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TYPE 2 QUARTERLY STATUS AND TECHNICAL PROGRESS REPORT

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M.J. Duggin, J. Lindsay, D.J. Piwinski and L.B. Schoch

Principal Investigator: M.J. Duggin

Technical Officer: H. Oseroff

Scientific Officer: B. Markham

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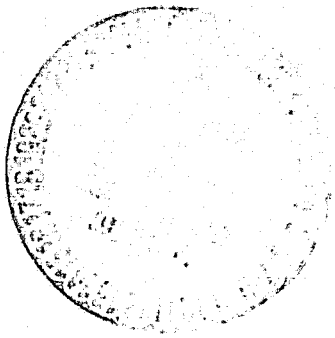

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1.1 INTRODUCTION

In this report, we extend the investigations which we have previously reported, demonstrating an angular anisotropy in the output of thematic mapper. That is, we show in this report that there is a dependence of sensor output (proportional to scene radiance in a manner which will be discussed) upon season, upon cover type and upon view angle. We are thus demonstrating the existence of a significant systematic variation across uniform scenes in p-type (radiometrically and geometrically pre-processed) data: present pre-processing has not removed the effects and the problem will have to be addressed because the effects are large. While this is in no way attributable to any shortcomings in the thematic mapper, it is an effect which is sufficiently important to warrant more study, with a view to developing suitable pre-processing correction algorithms. It is true that for multitemporal applications, in which images are acquired with differing illumination geometrics, such calibrations will have to be performed. Further, if thematic mapper data is to be compared with other data bases (multi-date or single date) then such calibrations will need to be applied to all data sets before they can be intercompared.

2. IMAGES ANALYZED

a. Agricultural areas

(i) Webster-Ft. Dodge

.Path 27 Row 31; image 4001716261. Pre-harvest, apparently cloud-free, 4-band p-type data.

.Path 27 Row 31; image 4009716273. Post-harvest, apparently cloud-free, 7-band p-type data.

(ii) Indianapolis

.Path 21 Row 32; image 4010315505. Post-harvest, apparently cloud-free, 7-band p-type data.

b. Forest area

(i) Jamestown

.Path 17 Row 31; image 4005915251. September 13 image - some change in deciduous foliage, minimal cloud, which is avoided in analysis, 7-band p-type data

.Path 17 Row 31; image 4004315244. August 29 image - zero apparent cloud, summer scene, 7-band, p-type data.

3. ANALYTICAL TECHNIQUES

The NASA LAS system was used and the data analyzed was that available on the LAS disk files. Extreme cooperation was received and the system proved excellent for the analyses performed. In fact, it was a real pleasure to use.

The agricultural data was analyzed in two ways:

a. A mask was constructed in which 16 pixel wide, by 300 line deep "slices" were selected for analysis at regular locations across the image on each of three swaths. The pixel start values used were:

300

500

1000

2000

3000

4000

5000

6000

6500

6700

The upper and lower lines defining the slices were:

500 to 800

1900 to 2200

5000 to 5300

It is noted that, due to earth rotation correction the image is trapezoidal and that the slices starting at pixels 300 and 6700 are therefore missing (i.e. radiance values are zero) at the bottom and top swaths respectively.

In this analysis, the mean digital counts for each band were computed from all of those pixels enclosed in the slices. The covariance matrix, histograms, etc. were also computed from all pixels enclosed in each slice. From this data, it was possible to calculate the scan angle (i.e. pixel no.) dependence of the digital counts (proportional to recorded radiance) in each bandpass, for each swath. The coefficient of variation (standard deviation divided by the mean) and the ratio

$$\frac{2 \times \text{standard error}}{\text{mean}} \times 100$$

were also computed and tabulated. The latter quantity is a measure of two standard errors as a percentage of the mean digital count value for any slice.

b. The same mask (overlay) was employed as in the method described above in order to define slices 16 pixels wide by 300 lines deep. However, in this analysis, we used the cursor whose size, shape and position could be defined interactively to "train" on areas considered to consist of the most vigorous vegetation because of their red hue and saturation when the interactive display was used with appropriate look up tables (LUT's) in the following modes:

(i) TM 2 = blue
TM 3 = green — best for agricultural scene
TM 4 = red

(ii) TM 4 = red
TM 5 = green — best for forest scene - separates forest from grassland and agricultural areas
TM 7 = blue

Each "slice" on each "swath" was taken to be a class, and training was performed on three vigorous vegetation sites in each class, or slice.

c. The cursor mode was used on the LAS interactive analysis terminal (IAT) in order to enclose those areas identified (a priori) by means of their appearance in a false color mode. The central point of the examined area was obtained (both screen coordinates and co-ordinates related to the master image) from the IAT control monitor, using the POLYSIT2 program. While the number of pixels enclosed in each slice was always constant, this quantity varied in the case of individually located and positioned cursors.

4. RESULTS AND DISCUSSION

4.1 Webster-Fort Dodge Agricultural Scene: Pre-Harvest.

a. Analytical method described in 3(a) was used (whole 16 x 300 pixel slices used in analysis).

The starting line and pixel values are shown in Table 1, together with the mean digital count values. Plots of the mean digital counts vs. pixel no. (proportional to scan angle) are shown in Figs. 1-2, for the seven TM bands and for the 3 swaths. The ordering is such that for each band, the swath start line is shown

in increasing sequence: Fig. 1 = TM 1, swath 1 (line start = 500). Fig. 2 = TM 1, swath 2 (line start = 1900). Fig. 3 = TM, swath 3 (line start = 5000). While there is a slight variation between swaths, it is seen that there is about a 10% change in an asymmetric manner about nadir in mean digital count value. Figs. 4-6 show that a similar condition exists for TM 2. Figs. 7-9 show that, although there is more scatter in the case of TM 3, there is probably a slightly greater dependence of digital count on scan angle. Figs. 10-12 show that (as indicated in Table 1) there is a higher digital count in TM band 4 than in the preceding 3 bands (TM 3 being approximately three times smaller, in average digital count value). There is approximately a 20% change in digital count with scan angle. This is very asymmetric about nadir. In fact, for the lowest swath, there is almost a 20% monatonic decrease in digital count across the image (!!). The scan angle-dependence of digital count value is therefore band dependent: this shows that the goniometric anisotropy in the upwelling radiance is spectrally dependent, to a very significant (20% in this case) extent. Table 2 shows the coefficient of variation for digital counts in each band, in each slice. Table 3 shows the value

$$\frac{2 \times \text{standard error}}{\text{mean}} \times 100$$

for digital counts in each slice.

b. Analytical method described in 3(b) was used (three training sites on apparently vigorous vegetation were selected in each slice and the data for the pooled sites in each slice are presented here).

Table 4 shows the mean digital counts presented as a function of slice (i.e. of swath, pixel) and bandpass: the values and the systematic change with pixel value are similar to those shown in analysis (a); Table 1. However, Table 5 (coefficient of variation) and Table 6

$$\frac{2 \times \text{standard error}}{\text{mean}} \times 100$$

show that the data contains more random variation: this is no doubt due to the arbitrary selection of training sites. The organization of Figs. 13-24 is identical to that of Figs. 1-12 (that is, starting with TM band 1, swath 1 (line start = 500) and ending with TM band 4, swath 3 (line start = 5000)). The systematic scan angle (pixel)-dependence is larger than is the case for analysis (a) (i.e., described in 3(a)). Effects of up to 20% in TM bands 1-3 are seen, while TM 4 shows highly anisotropic effects which exceed 20%. The reason for the difference in the results of the two analyses is probably due to the fact that analysis (a) includes areas which are less vegetated, or whose leaf area index is lower than those areas specifically (and subjectively) selected in analysis (b) on the basis of hue and saturation, taken from the IAT screen and assumed to correspond to enhanced vegetative vigor.

4.2 Webster-Fort Dodge Agricultural Scene: Post-harvest.

a. Analytical method discussed in 3(a) was used (whole 16 x 300 pixel slices used in the analysis). Here, Table 7 shows the mean digital counts for each slice and within each bandpass, while Tables 8 and 9 show the coefficient of variation and

$$\frac{2 \times \text{standard error}}{\text{mean}} \times 100$$

respectively.

While the random variation in the data is about the same as in the case of the pre-harvest data, the absolute radiance values in TM 2, 4 are lower (as one might expect, due to the depletion of vegetation) and the systematic variation in digital count with pixel no. (scan angle) is significantly less and different in nature to that observed in the earlier image, which was obtained approximately 02 August 1982. Figures 25-45 are arranged in a similar sequence to Figures 1-12 and 13-24. The only difference is that there are now seven bands of data, instead of four. Interestingly, there is a considerable dependence on swath. Whereas TM band 1, swath 1 (line start = 500) showed a significant scan angle dependence pre-harvest, this is no longer the case after harvest. However, swaths 2 (Fig. 26) and 3 (Fig. 27), bandpass TM 1 show almost a monatomic dependence of digital count on pixel no. (scan angle) across the image. This trend is also observed in TM bands 2-4. It is seen that the slope of the curve (mean digital counts vs. pixel no.) is reversed for TM band 6 (thermal IR band). However, TM band 7 is a "transition" band (mid-IR) and shows little systematic dependence of mean digital counts upon pixel no. (scan angle).

Even with post-harvest data, where there is minimal vegetation over agricultural targets, the scan angle dependence still appears to be about 10% or more, except in TM band 7.

b. Analytical method discussed in 3(b) was used.

Table 10 shows mean pixel radiance values which differ from those shown in Table 7 (analytical method discussed in 3(a) in the

following general manner. TM 1-3, 5-7 are slightly lower, while TM 4 is slightly higher. This is because training occurred on vegetation (or rather on areas appearing "red" in a false color rendition on the IAT, which is assumed to correspond to higher vegetation vigor). The dependence of mean digital count on pixel no. (scan angle) is shown in Figs. 46-59, there being only two swaths (line start = 500 and line start = 1900) investigated in this analysis. TM bands 1-4 show no obvious systematic effect, but do show larger random variations (due to the a priori site selection procedure) than in the less biased analysis using the method described in 3(a). TM bands 5-7 may show a systematic effect. However, the scatter is large, as may be seen from Tables 11-12.

4.3 Indiana Agricultural Scene: Post-harvest.

a. Analytical method described in 3(a) (whole slices of image considered).

Table 13, when compared to Table 7 shows that for this method of analysis, there is a generally lower mean digital radiance from the Indianapolis scene, than from the Webster-Ft. Dodge scene, although the spectral distribution of radiance over the two areas appears similar. Tables 14 and 15 show that the random variations in the radiance values over the Indianapolis area are generally less than in the case of the Webster-Ft. Dodge area. Figs. 60- are arranged in the same sequence as in the previously described analyses. Each band, for each of the three swaths (line start values = 500, 1900 and 5000) is displayed in a plot of mean digital count values vs. pixel no. Figs. 60-62 are interesting insofar

as they show that, in the case of TM band 1, while there is little obvious systematic variation across the image in the case of the upper and middle swath, for the swath starting at line 5000, there is a 15% (approximately) decrease in mean digital count across the image. This effect is also evident in TM bands 2 and 3. However systematic variations occur for all three swaths in TM band 4. TM bands 5-7 show a systematic increase in mean digital count with increasing pixel no. (scan angle) (except in the case of TM band 6, swath starting at line 500). Indeed, there is one monatonic increase of 30% across the image in the case of TM band 7.

4.4 Jamestown Forest Scene: September 13 Image.

a. Analysis method described in section 3(a).

One swath was taken across the image at (approximately) line 5000. The swath was chosen so that the slices contained forest and minimal cloud. When the "slices" (16 x 300 pixels each) were displayed in composite form on the IAT, a very strong angle-dependence was obvious to the eye. Table 16 supports this observation; Table 17 shows that the coefficient of variation for the mean digital count in each band and for each slice was generally less than 15%, while Table 18 shows

$$\frac{2 \times \text{standard error}}{\text{mean}} \times 100$$

was generally less than 2 per cent. Figs. 81-83 show anisotropic scan angle-dependence of the digital counts: the effect is up to approximately 30% in the case of TM band 3. TM bands 4 and 5 show scatter, TM 7 (Fig. 87) shows a large (over 20%) scan angle-dependence, while the thermal IR band (TM 6) shows a monatonic decrease with increasing pixel no. of about 10% (Fig. 86).

b. Analytical method described in section 3(c).

Line and pixel nos. for center of each site referenced to scene (master) coordinates are shown in the last two columns of Table 19. The coefficients of variation for the digital counts in each of the TM bandpasses, for each of the training sites are generally less than 20% of the mean value, but there are a few notable exceptions. This may well be due to variations in upwelling radiance caused by canopy anisotropy and by random topographic variations. Table 21 shows the ratio

$$\frac{2 \times \text{standard error}}{\text{mean}}$$

expressed as a percentage. This is always less than 1.0 (i.e., always less than 1%). Fig. 88 shows almost a 30% anisotropic change in TM band 1 with increasing pixel no. (scan angle). This effect is approximately 35% for TM band 2 (Fig. 89), almost 60% in TM band 3 (Fig. 90). TM band 4 (Fig. 91) shows more random variation when mean digital counts are plotted against pixel no., but there seems to be a general decreasing trend (about 10%) in mean digital count with increasing pixel no. There is an anisotropic variation of over 30% in TM band 5 with increasing scan angle (Fig. 92) and about 12% anisotropic effect in TM band 6 (Fig. 93). TM band 7 (Fig. 94) shows nearly 50% anisotropic dependence of mean digital count with scan angle over what appears to be forest.

c. Repeat of the analysis in 4.4(b) in order to verify or disprove the large variations observed in mean digital count with pixel no. (scan angle).

The mean values and line and pixel nos. for the centers of the selected cursor positions are shown in Table 22, while the coefficients

of variation are shown in Table 23 and

$$\frac{2 \times \text{standard error}}{\text{mean}}$$

expressed as a percentage is shown in Table 24 for each band and for each training site. Tables 23 and 24 show somewhat less random variation in the digital counts in each band, for each training site, than is the case for the example discussed in 4.4(b). Fig. 95 shows approximately 10% anisotropic effect for TM band 1. Figs. 96-100 show about the same order of magnitude effect in the other bands, although there is more random variation. It is pointed out that smaller training sites were used here, including greater topographic variation, which could be responsible for both a decrease in sensitivity of the dependence of mean digital counts on scan angle and could also be responsible for increased random variation in mean digital counts.

5. CONCLUSIONS, CONTINUING WORK AND RECOMMENDATIONS

There is a large systematic dependence of digital counts from ostensibly uniform ground targets upon scan angle. The effect depends upon the season, as shown by studies of the Webster-Ft. Dodge area before and after harvest. There is also a dependence upon cover type as may be seen by comparing the angle dependence of the mean digital counts over the forest area with those over the agricultural area.

The digital counts in p-type data are related to radiance incident upon the sensor in a manner which depends upon interactions of the effects of scene heterogeneity or topographic variability on upwelling radiance with sensor point spread function, after modification by the atmospheric modulation transfer function. The spectral upwelling radiance will interact with

the spectral response of the sensor, the spectral backscattered radiance and the spectral atmospheric transmission. These interactions need further study in order to optimize pre-processing procedures.

More scenes need to be examined to determine how the angular anisotropy in radiance incident on the sensor depends upon season (we need a multidate data set over different types of area) and upon cover type. We also need to better understand the effects of the atmosphere.

We are currently examining more images and we are using regression analysis to better understand the dependence of recorded radiance on scan angle, in order to search for some means of developing correction algorithms which may be used in pre-processing of the data, or of understanding the limitations to target identification and quantification imposed by non-correctable artifacts in digital multispectral (and possibly multitemporal) data sets.

Since a great deal of further work is required and since these effects are too large to ignore (they will be worse for multidate analysis) we sincerely hope that we can continue this interesting and urgent work.

6. ACKNOWLEDGEMENT

We wish to acknowledge the very generous cooperation of all colleagues with whom we have had contact at Goddard Space Flight Center. This cooperation has made this project both productive and very enjoyable. The excellent facilities and data base make possible a high productivity.

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TABLE 1

OBS	LINE	PIXEL	TM1	TM2	TM3	TM4
1	500	500	76.268	31.824	27.493	112.600
2	500	1000	76.383	31.731	27.382	110.670
3	500	2000	73.732	30.202	25.819	104.530
4	500	3000	72.231	29.100	24.545	92.955
5	500	4000	71.898	29.301	24.791	93.228
6	500	5000	72.828	29.869	25.351	98.787
7	500	6000	74.501	30.588	26.932	96.295
8	500	6500	74.965	30.491	26.694	98.222
9	500	6700	75.647	31.275	26.060	121.130
10	1900	300	80.245	35.248	34.049	116.400
11	1900	500	78.350	33.617	30.677	121.770
12	1900	1000	77.113	32.921	29.710	111.090
13	1900	2000	75.227	31.489	27.853	111.850
14	1900	3000	73.027	29.910	25.767	108.080
15	1900	4000	73.324	30.563	27.957	101.090
16	1900	5000	74.343	30.133	25.991	102.210
17	1900	6000	74.451	30.190	26.094	102.040
18	1900	6500	74.915	30.170	25.961	102.410
19	1900	6750	75.999	31.403	27.676	106.230
20	5000	300	79.308	34.293	31.680	116.480
21	5000	500	80.043	35.000	32.254	121.500
22	5000	1000	76.550	32.099	28.877	117.740
23	5000	2000	75.458	32.086	28.875	111.060
24	5000	3000	74.427	32.010	29.038	97.856
25	5000	4000	74.725	31.929	28.357	106.230
26	5000	5000	74.246	31.287	27.100	103.220
27	5000	6000	78.194	33.846	31.195	96.636
28	5000	6500	78.386	33.732	30.824	94.820

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TABLE 2

OBS	LINE	PIXEL	CV1	CV2	CV3	CV4
1	500	500	0.059790	0.106305	0.232926	0.197638
2	500	1000	0.091100	0.141537	0.281131	0.216996
3	500	2000	0.060472	0.105049	0.229097	0.163451
4	500	3000	0.052152	0.088170	0.160973	0.172415
5	500	4000	0.045903	0.083080	0.163498	0.196646
6	500	5000	0.055789	0.103397	0.187977	0.184759
7	500	6000	0.060100	0.113773	0.244994	0.163785
8	500	6500	0.055615	0.100574	0.205032	0.168290
9	500	6700	0.098804	0.126951	0.205956	0.171131
10	1900	300	0.077903	0.153719	0.339124	0.167799
11	1900	500	0.071646	0.135467	0.301734	0.191850
12	1900	1000	0.063283	0.124888	0.256001	0.183584
13	1900	2000	0.068856	0.126092	0.244110	0.151429
14	1900	3000	0.063651	0.111314	0.224525	0.130453
15	1900	4000	0.077882	0.143111	0.320565	0.203990
16	1900	5000	0.083241	0.138927	0.266695	0.193471
17	1900	6000	0.083164	0.139056	0.266649	0.193913
18	1900	6500	0.056807	0.095526	0.168056	0.215278
19	1900	6750	0.056593	0.102135	0.206053	0.191006
20	5000	300	0.075792	0.141391	0.281074	0.152233
21	5000	500	0.077888	0.137422	0.277970	0.160124
22	5000	1000	0.078718	0.156179	0.312838	0.135512
23	5000	2000	0.058108	0.114287	0.231097	0.173430
24	5000	3000	0.063095	0.114661	0.211386	0.159457
25	5000	4000	0.061313	0.110899	0.210740	0.185506
26	5000	5000	0.061788	0.115922	0.206830	0.160933
27	5000	6000	0.111503	0.163481	0.309023	0.196864
28	5000	6500	0.105932	0.166118	0.275587	0.147215

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TABLE 3

OBS	LINE	PIXEL	INT1	INT2	INT3	INT4
1	500	500	0.158124	0.281140	0.616009	0.522685
2	500	1000	0.255558	0.397044	0.788639	0.608726
3	500	2000	0.160461	0.278747	0.607908	0.433715
4	500	3000	0.138384	0.233957	0.427140	0.457501
5	500	4000	0.121802	0.220453	0.433840	0.521799
6	500	5000	0.147543	0.273450	0.497134	0.488624
7	500	6000	0.168594	0.319160	0.687267	0.459456
8	500	6500	0.147574	0.266872	0.544050	0.446556
9	500	6700	0.277169	0.356128	0.577756	0.480064
10	1900	300	0.212379	0.419070	0.924520	0.457454
11	1900	500	0.201660	0.381296	0.849281	0.539995
12	1900	1000	0.167363	0.330287	0.677036	0.485518
13	1900	2000	0.183324	0.335709	0.649921	0.403166
14	1900	3000	0.168897	0.295372	0.595774	0.346155
15	1900	4000	0.217750	0.400124	0.896269	0.570336
16	1900	5000	0.233511	0.389723	0.748143	0.542733
17	1900	6000	0.233294	0.390085	0.748015	0.543973
18	1900	6500	0.160434	0.269783	0.474624	0.607988
19	1900	6750	0.150675	0.271924	0.548597	0.508536
20	5000	300	0.212615	0.396635	0.788481	0.427049
21	5000	500	0.232606	0.410399	0.830132	0.478194
22	5000	1000	0.220823	0.438119	0.877586	0.380143
23	5000	2000	0.154708	0.304279	0.615275	0.461741
24	5000	3000	0.178192	0.323824	0.596996	0.450336
25	5000	4000	0.171997	0.311099	0.591176	0.520389
26	5000	5000	0.174500	0.327386	0.584127	0.454505
27	5000	6000	0.296867	0.435253	0.822746	0.524133
28	5000	6500	0.298165	0.467566	0.775687	0.414362

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TABLE 4

OBS	LINE	PIXEL	TM1	TM2	TM3	TM4
1	500	500	76.990	32.658	28.184	113.800
2	500	1000	75.957	31.345	27.402	102.050
3	500	2000	72.589	29.298	24.269	107.310
4	500	3000	71.574	29.013	24.359	91.587
5	500	4000	72.345	29.841	25.894	85.756
6	500	5000	73.552	30.419	26.220	95.401
7	500	6000	73.776	29.902	25.755	94.049
8	500	6500	75.269	31.086	27.441	91.703
9	500	6700	81.795	35.340	35.390	107.480
10	1900	300	77.061	32.652	26.315	151.930
11	1900	500	75.574	31.723	25.486	159.730
12	1900	1000	75.859	33.586	26.672	152.160
13	1900	2000	73.564	31.245	24.645	147.690
14	1900	3000	69.773	27.509	21.500	143.200
15	1900	4000	71.681	29.511	23.692	136.950
16	1900	5000	71.333	29.101	22.753	131.710
17	1900	6000	72.583	29.459	23.367	133.640
18	1900	6500	75.249	30.534	24.487	142.730
19	1900	6750	74.920	30.884	25.636	132.810
20	5000	300	78.691	33.580	28.401	149.620
21	5000	500	77.274	33.584	26.549	157.550
22	5000	1000	74.915	31.297	25.324	139.300
23	5000	2000	75.244	33.527	27.160	153.600
24	5000	3000	73.200	31.933	26.453	124.710
25	5000	4000	72.946	30.977	24.967	145.980
26	5000	5000	73.275	31.228	24.503	139.120
27	5000	6000	76.006	32.350	26.431	137.480
28	5000	6500	73.605	29.819	25.151	103.330

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TABLE 5

OBS	LINE	PIXEL	CV1	CV2	CV3	CV4
1	500	500	0.0563446	0.097135	0.217679	0.229749
2	500	1000	0.0680178	0.112993	0.207264	0.219702
3	500	2000	0.0414638	0.068698	0.134829	0.162787
4	500	3000	0.0390079	0.078552	0.170143	0.163075
5	500	4000	0.0593039	0.111335	0.274293	0.200681
6	500	5000	0.0546883	0.105377	0.194096	0.235111
7	500	6000	0.0554876	0.103812	0.221738	0.197308
8	500	6500	0.0480071	0.091571	0.179222	0.157944
9	500	6700	0.0839728	0.126324	0.309153	0.233420
10	1900	300	0.0463489	0.083407	0.208044	0.102449
11	1900	500	0.0355127	0.061336	0.130572	0.117010
12	1900	1000	0.0449246	0.055806	0.140379	0.114760
13	1900	2000	0.0179981	0.030715	0.041717	0.070149
14	1900	3000	0.0172165	0.029036	0.033183	0.043201
15	1900	4000	0.0412903	0.066419	0.184456	0.132236
16	1900	5000	0.0204693	0.037296	0.060470	0.140801
17	1900	6000	0.0229342	0.049309	0.060643	0.165866
18	1900	6500	0.0223954	0.038682	0.081205	0.073175
19	1900	6750	0.0380605	0.065587	0.143938	0.131210
20	5000	300	0.0464874	0.084733	0.213237	0.126784
21	5000	500	0.0282160	0.061738	0.102040	0.089192
22	5000	1000	0.0335522	0.065193	0.100249	0.084211
23	5000	2000	0.0542262	0.085119	0.179671	0.104385
24	5000	3000	0.0623616	0.106173	0.207269	0.120681
25	5000	4000	0.0452389	0.075612	0.155119	0.142115
26	5000	5000	0.0216040	0.044349	0.062189	0.153161
27	5000	6000	0.0448415	0.071406	0.151970	0.138530
28	5000	6500	0.0971102	0.167037	0.278515	0.132672

ORIGINAL PAGE IS
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TABLE 6

OBS	LINE	PIXEL	INT1	INT2	INT3	INT4
1	500	500	0.39473	0.68050	1.52499	1.60955
2	500	1000	0.53154	0.88300	1.61969	1.71689
3	500	2000	0.33278	0.55135	1.08210	1.30648
4	500	3000	0.52243	1.05205	2.27872	2.18407
5	500	4000	0.61086	1.14681	2.82536	2.06711
6	500	5000	0.39340	0.75803	1.39623	1.69127
7	500	6000	0.33445	0.62573	1.33652	1.18927
8	500	6500	0.42896	0.81822	1.60141	1.41129
9	500	6700	0.69917	1.05179	2.57404	1.94348
10	1900	300	0.68902	1.23992	3.09275	1.52300
11	1900	500	0.39158	0.67631	1.43974	1.29019
12	1900	1000	0.63853	0.79319	1.99526	1.63113
13	1900	2000	0.34321	0.58571	0.79550	1.33768
14	1900	3000	0.32831	0.55369	0.63278	0.82382
15	1900	4000	0.61213	0.98467	2.73455	1.96040
16	1900	5000	0.29094	0.53011	0.85948	2.00125
17	1900	6000	0.28501	0.61278	0.75363	2.06128
18	1900	6500	0.26912	0.46483	0.97583	0.87933
19	1900	6750	0.37011	0.63779	1.39970	1.27593
20	5000	300	0.73048	1.33146	3.35070	1.99222
21	5000	500	0.53087	1.16156	1.91982	1.67809
22	5000	1000	0.41697	0.81018	1.24583	1.04652
23	5000	2000	0.94755	1.48737	3.13958	1.82402
24	5000	3000	1.44018	2.45196	4.78667	2.78701
25	5000	4000	0.52325	0.87455	1.79415	1.64375
26	5000	5000	0.33042	0.67828	0.95114	2.34251
27	5000	6000	0.70901	1.12903	2.40285	2.19035
28	5000	6500	1.05799	1.81981	3.03433	1.44542

ORIGINAL PAGE IS
OF POOR QUALITY

TABLE 7

OBS	LINE	PIXEL	TM1	TM2	TM3	TM4	TM5	TM6	TM7
1	500	500	69.215	30.273	36.294	40.759	79.342	107.17	42.086
2	500	1000	68.950	30.126	36.062	40.831	78.164	107.35	40.400
3	500	2000	67.372	29.513	33.649	45.563	76.741	107.22	38.369
4	500	3000	70.154	31.669	37.604	44.030	79.656	108.86	41.784
5	500	4000	73.050	33.277	39.878	44.961	82.559	113.44	44.579
6	500	5000	71.195	32.202	38.310	45.090	79.644	113.28	41.672
7	500	6000	70.839	31.734	37.801	44.044	79.413	113.25	41.709
8	500	6700	70.647	31.570	37.586	42.121	76.256	112.62	40.961
9	1900	300	70.922	31.499	36.604	46.609	77.307	105.72	38.564
10	1900	500	75.692	34.783	42.821	48.283	90.056	106.22	48.103
11	1900	1000	74.372	33.829	40.950	48.347	86.817	106.88	44.547
12	1900	2000	70.476	30.723	33.642	45.447	64.379	108.66	31.628
13	1900	3000	73.155	33.154	39.502	45.902	83.009	109.88	43.975
14	1900	4000	69.674	31.298	37.247	44.216	81.649	112.44	41.339
15	1900	5000	70.397	32.314	39.198	46.655	86.004	113.26	43.262
16	1900	6000	69.526	31.478	37.578	42.654	80.802	111.94	41.903
17	1900	6700	66.347	30.166	35.777	42.839	78.001	104.18	39.891
18	5000	500	74.808	34.098	42.263	48.411	91.322	106.70	46.119
19	5000	1000	73.504	33.437	40.683	49.306	88.792	107.87	45.001
20	5000	2000	71.266	31.702	37.084	46.104	80.564	108.24	41.642
21	5000	3000	71.803	32.401	38.780	46.107	84.233	108.71	43.320
22	5000	4000	73.505	33.779	41.364	47.316	90.318	111.28	47.667
23	5000	5000	68.962	31.152	37.038	46.547	82.736	111.62	41.412
24	5000	6000	68.780	31.228	37.364	45.580	84.307	110.14	43.045
25	5000	6700	64.153	28.891	33.887	44.339	76.903	105.53	37.827

ORIGINAL PAGE IS
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TABLE 8

OBS	LINE	PIXEL	CV1	CV2	CV3	CV4	CV5	CV6	CV7
1	500	500	0.098697	0.155159	0.214232	0.205446	0.206061	0.024264	0.278577
2	500	1000	0.088283	0.140065	0.198606	0.214636	0.193570	0.017628	0.236444
3	500	2000	0.095493	0.144420	0.222522	0.217163	0.180358	0.015376	0.303780
4	500	3000	0.083661	0.134444	0.188551	0.169555	0.161173	0.023447	0.241482
5	500	4000	0.071792	0.110495	0.163934	0.162262	0.159772	0.020084	0.190411
6	500	5000	0.080423	0.124270	0.184514	0.167627	0.172499	0.020654	0.213525
7	500	6000	0.086926	0.134781	0.203698	0.202115	0.193630	0.024172	0.223396
8	500	6700	0.084658	0.140780	0.220681	0.248444	0.215847	0.023765	0.208426
9	1900	300	0.097284	0.156748	0.251558	0.190802	0.239830	0.015697	0.322141
10	1900	500	0.085977	0.137651	0.194308	0.190054	0.175834	0.014460	0.212655
11	1900	1000	0.091335	0.142016	0.214020	0.187690	0.210770	0.016024	0.255080
12	1900	2000	0.111669	0.154039	0.234995	0.226516	0.299196	0.018619	0.362313
13	1900	3000	0.088343	0.132051	0.203566	0.196844	0.216808	0.021971	0.257100
14	1900	4000	0.103563	0.164415	0.238740	0.193893	0.201362	0.025216	0.265608
15	1900	5000	0.105824	0.165585	0.235069	0.204867	0.188144	0.025020	0.235620
16	1900	6000	0.099462	0.140841	0.191712	0.198485	0.190594	0.051854	0.212999
17	1900	6700	0.264568	0.283814	0.324410	0.307258	0.312329	0.250622	0.343751
18	5000	500	0.100717	0.159207	0.225716	0.219089	0.196804	0.018310	0.229751
19	5000	1000	0.111432	0.171771	0.247929	0.201482	0.201938	0.018755	0.280721
20	5000	2000	0.110331	0.172400	0.249217	0.217553	0.216681	0.023272	0.319094
21	5000	3000	0.106227	0.168158	0.245270	0.220389	0.220861	0.022925	0.276435
22	5000	4000	0.085631	0.129228	0.183952	0.162136	0.164058	0.020383	0.206876
23	5000	5000	0.098218	0.150637	0.217486	0.173514	0.187440	0.022626	0.269949
24	5000	6000	0.102082	0.153872	0.216512	0.204696	0.189926	0.036555	0.261404
25	5000	6700	0.254099	0.278802	0.322918	0.303956	0.300544	0.237016	0.355320

ORIGINAL PAGE IS
OF POOR QUALITY

OBS	LINE	PIXEL	INT1	INT2	INT3	INT4	INT5	INT6	INT7
1	500	500	0.196104	0.308290	0.425664	0.408206	0.409428	0.048211	0.553513
2	500	1000	0.233479	0.370424	0.525245	0.567639	0.511926	0.046620	0.625314
3	500	2000	0.253391	0.383218	0.590461	0.576240	0.478578	0.040801	0.806077
4	500	3000	0.233908	0.375892	0.527171	0.474060	0.450625	0.065556	0.675161
5	500	4000	0.201395	0.309966	0.459874	0.455185	0.448200	0.056342	0.534149
6	500	5000	0.213402	0.329750	0.489606	0.444797	0.457725	0.054805	0.566588
7	500	6000	0.242234	0.375590	0.567638	0.563227	0.539582	0.067360	0.622529
8	500	6700	0.224638	0.373559	0.585575	0.659243	0.572749	0.063059	0.553056
9	1900	300	0.272904	0.439716	0.705681	0.535245	0.672781	0.044035	0.903682
10	1900	500	0.217003	0.347426	0.490428	0.479692	0.443801	0.036496	0.536734
11	1900	1000	0.229001	0.356071	0.536604	0.470587	0.528454	0.040175	0.639552
12	1900	2000	0.281850	0.388791	0.593121	0.571720	0.755163	0.046993	0.914468
13	1900	3000	0.223725	0.334413	0.515522	0.498499	0.549058	0.055640	0.651095
14	1900	4000	0.261391	0.414980	0.602574	0.489380	0.508234	0.063645	0.670388
15	1900	5000	0.295874	0.462959	0.657230	0.572789	0.526033	0.069953	0.658770
16	1900	6000	0.263922	0.373721	0.508707	0.526677	0.505740	0.137595	0.565191
17	1900	6700	0.739707	0.793518	0.907020	0.859065	0.873243	0.700714	0.961096
18	5000	500	0.267252	0.422453	0.598936	0.581351	0.522218	0.048586	0.609643
19	5000	1000	0.295683	0.455794	0.657876	0.534631	0.535841	0.049767	0.744891
20	5000	2000	0.308474	0.482015	0.696787	0.608257	0.605818	0.065065	0.892155
21	5000	3000	0.282821	0.447705	0.653009	0.586767	0.588022	0.061036	0.735985
22	5000	4000	0.215410	0.325083	0.462746	0.407866	0.412699	0.051276	0.520411
23	5000	5000	0.247075	0.378939	0.547102	0.436488	0.471519	0.056916	0.679077
24	5000	6000	0.269972	0.406938	0.572600	0.541352	0.502290	0.096675	0.691326
25	5000	6700	0.674250	0.739799	0.856859	0.806544	0.797492	0.628919	0.942838

TABLE 9

ORIGINAL PAGE IS
OF POOR QUALITY

TABLE 10

OBS	LINE	PIXEL	TM1	TM2	TM3	TM4	TM5	TM6	TM7
1	500	500	61.626	25.758	28.304	37.736	56.634	93.377	25.546
2	500	1000	61.958	25.484	28.484	30.137	55.358	92.484	26.916
3	500	2000	66.305	28.573	33.824	38.954	66.847	96.840	32.695
4	500	3000	63.520	26.587	31.373	35.413	64.467	95.000	31.853
5	500	4000	60.284	25.453	29.253	34.884	62.684	93.189	30.632
6	500	5000	60.660	25.980	29.360	45.280	69.400	91.800	32.040
7	500	6000	60.812	25.842	30.030	33.394	57.667	90.952	28.764
8	500	6500	61.760	27.093	31.533	47.507	74.387	92.400	34.480
9	500	6700	64.854	27.848	33.344	39.007	59.828	95.530	27.589
10	1900	300	61.132	25.893	23.770	67.218	60.514	93.572	22.350
11	1900	500	62.226	26.147	24.838	63.385	50.034	91.868	18.509
12	1900	1000	57.731	23.946	21.444	65.251	57.000	93.942	20.910
13	1900	2000	57.339	24.009	20.922	64.304	58.435	95.139	21.000
14	1900	3000	58.940	24.720	23.260	51.440	59.160	97.020	24.580
15	1900	4000	58.489	25.422	22.400	73.022	67.511	96.800	25.044
16	1900	5000	57.884	25.126	22.711	72.137	60.495	95.337	23.168
17	1900	6000	61.780	26.940	28.300	53.220	69.180	96.360	31.220
18	1900	6500	58.329	24.543	23.836	60.643	68.300	95.100	26.643
19	1900	6700	57.745	24.198	23.349	62.491	61.123	94.283	23.104

ORIGINAL PAGE IS
OF POOR QUALITY

OBS	LINE	PIXEL	CV1	CV2	CV3	CV4	CV5	CV6	CV7
1	500	500	0.062335	0.106009	0.164991	0.235804	0.147993	0.0167832	0.177613
2	500	1000	0.032272	0.050831	0.062062	0.082081	0.066708	0.0168310	0.089975
3	500	2000	0.042366	0.056768	0.075642	0.180371	0.082031	0.0160407	0.093919
4	500	3000	0.073311	0.107830	0.154987	0.169052	0.149118	0.0146841	0.184557
5	500	4000	0.057649	0.088734	0.113701	0.134772	0.095415	0.0153605	0.103569
6	500	5000	0.026144	0.027488	0.048540	0.163575	0.045193	0.0043980	0.064908
7	500	6000	0.038719	0.057644	0.089508	0.119767	0.089377	0.0137808	0.096508
8	500	6500	0.111763	0.173142	0.282415	0.224811	0.171360	0.0128282	0.261254
9	500	6700	0.056987	0.068350	0.100966	0.133556	0.117760	0.0168693	0.173593
10	1900	300	0.065986	0.082081	0.152766	0.166278	0.119347	0.0152902	0.178629
11	1900	500	0.054753	0.069402	0.130603	0.150915	0.092483	0.0112597	0.155258
12	1900	1000	0.042106	0.060847	0.153620	0.206884	0.109612	0.0212444	0.205476
13	1900	2000	0.035176	0.052487	0.137127	0.145798	0.086376	0.0186195	0.193277
14	1900	3000	0.045007	0.068889	0.138105	0.150949	0.048818	0.0076509	0.090075
15	1900	4000	0.022945	0.050666	0.087277	0.105573	0.058796	0.0074995	0.124815
16	1900	5000	0.051153	0.071395	0.164079	0.224745	0.129103	0.0153478	0.277998
17	1900	6000	0.081117	0.091971	0.190256	0.196642	0.142251	0.0110463	0.193520
18	1900	6500	0.048988	0.073533	0.169660	0.217644	0.081257	0.0146724	0.187588
19	1900	6700	0.052964	0.083902	0.181033	0.234398	0.089030	0.0135538	0.189931

TABLE 11

ORIGINAL PAGE IS
OF POOR QUALITY

OBS	LINE	PIXEL	INT1	INT2	INT3	INT4	INT5	INT6	INT7
1	500	500	0.75454	1.28319	1.99714	2.85431	1.79138	0.203153	2.14992
2	500	1000	0.66220	1.04303	1.27348	1.68426	1.36882	0.345365	1.84625
3	500	2000	0.74031	0.99197	1.32177	3.15181	1.43341	0.280297	1.64114
4	500	3000	1.69305	2.49023	3.57927	3.90410	3.44374	0.339115	4.26216
5	500	4000	1.18294	1.82078	2.33310	2.76546	1.95787	0.315192	2.12520
6	500	5000	0.73945	0.77748	1.37292	4.62661	1.27825	0.124393	1.83589
7	500	6000	0.60285	0.89751	1.39364	1.86477	1.39160	0.214567	1.50263
8	500	6500	2.58105	3.99855	6.52209	5.19178	3.95738	0.296255	6.03341
9	500	6700	0.92750	1.11245	1.64329	2.17372	1.91664	0.274560	2.82536
10	1900	300	0.84660	1.05310	1.95999	2.13335	1.53123	0.196173	2.29182
11	1900	500	0.67269	0.85267	1.60458	1.85412	1.13624	0.138336	1.90749
12	1900	1000	0.56393	0.81493	2.05744	2.77080	1.46803	0.284527	2.75194
13	1900	2000	0.65603	0.97889	2.55743	2.71915	1.61092	0.347255	3.60464
14	1900	3000	1.27300	1.94848	3.90620	4.26947	1.38078	0.216401	2.54771
15	1900	4000	0.68408	1.51056	2.60208	3.14758	1.75296	0.223591	3.72126
16	1900	5000	1.04963	1.46500	3.36682	4.61167	2.64913	0.314931	5.70439
17	1900	6000	2.29433	2.60133	5.38124	5.56187	4.02347	0.312438	5.47357
18	1900	6500	0.82806	1.24293	2.86777	3.67885	1.37350	0.248010	3.17081
19	1900	6700	1.02887	1.62986	3.51669	4.55335	1.72947	0.263291	3.68955

TABLE 12

ORIGINAL PAGE IS
OF POOR QUALITY

TABLE 13

OBS	LINE	PIXEL	TM1	TM2	TM3	TM4	TM5	TM6	TM7
1	500	500	61.403	25.569	28.844	36.806	57.121	92.525	25.856
2	500	1000	61.898	25.867	29.465	35.647	59.600	93.348	28.183
3	500	2000	64.251	27.519	32.419	37.296	65.347	95.270	32.013
4	500	3000	61.583	25.848	29.404	35.911	61.436	94.710	29.832
5	500	4000	61.743	26.519	30.646	38.625	65.916	93.789	31.997
6	500	5000	60.673	26.236	29.979	41.905	69.379	92.289	32.722
7	500	6000	60.684	26.015	30.439	39.099	65.631	91.651	31.285
8	500	6500	60.181	25.898	29.840	41.178	68.095	92.554	32.134
9	500	6700	62.059	28.000	30.176	50.941	72.176	93.706	32.294
10	1900	300	62.310	26.000	28.782	41.249	56.717	91.990	24.851
11	1900	500	63.701	26.627	28.841	43.886	55.454	91.040	24.128
12	1900	1000	59.659	24.681	26.046	43.134	58.507	92.574	25.457
13	1900	2000	60.048	25.034	27.193	41.337	59.929	93.227	26.894
14	1900	3000	61.438	25.838	29.686	37.040	60.338	93.794	28.194
15	1900	4000	61.574	26.088	30.120	37.723	65.646	95.050	31.702
16	1900	5000	60.360	25.586	29.053	39.157	66.516	95.145	32.084
17	1900	6000	63.004	27.348	32.076	40.221	70.963	95.771	35.431
18	1900	6500	61.926	26.682	30.851	41.308	69.305	94.948	33.470
19	1900	6700	61.545	26.782	30.515	44.387	72.285	95.352	34.001
20	5000	300	63.813	27.324	31.462	42.171	65.230	94.375	29.862
21	5000	500	63.485	27.180	30.711	43.892	64.953	94.203	29.497
22	5000	1000	62.530	26.816	30.137	45.098	63.368	93.635	27.979
23	5000	2000	60.806	25.935	28.324	45.853	61.633	92.902	26.768
24	5000	3000	59.832	25.664	27.311	48.459	64.564	94.098	27.629
25	5000	4000	60.054	25.928	28.097	49.292	68.445	96.157	30.122
26	5000	5000	59.496	25.440	27.903	45.185	69.317	96.860	31.140
27	5000	6000	59.336	25.312	27.336	45.976	68.914	96.653	30.415
28	5000	6500	57.034	24.399	26.103	45.605	66.553	94.749	29.186

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TABLE 14

OBS	LINE	PIXEL	CV1	CV2	CV3	CV4	CV5	CV6	CV7
1	500	500	0.054134	0.084245	0.138564	0.225674	0.104555	0.032203	0.131361
2	500	1000	0.056385	0.090878	0.142360	0.217873	0.109954	0.033993	0.132725
3	500	2000	0.068887	0.110972	0.160655	0.195878	0.134100	0.030595	0.148724
4	500	3000	0.060456	0.095246	0.147389	0.203334	0.132286	0.024997	0.154561
5	500	4000	0.070395	0.119918	0.177836	0.223973	0.172778	0.022248	0.188528
6	500	5000	0.056753	0.081740	0.131693	0.228371	0.109412	0.020545	0.137780
7	500	6000	0.062784	0.102850	0.159059	0.186200	0.136482	0.017300	0.166054
8	500	6500	0.075264	0.127071	0.197112	0.227976	0.163659	0.020746	0.204191
9	500	6700	0.060920	0.036753	0.143897	0.276866	0.062374	0.007666	0.095462
10	1900	300	0.073088	0.100015	0.145270	0.251411	0.119095	0.026371	0.141207
11	1900	500	0.104333	0.139413	0.150402	0.272689	0.122464	0.021381	0.162216
12	1900	1000	0.054683	0.084359	0.130617	0.273024	0.131436	0.026046	0.155479
13	1900	2000	0.055493	0.091693	0.146161	0.258579	0.129114	0.029250	0.154656
14	1900	3000	0.067559	0.105617	0.155533	0.197758	0.124818	0.030770	0.136436
15	1900	4000	0.086578	0.145777	0.216061	0.269798	0.180902	0.031524	0.201300
16	1900	5000	0.077208	0.121632	0.187886	0.231480	0.150602	0.025408	0.191104
17	1900	6000	0.086814	0.137509	0.194863	0.235431	0.166839	0.022319	0.192264
18	1900	6500	0.085642	0.136176	0.207752	0.240021	0.178434	0.022731	0.227472
19	1900	6700	0.074253	0.118057	0.194676	0.220904	0.170319	0.020028	0.210829
20	5000	300	0.064908	0.107082	0.169941	0.193501	0.153383	0.025866	0.181578
21	5000	500	0.071747	0.111952	0.169427	0.220354	0.143781	0.024736	0.174852
22	5000	1000	0.066952	0.111575	0.192271	0.225008	0.145276	0.029230	0.188295
23	5000	2000	0.065161	0.107063	0.180843	0.245031	0.152557	0.028079	0.189586
24	5000	3000	0.052244	0.084204	0.144164	0.228568	0.145232	0.030289	0.167703
25	5000	4000	0.067625	0.108150	0.196806	0.255051	0.161994	0.027681	0.223420
26	5000	5000	0.068280	0.116507	0.193146	0.237224	0.173518	0.025092	0.218923
27	5000	6000	0.085888	0.131077	0.212650	0.236458	0.183876	0.040629	0.237026
28	5000	6500	0.236633	0.259473	0.314243	0.329465	0.292957	0.150917	0.334330

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OBS	LINE	PIXEL	INT1	INT2	INT3	INT4	INT5	INT6	INT7
1	500	500	0.143167	0.222800	0.366456	0.596830	0.276512	0.085166	0.347405
2	500	1000	0.150120	0.241955	0.379021	0.580068	0.292742	0.090503	0.353368
3	500	2000	0.192601	0.310268	0.449175	0.547657	0.374931	0.085541	0.415817
4	500	3000	0.180545	0.284442	0.440163	0.607237	0.395059	0.074652	0.461581
5	500	4000	0.225069	0.383405	0.568583	0.716095	0.552413	0.071132	0.602769
6	500	5000	0.182980	0.263540	0.424597	0.736299	0.352759	0.066239	0.444220
7	500	6000	0.186875	0.306128	0.473433	0.554219	0.406234	0.051493	0.494254
8	500	6500	0.211133	0.356466	0.552948	0.639527	0.459101	0.058198	0.572805
9	500	6700	0.170894	0.103100	0.403665	0.776675	0.174973	0.021504	0.267794
10	1900	300	0.218271	0.298685	0.433834	0.750814	0.355665	0.078756	0.421701
11	1900	500	0.276847	0.369930	0.399090	0.723579	0.324956	0.056735	0.430439
12	1900	1000	0.152890	0.235860	0.365193	0.763350	0.367483	0.072823	0.434704
13	1900	2000	0.140064	0.231429	0.368905	0.652646	0.325881	0.073827	0.390348
14	1900	3000	0.191449	0.299298	0.440751	0.560410	0.353711	0.087195	0.386636
15	1900	4000	0.218520	0.367937	0.545333	0.680962	0.456593	0.079565	0.508076
16	1900	5000	0.194222	0.305974	0.472642	0.582304	0.378850	0.063916	0.480737
17	1900	6000	0.230361	0.364878	0.517068	0.624714	0.442705	0.059224	0.510172
18	1900	6500	0.215440	0.342562	0.522616	0.603791	0.448864	0.057181	0.572222
19	1900	6700	0.208297	0.331178	0.546113	0.619688	0.477785	0.056183	0.591426
20	5000	300	0.176543	0.291253	0.462221	0.526303	0.417184	0.070353	0.493872
21	5000	500	0.200599	0.313008	0.473701	0.616088	0.401998	0.069160	0.488870
22	5000	1000	0.169554	0.282558	0.486919	0.569823	0.367906	0.074024	0.476849
23	5000	2000	0.164465	0.270225	0.456444	0.618451	0.385050	0.070872	0.478510
24	5000	3000	0.130989	0.211122	0.361456	0.573080	0.364135	0.075941	0.420475
25	5000	4000	0.178845	0.286019	0.520484	0.674524	0.428418	0.073208	0.590870
26	5000	5000	0.171763	0.293083	0.485872	0.596754	0.436496	0.063121	0.550717
27	5000	6000	0.216059	0.329735	0.534937	0.594827	0.462553	0.102206	0.596258
28	5000	6500	0.597255	0.654902	0.793141	0.831561	0.739416	0.380910	0.843841

TABLE 15

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TABLE 16

OBS	LINE	PIXEL	TM1	TM2	TM3	TM4	TM5	TM6	TM7
1	5000	300	73.714	29.120	24.244	86.816	68.470	131.28	19.106
2	5000	500	71.608	27.302	21.743	87.694	58.620	128.72	15.327
3	5000	1000	68.156	26.848	21.675	83.741	60.975	129.60	16.630
4	5000	2000	63.169	24.708	19.583	83.072	58.587	126.37	15.236
5	5000	3000	64.302	25.163	19.907	83.387	61.529	125.22	16.275
6	5000	4000	62.701	23.845	19.456	88.311	61.065	125.47	15.808
7	5000	5000	68.070	26.398	21.440	87.549	60.618	124.80	16.117
8	5000	6000	72.006	29.180	24.013	83.913	72.839	124.91	20.614
9	5000	6500	70.758	27.775	22.818	78.866	66.527	121.11	18.664

TABLE 17

OBS	LINE	PIXEL	CV1	CV2	CV3	CV4	CV5	CV6	CV7
1	5000	300	0.025818	0.067267	0.101815	0.064260	0.151192	0.015753	0.223098
2	5000	500	0.021576	0.027114	0.042948	0.115735	0.107634	0.007403	0.132993
3	5000	1000	0.021089	0.040012	0.071265	0.083741	0.099814	0.007910	0.171424
4	5000	2000	0.026132	0.049964	0.060031	0.090784	0.080561	0.007705	0.130660
5	5000	3000	0.032529	0.064437	0.089537	0.096211	0.122189	0.014906	0.169311
6	5000	4000	0.024867	0.047853	0.056724	0.082624	0.116961	0.010931	0.143961
7	5000	5000	0.021879	0.027212	0.038462	0.073498	0.076007	0.007054	0.115945
8	5000	6000	0.035150	0.047275	0.076426	0.080918	0.122095	0.005610	0.155416
9	5000	6500	0.164374	0.168338	0.171187	0.192766	0.214626	0.143736	0.223059

TABLE 18

OBS	LINE	PIXEL	INT1	INT2	INT3	INT4	INT5	INT6	INT7
1	5000	300	0.35053	0.91328	1.38233	0.87245	2.05272	0.21388	3.02898
2	5000	500	0.27568	0.34645	0.54876	1.47881	1.37530	0.09459	1.69932
3	5000	1000	0.27058	0.51336	0.91433	1.07440	1.28061	0.10149	2.19938
4	5000	2000	0.18375	0.35133	0.42211	0.63836	0.56648	0.05418	0.91875
5	5000	3000	0.33960	0.67271	0.93476	1.00443	1.27564	0.15562	1.76759
6	5000	4000	0.20321	0.39104	0.46354	0.67519	0.95578	0.08932	1.17642
7	5000	5000	0.14249	0.17723	0.25050	0.47868	0.49502	0.04594	0.75514
8	5000	6000	0.39863	0.53615	0.86674	0.91769	1.38467	0.06362	1.76257
9	5000	6500	1.75473	1.79704	1.82746	2.05782	2.29118	1.53441	2.38120

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TABLE 19

OBS	TM1	TM2	TM3	TM4	TM5	TM6	TM7	LINE	PIXEL
1	69.779	28.979	25.053	93.249	71.067	114.87	24.460	4145	239
2	72.358	29.974	26.711	83.495	65.992	115.85	24.340	4173	393
3	66.518	28.486	24.112	97.805	75.273	114.35	25.072	4579	687
4	64.017	26.512	21.697	99.128	68.855	110.30	21.862	4327	995
5	62.909	25.856	21.081	97.176	67.276	111.23	21.160	4579	1309
6	61.778	25.015	20.146	90.754	64.705	110.53	20.003	4579	1611
7	60.547	24.190	19.318	92.395	63.710	107.81	19.287	4285	1919
8	59.367	23.425	18.183	90.122	59.814	106.44	17.343	4607	2241
9	59.154	23.467	18.332	87.400	59.345	106.10	17.474	4593	2549
10	58.152	22.728	17.590	90.073	58.655	105.35	17.349	4299	2843
11	57.989	22.589	17.695	94.426	61.869	105.05	18.198	4299	3095
12	58.128	23.135	18.668	95.137	63.418	105.60	19.047	4089	3417
13	57.043	22.426	17.739	87.903	56.069	105.01	16.746	4089	3697
14	57.482	22.528	17.706	94.192	61.159	105.43	17.779	4271	4019
15	57.546	22.577	17.860	94.429	61.118	105.72	17.885	4271	4355
16	56.327	22.070	17.171	96.345	58.148	104.21	16.589	4271	4621
17	56.809	22.722	17.833	89.397	58.000	104.13	16.980	4649	4957
18	57.001	22.923	17.874	95.071	62.077	105.30	17.951	4411	5223
19	55.534	22.003	17.026	94.638	59.765	103.93	17.070	4061	5545
20	57.038	23.028	18.286	87.740	63.248	108.08	19.033	4089	5867
21	56.734	23.435	18.708	89.754	62.593	105.75	18.930	4439	6147
22	57.238	24.544	19.656	85.003	63.370	106.93	19.445	4439	6483

TABLE 20

OBS	LINE	PIXEL	CV1	CV2	CV3	CV4	CV5	CV6	CV7
1	4145	239	0.153901	0.216460	0.368244	0.176038	0.204738	0.0584002	0.379683
2	4173	393	0.258444	0.332980	0.495404	0.312572	0.364222	0.0583822	0.500586
3	4579	687	0.085782	0.148490	0.258724	0.135088	0.185029	0.0343204	0.319390
4	4327	995	0.107650	0.166766	0.269526	0.161668	0.221410	0.0346418	0.324455
5	4579	1309	0.079979	0.158980	0.285236	0.130054	0.195867	0.0349667	0.350896
6	4579	1611	0.063036	0.132229	0.229028	0.189088	0.244242	0.0394405	0.342779
7	4285	1919	0.061980	0.118594	0.212446	0.101212	0.149491	0.0336487	0.275217
8	4607	2241	0.024479	0.047919	0.060820	0.098739	0.087684	0.0166240	0.109872
9	4593	2549	0.029212	0.054671	0.088447	0.108459	0.104996	0.0186106	0.154991
10	4299	2843	0.031248	0.054459	0.076632	0.105747	0.110547	0.0175900	0.134179
11	4299	3095	0.033121	0.065826	0.106749	0.108605	0.107898	0.0185002	0.146009
12	4089	3417	0.065570	0.135625	0.237341	0.119072	0.181993	0.0339934	0.289812
13	4089	3697	0.035867	0.089627	0.120907	0.177135	0.247886	0.0234484	0.270487
14	4271	4019	0.034746	0.073932	0.107990	0.129145	0.145562	0.0262667	0.185689
15	4271	4355	0.037741	0.078362	0.125175	0.110074	0.126065	0.0265828	0.185652
16	4271	4621	0.028588	0.045469	0.057002	0.095851	0.096331	0.0193640	0.126259
17	4649	4957	0.034517	0.056584	0.093126	0.083803	0.094834	0.0200524	0.147385
18	4411	5223	0.033240	0.055250	0.084033	0.073464	0.084381	0.0196354	0.132379
19	4061	5545	0.028260	0.044969	0.052991	0.119738	0.122744	0.0218440	0.132996
20	4089	5867	0.053747	0.104501	0.182624	0.123572	0.160087	0.0295339	0.250469
21	4439	6147	0.039001	0.081769	0.116804	0.133843	0.151368	0.0269030	0.183984
22	4439	6483	0.036140	0.064985	0.100212	0.099580	0.138469	0.0277753	0.186000

