Data from: Improved STEREO simulation with a new gamma ray spectrum of excited gadolinium isotopes using FIFRELIN

0.1 Available files

The files available are aimed to simulate the deexcitation cascade following neutron capture on ^{155}Gd and ^{157}Gd. Therefore, the `Fifrelin` simulation was done for the ^{156}Gd and ^{158}Gd isotopes, with the initial condition of an excitation energy of $E^* = S_n$, the neutron separation energy.

One `.txt` file per isotope is provided:
- `Gd156_fifrelin_ArbreMC0_tot.txt` for ^{156}Gd with $E^* = 8.5364\,\text{MeV}$
- `Gd158_fifrelin_ArbreMC0_tot.txt` for ^{158}Gd with $E^* = 7.9374\,\text{MeV}$

Each file contains 10^7 deexcitation cascades, resulting from the simulation of 5000 cascades for each of the 2000 level scheme realizations generated. Please note that in the files, events are ordered by level scheme. In case of the use of a subset of the available statistics only, a random drawing should be considered in order to mix the level schemes realizations and take into account properly the model uncertainties.

0.2 Structure

One line represents one deexcitation cascade and has the following structure:
$$\texttt{ZA}\ \ \texttt{E}_\texttt{k}\ \ \texttt{E}^*\ \ \texttt{J}\ \ \pi\qquad (\texttt{X}^i\ \ \texttt{E}^i_\texttt{lab}\ \ \texttt{E}^i_\texttt{nucl}\ \ \texttt{J}^i\ \ \pi^i)_{i=1..\texttt{N}}.$$

The first five fields are common for all lines, with:

- $\texttt{ZA}$ the atomic ($\texttt{Z}$) and mass ($\texttt{A}$) number of the simulated isotope
- $\texttt{E}_\texttt{k}$ the kinetic energy, in MeV, of the nucleus (always set to 0 in our case)
- $\texttt{E}^*$ the excitation energy, in MeV, of the nucleus (set to S_n)
- $\texttt{J}$ the spin, in $\hbar$ units, of the initial state (set to 2)
- π the parity the initial state (set to -1)

Each of the $\texttt{N}$ emitted particles in the cascade is then described by a tuple containing:

- $\texttt{X}$ the particle code ($\texttt{G}$ for gamma and $\texttt{E}$ for electron)
- $\texttt{E}_\texttt{lab}$ the emitted particle kinetic energy, in MeV, in the laboratory frame.
- $\texttt{E}_\texttt{nucl}$ the nucleus excitation energy after emission.
- $\texttt{J}$ the spin, in $\hbar$ units, of the nucleus after emission
- π the parity (± 1), of the nucleus after emission

0.3   Content of the files

This section provides an insight of the physical content of the available files, for the main observables of interest: gamma/electrons energy, multiplicity.
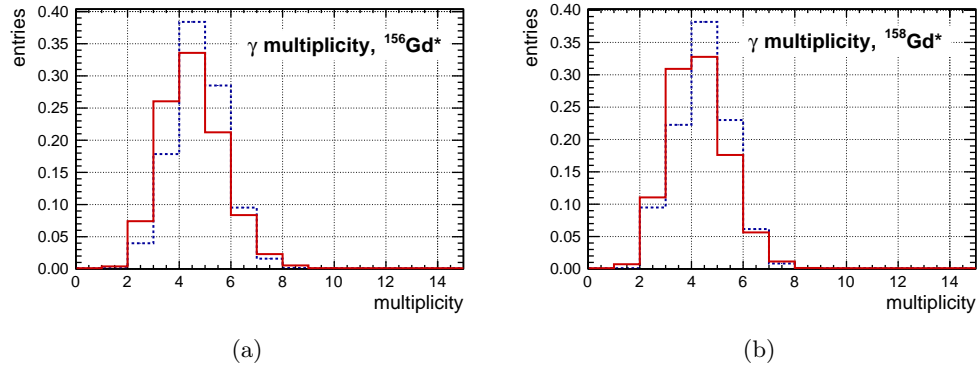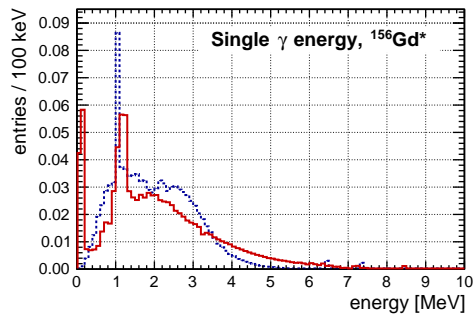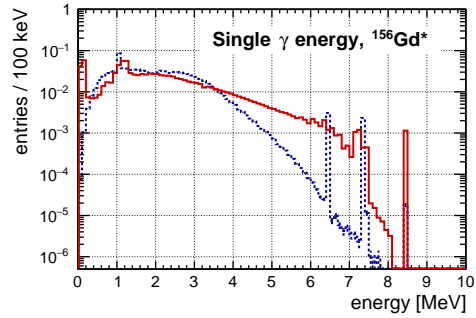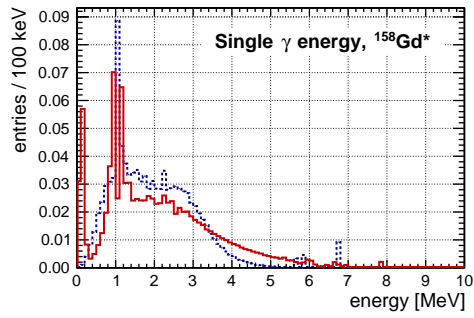

