



13698 - The environments and progenitors of calcium-rich transients

Cycle: 22, Proposal Category: GO

(Availability Mode: SUPPORTED)

INVESTIGATORS

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VISITS

<i>Visit</i>	<i>Targets used in Visit</i>	<i>Configurations used in Visit</i>	<i>Orbits Used</i>	<i>Last Orbit Planner Run</i>	<i>OP Current with Visit?</i>
01	(1) SN-2005E	ACS/WFC	2	23-Sep-2014 21:01:52.0	yes
02	(2) SN-2003DR	ACS/WFC	2	23-Sep-2014 21:01:54.0	yes
03	(3) SN-2007KE	ACS/WFC	2	23-Sep-2014 21:01:55.0	yes
04	(4) SN-2001CO	WFC3/UVIS	2	23-Sep-2014 21:01:56.0	yes
05	(5) SN-2003DG	WFC3/UVIS	2	23-Sep-2014 21:01:58.0	yes

10 Total Orbits Used

ABSTRACT

Calcium-rich transients represent a new, peculiar class of extra-galactic explosion in which up to half the ejecta is calcium. Exhibiting peak luminosities in the gap between novae and supernovae, and fast evolving light curves, they present a challenge for both observation and theory. Their

host galaxy locations prove a problem for most proposed progenitor systems as they are preferentially located at extreme offsets from their putative hosts, and no underlying stellar population has yet been detected in these cases.

In this proposal we will either detect for the first time, or conclusively rule out, underlying systems at the locations of a sample of these extreme-offset transients through very deep imaging provided by HST. Alongside this, we will characterise the underlying stellar population of examples of the class which appear, in projection, to be within the disks of their hosts. From these observations we will ascertain if Ca-rich transients are born in-situ or kicked from their birth sites at high velocity. Either scenario is of significant interest. If born in situ then there must be unusual chemical evolution properties in the exceptionally low mass systems in which they reside, which produce such unusual transients. In contrast if they are kicked then binary mergers (e.g. white dwarf -- neutron star) would become favoured systems, making these events powerful tools for constraining the evolution in creating tight binaries, and with important implications for gravitational wave searches.

OBSERVING DESCRIPTION

We will obtain deep broadband imaging data over the course of 6 orbits in order to probe sufficient depths at the locations of 3 local Ca-rich transients that appear to have no underlying systems in shallower imaging, labelled SNe 2003dr, 2005E and 2007ke. Imaging will be done using the ACS/WFC in filters F435W and F606W to give us good overall sensitivity, and specifically sensitivity to young stellar populations. Accounting for visibility and guide star and instrumental overheads respectively, with three frames per orbit, the HST ETC was used to estimate limiting magnitudes of $m_{F435W} = 28$ and $m_{F606W} = 28.3$. A F435W-F606W colour will be useful should we detect anything, however we can also combine both images to attempt to discover extremely faint sources of flux.

