# 15120 - Measuring the Deceleration of a Supernova Remnant Shock Wave using High-Precision Astrometry

Cycle: 25, 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) SN1006-NW-FILAMENT | ACS/WFC | 3 | 28-Jul-2017 15:00:40.0 | yes |

3 Total Orbits Used

**ABSTRACT**

We propose a third epoch of HST imaging of the NW filament of the remnant of SN 1006. Proper motions have been measured for this remnant in multiple wavelengths, and are nearly 0.3" per year in the NW filament, the only part of the remnant that is bright at optical wavelengths. A first epoch observation with HST was done in 2006, with a second epoch completed in 2013. We propose for a third epoch, with which we will measure, for the first time, the change in the velocity of the shock wave of a supernova remnant. Doing this will require high-precision astrometry, as we will need to measure the proper motions to an accuracy of a few tenths of a milliarcsecond per year. This is achievable with HST, and members of our group have made measurements even more accurate than this in recent years on other astronomical sources. A direct deceleration measurement

would avoid the sources of uncertainty that are encountered by indirect inferences. This measurement would add an additional constraint to hydrodynamic simulations of the evolution of SN 1006, as well as serve as a diagnostic on the density of the interstellar medium that the shock wave is sweeping up. Only Hubble has the capabilities of performing a measurement like this, and a measurement of the deceleration of this shock wave would open a new window into SNR evolution for SN 1006 and other remnants with fast shock waves.

**OBSERVING DESCRIPTION**

The observations required here are quite straightforward. We request ACS WFC F658N imaging of a fixed location centered on the NW filament of SN 1006, as was done in 2006 and 2013. The filament is quite bright and obtaining a high signal-to-noise is doable in only a few orbits time. The 2006 observation was quite deep, at 9 orbits, but this is because that program (10577) was searching for a faint shock precursor. It is not necessary to go this deep again. That program was divided in three 3-orbit visits, and we have determined that each of these 3-orbit observations is sufficient for our purposes. The filament is quite bright in thee orbits, and we can get good statistics on several fixed background galaxies for aligning the images. Additionally, we find $\sim 170$ stars in the 2006 image that appear in the GAIA first data release catalog in the magnitude range of 16-21 (brighter stars saturate). Our request of three orbits will be sufficient to obtain strong signal for all of these stars.

