AbstractID: 8204 Title: Air kerma based dosimetry calibration for the Elekta Gamma Knife

Purpose: To present an air kerma based dosimetry methodology using either an in-air or in-acrylic phantom measurement to determine the dose rate of fields collimated by the 18mm helmet of a Leksell Gamma Knife (GK) unit.

Method and Materials: This work used a small volume ionization chamber in either an in-air jig or a PMMA phantom to measure the dose rate provided by the 18mm helmet of the GK unit. The chamber was investigated with respect to angular response as well as size in the radiation field. Monte Carlo calculations were performed to determine accurate coefficients and corrections to enable the use of a modified and updated air-kerma based protocol with the unique and rigid geometry of the GK unit. In-air and in-PMMA measurements were made at three GK institutions and the dose rate was determined using the new protocol.

Results: Chamber and field dimension studies showed that the ionization chamber in use was appropriate for the 18mm field of the GK unit. A chamber orientation study showed the optimal orientation of the chamber was along the patient axis of the GK unit. Measurements made with the PMMA phantom and in-air result in equivalent dose rates to within 0.35%. The dose rates determined using these methods are consistently higher than the dose rates provided by the treatment planning system. This difference ranges from 1.6% to 2.4% high. The in-air method is repeatable throughout time to within 0.2%.

Conclusion: Although dosimetry protocols based on air-kerma calibrations have been appropriately replaced in many applications by dose-to-water calibrations, in the case of the GK unit, an air-kerma based calibration provides an elegant and direct method to calculate the dose rate from the 18mm GK helmet.