



## 14700 - Light Echoes and the Environments of SNe 2014J and 2016adj

Cycle: 24, Proposal Category: GO

(Availability Mode: SUPPORTED)

### INVESTIGATORS

| <i>Name</i>                                  | <i>Institution</i>                          | <i>E-Mail</i>                   |
|--|---|---------------------------------|
| <b>Dr. Ben E. K. Sugerman (PI) (Contact)</b> | <b>Goucher College</b>                      | <b>ben.sugerman@goucher.edu</b> |
| Dr. Greg Bryan (CoI)                         | Columbia University in the City of New York | gbryan@astro.columbia.edu       |
| Dr. Mookwang Ryan Joung (CoI)                | Columbia University in the City of New York | moo@astro.columbia.edu          |
| Dr. Stephen S. Lawrence (CoI)                | Hofstra University                          | stephen.lawrence@hofstra.edu    |
| Dr. Jeremiah P. Ostriker (CoI)               | Columbia University in the City of New York | jpo@astro.columbia.edu          |
| Dr. Joshua E. G. Peek (CoI)                  | Space Telescope Science Institute           | goldston@gmail.com              |
| Ms. Ashlee Bengé (CoI)                       | Goucher College                             | ashlee.benge@mail.goucher.edu   |
| Dr. Mordecai-Mark Mac Low (CoI)              | American Museum of Natural History          | mordecai@amnh.org               |

### 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           | (2) SN-2014J                 | WFC3/UVIS                           | 2                  | 29-Jul-2016 14:55:19.0        | yes                           |
| 02           | (2) SN-2014J                 | WFC3/UVIS                           | 2                  | 29-Jul-2016 14:55:21.0        | yes                           |
| 03           | (2) SN-2014J                 | WFC3/UVIS                           | 2                  | 29-Jul-2016 14:55:22.0        | yes                           |
| 04           | (1) SN-2016ADJ               | WFC3/UVIS                           | 2                  | 29-Jul-2016 14:55:24.0        | yes                           |
| 05           | (1) SN-2016ADJ               | WFC3/UVIS                           | 2                  | 29-Jul-2016 14:55:25.0        | yes                           |
| 06           | (1) SN-2016ADJ               | WFC3/UVIS                           | 2                  | 29-Jul-2016 14:55:27.0        | yes                           |

12 Total Orbits Used

## **ABSTRACT**

Light echoes are one of the most powerful and efficient probes of the structure and composition of dust in circumstellar and interstellar environments. Observations of light echoes provide exact three-dimensional (3-D) positions of dust while constraining its density, grain-size and chemical make-up. These can be used to study the evolutionary history of supernova (SN) progenitors, produce high-resolution maps of the structure and composition of interstellar media (ISM), and geometrically measure extragalactic distances. However, echoes pass through a given point only once, and only illuminate a thin slice of a complete structure at any given time, thus accomplishing meaningful science requires carefully-planned, repeated observations.

The Type Ia SN 2014J in M82, and the core-collapse SN 2016adj in Cen A are both nearby ( $\sim 3.5$  Mpc), highly reddened ( $A_V=2-4$  mags), and were reported within the last year to have produced resolved light echoes. With 12 orbits of HST and 2.4 hours of Spitzer follow-up observations proposed here, we will map out much more of the 3-D geometry and measure the dust properties of numerous independent structures within the ISM of the host galaxies, and map out or constrain the presence of circumstellar material around each SN. These results can be further used to investigate why the extinction toward SN 2014J ( $R_V=1.4$ ) differs from Galactic values; measure the geometric distances to both host galaxies; constrain the progenitor properties; test competing models of Type Ib/Ib SNe; and benchmark whether echoes can help us understand galactic feedback, by comparing the actual structures they reveal to ISM simulations.

## **OBSERVING DESCRIPTION**

With HST, echoes are best revealed through PSF-matched difference imaging using broad optical filters in which the SN was bright and in which dust scattering is efficient. This is possible for both of our SNe, as their fields were observed prior to explosion: SN 2014J was imaged in F435W, F555W, and F814W with ACS/WFC on 27 Mar 2006 (GO-10776), and SN 2016adj with WFC3/UVIS in F438W, F547M, and F814W on 06 Jul 2010 (GO-11360). In particular, we have successfully drizzled the ACS/WFC images to WFC3/UVIS resolution, and find that they produce very good difference images with the WFC3 F438W, F555W, and F814W images of SN 2014J from DD-13626 and GO-14146. However, these particular observations did not have sufficient exposure times to unambiguously reveal many faint echoes. Through our extensive experience imaging light echoes (e.g. GO-10204, 10607, and 13392) we have found that faint echoes require minimum exposure times of 2400 sec in blue (e.g. F438W) and 1600 sec in redder filters (e.g. F555W, F547M, and F814W); modeling confirms these will be sufficient for SN 2014J. We can fit these exposure lengths in all three filters for a given SN into two orbits using the WFC3 UVIS2-C512C-SUB aperture; this field contains enough stars to allow accurate geometric registration of images to the pre-explosion data. We use the four-point dither box with sub-pixel offsets to drizzle to higher

resolution and provide maximal rejection of artifacts.

An echo illuminates new material on a timescale equal to the effective width of its light pulse, 30-40 days for SN 2014J and an expected 50-80 days for SN 2016adj. In practice we have seen echoes completely appear and disappear on timescales of about a year (e.g. SN 1993J). We will therefore return to each SN on 5-6 month intervals, to ensure that we circumvent such variability while accurately mapping the echoing dust structures. Each SN was observed between Jun-Jul 2016 as part of Cycle 23 GO-14146 and DD-14487, thus we will begin the Cycle 24 observations in late 2016.

The choice of narrow observing windows for SN 2016adj reflects the need to match narrow visibility windows between HST and Spitzer. The roll-angle requirements are to keep diffraction spikes from a nearby bright star from covering the supernova and its known echoes, when possible.

Proposal 14700 - sn2014j-8th (01) - Light Echoes and the Environments of SNe 2014J and 2016adj

Fri Jul 29 18:55:28 GMT 2016

|              |   |
|--------------|---|
| <b>Visit</b> | <b>Proposal 14700, sn2014j-8th (01)</b><br><b>Diagnostic Status: Warning</b><br>Scientific Instruments: WFC3/UVIS<br>Special Requirements: BETWEEN 15-OCT-2016:00:00:00 AND 15-NOV-2016 |
|--------------|---|

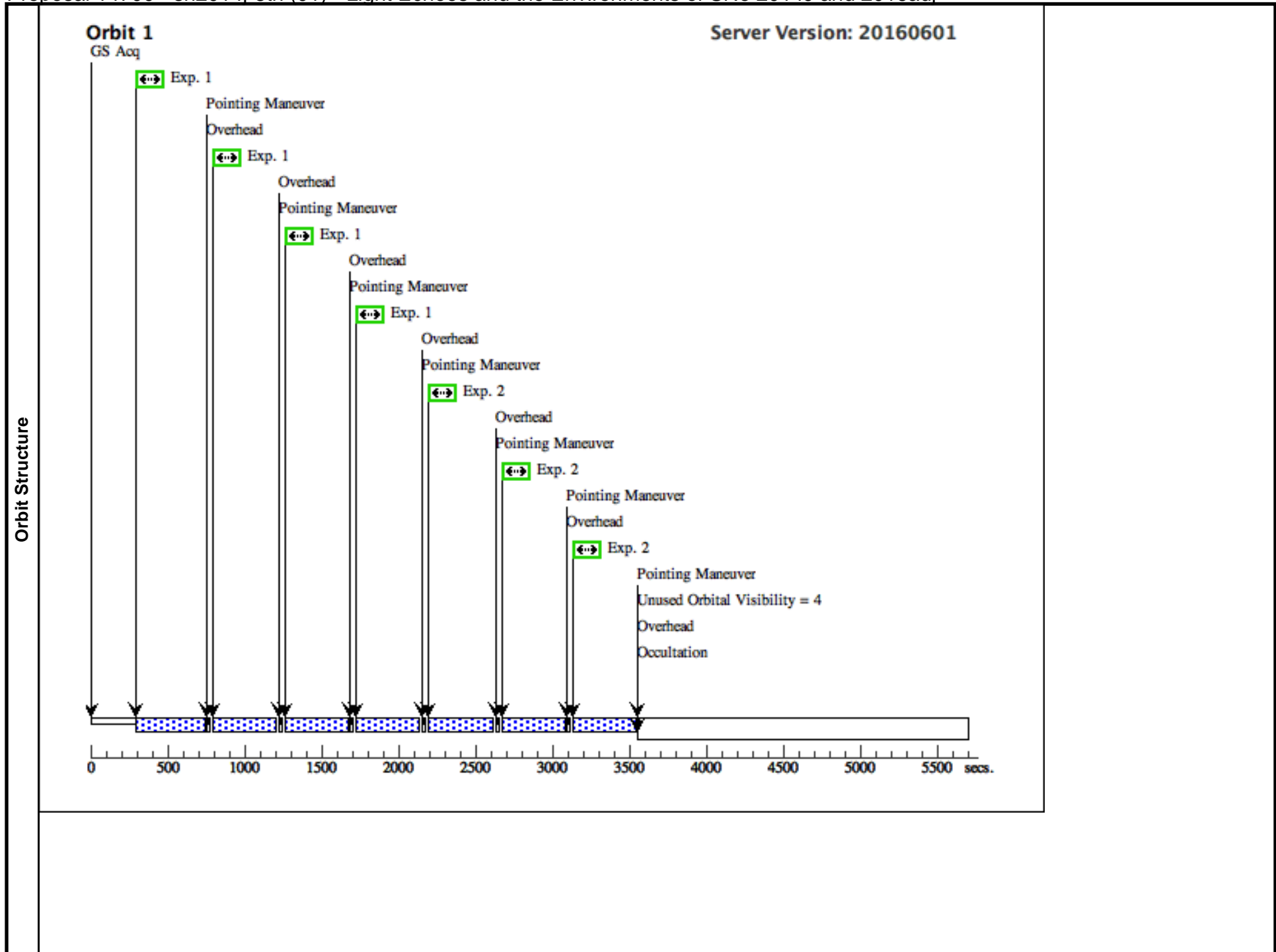
|                    |  |
|--------------------|--|
| <b>Diagnostics</b> | (Exposure 2 (Pattern 1, Exps 2-2 in sn2014j-8th (01))) Warning (Form): FLASH level may be too low for this exposure or a short subexposure. See extended explanation in the diagnostic browser |
|                    | (Exposure 3 (Pattern 1, Exps 3-3 in sn2014j-8th (01))) Warning (Form): FLASH level may be too low for this exposure or a short subexposure. See extended explanation in the diagnostic browser |

