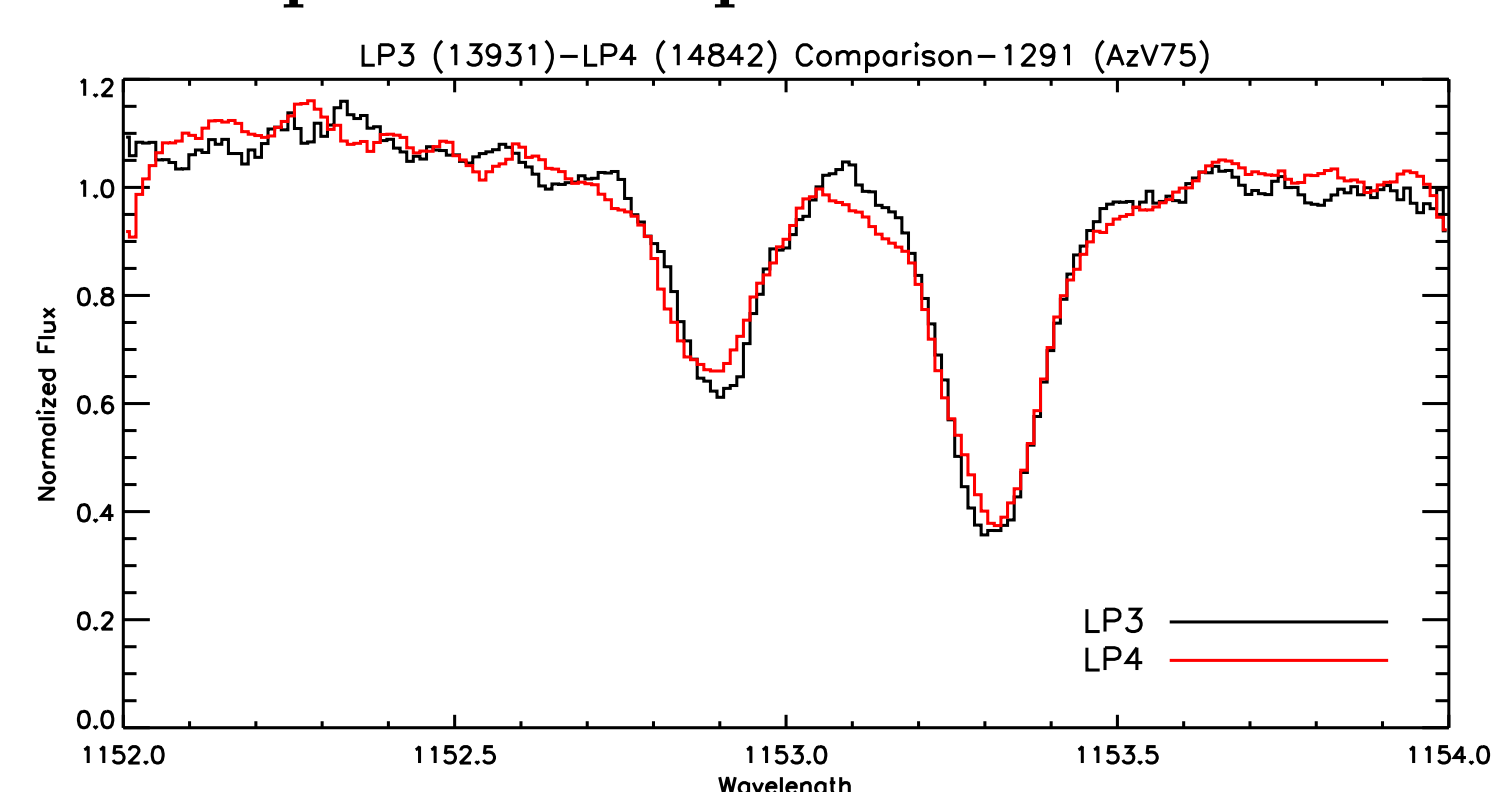


Abstract

The Cosmic Origins Spectrograph (COS) was installed on the Hubble Space Telescope (HST) in May 2009. COS was designed to perform high-sensitivity medium and low-resolution spectroscopy of astronomical objects in the far-ultraviolet (FUV) and near-ultraviolet (NUV) wavelength regimes. Here, we present updates on the time-dependent sensitivities (TDS) for the NUV and FUV detectors, NUV wavelength calibration, and the FUV and NUV dark rates. Additionally, we discuss the move to lifetime position four (LP4) planned for July 2017, including the detector location and impact on resolution.

Life Time Position 4

- Only a limited number of electrons can be extracted from the COS FUV detector resulting in a limited lifetime for each “pixel”. We refer to this effect as “gain-sag” which is enhanced around the airglow regions of FUVA and FUVB.
- To circumvent the gain-sag issue, the HV is periodically raised. When the maximum operational value of the HV is reached, science spectra are moved to a new pristine location on the detector, or lifetime position.
- With the move to LP4 in July 2017, the resolution is expected to drop 15% compared to LP3.

