12885 - Kepler's SNR: A Type Ia Supernova from a Single Degenerate System?

Cycle: 20, Proposal Category: GO

(Availability Mode: SUPPORTED)

INVESTIGATORS

Name	*Institution*	*E-Mail*
Dr. Ravi Sankrit (PI) (Contact)	**Universities Space Research Association**	**rsankrit@sofia.usra.edu**
Dr. William P. Blair (CoI)	The Johns Hopkins University	wpb@pha.jhu.edu
Dr. John C. Raymond (CoI)	Smithsonian Institution Astrophysical Observatory	jraymond@cfa.harvard.edu
Dr. Kazimierz J. Borkowski (CoI)	North Carolina State University	sps@ncsu.edu
Dr. Stephen Reynolds (CoI)	North Carolina State University	steve_reynolds@ncsu.edu
Dr. Brian J. Williams (CoI)	North Carolina State University	bjwilli2@ncsu.edu
Dr. Knox S. Long (CoI)	Space Telescope Science Institute	long@stsci.edu
Dr. Daniel J. Patnaude (CoI)	Smithsonian Institution Astrophysical Observatory	dpatnaude@cfa.harvard.edu

VISITS

Visit	*Targets used in Visit*	*Configurations used in Visit*	*Orbits Used*	*Last Orbit Planner Run*	*OP Current with Visit?*
01	(1) KEPLER-1	WFC3/UVIS	4	10-Jul-2012 21:48:17.0	yes
02	(1) KEPLER-1	WFC3/UVIS	2	10-Jul-2012 21:48:29.0	yes
03	(1) KEPLER-1	WFC3/UVIS	2	10-Jul-2012 21:48:39.0	yes

8 Total Orbits Used

ABSTRACT

Kepler's supernova remnant (SN1604) is now known to be the result of a Type Ia supernova explosion. The SN occurred in a region modified by the circumstellar material from the progenitor system, thus implying a likely single degenerate precursor. We request second epoch HST images of the remnant with WFC3 (first epoch was in 2003 with ACS) in order to (i) carry out a careful and accurate assessment of the proper motion of the

primary blast wave and, with improved modeling of the primary shock velocity, constrain the distance to this important object, and (ii) perform a sensitive search for any possible surviving companion star to the SN progenitor that should still be present near the center of the remnant. Resolving the distance uncertainty is key to understanding the dynamics of the system and establishing an accurate explosion energy for the SN, thus putting Kepler in the context of other Type Ia SNe. Constraining the precursor system by finding or placing stringent limits on a companion star could help answer one of the key outstanding questions about Type Ia SNe: how are they produced? Our second epoch observations will also allow us to measure the kinematics and brightness changes of the radiative knots and filaments, which arise from interactions between the blast wave and the densest portions of the circumstellar medium, and hence are tied to the evolution of the progenitor system. These changes can be seen to occur at ground-based resolution on a ~10 year timescale, but our first epoch data have shown that HST angular resolution is necessary to resolve the knot structures and complexes and accurately characterize these changes.

OBSERVING DESCRIPTION

WFC3 images will be obtained using two narrowband filters F656N and F658N, and four continuum filters, F336W, F438W, F547M and F814W. We will use 4 orbits for F656N, 2 orbits for F658N and 2 orbits total for the four continuum bands. All observations will use CR-SPLITS, offsets and dither patterns.

ADDITIONAL COMMENTS

We would prefer obtaining images at the same orientation as in our Cycle 12 program.

Visit

Proposal 12885, Visit 01, implementation Wed Jul 11 01:48:46 GMT 2012

Diagnostic Status: No Diagnostics

Scientific Instruments: WFC3/UVIS

Special Requirements: ORIENT 75D TO 105 D; ORIENT 255D TO 285 D

Patterns

#	Primary Pattern		Secondary Pattern		Exposures
(3)	Pattern Type=WFC3-UVIS-GAP-LINE Purpose=DITHER Number Of Points=2 Point Spacing=2.414 Line Spacing=	Coordinate Frame=POS-TARG Pattern Orientation=85.759 Angle Between Sides= Center Pattern=true	Pattern Type=WFC3-UVIS-DITHER-LINE Purpose=DITHER Number Of Points=2 Point Spacing=0.145 Line Spacing=	Coordinate Frame=POS-TARG Pattern Orientation=46.84 Angle Between Sides= Center Pattern=false	(1-2)

