13851 - The Origin of Intermediate-Luminosity Red Transients

Cycle: 22, Proposal Category: GO

(UV Initiative)

(Availability Mode: AVAILABLE)

INVESTIGATORS

Name	*Institution*	*E-Mail*
Dr. Howard E. Bond (PI) (Contact)	**The Pennsylvania State University**	**heb11@psu.edu**

VISITS

Visit	*Targets used in Visit*	*Configurations used in Visit*	*Orbits Used*	*Last Orbit Planner Run*	*OP Current with Visit?*
01	(1) V4332-SGR	WFC3/UVIS	1	09-Jul-2014 21:25:35.0	yes
02	(2) M31-RV	WFC3/IR WFC3/UVIS	1	09-Jul-2014 21:25:36.0	yes
03	(3) CK-VUL	WFC3/IR WFC3/UVIS	2	09-Jul-2014 21:25:38.0	yes

4 Total Orbits Used

ABSTRACT

Intermediate-luminosity red transients (ILRTs) are a new class of optical transients. They have maximum luminosities between novae and SNe, and outbursts lasting several months, becoming cool, dusty, and extremely red as the eruptions proceed. A prototype is V838 Mon, which illuminated a spectacular light echo. Their outbursts may be due to catastrophic stellar collisions and mergers. This is demonstrably true for V1309 Sco, which was a contact binary before its eruption and is now a single star. However, it is not yet clear whether all ILRTs are due to mergers.

I propose WFC3 imaging of 3 ILRTs: (1) V4332 Sgr, which erupted in the Galactic bulge in 1994, is now a 19th-mag, very red remnant. Based on a high degree of linear polarization in ground-based measurements, it has been proposed that it is surrounded and obscured by a dusty, edge-on

envelope, ejected during a stellar merger. If so, V4332 Sgr ought to display a dark lane at HST imaging resolution. (2) M31 RV is an ILRT that occurred in the bulge of M31 in 1988. HST images of the site taken between 1999 and 2010 failed to reveal a credible remnant of this event. However, models of expanding dusty envelopes predict that eventually, as the optical depth diminishes, the remnant should brighten. The passage of 5 years since the last HST observation of the field justifies another attempt to identify the putative merged binary. (3) CK Vul, the bright "nova" of 1670, is a candidate ILRT because of its red color and an outburst light curve resembling that of V838 Mon. A faint bipolar nebula lies at the site of CK Vul, but no credible remnant star has been found in ground-based images. HST resolution may reveal it.

OBSERVING DESCRIPTION

I will use WFC3 UVIS and IR channels to image the sites of three intermediate-luminosity transients:

V4332 Sgr: exposures in B (F438W), V (F606W), and I (F814W) in order to search for a resolved compact nebula and a possible dark band across it.

M31 RV: repeat imaging last done in 2009-2010 in F814W and F160W, to search for any faint red sources that may have brightened since the observations ~5 years ago.

CK Vul: deep images in F300X (to search for possible faint, hot star responsible for exciting the faint emission nebula at the outburst site), and in F606W and F160W (to search for a possible faint red remnant star).
Standard dithering patterns will be used for all of the imaging.

Visit

Proposal 13851, V4332 Sgr UVIS (01) Thu Jul 10 01:25:40 GMT 2014

Diagnostic Status: No Diagnostics

Scientific Instruments: WFC3/UVIS

Special Requirements: ORIENT 177.6D TO 254 D; ORIENT 267.6D TO 294.8 D; ORIENT 316.8D TO 344 D; ORIENT 357.6D TO 74 D; ORIENT 87.6D TO 114.8 D; ORIENT 136.8D TO 164 D

Comments: UVIS imaging of V4332 Sgr. ORIENT requirements are added to avoid charge bleed and diffraction spikes from a bright neighboring star 10".5 away from target.

