

A Measurement of Parity Violation in the Capture of Cold Neutrons on Helium-3: A wire chamber as a Target and Detector

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March 13, 2015

SSP 2015 Congress Abstract:

The n3He experiment aims to measure the parity violating asymmetry in the direction of proton emission from the capture polarized cold neutrons in an unpolarized gaseous ^3He target from the reaction $\vec{n} + ^3\text{He} \rightarrow T + p$. The size of the asymmetry is estimated to be $(-9.5 \rightarrow 2.5) \times 10^{-8}$, and our goal measurement accuracy is 2×10^{-8} . The asymmetry is a result of the low energy weak interaction between quarks and its measurement will provide a benchmark for modern effective field theory calculations.

The experiment uses a ^3He multiwire ionization chamber as the combined target and detector operated in current mode. The 144 signal wires are read out individually from the chamber. The frame stack consists of 16 signal wire planes and 17 HV planes. I will discuss the design, construction and assembly of the detector.

As simulation is required to study the performance of the chamber and verify it works as expected Garfield++ is used to simulate charge collection, electron avalanches and ion mobility in the HV field. Garfield++ does not simulate gas ionization by low energy particles, in our case protons and tritons, so it is paired with a Geant4 simulation for charge deposition in the chamber. The n3He experiment is currently running at the Oak Ridge National Laboratory. I will compare some initial chamber data to simulation.