17840 - Gamma-ray burst supernovae across cosmic time

Cycle: 32, Proposal Category: GO

(Availability Mode: SUPPORTED)

INVESTIGATORS

Name	*Institution*
Prof. Andrew James Levan (PI) (ESA Member) (Contact)	**Radboud University Nijmegen**
Dr. Luca Izzo (CoI) (ESA Member) (CoPI)	INAF - Osservatorio Astronomico di Capodimonte
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Prof. Nial Rahil Tanvir (CoI) (ESA Member)	University of Leicester

VISITS

Visit	*Targets used in Visit*	*Configurations used in Visit*	*Orbits Used*	*Last Orbit Planner Run*	*OP Current with Visit?*
A1	(4) GRB240801A	WFC3/IR	2	06-Feb-2026 11:00:14.0	yes
A2	(4) GRB240801A	WFC3/UVIS	2	06-Feb-2026 11:00:15.0	yes
A3	(5) GRB241026A	WFC3/IR	2	06-Feb-2026 11:00:16.0	yes
A4	(5) GRB241026A	WFC3/UVIS	2	06-Feb-2026 11:00:16.0	yes
A5	(7) GRB230818A	WFC3/IR	2	06-Feb-2026 11:00:17.0	yes
A6	(3) GRB3	WFC3/UVIS	2	06-Feb-2026 11:00:17.0	yes
G1	(6) GRB240414A	WFC3/IR	1	06-Feb-2026 11:00:18.0	yes
G2	(6) GRB240414A	WFC3/UVIS	1	06-Feb-2026 11:00:18.0	yes
G3	(7) GRB230818A	WFC3/UVIS	1	06-Feb-2026 11:00:18.0	yes

15 Total Orbits Used

ABSTRACT

Long-duration gamma-ray bursts (GRBs) are the most luminous stellar explosions in nature and are associated with the collapse of massive stars. GRBs are bright enough to see at great distances, with a median redshift of z>2 and some GRBs seen out to z>8, perhaps even z>9. Therefore, they pinpoint the locations of supernovae at distances where we have never directly observed them. Here we propose to measure the evolution of three GRB supernovae at 1.5 < z < 3 for the first time. These observations give us the ability to test if supernovae (in particular GRB-SNe) change with redshift. Differences in metallicity and stellar winds are quite likely to alter the evolution of massive stars with redshift. This is especially true if rare pathways only accessible at low metallicities, such as chemically homogeneous evolution, begin to dominate the lives of GRB progenitors. Since supernovae are a vital feedback mechanism to the interstellar and intergalactic medium via elements ejection and winds, a change in the properties of supernovae could have significant implications not only for the progenitors of GRBs but also for galaxy evolution more generally. Our photometric observations will determine the peak magnitude and decay, while a single JWST spectrum at peak will measure composition and velocities. This will provide a measurement of radioactive nickel production and luminosity. From this, we can begin to ascertain how the properties of GRB progenitors, and by extension massive stars, vary over cosmic time.

OBSERVING DESCRIPTION

Our aim is to study the evolution of GRB supernovae at 1.5 < z < 3.0 via 5 epochs of HST imaging (4 during the SN phase and one late time template). At each epoch we will obtain an optical (rest-frame UV) observation to track the afterglow and an IR (rest-frame optical) filter to track the supernova. We have set three possible set-ups depending on the redshfit of the supernova and the available ground based data (F606W/F125W, F606W/F140W and F606W/F160W) and we will use different IR filters depending on the redshift in order to track the supernova at similar rest-frame wavelengths.

At each epochs we will use 1 orbit visits in each filter with a 4-point dither. The visit should be sceduled within +/- 2 days of each other. At later epochs we will switch to 2 orbit visits per filter with an 8-point dither in the IR and a 6 point dither in the optical. Our observational plan is to ask for observations ~10-15 x (1+z) days apart and so we will schedule the first two epochs of observations at one time, but make adjust our strategy for the later observations on the basis of the outcome of the first observations.

We will observe 3 supernovae in total with 30 orbits in Cycle 31 and 12 in Cycle 32 for host subtraction. However, because of differences in supernovae (redshift, hosts etc) we may not use 10 orbits per SNe.

This new submission for GO17840 is for the late time templates, and contains observations for 2 orbits each in F606W, F125W, F140W and F160W. We will update with the details of the timing and sources once they are known.

Visit

Proposal 17840, Visit A1, completed Fri Feb 06 16:00:19 GMT 2026

Diagnostic Status: No Diagnostics

Scientific Instruments: WFC3/IR

Special Requirements: SCHED 100%; BEFORE 31-MAY-2025:00:00:00; TOO RESPONSE TIME 21.0D

Patterns

#	Primary Pattern		Secondary Pattern		Exposures
(4)	Pattern Type=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	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)

Fixed Targets

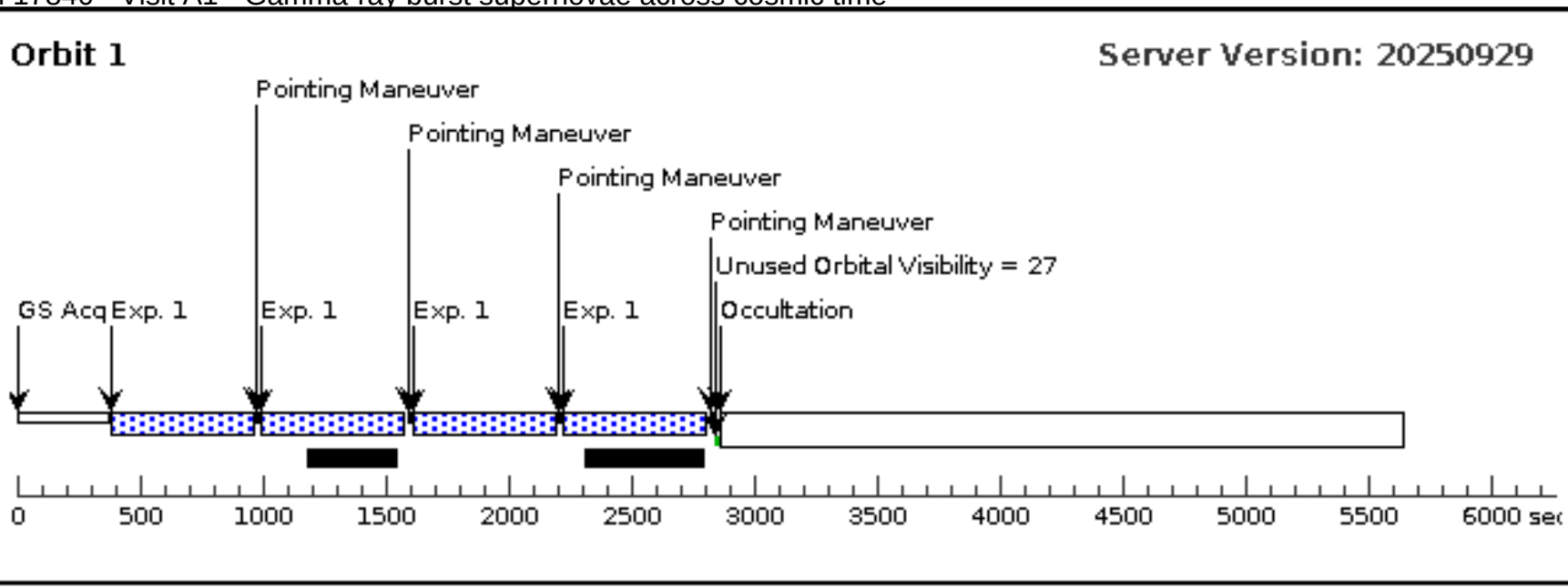
#	Name	Target Coordinates	Targ. Coord. Corrections	Fluxes	Miscellaneous
(4)	GRB240801A	RA: 23 00 39.0190 (345.1625792d) Dec: +32 35 37.20 (32.59367d) Equinox: J2000		V=25+/-1	Reference Frame: ICRS

