SR (screened relativistic) NIEL (non ionizing energy loss) Calculator
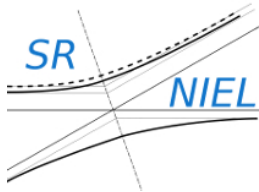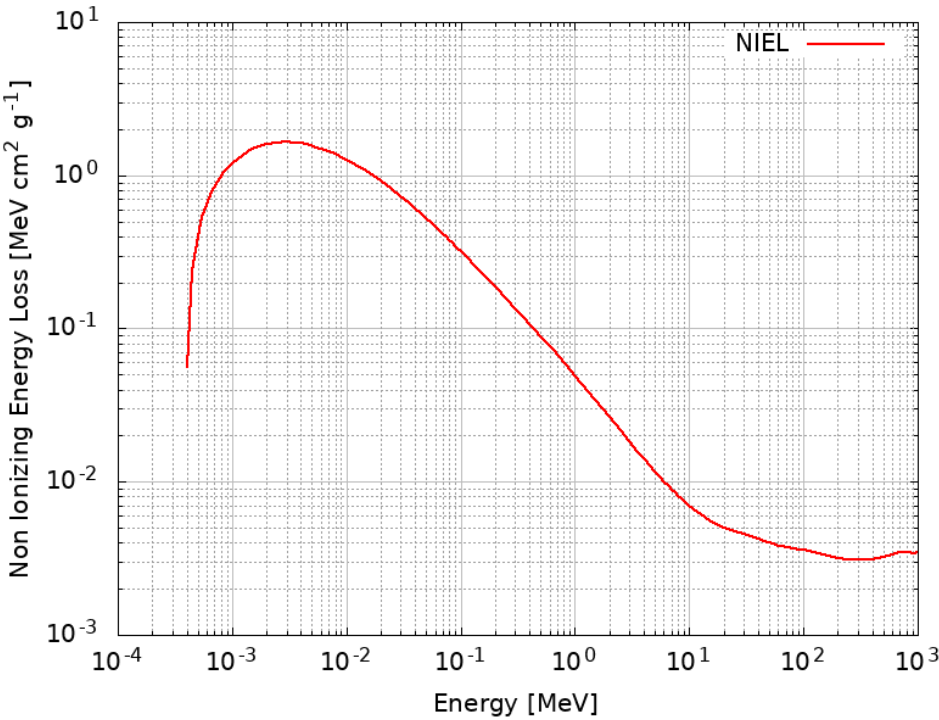
Ions&Protons: SR-NIEL – 7 ver. 11.0 - 15.September.2025

Input Parameters
^{1}H in GaAs
Displacement Threshold Energies [eV]: 21.00; 21.00;
Minimum Energy [MeV]: 1.0e-04
Maximum Energy [MeV]: 1.0e+04
IonModel Selected : Hadron+Coulomb
IonModel Available : Hadronic Contribution Available
Hadronic Contribution : No Scaling
Particle Fluence [cm^{-2}]: 1.00e+00

Maximum energy was modified accordingly to the available energy range of requested hadronic contribution.

In the present NIEL calculators, for protons up to 1 GeV and alpha-particles up to 1 GeV/nucleon impinging on elements with atomic number from Z=4 up to Z=51 , the hadronic contributions were interpolated or extrapolated from those obtained from [Jun et al. (2003, 2004), Jun (2017)]. For silicon absorbers, in addition, the hadronic contribution for energies from 1 up to 24 GeV was obtained from [Huhtinen (2002)].

