



# 11540 - COS-GTO: Search for Hydrocarbons and Nitriles in Pluto's Atmosphere

Cycle: 17, Proposal Category: GTO/COS

(Availability Mode: SUPPORTED)

## INVESTIGATORS

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Dr. Nathaniel J. Cunningham (CoI)	University of Nebraska - Lincoln	

## 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) PLUTO-90LONG	COS/NUV	3	14-Sep-2010 21:00:46.0	yes
02	(2) PLUTO-270LONG	COS/NUV	2	14-Sep-2010 21:00:53.0	yes
03	(2) PLUTO-270LONG	COS/NUV	2	14-Sep-2010 21:00:58.0	yes

7 Total Orbits Used

## ABSTRACT

Methane is highly abundant in Pluto's atmosphere, and methane photolysis is the starting point for a series of chemical processes that should result in the production of hydrocarbons and nitriles. Photochemical modeling of Pluto's atmosphere has suggested that detectable abundances of various hydrocarbons and nitriles should occur on Pluto. However, past analysis of 40 orbits of archival HST/FOS data in the mid-UV has only produced upper limits on abundances of C<sub>4</sub>H<sub>2</sub>, C<sub>6</sub>H<sub>2</sub>, HC<sub>3</sub>N, and C<sub>4</sub>N<sub>2</sub>. We will use COS to obtain spectra from 2060-2460Å, including absorption bands of the hydrocarbon diacetylene (C<sub>4</sub>H<sub>2</sub>) and the nitrile cyanoacetylene (HC<sub>3</sub>N). Previously-measured 2-sigma upper limits for these compounds are

somewhat below the values computed in the poorly-constrained models; the measurement uncertainties themselves are of the same order as the modeled values. By reducing the uncertainties by a factor of a few to several, we aim to detect the presence of these compounds, or to provide more restrictive abundance limits. These measurements will provide valuable new data on the nature and chemistry of the Plutonian atmosphere.

### **OBSERVING DESCRIPTION**

COS NUV spectra of Pluto from 2060 to 2460Å using G230L at 3360Å central wavelength, for a total of 5 orbits. Only one grating position (central wavelength) is required to cover the specified wavelength band.

Observations will be divided into two visits: 2 orbits at one central meridional longitude, and 3 orbits at another; in this way, the spectra can be coadded for the greatest signal-to-noise, and compared to look for longitude-specific differences in absorption spectrum. The chosen longitudes (90 and 270 degrees) correspond to greatest angular separation of Charon from Pluto, reaching 0.85"; the position angle (CCW from north) of Charon from Pluto is about 153 and 333 degrees for these cases. ORIENT is specified in order to minimize spectral confusion, by aligning Charon in the cross-dispersion direction.

### **ADDITIONAL COMMENTS**

ORIENT calculation: U3 axis is at 135 degrees from COS +Y (spatial) direction, and at  $135+180 = 315$  degrees from -Y

With Pluto viewed at CML = 90, Charon is near position angle 153 degrees; Pluto-Charon vector can extend along either +Y or -Y. So we have ORIENT near  $135+153 = 288$  degrees or near  $315 + 153 = 468 \implies 108$  degrees.

