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Meeting

December
15-16,
2016

COS Update

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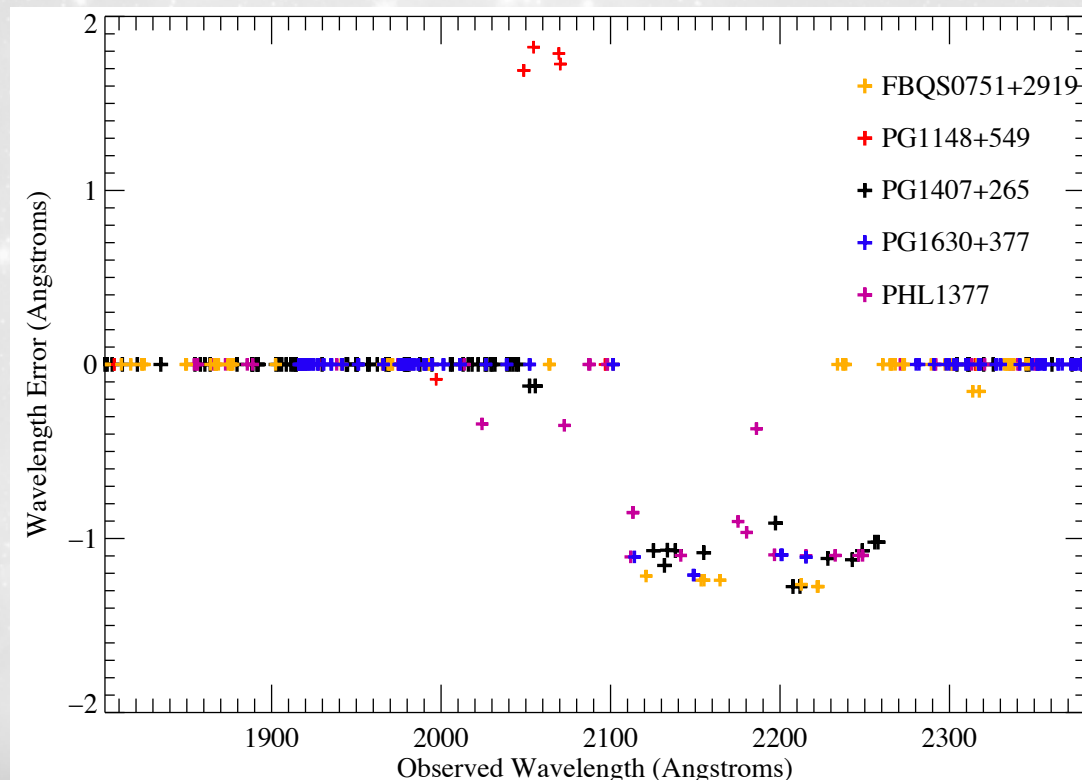


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COS NUV Wavelength Calibration

- During last MUG meeting in Jan 2016, Todd Tripp alerted COS team to potential serious issues with NUV wavelength calibration
 - Incorrect wavelength offsets up to $\sim +2 \text{ \AA}$ & -1.5 \AA seen in data from program 13846 (PI: Tripp)



- Investigation uncovered two types of issues affecting data, related to:
 1. OSM2 secular drift and position uncertainty
 2. On-orbit update of the NUV wavelength scales



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OSM2 Secular Drift and Position Uncertainty

- Optics Select Mechanism 2 (OSM2: NUV grating wheel) mechanism position uncertainty is removed by CalCOS pipeline for each exposure by cross-correlating lamp flash taken concurrently with science exposure, with lamp template
- Range over which cross-correlation search takes place defined in reference file (WCPTAB)
 - It was historically +/- 1 FP-POS (57 pix) around zero
 - Besides being non-repeatable, secular drift has also been seen
 - Zero point of search range has been adjusted since SMOV to take into account secular drift of mechanism
- Expanded search range reference file (WCPTAB) delivered in Mar 2016. Fixed some, but not all of the incorrect offsets seen in data from Tripp's program
- All COS users affected were notified through STAN (includes both issues that surfaced in Tripp's program)
- PIs of specific programs affected (few specific datasets only, taken since July 31st 2013) were also notified
- Will continue to monitor closely the OSM2 mechanism drift

