17260 - WFC3 IR Time-Dependent Sensitivity: Clusters

Cycle: 30, Proposal Category: CAL/WFC3

(Availability Mode: RESTRICTED)

INVESTIGATORS

Name	*Institution*	*E-Mail*
Varun Bajaj (PI) (Contact)	**Space Telescope Science Institute**	**vbajaj@stsci.edu**
Dr. Annalisa Calamida (CoI)	Space Telescope Science Institute	calamida@stsci.edu
Ms. Jennifer Mack (CoI)	Space Telescope Science Institute	mack@stsci.edu
Dr. Debopam Som (CoI)	Space Telescope Science Institute	dsom@stsci.edu

VISITS

Visit	*Targets used in Visit*	*Configurations used in Visit*	*Orbits Used*	*Last Orbit Planner Run*	*OP Current with Visit?*
01	(1) M-4-V1	WFC3/IR	1	23-Nov-2022 12:00:28.0	yes
02	(2) 47TUC DARK	WFC3/IR	1	23-Nov-2022 12:00:29.0	yes
03	(2) 47TUC DARK	WFC3/IR	1	23-Nov-2022 12:00:30.0	yes

3 Total Orbits Used

ABSTRACT

The IR grism flux monitor shows a sensitivity loss of 0.12+/-0.01%/yr in G102 and 0.06+/-0.01%/yr in G141. Observations of flux standards in the IR filters, however, show no evidence of any loss over time, but the repeatability is limited by systematic errors of +/- 1%. Scanned observations of M35 from 2015-2020 show marginal losses of 0.024+/- 0.008%/yr in F140W, but these data show a large scatter which may be related to detector preconditioning. Cluster observations allow for the measurement of many more stars, and photometry of the core Omega-Cen used for distortion monitoring suggests losses of 0.23 +/- 0.03%/yr in F160W, but crowding may play an effect on the results. Recent observations of a less dense stellar

field in M4 in F110W suggest losses of 0.13 +/- 0.02%/yr (first images only) and 0.20 +/- 0.03%/yr (all images), but these consist of only 4 visits. We propose continued monitoring of M4 at a ~6 month cadence. Two additional clusters are requested: the NGC104 field 6' from the core with F160W data from 2009-2013 and an Omega-Cen field 17' from the core with F110W & F160W images from 2016-2018, both of which mimic the observation strategy from the respective preceeding epochs, to eliminate systematics from differing observing modes.

To continue the monitoring of the WFC3/IR sensitivity loss we observe the clusters M4 and 47Tuc using the same observation strategies in HST programs 16864 and 16512, continuing the monitors for a subset of the clusters observed in those programs. Spefically, we propose a single epoch of M4 (using both F110W and F160W) and two epochs of 47Tuc (using solely F160W). This allows continued measurement of the sensitivity losses from M4, which has multiple epochs of observation since 2020, and will help better constrain the sensitivity losses derived from the 47Tuc measurements, which otherwise only had only a single epoch of observation after 2014. We use the same filters, exposure times, and sample sequences as the corresponding previous observations to minimize any systematic effects caused by using different configurations, and employ the same dithering strategy to obtain consistent detector preconditioning. The 47Tuc observations will be separated by approximately 6 months (180 degree roll), to more evenly sample the temporal change.

OBSERVING DESCRIPTION

In general, these observations copy the targets, sample sequences, NSamps, and orbit structure of previously obtained WFC3/IR observations in 16512, as this yields the fewest systematics when attempting to measure sensitivity losses over time.

We propose a single M4 Visit to match Visit 01 of 16864, using the same filters, exposure times, sample sequences, dithers, and roll angle. This will help eliminate systematics when comparing the relative photometry. The visit consists of 4 exposures, starting with two F110W and ending with two F160W exposures. The F110W exposures will use the SPARS50 sample sequence with 14 samples. The F160W exposures will only use 13 samples, due to the shorter orbital length (matching 16512). After each exposure POSTARGS of 2.5" will be applied, to mitigate self persistence.

