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High-Energy Photon Standard Dosimetry Data: A Quality Assurance Tool

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This investigation was supported by PHS grant CA10953 awarded by the NCI, DHHS.

RPC Radiological Physics Center
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Introduction

The Radiological Physics Center (RPC), through its on-site dosimetry reviews at institutions participating in NCI cooperative clinical trials, has accumulated high-energy photon dosimetry data for over 2350 photon beams. The measured values for percent depth dose, output factors, in-air off axis factors, wedge factors and tray factors have been collated for 81 different accelerator model/energy combinations for which we have 5 or more sets of measurements. For 56 of these combinations we have measurements on ten or more machines. The wedge and tray data come from 1087 Varian, Siemens and Philips/Elekta accelerators since 1985 and 343 tray transmission measurements since 1995. The data analyses indicate that for accelerator models of recent design the dosimetry data for a particular model/energy combination typically are within ±2%. There is a larger spread in the data for the older models. A comparison of the RPC measured depth dose data with published depth dose data is presented with recommendations on which published data best represent each accelerator model/energy combination. The RPC "standard data" is defined as the mean value of 5 or more sets of dosimetry data or agreement with the published depth dose data (within 2%) for each model/energy combination. The RPC standard data can be used as a quality assurance tool to assist the Medical Physicist when commissioning an accelerator or identifying questionable dosimetry data.

Materials and Methods

Measurements were made on a series of Varian, Siemens and Elekta/Philips accelerators. The make and models of those listed here reflect those in current use and most often seen by the RPC.

1. Varian – Clinac 4/80, 4/100, 6/100, 6, 600C, 18, 1800, 20, 2100C, 21EX, 2300C, and 2500

2. Siemens – Mevatron 6, 12, 20, 60, 63, 64, 67, 6740, 74, 77, KD series, MD series, MX series, and Primus

3. Elekta/Philips – SL 75-5, 18, 20 and 25

   Nominal energies from 4-25 MV, wedge angles from 15° – 60°, thin and thick trays

Materials and Methods

The RPC tray transmission factor (TF) is defined as:

$$TF\,(10 \text{ x } 10, 5^* \text{ cm}) = \frac{\text{tray ionization } (10 \text{ x } 10, 5 \text{ cm})}{\text{open ionization } (10 \text{ x } 10, 5 \text{ cm})}$$

The RPC wedge transmission factor (WTF) is defined as:

$$\text{WTF}\,(10 \text{ x } 10, 5^* \text{ cm}) = \frac{\text{wedged ionization } (10 \text{ x } 10, 5 \text{ cm})}{\text{open ionization } (10 \text{ x } 10, 5 \text{ cm})}$$

At 100 cm SSD/SAD in a water phantom. The WTF's ionization readings are averaged over heel-in and heel-out wedge orientations (if applicable) and centering of ion chamber is assured by measurements in multiple collimator orientations.

*For energies>15 MV, depth is 7 cm and after 1/2000 for all energies, depth is 10 cm.

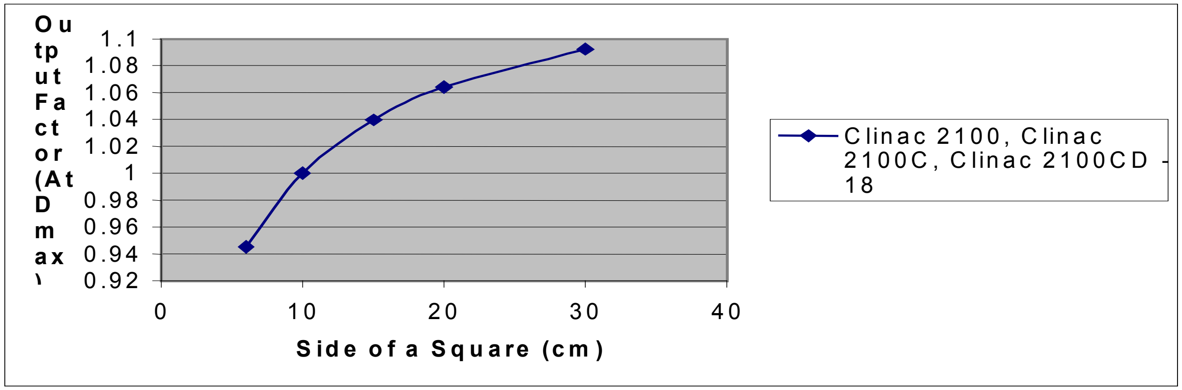
Output factors and In air off axis factors

