12538 - Detection of Hot (Escaping?) Hydrogen in the Martian Atmosphere

Cycle: 19, Proposal Category: GO

(Availability Mode: AVAILABLE)

INVESTIGATORS

Name	*Institution*	*E-Mail*
Prof. John T. Clarke (PI)	**Boston University**	**jclarke@bu.edu**
Dr. Jean L. Bertaux (CoI) (ESA Member)	CNRS, Service d'Aeronomie	bertaux@aerov.jussieu.fr
Dr. Eric Quemerais (CoI) (ESA Member)	CNRS, Service d'Aeronomie	quemerai@aerov.jussieu.fr
Dr. Jean-Ives Chaufray (CoI) (ESA Member)	Universite Paris	chaufray@aerov.jussieu.fr
Dr. Jody K. Wilson (CoI)	Boston University	jkwilson@bu.edu
Dr. G. Randall Gladstone (CoI)	Southwest Research Institute	rgladstone@swri.edu

VISITS

Visit	*Targets used in Visit*	*Configurations used in Visit*	*Orbits Used*	*Last Orbit Planner Run*	*OP Current with Visit?*
01	(1) MARS (2) SKY-NEAR-MARS-VISIT-01	STIS/FUV-MAMA	4	02-Nov-2011 21:19:08.0	yes
02	(1) MARS	STIS/FUV-MAMA	3	02-Nov-2011 21:19:16.0	yes
03	(3) SKY-NEAR-MARS-VISIT-02	STIS/FUV-MAMA	1	02-Nov-2011 21:19:22.0	yes

8 Total Orbits Used

ABSTRACT

This proposal is to make STIS spectroscopic observations of the H Ly alpha emission line profile from Mars to determine the fraction of hot hydrogen in the martian corona. Prior ACS/SBC images of the hydrogen corona have shown its large extent, and found it to be more highly variable than previously thought. The variation in the extent of the corona appears to be dependent on the water vapor abundance in the lower atmosphere, which would have profound implications for the escape of water over the history of Mars. The next step is to isolate the fraction of H atoms in the

corona that are superthermal, which can be done using STIS E140H and a long narrow aperture (52x0.2), providing 0.025 nm resolution. These observations are the next step is addressing the escape of hydrogen and water from Mars, and extending the loss rate into the past.

OBSERVING DESCRIPTION

This proposal is for STIS E140H 52x0.2 observations with the aperture E/W across Mars near opposition (Feb/March 2012). With STIS E140H and the 52x0.5 aperture the FWHM resolution at Ly is .0057 nm, and the count rate is 0.4 counts/sec – kR per arc sec2. We propose the narrower 52x0.2 aperture to increase the spectral resolution to ~ .0025 nm, but this will also decrease the count rate to 0.16 cts/sec-kR in the same aperture length. This spectral resolution corresponds to a 500 K Voigt profile, easily sufficient to separate the ~300 K thermal component broadened by multiple scattering (Fig. 2) from a hot (~ 1000 K) component. These observations will concentrate on the H line, ~ 6 kR on the disc, giving 38 counts per 0.2 arc sec resolution element in a 1000 sec exposure. To detect a hot component down to ~ 200 R at 3, we will need a total 8000 sec exposure time (3 orbits), and we can then bin the data along the aperture as needed to improve the S/N on the broad emission from the hot atoms in the wings of the line.

The geocoronal H Ly emission will contaminate one wing of the martian line. We propose to split the observations into 2 visits, one pre-opposition and one post-opposition, using the LOS orbital speeds of the Earth and Mars to Doppler shift the geocoronal line by 2 spectral resolution elements (.005 nm or 12 km/sec) in each direction, then average the spectra. Each visit will consist of 3 orbits observing Mars and 1 orbit observing the sky background a few arc min from Mars (to aid in the background subtraction). The roll angle will be loosely constrained to have the aperture E/W across Mars. Mars' motion across the sky generally makes it possible to locate good guide stars within any multi-week observing window, and we have shown in GO 8658 that bright object protection and counting rate limits will not hinder the observations of Mars. The long-slit mode of STIS E140H has been used many times for planetary observations, and has been well calibrated in our earlier programs (mainly for observations of Jupiter). The total program is for 8 HST orbits.

