13693 - The Ultraviolet Spectrum of Ceres

Cycle: 22, Proposal Category: GO

(UV Initiative)

(Availability Mode: SUPPORTED)

INVESTIGATORS

Name	*Institution*	*E-Mail*
Dr. Amanda R. Hendrix (PI) (Contact)	**Planetary Science Institute**	**arh@psi.edu**
Dr. Faith Vilas (CoI)	Planetary Science Institute	fvilas@psi.edu
Dr. Jian-Yang Li (CoI)	Planetary Science Institute	jyli@psi.edu

VISITS

Visit	*Targets used in Visit*	*Configurations used in Visit*	*Orbits Used*	*Last Orbit Planner Run*	*OP Current with Visit?*
01	(1) CERES-1	STIS/CCD STIS/NUV-MAMA	1	18-Jul-2015 21:21:54.0	yes
02	(1) CERES-1	STIS/CCD STIS/FUV-MAMA	1	18-Jul-2015 21:21:56.0	yes
03	(2) CERES-2	STIS/CCD STIS/NUV-MAMA	1	18-Jul-2015 21:21:57.0	yes
04	(2) CERES-2	STIS/CCD STIS/FUV-MAMA	1	18-Jul-2015 21:21:58.0	yes

4 Total Orbits Used

ABSTRACT

We propose a focused, four-orbit program to study Ceres, the largest -- yet most enigmatic -- asteroid, using ultraviolet spectroscopy. While Ceres will soon be visited by the Dawn spacecraft, Dawn does not have the capability to study Ceres in the UV, the spectral region of a mysterious surface absorption. The UV spectrum of Ceres may provide an important link with the most primitive materials in the solar system, and could reveal clues about the water activity on Ceres -- and HST is our only opportunity to study this unique object.

OBSERVING DESCRIPTION

The proposed observations will obtain excellent quality STIS-UV reflectivities in the 115- 318 nm spectral region (using G140L and G230L), and will also measure the reflectance in the 290-570 nm range (using G430L) to provide adequate overlap with Dawn instrumentation. There is simply no other way to study this critical spectral region, and whatever UV spectral shape we measure will be of unique importance in helping us understand the surface composition of Ceres. We will devote the bulk of our observing time to the G140L and G230L detectors, to maximize the signal-to-noise in the critical 115-318 nm region. We will use the 0.2" slit for the G230L exposures and the 0.5" slit for the G140L exposures to maximize SNR without saturating the detector. We are flexible regarding slit orientation.

We plan to observe Ceres at two sub-Earth longitudes (ideally centered on 0degE and either 120deg or 240deg E), to understand any large-scale variability on the surface; 120deg E and 240deg E are the regions in which Herschel detected H2O (Kueppers et al., 2014). Furthermore, based on the limited data in the existing map, these hemispheres appear to be sufficiently distinct in UV albedo and we thus suggest these hemispheres as interesting comparison regions, whether H2O is detected or not.

In order to thoroughly determine the spectral shape of Ceres in the far-UV -- and probe for the presence of H2O -- we have determined that we need to optimize SNR from both the G140L and the G230L detectors. We have estimated SNRs at several wavelengths by assuming an extended source (of 0.65") with a solar spectrum normalized to a 200-nm intensity of 3.1e-13 ergs/cm2-s-A-arcsec2, which is given by measured G230L fluxes from our Cycle 19 HST program (in which we observed that Saturn's C ring has a geometric albedo similar to Ceres at 200 nm), and correcting to solar flux levels at 2.54AU, and scaling to other wavelengths by the assumed Ceres broadband spectrum. In addition, we will take a single 1-sec exposure on each hemisphere using G430L, giving us high SNR at longer wavelengths and avoiding saturation. This will provide more leverage on the overall spectral shape of Ceres, the shape of the UV downturn, and a cross-calibration with Dawn-VIR at visual wavelengths, with little observing time impact. We have determined that our planned exposure times and slit widths accommodate the MAMA count rate restrictions for bright objects, and do not saturate the CCD at the longer wavelengths in the passband. We have verified that the total time accommodates guide star and target acquisition, as well as STIS overhead times. Acquiring 3 700-sec G140L exposures, 3 700-sec G230L exposures and one short G430L exposure

combination on each hemisphere will allow us to carefully and thoroughly measure two hemispheres of Ceres and look for large-scale variations in this part of the spectrum. Thus, over 4 orbits, we can (a) confirm the UV spectral shape suggested so far only in broad band passes, (b) test whether there is FUV variability across the surface, either in carbonaceous and/or H2O components, and (c) provide measurements that complement the approaching Dawn mission.

