Fermilab

INSTRUMENT ANGULAR RESPONSE

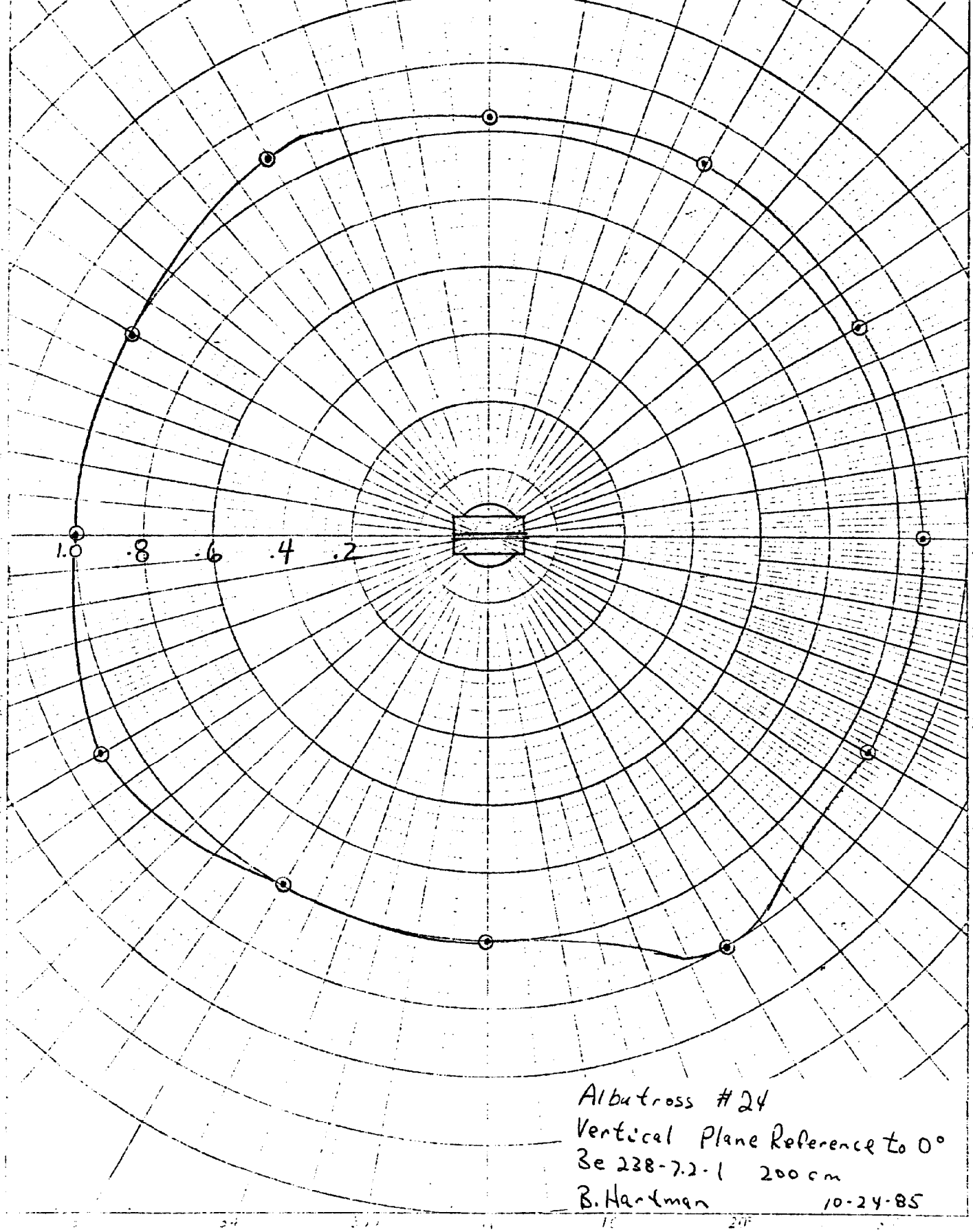
Butch Hartman

November 7, 1985

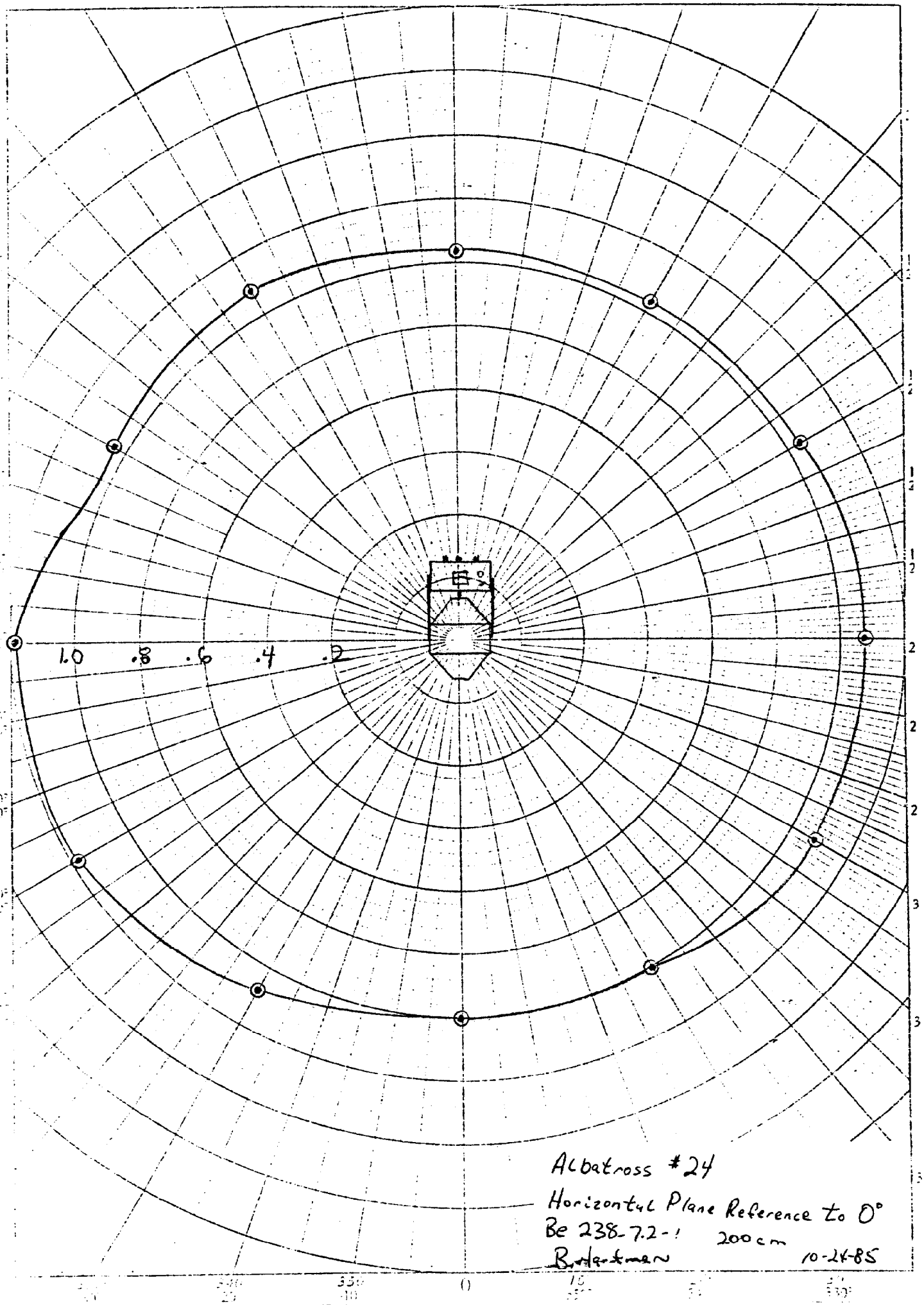
The prescribed radiation protection standard for DOE Order #5480.1A is ANSI N43.1-1978. Section 5.6.4.1 of the standard specifies that angular response performance data shall be available for each type of radiation survey instrument and detector.

The relative angular response for a sample of each type of survey instrument was measured for two mutually orthogonal planes with a resolution of 30°. The type of radioactive source normally used to calibrate each instrument was used to determine the angular response. The results of the measurements were plotted on the attached polar graphs, along with the source type used to measure the response.

Instruments that are intended to have narrow angular response (alpha probes and muon scopes) and instruments that angular response is meaningless (gas samplers) have been excluded.



Albatross #24
Vertical Plane Reference to 0°
Be 238-7.2-1 200 cm
B. Hartman 10-24-85

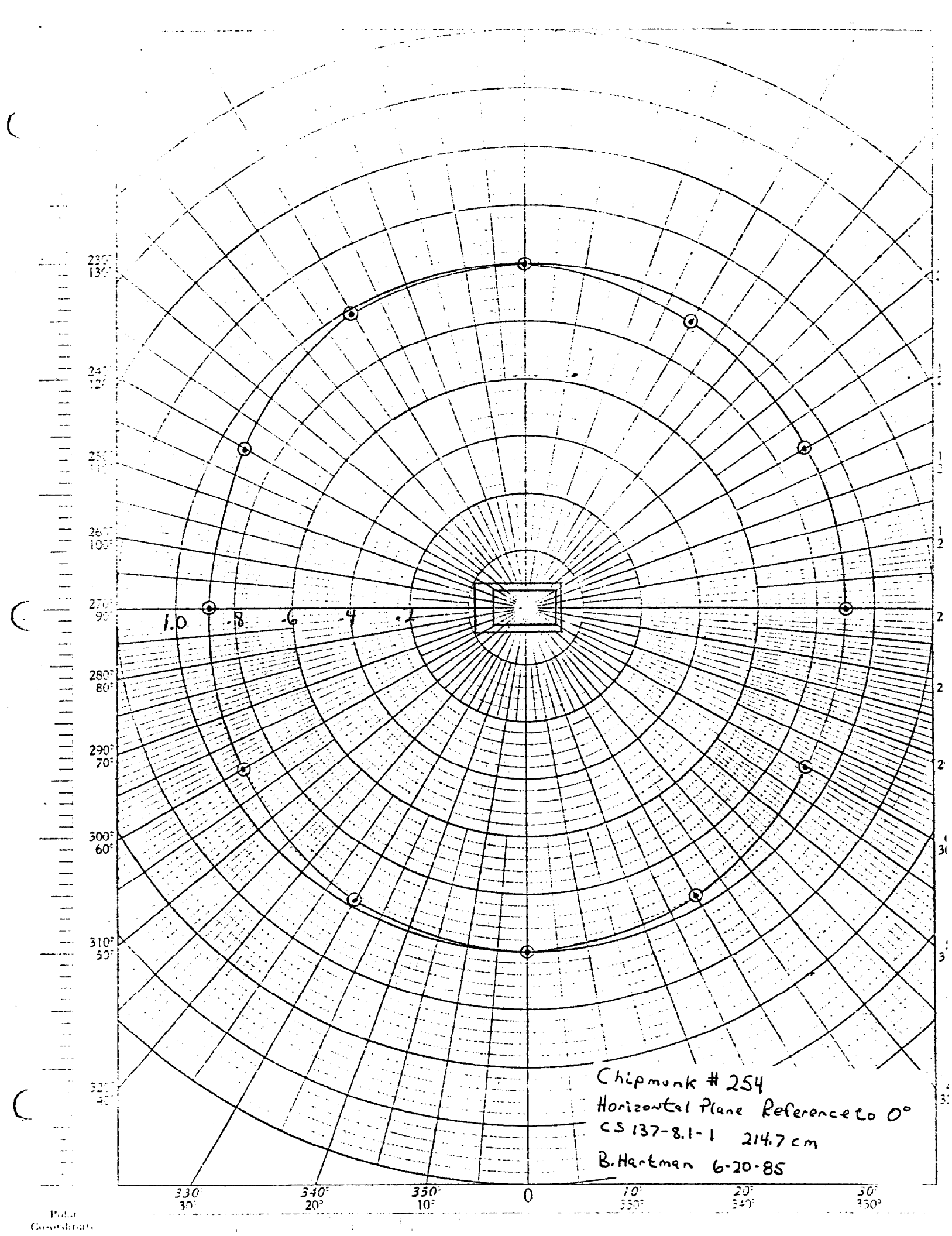


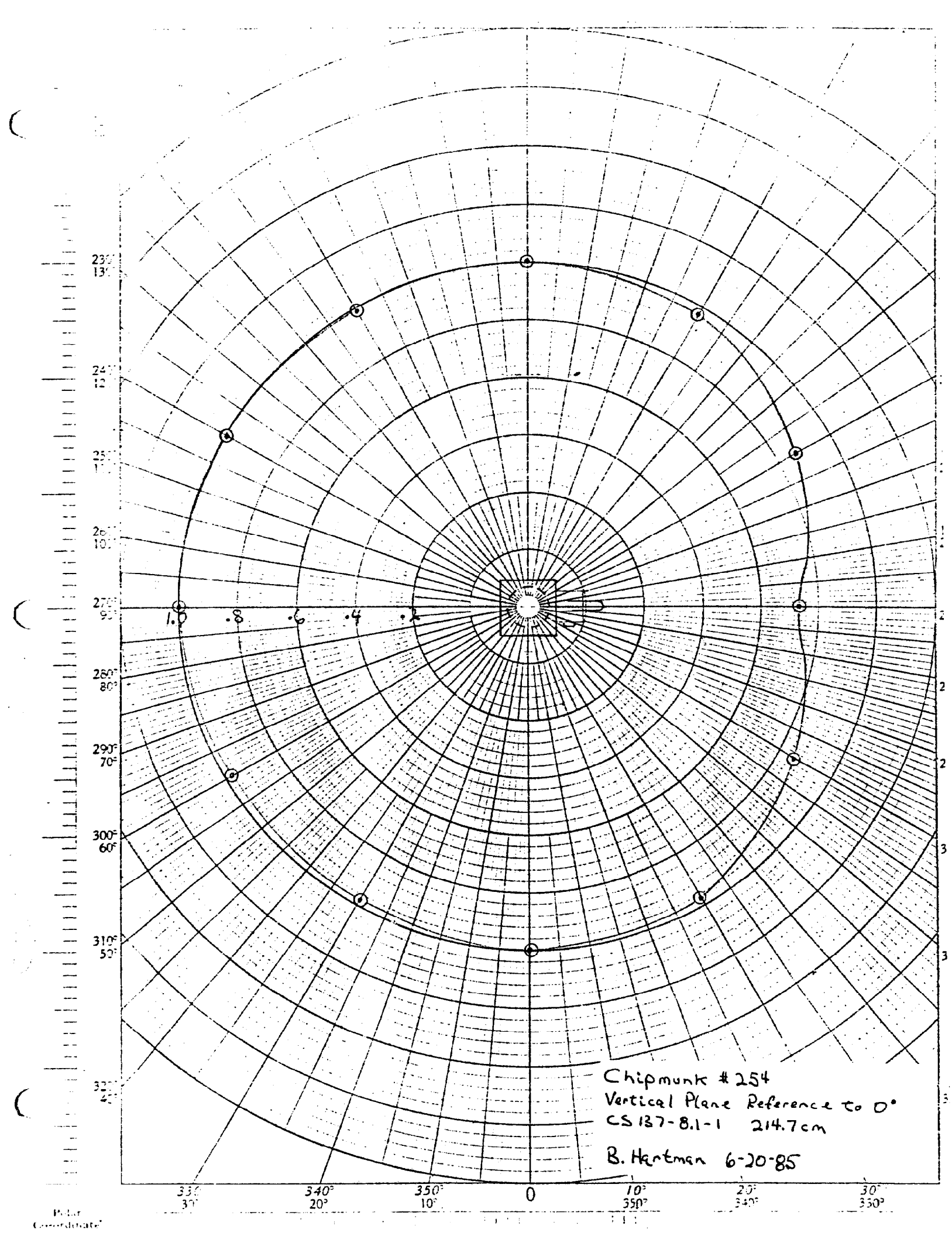
Albatross #24

Horizontal Plane Reference to 0°

Be 238-7.2-1 200 cm

B. Hartman 10-24-85


1.0
.8
.6
.4
.2
Chipmunk # 254
Horizontal Plane Reference to 0°
CS 137-8.1-1 214.7 cm
B. Hartman 6-20-85
330 30°
340° 20°
350° 10°
0
10° 350°
20° 340°
30° 330°
Polar Coordinate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.8
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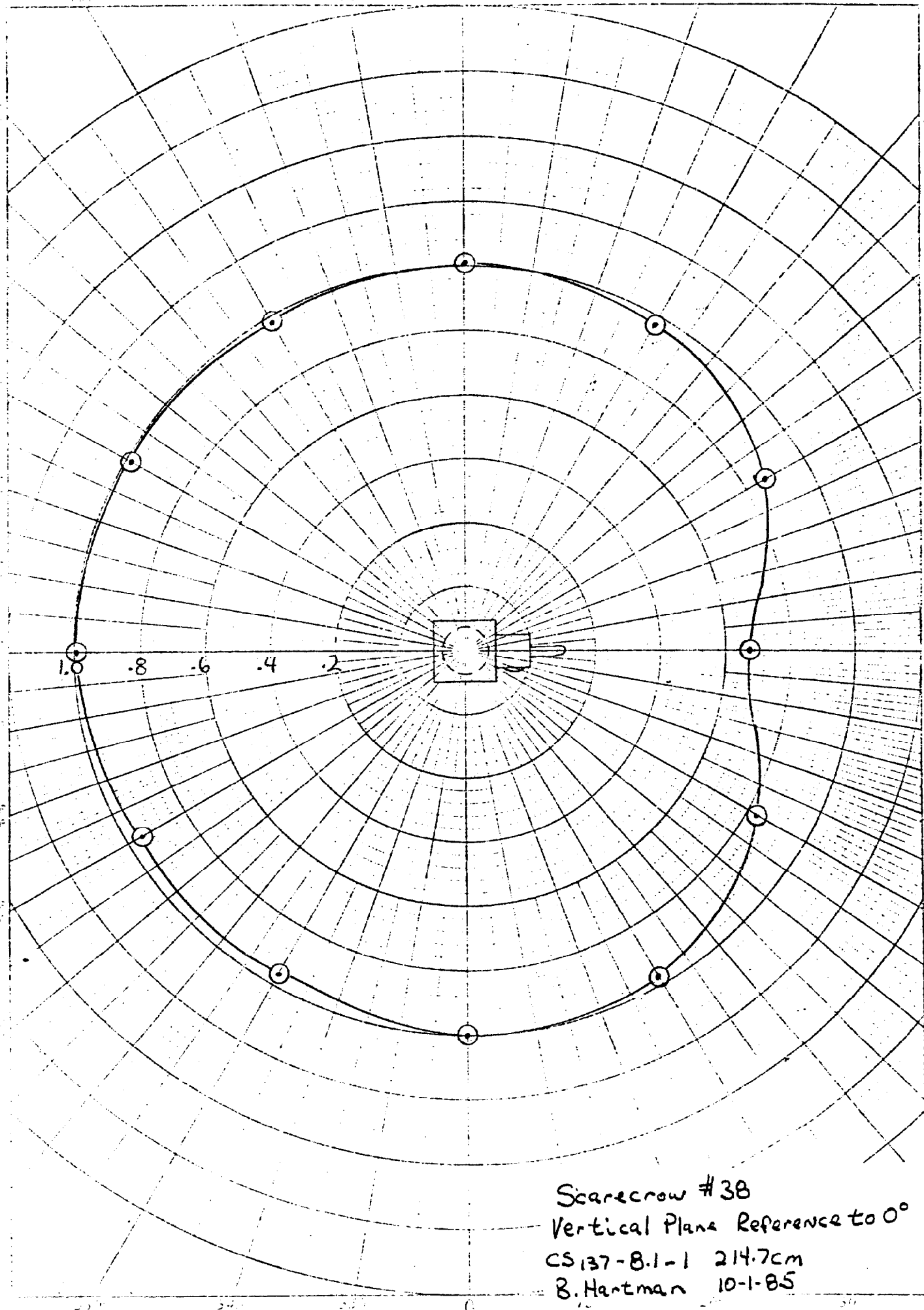
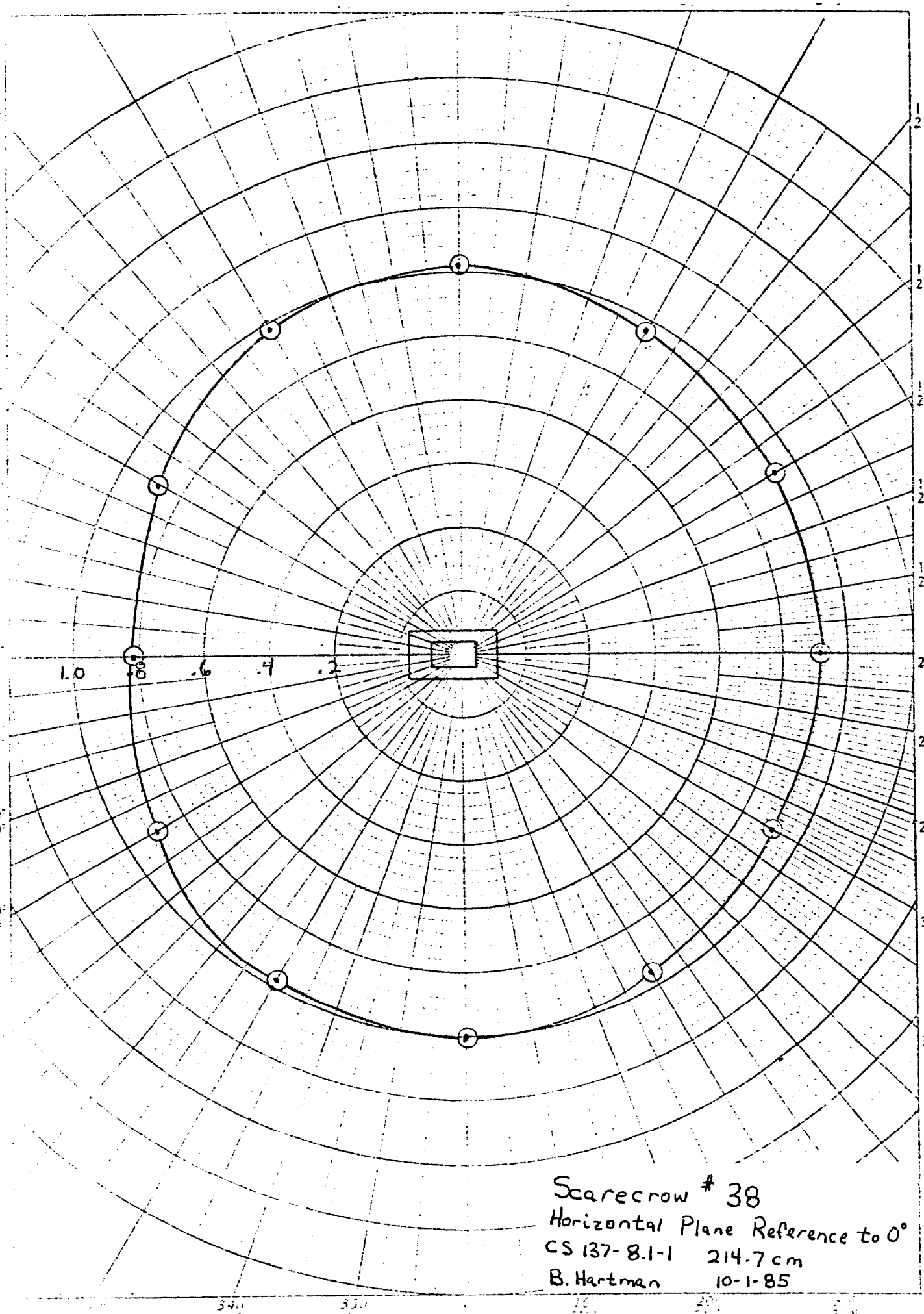
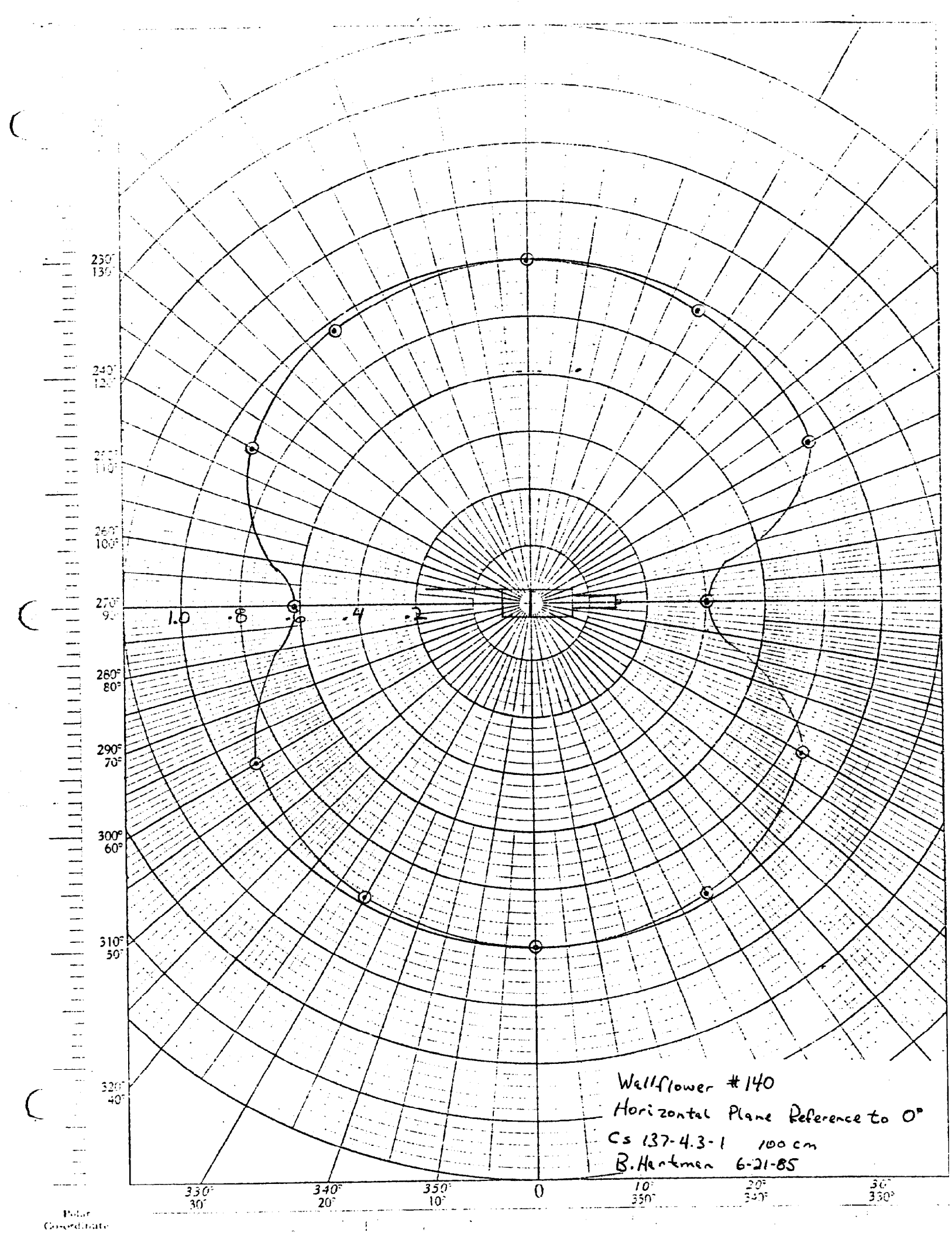
Chipmunk #254
Vertical Plane Reference to 0°
CS137-8.1-1 214.7cm
B. Hartman 6-20-85



