



12714 - UVIS and IR Geometric Distortion Corrections its stability

Cycle: 19, Proposal Category: CAL/WFC3

(Availability Mode: RESTRICTED)

INVESTIGATORS

| <i>Name</i> | <i>Institution</i> | <i>E-Mail</i> |
|--|--|------------------------|
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| Dr. Larry D. Petro (CoI) | Space Telescope Science Institute | petro@stsci.edu |

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/UVIS | 1 | 01-Feb-2012 21:09:59.0 | yes |
| 02 | (1) OMEGACEN | WFC3/UVIS | 1 | 01-Feb-2012 21:10:04.0 | yes |
| 03 | (1) OMEGACEN | WFC3/UVIS | 1 | 01-Feb-2012 21:10:07.0 | yes |
| 04 | (1) OMEGACEN | WFC3/UVIS | 1 | 01-Feb-2012 21:10:09.0 | yes |
| 05 | (1) OMEGACEN | WFC3/IR | 1 | 01-Feb-2012 21:10:12.0 | yes |
| 06 | (1) OMEGACEN | WFC3/IR | 1 | 01-Feb-2012 21:10:16.0 | yes |
| 07 | (1) OMEGACEN | WFC3/IR | 1 | 01-Feb-2012 21:10:18.0 | yes |
| 08 | (1) OMEGACEN | WFC3/IR | 1 | 01-Feb-2012 21:10:20.0 | yes |

8 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 UVIS and IR as function of wavelength in Cycle 17 & Cycle 18. All observations from Cycle 17 & 18 have been reduced and provide the multi-wavelength

Proposal 12714 (STScI Edit Number: 1, Created: Wednesday, February 1, 2012 9:10:24 PM EST) - Overview

geometric distortion in UVIS and IR detector. The derived geometric distortion coefficients implemented in IDCTAB format are used in HST pipeline to correct for ~7% distortion in WFC3 images down to 1%.

Additional to multi-wavelength WFC3 geometric distortion, all observations of Omega Cen taken through F606W and F160W UVIS and IR filters respectively during the last two years (all together 7 epochs) were used to look for time dependency of UVIS and IR geometric distortion and the effect of the scale change due to the thermal breathing. The preliminary results of the stability WFC3 geometric distortion have show that the WFC3 geometric distortion is stable over 2 years on-orbit within 0.05 pixels or 2 and 6 mas in UVIS and IR respectively.

The purpose of this calibration proposal is to continue the monitor of the WFC3 geometric distortion stability of over time.

The observations of Omega Cen through UVIS F606W filter and F160W IR filter will be used to derive the skew and scale terms of the geometric distortion and look for any secular changes.

OBSERVING DESCRIPTION

The observation of Omega Cen through F606W and F160W as a standard filters in UVIS and IR will be observed with the same pointing but with different roll-angle of the OTA in around March 2012.

The set of 8 exposures in F606W and F160W filters are sampled in the allowed full range of roll-angles at the ecliptic latitude of Omega Cen, and ranged approximately from 300 to 360 degree. Four UVIS exposures in 1 orbit will be observed in the following sequence of off-nominal (~360 degree) roll-angles: Orbit #1 - 0,+10,+15,-5 degree. Four IR exposures in 1 orbit will be observed in the following sequence of off-nominal (~360 degree) roll-angles: Orbit #2 - 0,+10,+15,-5 degree. In order to improve the schedule, a small range of roll is allowed at each specific roll angle. The order of the exposures in each orbit is specified by a SEQUENTIAL Special Requirement and the order of the orbits is specified by AFTER Special Requirements. 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 8 exposures.

REAL TIME JUSTIFICATION

Not applicable

CALIBRATION JUSTIFICATION

Proposal 12714 (STScI Edit Number: 1, Created: Wednesday, February 1, 2012 9:10:24 PM EST) - Overview

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 Martel, 2010). The goal of this proposal is to monitor the geometric distortion of UVIS and IR detector. The skew parameter (the non-perpendicularity of coordinate axes), which is the major parameter in the geometric distortion model, in the ACS/WFC case, is changing with time in the level of 40" over 5 years on board of HST.

