# 16802 - ULLYSES SMC O3-O5 Dwarfs - COS

Cycle: 29, Proposal Category: GO/DD

(Availability Mode: SUPPORTED)

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**VISITS**

| *Visit* | *Targets used in Visit* | *Configurations used in Visit* | *Orbits Used* | *Last Orbit Planner Run* | *OP Current with Visit?* |
|---|---|---|---|---|---|
| 1C | (1) AV296 | COS/FUV | 2 | 12-May-2022 10:00:21.0 | yes |
| 2C | (2) AV435 | COS/FUV | 2 | 12-May-2022 10:00:22.0 | yes |

4 Total Orbits Used

**ABSTRACT**

The Space Telescope Science Institute (STScI) Director has decided to devote up to 1000 orbits of Director's Discretionary time in observing Cycles 27-29 to a new Hubble Ultraviolet Legacy program focused on star formation and associated stellar physics. This new program, ULLYSES (UV Legacy Library of Young Stars as Essential Standards), will provide a UV spectroscopic reference sample of young (< 10 Myr) high- and low-mass stars. It will target over ~150 OB stars in the Magellanic Clouds and lower metallicity galaxies in the Local Group, and ~40 T Tauri stars and brown dwarfs in the Milky Way. In addition, ULLYSES will monitor 4 typical T Tauri stars over different rotational phases through at least three rotation periods, and over timescales of months to years. The resulting library will provide template spectra of massive stars at metallicities substantially below the well studied, while the low mass sample will cover a wide range of ages, accretion rates, and masses, including objects down to well below 0.5 M_sun. The legacy of this large UV dataset on the first 10 Myr of stellar evolution will be enhanced by complementary datasets obtained by the scientific community. In addition to the core goals of the program related to stellar astrophysics of low and high mass stars, this data will also enable exciting science in the fields of ISM, CGM, jets, and exoplanets. ULLYSES will be modeled after the Frontier Fields program: all data obtained will

be non-proprietary. The implementation team at STScI is developing high-level science data products and a sophisticated database and website for disseminating data from the ULLYSES program and ancillary datasets for the ULLYSES target sample from space and ground-based facilities.

**OBSERVING DESCRIPTION**

This proposal includes a subset of the massive ULLYSES stars being observed in the Magellanic clouds.

Depending on target brightness, the main FUV spectral range will generally use either the STIS E140M setting or the combination of the COS c1291 + c1611 settings. Sufficiently bright stars without good FUSE data in the archive will also be observed with the COS c1096 setting to provide coverage at shorter wavelengths. Where time permits, stars of type O9 or later will also be observed with STIS E230M/1978, while for supergiants of spectral type B5 or later E230M/2707 may also be included. Where possible, targets of a given spectral type were selected to span both a range in extinction and in rotation rates to support a variety of stellar and ISM studies.

Signal-to-noise requirements used to determine the desired exposures times were defined as follows:
COS/G130M/c1096: 20 / nine-pixel resel at 1080 A
COS/G130M/c1291: 30 / six-pixel resel at 1150 A
COS/G160M/c1611: 30 / six-pixel resel at 1590 A
COS/G185M/c1953: 30 / three-pixel resel at 1860 A
COS/G185M/c1986: 30 / three-pixel resel at 1980 A
STIS/E140M/c1425: 20 / two-pixel resel at 1200 A
STIS/E230M/c1978: 20 / two-pixel resel at 1800 A
STIS/E230M/c2707: 20 / two-pixel resel at 2800 A
The actual implemented exposure times may be adjusted to efficiently use HST orbits, but should always provide at least 80% of the desired time as defined by the above requirements.

Additional details about the scientific motivation and technical implementation strategy of the ULLYSES observations can be found at http://www.stsci.edu/stsci-research/research-topics-and-programs/ullyses. The ULLYSES program is based on the recommendations of a working group led by Sally Oey; the full text of that group's report can be found at http://www.stsci.edu/files/live/sites/www/files/home/stsci-research/research-topics-and-programs/ullyses/_documents/HSTUV-report-ULLYSES.pdf.

