A New Scanning Technique For Electron Depth Dose Curves With Beveled IORT Cones

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TASK:

To measure central axis electron depth dose/ionization data on beveled IORT cones. Data collected perpendicular to the beveled surface and along the true beam axis is compared to determine which measurement procedure is proper.

PROCEDURE:

Using the vector scanning capabilities (see fig. 1) of a commercially available computerized water phantom[1], measurements were made:

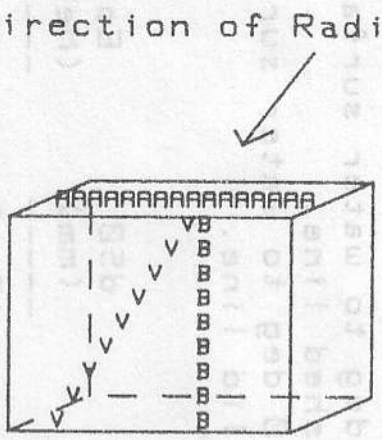
1- perpendicular to the surface of the phantom,

and

2- along the true beam axis (ie.: bevel angle of the cone),

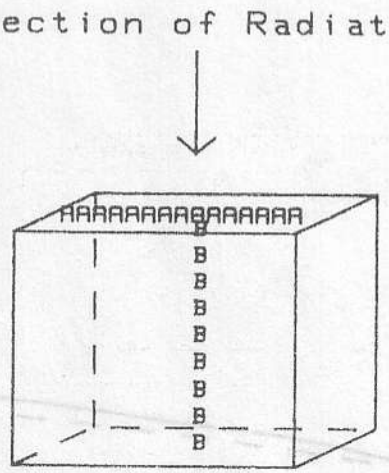
for a series of plastic IORT cones, fabricated[2] for a Philips SL 75/20 accelerator at UMDNJ, Newark, New Jersey.

