16441 - Understanding How CTE Affects the Faintest Point Sources in WFC3/UVIS

Cycle: 28, Proposal Category: CAL/WFC

(Availability Mode: RESTRICTED)

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?*
02	(1) NGC-5139 ANY	ACS/WFC WFC3/UVIS	2	12-Nov-2020 16:08:08.0	yes

2 Total Orbits Used

ABSTRACT

The calibration programs (such as CAL-16440) that attempt to pin-down the parameters of the CTE model involve a study of warm pixels. This is approprate for evaluating the pixel-based model, however stars are different from warm pixels. Their profiles involve multiple pixels, and the downstream pixels can have a significant shielding effect on the upstream pixels. Although the pixel-based models include this effect in principle, it is hard to evaluate exactly how shielding in the model compares with shielding in the real detectors. Therefore, it is useful to observe actual stars to evaluate the model.

In addition, one complication of the model involves the readnoise. The pixel-based CTE correction is a necessarily deconvolution process. The readnoise was added after the CTE-blurring took place, therefore its noise will be amplified by any pixel-based reconstruction process. For faint

sources, it may sometimes be preferable to forego the pixel-based reconstruction (which can amplify readnoise and diminish the significance of the sources) and analyze the _flt images directly, doing the CTE correction as part of the analysis. The observations in this program will allow users to construct photometric and astrometric corrections for the impact of CTE on faint sources on various backgrounds.

Finally, this program will provide advice to users about how much post-flash to add to maximize the signal-to-noise of their sources. A higher background will preserve more signal, while also increasing the noise.

This program is similar to CAL-14881, except that the target is Omega Cen instead of the bulge and we are finely sampling sky levels between 10e and 30e for UVIS, so that users can dial in the background level that optimizes the signal to noise of their program. The previous program sampled a less useful, wider variety of backgrounds. We are also observing ACS in parallel at 4 background levels.

OBSERVING DESCRIPTION

This program involves two external orbits. We will place WFC3/UVIS on the center of globular cluster Omega Centauri, and ACS in parallel on a field that is about 6' away. In each orbit, we are able to collect four short and two deep full-frame WFC3/UVIS exposures per orbit, and two short and two deep 2Kx2K subarray ACS observations.

There will be no dithering in this program, since the goal is to establish the "true" scene from the 800s deep exposures, then to downscale this true scene to the short exposures with different backgrounds in order to see how the background level affects the distribution/preservation of charge.

From the archive, 40s exposures of the scene at the center of Omega Cen have a background of 26e in WFC3/UVIS. This is way too high for our purposes of exploring the background between 10e and 30e. So we will scale down these exposure times to 4s so that we can get a background of 2.6e. We can then add postflash to get it into our desired range. For ACS at a 6' removed field, the natural background should be quite small, so our postflash will define the background.

For UVIS we will probe 8 background levels: 10e, 12e, 14e, 16e, 19e, 22e, 25e, and 29e.

For ACS we will probe 4 backgrond levels: 10e, 20e, 30e, and 40e.

4s exposures should have ~30,000 stars in each UVIS field in each magnitude bin at the faint end. This will provide us a very clear measurement of

how stellar profiles vary with flux and background level. The deep exposures will be 800s, so we will scale them down by a factor of 200, which will provide a very robust "truth" image for evaluating the short exposures. Saturation in the deep exposures should not have a big impact.

Visit

Proposal 16441, EXTERNAL-CTE-CHECK (02) Thu Nov 12 21:08:09 GMT 2020

Diagnostic Status: Warning

Scientific Instruments: WFC3/UVIS, ACS/WFC

Special Requirements: BETWEEN 11-NOV-2020 AND 15-JAN-2021

Diagnostics

(Primary uvis_bkg_10e (02.001)) Warning (Form): FLASH level may be too low for this exposure or a short subexposure. See extended explanation in the diagnostic browser

(Primary uvis_bkgd_12e (02.002)) Warning (Form): FLASH level may be too low for this exposure or a short subexposure. See extended explanation in the diagnostic browser

(Primary uvis_bkgd_14e (02.006)) Warning (Form): FLASH level may be too low for this exposure or a short subexposure. See extended explanation in the diagnostic browser

(Primary uvis_bkgd_19e (02.011)) Warning (Form): FLASH level may be too high for this exposure or a long subexposure. See extended explanation in the diagnostic browser

(Primary uvis_bkgd_22e (02.012)) Warning (Form): FLASH level may be too high for this exposure or a long subexposure. See extended explanation in the diagnostic browser

(Primary uvis_bkgd_25e (02.016)) Warning (Form): FLASH level may be too high for this exposure or a long subexposure. See extended explanation in the diagnostic browser

(Primary uvis_bkgd_29e (02.017)) Warning (Form): FLASH level may be too high for this exposure or a long subexposure. See extended explanation in the diagnostic browser

Fixed Targets

#	Name	Target Coordinates	Targ. Coord. Corrections	Fluxes	Miscellaneous
(1)	NGC-5139	RA: 13 26 47.2800 (201.6970000d) Dec: -47 28 46.20 (-47.47950d) Equinox: J2000	Proper Motion RA: -3.1959567280703653E-4 sec of time/yr Proper Motion Dec: -0.006729999904564465 arcsec/yr Epoch of Position: 2015.5	V=5.33	Reference Frame: SIMBAD

Comments: This object was generated by the targetselector and retrieved from the SIMBAD database.
Category=EXT-CLUSTER
Description=[GLOBULAR CLUSTER]

