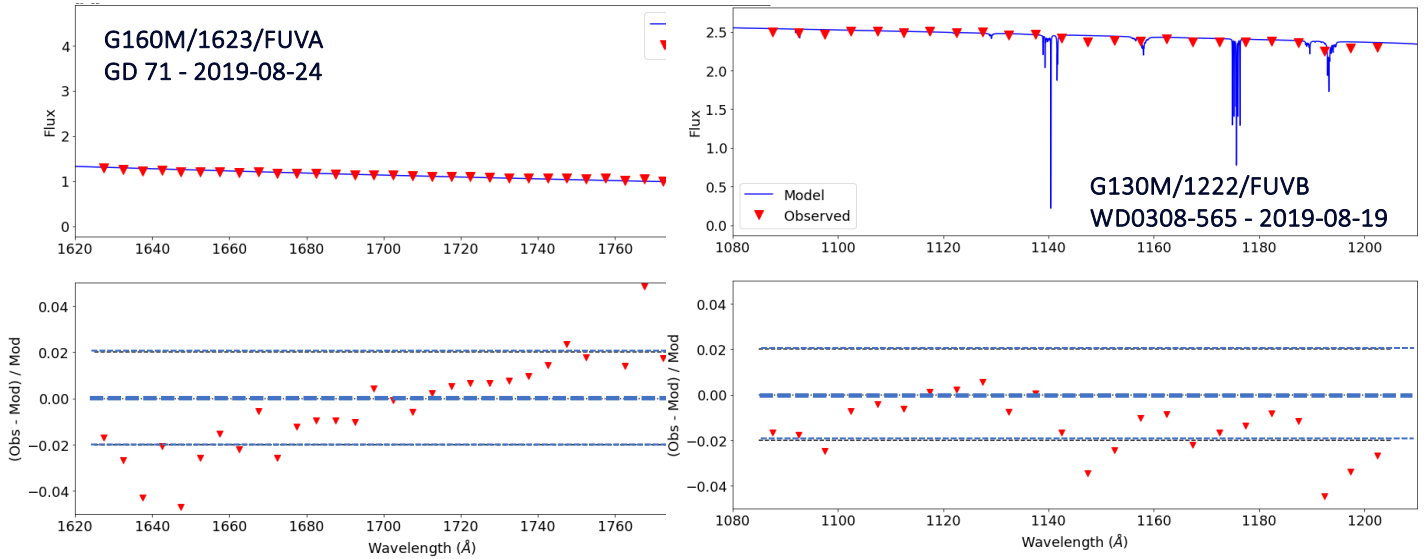

STScI | SPACE TELESCOPE SCIENCE INSTITUTE
EXPANDING THE FRONTIERS OF SPACE ASTRONOMY
COS Update
Cristina Oliveira