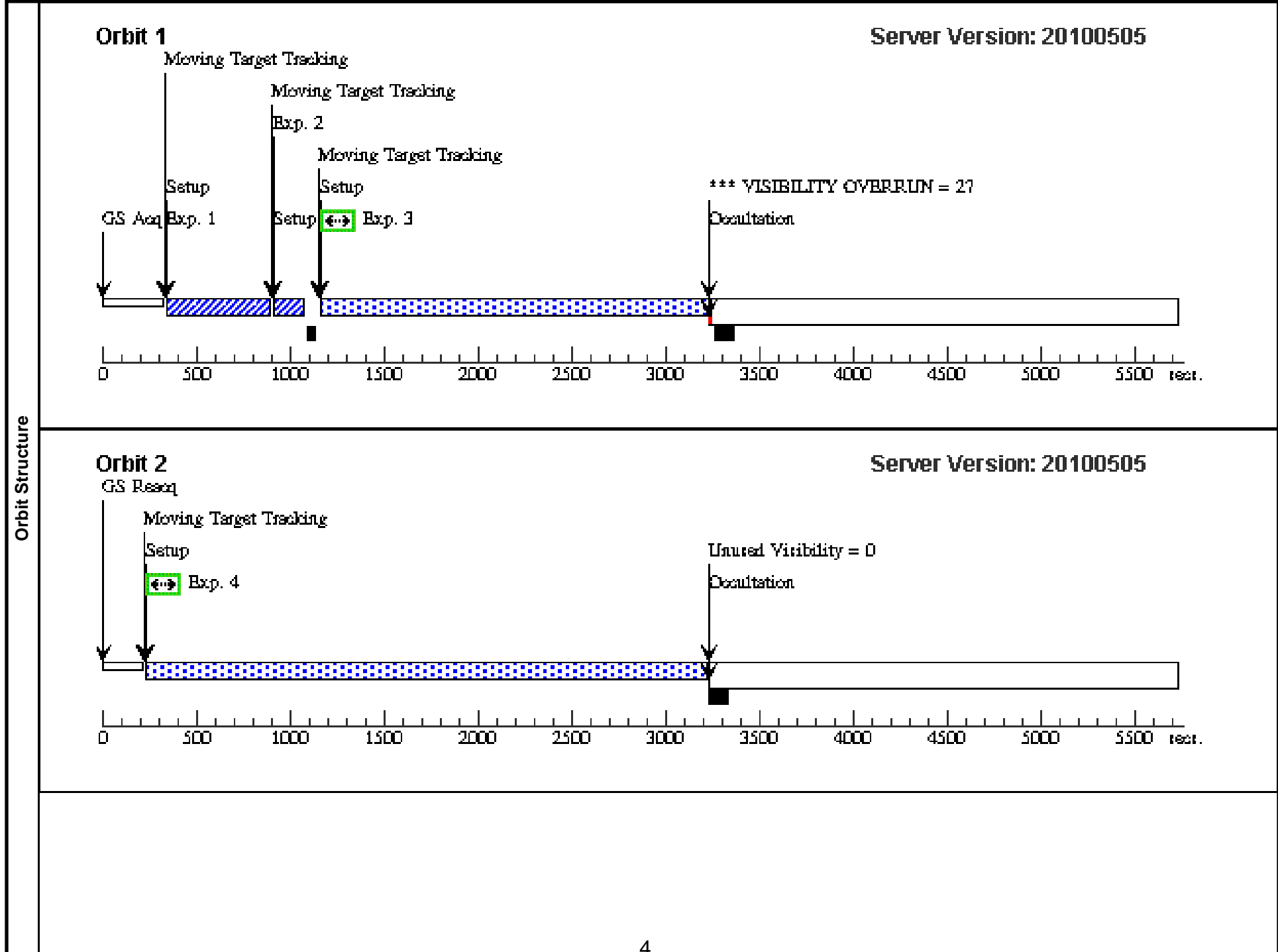
With Pluto viewed at CML = 270, Charon is near position angle 333 degrees (180 degrees from above). Same calculation as above --  $135 + 333 \implies 108$  degrees orient,  $315 + 333 \implies 288$  degrees.

