15482 - Unveiling the nature of GW170817 through late-time observations: A normal short GRB viewed off-axis or a unique event?

Cycle: 25, Proposal Category: GO

(Availability Mode: SUPPORTED)

INVESTIGATORS

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VISITS

Visit	*Targets used in Visit*	*Configurations used in Visit*	*Orbits Used*	*Last Orbit Planner Run*	*OP Current with Visit?*
1A	(1) GW170817	WFC3/UVIS	2	17-May-2018 16:02:32.0	yes
1B	(1) GW170817	WFC3/UVIS	3	17-May-2018 16:02:33.0	yes
2A	(1) GW170817	WFC3/UVIS	2	17-May-2018 16:02:34.0	yes

Visit	*Targets used in Visit*	*Configurations used in Visit*	*Orbits Used*	*Last Orbit Planner Run*	*OP Current with Visit?*
2B	(1) GW170817	WFC3/UVIS	3	17-May-2018 16:02:35.0	yes

10 Total Orbits Used

ABSTRACT

The first multi-messenger gravitational wave event, GW170817, continues to intrigue long after the fading of the fabled kilonova. The source is now detectable as a gamma-ray burst (GRB) afterglow, emitting synchrotron radiation across a wide range of electromagnetic frequencies. The continued, long rise of the afterglow thus far has shown the canonical beamed jet model, often used to interpret cosmological GRBs, is not correct for this event. Currently, competing models are able to reproduce the observed afterglow - these include the 'cocoon' and 'structured-jet' models. Distinguishing between these scenarios is vital to understanding the intrinsically subluminous GRB that accompanied GW170817, by either reconciling it with cosmological short GRBs (due to it being viewed off-axis), or confirming an entirely new means of gamma-ray production for this event. The coming months represent a crucial period of evolution for the afterglow light curve, where we have predicted it will peak and begin to decay. Observing the time of peak and the steepness of the decay are a means to directly distinguish between the competing models. Our proposed cadenced deep mid-cycle observations will provide the necessary coverage over this opportune epoch and will answer one of the outstanding mysteries of this unique event: the nature of the emission mechanism responsible for the GRB and afterglow. These results will shape future theoretical and observational effort in the new field of multi-messenger GW astrophysics.

OBSERVING DESCRIPTION

This proposal will perform 2 deep observations of GW170817 at very late times to constrain its optical flux and investigate the associated GRB afterglow emission mechanism.

Deep multi-orbit WFC3/UVIS imaging will be performed in the F606W filter utilising dithers. The strategy differs slightly from phase I in that we will perform 2 epochs of observations for 5 orbits each. We favour less epochs and better depth compared to phase I, owing to the increased fading of the source since proposal submission. Each observation will be split into 2+3 orbit visits. The 2-orbit visits have a window of 1 week and the subsequent associated 3-orbit visit can be performed anytime within several days afterward, to aid scheduability.

Note CTE aperture will be used owing to the desire to cover the whole galaxy, and the fact that the object is in a region of reasonable background brightness.

The WFC3-UVIS-MOS-DITH-LINE dither pattern has been used with adjusted point spacing to create a 6-point dither pattern since psf sampling, rather than chip gap coverage is desired.

Observation 1 (to be scheduled around start of July)

Visit 1A: 2 orbits - F606W - 4 point box dither spread over visit, 2 exposures per orbit
Visit 1B: 3 orbits - F606W - 6 point dither (3 line x 2 point) spread over visit, 2 exposures per orbit

Observation 2 (to be scheduled around middle of August)

Visit 2A: 2 orbits - F606W - 4 point box dither spread over visit, 2 exposures per orbit
Visit 2B: 3 orbits - F606W - 6 point dither (3 line x 2 point) spread over visit, 2 exposures per orbit

