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Isotope Production using High-Power Electron Accelerators[1]

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High power (up to 100 kW) electron accelerators are well suited for the production of some important isotopes for medical use because the high power can compensate for the lower cross- sections. The Low-energy Electron Recirculator Facility (LERF) at Jefferson Lab is ideal for this purpose, but high beam power requires targets and cooling systems that can handle the power dissipation. Irradiated target handling, multiple isotope separation, and adequate radiation shielding must also be considered. The focus of this research is photo-nuclear production of 67 Cu using the 71 Ga(,) 67 Cu reaction. 67 Cu is an attractive isotope with beta and gamma emissions that are near ideal for image-guided radiopharmaceutical therapy of cancer and inflammatory diseases. The use of liquid gallium as the target is viable because of the extremely high boiling point of gallium (2,400C). The goal is to demonstrate the viability of photonuclear production of 67 Cu from the liquid gallium target, addressing all of the issues of corrosion, radiation and thermal management. The initial target crucible made of boron nitride was tested at 1kW and then modified to improve cooling. The improved crucible made of graphite was successfully tested at 5kW and the yield and separation efficiency of 67 Cu from the irradiated target determined. A target design has been developed for beam power up to 50kW. This design is being built and will be tested at up to 5kW initially to confirm the thermal calculations. This design is designed to allow the gallium to be remotely removed from the irradiation area, a prerequisite for large- scale production.

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