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MERCY CATHOLIC MEDICAL CENTER
OF SOUTHEASTERN PENNSYLVANIA

February 10, 1986

Mr. Jack Davis
Nuclear Materials Safety Section A
Division of Radiation Safety and Safeguards
U.S. Nuclear Regulatory Commission
Region I
631 Park Avenue
King of Prussia, Pa. 19406

RE: License 37-00993-04

Dear Mr. Davis:

Enclosed is the report regarding the installation of our new CGR-MeV Alcyon II Cobalt Unit. The details of the installation and survey, as conducted by Dr. James Bierly, are as noted in the attached report that he has sent to me as the Chairman of the Department of Radiation Oncology.

As noted by Dr. Bierly, this Unit was installed and ready for operation on January 19, 1986 and this report is being sent within the thirty day period, as required by our license.

FEE EXEMPT
tt survey

| | |
|----------------------|---------|
| DATE | 2/18/86 |
| LOG | Feb 86 |
| BY | SK |
| ACTION COMPT 2/21/86 | |

Sincerely yours,

C. Jules Rominger
C. Jules Rominger, M.D.

CJR/me

c: James N. Bierly, Ph.D.
Cleveland Mair (Administration)
Files

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"OFFICIAL RECORD COPY"

MISERICORDIA DIVISION
54th Street and Cedar Avenue
Philadelphia, Pa. 19143
(215) 748-9000

JML13

RADIATION ONCOLOGY, INC.

February 4, 1986

TO: C. Jules Rominger, M.D.
FROM: James N. Bierly, Ph.D. *James N. Bierly*
SUBJECT: New CGR-MeV Alcyon II Cobalt Unit

On January 6, 1986, the Unit was delivered to the Misericordia Division of the Mercy Catholic Medical Center, Philadelphia, Pa.

Unit Serial Number 618

Source strength 6110 RHM - 5/31/85 by decay to Jan. 25, 1986 5608

French measurements 4664 curies - May 31, 1985

The Cobalt source was installed and ready for limited operation Jan. 19, 1986.

AREA SURVEY:

An area survey of the adjacent areas was made, using a Keithley 36100 digital cutie pie. The instrument was calibrated by Keithley on February 28, 1985.

A spot calibration was made the day of the survey, using a 10mg. Ba source .5mm PT Filter.

Calibration was 8.6 mr/hr. The meter read 4% high.

Table of survey - Appendix I.

The readings are acceptable.

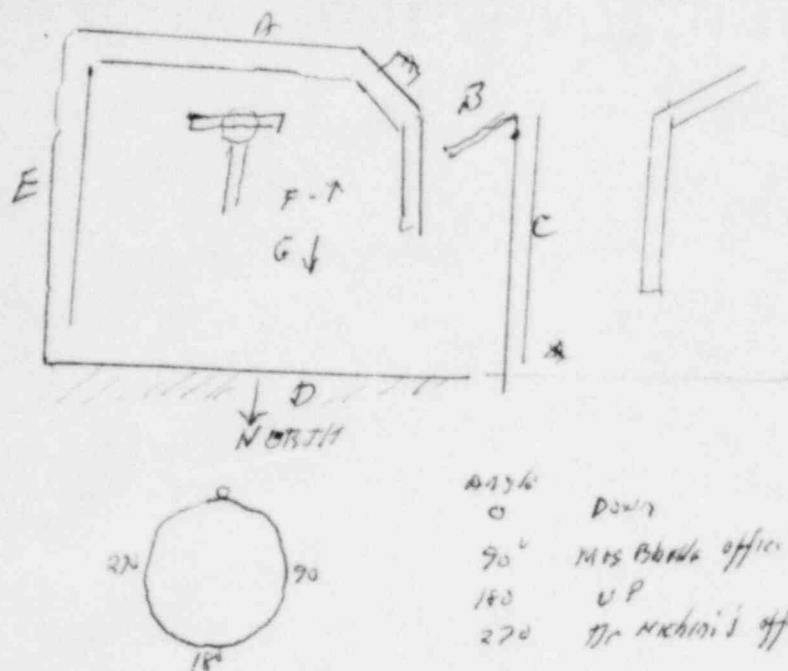
PLEASE REPLY TO:

☐ MISERICORDIA DIVISION, MCMC
5301 CEDAR AVENUE
PHILADELPHIA, PA. 19143
748-9360

☐ FITZGERALD DIVISION, MCMC
LANSDOWNE AVENUE AND BAILY ROAD
DARBY, PA. 19023
237-4370

☐ 30 SOUTH VALLEY ROAD
PAOLI, PA. 19301
647-7755

APPENDIX I - Area Survey:



- A - Hall and control panel
- B - Door
- C - Dr. Nichini's Office
- D - Outside wall underground
- E - Mrs. Bhalla's Office
- F - Medical Record's Room above
- G - Laundry Room below

A polystyrene phantom was placed in a 32 x 32 cm. field with a TSD of 75cm.

