



15886 - 1000 Days of GW170817: A Deep Multi-Band View of the First Neutron Star Merger with HST

Cycle: 27, 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) GW170817	WFC3/IR	4	22-Dec-2020 08:00:54.0	yes
02	(1) GW170817	WFC3/IR	3	22-Dec-2020 08:00:56.0	yes
03	(1) GW170817	WFC3/IR	3	22-Dec-2020 08:00:57.0	yes
04	(1) GW170817	WFC3/UVIS	3	22-Dec-2020 08:00:58.0	yes

13 Total Orbits Used

ABSTRACT

The joint detection of gravitational waves and light from the binary neutron star merger GW170817 has ushered in a new era of discovery. HST has played a pivotal role in characterizing the optical and near-infrared (NIR) evolution of GW170817, with reported detections of the kilonova and afterglow spanning ~ 10 -350 days post-merger. In particular, at >100 days, the afterglow brightness is extremely faint at >26 mag; thus all detections or constraining upper limits at late times were enabled by HST. One major complication in measuring accurate photometry of the faint optical and NIR afterglow is contaminating light from the host galaxy, which has complex morphological structure. The only way to properly address this issue is by re-visiting the field after the afterglow has faded to obtain deep multi-band template images, against which we can subtract earlier epochs. Motivated by a case study in one of the optical filters, here we propose 13 orbits of HST/WFC3 imaging to obtain late-time template images in four filters, comprising all filters which have HST imaging beyond ~ 100 days and for which no adequate template images exist. These images will enable reliable and uniform photometry of the optical/NIR afterglow to GW170817 for the first time. In conjunction with ongoing radio and X-ray campaigns by the community, this will allow accurate inferred properties of relativistic outflows from the merger, and the deepest limits on a star cluster at the merger position, strongly constraining the binary progenitor's formation. Given the high-impact nature of GW170817, we waive all proprietary rights associated with data from this proposal.