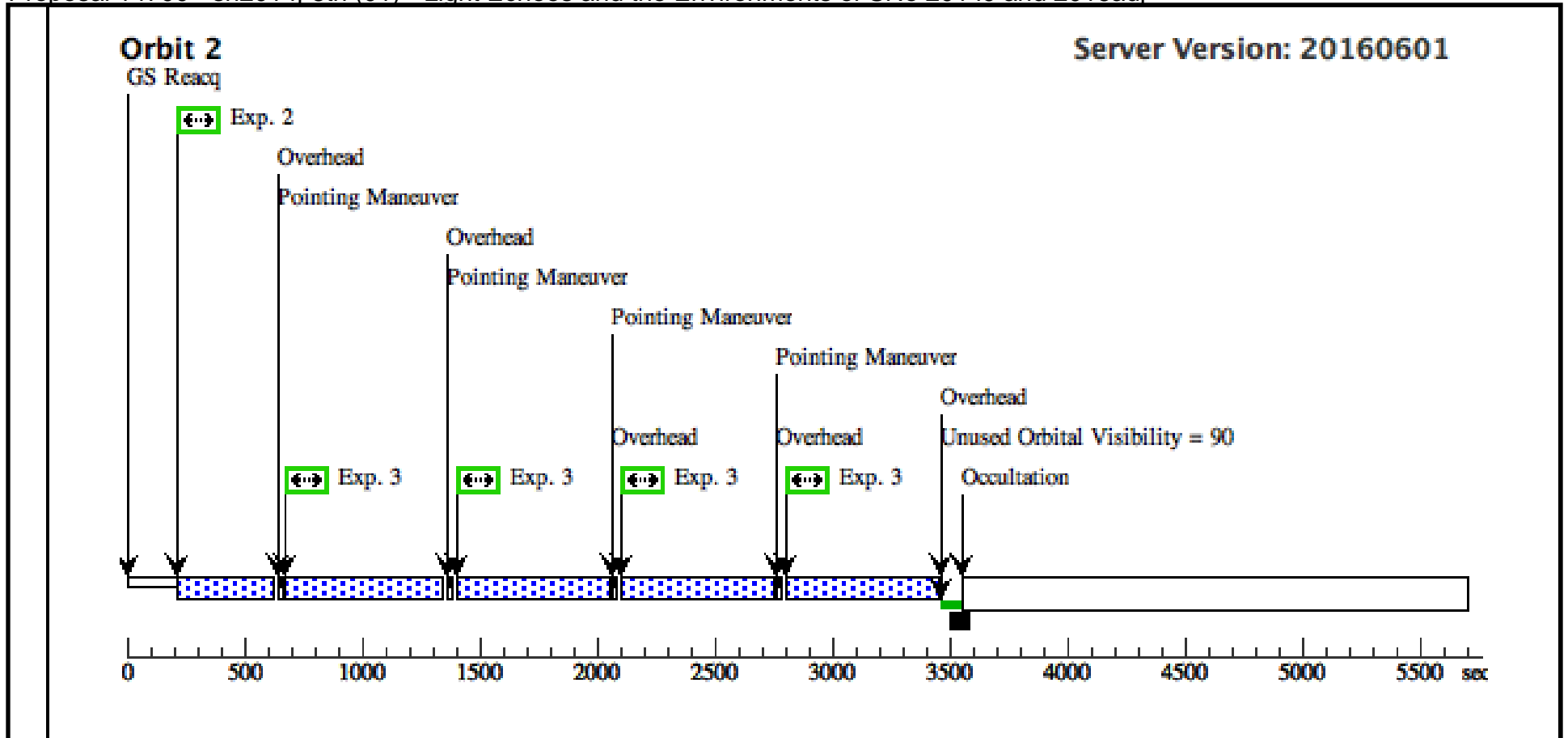
| <b>Patterns</b> | #   | Primary Pattern  | Secondary Pattern   | Exposures |
|-----------------|-----|--|---|-----------|
|                 | (1) | Pattern Type=WFC3-UVIS-DITHER-BOX<br>Purpose=DITHER<br>Number Of Points=4<br>Point Spacing=0.173<br>Line Spacing=0.112 | Coordinate Frame=POS-TARG<br>Pattern Orientation=23.884<br>Angle Between Sides=81.785<br>Center Pattern=false |           |

| <b>Fixed Targets</b> | #   | Name     | Target Coordinates  | Targ. Coord. Corrections | Fluxes | Miscellaneous           |
|----------------------|-----|----------|---|--------------------------|--------|-------------------------|
|                      | (2) | SN-2014J | RA: 09 55 42.1400 (148.9255833d)<br>Dec: +69 40 26.00 (69.67389d)<br>Equinox: J2000 |                          | V=23   | Reference Frame: SIMBAD |

*Comments: This position repeats the coordinates used with the same imaging configuration in past observations. As of Feb 2016, it had faded to B=23.9, V=22.3 mag, and it should continue to fade or remain constant throughout the duration of this proposal.*

| <b>Exposures</b> | #   | Label    | Target                            | Config,Mode,Aperture              | Spectral Els. | Opt. Params. | Special Reqs. | Groups                                      | Exp. Time (Total)/[Actual Dur.]  | Orbit  |
|------------------|-----|----------|-----------------------------------|-----------------------------------|---------------|--------------|---------------|---|--|--|
|                  | 1   | (2)      | SN-2014J                          | WFC3/UVIS, ACCUM, UVIS2-C512C-SUB | F555W         |              |               |   | Pattern 1, Exps 1-1 in sn2014j-8th (01) (1)  | 416 Secs (1664 Secs)<br>[=>(Pattern 1)]<br>[=>(Pattern 2)]<br>[=>(Pattern 3)]<br>[=>(Pattern 4)] |
| 2                | (2) | SN-2014J | WFC3/UVIS, ACCUM, UVIS2-C512C-SUB | F814W                             |               |              |               | Pattern 1, Exps 2-2 in sn2014j-8th (01) (1) | 410 Secs (1640 Secs)<br>[=>(Pattern 1)]<br>[=>(Pattern 2)]<br>[=>(Pattern 3)]<br>[=>(Pattern 4)] | [1]<br>[2]   |
| 3                | (2) | SN-2014J | WFC3/UVIS, ACCUM, UVIS2-C512C-SUB | F438W                             |               |              |               | Pattern 1, Exps 3-3 in sn2014j-8th (01) (1) | 650 Secs (2600 Secs)<br>[=>(Pattern 1)]<br>[=>(Pattern 2)]<br>[=>(Pattern 3)]<br>[=>(Pattern 4)] | [2]  |





Proposal 14700 - sn2014j-9th (02) - Light Echoes and the Environments of SNe 2014J and 2016adj

