



## 14106 - Probing Ceres' exosphere and water vapor outgassing

Cycle: 23, Proposal Category: GO

(UV Initiative)

(Availability Mode: SUPPORTED)

### INVESTIGATORS

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### 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	(2) CERES	COS/FUV COS/NUV	5	09-Nov-2016 10:50:03.0	yes
02	(3) CERES-COPY	COS/FUV COS/NUV	5	09-Nov-2016 10:50:05.0	yes

10 Total Orbits Used

### ABSTRACT

## Proposal 14106 (STScI Edit Number: 5, Created: Wednesday, November 9, 2016 10:50:06 AM EST) - Overview

Evidence is mounting that Ceres is a geophysically active icy world. The Herschel telescope measured water vapor above two surface regions and first-view images by the Dawn spacecraft suggest active outgassing above bright, intriguing surface features. Dawn will be in orbit probing the interior and surface of Ceres at least until the end of 2015. The high sensitivity and high resolution of COS provide the unique possibility to obtain supporting FUV spectra to constrain Ceres' exosphere and outgassing. We propose 5 consecutive orbits in the COS G130M mode to measure atomic emissions from O, H and possible trace species in the exosphere. During the ~7.5-hour long visit Ceres' active regions will be targeted on the dayside. Observed diurnal variations will be used to independently differentiate between sublimation and liquid reservoir source regions and detected exospheric signals will be related to surface features characterized by Dawn.

### **OBSERVING DESCRIPTION**

We use the COS G130M mode centered at 1291 Å for the two wavelength ranges of 1134 Å to 1274 Å (Segment A) and 1291 Å to 1431 Å (Segment B) that include the most important oxygen lines at 1304 Å and observe over almost one full Ceres rotation period (7.5 hours out of 9.1 hours).

We will locate Ceres with a small offset of ~0.5 arcsec in the lower part of the 2.5 arcsec pinhole in order to be able to simultaneously measure both Ceres and the sky background.

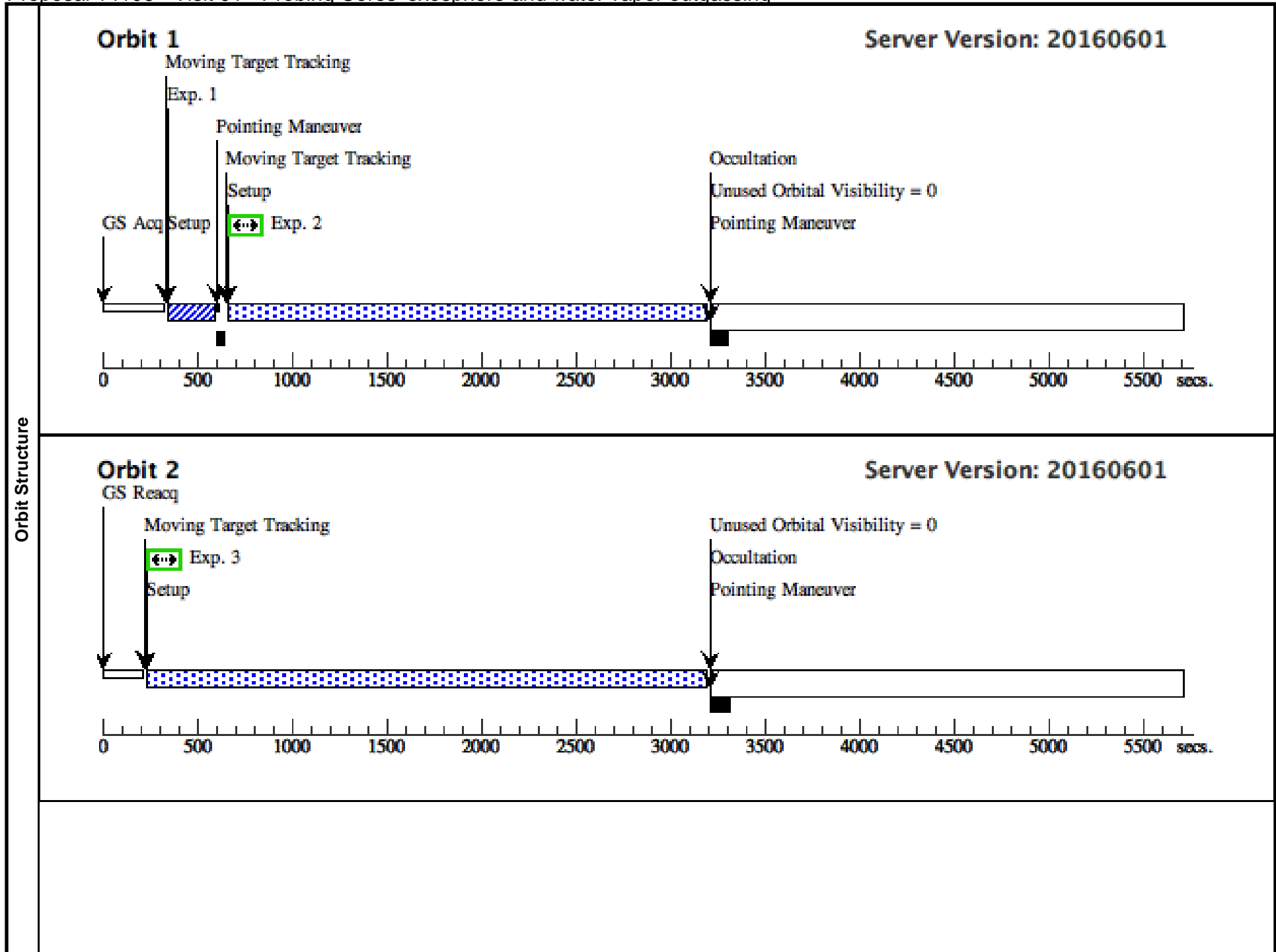
Proposal 14106 - Visit 01 - Probing Ceres' exosphere and water vapor outgassing

