16063 - The First Glimpse of A Candidate Recoiling Black Hole

Cycle: 27, 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) RXJ1756.4+5235	WFC3/IR WFC3/UVIS	2	06-Apr-2020 13:01:13.0	yes

2 Total Orbits Used

ABSTRACT

The coalescence of binary supermassive black holes (SMBH) in galaxy mergers is thought to constitute the strongest source of gravitational waves. Theory suggests these waves carry momentum causing the merged black hole to experience a velocity recoil or kick that displaces or indeed ejects it from the center of its host galaxy. We request the first XMM-Newton and HST imaging of RXJ1756.4+5235, a source with an o ffset broad line point source that is offset from the nucleus of a nearby galaxy to resolve whether the source is a potential recoiling black hole or a close dual AGN.

OBSERVING DESCRIPTION

The point of this observation is to look for extended emission around a point source to test for the presence of a possible recoiling black hole using the i-band and the H-band with WFC3. The object looks like a point source separated by 6.4" with QSO like emission from a nearby galaxy with extended emission. The WFC3 UVIS detector with F814W will provide the sharpest images with a smaller plate scale to best sample the PSF (0.04"). The F160W observation is critical since the NIR traces the bulk of the stellar mass because ofits sensitivity to the cooler stars in older stellar populations and the NIR is also much less aected by dust extinction.

We have designed our images to avoid saturation, but also to limit overheads, so that we have maximal sensitivity to faint features from a host galaxy in the potential recoiling black hole. The i-band psf mag from PS1, is 17.06, which leads to saturation in images of 256s assuming a QSO IRTF template. We chose a 2048x2048 subarray to minizimize buffer dump time. In order to have an unsaturated image we take a short image for 23 seconds followed by a 4 point dither pattern with 591s at each pointing. We use a 4-point dither pattern to improve PSF reconstruction/cosmic rays.

On the other hand, in the F160W images, based on the PSF z-band mag of 16.99 and assuming a QSO template there is a saturation in 28 seconds. We note the UKIDSS J-mag is somewhat shorter integrations at 15.43mag in J (2" diameter aperture) which suggests saturation in 24 seconds, but we expect it contains some amount of extended flux from the nearby host galaxy. We use the 512x512 subarray to reduce readout and buffer dump. This provides a field-of-view (FOV) of 60"x60". We will use the 4-step BOX dither pattern with 16 reads for cosmic-ray and hot-pixel rejection, and to better sample the PSF.

Proposal 16063 - Visit 01 - The First Glimpse of A Candidate Recoiling Black Hole

Visit

Proposal 16063, Visit 01, implementation Mon Apr 06 17:01:14 GMT 2020

Diagnostic Status: No Diagnostics

Scientific Instruments: WFC3/IR, WFC3/UVIS

Special Requirements: (none)

Patterns

#	Primary Pattern		Secondary Pattern	Exposures
(1)	Pattern Type=WFC3-IR-DITHER-BOX-MIN Purpose=DITHER Number Of Points=4 Point Spacing=1.716 Line Spacing=1.095	Coordinate Frame=POS-TARG Pattern Orientation=18.528 Angle Between Sides=74.653 Center Pattern=false		(3-5)
(4)	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		(2)