Visit

Proposal 12538, Visit 01, implementation Thu Nov 03 01:19:25 GMT 2011

Diagnostic Status: Warning

Scientific Instruments: STIS/FUV-MAMA

Special Requirements: ORIENT 305D TO 315. D; BETWEEN 2012.021:00:00:00 AND 2012.028:00:00:00; VISIBILITY INTERVAL 53 M

Diagnostics

(Visit 01) Warning (Form): A target acquisition should probably be performed before doing spectroscopy or coronography with STIS or COS.

(Exposure 1 (Visit 01)) Warning (Form): Sensitive exposures should have an ETC run number provided.

(Exposure 2 (Visit 01)) Warning (Form): Sensitive exposures should have an ETC run number provided.

(Exposure 3 (Visit 01)) Warning (Form): Sensitive exposures should have an ETC run number provided.

(Exposure 4 (Visit 01)) Warning (Form): Sensitive exposures should have an ETC run number provided.

(Exposure 5 (Visit 01)) Warning (Form): Sensitive exposures should have an ETC run number provided.

(Exposure 6 (Visit 01)) Warning (Form): Sensitive exposures should have an ETC run number provided.

(Exposure 7 (Visit 01)) Warning (Form): Sensitive exposures should have an ETC run number provided.

(Exposure 8 (Visit 01)) Warning (Form): Sensitive exposures should have an ETC run number provided.