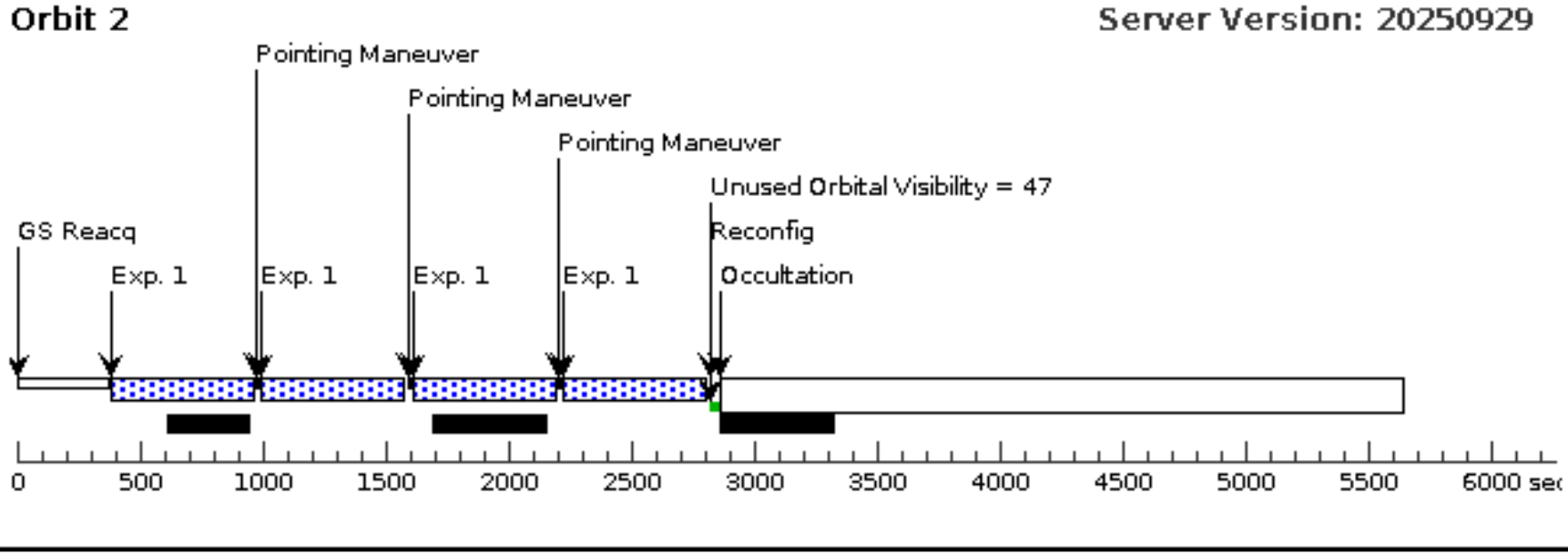
Comments:
Category=EXT-STAR
Description=[GAMMA RAY BURSTER, SUPERNOVA]

Exposures

#	Label	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time (Total)/[Actual Dur.]	Orbit
1		(4) GRB240801A	WFC3/IR, MULTIACCUM, IR	F140W	SAMP-SEQ=SPARS50; NSAMP=12		Pattern 4, Exps 1-1 in Visit A1 (4)	552.937252 Secs (4423.498 Secs)	
								[==>(Pattern 1,1)] *[==>(Pattern 1,2)]* *[==>(Pattern 1,3)]* *[==>(Pattern 1,4)]*	***[1]***
								[==>(Pattern 2,1)] *[==>(Pattern 2,2)]* *[==>(Pattern 2,3)]* *[==>(Pattern 2,4)]*	***[2]***

Orbit Structure





Visit

Proposal 17840, Visit A2, completed Fri Feb 06 16:00:19 GMT 2026

Diagnostic Status: Warning

Scientific Instruments: WFC3/UVIS

Special Requirements: SCHED 100%; BEFORE 31-MAY-2025:00:00:00; TOO RESPONSE TIME 21.0D

Diagnostics

(Visit A2) Warning (Orbit Planner): ORBITAL VISIBILITY OVERRUN

Patterns

#	Primary Pattern		Secondary Pattern		Exposures
(3)	Pattern Type=LINE Purpose=DITHER Number Of Points=2 Point Spacing=0.099 Line Spacing=	Coordinate Frame=POS-TARG Pattern Orientation=3.9 Angle Between Sides= Center Pattern=false	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)

Fixed Targets

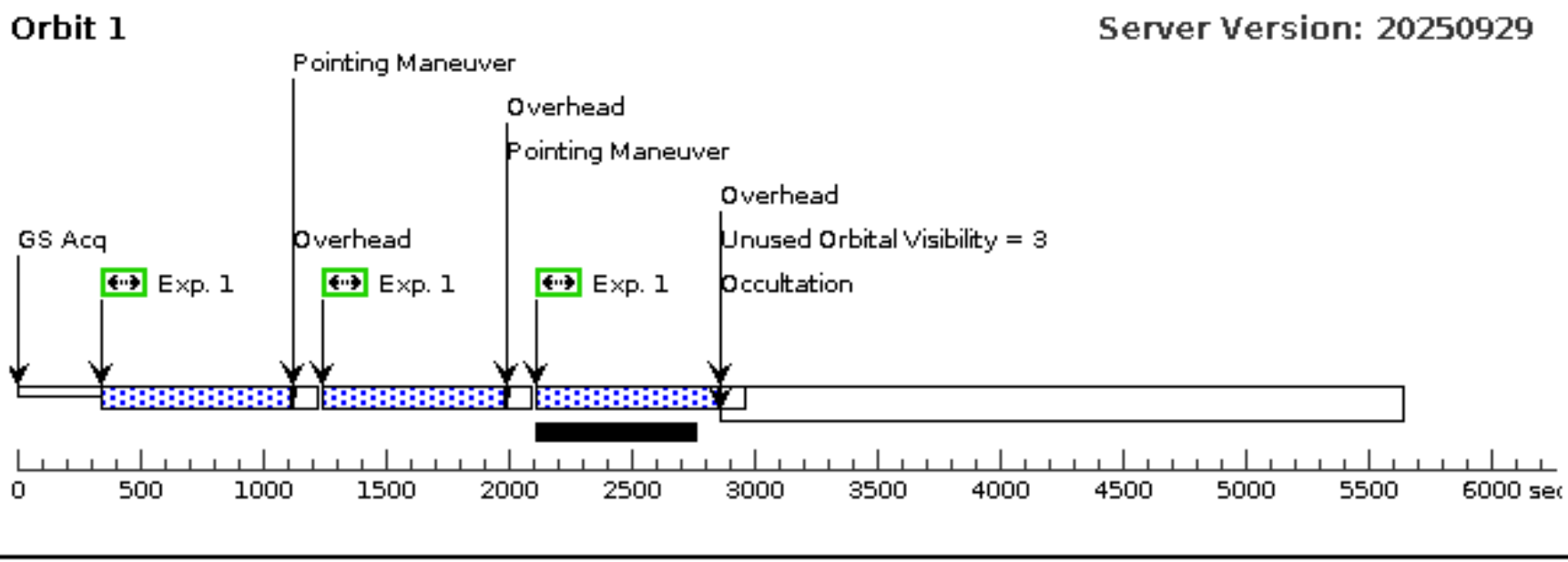
#	Name	Target Coordinates	Targ. Coord. Corrections	Fluxes	Miscellaneous
(4)	GRB240801A	RA: 23 00 39.0190 (345.1625792d) Dec: +32 35 37.20 (32.59367d) Equinox: J2000		V=25+/-1	Reference Frame: ICRS