Fri Jul 29 18:55:28 GMT 2016

|              |  |
|--------------|--|
| <b>Visit</b> | <b>Proposal 14700, sn2014j-9th (02)</b><br><b>Diagnostic Status: Warning</b><br>Scientific Instruments: WFC3/UVIS<br>Special Requirements: BETWEEN 15-MAR-2017 AND 15-APR-2017 |
|--------------|--|

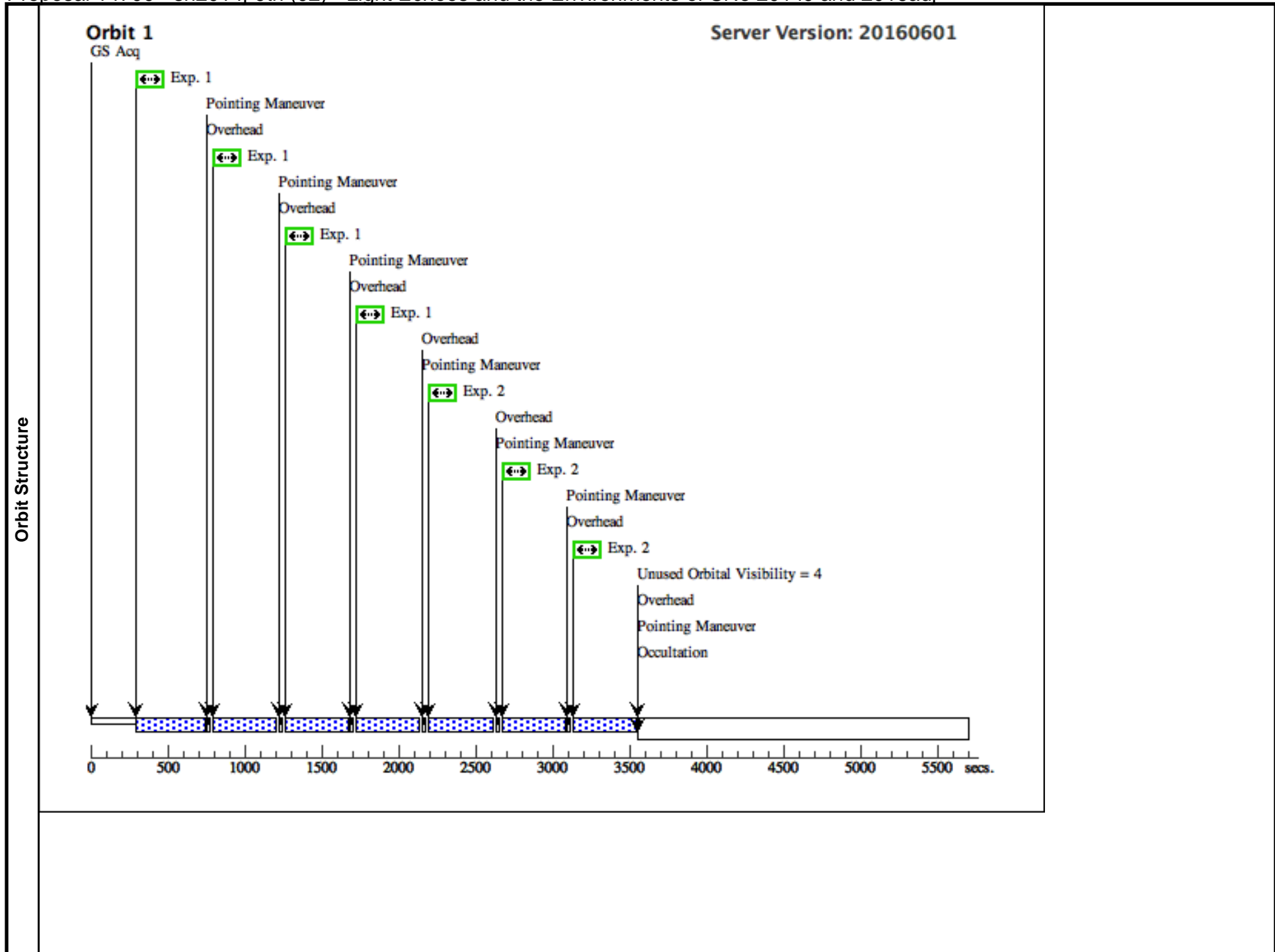
|                    |  |
|--------------------|--|
| <b>Diagnostics</b> | (Exposure 2 (Pattern 1, Exps 2-2 in sn2014j-9th (02))) Warning (Form): FLASH level may be too low for this exposure or a short subexposure. See extended explanation in the diagnostic browser |
|                    | (Exposure 3 (Pattern 1, Exps 3-3 in sn2014j-9th (02))) Warning (Form): FLASH level may be too low for this exposure or a short subexposure. See extended explanation in the diagnostic browser |

| <b>Patterns</b> | #   | Primary Pattern  | Secondary Pattern   | Exposures |
|-----------------|-----|--|---|-----------|
|                 | (1) | Pattern Type=WFC3-UVIS-DITHER-BOX<br>Purpose=DITHER<br>Number Of Points=4<br>Point Spacing=0.173<br>Line Spacing=0.112 | Coordinate Frame=POS-TARG<br>Pattern Orientation=23.884<br>Angle Between Sides=81.785<br>Center Pattern=false |           |

| <b>Fixed Targets</b> | #   | Name     | Target Coordinates  | Targ. Coord. Corrections | Fluxes | Miscellaneous           |
|----------------------|-----|----------|---|--------------------------|--------|-------------------------|
|                      | (2) | SN-2014J | RA: 09 55 42.1400 (148.9255833d)<br>Dec: +69 40 26.00 (69.67389d)<br>Equinox: J2000 |                          | V=23   | Reference Frame: SIMBAD |

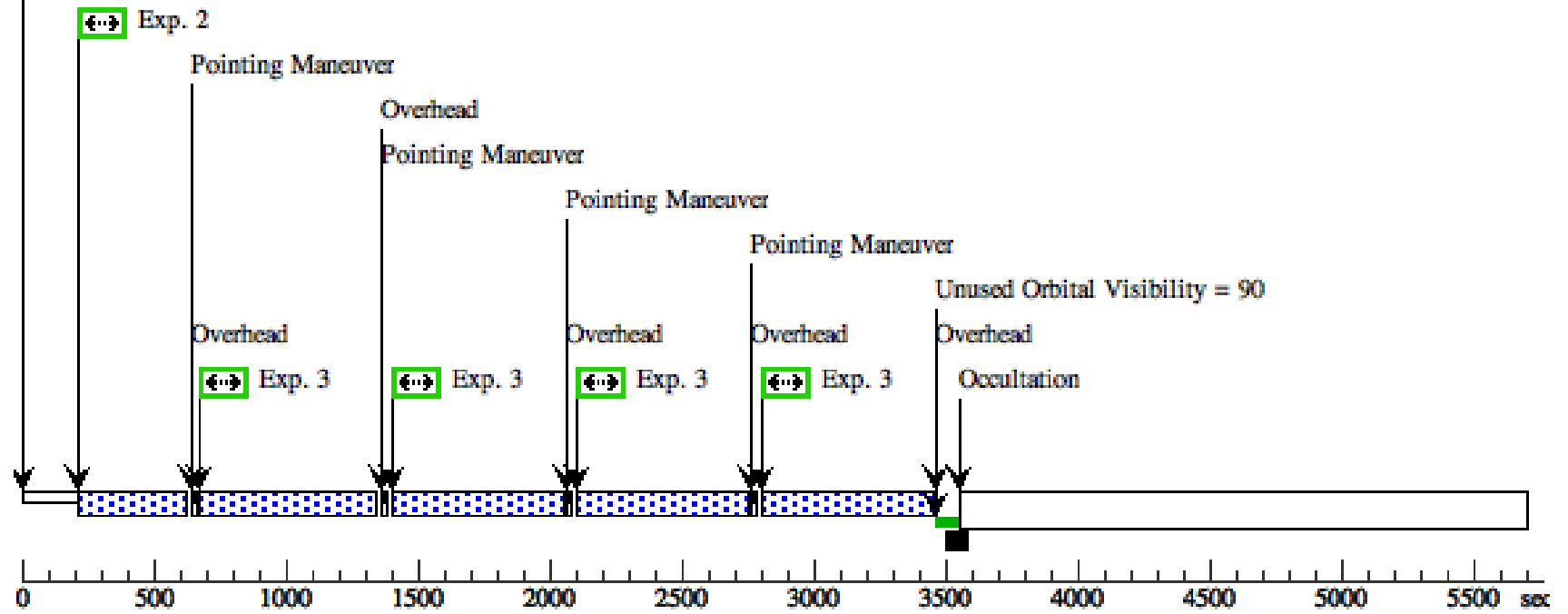
*Comments: This position repeats the coordinates used with the same imaging configuration in past observations. As of Feb 2016, it had faded to B=23.9, V=22.3 mag, and it should continue to fade or remain constant throughout the duration of this proposal.*

