# 17695 - Multiwavelength Campaign of the Extraordinary Novalike Cataclysmic Variable BZ Camelopardalis

Cycle: 31, Proposal Category: GO/DD

(Availability Mode: SUPPORTED)

**INVESTIGATORS**

| *Name* | *Institution* |
|---|---|
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| Dr. Eric M. Schlegel (CoI) | University of Texas at San Antonio |
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| Dr. Jeremy J. Drake (CoI) | Lockheed Martin Space |

**VISITS**

| *Visit* | *Targets used in Visit* | *Configurations used in Visit* | *Orbits Used* | *Last Orbit Planner Run* | *OP Current with Visit?* |
|---|---|---|---|---|---|
| 01 | (1) EGB-4 | COS/FUV | 2 | 20-Feb-2025 17:00:12.0 | yes |
| 51 | (1) EGB-4 | COS/FUV | 1 | 20-Feb-2025 17:00:13.0 | yes |
| 52 | (1) EGB-4 | COS/FUV | 1 | 20-Feb-2025 17:00:14.0 | yes |
| 53 | (1) EGB-4 | COS/FUV | 1 | 20-Feb-2025 17:00:14.0 | yes |

5 Total Orbits Used

**ABSTRACT**

Novalikes (NLs) are interacting binaries where a white dwarf accretes at a high rate by means of an accretion disk. They exhibit outflows and constitute important laboratories to study the effects of high accretion rate on accretion physics. NLs show hot optically thin plasma emission in the

X-rays that can be characterized with advective hot flows (ADAF-like) and particularly BZ Cam is a typical example. The standard disk is found inadequate to model NLs in the UV. Optically thin radiatively inefficient (advective) hot flows in nonmagnetic NLs and advective heating of WDs are important to understand as they influence accretion, evolution, and thermonuclear runaways that lead to nova explosions. We have approved Chandra HETG time for BZ Cam to determine the ionization conditions in the X-ray emitting plasma via emission line diagnosis for studying the radiatively inefficient hot accretion flows (ADAF-like) in this source with extrapolation to other NLs. It will also detect warm absorber effects for the first time in the X-rays via absorption line analysis. Thus, we started a multiwavelength campaign on BZ Cam for a comparative study and a global understanding of accretion physics in NLs. In this regard, we want to observe BZ Cam using the COS instrument contemporaneously with or very close to the Chandra Observations which is right before cycle 32 starts. We plan radio observations and further ground-based optical spectroscopic observations (DDT) using TFOSC at 1.5m RTT150 (Turkish National Observatory) and fast multi-color photometry with OPTICAM (GTO) at 2.1m telescope in SPM National Observatory (Mexico). In the last week, TESS observations have also been approved for the multiwavelength campaign of BZ Cam.

**OBSERVING DESCRIPTION**

SAFETY OF THE COS INSTRUMENT.

In the phase I of this DD proposal we requested COS G130M 1055 and COS G140L 1105 spectra of the nova-like BZ Cam. These are two of theCOS/FUV Science default modes of the COS intrument following the COS2025 policy. Therefore, our proposed observations do adhere to the restritions set forth by the COS2025 policy to prolong the lifetime of the COS/FUV detector.

The magnitude of BZ Cam is usually between 12 and 13.5, and can sometimes be found at 11.5 and as low as 14.5. It doesn't undergo outburst. As a VY Scl type of nova-like it is found mostly in a high state between v=12 and 13.5 and occasionally drop to 14.5 into a low state.

The IUE archival spectra show that the continuum flux level in the FUV near 1400A reaches a maximum of 3.e-13 erg/s/cm**2/A and a minimum of about 0.7e-13 erg/s/cm**2/A, while most of the time it is found at amplitude of about 1.e-13 erg/s/cm**2/A. It has some GHRS spectra which were obtained for the study of the absorption and emission lines and from these spectra we find that It exhibits some emission lines reaching a maximum of 6.e-13 erg/s/cm**2/A.

There is some orbital variability which is important for the science but, it too doesn't cause any concern for the instrument. It has a FUSE spectrum

going down the Lyman limit (900 A) which show a continuum flux level of 1.e-13 erg/s/cm**2/A with ISM absorption.

We have used the lowest continuum flux level of 7e-14 erg/s/cm**2/A for runs of the ETC assuming a flat continuum.
For the COS G130M (1055) configuration a S/N of 10 at 1100A is obtained for 1755 sec of exposure time (COS.sp.1923942). Since the FUV source is moderately weak, we do not need to worry about the buffer time.

