



## 11536 - COS-GTO: Sleuthing the Source of Distant Cometary Activity

Cycle: 17, Proposal Category: GTO/COS

(Availability Mode: SUPPORTED)

### INVESTIGATORS

<i>Name</i>	<i>Institution</i>	<i>E-Mail</i>
<b>Dr. James C. Green (PI)</b>	<b>University of Colorado at Boulder</b>	<b>jgreen@origins.colorado.edu</b>
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Dr. S. Alan Stern (CoI)	Southwest Research Institute	astern@swri.edu
Dr. John R. Spencer (CoI) (Contact)	Southwest Research Institute	spencer@boulder.swri.edu
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) 2060-CHIRON	COS/FUV COS/NUV	3	25-May-2010 21:00:57.0	yes
02	(2) 29P-SW1	COS/FUV WFC3/UVIS	1	25-May-2010 21:01:04.0	yes
03	(2) 29P-SW1	COS/FUV WFC3/UVIS	1	25-May-2010 21:01:10.0	yes
04	(2) 29P-SW1	COS/FUV WFC3/UVIS	1	25-May-2010 21:01:13.0	yes

6 Total Orbits Used

## **ABSTRACT**

Distant comets and Centaurs often show cometary activity and outbursts well beyond 3 AU, the boundary of the sublimation zone of water. Super-volatiles (most likely CO, but possibly CH<sub>4</sub>, N<sub>2</sub>, or S<sub>2</sub>) are suspected to be responsible, but have never been detected in distant comets in the UV. We will obtain FUV spectra of active bodies to cover important CO emission bands. We plan two sets of observations: comet 29P/Schwassmann-Wachmann at 6 AU, whose outbursts are too short to capture as a Target of Opportunity, but which also shows persistent cometary activity in quiescence; and Target of Opportunity observations of the Centaur 2060 Chiron (at ~15.5 AU) in outburst.

## **OBSERVING DESCRIPTION**

TOO observations of Chiron, after continued brightening beyond 0.7 visual magnitudes. 3 consecutive orbits, with grating G160M at central wavelength 1589? and 1623?. Scheduled observations of 29P/SW-1 with the same grating configuration; three separate 1-orbit visits staggered at 15+ day intervals, in order to improve chances of catching at least one outburst.