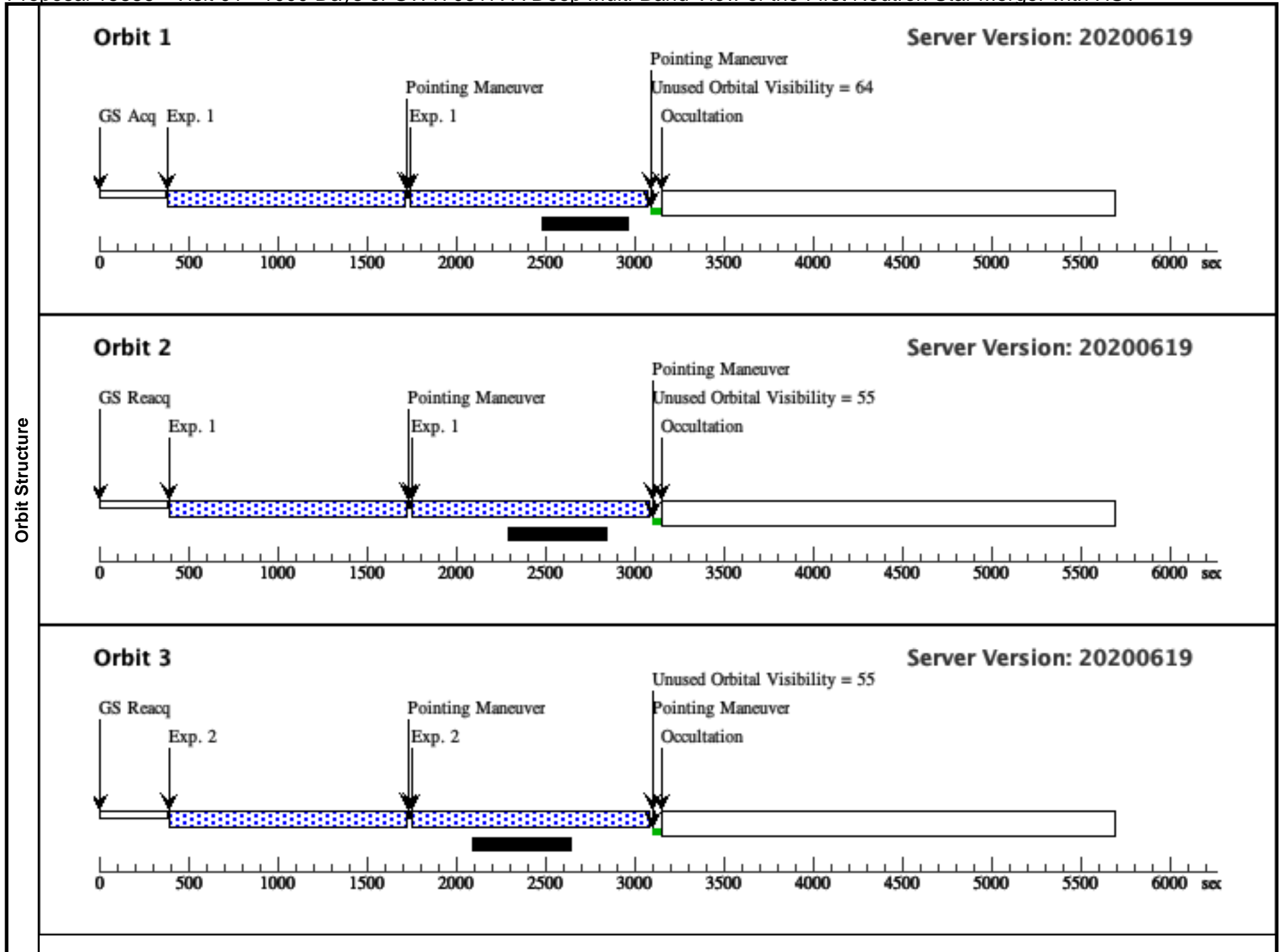
OBSERVING DESCRIPTION

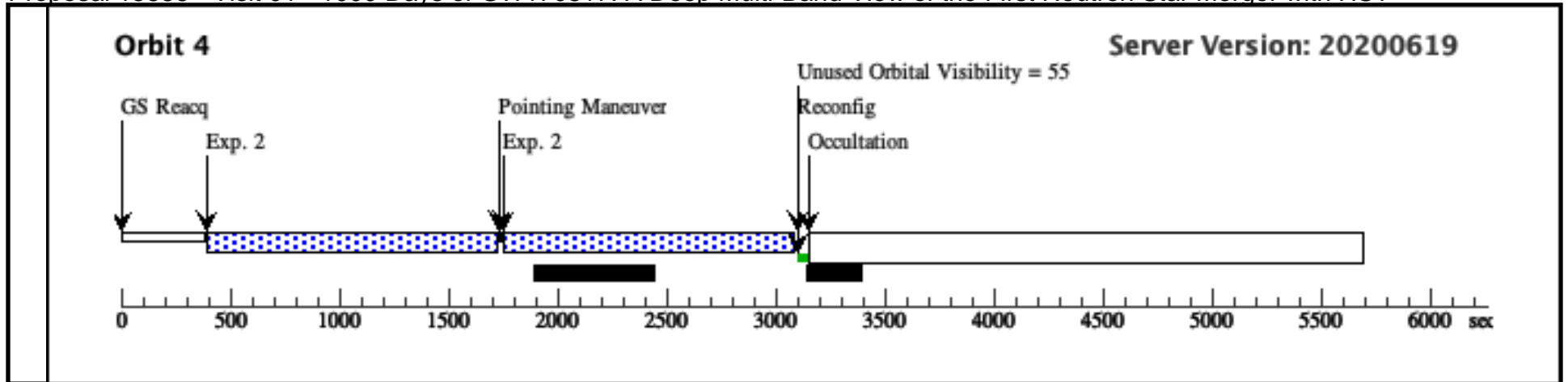
This proposal is for multi-wavelength observations of the optical counterpart of GW170817 with UVIS/F814W (3 orbits), WFC3/F110W (4 orbits), WFC3/F140W (3 orbits), and WFC3/F160W (3 orbits). These observations are for a template observation of the afterglow of GW170817 and the visits may occur at any point during the cycle. These filters and apertures have been purposely chosen to match those of previous observations of this source. We note that GW170817 is a point source on the outskirts of NGC4993, a bright S0 galaxy, and that the expected brightness of GW170817 is >28 mag.