The results from WFC3/UVIS supplemental calibration program 12094 from Cycle 17 have been reduced and have show that skew in UVIS geometric distortion model during one year of WFC3 on board is stable and in the range of $\pm 3''$ which give the offset at ± 0.05 pixels at the far edges of UVIS frames (Kozhurina-Platais et.al 2010 in "HST Calibration Workshop" and WFC3-ISR -2011 in preperation). Thus, the goal of this calibration proposal is to continue the monitor the UVIS and IR skew as function of time.

ADDITIONAL COMMENTS

The 4 exposures in UVIS with steps of roll-angles ± 5 degree of off-nominal roll-angles required 4 orbits, the same 4 exposures in IR with the steps of roll-angles ± 5 degree of nominal roll-angles, also required 4 orbits. However, APT requires each Visit to begin at the start of an orbit and therefore calculates that this proposal requires 8 orbits, which APT indicates is mostly unused. Accordingly, APT generates a Warning that the Visits will not fit within the required 2 orbits and 10 Warnings that the SEQUENTIAL sets cannot fit within one orbit. However, based upon known overheads for the moderate roll-slews used and overheads for full guide star acquisitions, these indicated VISITS (1,2,3,4, with UVIS and 5,6,7,8 with IR)

should be be schedule in 2 orbits. The exposures with UVIS are: Orbit #1, Visits 1,2,3,4 off-nominal roll 0, +10,+15 and -5 degree. The exposures with IR are: Orbit #2, Visits 5,6,7,8 off-nominal roll 0,+10,+15,-5 degree.

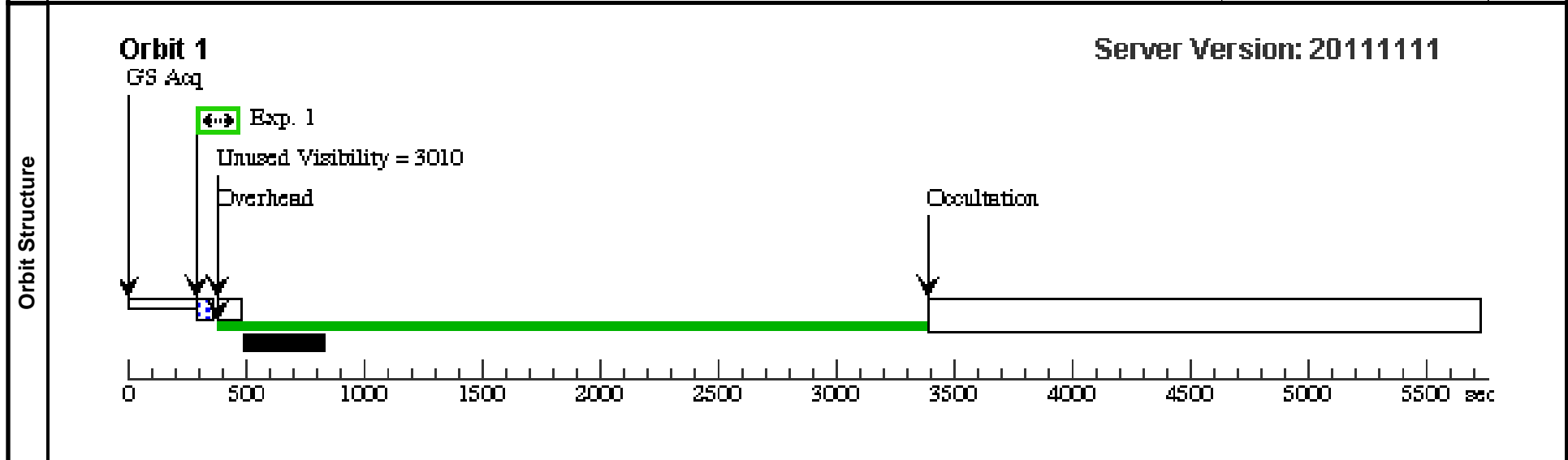
Proposal 12714 - Visit 01 - UVIS and IR Geometric Distortion Corrections its stability

