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RENTON, WASHINGTON

DOCUMENT NO. D6-25265

TITLE: Quantitative Texture Analysis by X-Ray Diffraction.

MODEL All

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PREPARED BY R. H. Olsen 9/24/70

SUPERVISED BY J. E. Balsch 10/19/70

APPROVED BY for J. C. McMillan 10-21-70

APPROVED BY

(DATE)

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ABSTRACT

Techniques have been developed to quantitatively plot pole figures using x-ray diffraction. Corrections are made for background and defocusing effects and the data is converted from angular coordinates to orthogonal coordinates using stereographic mapping equations. The x-ray data is taken using a modified Siemens Pole Figure Goniometer and plotting is done via CDC 6600 and SC 4020 processing.

Calculation of an anisotropy index (K_A) is made from the basal plane pole figures of titanium and empirically related to mechanical properties.

KEYWORDS LIST

Pole Figures
Computer Processing
Anisotropy Index (K_A)
Titanium

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1.0 INTRODUCTION AND SUMMARY

If single crystals were isotropic in their physicomechanical properties there would be no real requirement for texture, preferred orientation, analysis; polycrystalline properties would be independent of texture. Single crystals, however, do exhibit marked anisotropy and only a small degree of texture gives rise to anisotropic behavior in the polycrystalline materials. The anisotropy tends to be nullified if the crystals are oriented at random. Any perferential alignment caused by the thermal and mechanical history will cause a corresponding anisotropy in the polycrystalline material. The more perfect the alignment the closer the approach to single crystal properties.

Considerable variation with testing direction in Young's modulus for titanium and its alloys have been found. This variation is directly related to the anisotropy of basic single crystal elastic constants. Larson[1] has shown that E varies from 14.5×10^6 psi when tension is applied parallel to the basal plane and 21.0×10^6 psi when the stresses are applied normal to the basal plane. Thus the degree of texture is very important in determining polycrystalline titanium properties.

Texture can be measured using x-ray diffraction and is represented by pole figures. Pole figures are a polar stereographic plot of the degree of texture. The pole density is obtained by analyzing the diffracted x-ray intensity as function of orientation. The diffracted x-ray intensity from a particular plane is proportional to the number of crystallites properly oriented for Bragg reflection.

Pole figures are normally plotted manually from the x-ray diffraction intensity recorded on a strip chart. Using computer technology this very laborious and time consuming job can be done automatically[2].

This document describes a method from which pole figure data is automatically plotted from digital data obtained from a Siemens X-Ray Unit. Most of the procedures and data refers to 0002, basal, plane pole figures of titanium and its alloys. The method is, however, quite general and can be easily applied to other materials.

Calculation of K_A (anisotropy index) is made from the pole figures and has been related to mechanical properties.

This work was done under the 1969 IR&D Contract.

2.0 EXPERIMENTAL PROCEDURE

2.1 Equipment

The instrument used to measure the x-ray data is a pole figure goniometer. Figure 1 shows the Siemens X-Ray Pole Figure Goniometer, and identification of the various components. The x-ray tube (1)* is a line focus copper anode tube that gives about six times the intensity as conventional x-ray tubes. The entrance apertures (2), (3) and main slit (4) are used to control the horizontal and vertical divergence such that the specimen (5) is fully radiated as it is translated, tilted and rotated. The main slit (4) controls the vertical divergence such that the x-ray beam lies precisely on the tilt axis. The receiving slits (6), (7) are set to obtain the resolution required. The following conditions are those normally used for basal plane, 0002, pole figures of titanium:

Entrance Aperture:	2mm x 2mm
Receiving Slits:	1mm wide, 5mm high
Specimen Size:	$1\frac{1}{4}$" square

More detail on the specimen size and configuration is given in section 2.2.

The detector (8) is a sealed Krypton filled proportional counter. The output is fed through a pulse height analyzer to optimize the peak to background ratio.

Alignment plays an extremely important role in determining the success or failure of obtaining good pole figure data. The original Siemens $\theta:2\theta$ base plate was found inadequate, so a standard diffractometer (9) was modified to accommodate the pole figure goniometer. Using the arrangement precise control of the alignment is obtained. The instrument is aligned such that there is a variation of no more than .05° in 2θ between $\phi=0°$, $\phi=+45°$ and $\phi=-45°$ as recommended by Chernock and Beck[3]. The specimen tilt, ϕ angle, is 75° as recommended by Schulz[4].

2.2 Data Recording

Digital data is obtained by selecting a preset time of 6 seconds to accumulate a count on the scaler. The data is then printed on paper tape and automatically recycled. The texture goniometer operates continuously such that the α angle advances 7.74° per cycle.

* Numbers refer to labels in Figure 1.

2.0 EXPERIMENTAL PROCEDURE

2.3 Specimen Configuration and Preparation

The three sampling plans used for pole figure determinations by the Schulz[4] reflection method are shown in Figure 2. Of these, our laboratory uses primarily plans A and C. Sampling plan C, developed by Kula and Lopata[5], has the advantage that there is data throughout one quadrant of the figure. With this sampling plan one quadrant of the pole figure is obtained; this is usually sufficient due to symmetry conditions. Unless there is insufficient material all specimens are run using sampling plan C. Sampling plan A is used in cases of very little material. The disadvantage of plan A is that the data exists only in the inside 75° of the figure. Sampling plan B has been used in conjunction with plan A however, as discussed by Baggerly[6], the greatest amount of error is in the region of data overlap.

For all specimens configurations the minimum specimen size is $1\frac{1}{4}$" square. Cutting and mounting the specimen for sampling plan C was initially a problem, however, x-ray technicians E. A. Ledbury and W. H. Graham have developed techniques to overcome these serious obstacles. Titanium alloys are metallographically polished and given a light Krolls etch to remove smeared metal.

2.4 Data Recording and Computer Plotting

The specimen is placed in the goniometer and adjusted to position using an alignment rod. The x-rays are turned on and the diffraction profile(s) of the plane(s) of interest are recorded on the strip chart noting the Bragg angle to within .02°2θ. The background is measured, and the pole figure data is recorded by setting the diffractometer to the measured Bragg angle, tilting the specimen to 75°, and recording the diffracted intensity as the specimen is tilted and slowly rotated. The data is taken on a spiral whose pitch is 5°ϕ for every 360°α . The data is recorded in 0.1 minute increments, corresponding to angular increments of 7.74°, and is printed on paper tape. A total of 698 data points are required per figure. Instrument time is 75 minutes.

As the specimen is tilted the intensity drops off as a result of defocusing and absorption. To correct for this we measure the intensity from a random specimen at ϕ=0, 10, 20, 30, 40, 50, 60, 70, and 75° and the background intensity at ϕ=0. Figure 3 shows the loss of intensity at increasing ϕ angles for a silver random sample.

2.0 EXPERIMENTAL PROCEDURE

2.5 Computer Processing

Computer program POLE was written and programmed by R. Peterson, Organization 6-2550. Details of the programming will be in a forthcoming document(7). Basically the program was written to plot pole figures by first subtracting of the background then correcting for defocusing. The data is then ratioed to the random intensity which is either calculated in the program or input. For 0002 pole figures we use the emperical relationship that $I_{silver}/6.75 = I_{0002}$ random sample, for $10\bar{1}0$ and $10\bar{1}1$ pole figures we use 7.3 and 1.75 as divisors to obtain the random intensity. The X and Y coordinates of each data point are calculated using the sterographic mapping equations of Holland(8) and Love (9). The mapping equations are as follows:

For Sampling Plan A, Figure 4;

$$X = RO \tan \phi/2 \cdot \cos\alpha$$

$$Y = RO \tan \phi/2 \cdot \sin\alpha$$

Where

ϕ = Polar angle measured from reference direction

α = Azimuth angle measured from reference direction.

NOTE: Sampling Plan B can also be plotted using this routine.

For Sampling Plan C, Figure 5;

$$X = \frac{RO(\sin\phi' \cos\alpha' \cos\phi_o \cos\alpha_o - \sin\phi' \sin\alpha' \sin\alpha_o + \cos\phi' \sin\phi_o \cos\alpha_o)}{D}$$

$$Y = \frac{RO(\sin\phi' \cos\alpha' \cos\phi_o \sin\alpha_o + \sin\phi' \sin\alpha' \cos\alpha_o + \cos\phi' \sin\phi_o \sin\alpha_o)}{D}$$

$$D = 1 + \cos\phi' \cos\phi_o - \sin\phi' \cos\alpha' \sin\phi_o$$

Where

ϕ_o, α_o = Origin of starting position.

ϕ', α' = Measured from starting position.

Figure 4 and 5 show the distribution of the data points on the pole figures for the two sampling plans.

2.0 EXPERIMENTAL PROCEDURE

2.5 Computer Processing

There are two plot routines available for plotting Plan A pole figures, a Boeing developed procedure, designated KODI, and a method developed by Love[9], designated POLE-Code 1. The Boeing procedure extrapolates the outer 15° of the figure so that a "total" pole figure is obtained. The procedure involves arranging the data on radii and concentric circles. A more detailed discussion is in the computer program document[7]. Love's[9] procedure involves very little extrapolation and rearranging of the data. The Love procedure is used to plot the Sampling Plan C data, and is designated POLE-Code 3.

All plotting is done at selected contours of "times-random" intensity, up to ten contour levels can be made per plot.

In addition to plotting the pole figures a factor K_A (anisotropy index) is calculated for each basal (0002) plane pole figure.

K_A is calculated as follows:

$$K_A = \bar{\bar{I}}_T - \bar{\bar{I}}_L$$

Where

$$I_T = \sum_{i=1}^{N} I(\phi_i \cdot \alpha_i) \operatorname{Sin}\phi_i \operatorname{Sin}\alpha_i$$

$$I_L = \sum_{i=1}^{N} I(\phi_i \cdot \alpha_i) \operatorname{Sin}\phi_i \operatorname{Cos}\alpha_i$$

For Sampling Plan A the I_T and I_L values are the average of the vector summations for the four quadrants while for Sampling Plan C the vector summations are for only one quadrant.

Computer input includes the specimen identification, experimental conditions, background intensity and the defocusing correction profile. A defocusing correction profile is required daily for each hkl examined.

Computer output includes a tabular representation of the figure and an SC 4020 plot of the pole figure. Total computer time is about 2.5 seconds of combined 6600 and SC 4020 time per plot.

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3.0 RESULTS AND DISCUSSION

Some examples of Sampling Plan A pole figures are shown in Figures 6 through 8. These figures were plotted using program KODI which extrapolates the outer 15° of the pole figure from the inside data. The figure for specimen G is shown replotted, using plot program POLE, in Figure 9. Examples of pole figures produced using Sampling Plan C are shown in Figures 10 through 12.

Tables I through III give examples of the tabular listing of pole figures from KODI, POLE-Plan A and POLE-Plan C. The tabular listings are useful for noting the absolute magnitude of the pole figure maximums and I_T and I_L for the K_A calculation.

The pole figures shown give a wide variety of textures caused by variations in the thermomechanical processing. Hand mill material gives typically low values of K_A and generally much less preferred orientation than the continuously rolled material.

All of the figures shown thus far were 0002, basal plane, pole figures. Figure 13 is a $11\bar{2}0$ pole figure from continuously rolled specimen G. This specimen had a very strong $(11\bar{2}0)$ $\langle 10\bar{1}0\rangle$ texture, as also shown in the side view $10\bar{1}0$ figure shown in Figure 14.

K_A is an anisotropy index for basal plane pole figures. F. Parkinson[10] has noted that with increasing $11\bar{2}0$ $\langle 10\bar{1}0\rangle$ texture the anisotropy increased. Plots of the index K_A versus ΔF_{tu} and ΔF_{ty} are shown in Figures 15 and 16 respectively. The data represents several heats from various vendors and as shown K_A varies linearly with the difference in yield and ultimate strength. Hand milled material typically has a low K_A value and much less anisotropy than the continuously rolled material which always has a fairly strong $(11\bar{2}0)$ $\langle 10\bar{1}0\rangle$ texture of varying degrees.

The procedure developed and documented herein results in vary reproducible results as shown in Figures 17 and 18. Pole figures plotted several months apart can be compared so that vendor process evaluation can be made. The K_A index is a useful measure of the degree of anisotropy.

4.0 ACKNOWLEDGEMENTS

The author sincerly adknowledges the efforts of several individuals who contributed significantly to this work - to E. A. Ledbury and W. H. Graham for invaluable experimental assistance, to R. Peterson for computer programming and checkout and to F. Parkinson who generously allowed publication of work from his program.

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SAMPLE JOH 269M. G
RADIATION CU AT 35 KV 28 MA COUNTER TUBE SCINT DATE10/11/69
SLITS 2 M 2 V ENTRANCE 5 M 1 V RECEIVING ENGINEER H.M.OLSEN AT 1.250KV
SCAN RATE 1 PSI/MIN 72 ALPHA/MIN 0802 PKL
PHA 0.5 V BASE 20. V WINDOW CALIBRATION SAMPLE SILVER
RANDOM INTENSITY 710.0 K(A) 36.490 CALC DATE 02/19/70

CALIBRATION DATA

PHI= 0	PHI=10	PHI=20	PHI=30	PHI=40	PHI=50	PHI=60	PHI=70	PHI=75
4824.0	4835.0	4616.0	4231.0	3701.0	3037.0	2403.0	1636.0	1260.0

SAMPLE BACKGROUND = 108.0 CALIBRATION BACKGROUND = 130.0

ALPHA	PHI	INTENSITY	ALPHA	PHI	INTENSITY	ALPHA	PHI	INTENSITY	ALPHA	PHI	INTENSITY	ALPHA	PHI	INTENSITY
3.9	74.9	0.0000	11.6	74.8	0.0000	19.4	74.7	0.0000	27.1	74.6	.0517	34.8	74.5	0.0000
42.6	74.4	.0738	50.3	74.3	.0734	58.0	74.2	0.0000	65.8	74.1	0.0000	73.5	74.0	.0333
81.3	73.9	.9330	89.0	73.8	16.3971	96.7	73.7	23.4535	104.5	73.5	2.2955	112.2	73.4	.2698
120.0	73.3	0.0000	127.7	73.2	0.0000	135.4	73.1	0.0000	143.2	73.0	.0896	150.9	72.9	.0995
158.7	72.8	0.0000	166.4	72.7	0.0000	174.1	72.6	0.0000	181.9	72.5	0.0000	189.6	72.4	0.0000
197.4	72.3	.0202	205.1	72.2	0.0000	212.8	72.0	0.0000	220.6	71.9	.0595	228.3	71.8	.0342
236.1	71.7	.0342	243.8	71.6	.0826	251.5	71.5	.0580	259.3	71.4	.5710	267.0	71.3	3.9377
274.8	71.2	15.7228	282.5	71.1	5.1936	290.2	71.0	1.6140	298.0	70.9	0.0000	305.7	70.8	.0704
313.5	70.6	0.0000	321.2	70.5	.1319	328.9	70.4	.0708	336.7	70.3	0.0000	344.4	70.2	.0002
352.2	70.1	.0707	359.9	70.0	0.0000	7.6	69.9	0.0000	15.4	69.8	0.0000	23.1	69.7	0.0000
30.9	69.6	0.0000	38.6	69.5	0.0000	46.3	69.4	0.0000	54.1	69.2	.0599	61.8	69.1	.0256
69.6	69.0	.0042	77.3	68.9	.2792	85.0	68.8	2.1206	92.8	68.7	12.3998	100.5	68.6	9.9349
108.3	68.5	1.2002	116.0	68.4	0.0000	123.7	68.3	0.0000	131.5	68.2	.0743	139.2	68.1	0.0000
147.0	68.0	0.0000	154.7	67.9	0.0000	162.4	67.7	0.0000	170.2	67.6	0.0000	177.9	67.5	0.0000
185.7	67.4	.0641	193.4	67.3	0.0000	201.1	67.2	0.0000	208.9	67.1	.0079	216.6	67.0	0.0000
224.4	66.9	0.0000	232.1	66.8	.0235	239.8	66.7	.0870	247.6	66.6	.0427	255.3	66.5	.3749
263.1	66.3	1.0622	270.8	66.2	5.5499	278.5	66.1	9.5841	286.3	66.0	2.5770	294.0	65.9	.0002
301.8	65.8	.1545	309.5	65.7	.0413	317.2	65.6	.0107	325.0	65.5	0.0000	332.7	65.4	0.0000
340.5	65.3	0.0000	348.2	65.2	0.0000	355.9	65.1	0.0000	3.7	64.9	0.0000	11.4	64.8	0.0000
19.2	64.7	0.0000	26.9	64.6	0.0000	34.6	64.5	0.0000	42.4	64.4	0.0000	50.1	64.3	0.0000
57.9	64.2	0.0000	65.6	64.1	.0241	73.3	64.0	.0595	81.1	63.9	.5258	88.8	63.8	3.1388
96.6	63.7	10.0757	104.3	63.6	5.2680	112.0	63.4	.8718	119.8	63.3	.0987	127.5	63.2	.0439
135.3	63.1	0.0000	143.0	63.0	0.0000	150.7	62.9	0.0000	158.5	62.8	.0133	166.2	62.7	0.0000
174.0	62.6	0.0000	181.7	62.5	0.0000	189.4	62.4	0.0000	197.2	62.3	.0908	204.9	62.2	0.0000
212.7	62.0	0.0000	220.4	61.9	0.0000	228.1	61.8	.0350	235.9	61.7	0.0000	243.6	61.6	.0325
251.4	61.5	.1159	259.1	61.4	.4176	266.8	61.3	1.9656	274.6	61.2	5.4346	282.3	61.1	5.3709
290.1	61.0	1.5842	297.8	60.9	.4616	305.5	60.8	.1209	313.3	60.6	.0841	321.0	60.5	.0459
328.8	60.4	0.0000	336.5	60.3	0.0000	344.2	60.2	0.0000	352.0	60.1	.0293	359.7	60.0	0.0000
7.5	59.9	.0087	15.2	59.8	0.0000	22.9	59.7	.0402	30.7	59.6	0.0000	38.4	59.5	0.0000
46.2	59.4	0.0000	53.9	59.3	0.0000	61.6	59.1	.0408	69.4	59.0	.0005	77.1	58.9	.2983
84.9	58.8	.9068	92.6	58.7	3.4970	100.3	58.6	6.2741	108.1	58.5	3.3395	115.8	58.4	.6788
123.6	58.3	.1064	131.3	58.2	.0056	139.0	58.1	.0074	146.8	58.0	0.0000	154.5	57.9	0.0000
162.3	57.7	.0166	170.0	57.6	0.0000	177.7	57.5	0.0000	185.5	57.4	.0192	193.2	57.3	.0057
201.0	57.2	.0137	208.7	57.1	0.0000	216.4	57.0	0.0000	224.2	56.9	0.0000	231.9	56.8	0.0000
239.7	56.7	.0351	247.4	56.6	.1157	255.1	56.5	.2492	262.9	56.3	1.0869	270.6	56.2	2.7858
278.4	56.1	4.0470	286.1	56.0	2.6565	293.8	55.9	1.0069	301.6	55.8	.4307	309.3	55.7	.1008
317.1	55.6	.1709	324.8	55.5	.0577	332.5	55.4	0.0000	340.3	55.3	.0209	348.0	55.2	0.0000
355.8	55.1	0.0000	3.5	55.0	0.0000	11.2	54.8	.0052	19.0	54.7	0.0000	26.7	54.6	0.0000
34.5	54.5	0.0000	42.2	54.4	0.0000	49.9	54.3	.0153	57.7	54.2	.0483	65.4	54.1	.0912
73.2	54.0	.1466	80.9	53.9	.5570	88.6	53.8	1.1200	96.4	53.7	2.0725	104.1	53.6	3.9071
111.9	53.4	1.9569	119.6	53.3	.4141	127.3	53.2	.1006	135.1	53.1	.0841	142.8	53.0	.0008
150.6	52.9	0.0000	158.3	52.8	0.0000	166.0	52.7	.0024	173.8	52.6	.0122	181.5	52.5	0.0000

Table I - Example of Tabular Representation of POLE-CODE 1 Pole Figure.

