



12917 - The FUV bow-shock nebula of PSR J0437-4715

Cycle: 20, Proposal Category: GO

(Availability Mode: SUPPORTED)

INVESTIGATORS

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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 | (2) PSR-J0437-47-BOW | ACS/SBC | 3 | 11-Jul-2012 22:28:22.0 | yes |
| 02 | (2) PSR-J0437-47-BOW | ACS/SBC | 3 | 11-Jul-2012 22:28:31.0 | yes |
| 03 | (2) PSR-J0437-47-BOW | ACS/WFC | 1 | 11-Jul-2012 22:28:37.0 | yes |

7 Total Orbits Used

ABSTRACT

We serendipitously detected a small part of the bow-shock around PSR J0437-4715 in FUV, during our spectroscopic observations of this nearby pulsar. This pulsar is known to be accompanied by a prominent H-alpha bow-shock but, to our surprise, we have discovered its clear counterpart in the FUV image (Figure 1). We are not aware of any instance where both H-alpha and FUV emission are seen from a bow-shock outside the Solar system. The origin of the FUV emission is enigmatic, and the spatial structure of the FUV emission and its relative extent compared to the H-alpha

bow are not yet known.

We wish to understand the origin of the FUV emission and use both H-alpha and FUV images to constrain the bow-shock physics and the local ISM properties. Using three long-pass filters in the FUV, we will probe the spatially resolved spectrum of the FUV emission and, at the same time, image most of the bow-shock with subarcsecond resolution. We will also obtain a contemporaneous, high-resolution H-alpha image. This, together with knowledge of the pulsar energetics, will allow us to model the emission mechanism and physical conditions throughout the bow-shock, a unique opportunity only available for this object and only using HST's FUV capabilities.

OBSERVING DESCRIPTION

We are imaging the faint, extended bow-shock emission in the vicinity of J0437-4715. For such imaging, the final S/N ratio will be dominated by the glow component whose strength depends on the previous SBC usage. Therefore, if at all possible, we ask to schedule our observations in such a way that the SBC has not been used immediately prior to each of our visits.

For the FUV imaging, the F115LP and F125LP filters will be used while the spacecraft is in the earth's shadow, in order to avoid the high background associated with geocoronal emission. The F140LP imaging cuts out this emission and does not need to be taken in the shadow.

The pointing and orientation of the SBC are chosen such that a) the majority of the bow shock lies on the chip, away from the worst of the detector glow and b) the nearby bright object.

