Copied From Los Alamos National Laboratory Archives

Logged 712922 Bradbury

REPOSITORY LANL/ARC
COLLECTION MP-DO
BOX No. A-91-011
FOLDER 85-2

CANCER RESEARCH AND TREATMENT CENTER
Biomedical Physics

DATE: June 2, 1976

TO: LAMPF Biomedical Channel Users

FROM: Alfred R. Smith ARS

SUBJECT: Pion dose calculations

Effective immediately all patient doses will be calculated using pion parameters in the Bragg-Gray equation:

$$D = \frac{100\ Q(W/e)S}{M \cdot K}$$

D = dose to muscle (rads)

Q = collected ionization charge (coulombs)

W = energy required to produce ion pair in gas (joules)

e = electronic charge (coulombs)

S = average mass stopping power ratio (wall/gas) for secondary particles.

M = mass of gas (kilograms)

K = kerma correction (plastic/muscle)

The pion parameters are:

	Constant	Air	TE Gas
Peak:	W/e	34.9	30.1
	S_g^W	1.09	1.006
	K_π	1.09	

FILE BARCODE
00133505

COPIED FOR HSPT

00133505.001

1087647

	Constant	Air	TE Gas
Plateau:	W/e	34.5	29.6
	S_g^w	1.059	0.994
	K_π	1.02	

The corresponding cobalt-60 parameters are:

Constant	Air	TE Gas
W/e	33.73	29.1
S_g^w	1.146	1.001
K_γ	0.998	

All parameters are valid only for chambers which have walls made of shonka A-150 TE plastic. The mass of gas for all chambers has been calibrated for TE gas and is given in my memo of April 16, 1976. The gasing conditions must remain constant at a flow rate of approximately 5 cc/min. The collected ionization charge (Q) must be corrected for temperature and pressure referenced to 760 mm Hg pressure and 22°C temperature (273.15°K).

The relationships between the pion dose and the dose assuming that the collected charge came from cobalt-60 gamma rays are:

Peak:	Air gas	$D_\pi = 0.90\ D_\gamma$
	TE gas	$D_\pi = 0.95\ D_\gamma$
Plateau:	Air gas	$D_\pi = 0.92\ D_\gamma$
	TE gas	$D_\pi = 0.99\ D_\gamma$

COPIED FOR
HSPT

1087648

00133505.002

It is understood that the pion parameters may vary with field size, momentum, etc. but the changes should lie well within the uncertainties in the calculated dose which is about 10%. I recommend that people responsible for dosimetry for radiobiology experiments adopt the patient dose calculation parameters so that the two can be related or at least always state the result of experiments in the patient dose scheme as well as in "cobalt-60 equivalent rads". I personally feel that "cobalt-60 equivalent rads" is a bad choice of units because it implies that an RBE of cobalt-60 versus pions has been factored into the dose.