Thu Feb 02 02:10:25 GMT 2012

| | | | | | |
|--------------|--|--|--|--|--|
| Visit | Proposal 12714, Visit 01, implementation | | | | |
| | Diagnostic Status: No Diagnostics | | | | |
| | Scientific Instruments: WFC3/UVIS | | | | |
| | Special Requirements: PCS MODE FINE; ORIENT -5D TO -5D FROM 02; BETWEEN 01-MAR-2012:00:00:00 AND 30-APR-2012:00:00:00; SEQ 01,02,03,04 WITHIN 1 Orbits | | | | |

| 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 | | V=16.8 | Reference Frame: ICRS |
| <i>Comments: This is the same target (and coordinates) as used in CAL/WFC3 11911, UVIS L-Flats and Geometric Distortion</i> | | | | | | |

| Exposures | # | Label | Target | Config,Mode,Aperture | Spectral Els. | Opt. Params. | Special Reqs. | Groups | Exp. Time/[Actual Dur.] | Orbit |
|------------------|---|-------|--------------|------------------------|---------------|--------------|---|--------|-------------------------|-------|
| | 1 | F606W | (1) OMEGACEN | WFC3/UVIS, ACCUM, UVIS | F606W | CR-SPLIT=NO | EXP PCS MODE FINE; GS ACQ SCENARIO BASE1B3 | | 40. Secs [==>] | [1] |



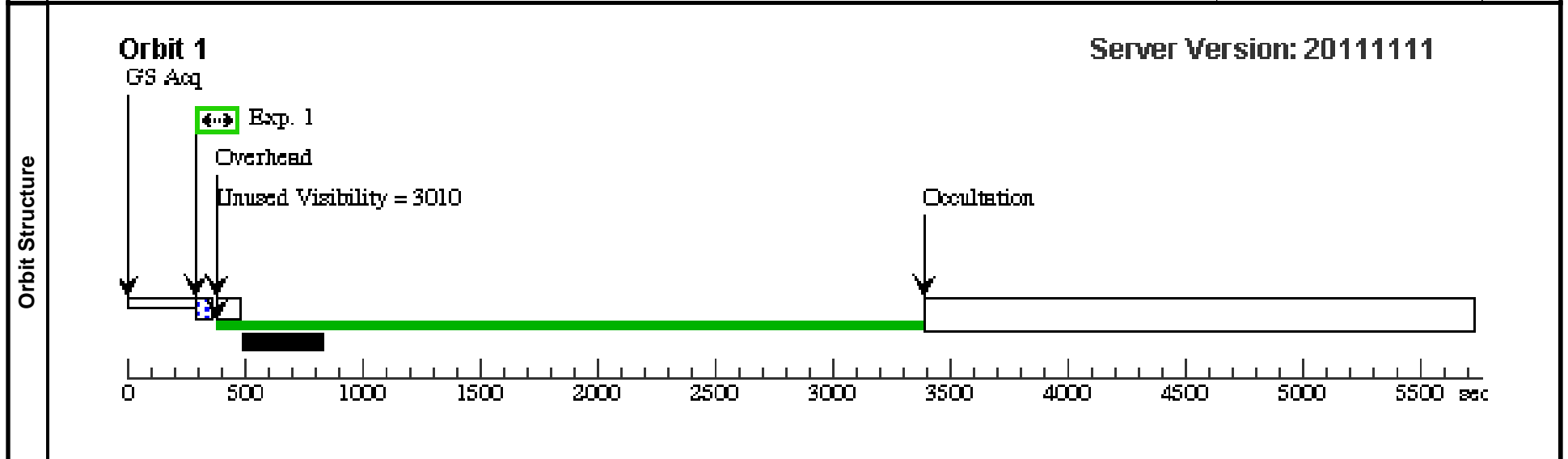
Proposal 12714 - Visit 02 - UVIS and IR Geometric Distortion Corrections its stability