The first visit of WFC3/IR observations of 47 Tuc (visit 02) was configued to be similar to 16864 Visit 05, which itself was based on Visit 01 of 13563. As opposed to previous observations, the roll for the first epoch is constrained to be similar to 16964 Visit 05 (previous observations were unconstrained, leading to a mix of roll angles used). The structure of the visit itself is the same as 16864 (which itself differs be the next most recent epoch, from 13563, by changing the last dark to another F160W exposure). As performed in 16864 Visit 05, the last exposure is also dithered by approximately 40 pixels as this help mitigate the effect of self persistence. Visit 03 of this program repeates the observations of Visit02, but rolled at

180 degrees, and will take place approximately 6 months later, to better sample temporal changes in sensitivity.

Visit

Proposal 17260, M-4 (01), implementation Wed Nov 23 17:00:31 GMT 2022

Diagnostic Status: No Diagnostics

Scientific Instruments: WFC3/IR

Special Requirements: ORIENT 100.0D TO 102.0 D; BETWEEN 20-AUG-2023:00:00:00 AND 15-SEP-2023:00:00:00

Fixed Targets

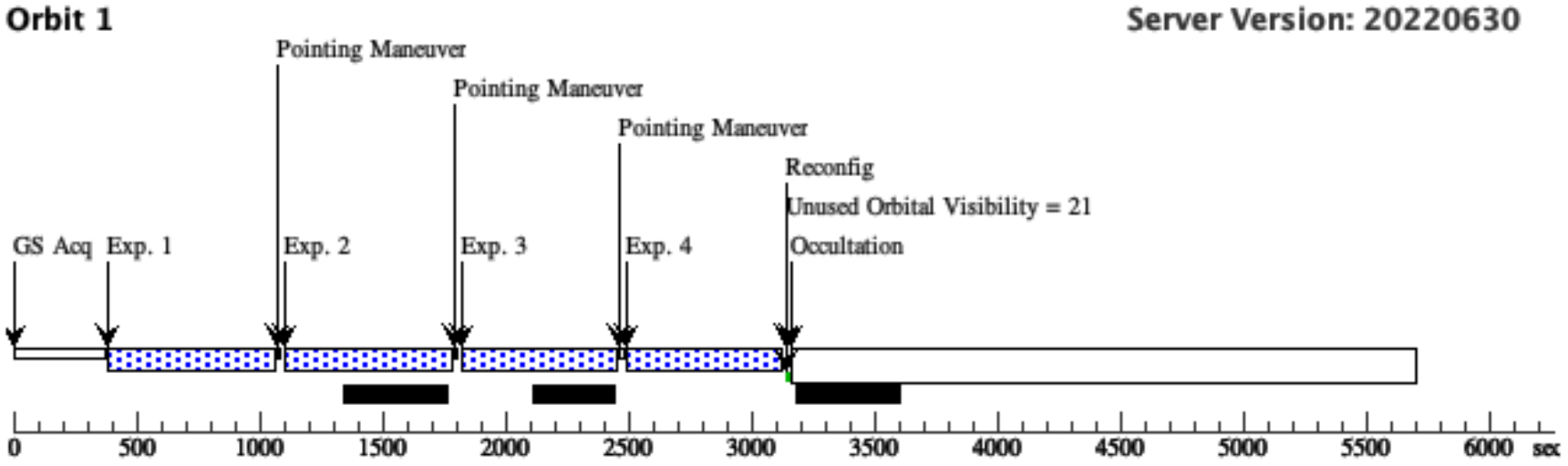
#	Name	Target Coordinates	Targ. Coord. Corrections	Fluxes	Miscellaneous
(1)	M-4-V1	RA: 16 23 41.5344 (245.9230600d) Dec: -26 29 54.22 (-26.49839d) Equinox: J2000		V=5.9	Reference Frame: ICRS

Comments:
Category=STELLAR CLUSTER
Description=[GLOBULAR CLUSTER]

