SWP Aperture Area Revisited

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Introduction

This method involves the examination of monochromatic images of the apertures (see Panek 1982 & Pérez and Loomis 1992). These types of images can be obtained from WAVECAL exposures taken with the aperture mechanism left open, thus simultaneously illuminating both the large and small apertures. This technique assumes that the light from the Pt-Ne lamps is collimated and that the illumination over the apertures is uniform. The first assumption is true because the distance between the aperture plate and the WAVECAL lamps is large compared with the size of the apertures. The second assumption, as is seen from the Trail-to-Point flux ratio analysis, is not true for the SWP (unlike the LWP which shows uniform illumination of the large aperture).

Analysis of Wavelength Calibration Data

The image chosen for this study (SWP 39479) was processed using the NEWSIPS processing software (Figure 1a). The image was rotated such that the orders are horizontal and the photometric correction applied. Each of the emission lines represents a projection of the aperture onto the camera faceplate. The effective large-aperture area in square pixels is found by ratioing the total flux of the line to the mean central flux. The ratio is converted to square arcseconds by applying the plate scale (1.51"/pixel). The total flux of the emission line is found by summing the FN contained within a rectangle ($\sim 12 \times 20$ pixels) encompassing the large-aperture emission feature. Care was taken to ensure that no flux fell outside the rectangle before summation. The mean central flux is the average FN of a rectangular box of pixels ($\sim 4 \times 8$) centered about the peak of the emission feature. Because the illumination over the apertures is not uniform, the central flux rectangle was shifted around so that the region of maximum flux was used. The average background, determined from a 12×12 box of pixels, was subtracted from the FN data in each case before performing any calculation. An example of the procedure is illustrated by Figure 1b. A total of 21 emission features (tabulated in Table 1) were measured to produce an average large-aperture area (Table 2).

The area of the small aperture was arrived at using a similar method. Pairs of large- and small-aperture emission lines were found and the total small-aperture flux, with a correction for the background, was measured. The ratio of the total flux in the large and small apertures is then the ratio of the aperture areas. Dividing the large-aperture area for a particular large-small pair by this large-to-small ratio yields a measurement of the small-aperture area. A total of 11 small-aperture emission lines (tabulated in Table 1) were used to determine the aperture area (Table 1).

Conclusion

The SWP aperture areas as determined from both the WAVECAL analysis and the Trail-to-Point (T/P) (Garhart 1992 a,b) flux ratios are displayed in Table 2. The aperture areas as determined by Panek (1982) and Bohlin, *et al.* (1980) are also shown for comparison purposes. As can be seen from the figures listed in Table 2, there is a large discrepancy between the large-aperture area derived from the T/P analysis versus the area determined from the WAVECAL analysis. The calibration group recommends using the aperture areas determined from the WAVECAL analysis as they are similar in value to the LWP areas (both apertures were fabricated from the same template) and they represent the true projections of the apertures onto the camera faceplate.

References

Bohlin, R.C.,*et al.* 1980, A&A, 85, 1

Garhart, M.P. 1992a, IUE NASA Newsletter, No. 48, 88

Garhart, M.P. 1992b, IUE NASA Newsletter, No. 49, 22

Panek, R. 1982, IUE NASA Newsletter, No. 18, 68

Pérez, M. and Loomis, C. 1992, *Record of the IUE Three Agency Coordination Meeting*, June 1992, p. III-41

Table 1: Results of WAVECAL Analysis

(X,Y)	BKGD	Total LGAP	Center Flux	Ratio	LGAP Area	Total SMAP	LG/SM Ratio	SMAP Area
307,351	457.36	587277	6733.6	87.22	198.86	16873	34.81	6.05
472,361	323.86	287214	3290.2	87.29	199.04			
577,361	102.63	437638	4866.7	89.93	205.04	13604	32.17	6.37
48,371	237.53	312446	3354.6	93.14	212.37			
207,381	379.67	237082	2566.8	92.37	210.60			
256,381	376.38	258008	2899.5	88.98	202.89			
375,381	416.97	288913	3298.1	87.60	199.74	8888.9	32.50	6.15
262,460	359.65	274720	3010.0	91.27	208.10			
219,471	379.56	414919	4546.6	91.26	208.08			
374,471	333.20	225216	2498.5	90.14	205.53	7208.0	31.25	6.58
462,471	283.40	427170	4536.7	94.16	214.69	15159	28.18	7.62
396,496	327.68	228171	2505.4	91.07	207.65	7230.5	31.56	6.58
93,509	254.96	421950	4370.3	96.55	220.14			
283,509	472.36	335217	3565.9	94.01	214.34			
445,509	366.45	101889	1101.2	92.53	210.97			
290,523	631.70	601465	6557.0	91.73	209.15	16093	37.37	5.60
617,523	173.95	422159	4505.7	93.69	213.63	9946.6	42.44	5.03
573,537	226.41	241132	2611.7	92.33	210.52			
385,580	447.01	494248	5100.2	96.91	220.96	15577	31.73	6.96
258,661	628.81	561440	5925.2	94.76	216.05	21467	26.15	8.26
432,661	479.15	365907	3860.9	94.77	216.09	12074	30.31	7.13

