# 17579 - A Newly Identified Merging Cluster Near Pericenter

Cycle: 31, Proposal Category: GO

(Availability Mode: SUPPORTED)

**INVESTIGATORS**



| *Name* | *Institution* |
|---|---|
| **Dr. John P. Hughes (PI) (Contact)** | **Rutgers the State University of New Jersey** |
| Mr. Peter Doze (CoI) | Rutgers the State University of New Jersey |
| Matt Hilton (CoI) | University of KwaZulu-Natal |
| Prof. Nicholas Battaglia (CoI) | Cornell University |
| Dr. Cristobal Sifon (CoI) | Pontificia Universidad Catolica de Valparaiso |
| Prof. Charles R. Keeton (CoI) | Rutgers the State University of New Jersey |
| Dr. Kenda Knowles (CoI) | University of KwaZulu-Natal |
| Dr. Kavilan Moodley (CoI) | University of KwaZulu-Natal |



**VISITS**

| *Visit* | *Targets used in Visit* | *Configurations used in Visit* | *Orbits Used* | *Last Orbit Planner Run* | *OP Current with Visit?* |
|---|---|---|---|---|---|
| 01 | (1) ACT-CL-J0034.4+0225-F0 | ACS/WFC | 1 | 09-Nov-2023 09:00:16.0 | yes |
| 02 | (2) ACT-CL-J0034.4+0225-F1 | ACS/WFC | 1 | 09-Nov-2023 09:00:16.0 | yes |
| 03 | (3) ACT-CL-J0034.4+0225-F2 | ACS/WFC | 1 | 09-Nov-2023 09:00:17.0 | yes |
| 04 | (4) ACT-CL-J0034.4+0225-F3 | ACS/WFC | 1 | 09-Nov-2023 09:00:17.0 | yes |
| 05 | (5) ACT-CL-J0034.4+0225-F4 | ACS/WFC | 1 | 09-Nov-2023 09:00:18.0 | yes |

5 Total Orbits Used

**ABSTRACT**

We have identified a massive cluster ACT-CL J0034.3+0225 at a redshift of 0.388 in the midst of a major merger and close to pericenter crossing based on an archival Chandra observation from Cycle 18. This proposal requests time for a much deeper Chandra observation to better define the cluster's morphology, to measure temperature differences within the core, and to search for shocks and cold fronts. This proposal also requests 5 HST orbits with the ACS/WFC for a gravitational lensing analysis to determine the distribution of total cluster mass for comparison to the gas and galaxies with the goal of setting constraints on the interaction properties of the dark matter, determining the properties of the merger, and studying the shocks and cold fronts in this cluster

**OBSERVING DESCRIPTION**

Our award of 5 HST orbits will use the ACS/WFC to image the full cluster extent out to 1 Mpc (roughly R500) in the F606W filter using a 2x2 mosaic. This will utilize 4 orbits which have an ORIENT constraint to "|avoid contaminating the central region of the cluster by diffraction spikes from the bright star toward the northwest."| The remaining orbit will be used to image the cluster core in the F775W filter also with an ORIENT constraint to match "the existing F814W image to maximize the overlap of HST imaging in the cluster center." In each orbit we will obtain an image through a single filter using a 4-point dither pattern that provides optimal coverage of the central chip gap area, while allowing for efficient cosmic-ray rejection. Review of the visit planner output indicates that a +/-1 deg tolerance on the ORIENT of the F775W image allows for good visibiity. For the 2x2 mosaic pointing, posiitons were genrated iteratively to ensure there were no gaps in coverage across the full mosaic. An ORIENT of 47.5 deg provided a decent visibiity window.

