# 16093 - ULLYSES LMC Early O/WN Stars - COS

Cycle: 27, Proposal Category: GO/DD

(Availability Mode: SUPPORTED)

**INVESTIGATORS**


| *Name* | *Institution* | *E-Mail* |
|---|---|---|
| **Dr. Julia Christine Roman-Duval (PI) (Contact)** | **Space Telescope Science Institute** | **duval@stsci.edu** |
| Dr. Kenneth Sembach (CoI) | Space Telescope Science Institute | sembach@stsci.edu |
| Dr. Joleen Carlberg (CoI) | Space Telescope Science Institute | jcarlberg@stsci.edu |
| Dr. Charles R. Proffitt (CoI) (Contact) | Space Telescope Science Institute | proffitt@stsci.edu |
| Dr. TalaWanda R. Monroe (CoI) (Contact) | Space Telescope Science Institute | tmonroe@stsci.edu |
| Joanna Taylor (CoI) | Space Telescope Science Institute | jotaylor@stsci.edu |
| Dr. William J. Fischer (CoI) | Space Telescope Science Institute | wfischer@stsci.edu |
| Dr. Alexander W. Fullerton (CoI) (Contact) | Space Telescope Science Institute | fullerton@stsci.edu |
| Dr. Alessandra Aloisi (CoI) | Space Telescope Science Institute | aloisi@stsci.edu |
| Christopher Britt (CoI) | Space Telescope Science Institute | cbritt@stsci.edu |
| Dr. Thomas M. Brown (CoI) | Space Telescope Science Institute | tbrown@stsci.edu |
| Ivo Busko (CoI) | Space Telescope Science Institute | busko@stsci.edu |
| Dr. Gisella De Rosa (CoI) | Space Telescope Science Institute | gderosa@stsci.edu |
| Elaine M Frazer (CoI) | Space Telescope Science Institute | efrazer@stsci.edu |
| Dr. Travis C Fischer (CoI) (ESA Member) | Space Telescope Science Institute - ESA | tfischer@stsci.edu |
| Dr. Bethan Lesley James (CoI) | Space Telescope Science Institute - ESA - JWST | bjames@stsci.edu |
| Robert Jedrzejewski (CoI) | Space Telescope Science Institute | rij@stsci.edu |
| Sean Lockwood (CoI) | Space Telescope Science Institute | lockwood@stsci.edu |
| Dr. Cristina Oliveira (CoI) | Space Telescope Science Institute | oliveira@stsci.edu |
| Rachel Plesha (CoI) | Space Telescope Science Institute | rplesha@stsci.edu |
| Dr. I. Neill Reid (CoI) | Space Telescope Science Institute | inr@stsci.edu |
| Dr. Adric R. Riedel (CoI) | Space Telescope Science Institute | riedel@stsci.edu |

| *Name* | *Institution* | *E-Mail* |
|---|---|---|
| Allyssa Riley (CoI) | Space Telescope Science Institute | ariley@stsci.edu |
| Dr. David J. Sahnow (CoI) | Space Telescope Science Institute | sahnow@stsci.edu |
| Dr. Ravi Sankrit (CoI) | Space Telescope Science Institute | rsankrit@stsci.edu |
| Dr. Richard Shaw (CoI) | Space Telescope Science Institute | shaw@stsci.edu |
| Dr. Linda J. Smith (CoI) (ESA Member) | Space Telescope Science Institute - ESA | lsmith@stsci.edu |
| Dr. Sangmo Tony Sohn (CoI) | Space Telescope Science Institute | tsohn@stsci.edu |
| Dr. Leonardo Ubeda (CoI) | Space Telescope Science Institute | lubeda@stsci.edu |
| Dr. Daniel E. Welty (CoI) | Space Telescope Science Institute | dwelty@stsci.edu |


**VISITS**

| *Visit* | *Targets used in Visit* | *Configurations used in Visit* | *Orbits Used* | *Last Orbit Planner Run* | *OP Current with Visit?* |
|---|---|---|---|---|---|
| 1C | (1) LMCE055-1 | COS/FUV | 3 | 22-Sep-2021 11:00:23.0 | yes |
| AC | (1) LMCE055-1 | COS/FUV | 3 | 22-Sep-2021 11:00:25.0 | yes |
| FC | (1) LMCE055-1 | COS/FUV | 3 | 22-Sep-2021 11:00:26.0 | yes |
| 2C | (2) VFTS-482 | COS/FUV | 2 | 22-Sep-2021 11:00:27.0 | yes |
| 3C | (3) W61-28-5 | COS/FUV | 3 | 22-Sep-2021 11:00:29.0 | yes |

14 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 16093, LMCE055-1-COS (1C), failed** Wed Sep 22 15:00:30 GMT 2021

**Diagnostic Status: No Diagnostics**

Scientific Instruments: COS/FUV

Special Requirements: SCHED 100%; AFTER 01-MAY-2021:00:00:00; ON HOLD

*Comments: vstatus; 1C; LMCE055-1; P/COS approved for submission; P/AF 10/08/20 ; intrev: complete; P/CP 05/10/20*
*vcheck; Enter targ name & Inst. & Resp. Sci.; LMCE055-1 ; COS ; AF*
*vcheck; ETC numbers entered in APT?; Completed*
*vcheck; Any screening violations?; None*
*vcheck; S/N ETC calcs done & documented?; Yes*
*vcheck; Field images checked & saved?; Yes - LMCE055-1_DSS.png and LMCE055-1_2MASS.png*
*vcheck; Selected ACQ strategy?; Dispersed 1291*
*vcheck; Possible ACQ or Sci spoilers?; None*
*vcheck; Field BOT clear?; Yes - 3 safe, 0 unknown*
*vcheck; Visual BOT check for stars not in catalog?; Completed*
*vcheck; Orbit packing finalized?; 3 orbits*
*vcheck; Buffer times optimized?; Done*
*vcheck; Verify visit grouping correct; Not applicable*
*vcheck; Is visit ready for int. review?; Yes*
*Allocated COS orbits = 3*

*On Hold Comments: On Hold until the end of the proprietary period for GO-16299 COS G140L/800 observations of LMCe055-1. The GO-16299 observations executed on October 3, 2020. Presuming their success, the proprietary period ends on April 4, 2021. To allow a brief period to check the flux levels used to plan the ULLYSES observations, an AFTER = 01-MAY-2021 constraint has also been set.*

**Fixed Targets**

| # | Name | Target Coordinates | Targ. Coord. Corrections | Fluxes | Miscellaneous |
|---|---|---|---|---|---|
| (1) | LMCE055-1 | RA: 04 56 48.8167 (74.2034029d) | | V=16.15 | Reference Frame: ICRS |
| | Alt Name1: MNM2015-LMCE055-1 | Dec: -69 36 40.61 (-69.61128d) | | SpT=WN4/O4; E(B-V)=0.18; V =16.15, | |
| | | Equinox: J2000 | | | |
| | Alt Name2: OGLE-LMC-ECL-3548 | | | B=16.05 | |

*Comments: LMCE055-1 : LMCe055-1, [MNM2015] LMCe055-1*
*Previous name : LMCe055-1*
*Input file: LMC_2020Feb20/input/LMC_all_do1_fixed_wr_NewCoords_pids.csv*
*SIMBAD link ([MNM2015] LMCe055-1): https://simbad.u-strasbg.fr/simbad/sim-id?Ident=[MNM2015]+LMCe055-1&submit=submit+id*
*SpT = WN4/O4*
*COS/G130M/c1096 : rn(CMFGEN-WN(model=9, Z=0.008, Teff=80000), johnson V mag=16.150 vegamag)*
*COS/G130M/c1291 : rn(CMFGEN-WN(model=9, Z=0.008, Teff=80000), johnson V mag=16.150 vegamag)*
*COS/G160M/c1611 : rn(CMFGEN-WN(model=9, Z=0.008, Teff=80000), johnson V mag=16.150 vegamag)*
*COS/G185M/c1921 : rn(CMFGEN-WN(model=9, Z=0.008, Teff=80000), johnson V mag=16.150 vegamag)*
*COS/G185M/c1953 : rn(CMFGEN-WN(model=9, Z=0.008, Teff=80000), johnson V mag=16.150 vegamag)*
*COS/G185M/c1986 : rn(CMFGEN-WN(model=9, Z=0.008, Teff=80000), johnson V mag=16.150 vegamag)*
*STIS/E140M/c1425 : rn(CMFGEN-WN(model=9, Z=0.008, Teff=80000), johnson V mag=16.150 vegamag)*
*STIS/E230M/c1978 : rn(CMFGEN-WN(model=9, Z=0.008, Teff=80000), johnson V mag=16.150 vegamag)*
*STIS/E230M/c2707 : rn(CMFGEN-WN(model=9, Z=0.008, Teff=80000), johnson V mag=16.150 vegamag)*
*Coordinate pedigree: Gaia*
*Calculation performed 2020-02-24T18:09:14, v0.4*
---
*tstatus; LMCE055-1; P/COS approved for submission; S/ins not started; P/AF 15/09/20; S/xx DD/MM/YY*
*tcheck; APT/SIMBAD target names: 'MNM2015 LMCe055-1', OGLE LMC-ECL-3548, GAIA DR2 4655168748370602880*
*tcheck; Target info verification status?; OK - SIMBAD does not record the SpType, which comes from 2017ApJ...837..122M*
*tcheck; Coordinates & P.M. updated?; Yes - Gaia DR2 2015.5 coords - PM set to 0*
*tcheck; Adopted SED compared to Observations?; Yes ...*
*The spectral classification denotes a newly recognized class of Wolf-Rayet stars whose spectra are characterized by the emission-line spectrum of a WN3 or WN4 star and an absorption-line spectrum of an O3 or O4 star. The objects in this class are substantially under-luminous compared to an O3 or O4 dwarf, so the spectrum cannot in general be considered to be a simple composite arising from a WR+O binary system. LMCe055-1 is an interesting exception in this regard, since it is known to be a detached or semi-detached member of an eclipsing binary system with a period of 2.159 days. Even so, Massey et al. (2017ApJ...837..122M) argue that the companion cannot be a massive star because the system is very under-luminous and its light curve does not exhibit the ellipsoidal variations that are expected.*

*The evolutionary status of the WN3/O3 and WN4/O4 stars is unknown. They may be the product of binary evolution, in which case the WN spectrum comes from the very hot stellar core that remains after it is stripped of its outer envelope during a Roche-lob overflow event. LMCe055-1 is an interesting test case for this hypothesis since it is known to be a member of a binary system. Alternately, these stars may represent a "missing link" in the normal evolutionary path traversed by an O star as it becomes a WN star. This interpretation is bolstered by the hybrid appearance of the spectrum, which evidently results from mass-loss rates that are more akin to O-stars and than the general WNE population. For similar input parameters, model atmospheres computed with CMFGEN for "stripped" stars (Gotberg et al. 2018A&A...615A..78G) are very similar in appearance to models of WN4 stars computed with PoWR (2015A&A...579A..75T), though (a) the flux of the "stripped" core must be increased by an order of magnitude or more to match the flux from the WN4 module; and (b) the He II 1640 line is about twice as strong in the "stripped" model. For a comparison, see*
*~/box/ullyses_tech/ullyses_proposals/c27_mc/16093/LMCE055-1/LMCE055-1_stripped_vs_wn4.pdf*

*For present purposes, a PoWR model appropriate to a WN4 star has been adopted. This model does not account for the H and HeII absorption features, which are not as much of a concern in terms of detector health & safety as the emission features. It also assumes that the WN4/O4 star is the dominant source of UV light from the binary system. The adopted model comes from the PoWR lmc-h40 grid (with "enhanced" hydrogen abundance of 0.40 by mass and metallicity appropriate to the LMC) with Teff = 70.795 kK, log g = 4.57, and a (comparatively small) mass-loss rate of logMdot = -6.89 Msun/year. The model flux has been extinguished by an LMC average extinction law with E(B-V) = 0.19. This value was adjusted to improve modestly the fit with the available UBV photometry, and is consistent with the value quoted by Massey et al. (2017ApJ...837..122M) of E(B-V) = 0.18.*
*Adopted illustrated: ~/box/ullyses_tech/ullyses_proposals/c27_mc/16093/LMCE055-1/LMCE055-1_adopted_sed_vs_UBV.png*
*Adopted SED: ~/box/ullyses_tech/ullyses_proposals/c27_mc/16093/LMCE055-1/LMCE055-1_adopted_sed.fits*

*Of course, extrapolating the UV spectrum from optical photometry alone entails risks. Even so, the anticipated flux levels do not appear to pose any health & safety risks for the COS detectors.*
*Category=EXT-STAR*
*Description=[WOLF RAYET - WN]*
*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/PEAKXD (COS.sa.1460685) | (1) LMCE055-1 | COS/FUV, ACQ/PEAKXD, PSA | G130M 1291 A | CENTER=FLUX-WT; NUM-POS=3; STEP-SIZE=1.3; SEGMENT=BOTH | | | 1.1 Secs (1.1 Secs) *[==>]* | ***[1]*** |

*Comments: SED PoWR_70795_4.57_m6.89_Z0.50_lmcavg_ebmv_0.19_sed.fits*
*~/box/ullyses_tech/ullyses_proposals/c27_mc/16093/LMCE055-1/LMCE055-1_adopted_sed.fits*

*ETC estimates an exposure time of 1.0503 s per dwell point. Rounded up to 1.1 s per dwell point.*

*BOT: 3 safe, 0 unknown*

| # | Label (ETC Run) | Target | Config,Mode,Aperture | Spectral Els. | Opt. Params. | Special Reqs. | Groups | Exp. Time (Total)/[Actual Dur.] | Orbit |
|---|---|---|---|---|---|---|---|---|---|
| 2 | ACQ/PEAKD (COS.sa.1460685) | (1) LMCE055-1 | COS/FUV, ACQ/PEAKD, PSA | G130M 1291 A | CENTER=FLUX-WT-FLR; NUM-POS=5; STEP-SIZE=0.9; SEGMENT=BOTH | | | 1.1 Secs (1.1 Secs) *[==>]* | ***[1]*** |

*Comments: SED PoWR_70795_4.57_m6.89_Z0.50_lmcavg_ebmv_0.19_sed.fits*
*~/box/ullyses_tech/ullyses_proposals/c27_mc/16093/LMCE055-1/LMCE055-1_adopted_sed.fits*

*ETC estimates an exposure time of 1.0503 s per dwell point. Rounded up to 1.1 s per dwell point.*

*BOT: 5 safe, 0 unknown*

| # | Label (ETC Run) | Target | Config,Mode,Aperture | Spectral Els. | Opt. Params. | Special Reqs. | Groups | Exp. Time (Total)/[Actual Dur.] | Orbit |
|---|---|---|---|---|---|---|---|---|---|
| 3 | G130M/1291-3 (COS.sp.1460677) | (1) LMCE055-1 | COS/FUV, TIME-TAG, PSA | G130M 1291 A | BUFFER-TIME=716; FP-POS=3 | | | 1030 Secs (1030 Secs) *[==>]* | ***[1]*** |

*Comments: SED PoWR_70795_4.57_m6.89_Z0.50_lmcavg_ebmv_0.19_sed.fits*
*~/box/ullyses_tech/ullyses_proposals/c27_mc/16093/LMCE055-1/LMCE055-1_adopted_sed.fits*

*ETC estimates SNR = 30/resel at 1150 +/- 0.5 A in 2,718.1280 s*
*Baseline exposure time rounded to 2720 s (1360 s per FP-POS)*
*countrate (total, brightest segment) = (2193.7, 1269.4) cts/s*
*brightest pixel: 0.105 cts/s at 1216.2 A*
*BUFFER-TIME = 2/3 * 1075 s = 716 s*

*Final exptime decreased during orbit packing to 1030 s per FP-POS; 2060 s total. This reduction amounts to 76% of the exposure time required to achieve the target value of SNR=30. Although it violates the mandate to reduce the nominal exposure time by no more than 80%, the trade-off is acceptable in this case. Estimated SNR at 1150 A = 26.1 per resel (COS.sp.1460691)*

*BOT: 3 safe, 0 unknown*

| # | Label (ETC Run) | Target | Config,Mode,Aperture | Spectral Els. | Opt. Params. | Special Reqs. | Groups | Exp. Time (Total)/[Actual Dur.] | Orbit |
|---|---|---|---|---|---|---|---|---|---|
| 4 | G130M/1291-4 (COS.sp.1460677) | (1) LMCE055-1 | COS/FUV, TIME-TAG, PSA | G130M 1291 A | BUFFER-TIME=716.0; FP-POS=4 | | | 1030 Secs (1030 Secs) *[==>]* | ***[1]*** |

*Comments: SED PoWR_70795_4.57_m6.89_Z0.50_lmcavg_ebmv_0.19_sed.fits*
*~/box/ullyses_tech/ullyses_proposals/c27_mc/16093/LMCE055-1/LMCE055-1_adopted_sed.fits*

*ETC estimates SNR = 30/resel at 1150 +/- 0.5 A in 2,718.1280 s*
*Baseline exposure time rounded to 2720 s (1360 s per FP-POS)*
*countrate (total, brightest segment) = (2193.7, 1269.4) cts/s*
*brightest pixel: 0.105 cts/s at 1216.2 A*
*BUFFER-TIME = 2/3 * 1075 s = 716 s*

*Final exptime decreased during orbit packing to 1030 s per FP-POS; 2060 s total. This reduction amounts to 76% of the exposure time required to achieve the target value of SNR=30. Although it violates the mandate to reduce the nominal exposure time by no more than 80%, the trade-off is acceptable in this case. Estimated SNR at 1150 A = 26.1 per resel (COS.sp.1460691)*

*BOT: 3 safe, 0 unknown*

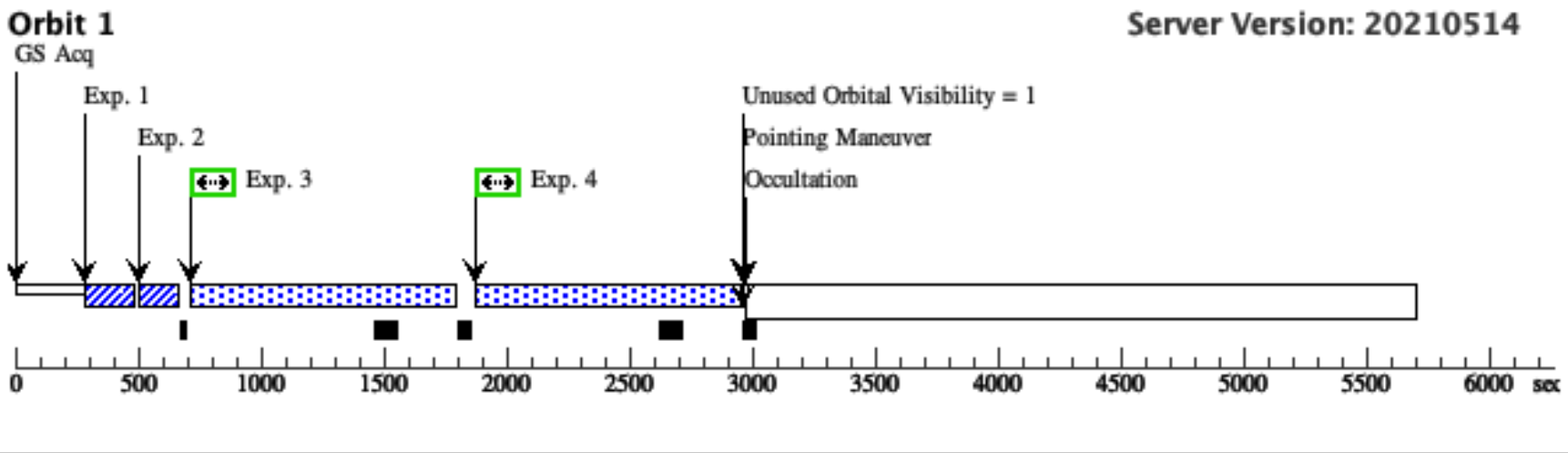
| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | 5 | G160M/1611 (COS.sp.1460681) | (1) LMCE055-1 | COS/FUV, TIME-TAG, PSA | G160M 1611 A | BUFFER-TIME=1680.0; FP-POS=ALL | 1175 Secs (4700 Secs)<br>*[==>(Split 1)]*<br>*[==>(Split 2)]*<br>*[==>(Split 3)]*<br>*[==>(Split 4)]* | <br>***[2]***<br>***[3]*** |

