



13328 - Observing Ganymede's atmosphere and auroras with COS and STIS

Cycle: 21, Proposal Category: GO

(UV Initiative)

(Availability Mode: SUPPORTED)

INVESTIGATORS

<i>Name</i>	<i>Institution</i>	<i>E-Mail</i>
Dr. Jonathan D. Nichols (PI) (ESA Member) (Contact)	University of Leicester	jdn@ion.le.ac.uk
Prof. John T. Clarke (CoI) (AdminUSPI)	Boston University	jclarke@bu.edu
Dr. Nigel Bannister (CoI) (ESA Member)	University of Leicester	nb101@le.ac.uk
Dr. Emma J. Bunce (CoI) (ESA Member)	University of Leicester	ejb10@ion.le.ac.uk
Prof. Stanley W. Cowley (CoI) (ESA Member)	University of Leicester	swhc1@ion.le.ac.uk
Prof. Stephen Milan (CoI) (ESA Member)	University of Leicester	ets@ion.le.ac.uk
Ms. Pippa Molyneux (CoI) (ESA Member)	University of Leicester	pmm13@le.ac.uk
Prof. Denis Grodent (CoI) (ESA Member)	Universite de Liege	d.grodent@ulg.ac.be
Prof. Carol Paty (CoI)	Georgia Institute of Technology	carol.paty@eas.gatech.edu

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>
G1	(1) GANYMEDE-EAST	COS/FUV COS/NUV STIS/CCD STIS/FUV-MAMA	4	11-Feb-2014 21:21:47.0	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>
G2	(4) GANYMEDE-WEST	COS/FUV COS/NUV STIS/CCD STIS/FUV-MAMA	4	11-Feb-2014 21:22:17.0	yes
G3	(5) GANYMEDE-WEST-EXTENDED	COS/FUV COS/NUV STIS/CCD STIS/FUV-MAMA	3	11-Feb-2014 21:22:37.0	yes

11 Total Orbits Used

ABSTRACT

Jupiter's satellite Ganymede is one of the solar system's most intriguing moons, and the importance of studying Ganymede is vividly highlighted by the recent selection of the ESA L-class mission JUICE. Ganymede possesses an oxygen atmosphere and the only known 'magnetosphere within a magnetosphere', and the continuous impingement of Jupiter's magnetospheric plasma on Ganymede thus makes the satellite an ideal control case for studying the interaction of any cosmic body with an external wind. Auroral emissions are crucial diagnostics of this interaction, but spectra of Ganymede's FUV auroras have only been obtained with GHRS and STIS. Fundamental outstanding questions thus remain as to the nature of this unique satellite's atmosphere and its magnetosphere, and we will use the significantly improved sensitivity of COS, combined with the imaging capabilities of STIS, to examine Ganymede's FUV atmospheric emissions in order to answer the following questions:

- * How does Ganymede's magnetosphere interact with Jupiter's?
- * What is the nature of Ganymede's oxygen atmosphere?

Ganymede has never been observed with COS, and STIS observations of both hemispheres have not been obtained in the same epoch, such that this program will provide the most significant advancements in our understanding of the atmosphere and magnetosphere of this enigmatic satellite for over a decade. HST is the only observatory capable of obtaining these observations and execution of this program during Cycle 21 is extremely highly desirable, since the unprecedented new information these observations will return are urgently required by those who are now designing instruments for the JUICE mission.

OBSERVING DESCRIPTION

The proposed observations will consist of COS and STIS exposures of Ganymede near eastern and western elongation, with two visits scheduled 1/2 Ganymede orbit apart. Each visit will consist of 4 orbits, 2 COS and 2 STIS, for a total of 8 orbits in the program. In orbits 1, 2, and 4 in each visit, Ganymede will first be acquired. The first and last orbit in each visit will consist of STIS/FUV-MAMA G140L 52X2 TIME-TAG spectroscopy, while the middle two orbits will consist of COS/FUV G140L TIME-TAG spectroscopy of the reflected solar continuum from the surface of Ganymede, plus the atmospheric absorption and airglow/auroral emissions. Ideally, the STIS and COS orbits would be contiguous, such that the first and last STIS image in each visit will be obtained roughly half a jovian rotation apart in order to capture variability.

Proposal 13328 - Visit G1 - Observing Ganymede's atmosphere and auroras with COS and STIS