Visit

Proposal 15482, Visit 1A Thu May 17 20:02:36 GMT 2018

Diagnostic Status: No Diagnostics

Scientific Instruments: WFC3/UVIS

Special Requirements: BETWEEN 08-JUL-2018:00:00:00 AND 15-JUL-2018:00:00:00

Patterns

#	Primary Pattern		Secondary Pattern	Exposures
(1)	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)

Fixed Targets

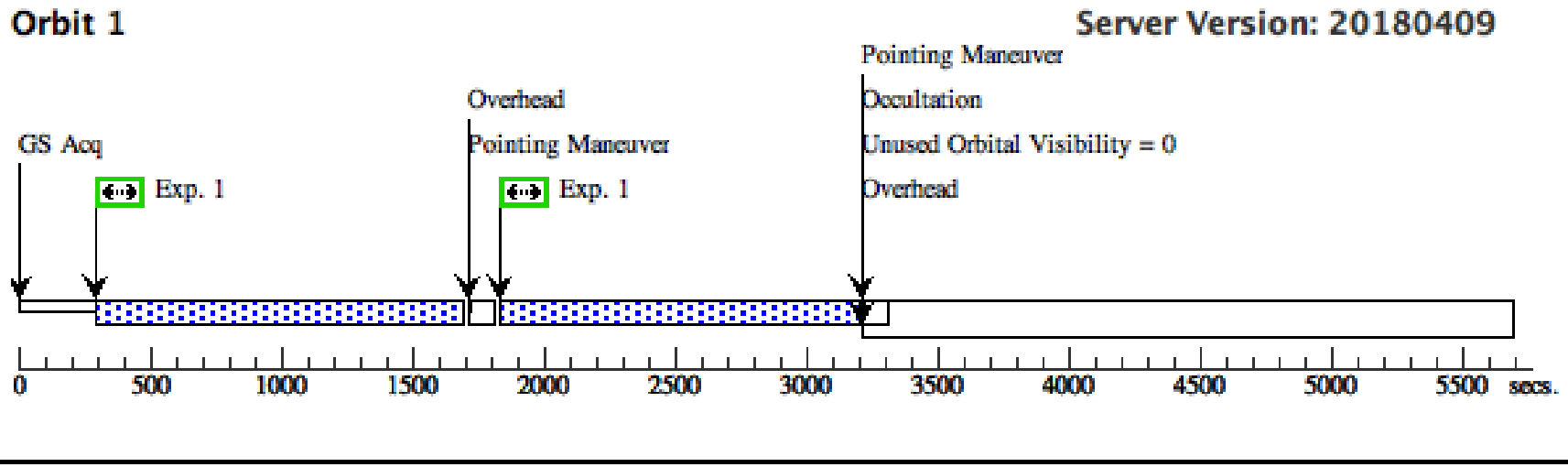
#	Name	Target Coordinates	Targ. Coord. Corrections	Fluxes	Miscellaneous
(1)	GW170817	RA: 13 09 48.0800 (197.4503333d) Dec: -23 22 53.20 (-23.38144d) Equinox: J2000		V=26.4+/-0.1	Reference Frame: ICRS

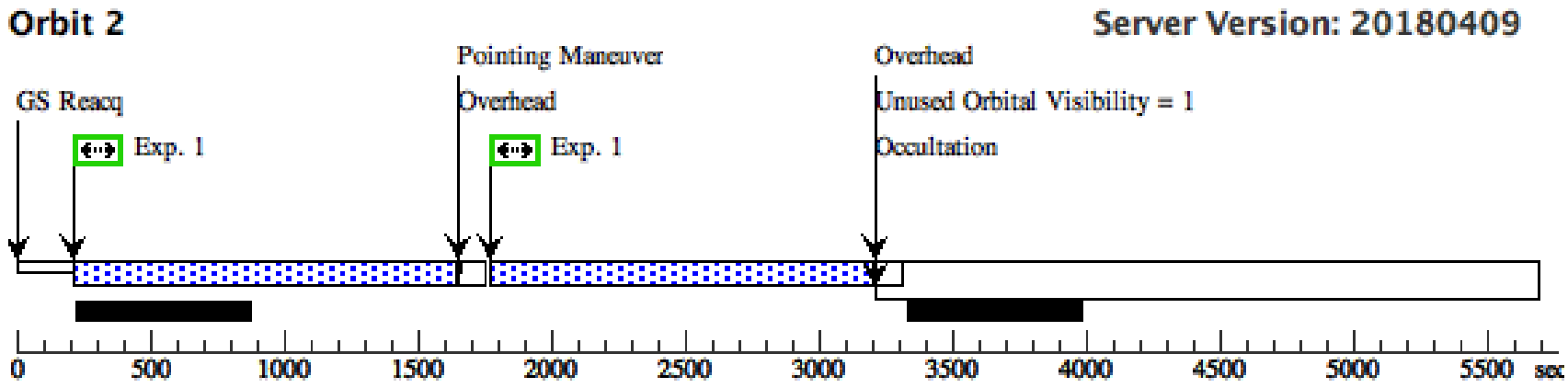
Comments: Actual flux at time of observations not known, is likely to be fading and will be somewhere 26.5-27 in V.
Category=GALAXY
Description=[UNDESIGNATED]

