



18358 - Ultra-rapid HST Target-of-Opportunity observations of a kilonova in LIGO-Virgo-KAGRA IR1

Cycle: 34, Proposal Category: GO

(UV Initiative)

(Availability Mode: SUPPORTED)

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Conor Larison (CoI)	Space Telescope Science Institute

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) KILONOVA	STIS/CCD WFC3/UVIS	2	18-Aug-2026 15:00:23.0	yes
02	(1) KILONOVA	STIS/CCD WFC3/UVIS	2	18-Aug-2026 15:00:24.0	yes
03	(1) KILONOVA	WFC3/UVIS	1	18-Aug-2026 15:00:25.0	yes
06	(1) KILONOVA	WFC3/UVIS	2	18-Aug-2026 15:00:25.0	yes
04	(1) KILONOVA	WFC3/UVIS	1	18-Aug-2026 15:00:26.0	yes
05	(1) KILONOVA	WFC3/UVIS	1	18-Aug-2026 15:00:26.0	yes
07	(1) KILONOVA	WFC3/UVIS	1	18-Aug-2026 15:00:26.0	yes

10 Total Orbits Used

ABSTRACT

The upcoming LVK run (IR1) will detect new neutron star mergers in gravitational waves, with wide-field optical and infrared survey support for electromagnetic follow up, but interpretation depends on day-timescale kilonova evolution: the early UV and faint optical are where ground-based follow-up is weakest. Only GW170817/AT 2017gfo has been characterized in both gravitational waves and across the electromagnetic spectrum in enough detail to map ejecta composition, geometry, and heating. A comparable event would again require rapid space-based UV spectroscopy and imaging while the photosphere is hot. We request one ultra-disruptive, ultra-rapid HST Target-of-Opportunity trigger in Cycle 34 (overlapping IR1), totaling 10 orbits for coordinated WFC3/UVIS imaging and STIS spectroscopy matched to a ground-based discovery, prioritizing UV throughput and HST's rapid response. Our science goals are (1) to separate weak- and heavy-r-process signatures using early UV/blue photometry with JWST data, (2) to combine electromagnetic ejecta constraints with gravitational-wave chirp mass to inform neutron star radii, equation of state, and maximum mass, and (3) to test models for early UV and optical emission. Theory predicts blue-to-red kilonova diversity, and our HST window extends to ~ 12 days post-merger while redder optical/NIR monitoring continues from the ground and with JWST. Joint gravitational-wave and electromagnetic analysis will constrain merger dynamics and the remnant. We will coordinate openly, document triggering criteria, and waive proprietary periods so the multimessenger community can use these data immediately.

OBSERVING DESCRIPTION

This Phase II program implements one ultra-disruptive Target-of-Opportunity activation (10 orbits) for early UV/optical observations of a kilonova counterpart to a LIGO-Virgo-KAGRA IR1 gravitational-wave event. We will not trigger unless the first visit can begin within 5 days of GW detection, aiming for first-epoch observations within ≤ 3 days of merger for counterparts with $r < 22$ mag.

Following the proposal Special Requirements, APT uses a simple five-epoch, two-orbit sequence (10 orbits total), with all visits On Hold until trigger, Sequential Observations in Time (After Observation links with variable cadence), and Non-Interruptible Sequential Observations within each visit. Exposure times and filter/instrument choices follow Scenario A of Table 1 (GW170817-like, m_F606W ~ 19.5 at $t\sim 1$ d), and will be optimized toward Scenario A or B at trigger.

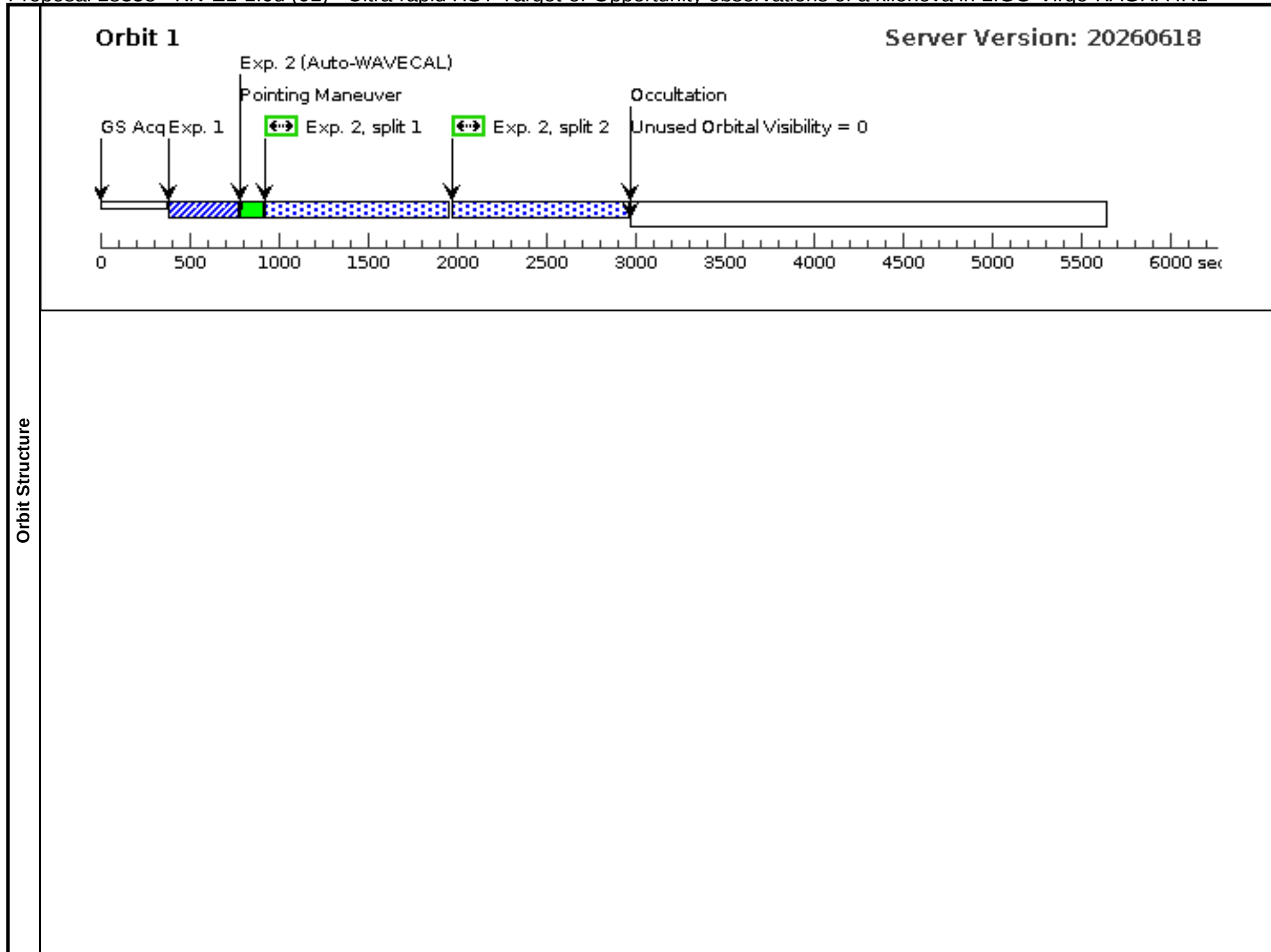
Epoch 1 ($t\sim 1.0$ d): WFC3/UVIS G280 spectroscopy with F225W/F275W/F336W imaging and STIS/CCD G430L (52x2 slit). Epoch 2 ($t\sim 1.5$ d): STIS G430L plus F225W/F275W/F336W. Epoch 3 ($t\sim 3.0$ d): F275W/F336W/F438W. Epoch 4 ($t\sim 5.0$ d): F336W/F438W. Epoch 5 ($t\sim 8-12$ d): F438W. Early cadence is 0.5-2 days; later cadence widens to a few days, ending by ~ 12 days post-merger. Within each visit, STIS exposures are

