# 16652 - Detecting Water on Metallic M-Type Asteroids in the Far-UV

Cycle: 29, Proposal Category: GO

(UV Initiative)

(Availability Mode: SUPPORTED)

**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 | (5) LYDIA | COS/FUV<br>COS/NUV | 1 | 16-Sep-2021 17:00:35.0 | yes |
| 02 | (3) KALLIOPE | COS/FUV<br>COS/NUV | 1 | 16-Sep-2021 17:00:36.0 | yes |

| *Visit* | *Targets used in Visit* | *Configurations used in Visit* | *Orbits Used* | *Last Orbit Planner Run* | *OP Current with Visit?* |
|---|---|---|---|---|---|
| 03 | (1) PSYCHE | COS/FUV<br>COS/NUV | 1 | 16-Sep-2021 17:00:37.0 | yes |
| 04 | (4) HERTHA | COS/FUV<br>COS/NUV | 1 | 16-Sep-2021 17:00:38.0 | yes |
| 05 | (2) KLEOPATRA | COS/FUV<br>COS/NUV | 1 | 16-Sep-2021 17:00:39.0 | yes |

5 Total Orbits Used

**ABSTRACT**

The presence of hydrated minerals and/or water on asteroids has important implications for how they, and the Solar System, formed and evolved. Techniques that unambiguously detect water on asteroids can be used to identify targets for exploration and in-situ resource utilization (ISRU) and could be used to better understand how water was delivered to Earth. Asteroid hydration is typically determined through detections of the near-infrared (NIR) 3-micron absorption feature; however, interpretation of this spectral feature is complicated by the need for thermal corrections to NIR data, telluric lines in our atmosphere, and the proximity of the OH (2.8 microns) and H2O (3 microns) spectral absorption features. In the far-ultraviolet (FUV), however, water produces a strong spectral edge causing a significant difference in albedo shortward and longward of 165 nm. We propose to conduct observations of five M-type asteroids using the FUV COS G140L mode to 1) evaluate if the hydrated sub-class of the M-type asteroids are in fact hydrated or are otherwise different from the non-hydrated, presumably metallic M-types; and 2) determine if this hydration is due to OH or H2O, since only H2O is expected to produce the strong FUV spectral signature. Only three asteroids have ever been observed at wavelengths <180 nm, so this proposed program would significantly increase the database of FUV asteroid observations while also verifying if the FUV can be used to unambiguously detect water or water-bearing minerals on asteroid surfaces.

**OBSERVING DESCRIPTION**

This program is designed to observe five asteroids at far-ultraviolet wavelengths. Each target will be observed for the entirety of one visit (following acquisition). Each target will be observed using the COS G140L centered at 1280 A. We intend to use the COS NUV image acquisition mode to acquire each target prior to the COS G140L observations.