## Visit

**Proposal 17579, F775W image (01), implementation** Thu Nov 09 14:00:18 GMT 2023

**Diagnostic Status: No Diagnostics**

Scientific Instruments: ACS/WFC

Special Requirements: ORIENT 69.5D TO 71.5 D

## Patterns

| # | Primary Pattern | | Secondary Pattern | Exposures |
|---|---|---|---|---|
| (2) | Pattern Type=ACS-WFC-DITHER-LINE<br>Purpose=DITHER<br>Number Of Points=4<br>Point Spacing=2.276<br>Line Spacing= | Coordinate Frame=POS-TARG<br>Pattern Orientation=85.29<br>Angle Between Sides=<br>Center Pattern=false | | (1) |

## Fixed Targets

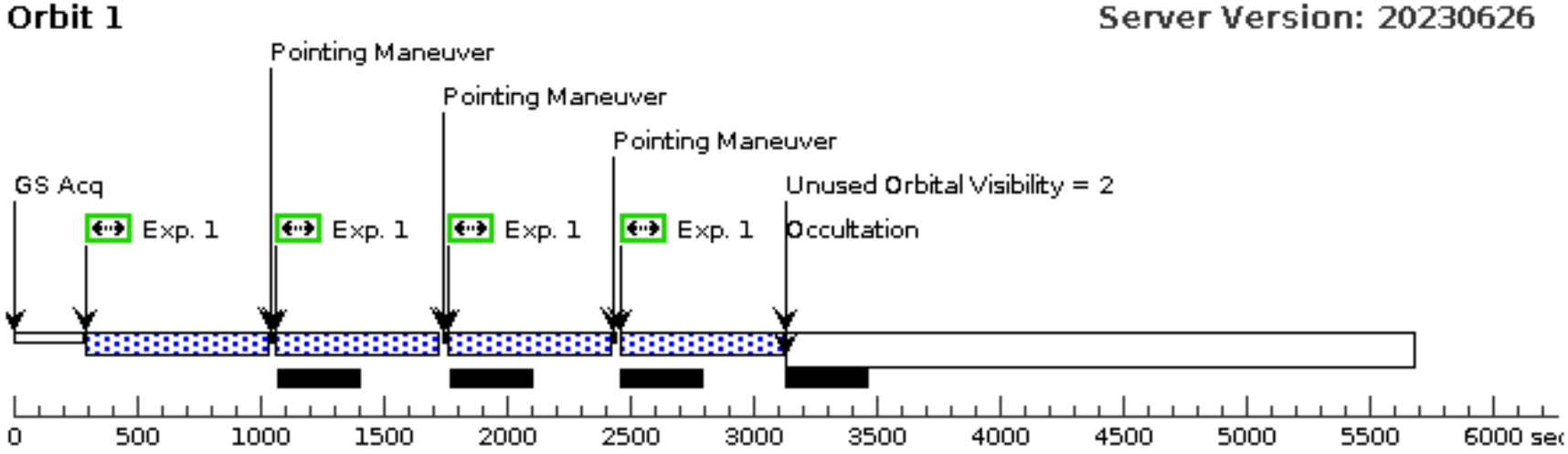
| # | Name | Target Coordinates | Targ. Coord. Corrections | Fluxes | Miscellaneous |
|---|---|---|---|---|---|
| (1) | ACT-CL-J0034.4+0225-F0 | RA: 00 34 28.1986 (8.6174942d)<br>Dec: +02 25 31.15 (2.42532d)<br>Equinox: J2000 | Epoch of Position: 2000 | V=20 | Reference Frame: ICRS |

*Comments: This position was selcted to match the previous F814W image of this cluster.*
*Category=CLUSTER OF GALAXIES*
*Description=[GRAVITATIONAL LENS, RICH CLUSTER]*
*Extended=YES*

## Exposures

| # | Label | Target | Config,Mode,Aperture | Spectral Els. | Opt. Params. | Special Reqs. | Groups | Exp. Time (Total)/[Actual Dur.] | Orbit |
|---|---|---|---|---|---|---|---|---|---|
| 1 | | (1) ACT-CL-J0034.4+0225-F0 | ACS/WFC, ACCUM, WFC | F775W | | GS ACQ SCENARIO ONEB1B3 | Pattern 2, Exps 1-1 in F775W image (01) (2) | 535 Secs (2140 Secs)<br>*[==>(Pattern 1)]*<br>*[==>(Pattern 2)]*<br>*[==>(Pattern 3)]*<br>*[==>(Pattern 4)]* | ***[1]*** |