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TABLE 21

OBS	LINE	PIXEL	INT1	INT2	INT3	INT4	INT5	INT6	INT7
1	4145	239	0.242363	0.340882	0.579912	0.277225	0.322422	0.0919688	0.597925
2	4173	393	0.406999	0.524377	0.780163	0.492239	0.573578	0.0919405	0.788324
3	4579	687	0.135090	0.233843	0.407439	0.212737	0.291385	0.0540479	0.502976
4	4327	995	0.169528	0.262624	0.424450	0.254596	0.348677	0.0545541	0.510953
5	4579	1309	0.125951	0.250363	0.449191	0.204810	0.308452	0.0550656	0.552592
6	4579	1611	0.099269	0.208235	0.360674	0.297777	0.384633	0.0621110	0.539809
7	4285	1919	0.097607	0.186763	0.334560	0.159390	0.235419	0.0529902	0.433412
8	4607	2241	0.038550	0.075463	0.095780	0.155495	0.138085	0.0261796	0.173028
9	4593	2549	0.046003	0.086096	0.139287	0.170802	0.165348	0.0293081	0.244081
10	4299	2843	0.049210	0.085762	0.120681	0.166531	0.174090	0.0277008	0.211306
11	4299	3095	0.052160	0.103663	0.168108	0.171032	0.169918	0.0291342	0.229935
12	4089	3417	0.103259	0.213582	0.373766	0.187516	0.286603	0.0535330	0.456397
13	4089	3697	0.056484	0.141145	0.190404	0.278952	0.390372	0.0369266	0.425963
14	4271	4019	0.054718	0.116428	0.170063	0.203378	0.229231	0.0413648	0.292424
15	4271	4355	0.059435	0.123405	0.197126	0.173344	0.198528	0.0418627	0.292366
16	4271	4621	0.045021	0.071604	0.089766	0.150947	0.151702	0.0304944	0.198834
17	4649	4957	0.054357	0.089108	0.146656	0.131973	0.149345	0.0315787	0.232102
18	4411	5223	0.052347	0.087008	0.132335	0.115691	0.132884	0.0309219	0.208471
19	4061	5545	0.044504	0.070817	0.083450	0.188564	0.193298	0.0343999	0.209443
20	4089	5867	0.084641	0.164569	0.287597	0.194602	0.252105	0.0465100	0.394440
21	4439	6147	0.061419	0.128769	0.183944	0.210776	0.238375	0.0423670	0.289738
22	4439	6483	0.056913	0.102339	0.157815	0.156820	0.218062	0.0437407	0.292913

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TABLE 22

OBS	TM1	TM2	TM3	TM4	TM5	TM6	TM7	LINE	PIXEL
1	61.565	24.188	18.890	98.018	63.190	107.91	18.460	5209	1205
2	60.764	24.094	18.893	91.110	60.879	107.89	18.210	5163	1569
3	59.715	23.505	18.384	89.184	60.392	107.21	17.828	4621	2045
4	58.995	23.236	18.089	89.855	60.354	106.39	17.822	3781	2409
5	58.782	23.299	18.085	93.923	61.895	106.73	18.252	3711	2633
6	59.157	23.452	18.265	88.042	61.522	105.35	18.173	3319	2521
7	58.866	23.486	18.345	91.776	60.679	104.71	17.826	3179	2815
8	58.296	22.937	18.038	97.786	63.671	105.44	18.822	3487	2955
9	57.510	22.209	17.524	93.627	61.223	105.61	17.957	3683	3221
10	58.174	22.786	18.045	98.886	63.275	103.92	18.673	3067	3571
11	57.246	22.265	17.351	95.947	59.401	102.29	16.713	2241	3711
12	57.372	22.518	17.707	97.058	60.833	102.03	17.794	1975	3935
13	57.075	22.501	17.801	95.323	61.409	101.70	18.148	2003	4159
14	57.070	22.937	18.296	96.805	62.141	103.33	18.673	2143	4719
15	55.840	21.793	17.373	95.415	61.193	103.67	17.749	3529	5153
16	55.690	21.894	17.382	94.202	60.950	104.99	17.842	3277	5531
17	55.765	22.025	17.311	92.471	60.277	105.16	17.555	3221	5811
18	55.990	22.132	17.438	90.174	58.750	106.06	17.243	3235	6035
19	55.196	21.750	17.181	94.727	60.758	104.23	17.559	3165	6259
20	55.466	21.965	17.391	92.469	60.174	105.08	17.609	3081	6511
21	54.730	21.585	17.333	93.634	60.827	103.95	17.866	2619	6693
22	55.539	22.286	17.466	96.210	58.785	102.67	16.978	1569	6119
23	57.651	23.753	18.888	91.886	58.603	104.52	17.909	85	6581
24	56.685	23.497	19.035	95.505	62.688	104.99	18.970	1555	6749
25	54.777	21.636	17.058	92.824	59.824	104.20	17.519	2731	6497
26	60.632	23.934	18.844	91.943	61.843	108.21	18.391	5083	1877
27	59.467	23.433	18.269	96.537	63.012	106.53	18.615	3697	2143

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TABLE 23

OBS	LINE	PIXEL	CV1	CV2	CV3	CV4	CV5	CV6	CV7
1	5209	1205	0.042122	0.083498	0.145767	0.108180	0.130176	0.0218748	0.214041
2	5163	1569	0.036946	0.077068	0.125712	0.145249	0.158976	0.0208020	0.203348
3	4621	2045	0.032160	0.062135	0.101034	0.099537	0.098725	0.0172873	0.161111
4	3781	2409	0.033880	0.069661	0.107793	0.103633	0.125883	0.0208255	0.181012
5	3711	2633	0.035575	0.072534	0.110464	0.128159	0.150968	0.0252558	0.189943
6	3319	2521	0.026367	0.055120	0.068338	0.095543	0.105149	0.0164902	0.134461
7	3179	2815	0.033720	0.066904	0.112324	0.095831	0.122883	0.0240790	0.173278
8	3487	2955	0.033249	0.076327	0.121700	0.090579	0.127221	0.0204579	0.186256
9	3683	3221	0.031659	0.063773	0.089702	0.111593	0.114606	0.0225687	0.155060
10	3067	3571	0.118430	0.155156	0.239226	0.124053	0.146667	0.0224605	0.216411
11	2241	3711	0.026613	0.039411	0.046071	0.089063	0.095312	0.0166252	0.114999
12	1975	3935	0.044880	0.078980	0.118879	0.116789	0.123695	0.0253864	0.164318
13	2003	4159	0.043330	0.074406	0.117112	0.120194	0.131952	0.0251017	0.168536
14	2143	4719	0.061516	0.116333	0.191447	0.120491	0.140621	0.0294337	0.233409
15	3529	5153	0.030391	0.056068	0.083294	0.107201	0.110523	0.0199301	0.143565
16	3277	5531	0.037998	0.072377	0.109369	0.127149	0.132368	0.0261297	0.171005
17	3221	5811	0.044895	0.080416	0.124178	0.146495	0.163033	0.0321198	0.207164
18	3235	6035	0.052441	0.099239	0.150526	0.180566	0.197971	0.0389004	0.244287
19	3165	6259	0.032155	0.059380	0.086134	0.136232	0.139432	0.0236550	0.162025
20	3081	6511	0.044993	0.095400	0.143603	0.181723	0.209265	0.0384756	0.254742
21	2619	6693	0.074255	0.108274	0.145142	0.156353	0.185608	0.0380969	0.230834
22	1569	6119	0.036329	0.071583	0.107097	0.106477	0.120252	0.0240144	0.171701
23	85	6581	0.056644	0.118038	0.174200	0.172102	0.238794	0.0392724	0.314878
24	1555	6749	0.052853	0.107151	0.168284	0.145279	0.174318	0.0391302	0.239513
25	2731	6497	0.035267	0.072566	0.098428	0.142362	0.159158	0.0221895	0.196370
26	5083	1877	0.042259	0.084570	0.145524	0.116749	0.149484	0.0263174	0.232663
27	3697	2143	0.034319	0.077358	0.117552	0.110388	0.126061	0.0216737	0.166714

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OBS	LINE	PIXEL	INT1	INT2	INT3	INT4	INT5	INT6	INT7
1	5209	1205	0.048355	0.095853	0.167336	0.124188	0.149438	0.0251115	0.245712
2	5163	1569	0.058183	0.121367	0.197972	0.228738	0.250355	0.0327590	0.320233
3	4621	2045	0.050645	0.097850	0.159109	0.156751	0.155473	0.0272242	0.253718
4	3781	2409	0.053354	0.109702	0.169753	0.163202	0.198242	0.0327961	0.285058
5	3711	2633	0.033274	0.067841	0.103318	0.119868	0.141201	0.0236219	0.177655
6	3319	2521	0.041523	0.086803	0.107619	0.150462	0.165590	0.0259688	0.211750
7	3179	2815	0.029663	0.058855	0.098811	0.084301	0.108099	0.0211821	0.152431
8	3487	2955	0.052361	0.120200	0.191653	0.142644	0.200349	0.0322172	0.293316
9	3683	3221	0.025356	0.051077	0.071844	0.089377	0.091790	0.0180757	0.124191
10	3067	3571	0.135954	0.178114	0.274623	0.142409	0.168369	0.0257839	0.248432
11	2241	3711	0.041910	0.062065	0.072552	0.140256	0.150098	0.0261814	0.181101
12	1975	3935	0.027240	0.047936	0.072152	0.070884	0.075076	0.0154080	0.099731
13	2003	4159	0.027694	0.047557	0.074852	0.076821	0.084337	0.0160437	0.107719
14	2143	4719	0.049269	0.093173	0.153333	0.096503	0.112625	0.0235739	0.186941
15	3529	5153	0.025860	0.047709	0.070876	0.091218	0.094045	0.0169587	0.122161
16	3277	5531	0.021686	0.041306	0.062418	0.072565	0.075544	0.0149125	0.097594
17	3221	5811	0.031038	0.055594	0.085848	0.101276	0.112710	0.0222054	0.143218
18	3235	6035	0.044622	0.084444	0.128084	0.153645	0.168456	0.0331007	0.207866
19	3165	6259	0.031752	0.058636	0.085055	0.134525	0.137686	0.0233588	0.159996
20	3081	6511	0.048867	0.103615	0.155968	0.197370	0.227285	0.0417886	0.276677
21	2619	6693	0.065322	0.095248	0.127681	0.137542	0.163278	0.0335136	0.203063
22	1569	6119	0.057211	0.112730	0.168657	0.167680	0.189373	0.0378180	0.270395
23	85	6581	0.089203	0.185886	0.274331	0.271027	0.376054	0.0618463	0.495871
24	1555	6749	0.083234	0.168742	0.265014	0.228786	0.274516	0.0616224	0.377186
25	2731	6497	0.055539	0.114277	0.155005	0.224192	0.250642	0.0349440	0.309244
26	5083	1877	0.066549	0.133182	0.229172	0.183857	0.235407	0.0414447	0.366398
27	3697	2143	0.054045	0.121824	0.185121	0.173839	0.198521	0.0341318	0.262542

TABLE 24

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Fig. 1

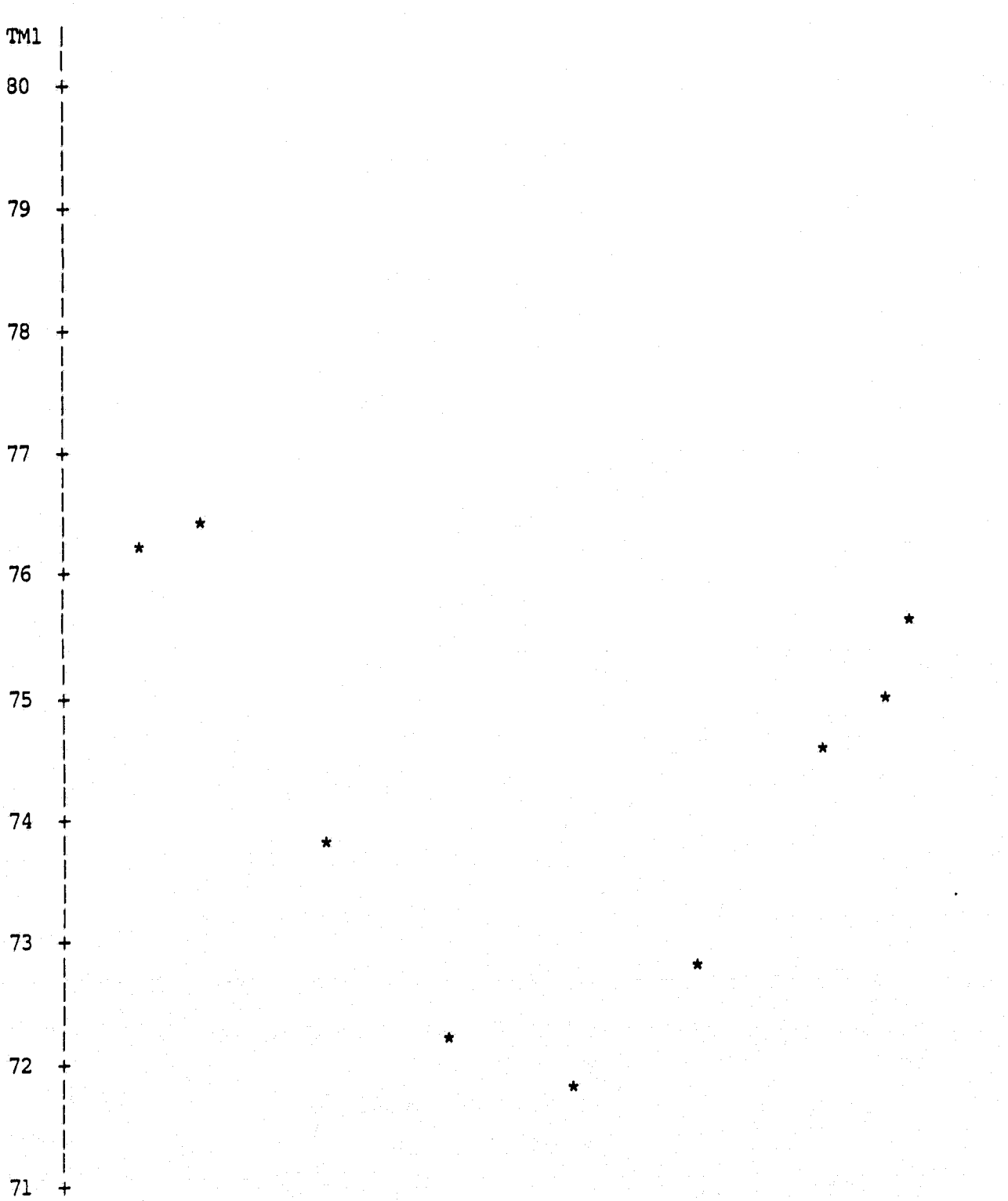

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Fig. 2

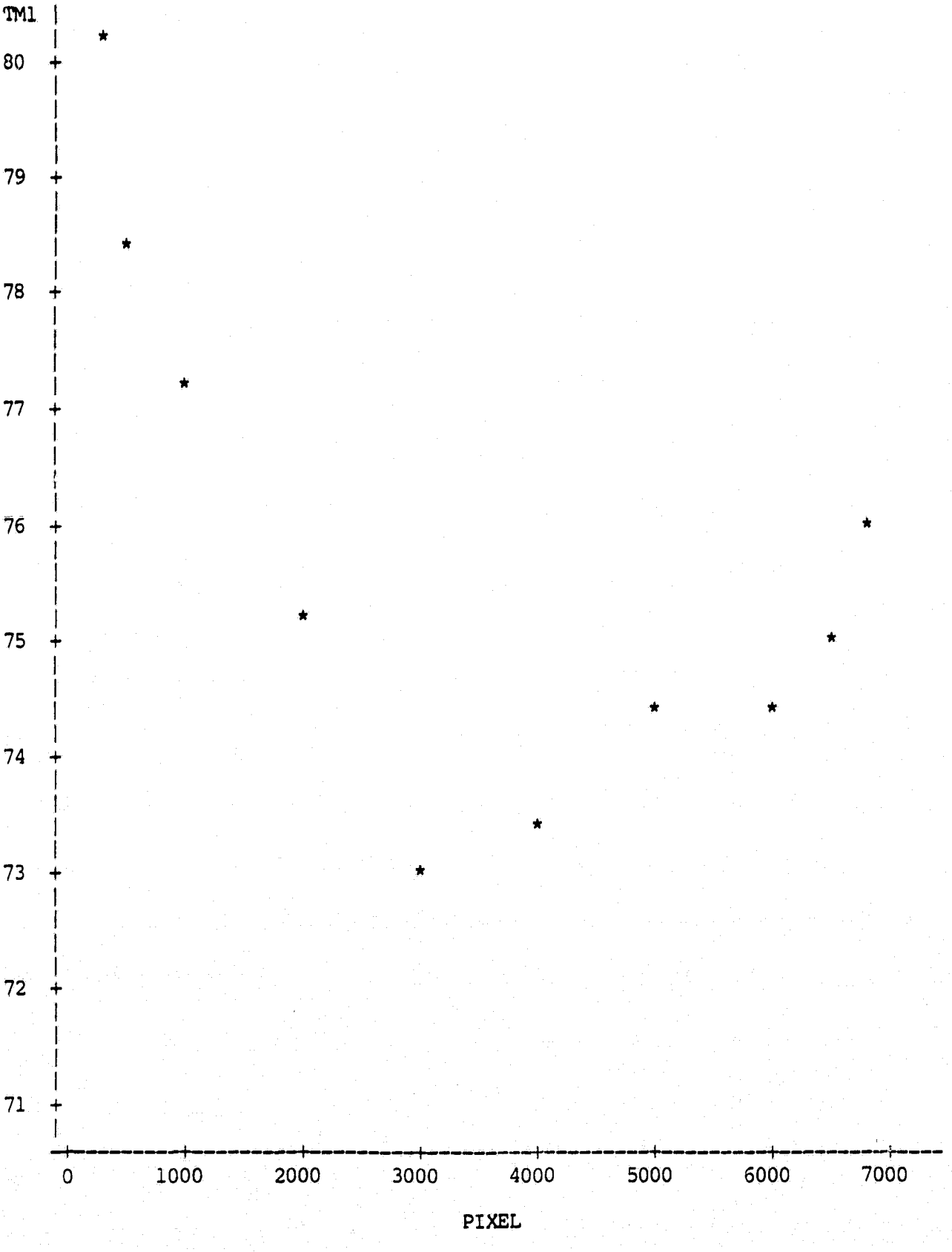

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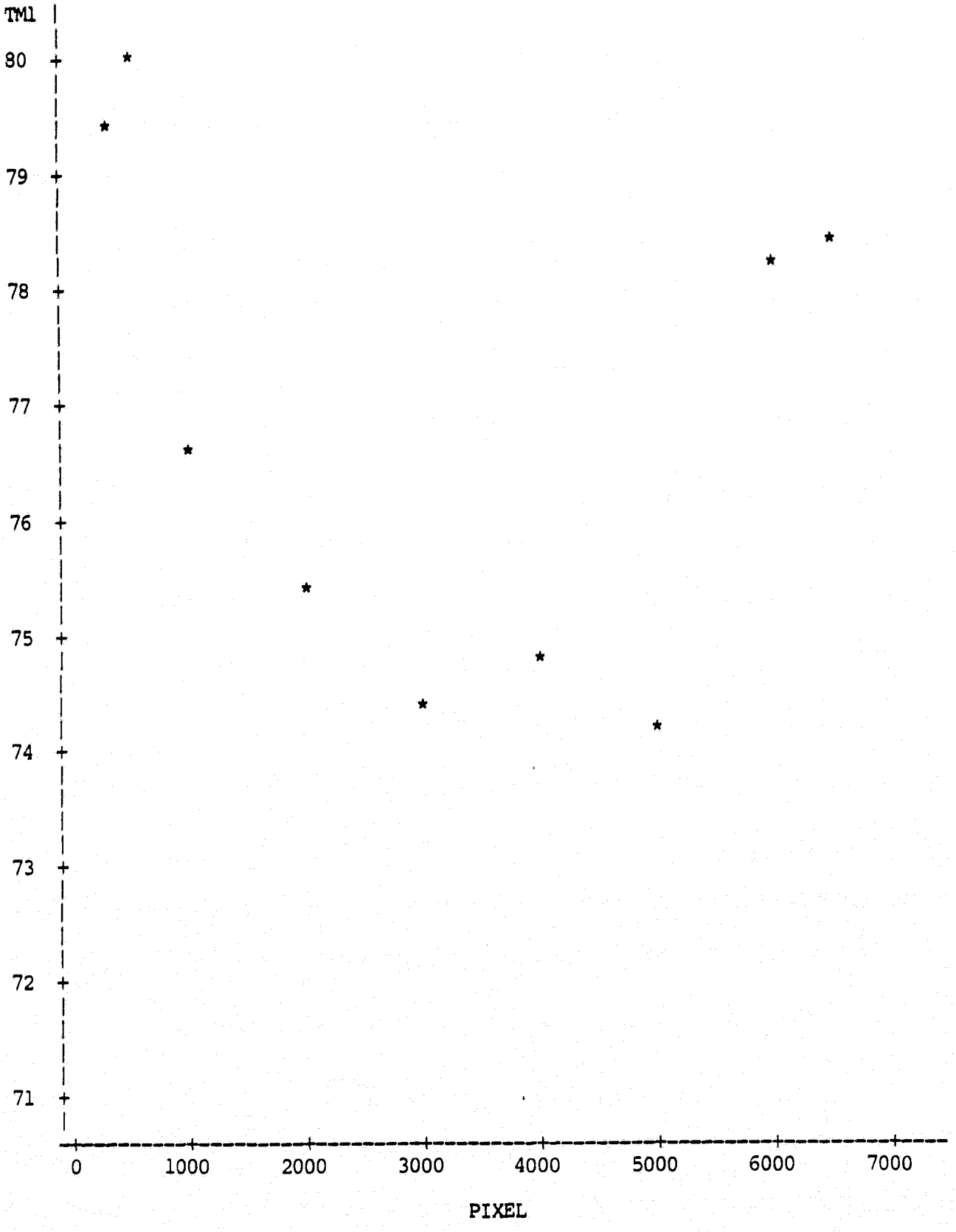
Fig. 3



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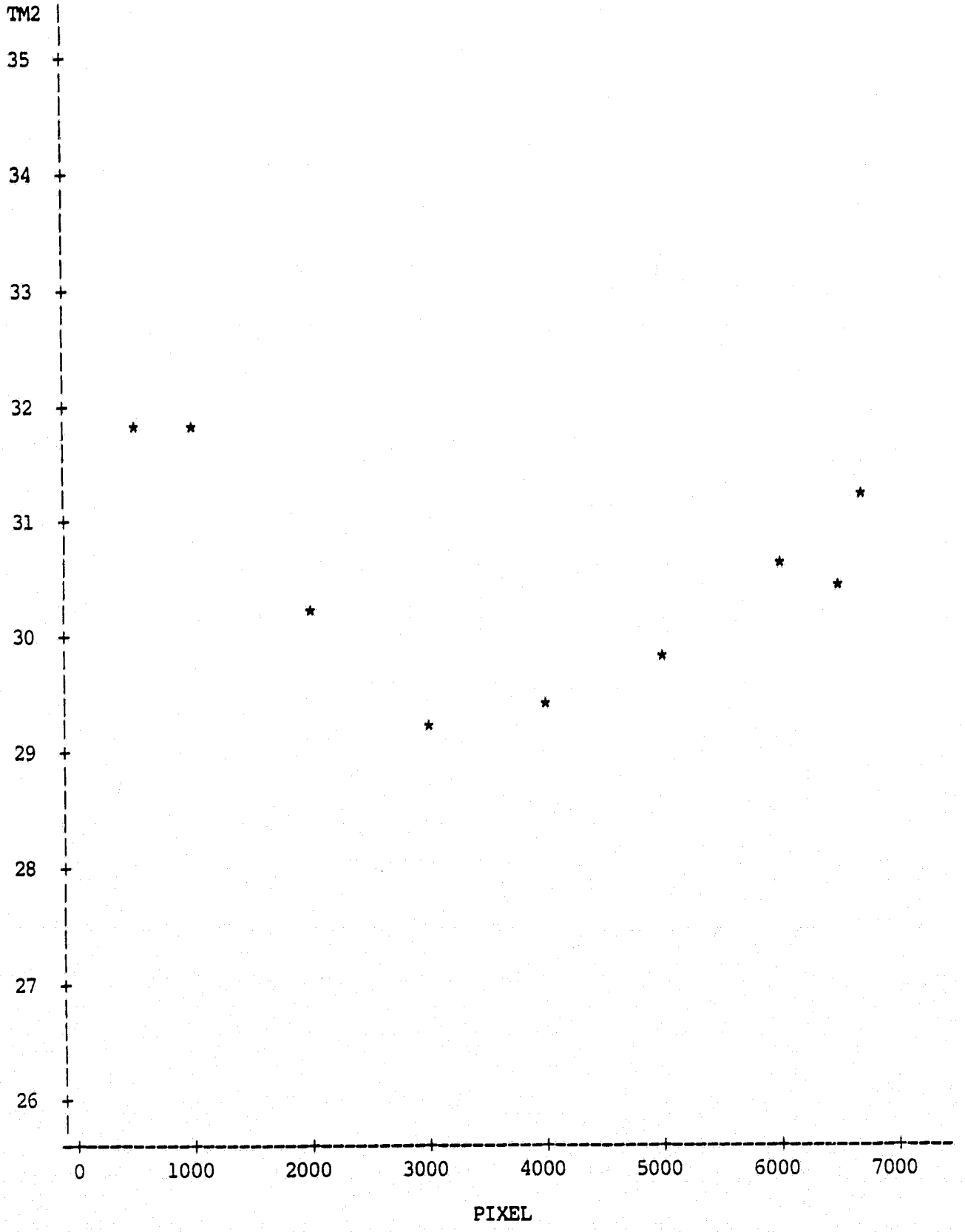

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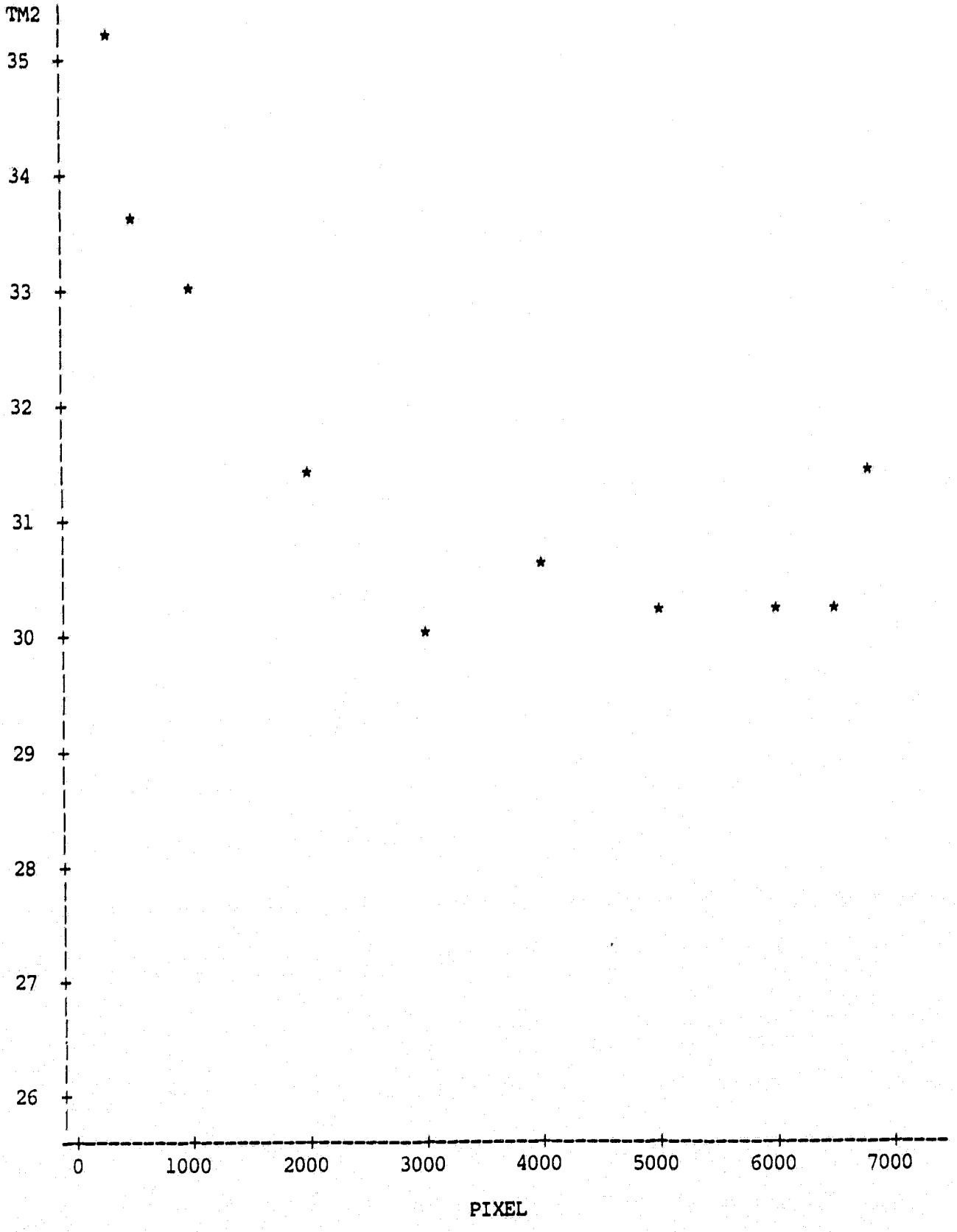
Fig. 5



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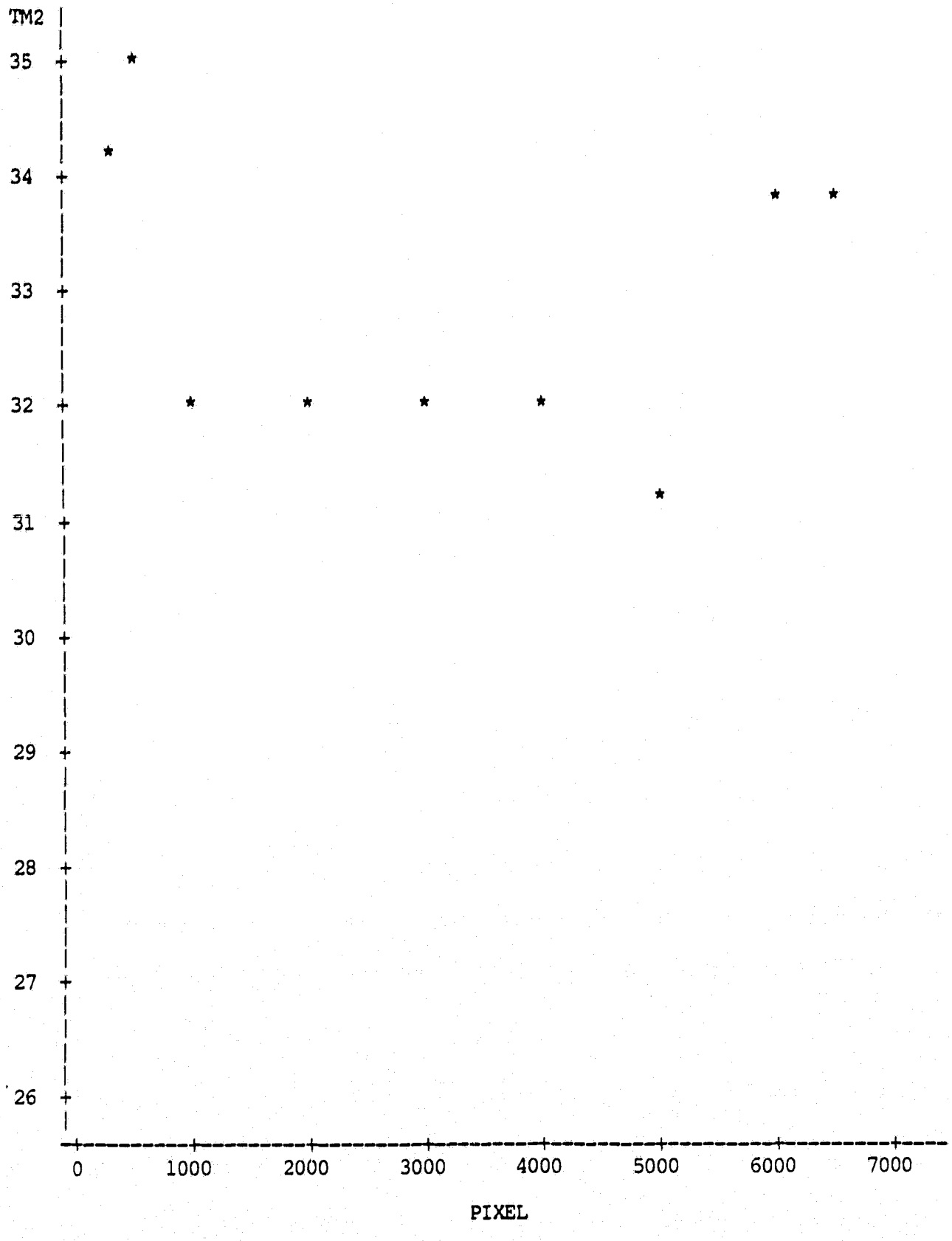

