# 16175 - Can Very Massive Stars form at the low-metallicity threshold of the nearby Universe?

Cycle: 28, Proposal Category: GO

(UV Initiative)

(Availability Mode: SUPPORTED)

**INVESTIGATORS**



| *Name* | *Institution* | *E-Mail* |
|---|---|---|
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**VISITS**

| *Visit* | *Targets used in Visit* | *Configurations used in Visit* | *Orbits Used* | *Last Orbit Planner Run* | *OP Current with Visit?* |
|---|---|---|---|---|---|
| 01 | (1) OFFSET-STAR<br>(2) SBS0335-052E-3 | STIS/CCD | 2 | 02-Feb-2022 16:00:12.0 | yes |
| 02 | (1) OFFSET-STAR<br>(2) SBS0335-052E-3 | STIS/CCD<br>STIS/FUV-MAMA | 3 | 02-Feb-2022 16:00:13.0 | yes |
| 03 | (1) OFFSET-STAR<br>(2) SBS0335-052E-3 | STIS/CCD<br>STIS/FUV-MAMA | 3 | 02-Feb-2022 16:00:14.0 | yes |
| 04 | (1) OFFSET-STAR<br>(2) SBS0335-052E-3 | STIS/CCD<br>STIS/FUV-MAMA | 2 | 02-Feb-2022 16:00:15.0 | yes |

10 Total Orbits Used

**ABSTRACT**

Very massive stars (VMS, >100 Msun) dominate the ionization and mechanical feedback in star-forming regions for the first few Myr. Evidence for VMS has been found from UV observations of young (< 3 Myr), massive star clusters (>5x10^4 Msun), in the LMC and two nearby starbursts. Larger samples of these stars are needed in order to determine the upper mass limit of the IMF and complete our understanding of massive star evolution. In addition, since JWST will obtain numerous UV rest-frame spectra of young high redshift galaxies, it is essential that we investigate whether VMS are common in local, low metallicity analogs, while we still have access to the UV domain. SBS 0335-052E is one of the nearest most metal-poor analogs and contains several super star clusters (SSC) of 10^5 M_sun. From ground-based optical spectroscopy, candidate Wolf-Rayet (WR) have been found in cluster 3 of the galaxy (SSC3). Given its young age, large mass, and WR-like signatures, SSC3 could host VMS. We request co-spatial STIS G140L UV + G430L optical 52x0.2 long-slit spectroscopy of SSC3 in SBS 0335-052E. The requested observations will cover the high-ionization UV emission lines of C IV, He II, and O III], and the optical He II 4686 line. Dust attenuation will be obtained from the UV to optical He II ratio. We will use the co-spatial UV + optical data to test if WR stars alone can explain the observed properties of SSC3 or if VMS are necessary. The observations will provide important constraints to state-of-the-art spectral synthesis models of the kind that will be used to interpret rest-frame UV spectra of the most distant galaxies, with future large telescopes.

**OBSERVING DESCRIPTION**

We will use 8 orbits of HST and the STIS 52"x0.2" long slit to observe super star cluster 3 in SBS 0335-052E.

Two visits are requried because STIS/MAMA visits must not be more than 5 orbit.

Orient. We request the same orient of the slit for visits 1 and 2.

Target acquisition. An ACS WFC F435W image was used to locate a GSC2 star to use as offset. The offset to cluster 3 was measured from the offset star coordinates on the HST image. We will acquire the GSC2 star with the CCD F28x50LP configuration in ACQ mode. With an exposure time of 3 s, we can reach a SNR of 100 with the latter configuration. We will then offset from the star to cluster 3.

Spectroscopy. We will use gratings G140L and G430L in ACCUM mode.

Orbits. The Vega magnitudes of SSC3 in ACS HRC filters F435W and F220W are 20.85 and 18.79 mag, respectively. We use the latter magnitues in order to calculate the exposure times to reach a SNR of 10 in the continuum of 4686*(1+z) and SNR of 5 in the continuum of 1640*(1+z). For the G430L observations, we assume that the target is a point source with a power law index of -2.6 and a normalization in the Vega system of 20.85 mag in filter ACS/WFC1/F435W. For the G140L observations we normalize to 18.79 mag in filter WFC3/UVIS1/F225W. The redshift of SBS 0335-052E is z=0.0135.