Visit

Proposal 13693, Visit 01, implementation Sun Jul 19 01:21:59 GMT 2015

Diagnostic Status: No Diagnostics

Scientific Instruments: STIS/CCD, STIS/NUV-MAMA

Special Requirements: AFTER 12-JUL-2015:00:00:00

Solar System Targets

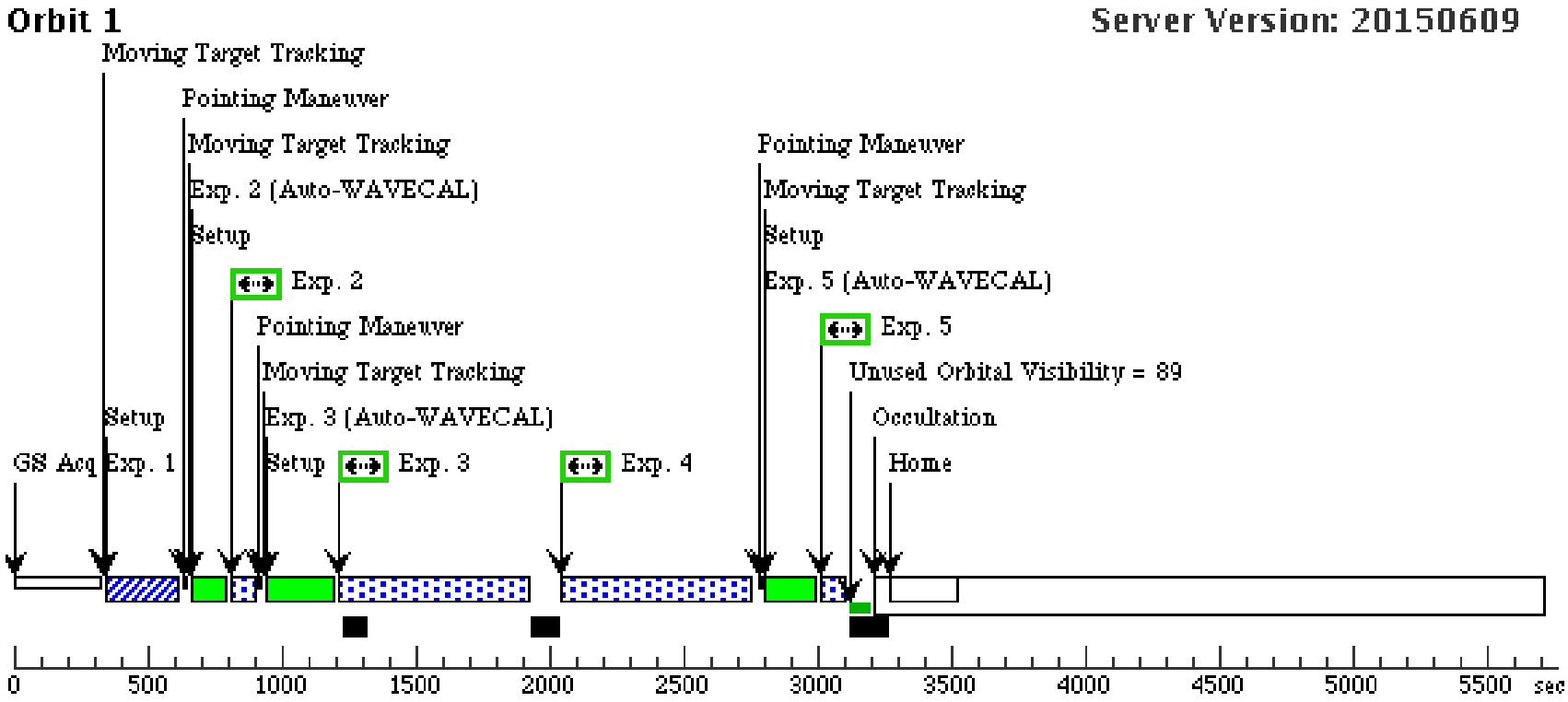
#	Name	Level 1	Level 2	Level 3	Window	Ephem Center
(1)	CERES-1	STD=CERES			CML OF CERES-1 FROM EARTH BETWEEN 335 25	EARTH

Comments: Ceres opposition is July 23, so close to that date is optimal.