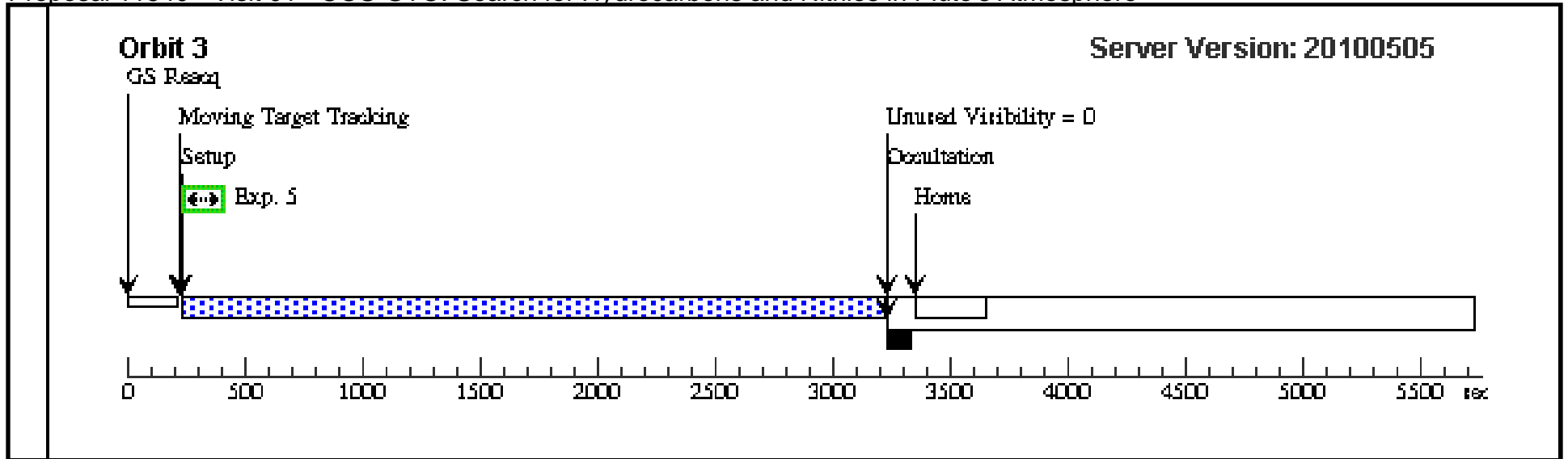
We've specified the desired CML +/- 15 degrees, which provides ~12 hr obs windows; ORIENT window of +/- 5 degrees keeps 4+ months available.

Proposal 11540 (STScI Edit Number: 6, Created: Tuesday, September 14, 2010 8:01:02 PM EST) - Overview