## Visit

**Proposal 16802, AV296-COS (1C)** Thu May 12 14:00:23 GMT 2022

**Diagnostic Status: No Diagnostics**

Scientific Instruments: COS/FUV

Special Requirements: SCHED 100%

*Comments: vstatus; 1C; AV296; P/COS approved for submission; P/RS 25/12/21 ; intrev: complete ; P/JRD 11/05/22*
*vcheck; Enter targ name & Inst. & Resp. Sci.; AV296 ; COS ; RS*
*vcheck; ETC numbers entered in APT?; yes*
*vcheck; Any screening violations?; no*
*vcheck; S/N ETC calcs done & documented?; yes*
*vcheck; Field images checked & saved?; yes*
*vcheck; Selected ACQ strategy?; yes spectroscopic acq G130M/1291*
*vcheck; Possible ACQ or Sci spoilers?; no*
*vcheck; Field BOT clear?; yes ...*
*stars with V=17.65 and 17.68 in Zaritsky catalog that make imaging ACQ problematic otherwise okay, GSCII warning due to O5V assumption*
*vcheck; Visual BOT check for stars not in catalog?; yes ok*
*vcheck; Orbit packing finalized?; yes*
*vcheck; Buffer times optimized?; yes*
*vcheck; Verify visit grouping correct; N/A*
*vcheck; Is visit ready for int. review?; yes*
*Allocated COS orbits = 2 (constrained in input CSV)*

## Fixed Targets

| # | Name | Target Coordinates | Targ. Coord. Corrections | Fluxes | Miscellaneous |
|---|---|---|---|---|---|
| (1) | AV296<br>Alt Name1: M2002-52948<br>Alt Name2: AZV-296 | RA: 01 02 8.6474 (15.5360308d)<br>Dec: -72 13 20.02 (-72.22223d)<br>Equinox: J2000 | Proper Motion RA: 0.948 mas/yr<br>Proper Motion Dec: -0.956 mas/yr<br>Parallax: 0"<br>Epoch of Position: 2000 | V=14.26<br>SpT=O7.5 V((f)); E(B-V)=0.09; U=13.05; B=14.07; V=14.26; F1160=3.600e-13; F1360=2.570e-13; F1700=1.640e-13 | Reference Frame: ICRS |

*Comments: AV296 : M2002-52948, AzV 296*
*Previous name : AV 296*
*Input file: ULLYSES_Cycle29_MassiveStar_ProgramInput_v5.csv*
*SpT = O7.5 V((f))*
*COS/G130M/c1096 : rn(PoWR-OB-new(PoWR_35000_3.60_m6.82_Z0.14.fits, smc-ob-i 35-36, Z=0.140 solar, Teff=35000, log_lum=5.50, log_g=3.60, log_mdot=-6.82) (extinction smcbar=0.090), flux1160 +-2.0A flux=3.6e-13 Flam)*
*Coordinate pedigree: Gaia DR2*
*Calculation performed 2021-10-25T00:53:19, v0.9*
---
*tstatus; AV296; P/COS approved for submission; S/ins not started; P/RS 23/12/21; S/xx DD/MM/YY*
*tcheck; APT/SIMBAD target names: ; AV296 'AzV 296'*
*tcheck; Target info verification status?; OK*
*tcheck; Coordinates & P.M. verified, epoch checked?; OK*
*tcheck; Adopted SED compared to Observations?; POWR model SED, AV296_COS_G130M_c1096_sed.fits matches at 1150A ...*
*but is about 19% higher than STIS and IUE spectra at longer wavelength ...*
*A new POWR model SED with E(B-V)=0.06 normalized to flux density of 3e-13 at 1160A (AV296_new_ext0pt06_scl3e-13_sed.fits) was used*
*Category=STAR*
*Description=[MAIN SEQUENCE O, OF]*
*Extended=NO*