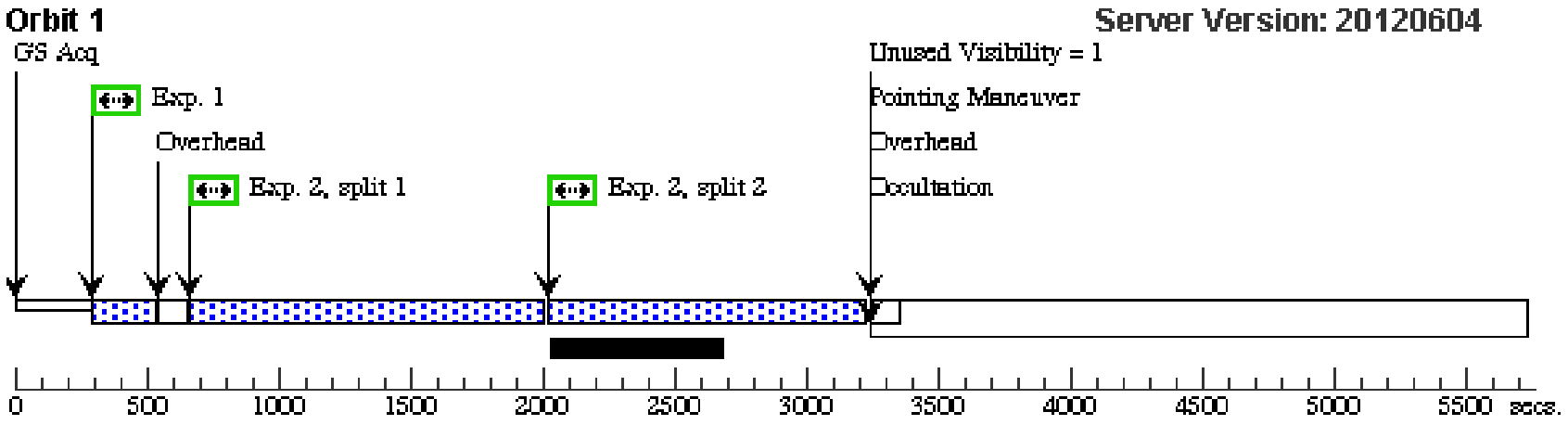
Fixed Targets

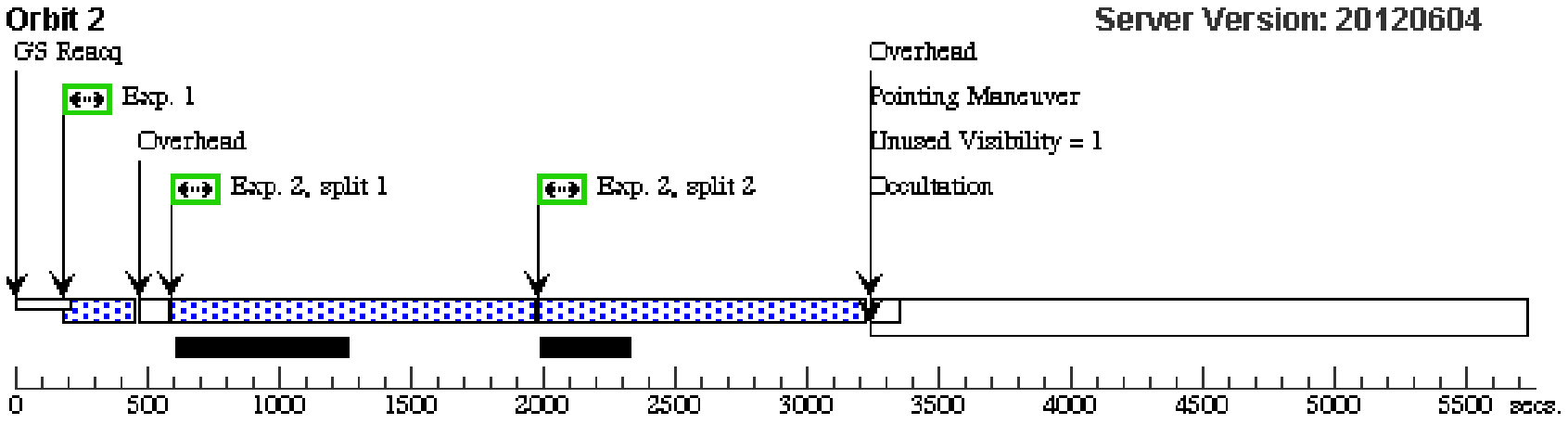
#	Name	Target Coordinates	Targ. Coord. Corrections	Fluxes	Miscellaneous
(1)	KEPLER-1	RA: 17 30 40.8000 (262.6700000d) Dec: -21 28 53.40 (-21.48150d) Equinox: J2000		V=35 4.4E-16 erg s-1 cm-2 arcsec-2 Faint H-alpha	Reference Frame: ICRS