Wed Feb 12 02:22:50 GMT 2014

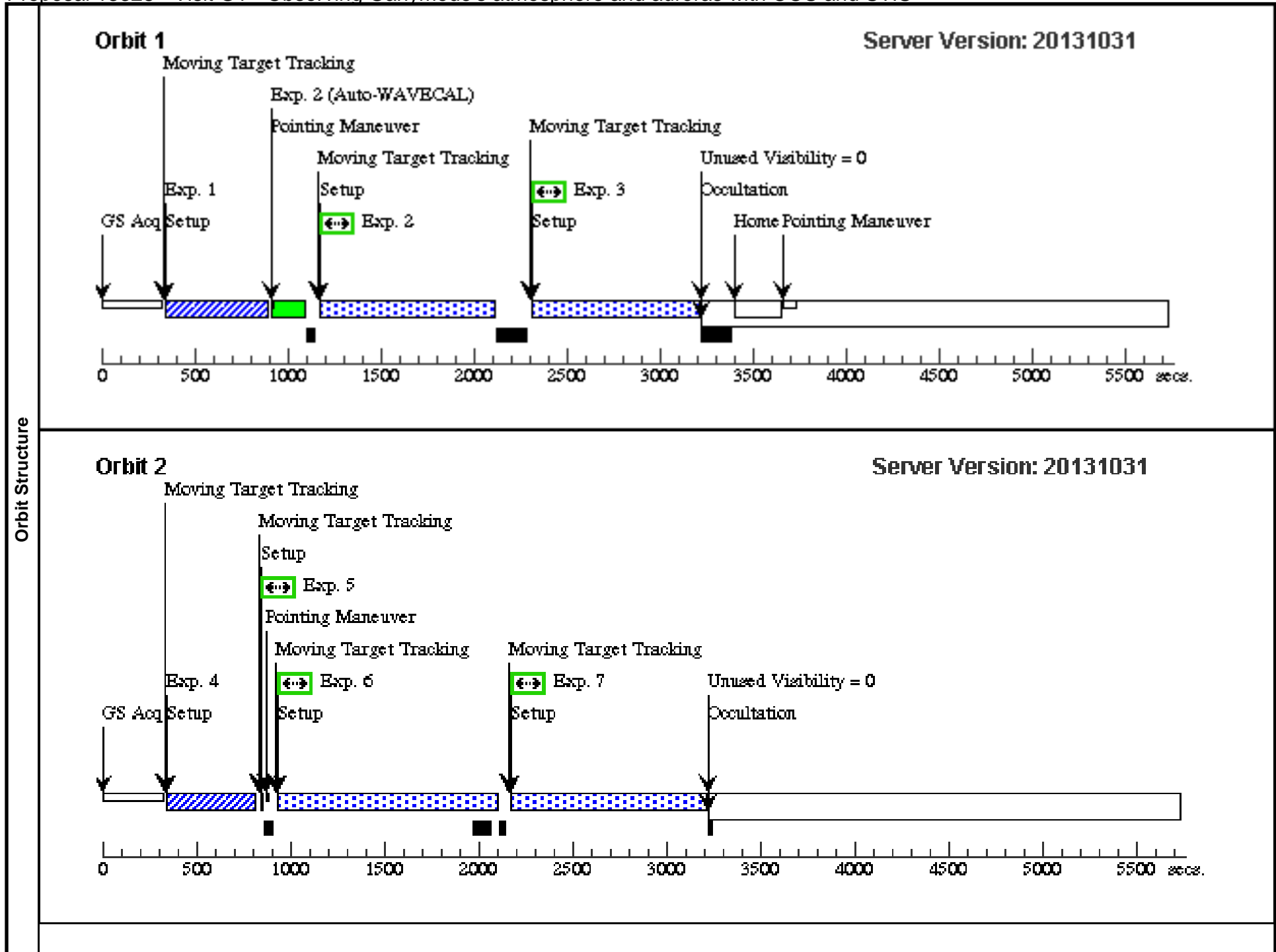
Visit	<p>Proposal 13328, Visit G1, completed</p> <p>Diagnostic Status: No Diagnostics</p> <p>Scientific Instruments: STIS/CCD, COS/NUV, COS/FUV, STIS/FUV-MAMA</p> <p>Special Requirements: (none)</p> <p><i>Comments: Eastern elongation - defined by target.</i></p>					
	Solar System Targets	#	Name	Level 1	Level 2	Level 3
(1)		GANYMEDE-EAST	STD=JUPITER	STD=GANYMEDE		SEP OF GANYMEDE-EAST JUPITER FROM EARTH GT 30", SEP OF GANYMEDE-EAST CALLISTO FROM EARTH GT 10", SEP OF GANYMEDE-EAST IO FROM EARTH GT 10", SEP OF GANYMEDE-EAST EUROPA FROM EARTH GT 10", OLG OF GANYMEDE-EAST BETWEEN 70 110, SEP OF GANYMEDE-EAST SUN FROM EARTH GT 150D
<p><i>Comments: Ganymede within +/-20 degrees of eastern elongation and within +/- 30 degrees of opposition. These constraints could be relaxed somewhat to ease scheduling if necessary.</i></p>						

Proposal 13328 - Visit G1 - Observing Ganymede's atmosphere and auroras with COS and STIS

#	Label (ETC Run)	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time (Total)/[Actual Dur.]	Orbit
1	(STIS.ta.510225)	(1) GANYMEDE-E AST	STIS/CCD, ACQ, F28X50LP	MIRROR	ACQTYPE=DIFFUSE; CHECKBOX=37; DIFFUSE-CENTER=GEOMETRIC-CENTER			0.1 Secs (0.1 Secs) [==>]	[1]
<p>Comments: Ganymede V mag near to opposition is ~4.6. Surface brightness for disc of diameter 1.7" is then ~5.5. In ETC run STIS.ta.510225, I used a Castelli-Kurucz G2V spectrum normalised to $V = 5.5 / \text{arcsec squared}$ and diameter = 1.7. The minimum exposure time is less than the CCD saturation time of ~0.5 s.</p>									
2	(STIS.sp.517958)	(1) GANYMEDE-E AST	STIS/FUV-MAMA, TIME-TAG, 52X2	G140L 1425 A	BUFFER-TIME=44 3	POS TARG null,-4		885 Secs (885 Secs) [==>]	[1]
<p>Comments: In STIS.sp.517958 I used an archive spectrum of the same target and instrument set-up. Buffer Time = $T_{exp} / 2$.</p> <p>POS-TARG of $y=-4''$ moves the target out of the blotch region (slightly less than does the 52X2D1 aperture, but the target is $>1''$)</p>									
3	(STIS.sp.517958)	(1) GANYMEDE-E AST	STIS/FUV-MAMA, TIME-TAG, 52X2	G140L 1425 A	BUFFER-TIME=44 3	POS TARG null,-4		885 Secs (885 Secs) [==>]	[1]
<p>Comments: In STIS.sp.517958 I used an archive spectrum of the same target and instrument set-up. Buffer Time = $T_{exp} / 2$.</p> <p>POS-TARG of $y=-4''$ moves the target out of the blotch region (slightly less than does the 52X2D1 aperture, but the target is $>1''$)</p>									
4	(COS.ta.517268)	(1) GANYMEDE-E AST	COS/NUV, ACQ/SEARCH, BOA	MIRRORA	SCAN-SIZE=2			3 Secs (3 Secs) [==>]	[2]
<p>Comments: Ganymede V mag near to opposition is ~4.6, and the surface brightness for a disc of diameter 1.7" is then ~5.5. Ganymede's albedo over 2400-3000 A ranges from ~7% on the trailing side to ~20% on the leading side (Nelson et al., 1987), vs. ~43% in the visible, and is thus ~0.8-2.0 mags dimmer in this waveband than in the visible. ACQ/SEARCH ETC runs using an extended source (a normalised Castelli-Kurucz G2V spectrum), yield for the BOA/MIRRORA:</p> <p>$mV_{eff} = 7.5$ (COS.ta.517264) $T_{exp}(SNR = 60) = 2.4873$ s $mV_{eff} = 6.3$ (COS.ta.517265) $T_{exp}(SNR = 60) = 0.7901$ s</p> <p>Using a 3 s exposure then gives a good SNR for all cases:</p> <p>$mV_{eff} = 7.5$ (COS.ta.517267) $SNR(T_{exp} = 3$ s) = 65.8941, total count rate = 2,554.089 counts/s $mV_{eff} = 6.3$ (COS.ta.517268) $SNR(T_{exp} = 3$ s) = 116.915, total count rate = 5,667.150 counts/s</p>									
5	(COS.im.517273)	(1) GANYMEDE-E AST	COS/NUV, ACCUM, BOA	MIRRORA				3 Secs (3 Secs) [==>]	[2]
<p>Comments: This exposure is to verify Ganymede's position in the aperture. We have the same T_{exp} and count rates as for Exposure 5, but imaging ETC runs give SNRs of:</p> <p>$mV_{eff} = 7.5$ (COS.im.517270) $SNR(T_{exp} = 3$ s) = 46.1111, total count rate = 2,554.089 counts/s $mV_{eff} = 6.3$ (COS.im.517273) $SNR(T_{exp} = 3$ s) = 80.2784, total count rate = 5,667.150 counts/s</p>									
6	(COS.sp.517981)	(1) GANYMEDE-E AST	COS/FUV, TIME-TAG, PSA	G140L 1280 A	BUFFER-TIME=87 8; FLASH=YES; FP-POS=1			988 Secs (988 Secs) [==>]	[2]
<p>Comments: Ganymede V mag near to opposition is ~4.6, and the surface brightness for a disc of diameter 1.7" is then ~5.5. Ganymede's albedo in near 1400 A is ~2.3% (Feldman et al., 2000), vs. ~43% in the visible, and is thus ~3.2 mags dimmer in this waveband than in the visible. In ETC run COS.sp.517981 I used a Castelli-Kurucz G2V spectrum normalised to $mV_{eff} = 8.7 / \text{arcsec squared}$ and diameter = 1.7", plus two emission lines representative of the fluxes observed by Feldman et al. (2000): Center 1304.0 A FWHM 30.0 A Flux $2.3e-15$ erg/cm²/s Center 1356.0 A FWHM 30.0 A Flux $4.4e-15$ erg/cm²/s The Buffer Time is 19,639 s, thus well over an orbit. Here, I've used $T_{exp} - 110$ to minimise the time between the two exposures.</p>									
7	(COS.sp.517981)	(1) GANYMEDE-E AST	COS/FUV, TIME-TAG, PSA	G140L 1280 A	BUFFER-TIME=1.3 E4; FLASH=YES; FP-POS=2			989 Secs (989 Secs) [==>]	[2]
<p>Comments: ETC Buffer Time is, as for Exposure 6, ~20k s. Multiplied by 2/3 = 13092, rounded down to 13,000 s as this is the second exposure in the orbit.</p>									

