16883 - The origin of NIR emission in the Fast radio burst source SGR 1935+2154

Cycle: 29, 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) SGR1935+2154	WFC3/IR WFC3/UVIS	2	26-Aug-2022 16:01:51.0	yes
02	(1) SGR1935+2154	WFC3/IR	2	26-Aug-2022 16:01:52.0	yes
03	(1) SGR1935+2154	WFC3/IR	1	26-Aug-2022 16:01:53.0	yes
04	(1) SGR1935+2154	WFC3/IR	1	26-Aug-2022 16:01:53.0	yes
06	(1) SGR1935+2154	WFC3/IR	1	26-Aug-2022 16:01:54.0	yes
05	(1) SGR1935+2154	WFC3/IR	1	26-Aug-2022 16:01:54.0	yes

8 Total Orbits Used

ABSTRACT

SGR 1935+2154 is a notoriously active magnetar undergoing a period of high energy activity. Similar recent activity in 2020 elicited a series of Fast Radio Burst (FRB) like events from the source and triggered a breakthrough in our understanding of extragalactic FRB progenitors. FRBs are one of the key mysteries of recent astrophysics, and SGR 1935+2154 represents our chance to study the systems that produce them in unprecedented detail. HST has already contributed significantly to this goal - a near-infrared detection of the source has been made and observed to undergo significant variability. Here we propose to capitalise on results from the most recent sighting by HST of the NIR counterpart, which has brightened by a factor of 4, to probe the origin of this emission. The origin of optical and NIR emission from magnetars is poorly known. Models range from fallback of material from a disc and magnetosphere-powered emisson, to surviving binary companions. Each has implications for the formation of magnetars and the nature of the emission is crucial to understand in order to motivate and inform future multi-wavelength follow-up of FRBs. Our proposed observations will obtain a NIR spectral energy distribution for SGR 1935+2154, to be readily compared with models for the emission, in order to uncover its origin. We will also enact a cycle-long monitoring campaign to double the epochs of observations for this object, in order to properly understand the nature of its variability, and its correlation (or lack of) with activity at both higher and lower frequencies.

OBSERVING DESCRIPTION

The aim of this proposal is to obtain observations of SGR 1935+2154 to obtain further detections of its counterpart in multiple filters and refine the measurement of its proper motion and determine the level of variability.

The source was found to be somewhat brighter in June 2021, and the source is known to vary. This motivates strongly a need to observe the visit to determine its SED as soon as possible (while the source is bright). We have scheduled these as 4xone-orbit visits, with time window between them in order to minimise the variability between these epochs.

For further observations, we aim to refine proper motion constraints and pin down the level of variability, and so there is also a significant advantage to matching the orient of the observations with those taken previously, or orientating at 90degree intervals. We will repeat the observational set-up previously used which is a simple 4-point dither pattern using the STEP reads for dynamic range.

Visit

Proposal 16883, Visit 01, completed Fri Aug 26 20:01:55 GMT 2022

Diagnostic Status: No Diagnostics

Scientific Instruments: WFC3/IR, WFC3/UVIS

Special Requirements: SCHED 40%; ORIENT 293.5D TO 295.219 D; BEFORE 31-MAR-2022:00:00:00

Comments: Visit to obtain part of NIR SED of a varying object. Grouped to other visits that should be completed in a small time-window to minimise impact of variability.

Patterns

#	Primary Pattern		Secondary Pattern	Exposures
(1)	Pattern Type=WFC3-IR-DITHER-BOX-MIN Purpose=DITHER Number Of Points=4 Point Spacing=0.572 Line Spacing=0.365	Coordinate Frame=POS-TARG Pattern Orientation=18.528 Angle Between Sides=74.653 Center Pattern=false		(2)
(2)	Pattern Type=WFC3-UVIS-DITHER-BOX Purpose=DITHER Number Of Points=4 Point Spacing=0.173 Line Spacing=0.112	Coordinate Frame=POS-TARG Pattern Orientation=23.884 Angle Between Sides=81.785 Center Pattern=false		(1)

