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# Energy Deposition in a Graphene Field Effect Transistor Based Radiation Detector

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## ABSTRACT

The development of high-performance radiation detectors is essential for commercial, scientific, and security applications [1]. Due to the unique electronic properties of graphene (high-speed, low-noise), recent radiation detectors utilize graphene field effect transistors to sense charge carriers produced by radiation interactions in a gated semiconductor [2]. A study of the energy deposition due to the transport of gamma rays and electrons/positrons through typical elemental and compound semiconductors (Si, Ge, GaAs, and CdTe) will allow for a material optimization of these detectors. Geant4, a Monte Carlo based program that simulates the passage of particles through matter, was used to simulate Compton scattering of gamma rays and multiple scattering of electrons emitted from the decay of Co-60 and Cs-137. The output from Geant4 was a histogram that displayed the percentage of interactions that deposited energy within set energy bins. Further simulations will be performed to determine the energy deposition for multiple gamma ray interactions (photoelectric effect, Compton scattering, and pair production) and multiple electron/positron interactions (multiple scattering, ionization, Bremsstrahlung, and $e^+$ $e^-$ annihilation).

KEYWORDS

GFET, graphene, semiconductor radiation detector

## REFERENCES

*(sample format provided below)*

[1] M. Foxe et al., “Graphene Field-Effect Transistors on Undoped Semiconductor Substrates for Radiation Detection,” *IEEE Trans. Nanotechnol.*, vol. 11, no. 3, pp. 581-587, May 2012.

[2] M. Foxe et al., “Numerical Model of Graphene-Based Radiation Detector Response,” *IEEE NSS/MIC*, pp. 667-670, 2010.