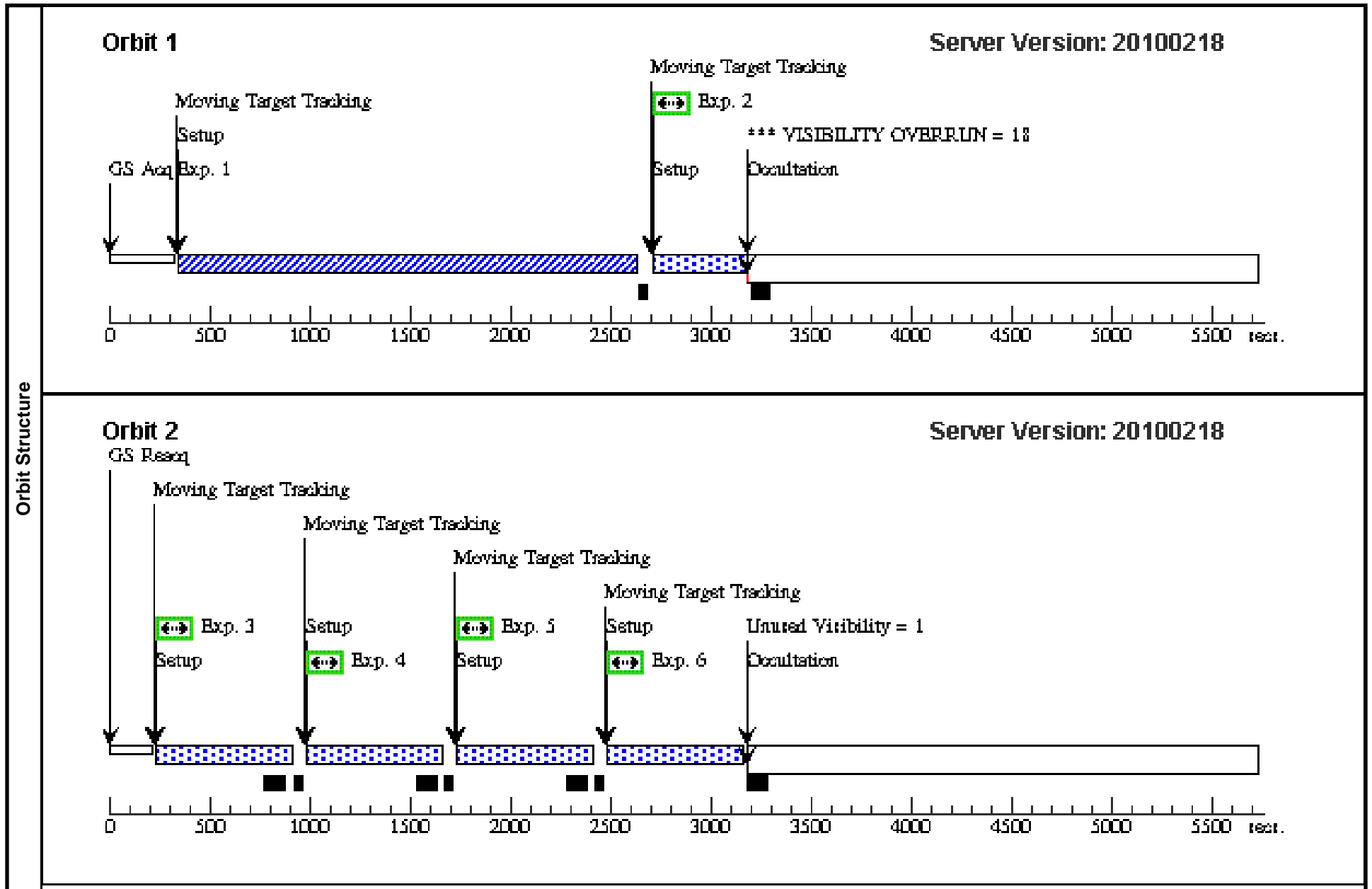
Proposal 11536 - Visit 01 - COS-GTO: Sleuthing the Source of Distant Cometary Activity