Fixed Targets

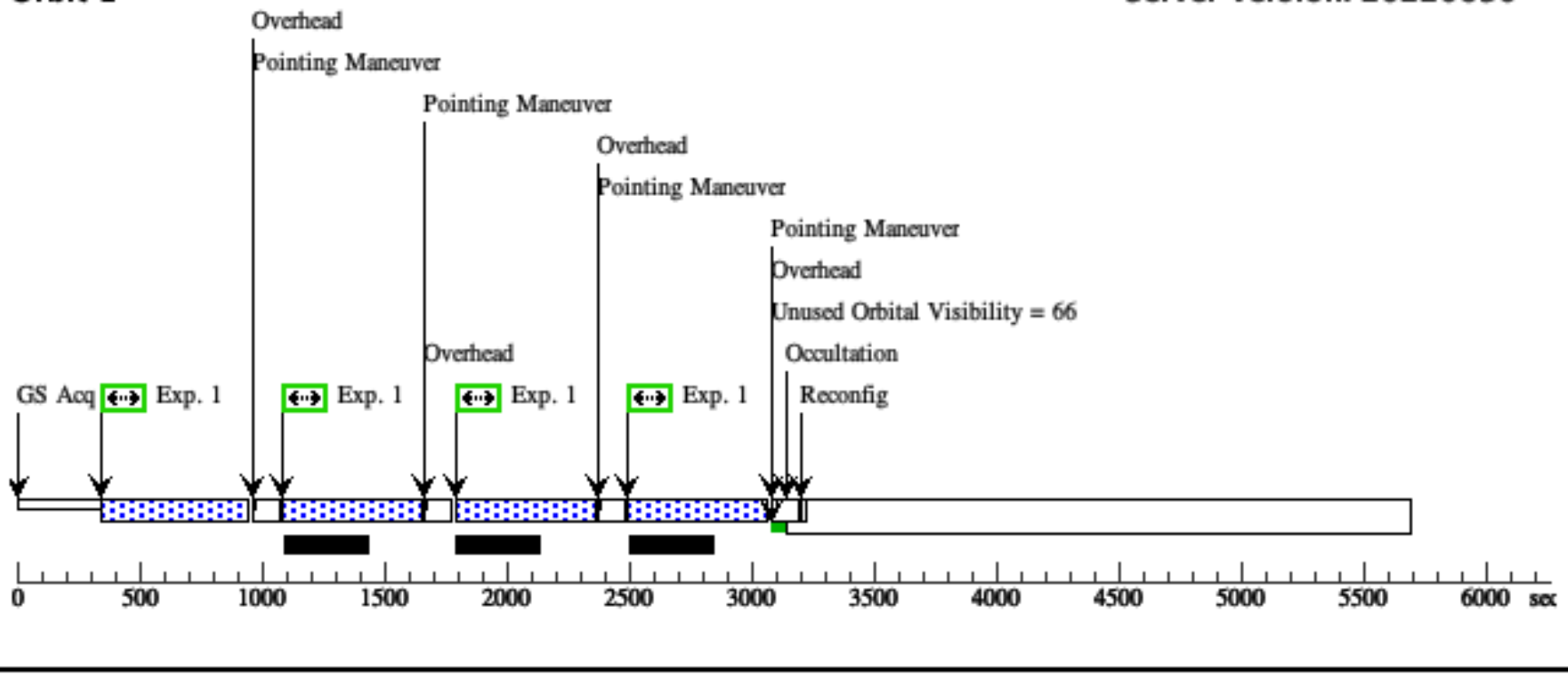
#	Name	Target Coordinates	Targ. Coord. Corrections	Fluxes	Miscellaneous
(1)	SGR1935+2154	RA: 19 34 55.6800 (293.7320000d) Dec: +21 53 48.20 (21.89672d) Equinox: J2000	Epoch of Position: 2015.5	V=(?) F140W = 24.5mag	Reference Frame: SIMBAD