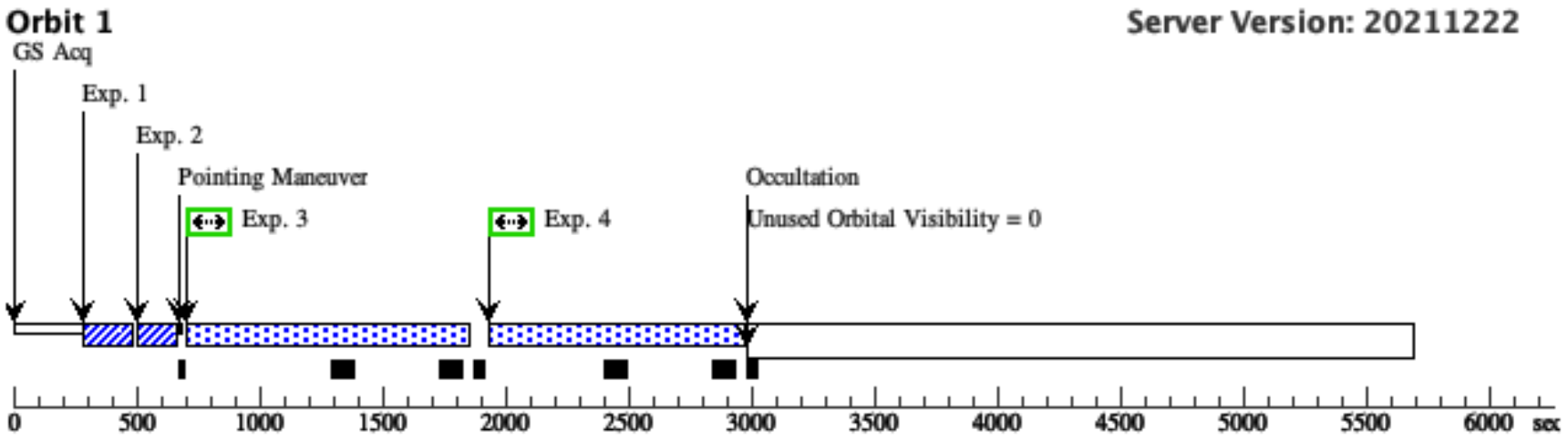
**Exposures**

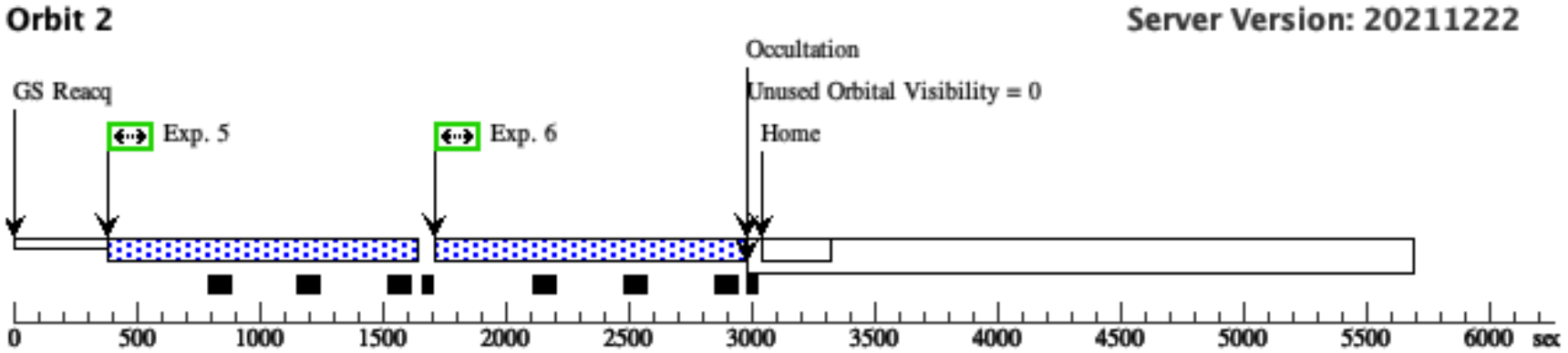
| # | Label (ETC Run) | Target | Config,Mode,Aperture | Spectral Els. | Opt. Params. | Special Reqs. | Groups | Exp. Time (Total)/[Actual Dur.] | Orbit |
|---|---|---|---|---|---|---|---|---|---|
| 1 | FUV PEAK XD (COS.sa.1746058) | (1) AV296 | COS/FUV, ACQ/PEAKXD, PSA | G130M 1291 A | NUM-POS=3; STEP-SIZE=1.3; CENTER=FLUX-WT | | | 1 Secs (1 Secs) *[==>]* | ***[1]*** |
| | *Comments: Exposure time based on scaled SED; original SED used to clear BOT.* | | | | | | | | |
| 2 | FUV PEAK D (COS.sa.1746058) | (1) AV296 | COS/FUV, ACQ/PEAKD, PSA | G130M 1291 A | NUM-POS=5; STEP-SIZE=0.9; CENTER=FLUX-WT-FLR | | | 1 Secs (1 Secs) *[==>]* | ***[1]*** |
| | *Comments: Exposure time based on scaled SED; original SED used to clear BOT.* | | | | | | | | |
| 3 | G130M/1096 (COS.sp.1746059) | (1) AV296 | COS/FUV, TIME-TAG, PSA | G130M 1096 A | BUFFER-TIME=437; FP-POS=1 | | | 985 Secs (985 Secs) *[==>]* | ***[1]*** |
| | *Comments: rn(PoWR-OB-new(PoWR_35000_3.60_m6.82_Z0.14.fits, smc-ob-i 35-36, Z=0.140 solar, Teff=35000, log_lum=5.50, log_g=3.60, log_mdot=-6.82) (extinction smcbar=0.090), flux1160 +- 2.0A flux=3.6e-13 Flam); cos,fuv,g130m,c1096,psa,mjd#59670; fp-pos=None, segment=None)*<br>*From file ULLYSES_Cycle29_MassiveStar_ProgramInput_v5.csv*<br>*Spectral type: O7.5 V((f))*<br>*SED = AV296_COS_G130M_c1096_sed.fits*<br>*For exptime=5518.8 s, spectral region:*<br>*1080.0 +- 0.5 A achieves SNR=20.0/resel*<br>*global countrate (brightest segment): 4130.2 cts/s/segment*<br>*brightest pixel: 0.081 cts/s/pix at 1227.0 A*<br>*Calculation performed 2021-10-25T00:53:26, v0.9* | | | | | | | | |