## Visit

**Proposal 16175, CCD (01), completed** Wed Feb 02 21:00:16 GMT 2022

**Diagnostic Status: No Diagnostics**

Scientific Instruments: STIS/CCD

Special Requirements: (none)

## Patterns

| # | Primary Pattern | | Secondary Pattern | Exposures |
|---|---|---|---|---|
| (1) | Pattern Type=STIS-ALONG-SLIT | Coordinate Frame=POS-TARG | | (3) |
| | Purpose=DITHER | Pattern Orientation=90.0 | | |
| | Number Of Points=2 | Angle Between Sides= | | |
| | Point Spacing=0.5 | Center Pattern=false | | |
| | Line Spacing= | | | |

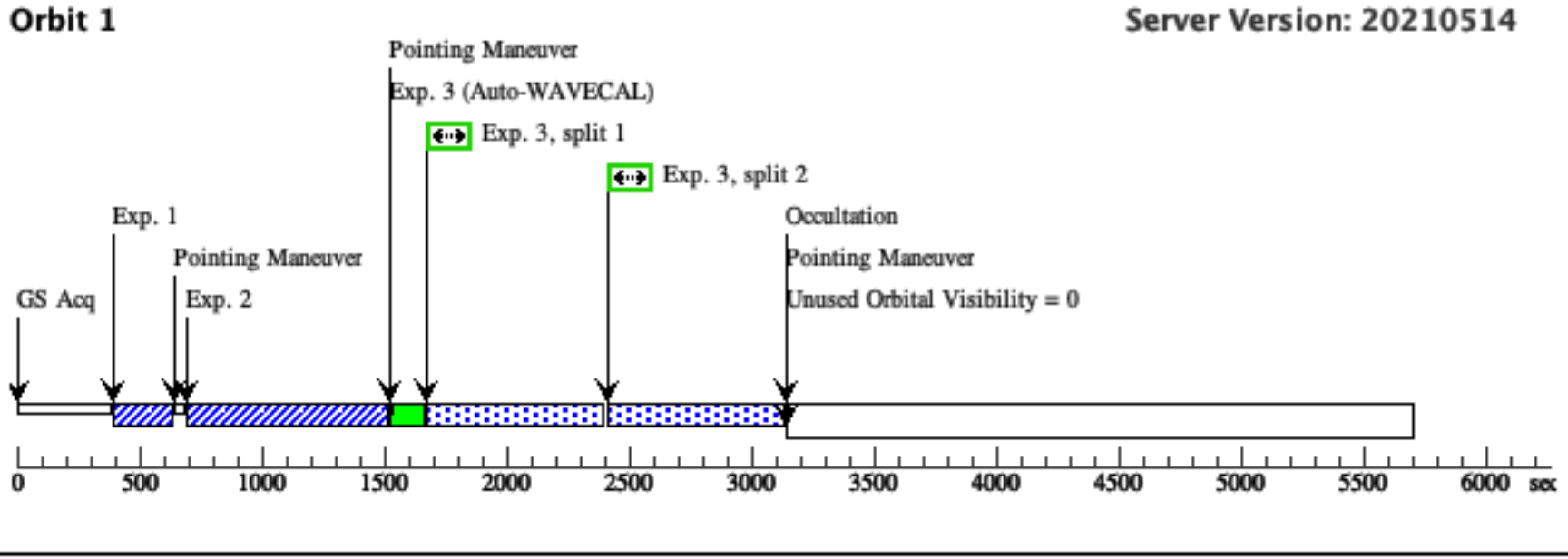
## Fixed Targets

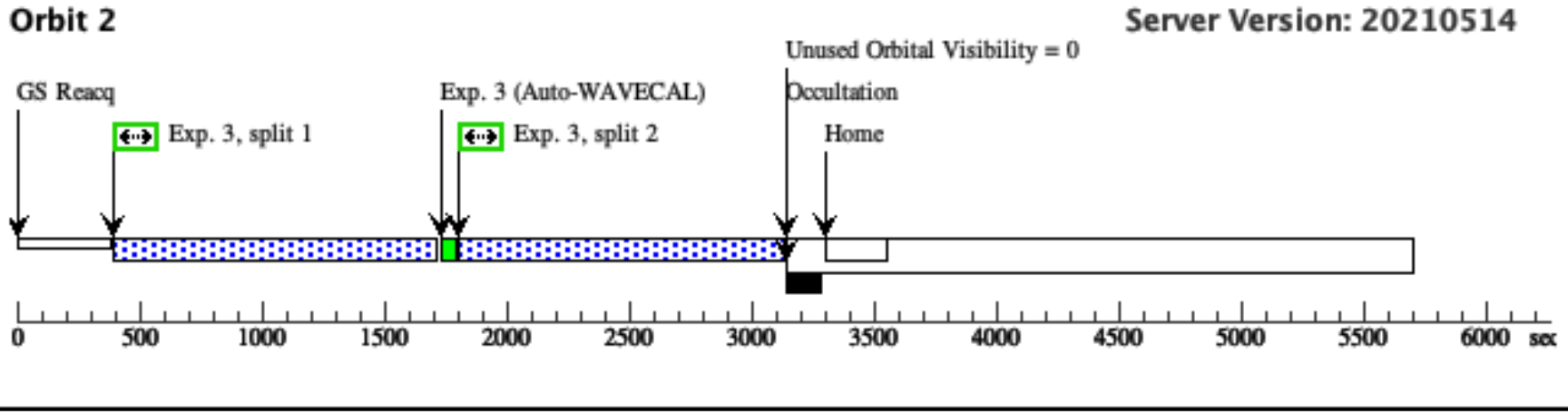
| # | Name | Target Coordinates | Targ. Coord. Corrections | Fluxes | Miscellaneous |
|---|---|---|---|---|---|
| (1) | OFFSET-STAR | RA: 03 37 48.0200 (54.4500833d)<br>Dec: -05 02 8.95 (-5.03582d)<br>Equinox: J2000 | | V=15.4 | Reference Frame: ICRS |
| *Comments:*<br>*Category=STAR*<br>*Description=[F0-F2]* | | | | | |
| (2) | SBS0335-052E-3 | Offset from OFFSET-STAR<br>RA Offset: -0.0167708 Degrees<br>Dec Offset: -0.0081909 Degrees | | V=20.98 | Offset Position (SBS0335-052E-3) |
| *Comments:*<br>*Category=EXT-CLUSTER*<br>*Description=[KNOT, STAR FORMING REGION]* | | | | | |

## Exposures

| # | Label (ETC Run) | Target | Config,Mode,Aperture | Spectral Els. | Opt. Params. | Special Reqs. | Groups | Exp. Time (Total)/[Actual Dur.] | Orbit |
