# 18008 - Using HST to Find Supernova Progenitor Stars in JWST, HST, and Euclid Imaging

Cycle: 33, Proposal Category: GO

(Availability Mode: SUPPORTED)

**INVESTIGATORS**


| *Name* | *Institution* |
|---|---|
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| Dr. Kirsty Taggart (CoI) | University of California - Santa Cruz |
| Dr. Wynn Vicente Jacobson-Galan (CoI) | California Institute of Technology |
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**VISITS**

| *Visit* | *Targets used in Visit* | *Configurations used in Visit* | *Orbits Used* | *Last Orbit Planner Run* | *OP Current with Visit?* |
|---|---|---|---|---|---|
| 01 | (3) SN2026DIX | WFC3/UVIS | 1 | 30-Mar-2026 13:00:13.0 | yes |
| 02 | (2) TOO2 | WFC3/UVIS | 1 | 30-Mar-2026 13:00:14.0 | yes |

2 Total Orbits Used

**ABSTRACT**

Supernovae and other luminous transients at <40 Mpc often have deep, high-resolution pre-explosion imaging in which a single progenitor system can be isolated. The vast archives of multi-band, multi-epoch HST imaging have revolutionized this field over the past 25 years, but as new missions such as JWST and Euclid come online, more such examples will be found. Each new event is extremely valuable for studying the correlation

between supernova properties and the mass, metallicity, and local environments of the specific stars that explode. However, the fields where these occur are crowded, and often multiple candidate counterparts are found to the limits of natural seeing in pre-explosion imaging. A follow-up, high-resolution image is typically needed, and this is often impossible to obtain from the ground with adaptive optics due to the lack of proper bright guide stars that are needed within ~30 arcseconds. In these cases, we will trigger a non-disruptive HST target-of-opportunity observation to obtain the necessary high-resolution imaging and isolate the individual star that exploded. With 2 such triggers during Cycle 33, we can catch supernovae and isolate their progenitor systems in pre-explosion imaging, catching these rare and valuable events as they occur in the nearby Universe.

**OBSERVING DESCRIPTION**

This is a target-of-opportunity proposal to observe up to 2 supernovae at <40 Mpc with pre-explosion JWST, HST, and/or Euclid imaging. The goal of the proposal is to obtain imaging at the site of each supernova in order to precisely align to the pre-explosion imaging and identify or rule out the presence of a counterpart in the pre-explosion data. We are requesting a 3 week minimum response time from the time of trigger in order to guarantee that we can calibrate our exposures to the expected brightness of the supernova at the time of observation and avoid either saturating or failing to detect the primary supernova target.

Our fiducial observation setup assumes that we will observe the supernova around or slightly after maximum light, with a required brightness of >16.5 mag to avoid saturating this source, which would limit the astrometric precision in centroiding on the supernova. We therefore use 68s exposures in F555W and use the UVIS2-C1K1C-SUB readout mode to reduce overheads between individual exposures. As we are targeting sources in galaxies at <40 Mpc, we expect the field around the supernova to be crowded with astrometric calibrators, and so the smaller readout region will not limit our science case. We have also adjusted FLASH=15 to avoid CTE losses. To improve PSF sampling, we use 4 iterations of a WFC3-UVIS-DITHER-BOX pattern for a total of 16 individual exposures.

