



17974 - WFC3 IR Astrometric Scale Monitoring

Cycle: 33, Proposal Category: CAL/WFC3

(Availability Mode: RESTRICTED)

INVESTIGATORS

| <i>Name</i> | <i>Institution</i> |
|---|--|
| Dr. Mitchell Revalski (PI) (Contact) | Space Telescope Science Institute |
| Anne O'Connor (CoI) (Contact) | Space Telescope Science Institute |
| Varun Bajaj (CoI) (Contact) | Space Telescope Science Institute |

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) OMEGACEN | WFC3/IR | 1 | 05-Jan-2026 12:00:47.0 | yes |
| 02 | (1) OMEGACEN | WFC3/IR WFC3/UVIS | 1 | 05-Jan-2026 12:00:48.0 | yes |
| 03 | (1) OMEGACEN | WFC3/IR WFC3/UVIS | 1 | 05-Jan-2026 12:00:48.0 | yes |

3 Total Orbits Used

ABSTRACT

The standard astrometric catalog in the field of globular cluster Omega Cen has been used to examine the geometric distortion of WFC3 IR as function of wavelength in multi-cycle calibration programs over last 12 years of WFC3 on HST board. All observations from these programs have been reduced and provided the multi-wavelength geometric distortion in IR detector. The derived geometric distortion coefficients implemented in the IDCTAB format are used in the HST pipe-line to correct for a ~7% distortion in WFC3/UVIS and IR images down to <1%.

Proposal 17974 (STScI Edit Number: 2, Created: Monday, January 5, 2026, 12:00:49PM Eastern Standard Time) - Overview

Additional to multi-wavelength WFC3 geometric distortion, all observations of Omega Cen taken through F160W IR filters during the last 12 years (all together 13 epochs) were used to look for time dependency of IR geometric distortion and the effect of the scale change due to the thermal breathing. The results of the stability WFC3 geometric distortion published in WFC3-ISR-2015-02 (Kozhurina-Platais & Anderson, 2015), WFC3-ISR-2019-09 (Martlin, Kozhurina-Platais), have shown that the IR geometric distortion is stable over 10 years on-orbit within 0.05 pixels or 2 mas in UVIS. In a more recent analysis, WFC3 ISR 2025-04 (O'Connor et. al., 2025), we find a period of increased uncertainty and offsets in the rotation term between 2018 and 2021, corresponding with a period of increased jitter. We find a similar pattern of increased uncertainty between 2018 and 2021 in the skew offsets to Gaia DR3, as well. We find no significant linear temporal evolution in the rotation, skew, or scale offsets between the WFC3/IR IDCTAB distortion solution and Gaia DR3 over the 16-year lifetime of the WFC3 instrument; however, we do see temporal evolution in the shift offsets (the difference -in pixels- between the IDCTAB and Gaia WCS positions), which are dominated by telescope pointing inaccuracy external to the WFC3/IR geometric distortion solution.

The purpose of this calibration proposal is to continue the monitor of the stability of the WFC3 geometric distortion over time. The observations of Omega Cen through the F160W IR filter will be used to derive the skew and scale terms of the geometric distortion and look for any secular changes over time.

In addition, several UVIS and IR filters have been appended for the purposes of generating new PSF models for the community.

OBSERVING DESCRIPTION

The observation of Omega Cen through F160W is used as a standard filter in IR. They are observed with the same pointing but with different roll-angle of the OTA at a single epoch in either July/August 2026 at an orient of ~126 degrees or in Jan -April 2027 at an orient of ~290 degrees.

The 3 exposures in IR have steps of roll-angles -1.5, 0, +1.5 degrees also require 3 orbits. To maintain accurate pointing control, 2-guide star acquisitions are used. If suitable guide stars can be found, the same pair of guide stars are used for all exposures.

In this cycle, similiar to Cycle 32, additional IR filters are added for the purpose of building additional PSF models, based on usage statistics in GO science programs.