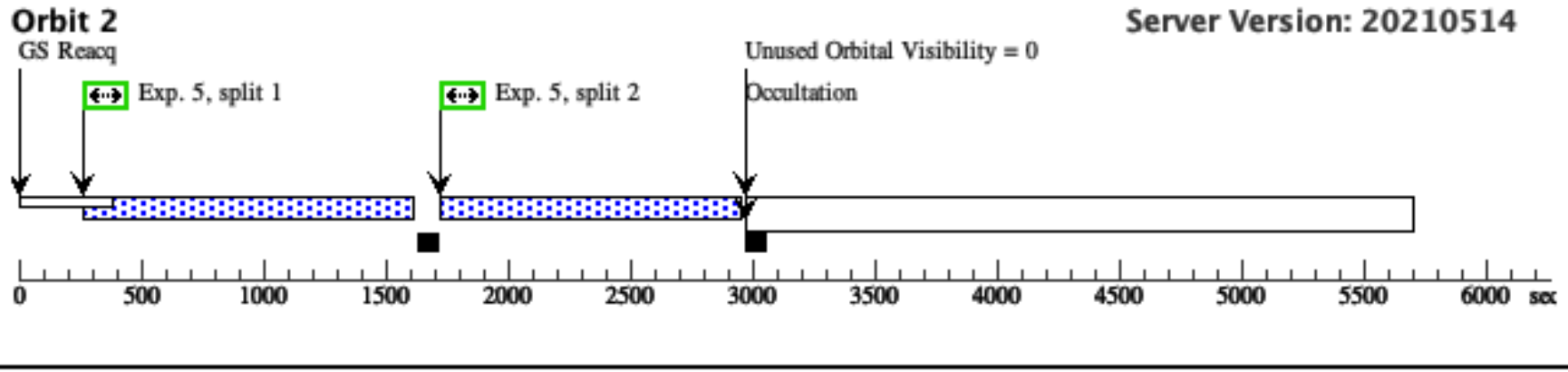
*Comments: SED PoWR_70795_4.57_m6.89_Z0.50_lmcavg_ebmv_0.19_sed.fits*
*~/box/ullyses_tech/ullyses_proposals/c27_mc/16093/LMCE055-1/LMCE055-1_adopted_sed.fits*

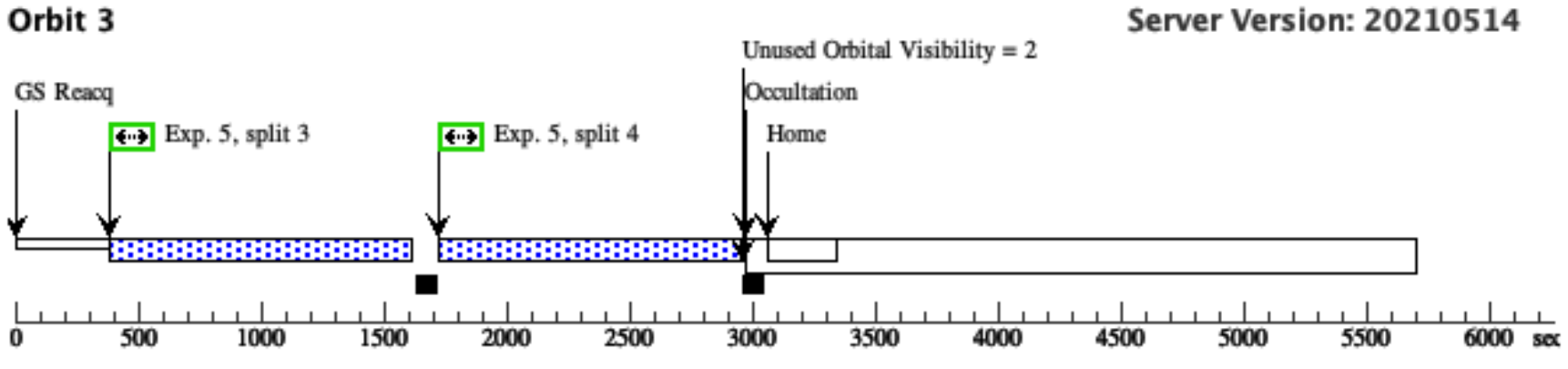
*ETC estimates SNR = 30/resel at 1590 +/- 0.5 A in 5,128.2952 s*
*Baseline exposure time rounded to 5128 s (1282 s per FP-POS)*
*countrate (total, brightest segment) = (935.6, 725.8) cts/s*
*brightest pixel: 0.011 cts/s at 1421.6 A*
*BUFFER-TIME = 2/3 * 2521 s = 1680 s*
*Final exptime decreased during orbit packing to 1175 s per FP-POS; 4700 s total. Estimated SNR at 1590 A = 28.7 per resel (COS.sp.1460690)*

*BOT: 3 safe, 0 unknown*

Orbit Structure



**Visit**

**Proposal 16093, LMCE055-1-COS (AC), completed** Wed Sep 22 15:00:30 GMT 2021

**Diagnostic Status: No Diagnostics**

Scientific Instruments: COS/FUV

Special Requirements: SCHED 100%; AFTER 01-MAY-2021:00:00:00; ON HOLD

*Comments: vstatus; 1C; LMCE055-1; P/COS approved for submission; P/AF 10/08/20 ; intrev: complete; P/CP 05/10/20*
*vcheck; Enter targ name & Inst. & Resp. Sci.; LMCE055-1 ; COS ; AF*
*vcheck; ETC numbers entered in APT?; Completed*
*vcheck; Any screening violations?; None*
*vcheck; S/N ETC calcs done & documented?; Yes*
*vcheck; Field images checked & saved?; Yes - LMCE055-1_DSS.png and LMCE055-1_2MASS.png*
*vcheck; Selected ACQ strategy?; Dispersed 1291*
*vcheck; Possible ACQ or Sci spoilers?; None*
*vcheck; Field BOT clear?; Yes - 3 safe, 0 unknown*
*vcheck; Visual BOT check for stars not in catalog?; Completed*
*vcheck; Orbit packing finalized?; 3 orbits*
*vcheck; Buffer times optimized?; Done*
*vcheck; Verify visit grouping correct; Not applicable*
*vcheck; Is visit ready for int. review?; Yes*
*Allocated COS orbits = 3*

*On Hold Comments: On Hold until the end of the proprietary period for GO-16299 COS G140L/800 observations of LMCe055-1. The GO-16299 observations executed on October 3, 2020. Presuming their success, the proprietary period ends on April 4, 2021. To allow a brief period to check the flux levels used to plan the ULLYSES observations, an AFTER = 01-MAY-2021 constraint has also been set.*

**Fixed Targets**

| # | Name | Target Coordinates | Targ. Coord. Corrections | Fluxes | Miscellaneous |
|---|---|---|---|---|---|
| (1) | LMCE055-1 | RA: 04 56 48.8167 (74.2034029d) | | V=16.15 | Reference Frame: ICRS |
| | Alt Name1: MNM2015-LMCE055-1 | Dec: -69 36 40.61 (-69.61128d) | | SpT=WN4/O4; E(B-V)=0.18; V =16.15, | |
| | | Equinox: J2000 | | | |
| | Alt Name2: OGLE-LMC-ECL-3548 | | | B=16.05 | |

*Comments: LMCE055-1 : LMCe055-1, [MNM2015] LMCe055-1*
*Previous name : LMCe055-1*
*Input file: LMC_2020Feb20/input/LMC_all_do1_fixed_wr_NewCoords_pids.csv*
*SIMBAD link ([MNM2015] LMCe055-1): https://simbad.u-strasbg.fr/simbad/sim-id?Ident=[MNM2015]+LMCe055-1&submit=submit+id*
*SpT = WN4/O4*
*COS/G130M/c1096 : rn(CMFGEN-WN(model=9, Z=0.008, Teff=80000), johnson V mag=16.150 vegamag)*
*COS/G130M/c1291 : rn(CMFGEN-WN(model=9, Z=0.008, Teff=80000), johnson V mag=16.150 vegamag)*
*COS/G160M/c1611 : rn(CMFGEN-WN(model=9, Z=0.008, Teff=80000), johnson V mag=16.150 vegamag)*
*COS/G185M/c1921 : rn(CMFGEN-WN(model=9, Z=0.008, Teff=80000), johnson V mag=16.150 vegamag)*
*COS/G185M/c1953 : rn(CMFGEN-WN(model=9, Z=0.008, Teff=80000), johnson V mag=16.150 vegamag)*
*COS/G185M/c1986 : rn(CMFGEN-WN(model=9, Z=0.008, Teff=80000), johnson V mag=16.150 vegamag)*
*STIS/E140M/c1425 : rn(CMFGEN-WN(model=9, Z=0.008, Teff=80000), johnson V mag=16.150 vegamag)*
*STIS/E230M/c1978 : rn(CMFGEN-WN(model=9, Z=0.008, Teff=80000), johnson V mag=16.150 vegamag)*
*STIS/E230M/c2707 : rn(CMFGEN-WN(model=9, Z=0.008, Teff=80000), johnson V mag=16.150 vegamag)*
*Coordinate pedigree: Gaia*
*Calculation performed 2020-02-24T18:09:14, v0.4*
---
*tstatus; LMCE055-1; P/COS approved for submission; S/ins not started; P/AF 15/09/20; S/xx DD/MM/YY*
*tcheck; APT/SIMBAD target names: 'MNM2015 LMCe055-1', OGLE LMC-ECL-3548, GAIA DR2 4655168748370602880*
*tcheck; Target info verification status?; OK - SIMBAD does not record the SpType, which comes from 2017ApJ...837..122M*
*tcheck; Coordinates & P.M. updated?; Yes - Gaia DR2 2015.5 coords - PM set to 0*
*tcheck; Adopted SED compared to Observations?; Yes ...*
*The spectral classification denotes a newly recognized class of Wolf-Rayet stars whose spectra are characterized by the emission-line spectrum of a WN3 or WN4 star and an absorption-line spectrum of an O3 or O4 star. The objects in this class are substantially under-luminous compared to an O3 or O4 dwarf, so the spectrum cannot in general be considered to be a simple composite arising from a WR+O binary system. LMCe055-1 is an interesting exception in this regard, since it is known to be a detached or semi-detached member of an eclipsing binary system with a period of 2.159 days. Even so, Massey et al. (2017ApJ...837..122M) argue that the companion cannot be a massive star because the system is very under-luminous and its light curve does not exhibit the ellipsoidal variations that are expected.*

*The evolutionary status of the WN3/O3 and WN4/O4 stars is unknown. They may be the product of binary evolution, in which case the WN spectrum comes from the very hot stellar core that remains after it is stripped of its outer envelope during a Roche-lob overflow event. LMCe055-1 is an interesting test case for this hypothesis since it is known to be a member of a binary system. Alternately, these stars may represent a "missing link" in the normal evolutionary path traversed by an O star as it becomes a WN star. This interpretation is bolstered by the hybrid appearance of the spectrum, which evidently results from mass-loss rates that are more akin to O-stars and than the general WNE population. For similar input parameters, model atmospheres computed with CMFGEN for "stripped" stars (Gotberg et al. 2018A&A...615A..78G) are very similar in appearance to models of WN4 stars computed with PoWR (2015A&A...579A..75T), though (a) the flux of the "stripped" core must be increased by an order of magnitude or more to match the flux from the WN4 module; and (b) the He II 1640 line is about twice as strong in the "stripped" model. For a comparison, see*
*~/box/ullyses_tech/ullyses_proposals/c27_mc/16093/LMCE055-1/LMCE055-1_stripped_vs_wn4.pdf*

*For present purposes, a PoWR model appropriate to a WN4 star has been adopted. This model does not account for the H and HeII absorption features, which are not as much of a concern in terms of detector health & safety as the emission features. It also assumes that the WN4/O4 star is the dominant source of UV light from the binary system. The adopted model comes from the PoWR lmc-h40 grid (with "enhanced" hydrogen abundance of 0.40 by mass and metallicity appropriate to the LMC) with Teff = 70.795 kK, log g = 4.57, and a (comparatively small) mass-loss rate of logMdot = -6.89 Msun/year. The model flux has been extinguished by an LMC average extinction law with E(B-V) = 0.19. This value was adjusted to improve modestly the fit with the available UBV photometry, and is consistent with the value quoted by Massey et al. (2017ApJ...837..122M) of E(B-V) = 0.18.*
*Adopted illustrated: ~/box/ullyses_tech/ullyses_proposals/c27_mc/16093/LMCE055-1/LMCE055-1_adopted_sed_vs_UBV.png*
*Adopted SED: ~/box/ullyses_tech/ullyses_proposals/c27_mc/16093/LMCE055-1/LMCE055-1_adopted_sed.fits*

*Of course, extrapolating the UV spectrum from optical photometry alone entails risks. Even so, the anticipated flux levels do not appear to pose any health & safety risks for the COS detectors.*
*Category=EXT-STAR*
*Description=[WOLF RAYET - WN]*
*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/PEAKXD (COS.sa.1460685) | (1) LMCE055-1 | COS/FUV, ACQ/PEAKXD, PSA | G130M 1291 A | CENTER=FLUX-WT; NUM-POS=3; STEP-SIZE=1.3; SEGMENT=BOTH | | | 1.1 Secs (1.1 Secs) *[==>]* | ***[1]*** |

*Comments: SED PoWR_70795_4.57_m6.89_Z0.50_lmcavg_ebmv_0.19_sed.fits*
*~/box/ullyses_tech/ullyses_proposals/c27_mc/16093/LMCE055-1/LMCE055-1_adopted_sed.fits*

*ETC estimates an exposure time of 1.0503 s per dwell point. Rounded up to 1.1 s per dwell point.*

*BOT: 3 safe, 0 unknown*

| # | Label (ETC Run) | Target | Config,Mode,Aperture | Spectral Els. | Opt. Params. | Special Reqs. | Groups | Exp. Time (Total)/[Actual Dur.] | Orbit |
|---|---|---|---|---|---|---|---|---|---|
| 2 | ACQ/PEAKD (COS.sa.1460685) | (1) LMCE055-1 | COS/FUV, ACQ/PEAKD, PSA | G130M 1291 A | CENTER=FLUX-WT-FLR; NUM-POS=5; STEP-SIZE=0.9; SEGMENT=BOTH | | | 1.1 Secs (1.1 Secs) *[==>]* | ***[1]*** |

*Comments: SED PoWR_70795_4.57_m6.89_Z0.50_lmcavg_ebmv_0.19_sed.fits*
*~/box/ullyses_tech/ullyses_proposals/c27_mc/16093/LMCE055-1/LMCE055-1_adopted_sed.fits*

*ETC estimates an exposure time of 1.0503 s per dwell point. Rounded up to 1.1 s per dwell point.*

*BOT: 5 safe, 0 unknown*

| # | Label (ETC Run) | Target | Config,Mode,Aperture | Spectral Els. | Opt. Params. | Special Reqs. | Groups | Exp. Time (Total)/[Actual Dur.] | Orbit |
|---|---|---|---|---|---|---|---|---|---|
| 3 | G130M/1291-3 (COS.sp.1460677) | (1) LMCE055-1 | COS/FUV, TIME-TAG, PSA | G130M 1291 A | BUFFER-TIME=716; FP-POS=3 | | | 1030 Secs (1030 Secs) *[==>]* | ***[1]*** |

*Comments: SED PoWR_70795_4.57_m6.89_Z0.50_lmcavg_ebmv_0.19_sed.fits*
*~/box/ullyses_tech/ullyses_proposals/c27_mc/16093/LMCE055-1/LMCE055-1_adopted_sed.fits*

*ETC estimates SNR = 30/resel at 1150 +/- 0.5 A in 2,718.1280 s*
*Baseline exposure time rounded to 2720 s (1360 s per FP-POS)*
*countrate (total, brightest segment) = (2193.7, 1269.4) cts/s*
*brightest pixel: 0.105 cts/s at 1216.2 A*
*BUFFER-TIME = 2/3 * 1075 s = 716 s*

*Final exptime decreased during orbit packing to 1030 s per FP-POS; 2060 s total. This reduction amounts to 76% of the exposure time required to achieve the target value of SNR=30. Although it violates the mandate to reduce the nominal exposure time by no more than 80%, the trade-off is acceptable in this case. Estimated SNR at 1150 A = 26.1 per resel (COS.sp.1460691)*

*BOT: 3 safe, 0 unknown*

| # | Label (ETC Run) | Target | Config,Mode,Aperture | Spectral Els. | Opt. Params. | Special Reqs. | Groups | Exp. Time (Total)/[Actual Dur.] | Orbit |
|---|---|---|---|---|---|---|---|---|---|
| 4 | G130M/1291-4 (COS.sp.1460677) | (1) LMCE055-1 | COS/FUV, TIME-TAG, PSA | G130M 1291 A | BUFFER-TIME=716.0; FP-POS=4 | | | 1030 Secs (1030 Secs) *[==>]* | ***[1]*** |

*Comments: SED PoWR_70795_4.57_m6.89_Z0.50_lmcavg_ebmv_0.19_sed.fits*
*~/box/ullyses_tech/ullyses_proposals/c27_mc/16093/LMCE055-1/LMCE055-1_adopted_sed.fits*

*ETC estimates SNR = 30/resel at 1150 +/- 0.5 A in 2,718.1280 s*
*Baseline exposure time rounded to 2720 s (1360 s per FP-POS)*
*countrate (total, brightest segment) = (2193.7, 1269.4) cts/s*
*brightest pixel: 0.105 cts/s at 1216.2 A*
*BUFFER-TIME = 2/3 * 1075 s = 716 s*

*Final exptime decreased during orbit packing to 1030 s per FP-POS; 2060 s total. This reduction amounts to 76% of the exposure time required to achieve the target value of SNR=30. Although it violates the mandate to reduce the nominal exposure time by no more than 80%, the trade-off is acceptable in this case. Estimated SNR at 1150 A = 26.1 per resel (COS.sp.1460691)*

*BOT: 3 safe, 0 unknown*

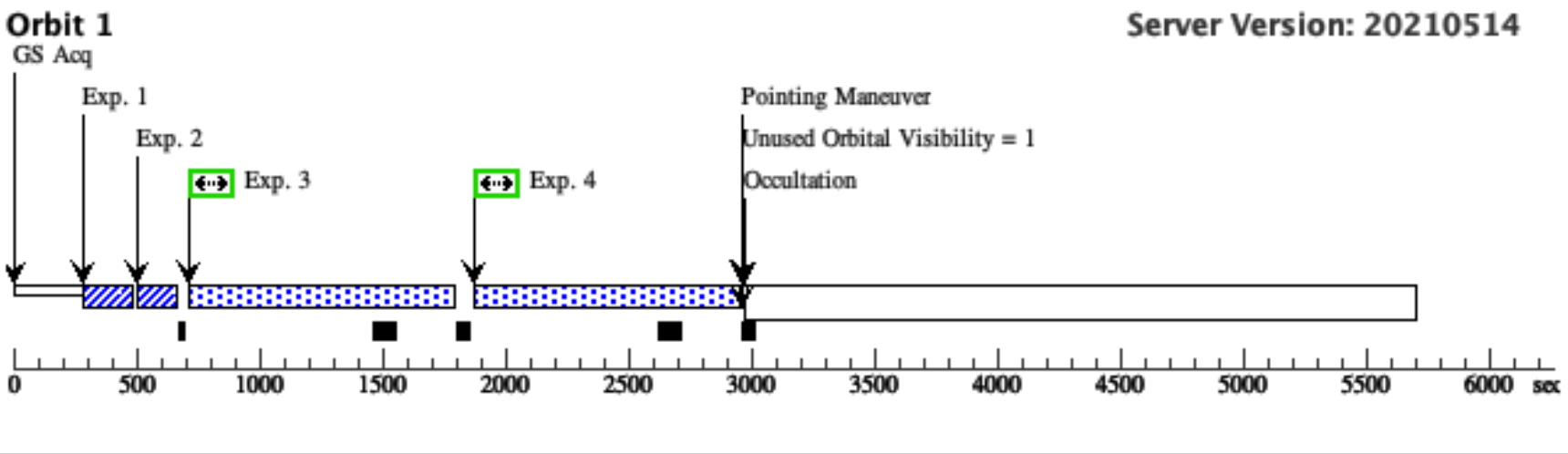
| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | 5 | G160M/1611 (COS.sp.1460681) | (1) LMCE055-1 | COS/FUV, TIME-TAG, PSA | G160M 1611 A | BUFFER-TIME=1680.0; FP-POS=ALL | 1175 Secs (4700 Secs)<br>*[==>(Split 1)]*<br>*[==>(Split 2)]*<br>*[==>(Split 3)]*<br>*[==>(Split 4)]* | <br>***[2]***<br>***[3]*** |