| 4 | G130M/1096 (COS.sp.1746059) | (1) AV296 | COS/FUV, TIME-TAG, PSA | G130M 1096 A | BUFFER-TIME=437; FP-POS=2 | | | 988 Secs (988 Secs) *[==>]* | ***[1]*** |
| | *Comments: rn(PoWR-OB-new(PoWR_35000_3.60_m6.82_Z0.14.fits, smc-ob-i 35-36, Z=0.140 solar, Teff=35000, log_lum=5.50, log_g=3.60, log_mdot=-6.82) (extinction smcbar=0.090), flux1160 +- 2.0A flux=3.6e-13 Flam); cos,fuv,g130m,c1096,psa,mjd#59670; fp-pos=None, segment=None)*<br>*From file ULLYSES_Cycle29_MassiveStar_ProgramInput_v5.csv*<br>*Spectral type: O7.5 V((f))*<br>*SED = AV296_COS_G130M_c1096_sed.fits*<br>*For exptime=5518.8 s, spectral region:*<br>*1080.0 +- 0.5 A achieves SNR=20.0/resel*<br>*global countrate (brightest segment): 4130.2 cts/s/segment*<br>*brightest pixel: 0.081 cts/s/pix at 1227.0 A*<br>*Calculation performed 2021-10-25T00:53:26, v0.9* | | | | | | | | |
| 5 | G130M/1096 (COS.sp.1746059) | (1) AV296 | COS/FUV, TIME-TAG, PSA | G130M 1096 A | BUFFER-TIME=365; FP-POS=3 | | | 1204 Secs (1204 Secs) *[==>]* | ***[2]*** |
| | *Comments: rn(PoWR-OB-new(PoWR_35000_3.60_m6.82_Z0.14.fits, smc-ob-i 35-36, Z=0.140 solar, Teff=35000, log_lum=5.50, log_g=3.60, log_mdot=-6.82) (extinction smcbar=0.090), flux1160 +- 2.0A flux=3.6e-13 Flam); cos,fuv,g130m,c1096,psa,mjd#59670; fp-pos=None, segment=None)*<br>*From file ULLYSES_Cycle29_MassiveStar_ProgramInput_v5.csv*<br>*Spectral type: O7.5 V((f))*<br>*SED = AV296_COS_G130M_c1096_sed.fits*<br>*For exptime=5518.8 s, spectral region:*<br>*1080.0 +- 0.5 A achieves SNR=20.0/resel*<br>*global countrate (brightest segment): 4130.2 cts/s/segment*<br>*brightest pixel: 0.081 cts/s/pix at 1227.0 A*<br>*Calculation performed 2021-10-25T00:53:26, v0.9* | | | | | | | | |

