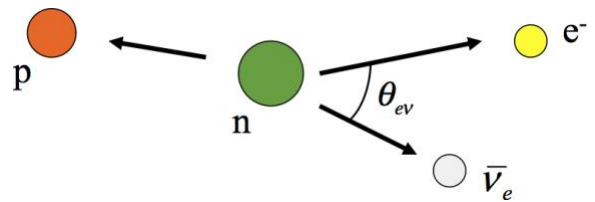


Fundamental Nuclear Physics Research with the Nab Experiment at Oak Ridge National Laboratory

J. Hamblen

The Nab experiment (<http://nab.phys.virginia.edu/>) is a nuclear physics experiment at Oak Ridge National Laboratory. It is installed at the Fundamental Neutron Physics Beamline at the Spallation Neutron Source at ORNL. The goal of the experiment is to conduct precision measurements of the neutron beta decay reaction $n \rightarrow p + e^- + \bar{\nu}_e$ at unprecedented levels.

The Spallation Neutron Source (<https://neutrons.ornl.gov>) at ORNL is a world-class facility for neutron physics research and currently provides the most intense beam of neutrons in the world. The Nab experiment will collect the proton and electron produced in the beta decay process, and a spectrometer will measure their energy and momentum. Correlation measurements between the electron energy and proton momentum will provide key tests of the standard model of particle physics and yield a deeper understanding of the weak nuclear force.



A model of a neutron beta decay reaction.

The experiment is fully installed and is currently being commissioned. Preliminary data collection has begun and should continue through 2025. Interested students will have the unique opportunity to participate in the operation of the experiment as well as data collection at ORNL. At the same time, data analysis and simulation of the detector using the C++ and GEANT4 software packages will occur using supercomputing resources at the University of Virginia. Overall, students will gain first-hand experience working with a collaboration of scientists from around the world on a cutting-edge nuclear physics experiment.



Former URP student Jackson Ricketts testing the Nab detector electronics at ORNL.