Recent Calibration Efforts and Performance Updates for HST/STIS

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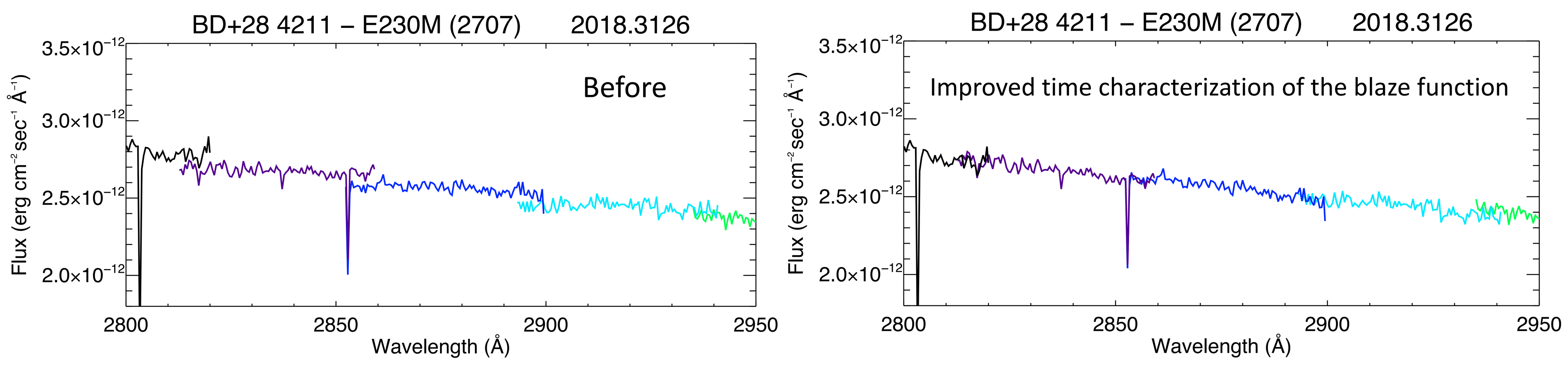
Abstract

The Space Telescope Imaging Spectrograph (STIS) continues to enable the astronomical community to carry out innovative UV and optical spectroscopic and imaging studies with its unique observing modes, over two decades after its deployment on the Hubble Space Telescope (HST). In particular, STIS allows spectroscopy in the FUV and NUV, including high spectral resolution echelle modes, imaging in the FUV, optical spectroscopy, coronagraphy, and long-slit spatial scanning on the CCD.