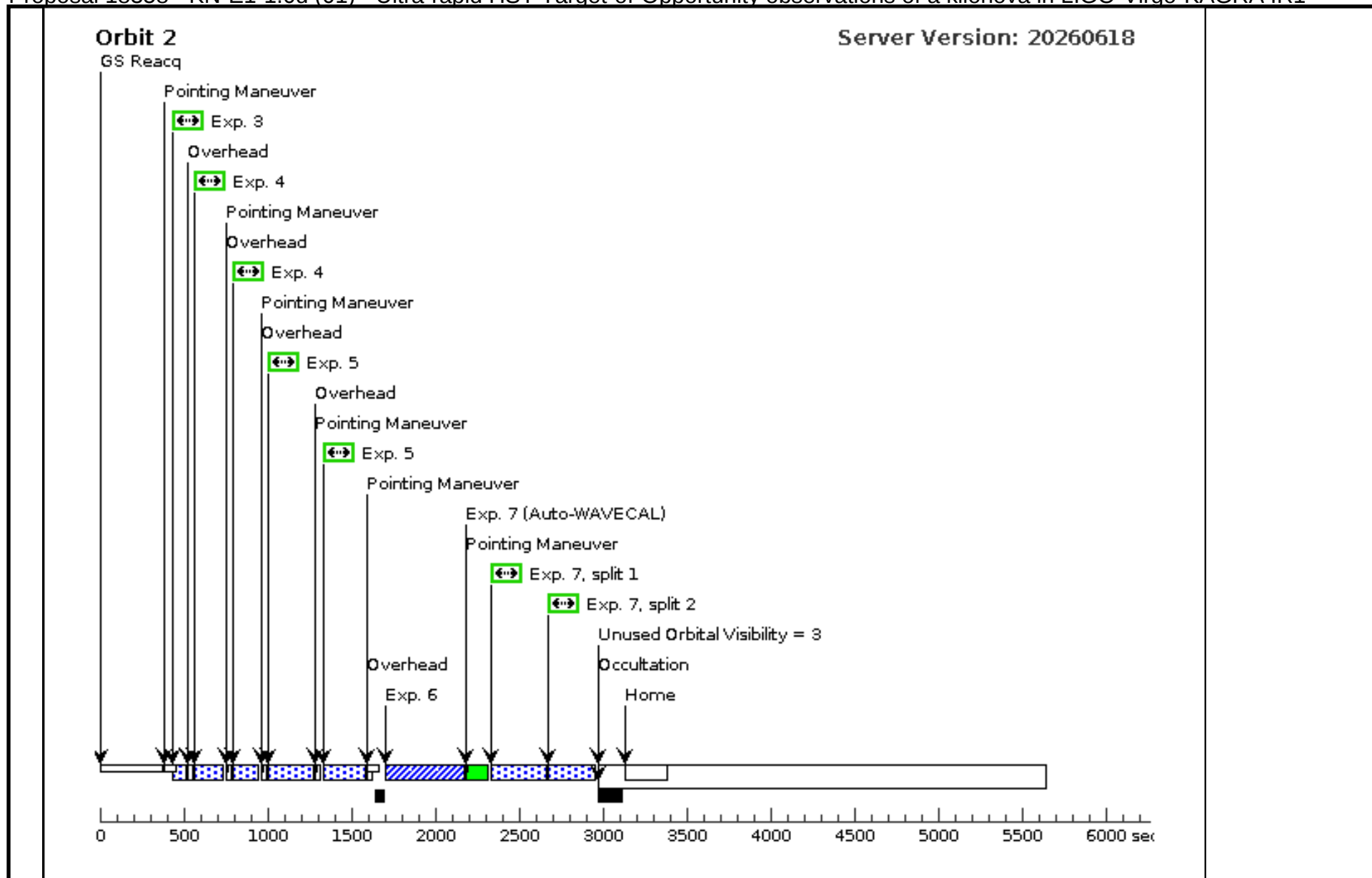
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placed first (STIS/CCD ACQ with MIRROR+F28X50LP, then G430L spectroscopy), followed by WFC3/UVIS imaging/spectroscopy, minimizing SI changes and placing target acquisition immediately before STIS science. Visit 01 uses an Ultra Disruptive response window of 1-2 days; visits 02-05 use Disruptive windows of 1-14 days to accommodate After Observation cadence.