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Fig. 7

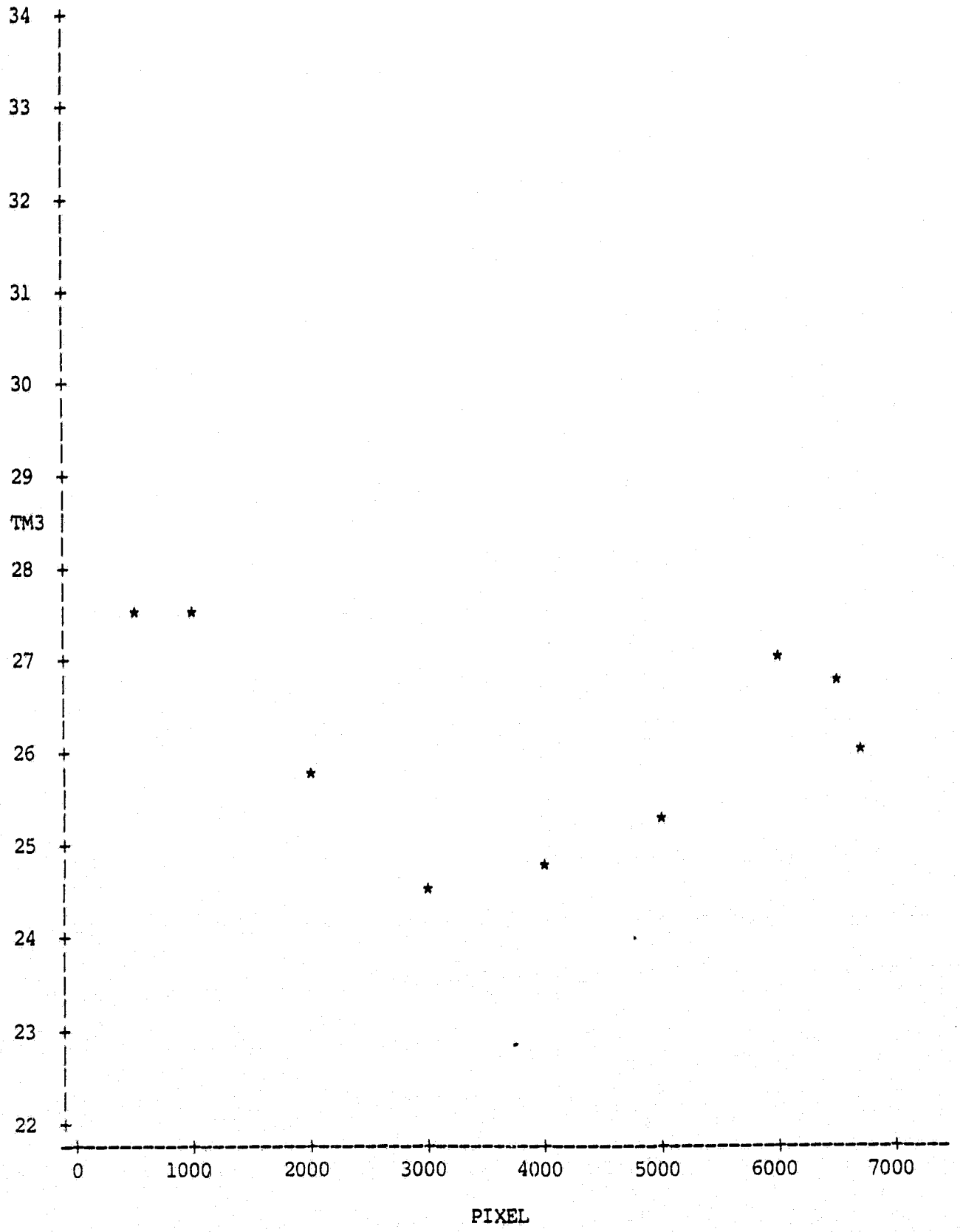

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Fig. 8

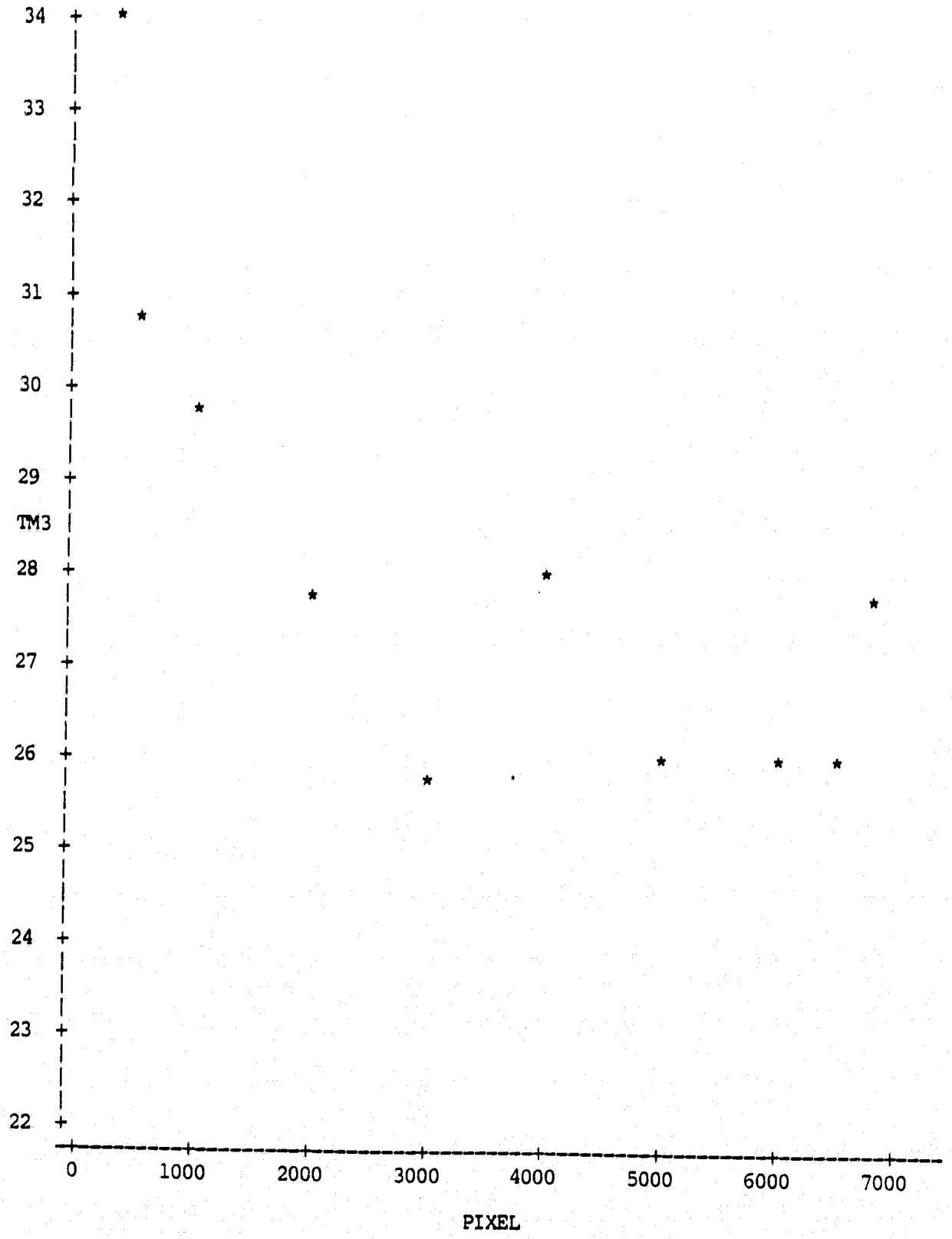

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Fig. 9

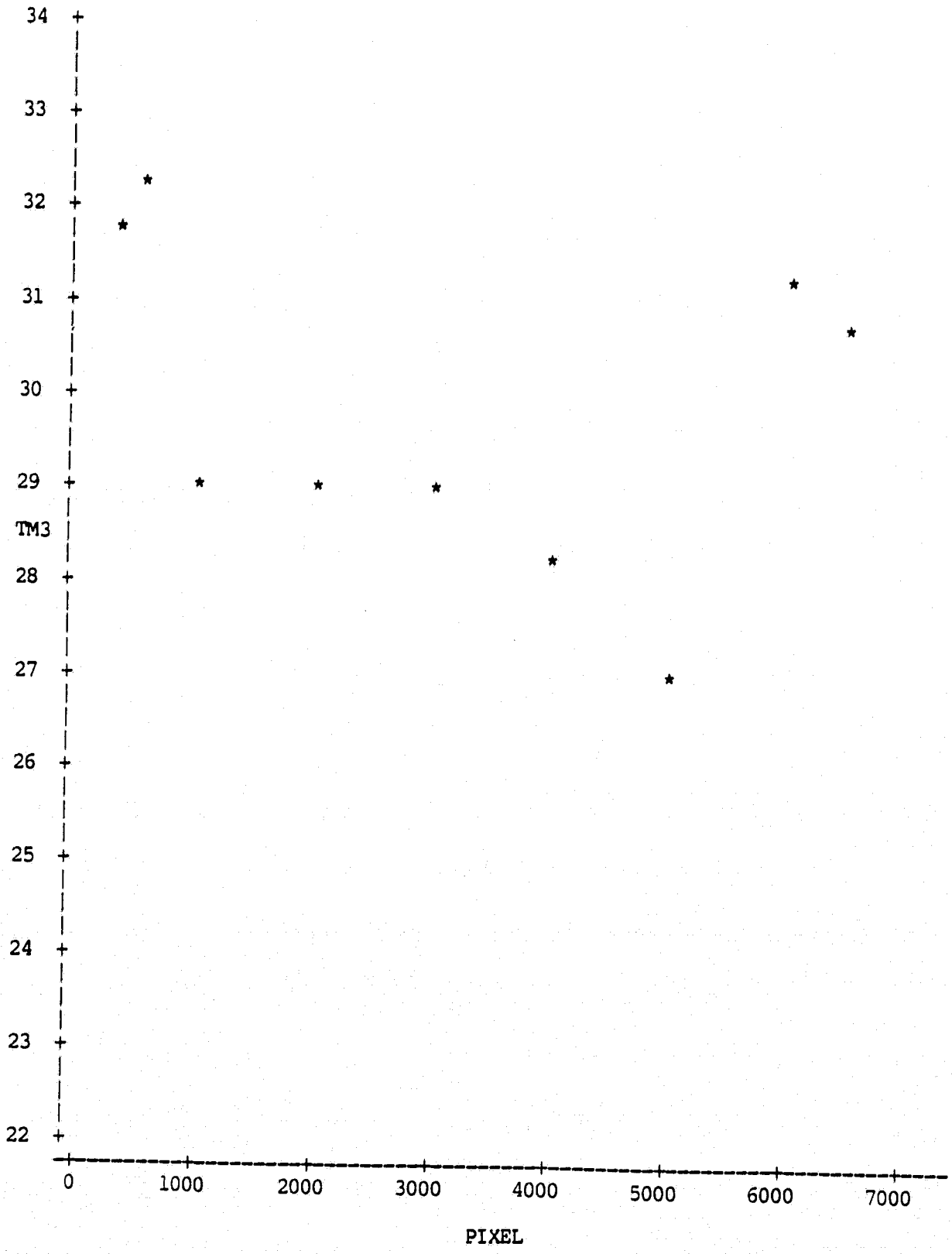

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Fig. 10

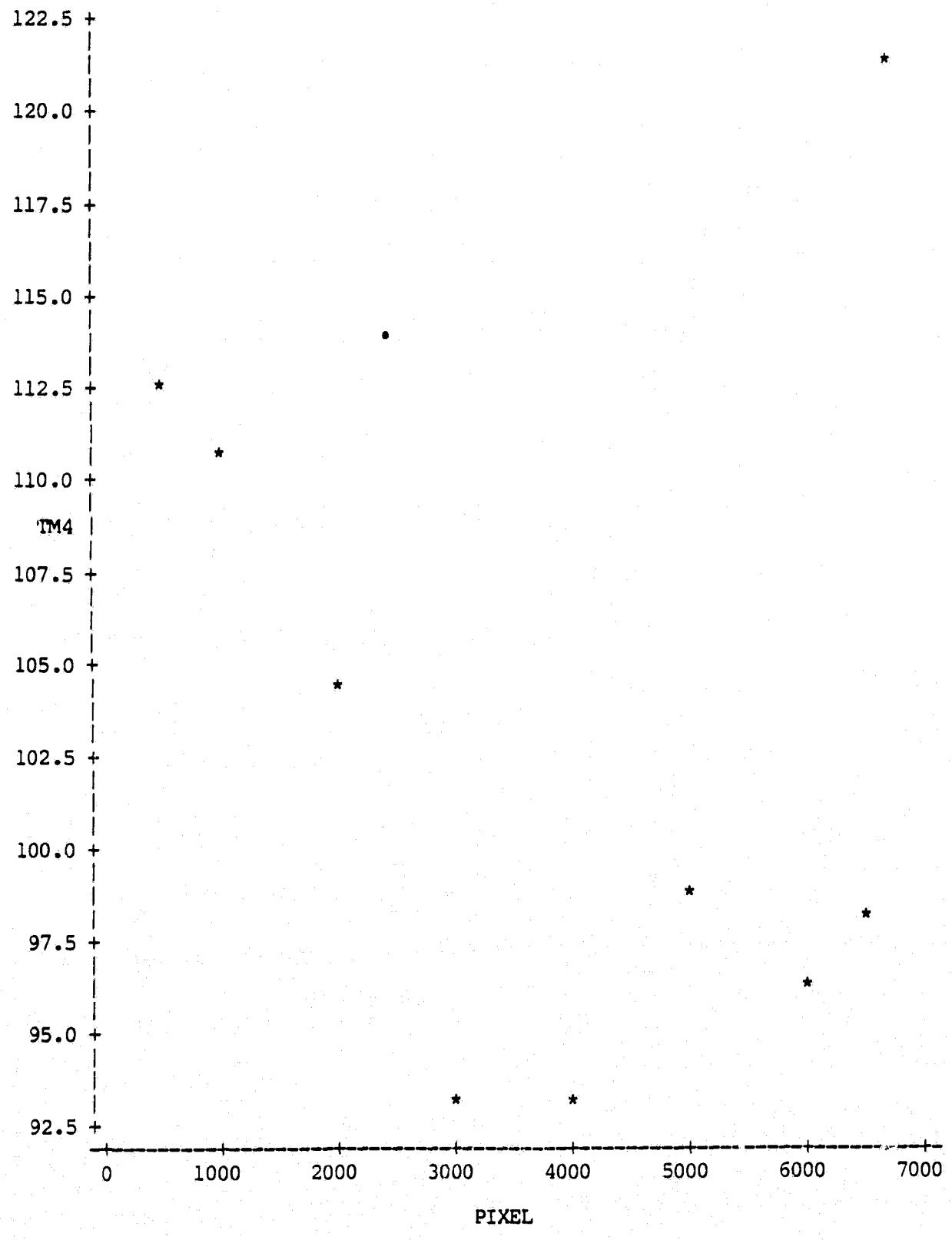

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Fig. 11

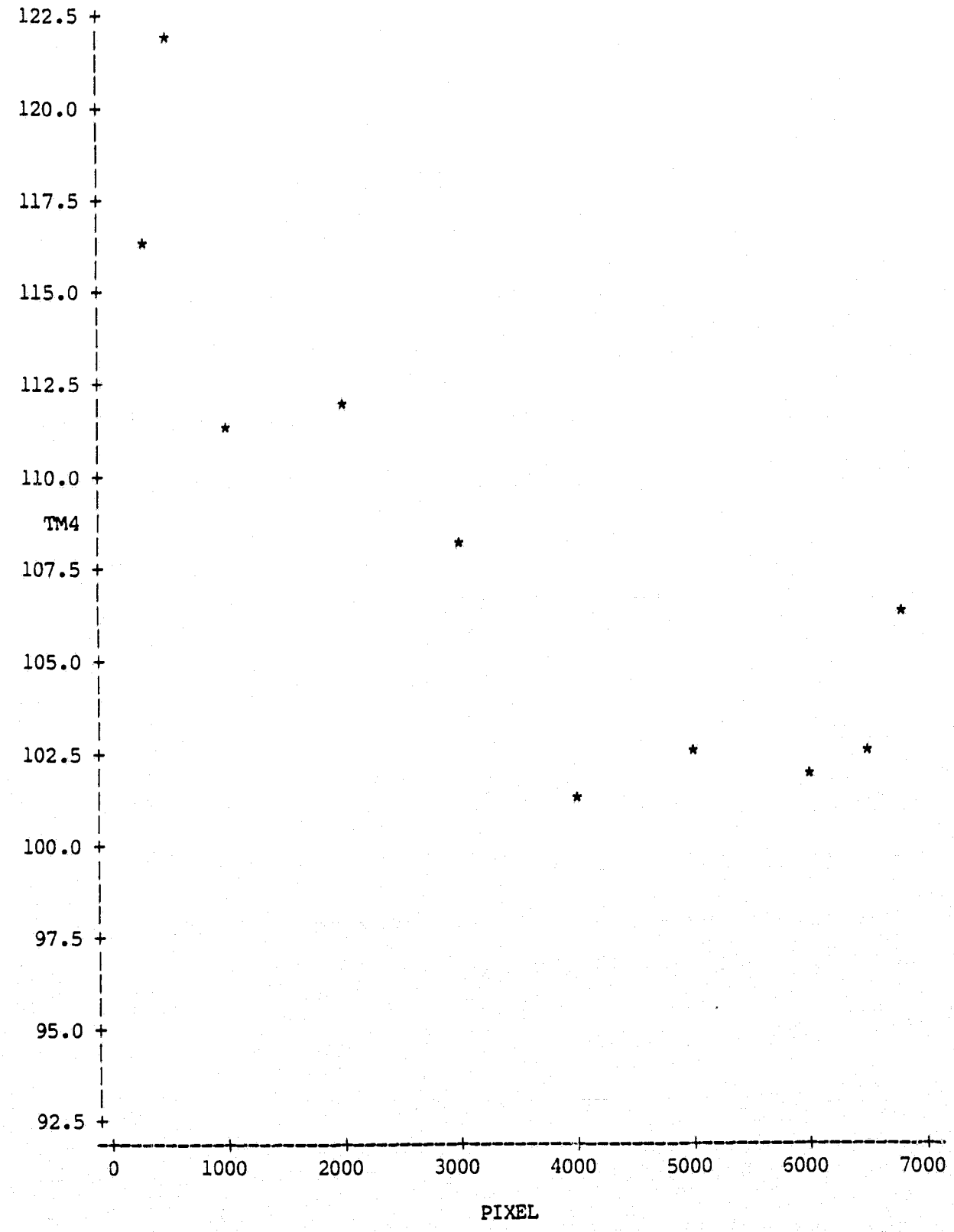

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Fig. 12

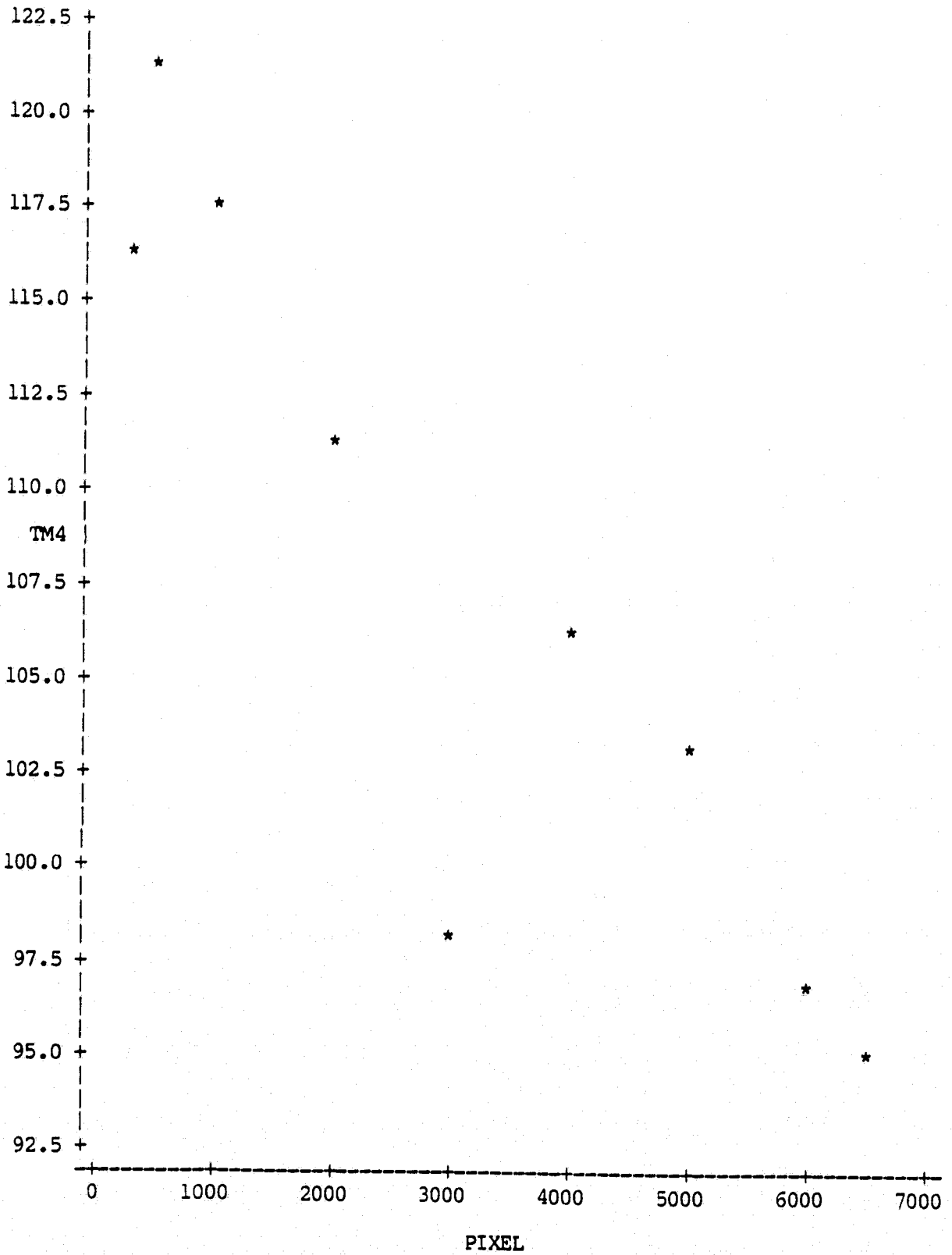

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Fig. 13

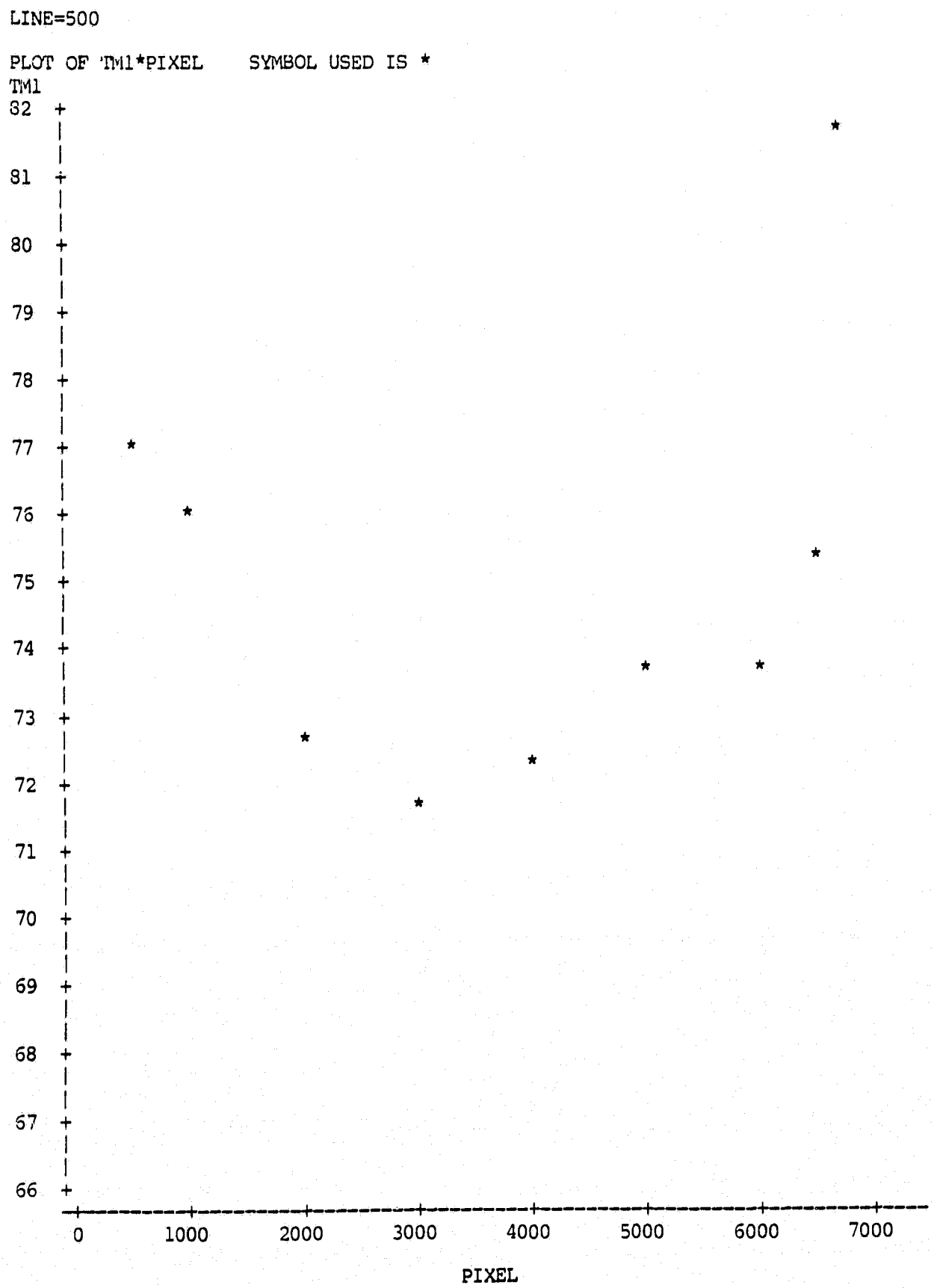

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Fig. 14

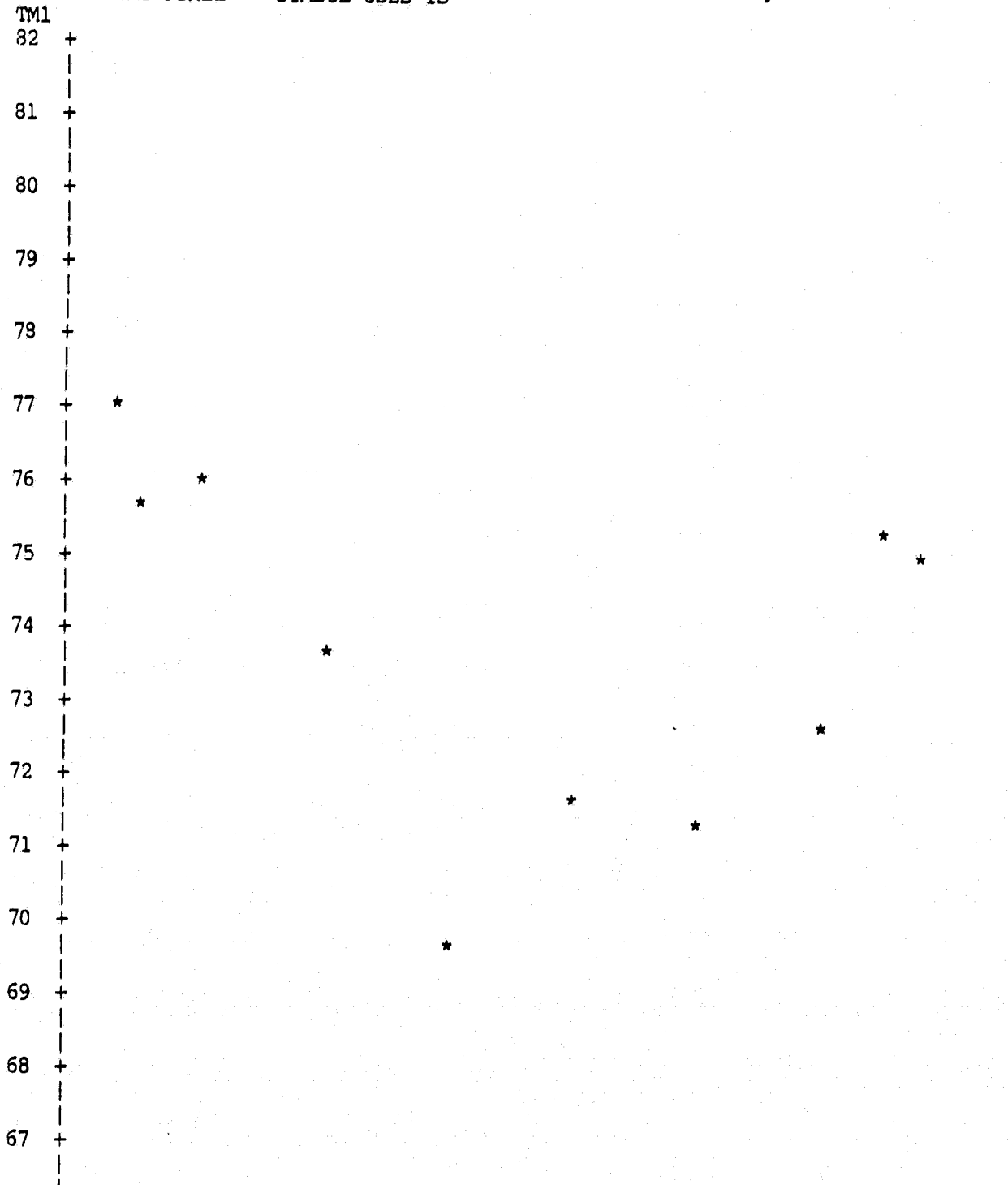

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Fig. 15

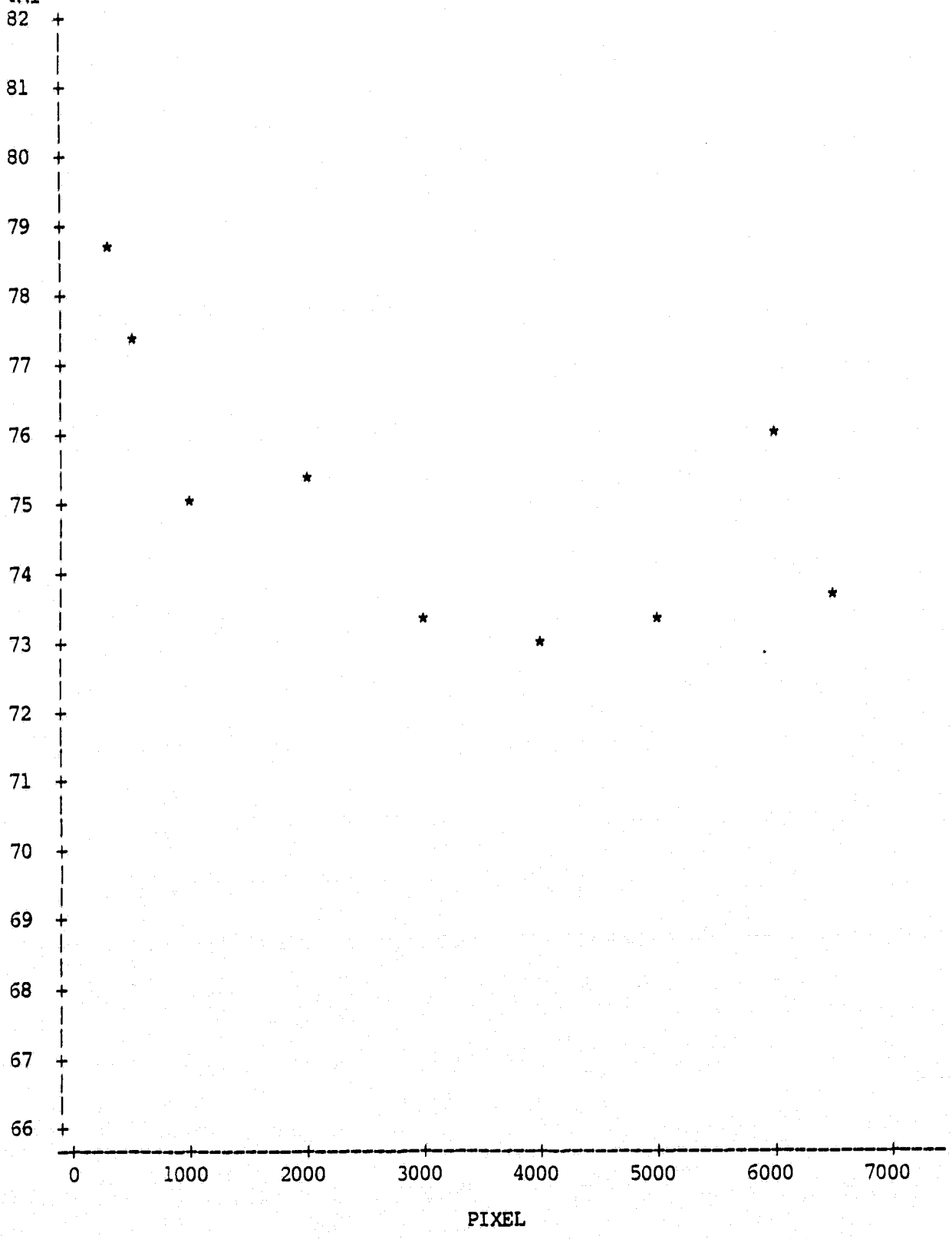

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Fig. 16

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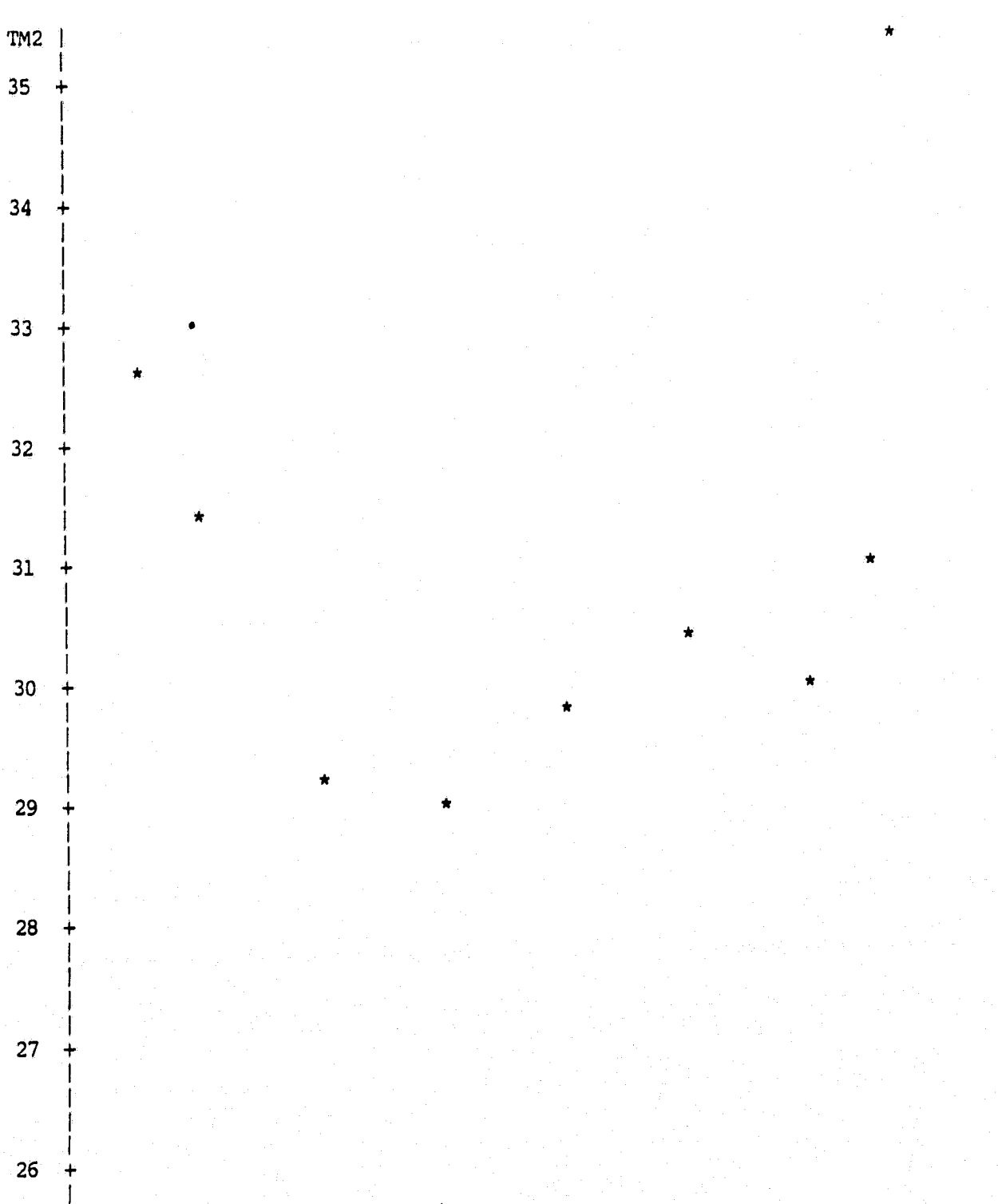

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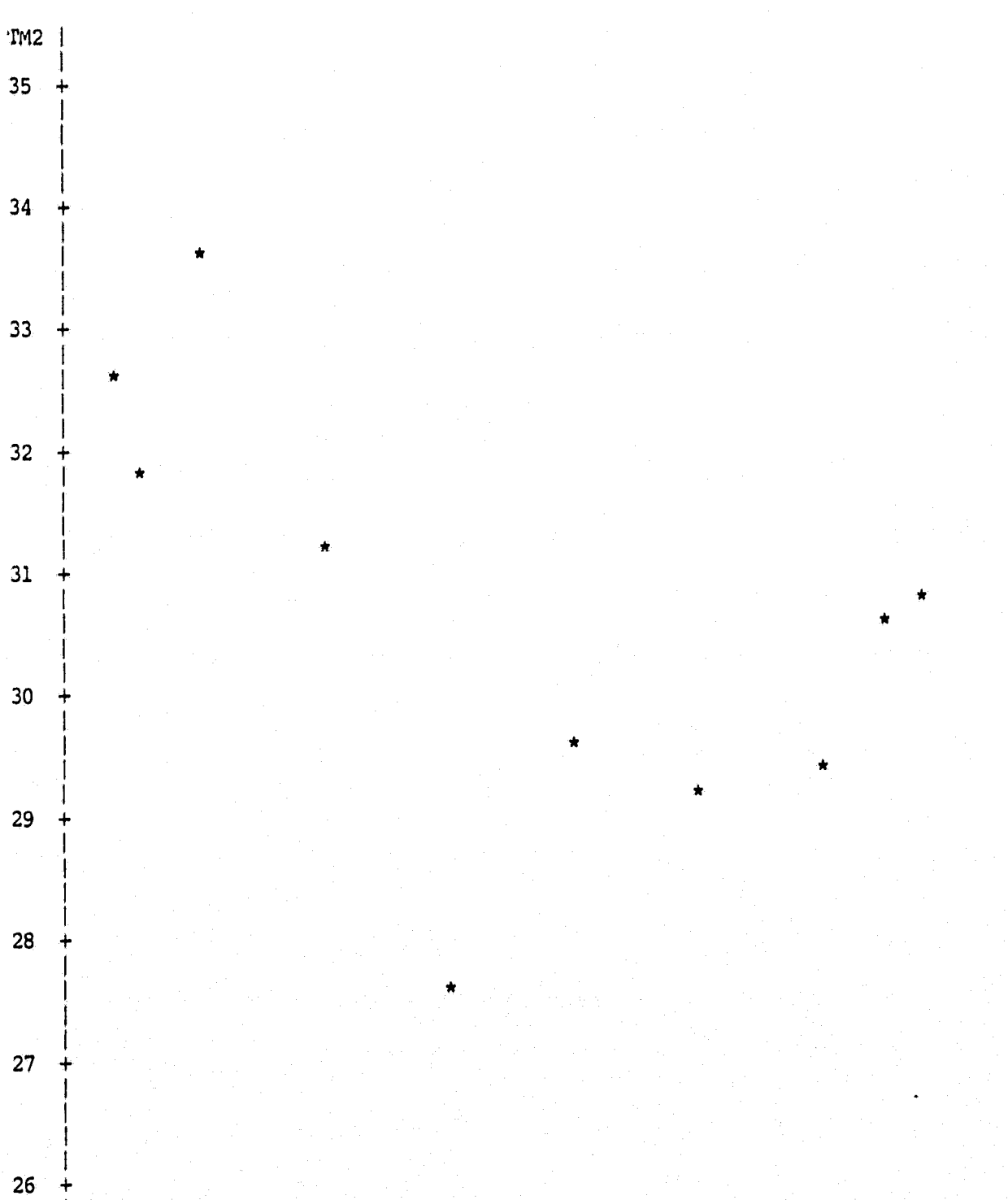
PLOT OF TM2*PIXEL SYMBOL USED IS *

Fig. 17



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PLOT OF TM2*PIXEL SYMBOL USED IS *

Fig. 18

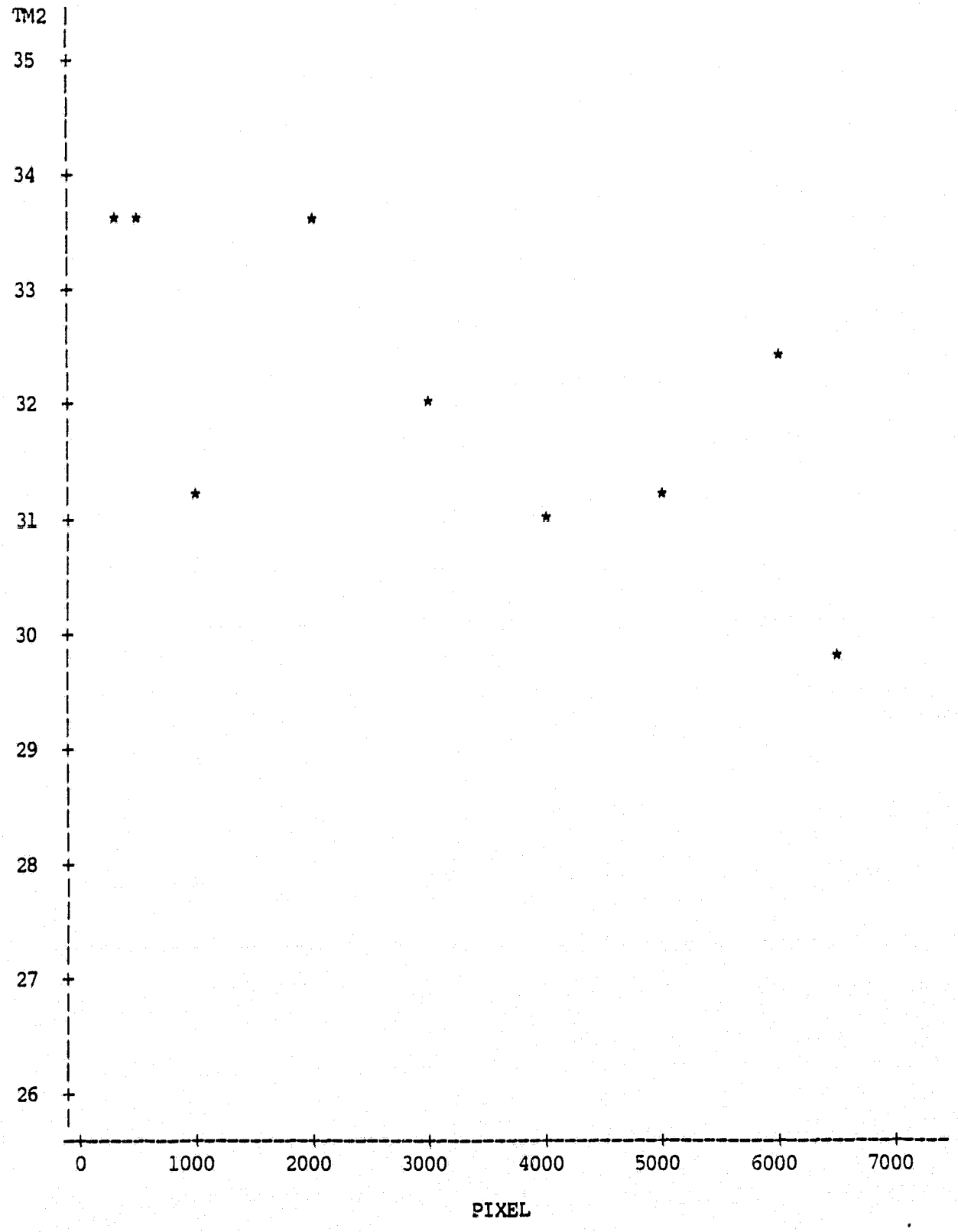

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Fig. 19

PLOT OF TM3*PIXEL SYMBOL USED IS *

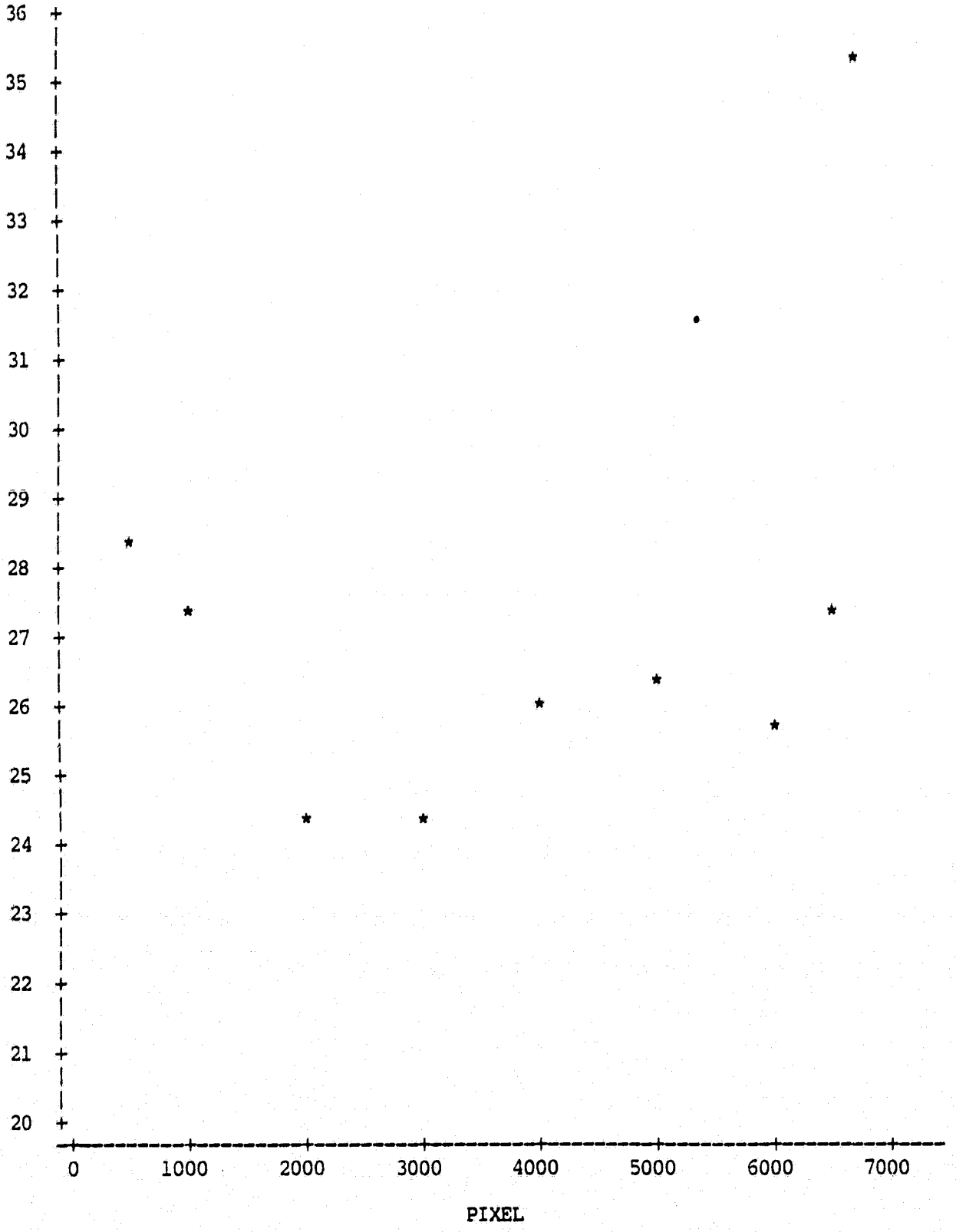

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Fig. 20

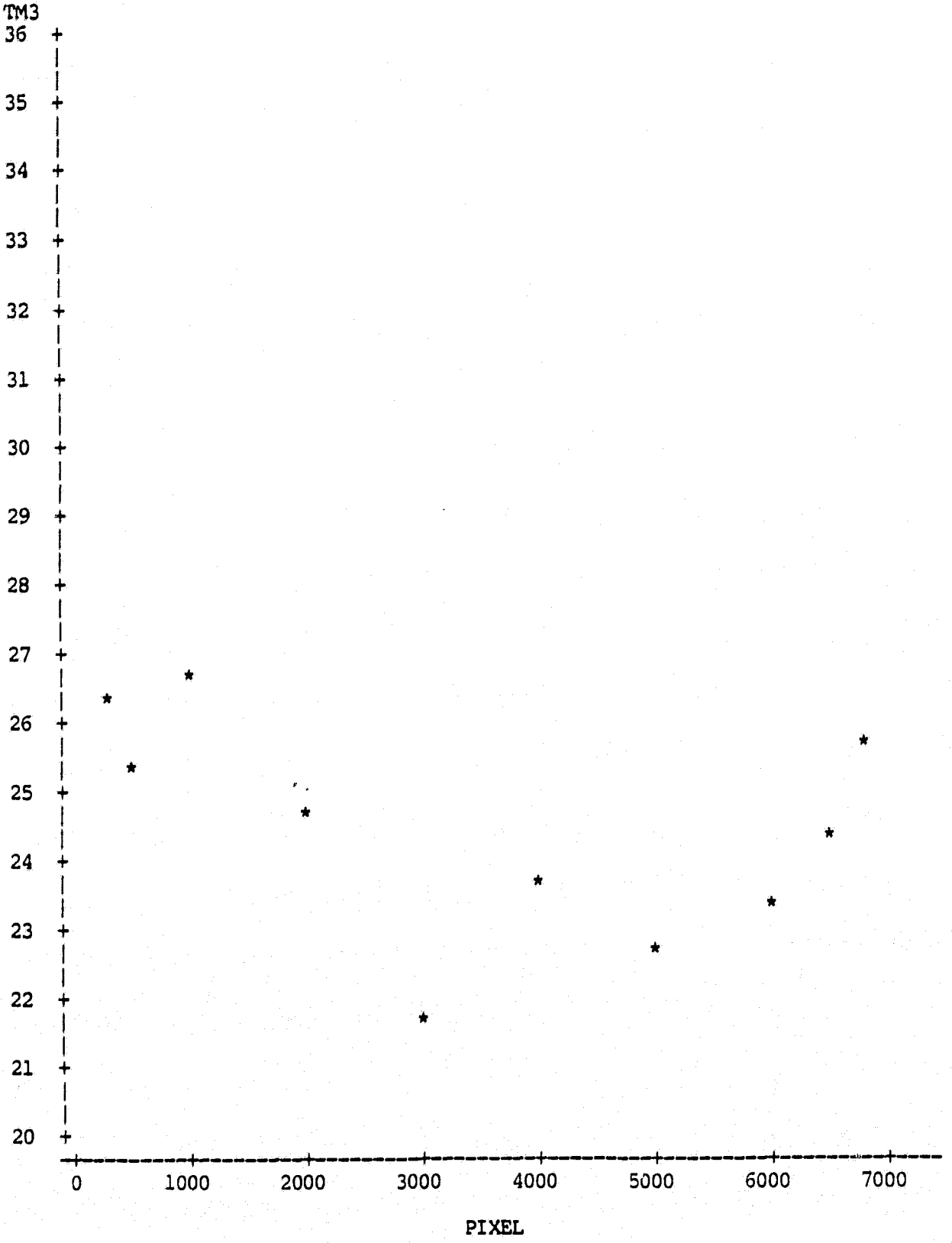

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Fig. 21

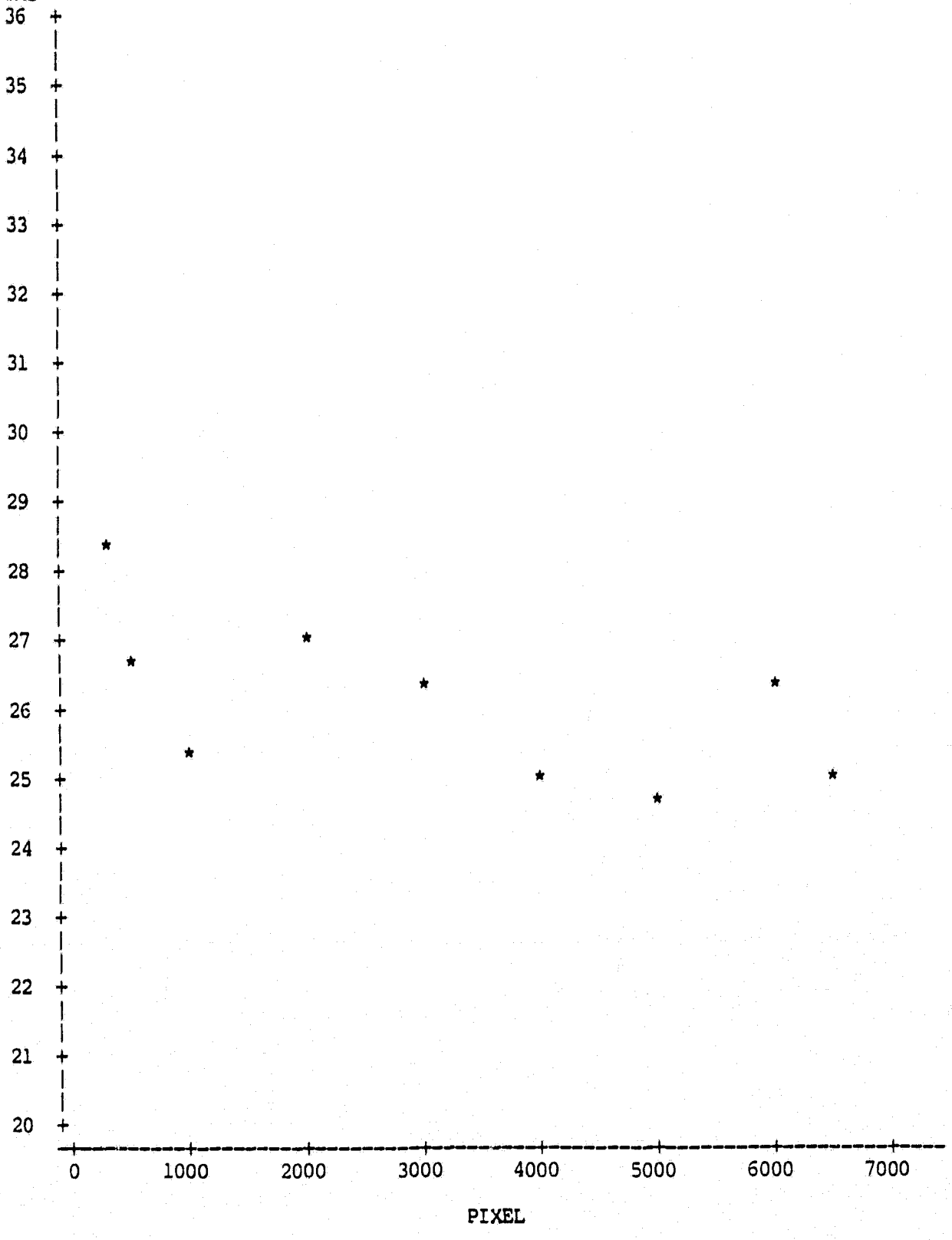

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Fig. 22

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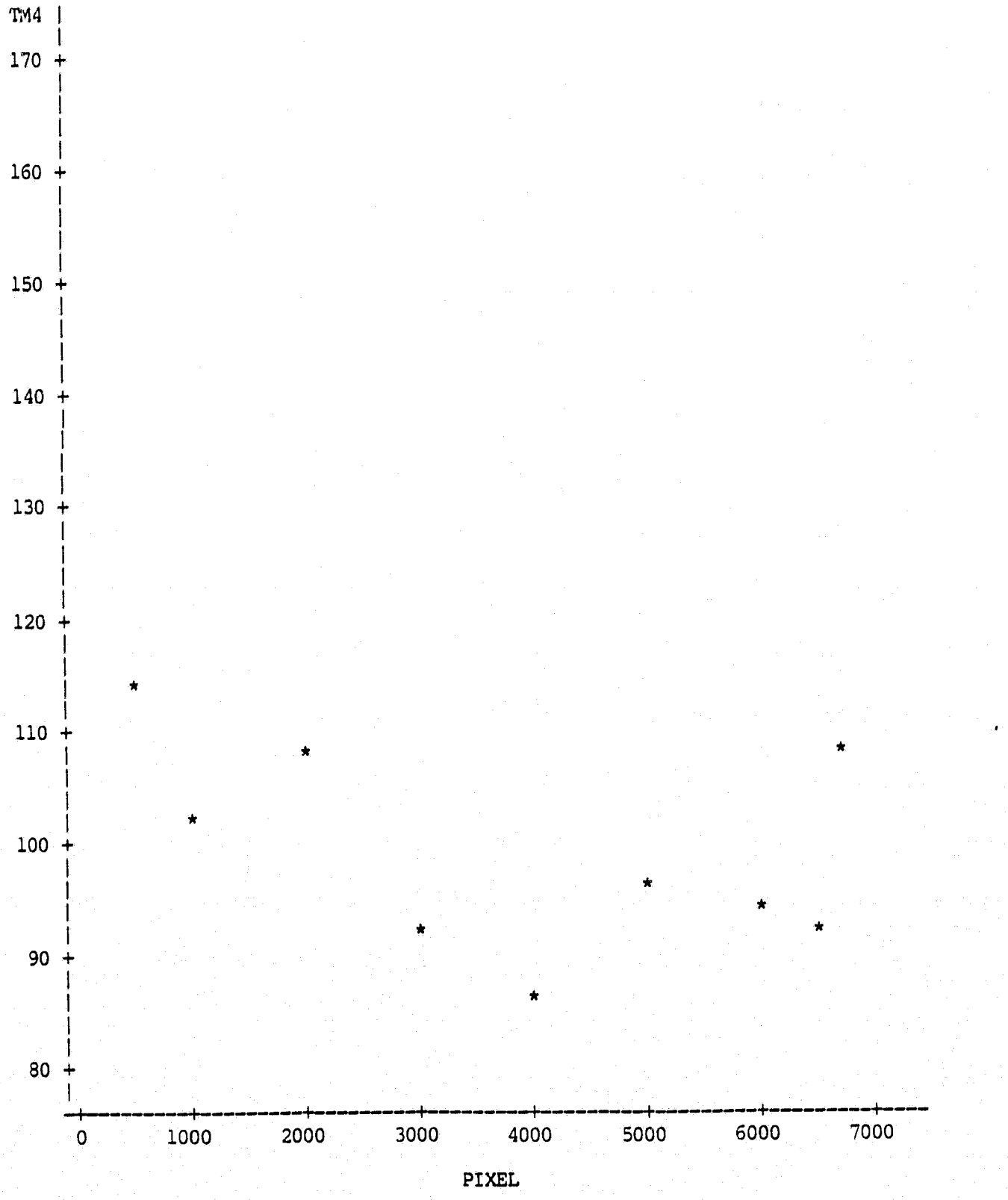

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PLOT OF TM4*PIXEL SYMBOL USED IS *

Fig. 23

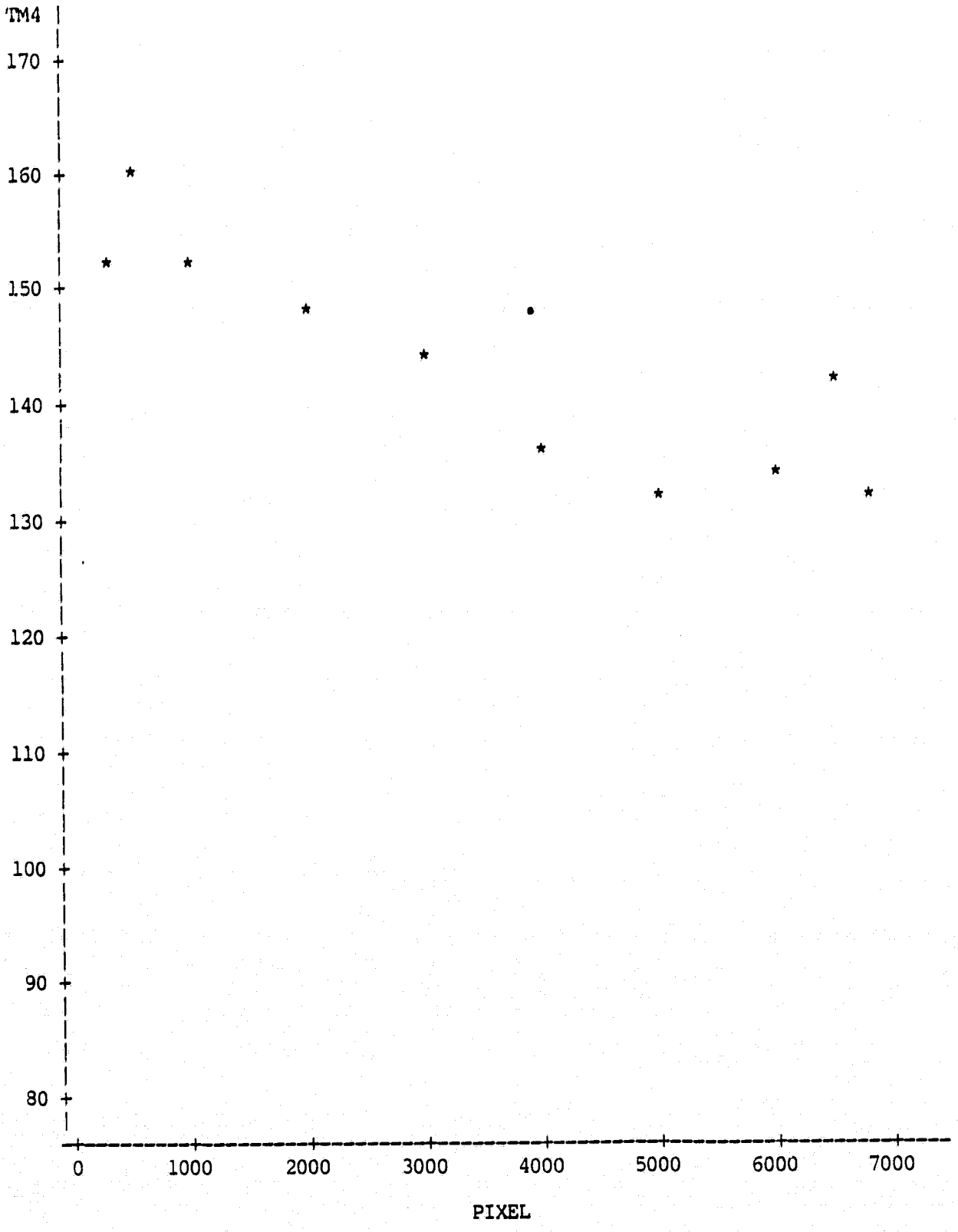

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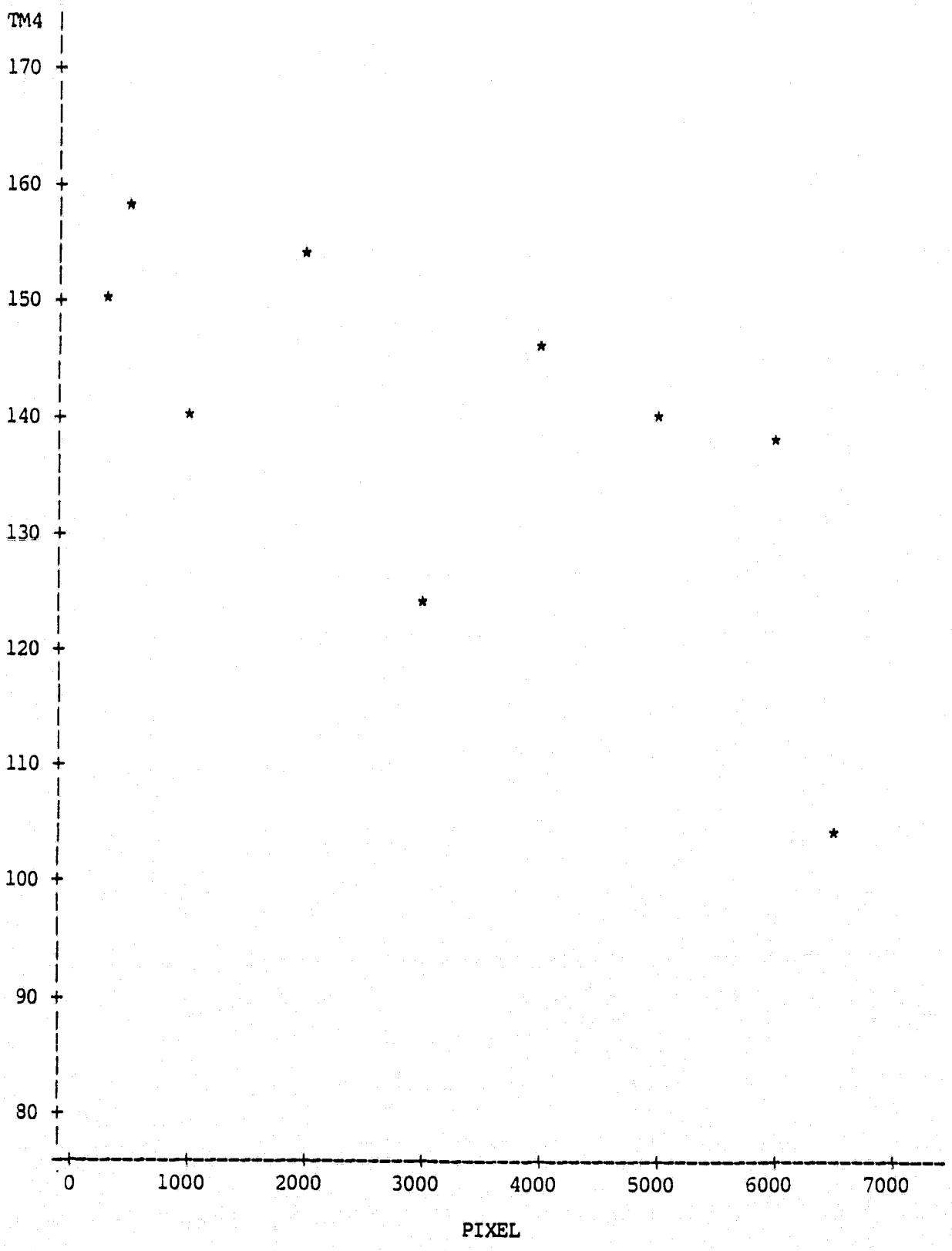
Fig. 24



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PLOT OF TM1*PIXEL SYMBOL USED IS *

Fig. 25

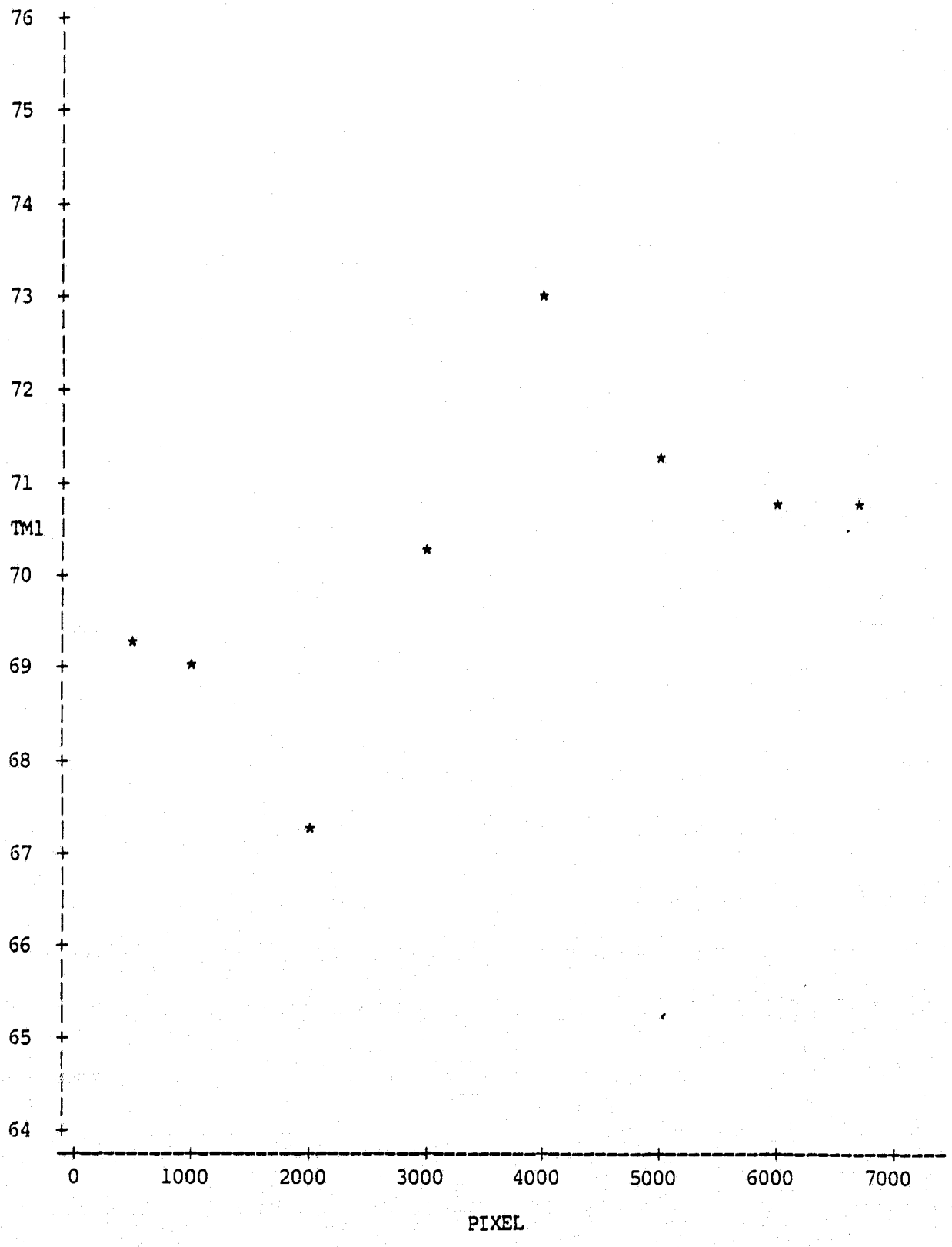

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Fig. 26

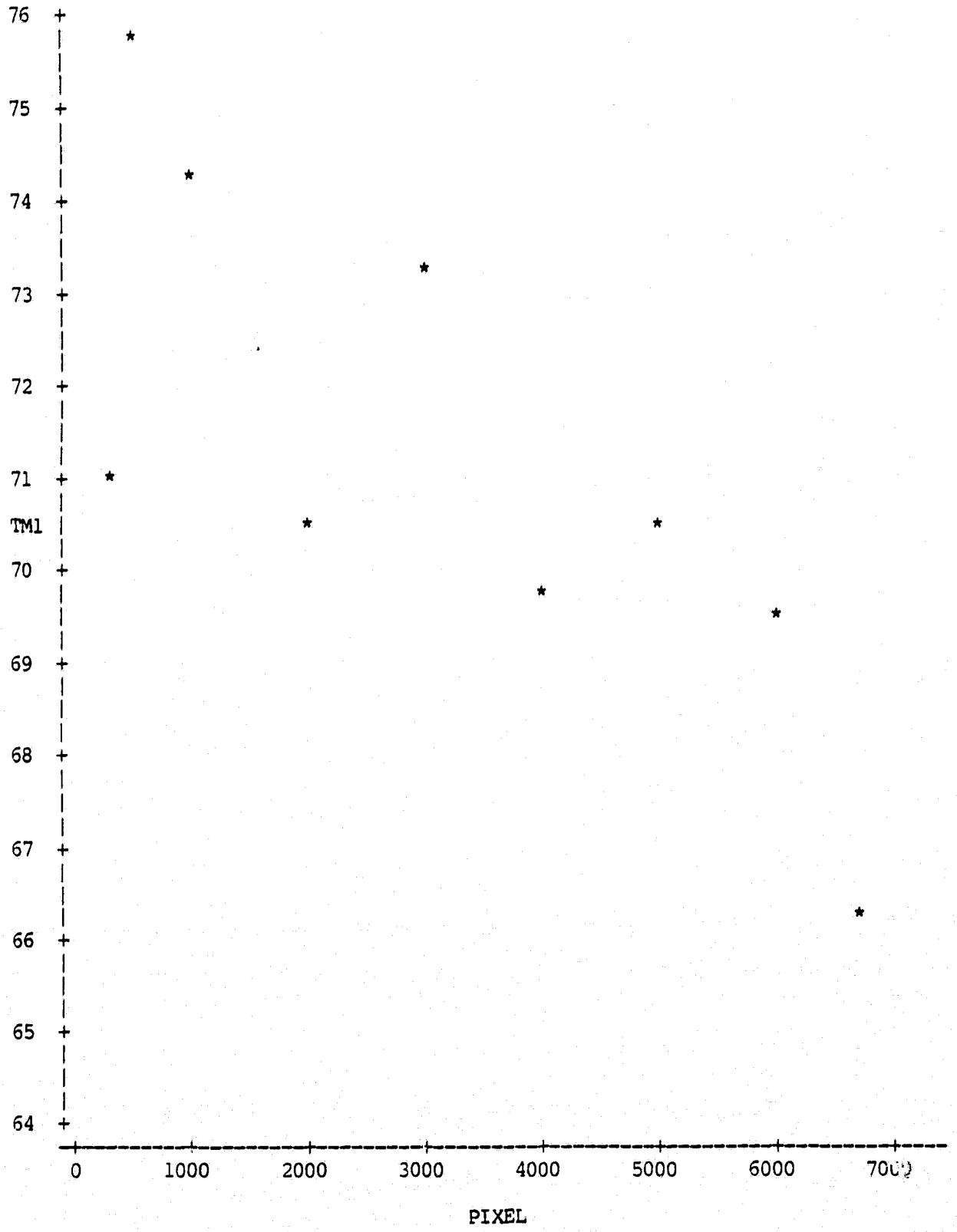

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Fig. 27

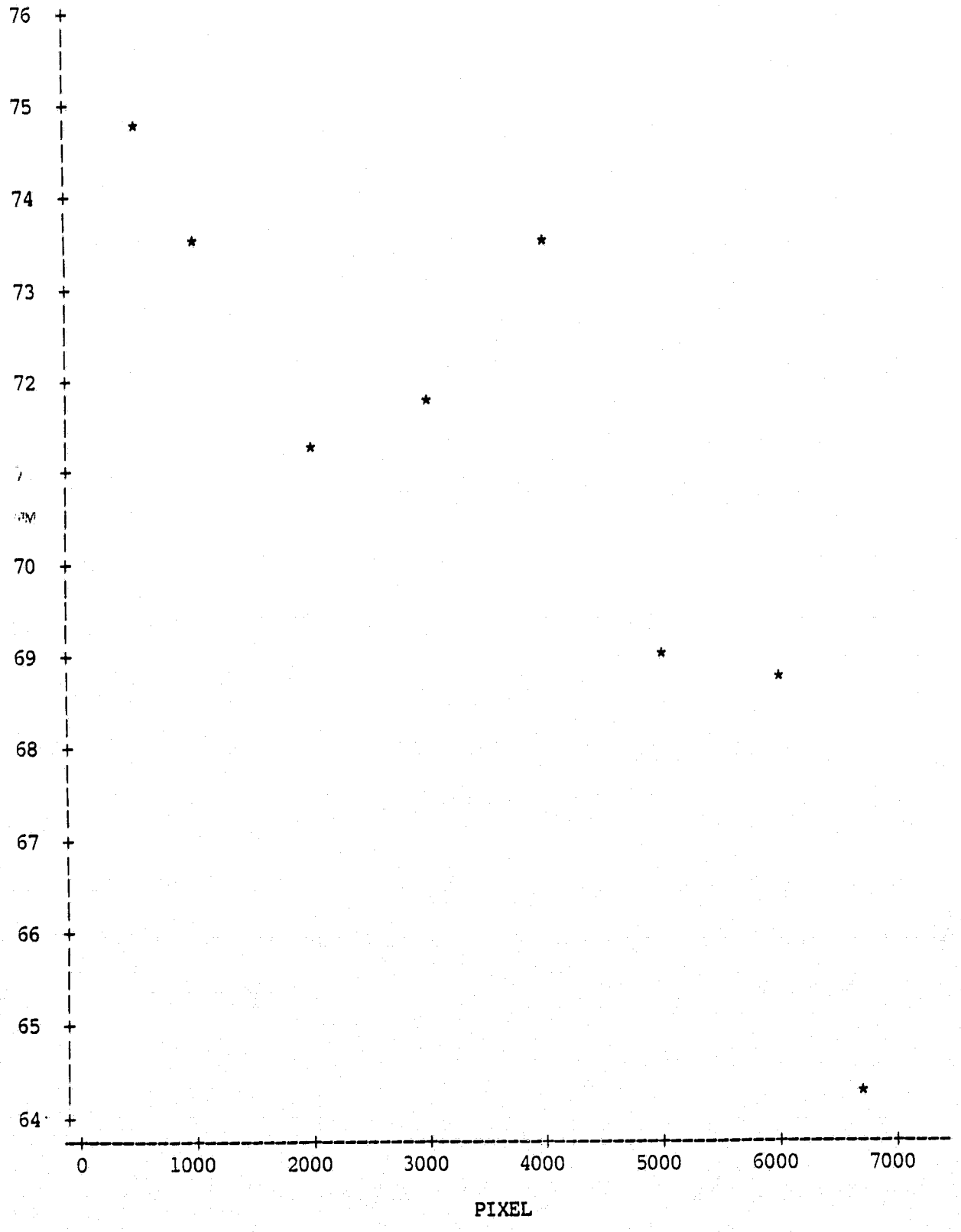

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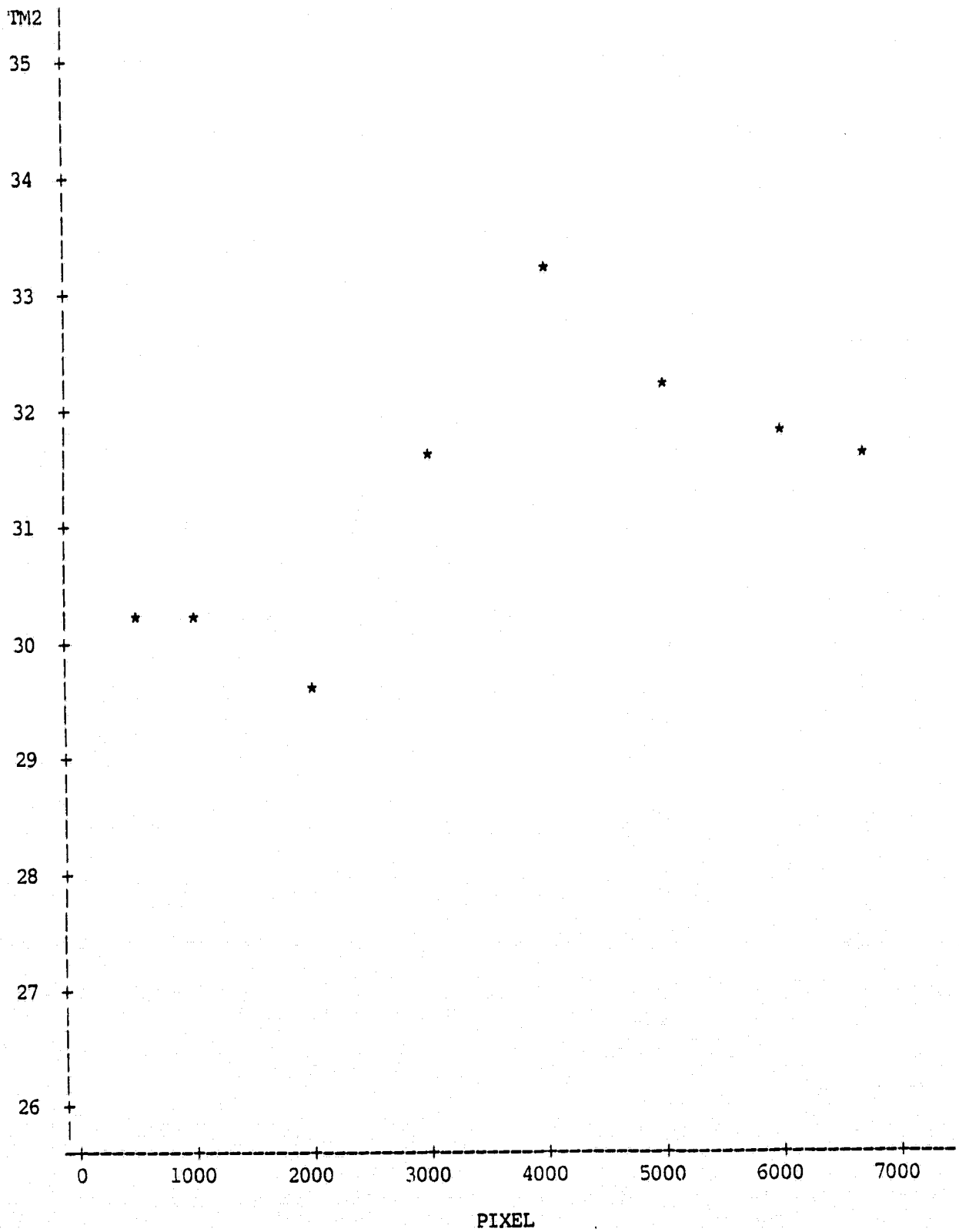
Fig. 28