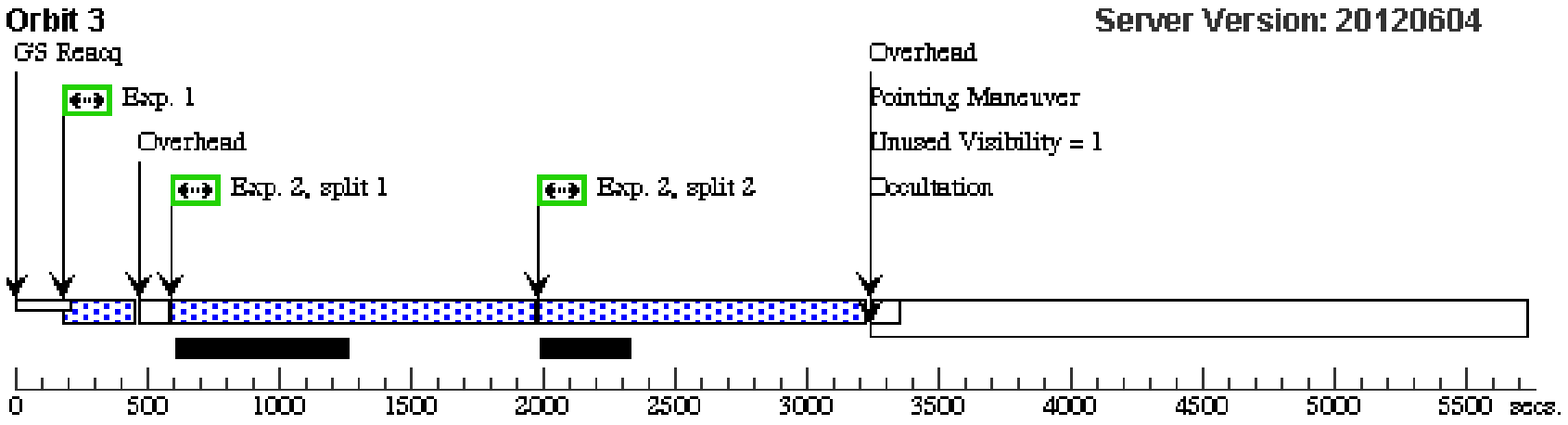
Exposures

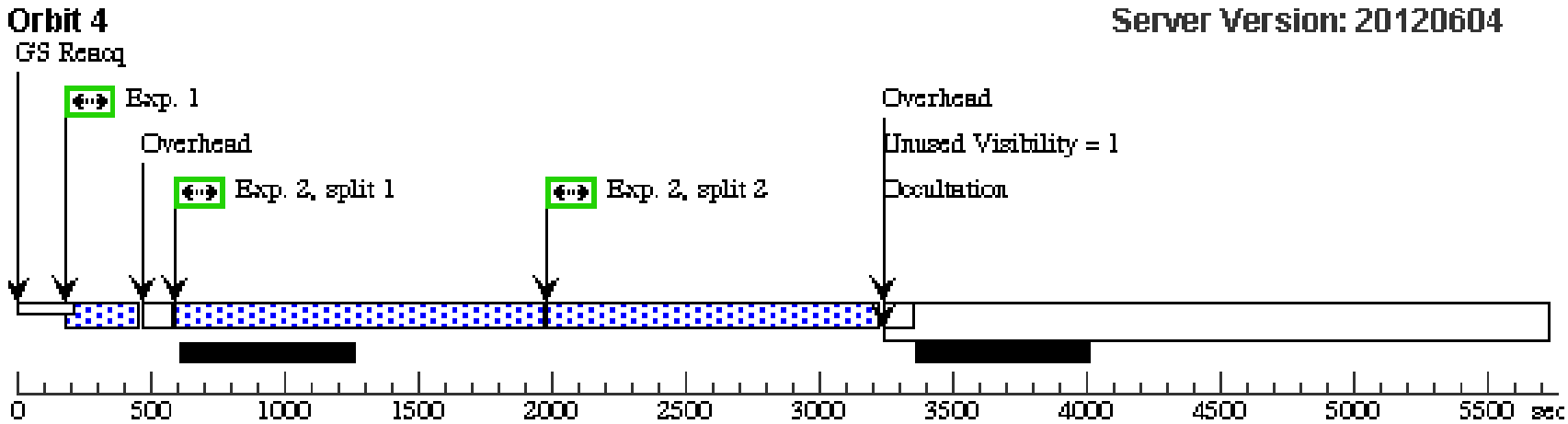
#	Label	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time/[Actual Dur.]	Orbit
1		(1) KEPLER-1	WFC3/UVIS, ACCUM, UVIS-CENTER	F814W	FLASH=3		Pattern 3, Exps 1-2 in Visit 01 (3)	200 Secs	
								[==>206.0 Secs (Pattern 1,1)]	***[1]***
								[==>243.0 Secs (Pattern 1,2)]	***[2]***
								[==>243.0 Secs (Pattern 2,1)]	***[3]***
								[==>243.0 Secs (Pattern 2,2)]	***[4]***
2		(1) KEPLER-1	WFC3/UVIS, ACCUM, UVIS-CENTER	F656N	FLASH=12; CR-SPLIT=2		Pattern 3, Exps 1-2 in Visit 01 (3)	2400 Secs	
								[==>1206.0 Secs (Pattern 1,1, Split 1)] *[==>1206.0 Secs (Pattern 1,1, Split 2)]*	***[1]***
								[==>1243.0 Secs (Pattern 1,2, Split 1)] *[==>1243.0 Secs (Pattern 1,2, Split 2)]*	***[2]***
								[==>1243.0 Secs (Pattern 2,1, Split 1)] *[==>1243.0 Secs (Pattern 2,1, Split 2)]*	***[3]***
								[==>1243.0 Secs (Pattern 2,2, Split 1)] *[==>1243.0 Secs (Pattern 2,2, Split 2)]*	***[4]***

Orbit Structure






Orbit 3
