



17973 - WFC3 UVIS Astrometric Scale Monitoring

Cycle: 33, Proposal Category: CAL/WFC3

(Availability Mode: RESTRICTED)

INVESTIGATORS

<i>Name</i>	<i>Institution</i>
Anne O'Connor (PI) (Contact)	Space Telescope Science Institute
Varun Bajaj (CoI) (Contact)	Space Telescope Science Institute
Dr. Mitchell Revalski (CoI) (Contact)	Space Telescope Science Institute

VISITS

<i>Visit</i>	<i>Targets used in Visit</i>	<i>Configurations used in Visit</i>	<i>Orbits Used</i>	<i>Last Orbit Planner Run</i>	<i>OP Current with Visit?</i>
01	(1) OMEGACEN	WFC3/UVIS	1	30-Dec-2025 11:00:15.0	yes
02	(1) OMEGACEN	WFC3/UVIS	1	30-Dec-2025 11:00:16.0	yes
03	(1) OMEGACEN	WFC3/UVIS	1	30-Dec-2025 11:00:17.0	yes

3 Total Orbits Used

ABSTRACT

The standard astrometric catalog in the field of globular cluster Omega Cen has been used to examine the geometric distortion of WFC3 UVIS as function of wavelength in multi-cycle calibration programs over last 12 years of WFC3 on HST board. All observations from these programs have been reduced and provided the multi-wavelength geometric distortion in UVIS detector. The derived geometric distortion coefficients implemented in the IDCTAB format are used in the HST pipe-line to correct for a ~7% distortion in WFC3/UVIS images down to <1%.

Additional to multi-wavelength WFC3 geometric distortion, all observations of Omega Cen taken through F606W UVIS filters during the last 12 years (all together 13 epochs) were used to look for time dependency of UVIS and IR geometric distortion and the effect of the scale change due to

Proposal 17973 (STScI Edit Number: 2, Created: Tuesday, December 30, 2025, 11:00:17AM Eastern Standard Time) - Overview the thermal breathing. The results of the stability WFC3 geometric distortion published in WFC3-ISR-2015-02 (Kozhurina-Platais & Anderson, 2015), WFC3-ISR-2019-09 (Martlin, Kozhurina-Platais), have shown that the UVIS geometric distortion is stable over 10 years on-orbit within 0.05 pixels or 2 mas in IR. A more recent study, WFC3 ISR 2024-15 (O'Connor et. al., 2024), finds small linear temporal changes in the UVIS scale and skew terms (less than 0.2 pixels in 13 years) which are generally dominated by intrinsic scatter (up to 0.3 pixels). Concurrently, a larger filter-dependent offset in the scale term is observed, with a maximum difference of 0.3 pixels between F275W and F814W images at all epochs. A small rotation offset to Gaia of 0.003 ± 0.004 degrees is measured from 2009 to mid-2017, after which the offsets are as large as 0.01 degrees, with a large scatter. Finally, the shift term is seen to evolve at about 0.2 pix/yr in X and -0.3 pix/yr in Y, though these changes are small compared to the uncertainty in pointing within any given observation, and the shift term is dominated by sources of uncertainty outside of the geometric distortion calibration.

The purpose of this calibration proposal is to continue the monitor of the stability of the WFC3 geometric distortion over time. The observations of Omega Cen through the UVIS F606W filter will be used to derive the skew and scale terms of the geometric distortion and look for any secular changes over time.

In addition, several UVIS filters have been appended for the purposes of generating new PSF models for the community.

OBSERVING DESCRIPTION

The observation of Omega Cen through F606W is used as a standard filter in UVIS. They are observed with the same pointing but with different roll-angle of the OTA at a single epoch in either July/August 2026 at an orient of ~126 degrees or in Jan -April 2027 at an orient of ~290 degrees.

