15095 - Constraining the Surface Composition of Europa with Spatially Resolved Mid-UV Spectra

Cycle: 25, Proposal Category: GO

(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) EUROPA-EAST	STIS/CCD STIS/NUV-MAMA	1	06-Feb-2019 16:00:13.0	yes
51	(1) EUROPA-EAST	STIS/CCD STIS/NUV-MAMA	1	06-Feb-2019 16:00:15.0	yes
02	(2) EUROPA-WEST	STIS/CCD STIS/NUV-MAMA	1	06-Feb-2019 16:00:16.0	yes
03	(3) EUROPA-SUBJUP	STIS/CCD STIS/NUV-MAMA	1	06-Feb-2019 16:00:17.0	yes

Visit	*Targets used in Visit*	*Configurations used in Visit*	*Orbits Used*	*Last Orbit Planner Run*	*OP Current with Visit?*
04	(4) EUROPA-ANTIJUP	STIS/CCD STIS/NUV-MAMA	1	06-Feb-2019 16:00:18.0	yes

5 Total Orbits Used

ABSTRACT

We propose to observe Jupiter's icy moon, Europa, to obtain spatially resolved UV spectra of its leading, trailing, sub-Jovian and anti-Jovian hemispheres that include diagnostic mid-UV wavelengths that have not previously been analyzed. Current published observations of Europa include near-UV observations from 210 nm - 320 nm, and far-UV observations from ~110 nm - 170 nm; however, the data in the mid-UV (170 nm - 210 nm) is lacking. Although Europa's surface consists mostly of water ice, the characteristic sharp absorption edge observed at ~165 nm in lab spectra and on the icy moons of Saturn has not been detected on Europa. Observations in the mid-UV could reveal the absorption edge at longer wavelengths, suggestive of larger ice grains on the surface. Conversely, the mid-UV spectrum could verify that the water ice absorption edge is not present on Europa. The reflectance of Europa's hemispheres drops significantly between the near- and far-UV. The spectral shape in the mid-UV will be used to constrain the surface composition across the satellite. Mid-UV observations with STIS will span the previous near- and far-UV data sets, providing a seamless UV spectrum. These observations will provide the first spatially resolved spectra of each of Europa's hemispheres in the mid-UV.

OBSERVING DESCRIPTION

We will use the STIS G230L mode with the 52 x 0.2 slit centered at 237.6 nm. We will use a pattern to shift the slit one time on Europa to cover the central ~0.4 arcseconds of the ~1" sized satellite and still obtain useful SNR at the shortest wavelengths. The observations will be scheduled such that we observe the sub-Jovian, leading, anti-Jovian, and trailing hemispheres (0 deg, 90 deg, 180 deg, and 270 deg orbital longitudes). Depening on the exact timing of the visits, the observations will need to be offset slightly from 0 or 180 deg to avoid observing Europa while in transit of Jupiter, or in eclipse by Jupiter, respectively.

We request to observe Europa when the Jovian system is within 5 weeks of opposition, which occurs on May 9, 2018, to maximize Europa's size, increase its brightness (and SNR), and reduce background from terrestrial UV airglow from ~10-15 kilorad (kR) to ~2.4 - 4 kR. We assume a 5 minute acquisition time for the target, followed by a 2400 s observation period, consisting of two exposures for each visit. The first exposure will be offset from the center of Europa by -0.1" and the second will be offset by +0.1" perpendicular to the slit, such that the 0.2" wide slit covers 0.4" of the central part of Europa's surface. The spectral range covered by this instrument (157 - 318 nm) will provide a spectrum covering the mid-UV

wavelengths not previously studied. This spectral range will confirm the lack of a water-ice absorption edge in the UV spectra on all hemispheres of Europa and will be used to constrain the composition of Europa's surface.