For the COS G140L (1105A) configuration a S/N of 20 near 1800 A is obtained for an exposure time of 1308 s (COS.sp.1923946). To this time we add the guide star time, the target acquisition time, and the instrument overhead, namely 1620 s. WIth an estimated visibility time of about 55 min or 3,300s, this justified our original request for a total of 2 orbits, one for each COS configuration, in our phase I.

In order to check whether the higher flux of 3.e-13 erg/s/cm**2/A might be problem for the COS instrument/detector, we ran an ETC for the COS G130M (1055) configuration assuming a flat flux of 3.e-13 erg/s/cm**2/A . The 2 emission lines: one
with 6.e-13 erg/s/cm**2/A at 1550A (FWHM=10 A, Carbon iv line) and the other with 5.e-13 erg/s/cm**2/A at 12616 A (FWHM=6A, Hydrogen Lyman alpha line) are outside the detector range and are not included.
We obtained for a 2000s exposure time a SNR=22 (1100A) with no warning. COS.sp.1927866

We perform a similar ETC run for the COS G140L (1105) configuration WITH the includsion of the 2 emission lines mentioned above, and obtained a HARD WARNING that the count rate on Segment A is larger than 40 percent of the 15,000 counts/s limit.

Therefore we checked which continuum flux level is too much for the instrument.
For the flat continuum with 2.5e-13 erg/s/cm**2/A we do get a hard warning as the CR is 6092 which is larger than the 6000 allowed (40 percent of the 15,000). COS.sp.1927520
For a flat continuum with 2.4e-13 erg/s/cm**2/A no hard warning as the CR drops below 6000 at 5858 (buffer 402 s).
COS.sp.1927619
So it seems that the threshold is from 2.4 to 2.5 e-13 erg/s/cm**2/A.

The limit of 15,000 CR is reached for a continuum flux level of 6.28e-13 erg/s/cm**2/A (COS.sp.1927733).

The minimum observed UV flux from IUE is about 0.5 e-13 and the maximum is at 3.e-13.

The visual magnitude has been observed to be between 11.5 and 14.5 with an average of 13 +/- 1.5 .
A change of a factor 6 from 0.5e-13 (minimum) to 3.0e-13 (maximum) in the UV
would correspond to a change in magnitude of ~2 (since a change of 1 corresponds to a factor 2.5).
So, being on safe side,we write the following relation between visual magnitude and continuum flux level:
V ==> UV Flux (in units of 1.e-13 erg/s/cm**2/A)
12.00 ==> 3.00
12.25 ==> 2.44
12.30 ==> LIMIT !!
12.5 ==> 1.94
13.00 ==> 1.225
14.00 ==> 0.50

The limit of 15,000 CR is reached for a continuum flux level of 6.28e-13 erg/s/cm**2/A (COS.sp.1927733)
which correspond to a magnitude of V=11.16 (which has not been observed so far).
Such that if the visual magnitude is 12.40 or larger, it is safe to observe, if it is 12.30 or smaller it is not safe.
In the last few years the visual magnitude was above 12.5, averaged at 13.0 +/- 0.2 (where the +/- 0.2 is due to
orbital modulation). We can monitor the target through the AAVSO (American Association of Variable Stars Observers),
which is something that is done regularly (and continuously) and make sure the target is observed only if it is safe to do so.

In the ETC form we now input the most likely (flat) continuum flux level of 1.5e-13 erg/s/cm**2/A for the
G140L configuration (COS.sp.1928288) for a 2000 sec exposure time (4x500) including the above mentioned emission lines.
This gives a buffer time of 630 sec, taking 2/3 of it we use 400 sec as the actual buffer time.
For the G130M configuration, using the same flux, the ETC gives a buffer fill time of 2400 sec (2300sec for Seg A, 2500 sec for Seg B),
2/3 of this is 1600 sec (COS.sp.1928290; note that the above mentioned emission lines are not in the band pass
and do not affect the run).

TIMING/SCHEDULING OF THE OBSERVATIONS.
Since our target is part of a multi-wavelength campaign, with X-ray Chandra observation the last week of September 2024, we request the HST observations to be concurrent to the Chandra observation. Namely we request the HST observations to be carried out between 23 Sep 2024 and 30

Sep 2024 (included). This is the last week of Cycle 31. If this time is impossible, one week before and one week after the last week of September 2024 can be used. We request one visit where the two COS observations/exposures are taken directly one after the other.

