

Geant4 Monte Carlo simulation study of the secondary radiation fields at the laser-driven ion source LION: **supplementary material**

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A. Tables of neutron and photon dose normalized to 10^9 incident primary particles

Neutron and photon doses per 10^9 primaries are listed in table S1, S2 and S3 for Zeil2010, Ma2019 and Wagner2016 primary proton and electron sources respectively. Since 120 cores have been used to run these simulations, statistical uncertainties have been calculated using the standard error of the mean. They are reported as relative (%) values in a separated column.

Zeil2010

Zeil2010	Neutron dose [nSv (10^9 primaries) ⁻¹]						Photon dose [nSv (10^9 primaries) ⁻¹]					
	ID	p ⁺	σ_{rel}	e ⁻	σ_{rel}	Sum	σ_{rel}	p ⁺	σ_{rel}	e ⁻	σ_{rel}	Sum
1	2.4×10^{-2}	0.7%	6.7×10^{-4}	7.6%	2.5×10^{-2}	0.7%	2.3×10^{-2}	0.3%	5.1×10^1	0.1%	5.1×10^1	0.1%
2	3.4×10^{-3}	2.1%	5.8×10^{-4}	8.2%	4.0×10^{-3}	2.1%	3.0×10^{-3}	0.8%	1.8×10^0	0.5%	1.8×10^0	0.5%
3	1.2×10^{-3}	6.5%	4.3×10^{-4}	9.5%	1.6×10^{-3}	5.4%	1.1×10^{-3}	2.4%	8.2×10^{-1}	0.7%	8.3×10^{-1}	0.7%
4	1.2×10^{-3}	4.6%	3.0×10^{-4}	11.0%	1.5×10^{-3}	4.3%	1.1×10^{-3}	1.7%	7.8×10^{-1}	0.8%	7.8×10^{-1}	0.8%
5	3.0×10^{-3}	4.9%	1.7×10^{-3}	4.3%	4.8×10^{-3}	3.5%	9.2×10^{-3}	0.9%	1.6×10^0	0.4%	1.6×10^0	0.4%
6	6.3×10^{-4}	10.4%	2.4×10^{-4}	11.6%	8.7×10^{-4}	8.2%	1.1×10^{-3}	2.5%	8.9×10^{-2}	1.2%	9.0×10^{-2}	1.2%
7	5.3×10^{-5}	25.7%	2.5×10^{-5}	28.5%	7.9×10^{-5}	19.7%	2.1×10^{-5}	8.9%	1.0×10^{-2}	4.2%	1.0×10^{-2}	4.2%
8	4.4×10^{-5}	27.8%	2.4×10^{-5}	35.3%	6.9×10^{-5}	21.9%	1.2×10^{-5}	6.8%	7.3×10^{-3}	4.7%	7.3×10^{-3}	4.7%
9	0	-	0	-	0	-	0	-	0	-	0	-
10	0	-	0	-	0	-	0	-	0	-	0	-
11	0	-	0	-	0	-	0	-	0	-	0	-
12	0	-	0	-	0	-	0	-	0	-	0	-

Table S1: Neutron and photon doses given in [nSv (10^9 primaries)⁻¹] for Zeil2010 proton and electron sources.

Ma2019

Ma2019	Neutron dose [nSv (10 ⁹ primaries) ⁻¹]						Photon dose [nSv (10 ⁹ primaries) ⁻¹]					
	ID	p ⁺	σ _{rel}	e ⁻	σ _{rel}	Sum	σ _{rel}	p ⁺	σ _{rel}	e ⁻	σ _{rel}	Sum
1	2.6×10 ¹	0.1%	6.8×10 ⁻¹	1.1%	2.7×10 ¹	0.1%	1.8×10 ⁰	0.1%	6.1×10 ²	0.0%	6.1×10 ²	0.0%
2	4.2×10 ⁰	0.2%	4.8×10 ⁻¹	1.6%	4.6×10 ⁰	0.2%	2.8×10 ⁻¹	0.1%	2.5×10 ¹	0.1%	2.5×10 ¹	0.1%
3	2.0×10 ⁰	0.3%	4.1×10 ⁻¹	1.9%	2.4×10 ⁰	0.3%	1.2×10 ⁻¹	0.2%	1.4×10 ¹	0.1%	1.5×10 ¹	0.1%
4	1.8×10 ⁰	0.3%	2.8×10 ⁻¹	2.2%	2.1×10 ⁰	0.3%	1.2×10 ⁻¹	0.1%	1.2×10 ¹	0.1%	1.2×10 ¹	0.1%
5	4.9×10 ⁰	0.2%	1.3×10 ⁰	1.0%	6.2×10 ⁰	0.2%	8.1×10 ⁻¹	0.1%	1.5×10 ¹	0.1%	1.5×10 ¹	0.1%
6	8.7×10 ⁻¹	0.4%	2.2×10 ⁻¹	2.3%	1.1×10 ⁰	0.4%	1.1×10 ⁻¹	0.2%	8.2×10 ⁻¹	0.2%	9.3×10 ⁻¹	0.2%
7	9.0×10 ⁻²	1.1%	2.6×10 ⁻²	6.8%	1.2×10 ⁻¹	0.9%	3.3×10 ⁻³	0.9%	1.6×10 ⁻¹	0.5%	1.7×10 ⁻¹	0.5%
8	8.9×10 ⁻²	1.4%	3.0×10 ⁻²	5.5%	1.2×10 ⁻¹	1.1%	3.2×10 ⁻³	0.8%	1.5×10 ⁻¹	0.6%	1.5×10 ⁻¹	0.6%
9	6.5×10 ⁻⁴	12.7%	6.3×10 ⁻⁵	21.6%	7.2×10 ⁻⁴	11.7%	2.5×10 ⁻⁵	9.4%	5.8×10 ⁻⁵	3.6%	8.4×10 ⁻⁵	3.8%
10	2.8×10 ⁻⁴	23.4%	6.9×10 ⁻⁵	24.0%	3.4×10 ⁻⁴	19.3%	2.1×10 ⁻⁵	10.7%	7.5×10 ⁻⁵	2.8%	9.6×10 ⁻⁵	3.2%
11	2.9×10 ⁻⁴	21.4%	9.6×10 ⁻⁵	25.0%	3.8×10 ⁻⁴	17.2%	1.7×10 ⁻⁵	11.1%	4.1×10 ⁻⁵	4.7%	5.7×10 ⁻⁵	4.6%
12	2.5×10 ⁻⁴	18.1%	6.5×10 ⁻⁵	22.3%	3.1×10 ⁻⁴	15.1%	2.0×10 ⁻⁵	11.6%	4.6×10 ⁻⁵	3.7%	6.6×10 ⁻⁵	4.3%