Visit

Proposal 15095, Leading (01), failed Wed Feb 06 21:00:19 GMT 2019

Diagnostic Status: Warning

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

Special Requirements: BETWEEN 04-APR-2018:00:00:00 AND 13-JUN-2018:00:00:00

Comments: The leading hemisphere of Europa can be observed when Europa is at an orbital longitude of 90 degrees. This is when Europa is at eastern elongation.

Diagnostics

(Leading (01)) Warning (Orbit Planner): ORBITAL VISIBILITY OVERRUN

Patterns

#	Primary Pattern		Secondary Pattern	Exposures
(2)	Pattern Type=STIS-PERP-TO-SLIT	Coordinate Frame=POS-TARG		(2)
	Purpose=MOSAIC	Pattern Orientation=0.0		
	Number Of Points=2	Angle Between Sides=		
	Point Spacing=0.2	Center Pattern=true		
	Line Spacing=			

Solar System Targets

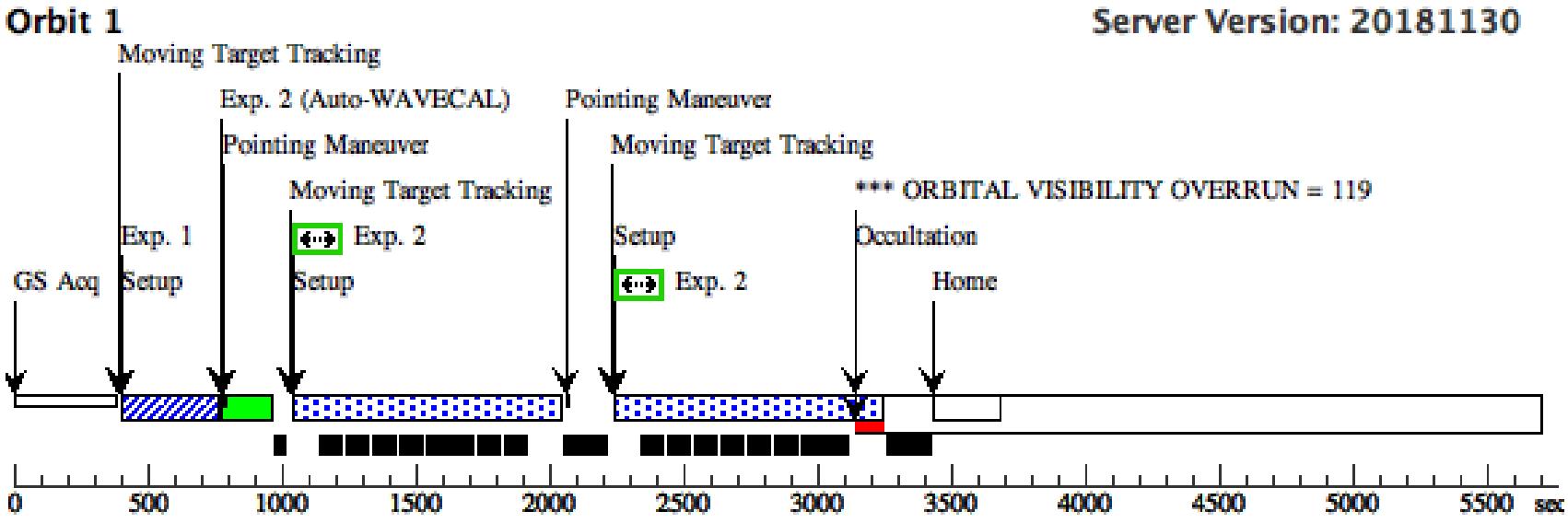
#	Name	Level 1	Level 2	Level 3	Window	Ephem Center
(1)	EUROPA-EAST	STD=JUPITER	STD=EUROPA		OLG OF EUROPA-EAST FROM EARTH BETWEEN 75 105, SEP OF EUROPA-EAST CALLISTO FROM EARTH GT 10", SEP OF EUROPA-EAST IO FROM EARTH GT 10", SEP OF EUROPA-EAST GANYMEDE FROM EARTH GT 10"	EARTH

