16494 - Re-Testing the Limits of AGN Feedback in Central Cluster Galaxies

Cycle: 28, Proposal Category: GO/DD

(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) RXJ1532.9+3021	ACS/WFC	2	17-Feb-2021 11:01:01.0	yes
02	(1) RXJ1532.9+3021	ACS/WFC	2	17-Feb-2021 11:01:02.0	yes

4 Total Orbits Used

ABSTRACT

In the cores of galaxy clusters, the hot intracluster medium should cool rapidly, leading to "cooling flows" of order ~100-1000 Msun/yr. Our current picture is that AGN feedback is responsible for preventing these runaway cooling events, leading to more typical star formation rates of ~1-10 Msun/yr in the centers of relaxed, cool core clusters. However, recent work suggests that feedback may saturate in the most massive clusters, leading to a cooling imbalance in the most extreme systems. In this proposal, we target one of the most star-forming central cluster galaxies in the Universe (with the other 5 having already been observed), which is forming stars at nearly the classical cooling flow prediction. We will obtain narrow-band [O II] imaging using the ACS ramp filter on this cluster, allowing us to probe the development of thermal instabilities as gas condenses out of the hot phase and ultimately forms stars. Combining these data with the larger sample sample of six massive clusters provides an opportunity to test the limits of AGN feedback, where cooling does not appear to be significantly suppressed. Three of these six clusters also harbor central QSOs, allowing us to probe the different effects of mechanical (radio-mode) and radiative (quasar-mode) feedback in the inner regions of clusters. As the six most

star-forming central cluster galaxies, these will make stunning and inspiring images and have tremendous legacy value, as recent Chandra+ALMA and future JWST targets. NOTE: This is a reobservation of a failed visit for a larger approved program.

OBSERVING DESCRIPTION

Our goal is to obtain a deep, high-angular resolution maps of [O II]3726,3729 for a single giant elliptical galaxy, following in methodology from HST Proposals 15315 and 15661. This is possible using the ramp filters on ACS, which provide narrow-band filters over the range 3700-10700A. At the redshift of our targets the filter width is ~120A. The width of this filter means that we will (easily) obtain both lines in the [O II] doublet, while avoiding any other strong lines. Given the inherent challenge in flux calibrating and flat fielding HST ramp filter data, achieving a reliable flux map would be challenging even with perfect knowledge of the intrinsic extinction.

We will use in-hand broadband filter observations to subtract continuum emission, which will contribute significantly to the narrow bandpass. Broadband filters have been chosen to bracket the 4000A break and avoid emission from Balmer lines and [O III] (5007A). These broadband filters are a factor of ~10x wider than the narrow-band filter, providing similar sensitivity to the continuum in a single orbit as we achieve over 8 exposures in the narrow band. Combining the two bands bracketing the [OII] line, we will have a factor of 5x deeper exposure in the continuum, compared to the narrow-band exposure. Without these deep continuum images, we would add significant amounts of noise during the continuum-subtraction procedure, reducing the effective depth of our narrow-band images.

Visit

Proposal 16494, RXJ1532-OII-v1 (01), scheduling Wed Feb 17 16:01:02 GMT 2021

Diagnostic Status: Warning

Scientific Instruments: ACS/WFC

Special Requirements: (none)

Diagnostics

(Exposure 2 (RXJ1532-OII-v1 (01))) Warning (Form): POS TARG & PATTERN should be used carefully with ACS ramp filters as central wavelengths & transmission efficiencies vary within the apertures.