189.3	52.4	0.0000	197.0	52.3	0.0000	204.7	52.2	0.0000	212.5	52.0	0.0000	220.2	51.9	.0872
228.0	51.9	.0287	235.7	51.7	.0453	243.4	51.6	.1100	251.2	51.5	.2489	258.9	51.4	.7468
266.7	51.3	1.9630	274.4	51.2	2.2463	282.1	51.1	2.4553	289.9	51.0	1.5955	297.6	50.9	.7360
305.4	50.8	.4482	313.1	50.7	.2269	320.8	50.5	.1131	328.6	50.4	.0529	336.3	50.3	.0413
344.1	50.2	.0206	351.9	50.1	.0068	359.5	50.0	0.0000	7.3	49.9	0.0000	15.0	49.8	0.0000
22.8	49.7	0.0000	30.5	49.6	0.0000	38.2	49.5	0.0000	46.0	49.4	.0292	53.7	49.3	.0561
61.5	49.1	.1522	69.2	49.0	.1832	76.9	48.9	.4250	84.7	48.8	.5628	92.4	48.7	1.2010
100.2	48.6	1.5865	107.9	48.5	1.9655	115.6	48.4	1.4606	123.4	48.3	.8689	131.1	48.2	.2571
138.9	48.1	.1041	146.6	48.0	.1007	154.3	47.9	0.0000	162.1	47.7	0.0000	169.8	47.6	0.0000
177.6	47.5	.0249	185.3	47.4	.0173	193.0	47.3	0.0000	200.8	47.2	0.0000	208.5	47.1	.0022
216.3	47.0	.0215	224.0	46.9	0.0000	231.7	46.8	.0834	239.5	46.7	.1451	247.2	46.6	.3151
255.0	46.5	.6628	262.7	46.4	1.4862	270.4	46.2	1.7766	278.2	46.1	1.4164	285.9	46.0	1.1732
293.7	45.9	.0197	301.4	45.8	.5977	309.1	45.7	.5232	316.9	45.6	.3487	324.6	45.5	.2842
332.4	45.4	.0995	340.1	45.3	.0560	347.8	45.2	0.0000	355.6	45.1	.0062	3.3	45.0	0.0000
11.1	44.8	.0062	18.8	44.7	.0165	26.5	44.6	0.0000	34.3	44.5	0.0000	42.0	44.4	.0061
49.8	44.3	.3641	57.5	44.2	.1968	65.2	44.1	.3150	73.0	44.0	.4020	80.7	43.9	.4353
88.5	43.8	.4947	96.2	43.7	.7303	103.9	43.6	.0007	111.7	43.4	.0800	119.4	43.3	.9824
127.2	43.2	1.0359	134.9	43.1	.5752	142.6	43.0	.3028	150.4	42.9	.1422	158.1	42.8	.0749
165.9	42.7	.0177	173.6	42.6	0.0000	181.3	42.5	0.0000	189.1	42.4	0.0000	196.8	42.3	0.0000
204.6	42.2	.0034	212.3	42.1	0.0000	220.0	41.9	0.0000	227.8	41.8	.0694	235.5	41.7	.1056
243.3	41.6	.5241	251.0	41.5	.9309	258.7	41.4	1.1561	266.5	41.3	1.5918	274.2	41.2	.0425
282.0	41.1	.6052	289.7	41.0	.4826	297.4	40.9	.4508	305.2	40.8	.3805	312.9	40.7	.4061
320.7	40.5	.4967	328.4	40.4	.3759	336.1	40.3	.1963	343.9	40.2	.1154	351.6	40.1	0.0000
359.4	40.0	.0294	7.1	39.9	0.0000	14.8	39.8	0.0000	22.6	39.7	.0010	30.3	39.6	.8106
38.1	39.5	.0405	45.8	39.4	.1432	53.5	39.3	.3502	61.3	39.1	.5987	69.0	39.0	.5229
76.8	38.9	.3798	84.5	38.8	.2826	92.2	38.7	.3059	100.0	38.6	.3527	107.7	38.5	.2014
115.5	38.4	.4261	123.2	38.3	.5630	130.9	38.2	.0515	138.7	38.1	.9279	146.4	38.0	.3204
154.2	37.9	.4554	161.9	37.8	.2481	169.6	37.6	.1005	177.4	37.5	.0448	185.1	37.4	0.0000
192.9	37.3	0.0000	200.6	37.2	0.0000	208.3	37.1	.0232	216.1	37.0	.0249	223.8	36.9	.1528
231.6	36.8	.2944	239.3	36.7	.7530	247.0	36.6	1.1890	254.8	36.5	1.4275	262.5	36.4	1.0797
270.3	36.2	.0359	278.0	36.1	.3360	285.7	36.0	.2266	293.5	35.9	.2070	301.2	35.8	.2357
309.0	35.7	.2763	316.7	35.6	.3807	324.4	35.5	.5701	332.2	35.4	.5728	339.9	35.3	.4442
347.7	35.2	.2500	355.4	35.1	.2050	3.1	35.0	.1073	10.9	34.8	.1020	18.6	34.7	.1035
26.4	34.6	.1301	34.1	34.5	.2305	41.8	34.4	.3570	49.6	34.3	.7153	57.3	34.2	.9317
65.1	34.1	.4034	72.8	34.0	.4081	80.5	33.9	.2012	88.3	33.8	.1030	96.0	33.7	.1008
103.8	33.6	.0872	111.5	33.5	.0946	119.2	33.3	.1523	127.0	33.2	.2923	134.7	33.1	.5415
142.5	33.0	.9702	150.2	32.9	1.0024	157.9	32.8	1.0546	165.7	32.7	.6824	173.4	32.6	.4109
181.2	32.5	.2140	188.9	32.4	.1552	196.6	32.3	.1533	204.4	32.2	.1880	212.1	32.1	.2475
219.9	31.9	.2870	227.6	31.9	.7072	235.3	31.7	1.0351	243.1	31.6	1.3637	250.8	31.5	1.1539
258.6	31.4	.7406	266.3	31.3	.4075	274.0	31.2	.1952	281.8	31.1	.1114	289.5	31.0	.0965
297.3	30.9	.1159	305.0	30.8	.1272	312.7	30.7	.2087	320.5	30.5	.2503	328.2	30.4	.4333
336.0	30.3	.6659	343.7	30.2	.7896	351.4	30.1	.7170	359.2	30.0	.7643	6.9	29.9	.0749
14.7	29.8	.7596	22.4	29.7	.7267	30.1	29.6	.0497	37.9	29.5	.9405	45.6	29.4	1.1143
53.4	29.3	1.1581	61.1	29.2	.8699	68.8	29.0	.4237	76.6	28.9	.2204	84.3	28.8	.1265
92.1	28.7	.0574	99.8	28.6	.0366	107.5	28.5	.0637	115.3	28.4	.0652	123.0	28.3	.1048
130.8	28.2	.1244	138.5	28.1	.3092	146.2	28.0	.0510	154.0	27.9	1.0682	161.7	27.8	1.4451
169.5	27.6	1.4026	177.2	27.5	1.1916	184.9	27.4	.7644	192.7	27.3	.9387	200.4	27.2	.9489
208.2	27.1	.3345	215.9	27.0	1.8413	223.6	26.9	1.2914	231.4	26.8	1.3106	239.1	26.7	1.1056
246.9	26.6	.9263	254.6	26.5	.4799	262.3	26.4	.2540	270.1	26.2	.1845	277.8	26.1	.0906
285.6	26.0	.0374	293.3	25.9	.0604	301.0	25.8	.0699	308.8	25.7	.0699	316.5	25.6	.1039
324.3	25.5	.1627	332.0	25.4	.2756	339.7	25.3	.9402	347.5	25.2	.0630	355.2	25.1	1.0977
3.0	25.0	1.3406	10.7	24.9	1.5178	18.4	24.7	1.7103	26.2	24.6	1.7378	33.9	24.5	1.0225
41.7	24.4	1.2407	49.4	24.3	.9799	57.1	24.2	.0327	64.9	24.1	.2904	72.6	24.0	.1338
80.4	23.9	.0611	88.1	23.8	.1336	95.8	23.7	.0015	103.6	23.6	.0487	111.3	23.5	.0122
119.1	23.3	.0167	126.8	23.2	.1258	134.5	23.1	.0819	142.3	23.0	.1485	150.0	22.9	.2741
157.8	22.8	.5234	165.5	22.7	.4341	173.2	22.6	1.1277	181.0	22.5	1.3076	188.7	22.4	1.3428
196.5	22.3	1.5512	204.2	22.2	1.4826	211.9	22.1	1.5107	219.7	21.9	1.2711	227.4	21.8	.9085

Table I (Continued)

235.2	21.7	.7519	242.9	21.6	.4474	250.6	21.5	.2048	258.4	21.9	.1747	266.1	21.3	.0820
273.9	21.2	.0934	281.6	21.1	.0819	289.3	21.0	.0595	297.1	20.9	.0282	304.8	20.8	.0074
312.6	20.7	.0282	320.3	20.6	.0430	328.0	20.4	.1190	335.8	20.3	.1582	343.5	20.2	.2762
351.3	20.1	.4401	359.0	20.0	.6721	6.7	19.9	.9163	14.5	19.8	.9335	22.2	19.7	1.0169
30.0	19.6	.9252	37.7	19.5	.6601	45.4	19.4	.4160	53.2	19.3	.2748	60.9	19.2	.1292
68.7	19.0	.0704	76.4	18.9	.0249	84.1	18.8	.0132	91.9	18.7	.0190	99.6	18.6	0.0000
107.4	18.5	.0015	115.1	18.4	.0322	122.8	18.3	.0117	130.6	18.2	.6190	138.3	18.1	.0409
146.1	18.0	.0540	153.8	17.9	.0875	161.5	17.8	.1541	169.3	17.6	.2157	177.0	17.5	.3715
184.8	17.4	.4965	192.5	17.3	.6535	200.2	17.2	.7855	208.0	17.1	.6165	215.7	17.0	.5566
223.5	16.9	.4551	231.2	16.8	.2511	238.9	16.7	.1872	246.7	16.6	.1117	254.4	16.5	.0913
262.2	16.4	.0522	269.9	16.3	.0304	277.6	16.1	.0420	285.4	16.0	.0434	293.1	15.9	.0333
300.9	15.8	.0275	308.6	15.7	.0202	316.3	15.6	0.0000	324.1	15.5	.0249	331.8	15.4	.0231
339.6	15.3	.0779	347.3	15.2	.1253	355.0	15.1	.1504	2.8	15.0	.2584	10.5	14.9	.2546
18.3	14.7	.2602	26.0	14.6	.2630	33.7	14.5	.2312	41.5	14.4	.1688	49.2	14.3	.1386
57.0	14.2	.0961	64.7	14.1	.0559	72.4	14.0	.0401	80.2	13.9	.0086	87.9	13.8	.0301
95.7	13.7	.3209	103.4	13.6	.0315	111.1	13.5	.0129	118.9	13.3	.0371	126.6	13.2	.0485
134.4	13.1	.1329	142.1	13.0	.0556	149.8	12.9	.0527	157.6	12.8	.0271	165.3	12.7	.0509
173.1	12.6	.3933	180.8	12.5	.0868	188.5	12.4	.1237	196.3	12.3	.1364	204.0	12.2	.1047
211.8	12.1	.1391	219.5	12.0	.1263	227.2	11.8	.0879	235.0	11.7	.1105	242.7	11.6	.0439
250.5	11.5	.0637	258.2	11.4	.0623	265.9	11.3	.0368	273.7	11.2	.0495	281.4	11.1	.0763
289.2	11.0	.0579	296.9	10.9	.3691	304.6	10.8	.0702	312.4	10.7	.0451	320.1	10.6	.0535
327.9	10.4	.0079	335.6	10.3	.0647	343.3	10.2	.0183	351.1	10.1	.0394	358.8	10.0	.0717
6.6	9.9	.0566	14.3	9.8	.0211	22.0	9.7	.0927	29.8	9.6	.0548	37.5	9.5	.0548
45.3	9.4	.0618	53.0	9.3	.0464	60.7	9.2	.0028	68.5	9.0	.0295	76.2	8.9	.0211
84.0	8.9	.0469	91.7	8.7	.0225	99.4	8.6	.0337	107.2	8.5	.0506	114.9	8.4	.0717
122.7	8.3	.0211	130.4	8.2	.0127	138.1	8.1	.0675	145.9	8.0	.0540	153.6	7.9	.0281
161.4	7.8	.0304	169.1	7.7	.0267	176.8	7.5	.0295	184.6	7.4	.0633	192.3	7.3	.0436
200.1	7.2	.0155	207.8	7.1	.0394	215.5	7.0	.0970	223.3	6.9	.0773	231.0	6.8	.0619
238.8	6.7	.0478	246.5	6.6	.0197	254.2	6.5	0.0000	262.0	6.4	.0506	269.7	6.3	.0464
277.5	6.1	.0446	285.2	6.0	.0661	292.9	5.9	.0520	300.7	5.8	.0619	308.4	5.7	.0239
316.2	5.6	.3394	323.9	5.5	.0506	331.6	5.4	.0309	339.4	5.3	.0366	347.1	5.2	.0169
354.9	5.1	.0098	2.6	5.0	.0478	10.3	4.9	.0404	18.1	4.7	.0308	25.8	4.6	.0388
33.6	4.5	.0478	41.3	4.4	.0352	49.0	4.3	.0408	56.8	4.2	.0366	64.5	4.1	.0422
72.3	4.0	.0239	80.0	3.9	.0436	87.7	3.8	.0201	95.5	3.7	.0503	103.2	3.6	.0563
111.0	3.5	.0577	118.7	3.4	.0591	126.4	3.2	.0422	134.2	3.1	.0479	141.9	3.0	.0647
149.7	2.9	.0183	157.4	2.8	.0479	165.1	2.7	.0239	172.9	2.6	.0253	180.6	2.5	.0484
188.4	2.4	.0435	196.1	2.3	.0493	203.8	2.2	.0507	211.6	2.1	.0324	219.3	2.0	.0076
227.1	1.8	.0619	234.8	1.7	.0252	242.5	1.6	.0338	250.3	1.5	.0465	258.0	1.4	.0577
265.8	1.3	.0451	273.5	1.2	.0282	281.2	1.1	.0620	289.0	1.0	.0507	296.7	.9	.0577
304.5	.8	.0248	312.2	.7	.0668	319.9	.6	.0253	327.7	.4	.0535	335.4	.3	.0592
343.2	.2	.9437	350.9	.1	.0775	358.6	.0	.0634						

Table I (Continued)

IT 1-4	39.2555	93.3137	-27.5172	-73.8894	IT AVERAGE	58.2390
IL 1-4	12.5322	-25.0295	-13.4075	19.5252	IL AVERAGE	17.7400
K(A)	3-.4904					
TIME	2.2490					
TIME	2.6200					

Table I (Continued)

SAMPLE SPECIMEN C 269M DATE01/20/70
RALIATION CU AT 35 KV 26 MA COUNTER TUBEPROPRUTIONALAT1.951 KV
SLITS 2 M 2 M ENTRANCE 5 M 1 M RECEIVING ENGINEER R M OLSEN
SCAN RATE 1 PSI/MIN 72 ALPHA/MIN 0002 HKL
PHA 6.5 V BASE 22.0V WINDOW CALIBRATION SAMPLE SILVER
RANDOM INTENSITY 240.0 K(4) 95.757 CALC DATE 02/19/70

CALIBRATION DATA

PHI= 0	PHI=10	PHI=20	PHI=30	PHI=40	PHI=50	PHI=60	PHI=70	PHI=75
1699.0	1690.0	1583.0	1482.0	1241.0	1023.0	803.0	556.0	450.0

