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Report that no interaction occurs in the physical process of heavy ions by G4-DNA ver.10.07.b01

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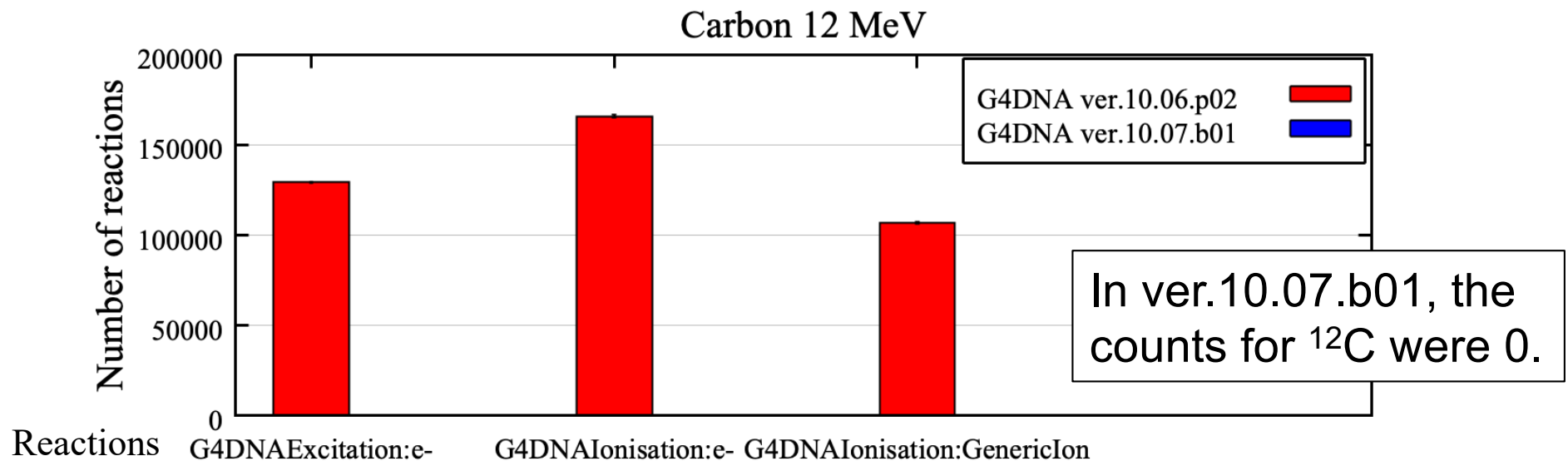
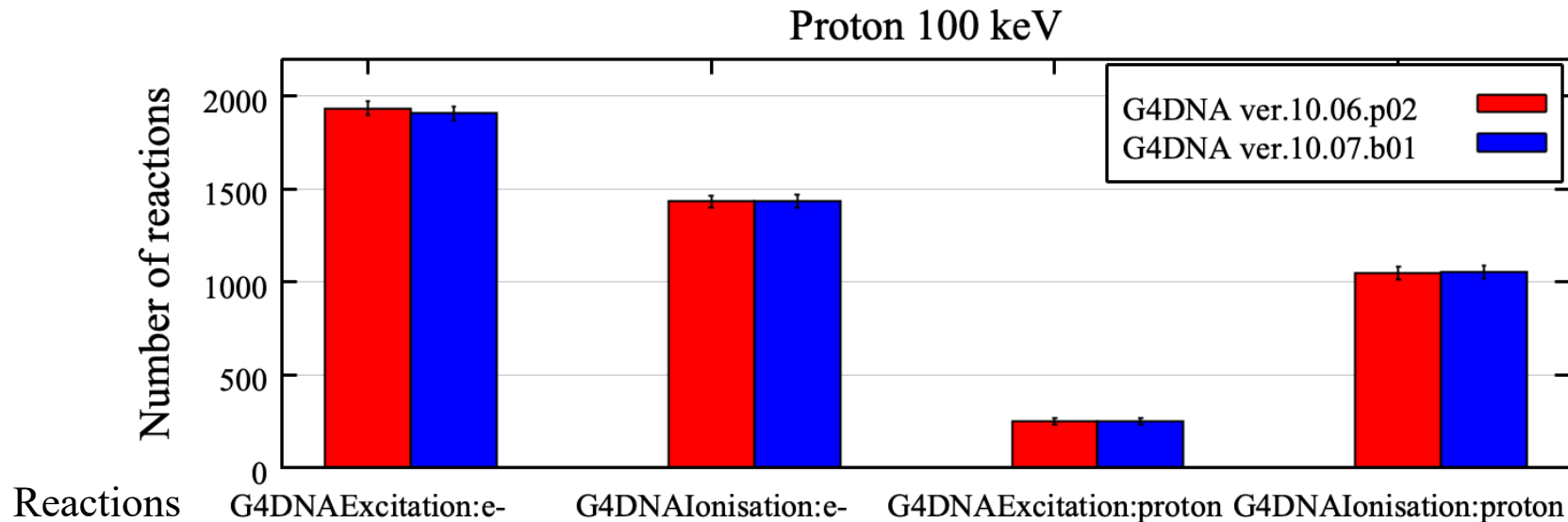
About the confirmed error

Overview

- When simulating the Generic ions using Geant4-DNA version 10.07.b01, no physical interaction occurred.
- In case of electron, proton, alpha, it can be calculated without any problem.
- I changed the physics list to option2, option4, option6, but no interaction occurred.
- We report the results of same simulations performed on G4-DNA ver.10.06.p02 and G4-DNA ver.10.07.b01.
- All the results described in this document are the calculation results on macOS High Sierra ver.10.13.4, but it was confirmed that the results are the same on macOS Catalina ver.10.15.6.

