

AbstractID: 12873 Title: Investigation of large discrepancies in dose-rates of Gamma-Knife units at various institutions

Purpose: Investigate the culprits responsible for large discrepancies in dose rates of Gamma-knife units as measured by the RPC-TLD.

Materials and Method: Measurements, conducted at the Advanced-Medicine Center, Washington University (WU) and MD Anderson (MDA) Cancer Center, involved combinations of different (i) ion-chamber types, (ii) ion-chamber planes, and (iii) calibration phantoms/calibration protocols (TG21, TG51). Three ion chambers: Capintec PR-05 (WU-Ch--C), Exradin A-16 (WU-Ch-E), and PTW TN13010 (MDA-Ch-P) were employed. Four phantoms were: WU's indigenous water phantom, Elekta AB-plastic spheres belonging to WU (WU-Ph-E) and MDA (MDA-Ph-E), and Elekta SW (SW-Ph-E) sphere. In addition, RPC-TLD measurements were performed in the SW-Ph-E sphere to provide an independent check of dose rate.

Results: All measurements were made with 16-mm collimator. Dose-rate comparisons are normalized to the TG21 calibration with the MDA-Ch-P in the MDA-Ph-E sphere. The TG51 dose-rate measured with the MDA-Ch-P in the SW-Ph-E sphere agrees very well with the RPC-TLD result. Moreover, the TG21 dose rate with the same chamber in the MDA-Ph-E sphere provides TG51/TG21 to be 1.009 which is also in good agreement with the established ratio. Surprisingly, the TG21 dose-rate measured with the WU-Ch-C in the WU-Ph-E is found to be 2.4% higher than that measured with the MDA-Ch-P chamber in the similar phantom MDA-Ph-E. This is consistent with the discrepancy seen by the RPC-TLD in the past. Impact of variation in composition among the two AB-plastic spheres (WU-Ph-E and MDA-Ph-E) on dose-rate measurement is seen to be negligible (<0.5%).

Conclusion: The measured 2.4% difference in TG21 dose-rate appears to be due to combination of difference in ion-chamber type and its orientation. Compounding this with ~1% due to the protocol difference (TG51 versus TG-21) explains the past RPC-TLD results. Our measurements rule out any significant contribution due to variation in phantom composition.