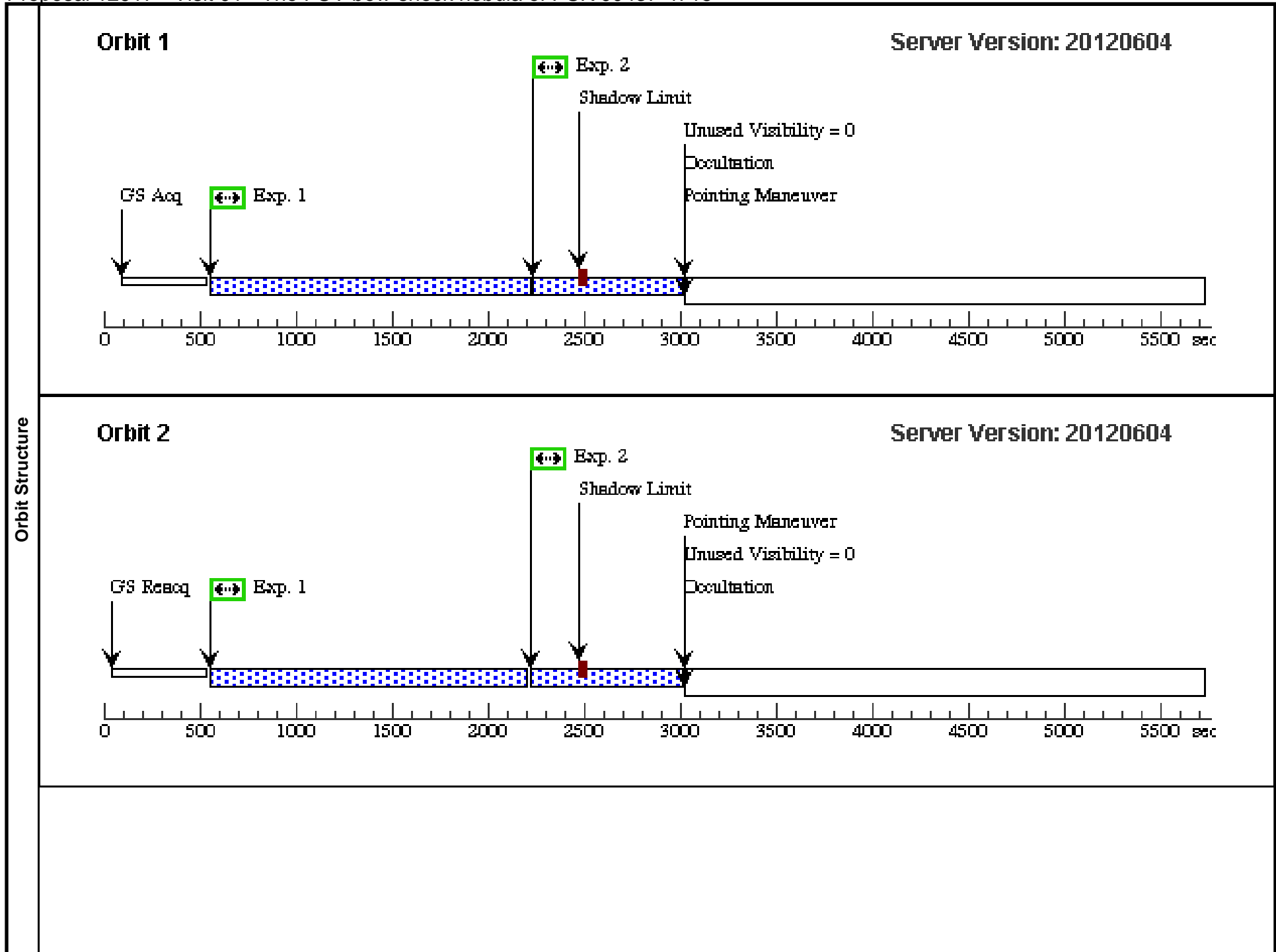
The one potentially concerning Bright Object in the field is S2J1010362. In GSC 2.2 it has $V=15.13$, $B-V=0.15$. According to http://www.stsci.edu/hst/acs/documents/handbooks/cycle19/c07_obstechniques03.html this object (which is a galaxy) would be dangerous if it were earlier type than A1. However, A1 has $B-V=0$, and so the object is clearly redder and therefore not a worry. Furthermore, it has $B-V=0.83$ in NOMAD (0427-0057510) and $J-K=1.01$ in 2MASS (069.310478), even redder.

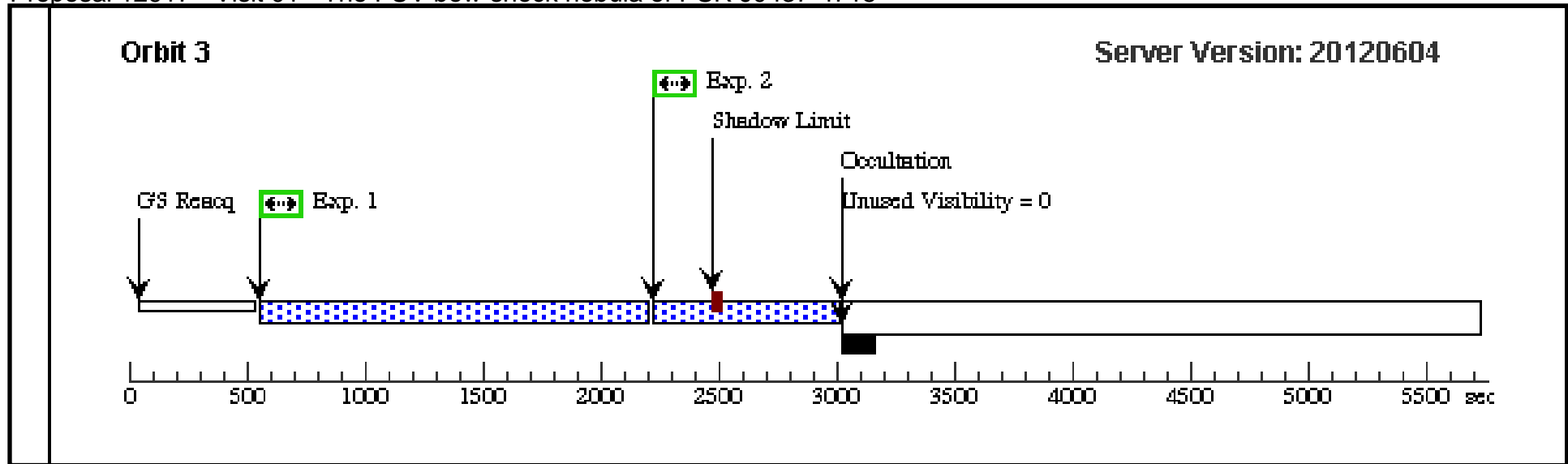
Additionally, we constrain the SBC detector orientation to ensure that the object is not in the field of view. The orientation and location of the SBC is very similar to our previous observation 10568, for which the nearby galaxy was not a problem.

