15236 - The mystery of a supposed massive star exploding in a brightest cluster galaxy

Cycle: 25, Proposal Category: GO

(UV Initiative)

(Availability Mode: SUPPORTED)

INVESTIGATORS

Name	*Institution*	*E-Mail*
Griffin Hosseinzadeh (PI) (Contact)	**Las Cumbres Observatory Global Telescope Network**	**griffin@lco.global**
Dr. Iair Arcavi (CoI)	University of California - Santa Barbara	arcavi@gmail.com
Dr. Dale Andy Howell (CoI) (AdminUSPI)	Las Cumbres Observatory Global Telescope Network	ahowell@lco.global
Dr. Curtis McCully (CoI)	Las Cumbres Observatory Global Telescope Network	cmccully@lco.global
Dr. Stefano Valenti (CoI)	University of California - Davis	stfn.valenti@gmail.com
Dr. Katheryn Decker French (CoI)	Carnegie Institution of Washington	kfrench@carnegiescience.edu
Prof. Ann Zabludoff (CoI)	University of Arizona	azabludoff@as.arizona.edu

VISITS

Visit	*Targets used in Visit*	*Configurations used in Visit*	*Orbits Used*	*Last Orbit Planner Run*	*OP Current with Visit?*
01	(1) PS1-12SK	WFC3/UVIS	1	10-Nov-2017 19:00:14.0	yes
02	(1) PS1-12SK	WFC3/UVIS	1	10-Nov-2017 19:00:15.0	yes
03	(1) PS1-12SK	WFC3/UVIS	1	10-Nov-2017 19:00:16.0	yes
04	(1) PS1-12SK	WFC3/UVIS	1	10-Nov-2017 19:00:16.0	yes
05	(1) PS1-12SK	WFC3/UVIS	1	10-Nov-2017 19:00:17.0	yes

5 Total Orbits Used

ABSTRACT

Most of the diversity of core-collapse supernovae results from late-stage mass loss by their progenitor stars. Supernovae that interact with circumstellar material (CSM) are a particularly good probe of these last stages of stellar evolution. Type Ibn supernovae are a rare and poorly understood class of hydrogen-poor explosions that show signs of interaction with helium-rich CSM. The leading hypothesis is that they are explosions of very massive Wolf-Rayet stars in which the supernova ejecta excites material previously lost by stellar winds. These massive stars have very short lifetimes, and therefore should only found in actively star-forming galaxies. However, PS1-12sk is a Type Ibn supernova found on the outskirts of a giant elliptical galaxy. As this is extraordinary unlikely, we propose to obtain deep UV images of the host environment of PS1-12sk in order to map nearby star formation and/or find a potential unseen star-forming host. If star formation is detected, its amount and location will provide deep insights into the progenitor picture for the poorly-understood Type Ibn class. If star formation is still not detected, these observations would challenge the well-accepted hypothesis that these are core-collapse supernovae at all.

OBSERVING DESCRIPTION

SUMMARY:

We plan to map the star formation rate in the region surrounding the explosion location of PS1-12sk now that the supernova has faded. This will be accomplished with 4.5 orbits of UV imaging of the field with WFC3+F300X. We need very deep ultraviolet images with very low sky background to detect low-surface-brightness star-forming regions.

In the event that we find an unseen host galaxy, we will also need an optical image that matches HST's resolution to aid in registration with the ground-based localization. We will therefore obtain an additional half orbit in SDSS r' (WFC3+F625W). In addition, HST will likely be able to resolve the nearby dwarf galaxy, which is a possible host, and any potential gas flows leading toward the supernova location from either the brightest cluster galaxy or the dwarf galaxy.

DETAILS:

We have separated each of our five orbits into a separate visit for flexibility. However, scheduling the orbits together would save some time reacquiring, which could be added to the UV exposure for deeper limits.

Because we are searching for a low-surface-brightness source, CTE losses may be important. We have used the FLASH settings recommended by the APT to reach 12 electrons per pixel. However, because we are potentially interested in sources up to ~30" from the supernova location, we cannot move the target closer to the amplifiers (i.e., we choose the UVIS2 aperture).

