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PIANO NAZIONALE
DI RIPRESA E RESILIENZA



Centro Nazionale di Ricerca in HPC,
Big Data and Quantum Computing

Flagship 2.6.2: Enhancing Geant4 Monte Carlo Simulations through Machine Learning Integration

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Hadrontherapy example Geant4 simulations

Simulations performed on multiple versions:

- Geant4 v.10.5.0
- Geant4 v.10.5.1
- Geant4 v.11.1.3
- Geant4 v.11.2.0b
- Geant4 v.11.2.0
- Geant4 v.11.2.2

Vsize=100 um
Cut=100 um
Nevents=1e6

/gps/pos/centre -310 0 0 cm,
/gps/pos/centre -1 0 0 cm
Energy: 62.3 MeV
PhysicsList: HADRONTHERAPY_1

/gps/pos/centre -310 0 0 cm,
/gps/pos/centre -1 0 0 cm
Energy: 62.3 MeV
PhysicsList: HADRONTHERAPY_5

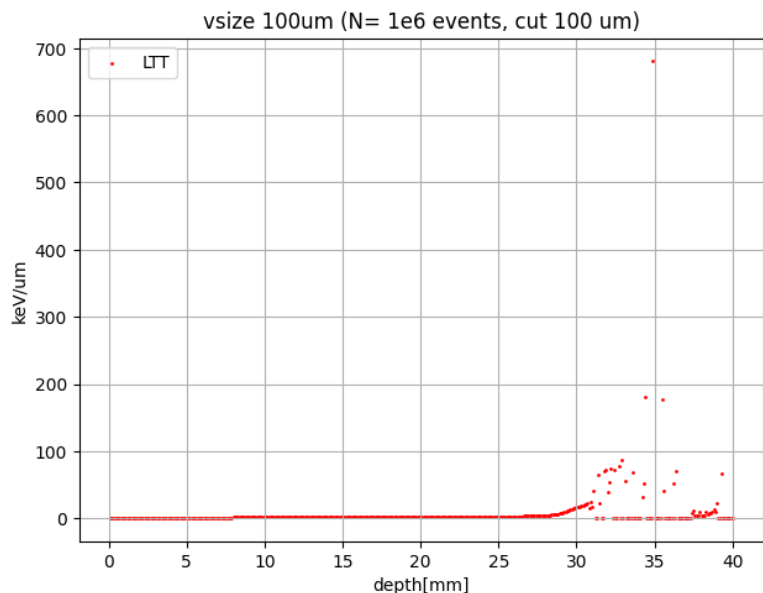


Simulation Results

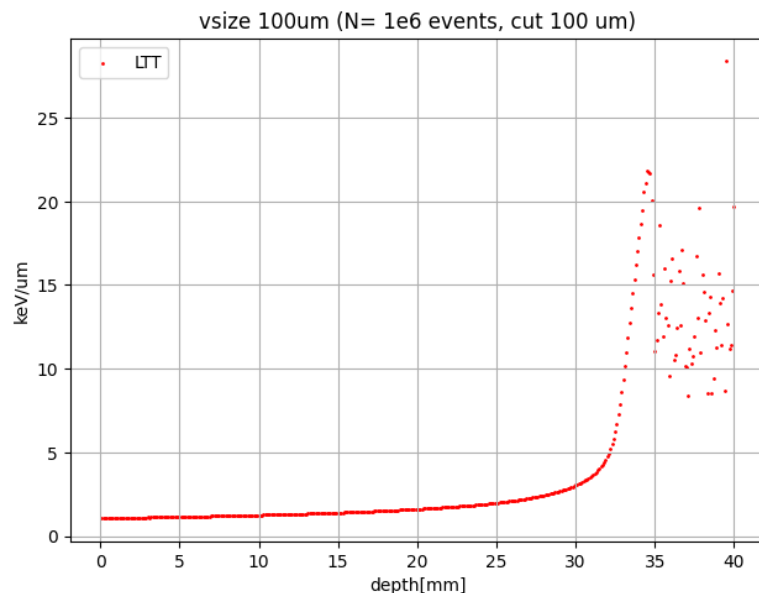
G4 version	Physics	LTT after the Bragg Peak	position along the X direction	energy
10.5.0	HADRONTHERAPY_1	OK	-310 0 0 cm ←	62.3 MeV
10.5.0	HADRONTHERAPY_1	NO	-1 0 0 cm ←	62.3 MeV
10.5.1	HADRONTHERAPY_1	OK	-310 0 0 cm	62.3 MeV
10.5.1	HADRONTHERAPY_1	NO	-1 0 0 cm	62.3 MeV
11.1.3	HADRONTHERAPY_1,HADRONTHERAPY_2	NO	-1 0 0 cm	62.3 MeV
11.2.0b	HADRONTHERAPY_1	OK	-310 0 0 cm	62.3 MeV
11.2.0b	HADRONTHERAPY_1, HADRONTHERAPY_2	NO	-1 0 0 cm	62.3 MeV
11.2.0	HADRONTHERAPY_1	OK	-310 0 0 cm	62.3 MeV
11.2.0	HADRONTHERAPY_1	NO	-1 0 0 cm	62.3 MeV
11.2.2	HADRONTHERAPY_1	OK	-310 0 0 cm	62.3 MeV
11.2.2	HADRONTHERAPY_1	NO	-1 0 0 cm	62.3 MeV
11.2.2	HADRONTHERAPY_5	OK	-310 0 0 cm ←	62.3 MeV
11.2.2	HADRONTHERAPY_5	OK	-1 0 0 cm ←	62.3 MeV



