# 18404 - It keeps getting better: Supernova 1987A entering its fourth decade

Cycle: 34, Proposal Category: GO

(Availability Mode: SUPPORTED)

**INVESTIGATORS**

| *Name* | *Institution* |
|---|---|
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| Dr. Jason Spyromilio (CoI) (ESA Member) | European Southern Observatory - Germany |
| Christos Tegkelidis (CoI) (ESA Member) | KTH - Royal Institute of Technology |
| Dr. Patrick Kavanagh (CoI) (ESA Member) | National University of Ireland, Maynooth |

**VISITS**

| *Visit* | *Targets used in Visit* | *Configurations used in Visit* | *Orbits Used* | *Last Orbit Planner Run* | *OP Current with Visit?* |
|---|---|---|---|---|---|
| 01 | (1) SN-1987A | WFC3/UVIS | 4 | 11-Aug-2026 13:00:16.0 | yes |
| 02 | (1) SN-1987A | WFC3/UVIS | 4 | 11-Aug-2026 13:00:17.0 | yes |
| 03 | (1) SN-1987A | WFC3/UVIS | 2 | 11-Aug-2026 13:00:18.0 | yes |

10 Total Orbits Used

**ABSTRACT**

SN 1987A, the brightest supernova (SN) since 1604, is the great supernova (SN) of the HST era. HST has monitored the evolution from the very beginning, providing astronomers with a unique observational record of a SN evolving into a remnant. The most recent observations show major changes in the interaction with the iconic triple-ring nebula of circumstellar material on a time scale of one year. A strong increase of flux has been observed as the dense, inner ejecta of processed material have started to crash into the equatorial ring, while the shocks further out in the system are gradually revealing the mass-loss history of the progenitor star. Furthermore, JWST has recently detected the first clear electromagnetic signal from the compact object created in the explosion, though its properties are yet to be determined. We request imaging in narrow and broad filters over the next three cycles to study the evolution of the shock interaction and compact object. The observations will be used to measure the density profile of the inner ejecta, determine the mass-loss history of the progenitor, and constrain the main competing scenarios for the compact object (thermally emitting neutron star or pulsar-wind nebula). These investigations offer a unique avenue for connecting late stellar evolution, SN physics and compact objects. The HST observations are also indispensable for interpreting other multiwavelength observations of SN 1987A.

**OBSERVING DESCRIPTION**

These observations are a part of a 3-year mointioring program of SN 1987A (cycles 34, 35 and 36) using WFC3/UVIS.

We will use the narrow filters F502N and F657N in all three cycles, where F502N will primarily be used to monitor the new interaction region in [O III] and F657N to track the expansion of the reverse shock. We will also use F625W in all three cycles, which probes the overall evolution of the structure of the remnant and connects to the previous long-term monitoring. The F438W filter will be used every 2nd year (Cycles 34 and 36) to monitor the color evolution. We will use the F763M filter in Cycle 35 to search for emerging emission from the compact object.

To obtain a similar or better S/N as the previous observations, considering the fading of most regions of the remnant, we require two orbits each for F438W, F625W, F657N, and F763M, and four orbits for F502N. This amounts to 10 orbits per cycle with the cadences described above. Since 2003, all HST imaging have used a fixed dither strategy to improve spatial resolution, which will be repeated for consistency.

We have placed an ORIENT constraint on the WFC3 imaging to make sure that the diffraction spikes from Stars 2 and 3 (Fig 1) do not overlap with the emission from the SN. The spikes are brightest in F438W, F502N, and F625W, but having the same orientation in all imaging observations will reduce systematic effects in the comparison between filters and epochs.