<dnaphysics> /medical/dna example

- The number of ionization events and excitation events was counted by irradiating 100 keV protons and 12 MeV carbon ions.



<spower> /medical/dna example

- Using the example with the «spower», we simulated the stopping power of electrons, protons, alpha, and genetic ions (carbon-12).

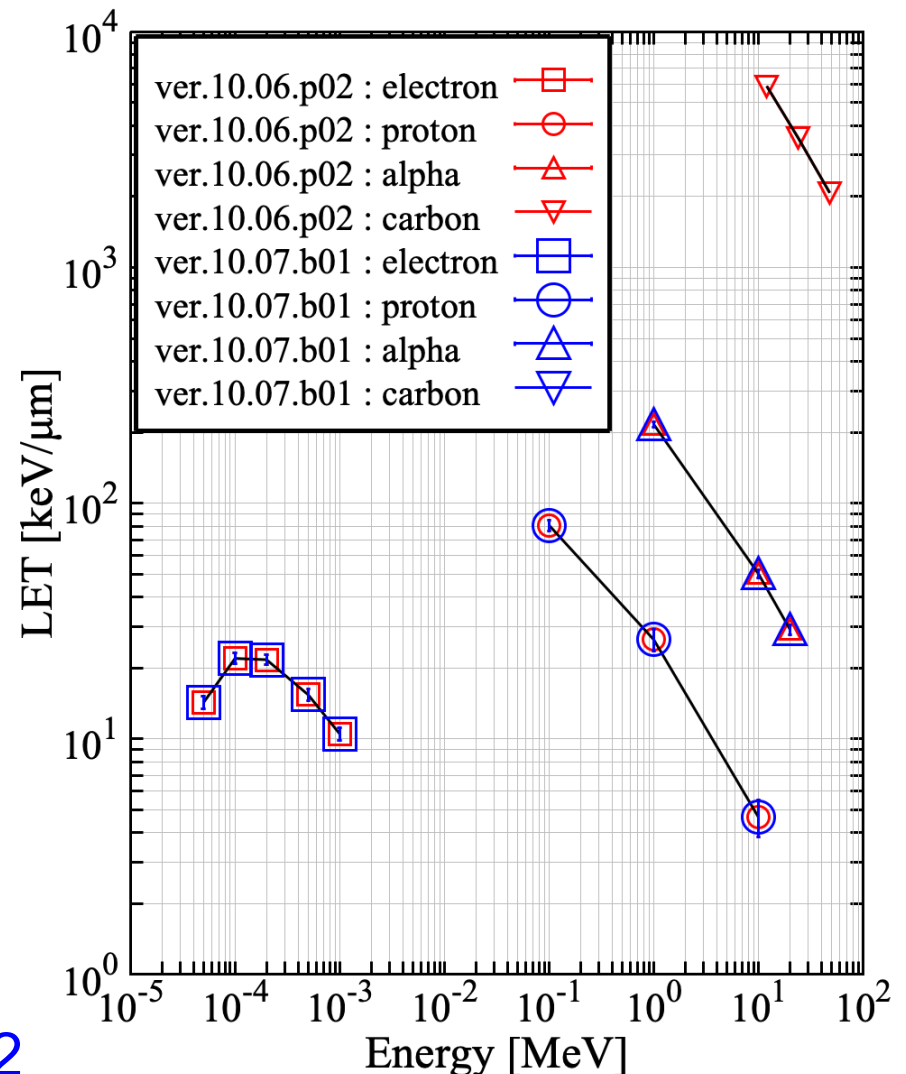
Macro file

```
/gun/particle e-  
/gun/energy 50, 100, 200, 500, 1000 eV
```

```
/gun/particle proton  
/gun/energy 0.1, 1, 10 MeV
```

```
/gun/particle alpha  
/gun/energy 1, 10, 20 MeV
```

```
/gun/particle ion  
/gun/ion 6 12 6  
/gun/energy 12, 24, 48 MeV
```



G4EmDNAPhysics_stationary_option2

```

===== run summary =====

The run is 10000 alpha of 1.00 MeV through a sphere of radius 1.00
m of G4_WATER (density: 1.00 g/cm3 )

total Stopping Power (keV/um)   = 216.04 +- 5.68

===== run summary =====

The run is 10000 alpha of 10.00 MeV through a sphere of radius 1.00
m of G4_WATER (density: 1.00 g/cm3 )

total Stopping Power (keV/um)   = 50.18 +- 1.80

===== run summary =====

The run is 10000 alpha of 20.00 MeV through a sphere of radius 1.00
m of G4_WATER (density: 1.00 g/cm3 )

