

Registering Multiple Exposure Images using Trailed Extraction

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Recently, there have been some questions raised about how well IUESIPS processing performs automatic registration for multiple exposure images using trailed extraction. Automatic registration for trailed spectra uses a template of the expected intensity profile perpendicular to the dispersion (Thompson and Bohlin, 1982, NASA IUE Newsletter No. 18, pg. 45). Since the intensity profile of multiple spectra differs from trailed spectra, the template may not be appropriate and the resulting registration may not be correct. If so, then only manual registration would give correct results for multiple spectra. A study was recently conducted to address these concerns, and this report documents the procedures used and the results obtained from this study.

There are two different groups of data used in this study. The multiple exposure spectra are taken from the set of GO data which originally prompted the investigation. These data are a set of 2 and 3 exposure, well exposed, continuum spectra of various hot stars (HD 141637, HD 142165, N1342 H8, BD +71 107). These multiple exposure images were processed using the trailed extraction with both automatic and manual registrations applied for later comparisons. For images registered manually, the extraction was carefully centered on the middle of the multiple spectra. We note that automatic registration failed consistently for LWP multiple spectra consisting of 2 exposures, but ran fine for LWP 3 exposures and SWP 2 and 3 exposures. For comparison, point source and trailed spectra of a calibration star were examined. These are recently obtained, optimally exposed images of the calibration standard HD 60753. These spectra were processed using automatic registration.

The data were reduced using the RDAF routines IUEIM and FEATURE. Using IUEIM, a crosscut of the fluxes perpendicular to the spectrum was taken over 1330-1800 Angstroms for each of the SWP images and over 2300-3100 Angstroms for each of the LWP and LWR images. Some typical intensity profiles for the spectra can be seen in Figure 1. FEATURE was then used to measure the center and width of the crosscuts. The WNET (weighted center) and WIDNET (weighted width, equivalent to sigma) measurements are listed in Tables 1 and 2.

The reductions gave encouraging results. In principle the central line of the ELBL file should be 55.5. The actual measurements obtained on both the standard

star images, as well as the GO data, varied from this by a few tenths. Similar accuracy was found in the width measurements. The GO multiple exposure images yielded width measurements very close to the ones obtained from the standard star trailed data. The type of registration did not make any difference with the center or width measurements of the multiple exposure images. The manual and automatic registrations produced similar results in both cases.

From these results, it is safe to assume that automatic registration and trailed extraction work adequately on multiple exposure images, regardless of the number of spectra in the aperture. It is also evident either automatic or manual registration can be applied in these cases. Although there were small differences in the obtained measurements, all can be attributed to the limitations of the technique.

Table 1

Spectrum Center and Widths for HD 60753
Point Source and Trailed Spectra

	IMAGE	WNET	WIDNET
LWP	17073 Pt So(S)	55.14	2.47
	17073 Pt So(L)	55.58	2.90
	17074 Trail	55.53	6.70
	17300 Pt So(S)	55.17	2.50
	17300 Pt So(L)	55.62	2.46
	17301 Trail	55.59	6.69
	17934 Pt So(S)	55.24	2.63
	17934 Pt So(L)	55.84	3.12
	17935 Trail	55.63	7.01
	18188 Pt So(S)	55.10	2.67
	18188 Pt So(L)	55.42	2.51
	18189 Trail	55.49	6.70
	18984 Pt So(S)	55.27	2.51
	18984 Pt So(L)	55.82	2.73
	18985 Trail	55.58	6.67
MEAN:	Pt So(S)	55.18 +/- .07	2.56 +/- .09
	Pt So(L)	55.66 +/- .18	2.74 +/- .27
	Trail	55.56 +/- .05	6.75 +/- .14

	IMAGE	WNET	WIDNET
LWR	18400 Pt So(S)	55.52	2.28
	18400 Pt So(L)	55.35	3.04
	18401 Trail	55.01	7.41
	18450 Pt So(S)	55.26	2.60
	18450 Pt So(L)	55.46	3.07
	18451 Trail	55.10	6.88
MEAN:	Pt So(S)	55.39 +/- .18	2.44 +/- .23
	Pt So(L)	55.41 +/- .08	3.06 +/- .02
	Trail	55.06 +/- .06	7.15 +/- .37

