# 11291 - Following Eta Carinae's Change of State

Cycle: 16, Proposal Category: GO

(Availability Mode: SUPPORTED)

**INVESTIGATORS**



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|---|---|---|
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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 | (1) ETA-CAR-A | WFPC2 | 1 | 18-Jan-2008 05:27:54.0 | yes |
| 02 | (1) ETA-CAR-A | WFPC2 | 1 | 18-Jan-2008 05:28:02.0 | yes |
| 03 | (1) ETA-CAR-A | WFPC2 | 1 | 18-Jan-2008 05:28:07.0 | yes |

3 Total Orbits Used

**ABSTRACT**

Eta Carinae is now known to be undergoing some unusually rapid changes on a timescale of several years. They are probably essential for modeling the star's long-term recovery from its Giant Eruption 160 years ago -- the prototype "supernova impostor" event. Since high spatial resolution is needed to isolate the central star, and the present state will probably not recur in the future, it is important to obtain HST data during the next two years. We propose a cost-effective set of ACS observations with three goals: (1) to obtain a continuing record of the star's rapid UV and visual brightening; (2) to lengthen the temporal baseline of ACS images enough to settle an important question concerning ejecta ages; and (3) to extend the record of morphological changes in the inner ejecta past the midpoint of eta Car's 5.5-year cycle.

**OBSERVING DESCRIPTION**

-- This plan, using WFPC2(PC), is a substitute for earlier ACS plan -- see Cycle 15 program 10844.
-- We concentrate on WFPC2 filter F336W because it nearly matches ACS F330W. Primary goal is to monitor the UV brightness of the central object (Eta Car, the star itself). Central object is too bright for the longer-wavelength WFPC2 'M' and 'W' filters, and the 'N' filters are contaminated by emission lines whose brightness cannot be assessed with available instruments.
-- We need at least two independent visits per year, with roughly uniform temporal spacing. This plan includes 3 one-orbit visits. We've chosen not to attempt a two-orbit visit because multicolor imaging has much lower priority than sampling the essential UV brightness trend.

**REAL TIME JUSTIFICATION**

Main goal is temporal coverage of progressive brightness trend.

**CALIBRATION JUSTIFICATION**

-- none requested --

**ADDITIONAL COMMENTS**

(Regarding early scheduling within Cycle 16): Ground-based photometry suggests that a rapid change occurred a few weeks after our last Cy 15 ACS observation. Therefore, it would be prudent to get data as soon as possible now.

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Criteria for visit timing (3 visits):

1. Visit 1 should occur as soon as feasible (see above).
2. Visit 3 should occur near the end of Cycle 16, even if that is delayed. Eta Carinae is expected to have another "spectroscopic event" in January 2009, and if possible we should get data near that time.
3. Vist 2 should be roughly midway between the other two, but there is no need for it to be exactly midway. After the mid-point may be a little better than before.

## Visit

**Proposal 11291, Visit 01, implementation** Fri Jan 18 10:28:12 GMT 2008

**Diagnostic Status: No Diagnostics**

Scientific Instruments: WFPC2

Special Requirements: BEFORE 01-SEP-2007:00:00:00

*Comments: Visit 1 should be done as early as feasible, see notes elsewhere in this plan. Target may have changed appreciably since our last Cy 15 HST observations.*

## Patterns

| # | Primary Pattern | | Secondary Pattern | Exposures |
|---|---|---|---|---|
| (1) | Pattern Type=WFPC2-BOX | Coordinate Frame=POS-TARG | | (1), (2) |
| | Purpose=DITHER | Pattern Orientation=26.56505 | | |
| | Number Of Points=4 | Angle Between Sides=143.1301 | | |
| | Point Spacing=0.559017 | Center Pattern=false | | |
| | Line Spacing=0.559017 | | | |

## Fixed Targets

| # | Name | Target Coordinates | Targ. Coord. Corrections | Fluxes | Miscellaneous |
|---|---|---|---|---|---|
| (1) | ETA-CAR-A | RA: 10 45 3.6000 (161.2650000d) | | V=6+/-0.5 | Reference Frame: GSC1 |
| | Alt Name1: HD93308 | Dec: -59 41 4.10 (-59.68447d) | | F(2600)=1.3+/-0.3 E-11, | |
| | | Equinox: J2000 | | F(3400)=1.7+/-0.4 E-11, | |
| | | Plate Id: ZZZQ | | F(6300)=2.4+/-0.60 E-11 | |