Server Version: 20120604
GS Reacq
Exp. 1
Overhead
Exp. 2, split 1
Exp. 2, split 2
Overhead
Pointing Maneuver
Unused Visibility = 1
Occultation
0
500
1000
1500
2000
2500
3000
3500
4000
4500
5000
5500
secs.


Orbit 4
Server Version: 20120604
GS Reacq
Exp. 1
Overhead
Exp. 2, split 1
Exp. 2, split 2
Overhead
Unused Visibility = 1
Occultation
0
500
1000
1500
2000
2500
3000
3500
4000
4500
5000
5500
sec

Visit

Proposal 12885, Visit 02, implementation Wed Jul 11 01:48:51 GMT 2012

Diagnostic Status: No Diagnostics

Scientific Instruments: WFC3/UVIS

Special Requirements: SAME ORIENT AS 01

Patterns

#	Primary Pattern		Secondary Pattern		Exposures
(3)	Pattern Type=WFC3-UVIS-GAP-LINE Purpose=DITHER Number Of Points=2 Point Spacing=2.414 Line Spacing=	Coordinate Frame=POS-TARG Pattern Orientation=85.759 Angle Between Sides= Center Pattern=true	Pattern Type=WFC3-UVIS-DITHER-LINE Purpose=DITHER Number Of Points=2 Point Spacing=0.145 Line Spacing=	Coordinate Frame=POS-TARG Pattern Orientation=46.84 Angle Between Sides= Center Pattern=false	(1-2)

