

AbstractID: 3623 Title: A new look at helmet output factor utility in Gamma Knife treatments

**Purpose:** To characterize the volume dose distribution of Gamma Knife (GK) stereotactic radiosurgery units to compare point-measurement based helmet factors and volume-based measurements of dose.

**Method and Materials:** Helmet factors were determined using radiochromic film and ionization chamber measurements as well as TLD arrays. Novel methods have been used to determine and characterize the volume of dose delivered by the GK unit. These methods include using large volume ionization chambers and deconvolving the measurement to remove volume averaging effects and creating a film phantom that allows us to map the entire dose volume in 3 dimensions by using cubes of radiochromic film.

**Results:** The preliminary work done using traditional methods to determine helmet factors has shown that a single point measurement may be insufficient when delivering doses of the magnitude seen in GK treatments. Analysis using TLDs and radiochromic film indicate that non-uniform dose distributions exist. It has also been shown that the isocenter of the GK does not always correspond with the point of maximum dose. Additionally, helmet factor determination is dependent on the size of the dosimeter being used, thus larger dosimeters demonstrate volume averaging effects preventing the proper determination of helmet factors.

**Conclusions:** GK treatment is the preferred modality for a number of cranial treatments, and physicians are continually prescribing smaller margins. For this reason, it is vital that the dosimetry of the GK be representative of what the patient receives. While point and plane dosimetry techniques may be adequate when delivering radiation from one direction, 3-D techniques must be developed for modalities like the GK, in which dose is delivered with multiple sources simultaneously and almost isotropically.