14800 - Mapping Calcium Rich Ejecta in Two Type Ia Supernovae

Cycle: 24, 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) SNR-0509-675	WFC3/UVIS	3	10-Jul-2017 21:01:41.0	yes
02	(2) SNR-0519-690	WFC3/UVIS	3	10-Jul-2017 21:01:43.0	yes

6 Total Orbits Used

ABSTRACT

Type Ia supernovae (SNe Ia) are thermonuclear explosions of white dwarfs (WDs) in close binary systems with either a non-degenerate or WD companion. SN Ia explosion computations are quite challenging, involving a complex interplay of turbulent hydrodynamics, nuclear burning, conduction, radiative transfer in iron-group rich material and possibly magnetic fields leading to significant uncertainties. Several key questions about expansion asymmetries and the overall characteristics of SNe Ia could be resolved if one could obtain direct observations of the internal kinematics and elemental distributions of young SN Ia remnants.

We propose to use WFC3/UVIS to obtain images of the normal Type Ia supernova remnant 0519-69.0 and the overluminous Type Ia supernova remnant 0509-67.5 in the LMC. The Ca II on-band F390M filter and off-band F336W and FQ422M filters will be used to determine the spatial extent and density distributions of the Ca-rich ejecta via resonance line absorption. Differences in the observed on and off band Ca II fluxes for LMC stars located behind these young 400 - 600 yr old remnants will yield calcium column density estimates for multiple lines-of-sight within these remnants. These results will be compared to the calcium distribution seen in SN 1885, a subluminous SN Ia in M31, already imaged by HST.

The resulting calcium density distribution maps for both a normal and overluminous SN Ia events will provide powerful insights regarding the structure and kinematics of calcium-rich ejecta in three different type Ia subclass events, and unique empirical data with which to test current SN Ia explosion models.

OBSERVING DESCRIPTION

This project aims at imaging two very young Type Ia supernova remnants in the LMC using three WFC3/UVIS filters. The filters are: F390M, the quad filter FQ422M, and F410M in place of the F336W filter.
Both targets have angular dimensions around 35 arcseconds.

The reason for the change of filters is in response to a discussion of how best to detect the Ca II 3934, 3968 line absorption. Based on available digital spectra of O to M stars, it has become apparent that several G type stars will have fainter continuum at 3700-3900 Ang which will confuse our identification of potential background stars using the F336W filter which covers this wavelength region.

A better approach is to replace the F336W filter with the F410M filter, which is immediately adjacent to the passband of the FQ422M filter but will sensitive to redshifted Ca II absorption like that observed in S And (SN 1885) in M31. (I have received notice that this filter swao has been approved by STScI.)

NOTE: REVISION MADE: 7 JULY 2017 - Due to recent ground-based observations, we have replaced the three filters for target 0519-690 to just two filters, namely F225W and F336W so as to detect the remnant's Fe-rich ejecta via strong Fe II absorptions in the F225W bandpass.

NOTE: 3rd REVISION: 10 JULY 2017: decreased exposures by 5 seconds (from 730 s to 725) to remove ORBIT VISIBILITY OVERRUN of 9 sec error. Re-ran orbit planner and visit planner in Cycle 25 APT.

Proposal 14800 - Visit 01 - Mapping Calcium Rich Ejecta in Two Type Ia Supernovae

Visit

Proposal 14800, Visit 01, implementation — Tue Jul 11 01:01:44 GMT 2017

Diagnostic Status: Warning

Scientific Instruments: WFC3/UVIS

Special Requirements: (none)

Diagnostics

(SNR_0509_FQ422M (01.003)) Warning (Form): POS TARG & PATTERN should be used carefully with WFC3 quad filters to avoid placing the target on the vignetted part of the field of view or moving it to another quadrant.

