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Design of a segmented high purity germanium detector for muonic X-ray spectroscopy and imaging at a pulsed muon source

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The muonic X-rays emitted in the capture and absorption process of negative muons in matter have higher energy than characteristic X-rays, which can be used for nondestructive analysis of ˜10 µm to ˜cm scale material samples. The excellent energy resolution of high purity germanium (HPGe) detector makes it a desirable solution to accurately distinguish the X-ray peaks and determine the specific elements in samples. We propose an HPGe detector with cross-strip electrode design, which can be operated
at high count rate and measure multiple X-ray events, suitable for the application at a pulsed muon source. The detector design also has high position resolution. A two-dimensional imaging of elements at a given analysis depth is possible. The novel combined electrode technique will be used in the fabrication to simplify the precise electrode design. The design, simulation, and prototype fabrication are in progress.

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