We choose a three-point dither for each of the first four orbits in order to (1) break up the exposures for cosmic ray rejection, (2) better sample the PSF, and (3) cover the chip gap. For the fifth orbit, we use the three-point dither for F625W but only a two-point dither for F300X to save time spent on overhead. Ultimately, we will stack all 14 exposures in F300X for analysis.

Visit

Proposal 15236, Visit 01, implementation Sat Nov 11 00:00:18 GMT 2017

Diagnostic Status: No Diagnostics

Scientific Instruments: WFC3/UVIS

Special Requirements: (none)

Patterns

#	Primary Pattern		Secondary Pattern	Exposures
(1)	Pattern Type=WFC3-UVIS-DITHER-LINE-3PT Purpose=DITHER Number Of Points=3 Point Spacing=1.813 Line Spacing=	Coordinate Frame=POS-TARG Pattern Orientation=85.759 Angle Between Sides= Center Pattern=true		(1)

Fixed Targets

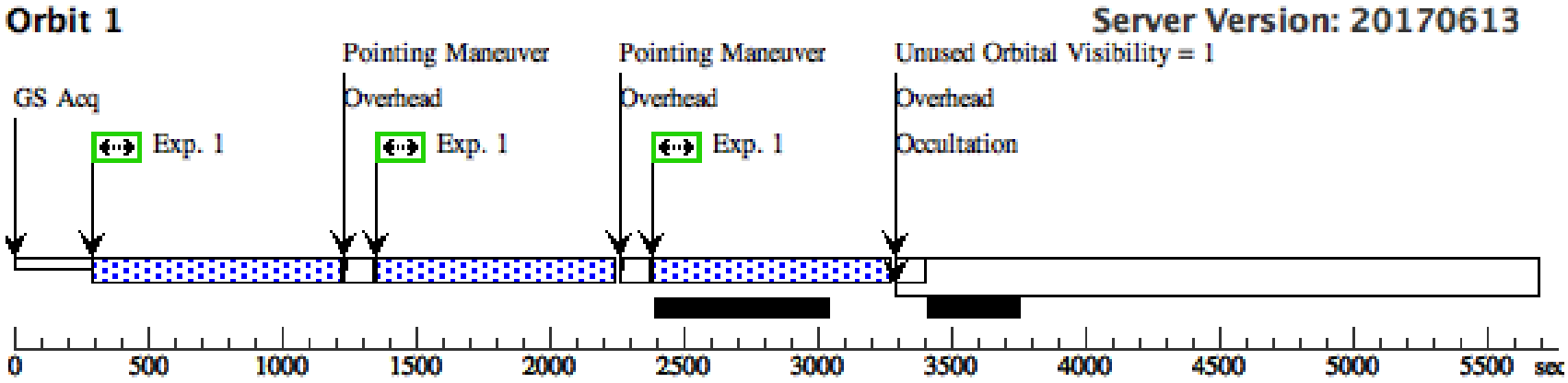
#	Name	Target Coordinates	Targ. Coord. Corrections	Fluxes	Miscellaneous
(1)	PS1-12SK Alt Name1: RXCJ0844.9+4258 Alt Name2: CGCG208-042	RA: 08 44 54.8592 (131.2285800d) Dec: +42 58 16.90 (42.97136d) Equinox: J2000		V=26.5	Reference Frame: NED

Comments: This object was generated by the target selector and retrieved from the NED database.

Exposures

#	Label	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time (Total)/[Actual Dur.]	Orbit
1		(1) PS1-12SK	WFC3/UVIS, ACCUM, UVIS2	F300X	FLASH=8		Pattern 1, Exps 1-1 in Visit 01 (1)	896 Secs (2688 Secs) *[==>(Pattern 1)]* *[==>(Pattern 2)]* *[==>(Pattern 3)]*	*[1]*

Orbit Structure



Visit

Proposal 15236, Visit 02, implementation Sat Nov 11 00:00:18 GMT 2017

Diagnostic Status: No Diagnostics

Scientific Instruments: WFC3/UVIS

Special Requirements: SAME ORIENT AS 01

Patterns

#	Primary Pattern		Secondary Pattern	Exposures
(1)	Pattern Type=WFC3-UVIS-DITHER-LINE-3PT Purpose=DITHER Number Of Points=3 Point Spacing=1.813 Line Spacing=	Coordinate Frame=POS-TARG Pattern Orientation=85.759 Angle Between Sides= Center Pattern=true		(1)