Ongoing Work

COS is Operating Nominally

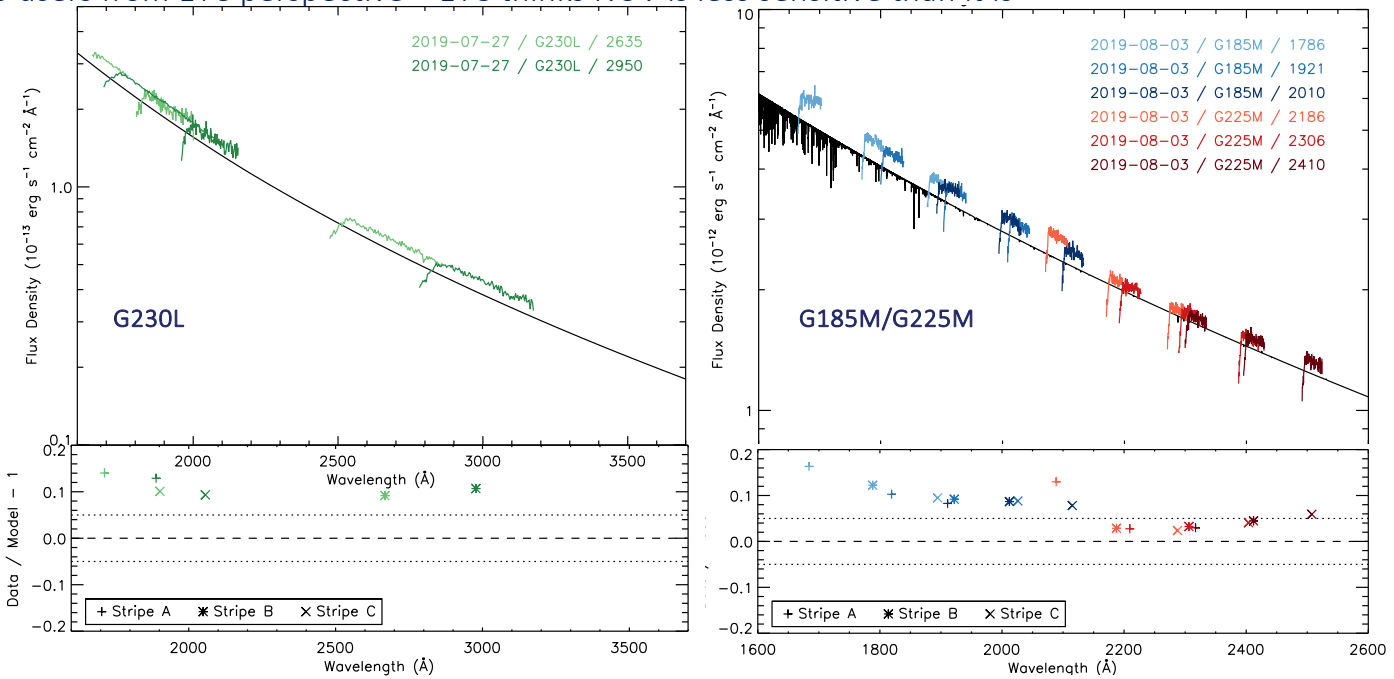
Update to COS/FUV Time Dependent Sensitivity Reference File (R. Sankrit)

- No significant change to TDS slopes but with more data points slope can be better constrained
- Red edge of FUVA slightly shallower than predicted by current ref. file, while blue edge is slightly steeper; FUVB slightly steeper slope than reference file. Expect updated reference file in early 2020



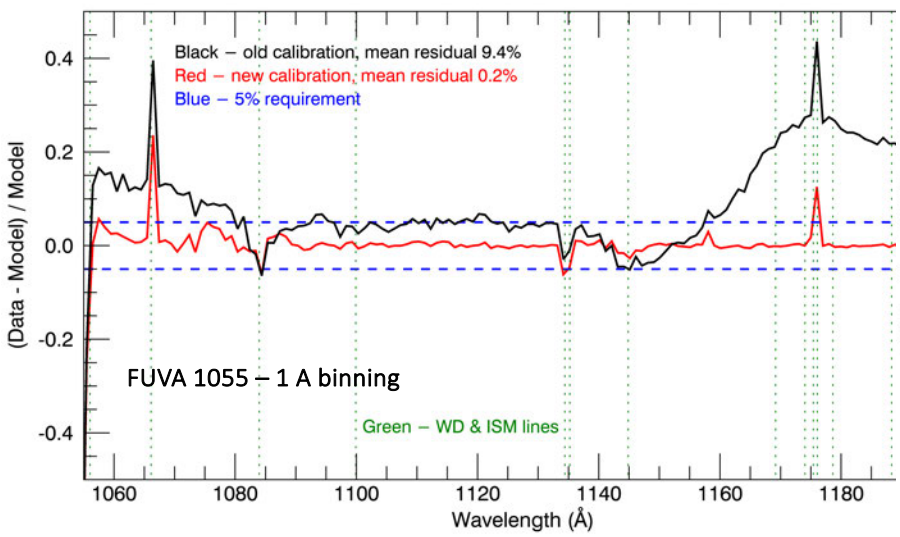
COS NUV Time Dependent Sensitivity and Flux Calibration (W. Fischer)

