

Sensitivity Monitor Report for the STIS First-Order Modes

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Abstract. The analysis of the STIS Sensitivity Monitor observations from 1997 through 2002 continues to show sensitivity trends correlated with time for all first-order modes, as well as temperature dependence in the FUV. The wavelength-averaged rate of sensitivity loss for the MAMA low-resolution (L) modes is nearly 2%/yr for G140L and about 1.5%/yr for G230L; the observed trends in the CCD modes are dominated by charge transfer efficiency (CTE) loss. Selected wavelength settings of the medium-resolution (M) gratings G140M, G230M, G230MB, G430M, and G750M have also been followed by this monitoring program. The lower exposure levels in the CCD M-mode observations result in significantly larger effects from CTE losses, than is the case for the L-mode observations. In general, the sensitivity losses are found to be wavelength dependent. The limited MAMA M-mode wavelength coverage is consistent with the same sensitivity trends observed in the L modes at the corresponding wavelengths. On this basis, the STIS pipeline processing software is currently being revised to correct the extracted fluxes for these sensitivity changes in both the MAMA L and M modes. The CCD sensitivity losses due to CTE depend on the signal and background exposure levels as well as detector location, and so require tailored corrections.

1. Observations

A spectroscopic flux standard, either the white dwarf GRW+70D5824 or the subdwarf AGK+81D266, is monitored with each STIS grating to detect changes in sensitivity due to contamination or other causes. Observations included in this report are from the STIS Sensitivity Monitor calibration program. The data are from Cycles 7–10 through May 2002. Each observation uses the 52×2 slit and is processed with on-the-fly reprocessing (OTFR). The MAMA L modes have been monitored monthly while the M mode measurements were taken at two-month intervals. The CCD L modes were monitored every three months while the CCD M modes were checked every six months. CCD observations are CR-SPLIT = 2 and GAIN = 1. G750L and G750M observations have contemporaneous ‘fringe-flat’ exposures for fringe removal. The normal mode select mechanism (MSM) shifting is disabled for these monitoring observations in order to minimize variations due to spatial displacements of the spectra. Detailed information regarding observing strategy can be found in Walborn and Bohlin (1998).

2. Analysis and Results

Prior to analysis, the FUV MAMA fluxes are corrected for a slight (0.25%/°C) temperature dependence. Thereafter, each STIS mode is examined for any variation in sensitivity with time. The earliest observation for each mode is defined as the reference. The sum of the NET counts for each observation is divided by the sum of the NET counts for the reference. These relative sensitivities are plotted versus time and are fitted with linear segments (as seen in Figures 1–3). The slope, i.e., percent-per-year change in sensitivity and 1σ uncertainty in the fits are printed at the bottom of each plot. The 1σ rms(%) of the data residuals from the linear fit is also provided (SIGMA). The tables below summarize the wavelength-averaged results for the MAMA and CCD L-modes.