Fixed Targets

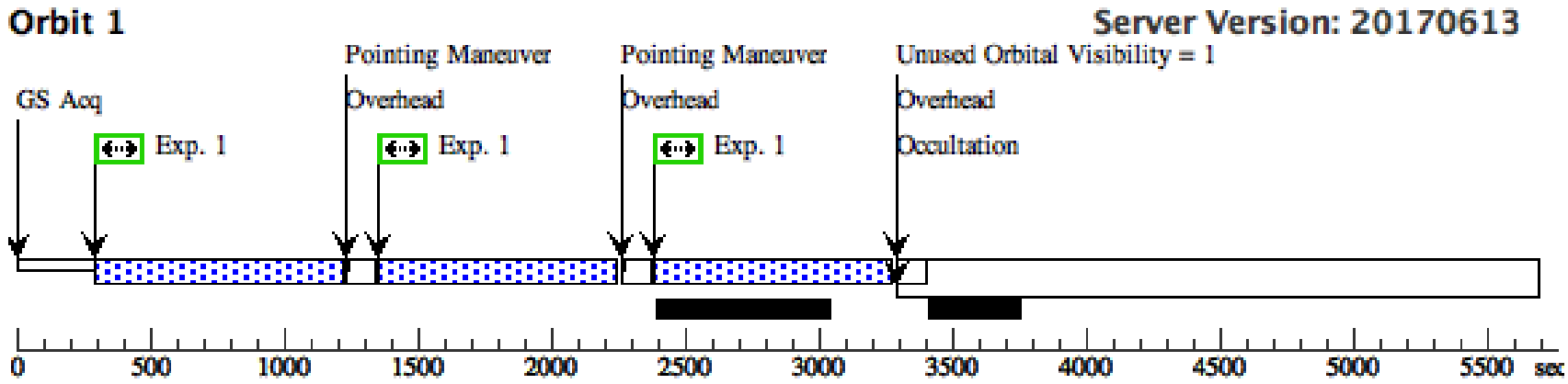
#	Name	Target Coordinates	Targ. Coord. Corrections	Fluxes	Miscellaneous
(1)	PS1-12SK Alt Name1: RXCJ0844.9+4258 Alt Name2: CGCG208-042	RA: 08 44 54.8592 (131.2285800d) Dec: +42 58 16.90 (42.97136d) Equinox: J2000		V=26.5	Reference Frame: NED

Comments: This object was generated by the target selector and retrieved from the NED database.

Exposures

#	Label	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time (Total)/[Actual Dur.]	Orbit
1		(1) PS1-12SK	WFC3/UVIS, ACCUM, UVIS2	F300X	FLASH=8		Pattern 1, Exps 1-1 in Visit 02 (1)	896 Secs (2688 Secs) *[==>(Pattern 1)]* *[==>(Pattern 2)]* *[==>(Pattern 3)]*	*[1]*

Orbit Structure



Visit

Proposal 15236, Visit 03, implementation Sat Nov 11 00:00:18 GMT 2017

Diagnostic Status: No Diagnostics

Scientific Instruments: WFC3/UVIS

Special Requirements: SAME ORIENT AS 01

Patterns

#	Primary Pattern		Secondary Pattern	Exposures
(1)	Pattern Type=WFC3-UVIS-DITHER-LINE-3PT Purpose=DITHER Number Of Points=3 Point Spacing=1.813 Line Spacing=	Coordinate Frame=POS-TARG Pattern Orientation=85.759 Angle Between Sides= Center Pattern=true		(1)