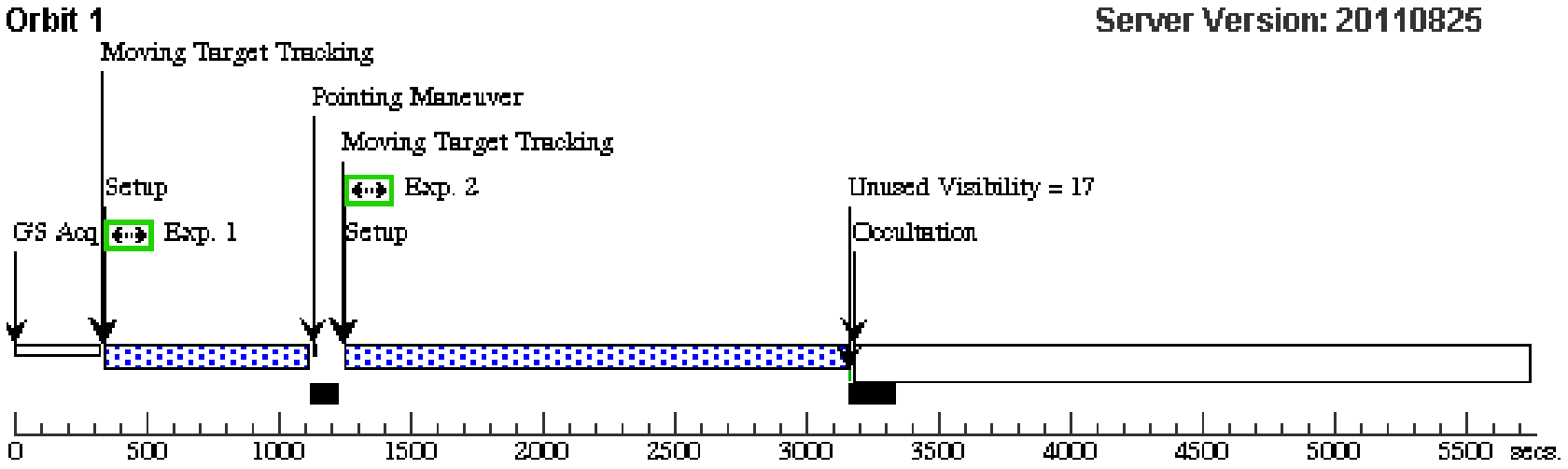
Solar System Targets

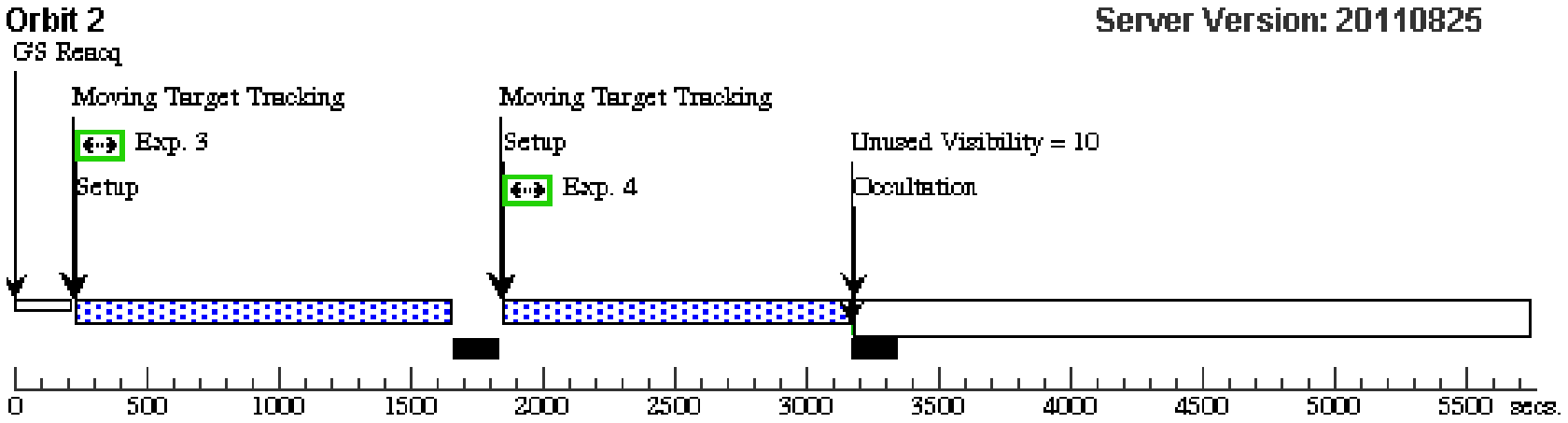
#	Name	Level 1	Level 2	Level 3	Window	Ephem Center
(1)	MARS	STD=MARS				EARTH
Comments: Long-aperture spectra centered on Mars, w/roll angle to place aperture close to E/W across disk - final roll angle will depend on time of year of observation.						
(2)	SKY-NEAR-MARS-VISIT-01	STD=MARS	TYPE=POS_ANGLE,RAD=300,ANG=10,REF=NORTH			EARTH
Comments: offset 5 arc min from Mars for sky background measurement						