## Visit

**Proposal 17695, COS (01), failed** Thu Feb 20 22:00:15 GMT 2025

**Diagnostic Status: No Diagnostics**

Scientific Instruments: COS/FUV

Special Requirements: BETWEEN 22-SEP-2024:00:00:00 AND 30-SEP-2024:23:00:00

## Fixed Targets

| # | Name | Target Coordinates | Targ. Coord. Corrections | Fluxes | Miscellaneous |
|---|---|---|---|---|---|
| (1) | EGB-4<br>Alt Name1: BZ-CAM | RA: 06 29 33.9600 (97.3915000d)<br>Dec: +71 04 36.39 (71.07677d)<br>Equinox: J2000 | Proper Motion RA: -2.291 mas/yr<br>Proper Motion Dec: -28.805000010834192 mas/yr<br>Parallax: 0.0026720000000000003"<br>Epoch of Position: 2000 | V=13.0+/-1.5<br>continuum: minimum 7.e-14 erg/s/cm**2/A,<br>maximum 3.e-13 erg/s/cm**2/A ; emission line 6.e-13 erg/s/cm**2/A | Reference Frame: ICRS |

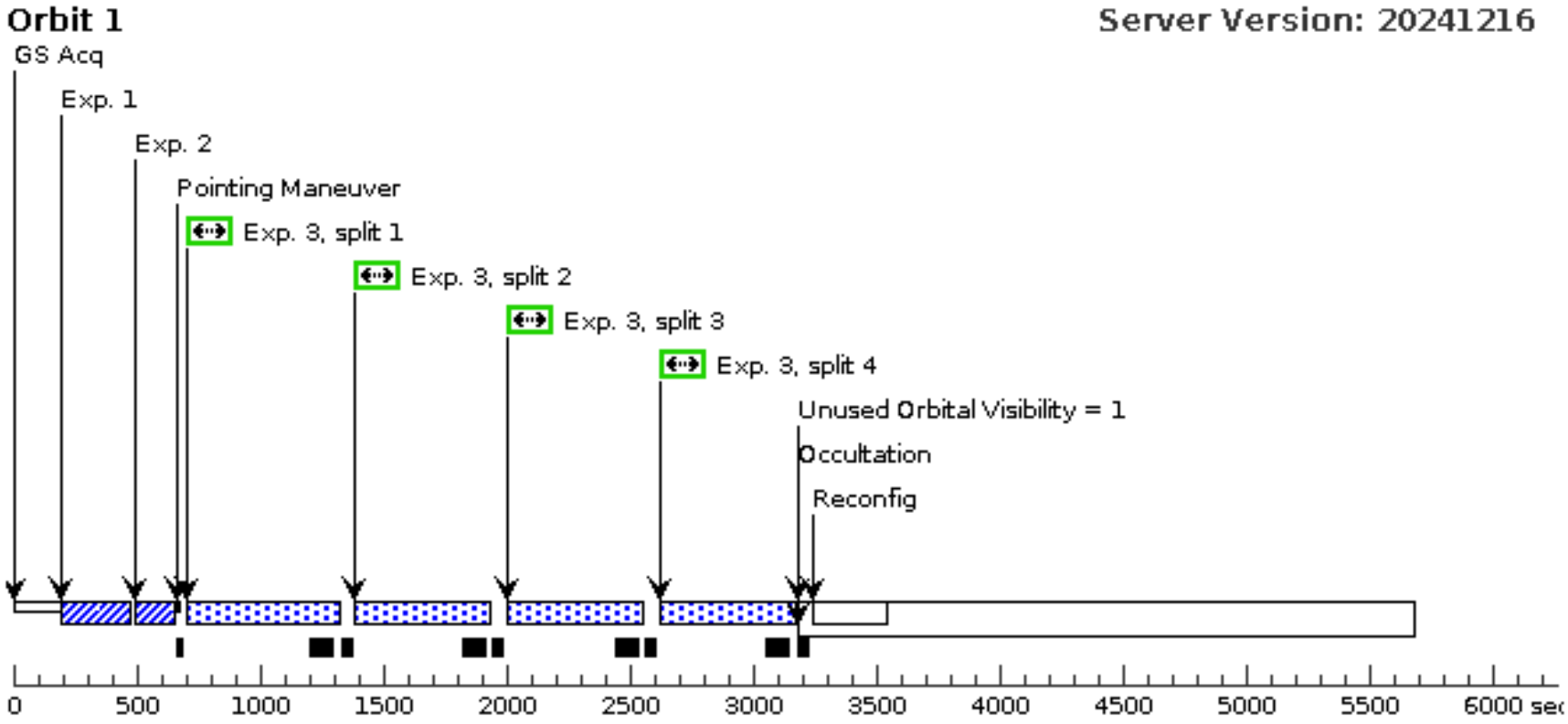
*Comments: This object was generated by the targetselector and retrieved from the SIMBAD database.*

