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Introduction

Gamma-ray imaging consists in reconstructing the position of a (radioactive) source emitting gamma-rays at energies ranging from a few keV to a few MeV. This process is used in a wide variety of applications such as astrophysics (space observations), nuclear safety [1], homeland security and medicine through positron-emission tomography (PET) and single photon emission computed tomography (SPECT).

Most often gamma-ray imaging devices are composed of two layers of a material, often called scatterer and absorber. Most used materials are NaI, CZT (Cadmium Zinc Tellurium), having different strengths:

- NaI: low cost and decent energy resolution (6-7% at 662 keV);
- CZT: room temperature semi-conductor and excellent energy resolution (1-2% at 662 keV);

This work studies the imaging capabilities of a single volume of segmented hyper pure germanium (HPGe). HPGe has the best energy resolution of all the materials presented above with 0.15% at 662 keV. Being a semi-conductor with a small band gap energy, it has to be cooled to avoid current leakage due to thermal excitation.

$$x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$$

Bibliography

[1] F. Gagliardi, L. Lepore, L. Meschini, A. Ciotoli, N. Cherubini, L. Falconi, D. Formenton, G. Gandolfo, E. Gorello, G. A. Marzo, E. Mauro, M. Pagliuca, and A. Roberti, "Novel applications of state-of-the-art gamma-ray imaging technique: From nuclear decommissioning and radioprotection to radiological characterization and safeguards," *IEEE Transactions on Nuclear Science*, vol. 71, pp. 1154–1167, 2024.