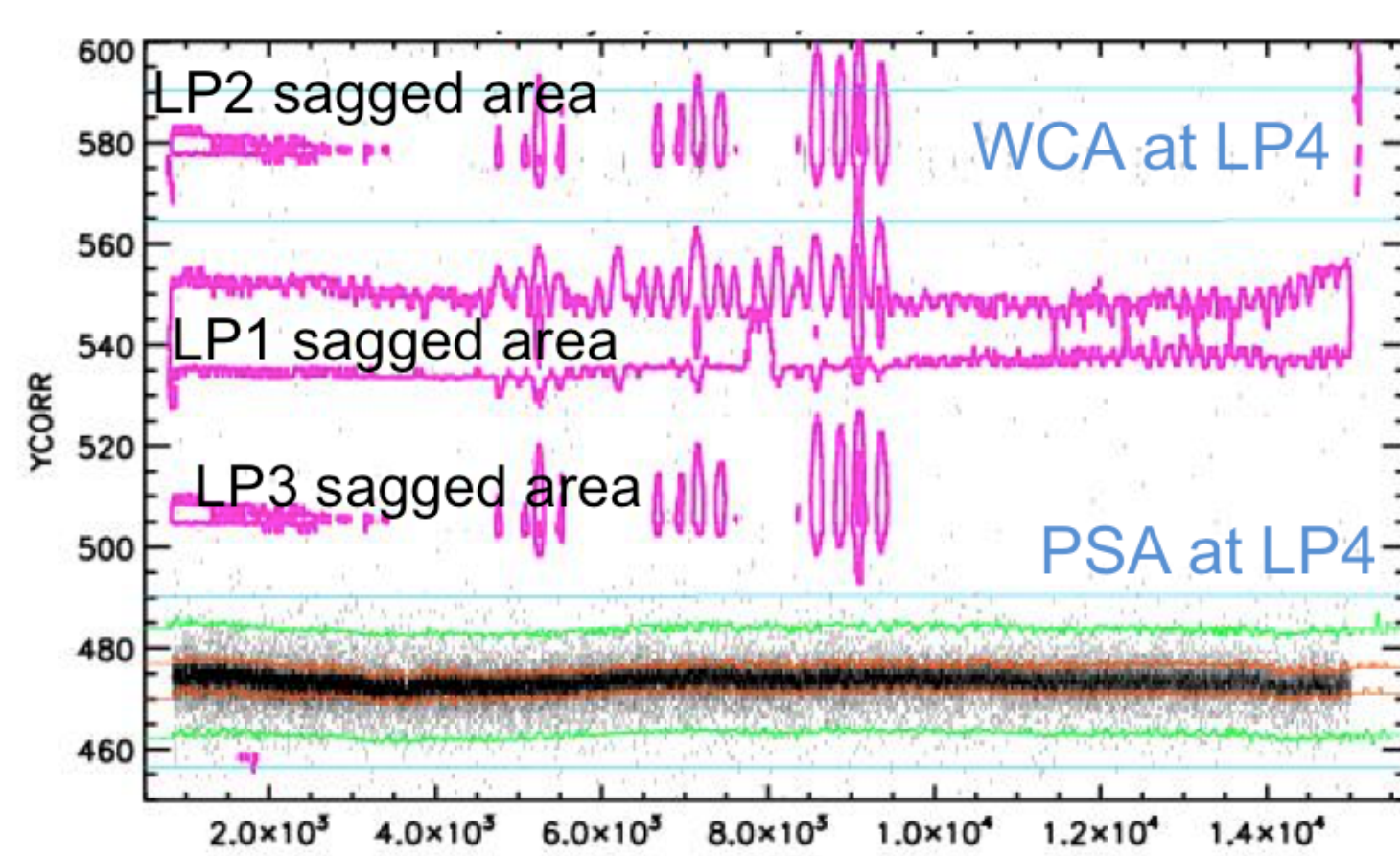


LP4 Resolution

A comparison of resolution from LP3 (black) & LP4 (red). The spectra are from programs 14842 (LP4) and 13931 (LP3).

