



# 15450 - New Horizons support observations for 2014MU69 encounter WFC3 WFCa

Cycle: 25, Proposal Category: GO/DD

(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> |
|--------------|------------------------------|-------------------------------------|--------------------|-------------------------------|-------------------------------|
| 13           | (3) 486958-E                 | WFC3/UVIS                           | 1                  | 25-Oct-2018 17:00:26.0        | yes                           |
| 15           | (2) MU20180804               | WFC3/UVIS                           | 1                  | 25-Oct-2018 17:00:28.0        | yes                           |

2 Total Orbits Used

## ABSTRACT

We propose observations in support of the upcoming New Horizons encounter for 2014MU69.

One visit is for support observations of a star to be occulted by 2014MU69 on 2018 August 4 from which ultra-precise astrometry and shape information about the target can be derived. The second visit is for a backup epoch of astrometry on 2014MU69 itself at the end of the 2018 observing window at a time when New Horizons will also be observing the target.

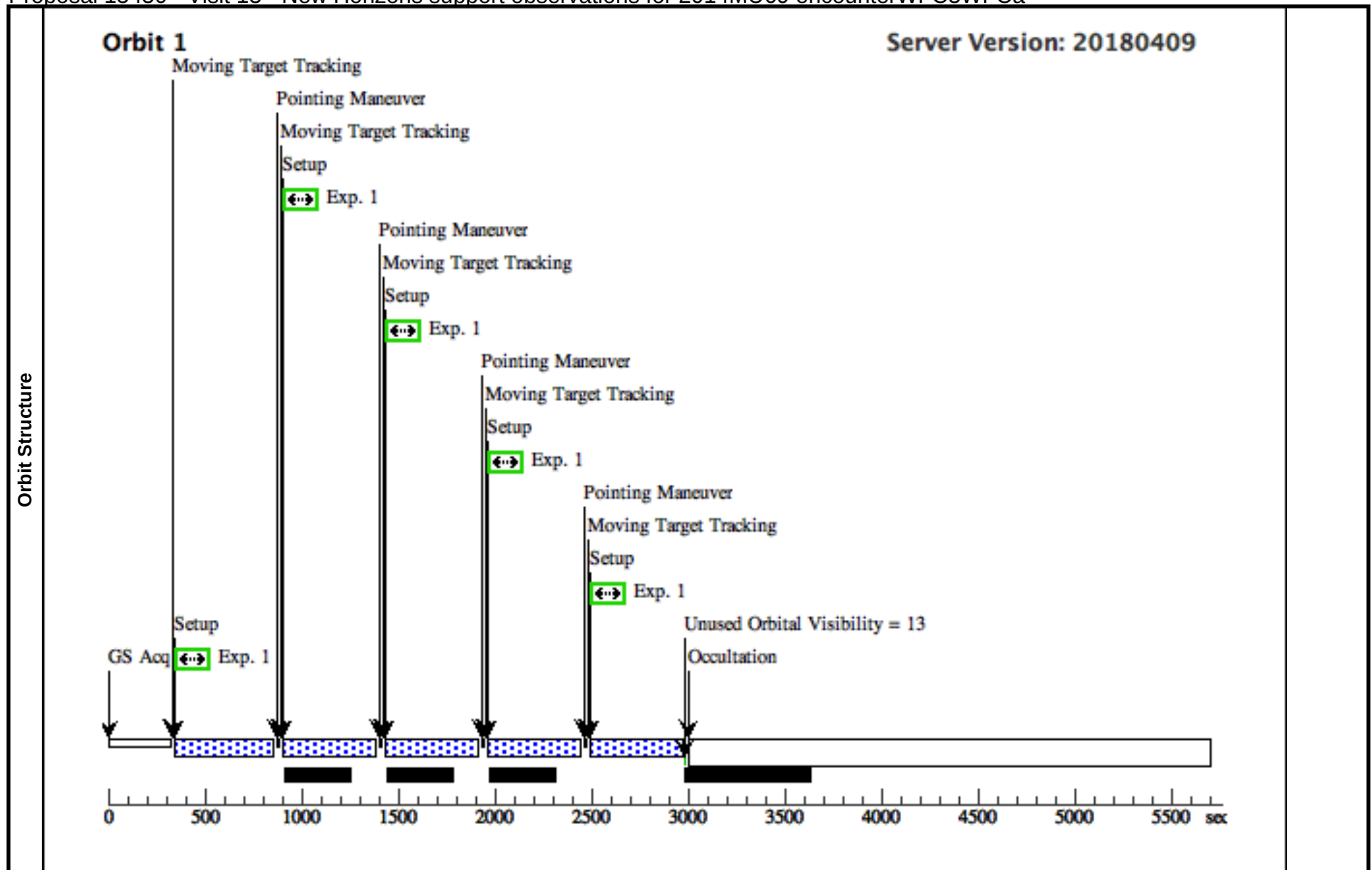
## **OBSERVING DESCRIPTION**

The two visits in this program are very different. One visit is a routine observation of 2014MU69 for astrometry and uses the same observing methods we have been using since 2014. Five long exposures, full field with WFC3, tracking 2014MU69. This visit needs to be coordinated with the last visit of the multi-cycle proposal started with proposal id 14629. The two visits will need to be scheduled about three days apart in October 2018. These will be the last HST data prior to the New Horizons encounter with 2014MU69.

The second visit is of a star that will be occulted by 2014MU69 on 2018 August 4. These observations are primarily intended to check for stellar duplicity that, if found, would provide a crucial update to the occultation prediction. These images also are used to get near-epoch observations of the occultation star for an improved position over what we have from the Gaia DR2 catalog. The observations consist of short sub-array exposures with dithering to reconstruct a diffraction limited image and a smaller number of full-field images for astrometry of the target star.

# Proposal 15450 - Visit 13 - New Horizons support observations for 2014MU69 encounterWFC3WFCa

|                      |                                                                                                                                                                                                                                                                                                                                                                                                              |                       |                                                                                                                                                                                                            |                            |               |                   |                             |                                                                                                     |                                                                                                  |           |                              |
|----------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------|---------------|-------------------|-----------------------------|-----------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------|-----------|------------------------------|
| Visit                | Proposal 15450, Visit 13, implementation                                                                                                                                                                                                                                                                                                                                                                     |                       |                                                                                                                                                                                                            |                            |               |                   |                             |                                                                                                     |                                                                                                  |           | Thu Oct 25 21:00:28 GMT 2018 |
|                      | Diagnostic Status: No Diagnostics                                                                                                                                                                                                                                                                                                                                                                            |                       |                                                                                                                                                                                                            |                            |               |                   |                             |                                                                                                     |                                                                                                  |           |                              |
|                      | Scientific Instruments: WFC3/UVIS                                                                                                                                                                                                                                                                                                                                                                            |                       |                                                                                                                                                                                                            |                            |               |                   |                             |                                                                                                     |                                                                                                  |           |                              |
|                      | Special Requirements: SCHED 90%; BETWEEN 25-OCT-2018:00:00:00 AND 11-NOV-2018:00:00:00<br><br>Comments: The scheduling for this visit must be coordinated with visit 12 from (14629/15158/????). These two visits are to be sheduled three days apart within the same one week window. We will need to verify the scheduling window for each visit to ensure there are no field star contamination problems. |                       |                                                                                                                                                                                                            |                            |               |                   |                             |                                                                                                     |                                                                                                  |           |                              |
| Patterns             | #                                                                                                                                                                                                                                                                                                                                                                                                            | Primary Pattern       |                                                                                                                                                                                                            |                            |               | Secondary Pattern |                             |                                                                                                     |                                                                                                  | Exposures |                              |
|                      | (1)                                                                                                                                                                                                                                                                                                                                                                                                          | Pattern Type=LINE     |                                                                                                                                                                                                            | Coordinate Frame=CELESTIAL |               |                   |                             |                                                                                                     |                                                                                                  | (1)       |                              |
