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Production of Radioisotopes using Secondary Neutrons at the Brookhaven Linac Isotope Producer

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The Brookhaven Linac Isotope Producer (BLIP) facility at Brookhaven National Laboratory routinely irradiates targets, using a proton beam of incrementally tunable energy (66-200 MeV) and intensity (up to 170 μA), for the creation of a host of radioisotopes for use in medical applications. During irradiation of these targets, secondary neutrons are generated by proton-induced reactions and have thus far largely been an untapped resource. These neutrons have the potential to produce additional isotopes of interest by placing targets downstream of the proton target stack after the protons have been stopped. Prior to their use for isotope production planning, the emitted neutron spectrum first needs to be characterized. To characterize this production pathway, several different elemental foils were irradiated using secondary neutrons and subsequently analyzed using gamma spectroscopy to measure activation products. After a 30-minute irradiation of the target stack at a proton energy of 200 MeV and beam current of 150 μA, the foils were measured using gamma spectroscopy for the identification and quantification of the isotopes produced during the experiment with secondary neutrons. Following gamma spectra analysis, the deduced activities of several isotopes that serve as flux monitor reaction products were used along with TENDL cross sections to determine a neutron spectrum that can be relied upon for future production planning.

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