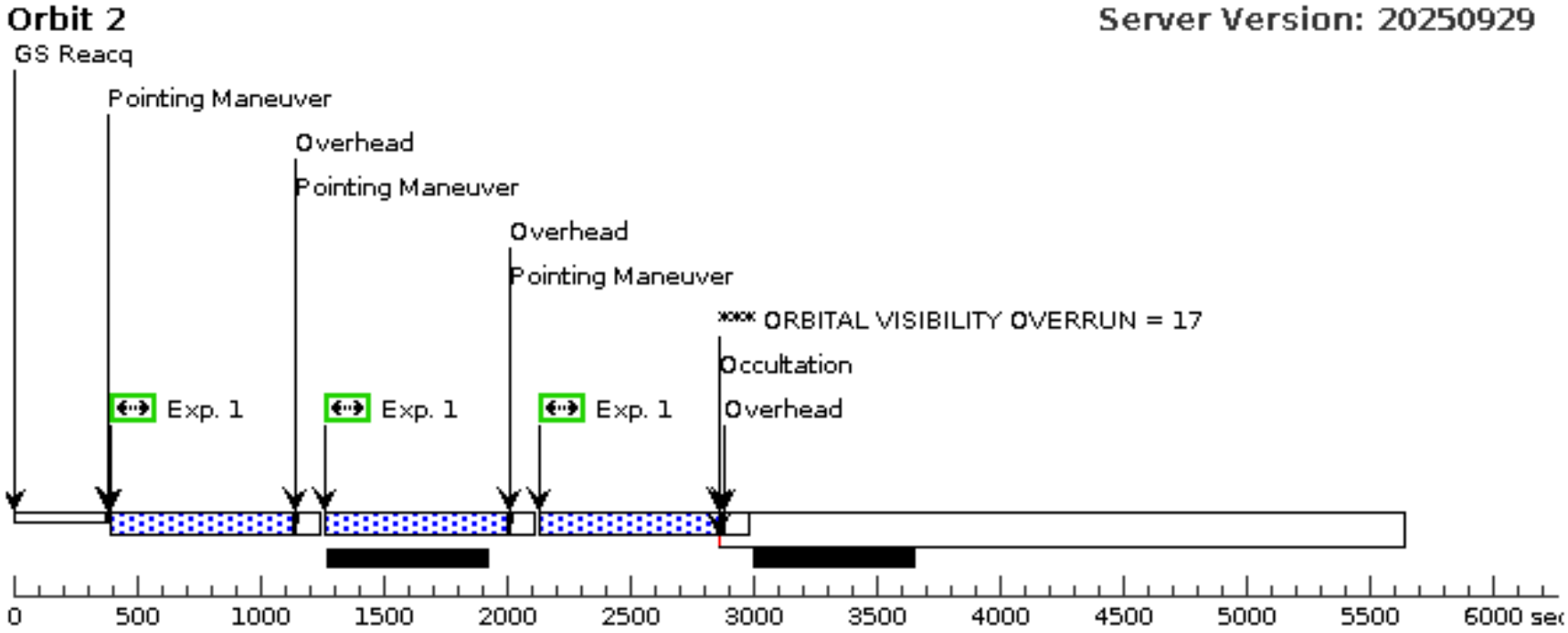
Comments:
Category=EXT-STAR
Description=[GAMMA RAY BURSTER, SUPERNOVA]

Exposures

#	Label	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time (Total)/[Actual Dur.]	Orbit
1		(4) GRB240801A	WFC3/UVIS, ACCUM, UVIS2	F606W	CR-SPLIT=NO	POS TARG -65,-30	Pattern 3, Exps 1-1 in Visit A2 (3)	740 Secs (4440 Secs)	
								[==>(Pattern 1,1)]	***[1]***
								[==>(Pattern 1,2)]	
								[==>(Pattern 1,3)]	
								[==>(Pattern 2,1)]	***[2]***
								[==>(Pattern 2,2)]	
								[==>(Pattern 2,3)]	

Orbit Structure





Visit

Proposal 17840, Visit A3, completed Fri Feb 06 16:00:19 GMT 2026

Diagnostic Status: No Diagnostics

Scientific Instruments: WFC3/IR

Special Requirements: SCHED 100%; BETWEEN 01-OCT-2025:00:00:00 AND 30-NOV-2025:00:00:00; TOO RESPONSE TIME 21.0D

Patterns

#	Primary Pattern		Secondary Pattern		Exposures
(4)	Pattern Type=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	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)

Fixed Targets

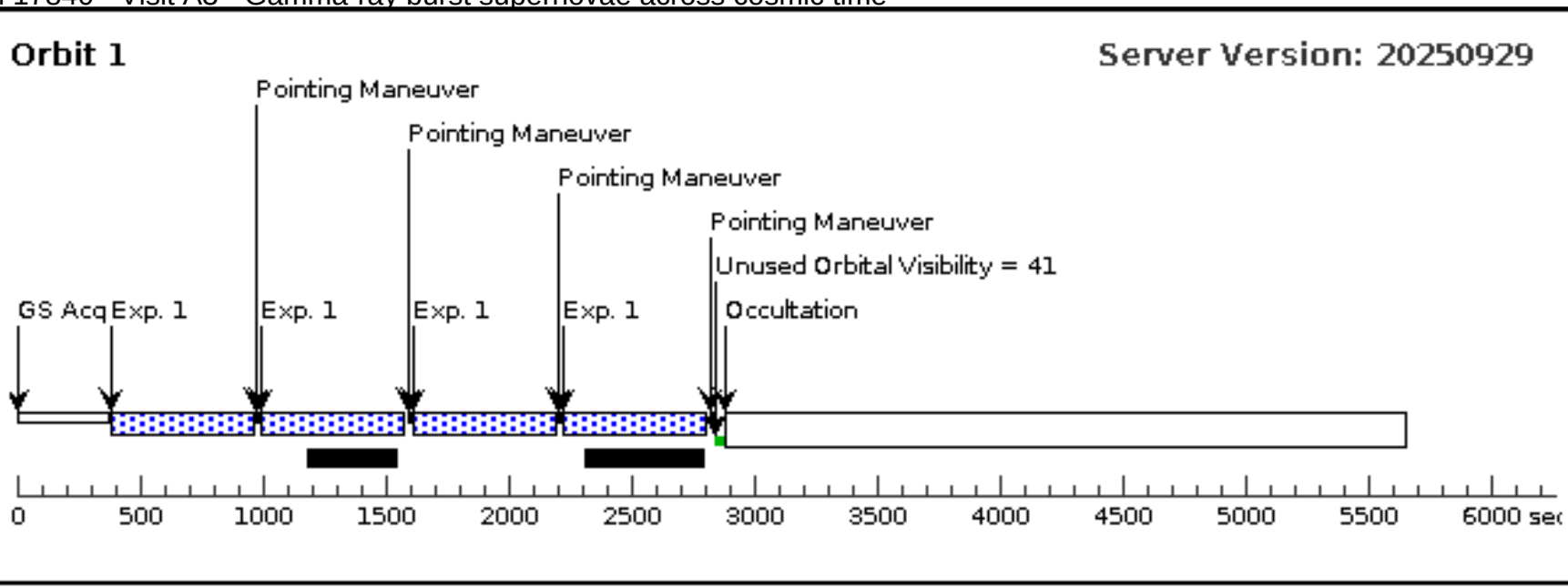
#	Name	Target Coordinates	Targ. Coord. Corrections	Fluxes	Miscellaneous
(5)	GRB241026A	RA: 19 33 36.0600 (293.4002500d) Dec: +57 59 9.04 (57.98584d) Equinox: J2000		V=25+/-1	Reference Frame: ICRS

