Small Active Readout Device for Dose Spectra from Energetic particles and Neutrons (DoSEN)

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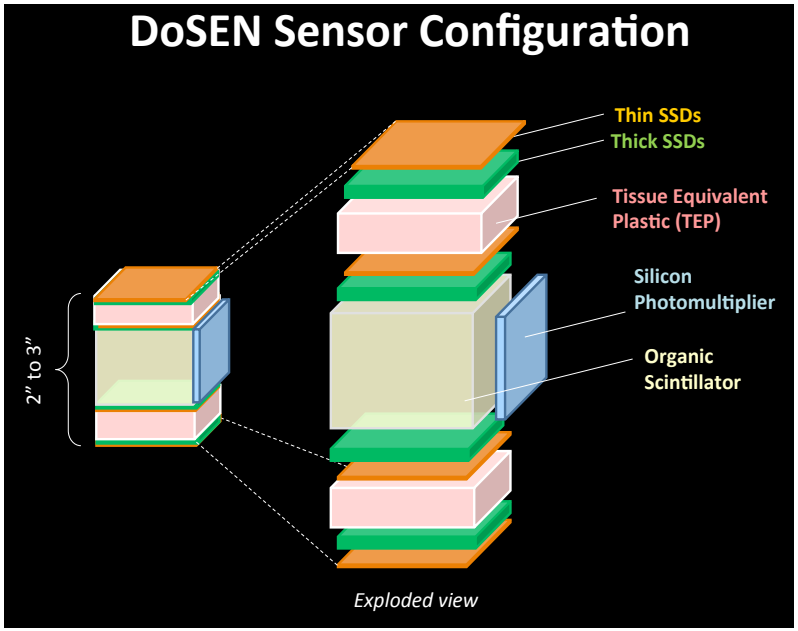
Summary: DoSEN is an early-stage space technology research project to develop the concept and to demonstrate the proof-of-principle of a space radiation dosimeter, DoSEN, possessing unprecedented performance capabilities despite a design requiring only minimal resources (mass, volume, power, cost). DoSEN combines two advanced complementary radiation detection concepts that present fundamental advantages over traditional dosimetry, but requires proof-of-concept to increase DoSEN's TRL. DoSEN not only measures the energy but also the charge distribution (including neutrons) of energetic particles that affect human (and robotic) health in a way not presently possible with current dosimeters. Thus, DoSEN lays the foundation for a new generation of dosimeters.

Objectives: **The sole focused objective of the DoSEN project is to demonstrate viability and benefits of coincidence energetic particle and neutron detection**.
We propose to provide proof-of-concept for :

- Low-power neutron detection in an organic scintillator with pulse-shape discrimination.
- Coincident detection of primary and neutron-recoil protons from the scintillator using solid state photo sensors.
- Background suppression and particle identification over a broad energy range for neutrons, electrons, protons and heavy ions, and gamma rays.
- Fast coincidence determination and active readout of dose, dose-equivalents, organ doses and neutron doses based on biologically appropriate quality factors in relevant energy ranges.

Methodology: UNH researchers assess the theoretical feasibility of DoSEN's novel combination of energetic particle and neutron dosimetry, and then advance the concept from TRL 1 to TRL to 3 by developing basic principles of operation, by formulating an application of the technology concept, and finally by proving the concept through analytical and experimental means.

Potential Impacts: DoSEN represents an innovative low-TRL technology for advanced space systems and space technology, with broad NASA applications, manned and robotic, that are not mission-specific. The DoSEN concept has the potential to dramatically improve system-level performance of missions and astronaut risk reduction through transformational improvement in dosimetry performance with only minimal resources.



The DoSEN sensor configuration includes a combination of Solid State Detectors, organic scintillator with Pulse-Shape Discrimination and Si photomulitipliers allowing coincident detection of energetic particles and neutrons. The unique coincidence offered by LET & neutron detection promises a significant advance for a new generation of dosimetry measurements.