AbstractID: 3523 Title: Dosimetry of small beams used in radiosurgery: a comparison between different detectors and Monte Carlo simulation

Purpose: To compare experimental results from different detectors to Monte Carlo simulation in the dosimetry of small fields employed in the Cyberknife radiosurgery system. The Monte Carlo code has also been used to decide whether protocols that require a 10x10 cm^2 field can be used for dosimetry under reference conditions.

Method and Materials: Total scatter factors ($s_{c,p}$) have been measured by means of the PTW PinPoint, Exradin A16 and T14P microchambers, Thomson and Nielsen micromosfet, PTW diamond and diode detectors, and MD 55-2 radiochromic films. A Monte Carlo calculation (BEAM code) was used to simulate the Cyberknife linac and to calculate $s_{c,p}$ and correction factors to be applied to raw data for various detectors. Two Farmer-type chambers were also simulated in order to calculate the ratio between k_Q factors for the Cyberknife and of for a standard 6MV linac.

Results: Monte Carlo simulations gave results in agreement within ±1% with experimental results for $s_{c,p}$, PDD and profiles for collimators above 10 mm. Results for $s_{c,p}$ of smaller collimators (5 to 10 mm) agreed with radiochromic film measurements within ± 2%, while results with ionization chambers and diamond suffer from a systematic underestimation, resolved after application of the Monte Carlo correction factor. Micro-mosfet detectors showed good results as compared to Monte Carlo and radiochromic films, but suffered from poor reproducibility. The PTW diode detector seemed to systematically overestimate $s_{c,p}$ values; for the 5 mm collimator, a value of 0.746 has been obtained versus values in the range 0.67-0.71 obtained with Monte Carlo, radiochromic films, ionization chambers and diamond. The ratio between k_Q factors at different beam qualities is 1.002 ± 0.5%.

Conclusion: Monte Carlo can be used in the dosimetry of small beams to help solve experimental problems due to the finite dimension and to non-water equivalence of the detectors.