Patterns

#	Primary Pattern		Secondary Pattern	Exposures
(1)	Pattern Type=WFC3-UVIS-DITHER-LINE-3PT Purpose=DITHER Number Of Points=3 Point Spacing=0.135 Line Spacing=	Coordinate Frame=POS-TARG Pattern Orientation=46.84 Angle Between Sides= Center Pattern=true		(1-3)

Fixed Targets

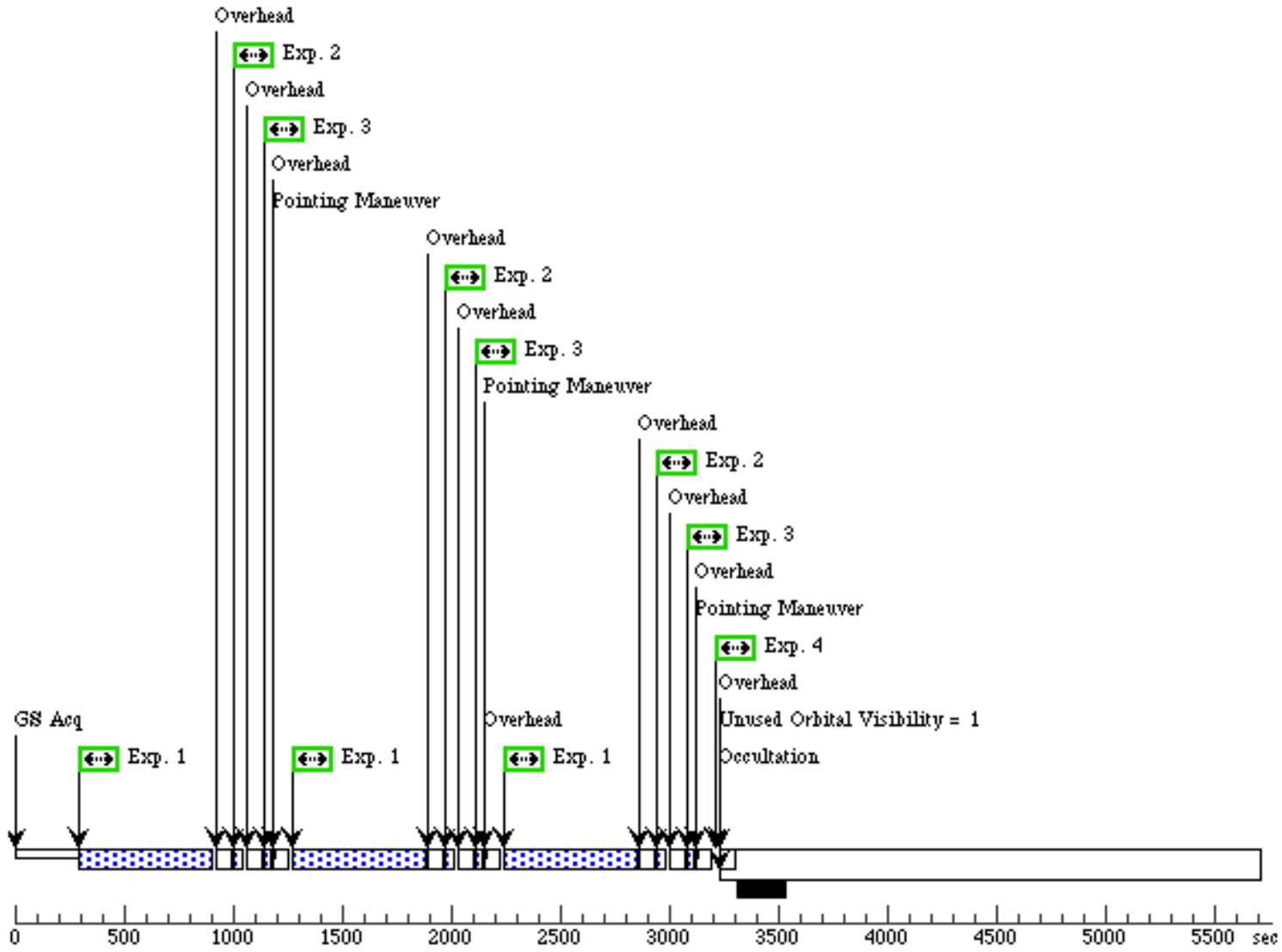
#	Name	Target Coordinates	Targ. Coord. Corrections	Fluxes	Miscellaneous
(1)	V4332-SGR	RA: 18 50 36.7000 (282.6529167d) Dec: -21 23 28.90 (-21.39136d) Equinox: J2000		V=19	Reference Frame: SIMBAD