Wed Sep 15 01:01:02 GMT 2010

<b>Visit</b>	<b>Proposal 11540, Visit 01, completed</b> <b>Diagnostic Status: Warning</b> Scientific Instruments: COS/NUV Special Requirements: ORIENT 105D TO 110 D; BETWEEN 30-AUG-2010:00:00:00 AND 30-SEP-2010:23:59:59																																																																																
	(Visit 01) Warning (Orbit Planner): VISIBILITY OVERRUN																																																																																
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<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>(1)</td> <td>PLUTO-90LONG</td> <td>STD=PLUTO</td> <td></td> <td></td> <td>CML OF PLUTO FROM EARTH BETWEEN 80 100</td> <td>EARTH</td> </tr> </tbody> </table>	#	Name	Level 1	Level 2	Level 3	Window	Ephem Center	(1)	PLUTO-90LONG	STD=PLUTO			CML OF PLUTO FROM EARTH BETWEEN 80 100	EARTH	<p><i>Comments: about 1 magnitude dimmer in mid-UV relative to visible, based on albedo measurements -- 0.2 - 0.25 in mid UV, instead of 0.5 - 0.66 in visible (used mV = 15 solar-type spectrum for ETC)</i></p> <p><i>Specified window -- CML of 90+/-10 degrees -- puts Charon near largest separation from Pluto, and at position angle near 150 degrees.</i></p>																																																																	
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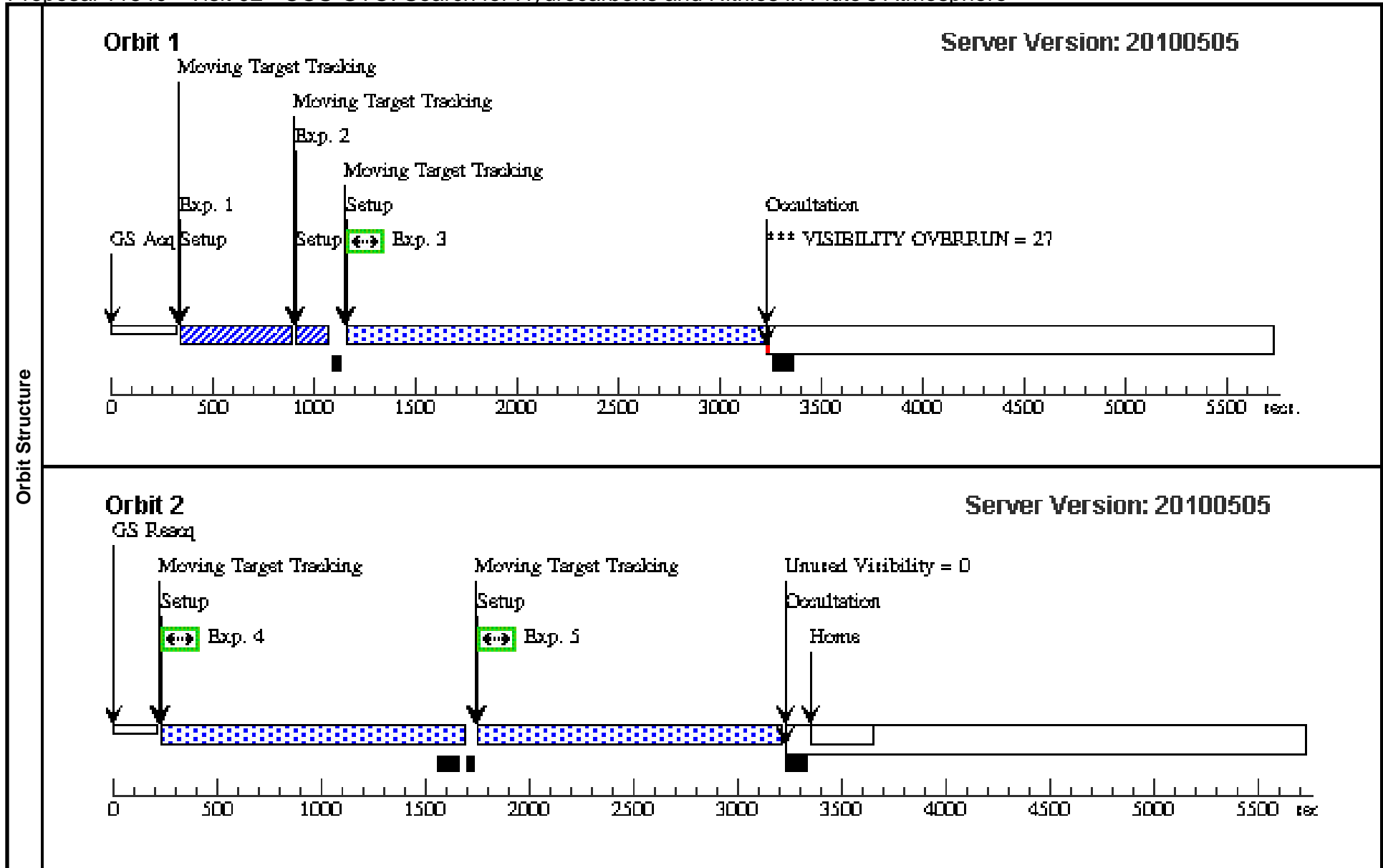




Proposal 11540 - Visit 01 - COS-GTO: Search for Hydrocarbons and Nitriles in Pluto's Atmosphere

