



## 12545 - Dust Destruction in the ISM: The Cygnus Loop Blast Wave

Cycle: 19, Proposal Category: GO

(Availability Mode: SUPPORTED)

### INVESTIGATORS

| <i>Name</i>                      | <i>Institution</i>                                       | <i>E-Mail</i>                   |
|----------------------------------|--|---------------------------------|
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| Dr. Terrance Gaetz (CoI)         | Smithsonian Institution Astrophysical Observatory        | gaetz@cfa.harvard.edu           |
| Dr. Parviz Ghavamian (CoI)       | Space Telescope Science Institute                        | parviz@stsci.edu                |

### VISITS

| <i>Visit</i> | <i>Targets used in Visit</i> | <i>Configurations used in Visit</i> | <i>Orbits Used</i> | <i>Last Orbit Planner Run</i> | <i>OP Current with Visit?</i> |
|--------------|------------------------------|-------------------------------------|--------------------|-------------------------------|-------------------------------|
| 01           | (1) CYG-P7-1<br>(2) CYG-P7-2 | COS/FUV                             | 4                  | 01-Jul-2011 21:24:07.0        | yes                           |
| 02           | (3) CYG-P7-3                 | COS/FUV                             | 5                  | 01-Jul-2011 21:24:20.0        | yes                           |

9 Total Orbits Used

### ABSTRACT

Interstellar dust is destroyed in supernova remnant shocks, but the destruction rate is poorly known. Model-dependent constraints can be obtained from IR observations with Spitzer and from X-ray images, since liberation of volatiles from grains increases the X-ray emissivity. We propose to obtain a more direct, model independent measurement by using COS to observe emission in the C IV lines from carbon sputtered from grains as it is ionized toward equilibrium at X-ray emitting temperatures. We have chosen a shock wave in the Cygnus Loop where we have dust parameters from

Spitzer, the electron temperature from Chandra, and shock speed and density from optical and FUSE spectra. The dust destruction zone is spatially resolved, and we have developed models for the evolution of Spitzer and Chandra spectra as grains are destroyed and refractory elements are returned to the gas phase. The UV sensitivity of COS makes this observation possible.

### **OBSERVING DESCRIPTION**

The program will observe three positions in the Cygnus Loop supernova remnant at and behind the shock wave. The COS 160M grating will be used to measure the fluxes of the C IV 1550 doublet and the He II 1640 line to determine the rate of sputtering of carbon atoms from dust grains swept up by the shock. This will be compared with X-ray and IR observations and models of the sputtering rate and grain size distribution. The positions are at the shock (1 orbit), 10" behind it (3 orbits) and 25" behind it (5 orbits). Depending on shock wave physics, it may be possible to measure the C IV line width as well as the intensity. No special orientation is required. Proper motion was taken into account when choosing the positions, and the proper motion over the course of a year of 0.1" is small enough that fine adjustment for the time of year is not necessary.

Proposal 12545 - Visit 01 - Dust Destruction in the ISM: The Cygnus Loop Blast Wave

