11645 - HST COS Observations of the Atmosphere and Airglow/Aurora of Enceladus

Cycle: 17, Proposal Category: GO

(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) ENCELADUS-EAST-ELONGATION	COS/FUV COS/NUV	2	23-Apr-2010 21:01:00.0	yes
02	(2) ENCELADUS-WEST-ELONGATION	COS/FUV COS/NUV	2	23-Apr-2010 21:01:08.0	yes

4 Total Orbits Used

ABSTRACT

Recent observations from several instruments on the Cassini spacecraft have revealed plumes of dust and water from the southern polar region, and clearly shown that Enceladus contributes large amounts of plasma to Saturn’s magnetosphere. This implies a global thin atmosphere containing water and likely other species, and a local region with orders of magnitude higher density near the plumes. While water and dust have been identified from the plumes, the presence of many other species in the atmosphere is possible and not yet ruled out. The identification of all

significant species in the atmosphere of Enceladus is of key importance to speculation about the source of the water plumes, and the implications for any form of life at or below the surface. In addition, modeling suggests that Enceladus' mass loading region may be comparable in extent to Io's, and interacts strongly with Saturn's corotating magnetic field and plasma. We have recently concluded a search for an auroral footprint of Enceladus in HST images, which set a low upper limit implying that the magnetospheric interaction is concentrated near Enceladus, rather than being communicated along field lines to Saturn's ionosphere. The next step will be to observe the interaction at the satellite, and to learn whatever we can about the physics of the release of the atmospheric gas. We propose here an exploratory set of spectral observations with HST COS to measure the solar reflection spectrum over a broad range of UV wavelengths for atmospheric absorption signatures. This will at the same time measure the emission spectrum of the atmosphere from both the leading and trailing hemispheres ? Enceladus orbit apart, as was done in HST STIS observations of Io to study its interaction at Jupiter. The higher sensitivity of COS will be needed to study the much smaller and relatively weakly-interacting Enceladus, and the outcome of these observations will determine the nature of future studies of the atmosphere of Enceladus and its plasma interaction with the Saturnian magnetosphere.

OBSERVING DESCRIPTION

The proposed observations will consist of COS spectra of Enceladus near eastern and western elongation, with the two visits scheduled ? Enceladus orbit apart. Each visit will consist of 2 orbits, for a total of 4 orbits in the program. In each orbit, Enceladus will first be acquired and centered in the aperture. Near elongation Enceladus appears ~ 30 arc sec from Saturn, which will be well outside the COS field of view, and should not introduce any problems for the acquisition or significant scattered light in the spectra. Each orbit will then consist of FUV and NUV low resolution spectra of the reflected solar continuum from the surface of Enceladus, plus any atmospheric absorption and airglow/auroral emissions. Two orbits are required to achieve the needed S/N in each visit, and to determine any short-term variations in emission strength. The two visits will be identical in terms of exposures, but scheduled at each elongation so that the leading and trailing sides (in terms of the plasma flow) of Enceladus can be observed and compared.

The COS far UV spectra will be split between the two low resolution grating settings to cover the whole spectrum without data gaps. The near UV low resolution grating will also be used at all four grating tilts. If STIS is available, it may prove more efficient to use STIS/CCD for the near UV spectroscopy. This will be explored in phase II. If COS were not available, the near UV observations could be undertaken with the STIS CCD.

However, the far UV observations will require the higher sensitivity of COS. In the event that COS is not available and the program changed to STIS, therefore, only 2 HST orbits would be scheduled for the near UV spectra. The observations in any event can be performed under either 3 or 2 gyro mode.

Visit

Proposal 11645, Visit 01, scheduling Sat Apr 24 01:01:12 GMT 2010

Diagnostic Status: Warning

Scientific Instruments: COS/NUV, COS/FUV

Special Requirements: AFTER 02 BY 0.5 D TO 0.9 D

Comments: The timing between the two visits as expressed in the AFTER requirement is important, but the order is not. The order may be reversed as long as the time separation is maintained.