Comments: Description=Europa at Eastern Elongation
Extended=YES

Exposures

#	Label (ETC Run)	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time (Total)/[Actual Dur.]	Orbit
1	Europa-Leading-ACQ (STIS.ta.1152964)	(1) EUROPA-EAST	STIS/CCD, ACQ, F28X50LP	MIRROR	ACQTYPE=DIFFUSE; CHECKBOX=21; DIFFUSE-CENTER=GEOMETRIC-CENTER			0.1 Secs (0.1 Secs) *[==>]*	***[1]***
2	Europa-Leading (STIS.sp.932114)	(1) EUROPA-EAST	STIS/NUV-MAMA, TIME-TAG, 52X0.2	G230L 2376 A	BUFFER-TIME=99		Pattern 2, Exps 2-2 in Leading (01) (2)	1200 Secs (1974 Secs) *[==>987.0 Secs (Pattern 1)]* *[==>987.0 Secs (Pattern 2)]*	***[1]***

Orbit Structure



Visit

Proposal 15095, Leading (51), implementation Wed Feb 06 21:00:19 GMT 2019

Diagnostic Status: No Diagnostics

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

Special Requirements: BETWEEN 24-MAY-2019:00:00:00 AND 28-JUN-2019:00:00:00

Comments: The leading hemisphere of Europa can be observed when Europa is at an orbital longitude of 90 degrees. This is when Europa is at eastern elongation.

Patterns

#	Primary Pattern		Secondary Pattern	Exposures
(2)	Pattern Type=STIS-PERP-TO-SLIT	Coordinate Frame=POS-TARG		(2)
	Purpose=MOSAIC	Pattern Orientation=0.0		
	Number Of Points=2	Angle Between Sides=		
	Point Spacing=0.2	Center Pattern=true		
	Line Spacing=			

Solar System Targets

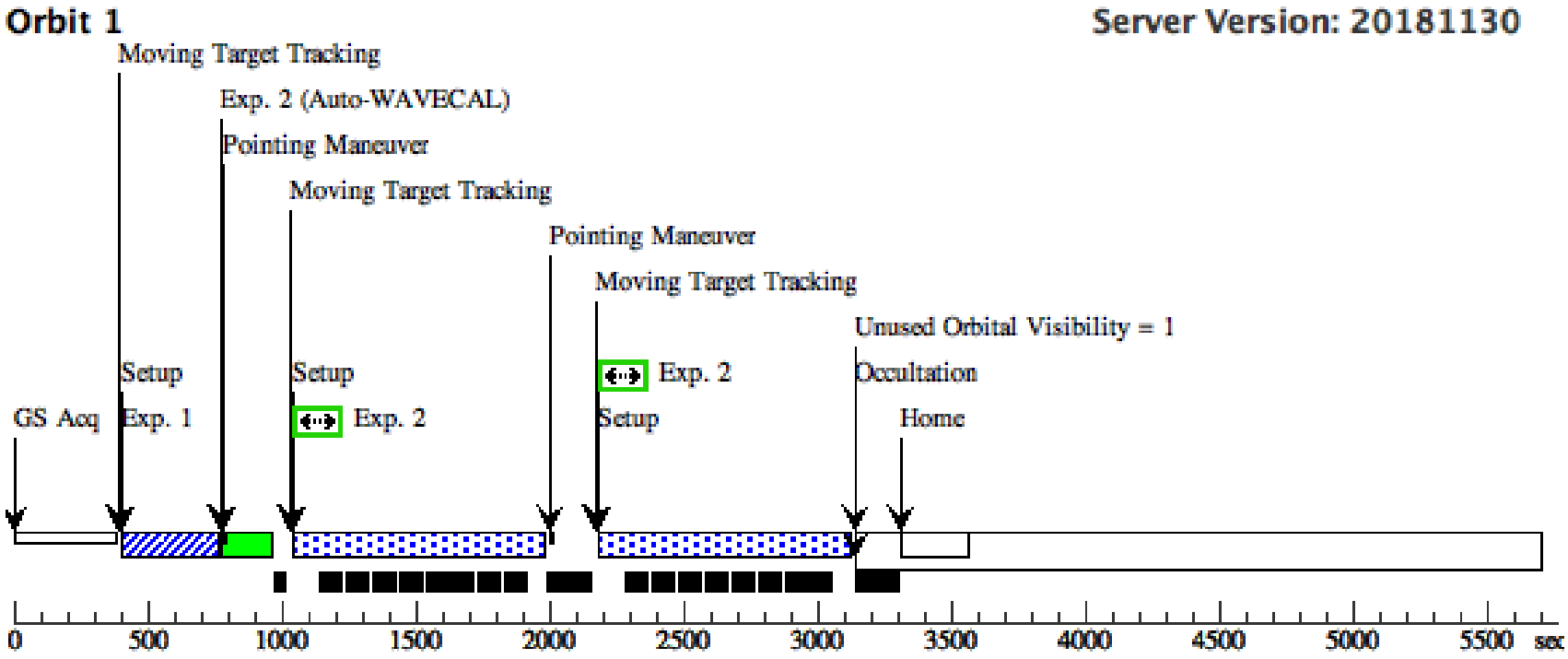
#	Name	Level 1	Level 2	Level 3	Window	Ephem Center
(1)	EUROPA-EAST	STD=JUPITER	STD=EUROPA		OLG OF EUROPA-EAST FROM EARTH BETWEEN 75 105, SEP OF EUROPA-EAST CALLISTO FROM EARTH GT 10", SEP OF EUROPA-EAST IO FROM EARTH GT 10", SEP OF EUROPA-EAST GANYMEDE FROM EARTH GT 10"	EARTH