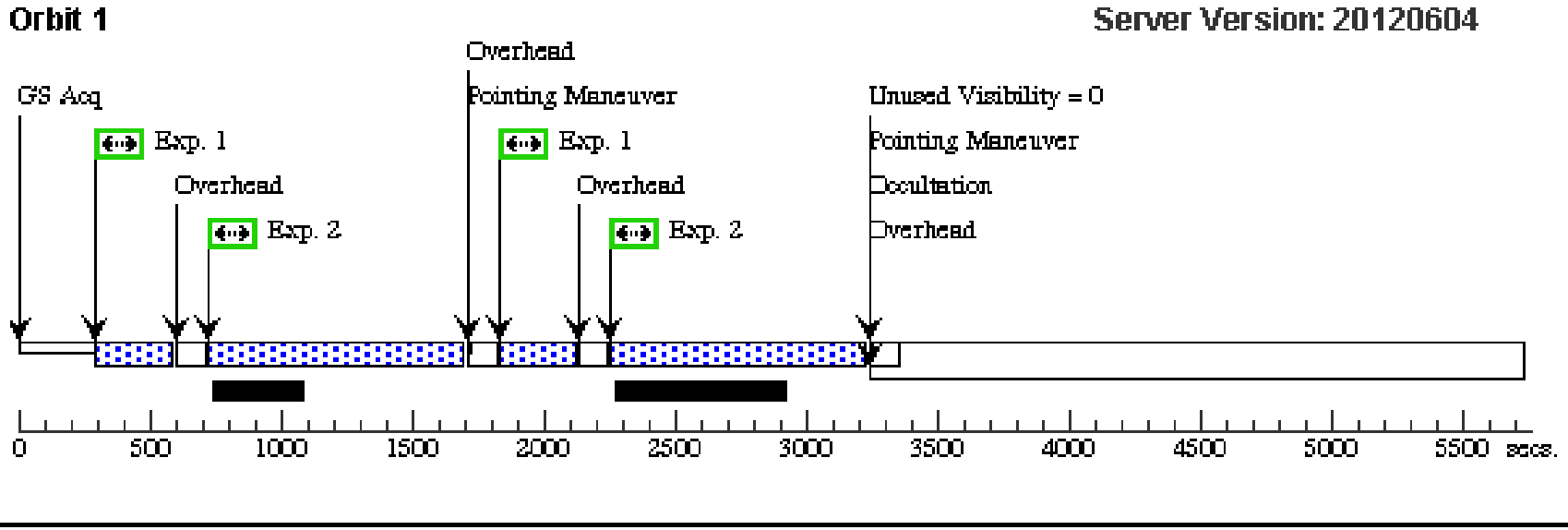
Fixed Targets

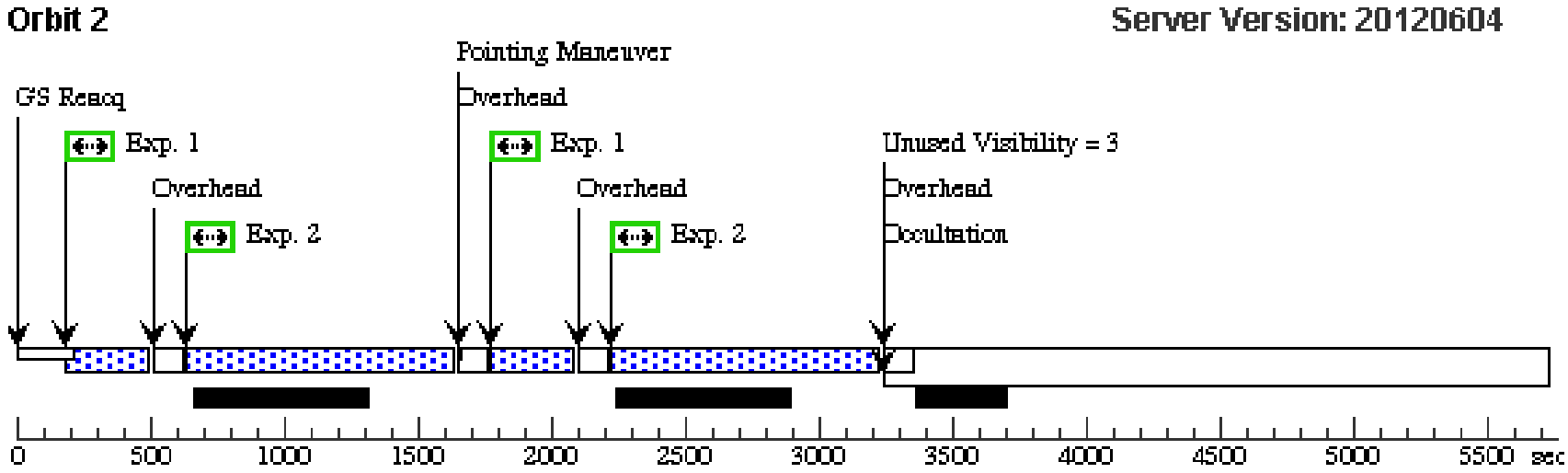
#	Name	Target Coordinates	Targ. Coord. Corrections	Fluxes	Miscellaneous
(1)	KEPLER-1	RA: 17 30 40.8000 (262.6700000d) Dec: -21 28 53.40 (-21.48150d) Equinox: J2000		V=35 4.4E-16 erg s-1 cm-2 arcsec-2 F aint H-alpha	Reference Frame: ICRS