NUV-MAMA Reference File Updates

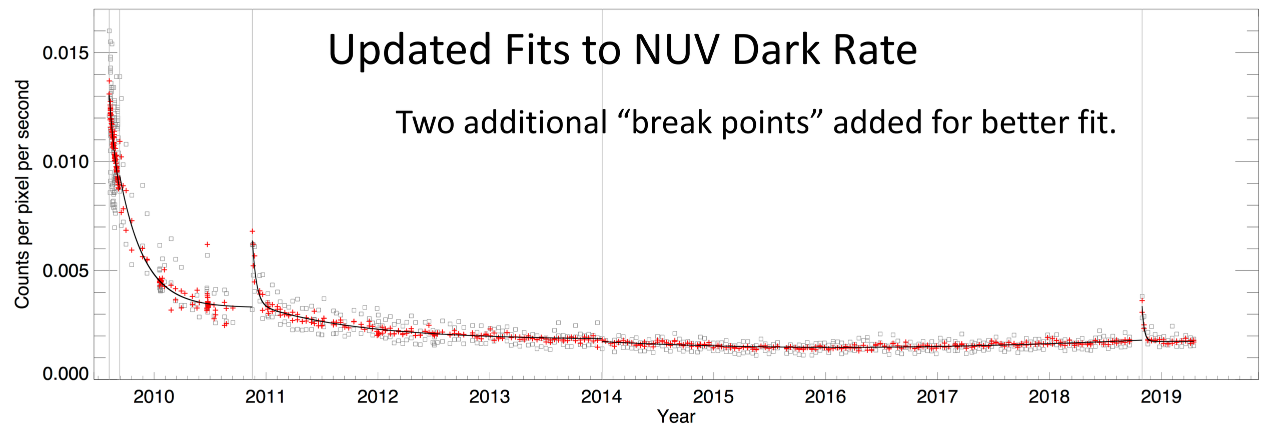
NUV Echelle Flux Calibration

An updated STIS NUV spectroscopic photometric conversion reference file (PHOTTAB) was delivered to the HST data pipeline for the E230M grating modes in June 2019. The file contains updates to the time component coefficients of the echelle blaze function shifts, and improves the relative flux accuracy of recent E230M modes in adjacent overlapping spectral regions.



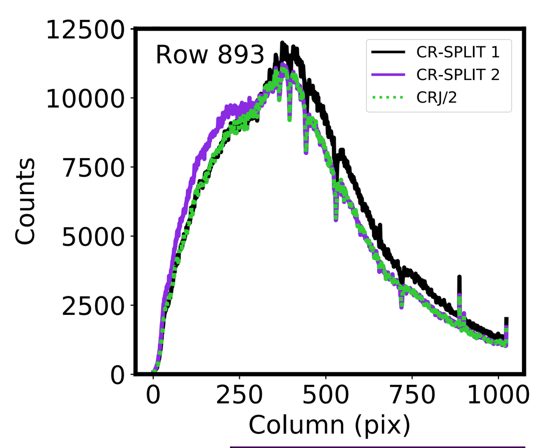
NUV-MAMA Dark Rate

A new NUV-MAMA dark correction table (TDCTAB) was installed in the pipeline in June 2019. New time and temperature dependent exponential solutions were derived for observations taken after Jan. 2014 and observations following an extended observatory safing in Oct. 2018. The previous model fit implemented in the TDCTAB was overestimating the dark rate for observations taken after Jan. 2014. The updated NUV-MAMA dark current trends are shown below.

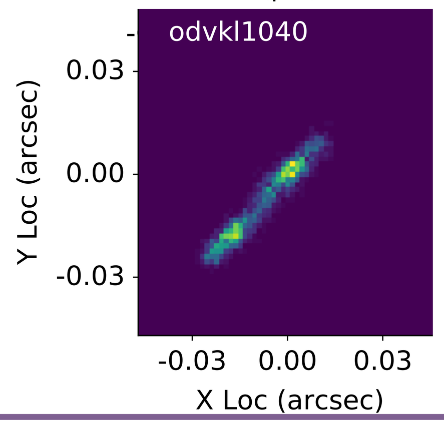


Impacts of Observatory Jitter

- STIS users are encouraged to examine the jitter files associated with their observations, given increased levels of spacecraft jitter due to recent gyro configuration changes. Elevated levels of jitter may impact some science goals.
- For coronagraphic observations higher levels of jitter can increase systematic noise and impact contrast performance (ISR STIS 2019-04).
- The spectroscopic modes most affected by increased jitter are FUV settings using narrow slits. Degradations in spectral resolution, broadening of spatial profiles, and decreases in overall data quality begin to occur when jitter levels exceed 7 mas RMS along-dispersion (STIS STAN, July 2018).
- Jitter can also induce errors in the combination of spectroscopic CCD CR-SPLIT observations when a target wanders significantly during a subexposure (ISR STIS 2019-02).



