AbstractID: 9481 Title: Measurements and evaluation of doses outside the treatment volume from photon external beam radiation therapy

Purpose: There has been increased concern about the amount of dose delivered outside the treatment volume from advanced radiation therapy techniques. It has been suggested that these treatments, such as IMRT, IGRT, and SBRT, present a potential impact on the induction of second malignancies due to a larger scattered and leakage radiation. Children have much higher risks to develop a radiation-induced cancer from radiotherapy. In this study, doses outside the treatment volume calculated from the Eclipse planning system were evaluated and compared with measurements from MOSFET and TL dosimeters. An anthropomorphic phantom and a 3-D polymer gel dosimeter were employed for measurements. **Method and Materials**: The "ATOM" anthropomorphic phantom was CT- scanned into the Eclipse-Helios system. An IMRT prostate plan was designed for the ATOM phantom. Both MOSFET detectors and TLD were calibrated based on ion chamber dosimetry. The MOSFET and TLD were precisely placed in positions corresponding to various internal organs, allowing point-dose measurements and comparison. BANG® polymer gel, prepared in a cylindrical container with a volume similar to that of a 10-year child, was placed next to the phantom head for 3D dose distribution measurement in a brain IMRT. The DVH in the gel cylinder, analyzed with an optical CT scanner, was compared with that from the planning system. **Results**: Our results show that the agreement between the MOSFET measurements and the calculated results are within 5% for points within the target. At medium-dose regions (2-50%), discrepancies are within 15%. At low dose regions (<2%) the measured results from MOSFET and TLD agree well, and can be 2-3 times larger than the planning results. DVH comparison between gels and the treatment planning will be presented. **Conclusion**: Anthropomorphic phantom with MOSFET and TL detectors as well as polymer gels can provide evaluation of doses outside the treatment volume.