Fig. 1A: Vector Scanning

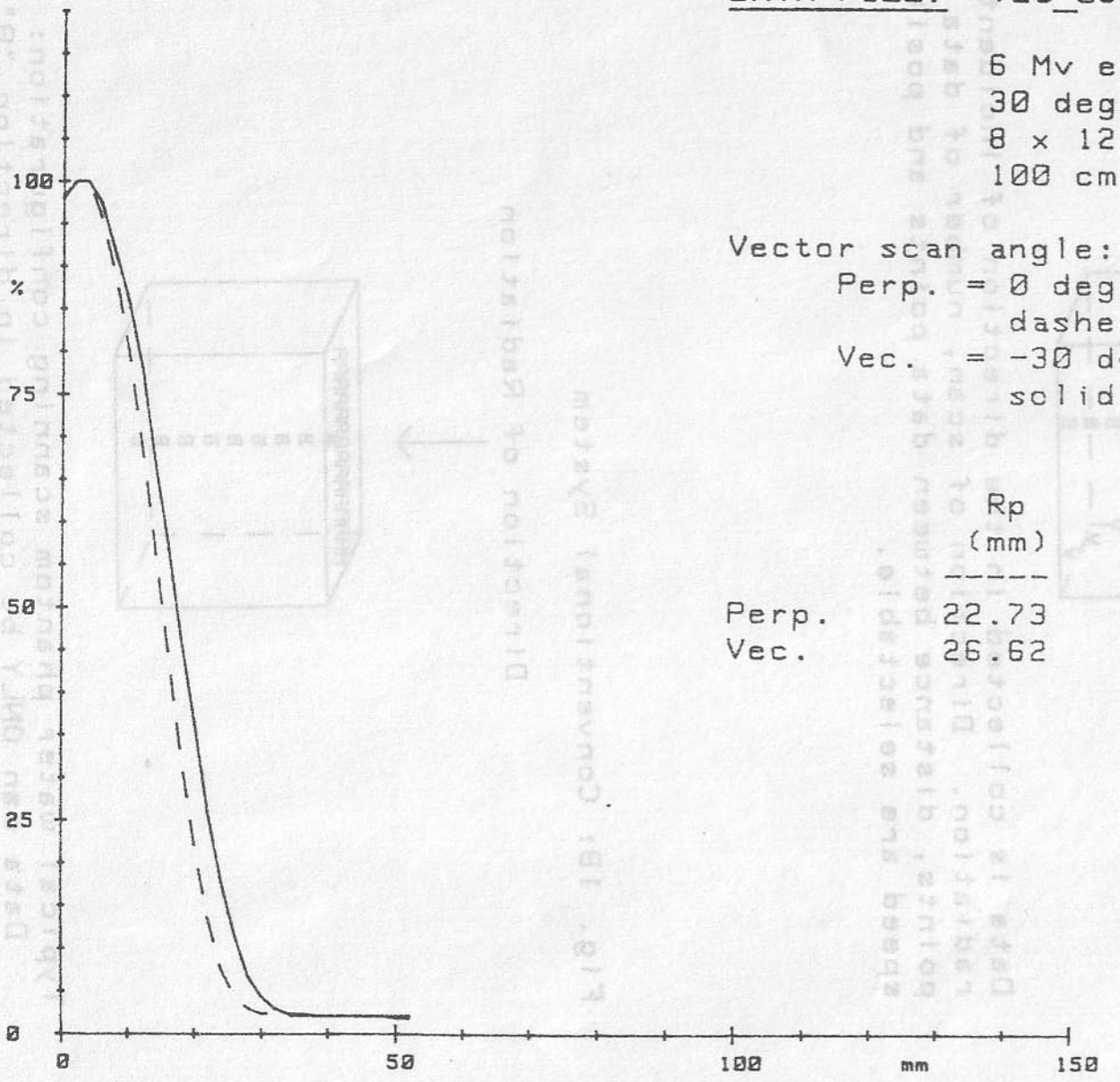


Data is collected in the direction of incident radiation. Direction of scan, number of data points, distance between data points and positioning speed are selectable.

Fig. 1B: Conventional System



Typical water phantom scanning configuration:
Data can ONLY be collected in direction "A" or direction "B", regardless of the direction of incident radiation.

