# 17095 - The Missing Link in Massive Binary Star Evolution

Cycle: 30, Proposal Category: GO

(Availability Mode: SUPPORTED)

**INVESTIGATORS**



| *Name* | *Institution* | *E-Mail* |
|---|---|---|
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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) HD113120<br>WAVE | STIS/CCD<br>STIS/FUV-MAMA | 1 | 20-Sep-2022 14:00:14.0 | yes |
| 02 | (1) HD113120<br>WAVE | STIS/CCD<br>STIS/FUV-MAMA | 1 | 20-Sep-2022 14:00:15.0 | yes |
| 03 | (1) HD113120<br>WAVE | STIS/CCD<br>STIS/FUV-MAMA | 1 | 20-Sep-2022 14:00:16.0 | yes |
| 04 | (2) HD137387<br>WAVE | STIS/CCD<br>STIS/FUV-MAMA | 1 | 20-Sep-2022 14:00:17.0 | yes |
| 05 | (2) HD137387<br>WAVE | STIS/CCD<br>STIS/FUV-MAMA | 1 | 20-Sep-2022 14:00:17.0 | yes |
| 06 | (2) HD137387<br>WAVE | STIS/CCD<br>STIS/FUV-MAMA | 1 | 20-Sep-2022 14:00:18.0 | yes |

| *Visit* | *Targets used in Visit* | *Configurations used in Visit* | *Orbits Used* | *Last Orbit Planner Run* | *OP Current with Visit?* |
|---|---|---|---|---|---|
| 07 | (3) HD152478<br>WAVE | STIS/CCD<br>STIS/FUV-MAMA | 1 | 20-Sep-2022 14:00:19.0 | yes |
| 08 | (3) HD152478<br>WAVE | STIS/CCD<br>STIS/FUV-MAMA | 1 | 20-Sep-2022 14:00:19.0 | yes |
| 09 | (3) HD152478<br>WAVE | STIS/CCD<br>STIS/FUV-MAMA | 1 | 20-Sep-2022 14:00:20.0 | yes |
| 10 | (4) HD157042<br>WAVE | STIS/CCD<br>STIS/FUV-MAMA | 1 | 20-Sep-2022 14:00:21.0 | yes |
| 11 | (4) HD157042<br>WAVE | STIS/CCD<br>STIS/FUV-MAMA | 1 | 20-Sep-2022 14:00:22.0 | yes |
| 12 | (4) HD157042<br>WAVE | STIS/CCD<br>STIS/FUV-MAMA | 1 | 20-Sep-2022 14:00:22.0 | yes |
| 13 | (5) HD-157832<br>WAVE | STIS/CCD<br>STIS/FUV-MAMA | 1 | 20-Sep-2022 14:00:23.0 | yes |
| 14 | (5) HD-157832<br>WAVE | STIS/CCD<br>STIS/FUV-MAMA | 1 | 20-Sep-2022 14:00:24.0 | yes |
| 15 | (5) HD-157832<br>WAVE | STIS/CCD<br>STIS/FUV-MAMA | 1 | 20-Sep-2022 14:00:24.0 | yes |

15 Total Orbits Used

**ABSTRACT**

Binaries are common among massive stars, and close pairs interact over their lifetime to transform the binary systems through the exchange of mass and angular momentum. The gainer star is spun up to near critical rotational velocity and the donor star is stripped of its outer envelope to reveal a hot and faint helium star. The detection of these faint helium stars is feasible using ultraviolet spectroscopy. Determining the orbital and physical properties of the helium stars is important to trace the evolutionary state of post-mass transfer binaries. Massive helium stars are the probable progenitors of neutron stars and black holes in X-ray binaries. Recent HST observations led to the detection of ten sdO stars in Be binaries and to estimates of their radii and effective temperatures. Five of the southern sky targets were not known binaries before the HST program, and a three-year program of optical spectroscopy reveals that they have very long periods that are only partially sampled in the existing HST data. Here we

propose to revisit these five targets and obtain HST/STIS FUV spectroscopy to cover the full range of orbital Doppler shifts. This information will lead to the determination of the orbital and physical properties of the stars. The individual spectral components will be reconstructed using Doppler tomography to investigate the abundances and element diffusion processes in the helium stars.

**OBSERVING DESCRIPTION**

In order to determine the atmospheric and physical properties of the Be+sdO binary systems, here we request an allocation of 15 orbits for high dispersion UV spectroscopy of five southern Be binaries that host a hot, evolved He companion star. We will use HST/STIS with the E140M grating and the MAMA detector (FUV-MAMA). The observations will cover the FUV regime in the range of $1150-1710$ Angstroms with a resolving power of R=45,800.

For each visit, four consecutive exposures will be included. These include the exposures for the STIS target acquisition (ACQ), target peak-up (ACQ/PEAK), STIS science exposure (ACCUM), and also observer-specified wavelength calibration exposure (ACCUM-WAVE) for the selected STIS/FUV-MAMA configuration. We used the STIS exposure time calculator (ETC) to estimate the time needed for exposures in each proposed visit, and we compared these with prior successful observations of the same targets. Because all the targets are bright in the UV, we selected the F25ND5 aperture and utilized the Castelli-Kurucz Models accordingly to the spectral type of target stars to determine the exposure time for the point source to achieve an S/N ratio of 40 for target acquisition. Extinction values E(B-V) were collected from Wang et al. (2021), and V magnitudes obtained from the SIMBAD were used to normalize the target flux. Standard average normalization values for the zodiacal light, earth shine light, and air glow were assumed throughout the calculation. Because all the selected apertures for science observations have dimensions less than 1 arcsec, we request target peak-up for each visit by using the 0.3X0.05ND aperture.

All five targets have prior FUV observations obtained in Cycle 26 (HST Program GO-15659) by Wang et al. (2021). We thus utilized the existing STIS spectra to specify the spectral energy distribution of the target stars. All the targets have 54 to 60 minutes of visibility in each orbit. By subtracting 6 minutes for guide star acquisition, 6 minutes for STIS target acquisition, 8 minutes for target peak-up, and 3 minutes for STIS science overhead observations, there remains about 31 minutes (1860 seconds) of science exposure time in one orbit. Following the strategy of achieving an S/N > 40 per resolution element at 1425 Angstroms for successful detection of the sdO star in the system from the prior study in Cycle 26, we used the ETC to determine the expected S/N for each target for the integration time available in one orbit. A neutral density filter is needed to avoid the photon counts exceeding the bright limit of the MAMA detector.

One of the major goals of this study is to sample the observations of the five Be+sdO binary systems to complete the full coverage of their orbital motion. The existing FUV spectra from Wang et al. (2021) display a small range of the Doppler shifts and comprise only a partial fraction of the orbital motion. In order to schedule the observations at times corresponding to the missing orbital phases and Doppler shifts and also to avoid coinciding with prior IUE and STIS FUV observations, we adopted the derived orbital period and the epoch at zero phases from the three-year program of optical spectroscopy of Wang et al. (2022, private communication) to constrain the timing requirement for the three visits of each target. We set the PERIOD and ZERO-PHASE constraints under each visit and link the PHASE constraint to the first exposure of each visit. By allocating three additional FUV observations, we will be able to measure the RVs for each component and combine these with the existing measurements to complete the orbit coverage to determine the orbital parameters of the Be+sdO binaries.

Throughout Cycle 30, uncertainty in the gyro lifetime may result in the proposed observations being observed in reduced gyro mode (RGM). The reduced field of regard and the observing window will lower the range of dates that can be scheduled for our observations. Otherwise, the program is not adversely affected by RGM limitations.

Our science goals are to measure the radial velocities of the Be star and hot companion star from a cross-correlation analysis with non-LTE TLUSTY model spectra. By combining the new results with existing measurements from both FUV and ground-based optical spectroscopy, the orbital solutions and the mass ratio can be determined. Consequently, based upon the estimation of Be star mass from optical spectroscopy and the derived orbital mass products, we will arrive at the mass of the sdO star. The derived orbital solutions will be used to reconstruct the individual spectra of the binary components using Doppler tomography. We will determine the companion's atmospheric abundances and stellar wind properties through the model fitting to the reconstructed spectral components. Ultimately, these results will enable a direct comparison to evolutionary tracks to trace the formation processes of Be+sdO binary systems.