Proposal 12917 - Visit 01 - The FUV bow-shock nebula of PSR J0437-4715

Thu Jul 12 02:28:44 GMT 2012

| Visit | Proposal 12917, Visit 01, implementation Diagnostic Status: No Diagnostics Scientific Instruments: ACS/SBC Special Requirements: SCHED 100%; ORIENT 150D TO 236 D | | | | | | | | | | |
|---------------|--|----------------------|--|---|---------------|-------------------|--|-------------------------------------|-------------------------|-----|-------|
| | Patterns | # | Primary Pattern | | | Secondary Pattern | | | Exposures | | |
| | | (2) | Pattern Type=ACS-SBC-DITHER-LINE Purpose=DITHER Number Of Points=3 Point Spacing=0.472 Line Spacing= | Coordinate Frame=POS-TARG Pattern Orientation=44.4 Angle Between Sides= Center Pattern=false | | | | | (1-2) | | |
| Fixed Targets | # | Name | Target Coordinates | Targ. Coord. Corrections | | Fluxes | Miscellaneous | | | | |
| | (2) | PSR-J0437-47-BOW | RA: 04 37 15.6434 (69.3151808d) Dec: -47 15 6.42 (-47.25178d) Equinox: J2000 | | | V=28+/-2 | Reference Frame: ICRS | | | | |
| Exposures | # | Label (ETC Run) | Target | Config,Mode,Aperture | Spectral Els. | Opt. Params. | Special Reqs. | Groups | Exp. Time/[Actual Dur.] | | Orbit |
| | 1 | (ACS.im.37 9528) | (2) PSR-J0437-47-BOW | ACS/SBC, ACCUM, SBC-FIX | F115LP | | SHADOW; GS ACQ SCENARI O BASE1B3 | Pattern 2, Exps 1-2 in Visit 01 (2) | 1600 Secs | | |
| | | | | | | | | | [=>(Pattern 1)] | | [1] |
| | | | | | | | | | [=>(Pattern 2)] | | [2] |
| | | | | | | | | | [=>(Pattern 3)] | | [3] |
| 2 | (ACS.im.37 9533) | (2) PSR-J0437-47-BOW | ACS/SBC, ACCUM, SBC-FIX | F140LP | | | Pattern 2, Exps 1-2 in Visit 01 (2) | 724 Secs | | | |
| | | | | | | | | [=>(Pattern 1)] | | [1] | |
| | | | | | | | | [=>737.0 Secs (Pattern 2)] | | [2] | |
| | | | | | | | | [=>737.0 Secs (Pattern 3)] | | [3] | |