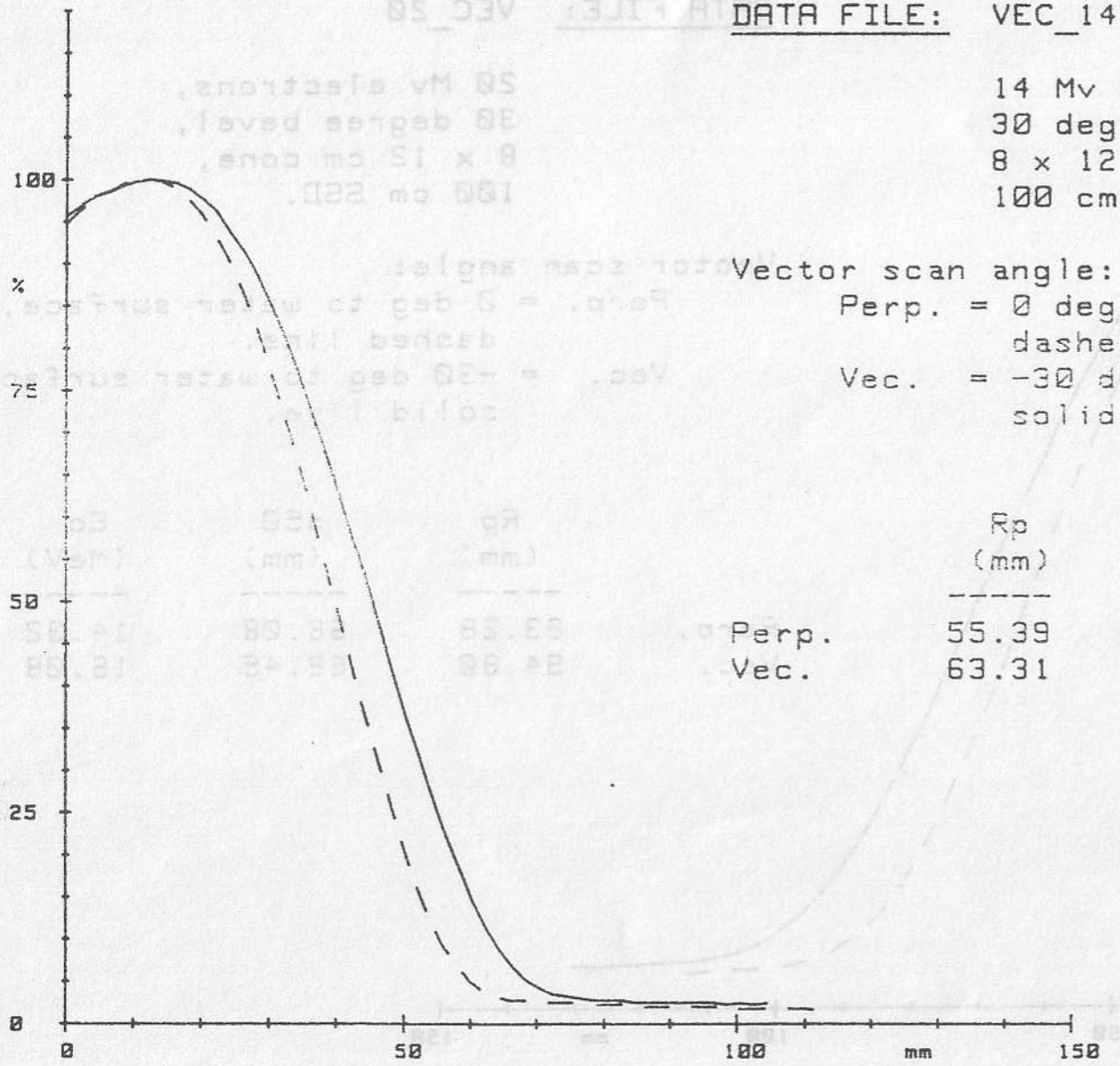


DATA FILE: VEC_06

6 Mv electrons,
30 degree bevel,
8 x 12 cm cone,
100 cm SSD.

Vector scan angle:
Perp. = 0 deg to water surface, dashed line.
Vec. = -30 deg to water surface, solid line.