Exposures

#	Label	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time/[Actual Dur.]	Orbit
1		(1) KEPLER-1	WFC3/UVIS, ACCUM, UVIS-CENTER	F438W	FLASH=7		Pattern 3, Exps 1-2 i n Visit 02 (3)	200 Secs	
								[==>260.0 Secs (Pattern 1,1)] *[==>260.0 Secs (Pattern 1,2)]*	***[1]***
								[==>287.0 Secs (Pattern 2,1)] *[==>287.0 Secs (Pattern 2,2)]*	***[2]***
2		(1) KEPLER-1	WFC3/UVIS, ACCUM, UVIS-CENTER	F658N	FLASH=10		Pattern 3, Exps 1-2 i n Visit 02 (3)	900 Secs	
								[==>960.0 Secs (Pattern 1,1)] *[==>960.0 Secs (Pattern 1,2)]*	***[1]***
								[==>987.0 Secs (Pattern 2,1)] *[==>987.0 Secs (Pattern 2,2)]*	***[2]***

Orbit Structure





Visit

Proposal 12885, Visit 03, implementation Wed Jul 11 01:48:53 GMT 2012

Diagnostic Status: No Diagnostics

Scientific Instruments: WFC3/UVIS

Special Requirements: SAME ORIENT AS 01

Patterns

#	Primary Pattern		Secondary Pattern		Exposures
(3)	Pattern Type=WFC3-UVIS-GAP-LINE Purpose=DITHER Number Of Points=2 Point Spacing=2.414 Line Spacing=	Coordinate Frame=POS-TARG Pattern Orientation=85.759 Angle Between Sides= Center Pattern=true	Pattern Type=WFC3-UVIS-DITHER-LINE Purpose=DITHER Number Of Points=2 Point Spacing=0.145 Line Spacing=	Coordinate Frame=POS-TARG Pattern Orientation=46.84 Angle Between Sides= Center Pattern=false	(1-2)

Fixed Targets

#	Name	Target Coordinates	Targ. Coord. Corrections	Fluxes	Miscellaneous
(1)	KEPLER-1	RA: 17 30 40.8000 (262.6700000d) Dec: -21 28 53.40 (-21.48150d) Equinox: J2000		V=35 4.4E-16 erg s-1 cm-2 arcsec-2 Faint H-alpha	Reference Frame: ICRS

Exposures

#	Label	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time/[Actual Dur.]	Orbit
1		(1) KEPLER-1	WFC3/UVIS, ACCUM, UVIS-CENTER	F547M	FLASH=5		Pattern 3, Exps 1-2 in Visit 03 (3)	450 Secs	
								[==>458.0 Secs (Pattern 1,1)] *[==>458.0 Secs (Pattern 1,2)]*	***[1]***
								[==>486.0 Secs (Pattern 2,1)] *[==>486.0 Secs (Pattern 2,2)]*	***[2]***
2		(1) KEPLER-1	WFC3/UVIS, ACCUM, UVIS-CENTER	F336W	FLASH=9		Pattern 3, Exps 1-2 in Visit 03 (3)	750 Secs	
								[==>758.0 Secs (Pattern 1,1)] *[==>758.0 Secs (Pattern 1,2)]*	***[1]***
								[==>786.0 Secs (Pattern 2,1)] *[==>786.0 Secs (Pattern 2,2)]*	***[2]***

Orbit Structure