SAMPLE BACKGROUND = 31.0 CALIBRATION BACKGROUND = 68.0

ALPHA	PHI	INTENSITY	ALPHA	PHI	INTENSITY	ALPHA	PHI	INTENSITY	ALPHA	PHI	INTENSITY	ALPHA	PHI	INTENSITY
3.9	74.9	1.1049	11.6	74.8	2.6879	19.4	74.7	5.4380	27.1	74.6	3.8808	34.8	74.5	1.0186
42.6	74.4	.4654	50.3	74.3	.1715	58.0	74.2	.2561	65.8	74.1	.1109	73.5	74.0	.0676
81.3	73.9	.3365	89.0	73.8	.4688	96.7	73.7	.1343	104.5	73.5	.4973	112.2	73.4	1.1051
120.0	73.3	1.9365	127.7	73.2	3.2168	135.4	73.1	3.3792	143.2	73.0	3.4590	150.9	72.9	2.9267
158.7	72.8	2.4957	166.4	72.7	1.5120	174.1	72.6	.4908	181.9	72.5	.3308	189.6	72.4	.0783
197.4	72.3	0.0000	205.1	72.2	.9465	212.8	72.0	0.0000	220.6	71.9	.1380	228.3	71.8	.0915
236.1	71.7	.0910	243.8	71.6	.0453	251.5	71.5	.3902	259.3	71.4	.7462	267.0	71.3	.1633
274.8	71.2	.1476	282.5	71.1	0.0000	290.2	71.0	0.0000	298.0	70.9	.1306	305.7	70.8	.1587
313.5	70.6	1.1764	321.2	70.5	1.1418	328.9	70.4	1.1061	336.7	70.3	.5075	344.4	70.2	0.0000
352.2	70.1	0.0000	359.9	70.0	.2909	7.6	69.9	.8418	15.4	69.8	3.2861	23.1	69.7	5.4790
30.9	69.6	4.1767	38.6	69.5	2.4615	46.3	69.4	.8807	54.1	69.2	.2025	61.8	69.1	.1876
69.6	69.0	.1206	77.3	68.9	.1869	85.0	68.8	.2261	92.8	68.7	.4902	100.5	68.6	1.0031
108.3	68.5	1.4727	116.0	68.4	2.2531	123.7	68.3	3.1187	131.5	68.2	4.0817	139.2	68.1	4.1437
147.0	68.0	3.6375	154.7	67.9	2.8011	162.4	67.7	1.4719	170.2	67.6	.7649	177.9	67.5	.4191
185.7	67.4	.0759	193.4	67.3	.1008	201.1	67.2	0.0000	208.9	67.1	0.0000	216.6	67.0	.0747
224.4	66.9	.0372	232.1	66.8	.0370	239.8	66.7	.0615	247.6	66.6	.4899	255.3	66.5	.0783
263.1	66.3	.4009	270.8	66.2	.2057	278.5	66.1	.1325	286.3	66.0	.0360	294.0	65.9	.1195
301.8	65.8	0.0000	309.5	65.7	.3791	317.2	65.6	1.2860	325.0	65.5	1.6330	332.7	65.4	1.0528
340.5	65.3	.4310	348.2	65.2	.1508	355.9	65.1	.0924	3.7	64.9	.1495	11.4	64.8	.0411
19.2	64.7	2.1200	26.9	64.6	3.9151	34.6	64.5	3.8074	42.4	64.4	2.2271	50.1	64.3	1.1086
57.9	64.2	.5797	65.6	64.1	.4550	73.3	64.0	.4640	81.1	63.9	.4619	88.8	63.8	.6659
96.6	63.7	1.0571	104.3	63.6	1.5295	112.0	63.4	2.8434	119.8	63.3	3.8477	127.5	63.2	4.4716
135.3	63.1	5.2386	143.0	63.0	3.7410	150.7	62.9	2.9428	158.5	62.8	1.7636	166.2	62.7	.8254
174.0	62.6	.3431	181.7	62.5	.1759	189.4	62.4	.0024	197.2	62.3	.1537	204.9	62.2	.0408
212.7	62.0	.0304	220.4	61.9	0.0000	228.1	61.8	0.0000	235.9	61.7	.3299	243.6	61.6	.7858
251.4	61.5	1.0089	259.1	61.4	.4234	266.8	61.3	.1176	274.6	61.2	.0682	282.3	61.1	.0873
290.1	61.0	.8096	297.8	60.9	.1248	305.5	60.8	.2578	313.3	60.6	.6838	321.0	60.5	2.0500
328.8	60.4	1.8700	336.5	60.3	.9880	344.2	60.2	.1580	352.0	60.1	0.0000	359.7	60.0	.2483
7.5	59.9	.0826	15.2	59.8	.3569	22.9	59.7	1.1136	30.7	59.6	2.1396	38.4	59.5	2.7791
46.2	59.4	1.7122	53.9	59.3	1.2109	61.6	59.1	.0112	69.4	59.0	.7103	77.1	58.9	.9237
84.9	58.8	.9750	92.6	58.7	1.4455	100.3	58.6	2.0647	108.1	58.5	2.5477	115.8	58.4	3.9667
123.6	58.3	4.4069	131.3	58.2	4.8624	139.0	58.1	3.7340	146.8	58.0	3.0583	154.5	57.9	2.0103
162.3	57.7	1.0984	170.0	57.6	.3913	177.7	57.5	.2688	185.5	57.4	.1038	193.2	57.3	0.0000
201.0	57.2	.1377	208.7	57.1	.0858	216.4	57.0	.1712	224.2	56.9	.0939	231.9	56.8	.4001
239.7	56.7	.0867	247.4	56.6	1.2955	255.1	56.5	.5689	262.9	56.3	.1516	270.6	56.2	.0808
278.4	56.1	.0670	286.1	56.0	0.0000	293.8	55.9	.0083	301.6	55.8	.1246	309.3	55.7	.2154
317.1	55.6	1.2806	324.8	55.5	2.8508	332.5	55.4	2.5472	340.3	55.3	1.0652	348.0	55.2	.2696
355.8	55.1	.0244	3.5	55.0	.0650	11.2	54.8	.2512	19.0	54.7	.3232	26.7	54.6	.4034
34.5	54.5	1.2052	42.2	54.4	1.5543	49.9	54.3	1.9733	57.7	54.2	1.4817	65.4	54.1	1.1518
73.2	54.0	1.3940	80.9	53.9	1.7059	88.6	53.8	2.1735	96.4	53.7	2.9682	104.1	53.6	3.2101
111.9	53.4	4.0839	119.6	53.3	5.0440	127.3	53.2	5.5182	135.1	53.1	4.5193	142.8	53.0	3.4103
150.6	52.9	2.4848	158.3	52.8	1.1965	166.0	52.7	.0194	173.8	52.6	.3584	181.5	52.5	.3117

Table II - Example of Tabular Representation of POLE-CODE 3 Pole Figure.

189.3	52.4	.1516	197.0	52.3	.1058	204.7	52.2	.0603	212.5	52.0	.0676	220.2	51.9	.1090
228.0	51.8	.5823	235.7	51.7	1.0345	243.4	51.6	1.0610	251.2	51.5	.5991	258.9	51.4	.1844
266.7	51.3	.0662	274.4	51.2	.0220	282.1	51.1	.1242	289.9	51.0	.0655	297.6	50.9	.0073
305.4	50.8	.1290	313.1	50.7	.5122	320.8	50.5	2.3662	328.6	50.4	4.2011	336.3	50.3	3.3016
344.1	50.2	1.4532	351.8	50.1	.4474	359.5	50.0	.1982	7.3	49.9	.1130	15.0	49.8	.1057
22.8	49.7	.1266	30.5	49.6	.2879	38.2	49.5	.0896	46.0	49.4	1.1538	53.7	49.3	1.4107
61.5	49.1	1.3372	69.2	49.0	1.8488	76.9	48.9	2.2057	84.7	48.8	2.5612	92.4	48.7	3.0089
100.2	48.6	3.5227	107.9	48.5	4.4787	115.6	48.4	5.4032	123.4	48.3	5.5839	131.1	48.2	6.1434
138.9	48.1	3.5617	146.6	48.0	2.4240	154.3	47.9	1.3522	162.1	47.7	.8001	169.8	47.6	.5819
177.6	47.5	.3039	185.3	47.4	.1819	193.0	47.3	.0807	200.8	47.2	.1745	208.5	47.1	.2544
216.3	47.0	.4076	224.0	46.9	.5401	231.7	46.8	.0783	239.5	46.7	.6971	247.2	46.6	.4373
255.0	46.5	.0066	262.7	46.4	0.0000	270.4	46.2	0.0000	278.2	46.1	0.0000	285.9	46.0	0.0000
293.7	45.9	.0392	301.4	45.8	0.0000	309.1	45.7	.1823	316.9	45.6	.8302	324.6	45.5	3.5726
332.4	45.4	5.4539	340.1	45.3	3.5053	347.8	45.2	1.6748	355.6	45.1	.5270	3.3	45.0	.1924
11.1	44.8	.0960	18.8	44.7	.1213	26.5	44.6	.0892	34.3	44.5	.1780	42.0	44.4	.4186
49.8	44.3	.7790	57.5	44.2	1.9512	65.2	44.1	1.8659	73.0	44.0	2.1120	80.7	43.9	2.6484
88.5	43.8	7.9348	96.2	43.7	3.7086	103.9	43.6	4.0927	111.7	43.4	5.4134	119.4	43.3	4.8926
127.2	43.2	4.3679	134.9	43.1	3.5864	142.6	43.0	2.2787	150.4	42.9	1.2596	158.1	42.8	.8299
165.9	42.7	.5138	173.6	42.6	.3478	181.3	42.5	.2557	189.1	42.4	.2794	196.8	42.3	.0067
204.6	42.2	.1995	212.3	42.1	.3498	220.0	41.9	.5175	227.8	41.8	.5703	235.5	41.7	.5150
243.3	41.6	.2808	251.0	41.5	.0715	258.7	41.4	0.0000	266.5	41.3	.0237	274.2	41.2	.0080
282.0	41.1	.0059	289.7	41.0	.9648	297.4	40.9	.0176	305.2	40.8	.0703	312.9	40.7	.3401
320.7	40.5	1.8095	328.4	40.4	4.4576	336.1	40.3	6.0083	343.9	40.2	4.4127	351.6	40.1	2.0566
359.4	40.0	.7837	7.1	39.9	.3048	14.8	39.8	.1722	22.6	39.7	.0630	30.3	39.6	.2280
38.1	39.5	.3255	45.8	39.4	.4730	53.5	39.3	.0988	61.3	39.1	1.2094	69.0	39.0	1.6266
76.8	38.9	2.4211	84.5	38.8	2.5860	92.2	38.7	3.2969	100.0	38.6	4.1289	107.7	38.5	4.0818
115.5	38.4	4.2479	123.2	38.3	4.0721	130.9	38.2	3.4442	138.7	38.1	2.5355	146.4	38.0	1.5240
154.2	37.9	.9881	161.9	37.8	.5541	169.6	37.6	.3926	177.4	37.5	.3036	185.1	37.4	.1763
192.9	37.3	.1979	200.6	37.2	.3183	208.3	37.1	.3122	216.1	37.0	.4100	223.8	36.9	.4038
231.6	36.8	.2668	239.3	36.7	.1141	247.0	36.6	.0434	254.8	36.5	.0596	262.5	36.4	.0054
270.3	36.2	.0108	278.0	36.1	.0054	285.7	36.0	.0483	293.5	35.9	.0054	301.2	35.8	0.0000
309.0	35.7	.0641	316.7	35.6	.5543	324.4	35.5	2.1383	332.2	35.4	4.6609	339.9	35.3	6.3641
347.7	35.2	4.8010	355.4	35.1	2.4748	3.1	35.0	.9269	10.9	34.8	.5098	18.6	34.7	.3304
26.4	34.6	.2251	34.1	34.5	.2299	41.8	34.4	.4119	49.6	34.3	.5515	57.3	34.2	.9035
65.1	34.1	1.3369	72.8	34.0	1.7065	80.5	33.9	2.2036	88.3	33.8	2.9871	96.0	33.7	3.5184
103.8	33.6	3.5596	111.5	33.5	3.9491	119.2	33.3	3.8156	127.0	33.2	2.8290	134.7	33.1	2.0005
142.5	33.0	1.5635	150.2	32.9	.8257	157.9	32.8	.6288	165.7	32.7	.3401	173.4	32.6	.2064
181.2	32.5	.1859	188.9	32.4	.2256	196.6	32.3	.2901	204.4	32.2	.2146	212.1	32.1	.2040
219.9	31.9	.2784	227.6	31.8	.7678	235.3	31.7	.1039	243.1	31.6	.0198	250.8	31.5	.0296
258.6	31.4	0.0000	266.3	31.3	.0245	274.0	31.2	.0078	281.8	31.1	.0635	289.5	31.0	.0146
297.3	30.9	.0487	305.0	30.8	.0874	312.7	30.7	.2858	320.5	30.5	1.0875	328.2	30.4	2.3729
336.0	30.3	4.2397	343.7	30.2	4.7586	351.4	30.1	4.0438	359.2	30.0	2.8445	6.9	29.9	1.5071
14.7	29.8	.9498	22.4	29.7	.6534	30.1	29.6	.5291	37.9	29.5	.5049	45.6	29.4	.6378
53.4	29.3	.9655	61.1	29.2	1.0788	68.8	29.0	1.5815	76.6	28.9	1.7939	84.3	28.8	2.3759
92.1	28.7	2.9381	99.8	28.6	3.0591	107.5	28.5	3.1842	115.3	28.4	2.7378	123.0	28.3	2.5752
130.8	28.2	1.6620	138.5	28.1	1.2551	146.2	28.0	.0534	154.0	27.9	.6832	161.7	27.8	.4082
169.5	27.6	.3246	177.2	27.5	.7774	184.9	27.4	.3147	192.7	27.3	.2112	200.4	27.2	.1829
208.2	27.1	.1486	215.9	27.0	.2108	223.6	26.9	.0421	231.4	26.8	.0561	239.1	26.7	.0280
246.9	26.6	.0514	254.6	26.5	0.0000	262.3	26.4	.0606	270.1	26.2	0.0000	277.8	26.1	0.0000
285.6	26.0	.0186	293.3	25.9	.0186	301.0	25.8	.0418	308.8	25.7	.0975	316.5	25.6	.4176
324.3	25.5	.8530	332.0	25.4	1.9947	339.7	25.3	3.4534	347.5	25.2	3.8070	355.2	25.1	3.6609
3.0	25.0	3.1778	10.7	24.9	1.9616	18.4	24.7	1.4943	26.2	24.6	1.1291	33.9	24.5	.0566
41.7	24.4	.9940	49.4	24.3	1.1496	57.1	24.2	1.3234	64.9	24.1	1.4785	72.6	24.0	1.8765
80.4	23.9	1.9852	88.1	23.8	2.3639	95.8	23.7	2.2615	103.6	23.6	2.4290	111.3	23.5	2.2215
119.1	23.3	1.7768	126.8	23.2	1.3964	134.5	23.1	.9897	142.3	23.0	.7292	150.0	22.9	.4918
157.8	22.8	.3322	165.5	22.7	.2918	173.2	22.6	.2908	181.0	22.5	.1498	188.7	22.4	.1815
196.5	22.3	.1315	204.2	22.2	.1767	211.9	22.1	.0905	219.7	21.9	.1402	227.4	21.8	.0633

Table II (Continued)