|---|---|---|---|---|---|---|---|---|---|
| 1 | Acquisition using offset star (STIS.ta.1450345) | (1) OFFSET-STAR | STIS/CCD, ACQ, F28X50LP | MIRROR | | | | 3 Secs (3 Secs)<br>*[==>]* | <br>***[1]*** |
| 2 | AQC/PEAK (STIS.ta.1472544) | (2) SBS0335-052E-3 | STIS/CCD, ACQ/PEAK, 52X0.1 | MIRROR | | | | 50 Secs (50 Secs)<br>*[==>]* | <br>***[1]*** |
| 3 | G430L (STIS.sp.1423230) | (2) SBS0335-052E-3 | STIS/CCD, ACCUM, 52X0.2 | G430L<br>4300 A | | | Pattern 1, Exps 3-3 in CCD (01) (1) | 2566 Secs (3952 Secs)<br>*[==>687.0 Secs (Pattern 1, Split 1)]*<br>*[==>687.0 Secs (Pattern 1, Split 2)]*<br>*[==>1289.0 Secs (Pattern 2, Split 1)]*<br>*[==>1289.0 Secs (Pattern 2, Split 2)]* | <br>***[1]***<br>***[2]*** |

Orbit Structure



## Visit

**Proposal 16175, MAMA (02), completed** Wed Feb 02 21:00:16 GMT 2022

**Diagnostic Status: No Diagnostics**

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

Special Requirements: SAME ORIENT AS 01

## Patterns

| # | Primary Pattern | | Secondary Pattern | Exposures |
|---|---|---|---|---|
| (1) | Pattern Type=STIS-ALONG-SLIT | Coordinate Frame=POS-TARG | | (3), (4) |
| | Purpose=DITHER | Pattern Orientation=90.0 | | |
| | Number Of Points=2 | Angle Between Sides= | | |
| | Point Spacing=0.5 | Center Pattern=false | | |
| | Line Spacing= | | | |