- OPF DATA -

MACHINE: Clinac 2100, Clinac 2100C, Clinac 2100CD - 18

ENERGY: 18 MV

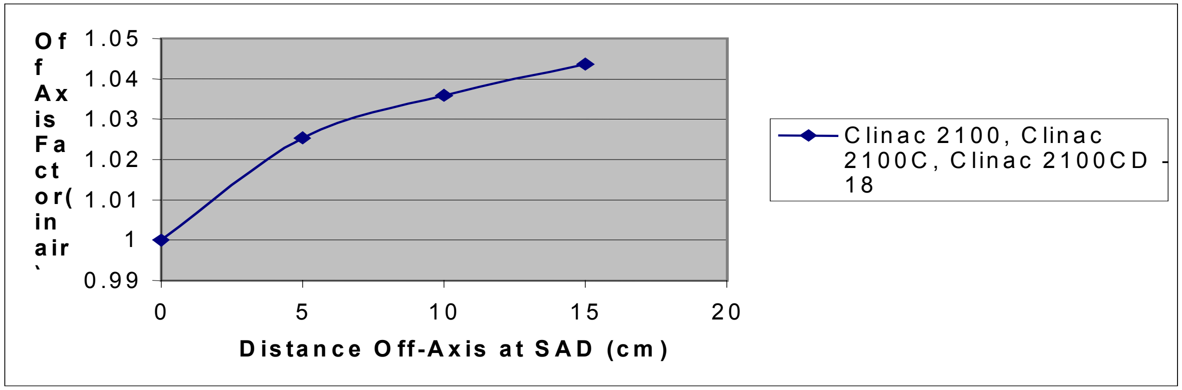
FIELD_SIZE	N	At Dmax MIN	MAX	MEAN	STD_DEV	(%)
6	115	0.9401	0.9564	0.945	0.0041	0.0043
10	154	1	1	1	0	0
15	147	1.0208	1.059	1.0398	0.0058	0.0056
20	152	1.0386	1.1108	1.0641	0.0087	0.0082
30	142	1.0554	1.1249	1.0923	0.0103	0.0095



IN-AIR OFF-AXIS FACTORS

ENERGY: 18 MV
DISTANCE: 100 cm

DISTANCE_OAF	N	MIN	MAX	MEAN	STD_DEV	(%)
0	1	1	1	1	0	0
5	146	1.006	1.048	1.0253	0.0072	0.007
10	146	1.01	1.056	1.0359	0.0087	0.0084
15	142	1.01	1.071	1.0436	0.0123	0.0118

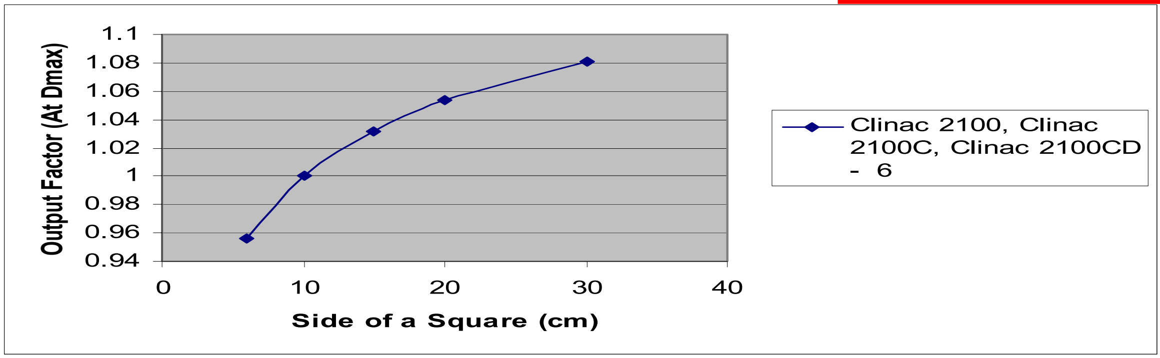


- OPF DATA -

MACHINE: Clinac 2100, Clinac 2100C, Clinac 2100CD - 6

ENERGY: 6 MV

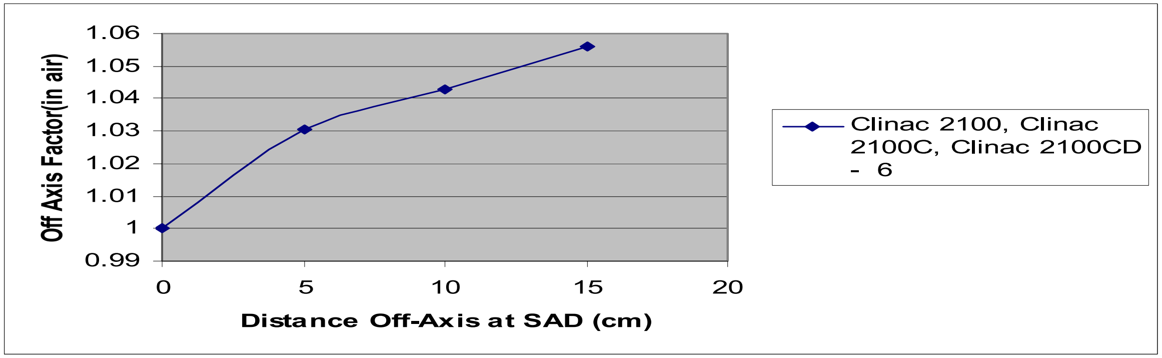
FIELD_SIZE	N	At Dmax MIN	MAX	MEAN	STD_DEV	(%)
6	231	0.9418	0.9712	0.9565	0.0049	0.0051
10	237	1	1	1	0	0
15	224	1.012	1.0605	1.032	0.0052	0.0051
20	232	1.017	1.099	1.0533	0.0071	0.0068
30	221	1.031	1.1502	1.0807	0.0097	0.009