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	F606W			Pattern 1, Exps 1-1 in Visit 1A (1)	600 Secs (5606 Secs)	
								[==>1374.0 Secs (Pattern 1)] *[==>1374.0 Secs (Pattern 2)]*	***[1]***
								[==>1429.0 Secs (Pattern 3)] *[==>1429.0 Secs (Pattern 4)]*	***[2]***

Orbit Structure





Visit

Proposal 15482, Visit 1B Thu May 17 20:02:36 GMT 2018

Diagnostic Status: No Diagnostics

Scientific Instruments: WFC3/UVIS

Special Requirements: SAME ORIENT AS 1A; AFTER 1A BY 0 Orbits TO 4 D

Patterns

#	Primary Pattern		Secondary Pattern		Exposures
(3)	Pattern Type=WFC3-UVIS-MOS-DITH-LINE Purpose=DITHER Number Of Points=3 Point Spacing=0.135 Line Spacing=	Coordinate Frame=POS-TARG Pattern Orientation=85.754 Angle Between Sides= Center Pattern=true	Pattern Type=WFC3-UVIS-MOS-DITH-LINE Purpose=DITHER Number Of Points=2 Point Spacing=0.119 Line Spacing=	Coordinate Frame=POS-TARG Pattern Orientation=33.606 Angle Between Sides= Center Pattern=false	(1)

Fixed Targets

#	Name	Target Coordinates	Targ. Coord. Corrections	Fluxes	Miscellaneous
(1)	GW170817	RA: 13 09 48.0800 (197.4503333d) Dec: -23 22 53.20 (-23.38144d) Equinox: J2000		V=26.4+/-0.1	Reference Frame: ICRS