| | | | | | | |
|---|---|---|---|---|---|---|
| 6 | G130M/109 6 (COS.sp.1746059) | (1) AV296 | COS/FUV, TIME-TAG, PSA | G130M 1096 A | BUFFER-TIME=365; FP-POS=4 | 1205 Secs (1205 Secs) [==>] [2] |

*Comments: rn(PoWR-OB-new(PoWR_35000_3.60_m6.82_Z0.14.fits, smc-ob-i 35-36, Z=0.140 solar, Teff=35000, log_lum=5.50, log_g=3.60, log_mdot=-6.82) (extinction smcbar=0.090), flux1160 +- 2.0A flux=3.6e-13 Flam); cos,fuv,g130m,c1096,psa,mjd#59670; fp-pos=None, segment=None)*
*From file ULLYSES_Cycle29_MassiveStar_ProgramInput_v5.csv*
*Spectral type: O7.5 V((f))*
*SED = AV296_COS_G130M_c1096_sed.fits*
*For exptime=5518.8 s, spectral region:*
*1080.0 +- 0.5 A achieves SNR=20.0/resel*
*global countrate (brightest segment): 4130.2 cts/s/segment*
*brightest pixel: 0.081 cts/s/pix at 1227.0 A*
*Calculation performed 2021-10-25T00:53:26, v0.9*

**Orbit Structure**



## Visit

**Proposal 16802, AV435-COS (2C)** Thu May 12 14:00:23 GMT 2022

**Diagnostic Status: No Diagnostics**

Scientific Instruments: COS/FUV

Special Requirements: SCHED 100%

*Comments: vstatus; 2C; AV435; P/COS approved for submission; P/RS 25/12/21 ; intrev: complete ; P/JRD 11/05/22*
*vcheck; Enter targ name & Inst. & Resp. Sci.; AV435 ; COS ; RS*
*vcheck; ETC numbers entered in APT?; yes*
*vcheck; Any screening violations?; no*
*vcheck; S/N ETC calcs done & documented?; yes ...*
*calculation 1681071 uses a flat spectrum 3.4e-13 cgs which is the peak of the c1291 model SED and shows it is safe. This is to account for any uncertainty in the short wavelength flux*
*vcheck; Field images checked & saved?; yes*
*vcheck; Selected ACQ strategy?; yes spectroscopic acq G130M/1291*
*vcheck; Possible ACQ or Sci spoilers?; no ...*
*but visit 02 of program 15837 which was supposed to be for this target apparently obtained data on some nearby star with significantly lower flux. That visit used an imaging acquisition, whereas a spectroscopic acquisition is specified here*
*vcheck; Field BOT clear?; yes ...*
*several stars bright enough that would pose a PSA brightness violation in the case of an NUV imaging ACQ*
*vcheck; Visual BOT check for stars not in catalog?; OK*
*vcheck; Orbit packing finalized?; yes*
*vcheck; Buffer times optimized?; yes*
*vcheck; Verify visit grouping correct; N/A*
*vcheck; Is visit ready for int. review?; yes*
*Allocated COS orbits = 2*