Wed Nov 09 15:50:06 GMT 2016

<b>Visit</b>	<p><b>Proposal 14106, Visit 01, failed</b></p> <p><b>Diagnostic Status: Warning</b></p> <p>Scientific Instruments: COS/FUV, COS/NUV</p> <p>Special Requirements: BETWEEN 10-JUL-2015:00:00:00 AND 30-SEP-2015:00:00:00</p> <p><i>Comments: - For acquisition, we use only ACQ/IMAGE with Mirror A assuming that the coordinates of Ceres are known with an accuracy smaller than 0.4". The ETC yields SNR=40 in 0.0234 seconds for the normalized solar spectrum and the exposure time of 5 second should give good margin.</i></p> <p><i>- For the science exposures, the target has an offset of <math>y = -0.5''</math> to locate Ceres in the lower half of the aperture. This way we can analyze the sky background only in the upper half of the detector. Ceres is located in the lower half, as the upper half might suffer a gain-sag from the previous lifetime position on the COS detector. The gain-sag might affect the sky background, but the primarily targeted OI lines fall on segment A, which is less strongly affected.</i></p> <p><i>- We take 2 science exposures per orbit cycling consecutively through the FP-POS positions.</i></p>														
	<p>(Visit 01) Warning (Orbit Planner): INVALID GS ACQ SCENARIO SPECIAL REQUIREMENT</p> <p>(Exposure 2 (Visit 01)) Warning (Form): COS FUV PSA science exposures with extended targets have special calibration limitations. See "Errors and Warnings" for more details.</p> <p>(Exposure 3 (Visit 01)) Warning (Form): COS FUV PSA science exposures with extended targets have special calibration limitations. See "Errors and Warnings" for more details.</p> <p>(Exposure 4 (Visit 01)) Warning (Form): COS FUV PSA science exposures with extended targets have special calibration limitations. See "Errors and Warnings" for more details.</p> <p>(Exposure 5 (Visit 01)) Warning (Form): COS FUV PSA science exposures with extended targets have special calibration limitations. See "Errors and Warnings" for more details.</p> <p>(Exposure 6 (Visit 01)) Warning (Form): COS FUV PSA science exposures with extended targets have special calibration limitations. See "Errors and Warnings" for more details.</p>														
<b>Solar System Targets</b>	<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>(2)</td> <td>CERES</td> <td>STD=CERES</td> <td></td> <td></td> <td>NOT CML OF CERES-ACQ FROM EARTH BETWEEN 340 20</td> <td>EARTH</td> </tr> </tbody> </table>	#	Name	Level 1	Level 2	Level 3	Window	Ephem Center	(2)	CERES	STD=CERES			NOT CML OF CERES-ACQ FROM EARTH BETWEEN 340 20	EARTH
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(2)	CERES	STD=CERES			NOT CML OF CERES-ACQ FROM EARTH BETWEEN 340 20	EARTH									
<p><i>Comments: The diameter of Ceres is roughly 0.6 arcsec in the sky near Ceres opposition, so that it falls just in the category of extended sources for COS. The CERES-ACQ target does not have observing window requirements, while the CERES target (for the science exposures) includes "CML OF CERES" requirements.</i></p> <p><i>Extended=YES</i></p>															