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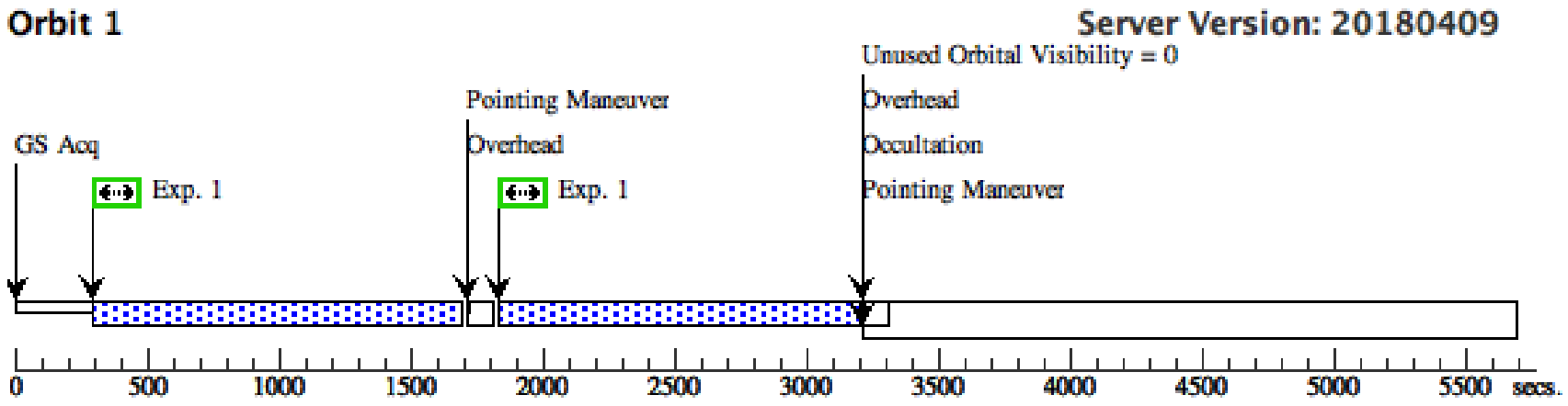
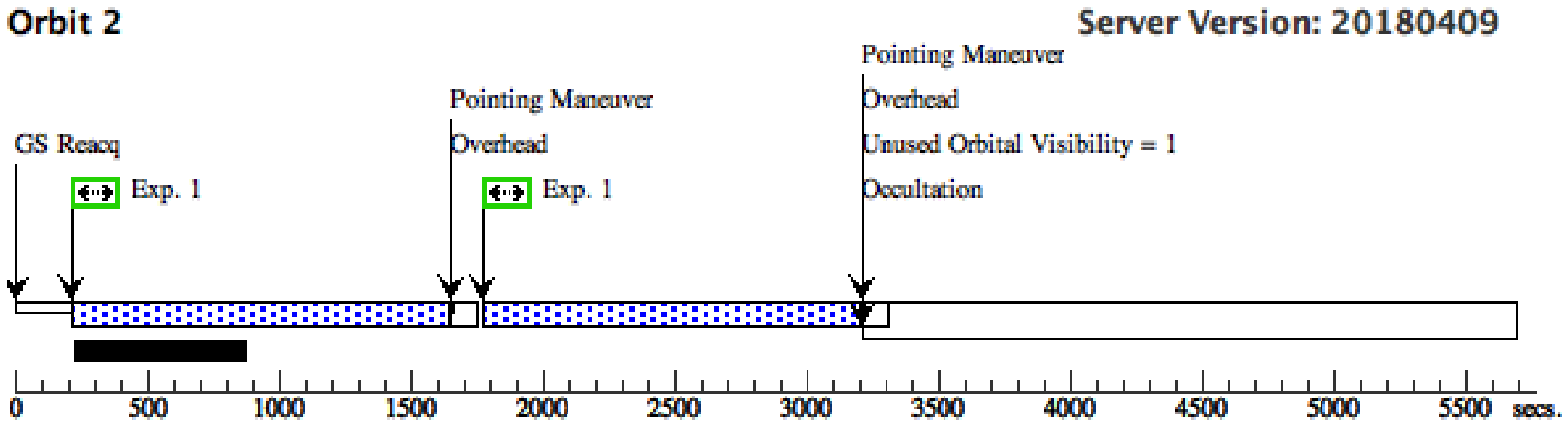
Description=[UNDESIGNATED]