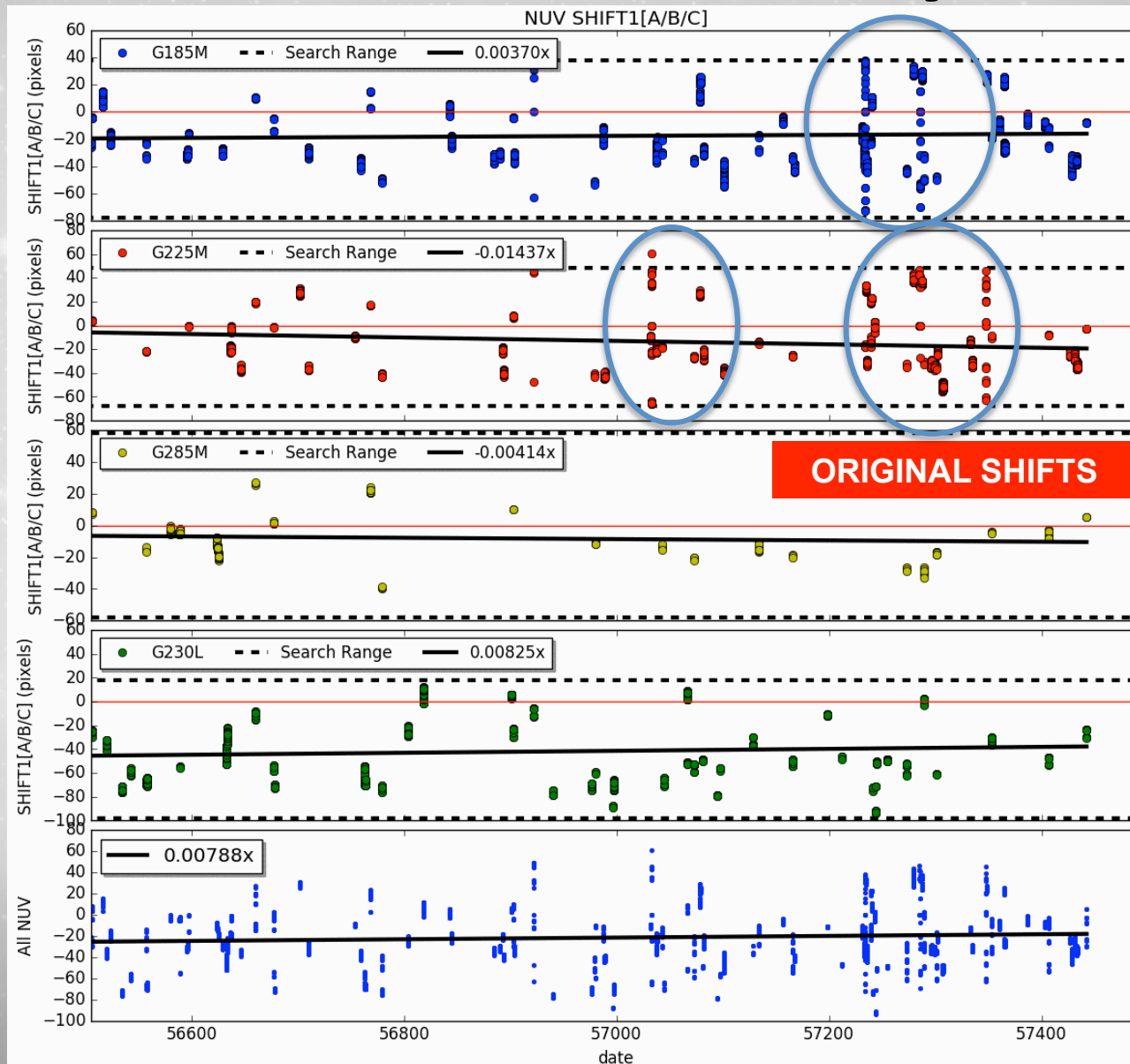


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OSM2 Secular Drift and Position Uncertainty