Exposures

#	Label	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time (Total)/[Actual Dur.]	Orbit
1		(1) M-4-V1	WFC3/IR, MULTIACCUM, IR-UVIS-FIX	F110W	SAMP-SEQ=SPARS50; NSAMP=14	POS TARG -5,5		652.938154 Secs (652.938 Secs) *[==>]*	*[1]*
2		(1) M-4-V1	WFC3/IR, MULTIACCUM, IR-UVIS-FIX	F110W	SAMP-SEQ=SPARS50; NSAMP=14	POS TARG -2.5,2.5		652.938154 Secs (652.938 Secs) *[==>]*	*[1]*
3		(1) M-4-V1	WFC3/IR, MULTIACCUM, IR-UVIS-FIX	F160W	SAMP-SEQ=SPARS50; NSAMP=13	POS TARG 0,0		602.937703 Secs (602.938 Secs) *[==>]*	*[1]*
4		(1) M-4-V1	WFC3/IR, MULTIACCUM, IR-UVIS-FIX	F160W	SAMP-SEQ=SPARS50; NSAMP=13	POS TARG -7.5,7.5		602.937703 Secs (602.938 Secs) *[==>]*	*[1]*

Orbit Structure



Visit

Proposal 17260, 47Tuc (02), implementation Wed Nov 23 17:00:31 GMT 2022

Diagnostic Status: No Diagnostics

Scientific Instruments: WFC3/IR

Special Requirements: ORIENT 120.D TO 135.0 D; BETWEEN 01-NOV-2022:00:00:00 AND 01-MAY-2023:00:00:00

Fixed Targets

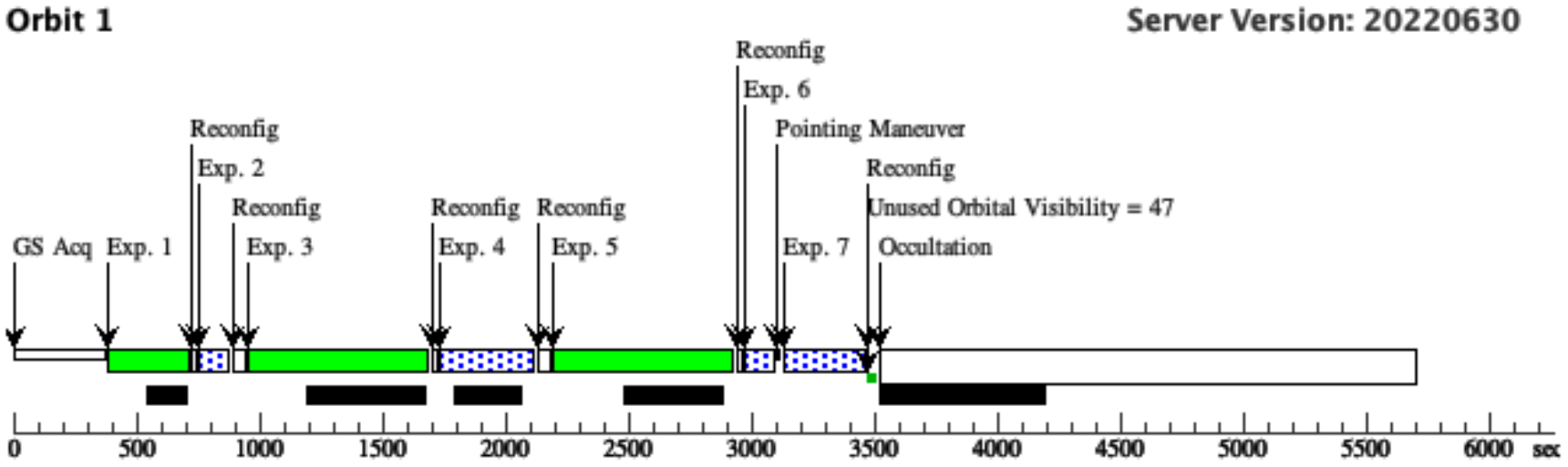
#	Name	Target Coordinates	Targ. Coord. Corrections	Fluxes	Miscellaneous
(2)	47TUC Alt Name1: NGC104	RA: 00 22 27.8446 (5.6160192d) Dec: -72 04 4.75 (-72.06799d) Equinox: J2000		V=22.0	Reference Frame: ICRS

Comments:
Category=CALIBRATION
Description=[DETECTOR LINEARITY TEST]

