Using Machine Learning to Streamline Radioisotope Development and Production

We propose to use Artificial Intelligence/Machine Learning (AI/ML) to simplify and streamline radioisotope research and production. The production of nuclides requires countless hours of human effort and input from numerous disciplines of physical science (i.e. chemistry, materials science, and nuclear physics). In our proposed work, we will use AI/ML techniques for automated information gathering and to aid in simulations. We will apply Natural Language Processing (NLP) techniques to accelerate retrieval of known information about aspects of production including, but not limited to, target material, target geometry, irradiation times, and separation techniques. Further we will use AI/ML approaches like Reinforcement Learning to aid in irradiation simulations to provide guidance on all aspects of isotope production. This project will be expanded to automating physical isotope production. Supported by AI/ML, robotic arms will be used to carry out the suggested physical and chemical manipulations, enabling improved experimental throughput, reduced processing time without compromising safety in radioactive environments. AI/ML and robotics can together close the loop on isotope production, supporting an Optimal Experimental Design approach. AI/ML and Isotope production are both areas of great importance to both BNL and the DOE isotope program. The development of this work would keep BNL at the forefront of research and production of radioisotopes.