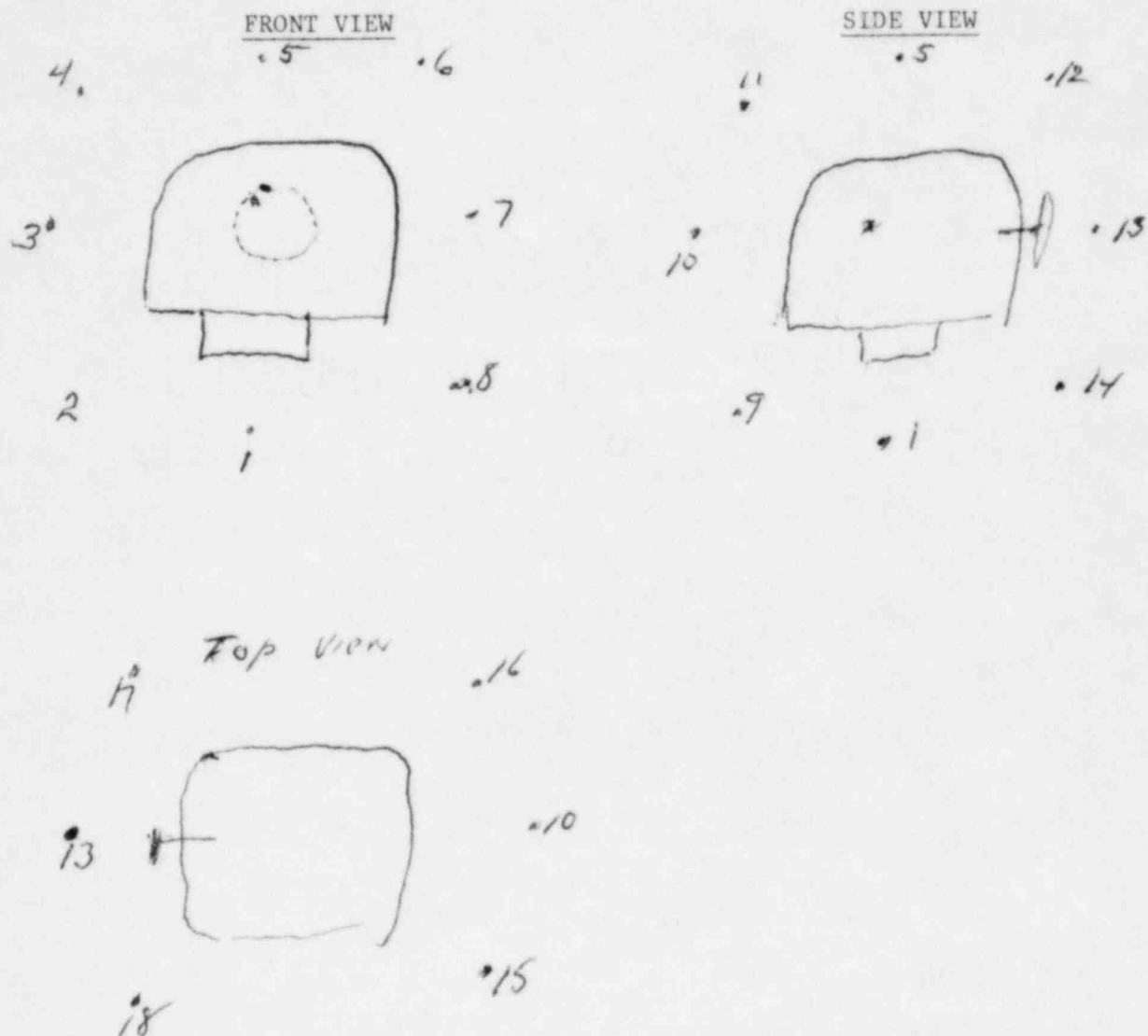
0° is for beam pointed downwards

| HEAD ANGLE | A | B | C | D | E | F | G |
|------------|-----|-------|------|---|-----|-----|-----|
| 0° | <.1 | .1 | <.1 | | <.1 | <.1 | <.1 |
| 30° | <.1 | .1 | <.1 | | <.1 | <.1 | <.1 |
| 60° | <.1 | .1 | <.1 | | <.1 | <.1 | <.1 |
| 90° | <.1 | .1 | <.1 | | <.1 | <.1 | <.1 |
| 120° | <.1 | .1 | <.1 | | <.1 | <.1 | <.1 |
| 150° | <.1 | .1 | <.1 | | <.1 | <.1 | <.1 |
| 180° | <.1 | .1 | <.1 | | <.1 | <.1 | <.1 |
| 210° | <.1 | .1 | <.1 | | <.1 | <.1 | <.1 |
| 240° | <.1 | .1 | <.1 | | <.1 | <.1 | <.1 |
| 270° | <.1 | <.2 * | .3 * | | <.1 | <.1 | <.1 |
| 300° | <.1 | .1 | | | <.1 | <.1 | <.1 |
| 330° | <.1 | .1 | | | <.1 | <.1 | <.1 |

HEAD SURVEY:

On February 2, 1986, a survey of the head leakage was made, using the Keithley 36100 meter.

Measurements were made at 1 meter from the source in the off position with the collimator 32 x 32 cm.



Data for head measurements made in France are in Appendix II.

APPENDIX IIHEAD SURVEY

| <u>Position</u> | <u>mr/hr</u> |
|-----------------|--------------|
| 1 | 1.2 |
| 2 | .1 |
| 3 | .2 |
| 4 | .1 |
| 5 | 1.0 |
| 6 | .3 |
| 7 | .4 |
| 8 | .1 |
| 9 | .1 |
| 10 | .6 |
| 11 | .4 |
| 12 | .4 |
| 13 | .9 |
| 14 | .1 |
| 15 | .1 |
| 16 | .2 |
| 17 | .1 |
| 18 | .2 |

Avg. .4

Measurements were also taken at field size indicators in contact with the head.

Width knob .1 mr/hr Length knob .3 mr/hr

Measurements in contact with field size control knobs .2 mr/hr

Interlock tests - all checked at least ten times

- 1) TV monitor - satisfactory
Mirror - satisfactory
- 2) Door interlock - checked ten times
Machine cannot be operated with door open.
Treatment terminated when door opened
Door light on console indicates when door is open.
- 3) Retractable beam shield

Unit cannot operate with shield retracted.
- 4) Unit will not operate in rotation mode if table is not centered
and at proper height to rotate around table.
- 5) All lights on console, door and on head functioning - red when on -
green when off.
- 6) Radiation monitor satisfactory.
Backup power supply functioning.
- 7) Emergency off switches on console and on pendant in room functioning
properly.
- 8) Dead man switch on pendant working.
- 9) The Unit cannot be rotated at any angle other than around the patient
so that the primary beam always hits the primary beam stopper.
Transmission less than .1%.

WIPE TEST:

Wipes were made on the tungsten wheel and head before the collimator
was installed.

The wipes were counted in a Baird Atomic Scintillation Counter and
compared to a CO_{60} standard.

There was less than .005 millicuries of CO_{60} detected.

| <u>FIELD SIZE CM.</u> | <u>AIR 10 x 10 NORMAL</u> | <u>BACKSCATTER</u> | <u>CORR. BS NORM</u> | <u>RADS/MIN. at 80.5</u> | <u>RADS/MIN. 80.5 with BS</u> |
|-----------------------|-----------------------------------|--------------------|--------------------------|------------------------------|-----------------------------------|
| 4 x 4 | .941 | 1.014 | .954 | | 136.9 |
| 5 x 5 | .954 | 1.017 | .970 | | 139.2 |
| 6 x 6 | .962 | 1.021 | .982 | | 140.9 |
| 7 x 7 | .970 | 1.025 | .994 | | 142.6 |
| 8 x 8 | .982 | 1.029 | 1.010 | | 144.9 |
| 9 x 9 | .989 | 1.033 | 1.022 | | 146.6 |
| 10 x 10 | 1.000 | 1.036 | 1.036 | 143.46 | 148.62 |
| 11 x 11 | 1.004 | 1.040 | 1.044 | | 149.8 |
| 12 x 12 | 1.011 | 1.043 | 1.054 | | 151.2 |
| 14 x 14 | 1.023 | 1.050 | 1.074 | | 154.1 |
| 16 x 16 | 1.036 | 1.054 | 1.092 | | 156.6 |
| 18 x 18 | 1.048 | 1.058 | 1.109 | | 159.1 |
| 20 x 20 | 1.054 | 1.061 | 1.118 | | 160.4 |
| 25 x 25 | 1.078 | 1.066 | 1.149 | | 164.8 |
| 30 x 30 | 1.082 | 1.070 | 1.158 | | 166.1 |
| 32 x 32 | 1.084 | 1.071 | 1.161 | | 166.6 |

Computer - Rad/min. at 80.0 No BS = 145.2 rads/min.

