FY19 Sandia National Laboratories Progress Report on Omega Laser Facility Experiments

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The Energetic Neutrons Campaign led by Sandia National Laboratories (SNL) had a successful year testing electronic devices under 14-MeV neutron irradiation at the Omega Laser Facility. During FY19 SNL employees were trained to take over new responsibilities while visiting LLE, continued collaborating with external organizations, and generated knowledge that supports SNL's national security mission.

In FY19 SNL trained a new engineer to become the Principal Investigator (PI) of the Energetic Neutrons Campaign. The transfer of knowledge and skills between the old and new PI's was seamless and enhances SNL's capability to test multiple setups by having more trained personnel during test campaigns at Omega. Also, the number of Omega-certified SNL radiation workers increased from one to three, allowing SNL to increase the number and complexity of the test campaigns at the facility.

In FY19 SNL collaborated with the U.S. Air Force Nuclear Weapons Center and others during the Energetic Neutrons Campaigns. SNL hosted engineers and scientists from these organizations at the Omega Laser Facility and supported experiments related to radiation effects in semiconductor devices. During FY19 SNL also provided an opportunity for others to collaborate on experiments at Los Alamos National Laboratory, Massachusetts Institute of Technology, LLE, Atomic Weapons Establishment, and Commissariat à l'énergie atomique et aux énergies.

SNL continued using the last two generations of neutron effects diagnostics [NED's, Fig. 1(a)] designed and built in previous years to field passive and active semiconductor devices and integrated circuits. The instant response of electronic devices to 14-MeV neutrons produced on OMEGA was monitored before, during, and after the irradiations, and the device physics of the

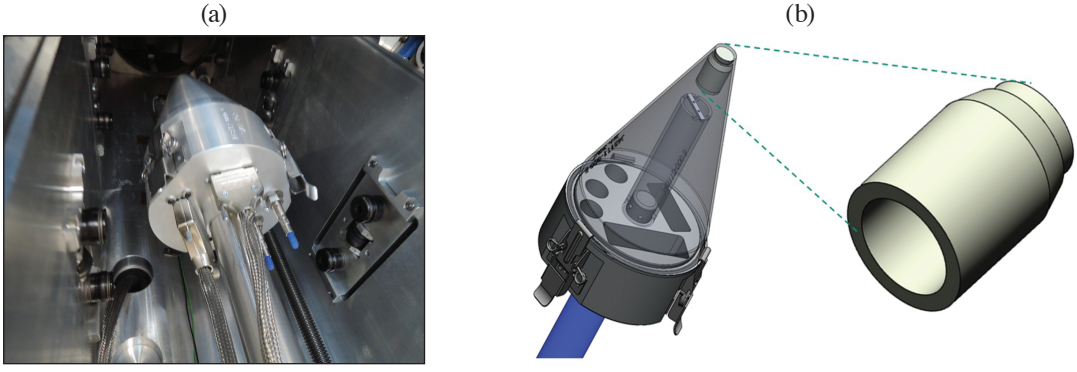

Figure 1
(a) The Gen 3 NED used at Omega; (b) the photon shielding designed for a Gen 3 NED.

irradiated devices was explored with post-irradiation characterization tools at SNL. Irradiations on OMEGA supported a 14-MeV neutron flux effect study on silicon-based devices (Fig. 2) and an ionization effect study on semiconductor devices exposed to high-flux neutron irradiations [Fig. 1(b)]. Some of the results were presented at the Hardened Electronics and Radiation Technology (HEART) Conference in the spring of 2019; the remainder of the results were used internally.

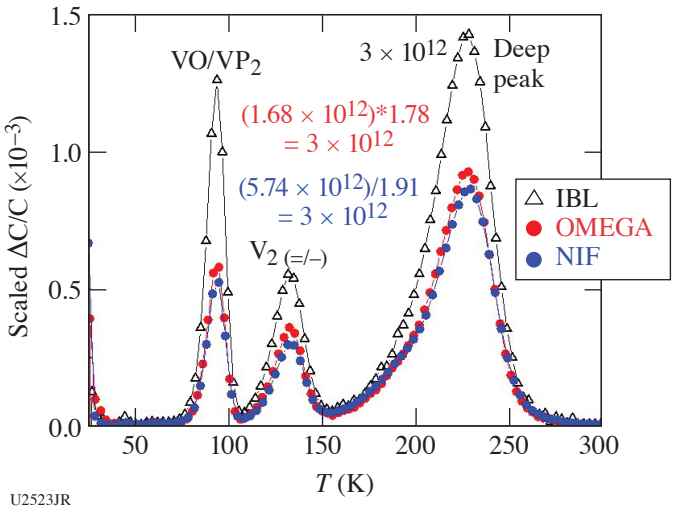

Figure 2
Radiation-induced defects for different 14-MeV neutron facilities. IBL: Ion Beam Laboratory; NIF: National Ignition Facility.

This work was performed at Sandia National Laboratories, a multimission laboratory managed and operated by National Technology and Engineering Solutions of Sandia LLC, a wholly owned subsidiary of Honeywell International Inc. for the U.S. Department of Energy's National Nuclear Security Administration under contract DE-NA0003525. The views expressed in the article do not necessarily represent the views of the U.S. Department of Energy or the United States Government. SAND2019-13909 R.