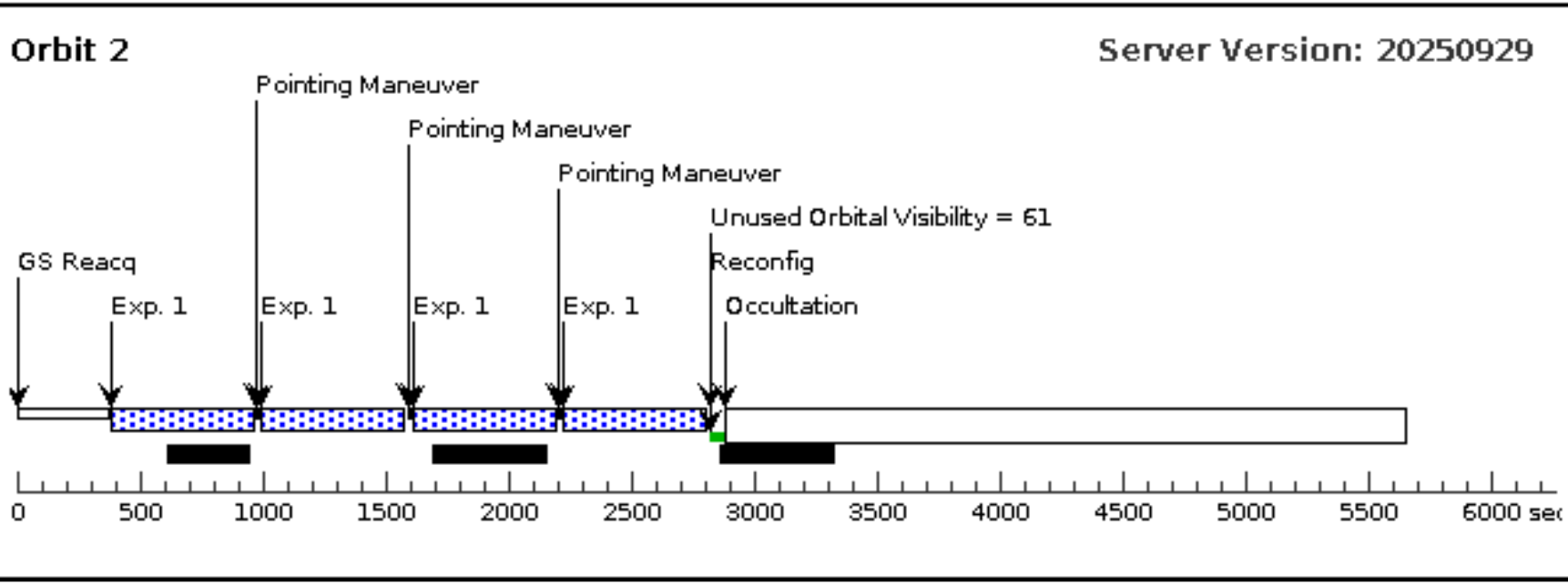
Comments:
Category=EXT-STAR
Description=[GAMMA RAY BURSTER, SUPERNOVA]

Exposures

#	Label	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time (Total)/[Actual Dur.]	Orbit
1		(5) GRB241026A	WFC3/IR, MULTIACCUM, IR	F160W	SAMP-SEQ=SPARS50; NSAMP=12		Pattern 4, Exps 1-1 in Visit A3 (4)	552.937252 Secs (4423.498 Secs)	
								[==>(Pattern 1,1)] *[==>(Pattern 1,2)]* *[==>(Pattern 1,3)]* *[==>(Pattern 1,4)]*	***[1]***
								[==>(Pattern 2,1)] *[==>(Pattern 2,2)]* *[==>(Pattern 2,3)]* *[==>(Pattern 2,4)]*	***[2]***

Orbit Structure





Visit

Proposal 17840, Visit A4, completed Fri Feb 06 16:00:19 GMT 2026

Diagnostic Status: Warning

Scientific Instruments: WFC3/UVIS

Special Requirements: SCHED 100%; BETWEEN 01-OCT-2025:00:00:00 AND 30-NOV-2025:00:00:00; TOO RESPONSE TIME 21.0D

Diagnostics

(Visit A4) Warning (Orbit Planner): ORBITAL VISIBILITY OVERRUN

Patterns

#	Primary Pattern		Secondary Pattern		Exposures
(3)	Pattern Type=LINE Purpose=DITHER Number Of Points=2 Point Spacing=0.099 Line Spacing=	Coordinate Frame=POS-TARG Pattern Orientation=3.9 Angle Between Sides= Center Pattern=false	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)

Fixed Targets

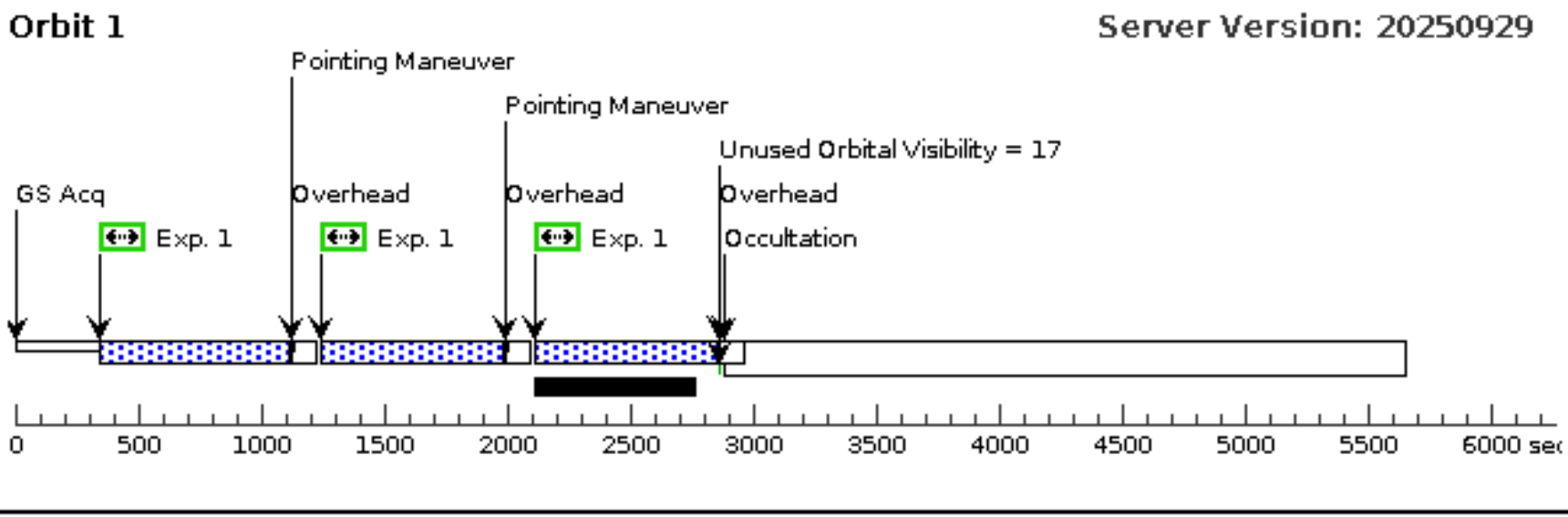
#	Name	Target Coordinates	Targ. Coord. Corrections	Fluxes	Miscellaneous
(5)	GRB241026A	RA: 19 33 36.0600 (293.4002500d) Dec: +57 59 9.04 (57.98584d) Equinox: J2000		V=25+/-1	Reference Frame: ICRS