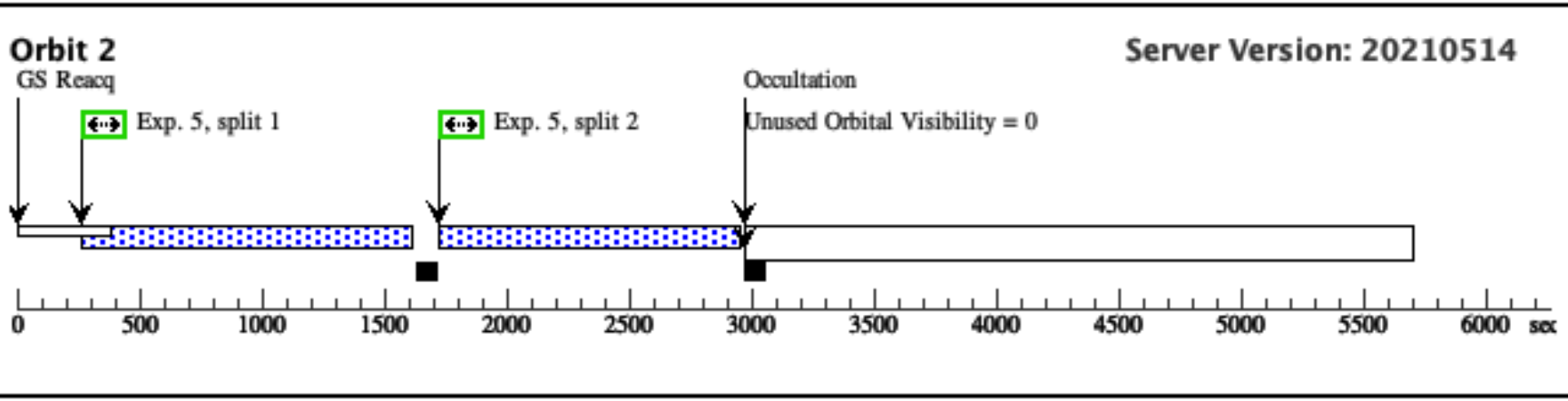
*Comments: SED PoWR_70795_4.57_m6.89_Z0.50_lmcavg_ebmv_0.19_sed.fits*
*~/box/ullyses_tech/ullyses_proposals/c27_mc/16093/LMCE055-1/LMCE055-1_adopted_sed.fits*

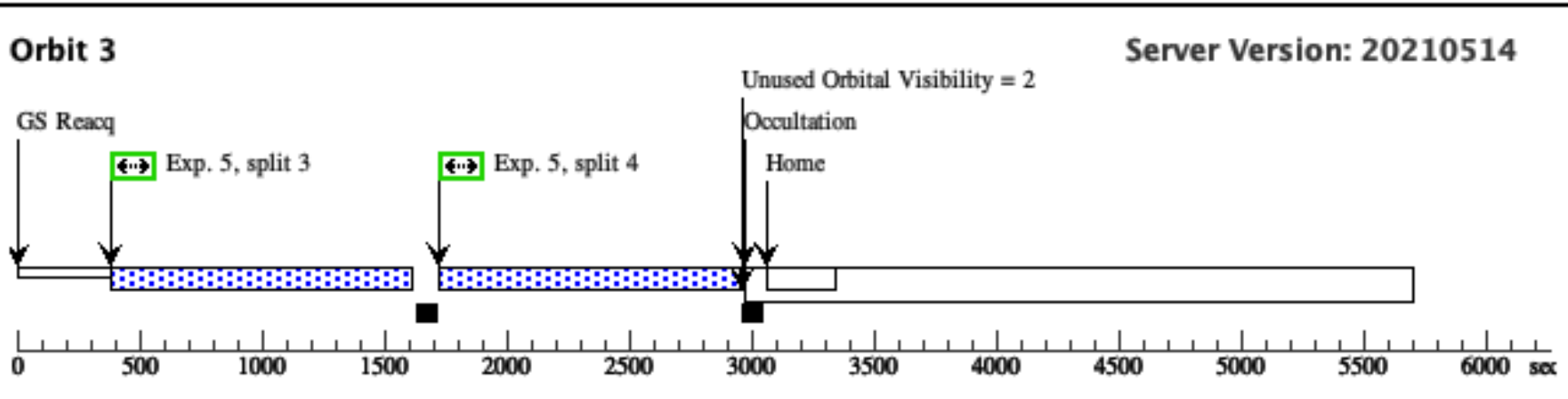
*ETC estimates SNR = 30/resel at 1590 +/- 0.5 A in 5,128.2952 s*
*Baseline exposure time rounded to 5128 s (1282 s per FP-POS)*
*countrate (total, brightest segment) = (935.6, 725.8) cts/s*
*brightest pixel: 0.011 cts/s at 1421.6 A*
*BUFFER-TIME = 2/3 * 2521 s = 1680 s*
*Final exptime decreased during orbit packing to 1175 s per FP-POS; 4700 s total. Estimated SNR at 1590 A = 28.7 per resel (COS.sp.1460690)*

*BOT: 3 safe, 0 unknown*

Orbit Structure



**Visit**

**Proposal 16093, LMCE055-1-COS (FC)** Wed Sep 22 15:00:30 GMT 2021

**Diagnostic Status: No Diagnostics**

Scientific Instruments: COS/FUV

Special Requirements: SCHED 100%; AFTER 01-MAY-2021:00:00:00; ON HOLD

*Comments: vstatus; 1C; LMCE055-1; P/COS approved for submission; P/AF 10/08/20 ; intrev: complete; P/CP 05/10/20*
*vcheck; Enter targ name & Inst. & Resp. Sci.; LMCE055-1 ; COS ; AF*
*vcheck; ETC numbers entered in APT?; Completed*
*vcheck; Any screening violations?; None*
*vcheck; S/N ETC calcs done & documented?; Yes*
*vcheck; Field images checked & saved?; Yes - LMCE055-1_DSS.png and LMCE055-1_2MASS.png*
*vcheck; Selected ACQ strategy?; Dispersed 1291*
*vcheck; Possible ACQ or Sci spoilers?; None*
*vcheck; Field BOT clear?; Yes - 3 safe, 0 unknown*
*vcheck; Visual BOT check for stars not in catalog?; Completed*
*vcheck; Orbit packing finalized?; 3 orbits*
*vcheck; Buffer times optimized?; Done*
*vcheck; Verify visit grouping correct; Not applicable*
*vcheck; Is visit ready for int. review?; Yes*
*Allocated COS orbits = 3*

*On Hold Comments: On Hold until the end of the proprietary period for GO-16299 COS G140L/800 observations of LMCe055-1. The GO-16299 observations executed on October 3, 2020. Presuming their success, the proprietary period ends on April 4, 2021. To allow a brief period to check the flux levels used to plan the ULLYSES observations, an AFTER = 01-MAY-2021 constraint has also been set.*

**Fixed Targets**

| # | Name | Target Coordinates | Targ. Coord. Corrections | Fluxes | Miscellaneous |
|---|---|---|---|---|---|
| (1) | LMCE055-1 | RA: 04 56 48.8167 (74.2034029d) | | V=16.15 | Reference Frame: ICRS |
| | Alt Name1: MNM2015-LMCE055-1 | Dec: -69 36 40.61 (-69.61128d) | | SpT=WN4/O4; E(B-V)=0.18; V =16.15, | |
| | | Equinox: J2000 | | | |
| | Alt Name2: OGLE-LMC-ECL-3548 | | | B=16.05 | |

*Comments: LMCE055-1 : LMCe055-1, [MNM2015] LMCe055-1*
*Previous name : LMCe055-1*
*Input file: LMC_2020Feb20/input/LMC_all_do1_fixed_wr_NewCoords_pids.csv*
*SIMBAD link ([MNM2015] LMCe055-1): https://simbad.u-strasbg.fr/simbad/sim-id?Ident=[MNM2015]+LMCe055-1&submit=submit+id*
*SpT = WN4/O4*
*COS/G130M/c1096 : rn(CMFGEN-WN(model=9, Z=0.008, Teff=80000), johnson V mag=16.150 vegamag)*
*COS/G130M/c1291 : rn(CMFGEN-WN(model=9, Z=0.008, Teff=80000), johnson V mag=16.150 vegamag)*
*COS/G160M/c1611 : rn(CMFGEN-WN(model=9, Z=0.008, Teff=80000), johnson V mag=16.150 vegamag)*
*COS/G185M/c1921 : rn(CMFGEN-WN(model=9, Z=0.008, Teff=80000), johnson V mag=16.150 vegamag)*
*COS/G185M/c1953 : rn(CMFGEN-WN(model=9, Z=0.008, Teff=80000), johnson V mag=16.150 vegamag)*
*COS/G185M/c1986 : rn(CMFGEN-WN(model=9, Z=0.008, Teff=80000), johnson V mag=16.150 vegamag)*
*STIS/E140M/c1425 : rn(CMFGEN-WN(model=9, Z=0.008, Teff=80000), johnson V mag=16.150 vegamag)*
*STIS/E230M/c1978 : rn(CMFGEN-WN(model=9, Z=0.008, Teff=80000), johnson V mag=16.150 vegamag)*
*STIS/E230M/c2707 : rn(CMFGEN-WN(model=9, Z=0.008, Teff=80000), johnson V mag=16.150 vegamag)*
*Coordinate pedigree: Gaia*
*Calculation performed 2020-02-24T18:09:14, v0.4*
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*tstatus; LMCE055-1; P/COS approved for submission; S/ins not started; P/AF 15/09/20; S/xx DD/MM/YY*
*tcheck; APT/SIMBAD target names: 'MNM2015 LMCe055-1', OGLE LMC-ECL-3548, GAIA DR2 4655168748370602880*
*tcheck; Target info verification status?; OK - SIMBAD does not record the SpType, which comes from 2017ApJ...837..122M*
*tcheck; Coordinates & P.M. updated?; Yes - Gaia DR2 2015.5 coords - PM set to 0*
*tcheck; Adopted SED compared to Observations?; Yes ...*
*The spectral classification denotes a newly recognized class of Wolf-Rayet stars whose spectra are characterized by the emission-line spectrum of a WN3 or WN4 star and an absorption-line spectrum of an O3 or O4 star. The objects in this class are substantially under-luminous compared to an O3 or O4 dwarf, so the spectrum cannot in general be considered to be a simple composite arising from a WR+O binary system. LMCe055-1 is an interesting exception in this regard, since it is known to be a detached or semi-detached member of an eclipsing binary system with a period of 2.159 days. Even so, Massey et al. (2017ApJ...837..122M) argue that the companion cannot be a massive star because the system is very under-luminous and its light curve does not exhibit the ellipsoidal variations that are expected.*

*The evolutionary status of the WN3/O3 and WN4/O4 stars is unknown. They may be the product of binary evolution, in which case the WN spectrum comes from the very hot stellar core that remains after it is stripped of its outer envelope during a Roche-lob overflow event. LMCe055-1 is an interesting test case for this hypothesis since it is known to be a member of a binary system. Alternately, these stars may represent a "missing link" in the normal evolutionary path traversed by an O star as it becomes a WN star. This interpretation is bolstered by the hybrid appearance of the spectrum, which evidently results from mass-loss rates that are more akin to O-stars and than the general WNE population. For similar input parameters, model atmospheres computed with CMFGEN for "stripped" stars (Gotberg et al. 2018A&A...615A..78G) are very similar in appearance to models of WN4 stars computed with PoWR (2015A&A...579A..75T), though (a) the flux of the "stripped" core must be increased by an order of magnitude or more to match the flux from the WN4 module; and (b) the He II 1640 line is about twice as strong in the "stripped" model. For a comparison, see*
*~/box/ullyses_tech/ullyses_proposals/c27_mc/16093/LMCE055-1/LMCE055-1_stripped_vs_wn4.pdf*

*For present purposes, a PoWR model appropriate to a WN4 star has been adopted. This model does not account for the H and HeII absorption features, which are not as much of a concern in terms of detector health & safety as the emission features. It also assumes that the WN4/O4 star is the dominant source of UV light from the binary system. The adopted model comes from the PoWR lmc-h40 grid (with "enhanced" hydrogen abundance of 0.40 by mass and metallicity appropriate to the LMC) with Teff = 70.795 kK, log g = 4.57, and a (comparatively small) mass-loss rate of logMdot = -6.89 Msun/year. The model flux has been extinguished by an LMC average extinction law with E(B-V) = 0.19. This value was adjusted to improve modestly the fit with the available UBV photometry, and is consistent with the value quoted by Massey et al. (2017ApJ...837..122M) of E(B-V) = 0.18.*
*Adopted illustrated: ~/box/ullyses_tech/ullyses_proposals/c27_mc/16093/LMCE055-1/LMCE055-1_adopted_sed_vs_UBV.png*
*Adopted SED: ~/box/ullyses_tech/ullyses_proposals/c27_mc/16093/LMCE055-1/LMCE055-1_adopted_sed.fits*

*Of course, extrapolating the UV spectrum from optical photometry alone entails risks. Even so, the anticipated flux levels do not appear to pose any health & safety risks for the COS detectors.*
*Category=EXT-STAR*
*Description=[WOLF RAYET - WN]*
*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/PEAKXD (COS.sa.1460685) | (1) LMCE055-1 | COS/FUV, ACQ/PEAKXD, PSA | G130M 1291 A | CENTER=FLUX-WT; NUM-POS=3; STEP-SIZE=1.3; SEGMENT=BOTH | | | 1.1 Secs (1.1 Secs) *[==>]* | ***[1]*** |

*Comments: SED PoWR_70795_4.57_m6.89_Z0.50_lmcavg_ebmv_0.19_sed.fits*
*~/box/ullyses_tech/ullyses_proposals/c27_mc/16093/LMCE055-1/LMCE055-1_adopted_sed.fits*

*ETC estimates an exposure time of 1.0503 s per dwell point. Rounded up to 1.1 s per dwell point.*

*BOT: 3 safe, 0 unknown*

| # | Label (ETC Run) | Target | Config,Mode,Aperture | Spectral Els. | Opt. Params. | Special Reqs. | Groups | Exp. Time (Total)/[Actual Dur.] | Orbit |
|---|---|---|---|---|---|---|---|---|---|
| 2 | ACQ/PEAKD (COS.sa.1460685) | (1) LMCE055-1 | COS/FUV, ACQ/PEAKD, PSA | G130M 1291 A | CENTER=FLUX-WT-FLR; NUM-POS=5; STEP-SIZE=0.9; SEGMENT=BOTH | | | 1.1 Secs (1.1 Secs) *[==>]* | ***[1]*** |

*Comments: SED PoWR_70795_4.57_m6.89_Z0.50_lmcavg_ebmv_0.19_sed.fits*
*~/box/ullyses_tech/ullyses_proposals/c27_mc/16093/LMCE055-1/LMCE055-1_adopted_sed.fits*

*ETC estimates an exposure time of 1.0503 s per dwell point. Rounded up to 1.1 s per dwell point.*

*BOT: 5 safe, 0 unknown*

| # | Label (ETC Run) | Target | Config,Mode,Aperture | Spectral Els. | Opt. Params. | Special Reqs. | Groups | Exp. Time (Total)/[Actual Dur.] | Orbit |
|---|---|---|---|---|---|---|---|---|---|
| 3 | G130M/1291-3 (COS.sp.1460677) | (1) LMCE055-1 | COS/FUV, TIME-TAG, PSA | G130M 1291 A | BUFFER-TIME=716; FP-POS=3 | | | 1030 Secs (1030 Secs) *[==>]* | ***[1]*** |

*Comments: SED PoWR_70795_4.57_m6.89_Z0.50_lmcavg_ebmv_0.19_sed.fits*
*~/box/ullyses_tech/ullyses_proposals/c27_mc/16093/LMCE055-1/LMCE055-1_adopted_sed.fits*

*ETC estimates SNR = 30/resel at 1150 +/- 0.5 A in 2,718.1280 s*
*Baseline exposure time rounded to 2720 s (1360 s per FP-POS)*
*countrate (total, brightest segment) = (2193.7, 1269.4) cts/s*
*brightest pixel: 0.105 cts/s at 1216.2 A*
*BUFFER-TIME = 2/3 * 1075 s = 716 s*

*Final exptime decreased during orbit packing to 1030 s per FP-POS; 2060 s total. This reduction amounts to 76% of the exposure time required to achieve the target value of SNR=30. Although it violates the mandate to reduce the nominal exposure time by no more than 80%, the trade-off is acceptable in this case. Estimated SNR at 1150 A = 26.1 per resel (COS.sp.1460691)*

*BOT: 3 safe, 0 unknown*

| # | Label (ETC Run) | Target | Config,Mode,Aperture | Spectral Els. | Opt. Params. | Special Reqs. | Groups | Exp. Time (Total)/[Actual Dur.] | Orbit |
|---|---|---|---|---|---|---|---|---|---|
| 4 | G130M/1291-4 (COS.sp.1460677) | (1) LMCE055-1 | COS/FUV, TIME-TAG, PSA | G130M 1291 A | BUFFER-TIME=716.0; FP-POS=4 | | | 1030 Secs (1030 Secs) *[==>]* | ***[1]*** |

*Comments: SED PoWR_70795_4.57_m6.89_Z0.50_lmcavg_ebmv_0.19_sed.fits*
*~/box/ullyses_tech/ullyses_proposals/c27_mc/16093/LMCE055-1/LMCE055-1_adopted_sed.fits*

*ETC estimates SNR = 30/resel at 1150 +/- 0.5 A in 2,718.1280 s*
*Baseline exposure time rounded to 2720 s (1360 s per FP-POS)*
*countrate (total, brightest segment) = (2193.7, 1269.4) cts/s*
*brightest pixel: 0.105 cts/s at 1216.2 A*
*BUFFER-TIME = 2/3 * 1075 s = 716 s*

*Final exptime decreased during orbit packing to 1030 s per FP-POS; 2060 s total. This reduction amounts to 76% of the exposure time required to achieve the target value of SNR=30. Although it violates the mandate to reduce the nominal exposure time by no more than 80%, the trade-off is acceptable in this case. Estimated SNR at 1150 A = 26.1 per resel (COS.sp.1460691)*

*BOT: 3 safe, 0 unknown*

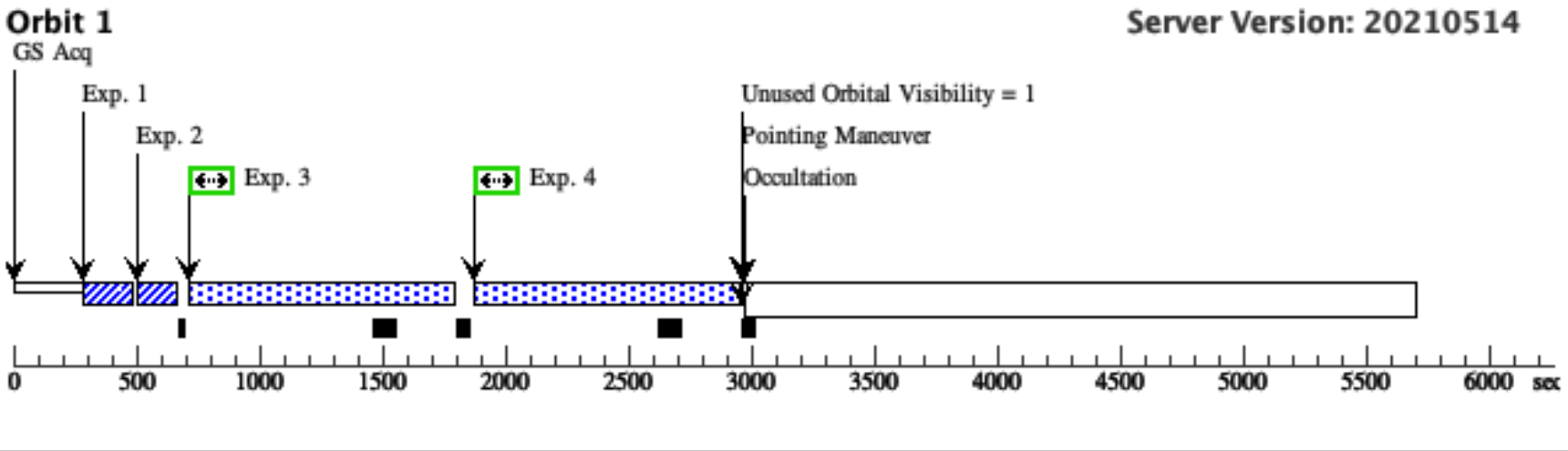
| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | 5 | G160M/1611 (COS.sp.1460681) | (1) LMCE055-1 | COS/FUV, TIME-TAG, PSA | G160M 1611 A | BUFFER-TIME=1680.0; FP-POS=ALL | 1175 Secs (4700 Secs)<br>*[==>(Split 1)]*<br>*[==>(Split 2)]*<br>*[==>(Split 3)]*<br>*[==>(Split 4)]* | <br>***[2]***<br>***[3]*** |