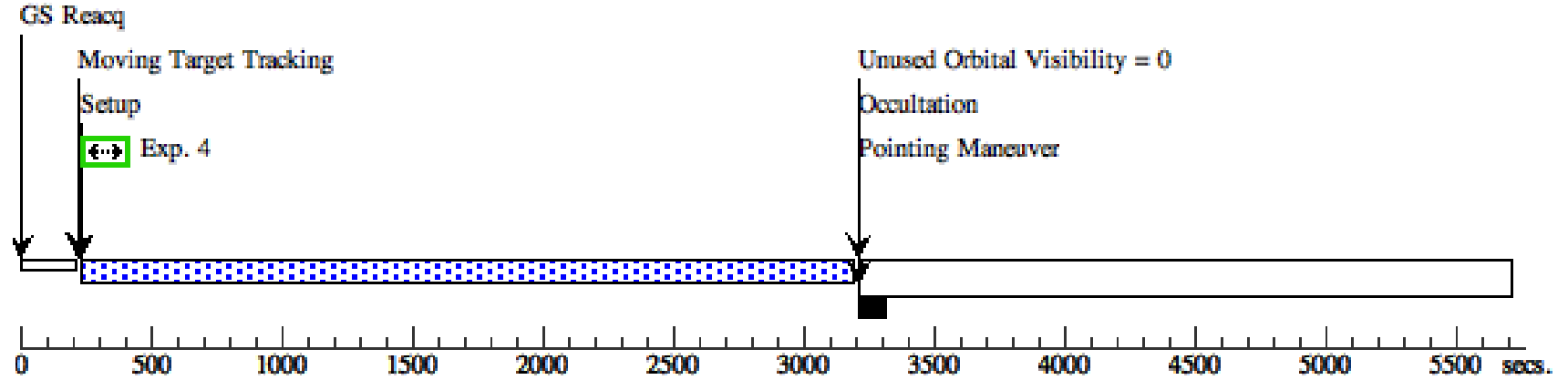
Proposal 14106 - Visit 01 - Probing Ceres' exosphere and water vapor outgassing

Exposures	#	Label (ETC Run)	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time (Total)/[Actual Dur.]	Orbit	
	1	(COS.ta.727 578)	(2) CERES	COS/NUV, ACQ/IMAGE, PSA	MIRRORA		GS ACQ SCENARI O BASE1B3		10 Secs (10 Secs) [==>]	[1]	
	<p><i>Comments: For the ETC, a SED of Ceres' surface brightness between 1200 and 4200 A was generated with a solar spectrum for average solar wind activity from UARS. The spectrum was scaled to Ceres' distance to the sun of ~2.9 AU during the observation and with an interpolated geometric albedo based on the albedo values from Li et al., 2006, Icarus.</i></p> <p><i>The ETC run for extended source yield a SNR of 40 after 1.1 seconds, so we choose 10 seconds for a sufficient margin.</i></p> <p><i>A imaging ETC run (not TA) was also performed: COS.ta.727578</i></p>										
	2	(COS.sp.717 649)	(2) CERES	COS/FUV, TIME-TAG, PSA	G130M 1291 A	FP-POS=1; BUFFER-TIME=30 00	POS TARG null,-0.5 ; GS ACQ SCENARI O BASE1B3		2000 Secs (2361 Secs) [==>2361.0 Secs ]	[1]	
	3	(COS.sp.717 650)	(2) CERES	COS/FUV, TIME-TAG, PSA	G130M 1291 A	FP-POS=2; BUFFER-TIME=30 00	POS TARG 0,0.5		2700 Secs (2912 Secs) [==>2912.0 Secs ]	[2]	
	<p><i>Comments: ETC buffer time calculations yields times larger than exposure time of ~1200 sec, so buffer time is set to exposure time</i></p>										
	4	(COS.sp.717 650)	(2) CERES	COS/FUV, TIME-TAG, PSA	G130M 1291 A	FP-POS=3; BUFFER-TIME=30 00	SAME POS AS 2		2700 Secs (2912 Secs) [==>2912.0 Secs ]	[3]	
	<p><i>Comments: ETC buffer time calculations yields times larger than exposure time of ~1200 sec, so buffer time is set to exposure time</i></p>										
	5	(COS.sp.717 650)	(2) CERES	COS/FUV, TIME-TAG, PSA	G130M 1291 A	FP-POS=3; BUFFER-TIME=30 00	SAME POS AS 3		2700 Secs (2915 Secs) [==>2915.0 Secs ]	[4]	
	<p><i>Comments: ETC buffer time calculations yields times larger than exposure time of ~1200 sec, so buffer time is set to exposure time</i></p>										
6	(COS.sp.717 650)	(2) CERES	COS/FUV, TIME-TAG, PSA	G130M 1291 A	FP-POS=4; BUFFER-TIME=30 00	SAME POS AS 2		2700 Secs (2912 Secs) [==>2912.0 Secs ]	[5]		
<p><i>Comments: ETC buffer time calculations yields times larger than exposure time of ~1200 sec, so buffer time is set to exposure time</i></p>											