The 3 exposures in UVIS have steps of roll-angles -1.5, 0, +1.5 degrees requiring 3 orbits. To maintain accurate pointing control, 2-guide star acquisitions are used. If suitable guide stars can be found, the same pair of guide stars are used for all exposures.

In this cycle, similiar to Cycle 32, additional UVIS filters are added for the purposes of building additional PSF models, based on usage statistics in GO science programs.

---Calibration Goals---

The geometric distortion of WFC3 in 13 UVIS and 8 IR filters were calibrated using the standard astrometric catalog of Omega Cen (Anderson &

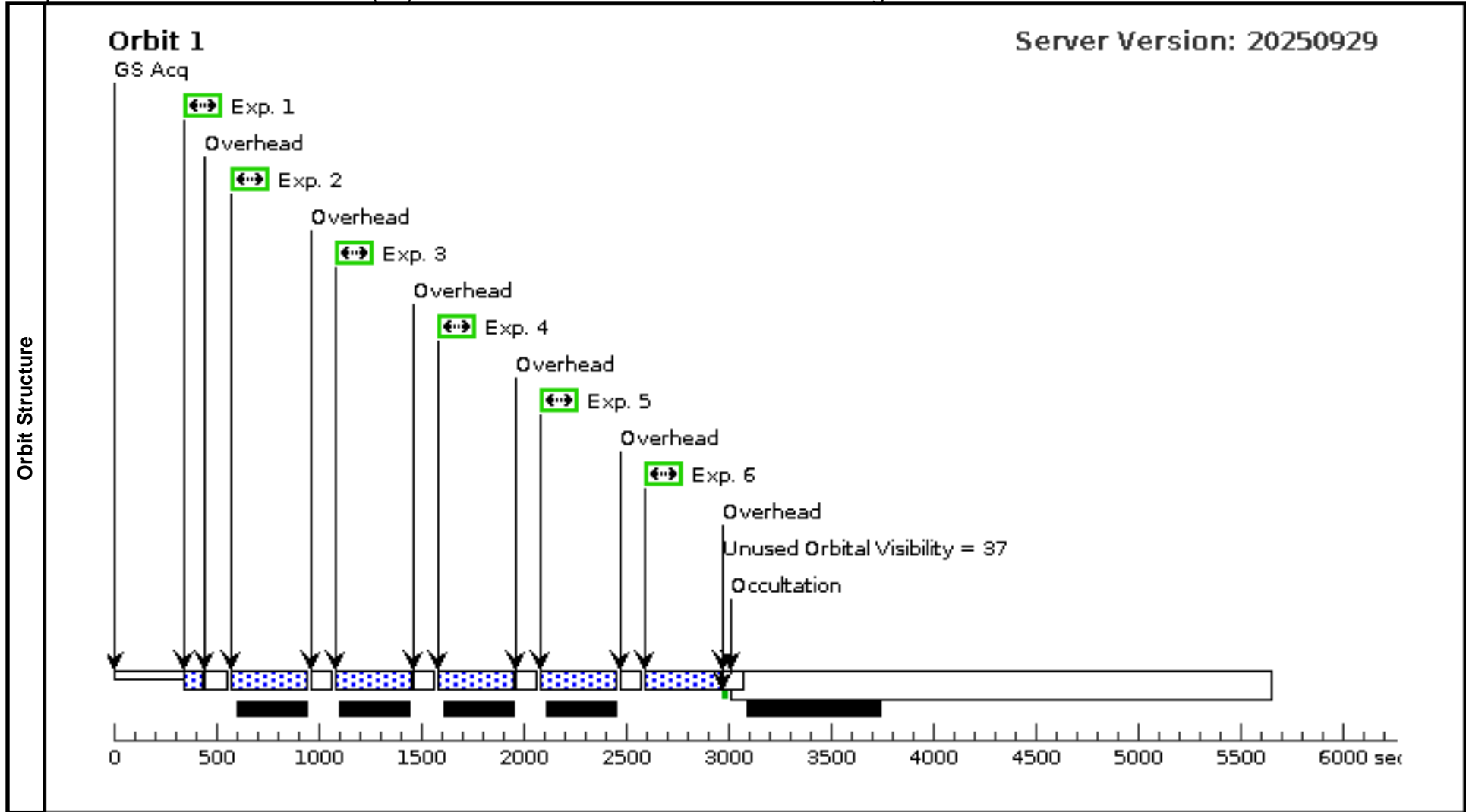
Proposal 17973 (STScI Edit Number: 2, Created: Tuesday, December 30, 2025, 11:00:17AM Eastern Standard Time) - Overview van der Marel, 2010). A set of updated distortions were obtained for 20 UVIS filters using the same standard astrometric catalog of Omega Cen (Kozhurina-Platais, WFC3-ISR-2014-12; Martlin et al. WFC3-ISR-2018-11).