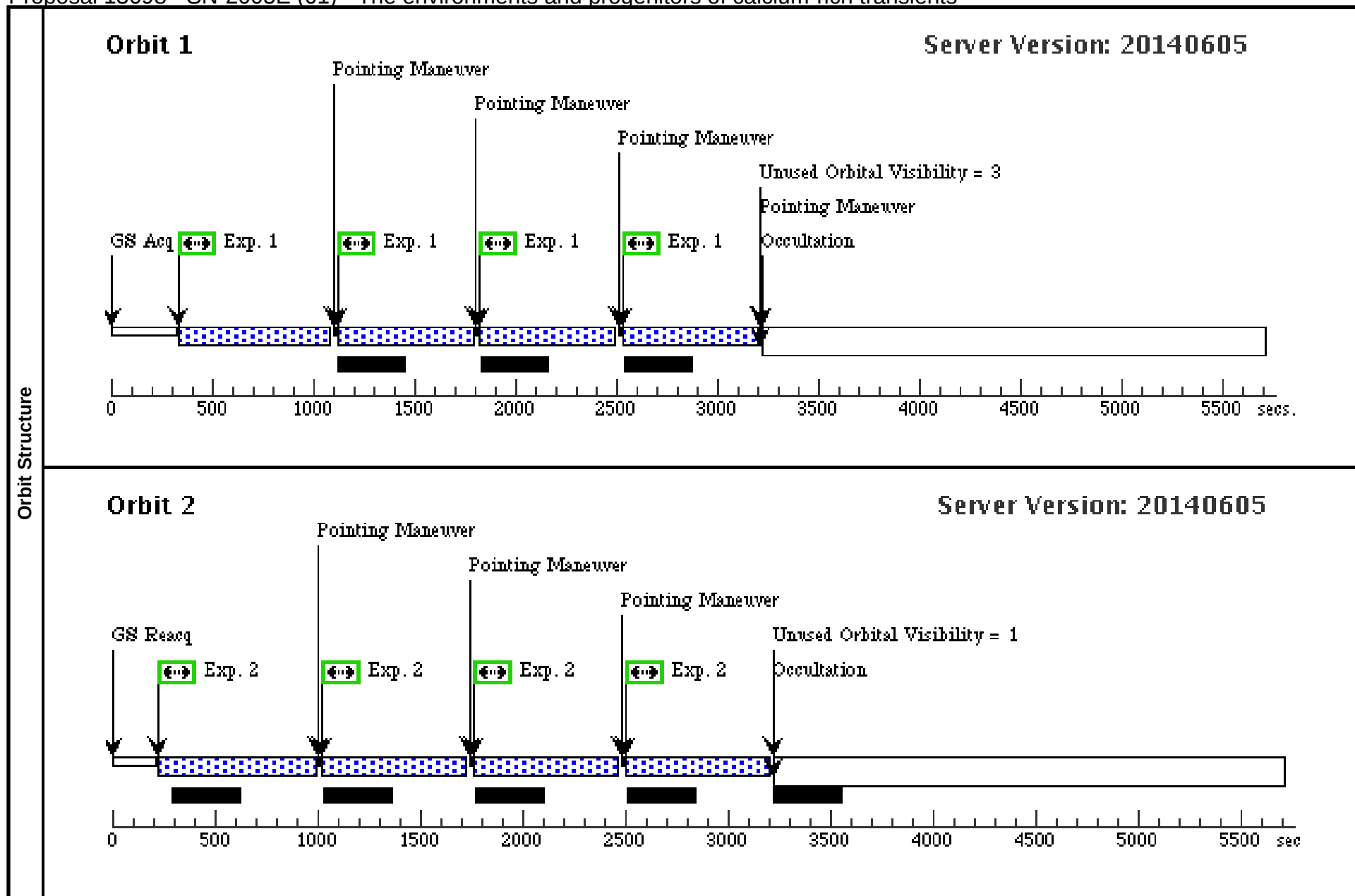
Additionally, we wish to characterise the stellar populations of two other proximate members, SNe 2001co and 2003dg, which are coincident with their hosts' stellar disks (therefore such deep imaging is not required to observe the underlying population) over 4 orbits.

For each, we will use the ACS/WFC to observe H α with FR656N (at central wavelength around 6680Å) to a depth of 24.5 mag over one orbit (after accounting for visibility and overheads) as a tight constraint on the age of the underlying population. Additionally, F435W and F606W exposures will be obtained for half an orbit each to reach 26 mag, these will allow subtraction of the continuum light from the H α observations and provide further constraints to the popu-

lation through the colour (which can be compared to the F435W and F606W observations for 2003dr, 2005E and 2007ke, should we detect anything).

Proposal 13698 - SN-2005E (01) - The environments and progenitors of calcium-rich transients