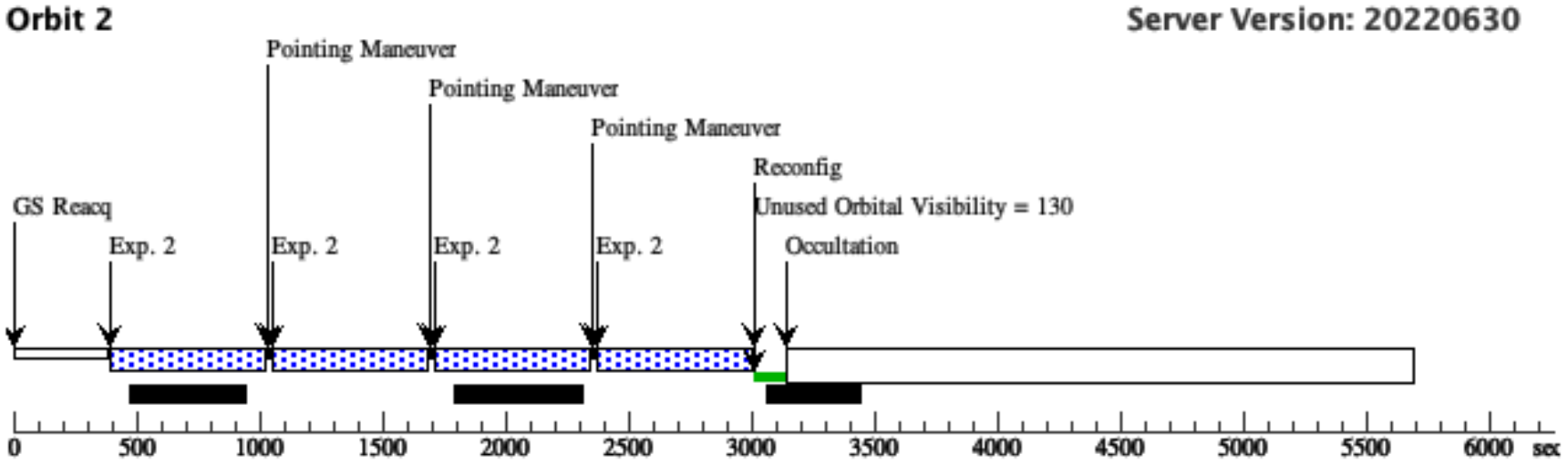
Comments: This object was generated by the targetselector and retrieved from the SIMBAD database.
Category=STAR
Description=[NEUTRON STAR]

Exposures

#	Label	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time (Total)/[Actual Dur.]	Orbit
1		(1) SGR1935+2154	WFC3/UVIS, ACCUM, UVIS	F814W	FLASH=10		Pattern 2, Exps 1-1 in Visit 01 (2)	500 Secs (2284 Secs)	
								[==>571.0 Secs (Pattern 1)] *[==>571.0 Secs (Pattern 2)]* *[==>571.0 Secs (Pattern 3)]* *[==>571.0 Secs (Pattern 4)]*	***[1]***
2		(1) SGR1935+2154	WFC3/IR, MULTIACCUM, IR	F125W	NSAMP=12; SAMP-SEQ=STEP100		Pattern 1, Exps 2-2 in Visit 01 (1)	599.232292 Secs (2396.929 Secs)	
								[==>(Pattern 1)] *[==>(Pattern 2)]* *[==>(Pattern 3)]* *[==>(Pattern 4)]*	***[2]***

Orbit Structure





Proposal 16883 - Visit 02 - The origin of NIR emission in the Fast radio burst source SGR 1935+2154

Visit

Proposal 16883, Visit 02, completed Fri Aug 26 20:01:55 GMT 2022

Diagnostic Status: No Diagnostics

Scientific Instruments: WFC3/IR

Special Requirements: SAME ORIENT AS 01; GROUP 02,01 WITHIN 5D

Comments: Visit to obtain part of NIR SED of a varying object. Grouped to other visits that should be completed in a small time-window to minimise impact of variability.

