SWP ITF Extension

The upper level of the Intensity Transfer Function (ITF) is known to lie below the saturation level of 255 DN over extended regions of both the SWP and the LWR cameras (Holm 1979; Turnrose 1980). This means that it is possible to expose a spectrum sufficiently heavily that it cannot be photometrically corrected properly even though the telemetry saturation of 255 DN is not reached. Shortly after this problem was discovered, the IUE Spectral Image Processing System was modified to extrapolate from the highest non-saturated levels in the ITF to generate an approximate photometric correction for these heavily exposed pixels (Turnrose, Harvel, and Bohlin 1980). It was thought that the extrapolation would reduce the photometric errors introduced into overexposed spectra, but that additional ITF levels at higher exposure levels would provide a more desirable solution to the problem. This report describes the testing of an SWP ITF constructed with one level more than the ITF used since May 1978.

In summary, this extended SWP ITF was found to provide no improvement in photometric accuracy for the overexposed SWP low dispersion spectra.

A twelfth level for the SWP ITF was constructed from images especially obtained during 1979 for this purpose. These images are listed in Table 1. Effective exposure times were calculated by the standard technique using the DN values of the 60% exposure meter images to determine relative lamp efficiency. Reseaux were found in each image to derive its own geometrical correction.

Table 1

SWP ITF Extension Images

Image	Commanded Exposure	Effective Exposure	DN (1300Å)
SWP5901	442.66 sec	355.89 sec	239.8
SWP7236	472.56	346.88	234.9
SWP7274	536.87	365.12	241.0
SWP7276	472.56	346.38	237.7
mean	-	353.57	238.4

The twelve level ITF was tested by using it to process two sets of spectra exposed at various levels. The photometric accuracy of the new ITF was determined by dividing each sample in the overexposed spectrum by the corresponding sample in the normally exposed spectrum. The same evaluation was conducted on the same sets of spectra processed with the eleven level ITF so that improvements to the photometric accuracy could be determined. The test data consisted of four spectra of BD+75° 325 (SWP4954, 50%; SWP4955, 100%; SWP4956, 150%; and SWP4957, 200%) and two spectra of BD+28°4211 (SWP9753, 100% trailed; and SWP9756, 200% trailed).

Figure 1 shows the eleventh level of the ITF is exceeded by the 200% spectrum from SWP9756 over a range of about 100Å near 1300Å. The twelve level ITF would be expected to produce more accurate fluxes in that range than the extrapolation from the eleven ITF does. In fact, Figure 2 shows that where the intensity of the spectrum exceeds the tenth level of the ITF a photometric error of 5% or more is introduced regardless of which ITF was used. This result was not expected because the lamp efficiency had been monitored somewhat more closely when the images for the twelfth level were obtained than when the original ITF images were taken.

The spectra displayed in Fig. 1 and Fig. 2 were processed during the fall of 1980 using the old low dispersion software that geometrically corrected the images before photometrically correcting them. During the spring of 1981 the test was repeated using the new low dispersion software which does not geometrically correct the images (Turnrose, Bohlin, and Lindler 1981) and which was implemented 1980 Nov 4 at GSFC and 1981 March 10 at VILSPA (Turnrose and Northover 1981). The same results were obtained with the new software as with the old, namely that the addition of a higher level to the ITF did not improve the photometric accuracy of overexposed spectra.

No attempt was made to create an extended ITF for the LWR camera because changes in the shape of the null prevents reproduction of flat field images obtained during the commissioning of the instrument.

In conclusion, we have not been able to improve the photometric accuracy of spectra which have been exposed so that a significant number of pixels are exposed to levels exceeding the ITF levels. While the tests

have been done on low dispersion spectra only, we have no reason to expect that the photometric properties of high dispersion spectra are any better.

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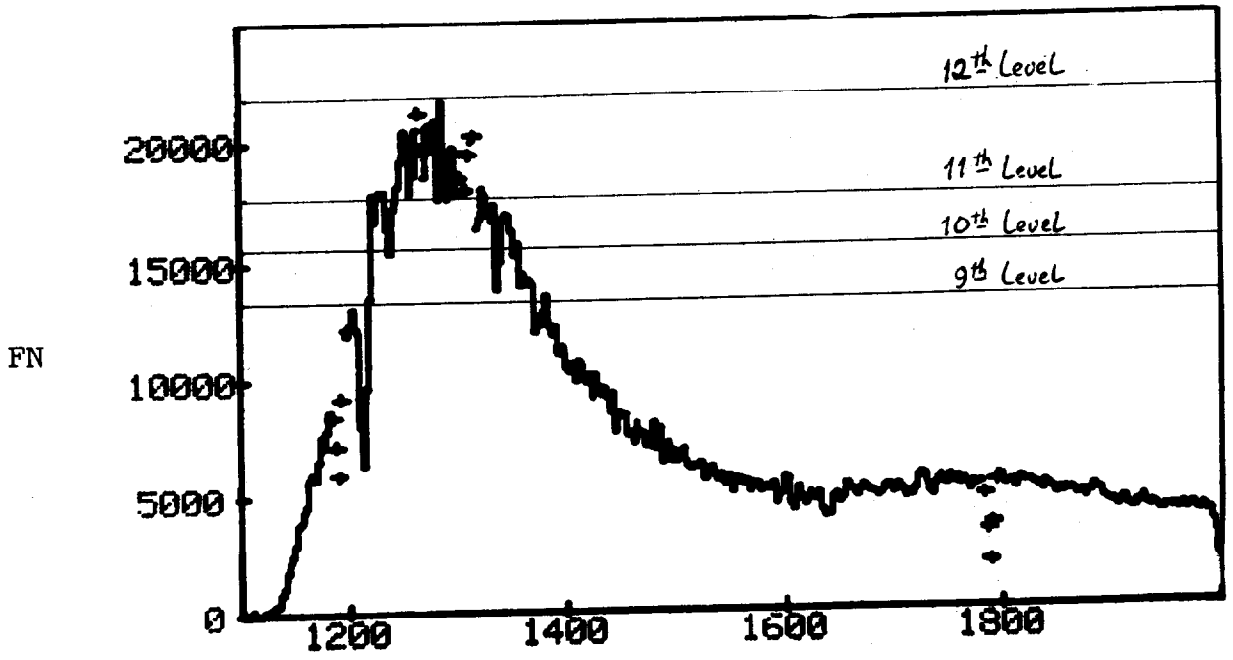