	Rp (mm)	d50 (mm)	Eo (MeV)
Perp.	22.73	15.19	3.54
Vec.	26.62	17.33	4.04

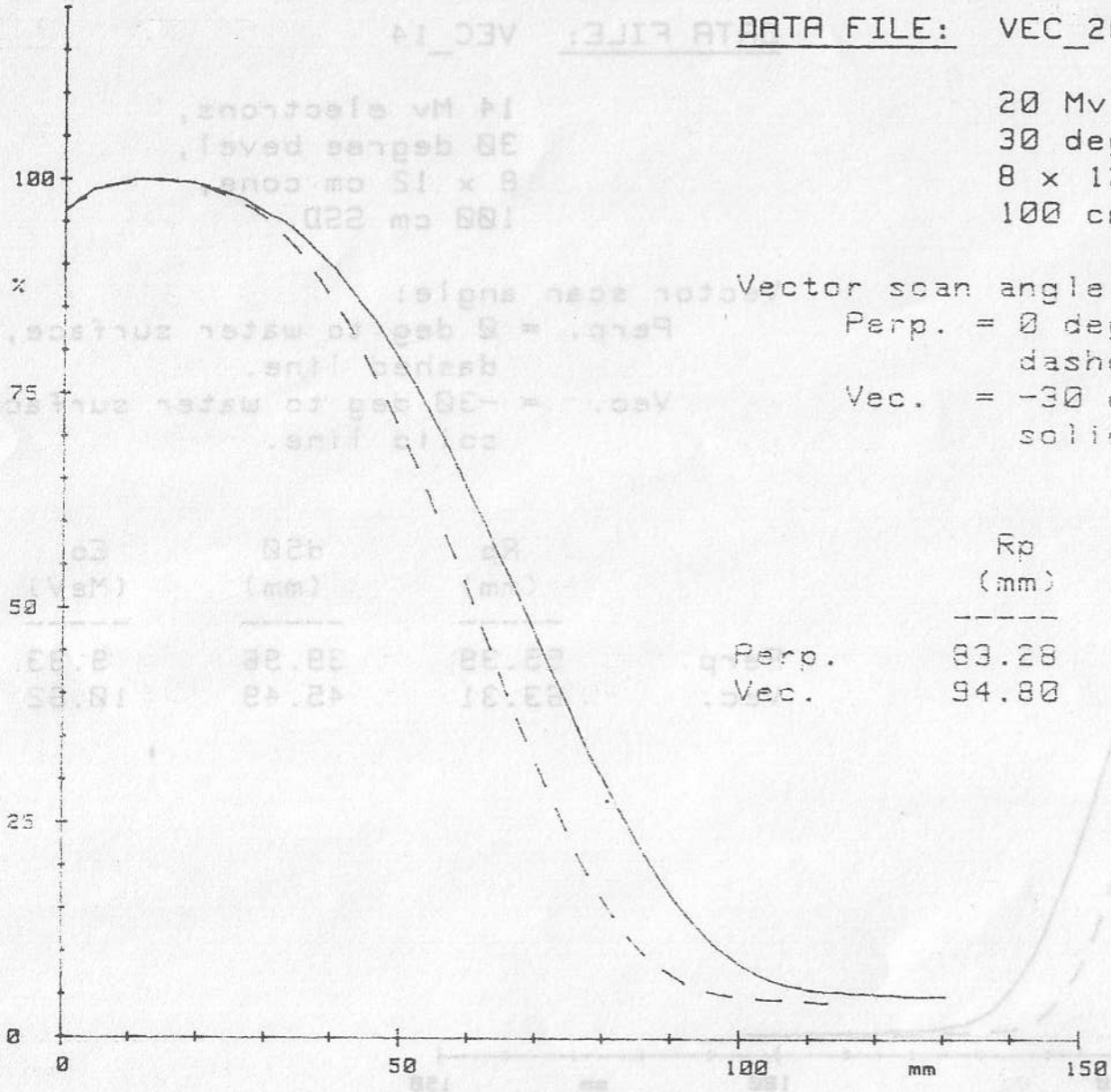


DATA FILE: VEC_14

14 Mv electrons,
30 degree bevel,
8 x 12 cm cone,
100 cm SSD.

Vector scan angle:
Perp. = 0 deg to water surface, dashed line.
Vec. = -30 deg to water surface, solid line.

