COMPTON BACKSCATTERING CONCEPT FOR THE PRODUCTION OF MOLYBDENUM-99

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Abstract

The medical isotope Molybdenum-99 is presently used for 80-85% of all nuclear medicine procedures and is produced by irradiating highly enriched uranium U-235 targets in NRU reactors. It was recently proposed that an electron linac be used for the production of 99Mo via photo-fission of a natural uranium target coming from the excitation of the giant dipole resonance around 15 MeV. The photons can be produced using the braking radiation ("bremsstrahlung") spectrum of an electron beam impinged on a high Z material. In this paper we present an alternate concept for the production of 99Mo which is also based on photo-fission of U-238, but where the ~15 MeV gamma-rays are produced by Compton backscattering of laser photons from relativistic electrons. We assume a laser wavelength of 330 nm, resulting in 485 MeV electron beam energy, and 10 mA of average current. Because the induced energy spread on the electron beam is a few percent, one may recover most of the electron beam energy, which substantially increases the efficiency of the system. The accelerator concept, based on a three-pass recirculation system with energy recovery, is described and efficiency estimates are presented.

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