Proposal 18358 - KN-E1-1.0d (01) - Ultra-rapid HST Target-of-Opportunity observations of a kilonova in LIGO-Virgo-KAGRA IR1

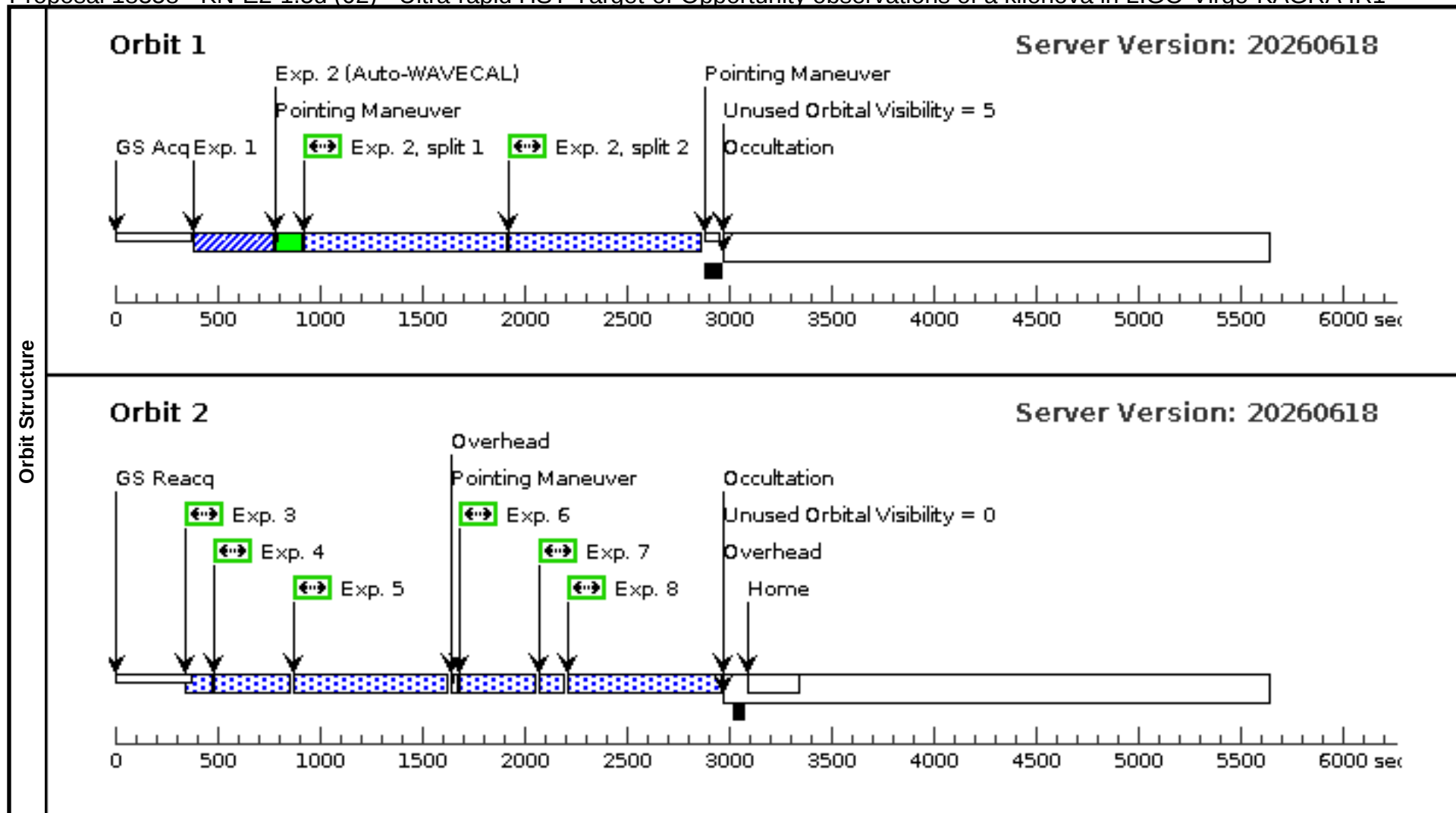
Visit	Proposal 18358, KN-E1-1.0d (01)										Tue Aug 18 19:00:27 GMT 2026
	Diagnostic Status: No Diagnostics										
	Scientific Instruments: WFC3/UVIS, STIS/CCD										
	Special Requirements: ON HOLD ; TOO MIN RESPONSE TIME 1.0D; TOO MAX RESPONSE TIME 2.0D										
	Comments: Scenario A, t~1.0 d (2 orbits): WFC3/UVIS G280 slitless spectroscopy and F225W/F275W/F336W imaging, plus STIS/CCD G430L spectroscopy (52x2 slit), per Table 1.										
On Hold Comments: On hold until trigger criteria are met: LVK IRI GW event with >=1 neutron star, EM kilonova counterpart with r < 22 mag, and first visit schedulable within 5 days of GW detection.											
Patterns	#	Primary Pattern				Secondary Pattern				Exposures	
	(1)	Pattern Type=WFC3-UVIS-DITHER-LINE Coordinate Frame=POS-TARG Pattern Orientation=14.04 Purpose=DITHER Angle Between Sides= Number Of Points=2 Center Pattern=false Point Spacing=0.149 Line Spacing=								(4), (5)	
Generic Targets	#	Name	Criteria		Description						
	(1)	KILONOVA			Electromagnetic counterpart (kilonova) to a LIGO-Virgo-KAGRA IR1 SUPERNOVA GW event with at least one neutron star, at a distance consistent with the GW localization, and with r < 22 mag at trigger.						
Exposures	#	Label	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time (Total)/[Actual Dur.]		Orbit
	1	STIS-ACQ	(1) KILONOVA	STIS/CCD, ACQ, F28X50LP	MIRROR	ACQTYPE=POINT			40 Secs (40 Secs)		
									[==>]		[1]
	2	G230LB	(1) KILONOVA	STIS/CCD, ACCUM, 52X2	G230LB 2375 A	CR-SPLIT=2			1908 Secs (1908 Secs)		
									[==>(Split 1)]		
									[==>(Split 2)]		[1]
	3	F336W	(1) KILONOVA	WFC3/UVIS, ACCUM, UVIS2-C512C-SUB	F336W	FLASH=21			50 Secs (49 Secs)		
									[==>49.0 Secs]		[2]
	4	F275W	(1) KILONOVA	WFC3/UVIS, ACCUM, UVIS2-C512C-SUB	F275W	FLASH=21		Pattern 1, Exps 4-4 i n KN-E1-1.0d (01) (1)	150 Secs (298 Secs)		
									[==>149.0 Secs (Pattern 1)]		
									[==>149.0 Secs (Pattern 2)]		[2]
	5	F225W	(1) KILONOVA	WFC3/UVIS, ACCUM, UVIS2-C512C-SUB	F225W	FLASH=20		Pattern 1, Exps 5-5 i n KN-E1-1.0d (01) (1)	250 Secs (498 Secs)		
									[==>249.0 Secs (Pattern 1)]		
									[==>249.0 Secs (Pattern 2)]		[2]
	6	STIS-ACQ2	(1) KILONOVA	STIS/CCD, ACQ, F28X50LP	MIRROR	ACQTYPE=POINT			40 Secs (40 Secs)		
								[==>]		[2]	
7	G430L	(1) KILONOVA	STIS/CCD, ACCUM, 52X2	G430L 4300 A	CR-SPLIT=2			500 Secs (498 Secs)			
								[==>249.0 Secs (Split 1)]			
								[==>249.0 Secs (Split 2)]		[2]	