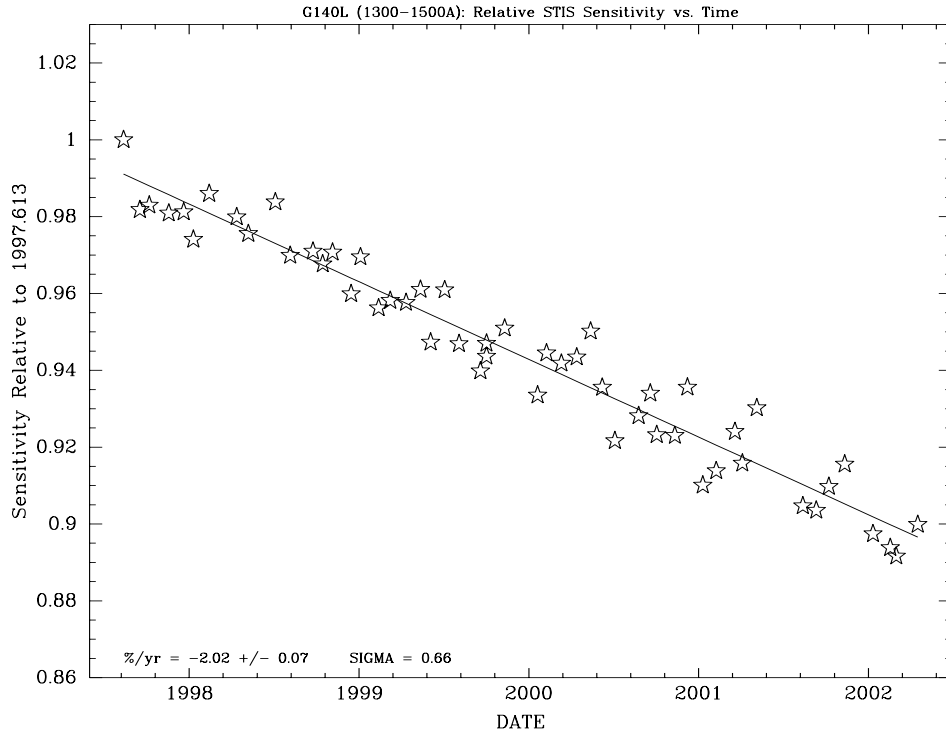


Figure 1. G140L Relative Sensitivity vs. Time

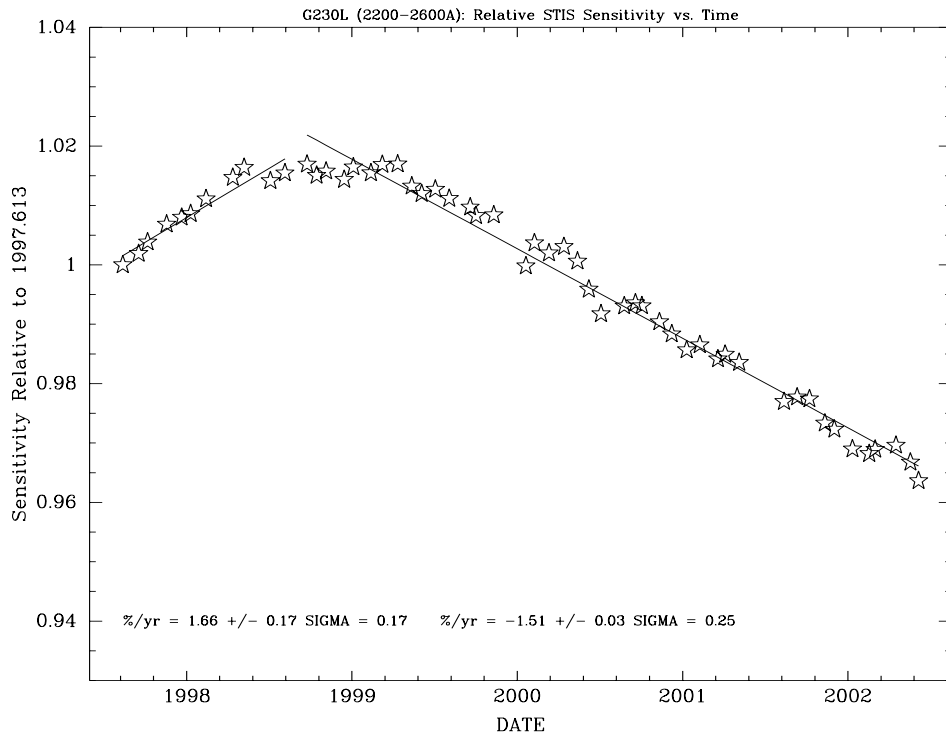


Figure 2. G230L Relative Sensitivity vs. Time

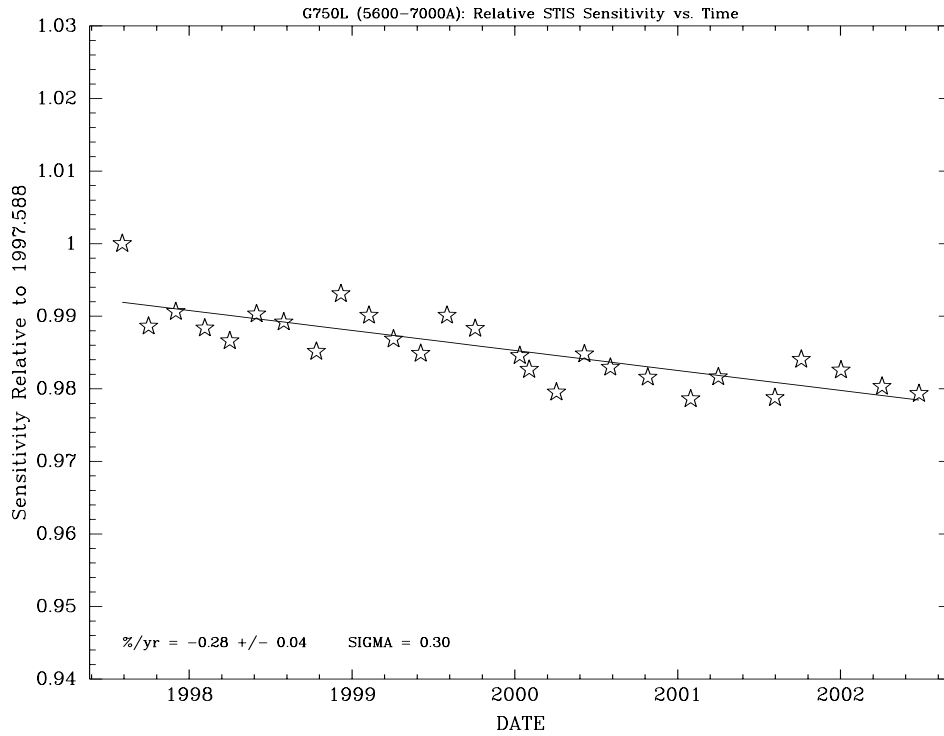


Figure 3. G750L Relative Sensitivity vs. Time

Prior to analysis, the FUV MAMA fluxes are corrected for a slight (0.25%/C) temperature dependence. Thereafter, each STIS mode is examined for any variation in sensitivity with time. The earliest observation for each mode is defined as the reference. The sum of the NET counts for each observation is divided by the sum of the NET counts for the reference. These relative sensitivities are plotted versus time and are fitted with linear segments (as seen in Figures 1-3). The slope, i.e., percent-per-year change in sensitivity and 1σ uncertainty in the fits are printed at the bottom of each plot. The 1σ rms(%) of the data residuals from the linear fit is also provided (SIGMA). The tables below summarize the wavelength-averaged results for the MAMA and CCD L-modes. Smith et al. (2002) discussed the entire analysis procedure for this program while Stys and Walborn (2001) reports the latest sensitivity trends.

Table 1. MAMA Time-Dependent Sensitivity Trends

Mode	Epoch	λ -Range (Å)	%/yr	+/-	SIGMA
G140L		1300-1500	-2.02	0.07	0.66
G140M		1150-1190	-2.52	0.12	0.67
G140M		1542-1592	-2.17	0.08	0.52