## Visit

**Proposal 16652, Lydia Visit (01), implementation** Thu Sep 16 21:00:39 GMT 2021

**Diagnostic Status: No Diagnostics**

Scientific Instruments: COS/FUV, COS/NUV

Special Requirements: BETWEEN 06-OCT-2021:00:00:00 AND 17-NOV-2021:00:00:00

## Solar System Targets

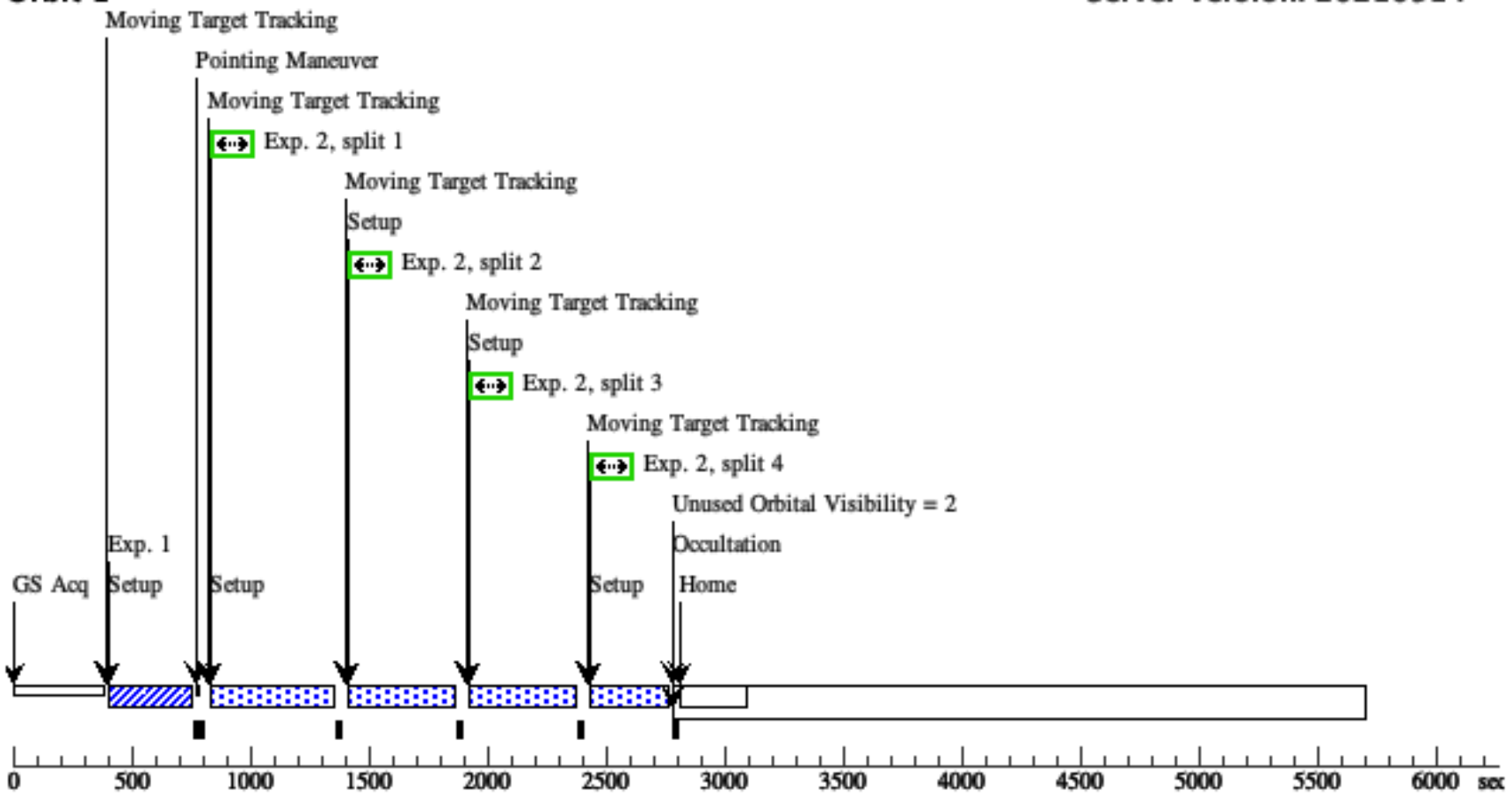
| # | Name | Level 1 | Level 2 | Level 3 | Window | Ephem Center |
|---|---|---|---|---|---|---|
| (5) | LYDIA | TYPE=ASTEROID,A=2.731859242175385,E=0.08089313772973283,I=5.964976656414284,O=56.87567806250901,W=283.6371058030182,M=280.9875611270469,EQUINOX=J2000,EPOCH=27-SEP-2015:00:00:00,EpochTimeScale=TDB | | | | EARTH |

*Comments: Description=Asteroid (110) Lydia*
*Extended=NO*

## Exposures

| # | Label (ETC Run) | Target | Config,Mode,Aperture | Spectral Els. | Opt. Params. | Special Reqs. | Groups | Exp. Time (Total)/[Actual Dur.] | Orbit |
|---|---|---|---|---|---|---|---|---|---|
| 1 | Lydia ACQ (COS.ta.1525232) | (5) LYDIA | COS/NUV, ACQ/IMAGE, PSA | MIRRORB | | | | 22 Secs (22 Secs)<br>*[==>]* | <br>***[1]*** |
| 2 | Lydia OBS (COS.sp.1504604) | (5) LYDIA | COS/FUV, TIME-TAG, PSA | G140L<br>1280 A | BUFFER-TIME=5000;<br>FP-POS=ALL | | | 2000 Secs (1417 Secs)<br>*[==>348.0 Secs (Split 1)]*<br>*[==>394.0 Secs (Split 2)]*<br>*[==>394.0 Secs (Split 3)]*<br>*[==>281.0 Secs (Split 4)]* | <br>***[1]*** |