## Orbit Structure



## Visit

**Proposal 17579, F606W F1 (02), implementation** Thu Nov 09 14:00:18 GMT 2023

**Diagnostic Status: No Diagnostics**

Scientific Instruments: ACS/WFC

Special Requirements: ORIENT 47.5D TO 47.5 D

## Patterns

| # | Primary Pattern | | Secondary Pattern | Exposures |
|---|---|---|---|---|
| (3) | Pattern Type=ACS-WFC-DITHER-BOX<br>Purpose=DITHER<br>Number Of Points=4<br>Point Spacing=5.943<br>Line Spacing=3.077 | Coordinate Frame=POS-TARG<br>Pattern Orientation=91.429<br>Angle Between Sides=166.993<br>Center Pattern=false | | (1) |

## Fixed Targets

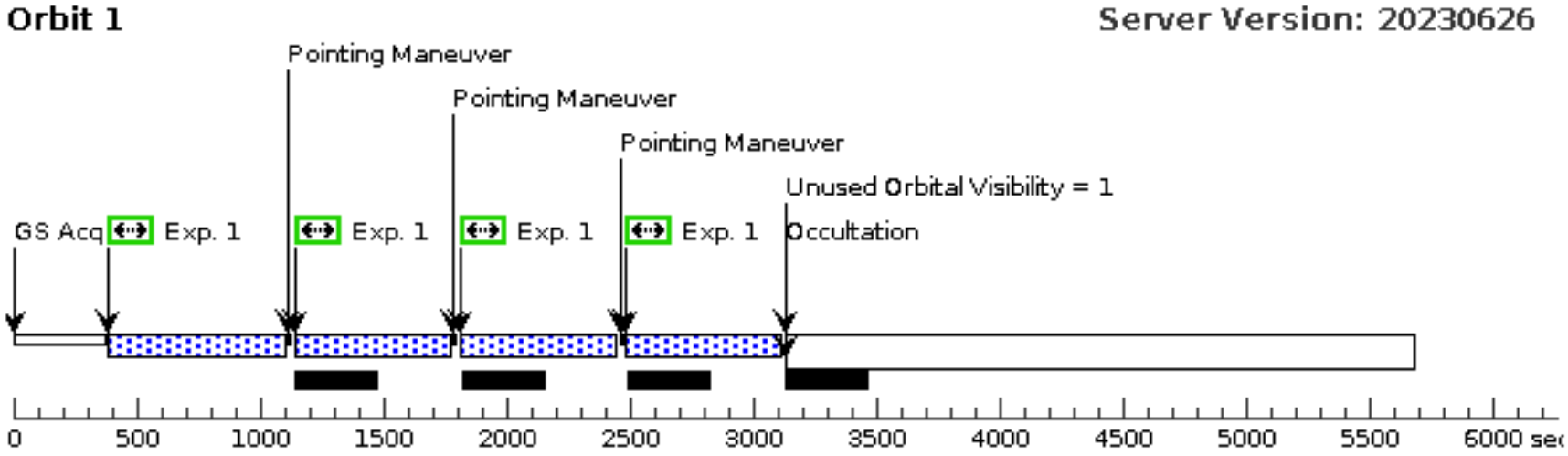
| # | Name | Target Coordinates | Targ. Coord. Corrections | Fluxes | Miscellaneous |
|---|---|---|---|---|---|
| (2) | ACT-CL-J0034.4+0225-F1 | RA: 00 34 17.1556 (8.5714817d)<br>Dec: +02 25 26.51 (2.42403d)<br>Equinox: J2000 | | V=20 | Reference Frame: ICRS |

*Comments: This position was entered by hand for the western field of the mosaic.*
*Category=CLUSTER OF GALAXIES*
*Description=[GRAVITATIONAL LENS, RICH CLUSTER]*
*Extended=YES*