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

Exposures

#	Label	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time (Total)/[Actual Dur.]	Orbit
1		(1) V4332-SGR	WFC3/UVIS, ACCUM, UVIS2-C1K1C-SUB	F438W	CR-SPLIT=NO; FLASH=12		Pattern 1, Exps 1-3 in V4332 Sgr UVIS (01) (1)	600 Secs (1746 Secs) *[==>582.0 Secs (Pattern 1)]* *[==>582.0 Secs (Pattern 2)]* *[==>582.0 Secs (Pattern 3)]*	***[1]***
2		(1) V4332-SGR	WFC3/UVIS, ACCUM, UVIS2-C1K1C-SUB	F606W	CR-SPLIT=NO; FLASH=12		Pattern 1, Exps 1-3 in V4332 Sgr UVIS (01) (1)	24 Secs (72 Secs) *[==>(Pattern 1)]* *[==>(Pattern 2)]* *[==>(Pattern 3)]*	***[1]***
3		(1) V4332-SGR	WFC3/UVIS, ACCUM, UVIS2-C1K1C-SUB	F814W	CR-SPLIT=NO; FLASH=12; BLADE=A		Pattern 1, Exps 1-3 in V4332 Sgr UVIS (01) (1)	5 Secs (15 Secs) *[==>(Pattern 1)]* *[==>(Pattern 2)]* *[==>(Pattern 3)]*	***[1]***
4		(1) V4332-SGR	WFC3/UVIS, ACCUM, UVIS2-C1K1C-SUB	F814W	CR-SPLIT=NO; FLASH=12; BLADE=A			5 Secs (5 Secs) *[==>]*	***[1]***

Orbit Structure



Visit

Proposal 13851, M31 RV UVIS & IR (02) Thu Jul 10 01:25:40 GMT 2014

Diagnostic Status: No Diagnostics

Scientific Instruments: WFC3/IR, 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=0.135 Line Spacing=	Coordinate Frame=POS-TARG Pattern Orientation=46.84 Angle Between Sides= Center Pattern=true		(1)
(2)	Pattern Type=WFC3-IR-DITHER-LINE-3PT Purpose=DITHER Number Of Points=3 Point Spacing=0.605 Line Spacing=	Coordinate Frame=POS-TARG Pattern Orientation=41.788 Angle Between Sides= Center Pattern=false		(2)