---Calibration Goals---

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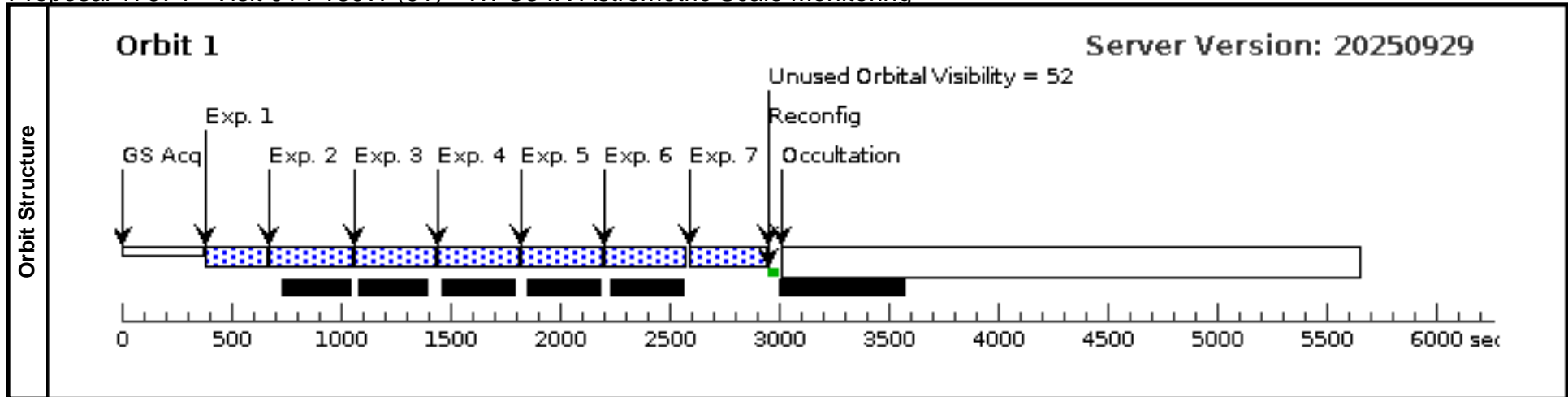
The geometric distortion of WFC3 in 13 UVIS and 8 IR filters were calibrated using the standard astrometric catalog of Omega Cen (Anderson & van der Marel, 2010). An update set of updated distortions were obtained for 20 UVIS filters using the same standard astrometric catalog of Omega Cen (Kozhurina-Platais, WFC3-ISR-2014-12; Martlin et al. WFC3-ISR-2018-11).

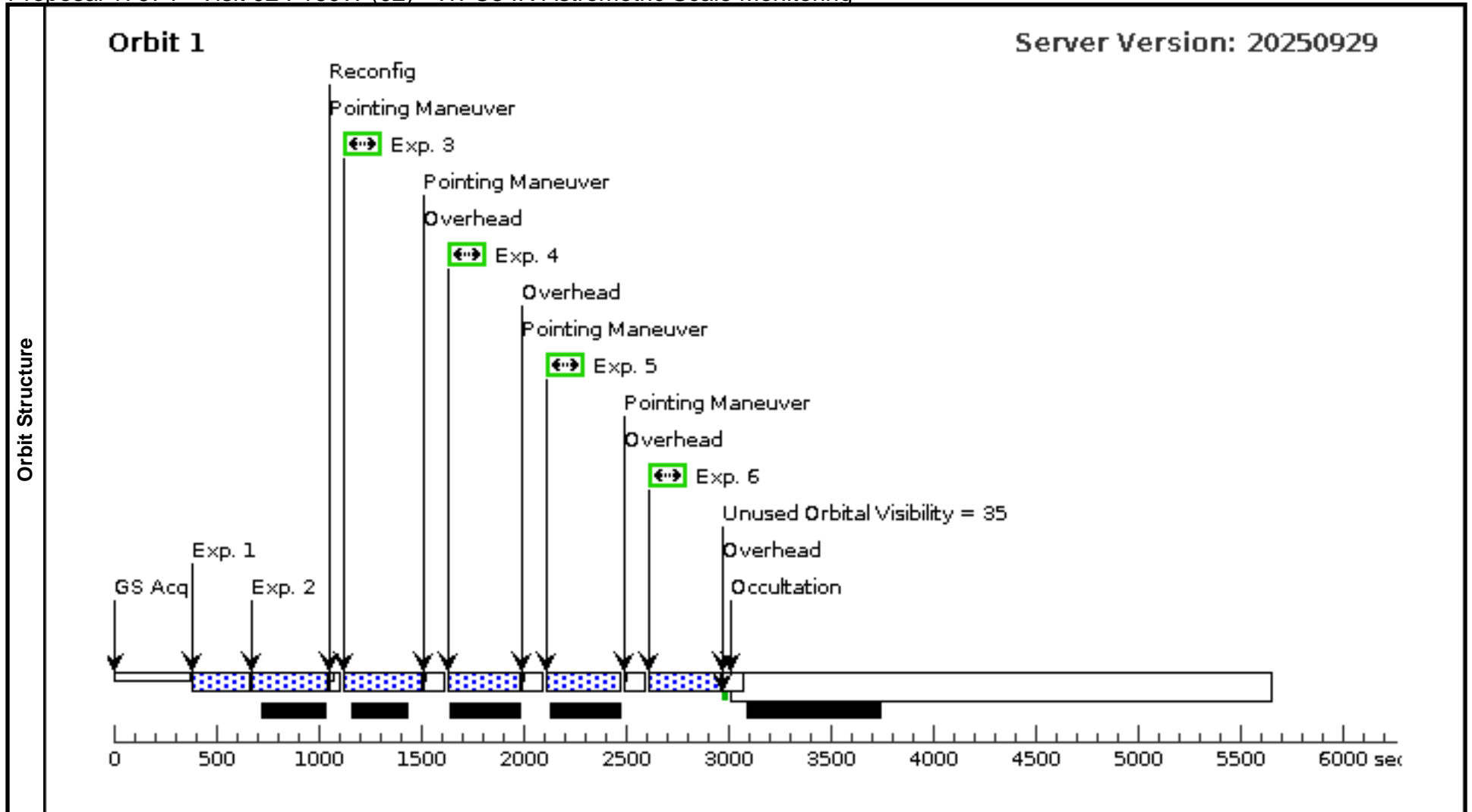
The goal of this proposal is to monitor the geometric distortion of the IR detector. The skew parameter in the ACS/WFC case, is changing with time in the level of 40 mas over 15 years on board of HST. The skew parameter is the non-perpendicularity of coordinate axes and is the major parameter in the geometric distortion model.