## Exposures

| # | Label | Target | Config,Mode,Aperture | Spectral Els. | Opt. Params. | Special Reqs. | Groups | Exp. Time (Total)/[Actual Dur.] | Orbit |
|---|---|---|---|---|---|---|---|---|---|
| 1 | | (2) ACT-CL-J0034.4+0225-F1 | ACS/WFC, ACCUM, WFCENTER | F606W | | | Pattern 3, Exps 1-1 in F606W F1 (02) (3) | 510 Secs (2040 Secs)<br>*[==>(Pattern 1)]*<br>*[==>(Pattern 2)]*<br>*[==>(Pattern 3)]*<br>*[==>(Pattern 4)]* | ***[1]*** |

## Orbit Structure



## Visit

**Proposal 17579, F606W F2 (03), implementation** Thu Nov 09 14:00:18 GMT 2023

**Diagnostic Status: No Diagnostics**

Scientific Instruments: ACS/WFC

Special Requirements: SAME ORIENT AS 02

## Patterns

| # | Primary Pattern | | Secondary Pattern | Exposures |
|---|---|---|---|---|
| (3) | Pattern Type=ACS-WFC-DITHER-BOX<br>Purpose=DITHER<br>Number Of Points=4<br>Point Spacing=5.943<br>Line Spacing=3.077 | Coordinate Frame=POS-TARG<br>Pattern Orientation=91.429<br>Angle Between Sides=166.993<br>Center Pattern=false | | (1) |

## Fixed Targets

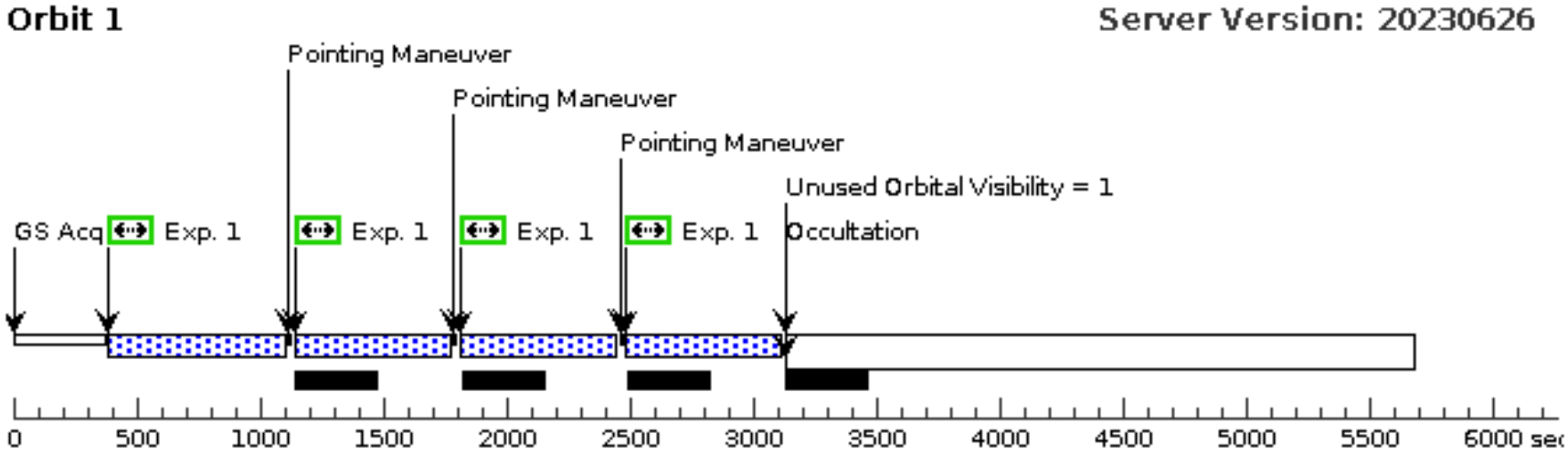
| # | Name | Target Coordinates | Targ. Coord. Corrections | Fluxes | Miscellaneous |
|---|---|---|---|---|---|
| (3) | ACT-CL-J0034.4+0225-F2 | RA: 00 34 25.3544 (8.6056433d)<br>Dec: +02 23 4.04 (2.38446d)<br>Equinox: J2000 | | V=20 | Reference Frame: ICRS |

