14250 - The ultraviolet light curve and spectrum of PSR B0540-69, the Crab Twin.

Cycle: 23, Proposal Category: GO

(UV Initiative)

(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) PSRB0540-69	STIS/NUV-MAMA	3	23-Jul-2015 23:20:50.0	yes
02	(1) PSRB0540-69	STIS/FUV-MAMA	3	23-Jul-2015 23:20:52.0	yes

6 Total Orbits Used

ABSTRACT

Ten rotation-powered pulsars are firmly identified in the optical domain, the brightest of which is the Crab pulsar (V~16.5). The ~1700 year old pulsar PSR B0540-69 in the LMC is considered the Crab pulsar twin because of its similar spin period and period derivative, hence similar inferred values of age, magnetic field, and spin-down energy, and is also one of the five pulsars for which optical pulsations have been detected. Strangely enough, however, although it is the second brightest pulsar (V~22.5) it is the only one of the five optical pulsars for which no search for UV

pulsations has been ever carried out. Thus, is is the only one for which no information on its UV light curve is available. The UV spectrum of PSR B0540-69 is also unknown. Its optical/near-IR spectrum is fit by a power-law, like that of the other young rotation-powered pulsars. At variance with them, however, PSR B0540-69 features a unique double break in the optical-to-X-ray spectrum, with the first one most likely occurring in the UV. We propose to perform time-resolved imaging of PSR B0540-69 with the STIS NUV and FUV MAMAs to determine, for the first time, both the slope of its power-law spectrum and its light curve profile in the UV. This will enable us both to search for the expected spectral break in the UV and determine whether this is associated with a different pulsar emission geometry in the UV with respect to the optical by comparing the pulsar UV and optical light curves. This information is crucial to track the location of optical and UV emission regions in the neutron star magnetosphere, and compare them with the predictions of different emission models.

OBSERVING DESCRIPTION

The goal of our proposal is to measure the NUV light curve of PSR B0540-69 and obtain an accurate measurement of its flux in both the NUV and FUV. In this way, by comparing the profile of the NUV light curve with the optical one, we will study whether the profile of the light curve depends on the wavelength, and whether the change in the light curve profile is related to a possible change of the spectrum from the optical to the UV. Flux measurements in the NUV and FUV will also yield the spectral slope of the pulsar in the UV.

We plan to observe our target, PSR B0540. with STIS NUV and FUV MAMAS. The NUV and FUV observations will be packed in two visits, each one consisting of three obits. We have no scheduling constraints for our observations and we have no preferred execution sequence for visit 1 and 2. Similarly, since all exposures in each visit are to be taken with the same set up, we do not have any constraint on the order of the exposure sequence. In both the first and second visit we will use the F25QTZ, for both the NUV and FUV MAMAs. Both observations should be executed in TIME-TAG mode. We have no constrain on the spacecraft roll angle.

Visit

Proposal 14250, Visit 01 Fri Jul 24 03:20:53 GMT 2015

Diagnostic Status: No Diagnostics

Scientific Instruments: STIS/NUV-MAMA

Special Requirements: (none)