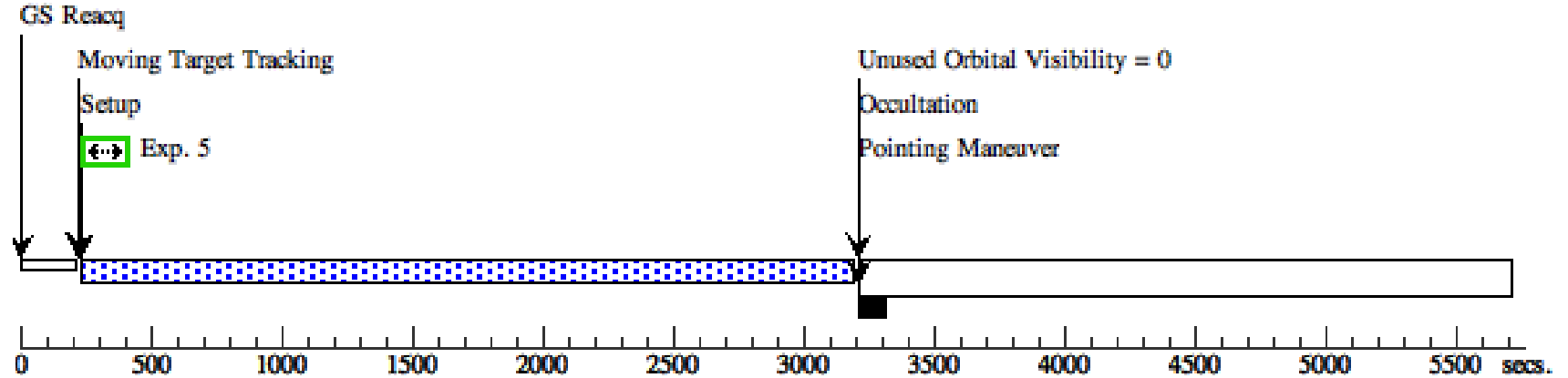
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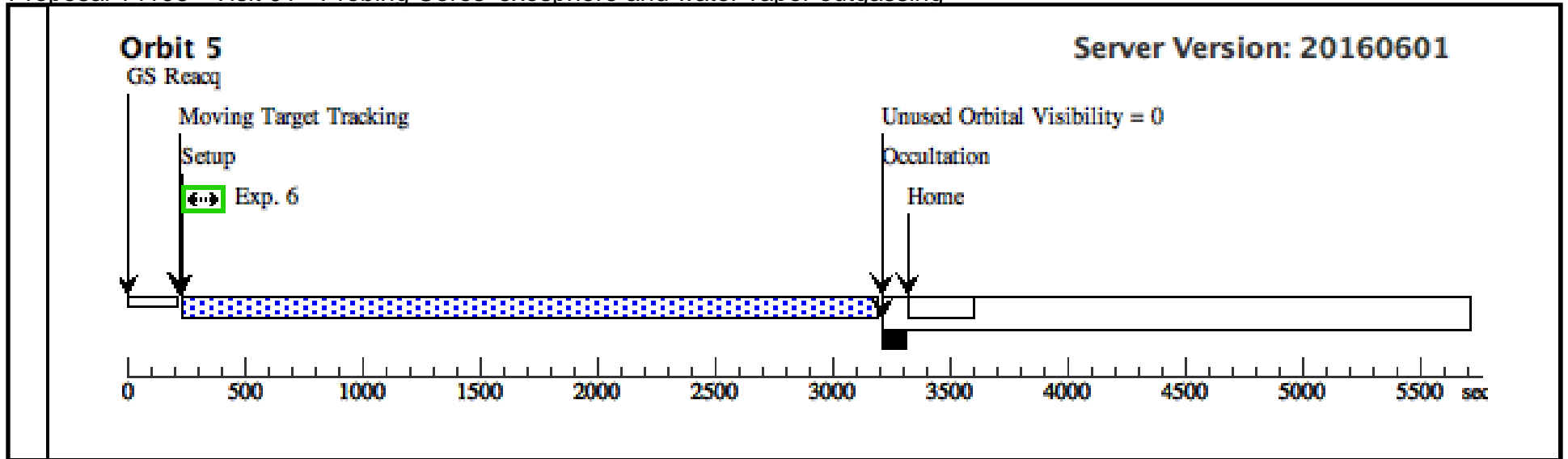
Server Version: 20160601