*Comments: This position was entered by hand for the southern field of the mosaic.*
*Category=CLUSTER OF GALAXIES*
*Description=[GRAVITATIONAL LENS, RICH CLUSTER]*
*Extended=YES*

## Exposures

| # | Label | Target | Config,Mode,Aperture | Spectral Els. | Opt. Params. | Special Reqs. | Groups | Exp. Time (Total)/[Actual Dur.] | Orbit |
|---|---|---|---|---|---|---|---|---|---|
| 1 | | (3) ACT-CL-J0034.4+0225-F2 | ACS/WFC, ACCUM, WFCENTER | F606W | | | Pattern 3, Exps 1-1 in F606W F2 (03) (3) | 510 Secs (2040 Secs)<br>*[==>(Pattern 1)]*<br>*[==>(Pattern 2)]*<br>*[==>(Pattern 3)]*<br>*[==>(Pattern 4)]* | ***[1]*** |

## Orbit Structure



## Visit

**Proposal 17579, F606W F3 (04), implementation** Thu Nov 09 14:00:18 GMT 2023

**Diagnostic Status: No Diagnostics**

Scientific Instruments: ACS/WFC

Special Requirements: SAME ORIENT AS 02

## Patterns

| # | Primary Pattern | | Secondary Pattern | Exposures |
|---|---|---|---|---|
| (3) | Pattern Type=ACS-WFC-DITHER-BOX<br>Purpose=DITHER<br>Number Of Points=4<br>Point Spacing=5.943<br>Line Spacing=3.077 | Coordinate Frame=POS-TARG<br>Pattern Orientation=91.429<br>Angle Between Sides=166.993<br>Center Pattern=false | | (1) |

## Fixed Targets

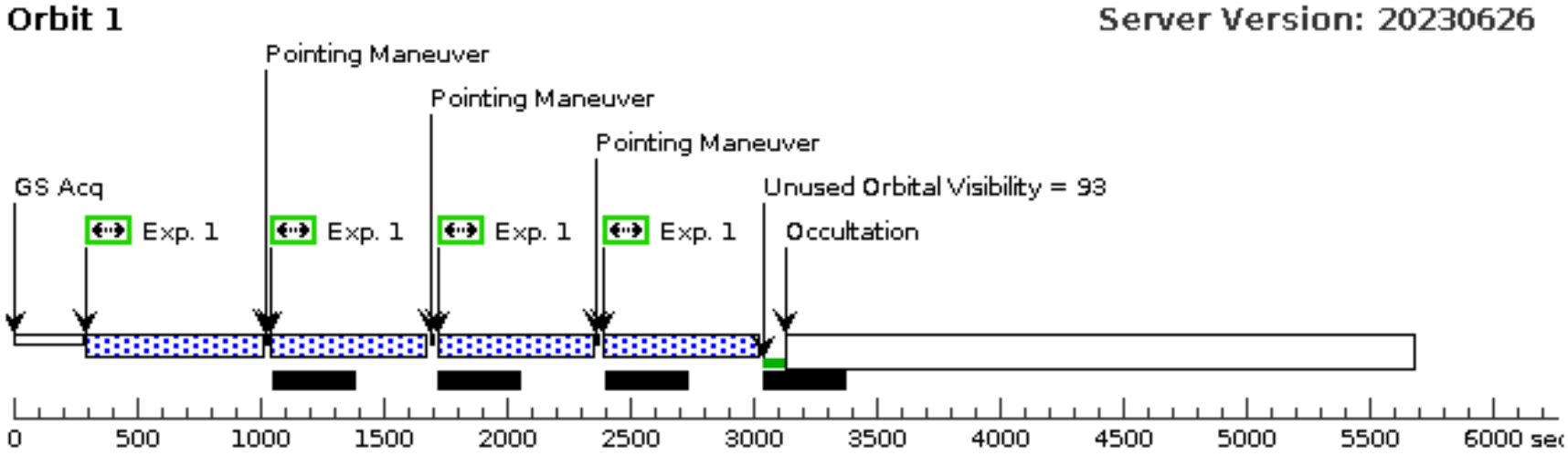
| # | Name | Target Coordinates | Targ. Coord. Corrections | Fluxes | Miscellaneous |
|---|---|---|---|---|---|
| (4) | ACT-CL-J0034.4+0225-F3 | RA: 00 34 34.5693 (8.6440387d)<br>Dec: +02 25 22.95 (2.42304d)<br>Equinox: J2000 | | V=20 | Reference Frame: ICRS |