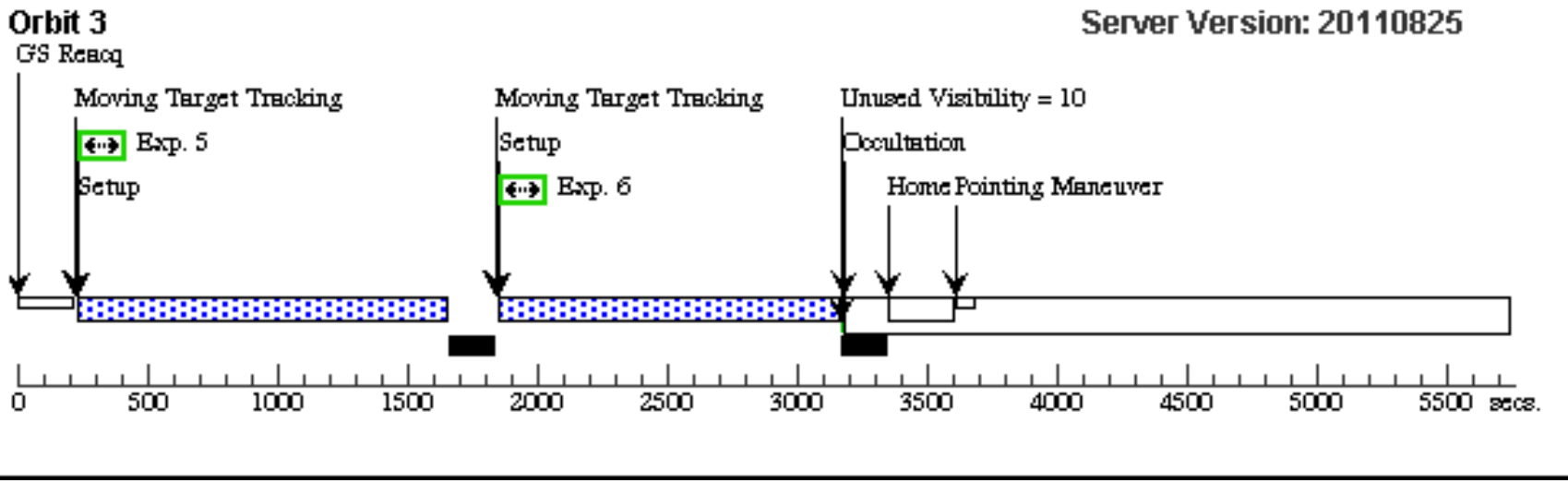
Exposures

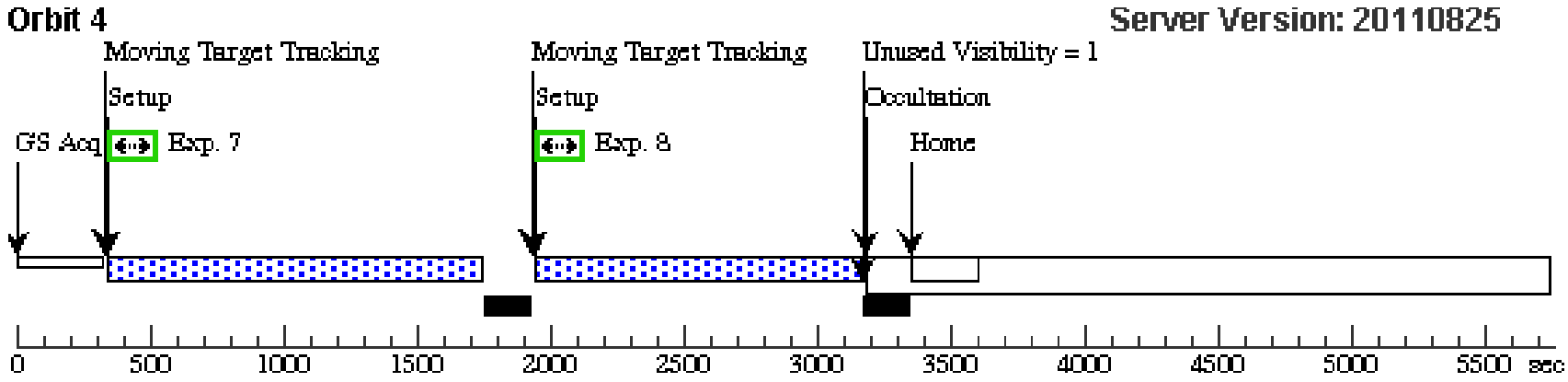
#	Label	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time/[Actual Dur.]	Orbit
1		(1) MARS	STIS/FUV-MAMA, ACCUM, 25MAMA	MIRROR		GS ACQ SCENARIO BASE1B3		600 Secs *[==>]*	 ***[1]***
2		(1) MARS	STIS/FUV-MAMA, TIME-TAG, 52X0.2	E140H 1234 A	BUFFER-TIME=890; WAVECAL=NO			1720 Secs *[==>]*	 ***[1]***
3		(1) MARS	STIS/FUV-MAMA, TIME-TAG, 52X0.2	E140H 1234 A	BUFFER-TIME=700; WAVECAL=NO			1400 Secs *[==>]*	 ***[2]***
4		(1) MARS	STIS/FUV-MAMA, TIME-TAG, 52X0.2	E140H 1234 A	BUFFER-TIME=670; WAVECAL=NO			1290 Secs *[==>]*	 ***[2]***
5		(1) MARS	STIS/FUV-MAMA, TIME-TAG, 52X0.2	E140H 1234 A	BUFFER-TIME=700; WAVECAL=NO			1400 Secs *[==>]*	 ***[3]***
6		(1) MARS	STIS/FUV-MAMA, TIME-TAG, 52X0.2	E140H 1234 A	BUFFER-TIME=670; WAVECAL=NO			1290 Secs *[==>]*	 ***[3]***
7		(2) SKY-NEAR-MARS-VISIT-01	STIS/FUV-MAMA, TIME-TAG, 52X0.2	E140H 1234 A	BUFFER-TIME=640; WAVECAL=NO	NEW OBSET FULL ACQ; GS ACQ SCENARIO BASE1B3		1205 Secs *[==>]*	 ***[4]***
8		(2) SKY-NEAR-MARS-VISIT-01	STIS/FUV-MAMA, TIME-TAG, 52X0.2	E140H 1234 A	BUFFER-TIME=640; WAVECAL=NO			1205 Secs *[==>]*	 ***[4]***