The goal of this proposal is to monitor the geometric distortion of the UVIS detector. The skew parameter in the ACS/WFC case, is changing with time in the level of 40 mas over 15 years on board of HST. The skew parameter is the non-perpendicularity of coordinate axes and is the major parameter in the geometric distortion model.

Proposal 17973 - Visit 01 F606W (01) - WFC3 UVIS Astrometric Scale Monitoring

Tue Dec 30 16:00:17 GMT 2025

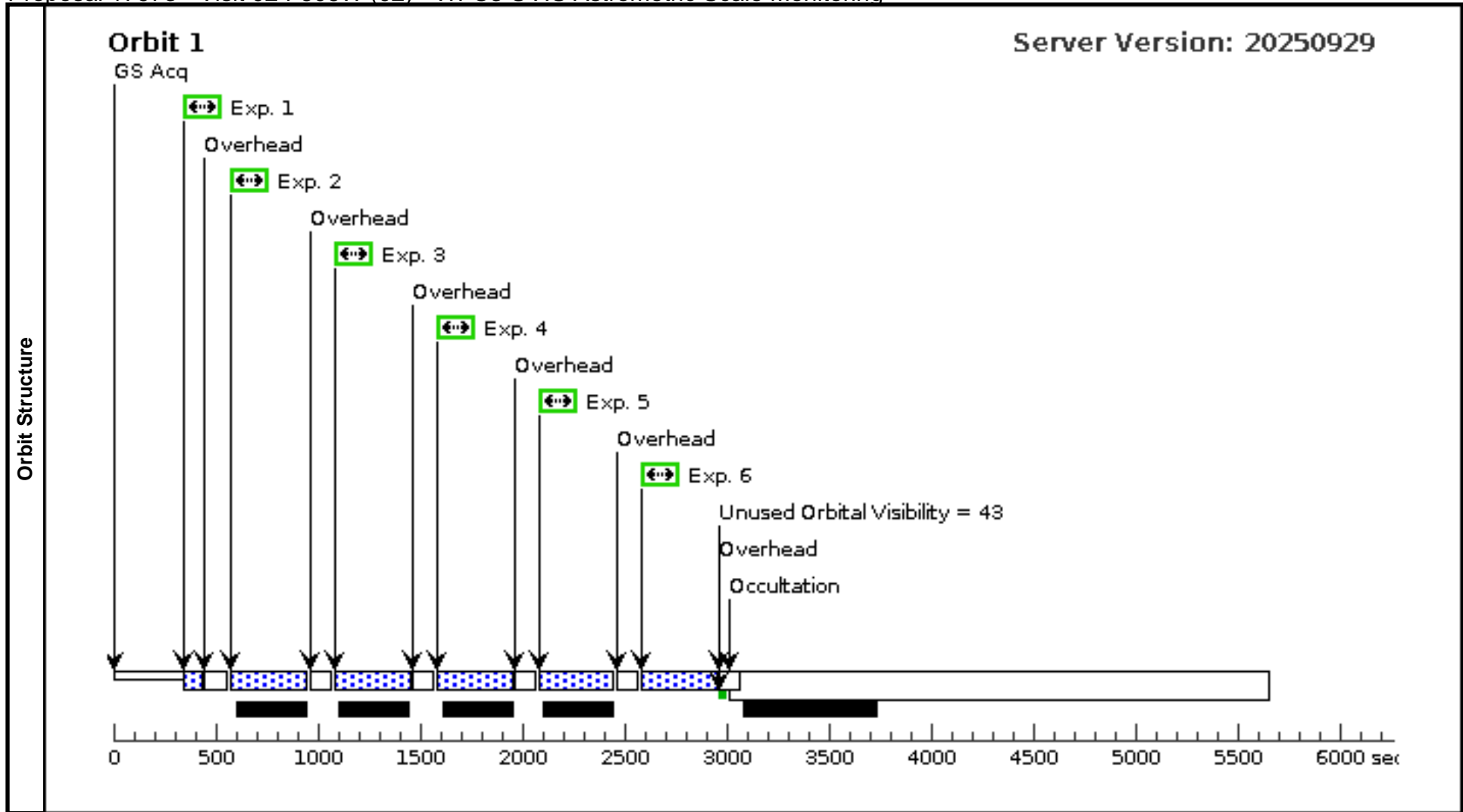
Visit	Proposal 17973, Visit 01 F606W (01), implementation Diagnostic Status: Warning Scientific Instruments: WFC3/UVIS Special Requirements: BETWEEN 01-JUN-2026:00:00:00 AND 01-SEP-2026:00:00:00																																																																										
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Proposal 17973 - Visit 02 F606W (02) - WFC3 UVIS Astrometric Scale Monitoring