Patterns

#	Primary Pattern	Secondary Pattern	Exposures
(1)	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), (2), (3)

Fixed Targets

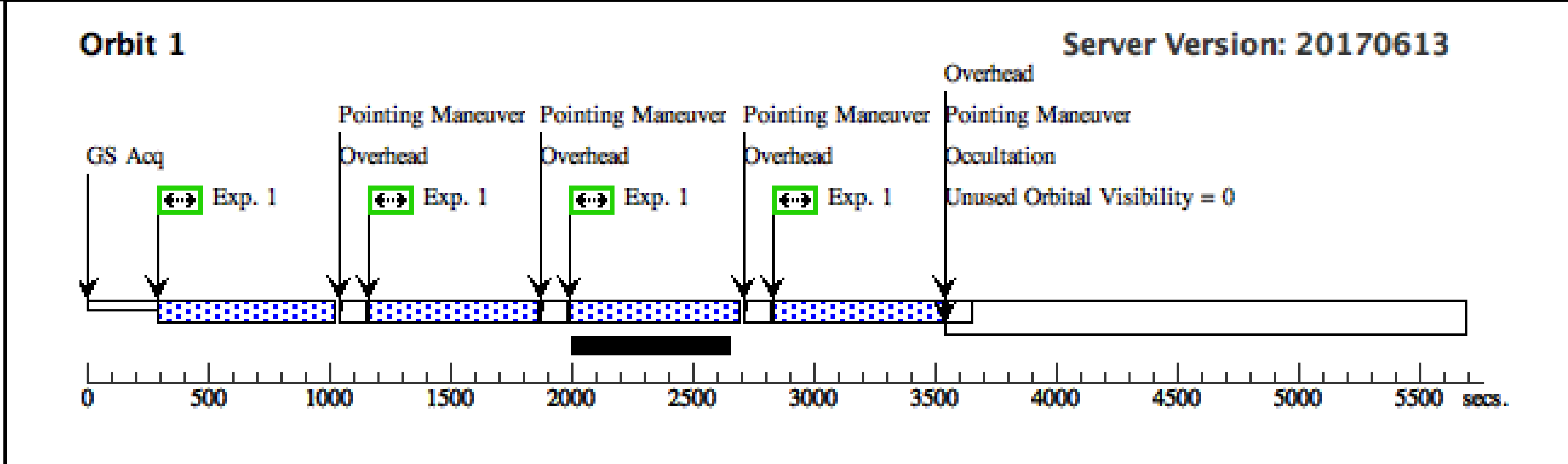
#	Name	Target Coordinates	Targ. Coord. Corrections	Fluxes	Miscellaneous
(1)	SNR-0509-675	RA: 05 09 31.0400 (77.3793333d) Dec: -67 31 16.50 (-67.52125d) Equinox: J2000		V=22+/-2	Reference Frame: ICRS