Patterns

#	Primary Pattern		Secondary Pattern	Exposures
(1)	Pattern Type=WFC3-IR-DITHER-BOX-MIN Purpose=DITHER Number Of Points=4 Point Spacing=0.572 Line Spacing=0.365	Coordinate Frame=POS-TARG Pattern Orientation=18.528 Angle Between Sides=74.653 Center Pattern=false		(1), (2)

Fixed Targets

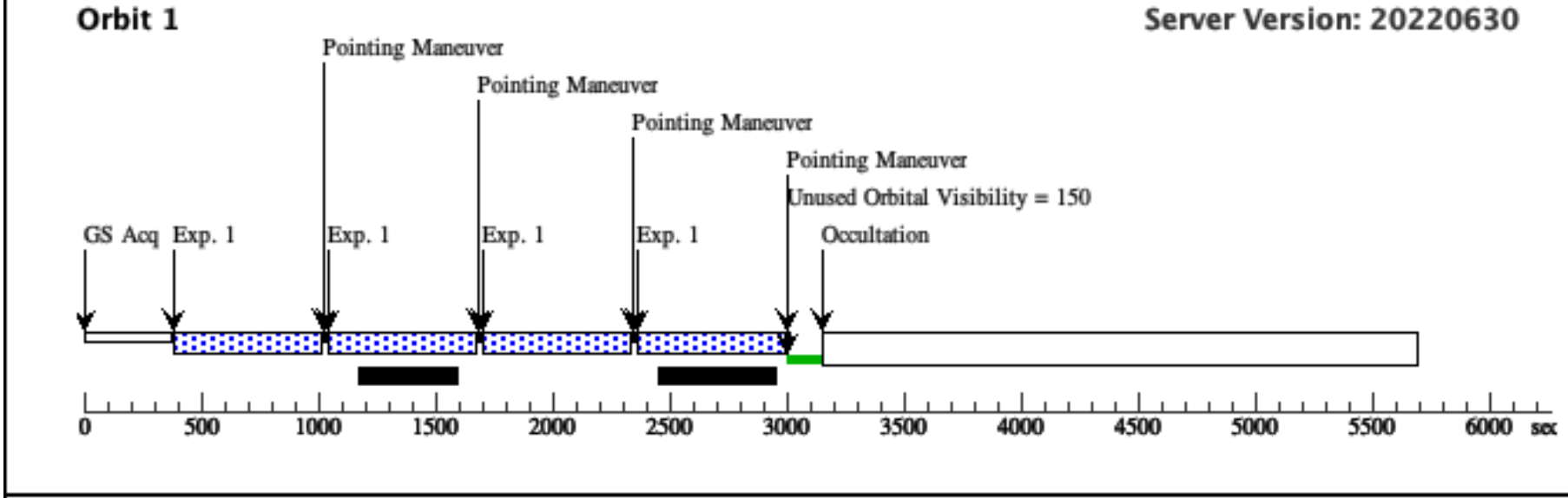
#	Name	Target Coordinates	Targ. Coord. Corrections	Fluxes	Miscellaneous
(1)	SGR1935+2154	RA: 19 34 55.6800 (293.7320000d) Dec: +21 53 48.20 (21.89672d) Equinox: J2000	Epoch of Position: 2015.5	V=(?) F140W = 24.5mag	Reference Frame: SIMBAD

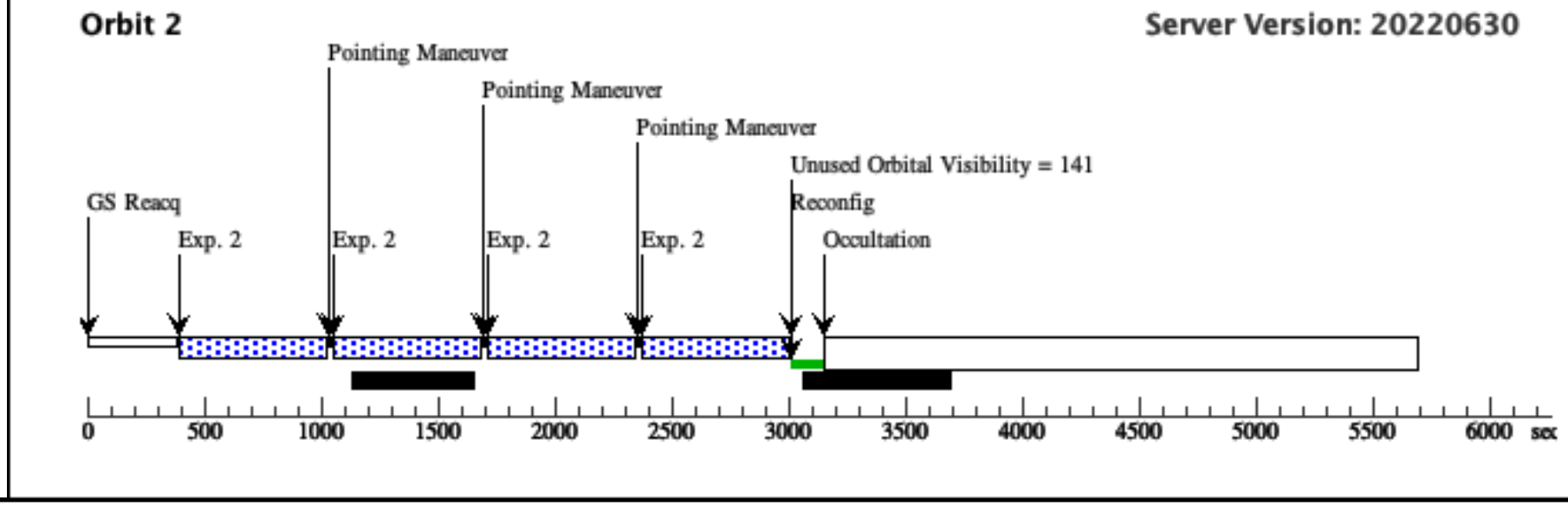
Comments: This object was generated by the targetselector and retrieved from the SIMBAD database.
Category=STAR
Description=[NEUTRON STAR]