## Visit

**Proposal 18008, SN2026dix (01), implementation** Mon Mar 30 17:00:15 GMT 2026

**Diagnostic Status: No Diagnostics**

Scientific Instruments: WFC3/UVIS

Special Requirements: TOO RESPONSE TIME 21.0D

*Comments: May 19 - 21 is the preferred observing window.*

## 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) |

## Fixed Targets

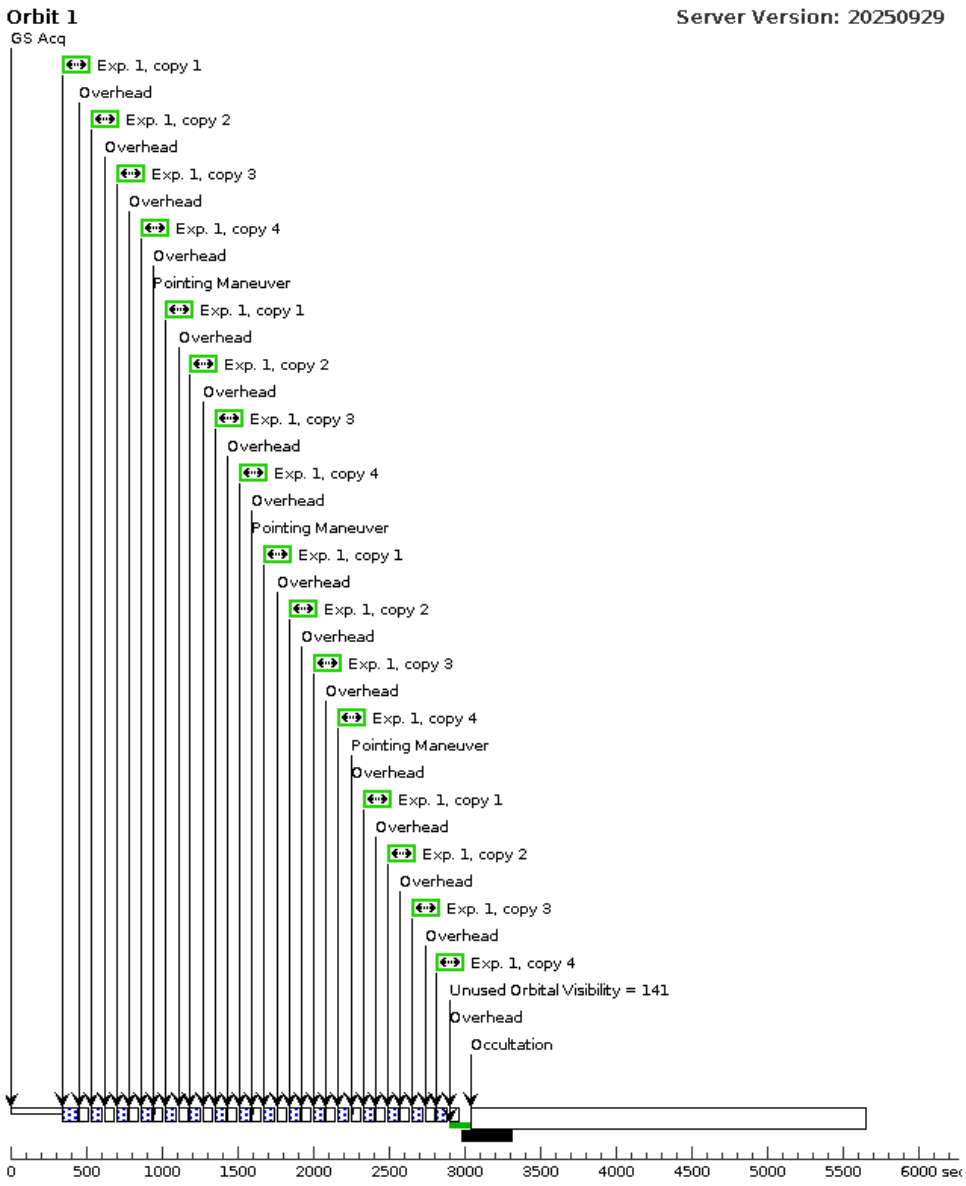
| # | Name | Target Coordinates | Targ. Coord. Corrections | Fluxes | Miscellaneous |
|---|---|---|---|---|---|
| (3) | SN2026DIX | RA: 11 50 37.4300 (177.6559583d)<br>Dec: +55 21 12.92 (55.35359d)<br>Equinox: J2000 | | V=16.5 | Reference Frame: ICRS |