Energy (MeV)	NIEL (MeV cm^2 g^{-1})	NIEL Dose* (MeV g^{-1})	NIEL Dose* (Gy)
1.0000e-04	0.0000e+00	0.0000e+00	0.0000e+00
1.5000e-04	0.0000e+00	0.0000e+00	0.0000e+00
2.0000e-04	0.0000e+00	0.0000e+00	0.0000e+00
2.5000e-04	0.0000e+00	0.0000e+00	0.0000e+00
3.0000e-04	0.0000e+00	0.0000e+00	0.0000e+00
3.5000e-04	0.0000e+00	0.0000e+00	0.0000e+00
4.0000e-04	5.5675e-02	5.5675e-02	8.9223e-12
4.5000e-04	2.3938e-01	2.3938e-01	3.8362e-11
5.0000e-04	3.9601e-01	3.9601e-01	6.3464e-11
5.5000e-04	5.3006e-01	5.3006e-01	8.4946e-11
6.0000e-04	6.4602e-01	6.4602e-01	1.0353e-10
6.5000e-04	7.4721e-01	7.4721e-01	1.1975e-10
7.0000e-04	8.3617e-01	8.3617e-01	1.3400e-10
7.5000e-04	9.1488e-01	9.1488e-01	1.4662e-10
8.0000e-04	9.8488e-01	9.8488e-01	1.5783e-10
8.5000e-04	1.0474e+00	1.0474e+00	1.6786e-10
9.0000e-04	1.1036e+00	1.1036e+00	1.7685e-10
9.5000e-04	1.1541e+00	1.1541e+00	1.8495e-10
1.0000e-03	1.1997e+00	1.1997e+00	1.9226e-10
1.5000e-03	1.4810e+00	1.4810e+00	2.3734e-10
2.0000e-03	1.5965e+00	1.5965e+00	2.5585e-10
2.5000e-03	1.6405e+00	1.6405e+00	2.6291e-10
3.0000e-03	1.6491e+00	1.6491e+00	2.6428e-10
3.5000e-03	1.6387e+00	1.6387e+00	2.6262e-10
4.0000e-03	1.6180e+00	1.6180e+00	2.5929e-10
4.5000e-03	1.5914e+00	1.5914e+00	2.5503e-10
5.0000e-03	1.5618e+00	1.5618e+00	2.5028e-10
5.5000e-03	1.5307e+00	1.5307e+00	2.4531e-10
6.0000e-03	1.4992e+00	1.4992e+00	2.4025e-10
6.5000e-03	1.4678e+00	1.4678e+00	2.3522e-10
7.0000e-03	1.4369e+00	1.4369e+00	2.3028e-10
7.5000e-03	1.4068e+00	1.4068e+00	2.2545e-10
8.0000e-03	1.3776e+00	1.3776e+00	2.2077e-10
8.5000e-03	1.3493e+00	1.3493e+00	2.1624e-10
9.0000e-03	1.3220e+00	1.3220e+00	2.1187e-10
9.5000e-03	1.2958e+00	1.2958e+00	2.0765e-10
1.0000e-02	1.2704e+00	1.2704e+00	2.0360e-10
1.5000e-02	1.0639e+00	1.0639e+00	1.7049e-10
2.0000e-02	9.1865e-01	9.1865e-01	1.4722e-10
2.5000e-02	8.1132e-01	8.1132e-01	1.3002e-10
3.0000e-02	7.2856e-01	7.2856e-01	1.1676e-10
3.5000e-02	6.6260e-01	6.6260e-01	1.0619e-10
4.0000e-02	6.0866e-01	6.0866e-01	9.7541e-11
4.5000e-02	5.6363e-01	5.6363e-01	9.0326e-11
5.0000e-02	5.2541e-01	5.2541e-01	8.4200e-11
5.5000e-02	4.9251e-01	4.9251e-01	7.8928e-11
6.0000e-02	4.6386e-01	4.6386e-01	7.4336e-11
6.5000e-02	4.3865e-01	4.3865e-01	7.0297e-11

