# Analyzing Decay Patterns of Xenon-134

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The primary objective of this experiment was to measure neutron-induced backgrounds on isotopes of interest to neutrinoless double-beta ($0\nu\beta\beta$) decay observations. At Triangle Universities Nuclear Laboratory (TUNL) we can study neutron-induced backgrounds with our enriched sample of $^{134}$Xe. In this study, we focused on the $^{134}$Xe(n, 2n)$^{133}$Xe interaction. We utilized germanium detectors to detect gamma rays emitted during the subsequent decay of $^{133}$Xe. The acquired data was analyzed to understand the decay patterns of $^{133}$Xe and evaluate the probability of external neutrons influencing future $0\nu\beta\beta$-decay experiments, which involve mixtures of Xenon isotopes. Two potential decay paths were identified for the resultant $^{133}$Xe: isomeric transition with a half-life of 2.918 days and typical beta-decay to $^{133}$Cs with a half-life of 5.2475 days. By measuring specific gamma-ray counts at 233.221 keV (for isomeric transition) and 81 keV (for typical beta-decay) over time, the study aimed to establish an exponential relation between the counts and decay time, which has been observed. These known half-lives and expected gamma-ray values were employed to identify false counts and determine the cross section of the $^{134}$Xe(n,2n)$^{133}$Xe interaction for incoming neutron energies of 10.0 and 12.0 MeV.