

AbstractID: 8998 Title: A Fast and Simple Method for Improving Accuracy of Helmet Output Factor Measurements for Gamma Knife Perfexion Unit

**Purpose:** To develop an efficient and an accurate method for measuring the helmet output factors for the new Gamma Knife Perfexion. The method aims to minimize the uncertainties caused by redundant equipment setup and the inter-dosimeter variations associated with the conventional method.

**Method and Materials:** The measurement was performed using a 16-cm spherical phantom with the radiochromic film inserts. For each output factor measurement, we exposed a single film with two shots (e.g. either a pair of 16-mm/8-mm or a pair of 16-mm/4-mm shots) symmetrically placed along the x-axis with respect to the central sagittal plane. The time of the exposure for each pair of shots was adjusted to deliver nearly equal amount of dose at the center of each shot. As a result, no calibration curve needed for the film analysis and the output factor was obtained directly from the ratio of the optical density readings for each pair of the shots.

**Results:** The average values for the 8-mm and 4-mm helmet output factors were measured to be  $0.928 \pm 0.009$  and  $0.817 \pm 0.012$ , respectively. These values were in excellent agreement (<1.5%) with the manufacturer default values of 0.924 and 0.805 for the 8-mm and the 4-mm helmet respectively. In particular, the agreement with the 4-mm helmet was the best reported in the literature showing the accuracy and the robustness of the method over the conventional measurement method.

**Conclusion:** A simple and accurate technique for the helmet output factor measurements was demonstrated for Gamma Knife Perfexion unit. Excellent agreement was found between the measured values and the manufacturer default values. Given the simplicity of our method, we recommend validation of the output factors as part of initial commissioning or routine quality assurance checks for the new Gamma Knife Perfexion.