Comments: Description=Europa at Eastern Elongation
Extended=YES

Exposures

#	Label (ETC Run)	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time (Total)/[Actual Dur.]	Orbit
1	Europa-Leading-ACQ (STIS.ta.1152964)	(1) EUROPA-EAST	STIS/CCD, ACQ, F28X50LP	MIRROR	ACQTYPE=DIFFUSE; CHECKBOX=21; DIFFUSE-CENTER=GEOMETRIC-CENTER	GS ACQ SCENARIO BASE1BE		0.1 Secs (0.1 Secs) *[==>]*	***[1]***
2	Europa-Leading (STIS.sp.932114)	(1) EUROPA-EAST	STIS/NUV-MAMA, TIME-TAG, 52X0.2	G230L 2376 A	BUFFER-TIME=99		Pattern 2, Exps 2-2 in Leading (51) (2)	1200 Secs (1854 Secs) *[==>927.0 Secs (Pattern 1)]* *[==>927.0 Secs (Pattern 2)]*	***[1]***

Orbit Structure



Visit

Proposal 15095, Trailing (02), completed Wed Feb 06 21:00:19 GMT 2019

Diagnostic Status: Warning

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

Special Requirements: BETWEEN 04-APR-2018:00:00:00 AND 13-JUN-2018:00:00:00

Comments: The trailing hemisphere of Europa can be observed when Europa is at an orbital longitude of 270 degrees. This is when Europa is at western elongation.

Diagnostics

(Trailing (02)) Warning (Orbit Planner): ORBITAL VISIBILITY OVERRUN

Patterns

#	Primary Pattern		Secondary Pattern	Exposures
(2)	Pattern Type=STIS-PERP-TO-SLIT	Coordinate Frame=POS-TARG		(2)
	Purpose=MOSAIC	Pattern Orientation=0.0		
	Number Of Points=2	Angle Between Sides=		
	Point Spacing=0.2	Center Pattern=true		
	Line Spacing=			