Sat Jul 02 01:24:25 GMT 2011

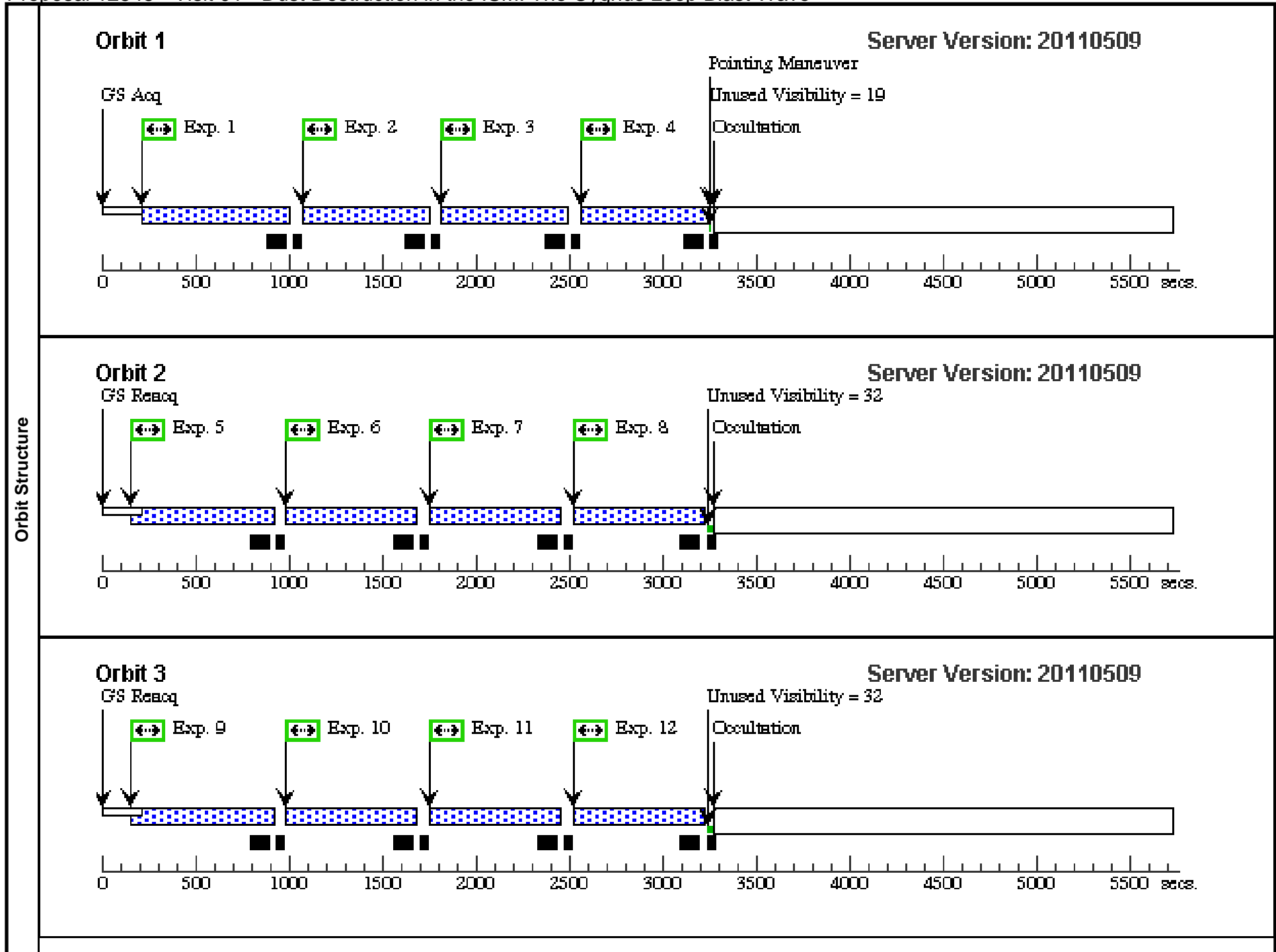
| <b>Visit</b>             | <b>Proposal 12545, Visit 01</b><br><b>Diagnostic Status: Warning</b><br>Scientific Instruments: COS/FUV<br>Special Requirements: (none)<br><i>Comments: Targets 1 and 2</i>  |   |                    |   |                       |               |      |                    |                          |        |               |     |          |  |  |   |                       |                          |  |  |  |  |  |     |          |   |  |   |                       |
|--------------------------|--|---|--------------------|---|-----------------------|---------------|------|--------------------|--------------------------|--------|---------------|-----|----------|--|--|---|-----------------------|--------------------------|--|--|--|--|--|-----|----------|---|--|---|-----------------------|
|                          | <b>Diagnosics</b><br>(Visit 01) Warning (Orbit Planner): INEFFICIENT ORDERING OF FP-POS POSITIONS<br>(Visit 01) Warning (Orbit Planner): INEFFICIENT ORDERING OF FP-POS POSITIONS<br>(Visit 01) Warning (Form): A target acquisition should probably be performed before doing spectroscopy or coronagraphy with STIS or COS.<br>(Visit 01) Warning (Orbit Planner): INEFFICIENT ORDERING OF FP-POS POSITIONS  |   |                    |   |                       |               |      |                    |                          |        |               |     |          |  |  |   |                       |                          |  |  |  |  |  |     |          |   |  |   |                       |
| <b>Fixed Targets</b>     | <table border="1"> <thead> <tr> <th>#</th> <th>Name</th> <th>Target Coordinates</th> <th>Targ. Coord. Corrections</th> <th>Fluxes</th> <th>Miscellaneous</th> </tr> </thead> <tbody> <tr> <td>(1)</td> <td>CYG-P7-1</td> <td>RA: 20 54 43.6110 (313.6817125d)<br/>Dec: +32 16 3.53 (32.26765d)<br/>Equinox: J2000</td> <td></td> <td>V=17.0<br/>3.8e-15 erg/(cm<sup>2</sup> s square arcsec)<br/>) in C IV 1550 Doublet</td> <td>Reference Frame: ICRS</td> </tr> <tr> <td colspan="6"><i>Comments: 1 orbit</i></td> </tr> <tr> <td>(2)</td> <td>CYG-P7-2</td> <td>RA: 20 54 43.0550 (313.6793958d)<br/>Dec: +32 15 56.46 (32.26568d)<br/>Equinox: J2000</td> <td></td> <td>V=20.0<br/>2.9e-16 ergs/(cm<sup>2</sup> s square arcsec)<br/>c) in C IV 1550 doublet</td> <td>Reference Frame: ICRS</td> </tr> </tbody> </table> |   |                    |   |                       | #             | Name | Target Coordinates | Targ. Coord. Corrections | Fluxes | Miscellaneous | (1) | CYG-P7-1 | RA: 20 54 43.6110 (313.6817125d)<br>Dec: +32 16 3.53 (32.26765d)<br>Equinox: J2000 |  | V=17.0<br>3.8e-15 erg/(cm <sup>2</sup> s square arcsec)<br>) in C IV 1550 Doublet | Reference Frame: ICRS | <i>Comments: 1 orbit</i> |  |  |  |  |  | (2) | CYG-P7-2 | RA: 20 54 43.0550 (313.6793958d)<br>Dec: +32 15 56.46 (32.26568d)<br>Equinox: J2000 |  | V=20.0<br>2.9e-16 ergs/(cm <sup>2</sup> s square arcsec)<br>c) in C IV 1550 doublet | Reference Frame: ICRS |
|                          | #  | Name  | Target Coordinates | Targ. Coord. Corrections  | Fluxes                | Miscellaneous |      |                    |                          |        |               |     |          |  |  |   |                       |                          |  |  |  |  |  |     |          |   |  |   |                       |
| (1)                      | CYG-P7-1   | RA: 20 54 43.6110 (313.6817125d)<br>Dec: +32 16 3.53 (32.26765d)<br>Equinox: J2000  |                    | V=17.0<br>3.8e-15 erg/(cm <sup>2</sup> s square arcsec)<br>) in C IV 1550 Doublet   | Reference Frame: ICRS |               |      |                    |                          |        |               |     |          |  |  |   |                       |                          |  |  |  |  |  |     |          |   |  |   |                       |
| <i>Comments: 1 orbit</i> |  |   |                    |   |                       |               |      |                    |                          |        |               |     |          |  |  |   |                       |                          |  |  |  |  |  |     |          |   |  |   |                       |
| (2)                      | CYG-P7-2   | RA: 20 54 43.0550 (313.6793958d)<br>Dec: +32 15 56.46 (32.26568d)<br>Equinox: J2000 |                    | V=20.0<br>2.9e-16 ergs/(cm <sup>2</sup> s square arcsec)<br>c) in C IV 1550 doublet | Reference Frame: ICRS |               |      |                    |                          |        |               |     |          |  |  |   |                       |                          |  |  |  |  |  |     |          |   |  |   |                       |
|                          |  |   |                    |   |                       |               |      |                    |                          |        |               |     |          |  |  |   |                       |                          |  |  |  |  |  |     |          |   |  |   |                       |

