AbstractID: 8628 Title: An experimental and Monte Carlo study of output factors for small radiosurgery beams

**Purpose:** To accurately determine output factors($S_{c,p}$) for small radiosurgery beams through experimental measurements using multiple detectors and Monte Carlo(MC) simulation.

**Methods and Materials**: A pinpoint chamber(PTW 31016), two solid state detectors(Scanditronix PFD and SFD) and radiographic film(Kodak EDR2) were used to measure $S_{c,p}$ for twelve cones($\phi$5mm~$\phi$30mm) for a 6MV photon beam on a Varian Trilogy linear accelerator. All measurements were made at a depth of 1.5cm with SAD 100cm. MC models based on BEAM and XVMC codes were developed to simulate the treatment head and detectors to obtain theoretical values of $S_{c,p}$ and correction factors for the detectors. The experimental data were compared with the MC values. The impacts of detector perturbation and energy dependence on the detector's behavior were also investigated.

**Results**: For the cones larger than 20mm, the differences between the measurements and MC calculations are within 1% for all the detectors except SFD. As the cone size decreases, the differences between the chamber measured and MC calculated values increase significantly. For example, the chamber underestimates $S_{c,p}$ by almost 23% for the 5mm cone. $S_{c,p}$ values obtained with films and PFD give most consistent results for all cones. Although the SFD detector has a very high spatial resolution(0.6mm), the data obtained with the SFD detector is found to be less than the theoretical values by about 5%. MC simulations show that the mean photon energy is higher in small beams. The response of SFD detector is larger for low energy beams than that for high energy beams. We contribute 5% underestimation to the energy dependence of SFD detector.

**Conclusions**: It is found that films and PFD diode provide reliable $S_{c,p}$ results for small beams. MC simulation is a useful tool, which provides benchmark and correction factors for detectors used for determination of output factors in small radiosurgical beams.