Diagnostics

(Visit 01) Warning (Orbit Planner): VISIBILITY OVERRUN

Solar System Targets

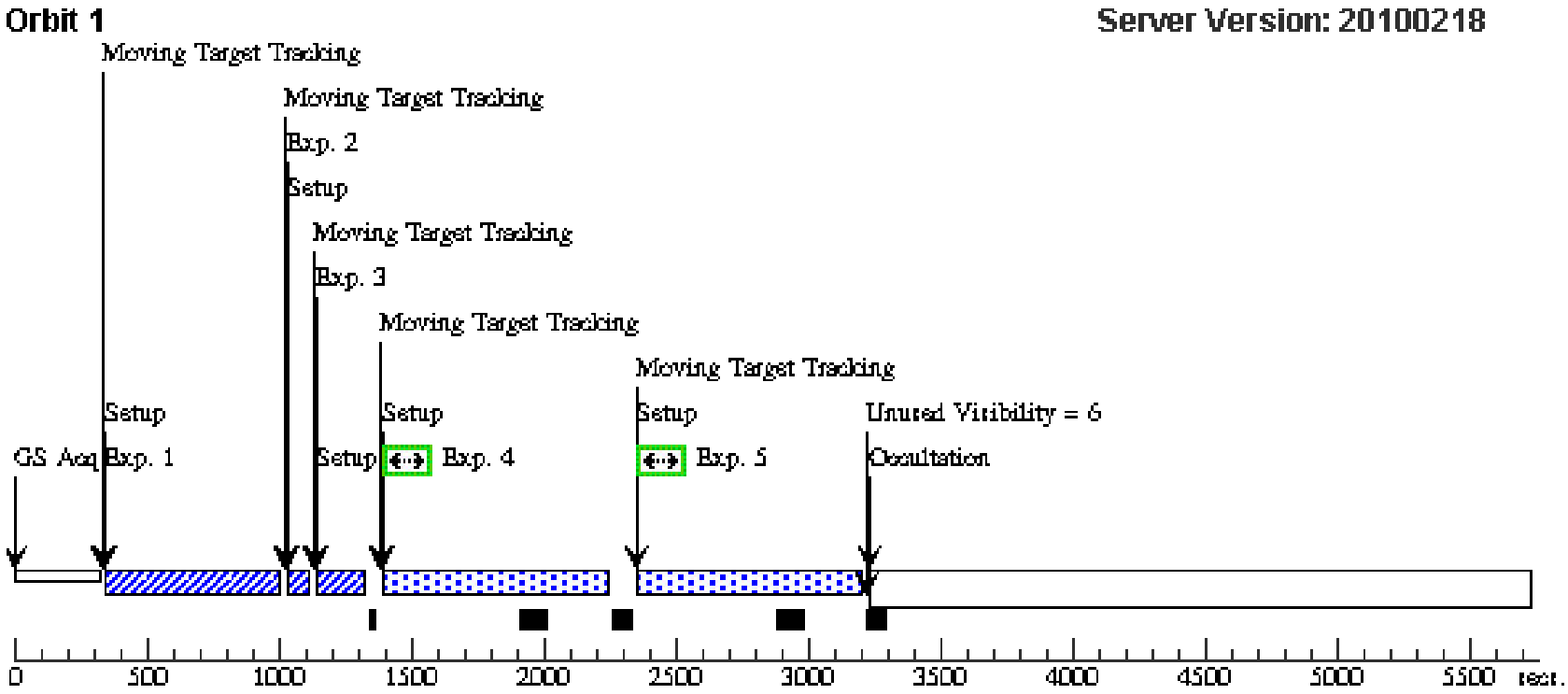
#	Name	Level 1	Level 2	Level 3	Window	Ephem Center
(1)	ENCELADUS-EAST-ELONGATION	STD=SATURN	STD=ENCELADUS		OLG OF ENCELADUS-EAST-ELONGATION BETWEEN 70 110, SEP OF ENCELADUS SATURN FROM EARTH GT 20", SIZE ENCELADUS GT 0.079	EARTH

