11538 - COS-GTO: Imaging of Mid-UV Emissions from Io in Eclipse

Cycle: 17, Proposal Category: GTO/COS

(Availability Mode: AVAILABLE)

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) IO-ECLIPSED (2) IO-SUNLIT	COS/NUV	1	25-May-2010 21:02:01.0	yes

1 Total Orbits Used

ABSTRACT

The atmosphere and corona of Jupiter's volcanic moon Io emit light at a wide variety of wavelengths, from FUV neutral O and S lines to SO emission at 1.7 microns. These emissions provide important constraints on the distribution and chemistry of Io's atmosphere, and Io's interaction with the Jovian magnetosphere. The neutral O and S FUV emissions, shortward of 2000?, have been imaged extensively by HST/STIS and visible emissions (from neutral Na, K and O line emission, and SO2 continuum emission) have been imaged by the Galileo, Cassini, and New Horizons spacecraft, but the spatial distribution of emissions in the 2000-3000? region, thought to be dominated by SO2 electron impact continuum emission, has not yet been determined. Earlier long-slit observations with STIS indicated strong concentration of 2800? emission over the active volcano Prometheus (Jessup et al. 2004), suggesting local volcanic control, but Cassini images suggest that the SO2 continuum seen at longer wavelengths is instead concentrated over the sub-Jovian and anti-Jovian points where there are magnetic connections between Io and the Jovian magnetosphere- the anti-Jovian point is

close to Prometheus. A series of 200-second integrations taken in Jupiter eclipse should determine whether emission is concentrated over volcanos or over the sub-Jovian point, and should be able to observe motion of the emission due to changing magnetic field orientation if it is magnetically controlled. This observation will also provide experience in the use of COS in imaging mode.

OBSERVING DESCRIPTION

TA1 imaging of Io in eclipse for 1 orbit, acquiring in sunlight and following into eclipse. Do a minimum of 15 minutes of imaging in eclipse, in order to avoid observing Io as it gets too close to bright Jupiter, and to allow a little flexibility in scheduling.

ADDITIONAL COMMENTS

2 targets are both Io, under 2 conditions: eclipsed, and sunlit- the plan is to acquire Io in sunlight and follow it into eclipse. APT treats these as separate targets with an offset between, but in fact no offset is necessary. Should they instead be treated as the same target, with Moving Target Tracking occuring between instead? We do not want to waste time doing a fictitious offset, if eclipe ingress occurs during the period reserved for the offset (see below).

Also because the acquisition must be done when Io is in sunlight, and the imaging must be done when Io is in eclipse, in order for there to be scheduling flexibilty the interval between acquisition and the science exposure needs to be flexible (we may have to acquire in sunlight, and then wait for Io to be eclipsed before starting the science exposure). We hope that this flexibility can be accomodated in order to make most efficient use of the time once the time of the observation is known.

Visit

Proposal 11538, Visit 01, implementation Wed May 26 01:02:05 GMT 2010

Diagnostic Status: No Diagnostics

Scientific Instruments: COS/NUV

Special Requirements: (none)

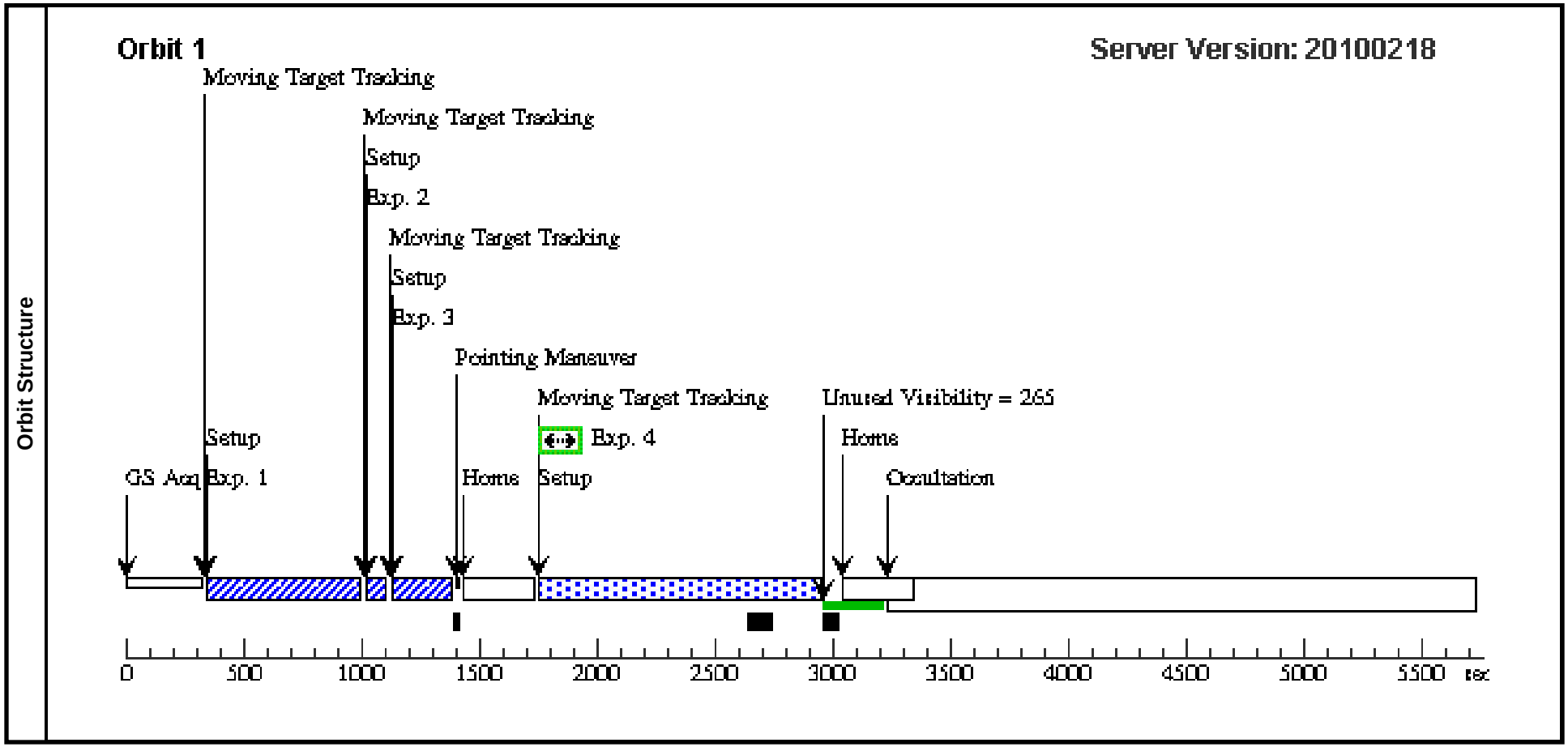
Comments: Acquire Io in sunlight (exposures 1-3) and do time-tag imaging (exposure 4) starting as soon as it enters eclipse, continuing until its distance from Jupiter reaches the 14.5 arcsec bright-object protection limit. The interval between eclipse ingress and reaching the bright-object limit is likely to be about 15 minutes, so this is the observation duration used in exposure 4. However this exposure duration should be expanded to fill the observable eclipse time.