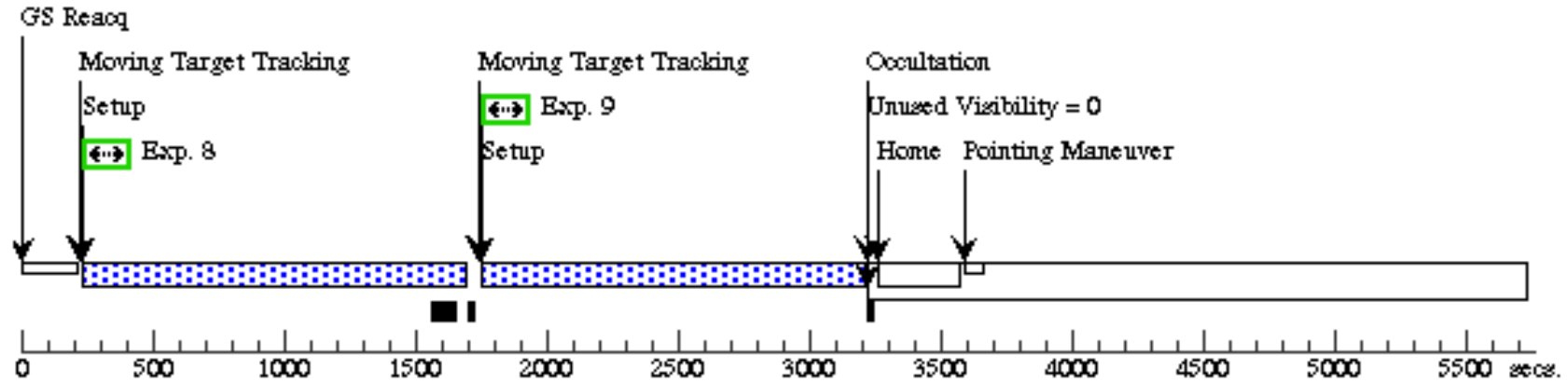
Proposal 13328 - Visit G1 - Observing Ganymede's atmosphere and auroras with COS and STIS

8	(COS.sp.517 981)	(1) GANYMEDE-E AST	COS/FUV, TIME-TAG, PSA	G140L 1280 A	BUFFER-TIME=12 98; FLASH=YES; FP-POS=3	1408 Secs (1408 Secs) [==>]	[3]
<i>Comments: ETC Buffer Time is, as for Exposure 6, ~20k s. Here, I've used Texp - 110 to minimise the time between the two exposures.</i>							
9	(COS.sp.517 981)	(1) GANYMEDE-E AST	COS/FUV, TIME-TAG, PSA	G140L 1280 A	BUFFER-TIME=1.3 E4; FLASH=YES; FP-POS=4	1409 Secs (1409 Secs) [==>]	[3]
<i>Comments: ETC Buffer Time is, as for Exposure 6, ~20k s. Multiplied by 2/3 = 13092, rounded down to 13,000 s as this is the second exposure in the orbit.</i>							
10	(STIS.ta.510 225)	(1) GANYMEDE-E AST	STIS/CCD, ACQ, F28X50LP	MIRROR	ACQTYPE=DIFFU SE; CHECKBOX=37; DIFFUSE-CENTER =GEOMETRIC-CEN TER	0.1 Secs (0.1 Secs) [==>]	[4]
<i>Comments: Ganymede V mag near to opposition is ~4.6. Surface brightness for disc of diameter 1.7" is then 5.6. In ETC run STIS.ta.510225, I used a Castelli-Kurucz G2V spectrum normalised to V = 5.6 / arcsec squared and diameter = 1.7.</i>							
11	(STIS.sp.51 7958)	(1) GANYMEDE-E AST	STIS/FUV-MAMA, TIME-TAG, 52X2	G140L 1425 A	BUFFER-TIME=44 POS TARG null,-4 3	885 Secs (885 Secs) [==>]	[4]
<i>Comments: In STIS.sp.517958 I used an archive spectrum of the same target and instrument set-up. Buffer Time = Texp / 2.</i>							
<i>POS-TARG of y=-4" moves the target out of the blotch region (slightly less than does the 52X2D1 aperture, but the target is >1")</i>							
12	(STIS.sp.51 7958)	(1) GANYMEDE-E AST	STIS/FUV-MAMA, TIME-TAG, 52X2	G140L 1425 A	BUFFER-TIME=44 POS TARG null,-4 3	885 Secs (885 Secs) [==>]	[4]
<i>Comments: In STIS.sp.517958 I used an archive spectrum of the same target and instrument set-up. Buffer Time = Texp / 2.</i>							
<i>POS-TARG of y=-4" moves the target out of the blotch region (slightly less than does the 52X2D1 aperture, but the target is >1")</i>							