Scarecrow #38
Vertical Plane Reference to 0°
CS 137-8.1-1 214.7cm
B. Hartman 10-1-85



Scarecrow # 38
Horizontal Plane Reference to 0°
CS 137-8.1-1 214.7 cm
B. Hartman 10-1-85


1.0
.8
.6
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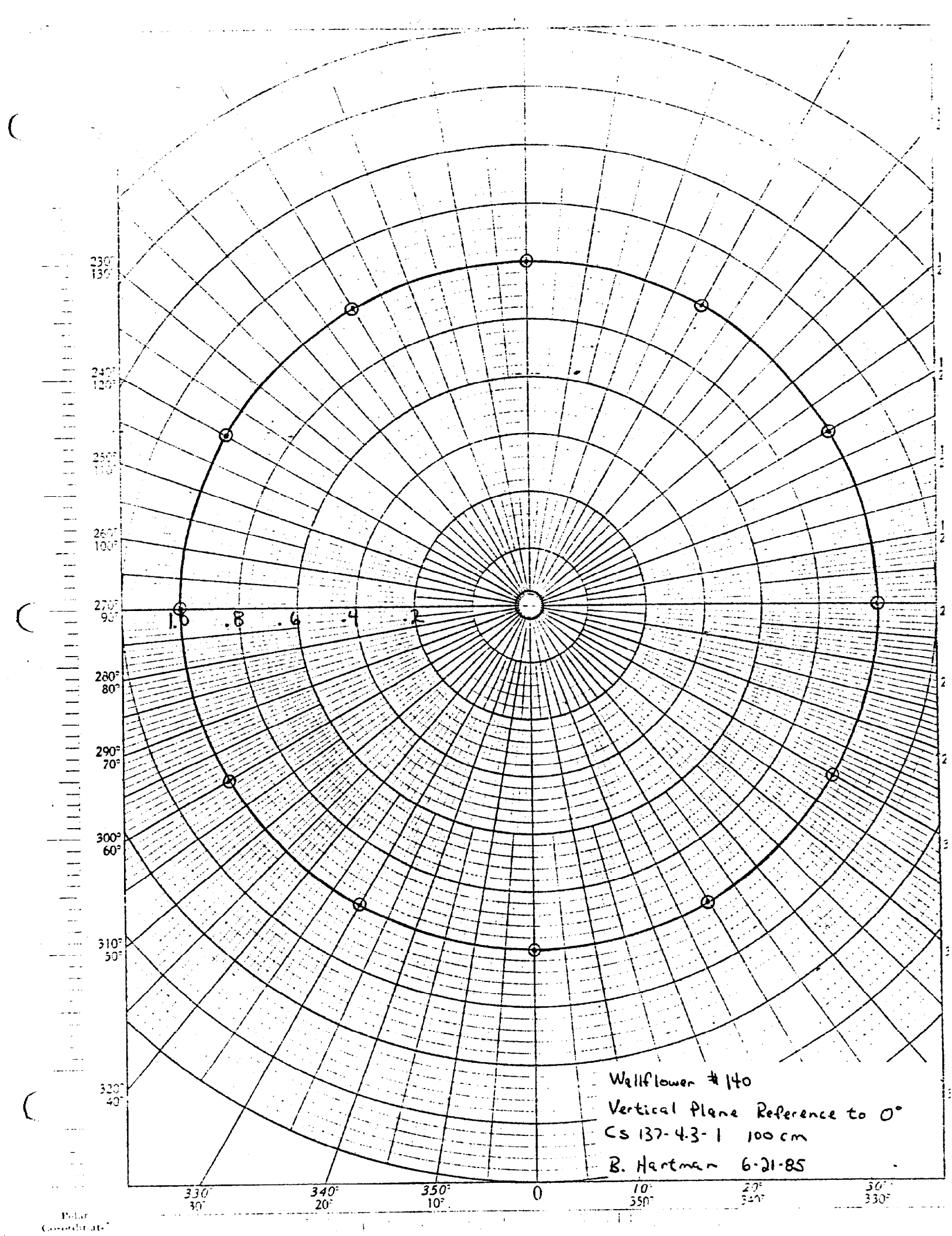
Wallflower #140
Horizontal Plane Reference to 0°
Cs 137-4.3-1 100 cm
B. Hartman 6-21-85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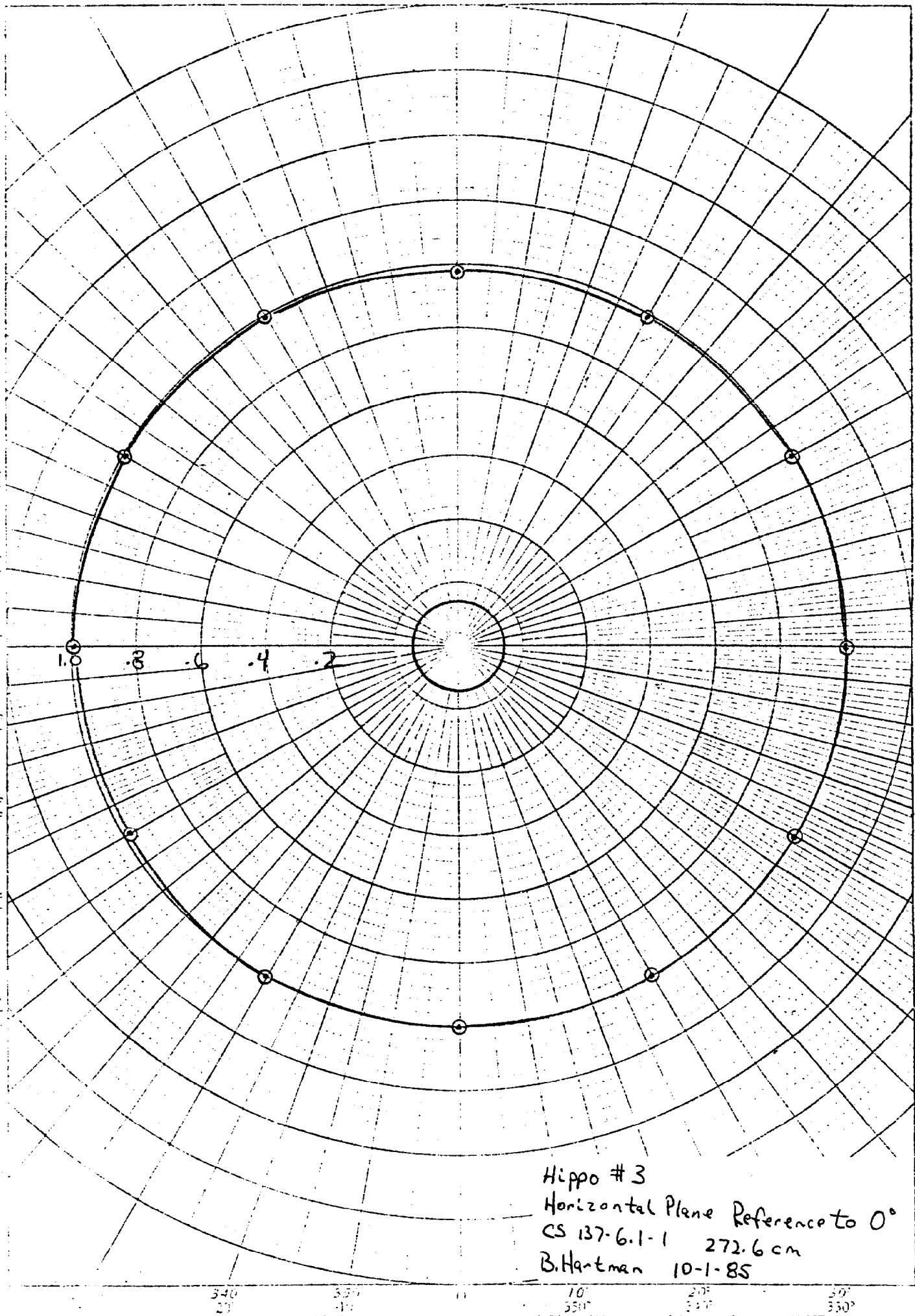
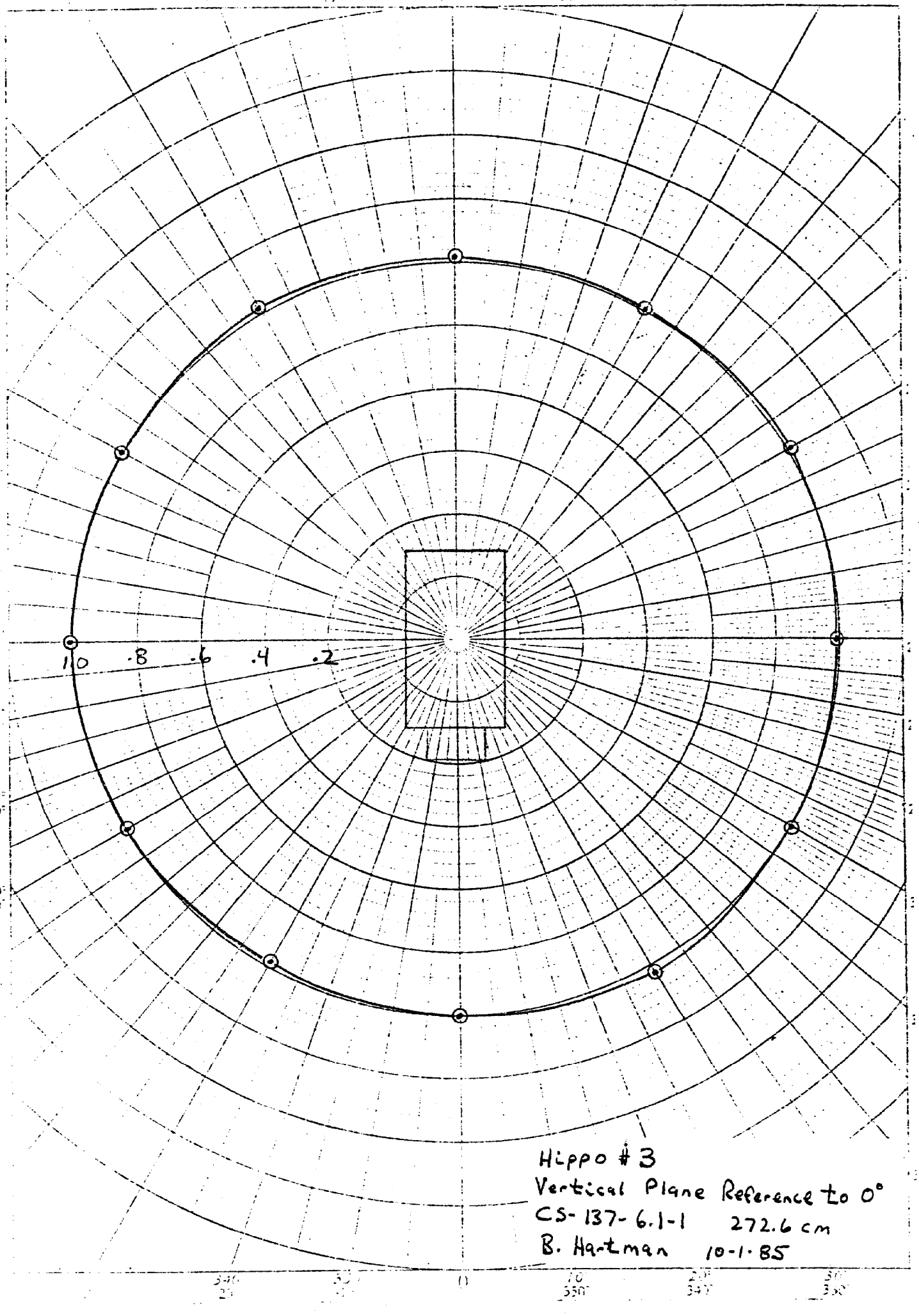
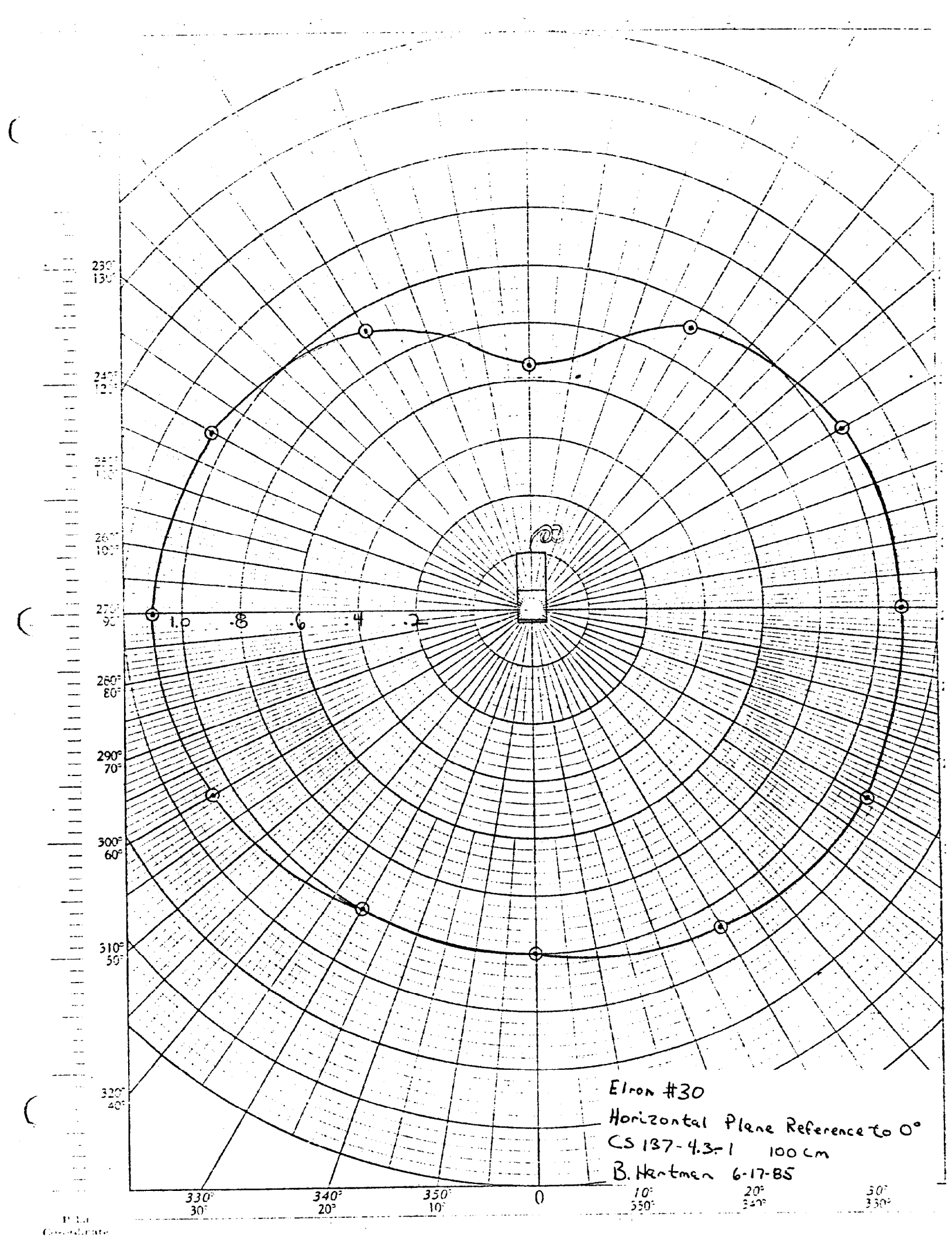
Wallflower #140
Vertical Plane Reference to 0°
Cs 137-4.3-1 100 cm
B. Hartman 6-21-85


1.0
.8
.6
.4
.2
Hippo #3
Horizontal Plane Reference to 0°
CS 137-6.1-1 272.6 cm
B. Hartman 10-1-85