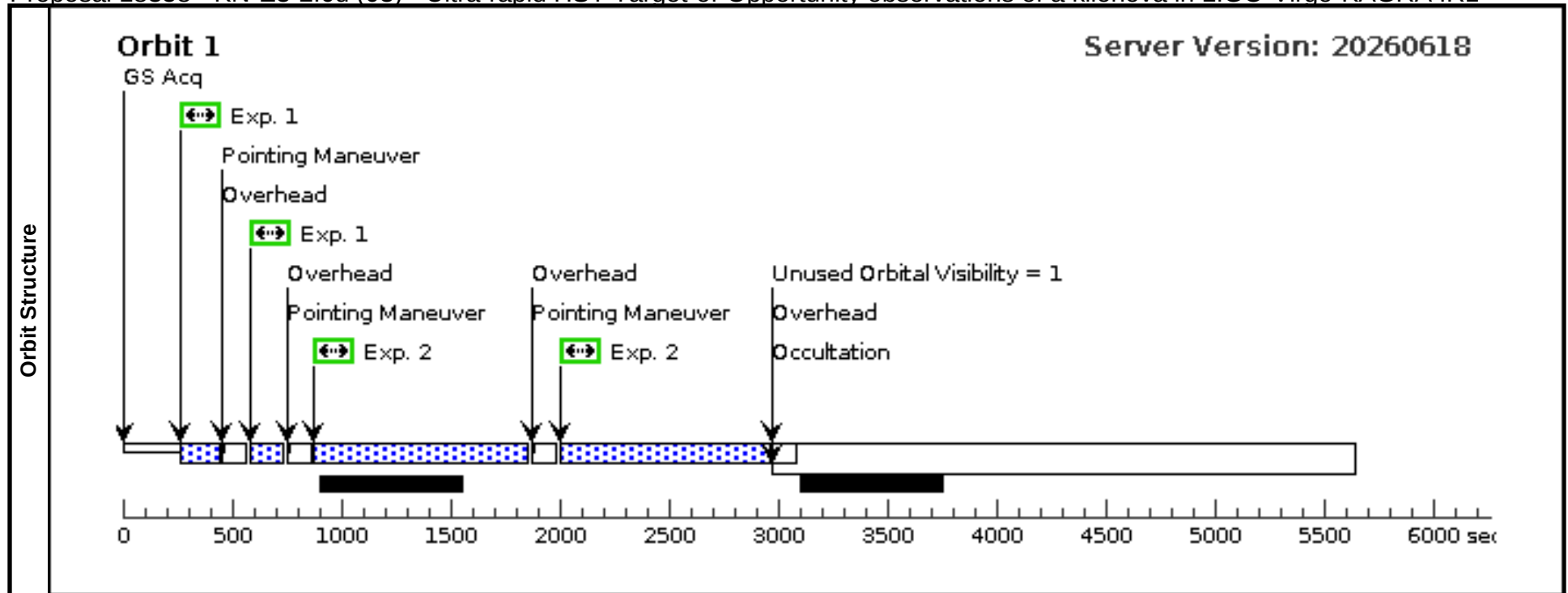
Proposal 18358 - KN-E2-1.5d (02) - Ultra-rapid HST Target-of-Opportunity observations of a kilonova in LIGO-Virgo-KAGRA IR1