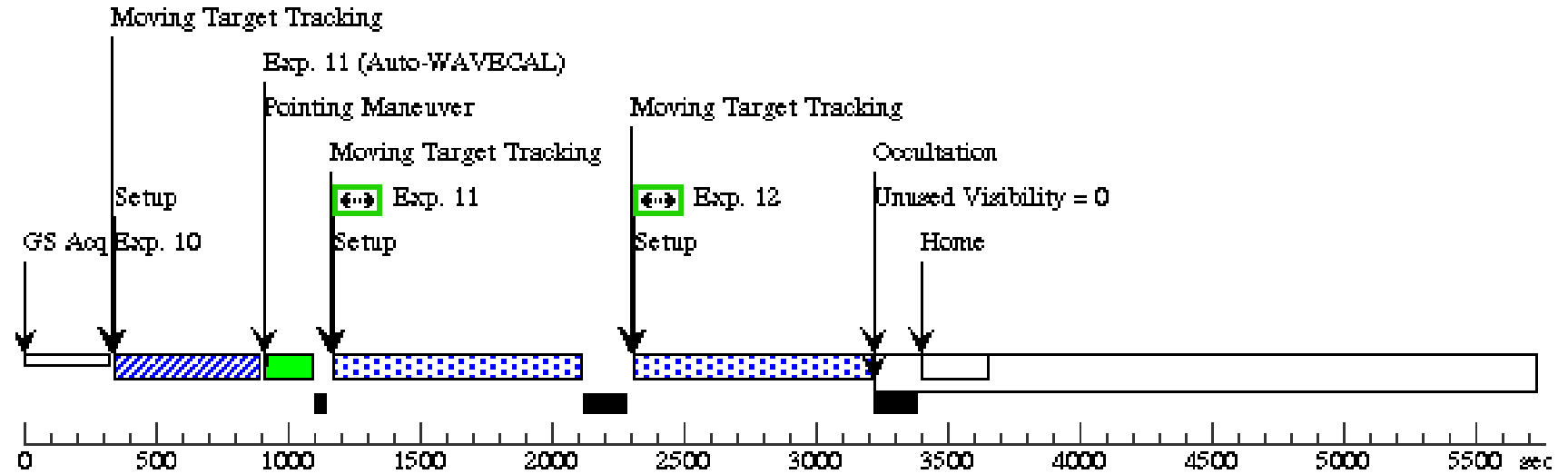
Orbit 3

Server Version: 20131031



Orbit 4

Server Version: 20131031



Proposal 13328 - Visit G2 - Observing Ganymede's atmosphere and auroras with COS and STIS

Wed Feb 12 02:22:54 GMT 2014

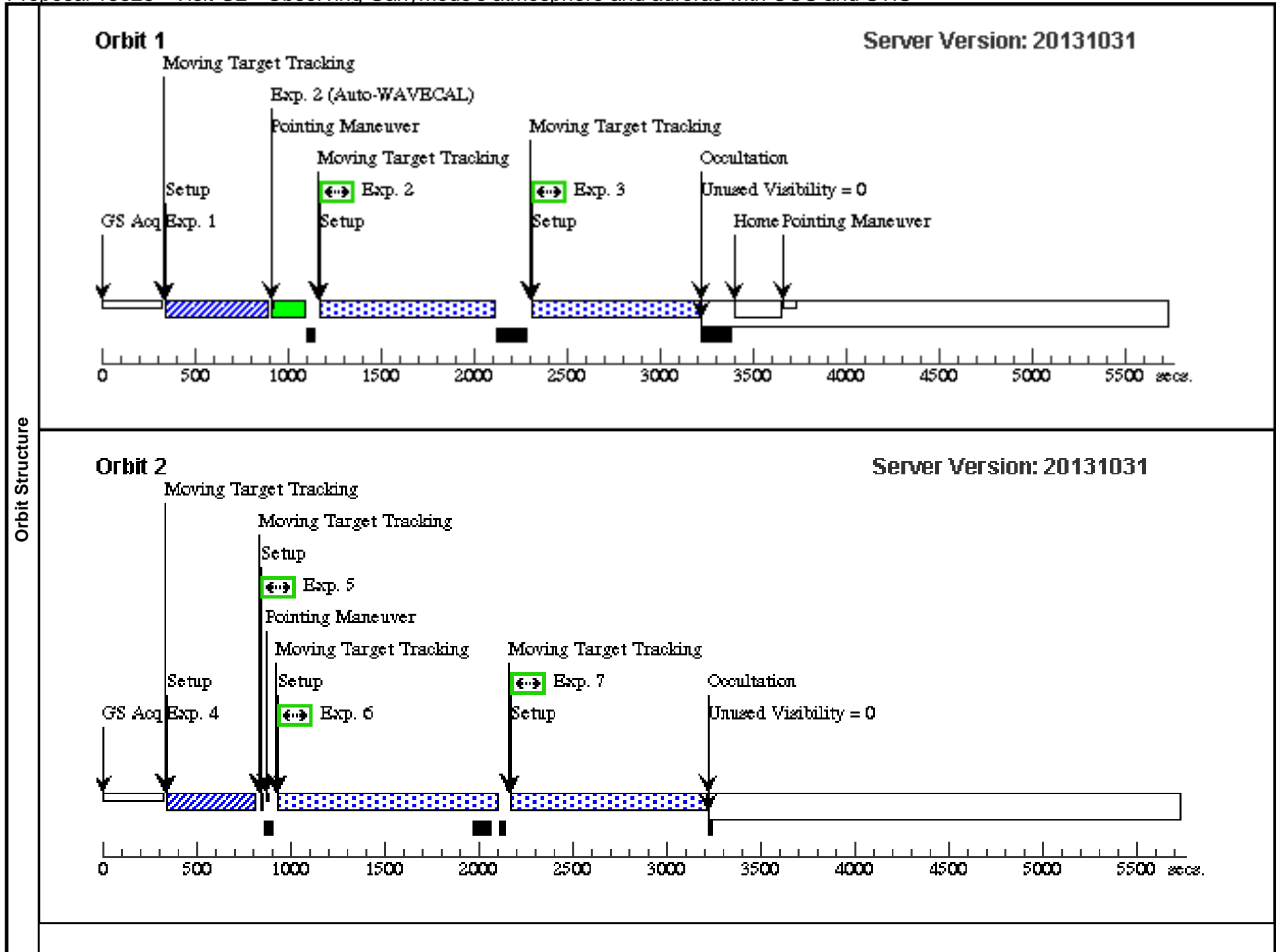
Visit	<p>Proposal 13328, Visit G2, failed</p> <p>Diagnostic Status: No Diagnostics</p> <p>Scientific Instruments: STIS/CCD, COS/NUV, COS/FUV, STIS/FUV-MAMA</p> <p>Special Requirements: AFTER G1 BY 2.5 D TO 4.5 D</p> <p><i>Comments: Western elongation - defined by target. The AFTER timing requirement ensures that the two visits occur in the same orbit of the satellite, a key aspect of this proposal. If scheduling is difficult, this could be interpreted as BEFORE by the same amount of time.</i></p>						
	Solar System Targets	#	Name	Level 1	Level 2	Level 3	Window
(4)		GANYMEDE-WEST	STD=JUPITER	STD=GANYMEDE		SEP OF GANYMEDE-WEST JUPITER FROM EARTH GT 30", SEP OF GANYMEDE-WEST CALLISTO FROM EARTH GT 10", SEP OF GANYMEDE-WEST IO FROM EARTH GT 10", SEP OF GANYMEDE-WEST EUROPA FROM EARTH GT 10", OLG OF GANYMEDE-WEST BETWEEN 250 290, SEP OF GANYMEDE-WEST SUN FROM EARTH GT 150D	EARTH
<p><i>Comments: Ganymede within +/-20 degrees of western elongation and within +/- 30 degrees of opposition. These constraints could be relaxed somewhat to ease scheduling if necessary.</i></p>							

