18013 - Searching for Strong Lensing Signatures in a Possible Lensed GRB.

Cycle: 33, 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?*
01	(1) 240205B	ACS/WFC	2	26-Nov-2025 14:00:13.0	yes
02	(1) 240205B	WFC3/IR	1	26-Nov-2025 14:00:14.0	yes

3 Total Orbits Used

ABSTRACT

Gamma-ray bursts (GRBs) are among the most energetic phenomena in the universe, capable of being detected at high redshifts with sub-second timing precision. This makes them compelling candidates for probing cosmological parameters through gravitational lensing. However, despite nearly 20 years of observations, no strong lensing candidate has been conclusively identified, largely due to uncertainties in the prompt emission and localisation of GRBs.

Recently, we have identified a potential lensed GRB pair. We now aim to leverage the excellent depth and resolution capabilities of the HST to search for a potential host galaxy, determine image multiplicity, and identify any intervening lensing object(s) along the line of sight. A confirmed detection of gravitational lensing in a GRB would be a historic first and return an immediate, high-impact scientific result.

OBSERVING DESCRIPTION

Images will be taken with ACS/WFC F435W, F814W and WFC/IR F160W. With this data, we will be able to 1) confirm the presence or absence of any host galaxy and enable a sensitive search for lensing systems in the foreground, i.e. z <0.824. 2) determine if lensing signatures are present, in particular, multiply imaged host galaxy candidates and 3) derive a photometric redshift for possible lenses and host galaxies. HST /ACS high resolution capabilities and multi-band colour information are essential in determining the existence of multiply imaged galaxies. Using this data it will be possible to construct a lensing model. We assume the the maximum possible redshift of the lens as z=1.6. The majority of past LGRB hosts can be recovered with a limiting magnitude of r <26 AB mag with all hosts being recovered with r <27 mag. ([5] figure 9). Therefore we require imaging to recover at minimum a r =27 AB mag Sc-galaxy-like host at z=1.6 as 1" extended source with S/N>5 in any of the filters. For ACS observations, we will use 4 dithered images to allow for the removal of artifacts and cosmic rays. Each set of 4 images will require 4 + 3 x 2.5 minutes with an additional 6.5 minutes for guide star acquisition and 1.5 minutes to allow for maneuvering for dithering.
This results in a total overhead of 19.5 minutes per orbit. This leaves ~1950s in the orbit to carry out the exposures. For a 26 and 27 AB mag target this would result in a S/N in F435W ~15.1 and 6.1, S/N F814W ~6.5 and 2.6 respectively. For WFC3/IR observations, we will also use a set of 4 dithered images. Total overheads from guide star acquisition, dither maneuvering and 4x1 min for each exposure results in a total overhead of 12 minutes. The remaining 1800s integration time split across the 4 exposures returns a S/NF 160W ~16 for a r =27 AB mag galaxy. These observations will allow for the unambiguous confirmation on the presence or absence of the host galaxy, whether it has been multiply imaged as well as the existence of nearby possible lensing objects.

To avoid diffraction spikes from a nearby star, constraints on orientation are required.
To mitigate the effects of CTE, the target will be placed in the corner of the B amplifier in ACS/WFC observations.

Visit

Proposal 18013, ACS/WFC (01), implementation Wed Nov 26 19:00:14 GMT 2025

Diagnostic Status: No Diagnostics

Scientific Instruments: ACS/WFC

Special Requirements: (none)

Patterns

#	Primary Pattern		Secondary Pattern	Exposures
(1)	Pattern Type=ACS-WFC-DITHER-BOX Purpose=DITHER Number Of Points=4 Point Spacing=0.2637 Line Spacing=0.1856	Coordinate Frame=POS-TARG Pattern Orientation=41.859 Angle Between Sides=69.02 Center Pattern=false		(1)
(2)	Pattern Type=ACS-WFC-DITHER-BOX Purpose=DITHER Number Of Points=4 Point Spacing=0.2637 Line Spacing=0.1856	Coordinate Frame=POS-TARG Pattern Orientation=20.7 Angle Between Sides=69.02 Center Pattern=false		(2)