235.2	21.7	.1219	242.9	21.6	.0496	250.6	21.5	0.0000	258.4	21.4	.0090	266.1	21.3	.0360
273.9	21.2	.0585	281.6	21.1	.0270	289.3	21.0	.0584	297.1	20.9	0.0000	304.8	20.8	.1301
312.6	20.7	.1768	320.3	20.6	.3672	328.0	20.4	.9048	335.8	20.3	1.3594	343.5	20.2	2.2073
351.3	20.1	2.5539	359.0	20.0	2.6813	6.7	19.9	2.2826	14.5	19.8	2.0805	22.2	19.7	1.6383
30.0	19.6	1.5348	37.7	19.5	1.2092	45.4	19.4	1.5682	53.2	19.3	1.4028	60.9	19.2	1.4595
68.7	19.0	1.6313	76.4	18.9	1.6036	84.1	18.8	1.6732	91.9	18.7	1.8224	99.6	18.6	1.7990
107.4	18.5	1.7227	115.1	18.4	1.3507	122.8	18.3	1.1468	130.6	18.2	.8587	138.3	18.1	.6519
146.1	18.0	.4005	153.8	17.9	.3782	161.5	17.8	.2769	169.3	17.6	.1801	177.0	17.5	.2194
184.8	17.4	.1272	192.5	17.3	.1008	200.2	17.2	.0963	208.0	17.1	.0481	215.7	17.0	.0525
223.5	16.9	.0437	231.2	16.8	.1786	238.9	16.7	.0262	246.7	16.6	.1090	254.4	16.5	.0741
262.2	16.4	.0261	269.9	16.3	.0087	277.6	16.1	.0522	285.4	16.0	.1130	293.1	15.9	.0564
300.9	15.8	.0694	308.6	15.7	.1517	316.3	15.6	.2382	324.1	15.5	.3766	331.8	15.4	.0018
339.6	15.3	1.0546	347.3	15.2	1.2784	355.0	15.1	1.4199	2.8	15.0	1.7984	10.5	14.9	1.9781
18.3	14.7	1.8646	26.0	14.6	1.6524	33.7	14.5	1.3609	41.5	14.4	1.7402	49.2	14.3	1.5028
57.0	14.2	1.3086	64.7	14.1	1.3074	72.4	14.0	1.3195	80.2	13.9	1.3186	87.9	13.8	1.2021
95.7	13.7	1.0900	103.4	13.6	1.2387	111.1	13.5	.7896	118.9	13.3	.6910	126.6	13.2	.6137
134.4	13.1	.5324	142.1	13.0	.3192	149.8	12.9	.2637	157.6	12.8	.1657	165.3	12.7	.1026
173.1	12.6	.1909	180.8	12.5	.0466	188.5	12.4	.0974	196.3	12.3	.1651	204.0	12.2	.1650
211.8	12.1	.0888	219.5	12.0	.0591	227.2	11.8	.0380	235.0	11.7	.0633	242.7	11.6	.0716
250.5	11.5	.0674	258.2	11.4	.0168	265.9	11.3	.0631	273.7	11.2	.0042	281.4	11.1	.0848
289.2	11.0	.0545	296.9	10.9	.0713	304.6	10.8	.1089	312.4	10.7	.1633	320.1	10.6	.2301
327.9	10.4	.4681	335.6	10.3	.4594	343.3	10.2	.0010	351.1	10.1	.6923	358.8	10.0	.8043
6.6	9.9	1.0083	14.3	9.8	.9833	22.0	9.7	1.0000	29.8	9.6	1.0292	37.5	9.5	.9958
45.3	9.4	1.1063	53.0	9.3	.8917	60.7	9.2	.9500	68.5	9.0	.8667	76.2	8.9	.9333
84.0	8.8	.7542	91.7	8.7	.5625	99.4	8.6	.7333	107.2	8.5	.6292	114.9	8.4	.5333
122.7	8.3	.6042	130.4	8.2	.3833	138.1	8.1	.3750	145.9	8.0	.3375	153.6	7.9	.4292
161.4	7.8	.2875	169.1	7.7	.1750	176.8	7.5	.2417	184.6	7.4	.1792	192.3	7.3	.1333
200.1	7.2	.1948	207.8	7.1	.1625	215.5	7.0	.0958	223.3	6.9	.1833	231.0	6.8	.0625
238.8	6.7	.1583	246.5	6.6	.0667	254.2	6.5	.1125	262.0	6.4	.0458	269.7	6.3	.0875
277.5	6.1	.0833	285.2	6.0	.0625	292.9	5.9	.1333	300.7	5.8	.2458	308.4	5.7	.1917
316.2	5.6	.2667	323.9	5.5	.2000	331.6	5.4	.2750	339.4	5.3	.4542	347.1	5.2	.3917
354.9	5.1	.4625	2.6	5.0	.5250	10.3	4.9	.5958	18.1	4.7	.4958	25.8	4.6	.4025
33.6	4.5	.5958	41.3	4.4	.5417	49.0	4.3	.4333	56.8	4.2	.4583	64.5	4.1	.4292
72.3	4.0	.3375	80.0	3.9	.3792	87.7	3.8	.4292	95.5	3.7	.3792	103.2	3.6	.3067
111.0	3.5	.4458	118.7	3.4	.4167	126.4	3.2	.3500	134.2	3.1	.3333	141.9	3.0	.2375
149.7	2.9	.2417	157.4	2.8	.2083	165.1	2.7	.2750	172.9	2.6	.1958	180.6	2.5	.2000
188.4	2.4	.1917	196.1	2.3	.2500	203.8	2.2	.2167	211.6	2.1	.2000	219.3	2.0	.2125
227.1	1.8	.1208	234.8	1.7	.1583	242.5	1.6	.1708	250.3	1.5	.2042	258.0	1.4	.1750
265.8	1.3	.1958	273.5	1.2	.2208	281.2	1.1	.2208	289.0	1.0	.2125	296.7	.9	.2458
304.5	.8	.2208	312.2	.7	.2292	319.9	.6	.2208	327.7	.4	.2083	335.4	.3	.2208
343.2	.2	.2917	350.9	.1	.2333	358.6	.0	.2458						

Table II (Continued)

AD 1546 D

II 1-4	-204.1127	0. .00	0.1000	u.0000	IT A.._AGE	204.1127
IL 1-4	108.3557	0.0000	0.1000	0.0000	IL AVERAGE	108.3557
K(A)	95.7570					
TIPE	3.6750					
IIPE	4.3110					
TIPE	4.3810					
IIPE	5.0250					

Table II (Continued)

AD 1546 D

SAMPLE JOH 2686.9 DATE10/11/69
RADIATION C AT 35 KV 25 MA COUNTER TUBE SCINT AT 1.240KV
SLITS 2 M 2 V ENTRANCE 5 M 1 V RECEIVING ENGINEER RAMSDLDEN
SCAN RATE 1 PSI/MIN 72 ALPHA/MIN 0002 HKL
PHA H.5 V BASE 20. V WINDOW CALIBRATION SAMPLE SILVER
RANDOM INTENSITY 710.0 R(A) 207.294 CALC DATE 04/01/70

CALIBRATION RATE

PHI= 3	PHI=10	PHI=20	PHI=33	PHI=40	PHI=50	PHI=60	PHI=70	PHI=75
4824.0	4835.0	4614.0	4231.0	3701.0	3047.0	2403.0	1634.0	1260.0

SAMPLE BACKGROUND = 108.0 CALIBRATION BACKGROUND = 130.0

ALPHA	PHI=90	PHI=88	PHI=85	PHI=81	PHI=76	PHI=71	PHI=64	PHI=56	PHI=44	PHI=36	PHI=27	PHI=14	PHI= 2
4.5	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	.0008	.0006	.0014	.0474	1.1708	.2041	.0370
8.4	0.0000	0.0010	0.0000	0.0000	0.0000	0.0000	.0016	.0035	.0028	.0423	1.1964	.2068	.0360
12.3	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	.0007	.0050	.0057	.0489	1.2417	.2053	.0482
16.2	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	.0021	.0116	.0484	1.3102	.2050	.0517
20.0	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	.0034	.0043	.0176	.0462	1.3560	.2173	.0267
23.9	.1037	.0348	.0746	.0531	.0298	.0043	.0064	.0091	.0090	.1069	1.3460	.2278	.0108
27.8	.2080	.1901	.1498	.1067	.0401	.0041	.0029	.0048	.0002	.1144	1.3696	.2271	.0213
31.6	.1043	.0254	.0752	.0536	.0303	.0048	0.0000	0.0000	.0002	.1530	1.3492	.2127	.0375
35.5	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	.0001	.1417	1.3264	.2016	.0447
39.4	.1604	.1378	.1088	.0778	.0443	.0076	0.0000	0.0000	.0030	.2431	1.2285	.1768	.0357
43.2	.3022	.2764	.2184	.1543	.0893	.0158	0.0000	0.0000	.0063	.3119	1.1502	.1519	.0254
47.1	.4026	.2144	.2188	.1509	.0899	.0165	0.0000	.0058	.0354	.4487	1.1118	.1374	.0261
51.0	.1436	.1794	.1486	.1151	.0769	.0392	0.0000	.0111	.0642	.6451	1.0505	.1210	.0354
54.9	0.0000	0.0000	0.0000	0.0000	.0217	.0524	0.0000	.0224	.1273	.7471	.9491	.1057	.0357
58.7	0.0000	0.0000	0.0000	0.0000	0.0000	.0306	.0008	.0400	.1913	.8144	.6085	.0887	.0412
62.6	0.0000	0.0000	0.0000	0.0000	0.0000	.0180	.0148	.0607	.2490	.7458	.6496	.0692	.0530
66.5	0.0000	0.0000	0.0000	0.0000	0.0000	.0104	.0280	.0702	.3038	.7352	.4620	.0527	.0516
70.3	.0545	.0503	.0408	.0304	.0196	.0076	.0436	.0830	.3428	.5419	.3190	.0467	.0343
74.2	0.0000	0.0000	0.0000	0.0000	0.0000	.1052	.0599	.1488	.3520	.4210	.2327	.0392	.0235
78.1	1.1110	.9498	.8121	.6448	.4056	.3312	.2423	.3332	.4194	.3279	.1663	.0242	.0379
81.9	0.0000	0.0000	0.0000	.2447	.0621	1.3762	.5434	.5731	.4425	.2428	.1232	.0394	.0476
85.8	16.2768	15.0488	12.4474	9.6113	6.4483	3.1912	1.9517	.8653	.4780	.1456	.0897	.0199	.0344
89.7	17.2620	16.4321	14.5620	12.5421	10.4014	8.3335	3.3505	1.5325	.5505	.1489	.0657	.0301	.0271
93.6	26.0974	24.9618	22.4053	13.6713	16.7175	13.4805	6.9477	2.5811	.7036	.1747	.0403	.0250	.0478
97.4	53.2021	55.2265	46.2450	34.7207	26.3670	15.9630	10.1461	3.0756	.4402	.1489	.0280	.0200	.0640
101.3	18.9461	17.3764	15.8089	13.2568	12.5151	10.4064	7.8472	4.4239	.9104	.1920	.0319	.0253	.0622
105.2	0.0000	0.0000	0.0000	0.0000	.1449	4.1286	5.2433	3.9959	.6829	.1731	.0496	.0306	.0599
109.0	1.0075	1.0233	1.0584	1.0969	1.1340	1.1830	2.8827	2.9652	1.0659	.1656	.0508	.0216	.0585
112.9	0.0000	0.0000	0.0000	0.0000	.0421	.4460	.8415	1.9778	1.0601	.2010	.0448	.0130	.0569
116.8	.5964	.5476	.4378	.3203	.1934	.0543	.4255	1.0067	1.0502	.2502	.0467	.0254	.0555
120.6	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	.0457	.5093	1.0231	.2486	.0608	.0361	.0618
124.5	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	.0269	.2397	.3733	.3716	.0761	.0404	.0565
128.4	0.0000	0.0000	0.0000	0.0000	0.0000	.0205	.0347	.0820	.4161	.4786	.0854	.0455	.0470
132.3	0.0000	0.0000	0.0000	0.0000	0.0000	.0402	.0269	.0508	.6620	.5167	.1024	.0385	.0508
136.1	0.0000	0.0000	0.0000	0.0000	0.0000	.0197	.0068	.0549	.4676	.7453	.1752	.0325	.0492
140.0	.2036	.1871	.1501	.1105	.0577	.0209	0.0000	.0662	.3440	.8386	.2509	.0438	.0546
143.9	.4082	.3753	.3012	.2226	.1364	.0426	0.0000	.0544	.2438	.8505	.3841	.0545	.0650
147.7	.4327	.3979	.3195	.2357	.1452	.0460	0.0000	.0204	.1854	.7549	.5285	.0341	.0392
151.6	.4573	.4206	.3379	.2496	.1541	.0474	0.0000	0.0000	.1132	.7396	.7028	.0555	.0152
155.5	.2293	.2109	.1696	.1253	.0776	.0252	.0051	0.0000	.0732	.7279	.8961	.0478	.0336
159.3	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	.0131	.0047	.0497	.6784	1.0761	.0435	.0494
163.2	0.0000	0.0000	0.0000	0.0000	0.0000	0.0040	.0350	.0102	.0302	.5297	1.2647	.0627	.0458
167.1	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	.0059	.0114	.3495	1.2916	.0821	.0233

Table III - Example of Tabular Representation of a KODI Pole Figure.

REV SYM

171.6	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	.0029	.0056	.2047	1.3124	.1052	.0245
174.8	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	.0047	.0045	.2178	1.2626	.1387	.0252
178.7	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	.0023	.0093	.1560	1.1964	.1554	.0333
182.6	0.0000	0.0000	0.0000	0.0000	0.0000	.0119	.0095	.0061	.0092	.0390	1.1196	.1702	.0406
186.4	0.0000	0.0000	0.0000	0.0000	0.0000	.0232	.0200	.0124	.0071	.0719	1.0432	.2034	.0417
190.3	0.0000	0.0000	0.0000	0.0000	0.0000	.0113	.0103	.0279	.0037	.0588	1.0980	.2418	.0435
194.2	.0484	.0448	.0362	.0270	.0171	.0062	.0303	.0443	0.0000	.0567	1.0366	.2726	.0465
198.0	.0478	.0444	.0727	.0543	.0344	.0127	.0595	.0270	0.0000	.0347	1.0413	.3015	.0492
201.9	.0480	.0451	.0365	.0273	.0173	.0064	.0293	.0094	.0011	.0591	1.0400	.3372	.0494
205.8	0.0000	0.0000	0.0000	0.0000	0.0000	.0012	.0014	.0048	.0026	.0707	1.0295	.3281	.0501
209.7	0.0000	0.0000	0.0000	0.0000	0.0000	.0023	.0030	0.0000	.0020	.0043	1.0082	.2984	.0414
213.5	0.0000	0.0000	0.0000	0.0000	0.0000	.0011	.0015	0.0000	.0057	.0042	1.0398	.2850	.0461
217.4	.1467	.1354	.1097	.0824	.1524	.0203	0.0000	.0010	.0107	.0983	1.0709	.2755	.0527
221.3	.2943	.2715	.2202	.1654	.1062	.0413	0.0000	.0018	.0055	.1867	1.1739	.2583	.0609
225.1	.2823	.2565	.2114	.1584	.1922	.0401	.0102	.0044	.0167	.2496	1.2807	.2321	.0650
229.0	.2201	.2040	.1679	.1292	.0874	.0417	.0250	.0067	.0547	.3544	1.2639	.1860	.0626
232.9	.1207	.1132	.0944	.0744	.1589	.0376	.0231	.0082	.0990	.4442	1.2923	.1569	.0468
236.7	0.0000	0.0000	0.0000	0.0000	.0099	.0378	.0252	.0234	.1372	.6510	1.2333	.1530	.0412
240.6	0.0000	0.0000	0.0000	0.0000	.0231	.0627	.0557	.0445	.2326	.8592	1.1746	.1213	.0330
244.5	.1327	.1276	.1161	.1039	.0906	.0761	.0545	.0836	.3557	1.0601	1.0511	.0874	.0338
248.4	.1725	.1626	.1463	.1164	.0907	.0624	.0644	.1273	.4869	1.2139	.9272	.0783	.0372
252.2	0.0000	0.0000	0.0000	0.0000	0.0000	.0824	.1616	.1915	.6682	1.2763	.7092	.0801	.0408
256.1	0.0000	.0043	.0761	.1487	.2272	.3131	.3211	.2846	.8131	1.3338	.4912	.0756	.0434
260.0	0.0000	0.0000	.0213	.1903	.3729	.5731	.5723	.5773	1.1063	1.1591	.4795	.0666	.0528
263.8	7.0137	6.4826	5.5681	4.4624	3.2304	2.0056	1.1231	1.1228	1.4452	.9421	.2676	.0507	.0512
267.7	5.4423	5.6474	5.2488	4.7748	4.2730	3.7177	2.6835	1.7388	1.6154	.7947	.1916	.0389	.0457
271.6	25.0031	25.1993	21.6893	17.7287	13.6577	8.4868	4.7103	2.7073	1.4755	.5452	.1177	.0369	.0387
275.4	48.0276	45.7194	38.7248	31.2447	23.1429	14.3066	9.6217	3.2938	1.3370	.4451	.1079	.0429	.0322
279.3	12.4134	12.1086	11.6456	11.1512	10.4170	10.0315	7.7795	3.8876	1.1874	.3123	.1016	.0522	.0454
283.2	.2745	.7145	1.6739	2.7410	3.4724	5.1123	5.7842	3.2771	1.0743	.2511	.0716	.0588	.0606
287.1	4.4358	4.7313	4.3387	3.9188	3.4451	2.4679	2.2554	2.6121	.4788	.2133	.0447	.0545	.0508
290.9	0.0000	0.0000	0.0000	0.0000	.2781	1.5294	1.6541	1.6175	.4432	.2051	.0458	.0473	.0529
294.8	0.0000	0.0000	0.0000	.1102	.2467	.5012	.8043	1.0147	.7194	.1483	.0491	.0468	.0536
298.7	0.0000	0.0000	0.0000	0.0000	0.0000	.0182	.4295	.7231	.6396	.2226	.0638	.0473	.0575
302.5	0.0000	0.0000	0.0000	0.0000	0.0000	.0421	.2056	.4425	.4504	.2470	.0778	.0467	.0490
306.4	0.0000	0.0000	.0077	.0269	.0518	.0770	.1092	.3019	.5145	.2565	.0792	.0456	.0417
310.3	.0266	.0258	.0285	.0315	.0367	.0383	.0634	.1614	.4985	.2716	.0867	.0366	.0348
314.1	0.0000	0.0000	0.0000	0.0000	0.0000	.0000	.0490	.1652	.4424	.3246	.1090	.0239	.0539
318.0	.2767	.2577	.2168	.1690	.1195	.0653	.0320	.1684	.3779	.3774	.1282	.0189	.0431
321.9	.4430	.6342	.5224	.4029	.2737	.1322	.0176	.1121	.3229	.4731	.1574	.0290	.0322
325.8	.5775	.5348	.4393	.3372	.2269	.1060	.0054	.0561	.2506	.5699	.2014	.0294	.0435
329.6	.2668	.3955	.3250	.2497	.1642	.0770	0.0000	.0274	.1943	.5591	.2677	.0193	.0408
333.5	.2139	.1962	.1630	.1253	.0866	.0399	0.0000	0.0000	.1325	.5663	.3407	.0274	.0467
337.4	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	.0097	.0967	.5776	.4509	.0552	.0492
341.2	.2260	.2095	.1724	.1327	.0899	.0429	0.0000	.0192	.0712	.4506	.5472	.0662	.0454
345.1	.4531	.4201	.3459	.2665	.1807	.0866	0.0000	.0095	.0407	.3440	.7050	.0759	.0367
349.0	.4283	.3972	.3271	.2522	.1712	.0825	.0034	.0015	.0078	.2375	.8327	.0966	.0420
352.8	.4033	.3741	.3092	.2378	.1617	.0783	.0066	.0033	.0027	.2117	.9634	.1125	.0496
356.7	.2022	.1875	.1565	.1193	.0813	.0395	.0031	.0018	.0072	.1014	.9898	.1300	.0434

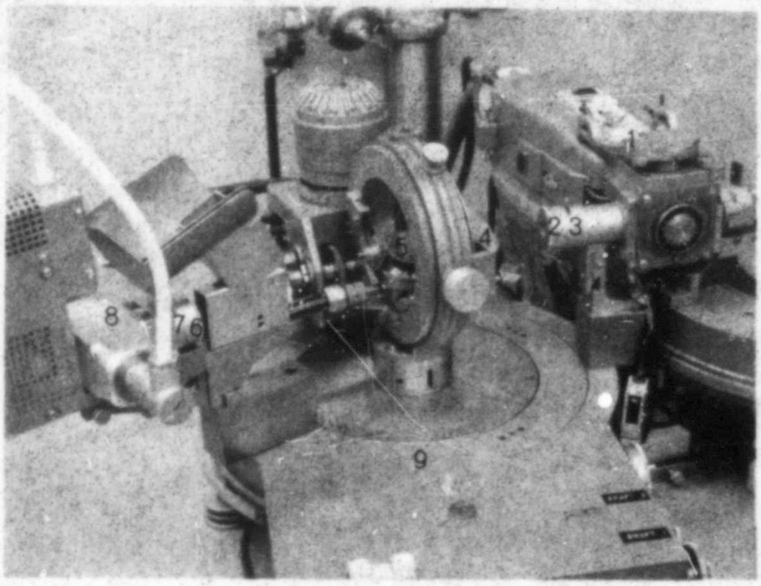
Table III (Continued)

AD 1546 D

IT 1=4	131.7181	406.9986	-68.3028	-384.4776	IT AVERAGE	247.2748
IL 1=4	15.8529	-66.2478	-16.1124	56.7255	IL AVERAGE	39.9771
K(A)	207.2477					

Table III (Continued)

REV SYM



1 - Line Focus Copper Tube

2 - Horizontal Entrance Aperature

3 - Vertical Entrance Aperature

4 - Main Slit

5 - Specimen

6 - Horizontal Receiving Aperature

7 - Vertical Receiving Aperature

8 - Detector

9 - Diffractometer

Figure 1 - Siemens X-Ray Pole Figure Goniometer.