Exposures

#	Label	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time (Total)/[Actual Dur.]	Orbit
1	uvis_bkg_10e	(1) NGC-5139	WFC3/UVIS, ACCUM, UVIS	F606W	FLASH=6; BLADE=A	POS TARG null,0	Prime + Parallel Group 1-5 in EXTERNAL-CTE-CHECK (02)	4 Secs (4 Secs) *[==>]*	*[1]*
2	uvis_bkgd_12e	(1) NGC-5139	WFC3/UVIS, ACCUM, UVIS	F606W	FLASH=8; BLADE=A	SAME POS AS 1	Prime + Parallel Group 1-5 in EXTERNAL-CTE-CHECK (02)	4 Secs (4 Secs) *[==>]*	*[1]*
3	uvis_deep1	(1) NGC-5139	WFC3/UVIS, ACCUM, UVIS	F606W		SAME POS AS 1	Prime + Parallel Group 1-5 in EXTERNAL-CTE-CHECK (02)	800 Secs (800 Secs) *[==>]*	*[1]*
4	acs_bkgd_10e	ANY	ACS/WFC, ACCUM, WFC1B-2K	F606W	FLASH=10		Prime + Parallel Group 1-5 in EXTERNAL-CTE-CHECK (02)	4 Secs (4 Secs) *[==>]*	*[1]*
5	acs deep1	ANY	ACS/WFC, ACCUM, WFC1B-2K	F606W			Prime + Parallel Group 1-5 in EXTERNAL-CTE-CHECK (02)	800 Secs (800 Secs) *[==>]*	*[1]*
6	uvis_bkgd_14e	(1) NGC-5139	WFC3/UVIS, ACCUM, UVIS	F606W	FLASH=10; BLADE=A		Prime + Parallel Group 6-10 in EXTERNAL-CTE-CHECK (02)	4 Secs (4 Secs) *[==>]*	*[1]*
7	uvis_bkgd_16e	(1) NGC-5139	WFC3/UVIS, ACCUM, UVIS	F606W	FLASH=12; BLADE=A		Prime + Parallel Group 6-10 in EXTERNAL-CTE-CHECK (02)	4 Secs (4 Secs) *[==>]*	*[1]*
8	uvis_deep2	(1) NGC-5139	WFC3/UVIS, ACCUM, UVIS	F606W			Prime + Parallel Group 6-10 in EXTERNAL-CTE-CHECK (02)	800 Secs (800 Secs) *[==>]*	*[1]*
9	acs_bkgd_20e	ANY	ACS/WFC, ACCUM, WFC1B-2K	F606W	FLASH=20		Prime + Parallel Group 6-10 in EXTERNAL-CTE-CHECK (02)	4 Secs (4 Secs) *[==>]*	*[1]*
10	acs_deep2	ANY	ACS/WFC, ACCUM, WFC1B-2K	F606W			Prime + Parallel Group 6-10 in EXTERNAL-CTE-CHECK (02)	800 Secs (800 Secs) *[==>]*	*[1]*
11	uvis_bkgd_19e	(1) NGC-5139	WFC3/UVIS, ACCUM, UVIS	F606W	FLASH=15; BLADE=A	POS TARG null,0	Prime + Parallel Group 11-15 in EXTERNAL-CTE-CHECK (02)	4 Secs (4 Secs) *[==>]*	*[2]*
12	uvis_bkgd_22e	(1) NGC-5139	WFC3/UVIS, ACCUM, UVIS	F606W	FLASH=18; BLADE=A		Prime + Parallel Group 11-15 in EXTERNAL-CTE-CHECK (02)	4 Secs (4 Secs) *[==>]*	*[2]*
13	uvis_deep3	(1) NGC-5139	WFC3/UVIS, ACCUM, UVIS	F606W			Prime + Parallel Group 11-15 in EXTERNAL-CTE-CHECK (02)	800 Secs (800 Secs) *[==>]*	*[2]*
14	acs_bkgd_30e	ANY	ACS/WFC, ACCUM, WFC1B-2K	F606W	FLASH=30		Prime + Parallel Group 11-15 in EXTERNAL-CTE-CHECK (02)	4 Secs (4 Secs) *[==>]*	*[2]*
15	acs_deep3	ANY	ACS/WFC, ACCUM, WFC1B-2K	F606W			Prime + Parallel Group 11-15 in EXTERNAL-CTE-CHECK (02)	800 Secs (800 Secs) *[==>]*	*[2]*

	16	uvis_bkgd_25e	(1) NGC-5139	WFC3/UVIS, ACCUM, UVIS	F606W	FLASH=21; BLADE=A	Prime + Parallel Group 16-20 in EXTERNAL-CTE-CHECK (02)	4 Secs (4 Secs) *[==>]*	 ***[2]***
	17	uvis_bkgd_29e	(1) NGC-5139	WFC3/UVIS, ACCUM, UVIS	F606W	FLASH=25; BLADE=A	Prime + Parallel Group 16-20 in EXTERNAL-CTE-CHECK (02)	4 Secs (4 Secs) *[==>]*	 ***[2]***
	18	uvis_deep4	(1) NGC-5139	WFC3/UVIS, ACCUM, UVIS	F606W		Prime + Parallel Group 16-20 in EXTERNAL-CTE-CHECK (02)	800 Secs (800 Secs) *[==>]*	 ***[2]***
	19	acs_bkgd_40e	ANY	ACS/WFC, ACCUM, WFC1B-2K	F606W	FLASH=40	Prime + Parallel Group 16-20 in EXTERNAL-CTE-CHECK (02)	4 Secs (4 Secs) *[==>]*	 ***[2]***
	20	acs_deep4	ANY	ACS/WFC, ACCUM, WFC1B-2K	F606W		Prime + Parallel Group 16-20 in EXTERNAL-CTE-CHECK (02)	800 Secs (800 Secs) *[==>]*	 ***[2]***

Orbit Structure