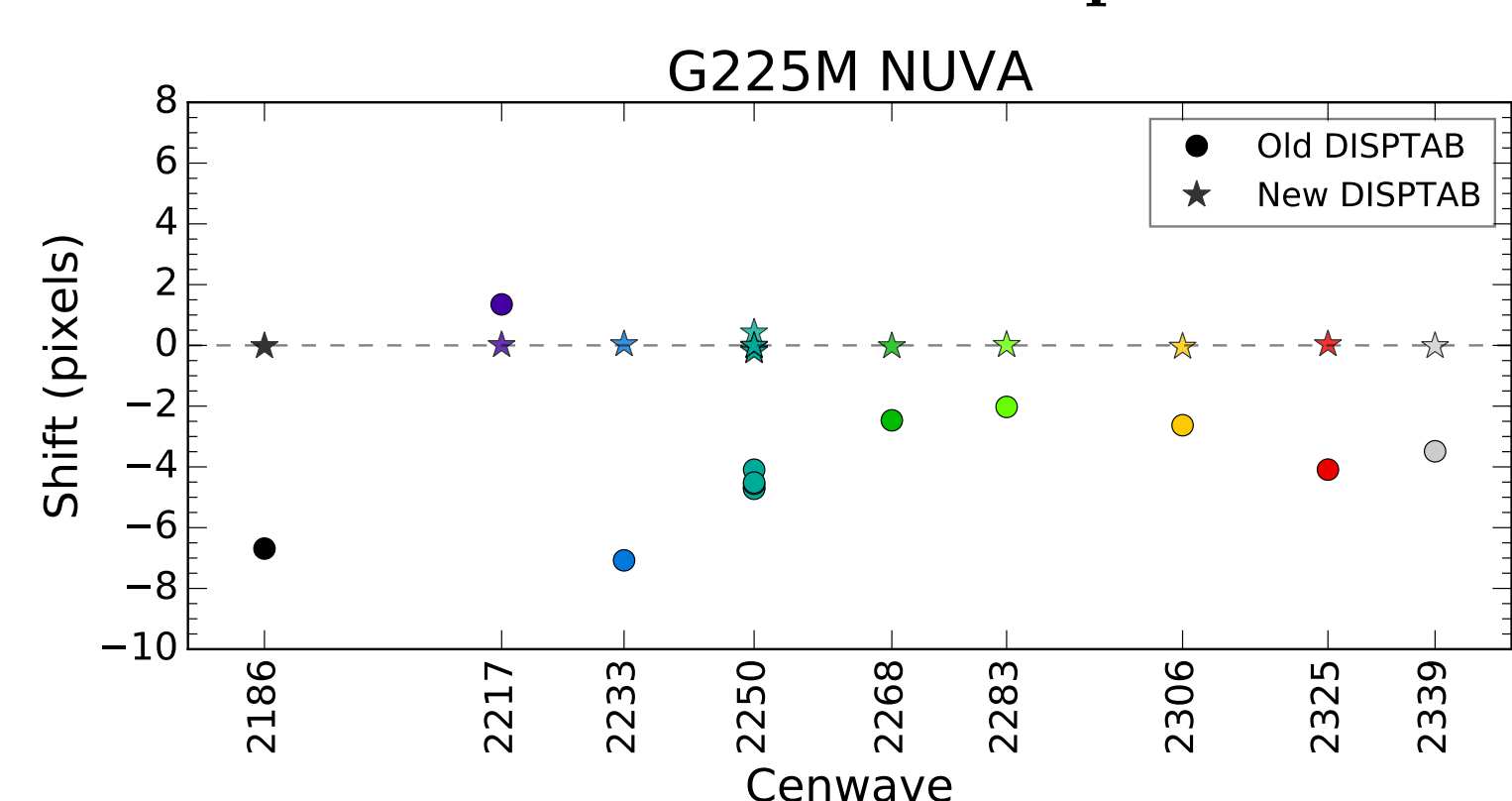
LP4 Location

A 2-D figure of FUVB G130M/1623 with the location of LP4 along with the gain-sag holes from other LP's in magenta.