## Visit

**Proposal 18404, Visit 01** Tue Aug 11 17:00:18 GMT 2026

**Diagnostic Status: No Diagnostics**

Scientific Instruments: WFC3/UVIS

Special Requirements: ORIENT 78D TO 82 D; ORIENT 168D TO 172 D; ORIENT 258D TO 262 D; ORIENT 348D TO 352 D; BETWEEN 01-MAY-2027:00:00:00 AND 31-OCT-2027:00:00:00; SEQ 01,02,03 WITHIN 30 D

*Comments: The orienation constraints are set to make sure that the diffraction spikes from the bright nearby stars do not overlap with the emission from the SN. The timing requirement is to keep the appximate one year cadence of the monitoring.*

## Patterns

| # | 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 | | (1-4) |

## Fixed Targets

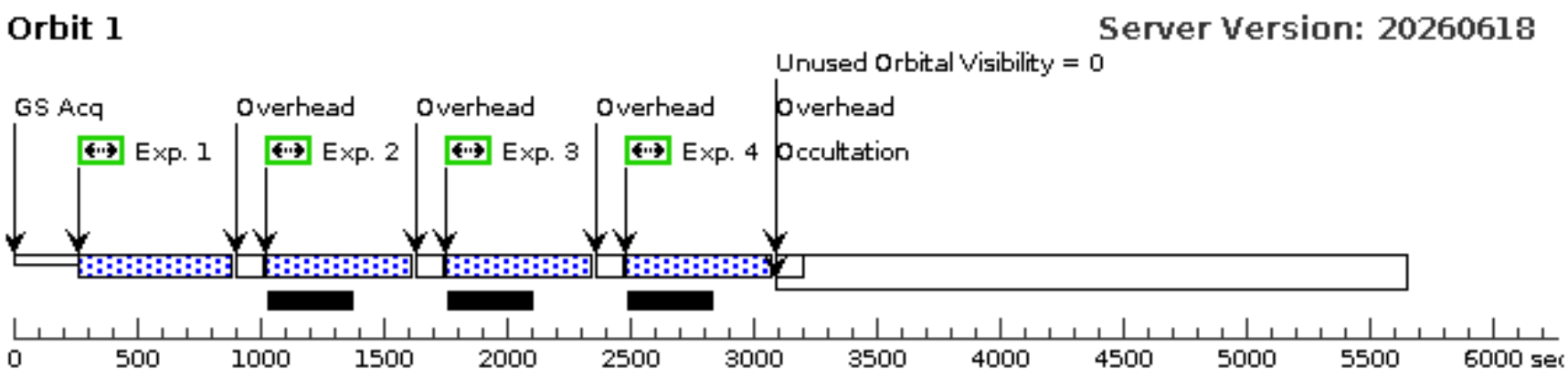
| # | Name | Target Coordinates | Targ. Coord. Corrections | Fluxes | Miscellaneous |
|---|---|---|---|---|---|
| (1) | SN-1987A | RA: 05 35 28.0200 (83.8667500d)<br>Dec: -69 16 11.07 (-69.26974d)<br>Equinox: J2000 | Epoch of Position: 2015.5 | V=22 | Reference Frame: SIMBAD |

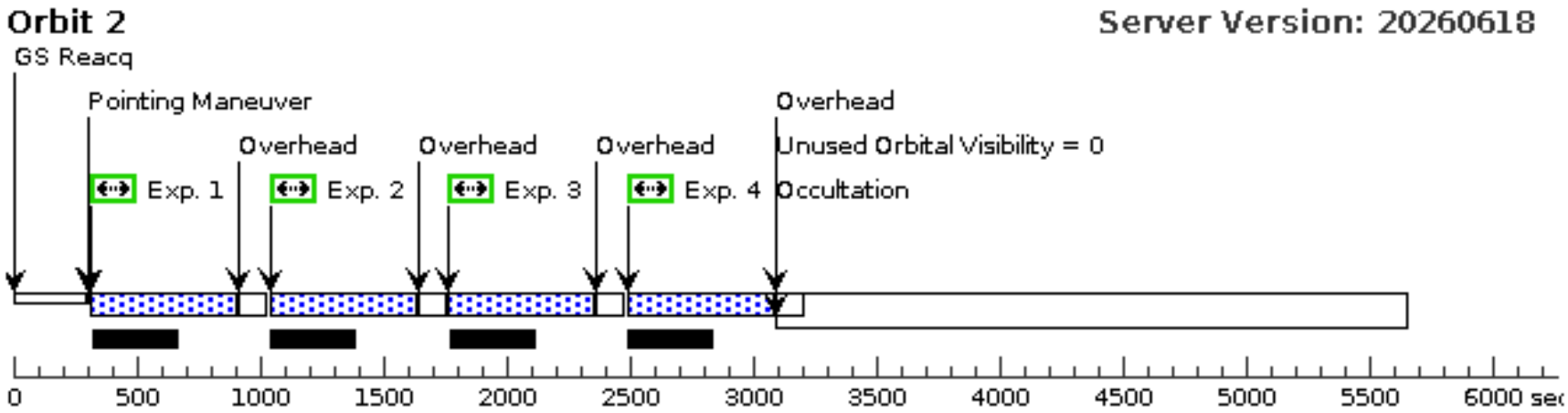
*Comments: This object was generated by the targetselector and retrieved from the SIMBAD database.*
*Category=EXT-MEDIUM*
*Description=[SNR]*

