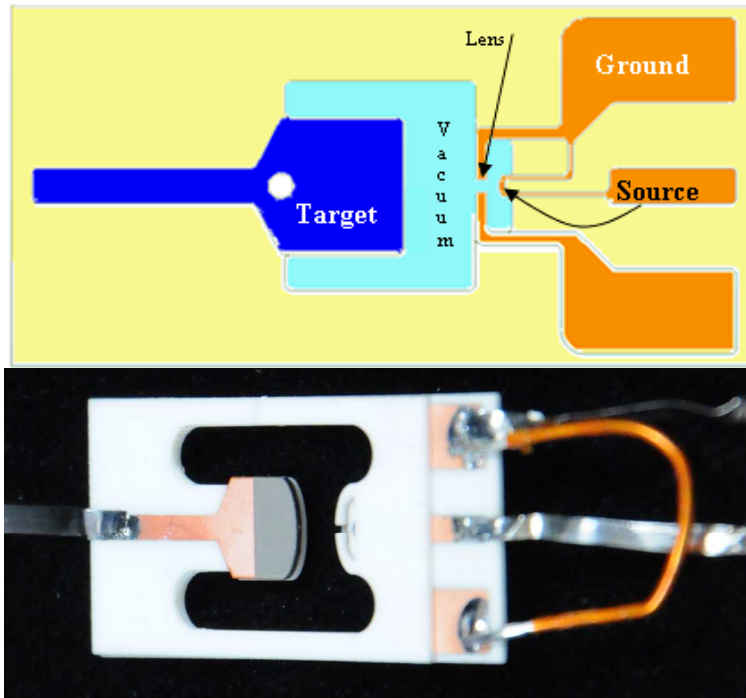


Surface Mounted Neutron Generator

The mission focus of this LDRD is to develop the next generation of neutron sources that can be scaled, programmed, used on various applications including medical, and fabricated using modern solid-state manufacturing technologies. In finding the scaling laws that control accelerator-based neutron production, several remarkable innovations were developed, such as the one presented here.

Conventional accelerator-based neutron tubes use a deuterium (D) ion source, an aperture from which the ions are extracted into an accelerating gap, and a tritium (T) loaded target. Most available systems are made with a cylindrical envelope to facilitate the ion beam control and to symmetrically allow the radial beam expansion resulting from space charge. It also makes it easy to control the accelerating gap high-voltage gradients, especially wall surface effects. The D ions are accelerated towards the tritium-loaded target to produce a high-energy collision that induces a neutron producing fusion reaction between D and T.

We have successfully demonstrated deuterium ion sources of micron size, and DD and DT reaction-based neutron production with mm-size devices. These successes are based on ion production from a flat strip ion source deposited on a ceramic substrate, an aperture to extract the ions with an innovative elliptico-cylindrical ion lens that produces and controls a flat (rectangular) ion beam, which is accelerated onto an elliptico-rectangular shaped target. The final device uses a rectangular vacuum sealed structure that is mostly made as a printed circuit board. Several patents are being processed based on the concept.



Surface mounted neutron generator components

Work funded under the LDRD/Sandia National Laboratories program. Sandia National Laboratories is a multi-program laboratory managed and operated by Sandia Corporation, a wholly owned subsidiary of Lockheed Martin Corporation, for the U.S. Department of Energy's National Nuclear Security Administration.