Orbit Structure



## Visit

**Proposal 16652, Kalliope Visit (02), implementation** Thu Sep 16 21:00:39 GMT 2021

**Diagnostic Status: No Diagnostics**

Scientific Instruments: COS/FUV, COS/NUV

Special Requirements: BETWEEN 07-DEC-2021:00:00:00 AND 18-JAN-2022:00:00:00

## Solar System Targets

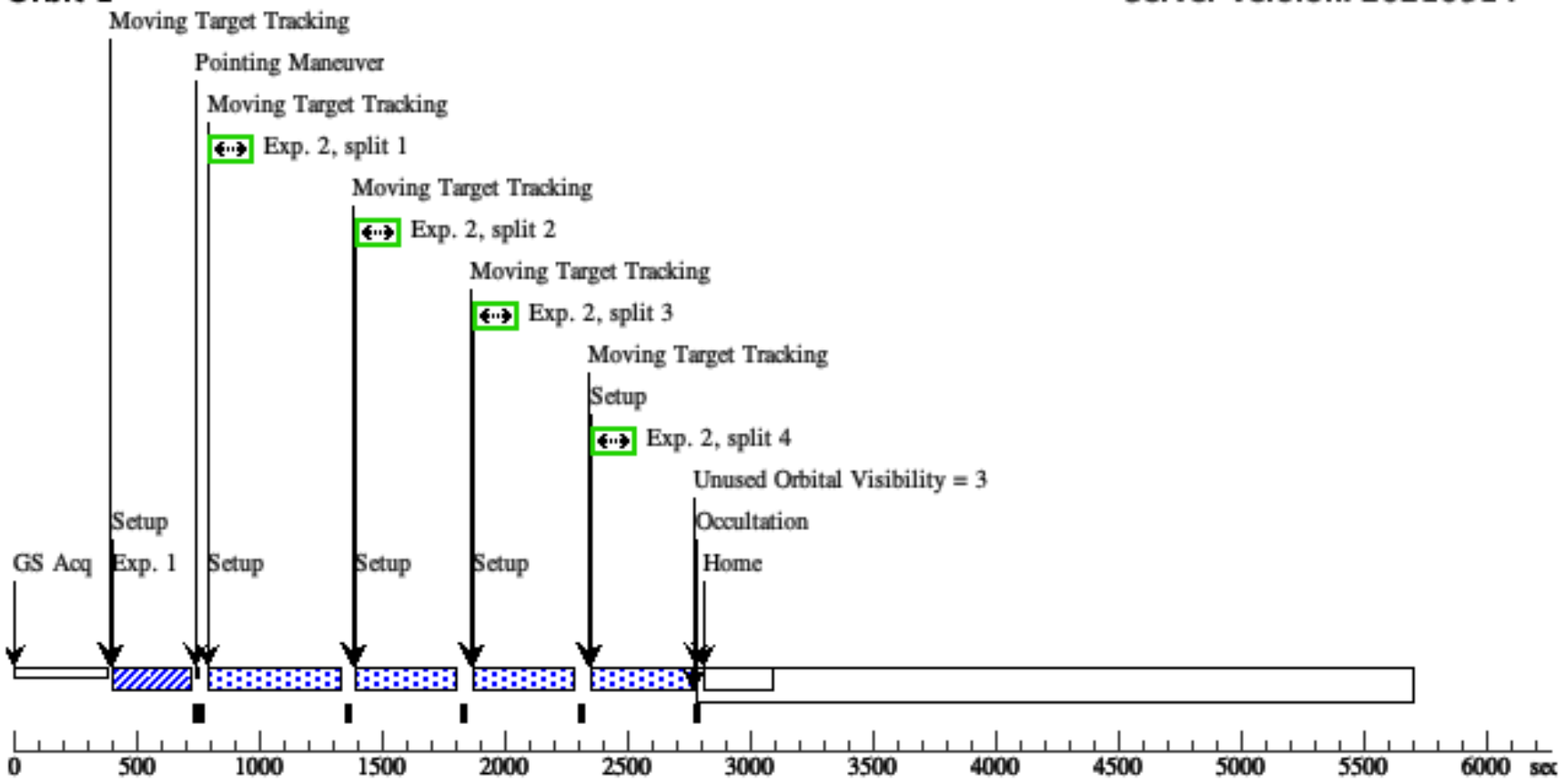
| # | Name | Level 1 | Level 2 | Level 3 | Window | Ephem Center |
|---|---|---|---|---|---|---|
| (3) | KALLIOPE | TYPE=ASTEROID,A=2.910811086370775,E=0.1026126721936686,I=13.71800616908085,O=66.32384713978851,W=357.2358458220123,M=23.27708382605396,EQUINOX=J2000,EPOCH=21-JAN-2002:00:00:00,EpochTimeScale=TDB | | | | EARTH |

