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A Study of Rare-Isotope Beams in Hadron Therapy PAIGE LYONS, ALAIN LAPIERRE, PAUL GUEYE, Michigan State University, MONA COLLABORATION — Hadron (e.g., proton, neutrons, heavy ions) beams in Radiotherapy have many biological and physical advantages in comparison to traditional beams such as electrons and photons. Within the past decades, many researchers have found promising results in the use of radioisotopes. For instance, one important advantage in hadron therapy is the possibility of accurately measuring delivered doses in real-time by monitoring the nuclear decay of the isotopes. These advantages have been at the forefront of cancer research, further expanding clinical modalities for cancer patients of various classifications. We first performed a comprehensive review of existing isotopes and techniques (imaging, dose measurements) used in clinical settings (from hadron therapy to brachytherapy) to identify the specificities of the use of radioisotopes. In our second study, we used the hadron therapy example of the Geant4 simulation toolkit to compare the dose distributions between stable and rare isotopes beams. We will present and discuss the results obtained from this study. In the near future, the impact on the DNA single and double strand breaks will be investigated. The Facility for Rare Isotope Beams (FRIB) under construction at Michigan State University will provide rare-isotope beams of high intensities. Ion sources are currently being used to deliver heavy ion rare-isotope beams to accelerator systems for nuclear physics. The current work will provide the foundation for the possible development of an ion source optimized for the delivery of rare isotope beams for hadron therapy and hence the treatment of various diseases.

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