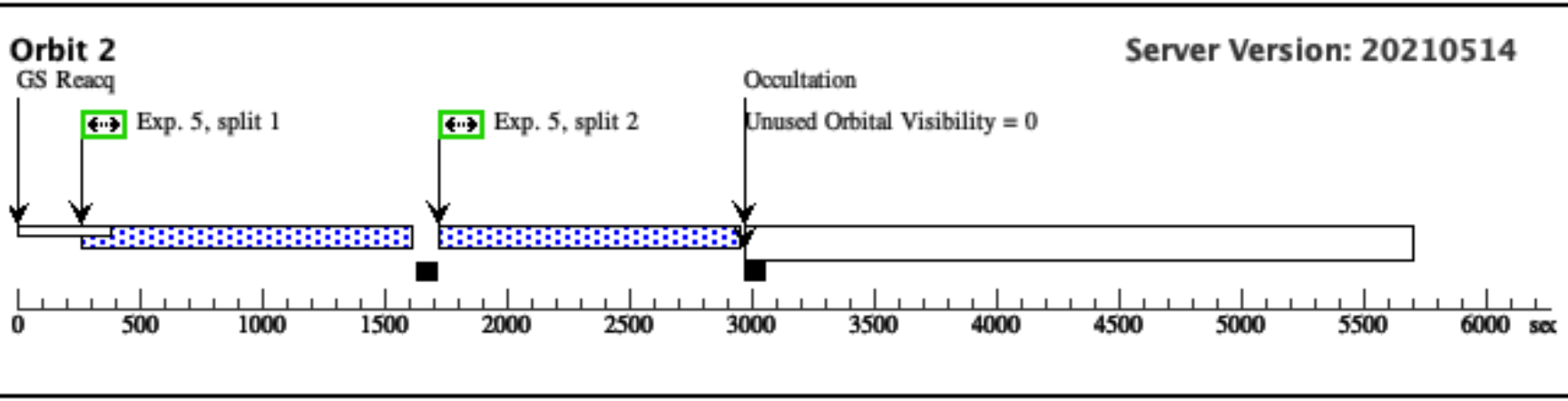
*Comments: SED PoWR_70795_4.57_m6.89_Z0.50_lmcavg_ebmv_0.19_sed.fits*
*~/box/ullyses_tech/ullyses_proposals/c27_mc/16093/LMCE055-1/LMCE055-1_adopted_sed.fits*

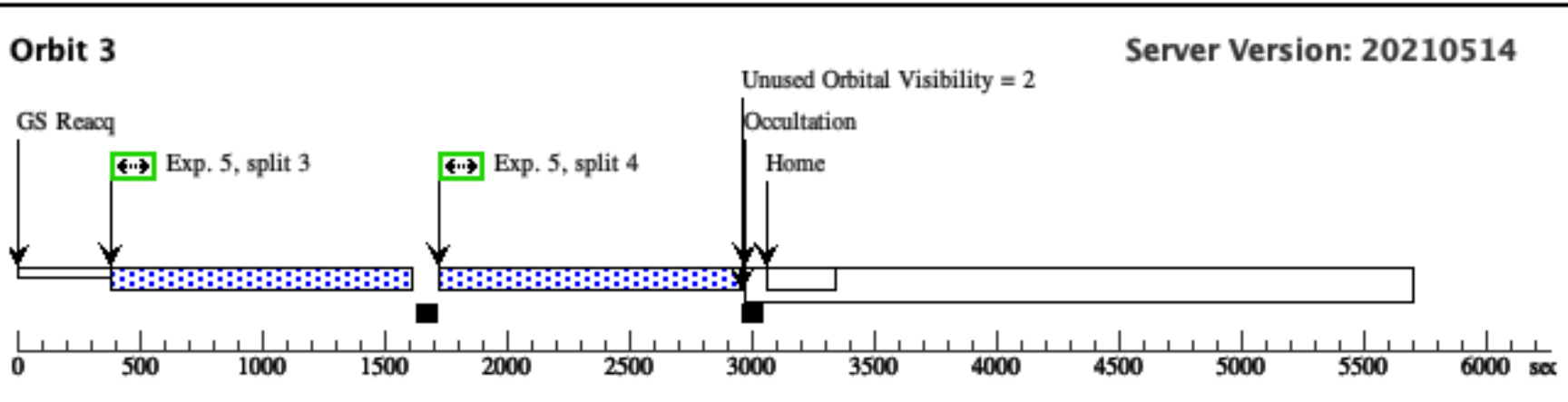
*ETC estimates SNR = 30/resel at 1590 +/- 0.5 A in 5,128.2952 s*
*Baseline exposure time rounded to 5128 s (1282 s per FP-POS)*
*countrate (total, brightest segment) = (935.6, 725.8) cts/s*
*brightest pixel: 0.011 cts/s at 1421.6 A*
*BUFFER-TIME = 2/3 * 2521 s = 1680 s*
*Final exptime decreased during orbit packing to 1175 s per FP-POS; 4700 s total. Estimated SNR at 1590 A = 28.7 per resel (COS.sp.1460690)*

*BOT: 3 safe, 0 unknown*

Orbit Structure



## Visit

**Proposal 16093, VFTS-482-COS (2C), completed** Wed Sep 22 15:00:30 GMT 2021

**Diagnostic Status: No Diagnostics**

Scientific Instruments: COS/FUV

Special Requirements: SCHED 100%; ORIENT 120D TO 340 D

*Comments: vstatus; 2C; VFTS-482; P/COS approved for submission; P/AF 10/08/20 ; intrev: complete; P/CP 05/10/20*
*vcheck; Enter targ name & Inst. & Resp. Sci.; VFTS-482 ; COS ; AF*
*vcheck; ETC numbers entered in APT?; Completed*
*vcheck; Any screening violations?; None*
*vcheck; S/N ETC calcs done & documented?; Completed*
*vcheck; Field images checked & saved?; Yes - VFTS-482_HTTP_f275w.png*
*vcheck; Selected ACQ strategy?; Dispersed 1291*
*vcheck; Possible ACQ or Sci spoilers?; No; see notes*
*vcheck; Field BOT clear?; Yes; see notes*
*vcheck; Visual BOT check for stars not in catalog?; None; see notes*
*vcheck; Orbit packing finalized?; 2 orbits - could not fit everything into 1 orbit without compromising SNR, so exp. times increased by factors of (2, 2.3) for (G130M, G160M)*
*vcheck; Buffer times optimized?; Done*
*vcheck; Verify visit grouping correct; Not applicable*
*vcheck; Is visit ready for int. review?; Yes*
*Allocated COS orbits = 2*

## Fixed Targets

| # | Name | Target Coordinates | Targ. Coord. Corrections | Fluxes | Miscellaneous |
|---|---|---|---|---|---|
| (2) | VFTS-482 | RA: 05 38 40.2300 (84.6676250d) | | V=12.85 | Reference Frame: ICRS |
| | Alt Name1: MK-39 | Dec: -69 05 59.76 (-69.09993d) | | SpT=O2.5 If*/WN6; E(B-V)=0. 40; U=12.12; B=12.97; V=12.85 ; F1160=2.20e-13; F1360=2.40e -13; F1700=2.20e-13 | |
| | Alt Name2: BAT99-99 | Equinox: J2000 | | | |

*Comments: VFTS-482 : BAT99_99, Brey 78, Mk 39, Cl* NGC 2070 MEL 39*
*Previous name : Mk 39*
*Input file: LMC_2020Feb20/input/LMC_all_do1_fixed_wr_NewCoords_pids.csv*
*SIMBAD link (Cl* NGC 2070 MEL 39): https://simbad.u-strasbg.fr/simbad/sim-id?Ident=Cl*+NGC+2070+MEL+39&submit=submit+id*
*SpT = O2.5 If*/WN6*
*COS/G130M/c1096 : rn-max(WM-Basic(O3 I, Z=0.008, Teff=48978, log_lum=6.16, log_g=3.88) (extinction lmc30dor=0.380), flux1160 +- 30.0A flux=2.2e-13 Flam)*
*COS/G130M/c1291 : rn-max(WM-Basic(O3 I, Z=0.008, Teff=48978, log_lum=6.16, log_g=3.88) (extinction lmc30dor=0.380), flux1360 +- 30.0A flux=2.4e-13 Flam)*
*COS/G160M/c1611 : rn-max(WM-Basic(O3 I, Z=0.008, Teff=48978, log_lum=6.16, log_g=3.88) (extinction lmc30dor=0.380), flux1700 +- 5.0A flux=2.2e-13 Flam)*
*COS/G185M/c1921 : rn-max(WM-Basic(O3 I, Z=0.008, Teff=48978, log_lum=6.16, log_g=3.88) (extinction lmc30dor=0.380), flux1700 +- 5.0A flux=2.2e-13 Flam)*
*COS/G185M/c1953 : rn-max(WM-Basic(O3 I, Z=0.008, Teff=48978, log_lum=6.16, log_g=3.88) (extinction lmc30dor=0.380), flux1700 +- 5.0A flux=2.2e-13 Flam)*
*COS/G185M/c1986 : rn-max(WM-Basic(O3 I, Z=0.008, Teff=48978, log_lum=6.16, log_g=3.88) (extinction lmc30dor=0.380), flux1700 +- 5.0A flux=2.2e-13 Flam)*
*STIS/E140M/c1425 : rn-max(WM-Basic(O3 I, Z=0.008, Teff=48978, log_lum=6.16, log_g=3.88) (extinction lmc30dor=0.380), flux1360 +- 30.0A flux=2.4e-13 Flam)*
*STIS/E230M/c1978 : rn-max(WM-Basic(O3 I, Z=0.008, Teff=48978, log_lum=6.16, log_g=3.88) (extinction lmc30dor=0.380), flux1700 +- 5.0A flux=2.2e-13 Flam)*
*STIS/E230M/c2707 : rn-max(WM-Basic(O3 I, Z=0.008, Teff=48978, log_lum=6.16, log_g=3.88) (extinction lmc30dor=0.380), flux1700 +- 5.0A flux=2.2e-13 Flam)*
*Coordinate pedigree: InputCatalog, which orginated from the VFTS Catalog 2011A&A...530A.108E*
*Calculation performed 2020-02-24T17:55:15, v0.4*
---
*tstatus; VFTS-482; P/COS approved for submission; S/ins not started; P/AF 15/09/20; S/xx DD/MM/YY*
*tcheck; APT/SIMBAD target names: ; 'VFTS 482", MK-39, Brey 78, [P93] 767, [HSH95] 7 ...*
*the cross-identification VFTS 482 = BAT99 99 = Brey 78 is confirmed in 2011A&A...530A.108E, but not by SIMBAD. The root cause is SIMBAD confusing Mk 37 and Mk 39.*
*tcheck; Target info verification status?; The photometry in the input catalog disagreed significantly with values in SIMBAD and was incorrect ...*
*it has been replaced by (U, B ,V) = (12.12, 12.97, 12.85) from 1999A&A...341...98S. The implied E(B-V) is 0.40.*
*tcheck; Coordinates & P.M. updated?; Yes - coords from VFTS catalog 2011A&A...530A.108E - PM set to 0*
*tcheck; Adopted SED compared to Observations?; Yes ...*
*Baseline fits were inadequate because of the coarse sampling of the underlying models. Explored parameter space defined by previous modeling efforts of Bestenlehner et al. (2014A&A...570A..38B; CMFGEN) and Hainich et al. (2014A&A...565A..27H; PoWR) by using two PoWR models: PoWR_45000_4.00_Z0.50 and PoWR_42000_3.80_Z0.50. Adjusted the reddening and the effective radius of the model to obtain a good fit to the existing STIS/G140L, STIS/G430M, and FOS spectra and UBV photometry. The adopted model is PoWR_42000_3.80_Z0.50, with flux increased by a factor of 1.7 (which is equivalent to increasing the radius of the model from 15.3 Rsun to 19.9 Rsun) and extinguished by an LMC 30 Dor extinction law with E(B-V) = 0.33. Although this degere of reddening is smaller than the baseline estimate (0.40), it is consistent with the range determined from previous modeling efforts.*
*Baseline illustrated: ~/box/ullyses_tech/ullyses_proposals/c27_mc/16093/VFTS-482/VFTS-482_c1611_auto_sed.png*
*Adopted illustrated: ~/box/ullyses_tech/ullyses_proposals/c27_mc/16093/VFTS-482/VFTS-482_adopted_sed_vs_STIS+FOS.png*
*Adopted SED: ~/box/ullyses_tech/ullyses_proposals/c27_mc/16093/VFTS-482/VFTS-482_adopted_sed.fits*
*Category=EXT-STAR*
*Description=[SUPERGIANT O, OF, WOLF RAYET - WN]*
*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/PEAK (2) VFTS-482 XD (COS.sa.145 4810) | COS/FUV, ACQ/PEAKXD, PSA | G130M 1291 A | CENTER=FLUX-WT; NUM-POS=3; STEP-SIZE=1.3; SEGMENT=BOTH | 0.3 Secs (0.3 Secs)<br>*[==>]* | ***[1]*** |

*Comments: SED PoWR_42000_3.80_Z0.50_lmc30Dor_ebmv_0.33; includes an increase in model flux by a factor of 1.7*
*~/box/ullyses_tech/ullyses_proposals/c27_mc/16093/VFTS-482/VFTS-482_adopted_sed.fits*
*ETC estimates an exposure time of 0.2967 s per dwell point. Rounded up to 0.3 s per dwell point.*

*Notes on Bright Object Checking:*

*VFTS 482 is on the outskirts of the 30 Dor region. The BOT cannot identify any targets in the GSC II or Galex catalogs because the DSS and 2MASS images are saturated by the bright nebulosity. Instead, the capabilities of the BOT have been reproduced by using the catalog and imaging products developed by the Hubble Tarantula Treasury Project (HTTP). See Sabbi et al. (2016ApJS..222...11S) and https://archive.stsci.edu/prepds/30dor/ for details.*

*The HTTP catalog provides magnitudes in the VEGAMAG system for the WFC3 F275W filter, which is a more reliable estimator of the UV flux of an early-type star than the Johnson V-band. ETC calculations were run for a range of m_f275w values to probe the count-rate limits for the COS G130M/1291 and G160M/1611 configurations. A model spectrum from the PoWR grid that corresponds to an unreddened O5 V star in the LMC - (Teff, logg, Z/Zsun) = (41 kK, 4.00, 0.50) - was used for these calculation.*
*See:*
*~/box/ullyses_tech/ullyses_proposals/c27_mc/16093/VFTS-482/myBOT/F275W_Limiting_Magnitudes/PoWR_41000_4.00_Z0.50_lmc30Dor_ebmv_0.0_sed.png*
*~/box/ullyses_tech/ullyses_proposals/c27_mc/16093/VFTS-482/myBOT/F275W_Limiting_Magnitudes/PoWR_41000_4.00_Z0.50_lmc30Dor_ebmv_0.0_sed.fits*

*The results of these calculations are summarized in the spreadsheet:*
*~/box/ullyses_tech/ullyses_proposals/c27_mc/16093/VFTS-482/myBOT/F275W_Limiting_Magnitudes/Limiting_F275w_magnitudes_for_O5V.xlsx*

*They show that*
*1. An unreddened O5 V star with VEGAMAG m_f275w < 11.9 can be safely observed through the PSA with COS G130M/1291 and G160M/1611.*
*2. By assuming a throughput of 0.6% relative to the PSA (extrapolated from Fig. 3.2 in the COS IHB), the spectroscopic limit for the BOA is m_f275w < 6.4.*
*3. Since the extinction in the 30 Dor region is actually quite significant, these limits are very conservative.*
*For subsequent bright-object checking:*
*- Any star with m_f275w > 11.9 in the HTTP catalog is deemed to pose no threat to the health & safety of the COS detectors if observed through the PSA in the (G130M/1291, G160M/1611) configurations.*
*- Any star with m_f2752 > 6.4 in the HTTP catalog is deemed to pose no threat to the health & safety of the COS detectors if observed through the BOA in the (G130M/1291, G160M/1611) configurations.*
*Stars in the search region for the PSA that are brighter than m_f275w = 11.9 require explicit ETC calculations to verify their status.*

*FIRST:*
*Consider the circular region within 8 arcsec of the center of the PSA.*

*a) There are 24 sources in the HTTP catalog with m_f275w < 15.0, including VFTS 482.*
*See:*
*~/box/ullyses_tech/ullyses_proposals/c27_mc/16093/VFTS-482/myBOT/PSA/HTTP_VFTS482_r8.0arcsec_m_f275w15.0.png*
*~/box/ullyses_tech/ullyses_proposals/c27_mc/16093/VFTS-482/myBOT/PSA/HTTP_VFTS482_r8.0arcsec_m_f275w15.0.csv*

*Note that the numbers indicated on the image refer to the row in the csv table. There is no "1" because the first row in the csv file contains column names.*

*The brightest contaminant within the PSA is Star 18 = SABBI 053840.331-690559.65, which is 0.66 arcsec from VFTS 482. The magnitude difference at 2750 Angstroms implies that Star 18 has ~4% of the measured flux of VFTS 482. If Star 18 were an unreddened O5 V star - WHICH IT IS NOT! - it would contribute to the G130M/1291 count rate as follows:*

| | Count Rate Segment A | Count Rate Segment B | ETC Calculation |
|---|---|---|---|
| Star 18 | 522.944 | 993.490 | COS.sp.1458280 |
| VFTS 482 | 3466.719 | 3639.238 | COS.sp.1454809 |
| TOTAL | 3989.663 | 4632.728 | |

*These count rates are well below the limit of 15000 counts/s per segment. Consequently, contamination by Star 18 poses no threat to the health & safety of the COS detectors.*

*b) There are 2 sources in the HTTP catalog with m_f275w < 11.9, one of which is VFTS 482.*
*See:*
*~/box/ullyses_tech/ullyses_proposals/c27_mc/16093/VFTS-482/myBOT/PSA/HTTP_VFTS482_r8.0arcsec_m_f275w11.9.png*
*~/box/ullyses_tech/ullyses_proposals/c27_mc/16093/VFTS-482/myBOT/PSA/HTTP_VFTS482_r8.0arcsec_m_f275w11.9.csv*

*VFTS 482 has been shown to be safe by ETC calculation COS.sp.1454809*

*The other bright star is SABBI 053840.539-690557.18 = VFTS 1001 = Brey 75 = BAT99 100 = R134 = [P93] 786 = Cl* NGC 2070 SMB 013 = [HSH95] 4:*
*SpType = WN6h 1998ApJ...493..180M*
*V = 12.747 1999A&A...341...98S*
*B = 12.838 1999A&A...341...98S*
*U = 12.171 1999A&A...341...98S*