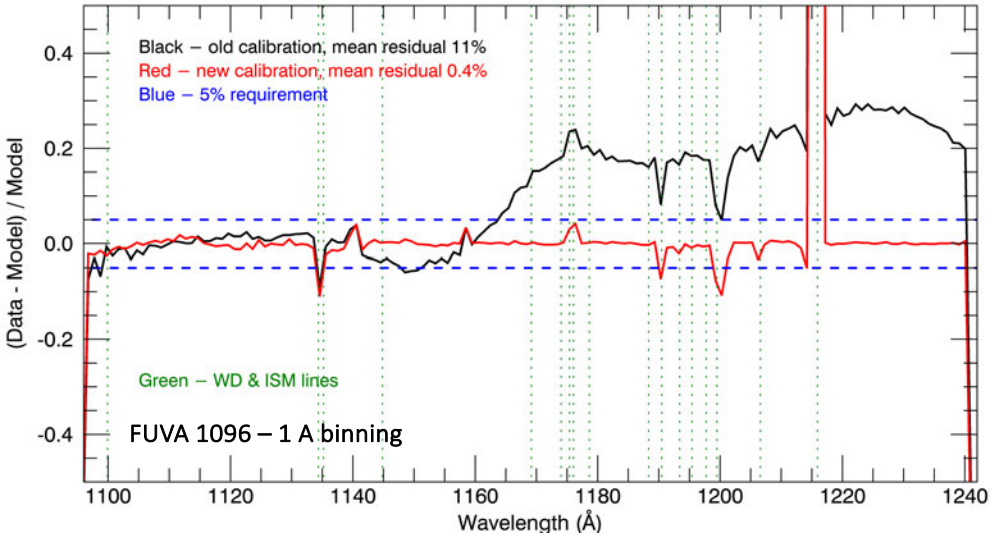
- Current TDS tab delivered in 2010, with slopes of -0.8%/yr for G185M, -3.3%/yr for G225M, -10.8%/yr for G285M, and -1.1%/yr G230L
- Trend have remained ~ constant but slightly smaller than TDS values; after 10 years the difference has grown significantly and needs updating (+ STAN to inform users)
- No impact to users from ETC perspective – ETC thinks NUV is less sensitive than it is



Blue Mode Absolute Flux Calibration (S. Dieterich)

- Flux calibration of blue modes (G130M/1055/1096) derived initially and never updated – accuracy of up to ~20%; ULLYSES will need higher flux calibration accuracy
- Flux calibration of FUVA essentially complete, FUVB is almost complete (lower S/N and many absorption lines)
- Blue modes will need their own flat field reference file (change to CRDS selection rules)
- Expect to have these calibrations available and used by pipeline by Spring 2020