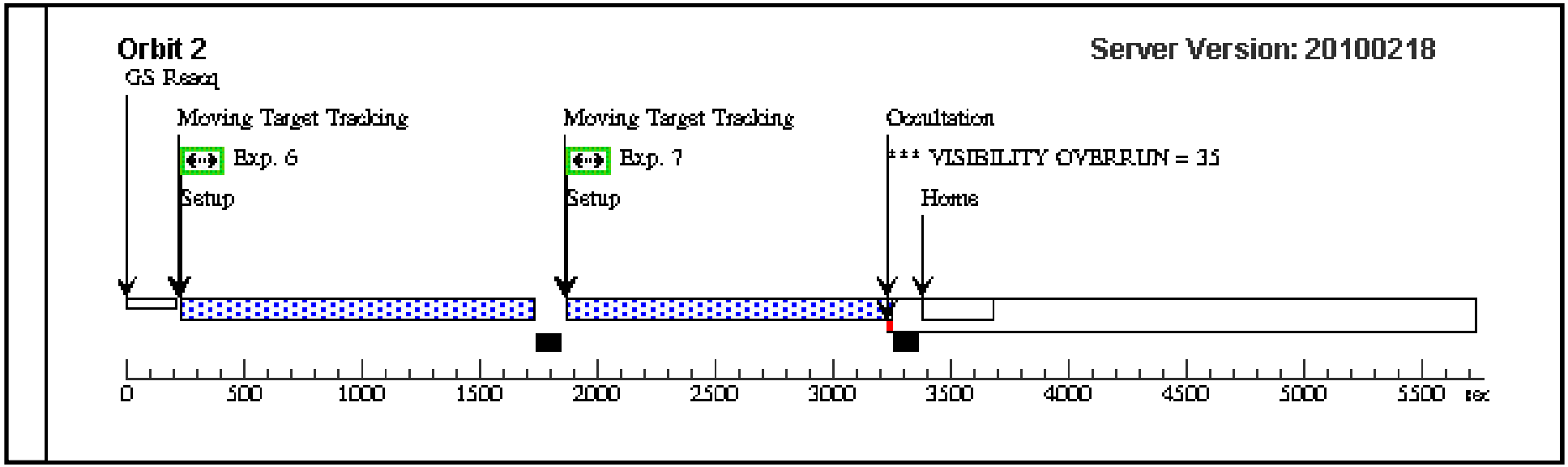
Comments: Observe Enceladus within 20 deg. of eastern elongation.
The apparent diameter window is a preference and not a hard requirement. It can be relaxed if necessary.

Exposures

#	Label	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time/[Actual Dur.]	Orbit
1		(1) ENCELADUS-EAST-ELONGATION	COS/NUV, ACQ/SEARCH, PSA	G230L 3000 A	SCAN-SIZE=3; STEP-SIZE=1.767	GS ACQ SCENARIO BASE1B3		6 Secs *[==>]*	*[1]*
2		(1) ENCELADUS-EAST-ELONGATION	COS/NUV, ACQ/PEAKXD, PSA	G230L 3000 A	STRIPE=MEDIUM			6. Secs *[==>]*	*[1]*
3		(1) ENCELADUS-EAST-ELONGATION	COS/NUV, ACQ/PEAKD, PSA	G230L 3000 A	NUM-POS=5; STEP-SIZE=1.2			6. Secs *[==>]*	*[1]*
4		(1) ENCELADUS-EAST-ELONGATION	COS/NUV, TIME-TAG, PSA	G230L 3000 A	BUFFER-TIME=525; FLASH=YES			840 Secs *[==>]*	*[1]*
5		(1) ENCELADUS-EAST-ELONGATION	COS/NUV, TIME-TAG, PSA	G230L 3000 A	BUFFER-TIME=525; FLASH=YES			840 Secs *[==>]*	*[1]*
6		(1) ENCELADUS-EAST-ELONGATION	COS/FUV, TIME-TAG, PSA	G140L 1230 A	BUFFER-TIME=1330; FLASH=YES			1330 Secs *[==>]*	*[2]*
7		(1) ENCELADUS-EAST-ELONGATION	COS/FUV, TIME-TAG, PSA	G140L 1230 A	BUFFER-TIME=1330; FLASH=YES			1330 Secs *[==>]*	*[2]*

Orbit Structure




Orbit 2
Server Version: 20100218
GS Reacq
Moving Target Tracking
Exp. 6
Setup
Moving Target Tracking
Exp. 7
Setup
Occultation
*** VISIBILITY OVERRUN = 35
Home
0
500
1000
1500
2000
2500
3000
3500
4000
4500
5000
5500
sec

Visit

Proposal 11645, Visit 02, scheduling Sat Apr 24 01:01:14 GMT 2010

Diagnostic Status: Warning

Scientific Instruments: COS/NUV, COS/FUV

Special Requirements: (none)

Comments: The timing between the two visits as expressed in the AFTER requirement is important, but the order is not. The order may be reversed as long as the time separation is maintained.

