



14609 - Psyche's UV Reflectance Spectra: Exploring the origins of the largest exposed-core metallic asteroid

Cycle: 24, Proposal Category: GO

(UV Initiative)

(Availability Mode: SUPPORTED)

INVESTIGATORS

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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) PSYCHE	COS/FUV	1	17-Mar-2017 21:02:32.0	yes
02	(1) PSYCHE	STIS/CCD STIS/NUV-MAMA	1	17-Mar-2017 21:02:33.0	yes
03	(1) PSYCHE	COS/FUV	1	17-Mar-2017 21:02:35.0	yes
04	(1) PSYCHE	STIS/CCD STIS/NUV-MAMA	1	17-Mar-2017 21:02:36.0	yes

<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>
54	(1) PSYCHE	STIS/CCD STIS/NUV-MAMA	1	17-Mar-2017 21:02:37.0	yes

5 Total Orbits Used

ABSTRACT

(16) Psyche is the largest of the M-class asteroids, and is presumed to be the exposed core of a differentiated asteroid stripped of its mantle through hit-and-run collisions. However, other origins for Psyche have been proposed, including that it formed from a highly-reduced, metal rich material in the inner solar system or that its surface is olivine that has been space weathered. If (16) Psyche is an exposed core, then studying its properties enhances our understanding of the cores of all terrestrial planets, including the Earth's. If it accreted in the inner part of the solar system and was later injected into the asteroid belt, then Psyche sheds light on the conditions and subsequent evolution of the early solar system. Lastly, if Psyche is weathered olivine, then olivine may be more abundant in the solar system than currently measured, rectifying the so-called "Great Dunitite Shortage". Our program to obtain high-resolution UV spectra of Psyche with the COS G140L mode and the STIS NUV MAMA G230L mode to measure spectral signatures between 90 - 315 nm is designed to distinguish between the 3 hypothesized cases. These observations will enable identification of absorption bands, especially Fe-O charge transfer bands and will be sensitive to "spectral blueing" that occurs at UV wavelengths for space-weathered objects. When combined, the presence of these UV features, or not, provides a novel test of Psyche formation theories.

OBSERVING DESCRIPTION

We plan to observe (16) Psyche with two visits composed of two orbits each, with each pair of orbits dedicated to FUV and NUV spectral albedo measurements, respectively. The COS G140L mode centered at 128 nm will be used to obtain high-resolution spectra at wavelengths between ~90 - 205 nm, and would produce the first FUV spectrum of Psyche. The STIS 1st order NUV MAMA G230L mode with 52 x 0.2 slit will be used to obtain NUV spectra for the wavelength range 165 - 310 nm. We will alternate one bandpass per orbit, in two orbits per visit (FUV then NUV). During each visit, we will acquire two 1200-sec COS G140L exposures and two 1400-sec STIS NUV MAMA G230L exposures. We plan to schedule the visits so that the hemisphere viewed with each bandpass (mode) is separated by as close to 180 degrees as possible, for an asteroid with a 4.196-hour rotation period.

Psyche's position will be offset in the 2.5-arcsec aperture by 0.5 arcsec in the COS observations in order to distinguish between signal from Psyche versus extended emissions from the geocorona + sky background. Psyche is offset toward the bottom of the aperture to avoid gain-sagged regions