| <b>Exposures</b> | #   | Label    | Target                            | Config,Mode,Aperture              | Spectral Els. | Opt. Params. | Special Reqs. | Groups                                      | Exp. Time (Total)/[Actual Dur.]  | Orbit  |
|------------------|-----|----------|-----------------------------------|-----------------------------------|---------------|--------------|---------------|---|--|--|
|                  | 1   | (2)      | SN-2014J                          | WFC3/UVIS, ACCUM, UVIS2-C512C-SUB | F555W         |              |               |   | Pattern 1, Exps 1-1 in sn2014j-9th (02) (1)  | 416 Secs (1664 Secs)<br>[=>(Pattern 1)]<br>[=>(Pattern 2)]<br>[=>(Pattern 3)]<br>[=>(Pattern 4)] |
| 2                | (2) | SN-2014J | WFC3/UVIS, ACCUM, UVIS2-C512C-SUB | F814W                             |               |              |               | Pattern 1, Exps 2-2 in sn2014j-9th (02) (1) | 410 Secs (1640 Secs)<br>[=>(Pattern 1)]<br>[=>(Pattern 2)]<br>[=>(Pattern 3)]<br>[=>(Pattern 4)] | [1]<br>[2]   |
| 3                | (2) | SN-2014J | WFC3/UVIS, ACCUM, UVIS2-C512C-SUB | F438W                             |               |              |               | Pattern 1, Exps 3-3 in sn2014j-9th (02) (1) | 650 Secs (2600 Secs)<br>[=>(Pattern 1)]<br>[=>(Pattern 2)]<br>[=>(Pattern 3)]<br>[=>(Pattern 4)] | [2]  |



**Orbit 2**

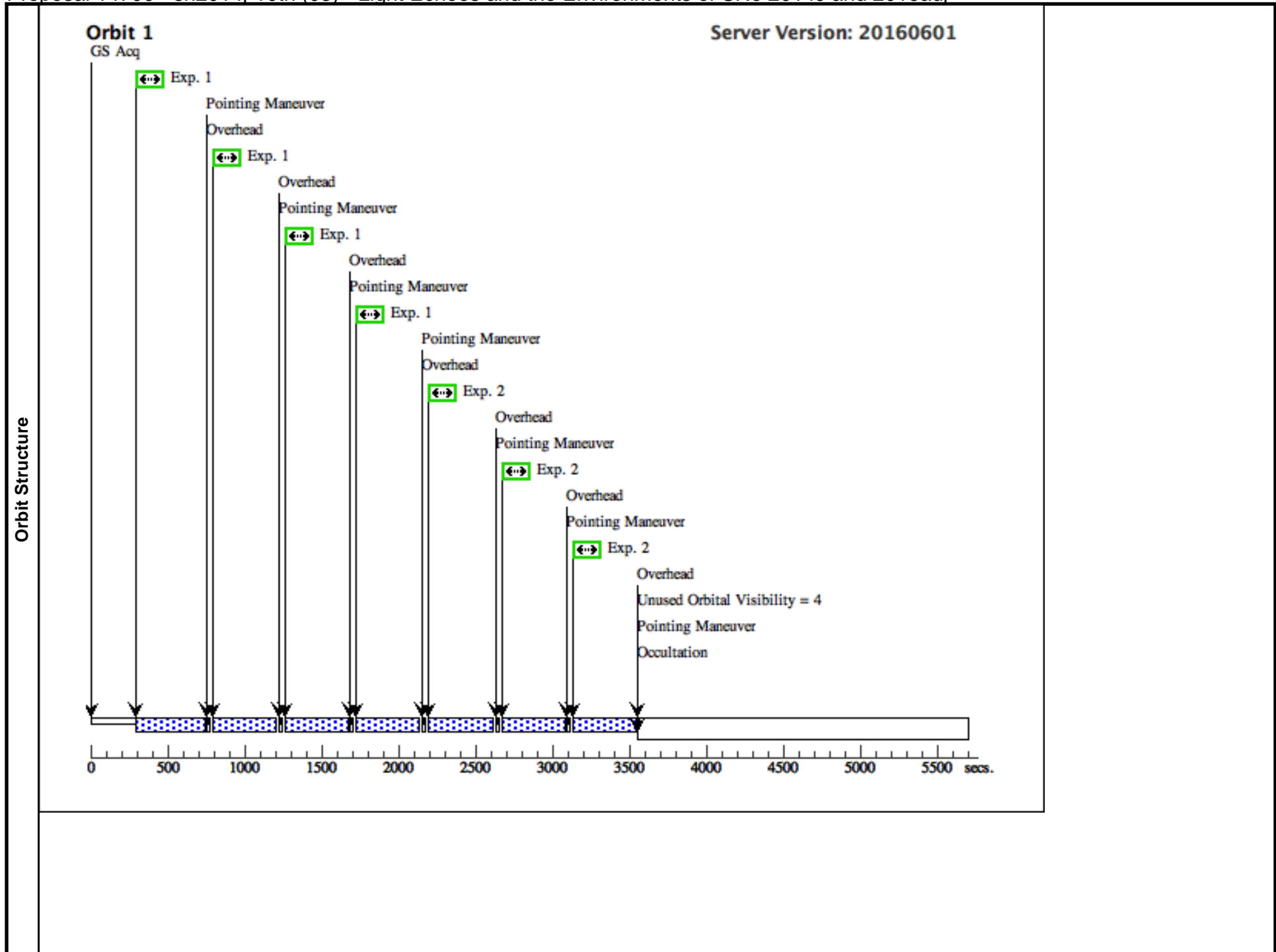
GS Reacq

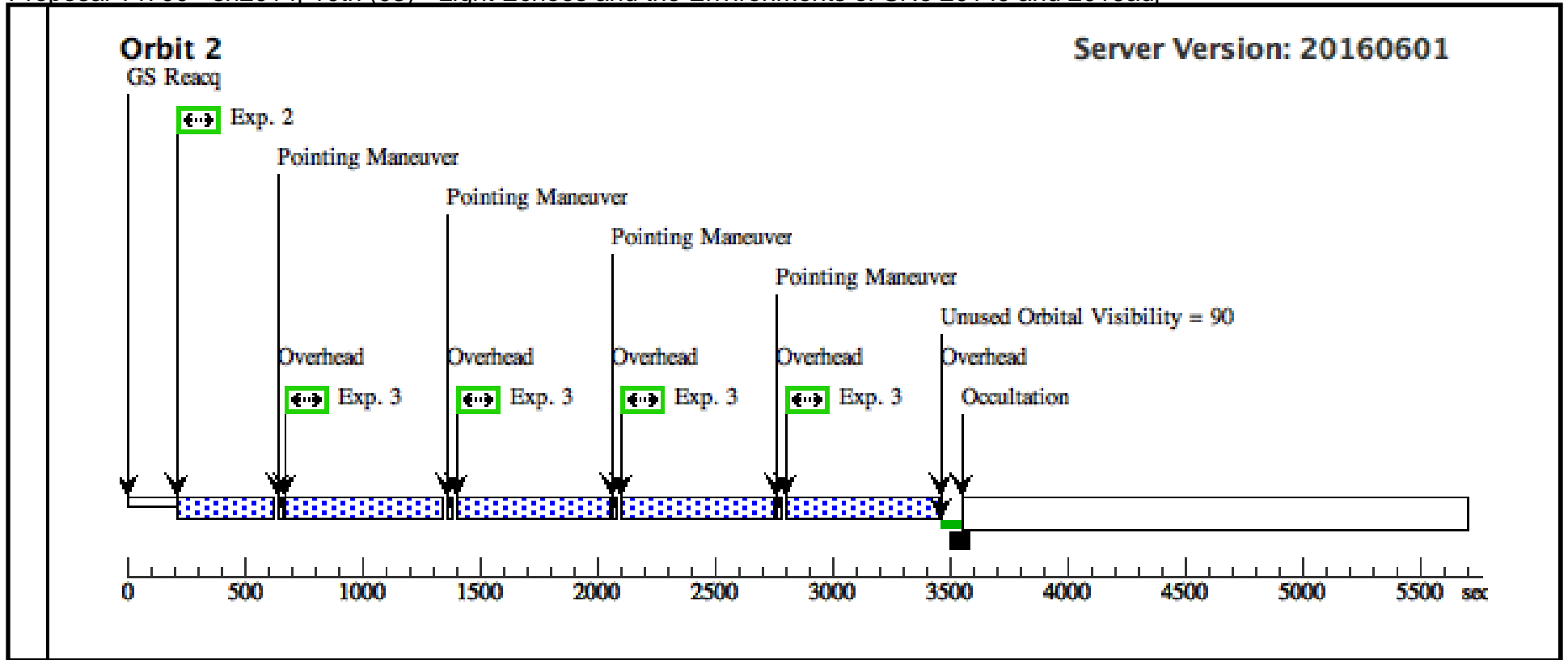


Proposal 14700 - sn2014j-10th (03) - Light Echoes and the Environments of SNE 2014J and 2016adj