*It is 3.19 arcsec from VFTS 482, which corresponds to 2.55 times the radius of the PSA. The STEP_SIZE for FUV/ACQ PEAKXD is 1.3 arcsec = 1.04 times the radius of the PSA. With NUM_POS=3, there would be at most a single step in the direction of VFTS 1001, which could therefore not appear in the PSA during a PEAKXD scan irrespective of the orientation. Similarly, the SAMS for a PEAKD maneuver with NUM_POS=5 and STEP_SIZE=0.9 will move the PSA 2*0.9 arcsec = 1.8 arcsec = 1.44 times the radius of the PSA in the direction of a nearby spoiler star. Consequently, it is unlikely that VFTS 1001 star will be encountered durin*

*g the target acquisition procedure.*

*Fits to model atmospheres have been published for VFTS 1001 by Bestenlehner et al. (2014A&A...570A..38B) and Hainich et al. (2014A&A...565A..27H). A PoWR model atmosphere for a WNL star with a depleted H content of 0.2 by mass and with other parameters parameters similar to those derived by Hainich et al. provides a good match to the available data: see*
*~/box/ullyses_tech/ullyses_proposals/c27_mc/16093/VFTS-482/myBOT/VFTS1001/VFTS-1001_adopted_sed_vs_FOS.png*

*The adopted SED*
*~/box/ullyses_tech/ullyses_proposals/c27_mc/16093/VFTS-482/myBOT/VFTS1001/VFTS-1001_adopted_sed.fits*

*corresponds to the file*
*~/box/ullyses_tech/ullyses_proposals/c27_mc/16093/VFTS-482/myBOT/VFTS1001/seds/PoWR_44668_3.77_m4.49_Z0.50_lmc30Dor_ebmv_0.3_sed.fits.*

*ETC calculations with this input spectrum centered in the PSA give the following results with NO WARNINGS:*

| Configuration | ETC Calculation | Count Rate(SegA) | CountRate(SegB) | Total CountRate | Brightest Pixel |
|---|---|---|---|---|---|
| G130M/1291 | COS.sp.1458984 | 2988.915 | 3467.354 | 6456.269 | 0.319 ct/s @ 1216.11 A |
| G160M/1611 | COS.sp.1458985 | 1027.378 | 2852.074 | 3879.452 | 0.063 ct/s @ 1420.48 A |

*Consequently, inadvertent exposure to this target poses no health & safety risk to the COS detectors.*

*SECOND:*
*Consider the annulus that the region of interest (ROI) associated with the BOA sweeps out for a range of PAs between 0 and 360 degrees. Like the PSA, this ROI is circular with a radius of 8 arcsec. Since the center of the BOA is approximately 13 arcsec from the center of the PSA, the (inner, outer) radii that define the annulus are (5, 22) arcsec from the position of VFTS 482. Within this annulus, there are 3 sources in the HTTP catalog with m_f275w < 11.9.*

*See:*
*~/box/ullyses_tech/ullyses_proposals/c27_mc/16093/VFTS-482/myBOT/BOA/HTTP_VFTS482_r22.0arcsec_m_f275w11.9_BOA.png*
*~/box/ullyses_tech/ullyses_proposals/c27_mc/16093/VFTS-482/myBOT/BOA/HTTP_VFTS482_r22.0arcsec_m_f275w11.9_BOA.csv*

*The brightest of these 3 sources has m_f275w = 9.728, which is 3.3 magnitudes (a factor of 20.9 in flux) fainter than the BOA bright limit. There are NO individual stars brighter than the f275w bright limit for the BOA. However, for a range of PA's near 60 degrees, the BOA samples the central region of the R136 cluster. See:*
*~/box/ullyses_tech/ullyses_proposals/c27_mc/16093/VFTS-482/myBOT/BOA/HTTP_VFTS482_r22.0arcsec_pa_60_to_60_m_F275w11.9_BOA.png*

*Consequently, it is conceivable that together with the flux from VFTS 482 in the PSA, the cumulative flux from multiple stars could contribute count rates that exceed the detector segment count-rate limits. This possibility can be eliminated by imposing a PA constraint on the visit: 120 degrees < PA < 340 degrees. The position of the BOA at these two extremes confirms that the core of the R136 cluster is avoided; see:*
*~/box/ullyses_tech/ullyses_proposals/c27_mc/16093/VFTS-482/myBOT/BOA/HTTP_VFTS482_r22.0arcsec_pa_120_to_340_m_F275w11.9_BOA.png*

*CONCLUSION:*
*Within the specified PA restrictions, this analysis confirms that there are NO Health & Safety issues associated with the dispersed light acquisition or G130M and G160M observations of VFTS 482 through the PSA.*

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| | 2 | ACQ/PEAKD (COS.sa.1454810) | (2) VFTS-482 | COS/FUV, ACQ/PEAKD, PSA | G130M 1291 A | CENTER=FLUX-WT-FLR; NUM-POS=5; STEP-SIZE=0.9; SEGMENT=BOTH | 0.3 Secs (0.3 Secs)<br>*[==>]* | ***[1]*** |

*Comments: SED PoWR_42000_3.80_Z0.50_lmc30Dor_ebmv_0.33; includes an increase in model flux by a factor of 1.7*
*~/box/ullyses_tech/ullyses_proposals/c27_mc/16093/VFTS-482/VFTS-482_adopted_sed.fits*
*ETC estimates an exposure time of 0.2967 s per dwell point. Rounded up to 0.3 s per dwell point.*

*Notes on Bright Object Checking:*

*VFTS 482 is on the outskirts of the 30 Dor region. The BOT cannot identify any targets in the GSC II or Galex catalogs because the DSS and 2MASS images are saturated by the bright nebulosity. Instead, the capabilities of the BOT have been reproduced by using the catalog and imaging products developed by the Hubble Tarantula Treasury Project (HTTP). See Sabbi et al. (2016ApJS..222...11S) and https://archive.stsci.edu/prepds/30dor/ for details.*

*The HTTP catalog provides magnitudes in the VEGAMAG system for the WFC3 F275W filter, which is a more reliable estimator of the UV flux of an early-type star than the Johnson V-band. ETC calculations were run for a range of m_f275w values to probe the count-rate limits for the COS G130M/1291 and G160M/1611 configurations. A model spectrum from the PoWR grid that corresponds to an unreddened O5 V star in the LMC - (Teff, logg, Z/Zsun) = (41 kK, 4.00, 0.50) - was used for these calculation.*
*See:*
*~/box/ullyses_tech/ullyses_proposals/c27_mc/16093/VFTS-482/myBOT/F275W_Limiting_Magnitudes/PoWR_41000_4.00_Z0.50_lmc30Dor_ebmv_0.0_sed.png*
*~/box/ullyses_tech/ullyses_proposals/c27_mc/16093/VFTS-482/myBOT/F275W_Limiting_Magnitudes/PoWR_41000_4.00_Z0.50_lmc30Dor_ebmv_0.0_sed.fits*

*The results of these calculations are summarized in the spreadsheet:*
*~/box/ullyses_tech/ullyses_proposals/c27_mc/16093/VFTS-482/myBOT/F275W_Limiting_Magnitudes/Limiting_F275w_magnitudes_for_O5V.xlsx*

*They show that*
*1. An unreddened O5 V star with VEGAMAG m_f275w < 11.9 can be safely observed through the PSA with COS G130M/1291 and G160M/1611.*
*2. By assuming a throughput of 0.6% relative to the PSA (extrapolated from Fig. 3.2 in the COS IHB), the spectroscopic limit for the BOA is m_f275w < 6.4.*
*3. Since the extinction in the 30 Dor region is actually quite significant, these limits are very conservative.*
*For subsequent bright-object checking:*
*- Any star with m_f275w > 11.9 in the HTTP catalog is deemed to pose no threat to the health & safety of the COS detectors if observed through the PSA in the (G130M/1291, G160M/1611) configurations.*
*- Any star with m_f2752 > 6.4 in the HTTP catalog is deemed to pose no threat to the health & safety of the COS detectors if observed through the BOA in the (G130M/1291, G160M/1611) configurations.*
*Stars in the search region for the PSA that are brighter than m_f275w = 11.9 require explicit ETC calculations to verify their status.*

*FIRST:*
*Consider the circular region within 8 arcsec of the center of the PSA.*

*a) There are 24 sources in the HTTP catalog with m_f275w < 15.0, including VFTS 482.*
*See:*
*~/box/ullyses_tech/ullyses_proposals/c27_mc/16093/VFTS-482/myBOT/PSA/HTTP_VFTS482_r8.0arcsec_m_f275w15.0.png*
*~/box/ullyses_tech/ullyses_proposals/c27_mc/16093/VFTS-482/myBOT/PSA/HTTP_VFTS482_r8.0arcsec_m_f275w15.0.csv*

*Note that the numbers indicated on the image refer to the row in the csv table. There is no "1" because the first row in the csv file contains column names.*

*The brightest contaminant within the PSA is Star 18 = SABBI 053840.331-690559.65, which is 0.66 arcsec from VFTS 482. The magnitude difference at 2750 Angstroms implies that Star 18 has ~4% of the measured flux of VFTS 482. If Star 18 were an unreddened O5 V star - WHICH IT IS NOT! - it would contribute to the G130M/1291 count rate as follows:*

| | Count Rate Segment A | Count Rate Segment B | ETC Calculation |
|---|---|---|---|
| Star 18 | 522.944 | 993.490 | COS.sp.1458280 |
| VFTS 482 | 3466.719 | 3639.238 | COS.sp.1454809 |
| TOTAL | 3989.663 | 4632.728 | |

*These count rates are well below the limit of 15000 counts/s per segment. Consequently, contamination by Star 18 poses no threat to the health & safety of the COS detectors.*

*b) There are 2 sources in the HTTP catalog with m_f275w < 11.9, one of which is VFTS 482.*
*See:*
*~/box/ullyses_tech/ullyses_proposals/c27_mc/16093/VFTS-482/myBOT/PSA/HTTP_VFTS482_r8.0arcsec_m_f275w11.9.png*
*~/box/ullyses_tech/ullyses_proposals/c27_mc/16093/VFTS-482/myBOT/PSA/HTTP_VFTS482_r8.0arcsec_m_f275w11.9.csv*

*VFTS 482 has been shown to be safe by ETC calculation COS.sp.1454809*

*The other bright star is SABBI 053840.539-690557.18 = VFTS 1001 = Brey 75 = BAT99 100 = R134 = [P93] 786 = Cl* NGC 2070 SMB 013 = [HSH95] 4:*
*SpType = WN6h 1998ApJ...493..180M*
*V = 12.747 1999A&A...341...98S*
*B = 12.838 1999A&A...341...98S*
*U = 12.171 1999A&A...341...98S*

*It is 3.19 arcsec from VFTS 482, which corresponds to 2.55 times the radius of the PSA. The STEP_SIZE for FUV/ACQ PEAKXD is 1.3 arcsec = 1.04 times the radius of the PSA. With NUM_POS=3, there would be at most a single step in the direction of VFTS 1001, which could therefore not appear in the PSA during a PEAKXD scan irrespective of the orientation. Similarly, the SAMS for a PEAKD maneuver with NUM_POS=5 and STEP_SIZE=0.9 will move the PSA 2*0.9 arcsec = 1.8 arcsec = 1.44 times the radius of the PSA in the direction of a nearby spoiler star. Consequently, it is unlikely that VFTS 1001 star will be encountered durin*

*g the target acquisition procedure.*

*Fits to model atmospheres have been published for VFTS 1001 by Bestenlehner et al. (2014A&A...570A..38B) and Hainich et al. (2014A&A...565A..27H). A PoWR model atmosphere for a WNL star with a depleted H content of 0.2 by mass and with other parameters parameters similar to those derived by Hainich et al. provides a good match to the available data: see*
*~/box/ullyses_tech/ullyses_proposals/c27_mc/16093/VFTS-482/myBOT/VFTS1001/VFTS-1001_adopted_sed_vs_FOS.png*

*The adopted SED*
*~/box/ullyses_tech/ullyses_proposals/c27_mc/16093/VFTS-482/myBOT/VFTS1001/VFTS-1001_adopted_sed.fits*

*corresponds to the file*
*~/box/ullyses_tech/ullyses_proposals/c27_mc/16093/VFTS-482/myBOT/VFTS1001/seds/PoWR_44668_3.77_m4.49_Z0.50_lmc30Dor_ebmv_0.3_sed.fits.*

*ETC calculations with this input spectrum centered in the PSA give the following results with NO WARNINGS:*

| Configuration | ETC Calculation | Count Rate(SegA) | CountRate(SegB) | Total CountRate | Brightest Pixel |
|---|---|---|---|---|---|
| G130M/1291 | COS.sp.1458984 | 2988.915 | 3467.354 | 6456.269 | 0.319 ct/s @ 1216.11 A |
| G160M/1611 | COS.sp.1458985 | 1027.378 | 2852.074 | 3879.452 | 0.063 ct/s @ 1420.48 A |

*Consequently, inadvertent exposure to this target poses no health & safety risk to the COS detectors.*

*SECOND:*
*Consider the annulus that the region of interest (ROI) associated with the BOA sweeps out for a range of PAs between 0 and 360 degrees. Like the PSA, this ROI is circular with a radius of 8 arcsec. Since the center of the BOA is approximately 13 arcsec from the center of the PSA, the (inner, outer) radii that define the annulus are (5, 22) arcsec from the position of VFTS 482. Within this annulus, there are 3 sources in the HTTP catalog with m_f275w < 11.9.*

*See:*
*~/box/ullyses_tech/ullyses_proposals/c27_mc/16093/VFTS-482/myBOT/BOA/HTTP_VFTS482_r22.0arcsec_m_f275w11.9_BOA.png*
*~/box/ullyses_tech/ullyses_proposals/c27_mc/16093/VFTS-482/myBOT/BOA/HTTP_VFTS482_r22.0arcsec_m_f275w11.9_BOA.csv*

*The brightest of these 3 sources has m_f275w = 9.728, which is 3.3 magnitudes (a factor of 20.9 in flux) fainter than the BOA bright limit. There are NO individual stars brighter than the f275w bright limit for the BOA. However, for a range of PA's near 60 degrees, the BOA samples the central region of the R136 cluster. See:*
*~/box/ullyses_tech/ullyses_proposals/c27_mc/16093/VFTS-482/myBOT/BOA/HTTP_VFTS482_r22.0arcsec_pa_60_to_60_m_F275w11.9_BOA.png*

*Consequently, it is conceivable that together with the flux from VFTS 482 in the PSA, the cumulative flux from multiple stars could contribute count rates that exceed the detector segment count-rate limits. This possibility can be eliminated by imposing a PA constraint on the visit: 120 degrees < PA < 340 degrees. The position of the BOA at these two extremes confirms that the core of the R136 cluster is avoided; see:*
*~/box/ullyses_tech/ullyses_proposals/c27_mc/16093/VFTS-482/myBOT/BOA/HTTP_VFTS482_r22.0arcsec_pa_120_to_340_m_F275w11.9_BOA.png*

*CONCLUSION:*
*Within the specified PA restrictions, this analysis confirms that there are NO Health & Safety issues associated with the dispersed light acquisition or G130M and G160M observations of VFTS 482 through the PSA.*

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | 3 | G130M/1291-3 (COS.sp.1454809) | (2) VFTS-482 | COS/FUV, TIME-TAG, PSA | G130M 1291 A | BUFFER-TIME=220.0; FP-POS=3 | 1020 Secs (1020 Secs)<br>*[==>]* | ***[1]*** |

*Comments: SED PoWR_42000_3.80_Z0.50_lmc30Dor_ebmv_0.33; includes an increase in model flux by a factor of 1.7*
*~/box/ullyses_tech/ullyses_proposals/c27_mc/16093/VFTS-482/VFTS-482_adopted_sed.fits*
*ETC estimates SNR = 30/resel at 1150 +/- 0.5 A in 1,019.5160 s*
*Baseline exposure time rounded to 1020 s (510 s per FP-POS)*
*countrate (total, brightest segment) = (7105.9, 3639.2) cts/s*
*brightest pixel: 0.137 cts/s at 1216.2 A*
*BUFFER-TIME = 2/3 * 331 s = 220 s*

*Notes on Bright Object Checking:*

*VFTS 482 is on the outskirts of the 30 Dor region. The BOT cannot identify any targets in the GSC II or Galex catalogs because the DSS and 2MASS images are saturated by the bright nebulosity. Instead, the capabilities of the BOT have been reproduced by using the catalog and imaging products developed by the Hubble Tarantula Treasury Project (HTTP). See Sabbi et al. (2016ApJS..222...11S) and https://archive.stsci.edu/prepds/30dor/ for details.*

*The HTTP catalog provides magnitudes in the VEGAMAG system for the WFC3 F275W filter, which is a more reliable estimator of the UV flux of an early-type star than the Johnson V-band. ETC calculations were run for a range of m_f275w values to probe the count-rate limits for the COS G130M/1291 and G160M/1611 configurations. A model spectrum from the PoWR grid that corresponds to an unreddened O5 V star in the LMC - (Teff, logg, Z/Zsun) = (41 kK, 4.00, 0.50) - was used for these calculation.*
*See:*
*~/box/ullyses_tech/ullyses_proposals/c27_mc/16093/VFTS-482/myBOT/F275W_Limiting_Magnitudes/PoWR_41000_4.00_Z0.50_lmc30Dor_ebmv_0.0_sed.png*
*~/box/ullyses_tech/ullyses_proposals/c27_mc/16093/VFTS-482/myBOT/F275W_Limiting_Magnitudes/PoWR_41000_4.00_Z0.50_lmc30Dor_ebmv_0.0_sed.fits*

*The results of these calculations are summarized in the spreadsheet:*
*~/box/ullyses_tech/ullyses_proposals/c27_mc/16093/VFTS-482/myBOT/F275W_Limiting_Magnitudes/Limiting_F275w_magnitudes_for_O5V.xlsx*

*They show that*
*1. An unreddened O5 V star with VEGAMAG m_f275w < 11.9 can be safely observed through the PSA with COS G130M/1291 and G160M/1611.*
*2. By assuming a throughput of 0.6% relative to the PSA (extrapolated from Fig. 3.2 in the COS IHB), the spectroscopic limit for the BOA is m_f275w < 6.4.*
*3. Since the extinction in the 30 Dor region is actually quite significant, these limits are very conservative.*
*For subsequent bright-object checking:*
*- Any star with m_f275w > 11.9 in the HTTP catalog is deemed to pose no threat to the health & safety of the COS detectors if observed through the PSA in the (G130M/1291, G160M/1611) configurations.*
*- Any star with m_f2752 > 6.4 in the HTTP catalog is deemed to pose no threat to the health & safety of the COS detectors if observed through the BOA in the (G130M/1291, G160M/1611) configurations.*
*Stars in the search region for the PSA that are brighter than m_f275w = 11.9 require explicit ETC calculations to verify their status.*

*FIRST:*
*Consider the circular region within 8 arcsec of the center of the PSA.*

*a) There are 24 sources in the HTTP catalog with m_f275w < 15.0, including VFTS 482.*
*See:*
*~/box/ullyses_tech/ullyses_proposals/c27_mc/16093/VFTS-482/myBOT/PSA/HTTP_VFTS482_r8.0arcsec_m_f275w15.0.png*
*~/box/ullyses_tech/ullyses_proposals/c27_mc/16093/VFTS-482/myBOT/PSA/HTTP_VFTS482_r8.0arcsec_m_f275w15.0.csv*

*Note that the numbers indicated on the image refer to the row in the csv table. There is no "1" because the first row in the csv file contains column names.*

*The brightest contaminant within the PSA is Star 18 = SABBI 053840.331-690559.65, which is 0.66 arcsec from VFTS 482. The magnitude difference at 2750 Angstroms implies that Star 18 has ~4% of the measured flux of VFTS 482. If Star 18 were an unreddened O5 V star - WHICH IT IS NOT! - it would contribute to the G130M/1291 count rate as follows:*

| | Count Rate Segment A | Count Rate Segment B | ETC Calculation |
|---|---|---|---|
| Star 18 | 522.944 | 993.490 | COS.sp.1458280 |
| VFTS 482 | 3466.719 | 3639.238 | COS.sp.1454809 |
| TOTAL | 3989.663 | 4632.728 | |

*These count rates are well below the limit of 15000 counts/s per segment. Consequently, contamination by Star 18 poses no threat to the health & safety of the COS detectors.*

