Recently, there has been growth in the number of prostate seed implants using 125I. In this work, we investigate production of radionuclides using a special dedicated linear accelerator. The purpose of this talk is to determine the range of energies and power levels necessary for production of clinically useful amounts of activity for prostate seed implants using linear accelerators.

An intense beam of electrons can be used to produce radioisotopes from stable target material. The physics process is the emission of neutrons or protons from the nucleus via the giant dipole resonance. The principle of our approach is to maximize the flux of electromagnetic energy into the resonance window of this reaction for a given material. Nuclear physics cross section data and Monte Carlo modeling is used to provide input for calculating activation yields and prediction of dose. A 2 kW linear accelerator operating at 25 MeV can produce radioactive tantalum , gold and rhenium. The properties of these three materials are summarized and compared. The half lives range from 8 hours to 6 days. Using volume estimates derived from clinical 125I implants, we calculate the time needed to produce enough radioisotope to deliver periphery doses of 30-100 Gy. The production times are on the order of an hour and are dependent on irradiation geometry, machine parameters and dose level. Linear accelerators designed for in-house production of radioisotopes for prostate cancer radiation therapy are feasible. The clinical efficacy of the new radioisotopes remains to be determined.