## Fixed Targets

| # | Name | Target Coordinates | Targ. Coord. Corrections | Fluxes | Miscellaneous |
|---|---|---|---|---|---|
| (2) | AV435<br>Alt Name1: M2002-67670<br>Alt Name2: AZV-435 | RA: 01 08 17.9030 (17.0745958d)<br>Dec: -71 59 54.34 (-71.99843d)<br>Equinox: J2000 | Proper Motion RA: 1.479 mas/yr<br>Proper Motion Dec: -3.104 mas/yr<br>Parallax: 0"<br>Epoch of Position: 2000 | V=14.0<br>SpT=O3 V((f*)); E(B-V)=0.22; U=12.96; B=13.94; V=14.00; F1160=3.660e-13; F1360=2.720e-13; F1700=2.070e-13 | Reference Frame: ICRS |

*Comments: AV435 : M2002-67670, AzV 435*
*Previous name : AV 435*
*Input file: ULLYSES_Cycle29_MassiveStar_ProgramInput_v5.csv*
*SpT = O3 V((f*))*
*COS/G130M/c1291 : rn(PoWR-OB-new(PoWR_46000_4.00_m6.74_Z0.14.fits, smc-ob-i 46-40, Z=0.140 solar, Teff=46000, log_lum=5.78, log_g=4.00, log_mdot=-6.74) (extinction smcbar=0.220), flux1360 +-2.0A flux=2.7e-13 Flam)*
*COS/G160M/c1611 : rn(PoWR-OB-new(PoWR_46000_4.00_m6.74_Z0.14.fits, smc-ob-i 46-40, Z=0.140 solar, Teff=46000, log_lum=5.78, log_g=4.00, log_mdot=-6.74) (extinction smcbar=0.220), flux1700 +-2.0A flux=2.1e-13 Flam)*
*Coordinate pedigree: Gaia DR2*
*Calculation performed 2021-10-25T00:53:34, v0.9*
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*tstatus; AV435; P/COS approved for submission; S/ins not started; P/RS 24/12/21; S/xx DD/MM/YY*
*tcheck; APT/SIMBAD target names: ; AV435 'AzV 435'*
*tcheck; Target info verification status?; OK*
*tcheck; Coordinates & P.M. verified, epoch checked?; OK*
*tcheck; Adopted SED compared to Observations?; Yes ...*
*There was a discrepancy between FUSE and STIS data on the one hand and COS and IUE on the other ...*
*it was determined that FUSE and STIS had the correct fluxes for the target and a new SED, AV435_PoWR_46000_4.00_m6.74_Z0.14.fits_smcbar_ebmv_0.08_norm_U_sed.fits, matching those data was used*
*Category=STAR*
*Description=[MAIN SEQUENCE O, OF]*
*Extended=NO*