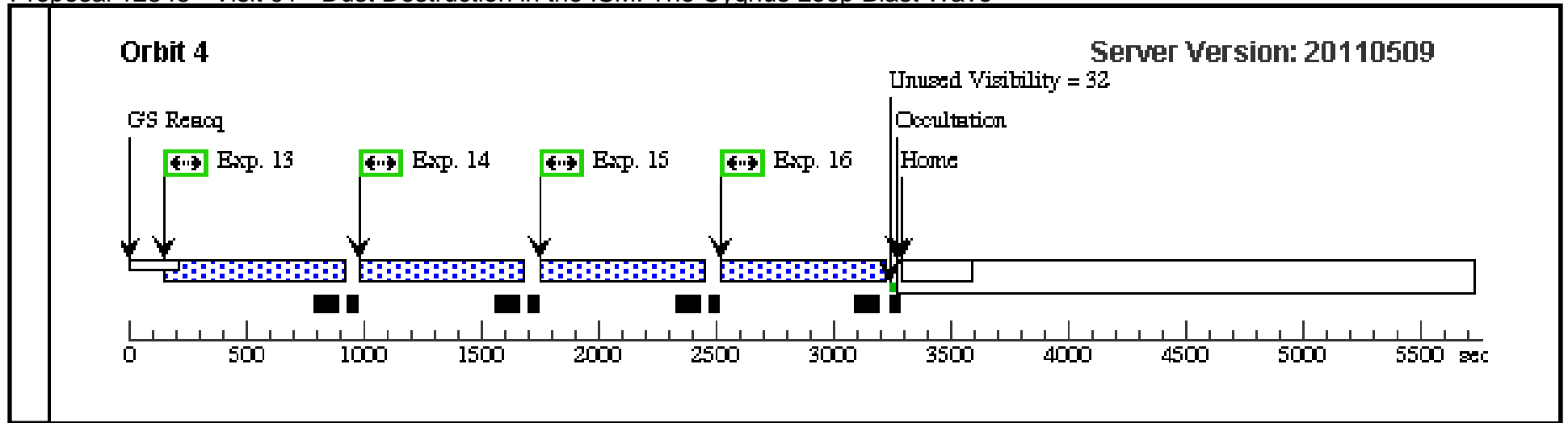
Proposal 12545 - Visit 01 - Dust Destruction in the ISM: The Cygnus Loop Blast Wave