Exposures

#	Label	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time (Total)/[Actual Dur.]	Orbit
1		(1) SGR1935+2154	WFC3/IR, MULTIACCUM, IR	F105W	NSAMP=12; SAMP-SEQ=STEP100		Pattern 1, Exps 1-1 in Visit 02 (1)	599.232292 Secs (2396.929 Secs) *[==>(Pattern 1)]* *[==>(Pattern 2)]* *[==>(Pattern 3)]* *[==>(Pattern 4)]*	***[1]***
2		(1) SGR1935+2154	WFC3/IR, MULTIACCUM, IR	F160W	NSAMP=12; SAMP-SEQ=STEP100		Pattern 1, Exps 2-2 in Visit 02 (1)	599.232292 Secs (2396.929 Secs) *[==>(Pattern 1)]* *[==>(Pattern 2)]* *[==>(Pattern 3)]* *[==>(Pattern 4)]*	***[2]***

Orbit Structure





Visit

Proposal 16883, Visit 03, completed Fri Aug 26 20:01:55 GMT 2022

Diagnostic Status: No Diagnostics

Scientific Instruments: WFC3/IR

Special Requirements: ORIENT 205.218D TO 205.219 D

Comments: Visit for single observation in F140W at 90deg angle to previous observations for variability and proper motion study

Patterns

#	Primary Pattern		Secondary Pattern	Exposures
(1)	Pattern Type=WFC3-IR-DITHER-BOX-MIN Purpose=DITHER Number Of Points=4 Point Spacing=0.572 Line Spacing=0.365	Coordinate Frame=POS-TARG Pattern Orientation=18.528 Angle Between Sides=74.653 Center Pattern=false		(1)