**Exposures**

| # | Label (ETC Run) | Target | Config,Mode,Aperture | Spectral Els. | Opt. Params. | Special Reqs. | Groups | Exp. Time (Total)/[Actual Dur.] | Orbit |
|---|---|---|---|---|---|---|---|---|---|
| 1 | FUV PEAK XD (COS.sa.1748465) | (2) AV435 | COS/FUV, ACQ/PEAKXD, PSA | G130M 1291 A | NUM-POS=3; STEP-SIZE=1.3; CENTER=FLUX-WT | | | 1 Secs (1 Secs)<br>*[==>]* | ***[1]*** |
| | *Comments: Exposure time not yet calculated.* | | | | | | | | |
| 2 | FUV PEAK D (COS.sa.1748465) | (2) AV435 | COS/FUV, ACQ/PEAKD, PSA | G130M 1291 A | NUM-POS=5; STEP-SIZE=0.9; CENTER=FLUX-WT-FLR | | | 1.0 Secs (1 Secs)<br>*[==>]* | ***[1]*** |
| | *Comments: Exposure time not yet calculated.* | | | | | | | | |
| 3 | G130M/1291-3 (COS.sp.1748468) | (2) AV435 | COS/FUV, TIME-TAG, PSA | G130M 1291 A | BUFFER-TIME=1844; FP-POS=3 | | | 1030 Secs (1030 Secs)<br>*[==>]* | ***[1]*** |
| | *Comments: rn(PoWR-OB-new(PoWR_46000_4.00_m6.74_Z0.14.fits, smc-ob-i 46-40, Z=0.140 solar, Teff=46000, log_lum=5.78, log_g=4.00, log_mdot=-6.74) (extinction smcbar=0.220), flux1360 +- 2.0A flux=2.7e-13 Flam); cos,fuv,g130m,c1291,psa,mjd#59670; fp-pos=None, segment=None)*<br>*From file ULLYSES_Cycle29_MassiveStar_ProgramInput_v5.csv*<br>*Spectral type: O3 V((f*))*<br>*SED = AV435_COS_G130M_c1291_sed.fits*<br>*For exptime=1120.5 s, spectral region:*<br>*1150.0 +- 0.5 A achieves SNR=30.0/resel*<br>*global countrate (brightest segment): 3813.0 cts/s/segment*<br>*brightest pixel: 0.089 cts/s/pix at 1243.5 A*<br>*Calculation performed 2021-10-25T00:53:37, v0.9* | | | | | | | | |
| 4 | G130M/1291-4 (COS.sp.1748468) | (2) AV435 | COS/FUV, TIME-TAG, PSA | G130M 1291 A | BUFFER-TIME=1712; FP-POS=4 | | | 1033 Secs (1033 Secs)<br>*[==>]* | ***[1]*** |
| | *Comments: rn(PoWR-OB-new(PoWR_46000_4.00_m6.74_Z0.14.fits, smc-ob-i 46-40, Z=0.140 solar, Teff=46000, log_lum=5.78, log_g=4.00, log_mdot=-6.74) (extinction smcbar=0.220), flux1360 +- 2.0A flux=2.7e-13 Flam); cos,fuv,g130m,c1291,psa,mjd#59670; fp-pos=None, segment=None)*<br>*From file ULLYSES_Cycle29_MassiveStar_ProgramInput_v5.csv*<br>*Spectral type: O3 V((f*))*<br>*SED = AV435_COS_G130M_c1291_sed.fits*<br>*For exptime=1120.5 s, spectral region:*<br>*1150.0 +- 0.5 A achieves SNR=30.0/resel*<br>*global countrate (brightest segment): 3813.0 cts/s/segment*<br>*brightest pixel: 0.089 cts/s/pix at 1243.5 A*<br>*Calculation performed 2021-10-25T00:53:37, v0.9* | | | | | | | | |
| 5 | G160M/1611 (COS.sp.1748469) | (2) AV435 | COS/FUV, TIME-TAG, PSA | G160M 1611 A | BUFFER-TIME=2088; FP-POS=ALL | | | 525 Secs (2100 Secs)<br>*[==>(Split 1)]*<br>*[==>(Split 2)]*<br>*[==>(Split 3)]*<br>*[==>(Split 4)]* | ***[2]*** |
| | *Comments: rn(PoWR-OB-new(PoWR_46000_4.00_m6.74_Z0.14.fits, smc-ob-i 46-40, Z=0.140 solar, Teff=46000, log_lum=5.78, log_g=4.00, log_mdot=-6.74) (extinction smcbar=0.220), flux1700 +- 2.0A flux=2.1e-13 Flam); cos,fuv,g160m,c1611,psa,mjd#59670; fp-pos=None, segment=None)*<br>*From file ULLYSES_Cycle29_MassiveStar_ProgramInput_v5.csv*<br>*Spectral type: O3 V((f*))*<br>*SED = AV435_COS_G160M_c1611_sed.fits*<br>*For exptime=1152.0 s, spectral region:*<br>*1590.0 +- 0.5 A achieves SNR=30.0/resel*<br>*global countrate (brightest segment): 2574.1 cts/s/segment*<br>*brightest pixel: 0.037 cts/s/pix at 1423.5 A*<br>*Calculation performed 2021-10-25T00:53:38, v0.9* | | | | | | | | |

Orbit Structure