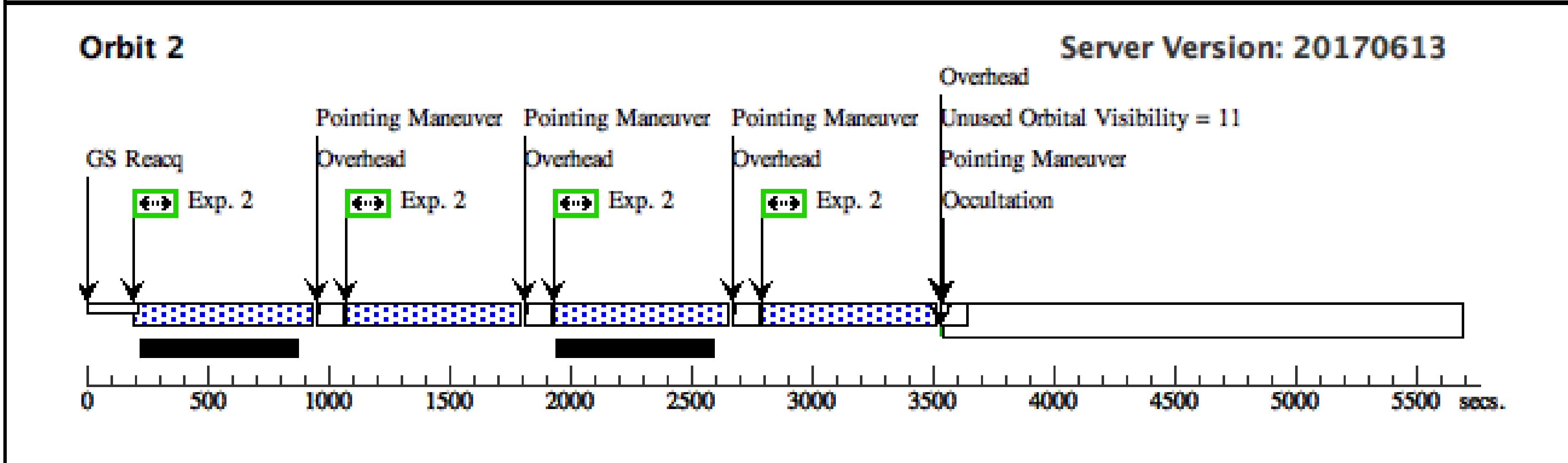
Comments: Extended=YES

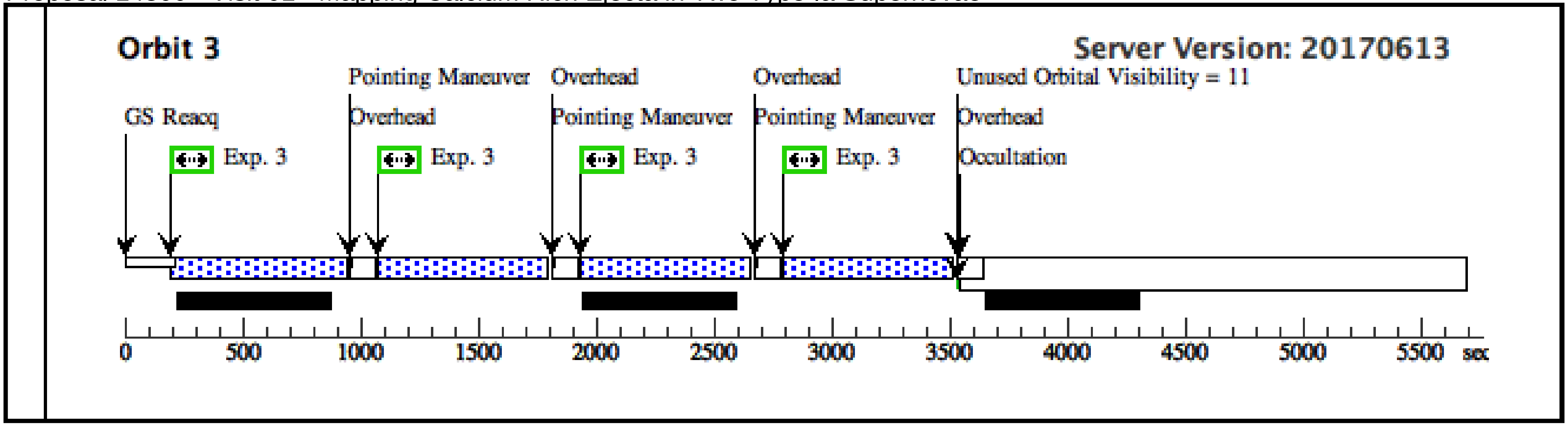
Exposures

#	Label	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time (Total)/[Actual Dur.]	Orbit
1	SNR_0509_F390M	(1) SNR-0509-675	WFC3/UVIS, ACCUM, UVIS2	F390M	FLASH=12		Pattern 1, Exps 1-1 in Visit 01 (1)	700 Secs (2800 Secs) *[==>(Pattern 1)]* *[==>(Pattern 2)]* *[==>(Pattern 3)]* *[==>(Pattern 4)]*	***[1]***
2	SNR_0509_F410M	(1) SNR-0509-675	WFC3/UVIS, ACCUM, UVIS2	F410M	FLASH=12		Pattern 1, Exps 2-2 in Visit 01 (1)	725 Secs (2900 Secs) *[==>(Pattern 1)]* *[==>(Pattern 2)]* *[==>(Pattern 3)]* *[==>(Pattern 4)]*	***[2]***
3	SNR_0509_FQ422M	(1) SNR-0509-675	WFC3/UVIS, ACCUM, UVIS-QUAD	FQ422M	FLASH=12		Pattern 1, Exps 3-3 in Visit 01 (1)	725 Secs (2900 Secs) *[==>(Pattern 1)]* *[==>(Pattern 2)]* *[==>(Pattern 3)]* *[==>(Pattern 4)]*	***[3]***

Orbit Structure






Orbit 3
Server Version: 20170613
GS Reacq
Exp. 3
Pointing Maneuver
Overhead
Exp. 3
Overhead
Pointing Maneuver
Exp. 3
Overhead
Pointing Maneuver
Exp. 3
Unused Orbital Visibility = 11
Overhead
Occultation
0
500
1000
1500
2000
2500
3000
3500
4000
4500
5000
5500
sec

Proposal 14800 - Visit 02 - Mapping Calcium Rich Ejecta in Two Type Ia Supernovae

Visit

Proposal 14800, Visit 02, implementation — Tue Jul 11 01:01:44 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-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), (2), (3)