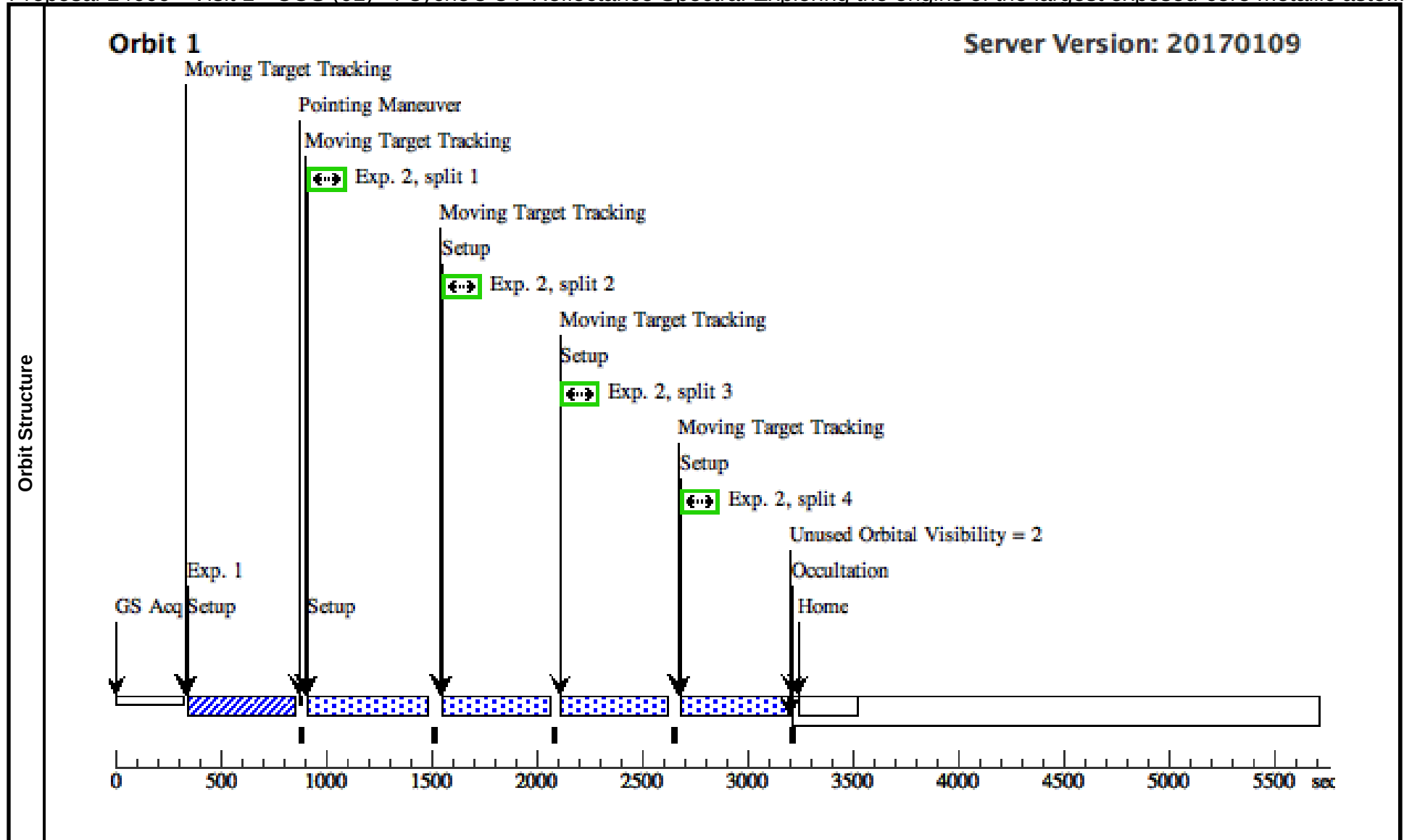
Proposal 14609 (STScI Edit Number: 4, Created: Friday, March 17, 2017 8:02:37 PM EST) - Overview

located higher on the detector. The empty pixels in the COS field of view in the detector rows adjacent to the Psyche spectrum for each observation are used to simultaneously measure the geocorona and sky background features. TIME-TAG mode will be used for both COS and STIS MAMA datasets.

An essential requirement is to capture (16) Psyche within 4 weeks of opposition (March 3, 2017) to maximize both the size of the asteroid and also the amount of time in Earth's shadow, reducing the FUV Lyman-alpha background from terrestrial airglow from ~10-15 kR to ~2.5-4 kR.