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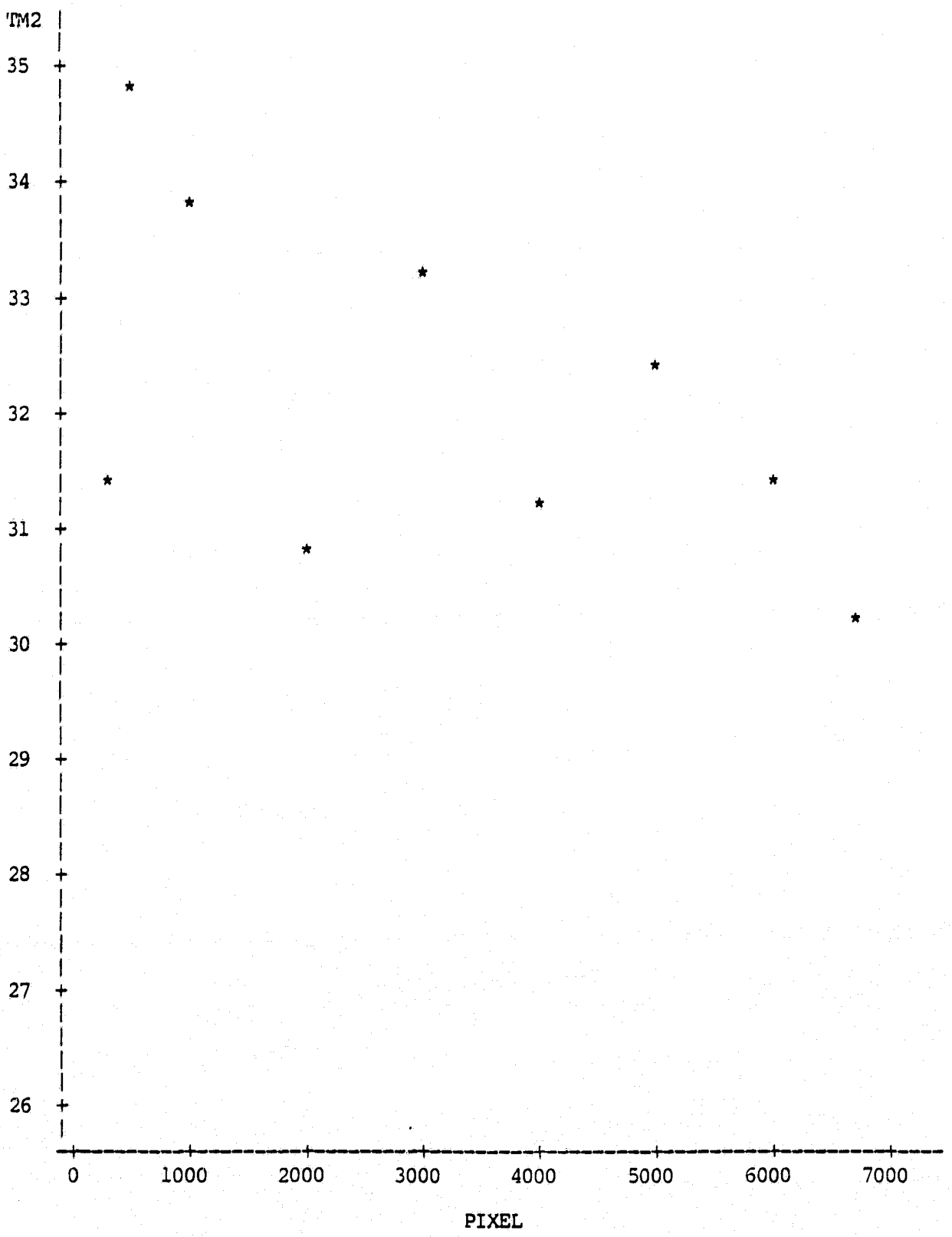
PLOT OF TM2*PIXEL SYMBOL USED IS *

Fig. 29



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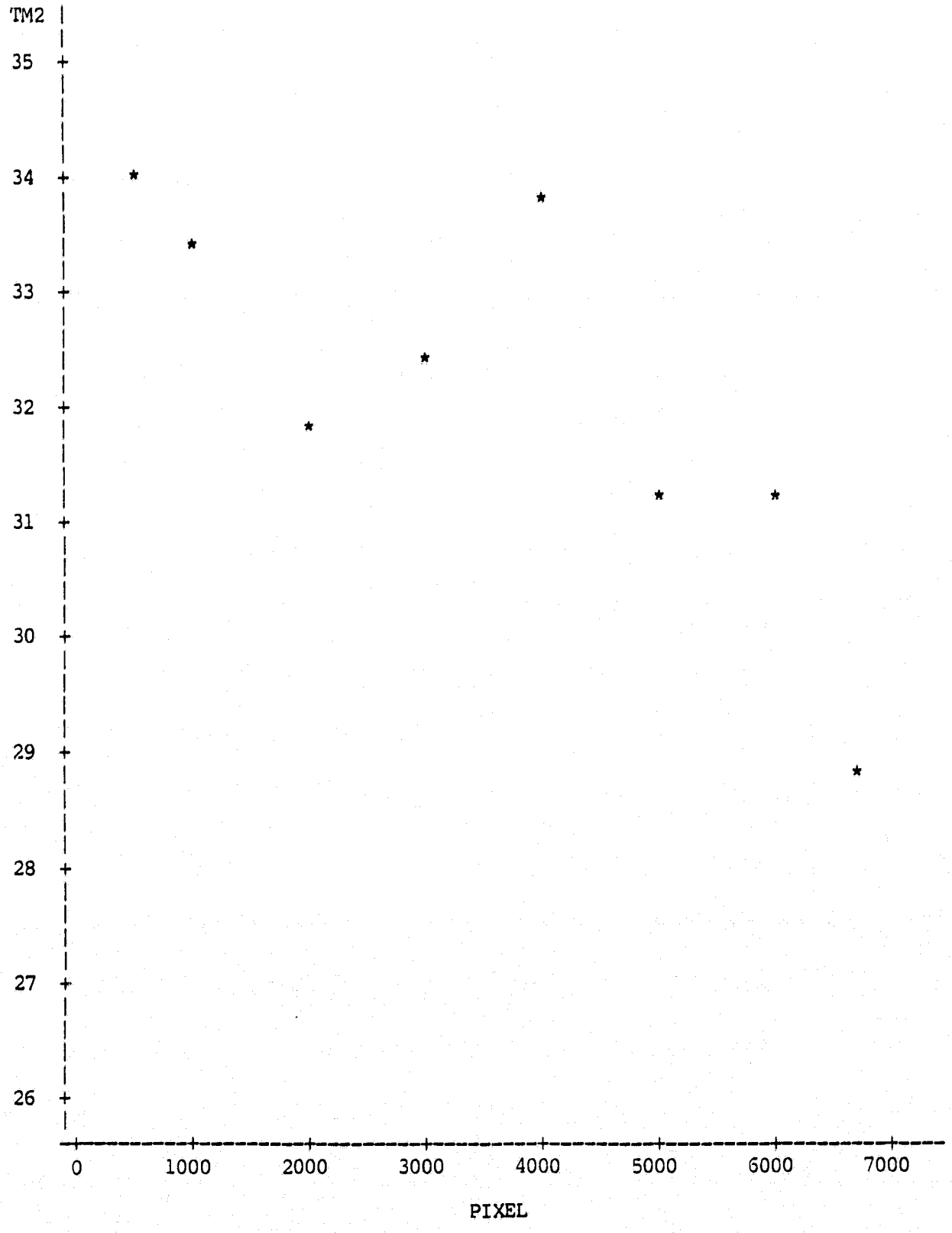
PLOT OF TM2*PIXEL SYMBOL USED IS *

Fig. 30



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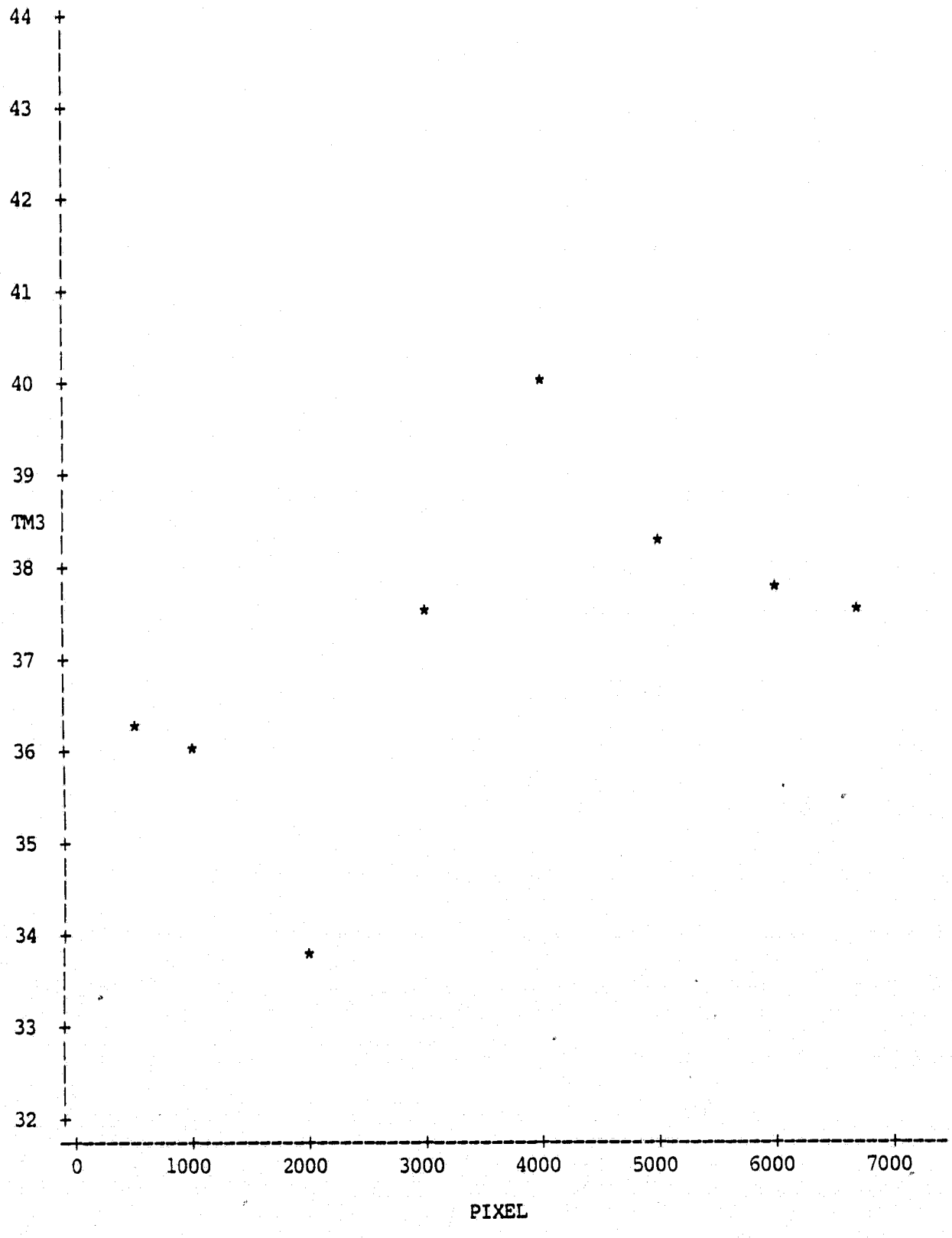
PLOT OF TM3*PIXEL SYMBOL USED IS *

Fig. 31



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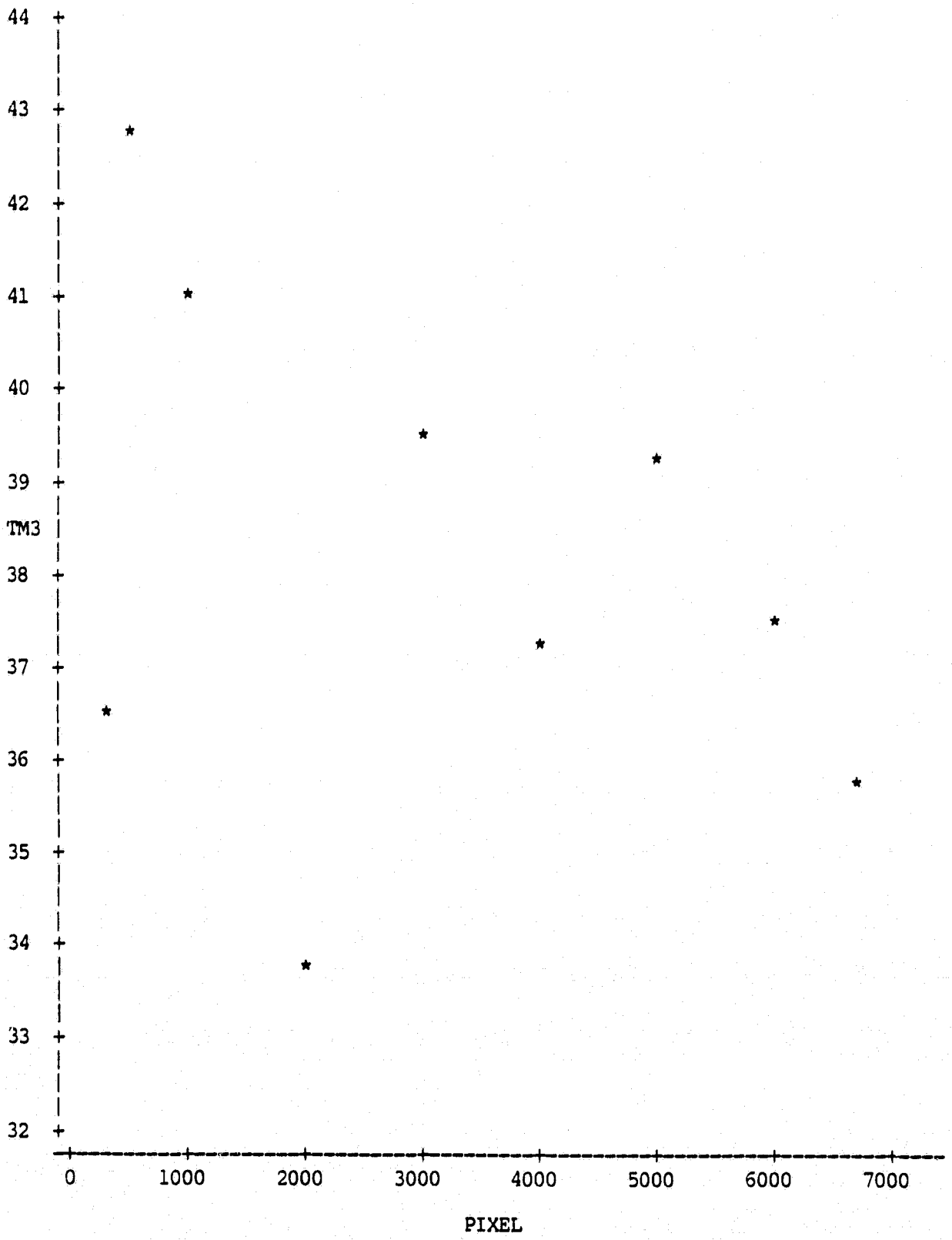
PLOT OF TM3*PIXEL SYMBOL USED IS *

Fig. 32



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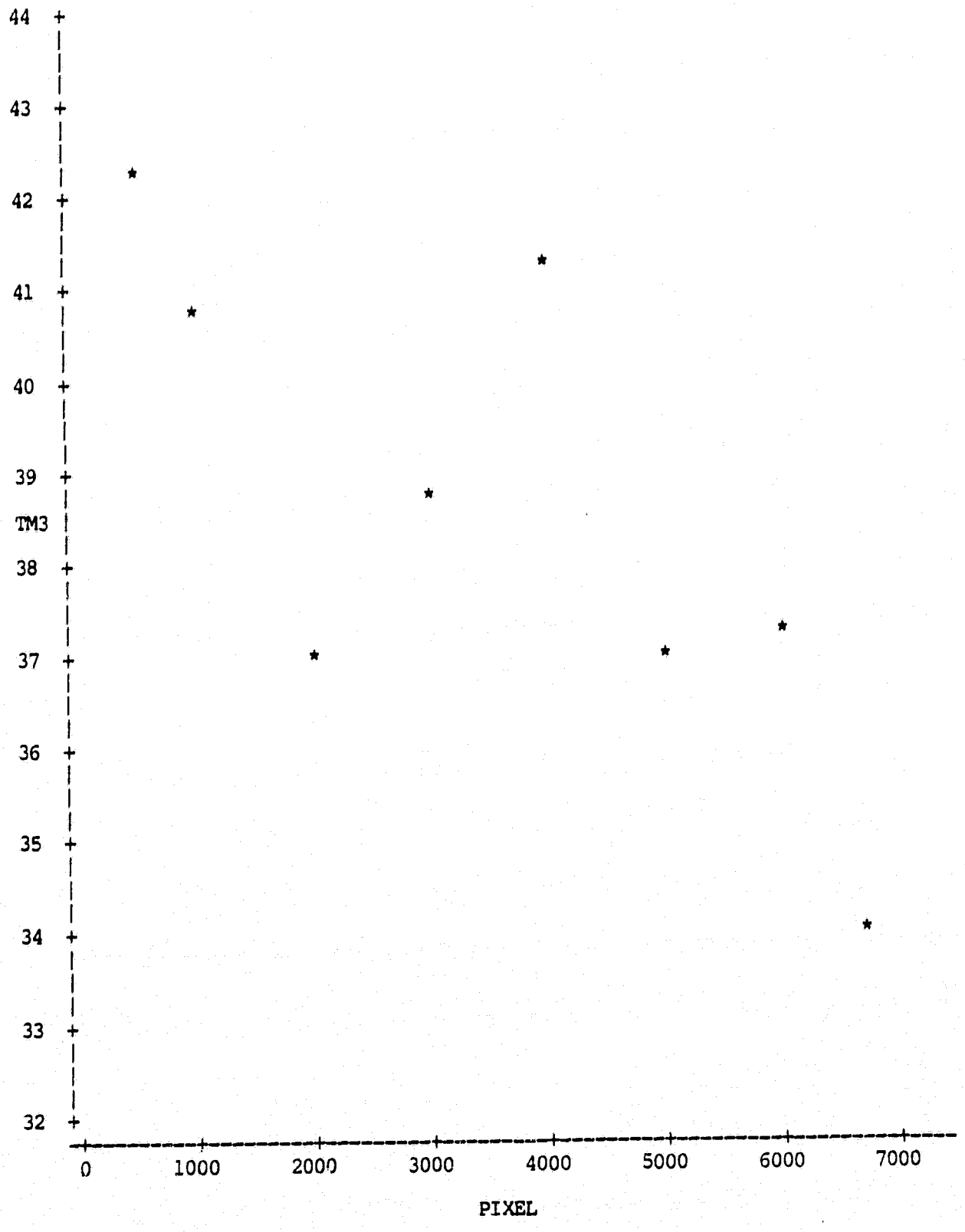
PLOT OF TM3*PIXEL SYMBOL USED IS *

Fig. 33



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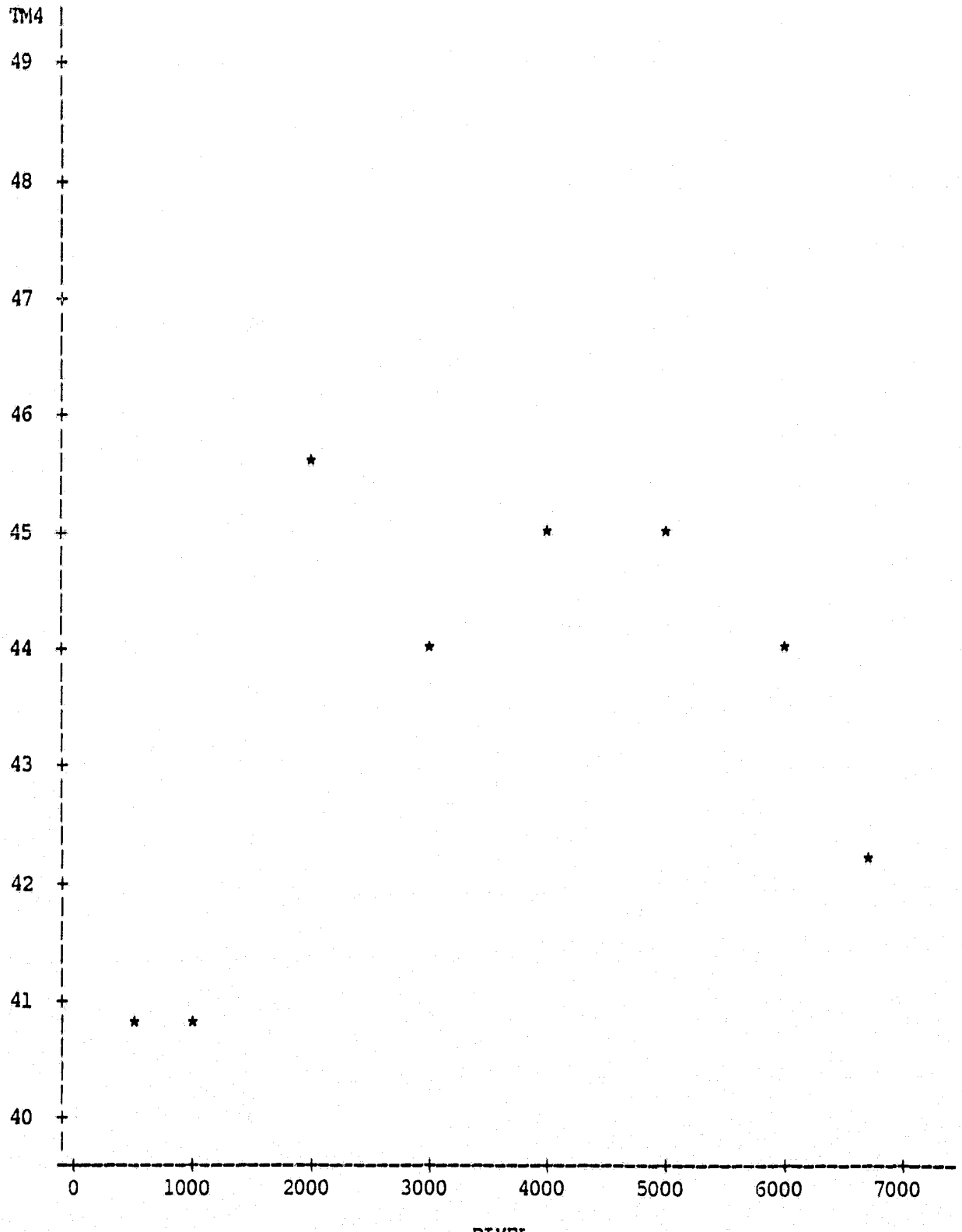
PLOT OF TM4*PIXEL SYMBOL USED IS *

Fig. 34



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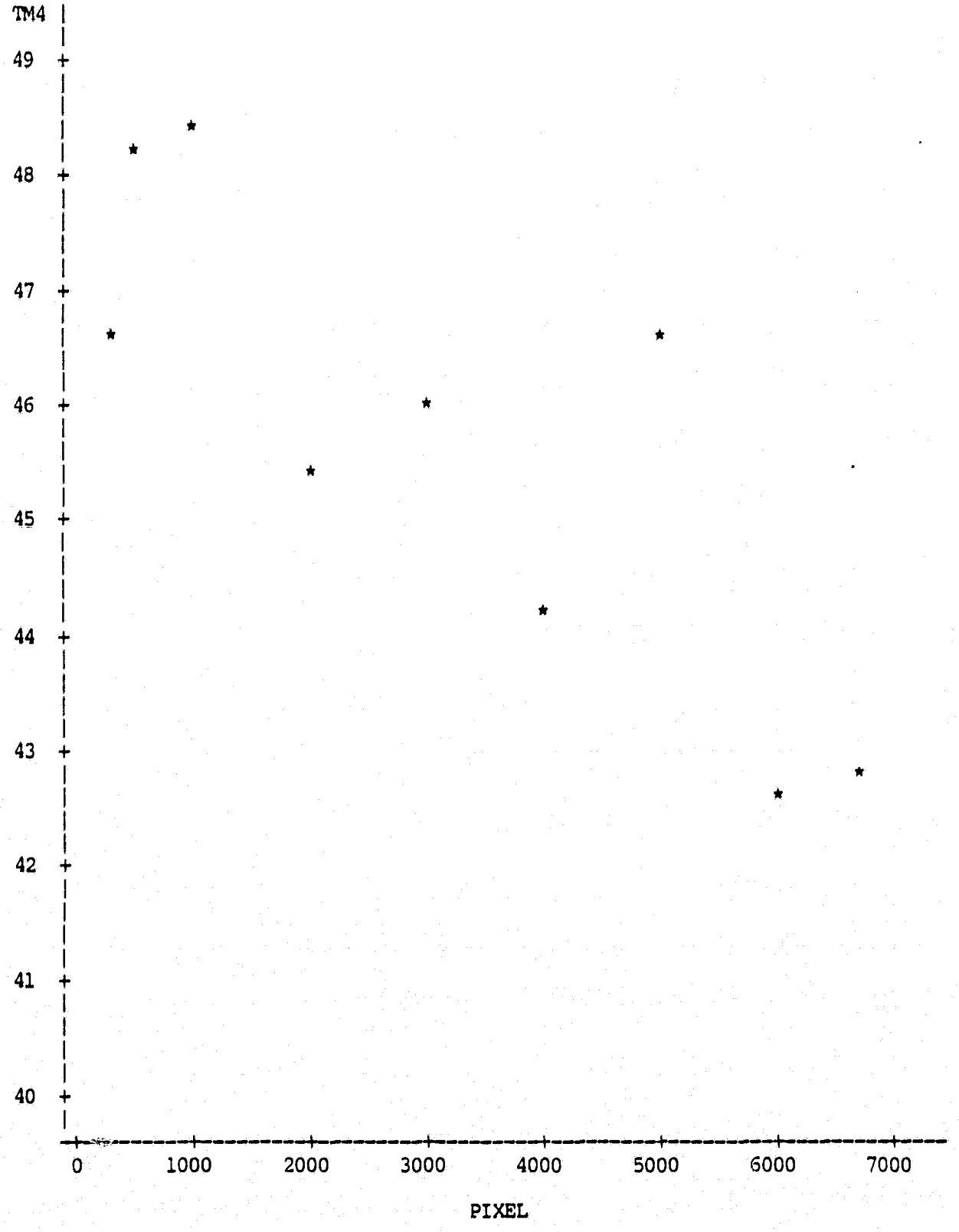
PLOT OF TM4*PIXEL SYMBOL USED IS *

Fig. 35



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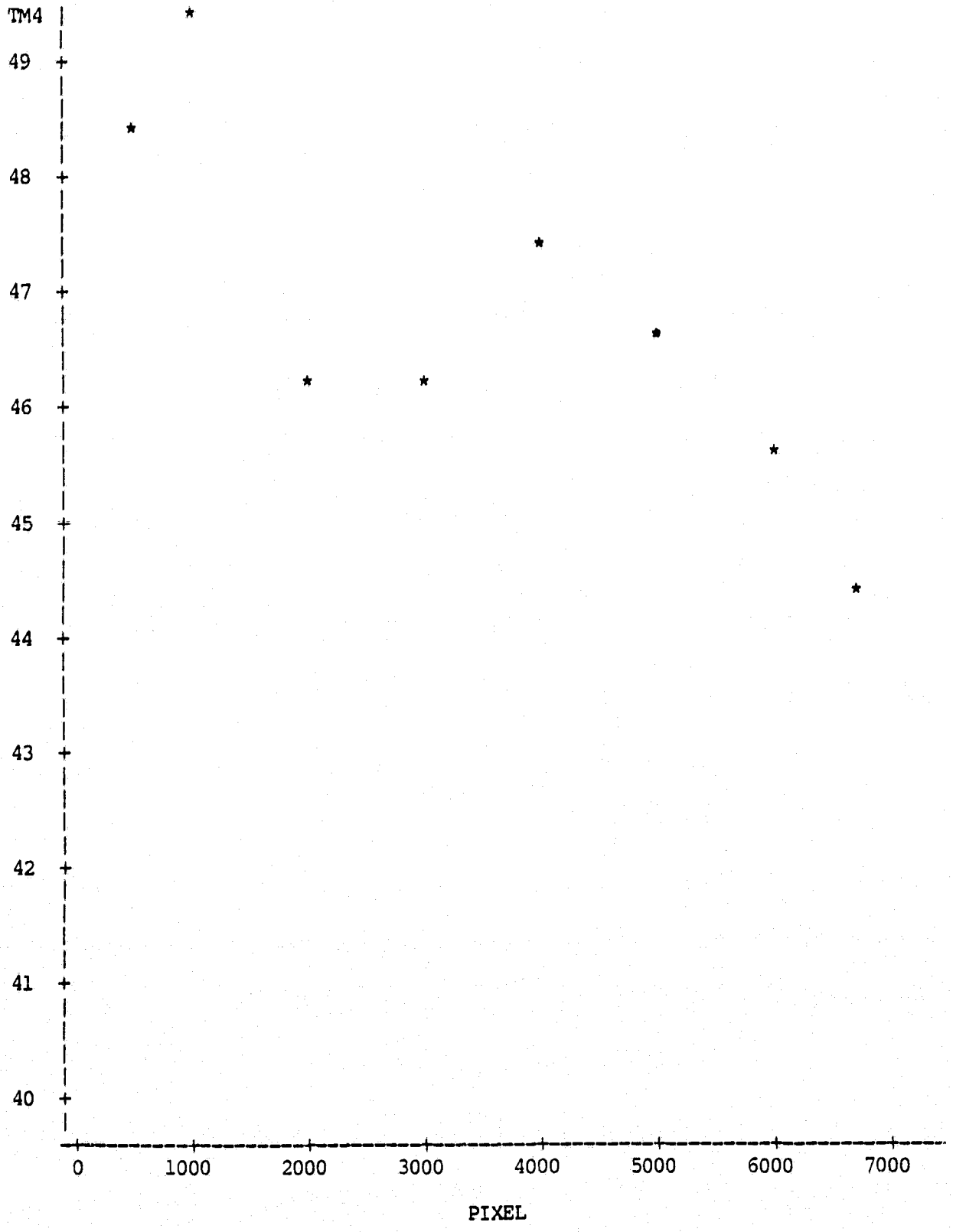
PLOT OF TM4*PIXEL SYMBOL USED IS *

Fig. 36



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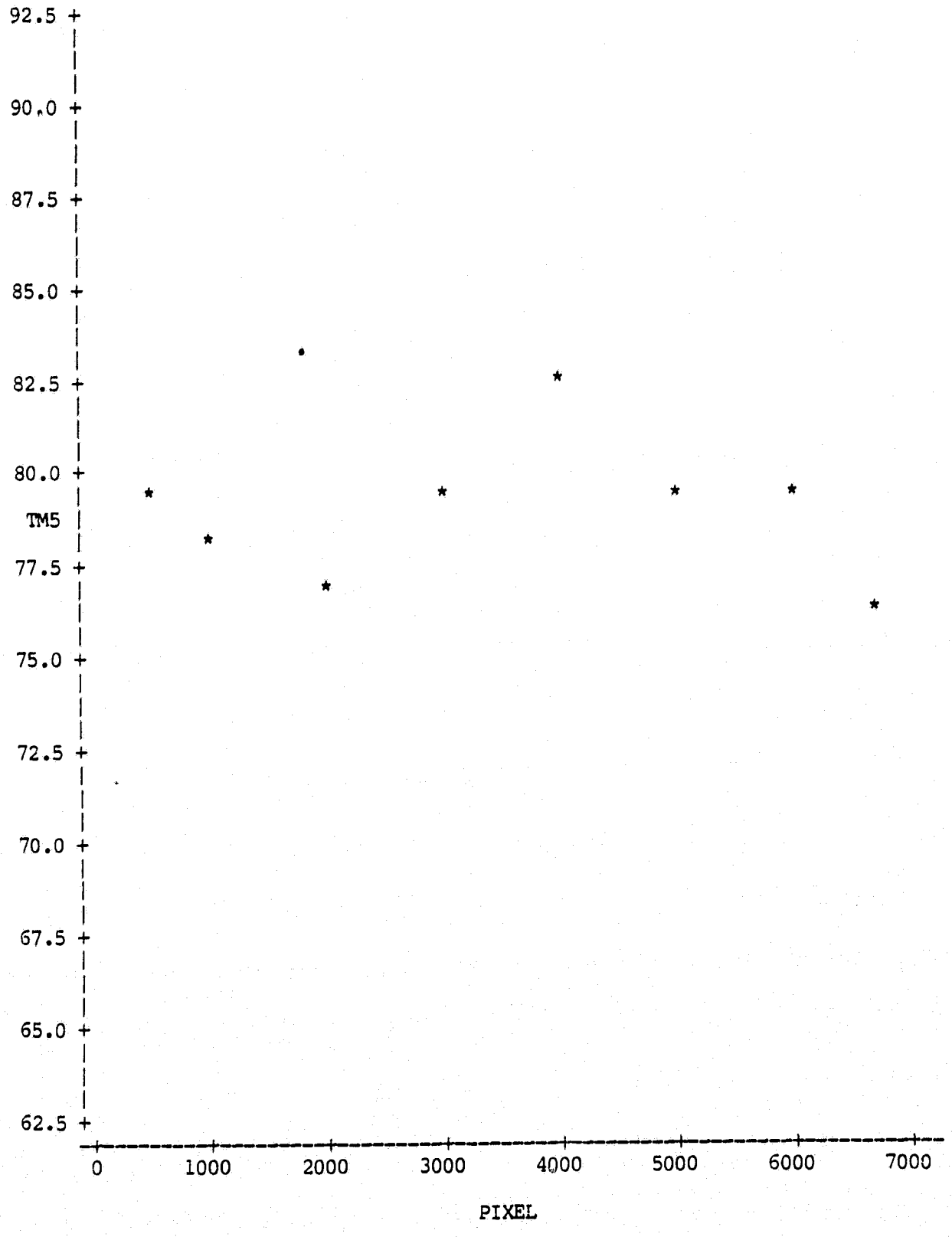
PLOT OF TM5*PIXEL SYMBOL USED IS *

Fig. 37



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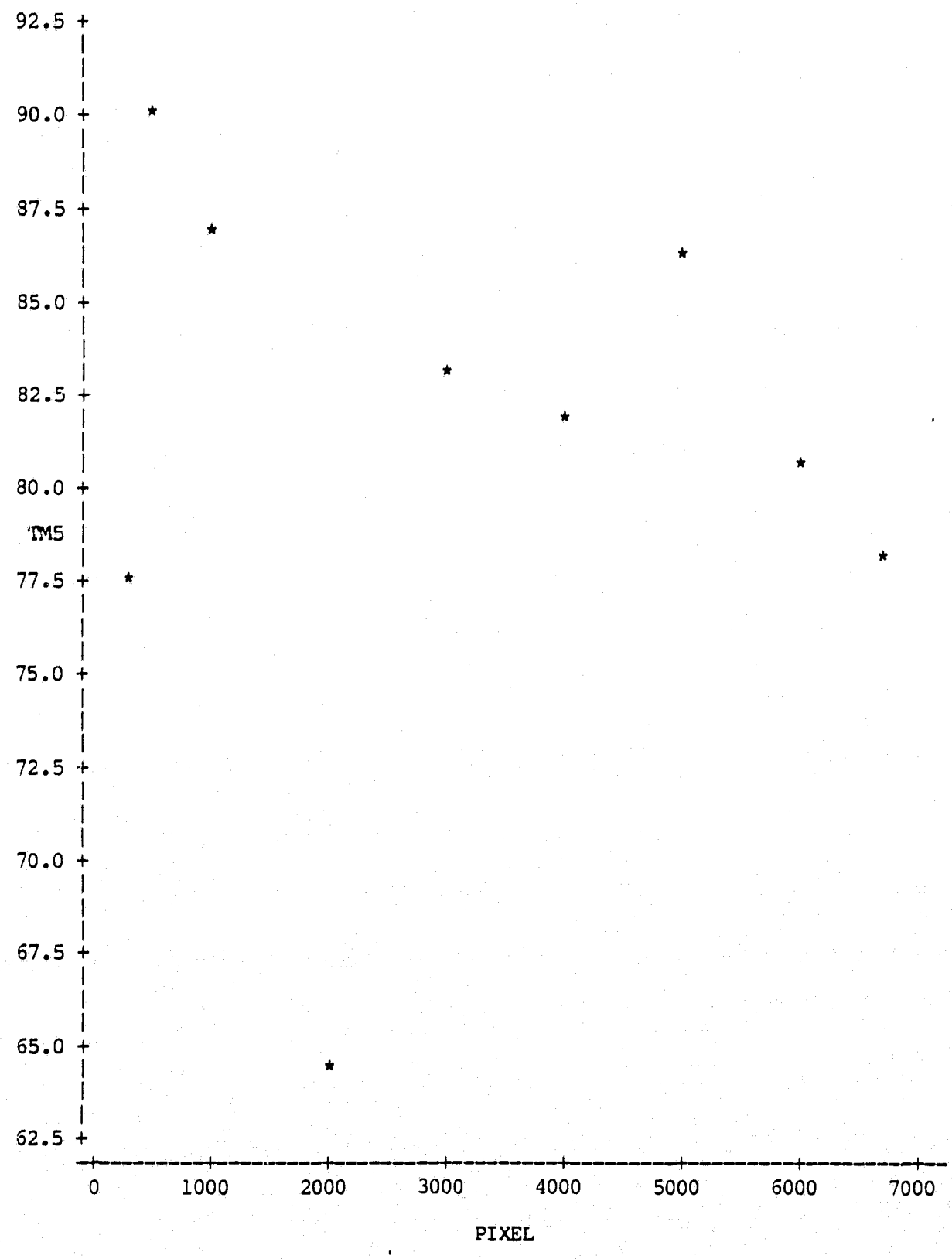
PLOT OF TM5*PIXEL SYMBOL USED IS *

Fig. 38



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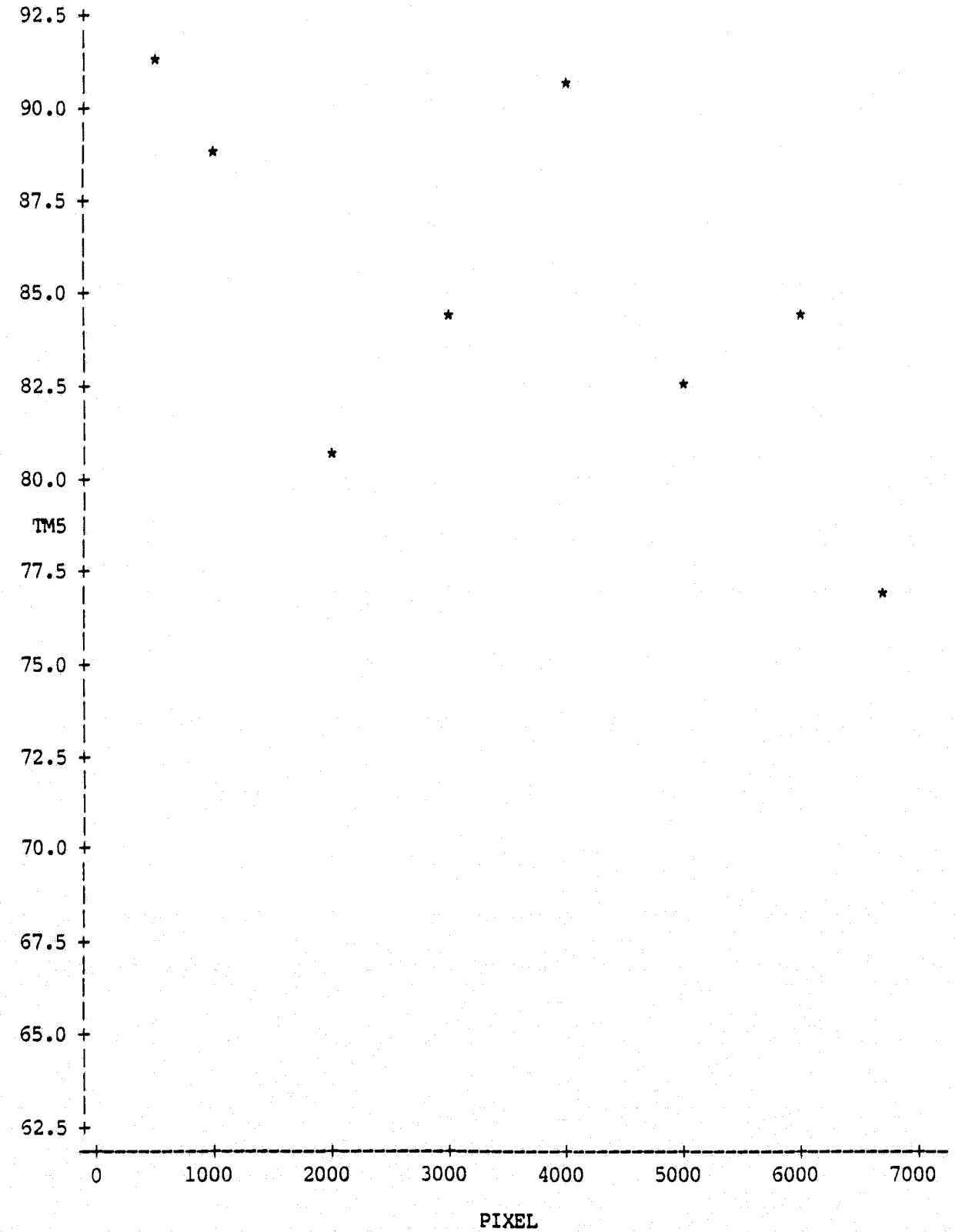
PLOT OF TM5*PIXEL SYMBOL USED IS *

Fig. 39



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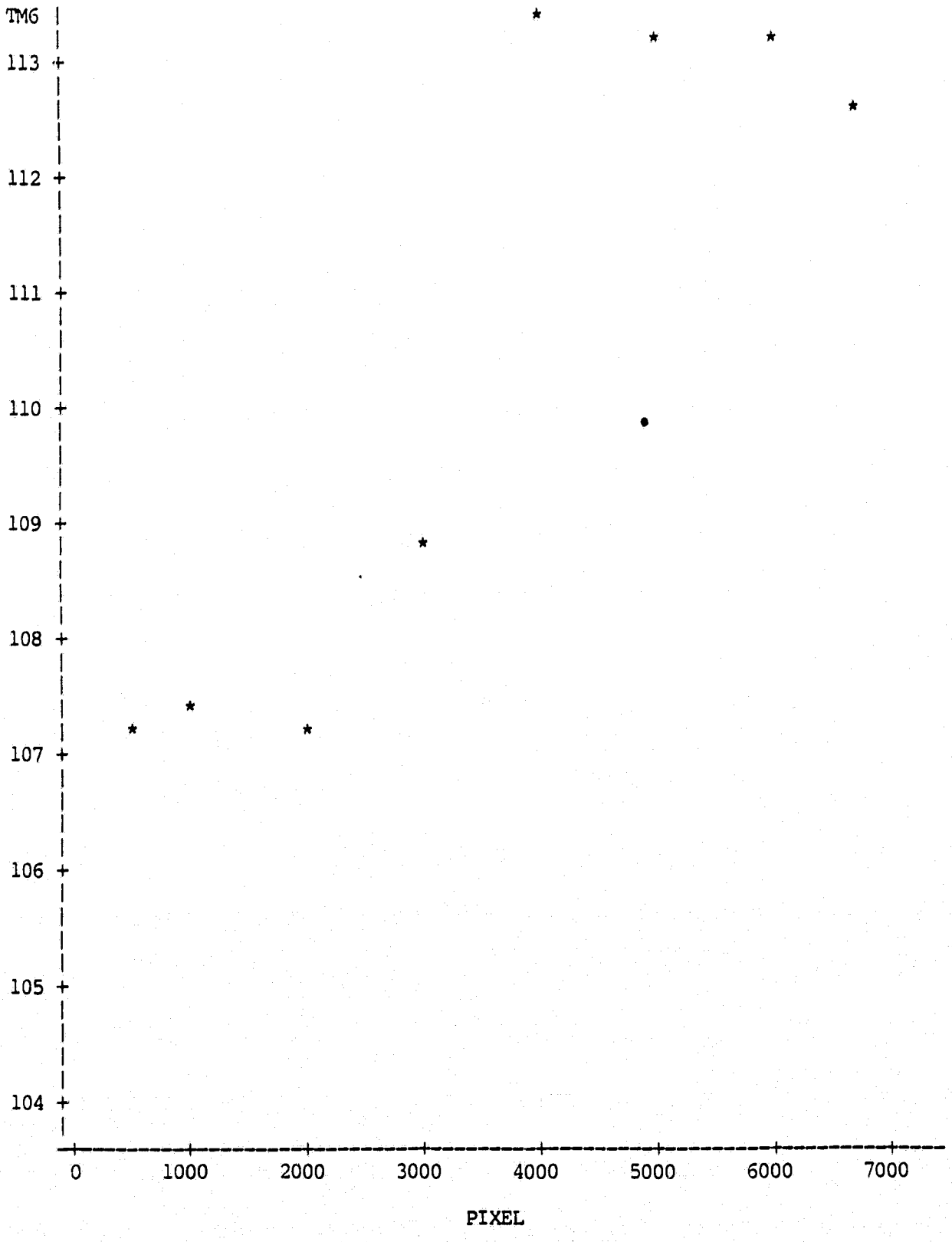
PLOT OF TM6*PIXEL SYMBOL USED IS *

Fig. 40



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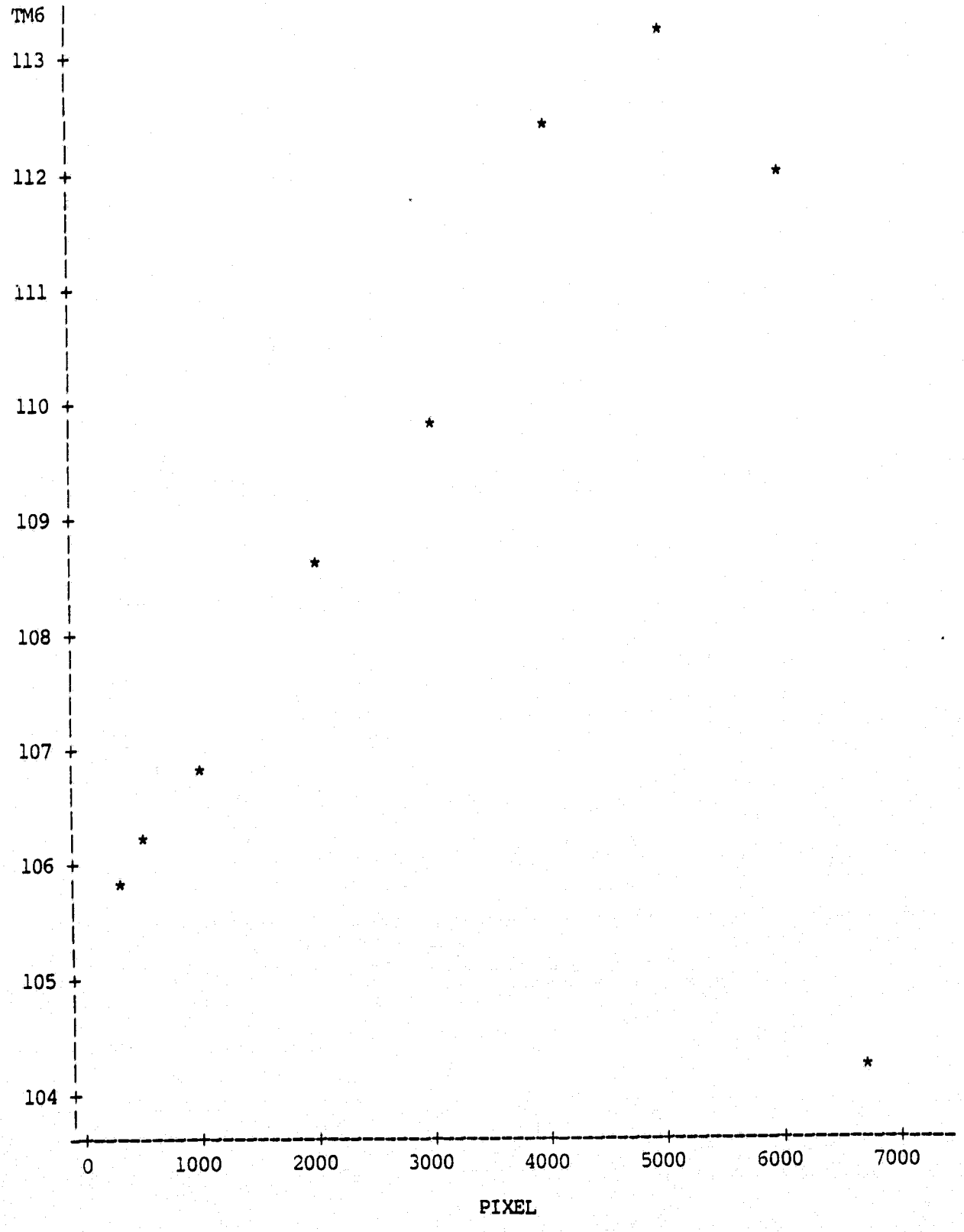
PLOT OF TM6*PIXEL SYMBOL USED IS *

Fig. 41



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PLOT OF TM6*PIXEL SYMBOL USED IS *