Hippo #3
Vertical Plane Reference to 0°
CS-137-6.1-1 272.6 cm
B. Hartman 10-1-85


230°
130°
240°
120°
250°
110°
260°
100°
270°
90°
280°
80°
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60°
310°
50°
320°
40°
1.0
.8
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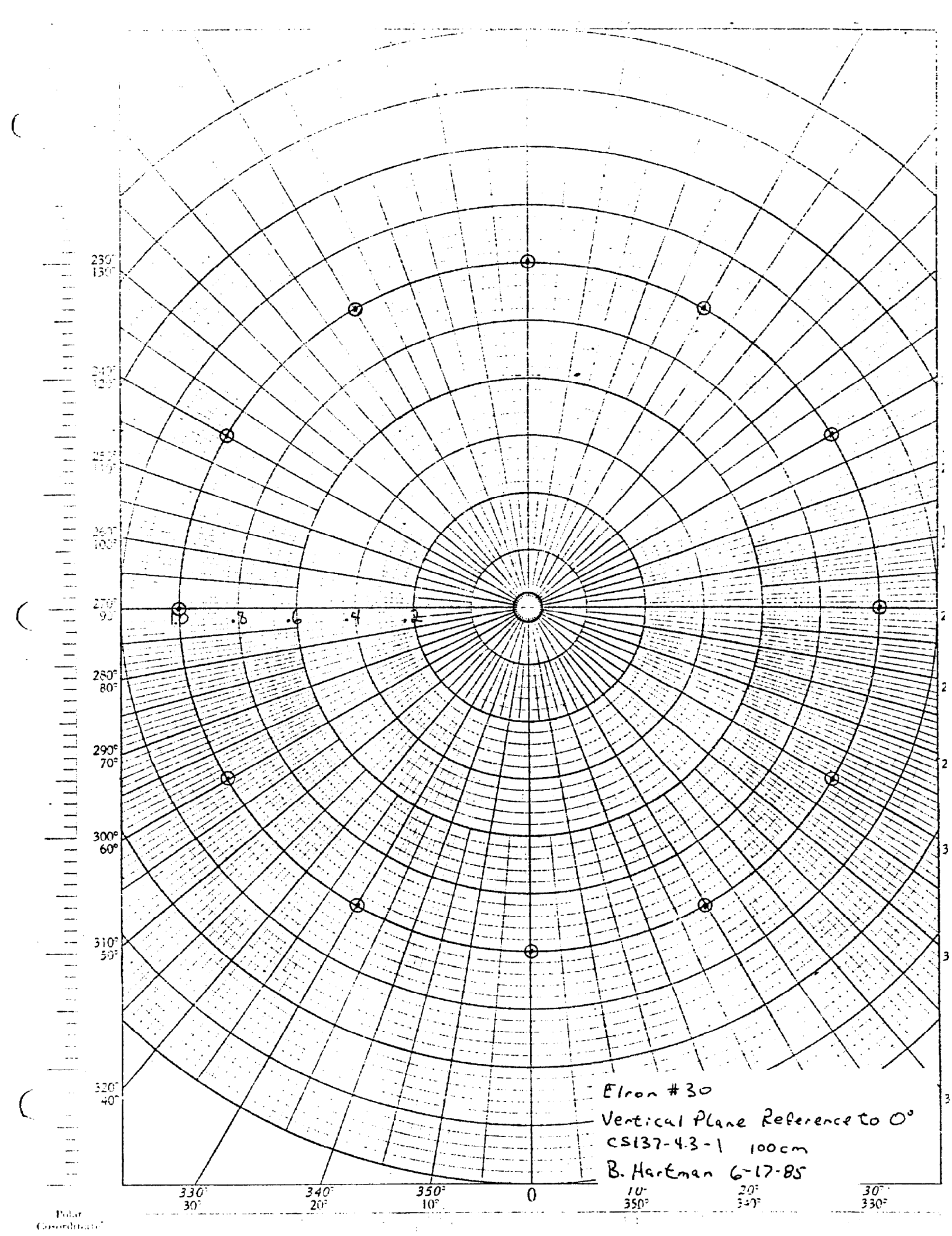
.2
330°
30°
340°
20°
350°
10°
0
10°
350°
20°
340°
30°
330°
Elron #30
Horizontal Plane Reference to 0°
CS 137-4.3-1 100 cm
B. Hartmen 6-17-85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260°
100°
270°
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290°
70°
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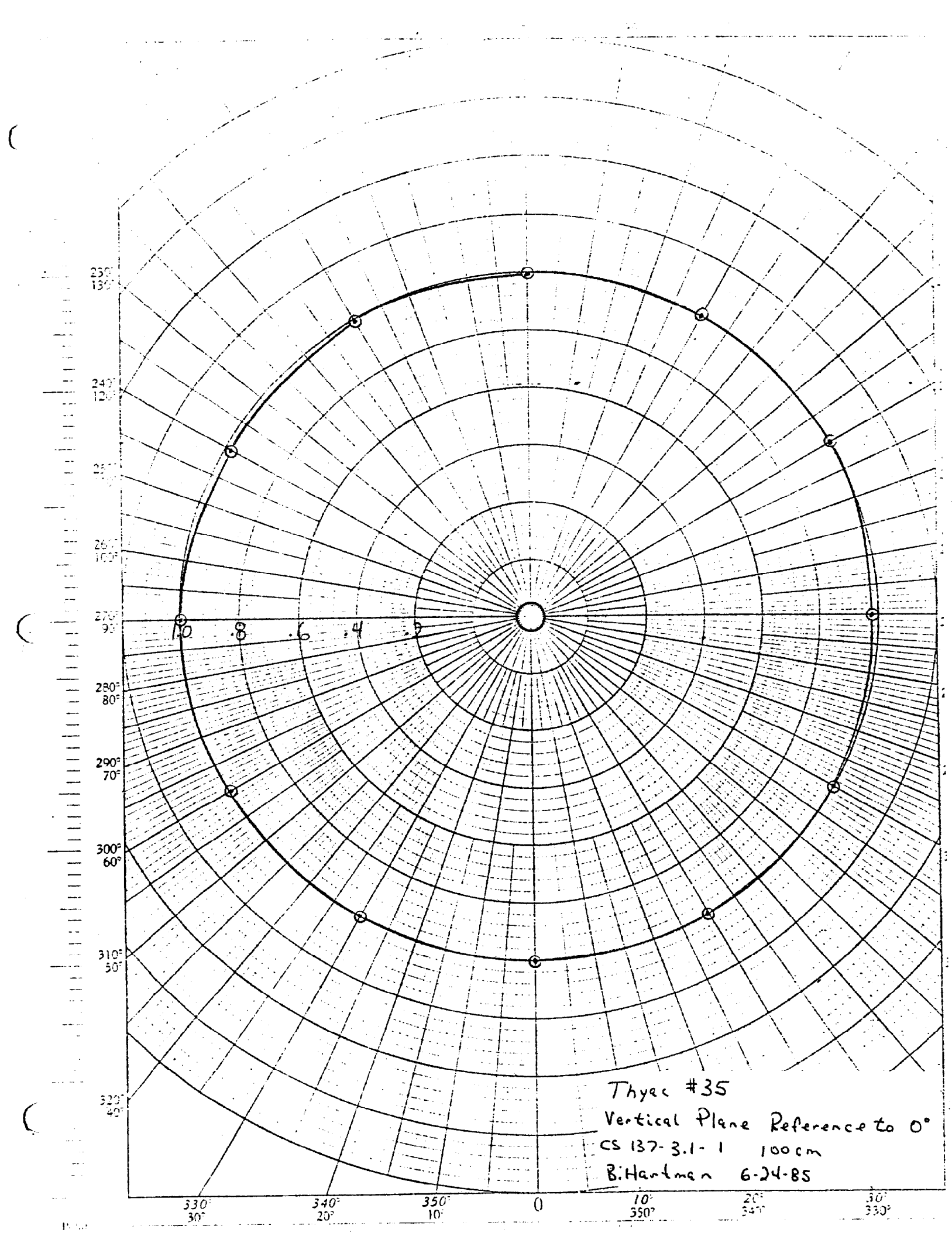
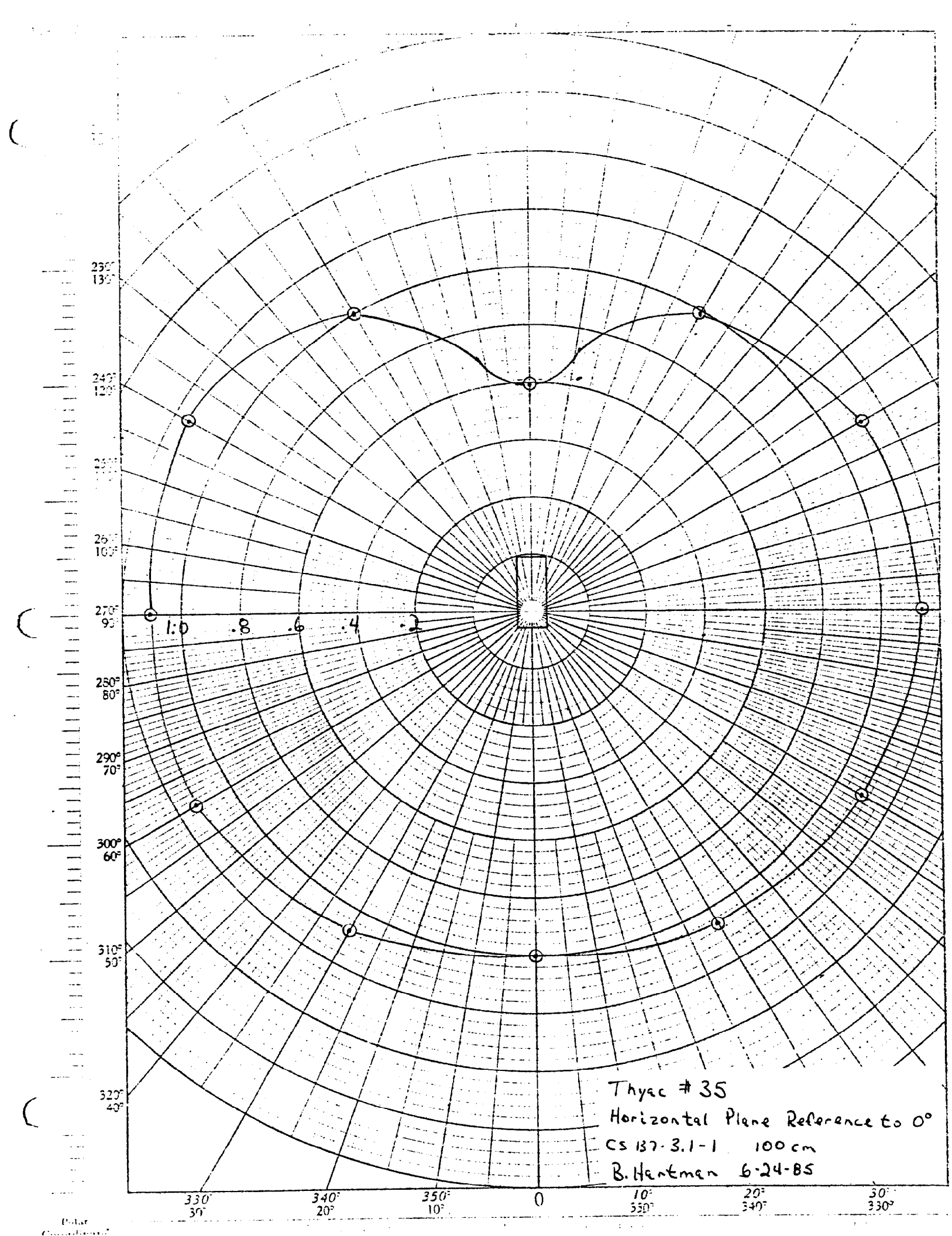
60°
310°
50°
320°
40°
1.0
.8
.6
.4
.2
330°
30°
340°
20°
350°
10°
0
10°
350°
20°
340°
30°
330°
Elron #30
Vertical Plane Reference to 0°
CS137-4.3-1 100cm
B. Hartman 6-17-85
Polar
Coordinates


1.0 .8 .6 .4 .2
Thyac #35
Vertical Plane Reference to 0°
CS 137-3.1-1 100cm
B. Hartman 6-24-85


1.0
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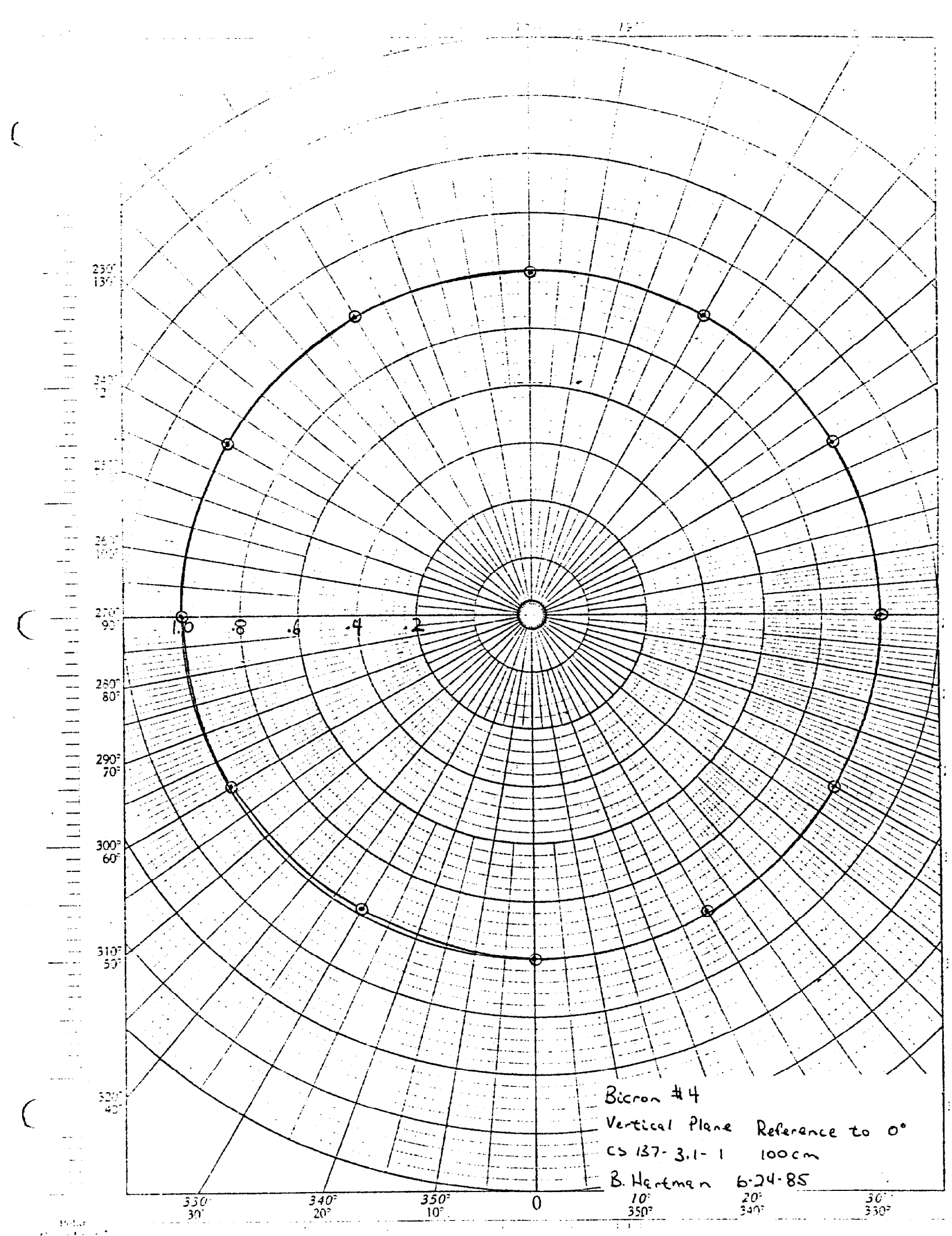
270°
90°
280°
80°
290°
70°
300°
60°
310°
50°
320°
40°
330°
30°
340°
20°
350°
10°
0
10°
350°
20°
340°
30°
330°
Thyac # 35
Horizontal Plane Reference to 0°
CS 137-3.1-1 100 cm
B. Hartman 6-24-85


1.0
.8
.6
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.2
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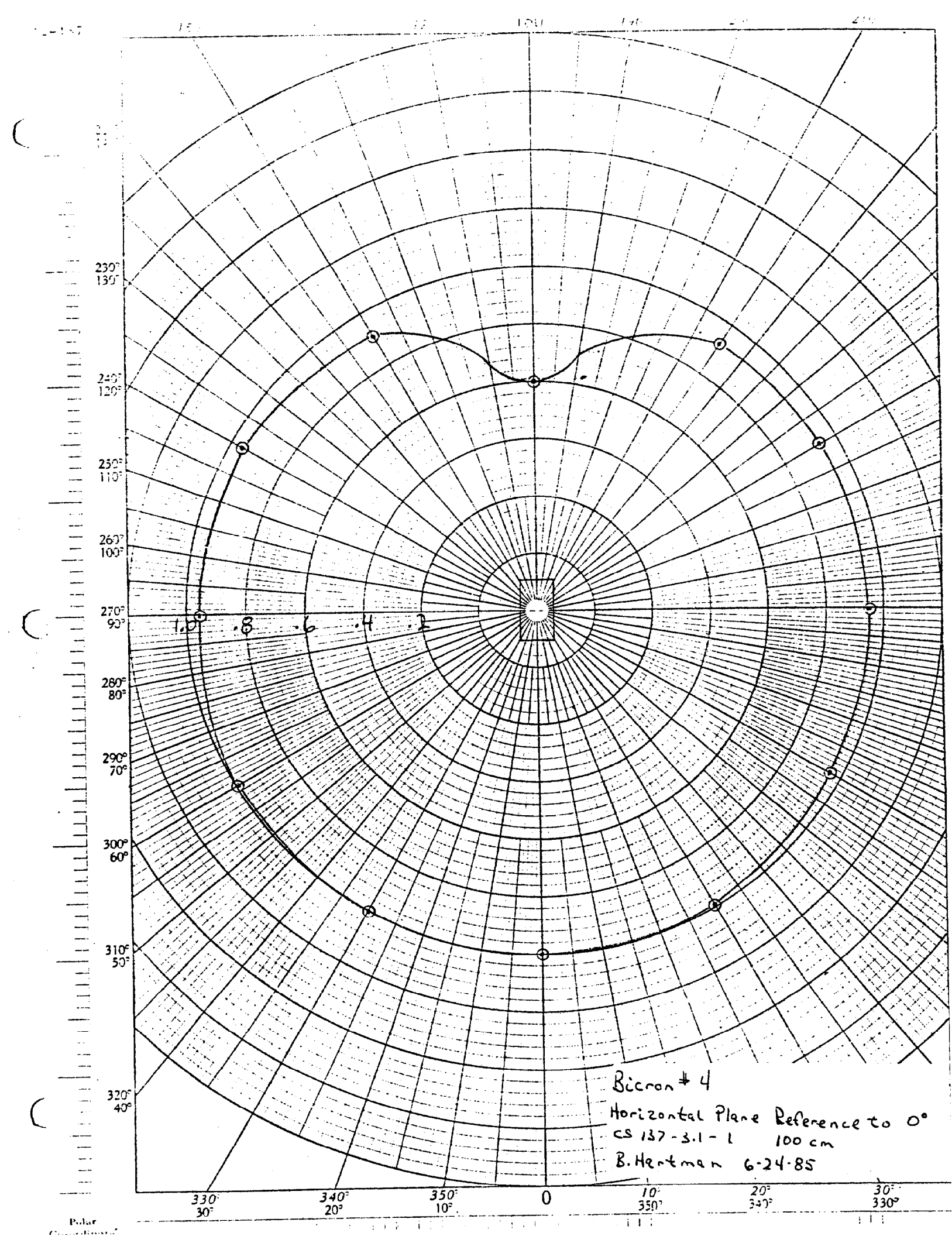
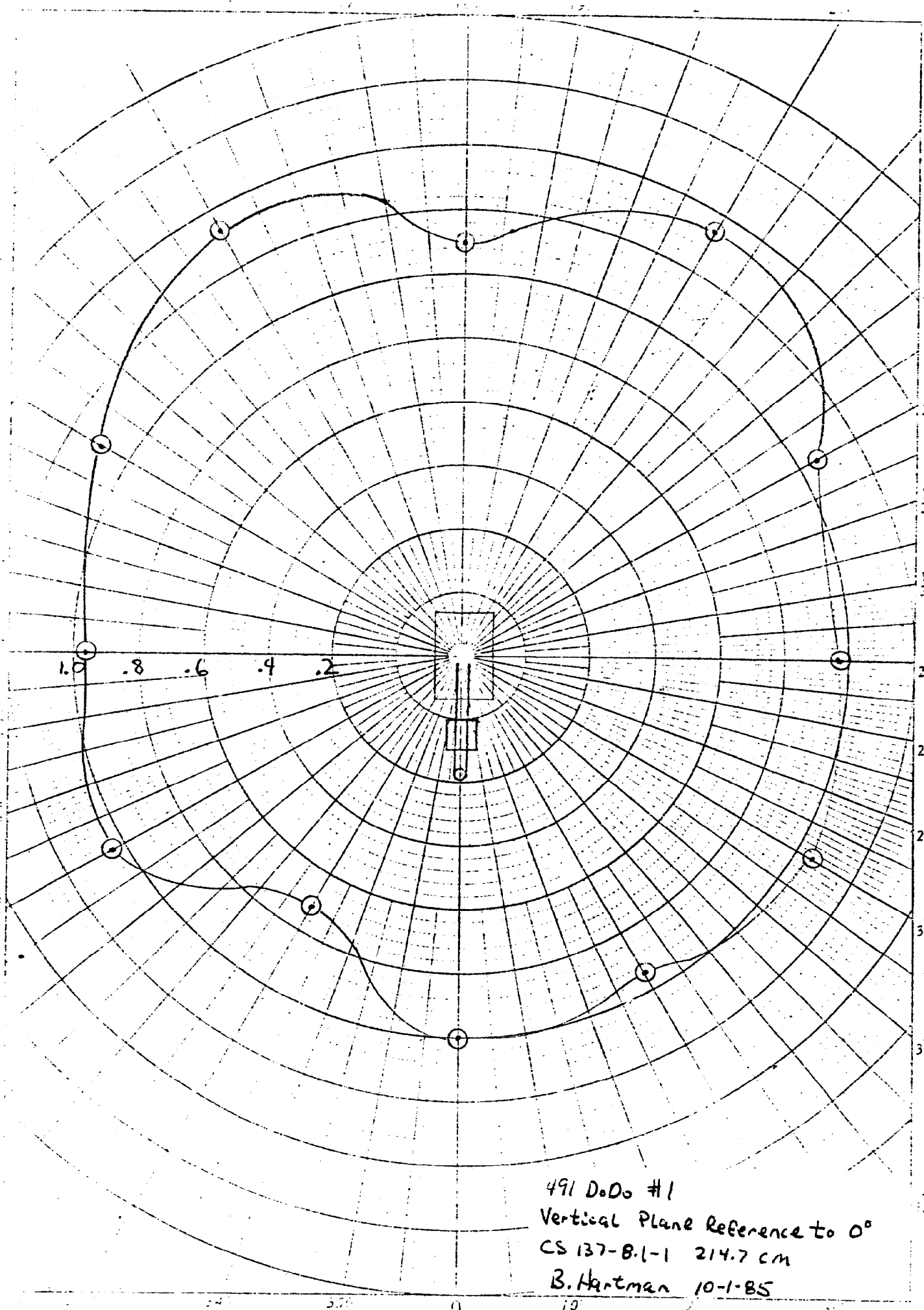
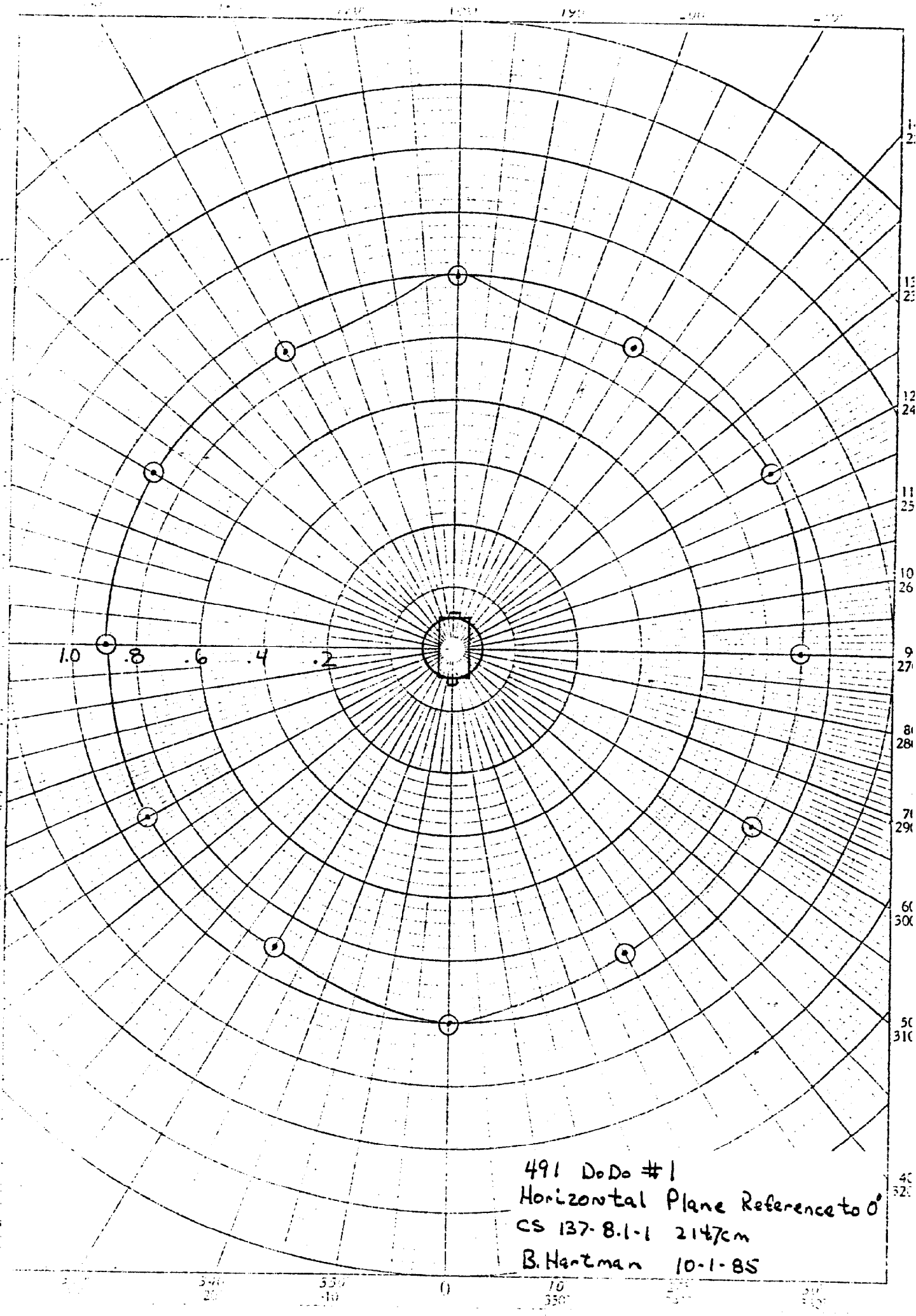
Bicron #4
Vertical Plane Reference to 0°
CS 137- 3.1- 1 100cm
B. Hartman 6-24-85