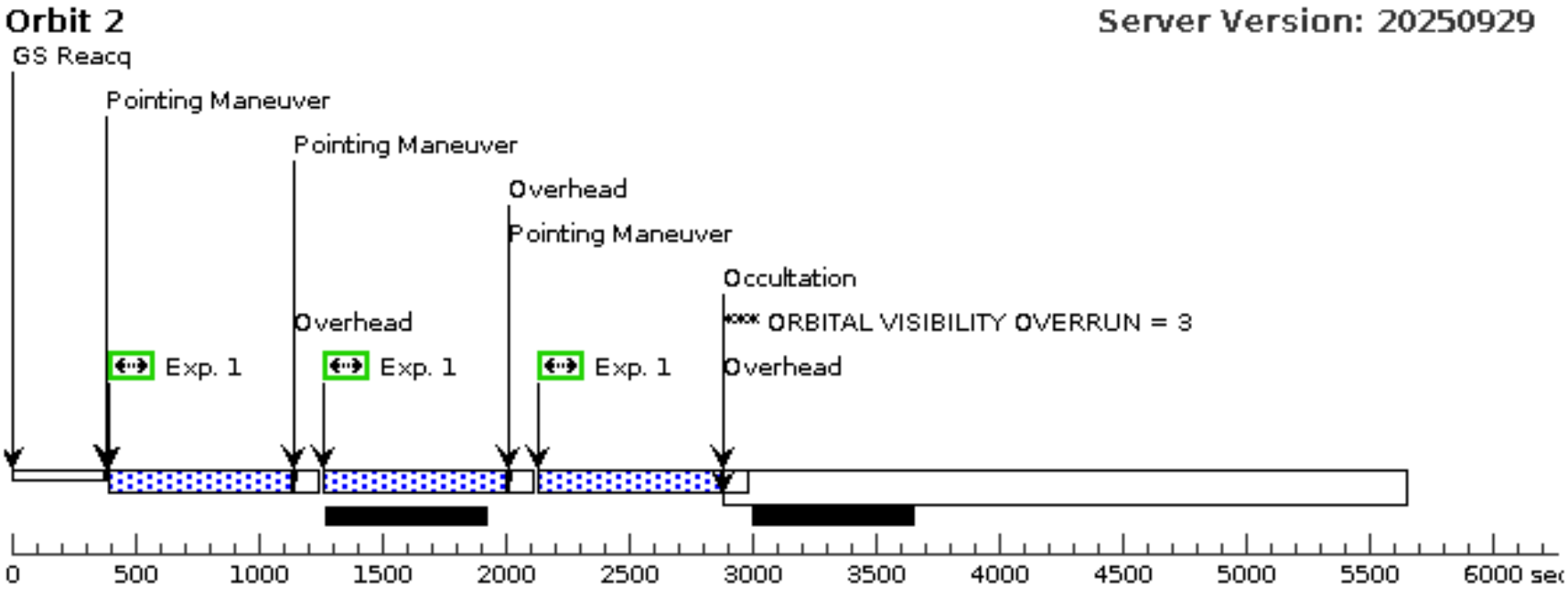
Comments:
Category=EXT-STAR
Description=[GAMMA RAY BURSTER, SUPERNOVA]

Exposures

#	Label	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time (Total)/[Actual Dur.]	Orbit
1		(5) GRB241026A	WFC3/UVIS, ACCUM, UVIS2	F606W	CR-SPLIT=NO	POS TARG -65,-30	Pattern 3, Exps 1-1 in Visit A4 (3)	740 Secs (4440 Secs)	
								[==>(Pattern 1,1)]	***[1]***
								[==>(Pattern 1,2)]	
								[==>(Pattern 1,3)]	
								[==>(Pattern 2,1)]	***[2]***
								[==>(Pattern 2,2)]	
								[==>(Pattern 2,3)]	

Orbit Structure





Visit

Proposal 17840, Visit A5, failed Fri Feb 06 16:00:19 GMT 2026

Diagnostic Status: No Diagnostics

Scientific Instruments: WFC3/IR

Special Requirements: SCHED 100%; BEFORE 31-DEC-2025:00:00:00; TOO RESPONSE TIME 21.0D

Patterns

#	Primary Pattern		Secondary Pattern		Exposures
(4)	Pattern Type=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	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)

Fixed Targets

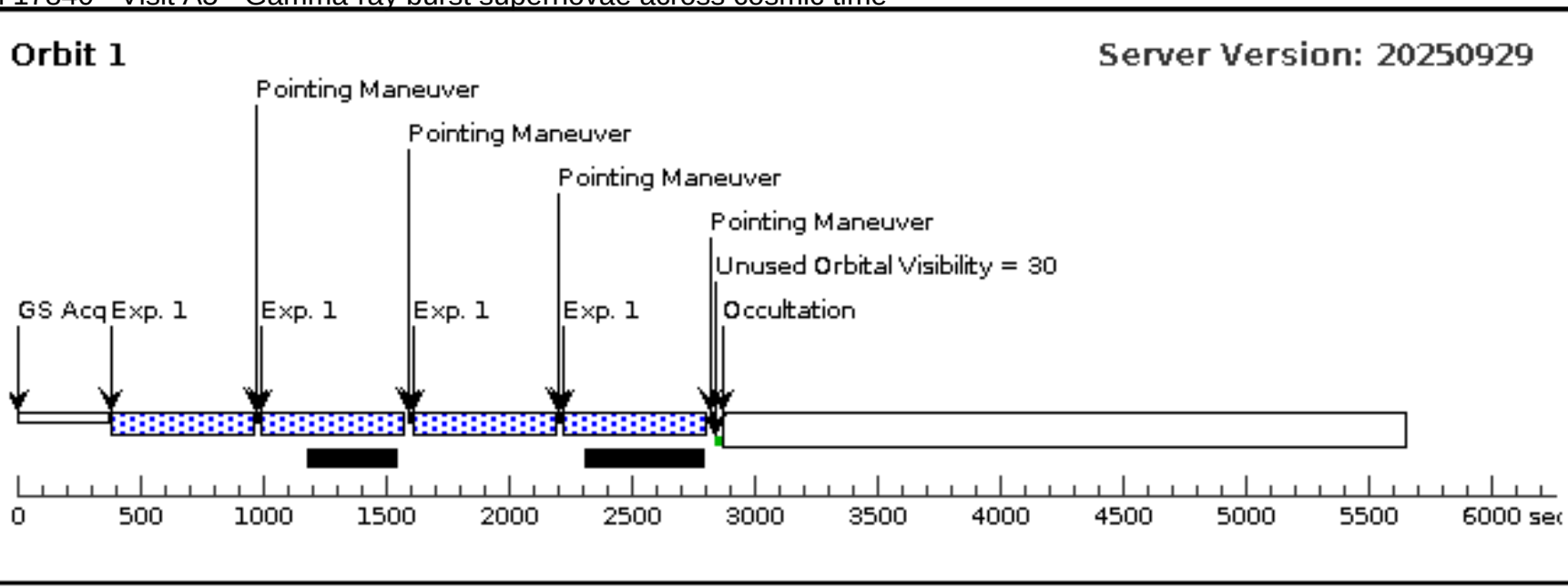
#	Name	Target Coordinates	Targ. Coord. Corrections	Fluxes	Miscellaneous
(7)	GRB230818A	RA: 19 03 33.1200 (285.8880000d) Dec: +40 53 49.10 (40.89697d) Equinox: J2000		V=27+/-2	Reference Frame: ICRS