Visit	Proposal 13698, SN-2005E (01), implementation										Wed Sep 24 01:01:59 GMT 2014		
	Diagnostic Status: No Diagnostics												
	Scientific Instruments: ACS/WFC												
	Special Requirements: ORIENT 40D TO 55 D												
	Comments: 4-point dither of the location of SN 2005E will be perform in filters F606W and F435W over 1 orbit each. WFC1-CTE aperture is used to combat CTE.												
Patterns	#	Primary Pattern					Secondary Pattern					Exposures	
	(1)	Pattern Type=ACS-WFC-DITHER-BOX Purpose=DITHER Number Of Points=4 Point Spacing=0.265 Line Spacing=0.187			Coordinate Frame=POS-TARG Pattern Orientation=20.67 Angle Between Sides=69.05 Center Pattern=false							(1), (2)	
Fixed Targets	#	Name		Target Coordinates		Targ. Coord. Corrections		Fluxes		Miscellaneous			
	(1)	SN-2005E		RA: 02 39 14.3400 (39.8097500d) Dec: +01 05 55.00 (1.09861d) Equinox: J2000				V=26		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	05E-F606W	(1) SN-2005E	ACS/WFC, ACCUM, WFC2		F606W		POS TARG 87.3845 1032464434,-31.705 764036529335	Pattern 1, Exps 1-1 i n SN-2005E (01) (1)	500 Secs (2192 Secs) [==>548.0 Secs (Pattern 1)] [==>548.0 Secs (Pattern 2)] [==>548.0 Secs (Pattern 3)] [==>548.0 Secs (Pattern 4)]		[1]	
	2	05E-F435W	(1) SN-2005E	ACS/WFC, ACCUM, WFC2		F435W		POS TARG 87.3845 1032464434,-31.705 764036529335	Pattern 1, Exps 2-2 i n SN-2005E (01) (1)	500 Secs (2324 Secs) [==>581.0 Secs (Pattern 1)] [==>581.0 Secs (Pattern 2)] [==>581.0 Secs (Pattern 3)] [==>581.0 Secs (Pattern 4)]		[2]	



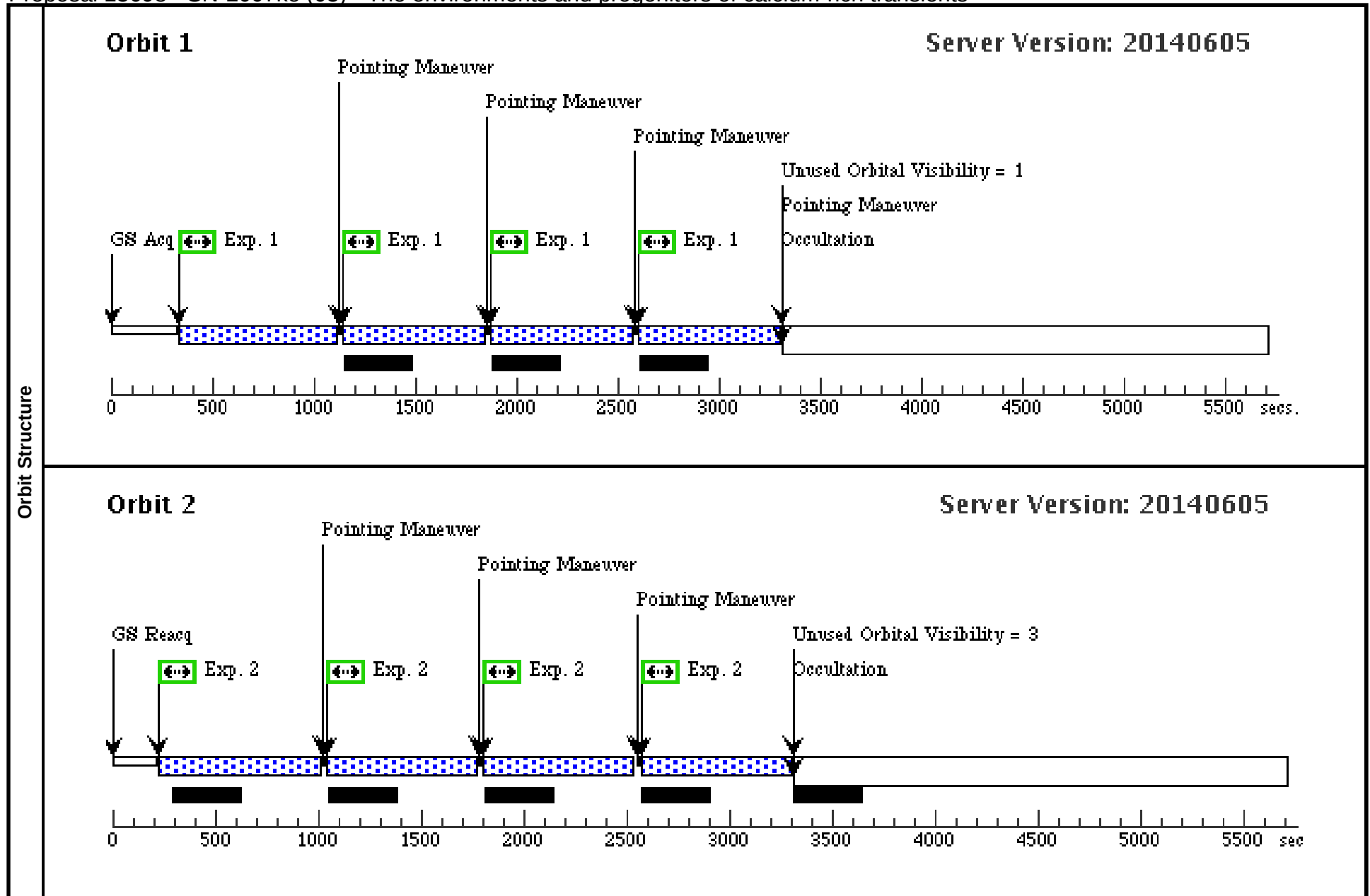
Proposal 13698 - SN-2003dr (02) - The environments and progenitors of calcium-rich transients