Fixed Targets

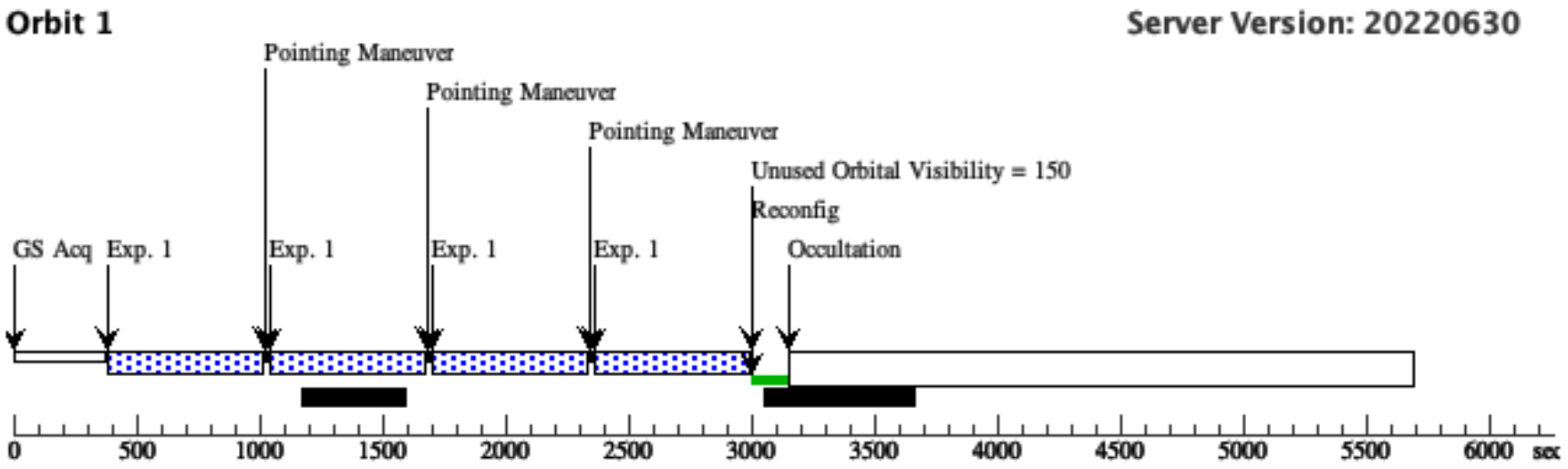
#	Name	Target Coordinates	Targ. Coord. Corrections	Fluxes	Miscellaneous
(1)	SGR1935+2154	RA: 19 34 55.6800 (293.7320000d) Dec: +21 53 48.20 (21.89672d) Equinox: J2000	Epoch of Position: 2015.5	V=(?) F140W = 24.5mag	Reference Frame: SIMBAD

Comments: This object was generated by the targetselector and retrieved from the SIMBAD database.
Category=STAR
Description=[NEUTRON STAR]

Exposures

#	Label	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time (Total)/[Actual Dur.]	Orbit
1		(1) SGR1935+2154	WFC3/IR, MULTIACCUM, IR	F140W	NSAMP=12; SAMP-SEQ=STEP100		Pattern 1, Exps 1-1 in Visit 03 (1)	599.232292 Secs (2396.929 Secs) *[==>(Pattern 1)]* *[==>(Pattern 2)]* *[==>(Pattern 3)]* *[==>(Pattern 4)]*	*[1]*

Orbit Structure



Visit

Proposal 16883, Visit 04, failed Fri Aug 26 20:01:55 GMT 2022

Diagnostic Status: No Diagnostics

Scientific Instruments: WFC3/IR

Special Requirements: ORIENT -90D TO -90D FROM 03; BETWEEN 01-AUG-2022:00:00:00 AND 31-AUG-2022:00:00:00

Comments: Visit for single observation in F140W at 90deg angle to previous observations for variability and proper motion study

Patterns

#	Primary Pattern		Secondary Pattern	Exposures
(1)	Pattern Type=WFC3-IR-DITHER-BOX-MIN Purpose=DITHER Number Of Points=4 Point Spacing=0.572 Line Spacing=0.365	Coordinate Frame=POS-TARG Pattern Orientation=18.528 Angle Between Sides=74.653 Center Pattern=false		(1)