OUTPUT:

On January 19, 1986, output measurements were made using a Keithley Electrometer Model 35614 and a .66cc BF Chamber Serial No. 2571. Both Units had been calibrated May, 1984 by the Regional Calibration Lab. at Memorial Hospital, New York.

The measurements were made following AAPM Protocol 21.

Measurements were made in a polystyrene phantom at a depth of 5cm.

Field size versus output were made in air at 80.0 cm. No trimmer bars were used.

A table of RAD output at 80.5cm. is enclosed and a curve of air output versus field size normalizer to a 10 x 10 field is enclosed.

Shutter error was measured using multiple-exposures.

The shutter error is $\pm .005$ min.

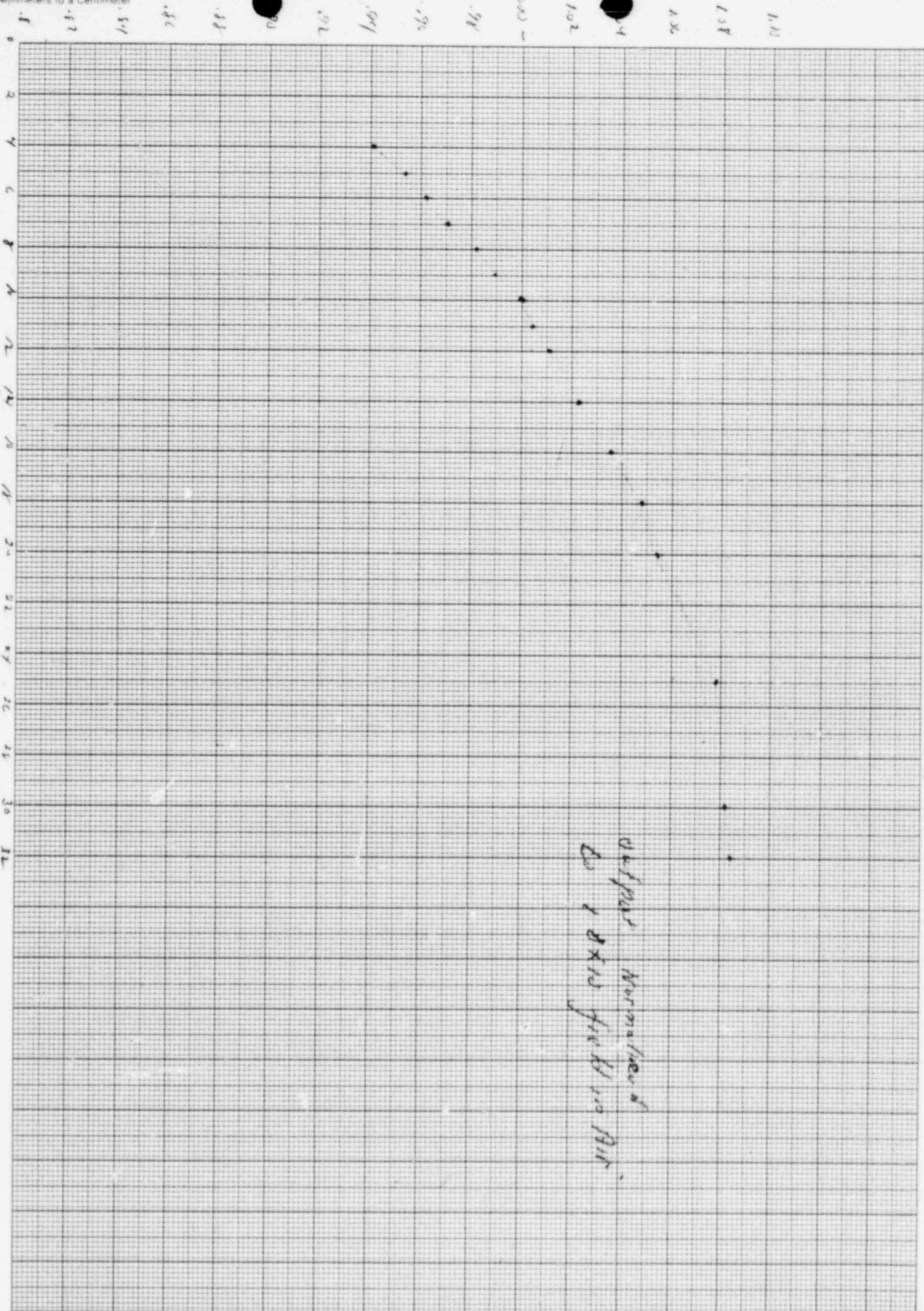
The two timers were checked against a stop watch and agreed within .01 min.

The preset timer and elapsed timer agreed within .01 min.