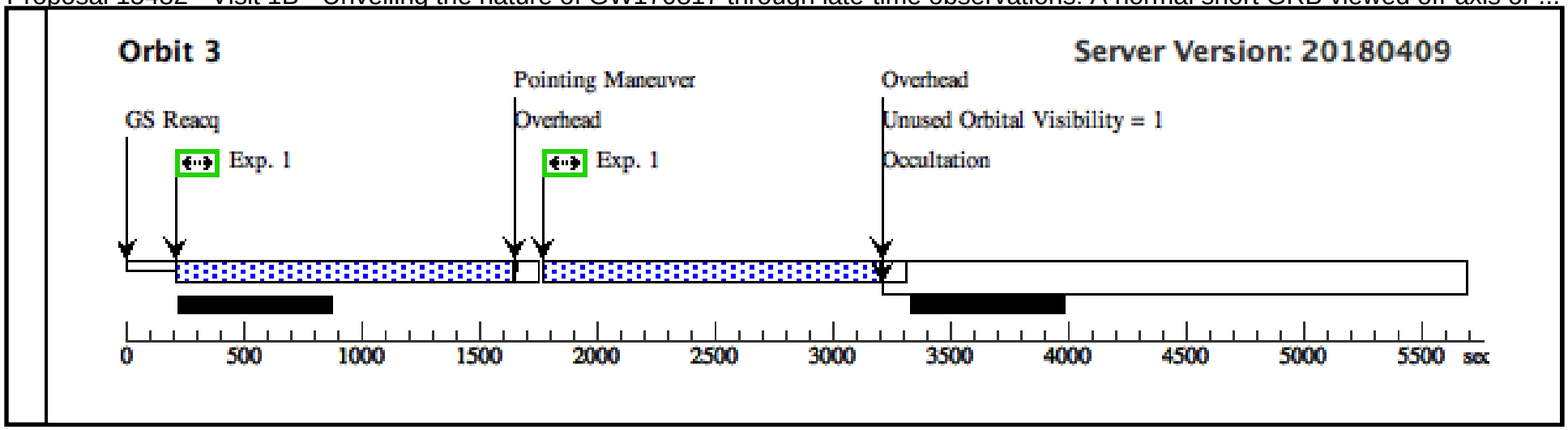
Exposures

#	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	F606W			Pattern 3, Exps 1-1 in Visit 1B (3)	600 Secs (8464 Secs)	
								[==>1374.0 Secs (Pattern 1,1)] *[==>1374.0 Secs (Pattern 1,2)]*	***[1]***
								[==>1429.0 Secs (Pattern 2,1)] *[==>1429.0 Secs (Pattern 2,2)]*	***[2]***
								[==>1429.0 Secs (Pattern 3,1)] *[==>1429.0 Secs (Pattern 3,2)]*	***[3]***

Orbit Structure






Orbit 3
Server Version: 20180409
GS Reacq
Exp. 1
Pointing Maneuver
Overhead
Exp. 1
Overhead
Unused Orbital Visibility = 1
Occultation
0
500
1000
1500
2000
2500
3000
3500
4000
4500
5000
5500
sec

