRANSIT CALLISTO FROM EARTH GT 10", TRANSIT OF GANYMEDE ACROSS JUPITER FROM EARTH, CML OF JUPITER FROM EARTH BETWEEN 250 200	EARTH				
Comments: Description=Ganymede in transit of Jupiter											
Exposures	#	Label	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time (Total)/[Actual Dur.]	Orbit	
	1		(1) GANYMEDE-TRANSIT	STIS/FUV-MAMA, TIME-TAG, 6X6	G140L 1425 A	BUFFER-TIME=50 0			2400 Secs (2030 Secs)		
									[>=>2030.0 Secs]		[1]
	2		(1) GANYMEDE-TRANSIT	STIS/FUV-MAMA, TIME-TAG, 6X6	G140L 1425 A	BUFFER-TIME=50 0			2400 Secs (2353 Secs)		
									[>=>2353.0 Secs]		[2]



Proposal 16199 - Ganymede visit - repeat orbit 1 (03) - Exploiting the fortunate Jupiter transit geometry to probe Ganymede's and Call...

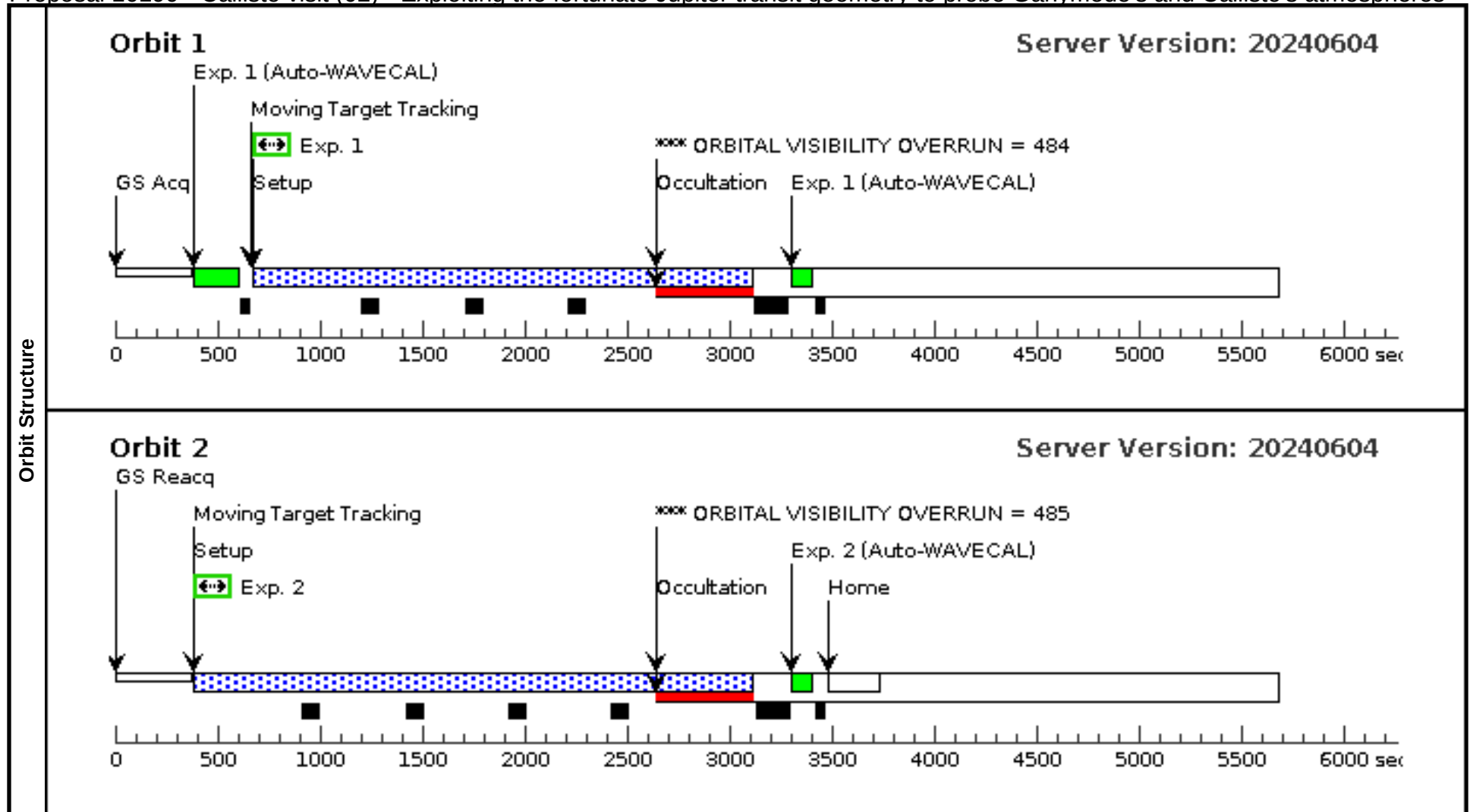
Visit	Proposal 16199, Ganymede visit - repeat orbit 1 (03), completed										Wed Jul 03 14:00:39 GMT 2024
	Diagnostic Status: Warning										
	Scientific Instruments: STIS/FUV-MAMA										
	Special Requirements: BETWEEN 27-SEP-2021:11:00:00 AND 27-SEP-2021:15:00:00; VISIBILITY INTERVAL 45 M										
Comments: HOPR repeat of orbit 1 of visit 1											
Diagnostics	(Ganymede visit - repeat orbit 1 (03)) Warning (Form): A target acquisition should probably be performed before doing spectroscopy or coronagraphy with STIS or COS.										
	(Exposure 1 (Ganymede visit - repeat orbit 1 (03))) Warning (Form): Sensitive exposures should have an ETC run number provided.										
	(Ganymede visit - repeat orbit 1 (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				
	(3)	GANYMEDE-TRANSIT-COPY	STD=JUPITER	STD=GANYMEDE		NOT OCC OF GANYMEDE-TRANSIT-COPY BY JUPITER FROM EARTH, SEP OF GANYMEDE-TRANSIT-COPY IO FROM EARTH GT 10", SEP OF GANYMEDE-TRANSIT-COPY EUROPA FROM EARTH GT 10", SEP OF GANYMEDE-TRANSIT-COPY CALLISTO FROM EARTH GT 10", TRANSIT OF GANYMEDE ACROSS JUPITER FROM EARTH, CML OF JUPITER FROM EARTH BETWEEN 340 240	EARTH				
	Comments: This is a copy of the Ganymede target to change the CML of Jupiter in the observing windows for the HOPR repeat visits, 3-4. Description=Ganymede in transit of Jupiter										
Exposures	#	Label	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time (Total)/[Actual Dur.]	Orbit	
	1		(3) GANYMEDE-T RANSIT-COPY	STIS/FUV-MAMA, TIME-TAG, 6X6	G140L 1425 A	BUFFER-TIME=50 0			2400 Secs (1948 Secs)		
									[>=>1948.0 Secs]	[1]	
Orbit Structure	Orbit 1 Server Version: 20240604 GS Acq Exp. 1 (Auto-WAVECAL) Moving Target Tracking Setup Exp. 1 Occultation Home Unused Orbital Visibility = 13 0 500 1000 1500 2000 2500 3000 3500 4000 4500 5000 5500 6000 sec										