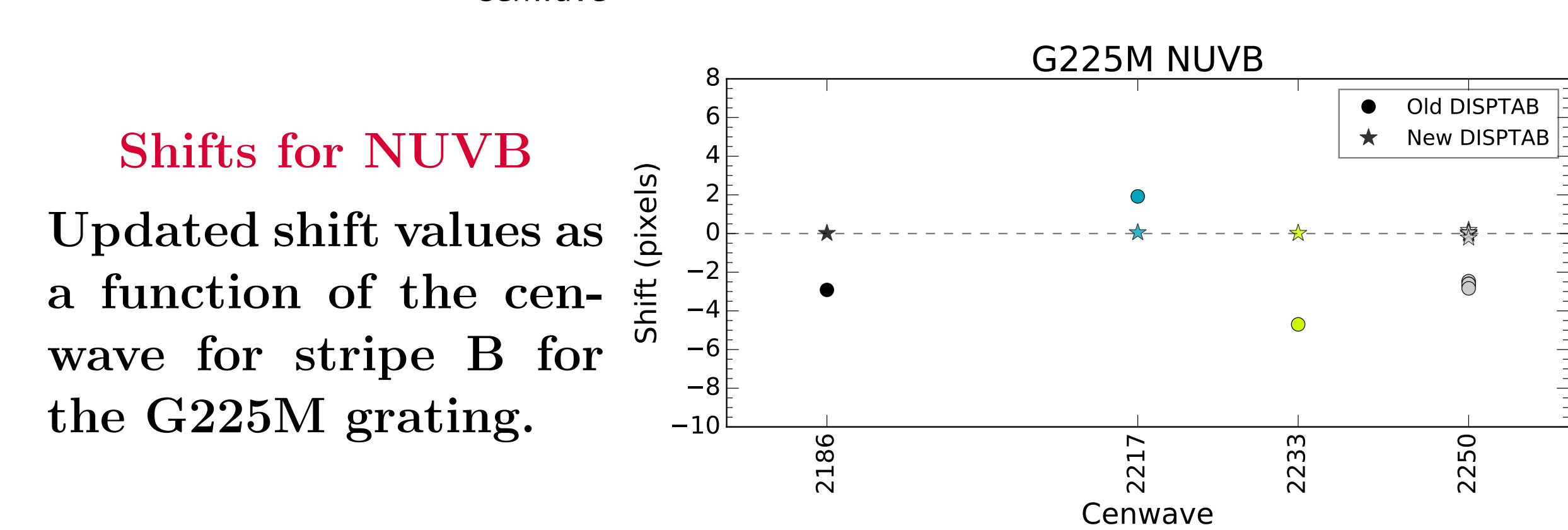
NUV Wavelength Calibration

- Due to lack of calibration data and demand from the community, the calibration of wavelength zero-points for a subset of NUV settings were not updated since Servicing Mission Observatory Verification (SMOV) in 2009. As a result, offsets up to 1Å were observed in recent data. Using STIS data that overlaps with existing COS data taken shortly after launch with the G225M, G230L, and G285 settings we were able improved to ± 2 pixels. A new NUV DISPTAB was delivered with zero-point calibration with mission specifications.



Shifts for NUVA

Updated shift values as a function of the cenwave for stripe A for the G225M grating.