230° 130°
240° 120°
250° 110°
260° 100°
270° 90°
280° 80°
290° 70°
300° 60°
310° 50°
320° 40°
1.0 .8 .6 .4 .2
330° 30°
340° 20°
350° 10°
0
10° 350°
20° 340°
30° 330°
Bicron # 4
Horizontal Plane Reference to 0°
cs 137 - 3.1 - 1 100 cm
B. Hartman 6-24-85



491 DoDo #1
Vertical Plane Reference to 0°
CS 137-B.1-1 214.7 cm
B. Hartman 10-1-85


1.0
.8
.6
.4
.2
0
491 DoDo #1
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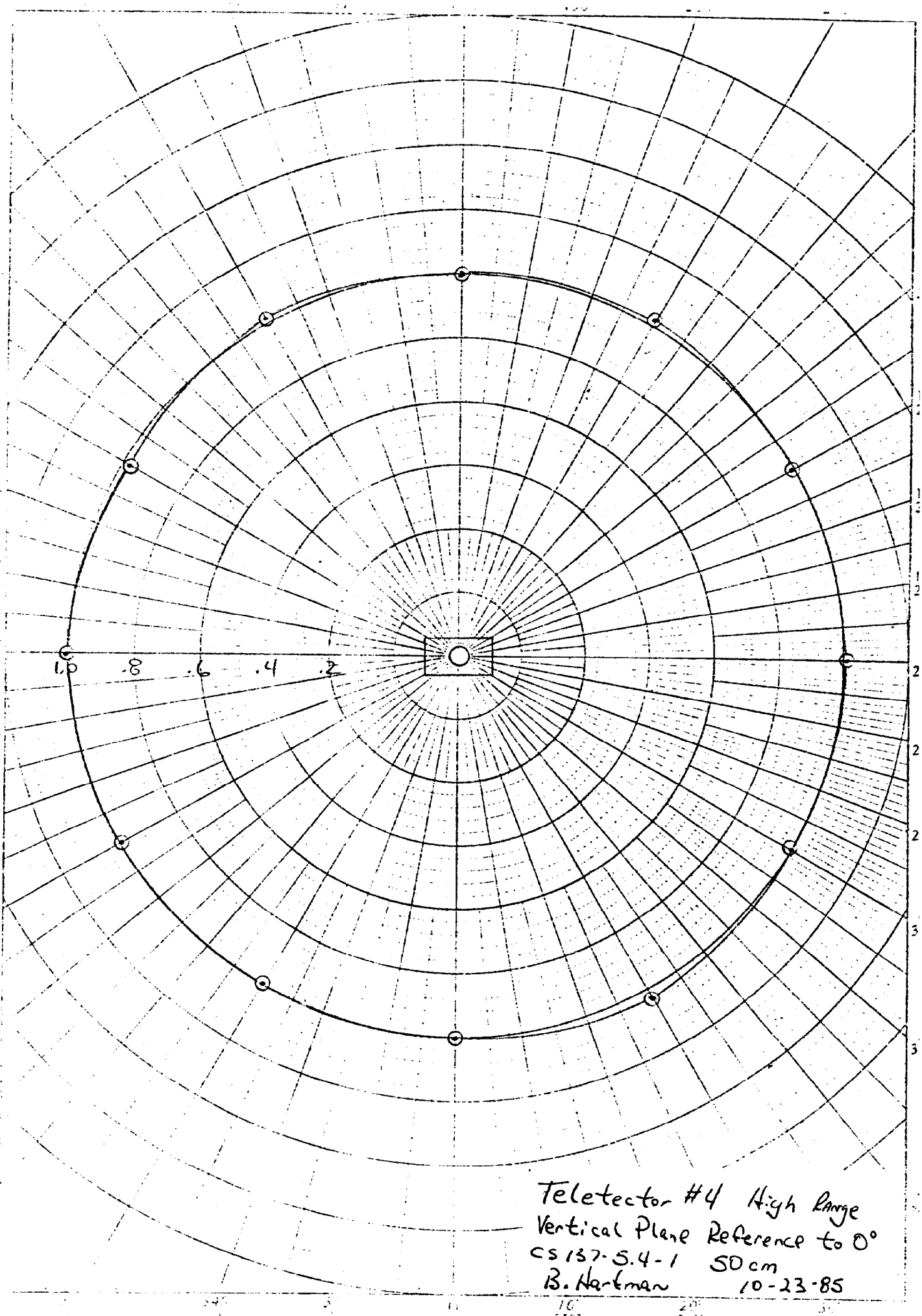
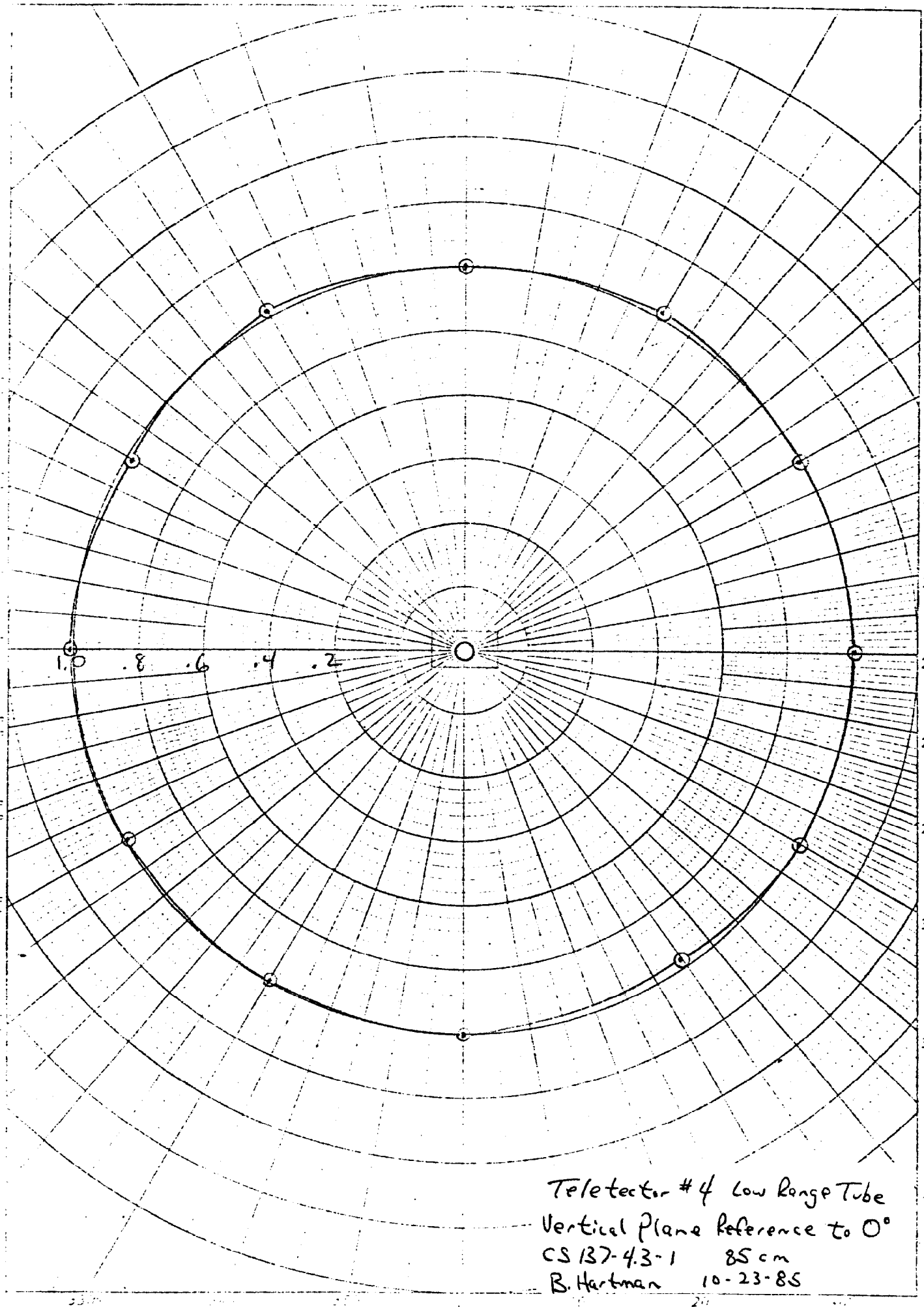
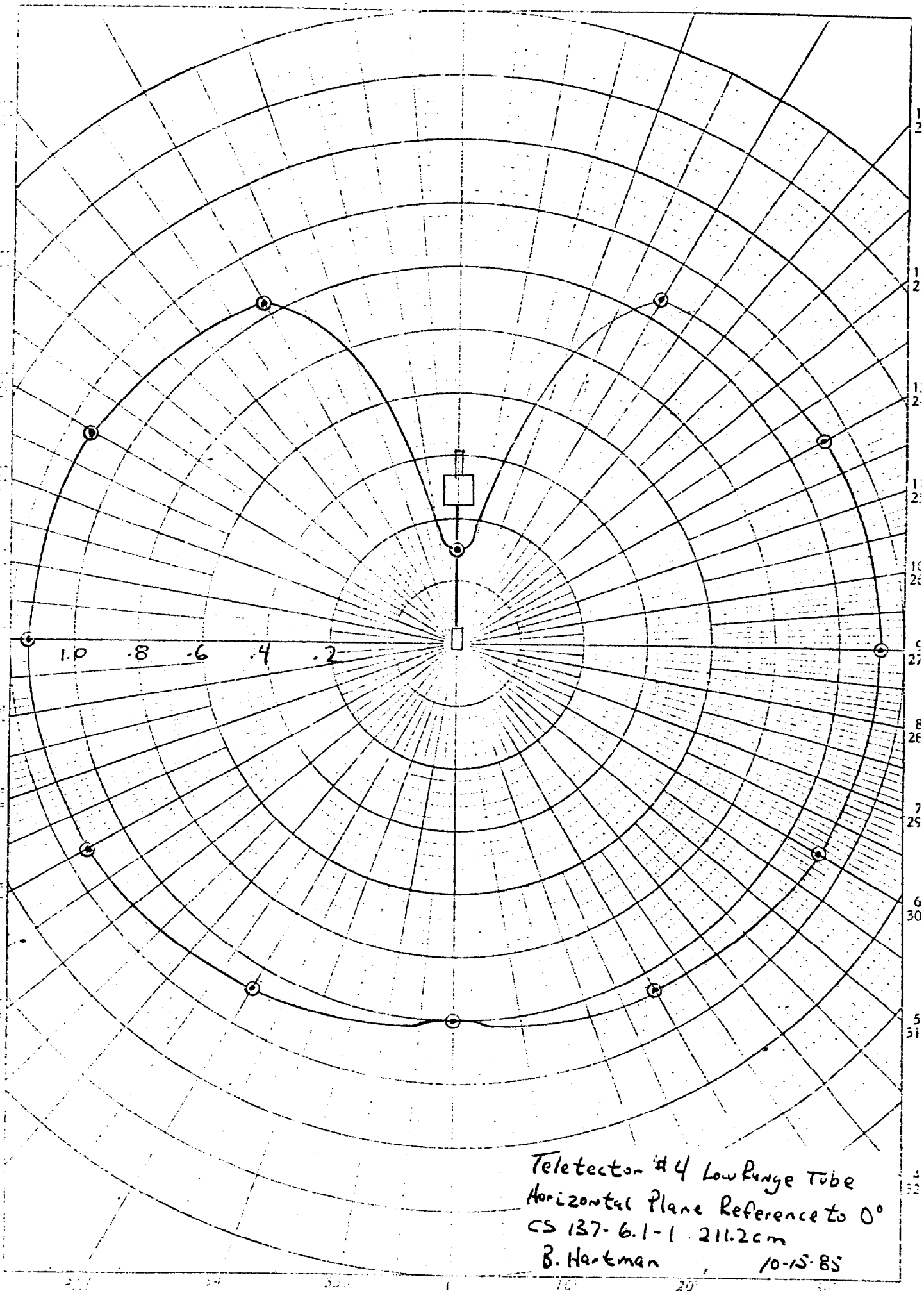
CS 137-8.1-1 214/cm
B. Hartman 10-1-85



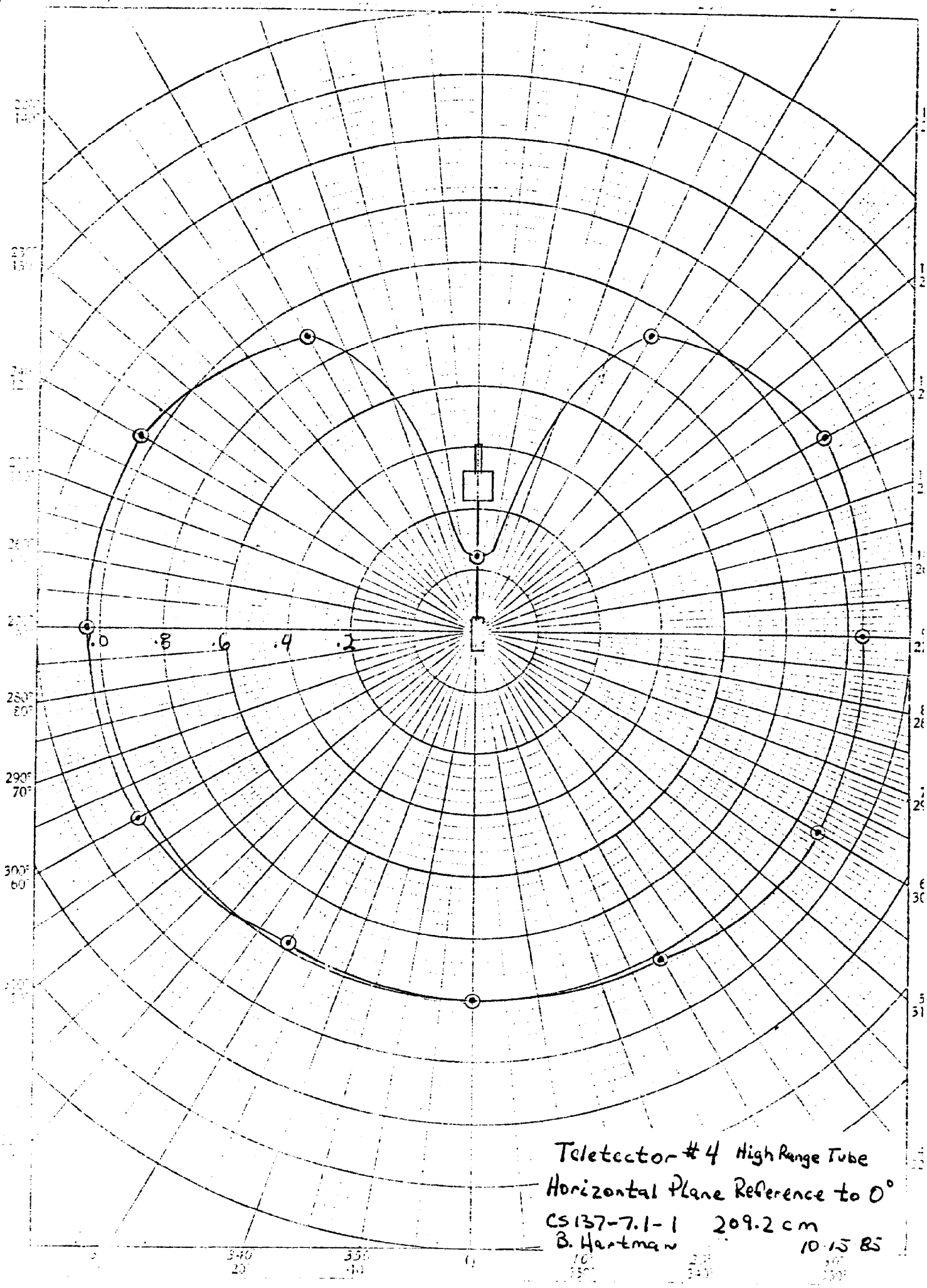
Teletector #4 High Range
Vertical Plane Reference to 0°
CS137-5.4-1 50cm
B. Hartman 10-23-85



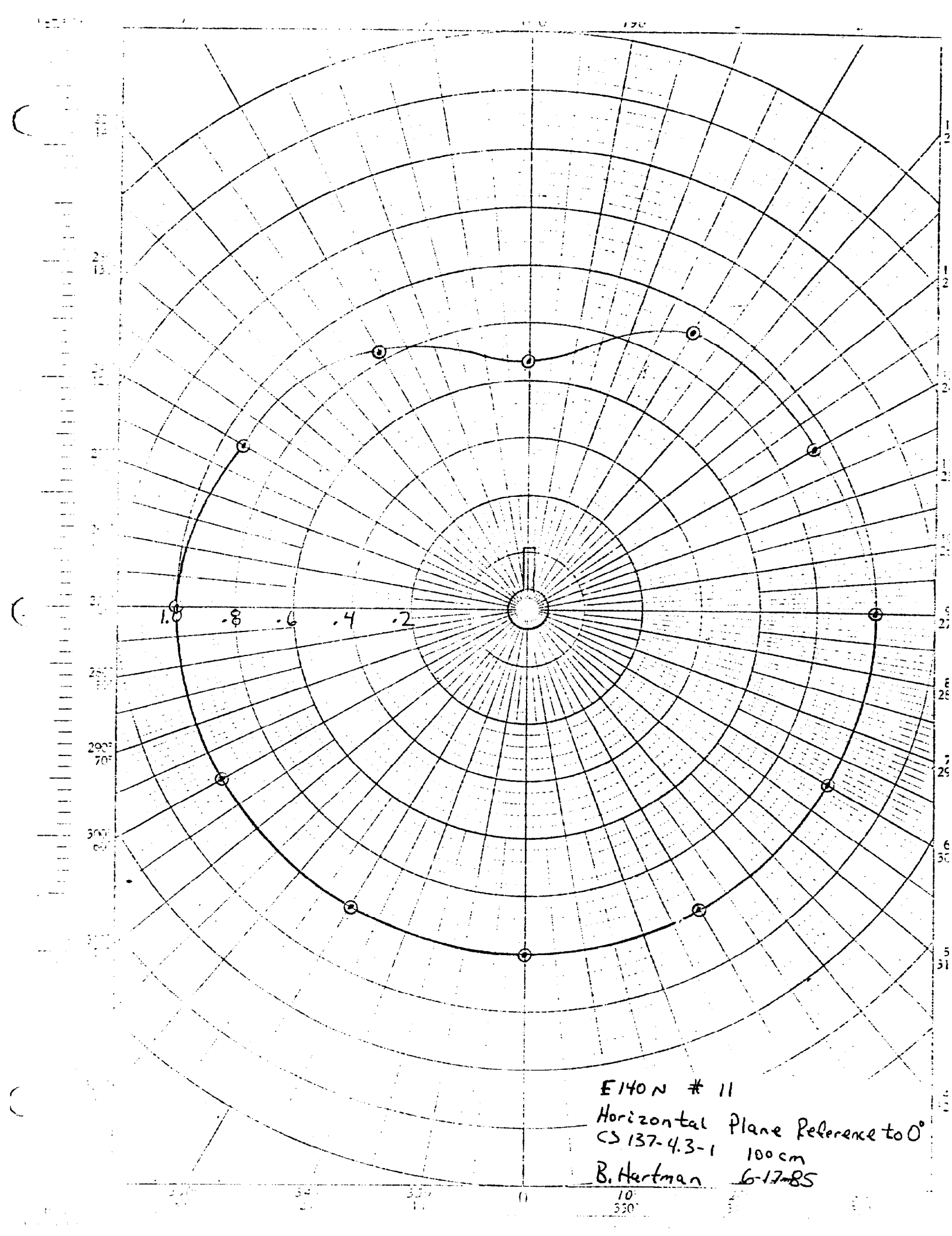
Teletector #4 Low Range Tube
Vertical Plane Reference to 0°
CS 137-4.3-1 85 cm
B. Hartman 10-23-85