Fig. 42

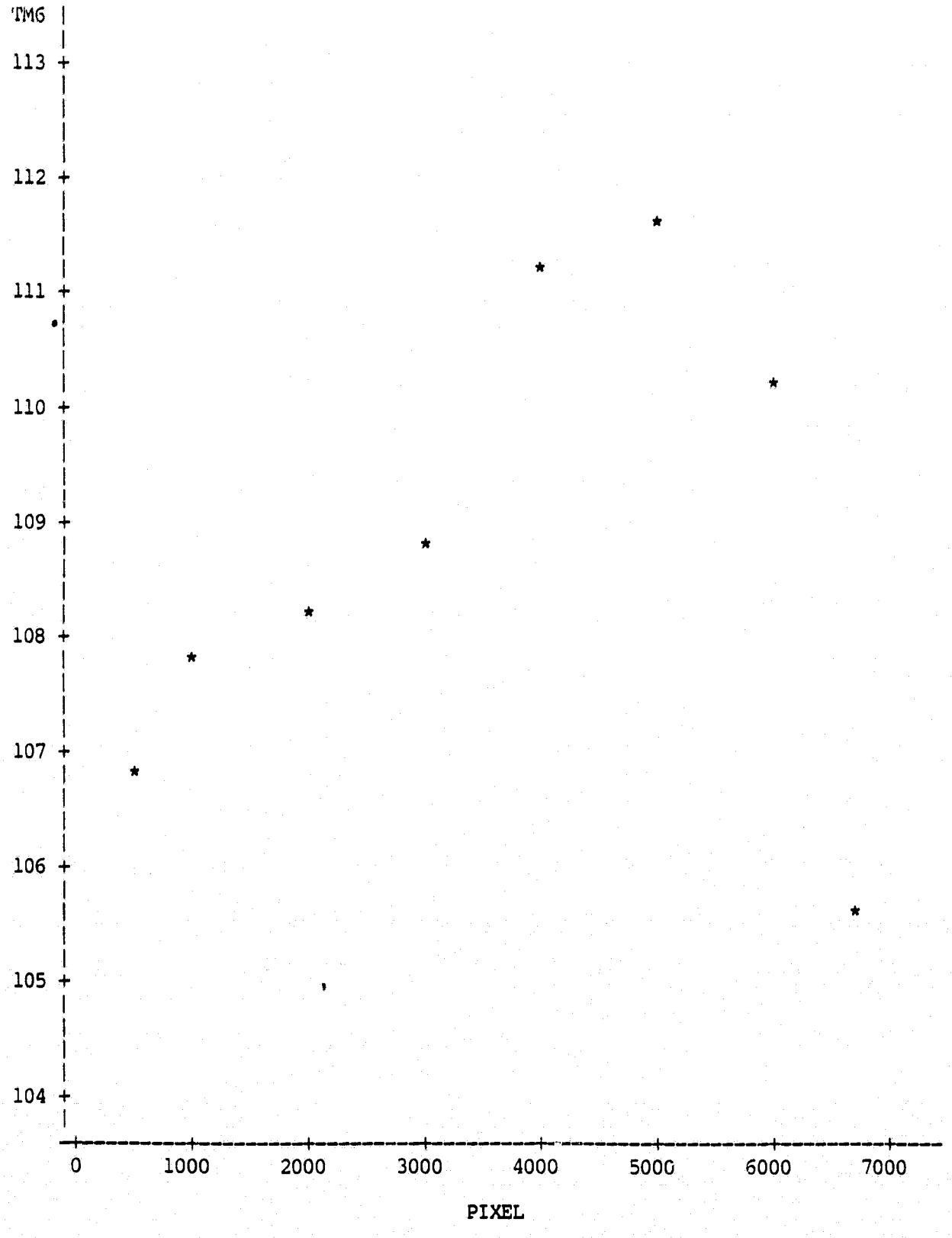

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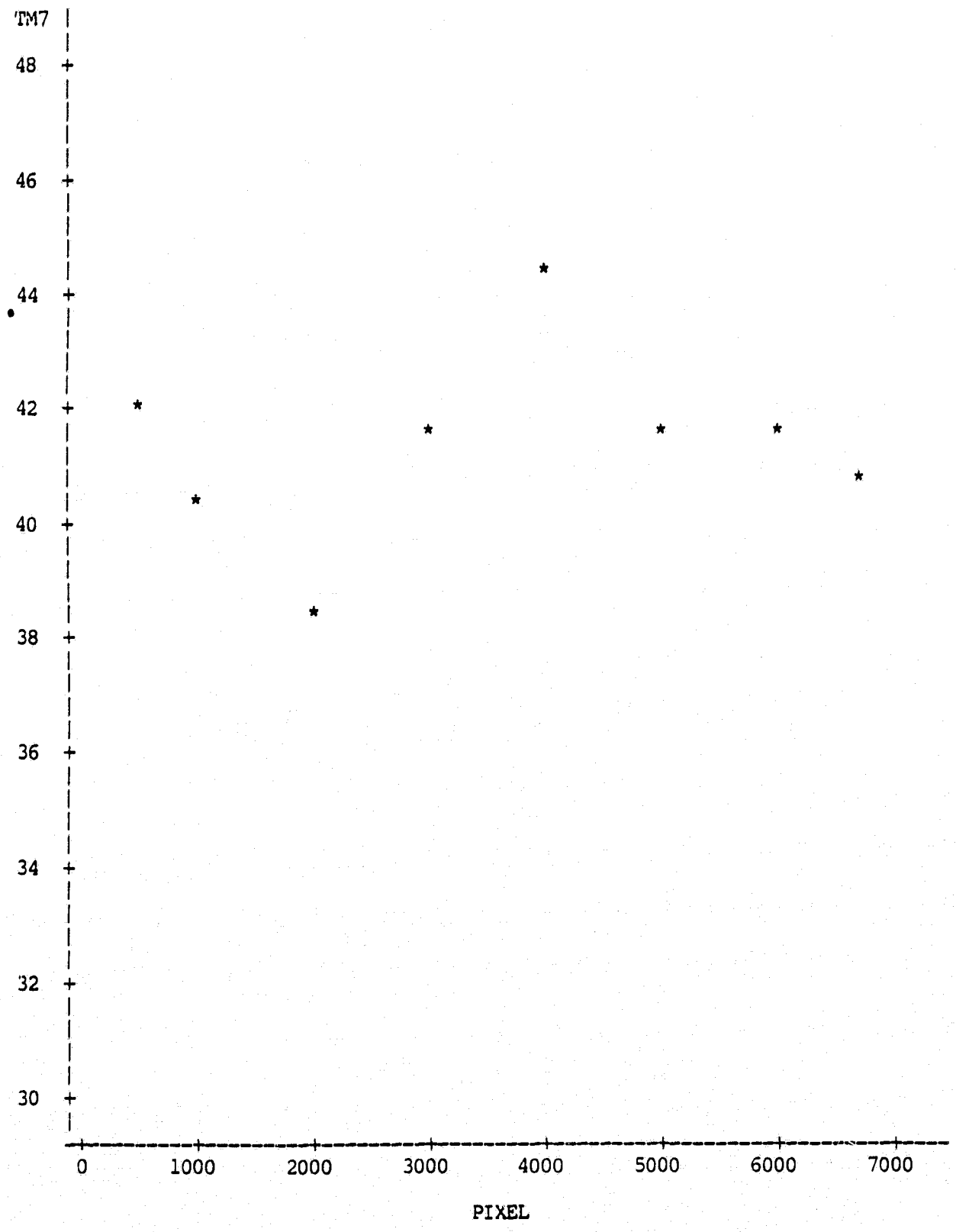
Fig. 43



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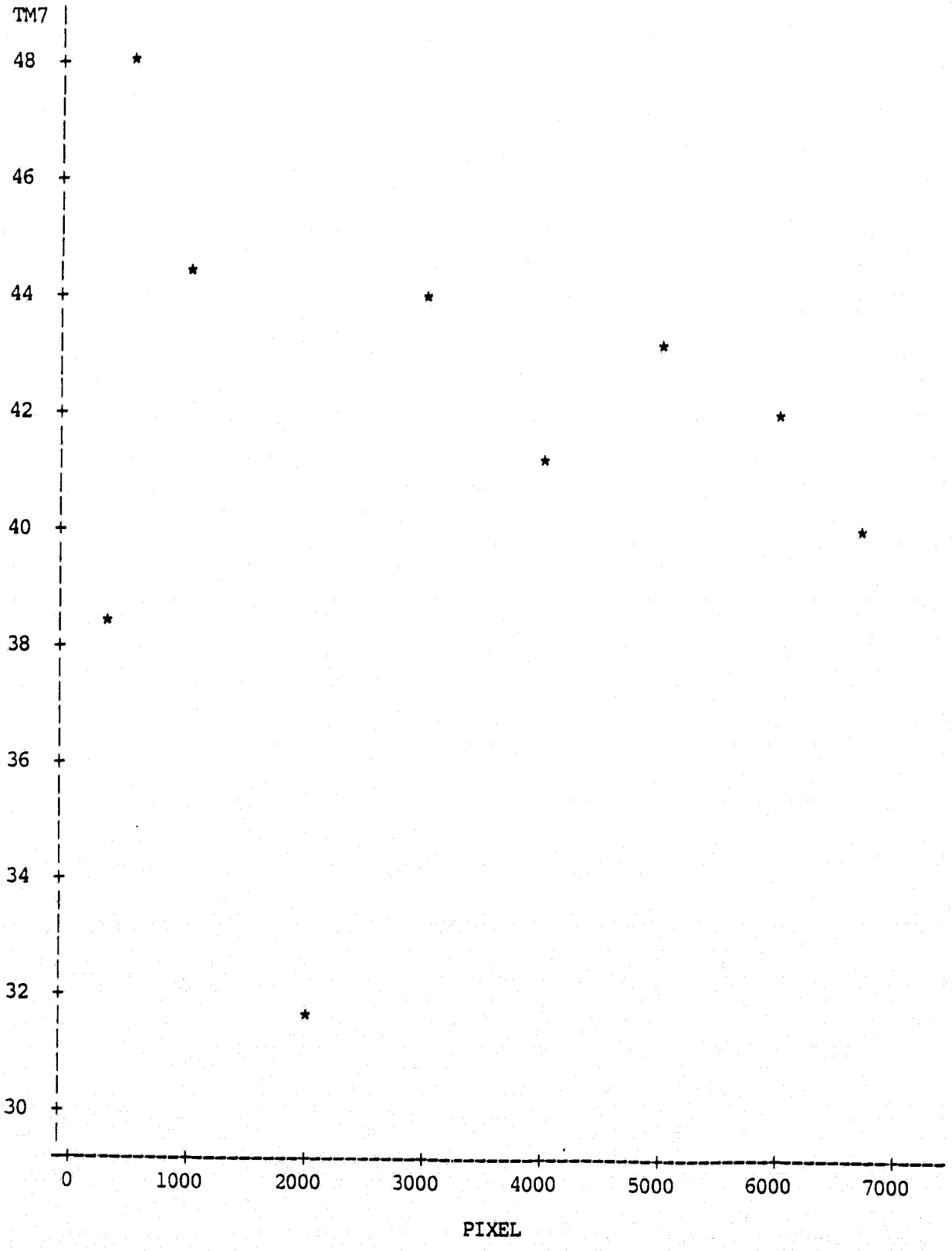
PLOT OF TM7*PIXEL SYMBOL USED IS *

Fig. 44



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PLOT OF TM7*PIXEL SYMBOL USED IS *

Fig. 45

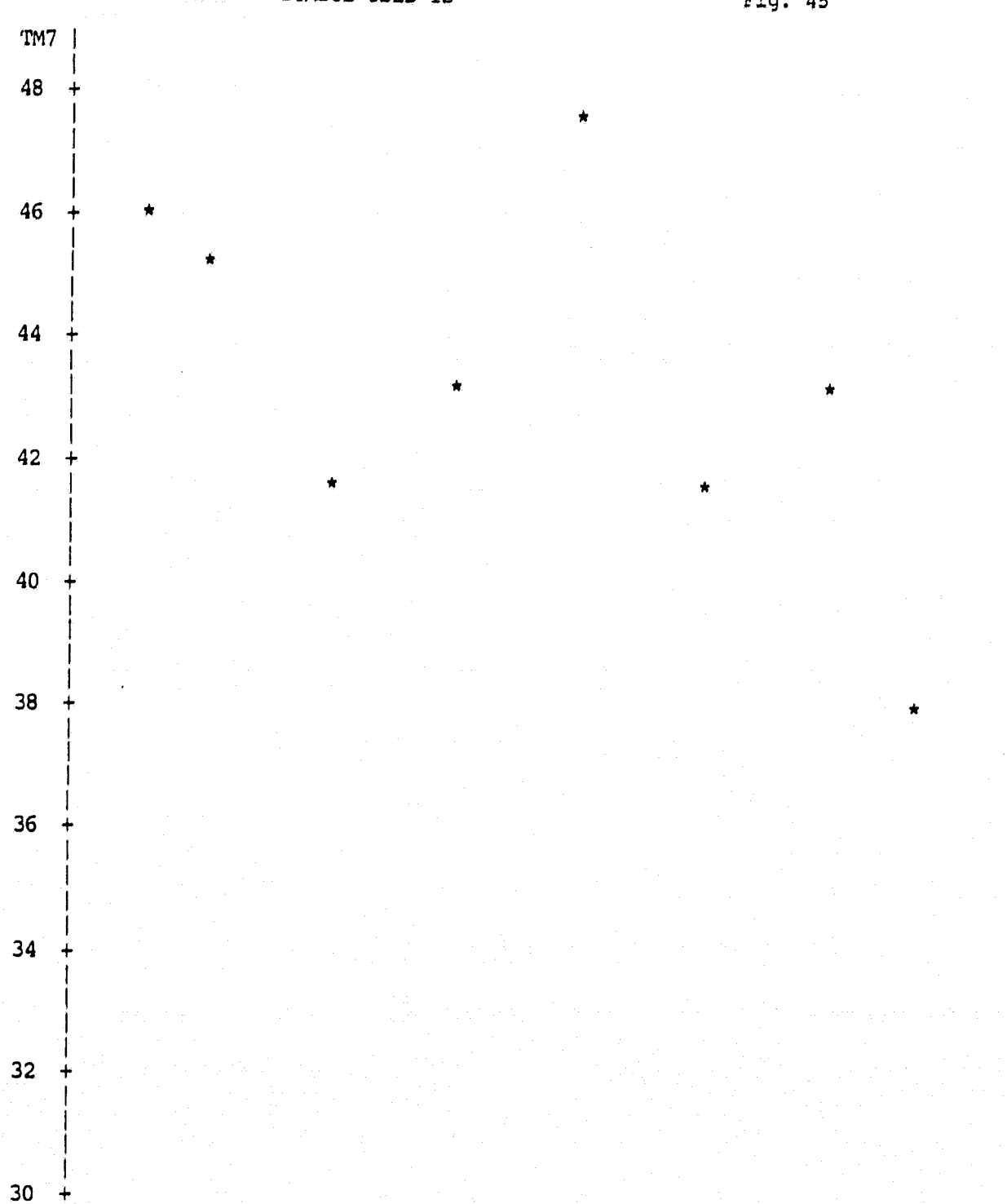

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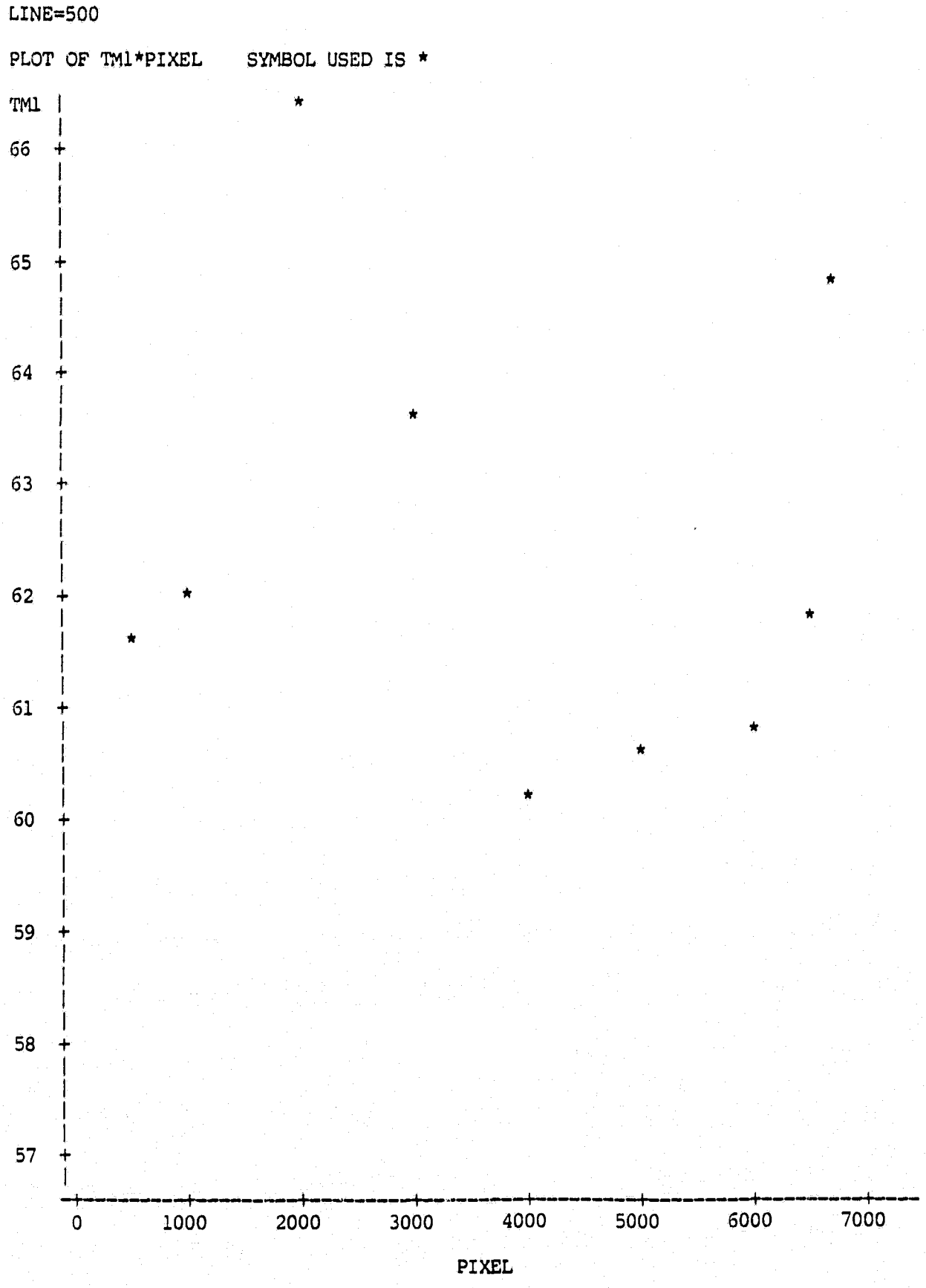
Fig. 46



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PLOT OF TM1*PIXEL SYMBOL USED IS *

Fig. 47

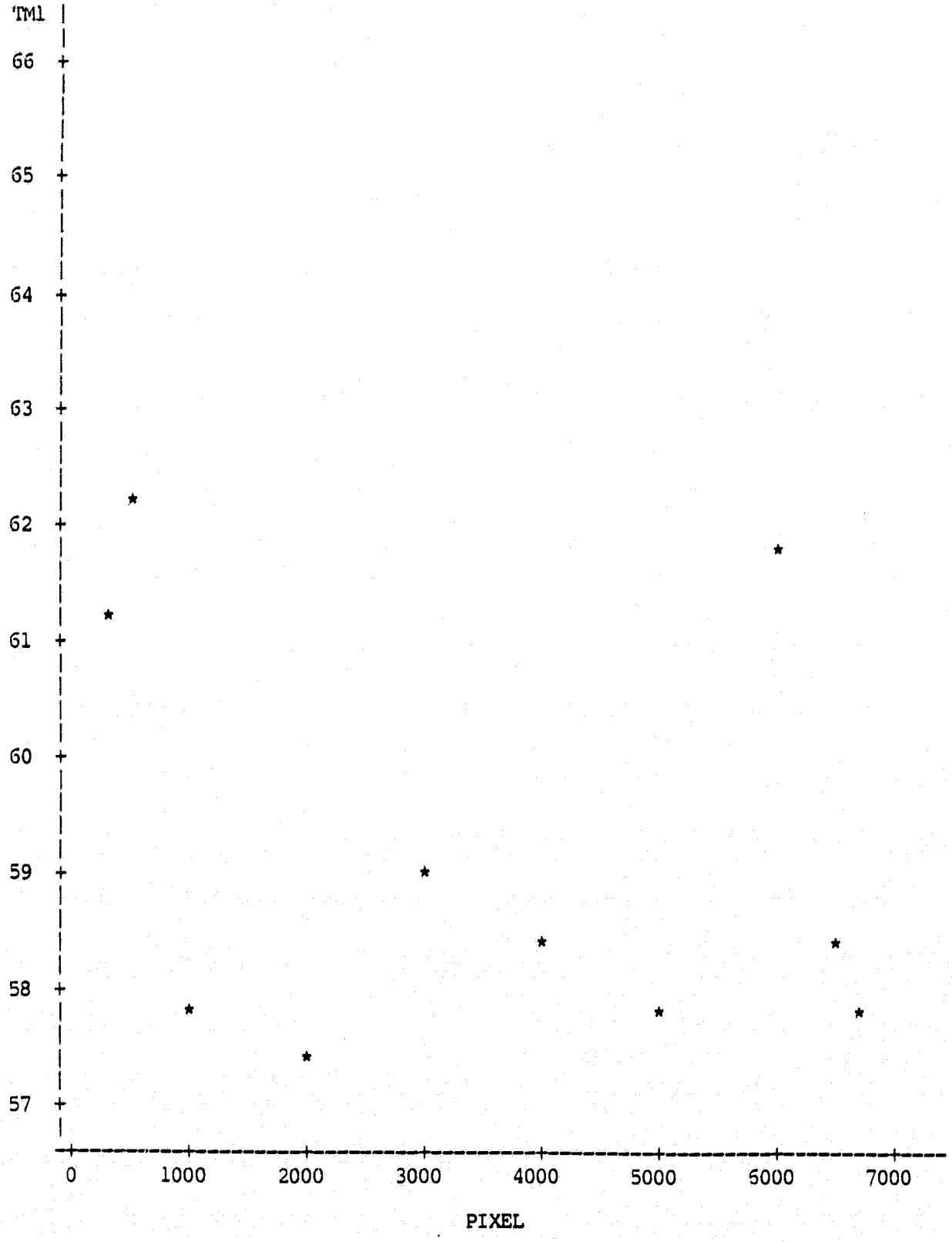

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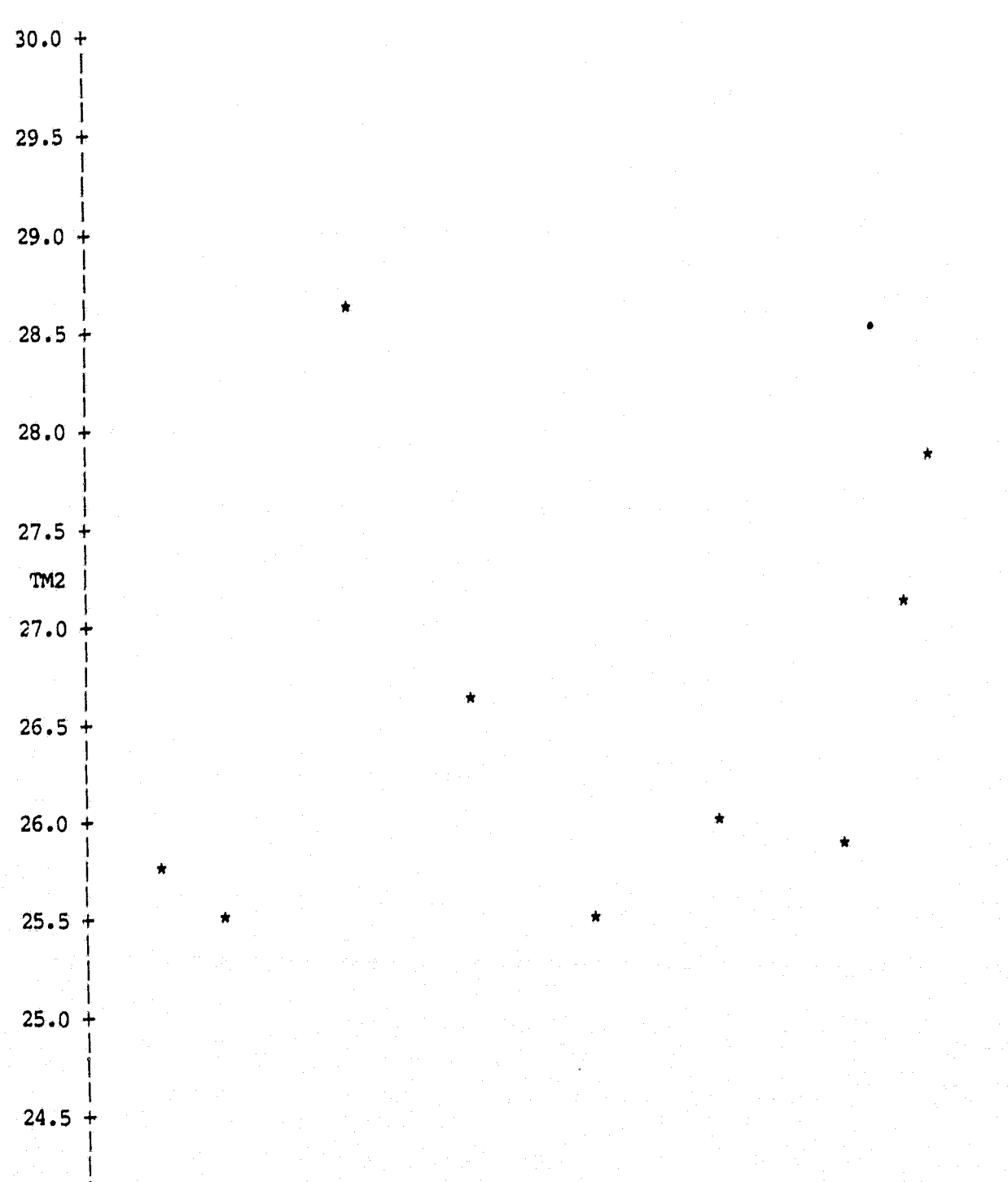
Fig. 48

PLOT OF TM2*PIXEL SYMBOL USED IS *



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PLOT OF TM2*PIXEL SYMBOL USED IS *

Fig. 49

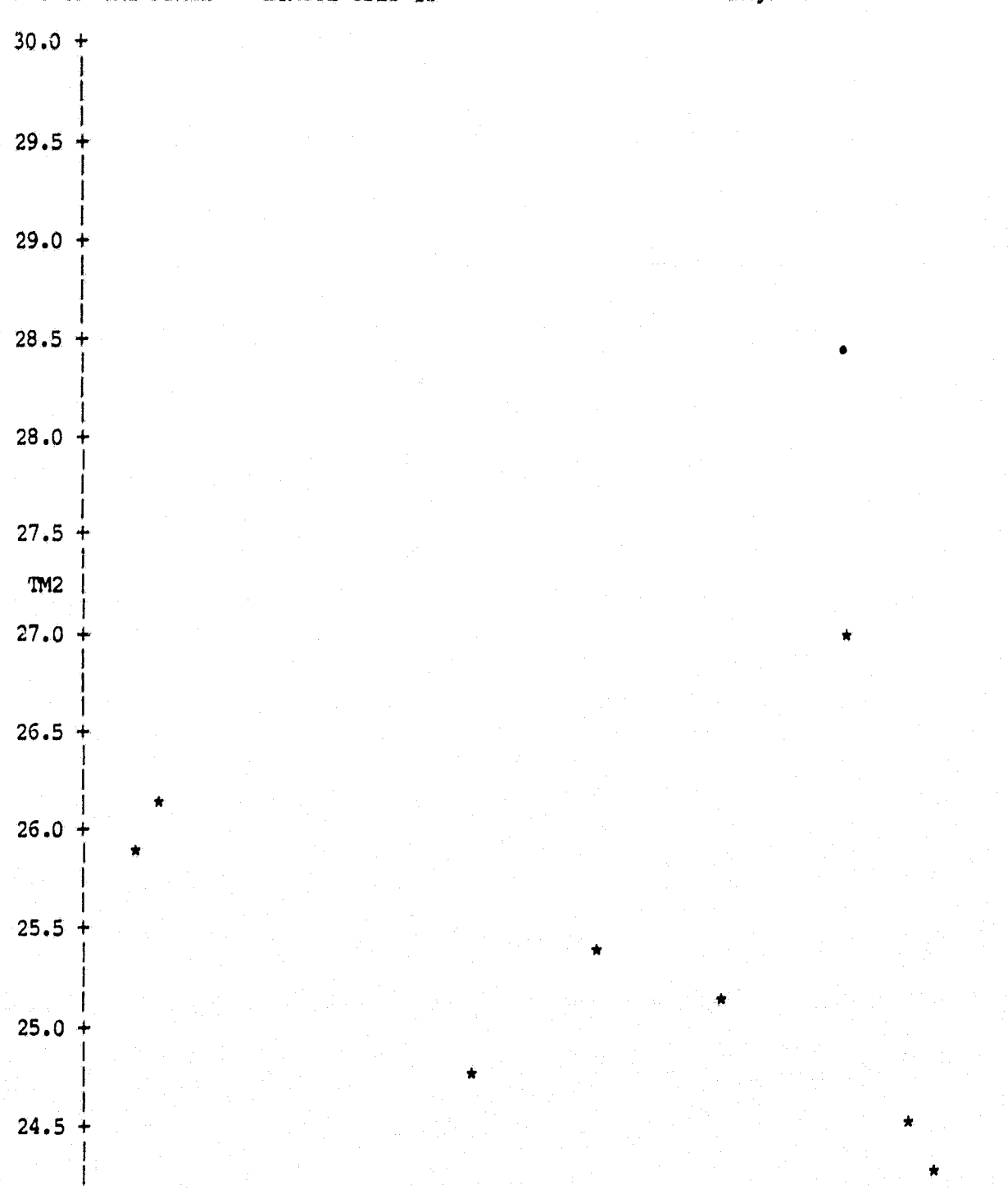

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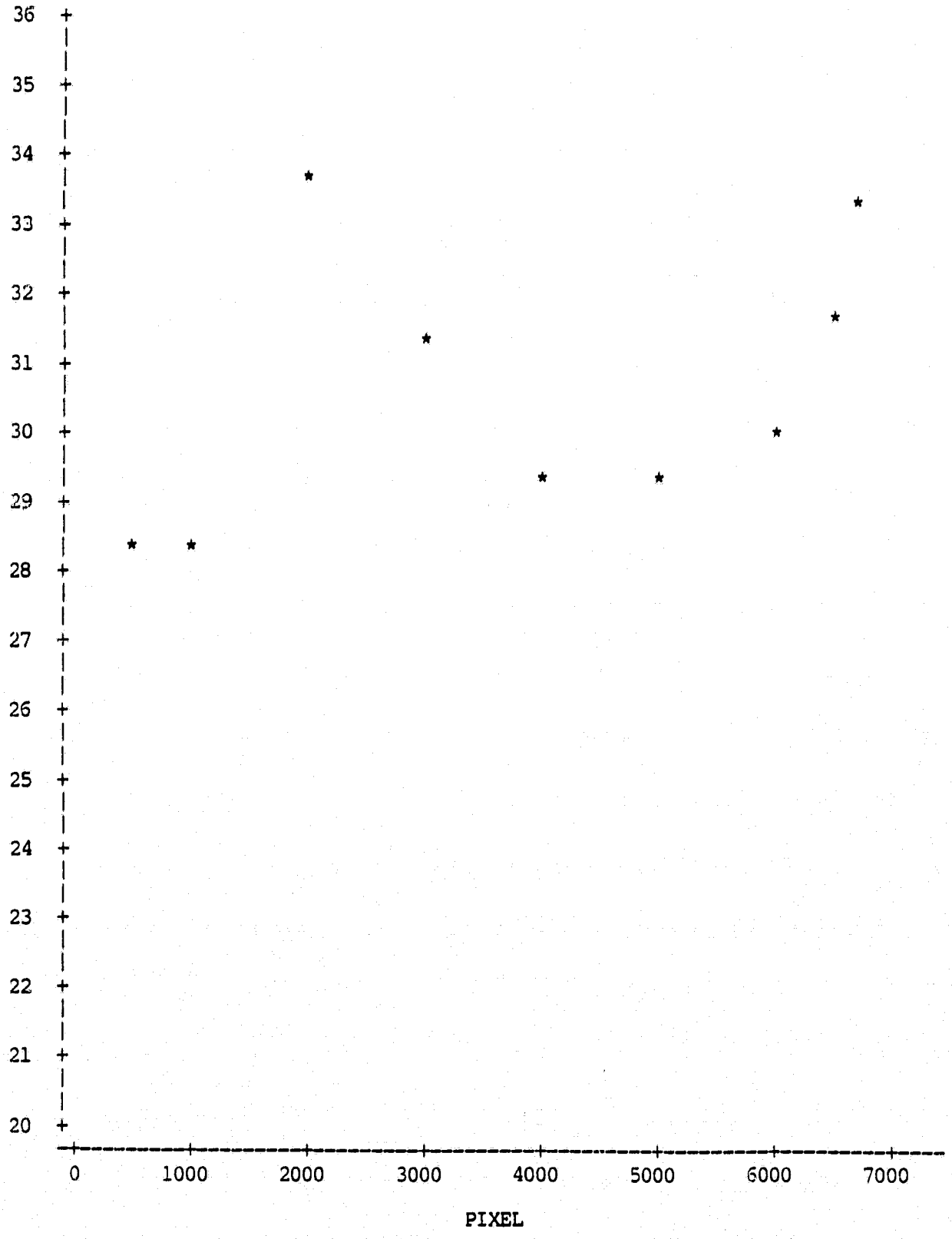
Fig. 50



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PLOT OF TM3*PIXEL SYMBOL USED IS *

Fig. 51

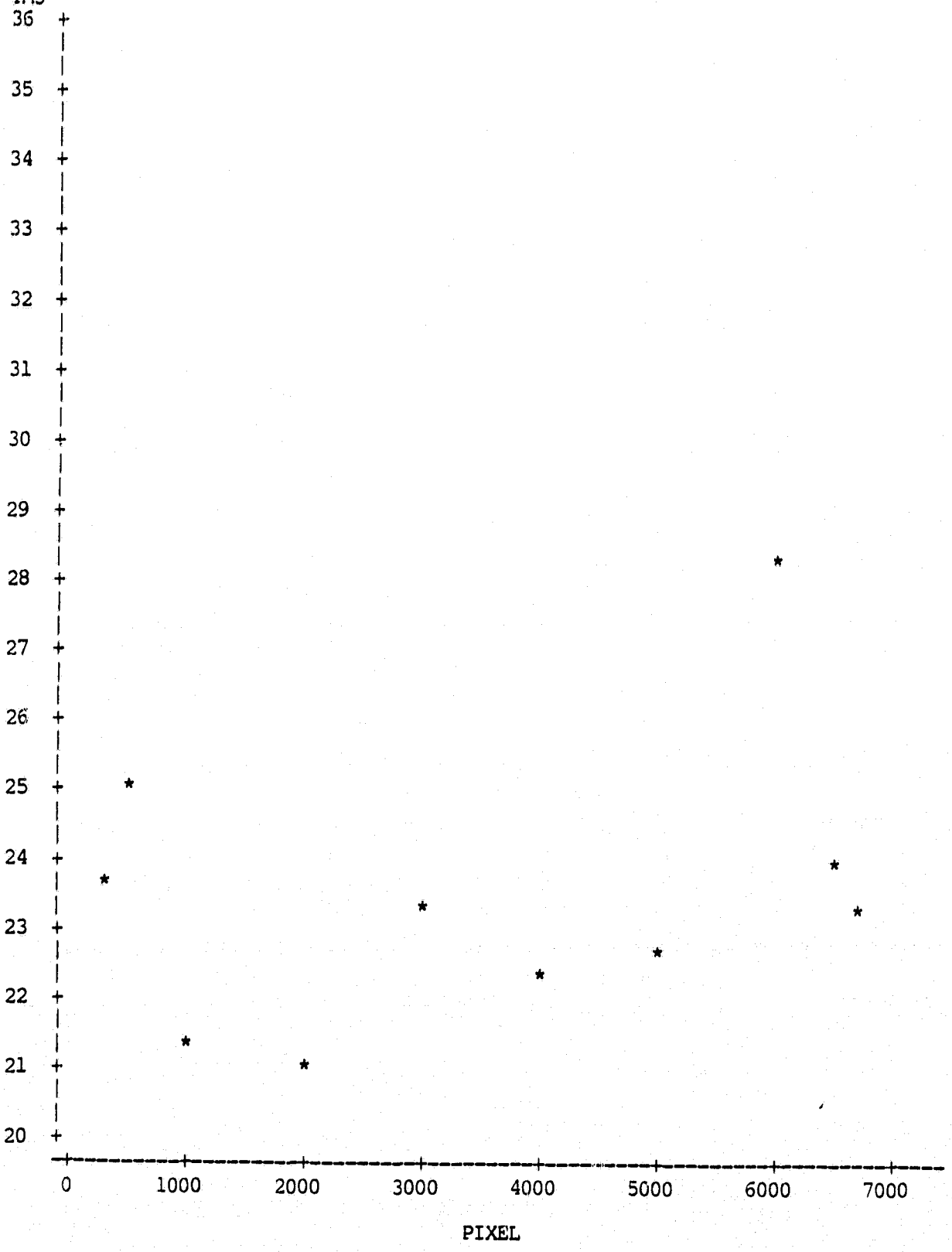

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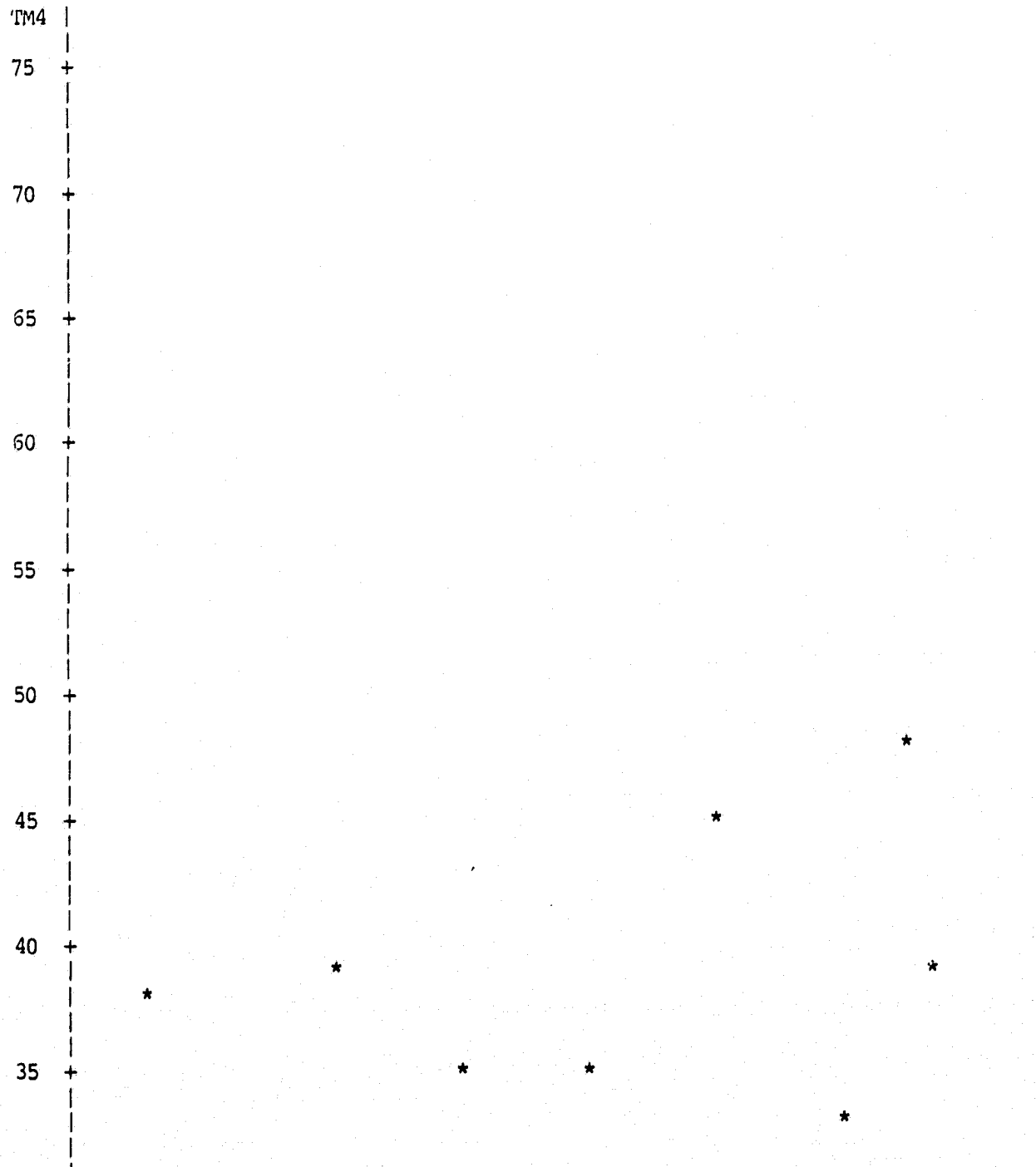
Fig. 52

PLOT OF TM4*PIXEL SYMBOL USED IS *



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PLOT OF TM4*PIXEL SYMBOL USED IS *

Fig. 53

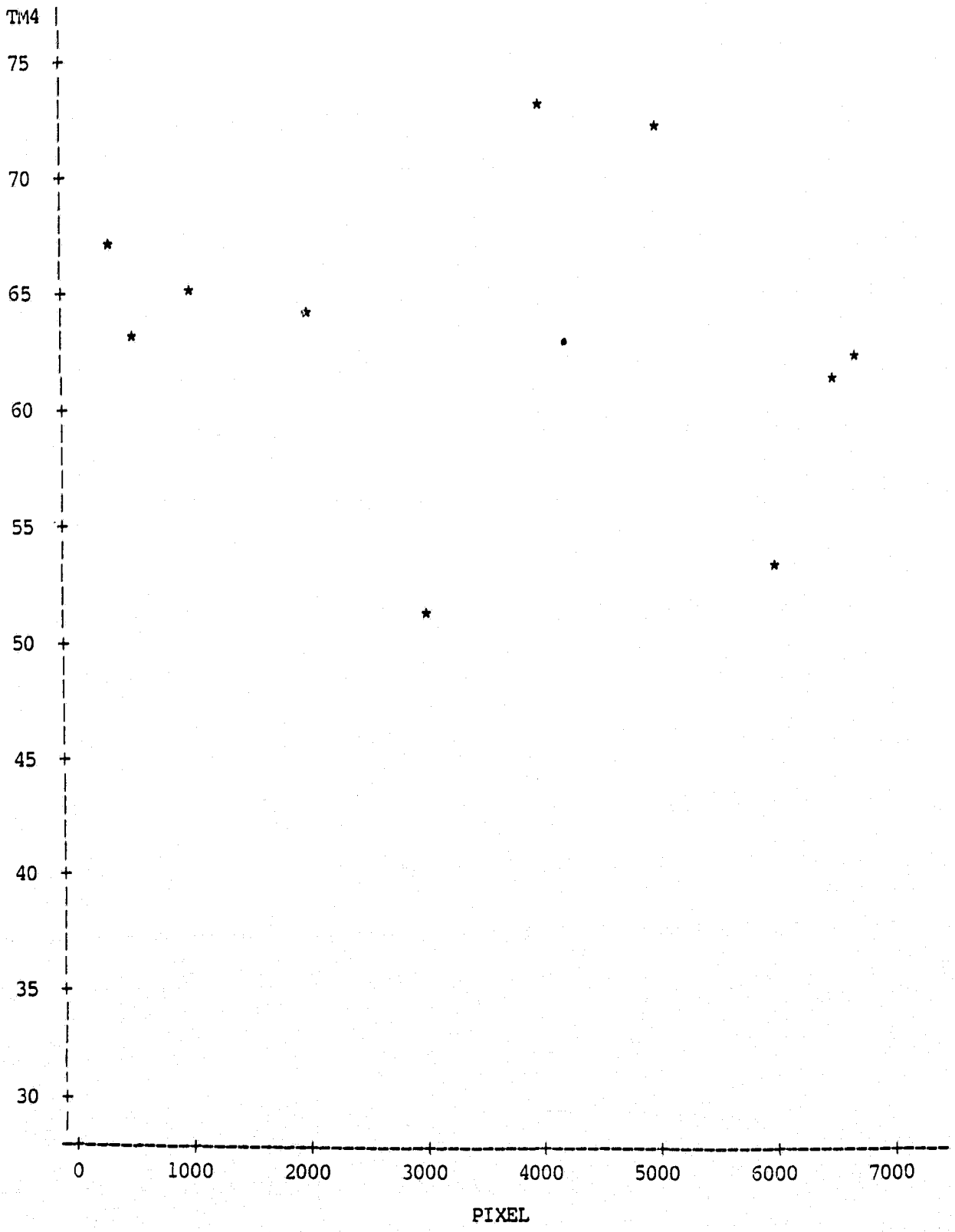

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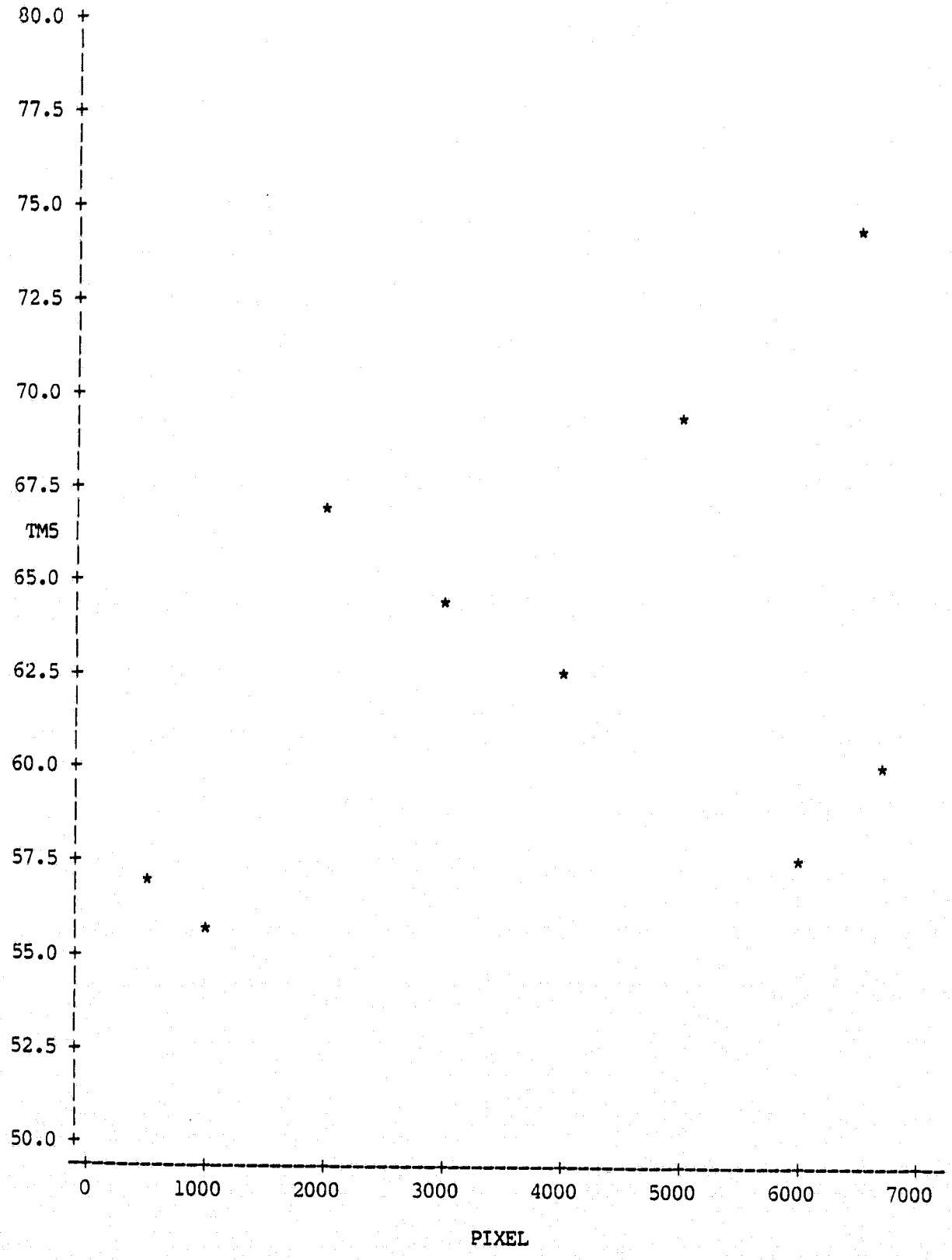
Fig. 54

PLOT OF TM5*PIXEL SYMBOL USED IS *



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PLOT OF TM5*PIXEL SYMBOL USED IS *

Fig. 55

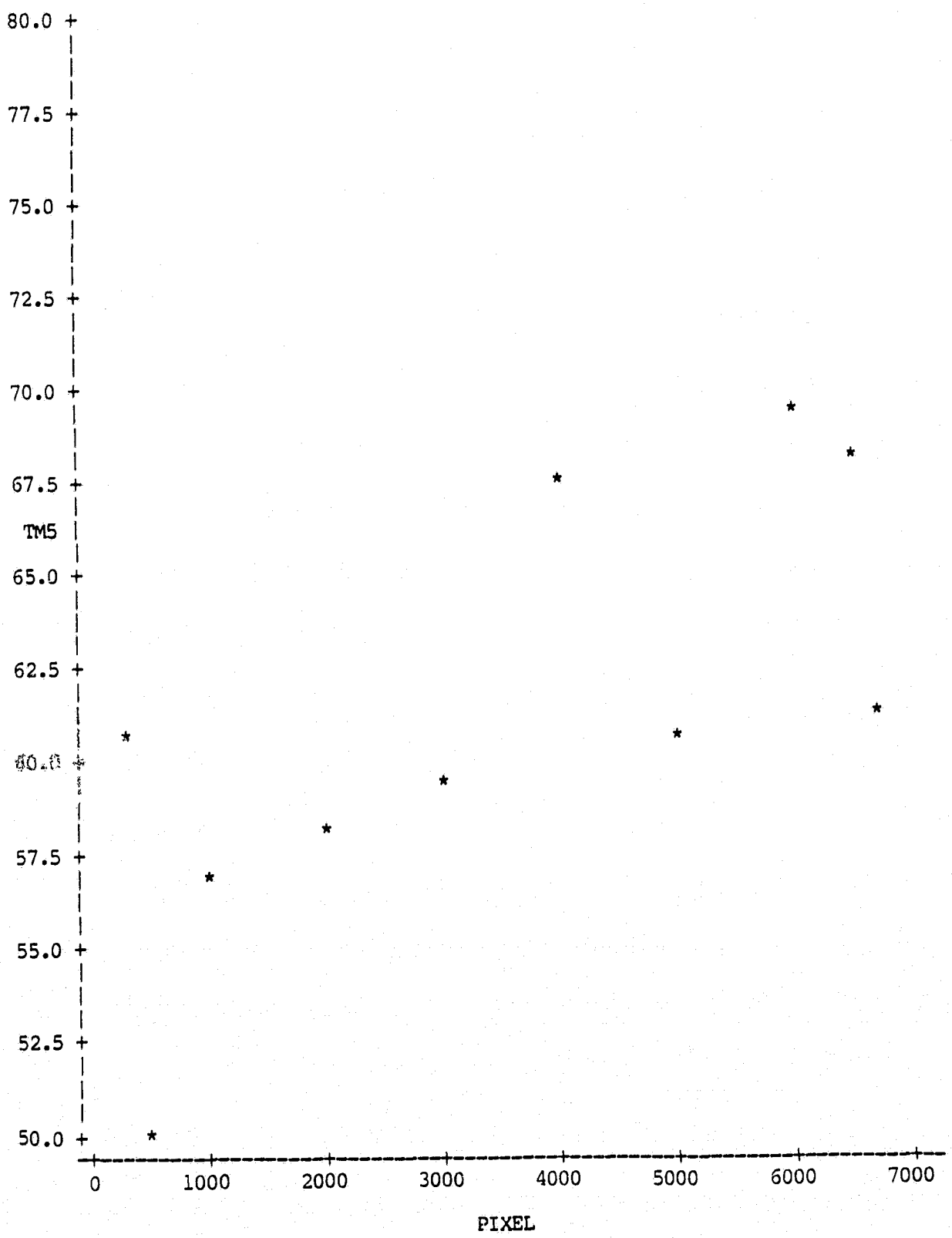

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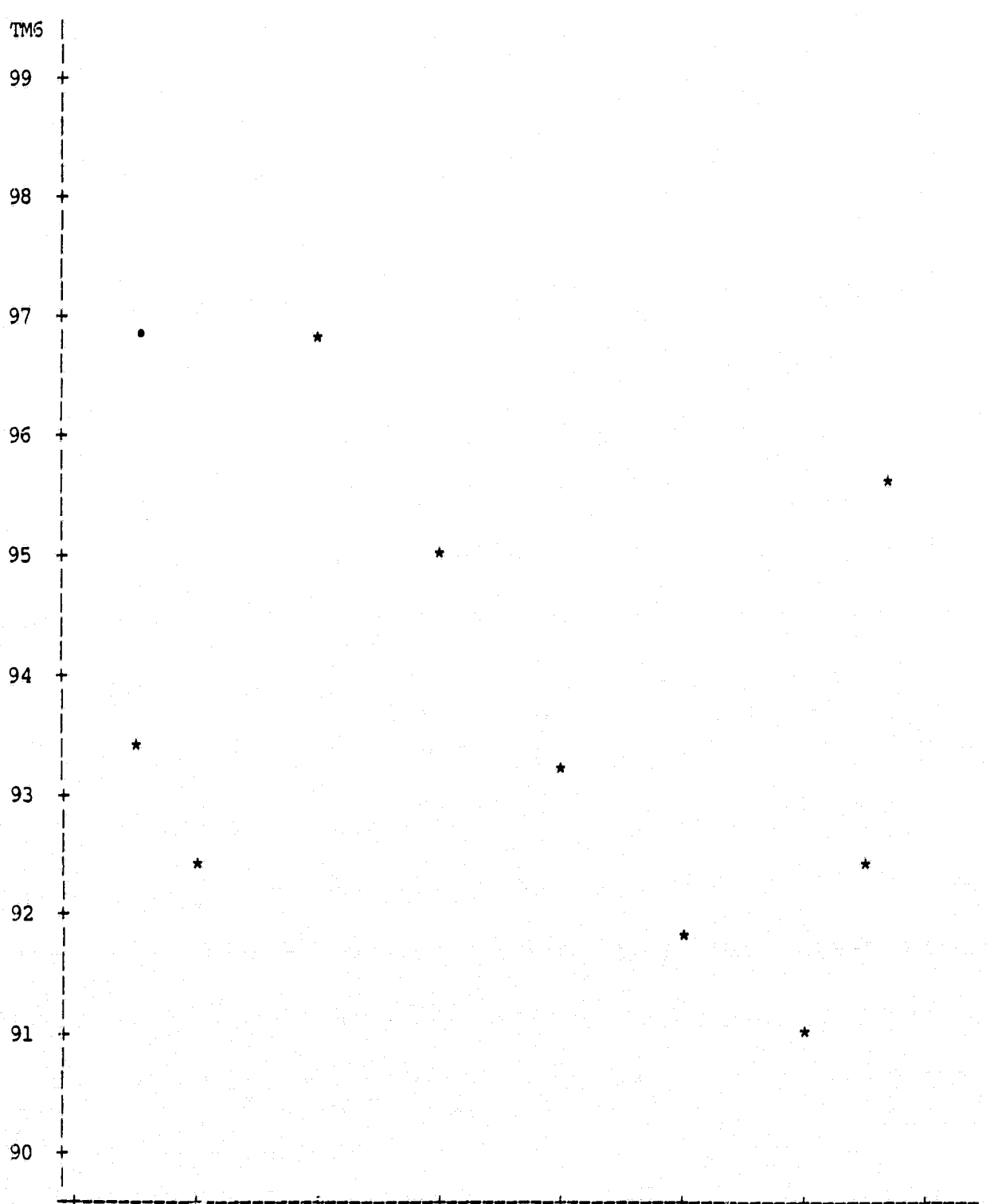
Fig. 56

PLOT OF TM6*PIXEL SYMBOL USED IS *



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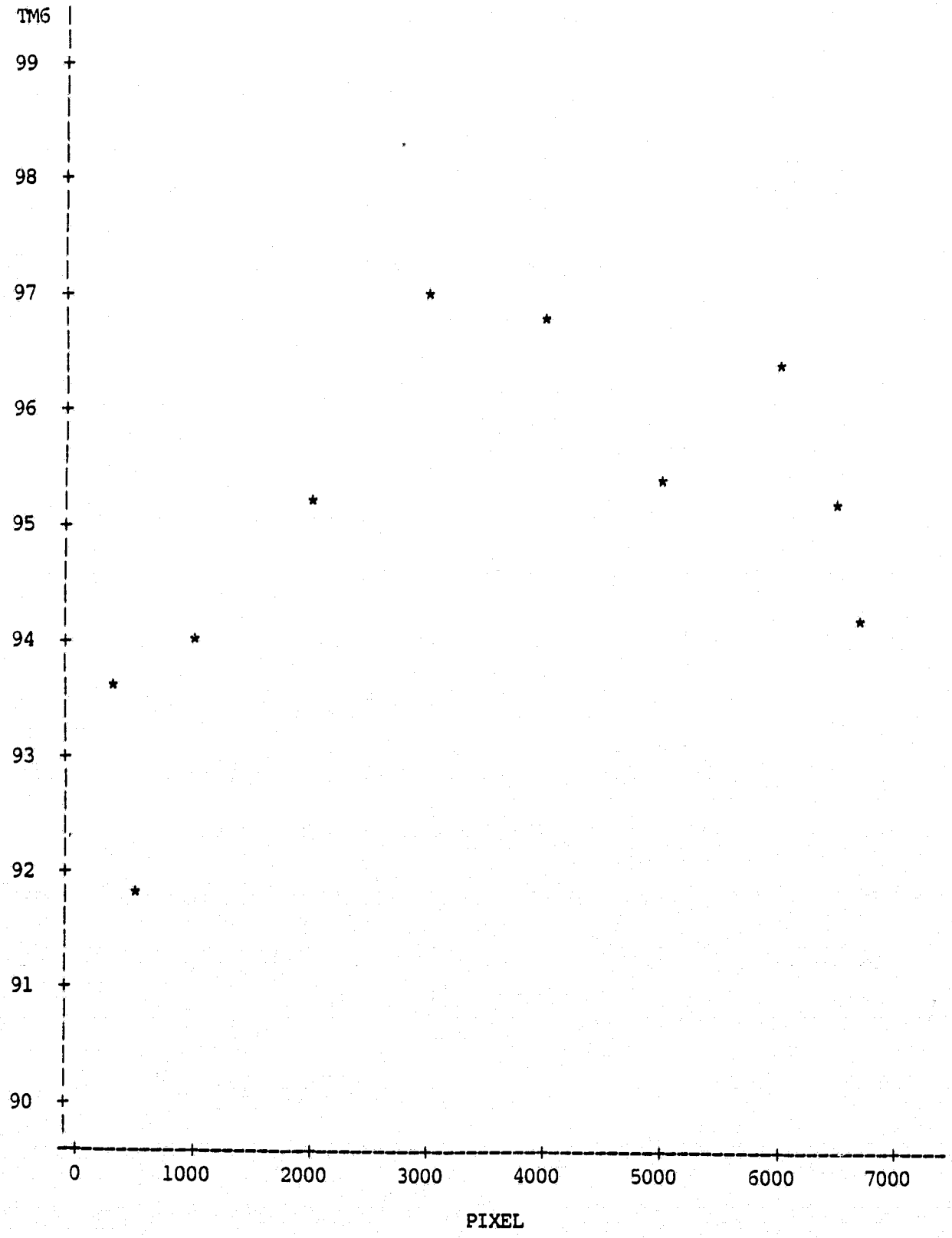
PLOT OF TM6*PIXEL SYMBOL USED IS *