### Orbit 4

Server Version: 20160601





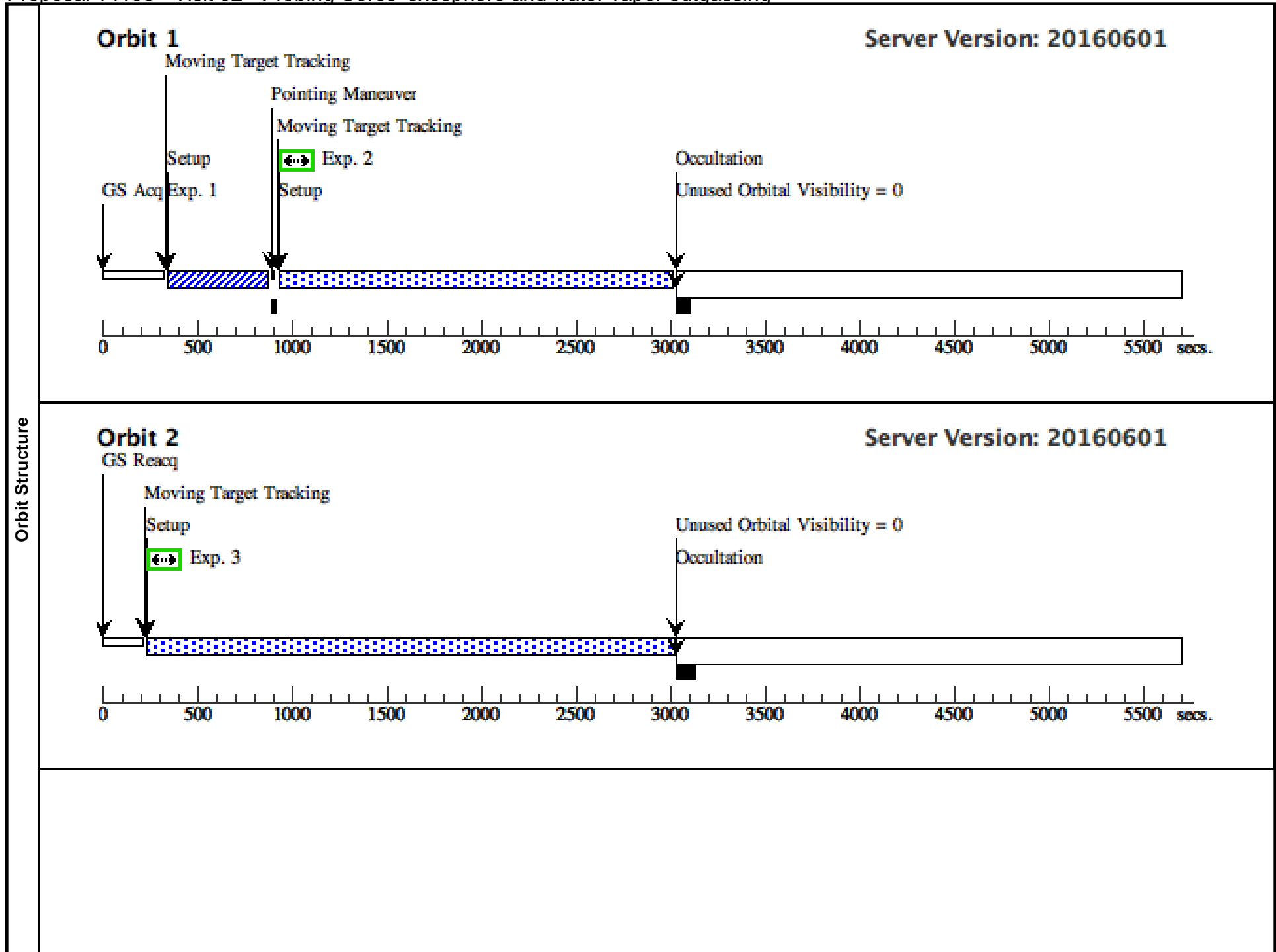
Proposal 14106 - Visit 02 - Probing Ceres' exosphere and water vapor outgassing