Proposal 15886 - Visit 01 - 1000 Days of GW170817: A Deep Multi-Band View of the First Neutron Star Merger with HST

Tue Dec 22 13:00:58 GMT 2020

Visit	Proposal 15886, Visit 01 Diagnostic Status: No Diagnostics Scientific Instruments: WFC3/IR Special Requirements: ORIENT 345D TO 76 D; ORIENT 84D TO 164 D; ORIENT 174D TO 248 D; ORIENT 274D TO 326 D <i>Comments: 4-orbit observation with IR/F110W. We restrict the ORIENT ranges to avoid a bright star positioned at the edge of the chip (which has previously caused contamination in other observations).</i>									
	Patterns	#	Primary Pattern			Secondary Pattern			Exposures	
		(1)	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=false					(1), (2)	
Fixed Targets	#	Name	Target Coordinates	Targ. Coord. Corrections	Fluxes	Miscellaneous				
	(1)	GW170817	RA: 13 09 48.0900 (197.4503750d) Dec: -23 22 53.35 (-23.38149d) Equinox: J2000		V=27	Reference Frame: SIMBAD				
	<i>Comments: Category=EXT-STAR Description=[GAMMA RAY BURSTER] Extended=NO</i>									
Exposures	#	Label	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time (Total)/[Actual Dur.]	Orbit
	1	(1) GW170817	WFC3/IR, MULTIACCUM, IR	F110W	NSAMP=14; SAMP-SEQ=SPAR S100			Pattern 1, Exps 1-1 in Visit 01 (1)	1302.93649 Secs (5211.746 Secs)	
									[==>(Pattern 1)]	[1]
									[==>(Pattern 2)]	
									[==>(Pattern 3)]	[2]
								[==>(Pattern 4)]		
2	(1) GW170817	WFC3/IR, MULTIACCUM, IR	F110W	NSAMP=14; SAMP-SEQ=SPAR S100	POS TARG 0.68,0.61			Pattern 1, Exps 2-2 in Visit 01 (1)	1302.93649 Secs (5211.746 Secs)	
								[==>(Pattern 1)]	[3]	
								[==>(Pattern 2)]		
								[==>(Pattern 3)]	[4]	
								[==>(Pattern 4)]		