*Comments: Description=Asteroid (22) Kalliope*
*Extended=NO*

## Exposures

| # | Label (ETC Run) | Target | Config,Mode,Aperture | Spectral Els. | Opt. Params. | Special Reqs. | Groups | Exp. Time (Total)/[Actual Dur.] | Orbit |
|---|---|---|---|---|---|---|---|---|---|
| 1 | Kalliope ACQ (COS.ta.1525231) | (3) KALLIOPE | COS/NUV, ACQ/IMAGE, PSA | MIRRORB | | | | 6 Secs (6 Secs)<br>*[==>]* | *[1]* |
| 2 | Kalliope OBS (COS.sp.1504604) | (3) KALLIOPE | COS/FUV, TIME-TAG, PSA | G140L<br>1280 A | BUFFER-TIME=5000;<br>FP-POS=ALL | | | 2000 Secs (1448 Secs)<br>*[==>362.0 Secs (Split 1)]*<br>*[==>362.0 Secs (Split 2)]*<br>*[==>362.0 Secs (Split 3)]*<br>*[==>362.0 Secs (Split 4)]* | *[1]* |

Orbit Structure



## Visit

**Proposal 16652, Psyche Visit (03), implementation** Thu Sep 16 21:00:40 GMT 2021

**Diagnostic Status: No Diagnostics**

Scientific Instruments: COS/FUV, COS/NUV

Special Requirements: BETWEEN 10-FEB-2022:00:00:00 AND 24-MAR-2022:00:00:00

## Solar System Targets

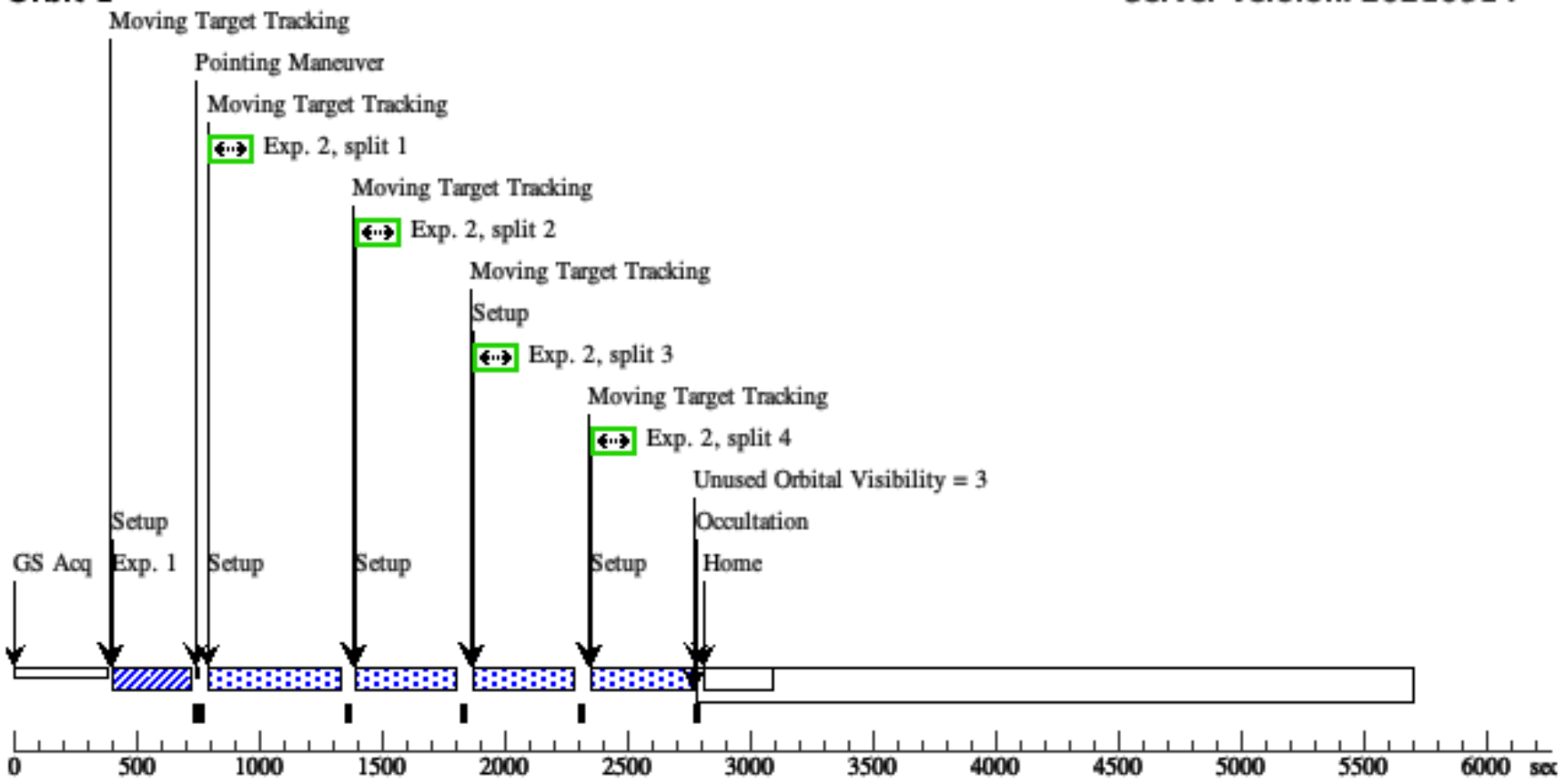