Exposures

#	Label (ETC Run)	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time (Total)/[Actual Dur.]	Orbit
1		(1) CERES-1	STIS/CCD, ACQ, F28X50LP	MIRROR	ACQTYPE=DIFFUSE; DIFFUSE-CENTER=GEOMETRIC-CENTER; CHECKBOX=3.0	GS ACQ SCENARIO BASE1B3		.5 Secs (0.5 Secs) *[==>]*	 ***[1]***
2		(1) CERES-1	STIS/CCD, ACCUM, 52X0.5	G430L 4300 A	CR-SPLIT=NO			1 Secs (1 Secs) *[==>]*	 ***[1]***
3	(STIS.sp.653951)	(1) CERES-1	STIS/NUV-MAMA, ACCUM, 52X0.2	G230L 2376 A				700 Secs (700 Secs) *[==>]*	 ***[1]***
4	(STIS.sp.653951)	(1) CERES-1	STIS/NUV-MAMA, ACCUM, 52X0.2	G230L 2376 A				700 Secs (700 Secs) *[==>]*	 ***[1]***
5		(1) CERES-1	STIS/CCD, ACCUM, 52X0.5	G430L 4300 A	CR-SPLIT=NO			1 Secs (1 Secs) *[==>]*	 ***[1]***

Orbit Structure



Visit

Proposal 13693, Visit 02, implementation Sun Jul 19 01:22:00 GMT 2015

Diagnostic Status: No Diagnostics

Scientific Instruments: STIS/CCD, STIS/FUV-MAMA

Special Requirements: (none)

Solar System Targets

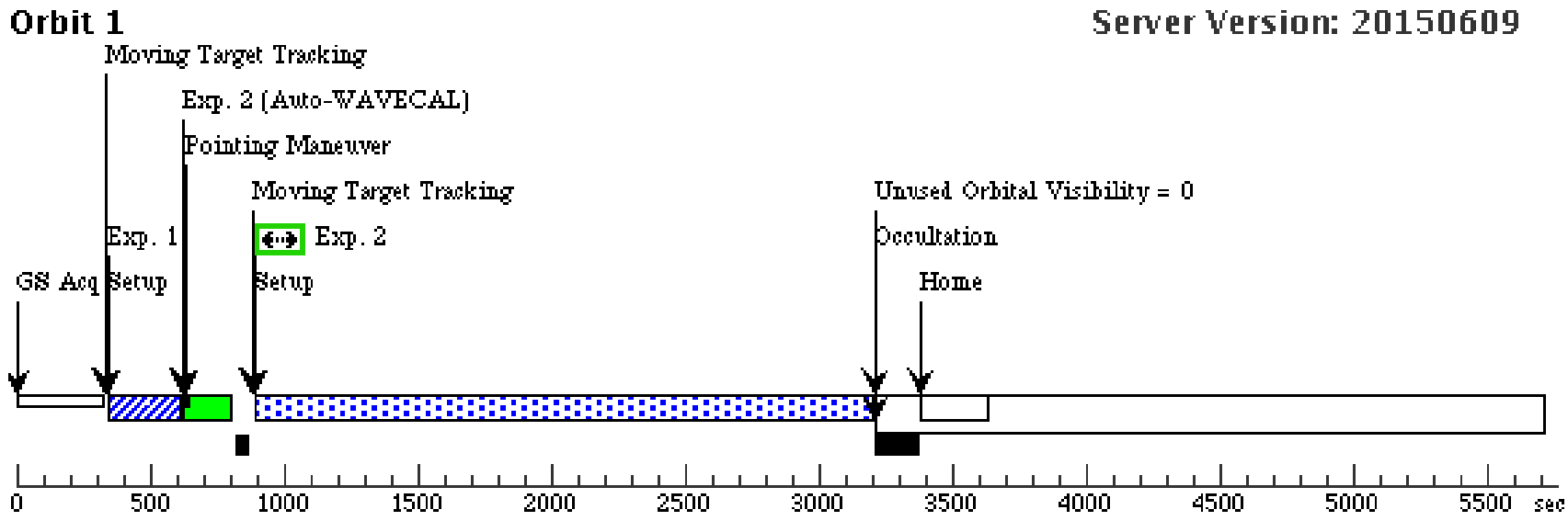
#	Name	Level 1	Level 2	Level 3	Window	Ephem Center
(1)	CERES-1	STD=CERES			CML OF CERES-1 FROM EARTH BETWEEN 335 25	EARTH