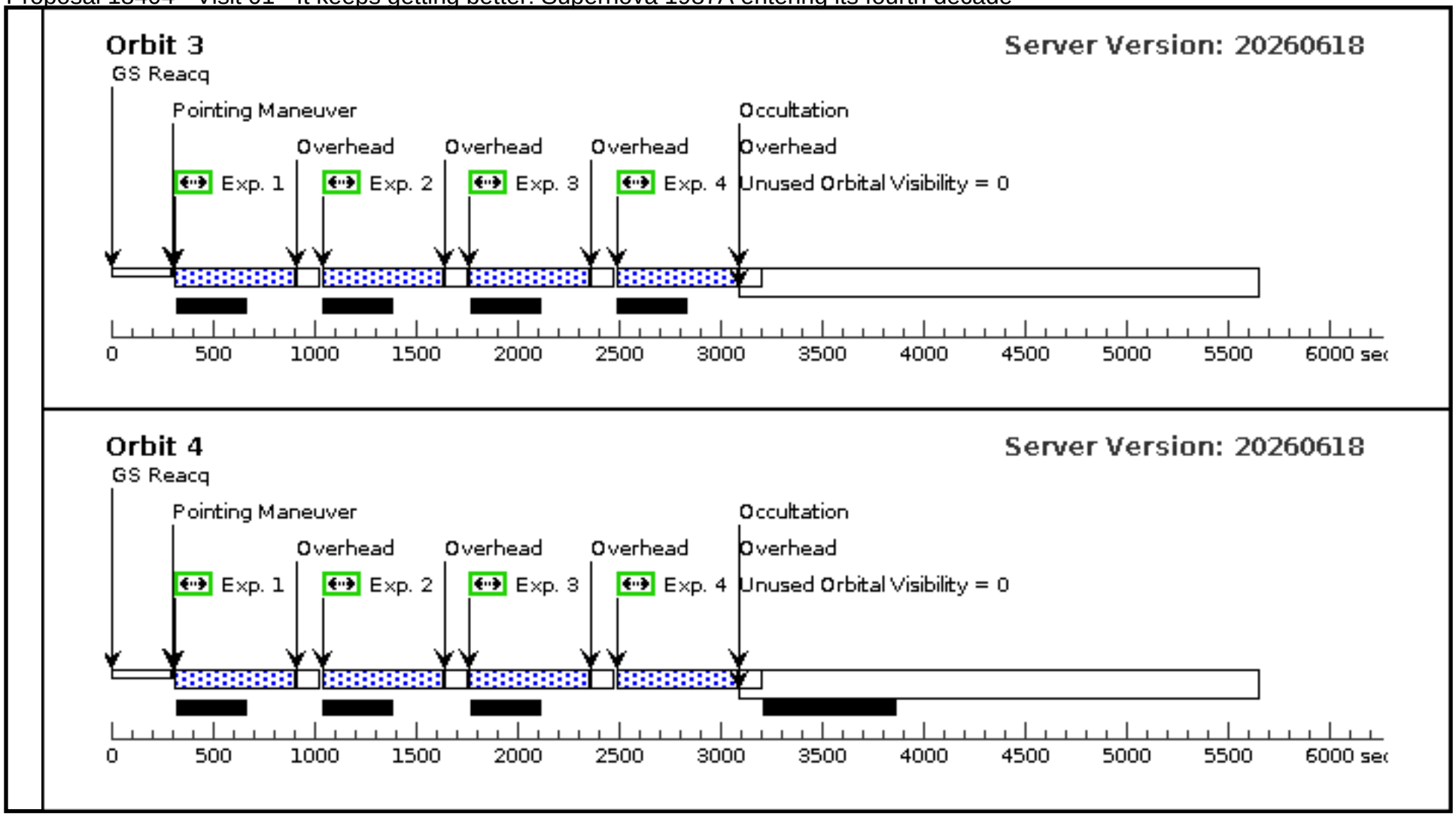
## Exposures

| # | Label | Target | Config,Mode,Aperture | Spectral Els. | Opt. Params. | Special Reqs. | Groups | Exp. Time (Total)/[Actual Dur.] | Orbit |
|---|---|---|---|---|---|---|---|---|---|
| 1 | | (1) SN-1987A | WFC3/UVIS, ACCUM, UVIS2-C1K1C-CTE | F502N | FLASH=16 | | Pattern 1, Exps 1-4 in Visit 01 (1) | 580 Secs (2357 Secs) | |
| | | | | | | | | *[==>593.0 Secs (Pattern 1)]* | ***[1]*** |
| | | | | | | | | *[==>588.0 Secs (Pattern 2)]* | ***[2]*** |
| | | | | | | | | *[==>588.0 Secs (Pattern 3)]* | ***[3]*** |
| | | | | | | | | *[==>588.0 Secs (Pattern 4)]* | ***[4]*** |
| 2 | | (1) SN-1987A | WFC3/UVIS, ACCUM, UVIS2-C1K1C-CTE | F502N | FLASH=16 | | Pattern 1, Exps 1-4 in Visit 01 (1) | 580 Secs (2357 Secs) | |
| | | | | | | | | *[==>593.0 Secs (Pattern 1)]* | ***[1]*** |
| | | | | | | | | *[==>588.0 Secs (Pattern 2)]* | ***[2]*** |
| | | | | | | | | *[==>588.0 Secs (Pattern 3)]* | ***[3]*** |
| | | | | | | | | *[==>588.0 Secs (Pattern 4)]* | ***[4]*** |
| 3 | | (1) SN-1987A | WFC3/UVIS, ACCUM, UVIS2-C1K1C-CTE | F502N | FLASH=16 | | Pattern 1, Exps 1-4 in Visit 01 (1) | 580 Secs (2357 Secs) | |