IN-AIR OFF-AXIS FACTORS

ENERGY: 6 MV
DISTANCE 100 cm

DISTANCE_OAF	N	MIN	MAX	MEAN	STD_DEV	(%)
0	1	1	1	1	0	0
5	223	1.001	1.049	1.0306	0.0072	0.0069
10	223	1.015	1.082	1.0428	0.0098	0.0094
15	217	1.007	1.117	1.0561	0.0154	0.0146



Depth Dose Data

Machine	Energy	Data Sets	Max RPC Std. DeV.	"Best Fit" Published Data	Range of RPC/Rec.
Clinac 2100	4	6	1.1%	BJR #17, 4 MV[4]	-1.6% - 1.0%
Clinac 600	4	7	2.2%	Biggs[2]	-0.3% - 0.7%
Clinac 4	4	248	1.6%	Peterson & Golden[1]	0.0% - 0.7%
Clinac 4/100	4	44	1.6%	Biggs[2]	-0.8% - 0.7%
Clinac 4 U/80	4	6	1.2%	U Filter report	0.1% - 1.4%
EMI 400	4	6	1.2%	?	
SHM 4	4	18	1.9%	BJR #11, 4 MV[3]	-0.9% - 1.5%
SHM 400	4	7	1.3%	BJR #17, 4 MV[4]	-1.5% - 0.9%
Clinac 1800	6	101	0.8%	Barnes[5]	-0.4% - 0.7%
Clinac 2100	6	237	0.8%	Barnes[5]	-0.6% - 0.6%
Clinac 2100EX	6	14	0.7%	Fontenla[6]	-0.9% - -0.1%
Clinac 2300	6	26	0.8%	Barnes[5]	-0.2% - 0.9%
Clinac 2500	6	24	1.1%	Barnes[5]	-0.3% - 1.0%
Clinac 6	6	63	2.3%	Fontenla[6]	-0.8% - 0.0%
Clinac 6/100	6	192	1.3%	Coffey[7]	-0.6% - 1.3%
			or	*U. of Pennsylvania*	-0.4% - 0.6%
Clinac 600C	6	74	1.0%	Fontela[6]	-1.3% - 0.2%
Clinac 6X	6	16	1.7%	Dixon[8]	-1.0% - 0.6%
Mevatron 6	6	40	2.0%	BJR #11, 6 MV[3]	-1.2% - 0.2%
Mevatron 6700/6740	6	51	1.2%	BJR #11, 6 MV[3]	-0.7% - 0.3%
Primus	6	15	0.7%	Al-Ghazi[9]	-0.3% - -1.6%
			or	*U. of North Carolina*	-1.4% - 0.0%
Mevatron MXE	6	5	0.8%	Al-Ghazi[9]	-1.4% - 0.2%
			or	*U. of North Carolina*	-0.8% - 0.4%
Mevatron MX	6	5	0.5%	Al-Ghazi[9]	-0.9% - 1.2%
			or	*U. of North Carolina*	-0.6% - 0.7%
Mevatron KD	6	69	0.8%	Al-Ghazi[9]	-0.9% - 0.3%
Mevatron MD	6	46	1.0%	Al-Ghazi[9]	-1.5% - -0.1%
			or	*U. of North Carolina*	-0.9% - 0.4%
Saturn	6	5	1.5%	BJR #17, 6 MV[4]	-0.7% - 1.8%