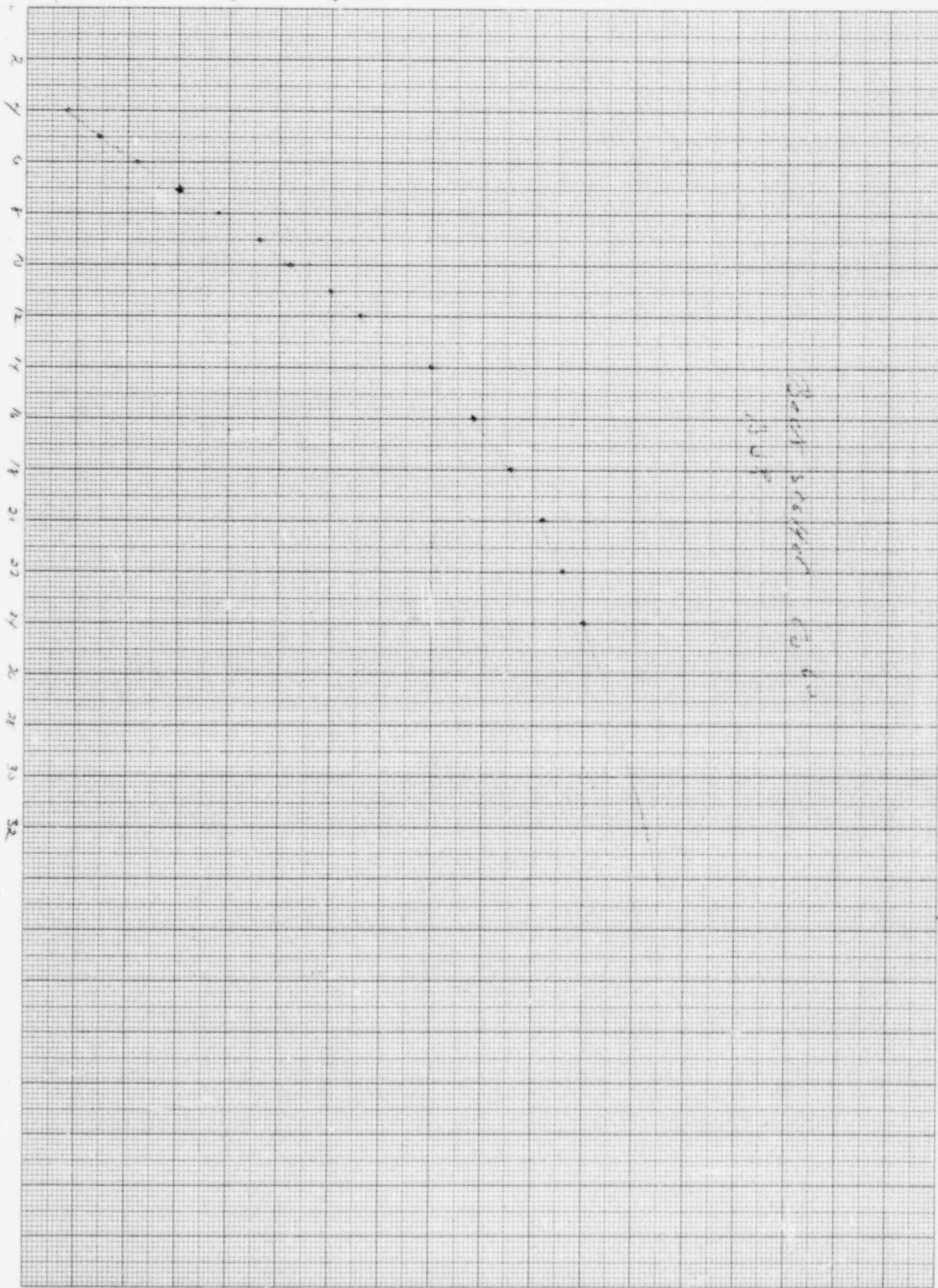
The angular speed for rotation was calibrated.

In cyclo mode, the unit is to rotate 360° in one minute. The measured value was within 2%. This is within the manufacturer's specifications.

Arc mode is controlled by a 10 turn potentiometer. A calibration curve of angular speed versus pot setting is enclosed. The curve is within 1% Better than manufacturer's specification of 2%.



Jan 14, 1986

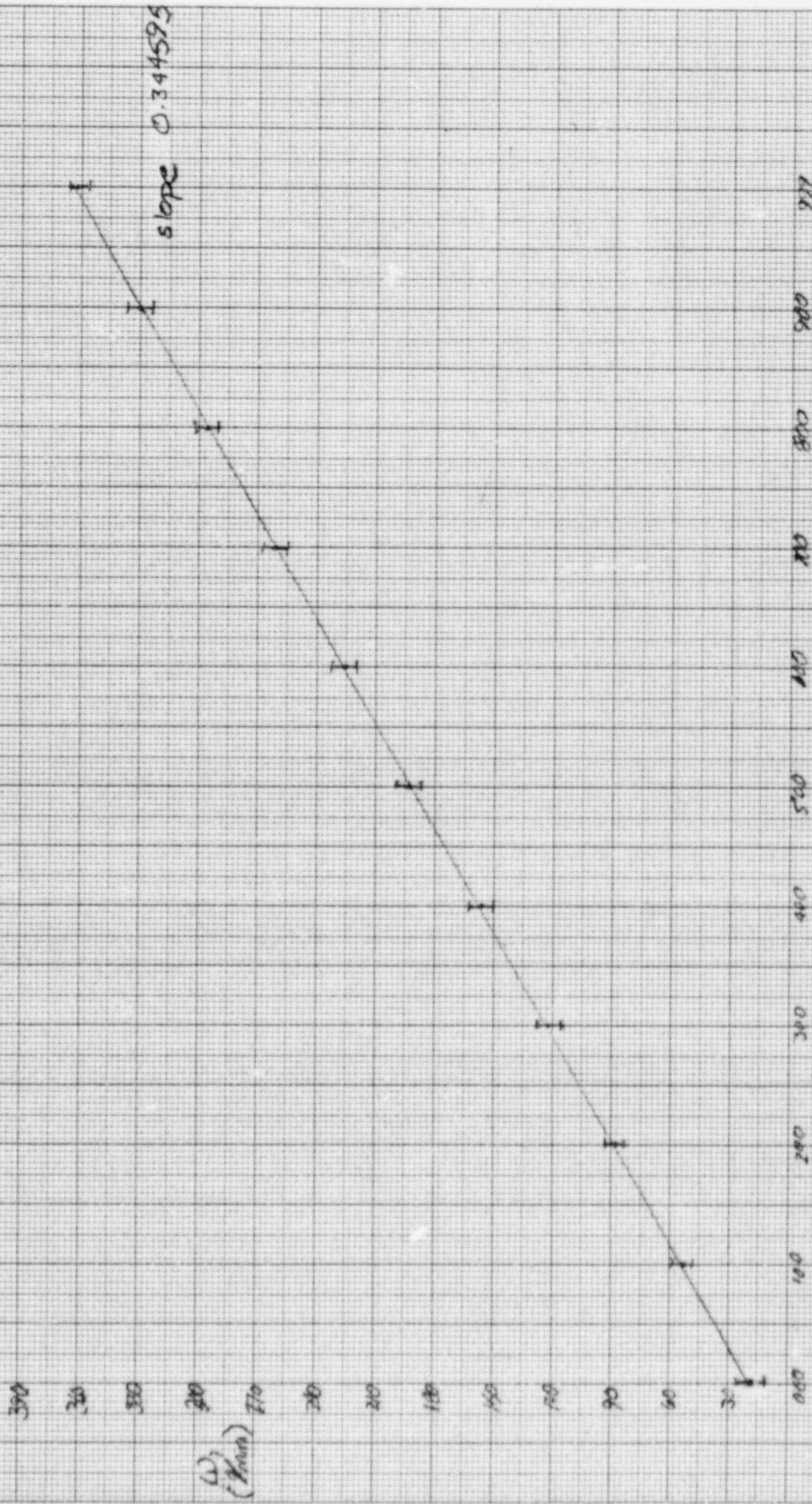


No. 19-0610 (R-2470-10-C) 10 Millimeters to a Centimeter • Made in U.S.A.