| | | | | | | | | *[==>593.0 Secs (Pattern 1)]* | ***[1]*** |
| | | | | | | | | *[==>588.0 Secs (Pattern 2)]* | ***[2]*** |
| | | | | | | | | *[==>588.0 Secs (Pattern 3)]* | ***[3]*** |
| | | | | | | | | *[==>588.0 Secs (Pattern 4)]* | ***[4]*** |
| 4 | | (1) SN-1987A | WFC3/UVIS, ACCUM, UVIS2-C1K1C-CTE | F502N | FLASH=16 | | Pattern 1, Exps 1-4 in Visit 01 (1) | 580 Secs (2357 Secs) | |
| | | | | | | | | *[==>593.0 Secs (Pattern 1)]* | ***[1]*** |
| | | | | | | | | *[==>588.0 Secs (Pattern 2)]* | ***[2]*** |
| | | | | | | | | *[==>588.0 Secs (Pattern 3)]* | ***[3]*** |
| | | | | | | | | *[==>588.0 Secs (Pattern 4)]* | ***[4]*** |

Orbit Structure




Orbit 3
Server Version: 20260618
GS Reacq
Pointing Maneuver
Occultation
Overhead
Overhead
Overhead
Overhead
Exp. 1
Exp. 2
Exp. 3
Exp. 4
Unused Orbital Visibility = 0
0
500
1000
1500
2000
2500
3000
3500
4000
4500
5000
5500
6000 sec
Orbit 4
Server Version: 20260618
GS Reacq
Pointing Maneuver
Occultation
Overhead
Overhead
Overhead
Overhead
Exp. 1
Exp. 2
Exp. 3
Exp. 4
Unused Orbital Visibility = 0
0
500
1000
1500
2000
2500
3000
3500
4000
4500
5000
5500
6000 sec

