Three-Dimensional Computed Tomography for Advanced Instrumentation Imaging

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ABSTRACT:

This infrastructure support activity will enable INL researchers at the High Temperature Test Laboratory (HTTL) to perform high resolution non-destructive imaging of unique sensors using a three dimensional computed tomography machine. HTTL efforts to develop enhanced instrumentation for high performance US materials testing reactors (MTRs) were initiated as part of the Advanced Test Reactor National Scientific User Facility (ATR NSUF) in 2007. Although this effort has only been underway for seven years, HTTL researchers have already successfully developed and deployed a large number of sensors to support irradiation testing required for Department of Energy Office of Nuclear Energy (DOE-NE) programs, such as the ATR NSUF, the Fuel Cycle Research and Development (FCRD), the Nuclear Energy Enabling Technology (NEET), and the Next Generation Nuclear Plant (NGNP). However, development and deployment of ever increasingly complex and sophisticated sensors requires the diagnostic capabilities that can only be achieved using a three dimensional computed tomography machine.

Sensor design, fabrication and evaluation activities are completed by experienced researchers at the HTTL to support irradiations at a wide range of MTRs, including the ATR and ATR critical facility (ATRC) located at INL, other MTRs participating in the ATR NSUF, such as the Massachusetts Institute of Technology Research Reactor (MITR), and international collaborating MTRs, such as the Halden Boiling Water Reactor (HBWR). Although the HTTL includes a wide range of sensor fabrication and evaluation equipment, including a real-time two-dimensional x-ray imaging system, a three dimensional computed tomography capability is sorely needed to non-destructively evaluate new advanced and complex sensors being developed to meet DOE-NE program requirements for high accuracy and high resolution data to validate new modeling and simulation tools and would greatly enhance on-going HTTL research efforts supporting the ATR NSUF, NEET, NGNP, FCRD, and other DOE-NE programs.