Proposal 17974 - Visit 01 F160W (01) - WFC3 IR Astrometric Scale Monitoring

Mon Jan 05 17:00:49 GMT 2026

| Visit | Proposal 17974, Visit 01 F160W (01), implementation Diagnostic Status: No Diagnostics Scientific Instruments: WFC3/IR Special Requirements: PCS MODE FINE; BETWEEN 01-JUN-2026:00:00:00 AND 01-SEP-2026:00:00:00 | | | | | | | | | |
|-----------|---|--|--------------|-------------------------|---------------|-----------------------------------|-----------------------|--------|---|-------|
| | Fixed Targets | # Name Target Coordinates Targ. Coord. Corrections Fluxes Miscellaneous (1) OMEGACEN RA: 13 26 46.2800 (201.6928333d) Dec: -47 28 44.60 (-47.47906d) Equinox: J2000 <i>Comments: This is the same target (and coordinates) as used in CAL/WFC3 11911, UVIS L-Flats and Geometric Distortion and in other multi-cycles calibration proposals</i> Category=CALIBRATION Description=[ASTROMETRIC, SPATIAL DISTORTION TEST] | | | | | | | | |
| Exposures | # | Label | Target | Config,Mode,Aperture | Spectral Els. | Opt. Params. | Special Reqs. | Groups | Exp. Time (Total)/[Actual Dur.] | Orbit |
| | 1 | F160W | (1) OMEGACEN | WFC3/IR, MULTIACCUM, IR | F160W | SAMP-SEQ=SPARS 25; NSAMP=11 | EXP PCS MODE FI NE | | 252.937441 Secs (252.937 Secs) [==>] | [1] |
| | 2 | F130N | (1) OMEGACEN | WFC3/IR, MULTIACCUM, IR | F130N | SAMP-SEQ=SPARS 25; NSAMP=15 | EXP PCS MODE FI NE | | 352.939501 Secs (352.94 Secs) [==>] | [1] |
| | 3 | F132N | (1) OMEGACEN | WFC3/IR, MULTIACCUM, IR | F132N | SAMP-SEQ=SPARS 25; NSAMP=15 | EXP PCS MODE FI NE | | 352.939501 Secs (352.94 Secs) [==>] | [1] |
| | 4 | F126N | (1) OMEGACEN | WFC3/IR, MULTIACCUM, IR | F126N | SAMP-SEQ=SPARS 25; NSAMP=15 | EXP PCS MODE FI NE | | 352.939501 Secs (352.94 Secs) [==>] | [1] |
| | 5 | F128N | (1) OMEGACEN | WFC3/IR, MULTIACCUM, IR | F128N | SAMP-SEQ=SPARS 25; NSAMP=15 | EXP PCS MODE FI NE | | 352.939501 Secs (352.94 Secs) [==>] | [1] |
| | 6 | F167N | (1) OMEGACEN | WFC3/IR, MULTIACCUM, IR | F167N | SAMP-SEQ=SPARS 25; NSAMP=15 | EXP PCS MODE FI NE | | 352.939501 Secs (352.94 Secs) [==>] | [1] |
| | 7 | F139M | (1) OMEGACEN | WFC3/IR, MULTIACCUM, IR | F139M | SAMP-SEQ=SPARS 25; NSAMP=14 | EXP PCS MODE FI NE | | 327.938986 Secs (327.939 Secs) [==>] | [1] |





