

## SUPPLEMENTAL DATA

**Supplemental Table 1.** Densities and corresponding materials elemental compositions of simulated multiple VSVs.

Medium	Density [g/cm <sup>3</sup> ]	Elemental % mass composition											
		H	C	N	O	Na	Mg	P	S	Cl	Ar	K	Ca
<b>Air</b>	0.00129	0.0	0.0	75.5	23.2	0.0	0.0	0.0	0.0	0.0	1.3	0.0	0.0
<b>Medium 1</b>	0.1	10.3	10.5	3.1	74.9	0.2	0.0	0.2	0.3	0.3	0.0	0.2	0.0
<b>Lung</b>	0.26	10.3	10.5	3.1	74.9	0.2	0.0	0.2	0.3	0.3	0.0	0.2	0.0
<b>Medium 2</b>	0.3	10.3	10.5	3.1	74.9	0.2	0.0	0.2	0.3	0.3	0.0	0.2	0.0
<b>Medium 3</b>	0.4	10.3	10.5	3.1	74.9	0.2	0.0	0.2	0.3	0.3	0.0	0.2	0.0
<b>Medium 4</b>	0.5	10.3	10.5	3.1	74.9	0.2	0.0	0.2	0.3	0.3	0.0	0.2	0.0
<b>Medium 5</b>	0.6	10.3	10.5	3.1	74.9	0.2	0.0	0.2	0.3	0.3	0.0	0.2	0.0
<b>Medium 6</b>	0.7	10.3	10.5	3.1	74.9	0.2	0.0	0.2	0.3	0.3	0.0	0.2	0.0
<b>Medium 7</b>	0.8	10.3	10.5	3.1	74.9	0.2	0.0	0.2	0.3	0.3	0.0	0.2	0.0
<b>Medium 8</b>	0.9	11.6	68.1	0.2	19.8	0.1	0.0	0.0	0.1	0.1	0.0	0.0	0.0
<b>Water</b>	1.0	11.1	0.0	0.0	88.9	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
<b>Medium 9</b>	1.1	9.4	20.7	6.2	62.2	0.6	0.0	0.0	0.6	0.3	0.0	0.0	0.0
<b>Medium 10</b>	1.2	8.2	39.1	2.9	37.2	0.1	0.0	3.9	0.1	0.1	0.0	0.1	8.3
<b>Medium 11</b>	1.3	7.1	33.5	3.2	38.7	0.1	0.1	5.4	0.2	0.0	0.0	0.0	11.7
<b>Bone</b>	1.42	6.3	26.1	3.9	43.6	0.1	0.1	6.1	0.3	0.1	0.0	0.1	13.3
<b>Medium 12</b>	1.5	5.6	26.5	3.6	40.5	0.1	0.2	7.3	0.3	0.0	0.0	0.0	15.9
<b>Medium 13</b>	1.6	5.2	24.6	3.7	41.1	0.1	0.2	7.8	0.3	0.0	0.0	0.0	17.0
<b>Medium 14</b>	1.7	4.5	21.0	3.9	42.0	0.1	0.2	8.8	0.3	0.0	0.0	0.0	19.2
<b>Medium 1a5</b>	1.8	3.9	17.9	4.1	42.9	0.1	0.2	9.6	0.3	0.0	0.0	0.0	21.0
<b>Medium 16</b>	1.9	3.4	15.5	4.2	43.5	0.1	0.2	10.3	0.3	0.0	0.0	0.0	22.5

**Supplemental Table 2.** Organ-level voxel dose errors for VSV approaches.

	<b>Organ-level voxel dose % difference = <math>\frac{\text{Method} - \text{direct Monte Carlo}}{\text{direct Monte Carlo}} \times 100</math> [%]</b>					
<b>Methods</b>	<b><i>N</i> = 1</b>	<b><i>N</i> = 4</b>	<b><i>N</i> = 6</b>	<b><i>N</i> = 8</b>	<b><i>N</i> = 10</b>	<b><i>N</i> = 20</b>
Gallbladder wall	-1.64	-0.99	-0.67	-0.7	-0.76	-1.01
Heart wall	-4.68	0.43	1.98	1.57	0.51	0.1
Kidney	2.11	2.11	2.74	2.75	2.74	2.74
Liver	1.44	1.66	1.75	1.78	1.71	1.54
Lung	-57.61	10.48	10.7	4.58	2.72	-0.63
Pancreas	1.33	1.5	1.71	1.72	1.69	1.67
Spleen	0.73	1.15	1.52	1.62	1.43	1.34
Stomach wall	-3.96	2.32	3.27	3.12	2.58	0.66
Whole body	-10.55	-0.19	1.46	0.77	0.27	-2.59
Average (organs only)	-7.79	2.33	2.87	2.06	1.58	0.80

**Supplemental Fig. 1.** Errors at the voxel-level represented in (A) relative and (B) absolute differences. Difference maps were generated for the single VSV and multiple VSVs with  $N = 4, 6, 8, 10,$  and  $20$ , where the direct Monte Carlo (ground truth).