Proposal 13328 - Visit G2 - Observing Ganymede's atmosphere and auroras with COS and STIS

#	Label (ETC Run)	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time (Total)/[Actual Dur.]	Orbit
1	(STIS.ta.510225)	(4) GANYMEDE-W EST	STIS/CCD, ACQ, F28X50LP	MIRROR	ACQTYPE=DIFFUSE; SE; CHECKBOX=37; DIFFUSE-CENTER=GEOMETRIC-CENTER			0.1 Secs (0.1 Secs) [==>]	[1]
<p>Comments: Ganymede V mag near to opposition is ~4.6. Surface brightness for disc of diameter 1.7" is then ~5.5. In ETC run STIS.ta.510225, I used a Castelli-Kurucz G2V spectrum normalised to $V = 5.5 / \text{arcsec squared}$ and diameter = 1.7. The minimum exposure time is less than the CCD saturation time of ~0.5 s.</p>									
2	(STIS.sp.517958)	(4) GANYMEDE-W EST	STIS/FUV-MAMA, TIME-TAG, 52X2	G140L 1425 A	BUFFER-TIME=44 3	POS TARG null,-4		885 Secs (885 Secs) [==>]	[1]
<p>Comments: In STIS.sp.517958 I used an archive spectrum of the same target and instrument set-up. Buffer Time = $T_{exp} / 2$.</p> <p>POS-TARG of $y=-4''$ moves the target out of the blotch region (slightly less than does the 52X2D1 aperture, but the target is $>1''$)</p>									
3	(STIS.sp.517958)	(4) GANYMEDE-W EST	STIS/FUV-MAMA, TIME-TAG, 52X2	G140L 1425 A	BUFFER-TIME=44 3	POS TARG null,-4		885 Secs (885 Secs) [==>]	[1]
<p>Comments: In STIS.sp.517958 I used an archive spectrum of the same target and instrument set-up. Buffer Time = $T_{exp} / 2$.</p> <p>POS-TARG of $y=-4''$ moves the target out of the blotch region (slightly less than does the 52X2D1 aperture, but the target is $>1''$)</p>									
4	(COS.ta.517268)	(4) GANYMEDE-W EST	COS/NUV, ACQ/SEARCH, BOA	MIRRORA	SCAN-SIZE=2			3 Secs (3 Secs) [==>]	[2]
<p>Comments: Ganymede V mag near to opposition is ~4.6, and the surface brightness for a disc of diameter 1.7" is then ~5.5. Ganymede's albedo over 2400-3000 A ranges from ~7% on the trailing side to ~20% on the leading side (Nelson et al., 1987), vs. ~43% in the visible, and is thus ~0.8-2.0 mags dimmer in this waveband than in the visible. ACQ/SEARCH ETC runs using an extended source (a normalised Castelli-Kurucz G2V spectrum), yield for the BOA/MIRRORA:</p> <p>$mV_{eff} = 7.5$ (COS.ta.517264) $T_{exp}(SNR = 60) = 2.4873$ s $mV_{eff} = 6.3$ (COS.ta.517265) $T_{exp}(SNR = 60) = 0.7901$ s</p> <p>Using a 3 s exposure then gives a good SNR for all cases:</p> <p>$mV_{eff} = 7.5$ (COS.ta.517267) $SNR(T_{exp} = 3$ s) = 65.8941, total count rate = 2,554.089 counts/s $mV_{eff} = 6.3$ (COS.ta.517268) $SNR(T_{exp} = 3$ s) = 116.915, total count rate = 5,667.150 counts/s</p>									
5	(COS.im.517273)	(4) GANYMEDE-W EST	COS/NUV, ACCUM, BOA	MIRRORA				3 Secs (3 Secs) [==>]	[2]
<p>Comments: This exposure is to verify Ganymede's position in the aperture. We have the same T_{exp} and count rates as for Exposure 5, but imaging ETC runs give SNRs of:</p> <p>$mV_{eff} = 7.5$ (COS.im.517270) $SNR(T_{exp} = 3$ s) = 46.1111, total count rate = 2,554.089 counts/s $mV_{eff} = 6.3$ (COS.im.517273) $SNR(T_{exp} = 3$ s) = 80.2784, total count rate = 5,667.150 counts/s</p>									
6	(COS.sp.517981)	(4) GANYMEDE-W EST	COS/FUV, TIME-TAG, PSA	G140L 1280 A	BUFFER-TIME=87 8; FLASH=YES; FP-POS=1			988 Secs (988 Secs) [==>]	[2]
<p>Comments: Ganymede V mag near to opposition is ~4.6, and the surface brightness for a disc of diameter 1.7" is then ~5.5. Ganymede's albedo in near 1400 A is ~2.3% (Feldman et al., 2000), vs. ~43% in the visible, and is thus ~3.2 mags dimmer in this waveband than in the visible. In ETC run COS.sp.517981 I used a Castelli-Kurucz G2V spectrum normalised to $mV_{eff} = 8.7 / \text{arcsec squared}$ and diameter = 1.7", plus two emission lines representative of the fluxes observed by Feldman et al. (2000): Center 1304.0 A FWHM 30.0 A Flux $2.3e-15$ erg/cm²/s Center 1356.0 A FWHM 30.0 A Flux $4.4e-15$ erg/cm²/s The Buffer Time is 19,639 s, thus well over an orbit. Here, I've used $T_{exp} - 110$ to minimise the time between the two exposures.</p>									
7	(COS.sp.517981)	(4) GANYMEDE-W EST	COS/FUV, TIME-TAG, PSA	G140L 1280 A	BUFFER-TIME=1.3 E4; FLASH=YES; FP-POS=2			989 Secs (989 Secs) [==>]	[2]
<p>Comments: ETC Buffer Time is, as for Exposure 6, ~20k s. Multiplied by 2/3 = 13092, rounded down to 13,000 s as this is the second exposure in the orbit.</p>									