Fixed Targets

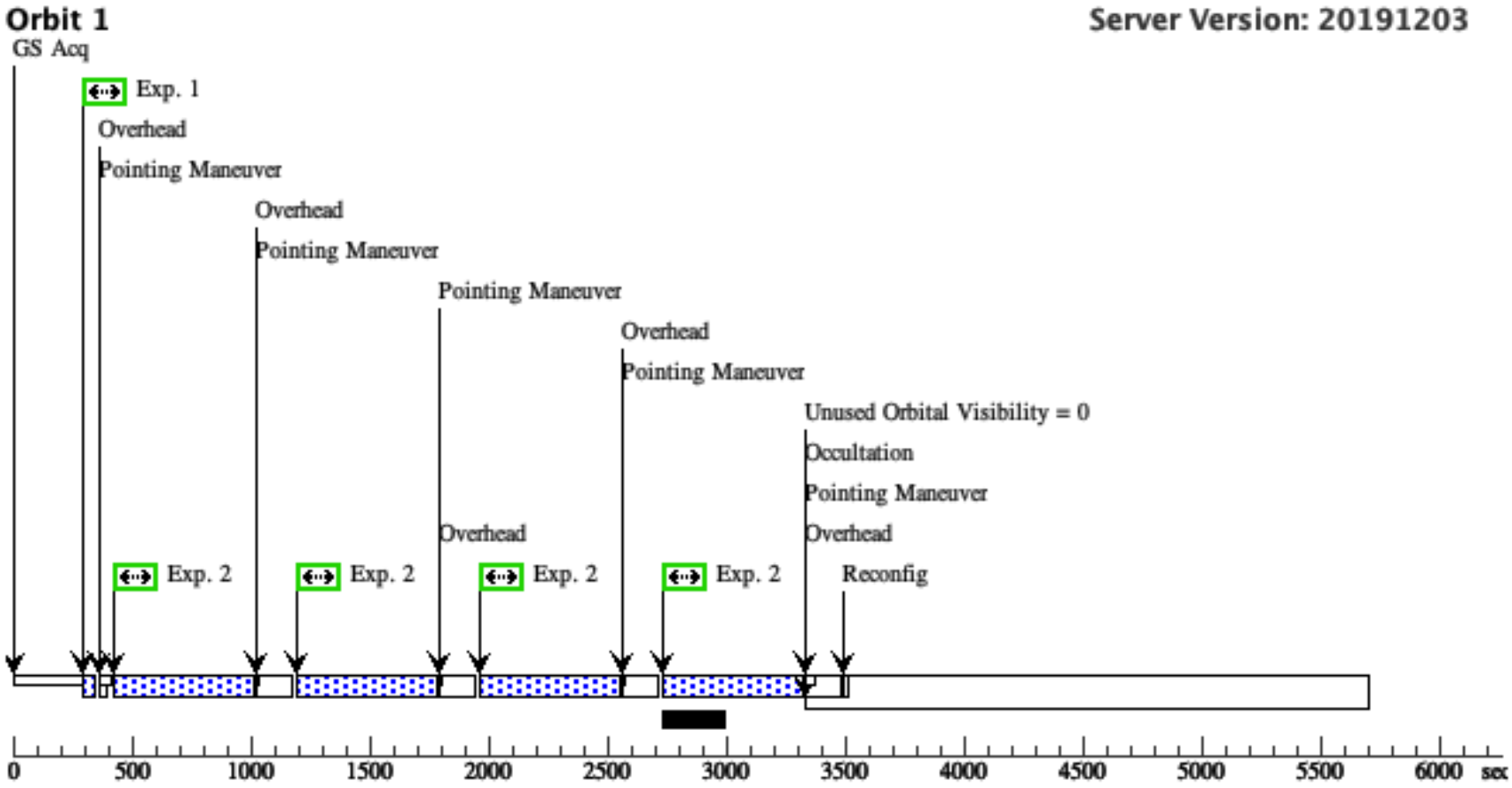
#	Name	Target Coordinates	Targ. Coord. Corrections	Fluxes	Miscellaneous
(1)	RXJ1756.4+5235	RA: 17 56 24.8000 (269.1033333d) Dec: +52 35 20.40 (52.58900d) Equinox: J2000		V=18.15 i=17.05, 15.43 J	Reference Frame: ICRS