| #         | Label<br>(ETC Run) | Target                               | Config,Mode,Aperture | Spectral Els.          | Opt. Params.    | Special Reqs.                                     | Groups | Exp. Time/[Actual Dur.] | Orbit |
|-----------|--------------------|--------------------------------------|----------------------|------------------------|-----------------|---|--------|-------------------------|-------|
| Exposures | 1                  | Cyg-P7-1 E<br>xposure 1a<br>(177558) | (1) CYG-P7-1         | COS/FUV, TIME-TAG, PSA | G160M<br>1577 A | FP-POS=1;<br>EXTENDED=YES;<br>BUFFER-TIME=51<br>5 |        | 625 Secs<br>[==>]       | [1]   |
|           | 2                  | Cyg-P7-1 E<br>xposure 1b<br>(177558) | (1) CYG-P7-1         | COS/FUV, TIME-TAG, PSA | G160M<br>1577 A | FP-POS=2;<br>EXTENDED=YES;<br>BUFFER-TIME=51<br>5 |        | 625 Secs<br>[==>]       | [1]   |
|           | 3                  | Cyg-P7-1 E<br>xposure 1c<br>(177558) | (1) CYG-P7-1         | COS/FUV, TIME-TAG, PSA | G160M<br>1577 A | FP-POS=3;<br>EXTENDED=YES;<br>BUFFER-TIME=52<br>5 |        | 625 Secs<br>[==>]       | [1]   |
|           | 4                  | Cyg-P7-1 E<br>xposure 1d<br>(177558) | (1) CYG-P7-1         | COS/FUV, TIME-TAG, PSA | G160M<br>1577 A | FP-POS=4;<br>EXTENDED=YES;<br>BUFFER-TIME=51<br>5 |        | 625 Secs<br>[==>]       | [1]   |
|           | 5                  | Cyg-P7-2 E<br>xposure 1a<br>(177559) | (2) CYG-P7-2         | COS/FUV, TIME-TAG, PSA | G160M<br>1577 A | BUFFER-TIME=54<br>0;<br>FP-POS=1;<br>EXTENDED=YES |        | 650 Secs<br>[==>]       | [2]   |
|           | 6                  | Cyg-P7-2 E<br>xposure 1b<br>(177559) | (2) CYG-P7-2         | COS/FUV, TIME-TAG, PSA | G160M<br>1577 A | BUFFER-TIME=54<br>0;<br>FP-POS=2;<br>EXTENDED=YES |        | 650 Secs<br>[==>]       | [2]   |
|           | 7                  | Cyg-P7-2 E<br>xposure 1c<br>(177559) | (2) CYG-P7-2         | COS/FUV, TIME-TAG, PSA | G160M<br>1577 A | BUFFER-TIME=54<br>0;<br>FP-POS=3;<br>EXTENDED=YES |        | 650 Secs<br>[==>]       | [2]   |
|           | 8                  | Cyg-P7-2 E<br>xposure 1d<br>(177559) | (2) CYG-P7-2         | COS/FUV, TIME-TAG, PSA | G160M<br>1577 A | BUFFER-TIME=54<br>0;<br>FP-POS=4;<br>EXTENDED=YES |        | 650 Secs<br>[==>]       | [2]   |
|           | 9                  | Cyg-P7-2 E<br>xposure 2a<br>(177559) | (2) CYG-P7-2         | COS/FUV, TIME-TAG, PSA | G160M<br>1577 A | BUFFER-TIME=54<br>0;<br>FP-POS=1;<br>EXTENDED=YES |        | 650 Secs<br>[==>]       | [3]   |
|           | 10                 | Cyg-P7-2 E<br>xposure 2b<br>(177559) | (2) CYG-P7-2         | COS/FUV, TIME-TAG, PSA | G160M<br>1577 A | BUFFER-TIME=54<br>0;<br>FP-POS=2;<br>EXTENDED=YES |        | 650 Secs<br>[==>]       | [3]   |
|           | 11                 | Cyg-P7-2 E<br>xposure 2c<br>(177559) | (2) CYG-P7-2         | COS/FUV, TIME-TAG, PSA | G160M<br>1577 A | BUFFER-TIME=54<br>0;<br>FP-POS=3;<br>EXTENDED=YES |        | 650 Secs<br>[==>]       | [3]   |