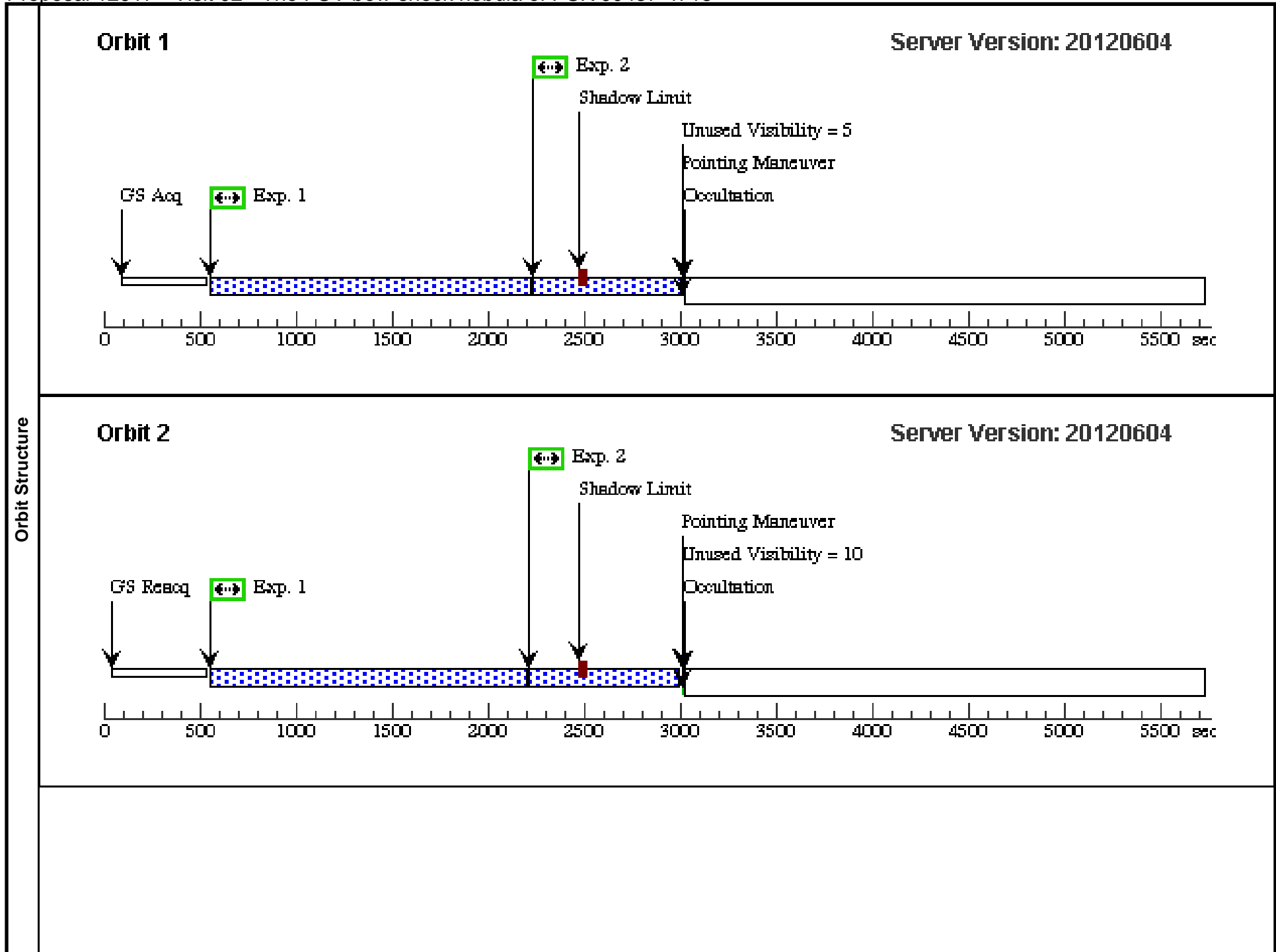


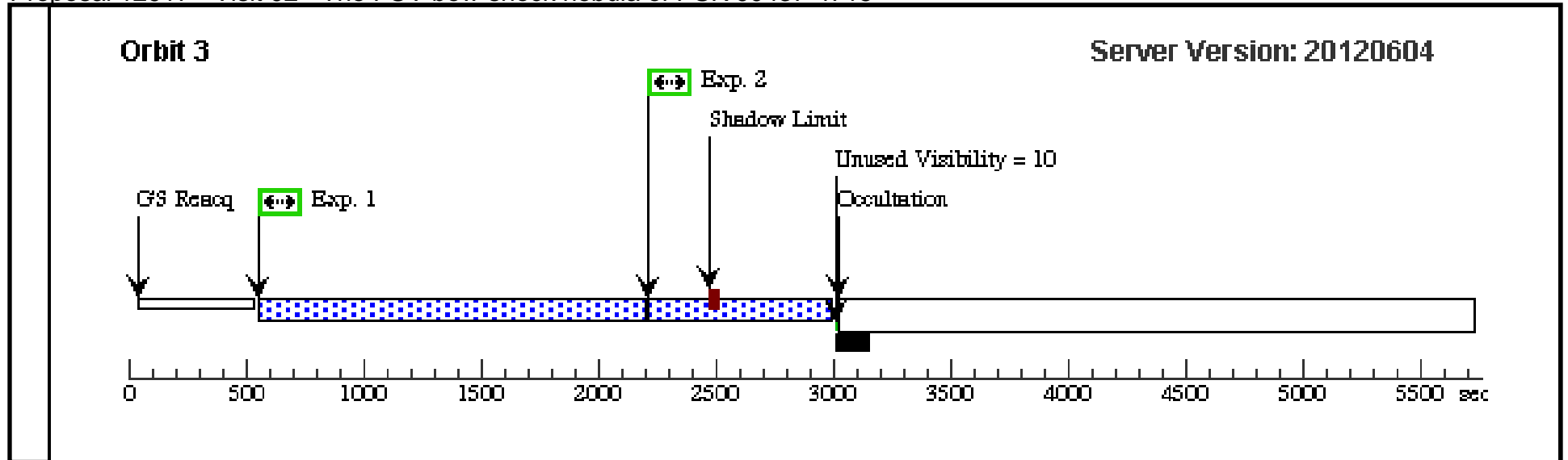


Proposal 12917 - Visit 02 - The FUV bow-shock nebula of PSR J0437-4715

Thu Jul 12 02:28:47 GMT 2012

| Visit | Proposal 12917, Visit 02, implementation Diagnostic Status: No Diagnostics Scientific Instruments: ACS/SBC Special Requirements: SCHED 100%; ORIENT 150D TO 236 D | | | | | | | | | |
|---------------|--|----------------------|--|---|---------------|-------------------|--|-------------------------------------|-------------------------|-------|
| | Patterns | # | Primary Pattern | | | Secondary Pattern | | | Exposures | |
| | | (2) | Pattern Type=ACS-SBC-DITHER-LINE Purpose=DITHER Number Of Points=3 Point Spacing=0.472 Line Spacing= | Coordinate Frame=POS-TARG Pattern Orientation=44.4 Angle Between Sides= Center Pattern=false | | | | | (1-2) | |
| Fixed Targets | # | Name | Target Coordinates | Targ. Coord. Corrections | | Fluxes | Miscellaneous | | | |
| | (2) | PSR-J0437-47-BOW | RA: 04 37 15.6434 (69.3151808d) Dec: -47 15 6.42 (-47.25178d) Equinox: J2000 | | | V=28+/-2 | Reference Frame: ICRS | | | |
| Exposures | # | Label (ETC Run) | Target | Config,Mode,Aperture | Spectral Els. | Opt. Params. | Special Reqs. | Groups | Exp. Time/[Actual Dur.] | Orbit |
| | 1 | (ACS.im.37 9528) | (2) PSR-J0437-47-BOW | ACS/SBC, ACCUM, SBC-FIX | F125LP | | SHADOW; GS ACQ SCENARI O BASE1B3 | Pattern 2, Exps 1-2 in Visit 02 (2) | 1600 Secs | |
| | | | | | | | | | [=>(Pattern 1)] | [1] |
| | | | | | | | | | [=>(Pattern 2)] | [2] |
| | | | | | | | | | [=>(Pattern 3)] | [3] |
| 2 | (ACS.im.37 9533) | (2) PSR-J0437-47-BOW | ACS/SBC, ACCUM, SBC-FIX | F140LP | | | Pattern 2, Exps 1-2 in Visit 02 (2) | 724 Secs | | |
