AbstractID: 7561 Title: Characteristics of narrow field photon beam measurements for a micro-MLC based radiosurgery system

Purpose: To determine the response of various detectors in the commissioning of narrow field megavoltage photon beams for a micro-MLC based radiosurgery system.

Method and Materials: We commissioned both a standard and a high dose rate 6 MV photon beams from a Trilogy unit (Varian Medical systems, Palo Alto CA) for the pencil beam algorithm using a micro-MLC based Radiosurgery system (BrainLAB AG Germany).

The loss of lateral equilibrium, high dose gradients, and spectral changes within high energy narrow photon beams imposes restrictions on detector composition and size used for relative measurements. We investigated the response of two p-type Si-diodes (Scanditronix photon and stereotactic diodes), a diamond (PTW) detector, a cylindrical (Scanditronix RK chamber) and a micro-ion-chamber (Exradin A16) for depth dose and relative output measurements.

Results: Percent depth dose measurements with photon diode (guarded) yielded consistently higher measurements by 1-2% compared to ionization chamber results for larger depths with increasing field sizes. Stereotactic diode measurements of depth doses for field sizes $\geq$18x18 mm^2 yielded 1-2% lower values compared to ionization chamber results. For field sizes $\leq$12x12mm^2 photon diode depth dose measurements were higher by 1-5% at depths > 5cm compared to those measured by stereotactic diode. The relative output factors measured by photon diode, diamond detector and both ion chambers were within 1% agreement with each other for all field sizes $\geq$ 30x30mm^2. The stereotactic diode measurements were lower by ~2.5% for all but the smallest field size of 6x6 mm^2 compared to other detectors. Relative output factors for the high dose rate beam were higher by 2-4% for fields < 18x18mm^2 compared to the standard 6 MV photon beam.

Conclusion: Measurement of relative output factors and depth doses for megavoltage narrow photon fields require multiple detectors to correctly estimate the true response over the range of measurements.