# 11667 - Detailed Probing of a 3000 km/s Ly-alpha + Metal Line Absorption Complex Near Two Galaxies at z=0.67

Cycle: 17, Proposal Category: GO

(Availability Mode: SUPPORTED)


**INVESTIGATORS**

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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) CSO-0873 | COS/NUV | 4 | 02-Jul-2008 22:10:30.0 | yes |
| 02 | (1) CSO-0873 | COS/FUV<br>COS/NUV | 5 | 02-Jul-2008 22:10:47.0 | yes |

9 Total Orbits Used


**ABSTRACT**

At intermediate redshifts, Ly-alpha absorbers cluster around rich metal-line systems [those with numerous low and high ionization species (Bahcall et al.)], and at z=3, higher ionization clouds reside at the velocity extremes of clustered Ly-alpha lines, a signature of the physics of collapse and layered

gas structures (Songaila & Cowie). These extraordinary HI environments provide unique astrophysical laboratories for probing relatively high overdensity IGM structures and for placing powerful constraints on our understanding of the intergalactic medium and extended galaxy halos in the context of structure evolution, galactic stellar feedback chemical enrichment to large galactocentric distances, and the cosmic baryon budget.

We have undertaken a comprehensive study of the remarkable 1400 km/s velocity width, optically thin Ly-alpha only complex (five components) at z=0.67 within 1600 km/s of the Lyman limit z=0.66 metal-line system toward TON 153 (Churchill et al.). We have collected FOS, STIS, and HIRES quasar spectra covering the Lyman series, OVI, CIV, and MgII absorption, an F702W/WFPC-2 image, and set of ground based narrow-band SDSS filter images of the quasar field. Two galaxies aligned in velocity with the z=0.67 Ly-alpha complex and z=0.66 metal-line system lie within 100 kpc of the quasar sightline; the absorption is not consistent with our standard model of extended "halo" gas for either galaxy, which suggests that a large scale structure (i.e., filament) may extend between these galaxies.

We propose to obtain G160M/1600 and G185M/1921+1941 (S/N>10) COS spectra of the z=1.01 quasar TON 153 to obtain detailed kinematic, chemical, and ionization conditions of this extraordinary absorber/galaxy system (total velocity spread 3000 km/s). The propose observations will provide an unprecedented first high resolution examination of the full Lyman series and MgII, CIV, and OVI metal lines arising in galaxy halos or a possible large scale structure (i.e., filament) asscociated with thoroughly studied galaxies. We aim to discern if the HI extends between the galaxies and test for multiphase absorption signatures suggestive of a galactic feedback or large scale collapsing structure.

**OBSERVING DESCRIPTION**

The observing description here is slightly modified from, and supercedes, the description in the Phase I proposal. The object coordinates were otbtained from the SDSS aperture center for the spectrsocopy of the object. They coordinates are on the GSC2 reference frame and are accurate to better than 0.1", though we have specified FWHM=0.2".

We plan to obtain FUV G160M/1600 and NUV G185M/1921 and G185M/1421 COS spectra of the QSO CSO 873 (TON 153, Q1317+277 [HB]). From the arhived FOS spectra, we measured UV fluxes of f_lambda = 6.9E-15 at 1570A (LL break), 6.5E-15 at 1700A} (Lybeta), and 7.9-15 at 2030A (Lyalpha} complex). We used the online COS ETC to estimate the exposure times require to obtain the required SNR.

We sequence the observations so that the program can be implemented using 2 visits: Visit 1 (4 orbits) is the NUV observations and Visit 2 (5 orbits) is the FUV observations. For both visits, we use NUV ACQ-SEARCH followed by NUV ACQ-IMAGE. The exposures are 2 seconds, which delivers SNR=10 of the QSO. MIRROR B is required in order to not exceed the bright count rate limit. The ACQ-SEARCH observations use SCAN-SIZE=2 and STEP-SIZE=1.767". All spectroscopic observations will be through the PSA, and invoke TIME-TAG mode, manual FP-SPLIT, and FLASH=yes. From the COS-ETC, B_2/3 was always greater than the exposure times, so all BUFFER-TIMEs equal the exposure times.

VISIT 1, ORBIT 1: Guide star aquisition, followed by observation 1-2, the acquisition images using MIRROR B. Shuttle to central wavelength 1921 of the G185M grating. Observations 3-4 are G185M/1921 spectroscopy of at FP-POS=3 (default) and FP-POS=4, respectively. One FP-POS forward movement.