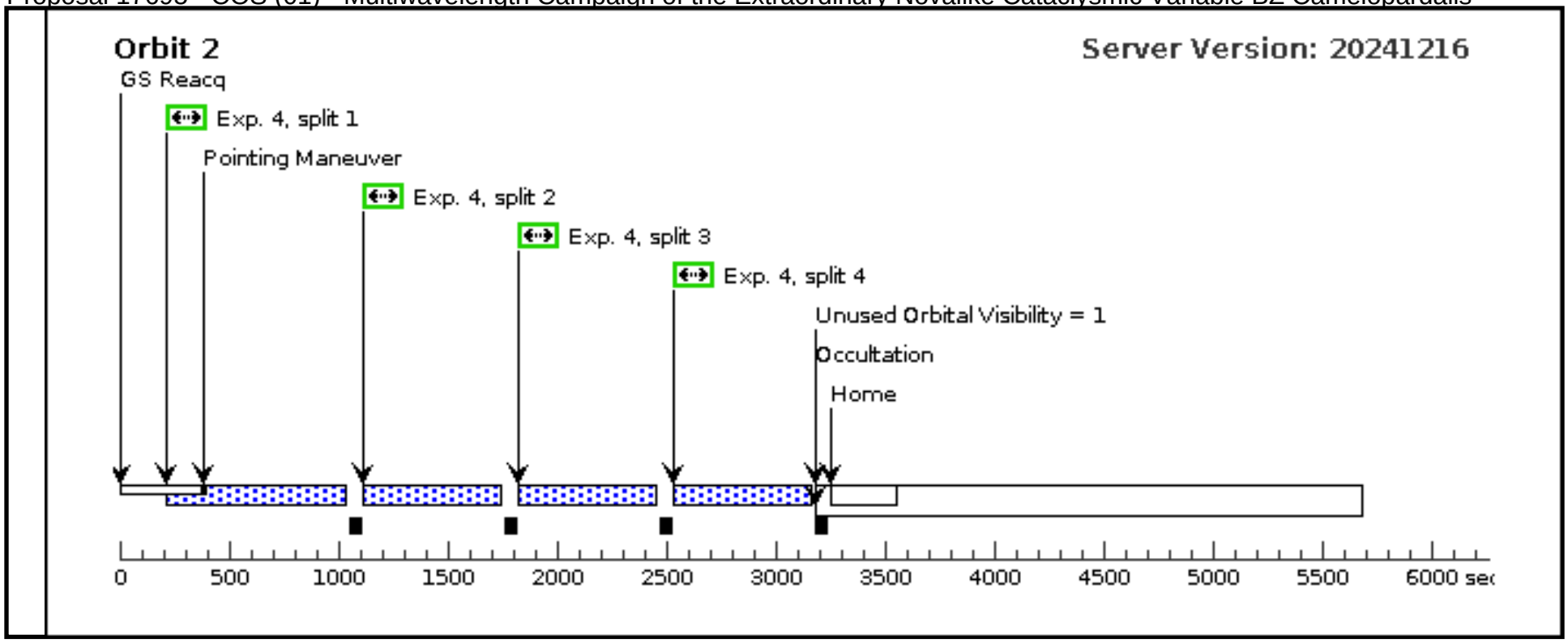
*SIMBAD listed proper motion for this target. When retrieving targets with PM from SIMBAD, APT requests the coordinates be calculated with an epoch of the year 2000. Do not modify this epoch. Always review coordinates using the Target Confirmation tool, which graphically displays the PM.This object was generated by the targetselector and retrieved from the SIMBAD database.*
*Category=STAR*
*Description=[NOVA-LIKE]*
*Extended=NO*