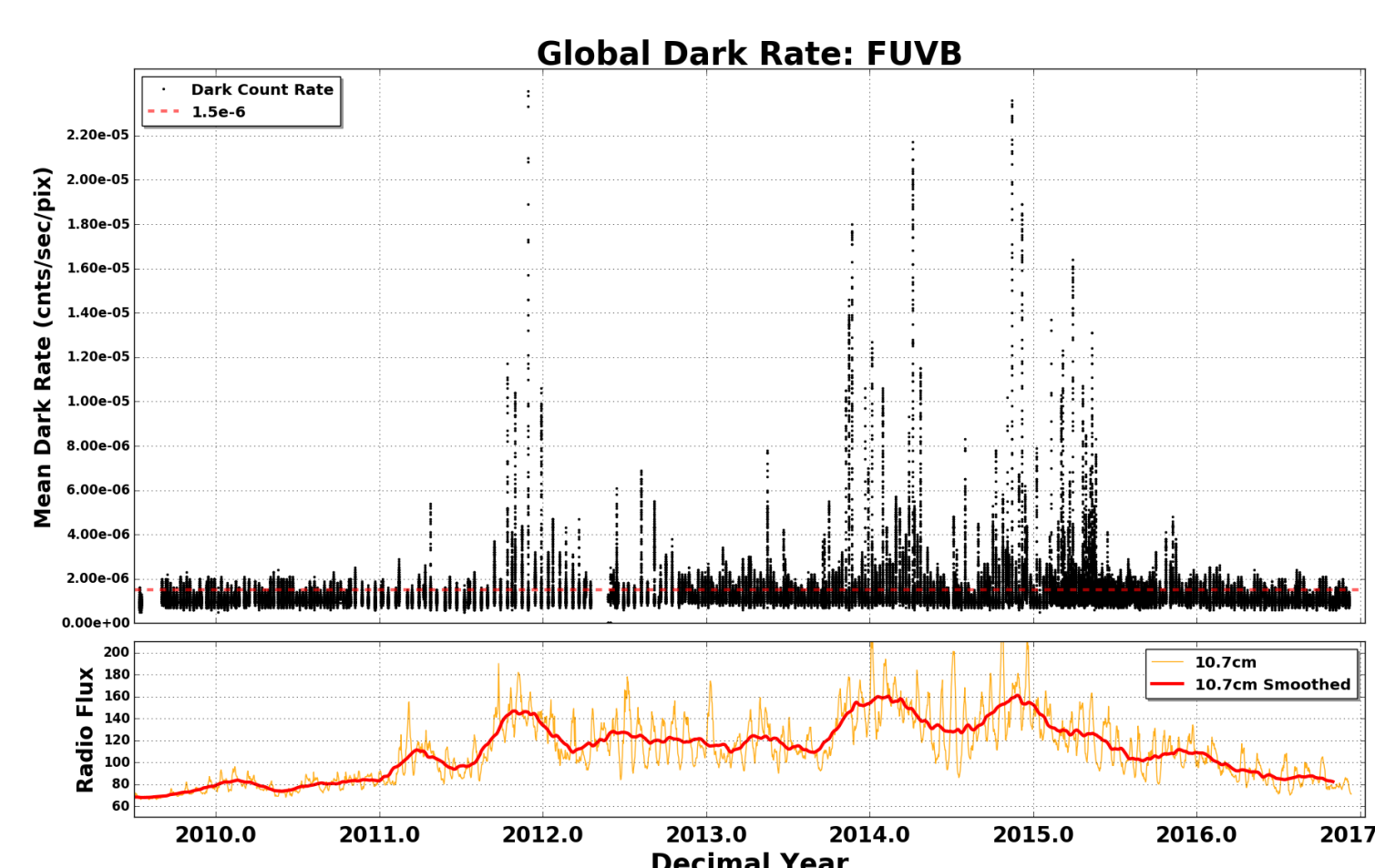


Shifts for NUVB

Updated shift values as a function of the cenwave for stripe B for the G225M grating.

FUV & NUV Dark Rates

- Regular monitoring of the dark rate shows that the FUV dark rate is currently at its lowest since launch.
- For the FUV detector, the scatter in dark rate values has decreased since the solar maximum in 2014.
- The NUV detector shows that the rate is flattening out but has increasing scatter.
- Calculated dark rates in Cycle 24 through mid-cycle 25:
 - FUVA: 1.78×10^{-6} cnts/sec/pix
 - FUVB: 1.68×10^{-6} cnts/sec/pix
 - NUV: 8.23×10^{-6} cnts/sec/pix