Visit	Proposal 18358, KN-E2-1.5d (02) Tue Aug 18 19:00:27 GMT 2026 Diagnostic Status: No Diagnostics Scientific Instruments: WFC3/UVIS, STIS/CCD Special Requirements: ON HOLD ; TOO MIN RESPONSE TIME 1.0D; TOO MAX RESPONSE TIME 14.0D Comments: Scenario A, $t \sim 1.5$ d (2 orbits): STIS/CCD G430L spectroscopy and WFC3/UVIS F225W/F275W/F336W imaging, per Table 1. On Hold Comments: On hold until trigger criteria are met: LVK IR1 GW event with ≥ 1 neutron star, EM kilonova counterpart with $r < 22$ mag, and first visit schedulable within 5 days of GW detection.									
Generic Targets	#	Name	Criteria			Description				
	(1)	KILONOVA	Electromagnetic counterpart (kilonova) to a LIGO-Virgo-KAGRA IR1 GW event with at least one neutron star, at a distance consistent with the GW localization, and with $r < 22$ mag at trigger.			SUPERNOVA				
Exposures	#	Label	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time (Total)/[Actual Dur.]	Orbit
	1	STIS-ACQ	(1) KILONOVA	STIS/CCD, ACQ, F28X50LP	MIRROR	ACQTYPE=POINT			40 Secs (40 Secs)	
									[==>]	[1]
	2	G430L	(1) KILONOVA	STIS/CCD, ACCUM, 52X2	G430L 4300 A	CR-SPLIT=2			1814 Secs (1814 Secs)	
									[==>(Split 1)]	
									[==>(Split 2)]	[1]
	3	F336W-1	(1) KILONOVA	WFC3/UVIS, ACCUM, UVIS2-C512C-SUB	F336W	FLASH=19	POS TARG 0,0	Sequence 3-5 Non-Int in KN-E2-1.5d (02)	50 Secs (50 Secs)	
									[==>]	[2]
	4	F275W-1	(1) KILONOVA	WFC3/UVIS, ACCUM, UVIS2-C512C-SUB	F275W	FLASH=18	SAME POS AS 3	Sequence 3-5 Non-Int in KN-E2-1.5d (02)	300 Secs (300 Secs)	
									[==>]	[2]
	5	F225W-1	(1) KILONOVA	WFC3/UVIS, ACCUM, UVIS2-C512C-SUB	F225W	FLASH=15	SAME POS AS 3	Sequence 3-5 Non-Int in KN-E2-1.5d (02)	737 Secs (737 Secs)	
									[==>]	[2]
	6	F275W-2	(1) KILONOVA	WFC3/UVIS, ACCUM, UVIS2-C512C-SUB	F275W	FLASH=18	POS TARG .099,.106	Sequence 6-8 Non-Int in KN-E2-1.5d (02)	300 Secs (300 Secs)	
									[==>]	[2]
	7	F336W-2	(1) KILONOVA	WFC3/UVIS, ACCUM, UVIS2-C512C-SUB	F336W	FLASH=19	SAME POS AS 6	Sequence 6-8 Non-Int in KN-E2-1.5d (02)	50 Secs (50 Secs)	
									[==>]	[2]
	8	F225W-2	(1) KILONOVA	WFC3/UVIS, ACCUM, UVIS2-C512C-SUB	F225W	FLASH=15	SAME POS AS 6	Sequence 6-8 Non-Int in KN-E2-1.5d (02)	737 Secs (737 Secs)	
									[==>]	[2]



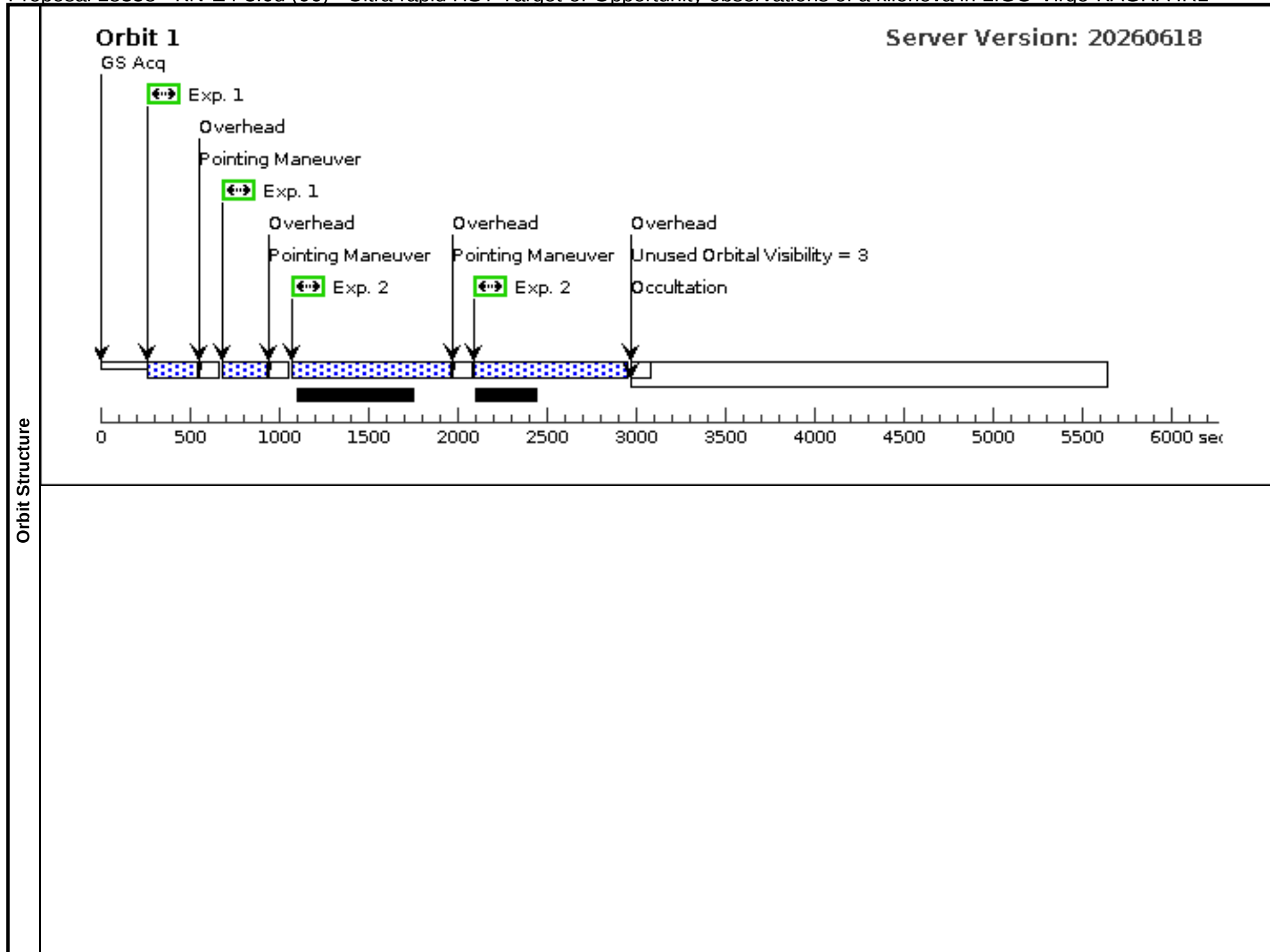
Proposal 18358 - KN-E3-2.0d (03) - Ultra-rapid HST Target-of-Opportunity observations of a kilonova in LIGO-Virgo-KAGRA IR1