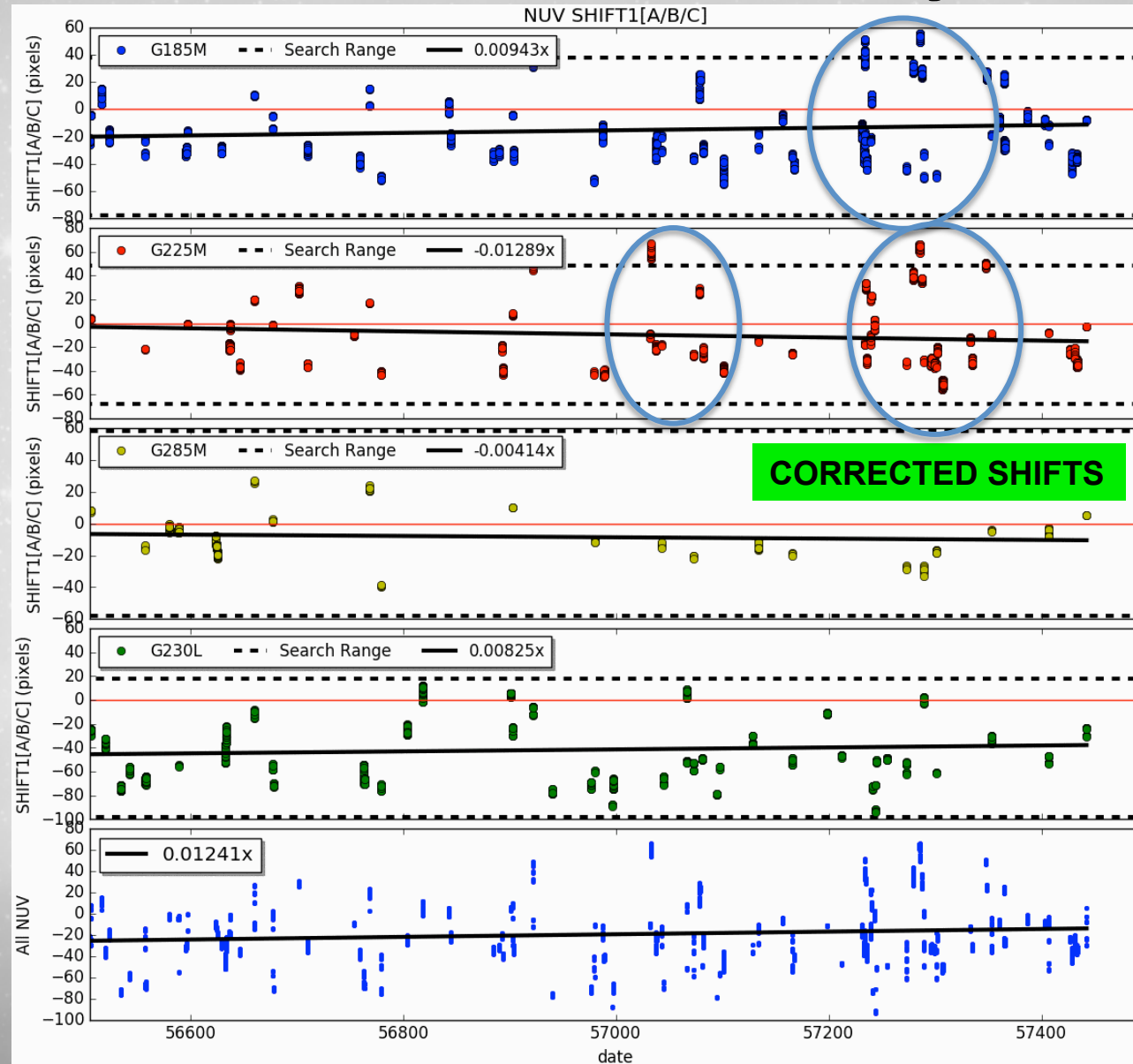


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OSM2 Secular Drift and Position Uncertainty





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COS NUV Zero-Point Offsets

- NUV dispersion solutions in use were derived in TV03 (2nd order poly)
- Zero points, to place TV03 solutions in on-orbit frame of reference derived during SMOV (2009)
 - “d (pixel)” in DISPTAB: cenwave + stripe dependent
 - Derived by using STIS data of same target
 - For some settings zero points were never derived
 - All cenwaves of G185M
 - G225M: 2186/2217/2233/2250 – A,B
 - G225M: 2268/2283/2306/2325/2339 – A
 - G285M: 2996/3035/3057/3074/3094 – C
 - G230L: 2635/2950/3000 – A, B, 3360 – B, C
 - Due to lack of overlap with STIS data or low S/N
 - Unsuitable target (G185M: Feige 48 – pulsating binary)
- Why did problem not surface before?
 - NUV has very low usage
 - Tripp had FUV data which allowed him to predicted expected NUV data (Ly series at $z \sim 1$)

Grating	Cenwave	d (pixel)
G225M	2186	... , ... , -25.798
	2217	... , ... , -21.873
	2233	... , ... , -21.359
	2250	... , ... , -24.069
	2268	... , -23.694, -23.324
	2283	... , -19.864, -16.895
	2306	... , -19.223, -15.621
	2325	... , -18.477, -15.735
	2339	... , -21.028, -19.789
	2357	-20.366, -19.090, -15.920
	2373	-23.128, -20.386, -16.533
	2390	-22.338, -20.363, -16.340
	2410	-17.735, -15.621, -11.394