Tue Dec 30 16:00:17 GMT 2025

Visit	Proposal 17973, Visit 02 F606W (02), implementation Diagnostic Status: Warning Scientific Instruments: WFC3/UVIS Special Requirements: ORIENT 1.5D TO 1.5D FROM 01; BETWEEN 01-JUN-2026:00:00:00 AND 01-SEP-2026:00:00:00									
	(F606W (02.001)) Warning (Form): FLASH level may be too low for this exposure or a short subexposure. See extended explanation in the diagnostic browser									
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	1	F606W	(1) OMEGACEN	WFC3/UVIS, ACCUM, UVIS	F606W	FLASH=12			60.0 Secs (60 Secs)	
									[==>]	[1]
	2	F390W	(1) OMEGACEN	WFC3/UVIS, ACCUM, UVIS	F390W	FLASH=14			350 Secs (350 Secs)	
									[==>]	[1]
	3	F218W	(1) OMEGACEN	WFC3/UVIS, ACCUM, UVIS	F218W	FLASH=21			350 Secs (350 Secs)	
									[==>]	[1]
4	F547M	(1) OMEGACEN	WFC3/UVIS, ACCUM, UVIS	F547M	FLASH=14			350 Secs (350 Secs)		
								[==>]	[1]	
5	F845M	(1) OMEGACEN	WFC3/UVIS, ACCUM, UVIS	F845M	FLASH=14			350 Secs (350 Secs)		
								[==>]	[1]	
6	F763M	(1) OMEGACEN	WFC3/UVIS, ACCUM, UVIS	F763M	FLASH=14			350 Secs (350 Secs)		
								[==>]	[1]	



Proposal 17973 - Visit 03 F606W (03) - WFC3 UVIS Astrometric Scale Monitoring

Tue Dec 30 16:00:17 GMT 2025

Visit	Proposal 17973, Visit 03 F606W (03), implementation Diagnostic Status: Warning Scientific Instruments: WFC3/UVIS Special Requirements: ORIENT 3D TO 3D FROM 01; BETWEEN 01-JUN-2026:00:00:00 AND 01-SEP-2026:00:00:00																																																																										
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