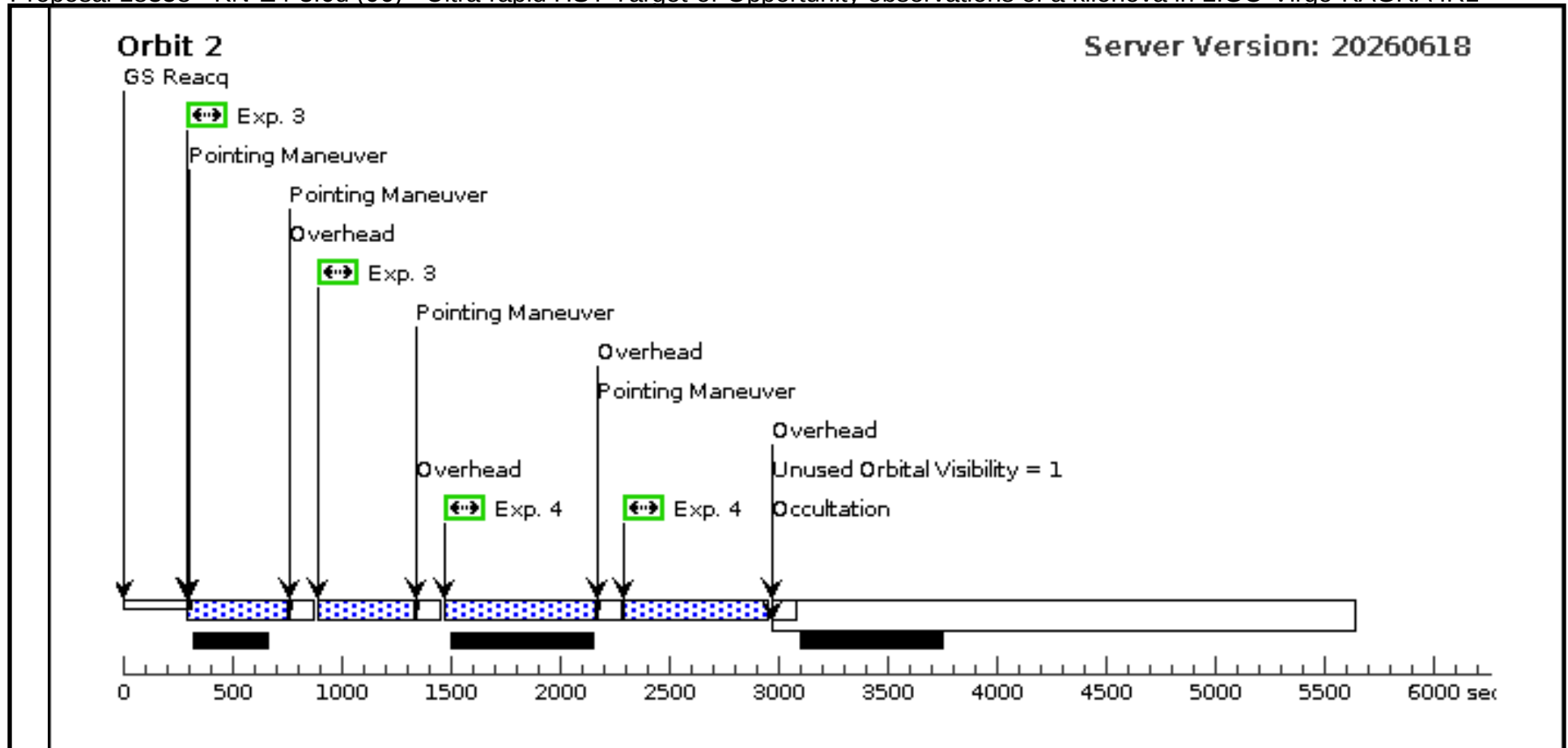
Visit	Proposal 18358, KN-E3-2.0d (03)										Tue Aug 18 19:00:27 GMT 2026	
	Diagnostic Status: No Diagnostics											
	Scientific Instruments: WFC3/UVIS											
	Special Requirements: ON HOLD ; TOO MIN RESPONSE TIME 1.0D; TOO MAX RESPONSE TIME 14.0D											
	Comments: Scenario A, t~3.0 d (2 orbits): WFC3/UVIS F275W/F336W/F438W imaging, per Table 1. The Table 1 t~2 d epoch is absorbed into the cadence between epochs 2 and 3.											
On Hold Comments: On hold until trigger criteria are met; LVK IRI GW event with >=1 neutron star, EM kilonova counterpart with r < 22 mag, and first visit schedulable within 5 days of GW detection.												
Patterns	#	Primary Pattern					Secondary Pattern				Exposures	
	(1)	Pattern Type=WFC3-UVIS-DITHER-LINE Purpose=DITHER Number Of Points=2 Point Spacing=0.149 Line Spacing=			Coordinate Frame=POS-TARG Pattern Orientation=14.04 Angle Between Sides= Center Pattern=false						(1), (2)	
Generic Targets	#	Name	Criteria		Description							
	(1)	KILONOVA			Electromagnetic counterpart (kilonova) to a LIGO-Virgo-KAGRA IR1 SUPERNOVA GW event with at least one neutron star, at a distance consistent with the GW localization, and with r < 22 mag at trigger.							
Exposures	#	Label	Target	Config,Mode,Aperture		Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time (Total)/[Actual Dur.]		Orbit
	1	F336W	(1) KILONOVA	WFC3/UVIS, ACCUM, UVIS2		F336W	FLASH=19		Pattern 1, Exps 1-1 in KN-E3-2.0d (03) (1)	150 Secs (300 Secs)		
										[==>(Pattern 1)]		[1]
										[==>(Pattern 2)]		
	2	F275W	(1) KILONOVA	WFC3/UVIS, ACCUM, UVIS2		F275W	FLASH=19		Pattern 1, Exps 2-2 in KN-E3-2.0d (03) (1)	963 Secs (1926 Secs)		
										[==>(Pattern 1)]		[1]
										[==>(Pattern 2)]		



Proposal 18358 - KN-E4-3.0d (06) - Ultra-rapid HST Target-of-Opportunity observations of a kilonova in LIGO-Virgo-KAGRA IR1