Fig.1- Flux Numbers per pixel from the central order of the essr file for SWP9756, the 200% level spectrum of BD+28°4211.

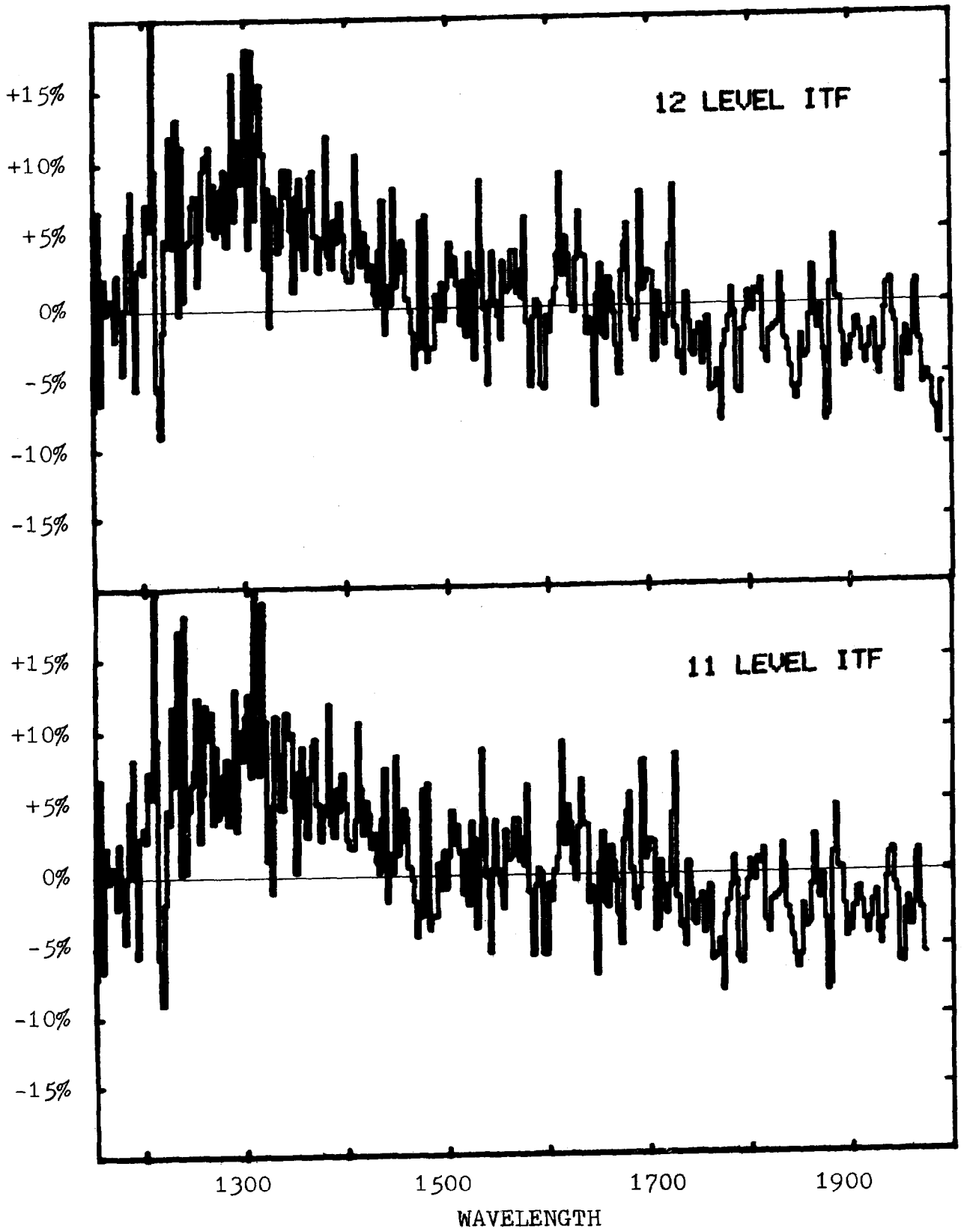

Fig. 2- Photometric errors in the 200% spectrum processed with the 11 level and the 12 level ITFs. These errors, in SWP9756,a trailed spectrum of BD+28^{o}4211, were determined by dividing the over exposed spectrum by a normally exposed spectrum, SWP9753, and scaling the result by the inverse ratio of exposure times.