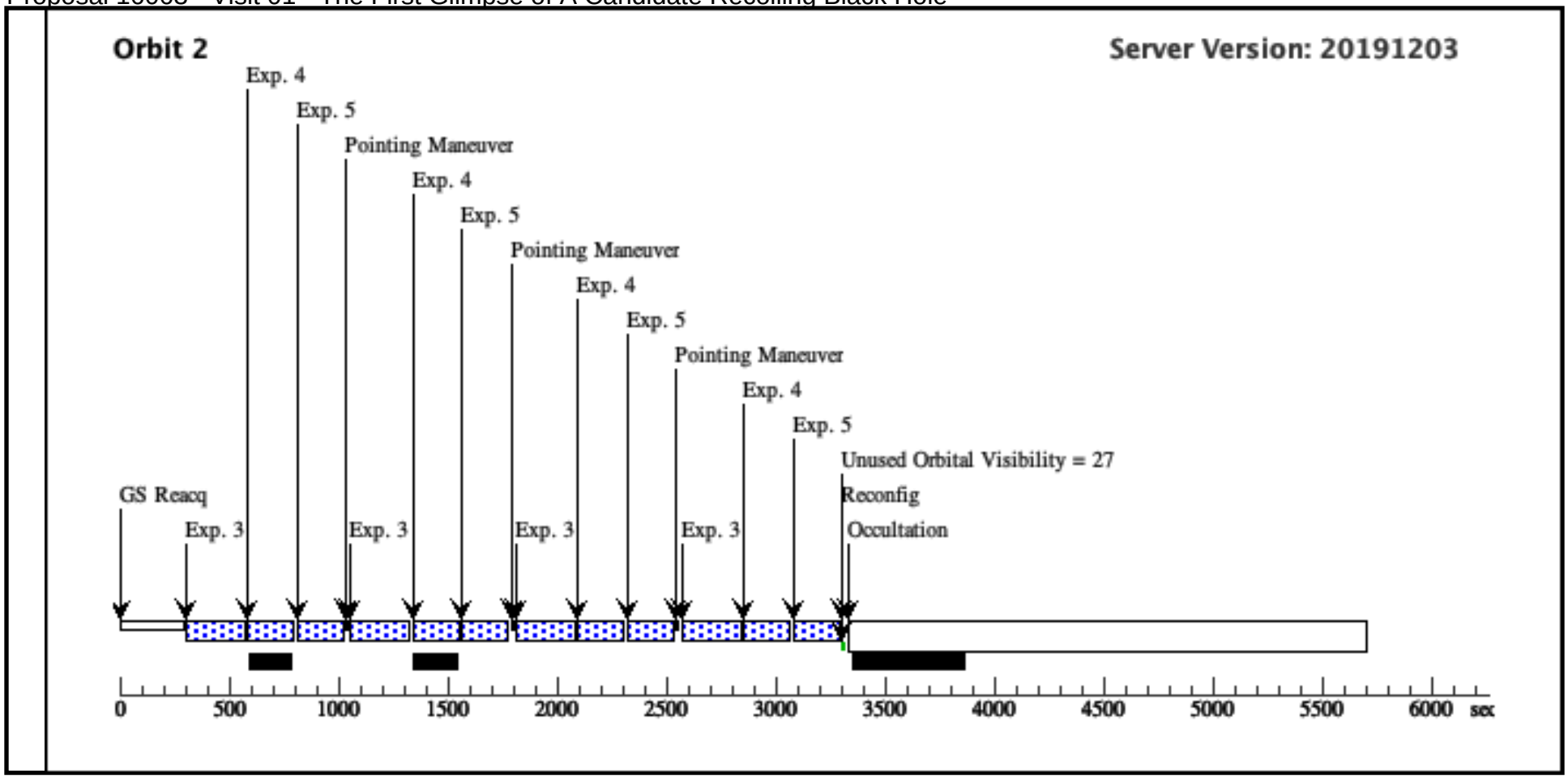
Comments:
Category=GALAXY
Description=[QUASAR]

Exposures

#	Label	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time (Total)/[Actual Dur.]	Orbit
1		(1) RXJ1756.4+5235	WFC3/UVIS, ACCUM, UVIS2-C512C-SUB	F814W	FLASH=14			23 Secs (23 Secs) *[==>]*	***[1]***
2		(1) RXJ1756.4+5235	WFC3/UVIS, ACCUM, UVIS1-2K2A-SUB	F814W			Pattern 4, Exps 2-2 in Visit 01 (4)	591 Secs (2364 Secs) *[==>(Pattern 1)]* *[==>(Pattern 2)]* *[==>(Pattern 3)]* *[==>(Pattern 4)]*	***[1]***
3		(1) RXJ1756.4+5235	WFC3/IR, MULTIACCUM, IRSUB512	F160W	SAMP-SEQ=STEP25; NSAMP=15		Pattern 1, Exps 3-5 in Visit 01 (1)	243.045901 Secs (972.184 Secs) *[==>(Pattern 1)]* *[==>(Pattern 2)]* *[==>(Pattern 3)]* *[==>(Pattern 4)]*	***[2]***
4		(1) RXJ1756.4+5235	WFC3/IR, MULTIACCUM, IRSUB512	F160W	SAMP-SEQ=SPARS25; NSAMP=10		Pattern 1, Exps 3-5 in Visit 01 (1)	207.144286 Secs (828.577 Secs) *[==>(Pattern 1)]* *[==>(Pattern 2)]* *[==>(Pattern 3)]* *[==>(Pattern 4)]*	***[2]***
5		(1) RXJ1756.4+5235	WFC3/IR, MULTIACCUM, IRSUB512	F160W	SAMP-SEQ=SPARS25; NSAMP=10		Pattern 1, Exps 3-5 in Visit 01 (1)	207.144286 Secs (828.577 Secs) *[==>(Pattern 1)]* *[==>(Pattern 2)]* *[==>(Pattern 3)]* *[==>(Pattern 4)]*	***[2]***

Orbit Structure




Orbit 2
Server Version: 20191203
Exp. 4
Exp. 5
Pointing Maneuver
Exp. 4
Exp. 5
Pointing Maneuver
Exp. 4
Exp. 5
Pointing Maneuver
Exp. 4
Exp. 5
Unused Orbital Visibility = 27
Reconfig
Occultation
GS Reacq
Exp. 3
Exp. 3
Exp. 3
Exp. 3
0
500
1000
1500
2000
2500
3000
3500
4000
4500
5000
5500
6000
sec