

AbstractID: 3530 Title: A comparison of three ionization chambers for IMRT patient specific quality assurance

Purpose: To compare fifty IMRT patient specific point dose measurements between three thimble-type ionization chambers of varying volumes, and with dose calculations from a commercial treatment planning system (TPS).

Methods and Materials: Fifty patient plans were recomputed with unmodified fluence patterns on three separate CT image sets of a 30x30x17 cm³ solid water phantom and three different ionization chambers: 0.6 cm³ NE 2571 Farmer; 0.125 cm³ Wellhofer IC10; and 0.015 cm³ PTW Freiburg 31006 PinPoint. Dose volume statistics were generated by the TPS over outlined chamber volumes, as seen on the scans. The phantom and chamber were set up on the treatment couch and irradiated as would have been for one patient's fraction. IMRT measurement reproducibility, and the TPS dose calculation accuracy under reference conditions was evaluated. Chamber-type to chamber-type differences, as well as differences between measured and treatment planning dose calculations were compared.

Results:

The PinPoint chamber experienced the most inferior reproducibility (3.57%) as well the greatest discrepancy from the dose calculation of the TPS. For the same delivery, chamber-type to chamber-type response can vary by up to 8%. The average of the ratios of PinPoint-to-NE2571 and IC10-to-NE2571 measured absorbed dose to water, for 50 IMRT plans, amounts to 1.023 ± 0.005 and 1.007 ± 0.003 , respectively. The corrected ionization measurement and TPS dose in IMRT fields were normalized to the values in reference conditions, i.e., we compared $D_{TPS}^{IMRT} / D_{TPS}^{ref}$ with M_c^{IMRT} / M_c^{ref} . The mean ratios of $(D_{TPS} / M_c)_{ref}^{IMRT}$ for the PinPoint, IC10, and NE2571 are 0.933, 0.940, and 0.948 respectively, illustrating a 6% difference in TPS predicted chamber dose and measured signal

Conclusions: The chamber-type-to-chamber-type dose measurement variation is systematic for the dosimeters used. The application of the absorbed dose to water calibration coefficient, which was determined under reference conditions may not hold in IMRT fields, whose specific characteristics are not known.