Fri Jul 29 18:55:28 GMT 2016

|   |  |  |   |                                   |                      |                         |                      |  |  |              |
|---|--|--|---|-----------------------------------|----------------------|-------------------------|----------------------|--|--|--------------|
| <b>Visit</b>  | <b>Proposal 14700, sn2014j-10th (03)</b><br><b>Diagnostic Status: Warning</b><br>Scientific Instruments: WFC3/UVIS<br>Special Requirements: BETWEEN 15-AUG-2017 AND 15-SEP-2017  |  |   |                                   |                      |                         |                      |  |  |              |
|   | (Exposure 2 (Pattern 1, Exps 2-2 in sn2014j-10th (03))) Warning (Form): FLASH level may be too low for this exposure or a short subexposure. See extended explanation in the diagnostic browser<br>(Exposure 3 (Pattern 1, Exps 3-3 in sn2014j-10th (03))) Warning (Form): FLASH level may be too low for this exposure or a short subexposure. See extended explanation in the diagnostic browser |  |   |                                   |                      |                         |                      |  |  |              |
| <b>Diagnosics</b>   |  |  |   |                                   |                      |                         |                      |  |  |              |
|   |  |  |   |                                   |                      |                         |                      |  |  |              |
| <b>Patterns</b>   | <b>#</b>   | <b>Primary Pattern</b>   | <b>Secondary Pattern</b>  | <b>Exposures</b>                  |                      |                         |                      |  |  |              |
|   | (1)  | Pattern Type=WFC3-UVIS-DITHER-BOX<br>Purpose=DITHER<br>Number Of Points=4<br>Point Spacing=0.173<br>Line Spacing=0.112 | Coordinate Frame=POS-TARG<br>Pattern Orientation=23.884<br>Angle Between Sides=81.785<br>Center Pattern=false |                                   | (1), (2), (3)        |                         |                      |  |  |              |
| <b>Fixed Targets</b>  | <b>#</b>   | <b>Name</b>  | <b>Target Coordinates</b>   | <b>Targ. Coord. Corrections</b>   | <b>Fluxes</b>        | <b>Miscellaneous</b>    |                      |  |  |              |
|   | (2)  | SN-2014J   | RA: 09 55 42.1400 (148.9255833d)<br>Dec: +69 40 26.00 (69.67389d)<br>Equinox: J2000                           |                                   | V=23                 | Reference Frame: SIMBAD |                      |  |  |              |
| <i>Comments: This position repeats the coordinates used with the same imaging configuration in past observations. As of Feb 2016, it had faded to B=23.9, V=22.3 mag, and it should continue to fade or remain constant throughout the duration of this proposal.</i> |  |  |   |                                   |                      |                         |                      |  |  |              |
| <b>Exposures</b>  | <b>#</b>   | <b>Label</b>   | <b>Target</b>   | <b>Config,Mode,Aperture</b>       | <b>Spectral Els.</b> | <b>Opt. Params.</b>     | <b>Special Reqs.</b> | <b>Groups</b>                                | <b>Exp. Time (Total)/[Actual Dur.]</b> | <b>Orbit</b> |
|   | 1  | (2) SN-2014J   | (2) SN-2014J  | WFC3/UVIS, ACCUM, UVIS2-C512C-SUB | F555W                |                         |                      | Pattern 1, Exps 1-1 in sn2014j-10th (03) (1) | 416 Secs (1664 Secs)                   |              |
|   |  |  |   |                                   |                      |                         |                      |  | [==>(Pattern 1)]                       | [1]          |
|   |  |  |   |                                   |                      |                         |                      |  | [==>(Pattern 2)]                       |              |
|   |  |  |   |                                   |                      |                         |                      |  | [==>(Pattern 3)]                       |              |
|   |  |  |   |                                   |                      |                         |                      |  | [==>(Pattern 4)]                       |              |
| 2   | (2) SN-2014J   | (2) SN-2014J   | WFC3/UVIS, ACCUM, UVIS2-C512C-SUB   | F814W                             |                      |                         |                      | Pattern 1, Exps 2-2 in sn2014j-10th (03) (1) | 410 Secs (1640 Secs)                   |              |
|   |  |  |   |                                   |                      |                         |                      |  | [==>(Pattern 1)]                       | [1]          |
|   |  |  |   |                                   |                      |                         |                      |  | [==>(Pattern 2)]                       |              |
|   |  |  |   |                                   |                      |                         |                      |  | [==>(Pattern 3)]                       | [2]          |
|   |  |  |   |                                   |                      |                         |                      |  | [==>(Pattern 4)]                       |              |
| 3   | (2) SN-2014J   | (2) SN-2014J   | WFC3/UVIS, ACCUM, UVIS2-C512C-SUB   | F438W                             |                      |                         |                      | Pattern 1, Exps 3-3 in sn2014j-10th (03) (1) | 650 Secs (2600 Secs)                   |              |
|   |  |  |   |                                   |                      |                         |                      |  | [==>(Pattern 1)]                       | [2]          |
|   |  |  |   |                                   |                      |                         |                      |  | [==>(Pattern 2)]                       |              |
|   |  |  |   |                                   |                      |                         |                      |  | [==>(Pattern 3)]                       |              |
|   |  |  |   |                                   |                      |                         |                      |  | [==>(Pattern 4)]                       |              |





Proposal 14700 - sn2016adj-5th (04) - Light Echoes and the Environments of SNe 2014J and 2016adj

Fri Jul 29 18:55:28 GMT 2016

|              |   |
|--------------|---|
| <b>Visit</b> | <b>Proposal 14700, sn2016adj-5th (04)</b><br><b>Diagnostic Status: Warning</b><br>Scientific Instruments: WFC3/UVIS<br>Special Requirements: BETWEEN 11-DEC-2016:00:00:00 AND 25-DEC-2016 |
|--------------|---|

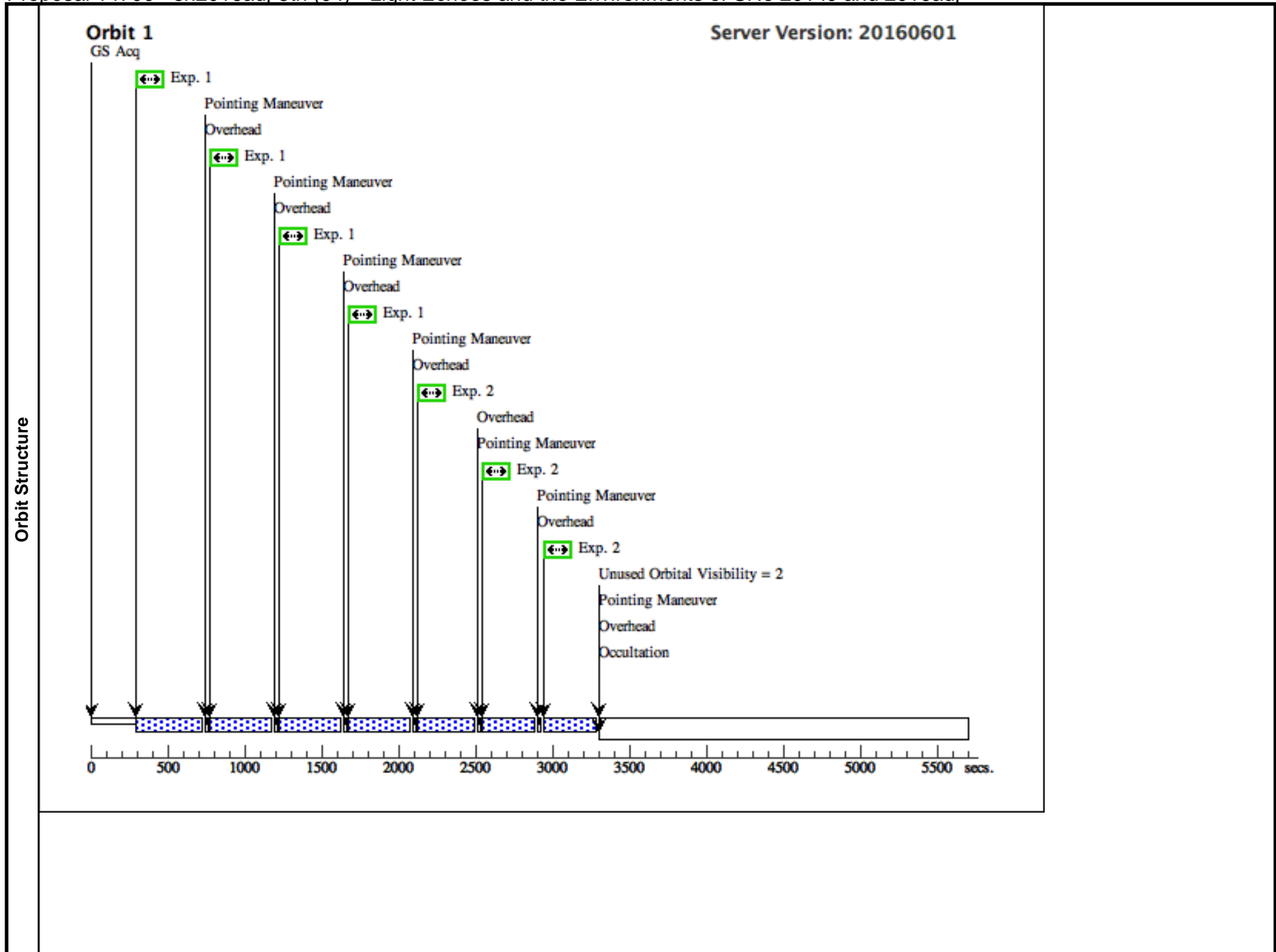
|                    |  |
|--------------------|--|
| <b>Diagnostics</b> | (Exposure 1 (Pattern 1, Exps 1-1 in sn2016adj-5th (04))) Warning (Form): FLASH level may be too low for this exposure or a short subexposure. See extended explanation in the diagnostic browser |
|                    | (Exposure 2 (Pattern 1, Exps 2-2 in sn2016adj-5th (04))) Warning (Form): FLASH level may be too low for this exposure or a short subexposure. See extended explanation in the diagnostic browser |
|                    | (Exposure 3 (Pattern 1, Exps 3-3 in sn2016adj-5th (04))) Warning (Form): FLASH level may be too low for this exposure or a short subexposure. See extended explanation in the diagnostic browser |