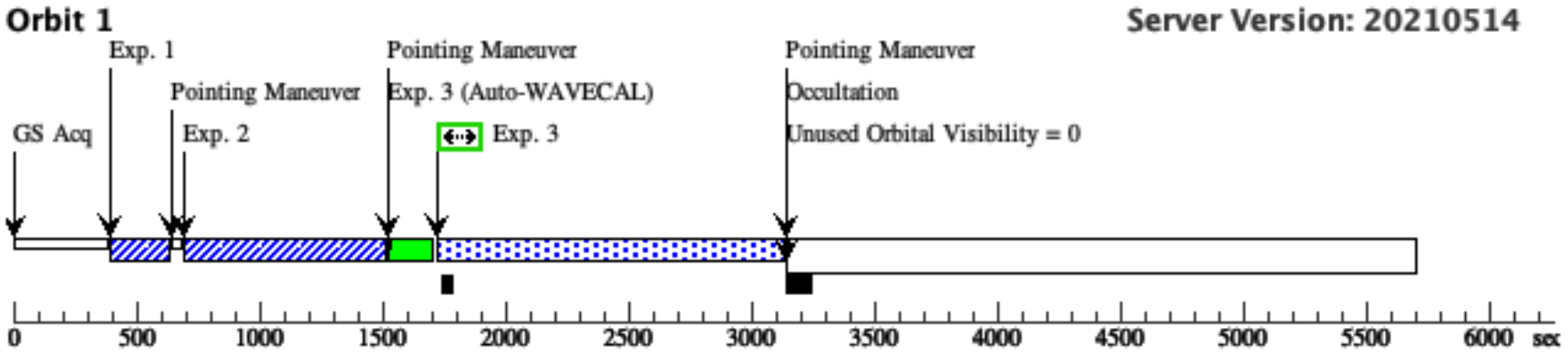
## Fixed Targets

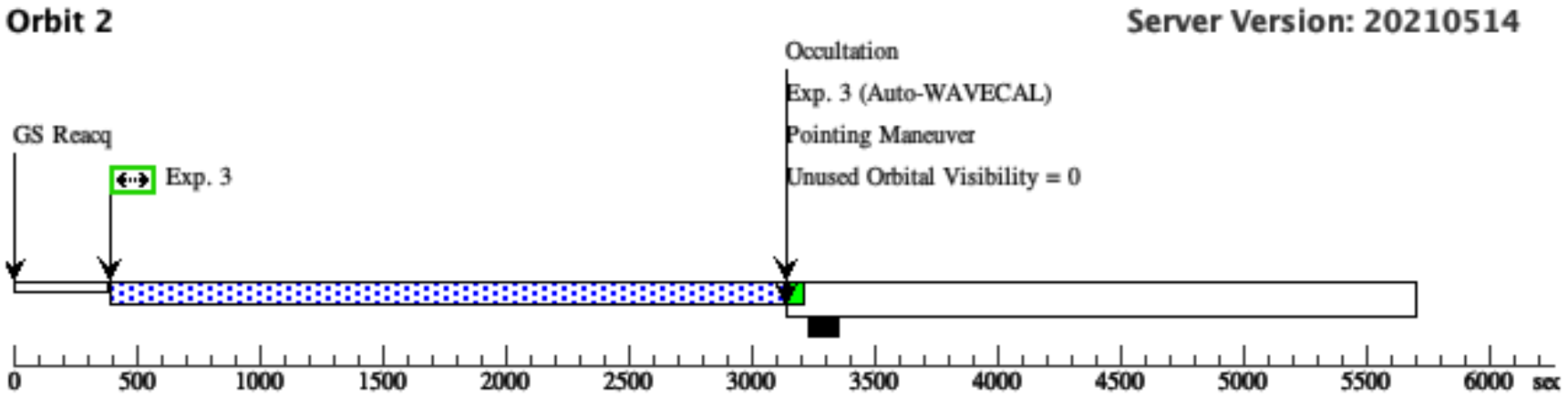
| # | Name | Target Coordinates | Targ. Coord. Corrections | Fluxes | Miscellaneous |
|---|---|---|---|---|---|
| (1) | OFFSET-STAR | RA: 03 37 48.0200 (54.4500833d)<br>Dec: -05 02 8.95 (-5.03582d)<br>Equinox: J2000 | | V=15.4 | Reference Frame: ICRS |
| *Comments:*<br>*Category=STAR*<br>*Description=[F0-F2]* | | | | | |
| (2) | SBS0335-052E-3 | Offset from OFFSET-STAR<br>RA Offset: -0.0167708 Degrees<br>Dec Offset: -0.0081909 Degrees | | V=20.98 | Offset Position (SBS0335-052E-3) |
| *Comments:*<br>*Category=EXT-CLUSTER*<br>*Description=[KNOT, STAR FORMING REGION]* | | | | | |