SL18	6	9	0.9%	BJR #11, 6 MV[3]	-0.8% - 0.5%
SL20	6	16	1.5%	BJR #11, 6 MV[3]	-0.3% - 0.7%
			or	Palta[13]	-1.0% - -0.2%
SL25	6	23	1.6%	Palta[14]	-0.6% - 0.2%
SL75	6	18	1.7%	BJR #11, 6 MV[3]	-0.4% - 0.6%
Therac 6	6	26	1.1%	BJR #11, 6 MV[3]	-0.4% - 1.3%
SL75	8	18	1.3%	BJR #17, 8 MV[4]	-0.1% - 1.7%
			better	*Clatterbridge*	-0.5% - 0.3%
Clinac 18	10	126	0.9%	Purdy[10]	-0.3% - 0.0%
Clinac 1800	10	23	0.5%	Findley[11]	-0.5% - 0.7%
			or	*Mayo Scottsdale*	0.0% - 0.4%
Clinac 2100	10	48	0.7%	Findley[11]	-0.7% - 0.3%
			or	*Mayo Scottsdale*	-0.2% - 0.2%
Mevatron 12	10	30	1.1%	No published data, but	
	wrong manufacturer			Purdy[10]	-0.3% - 0.5%
Mevatron 74	10	37	0.6%	Keller[12]	-0.7% - 0.7%
Mevatron KD	10	5	0.4%	Keller[12]	0.4% - 1.1%
Mevatron MD	10	20	0.9%	Keller[12]	-0.3% - 0.9%
Clinac 1800	15	17	0.6%	BJR #17, 16 MV[4]	-1.0% - 0.4%
			or	*U. of Cleveland*	-0.5% - 0.9%
Clinac 2100	15	36	0.4%	BJR #17, 16 MV[4]	-0.9% - 0.9%
			or	*U. of Cleveland*	-0.1% - 1.0%
Clinac 2100EX	15	6	0.4	BJR #17, 16 MV[4]	-1.2% - 0.6%
			or	*U. of Cleveland*	-0.5% - 0.8%
Clinac 20	15	27	1.0%	BJR #17, 16 MV[4]	-1.4% - 0.7%
			or	*U. of Cleveland*	-0.5% - 0.7%
Mevatron 77	15	13	0.7%	BJR #17, 16 MV[4]	-0.2% - 1.4%
Mevatron KD	15	17	0.4%	BJR #17, 16 MV[4]	-0.6% - 1.0%
			or	*U. of North Carolina*	0.1% - 0.9%
Mevatron MD	15	23	0.7%	BJR #17, 16 MV[4]	-1.1% - 0.8%
			or	*U. of North Carolina*	0.0% - 0.3%
Mevatron 20	15	5	0.6%	BJR #17, 16 MV[4]	-0.1% - 1.6%
SL75	16	5	0.5%	BJR #17, 16 MV[4]	-0.9% - 0.6%
SL18	15	5	1.2%	BJR #17, 16 MV[4]	-1.6% - 0.4%
Clinac 1800	18	59	0.4%	BJR #17, 21 MV[4]	-0.4% - 0.8%
Clinac 2100	18	154	0.3%	BJR #17, 21 MV[4]	-0.5% - 0.8%
Clinac 2300	18	6	0.4%	BJR #17, 21 MV[4]	0.1% - 1.5%
Clinac 20	18	22	0.6%	BJR #17, 21 MV[4]	-0.6% - 0.5%

Mevatron KD	18	14	1.2%	Al-Ghazi[9]	-1.0% - 0.0%
Primus	18	10	0.3%	BJR #17, 16 MV[4]	0.2% - 1.1%
Mevatron 77	18	7	1.2%	Palta[13]	-0.6% - 0.5%
SL20	18	12	0.8%	BJR #17, 21 MV[4]	-0.9% - 0.4%
Therac 20	18	28	0.5%	?	
Mevatron KD	20	8	0.6%	Palta[13]	-0.3% - 0.3%
Clinac 2300	20	8	0.6%	BJR #17, 25 MV[4]	0.1% - 1.6%
Mevatron KD	23	23	0.4%	BJR #17, 16 MV[4]	-0.5% - 1.1%
Clinac 2500	24	24	0.3%	Banes[5]	-1.4% - 0.0%
SL25	25	19	0.6%	Palta[14]	-0.3% - 0.1%
Therac 25	25	14	0.4%	Aldrich[15]	-0.5% - 0.5%

Italics indicate that the recommended data is not published or is for a different manufacturer.