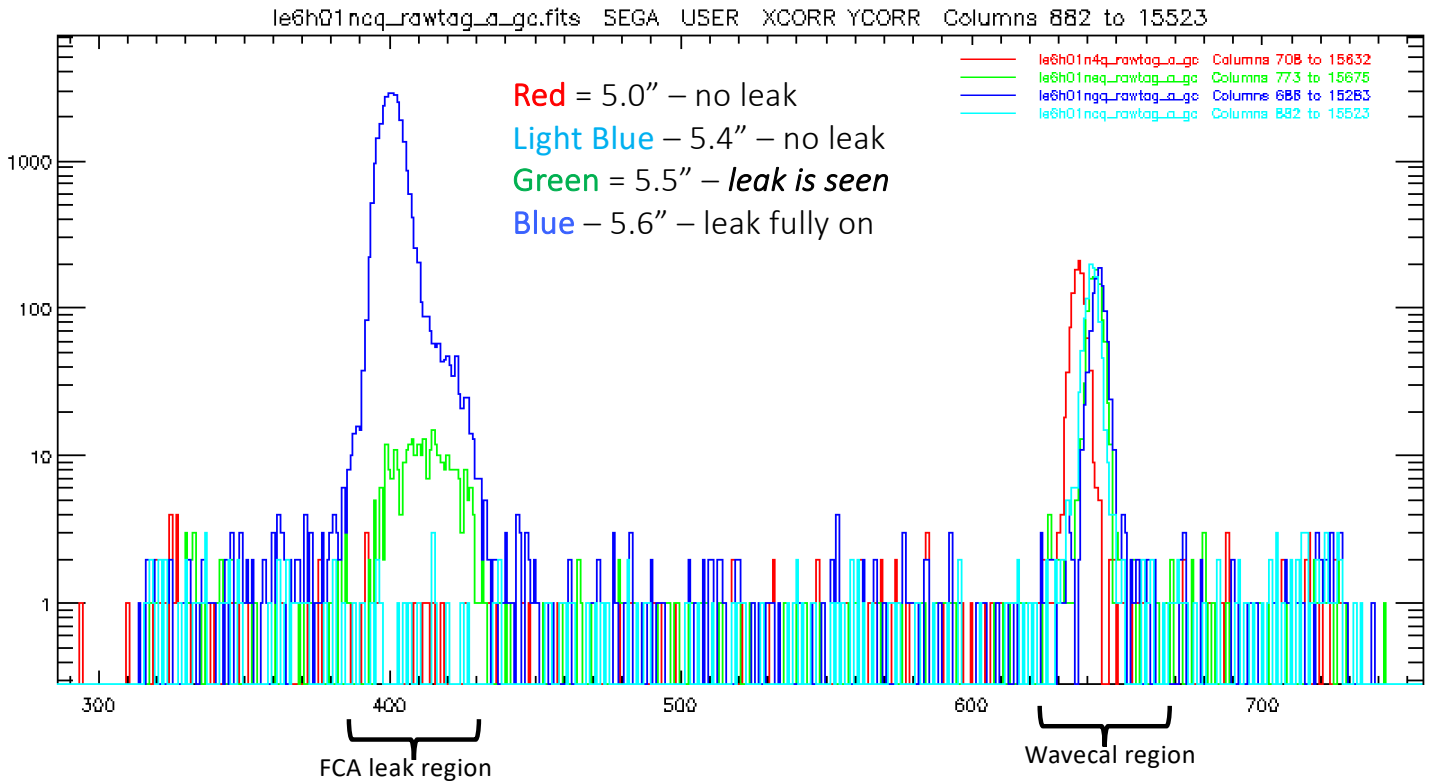


LP5 Feasibility Study (Oliveira, Dashtamirova, James, Fox, Plesha, Roman-Duval, Sahnow)

- COS2025 initiative prolongs lifetime of COS detector to ~2023 (ULLYSES not considered)
- Real estate near top of FUV detector is pristine but light leak appears when wavecal lamp is flashed
- A number of programs executed over last few months to understand exact starting point of light leak that appears when aperture moved, as well as gain in the region around LP5