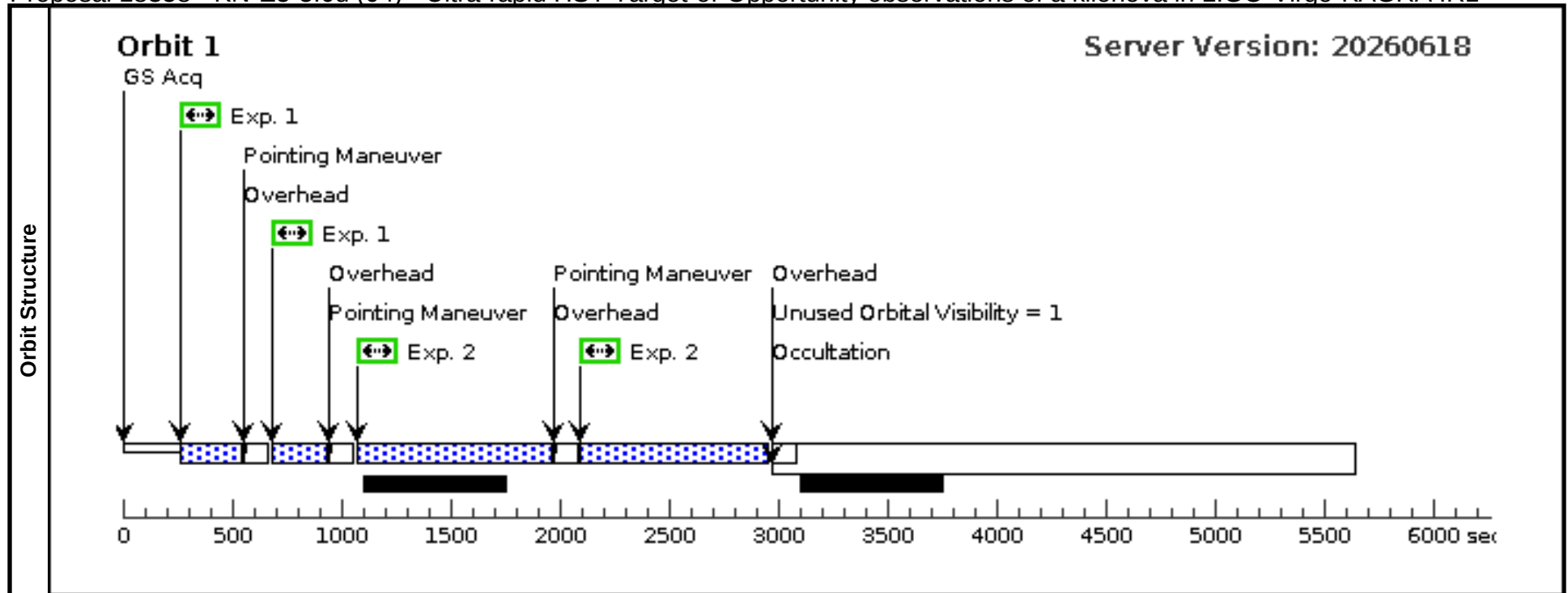
Visit	Proposal 18358, KN-E4-3.0d (06)										Tue Aug 18 19:00:27 GMT 2026	
	Diagnostic Status: No Diagnostics											
	Scientific Instruments: WFC3/UVIS											
	Special Requirements: ON HOLD ; TOO MIN RESPONSE TIME 1.0D; TOO MAX RESPONSE TIME 14.0D											
	Comments: Scenario A, t~3.0 d (2 orbits): WFC3/UVIS F275W/F336W/F438W imaging, per Table 1. The Table 1 t~2 d epoch is absorbed into the cadence between epochs 2 and 3.											
On Hold Comments: On hold until trigger criteria are met: LVK IRI GW event with >=1 neutron star, EM kilonova counterpart with r < 22 mag, and first visit schedulable within 5 days of GW detection.												
Patterns	#	Primary Pattern					Secondary Pattern				Exposures	
	(1)	Pattern Type=WFC3-UVIS-DITHER-LINE Purpose=DITHER Number Of Points=2 Point Spacing=0.149 Line Spacing=			Coordinate Frame=POS-TARG Pattern Orientation=14.04 Angle Between Sides= Center Pattern=false						(1), (2), (3), (4)	
Generic Targets	#	Name		Criteria		Description						
	(1)	KILONOVA				Electromagnetic counterpart (kilonova) to a LIGO-Virgo-KAGRA IR1 SUPERNOVA GW event with at least one neutron star, at a distance consistent with the GW localization, and with r < 22 mag at trigger.						
Exposures	#	Label	Target	Config,Mode,Aperture		Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time (Total)/[Actual Dur.]		Orbit
	1	F438W	(1) KILONOVA	WFC3/UVIS, ACCUM, UVIS2		F438W	FLASH=18		Pattern 1, Exps 1-1 in KN-E4-3.0d (06) (1)	250 Secs (500 Secs)		
										[==>(Pattern 1)]		[1]
										[==>(Pattern 2)]		
	2	F275W	(1) KILONOVA	WFC3/UVIS, ACCUM, UVIS2		F275W	FLASH=19		Pattern 1, Exps 2-2 in KN-E4-3.0d (06) (1)	865 Secs (1730 Secs)		
										[==>(Pattern 1)]		[1]
										[==>(Pattern 2)]		
	3	F336W	(1) KILONOVA	WFC3/UVIS, ACCUM, UVIS2		F336W	FLASH=19		Pattern 1, Exps 3-3 in KN-E4-3.0d (06) (1)	440 Secs (878 Secs)		
									[==>439.0 Secs (Pattern 1)]		[2]	
									[==>439.0 Secs (Pattern 2)]			
4	F275W	(1) KILONOVA	WFC3/UVIS, ACCUM, UVIS2		F275W	FLASH=19		Pattern 1, Exps 4-4 in KN-E4-3.0d (06) (1)	668 Secs (1334 Secs)			
									[==>667.0 Secs (Pattern 1)]		[2]	
									[==>667.0 Secs (Pattern 2)]			





Proposal 18358 - KN-E5-5.0d (04) - Ultra-rapid HST Target-of-Opportunity observations of a kilonova in LIGO-Virgo-KAGRA IR1