Proposal 14609 - Visit 1 - COS (01) - Psyche's UV Reflectance Spectra: Exploring the origins of the largest exposed-core metallic aste...

Visit	Proposal 14609, Visit 1 - COS (01), scheduled Sat Mar 18 01:02:37 GMT 2017									
	Diagnostic Status: Warning Scientific Instruments: COS/FUV Special Requirements: BETWEEN 03-FEB-2017:00:00:00 AND 31-MAR-2017:00:00:00									
Diagnos	(COS Exp 1 (01.002)) Warning (Form): COS FUV PSA science exposures with extended targets have special calibration limitations. See "Errors and Warnings" for more details.									
Solar System Targets	#	Name	Level 1	Level 2	Level 3	Window	Ephem Center			
	(1)	PSYCHE	TYPE=ASTEROID,A=2.92056188067 1045,E=.1382408738943603,I=3.0933 66819603944,O=150.4660463936781, W=229.1191158619876,M=335.49330 59174967,EQUINOX=J2000,EPOCH =01-JAN- 2000:00:00:00,EpochTimeScale=TDB Comments: Extended=YES				EARTH			
Exposures	#	Label (ETC Run)	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time (Total)/[Actual Dur.]	Orbit
	1	ACQ-COS (COS.sa.823 996)	(1) PSYCHE	COS/FUV, ACQ/SEARCH, PSA	G140L 1280 A	SCAN-SIZE=3			6 Secs (6 Secs) [==>]	[1]
	2	COS Exp 1 (COS.sp.824 000)	(1) PSYCHE	COS/FUV, TIME-TAG, PSA	G140L 1280 A	BUFFER-TIME=14 900; FP-POS=ALL	POS TARG null,-00. 50		60 Secs (1816 Secs) [==>454.0 Secs (Split 1)] [==>454.0 Secs (Split 2)] [==>454.0 Secs (Split 3)] [==>454.0 Secs (Split 4)]	[1]