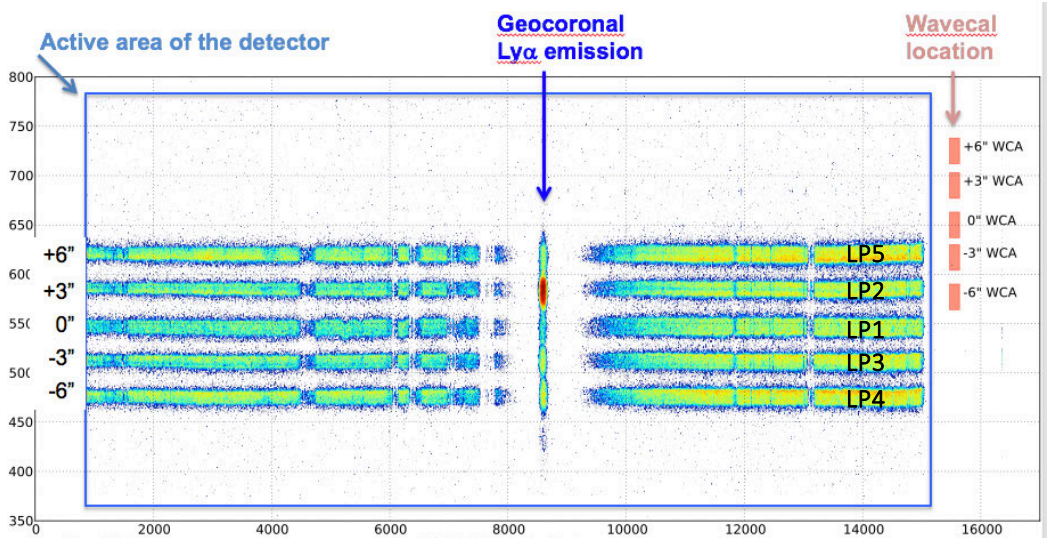
Program	Title	PI	Orbits	Executed on
15689	COS/FUV Mapping of FCA Light Leak Between +5'' and +6’	C. Oliveira	1 int	Apr 2019
15711	Characterization of COS/FUV detector modal gain at Lifetime Position 5	D. Sahnow	4 int	June 2019
15983	COS/FUV Mapping of PtNe1 medium current to PtNe2 low current with G160M/1577/4	C. Oliveira	1 int	Aug 2019
16006	Mapping COS/FUV FCA Light Leak with PtNe1 Medium Current	C. Oliveira	1 int	Oct 2019

COS FUV LP5 – Location of Light Leak



Implications of Light Leak at +5.5”

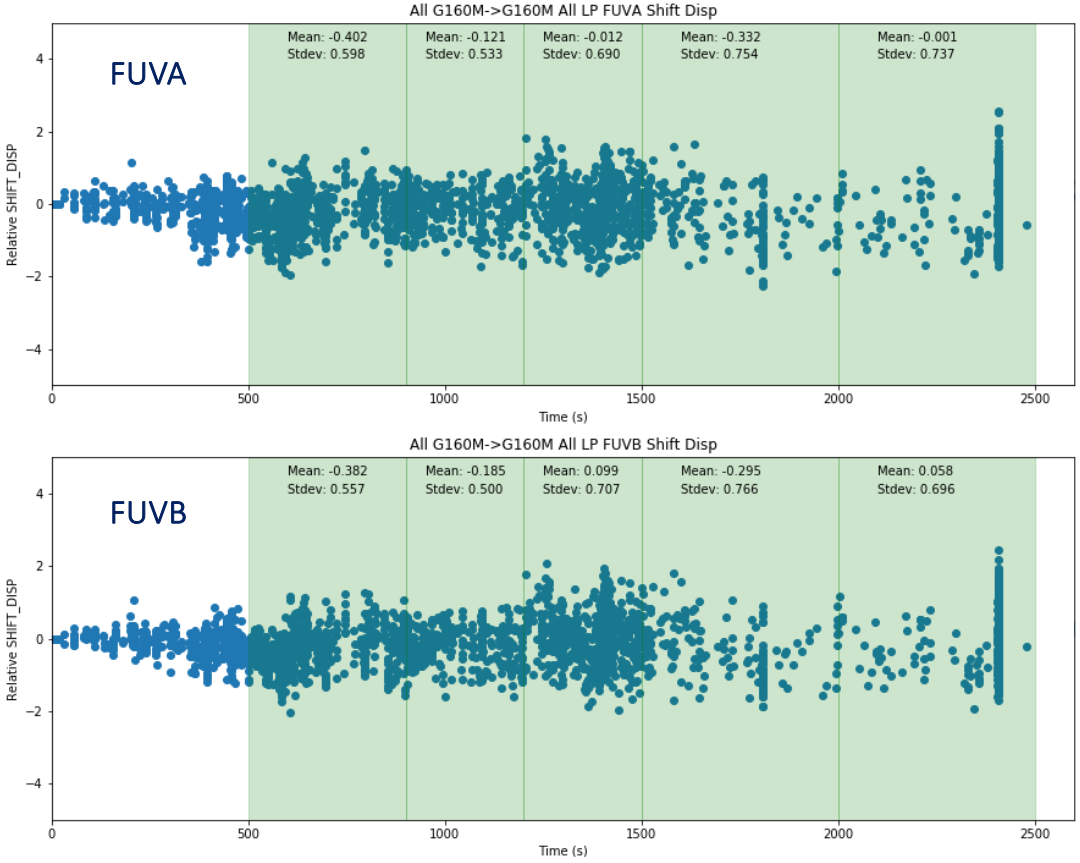
- Not clear that G130M grating can be placed at 5.4” and avoid LP2 gain sag
  - Preparing a special calibration program to evaluate this by obtaining external data at 5.4”
- G160M grating projects lower on the detector – no wavecal data can be taken concurrently with science data
  - Current plan is to obtain wavecal at LP2 and science data at LP5 - some increase in overheads
    - Pending results on program to evaluate stability of aperture mechanism
    - Typical sequence would be TA -> LP2 wave -> LP5 science -> LP2 wave, repeat sequence per exposure
    - There would be a maximum exposure time for science exposure so that drift can be properly corrected



