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Enhanced Sensitivity in the Detection of 129I Using Accelerator Mass Spectrometry at the University of Notre Dame

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The isotope ^{129}I, with a half-life of 15.7 million years, serves critical roles ranging from an environmental tracer of fission products to a significant marker in nuclear astrophysics. Due to its low natural terrestrial abundance (approximately one part per trillion), accelerator mass spectrometry (AMS) offers a robust method for its detection, accurately distinguishing the ^{129}I signal from the stable isotope ^{127}I in aqueous samples. Recent advancements in our beamline configuration and time-of-flight detection systems at the University of Notre Dame's Nuclear Science Laboratory have significantly increased our measurement sensitivity for ^{129}I. This study presents a comprehensive analysis of reference standards, highlighting the enhanced detection capabilities achieved. The modifications to the AMS system, improved time-of-flight resolution, detailed analysis results, and implications for environmental and astrophysical applications will be discussed. In particular, we will highlight our collaboration with the nuclear theory group at Notre Dame, and how future experiments may be used to build upon advancements made by Wang et al. (2021, 2023) on the understanding of certain astrophysical processes (Wang, X., Clark, A. M., Ellis, J., et al. 2021, *r*-Process Radioisotopes from Near-Earth Supernovae and Kilonovae), (Wang, X., Clark, A. M., Ellis, J., et al. 2023, Proposed Lunar Measurements of *r*-process Radioisotopes to Distinguish the Origin of Deep-sea ^{244}Pu).

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Student Submission

Yes

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