## Visit

**Proposal 15120, Visit 01, implementation** Fri Jul 28 19:00:41 GMT 2017

**Diagnostic Status: No Diagnostics**

Scientific Instruments: ACS/WFC

Special Requirements: ORIENT 288.3D TO 289.1 D

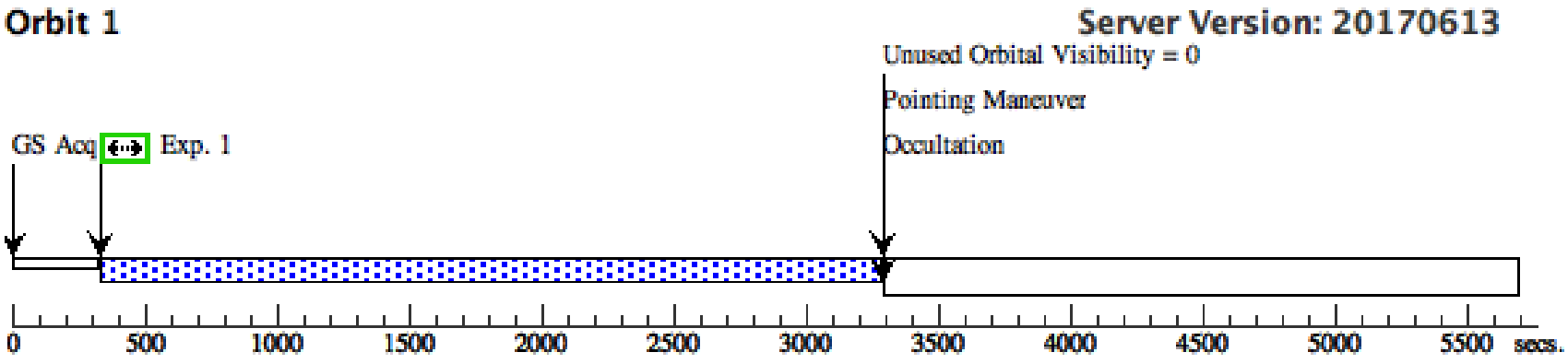
## Fixed Targets

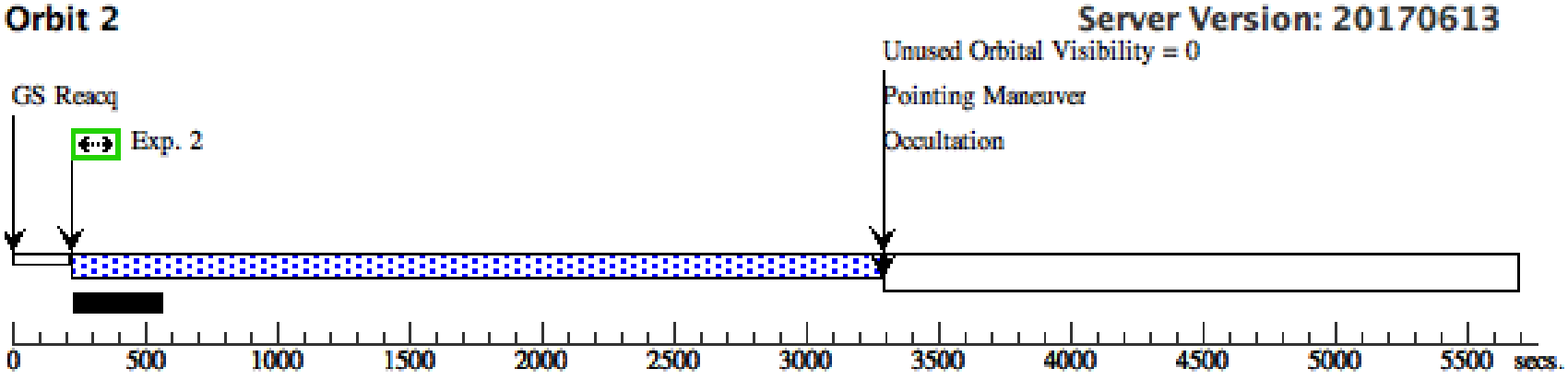
| # | Name | Target Coordinates | Targ. Coord. Corrections | Fluxes | Miscellaneous |
|---|---|---|---|---|---|
| (1) | SN1006-NW-FILAMENT | RA: 15 02 20.0000 (225.5833333d)<br>Dec: -41 44 43.00 (-41.74528d)<br>Equinox: J2000 | | V=16 | Reference Frame: ICRS |

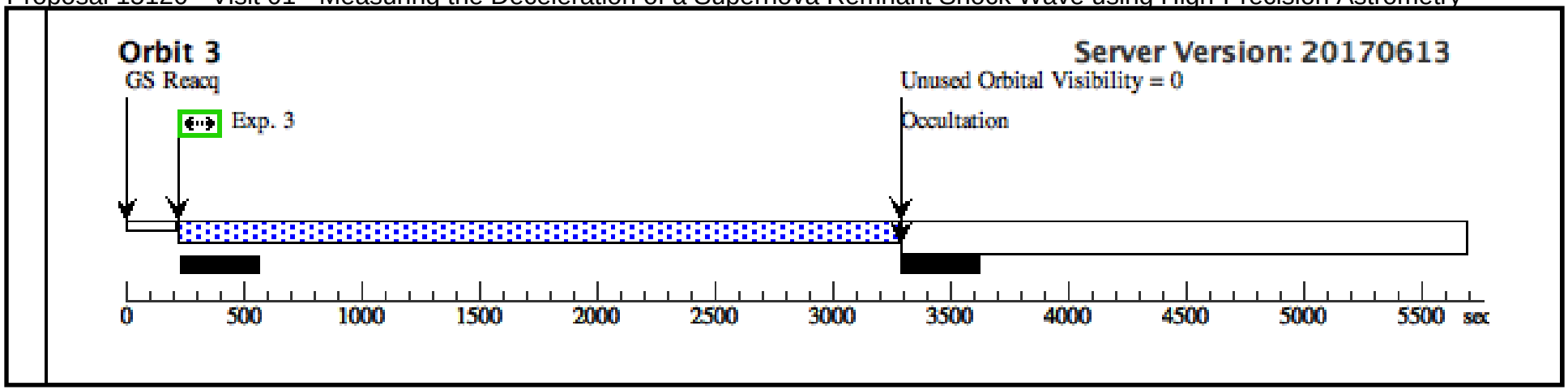
## Exposures

| # | Label | Target | Config,Mode,Aperture | Spectral Els. | Opt. Params. | Special Reqs. | Groups | Exp. Time (Total)/[Actual Dur.] | Orbit |
|---|---|---|---|---|---|---|---|---|---|
| 1 | | (1) SN1006-NW-FILAMENT | ACS/WFC, ACCUM, WFC | F658N | CR-SPLIT=NO | | | 3300 Secs (2745 Secs)<br>*[==>2745.0 Secs ]* | <br>***[1]*** |
| 2 | | (1) SN1006-NW-FILAMENT | ACS/WFC, ACCUM, WFC | F658N | CR-SPLIT=NO | POS TARG 0.1488,0.08595 | | 3300 Secs (2938 Secs)<br>*[==>2938.0 Secs ]* | <br>***[2]*** |
| 3 | | (1) SN1006-NW-FILAMENT | ACS/WFC, ACCUM, WFC | F658N | | POS TARG 0.2232,0.24075 | | 3300 Secs (2938 Secs)<br>*[==>2938.0 Secs ]* | <br>***[3]*** |

Orbit Structure

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