Monte Carlo study of Resistive plate chamber technology performance for in vivo beam range verification in hadron therapy

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Background: Nowadays, more than ever, it's paying attention to cancer treatment techniques to improve them. Hadron therapy is one of the most promising modern techniques, where, instead of the use of gamma and X rays in conventional brachytherapy, hadronic particles such as protons and heavy ions offer us a unique benefit such high accuracy to deliver the local dose distribution in the target tumor volume while minimizing the overspill of radiation on the healthy tissue. In this talk is discussed Monte Carlo simulations for in vivo beam range verification using detection of secondary gammas and Resistive Plate Chamber technology.
Material and Methods: It used Geant4 libraries to simulate a 1mm gas gap thickness RPC detector and soda-lime glass MRPC. Using a beam-target geometry, it was studied the secondary gamma and neutron production parameters as well as the sensitivity and efficiency of both detector configurations under study. Both systems were covered by a matrix hole collimator to ensure perpendicular gamma detection and were tested with pencil beams of 1H, 4He, and 12C with different reference energies, and gamma sources.
Preliminary results: First it was calculated the dose-normalized in the target/phantom by each beam, studying the spectra and angular distribution of the secondary produced particles. It was proved a beam verification method using the secondary gamma produced during the hadron therapy. The gamma sensitivity resulted low using RPC geometry but the efficiency study of the MRPC gives more suitable results for the application.