*b) There are 2 sources in the HTTP catalog with m_f275w < 11.9, one of which is VFTS 482.*
*See:*
*~/box/ullyses_tech/ullyses_proposals/c27_mc/16093/VFTS-482/myBOT/PSA/HTTP_VFTS482_r8.0arcsec_m_f275w11.9.png*
*~/box/ullyses_tech/ullyses_proposals/c27_mc/16093/VFTS-482/myBOT/PSA/HTTP_VFTS482_r8.0arcsec_m_f275w11.9.csv*

*VFTS 482 has been shown to be safe by ETC calculation COS.sp.1454809*

*The other bright star is SABBI 053840.539-690557.18 = VFTS 1001 = Brey 75 = BAT99 100 = R134 = [P93] 786 = Cl* NGC 2070 SMB 013 = [HSH95] 4:*
*SpType = WN6h 1998ApJ...493..180M*
*V = 12.747 1999A&A...341...98S*
*B = 12.838 1999A&A...341...98S*
*U = 12.171 1999A&A...341...98S*

*It is 3.19 arcsec from VFTS 482, which corresponds to 2.55 times the radius of the PSA. The STEP_SIZE for FUV/ACQ PEAKXD is 1.3 arcsec = 1.04 times the radius of the PSA. With NUM_POS=3, there would be a t most a single step in the direction of VFTS 1001, which could therefore not appear in the PSA during a PEAKXD scan irrespective of the orientation. Similarly, the SAMS for a PEAKD maneuver with NUM_POS=5 and STEP_SIZE=0.9 will move the PSA 2*0.9 arcsec = 1.8 arcsec = 1.44 times the radius of the PSA in the direction of a nearby spoiler star. Consequently, it is unlikely that VFTS 1001 star will be encountered durin g the target acquisition procedure.*

*Fits to model atmospheres have been published for VFTS 1001 by Bestenlehner et al. (2014A&A...570A..38B) and Hainich et al. (2014A&A...565A..27H). A PoWR model atmosphere for a WNL star with a depleted H content of 0.2 by mass and with other parameters parameters similar to those derived by Hainich et al. provides a good match to the available data: see*
*~/box/ullyses_tech/ullyses_proposals/c27_mc/16093/VFTS-482/myBOT/VFTS1001/VFTS-1001_adopted_sed_vs_FOS.png*

*The adopted SED*
*~/box/ullyses_tech/ullyses_proposals/c27_mc/16093/VFTS-482/myBOT/VFTS1001/VFTS-1001_adopted_sed.fits*

*corresponds to the file*
*~/box/ullyses_tech/ullyses_proposals/c27_mc/16093/VFTS-482/myBOT/VFTS1001/seds/PoWR_44668_3.77_m4.49_Z0.50_lmc30Dor_ebmv_0.3_sed.fits.*

*ETC calculations with this input spectrum centered in the PSA give the following results with NO WARNINGS:*

| *Configuration* | *ETC Calculation* | *Count Rate(SegA)* | *CountRate(SegB)* | *Total CountRate* | *Brightest Pixel* |
|---|---|---|---|---|---|
| *G130M/1291* | *COS.sp.1458984* | *2988.915* | *3467.354* | *6456.269* | *0.319 ct/s @ 1216.11 A* |
| *G160M/1611* | *COS.sp.1458985* | *1027.378* | *2852.074* | *3879.452* | *0.063 ct/s @ 1420.48 A* |

*Consequently, inadvertent exposure to this target poses no health & safety risk to the COS detectors.*

*SECOND:*
*Consider the annulus that the region of interest (ROI) associated with the BOA sweeps out for a range of PAs between 0 and 360 degrees. Like the PSA, this ROI is circular with a radius of 8 arcsec. Since the center o f the BOA is approximately 13 arcsec from the center of the PSA, the (inner, outer) radii that define the annulus are (5, 22) arcsec from the position of VFTS 482. Within this annulus, there are 3 sources in the HTTP c atalog with m_f275w < 11.9.*

*See:*
*~/box/ullyses_tech/ullyses_proposals/c27_mc/16093/VFTS-482/myBOT/BOA/HTTP_VFTS482_r22.0arcsec_m_f275w11.9_BOA.png*
*~/box/ullyses_tech/ullyses_proposals/c27_mc/16093/VFTS-482/myBOT/BOA/HTTP_VFTS482_r22.0arcsec_m_f275w11.9_BOA.csv*

*The brightest of these 3 sources has m_f275w = 9.728, which is 3.3 magnitudes (a factor of 20.9 in flux) fainter than the BOA bright limit. There are NO individual stars brighter than the f275w bright limit for the BO A. However, for a range of PA's near 60 degrees, the BOA samples the central region of the R136 cluster. See:*
*~/box/ullyses_tech/ullyses_proposals/c27_mc/16093/VFTS-482/myBOT/BOA/HTTP_VFTS482_r22.0arcsec_pa_60_to_60_m_F275w11.9_BOA.png*

*Consequently, it is conceivable that together with the flux from VFTS 482 in the PSA, the cumulative flux from multiple stars could contribute count rates that exceed the detector segment count-rate limits. This possibi lity can be eliminated by imposing a PA constraint on the visit: 120 degrees < PA < 340 degrees. The position of the BOA at these two extremes confirms that the core of the R136 cluster is avoided; see:*
*~/box/ullyses_tech/ullyses_proposals/c27_mc/16093/VFTS-482/myBOT/BOA/HTTP_VFTS482_r22.0arcsec_pa_120_to_340_m_F275w11.9_BOA.png*

*CONCLUSION:*
*Within the specified PA restrictions, this analysis confirms that there are NO Health & Safety issues associated with the dispersed light acquisition or G130M and G160M observations of VFTS 482 through the PSA.*

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | 4 | G130M/1291-4 (COS.sp.1454809) | (2) VFTS-482 | COS/FUV, TIME-TAG, PSA | G130M 1291 A | BUFFER-TIME=2200.0; FP-POS=4 | 1020 Secs (1020 Secs)<br>*[==>]* | ***[1]*** |

*Comments: SED PoWR_42000_3.80_Z0.50_lmc30Dor_ebmv_0.33; includes an increase in model flux by a factor of 1.7*
*~/box/ullyses_tech/ullyses_proposals/c27_mc/16093/VFTS-482/VFTS-482_adopted_sed.fits*
*ETC estimates SNR = 30/resel at 1150 +/- 0.5 A in 1,019.5160 s*
*Baseline exposure time rounded to 1020 s (510 s per FP-POS)*
*countrate (total, brightest segment) = (7105.9, 3639.2) cts/s*
*brightest pixel: 0.137 cts/s at 1216.2 A*
*BUFFER-TIME = 2/3 * 331 s = 220 s*

*The final exposure time was increased SUBSTANTIALLY during orbit-packing to 1020 s per FP-POS, or 2040 s in total.. ETC Calculation COS.sp.1460213 show that the expected SNR is 42.4 per resel @ 1150 +/- 0 .5 A.*

*Notes on Bright Object Checking:*

*VFTS 482 is on the outskirts of the 30 Dor region. The BOT cannot identify any targets in the GSC II or Galex catalogs because the DSS and 2MASS images are saturated by the bright nebulosity. Instead, the capabili ties of the BOT have been reproduced by using the catalog and imaging products developed by the Hubble Tarantula Treasury Project (HTTP). See Sabbi et al. (2016ApJS..222...11S) and https://archive.stsci.edu/prep ds/30dor/ for details.*

*The HTTP catalog provides magnitudes in the VEGAMAG system for the WFC3 F275W filter, which is a more reliable estimator of the UV flux of an early-type star than the Johnson V-band. ETC calculations were r un for a range of m_f275w values to probe the count-rate limits for the COS G130M/1291 and G160M/1611 configurations. A model spectrum from the PoWR grid that corresponds to an unreddened O5 V star in the LMC - (Teff, logg, Z/Zsun) = (41 kK, 4.00, 0.50) - was used for these calculation.*
*See:*
*~/box/ullyses_tech/ullyses_proposals/c27_mc/16093/VFTS-482/myBOT/F275W_Limiting_Magnitudes/PoWR_41000_4.00_Z0.50_lmc30Dor_ebmv_0.0_sed.png*
*~/box/ullyses_tech/ullyses_proposals/c27_mc/16093/VFTS-482/myBOT/F275W_Limiting_Magnitudes/PoWR_41000_4.00_Z0.50_lmc30Dor_ebmv_0.0_sed.fits*

*The results of these calculations are summarized in the spreadsheet:*
*~/box/ullyses_tech/ullyses_proposals/c27_mc/16093/VFTS-482/myBOT/F275W_Limiting_Magnitudes/Limiting_F275w_magnitudes_for_O5V.xlsx*

*They show that*
*1. An unreddened O5 V star with VEGAMAG m_f275w < 11.9 can be safely observed through the PSA with COS G130M/1291 and G160M/1611.*
*2. By assuming a throughput of 0.6% relative to the PSA (extrapolated from Fig. 3.2 in the COS IHB), the spectroscopic limit for the BOA is m_f275w < 6.4.*
*3. Since the extinction in the 30 Dor region is actually quite significant, these limits are very conservative.*
*For subsequent bright-object checking:*
*- Any star with m_f275w > 11.9 in the HTTP catalog is deemed to pose no threat to the health & safety of the COS detectors if observed through the PSA in the (G130M/1291, G160M/1611) configurations.*
*- Any star with m_f2752 > 6.4 in the HTTP catalog is deemed to pose no threat to the health & safety of the COS detectors if observed through the BOA in the (G130M/1291, G160M/1611) configurations.*
*Stars in the search region for the PSA that are brighter than m_f275w = 11.9 require explicit ETC calculations to verify their status.*

*FIRST:*
*Consider the circular region within 8 arcsec of the center of the PSA.*

*a) There are 24 sources in the HTTP catalog with m_f275w < 15.0, including VFTS 482.*
*See:*
*~/box/ullyses_tech/ullyses_proposals/c27_mc/16093/VFTS-482/myBOT/PSA/HTTP_VFTS482_r8.0arcsec_m_f275w15.0.png*
*~/box/ullyses_tech/ullyses_proposals/c27_mc/16093/VFTS-482/myBOT/PSA/HTTP_VFTS482_r8.0arcsec_m_f275w15.0.csv*

*Note that the numbers indicated on the image refer to the row in the csv table. There is no "1" because the first row in the csv file contains column names.*

*The brightest contaminant within the PSA is Star 18 = SABBI 053840.331-690559.65, which is 0.66 arcsec from VFTS 482. The magnitude difference at 2750 Angstroms implies that Star 18 has ~4% of the measured fl ux of VFTS 482. If Star 18 were an unreddened O5 V star - WHICH IT IS NOT! - it would contribute to the G130M/1291 count rate as follows:*

| | Count Rate Segment A | Count Rate Segment B | ETC Calculation |
|---|---|---|---|
| Star 18 | 522.944 | 993.490 | COS.sp.1458280 |
| VFTS 482 | 3466.719 | 3639.238 | COS.sp.1454809 |
| TOTAL | 3989.663 | 4632.728 | |

*These count rates are well below the limit of 15000 counts/s per segment. Consequently, contamination by Star 18 poses no threat to the health & safety of the COS detectors.*

*b) There are 2 sources in the HTTP catalog with m_f275w < 11.9, one of which is VFTS 482.*
*See:*
*~/box/ullyses_tech/ullyses_proposals/c27_mc/16093/VFTS-482/myBOT/PSA/HTTP_VFTS482_r8.0arcsec_m_f275w11.9.png*
*~/box/ullyses_tech/ullyses_proposals/c27_mc/16093/VFTS-482/myBOT/PSA/HTTP_VFTS482_r8.0arcsec_m_f275w11.9.csv*

*VFTS 482 has been shown to be safe by ETC calculation COS.sp.1454809*

*The other bright star is SABBI 053840.539-690557.18 = VFTS 1001 = Brey 75 = BAT99 100 = R134 = [P93] 786 = Cl* NGC 2070 SMB 013 = [HSH95] 4:*

*SpType = WN6h 1998ApJ...493..180M*
*V = 12.747 1999A&A...341...98S*
*B = 12.838 1999A&A...341...98S*
*U = 12.171 1999A&A...341...98S*

*It is 3.19 arcsec from VFTS 482, which corresponds to 2.55 times the radius of the PSA. The STEP_SIZE for FUV/ACQ PEAKXD is 1.3 arcsec = 1.04 times the radius of the PSA. With NUM_POS=3, there would be at most a single step in the direction of VFTS 1001, which could therefore not appear in the PSA during a PEAKXD scan irrespective of the orientation. Similarly, the SAMS for a PEAKD maneuver with NUM_POS=5 and STEP_SIZE=0.9 will move the PSA 2*0.9 arcsec = 1.8 arcsec = 1.44 times the radius of the PSA in the direction of a nearby spoiler star. Consequently, it is unlikely that VFTS 1001 star will be encountered during the target acquisition procedure.*

*Fits to model atmospheres have been published for VFTS 1001 by Bestenlehner et al. (2014A&A...570A..38B) and Hainich et al. (2014A&A...565A..27H). A PoWR model atmosphere for a WNL star with a depleted H content of 0.2 by mass and with other parameters parameters similar to those derived by Hainich et al. provides a good match to the available data: see*
*~/box/ullyses_tech/ullyses_proposals/c27_mc/16093/VFTS-482/myBOT/VFTS1001/VFTS-1001_adopted_sed_vs_FOS.png*

*The adopted SED*
*~/box/ullyses_tech/ullyses_proposals/c27_mc/16093/VFTS-482/myBOT/VFTS1001/VFTS-1001_adopted_sed.fits*

*corresponds to the file*
*~/box/ullyses_tech/ullyses_proposals/c27_mc/16093/VFTS-482/myBOT/VFTS1001/seds/PoWR_44668_3.77_m4.49_Z0.50_lmc30Dor_ebmv_0.3_sed.fits.*

*ETC calculations with this input spectrum centered in the PSA give the following results with NO WARNINGS:*

| Configuration | ETC Calculation | Count Rate(SegA) | CountRate(SegB) | Total CountRate | Brightest Pixel |
|---|---|---|---|---|---|
| G130M/1291 | COS.sp.1458984 | 2988.915 | 3467.354 | 6456.269 | 0.319 ct/s @ 1216.11 A |
| G160M/1611 | COS.sp.1458985 | 1027.378 | 2852.074 | 3879.452 | 0.063 ct/s @ 1420.48 A |

*Consequently, inadvertent exposure to this target poses no health & safety risk to the COS detectors.*

*SECOND:*
*Consider the annulus that the region of interest (ROI) associated with the BOA sweeps out for a range of PAs between 0 and 360 degrees. Like the PSA, this ROI is circular with a radius of 8 arcsec. Since the center of the BOA is approximately 13 arcsec from the center of the PSA, the (inner, outer) radii that define the annulus are (5, 22) arcsec from the position of VFTS 482. Within this annulus, there are 3 sources in the HTTP catalog with m_f275w < 11.9.*

*See:*
*~/box/ullyses_tech/ullyses_proposals/c27_mc/16093/VFTS-482/myBOT/BOA/HTTP_VFTS482_r22.0arcsec_m_f275w11.9_BOA.png*
*~/box/ullyses_tech/ullyses_proposals/c27_mc/16093/VFTS-482/myBOT/BOA/HTTP_VFTS482_r22.0arcsec_m_f275w11.9_BOA.csv*

*The brightest of these 3 sources has m_f275w = 9.728, which is 3.3 magnitudes (a factor of 20.9 in flux) fainter than the BOA bright limit. There are NO individual stars brighter than the f275w bright limit for the BOA. However, for a range of PA's near 60 degrees, the BOA samples the central region of the R136 cluster. See:*
*~/box/ullyses_tech/ullyses_proposals/c27_mc/16093/VFTS-482/myBOT/BOA/HTTP_VFTS482_r22.0arcsec_pa_60_to_60_m_F275w11.9_BOA.png*

*Consequently, it is conceivable that together with the flux from VFTS 482 in the PSA, the cumulative flux from multiple stars could contribute count rates that exceed the detector segment count-rate limits. This possibility can be eliminated by imposing a PA constraint on the visit: 120 degrees < PA < 340 degrees. The position of the BOA at these two extremes confirms that the core of the R136 cluster is avoided; see:*
*~/box/ullyses_tech/ullyses_proposals/c27_mc/16093/VFTS-482/myBOT/BOA/HTTP_VFTS482_r22.0arcsec_pa_120_to_340_m_F275w11.9_BOA.png*

*CONCLUSION:*
*Within the specified PA restrictions, this analysis confirms that there are NO Health & Safety issues associated with the dispersed light acquisition or G130M and G160M observations of VFTS 482 through the PSA.*

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | 5 | G160M/1611 (COS.sp.1454808) | (2) VFTS-482 | COS/FUV, TIME-TAG, PSA | G160M 1611 A | BUFFER-TIME=342.0; FP-POS=ALL | 520 Secs (2080 Secs)<br>*[==>(Split 1)]*<br>*[==>(Split 2)]*<br>*[==>(Split 3)]*<br>*[==>(Split 4)]* | ***[2]*** |

*Comments: SED PoWR_42000_3.80_Z0.50_lmc30Dor_ebmv_0.33; includes an increase in model flux by a factor of 1.7*
*~/box/ullyses_tech/ullyses_proposals/c27_mc/16093/VFTS-482/VFTS-482_adopted_sed.fits*
*ETC estimates SNR = 30/resel at 1590 +/- 0.5 A in 901.7 s*
*Baseline exposure time rounded to 904 s (226 s per FP-POS)*
*countrate (total, brightest segment) = (4591.6, 3450.2) cts/s*
*brightest pixel: 0.055 cts/s at 1423.5 A*
*BUFFER-TIME = 2/3 * 513 s = 342 s*

*The final exposure time was increased SUBSTANTIALLY during orbit-packing to 520 s per FP-POS, or 2080 s in total.. ETC Calculation COS.sp.1460212 show that the expected SNR is 45.6 per resel @ 1590 +/- 0.5 A.*

*Notes on Bright Object Checking:*

*VFTS 482 is on the outskirts of the 30 Dor region. The BOT cannot identify any targets in the GSC II or Galex catalogs because the DSS and 2MASS images are saturated by the bright nebulosity. Instead, the capabilities of the BOT have been reproduced by using the catalog and imaging products developed by the Hubble Tarantula Treasury Project (HTTP). See Sabbi et al. (2016ApJS..222...11S) and https://archive.stsci.edu/prepds/30dor/ for details.*

*The HTTP catalog provides magnitudes in the VEGAMAG system for the WFC3 F275W filter, which is a more reliable estimator of the UV flux of an early-type star than the Johnson V-band. ETC calculations were run for a range of m_f275w values to probe the count-rate limits for the COS G130M/1291 and G160M/1611 configurations. A model spectrum from the PoWR grid that corresponds to an unreddened O5 V star in the LMC - (Teff, logg, Z/Zsun) = (41 kK, 4.00, 0.50) - was used for these calculation.*
*See:*
*~/box/ullyses_tech/ullyses_proposals/c27_mc/16093/VFTS-482/myBOT/F275W_Limiting_Magnitudes/PoWR_41000_4.00_Z0.50_lmc30Dor_ebmv_0.0_sed.png*
*~/box/ullyses_tech/ullyses_proposals/c27_mc/16093/VFTS-482/myBOT/F275W_Limiting_Magnitudes/PoWR_41000_4.00_Z0.50_lmc30Dor_ebmv_0.0_sed.fits*

*The results of these calculations are summarized in the spreadsheet:*
*~/box/ullyses_tech/ullyses_proposals/c27_mc/16093/VFTS-482/myBOT/F275W_Limiting_Magnitudes/Limiting_F275w_magnitudes_for_O5V.xlsx*

*They show that*
*1. An unreddened O5 V star with VEGAMAG m_f275w < 11.9 can be safely observed through the PSA with COS G130M/1291 and G160M/1611.*
*2. By assuming a throughput of 0.6% relative to the PSA (extrapolated from Fig. 3.2 in the COS IHB), the spectroscopic limit for the BOA is m_f275w < 6.4.*
*3. Since the extinction in the 30 Dor region is actually quite significant, these limits are very conservative.*
*For subsequent bright-object checking:*
*- Any star with m_f275w > 11.9 in the HTTP catalog is deemed to pose no threat to the health & safety of the COS detectors if observed through the PSA in the (G130M/1291, G160M/1611) configurations.*
*- Any star with m_f2752 > 6.4 in the HTTP catalog is deemed to pose no threat to the health & safety of the COS detectors if observed through the BOA in the (G130M/1291, G160M/1611) configurations.*
*Stars in the search region for the PSA that are brighter than m_f275w = 11.9 require explicit ETC calculations to verify their status.*