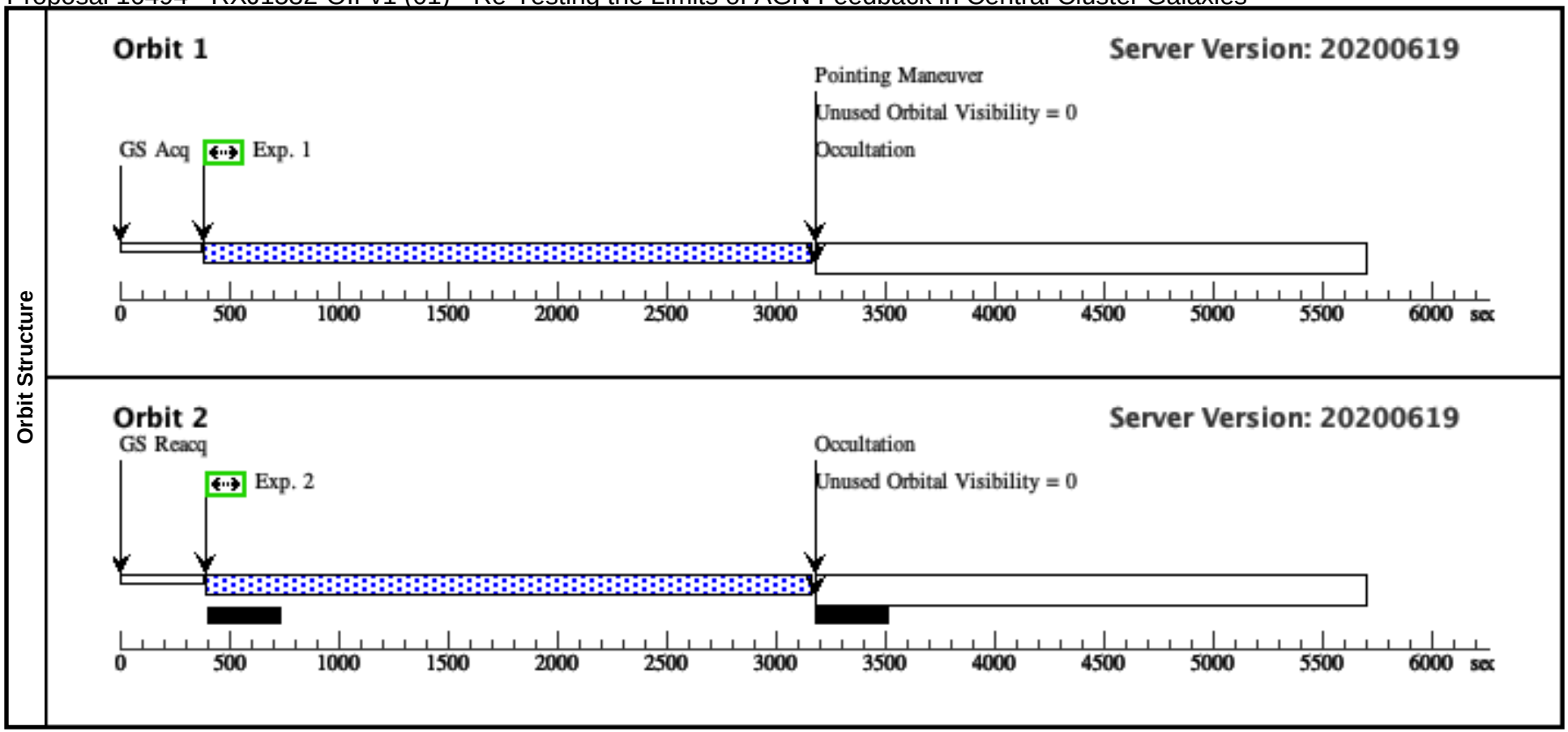
Fixed Targets

#	Name	Target Coordinates	Targ. Coord. Corrections	Fluxes	Miscellaneous
(1)	RXJ1532.9+3021	RA: 15 32 53.7777 (233.2240738d) Dec: +30 20 59.37 (30.34982d) Equinox: J2000		V=18.7	Reference Frame: NED

Comments:
Category=CLUSTER OF GALAXIES
Description=[COOLING FLOW, EMISSION LINE NEBULA, NUCLEUS, STAR FORMING REGION]

Exposures

#	Label	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time (Total)/[Actual Dur.]	Orbit
1		(1) RXJ1532.9+3021	ACS/WFC, ACCUM, WFC1-MRAMP	FR505N 5080 A				2000 Secs (2577 Secs) *[==>2577.0 Secs]*	 ***[1]***
2		(1) RXJ1532.9+3021	ACS/WFC, ACCUM, WFC1-MRAMP	FR505N 5080 A		POS TARG 0.247,0.094		2000 Secs (2650 Secs) *[==>2650.0 Secs]*	 ***[2]***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Pointing Maneuver
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GS Acq
Exp. 1
Occultation
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1500
2000
2500
3000
3500
4000
4500
5000
5500
6000
sec
Orbit 2
Server Version: 20200619
GS Reacq
Occultation
Exp. 2
Unused Orbital Visibility = 0
0
500
1000
1500
2000
2500
3000
3500
4000
4500
5000
5500
6000
sec

Visit

Proposal 16494, RXJ1532-OII-v2 (02), scheduling Wed Feb 17 16:01:02 GMT 2021

Diagnostic Status: Warning

Scientific Instruments: ACS/WFC

Special Requirements: (none)

Diagnostics

(Exposure 1 (RXJ1532-OII-v2 (02))) Warning (Form): POS TARG & PATTERN should be used carefully with ACS ramp filters as central wavelengths & transmission efficiencies vary within the apertures.

(Exposure 2 (RXJ1532-OII-v2 (02))) Warning (Form): POS TARG & PATTERN should be used carefully with ACS ramp filters as central wavelengths & transmission efficiencies vary within the apertures.