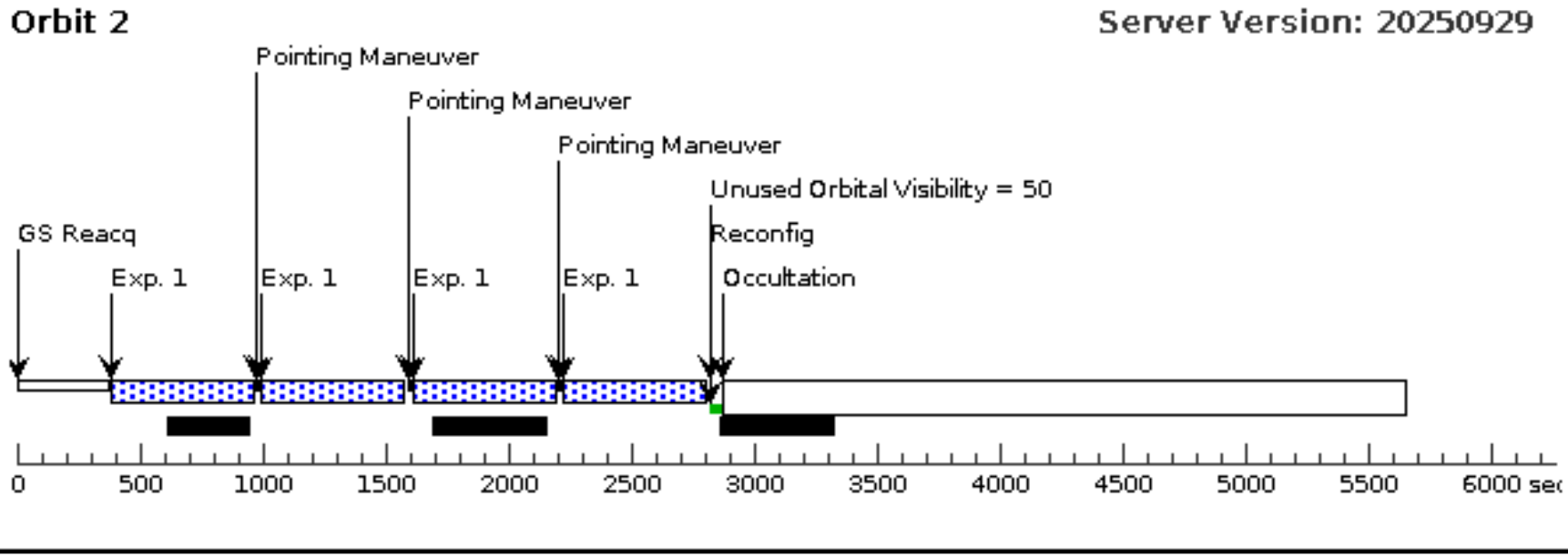
Comments:
Category=EXT-STAR
Description=[SUPERNOVA]

Exposures

#	Label	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time (Total)/[Actual Dur.]	Orbit
1		(7) GRB230818A	WFC3/IR, MULTIACCUM, IR	F140W	SAMP-SEQ=SPARS50; NSAMP=12		Pattern 4, Exps 1-1 in Visit A5 (4)	552.937252 Secs (4423.498 Secs)	
								[==>(Pattern 1,1)] *[==>(Pattern 1,2)]* *[==>(Pattern 1,3)]* *[==>(Pattern 1,4)]*	***[1]***
								[==>(Pattern 2,1)] *[==>(Pattern 2,2)]* *[==>(Pattern 2,3)]* *[==>(Pattern 2,4)]*	***[2]***

Orbit Structure





Visit

Proposal 17840, Visit A6, withdrawn Fri Feb 06 16:00:19 GMT 2026

Diagnostic Status: Warning

Scientific Instruments: WFC3/UVIS

Special Requirements: SCHED 100%; ON HOLD ; TOO RESPONSE TIME 21.0D

On Hold Comments: Awaiting GRB trigger

Diagnostics

(Visit A6) Warning (Orbit Planner): ORBITAL VISIBILITY OVERRUN

Patterns

#	Primary Pattern		Secondary Pattern		Exposures
(3)	Pattern Type=LINE Purpose=DITHER Number Of Points=2 Point Spacing=0.099 Line Spacing=	Coordinate Frame=POS-TARG Pattern Orientation=3.9 Angle Between Sides= Center Pattern=false	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)