	Rp (mm)	d50 (mm)	Eo (MeV)
Perp.	55.39	39.96	9.33
Vec.	63.31	45.49	10.62

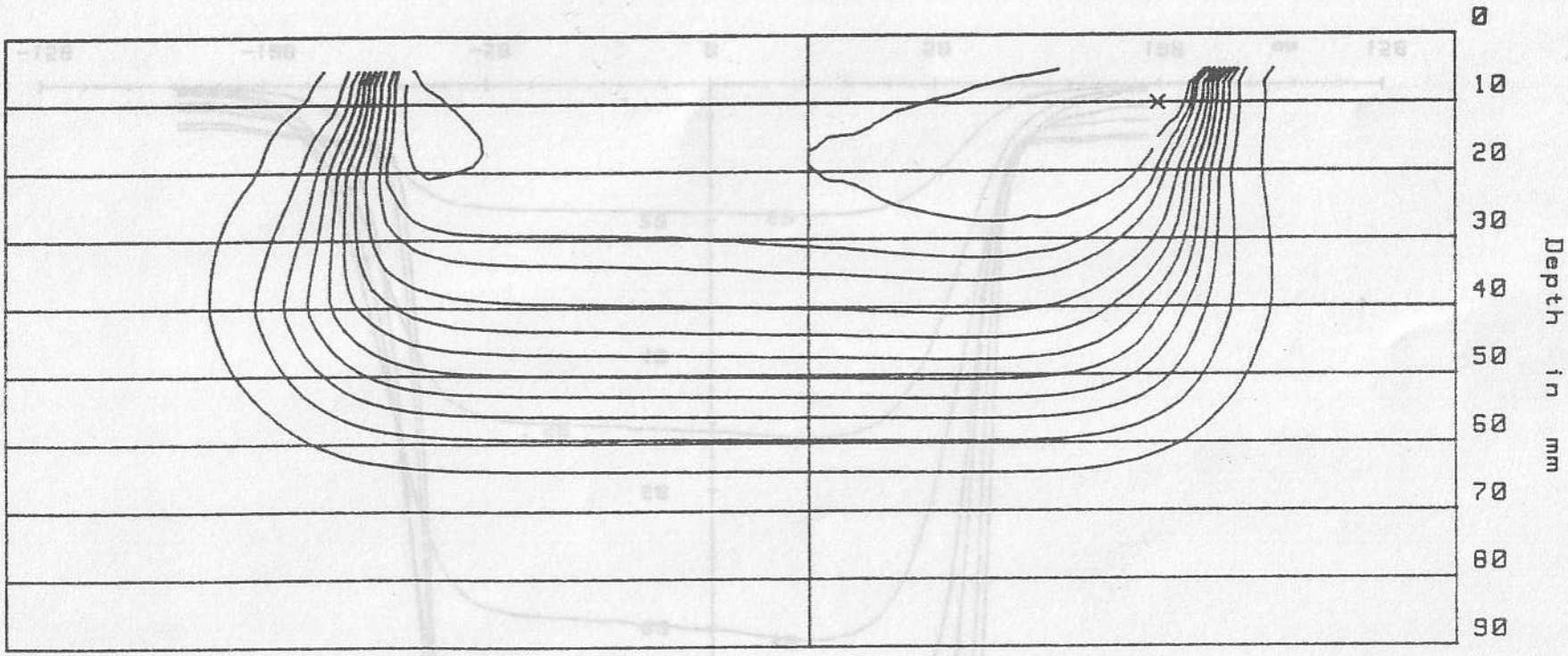


DATA FILE: VEC_20

20 Mv electrons,
30 degree bevel,
8 x 12 cm cone,
100 cm SSD.

Vector scan angle:
Perp. = 0 deg to water surface, dashed line.
Vec. = -30 deg to water surface, solid line.