Proposal 12545 - Visit 01 - Dust Destruction in the ISM: The Cygnus Loop Blast Wave

|    |                                      |              |                        |                 |   |          |     |
|----|--------------------------------------|--------------|------------------------|-----------------|---|----------|-----|
| 12 | Cyg-P7-2 E<br>xposure 2d<br>(177559) | (2) CYG-P7-2 | COS/FUV, TIME-TAG, PSA | G160M<br>1577 A | BUFFER-TIME=54<br>0;<br>FP-POS=4;<br>EXTENDED=YES | 650 Secs |     |
|    |                                      |              |                        |                 |   | [==>]    | [3] |
| 13 | Cyg-P7-2 E<br>xposure 3a<br>(177559) | (2) CYG-P7-2 | COS/FUV, TIME-TAG, PSA | G160M<br>1577 A | BUFFER-TIME=54<br>0;<br>FP-POS=1;<br>EXTENDED=YES | 650 Secs |     |
|    |                                      |              |                        |                 |   | [==>]    | [4] |
| 14 | Cyg-P7-2 E<br>xposure 3b<br>(177559) | (2) CYG-P7-2 | COS/FUV, TIME-TAG, PSA | G160M<br>1577 A | BUFFER-TIME=54<br>0;<br>FP-POS=2;<br>EXTENDED=YES | 650 Secs |     |
|    |                                      |              |                        |                 |   | [==>]    | [4] |
| 15 | Cyg-P7-2 E<br>xposure 3c<br>(177559) | (2) CYG-P7-2 | COS/FUV, TIME-TAG, PSA | G160M<br>1577 A | BUFFER-TIME=54<br>0;<br>FP-POS=3;<br>EXTENDED=YES | 650 Secs |     |
|    |                                      |              |                        |                 |   | [==>]    | [4] |
| 16 | Cyg-P7-2 E<br>xposure 3d<br>(177559) | (2) CYG-P7-2 | COS/FUV, TIME-TAG, PSA | G160M<br>1577 A | BUFFER-TIME=54<br>0;<br>FP-POS=4;<br>EXTENDED=YES | 650 Secs |     |
|    |                                      |              |                        |                 |   | [==>]    | [4] |