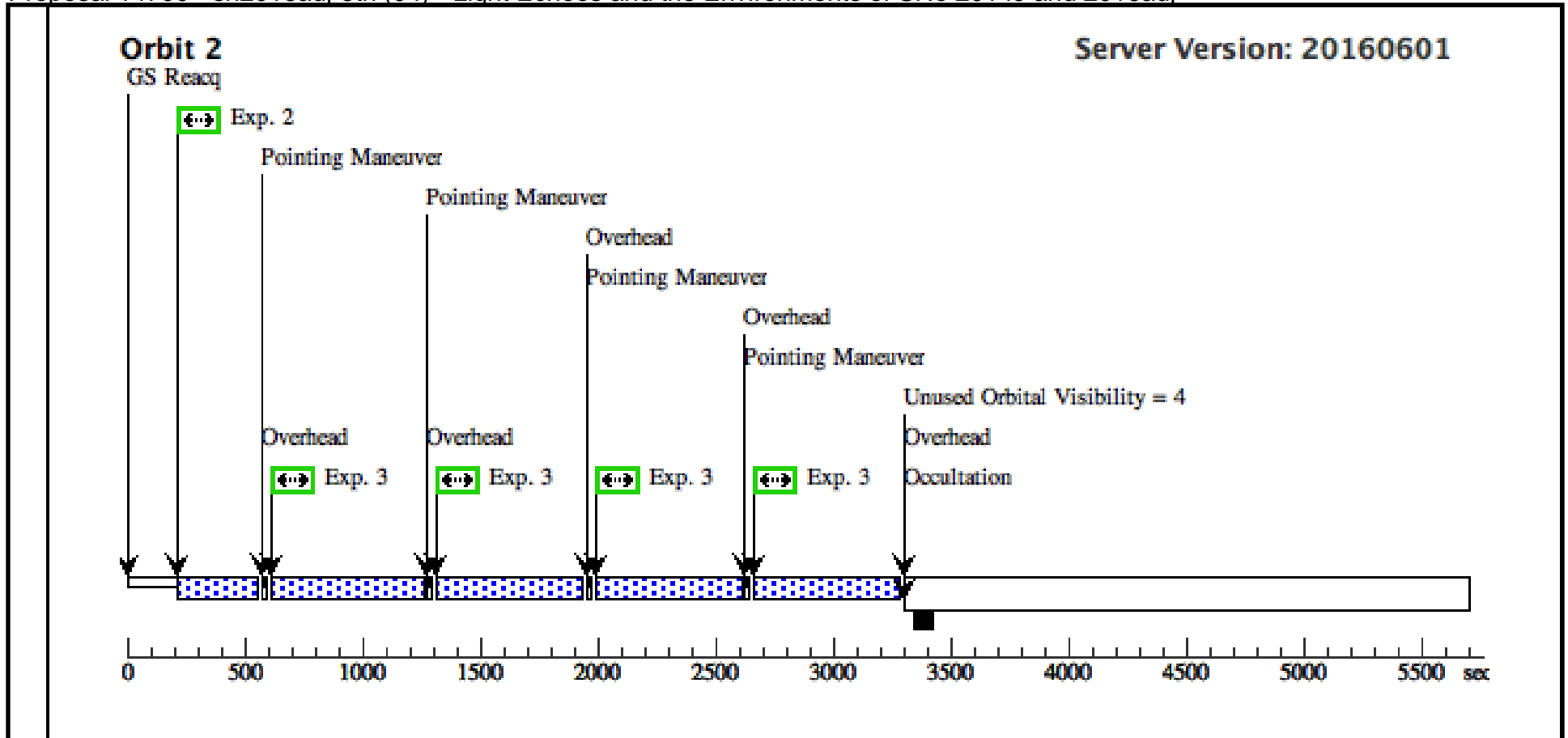
| <b>Patterns</b> | #   | Primary Pattern  | Secondary Pattern   | Exposures |
|-----------------|-----|--|---|-----------|
|                 | (1) | Pattern Type=WFC3-UVIS-DITHER-BOX<br>Purpose=DITHER<br>Number Of Points=4<br>Point Spacing=0.173<br>Line Spacing=0.112 | Coordinate Frame=POS-TARG<br>Pattern Orientation=23.884<br>Angle Between Sides=81.785<br>Center Pattern=false |           |

| <b>Fixed Targets</b> | #   | Name       | Target Coordinates   | Targ. Coord. Corrections | Fluxes   | Miscellaneous         |
|----------------------|-----|------------|--|--------------------------|----------|-----------------------|
|                      | (1) | SN-2016ADJ | RA: 13 25 24.1100 (201.3504583d)<br>Dec: -43 00 57.50 (-43.01597d)<br>Equinox: J2000 |                          | V=18+/-1 | Reference Frame: ICRS |

*Comments: As of mid-March 2016, the SN had faded to B=20.3, V=17.4 mags, and should continue to fade or remain constant throughout the duration of this proposal.*

| <b>Exposures</b> | # | Label          | Target                            | Config,Mode,Aperture | Spectral Els. | Opt. Params. | Special Reqs. | Groups  | Exp. Time (Total)/[Actual Dur.]  | Orbit |
|------------------|---|----------------|-----------------------------------|----------------------|---------------|--------------|---------------|---|--|-------|
|                  | 1 | (1) SN-2016ADJ | WFC3/UVIS, ACCUM, UVIS2-C512C-SUB | F547M                |               |              |               | Pattern 1, Exps 1-1 in sn2016adj-5th (04) (1) | 400 Secs (1600 Secs)<br>[==>(Pattern 1)]<br>[==>(Pattern 2)]<br>[==>(Pattern 3)]<br>[==>(Pattern 4)] | [1]   |
|                  | 2 | (1) SN-2016ADJ | WFC3/UVIS, ACCUM, UVIS2-C512C-SUB | F814W                |               |              |               | Pattern 1, Exps 2-2 in sn2016adj-5th (04) (1) | 347 Secs (1388 Secs)<br>[==>(Pattern 1)]<br>[==>(Pattern 2)]<br>[==>(Pattern 3)]<br>[==>(Pattern 4)] | [1]   |
|                  | 3 | (1) SN-2016ADJ | WFC3/UVIS, ACCUM, UVIS2-C512C-SUB | F438W                |               |              |               | Pattern 1, Exps 3-3 in sn2016adj-5th (04) (1) | 625 Secs (2500 Secs)<br>[==>(Pattern 1)]<br>[==>(Pattern 2)]<br>[==>(Pattern 3)]<br>[==>(Pattern 4)] | [2]   |





Proposal 14700 - sn2016adj-6th (05) - Light Echoes and the Environments of SNe 2014J and 2016adi