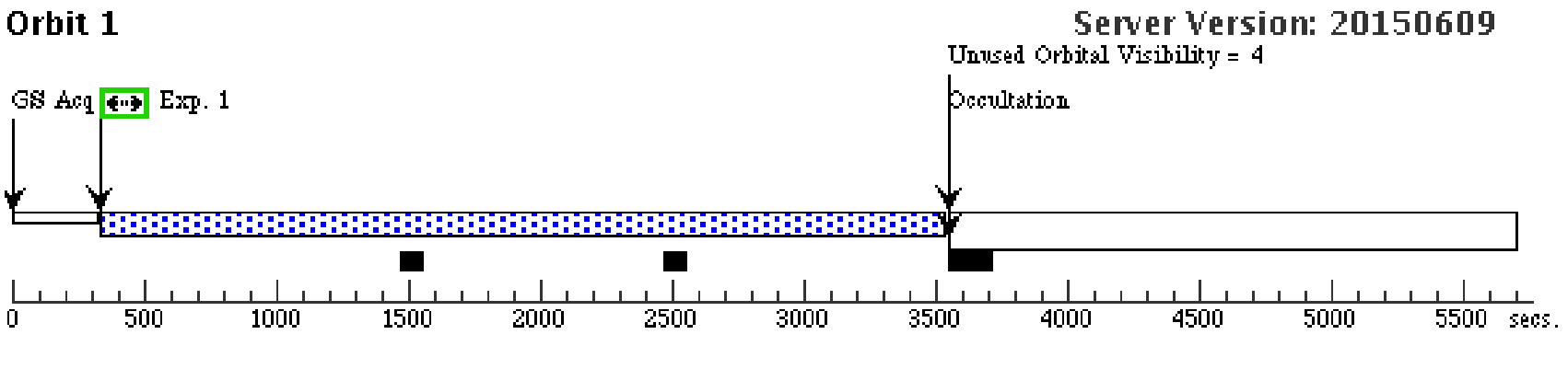
Fixed Targets

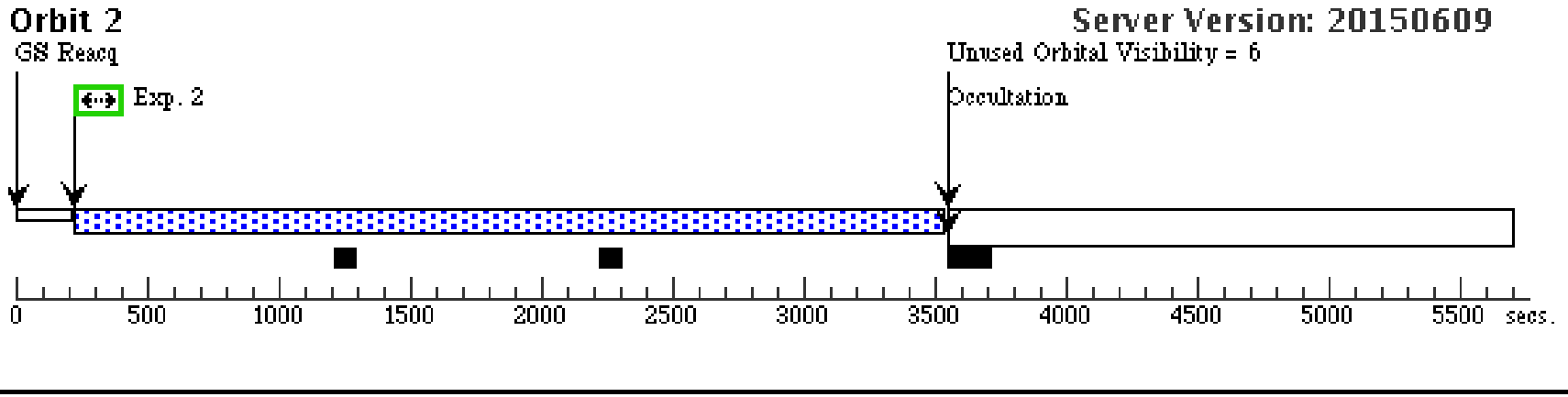
#	Name	Target Coordinates	Targ. Coord. Corrections	Fluxes	Miscellaneous
(1)	PSRB0540-69	RA: 05 40 11.2020 (85.0466750d) Dec: -69 19 54.17 (-69.33171d) Equinox: J2000		V=22.5+/-0.05	Reference Frame: ICRS