Orbit Structure






Orbit 3
Server Version: 20110825
GS Reacq
Moving Target Tracking
Exp. 5
Setup
Moving Target Tracking
Setup
Exp. 6
Unused Visibility = 10
Occultation
Home Pointing Maneuver
0
500
1000
1500
2000
2500
3000
3500
4000
4500
5000
5500
secs.


Orbit 4
Server Version: 20110825
Moving Target Tracking
Setup
GS Acq
Exp. 7
Moving Target Tracking
Setup
Exp. 8
Unused Visibility = 1
Occultation
Home
0
500
1000
1500
2000
2500
3000
3500
4000
4500
5000
5500
sec

Visit

Proposal 12538, Visit 02, implementation Thu Nov 03 01:19:26 GMT 2011

Diagnostic Status: Warning

Scientific Instruments: STIS/FUV-MAMA

Special Requirements: ORIENT 126.D TO 133. D; BETWEEN 2012.107:00:00:00 AND 2012.128:00:00:00

Diagnostics

(Visit 02) Warning (Form): A target acquisition should probably be performed before doing spectroscopy or coronography with STIS or COS.

(Exposure 1 (Visit 02)) Warning (Form): Sensitive exposures should have an ETC run number provided.

(Exposure 2 (Visit 02)) Warning (Form): Sensitive exposures should have an ETC run number provided.

(Exposure 3 (Visit 02)) Warning (Form): Sensitive exposures should have an ETC run number provided.

(Exposure 4 (Visit 02)) Warning (Form): Sensitive exposures should have an ETC run number provided.

(Exposure 5 (Visit 02)) Warning (Form): Sensitive exposures should have an ETC run number provided.

(Exposure 6 (Visit 02)) Warning (Form): Sensitive exposures should have an ETC run number provided.

Solar System Targets

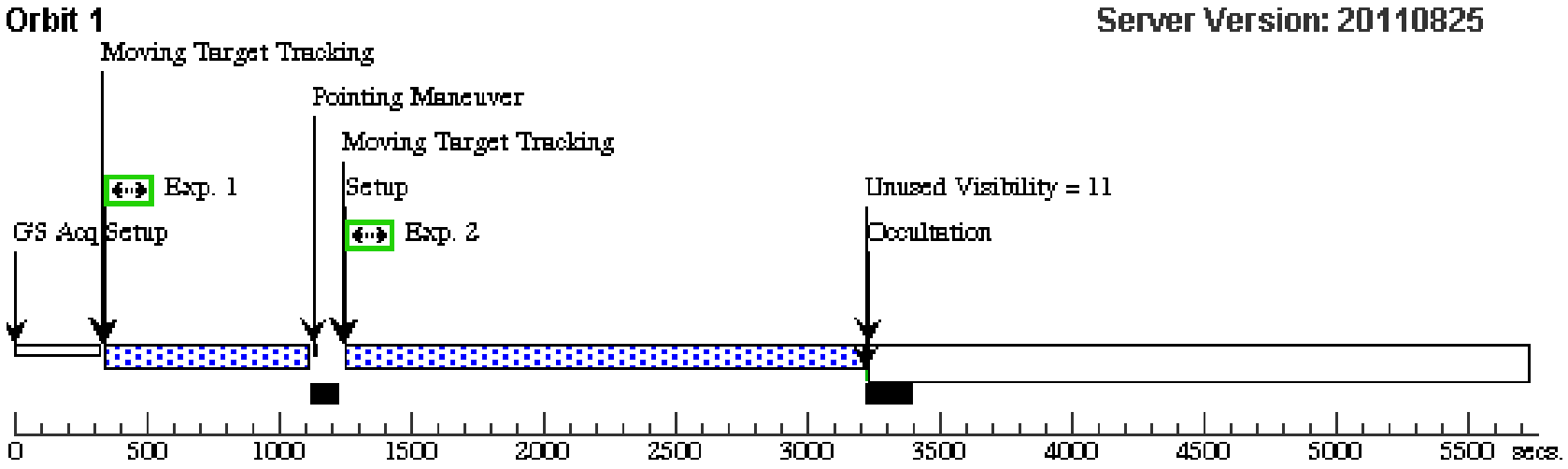
#	Name	Level 1	Level 2	Level 3	Window	Ephem Center
(1)	MARS	STD=MARS				EARTH