Standard Data References

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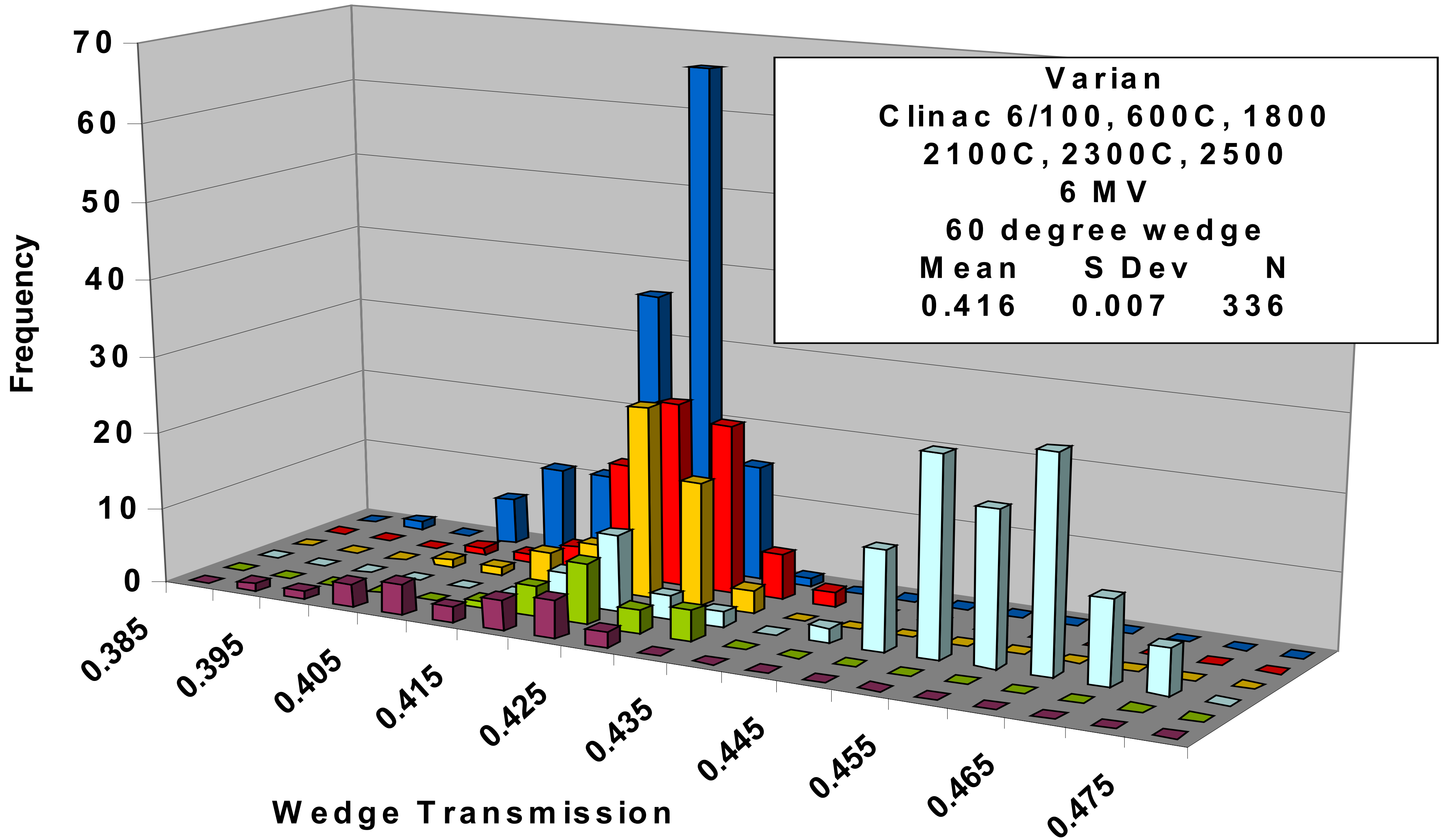
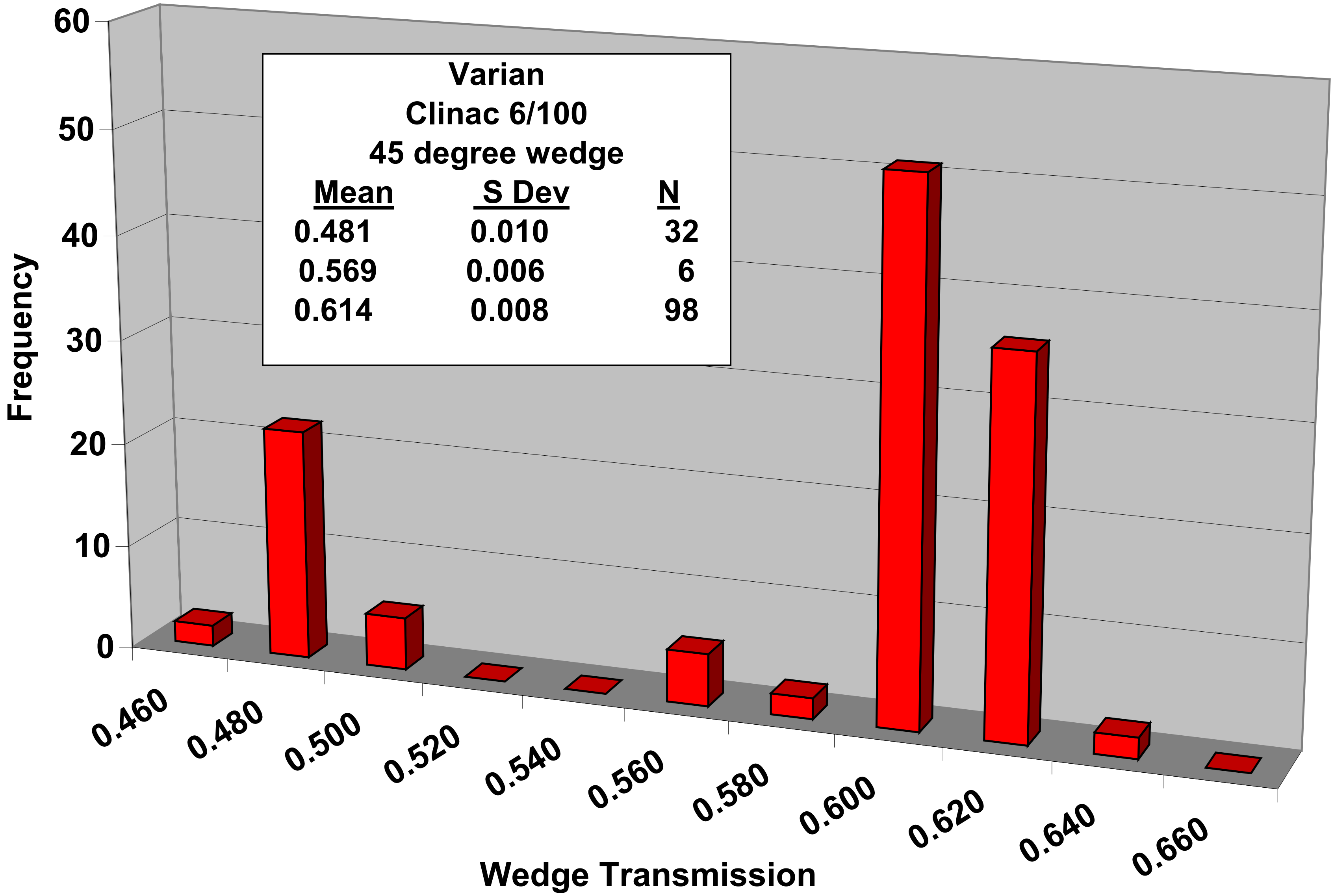
Wedge Factors