VERNON M. MILLAN, INC. ELIZABETH, N.J. 07208

ALCYON II
ARC ROTATION SPEED
MISERICORDIA DIVISION
MERCY CATHOLIC MEDICAL CENTER
PHILA PA 1/20/86 S. SYDNEY

SOURCE DATA: SEE SHEET 2



Pot. setting = $\frac{\omega - 18}{0.2441}$, ω : angular velocity

| POT SETTING | METER READING | DVM (YAKU) High Low | Ω (V) 2mV | CALC. ω (°/min) | θ (V) START END |
|----------------|------------------|------------------------|---------------------|------------------------------|---------------------------|
| 000 | 19 | 8.28 8.14 | 36 | 18 | 0° 36° |
| 100 | 53 | 22.3 22.5 | 105.5 | 52.75 | 36 141.5 |
| 200 | 92 | 36.5 36.7 | 176° | 88 | 141.5 317.5 |
| 300 | 125 | 50.7 50.5 | 245 | 122.5 | 317.5 502.5 |
| 400 | 159 | 64.6 64.4 | 315 | 157.5 | 502.5 877.5 |
| 500 | 195 | 78.5 78.3 | 385.5 | 192.75 | 877.5 1263.0 |
| 600 | 230 | 92.3 92.0 | 451 | 225.5 | 0° 451 |
| 700 | 265 | 105.6 106.0 | 524 | 262 | 90° 614 |
| 800 | 300 | 119.5 119.1 | 592.5 | 296.25 | 270° 862.5 |
| 900 | 331 | 133.2 132.5 | 661.0 | 330.5 | 180° 841.0 |
| 999 | 365 | 145.5 144.6 | 724.5 | 362.25 | 180° 704.5 |

1263
1877.5
385.5

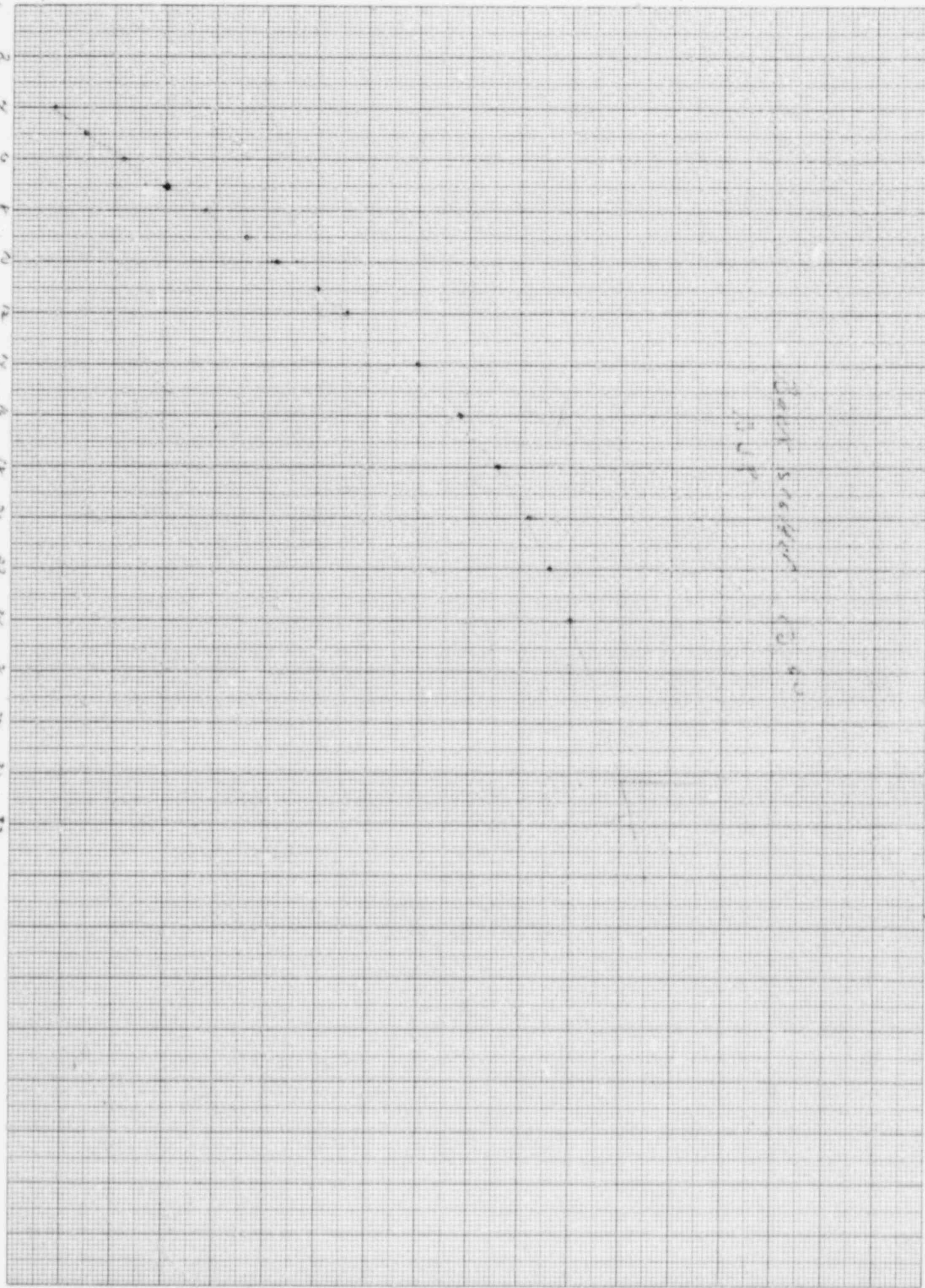
$r_j = \max. 16$
least sq fit

$m = 34.5977$
 $b = 18629$
 $R^2 = 1$

No. 19-0610 (R 2475-10 C) 10 Millimeters to a Centimeter • Made in U.S.A.