Visit	Proposal 13698, SN-2003dr (02), implementation										Wed Sep 24 01:01:59 GMT 2014		
	Diagnostic Status: No Diagnostics												
	Scientific Instruments: ACS/WFC												
	Special Requirements: ORIENT 352D TO 20 D; ORIENT 163D TO 177 D												
	Comments: 4-point dither of the location of SN 2003dr will be perform in filters F606W and F435W over 1 orbit each. WFC2 aperture is used to contain the galaxy within a single chip.												
Patterns	#	Primary Pattern					Secondary Pattern					Exposures	
	(1)	Pattern Type=ACS-WFC-DITHER-BOX Purpose=DITHER Number Of Points=4 Point Spacing=0.265 Line Spacing=0.187			Coordinate Frame=POS-TARG Pattern Orientation=20.67 Angle Between Sides=69.05 Center Pattern=false							(1), (2)	
Fixed Targets	#	Name		Target Coordinates		Targ. Coord. Corrections		Fluxes		Miscellaneous			
	(2)	SN-2003DR		RA: 14 38 11.1300 (219.5463750d) Dec: +46 38 3.40 (46.63428d) Equinox: J2000				V=26		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	03dr-F606W	(2) SN-2003DR	ACS/WFC, ACCUM, WFC2		F606W		POS TARG -9.2988 5365064924,-12.702 731862764875	Pattern 1, Exps 1-1 i n SN-2003dr (02) (1)	500 Secs (2328 Secs) [==>582.0 Secs (Pattern 1)] [==>582.0 Secs (Pattern 2)] [==>582.0 Secs (Pattern 3)] [==>582.0 Secs (Pattern 4)]		[1]	
	2	03dr-F435W	(2) SN-2003DR	ACS/WFC, ACCUM, WFC2		F435W		POS TARG -9.2988 5365064924,-12.702 731862764875	Pattern 1, Exps 2-2 i n SN-2003dr (02) (1)	600 Secs (2460 Secs) [==>615.0 Secs (Pattern 1)] [==>615.0 Secs (Pattern 2)] [==>615.0 Secs (Pattern 3)] [==>615.0 Secs (Pattern 4)]		[2]	