LTT distribution Geant4 v.10.5.0



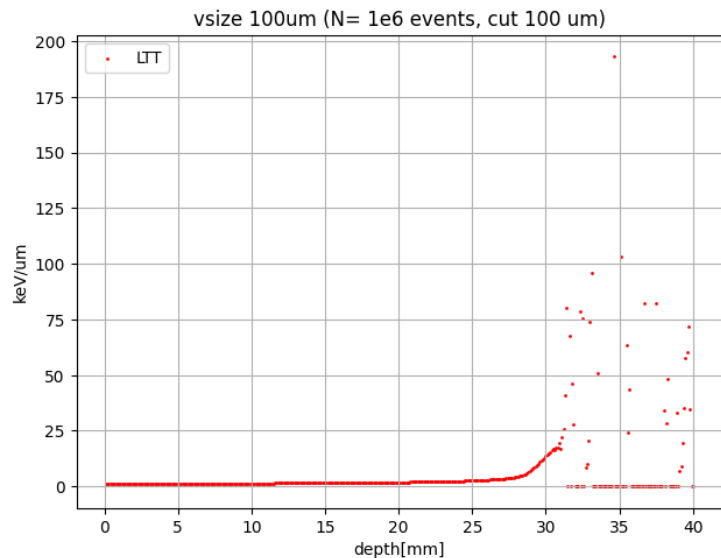
gps/pos/centre/-310 0 0 cm
PhysicsList:HADRONTHERAPY_1
energy=62.3 MeV



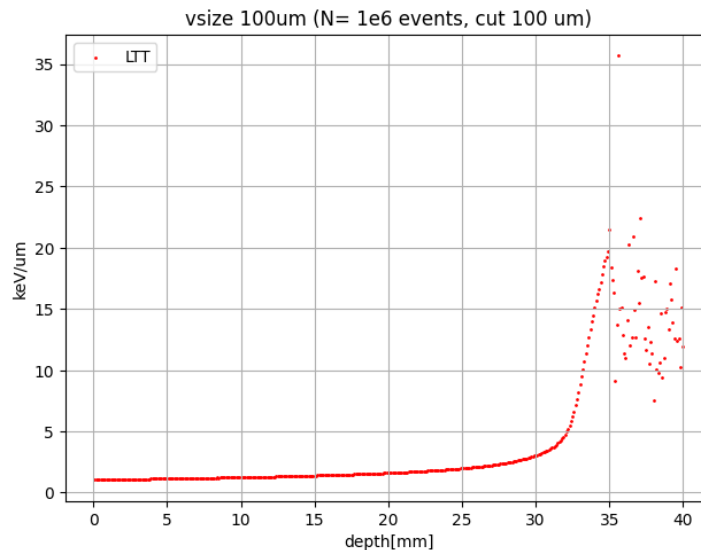
gps/pos/centre/-1 0 0 cm
PhysicdList:HADRONTHERAPY_1
energy=62.3 MeV



LTT distribution Geant4 v.11.2.2



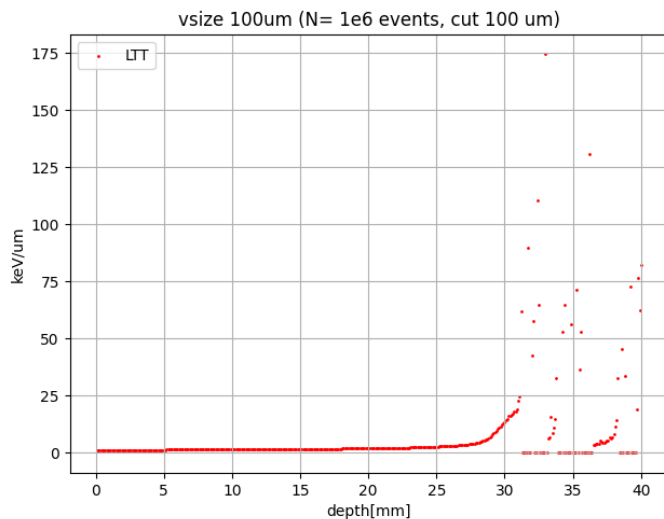
gps/pos/centre/-310 0 0 cm
PhysicsList:HADRONTHERAPY_1
energy=62.3 MeV



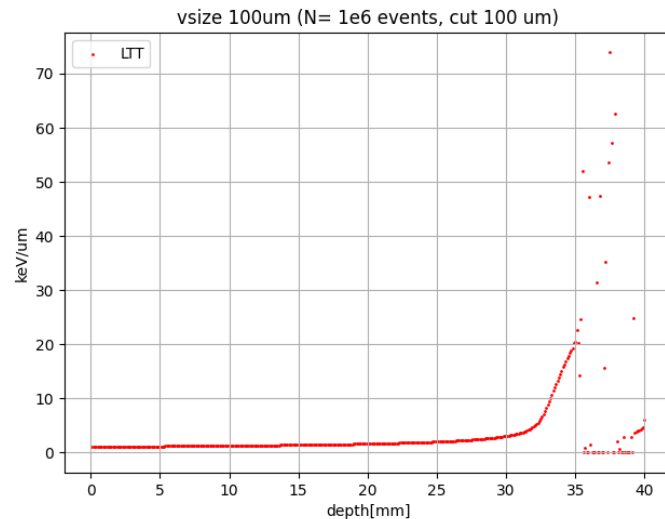
gps/pos/centre/-1 0 0 cm
PhysicdList:HADRONTHERAPY_1
energy=62.3 MeV



LTT distribution Geant4 v.11.2.2



gps/pos/centre/-310 0 0 cm
PhysicsList:HADRONTHERAPY_5
energy=62.3 MeV



gps/pos/centre/-1 0 0 cm
PhysicsList:HADRONTHERAPY_5
energy=62.3 MeV



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Grazie