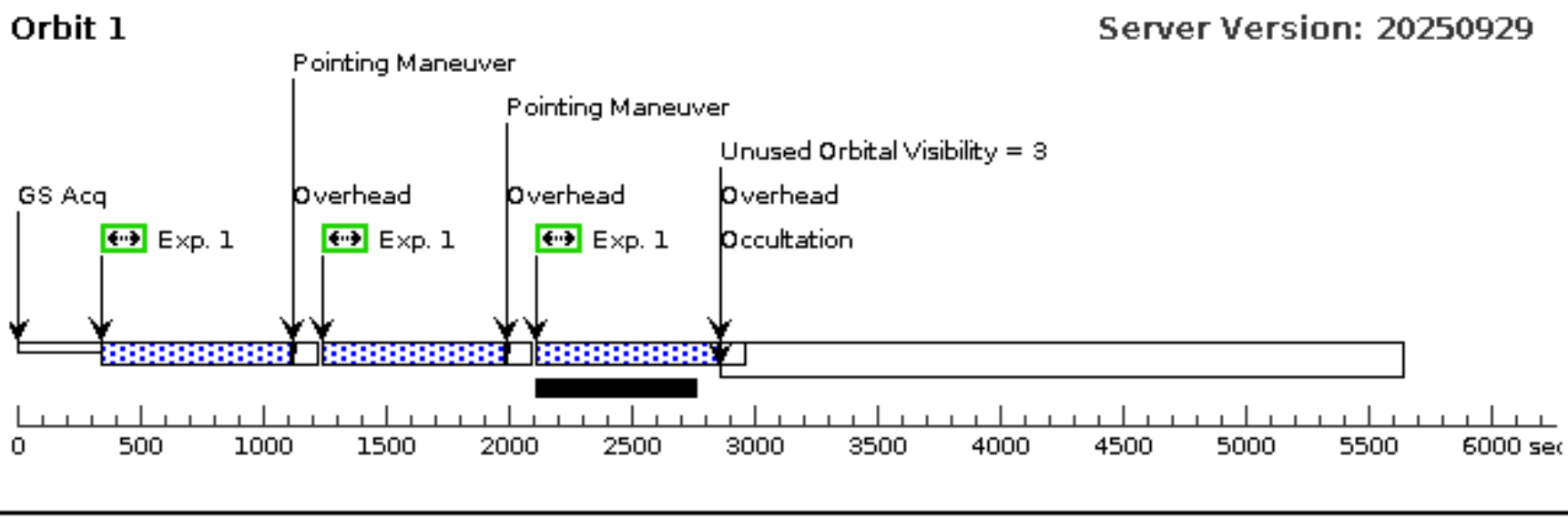
Generic Targets

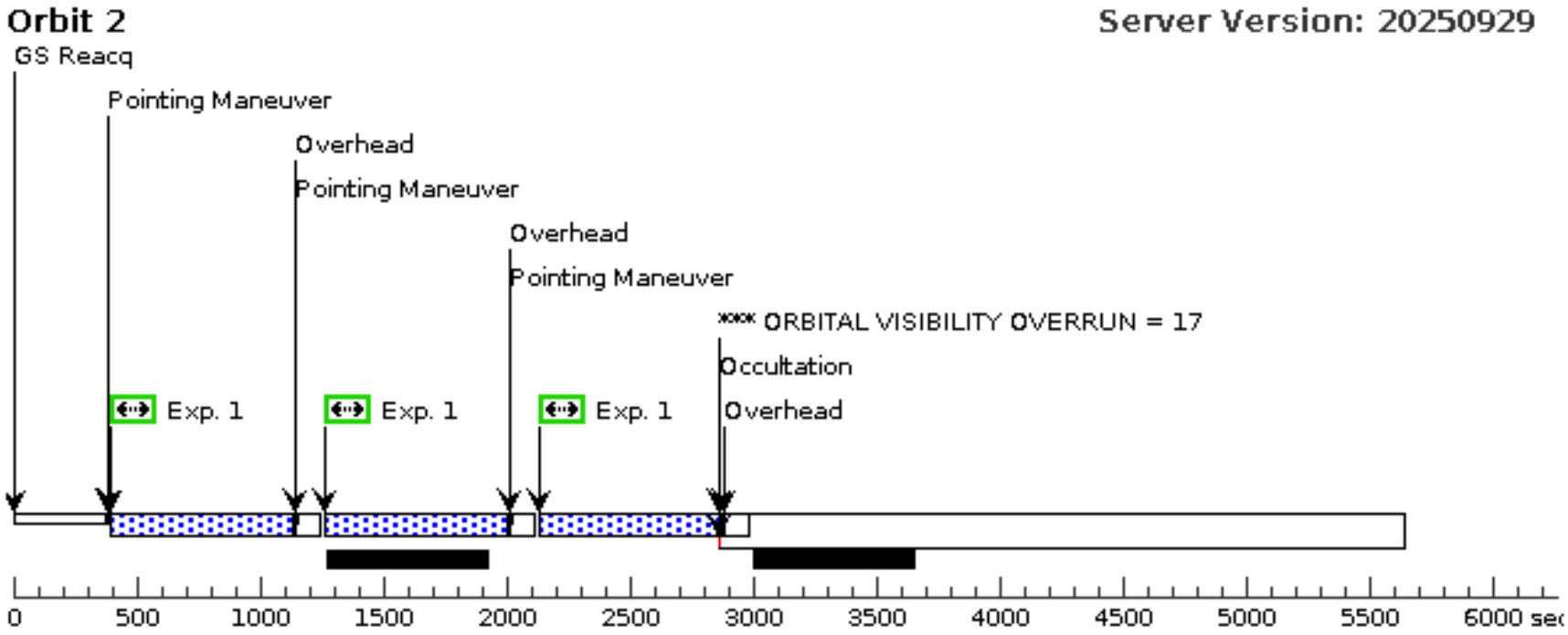
#	Name	Criteria	Description
(3)	GRB3	GRB detection at ~ 1.5 < z < 3.0	

Exposures

#	Label	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time (Total)/[Actual Dur.]	Orbit
1		(3) GRB3	WFC3/UVIS, ACCUM, UVIS2	F606W	CR-SPLIT=NO	POS TARG -65,-30	Pattern 3, Exps 1-1 in Visit A6 (3)	740 Secs (4440 Secs)	
								[==>(Pattern 1,1)]	
								[==>(Pattern 1,2)]	***[1]***
								[==>(Pattern 1,3)]	
								[==>(Pattern 2,1)]	
								[==>(Pattern 2,2)]	***[2]***
								[==>(Pattern 2,3)]	

Orbit Structure





Visit

Proposal 17840, Visit G1, completed Fri Feb 06 16:00:19 GMT 2026

Diagnostic Status: No Diagnostics

Scientific Instruments: WFC3/IR

Special Requirements: SCHED 100%; BEFORE 31-JUL-2025:00:00:00; ON HOLD ; TOO RESPONSE TIME 21.0D

On Hold Comments: Awaiting GRB trigger

Patterns

#	Primary Pattern		Secondary Pattern	Exposures
(5)	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)

Fixed Targets

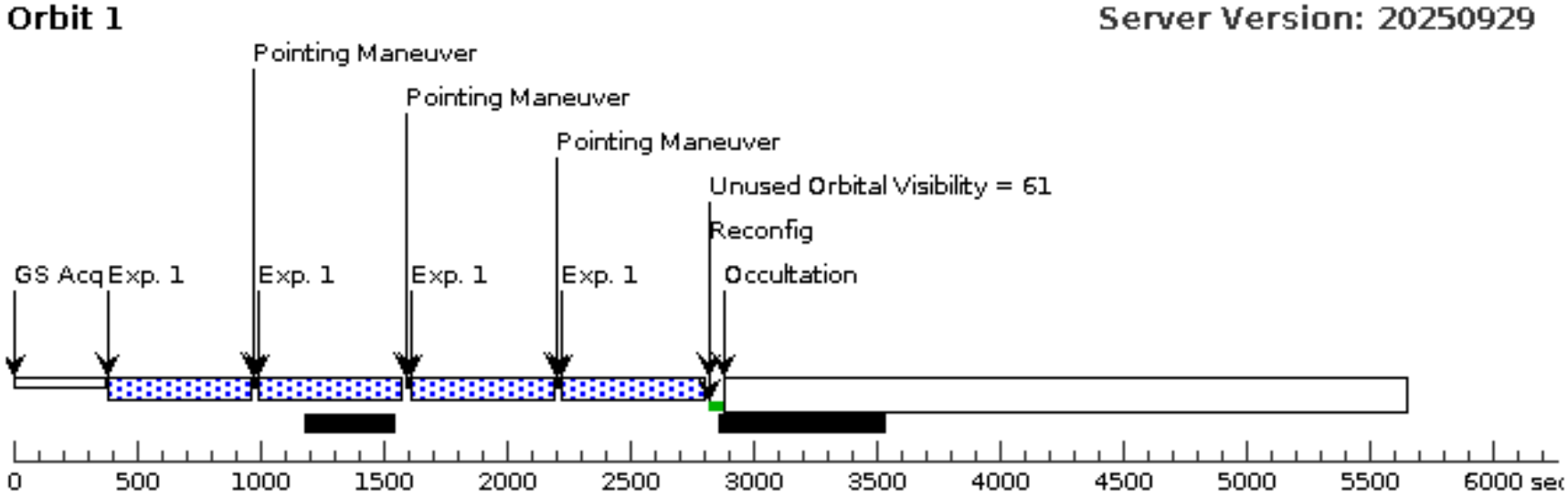
#	Name	Target Coordinates	Targ. Coord. Corrections	Fluxes	Miscellaneous
(6)	GRB240414A	RA: 12 19 8.1120 (184.7838000d) Dec: +56 44 28.70 (56.74131d) Equinox: J2000		V=25+/-1	Reference Frame: ICRS