Fig. 57



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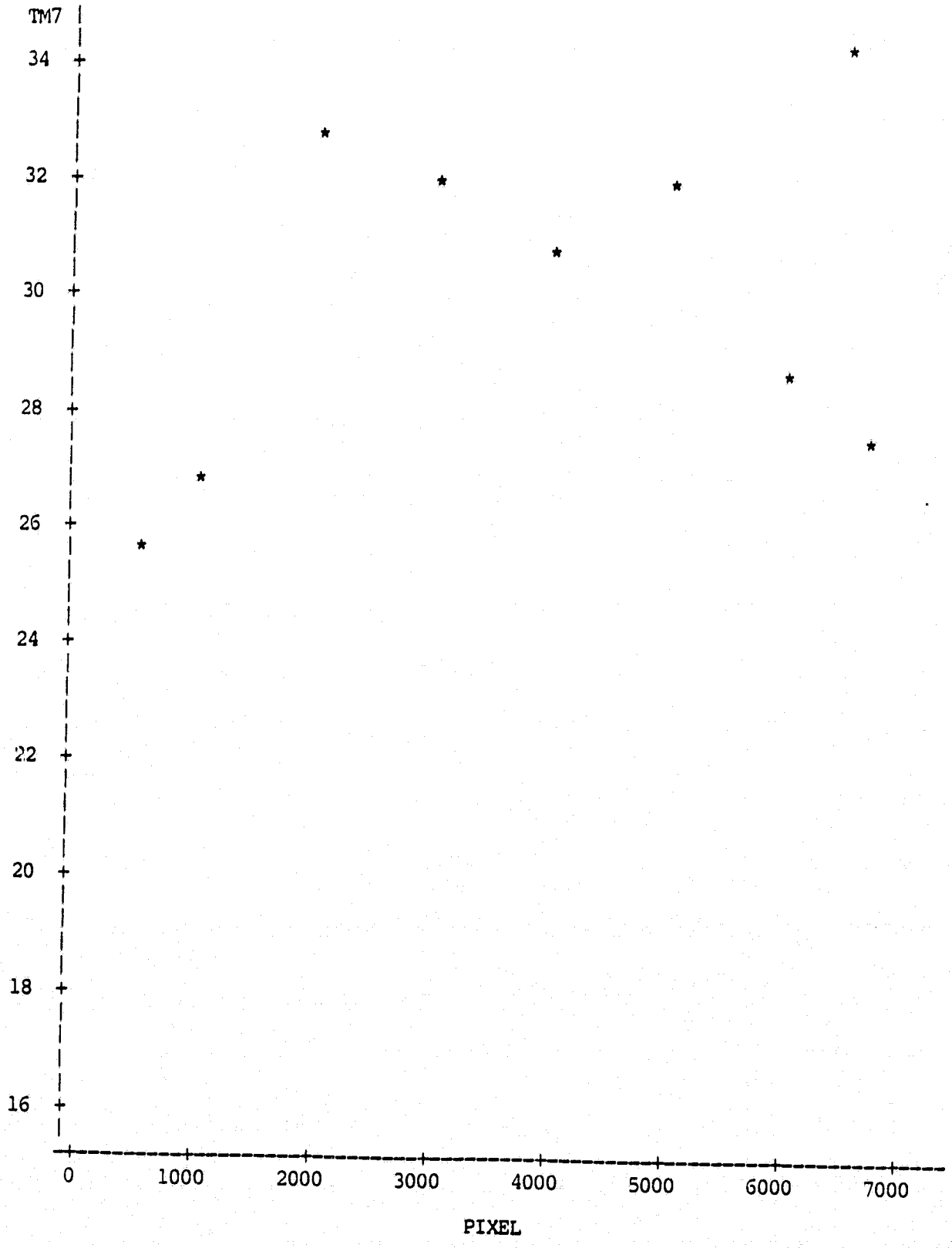
PLOT OF TM7*PIXEL SYMBOL USED IS *

Fig. 58



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PLOT OF TM7*PIXEL SYMBOL USED IS *

Fig. 59

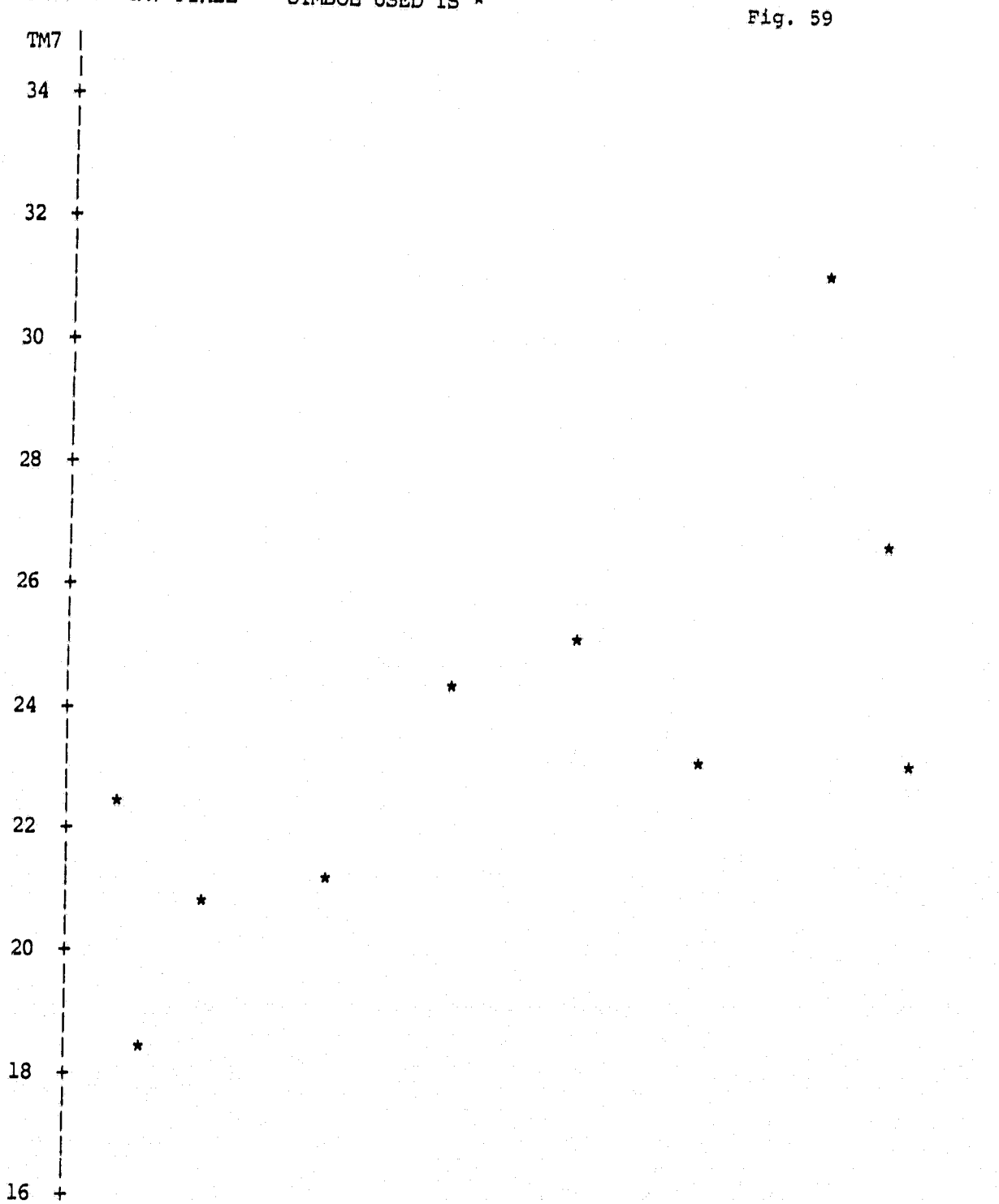

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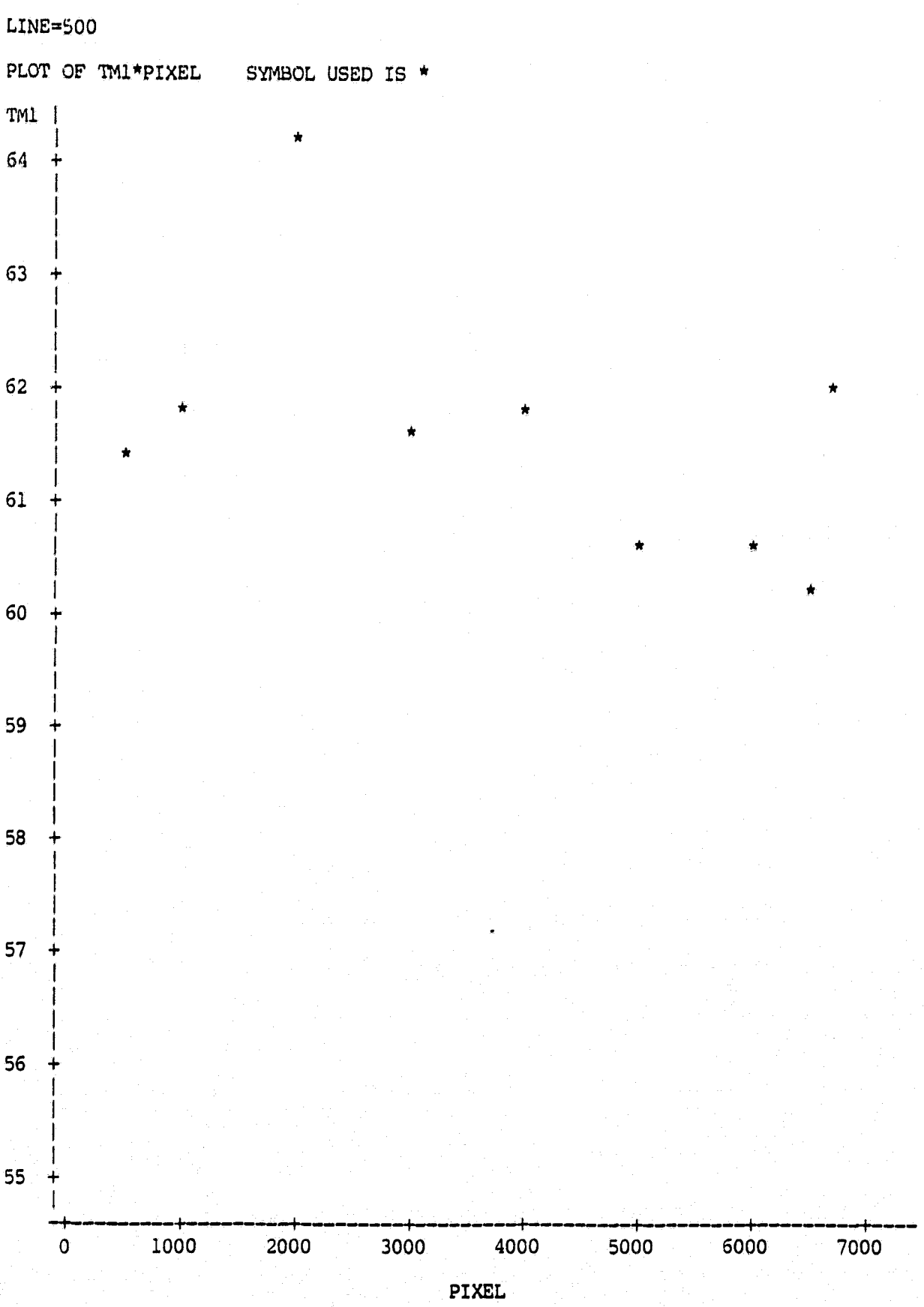
Fig. 60



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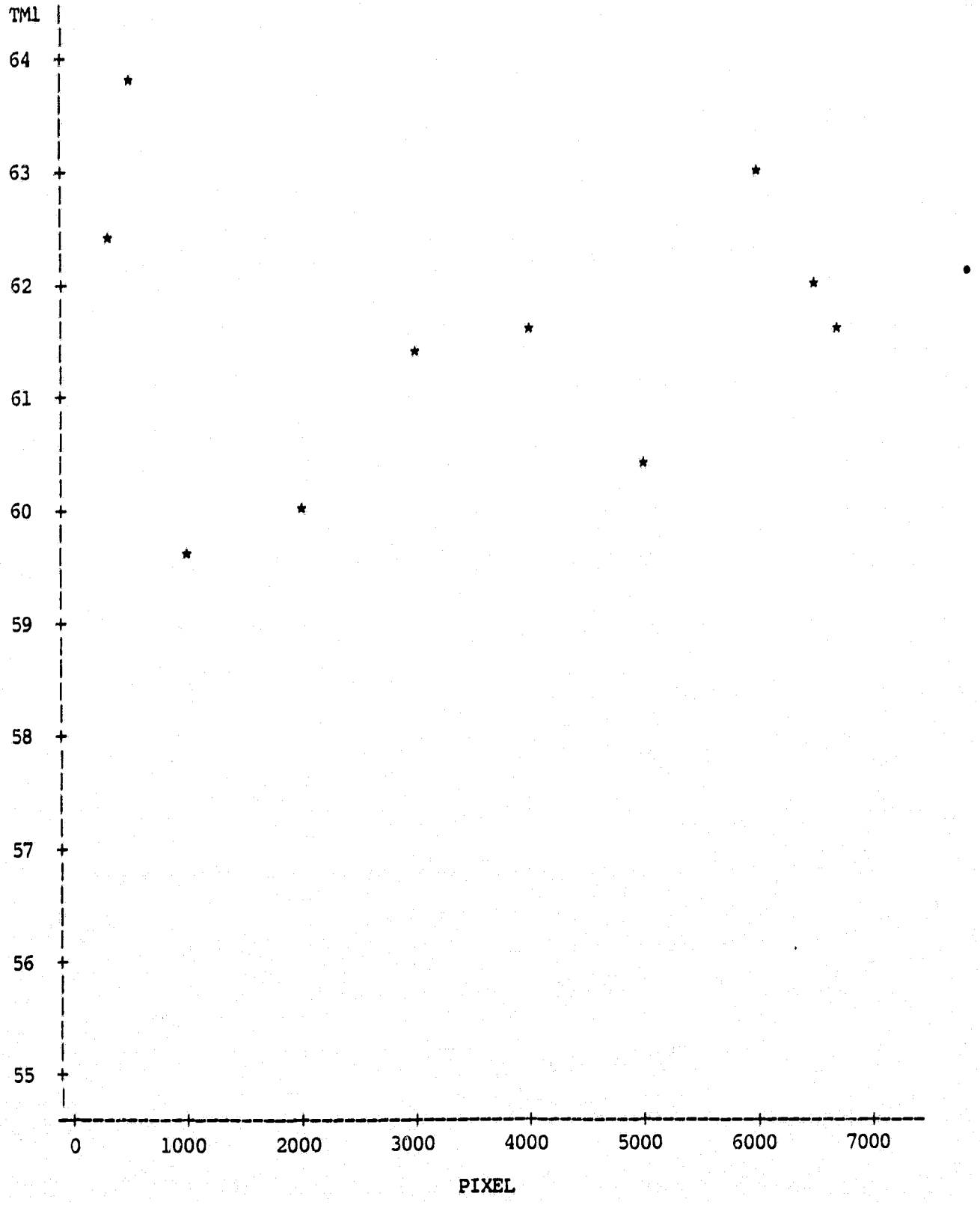
PLOT OF TM1*PIXEL SYMBOL USED IS *

Fig. 61



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PLOT OF TM1*PIXEL SYMBOL USED IS *

Fig. 62

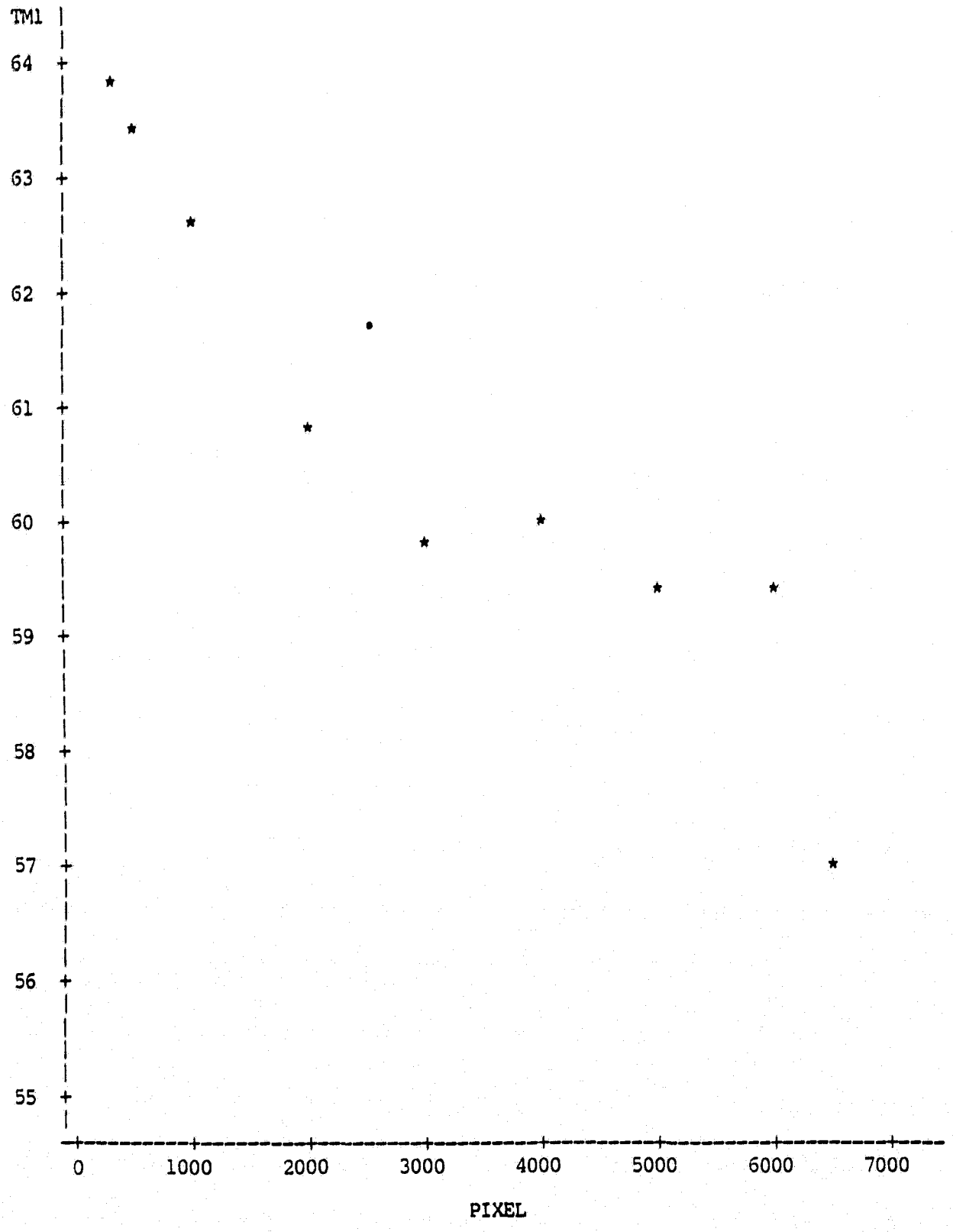

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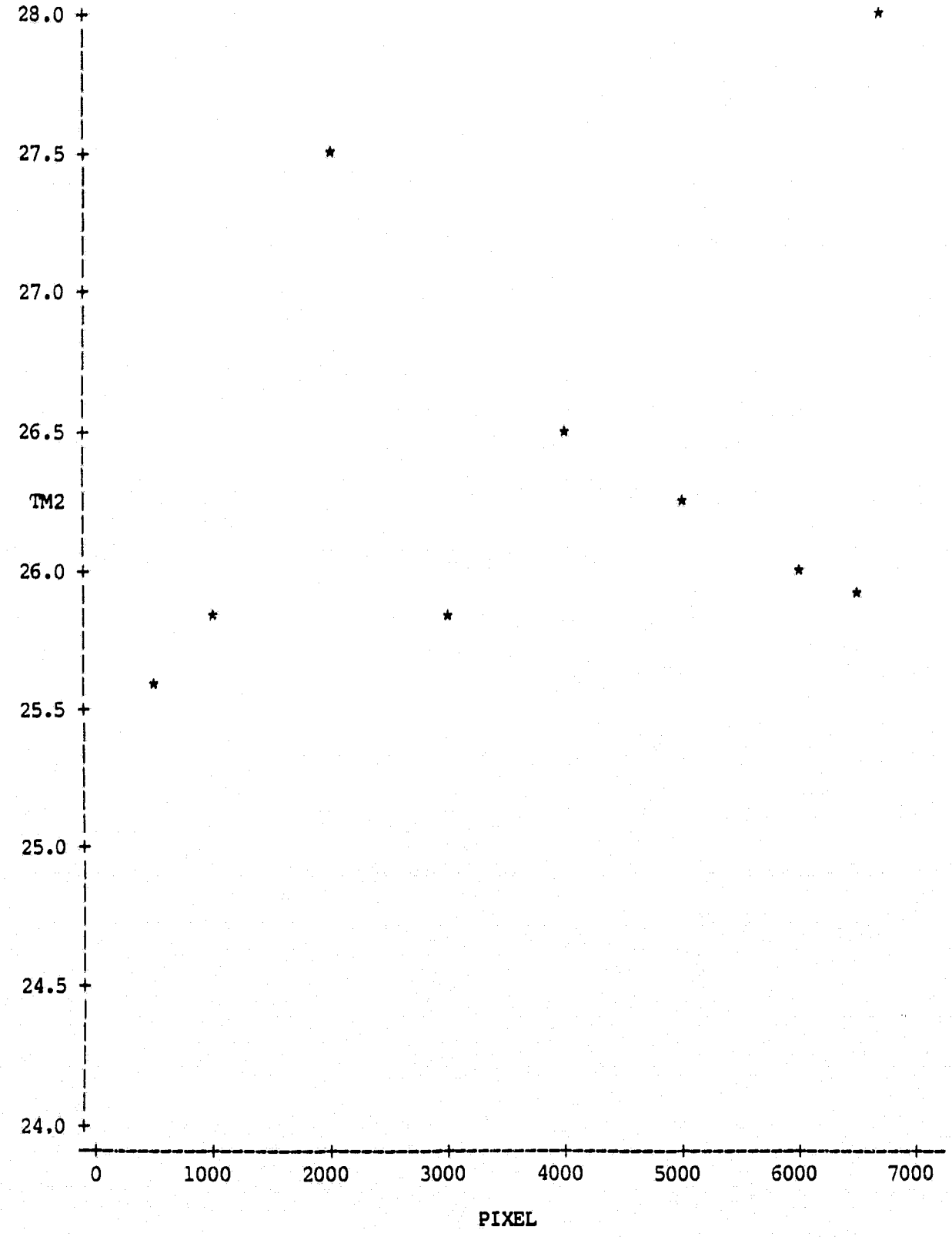
Fig. 63

PLOT OF TM2*PIXEL SYMBOL USED IS *



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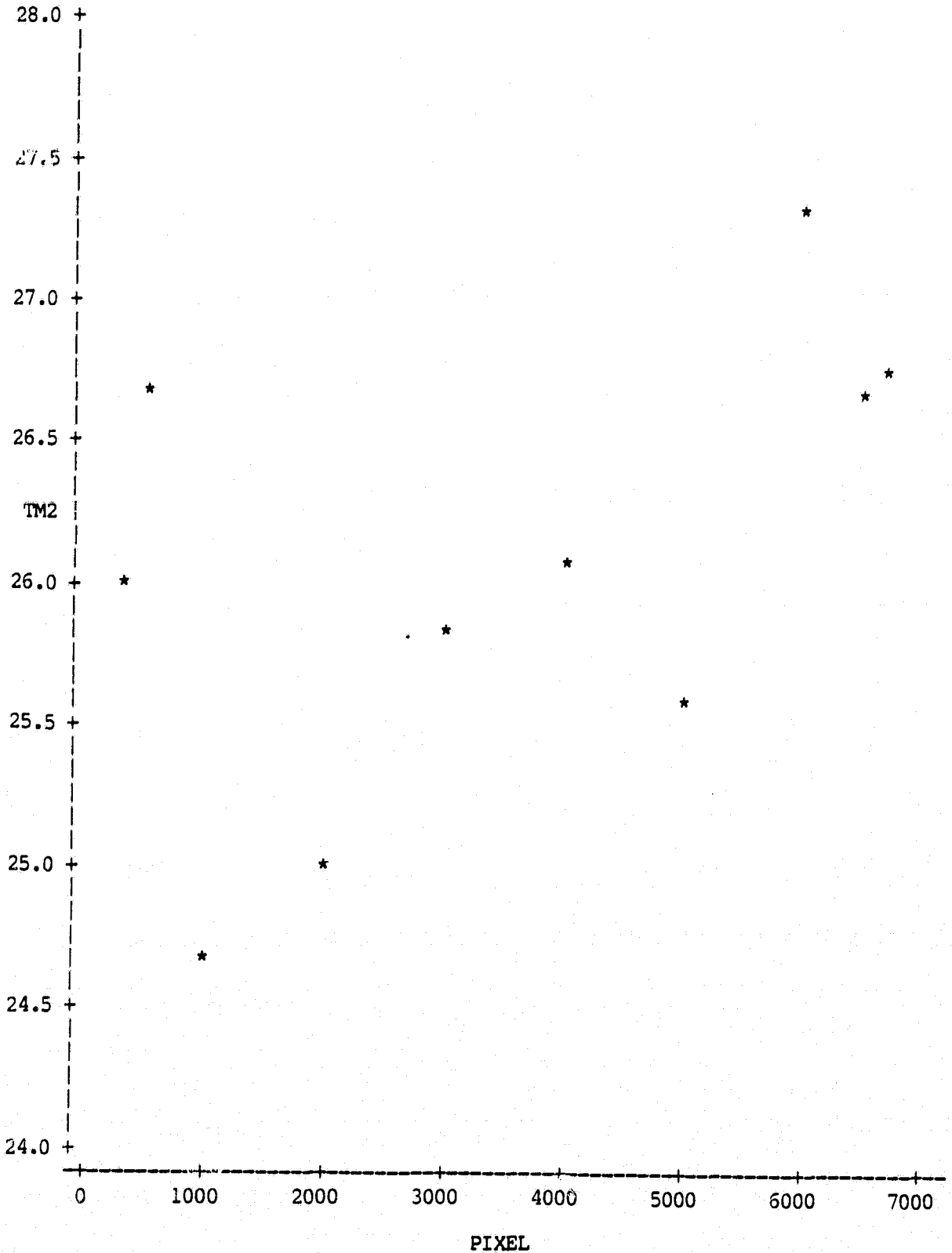
PLOT OF TM2*PIXEL SYMBOL USED IS *

Fig. 64



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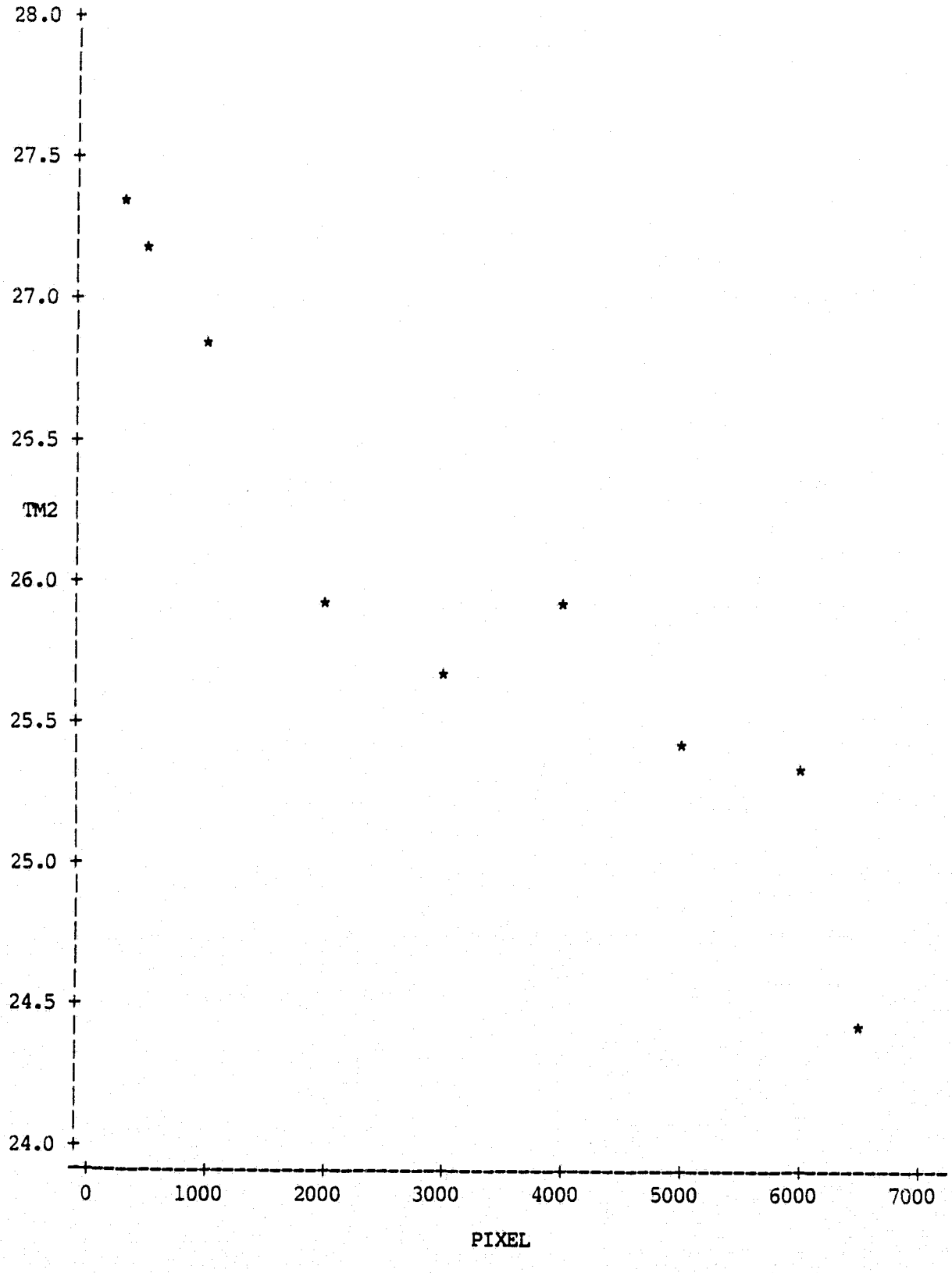
PLOT OF TM2*PIXEL SYMBOL USED IS *

Fig. 65



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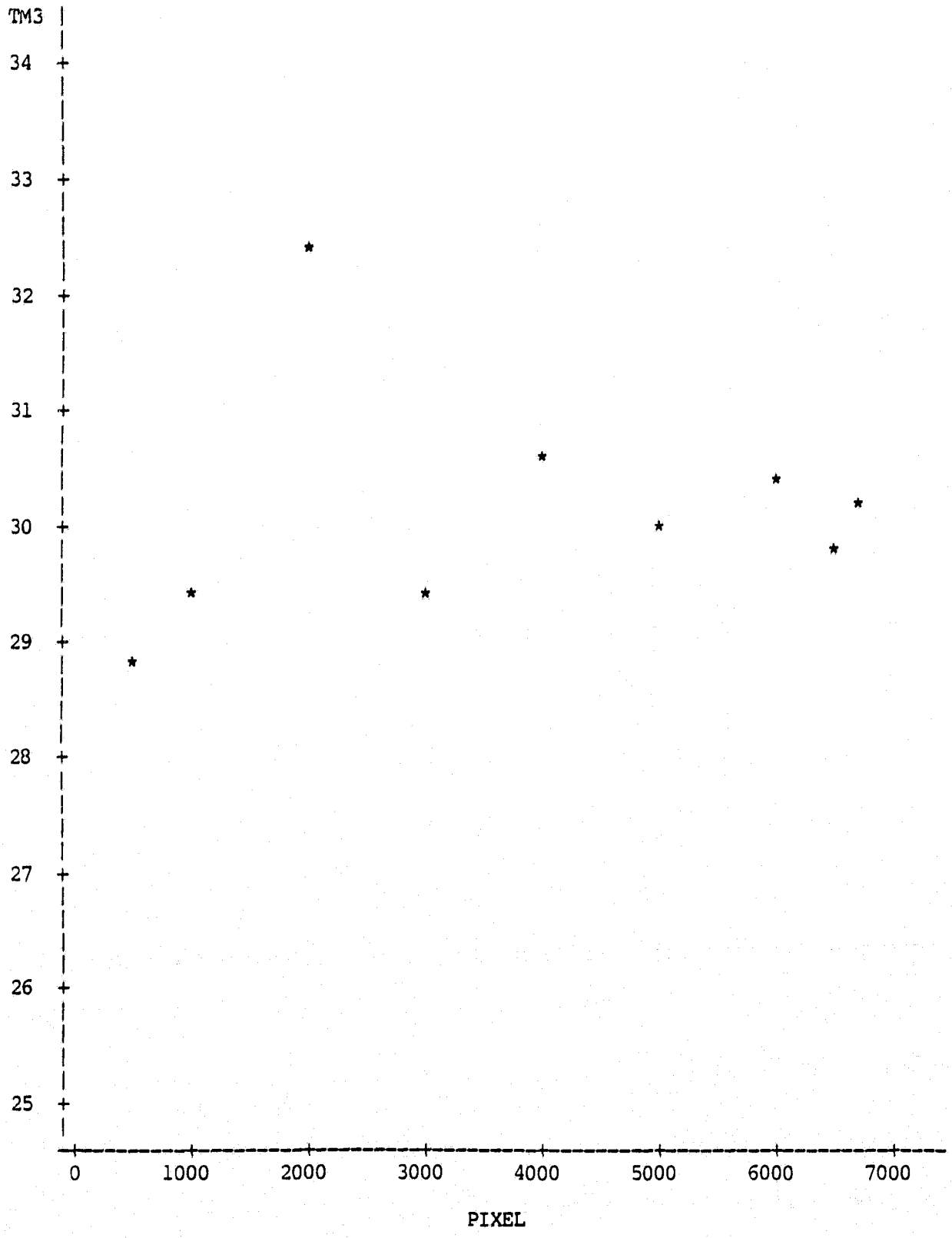
PLOT OF TM3*PIXEL SYMBOL USED IS *

Fig. 66



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PLOT OF TM3*PIXEL SYMBOL USED IS *

Fig. 67

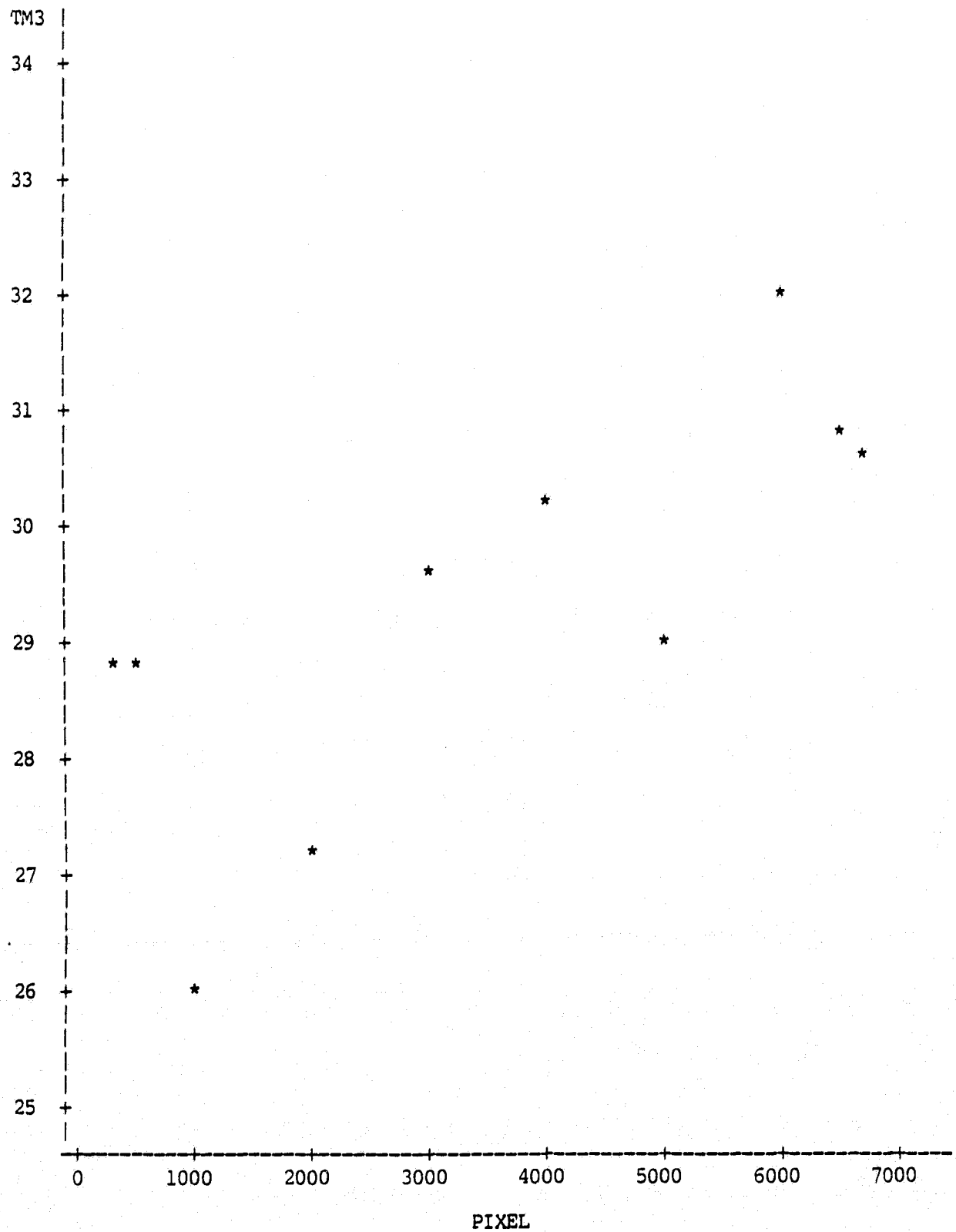

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Fig. 68

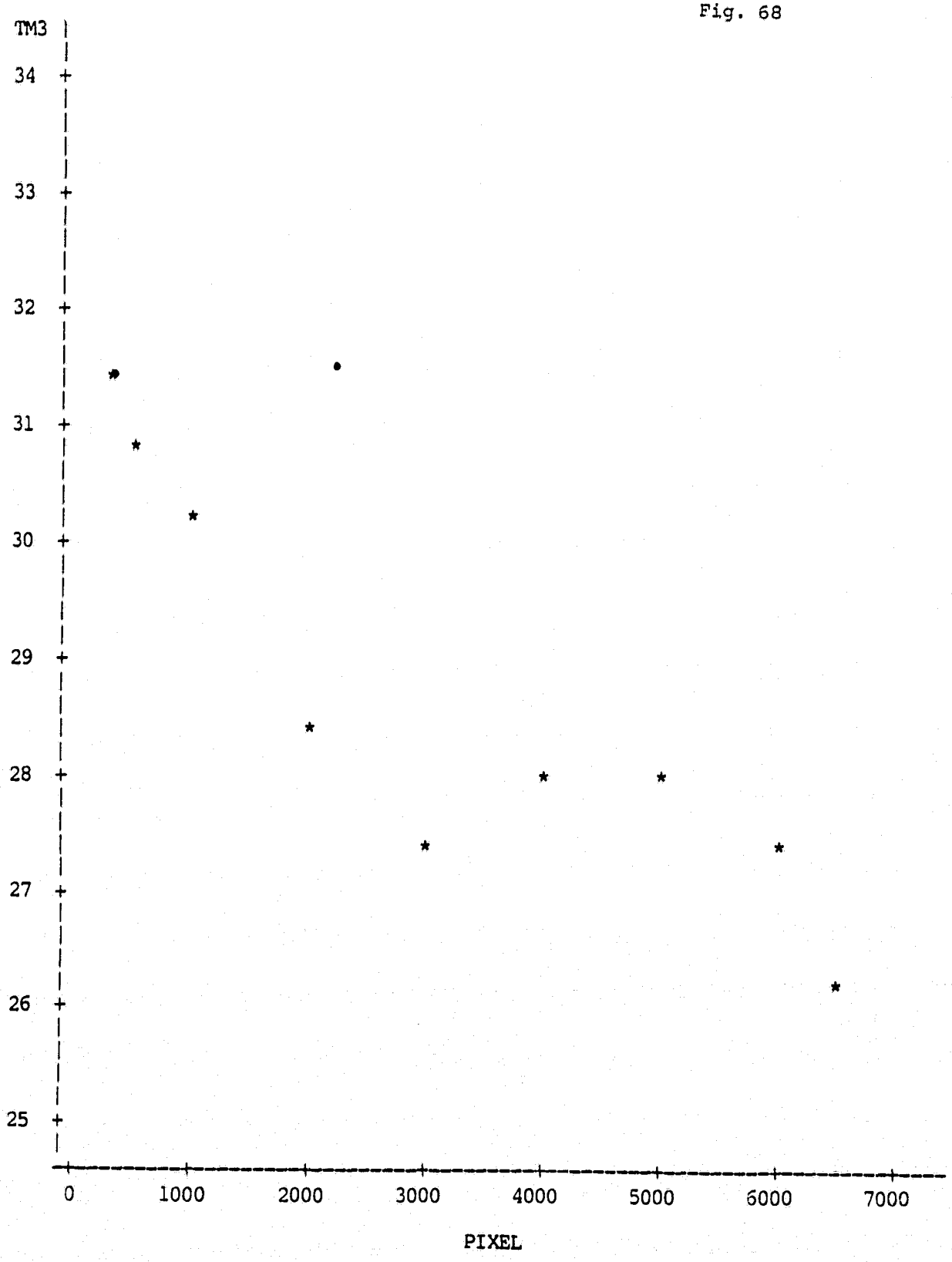

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Fig. 69

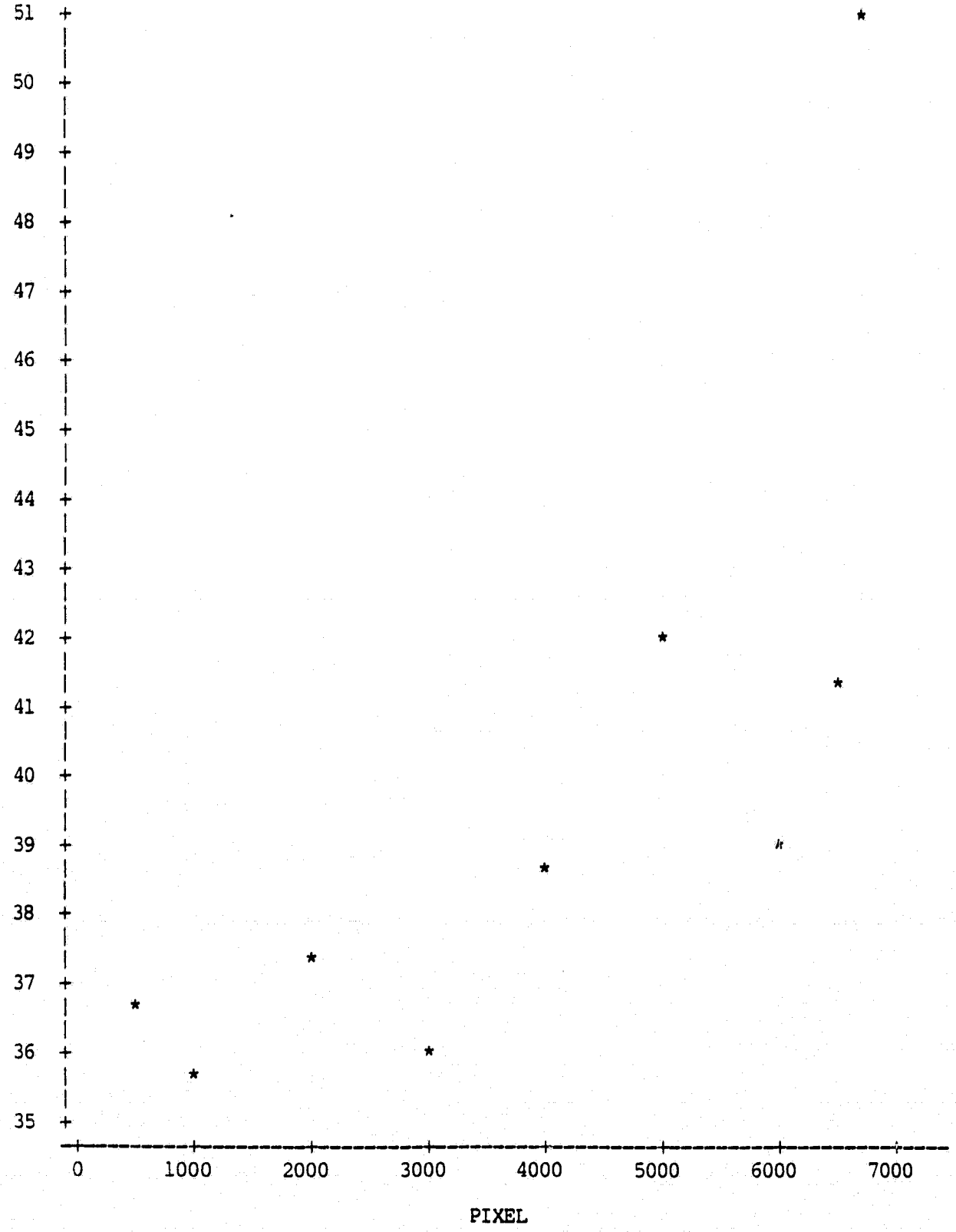

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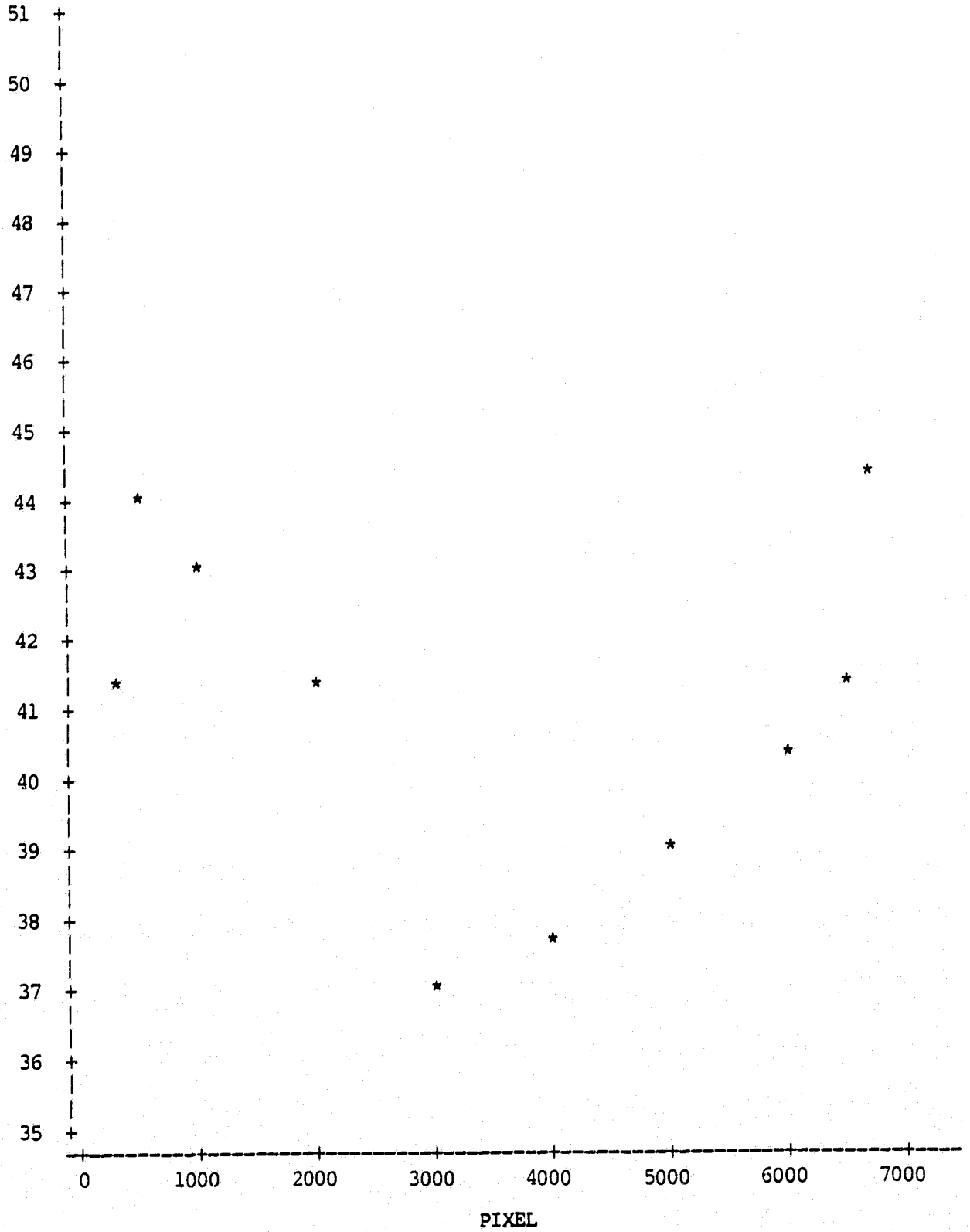
Fig. 70



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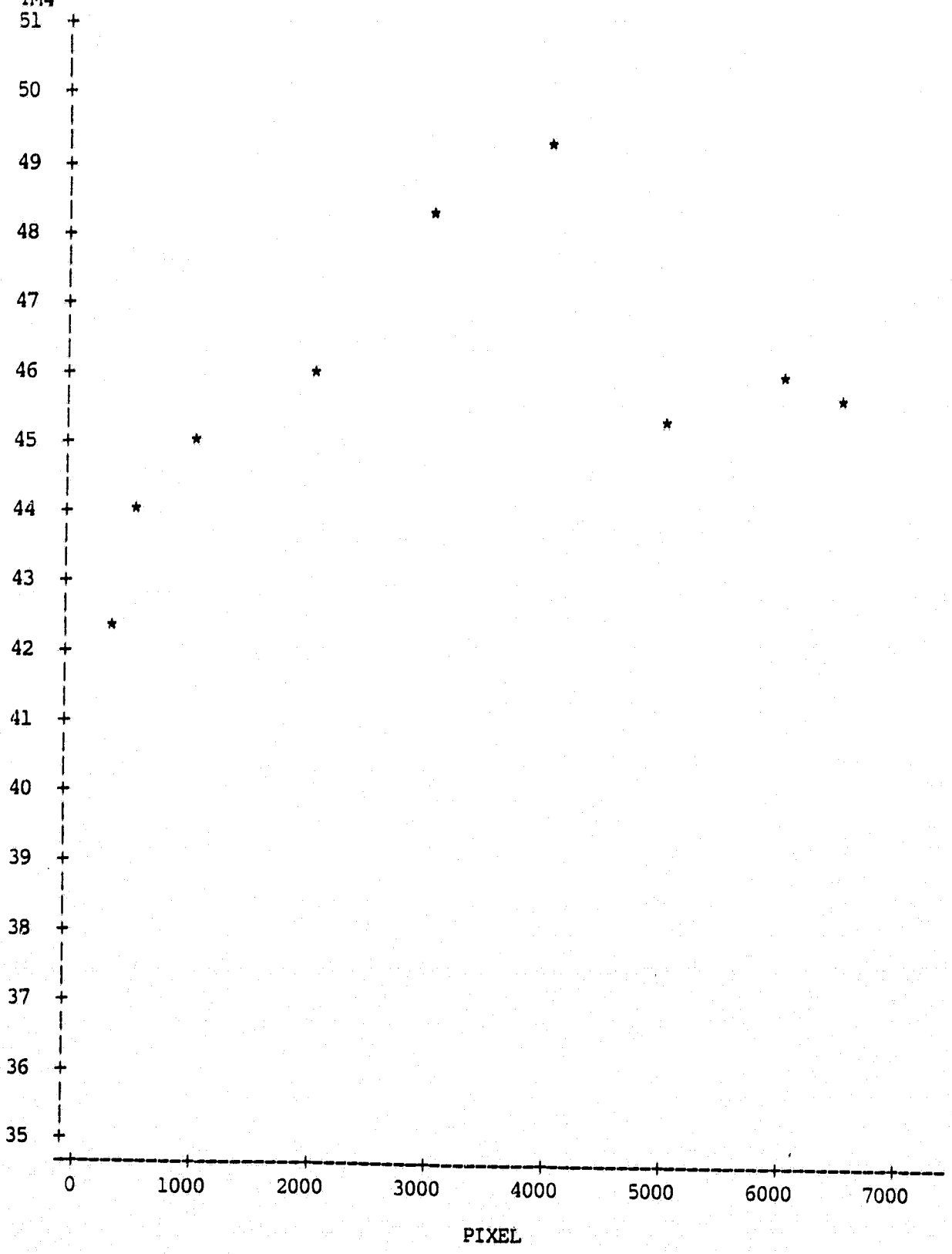
PLOT OF TM4*PIXEL SYMBOL USED IS *

Fig. 71



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PLOT OF TM5*PIXEL SYMBOL USED IS *