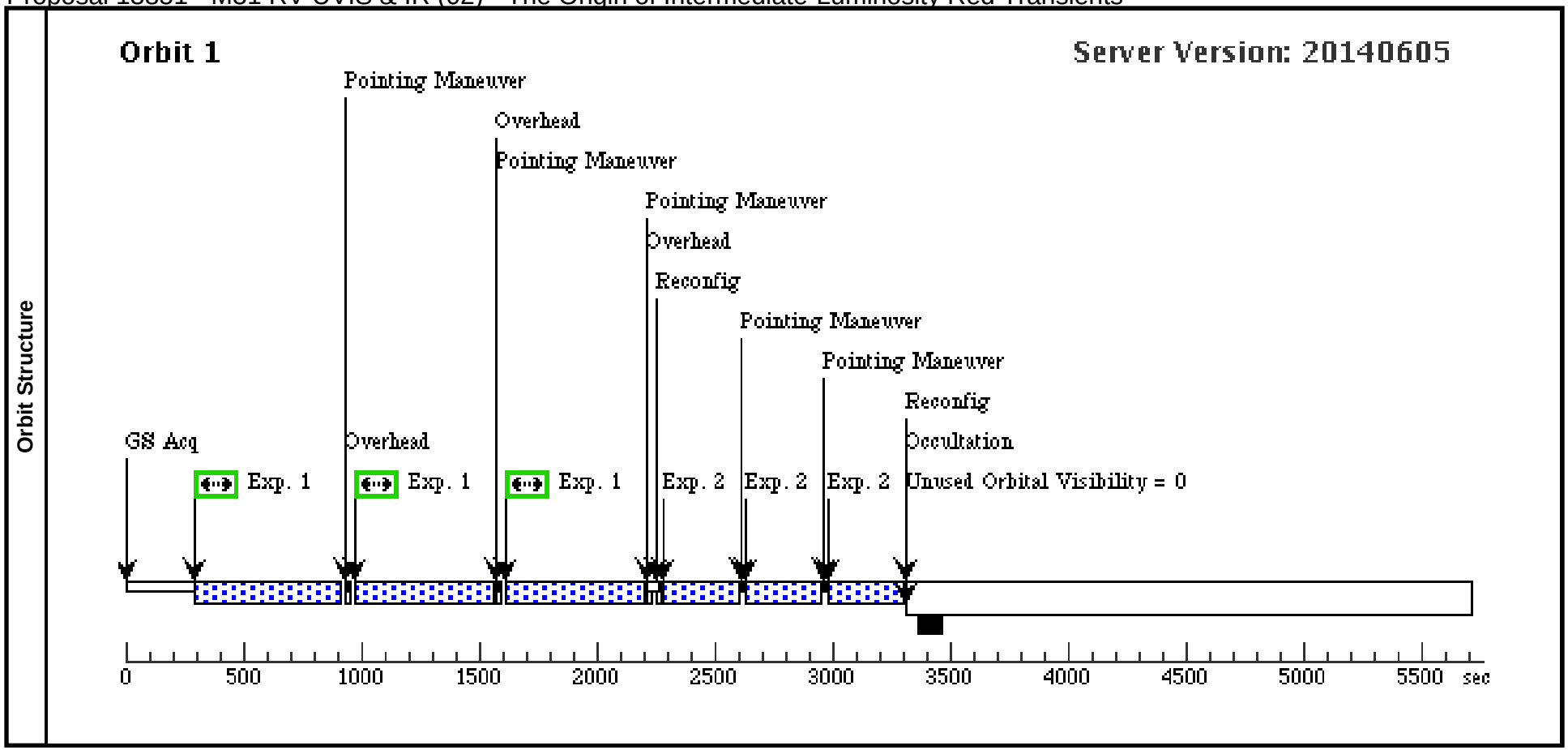
Fixed Targets

#	Name	Target Coordinates	Targ. Coord. Corrections	Fluxes	Miscellaneous
(2)	M31-RV	RA: 00 43 2.4330 (10.7601375d) Dec: +41 12 56.17 (41.21560d) Equinox: J2000		V=21	Reference Frame: SIMBAD

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

Exposures

#	Label	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time (Total)/[Actual Dur.]	Orbit
1		(2) M31-RV	WFC3/UVIS, ACCUM, UVIS2-C512C-SUB	F814W	CR-SPLIT=NO		Pattern 1, Exps 1-1 in M31 RV UVIS & IR (02) (1)	600 Secs (1776 Secs) *[==>592.0 Secs (Pattern 1)]* *[==>592.0 Secs (Pattern 2)]* *[==>592.0 Secs (Pattern 3)]*	***[1]***
2		(2) M31-RV	WFC3/IR, MULTIACCUM, IRSUB256	F160W	NSAMP=14; SAMP-SEQ=SPARS25		Pattern 2, Exps 2-2 in M31 RV UVIS & IR (02) (2)	290.776322 Secs (872.329 Secs) *[==>(Pattern 1)]* *[==>(Pattern 2)]* *[==>(Pattern 3)]*	***[1]***


Orbit Structure
Orbit 1
Server Version: 20140605
Pointing Maneuver
Overhead
Pointing Maneuver
Pointing Maneuver
Overhead
Reconfig
Pointing Maneuver
Pointing Maneuver
Reconfig
Occultation
GS Acq
Overhead
Exp. 1
Exp. 1
Exp. 1
Exp. 2
Exp. 2
Exp. 2
Unused Orbital Visibility = 0
0
500
1000
1500
2000
2500
3000
3500
4000
4500
5000
5500
sec

Visit

Proposal 13851, CK Vul UVIS & IR (03) Thu Jul 10 01:25:40 GMT 2014

Diagnostic Status: No Diagnostics

Scientific Instruments: WFC3/IR, 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=0.135 Line Spacing=	Coordinate Frame=POS-TARG Pattern Orientation=46.84 Angle Between Sides= Center Pattern=true		(1), (2-3)
(3)	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=true		(4)