Proposal 16199 - Ganymede visit - repeat orbit 2 (04) - Exploiting the fortunate Jupiter transit geometry to probe Ganymede's and Call...

Visit	Proposal 16199, Ganymede visit - repeat orbit 2 (04), completed										Wed Jul 03 14:00:39 GMT 2024	
	Diagnostic Status: Warning											
	Scientific Instruments: STIS/FUV-MAMA											
	Special Requirements: AFTER 03 BY 0.8 Orbits TO 1.2 Orbits; VISIBILITY INTERVAL 53 M											
Comments: HOPR repeat of orbit 2 of visit 1												
Diagnostics	(Ganymede visit - repeat orbit 2 (04)) Warning (Form): A target acquisition should probably be performed before doing spectroscopy or coronagraphy with STIS or COS.											
	(Exposure 1 (Ganymede visit - repeat orbit 2 (04))) Warning (Form): Sensitive exposures should have an ETC run number provided.											
	(Ganymede visit - repeat orbit 2 (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					
	(3)	GANYMEDE-TRANSIT-COPY	STD=JUPITER	STD=GANYMEDE		NOT OCC OF GANYMEDE-TRANSIT-COPY BY JUPITER FROM EARTH, SEP OF GANYMEDE-TRANSIT-COPY IO FROM EARTH GT 10", SEP OF GANYMEDE-TRANSIT-COPY EUROPA FROM EARTH GT 10", SEP OF GANYMEDE-TRANSIT-COPY CALLISTO FROM EARTH GT 10", TRANSIT OF GANYMEDE ACROSS JUPITER FROM EARTH, CML OF JUPITER FROM EARTH BETWEEN 340 240	EARTH					
	Comments: This is a copy of the Ganymede target to change the CML of Jupiter in the observing windows for the HOPR repeat visits, 3-4. Description=Ganymede in transit of Jupiter											
Exposures	#	Label	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time (Total)/[Actual Dur.]		Orbit	
	1		(3) GANYMEDE-T RANSIT-COPY	STIS/FUV-MAMA, TIME-TAG, 6X6	G140L 1425 A	BUFFER-TIME=50 0			2400 Secs (2428 Secs)			
									[=>2428.0 Secs]		[1]	
Orbit Structure	Orbit 1											
	Server Version: 20240604											