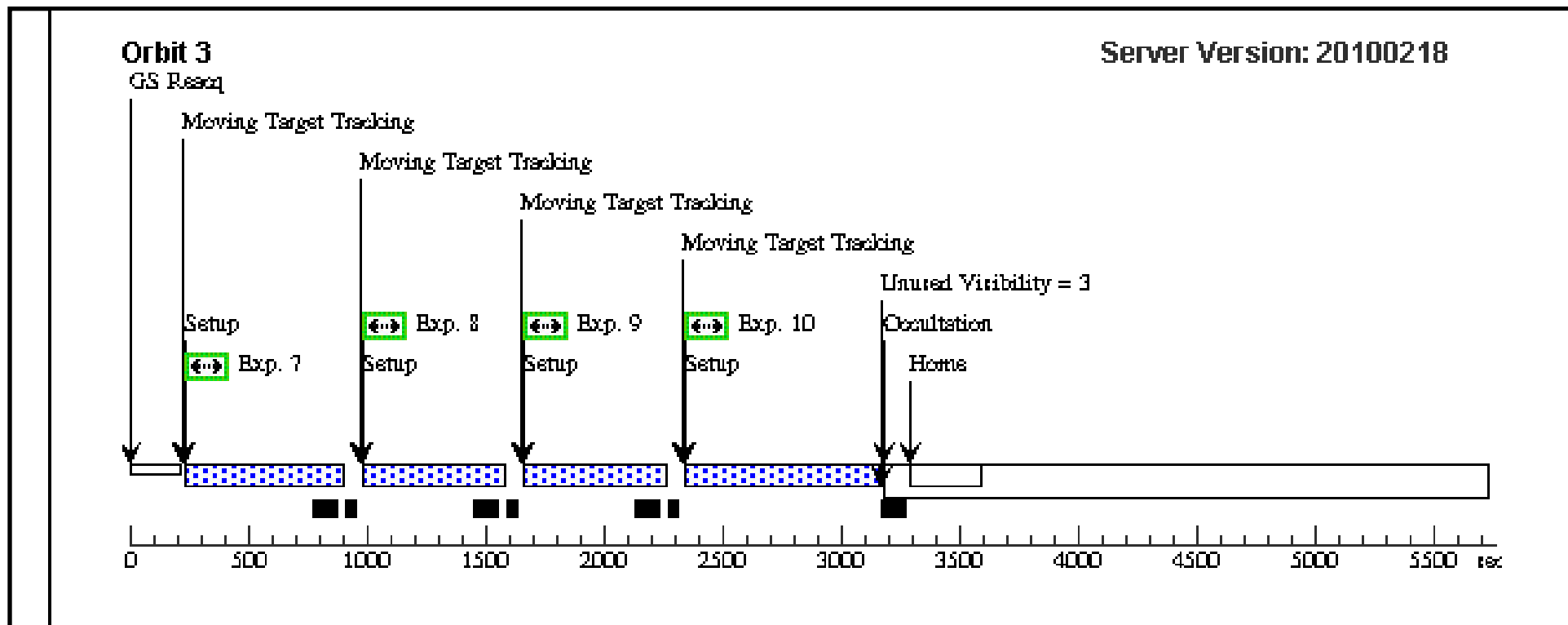
Wed May 26 01:01:17 GMT 2010

<b>Visit</b>	<p><b>Proposal 11536, Visit 01, scheduling</b></p> <p><b>Diagnostic Status: Warning</b></p> <p>Scientific Instruments: COS/NUV, COS/FUV</p> <p>Special Requirements: SCHED 40%</p> <p><i>Comments: Oh hold as Target of Opportunity waiting for outburst.</i></p>						
	<p><b>Diagnosics</b></p> <p>(Visit 01) Warning (Orbit Planner): VISIBILITY OVERRUN</p>						
<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>
	(1)	2060-CHIRON	TYPE=ASTEROID,A=13.7038709242 6883,E=.378760177032046,I=6.92974 7024642194,O=209.3385535947615, W=339.898328429563,M=98.7290382 2472631,EQUINOX=J2000,EPOCH= 04-JAN-2010:00:00:00				EARTH
<p><i>Comments: Orbital elements retrieved from JPL Small-Body Database Browser, http://ssd.jpl.nasa.gov/sbdb.cgi#top on 1/21/2010</i></p> <p><i>Date of solution: 2009-Oct-06 16:17:00; based on 1104 observations</i></p> <p><i>Formal errors in sky coordinates through 2010: &lt;= 0.18", from JPL Horizons ephemeris generator, http://ssd.jpl.nasa.gov/horizons.cgi</i></p>							

Proposal 11536 - Visit 01 - COS-GTO: Sleuthing the Source of Distant Cometary Activity

#	Label	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time/[Actual Dur.]	Orbit	
Exposures	1	(1) 2060-CHIRON	COS/NUV, ACQ/IMAGE, PSA	MIRRORA				945 Secs [==>]	[1]	
	<i>Comments: Acquisition time from ETC COS.A219019, assuming 19th magnitude point source with solar spectrum and average airglow, S/N = 40.</i>									
	2	(1) 2060-CHIRON	COS/FUV, TIME-TAG, PSA	G160M 1589 A	BUFFER-TIME=31 8; EXTENDED=YES; FP-POS=1			266 Secs [==>]	[1]	
	<i>Comments: ETC COS67398: 2" diameter (1" radius), 18th magnitude = 19.2 mags per sq arcsec, 8 R = 2.0e-16 erg/cm^2/s/sq. arcsec @ 1510? (5? wide band). Calculated buffer time is 2/3 of 93000s</i>									
	3	(1) 2060-CHIRON	COS/FUV, TIME-TAG, PSA	G160M 1589 A	BUFFER-TIME=51 5; FP-POS=1; EXTENDED=YES			625 Secs [==>]	[2]	
	4	(1) 2060-CHIRON	COS/FUV, TIME-TAG, PSA	G160M 1589 A	BUFFER-TIME=51 5; FP-POS=2; EXTENDED=YES			625 Secs [==>]	[2]	
	5	(1) 2060-CHIRON	COS/FUV, TIME-TAG, PSA	G160M 1589 A	BUFFER-TIME=51 5; FP-POS=3; EXTENDED=YES			625 Secs [==>]	[2]	
	6	(1) 2060-CHIRON	COS/FUV, TIME-TAG, PSA	G160M 1589 A	BUFFER-TIME=62 5; FP-POS=4; EXTENDED=YES			625 Secs [==>]	[2]	
	7	(1) 2060-CHIRON	COS/FUV, TIME-TAG, PSA	G160M 1623 A	BUFFER-TIME=43 5; FP-POS=1; EXTENDED=YES			545 Secs [==>]	[3]	
	8	(1) 2060-CHIRON	COS/FUV, TIME-TAG, PSA	G160M 1623 A	BUFFER-TIME=43 5; FP-POS=2; EXTENDED=YES			545 Secs [==>]	[3]	
9	(1) 2060-CHIRON	COS/FUV, TIME-TAG, PSA	G160M 1623 A	BUFFER-TIME=43 5; FP-POS=3; EXTENDED=YES			545 Secs [==>]	[3]		
10	(1) 2060-CHIRON	COS/NUV, TIME-TAG, PSA	G230L 3000 A	BUFFER-TIME=54 5			545 Secs [==>]	[3]		