Proposal 17974 - Visit 03 F160W (03) - WFC3 IR Astrometric Scale Monitoring

Mon Jan 05 17:00:49 GMT 2026

| Visit | Proposal 17974, Visit 03 F160W (03), implementation Diagnostic Status: Warning Scientific Instruments: WFC3/IR, WFC3/UVIS Special Requirements: PCS MODE FINE; ORIENT 3D TO 3D FROM 01: BETWEEN 01-JUN-2026:00:00:00 AND 01-SEP-2026:00:00:00 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
|---|---|--|-------------------------|--------------------------|-----------------------------------|-----------------------|---------------|---|----------------------|--|--------------|---------------|-----------------------|---|-------|---|-------|--------------|-------------------------|-------|-----------------------------------|-----------------------|--|---|-----|---|-------|--------------|------------------------|-------|----------|--|--|------------------------------|-----|---|-------|--------------|------------------------|-------|----------|--|--|------------------------------|-----|---|-------|--------------|------------------------|-------|----------|----------------|--|------------------------------|-----|---|-------|--------------|------------------------|-------|----------|--|--|------------------------------|-----|---|-------|--------------|------------------------|-------|----------|--|--|------------------------------|-----|
| | (F390W (03.006)) Warning (Form): FLASH level may be too low for this exposure or a short subexposure. See extended explanation in the diagnostic browser | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Fixed Targets | <table border="1"> <thead> <tr> <th>#</th> <th>Name</th> <th>Target Coordinates</th> <th>Targ. Coord. Corrections</th> <th>Fluxes</th> <th>Miscellaneous</th> </tr> </thead> <tbody> <tr> <td>(1)</td> <td>OMEGACEN</td> <td>RA: 13 26 46.2800 (201.6928333d) Dec: -47 28 44.60 (-47.47906d) Equinox: J2000</td> <td></td> <td>V=16.8+/-0.1</td> <td>Reference Frame: ICRS</td> </tr> </tbody> </table> | # | Name | Target Coordinates | Targ. Coord. Corrections | Fluxes | Miscellaneous | (1) | OMEGACEN | RA: 13 26 46.2800 (201.6928333d) Dec: -47 28 44.60 (-47.47906d) Equinox: J2000 | | V=16.8+/-0.1 | Reference Frame: ICRS | <i>Comments: This is the same target (and coordinates) as used in CAL/WFC3 11911, UVIS L-Flats and Geometric Distortion and in other multi-cycles calibration proposals</i> Category=CALIBRATION Description=[ASTROMETRIC, SPATIAL DISTORTION TEST] | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | # | Name | Target Coordinates | Targ. Coord. Corrections | Fluxes | Miscellaneous | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| (1) | OMEGACEN | RA: 13 26 46.2800 (201.6928333d) Dec: -47 28 44.60 (-47.47906d) Equinox: J2000 | | V=16.8+/-0.1 | Reference Frame: ICRS | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| <table border="1"> <thead> <tr> <th>#</th> <th>Label</th> <th>Target</th> <th>Config,Mode,Aperture</th> <th>Spectral Els.</th> <th>Opt. Params.</th> <th>Special Reqs.</th> <th>Groups</th> <th>Exp. Time (Total)/[Actual Dur.]