Table 2

Spectrum Center and Widths for GO's Multiple Spectra

	IMAGE	Manual Registration WNET	WIDNET
LWP	20988 3 exp	56.019	5.682
	20989 3 exp	55.994	5.558
SWP	42216 3 exp	56.428	6.492
	42217 3 exp	56.066	7.167
	42243 2 exp	54.682	7.242
	42250 2 exp	55.054	6.732

	IMAGE	Automatic Registration WNET	WIDNET
LWP	20988 3 exp	55.914	5.722
	20989 3 exp	56.065	5.848
SWP	42216 3 exp	55.525	6.121
	42217 3 exp	55.123	6.617
	42243 2 exp	54.510	7.029
	42250 2 exp	55.268	6.832

Table 1 (con't)

	IMAGE	WNET	WIDNET
SWP	38145 Pt So(S)	55.70	3.18
	38145 Pt So(L)	56.18	3.61
	38146 Trail	56.74	8.02
	38828 Pt So(S)	56.25	3.94
	38828 Pt So(L)	56.50	4.09
	38829 Trail	55.96	8.00
	39635 Pt So(S)	55.82	3.30
	39635 Pt So(L)	55.97	3.61
	39636 Trail	55.84	7.37
	39808 Pt So(S)	56.03	3.33
	39808 Pt So(L)	56.22	3.48
	39809 Trail	55.60	7.58
	40367 Pt So(S)	55.81	3.43
	40367 Pt So(L)	56.26	3.90
	40368 Trail	55.66	7.91
MEAN:	Pt So(S)	55.92 +/- .22	3.44 +/- .30
	Pt So(L)	56.23 +/- .19	3.74 +/- .25
	Trail	55.96 +/- .46	7.78 +/- .29