*Comments:*
*Category=EXT-STAR*
*Description=[SUPERNOVA]*
*Extended=NO*

## Exposures

| # | Label | Target | Config,Mode,Aperture | Spectral Els. | Opt. Params. | Special Reqs. | Groups | Exp. Time (Total)/[Actual Dur.] | Orbit |
|---|---|---|---|---|---|---|---|---|---|
| 1 | | (3) SN2026DIX | WFC3/UVIS, ACCUM, UVIS2-C1K1C-SUB | F555W | FLASH=21 | | Pattern 1, Exps 1-1 in SN2026dix (01) (1) | 68 Secs X 4 (1120 Secs) | |
| | | | | | | | | *[==>70.0 Secs (Pattern 1, Copy 1)]* | ***[1]*** |
| | | | | | | | | *[==>70.0 Secs (Pattern 1, Copy 2)]* | |
| | | | | | | | | *[==>70.0 Secs (Pattern 1, Copy 3)]* | |
| | | | | | | | | *[==>70.0 Secs (Pattern 1, Copy 4)]* | |
| | | | | | | | | *[==>70.0 Secs (Pattern 2, Copy 1)]* | |
| | | | | | | | | *[==>70.0 Secs (Pattern 2, Copy 2)]* | |
| | | | | | | | | *[==>70.0 Secs (Pattern 2, Copy 3)]* | |
| | | | | | | | | *[==>70.0 Secs (Pattern 2, Copy 4)]* | |
| | | | | | | | | *[==>70.0 Secs (Pattern 3, Copy 1)]* | |
| | | | | | | | | *[==>70.0 Secs (Pattern 3, Copy 2)]* | |
| | | | | | | | | *[==>70.0 Secs (Pattern 3, Copy 3)]* | |
| | | | | | | | | *[==>70.0 Secs (Pattern 3, Copy 4)]* | |
| | | | | | | | | *[==>70.0 Secs (Pattern 4, Copy 1)]* | |
| | | | | | | | | *[==>70.0 Secs (Pattern 4, Copy 2)]* | |
| | | | | | | | | *[==>70.0 Secs (Pattern 4, Copy 3)]* | |
| | | | | | | | | *[==>70.0 Secs (Pattern 4, Copy 4)]* | |

**Orbit Structure**



## Visit

**Proposal 18008, TOO-2 (02), implementation** Mon Mar 30 17:00:15 GMT 2026

**Diagnostic Status: No Diagnostics**

Scientific Instruments: WFC3/UVIS

Special Requirements: ON HOLD ; TOO RESPONSE TIME 21.0D

*On Hold Comments: On hold until trigger on a supernova discovered at <40 Mpc with pre-explosion JWST, HST, or Euclid imaging*

## 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) |

## Generic Targets

| # | Name | Criteria | Description |
|---|---|---|---|
| (2) | TOO2 | Second supernova at <40 Mpc with pre-explosion imaging | |

## Exposures

| # | Label | Target | Config,Mode,Aperture | Spectral Els. | Opt. Params. | Special Reqs. | Groups | Exp. Time (Total)/[Actual Dur.] | Orbit |
|---|---|---|---|---|---|---|---|---|---|
| 1 | | (2) TOO2 | WFC3/UVIS, ACCUM, UVIS2-C1K1C-SUB | F555W | FLASH=21 | | Pattern 1, Exps 1-1 in TOO-2 (02) (1) | 68 Secs X 4 (1088 Secs) | |
| | | | | | | | | *[==>(Pattern 1, Copy 1)]* | ***[1]*** |
| | | | | | | | | *[==>(Pattern 1, Copy 2)]* | |
| | | | | | | | | *[==>(Pattern 1, Copy 3)]* | |
| | | | | | | | | *[==>(Pattern 1, Copy 4)]* | |
| | | | | | | | | *[==>(Pattern 2, Copy 1)]* | |
| | | | | | | | | *[==>(Pattern 2, Copy 2)]* | |
| | | | | | | | | *[==>(Pattern 2, Copy 3)]* | |
| | | | | | | | | *[==>(Pattern 2, Copy 4)]* | |
| | | | | | | | | *[==>(Pattern 3, Copy 1)]* | |
| | | | | | | | | *[==>(Pattern 3, Copy 2)]* | |
| | | | | | | | | *[==>(Pattern 3, Copy 3)]* | |
| | | | | | | | | *[==>(Pattern 3, Copy 4)]* | |
| | | | | | | | | *[==>(Pattern 4, Copy 1)]* | |
| | | | | | | | | *[==>(Pattern 4, Copy 2)]* | |
| | | | | | | | | *[==>(Pattern 4, Copy 3)]* | |
| | | | | | | | | *[==>(Pattern 4, Copy 4)]* | |

**Orbit Structure**