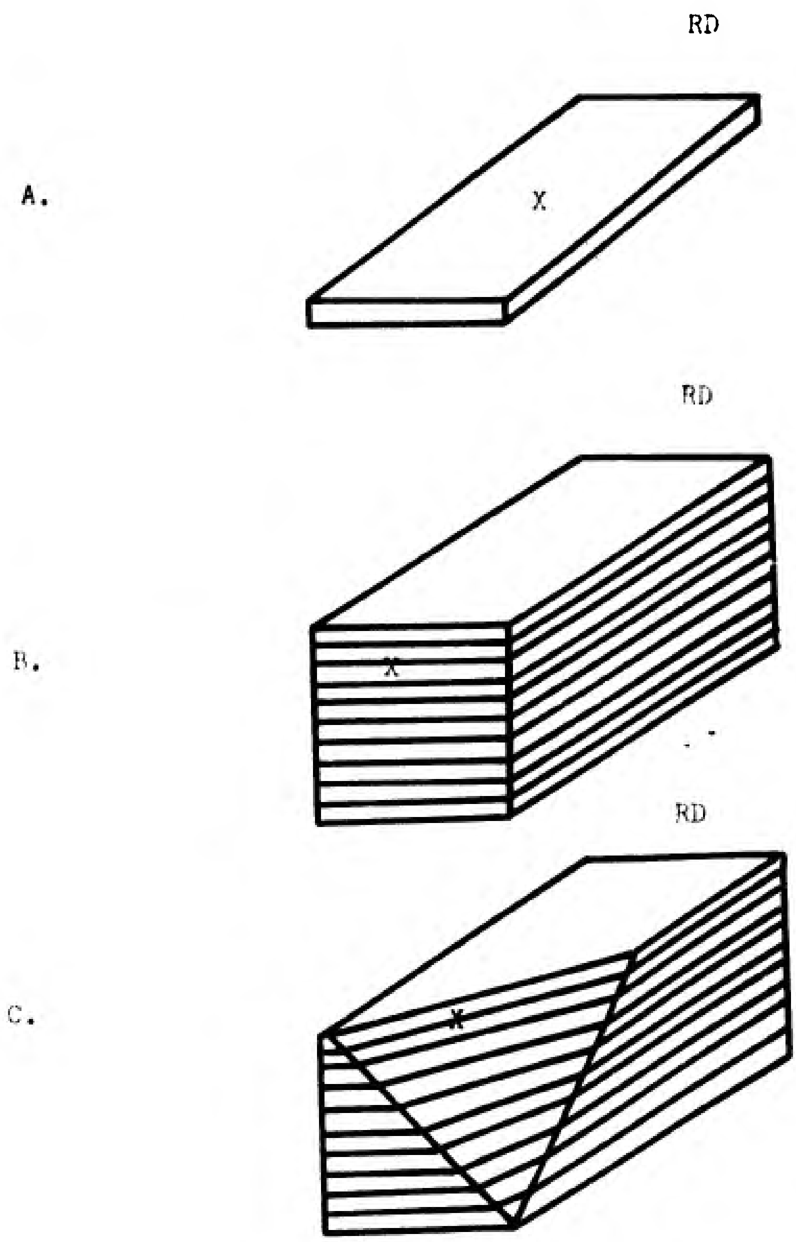


Figure 2 - Sampling plan for various types of pole figures. A. Normal
B. Longitudinal or transverse C. One quadrant.
(Surface with X is x-rayed)

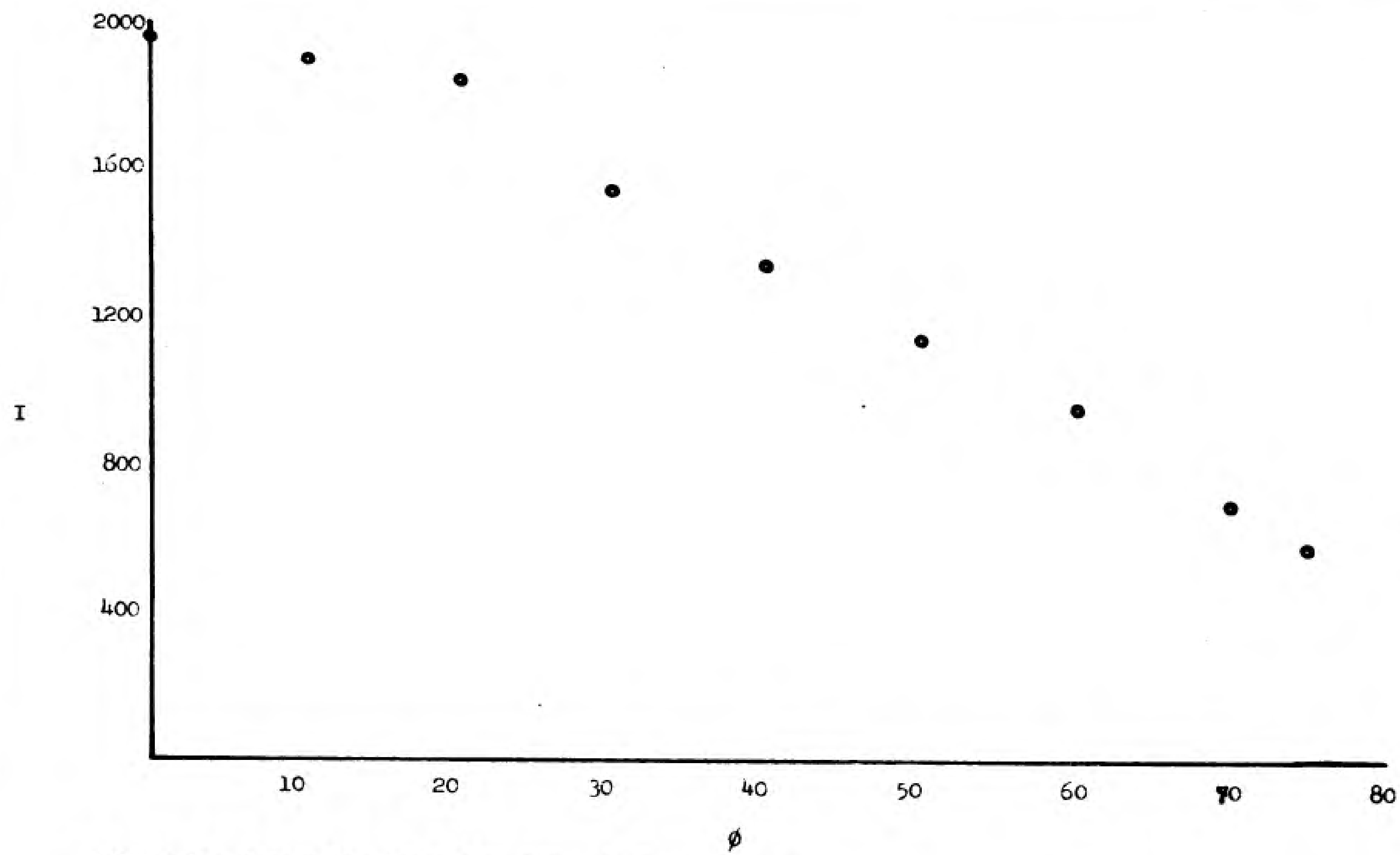


Figure 3 - Defocusing Correction Using Ag Random Sample.

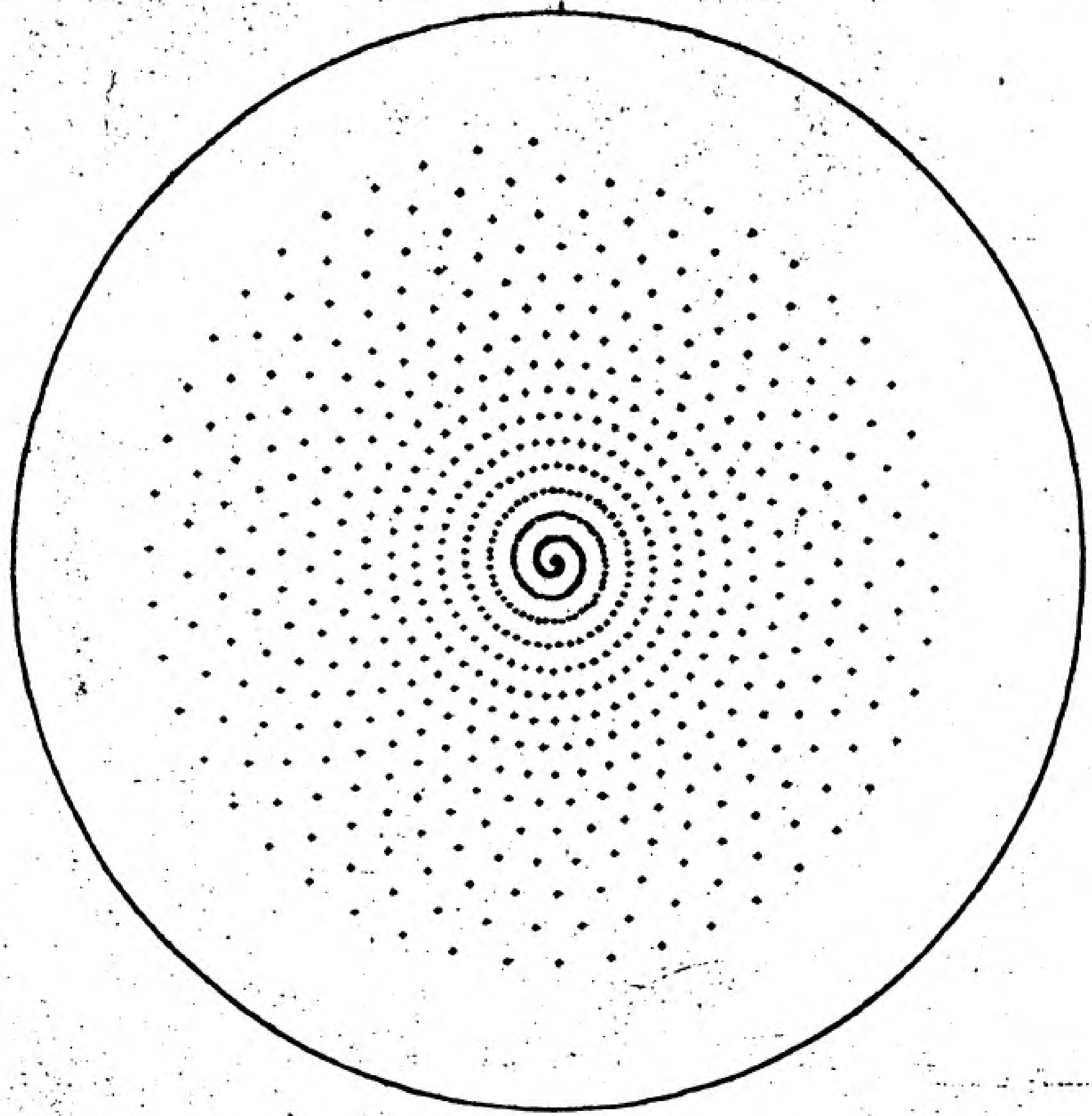


Figure 4 - Location of data points for Sampling Plan A.

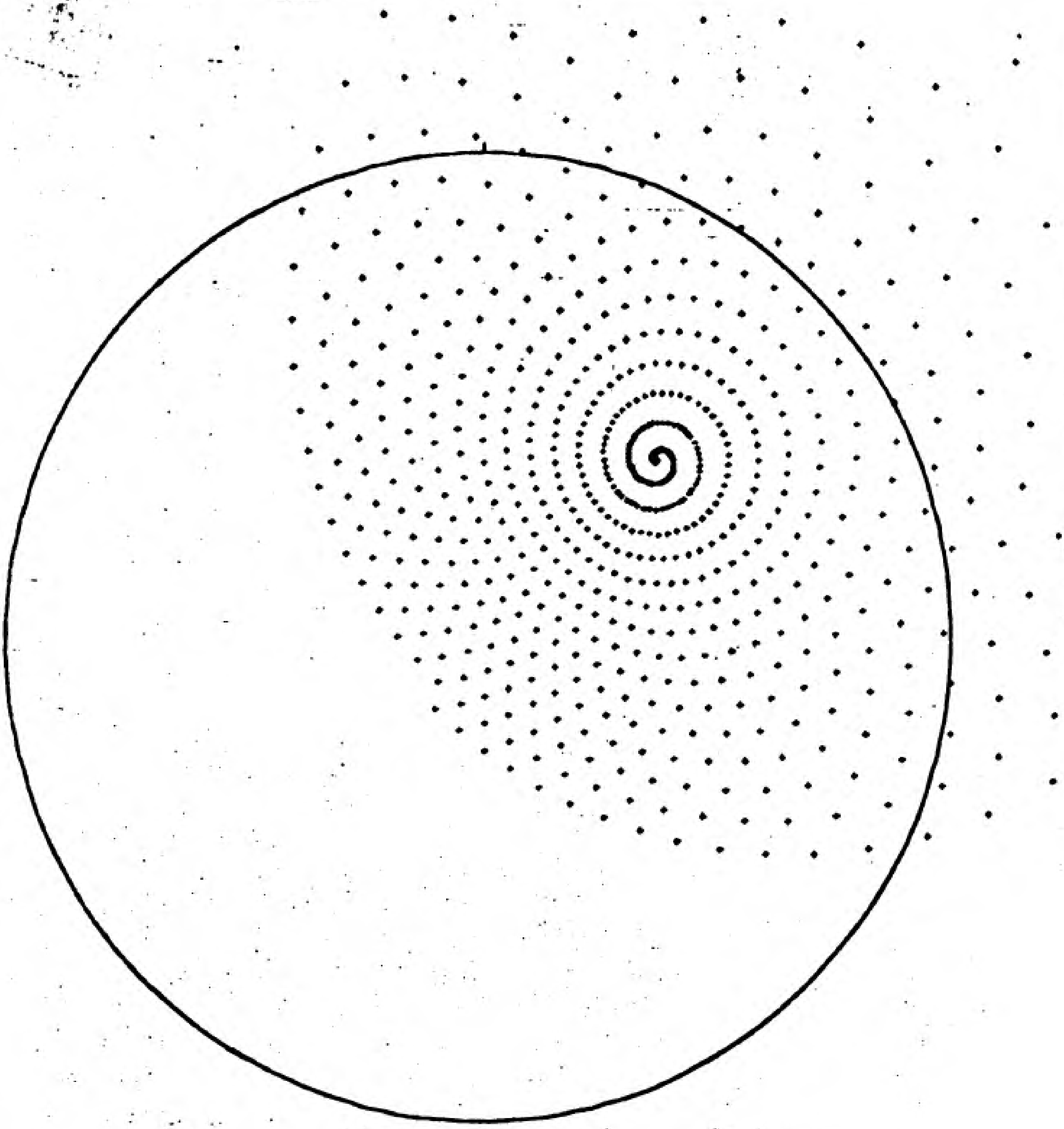
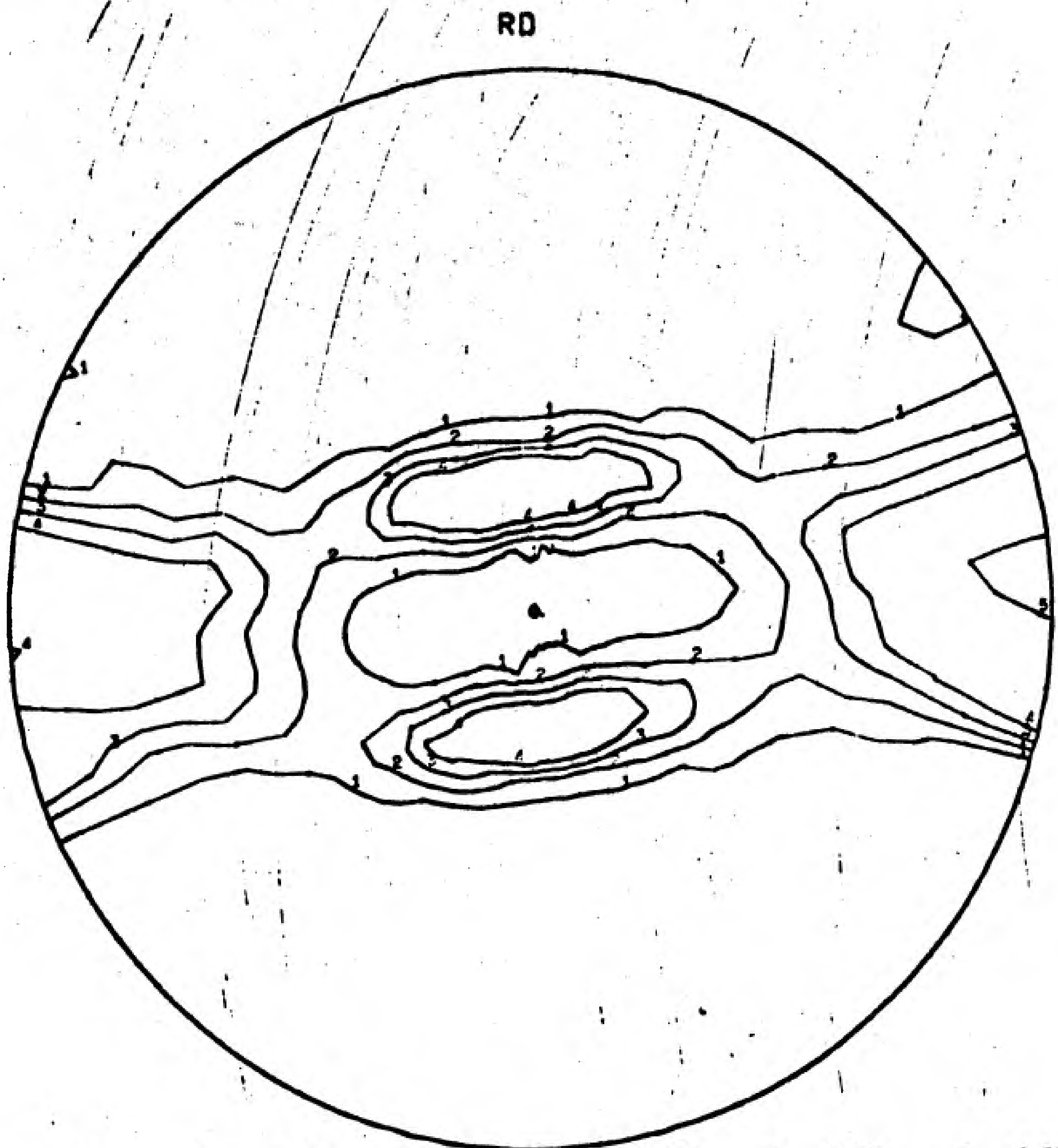


Figure 5 - Location of data points using Sampling Plan C.