Wed Nov 09 15:50:07 GMT 2016

<b>Visit</b>	<p><b>Proposal 14106, Visit 02, implementation</b></p> <p><b>Diagnostic Status: Warning</b></p> <p>Scientific Instruments: COS/FUV, COS/NUV</p> <p>Special Requirements: SCHED 80%; BETWEEN 17-OCT-2016:00:00:00 AND 08-NOV-2016:00:00:00</p> <p><i>Comments: - For the science exposures, the target has an offset of <math>y = -1.85''</math> to locate Ceres just outside the aperture allowing an location error of <math>0.3''</math>. This way we get only the signal from the exosphere without contributions from bright surface reflected light.</i></p> <p><i>- The last science exposure target 20" away from Ceres to get a comparable sky background (minimal exosphere contributions)</i></p> <p><i>- We cycle consecutively through the FP-POS positions, repeating POS=4 in the fifth exposure.</i></p>																				
	<b>Diagnostics</b>	<p>(Visit 02) Warning (Orbit Planner): POS TARG OUTSIDE OF APERTURE NO ORIENT</p> <p>(Visit 02) Warning (Orbit Planner): POS TARG OUTSIDE OF APERTURE NO ORIENT</p> <p>(Visit 02) Warning (Orbit Planner): POS TARG OUTSIDE OF APERTURE</p> <p>(Visit 02) Warning (Orbit Planner): POS TARG OUTSIDE OF APERTURE</p> <p>(Exposure 2 (Visit 02)) Warning (Form): COS FUV PSA science exposures with extended targets have special calibration limitations. See "Errors and Warnings" for more details.</p> <p>(Exposure 3 (Visit 02)) Warning (Form): COS FUV PSA science exposures with extended targets have special calibration limitations. See "Errors and Warnings" for more details.</p> <p>(Exposure 4 (Visit 02)) Warning (Form): COS FUV PSA science exposures with extended targets have special calibration limitations. See "Errors and Warnings" for more details.</p> <p>(Exposure 5 (Visit 02)) Warning (Form): COS FUV PSA science exposures with extended targets have special calibration limitations. See "Errors and Warnings" for more details.</p> <p>(Exposure 6 (Visit 02)) Warning (Form): COS FUV PSA science exposures with extended targets have special calibration limitations. See "Errors and Warnings" for more details.</p>																			
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		#	Name	Level 1	Level 2	Level 3	Window	Ephem Center													
(3)		CERES-COPY	STD=CERES				EARTH														

