

A revised Gaussian pencil beam model for calculation of the in-water dose caused by clinical electron-beam irradiation

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<http://dx.doi.org/10.14312/2399-8172.2022-1>

Supplementary Table 1 Values of the factors used to rebuild the DD and OAD datasets caused by the direct-plus-indirect electron beams. The DD datasets were obtained from figs. 3(a), 5(a), and 3(d) in the W-K eMC dose work in Ref. (5); and the OAD datasets were similarly obtained from figs. 3(b), 3(c), 5(b), 5(c), 3(e), and 3(f), where the stepped and the dotted DD and OAD curves were yielded, respectively, using (i) the standard eMC simulation and (ii) the commercial TPS. It should be noted that the values of $R_p^{MC}(E)$ to $c_2(E)$ are mainly derived from the DD datasets and only the values of $R_{scale}^{OAD}(Z_c)$ are derived from the OAD datasets.

<i>W-K eMC DD & OAD datasets</i>	<i>E</i>	<i>A_{appl}</i>	<i>SSD_{eff}</i>	<i>R_p^{ICRU}(E)</i>	<i>R_p^{MC}(E)</i>	<i>FAC_{adjust}(E)</i>	<i>Z₁(E)</i>	<i>Z₂(E)</i>	<i>θ₀(E)</i>	<i>W_a(E)</i>
<i>for the direct-plus-indirect electron beams (KK=13-24)</i>	<i>(MeV)</i>	<i>(cm²)</i>	<i>(cm)</i>	<i>(cm)</i>	<i>(cm)</i>	<i>(no unit)</i>	<i>(cm)</i>	<i>(cm)</i>	<i>(rad)</i>	<i>(no unit)</i>
<i>(i) Using the standard eMC (in stepped curves)</i>										
KK=13: fig. 3(b)-OAD (<i>Z_c</i> =1 cm) under fig. 3(a)-DD	6	10 × 10	82.9	2.834	3.364	0.894	1.7	2.5	1.76	0.0942
KK=14: fig. 3(c)-OAD (<i>Z_c</i> =5 cm) under fig. 3(a)-DD	6	10 × 10	82.9	2.834	3.364	0.894	1.7	2.5	1.76	0.0942
KK=15 fig. 5(b)-OAD (<i>Z_c</i> =2 cm) under fig. 5(a)-DD	12	10 × 10/14 × 14	91.5	5.915	6.018	0.878	1.5	4.5	1.56	0.117

KK=16: fig. 5(c)-OAD ($Z_c=10$ cm) under fig. 5(a)-DD	12	$10 \times 10/14 \times 14$	91.5	5.915	6.018	0.878	1.5	4.5	1.56	0.117
KK=17: fig. 3(e)-OAD ($Z_c=3$ cm) under fig. 3(d)-DD	18	10×10	86.9	8.996	8.506	0.779	0.9	9.0	1.55	0.233
KK=18: fig. 3(f)-OAD ($Z_c=15$ cm) under fig. 3(d)-DD	18	10×10	86.9	8.996	8.506	0.779	0.9	9.0	1.55	0.233
<i>(ii) Using the commercial eMC (in Dotted Curves)</i>										
KK=19: fig. 3(b)-OAD ($Z_c=1$ cm) under fig. 3(a)-DD	6	10×10	82.9	2.834	3.364	0.909	1.7	2.5	1.764	0.0716
KK=20: fig. 3(c)-OAD ($Z_c=5$ cm) under fig. 3(a)-DD	6	10×10	82.9	2.834	3.364	0.909	1.7	2.5	1.764	0.0716
KK=21: fig. 5(b)-OAD ($Z_c=2$ cm) under fig. 5(a)-DD	12	$10 \times 10/14 \times 14$	91.5	5.915	6.000	0.887	1.75	4.5	1.62	0.103
KK=22: fig. 5(c)-OAD ($Z_c=10$ cm) under fig. 5(a)-DD	12	$10 \times 10/14 \times 14$	91.5	5.915	6.000	0.887	1.75	4.5	1.62	0.103
KK=23: fig. 3(e)-OAD ($Z_c=3$ cm) under fig. 3(d)-DD	18	10×10	86.9	8.996	8.530	0.795	0.9	9.0	0.163	0.209
KK=24: fig. 3(f)-OAD ($Z_c=15$ cm) under fig. 3(d)-DD	18	10×10	86.9	8.996	8.530	0.795	0.9	9.0	0.163	0.209
<i>W-K eMC DD & OAD datasets</i>										
	$S_c^{eff}(Z_c, E)$	$a_1(E)$	$b_1(E)$	$c_1(E)$	$T_0(Z_c, E)$	$a_2(E)$	$b_2(E)$	$c_2(E)$	$R_{scale}^{OAD}(Z_c)$	
<i>for the direct-plus-indirect electron beams (KK=13-24)</i>	(cm)	(cm)	(no unit)	(no unit)	(cm)	(cm)	(no unit)	(no unit)	(no unit)	
<i>(i) Using the standard eMC (in stepped curves)</i>										
KK=13: fig. 3(b)-OAD ($Z_c=1$ cm) under fig. 3(a)-DD	13.40	3.72E-07	17.40	9.86E-03	3.00	6.17E-31	70.66	6.60E-03	0.988	