Table 2: SWP Aperture Dimensions

Garhart	Panek	Bohlin	Dimension
182.62±3.97	175.0±9.0		Large Aperture Area from T/P ratios (arcsec^2)
209.74±6.23	205.0±6.0		Large Aperture Area from λCAL image (arcsec^2)
		<214.0	Large-Aperture Area from Pre-flight Measurement
6.58±0.86	7.54		Small Aperture Area (arcsec^2)

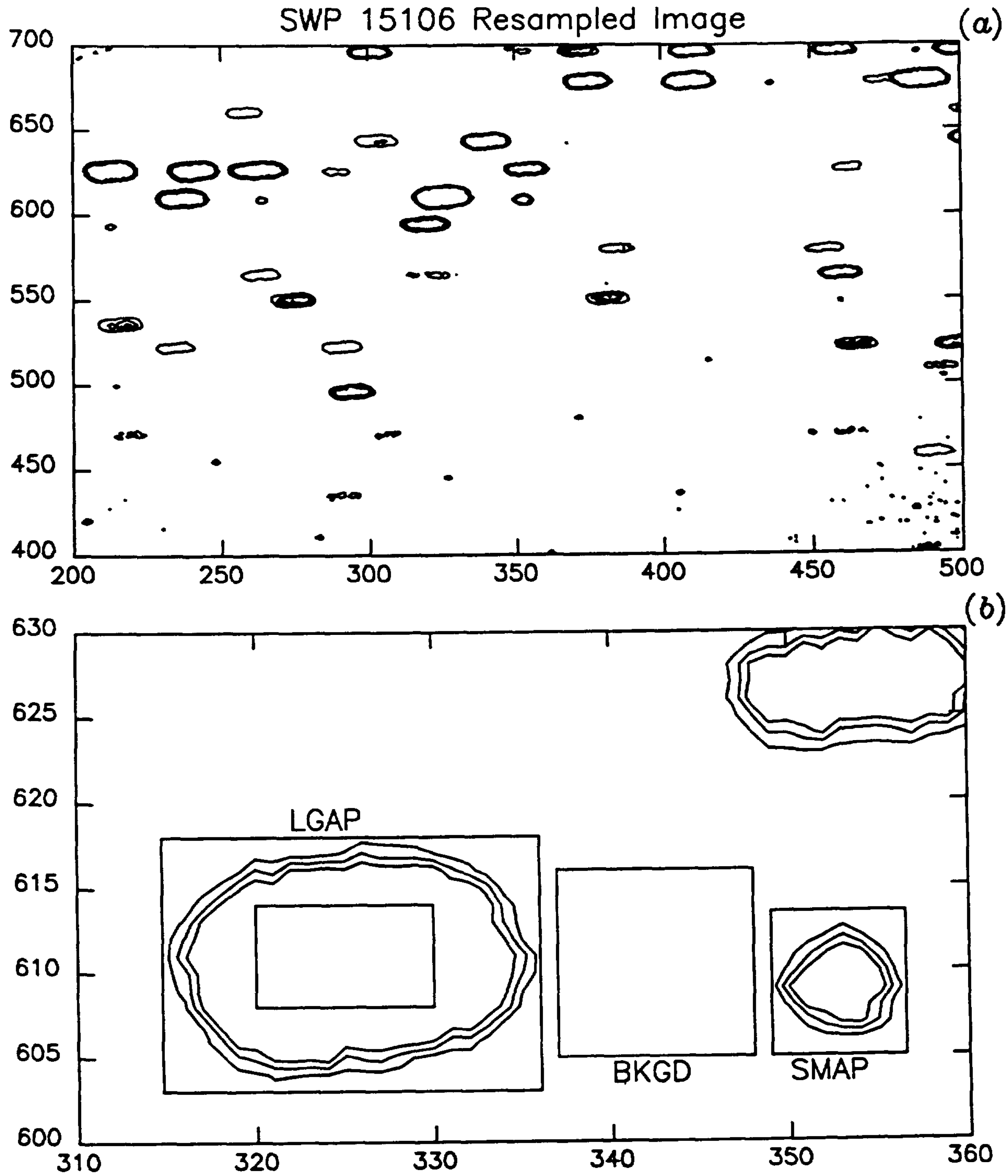

Figure 1: Panel *a* shows a section of the camera faceplate for a WAVECAL image. Panel *b* shows an expanded view of a small- and large- aperture Pt-Ne emission feature.