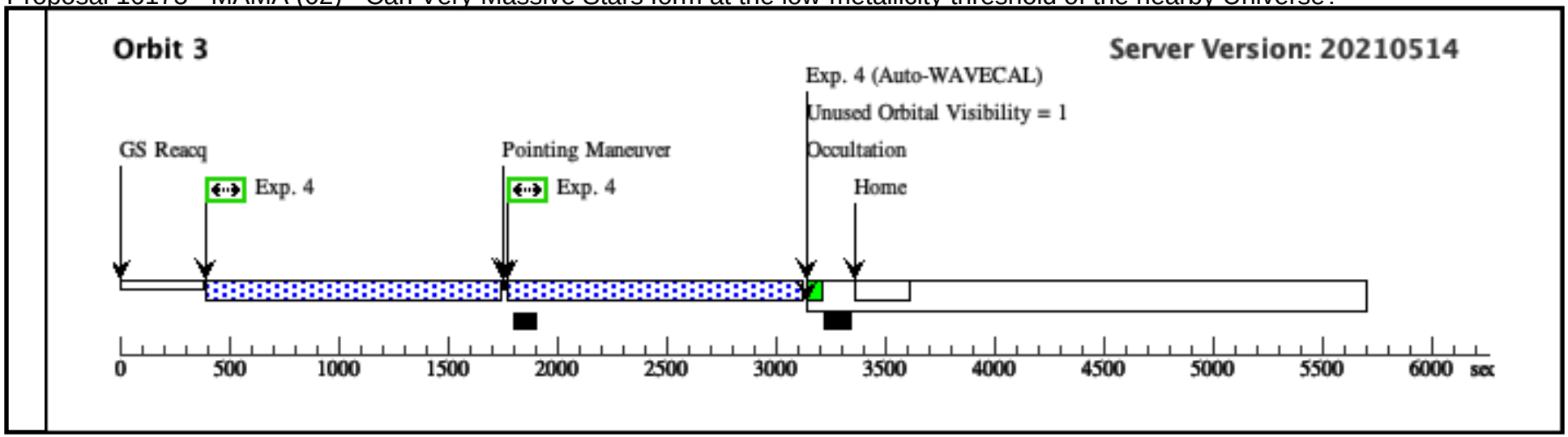
## Exposures

| # | Label (ETC Run) | Target | Config,Mode,Aperture | Spectral Els. | Opt. Params. | Special Reqs. | Groups | Exp. Time (Total)/[Actual Dur.] | Orbit |
|---|---|---|---|---|---|---|---|---|---|
| 1 | Acquisition using offset star (STIS.ta.1450345) | (1) OFFSET-STAR | STIS/CCD, ACQ, F28X50LP | MIRROR | | | | 3 Secs (3 Secs)<br>*[==>]* | <br>***[1]*** |
| 2 | AQC/PEAK (STIS.ta.1472544) | (2) SBS0335-052E-3 | STIS/CCD, ACQ/PEAK, 52X0.1 | MIRROR | | | | 50 Secs (50 Secs)<br>*[==>]* | <br>***[1]*** |
| 3 | G140L (STIS.sp.1423251) | (2) SBS0335-052E-3 | STIS/FUV-MAMA, ACCUM, 52X0.2 | G140L<br>1425 A | | | Pattern 1, Exps 3-3 in MAMA (02) (1) | 2725 Secs (4118 Secs)<br>*[==>1393.0 Secs (Pattern 1)]*<br>*[==>(Pattern 2)]* | <br>***[1]***<br>***[2]*** |
| 4 | G140L (STIS.sp.1423251) | (2) SBS0335-052E-3 | STIS/FUV-MAMA, ACCUM, 52X0.2 | G140L<br>1425 A | | | Pattern 1, Exps 4-4 in MAMA (02) (1) | 2725 Secs (2676 Secs)<br>*[==>1338.0 Secs (Pattern 1)]*<br>*[==>1338.0 Secs (Pattern 2)]* | <br>***[3]*** |

