12924 - Measuring the Wind Properties of a Galactic SN1987A analog with COS

Cycle: 20, Proposal Category: GO

(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) SBW2007-1	COS/FUV COS/NUV	4	06-Jul-2012 21:51:17.0	yes

4 Total Orbits Used

ABSTRACT

We propose to use COS to obtain an FUV spectrum of the B supergiant SBW1, in order to measure this star's wind speed and mass-loss rate. This star is of particular interest because it is surrounded by a ring nebula that closely resembles the triple-ring nebula around SN 1987A. The unusual nebula, combined with the luminosity and spectral type of the star, make SBW1 the closest known Galactic twin of the progenitor of SN 1987A. We recently obtained WFC3 images and STIS spectra of SBW1 that not only verify this close comparison with SN 1987A and elucidate some of the detailed structures in the nebula, but the new HST images also show additional features that we didn't expect. Namely, our HST images and ground-based mid-IR images from Gemini show evidence for a structure interior to the ring that appears to be the terminal shock of the wind interacting with a backflow from the ring. Such structures were predicted to exist around the SN 1987A progenitor based on models for the speed of the expanding blast wave, but they were never actually seen. The reason we want to measure the wind speed and mass-loss rate from the COS spectrum is so that

we can test whether or not the terminal wind shock provides a suitable physical explanation for the structure seen in WFC3 and Gemini images. If so, it would significantly alter ideas about the formation of the SN 1987A rings, because it would mean that the B supergiant wind is actually not interacting directly with the outer ring nebula, as proposed based on some hydrodynamic models.

OBSERVING DESCRIPTION

The observations in this program will obtain a UV spectrum of the type B1.5 Iab blue supergiant that is the central source of the SBW1 nebula, which is a near twin of the ring nebula around SN 1987A. The purpose is to use UV line diagnoistics to estimate the wind mass-loss rate of the blue supergiant star. Like the progenitor of SN 1987A, there are indications that the wind of this supergiant is rathern weak, and the mass-loss rate has important implications for understanding the shaping of the nebula. The observations will use the G160M grating at central wavelengths of 1577 and 1600 Angstroms. The expected UV flux at these wavelengths is based on extrapolating from the visual magnitudes using the observed spectral type and reddening of the star.

Visit

Proposal 12924, SWB1-COS (01) Sat Jul 07 01:51:27 GMT 2012

Diagnostic Status: Warning

Scientific Instruments: COS/NUV, COS/FUV

Special Requirements: (none)

Diagnostics

(SWB1-COS (01)) Warning (Form): For the best data quality, it is strongly recommended that all four FP-POS positions be used when observing at a given COS CENWAVE setting.

Fixed Targets

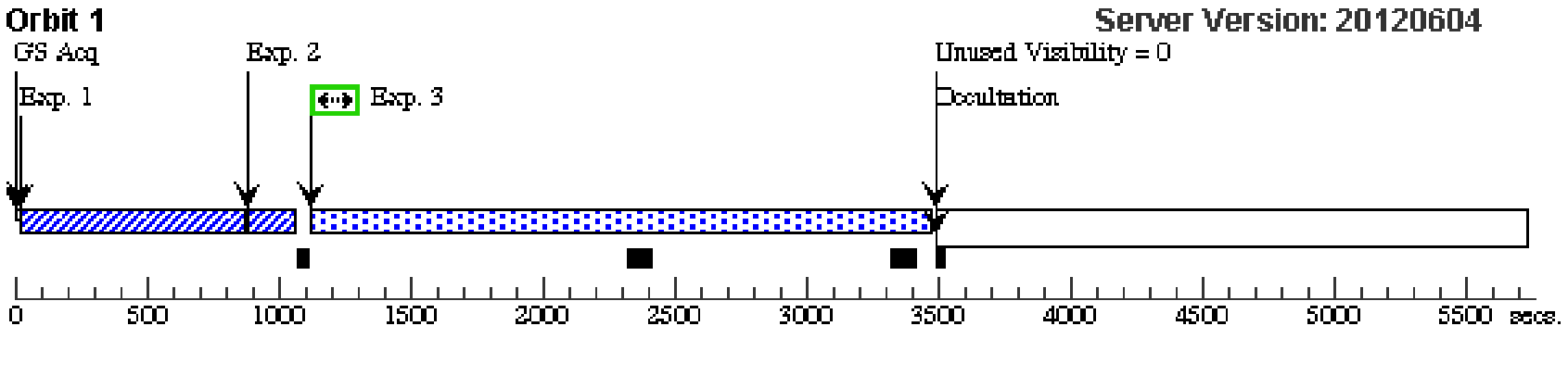
#	Name	Target Coordinates	Targ. Coord. Corrections	Fluxes	Miscellaneous
(1)	SBW2007-1	RA: 10 40 19.4000 (160.0808333d) Dec: -59 49 9.70 (-59.81936d) Equinox: J2000	Proper Motion RA: 0000 Proper Motion Dec: 0000 Epoch of Position: 2000	V=12.7	Reference Frame: ICRS

