



Advances in CRNS with Lithium-Based Neutron Detectors

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In response to a demand for alternatives to helium-3 detectors in the field of nuclear security, Silverside Detectors developed a novel thermal neutron detector with a goal of reducing the cost per neutron count. We use lithium-6 foil in a rectangular multi-wire proportional counter. The design is resistant to impact and vibrations, and can be used in a wide range of temperatures. The cost per neutron count of Li-6 panels is less than half that of He-3 tubes, with a comparable sensitivity. Silverside's detectors are currently deployed by the United States Departments of Defense and Homeland Security at airport and border locations.

Silverside's detection technology has been tested for and incorporated into a sensor for measuring soil moisture. Field tests have demonstrated that the lithium-based sensor performs well compared with the standard COSMOS sensor employing He-3 tubes. Furthermore, the flat panel geometry of Silverside's sensor offers the possibility of hitherto unexplored directional measurements for CRNS applications.

Our current research efforts are focused on developing a moderator configuration that is optimized for the shape of the Li-6 detectors. The new moderator design will enhance the directional nature of the panels, and improve the soil moisture signal. As part of this research, we have conducted neutron transport simulations, as well as field tests of prototype moderator designs. Future work will include a combination of environmental neutron transport modeling using URANOS, and detector geometry modeling with GEANT. In addition to advancing low-energy neutron sensing to quantify water near the land surface, we are working on using the lithium detector for other environmental applications.