Table S2: Neutron and photon doses given in [nSv (10⁹ primaries)⁻¹] for Ma2019 proton and electron sources.

Wagner2016

Wagner2016	Neutron dose [nSv (10 ⁹ primaries) ⁻¹]						Photon dose [nSv (10 ⁹ primaries) ⁻¹]					
	ID	p ⁺	σ _{rel}	e ⁻	σ _{rel}	Sum	σ _{rel}	p ⁺	σ _{rel}	e ⁻	σ _{rel}	Sum
1	8.5×10 ¹	0.1%	1.9×10 ⁰	0.5%	8.7×10 ¹	0.1%	3.6×10 ⁰	0.0%	1.0×10 ³	0.0%	1.0×10 ³	0.0%
2	1.4×10 ¹	0.2%	1.3×10 ⁰	0.7%	1.6×10 ¹	0.2%	5.8×10 ⁻¹	0.1%	4.7×10 ¹	0.1%	4.8×10 ¹	0.1%
3	7.9×10 ⁰	0.3%	1.1×10 ⁰	0.7%	9.1×10 ⁰	0.3%	2.5×10 ⁻¹	0.3%	2.8×10 ¹	0.1%	2.8×10 ¹	0.1%
4	6.9×10 ⁰	0.3%	7.6×10 ⁻¹	0.8%	7.6×10 ⁰	0.3%	2.4×10 ⁻¹	0.2%	2.2×10 ¹	0.1%	2.2×10 ¹	0.1%
5	2.1×10 ¹	0.2%	3.5×10 ⁰	0.5%	2.4×10 ¹	0.2%	1.5×10 ⁰	0.1%	2.5×10 ¹	0.1%	2.6×10 ¹	0.1%
6	3.7×10 ⁰	0.5%	6.2×10 ⁻¹	1.1%	4.3×10 ⁰	0.5%	2.1×10 ⁻¹	0.3%	1.4×10 ⁰	0.2%	1.6×10 ⁰	0.2%
7	3.7×10 ⁻¹	1.6%	6.8×10 ⁻²	2.6%	4.4×10 ⁻¹	1.4%	1.1×10 ⁻²	1.3%	3.2×10 ⁻¹	0.5%	3.3×10 ⁻¹	0.4%
8	4.1×10 ⁻¹	1.3%	7.9×10 ⁻²	2.3%	4.9×10 ⁻¹	1.2%	1.1×10 ⁻²	1.3%	2.9×10 ⁻¹	0.6%	3.0×10 ⁻¹	0.5%
9	1.6×10 ⁻³	19.6%	2.6×10 ⁻⁴	42.2%	1.8×10 ⁻³	17.9%	9.5×10 ⁻⁵	11.6%	1.7×10 ⁻⁴	22.4%	2.6×10 ⁻⁴	14.9%
10	1.6×10 ⁻³	20.1%	7.7×10 ⁻⁵	27.9%	1.6×10 ⁻³	19.2%	9.1×10 ⁻⁵	9.0%	1.6×10 ⁻⁴	20.5%	2.5×10 ⁻⁴	13.4%
11	1.1×10 ⁻³	20.3%	2.3×10 ⁻⁴	31.7%	1.3×10 ⁻³	17.6%	9.4×10 ⁻⁵	11.3%	7.6×10 ⁻⁵	15.6%	1.7×10 ⁻⁴	9.4%
12	1.6×10 ⁻³	23.4%	1.7×10 ⁻⁴	46.8%	1.7×10 ⁻³	21.6%	6.6×10 ⁻⁵	13.7%	1.1×10 ⁻⁴	21.6%	1.7×10 ⁻⁴	14.3%

Table S3: Neutron and photon doses given in [nSv (10⁹ primaries)⁻¹] for Wagner2016 proton and electron sources.