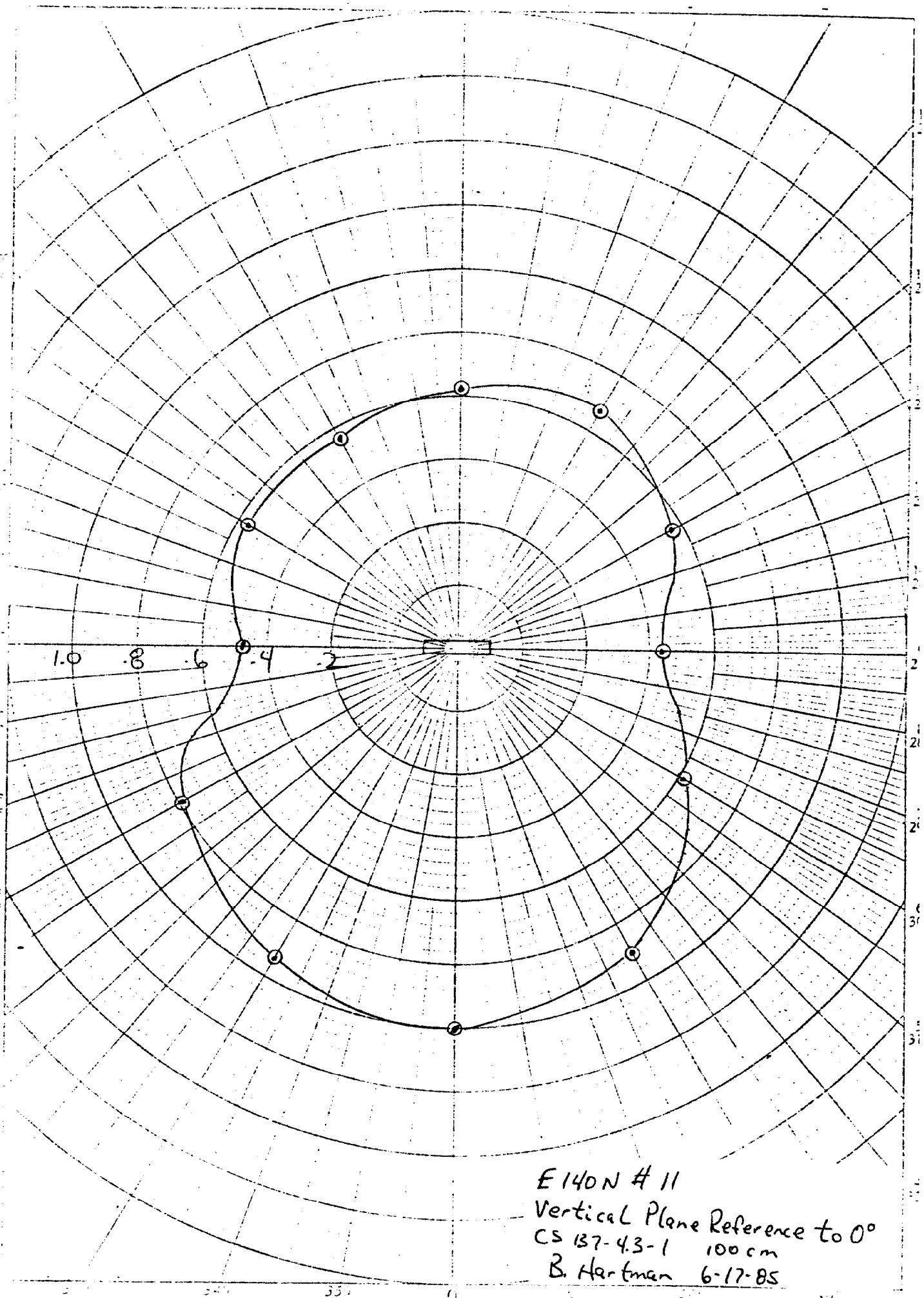


Teletector #4 Low Range Tube
Horizontal Plane Reference to 0°
CS 137-6.1-1 211.2cm
B. Hartman 10-15-85

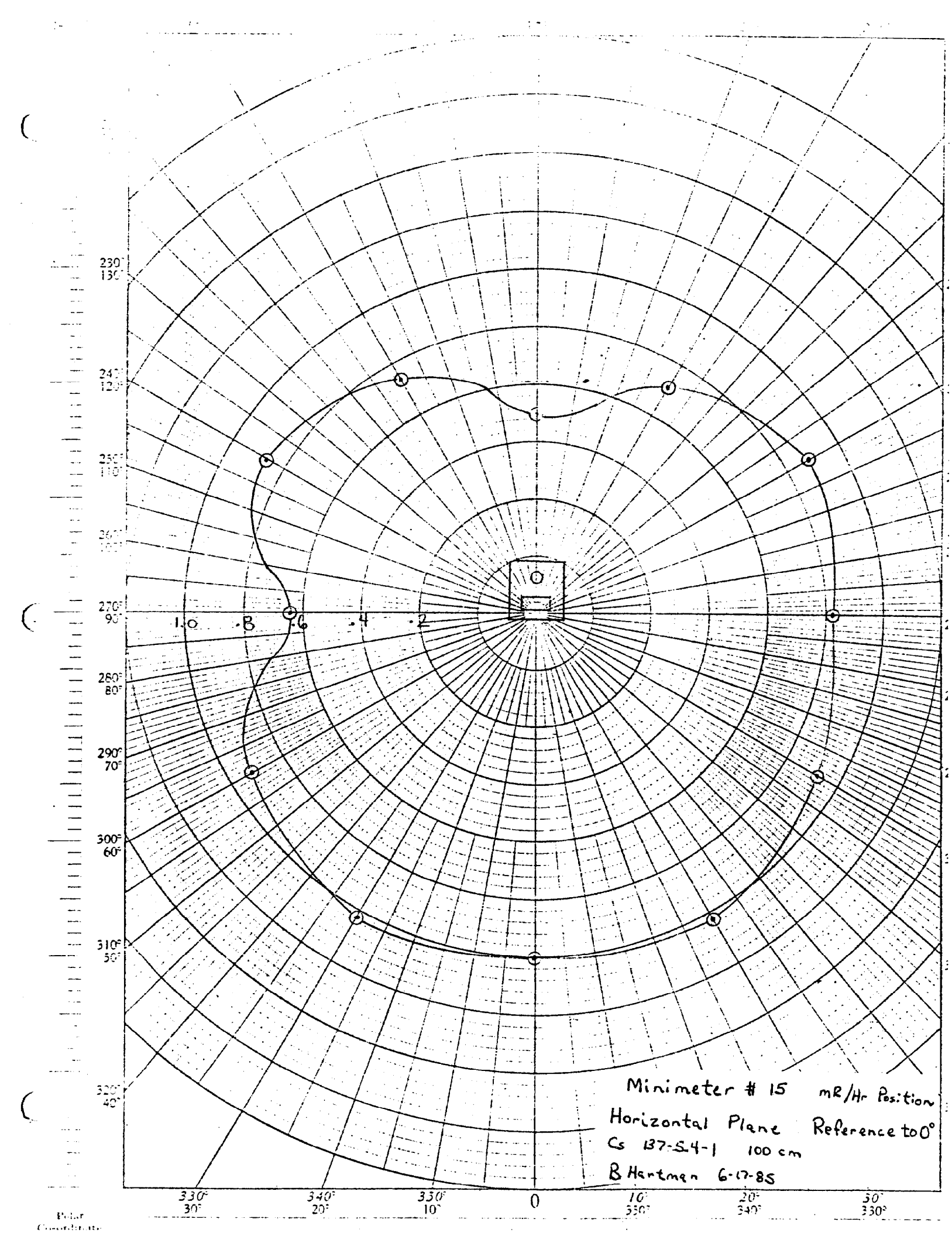


Teletector #4 High Range Tube
Horizontal Plane Reference to 0°
CS137-7.1-1 209.2 cm
B. Hartman 10.15.85


1.8
.8
.6
.4
.2
E140N # 11
Horizontal Plane Reference to 0°
CS 137-4.3-1
100 cm
B. Hartman
6-17-85



E140N #11
Vertical Plane Reference to 0°
CS 137-4.3-1 100 cm
B. Hartman 6-17-85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240° 120°
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260° 100°
270° 90°
280° 80°
290° 70°
300° 60°
310° 50°
320° 40°
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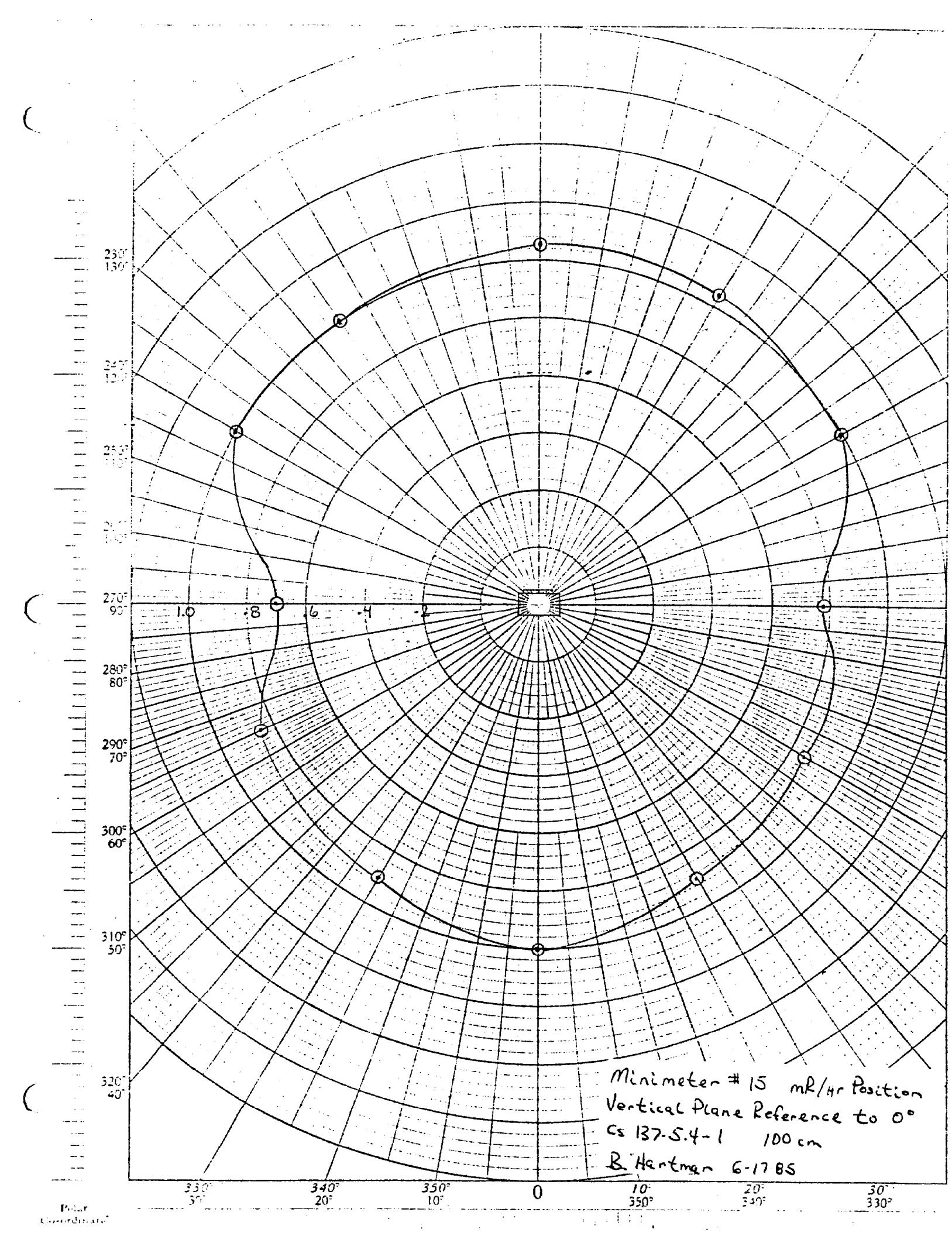
330° 30°
340° 20°
350° 10°
0
10° 350°
20° 340°
30° 330°
Minimeter # 15 mR/Hr Position
Horizontal Plane Reference to 0°
Cs 137-S-4-1 100 cm
B Hartman 6-17-85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300° 60°
310° 50°
320° 40°
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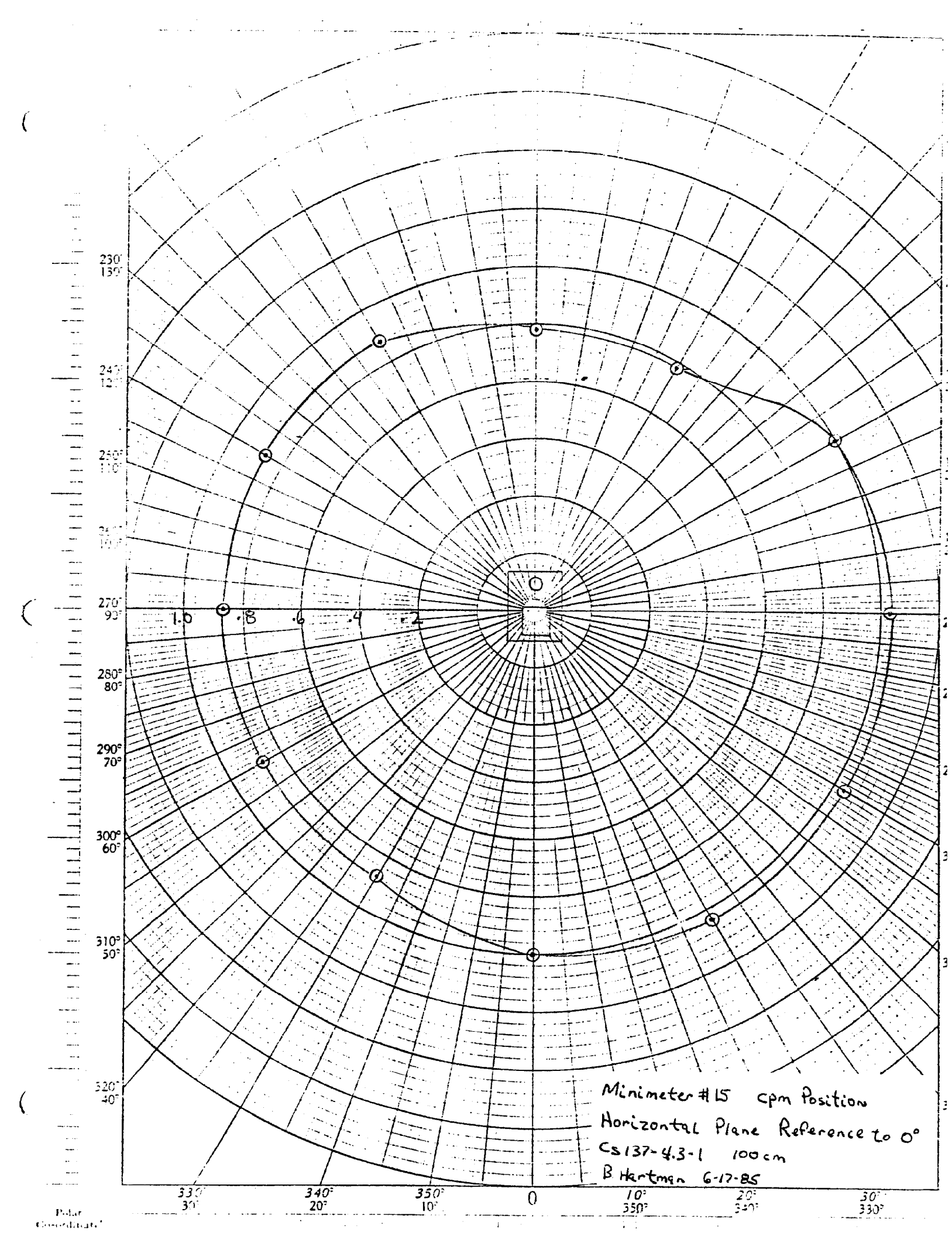
350° 10°
340° 20°
350° 10°
0
10° 350°
20° 340°
30° 330°
Minimeter # 15 mR/Hr Position
Vertical Plane Reference to 0°
Cs 137-5.4-1 100 cm
B. Hartman 6-17 85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330°
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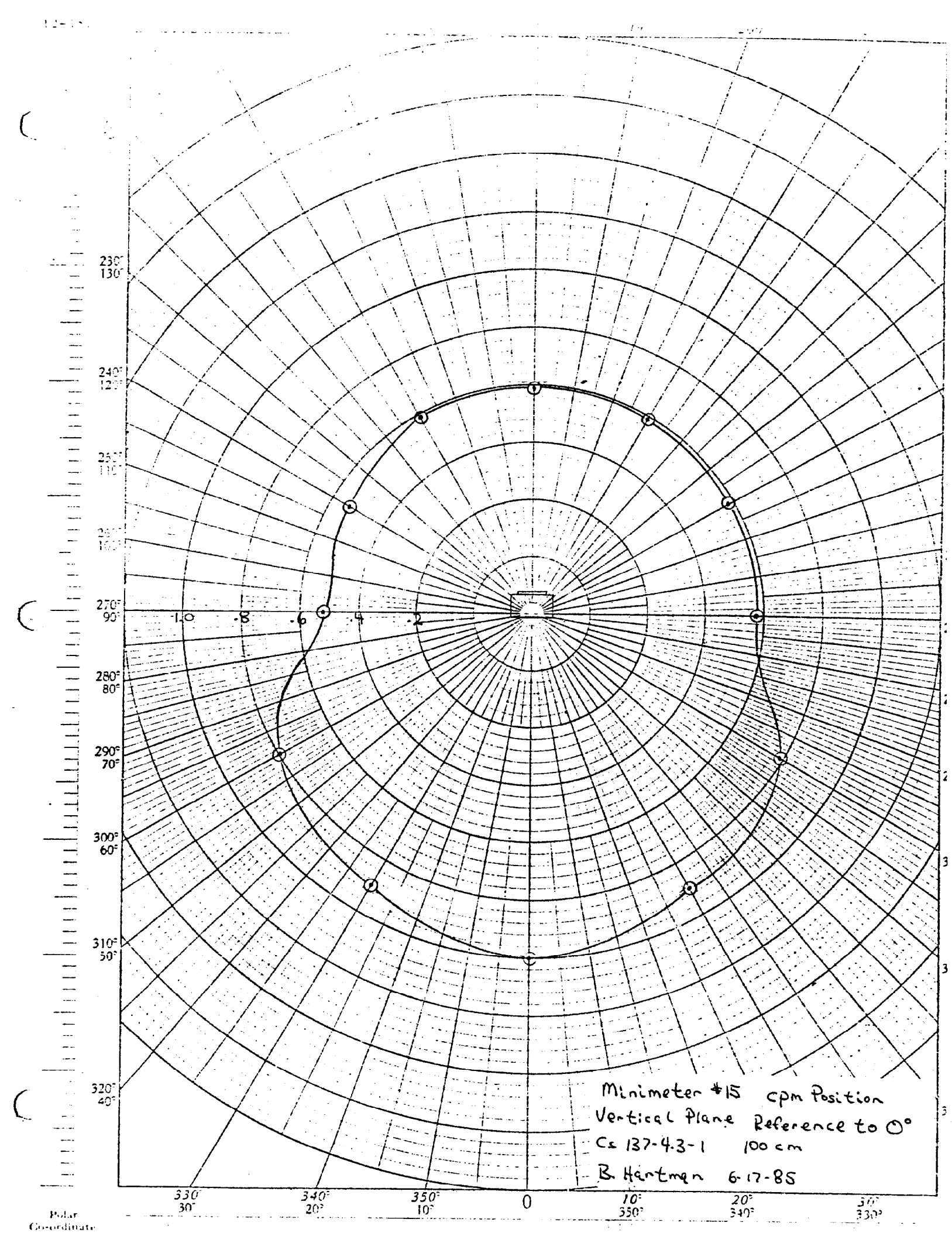
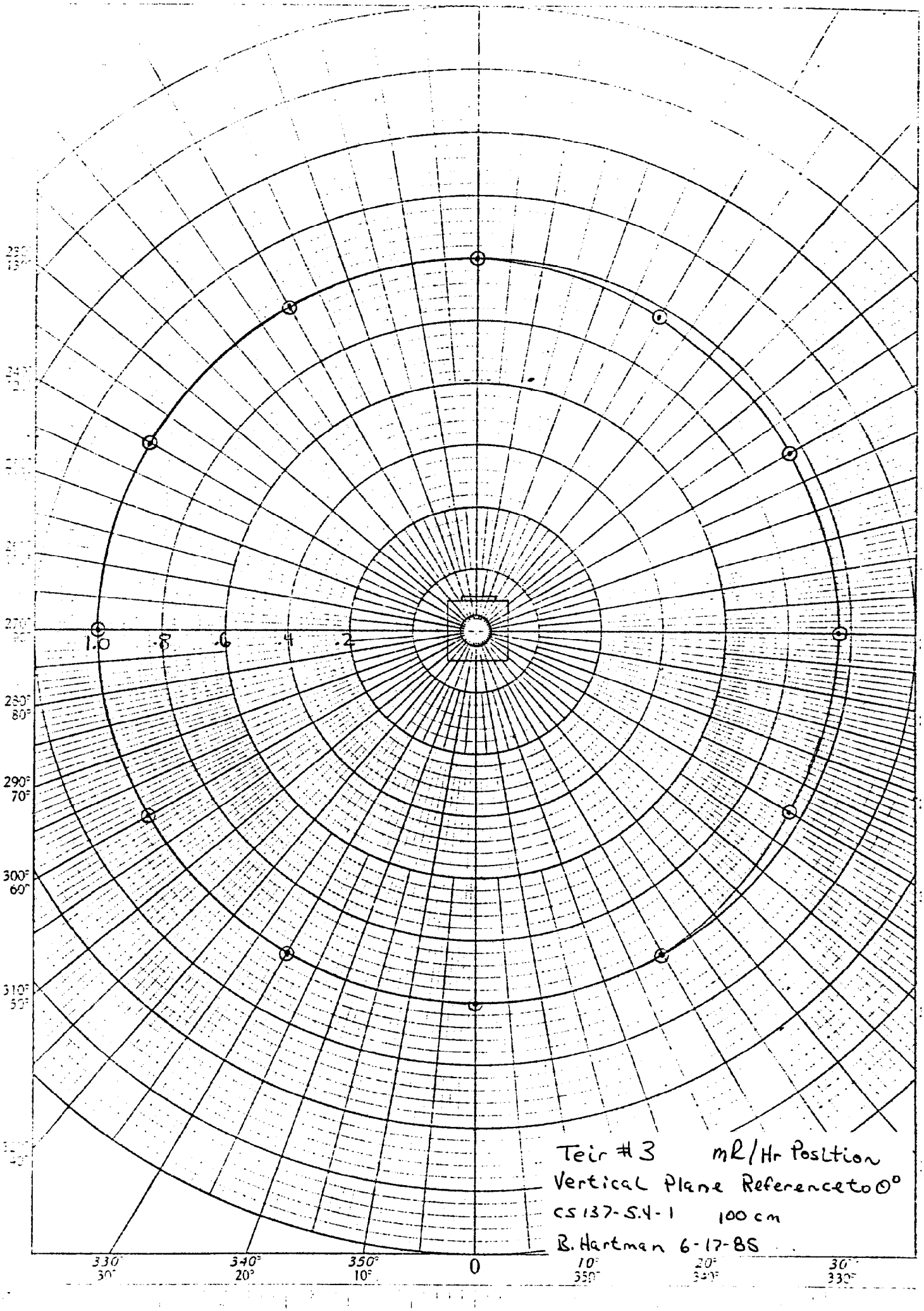
340°
20°
350°
10°
0
10°
350°
20°
340°
30°
330°
Minimeter #15 cpm Position
Horizontal Plane Reference to 0°
Cs137-4.3-1 100cm
B Hartman 6-17-85