Wedge Factors



Wedge Factors

Table I: Standard wedge Transmission Values for Varian Accelerators

					15 deg wedge			30 deg wedge			45 deg wedge			60 deg wedge		
Machine Model	Energy	%dd(10)$_x$	Std Dev	N	WTF	Std Dev	N	WTF	Std Dev	N	WTF	Std Dev	N	WTF	Std Dev	N
CI 4	4 MV	62.6	0.9	90	0.795	0.006	21	0.755	0.009	77	0.578	0.012	89	0.489	0.011	78
CI 4/100	4 MV	63.6	0.6	31	0.776 0.805	0.008 0.006	7 16	0.736 0.764	0.004 0.006	6 16	0.495 0.589	0.011 0.005	10 16	0.491	0.012	15
CI 600C	4 MV	63.7	0.5	8	0.769	0.011	4	Insufficent Data			0.477	0.004	5	0.394	0.008	5
CI 6, CI 6X	6 MV	66.5	1.2	38	0.780 0.827 0.873	0.008 0.003 0.004	3 8 6	0.627 0.777	0.003 0.009	5 17	0.617 0.651	0.008 0.008	9 11	0.425 0.459	0.004 0.008	4 26
CI 6/100	6 MV	66.3	0.6	140	0.780 0.823	0.002 0.006	9 80	0.643 0.704 0.783	0.015 0.005 0.007	27 4 78	0.481 0.569 0.614	0.010 0.006 0.008	32 6 98	0.418 0.455	0.005 0.009	24 110
CI 600C	6 MV	66.6	0.5	66	0.708 0.780	0.002 0.002	8 27	0.545 0.631	0.003 0.004	8 37	0.499	0.007	62	0.418	0.005	54
CI 18	10 MV	73.7	0.5	63	0.892	0.007	45	0.752 0.803	0.009 0.005	8 50	0.696	0.007	20	0.511	0.005	56
CI-1800	6 MV	68.7	2.4	89	0.788	0.013	49	0.638 0.706	0.006 0.009	52 9	0.485 0.572	0.006 0.008	72 13	0.419	0.006	74
CI-1800	10 MV	74.4	0.3	16	0.814 0.850	0.004 0.004	6 5	0.681 0.751	0.002 0.005	6 4	0.536 0.626	0.006 0.007	10 6	0.451	0.003	13
CI-1800	15 MV	77.1	0.2	18	0.824	0.003	12	0.697	0.003	12	0.556	0.003	15	0.449	0.006	15
CI-1800	18 MV	80.6	0.2	52	0.830	0.004	25	0.706	0.004	28	0.514 0.570 0.652	0.010 0.004 0.007	7 40 5	0.443	0.006	43
CI-20	15 MV	76.8	0.7	20	0.854	0.004	10	0.758	0.004	11	0.642	0.006	17	0.452	0.004	14
CI-20	18 MV	80.0	0.4	14	0.859	0.002	10	0.767	0.003	10	0.650	0.003	13	0.442	0.007	14

Machine Model	Energy	$\%dd(10)_x$	Std Dev	N	15 deg wedge			30 deg wedge			45 deg wedge			60 deg wedge		
					WTF	Std Dev	N	WTF	Std Dev	N	WTF	Std Dev	N	WTF	Std Dev	N
CI-2100, CI-2100 C, 2100 CD	4 MV	62.1	1.0	19	0.664	0.003	2	0.490	0.004	2	0.432	0.009	6	0.357	0.005	5
CI-2100, CI-2100 C, 2100 CD	6 MV	67.4	0.4	180	0.711	0.004	14	0.547	0.003	6	0.493	0.009	178	0.414	0.006	147
					0.783	0.007	53	0.632	0.008	94	0.507	0.006	24			
CI-2100 CI-2100 C, 2100 CD	10 MV	73.9	0.3	38	0.751	0.002	3	0.602	0.002	3	0.530	0.006	34	0.448	0.005	23
					0.813	0.002	16	0.680	0.003	16						
CI-2100 CI-2100 C, 2100 CD	15 MV	77.3	0.2	28	0.820	0.008	18	0.692	0.008	23	0.527	0.004	23	0.445	0.007	24
											0.554	0.003	5			
CI-2100 CI-2100 C, 2100 CD	18 MV	80.4	0.9	110	0.768	0.003	12	0.629	0.002	15	0.521	0.005	88	0.439	0.006	92
					0.827	0.006	42	0.703	0.005	54	0.566	0.003	19			
CI-21EX	6 MV	66.4	0.2	31	Insufficent Data			Insufficent Data			0.490	0.004	19	0.405	0.004	18
CI-21EX	15 MV	78.0	0.4	15	Insufficent Data			Insufficent Data			0.523	0.002	7	0.434	0.001	7
CI-21EX	18 MV	82.0	0.2	6	Insufficent Data			Insufficent Data			0.516	0.001	6	0.427	0.001	6
CI-2300 CI-2300C, 2300 CD	6 MV	67.4	0.4	35	0.773	0.007	12	0.625	0.008	15	0.493	0.012	33	0.408	0.010	22
CI-2300 CI-2300C, 2300 CD	15 MV	77.4	0.3	10	0.813	0.005	6	0.684	0.005	6	0.531	0.014	9	Insufficient Data		
CI-2300 CI-2300C, 2300 CD	18 MV	80.5	0.2	15	Insufficent Data			0.700	0.005	6	0.519	0.003	8	0.430	0.010	10
CI-2500, 2500C	6 MV	67.6	0.5	23	0.783	0.004	11	0.635	0.005	12	0.489	0.006	13	0.419	0.005	20
					0.821	0.003	6	0.709	0.005	7	0.577	0.005	8			
CI-2500, 2500C	24 MV	84.4	0.3	22	0.832	0.005	11	0.710	0.004	11	0.508	0.004	5	0.428	0.004	19
					0.861	0.004	6	0.770	0.006	7	0.578	0.003	7			
											0.658	0.006	9			