## Visit

**Proposal 17095, HD113120-v1 (01), implementation** Tue Sep 20 18:00:25 GMT 2022

**Diagnostic Status: No Diagnostics**

Scientific Instruments: STIS/CCD, STIS/FUV-MAMA

Special Requirements: Period 183.9993 D AND ZERO-PHASE HJD2458591.6043

## Fixed Targets

| # | Name | Target Coordinates | Targ. Coord. Corrections | Fluxes | Miscellaneous |
|---|---|---|---|---|---|
| (1) | HD113120<br>Alt Name1: LS-MUS<br>Alt Name2: HR-4930 | RA: 13 03 5.2972 (195.7720717d)<br>Dec: -71 28 32.70 (-71.47575d)<br>Equinox: J2000 | Proper Motion RA: -11.508187733548466 mas/yr<br>Proper Motion Dec: -3.508008275604783 mas/yr<br>Parallax: 0.002356573862283452"<br>Epoch of Position: 2016.0<br>Radial Velocity: -11.87 km/sec | V=6.03 | Reference Frame: ICRS |

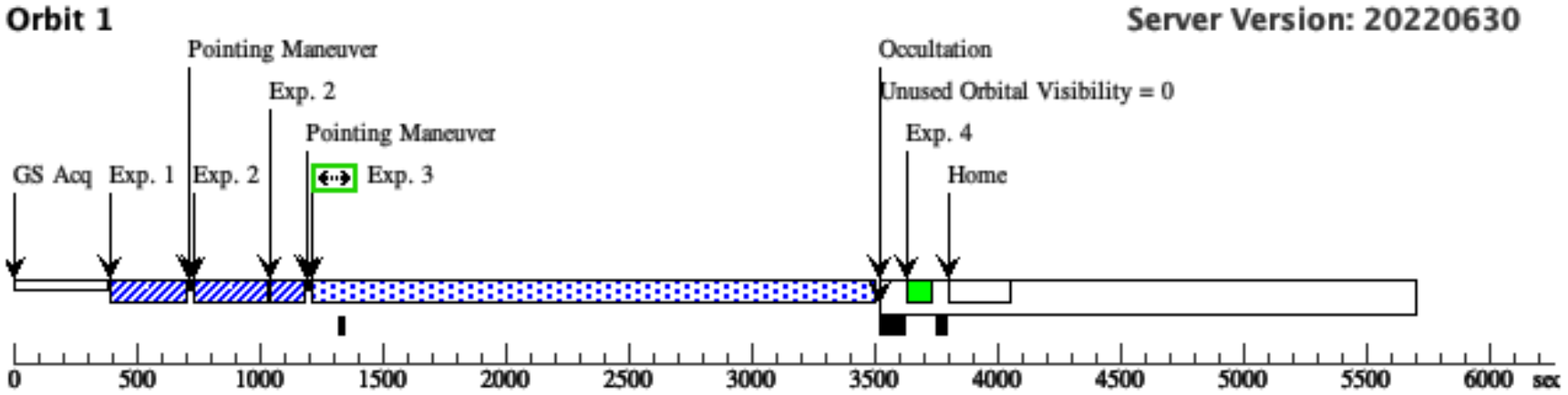
*Comments: This object was generated by the targetselector and retrieved from the SIMBAD and Gaia DR3 database.*
*Category=STAR*
*Description=[B0-B2 V-IV, BE, EMISSION LINE STAR, INTERACTING BINARY]*
*Extended=NO*

## Exposures

| # | Label (ETC Run) | Target | Config,Mode,Aperture | Spectral Els. | Opt. Params. | Special Reqs. | Groups | Exp. Time (Total)/[Actual Dur.] | Orbit |
|---|---|---|---|---|---|---|---|---|---|
| 1 | ACQ (STIS.ta.1809435) | (1) HD113120 | STIS/CCD, ACQ, F25ND5 | MIRROR | ACQTYPE=POINT | PHASE 0.06 TO 0.30 | | 4.7 Secs (4.7 Secs)<br>*[==>]* | <br>***[1]*** |
| 2 | ACQ/PEAK (STIS.ta.1809449) | (1) HD113120 | STIS/CCD, ACQ/PEAK, 0.3X0.05ND | MIRROR | | | | 0.2 Secs (0.2 Secs)<br>*[==>]* | <br>***[1]*** |
| 3 | ACCUM (STIS.sp.1811239) | (1) HD113120 | STIS/FUV-MAMA, ACCUM, 0.2X0.05ND | E140M 1425 A | WAVECAL=NO | | | 2195 Secs (2192 Secs)<br>*[==>2192.0 Secs ]* | <br>***[1]*** |
| 4 | WAVECAL | WAVE | STIS/FUV-MAMA, ACCUM, 0.2X0.06 | E140M 1425 A | | | | *[==>]* | ***[1]*** |

*Comments: In Earth shadow*

## Orbit Structure



## Visit

**Proposal 17095, HD113120-v2 (02), implementation** Tue Sep 20 18:00:25 GMT 2022

**Diagnostic Status: No Diagnostics**

Scientific Instruments: STIS/CCD, STIS/FUV-MAMA

Special Requirements: Period 183.9993 D AND ZERO-PHASE HJD2458591.6043

## Fixed Targets

| # | Name | Target Coordinates | Targ. Coord. Corrections | Fluxes | Miscellaneous |
|---|---|---|---|---|---|
| (1) | HD113120<br>Alt Name1: LS-MUS<br>Alt Name2: HR-4930 | RA: 13 03 5.2972 (195.7720717d)<br>Dec: -71 28 32.70 (-71.47575d)<br>Equinox: J2000 | Proper Motion RA: -11.508187733548466 mas/yr<br>Proper Motion Dec: -3.508008275604783 mas/yr<br>Parallax: 0.002356573862283452"<br>Epoch of Position: 2016.0<br>Radial Velocity: -11.87 km/sec | V=6.03 | Reference Frame: ICRS |

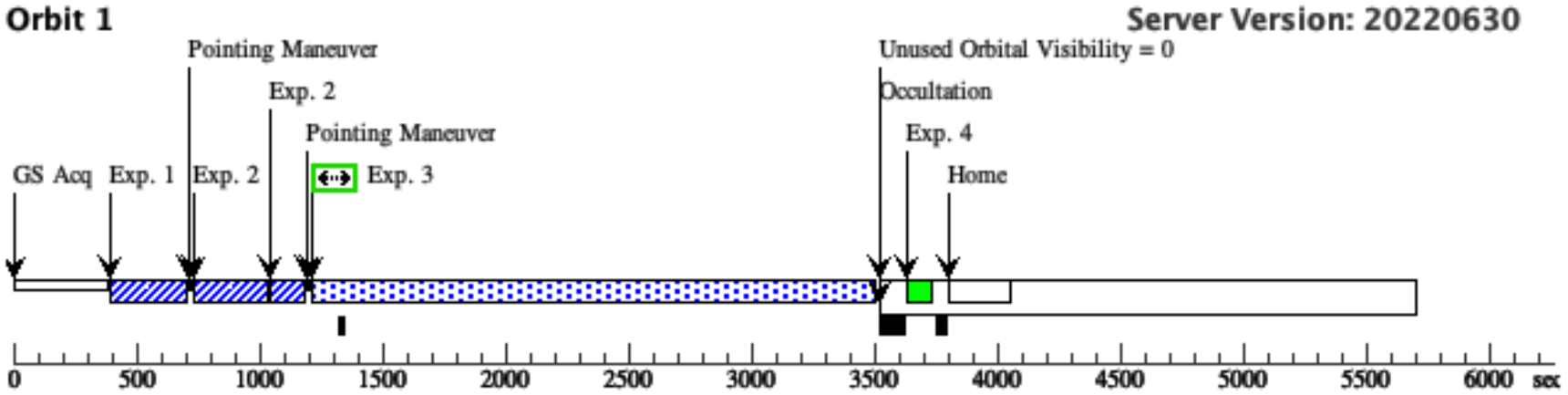
*Comments: This object was generated by the targetselector and retrieved from the SIMBAD and Gaia DR3 database.*
*Category=STAR*
*Description=[B0-B2 V-IV, BE, EMISSION LINE STAR, INTERACTING BINARY]*
*Extended=NO*

## Exposures

| # | Label (ETC Run) | Target | Config,Mode,Aperture | Spectral Els. | Opt. Params. | Special Reqs. | Groups | Exp. Time (Total)/[Actual Dur.] | Orbit |
|---|---|---|---|---|---|---|---|---|---|
| 1 | ACQ (STIS.ta.1809435) | (1) HD113120 | STIS/CCD, ACQ, F25ND5 | MIRROR | ACQTYPE=POINT | PHASE 0.33 TO 0.56 | | 4.7 Secs (4.7 Secs)<br>*[==>]* | *[1]* |
| 2 | ACQ/PEAK (STIS.ta.1809449) | (1) HD113120 | STIS/CCD, ACQ/PEAK, 0.3X0.05ND | MIRROR | | | | 0.2 Secs (0.2 Secs)<br>*[==>]* | *[1]* |
| 3 | ACCUM (STIS.sp.1811239) | (1) HD113120 | STIS/FUV-MAMA, ACCUM, 0.2X0.05ND | E140M 1425 A | WAVECAL=NO | | | 2192 Secs (2192 Secs)<br>*[==>]* | *[1]* |
| 4 | WAVECAL | WAVE | STIS/FUV-MAMA, ACCUM, 0.2X0.06 | E140M 1425 A | | | | *[==>]* | *[1]* |

*Comments: In Earth shadow*

## Orbit Structure



## Visit

**Proposal 17095, HD113120-v3 (03), implementation** Tue Sep 20 18:00:25 GMT 2022

**Diagnostic Status: No Diagnostics**

Scientific Instruments: STIS/CCD, STIS/FUV-MAMA

Special Requirements: Period 183.9993 D AND ZERO-PHASE HJD2458591.6043

## Fixed Targets

| # | Name | Target Coordinates | Targ. Coord. Corrections | Fluxes | Miscellaneous |
|---|---|---|---|---|---|
| (1) | HD113120<br>Alt Name1: LS-MUS<br>Alt Name2: HR-4930 | RA: 13 03 5.2972 (195.7720717d)<br>Dec: -71 28 32.70 (-71.47575d)<br>Equinox: J2000 | Proper Motion RA: -11.508187733548466 mas/yr<br>Proper Motion Dec: -3.508008275604783 mas/yr<br>Parallax: 0.002356573862283452"<br>Epoch of Position: 2016.0<br>Radial Velocity: -11.87 km/sec | V=6.03 | Reference Frame: ICRS |