## Exposures

| # | Label (ETC Run) | Target | Config,Mode,Aperture | Spectral Els. | Opt. Params. | Special Reqs. | Groups | Exp. Time (Total)/[Actual Dur.] | Orbit |
|---|---|---|---|---|---|---|---|---|---|
| 1 | COS Target Acquisition (COS.sa.1927130) | (1) EGB-4 | COS/FUV, ACQ/PEAKXD, PSA | G140L 1105 A | | | | 2 Secs (2 Secs)<br>*[==>]* | *[1]* |
| 2 | PEAKD (COS.sa.1927130) | (1) EGB-4 | COS/FUV, ACQ/PEAKD, PSA | G140L 1105 A | NUM-POS=5; STEP-SIZE=0.9; CENTER=FLUX-WT-FLR | | | 2 Secs (2 Secs)<br>*[==>]* | *[1]* |
| 3 | COS G140L 1105 (COS.sp.1928288) | (1) EGB-4 | COS/FUV, TIME-TAG, PSA | G140L 1105 A | FP-POS=ALL; BUFFER-TIME=400 | | | 500 Secs (1972 Secs)<br>*[==>493.0 Secs (Split 1)]*<br>*[==>493.0 Secs (Split 2)]*<br>*[==>493.0 Secs (Split 3)]*<br>*[==>493.0 Secs (Split 4)]* | *[1]* |
| 4 | COS G130M 1055 (1928290) | (1) EGB-4 | COS/FUV, TIME-TAG, PSA | G130M 1055 A | BUFFER-TIME=1600; FP-POS=ALL | | | 100 Secs (2308 Secs)<br>*[==>577.0 Secs (Split 1)]*<br>*[==>577.0 Secs (Split 2)]*<br>*[==>577.0 Secs (Split 3)]*<br>*[==>577.0 Secs (Split 4)]* | *[2]* |

Orbit Structure




Orbit 2
Server Version: 20241216
GS Reacq
Exp. 4, split 1
Pointing Maneuver
Exp. 4, split 2
Exp. 4, split 3
Exp. 4, split 4
Unused Orbital Visibility = 1
Occultation
Home
0
500
1000
1500
2000
2500
3000
3500
4000
4500
5000
5500
6000 sec

## Visit

**Proposal 17695, COS (51), failed**

Thu Feb 20 22:00:15 GMT 2025

**Diagnostic Status: No Diagnostics**

Scientific Instruments: COS/FUV

Special Requirements: (none)

## Fixed Targets

| # | Name | Target Coordinates | Targ. Coord. Corrections | Fluxes | Miscellaneous |
|---|---|---|---|---|---|
| (1) | EGB-4<br>Alt Name1: BZ-CAM | RA: 06 29 33.9600 (97.3915000d)<br>Dec: +71 04 36.39 (71.07677d)<br>Equinox: J2000 | Proper Motion RA: -2.291 mas/yr<br>Proper Motion Dec: -28.805000010834192 mas/yr<br>Parallax: 0.0026720000000000003"<br>Epoch of Position: 2000 | V=13.0+/-1.5<br>continuum: minimum 7.e-14 erg/s/cm**2/A,<br>maximum 3.e-13 erg/s/cm**2/A; emission line 6.e-13 erg/s/cm**2/A | Reference Frame: ICRS |