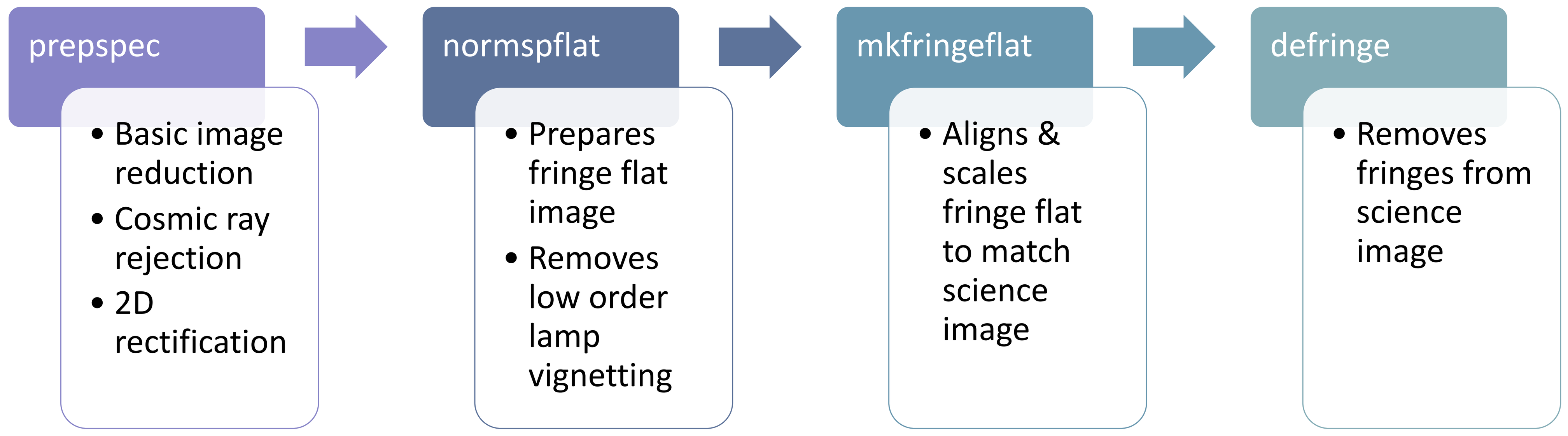
Spatial mis-alignments of subexposures due to jitter may cause the cosmic ray rejection algorithm to falsely reject valid data and underestimate the net counts. The rejection parameters may be adjusted to recover lost flux.

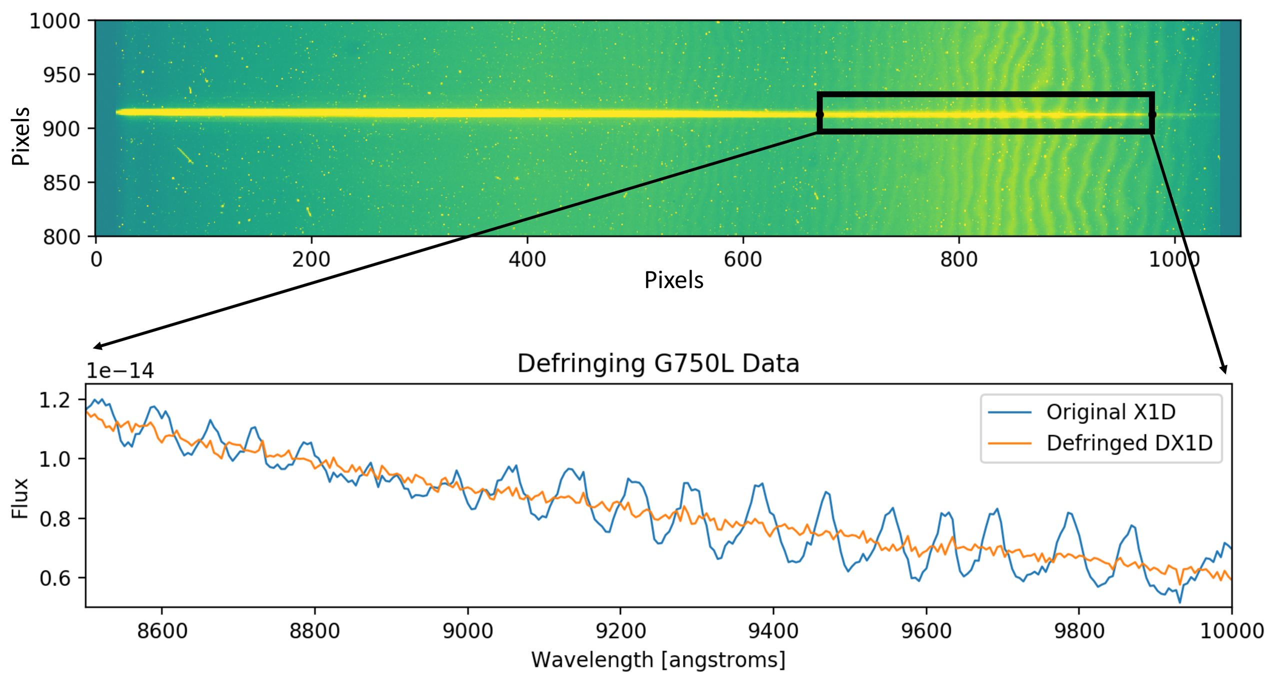


An example of different jitter distributions caused by telescope motion between two CR-SPLIT subexposures is shown. Users are encouraged to inspect their jitter files for differences between subexposures. Contact the HST Help Desk for any concerns.

