17262 - WFC3/UVIS Faint-Source CTE Characterization

Cycle: 30, Proposal Category: CAL/WFC3

(Availability Mode: RESTRICTED)

INVESTIGATORS

Name	*Institution*	*E-Mail*
Dr. Jay Anderson (PI) (Contact)	**Space Telescope Science Institute**	**jayander@stsci.edu**
Benjamin Kuhn (CoI)	Space Telescope Science Institute	bkuhn@stsci.edu
Dr. Sylvia M. Baggett (CoI)	Space Telescope Science Institute	sbaggett@stsci.edu

VISITS

Visit	*Targets used in Visit*	*Configurations used in Visit*	*Orbits Used*	*Last Orbit Planner Run*	*OP Current with Visit?*
01	(1) OMEGACEN	WFC3/UVIS	1	15-Nov-2022 16:00:35.0	yes

1 Total Orbits Used

ABSTRACT

This program is a follow-on to CAL-16441 (PI-Anderson), which examined how faint sources near the background are impacted by CTE (charge-transfer efficiency) losses. See WFC3/ISR 2021-09 for a description of CAL-16441's findings.

Many WFC3/UVIS programs involve taking multiple long exposures of fields in order to find extremely faint sources that cannot be detected reliably in single exposures. It is unclear how well the pixel-based CTE-correction algorithm is able to correct for CTE losses when the sources are very close to the background. We need to assess this directly so that we can help observes plan and interpret their observations.

The previous program --- CAL-16441 --- explored backgrounds from 0e to 30e, spanning the levels that users get when they post-flash low-background images (or when they neglect to use a proper post-flash).

CTE continues to improve beyond 30e, and observations with wide-band filters often get natural backgrounds higher than 30e, so it is useful to extend the CAL-16441 analysis to backgrounds from 30e all the way up to 100e. In particular, users often decide whether to take 3 exposures per orbit or 2 exposures per orbit (or even one exposure per orbit) based on CTE considerations. CTE improves in two ways with fewer longer exposures: (1) the source flux per exposure is larger, and (2) the natural background per exposure is larger. The downside is that cosmic rays impact more pixels in longer exposures. This 1-orbit external program will help users better weigh their options.

We will take backgrounds of 20e, 35e, 50e, 70e, and 100e. The 20e background is so that we can have a more direct tie-in at the current epoch to the "recommended" level. We will take two deep exposures to provide the "truth" against which the short 1s exposures are compared.

OBSERVING DESCRIPTION

We will take five short 1-s exposures with post-flashed backgrounds of 20e, 35e, 50e, 70e, and 100e, and two deep 350-s exposures of the same field with no dither. The deep exposures can be combined to show us the true astronomical scene present in the short exposures. The survival of flux in the variously post-flashed short exposures will tell us about how CTE impacts faint sources near background levels from 20e up to 100e.

The medium post-flash gives about 85e per second (from FIg 16 of WFC3/ISR 2013-12, Biretta & Baggett) . So:

25e = 0.3s * 85 e/s
34e = 0.4s * 85 e/s
51e = 0.6s * 85 e/s
76e = 0.9s * 85 e/s
105e = 1.2s * 85 e/s

Visit

Proposal 17262, OMEGA CEN (01) Tue Nov 15 21:00:35 GMT 2022

Diagnostic Status: Warning

Scientific Instruments: WFC3/UVIS

Special Requirements: (none)

Comments: Take five short 1-s exposures with various postflash and two long 350-s exposures. The long exposures can be scaled down by x350 (6.3 mags), such that a star near saturation with 70000 counts in the deep exposure will have 200 counts in the central pixel in the short 1s images. And marginally detectable stars with 5e in their central pixels in the short exposures will have 1750 counts in their central pixels in the deep exposures.

We use "medium" flash for all these exposures for consistency. The medium flash gets about 85e/s. Thus

Diagnostics

(25e background (01.001)) Warning (Form): FLASH level may be too low for this exposure or a short subexposure. See extended explanation in the diagnostic browser

(34e background (01.002)) Warning (Form): FLASH level may be too low for this exposure or a short subexposure. See extended explanation in the diagnostic browser

(51e background (01.003)) Warning (Form): FLASH level may be too low for this exposure or a short subexposure. See extended explanation in the diagnostic browser

(76e background (01.004)) Warning (Form): FLASH level may be too low for this exposure or a short subexposure. See extended explanation in the diagnostic browser

(102e background (01.005)) Warning (Form): FLASH level may be too low for this exposure or a short subexposure. See extended explanation in the diagnostic browser

(deep exposure #1 (01.006)) Warning (Form): FLASH level may be too low for this exposure or a short subexposure. See extended explanation in the diagnostic browser

(deep exposure #2 (01.007)) Warning (Form): FLASH level may be too low for this exposure or a short subexposure. See extended explanation in the diagnostic browser

