

AbstractID: 12603 Title: Perturbations to proton dose delivery due to high-voltage leads from implanted cardiac devices.

Purpose: With the increase in patients treated with proton therapy worldwide, comes an increase in the number of patients who have implanted cardiac devices (ICD), such as pacemakers and defibrillators. While the effects of proton beam delivery on the actual ICD is of serious interest, we have also recently encountered a new concern in which a high-voltage ICD lead was located within the clinical treatment volume for a patient receiving proton radiotherapy for esophageal cancer. The high-voltage lead is composed of several high-Z materials and could therefore significantly perturb the delivered proton dose. The purpose of this work was to study the effects of the high voltage ICD leads present within the treatment volume on delivered proton dose.

Method and Materials: We studied the perturbations to delivered dose due to the ICD leads by performing both calculations with an Eclipse treatment planning system and measurements using EBT2 Gafchromic film. Studies were performed with the ICD placed in a water phantom in a fixed position, as well as with the lead moving in a periodic motion to simulate movement of the lead due to respiration and cardiac motion.

Results: Results from both the Eclipse calculations and film measurements show up to a 10% perturbation in the delivered proton dose when the ICD lead was not moving. However, slight motion of the ICD lead due to respiration and/or cardiac motion can significantly reduce, or even completely wash-out, the affects of the ICD leads on the delivered dose.

Conclusion: Presence of the ICD lead in the proton treatment field can lead to clinically significant perturbations of the delivered dose. However, these perturbations seem to be greatly reduced in the presence of cardiac and/or respiratory motion.

Conflict of Interest: This work was carried out in collaboration with Medtronic Inc.