Thu Feb 02 02:10:26 GMT 2012

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|--------------|--|--|--|--|--|
| Visit | Proposal 12714, Visit 02, implementation | | | | |
| | Diagnostic Status: No Diagnostics | | | | |
| | Scientific Instruments: WFC3/UVIS | | | | |
| | Special Requirements: PCS MODE FINE; BETWEEN 01-MAR-2012:00:00:00 AND 30-APR-2012:00:00:00 | | | | |

| 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 | | V=16.8 | Reference Frame: ICRS |
| | <i>Comments: This is the same target (and coordinates) as used in CAL/WFC3 11911, UVIS L-Flats and Geometric Distortion</i> | | | | | |

| Exposures | # | Label | Target | Config,Mode,Aperture | Spectral Els. | Opt. Params. | Special Reqs. | Groups | Exp. Time/[Actual Dur.] | Orbit |
|------------------|---|-------|--------------|------------------------|---------------|--------------|---|--------|-------------------------|-------|
| | 1 | F606W | (1) OMEGACEN | WFC3/UVIS, ACCUM, UVIS | F606W | CR-SPLIT=NO | EXP PCS MODE FINE; GS ACQ SCENARIO BASE1B3 | | 40. Secs [==>] | [1] |



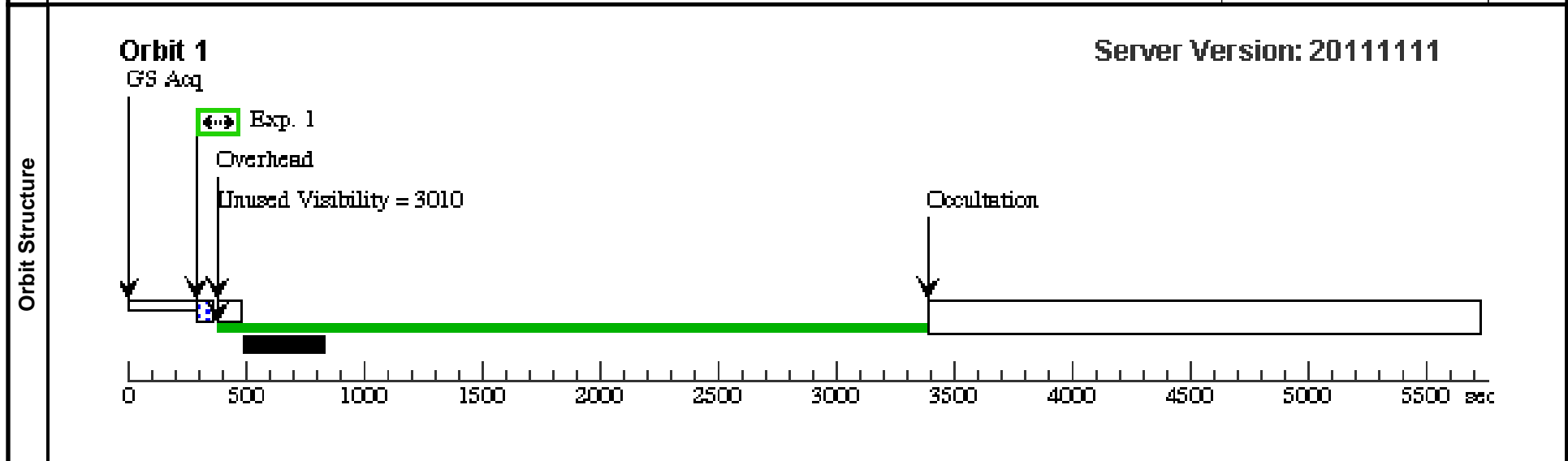
Proposal 12714 - Visit 03 - UVIS and IR Geometric Distortion Corrections its stability