Solar System Targets

#	Name	Level 1	Level 2	Level 3	Window	Ephem Center
(1)	IO-ECLIPSED	STD=JUPITER	STD=IO		ECL U OF IO-ECLIPSED BY JUPITER, SEP OF IO-ECLIPSED JUPITER FROM EARTH GT 14.5"	EARTH
Comments: Io must be eclipsed for NUV imaging; too bright in sunlight. Override default window specifying separation from Jupiter, as this prevents observing during eclipse.						
(2)	IO-SUNLIT	STD=JUPITER	STD=IO		NOT ECL U OF IO-SUNLIT BY JUPITER, NOT ECL P OF IO-SUNLIT BY JUPITER, SEP OF IO-SUNLIT JUPITER FROM EARTH GT 14.5"	EARTH
Comments: Acquisition target; must be sunlit for sufficient signal. Need to override default separation from Jupiter limb (30") to allow observation near eclipse.						

Exposures

#	Label	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time/[Actual Dur.]	Orbit
1		(2) IO-SUNLIT	COS/NUV, ACQ/SEARCH, PSA	G230L 3000 A	SCAN-SIZE=3	GS ACQ SCENARIO BASE1B3		5 Secs *[==>]*	***[1]***
Comments: ETC: COS95670 with composite spectrum of Io, based on (1) direct flux measurements (below 2300?) and (2) albedo measurements + solar flux scaled for Io distance/size. Scaled to mV=5.3, but makes only slight difference from unscaled spectrum. *ACQ/Search* *0.5 mags brighter: COS95672* *0.5 mags dimmer: COS95671* *All need < 1.5s to get S/N = 40*									
2		(2) IO-SUNLIT	COS/NUV, ACQ/PEAKXD, PSA	G230L 3000 A				5 Secs *[==>]*	***[1]***
Comments: ETC: COS94142 with effective mV = 8.9 solar-type spectrum (3.5 mags dimmer in this waveband relative to visible, based on albedo difference) *ACQ/PeakXD* *0.5 mags brighter: COS94143* *0.5 mags dimmer: COS94144* *All require < 1.5s to get S/N = 40*									
3		(2) IO-SUNLIT	COS/NUV, ACQ/PEAKD, PSA	G230L 3000 A	NUM-POS=7; STEP-SIZE=1.2			5 Secs *[==>]*	***[1]***
4		(1) IO-ECLIPSED	COS/NUV, TIME-TAG, PSA	MIRRORA	BUFFER-TIME=600.; EXTENDED=YES	AFTER BY 730 S; GS ACQ SCENARIO BASE1B3		900 Secs *[==>]*	***[1]***
Comments: Buffer-time to accomodate scattered light must be 2/3 of 1763s, based on HST/FOS measurement of scattered light from Jupiter while observing Io in eclipse; no measureable Io signal was found. (Clarke et al. 1994, JGR 99) Used 5e-15 erg/cm^2/s/A flat spectrum without scaling; COS and FOS 4.3 apertures have same angular acceptance. *ETC COS.A310846 -- used point source to check total countrate. Further decrease buffer time by factor of 2 to accomodate comparable NUV SO2 emission from Io.* *(previously: ETC COS78224 -- used point source to check total countrate.)*									


Orbit Structure
Orbit 1
Server Version: 20100218
Moving Target Tracking
Moving Target Tracking
Setup
Exp. 2
Moving Target Tracking
Setup
Exp. 3
Pointing Maneuver
Moving Target Tracking
Exp. 4
Unused Visibility = 265
Setup
GS Acq
Exp. 1
Home
Setup
Home
Occultation
0
500
1000
1500
2000
2500
3000
3500
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