| Purpose=OTHER        |                                                                                                                                                                                                                                                                                                                                                                                                              | Pattern Orientation=0 |                                                                                                                                                                                                            |                            |               |                   |                             |                                                                                                     |                                                                                                  |           |                              |
| Number Of Points=5   |                                                                                                                                                                                                                                                                                                                                                                                                              | Angle Between Sides=  |                                                                                                                                                                                                            |                            |               |                   |                             |                                                                                                     |                                                                                                  |           |                              |
| Point Spacing=.030   |                                                                                                                                                                                                                                                                                                                                                                                                              | Center Pattern=true   |                                                                                                                                                                                                            |                            |               |                   |                             |                                                                                                     |                                                                                                  |           |                              |
|                      |                                                                                                                                                                                                                                                                                                                                                                                                              | Line Spacing=         |                                                                                                                                                                                                            |                            |               |                   |                             |                                                                                                     |                                                                                                  |           |                              |
| Solar System Targets | #                                                                                                                                                                                                                                                                                                                                                                                                            | Name                  | Level 1                                                                                                                                                                                                    | Level 2                    | Level 3       | Window            | Ephem Center                |                                                                                                     |                                                                                                  |           |                              |
|                      | (3)                                                                                                                                                                                                                                                                                                                                                                                                          | 486958-E              | TYPE=ASTEROID,A=44.5226075626<br>38,E=0.040269637522,I=2.452265958<br>242,O=158.963182412558,W=174.926<br>199040395,M=315.140003030700,EQ<br>UINOX=J2000,EPOCH=15-AUG-<br>2018:00:00:00,EpochTimeScale=UTC | EARTH                      |               |                   |                             |                                                                                                     |                                                                                                  |           |                              |
|                      | Comments: Description=Kuiper-Belt Object                                                                                                                                                                                                                                                                                                                                                                     |                       |                                                                                                                                                                                                            |                            |               |                   |                             |                                                                                                     |                                                                                                  |           |                              |
| Exposures            | #                                                                                                                                                                                                                                                                                                                                                                                                            | Label                 | Target                                                                                                                                                                                                     | Config,Mode,Aperture       | Spectral Els. | Opt. Params.      | Special Reqs.               | Groups                                                                                              | Exp. Time (Total)/[Actual Dur.]                                                                  |           | Orbit                        |
|                      | 1                                                                                                                                                                                                                                                                                                                                                                                                            |                       | (3) 486958-E                                                                                                                                                                                               | WFC3/UVIS, ACCUM, UVIS2    | F350LP        |                   | GS ACQ SCENARI<br>O BASE1B3 | Sequence 1-1 Non-Int in Visit 13<br><br>Pattern 1, Exps 1-1 in Sequence 1-1 Non-Int in Visit 13 (1) | 367.0 Secs (1835 Secs)                                                                           |           | [1]                          |
|                      |                                                                                                                                                                                                                                                                                                                                                                                                              |                       |                                                                                                                                                                                                            |                            |               |                   |                             |                                                                                                     | [==>(Pattern 1)]<br>[==>(Pattern 2)]<br>[==>(Pattern 3)]<br>[==>(Pattern 4)]<br>[==>(Pattern 5)] |           |                              |