| | | | | | | | | [=>(Pattern 1)] | [1] | |
| | | | | | | | | [=>737.0 Secs (Pattern 2)] | [2] | |
| | | | | | | | | [=>737.0 Secs (Pattern 3)] | [3] | |





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|--------------|--|--|--|
| Visit | Proposal 12917, Visit 03, implementation Diagnostic Status: No Diagnostics Scientific Instruments: ACS/WFC Special Requirements: SCHED 100% | | |
| | | | |

| Patterns | # | Primary Pattern | Secondary Pattern | Exposures |
|-----------------|-----|--|---|-----------|
| | (1) | Pattern Type=ACS-WFC-DITHER-BOX Purpose=DITHER Number Of Points=4 Point Spacing=0.265 Line Spacing=0.187 | Coordinate Frame=POS-TARG Pattern Orientation=20.67 Angle Between Sides=69.05 Center Pattern=false | |

| Fixed Targets | # | Name | Target Coordinates | Targ. Coord. Corrections | Fluxes | Miscellaneous |
|----------------------|-----|------------------|--|--------------------------|----------|-----------------------|
| | (2) | PSR-J0437-47-BOW | RA: 04 37 15.6434 (69.3151808d) Dec: -47 15 6.42 (-47.25178d) Equinox: J2000 | | V=28+/-2 | Reference Frame: ICRS |

| Exposures | # | Label (ETC Run) | Target | Config,Mode,Aperture | Spectral Els. | Opt. Params. | Special Reqs. | Groups | Exp. Time/[Actual Dur.] | Orbit |
|------------------|---|------------------|----------------------|----------------------|---------------|--------------|---------------|--------|-------------------------------------|--|
| | 1 | (ACS.im.37 9533) | (2) PSR-J0437-47-BOW | ACS/WFC, ACCUM, WFC1 | F658N | | | | Pattern 1, Exps 1-1 in Visit 03 (1) | 450 Secs [==>499.0 Secs (Pattern 1)] [==>499.0 Secs (Pattern 2)] [==>499.0 Secs (Pattern 3)] [==>500.0 Secs (Pattern 4)] |