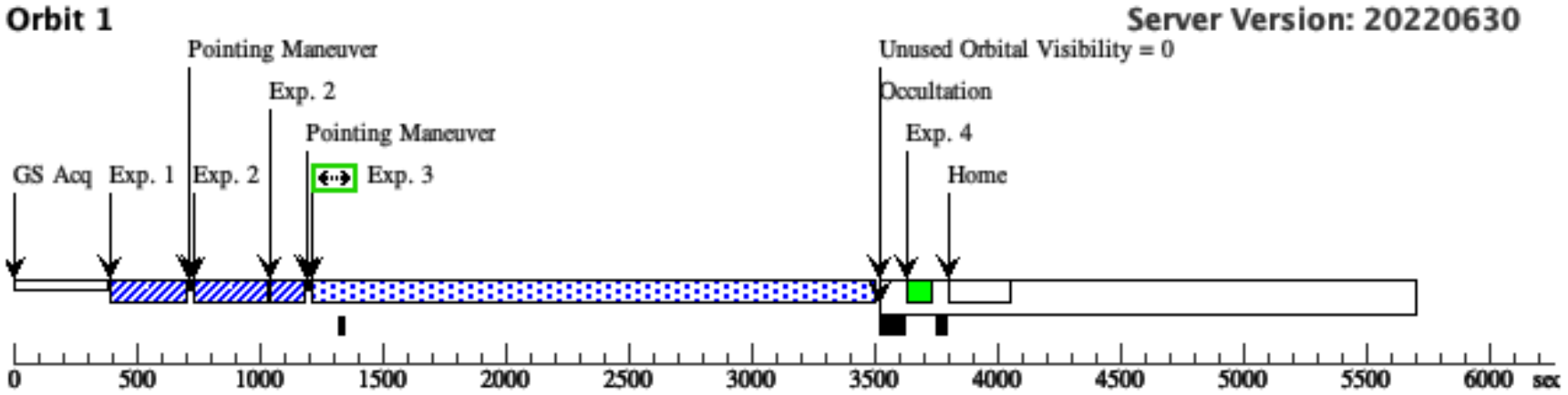
*Comments: This object was generated by the targetselector and retrieved from the SIMBAD and Gaia DR3 database.*
*Category=STAR*
*Description=[B0-B2 V-IV, BE, EMISSION LINE STAR, INTERACTING BINARY]*
*Extended=NO*

## Exposures

| # | Label (ETC Run) | Target | Config,Mode,Aperture | Spectral Els. | Opt. Params. | Special Reqs. | Groups | Exp. Time (Total)/[Actual Dur.] | Orbit |
|---|---|---|---|---|---|---|---|---|---|
| 1 | ACQ (STIS.ta.1809435) | (1) HD113120 | STIS/CCD, ACQ, F25ND5 | MIRROR | ACQTYPE=POINT | PHASE 0.63 TO 0.92 | | 4.7 Secs (4.7 Secs)<br>*[==>]* | *[1]* |
| 2 | ACQ/PEAK (STIS.ta.1809449) | (1) HD113120 | STIS/CCD, ACQ/PEAK, 0.3X0.05ND | MIRROR | | | | 0.2 Secs (0.2 Secs)<br>*[==>]* | *[1]* |
| 3 | ACCUM (STIS.sp.1811239) | (1) HD113120 | STIS/FUV-MAMA, ACCUM, 0.2X0.05ND | E140M 1425 A | WAVECAL=NO | | | 2192 Secs (2192 Secs)<br>*[==>]* | *[1]* |
| 4 | WAVECAL | WAVE | STIS/FUV-MAMA, ACCUM, 0.2X0.06 | E140M 1425 A | | | | *[==>]* | *[1]* |

*Comments: In Earth shadow*

## Orbit Structure



## Visit

**Proposal 17095, HD137387-v1 (04), implementation** Tue Sep 20 18:00:25 GMT 2022

**Diagnostic Status: No Diagnostics**

Scientific Instruments: STIS/CCD, STIS/FUV-MAMA

Special Requirements: Period 190.8543 D AND ZERO-PHASE HJD2458403.5715

## Fixed Targets

| # | Name | Target Coordinates | Targ. Coord. Corrections | Fluxes | Miscellaneous |
|---|---|---|---|---|---|
| (2) | HD137387<br>Alt Name1: -KAP01-APS<br>Alt Name2: HR5730 | RA: 15 31 30.8258 (232.8784408d)<br>Dec: -73 23 22.82 (-73.38967d)<br>Equinox: J2000 | Proper Motion RA: 0.9957109241326041 mas/yr<br>Proper Motion Dec: -18.34479819771808 mas/yr<br>Parallax: 0.003079816610437999 "<br>Epoch of Position: 2016.0 | V=5.49 | Reference Frame: ICRS |

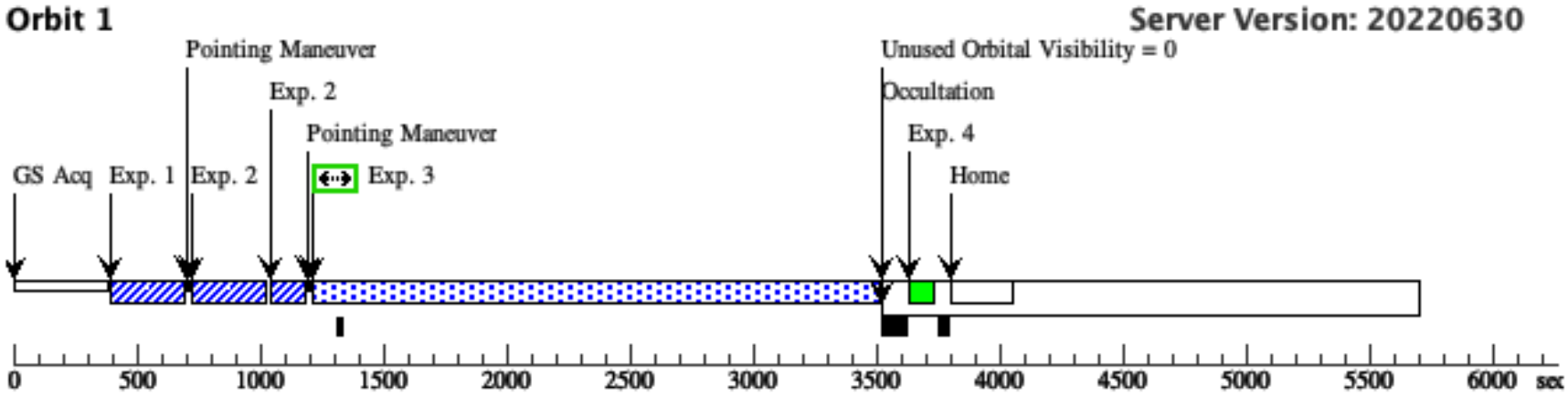
*Comments: This object was generated by the targetselector and retrieved from the SIMBAD and Gaia DR3 database.*
*Category=STAR*
*Description=[B0-B2 V-IV, BE, EMISSION LINE STAR, INTERACTING BINARY]*
*Extended=NO*

## Exposures

| # | Label (ETC Run) | Target | Config,Mode,Aperture | Spectral Els. | Opt. Params. | Special Reqs. | Groups | Exp. Time (Total)/[Actual Dur.] | Orbit |
|---|---|---|---|---|---|---|---|---|---|
| 1 | ACQ (STIS.ta.1809685) | (2) HD137387 | STIS/CCD, ACQ, F25ND5 | MIRROR | | PHASE 0.07 TO 0.43 | | 2.9 Secs (2.9 Secs)<br>*[==>]* | *[1]* |
| 2 | ACQ/PEAK (STIS.ta.1809687) | (2) HD137387 | STIS/CCD, ACQ/PEAK, 0.3X0.05ND | MIRROR | | | | 0.2 Secs (0.2 Secs)<br>*[==>]* | *[1]* |
| 3 | ACCUM (STIS.sp.1811240) | (2) HD137387 | STIS/FUV-MAMA, ACCUM, 0.2X0.05ND | E140M 1425 A | WAVECAL=NO | | | 2200 Secs (2200 Secs)<br>*[==>]* | *[1]* |
| 4 | WAVECAL | WAVE | STIS/FUV-MAMA, ACCUM, 0.2X0.06 | E140M 1425 A | | | | *[==>]* | *[1]* |

*Comments: In Earth shadow*

## Orbit Structure



## Visit

**Proposal 17095, HD137387-v2 (05), implementation** Tue Sep 20 18:00:25 GMT 2022

**Diagnostic Status: No Diagnostics**

Scientific Instruments: STIS/CCD, STIS/FUV-MAMA

Special Requirements: Period 190.8543 D AND ZERO-PHASE HJD2458403.5715

## Fixed Targets

| # | Name | Target Coordinates | Targ. Coord. Corrections | Fluxes | Miscellaneous |
|---|---|---|---|---|---|
| (2) | HD137387<br>Alt Name1: -KAP01-APS<br>Alt Name2: HR5730 | RA: 15 31 30.8258 (232.8784408d)<br>Dec: -73 23 22.82 (-73.38967d)<br>Equinox: J2000 | Proper Motion RA: 0.9957109241326041 mas/yr<br>Proper Motion Dec: -18.34479819771808 mas/yr<br>Parallax: 0.003079816610437999 "<br>Epoch of Position: 2016.0 | V=5.49 | Reference Frame: ICRS |