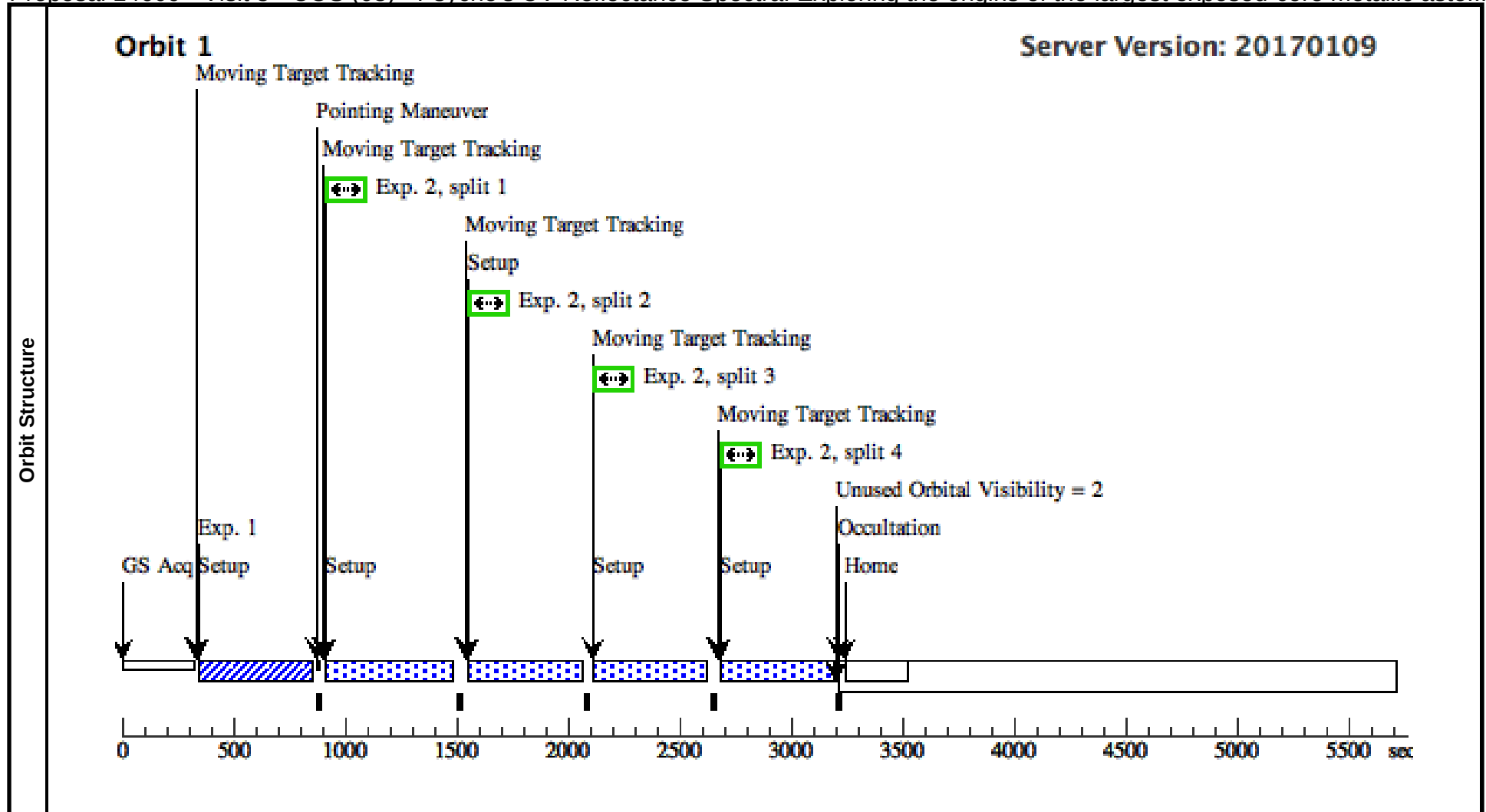


Proposal 14609 - Visit 2 - STIS (02) - Psyche's UV Reflectance Spectra: Exploring the origins of the largest exposed-core metallic ast...

Visit	Proposal 14609, Visit 2 - STIS (02), scheduling Sat Mar 18 01:02:38 GMT 2017									
	Diagnostic Status: No Diagnostics Scientific Instruments: STIS/NUV-MAMA, STIS/CCD Special Requirements: BETWEEN 03-FEB-2017:00:00:00 AND 07-APR-2017:00:00:00 <i>Comments: The timing of the visit is meant to view the hemisphere of Psyche nearly 180 degrees from the Visit 1 observations. Psyche's orbit is ~4.1 hours.</i>									
Solar System Targets	#	Name	Level 1	Level 2	Level 3	Window	Ephem Center			
	(1)	PSYCHE	TYPE=ASTEROID,A=2.92056188067 1045,E=.1382408738943603,I=3.0933 66819603944,O=150.4660463936781, W=229.1191158619876,M=335.49330 59174967,EQUINOX=J2000,EPOCH =01-JAN- 2000:00:00:00,EpochTimeScale=TDB <i>Comments: Extended=YES</i>				EARTH			
Exposures	#	Label (ETC Run)	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time (Total)/[Actual Dur.]	Orbit
	1	ACQ - STIS (STIS.ta.825 915)	(1) PSYCHE	STIS/CCD, ACQ, F28X50LP	MIRROR				.5 Secs (0.5 Secs) [==>]	[1]
	2	STIS Exp 1 (STIS.sp.82 4002)	(1) PSYCHE	STIS/NUV-MAMA, TIME-TAG, 52X0.2	G230L 2376 A	BUFFER-TIME=34 0			1000 Secs (2288 Secs) [==>2288.0 Secs]	[1]
Orbit Structure	Orbit 1 Server Version: 20170109									
	The diagram illustrates the mission timeline for Orbit 1, showing various activities and their durations. The timeline is marked with a scale from 0 to 5500 seconds. Key events include: GS Acq Setup: 0 to 100 seconds. Exp. 1: 100 to 200 seconds. Exp. 2 (Auto-WAVECAL): 200 to 300 seconds. Pointing Maneuver: 300 to 400 seconds. Moving Target Tracking: 400 to 500 seconds. Exp. 2: 500 to 600 seconds. Setup: 600 to 700 seconds. Moving Target Tracking: 700 to 800 seconds. Unused Orbital Visibility = 2: 800 to 3200 seconds. Occultation: 3200 to 3300 seconds. Home: 3300 to 3400 seconds.									