VISIT 1, ORBIT 2: Guide star acquisition. Observations 5-7 are G185M/1921 spectroscopy at FP-POS=1, FP-POS=2, and FP-POS=3, respectively. Initial FP-POS backward movement, followed by two FP-POS forward movements.

VISIT 1, ORBIT 3: Shuttle to central wavelength 1941 of the G185M grating. Guide star acquisition. Observations 8-10 are G185M/1941 spectroscopy at FP-POS=3, FP-POS=4, and FP-POS=1, respectively. Two FP=POS foward movements, one FP-POS backward movement.

VISIT 1, ORBIT 4: Guide star acquisition. Observations 11-13 are G185M/1941 spectroscopy at FP-POS=2, FP-POS=3, and FP-POS=4, respectively. Three FP-POS foward movements.

VISIT 2, ORBIT 1: Guide star aquisition, followed by observation 1-2, the NUV acquisition images using MIRROR B. Shuttle OSM1 from NCM1 to central wavelength 1600 of the G160M grating. Observations 3-4 are G160/1600 spectroscopy of at FP-POS=3 (default) and FP-POS=4, respectively. One FP-POS forward movement.

VISIT 2, ORBIT 2:Guide star acquisition. Observations 5-7 are G160M/1600 spectroscopy at FP-POS=1, FP-POS=2, and FP-POS=3, respectively. Initial FP-POS backward movement, followed by two FP-POS forward movements.

VISIT 2, ORBIT 3: Guide star acquisition. Observations 8-10 are G160M/1600 spectroscopy at FP-POS=4, FP-POS=1, and FP-POS=2, respectively. Two FP=POS foward movements, one FP-POS backward movement.

VISIT 2, ORBIT 4: Guide star acquisition. Observations 11-13 are G160M/1600 spectroscopy at FP-POS=3, FP-POS=4, and FP-POS=1, respectively. Two FP=POS foward movements, one FP-POS backward movement.

VISIT 2, ORBIT 5: Guide star acquisition. Observations 14-16 are G160M/1600 spectroscopy at FP-POS=2, FP-POS=3, and FP-POS=4, respectively. Three FP=POS foward movements.

## Visit

**Proposal 11667, Visit 01** Thu Jul 03 02:10:52 GMT 2008

**Diagnostic Status: No Diagnostics**

Scientific Instruments: COS/NUV

Special Requirements: (none)

## Fixed Targets

| # | Name | Target Coordinates | Targ. Coord. Corrections | Fluxes | Miscellaneous |
|---|---|---|---|---|---|
| (1) | CSO-0873 | RA: 13 19 56.2388 (199.9843283d) | Redshift: 1.022 | V=16.0+/-0.2 | Reference Frame: ICRS |
| | Alt Name1: TON-0153 | Dec: +27 28 8.22 (27.46895d) | | FUV f_lambda=6.9e-15; NUV f_lambda=7.9e-15 | |
| | Alt Name2: HB-Q1317+277 | Equinox: J2000 | | | |