Visit

Proposal 15482, Visit 2A Thu May 17 20:02:36 GMT 2018

Diagnostic Status: No Diagnostics

Scientific Instruments: WFC3/UVIS

Special Requirements: BETWEEN 14-AUG-2018:00:00:00 AND 21-AUG-2018:00:00:00

Patterns

#	Primary Pattern		Secondary Pattern	Exposures
(1)	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)

Fixed Targets

#	Name	Target Coordinates	Targ. Coord. Corrections	Fluxes	Miscellaneous
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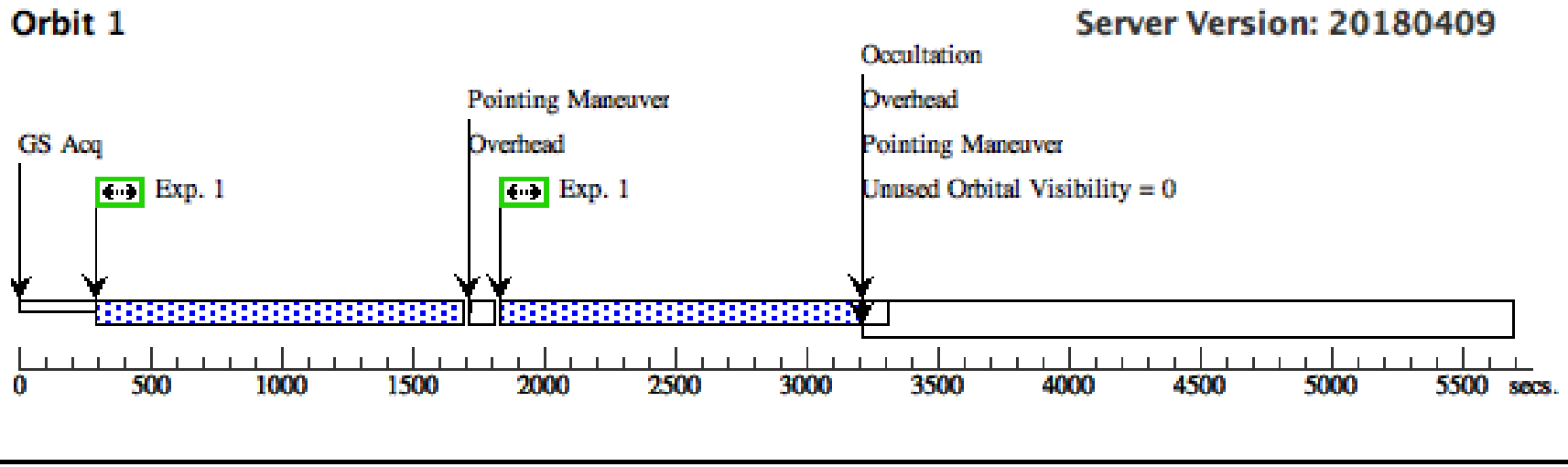
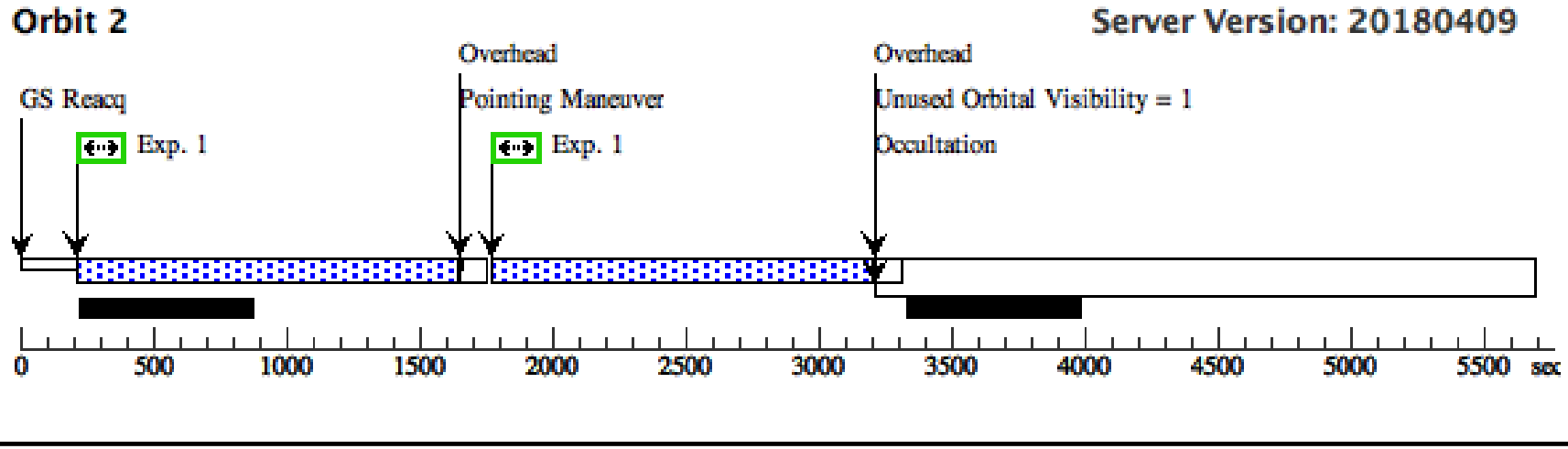
Exposures

#	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	F606W			Pattern 1, Exps 1-1 in Visit 2A (1)	600 Secs (5606 Secs)	
								[==>1374.0 Secs (Pattern 1)] *[==>1374.0 Secs (Pattern 2)]*	***[1]***
								[==>1429.0 Secs (Pattern 3)] *[==>1429.0 Secs (Pattern 4)]*	***[2]***