| # | Name | Level 1 | Level 2 | Level 3 | Window | Ephem Center |
|---|---|---|---|---|---|---|
| (1) | PSYCHE | TYPE=ASTEROID,A=2.923229269737752,E=0.1336522060480093,I=3.09651191862866,O=150.0382290044058,W=229.0561885944505,M=27.14022917776214,EQUINOX=J2000,EPOCH=10-SEP-2020:00:00:00,EpochTimeScale=TDB | | | | EARTH |

*Comments: Description=Asteroid (16) Psyche*
*Extended=NO*

## Exposures

| # | Label (ETC Run) | Target | Config,Mode,Aperture | Spectral Els. | Opt. Params. | Special Reqs. | Groups | Exp. Time (Total)/[Actual Dur.] | Orbit |
|---|---|---|---|---|---|---|---|---|---|
| 1 | Pysche ACQ (COS.ta.1525231) | (1) PSYCHE | COS/NUV, ACQ/IMAGE, PSA | MIRRORB | | | | 6 Secs (6 Secs)<br>*[==>]* | <br>***[1]*** |
| 2 | Psyche OBS (COS.sp.1504666) | (1) PSYCHE | COS/FUV, TIME-TAG, PSA | G140L<br>1280 A | BUFFER-TIME=5000;<br>FP-POS=ALL | | | 2000 Secs (1448 Secs)<br>*[==>362.0 Secs (Split 1)]*<br>*[==>362.0 Secs (Split 2)]*<br>*[==>362.0 Secs (Split 3)]*<br>*[==>362.0 Secs (Split 4)]* | <br>***[1]*** |