*Comments: IMPORTANT: Acquiring Eta Car is potentially tricky because of the surrounding Carina Nebula. In this region, bright nebulosity tends to hide large areas in ordinary wide-field plates. (VTT, for instance, is murky around Eta Car.) Therefore we fear that the area distribution of GSC2 guide stars contains "holes." Even worse, some official guide stars cannot be trusted because they're perturbed by nebular features seen with inadequate plate scale.*
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*All our previous acquisitions of this object, in the years 1991--2006, used special catalog ZZZQ, and it didn't cause any failures. The normal type of acquisition would PROBABLY work, but we're not sure. Therefore we specify ZZZQ in this plan.*
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## Exposures

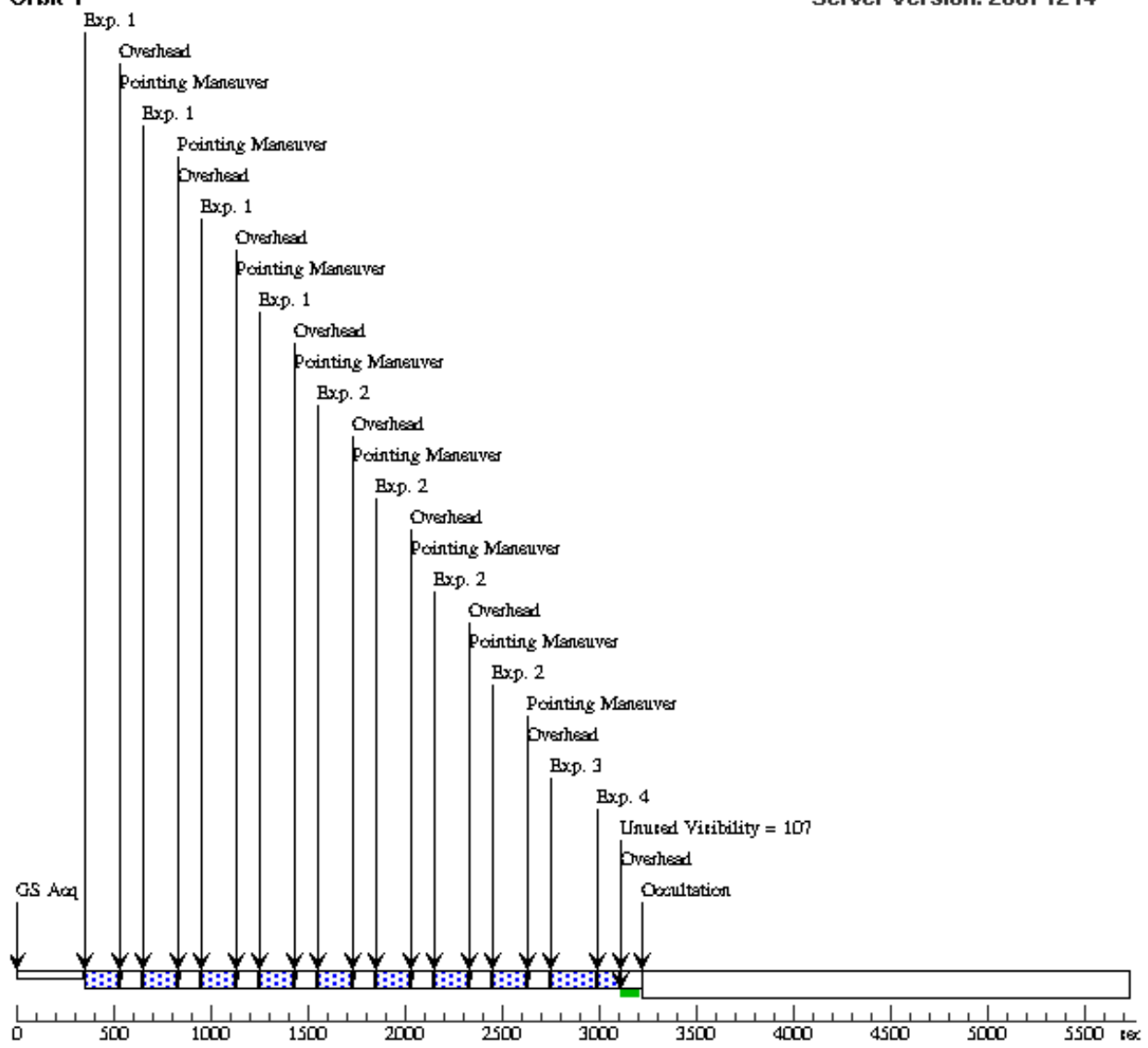
| # | Label | Target | Config,Mode,Aperture | Spectral Els. | Opt. Params. | Special Reqs. | Groups | Exp. Time/[Actual Dur.] | Orbit |
|---|---|---|---|---|---|---|---|---|---|
| 1 | 336 SHORT | (1) ETA-CAR-A | WFPC2, IMAGE, PC1 | F336W | ATD-GAIN=15 | POS TARG 0.0,-1.5 | Pattern 1-1 (1) | 0.11 Secs | |
| | | | | | | | | *[==>(Pattern 1)]*<br>*[==>(Pattern 2)]*<br>*[==>(Pattern 3)]*<br>*[==>(Pattern 4)]* | ***[1]*** |
| | *Comments: Gain 15, because very high count rate in central object. Brightest pixel may saturate at one of the dither points, but probably not at all of them.* | | | | | | | | |
| 2 | 336 MEDIUM | (1) ETA-CAR-A | WFPC2, IMAGE, PC1 | F336W | ATD-GAIN=15 | POS TARG 0.0,-1.5 | Pattern 2-2 (1) | 0.8 Secs | |
| | | | | | | | | *[==>(Pattern 1)]*<br>*[==>(Pattern 2)]*<br>*[==>(Pattern 3)]*<br>*[==>(Pattern 4)]* | ***[1]*** |
| | *Comments: Gain 15, because very high count rate in central object. We use two different exposure times in order to get high dynamic range in surrounding ejecta.* | | | | | | | | |
| 3 | 255 SINGLE | (1) ETA-CAR-A | WFPC2, IMAGE, PC1 | F255W | ATD-GAIN=15 | | | 0.6 Secs | |
| | | | | | | | | *[==>]* | ***[1]*** |
| | *Comments: Minimal short-wvl observation for comparison with earlier ACS data. Count rate is expected to be high, but not as high as for the other filters.* | | | | | | | | |