Proposal 14609 - Visit 3 - COS (03) - Psyche's UV Reflectance Spectra: Exploring the origins of the largest exposed-core metallic aste...

Visit	Proposal 14609, Visit 3 - COS (03), scheduled Sat Mar 18 01:02:38 GMT 2017									
	Diagnostic Status: Warning Scientific Instruments: COS/FUV Special Requirements: BETWEEN 03-FEB-2017:00:00:00 AND 31-MAR-2017:00:00:00 <i>Comments: The timing of the visit is meant to view the hemisphere of Psyche nearly 180 degrees from the Visit 1 observations. Psyche's orbit is ~4.1 hours.</i>									
Diagnostics	(COS Exp 1 (03.002)) Warning (Form): COS FUV PSA science exposures with extended targets have special calibration limitations. See "Errors and Warnings" for more details.									
Solar System Targets	#	Name	Level 1	Level 2	Level 3	Window	Ephem Center			
	(1)	PSYCHE	TYPE=ASTEROID,A=2.92056188067 1045,E=.1382408738943603,I=3.0933 66819603944,O=150.4660463936781, W=229.1191158619876,M=335.49330 59174967,EQUINOX=J2000,EPOCH =01-JAN- 2000:00:00:00,EpochTimeScale=TDB <i>Comments: Extended=YES</i>				EARTH			
Exposures	#	Label (ETC Run)	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time (Total)/[Actual Dur.]	Orbit
	1	ACQ-COS (COS.sa.823 996)	(1) PSYCHE	COS/FUV, ACQ/SEARCH, PSA	G140L 1280 A	SCAN-SIZE=3			6 Secs (6 Secs) [==>]	[1]
	2	COS Exp 1 (COS.sp.824 000)	(1) PSYCHE	COS/FUV, TIME-TAG, PSA	G140L 1280 A	BUFFER-TIME=14 900; FP-POS=ALL	POS TARG null,-00. 50		60 Secs (1816 Secs) [==>454.0 Secs (Split 1)] [==>454.0 Secs (Split 2)] [==>454.0 Secs (Split 3)] [==>454.0 Secs (Split 4)]	[1]



Proposal 14609 - Visit 4 - STIS (04) - Psyche's UV Reflectance Spectra: Exploring the origins of the largest exposed-core metallic ast...