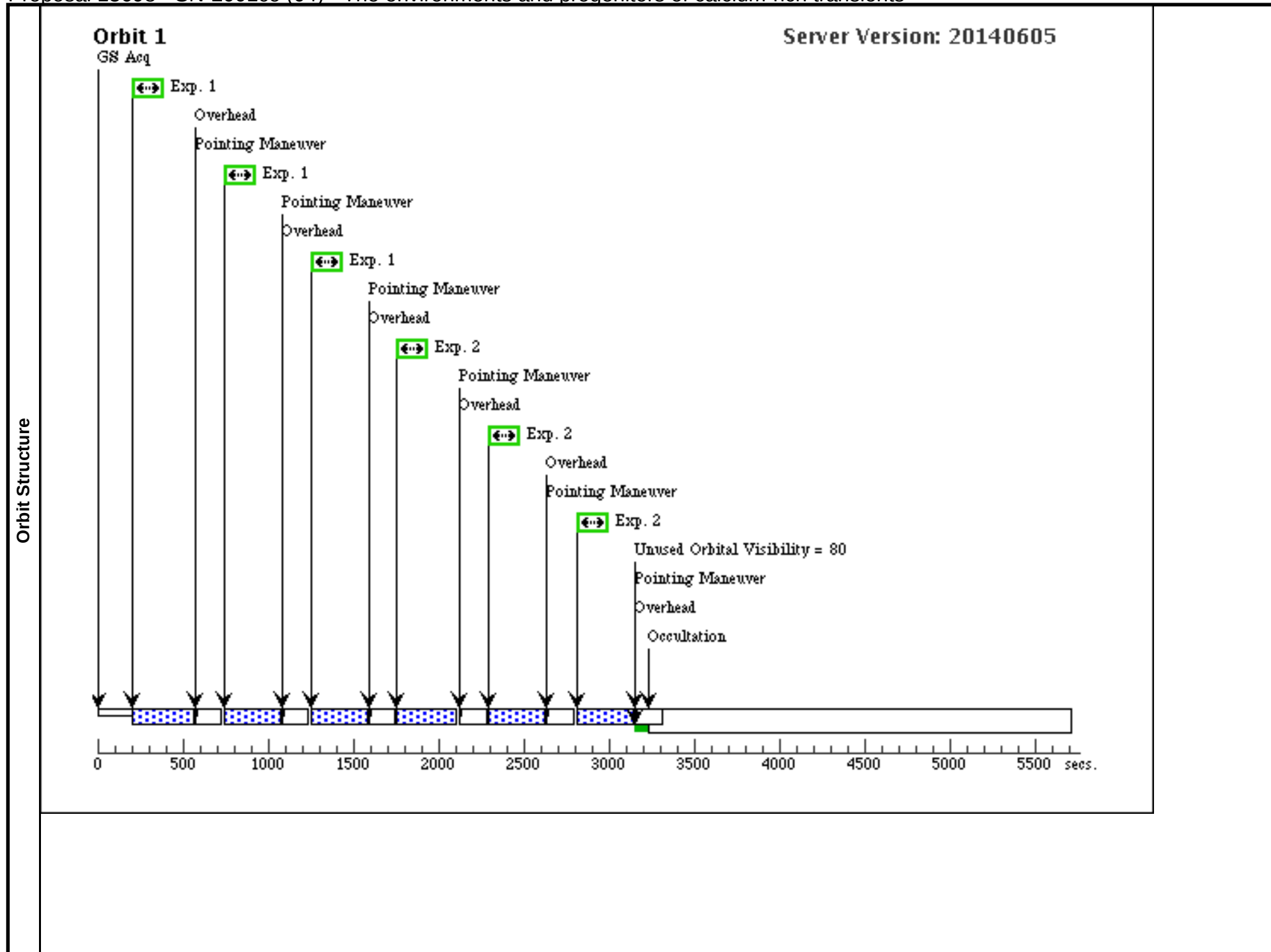
Proposal 13698 - SN-2007ke (03) - The environments and progenitors of calcium-rich transients