Proposal 16199 - Callisto visit (02) - Exploiting the fortunate Jupiter transit geometry to probe Ganymede's and Callisto's atmospheres

Visit	Proposal 16199, Callisto visit (02), failed										Wed Jul 03 14:00:39 GMT 2024	
	Diagnostic Status: Warning											
	Scientific Instruments: STIS/FUV-MAMA											
	Special Requirements: BETWEEN 20-JUN-2021:00:00:00 AND 17-AUG-2021:00:00:00; BETWEEN 04-OCT-2021:07:45:00 AND 04-OCT-2021:08:45:00											
Diagnostics	(Callisto visit (02)) Warning (Form): A target acquisition should probably be performed before doing spectroscopy or coronagraphy with STIS or COS.											
	(Callisto visit (02)) Warning (Orbit Planner): ORBITAL VISIBILITY OVERRUN											
	(Callisto visit (02)) Warning (Orbit Planner): ORBITAL VISIBILITY OVERRUN											
	(Exposure 1 (Callisto visit (02))) Warning (Form): Sensitive exposures should have an ETC run number provided.											
	(Exposure 2 (Callisto visit (02))) Warning (Form): Sensitive exposures should have an ETC run number provided.											
	(Callisto 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)	CALLISTO-TRANSIT	STD=JUPITER	STD=CALLISTO		NOT OCC OF CALLISTO-TRANSIT BY JUPITER FROM EARTH, SEP OF CALLISTO-TRANSIT IO FROM EARTH GT 10", SEP OF CALLISTO-TRANSIT GANYMEDE FROM EARTH GT 10", TRANSIT OF CALLISTO ACROSS JUPITER FROM EARTH, CML OF JUPITER FROM EARTH BETWEEN 340 200	EARTH					
	Comments: Description=Callisto in transit of Jupiter											
Exposures	#	Label	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time (Total)/[Actual Dur.]		Orbit	
	1		(2) CALLISTO-TRANSIT	STIS/FUV-MAMA, TIME-TAG, 6X6	G140L 1425 A	BUFFER-TIME=50 0			2400 Secs (2390 Secs)			
									[>=>2390.0 Secs]		[1]	
	2		(2) CALLISTO-TRANSIT	STIS/FUV-MAMA, TIME-TAG, 6X6	G140L 1425 A	BUFFER-TIME=50 0			2400 Secs (2680 Secs)			
									[>=>2680.0 Secs]		[2]	



Proposal 16199 - Callisto visit (52) - Exploiting the fortunate Jupiter transit geometry to probe Ganymede's and Callisto's atmospheres

Visit	Proposal 16199, Callisto visit (52), implementation										Wed Jul 03 14:00:39 GMT 2024	
	Diagnostic Status: Warning											
	Scientific Instruments: STIS/FUV-MAMA											
	Special Requirements: SCHED 70%; VISIBILITY INTERVAL NO GYRO BIAS UPDATE ON MOVING TARGET											
Diagnostics	(Callisto visit (52)) Warning (Form): A target acquisition should probably be performed before doing spectroscopy or coronagraphy with STIS or COS.											
	(Exposure 1 (Callisto visit (52))) Warning (Form): Sensitive exposures should have an ETC run number provided.											
	(Exposure 2 (Callisto visit (52))) Warning (Form): Sensitive exposures should have an ETC run number provided.											
	(Callisto visit (52)) 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					
	(4)	CALLISTO-TRANSIT2	STD=JUPITER	STD=CALLISTO		NOT OCC OF CALLISTO-TRANSIT2 BY JUPITER FROM EARTH, SEP OF CALLISTO-TRANSIT2 IO FROM EARTH GT 10", SEP OF CALLISTO-TRANSIT2 GANYMEDE FROM EARTH GT 10", TRANSIT OF CALLISTO ACROSS JUPITER FROM EARTH, CML OF JUPITER FROM EARTH BETWEEN 310 200	EARTH					
	Comments: Used with HOPR visit 52. Description=Callisto in transit of Jupiter											
Exposures	#	Label	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time (Total)/[Actual Dur.]		Orbit	
	1		(4) CALLISTO-TRA NSIT2	STIS/FUV-MAMA, TIME-TAG, 6X6	G140L 1425 A	BUFFER-TIME=50 0			2390 Secs (2266 Secs)			
									[>=>2266.0 Secs]		[1]	
	2		(4) CALLISTO-TRA NSIT2	STIS/FUV-MAMA, TIME-TAG, 6X6	G140L 1425 A	BUFFER-TIME=50 0			2400 Secs (2588 Secs)			
									[>=>2588.0 Secs]		[2]	