Thu Feb 02 02:10:27 GMT 2012

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|--------------|---|--|--|--|--|
| Visit | Proposal 12714, Visit 03, implementation | | | | |
| | Diagnostic Status: No Diagnostics | | | | |
| | Scientific Instruments: WFC3/UVIS | | | | |
| | Special Requirements: PCS MODE FINE; ORIENT +10D TO +10D FROM 02; BETWEEN 01-MAR-2012:00:00:00 AND 30-APR-2012:00:00:00 | | | | |

| 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 | | V=16.8 | Reference Frame: ICRS |
| | <i>Comments: This is the same target (and coordinates) as used in CAL/WFC3 11911, UVIS L-Flats and Geometric Distortion</i> | | | | | |

| Exposures | # | Label | Target | Config,Mode,Aperture | Spectral Els. | Opt. Params. | Special Reqs. | Groups | Exp. Time/[Actual Dur.] | Orbit |
|------------------|---|-------|--------------|------------------------|---------------|--------------|---|--------|-------------------------|-------|
| | 1 | F606W | (1) OMEGACEN | WFC3/UVIS, ACCUM, UVIS | F606W | CR-SPLIT=NO | EXP PCS MODE FINE; GS ACQ SCENARIO BASE1B3 | | 40. Secs [==>] | [1] |



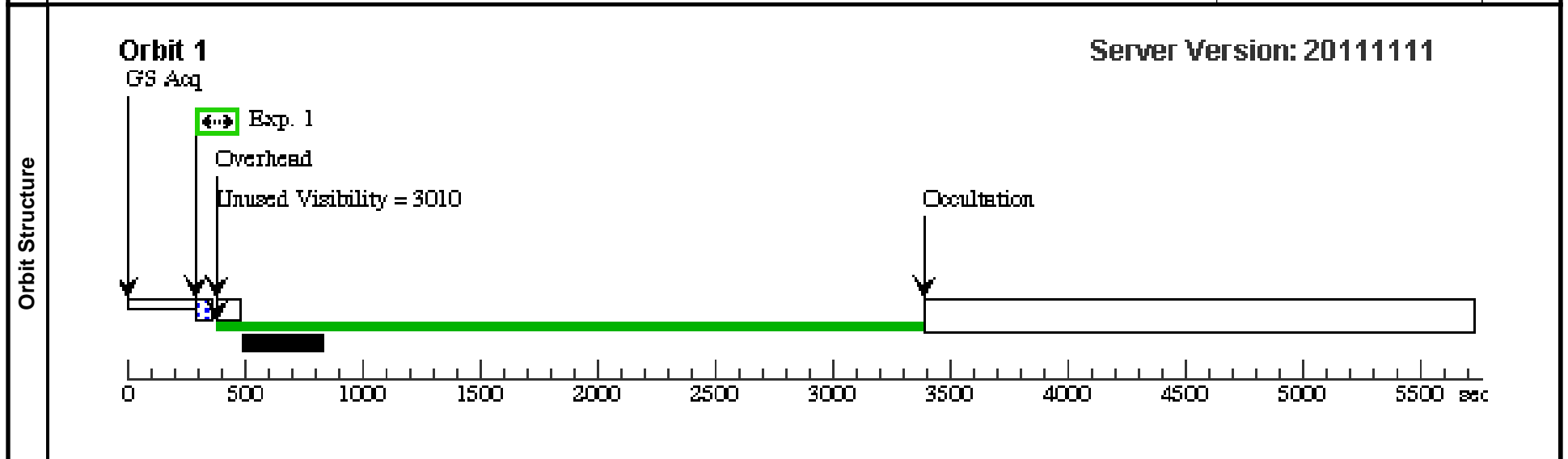
Proposal 12714 - Visit 04 - UVIS and IR Geometric Distortion Corrections its stability