Fixed Targets

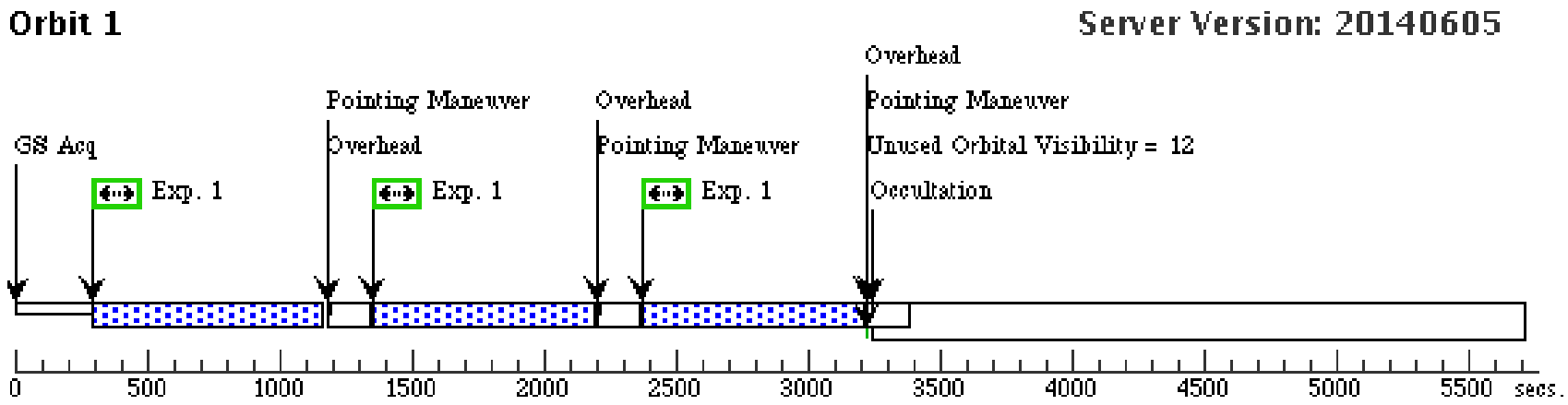
#	Name	Target Coordinates	Targ. Coord. Corrections	Fluxes	Miscellaneous
(3)	CK-VUL	RA: 19 47 37.9000 (296.9079167d) Dec: +27 18 42.20 (27.31172d) Equinox: J2000		V=21	Reference Frame: SIMBAD

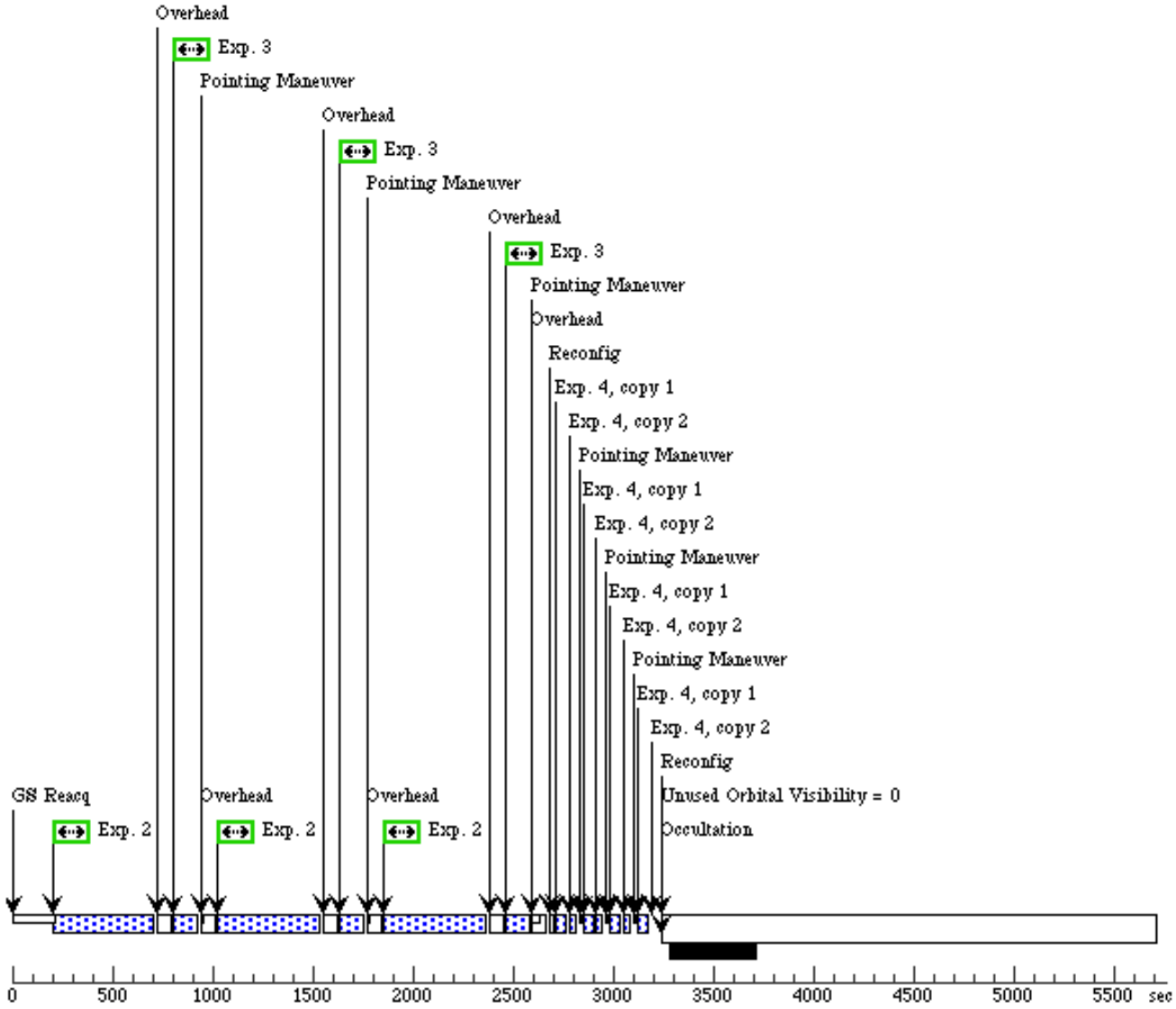
Comments: This object was generated by the targetselector and retrieved from the SIMBAD database.