Fixed Targets

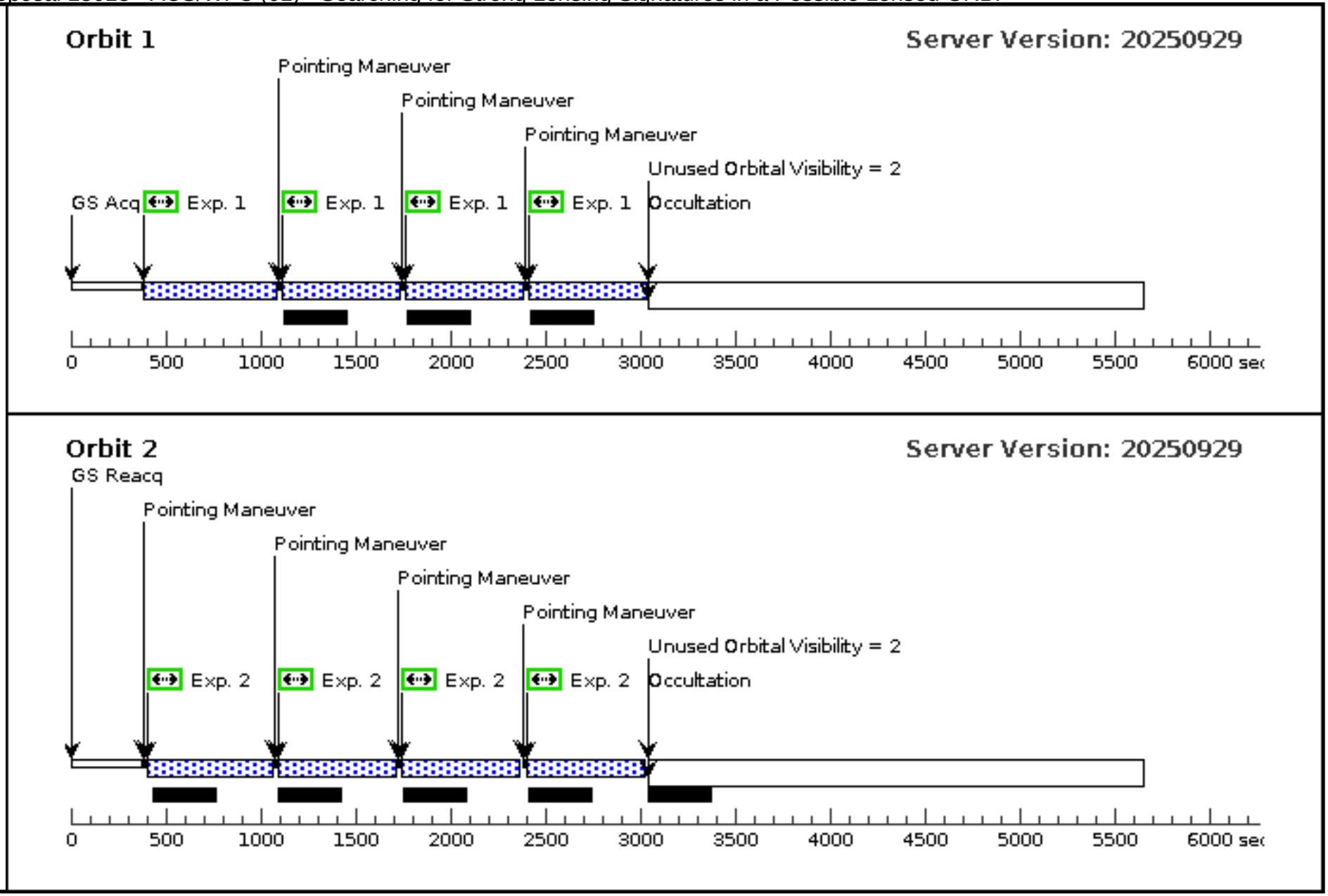
#	Name	Target Coordinates	Targ. Coord. Corrections	Fluxes	Miscellaneous
(1)	240205B	RA: 23 25 50.1200 (351.4588333d) Dec: -55 07 5.50 (-55.11819d) Equinox: J2000		V=27+/-0.1	Reference Frame: ICRS

Comments:
Category=GALAXY
Description=[GRAVITATIONAL LENS]

Exposures

#	Label	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time (Total)/[Actual Dur.]	Orbit
1	F435W	(1) 240205B	ACS/WFC, ACCUM, WFC1	F435W	FLASH=8	POS TARG 57.2505 86000784864,5.9751 22184783851	Pattern 1, Exps 1-1 in ACS/WFC (01) (1)	485 Secs (1948 Secs) *[==>487.0 Secs (Pattern 1)]* *[==>487.0 Secs (Pattern 2)]* *[==>487.0 Secs (Pattern 3)]* *[==>487.0 Secs (Pattern 4)]*	***[1]***
2	F814W	(1) 240205B	ACS/WFC, ACCUM, WFC1	F814W		POS TARG 57.2505 86000784864,5.9751 22184783851	Pattern 2, Exps 2-2 in ACS/WFC (01) (2)	490 Secs (2008 Secs) *[==>511.0 Secs (Pattern 1)]* *[==>499.0 Secs (Pattern 2)]* *[==>499.0 Secs (Pattern 3)]* *[==>499.0 Secs (Pattern 4)]*	***[2]***

Orbit Structure



Visit

Proposal 18013, ACS/WFC3-IR (02), implementation Wed Nov 26 19:00:14 GMT 2025

Diagnostic Status: No Diagnostics

Scientific Instruments: WFC3/IR

Special Requirements: (none)

Patterns

#	Primary Pattern		Secondary Pattern	Exposures
(3)	Pattern Type=WFC3-IR-DITHER-BLOB Purpose=DITHER Number Of Points=4 Point Spacing=5.183 Line Spacing=	Coordinate Frame=POS-TARG Pattern Orientation=41.859 Angle Between Sides= Center Pattern=true		(1)

Fixed Targets

#	Name	Target Coordinates	Targ. Coord. Corrections	Fluxes	Miscellaneous
(1)	240205B	RA: 23 25 50.1200 (351.4588333d) Dec: -55 07 5.50 (-55.11819d) Equinox: J2000		V=27+/-0.1	Reference Frame: ICRS

Comments:
Category=GALAXY
Description=[GRAVITATIONAL LENS]

Exposures

#	Label	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time (Total)/[Actual Dur.]	Orbit
1	F160W	(1) 240205B	WFC3/IR, MULTIACCUM, IR	F160W	NSAMP=13; SAMP-SEQ=SPARS50		Pattern 3, Exps 1-1 in ACS/WFC3-IR (02) (3)	602.937703 Secs (2411.751 Secs) *[==>(Pattern 1)]* *[==>(Pattern 2)]* *[==>(Pattern 3)]* *[==>(Pattern 4)]*	*[1]*

Orbit Structure