## Visit

**Proposal 18404, Visit 02** Tue Aug 11 17:00:18 GMT 2026

**Diagnostic Status: No Diagnostics**

Scientific Instruments: WFC3/UVIS

Special Requirements: ORIENT 78D TO 82 D; ORIENT 168D TO 172 D; ORIENT 258D TO 262 D; ORIENT 348D TO 352 D; BETWEEN 01-MAY-2027:00:00:00 AND 31-OCT-2027:00:00:00; SEQ 01,02,03 WITHIN 30 D

*Comments: The orienation constraints are set to make sure that the diffraction spikes from the bright nearby stars do not overlap with the emission from the SN. The timing requirement is to keep the appximate one year cadence of the monitoring.*

## Patterns

| # | 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 | | (1-4) |

## Fixed Targets

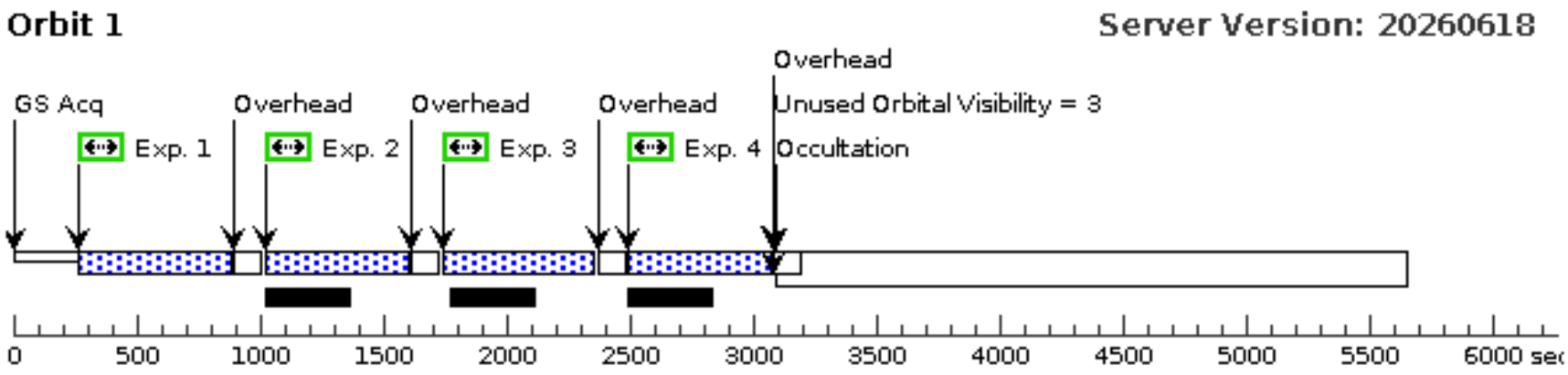
| # | Name | Target Coordinates | Targ. Coord. Corrections | Fluxes | Miscellaneous |
|---|---|---|---|---|---|
| (1) | SN-1987A | RA: 05 35 28.0200 (83.8667500d)<br>Dec: -69 16 11.07 (-69.26974d)<br>Equinox: J2000 | Epoch of Position: 2015.5 | V=22 | Reference Frame: SIMBAD |