VERNON-MILLAN, INC. ELIZABETH, N.J. 07208

1.01 1.02 1.03 1.04 1.05 1.06 1.07 1.08 1.09 1.10 1.11 1.12 1.13 1.14 1.15 1.16 1.17 1.18 1.19 1.20 1.21 1.22 1.23 1.24 1.25 1.26 1.27 1.28 1.29 1.30 1.31 1.32 1.33 1.34 1.35 1.36 1.37 1.38 1.39 1.40 1.41 1.42 1.43 1.44 1.45 1.46 1.47 1.48 1.49 1.50 1.51 1.52 1.53 1.54 1.55 1.56 1.57 1.58 1.59 1.60 1.61 1.62 1.63 1.64 1.65 1.66 1.67 1.68 1.69 1.70 1.71 1.72 1.73 1.74 1.75 1.76 1.77 1.78 1.79 1.80 1.81 1.82 1.83 1.84 1.85 1.86 1.87 1.88 1.89 1.90 1.91 1.92 1.93 1.94 1.95 1.96 1.97 1.98 1.99 2.00



Jan 1974

ISOCENTER:

The Isocenter was measured by placing a sharp point 45 cm. from the end of the collimator to give an 80 cm. distance. The movement of the cross hairs shadow was less than 1 mm. when the gantry was rotated through 0, 90°, 180°, 270° and 360°. This is within the manufacturer's specifications.

CENTERING OF CROSS HAIRS:

The intersection of the cross hairs from 0-180° and 90-270° was checked. The difference was 1 mm., manufacturer's specifications 2 mm.

Verification of field size settings and light field.

Fields set at 80cm. no trimmer bars

| FIELD SETTING | 0° | | 90° rotation of coll. | |
|---------------|----------|----------|-----------------------|----------|
| | <u>W</u> | <u>L</u> | <u>W</u> | <u>L</u> |
| 5.0 | 5.0 | 5.0 | 5.0 | 5.05 |
| 10 | 10.1 | 10.15 | 10.1 | 10.1 |
| 15 | 15.1 | 15.1 | 15.0 | 15.1 |
| 20 | 20.2 | 20.05 | 20.1 | 20.2 |
| 25 | 25.05 | 25.2 | 25.1 | 25.15 |
| 30 | 30.1 | 30.15 | 30.1 | 30.15 |

Congruence within .2 cm. - satisfactory

Verification of optical indicator - 10 x 10 field set at 35.0 cm. from coll.

| <u>SCALE READING</u> | <u>MEASURED FROM COLL.</u> | <u>DISTANCE + 45</u> |
|----------------------|----------------------------|----------------------|
| 110. cm | 64.8 | 109.8 |
| 105. | 59.95 | 104.95 |
| 100. | 54.95 | 99.95 |
| 95. | 50.0 | 95.00 |
| 90. | 45.1 | 90.1 |
| 85. | 40.05 | 85.05 |
| 80.0 | 35.1 | 80.1 |
| 75.0 | 30.15 | 75.15 |

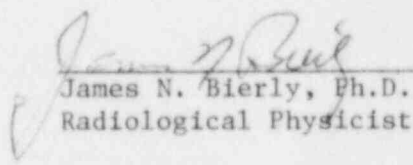
Max deviation less than 2 mm.

OPTICAL FIELD SIZE VERSUS RADIATION FIELD SIZE:

Kodak X-Omart TL film was placed at a 80.0 cm. TSD and .1 min. exposures made for 5 x 5, 10 x 10, 15 x 15 and 20 x 20 fields.

Pencil lines showing in the film indicates the optical field in addition pin pricks were made of the four corners and intersection of the cross hairs.

Beam profile in air was measured for a 15 x 15 cm. field at 80 cm. Curve is enclosed.