Comments: Ceres opposition is July 23, so close to that date is optimal.

Exposures

#	Label (ETC Run)	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time (Total)/[Actual Dur.]	Orbit
1		(1) CERES-1	STIS/CCD, ACQ, F28X50LP	MIRROR		GS ACQ SCENARIO BASE1B3		0.5 Secs (0.5 Secs)	
								[==>]	***[1]***
2	(STIS.sp.653950)	(1) CERES-1	STIS/FUV-MAMA, TIME-TAG, 52X0.5	G140L 1425 A	BUFFER-TIME=1131			2250 Secs (2250 Secs)	
								[==>]	***[1]***

Orbit Structure



Visit

Proposal 13693, Visit 03, implementation Sun Jul 19 01:22:00 GMT 2015

Diagnostic Status: No Diagnostics

Scientific Instruments: STIS/CCD, STIS/NUV-MAMA

Special Requirements: (none)

Solar System Targets

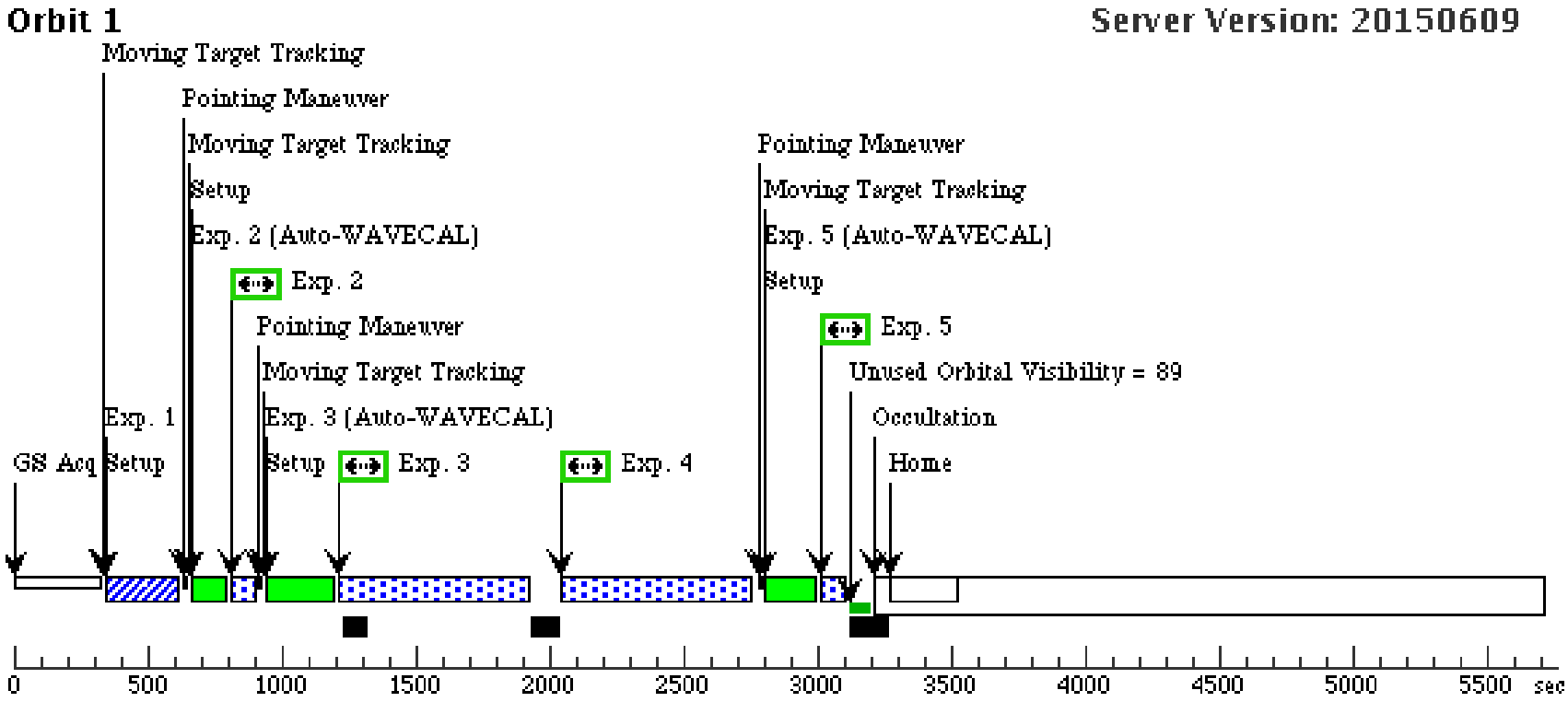
#	Name	Level 1	Level 2	Level 3	Window	Ephem Center
(2)	CERES-2	STD=CERES			CML OF CERES-2 FROM EARTH BETWEEN 95 145	EARTH