Thu Feb 02 02:10:28 GMT 2012

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|--------------|---|--|--|--|--|
| Visit | Proposal 12714, Visit 04, implementation | | | | |
| | Diagnostic Status: No Diagnostics | | | | |
| | Scientific Instruments: WFC3/UVIS | | | | |
| | Special Requirements: PCS MODE FINE; ORIENT +15D TO +15D FROM 02; BETWEEN 01-MAR-2012:00:00:00 AND 30-APR-2012:00:00:00 | | | | |

| 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 | | V=16.8 | Reference Frame: ICRS |
| | <i>Comments: This is the same target (and coordinates) as used in CAL/WFC3 11911, UVIS L-Flats and Geometric Distortion</i> | | | | | |

| Exposures | # | Label | Target | Config,Mode,Aperture | Spectral Els. | Opt. Params. | Special Reqs. | Groups | Exp. Time/[Actual Dur.] | Orbit |
|------------------|---|-------|--------------|------------------------|---------------|--------------|---|--------|-------------------------|-------|
| | 1 | F606W | (1) OMEGACEN | WFC3/UVIS, ACCUM, UVIS | F606W | CR-SPLIT=NO | EXP PCS MODE FINE; GS ACQ SCENARIO BASE1B3 | | 40. Secs [==>] | [1] |



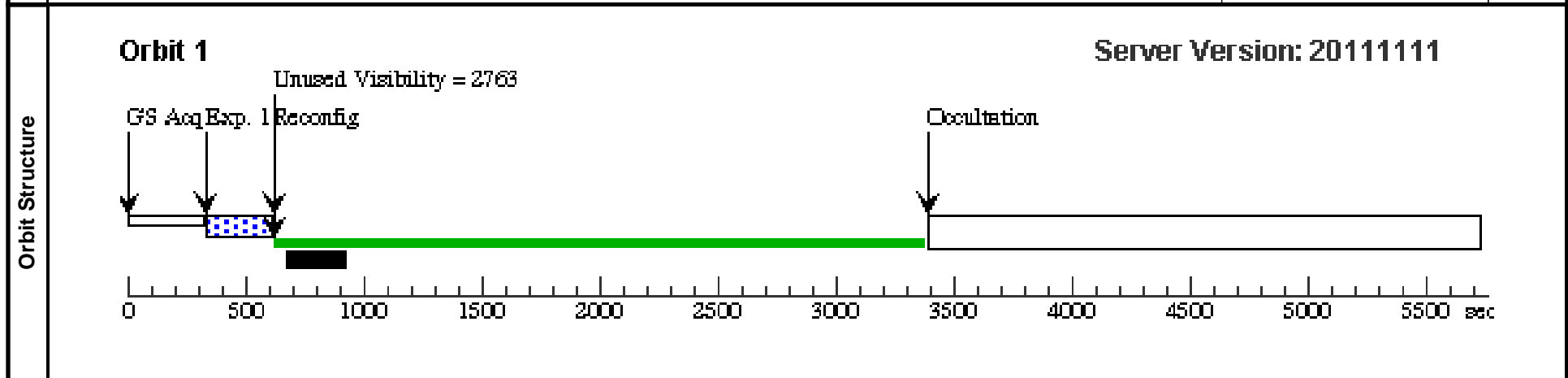
Proposal 12714 - Visit 05 - UVIS and IR Geometric Distortion Corrections its stability

Thu Feb 02 02:10:28 GMT 2012

| | | | | | |
|--------------|---|--|--|--|--|
| Visit | Proposal 12714, Visit 05, implementation | | | | |
| | Diagnostic Status: No Diagnostics | | | | |
| | Scientific Instruments: WFC3/IR | | | | |
| | Special Requirements: PCS MODE FINE; ORIENT -5D TO -5D FROM 02; BETWEEN 01-MAR-2012:00:00:00 AND 30-APR-2012:00:00:00; SEQ 05,06,07 WITHIN 1 Orbits | | | | |

| 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 | | V=16.8 | Reference Frame: ICRS |
| <i>Comments: This is the same target (and coordinates) as used in CAL/WFC3 11911, UVIS L-Flats and Geometric Distortion</i> | | | | | | |