Comments:
Category=EXT-STAR
Description=[GAMMA RAY BURSTER, SUPERNOVA]

Exposures

#	Label	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time (Total)/[Actual Dur.]	Orbit
1		(6) GRB240414A	WFC3/IR, MULTIACCUM, IR	F160W	SAMP-SEQ=SPARS50; NSAMP=12		Pattern 5, Exps 1-1 in Visit G1 (5)	552.937252 Secs (2211.749 Secs) *[==>(Pattern 1)]* *[==>(Pattern 2)]* *[==>(Pattern 3)]* *[==>(Pattern 4)]*	***[1]***

Orbit Structure



Visit

Proposal 17840, Visit G2, completed Fri Feb 06 16:00:19 GMT 2026

Diagnostic Status: No Diagnostics

Scientific Instruments: WFC3/UVIS

Special Requirements: SCHED 100%; BEFORE 31-JUL-2025:00:00:00

Patterns

#	Primary Pattern		Secondary Pattern	Exposures
(6)	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)

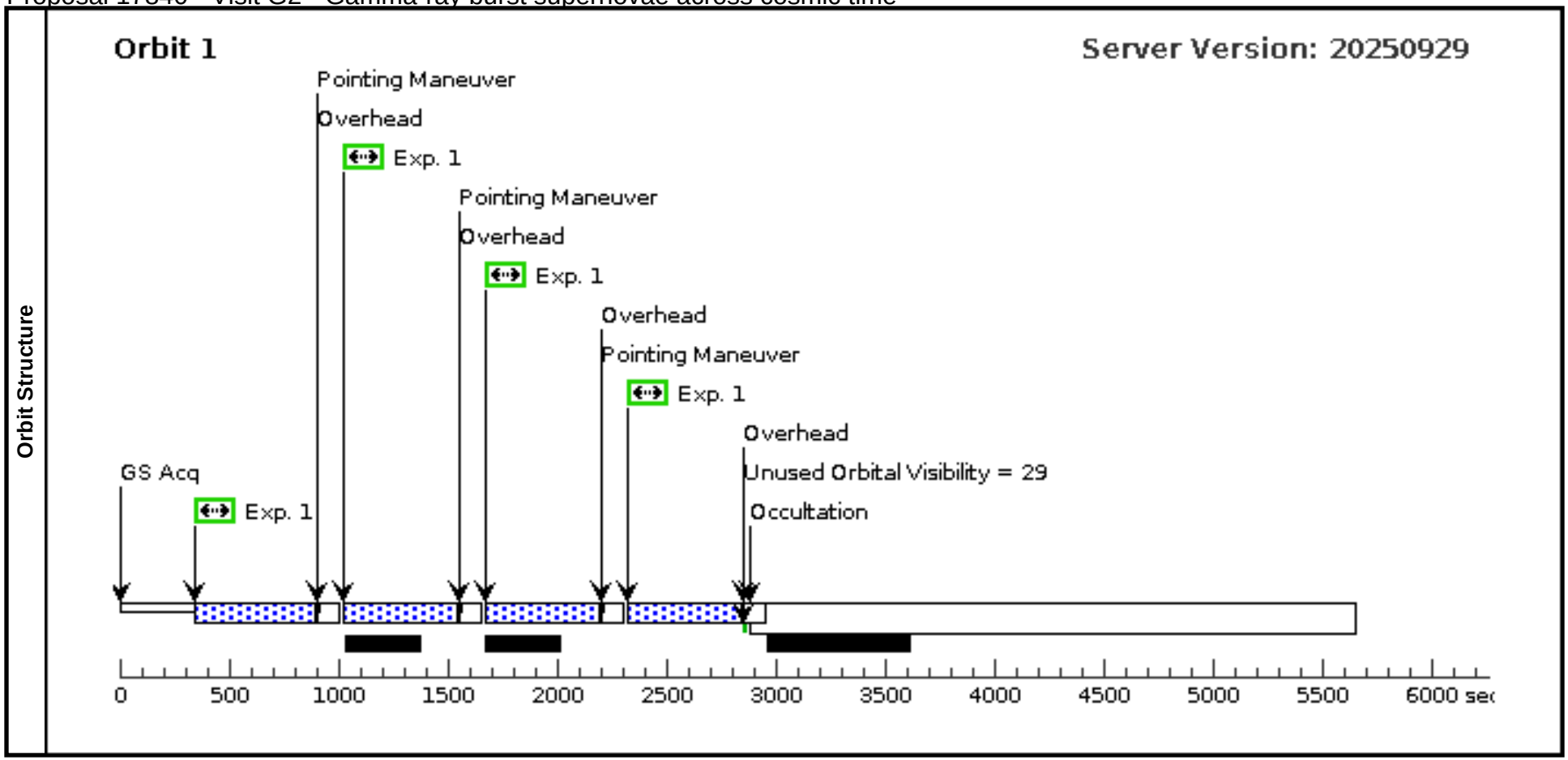
Fixed Targets

#	Name	Target Coordinates	Targ. Coord. Corrections	Fluxes	Miscellaneous
(6)	GRB240414A	RA: 12 19 8.1120 (184.7838000d) Dec: +56 44 28.70 (56.74131d) Equinox: J2000		V=25+/-1	Reference Frame: ICRS

Comments:
Category=EXT-STAR
Description=[GAMMA RAY BURSTER, SUPERNOVA]

Exposures

#	Label	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time (Total)/[Actual Dur.]	Orbit
1		(6) GRB240414A	WFC3/UVIS, ACCUM, UVIS2	F606W	CR-SPLIT=NO	POS TARG -65,-30	Pattern 6, Exps 1-1 in Visit G2 (6)	520 Secs (2080 Secs) *[==>(Pattern 1)]* *[==>(Pattern 2)]* *[==>(Pattern 3)]* *[==>(Pattern 4)]*	***[1]***


Orbit Structure
Orbit 1
Server Version: 20250929
Pointing Maneuver
Overhead
Exp. 1
Pointing Maneuver
Overhead
Exp. 1
Overhead
Pointing Maneuver
Exp. 1
Overhead
Unused Orbital Visibility = 29
Occultation
GS Acq
Exp. 1
0
500
1000
1500
2000
2500
3000
3500
4000
4500
5000
5500
6000 sec

Visit

Proposal 17840, Visit G3 Fri Feb 06 16:00:19 GMT 2026

Diagnostic Status: No Diagnostics

Scientific Instruments: WFC3/UVIS

Special Requirements: SCHED 100%; BEFORE 20-MAR-2026:00:00:00

Patterns

#	Primary Pattern		Secondary Pattern	Exposures
(6)	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
(7)	GRB230818A	RA: 19 03 33.1200 (285.8880000d) Dec: +40 53 49.10 (40.89697d) Equinox: J2000		V=27+/-2	Reference Frame: ICRS

Comments:
Category=EXT-STAR
Description=[SUPERNOVA]

Exposures

#	Label	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time (Total)/[Actual Dur.]	Orbit
1		(7) GRB230818A	WFC3/UVIS, ACCUM, UVIS2	F606W	CR-SPLIT=NO	POS TARG -65,-30	Pattern 6, Exps 1-1 in Visit G3 (6)	520 Secs (2080 Secs) *[==>(Pattern 1)]* *[==>(Pattern 2)]* *[==>(Pattern 3)]* *[==>(Pattern 4)]*	***[1]***

Orbit Structure