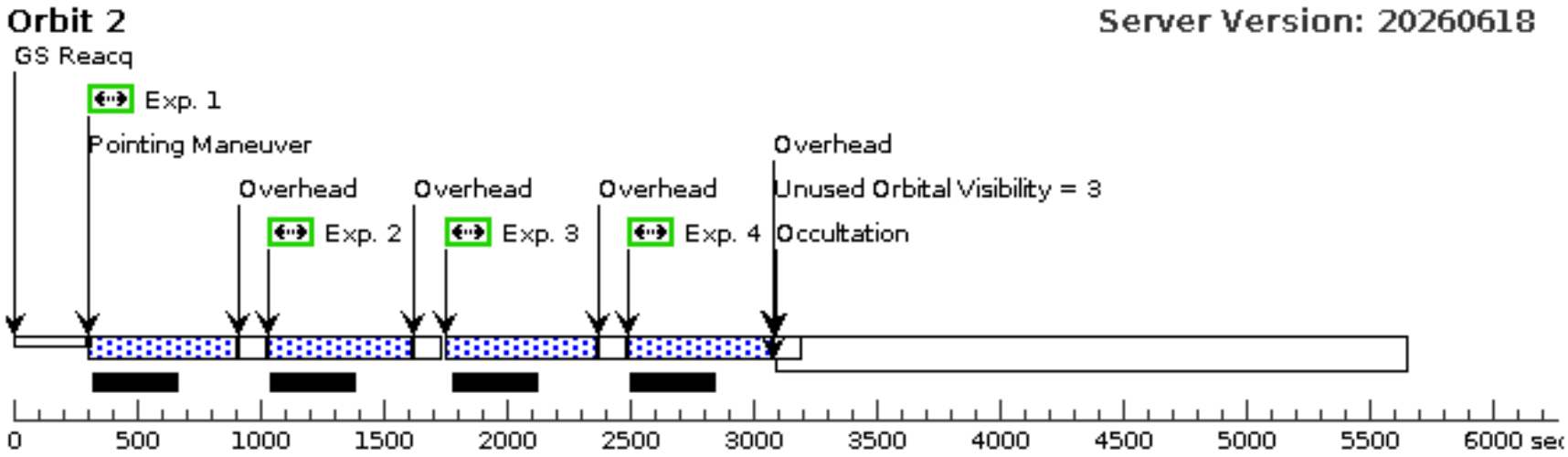
*Comments: This object was generated by the targetselector and retrieved from the SIMBAD database.*
*Category=EXT-MEDIUM*
*Description=[SNR]*