KK=14: fig. 3(c)-OAD ($Z_c=5$ cm) under fig. 3(a)-DD	17.70	3.72E-07	17.40	9.86E-03	6.38	6.17E-31	70.66	6.60E-03	0.159
KK=15: fig. 5(b)-OAD ($Z_c=2$ cm) under fig. 5(a)-DD	12.41	1.52E-22	52.45	8.56E-03	2.10	1.28E-37	84.86	1.40E-02	0.979
KK=16: fig. 5(c)-OAD ($Z_c=10$ cm) under fig. 5(a)-DD	25.80	1.52E-22	52.45	8.56E-03	14.8	1.28E-37	84.86	1.40E-02	0.214
KK=17: fig. 3(e)-OAD ($Z_c=3$ cm) under fig. 3(d)-DD	13.20	3.17E-23	53.88	8.50E-03	2.56	9.02E-37	82.75	1.30E-02	0.997
KK=18: fig. 3(f)-OAD ($Z_c=15$ cm) under fig. 3(d)-DD	27.92	3.17E-23	53.88	8.50E-03	15.10	9.02E-37	82.75	1.30E-02	1.21E+02
<i>(ii) Using the commercial eMC (in dotted curves)</i>									
KK=19: fig. 3(b)-OAD ($Z_c=1$ cm) under fig. 3(a)-DD	13.36	2.02E-07	18.01	9.88E-03	2.81	3.69E-38	87.23	6.01E-03	0.991
KK=20: fig. 3(c)-OAD ($Z_c=5$ cm) under fig. 3(a)-DD	17.83	2.02E-07	18.01	9.88E-03	6.56	3.69E-38	87.23	6.01E-03	0.156
KK=21: fig. 5(b)-OAD ($Z_c=2$ cm) under fig. 5(a)-DD	12.43	3.28E-16	37.95	8.37E-03	2.10	7.01E-35	78.78	1.10E-02	0.979
KK=22: fig. 5(c)-OAD ($Z_c=10$ cm) under fig. 5(a)-DD	20.86	3.28E-16	37.95	8.37E-03	8.67	7.01E-35	78.78	1.10E-02	0.180
KK=23: fig. 3(e)-OAD ($Z_c=3$ cm) under fig. 3(d)-DD	13.20	7.13E-24	55.36	8.50E-03	2.50	2.87E-37	83.85	1.30E-02	0.999
KK=24: fig. 3(f)-OAD ($Z_c=15$ cm) under fig. 3(d)-DD	28.50	7.13E-24	55.36	8.50E-03	15.10	2.87E-37	83.85	1.30E-02	1.72E+02

Supplementary 2 Values of dimensionless parameters $a(E)$, $b(E)$, $c(E)$, $d(E)$, and $e(E)$ in Eq. 13 for $E = 6, 10, 14$, and 20 MeV.

	$E = 6 \text{ MeV}$	$E = 10 \text{ MeV}$	$E = 14 \text{ MeV}$	$E = 20 \text{ MeV}$
$a(E)$	5.050×10^{-2}	3.283×10^{-2}	1.940×10^{-2}	1.411×10^{-2}
$b(E)$	0.270	0.252	0.203	0.174
$c(E)$	1.562	1.996	1.836	1.760
$d(E)$	1.051	0.839	0.951	0.985
$e(E)$	3.256	2.804	3.748	2.373