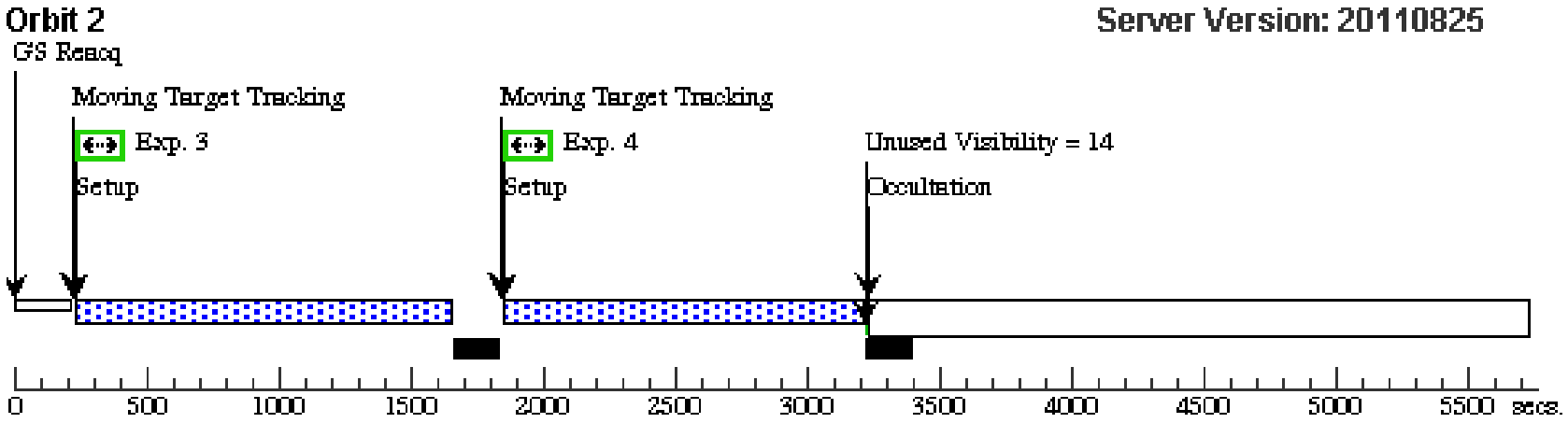
Comments: Long-aperture spectra centered on Mars, w/roll angle to place aperture close to E/W across disk - final roll angle will depend on time of year of observation.