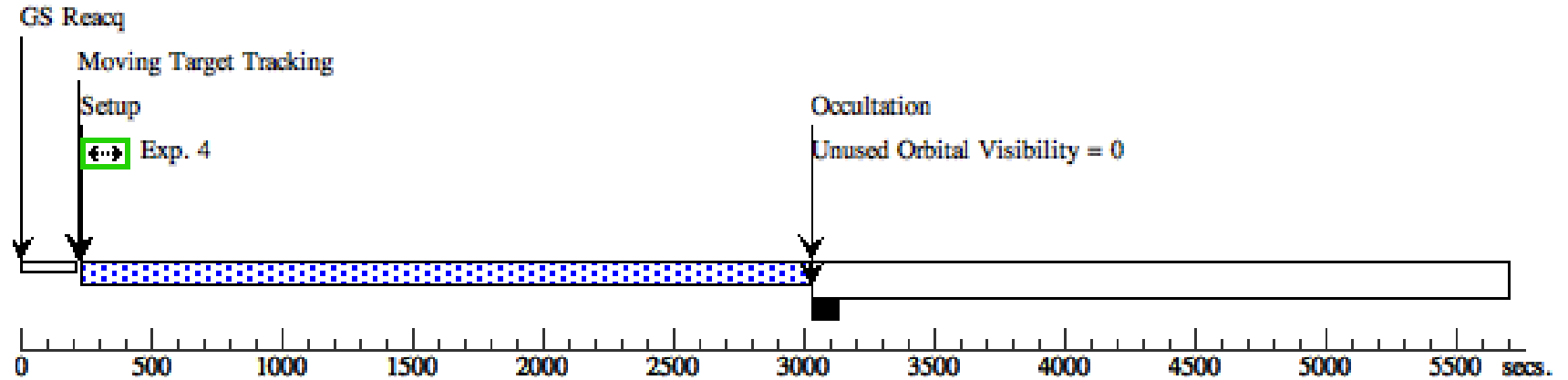
Proposal 14106 - Visit 02 - Probing Ceres' exosphere and water vapor outgassing

#	Label (ETC Run)	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time (Total)/[Actual Dur.]	Orbit
1	(COS.SA.83 0083)	(3) CERES-COPY	COS/NUV, ACQ/SEARCH, PSA	G230L 3000 A	SCAN-SIZE=3; CENTER=FLUX-W T-FLR	GS ACQ SCENARI O BASE1B3		2 Secs (2 Secs) [==>]	[1]
<p><i>Comments: For the ETC, a SED of Ceres' surface brightness between 1200 and 4200 A was generated with a solar spectrum for average solar wind activity from UARS. The spectrum was scaled to Ceres' distance to the sun of ~2.9 AU during the observation and with an interpolated geometric albedo based on the albedo values from Li et al., 2006, Icarus.</i></p> <p><i>The ETC run for extended source yield a SNR of 40 after 1.1 seconds, so we choose 10 seconds for a sufficient margin.</i></p> <p><i>A imaging ETC run (not TA) was also performed: COS.ta.727578</i></p>									
2	(COS.sp.717 649)	(3) CERES-COPY	COS/FUV, TIME-TAG, PSA	G130M 1327 A	FP-POS=1; BUFFER-TIME=30 00	POS TARG null,-1.9 5		1800 Secs (1904 Secs) [==>1904.0 Secs ]	[1]
3	(COS.sp.717 650)	(3) CERES-COPY	COS/FUV, TIME-TAG, PSA	G130M 1327 A	FP-POS=2; BUFFER-TIME=30 00	SAME POS AS 2		2700 Secs (2737 Secs) [==>2737.0 Secs ]	[2]
<p><i>Comments: ETC buffer time calculations yields times larger than exposure time of ~1200 sec, so buffer time is set to exposure time</i></p>									
4	(COS.sp.717 650)	(3) CERES-COPY	COS/FUV, TIME-TAG, PSA	G130M 1327 A	FP-POS=3; BUFFER-TIME=30 00	SAME POS AS 2		2700 Secs (2737 Secs) [==>2737.0 Secs ]	[3]
<p><i>Comments: ETC buffer time calculations yields times larger than exposure time of ~1200 sec, so buffer time is set to exposure time</i></p>									
5	(COS.sp.717 650)	(3) CERES-COPY	COS/FUV, TIME-TAG, PSA	G130M 1327 A	FP-POS=4; BUFFER-TIME=30 00	SAME POS AS 2		2700 Secs (2737 Secs) [==>2737.0 Secs ]	[4]
<p><i>Comments: ETC buffer time calculations yields times larger than exposure time of ~1200 sec, so buffer time is set to exposure time</i></p>									
6	(COS.sp.717 650)	(3) CERES-COPY	COS/FUV, TIME-TAG, PSA	G130M 1327 A	FP-POS=4; BUFFER-TIME=30 00	POS TARG null,-20; NEW OBSET FULL ACQ; GS ACQ SCENARI O BASE1B3		2700 Secs (2550 Secs) [==>2550.0 Secs ]	[5]
<p><i>Comments: ETC buffer time calculations yields times larger than exposure time of ~1200 sec, so buffer time is set to exposure time</i></p>									



### Orbit 3

Server Version: 20160601



### Orbit 4

Server Version: 20160601