Software Updates: CCD Defringe

- A new Python-based defringing tool has been developed to defringe STIS CCD G750L and G750M spectral observations. IRAF/PyRAF is no longer supported by STScI and the IRAF STIS defringe tasks will soon be deprecated.
- STIS calibration software is available to the community in the AstroConda package *stistools*. The new **stistools.defringe** module will be released in early 2020.
- The stistools.defringe module includes tools to replicate the behavior of the existing IRAF tasks:



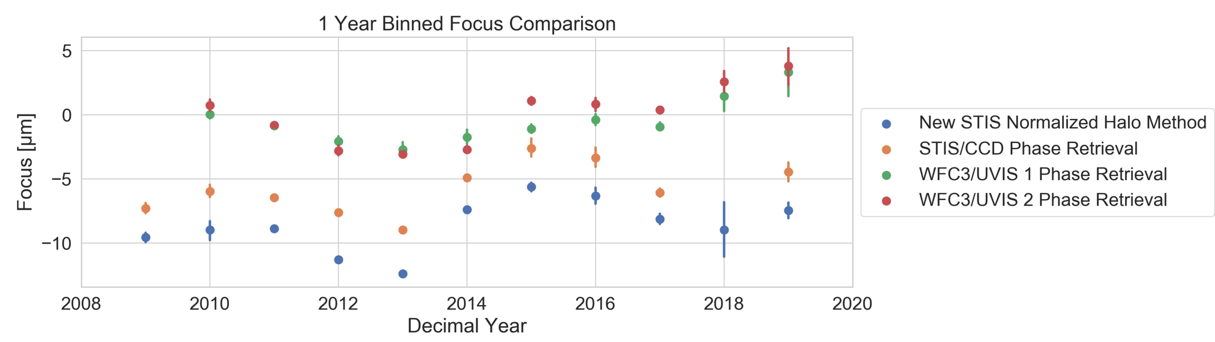


An example G750L spectral image with the fringe flat superimposed to illustrate the spatial locations of the fringe pattern.

A before and after extracted G750L spectrum illustrates the effectiveness of the new defringe module.

STIS Instrument Focus

A new automated monitor has been created to track the STIS instrument focus with time using the "Normalized Halo Method" (ISR STIS 2019-01).



Documentation Updates

STIS Data Handbook

- The STIS Data Handbook was overhauled in 2019 to now include data calibration examples with our Python-based software package, stistools.
- New content was added for pixel-based CTI corrections and the STIS target acquisition simulator.

STIS Instrument Reports (ISRs)

- *The Impact of Spacecraft Jitter on STIS Coronagraphy* (Debes, Anderson, Wenz, & Stock, 2019, ISR STIS 2019-04)
- *Pushing the Limits of the Coronagraphic Occulters on HST/STIS* (Debes, Ren, & Schneider, 2019, JATIS, in press, arXiv:1905.06838)
- *Identifying Jitter Induced CCD CR-SPLIT Combination Errors* (Carlberg, 2019, ISR STIS 2019-02)
- *A New Method to Monitor the HST/STIS Focus* (Maclay & Debes, 2019, ISR STIS 2019-01)

Website Updates

- The new STIS instrument website provides links for all documentation updates, available with the QR code on this poster.
- The Python-based STIS calibration package stistools is documented at https://stistools.readthedocs.io. This is a helpful resource for new Python users, with examples to get started.

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Visit http://www.stsci.edu/hst/stis for the latest updates.
Submit a ticket at http://hsthelp.stsci.edu for help.