**Exposures (continued)**

| # | Label | Target | Config,Mode,Aperture | Spectral Els. | Opt. Params. | Special Reqs. | Groups | Exp. Time/[Actual Dur.] | Orbit |
|---|---|---|---|---|---|---|---|---|---|
| 4 | 631 SINGLE | (1) ETA-CAR-A | WFPC2, IMAGE, PC1 | F631N | ATD-GAIN=15 | | | 0.11 Secs | |
| | | | | | | | | *[==>]* | ***[1]*** |

*Comments: Minimal red observation, for comparison with many pre-2003 WFPC2(PC) F631N data. Very high count rate in central object.*

**Orbit Structure**



## Visit

**Proposal 11291, Visit 02, implementation** Fri Jan 18 10:28:13 GMT 2008

**Diagnostic Status: No Diagnostics**

Scientific Instruments: WFPC2

Special Requirements: AFTER 01 BY 150.0 D TO 260.0 D

*Comments: Visit 2 should occur roughly midway between Visits 1 and 3, if feasible -- but it doesn't need to be exactly midway. The main requirement is that Visit 2 should not be close to either of the other two.*

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## Patterns

| # | Primary Pattern | | Secondary Pattern | Exposures |
|---|---|---|---|---|
| (1) | Pattern Type=WFPC2-BOX | Coordinate Frame=POS-TARG | | (1), (2) |
| | Purpose=DITHER | Pattern Orientation=26.56505 | | |
| | Number Of Points=4 | Angle Between Sides=143.1301 | | |
| | Point Spacing=0.559017 | Center Pattern=false | | |
| | Line Spacing=0.559017 | | | |