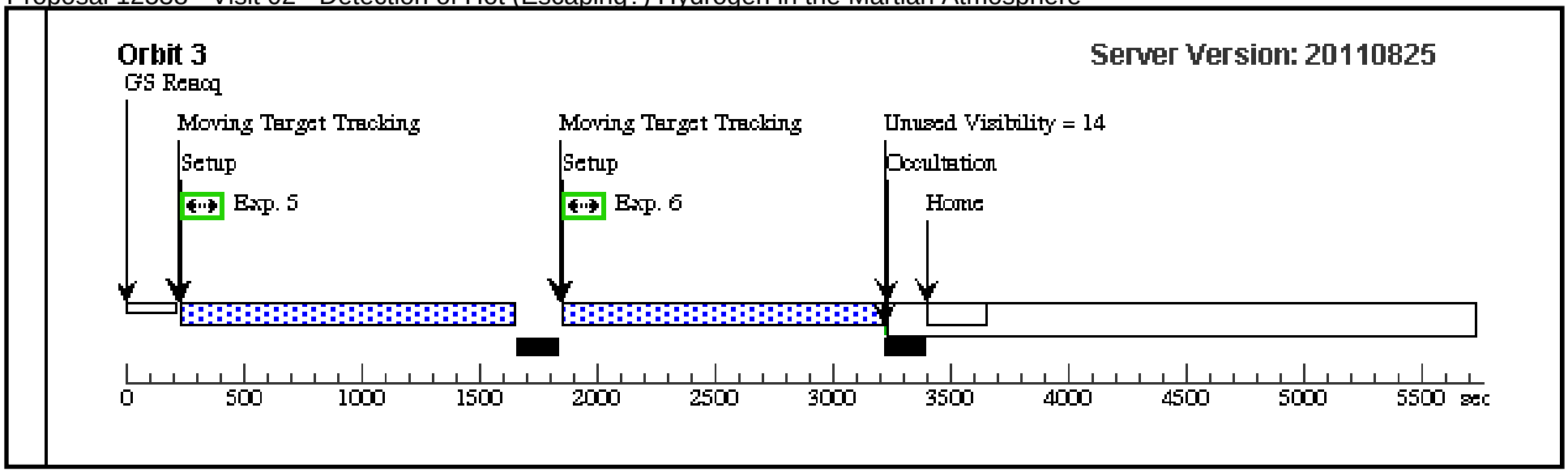
Exposures

#	Label	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time/[Actual Dur.]	Orbit
1		(1) MARS	STIS/FUV-MAMA, ACCUM, 25MAMA	MIRROR				600 Secs	
								[==>]	***[1]***
2		(1) MARS	STIS/FUV-MAMA, TIME-TAG, 52X0.2	E140H 1234 A	BUFFER-TIME=890; WAVECAL=NO			1780 Secs	
								[==>]	***[1]***
3		(1) MARS	STIS/FUV-MAMA, TIME-TAG, 52X0.2	E140H 1234 A	BUFFER-TIME=700; WAVECAL=NO			1400 Secs	
								[==>]	***[2]***
4		(1) MARS	STIS/FUV-MAMA, TIME-TAG, 52X0.2	E140H 1234 A	BUFFER-TIME=670; WAVECAL=NO			1340 Secs	
								[==>]	***[2]***
5		(1) MARS	STIS/FUV-MAMA, TIME-TAG, 52X0.2	E140H 1234 A	BUFFER-TIME=700; WAVECAL=NO			1400 Secs	
								[==>]	***[3]***
6		(1) MARS	STIS/FUV-MAMA, TIME-TAG, 52X0.2	E140H 1234 A	BUFFER-TIME=670; WAVECAL=NO			1340 Secs	
								[==>]	***[3]***

Orbit Structure






Orbit 3
Server Version: 20110825
GS Reacq
Moving Target Tracking
Setup
Exp. 5
Moving Target Tracking
Setup
Exp. 6
Unused Visibility = 14
Occultation
Home
0
500
1000
1500
2000
2500
3000
3500
4000
4500
5000
5500
sec

Visit

Proposal 12538, Visit 03, implementation Thu Nov 03 01:19:27 GMT 2011

Diagnostic Status: Warning

Scientific Instruments: STIS/FUV-MAMA

Special Requirements: AFTER_02 BY 2.9_Orbits TO 3.1_Orbits; BETWEEN 2012.107:00:00:00 AND 2012.128:00:00:00

Diagnostics

(Visit 03) Warning (Form): A target acquisition should probably be performed before doing spectroscopy or coronography with STIS or COS.

(Exposure 1 (Visit 03)) Warning (Form): Sensitive exposures should have an ETC run number provided.

(Exposure 2 (Visit 03)) Warning (Form): Sensitive exposures should have an ETC run number provided.

Solar System Targets

#	Name	Level 1	Level 2	Level 3	Window	Ephem Center
(3)	SKY-NEAR-MARS-VISIT-02	STD=MARS	TYPE=POS_ANGLE,RAD=300,ANG=30,REF=NORTH			EARTH

Comments: offset 5 arc min from Mars for sky background measurement

Exposures

#	Label	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time/[Actual Dur.]	Orbit
1		(3) SKY-NEAR-MARS-VISIT-02	STIS/FUV-MAMA, TIME-TAG, 52X0.2	E140H 1234 A	BUFFER-TIME=640; WAVECAL=NO			1232 Secs *[==>]*	*[1]*
2		(3) SKY-NEAR-MARS-VISIT-02	STIS/FUV-MAMA, TIME-TAG, 52X0.2	E140H 1234 A	BUFFER-TIME=640; WAVECAL=NO			1232 Secs *[==>]*	*[1]*

Orbit Structure