Visit	Proposal 18358, KN-E5-5.0d (04)										Tue Aug 18 19:00:27 GMT 2026	
	Diagnostic Status: No Diagnostics											
	Scientific Instruments: WFC3/UVIS											
	Special Requirements: ON HOLD ; TOO MIN RESPONSE TIME 1.0D; TOO MAX RESPONSE TIME 14.0D											
	Comments: Scenario A, t~5.0 d (2 orbits): WFC3/UVIS F336W/F438W imaging. Table 1 allocates 1 orbit here; the second orbit deepens F438W in this simplified 5x2 APT sequence.											
On Hold Comments: On hold until trigger criteria are met; LVK IRI GW event with >=1 neutron star, EM kilonova counterpart with r < 22 mag, and first visit schedulable within 5 days of GW detection.												
Patterns	#	Primary Pattern					Secondary Pattern				Exposures	
	(1)	Pattern Type=WFC3-UVIS-DITHER-LINE Purpose=DITHER Number Of Points=2 Point Spacing=0.149 Line Spacing=			Coordinate Frame=POS-TARG Pattern Orientation=14.04 Angle Between Sides= Center Pattern=false						(1), (2)	
Generic Targets	#	Name	Criteria		Description							
	(1)	KILONOVA			Electromagnetic counterpart (kilonova) to a LIGO-Virgo-KAGRA IR1 SUPERNOVA GW event with at least one neutron star, at a distance consistent with the GW localization, and with r < 22 mag at trigger.							
Exposures	#	Label	Target	Config,Mode,Aperture		Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time (Total)/[Actual Dur.]		Orbit
	1	F438W	(1) KILONOVA	WFC3/UVIS, ACCUM, UVIS2		F438W	FLASH=15		Pattern 1, Exps 1-1 in KN-E5-5.0d (04) (1)	250 Secs (500 Secs)		
										[==>(Pattern 1)]		[1]
										[==>(Pattern 2)]		
	2	F336W	(1) KILONOVA	WFC3/UVIS, ACCUM, UVIS2		F336W	FLASH=17		Pattern 1, Exps 2-2 in KN-E5-5.0d (04) (1)	867 Secs (1734 Secs)		
									[==>(Pattern 1)]		[1]	
									[==>(Pattern 2)]			



Proposal 18358 - KN-E6-8 (05) - Ultra-rapid HST Target-of-Opportunity observations of a kilonova in LIGO-Virgo-KAGRA IR1

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Visit	Proposal 18358, KN-E6-8 (05)										Tue Aug 18 19:00:27 GMT 2026	
	Diagnostic Status: No Diagnostics											
	Scientific Instruments: WFC3/UVIS											
	Special Requirements: ON HOLD ; TOO MIN RESPONSE TIME 1.0D; TOO MAX RESPONSE TIME 14.0D											
	Comments: Scenario A, t~8-12 d (2 orbits): WFC3/UVIS F438W imaging combining the Table 1 t~8 d and t~12 d epochs.											
On Hold Comments: On hold until trigger criteria are met: LVK IR1 GW event with >=1 neutron star, EM kilonova counterpart with r < 22 mag, and first visit schedulable within 5 days of GW detection.												
Patterns	#	Primary Pattern					Secondary Pattern			Exposures		
	(1)	Pattern Type=WFC3-UVIS-DITHER-LINE Coordinate Frame=POS-TARG Pattern Orientation=14.04 Purpose=DITHER Angle Between Sides= Number Of Points=2 Center Pattern=false Point Spacing=0.149 Line Spacing=								(1)		
Generic Targets	#	Name		Criteria		Description						
	(1)	KILONOVA				Electromagnetic counterpart (kilonova) to a LIGO-Virgo-KAGRA IR1 SUPERNOVA GW event with at least one neutron star, at a distance consistent with the GW localization, and with r < 22 mag at trigger.						
Exposures	#	Label	Target	Config,Mode,Aperture		Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time (Total)/[Actual Dur.]		Orbit
	1	F438W	(1) KILONOVA	WFC3/UVIS, ACCUM, UVIS2		F438W	FLASH=10		Pattern 1, Exps 1-1 in KN-E6-8 (05) (1)	1100 Secs (2456 Secs) [=>1228.0 Secs (Pattern 1)] [=>1228.0 Secs (Pattern 2)]		[1]
Orbit Structure	Orbit 1											
	Server Version: 20260618											

Proposal 18358 - KN-E7-12 (07) - Ultra-rapid HST Target-of-Opportunity observations of a kilonova in LIGO-Virgo-KAGRA IR1

Tue Aug 18 19:00:27 GMT 2026

Visit	Proposal 18358, KN-E7-12 (07) Diagnostic Status: No Diagnostics Scientific Instruments: WFC3/UVIS Special Requirements: ON HOLD ; TOO MIN RESPONSE TIME 1.0D; TOO MAX RESPONSE TIME 14.0D Comments: Scenario A, $t \sim 8-12$ d (2 orbits): WFC3/UVIS F438W imaging combining the Table 1 $t \sim 8$ d and $t \sim 12$ d epochs. On Hold Comments: On hold until trigger criteria are met: LVK IRI GW event with ≥ 1 neutron star, EM kilonova counterpart with $r < 22$ mag, and first visit schedulable within 5 days of GW detection.									
Patterns	#	Primary Pattern				Secondary Pattern				Exposures
	(1)	Pattern Type=WFC3-UVIS-DITHER-LINE Coordinate Frame=POS-TARG Pattern Orientation=14.04 Purpose=DITHER Angle Between Sides= Number Of Points=2 Center Pattern=false Point Spacing=0.149 Line Spacing=								(1)
Generic Targets	#	Name	Criteria			Description				
	(1)	KILONOVA				Electromagnetic counterpart (kilonova) to a LIGO-Virgo-KAGRA IR1 SUPERNOVA GW event with at least one neutron star, at a distance consistent with the GW localization, and with $r < 22$ mag at trigger.				
Exposures	#	Label	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time (Total)/[Actual Dur.]	Orbit
	1	F438W	(1) KILONOVA	WFC3/UVIS, ACCUM, UVIS2	F438W	FLASH=10		Pattern 1, Exps 1-1 in KN-E7-12 (07) (1)	1100 Secs (2456 Secs) [= > 1228.0 Secs (Pattern 1)] [= > 1228.0 Secs (Pattern 2)]	[1]
Orbit Structure	Orbit 1									
	Server Version: 20260618 									