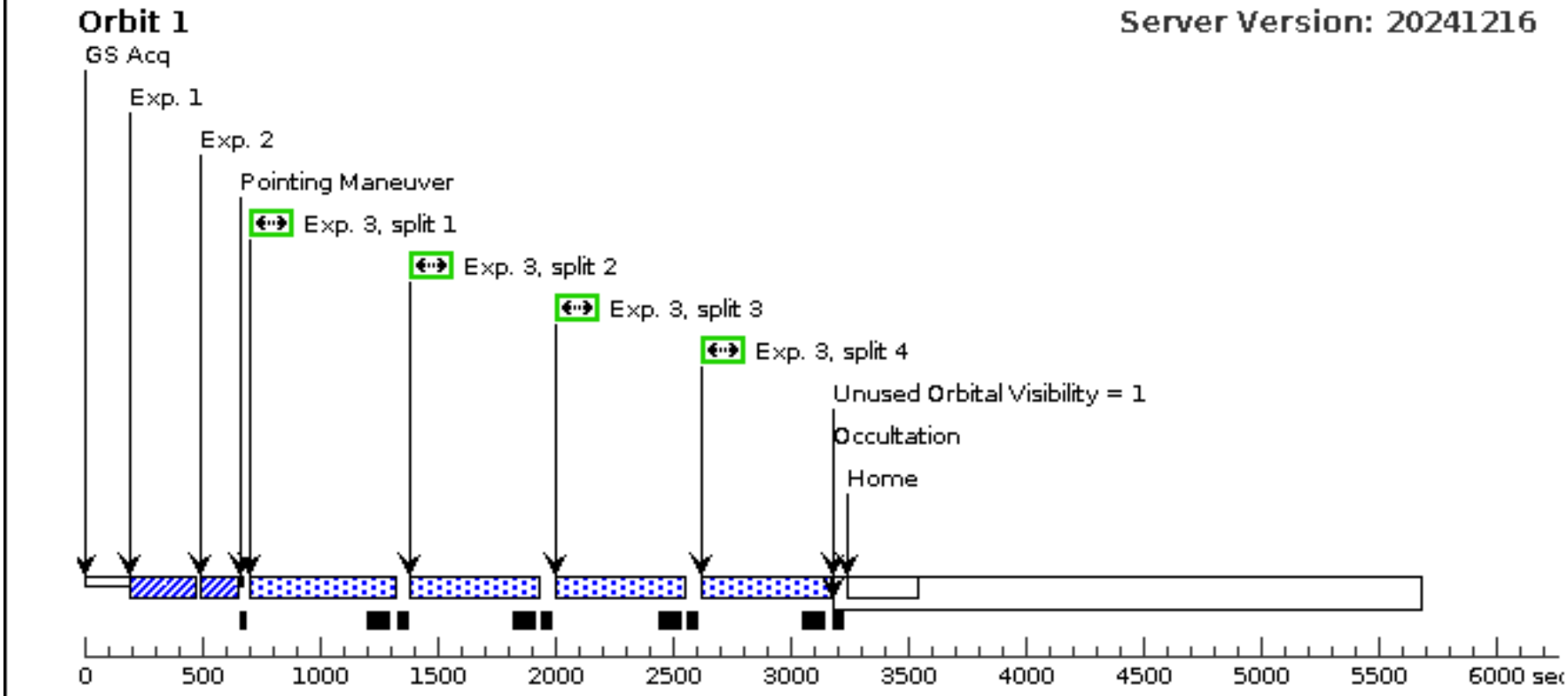
*Comments: This object was generated by the targetselector and retrieved from the SIMBAD database.*

*SIMBAD listed proper motion for this target. When retrieving targets with PM from SIMBAD, APT requests the coordinates be calculated with an epoch of the year 2000. Do not modify this epoch. Always review coordinates using the Target Confirmation tool, which graphically displays the PM.This object was generated by the targetselector and retrieved from the SIMBAD database.*
*Category=STAR*
*Description=[NOVA-LIKE]*
*Extended=NO*

## Exposures

| # | Label (ETC Run) | Target | Config,Mode,Aperture | Spectral Els. | Opt. Params. | Special Reqs. | Groups | Exp. Time (Total)/[Actual Dur.] | Orbit |
|---|---|---|---|---|---|---|---|---|---|
| 1 | COS Target Acquisition (COS.sa.1927130) | (1) EGB-4 | COS/FUV, ACQ/PEAKXD, PSA | G140L<br>1105 A | | | | 2 Secs (2 Secs)<br>*[==>]* | ***[1]*** |
| 2 | PEAKD (COS.sa.1927130) | (1) EGB-4 | COS/FUV, ACQ/PEAKD, PSA | G140L<br>1105 A | NUM-POS=5;<br>STEP-SIZE=0.9;<br>CENTER=FLUX-WT-FLR | | | 2 Secs (2 Secs)<br>*[==>]* | ***[1]*** |
| 3 | COS G140L 1105 (COS.sp.1928288) | (1) EGB-4 | COS/FUV, TIME-TAG, PSA | G140L<br>1105 A | FP-POS=ALL;<br>BUFFER-TIME=400 | | | 500 Secs (1972 Secs)<br>*[==>493.0 Secs (Split 1)]*<br>*[==>493.0 Secs (Split 2)]*<br>*[==>493.0 Secs (Split 3)]*<br>*[==>493.0 Secs (Split 4)]* | ***[1]*** |

Orbit Structure



## Visit

**Proposal 17695, COS (52), failed** Thu Feb 20 22:00:15 GMT 2025

**Diagnostic Status: No Diagnostics**

Scientific Instruments: COS/FUV

Special Requirements: (none)