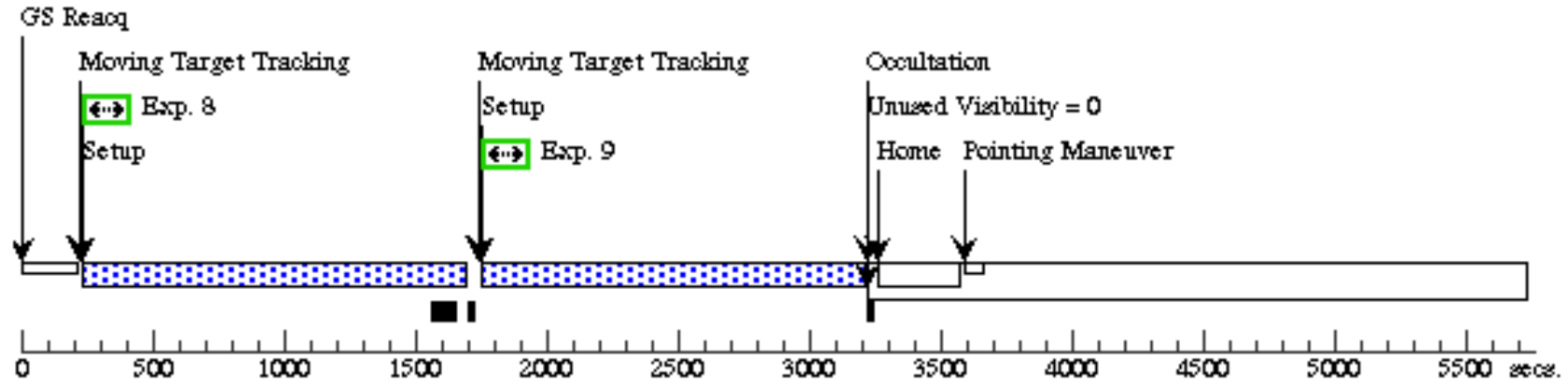
Proposal 13328 - Visit G2 - Observing Ganymede's atmosphere and auroras with COS and STIS

8	(COS.sp.517 981)	(4) GANYMEDE-W EST	COS/FUV, TIME-TAG, PSA	G140L 1280 A	BUFFER-TIME=12 98; FLASH=YES; FP-POS=3	1408 Secs (1408 Secs) [==>]	[3]
<i>Comments: ETC Buffer Time is, as for Exposure 6, ~20k s. Here, I've used Texp - 110 to minimise the time between the two exposures.</i>							
9	(COS.sp.517 981)	(4) GANYMEDE-W EST	COS/FUV, TIME-TAG, PSA	G140L 1280 A	BUFFER-TIME=1.3 E4; FLASH=YES; FP-POS=4	1409 Secs (1409 Secs) [==>]	[3]
<i>Comments: ETC Buffer Time is, as for Exposure 6, ~20k s. Multiplied by 2/3 = 13092, rounded down to 13,000 s as this is the second exposure in the orbit.</i>							
10	(STIS.ta.510 225)	(4) GANYMEDE-W EST	STIS/CCD, ACQ, F28X50LP	MIRROR	ACQTYPE=DIFFU SE; CHECKBOX=37; DIFFUSE-CENTER =GEOMETRIC-CE NTER	0.1 Secs (0.1 Secs) [==>]	[4]
<i>Comments: Ganymede V mag near to opposition is ~4.6. Surface brightness for disc of diameter 1.7" is then 5.6. In ETC run STIS.ta.510225, I used a Castelli-Kurucz G2V spectrum normalised to V = 5.6 / arcsec squared and diameter = 1.7.</i>							
11	(STIS.sp.51 7958)	(4) GANYMEDE-W EST	STIS/FUV-MAMA, TIME-TAG, 52X2	G140L 1425 A	BUFFER-TIME=44 POS TARG null,-4 3	885 Secs (885 Secs) [==>]	[4]
<i>Comments: In STIS.sp.517958 I used an archive spectrum of the same target and instrument set-up. Buffer Time = Texp / 2.</i>							
<i>POS-TARG of y=-4" moves the target out of the blotch region (slightly less than does the 52X2D1 aperture, but the target is >1")</i>							
12	(STIS.sp.51 7958)	(4) GANYMEDE-W EST	STIS/FUV-MAMA, TIME-TAG, 52X2	G140L 1425 A	BUFFER-TIME=44 POS TARG null,-4 3	885 Secs (885 Secs) [==>]	[4]
<i>Comments: In STIS.sp.517958 I used an archive spectrum of the same target and instrument set-up. Buffer Time = Texp / 2.</i>							
<i>POS-TARG of y=-4" moves the target out of the blotch region (slightly less than does the 52X2D1 aperture, but the target is >1")</i>							