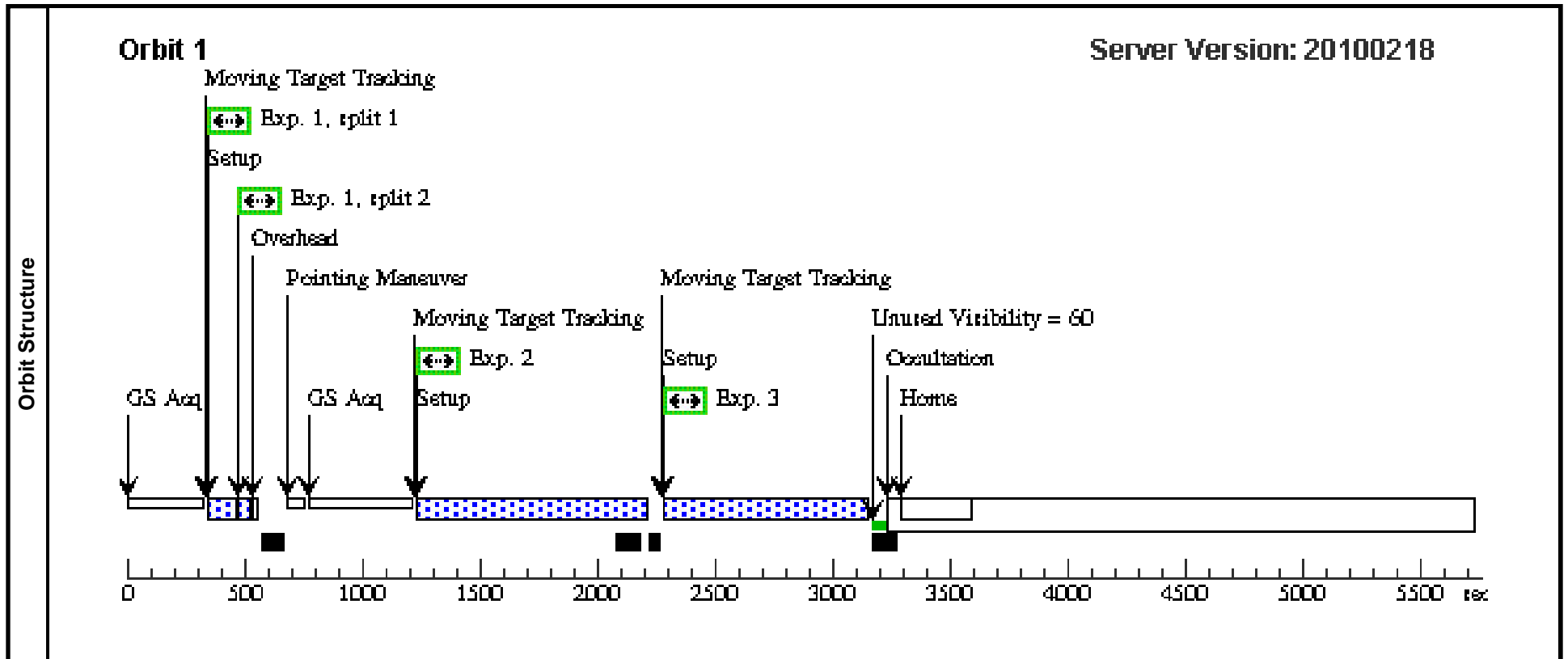
Proposal 11536 - Visit 02 - COS-GTO: Sleuthing the Source of Distant Cometary Activity