7.0000e-02	4.1629e-01	4.1629e-01	6.6713e-11
7.5000e-02	3.9629e-01	3.9629e-01	6.3508e-11
8.0000e-02	3.7830e-01	3.7830e-01	6.0625e-11
8.5000e-02	3.6201e-01	3.6201e-01	5.8014e-11
9.0000e-02	3.4718e-01	3.4718e-01	5.5638e-11
9.5000e-02	3.3363e-01	3.3363e-01	5.3466e-11
1.0000e-01	3.2118e-01	3.2118e-01	5.1471e-11
1.5000e-01	2.3599e-01	2.3599e-01	3.7819e-11
2.0000e-01	1.8824e-01	1.8824e-01	3.0167e-11
2.5000e-01	1.5726e-01	1.5726e-01	2.5202e-11
3.0000e-01	1.3555e-01	1.3555e-01	2.1724e-11
3.5000e-01	1.1956e-01	1.1956e-01	1.9160e-11
4.0000e-01	1.0724e-01	1.0724e-01	1.7185e-11
4.5000e-01	9.7426e-02	9.7426e-02	1.5613e-11
5.0000e-01	8.9413e-02	8.9413e-02	1.4329e-11
5.5000e-01	8.2734e-02	8.2734e-02	1.3259e-11
6.0000e-01	7.7073e-02	7.7073e-02	1.2351e-11
6.5000e-01	7.2208e-02	7.2208e-02	1.1572e-11
7.0000e-01	6.7830e-02	6.7830e-02	1.0870e-11
7.5000e-01	6.3830e-02	6.3830e-02	1.0229e-11
8.0000e-01	6.0291e-02	6.0291e-02	9.6621e-12
8.5000e-01	5.7141e-02	5.7141e-02	9.1573e-12
9.0000e-01	5.4319e-02	5.4319e-02	8.7049e-12
9.5000e-01	5.1774e-02	5.1774e-02	8.2971e-12
1.0000e+00	4.9467e-02	4.9467e-02	7.9274e-12
1.5000e+00	3.4439e-02	3.4439e-02	5.5190e-12
2.0000e+00	2.6588e-02	2.6588e-02	4.2608e-12
2.5000e+00	2.1733e-02	2.1733e-02	3.4828e-12
3.0000e+00	1.8421e-02	1.8421e-02	2.9521e-12
3.5000e+00	1.6012e-02	1.6012e-02	2.5661e-12
4.0000e+00	1.4180e-02	1.4180e-02	2.2725e-12
4.5000e+00	1.2775e-02	1.2775e-02	2.0473e-12
5.0000e+00	1.1700e-02	1.1700e-02	1.8750e-12
5.5000e+00	1.0821e-02	1.0821e-02	1.7342e-12
6.0000e+00	1.0079e-02	1.0079e-02	1.6153e-12
6.5000e+00	9.4502e-03	9.4502e-03	1.5144e-12
7.0000e+00	8.9165e-03	8.9165e-03	1.4289e-12
7.5000e+00	8.4625e-03	8.4625e-03	1.3562e-12
8.0000e+00	8.0738e-03	8.0738e-03	1.2939e-12
8.5000e+00	7.7384e-03	7.7384e-03	1.2401e-12
9.0000e+00	7.4461e-03	7.4461e-03	1.1933e-12
9.5000e+00	7.1891e-03	7.1891e-03	1.1521e-12
1.0000e+01	6.9609e-03	6.9609e-03	1.1155e-12
1.5000e+01	5.5898e-03	5.5898e-03	8.9579e-13
2.0000e+01	5.0290e-03	5.0290e-03	8.0593e-13
2.5000e+01	4.7620e-03	4.7620e-03	7.6314e-13
3.0000e+01	4.5763e-03	4.5763e-03	7.3338e-13
3.5000e+01	4.4086e-03	4.4086e-03	7.0650e-13
4.0000e+01	4.2535e-03	4.2535e-03	6.8165e-13
4.5000e+01	4.1173e-03	4.1173e-03	6.5982e-13
5.0000e+01	4.0037e-03	4.0037e-03	6.4162e-13
5.5000e+01	3.9126e-03	3.9126e-03	6.2702e-13
6.0000e+01	3.8413e-03	3.8413e-03	6.1560e-13
6.5000e+01	3.7861e-03	3.7861e-03	6.0675e-13
7.0000e+01	3.7432e-03	3.7432e-03	5.9987e-13
7.5000e+01	3.7091e-03	3.7091e-03	5.9441e-13
8.0000e+01	3.6811e-03	3.6811e-03	5.8992e-13

8.5000e+01	3.6569e-03	3.6569e-03	5.8604e-13
9.0000e+01	3.6347e-03	3.6347e-03	5.8249e-13
9.5000e+01	3.6135e-03	3.6135e-03	5.7908e-13
1.0000e+02	3.5923e-03	3.5923e-03	5.7569e-13
1.5000e+02	3.3609e-03	3.3609e-03	5.3861e-13
2.0000e+02	3.1875e-03	3.1875e-03	5.1082e-13
2.5000e+02	3.1160e-03	3.1160e-03	4.9936e-13
3.0000e+02	3.1039e-03	3.1039e-03	4.9743e-13
3.5000e+02	3.1155e-03	3.1155e-03	4.9929e-13
4.0000e+02	3.1377e-03	3.1377e-03	5.0284e-13
4.5000e+02	3.1704e-03	3.1704e-03	5.0808e-13
5.0000e+02	3.2161e-03	3.2161e-03	5.1541e-13
5.5000e+02	3.2743e-03	3.2743e-03	5.2472e-13
6.0000e+02	3.3392e-03	3.3392e-03	5.3512e-13
6.5000e+02	3.4011e-03	3.4011e-03	5.4506e-13
7.0000e+02	3.4488e-03	3.4488e-03	5.5269e-13
7.5000e+02	3.4726e-03	3.4726e-03	5.5650e-13
8.0000e+02	3.4692e-03	3.4692e-03	5.5596e-13
8.5000e+02	3.4444e-03	3.4444e-03	5.5199e-13
9.0000e+02	3.4148e-03	3.4148e-03	5.4725e-13
9.5000e+02	3.4086e-03	3.4086e-03	5.4624e-13
1.0000e+03	3.4676e-03	3.4676e-03	5.5571e-13

* The mediun has to to be thick enough to fully
absorb the kinetic energy of recoil nuclei.