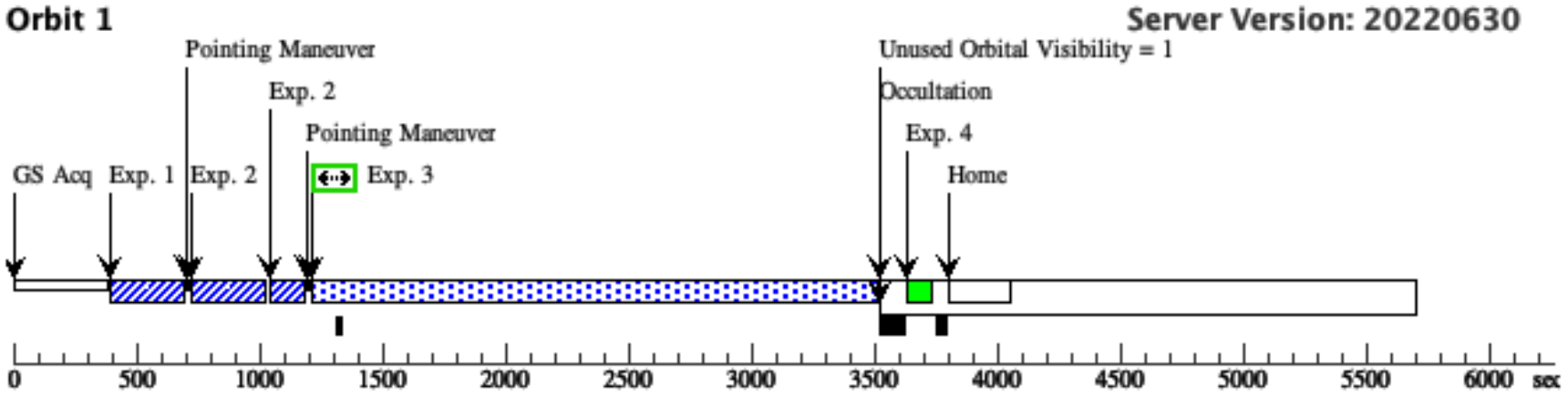
*Comments: This object was generated by the targetselector and retrieved from the SIMBAD and Gaia DR3 database.*
*Category=STAR*
*Description=[B0-B2 V-IV, BE, EMISSION LINE STAR, INTERACTING BINARY]*
*Extended=NO*

## Exposures

| # | Label (ETC Run) | Target | Config,Mode,Aperture | Spectral Els. | Opt. Params. | Special Reqs. | Groups | Exp. Time (Total)/[Actual Dur.] | Orbit |
|---|---|---|---|---|---|---|---|---|---|
| 1 | ACQ (STIS.ta.1809685) | (2) HD137387 | STIS/CCD, ACQ, F25ND5 | MIRROR | ACQTYPE=POINT | PHASE 0.56 TO 0.70 | | 2.9 Secs (2.9 Secs)<br>*[==>]* | <br>***[1]*** |
| 2 | ACQ/PEAK (STIS.ta.1809687) | (2) HD137387 | STIS/CCD, ACQ/PEAK, 0.3X0.05ND | MIRROR | | | | 0.1 Secs (0.1 Secs)<br>*[==>]* | <br>***[1]*** |
| 3 | ACCUM (STIS.sp.1811240) | (2) HD137387 | STIS/FUV-MAMA, ACCUM, 0.2X0.05ND | E140M 1425 A | WAVECAL=NO | | | 2200 Secs (2200 Secs)<br>*[==>]* | <br>***[1]*** |
| 4 | WAVECAL | WAVE | STIS/FUV-MAMA, ACCUM, 0.2X0.06 | E140M 1425 A | | | | *[==>]* | ***[1]*** |

*Comments: In Earth shadow*

## Orbit Structure



## Visit

**Proposal 17095, HD137387-v3 (06), implementation** Tue Sep 20 18:00:26 GMT 2022

**Diagnostic Status: No Diagnostics**

Scientific Instruments: STIS/CCD, STIS/FUV-MAMA

Special Requirements: Period 190.8543 D AND ZERO-PHASE HJD2458403.5715

## Fixed Targets

| # | Name | Target Coordinates | Targ. Coord. Corrections | Fluxes | Miscellaneous |
|---|---|---|---|---|---|
| (2) | HD137387<br>Alt Name1: -KAP01-APS<br>Alt Name2: HR5730 | RA: 15 31 30.8258 (232.8784408d)<br>Dec: -73 23 22.82 (-73.38967d)<br>Equinox: J2000 | Proper Motion RA: 0.9957109241326041 mas/yr<br>Proper Motion Dec: -18.34479819771808 mas/yr<br>Parallax: 0.003079816610437999 "<br>Epoch of Position: 2016.0 | V=5.49 | Reference Frame: ICRS |

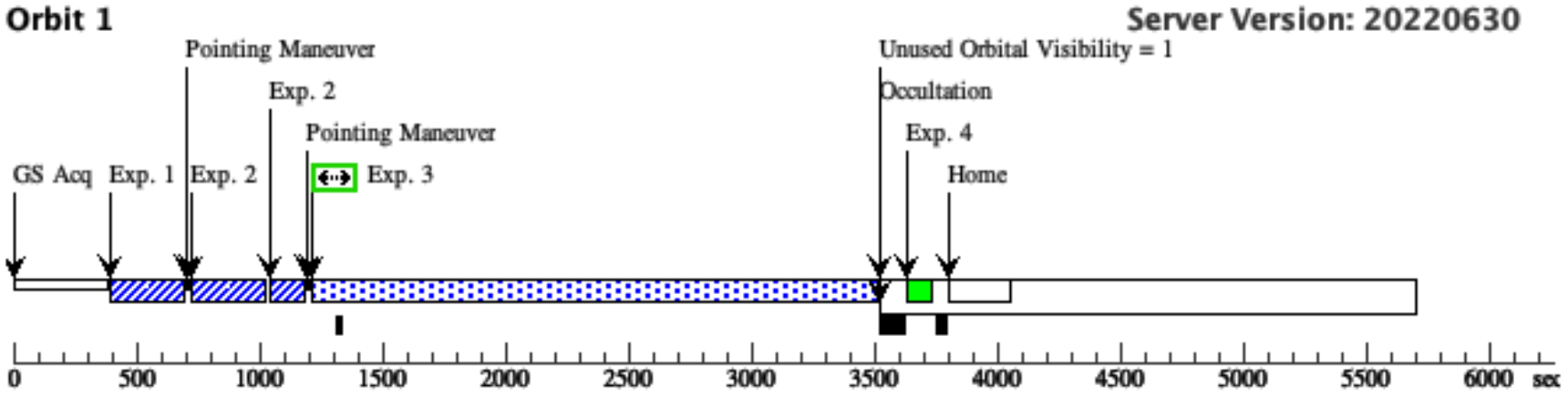
*Comments: This object was generated by the targetselector and retrieved from the SIMBAD and Gaia DR3 database.*
*Category=STAR*
*Description=[B0-B2 V-IV, BE, EMISSION LINE STAR, INTERACTING BINARY]*
*Extended=NO*

## Exposures

| # | Label (ETC Run) | Target | Config,Mode,Aperture | Spectral Els. | Opt. Params. | Special Reqs. | Groups | Exp. Time (Total)/[Actual Dur.] | Orbit |
|---|---|---|---|---|---|---|---|---|---|
| 1 | ACQ (STIS.ta.1809685) | (2) HD137387 | STIS/CCD, ACQ, F25ND5 | MIRROR | ACQTYPE=POINT | PHASE 0.73 TO 0.96 | | 2.9 Secs (2.9 Secs)<br>*[==>]* | <br>***[1]*** |
| 2 | ACQ/PEAK (STIS.ta.1809687) | (2) HD137387 | STIS/CCD, ACQ/PEAK, 0.3X0.05ND | MIRROR | | | | 0.1 Secs (0.1 Secs)<br>*[==>]* | <br>***[1]*** |
| 3 | ACCUM (STIS.sp.1811240) | (2) HD137387 | STIS/FUV-MAMA, ACCUM, 0.2X0.05ND | E140M 1425 A | WAVECAL=NO | | | 2200 Secs (2200 Secs)<br>*[==>]* | <br>***[1]*** |
| 4 | WAVECAL | WAVE | STIS/FUV-MAMA, ACCUM, 0.2X0.06 | E140M 1425 A | | | | *[==>]* | ***[1]*** |

*Comments: In Earth shadow*

## Orbit Structure



## Visit

**Proposal 17095, HD152478-v1 (07), implementation** Tue Sep 20 18:00:26 GMT 2022

**Diagnostic Status: No Diagnostics**

Scientific Instruments: STIS/CCD, STIS/FUV-MAMA

Special Requirements: Period 236.3653 D AND ZERO-PHASE HJD2458672.6846

## Fixed Targets

| # | Name | Target Coordinates | Targ. Coord. Corrections | Fluxes | Miscellaneous |
|---|---|---|---|---|---|
| (3) | HD152478<br>Alt Name1: V846-ARA<br>Alt Name2: HR6274 | RA: 16 56 8.8262 (254.0367758d)<br>Dec: -50 40 29.40 (-50.67483d)<br>Equinox: J2000 | Proper Motion RA: -9.403350372458535 mas/yr<br>Proper Motion Dec: -9.591608099231062 mas/yr<br>Parallax: 0.00330892174477081 "<br>Epoch of Position: 2016.0 | V=6.33 | Reference Frame: ICRS |

