AbstractID: 6711 Title: Improved Accuracy in Radiotherapy Dosimetry of High-Energy Photon and Electron Beam using Optically Stimulated Luminescence

Purpose: The interest in the Optically Stimulated Luminescence (OSL) technique for radiotherapy dosimetry originates from its precision and advantages over thermoluminescence (TL) technique. Previously we demonstrated that a precision of <0.7% for a single measurement can be achieved using the appropriate readout methodology. In this study we used a newly designed dosimeter holder to improve the dosimeter positioning and demonstrate the accuracy of the OSL technique for determining the percent-depth-dose (PDD) in a variety of photon and electron beams.

Method and Materials: PDD curves were obtained with the OSL technique for 6 and 18 MV photons beams, and 6, 9, 12, 16, and 20 MeV electron beams. The Al_2O_3:C OSL dosimeters placed on dosimeter holder were irradiated in water phantom at different depths. The holder is made of a Plastic Water™ frame with thin nylon strings running across the frame to support the dosimeters, improving the dosimeter positioning. The OSL measurements were performed using an automated Risø TL/OSL-DA-15 reader without monitoring the mass of the dosimeters or the reader sensitivity.

Results: In the low-gradient region of the depth-dose curves the difference between the OSL and ionization chamber PDD was typically less than 1% for all beams. In the high-gradient region, the distance-to-agreement was typically less than 1 mm. The reproducibility in the position of the dosimeters show that the maximum difference due to position around d_{max} (depths between 8 and 16 mm) was 1.1% for 6 MeV electron.

Conclusion: Using accurate positioning device and proper data analysis technique the OSL demonstrated highly precise and accurate dose readings for variety of photon and electron high energy beams. These results show that OSL is a viable alternative to TLDs, offering an easy readout method and additional advantages such as the absence of dose-rate or temperature dependence.