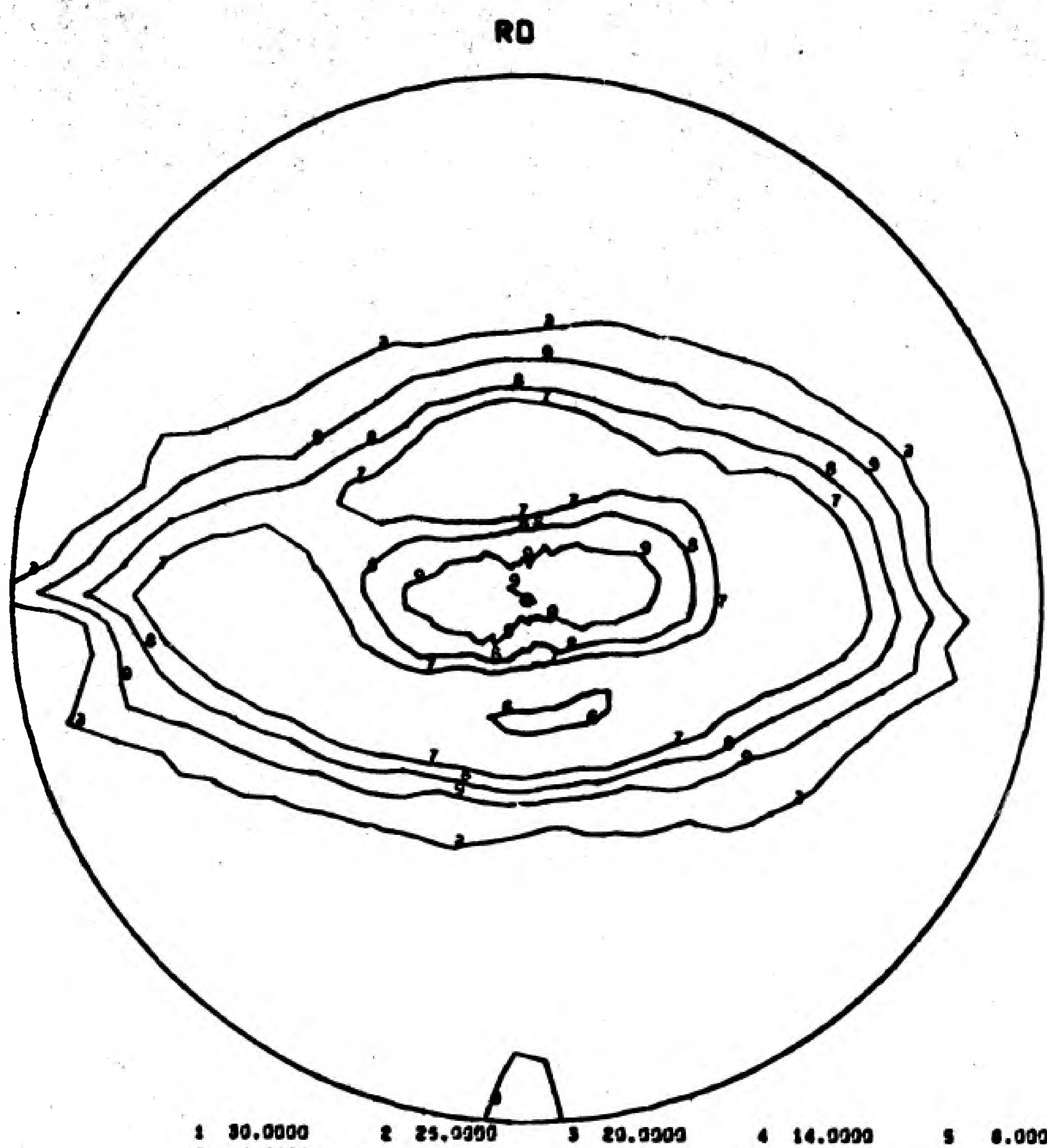


1	.500	2	1.000	3	1.500	4	2.000	5	4.000
6	8.000	7	14.000	8	20.000	9	25.000	0	30.000

RANDOM INTENSITY 656.0

SAMPLE A TOP 2E9M DATE05/09/69
RADIATION CU AT 35 KV 26 MA COUNTER TUBE SCINT 2 AT 1.255 KV
SLITS 2 H 2 V ENTRANCE 5 H 1 V RECEIVING ENGINEER RAY OLSEN
SCAN RATE 72 PSI/MIN 1 ALPHA/MIN 0002 HKL
PHA 8.5 V BASE 25.0V WINDOW CALIBRATION SAMPLE SILVER

Figure 6 - KODI plot of continuously rolled Ti:6Al-4V.

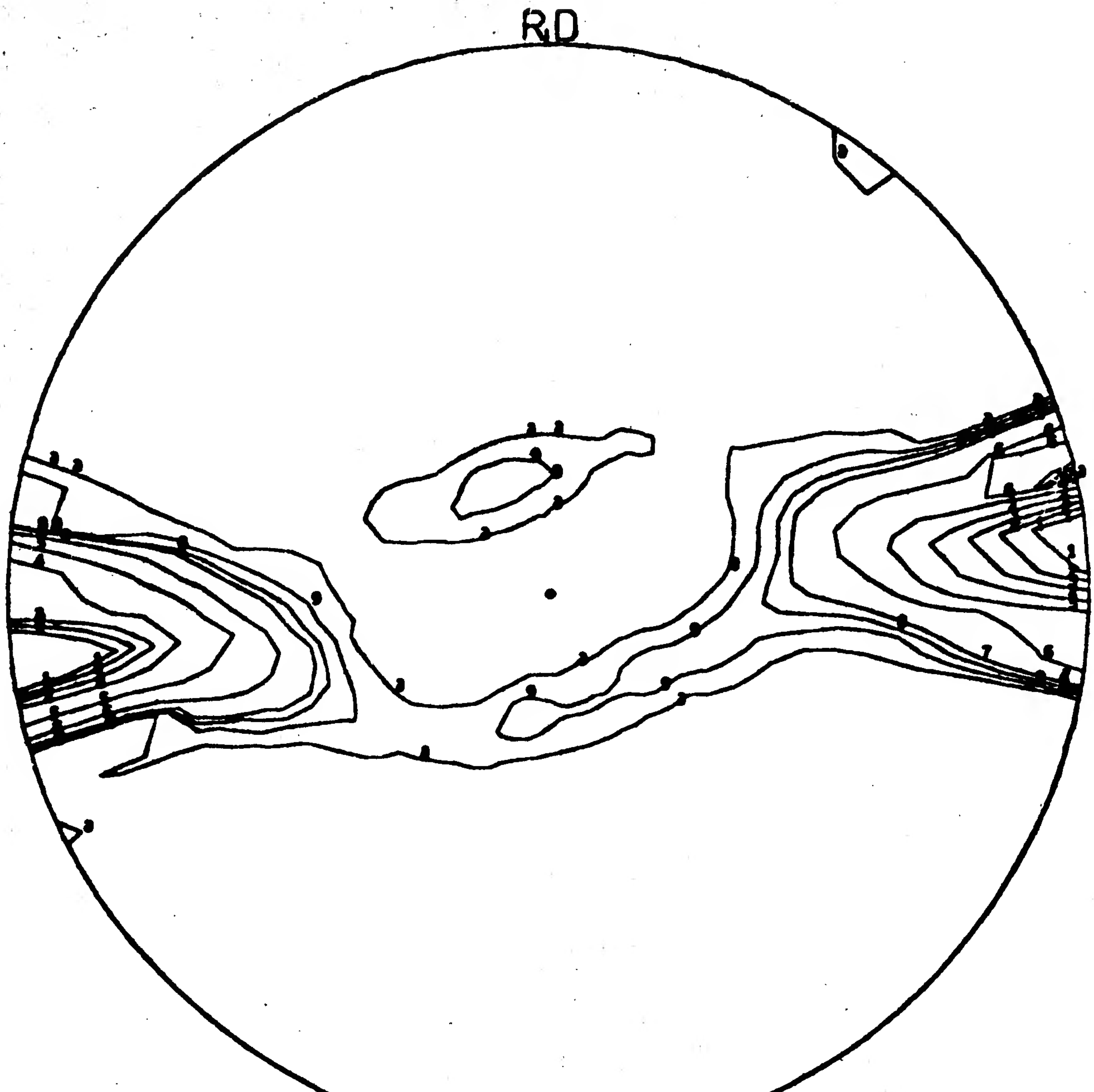


1	30.0000	2	25.0000	3	20.0000	4	14.0000	5	8.0000
6	4.0000	7	2.0000	8	1.5000	9	1.0000	0	.5000

RANDOM INTENSITY 680.3

SAMPLE FM 161-8 TOP DATE10/16/69
RADIATION CU AT 35 KV 28 MA COUNTER TUBE SCINT. AT1.245 KV
SLITS 2 H 2 V ENTRANCE 5 H 1 V RECEIVING ENGINEER R.H. OLSEN
SCAN RATE 1 PSI/MIN 72 ALPHA/MIN 0002 HKL
PHA 8.5 V BASE 20.V WINDOW CALIBRATION SAMPLE SILVER

Figure 7 - KODI plot of hand milled Ti-6Al-4V.

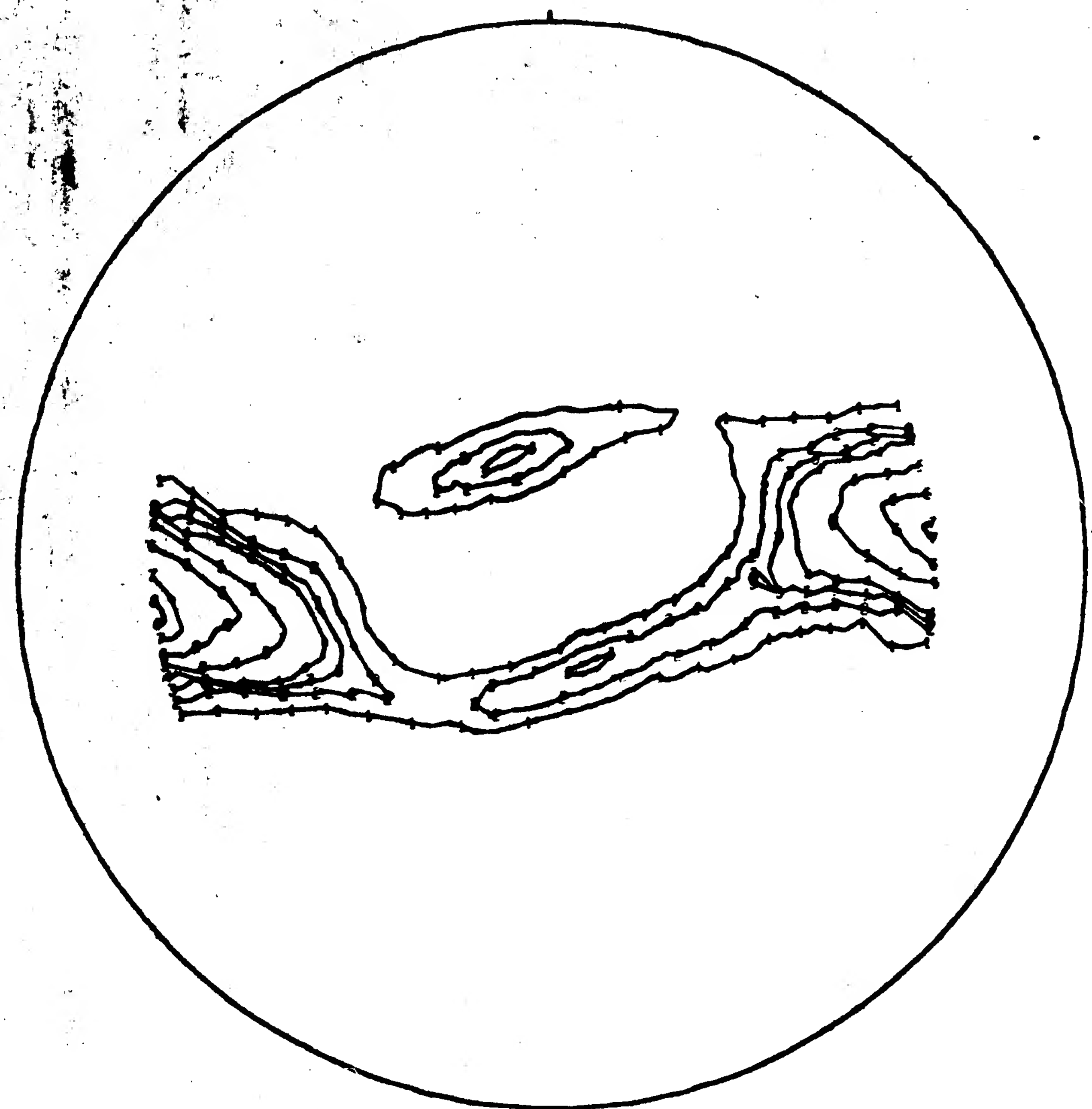


1	30.0000	2	25.0000	3	20.0000	4	14.0000	5	8.0000
6	4.0000	7	2.0000	8	1.5000	9	1.0000	0	.5000

```
SAMPLE  JOB 269M, 6                                  DATE10/11/69
RADIATION  CU AT 35 KV 20 MA   COUNTER TUBE   SCINT   AT 1.250KV
SLITS 2 H 2 V ENTRANCE 5 H 1 V RECEIVING   ENGINEER  R.H.OLSEN
SCAN RATE        1    PSI/MIN       72   ALPHA/MIN      0002    HKL
PHA 0.5 V BASE 20. V WINDOW   CALIBRATION SAMPLE    SILVER
RANDOM INTENSITY      710.0          K(A)   207.206 CALC DATE 04/01/70
```

Figure 8 - KODI plot of continuously rolled Ti:6Al-4V.