James N. Bierly, Ph.D.
Radiological Physicist

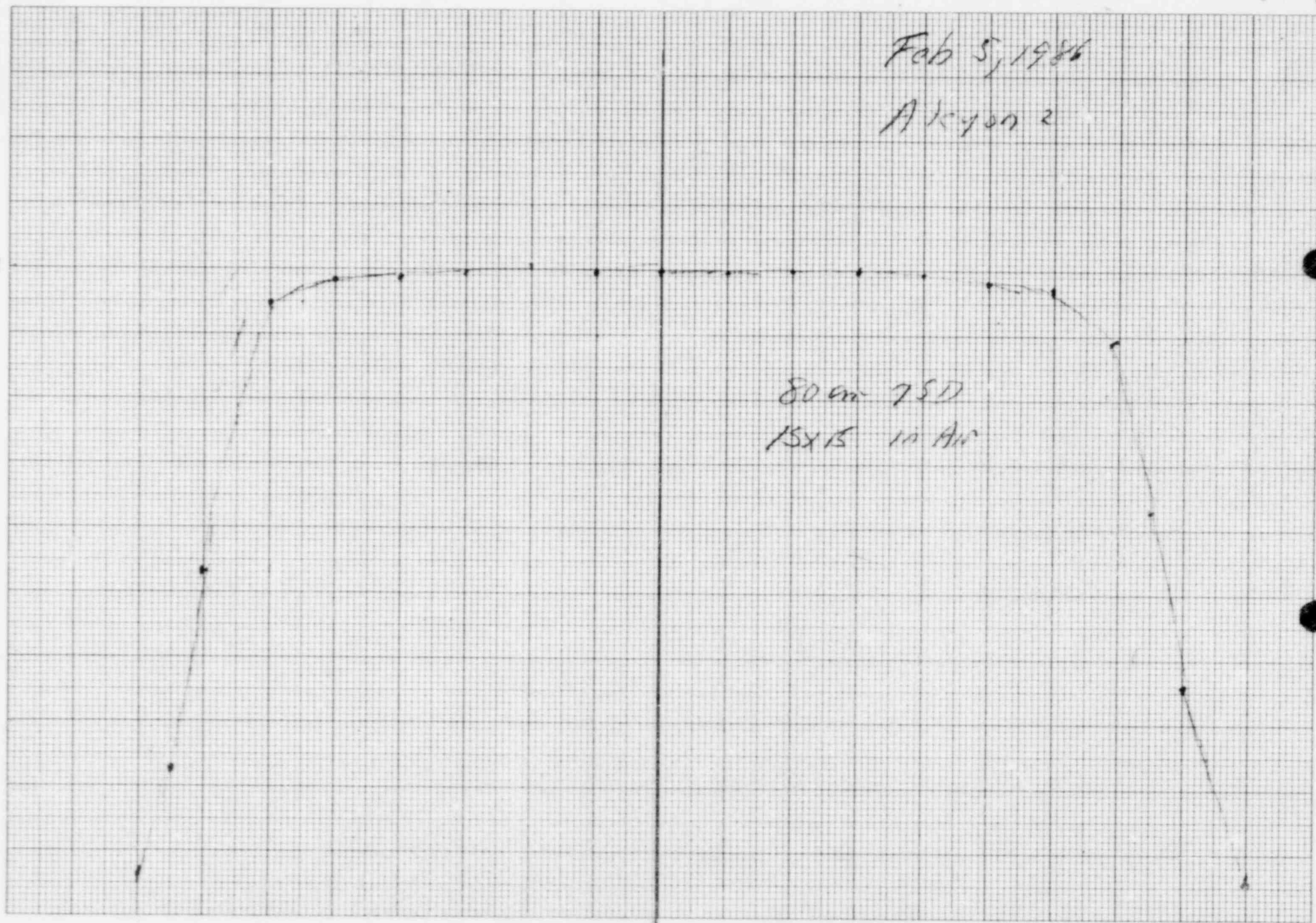
Feb 5, 1986

Akron 2

80 cm 75D
15x15 in Air100
90
80
70
60
50
40
30
20
10
0

-8 -7 -6 -5 -4 -3 -2 -1

1 2 3 4 5 6 7 8



- TABLEAU IV -

Valeurs des débits d'exposition à 5 cm de la paroi

N° du bloc d'irradiation : B 60-15

N° de la source CEA-ORIS : 3245

Date du contrôle : le 28 Juin 1985

| Points n° | \dot{X} $\mu\text{C.kg}^{-1}.\text{h}^{-1}$ | \dot{X} mR.h^{-1} |
|-----------|--|---------------------------------|
| 1 | 4,9 | 19 |
| 2 | 0,28 | 1,0 |
| 3 | 0,91 | 3,5 |
| 4 | 0,98 | 3,8 |
| 5 | 0,48 | 1,8 |
| 6 | 1,44 | 5,6 |
| 15 | 0,11 | 0,4 |
| 16 | 1,33 | 5,1 |
| 17 | 0,09 | 0,3 |
| 18 | 0,06 | 0,2 |
| 19 | 0,73 | 2,8 |
| 20 | 0,70 | 2,7 |
| 21 | 0,18 | 0,6 |
| 22 | 0,04 | 0,1 |
| 23 | 0,06 | 0,2 |
| 24 | 0,02 | 0,1 |
| 25 | 0,07 | 0,2 |
| 26 | 0,48 | 1,8 |
| moyenne | 0,71 | 2,7 |

Sur l'ensemble de la surface située à 5 cm de la paroi le débit d'exposition est inférieur à :

5,2 $\mu\text{C.kg}^{-1}.\text{h}^{-1}$ (20 mR.h^{-1})

- TABLEAU IV -

Valeurs des débits d'exposition à 100 cm de la source

N° du bloc d'irradiation : B 60-15

N° de la source CEA-ORIS : 3245

Date du contrôle : le 28 Juin 1985

| Points n° | \dot{X} $\mu\text{C.kg}^{-1}.\text{h}^{-1}$ | \dot{X} mR.h^{-1} |
|-----------|--|---------------------------------|
| 1 | 0,21 | 0,8 |
| 2 | 0,14 | 0,5 |
| 3 | 0,11 | 0,4 |
| 4 | 0,24 | 0,9 |
| 5 | 0,09 | 0,3 |
| 6 | 0,14 | 0,5 |
| 7 | 0,02 | 0,1 |
| 8 | 0,06 | 0,2 |
| 9 | 0,02 | 0,1 |
| 10 | 0,04 | 0,1 |
| 11 | 0,03 | 0,1 |
| 12 | 0,03 | 0,1 |
| 13 | 0,02 | 0,1 |
| 14 | 0,03 | 0,1 |
| 15 | 0,04 | 0,1 |
| 16 | 0,10 | 0,3 |
| 17 | 0,04 | 0,1 |
| 18 | 0,03 | 0,1 |
| 19 | 0,08 | 0,3 |
| 20 | 0,11 | 0,4 |
| 21 | 0,09 | 0,3 |
| 22 | 0,02 | 0,1 |
| 23 | 0,22 | 0,8 |
| 24 | 0,02 | 0,1 |
| 25 | 0,04 | 0,1 |
| 26 | 0,09 | 0,3 |
| Moyenne | 0,07 | 0,2 |

Sur l'ensemble de la sphère centrée sur la source et de rayon égal à 100 cm, le débit d'exposition est inférieur à :

0,52 $\mu\text{C.kg}^{-1}.\text{h}^{-1}$ (2 mR.h⁻¹)

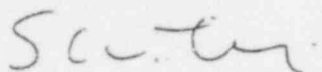
Incertitude de mesure.

Chaque résultat est entaché d'une incertitude relative totale estimée à $\pm 17 \%$. Cette valeur est obtenue par combinaison quadratique des incertitudes élémentaires suivantes :

- Incertitude sur le facteur d'étalonnage 12 %
- Incertitude de lecture 10 %
- Incertitude due à l'influence des différences spectrales et directionnelles entre le faisceau d'étalonnage et le champ de rayonnement à contrôler 5 %

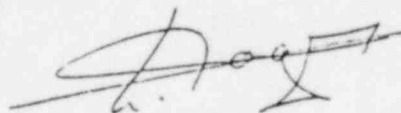
Le Chef du L.M.R.I

Le Responsable du Centre d'Etalonnage
(dosimétrie)