	Rp (mm)	d50 (mm)	Eo (MeV)
Perp.	83.28	66.08	14.32
Vec.	94.80	68.45	16.08



ISODOSES IN % : 100 95 90 80 70 60 50 40 30 20 10

15 MEV ELECTRONS, FIELD 8 CM X 12 CM, SSD 100 CM

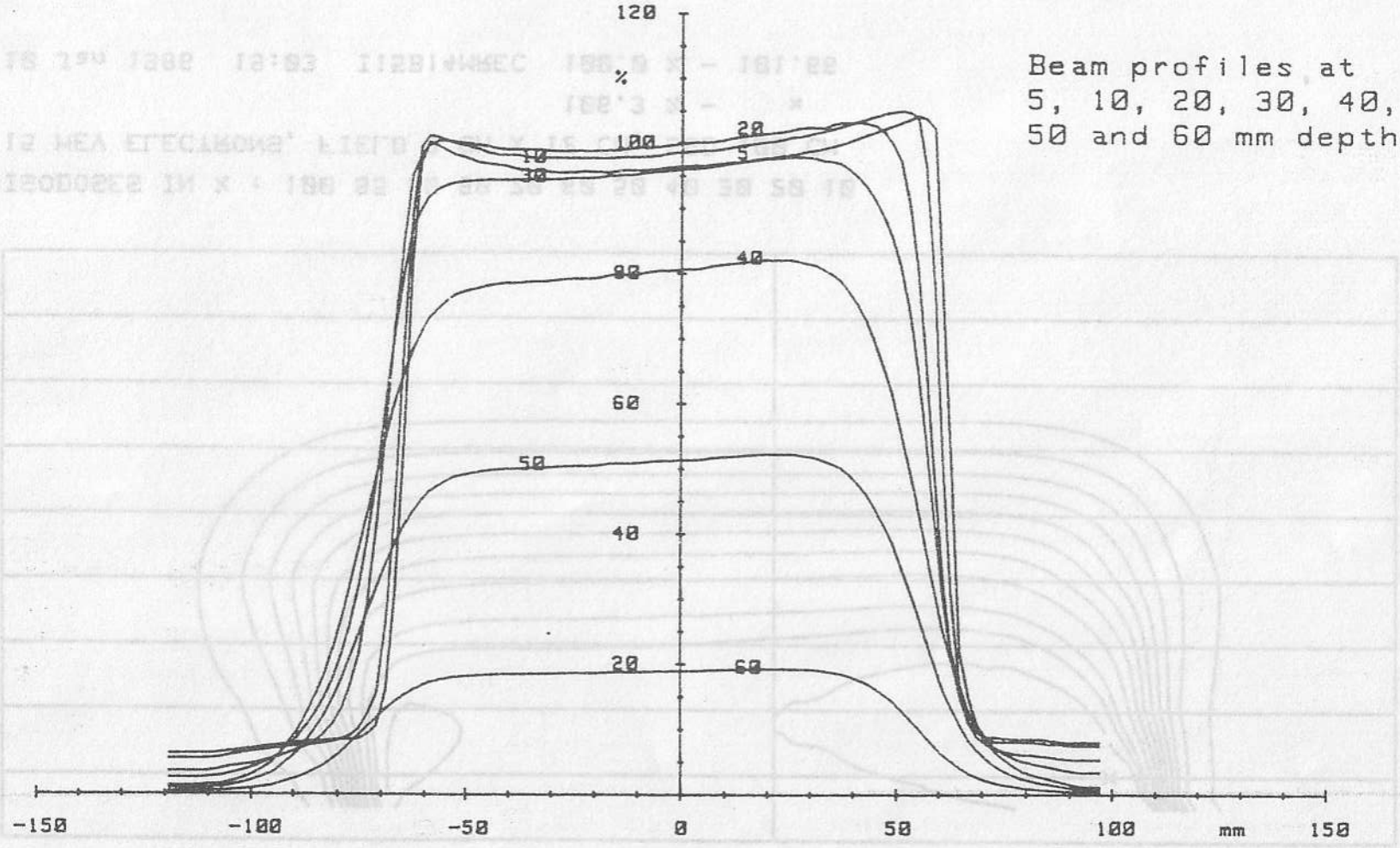
106.3 % - x