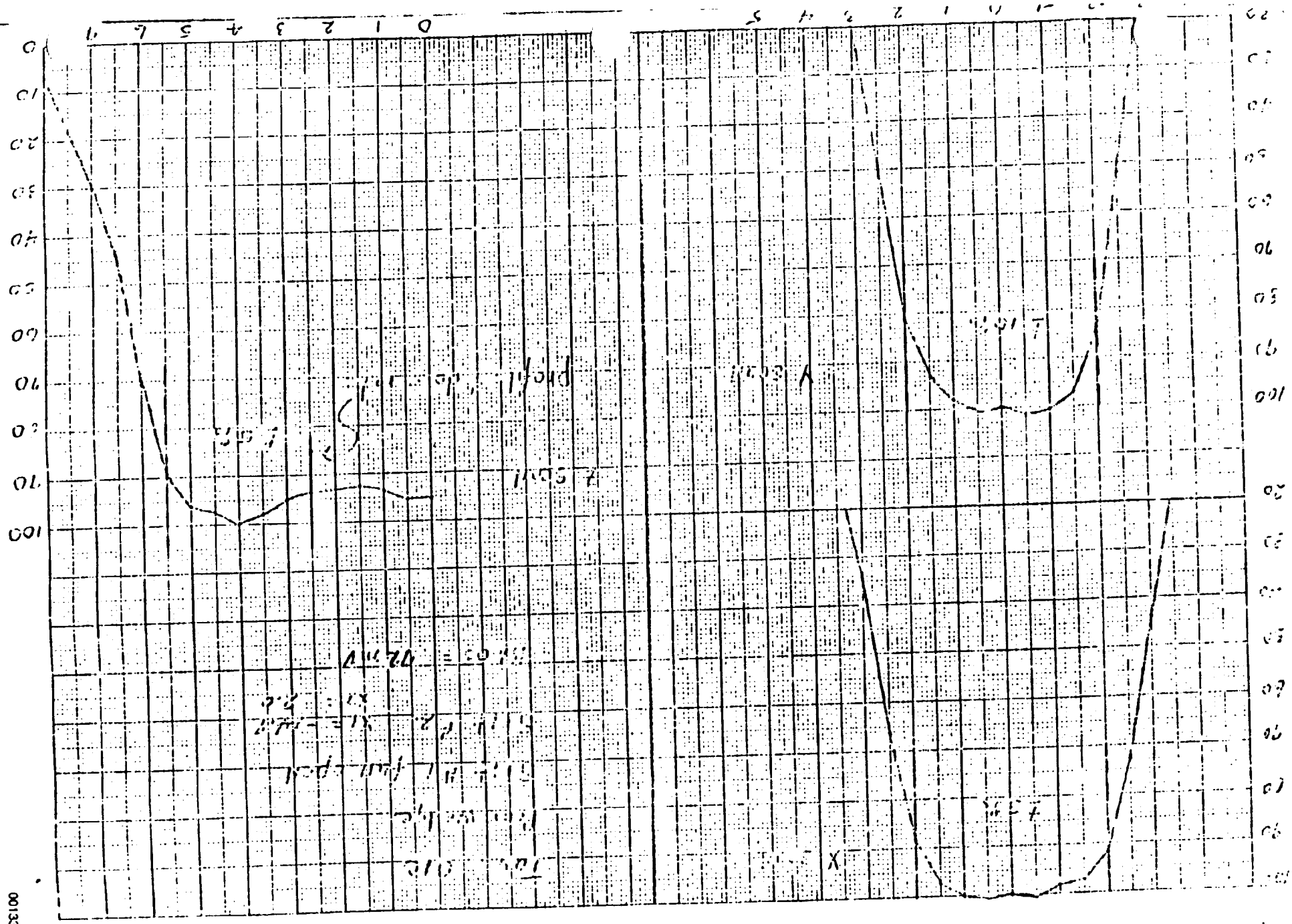
ARS/jo

Dist: Kligerman
Kelsey
Lane
Rosen
Knapp
Bradbury
Dicello
Amols

COPIED FOR
HSPT

00133505.003

1087649



1087650

00133505.004

COPIED FOR
HSPT

[illegible]

X1 = -14.7, X2 = 2.0, [illegible]

Z		C		Z'		%	X	C	%	[illegible]	[illegible]	[illegible]
-.5		[illegible]		0		95.7	-5	[illegible]	[illegible]	-5	[illegible]	[illegible]
0		[illegible]		.5		[illegible]	-4.5	99	5.7	-4.5	[illegible]	1.7
.5		[illegible]		1.0		[illegible]	-4.0	[illegible]	10.7	-4	[illegible]	[illegible]
1.0		[illegible]		1.5		92.5	-3.5	[illegible]	17.7	[illegible]	[illegible]	[illegible]
1.5		[illegible]		2.0		93.1	-3.0	749	44.1	-3	[illegible]	17.9
2.0		[illegible]		2.5		[illegible]	-2.5	1236	72.8	[illegible]	[illegible]	[illegible]
2.5		[illegible]		[illegible]		[illegible]	-2.0	[illegible]	91.5	[illegible]	[illegible]	[illegible]
3.0		[illegible]		[illegible]		[illegible]	-1.5	1651	[illegible]	[illegible]	[illegible]	[illegible]
3.5		[illegible]		[illegible]		10.0	-1.0	1639	[illegible]	-1	[illegible]	[illegible]
4.0		[illegible]		[illegible]		[illegible]	-.5	1717	101.1	-.5	[illegible]	[illegible]
4.5		[illegible]		5.0		[illegible]	0	[illegible]	100	0	[illegible]	[illegible]
5.0		[illegible]		[illegible]		[illegible]	.5	[illegible]	102.1	.5	[illegible]	[illegible]
5.5		[illegible]		6.0		[illegible]	1.0	[illegible]	[illegible]	1.0	[illegible]	[illegible]
6.0		[illegible]		6.5		[illegible]	1.5	[illegible]	97.6	1.5	[illegible]	[illegible]
6.5		512		7.0		[illegible]	2.0	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
7.0		356		7.5		[illegible]	2.5	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
							3.0	569	[illegible]	[illegible]	[illegible]	[illegible]
							3.5	[illegible]	12.7	[illegible]	[illegible]	[illegible]
							4.0	[illegible]	5.8	[illegible]	[illegible]	[illegible]
							4.5	[illegible]	4.9	[illegible]	[illegible]	[illegible]
							5.0	96	4.6	[illegible]	[illegible]	[illegible]

COPIED FOR HSPT

00133505.005

1087651