Comments: The second target is Ceres, either centered on 120 deg. E or centered on 240 deg. E .

Exposures

#	Label (ETC Run)	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time (Total)/[Actual Dur.]	Orbit
1		(2) CERES-2	STIS/CCD, ACQ, F28X50LP	MIRROR	ACQTYPE=DIFFUSE; DIFFUSE-CENTER=GEOMETRIC-CENTER; CHECKBOX=3.0	GS ACQ SCENARIO BASE1B3		.5 Secs (0.5 Secs) *[==>]*	 ***[1]***
2		(2) CERES-2	STIS/CCD, ACCUM, 52X0.5	G430L 4300 A	CR-SPLIT=NO			1 Secs (1 Secs) *[==>]*	 ***[1]***
3	(STIS.sp.653951)	(2) CERES-2	STIS/NUV-MAMA, ACCUM, 52X0.2	G230L 2376 A				700 Secs (700 Secs) *[==>]*	 ***[1]***
4	(STIS.sp.653951)	(2) CERES-2	STIS/NUV-MAMA, ACCUM, 52X0.2	G230L 2376 A				700 Secs (700 Secs) *[==>]*	 ***[1]***
5		(2) CERES-2	STIS/CCD, ACCUM, 52X0.5	G430L 4300 A	CR-SPLIT=NO			1 Secs (1 Secs) *[==>]*	 ***[1]***

Orbit Structure



Visit

Proposal 13693, Visit 04, implementation Sun Jul 19 01:22:00 GMT 2015

Diagnostic Status: No Diagnostics

Scientific Instruments: STIS/CCD, STIS/FUV-MAMA

Special Requirements: (none)

Comments: Visit 4 should be 6N orbits after Visit 3, where N is an integer, to observe roughly the same longitude on Ceres given Ceres' 9 hour rotational period.

Solar System Targets

#	Name	Level 1	Level 2	Level 3	Window	Ephem Center
(2)	CERES-2	STD=CERES			CML OF CERES-2 FROM EARTH BETWEEN 95 145	EARTH

Comments: The second target is Ceres, either centered on 120 deg. E or centered on 240 deg. E .

Exposures

#	Label (ETC Run)	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time (Total)/[Actual Dur.]	Orbit
1		(2) CERES-2	STIS/CCD, ACQ, F28X50LP	MIRROR		GS ACQ SCENARIO BASE1B3		0.5 Secs (0.5 Secs) *[==>]*	 ***[1]***
2	(STIS.sp.653950)	(2) CERES-2	STIS/FUV-MAMA, TIME-TAG, 52X0.5	G140L 1425 A	BUFFER-TIME=1131			2250 Secs (2250 Secs) *[==>]*	 ***[1]***

Orbit Structure