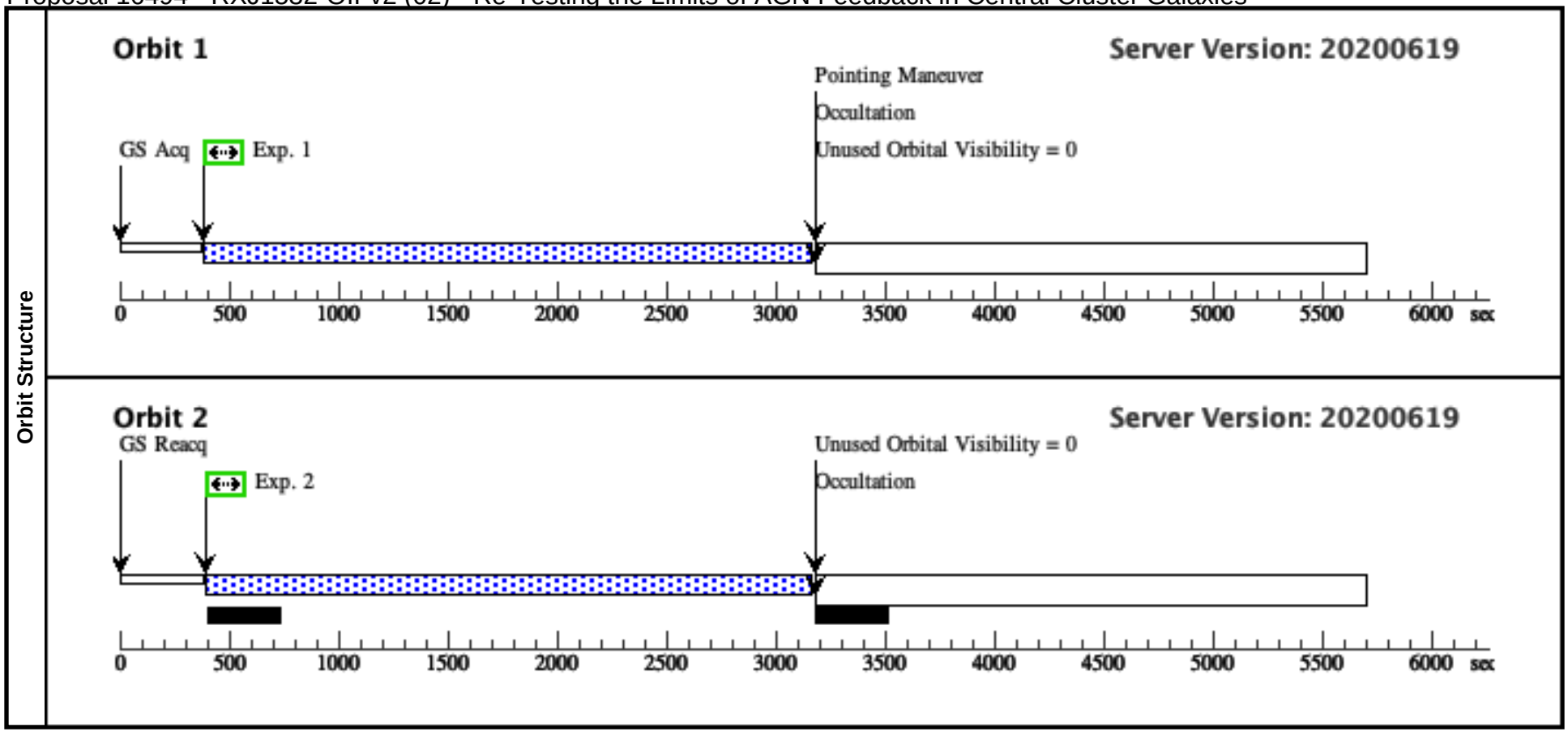
Fixed Targets

#	Name	Target Coordinates	Targ. Coord. Corrections	Fluxes	Miscellaneous
(1)	RXJ1532.9+3021	RA: 15 32 53.7777 (233.2240738d) Dec: +30 20 59.37 (30.34982d) Equinox: J2000		V=18.7	Reference Frame: NED

Comments:
Category=CLUSTER OF GALAXIES
Description=[COOLING FLOW, EMISSION LINE NEBULA, NUCLEUS, STAR FORMING REGION]

Exposures

#	Label	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time (Total)/[Actual Dur.]	Orbit
1		(1) RXJ1532.9+3021	ACS/WFC, ACCUM, WFC1-MRAMP	FR505N 5080 A		POS TARG 0.124,0.232		2000 Secs (2577 Secs) *[==>2577.0 Secs]*	 ***[1]***
2		(1) RXJ1532.9+3021	ACS/WFC, ACCUM, WFC1-MRAMP	FR505N 5080 A		POS TARG -0.124,0.138		2000 Secs (2650 Secs) *[==>2650.0 Secs]*	 ***[2]***


Orbit Structure
Orbit 1
Server Version: 20200619
Pointing Maneuver
Occultation
Unused Orbital Visibility = 0
GS Acq
Exp. 1
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1500
2000
2500
3000
3500
4000
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5000
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6000
sec
Orbit 2
Server Version: 20200619
GS Reacq
Unused Orbital Visibility = 0
Exp. 2
Occultation
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2500
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5500
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sec