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Accelerators for Medical Isotope Production

STEPHEN MILTON, Los Alamos National Laboratory

Ionizing radiation has been used for decades in many applications, and it comes in two primary forms: particles and electromagnetic radiation. While ionizing radiation is generally not the best thing for you, it does have its place in medical applications, both x-rays for diagnostics purposes and proton beams for cancer treatment come immediately to mind. But there are other sources of beneficial ionizing radiation, specifically atomic isotopes. "Stable" atoms found in abundance in nature have a specific atomic mass number (total number of protons and neutrons in the nucleus). Atomic isotopes are atoms with an atomic mass number different than the stable atom, i.e. they have more or less neutrons in the nucleus. They have, therefore, identical electronic properties, but very different nuclear properties. Some isotopes are stable while others are not, and the unstable, radioactive, isotopes emit ionizing radiation. While not all radioactive isotopes are useful for medical applications, there are many that are. Strontium-82, for instance, is used worldwide for heart imaging. But these isotopes, by their very unstable nature, are not found in abundance in nature. They must be produced. And that is where the accelerator comes back in to the picture. In this talk I will describe the history of medical isotope production via particle accelerators and in some cases the subsequent use. I will walk through the process for some commonly used isotopes and then delve into where we are headed in the future and the machines that will be used for this important component of the medical industry. LA-UR-21-20176 Approved for unlimited release.