Orbit Structure





Visit

Proposal 15482, Visit 2B Thu May 17 20:02:36 GMT 2018

Diagnostic Status: No Diagnostics

Scientific Instruments: WFC3/UVIS

Special Requirements: SAME ORIENT AS 2A; AFTER 2A BY 0 Orbits TO 4 D

Patterns

#	Primary Pattern		Secondary Pattern		Exposures
(3)	Pattern Type=WFC3-UVIS-MOS-DITH-LINE Purpose=DITHER Number Of Points=3 Point Spacing=0.135 Line Spacing=	Coordinate Frame=POS-TARG Pattern Orientation=85.754 Angle Between Sides= Center Pattern=true	Pattern Type=WFC3-UVIS-MOS-DITH-LINE Purpose=DITHER Number Of Points=2 Point Spacing=0.119 Line Spacing=	Coordinate Frame=POS-TARG Pattern Orientation=33.606 Angle Between Sides= Center Pattern=false	(1)

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								[==>1374.0 Secs (Pattern 1,1)] *[==>1374.0 Secs (Pattern 1,2)]*	***[1]***
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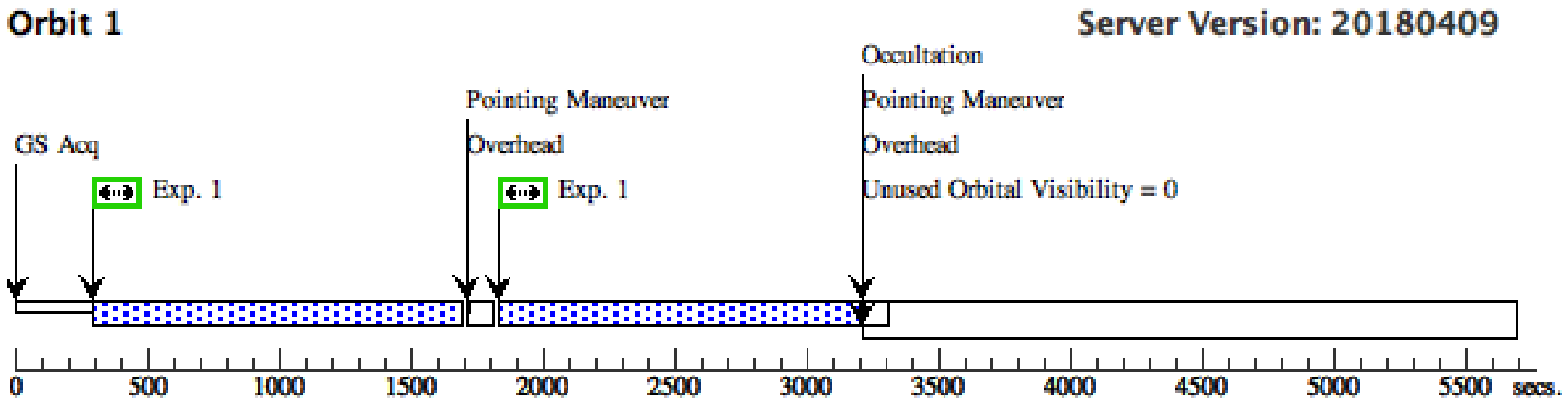