Proposal 15450 - MU20180804 OCCULTATION STAR (15) - New Horizons support observations for 2014MU69 encounterWFC3WFCa

|               |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |                                                                                                                                                                                                                                         |                                                                                      |                             |                |
|---------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------|-----------------------------|----------------|
| Visit         | <b>Proposal 15450, MU20180804 OCCULTATION STAR (15), completed</b> <span style="float: right;">Thu Oct 25 21:00:29 GMT 2018</span>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |                                                                                                                                                                                                                                         |                                                                                      |                             |                |
|               | <b>Diagnostic Status: No Diagnostics</b><br>Scientific Instruments: WFC3/UVIS<br>Special Requirements: BETWEEN 30-APR-2018:00:00:00 AND 20-MAY-2018:00:00:00<br><i>Comments: Observations consist of a set of exposures that just avoid saturation on the target star using a 1k sub-array and then a longer exposure set with a spatial scan to get nearby fainter field stars. All observations should be done within a single visibility window. The scheduling window is based on needing to get advance information for the occultation prediction while being close in time to the occultation. These observations should be done in mid-May, preferably somewhat before visit 09 of HST-GO-15158.</i> |                                                                                                                                                                                                                                         |                                                                                      |                             |                |
| Patterns      | #                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | Primary Pattern                                                                                                                                                                                                                         | Secondary Pattern                                                                    | Exposures                   |                |
|               | (2)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | Pattern Type=WFC3-UVIS-DITHER-BOX<br>Purpose=DITHER<br>Number Of Points=4<br>Point Spacing=0.173<br>Line Spacing=0.112<br>Coordinate Frame=POS-TARG<br>Pattern Orientation=23.884<br>Angle Between Sides=81.785<br>Center Pattern=false |                                                                                      | (1)                         |                |
| Fixed Targets | #                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | Name                                                                                                                                                                                                                                    | Target Coordinates                                                                   | Targ. Coord. Corrections    | Fluxes         |
|               | (2)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | MU20180804                                                                                                                                                                                                                              | RA: 19 04 21.4790 (286.0894958d)<br>Dec: -20 35 36.55 (-20.59349d)<br>Equinox: J2000 | Epoch of Position: 2018.589 | V=13.38+/-0.02 |
| Fixed Targets | Miscellaneous                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |                                                                                                                                                                                                                                         |                                                                                      |                             |                |
|               | Reference Frame: ICRS<br><i>Comments:</i><br>Category=STAR<br>Description=[UNDESIGNATED]                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |                                                                                                                                                                                                                                         |                                                                                      |                             |                |

