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Development and Modeling of a Thin, Radiopure Germanium Detector Entrance Window

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Ultra-low-background (ULB) high purity germanium (HPGe) detectors are essential tools for measurements of materials with extremely low levels of radioactivity. Such detectors support research areas ranging from fundamental physics of rare events like dark matter and neutrinoless double beta decay, to nuclear safeguards and treaty verification.

A common shortcoming specific to ULB HPGe detectors is a lack of sensitivity to lower energy gamma radiation (<100 keV), due to the requirement of using highly radiopure copper for the detector shell which attenuates these low energies. At Pacific Northwest National Laboratory, we are developing a radiopure entrance window with high transmission of gammas down to 10 keV. Our team is working to create a thin window from radiopure polymers and ceramics, namely looking at polyetherimide and pyrolytic boron nitride as candidate materials. In this poster, I will present an overview of the project, along with a focus on modeling efforts used to guide the material selection, window design, and performance validation.

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