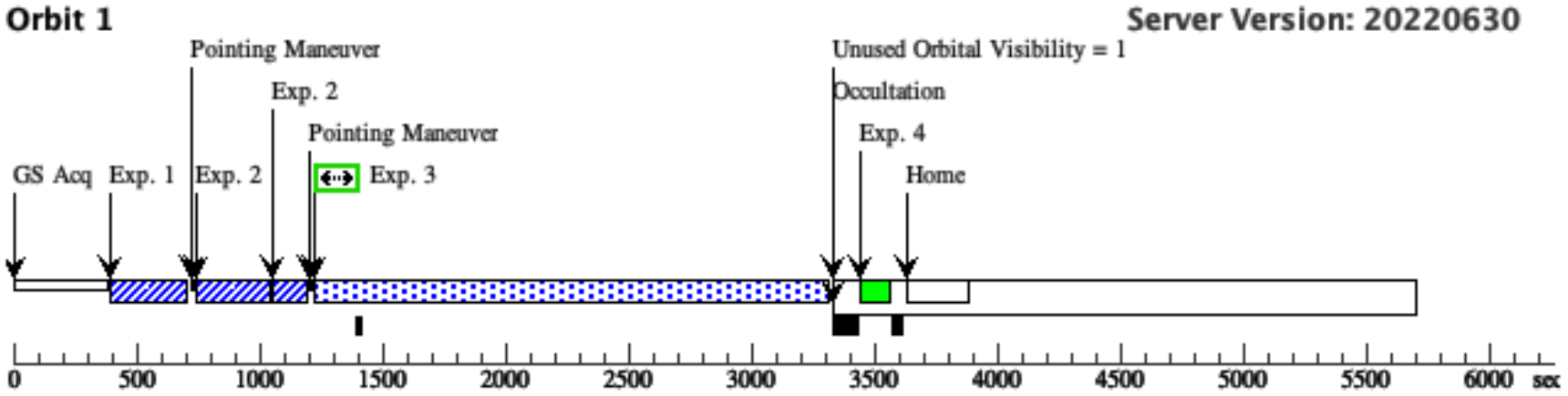
*Comments: This object was generated by the targetselector and retrieved from the SIMBAD and Gaia DR3 database.*
*Category=STAR*
*Description=[B3-B5 V-IV, BE, EMISSION LINE STAR, INTERACTING BINARY]*
*Extended=NO*

## Exposures

| # | Label (ETC Run) | Target | Config,Mode,Aperture | Spectral Els. | Opt. Params. | Special Reqs. | Groups | Exp. Time (Total)/[Actual Dur.] | Orbit |
|---|---|---|---|---|---|---|---|---|---|
| 1 | ACQ (STIS.ta.1809697) | (3) HD152478 | STIS/CCD, ACQ, F25ND5 | MIRROR | ACQTYPE=POINT | PHASE 0.40 TO 0.60 | | 6.1 Secs (6.1 Secs)<br>*[==>]* | *[1]* |
| 2 | ACQ/PEAK (STIS.ta.1809700) | (3) HD152478 | STIS/CCD, ACQ/PEAK, 0.3X0.05ND | MIRROR | | | | 0.3 Secs (0.3 Secs)<br>*[==>]* | *[1]* |
| 3 | ACCUM (STIS.sp.1814102) | (3) HD152478 | STIS/FUV-MAMA, ACCUM, 31X0.05NDB | E140M 1425 A | WAVECAL=NO | | | 1930 Secs (1929 Secs)<br>*[==>1929.0 Secs ]* | *[1]* |
| 4 | WAVECAL | WAVE | STIS/FUV-MAMA, ACCUM, 0.2X0.06 | E140M 1425 A | | | | *[==>]* | *[1]* |

*Comments: In Earth shadow*

## Orbit Structure



## Visit

**Proposal 17095, HD152478-v2 (08), implementation** Tue Sep 20 18:00:26 GMT 2022

**Diagnostic Status: No Diagnostics**

Scientific Instruments: STIS/CCD, STIS/FUV-MAMA

Special Requirements: Period 236.3653 D AND ZERO-PHASE HJD2458672.6846

## Fixed Targets

| # | Name | Target Coordinates | Targ. Coord. Corrections | Fluxes | Miscellaneous |
|---|---|---|---|---|---|
| (3) | HD152478<br>Alt Name1: V846-ARA<br>Alt Name2: HR6274 | RA: 16 56 8.8262 (254.0367758d)<br>Dec: -50 40 29.40 (-50.67483d)<br>Equinox: J2000 | Proper Motion RA: -9.403350372458535 mas/yr<br>Proper Motion Dec: -9.591608099231062 mas/yr<br>Parallax: 0.00330892174477081 "<br>Epoch of Position: 2016.0 | V=6.33 | Reference Frame: ICRS |

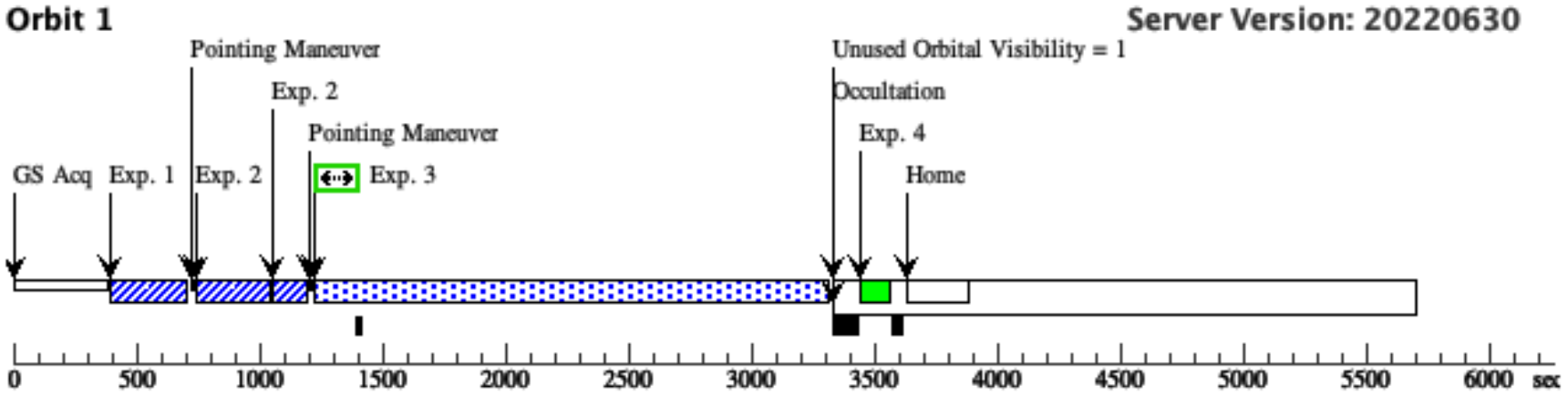
*Comments: This object was generated by the targetselector and retrieved from the SIMBAD and Gaia DR3 database.*
*Category=STAR*
*Description=[B3-B5 V-IV, BE, EMISSION LINE STAR, INTERACTING BINARY]*
*Extended=NO*

## Exposures

| # | Label (ETC Run) | Target | Config,Mode,Aperture | Spectral Els. | Opt. Params. | Special Reqs. | Groups | Exp. Time (Total)/[Actual Dur.] | Orbit |
|---|---|---|---|---|---|---|---|---|---|
| 1 | ACQ (STIS.ta.1809697) | (3) HD152478 | STIS/CCD, ACQ, F25ND5 | MIRROR | ACQTYPE=POINT | PHASE 0.63 TO 0.80 | | 6.1 Secs (6.1 Secs)<br>*[==>]* | *[1]* |
| 2 | ACQ/PEAK (STIS.ta.1809700) | (3) HD152478 | STIS/CCD, ACQ/PEAK, 0.3X0.05ND | MIRROR | | | | 0.3 Secs (0.3 Secs)<br>*[==>]* | *[1]* |
| 3 | ACCUM (STIS.sp.1814102) | (3) HD152478 | STIS/FUV-MAMA, ACCUM, 31X0.05NDB | E140M 1425 A | WAVECAL=NO | | | 1930 Secs (1929 Secs)<br>*[==>1929.0 Secs ]* | *[1]* |
| 4 | WAVECAL | WAVE | STIS/FUV-MAMA, ACCUM, 0.2X0.06 | E140M 1425 A | | | | *[==>]* | *[1]* |

*Comments: In Earth shadow*

## Orbit Structure



## Visit

**Proposal 17095, HD152478-v3 (09), implementation** Tue Sep 20 18:00:26 GMT 2022

**Diagnostic Status: No Diagnostics**

Scientific Instruments: STIS/CCD, STIS/FUV-MAMA

Special Requirements: Period 236.3653 D AND ZERO-PHASE HJD2458672.6846

## Fixed Targets

| # | Name | Target Coordinates | Targ. Coord. Corrections | Fluxes | Miscellaneous |
|---|---|---|---|---|---|
| (3) | HD152478<br>Alt Name1: V846-ARA<br>Alt Name2: HR6274 | RA: 16 56 8.8262 (254.0367758d)<br>Dec: -50 40 29.40 (-50.67483d)<br>Equinox: J2000 | Proper Motion RA: -9.403350372458535 mas/yr<br>Proper Motion Dec: -9.591608099231062 mas/yr<br>Parallax: 0.00330892174477081 "<br>Epoch of Position: 2016.0 | V=6.33 | Reference Frame: ICRS |