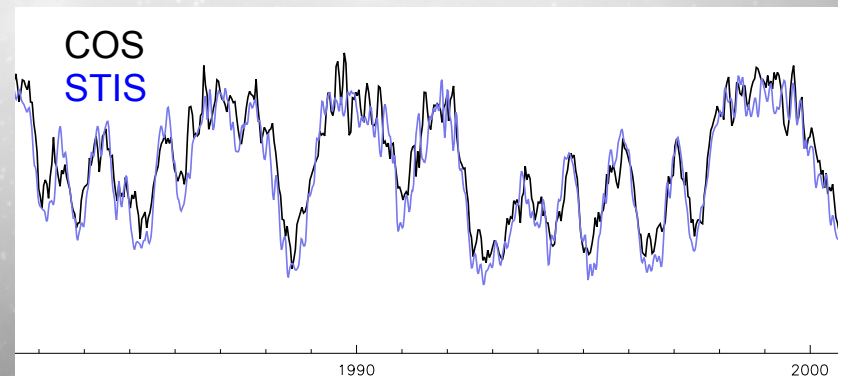


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COS NUV Zero-Point Offsets

- Updated DISPTAB was quickly produced using “d” offsets from the nearest stripe, and delivered in the Spring 2016
 - Significantly improved zero points available at the time
- Special NUV wavelength calibration programs were created to update zero points
 - 3 special calibration programs (1 COS + 2 STIS, for a total of 5 orbits)
 - COS/G185M/NGC330-B37 to update G185M
 - STIS/E230M + G430M/HD187691 to update G225M + G285M zero points
 - STIS/G230MB + G230M/HD6655 to update G285M + G230L zero points
 - Programs executed over Summer 2016
 - Analysis has been completed and reference file prepared
 - New zero-points undergoing testing with help from T. Tripp (no other suitable datasets available to test data, other than data obtained to derive zero points)
 - Expect to deliver updated reference file within next couple of months
 - At that time STAN will be released to inform community