Wed Sep 15 01:01:04 GMT 2010

<b>Visit</b>	<b>Proposal 11540, Visit 02, failed</b> <b>Diagnostic Status: Warning</b> Scientific Instruments: COS/NUV Special Requirements: ORIENT 280D TO 290 D; ORIENT 100D TO 110 D; BETWEEN 01-SEP-2010:00:00:00 AND 30-SEP-2010:23:59:59									
	(Visit 02) Warning (Orbit Planner): VISIBILITY OVERRUN									
<b>Diagnostics</b>										
<b>Solar System Targets</b>	#	Name	Level 1	Level 2	Level 3	Window	Ephem Center			
	(2)	PLUTO-270LONG	STD=PLUTO			CML OF PLUTO FROM EARTH BETWEEN 260 280	EARTH			
Comments: Specified window -- CML of 270+/-10 degrees -- puts Charon near largest separation from Pluto, and at position angle near 330 degrees.										
<b>Exposures</b>	#	Label	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time/[Actual Dur.]	Orbit
	1		(2) PLUTO-270LON G	COS/NUV, ACQ/SEARCH, PSA	MIRRORA	SCAN-SIZE=2	GS ACQ SCENARI O BASE1B3		25 Secs [==>]	[1]
	2		(2) PLUTO-270LON G	COS/NUV, ACQ/IMAGE, PSA	MIRRORA				25 Secs [==>]	[1]
	3		(2) PLUTO-270LON G	COS/NUV, TIME-TAG, PSA	G230L 3360 A	BUFFER-TIME=19 70; FP-POS=2			1970 Secs [==>]	[1]
	4		(2) PLUTO-270LON G	COS/NUV, TIME-TAG, PSA	G230L 3360 A	BUFFER-TIME=13 35; FP-POS=3			1445 Secs [==>]	[2]
	5		(2) PLUTO-270LON G	COS/NUV, TIME-TAG, PSA	G230L 3360 A	BUFFER-TIME=14 45; FP-POS=4			1445 Secs [==>]	[2]



Proposal 11540 - Visit 02 - COS-GTO: Search for Hydrocarbons and Nitriles in Pluto's Atmosphere

Wed Sep 15 01:01:04 GMT 2010

<b>Visit</b>	<b>Proposal 11540, Visit 03, implementation</b> <b>Diagnostic Status: Warning</b> Scientific Instruments: COS/NUV Special Requirements: ORIENT 280D TO 290 D; ORIENT 75D TO 135 D; BETWEEN 01-SEP-2010:00:00:00 AND 31-OCT-2010:23:59:59									
	(Visit 03) Warning (Orbit Planner): VISIBILITY OVERRUN									
<b>Diagnostics</b>										
<b>Solar System Targets</b>	<b>#</b>	<b>Name</b>	<b>Level 1</b>	<b>Level 2</b>	<b>Level 3</b>	<b>Window</b>	<b>Ephem Center</b>			
	(2)	PLUTO-270LONG	STD=PLUTO				CML OF PLUTO FROM EARTH BETWEEN 260 280	EARTH		
<i>Comments: Specified window -- CML of 270+/-10 degrees -- puts Charon near largest separation from Pluto, and at position angle near 330 degrees.</i>										
<b>Exposures</b>	<b>#</b>	<b>Label</b>	<b>Target</b>	<b>Config,Mode,Aperture</b>	<b>Spectral Els.</b>	<b>Opt. Params.</b>	<b>Special Reqs.</b>	<b>Groups</b>	<b>Exp. Time/[Actual Dur.]</b>	<b>Orbit</b>
	1		(2) PLUTO-270LON G	COS/NUV, ACQ/SEARCH, PSA	MIRRORA	SCAN-SIZE=2	GS ACQ SCENARI O BASE1B3		25 Secs [==>]	[1]
	2		(2) PLUTO-270LON G	COS/NUV, ACQ/IMAGE, PSA	MIRRORA				25 Secs [==>]	[1]
	3		(2) PLUTO-270LON G	COS/NUV, TIME-TAG, PSA	G230L 3360 A	BUFFER-TIME=19 70; FP-POS=2			1970 Secs [==>]	[1]
	4		(2) PLUTO-270LON G	COS/NUV, TIME-TAG, PSA	G230L 3360 A	BUFFER-TIME=13 35; FP-POS=3			1445 Secs [==>]	[2]
	5		(2) PLUTO-270LON G	COS/NUV, TIME-TAG, PSA	G230L 3360 A	BUFFER-TIME=14 45; FP-POS=4			1445 Secs [==>]	[2]