Fig. 72

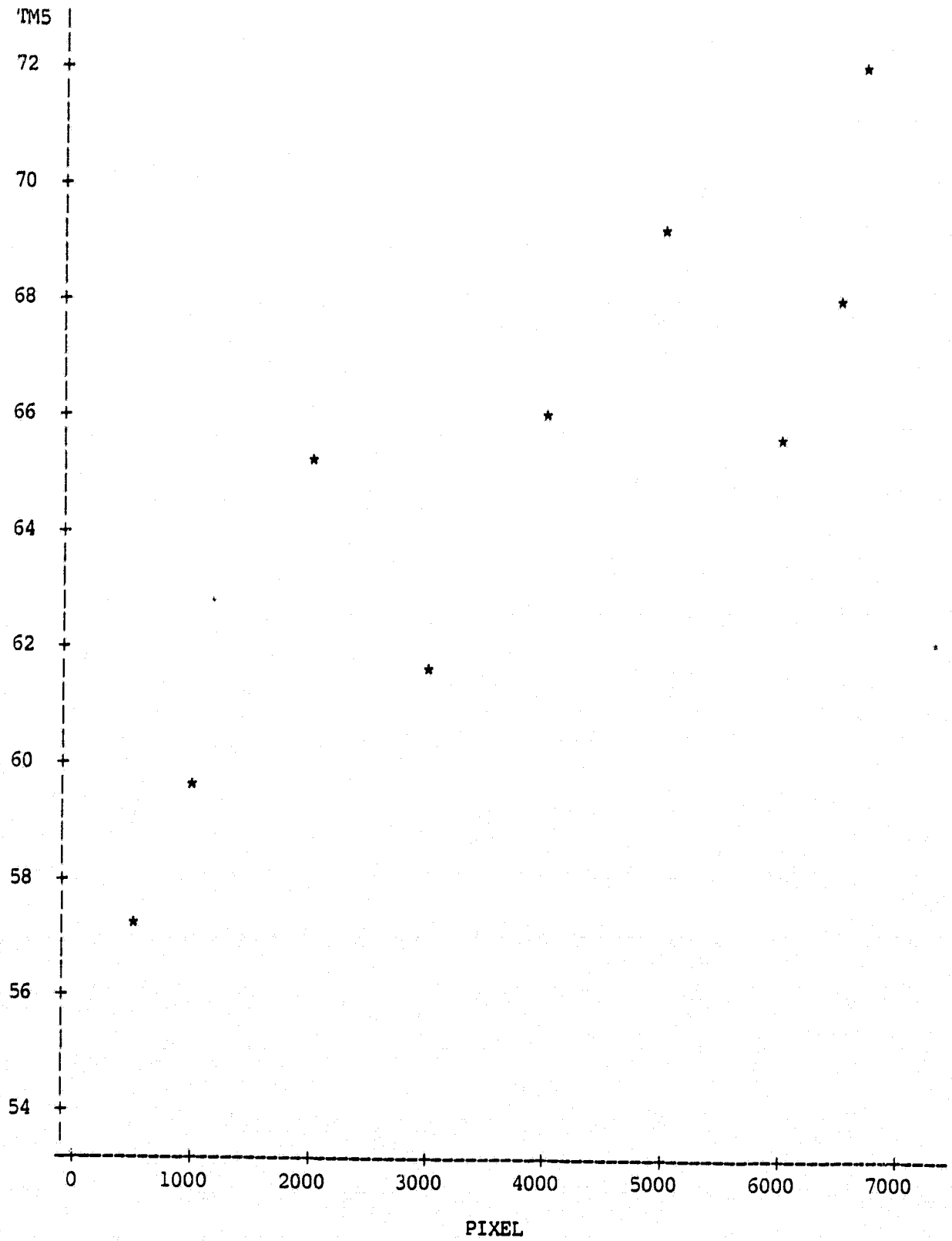

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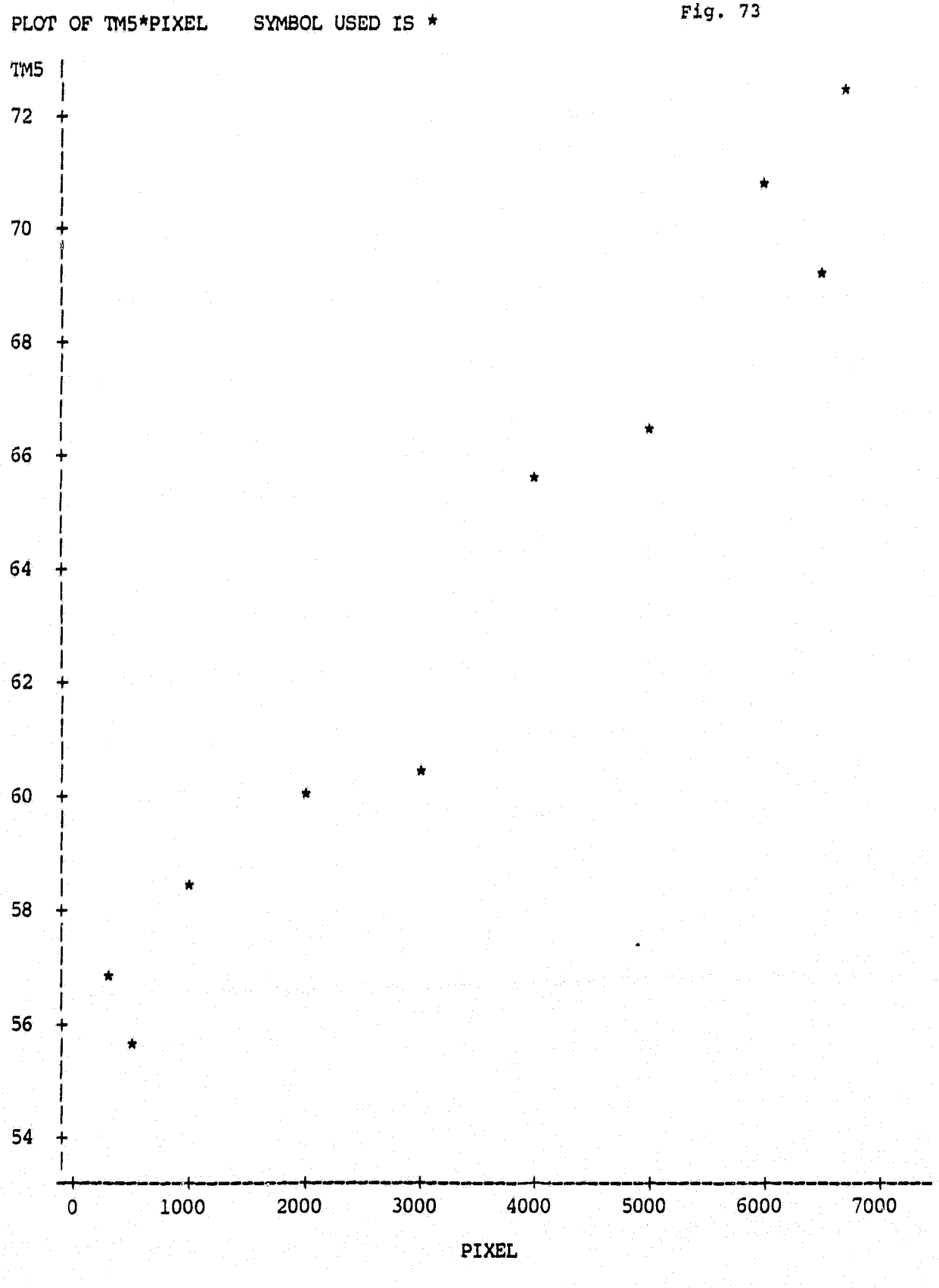
Fig. 73



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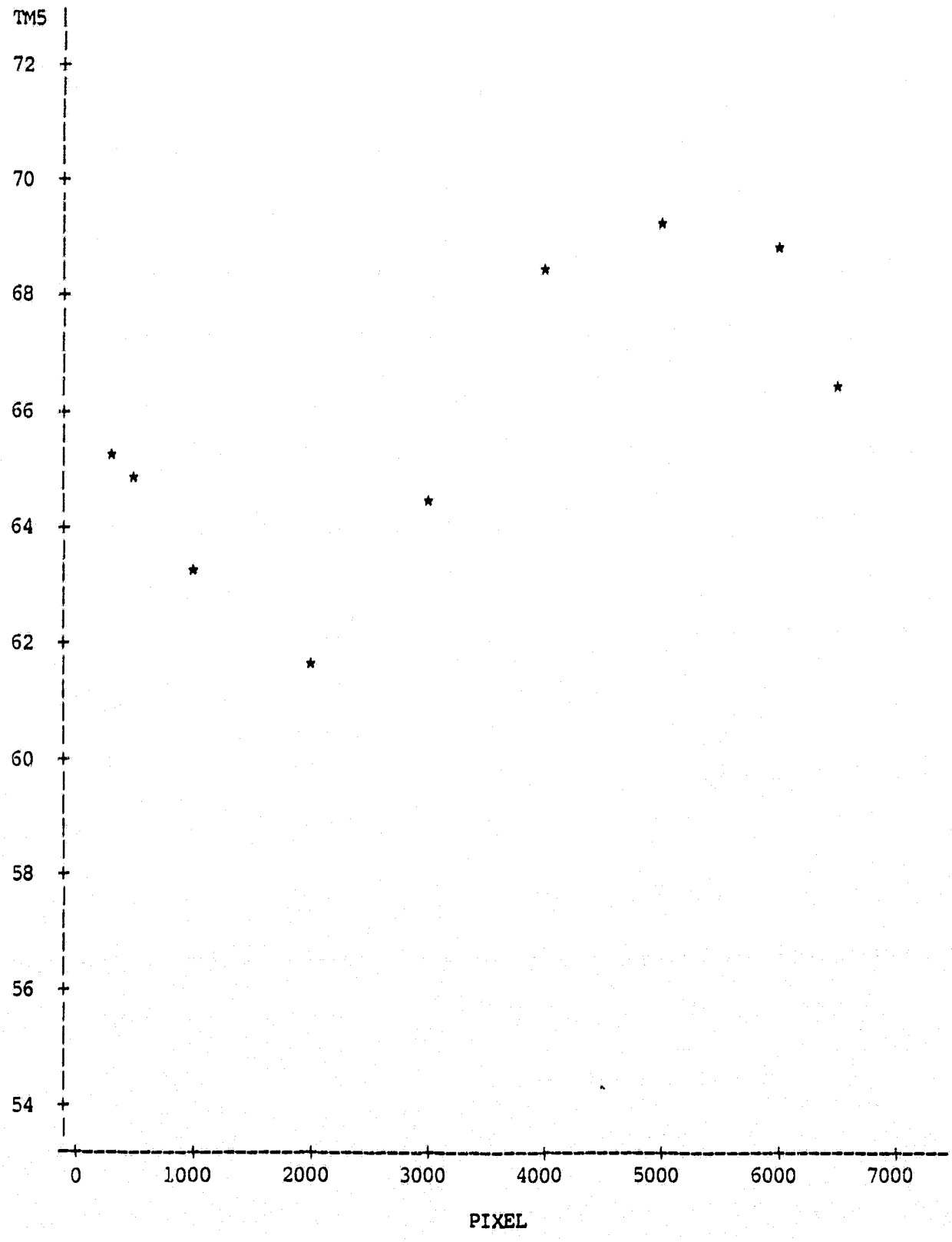
PLOT OF TM5*PIXEL SYMBOL USED IS *

Fig. 74



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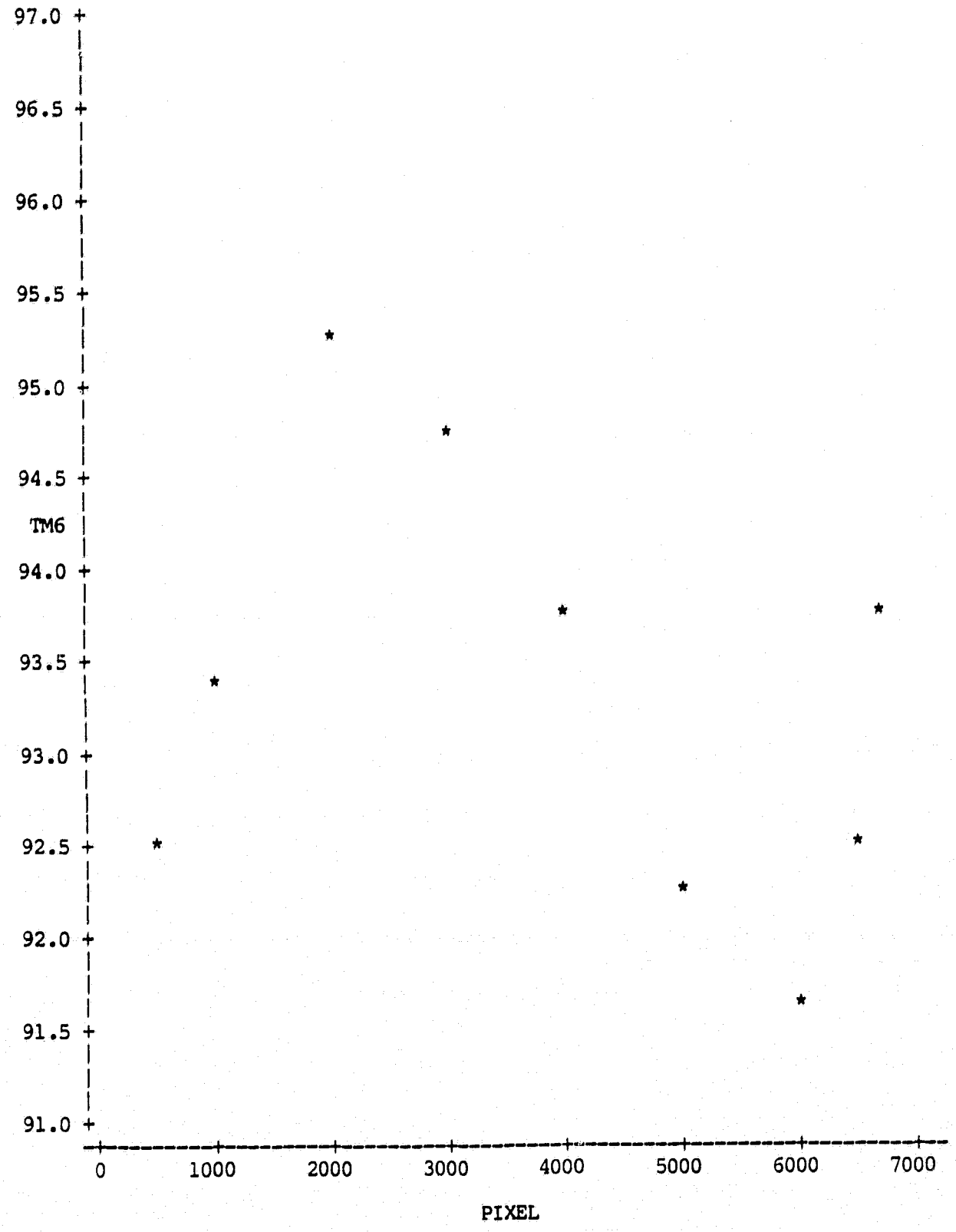
PLOT OF TM6*PIXEL SYMBOL USED IS *

Fig. 75



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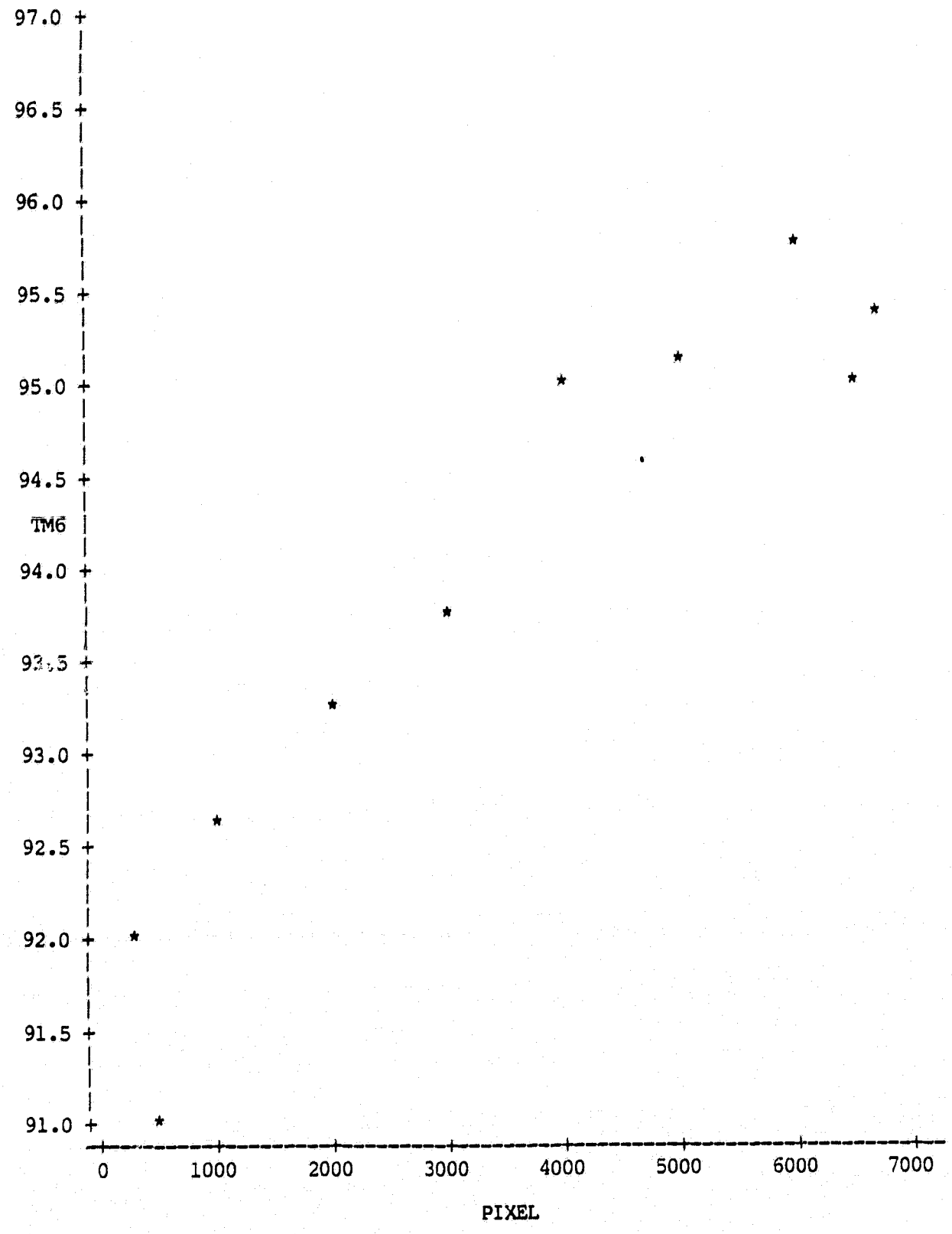
PLOT OF TM6*PIXEL SYMBOL USED IS *

Fig. 76



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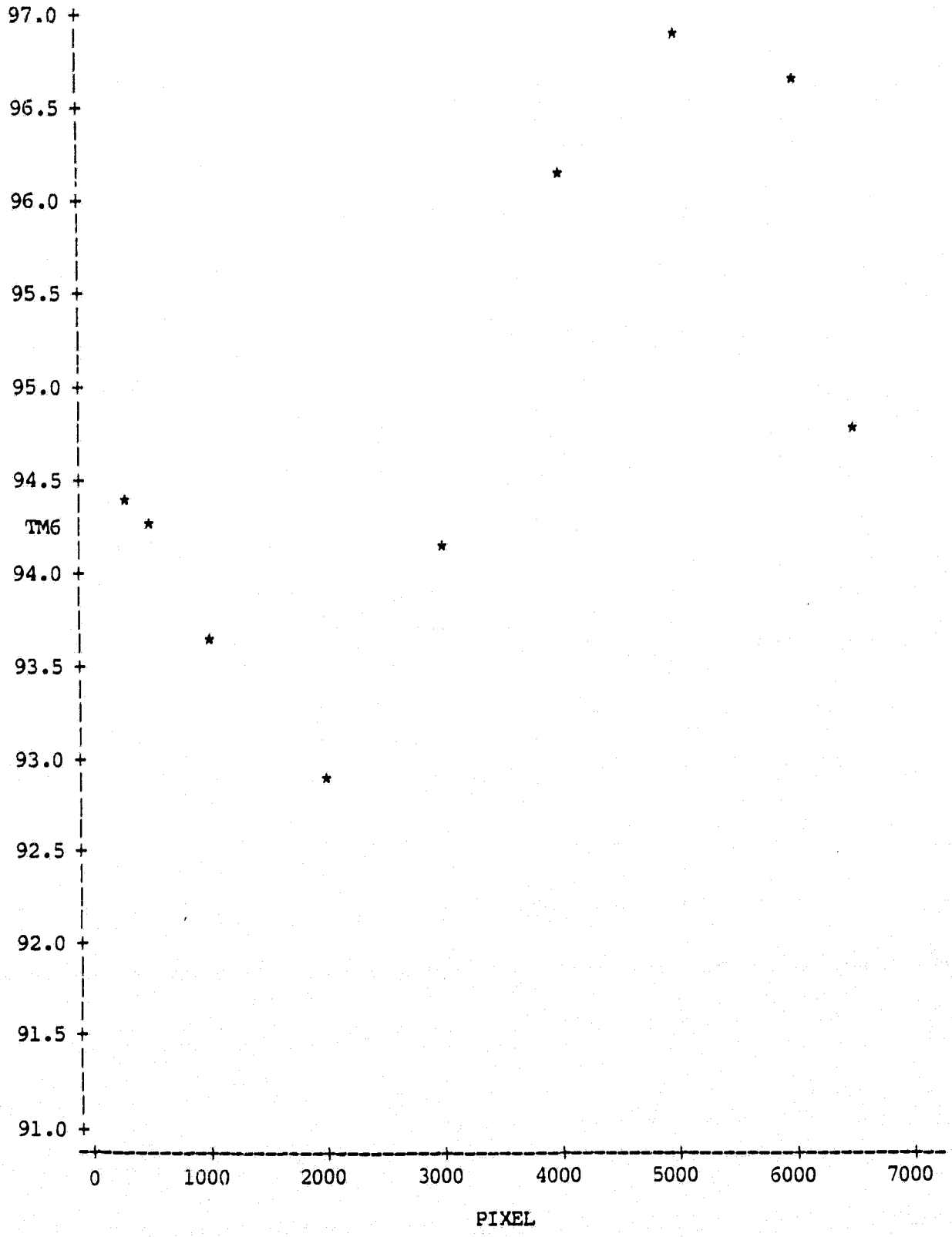
PLOT OF TM6*PIXEL SYMBOL USED IS *

Fig. 77



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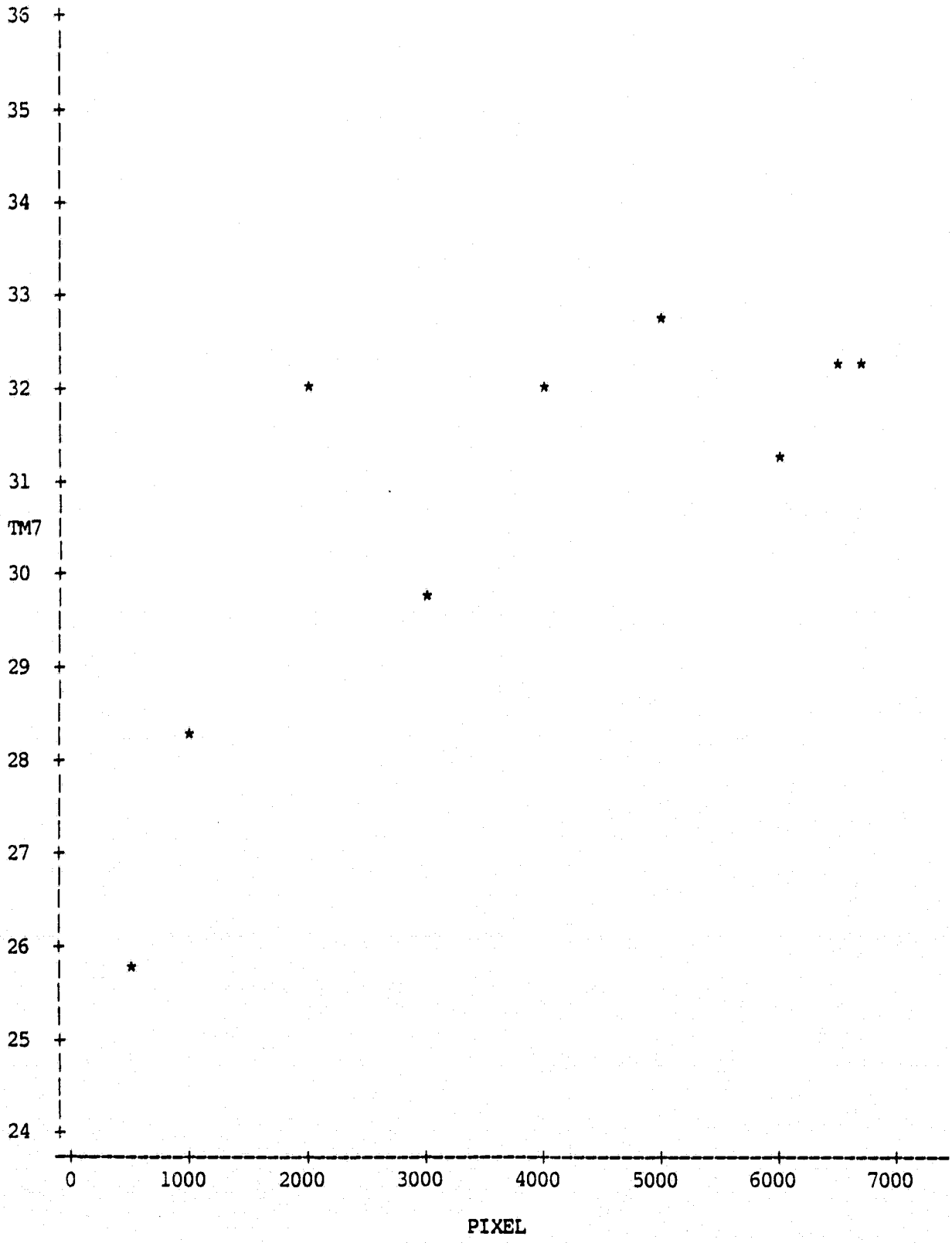
PLOT OF TM7*PIXEL SYMBOL USED IS *

Fig. 78



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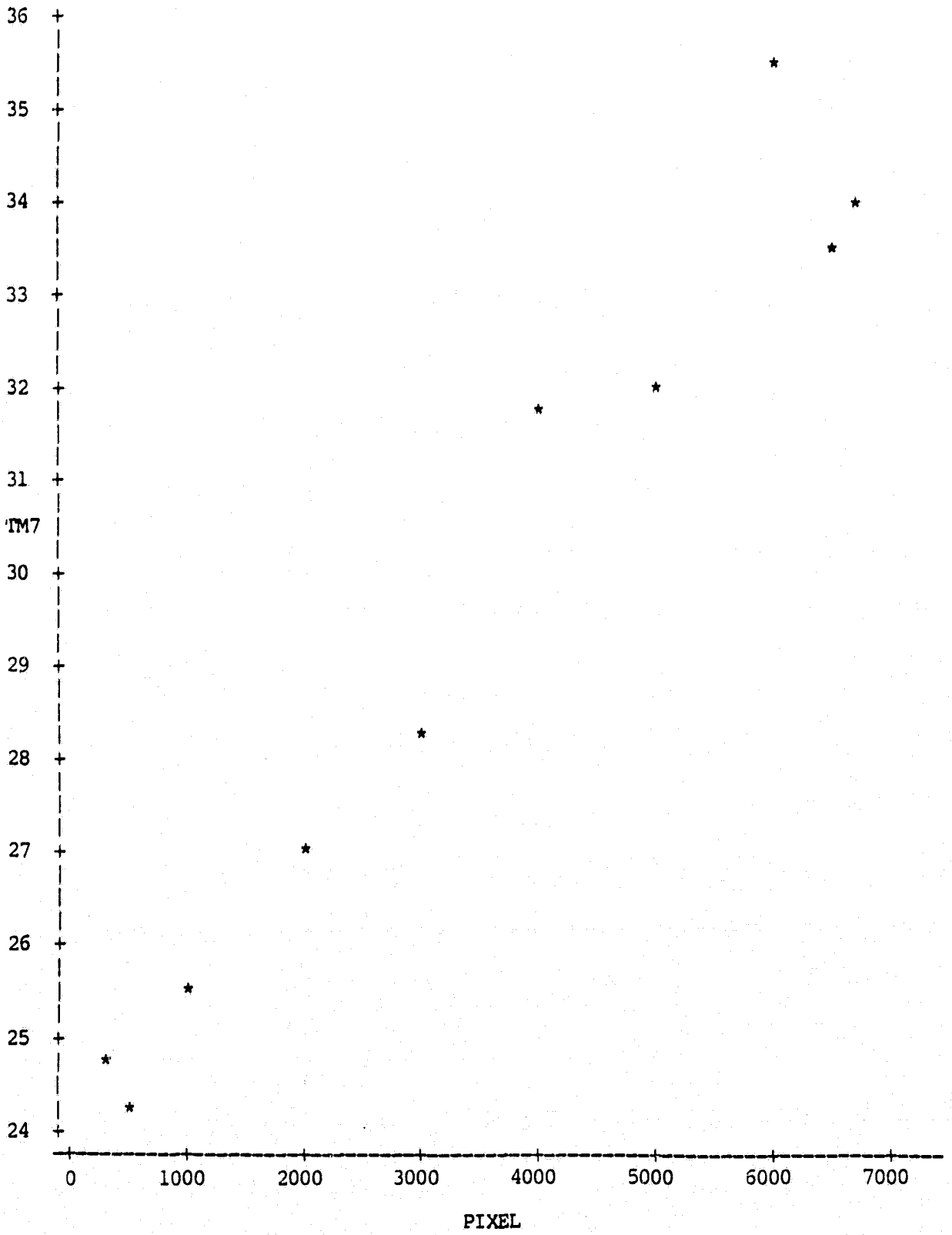
PLOT OF TM7*PIXEL SYMBOL USED IS *

Fig. 79



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PLOT OF TM7*PIXEL SYMBOL USED IS *

Fig. 80

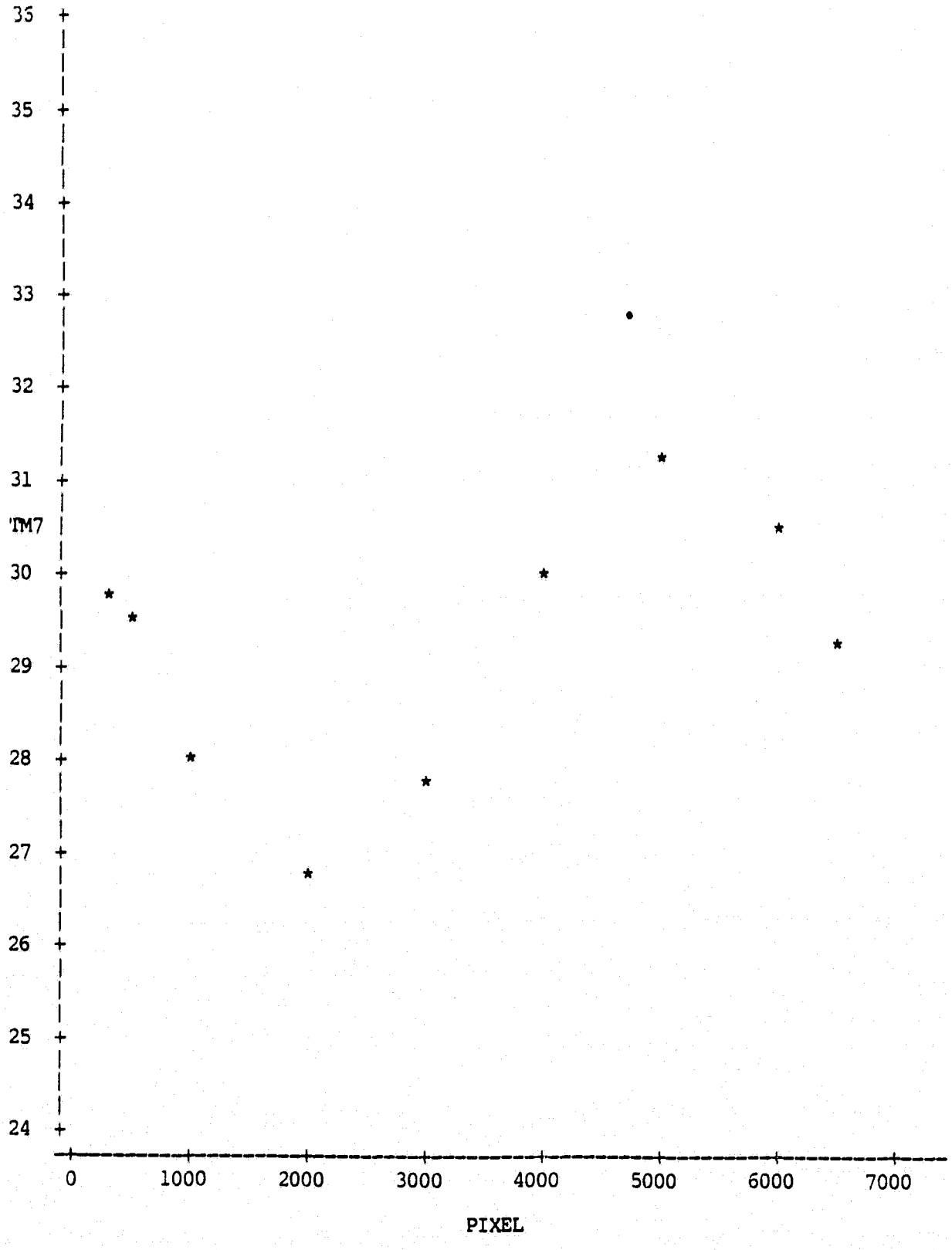

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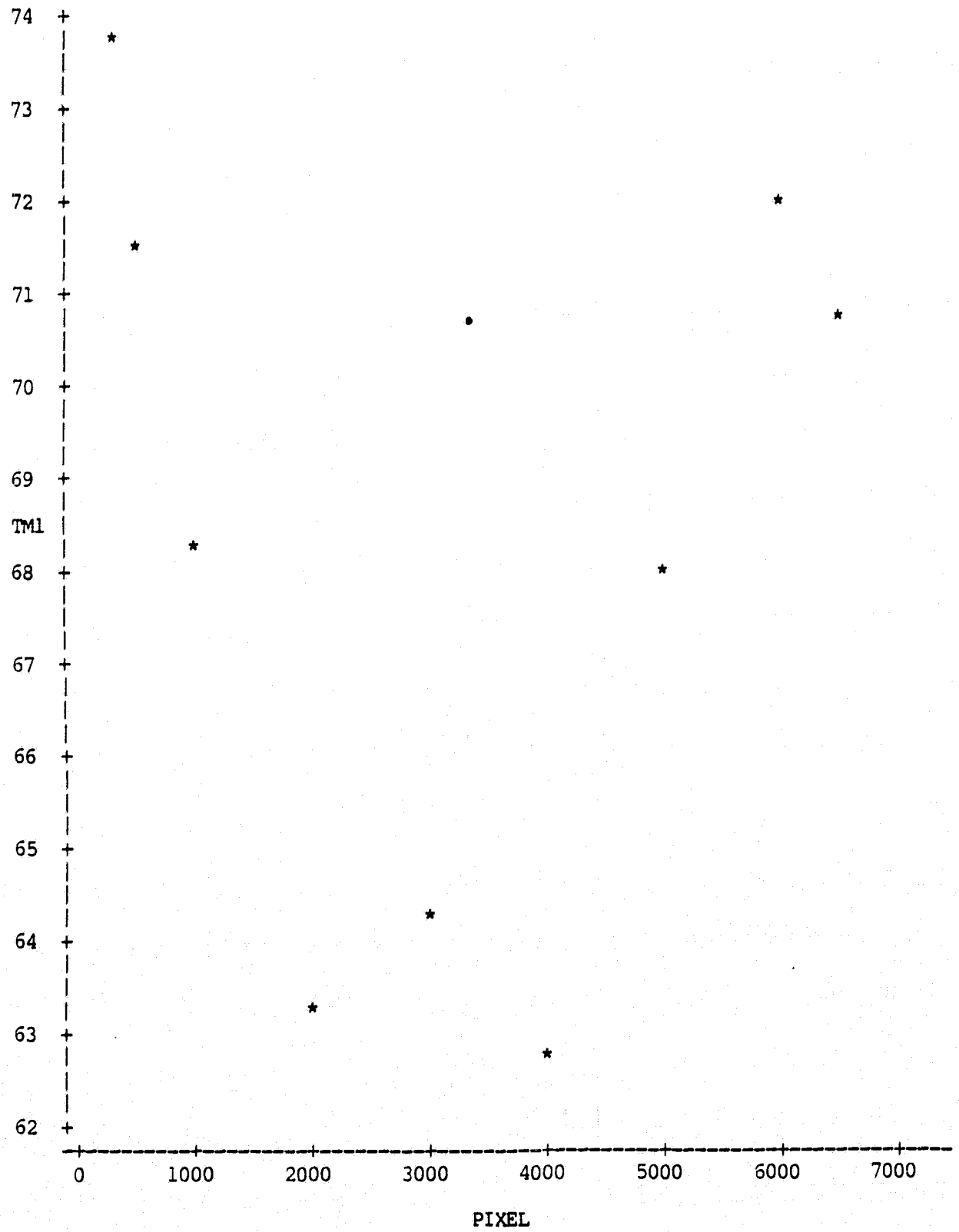
Fig. 81

PLOT OF TM1*PIXEL SYMBOL USED IS *



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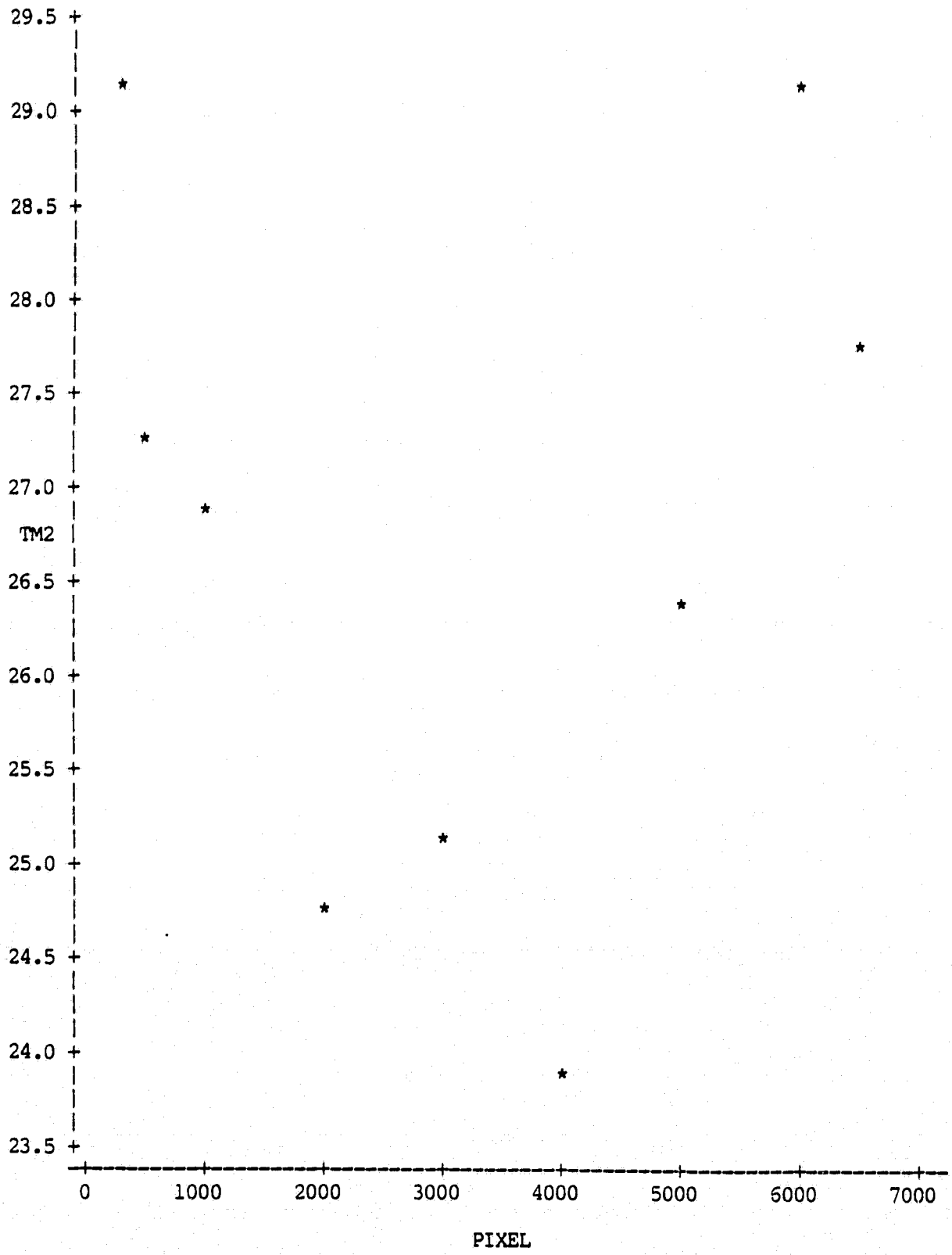
PLOT OF TM2*PIXEL SYMBOL USED IS *

Fig. 82



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PLOT OF TM3*PIXEL SYMBOL USED IS *

Fig. 83

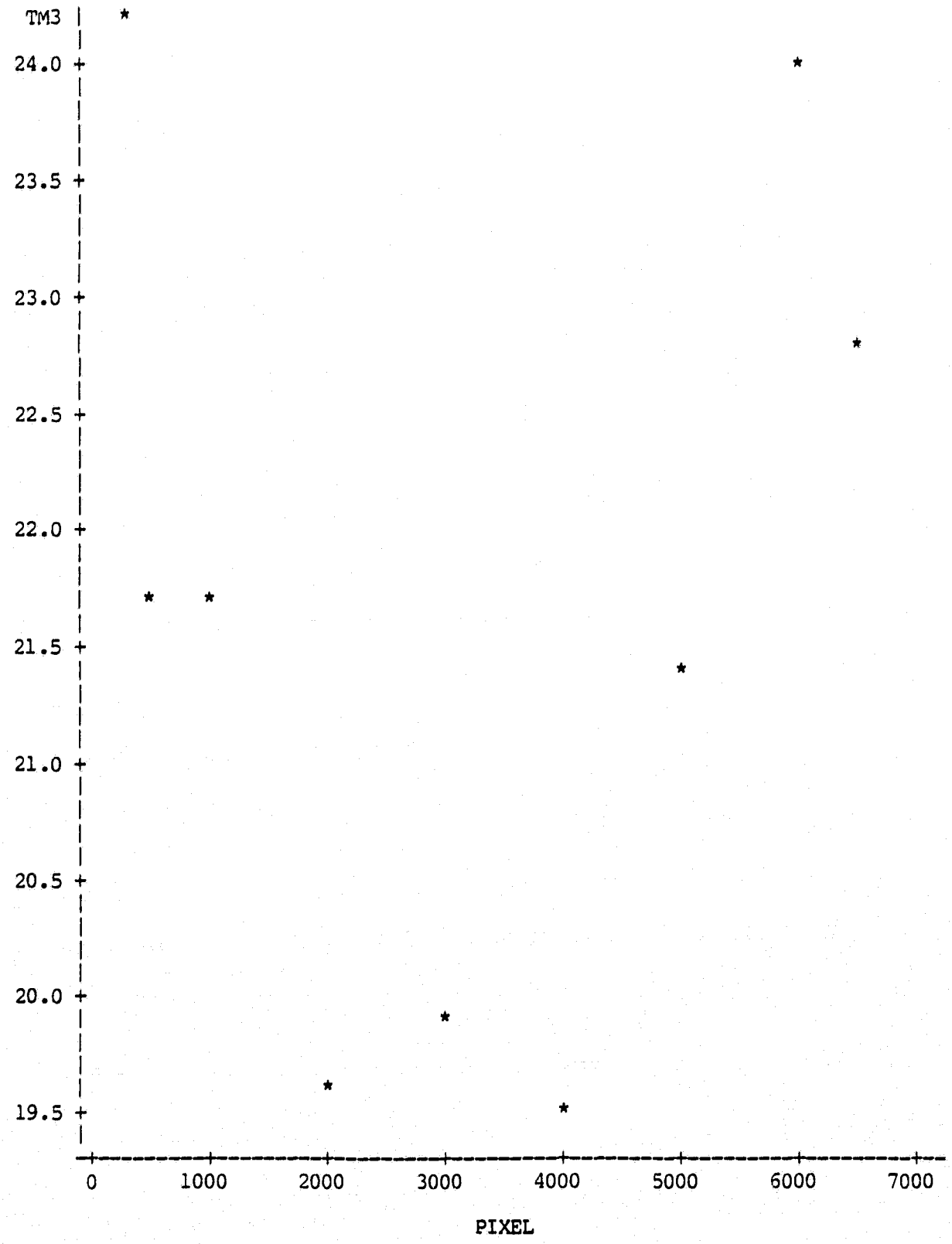

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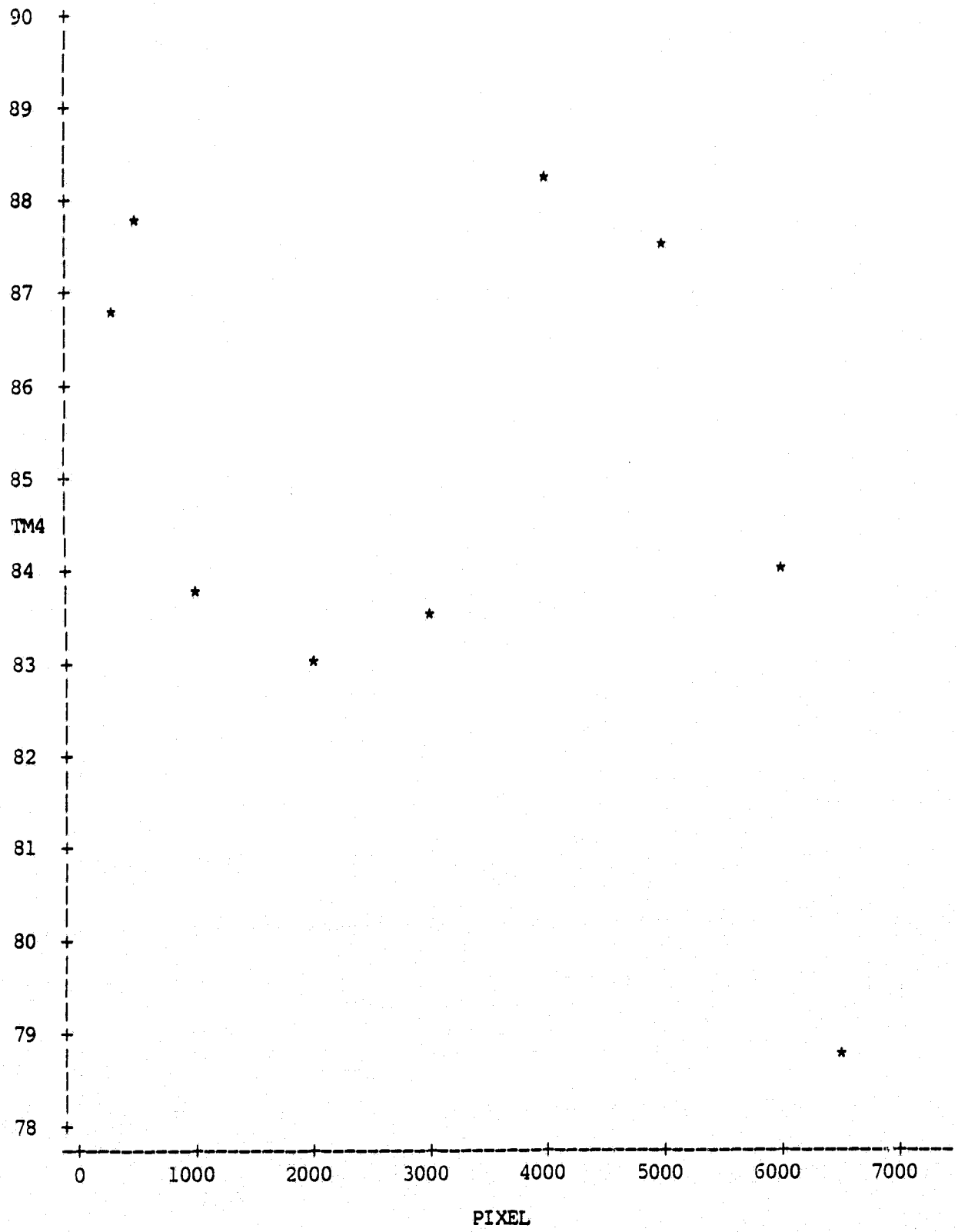
Fig. 84

PLOT OF TM4*PIXEL SYMBOL USED IS *



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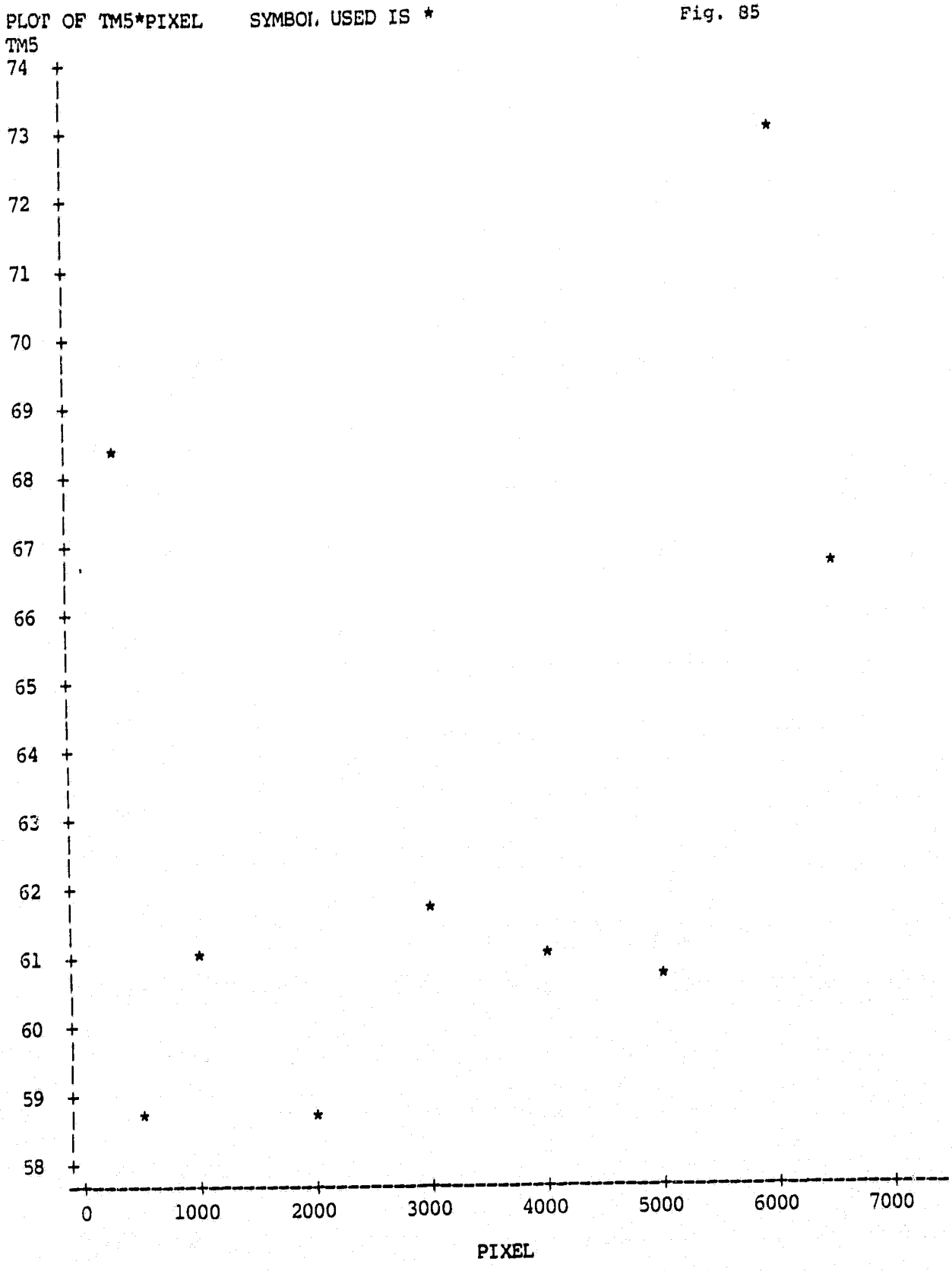
PLOT OF TM5*PIXEL SYMBOL USED IS *

Fig. 85



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PLOT OF TM6*PIXEL SYMBOL USED IS *

