Introduction

In August 2004, the Space Telescope Imaging Spectrograph (STIS) suspended operations on a flight critical error (FCE). In particular, this error necessitates several new risers be replaced, produced a command error where the new risers were inserted, and produced a flight critical error (FCE) that resulted in a reconfiguration of the spectrometer. This reconfiguration was done to ensure stability and reliability of the STIS system.

The improvements to the calibration of STIS made as part of this effort include:

1. Improved echelle flux calibration
2. Improved photometric throughput reference files
3. Blaze correction for echelle modes
4. Charge transfer inefficiency (CTI) losses for echelle modes
5. New post-pipeline analysis tasks
6. Updated calibration reference files

Table 1: Comparison of Peak Rows for X2D and WX2D

<table>
<thead>
<tr>
<th>Peak Row</th>
<th>X2D Image</th>
<th>WX2D Image</th>
</tr>
</thead>
<tbody>
<tr>
<td>Average</td>
<td>10.2 ± 0.2</td>
<td>10.3 ± 0.3</td>
</tr>
<tr>
<td>Standard Deviation</td>
<td>0.5 ± 0.1</td>
<td>0.6 ± 0.2</td>
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Updated Calibration Reference Files

Several updates to calibration files for use in the STIS pipeline have been delivered:

• PHA tables contain the throughput as a function of wavelength for each STIS mode. To perform the necessary integration over shorter time scales, the latest CTI correction, revised sensitivity, and optical red shifts for the imaging, spectrophotometric, and photometric modes for the echelle modes were delivered. They include extensive revisions to throughput curves for all MAMA medium- and high-resolution echelle modes. Coefficients characterizing the echelle blaze correction were adjusted and the position on the detector, new coefficients and zero points as a function of order and Side 1 and Side 2 are updated. The same coefficients characterize the temperature dependence of the blazed blaze. An improved literature correction was provided.

• TDS files also include flux-calibration files to be corrected for throughput which vary with time or detector temperature. Updated TDS tables, derived from all the updated CTI and sensitivity information, are delivered for all STIS modes: MAMA, and the FUV/MAMA detectors.

• MAMA and FUV/MAMA detectors have a new response function derived from a photon flux measurement from the detector window. This glow-scales with temporal and spatial time scales but shows more complicated behavior over longer timescales. The coefficients provided in the Temperature Dark Correction Routine (TDC) and the average NUV-MAMA dark as a function of temperature. Both the baseline dark current (DRK) and TDC files were updated using all dark monitor data available. DRK files for several epochs are available. FUV/MAMA dark current exhibits an irregular glow which has become bright on several occasion. Over time, this glow, which increases with detector temperatures as well as with the time the detector has been powered on, cannot be properly modeled by the standard dark calibration.

• The DRK files, excluding this glow, and containing only the baseline dark current and the hot pixels, were updated using all monitor data available. Images of the glow are available from the STIS website at stsci.edu.

Improved CTI Correction

In CoDs, the transfer of charge from one pixel to the next is not perfect. This so-called Charge Transfer Efficiency (CTE) is quantified by the fraction of charge successfully transferred between adjacent pixels. Charge Transfer Inefficiency (CTI) manifests itself as a loss of signal along the charge-drift axis at the detector. This means that a charge-transfer efficiency of 1-CTE. Observationally, CTI manifests as the apparent dimming of a target the further the position of the target is away from the real world. This effect is visible in the order of 10-25% were seen before STIS suspensions in 2004. Since charge transfer increases with on-chip time, the detector accuorses radiation damage, the CTE correction is expected to be even more important in Cycle 17 and thereafter.

The CTI losses for STIS CCD spectrophotometry of point sources has been newly calibrated, allowing for dependency on the observing epoch, signal level, background level, and the charge trap filling effect of the red halo of the STIS CCD PSF longward of ~8000Å. Systematic residuals of corrected observed data stay within 1.5% (RMS) throughout the wavelength range covered by the CCD grating modes. This CTE correction has been incorporated into CALSTIS and OTFR pipelines and is available for use as the standalone task CTESIS in the STIS package of STSDAS.

Improved Echelle Flux Calibration

New throughput curves for all MAMA medium- and high-resolution echelle spectroscopic modes were obtained based on observation of the fundamental blue (FUV) and red (VIS) W2000 in Cycle 11 (targets 1998-2001 (HST program IDs 7657, 8067, 8421, and 8915) which involved on-orbit sensitivity curves were derived using data taken in the time period 1998-2001 (HST program IDs 7657, 8067, 8421, and 8915) and as well as 2002. Both the baseline sensitivity monitor data collected, were delivered for the CCD, the NUV-MAMA dark current (DRK) and TDC files were updated using all dark monitor data available. MAMA dark current (DRK) and TDC files were updated using all dark monitor data available.