J.F. SIMOEN

P.1



M. CANCE

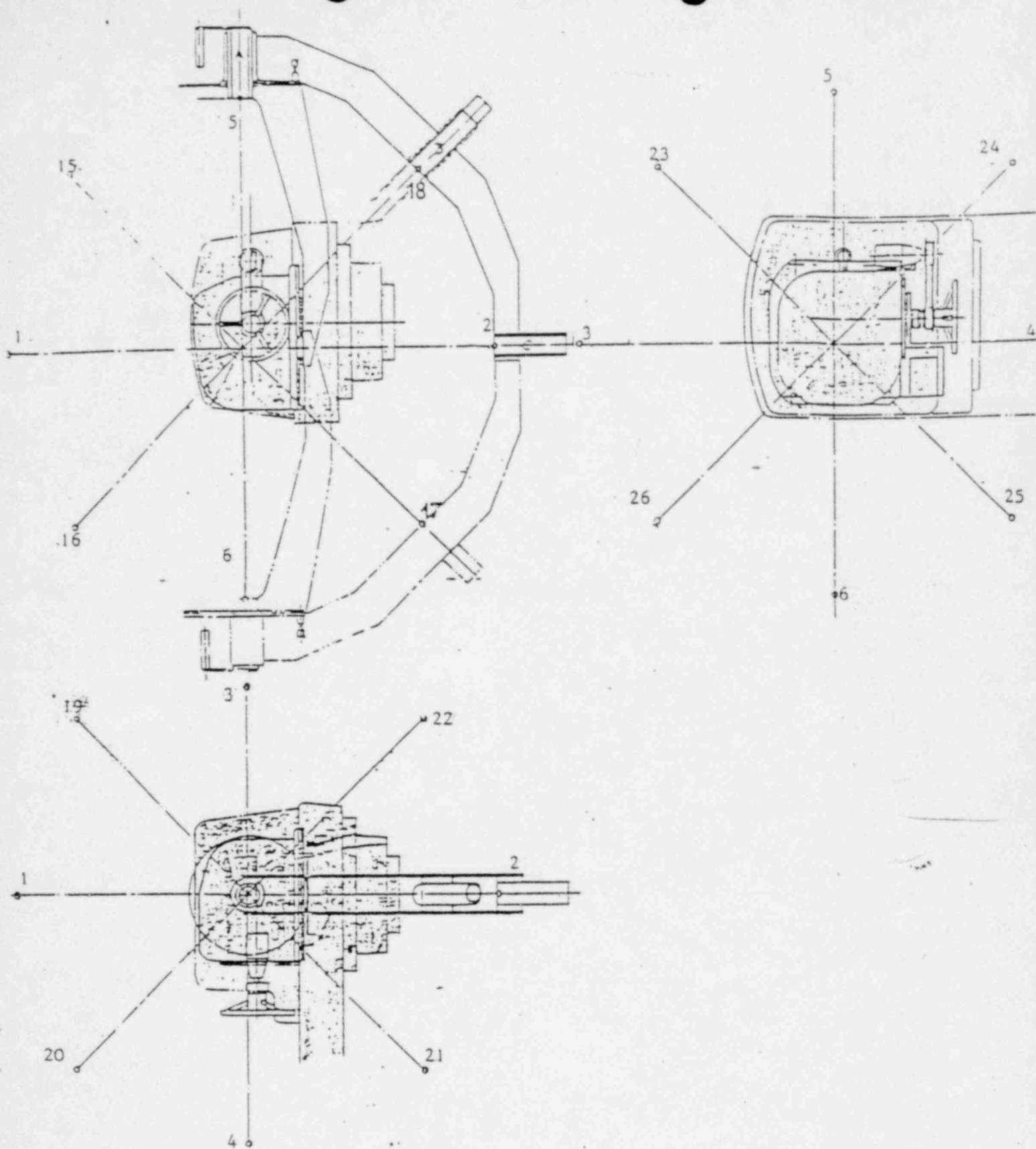


FIG. 1 - Schéma du bâti de mesure

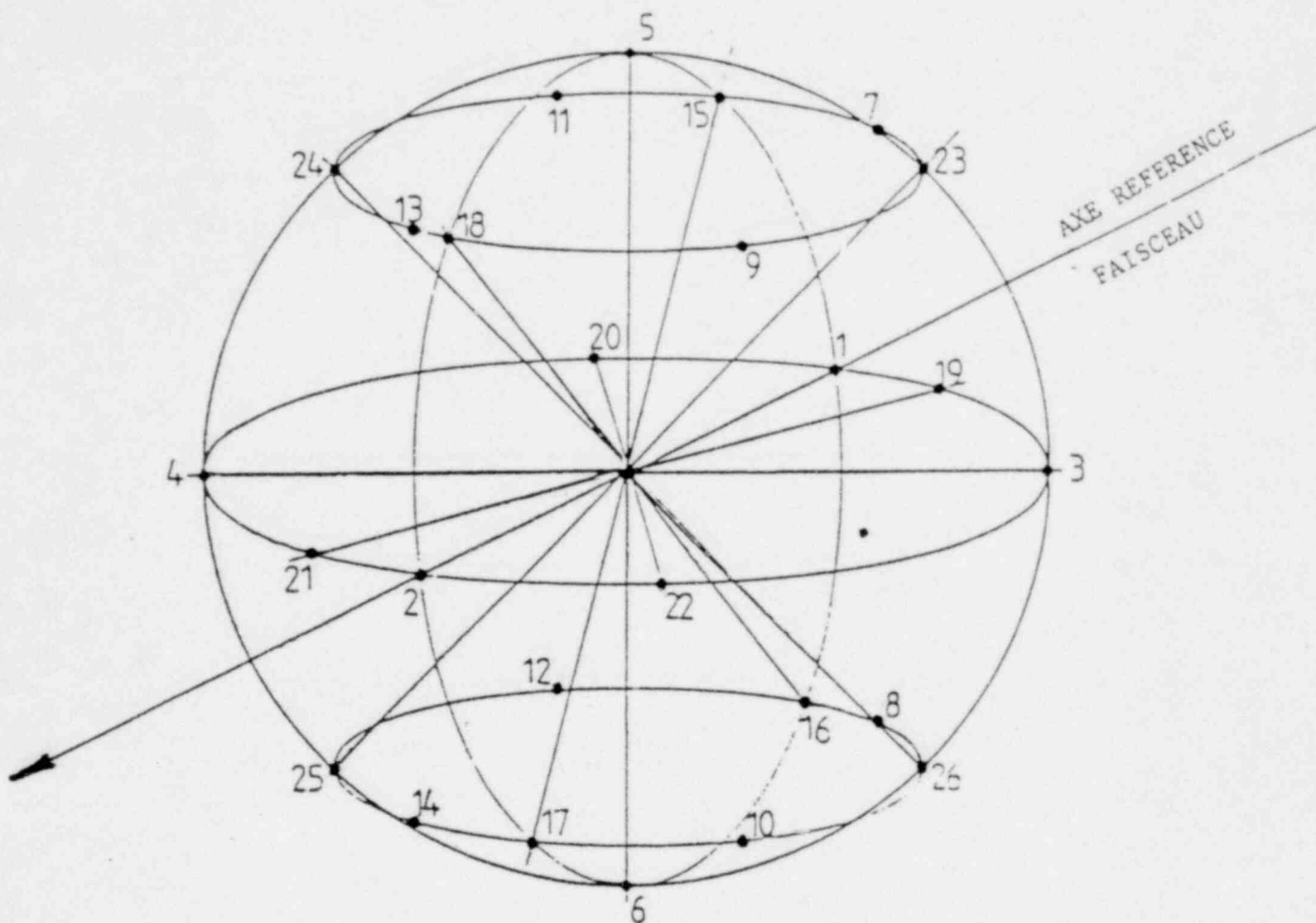


FIG. 2 - Localisation des axes de mesure