Table 2: Standard wedge Transmission Values for Siemens Accelerators

					15 deg wedge			30 deg wedge			45 deg wedge			60 deg wedge		
Machine Model	**Energy**	**%dd(10)$_x$**	**Std Dev**	**N**	**WTF**	**Std Dev**	**N**	**WTF**	**Std Dev**	**N**	**WTF**	**Std Dev**	**N**	**WTF**	**Std Dev**	**N**
Mev 12	8 MV	71.7	0.8	6	Insufficent Data			Insufficent Data			0.694	0.007	5	Insufficent Data		
Mev 12	10 MV	74.1	0.8	13	Insufficent Data			0.719	0.004	9	0.696	0.008	11	0.685	0.005	12
Mev 20	15 MV	78.1	0.5	5	Insufficent Data			Insufficent Data			0.640	0.006	5	0.611	0.004	5
Mev 6	6 MV	67.3	0.9	13	Insufficent Data			0.684	0.009	12	0.636	0.008	3	Insufficent Data		
Mev 60, 63, 64	4 MV	61.9	1.6	9	0.705	0.003	6	0.638	0.007	3	0.513	0.006	6	0.481	0.005	5
Mev 67, 6740	6 MV	67.6	0.6	43	0.685 0.742	0.004 0.005	5 20	0.523 0.714	0.005 0.005	5 25	0.317 0.563	0.007 0.005	11 31	0.350 0.535	0.003 0.006	5 29
Mev 74, 77	10 MV	74.7	0.6	33	0.782	0.002	19	0.757	0.003	25	0.388 0.620	0.007 0.003	5 28	0.592	0.004	26
Mev 77	15 MV	78.0	0.3	12	0.794	0.002	10	0.770	0.003	11	0.637	0.005	12	0.608	0.004	10
Mev 77	18 MV	80.8	0.4	7	0.802	0.003	5	0.777	0.002	5	0.647	0.003	6	0.619	0.003	7
Mev KD, KD2, KDS	6 MV	67.6	0.4	179	0.683 0.745	0.004 0.003	13 14	0.520 0.716	0.005 0.004	21 18	0.317 0.565	0.006 0.005	40 24	0.345 0.538	0.008 0.006	34 22
Mev KD, KD2, KDS	10 MV	75.6	0.5	16	0.73	0.001	3	0.581	0.004	4	0.379	0.005	5	0.406	0.007	4
Mev KD, KD2, KDS	15 MV	77.5	0.3	20	0.745 0.795	0.001 0.004	5 5	0.599 0.770	0.003 0.002	7 5	0.397 0.633	0.003 0.002	10 6	0.428 0.611	0.003 0.006	9 6
Mev KD, KD2, KDS	18 MV	78.2	0.8	23	0.741	0.004	2	0.595 0.773	0.005 0.005	3 3	0.401 0.635	0.005 0.002	6 2	0.414 0.433 0.612	0.003 0.002 0.003	2 3 3
Mev KD, KD2, KDS	23 MV	80.5	0.8	55	0.753	0.004	7	0.607 0.778	0.004 0.002	9 3	0.406 0.645	0.005 0.003	17 4	0.426 0.441 0.622	0.002 0.002 0.001	7 9 2
Mev MD, MD2	6 MV	67.4	0.4	112	0.682 0.739	0.005 0.004	11 9	0.521 0.646 0.711	0.006 0.005 0.005	15 3 8	0.316 0.491 0.560	0.006 0.007 0.005	30 3 11	0.344 0.532	0.008 0.005	51 10
Mev MD, MD2	10 MV	75.1	0.5	57	0.731 0.782	0.004 0.004	7 5	0.580 0.698 0.761	0.004 0.001 0.003	8 2 3	0.378 0.551 0.625	0.005 0.003 0.003	13 3 4	0.405 0.428 0.597	0.006 0.004 0.003	12 3 3
Mev MD, MD2	15 MV	77.1	0.5	53	0.742	0.004	4	0.598 0.768	0.008 0.002	8 2	0.394 0.634	0.005 0.004	17 5	0.423 0.607	0.007 0.005	15 5
Mev MX, MX2, MXE	6 MV	67.8	0.5	22	Insufficent Data			Insufficent Data			0.317 0.338	0.007 0.006	5 5	0.346	0.009	5
Primus	6 MV	67.0	0.3	48	0.691	0.003	7	0.528	0.003	7	0.321	0.003	11	0.352	0.004	11
Primus	18 MV	78.8	0.2	31	0.753	0.003	5	0.607	0.001	5	0.404	0.001	6	0.435	0.003	6