Solar System Targets

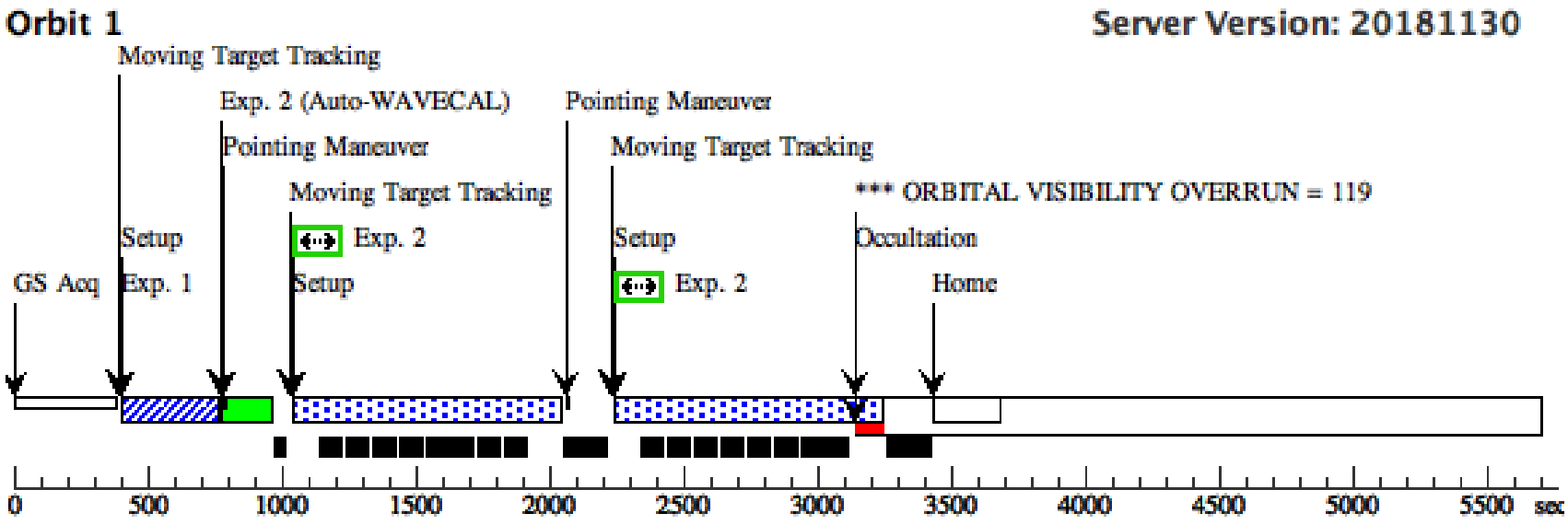
#	Name	Level 1	Level 2	Level 3	Window	Ephem Center
(2)	EUROPA-WEST	STD=JUPITER	STD=EUROPA		SEP OF EUROPA-WEST CALLISTO FROM EARTH GT 10", SEP OF EUROPA-WEST IO FROM EARTH GT 10", SEP OF EUROPA-WEST GANYMEDE FROM EARTH GT 10", OLG OF EUROPA-WEST FROM EARTH BETWEEN 255 285	EARTH

Comments: Description=Europa at Western Elongation
Extended=YES

Exposures

#	Label (ETC Run)	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time (Total)/[Actual Dur.]	Orbit
1	Europa-Trailing-ACQ	(2) EUROPA-WEST	STIS/CCD, ACQ, F28X50LP	MIRROR	ACQTYPE=DIFFUSE; CHECKBOX=21; DIFFUSE-CENTER=GEOMETRIC-CENTER			0.1 Secs (0.1 Secs) *[==>]*	***[1]***
2	Europa-Trailing (STIS.sp.932114)	(2) EUROPA-WEST	STIS/NUV-MAMA, TIME-TAG, 52X0.2	G230L 2376 A	BUFFER-TIME=99		Pattern 2, Exps 2-2 in Trailing (02) (2)	1200 Secs (1974 Secs) *[==>987.0 Secs (Pattern 1)]* *[==>987.0 Secs (Pattern 2)]*	***[1]***