Exposures

#	Label	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time (Total)/[Actual Dur.]	Orbit
1		(3) CK-VUL	WFC3/UVIS, ACCUM, UVIS2-2K2C-SUB	F656N	CR-SPLIT=NO; FLASH=12		Pattern 1, Exps 1-1 in CK Vul UVIS & IR (03) (1)	840 Secs (2520 Secs) *[==>(Pattern 1)]* *[==>(Pattern 2)]* *[==>(Pattern 3)]*	***[1]***
2		(3) CK-VUL	WFC3/UVIS, ACCUM, UVIS2-C1K1C-SUB	F300X	CR-SPLIT=NO; FLASH=12		Pattern 1, Exps 2-3 in CK Vul UVIS & IR (03) (1)	400 Secs (1479 Secs) *[==>493.0 Secs (Pattern 1)]* *[==>493.0 Secs (Pattern 2)]* *[==>493.0 Secs (Pattern 3)]*	***[2]***
3		(3) CK-VUL	WFC3/UVIS, ACCUM, UVIS2-C1K1C-SUB	F606W	CR-SPLIT=NO; FLASH=12		Pattern 1, Exps 2-3 in CK Vul UVIS & IR (03) (1)	100 Secs (300 Secs) *[==>(Pattern 1)]* *[==>(Pattern 2)]* *[==>(Pattern 3)]*	***[2]***
4		(3) CK-VUL	WFC3/IR, MULTIACCUM, IRSUB256	F160W	NSAMP=5; SAMP-SEQ=SPARS10		Pattern 3, Exps 4-4 in CK Vul UVIS & IR (03) (3)	29.663763 Secs X 2 (237.31 Secs) *[==>(Pattern 1, Copy 1)]* *[==>(Pattern 1, Copy 2)]* *[==>(Pattern 2, Copy 1)]* *[==>(Pattern 2, Copy 2)]* *[==>(Pattern 3, Copy 1)]* *[==>(Pattern 3, Copy 2)]* *[==>(Pattern 4, Copy 1)]* *[==>(Pattern 4, Copy 2)]*	***[2]***

Orbit Structure




Orbit 2
Server Version: 20140605
Overhead
Exp. 3
Pointing Maneuver
Overhead
Exp. 3
Pointing Maneuver
Overhead
Exp. 3
Pointing Maneuver
Overhead
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Exp. 4, copy 2
Pointing Maneuver
Exp. 4, copy 1
Exp. 4, copy 2
Pointing Maneuver
Exp. 4, copy 1
Exp. 4, copy 2
Pointing Maneuver
Exp. 4, copy 1
Exp. 4, copy 2
Reconfig
Unused Orbital Visibility = 0
Occultation
GS Reacq
Exp. 2
Overhead
Exp. 2
Overhead
Exp. 2
0
500
1000
1500
2000
2500
3000
3500
4000
4500
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sec