Polar Coordinate


1.0
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.6
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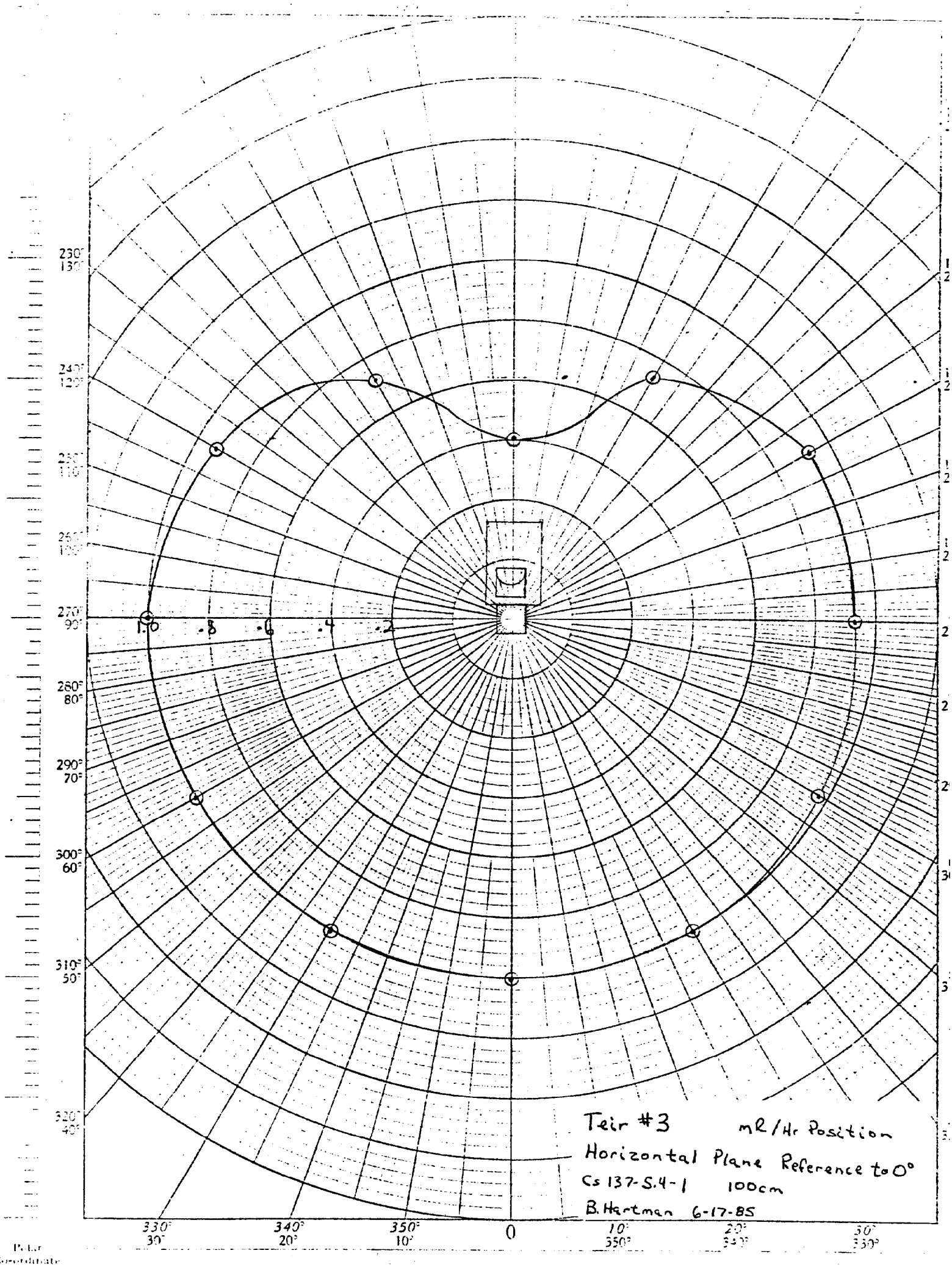
.2
280° 80°
290° 70°
300° 60°
310° 50°
330° 30°
340° 20°
350° 10°
0
10° 350°
20° 340°
30° 330°
Teir #3 mR/Hr Position
Vertical Plane Reference to 0°
CS 137-S.4-1 100 cm
B. Hartman 6-17-85



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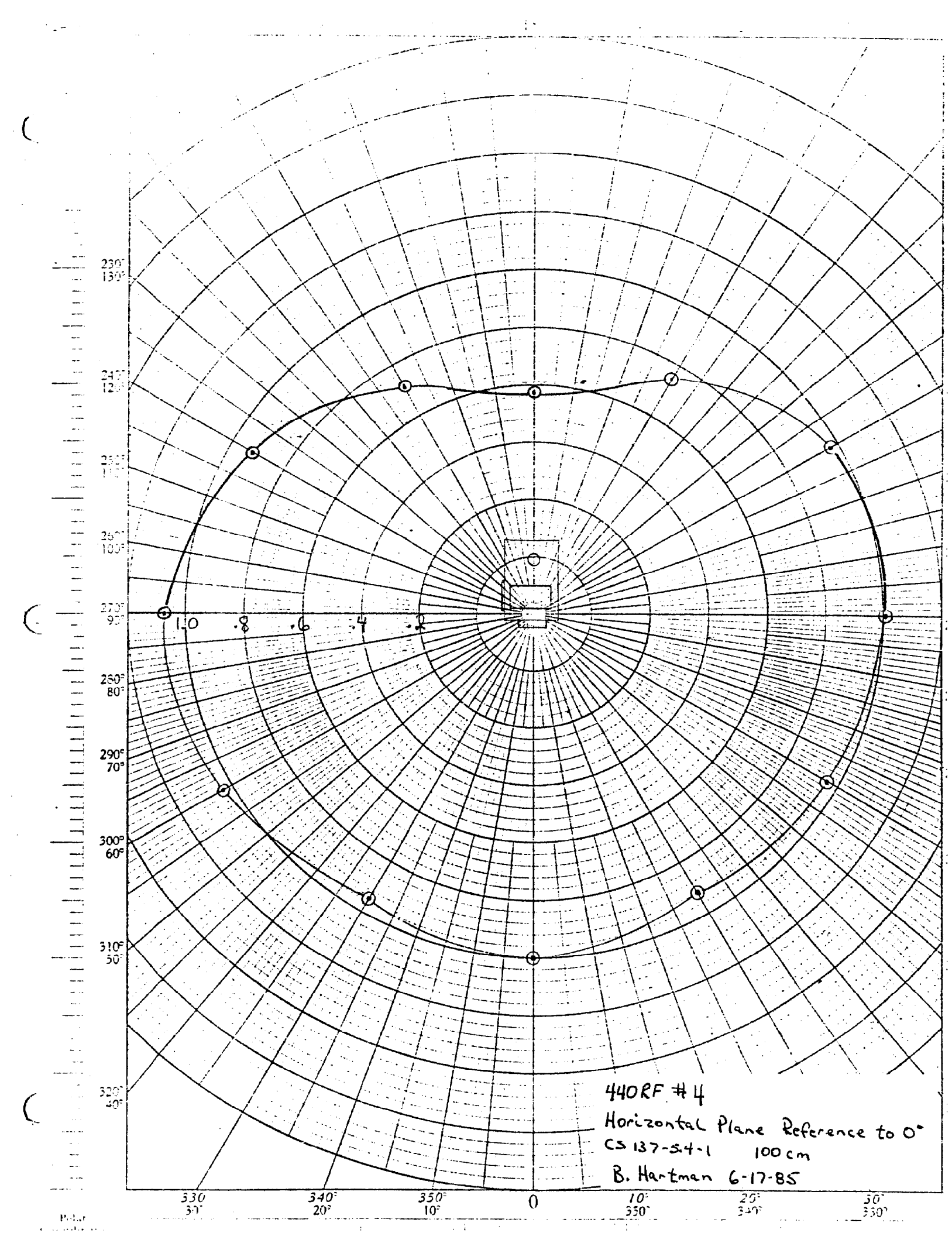
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270° 90°
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290° 70°
300° 60°
310° 50°
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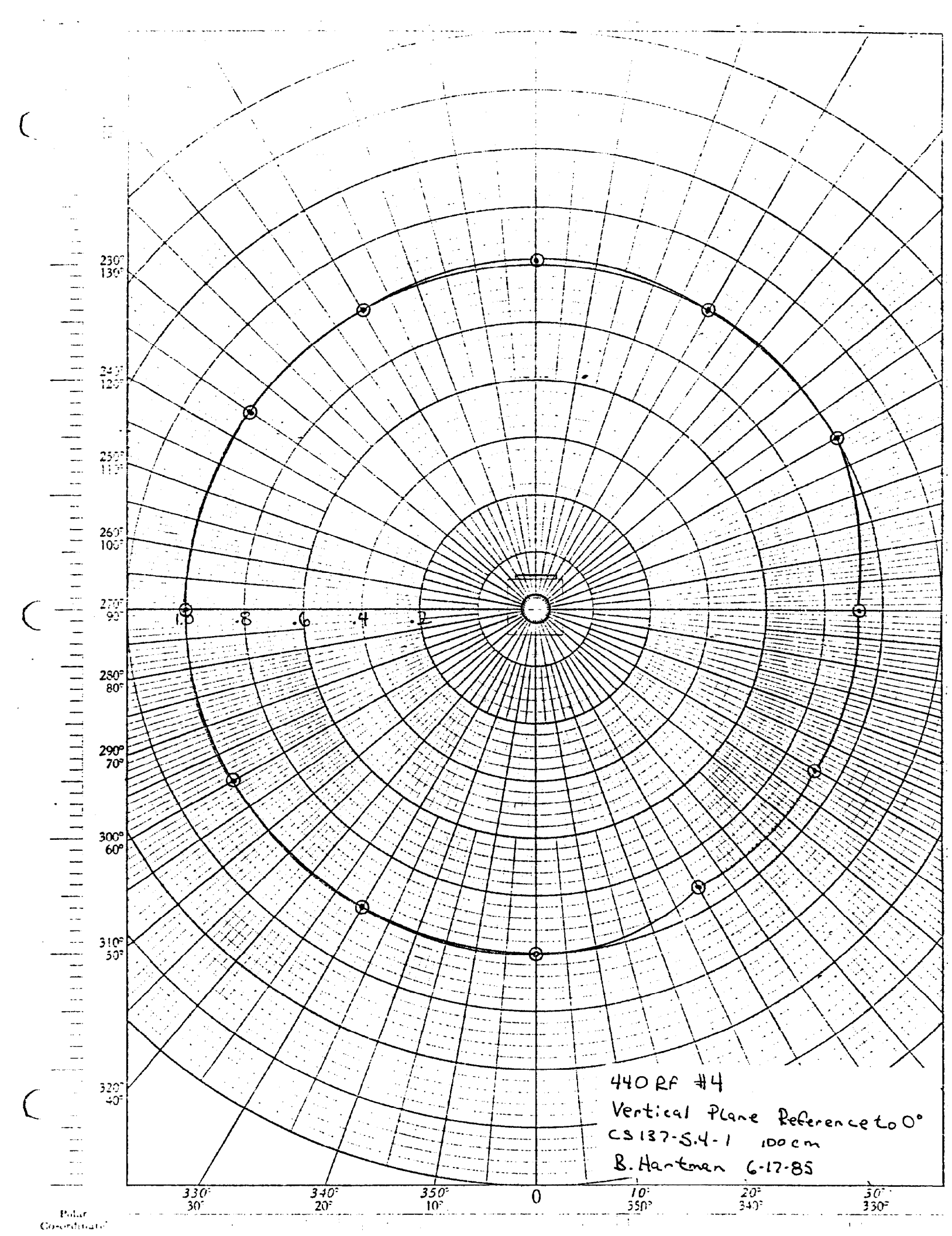
330° 30°
340° 20°
350° 10°
0
10° 350°
20° 340°
30° 330°
440RF #4
Horizontal Plane Reference to 0°
CS 137-5.4-1 100 cm
B. Hartman 6-17-85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250° 110°
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270° 90°
280° 80°
290° 70°
300° 60°
310° 50°
320° 40°
1.8
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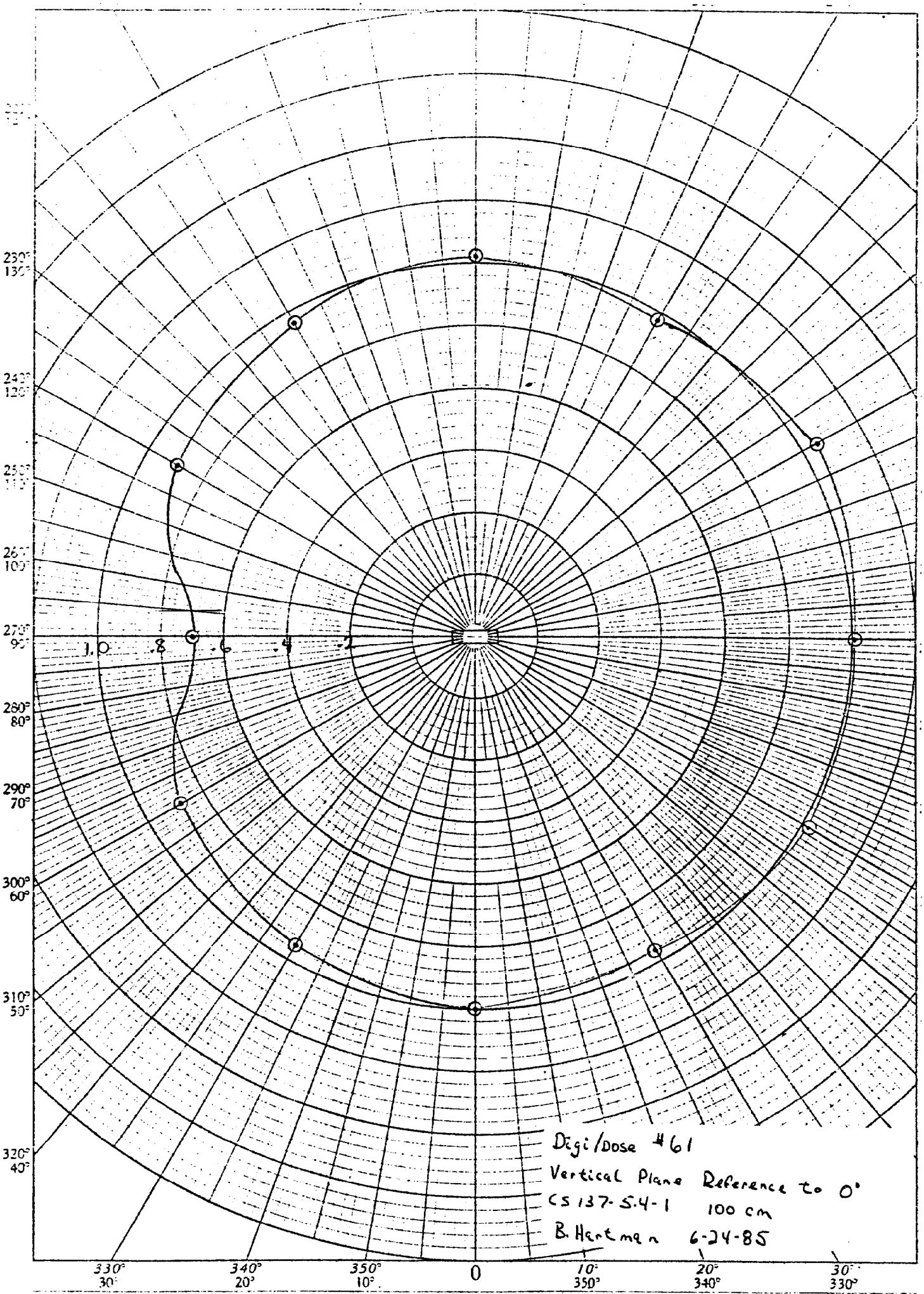
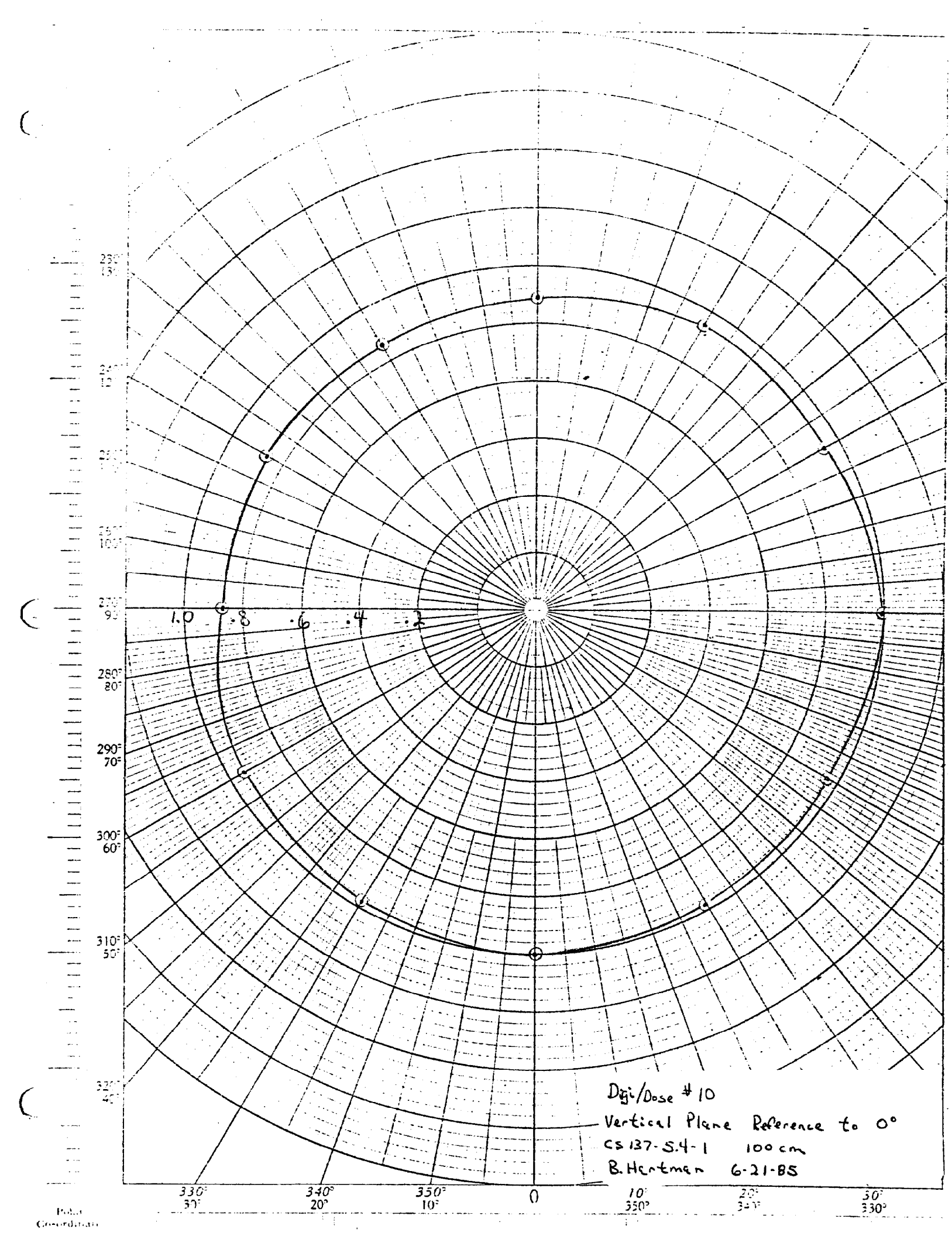
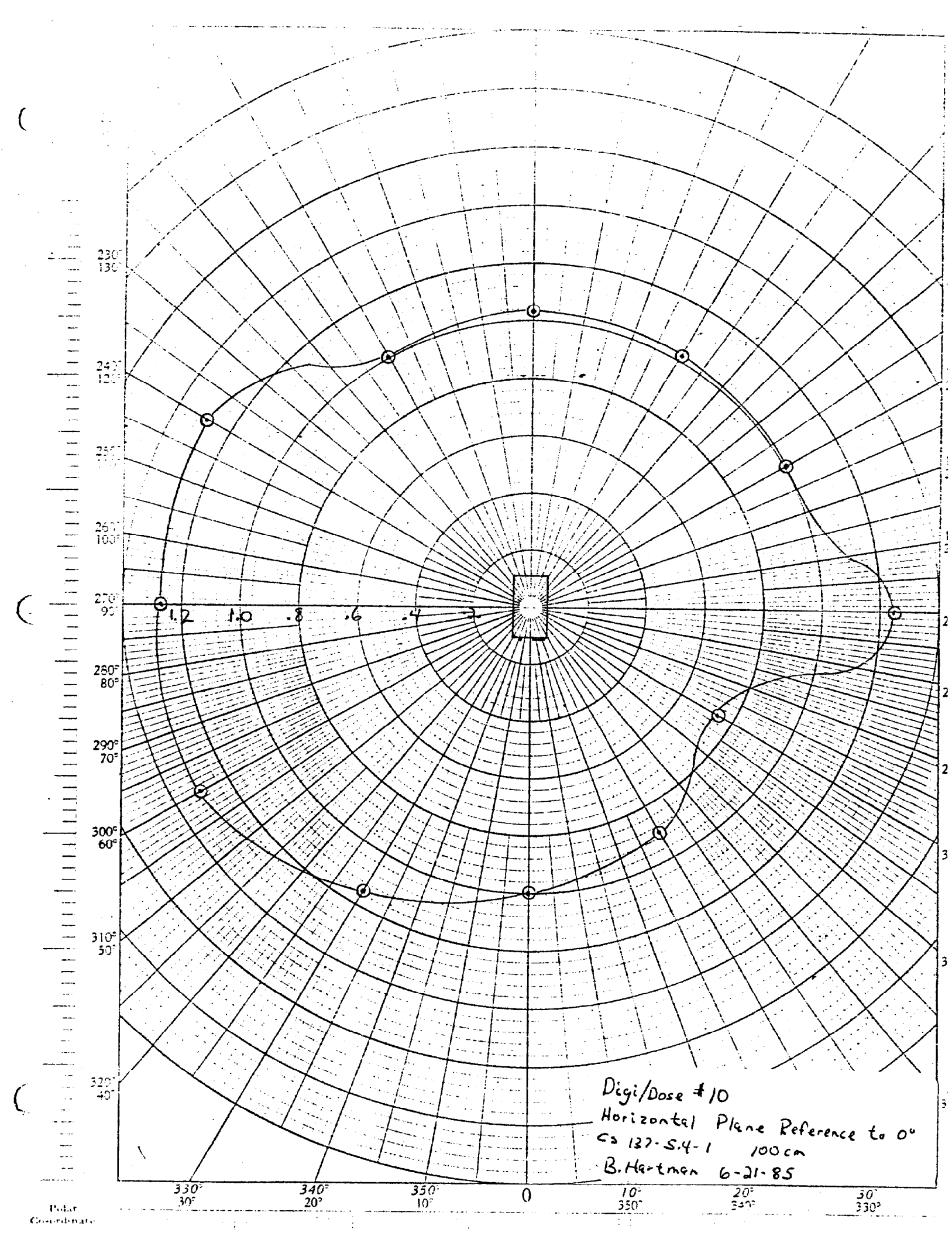
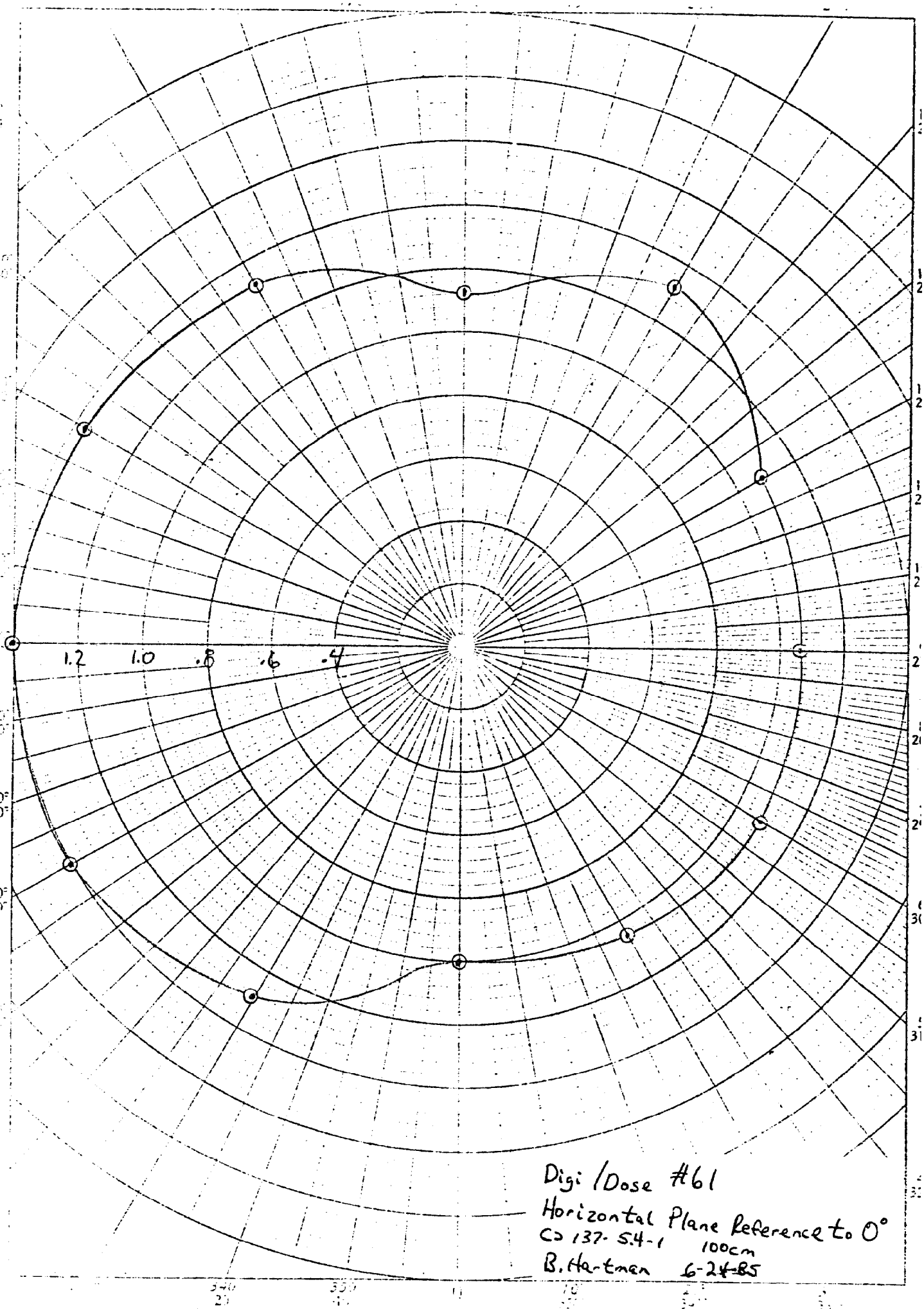
.2
330° 30°
340° 20°
350° 10°
0
10° 350°
20° 340°
30° 330°
440 RF #4
Vertical Plane Reference to 0°
CS 137-5.4-1 100 cm
B. Hartman 6-17-85
Polar Coordinate