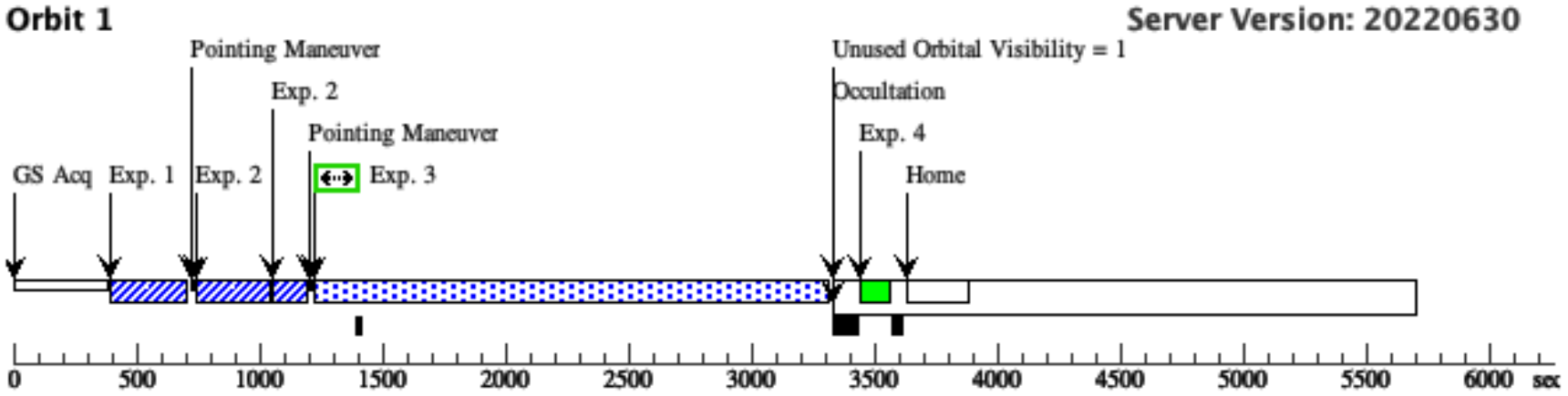
*Comments: This object was generated by the targetselector and retrieved from the SIMBAD and Gaia DR3 database.*
*Category=STAR*
*Description=[B3-B5 V-IV, BE, EMISSION LINE STAR, INTERACTING BINARY]*
*Extended=NO*

## Exposures

| # | Label (ETC Run) | Target | Config,Mode,Aperture | Spectral Els. | Opt. Params. | Special Reqs. | Groups | Exp. Time (Total)/[Actual Dur.] | Orbit |
|---|---|---|---|---|---|---|---|---|---|
| 1 | ACQ (STIS.ta.1809697) | (3) HD152478 | STIS/CCD, ACQ, F25ND5 | MIRROR | ACQTYPE=POINT | PHASE 0.83 TO 0.99 | | 6.1 Secs (6.1 Secs)<br>*[==>]* | *[1]* |
| 2 | ACQ/PEAK (STIS.ta.1809700) | (3) HD152478 | STIS/CCD, ACQ/PEAK, 0.3X0.05ND | MIRROR | | | | 0.3 Secs (0.3 Secs)<br>*[==>]* | *[1]* |
| 3 | ACCUM (STIS.sp.1814102) | (3) HD152478 | STIS/FUV-MAMA, ACCUM, 31X0.05NDB | E140M 1425 A | WAVECAL=NO | | | 1930 Secs (1929 Secs)<br>*[==>1929.0 Secs ]* | *[1]* |
| 4 | WAVECAL | WAVE | STIS/FUV-MAMA, ACCUM, 0.2X0.06 | E140M 1425 A | | | | *[==>]* | *[1]* |

*Comments: In Earth shadow*

## Orbit Structure



## Visit

**Proposal 17095, HD157042-v1 (10), implementation** Tue Sep 20 18:00:26 GMT 2022

**Diagnostic Status: No Diagnostics**

Scientific Instruments: STIS/CCD, STIS/FUV-MAMA

Special Requirements: Period 178.2518 D AND ZERO-PHASE HJD2458650.0441

## Fixed Targets

| # | Name | Target Coordinates | Targ. Coord. Corrections | Fluxes | Miscellaneous |
|---|---|---|---|---|---|
| (4) | HD157042<br>Alt Name1: IOT-ARA<br>Alt Name2: HR6451 | RA: 17 23 16.0664 (260.8169433d)<br>Dec: -47 28 5.79 (-47.46828d)<br>Equinox: J2000 | Proper Motion RA: -6.208732419332206 mas/yr<br>Proper Motion Dec: -17.698978512725702 mas/yr<br>Parallax: 0.0035612740787034896 "<br>Epoch of Position: 2016.0 | V=5.25 | Reference Frame: ICRS |

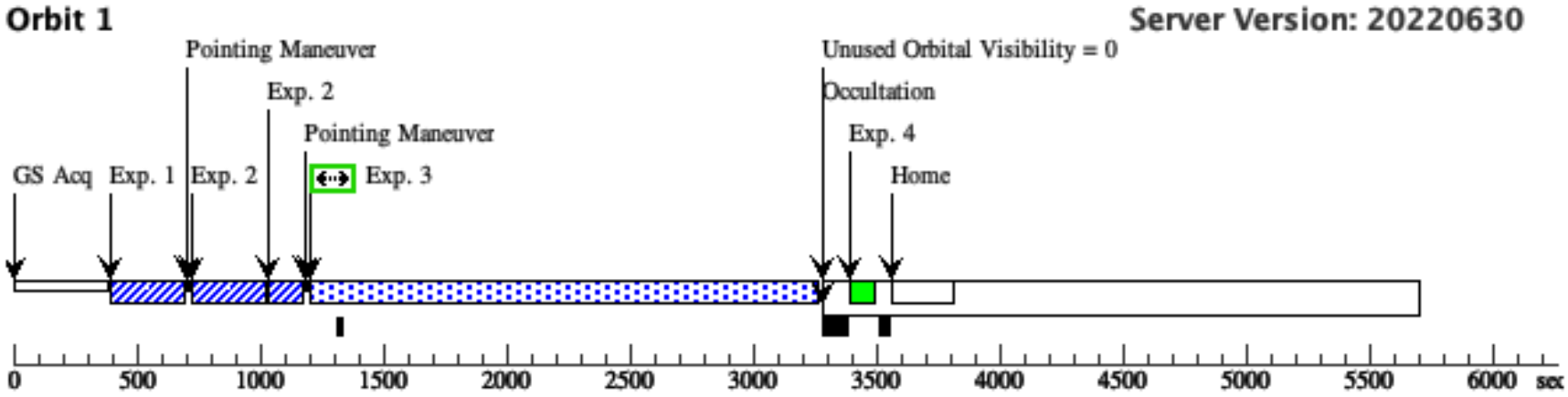
*Comments: This object was generated by the targetselector and retrieved from the SIMBAD and Gaia DR3 database.*
*Category=STAR*
*Description=[B0-B2 V-IV, BE, EMISSION LINE STAR, INTERACTING BINARY]*
*Extended=NO*

## Exposures

| # | Label (ETC Run) | Target | Config,Mode,Aperture | Spectral Els. | Opt. Params. | Special Reqs. | Groups | Exp. Time (Total)/[Actual Dur.] | Orbit |
|---|---|---|---|---|---|---|---|---|---|
| 1 | ACQ (STIS.ta.1809715) | (4) HD157042 | STIS/CCD, ACQ, F25ND5 | MIRROR | ACQTYPE=POINT | PHASE 0.00 TO 0.20 | | 2.3 Secs (2.3 Secs)<br>*[==>]* | *[1]* |
| 2 | ACQ/PEAK (STIS.ta.1809723) | (4) HD157042 | STIS/CCD, ACQ/PEAK, 0.3X0.05ND | MIRROR | | | | 0.2 Secs (0.2 Secs)<br>*[==>]* | *[1]* |
| 3 | ACCUM (STIS.sp.1811255) | (4) HD157042 | STIS/FUV-MAMA, ACCUM, 0.2X0.05ND | E140M 1425 A | WAVECAL=NO | | | 1901 Secs (1962 Secs)<br>*[==>1962.0 Secs ]* | *[1]* |
| 4 | WAVECAL | WAVE | STIS/FUV-MAMA, ACCUM, 0.2X0.06 | E140M 1425 A | | | | *[==>]* | *[1]* |

*Comments: In Earth shadow*

## Orbit Structure



## Visit

**Proposal 17095, HD157042-v2 (11), implementation** Tue Sep 20 18:00:26 GMT 2022

**Diagnostic Status: No Diagnostics**

Scientific Instruments: STIS/CCD, STIS/FUV-MAMA

Special Requirements: Period 178.2518 D AND ZERO-PHASE HJD2458650.0441

## Fixed Targets

| # | Name | Target Coordinates | Targ. Coord. Corrections | Fluxes | Miscellaneous |
|---|---|---|---|---|---|
| (4) | HD157042<br>Alt Name1: IOT-ARA<br>Alt Name2: HR6451 | RA: 17 23 16.0664 (260.8169433d)<br>Dec: -47 28 5.79 (-47.46828d)<br>Equinox: J2000 | Proper Motion RA: -6.208732419332206 mas/yr<br>Proper Motion Dec: -17.698978512725702 mas/yr<br>Parallax: 0.0035612740787034896 "<br>Epoch of Position: 2016.0 | V=5.25 | Reference Frame: ICRS |

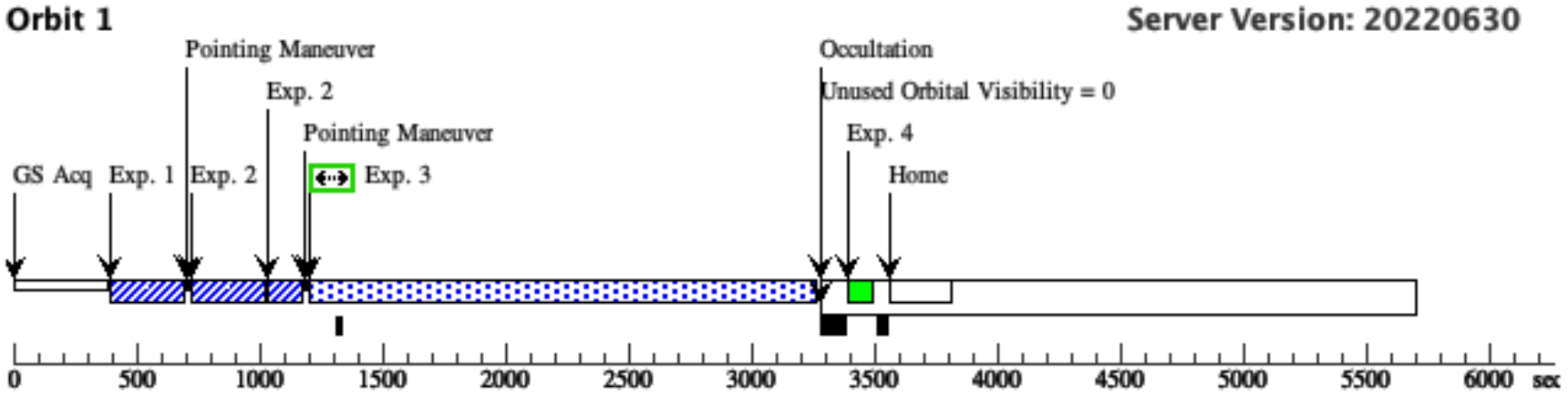
*Comments: This object was generated by the targetselector and retrieved from the SIMBAD and Gaia DR3 database.*
*Category=STAR*
*Description=[B0-B2 V-IV, BE, EMISSION LINE STAR, INTERACTING BINARY]*
*Extended=NO*