## Fixed Targets

| # | Name | Target Coordinates | Targ. Coord. Corrections | Fluxes | Miscellaneous |
|---|---|---|---|---|---|
| (1) | ETA-CAR-A | RA: 10 45 3.6000 (161.2650000d) | | V=6+/-0.5 | Reference Frame: GSC1 |
| | Alt Name1: HD93308 | Dec: -59 41 4.10 (-59.68447d) | | F(2600)=1.3+/-0.3 E-11, | |
| | | Equinox: J2000 | | F(3400)=1.7+/-0.4 E-11, | |
| | | Plate Id: ZZZQ | | F(6300)=2.4+/-0.60 E-11 | |

*Comments: IMPORTANT: Acquiring Eta Car is potentially tricky because of the surrounding Carina Nebula. In this region, bright nebulosity tends to hide large areas in ordinary wide-field plates. (VTT, for instance, is murky around Eta Car.) Therefore we fear that the area distribution of GSC2 guide stars contains "holes." Even worse, some official guide stars cannot be trusted because they're perturbed by nebular features seen with inadequate plate scale.*

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*All our previous acquisitions of this object, in the years 1991--2006, used special catalog ZZZQ, and it didn't cause any failures. The normal type of acquisition would PROBABLY work, but we're not sure. Therefore we specify ZZZQ in this plan.*