## Fixed Targets

| # | Name | Target Coordinates | Targ. Coord. Corrections | Fluxes | Miscellaneous |
|---|---|---|---|---|---|
| (1) | EGB-4<br>Alt Name1: BZ-CAM | RA: 06 29 33.9600 (97.3915000d)<br>Dec: +71 04 36.39 (71.07677d)<br>Equinox: J2000 | Proper Motion RA: -2.291 mas/yr<br>Proper Motion Dec: -28.805000010834192 mas/yr<br>Parallax: 0.0026720000000000003"<br>Epoch of Position: 2000 | V=13.0+/-1.5<br>continuum: minimum 7.e-14 erg/s/cm**2/A,<br>maximum 3.e-13 erg/s/cm**2/A; emission line 6.e-13 erg/s/cm**2/A | Reference Frame: ICRS |

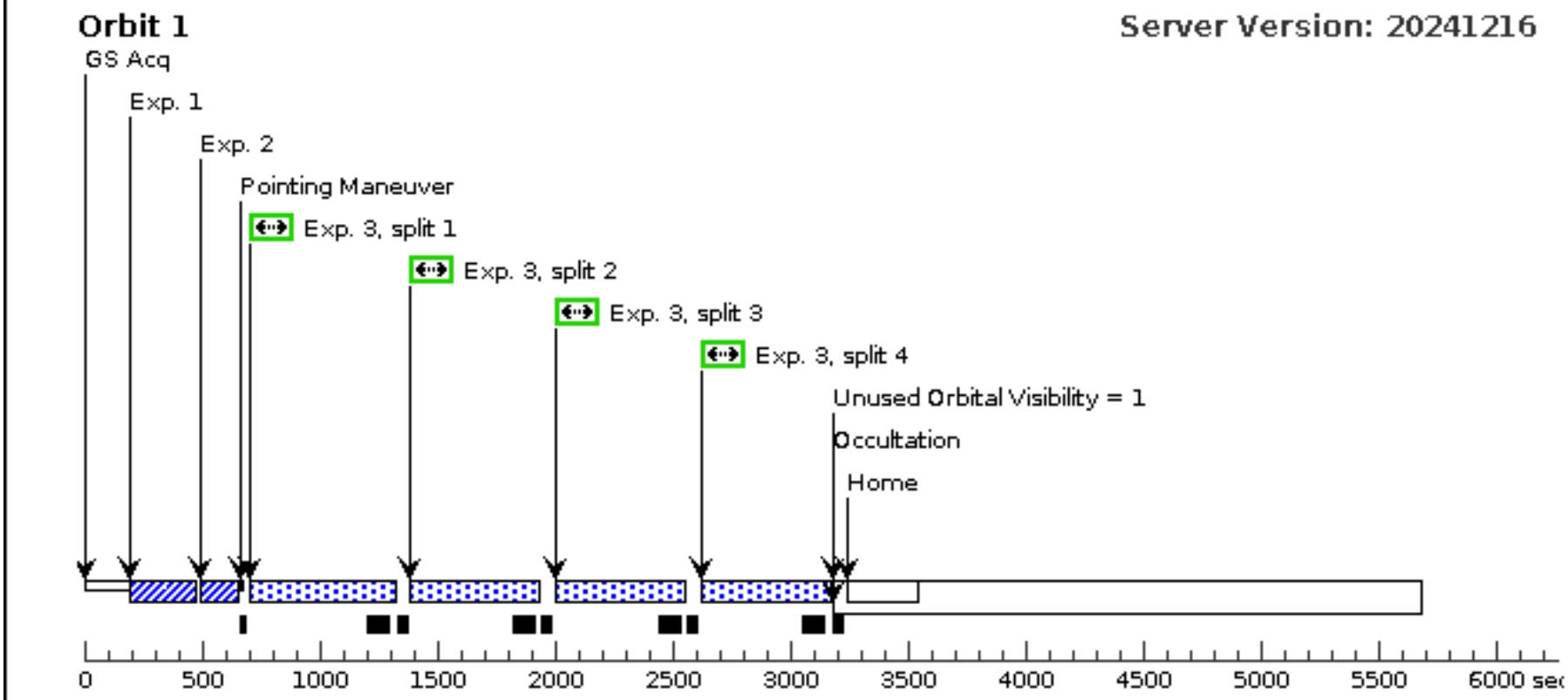
*Comments: This object was generated by the targetselector and retrieved from the SIMBAD database.*

*SIMBAD listed proper motion for this target. When retrieving targets with PM from SIMBAD, APT requests the coordinates be calculated with an epoch of the year 2000. Do not modify this epoch. Always review coordinates using the Target Confirmation tool, which graphically displays the PM.This object was generated by the targetselector and retrieved from the SIMBAD database.*
*Category=STAR*
*Description=[NOVA-LIKE]*
*Extended=NO*