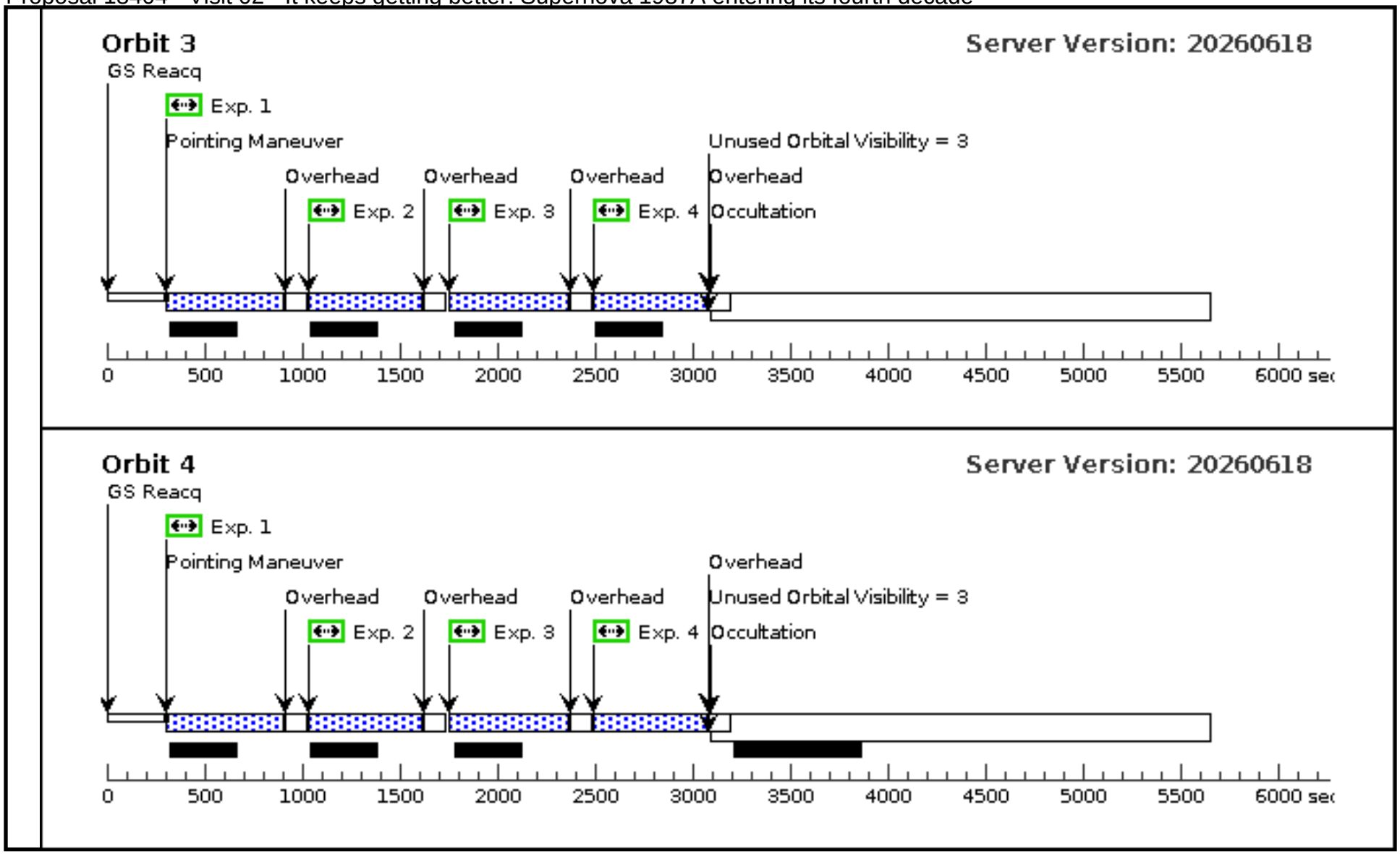
## Exposures

| # | Label | Target | Config,Mode,Aperture | Spectral Els. | Opt. Params. | Special Reqs. | Groups | Exp. Time (Total)/[Actual Dur.] | Orbit |
|---|---|---|---|---|---|---|---|---|---|
| 1 | | (1) SN-1987A | WFC3/UVIS, ACCUM, UVIS2-C1K1C-CTE | F657N | FLASH=15 | | Pattern 1, Exps 1-4 in Visit 02 (1) | 580 Secs (2329 Secs) | |
| | | | | | | | | *[==>586.0 Secs (Pattern 1)]* | ***[1]*** |
| | | | | | | | | *[==>581.0 Secs (Pattern 2)]* | ***[2]*** |
| | | | | | | | | *[==>581.0 Secs (Pattern 3)]* | ***[3]*** |
| | | | | | | | | *[==>581.0 Secs (Pattern 4)]* | ***[4]*** |
| 2 | | (1) SN-1987A | WFC3/UVIS, ACCUM, UVIS2-C1K1C-CTE | F657N | FLASH=15 | | Pattern 1, Exps 1-4 in Visit 02 (1) | 580 Secs (2329 Secs) | |
| | | | | | | | | *[==>586.0 Secs (Pattern 1)]* | ***[1]*** |
| | | | | | | | | *[==>581.0 Secs (Pattern 2)]* | ***[2]*** |
| | | | | | | | | *[==>581.0 Secs (Pattern 3)]* | ***[3]*** |
| | | | | | | | | *[==>581.0 Secs (Pattern 4)]* | ***[4]*** |
| 3 | | (1) SN-1987A | WFC3/UVIS, ACCUM, UVIS2-C1K1C-CTE | F625W | FLASH=5 | | Pattern 1, Exps 1-4 in Visit 02 (1) | 580 Secs (2329 Secs) | |
| | | | | | | | | *[==>586.0 Secs (Pattern 1)]* | ***[1]*** |
| | | | | | | | | *[==>581.0 Secs (Pattern 2)]* | ***[2]*** |
| | | | | | | | | *[==>581.0 Secs (Pattern 3)]* | ***[3]*** |
| | | | | | | | | *[==>581.0 Secs (Pattern 4)]* | ***[4]*** |
| 4 | | (1) SN-1987A | WFC3/UVIS, ACCUM, UVIS2-C1K1C-CTE | F625W | FLASH=5 | | Pattern 1, Exps 1-4 in Visit 02 (1) | 580 Secs (2329 Secs) | |
| | | | | | | | | *[==>586.0 Secs (Pattern 1)]* | ***[1]*** |
| | | | | | | | | *[==>581.0 Secs (Pattern 2)]* | ***[2]*** |
| | | | | | | | | *[==>581.0 Secs (Pattern 3)]* | ***[3]*** |
| | | | | | | | | *[==>581.0 Secs (Pattern 4)]* | ***[4]*** |