Orbit Structure



Visit

Proposal 15095, Sub-Jovian (03), completed Wed Feb 06 21:00:19 GMT 2019

Diagnostic Status: Warning

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

Special Requirements: BETWEEN 04-APR-2018:00:00:00 AND 13-JUN-2018:00:00:00

Comments: The sub_Jovian hemisphere of Europa can be observed when Europa is at an orbital longitude near 0 degrees. This is when Europa is near eclipse. We do not want Europa to be in eclipse for the observation, however

Diagnostics

(Sub-Jovian (03)) Warning (Orbit Planner): ORBITAL VISIBILITY OVERRUN

Patterns

#	Primary Pattern		Secondary Pattern	Exposures
(2)	Pattern Type=STIS-PERP-TO-SLIT	Coordinate Frame=POS-TARG		(2)
	Purpose=MOSAIC	Pattern Orientation=0.0		
	Number Of Points=2	Angle Between Sides=		
	Point Spacing=0.2	Center Pattern=true		
	Line Spacing=			

Solar System Targets

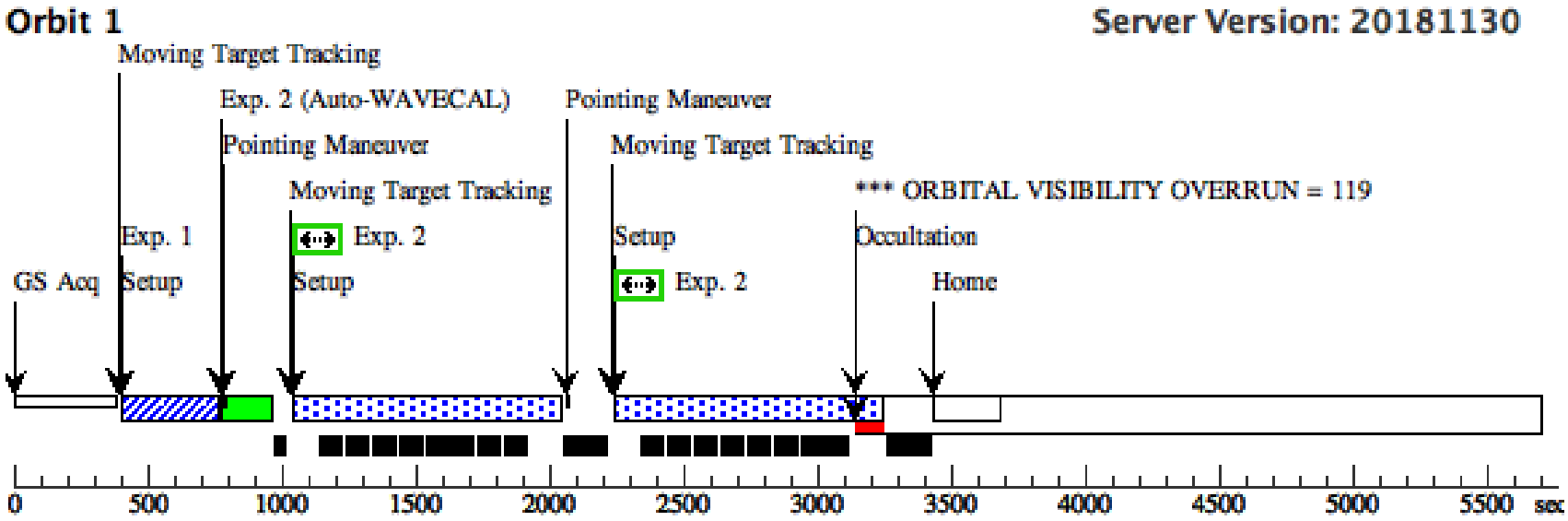
#	Name	Level 1	Level 2	Level 3	Window	Ephem Center
(3)	EUROPA-SUBJUP	STD=JUPITER	STD=EUROPA		SEP OF EUROPA-SUBJUP CALLISTO FROM EARTH GT 10", SEP OF EUROPA-SUBJUP IO FROM EARTH GT 10", SEP OF EUROPA-SUBJUP GANYMEDE FROM EARTH GT 10", OLG OF EUROPA-SUBJUP FROM EARTH BETWEEN 340 20	EARTH

