AbstractID: 4936 Title: Investigation of Properties of a New Liquid Ionization Chamber

Purpose: Liquid ionization chambers (LICs) have characteristics that can remedy some of the drawbacks of air-filled ionization chamber dosimetry: large sensitive volumes (i.e. low spatial resolution), fluence perturbations, and energy dependence over the clinical range of beam qualities. However, there are significant problems in liquid chambers. High ionization density and low ion mobility lead to high ion recombination rates. In this work, extensive experimental work has been performed to investigate properties of a new liquid chamber. This includes chamber stability over time, chamber reproducibility, and establishing recombination corrections.

Methods and Materials: The new chamber is called the GLIC-03 (Guarded Liquid Ionization Chamber). The diameter of the collecting electrode is 1.5 mm and the plate separation is 0.4 mm, giving a sensitive volume of 0.7 mm^3. The dielectric liquid used is isooctane. We used the 18 MV beam of a Varian Clinac 21EX linear accelerator. The lowest pulse rate setting, 100 MU/min, was used in order to avoid incomplete collection of charge from one pulse before the arrival of the next. Measurements were taken in solid water at 15 cm depth, with various field sizes and SSDs. Boag's theory for general collection efficiency for parallel-plate gas ionization chambers, applied to isooctane in pulsed radiation, was used for recombination corrections.

Results: The GLIC-03 response varied by less than 1% over 10 hours, and was reproducible within 1.5% of the mean over different liquid fills. The collection efficiency decreased with increasing dose per pulse due to general recombination of ions from a larger number of ionizing particle tracks. Recombination corrections were within 1% for low dose rates and high electric field strengths.

Conclusion: The establishment of these characteristics in the present work allows us to perform accurate relative measurements in high gradient non-equilibrium fields as well as energy dependence investigations.