Table 3: Standard wedge Transmission Values for Philips Accelerators

Machine Model	Energy	$\%dd(10)_x$	Std Dev	N	60 deg wedge WTF	60 deg wedge Std Dev	60 deg wedge N
SL 18	6 MV	68.0	0.7	7	0.269	0.005	7
SL18	15 MV	77.2	0.8	7	0.283	0.004	7
SL 20	6 MV	68.0	0.8	19	0.271	0.007	13
SL 20	18 MV	79.3	0.4	12	0.279	0.007	11
SL 25	6 MV	68.1	1.0	15	0.270	0.004	14
SL 25	25 MV	83.5	0.3	12	0.268	0.005	13
SL 75-5	6 MV	68.1	0.3	15	0.261	0.010	14

Tray Factors

STANDARD AVERAGE THIN TRAY FACTORS

Machine	Energy	Ave IR	Std Dev IR	Ave TF	std dev	N
Clinac 18	10	0.733	0.005	**0.970**	0.009	6
Clinac 1800	6	0.676	0.006	**0.967**	0.007	16
	10	0.739	0.005	**0.975**	0.009	3
	15	0.760	0.001	**0.980**	0.007	4
	18	0.784	0.002	**0.979**	0.004	10
Clinac 2100C	6	0.674	0.004	**0.966**	0.008	60
	10	0.736	0.004	**0.973**	0.007	12
	15	0.760	0.002	**0.976**	0.007	11
	18	0.783	0.002	**0.978**	0.005	36
Clinac 2300C	6	0.674	0.003	**0.964**	0.008	13
	18	0.774	0.004	**0.980**	0.007	11
Clinac 2500	6	0.678	0.005	**0.972**	0.003	4
	24	0.804	0.002	**0.984**	0.002	4
Clinac 4	4	0.620	0.015	**0.961**	0.007	23
Clinac 6/100	6	0.663	0.006	**0.969**	0.007	18
Clinac 600C	6	0.667	0.005	**0.969**	0.002	10
Mev 67 series	6	0.674	0.005	**0.960**	0.013	10
Mev KD	6	0.675	0.003	**0.959**	0.008	13
	15	0.763	0.004	**0.970**	0.003	4
	18-23	0.782	0.003	**0.978**	0.009	7
Mev MD	6	0.673	0.005	**0.955**	0.006	11
	10	0.746	0.003	**0.966**	0.003	8
	15	0.760	0.003	**0.972**	0.011	3
Philips units	6	0.681	0.017	**0.957**	0.016	29
	15	0.761	0.006	**0.969**	0.004	4
	18-25	0.785	0.010	**0.972**	0.007	13
Theratron 780	Co-60	0.572		**0.942**	0.019	13

Results

- The wedge transmission data for the manufacturer's standard wedges on most makes and models of accelerators exhibit a gaussian distribution with a standard deviation of $\pm$ 2%.

- The distribution of the wedge transmission factor data is often bimodal exhibiting more than one standard factor for each wedge angle.

- Some of the wedge transmission data for differing makes and models of accelerators for a specific manufacturer, dependent on energy and wedge angle, are in good agreement.

- The tray transmission data, is not dependent on make and model of accelerator, but rather the beam energy.

- There appear to be two types of trays in clinical use today; thin and thick trays.

- Accelerators of the same Make/Model/energy combination have the same dosimetric properties in terms of depth dose data and FSD.

Conclusions

1. For each combination of energy, and accelerator make and model, a "standard" percent depth dose, mean output factors, and in-air off axis factors can be assigned.
2. For each combination of nominal wedge angle, energy, and accelerator make and model, a "standard" wedge transmission factor can be assigned.
3. Frequently, there is more than one "standard" wedge transmission factor for a given make and model of accelerator. (The RPC has not captured data to determine whether the different wedges represent different sizes, composition or location of wedges).
4. The same or similar wedges are used on different makes and models of accelerators by the same manufacturer.
5. There are two types of blocking trays in clinical use today, thin and thick trays.
6. These percent depth dose, mean output factors, in-air off axis factors, standard wedge and tray transmission values provide a good redundant check of an institution's own measured values.
7. With few exceptions, these data can be used to predict the percent depth dose, output factors, in-air off axis factors, wedge and tray transmission factors for most wedges and trays in clinical use today to within $\pm$ 2%.