Orbit Structure




Orbit 3
Server Version: 20210514
Exp. 4 (Auto-WAVECAL)
Unused Orbital Visibility = 1
GS Reacq
Exp. 4
Pointing Maneuver
Exp. 4
Occultation
Home
0
500
1000
1500
2000
2500
3000
3500
4000
4500
5000
5500
6000
sec

## Visit

**Proposal 16175, MAMA (03), failed** Wed Feb 02 21:00:16 GMT 2022

**Diagnostic Status: No Diagnostics**

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

Special Requirements: (none)

## Patterns

| # | Primary Pattern | | Secondary Pattern | Exposures |
|---|---|---|---|---|
| (1) | Pattern Type=STIS-ALONG-SLIT | Coordinate Frame=POS-TARG | | (3), (4) |
| | Purpose=DITHER | Pattern Orientation=90.0 | | |
| | Number Of Points=2 | Angle Between Sides= | | |
| | Point Spacing=0.5 | Center Pattern=false | | |
| | Line Spacing= | | | |

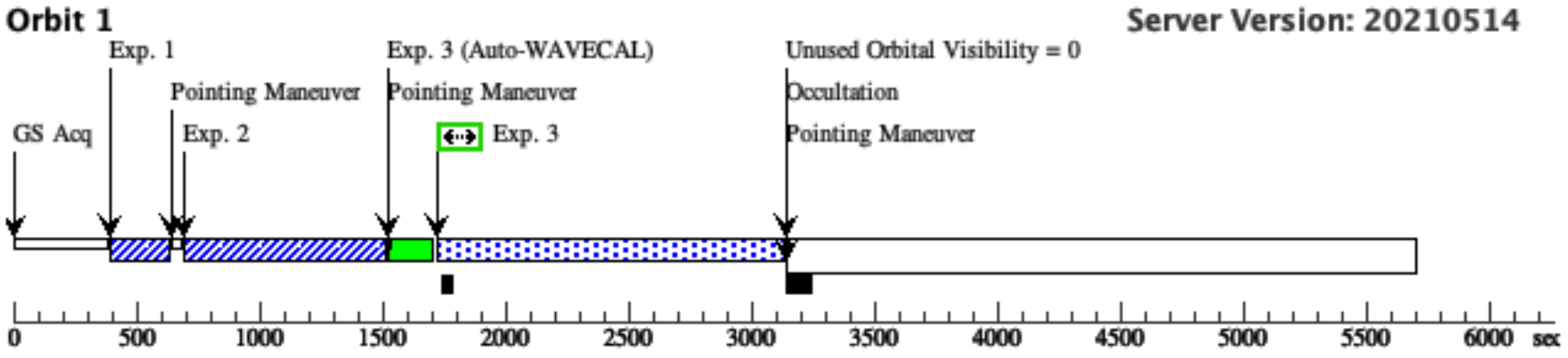
## Fixed Targets

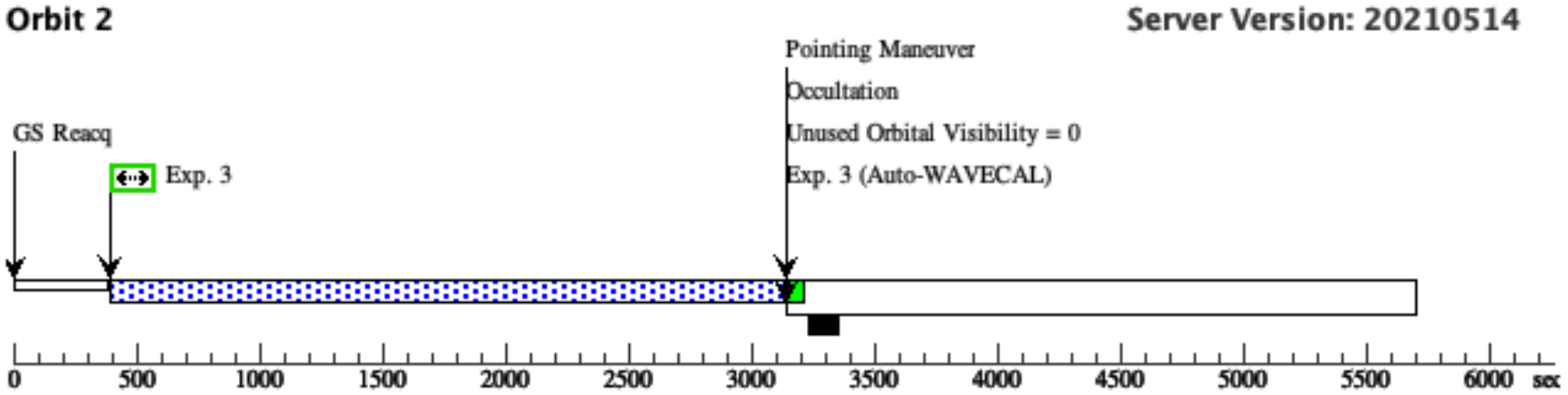
| # | Name | Target Coordinates | Targ. Coord. Corrections | Fluxes | Miscellaneous |
|---|---|---|---|---|---|
| (1) | OFFSET-STAR | RA: 03 37 48.0200 (54.4500833d)<br>Dec: -05 02 8.95 (-5.03582d)<br>Equinox: J2000 | | V=15.4 | Reference Frame: ICRS |
| *Comments:*<br>*Category=STAR*<br>*Description=[F0-F2]* | | | | | |
| (2) | SBS0335-052E-3 | Offset from OFFSET-STAR<br>RA Offset: -0.0167708 Degrees<br>Dec Offset: -0.0081909 Degrees | | V=20.98 | Offset Position (SBS0335-052E-3) |
| *Comments:*<br>*Category=EXT-CLUSTER*<br>*Description=[KNOT, STAR FORMING REGION]* | | | | | |