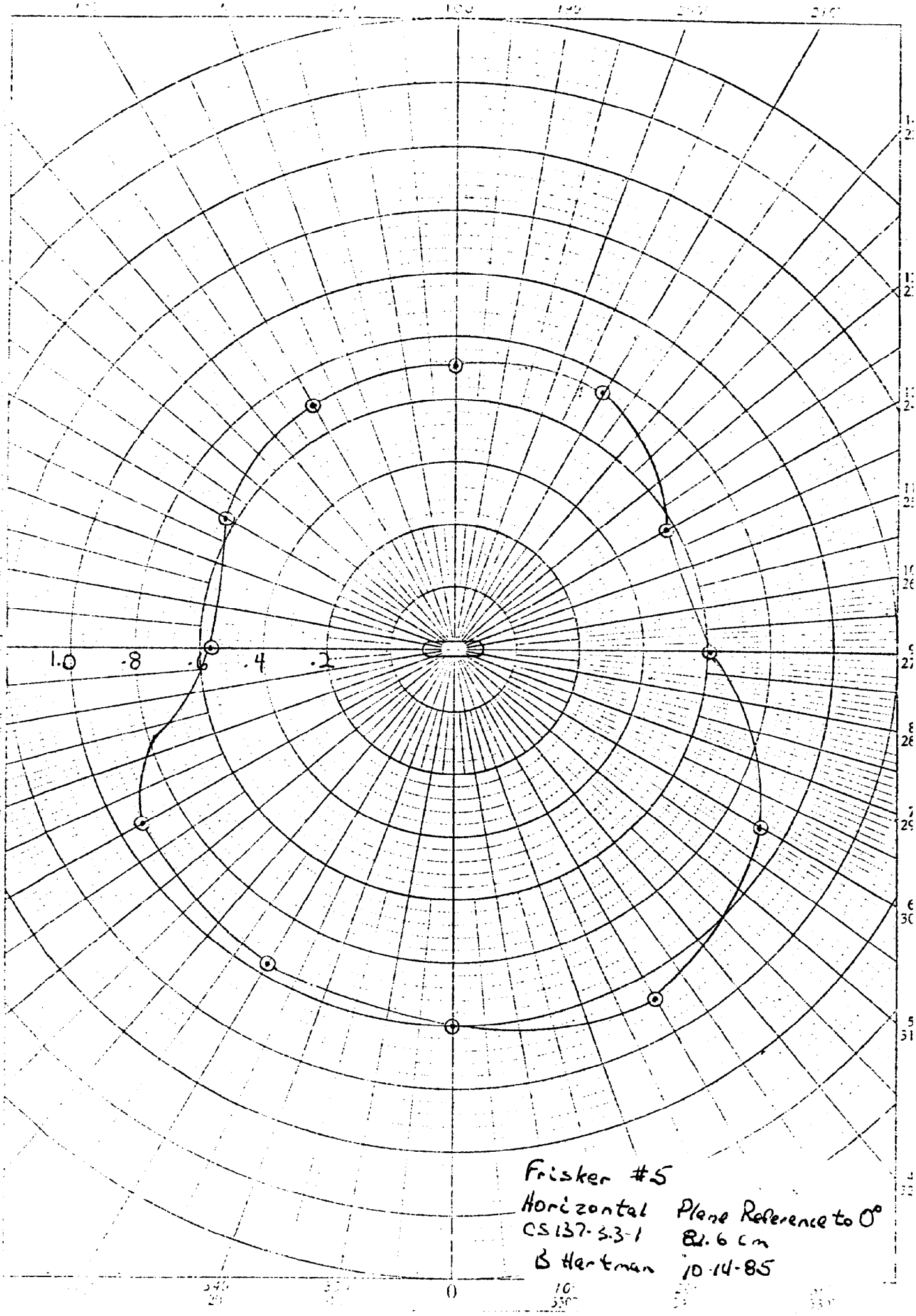


Polar Co-ordinate

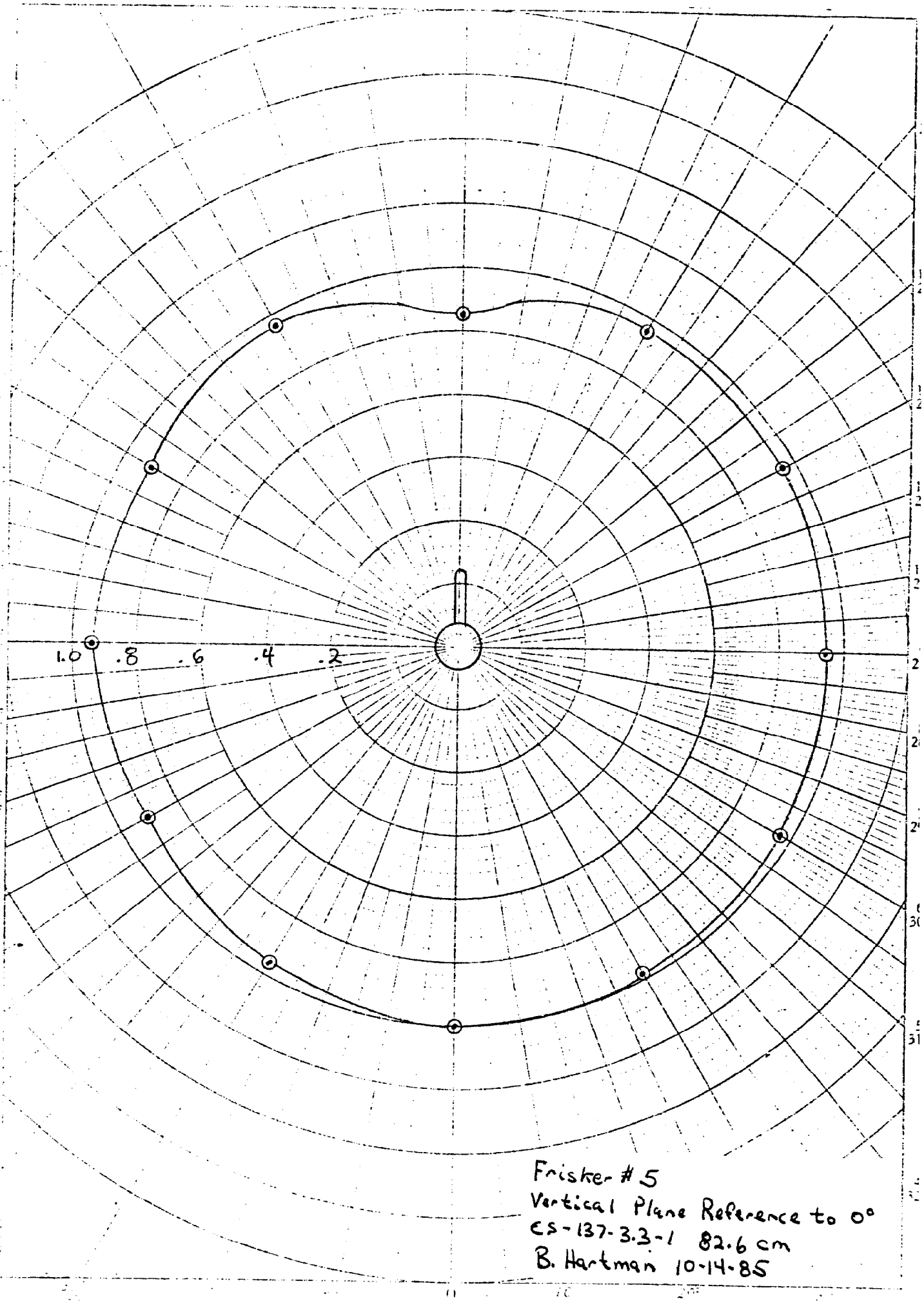

1.0
.8
.6
.4
.2
0
Digi/Dose #10
Vertical Plane Reference to 0°
Cs 137-5.4-1 100 cm
B. Hertman 6-21-85


230° 130°
240° 120°
250° 110°
260° 100°
270° 90°
280° 80°
290° 70°
300° 60°
310° 50°
320° 40°
1.2
1.0
.8
.6
.4
.2
330° 30°
340° 20°
350° 10°
0
10° 350°
20° 340°
30° 330°
Digi/Dose #10
Horizontal Plane Reference to 0°
Cs 137-5.4-1 100 cm
B. Hartman 6-21-85
Polar Coordinate

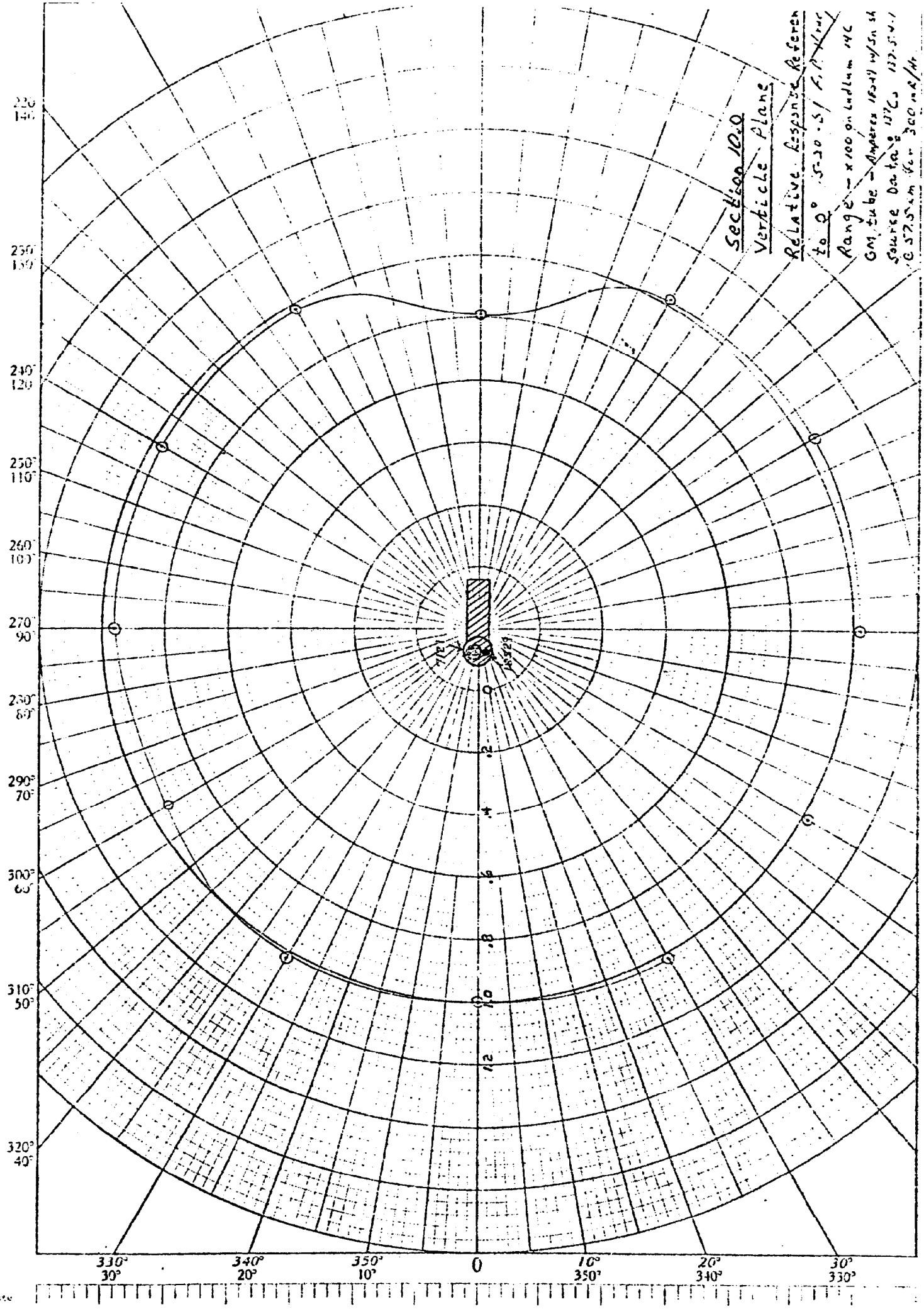

1.2
1.0
.8
.6
.4
Digi/Dose #61
Horizontal Plane Reference to 0°
C> 137-5.4-1 100cm
B. Hartman 6-24-85

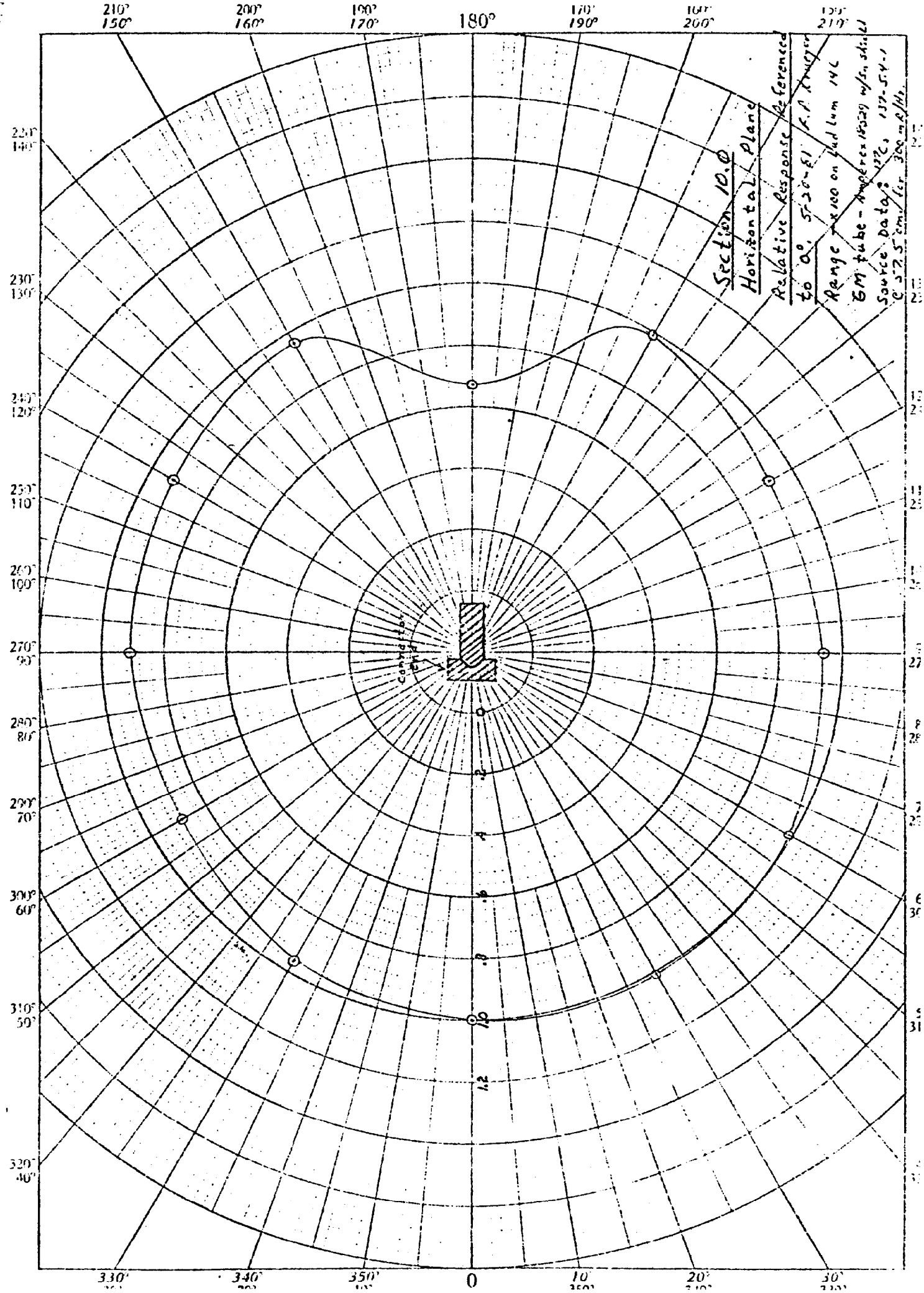


Frisker #5
Horizontal Plane Reference to 0°
CS137-5.3-1 82.6 cm
B Hartman 10-14-85