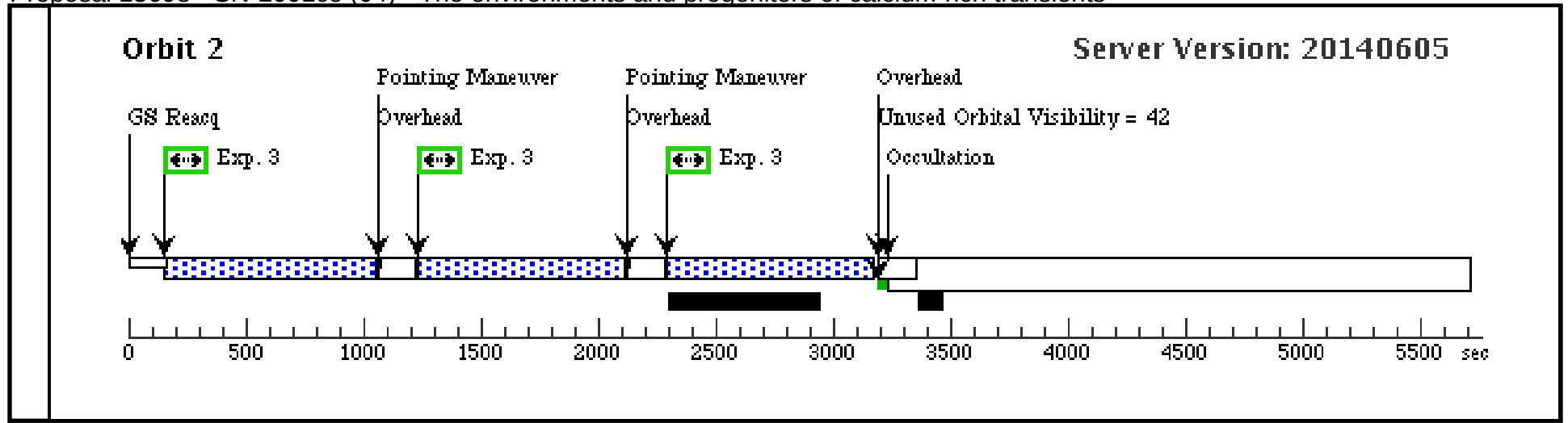
Visit	Proposal 13698, SN-2007ke (03), implementation										Wed Sep 24 01:02:00 GMT 2014		
	Diagnostic Status: No Diagnostics												
	Scientific Instruments: ACS/WFC												
	Special Requirements: ORIENT 250D TO 300 D												
	Comments: 4-point dither of the location of SN 2007ke will be perform in filters F606W and F435W over 1 orbit each. WFC1-CTE aperture is used to combat CTE.												
Patterns	#	Primary Pattern					Secondary Pattern					Exposures	
	(1)	Pattern Type=ACS-WFC-DITHER-BOX Purpose=DITHER Number Of Points=4 Point Spacing=0.265 Line Spacing=0.187			Coordinate Frame=POS-TARG Pattern Orientation=20.67 Angle Between Sides=69.05 Center Pattern=false							(1), (2)	
Fixed Targets	#	Name		Target Coordinates		Targ. Coord. Corrections			Fluxes		Miscellaneous		
	(3)	SN-2007KE		RA: 02 54 23.9000 (43.5995833d) Dec: +41 34 16.30 (41.57119d) Equinox: J2000					V=26		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	07ke-F606W	(3) SN-2007KE	ACS/WFC, ACCUM, WFC1-CTE		F606W		POS TARG -1.9911 196793179953,-3.03 97210319149726	Pattern 1, Exps 1-1 in SN-2007ke (03) (1)	500 Secs (2288 Secs) [==>572.0 Secs (Pattern 1)] [==>572.0 Secs (Pattern 2)] [==>572.0 Secs (Pattern 3)] [==>572.0 Secs (Pattern 4)]		[1]	
	2	07ke-F435W	(3) SN-2007KE	ACS/WFC, ACCUM, WFC1-CTE		F435W		POS TARG -1.9911 196793179953,-3.03 97210319149726	Pattern 1, Exps 2-2 in SN-2007ke (03) (1)	600 Secs (2416 Secs) [==>604.0 Secs (Pattern 1)] [==>604.0 Secs (Pattern 2)] [==>604.0 Secs (Pattern 3)] [==>604.0 Secs (Pattern 4)]		[2]	



Proposal 13698 - SN-2001co (04) - The environments and progenitors of calcium-rich transients