Fixed Targets

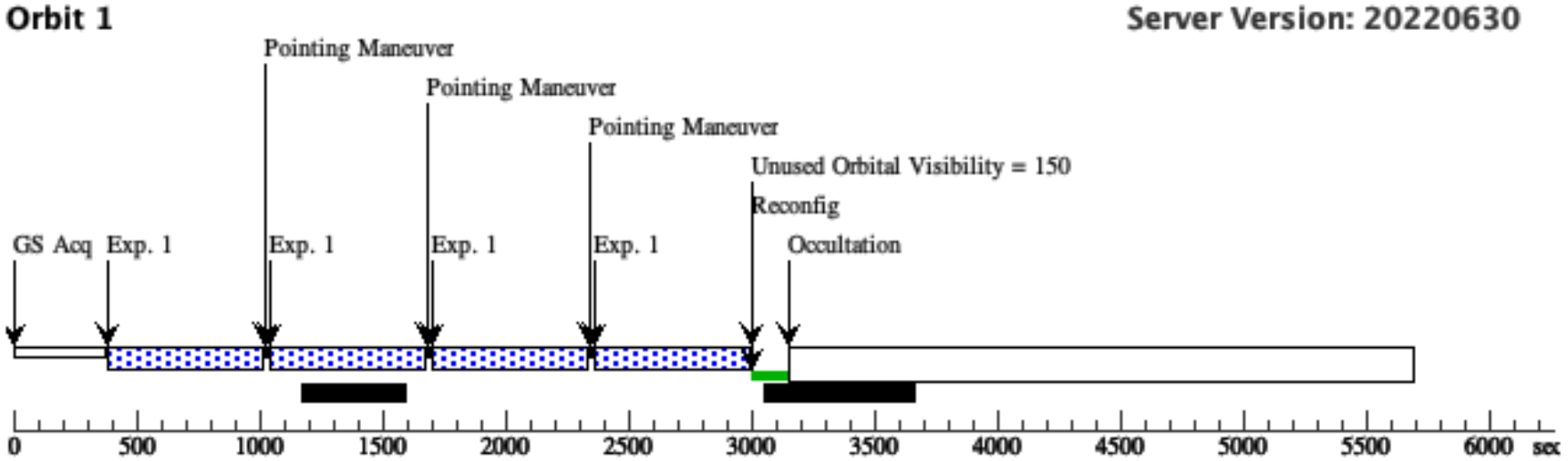
#	Name	Target Coordinates	Targ. Coord. Corrections	Fluxes	Miscellaneous
(1)	SGR1935+2154	RA: 19 34 55.6800 (293.7320000d) Dec: +21 53 48.20 (21.89672d) Equinox: J2000	Epoch of Position: 2015.5	V=(?) F140W = 24.5mag	Reference Frame: SIMBAD

Comments: This object was generated by the targetselector and retrieved from the SIMBAD database.
Category=STAR
Description=[NEUTRON STAR]

Exposures

#	Label	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time (Total)/[Actual Dur.]	Orbit
1		(1) SGR1935+2154	WFC3/IR, MULTIACCUM, IR	F140W	NSAMP=12; SAMP-SEQ=STEP100		Pattern 1, Exps 1-1 in Visit 04 (1)	599.232292 Secs (2396.929 Secs) *[==>(Pattern 1)]* *[==>(Pattern 2)]* *[==>(Pattern 3)]* *[==>(Pattern 4)]*	*[1]*

Orbit Structure



Visit

Proposal 16883, Visit 06 Fri Aug 26 20:01:55 GMT 2022

Diagnostic Status: No Diagnostics

Scientific Instruments: WFC3/IR

Special Requirements: ORIENT -90D TO -90D FROM 03; AFTER 05 BY 10 D TO 40 D

Comments: Replacement for failed visit 4. Visit for single observation in F140W at 90deg angle to previous observations for variability and proper motion study

Patterns

#	Primary Pattern		Secondary Pattern	Exposures
(1)	Pattern Type=WFC3-IR-DITHER-BOX-MIN Purpose=DITHER Number Of Points=4 Point Spacing=0.572 Line Spacing=0.365	Coordinate Frame=POS-TARG Pattern Orientation=18.528 Angle Between Sides=74.653 Center Pattern=false		(1)