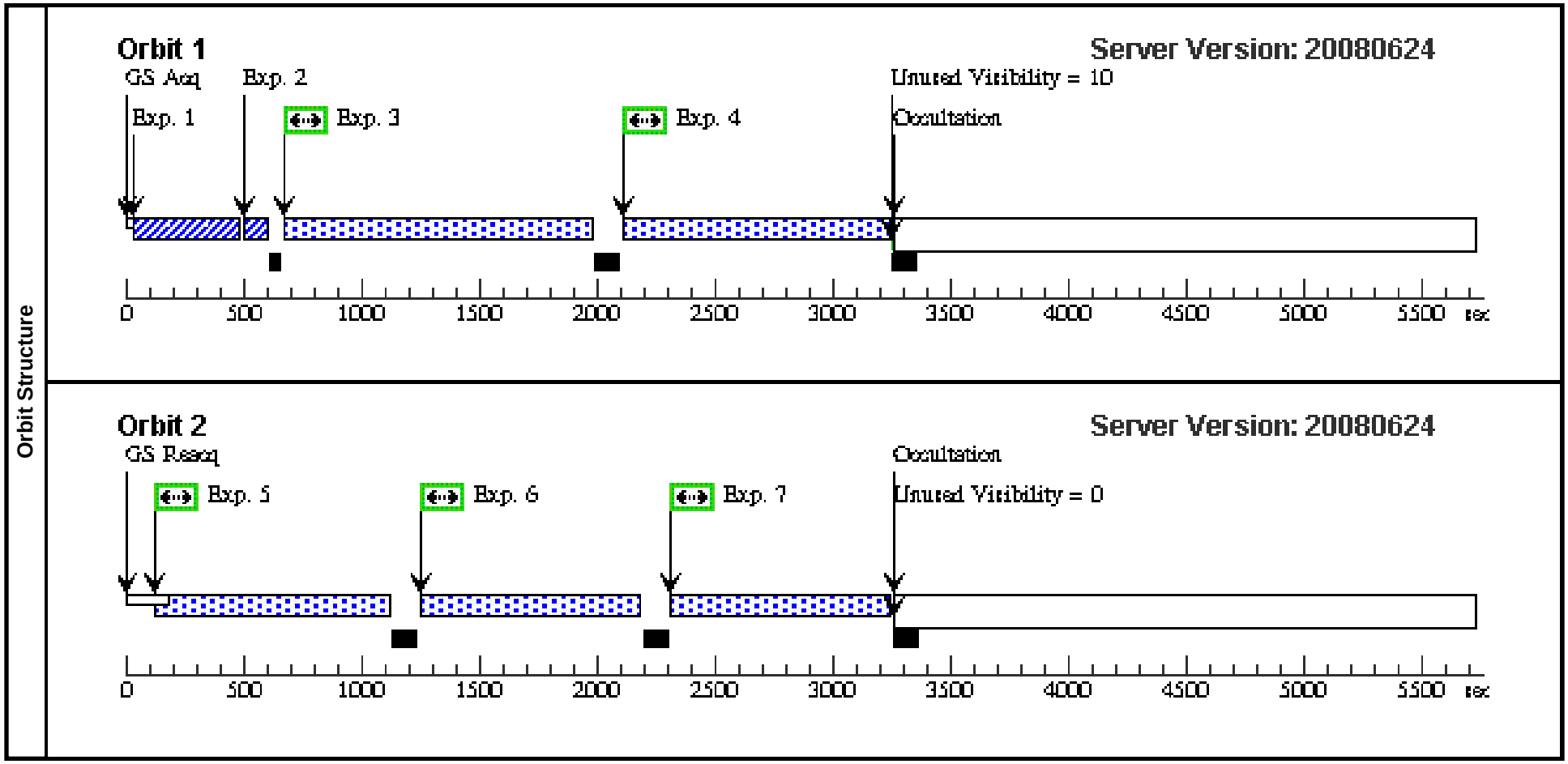
*Comments: This object was first generated by the targetselector and retrieved from the NED database. The ICRS webpages state the the SDSS coordinate system is ICRS. The RA and DEC coordinates were then determined for the ICRS frame from spectroscopic observations of the object with SDSS (SDSS objID=587741722825719846).*

## Exposures

| # | Label | Target | Config,Mode,Aperture | Spectral Els. | Opt. Params. | Special Reqs. | Groups | Exp. Time/[Actual Dur.] | Orbit |
|---|---|---|---|---|---|---|---|---|---|
| 1 | ACQ-SEARCH | (1) CSO-0873 | COS/NUV, ACQ/SEARCH, PSA | MIRRORB | SCAN-SIZE=2; STEP-SIZE=1.767 | | Sequence 1-4 Non-Int | 2 Secs<br>*[==>]* | <br>***[1]*** |
| *Comments: Exposure Time 16 sec gives SNR=10 (default settings of COS ETC). MIRROR B required to avoid bright limit.* | | | | | | | | | |
| 2 | NUV_ACQ-IMAGE | (1) CSO-0873 | COS/NUV, ACQ/IMAGE, PSA | MIRRORB | | | Sequence 1-4 Non-Int | 2 Secs<br>*[==>]* | <br>***[1]*** |
| *Comments: Exposure Time gives SNR=10; MIRROR B required to not exceed bright count limit* | | | | | | | | | |
| 3 | NUV1921_FP3-1 | (1) CSO-0873 | COS/NUV, TIME-TAG, PSA | G185M 1921 A | FP-POS=3; BUFFER-TIME=1112; FLASH=YES | | Sequence 1-4 Non-Int | 1112 Secs<br>*[==>]* | <br>***[1]*** |
| *Comments: First exposure at FP-POS=3* | | | | | | | | | |
| 4 | NUV1921_FP4-1 | (1) CSO-0873 | COS/NUV, TIME-TAG, PSA | G185M 1921 A | FP-POS=4; BUFFER-TIME=1112; FLASH=YES | | Sequence 1-4 Non-Int | 1112 Secs<br>*[==>]* | <br>***[1]*** |
| *Comments: First and only exposure at FP-POS=4* | | | | | | | | | |
| 5 | NUV1921_FP1-1 | (1) CSO-0873 | COS/NUV, TIME-TAG, PSA | G185M 1921 A | FP-POS=1; BUFFER-TIME=915; FLASH=YES | | Sequence 5-7 Non-Int | 915 Secs<br>*[==>]* | <br>***[2]*** |
| *Comments: first and only exposure at FP-POS=1* | | | | | | | | | |
| 6 | NUV1921_FP2-1 | (1) CSO-0873 | COS/NUV, TIME-TAG, PSA | G185M 1921 A | FP-POS=2; BUFFER-TIME=914; FLASH=YES | | Sequence 5-7 Non-Int | 914 Secs<br>*[==>]* | <br>***[2]*** |
| *Comments: first and only observation at FP-POS=2* | | | | | | | | | |

**Exposures (continued)**

| # | Label | Target | Config,Mode,Aperture | Spectral Els. | Opt. Params. | Special Reqs. | Groups | Exp. Time/[Actual Dur.] | Orbit |
|---|---|---|---|---|---|---|---|---|---|
| 7 | NUV1921_ FP3-2 | (1) CSO-0873 | COS/NUV, TIME-TAG, PSA | G185M 1921 A | FP-POS=3; BUFFER-TIME=914; FLASH=YES | | Sequence 5-7 Non-Int | 914 Secs<br>*[==>]* | *[2]* |
| *Comments: second exposure at FP-POS=3* | | | | | | | | | |
| 8 | NUV1941_ FP3-1 | (1) CSO-0873 | COS/NUV, TIME-TAG, PSA | G185M 1941 A | FP-POS=3; BUFFER-TIME=892; FLASH=YES | | Sequence 8-10 Non-Int | 892 Secs<br>*[==>]* | *[3]* |
| 9 | NUV1941_ FP4-1 | (1) CSO-0873 | COS/NUV, TIME-TAG, PSA | G185M 1941 A | FP-POS=4; BUFFER-TIME=892; FLASH=YES | | Sequence 8-10 Non-Int | 892 Secs<br>*[==>]* | *[3]* |
| *Comments: First and only exposure at FP-POS=4* | | | | | | | | | |
| 10 | NUV1941_ FP1-1 | (1) CSO-0873 | COS/NUV, TIME-TAG, PSA | G185M 1941 A | FP-POS=1; BUFFER-TIME=892; FLASH=YES | | Sequence 8-10 Non-Int | 892 Secs<br>*[==>]* | *[3]* |
| *Comments: First an only exposure at FP-POS=1* | | | | | | | | | |
| 11 | NUV1941_ FP2-1 | (1) CSO-0873 | COS/NUV, TIME-TAG, PSA | G185M 1941 A | FP-POS=2; BUFFER-TIME=915; FLASH=YES | | Sequence 11-13 Non-Int | 915 Secs<br>*[==>]* | *[4]* |
| *Comments: First and only exposure at FP-POS=2* | | | | | | | | | |
| 12 | NUV1941_ FP3-2 | (1) CSO-0873 | COS/NUV, TIME-TAG, PSA | G185M 1941 A | FP-POS=3; BUFFER-TIME=914; FLASH=YES | | Sequence 11-13 Non-Int | 914 Secs<br>*[==>]* | *[4]* |
| *Comments: Second exposure at FP-POS=3* | | | | | | | | | |
| 13 | NUV1941_ Fp4-2 | (1) CSO-0873 | COS/NUV, TIME-TAG, PSA | G185M 1941 A | FP-POS=4; BUFFER-TIME=914; FLASH=YES | | Sequence 11-13 Non-Int | 914 Secs<br>*[==>]* | *[4]* |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GS Acq
Exp. 2
Unused Visibility = 10
Exp. 1
Exp. 3
Exp. 4
Occultation
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1500
2000
2500
3000
3500
4000
4500
5000
5500
sec
Orbit 2
Server Version: 20080624
GS Reacq
Occultation
Exp. 5
Exp. 6
Exp. 7
Unused Visibility = 0
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500
1000
1500
2000
2500
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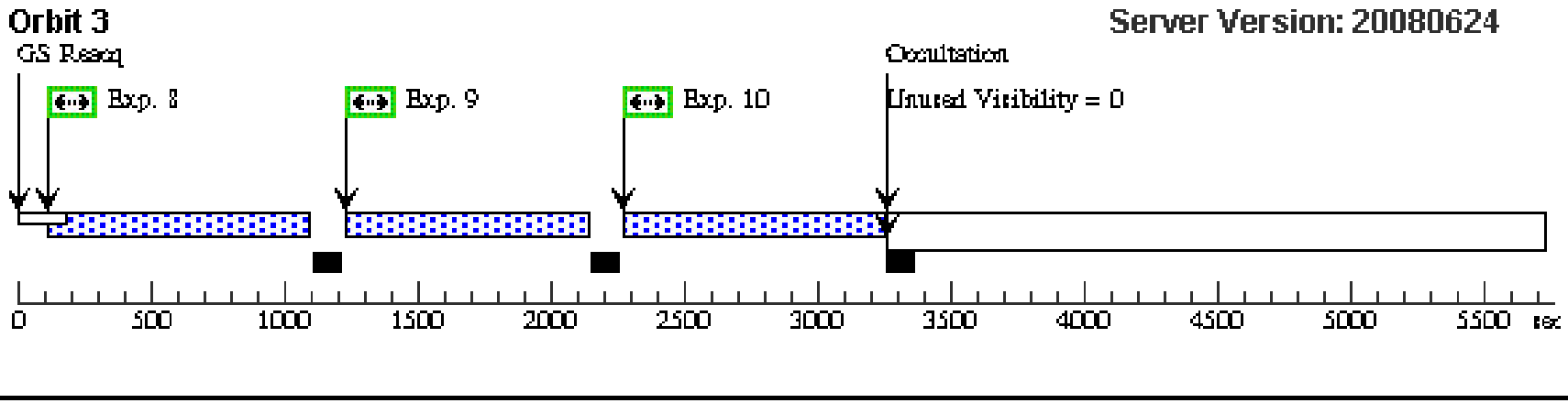
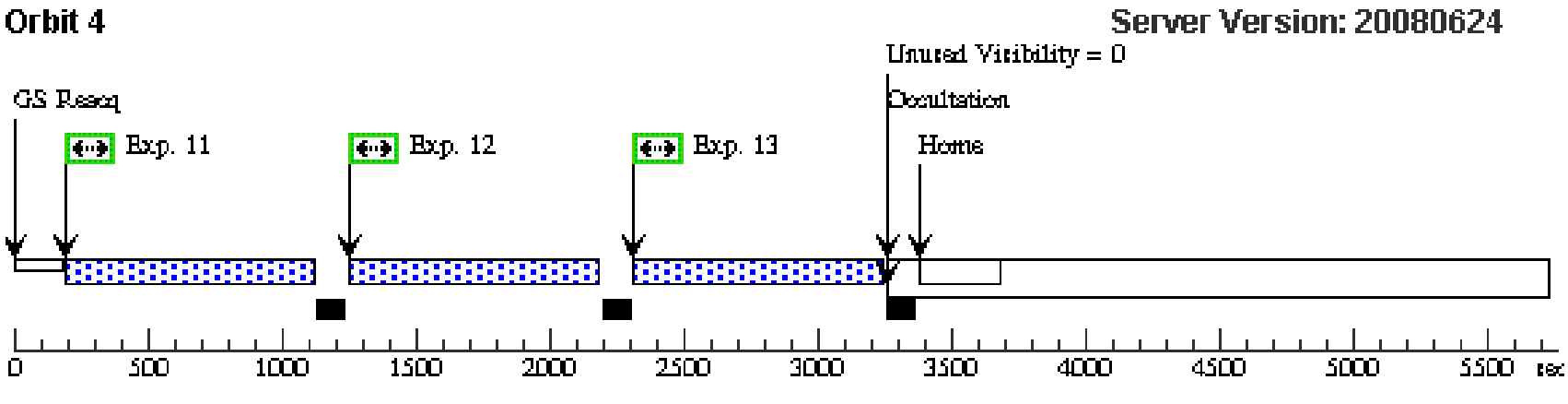
5500
sec

Orbit Structure (continued)



## Visit

**Proposal 11667, Visit 02** Thu Jul 03 02:10:55 GMT 2008

**Diagnostic Status: No Diagnostics**

Scientific Instruments: COS/NUV, COS/FUV

Special Requirements: (none)

## Fixed Targets

| # | Name | Target Coordinates | Targ. Coord. Corrections | Fluxes | Miscellaneous |
|---|---|---|---|---|---|
| (1) | CSO-0873 | RA: 13 19 56.2388 (199.9843283d) | Redshift: 1.022 | V=16.0+/-0.2 | Reference Frame: ICRS |
| | Alt Name1: TON-0153 | Dec: +27 28 8.22 (27.46895d) | | FUV f_lambda=6.9e-15; NUV f_lambda=7.9e-15 | |
| | Alt Name2: HB-Q1317+277 | Equinox: J2000 | | | |

*Comments: This object was first generated by the targetselector and retrieved from the NED database. The ICRS webpages state the the SDSS coordinate system is ICRS. The RA and DEC coordinates were then determined for the ICRS frame from spectroscopic observations of the object with SDSS (SDSS objID=587741722825719846).*

## Exposures

| # | Label | Target | Config,Mode,Aperture | Spectral Els. | Opt. Params. | Special Reqs. | Groups | Exp. Time/[Actual Dur.] | Orbit |
|---|---|---|---|---|---|---|---|---|---|
| 1 | AC-SEARCH | (1) CSO-0873 | COS/NUV, ACQ/SEARCH, PSA | MIRRORB | SCAN-SIZE=2; STEP-SIZE=1.767 | | Sequence 1-4 Non-Int | 2 Secs<br>*[==>]* | <br>***[1]*** |
| *Comments: Exposure Time give SNR=10; MIRROR B required to avoid bright count limit* | | | | | | | | | |
| 2 | NUV_ACQ-IMAGE | (1) CSO-0873 | COS/NUV, ACQ/IMAGE, PSA | MIRRORB | | | Sequence 1-4 Non-Int | 2 Secs<br>*[==>]* | <br>***[1]*** |
| *Comments: Exposure time gives SNR=10; MIRROR B required to avoide bright count limit* | | | | | | | | | |
| 3 | FUV1600_FP3-1 | (1) CSO-0873 | COS/FUV, TIME-TAG, PSA | G160M 1600 A | FP-POS=3; SEGMENT=BOTH; BUFFER-TIME=1093; FLASH=YES | | Sequence 1-4 Non-Int | 1093 Secs<br>*[==>]* | <br>***[1]*** |
| 4 | FUV1600_FP4-1 | (1) CSO-0873 | COS/FUV, TIME-TAG, PSA | G160M 1600 A | FP-POS=4; SEGMENT=BOTH; BUFFER-TIME=1094; FLASH=YES | | Sequence 1-4 Non-Int | 1094 Secs<br>*[==>]* | <br>***[1]*** |
| 5 | FUV1600_FP1-1 | (1) CSO-0873 | COS/FUV, TIME-TAG, PSA | G160M 1600 A | FP-POS=1; SEGMENT=BOTH; BUFFER-TIME=950; FLASH=YES | | Sequence 5-7 Non-Int | 950 Secs<br>*[==>]* | <br>***[2]*** |
| 6 | FUV1600_FP2-1 | (1) CSO-0873 | COS/FUV, TIME-TAG, PSA | G160M 1600 A | FP-POS=2; SEGMENT=BOTH; BUFFER-TIME=950; FLASH=YES | | Sequence 5-7 Non-Int | 950 Secs<br>*[==>]* | <br>***[2]*** |