Wed May 26 01:01:18 GMT 2010

<b>Visit</b>	<p><b>Proposal 11536, Visit 02, completed</b></p> <p><b>Diagnostic Status: Warning</b></p> <p>Scientific Instruments: COS/FUV, WFC3/UVIS</p> <p>Special Requirements: (none)</p>						
	<p>(Visit 02) Warning (Form): A target acquisition should probably be performed before doing spectroscopy or coronagraphy with STIS or COS.</p>						
<b>Diagnosics</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)	29P-SW1	TYPE=COMET,Q=5.7177821417888 301525067,E=0.044999022128034187 0513,I=9.3946369470700457071643, O=312.634502088065,W=48.1693967 0906947,T=30-JUN- 2004:09:21:17,EQUINOX=J2000,EPO CH=10-JAN-2009:00:00:00				
<p><i>Comments: Orbital elements retrieved from JPL Small-Body Database Browser, <a href="http://ssd.jpl.nasa.gov/sbdb.cgi#top">http://ssd.jpl.nasa.gov/sbdb.cgi#top</a> on 1/21/2010</i></p> <p><i>Date of solution: 2010-Jan-08 12:05:58; based on 12538 observations</i></p> <p><i>Formal errors in sky coordinates through 2010: &lt;= 0.08", from JPL Horizons ephemeris generator, <a href="http://ssd.jpl.nasa.gov/horizons.cgi">http://ssd.jpl.nasa.gov/horizons.cgi</a></i></p>							

Proposal 11536 - Visit 02 - COS-GTO: Sleuthing the Source of Distant Cometary Activity