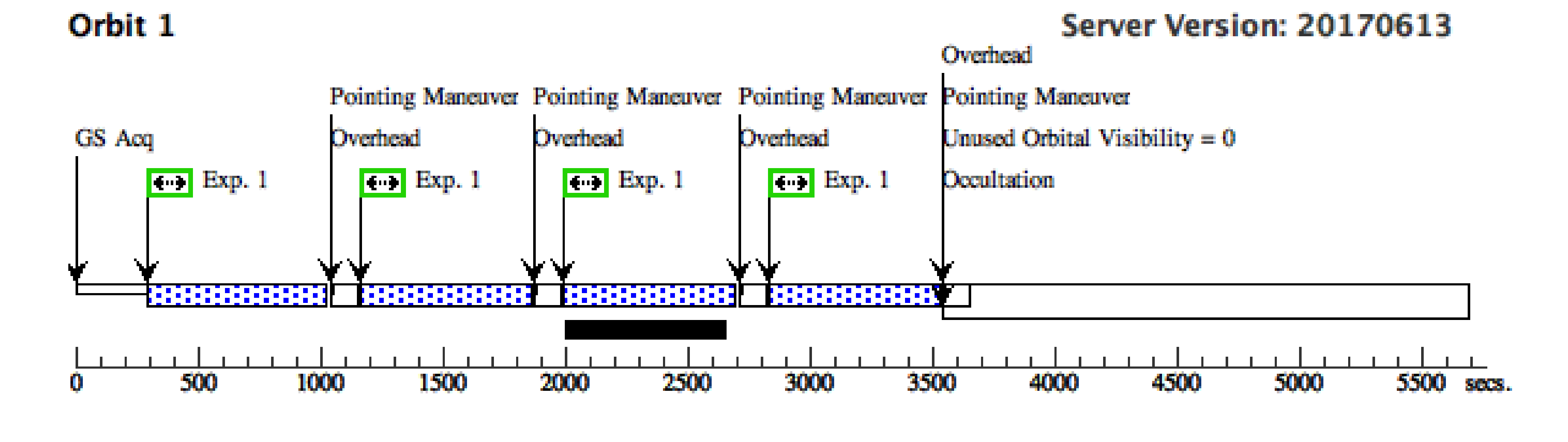
Fixed Targets

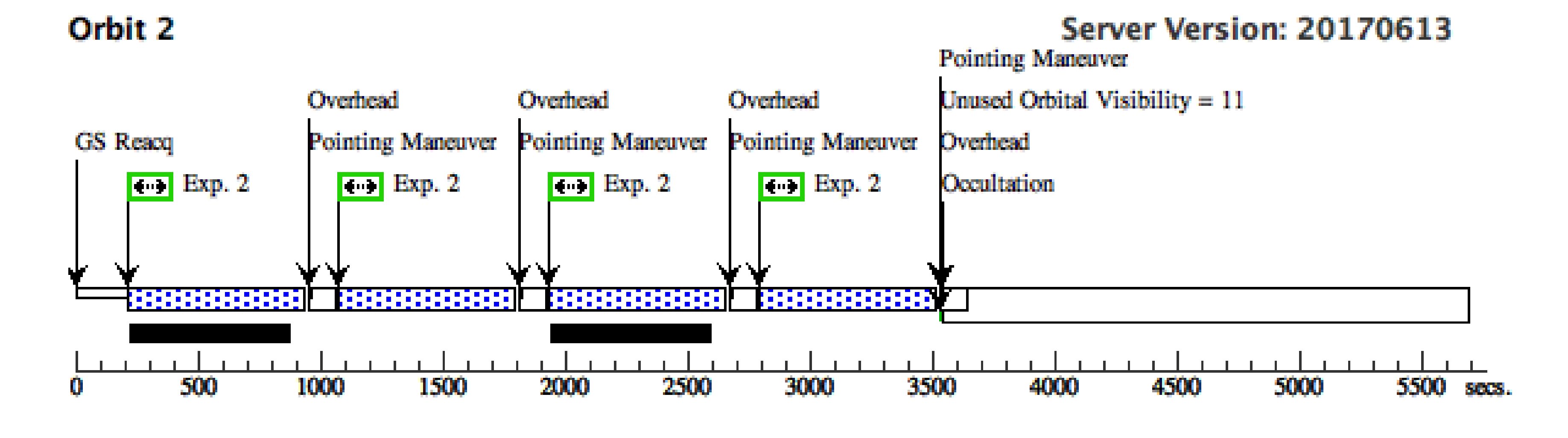
#	Name	Target Coordinates	Targ. Coord. Corrections	Fluxes	Miscellaneous
(2)	SNR-0519-690	RA: 05 19 34.6000 (79.8941667d) Dec: -69 02 6.70 (-69.03519d) Equinox: J2000		V=22+/-2	Reference Frame: ICRS