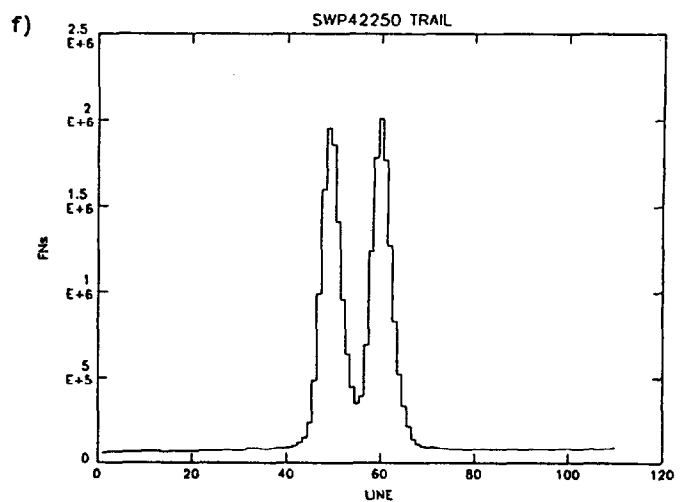
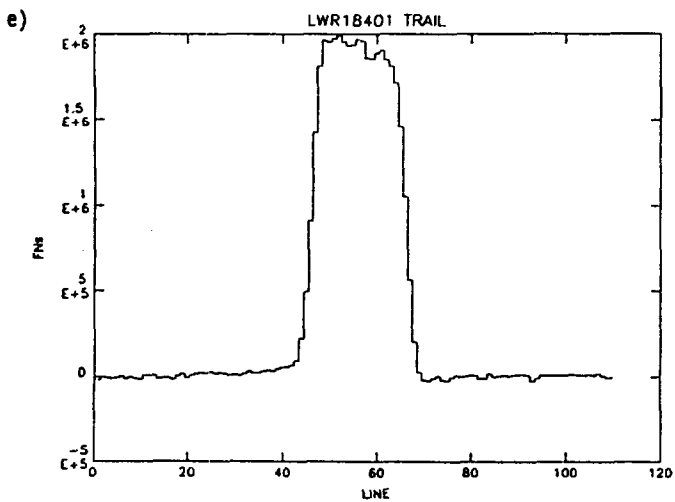
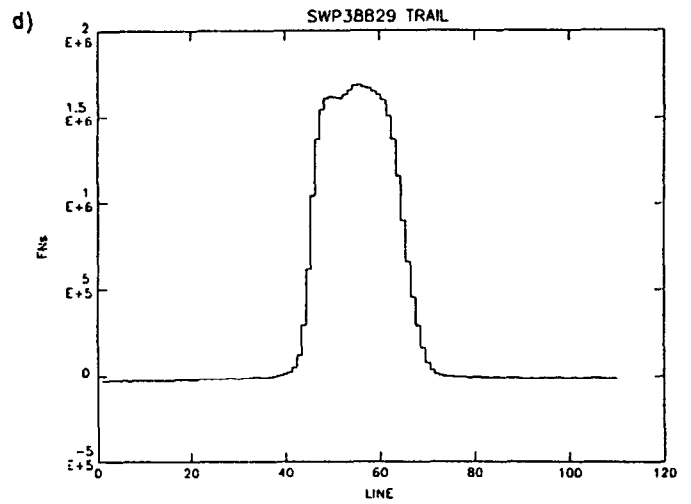
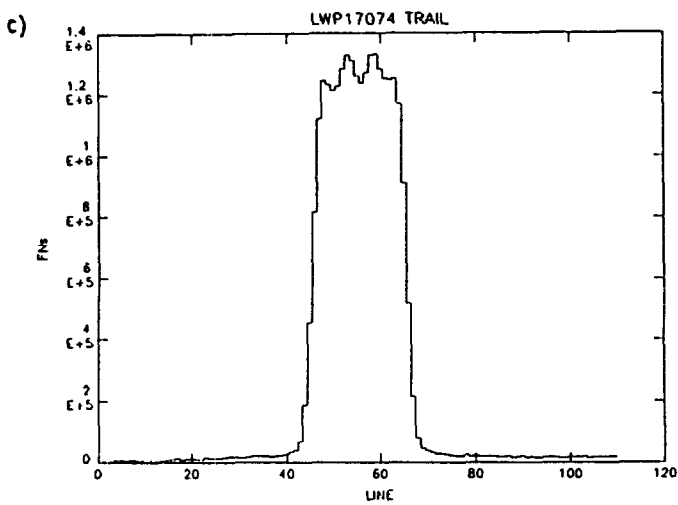
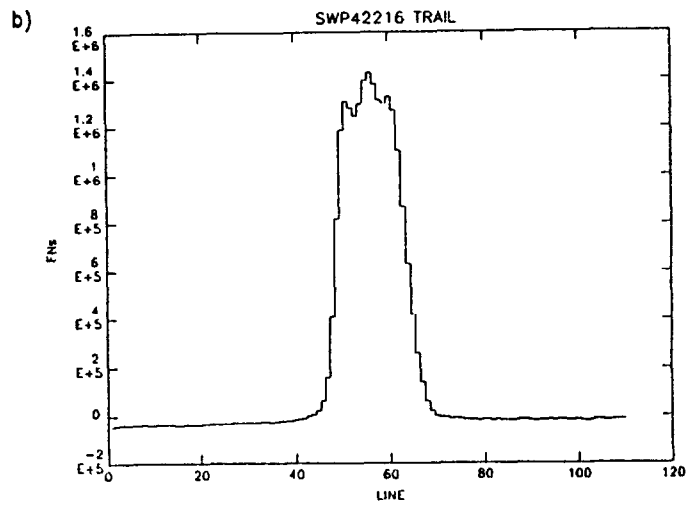
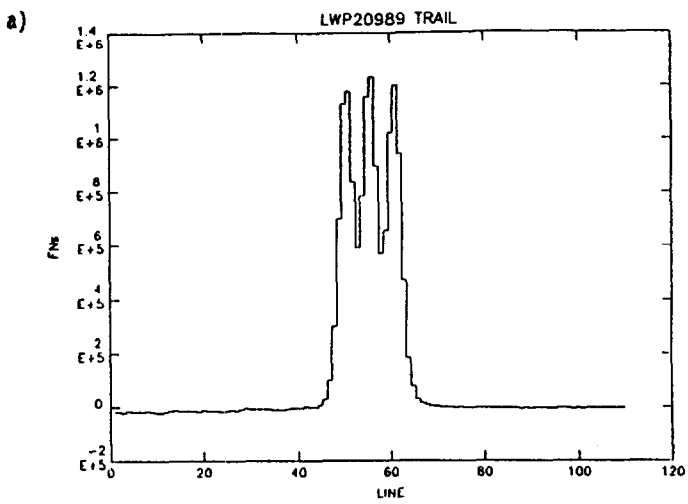


Figure 1: Typical intensity profiles for the spectra of various types of images.

a) LWP - 3 exposure image

b) SWP - 3 exposure image

c) LWP - trailed image

d) SWP - trailed image

e) LWR - trailed image

f) SWP - 2 exposure image