Fri Jul 29 18:55:28 GMT 2016

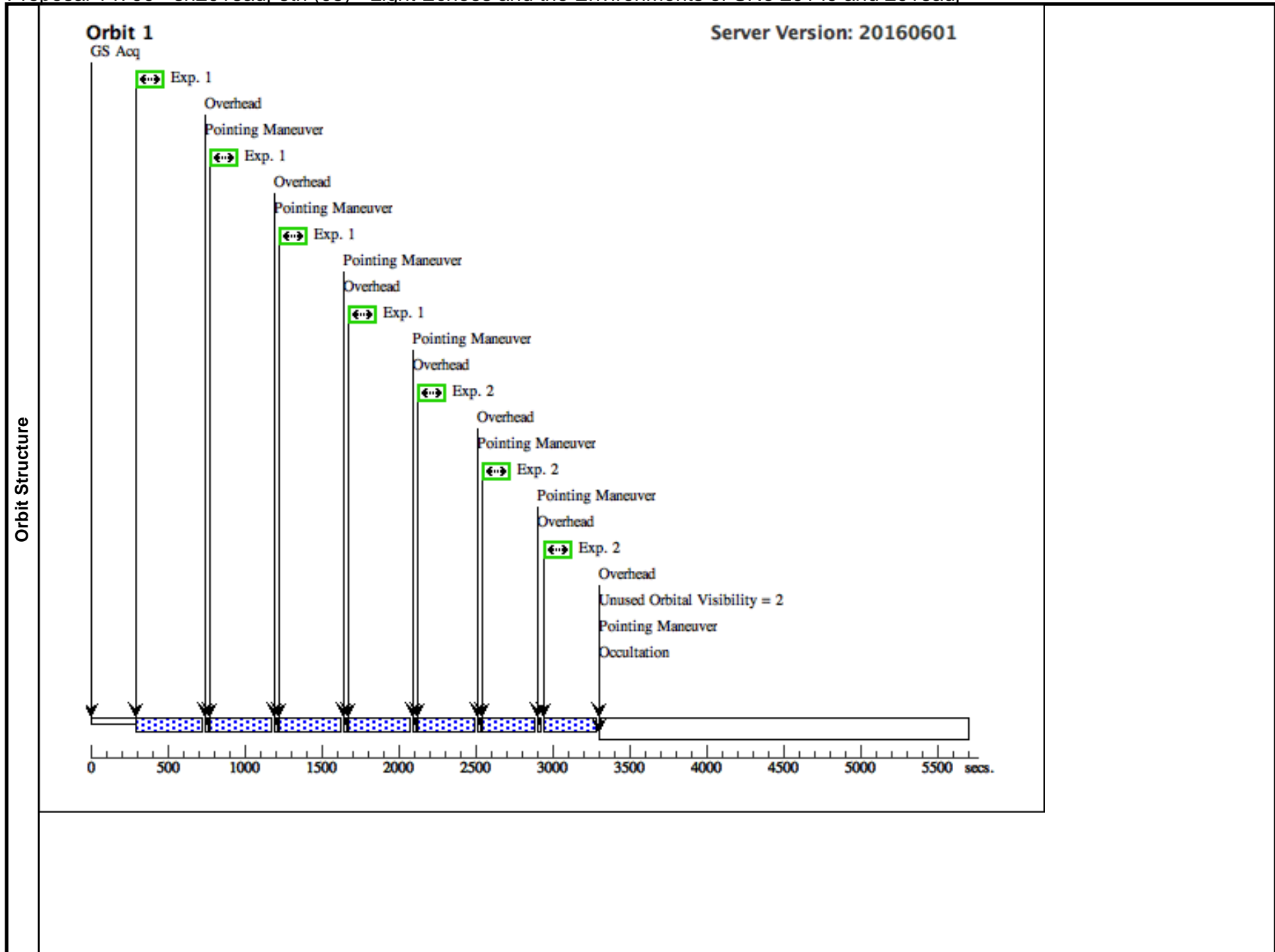
|              |  |
|--------------|--|
| <b>Visit</b> | <b>Proposal 14700, sn2016adj-6th (05)</b><br><b>Diagnostic Status: Warning</b><br>Scientific Instruments: WFC3/UVIS<br>Special Requirements: ORIENT 340D TO 25 D: BETWEEN 29-MAR-2017:00:00:00 AND 15-APR-2017   |
|              | (Exposure 1 (Pattern 1, Exps 1-1 in sn2016adj-6th (05))) Warning (Form): FLASH level may be too low for this exposure or a short subexposure. See extended explanation in the diagnostic browser<br>(Exposure 2 (Pattern 1, Exps 2-2 in sn2016adj-6th (05))) Warning (Form): FLASH level may be too low for this exposure or a short subexposure. See extended explanation in the diagnostic browser<br>(Exposure 3 (Pattern 1, Exps 3-3 in sn2016adj-6th (05))) Warning (Form): FLASH level may be too low for this exposure or a short subexposure. See extended explanation in the diagnostic browser |

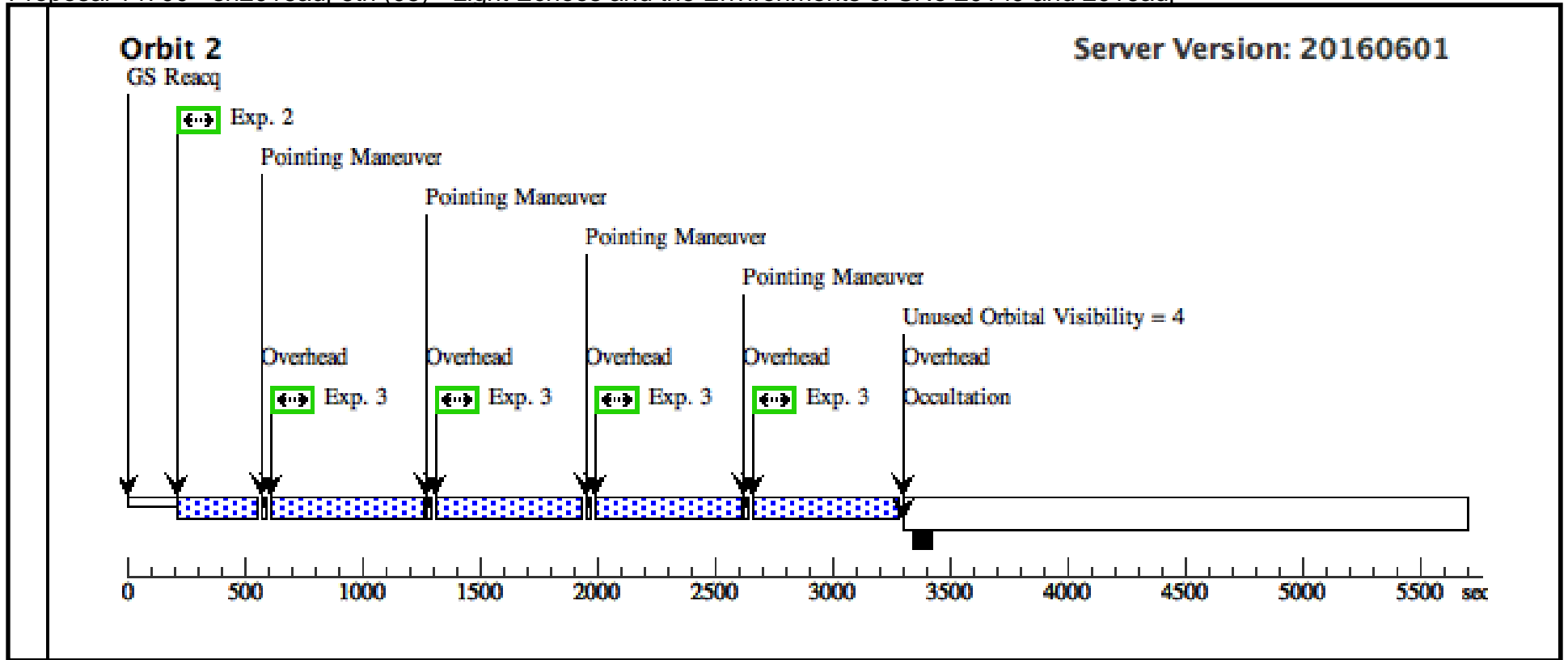
|                   |  |
|-------------------|--|
| <b>Diagnosics</b> | (Exposure 1 (Pattern 1, Exps 1-1 in sn2016adj-6th (05))) Warning (Form): FLASH level may be too low for this exposure or a short subexposure. See extended explanation in the diagnostic browser<br>(Exposure 2 (Pattern 1, Exps 2-2 in sn2016adj-6th (05))) Warning (Form): FLASH level may be too low for this exposure or a short subexposure. See extended explanation in the diagnostic browser<br>(Exposure 3 (Pattern 1, Exps 3-3 in sn2016adj-6th (05))) Warning (Form): FLASH level may be too low for this exposure or a short subexposure. See extended explanation in the diagnostic browser |
|                   | (Exposure 1 (Pattern 1, Exps 1-1 in sn2016adj-6th (05))) Warning (Form): FLASH level may be too low for this exposure or a short subexposure. See extended explanation in the diagnostic browser<br>(Exposure 2 (Pattern 1, Exps 2-2 in sn2016adj-6th (05))) Warning (Form): FLASH level may be too low for this exposure or a short subexposure. See extended explanation in the diagnostic browser<br>(Exposure 3 (Pattern 1, Exps 3-3 in sn2016adj-6th (05))) Warning (Form): FLASH level may be too low for this exposure or a short subexposure. See extended explanation in the diagnostic browser |