Visit	Proposal 13698, SN-2001co (04), implementation										Wed Sep 24 01:02:00 GMT 2014	
	Diagnostic Status: No Diagnostics											
	Scientific Instruments: WFC3/UVIS											
	Special Requirements: ORIENT 139D TO 161 D											
Comments: 3 point line dither will be used to obtain F606W and F438W observations over half an orbit each of the location of SN 2001co. These observations used the UVIS-2k2c-SUB subarray to combat buffer issues due to short exposure lengths. Halpha (F665N) observations will be taken over the subsequent orbit using the same aperture.												
Patterns	#	Primary Pattern					Secondary Pattern				Exposures	
	(3)	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=false				(1), (2), (3)	
Fixed Targets	#	Name	Target Coordinates			Targ. Coord. Corrections		Fluxes		Miscellaneous		
	(4)	SN-2001CO	RA: 14 19 12.8348 (214.8034783d) Dec: +24 47 57.03 (24.79918d) Equinox: J2000					V=(?) ~23 mag/arcsec^2 in visual		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	01co-F606W	(4) SN-2001CO	WFC3/UVIS, ACCUM, UVIS2-2K2C-SUB		F606W		POS TARG 10.8406 8327360652,8.32818 3421021627;	Pattern 3, Exps 1-1 in SN-2001co (04) (3)	330 Secs (990 Secs)		[1]
										[==>(Pattern 1)]	[1]	
										[==>(Pattern 2)]		
										[==>(Pattern 3)]		
	2	01co-F438W	(4) SN-2001CO	WFC3/UVIS, ACCUM, UVIS2-2K2C-SUB		F438W	FLASH=9	POS TARG 10.8406 8327360652,8.32818 3421021627	Pattern 3, Exps 2-2 in SN-2001co (04) (3)	330 Secs (990 Secs)		[1]
									[==>(Pattern 1)]	[1]		
									[==>(Pattern 2)]			
									[==>(Pattern 3)]			
3	01co-F665N	(4) SN-2001CO	WFC3/UVIS, ACCUM, UVIS2-2K2C-SUB		F665N	FLASH=9	POS TARG 10.8406 8327360652,8.32818 3421021627	Pattern 3, Exps 3-3 in SN-2001co (04) (3)	880 Secs (2640 Secs)		[2]	
									[==>(Pattern 1)]	[2]		
									[==>(Pattern 2)]			
									[==>(Pattern 3)]			





Proposal 13698 - SN-2003dg (05) - The environments and progenitors of calcium-rich transients

Visit	Proposal 13698, SN-2003dg (05), implementation										Wed Sep 24 01:02:00 GMT 2014		
	Diagnostic Status: No Diagnostics												
	Scientific Instruments: WFC3/UVIS												
	Special Requirements: ORIENT 312D TO 328 D; ORIENT 133D TO 145 D												
Comments: 3 point line dither will be used to obtain F606W and F438W observations over half an orbit each of the location of SN 2001co. These observations used the UVIS-2k2c-SUB subarray to combat buffer issues due to short exposure lengths. Halpha (F665N) observations will be taken over the subsequent orbit using the same aperture.													
Patterns	#	Primary Pattern						Secondary Pattern				Exposures	
	(3)	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=false				(1), (2), (3)	
Fixed Targets	#	Name		Target Coordinates		Targ. Coord. Corrections		Fluxes		Miscellaneous			
	(5)	SN-2003DG		RA: 11 57 31.9700 (179.3832083d) Dec: -01 15 13.60 (-1.25378d) Equinox: J2000				V=(?) ~23 mag/arcsec^2 in V		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	03dg-F606 W	(5) SN-2003DG	WFC3/UVIS, ACCUM, UVIS2-2K2C-SUB		F606W		POS TARG 8.81978 8488036544,9.08589 194666145	Pattern 3, Exps 1-1 in SN-2003dg (05) (3)	330 Secs (978 Secs)			
										[==>326.0 Secs (Pattern 1)] [==>326.0 Secs (Pattern 2)] [==>326.0 Secs (Pattern 3)]		[1]	
	2	03dg-F438 W	(5) SN-2003DG	WFC3/UVIS, ACCUM, UVIS2-2K2C-SUB		F438W	FLASH=9	POS TARG 8.81978 8488036544,9.08589 194666145	Pattern 3, Exps 2-2 in SN-2003dg (05) (3)	330 Secs (978 Secs)			
										[==>326.0 Secs (Pattern 1)] [==>326.0 Secs (Pattern 2)] [==>326.0 Secs (Pattern 3)]		[1]	
	3	03dg-FR665 N	(5) SN-2003DG	WFC3/UVIS, ACCUM, UVIS2-2K2C-SUB		F665N	FLASH=9	POS TARG 8.81978 8488036544,9.08589 194666145	Pattern 3, Exps 3-3 in SN-2003dg (05) (3)	880 Secs (2625 Secs)			
										[==>875.0 Secs (Pattern 1)] [==>875.0 Secs (Pattern 2)] [==>875.0 Secs (Pattern 3)]		[2]	