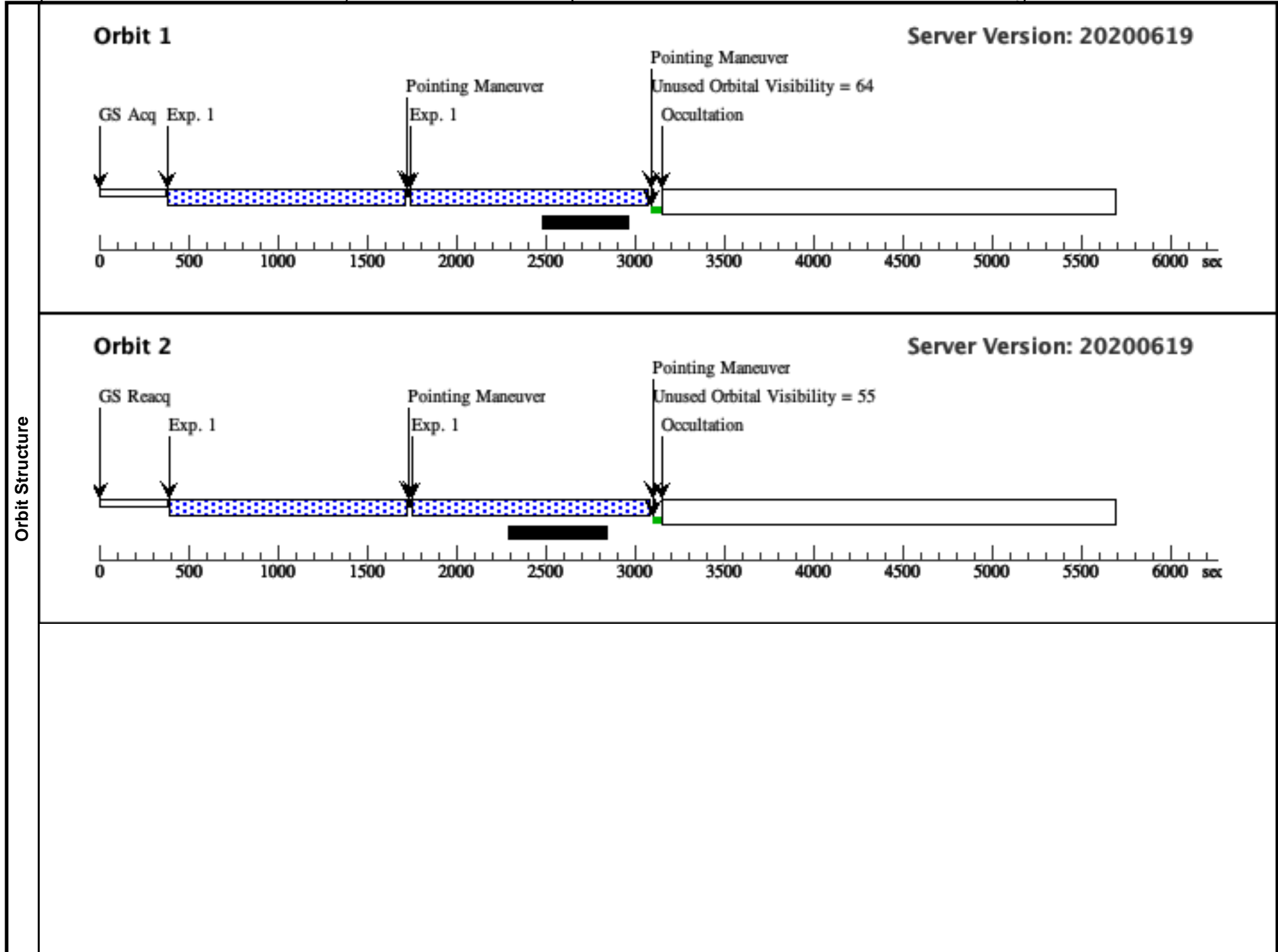


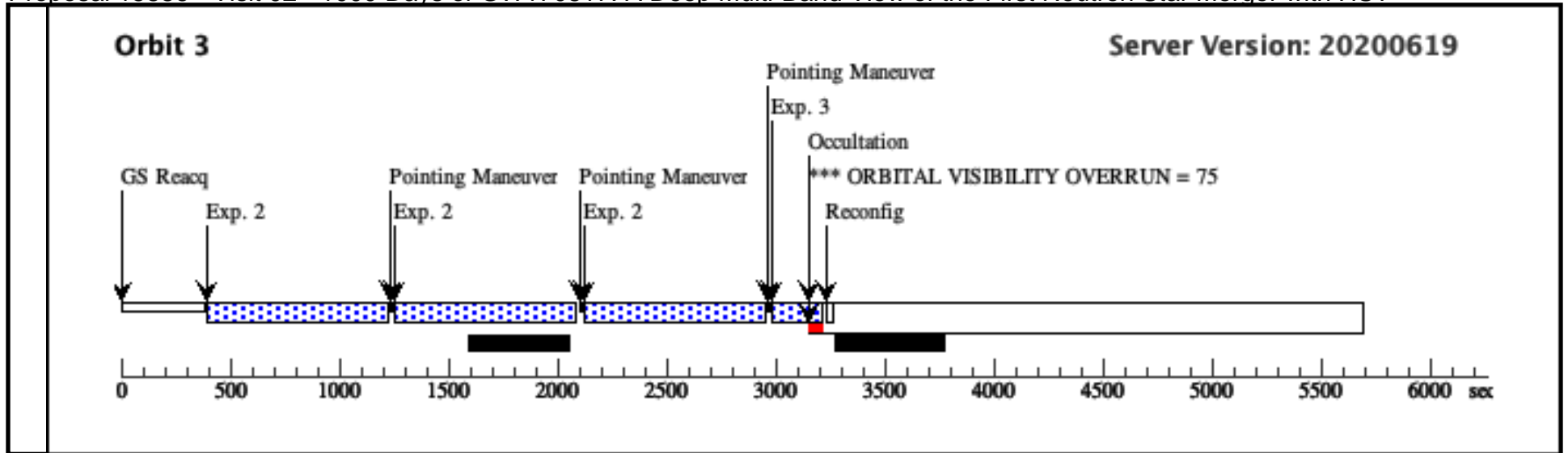


Proposal 15886 - Visit 02 - 1000 Days of GW170817: A Deep Multi-Band View of the First Neutron Star Merger with HST