```

Geant4 ver.10.06.p02

```

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The run is 10000 C12 of 12.00 MeV through a sphere of radius 1.00 m
of G4_WATER (density: 1.00 g/cm3 )

total Stopping Power (keV/um)   = 5887.71 +- 108017.12

===== run summary =====

The run is 10000 C12 of 24.00 MeV through a sphere of radius 1.00 m
of G4_WATER (density: 1.00 g/cm3 )

total Stopping Power (keV/um)   = 3547.01 +- 41637.13

===== run summary =====

The run is 10000 C12 of 48.00 MeV through a sphere of radius 1.00 m
of G4_WATER (density: 1.00 g/cm3 )

total Stopping Power (keV/um)   = 2075.36 +- 30266.86

```

```

===== run summary =====

The run is 10000 alpha of 1.00 MeV through a sphere of radius 1.00
m of G4_WATER (density: 1.00 g/cm3 )

total Stopping Power (keV/um)   = 216.04 +- 5.68

===== run summary =====

The run is 10000 alpha of 10.00 MeV through a sphere of radius 1.00
m of G4_WATER (density: 1.00 g/cm3 )

total Stopping Power (keV/um)   = 50.18 +- 1.80

===== run summary =====

The run is 10000 alpha of 20.00 MeV through a sphere of radius 1.00
m of G4_WATER (density: 1.00 g/cm3 )

```

Geant4 ver.10.07.b01

```

=====

The run is 10000 C12 of 12.00 MeV through a sphere of radius 1.00 m
of G4_WATER (density: 1.00 g/cm3 )

total Stopping Power (keV/um)   = 0.00 +- 0.00

===== run summary =====

The run is 10000 C12 of 24.00 MeV through a sphere of radius 1.00 m
of G4_WATER (density: 1.00 g/cm3 )

total Stopping Power (keV/um)   = 0.00 +- 0.00

===== run summary =====

The run is 10000 C12 of 48.00 MeV through a sphere of radius 1.00 m
of G4_WATER (density: 1.00 g/cm3 )

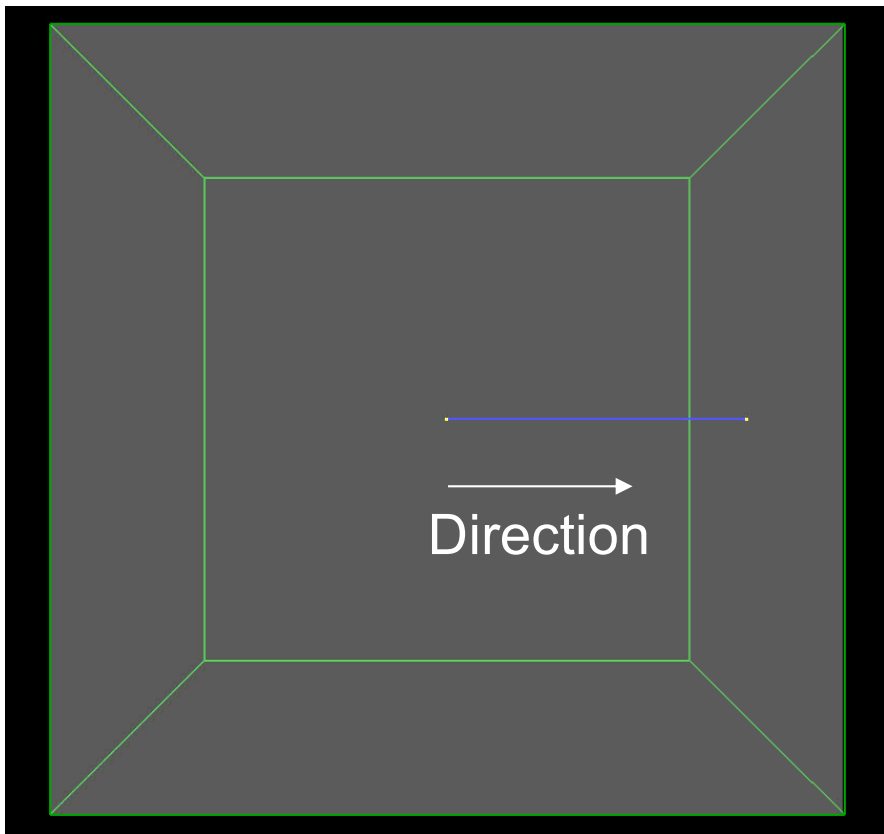
total Stopping Power (keV/um)   = 0.00 +- 0.00

```

- In version 10.07.b01, the calculated stopping power of carbon-12 was 0 keV/μm.
- Similar results were obtained by changing the physical list to option2, 4, and 6.

Summary

- When simulating the Generic ions using Geant4-DNA version 10.07.b01, no physical interaction occurred.
- The figure below is a visualization of the 12 MeV carbon ion trajectory. It can be confirmed that the particle do not interact and reach outside the boundary from the center.



12 MeV carbon ion track.
Calculated with G4DNA ver.10.7.b01.