</th> <th>Orbit</th> </tr> </thead> <tbody> <tr> <td>1</td> <td>F160W</td> <td>(1) OMEGACEN</td> <td>WFC3/IR, MULTIACCUM, IR</td> <td>F160W</td> <td>SAMP-SEQ=SPARS 25; NSAMP=11</td> <td>EXP PCS MODE FI NE</td> <td></td> <td>252.937441 Secs (252.937 Secs) [==>]</td> <td>[1]</td> </tr> <tr> <td>2</td> <td>F395N</td> <td>(1) OMEGACEN</td> <td>WFC3/UVIS, ACCUM, UVIS</td> <td>F395N</td> <td>FLASH=21</td> <td></td> <td></td> <td>350 Secs (350 Secs) [==>]</td> <td>[1]</td> </tr> <tr> <td>3</td> <td>F657N</td> <td>(1) OMEGACEN</td> <td>WFC3/UVIS, ACCUM, UVIS</td> <td>F657N</td> <td>FLASH=21</td> <td></td> <td></td> <td>350 Secs (350 Secs) [==>]</td> <td>[1]</td> </tr> <tr> <td>4</td> <td>F657N</td> <td>(1) OMEGACEN</td> <td>WFC3/UVIS, ACCUM, UVIS</td> <td>F657N</td> <td>FLASH=21</td> <td>POS TARG .3,.3</td> <td></td> <td>350 Secs (350 Secs) [==>]</td> <td>[1]</td> </tr> <tr> <td>5</td> <td>F343N</td> <td>(1) OMEGACEN</td> <td>WFC3/UVIS, ACCUM, UVIS</td> <td>F343N</td> <td>FLASH=21</td> <td></td> <td></td> <td>350 Secs (350 Secs) [==>]</td> <td>[1]</td> </tr> <tr> <td>6</td> <td>F390W</td> <td>(1) OMEGACEN</td> <td>WFC3/UVIS, ACCUM, UVIS</td> <td>F390W</td> <td>FLASH=14</td> <td></td> <td></td> <td>200 Secs (200 Secs) [==>]</td> <td>[1]</td> </tr> </tbody> </table> | | | | | | # | Label | Target | Config,Mode,Aperture | Spectral Els. | Opt. Params. | Special Reqs. | Groups | Exp. Time (Total)/[Actual Dur.] | Orbit | 1 | F160W | (1) OMEGACEN | WFC3/IR, MULTIACCUM, IR | F160W | SAMP-SEQ=SPARS 25; NSAMP=11 | EXP PCS MODE FI NE | | 252.937441 Secs (252.937 Secs) [==>] | [1] | 2 | F395N | (1) OMEGACEN | WFC3/UVIS, ACCUM, UVIS | F395N | FLASH=21 | | | 350 Secs (350 Secs) [==>] | [1] | 3 | F657N | (1) OMEGACEN | WFC3/UVIS, ACCUM, UVIS | F657N | FLASH=21 | | | 350 Secs (350 Secs) [==>] | [1] | 4 | F657N | (1) OMEGACEN | WFC3/UVIS, ACCUM, UVIS | F657N | FLASH=21 | POS TARG .3,.3 | | 350 Secs (350 Secs) [==>] | [1] | 5 | F343N | (1) OMEGACEN | WFC3/UVIS, ACCUM, UVIS | F343N | FLASH=21 | | | 350 Secs (350 Secs) [==>] | [1] | 6 | F390W | (1) OMEGACEN | WFC3/UVIS, ACCUM, UVIS | F390W | FLASH=14 | | | 200 Secs (200 Secs) [==>] | [1] |
| # | Label | Target | Config,Mode,Aperture | Spectral Els. | Opt. Params. | Special Reqs. | Groups | Exp. Time (Total)/[Actual Dur.] | Orbit | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
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| 2 | F395N | (1) OMEGACEN | WFC3/UVIS, ACCUM, UVIS | F395N | FLASH=21 | | | 350 Secs (350 Secs) [==>] | [1] | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 3 | F657N | (1) OMEGACEN | WFC3/UVIS, ACCUM, UVIS | F657N | FLASH=21 | | | 350 Secs (350 Secs) [==>] | [1] | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 4 | F657N | (1) OMEGACEN | WFC3/UVIS, ACCUM, UVIS | F657N | FLASH=21 | POS TARG .3,.3 | | 350 Secs (350 Secs) [==>] | [1] | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 5 | F343N | (1) OMEGACEN | WFC3/UVIS, ACCUM, UVIS | F343N | FLASH=21 | | | 350 Secs (350 Secs) [==>] | [1] | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 6 | F390W | (1) OMEGACEN | WFC3/UVIS, ACCUM, UVIS | F390W | FLASH=14 | | | 200 Secs (200 Secs) [==>] | [1] | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |