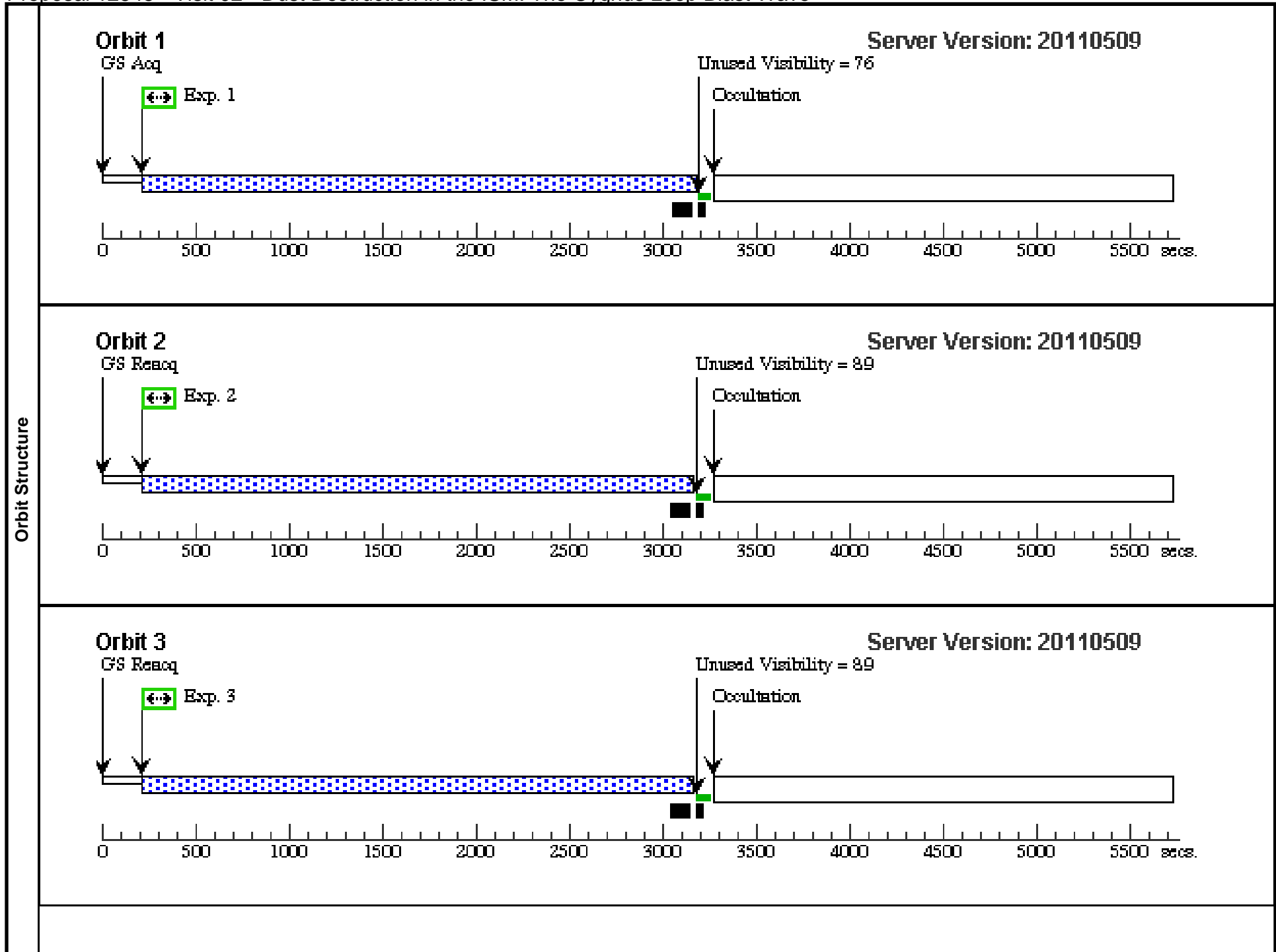
Proposal 12545 - Visit 02 - Dust Destruction in the ISM: The Cygnus Loop Blast Wave

Sat Jul 02 01:24:27 GMT 2011

| <b>Visit</b>         | <b>Proposal 12545, Visit 02</b><br><b>Diagnostic Status: Warning</b><br>Scientific Instruments: COS/FUV<br>Special Requirements: (none)  |   |                    |   |                       |               |      |                    |                          |        |               |     |          |   |  |   |                       |
|----------------------|--|---|--------------------|---|-----------------------|---------------|------|--------------------|--------------------------|--------|---------------|-----|----------|---|--|---|-----------------------|
|                      | (Visit 02) Warning (Orbit Planner): INEFFICIENT ORDERING OF FP-POS POSITIONS<br>(Visit 02) Warning (Form): A target acquisition should probably be performed before doing spectroscopy or coronagraphy with STIS or COS.   |   |                    |   |                       |               |      |                    |                          |        |               |     |          |   |  |   |                       |
| <b>Fixed Targets</b> | <table border="1"> <thead> <tr> <th>#</th> <th>Name</th> <th>Target Coordinates</th> <th>Targ. Coord. Corrections</th> <th>Fluxes</th> <th>Miscellaneous</th> </tr> </thead> <tbody> <tr> <td>(3)</td> <td>CYG-P7-3</td> <td>RA: 20 54 42.2210 (313.6759208d)<br/>Dec: +32 15 45.85 (32.26274d)<br/>Equinox: J2000</td> <td></td> <td>V=20.0<br/>9.0e-17 ergs/(cm<sup>2</sup> s square arcse<br/>c) in C IV 1550 doublet</td> <td>Reference Frame: ICRS</td> </tr> </tbody> </table> |   |                    |   |                       | #             | Name | Target Coordinates | Targ. Coord. Corrections | Fluxes | Miscellaneous | (3) | CYG-P7-3 | RA: 20 54 42.2210 (313.6759208d)<br>Dec: +32 15 45.85 (32.26274d)<br>Equinox: J2000 |  | V=20.0<br>9.0e-17 ergs/(cm <sup>2</sup> s square arcse<br>c) in C IV 1550 doublet | Reference Frame: ICRS |
|                      | #  | Name  | Target Coordinates | Targ. Coord. Corrections  | Fluxes                | Miscellaneous |      |                    |                          |        |               |     |          |   |  |   |                       |
| (3)                  | CYG-P7-3   | RA: 20 54 42.2210 (313.6759208d)<br>Dec: +32 15 45.85 (32.26274d)<br>Equinox: J2000 |                    | V=20.0<br>9.0e-17 ergs/(cm <sup>2</sup> s square arcse<br>c) in C IV 1550 doublet | Reference Frame: ICRS |               |      |                    |                          |        |               |     |          |   |  |   |                       |
|                      |  |   |                    |   |                       |               |      |                    |                          |        |               |     |          |   |  |   |                       |

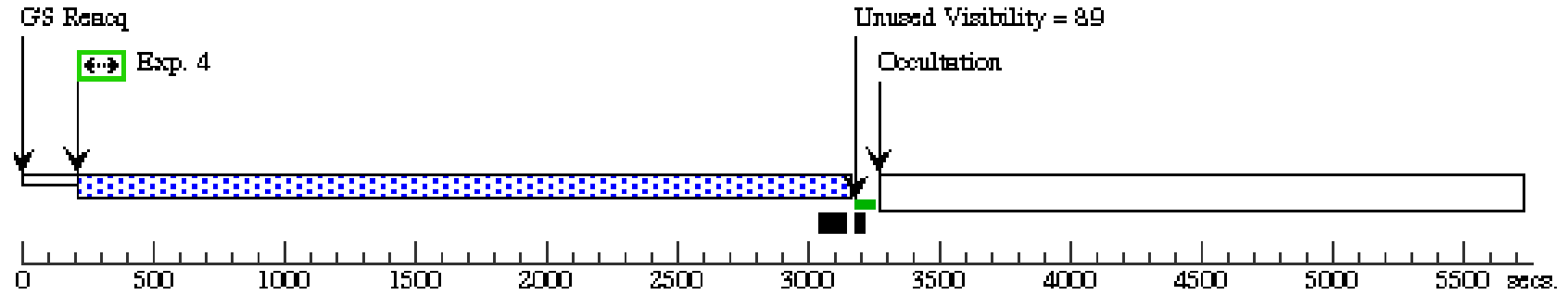
Proposal 12545 - Visit 02 - Dust Destruction in the ISM: The Cygnus Loop Blast Wave

| Exposures | # | Label<br>(ETC Run)                   | Target       | Config,Mode,Aperture   | Spectral Els.   | Opt. Params.                                       | Special Reqs. | Groups | Exp. Time/[Actual Dur.] | Orbit |
|-----------|---|--------------------------------------|--------------|------------------------|-----------------|--|---------------|--------|-------------------------|-------|
|           | 1 | Cyg-P7-3 ex<br>posure 1a<br>(177560) | (3) CYG-P7-3 | COS/FUV, TIME-TAG, PSA | G160M<br>1577 A | BUFFER-TIME=26<br>90;<br>EXTENDED=YES;<br>FP-POS=1 |               |        | 2800 Secs<br>[==>]      | [1]   |
|           | 2 | Cyg-P7-3 ex<br>posure 1b<br>(177560) | (3) CYG-P7-3 | COS/FUV, TIME-TAG, PSA | G160M<br>1577 A | BUFFER-TIME=27<br>90;<br>EXTENDED=YES;<br>FP-POS=2 |               |        | 2900 Secs<br>[==>]      | [2]   |
|           | 3 | Cyg-P7-3 ex<br>posure 1c<br>(177560) | (3) CYG-P7-3 | COS/FUV, TIME-TAG, PSA | G160M<br>1577 A | BUFFER-TIME=27<br>90;<br>EXTENDED=YES;<br>FP-POS=3 |               |        | 2900 Secs<br>[==>]      | [3]   |
|           | 4 | Cyg-P7-3 ex<br>posure 1d<br>(177560) | (3) CYG-P7-3 | COS/FUV, TIME-TAG, PSA | G160M<br>1577 A | BUFFER-TIME=27<br>90;<br>EXTENDED=YES;<br>FP-POS=4 |               |        | 2900 Secs<br>[==>]      | [4]   |
|           | 5 | Cyg-P7-3 ex<br>posure 2a<br>(177560) | (3) CYG-P7-3 | COS/FUV, TIME-TAG, PSA | G160M<br>1577 A | BUFFER-TIME=51<br>5;<br>EXTENDED=YES;<br>FP-POS=1  |               |        | 625 Secs<br>[==>]       | [5]   |
|           | 6 | Cyg-P7-3 ex<br>posure 2b<br>(177560) | (3) CYG-P7-3 | COS/FUV, TIME-TAG, PSA | G160M<br>1577 A | BUFFER-TIME=51<br>5;<br>EXTENDED=YES;<br>FP-POS=2  |               |        | 625 Secs<br>[==>]       | [5]   |
|           | 7 | Cyg-P7-3 ex<br>posure 2c<br>(177560) | (3) CYG-P7-3 | COS/FUV, TIME-TAG, PSA | G160M<br>1577 A | BUFFER-TIME=51<br>5;<br>EXTENDED=YES;<br>FP-POS=3  |               |        | 625 Secs<br>[==>]       | [5]   |
|           | 8 | Cyg-P7-3 ex<br>posure 2d<br>(177560) | (3) CYG-P7-3 | COS/FUV, TIME-TAG, PSA | G160M<br>1577 A | BUFFER-TIME=51<br>5;<br>EXTENDED=YES;<br>FP-POS=4  |               |        | 625 Secs<br>[==>]       | [5]   |



### Orbit 4

Server Version: 20110509



### Orbit 5

Server Version: 20110509