Tue Dec 22 13:00:59 GMT 2020

Visit	Proposal 15886, Visit 02 Diagnostic Status: Warning Scientific Instruments: WFC3/IR Special Requirements: ORIENT 345D TO 76 D; ORIENT 84D TO 164 D; ORIENT 174D TO 248 D; ORIENT 274D TO 326 D <i>Comments: 3-orbit observation with IR/F140W. We restrict the ORIENT ranges to avoid a bright star positioned at the edge of the chip (which has previously caused contamination in other observations).</i> <i>We employ a small POS-TARG offset between dither patterns. We add a small exposure at the end of the visit to fill out the orbit.</i>									
	Diagnosics (Visit 02) Warning (Orbit Planner): ORBITAL VISIBILITY OVERRUN									
Patterns	#	Primary Pattern				Secondary Pattern			Exposures	
	(1)	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=false				(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				
	(1)	GW170817	RA: 13 09 48.0900 (197.4503750d) Dec: -23 22 53.35 (-23.38149d) Equinox: J2000		V=27	Reference Frame: SIMBAD				
<i>Comments:</i> Category=EXT-STAR Description=[GAMMA RAY BURSTER] Extended=NO										
Exposures	#	Label	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time (Total)/[Actual Dur.]	Orbit
	1	(1) GW170817	WFC3/IR, MULTIACCUM, IR	F140W	NSAMP=14; SAMP-SEQ=SPAR S100	POS TARG 0.67,0.2	Pattern 1, Exps 1-1 in Visit 02 (1)	1302.93649 Secs (5211.746 Secs)	[1]	
								[==>(Pattern 1)]		
								[==>(Pattern 2)]	[2]	
2	(1) GW170817	WFC3/IR, MULTIACCUM, IR	F140W	NSAMP=9; SAMP-SEQ=SPAR S100	POS TARG 0.68,0.6 ¹	Pattern 2, Exps 2-2 in Visit 02 (2)	802.934875 Secs (2408.805 Secs)	[3]		
							[==>(Pattern 1)]			
							[==>(Pattern 2)]			
							[==>(Pattern 3)]			
3	(1) GW170817	WFC3/IR, MULTIACCUM, IR	F140W	NSAMP=9; SAMP-SEQ=SPAR S25	POS TARG 0.68,0.6 ¹		202.936411 Secs (202.936 Secs)	[3]		
							[==>]			