## Exposures

| # | Label (ETC Run) | Target | Config,Mode,Aperture | Spectral Els. | Opt. Params. | Special Reqs. | Groups | Exp. Time (Total)/[Actual Dur.] | Orbit |
|---|---|---|---|---|---|---|---|---|---|
| 1 | ACQ (STIS.ta.1809715) | (4) HD157042 | STIS/CCD, ACQ, F25ND5 | MIRROR | ACQTYPE=POINT | PHASE 0.23 TO 0.43 | | 2.3 Secs (2.3 Secs)<br>*[==>]* | *[1]* |
| 2 | ACQ/PEAK (STIS.ta.1809723) | (4) HD157042 | STIS/CCD, ACQ/PEAK, 0.3X0.05ND | MIRROR | | | | 0.2 Secs (0.2 Secs)<br>*[==>]* | *[1]* |
| 3 | ACCUM (STIS.sp.1811255) | (4) HD157042 | STIS/FUV-MAMA, ACCUM, 0.2X0.05ND | E140M 1425 A | WAVECAL=NO | | | 1901 Secs (1962 Secs)<br>*[==>1962.0 Secs ]* | *[1]* |
| 4 | WAVECAL | WAVE | STIS/FUV-MAMA, ACCUM, 0.2X0.06 | E140M 1425 A | | | | *[==>]* | *[1]* |

*Comments: In Earth shadow*

## Orbit Structure



## Visit

**Proposal 17095, HD157042-v3 (12), implementation** Tue Sep 20 18:00:26 GMT 2022

**Diagnostic Status: No Diagnostics**

Scientific Instruments: STIS/CCD, STIS/FUV-MAMA

Special Requirements: Period 178.2518 D AND ZERO-PHASE HJD2458650.0441

## Fixed Targets

| # | Name | Target Coordinates | Targ. Coord. Corrections | Fluxes | Miscellaneous |
|---|---|---|---|---|---|
| (4) | HD157042<br>Alt Name1: IOT-ARA<br>Alt Name2: HR6451 | RA: 17 23 16.0664 (260.8169433d)<br>Dec: -47 28 5.79 (-47.46828d)<br>Equinox: J2000 | Proper Motion RA: -6.208732419332206 mas/yr<br>Proper Motion Dec: -17.698978512725702 mas/yr<br>Parallax: 0.0035612740787034896 "<br>Epoch of Position: 2016.0 | V=5.25 | Reference Frame: ICRS |

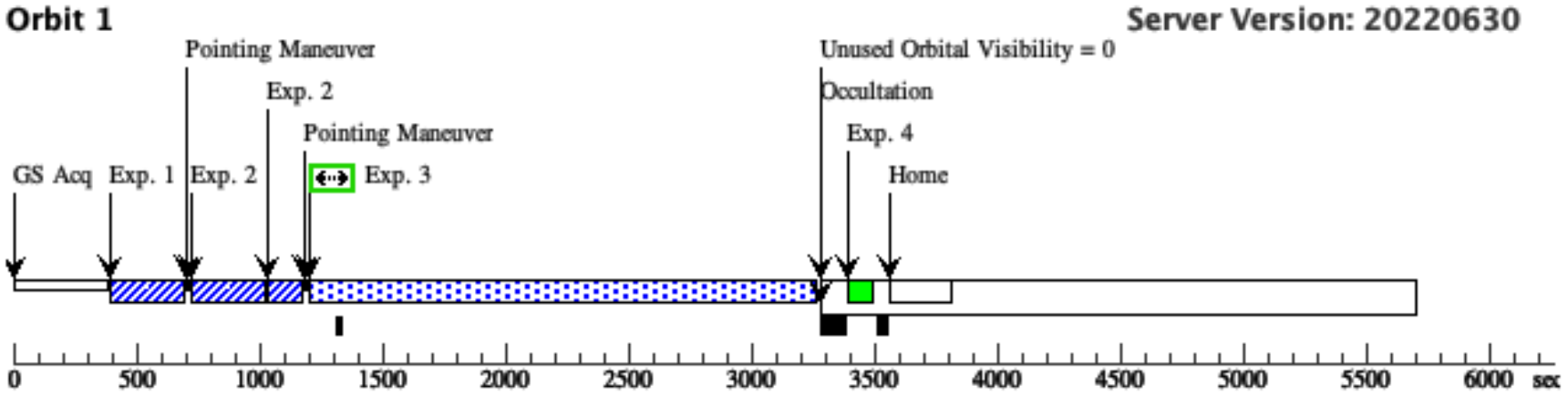
*Comments: This object was generated by the targetselector and retrieved from the SIMBAD and Gaia DR3 database.*
*Category=STAR*
*Description=[B0-B2 V-IV, BE, EMISSION LINE STAR, INTERACTING BINARY]*
*Extended=NO*

## Exposures

| # | Label (ETC Run) | Target | Config,Mode,Aperture | Spectral Els. | Opt. Params. | Special Reqs. | Groups | Exp. Time (Total)/[Actual Dur.] | Orbit |
|---|---|---|---|---|---|---|---|---|---|
| 1 | ACQ (STIS.ta.1809715) | (4) HD157042 | STIS/CCD, ACQ, F25ND5 | MIRROR | ACQTYPE=POINT | PHASE 0.70 TO 0.96 | | 2.4 Secs (2.4 Secs)<br>*[==>]* | *[1]* |
| 2 | ACQ/PEAK (STIS.ta.1809723) | (4) HD157042 | STIS/CCD, ACQ/PEAK, 0.3X0.05ND | MIRROR | | | | 0.2 Secs (0.2 Secs)<br>*[==>]* | *[1]* |
| 3 | ACCUM (STIS.sp.1811255) | (4) HD157042 | STIS/FUV-MAMA, ACCUM, 0.2X0.05ND | E140M<br>1425 A | WAVECAL=NO | | | 1901 Secs (1962 Secs)<br>*[==>1962.0 Secs ]* | *[1]* |
| 4 | WAVECAL | WAVE | STIS/FUV-MAMA, ACCUM, 0.2X0.06 | E140M<br>1425 A | | | | *[==>]* | *[1]* |

*Comments: In Earth shadow*

## Orbit Structure



## Visit

**Proposal 17095, HD157832-v1 (13), implementation** Tue Sep 20 18:00:26 GMT 2022

**Diagnostic Status: No Diagnostics**

Scientific Instruments: STIS/CCD, STIS/FUV-MAMA

Special Requirements: Period 95.7098 D AND ZERO-PHASE HJD2458561.1092

## Fixed Targets

| # | Name | Target Coordinates | Targ. Coord. Corrections | Fluxes | Miscellaneous |
|---|---|---|---|---|---|
| (5) | HD-157832<br>Alt Name1: V750-ARA<br>Alt Name2: MWC259 | RA: 17 27 54.8099 (261.9783746d)<br>Dec: -47 01 34.42 (-47.02623d)<br>Equinox: J2000 | Proper Motion RA: -0.9380690820341527 mas/yr<br>Proper Motion Dec: -1.6252228916207976 mas/yr<br>Parallax: 0.0009867369435648632 "<br>Epoch of Position: 2016.0 | V=6.663 | Reference Frame: ICRS |

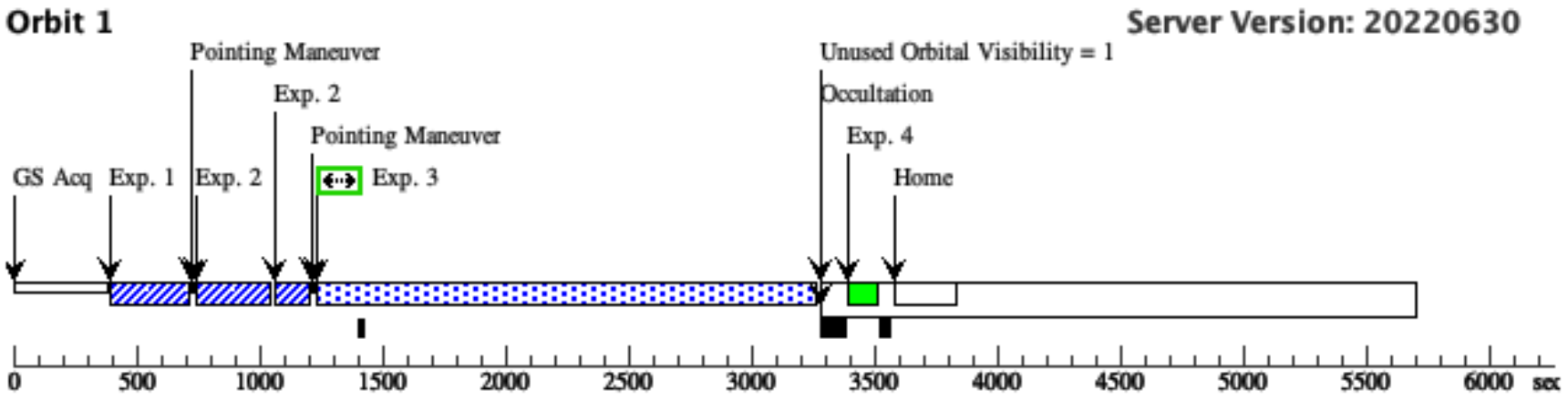
*Comments: This object was generated by the targetselector and retrieved from the SIMBAD and Gaia DR3 database.*
*Category=STAR*
*Description=[B0-B2 V-IV, BE, EMISSION LINE STAR, INTERACTING BINARY]*