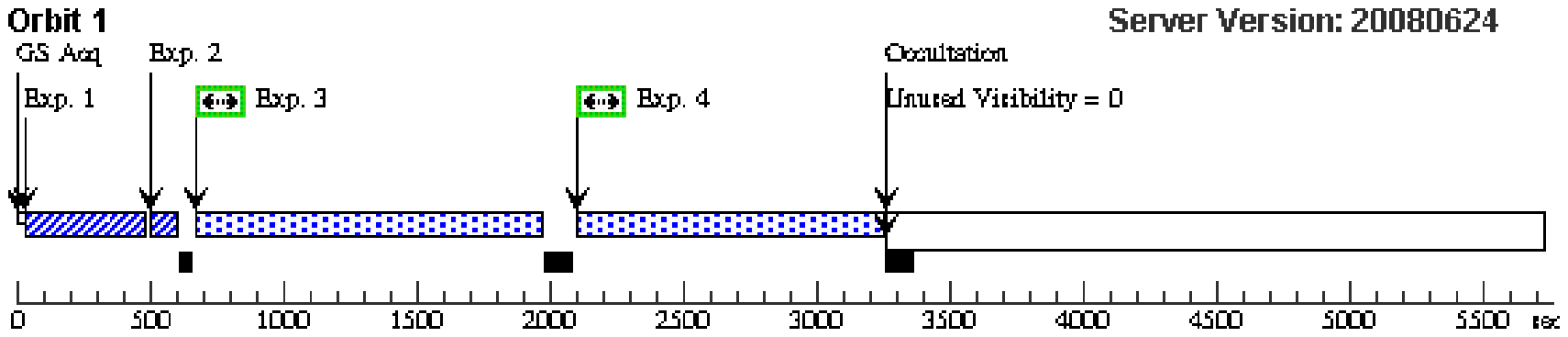
**Exposures (continued)**

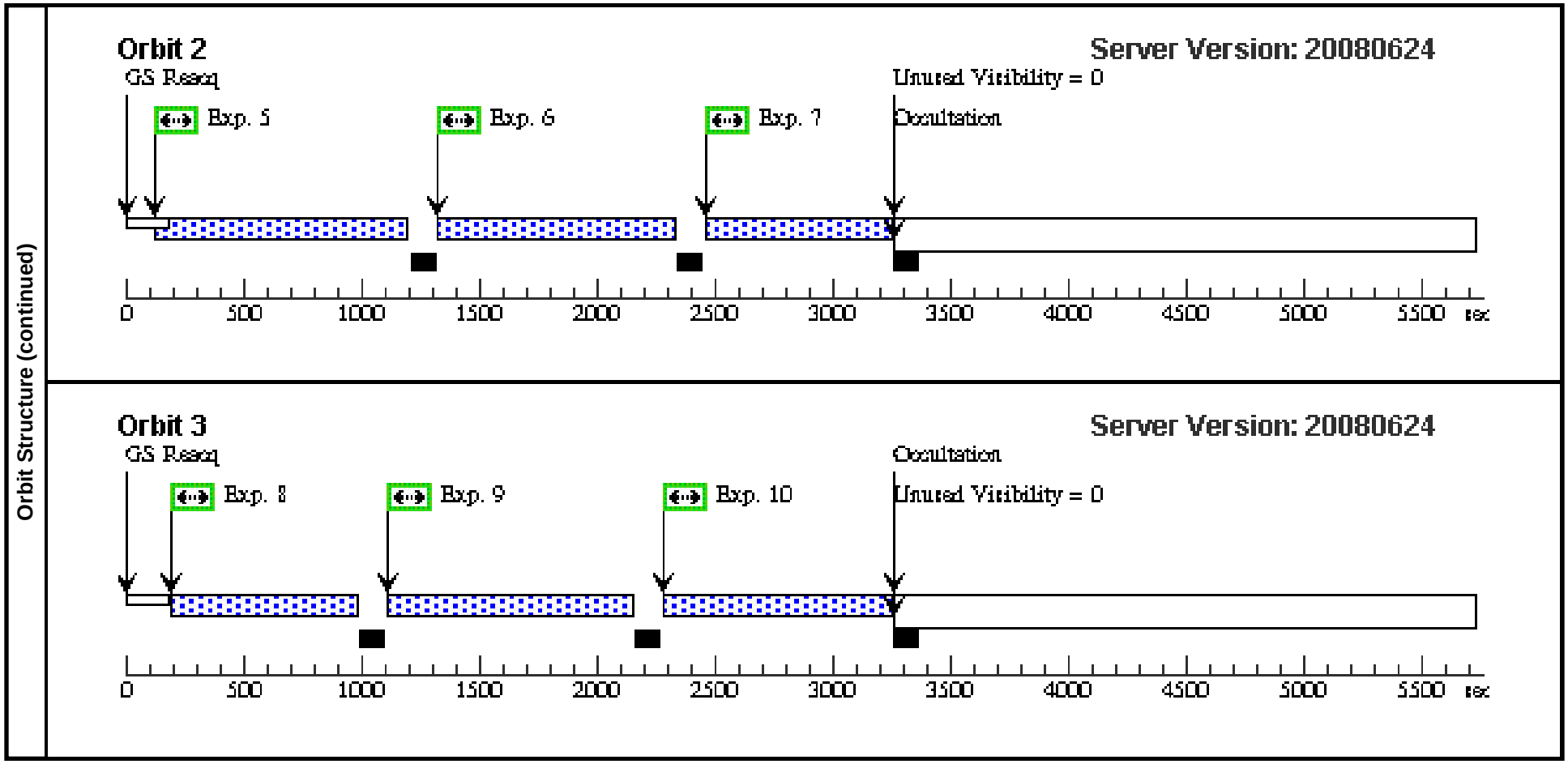
| # | Label | Target | Config,Mode,Aperture | Spectral Els. | Opt. Params. | Special Reqs. | Groups | Exp. Time/[Actual Dur.] | Orbit |
|---|---|---|---|---|---|---|---|---|---|
| 7 | FUV1600_FP3-2 | (1) CSO-0873 | COS/FUV, TIME-TAG, PSA | G160M 1600 A | FP-POS=3; SEGMENT=BOTH; BUFFER-TIME=732; FLASH=YES | | Sequence 5-7 Non-Int | 732 Secs<br>*[==>]* | ***[2]*** |
| 8 | FUV1600_FP4-2 | (1) CSO-0873 | COS/FUV, TIME-TAG, PSA | G160M 1600 A | FP-POS=4; SEGMENT=BOTH; BUFFER-TIME=735; FLASH=YES | | Sequence 8-10 Non-Int | 735 Secs<br>*[==>]* | ***[3]*** |
| 9 | FUV1600_FP1-2 | (1) CSO-0873 | COS/FUV, TIME-TAG, PSA | G160M 1600 A | FP-POS=1; SEGMENT=BOTH; BUFFER-TIME=915; FLASH=YES | | Sequence 8-10 Non-Int | 915 Secs<br>*[==>]* | ***[3]*** |
