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Monte Carlo Simulation of a Micro-Nuclear Battery BENJAMIN GUTHRIE[1], PHILLIP WOMBLE, KEITH ANDREW, Western Kentucky University — Betavoltaics are beta decay-powered batteries that could potentially last for decades, but direct radiation damages the semiconductors of a battery long before its potential lifetime is over. Photon Assisted Radioisotopic Energy Source (PARES) batteries use a phosphorescent scintillator to convert radiation to photons which then impinge on a photovoltaic, which, in essence, shields the photovoltaic from the ionizing radiation. As part of an on-going research project, we plan to perform a survey of optimal fuel/scintillator/photovoltaic combinations. A Monte Carlo simulation code was developed to simulate the radioactive decay of the fuel, its subsequent interaction with the scintillator, the emission and absorption of photons from scintillation and the resulting potential differences in the photovoltaic. Two radioisotopes, Ni-63 and Sm-151, were selected as potential fuels and subsequently modeled. The calculations indicate that Ni-63 would deposit 1.23 +/- 0.2 times as much energy in the scintillator as Sm-151 did. The simulation was then benchmarked against the Monte Carlo N-Particle (MCNP) transport code. Our initial results indicate that our code can serve as a reliable platform for simulating the photovoltaic cells of the PARES battery in future research.

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