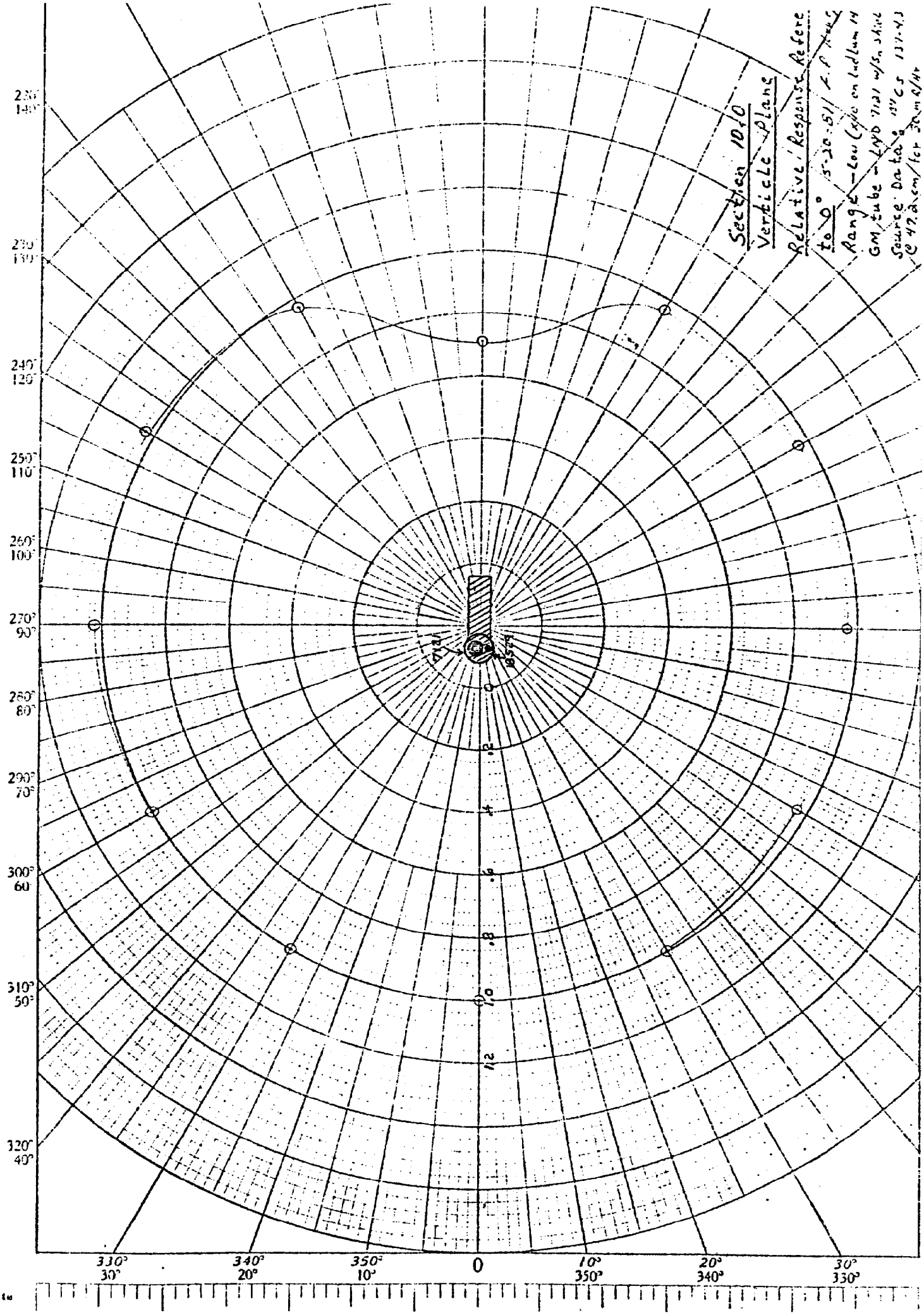


Frisker #5
Vertical Plane Reference to 0°
CS-137-3.3-1 82.6 cm
B. Hartman 10-14-85

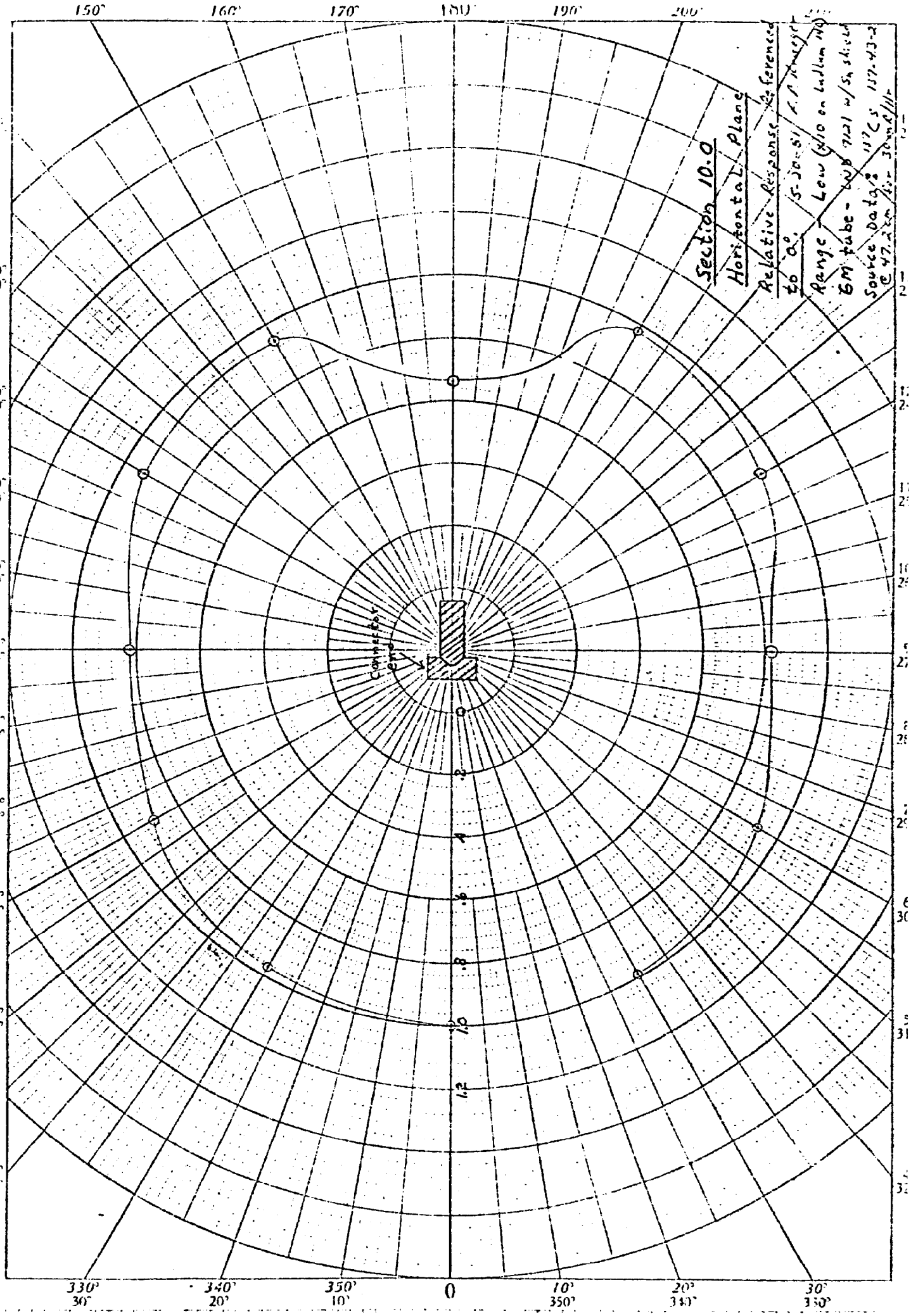

Section 10.0
Verticle Plane
Relative Response Referen
to 0° 5-20-51 F.P. V/rac
Range — x 100 on Ludlum 14C
GM tube — Amperex 18349 w/Sn sh
Source Data: 137Cs 137.5.4.1
C 57.5 cm for 300 mR/Hr
220° 140°
230° 130°
240° 120°
250° 110°
260° 100°
270° 90°
280° 80°
290° 70°
300° 60°
310° 50°
320° 40°
330° 30°
340° 20°
350° 10°
0
10° 350°
20° 340°
30° 330°
.2
.4
.6
.8
1.0
1.2
Polar Co-ordinate



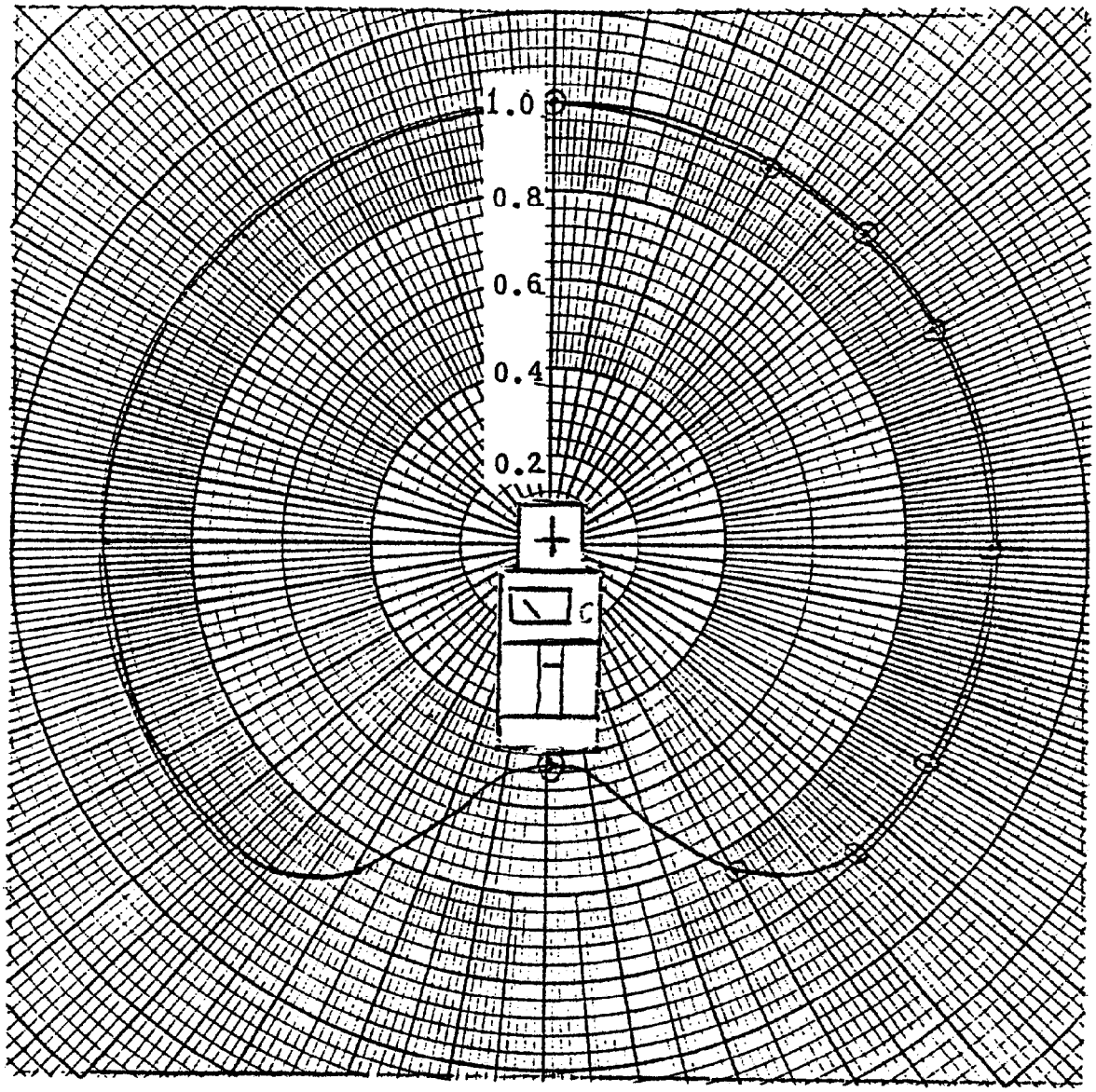
Section 10.0
Horizontal Plane
Relative Response Referenced to 0°, 5-20-81 F.P. Krueger
Range - x100 on Ludlum 14C
GM tube - Amperex 18529 w/Sn shield
Source Data: 137Cs 137-5.4-1
@ 57.5 cm. for 300 mR/Hr.
Connector End
180°
0


Section 10.0
Vertical Plane
Relative Response Refere
to 0°
Range - Low (x10 on ludlum 14
GM tube - LND 7121 w/Sn shiel
Source Data: 137Cs 137-4.3
@ 47.2 cm/for 30 mR/Hr
220° 140°
230° 130°
240° 120°
250° 110°
260° 100°
270° 90°
280° 80°
290° 70°
300° 60°
310° 50°
320° 40°
330° 30°
340° 20°
350° 10°
0
10° 350°
20° 340°
30° 330°
.2
.4
.6
.8
1.0
1.2
Polar Co-ordinate

12-187



Section 10.0
Horizontal Plane
Relative Response Referenced to 0°.
Range - Low (x10 on Ludlum 140)
GM tube - LND 7121 w/Sn shield
Source Data: 137Cs 137-43-2
Connector end
150°
160°
170°
180°
190°
200°
230° 130°
240° 120°
250° 110°
260° 100°
270° 90°
280° 80°
290° 70°
300° 60°
310° 50°
320° 40°
330° 30°
340° 20°
350° 10°
0
10° 350°
20° 340°
30° 330°
.2
.4
.6
.8
1.0
1.2



Model 1010 Angular Dependence

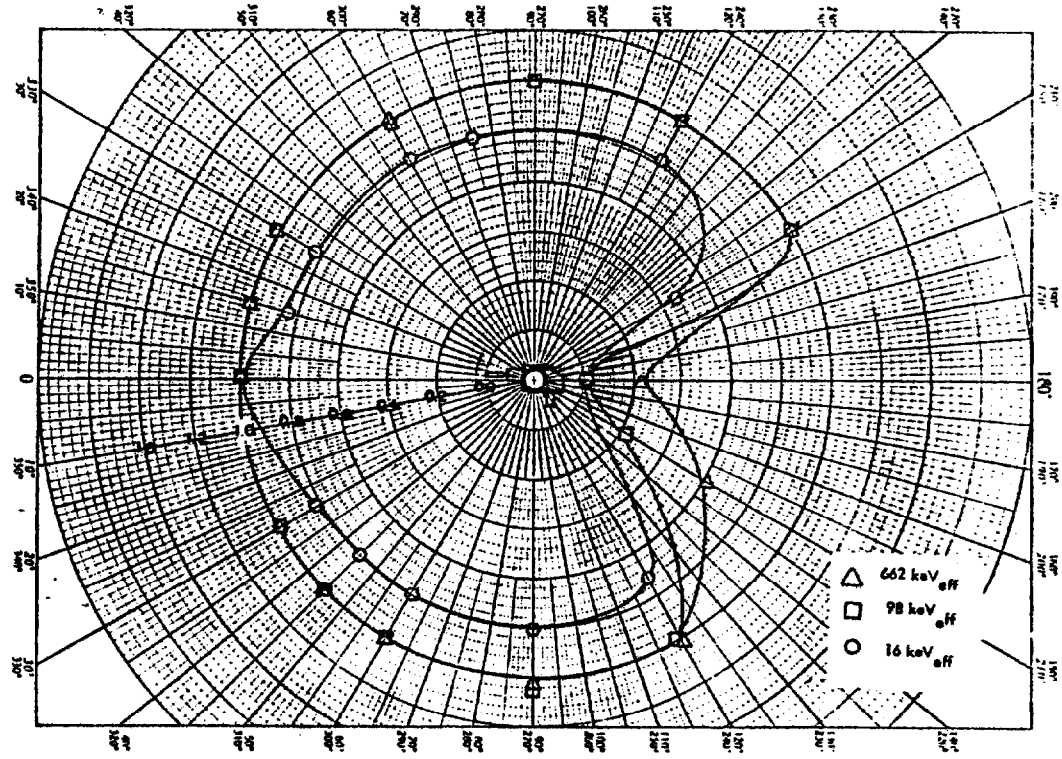


Figure 6 Model 2594 Ion Chamber
Angular Response (Horizontal Plane)

Normalized to Zero Degrees

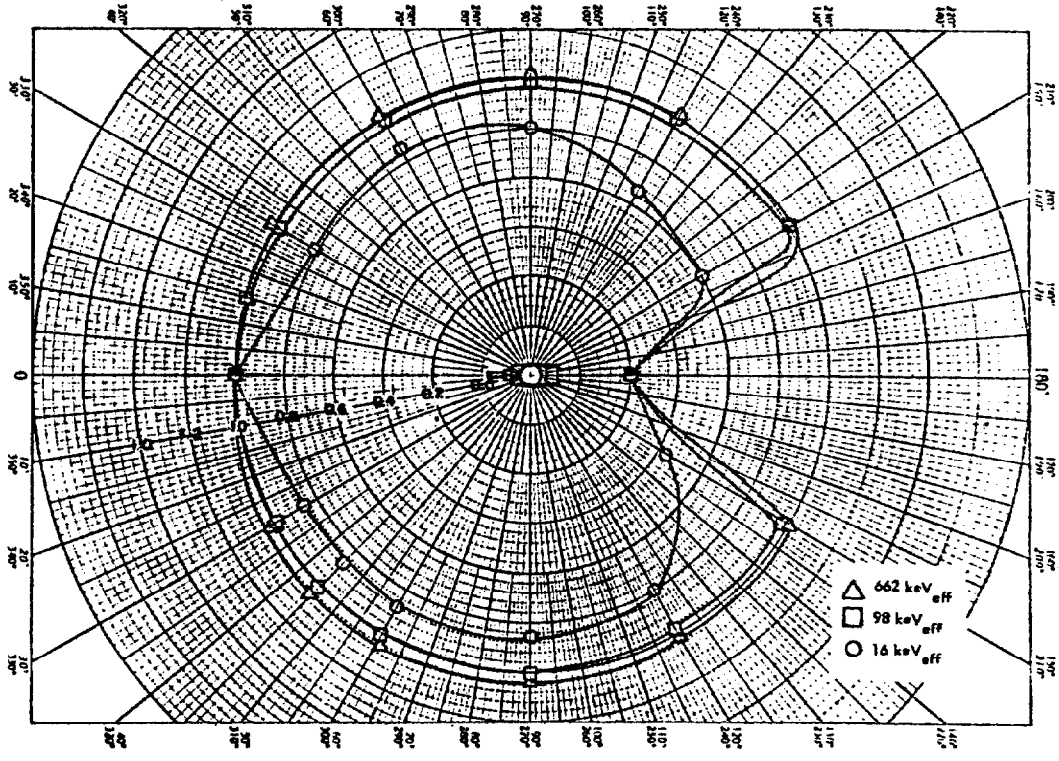


Figure 7 Model 2594 Ion Chamber
Angular Response (Vertical Plane)

Normalized to Zero Degrees

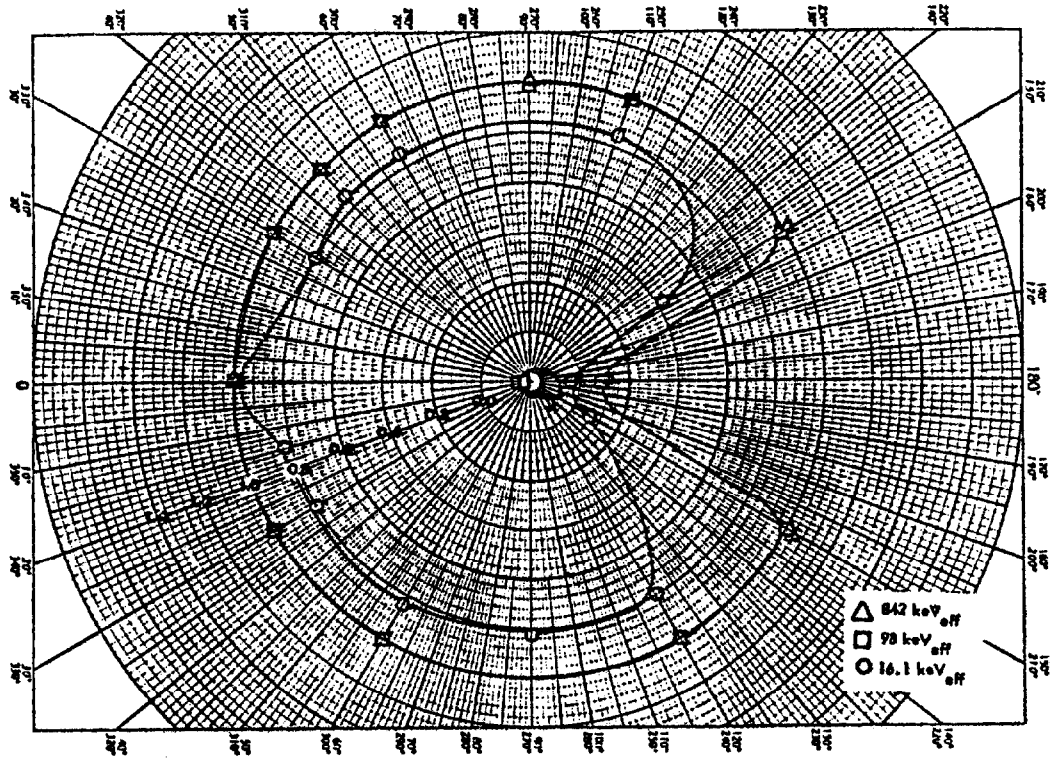


Figure 4 Model 2593 Ion Chamber
Angular Response (Horizontal Plane)

Normalized to Zero Degrees

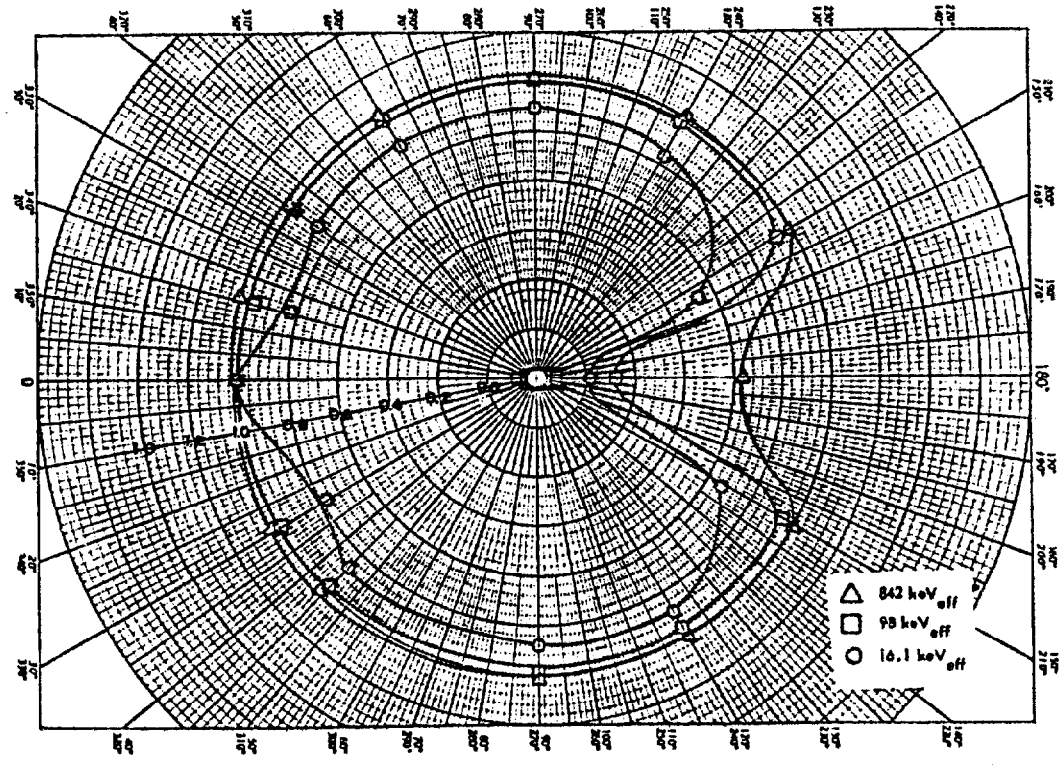


Figure 5 Model 2593 Ion Chamber
Angular Response (Vertical Plane)

Normalized to Zero Degrees