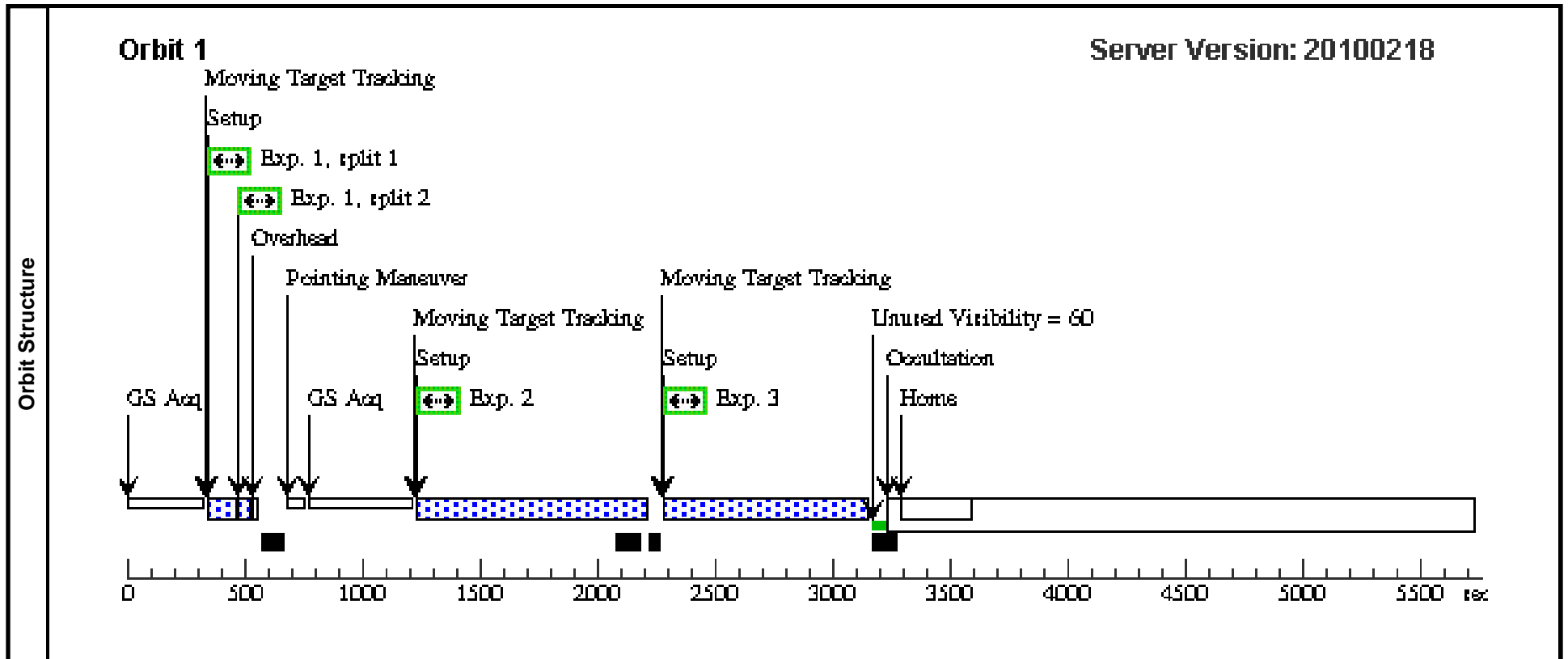
	#	Label	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time/[Actual Dur.]	Orbit
<b>Exposures</b>	1		(2) 29P-SW1	WFC3/UVIS, ACCUM, UVIS	F606W	BIN=3			100 Secs [==>(Split 1)] [==>(Split 2)]	[1]
	<p><i>Comments: Visible context image, to check comet morphology/brightness/activity level.</i></p> <p><i>Use F606W filter for maximum signal; comet spectrum from 4500 - 6500 A is largely flat.</i></p> <p><i>use 3x3 binning to</i></p> <ul style="list-style-type: none"> <li>- minimize overhead time, to get most UV spectroscopy time available, while still viewing field larger than expected comet nucleus (~1+ arcmin)</li> <li>- reduce readout noise, thereby maximizing S/N for faint comet coma</li> </ul> <p><i>Comet nucleus (up to 50km, viewed from 5.2+ AU) is unresolved even without binning. Coma covers ~ 1+ arcmin in visible images.</i></p>									
	2		(2) 29P-SW1	COS/FUV, TIME-TAG, PSA	G160M 1589 A	BUFFER-TIME=70 9; FP-POS=3; EXTENDED=YES			819 Secs [==>]	[1]
<p><i>Comments: ETC COS78955: approx. as point source, solar-type spectrum at max 13th magnitude, 2.5 R within 1" diameter: 5e-17 erg/cm^2/s @ 1510 A. Calculated buffer time is 2/3 of 93000s, even with high airglow. We will be safe even with very large outburst.</i></p>										
	3		(2) 29P-SW1	COS/FUV, TIME-TAG, PSA	G160M 1589 A	BUFFER-TIME=81 9; FP-POS=4; EXTENDED=YES			819 Secs [==>]	[1]



Proposal 11536 - Visit 03 - COS-GTO: Sleuthing the Source of Distant Cometary Activity

Wed May 26 01:01:19 GMT 2010

<b>Visit</b>	<b>Proposal 11536, Visit 03, scheduling</b> <b>Diagnostic Status: Warning</b> Scientific Instruments: COS/FUV, WFC3/UVIS Special Requirements: AFTER 02 BY 14.5 D TO 300 D																																													
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Proposal 11536 - Visit 04 - COS-GTO: Sleuthing the Source of Distant Cometary Activity

Wed May 26 01:01:19 GMT 2010

<b>Visit</b>	<b>Proposal 11536, Visit 04, implementation</b> <b>Diagnostic Status: Warning</b> Scientific Instruments: COS/FUV, WFC3/UVIS Special Requirements: AFTER 03 BY 15 D TO 300 D																																															
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