- 2-D image of G130M/FUV spectra a different LPs (left image)
- Other settings project at other slightly different locations

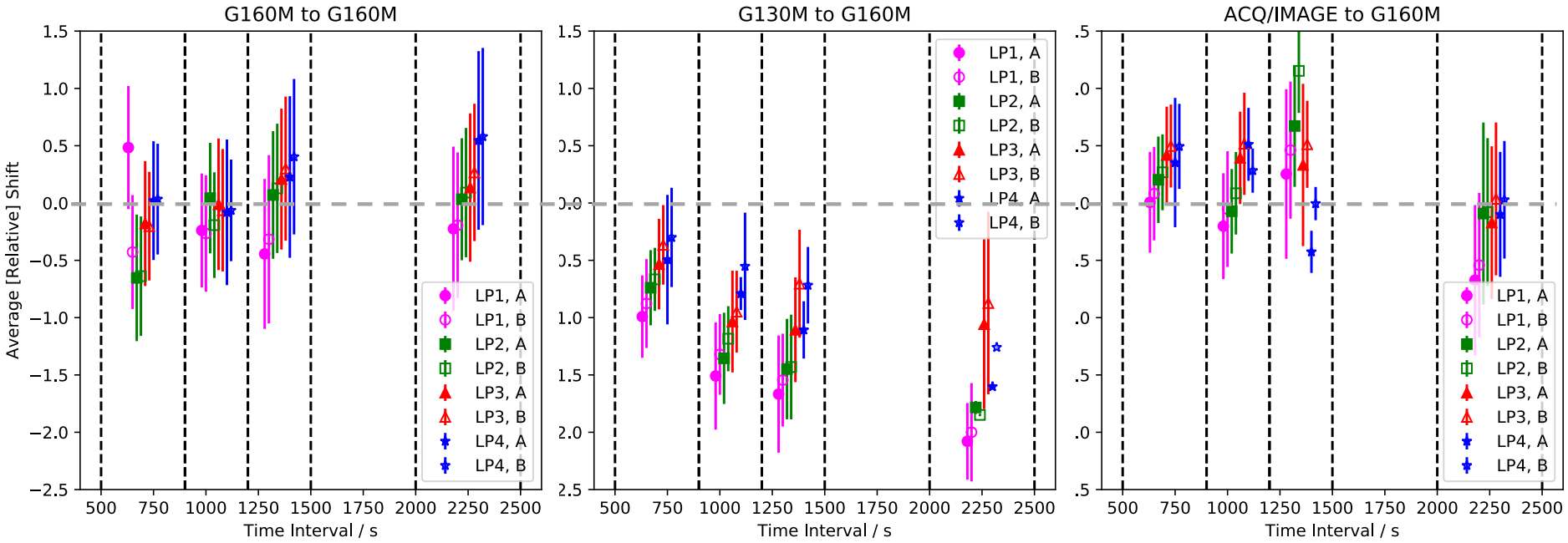
G130M and G160M Drift Study

- Study of the nature of the drift to understand impact of obtaining wavecal and science data at different times



- Tagflag mode injects flashes of wavecal lamp at predetermined times in exposure
- Pipeline calculates shift of each flash in relation to template
