

## AbstractID: 13400 Title: Quantification of the Peripheral Dose Components in Perfexion

### **Purpose:**

To explore the possibility of separately quantifying the leakage and scatter components of the peripheral radiation dose resulting from Leksell GammaKnife<sup>®</sup> Perfexion<sup>™</sup> radiotherapy.

### **Methods and Materials:**

In this study, peripheral dose was defined as the dose arising at points outside the paths of the primary beams. Consider a spherical skull phantom centered at Leksell coordinates (100,100,100). Peripheral dose may arise from: (1) In-phantom scattered radiation originating from primary beams; (2) Radiation first scattered within the collimator structure (3) Photons undergoing multiple scattering and exiting through adjacent collimator openings and (4) Leakage radiation that passes directly through the collimator body. Contributions (1) and (2) were separately quantified via Monte-Carlo simulations. Types (3) and (4) were measured using EBTII Gafchromic film inserts and placing the sources in "beam-off" position (i.e. between collimator openings). Additionally, the total peripheral dose arising from a 16-mm shot was measured using film. The combination of simulated type\_1 and type\_2 doses and measured type\_3 and type\_4 were compared to the measured total dose at 40 mm superior and inferior to the isocentre.

### **Results:**

At the isocentre of the 16-mm shot, the dose-rate determined by Monte Carlo simulations agreed with measured dose-rates to 0.8%, thereby establishing consistency between measurement and simulation. The simulated sum of Type\_1 and Type\_2 contributions at 40 mm inferior and superior to the isocentre was 0.40% and 0.35% of the isocentre dose-rate, respectively. Of those totals, 87% was Type\_1 a 13% came from Type 2. The measured total peripheral dose-rate was 0.40% and 0.38% at 40 mm inferiorly and superiorly, respectively. The measured Type\_3 and Type\_4 dose-rates were less than 0.01% of the isocentre dose-rate in either direction.

### **Conclusion:**

The results of this study indicate that peripheral dose arising from a single 16-mm shot arises primarily from Type\_1, with <0.01% contribution from leakage radiation.