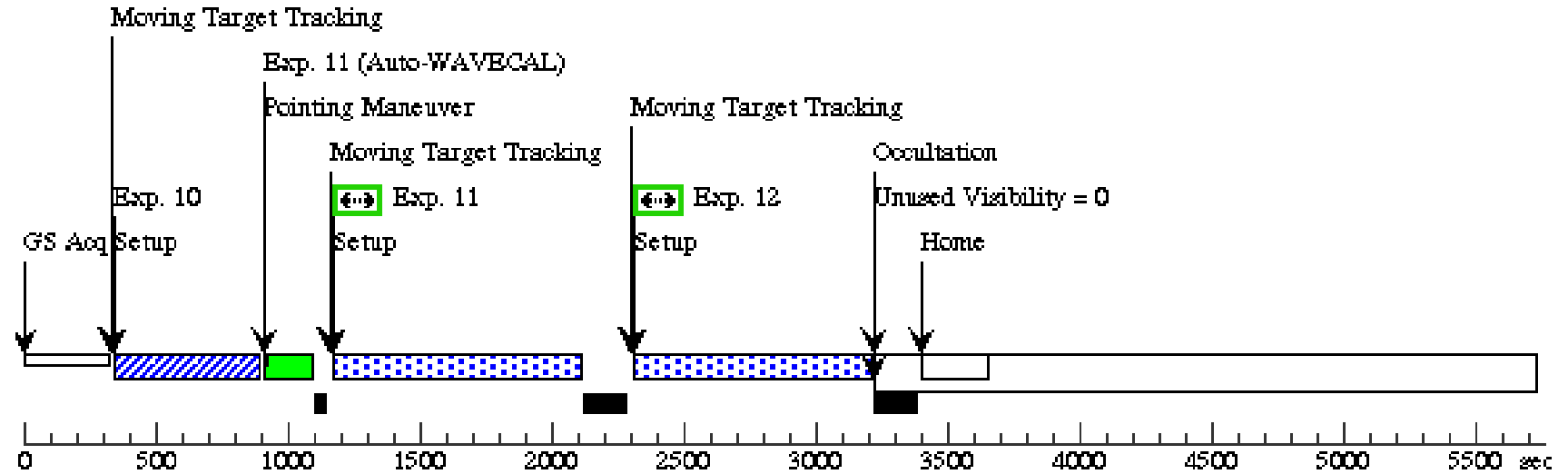
Orbit 3

Server Version: 20131031



Orbit 4

Server Version: 20131031



Proposal 13328 - Visit G3 - Observing Ganymede's atmosphere and auroras with COS and STIS

Wed Feb 12 02:22:57 GMT 2014

Visit	<p>Proposal 13328, Visit G3, implementation</p> <p>Diagnostic Status: Warning</p> <p>Scientific Instruments: STIS/CCD, COS/NUV, COS/FUV, STIS/FUV-MAMA</p> <p>Special Requirements: (none)</p> <p><i>Comments: Western elongation - defined by target. The AFTER timing requirement ensures that the two visits occur in the same orbit of the satellite, a key aspect of this proposal. If scheduling is difficult, this could be interpreted as BEFORE by the same amount of time.</i></p>																				
	<p>Diagnosics</p> <p>(Visit G3) Warning (Form): For the best data quality, it is strongly recommended that all four FP-POS positions be used when observing at a given COS CENWAVE setting.</p>																				
Solar System Targets	<table border="1"> <thead> <tr> <th>#</th> <th>Name</th> <th>Level 1</th> <th>Level 2</th> <th>Level 3</th> <th>Window</th> <th>Ephem Center</th> </tr> </thead> <tbody> <tr> <td>(5)</td> <td>GANYMEDE-WEST-EXTENDED</td> <td>STD=JUPITER</td> <td>STD=GANYMEDE</td> <td></td> <td>SEP OF GANYMEDE-WEST-EXTENDED JUPITER FROM EARTH GT 30", SEP OF GANYMEDE-WEST-EXTENDED CALLISTO FROM EARTH GT 10", SEP OF GANYMEDE-WEST-EXTENDED IO FROM EARTH GT 10", SEP OF GANYMEDE-WEST-EXTENDED EUROPA FROM EARTH GT 10", OLG OF GANYMEDE-WEST-EXTENDED BETWEEN 250 290, SEP OF GANYMEDE-WEST-EXTENDED SUN FROM EARTH GT 120D</td> <td>EARTH</td> </tr> </tbody> </table>							#	Name	Level 1	Level 2	Level 3	Window	Ephem Center	(5)	GANYMEDE-WEST-EXTENDED	STD=JUPITER	STD=GANYMEDE		SEP OF GANYMEDE-WEST-EXTENDED JUPITER FROM EARTH GT 30", SEP OF GANYMEDE-WEST-EXTENDED CALLISTO FROM EARTH GT 10", SEP OF GANYMEDE-WEST-EXTENDED IO FROM EARTH GT 10", SEP OF GANYMEDE-WEST-EXTENDED EUROPA FROM EARTH GT 10", OLG OF GANYMEDE-WEST-EXTENDED BETWEEN 250 290, SEP OF GANYMEDE-WEST-EXTENDED SUN FROM EARTH GT 120D	EARTH
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<p><i>Comments: Ganymede within +/-20 degrees of western elongation and within +/- 30 degrees of opposition. These constraints could be relaxed somewhat to ease scheduling if necessary.</i></p>																					

Proposal 13328 - Visit G3 - Observing Ganymede's atmosphere and auroras with COS and STIS