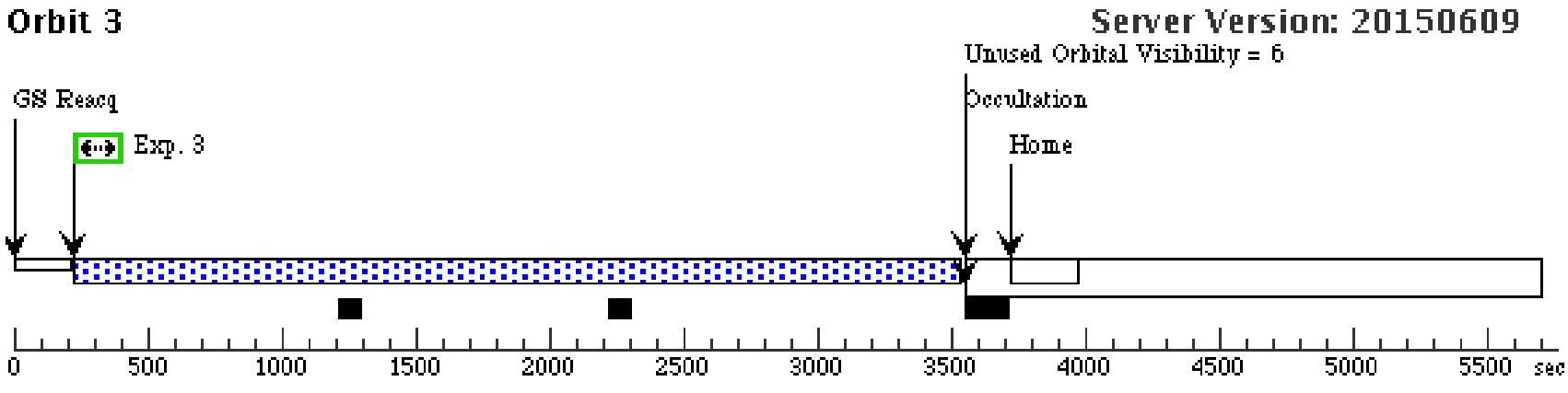
Exposures

#	Label (ETC Run)	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time (Total)/[Actual Dur.]	Orbit
1	(STIS.im.723175)	(1) PSRB0540-69	STIS/NUV-MAMA, TIME-TAG, F25QTZ	MIRROR	BUFFER-TIME=1000			3050 Secs (3050 Secs) *[==>]*	 ***[1]***
2	(STIS.im.723175)	(1) PSRB0540-69	STIS/NUV-MAMA, TIME-TAG, F25QTZ	MIRROR	BUFFER-TIME=1000			3300 Secs (3300 Secs) *[==>]*	 ***[2]***
3	(STIS.im.723175)	(1) PSRB0540-69	STIS/NUV-MAMA, TIME-TAG, F25QTZ	MIRROR	BUFFER-TIME=1000			3300 Secs (3300 Secs) *[==>]*	 ***[3]***

Orbit Structure







Visit

Proposal 14250, Visit 02 Fri Jul 24 03:20:53 GMT 2015

Diagnostic Status: No Diagnostics

Scientific Instruments: STIS/FUV-MAMA

Special Requirements: (none)

Fixed Targets

#	Name	Target Coordinates	Targ. Coord. Corrections	Fluxes	Miscellaneous
(1)	PSRB0540-69	RA: 05 40 11.2020 (85.0466750d) Dec: -69 19 54.17 (-69.33171d) Equinox: J2000		V=22.5+/-0.05	Reference Frame: ICRS

Exposures

#	Label (ETC Run)	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time (Total)/[Actual Dur.]	Orbit
1	(STIS.im.723176)	(1) PSRB0540-69	STIS/FUV-MAMA, TIME-TAG, F25QTZ	MIRROR	BUFFER-TIME=1000			3050 Secs (3050 Secs) *[==>]*	 ***[1]***
2	(STIS.im.723176)	(1) PSRB0540-69	STIS/FUV-MAMA, TIME-TAG, F25QTZ	MIRROR	BUFFER-TIME=1000			3300 Secs (3300 Secs) *[==>]*	 ***[2]***
3	(STIS.im.723176)	(1) PSRB0540-69	STIS/FUV-MAMA, TIME-TAG, F25QTZ	MIRROR	BUFFER-TIME=1000			3300 Secs (3300 Secs) *[==>]*	 ***[3]***

Orbit Structure