2ND QUARTER
2022 EDITION

THE NEUTRON PULSE

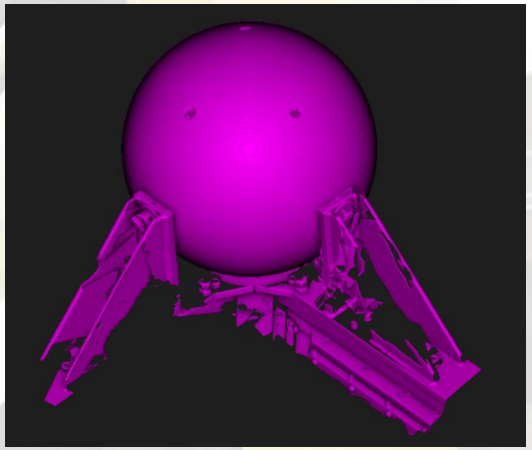
Critical Assembly Operations

NCERC experimenters performed seven weeks of critical assembly operations during the quarter including Godiva Pulse Reproducibility Measurements on Godiva, Fission Product Yield Measurements on Godiva and Activation Product Yield Measurements on Flattop. The Godiva operations utilized the upgraded NCERC Count Room described in the previous edition of The Neutron Pulse. Additionally, physical measurements of Flat-Top with HEU core were performed to better define component dimension and mass uncertainties.

Flat-Top HEU Benchmark Reevaluation

Physical measurements were performed on Flat-Top components using modern instruments and techniques as part of an effort to update the Flattop benchmark evaluation to meet contemporary International Criticality Safety Benchmark Evaluation Project (ICSBEP) standards. The uncertainty in the original benchmark evaluation is primarily caused by conservative estimates of mass and volume uncertainties. These values can be reduced with improved measurements.

◄ *Charley Kiehne (NEN-2) performs a CMM scan of Flat-Top.*



Digital rendering of CMM scan of Flat-Top. ►

Several types of measurements were performed over the course of two weeks. A high-precision balance was used to weigh the glory hole and mass adjustment pieces. An instrument called a pycnometer, which utilizes gas displacement to measure volume (similar to liquid displacement methods) was then used to measure the volume of the glory hole and mass adjustment pieces. The combination of measurements allows precise calculation of the party densities for the benchmark evaluation. A coordinate measuring machine (CMM) was used to determine key dimensions as well as to completely scan the surface of the Flattop reflector components and HEU core.

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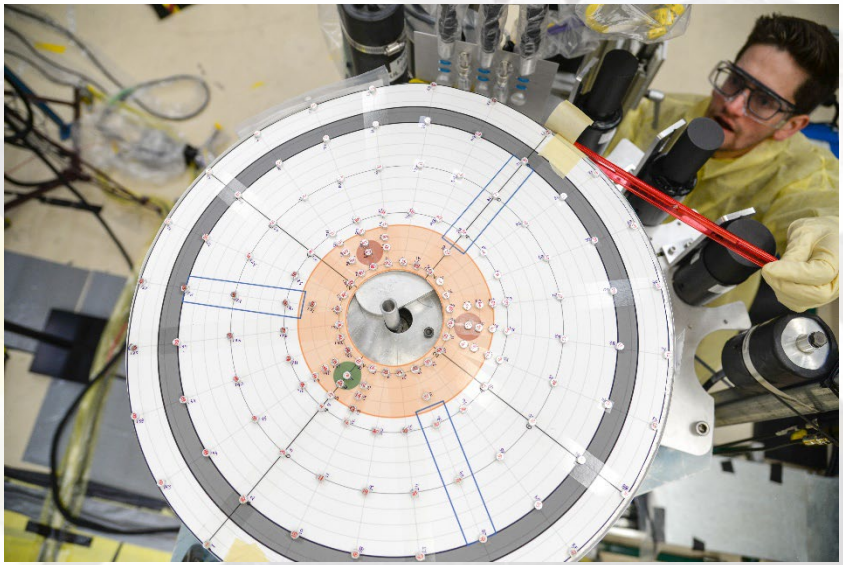
Godiva Pulse Repeatability and Characterization

In May, twelve 70°C delta-T Godiva bursts were performed to determine the reproducibility between bursts. Several types of activation foils were deployed to determine the variation. Both Sandia National Laboratories and Pacific Northwest National Laboratory participated in the measurement. Nickel foils and sulfur pellets from Sandia, gold and iron foils and wires from LANL, and foil packs from PNNL were placed in the center of Godiva. After the irradiation, the LANL foils and PNNL foil packs were counted in the NCERC Count Room, and the Sandia foils and pellets were counted at the Sandia Radiation Metrology Laboratory. Data from the pulse monitor nickel foils and sulfur pellets indicated pulse-to-pulse variations of no more than 1.9% based on the neutron fluence. Confirming the variation is essential to reducing uncertainty in a shielding benchmark experiment planned in collaboration with ORNL.

Criticality Safety Classes

Four criticality safety classes were conducted this quarter targeting different audiences—the main Nuclear Criticality Safety Program Class for criticality safety practitioners as well as similar courses tailored for PF4 personnel, Nuclear Material Management personnel and Emergency Response personnel. These classes focus on fundamentals of criticality, criticality safety, and are designed to demonstrate the effects of changing parameters important to nuclear criticality safety.



▲ *Robert Weldon (NEN-2) positions ex-core dosimetry on the Godiva Top Hat to monitor the radiation field.*

Additionally, a newly developed contamination class was conducted allowing students to gain hands on experience working with bare Uranium in a controlled setting in a contamination hood.

Additional Support Operations

Quarterly Maintenance, Surveillance, and In-Service Inspection procedures were performed according to schedule. The 24V Planet Analog Power Supply was replaced and subsequent Post Maintenance Testing was completed successfully. Also, the hydraulic fluid on all four critical assembly pump packages was exchanged. This process is only performed every 5 years.