| <b>Patterns</b> | #   | Primary Pattern  | Secondary Pattern   | Exposures |
|-----------------|-----|--|---|-----------|
|                 | (1) | Pattern Type=WFC3-UVIS-DITHER-BOX<br>Purpose=DITHER<br>Number Of Points=4<br>Point Spacing=0.173<br>Line Spacing=0.112 | Coordinate Frame=POS-TARG<br>Pattern Orientation=23.884<br>Angle Between Sides=81.785<br>Center Pattern=false |           |

| <b>Fixed Targets</b>   | #   | Name       | Target Coordinates   | Targ. Coord. Corrections | Fluxes   | Miscellaneous         |
|--|-----|------------|--|--------------------------|----------|-----------------------|
|  | (1) | SN-2016ADJ | RA: 13 25 24.1100 (201.3504583d)<br>Dec: -43 00 57.50 (-43.01597d)<br>Equinox: J2000 |                          | V=18+/-1 | Reference Frame: ICRS |
| <i>Comments: As of mid-March 2016, the SN had faded to B=20.3, V=17.4 mags, and should continue to fade or remain constant throughout the duration of this proposal.</i> |     |            |  |                          |          |                       |

| <b>Exposures</b> | #              | Label                             | Target                            | Config,Mode,Aperture | Spectral Els. | Opt. Params. | Special Reqs.                                 | Groups   | Exp. Time (Total)/[Actual Dur.]  | Orbit |
|------------------|----------------|-----------------------------------|-----------------------------------|----------------------|---------------|--------------|---|--|--|-------|
|                  | 1              | (1) SN-2016ADJ                    | WFC3/UVIS, ACCUM, UVIS2-C512C-SUB | F547M                |               |              |   | Pattern 1, Exps 1-1 in sn2016adj-6th (05) (1)  | 400 Secs (1600 Secs)<br>[==>(Pattern 1)]<br>[==>(Pattern 2)]<br>[==>(Pattern 3)]<br>[==>(Pattern 4)] | [1]   |
| 2                | (1) SN-2016ADJ | WFC3/UVIS, ACCUM, UVIS2-C512C-SUB | F814W                             |                      |               |              | Pattern 1, Exps 2-2 in sn2016adj-6th (05) (1) | 347 Secs (1388 Secs)<br>[==>(Pattern 1)]<br>[==>(Pattern 2)]<br>[==>(Pattern 3)]<br>[==>(Pattern 4)] | [1]  |       |
| 3                | (1) SN-2016ADJ | WFC3/UVIS, ACCUM, UVIS2-C512C-SUB | F438W                             |                      |               |              | Pattern 1, Exps 3-3 in sn2016adj-6th (05) (1) | 625 Secs (2500 Secs)<br>[==>(Pattern 1)]<br>[==>(Pattern 2)]<br>[==>(Pattern 3)]<br>[==>(Pattern 4)] | [2]  |       |





Proposal 14700 - sn2016adj-7th (06) - Light Echoes and the Environments of SNe 2014J and 2016adi

Fri Jul 29 18:55:28 GMT 2016

|              |  |
|--------------|--|
| <b>Visit</b> | <b>Proposal 14700, sn2016adj-7th (06)</b><br><b>Diagnostic Status: Warning</b><br>Scientific Instruments: WFC3/UVIS<br>Special Requirements: BETWEEN 11-SEP-2017 AND 17-SEP-2017   |
|              | (Exposure 1 (Pattern 1, Exps 1-1 in sn2016adj-7th (06))) Warning (Form): FLASH level may be too low for this exposure or a short subexposure. See extended explanation in the diagnostic browser<br>(Exposure 2 (Pattern 1, Exps 2-2 in sn2016adj-7th (06))) Warning (Form): FLASH level may be too low for this exposure or a short subexposure. See extended explanation in the diagnostic browser<br>(Exposure 3 (Pattern 1, Exps 3-3 in sn2016adj-7th (06))) Warning (Form): FLASH level may be too low for this exposure or a short subexposure. See extended explanation in the diagnostic browser |

|                   |  |
|-------------------|--|
| <b>Diagnosics</b> | (Exposure 1 (Pattern 1, Exps 1-1 in sn2016adj-7th (06))) Warning (Form): FLASH level may be too low for this exposure or a short subexposure. See extended explanation in the diagnostic browser<br>(Exposure 2 (Pattern 1, Exps 2-2 in sn2016adj-7th (06))) Warning (Form): FLASH level may be too low for this exposure or a short subexposure. See extended explanation in the diagnostic browser<br>(Exposure 3 (Pattern 1, Exps 3-3 in sn2016adj-7th (06))) Warning (Form): FLASH level may be too low for this exposure or a short subexposure. See extended explanation in the diagnostic browser |
|                   | (Exposure 1 (Pattern 1, Exps 1-1 in sn2016adj-7th (06))) Warning (Form): FLASH level may be too low for this exposure or a short subexposure. See extended explanation in the diagnostic browser<br>(Exposure 2 (Pattern 1, Exps 2-2 in sn2016adj-7th (06))) Warning (Form): FLASH level may be too low for this exposure or a short subexposure. See extended explanation in the diagnostic browser<br>(Exposure 3 (Pattern 1, Exps 3-3 in sn2016adj-7th (06))) Warning (Form): FLASH level may be too low for this exposure or a short subexposure. See extended explanation in the diagnostic browser |

| <b>Patterns</b> | #   | Primary Pattern  | Secondary Pattern   | Exposures |
|-----------------|-----|--|---|-----------|
|                 | (1) | Pattern Type=WFC3-UVIS-DITHER-BOX<br>Purpose=DITHER<br>Number Of Points=4<br>Point Spacing=0.173<br>Line Spacing=0.112 | Coordinate Frame=POS-TARG<br>Pattern Orientation=23.884<br>Angle Between Sides=81.785<br>Center Pattern=false |           |

| <b>Fixed Targets</b>   | #   | Name       | Target Coordinates   | Targ. Coord. Corrections | Fluxes   | Miscellaneous         |
|--|-----|------------|--|--------------------------|----------|-----------------------|
|  | (1) | SN-2016ADJ | RA: 13 25 24.1100 (201.3504583d)<br>Dec: -43 00 57.50 (-43.01597d)<br>Equinox: J2000 |                          | V=18+/-1 | Reference Frame: ICRS |
| <i>Comments: As of mid-March 2016, the SN had faded to B=20.3, V=17.4 mags, and should continue to fade or remain constant throughout the duration of this proposal.</i> |     |            |  |                          |          |                       |

| <b>Exposures</b> | # | Label          | Target         | Config,Mode,Aperture              | Spectral Els.                     | Opt. Params. | Special Reqs. | Groups  | Exp. Time (Total)/[Actual Dur.]  | Orbit  |
|------------------|---|----------------|----------------|-----------------------------------|-----------------------------------|--------------|---------------|---|--|--|
|                  |   | 1              | (1) SN-2016ADJ | (1) SN-2016ADJ                    | WFC3/UVIS, ACCUM, UVIS2-C512C-SUB | F547M        |               |   | Pattern 1, Exps 1-1 in sn2016adj-7th (06) (1)  | 400 Secs (1600 Secs)<br>[=>(Pattern 1)]<br>[=>(Pattern 2)]<br>[=>(Pattern 3)]<br>[=>(Pattern 4)] |
| 2                |   | (1) SN-2016ADJ | (1) SN-2016ADJ | WFC3/UVIS, ACCUM, UVIS2-C512C-SUB | F814W                             |              |               | Pattern 1, Exps 2-2 in sn2016adj-7th (06) (1) | 347 Secs (1388 Secs)<br>[=>(Pattern 1)]<br>[=>(Pattern 2)]<br>[=>(Pattern 3)]<br>[=>(Pattern 4)] | [1]  |
| 3                |   | (1) SN-2016ADJ | (1) SN-2016ADJ | WFC3/UVIS, ACCUM, UVIS2-C512C-SUB | F438W                             |              |               | Pattern 1, Exps 3-3 in sn2016adj-7th (06) (1) | 625 Secs (2500 Secs)<br>[=>(Pattern 1)]<br>[=>(Pattern 2)]<br>[=>(Pattern 3)]<br>[=>(Pattern 4)] | [2]  |

