Study of an automated positioning system source-detector for characterization of NaI (Tl) detectors

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This study proposes the use of the NaI(Tl) scintillation detectors to determine response functions when plotted versus the energy of incident photons. The pulse height distributions (PHD) can be experimentally measured with several calibrated mono-energetic radiation sources with energy emission over all the range of interest or using MCNP-X code. The researchers of the Radiotracer Laboratory at the "Instituto de Engenharia Nuclear (IEN)" have been developing several methodologies using this kind of detectors [1]. Some difficulties related to the measurement of the accuracy of the source-detector system [2] were found. It seems evident that a methodology which aims to find efficiency and resolution curves, dependent on the energy, to guarantee reproducibility and accuracy is very important for our laboratory. Therefore, this report shows the study of an automatic positioning system based on the use of NaI(Tl) scintillation detectors in order to find the response functions, as shown in Fig. 1 (This diagram was elaborated using the Solid Edge software).

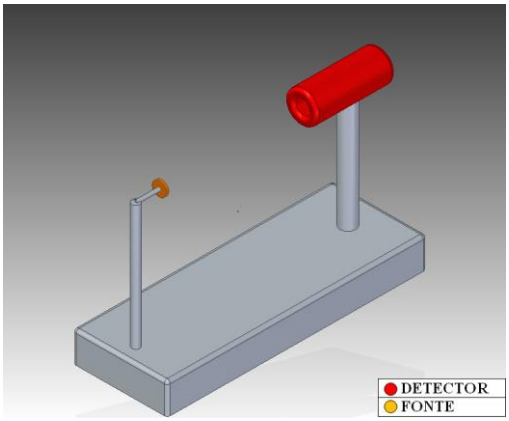

Figure 1. Schematic diagram of positioning system.

The automated system has fixing brackets for the source and the detector. The source detector system movement will be controlled by stepper-motors with a micro-controller as shown in the schematic diagram in Fig. 2 (Elaborated with Fritzing software). The Stepper motors are electromechanical devices that convert electrical pulses into mechanical movements, which generate discrete angular variations. The great advantage of this type of engine is the ability to control its own movements accurately. In addition, it can be used in printers, robots, video cameras, industrial automation etc.

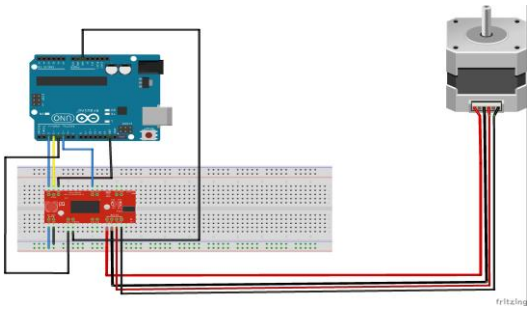

Figure 2. Schematic diagram.

This system will be controlled by a programmable microcontroller using a free software: Arduino. Electronic circuits based on Arduino receive several kinds of signals, allowing the communication with sensors that can be added to prototypes, enabling the connection with others devices: LED's, motors, and other several functions, such as light control. Therefore it allows for the development of specific applications for basic electronic circuits, which, in turn, favors an electronic devices project that is able to communicate with the applications installed on a computer. This system can carry out measurement of the radiation source placed frontally and laterally to the detector, allowing for the use of the methodology in new applications.

References

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