#	Label (ETC Run)	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time (Total)/[Actual Dur.]	Orbit
1	(COS.ta.517268)	(5) GANYMEDE-W EST-EXTENDED	COS/NUV, ACQ/SEARCH, BOA	MIRRORA	SCAN-SIZE=2	GS ACQ SCENARI O BASE1B3		3 Secs (3 Secs) [==>]	[1]
<p><i>Comments: Ganymede V mag near to opposition is ~4.6, and the surface brightness for a disc of diameter 1.7" is then ~5.5. Ganymede's albedo over 2400-3000 A ranges from ~7% on the trailing side to ~20% on the leading side (Nelson et al., 1987), vs. ~43% in the visible, and is thus ~0.8-2.0 mags dimmer in this waveband than in the visible. ACQ/SEARCH ETC runs using an extended source (a normalised Castelli-Kurucz G2V spectrum), yield for the BOA/MIRRORA:</i></p> <p>$mV_{eff} = 7.5$ (COS.ta.517264) $Texp(SNR = 60) = 2.4873$ s $mV_{eff} = 6.3$ (COS.ta.517265) $Texp(SNR = 60) = 0.7901$ s</p> <p>Using a 3 s exposure then gives a good SNR for all cases:</p> <p>$mV_{eff} = 7.5$ (COS.ta.517267) $SNR(Texp = 3 s) = 65.8941$, total count rate = 2,554.089 counts/s $mV_{eff} = 6.3$ (COS.ta.517268) $SNR(Texp = 3 s) = 116.915$, total count rate = 5,667.150 counts/s</p>									
2	(COS.im.517273)	(5) GANYMEDE-W EST-EXTENDED	COS/NUV, ACCUM, BOA	MIRRORA				3 Secs (3 Secs) [==>]	[1]
<p><i>Comments: This exposure is to verify Ganymede's position in the aperture. We have the same Texp and count rates as for Exposure 5, but imaging ETC runs give SNRs of:</i></p> <p>$mV_{eff} = 7.5$ (COS.im.517270) $SNR(Texp = 3 s) = 46.1111$, total count rate = 2,554.089 counts/s $mV_{eff} = 6.3$ (COS.im.517273) $SNR(Texp = 3 s) = 80.2784$, total count rate = 5,667.150 counts/s</p>									
3	(COS.sp.517981)	(5) GANYMEDE-W EST-EXTENDED	COS/FUV, TIME-TAG, PSA	G140L 1280 A	BUFFER-TIME=87 8; FLASH=YES; FP-POS=3			988 Secs (988 Secs) [==>]	[1]
<p><i>Comments: Ganymede V mag near to opposition is ~4.6, and the surface brightness for a disc of diameter 1.7" is then ~5.5. Ganymede's albedo in near 1400 A is ~2.3% (Feldman et al., 2000), vs. ~43% in the visible, and is thus ~3.2 mags dimmer in this waveband than in the visible. In ETC run COS.sp.517981 I used a Castelli-Kurucz G2V spectrum normalised to $mV_{eff} = 8.7$ / arcsec squared and diameter = 1.7", plus two emission lines representative of the fluxes observed by Feldman et al. (2000):</i> Center 1304.0 A FWHM 30.0 A Flux $2.3e-15$ erg/cm²/s Center 1356.0 A FWHM 30.0 A Flux $4.4e-15$ erg/cm²/s <i>The Buffer Time is 19.639 s, thus well over an orbit. Here, I've used Texp - 110 to minimise the time between the two exposures.</i></p>									
4	(COS.sp.517981)	(5) GANYMEDE-W EST-EXTENDED	COS/FUV, TIME-TAG, PSA	G140L 1280 A	BUFFER-TIME=1.3 E4; FLASH=YES; FP-POS=3			989 Secs (989 Secs) [==>]	[1]
<p><i>Comments: ETC Buffer Time is, as for Exposure 6, ~20k s. Multiplied by 2/3 = 13092, rounded down to 13,000 s as this is the second exposure in the orbit.</i></p>									
5	(COS.sp.517981)	(5) GANYMEDE-W EST-EXTENDED	COS/FUV, TIME-TAG, PSA	G140L 1280 A	BUFFER-TIME=12 98; FLASH=YES; FP-POS=4			1408 Secs (1408 Secs) [==>]	[2]
<p><i>Comments: ETC Buffer Time is, as for Exposure 6, ~20k s. Here, I've used Texp - 110 to minimise the time between the two exposures.</i></p>									
6	(COS.sp.517981)	(5) GANYMEDE-W EST-EXTENDED	COS/FUV, TIME-TAG, PSA	G140L 1280 A	BUFFER-TIME=1.3 E4; FLASH=YES; FP-POS=4			1409 Secs (1409 Secs) [==>]	[2]
<p><i>Comments: ETC Buffer Time is, as for Exposure 6, ~20k s. Multiplied by 2/3 = 13092, rounded down to 13,000 s as this is the second exposure in the orbit.</i></p>									
7	(STIS.ta.510225)	(5) GANYMEDE-W EST-EXTENDED	STIS/CCD, ACQ, F28X50LP	MIRROR	ACQTYPE=DIFFUSE; CHECKBOX=37; DIFFUSE-CENTER=GEOMETRIC-CENTER	GS ACQ SCENARI O BASE1B3		0.1 Secs (0.1 Secs) [==>]	[3]
<p><i>Comments: Ganymede V mag near to opposition is ~4.6. Surface brightness for disc of diameter 1.7" is then 5.6. In ETC run STIS.ta.510225, I used a Castelli-Kurucz G2V spectrum normalised to $V = 5.6$ / arcsec squared and diameter = 1.7.</i></p>									

Exposures

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8	(STIS.sp.51 7958)	(5) GANYMEDE-W EST-EXTENDED	STIS/FUV-MAMA, TIME-TAG, 52X2	G140L 1425 A	BUFFER-TIME=44 3	POS TARG null,-4	885 Secs (885 Secs)	
							[==>]	[3]
<p><i>Comments: In STIS.sp.517958 I used an archive spectrum of the same target and instrument set-up. Buffer Time = Tex_p / 2.</i></p> <p><i>POS-TARG of y=-4" moves the target out of the blotch region (slightly less than does the 52X2D1 aperture, but the target is >1")</i></p>								
9	(STIS.sp.51 7958)	(5) GANYMEDE-W EST-EXTENDED	STIS/FUV-MAMA, TIME-TAG, 52X2	G140L 1425 A	BUFFER-TIME=44 3	POS TARG null,-4	885 Secs (885 Secs)	
							[==>]	[3]
<p><i>Comments: In STIS.sp.517958 I used an archive spectrum of the same target and instrument set-up. Buffer Time = Tex_p / 2.</i></p> <p><i>POS-TARG of y=-4" moves the target out of the blotch region (slightly less than does the 52X2D1 aperture, but the target is >1")</i></p>								