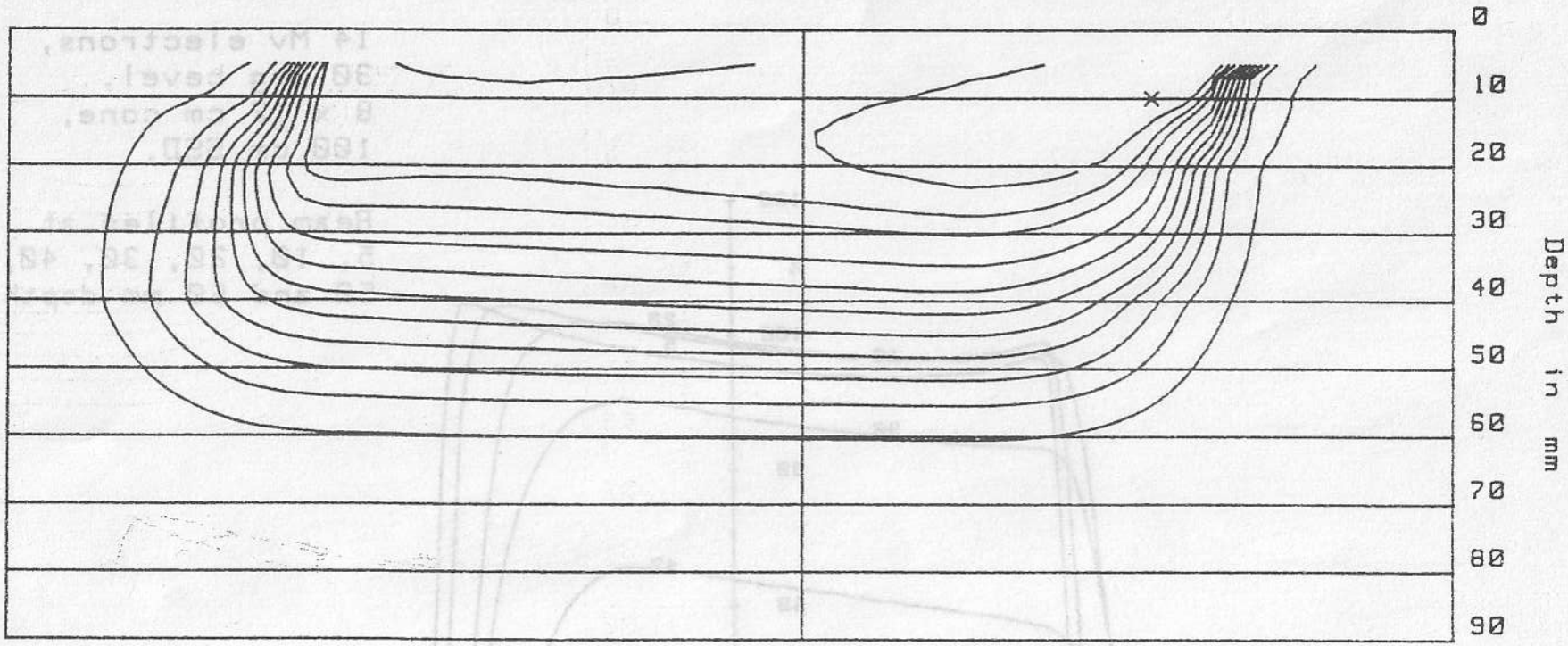
10 Jan 1986 19:03 I15B14MREC 100.0 % - 101.66

DATA FILES: I15B14MREC

14 Mv electrons,
15 deg bevel,
8 x 12 cm cone,
100 cm SSD.

Beam profiles at
5, 10, 20, 30, 40,
50 and 60 mm depths.