Diagnostics

(Visit 02) Warning (Orbit Planner): VISIBILITY OVERRUN

Solar System Targets

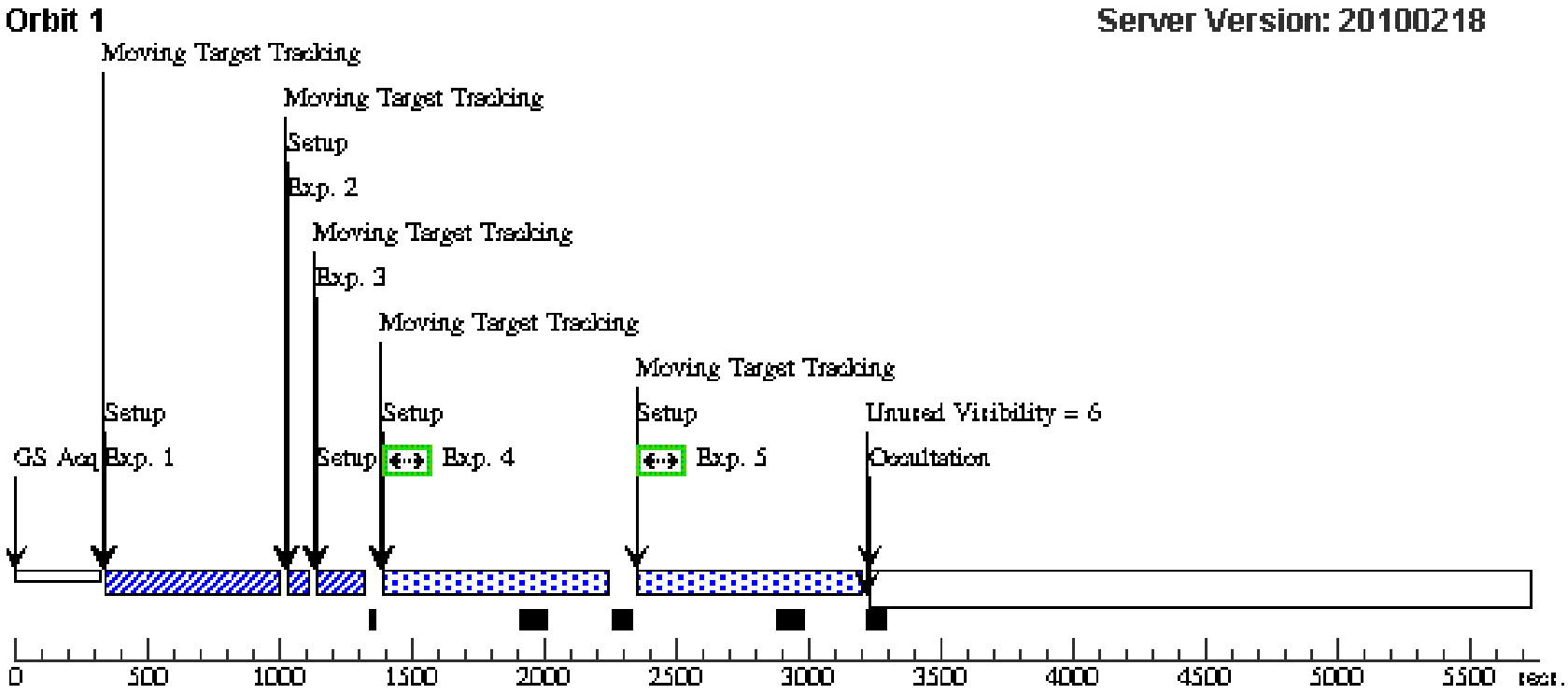
#	Name	Level 1	Level 2	Level 3	Window	Ephem Center
(2)	ENCELADUS-WEST-ELONGATION	STD=SATURN	STD=ENCELADUS		OLG OF ENCELADUS-WEST-ELONGATION BETWEEN 250 290, SEP OF ENCELADUS SATURN FROM EARTH GT 20", SIZE ENCELADUS GT 0.079	EARTH