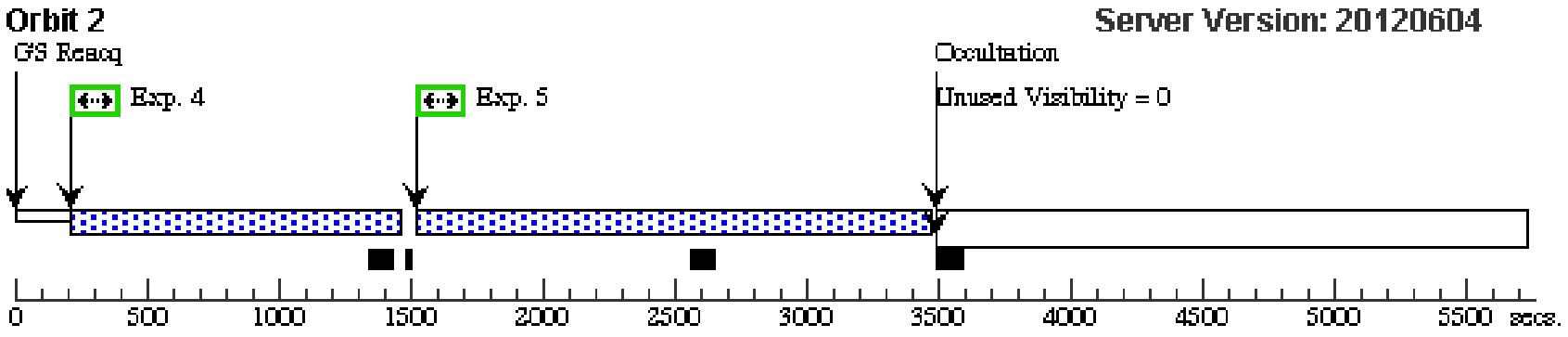
Comments: This object was generated by the targetselector and retrieved from the SIMBAD database.