Visit	Proposal 14609, Visit 4 - STIS (04), failed										Sat Mar 18 01:02:38 GMT 2017
	Diagnostic Status: No Diagnostics										
	Scientific Instruments: STIS/NUV-MAMA, STIS/CCD										
	Special Requirements: BETWEEN 03-FEB-2017:00:00:00 AND 31-MAR-2017:00:00:00										
Comments: The timing of the visit is meant to view the same hemisphere of Psyche as the Visit 1 observations. Psyche's orbit is ~4.1 hours.											
Solar System Targets	#	Name	Level 1	Level 2	Level 3	Window	Ephem Center				
	(1)	PSYCHE	TYPE=ASTEROID,A=2.92056188067 1045,E=.1382408738943603,I=3.0933 66819603944,O=150.4660463936781, W=229.1191158619876,M=335.49330 59174967,EQUINOX=J2000,EPOCH =01-JAN- 2000:00:00:00,EpochTimeScale=TDB				EARTH				
Comments: Extended=YES											
Exposures	#	Label (ETC Run)	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time (Total)/[Actual Dur.]		Orbit
	1	ACQ - STIS (STIS.ta.825 915)	(1) PSYCHE	STIS/CCD, ACQ, F28X50LP	MIRROR				.5 Secs (0.5 Secs)		
									[>=>]		[1]
	2	STIS Exp 1 (STIS.sp.82 4002)	(1) PSYCHE	STIS/NUV-MAMA, TIME-TAG, 52X0.2	G230L 2376 A	BUFFER-TIME=34 0			1000 Secs (2288 Secs)		
									[>=>2288.0 Secs]		[1]
Orbit Structure	Orbit 1 Server Version: 20170109 Moving Target Tracking Exp. 2 (Auto-WAVECAL) Pointing Maneuver Moving Target Tracking Unused Orbital Visibility = 2 Occultation Home Setup Setup GS Acq Exp. 1 Exp. 2 0 500 1000 1500 2000 2500 3000 3500 4000 4500 5000 5500 sec										

Visit	Proposal 14609, Visit 54 - STIS (54) Sat Mar 18 01:02:38 GMT 2017									
	Diagnostic Status: No Diagnostics Scientific Instruments: STIS/NUV-MAMA, STIS/CCD Special Requirements: BETWEEN 03-FEB-2017:00:00:00 AND 07-APR-2017:00:00:00 <i>Comments: The timing of the visit is meant to view the same hemisphere of Psyche as the Visit 1 observations. Psyche's orbit is ~4.1 hours.</i>									
Solar System Targets	#	Name	Level 1	Level 2	Level 3	Window	Ephem Center			
	(1)	PSYCHE	TYPE=ASTEROID,A=2.92056188067 1045,E=.1382408738943603,I=3.0933 66819603944,O=150.4660463936781, W=229.1191158619876,M=335.49330 59174967,EQUINOX=J2000,EPOCH =01-JAN- 2000:00:00:00,EpochTimeScale=TDB <i>Comments: Extended=YES</i>				EARTH			
Exposures	#	Label (ETC Run)	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time (Total)/[Actual Dur.]	Orbit
	1	ACQ - STIS (STIS.ta.825 915)	(1) PSYCHE	STIS/CCD, ACQ, F28X50LP	MIRROR				.5 Secs (0.5 Secs) [==>]	[1]
	2	STIS Exp 1 (STIS.sp.82 4002)	(1) PSYCHE	STIS/NUV-MAMA, TIME-TAG, 52X0.2	G230L 2376 A	BUFFER-TIME=34 0			1000 Secs (2288 Secs) [==>2288.0 Secs]	[1]
Orbit Structure	Orbit 1 Server Version: 20170109									
	The diagram illustrates the mission timeline for Orbit 1, spanning from 0 to 5500 seconds. Key events include: GS Acq: Ground Station Acquisition at the start of the orbit. Setup: Initial instrument setup between 100 and 150 seconds. Exp. 1: First exposure (green bar) from 150 to 250 seconds. Exp. 2 (Auto-WAVECAL): Second exposure (green bar) from 250 to 350 seconds. Pointing Maneuver: A period of instrument adjustment from 350 to 450 seconds. Setup: Second setup period from 450 to 550 seconds. Exp. 2: Third exposure (green bar with a green box containing a double arrow) from 550 to 650 seconds. Moving Target Tracking: A long period of tracking the target (blue checkered bar) from 650 seconds to 3200 seconds. Occultation: A period where the target is occulted from 3200 to 3300 seconds. Home: Return to home position from 3300 to 3500 seconds. Unused Orbital Visibility = 2: A period of unused visibility from 3500 to 5500 seconds.									