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## Exposures

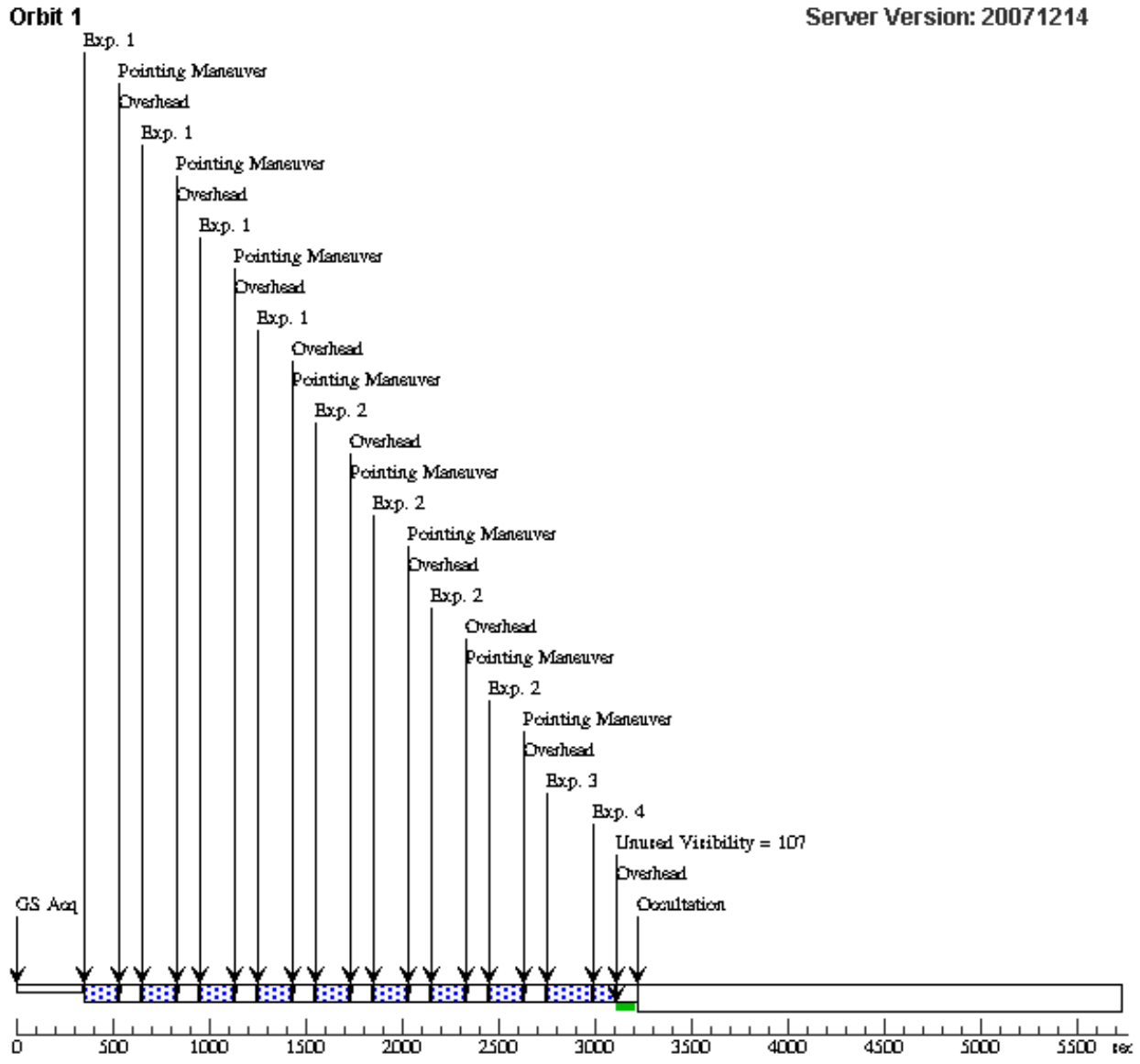
| # | Label | Target | Config,Mode,Aperture | Spectral Els. | Opt. Params. | Special Reqs. | Groups | Exp. Time/[Actual Dur.] | Orbit |
|---|---|---|---|---|---|---|---|---|---|
| 1 | 336 SHORT | (1) ETA-CAR-A | WFPC2, IMAGE, PC1 | F336W | ATD-GAIN=15 | POS TARG 0.0,-1.5 | Pattern 1-1 (1) | 0.11 Secs | |
| | | | | | | | | *[==>(Pattern 1)]* | ***[1]*** |
| | | | | | | | | *[==>(Pattern 2)]* | |
| | | | | | | | | *[==>(Pattern 3)]* | |
| | | | | | | | | *[==>(Pattern 4)]* | |
| | *Comments: Gain 15, because very high count rate in central object. Brightest pixel may saturate at one of the dither points, but probably not at all of them.* | | | | | | | | |
| 2 | 336 MEDIUM | (1) ETA-CAR-A | WFPC2, IMAGE, PC1 | F336W | ATD-GAIN=15 | POS TARG 0.0,-1.5 | Pattern 2-2 (1) | 0.8 Secs | |
| | | | | | | | | *[==>(Pattern 1)]* | ***[1]*** |
| | | | | | | | | *[==>(Pattern 2)]* | |
| | | | | | | | | *[==>(Pattern 3)]* | |
| | | | | | | | | *[==>(Pattern 4)]* | |
| | *Comments: Gain 15, because very high count rate in central object. We use two different exposure times in order to get high dynamic range in surrounding ejecta.* | | | | | | | | |
| 3 | 255 SINGLE | (1) ETA-CAR-A | WFPC2, IMAGE, PC1 | F255W | ATD-GAIN=15 | | | 0.6 Secs | |
| | | | | | | | | *[==>]* | ***[1]*** |
| | *Comments: Minimal short-wvl observation for comparison with earlier ACS data. Count rate is expected to be high, but not as high as for the other filters.* | | | | | | | | |

**Exposures (continued)**

| # | Label | Target | Config,Mode,Aperture | Spectral Els. | Opt. Params. | Special Reqs. | Groups | Exp. Time/[Actual Dur.] | Orbit |
|---|---|---|---|---|---|---|---|---|---|
| 4 | 631 SINGLE | (1) ETA-CAR-A | WFPC2, IMAGE, PC1 | F631N | ATD-GAIN=15 | | | 0.11 Secs | |
| | | | | | | | | *[==>]* | ***[1]*** |

*Comments: Minimal red observation, for comparison with many pre-2003 WFPC2(PC) F631N data. Very high count rate in central object.*

**Orbit Structure**



## Visit

**Proposal 11291, Visit 03, implementation** Fri Jan 18 10:28:14 GMT 2008

**Diagnostic Status: No Diagnostics**

Scientific Instruments: WFPC2

Special Requirements: AFTER 01-JUL-2008:00:00:00

*Comments: Visit 3 should occur near the end of Cycle 16, if feasible. Eta Carinae is expected to have an important "spectroscopic event" in January 2009, so we're especially interested in the brightness just before that.*
*If the end of Cy 16 is delayed far enough, it may be useful for visit 3 to occur in January 2009, or close to that.*
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*Anyway, if a further delay in the end of Cy 16 is announced beforehand, then it will be advantageous to postpone Visit 3 accordingly.*