G230L	< 1998.7	2200-2600	1.66	0.17	0.17
G230L	> 1998.7	2200-2600	-1.50	0.04	0.25
G230M	< 1998.7	2775-2860	1.40	0.23	0.12
G230M	> 1998.7	2775-2860	-0.90	0.05	0.22

Table 2. CCD Time-Dependent Sensitivity Trends

Mode	Epoch	λ -Range (\AA)	%/yr	+/-	SIGMA
G230LB	< 1998.7	2000–3000	0.79	0.20	0.16
G230LB	> 1998.7	2000–3000	-1.59	0.08	0.34
G230MB	< 1998.7	2340–2490	0.23	0.49	0.29
G230MB	> 1998.7	2340–2490	-2.23	0.14	0.43
G430L		3100–5500	-0.39	0.07	0.46
G430M		3050–3300	-1.20	0.06	0.28
G750L		5600–7000	-0.28	0.05	0.30
G750M		7000–7500	-1.07	0.10	0.51

3. Pipeline Correction

Corrections for the time dependences of all MAMA first-order configurations have been incorporated into the STScI data-reduction pipeline as of mid-2002, so that all OTFR retrievals of such data will have corrected fluxes regardless of their acquisition epoch. The CCD sensitivity losses due to CTE depend on the exposure levels and detector location, and so require tailored corrections. Sensitivity-monitor data for the echelle and MAMA imaging configurations are currently under investigation; they appear to show analogous effects, and pipeline corrections for them will become available at a later time. The SYNPHOT package has been updated to model the time dependent sensitivities for both spectroscopic and imaging modes.

References

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