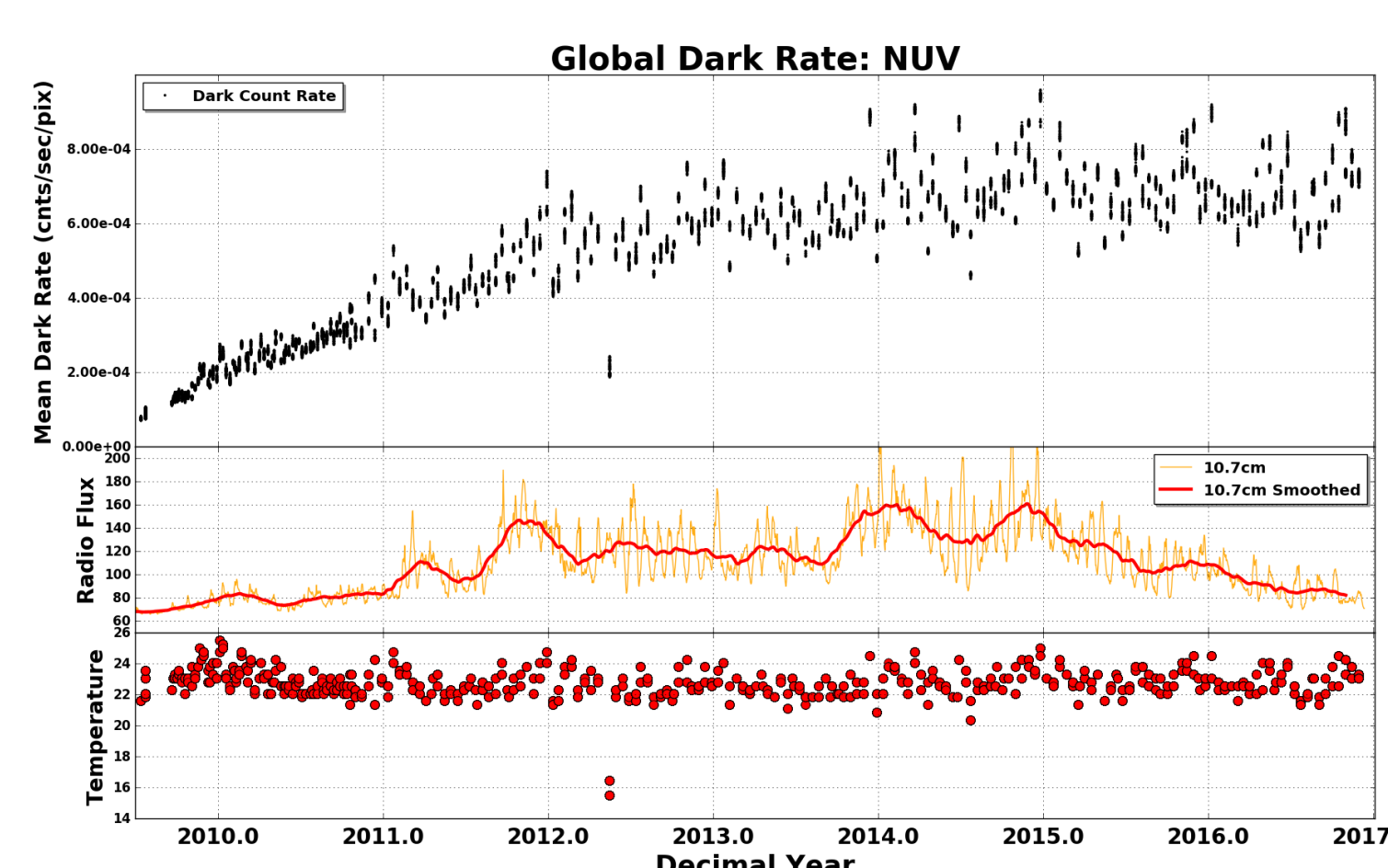
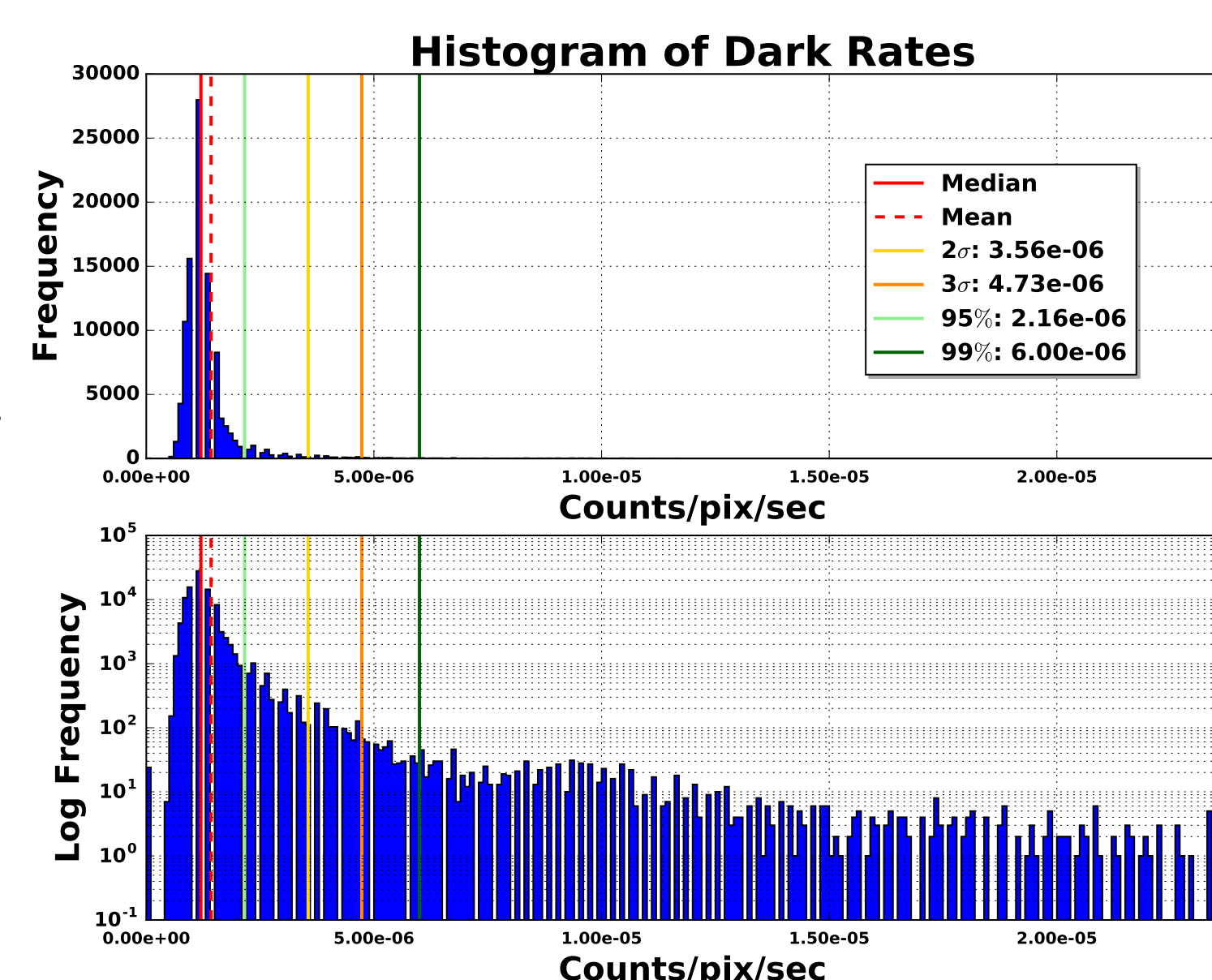


FUVB Dark Rate

The mean dark rate of segment FUVB (Top) and Solar Flux (Bottom) vs time.