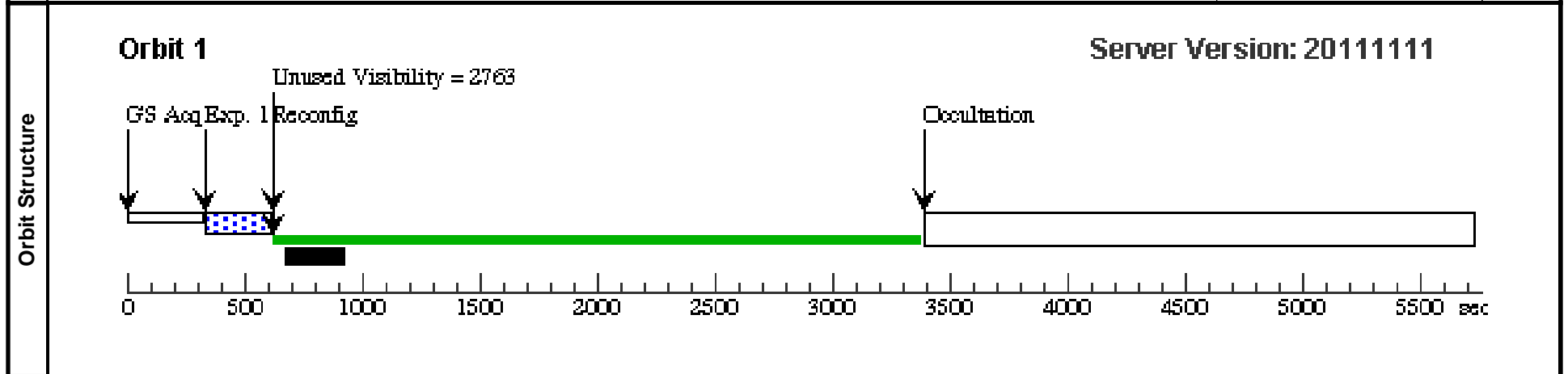
| Exposures | # | Label | Target | Config,Mode,Aperture | Spectral Els. | Opt. Params. | Special Reqs. | Groups | Exp. Time/[Actual Dur.] | Orbit |
|------------------|---|-------|--------------|-------------------------|---------------|-----------------------------------|---|--------|-------------------------|-------|
| | 1 | F160W | (1) OMEGACEN | WFC3/IR, MULTIACCUM, IR | F160W | SAMP-SEQ=SPARS 25; NSAMP=11 | EXP PCS MODE FI NE; GS ACQ SCENARI O BASE1B3 | | [==>] | [1] |



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|--------------|--|--|--|--|--|
| Visit | Proposal 12714, Visit 06, implementation | | | | |
| | Diagnostic Status: No Diagnostics | | | | |
| | Scientific Instruments: WFC3/IR | | | | |
| | Special Requirements: PCS MODE FINE; AFTER 04; BETWEEN 01-MAR-2012:00:00:00 AND 30-APR-2012:00:00:00 | | | | |

| 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 | | V=16.8 | Reference Frame: ICRS |
| <i>Comments: This is the same target (and coordinates) as used in CAL/WFC3 11911, UVIS L-Flats and Geometric Distortion</i> | | | | | | |