| 10 | FUV1600-FP2-2 | (1) CSO-0873 | COS/FUV, TIME-TAG, PSA | G160M 1600 A | FP-POS=2; SEGMENT=BOTH; BUFFER-TIME=915; FLASH=YES | | Sequence 8-10 Non-Int | 915 Secs<br>*[==>]* | ***[3]*** |
| 11 | FUV1600_FP3-3 | (1) CSO-0873 | COS/FUV, TIME-TAG, PSA | G160M 1600 A | FP-POS=3; SEGMENT=BOTH; BUFFER-TIME=730; FLASH=YES | | Sequence 11-13 Non-Int | 730 Secs<br>*[==>]* | ***[4]*** |
| 12 | FUV1600_FP4-3 | (1) CSO-0873 | COS/FUV, TIME-TAG, PSA | G160M 1600 A | FP-POS=4; SEGMENT=BOTH; BUFFER-TIME=730; FLASH=YES | | Sequence 11-13 Non-Int | 730 Secs<br>*[==>]* | ***[4]*** |
| 13 | FUV1600_FP1-3 | (1) CSO-0873 | COS/FUV, TIME-TAG, PSA | G160M 1600 A | FP-POS=1; SEGMENT=BOTH; BUFFER-TIME=1105; FLASH=YES | | Sequence 11-13 Non-Int | 1105 Secs<br>*[==>]* | ***[4]*** |
| 14 | FUV1600_FP2-3 | (1) CSO-0873 | COS/FUV, TIME-TAG, PSA | G160M 1600 A | FP-POS=2; SEGMENT=BOTH; BUFFER-TIME=1172; FLASH=YES | | Sequence 14-16 Non-Int | 1172 Secs<br>*[==>]* | ***[5]*** |

