RESPONSE TIME OF THE LWR CAMERA
AT THE UVC SETTING OF -4.5 KV

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Abstract

The response time of the LWR camera at the UVC setting of -4.5 kv is determined to be 128 msec (with an expected error of ± 15 msec). This value is similar to those obtained previously for the three operational cameras at the UVC setting of -5 kv: 126 msec for the LWP camera and 120 msec for the LWR and SWP cameras.

Introduction

The actual exposure time for an IUE spectrum is, in general, not exactly equal to the exposure time requested by an observer on the script. One reason for this difference is that the exposure time performed by the on-board computer is an integer multiple of 0.4096 seconds (one "OBC tic"). The requested exposure time is always rounded down to an integral number of OBC tics.

Another reason for the difference in requested and actual exposure times arises from the fact that a significant amount of time is required to bring the UVC and SEC voltages up for the exposure and to bring the voltages back down again. Thus, there is a net response time for each camera. The actual exposure time is just the requested exposure time rounded down to the next lowest multiple of 0.4096 seconds, minus the response time. For example, a requested exposure time of 1.0 sec is rounded down to 0.819 sec (2 OBC tics) and, assuming a response time of 0.120 sec, results in an actual exposure time of approximately 0.699 sec.

The LWR camera at the UVC setting of -5 kv is no longer available to guest observers, due to the presence of a flare in the UVC at this setting. Since the LWR camera is now available at a UVC setting of -4.5 kv (Imhoff 1985), it was decided that the response time should be redetermined for the LWR camera in this configuration. The procedure used is essentially identical to that used by Imhoff (1984) to determine the response time for the LWP camera. A single exposure of duration N OBC tics is taken and compared to a multiple exposure obtained with M exposures of duration one OBC tic, where N and M are chosen to produce spectra of about the same DN level. The ratio of the flux numbers at a given wavelength for the two spectra is then:

$$R = \frac{FN(M)}{FN(1)} = \frac{M * (0.4096 - T_r)}{(N * 0.4096) - T_r},$$

where FN(1) is the flux for the single exposure, FN(M) is the flux for the multiple exposure, and T_r is the response time. The equation can be solved for T_r:

$$T_r = 0.4096 * \frac{M - (R * N)}{M - R} .$$

Results

Three low dispersion LWR spectra of HD 93521 were obtained on 1 November 1985 during a maintenance shift to determine the response time of the LWR camera at the UVC setting of -4.5 kv. LWR 17812 and LWR 17814 were each obtained with a single 12 tic exposure (N = 12), and LWR 17813 was obtained with 16 separate exposures of duration one tic each (M = 16). The number of exposures for LWR 17813 was selected so that the flux levels would be similar to those for the single exposures, in order to avoid errors that arise from nonlinearities in the Intensity Transfer Function (Holm et al. 1982).

Ratios were formed by dividing one spectrum by another, and average values were obtained over 100 A intervals. Only those portions of the spectra with FN > 10000 were used. As can be seen in Table 1, the flux levels of the single exposure spectra are in good agreement; the average ratio of the flux numbers (LWR 17812/LWR 17814) is 0.986. Since the percentage difference is only 1.4%, the two spectra were averaged together to produce a single reference spectrum.

The ratio of the multiple exposure spectrum to the reference spectrum for each 100 A bin is also given in Table 1. The average ratio "R" is 0.940 ±0.020. Substitution of this value into the equation for the response time "T_r" gives a value of 128 msec (±6 msec). The uncertainty should be considered a lower limit, as it is based on the standard deviation of ratios for different bins from one multiple exposure spectrum.

The major source of uncertainty in the response time is likely the interaction of various pieces of timing hardware on the spacecraft (Schiffer 1980). Therefore, a more realistic value for the uncertainty is obtained by comparison of the results from two or more multiple exposure spectra. This is done by Imhoff (1984), who determines the response time of the LWP camera at the UVC setting of -5 kv to be 126 msec (±16 msec) ,and Schiffer (1980), who determines the response time of the LWR and SWP cameras at the UVC setting of -5 kv to be 120 msec (±15 msec). The value of 128 msec obtained for the LWR camera at -4.5 kv agrees well with those determined for the cameras at -5 kv, and the uncertainty is expected to be about the same (approximately 15 msec).

References

Holm, A., Bohlin, R. S., Cassatella, A., Ponz, D. P. and Schiffer, F. H., III 1982, Astron. Astrophys., 112, 341.

Imhoff, C. L. 1984, NASA IUE Newsletter, No. 24, 24.

Imhoff, C. L. 1985, NASA IUE Newsletter, No. 28, 7.

Schiffer, F. H., III 1980, NASA IUE Newsletter, No. 11, 33.

Table 1

Flux Ratios

Wavelength (A)		Ratio of FN (LWR 17812/LWR 17814)	Ratio of FN (LWR 17813/Reference)
2000		0.983	0.959
2100		0.993	0.930
2200		0.996	0.980
2300		1.008	0.959
2400		0.971	0.925
2500		0.975	0.930
2600		0.986	0.943
2700		0.990	0.941
2800		1.001	0.934
2900		0.970	0.927
3000		0.977	0.908
	Mean	0.986	0.940
	St. Dev.	0.013	0.020