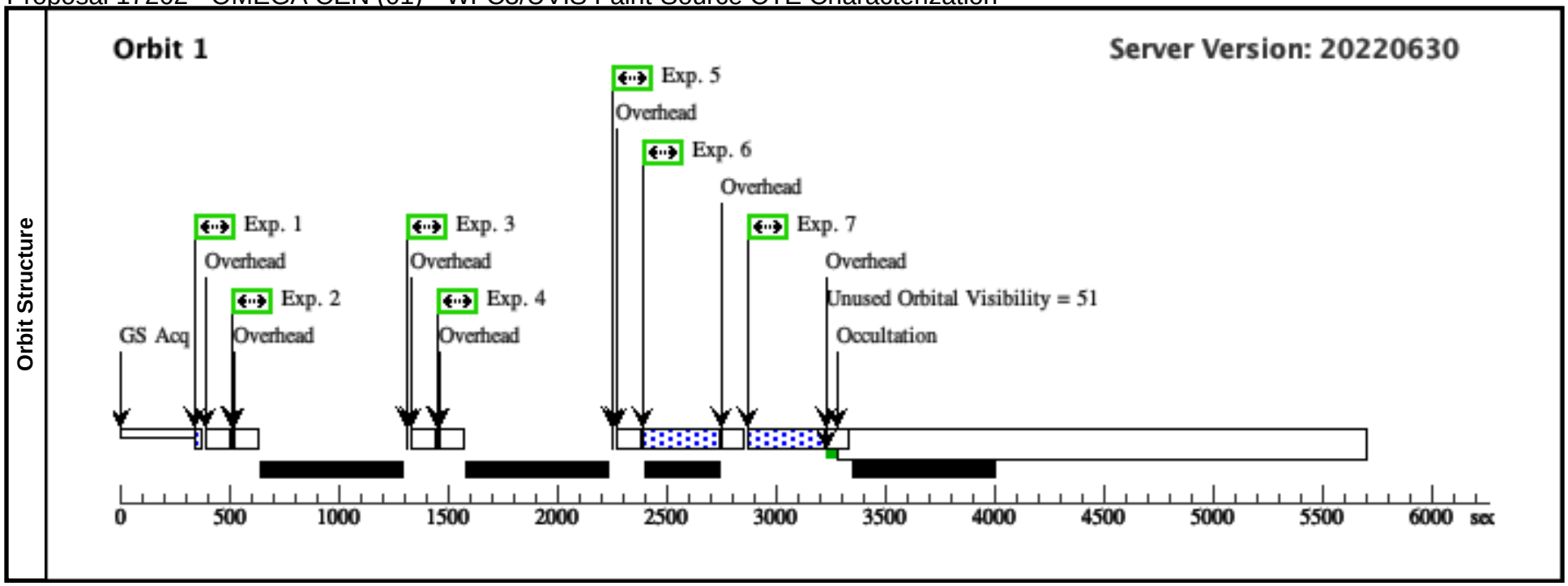
Fixed Targets

#	Name	Target Coordinates	Targ. Coord. Corrections	Fluxes	Miscellaneous
(1)	OMEGACEN	RA: 13 26 47.2400 (201.6968333d) Dec: -47 28 46.45 (-47.47957d) Equinox: J2000		V=-10.26	Reference Frame: ICRS

Comments:
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	25e background	(1) OMEGACEN	WFC3/UVIS, ACCUM, UVIS-CENTER	F606W	FLASHCUR=MEDIUM; FLASHEXP=0.3			1 Secs (1 Secs) *[==>]*	 ***[1]***
2	34e background	(1) OMEGACEN	WFC3/UVIS, ACCUM, UVIS-CENTER	F606W	FLASHCUR=MEDIUM; FLASHEXP=0.4			1 Secs (1 Secs) *[==>]*	 ***[1]***
3	51e background	(1) OMEGACEN	WFC3/UVIS, ACCUM, UVIS-CENTER	F606W	FLASHCUR=MEDIUM; FLASHEXP=0.6			1 Secs (1 Secs) *[==>]*	 ***[1]***
4	76e background	(1) OMEGACEN	WFC3/UVIS, ACCUM, UVIS-CENTER	F606W	FLASHCUR=MEDIUM; FLASHEXP=0.9			1 Secs (1 Secs) *[==>]*	 ***[1]***
5	102e background	(1) OMEGACEN	WFC3/UVIS, ACCUM, UVIS-CENTER	F606W	FLASHCUR=MEDIUM; FLASHEXP=1.2			1 Secs (1 Secs) *[==>]*	 ***[1]***
6	deep exposure #1	(1) OMEGACEN	WFC3/UVIS, ACCUM, UVIS-CENTER	F606W				350 Secs (350 Secs) *[==>]*	 ***[1]***
7	deep exposure #2	(1) OMEGACEN	WFC3/UVIS, ACCUM, UVIS-CENTER	F606W				350 Secs (350 Secs) *[==>]*	 ***[1]***


Orbit Structure
Orbit 1
Server Version: 20220630
GS Acq
Exp. 1
Overhead
Exp. 2
Overhead
Exp. 3
Overhead
Exp. 4
Overhead
Exp. 5
Overhead
Exp. 6
Overhead
Exp. 7
Overhead
Unused Orbital Visibility = 51
Occultation
0
500
1000
1500
2000
2500
3000
3500
4000
4500
5000
5500
6000
sec