Comments: Description=Europa at near 0 deg orb longitude
Extended=YES

Exposures

#	Label (ETC Run)	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time (Total)/[Actual Dur.]	Orbit
1	Europa-SubJup-ACQ	(3) EUROPA-SUBJUP	STIS/CCD, ACQ, F28X50LP	MIRROR	DIFFUSE-CENTER=GEOMETRIC-CENTER; ACQTYPE=DIFFUSE; CHECKBOX=21			0.1 Secs (0.1 Secs) *[==>]*	*[1]*
2	Europa-SubJup (STIS.sp.932114)	(3) EUROPA-SUBJUP	STIS/NUV-MAMA, TIME-TAG, 52X0.2	G230L 2376 A	BUFFER-TIME=99		Pattern 2, Exps 2-2 in Sub-Jovian (03) (2)	1200 Secs (1974 Secs) *[==>987.0 Secs (Pattern 1)]* *[==>987.0 Secs (Pattern 2)]*	*[1]*

Orbit Structure



Visit

Proposal 15095, Anti-Jovian (04), completed Wed Feb 06 21:00:19 GMT 2019

Diagnostic Status: Warning

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

Special Requirements: BETWEEN 04-APR-2018:00:00:00 AND 13-JUN-2018:00:00:00

Comments: The anti-Jovian hemisphere of Europa can be observed when Europa is at an orbital longitude of 180 degrees. We will observe Europa near this longitude, but do not want it to be transiting Jupiter during the observation.

Diagnostics

(Anti-Jovian (04)) Warning (Orbit Planner): ORBITAL VISIBILITY OVERRUN

Patterns

#	Primary Pattern		Secondary Pattern	Exposures
(2)	Pattern Type=STIS-PERP-TO-SLIT	Coordinate Frame=POS-TARG		(2)
	Purpose=MOSAIC	Pattern Orientation=0.0		
	Number Of Points=2	Angle Between Sides=		
	Point Spacing=0.2	Center Pattern=true		
	Line Spacing=			

Solar System Targets

#	Name	Level 1	Level 2	Level 3	Window	Ephem Center
(4)	EUROPA-ANTIJUP	STD=JUPITER	STD=EUROPA		SEP OF EUROPA-ANTIJUP CALLISTO FROM EARTH GT 10", SEP OF EUROPA-ANTIJUP IO FROM EARTH GT 10", SEP OF EUROPA-ANTIJUP GANYMEDE FROM EARTH GT 10", OLG OF EUROPA-ANTIJUP FROM EARTH BETWEEN 160 200	EARTH

Comments: Description=Europa near 180 deg orbital longitude
Extended=YES

Exposures

#	Label (ETC Run)	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time (Total)/[Actual Dur.]	Orbit
1	Europa-Anti Jup-ACQ	(4) EUROPA-ANTIJUP	STIS/CCD, ACQ, F28X50LP	MIRROR	DIFFUSE-CENTER=GEOMETRIC-CENTER; CHECKBOX=21; ACQTYPE=DIFFUSE			0.1 Secs (0.1 Secs) *[==>]*	 ***[1]***
2	Europa-Anti Jup (STIS.sp.932114)	(4) EUROPA-ANTIJUP	STIS/NUV-MAMA, TIME-TAG, 52X0.2	G230L 2376 A	BUFFER-TIME=99		Pattern 2, Exps 2-2 in Anti-Jovian (04) (2)	1200 Secs (1974 Secs) *[==>987.0 Secs (Pattern 1)]* *[==>987.0 Secs (Pattern 2)]*	 ***[1]***

Orbit Structure