*Comments: This position was entered by hand for the eastern field of the mosaic.*
*Category=CLUSTER OF GALAXIES*
*Description=[GRAVITATIONAL LENS, RICH CLUSTER]*
*Extended=YES*

## Exposures

| # | Label | Target | Config,Mode,Aperture | Spectral Els. | Opt. Params. | Special Reqs. | Groups | Exp. Time (Total)/[Actual Dur.] | Orbit |
|---|---|---|---|---|---|---|---|---|---|
| 1 | | (4) ACT-CL-J0034.4+0225-F3 | ACS/WFC, ACCUM, WFCENTER | F606W | | GS ACQ SCENARIO ONEB1B3 | Pattern 3, Exps 1-1 in F606W F3 (04) (3) | 510 Secs (2040 Secs)<br>*[==>(Pattern 1)]*<br>*[==>(Pattern 2)]*<br>*[==>(Pattern 3)]*<br>*[==>(Pattern 4)]* | ***[1]*** |

## Orbit Structure



## Visit

**Proposal 17579, F606W F4 (05), implementation** Thu Nov 09 14:00:18 GMT 2023

**Diagnostic Status: No Diagnostics**

Scientific Instruments: ACS/WFC

Special Requirements: SAME ORIENT AS 02

## Patterns

| # | Primary Pattern | | Secondary Pattern | Exposures |
|---|---|---|---|---|
| (3) | Pattern Type=ACS-WFC-DITHER-BOX<br>Purpose=DITHER<br>Number Of Points=4<br>Point Spacing=5.943<br>Line Spacing=3.077 | Coordinate Frame=POS-TARG<br>Pattern Orientation=91.429<br>Angle Between Sides=166.993<br>Center Pattern=false | | (1) |

## Fixed Targets

| # | Name | Target Coordinates | Targ. Coord. Corrections | Fluxes | Miscellaneous |
|---|---|---|---|---|---|
| (5) | ACT-CL-J0034.4+0225-F4 | RA: 00 34 26.5056 (8.6104400d)<br>Dec: +02 27 46.40 (2.46289d)<br>Equinox: J2000 | | V=20 | Reference Frame: ICRS |

*Comments: This position was entered by hand for the northern field of the mosaic.*
*Category=CLUSTER OF GALAXIES*
*Description=[GRAVITATIONAL LENS, RICH CLUSTER]*
*Extended=YES*

## Exposures

| # | Label | Target | Config,Mode,Aperture | Spectral Els. | Opt. Params. | Special Reqs. | Groups | Exp. Time (Total)/[Actual Dur.] | Orbit |
|---|---|---|---|---|---|---|---|---|---|
| 1 | | (5) ACT-CL-J0034.4+0225-F4 | ACS/WFC, ACCUM, WFCENTER | F606W | | | Pattern 3, Exps 1-1 in F606W F4 (05) (3) | 510 Secs (2040 Secs)<br>*[==>(Pattern 1)]*<br>*[==>(Pattern 2)]*<br>*[==>(Pattern 3)]*<br>*[==>(Pattern 4)]* | ***[1]*** |

## Orbit Structure