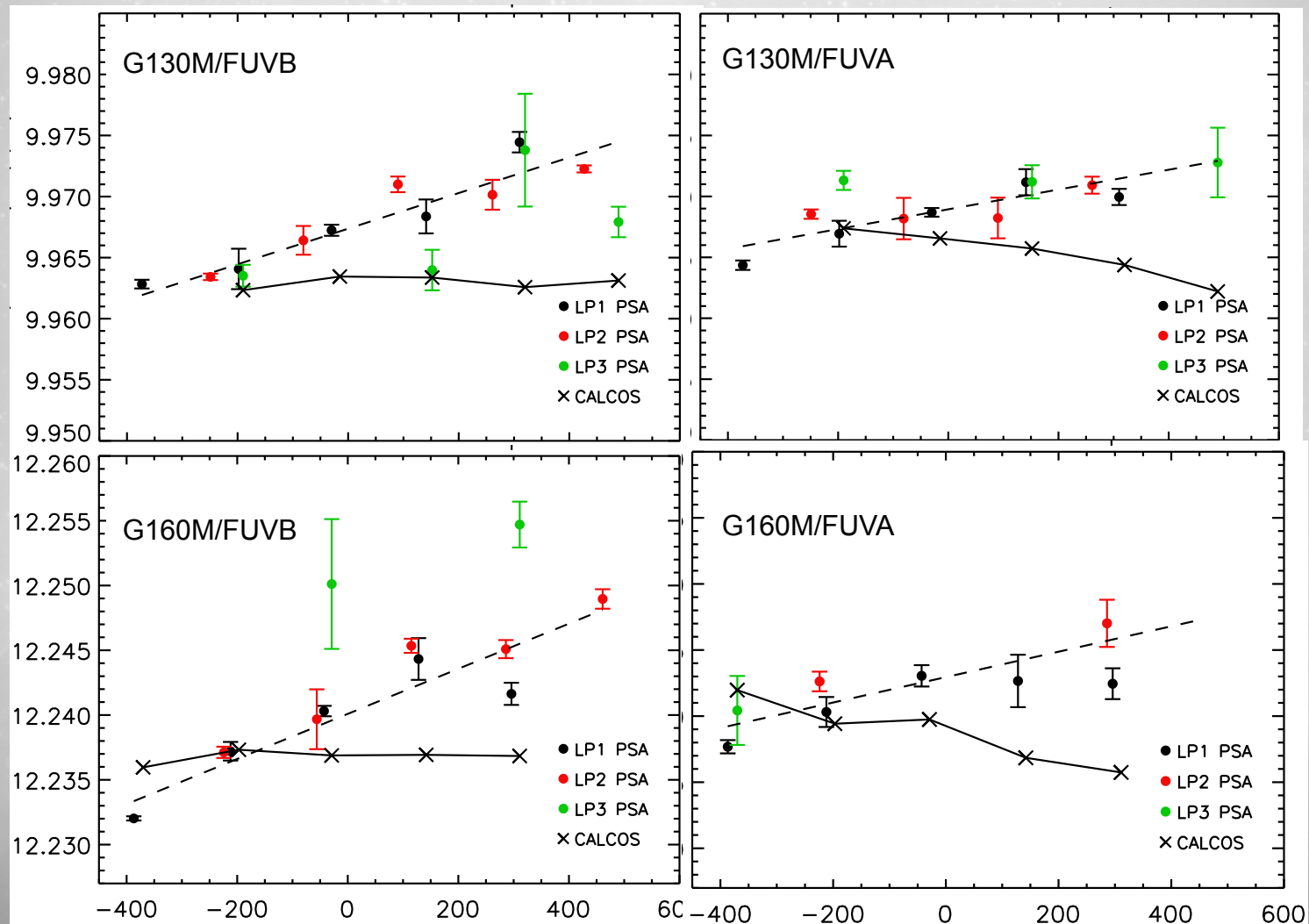


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COS/FUV Wavelength Calibration I

- LP1 dispersion solutions derived by cross-correlating COS and STIS data for same target + scaling ray-trace models; updated ref file delivered in May 2016
- For LP2 and LP3 lack of COS+STIS data led us to explore other possibilities





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COS/FUV Wavelength Calibration II

- LP1 dispersion solutions updated ref file delivered in May 2016, STAN released
- LP2 dispersion solutions updated ref file delivered in Nov 2016, STAN released
- Putting together a special wavelength calibration program to derived LP3 dispersion solutions, using similar methods as described above
- Expect to have updated LP3 dispersion solutions released by Summer 2017
- For LP4 a special wavelength calibration program will be incorporated in the LP4 cal program so that updated dispersions solutions can be in place not too long after the LP4 move in Jul 2017
- Walk correction for dispersion direction has been derived
 - Current walk correction pipeline implementation (high order polynomial in x , and PHA) leads to issues at the edge of parameter space
 - Working to implement walk correction as a look up table; expect to have it in place by Summer 2017



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Hubble Spectroscopic Legacy Archive

- First version of the Hubble Spectroscopic Legacy Archive officially released to the community in January 2016 (at AAS)
 - https://archive.stsci.edu/hst/spectral_legacy/
 - Contains all COS/FUV data, publicly available up Feb 2016, coadded for same target, in “smart archives”
 - COS/FUV archives will be re-generated in the near future
 - Will include data beyond Feb 2016
 - Will use most recent wavelength calibrations for LP1 and LP2 data
 - Goal is to periodically update archive
 - COS/NUV data will also be coadded and released over the next year
 - In the more distant future, STIS data will be included as well



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BACK-UP SLIDES



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COS/FUV Gain Sag Management

- Ongoing activities to mitigate the gain sag effects of the COS/FUV detector
 - Moved to current LP3 in February 2015
 - HV increases
 - FUVB increased on October 17 2016 to max value of 175, no more HV increases available at LP3
 - Expect to increase HV on FUVA sometime in 2017
 - Cycle 24 original/proposed G130M cenwave distribution adjusted by team
 - Move to COS/FUV Lifetime Position 4 scheduled for July 2017
 - Blue modes (G130M/1055, G130M/1096) will remain at LP2



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COS/FUV Move to LP4

- No Lifetime Move ever “routine” – always something new and challenging
 - Major changes to FSW to accommodate LP1 – LP8 and change LP names (original = LP1, best = LP in use, alternate = LP2)
 - Geometric distortion correction at LP4 detector location is poor (edge of detector)
 - FUV dispersed light TA does not work as originally implemented because of the above
 - Lamp wavecal spectrum falls on top of sagged LP2 location and if not fixed will lead to systematic offsets in the zero-point of the FUV wavelength scales



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COS/FUV Detector Available Lifetime Positions