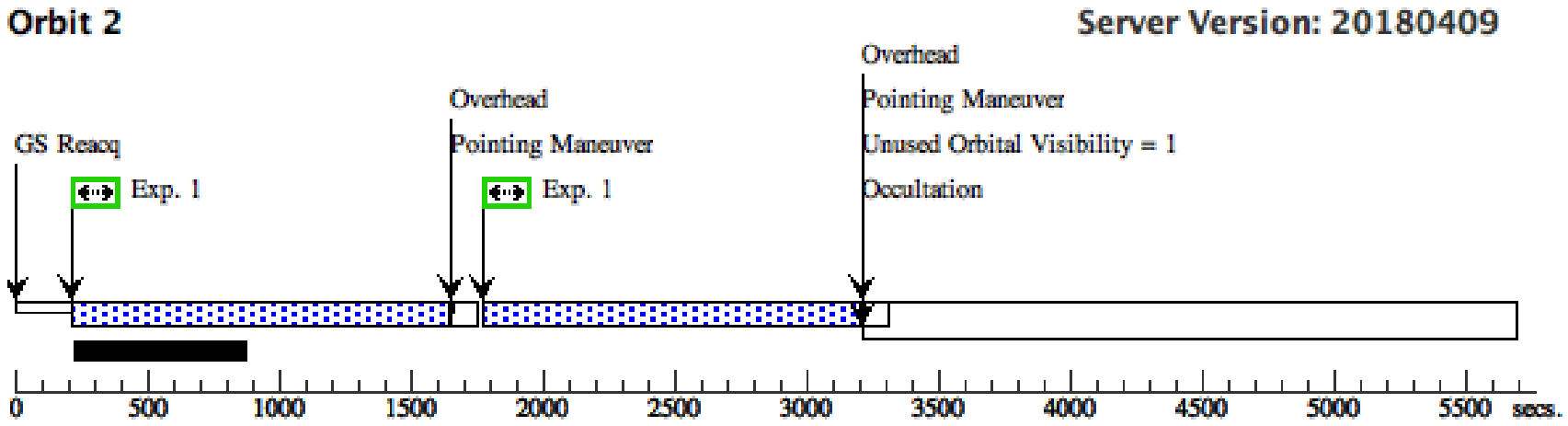

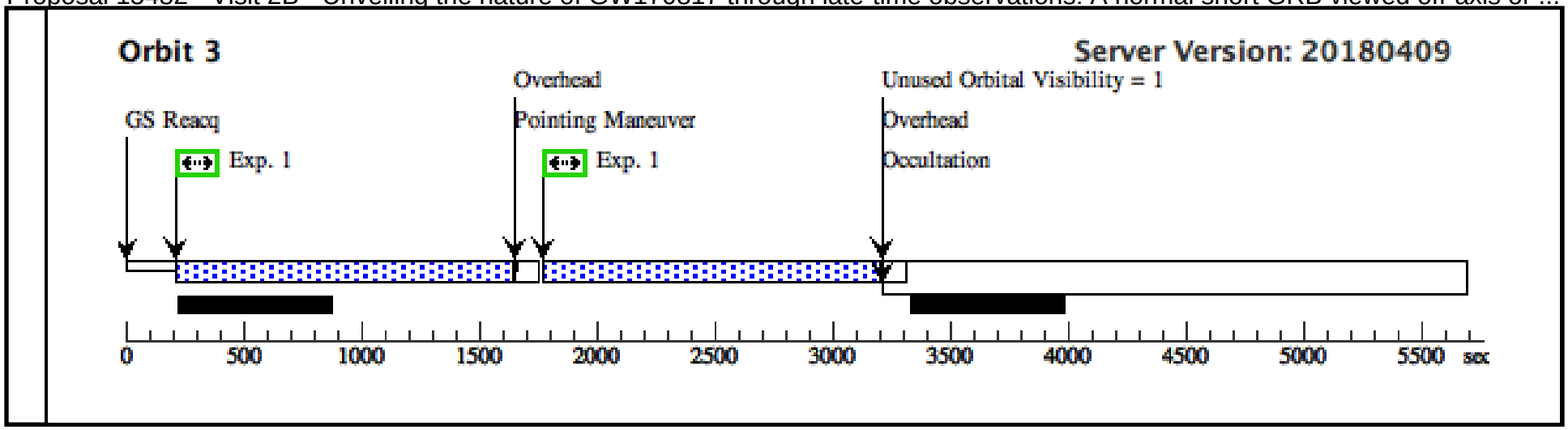
Orbit 3
Server Version: 20180409
GS Reacq
Exp. 1
Overhead
Pointing Maneuver
Exp. 1
Unused Orbital Visibility = 1
Overhead
Occultation
0
500
1000
1500
2000
2500
3000
3500
4000
4500
5000
5500
sec