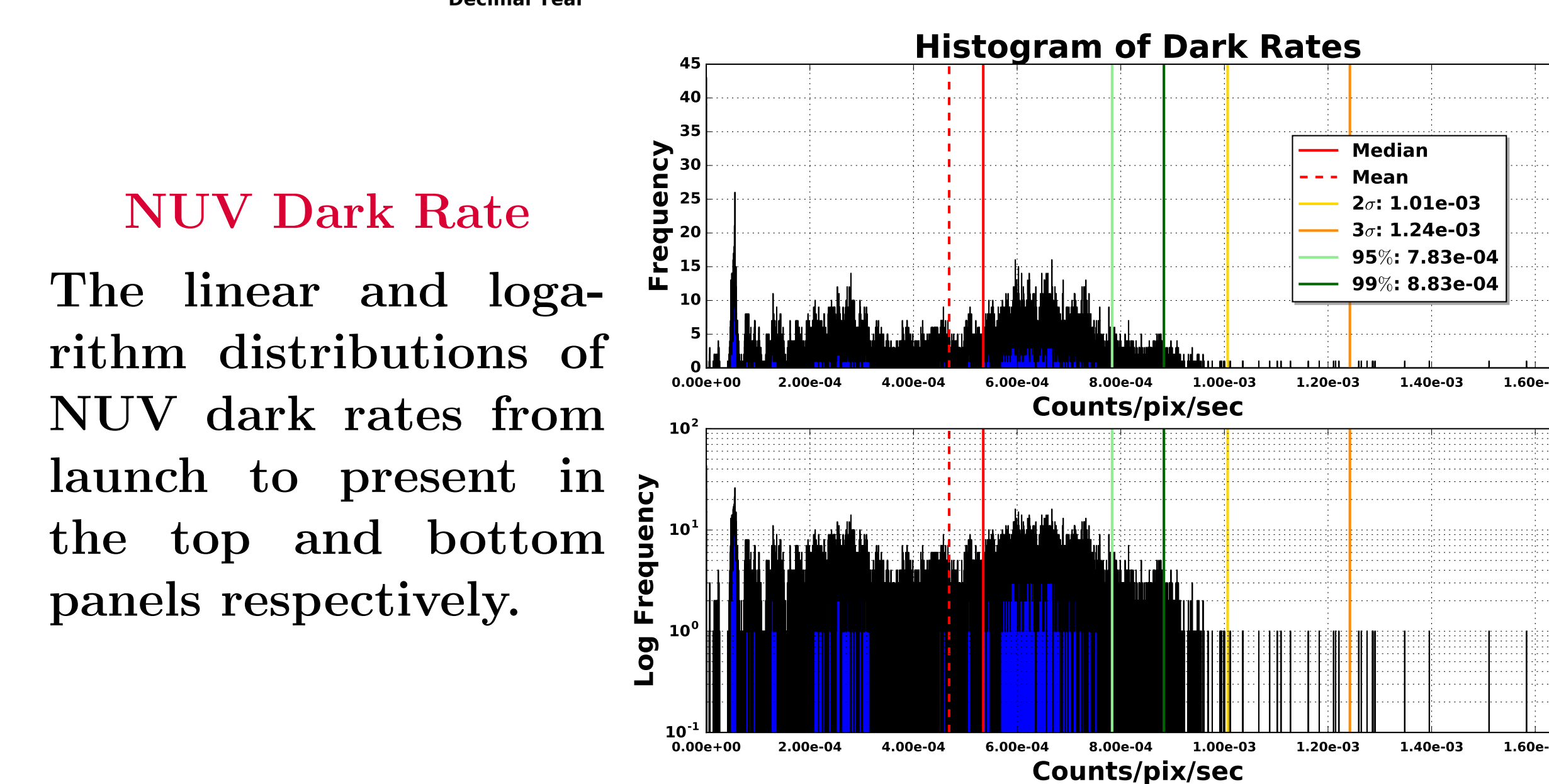
FUV Dark Rate

The linear and logarithm distributions of FUVB dark rates from launch to present in the top and bottom panels respectively.



NUV Dark Rate

The mean NUV dark rate (top) solar flux (middle) and temperature (bottom) vs time.

