NEUP Nuclear Energy University Programs

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Enhancement of radiation safety, security, and research infrastructure at newly constructed Neutron Beam Hall at the Penn State Breazeale Nuclear Reactor

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Collaborators: N/A

Program: University Research Reactor Upgrades Infrastructure

ABSTRACT:

The Penn State Breazeale Reactor (PSBR), the centerpiece of the Radiation Science and Engineering Center (RSEC), first went critical in 1955 and is the nation's longest continuously operating university research reactor. A new core-moderator assembly, reactor core upper and lower grid plates, safety plates, reactor tower structure, and new and geometrically aligned neutron beam ports were designed, constructed, and installed in August 2018. After this upgrade and improvements, full use of the PSBR's capabilities and the establishment of state-of-the-art neutron beam facilities are possible. To fully utilize new beam ports with cold neutron source and installations of neutron guides for various experiments, we identified a need to expand our existing neutron beam hall from about 1,000 sq ft area to 5,000 sq ft. To this end the PSU funded ($9.4M) construction of an expanded new neutron beam hall. The construction commenced in June 2021 and will be completed in May 2022. Our new upgraded and improved facility will offer unparalleled research opportunities for PSU faculty and graduate students in multiple disciplines while providing an excellent testbed for the development of instruments and experiments for researchers at PSU, as well as other regional and national university researchers, industry, and national laboratories. The addition of new neutron beam port facilities including a Small Angle Neutron Scattering (SANS) instrument that is donated to Penn State by The Helmholz-Zentrum Berlin, Germany (over $9.8M value), new time-of-fight neutron depth profiling, new prompt gamma activation analysis system, and new neutron imaging system in addition to the existing RSEC capabilities, will expose students to a range of important applications.

In this application, we seek DOE NEUP reactor infrastructure funds for enhancement of radiation safety and security infrastructure for our new expanded beam hall, a triple neutron beam catcher for new cold neutron beamline, and a neutron beam cave for the beam bender and neutron chopper sections of the extended beam line for the SANS facility. The funds requested for this application will enable us to utilize the expanded beam hall safely and efficiently. First floor of the expanded beam hall is designated for office spaces for faculty, staff, and students. Therefore, for ALARA reasons radiation safety and security infrastructure of the facilities used in the beam hall is especially important. The safe operation of our neutron beam lines is also vital for the expansion of our research, instruction, and training capabilities. Development and utilization of new neutron beam techniques including a new SANS facility will strengthen significantly academic communities' infrastructure not just for nuclear engineering, but also material science, chemistry, biology, and physics. The PSBR will be the only university research reactor with SANS capability in the USA. To operate and use the newly expanded neutron beam hall we need to enhanced safety and security of the expanded infrastructure. The total project cost will be $364,240. This small investment from DOE NEUP will enable us fully and safely utilize the $9.8M donated SANS and $9.4M new neutron beam hall.