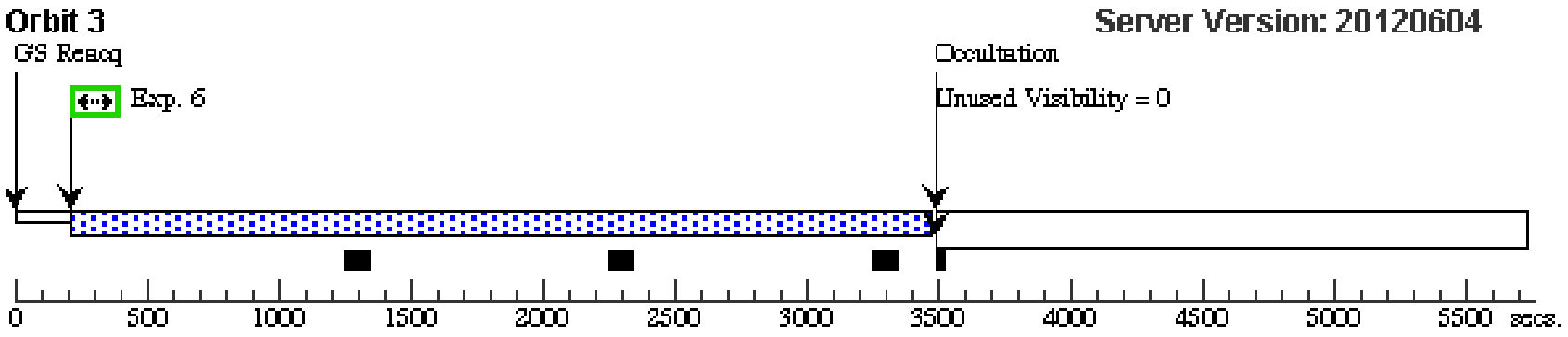
Exposures

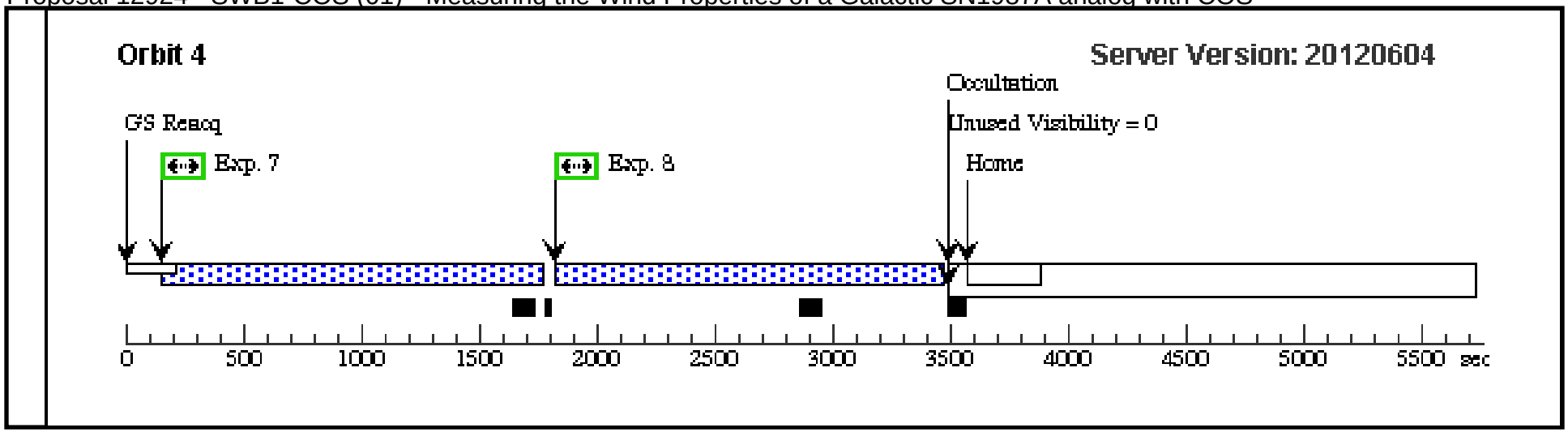
#	Label (ETC Run)	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time/[Actual Dur.]	Orbit
1	SWB1-ACQ/SEARCH (COS.ta.411261)	(1) SBW2007-1	COS/NUV, ACQ/SEARCH, PSA	MIRRORB	SCAN-SIZE=3			28 Secs *[==>]*	 ***[1]***
Comments: Target Acq: B0I star Castelli & Kurucz model, V=12.7, E(B-V) = 1.15. F(1550A) = 2x10^{-15} [erg/cm2/s/A]. Spectroscopic observation assumes a flat spectrum normalized to this value (COS.sp.412090).									
2	SWB1-ACQ/IMAGE (COS.ta.411261)	(1) SBW2007-1	COS/NUV, ACQ/IMAGE, PSA	MIRRORB				28 Secs *[==>]*	 ***[1]***
3	SWB1-l1577-FP1 (COS.sp.412090)	(1) SBW2007-1	COS/FUV, TIME-TAG, PSA	G160M 1577 A	BUFFER-TIME=1000; FP-POS=1			2136 Secs *[==>]*	 ***[1]***
4	SWB1-l1577-FP2 (COS.sp.412090)	(1) SBW2007-1	COS/FUV, TIME-TAG, PSA	G160M 1577 A	BUFFER-TIME=1090; FP-POS=2			1200 Secs *[==>]*	 ***[2]***
5	SWB1-l1577-FP3 (COS.sp.412090)	(1) SBW2007-1	COS/FUV, TIME-TAG, PSA	G160M 1577 A	BUFFER-TIME=1000; FP-POS=3			1900 Secs *[==>]*	 ***[2]***
6	SWB1-l1577-FP4 (COS.sp.412090)	(1) SBW2007-1	COS/FUV, TIME-TAG, PSA	G160M 1577 A	BUFFER-TIME=1000; FP-POS=4			3205 Secs *[==>]*	 ***[3]***
7	SWB1-l1600-FP1 (COS.sp.412090)	(1) SBW2007-1	COS/FUV, TIME-TAG, PSA	G160M 1600 A	BUFFER-TIME=1390; FP-POS=1			1500 Secs *[==>]*	 ***[4]***
8	SWB1-l1600-FP2 (COS.sp.412090)	(1) SBW2007-1	COS/FUV, TIME-TAG, PSA	G160M 1600 A	BUFFER-TIME=1000; FP-POS=2			1600 Secs *[==>]*	 ***[4]***

Orbit Structure





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