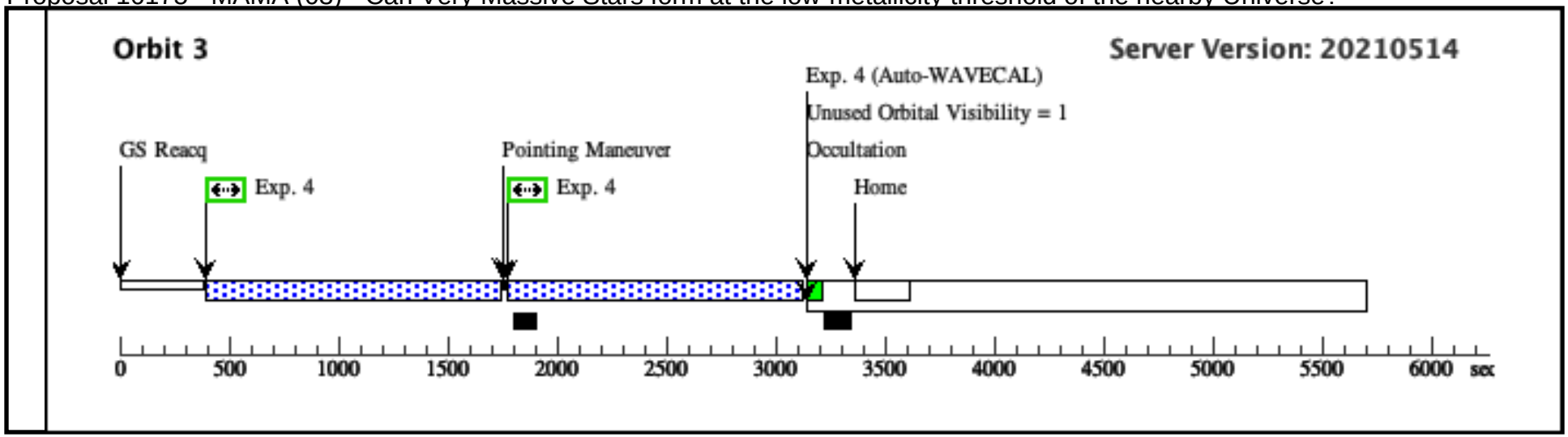
## Exposures

| # | Label (ETC Run) | Target | Config,Mode,Aperture | Spectral Els. | Opt. Params. | Special Reqs. | Groups | Exp. Time (Total)/[Actual Dur.] | Orbit |
|---|---|---|---|---|---|---|---|---|---|
| 1 | Acquisition using offset star (STIS.ta.1450345) | (1) OFFSET-STAR | STIS/CCD, ACQ, F28X50LP | MIRROR | | | | 3 Secs (3 Secs)<br>*[==>]* | <br>***[1]*** |
| 2 | AQC/PEAK (STIS.ta.1472544) | (2) SBS0335-052E-3 | STIS/CCD, ACQ/PEAK, 52X0.1 | MIRROR | | | | 50 Secs (50 Secs)<br>*[==>]* | <br>***[1]*** |
| 3 | G140L (STIS.sp.1423251) | (2) SBS0335-052E-3 | STIS/FUV-MAMA, ACCUM, 52X0.2 | G140L<br>1425 A | | | Pattern 1, Exps 3-3 in MAMA (03) (1) | 2725 Secs (4118 Secs)<br>*[==>1393.0 Secs (Pattern 1)]*<br>*[==>(Pattern 2)]* | <br>***[1]***<br>***[2]*** |
| 4 | G140L (STIS.sp.1423251) | (2) SBS0335-052E-3 | STIS/FUV-MAMA, ACCUM, 52X0.2 | G140L<br>1425 A | | | Pattern 1, Exps 4-4 in MAMA (03) (1) | 2725 Secs (2676 Secs)<br>*[==>1338.0 Secs (Pattern 1)]*<br>*[==>1338.0 Secs (Pattern 2)]* | <br>***[3]*** |

Orbit Structure




Orbit 3
Server Version: 20210514
Exp. 4 (Auto-WAVECAL)
Unused Orbital Visibility = 1
GS Reacq
Exp. 4
Pointing Maneuver
Exp. 4
Occultation
Home
0
500
1000
1500
2000
2500
3000
3500
4000
4500
5000
5500
6000
sec

## Visit

**Proposal 16175, MAMA - Repeat (04)** Wed Feb 02 21:00:16 GMT 2022

**Diagnostic Status: No Diagnostics**

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

Special Requirements: (none)

## Patterns

| # | Primary Pattern | | Secondary Pattern | Exposures |
|---|---|---|---|---|
| (1) | Pattern Type=STIS-ALONG-SLIT | Coordinate Frame=POS-TARG | | (3) |