Fixed Targets

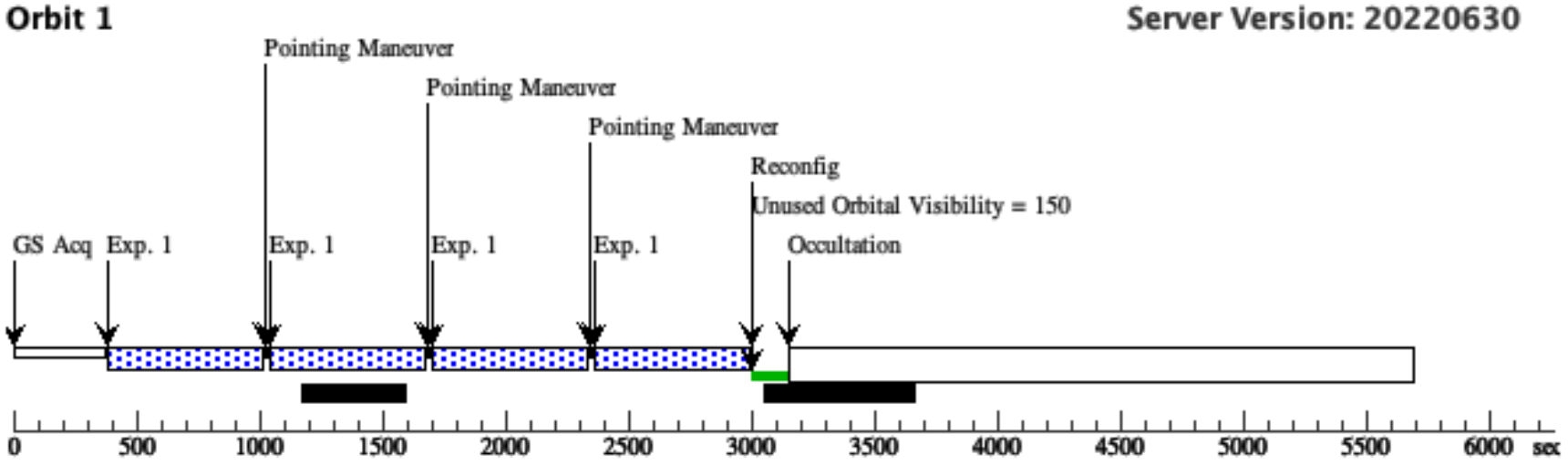
#	Name	Target Coordinates	Targ. Coord. Corrections	Fluxes	Miscellaneous
(1)	SGR1935+2154	RA: 19 34 55.6800 (293.7320000d) Dec: +21 53 48.20 (21.89672d) Equinox: J2000	Epoch of Position: 2015.5	V=(?) F140W = 24.5mag	Reference Frame: SIMBAD

Comments: This object was generated by the targetselector and retrieved from the SIMBAD database.
Category=STAR
Description=[NEUTRON STAR]

Exposures

#	Label	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time (Total)/[Actual Dur.]	Orbit
1		(1) SGR1935+2154	WFC3/IR, MULTIACCUM, IR	F140W	NSAMP=12; SAMP-SEQ=STEP100		Pattern 1, Exps 1-1 in Visit 06 (1)	599.232292 Secs (2396.929 Secs) *[==>(Pattern 1)]* *[==>(Pattern 2)]* *[==>(Pattern 3)]* *[==>(Pattern 4)]*	***[1]***

Orbit Structure



Visit

Proposal 16883, Visit 05, scheduling Fri Aug 26 20:01:55 GMT 2022

Diagnostic Status: No Diagnostics

Scientific Instruments: WFC3/IR

Special Requirements: ORIENT -90D TO -90D FROM 03

Comments: Visit for single observation in F140W at 90deg angle to previous observations for variability and proper motion study

Patterns

#	Primary Pattern		Secondary Pattern	Exposures
(1)	Pattern Type=WFC3-IR-DITHER-BOX-MIN Purpose=DITHER Number Of Points=4 Point Spacing=0.572 Line Spacing=0.365	Coordinate Frame=POS-TARG Pattern Orientation=18.528 Angle Between Sides=74.653 Center Pattern=false		(1)

Fixed Targets

#	Name	Target Coordinates	Targ. Coord. Corrections	Fluxes	Miscellaneous
(1)	SGR1935+2154	RA: 19 34 55.6800 (293.7320000d) Dec: +21 53 48.20 (21.89672d) Equinox: J2000	Epoch of Position: 2015.5	V=(?) F140W = 24.5mag	Reference Frame: SIMBAD

Comments: This object was generated by the targetselector and retrieved from the SIMBAD database.
Category=STAR
Description=[NEUTRON STAR]

Exposures

#	Label	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time (Total)/[Actual Dur.]	Orbit
1		(1) SGR1935+2154	WFC3/IR, MULTIACCUM, IR	F140W	NSAMP=12; SAMP-SEQ=STEP100		Pattern 1, Exps 1-1 in Visit 05 (1)	599.232292 Secs (2396.929 Secs) *[==>(Pattern 1)]* *[==>(Pattern 2)]* *[==>(Pattern 3)]* *[==>(Pattern 4)]*	*[1]*

Orbit Structure