Exposures

#	Label	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time (Total)/[Actual Dur.]	Orbit
1	Dark	DARK	WFC3/IR, MULTIACCUM, IR	BLANK	SAMP-SEQ=SPARS 25; NSAMP=13			302.938471 Secs (302.938 Secs) *[==>]*	 ***[1]***
2	Short	(2) 47TUC	WFC3/IR, MULTIACCUM, IR-FIX	F160W	SAMP-SEQ=SPARS 10; NSAMP=10			92.940958 Secs (92.941 Secs) *[==>]*	 ***[1]***
3	Dark	DARK	WFC3/IR, MULTIACCUM, IR	BLANK	SAMP-SEQ=SPARS 50; NSAMP=15			702.938605 Secs (702.939 Secs) *[==>]*	 ***[1]***
4	Long	(2) 47TUC	WFC3/IR, MULTIACCUM, IR-FIX	F160W	SAMP-SEQ=SPARS 25; NSAMP=15			352.939501 Secs (352.94 Secs) *[==>]*	 ***[1]***
Comments: Designed to just saturate V=20 stars.									
5	Dark	DARK	WFC3/IR, MULTIACCUM, IR	BLANK	SAMP-SEQ=SPARS 50; NSAMP=15			702.938605 Secs (702.939 Secs) *[==>]*	 ***[1]***
6	Short	(2) 47TUC	WFC3/IR, MULTIACCUM, IR-FIX	F160W	SAMP-SEQ=SPARS 10; NSAMP=10			92.940958 Secs (92.941 Secs) *[==>]*	 ***[1]***
7	Extra Extern al	(2) 47TUC	WFC3/IR, MULTIACCUM, IR-FIX	F160W	SAMP-SEQ=SPARS 25; NSAMP=13	POS TARG 4,4		302.938471 Secs (302.938 Secs) *[==>]*	 ***[1]***

Orbit Structure



Visit

Proposal 17260, 47Tuc Rolled (03), implementation Wed Nov 23 17:00:31 GMT 2022

Diagnostic Status: No Diagnostics

Scientific Instruments: WFC3/IR

Special Requirements: ORIENT 179.9D TO 180D FROM 02; BETWEEN 01-AUG-2023:00:00:00 AND 01-NOV-2023:00:00:00

Fixed Targets

#	Name	Target Coordinates	Targ. Coord. Corrections	Fluxes	Miscellaneous
(2)	47TUC Alt Name1: NGC104	RA: 00 22 27.8446 (5.6160192d) Dec: -72 04 4.75 (-72.06799d) Equinox: J2000		V=22.0	Reference Frame: ICRS

Comments:
Category=CALIBRATION
Description=[DETECTOR LINEARITY TEST]

Exposures

#	Label	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time (Total)/[Actual Dur.]	Orbit
1	Dark	DARK	WFC3/IR, MULTIACCUM, IR	BLANK	SAMP-SEQ=SPARS25; NSAMP=13	GS ACQ SCENARIO BASE1B3		302.938471 Secs (302.938 Secs) *[==>]*	***[1]***
2	Short	(2) 47TUC	WFC3/IR, MULTIACCUM, IR-FIX	F160W	SAMP-SEQ=SPARS10; NSAMP=10			92.940958 Secs (92.941 Secs) *[==>]*	***[1]***
3	Dark	DARK	WFC3/IR, MULTIACCUM, IR	BLANK	SAMP-SEQ=SPARS50; NSAMP=15			702.938605 Secs (702.939 Secs) *[==>]*	***[1]***
4	Long	(2) 47TUC	WFC3/IR, MULTIACCUM, IR-FIX	F160W	SAMP-SEQ=SPARS25; NSAMP=15			352.939501 Secs (352.94 Secs) *[==>]*	***[1]***
Comments: Designed to just saturate V=20 stars.									
5	Dark	DARK	WFC3/IR, MULTIACCUM, IR	BLANK	SAMP-SEQ=SPARS50; NSAMP=15			702.938605 Secs (702.939 Secs) *[==>]*	***[1]***
6	Short	(2) 47TUC	WFC3/IR, MULTIACCUM, IR-FIX	F160W	SAMP-SEQ=SPARS10; NSAMP=10			92.940958 Secs (92.941 Secs) *[==>]*	***[1]***
7	Extra External	(2) 47TUC	WFC3/IR, MULTIACCUM, IR-FIX	F160W	SAMP-SEQ=SPARS25; NSAMP=13	POS TARG 4,4		302.938471 Secs (302.938 Secs) *[==>]*	***[1]***

Orbit Structure