

# Harmonizing Future NNSS and LANSCE Facility Upgrades with Science Drivers: P-3 group contributions to NDSE gamma-ray detector development and spallation neutron target design

Andrew L. Cooper (LANL)

July 8, 2021

The scientific impact of experiments conducted at the Nevada National Security Site (NNSS) and Los Alamos Neutron Science Center (LANSCE) depends on close collaboration and communication between the facility operations and user communities. The development of future diagnostic detector systems for subcritical experiments capable of meeting stockpile stewardship data needs will rely on coordination between the data recipients at the national laboratories and the fielding operations communities at the NNSS. Similarly, a successful performance alignment of future upgrades to the LANSCE accelerator and spallation target facilities with the experimental needs of flight path users at the Weapons Neutron Research (WNR) Facility and Lujan Center will critically depend on this relationship. Science deliverables are achieved when members of the P-3 group support and stimulate these relationships by establishing lines of communication, and with simulations and proof-of-principle laboratory measurements that inform facility upgrade pathways and demonstrate their experimental impact. Results from diagnostic detector and spallation target research efforts will be presented in this context. Specifically, a new  $\gamma$ -ray detection response model and final detector design for Neutron-Diagnosed Subcritical Experiments (NDSEs) at the NNSS will be described. Recent MCNP6 simulations of future WNR Target 4 design concepts will be introduced. Additionally, charged-particle

shielding calculations for the Detector for Advanced Neutron Capture Experiments flight path will be presented in preparation for the Mark IV target upgrade at the Lujan Center. In closing, new simulation efforts and fielding considerations for a heavily-moderated, high-intensity spallation neutron target and radioactive ion beam storage ring facility will be discussed. This next-generation facility will permit once-impossible neutron reaction measurements on short-lived nuclei at LANSCE.