

# The First Search for Neutrino-Induced Nuclear Fission

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For over 53 years, it was predicted that the neutrino, the smallest particle in the universe, is capable of splitting the atom. This phenomenon of neutrino-induced nuclear fission, or nuFission, is a portal between the weak and strong interactions and may lead to a new method for nuclear reactor monitoring. However, before these use cases can be leveraged, the central question must be meted out—is it possible to split an atom with a neutrino? To investigate, we turn to Oak Ridge National Laboratory’s Spallation Neutron Source (SNS) which is an intense source of neutrinos that stream isotropically outwards where the COHERENT Collaboration has established a basement corridor facility called “Neutrino Alley” in close proximity to the accelerator target (the neutrino source) while boasting a sharp decrease in beam-related backgrounds.

At Neutrino Alley, a new neutrino detector subsystem called “NuThor” was commissioned and deployed in the summer of 2022 where it is currently amassing data. NuThor is a bespoke neutron counting apparatus (or neutron multiplicity meter) that envelops a 52 kg thorium metal target. The neutrinos occasionally burrow straight through the outer shielding and active detectors in NuThor to interact with the inner thorium mass where there is a probability of inducing nuclear fission. The nuclear fission events will be accompanied by an outflow of neutrons. NuThor then counts these neutron detections in time with the neutrino beam’s onset.

With the accelerator currently in a sustained down period for upgrades and maintenance, the NuThor analysis is rapidly progressing through a multi-tier pipeline optimized for this experiment’s science goal.

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