Fig. 86

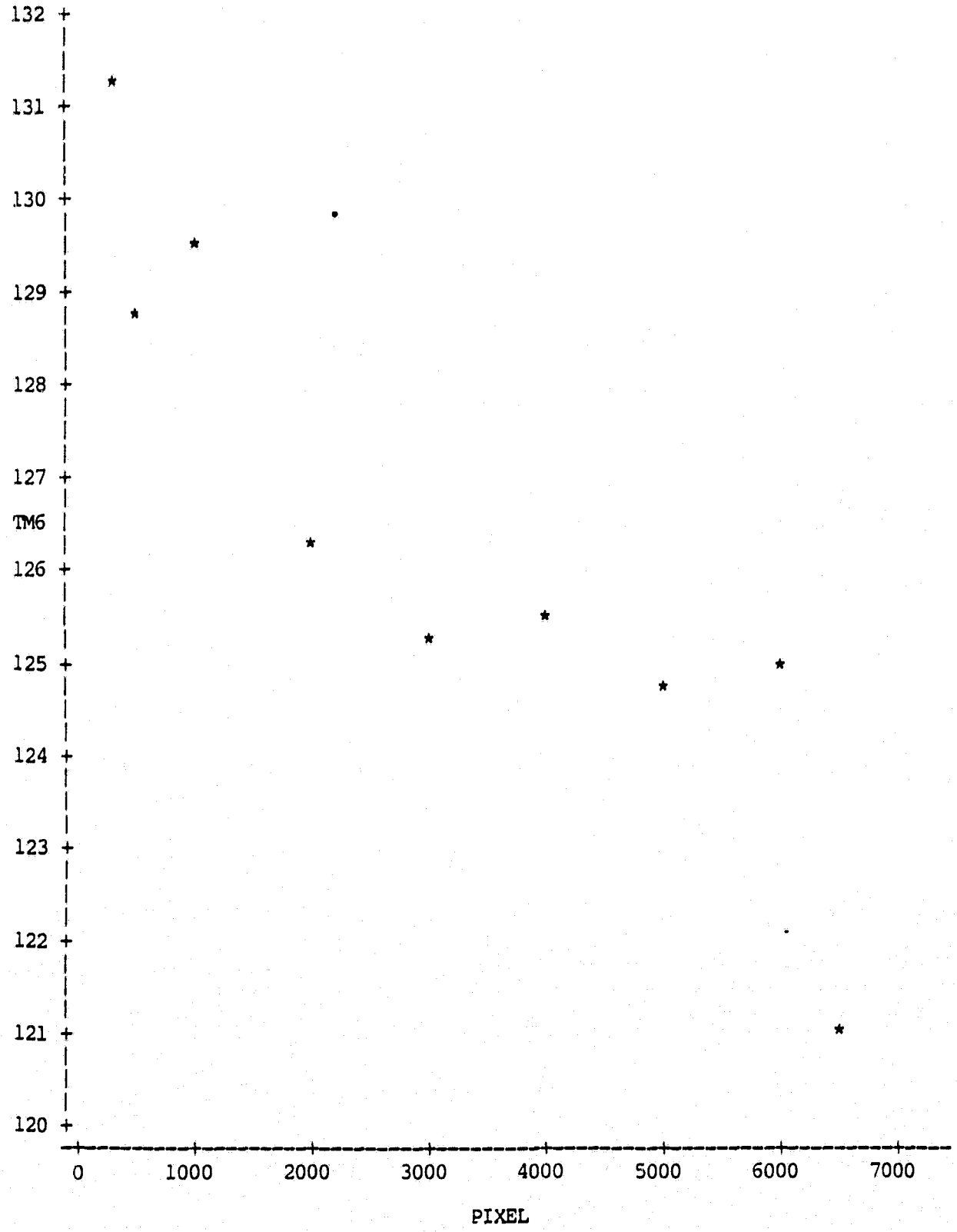

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Fig. 87

PLOT OF TM7*PIXEL SYMBOL USED IS *

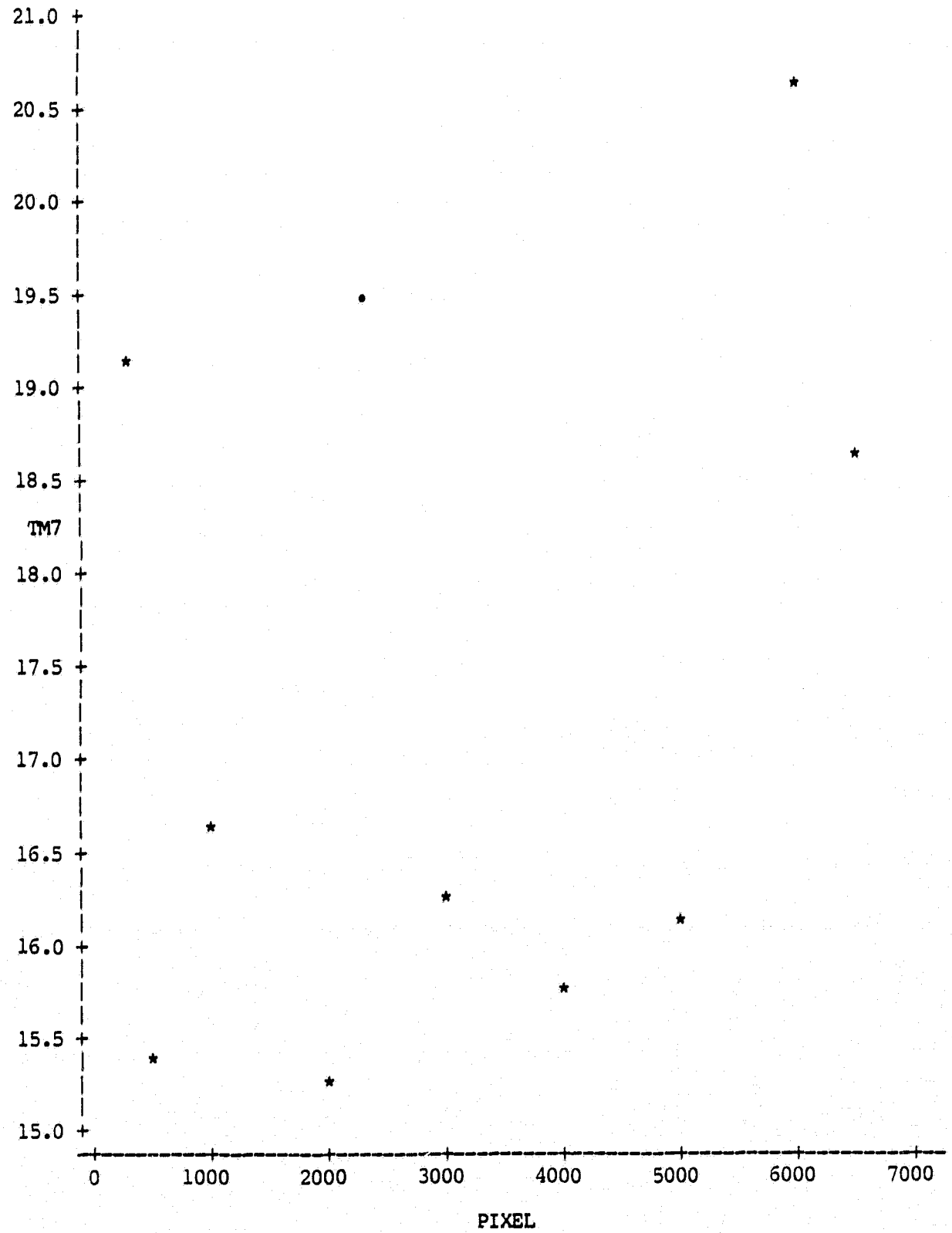

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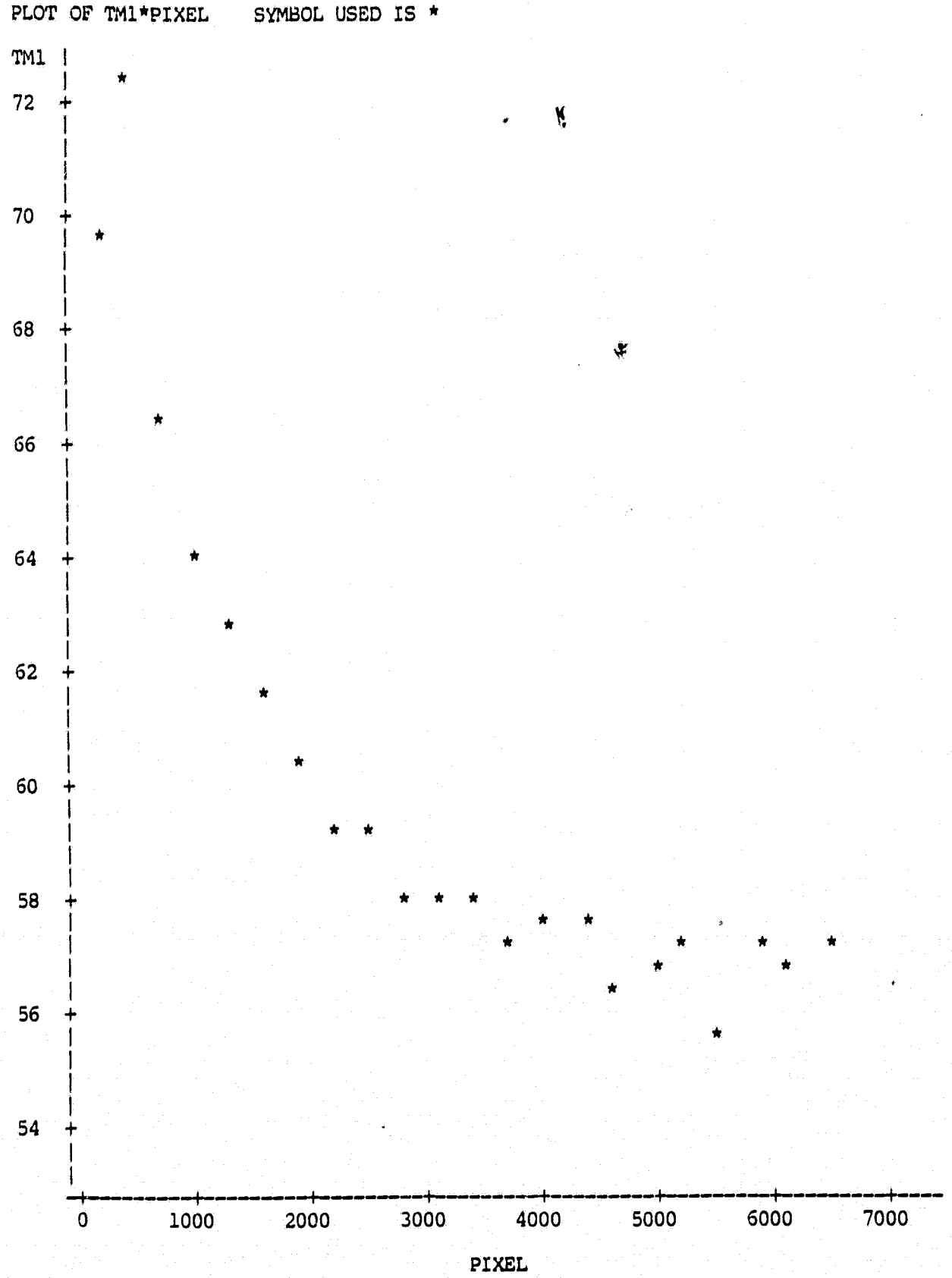
Fig. 88



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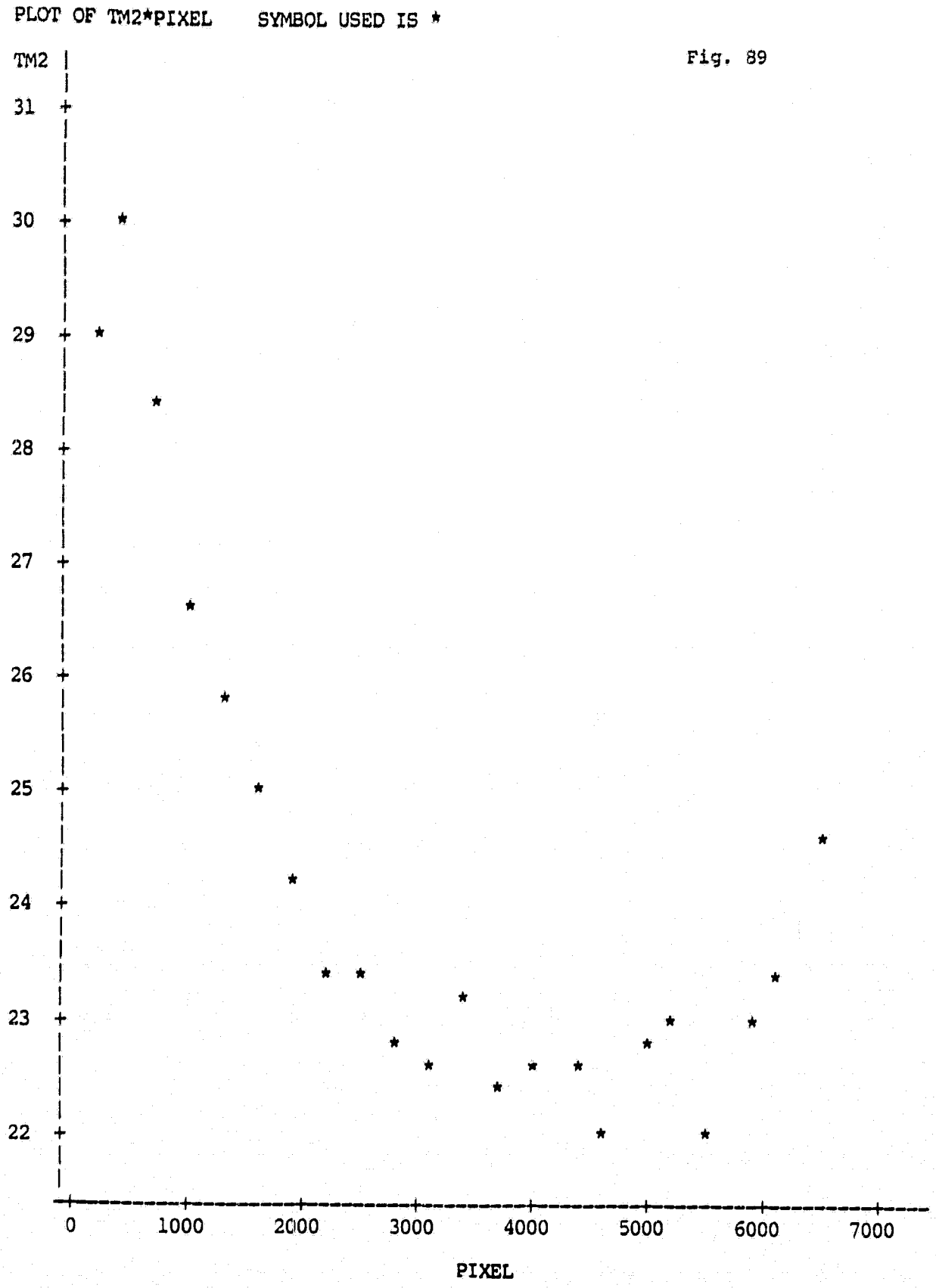

Fig. 89

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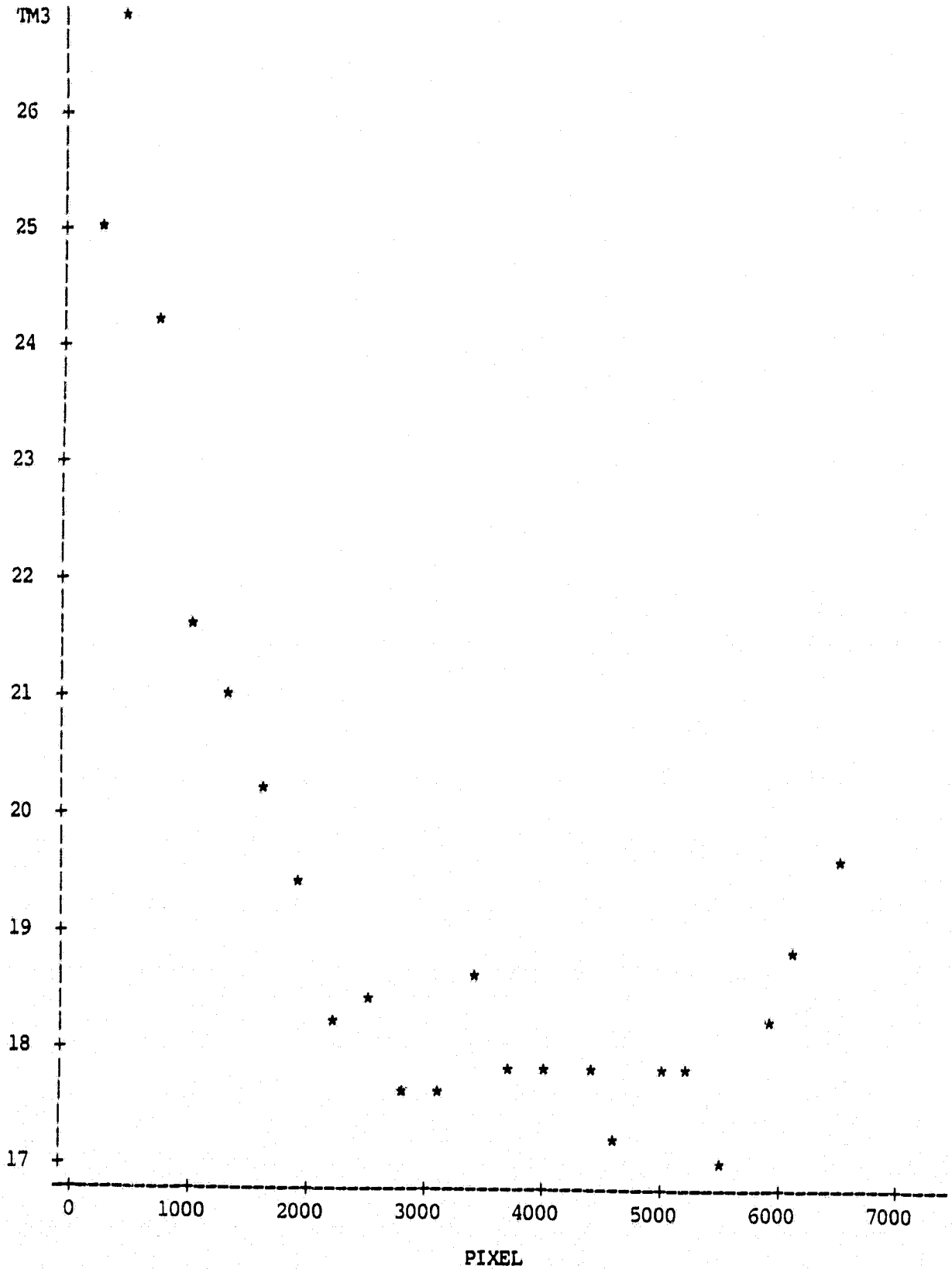
PLOT OF TM3*PIXEL SYMBOL USED IS *

Fig. 90



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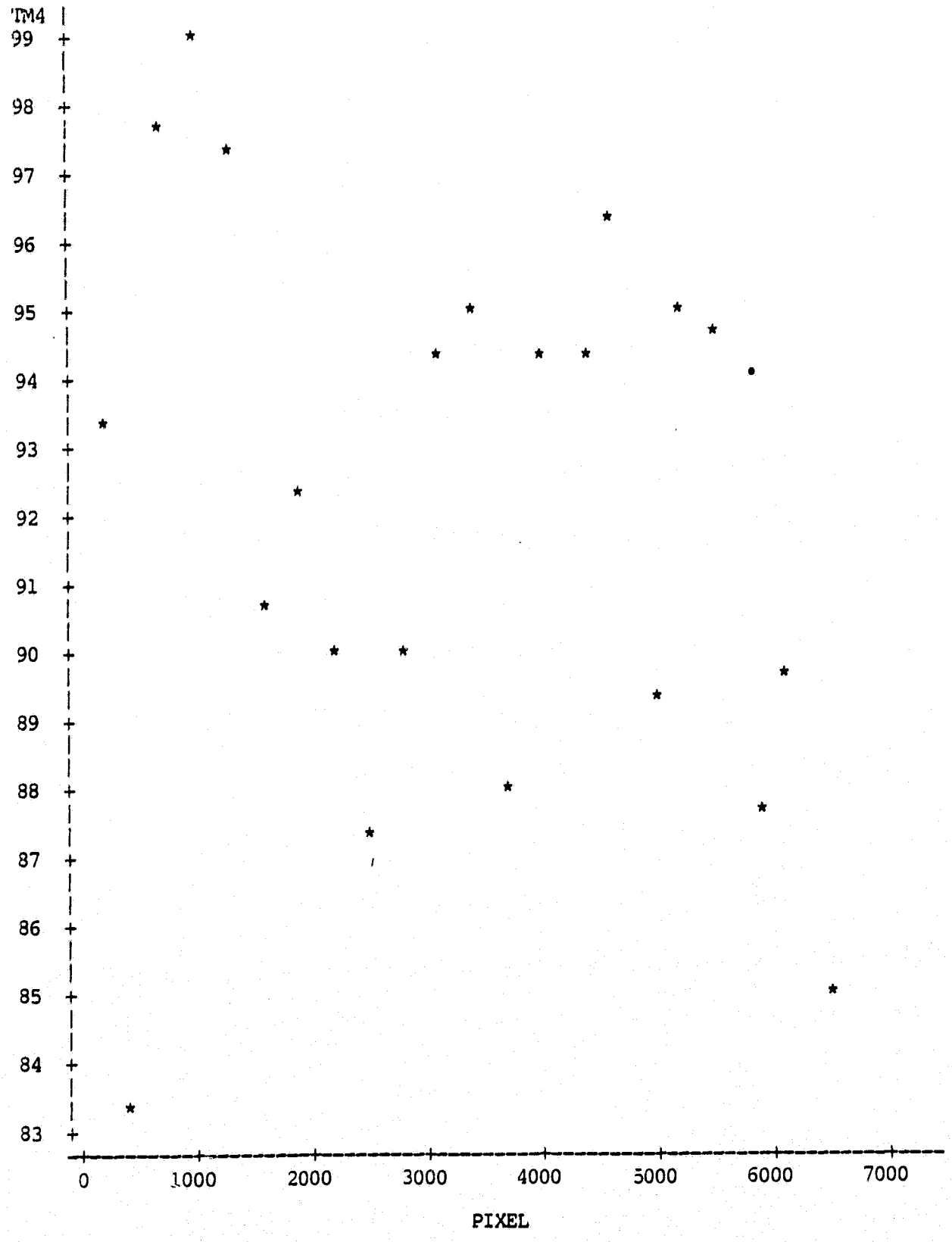
PLOT OF TM4*PIXEL SYMBOL USED IS *

Fig. 91



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PLOT OF TM5*PIXEL SYMBOL USED IS *

Fig. 92

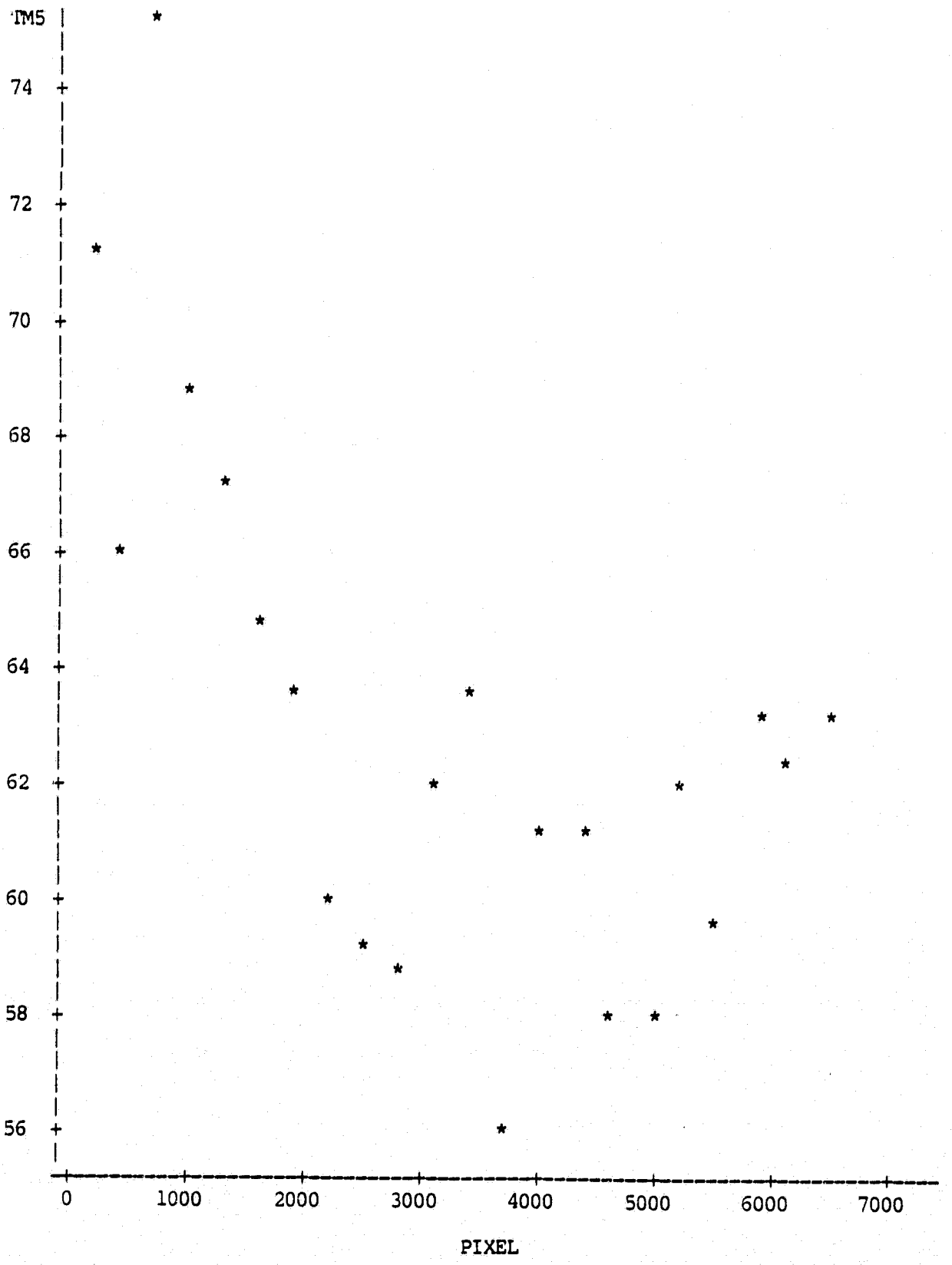

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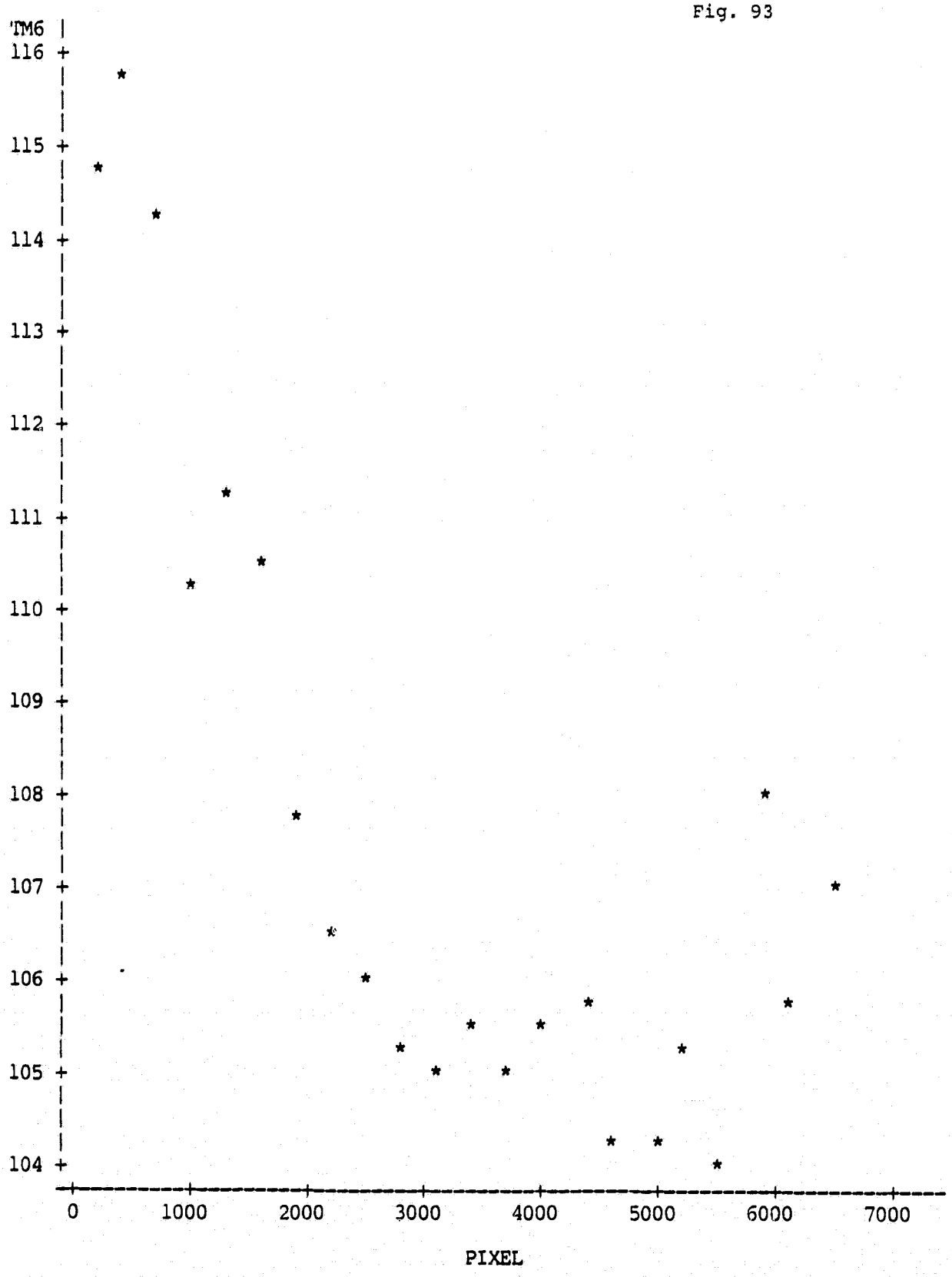
Fig. 93



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PLOT OF TM7*PIXEL SYMBOL USED IS *

Fig. 94

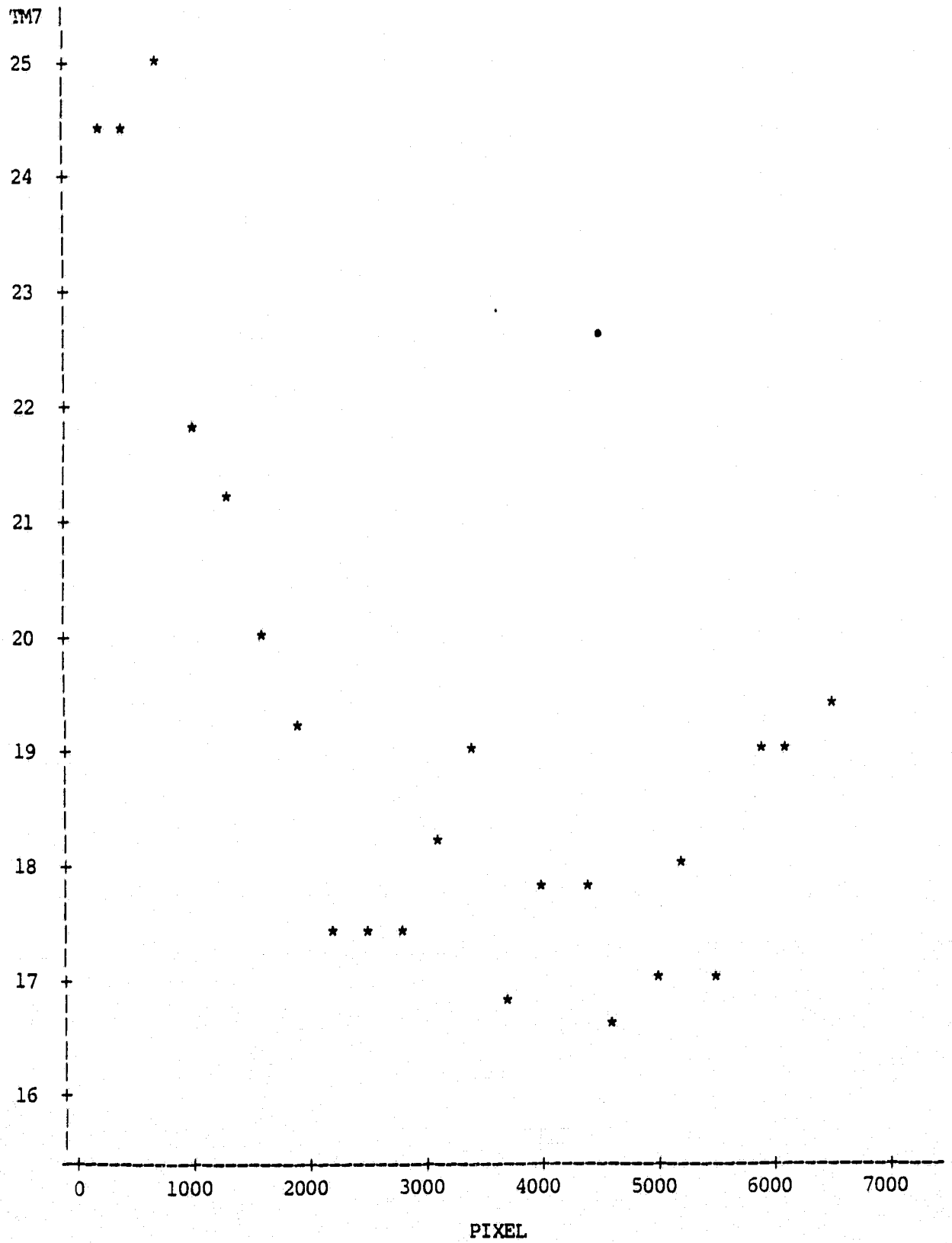

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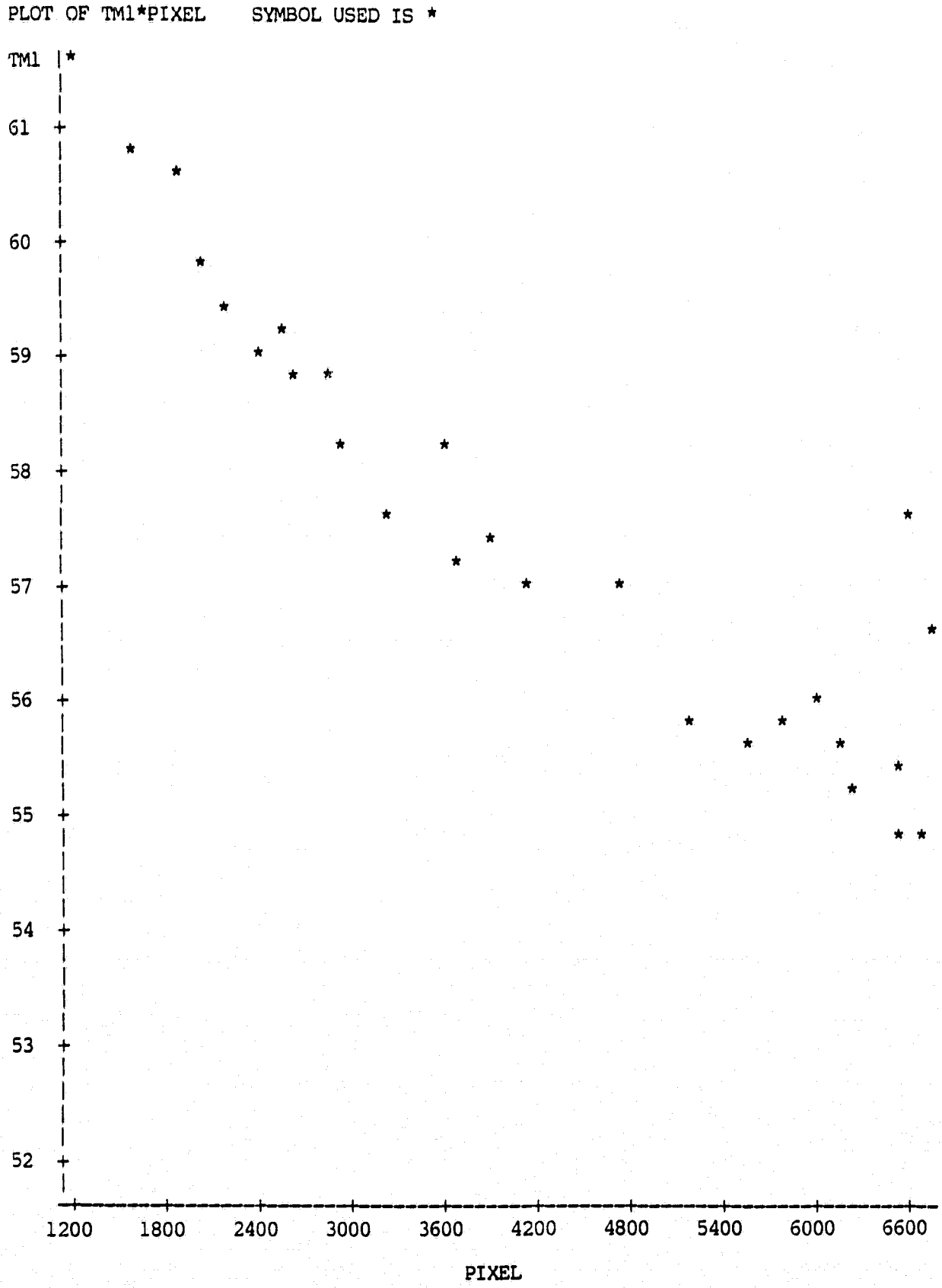
Fig. 95



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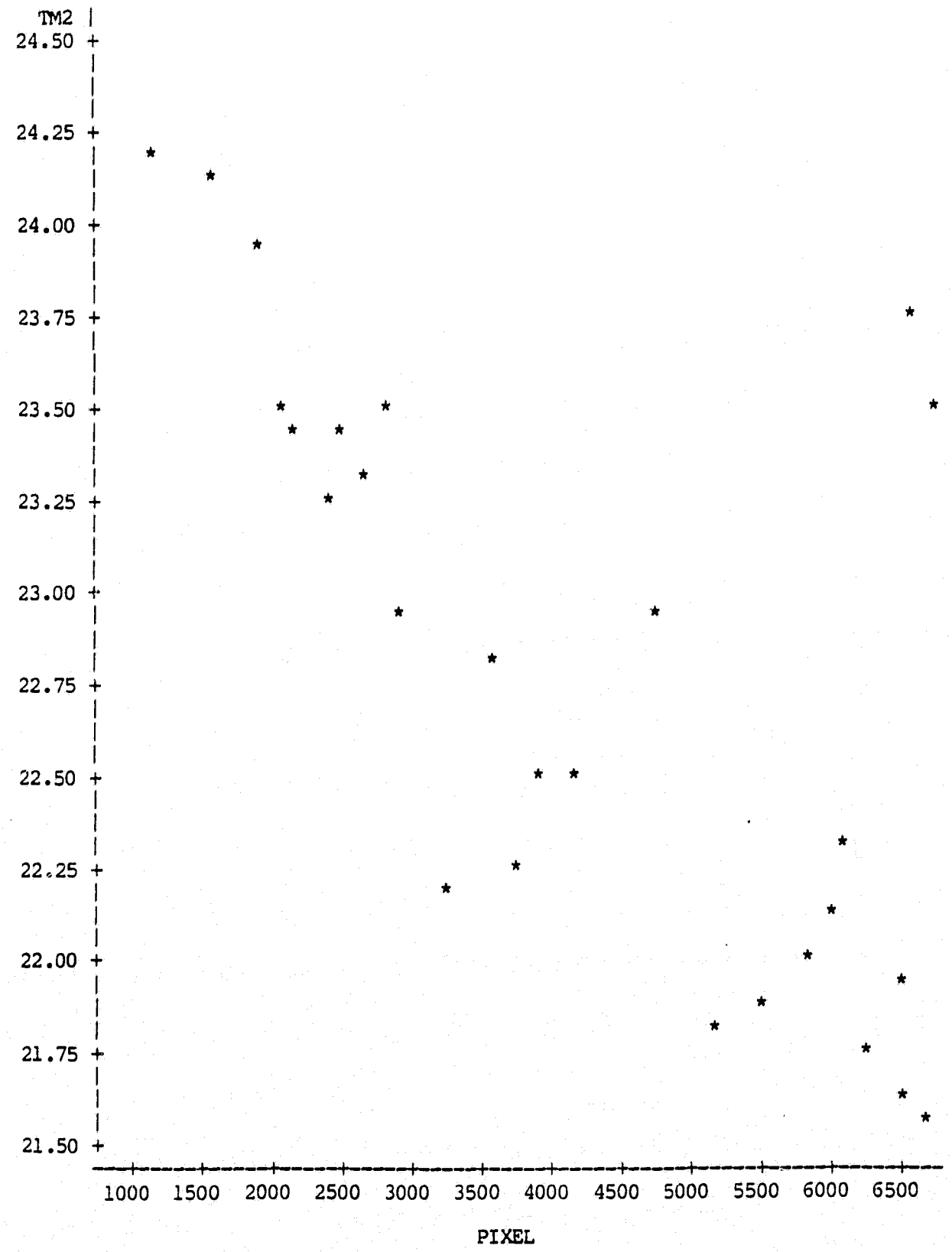
PLOT OF TM2*PIXEL SYMBOL USED IS *

Fig. 96



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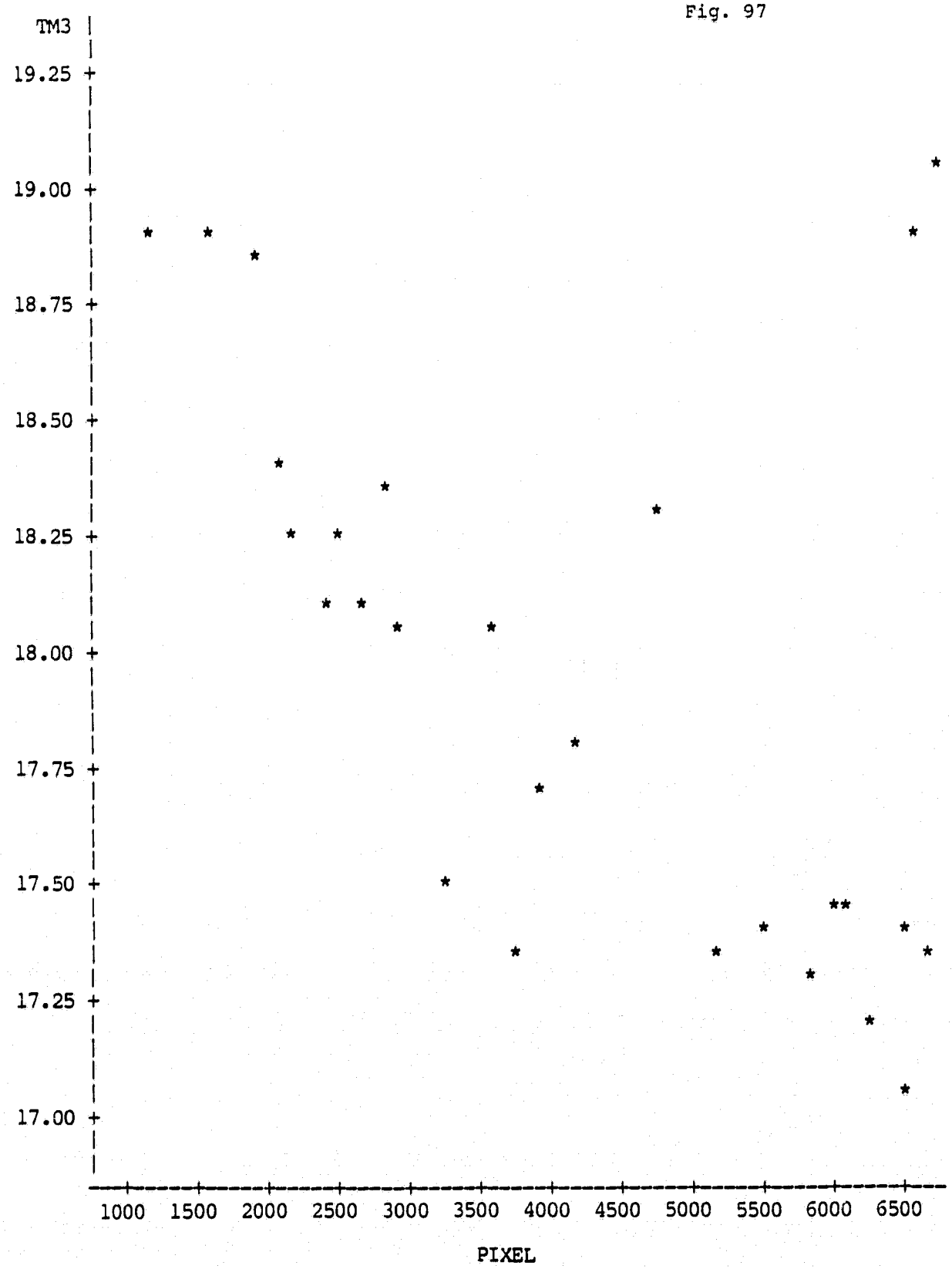
PLOT OF TM3*PIXEL SYMBOL USED IS *

Fig. 97



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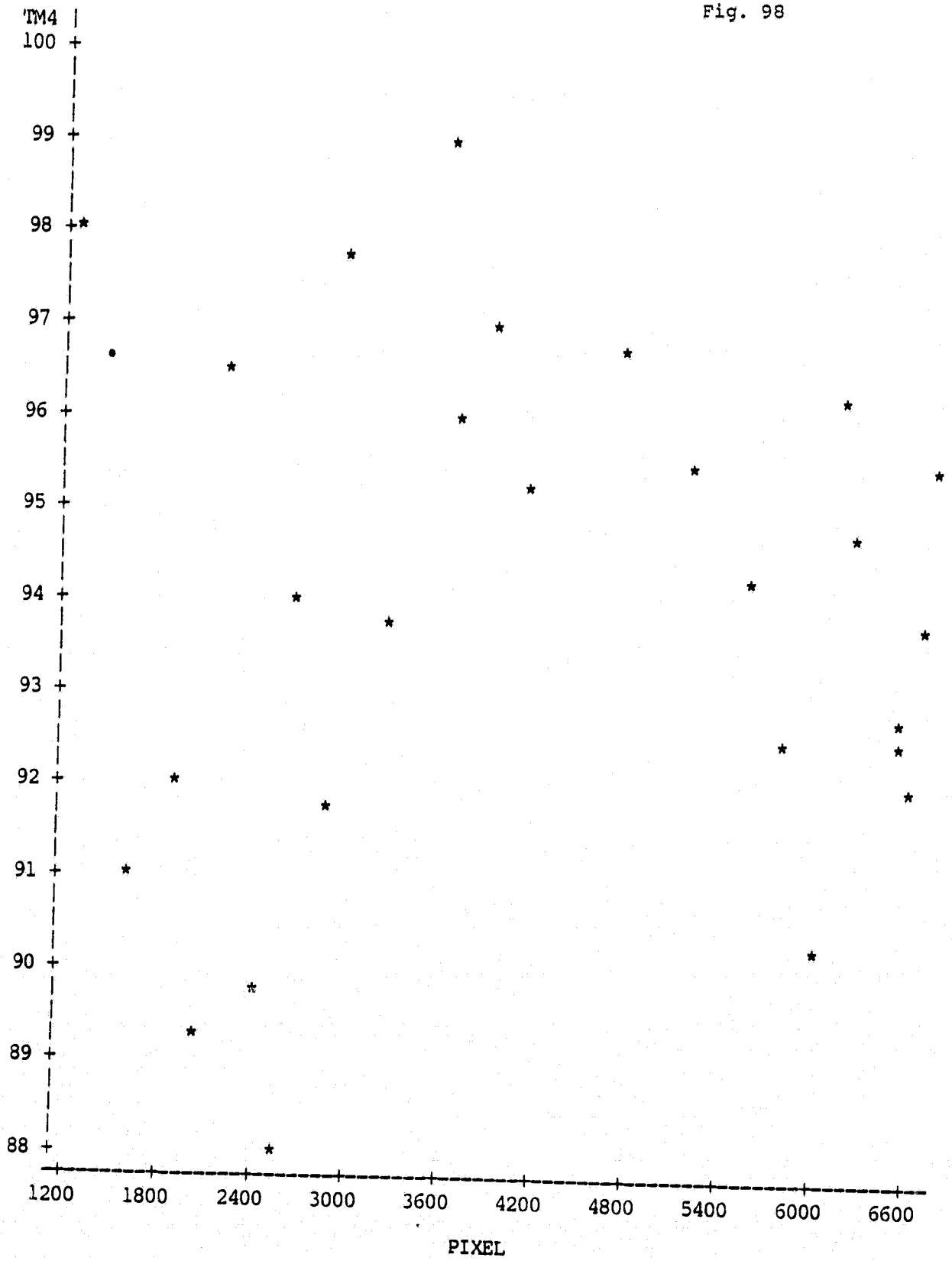
PLOT OF TM4*PIXEL SYMBOL USED IS *

Fig. 98



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PLOT OF TM5*PIXEL SYMBOL USED IS *

Fig. 99

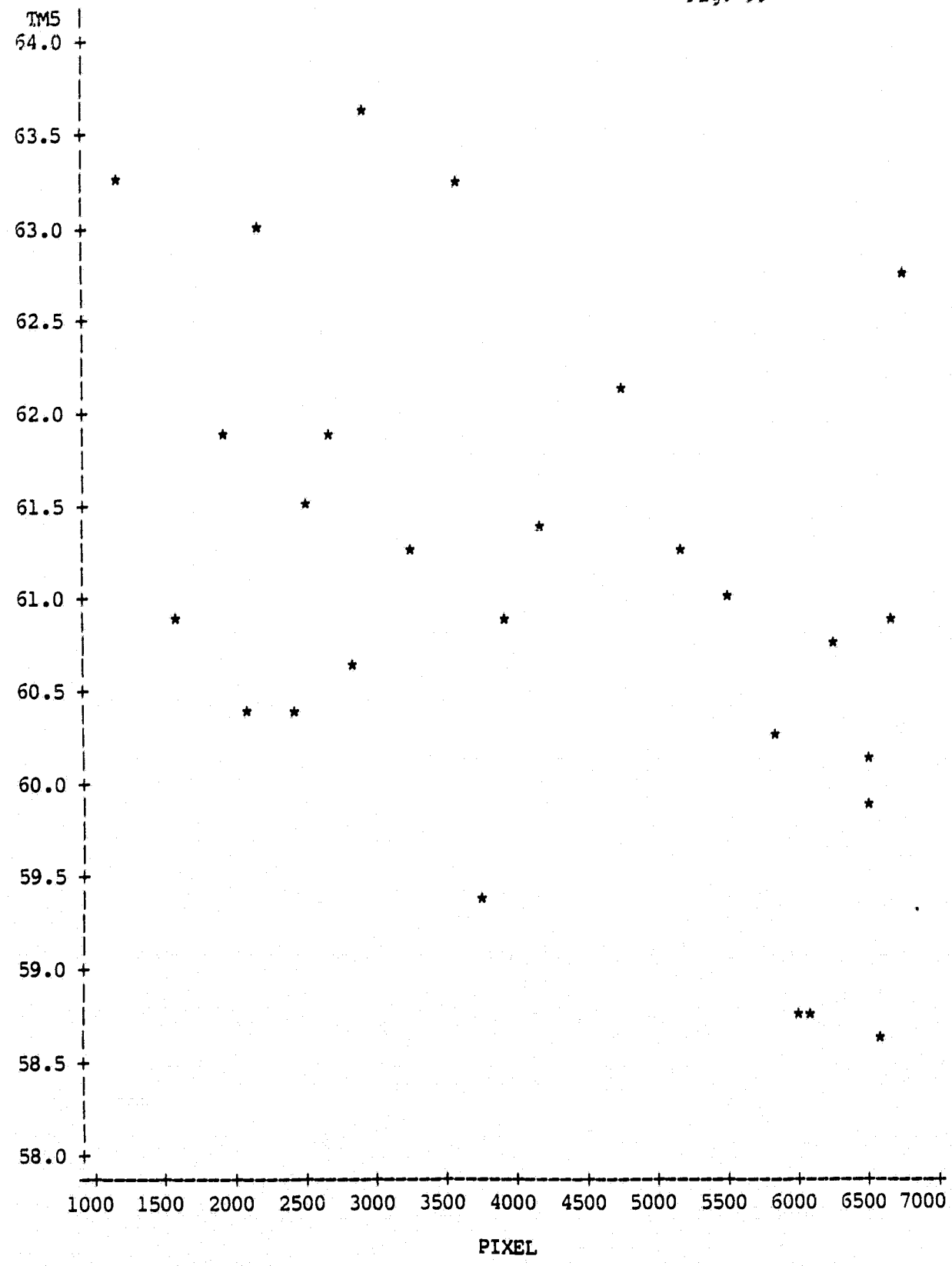

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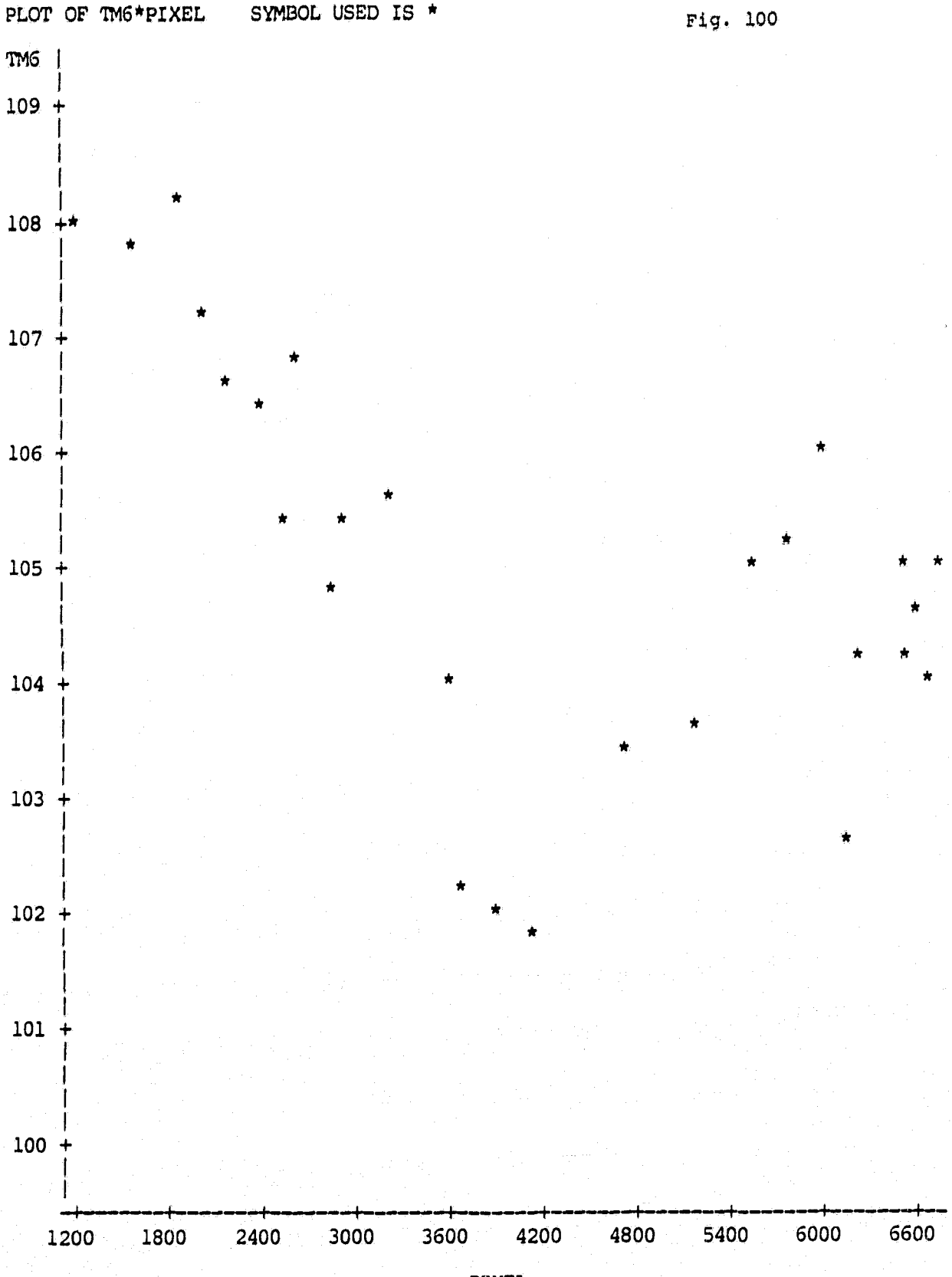
Fig. 100



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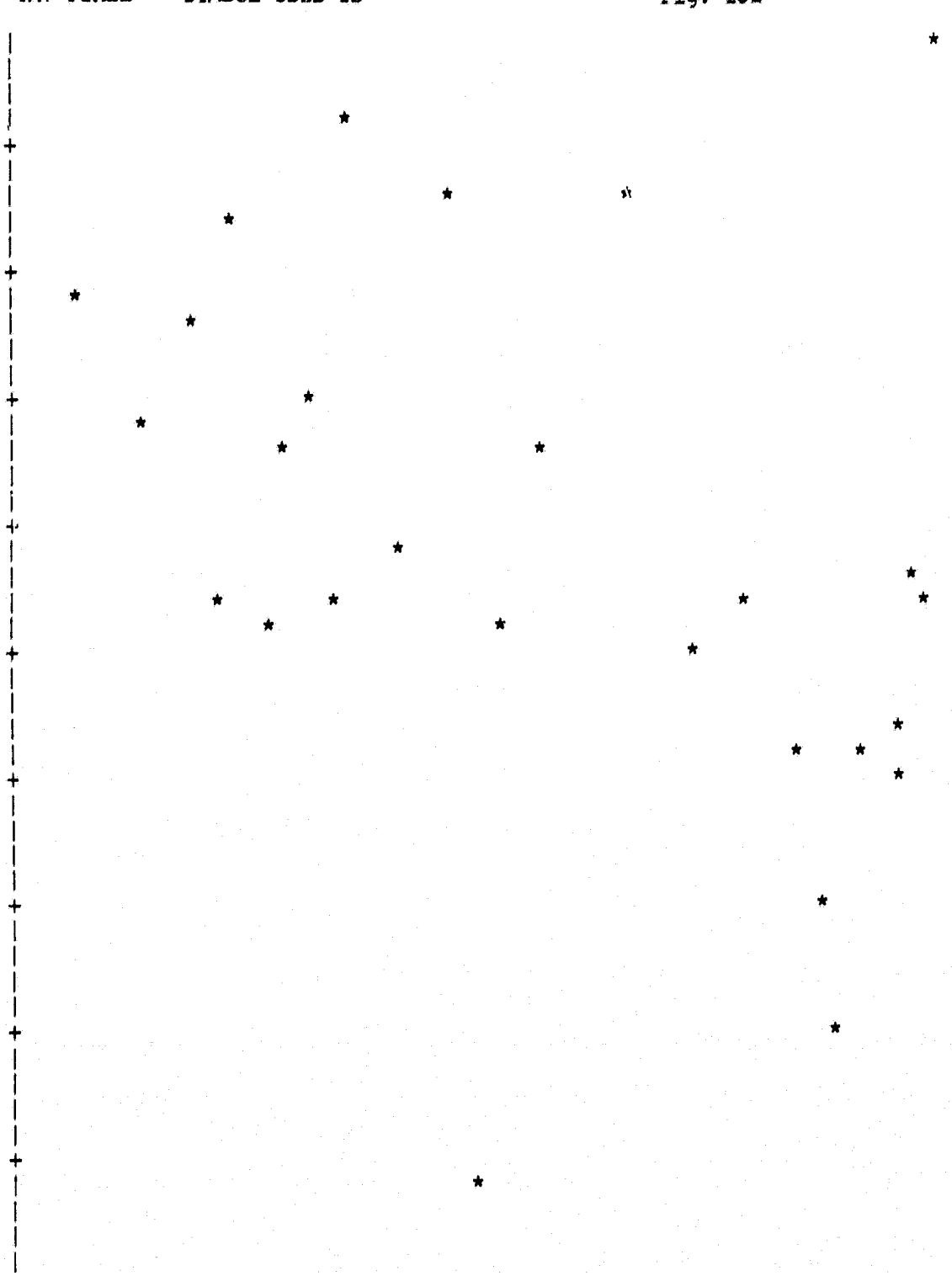
Fig. 101