Figure 1: Gamma multiplicity of the deexcitation cascade simulated in `GLG4sim` (dashed blue) and `FIFRELIN` (red) for the cascade of the ^{156}Gd (a) and the ^{158}Gd (b) isotopes.
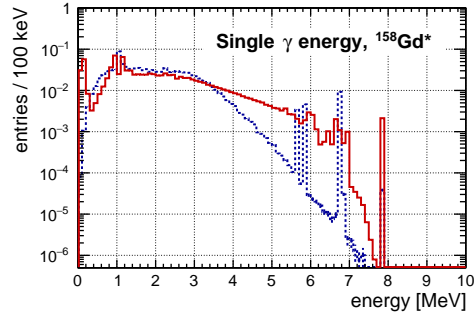
(a)

(b)

(c)

(d)

Figure 2: Energy distribution of the γ from the deexcitation cascade simulated in `GLG4sim` (dashed blue) and `FIFRELIN` (red) for the cascade of the ^{156}Gd (Fig. (a) and (b)) and the ^{158}Gd (Fig. (c) and (d)) isotopes.
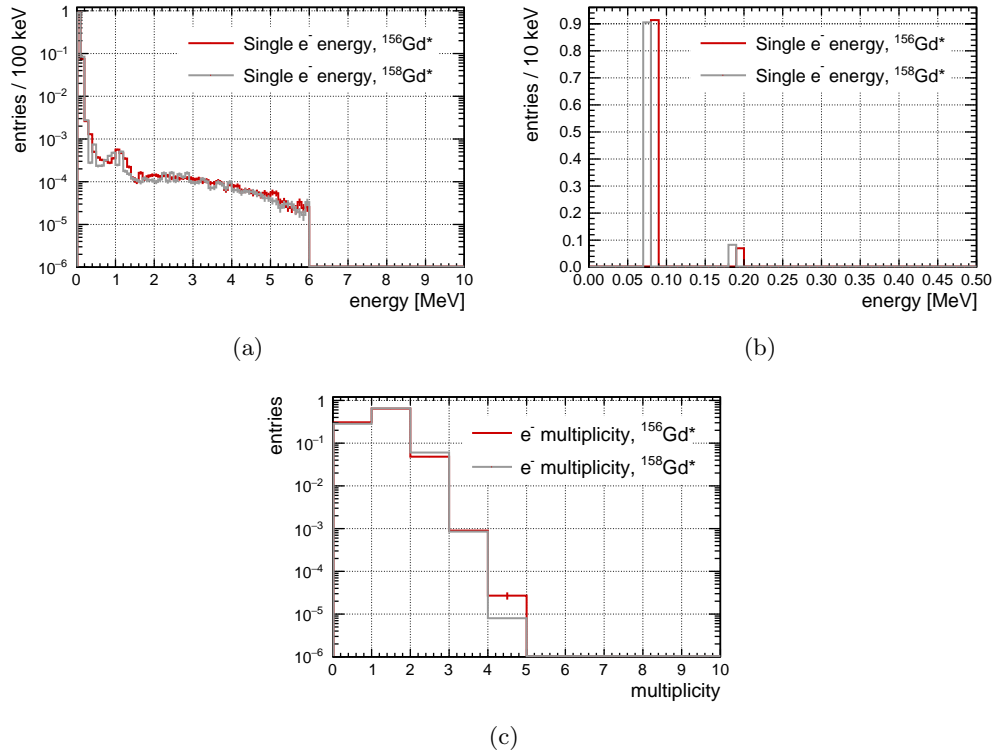
(a)

(b)

(c)

Figure 3: Energy distribution of the electrons from the deexcitation cascade simulated in FIFRELIN (Fig. (a) and (b)) for the cascade of the ^{156}Gd (red) and the ^{158}Gd (gray) isotopes. The multiplicity of electrons per cascade is presented in Fig. (c), for the ^{156}Gd (red) and the ^{158}Gd (gray) isotopes.