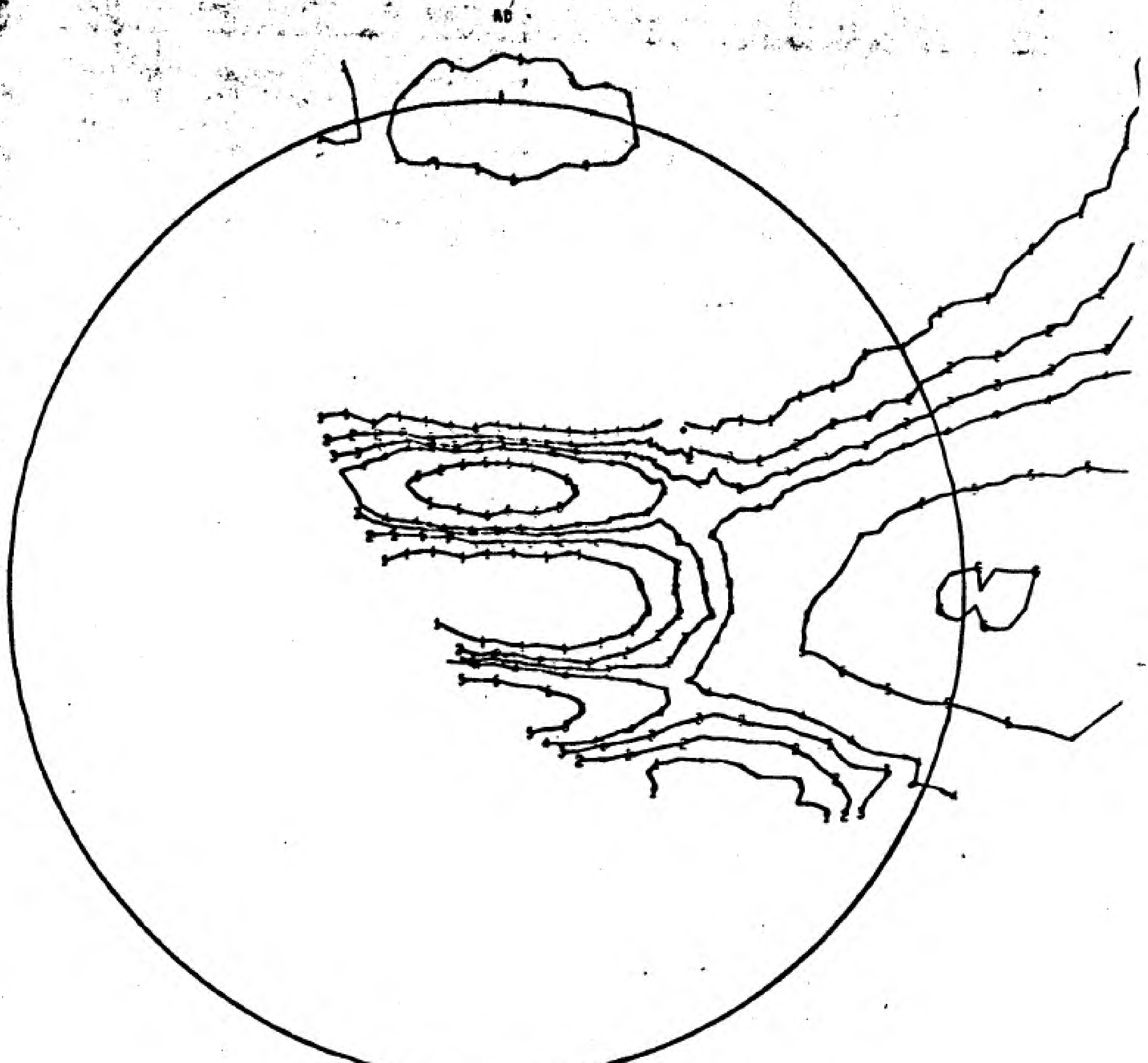
RD



1	.5000	2	1.0000	3	1.5000	4	2.0000	5	4.0000
6	8.0000	7	14.0000	8	20.0000	9	25.0000	0	30.0000

SAMPLE JOB 269M, 6 DATE10/11/69
RADIATION CU AT 35 KV 20 MA COUNTER TUBE SCINT AT 1.250KV
SLITS 2 H 2 V ENTRANCE 5 H 1 V RECEIVING ENGINEER R.H.OLSEN
SCAN RATE 1 PSI/MIN 72 ALPHA/MIN 0002 MKL
PHA 8.5 V BASE 20. V WINDOW CALIBRATION SAMPLE SILVER
RANDOM INTENSITY 710.0 K(A) 38.490 CALC DATE 02/19/70

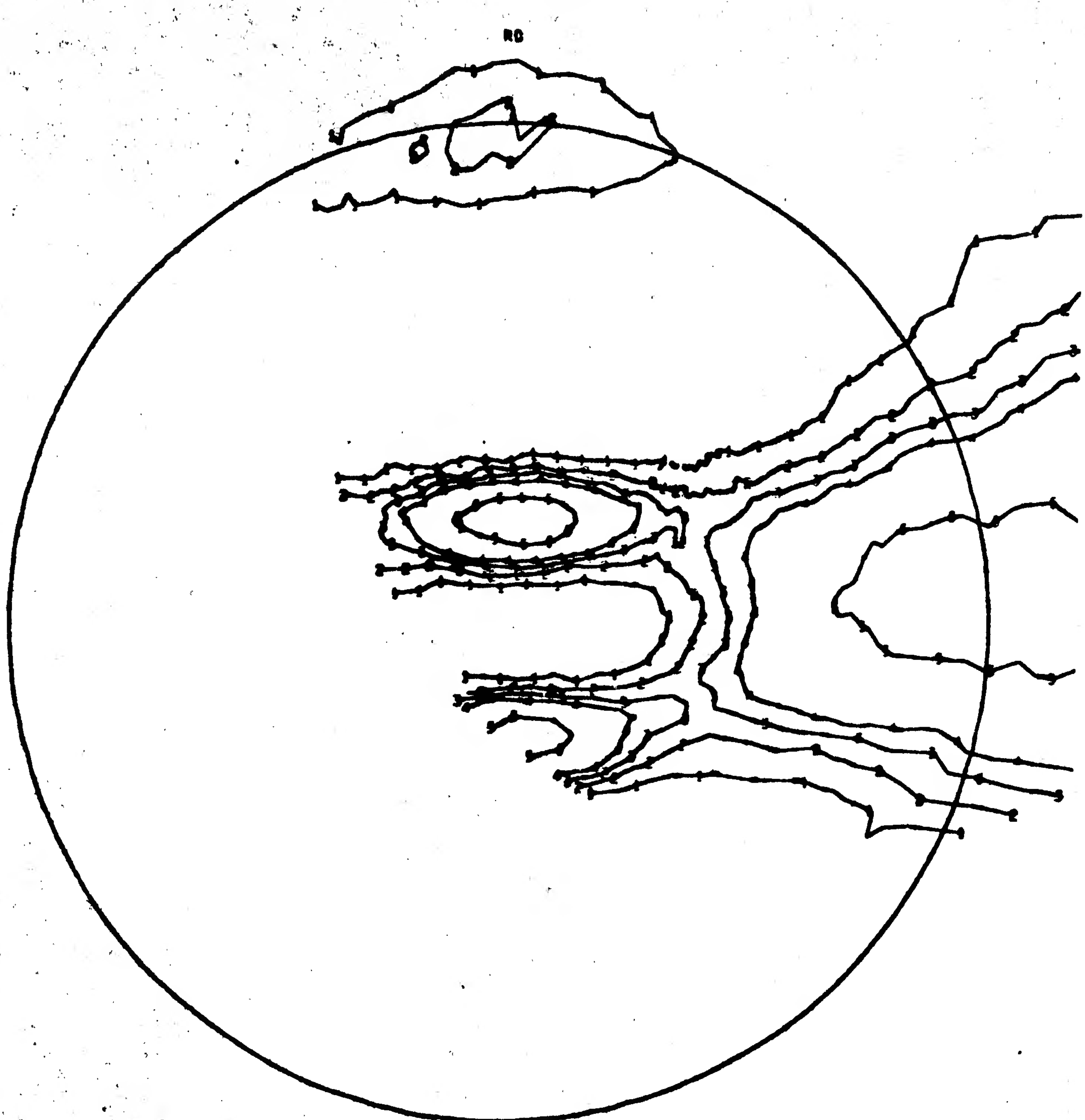
Figure 9 - POLE, Code 1, plot of continuously rolled Ti:6Al-4V.



1	.5000	2	1.0000	3	1.5000	4	2.0000	5	4.0000
6	8.0000	7	14.0000	8	20.0000	9	25.0000	0	30.0000

SAMPLE SPECIMEN A 269M DATE01/19/70
RADIATION CU AT 35 KV 26 MA COUNTER TUBEPROPORTIONALAT1.951 KV
SLITS 2 H 2 V ENTRANCE 5 H 1V RECEIVING ENGINEER R. H. OLSEN
SCAN RATE 1 PSI/MIN 72 ALPHA/MIN 0002 HKL
PHA 6.5 V BASE 22.0V WINDOW CALIBRATION SAMPLE SILVER
RANDOM INTENSITY 245.0 K(A) 95.204 CALC DATE 01/29/70

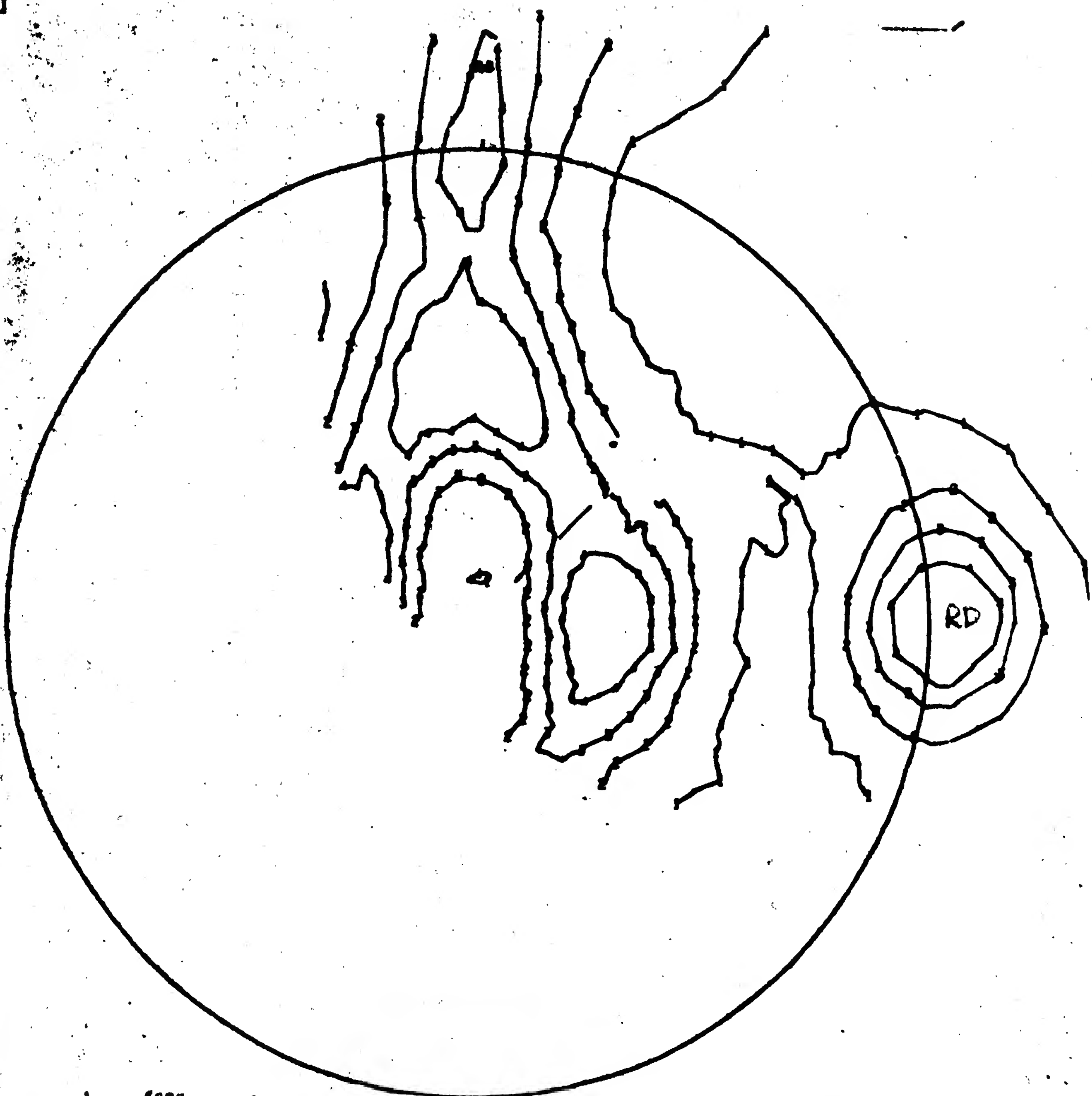
Figure 10 - POLE, Code 3, plot of continuously rolled Ti:6Al-4V.



1 .5000 2 1.0000 3 1.5000 4 2.0000 5 4.0000
6 8.0000 7 14.0000 8 20.0000 9 25.0000 0 30.0000

SAMPLE SPECIMEN C 289M DATE01/20/70
RADIATION CU AT 35 KV 28 MA COUNTER TUBEPROPROTIONALAT1.851 KV
SLITS 2 H 2 V ENTRANCE 5 H 1 V RECEIVING ENGINEER R H OLSEN
SCAN RATE 1 PSI/MIN 72 ALPHA/MIN 0002 HKL
PHA 6.5 V BASE 22.0V WINDOW CALIBRATION SAMPLE SILVER
RANDOM INTENSITY 240.0 K(A) 95.757 CALC DATE 02/19/70

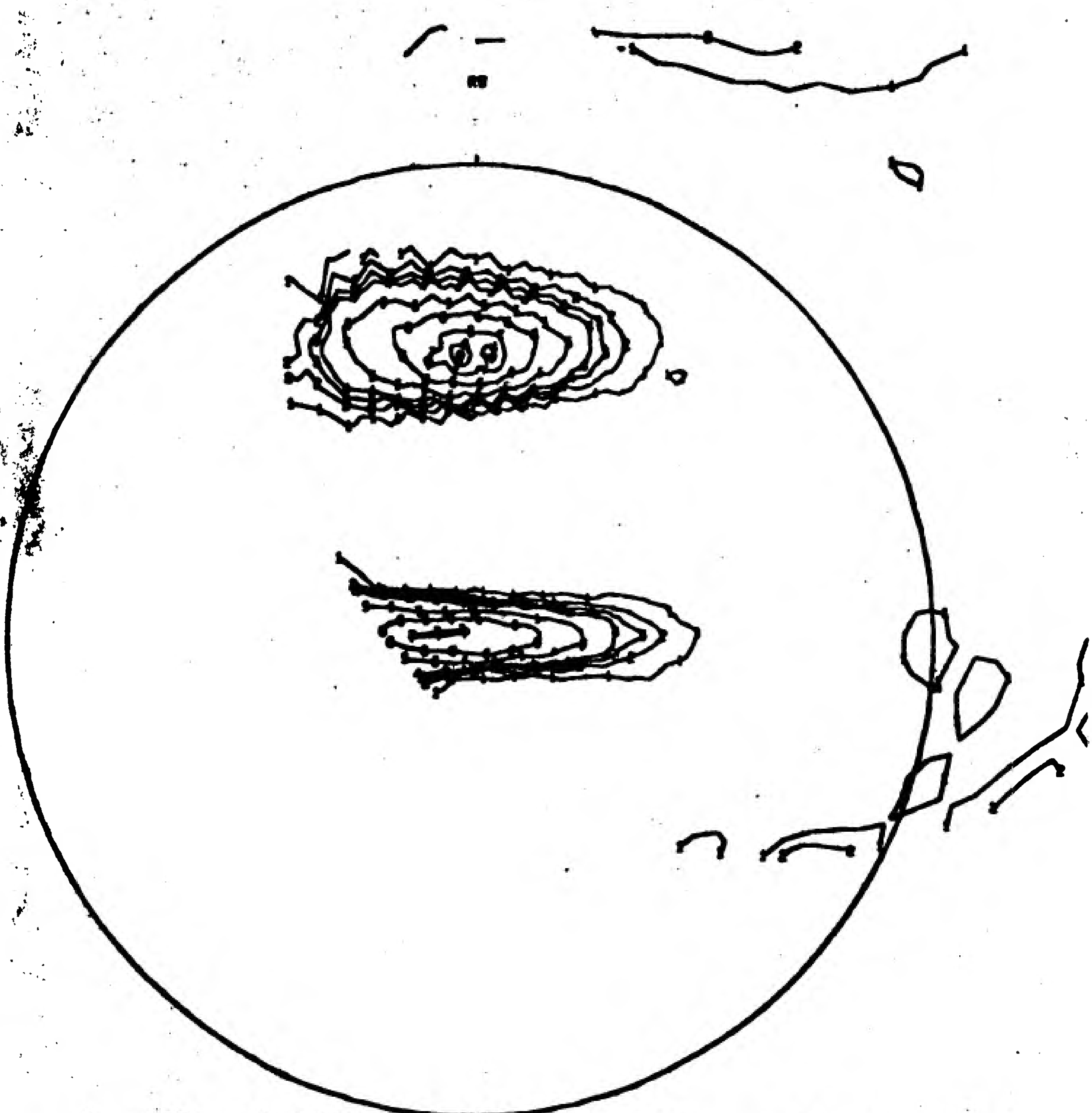
Figure 11 - [redacted], Code 3, plot of continuously rolled Ti:6Al-4V.



