

AbstractID: 10681 Title: Measurements and Comparison of Out-of-Field Organ Doses from Varian Clinac IMRT Plans Using the Atom Phantom

**Purpose:** To quantify and analyze the unwanted out-of-field organ doses during different IMRT prostate treatments and make a systematical comparison of previously reported organ doses.

**Method and Materials:** The measurement involved an ATOM Phantom, thermoluminescent dosimeters (TLD) and a Varian 2100C Clinac. The ATOM phantom was scanned using CT machine to create virtual images for treatment planning. We developed two 6-MV prostate IMRT plans of 5- and 9-field with the same dose prescriptions, constraints to organs-at-risk, and similar in-field dose distributions. A total of 162 TLDs were placed in the predefined holes to measure the average organ doses of 7 different organs. The results of the two treatment plans were compared to estimate the difference of the out-of-field doses.

**Results:** The measurements showed that dose decreases as the distances from the measurement point to the radiation field increases for all treatment plans. The average out-of-field organ doses ranged from a maximum of 30.92 cGy to the small intestines to a minimum of 4.40 cGy to the thyroid. The 9-field IMRT plan resulted in an absorbed dose up to 30% higher than the 5-field plan which is mainly due to the increased accumulative scatter and lower MU efficiency of the 9-field IMRT plan. The results were also compared with other studies and the discrepancies were mainly due to the different distances from organs to treatment fields.

**Conclusion:** A method to use TLD and the ATOM physical phantom to measure out-of-field organ doses for IMRT has been presented. The measurement results demonstrated that the 9-field IMRT treatment delivered higher photon doses than the 5-field IMRT treatment to the out-of-field organs. Findings from this study involving the prostate treatments express the need to implement the out-of-field dose estimation to the treatment planning in order to minimize the secondary cancer and other radiation risk.