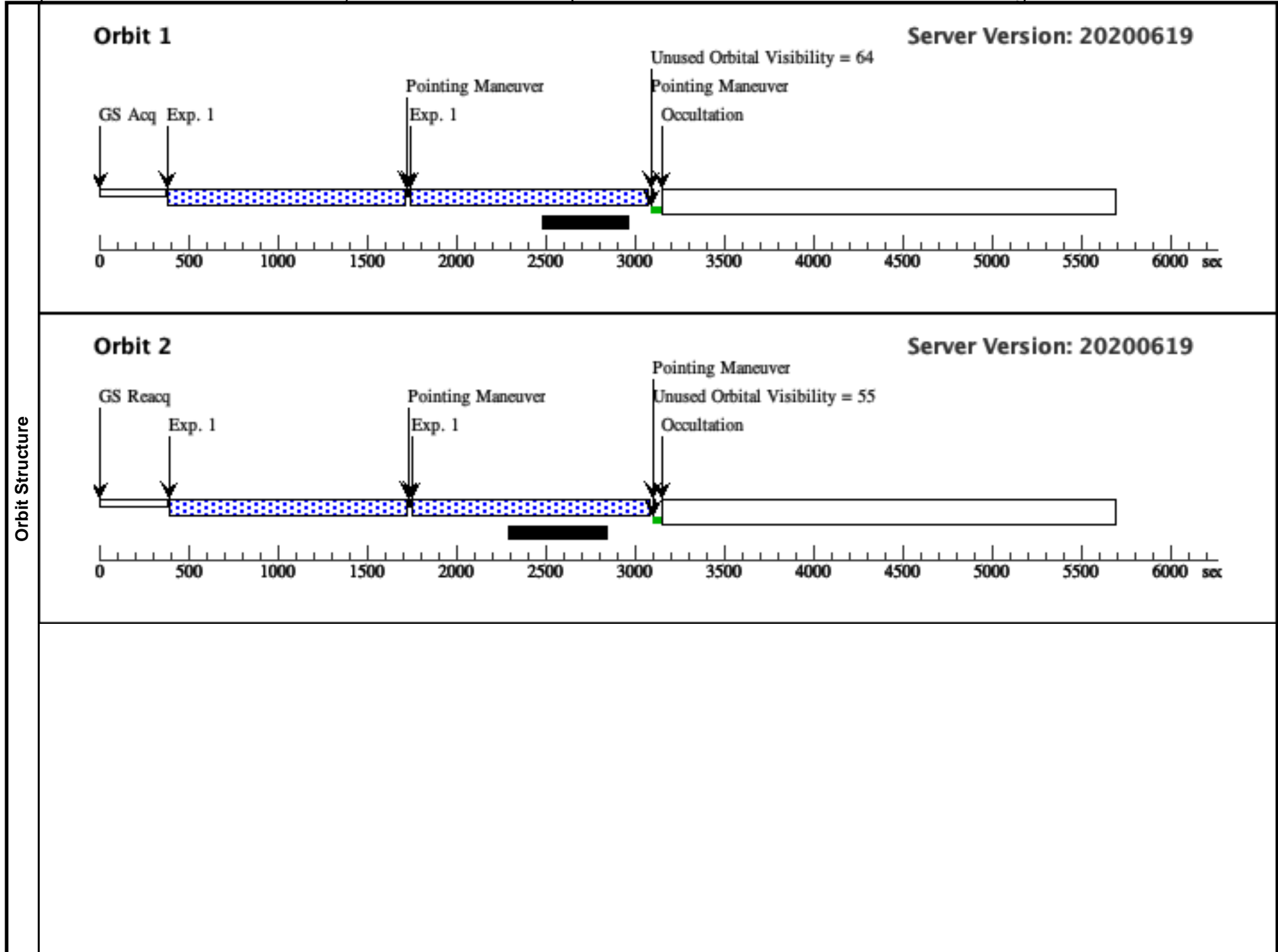


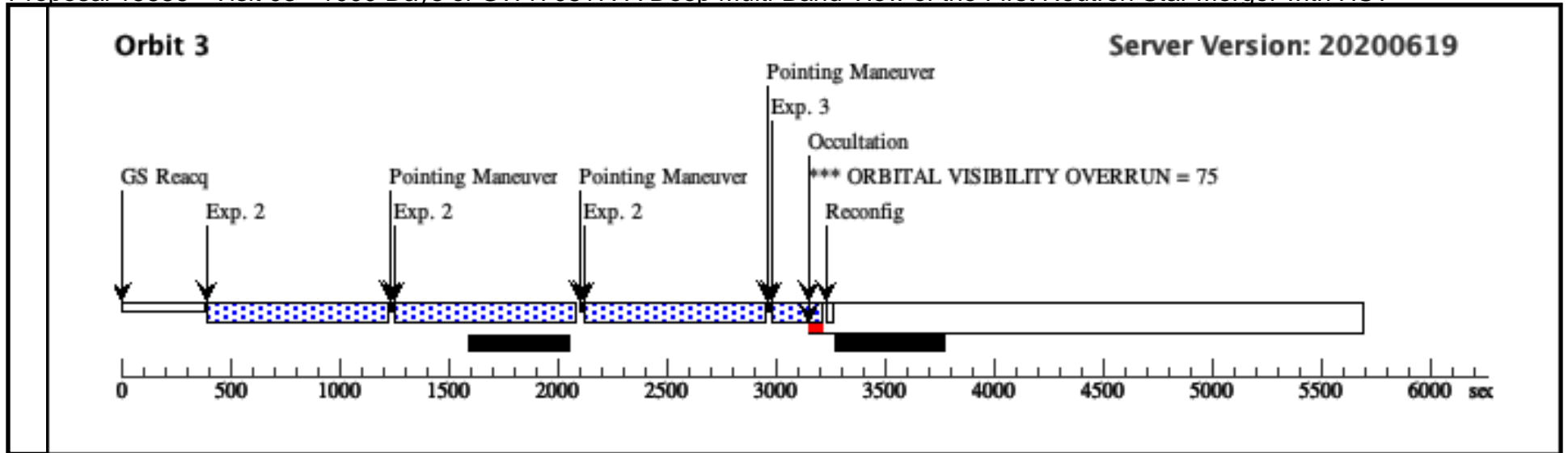


Proposal 15886 - Visit 03 - 1000 Days of GW170817: A Deep Multi-Band View of the First Neutron Star Merger with HST

