AbstractID: 6962 Title: A Radioactive Marker System to Reduce Positioning Errors

Statistical Analysis of a System for Radiation Treatment Positioning Accuracy

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ABSTRACT

The purpose of this research is to provide an improved system for accurately positioning patients for external beam radiation treatments. Specifically, this paper addresses the statistics of the process and the selection of the source energy to obtain the greatest positioning accuracy. A change in detected counts of 1% results in either a dose change of 5% to 10% due to a position error or a dose change of around 1% due to density changes. Using a single high energy source and assuming the density doesn't change is more accurate than the uncertainties created by the dual source method. The dual source method has greater distance uncertainty than the single source if small changes in density are assumed. However, high energy sources are less sensitive to tissue density changes and are more precise for positioning confirmation. Therefore, a single marker source with high energy which is on the order of MeV range provides the greatest dose delivery accuracy by simply assuming all measured discrepancies are attributed to positioning errors only.