*FIRST:*
*Consider the circular region within 8 arcsec of the center of the PSA.*

*a) There are 24 sources in the HTTP catalog with m_f275w < 15.0, including VFTS 482.*
*See:*
*~/box/ullyses_tech/ullyses_proposals/c27_mc/16093/VFTS-482/myBOT/PSA/HTTP_VFTS482_r8.0arcsec_m_f275w15.0.png*
*~/box/ullyses_tech/ullyses_proposals/c27_mc/16093/VFTS-482/myBOT/PSA/HTTP_VFTS482_r8.0arcsec_m_f275w15.0.csv*

*Note that the numbers indicated on the image refer to the row in the csv table. There is no "1" because the first row in the csv file contains column names.*

*The brightest contaminant within the PSA is Star 18 = SABBI 053840.331-690559.65, which is 0.66 arcsec from VFTS 482. The magnitude difference at 2750 Angstroms implies that Star 18 has ~4% of the measured flux of VFTS 482. If Star 18 were an unreddened O5 V star - WHICH IT IS NOT! - it would contribute to the G130M/1291 count rate as follows:*

| | Count Rate Segment A | Count Rate Segment B | ETC Calculation |
|---|---|---|---|
| Star 18 | 522.944 | 993.490 | COS.sp.1458280 |
| VFTS 482 | 3466.719 | 3639.238 | COS.sp.1454809 |
| TOTAL | 3989.663 | 4632.728 | |

*These count rates are well below the limit of 15000 counts/s per segment. Consequently, contamination by Star 18 poses no threat to the health & safety of the COS detectors.*

*b) There are 2 sources in the HTTP catalog with m_f275w < 11.9, one of which is VFTS 482.*
*See:*
*~/box/ullyses_tech/ullyses_proposals/c27_mc/16093/VFTS-482/myBOT/PSA/HTTP_VFTS482_r8.0arcsec_m_f275w11.9.png*
*~/box/ullyses_tech/ullyses_proposals/c27_mc/16093/VFTS-482/myBOT/PSA/HTTP_VFTS482_r8.0arcsec_m_f275w11.9.csv*

*VFTS 482 has been shown to be safe by ETC calculation COS.sp.1454809*

*The other bright star is SABBI 053840.539-690557.18 = VFTS 1001 = Brey 75 = BAT99 100 = R134 = [P93] 786 = Cl* NGC 2070 SMB 013 = [HSH95] 4:*
*SpType = WN6h 1998ApJ...493..180M*

*V = 12.747 1999A&A...341...98S*
*B = 12.838 1999A&A...341...98S*
*U = 12.171 1999A&A...341...98S*

*It is 3.19 arcsec from VFTS 482, which corresponds to 2.55 times the radius of the PSA. The STEP_SIZE for FUV/ACQ PEAKXD is 1.3 arcsec = 1.04 times the radius of the PSA. With NUM_POS=3, there would be a t most a single step in the direction of VFTS 1001, which could therefore not appear in the PSA during a PEAKXD scan irrespective of the orientation. Similarly, the SAMS for a PEAKD maneuver with NUM_POS=5 and STEP_SIZE=0.9 will move the PSA 2*0.9 arcsec = 1.8 arcsec = 1.44 times the radius of the PSA in the direction of a nearby spoiler star. Consequently, it is unlikely that VFTS 1001 star will be encountered durin g the target acquisition procedure.*

*Fits to model atmospheres have been published for VFTS 1001 by Bestenlehner et al. (2014A&A...570A..38B) and Hainich et al. (2014A&A...565A..27H). A PoWR model atmosphere for a WNL star with a depleted H content of 0.2 by mass and with other parameters parameters similar to those derived by Hainich et al. provides a good match to the available data: see*
*~/box/ullyses_tech/ullyses_proposals/c27_mc/16093/VFTS-482/myBOT/VFTS1001/VFTS-1001_adopted_sed_vs_FOS.png*

*The adopted SED*
*~/box/ullyses_tech/ullyses_proposals/c27_mc/16093/VFTS-482/myBOT/VFTS1001/VFTS-1001_adopted_sed.fits*

*corresponds to the file*
*~/box/ullyses_tech/ullyses_proposals/c27_mc/16093/VFTS-482/myBOT/VFTS1001/seds/PoWR_44668_3.77_m4.49_Z0.50_lmc30Dor_ebmv_0.3_sed.fits.*

*ETC calculations with this input spectrum centered in the PSA give the following results with NO WARNINGS:*

| Configuration | ETC Calculation | Count Rate(SegA) | CountRate(SegB) | Total CountRate | Brightest Pixel |
|---|---|---|---|---|---|
| G130M/1291 | COS.sp.1458984 | 2988.915 | 3467.354 | 6456.269 | 0.319 ct/s @ 1216.11 A |
| G160M/1611 | COS.sp.1458985 | 1027.378 | 2852.074 | 3879.452 | 0.063 ct/s @ 1420.48 A |

*Consequently, inadvertent exposure to this target poses no health & safety risk to the COS detectors.*

*SECOND:*
*Consider the annulus that the region of interest (ROI) associated with the BOA sweeps out for a range of PAs between 0 and 360 degrees. Like the PSA, this ROI is circular with a radius of 8 arcsec. Since the center o f the BOA is approximately 13 arcsec from the center of the PSA, the (inner, outer) radii that define the annulus are (5, 22) arcsec from the position of VFTS 482. Within this annulus, there are 3 sources in the HTTP c atalog with m_f275w < 11.9.*

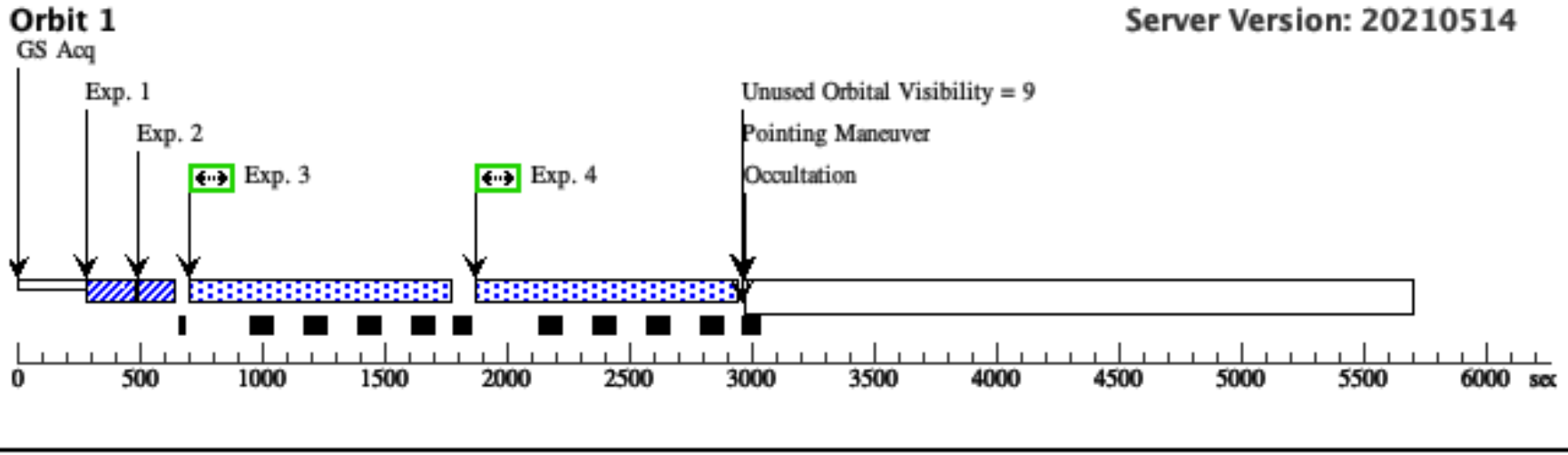
*See:*
*~/box/ullyses_tech/ullyses_proposals/c27_mc/16093/VFTS-482/myBOT/BOA/HTTP_VFTS482_r22.0arcsec_m_f275w11.9_BOA.png*
*~/box/ullyses_tech/ullyses_proposals/c27_mc/16093/VFTS-482/myBOT/BOA/HTTP_VFTS482_r22.0arcsec_m_f275w11.9_BOA.csv*

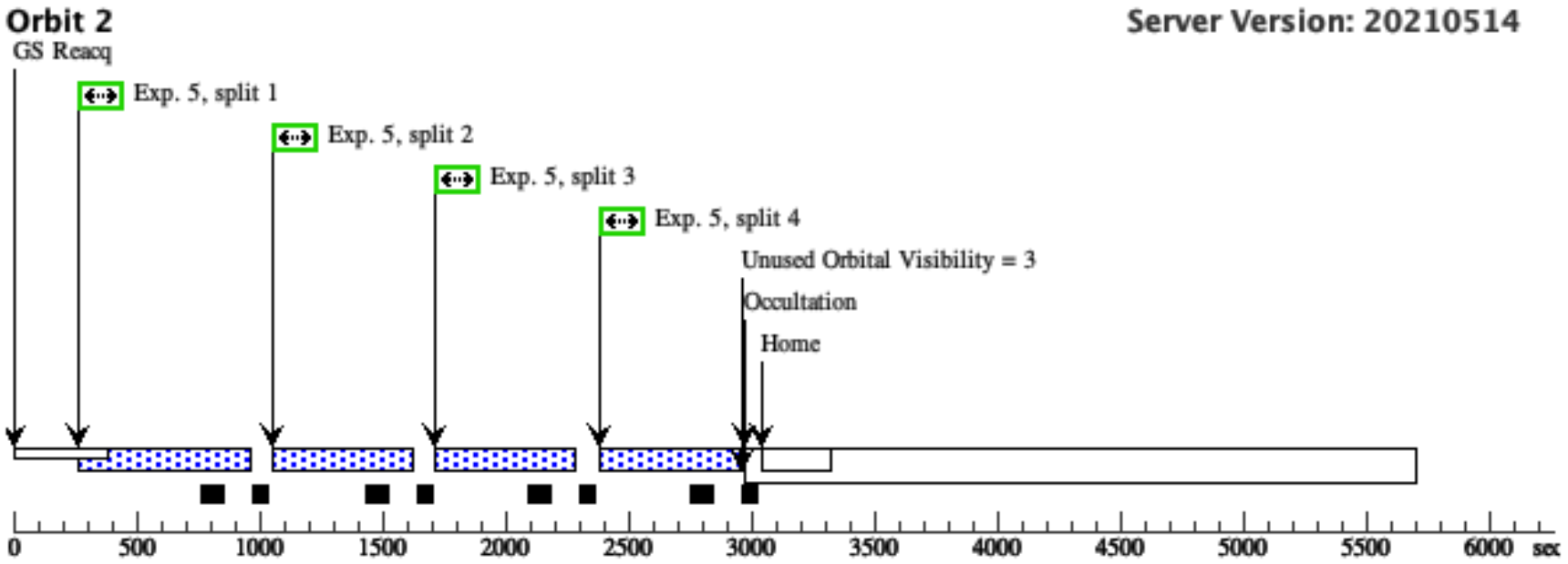
*The brightest of these 3 sources has m_f275w = 9.728, which is 3.3 magnitudes (a factor of 20.9 in flux) fainter than the BOA bright limit. There are NO individual stars brighter than the f275w bright limit for the BO A. However, for a range of PA's near 60 degrees, the BOA samples the central region of the R136 cluster. See:*
*~/box/ullyses_tech/ullyses_proposals/c27_mc/16093/VFTS-482/myBOT/BOA/HTTP_VFTS482_r22.0arcsec_pa_60_to_60_m_F275w11.9_BOA.png*

*Consequently, it is conceivable that together with the flux from VFTS 482 in the PSA, the cumulative flux from multiple stars could contribute count rates that exceed the detector segment count-rate limits. This possibi lity can be eliminated by imposing a PA constraint on the visit: 120 degrees < PA < 340 degrees. The position of the BOA at these two extremes confirms that the core of the R136 cluster is avoided; see:*
*~/box/ullyses_tech/ullyses_proposals/c27_mc/16093/VFTS-482/myBOT/BOA/HTTP_VFTS482_r22.0arcsec_pa_120_to_340_m_F275w11.9_BOA.png*

*CONCLUSION:*
*Within the specified PA restrictions, this analysis confirms that there are NO Health & Safety issues associated with the dispersed light acquisition or G130M and G160M observations of VFTS 482 through the PSA.*

Orbit Structure



**Visit**

**Proposal 16093, W61-28-5-COS (3C), completed** Wed Sep 22 15:00:30 GMT 2021

**Diagnostic Status: Warning**

Scientific Instruments: COS/FUV

Special Requirements: SCHED 100%

*Comments: vstatus; 3C; W61-28-5; P/COS approved for submission; P/AF 10/08/20 ; intrev: complete; P/CP 05/10/20*
*vcheck; Enter targ name & Inst. & Resp. Sci.; W61-28-5 ; COS ; AF*
*vcheck; ETC numbers entered in APT?; Completed*
*vcheck; Any screening violations?; Benign warning - exceeds segment count-rate limit for irregularly variable source*
*vcheck; S/N ETC calcs done & documented?; Yes*
*vcheck; Field images checked & saved?; Yes - W61-28-5_DSS.png and W61-28-5_2MASS.png*
*vcheck; Selected ACQ strategy?; Dispersed 1291*
*vcheck; Possible ACQ or Sci spoilers?; None*
*vcheck; Field BOT clear?; Yes*
*vcheck; Visual BOT check for stars not in catalog?; No sources of concern - all have V > 17 in Zaritsky catalog*
*vcheck; Orbit packing finalized?; 3 orbits*
*vcheck; Buffer times optimized?; Done*
*vcheck; Verify visit grouping correct; Not applicable*
*vcheck; Is visit ready for int. review?; Yes*
*Allocated COS orbits = 3*

**Diagnostics**

(W61-28-5-COS (3C)) Warning (Orbit Planner): ORBITAL VISIBILITY OVERRUN

**Fixed Targets**

| # | Name | Target Coordinates | Targ. Coord. Corrections | Fluxes | Miscellaneous |
|---|---|---|---|---|---|
| (3) | W61-28-5 | RA: 05 34 28.4703 (83.6186263d) | | V=13.92 | Reference Frame: ICRS |
| | Alt Name1: 2MASS-J05342846-6943568 | Dec: -69 43 56.83 (-69.73245d)<br>Equinox: J2000 | | SpT=O4 V((f+)); E(B-V)=0.13; U=12.64; B=13.74; V=13.92; F1160=5.15e-13; F1360=3.30e-13; F1700=2.69e-13 | |

*Comments: W61-28-5 : W28-5, W28_5, W61 28-5*
*Previous name : W28-5*
*Input file: LMC_2020Feb20/input/LMC_all_do1_fixed_wr_NewCoords_pids.csv*
*SIMBAD link (W61 28-5): https://simbad.u-strasbg.fr/simbad/sim-id?Ident=W61+28-5&submit=submit+id*
*SpT = O4 V((f+))*
*COS/G130M/c1096 : rn-max(WM-Basic(O4 V, Z=0.008, Teff=45709, log_lum=5.60, log_g=4.00) (extinction lmcavg=0.100), flux1160 +- 30.0A flux=5.2e-13 Flam)*
*COS/G130M/c1291 : rn-max(WM-Basic(O4 V, Z=0.008, Teff=45709, log_lum=5.60, log_g=4.00) (extinction lmcavg=0.100), flux1360 +- 30.0A flux=3.3e-13 Flam)*
*COS/G160M/c1611 : rn-max(WM-Basic(O4 V, Z=0.008, Teff=45709, log_lum=5.60, log_g=4.00) (extinction lmcavg=0.100), flux1700 +- 5.0A flux=2.7e-13 Flam)*
*COS/G185M/c1921 : rn-max(WM-Basic(O4 V, Z=0.008, Teff=45709, log_lum=5.60, log_g=4.00) (extinction lmcavg=0.100), flux1700 +- 5.0A flux=2.7e-13 Flam)*
*COS/G185M/c1953 : rn-max(WM-Basic(O4 V, Z=0.008, Teff=45709, log_lum=5.60, log_g=4.00) (extinction lmcavg=0.100), flux1700 +- 5.0A flux=2.7e-13 Flam)*
*COS/G185M/c1986 : rn-max(WM-Basic(O4 V, Z=0.008, Teff=45709, log_lum=5.60, log_g=4.00) (extinction lmcavg=0.100), flux1700 +- 5.0A flux=2.7e-13 Flam)*
*STIS/E140M/c1425 : rn-max(WM-Basic(O4 V, Z=0.008, Teff=45709, log_lum=5.60, log_g=4.00) (extinction lmcavg=0.100), flux1360 +- 30.0A flux=3.3e-13 Flam)*
*STIS/E230M/c1978 : rn-max(WM-Basic(O4 V, Z=0.008, Teff=45709, log_lum=5.60, log_g=4.00) (extinction lmcavg=0.100), flux1700 +- 5.0A flux=2.7e-13 Flam)*
*STIS/E230M/c2707 : rn-max(WM-Basic(O4 V, Z=0.008, Teff=45709, log_lum=5.60, log_g=4.00) (extinction lmcavg=0.100), flux1700 +- 5.0A flux=2.7e-13 Flam)*
*Coordinate pedigree: Gaia*
*v sin i = 120*
*Calculation performed 2020-02-24T17:59:07, v0.4*
---
*tstatus; W61-28-5; P/COS approved for submission; S/ins not started; P/AF 15/09/20; S/xx DD/MM/YY*
*tcheck; APT/SIMBAD target names: ; 'W61 28-5'*
*tcheck; Target info verification status?; OK - adopted photometry (from 2000AJ....119.2214M) is slightly different from values in SIMBAD*
*tcheck; Coordinates & P.M. updated?; Yes - Gaia DR2 2015.5 coords - PM set to 0*
*tcheck; Adopted SED compared to Observations?; Yes ...*
*Baseline fits were poor. Guided bythe published model atmosphere analysis of Massey et al. (2004ApJ...608.1001M), explored using a model that was a slightly hotter than the nominal SpT-Teff calibration. Adjusted the reddening and the effective radius of the model to obtain a good fit to the existing STIS/G140L spectrum and UBV photometry. The adoped model is PoWR_45000_4.00_Z0.50, with flux reduced by 2/3 (which is equivalent to reducing the radius of the model from 11.9 Rsun to 9.7 Rsun, consistent with results from Massey et al.) and extinguished by an LMC average extinction law with E(B-V) = 0.13. Although this degere of reddening is larger than the baseline estimate (0.10), it is consistent with the lower limit for LH 81 determined by Massey et al. (2000AJ....119.2214M).*
*Baseline illustrated: ~/box/ullyses_tech/ullyses_proposals/c27_mc/16093/W61-28-5/W61-28-5_c1096_auto_sed.png*
*Adopted illustrated: ~/box/ullyses_tech/ullyses_proposals/c27_mc/16093/W61-28-5/W61-28-5_adopted_sed_vs_STIS.png*
*Adopted SED: ~/box/ullyses_tech/ullyses_proposals/c27_mc/16093/W61-28-5/W61-28-5_adopted_sed.fits*
*Category=EXT-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 | ACQ/PEAK XD (COS.sa.145 4806) | (3) W61-28-5 | COS/FUV, ACQ/PEAKXD, PSA | G130M 1291 A | CENTER=FLUX-WT; NUM-POS=3; STEP-SIZE=1.3; SEGMENT=BOTH | | | 0.2 Secs (0.2 Secs) *[==>]* | ***[1]*** |