ISODOSES IN % : 100 95 90 80 70 60 50 40 30 20 10

15 MEV ELECTRONS, FIELD 8 CM X 12 CM, SSD 100 CM

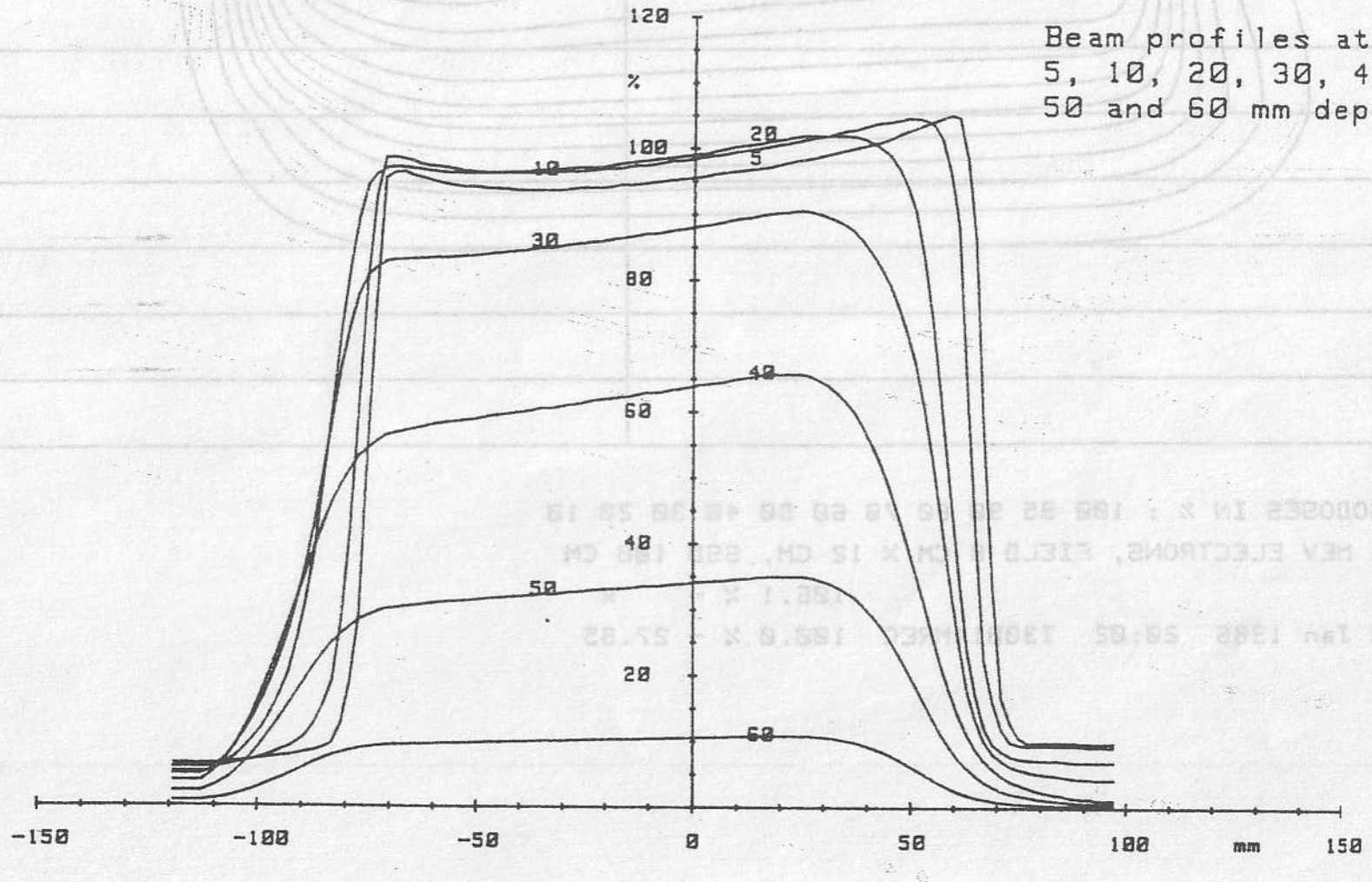
106.1 % - x

10 Jan 1986 20:02 I30B14MREC 100.0 % - 27.65

DATA FILES: I30B14MREC

14 Mv electrons,
30 deg bevel,
8 x 12 cm cone,
100 cm SSD.

Beam profiles at
5, 10, 20, 30, 40,
50 and 60 mm depths.



ANALYSIS:

Since CAX represents the true path length of electrons, and

$$\text{COS(bevel)} = \frac{\text{perpendicular distance}}{\text{slant distance}}$$

where "bevel" is the angle of the cone with the water surface.

Then for a 30 degree beveled cone:

$$\text{COS(30)} = \frac{\text{Rp - perpendicular scan}}{\text{Rp - slant scan}}$$

06 Mv: $\frac{22.73}{26.62} = .854$

14 Mv: $\frac{55.39}{63.31} = .875$

20 Mv: $\frac{83.28}{94.80} = .878$

ave. = .869

COS(30) = .866

$$\% \text{ ERROR} = \frac{|.869 - .866|}{.866} \times 100$$

$$= 0.3\ \%$$

CONCLUSIONS:

By comparing the ratio of Rp-perpendicular to Rp-vector it is readily apparent that the the central axis data for beveled electron cones is a function of angle. Hence, electron depth-dose or depth-ionization data should only be collected along the true beam axis.

ACKNOWLEDGEMENT:

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1 - BeamScan^{tm}, PTW/Nuclear Associates, division of Victoreen, Carle Place, New York.

2- Mick Radio-Nuclear Instruments, Inc., Bronx, New York.