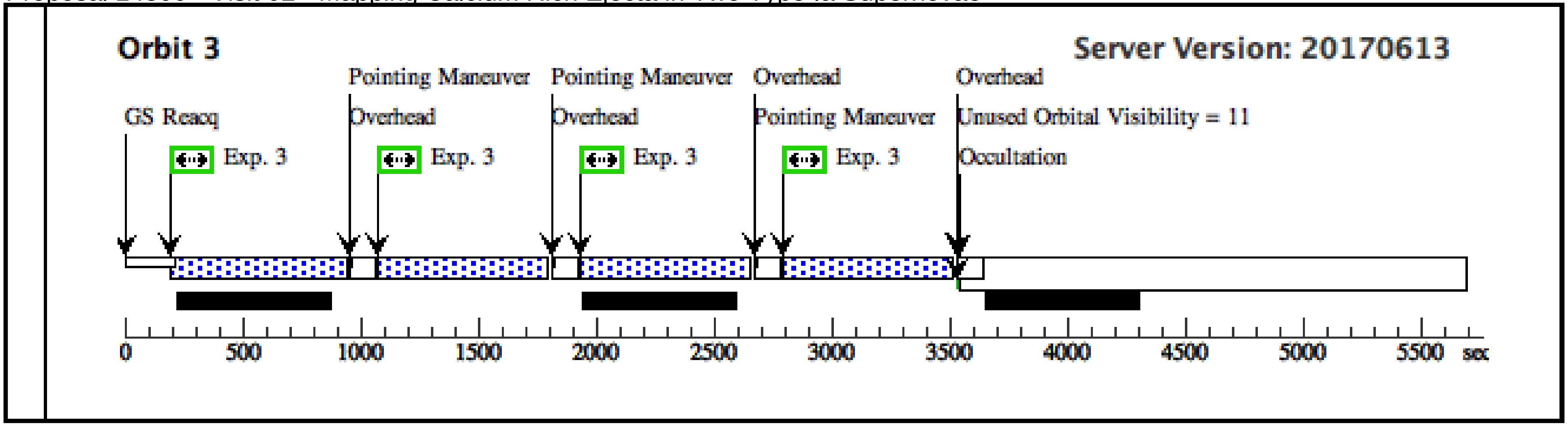
Exposures

#	Label	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time (Total)/[Actual Dur.]	Orbit
1	SNR_0519_F225W	(2) SNR-0519-690	WFC3/UVIS, ACCUM, UVIS2	F225W	FLASH=12		Pattern 1, Exps 1-1 in Visit 02 (1)	700 Secs (2800 Secs) *[==>(Pattern 1)]* *[==>(Pattern 2)]* *[==>(Pattern 3)]* *[==>(Pattern 4)]*	***[1]***
2	SNR_0519_F225W	(2) SNR-0519-690	WFC3/UVIS, ACCUM, UVIS2	F225W	FLASH=12		Pattern 1, Exps 2-2 in Visit 02 (1)	725 Secs (2900 Secs) *[==>(Pattern 1)]* *[==>(Pattern 2)]* *[==>(Pattern 3)]* *[==>(Pattern 4)]*	***[2]***
3	SNR_0519_F336W	(2) SNR-0519-690	WFC3/UVIS, ACCUM, UVIS2	F336W	FLASH=12		Pattern 1, Exps 3-3 in Visit 02 (1)	725 Secs (2900 Secs) *[==>(Pattern 1)]* *[==>(Pattern 2)]* *[==>(Pattern 3)]* *[==>(Pattern 4)]*	***[3]***

Orbit Structure






Orbit 3
Server Version: 20170613
GS Reacq
Exp. 3
Pointing Maneuver
Overhead
Exp. 3
Pointing Maneuver
Overhead
Exp. 3
Overhead
Pointing Maneuver
Exp. 3
Overhead
Unused Orbital Visibility = 11
Occultation
0
500
1000
1500
2000
2500
3000
3500
4000
4500
5000
5500
sec