Tue Dec 22 13:00:59 GMT 2020

Visit	Proposal 15886, Visit 03 Diagnostic Status: Warning Scientific Instruments: WFC3/IR Special Requirements: ORIENT 345D TO 76 D; ORIENT 84D TO 164 D; ORIENT 174D TO 248 D; ORIENT 274D TO 326 D <i>Comments: 3-orbit observation with IR/F160W. We restrict the ORIENT ranges to avoid a bright star positioned at the edge of the chip (which has previously caused contamination in other observations).</i> <i>We employ a small POS-TARG offset between dither patterns. We add a small exposure at the end of the visit to fill out the orbit.</i>									
	Diagnosics (Visit 03) Warning (Orbit Planner): ORBITAL VISIBILITY OVERRUN									
Patterns	#	Primary Pattern	Secondary Pattern	Exposures						
	(1)	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=false		(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				
	(1)	GW170817	RA: 13 09 48.0900 (197.4503750d) Dec: -23 22 53.35 (-23.38149d) Equinox: J2000		V=27	Reference Frame: SIMBAD				
<i>Comments:</i> Category=EXT-STAR Description=[GAMMA RAY BURSTER] Extended=NO										
Exposures	#	Label	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time (Total)/[Actual Dur.]	Orbit
	1	(1) GW170817	WFC3/IR, MULTIACCUM, IR	F160W	NSAMP=14; SAMP-SEQ=SPAR S100			Pattern 1, Exps 1-1 in Visit 03 (1)	1302.93649 Secs (5211.746 Secs)	
									[==>(Pattern 1)]	[1]
									[==>(Pattern 2)]	[2]
2	(1) GW170817	WFC3/IR, MULTIACCUM, IR	F160W	NSAMP=9; SAMP-SEQ=SPAR S100		POS TARG 0.68,0.6 1		Pattern 2, Exps 2-2 in Visit 03 (2)	802.934875 Secs (2408.805 Secs)	
									[==>(Pattern 1)]	[3]
									[==>(Pattern 2)]	
									[==>(Pattern 3)]	
3	(1) GW170817	WFC3/IR, MULTIACCUM, IR	F160W	NSAMP=9; SAMP-SEQ=SPAR S25		POS TARG 0.68,0.6 1			202.936411 Secs (202.936 Secs)	
									[==>]	[3]





Proposal 15886 - Visit 04 - 1000 Days of GW170817: A Deep Multi-Band View of the First Neutron Star Merger with HST

Tue Dec 22 13:00:59 GMT 2020

Visit	Proposal 15886, Visit 04 Diagnostic Status: Warning Scientific Instruments: WFC3/UVIS Special Requirements: ORIENT 338D TO 81 D; ORIENT 150D TO 265 D; ORIENT 287D TO 318 D <i>Comments: 3-orbit observation with UVIS/F814W. We restrict the ORIENT ranges to avoid a bright star positioned at the edge of the chip (which has previously caused contamination in other observations).</i>									
	Diagnosics (Visit 04) Warning (Orbit Planner): ORBITAL VISIBILITY OVERRUN (Visit 04) Warning (Orbit Planner): ORBITAL VISIBILITY OVERRUN (Visit 04) Warning (Orbit Planner): ORBITAL VISIBILITY OVERRUN									
Patterns	#	Primary Pattern	Secondary Pattern		Exposures					
	(3)	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)					
(4)	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		(2)						
Fixed Targets	#	Name	Target Coordinates	Targ. Coord. Corrections	Fluxes	Miscellaneous				
	(1)	GW170817	RA: 13 09 48.0900 (197.4503750d) Dec: -23 22 53.35 (-23.38149d) Equinox: J2000		V=27	Reference Frame: SIMBAD				
<i>Comments:</i> Category=EXT-STAR Description=[GAMMA RAY BURSTER] Extended=NO										
Exposures	#	Label	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time (Total)/[Actual Dur.]	Orbit
	1	(1) GW170817		WFC3/UVIS, ACCUM, UVIS2	F814W			Pattern 3, Exps 1-1 in Visit 04 (3)	1340 Secs (5360 Secs)	
									[==>(Pattern 1)]	[1]
									[==>(Pattern 2)]	
									[==>(Pattern 3)]	[2]
									[==>(Pattern 4)]	
2	(1) GW170817		WFC3/UVIS, ACCUM, UVIS2	F814W		POS TARG 0.68,0.2		Pattern 4, Exps 2-2 in Visit 04 (4)	860 Secs (2580 Secs)	
									[==>(Pattern 1)]	
									[==>(Pattern 2)]	[3]
									[==>(Pattern 3)]	