Orbit Structure



## Visit

**Proposal 16652, Hertha Visit (04), implementation** Thu Sep 16 21:00:40 GMT 2021

**Diagnostic Status: No Diagnostics**

Scientific Instruments: COS/FUV, COS/NUV

Special Requirements: BETWEEN 22-MAR-2022:00:00:00 AND 03-MAY-2022:00:00:00

## Solar System Targets

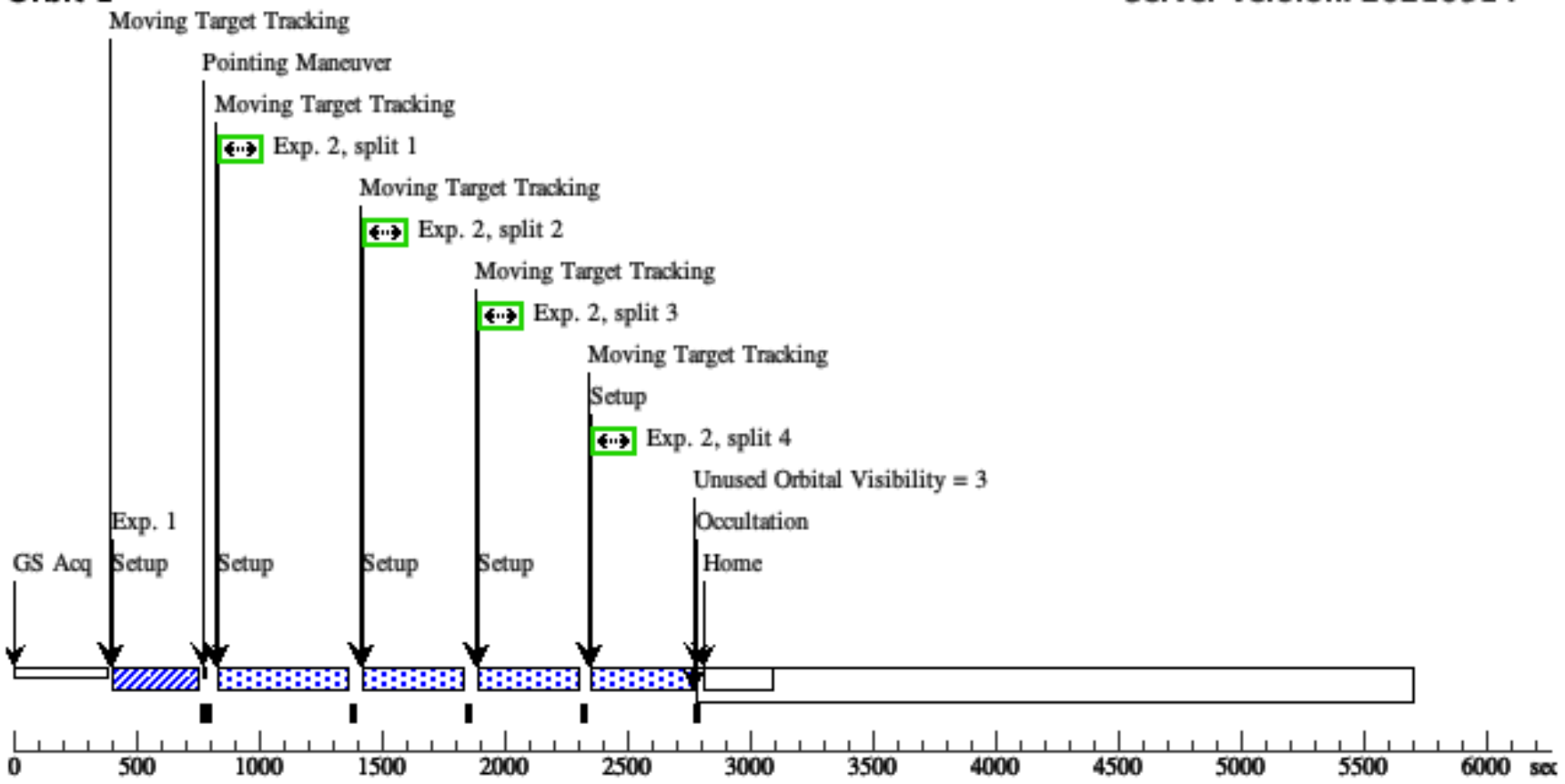
| # | Name | Level 1 | Level 2 | Level 3 | Window | Ephem Center |
|---|---|---|---|---|---|---|
| (4) | HERTHA | TYPE=ASTEROID,A=2.42912091518 2235,E=0.2057287123292141,I=2.303 965508339807 ,O=343.8209847543632,W=340.22772 02082004,M=41.18374923605137,EQ UINOX=J2000,EPOCH=01-JUN-2012:00:00:00,EpochTimeScale=TDB | | | | EARTH |