## Exposures

| # | Label (ETC Run) | Target | Config,Mode,Aperture | Spectral Els. | Opt. Params. | Special Reqs. | Groups | Exp. Time (Total)/[Actual Dur.] | Orbit |
|---|---|---|---|---|---|---|---|---|---|
| 1 | ACQ (STIS.ta.1809736) | (5) HD-157832 | STIS/CCD, ACQ, F25ND5 | MIRROR | ACQTYPE=POINT | PHASE 0.00 TO 0.20 | | 8.4 Secs (8.4 Secs)<br>*[==>]* | <br>***[1]*** |
| 2 | ACQ/PEAK (STIS.ta.1809742) | (5) HD-157832 | STIS/CCD, ACQ/PEAK, 0.3X0.05ND | MIRROR | | | | 0.4 Secs (0.4 Secs)<br>*[==>]* | <br>***[1]*** |
| 3 | ACCUM (STIS.sp.1814104) | (5) HD-157832 | STIS/FUV-MAMA, ACCUM, 31X0.05NDB | E140M 1425 A | WAVECAL=NO | | | 1871 Secs (1870 Secs)<br>*[==>1870.0 Secs ]* | <br>***[1]*** |
| 4 | WAVECAL | WAVE | STIS/FUV-MAMA, ACCUM, 0.2X0.06 | E140M 1425 A | | | | *[==>]* | ***[1]*** |

*Comments: In Earth shadow*

## Orbit Structure



## Visit

**Proposal 17095, HD157832-v2 (14), implementation** Tue Sep 20 18:00:26 GMT 2022

**Diagnostic Status: No Diagnostics**

Scientific Instruments: STIS/CCD, STIS/FUV-MAMA

Special Requirements: Period 95.7098 D AND ZERO-PHASE HJD2458561.1092

## Fixed Targets

| # | Name | Target Coordinates | Targ. Coord. Corrections | Fluxes | Miscellaneous |
|---|---|---|---|---|---|
| (5) | HD-157832<br>Alt Name1: V750-ARA<br>Alt Name2: MWC259 | RA: 17 27 54.8099 (261.9783746d)<br>Dec: -47 01 34.42 (-47.02623d)<br>Equinox: J2000 | Proper Motion RA: -0.9380690820341527 mas/yr<br>Proper Motion Dec: -1.6252228916207976 mas/yr<br>Parallax: 0.0009867369435648632 "<br>Epoch of Position: 2016.0 | V=6.663 | Reference Frame: ICRS |

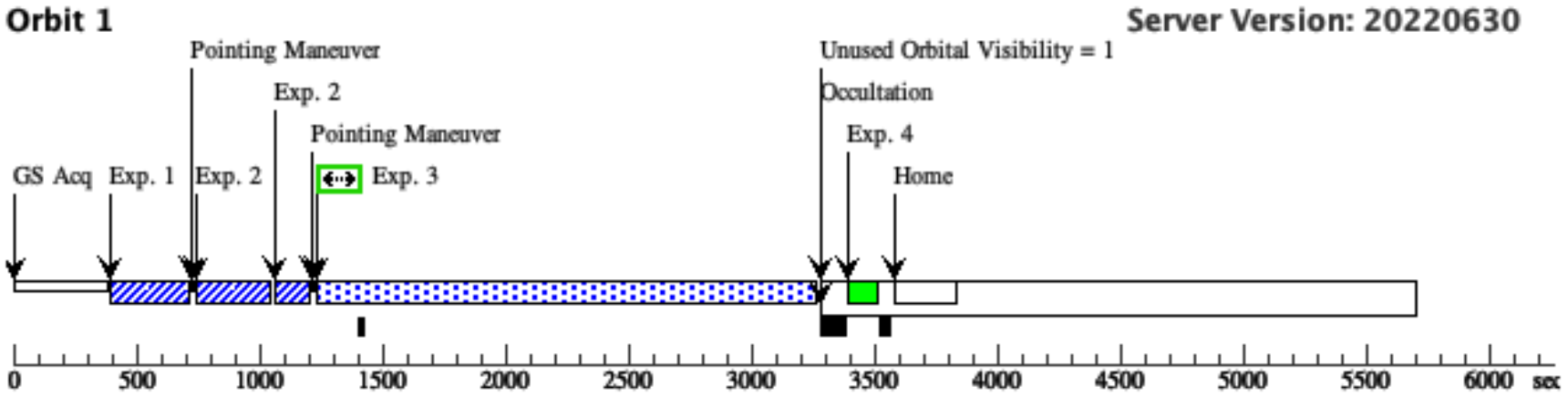
*Comments: This object was generated by the targetselector and retrieved from the SIMBAD and Gaia DR3 database.*
*Category=STAR*
*Description=[B0-B2 V-IV, BE, EMISSION LINE STAR, INTERACTING BINARY]*

## Exposures

| # | Label (ETC Run) | Target | Config,Mode,Aperture | Spectral Els. | Opt. Params. | Special Reqs. | Groups | Exp. Time (Total)/[Actual Dur.] | Orbit |
|---|---|---|---|---|---|---|---|---|---|
| 1 | ACQ (STIS.ta.1809736) | (5) HD-157832 | STIS/CCD, ACQ, F25ND5 | MIRROR | ACQTYPE=POINT | PHASE 0.23 TO 0.50 | | 8.4 Secs (8.4 Secs)<br>*[==>]* | <br>***[1]*** |
| 2 | ACQ/PEAK (STIS.ta.1809742) | (5) HD-157832 | STIS/CCD, ACQ/PEAK, 0.3X0.05ND | MIRROR | | | | 0.4 Secs (0.4 Secs)<br>*[==>]* | <br>***[1]*** |
| 3 | ACCUM (STIS.sp.1814104) | (5) HD-157832 | STIS/FUV-MAMA, ACCUM, 31X0.05NDB | E140M 1425 A | WAVECAL=NO | | | 1871 Secs (1870 Secs)<br>*[==>1870.0 Secs ]* | <br>***[1]*** |
| 4 | WAVECAL | WAVE | STIS/FUV-MAMA, ACCUM, 0.2X0.06 | E140M 1425 A | | | | *[==>]* | ***[1]*** |

*Comments: In Earth shadow*

## Orbit Structure



## Visit

**Proposal 17095, HD157832-v3 (15), implementation** Tue Sep 20 18:00:26 GMT 2022

**Diagnostic Status: No Diagnostics**

Scientific Instruments: STIS/CCD, STIS/FUV-MAMA

Special Requirements: Period 95.7098 D AND ZERO-PHASE HJD2458561.1092

## Fixed Targets

| # | Name | Target Coordinates | Targ. Coord. Corrections | Fluxes | Miscellaneous |
|---|---|---|---|---|---|
| (5) | HD-157832<br>Alt Name1: V750-ARA<br>Alt Name2: MWC259 | RA: 17 27 54.8099 (261.9783746d)<br>Dec: -47 01 34.42 (-47.02623d)<br>Equinox: J2000 | Proper Motion RA: -0.9380690820341527 mas/yr<br>Proper Motion Dec: -1.6252228916207976 mas/yr<br>Parallax: 0.0009867369435648632 "<br>Epoch of Position: 2016.0 | V=6.663 | Reference Frame: ICRS |

*Comments: This object was generated by the targetselector and retrieved from the SIMBAD and Gaia DR3 database.*
*Category=STAR*
*Description=[B0-B2 V-IV, BE, EMISSION LINE STAR, INTERACTING BINARY]*

## Exposures

| # | Label (ETC Run) | Target | Config,Mode,Aperture | Spectral Els. | Opt. Params. | Special Reqs. | Groups | Exp. Time (Total)/[Actual Dur.] | Orbit |
|---|---|---|---|---|---|---|---|---|---|
| 1 | ACQ (STIS.ta.1809736) | (5) HD-157832 | STIS/CCD, ACQ, F25ND5 | MIRROR | ACQTYPE=POINT | PHASE 0.53 TO 0.76 | | 8.4 Secs (8.4 Secs)<br>*[==>]* | <br>***[1]*** |
| 2 | ACQ/PEAK (STIS.ta.1809742) | (5) HD-157832 | STIS/CCD, ACQ/PEAK, 0.3X0.05ND | MIRROR | | | | 0.4 Secs (0.4 Secs)<br>*[==>]* | <br>***[1]*** |
| 3 | ACCUM (STIS.sp.1814104) | (5) HD-157832 | STIS/FUV-MAMA, ACCUM, 31X0.05NDB | E140M 1425 A | WAVECAL=NO | | | 1871 Secs (1870 Secs)<br>*[==>1870.0 Secs ]* | <br>***[1]*** |
| 4 | WAVECAL | WAVE | STIS/FUV-MAMA, ACCUM, 0.2X0.06 | E140M 1425 A | | | | *[==>]* | ***[1]*** |

*Comments: In Earth shadow*

## Orbit Structure