Fixed Targets

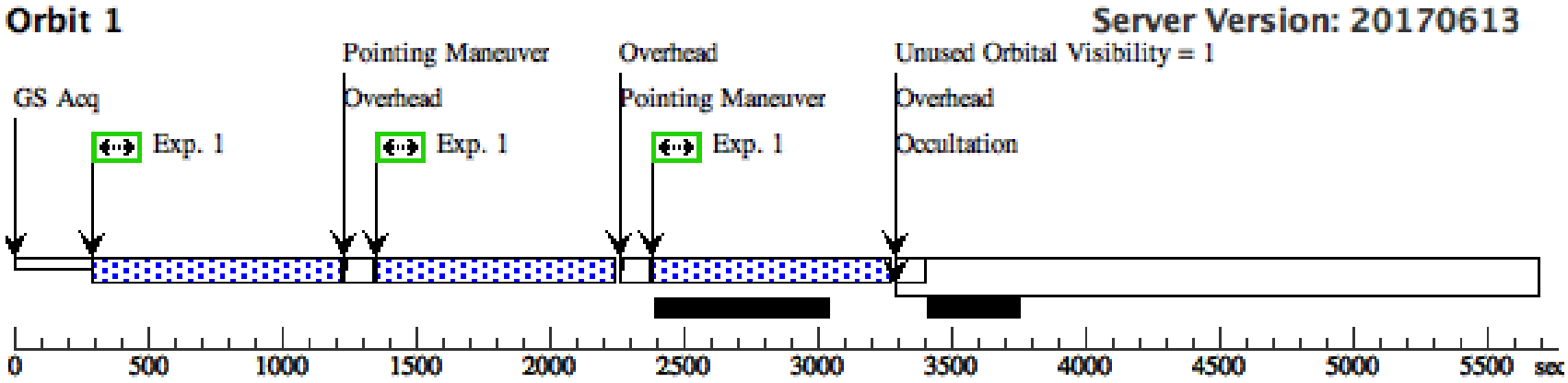
#	Name	Target Coordinates	Targ. Coord. Corrections	Fluxes	Miscellaneous
(1)	PS1-12SK Alt Name1: RXCJ0844.9+4258 Alt Name2: CGCG208-042	RA: 08 44 54.8592 (131.2285800d) Dec: +42 58 16.90 (42.97136d) Equinox: J2000		V=26.5	Reference Frame: NED

Comments: This object was generated by the target selector and retrieved from the NED database.

Exposures

#	Label	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time (Total)/[Actual Dur.]	Orbit
1		(1) PS1-12SK	WFC3/UVIS, ACCUM, UVIS2	F300X	FLASH=8		Pattern 1, Exps 1-1 in Visit 03 (1)	896 Secs (2688 Secs) *[==>(Pattern 1)]* *[==>(Pattern 2)]* *[==>(Pattern 3)]*	*[1]*

Orbit Structure



Visit

Proposal 15236, Visit 04, implementation Sat Nov 11 00:00:18 GMT 2017

Diagnostic Status: No Diagnostics

Scientific Instruments: WFC3/UVIS

Special Requirements: SAME ORIENT AS 01

Patterns

#	Primary Pattern		Secondary Pattern	Exposures
(1)	Pattern Type=WFC3-UVIS-DITHER-LINE-3PT Purpose=DITHER Number Of Points=3 Point Spacing=1.813 Line Spacing=	Coordinate Frame=POS-TARG Pattern Orientation=85.759 Angle Between Sides= Center Pattern=true		(1)