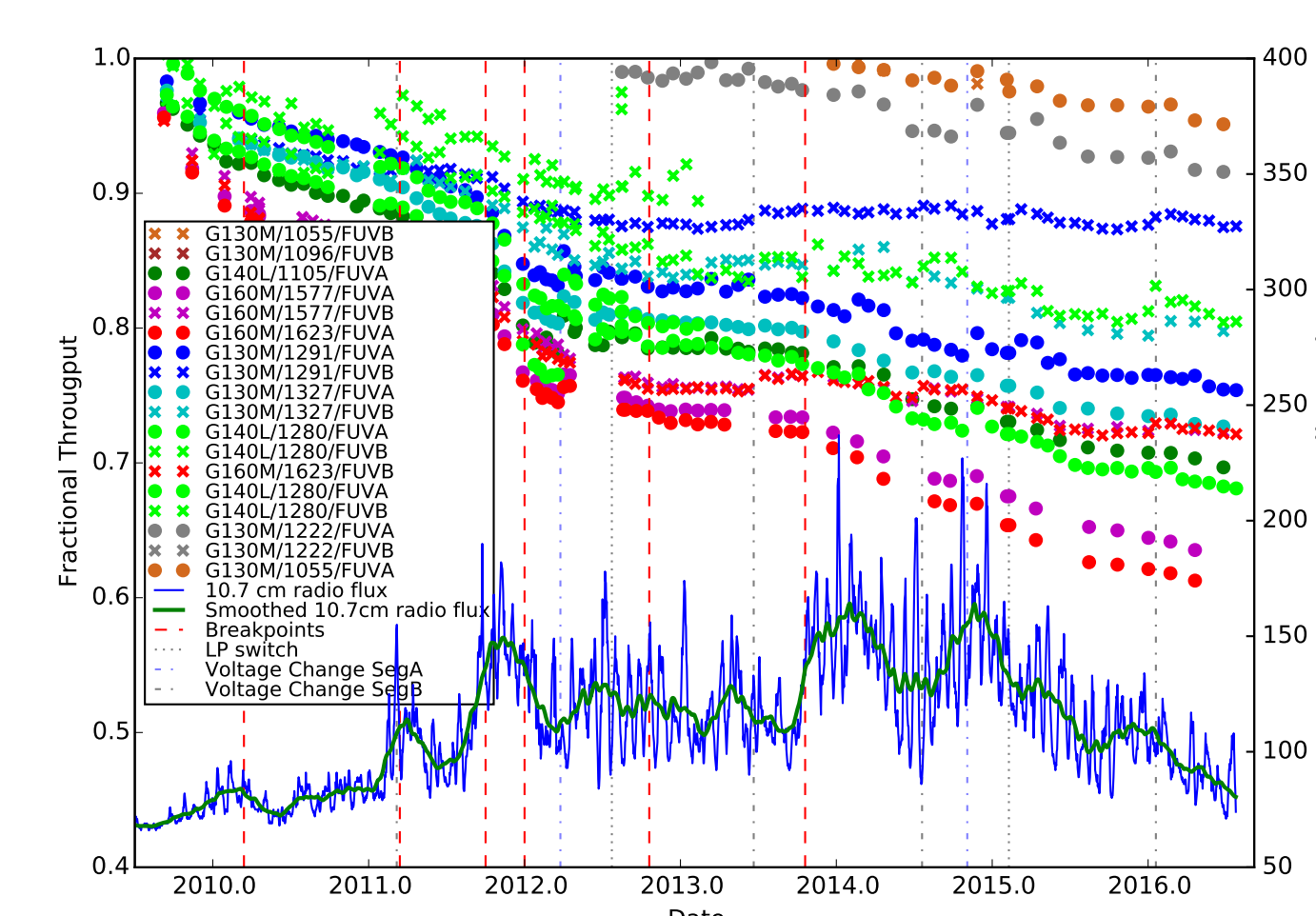


NUV Dark Rate

The linear and logarithm distributions of NUV dark rates from launch to present in the top and bottom panels respectively.

FUV & NUV Time-Dependent Sensitivity

- Regular monitoring of HST standard stars shows there is a time dependence to the spectroscopic sensitivity of the COS observing modes.
- The COS FUV Time-Dependent Sensitivity (TDS) initially showed steep declines, some of which correlated to the solar cycle.
- Since January 2012 the FUV sensitivity has a stable trend of between 1% and 5% per year, with steeper declines at longer wavelengths.
- A new reference file was delivered in June of 2016 and applies to all COS FUV settings except for G130M/1055 and G130M/1096 because the TDS trends remain unchanged.



FUV TDS

FUV TDS for FUVB/FUVA cenwaves including solar flux to show if it has any effect on the TDS trends.

- Since launch COS NUV G225M and G285M gratings show a decrease of 3% and 10% per year respectively independent of wavelength.
- Projected NUV ETC calculations for cycle 24 revealed that the TDS values were outside of the defined accuracy limits.
- New synphot files were delivered that contain updated NUV TDS slopes and Y-intercepts.

NUV TDS

NUV TDS for G285M/3094 showing the log of the relative net throughput of stripes A,B,C in the top, middle, and bottom panels respectively.