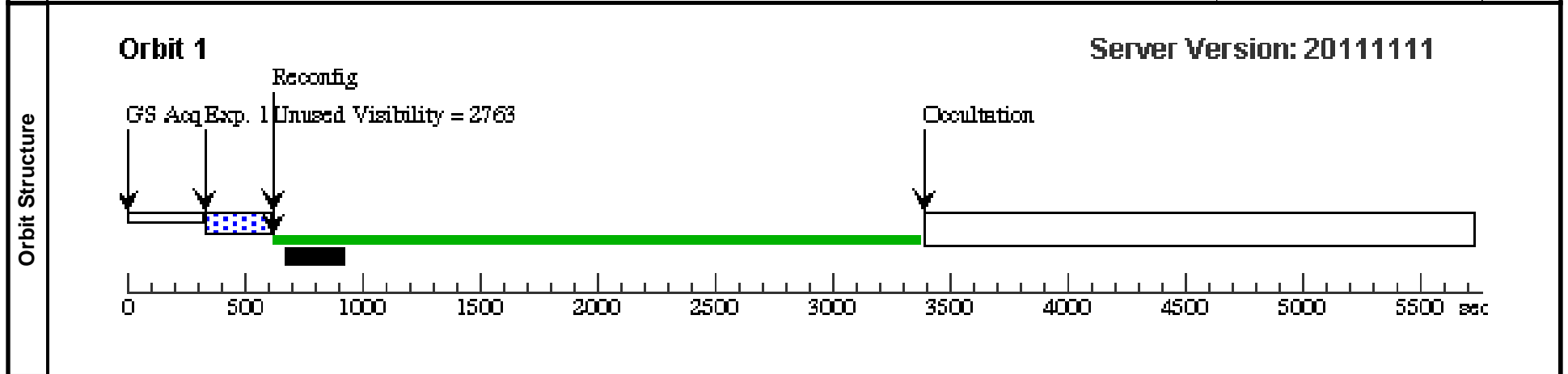
| Exposures | # | Label | Target | Config,Mode,Aperture | Spectral Els. | Opt. Params. | Special Reqs. | Groups | Exp. Time/[Actual Dur.] | Orbit |
|------------------|---|-------|--------------|-------------------------|---------------|-----------------------------------|---|--------|-------------------------|-------|
| | 1 | F160W | (1) OMEGACEN | WFC3/IR, MULTIACCUM, IR | F160W | SAMP-SEQ=SPARS 25; NSAMP=11 | EXP PCS MODE FI NE; GS ACQ SCENARI O BASE1B3 | | [==>] | [1] |



| | | | | | |
|--------------|---|--|--|--|--|
| Visit | Proposal 12714, Visit 07, implementation | | | | |
| | Diagnostic Status: No Diagnostics | | | | |
| | Scientific Instruments: WFC3/IR | | | | |
| | Special Requirements: PCS MODE FINE; ORIENT +15D TO +15D FROM 06; AFTER 04; BETWEEN 01-MAR-2012:00:00:00 AND 30-APR-2012:00:00:00 | | | | |

| 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 | | V=16.8 | Reference Frame: ICRS |
| | <i>Comments: This is the same target (and coordinates) as used in CAL/WFC3 11911, UVIS L-Flats and Geometric Distortion</i> | | | | | |

| Exposures | # | Label | Target | Config,Mode,Aperture | Spectral Els. | Opt. Params. | Special Reqs. | Groups | Exp. Time/[Actual Dur.] | Orbit |
|------------------|---|-------|--------------|-------------------------|---------------|-----------------------------------|---|--------|-------------------------|-------|
| | 1 | F160W | (1) OMEGACEN | WFC3/IR, MULTIACCUM, IR | F160W | SAMP-SEQ=SPARS 25; NSAMP=11 | EXP PCS MODE FI NE; GS ACQ SCENARI O BASE1B3 | | [==>] | [1] |



| | | | | | |
|--------------|--|--|--|--|--|
| Visit | Proposal 12714, Visit 08, implementation | | | | |
| | Diagnostic Status: No Diagnostics | | | | |
| | Scientific Instruments: WFC3/IR | | | | |
| | Special Requirements: PCS MODE FINE; AFTER 04; BETWEEN 01-MAR-2012:00:00:00 AND 30-APR-2012:00:00:00 | | | | |

| 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 | | V=16.8 | Reference Frame: ICRS |
| | <i>Comments: This is the same target (and coordinates) as used in CAL/WFC3 11911, UVIS L-Flats and Geometric Distortion</i> | | | | | |

| Exposures | # | Label | Target | Config,Mode,Aperture | Spectral Els. | Opt. Params. | Special Reqs. | Groups | Exp. Time/[Actual Dur.] | Orbit |
|------------------|---|-------|--------------|-------------------------|---------------|-----------------------------------|---|--------|-------------------------|-------|
| | 1 | F160W | (1) OMEGACEN | WFC3/IR, MULTIACCUM, IR | F160W | SAMP-SEQ=SPARS 25; NSAMP=11 | EXP PCS MODE FI NE; GS ACQ SCENARI O BASE1B3 | | [==>] | [1] |