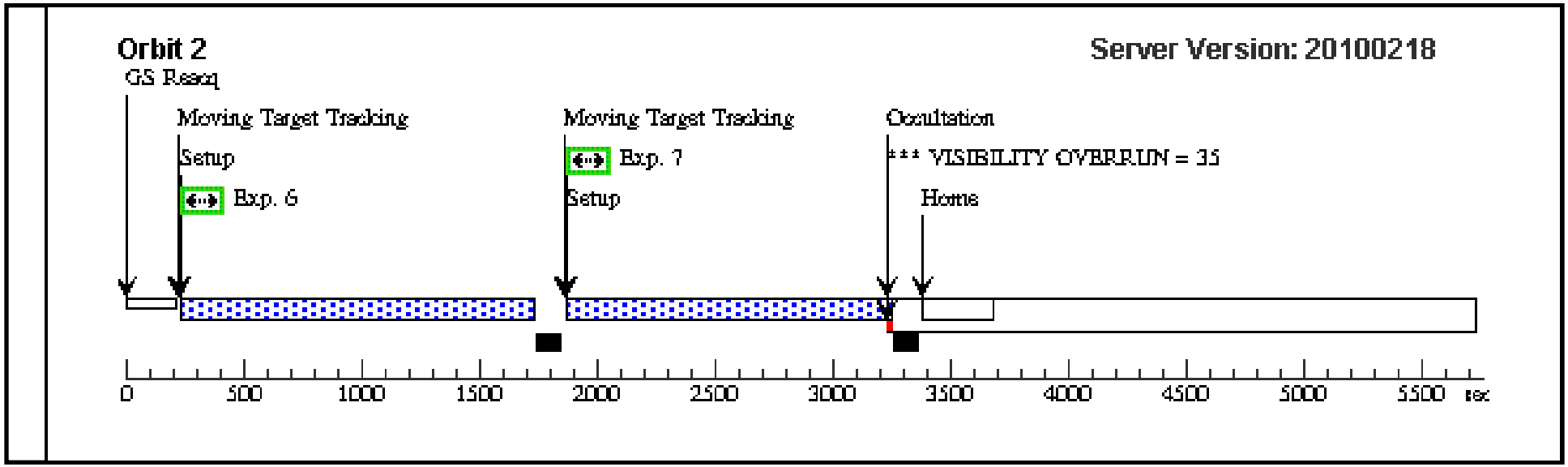
Comments: Observe Enceladus within 20 deg. of western elongation.
The apparent diameter window is a preference and not a hard requirement. It can be relaxed if necessary.

Exposures

#	Label	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time/[Actual Dur.]	Orbit
1		(2) ENCELADUS-WEST-ELONGATION	COS/NUV, ACQ/SEARCH, PSA	G230L 3000 A	SCAN-SIZE=3; STEP-SIZE=1.767	GS ACQ SCENARIO BASE1B3		6 Secs *[==>]*	 ***[1]***
2		(2) ENCELADUS-WEST-ELONGATION	COS/NUV, ACQ/PEAKXD, PSA	G230L 3000 A	STRIPE=MEDIUM			6. Secs *[==>]*	 ***[1]***
3		(2) ENCELADUS-WEST-ELONGATION	COS/NUV, ACQ/PEAKD, PSA	G230L 3000 A	NUM-POS=5; STEP-SIZE=1.2			6. Secs *[==>]*	 ***[1]***
4		(2) ENCELADUS-WEST-ELONGATION	COS/NUV, TIME-TAG, PSA	G230L 3000 A	BUFFER-TIME=525; FLASH=YES			840 Secs *[==>]*	 ***[1]***
5		(2) ENCELADUS-WEST-ELONGATION	COS/NUV, TIME-TAG, PSA	G230L 3000 A	BUFFER-TIME=525; FLASH=YES			840 Secs *[==>]*	 ***[1]***
6		(2) ENCELADUS-WEST-ELONGATION	COS/FUV, TIME-TAG, PSA	G140L 1230 A	BUFFER-TIME=1330; FLASH=YES			1330 Secs *[==>]*	 ***[2]***
7		(2) ENCELADUS-WEST-ELONGATION	COS/FUV, TIME-TAG, PSA	G140L 1230 A	BUFFER-TIME=1330; FLASH=YES			1330 Secs *[==>]*	 ***[2]***

Orbit Structure




Orbit 2
Server Version: 20100218
GS Reacq
Moving Target Tracking
Setup
Exp. 6
Moving Target Tracking
Exp. 7
Setup
Occultation
*** VISIBILITY OVERRUN = 35
Home
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500
1000
1500
2000
2500
3000
3500
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