**Exposures (continued)**

| # | Label | Target | Config,Mode,Aperture | Spectral Els. | Opt. Params. | Special Reqs. | Groups | Exp. Time/[Actual Dur.] | Orbit |
|---|---|---|---|---|---|---|---|---|---|
| 15 | FUV1600-F P3-4 | (1) CSO-0873 | COS/FUV, TIME-TAG, PSA | G160M 1600 A | FP-POS=3; SEGMENT=BOTH; BUFFER-TIME=730; FLASH=YES | | Sequence 14-16 Non-Int | 730 Secs<br>*[==>]* | *[5]* |
| 16 | FUV1600_F P4-4 | (1) CSO-0873 | COS/FUV, TIME-TAG, PSA | G160M 1600 A | FP-POS=4; SEGMENT=BOTH; BUFFER-TIME=730; FLASH=YES | | Sequence 14-16 Non-Int | 730 Secs<br>*[==>]* | *[5]* |

**Orbit Structure**

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Exp. 6
Exp. 7
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1500
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3500
4000
4500
5000
5500
sec
Orbit 3
Server Version: 20080624
GS Reacq
Exp. 8
Exp. 9
Exp. 10
Occultation
Unused Visibility = 0
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1000
1500
2000
2500
3000
3500
4000
4500
5000
5500
sec

Orbit Structure (continued)