Fixed Targets

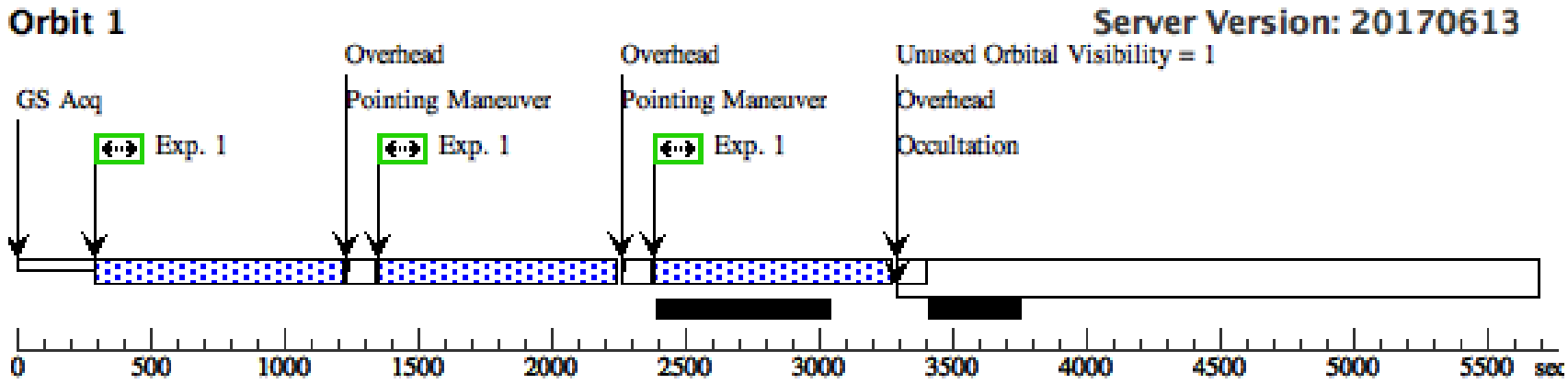
#	Name	Target Coordinates	Targ. Coord. Corrections	Fluxes	Miscellaneous
(1)	PS1-12SK Alt Name1: RXCJ0844.9+4258 Alt Name2: CGCG208-042	RA: 08 44 54.8592 (131.2285800d) Dec: +42 58 16.90 (42.97136d) Equinox: J2000		V=26.5	Reference Frame: NED

Comments: This object was generated by the target selector and retrieved from the NED database.

Exposures

#	Label	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time (Total)/[Actual Dur.]	Orbit
1		(1) PS1-12SK	WFC3/UVIS, ACCUM, UVIS2	F300X	FLASH=8		Pattern 1, Exps 1-1 in Visit 04 (1)	896 Secs (2688 Secs) *[==>(Pattern 1)]* *[==>(Pattern 2)]* *[==>(Pattern 3)]*	*[1]*

Orbit Structure



Visit

Proposal 15236, Visit 05, implementation Sat Nov 11 00:00:18 GMT 2017

Diagnostic Status: No Diagnostics

Scientific Instruments: WFC3/UVIS

Special Requirements: SAME ORIENT AS 01

Patterns

#	Primary Pattern		Secondary Pattern	Exposures
(1)	Pattern Type=WFC3-UVIS-DITHER-LINE-3PT Purpose=DITHER Number Of Points=3 Point Spacing=1.813 Line Spacing=	Coordinate Frame=POS-TARG Pattern Orientation=85.759 Angle Between Sides= Center Pattern=true		(2)
(2)	Pattern Type=WFC3-UVIS-DITHER-LINE Purpose=DITHER Number Of Points=2 Point Spacing=1.82 Line Spacing=	Coordinate Frame=POS-TARG Pattern Orientation=85.759 Angle Between Sides= Center Pattern=true		(1)

