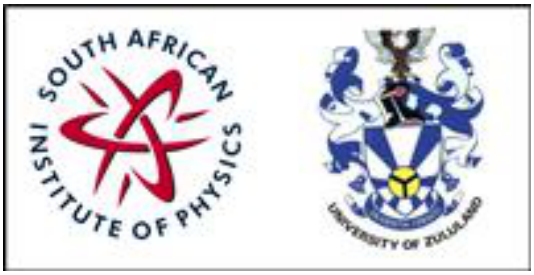

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Measuring the performance of the iThemba LABS Segmented Clover Detector

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Abstract content
   (Max 300 words)

Large volume high-purity germanium (HPGe) detectors are commonly used in applications (such as gamma-ray spectroscopy) that require good energy resolution and high detection efficiency. iThemba LABS recently bought a new state of the art segmented clover detector. The new detector contains four cylindrical HPGe crystals housed in a common vacuum cryostat and held at temperature of around 75 K by a metal cooling structure that extends back into a dewar of liquid nitrogen. This detector has 32 outer contacts. These are in addition to the four inner-core contacts, and so the total number of electrical signals from the detector is thirty-six. The principal reason for this segmentation is to provide information about the three-dimensional localization of gamma-ray interactions within the detector. Charge sensitive preamplifiers allow all thirty-six electrical signals to be read out, providing precise energy information from the core contact and signals for position localization from the outer contacts. Due to its segmentation, the detector can be used not just as a standard clover detector, but also in a gamma-ray tracking mode. Details on the performance of this new type of germanium clover detector are now determined. The tests include measuring the depletion voltage for each crystal, measuring the energy resolutions for each crystal and for the outside electrodes at different rates, measuring rise and decay times, cross-talk, efficiency at different source-to-detector distance, etc. In addition the coincidence summing effect was studied. Tests were carried out mainly by means of Pixie-4 digital electronics. Results on energy resolution, detection efficiency, preamplifier response (i.e. signal rise and decay times) and noise characteristics will be presented.

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