1 .5000 2 1.0000 3 1.5000 4 2.0000 5 4.0000
6 8.0000 7 14.0000 8 20.0000 9 25.0000 0 30.0000

SAMPLE FM 161-6
RADIATION CU AT 35 KV 28 MA COUNTER TUBE SCINT AT 1.285KV DATE10/10/69
SLITS 2 H 2 V ENTRANCE 1 H 1 V RECEIVING ENGINEER R.H. OLSEN
SCAN RATE 1 PSI/MIN 72 ALPHA/MIN 0002 HKL
PHA 0.5V BASE 20 V WINDOW CALIBRATION SAMPLE SILVER
RANDOM INTENSITY 655.0 BIAS -15.257 CALC DATE 01/15/

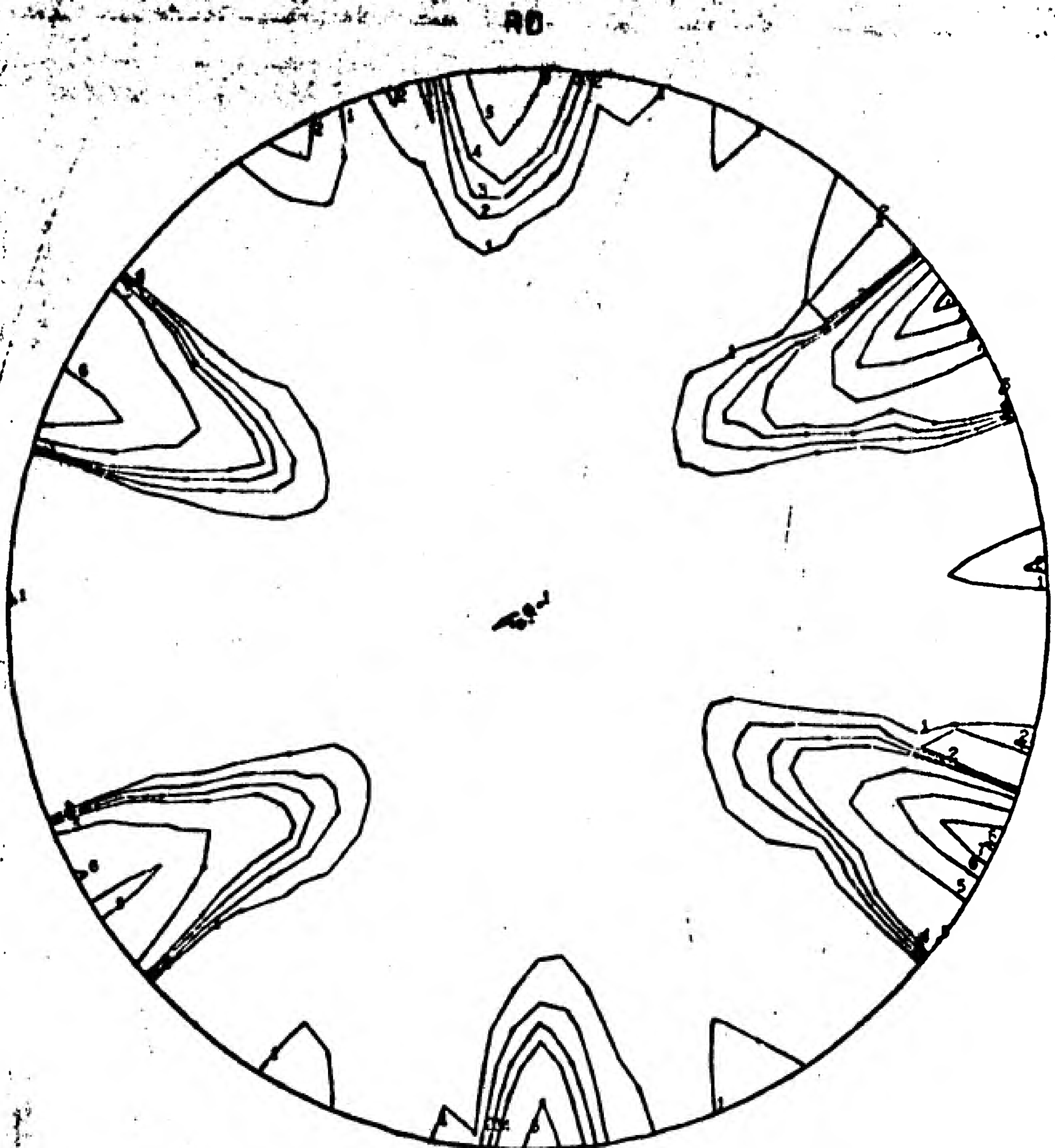
Figure 12 - POLE, Code 3, of hand milled Ti:6Al-4V. (NOTE: RD)



1	.5000	2	1.0000	3	1.5000	4	2.0000	5	4.0000
6	6.0000	7	14.0000	8	20.0000	9	25.0000	0	30.0000

SAMPLE 209M SPECIMEN 6 DATE03/11/70
RADIATION CU AT 35 KV 20 MA COUNTER TUBEPROPROTIONALAT 1.075KV
SLITS 2 H 2 V ENTRANCE 5 H 1 V RECEIVING ENGINEER RAY OLSEN
SCAN RATE 72 PSI/MIN / 1 ALPHA/MIN 1120 HKL
PHA 5. V BASE 25. V WINDOW CALIBRATION SAMPLE C.P. TI RANDOM
RANDOM INTENSITY 160.0 9 K(A) CALC DATE 03/25/70

Figure 13 - 11$\bar{2}$0 POLE, Code 3, figure of Specimen G, continuously rolled.



1	.500	2	1.000	3	1.500	4	2.000	5	4.000
6	8.000	7	14.000	8	20.000	9	25.000	0	30.000

RANDOM INTENSITY 555.0

SAMPLE G SIDE DATE06/02/69
RADIATION CU AT 35 KV 28 MA COUNTER TUBE SCINT AT 1.255KV
SLITS 2H 2 V ENTRANCE 5 H 1 V RECEIVING ENGINEER R.H. OLSEN
SCAN RATE 1 PSI/MIN 72 ALPHA/MIN 1010 HKL
PHA 8.5V BASE 25 V WINDOW CALIBRATION SAMPLE SILVER

Figure 14 - $10\bar{1}0$ KODI plot of side view, continuously rolled, Specimen G.

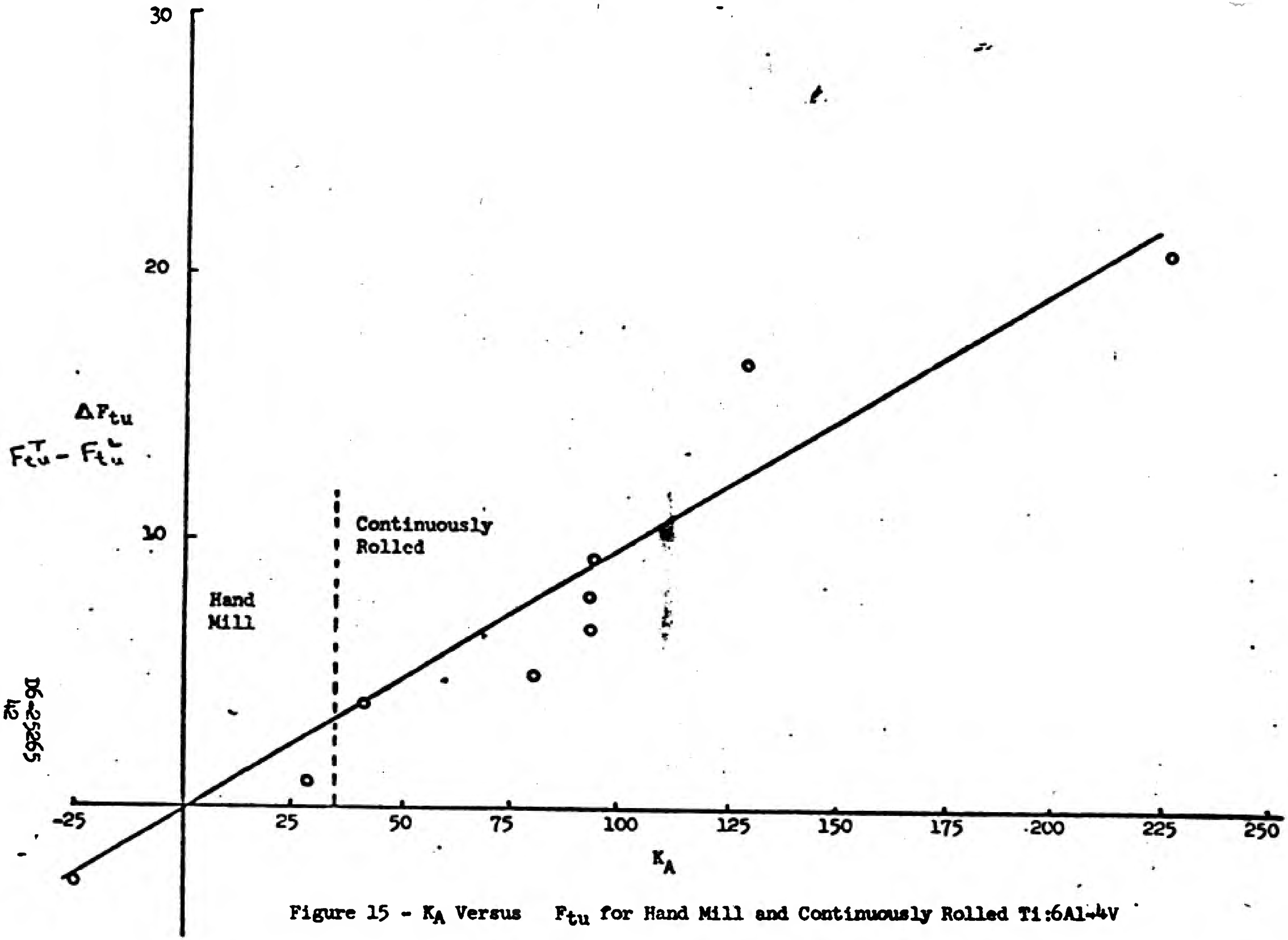


Figure 15 - K_A Versus F_{tu} for Hand Mill and Continuously Rolled Ti:6Al-4V

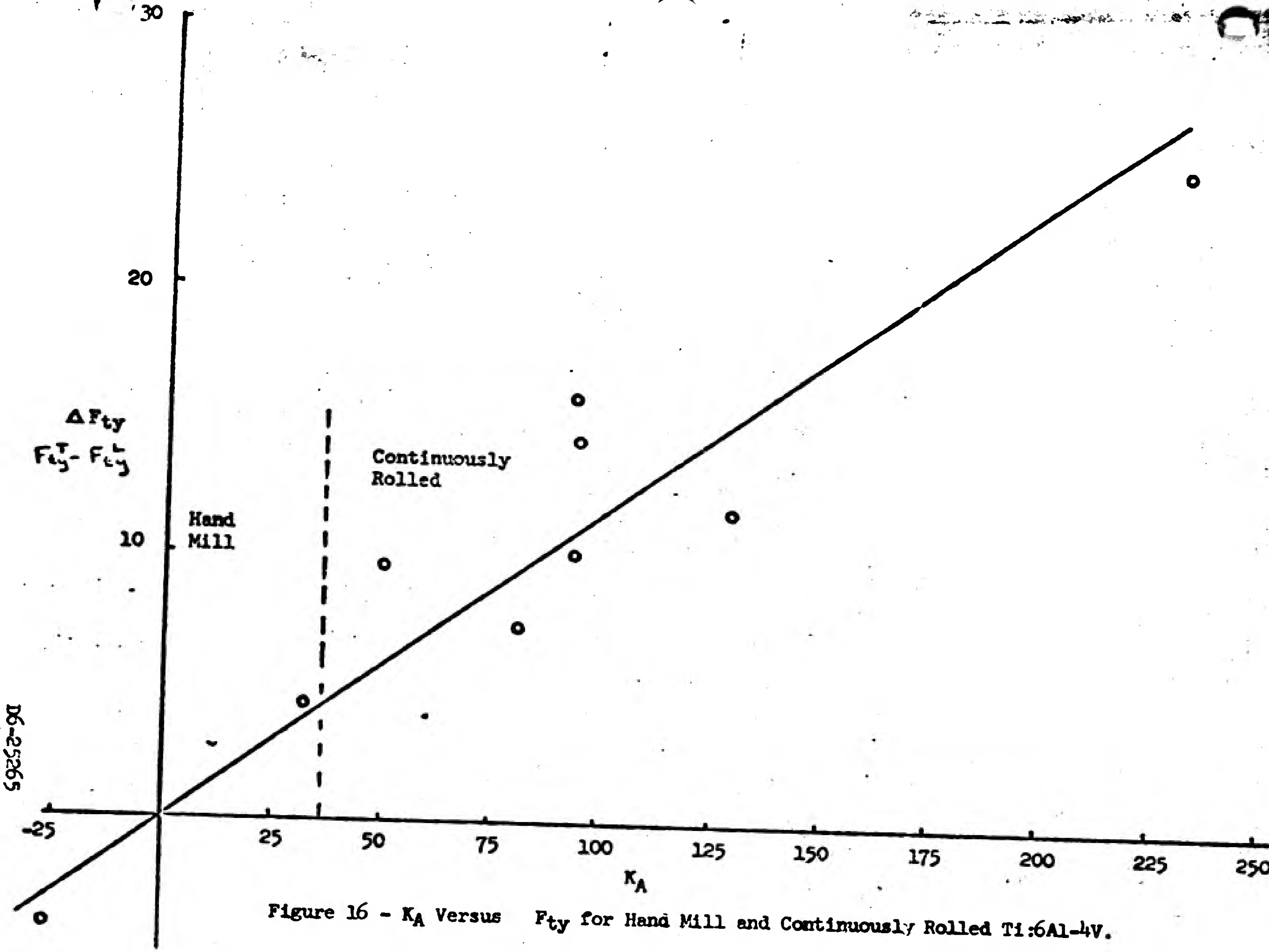
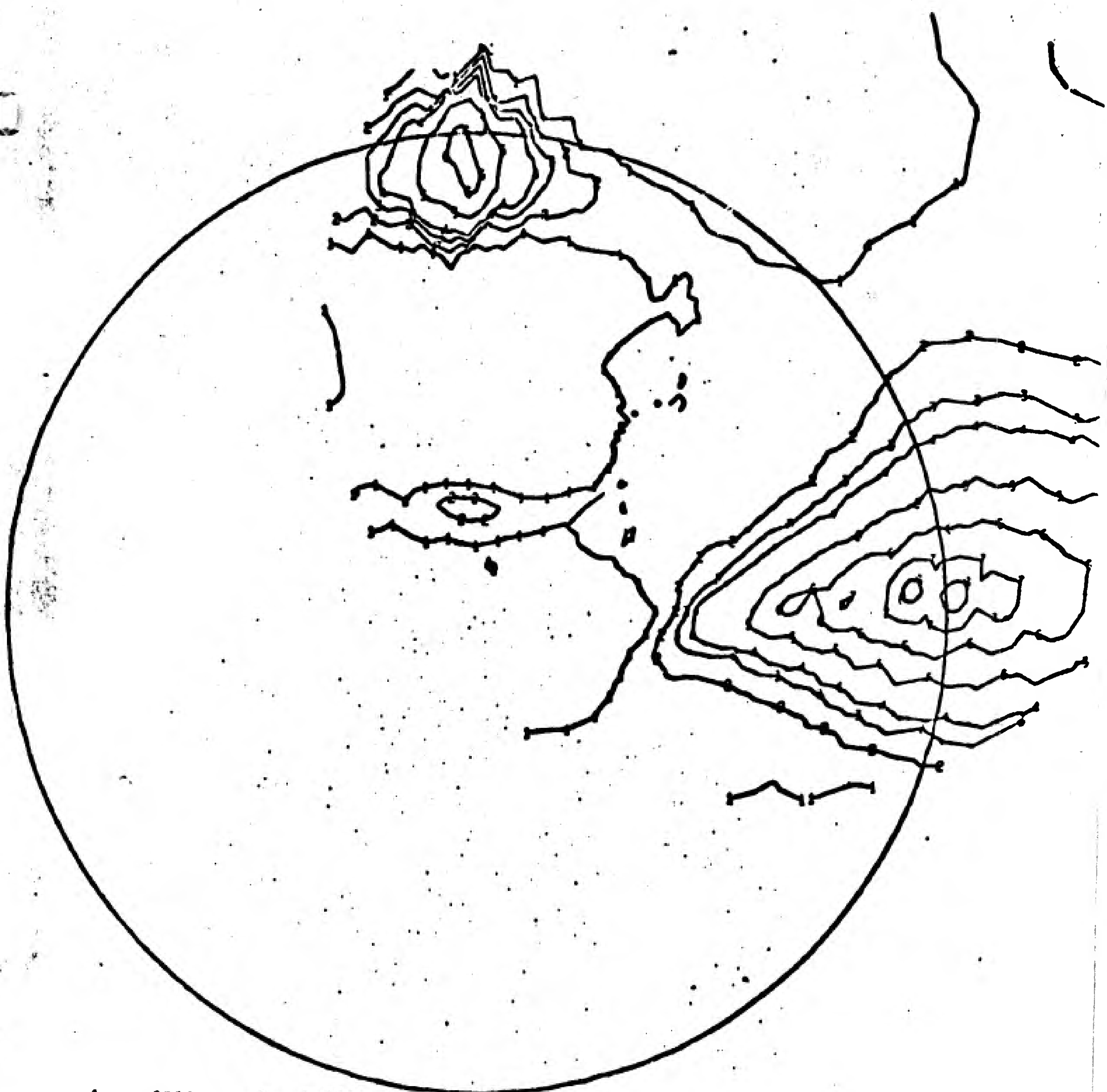


Figure 16 - K_A Versus F_{ty} for Hand Mill and Continuously Rolled Ti:6Al-4V.



1	.5000	2	1.0000	3	1.5000	4	2.0000	5	4.0000
6	8.0000	7	14.0000	8	20.0000	9	25.0000	0	30.0000

```
SAMPLE                    .F.260M.RERUN        2b       DATE10/07/69
RADIATION  CU AT 35 KV 20 MA   COUNTER TUBE   SCINT    AT 1.245KV
SLITS 2 H 2 V ENTRANCE 5 H 1 V RECEIVING   ENGINEER   R.H.OLSEN
SCAN RATE       1      PSI/MIN        72   ALPHA/MIN      0002  HKL
PHA 8.5 V CASE  25 V WINDOW  CALIBRATION SAMPLE    SILVER
RANDOM INTENSITY     600.0          K(A)  125.699 CALC DATE 01/15/75
```

Figure 17 - POLE, Code 3, plot of continuously rolled Specimen F, Dated 10-7-69.

1	.5000	2	1.0000	3	1.5000	4	2.0000	5	4.0000
6	8.0000	7	14.0000	8	20.0000	9	25.0000	0	30.0000

SAMPLE 269H F DATED2/25/70 1
RADIATION CU AT35 KV 28 MA COUNTER TUBEPROPROTIONALAT1.975 KV
SLITS 2 H 2 V ENTRANCE 5 H / V RECEIVING ENGINEER RAY OLSEN
SCAN RATE / PSI/MIN 72 ALPHA/MIN 0002 HKL
PHA 5. V BASE 25.0V WINDOW CALIBRATION SAMPLE SILVER
RANDOM INTENSITY . 375.0 K(A) 121.396 CALC DATE 02/26/70

Figure 18 - POLE, Code 3, plot of continuously rolled Specimen F, Dated 2-25-70.