*Comments: Description=Asteroid (135) Hertha*
*Extended=NO*

## Exposures

| # | Label (ETC Run) | Target | Config,Mode,Aperture | Spectral Els. | Opt. Params. | Special Reqs. | Groups | Exp. Time (Total)/[Actual Dur.] | Orbit |
|---|---|---|---|---|---|---|---|---|---|
| 1 | Hertha ACQ (COS.ta.1525235) | (4) HERTHA | COS/NUV, ACQ/IMAGE, PSA | MIRRORB | | | | 22 Secs (22 Secs)<br>*[==>]* | <br>***[1]*** |
| 2 | (COS.sp.1504604) | (4) HERTHA | COS/FUV, TIME-TAG, PSA | G140L<br>1280 A | BUFFER-TIME=5000;<br>FP-POS=ALL | | | 2000 Secs (1416 Secs)<br>*[==>354.0 Secs (Split 1)]*<br>*[==>354.0 Secs (Split 2)]*<br>*[==>354.0 Secs (Split 3)]*<br>*[==>354.0 Secs (Split 4)]* | <br>***[1]*** |

Orbit Structure



## Visit

**Proposal 16652, Kleopatra Visit (05), implementation** Thu Sep 16 21:00:40 GMT 2021

**Diagnostic Status: No Diagnostics**

Scientific Instruments: COS/FUV, COS/NUV

Special Requirements: BETWEEN 26-AUG-2022:00:00:00 AND 07-OCT-2022:00:00:00

## Solar System Targets

| # | Name | Level 1 | Level 2 | Level 3 | Window | Ephem Center |
|---|---|---|---|---|---|---|
| (2) | KLEOPATRA | TYPE=ASTEROID,A=2.795981864738576,E=0.2496748590403307,I=13.10070257588763,O=215.389402926145,W=180.2871818940264,M=101.384231517913,EQUINOX=J2000,EPOCH=19-JAN-2015:00:00:00,EpochTimeScale=TDB | | | | EARTH |

*Comments: Description=Asteroid (216) Kleopatra*
*Extended=NO*

## Exposures

| # | Label (ETC Run) | Target | Config,Mode,Aperture | Spectral Els. | Opt. Params. | Special Reqs. | Groups | Exp. Time (Total)/[Actual Dur.] | Orbit |
|---|---|---|---|---|---|---|---|---|---|
| 1 | Kleopatra ACQ (COS.ta.1525237) | (2) KLEOPATRA | COS/NUV, ACQ/IMAGE, BOA | MIRRORA | | | | 30 Secs (30 Secs)<br>*[==>]* | *[1]* |
| 2 | Kleopatra OBS (COS.sp.1504666) | (2) KLEOPATRA | COS/FUV, TIME-TAG, PSA | G140L<br>1280 A | BUFFER-TIME=5000;<br>FP-POS=ALL | | | 2000 Secs (1464 Secs)<br>*[==>366.0 Secs (Split 1)]*<br>*[==>366.0 Secs (Split 2)]*<br>*[==>366.0 Secs (Split 3)]*<br>*[==>366.0 Secs (Split 4)]* | *[1]* |

Orbit Structure