| | Purpose=DITHER | Pattern Orientation=90.0 | | |
| | Number Of Points=2 | Angle Between Sides= | | |
| | Point Spacing=0.5 | Center Pattern=false | | |
| | Line Spacing= | | | |

## Fixed Targets

| # | Name | Target Coordinates | Targ. Coord. Corrections | Fluxes | Miscellaneous |
|---|---|---|---|---|---|
| (1) | OFFSET-STAR | RA: 03 37 48.0200 (54.4500833d)<br>Dec: -05 02 8.95 (-5.03582d)<br>Equinox: J2000 | | V=15.4 | Reference Frame: ICRS |
| *Comments:*<br>*Category=STAR*<br>*Description=[F0-F2]* | | | | | |
| (2) | SBS0335-052E-3 | Offset from OFFSET-STAR<br>RA Offset: -0.0167708 Degrees<br>Dec Offset: -0.0081909 Degrees | | V=20.98 | Offset Position (SBS0335-052E-3) |
| *Comments:*<br>*Category=EXT-CLUSTER*<br>*Description=[KNOT, STAR FORMING REGION]* | | | | | |

## Exposures

| # | Label (ETC Run) | Target | Config,Mode,Aperture | Spectral Els. | Opt. Params. | Special Reqs. | Groups | Exp. Time (Total)/[Actual Dur.] | Orbit |
|---|---|---|---|---|---|---|---|---|---|
| 1 | Acquisition using offset star (STIS.ta.1450345) | (1) OFFSET-STAR | STIS/CCD, ACQ, F28X50LP | MIRROR | | | | 3 Secs (3 Secs) | |
| | | | | | | | | *[==>]* | ***[1]*** |
| 2 | AQC/PEAK (STIS.ta.1472544) | (2) SBS0335-052E-3 | STIS/CCD, ACQ/PEAK, 52X0.1 | MIRROR | | | | 50 Secs (50 Secs) | |
| | | | | | | | | *[==>]* | ***[1]*** |
| 3 | G140L (STIS.sp.1423251) | (2) SBS0335-052E-3 | STIS/FUV-MAMA, ACCUM, 52X0.2 | G140L 1425 A | | | Pattern 1, Exps 3-3 in MAMA - Repeat (04) (1) | 2725 Secs (4118 Secs) | |
| | | | | | | | | *[==>1393.0 Secs (Pattern 1)]* | ***[1]*** |
| | | | | | | | | *[==>(Pattern 2)]* | ***[2]*** |

Orbit Structure