- Values are used to correct drift during exposure and overall shift
- Figure left plots shift of flashes in exposure, relative to shift of first flash in same exposure
- Data for all G160M cenwave/FP-POS/LP occurring after another G160M exposure
- Mean at standard dev for each time bin

Summary of Drift for G160M – by Lifetime Position

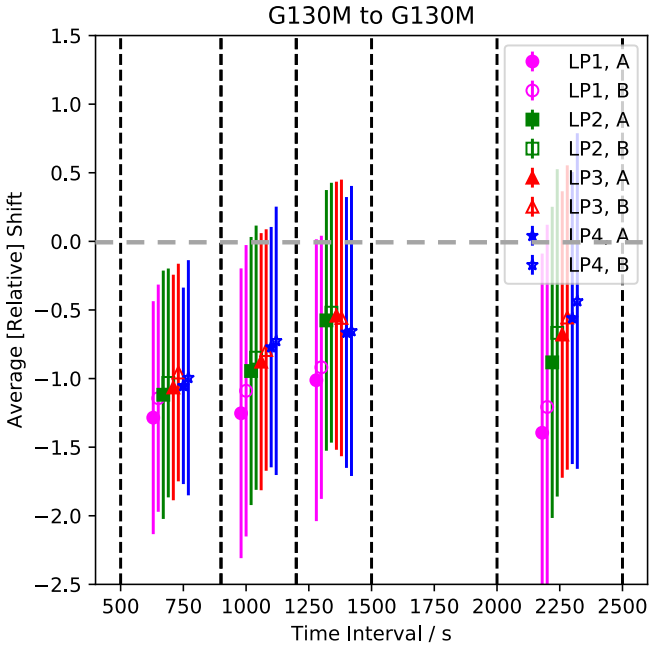


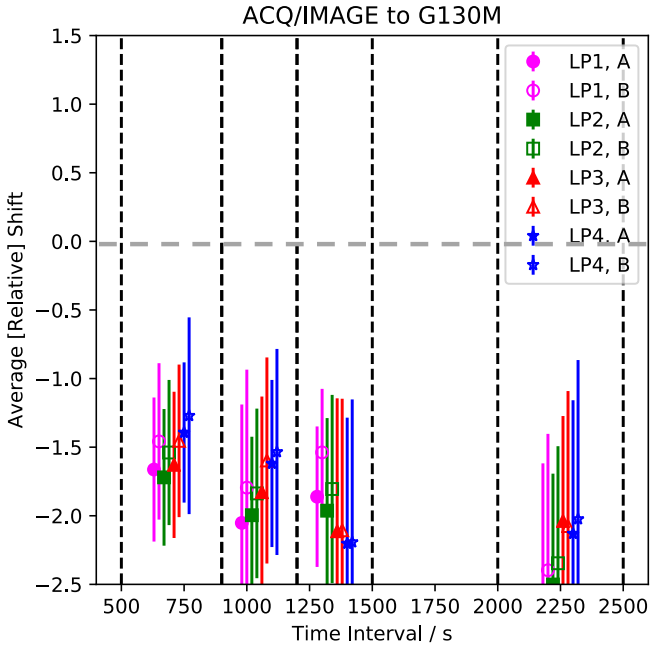
G160M > G160M
- Drift rate seems to be very low overall
- Can potentially have texp_max ~ 2000 s