Proposal 15450 - MU20180804 OCCULTATION STAR (15) - New Horizons support observations for 2014MU69 encounterWFC3WFCa

| Exposures | #                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | Label            | Target         | Config,Mode,Aperture              | Spectral Els. | Opt. Params.             | Special Reqs.                                                             | Groups                                                      | Exp. Time (Total)/[Actual Dur.]                                                                   | Orbit |
|-----------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------|----------------|-----------------------------------|---------------|--------------------------|---------------------------------------------------------------------------|-------------------------------------------------------------|---------------------------------------------------------------------------------------------------|-------|
|           | 1                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | SHORT EX POSURES | (2) MU20180804 | WFC3/UVIS, ACCUM, UVIS2-C1K1C-SUB | F438W         | FLASH=12;<br>CR-SPLIT=NO |                                                                           | Pattern 2, Exps 1-1 in MU20180804 OCCULTATION STAR (15) (2) | 15 Secs (60 Secs)<br>[==>(Pattern 1)]<br>[==>(Pattern 2)]<br>[==>(Pattern 3)]<br>[==>(Pattern 4)] | [1]   |
|           | <i>Comments: Similar observations with HST-GO-14926 used BLADE=A but this was flagged as an error with APT.</i>                                                                                                                                                                                                                                                                                                                                                                                                   |                  |                |                                   |               |                          |                                                                           |                                                             |                                                                                                   |       |
|           | 2                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |                  | (2) MU20180804 | WFC3/UVIS, ACCUM, UVIS2           | F438W         | CR-SPLIT=NO;<br>FLASH=10 | POS TARG 0,0;<br>SPATIAL SCAN 0.0 046,45.0 Degrees,Forward,null,1         |                                                             | 430 Secs (430 Secs)<br>[==>]                                                                      | [1]   |
|           | <i>Comments: This is being done as a spatial scan to increase the dynamic range of the images. The rate is chosen to be 1.5 pixels per 16 seconds. 16 seconds is the time for the target star to reach ~80% of saturation. The exposure time is set to put four full-frame exposures in the visibility window with a little bit left over to make sure this will schedule anywhere in the entire scheduling window requested. The angles are all different to mitigate against systematic field star overlap.</i> |                  |                |                                   |               |                          |                                                                           |                                                             |                                                                                                   |       |
|           | 3                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |                  | (2) MU20180804 | WFC3/UVIS, ACCUM, UVIS2           | F438W         | CR-SPLIT=NO;<br>FLASH=10 | POS TARG 0.090,0.02;<br>SPATIAL SCAN 0.0 046,135.0 Degrees,Forward,null,1 |                                                             | 430 Secs (430 Secs)<br>[==>]                                                                      | [1]   |
|           | 4                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |                  | (2) MU20180804 | WFC3/UVIS, ACCUM, UVIS2           | F438W         | CR-SPLIT=NO;<br>FLASH=10 | POS TARG 0.18,0.04;<br>SPATIAL SCAN 0.0 046,235.0 Degrees,Forward,null,1  |                                                             | 430 Secs (430 Secs)<br>[==>]                                                                      | [1]   |
|           | 5                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |                  | (2) MU20180804 | WFC3/UVIS, ACCUM, UVIS2           | F438W         | CR-SPLIT=NO;<br>FLASH=10 | POS TARG 0.270,0.06;<br>SPATIAL SCAN 0.0 046,325.0 Degrees,Forward,null,1 |                                                             | 430 Secs (430 Secs)<br>[==>]                                                                      | [1]   |