*Comments: SED PoWR_45000_4.00_Z0.50_lmcavg_ebmv_0.13; includes reduction in model flux by a factor of 0.666*
*~/box/ullyses_tech/ullyses_proposals/c27_mc/16093/W61-28-5/W61-28-5_adopted_sed.fits*
*ETC estimates an exposure time of 0.15 s per dwell point. Rounded up to 0.2 s per dwell point.*
*ETC WARNING - Segment B count rate (8070 per s) exceeds segment limit of irregulary variable source - is benign because the source is not irregularly variable.*
*BOT Check: 9 Safe, 3 Unknown*
*BOA S0U9148249 05 34 25.7043 -69 43 58.28 probably Gaia DR2 4657273660375612544 (G, BP-RP) = (18.67, 0.76) Probably F9 V Parallax = -0.23 mas*
*PSA S0U9000147 05 34 28.4418 -69 43 57.08 marked safe in graphical display????*
*PSA S0U9111041 05 34 28.5480 -69 43 57.41 ???*
*The source in the BOA is safe. The two sources reported to be within the PSA appear to be spurious. On a WFC3 image, the target is single and unblended, in stark contrast to its appearance in the DSS image shown by Aladin/BOT. There are no Gaia DR2 sources near the locations specified by the BOT. See*
*~/box/ullyses_tech/ullyses_proposals/c27_mc/16093/W61-28-5/W61-28-5_WFC3_zoom.png*
*~/box/ullyses_tech/ullyses_proposals/c27_mc/16093/W61-28-5/W61-28-5_WFC3_GaiaDR2.png*

| # | Label (ETC Run) | Target | Config,Mode,Aperture | Spectral Els. | Opt. Params. | Special Reqs. | Groups | Exp. Time (Total)/[Actual Dur.] | Orbit |
|---|---|---|---|---|---|---|---|---|---|
| 2 | ACQ/PEAK D (COS.sa.145 4806) | (3) W61-28-5 | COS/FUV, ACQ/PEAKD, PSA | G130M 1291 A | CENTER=FLUX-WT-FLR; NUM-POS=5; STEP-SIZE=0.9; SEGMENT=BOTH | | | 0.2 Secs (0.2 Secs) *[==>]* | ***[1]*** |

*Comments: SED PoWR_45000_4.00_Z0.50_lmcavg_ebmv_0.13; includes reduction in model flux by a factor of 0.666*
*~/box/ullyses_tech/ullyses_proposals/c27_mc/16093/W61-28-5/W61-28-5_adopted_sed.fits*
*ETC estimates an exposure time of 0.15 s per dwell point. Rounded up to 0.2 s per dwell point.*
*ETC WARNING - Segment B count rate (8070 per s) exceeds segment limit of irregulary variable source - is benign because the source is not irregularly variable.*
*BOT Check: 10 Safe, 3 Unknown*
*BOA S0U9148249 05 34 25.7043 -69 43 58.28 probably Gaia DR2 4657273660375612544 (G, BP-RP) = (18.67, 0.76) Probably F9 V Parallax = -0.23 mas*
*PSA S0U9000147 05 34 28.4418 -69 43 57.08 marked safe in graphical display????*
*PSA S0U9111041 05 34 28.5480 -69 43 57.41 ???*
*The source in the BOA is safe. The two sources reported to be within the PSA appear to be spurious. On a WFC3 image, the target is single and unblended, in stark contrast to its appearance in the DSS image shown by Aladin/BOT. There are no Gaia DR2 sources near the locations specified by the BOT. See*
*~/box/ullyses_tech/ullyses_proposals/c27_mc/16093/W61-28-5/W61-28-5_WFC3_zoom.png*
*~/box/ullyses_tech/ullyses_proposals/c27_mc/16093/W61-28-5/W61-28-5_WFC3_GaiaDR2.png*

| # | Label (ETC Run) | Target | Config,Mode,Aperture | Spectral Els. | Opt. Params. | Special Reqs. | Groups | Exp. Time (Total)/[Actual Dur.] | Orbit |
|---|---|---|---|---|---|---|---|---|---|
| 3 | G130M/1291-3 (COS.sp.145 4629) | (3) W61-28-5 | COS/FUV, TIME-TAG, PSA | G130M 1291 A | BUFFER-TIME=112; FP-POS=3 | | | 185 Secs (185 Secs) *[==>]* | ***[1]*** |

*Comments: SED PoWR_45000_4.00_Z0.50_lmcavg_ebmv_0.13; includes reduction in model flux by a factor of 0.666*
*~/box/ullyses_tech/ullyses_proposals/c27_mc/16093/W61-28-5/W61-28-5_adopted_sed.fits*
*ETC estimates SNR=30/resel at 1150 +/- 0.5 A in 369.2 s*
*ETC WARNING - Segment B count rate (8070 per s) exceeds segment limit of irregulary variable source - is benign because the source is not irregularly variable.*
*Baseline exposure time rounded to 370 s (185 s per FP-POS)*
*countrate (total, brightest segment) = (13962.3, 8051.0) cts/s*
*brightest pixel: 0.20 cts/s at 1243.5 A*
*BUFFER-TIME = 2/3 * 168 s = 112 s*
*BOT Check: 9 Safe, 3 Unknown*
*BOA S0U9148249 05 34 25.7043 -69 43 58.28 probably Gaia DR2 4657273660375612544 (G, BP-RP) = (18.67, 0.76) Probably F9 V Parallax = -0.23 mas*
*PSA S0U9000147 05 34 28.4418 -69 43 57.08 marked safe in graphical display????*
*PSA S0U9111041 05 34 28.5480 -69 43 57.41 ???*
*The source in the BOA is safe. The two sources reported to be within the PSA appear to be spurious. On a WFC3 image, the target is single and unblended, in stark contrast to its appearance in the DSS image shown by Aladin/BOT. There are no Gaia DR2 sources near the locations specified by the BOT. See*
*~/box/ullyses_tech/ullyses_proposals/c27_mc/16093/W61-28-5/W61-28-5_WFC3_zoom.png*
*~/box/ullyses_tech/ullyses_proposals/c27_mc/16093/W61-28-5/W61-28-5_WFC3_GaiaDR2.png*

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| 4 | G130M/129 1-4 (COS.sp.145 4629) | (3) W61-28-5 | COS/FUV, TIME-TAG, PSA | G130M 1291 A | BUFFER-TIME=11 2.0; FP-POS=4 | 185 Secs (185 Secs)<br>*[==>]* | ***[1]*** |

*Comments: SSED PoWR_45000_4.00_Z0.50_lmcavg_ebmv_0.13; includes reduction in model flux by a factor of 0.666*
*~/box/ullyses_tech/ullyses_proposals/c27_mc/16093/W61-28-5/W61-28-5_adopted_sed.fits*
*ETC estimates SNR=30/resel at 1150 +/- 0.5 A in 369.2 s*
*ETC WARNING - Segment B count rate (8070 per s) exceeds segment limit of irregulary variable source - is benign because the source is not irregularly variable.*
*Baseline exposure time rounded to 370 s (185 s per FP-POS)*
*countrate (total, brightest segment) = (13962.3, 8051.0) cts/s*
*brightest pixel: 0.20 cts/s at 1243.5 A*
*BUFFER-TIME = 2/3 * 168 s = 112 s*
*BOT Check: 9 Safe, 3 Unknown*
*BOA S0U9148249 05 34 25.7043 -69 43 58.28 probably Gaia DR2 4657273660375612544 (G, BP-RP) = (18.67, 0.76) Probably F9 V Parallax = -0.23 mas*
*PSA S0U9000147 05 34 28.4418 -69 43 57.08 marked safe in graphical display????*
*PSA S0U9111041 05 34 28.5480 -69 43 57.41 ???*
*The source in the BOA is safe. The two sources reported to be within the PSA appear to be spurious. On a WFC3 image, the target is single and unblended, in stark contrast to its appearance in the DSS image shown by Aladin/BOT. There are no Gaia DR2 sources near the locations specified by the BOT. See*
*~/box/ullyses_tech/ullyses_proposals/c27_mc/16093/W61-28-5/W61-28-5_WFC3_zoom.png*
*~/box/ullyses_tech/ullyses_proposals/c27_mc/16093/W61-28-5/W61-28-5_WFC3_GaiaDR2.png*

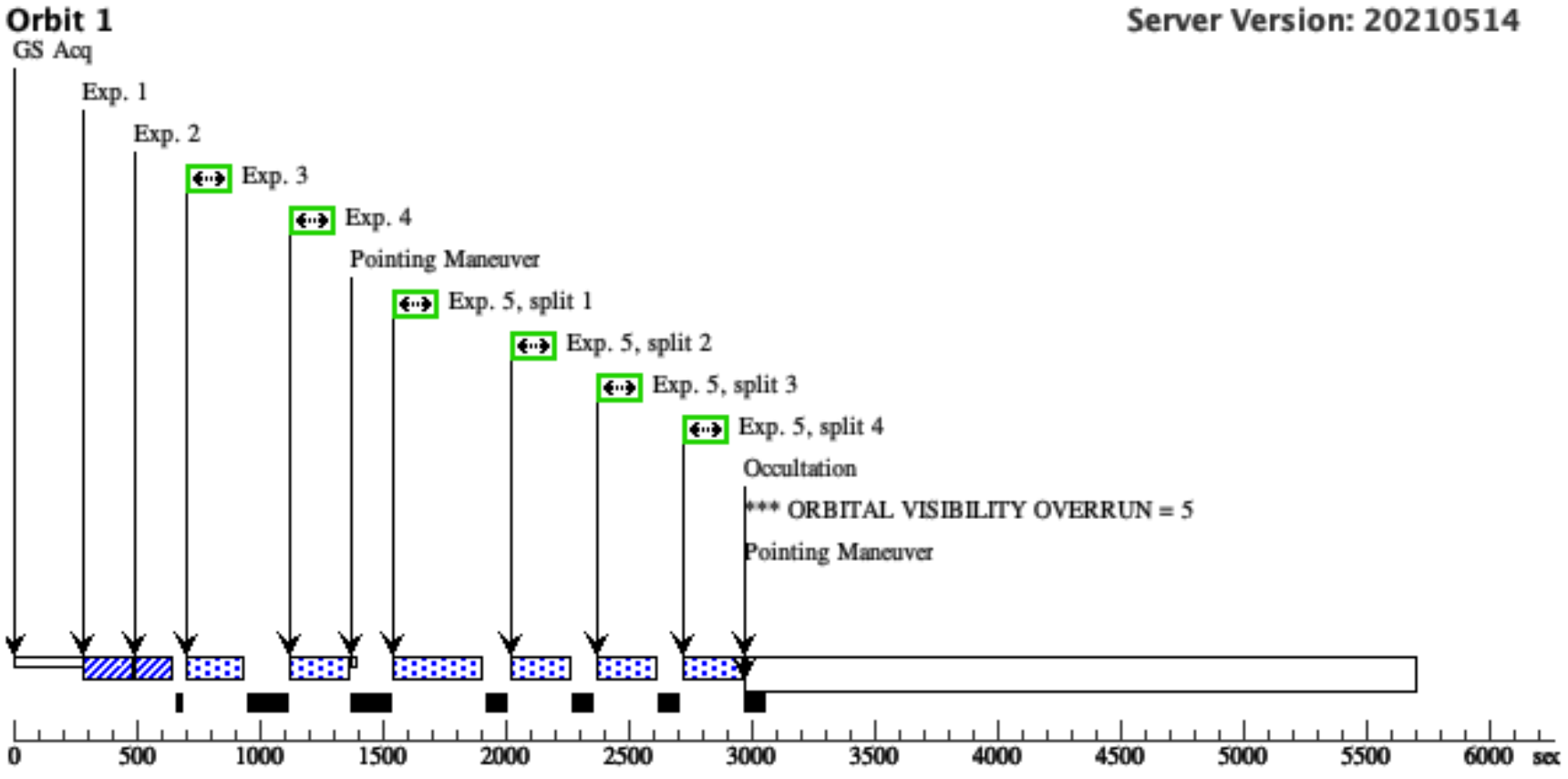
| | | | | | | | |
|---|---|---|---|---|---|---|---|
| 5 | G160M/161 1 (COS.sp.145 4631) | (3) W61-28-5 | COS/FUV, TIME-TAG, PSA | G160M 1611 A | BUFFER-TIME=25 2.0; FP-POS=ALL | 188 Secs (752 Secs)<br>*[==>(Split 1)]*<br>*[==>(Split 2)]*<br>*[==>(Split 3)]*<br>*[==>(Split 4)]* | ***[1]*** |

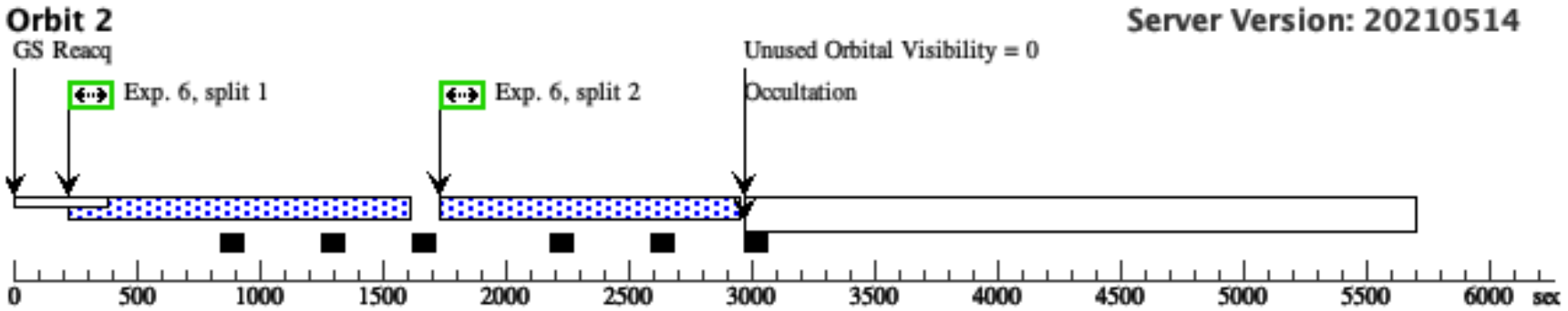
*Comments: SED PoWR_45000_4.00_Z0.50_lmcavg_ebmv_0.13; includes reduction in model flux by a factor of 0.666*
*~/box/ullyses_tech/ullyses_proposals/c27_mc/16093/W61-28-5/W61-28-5_adopted_sed.fits*
*ETC estimates SNR=30/resel at 1590 +/- 0.5 A in 716.8 s*
*Baseline exposure time rounded to 720 s (180 s per FP-POS)*
*countrate (total, brightest segment) = (6230.4, 4893.2) cts/s*
*brightest pixel: 0.085 cts/s at 1423.5 A*
*BUFFER-TIME = 2/3 * 378 s = 252 s*
*BOT Check: 9 Safe, 3 Unknown*
*BOA S0U9148249 05 34 25.7043 -69 43 58.28 probably Gaia DR2 4657273660375612544 (G, BP-RP) = (18.67, 0.76) Probably F9 V Parallax = -0.23 mas*
*PSA S0U9000147 05 34 28.4418 -69 43 57.08 marked safe in graphical display????*
*PSA S0U9111041 05 34 28.5480 -69 43 57.41 ???*
*Final exptime per FP-POS increased during orbit packing to 188 s per FP-POS; 752 s total.*
*The source in the BOA is safe. The two sources reported to be within the PSA appear to be spurious. On a WFC3 image, the target is single and unblended, in stark contrast to its appearance in the DSS image shown by Aladin/BOT. There are no Gaia DR2 sources near the locations specified by the BOT. See*
*~/box/ullyses_tech/ullyses_proposals/c27_mc/16093/W61-28-5/W61-28-5_WFC3_zoom.png*
*~/box/ullyses_tech/ullyses_proposals/c27_mc/16093/W61-28-5/W61-28-5_WFC3_GaiaDR2.png*

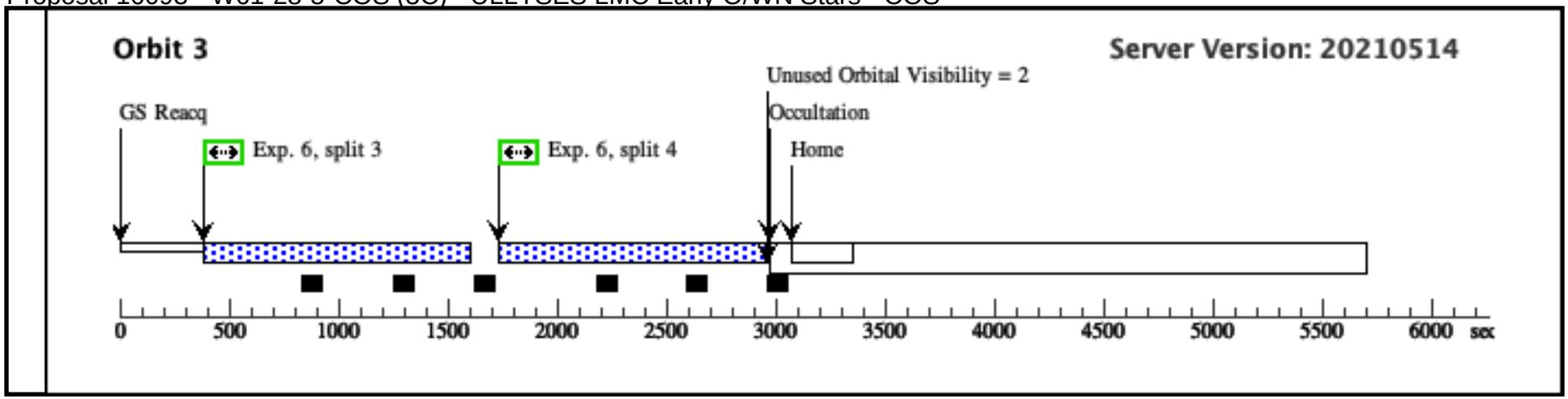
| | | | | | | | |
|---|---|---|---|---|---|---|---|
| | 6 | G130M/109 6 (COS.sp.1454801) | (3) W61-28-5 | COS/FUV, TIME-TAG, PSA | G130M 1096 A | BUFFER-TIME=4140.0; FP-POS=ALL | 1170 Secs (4680 Secs) |
| | | | | | | | *[==>(Split 1)]* *[==>(Split 2)]* ***[2]*** |
| | | | | | | | *[==>(Split 3)]* *[==>(Split 4)]* ***[3]*** |

*Comments: SED PoWR_45000_4.00_Z0.50_lmcavg_ebmv_0.13; includes reduction in model flux by a factor of 0.666*
*~/box/ullyses_tech/ullyses_proposals/c27_mc/16093/W61-28-5/W61-28-5_adopted_sed.fits*
*ETC estimates SNR=20/resel at 1080 +/- 0.5 A in 3,966.3633 s*
*Baseline exposure time rounded to 3968 s (992 s per FP-POS)*
*countrate (total, brightest segment) = (3795.6, 3697.4) cts/s*
*brightest pixel: 0.075 cts/s at 1216.2 A*
*BUFFER-TIME = 2/3 * 621 s = 414 s*
*Final exptime per FP-POS increased during orbit packing to 1170 s per FP-POS; 4680 s total. SNR @ 1080 A = 21,7 per resel; see COS.sp.1455679.*
*BOT Check: 9 Safe, 3 Unknown*
*BOA S0U9148249 05 34 25.7043 -69 43 58.28 probably Gaia DR2 4657273660375612544 (G, BP-RP) = (18.67, 0.76) Probably F9 V Parallax = -0.23 mas*
*PSA S0U9000147 05 34 28.4418 -69 43 57.08 marked safe in graphical display????*
*PSA S0U9111041 05 34 28.5480 -69 43 57.41 ???*
*The source in the BOA is safe. The two sources reported to be within the PSA appear to be spurious. On a WFC3 image, the target is single and unblended, in stark contrast to its appearance in the DSS image shown by Aladin/BOT. There are no Gaia DR2 sources near the locations specified by the BOT. See*
*~/box/ullyses_tech/ullyses_proposals/c27_mc/16093/W61-28-5/W61-28-5_WFC3_zoom.png*
*~/box/ullyses_tech/ullyses_proposals/c27_mc/16093/W61-28-5/W61-28-5_WFC3_GaiaDR2.png*

Orbit Structure




Orbit 3
Server Version: 20210514
Unused Orbital Visibility = 2
GS Reacq
Occultation
Exp. 6, split 3
Exp. 6, split 4
Home
0
500
1000
1500
2000
2500
3000
3500
4000
4500
5000
5500
6000
sec