G130M > G160M
- Drift rate seems linear
- Can potentially have texp_max ~ 1500 s

ACQ/IMAGE > G160M
- Drift rate seems to be very low overall
- Can potentially have texp_max ~ 1500 s

Summary of Drift for G130M – by Lifetime Position





- In both cases there seems to be a large drift rate in the first ~600 sec of exposure that becomes shallower at later times
- Discussing with engineers – it might be due to excess lubricant near the G130M grating (most used, also is home position)
- Will try to create a model for drift and see if it is repeatable (with some parameter dependence – could then be implemented in calibration if need be)

**Not enough data for G160M > G130M

Future Work in FY20

- Complete LP5 feasibility studies and commission new LP
- Detailed modeling/predictions of gain sag evolution vs. usage
- Study of FUV TDS vs. cenwave – monitoring & pipeline implementation
- Study of FUV TDS vs. HV
- Improve Blue Mode TDS calibration (K. Rowlands)
- Improve Blue Mode wavelength calibration (N. Kumari)

Documentation since last STUC Meeting

Authors	Title	
D. Sahnow	COS FUV Detector Gain Maps Obtained at the Time of the LP4 Move	ISR 2019-22
D. Sahnow	Cycle 25 COS FUV Detector Gain Maps	ISR 2019-21
B. James	Summary of COS Cycle 25 Calibration Plan	ISR 2019-20
C. Magness	Cycle 25 COS NUV Detector Dark Monitor	ISR 2019-19
R. Sankrit	Cycle 25 COS FUV Spectroscopic Sensitivity Monitor	ISR 2019-18
D. Dashtamirova	Cycle 25 COS FUV Detector Dark Monitor	ISR 2019-17
W. Fischer	Cycle 25 COS FUV Wavelength Scale Monitor	ISR 2019-16
W. Fischer	Cycle 25 COS NUV Wavelength Scale Monitor	ISR 2019-15
T. Wheeler	Cycle 26 COS NUV MAMA Fold Distribution	ISR 2019-14
T. Wheeler	Cycle 25 COS NUV MAMA Fold Distribution	ISR 2019-13
W. Fischer	Cycle 25 COS NUV Spectroscopic Sensitivity Monitor	ISR 2019-12
D. Dashtamirova	Changes in the COS/FUV Dark Rate: Impact on the Monitoring Program and Background Extraction Regions	ISR 2019-11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Backup Slides

COS Cycle 27 Usage Statistics (B. James)

- 1.2% of total COS prime observing time = *acquisition exposures 1.17% NUV + 0.03% FUV*
- 98.8% of the total COS prime observing time consists of *science* exposures

Configuration/Mode	**Prime Usage** (COS science exposures)	**SNAP Usage**
FUV / Spectroscopy	90.1%	N/A
NUV / Imaging	0.1%	N/A
NUV / Spectroscopy	9.8%	N/A

Configuration	**Grating**	**% of COS Prime Science Exposures**	
		C27 (%)	**C26 (%)**
COS/FUV	**G140L**	**13.4**	**34.3**
(C27: 90% prime)	**G130M**	**49.9**	**24.4**
	G160M	**26.7**	**41.3**
COS/NUV	**G230L**	**0.7**	**--**
(C27: 10% prime)	**G185M**	**6.6**	**--**
	G225M	**2.5**	**--**
	MIRROR A/B	**0.1**	**--**

Cycle 27 FUV Usage Statistics (W. Fisher)