## Exposures

| # | Label (ETC Run) | Target | Config,Mode,Aperture | Spectral Els. | Opt. Params. | Special Reqs. | Groups | Exp. Time (Total)/[Actual Dur.] | Orbit |
|---|---|---|---|---|---|---|---|---|---|
| 1 | COS Target Acquisition (COS.sa.1927130) | (1) EGB-4 | COS/FUV, ACQ/PEAKXD, PSA | G140L<br>1105 A | | | | 2 Secs (2 Secs)<br>*[==>]* | ***[1]*** |
| 2 | PEAKD (COS.sa.1927130) | (1) EGB-4 | COS/FUV, ACQ/PEAKD, PSA | G140L<br>1105 A | NUM-POS=5;<br>STEP-SIZE=0.9;<br>CENTER=FLUX-WT-FLR | | | 2 Secs (2 Secs)<br>*[==>]* | ***[1]*** |
| 3 | COS G140L 1105 (COS.sp.1928288) | (1) EGB-4 | COS/FUV, TIME-TAG, PSA | G140L<br>1105 A | FP-POS=ALL;<br>BUFFER-TIME=400 | | | 500 Secs (1972 Secs)<br>*[==>493.0 Secs (Split 1)]*<br>*[==>493.0 Secs (Split 2)]*<br>*[==>493.0 Secs (Split 3)]*<br>*[==>493.0 Secs (Split 4)]* | ***[1]*** |

Orbit Structure



## Visit

**Proposal 17695, COS (53)** Thu Feb 20 22:00:15 GMT 2025

**Diagnostic Status: No Diagnostics**

Scientific Instruments: COS/FUV

Special Requirements: (none)

*Comments: Repeat of observations that have been repeatedly lost from visit 01*

## Fixed Targets

| # | Name | Target Coordinates | Targ. Coord. Corrections | Fluxes | Miscellaneous |
|---|---|---|---|---|---|
| (1) | EGB-4<br>Alt Name1: BZ-CAM | RA: 06 29 33.9600 (97.3915000d)<br>Dec: +71 04 36.39 (71.07677d)<br>Equinox: J2000 | Proper Motion RA: -2.291 mas/yr<br>Proper Motion Dec: -28.805000010834192 mas/yr<br>Parallax: 0.0026720000000000003"<br>Epoch of Position: 2000 | V=13.0+/-1.5<br>continuum: minimum 7.e-14 erg/s/cm**2/A,<br>maximum 3.e-13 erg/s/cm**2/A; emission line 6.e-13 erg/s/cm**2/A | Reference Frame: ICRS |

*Comments: This object was generated by the targetselector and retrieved from the SIMBAD database.*

*SIMBAD listed proper motion for this target. When retrieving targets with PM from SIMBAD, APT requests the coordinates be calculated with an epoch of the year 2000. Do not modify this epoch. Always review coordinates using the Target Confirmation tool, which graphically displays the PM.This object was generated by the targetselector and retrieved from the SIMBAD database.*
*Category=STAR*
*Description=[NOVA-LIKE]*
*Extended=NO*

## Exposures

| # | Label (ETC Run) | Target | Config,Mode,Aperture | Spectral Els. | Opt. Params. | Special Reqs. | Groups | Exp. Time (Total)/[Actual Dur.] | Orbit |
|---|---|---|---|---|---|---|---|---|---|
| 1 | COS Target Acquisition (COS.sa.1927130) | (1) EGB-4 | COS/FUV, ACQ/PEAKXD, PSA | G140L<br>1105 A | | | | 2 Secs (2 Secs)<br>*[==>]* | ***[1]*** |
| 2 | PEAKD (COS.sa.1927130) | (1) EGB-4 | COS/FUV, ACQ/PEAKD, PSA | G140L<br>1105 A | NUM-POS=5;<br>STEP-SIZE=0.9;<br>CENTER=FLUX-WT-FLR | | | 2 Secs (2 Secs)<br>*[==>]* | ***[1]*** |
| 3 | COS G140L 1105 (COS.sp.1928288) | (1) EGB-4 | COS/FUV, TIME-TAG, PSA | G140L<br>1105 A | FP-POS=ALL;<br>BUFFER-TIME=400 | | | 500 Secs (1972 Secs)<br>*[==>493.0 Secs (Split 1)]*<br>*[==>493.0 Secs (Split 2)]*<br>*[==>493.0 Secs (Split 3)]*<br>*[==>493.0 Secs (Split 4)]* | ***[1]*** |

Orbit Structure