Orbit Structure




Orbit 3
Server Version: 20260618
GS Reacq
Exp. 1
Pointing Maneuver
Overhead
Exp. 2
Overhead
Exp. 3
Overhead
Exp. 4
Unused Orbital Visibility = 3
Overhead
Occultation
0
500
1000
1500
2000
2500
3000
3500
4000
4500
5000
5500
6000 sec
Orbit 4
Server Version: 20260618
GS Reacq
Exp. 1
Pointing Maneuver
Overhead
Exp. 2
Overhead
Exp. 3
Overhead
Exp. 4
Overhead
Unused Orbital Visibility = 3
Occultation
0
500
1000
1500
2000
2500
3000
3500
4000
4500
5000
5500
6000 sec

## Visit

**Proposal 18404, Visit 03** Tue Aug 11 17:00:19 GMT 2026

**Diagnostic Status: No Diagnostics**

Scientific Instruments: WFC3/UVIS

Special Requirements: ORIENT 78D TO 82 D; ORIENT 168D TO 172 D; ORIENT 258D TO 262 D; ORIENT 348D TO 352 D; BETWEEN 01-MAY-2027:00:00:00 AND 31-AUG-2027:00:00:00; SEQ 01,02,03 WITHIN 30 D

*Comments: The orienation constraints are set to make sure that the diffraction spikes from the bright nearby stars do not overlap with the emission from the SN. The timing requirement is to keep the appximate one year cadence of the monitoring.*

## Patterns

| # | 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 | | (1-2) |

## Fixed Targets

| # | Name | Target Coordinates | Targ. Coord. Corrections | Fluxes | Miscellaneous |
|---|---|---|---|---|---|
| (1) | SN-1987A | RA: 05 35 28.0200 (83.8667500d)<br>Dec: -69 16 11.07 (-69.26974d)<br>Equinox: J2000 | Epoch of Position: 2015.5 | V=22 | Reference Frame: SIMBAD |

*Comments: This object was generated by the targetselector and retrieved from the SIMBAD database.*
*Category=EXT-MEDIUM*
*Description=[SNR]*

## Exposures

| # | Label | Target | Config,Mode,Aperture | Spectral Els. | Opt. Params. | Special Reqs. | Groups | Exp. Time (Total)/[Actual Dur.] | Orbit |
|---|---|---|---|---|---|---|---|---|---|
| 1 | | (1) SN-1987A | WFC3/UVIS, ACCUM, UVIS2-C1K1C-CTE | F438W | FLASH=12 | | Pattern 1, Exps 1-2 in Visit 03 (1) | 585 Secs (2366 Secs) | |
| | | | | | | | | *[==>594.0 Secs (Pattern 1)]*<br>*[==>594.0 Secs (Pattern 2)]* | ***[1]*** |
| | | | | | | | | *[==>589.0 Secs (Pattern 3)]*<br>*[==>589.0 Secs (Pattern 4)]* | ***[2]*** |
| 2 | | (1) SN-1987A | WFC3/UVIS, ACCUM, UVIS2-C1K1C-CTE | F438W | FLASH=12 | | Pattern 1, Exps 1-2 in Visit 03 (1) | 585 Secs (2366 Secs) | |
| | | | | | | | | *[==>594.0 Secs (Pattern 1)]*<br>*[==>594.0 Secs (Pattern 2)]* | ***[1]*** |
| | | | | | | | | *[==>589.0 Secs (Pattern 3)]*<br>*[==>589.0 Secs (Pattern 4)]* | ***[2]*** |

Orbit Structure