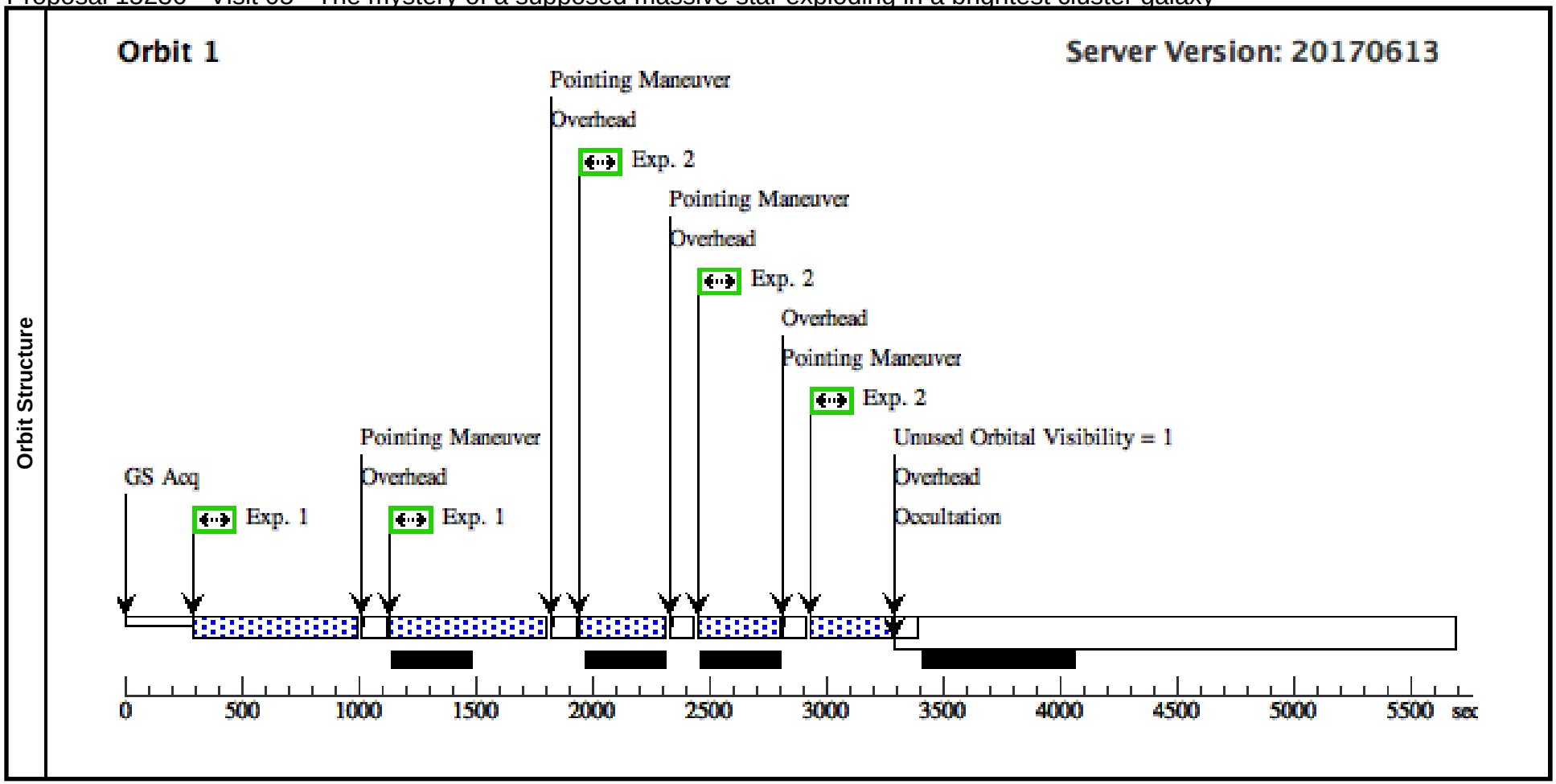
Fixed Targets

#	Name	Target Coordinates	Targ. Coord. Corrections	Fluxes	Miscellaneous
(1)	PS1-12SK Alt Name1: RXCJ0844.9+4258 Alt Name2: CGCG208-042	RA: 08 44 54.8592 (131.2285800d) Dec: +42 58 16.90 (42.97136d) Equinox: J2000		V=26.5	Reference Frame: NED

Comments: This object was generated by the target selector and retrieved from the NED database.

Exposures

#	Label	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time (Total)/[Actual Dur.]	Orbit
1		(1) PS1-12SK	WFC3/UVIS, ACCUM, UVIS2	F300X	FLASH=9		Pattern 2, Exps 1-1 in Visit 05 (2)	675 Secs (1350 Secs) *[==>(Pattern 1)]* *[==>(Pattern 2)]*	***[1]***
2		(1) PS1-12SK	WFC3/UVIS, ACCUM, UVIS2	F625W	FLASH=2		Pattern 1, Exps 2-2 in Visit 05 (1)	350 Secs (1050 Secs) *[==>(Pattern 1)]* *[==>(Pattern 2)]* *[==>(Pattern 3)]*	***[1]***


Orbit 1
Server Version: 20170613
Orbit Structure
GS Acq
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Pointing Maneuver
Overhead
Exp. 1
Pointing Maneuver
Overhead
Exp. 2
Pointing Maneuver
Overhead
Exp. 2
Overhead
Pointing Maneuver
Exp. 2
Unused Orbital Visibility = 1
Overhead
Occultation
0
500
1000
1500
2000
2500
3000
3500
4000
4500
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5500
sec