## Patterns

| # | Primary Pattern | | Secondary Pattern | Exposures |
|---|---|---|---|---|
| (1) | Pattern Type=WFPC2-BOX | Coordinate Frame=POS-TARG | | (1), (2) |
| | Purpose=DITHER | Pattern Orientation=26.56505 | | |
| | Number Of Points=4 | Angle Between Sides=143.1301 | | |
| | Point Spacing=0.559017 | Center Pattern=false | | |
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## Fixed Targets

| # | Name | Target Coordinates | Targ. Coord. Corrections | Fluxes | Miscellaneous |
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*Comments: IMPORTANT: Acquiring Eta Car is potentially tricky because of the surrounding Carina Nebula. In this region, bright nebulosity tends to hide large areas in ordinary wide-field plates. (VTT, for instance, is murky around Eta Car.) Therefore we fear that the area distribution of GSC2 guide stars contains "holes." Even worse, some official guide stars cannot be trusted because they're perturbed by nebular features seen with inadequate plate scale.*
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*All our previous acquisitions of this object, in the years 1991--2006, used special catalog ZZZQ, and it didn't cause any failures. The normal type of acquisition would PROBABLY work, but we're not sure. Therefore we specify ZZZQ in this plan.*
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## Exposures

| # | Label | Target | Config,Mode,Aperture | Spectral Els. | Opt. Params. | Special Reqs. | Groups | Exp. Time/[Actual Dur.] | Orbit |
|---|---|---|---|---|---|---|---|---|---|
| 1 | 336 SHORT | (1) ETA-CAR-A | WFPC2, IMAGE, PC1 | F336W | ATD-GAIN=15 | POS TARG 0.0,-1.5 | Pattern 1-1 (1) | 0.11 Secs | |
| | | | | | | | | *[==>(Pattern 1)]* | ***[1]*** |
| | | | | | | | | *[==>(Pattern 2)]* | |
| | | | | | | | | *[==>(Pattern 3)]* | |
| | | | | | | | | *[==>(Pattern 4)]* | |

*Comments: Gain 15, because very high count rate in central object. Brightest pixel may saturate at one of the dither points, but probably not at all of them.*

| 2 | 336 MEDIUM | (1) ETA-CAR-A | WFPC2, IMAGE, PC1 | F336W | ATD-GAIN=15 | POS TARG 0.0,-1.5 | Pattern 2-2 (1) | 0.8 Secs | |
|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | *[==>(Pattern 1)]* | ***[1]*** |
| | | | | | | | | *[==>(Pattern 2)]* | |
| | | | | | | | | *[==>(Pattern 3)]* | |
| | | | | | | | | *[==>(Pattern 4)]* | |

*Comments: Gain 15, because very high count rate in central object. We use two different exposure times in order to get high dynamic range in surrounding ejecta.*

**Exposures (continued)**

| # | Label | Target | Config,Mode,Aperture | Spectral Els. | Opt. Params. | Special Reqs. | Groups | Exp. Time/[Actual Dur.] | Orbit |
|---|---|---|---|---|---|---|---|---|---|
| 3 | 255 SINGLE | (1) ETA-CAR-A | WFPC2, IMAGE, PC1 | F255W | ATD-GAIN=15 | | | 0.6 Secs | |
| | | | | | | | | *[==>]* | ***[1]*** |
| *Comments: Minimal short-wvl observation for comparison with earlier ACS data. Count rate is expected to be high, but not as high as for the other filters.* | | | | | | | | | |
| 4 | 631 SINGLE | (1) ETA-CAR-A | WFPC2, IMAGE, PC1 | F631N | ATD-GAIN=15 | | | 0.11 Secs | |
| | | | | | | | | *[==>]* | ***[1]*** |
| *Comments: Minimal red observation, for comparison with many pre-2003 WFPC2(PC) F631N data. Very high count rate in central object.* | | | | | | | | | |

**Orbit Structure**