AbstractID: 6472 Title: Using a commercial MOSFET system for TBI in vivo dosimetry: Characterization, calibration and mid-plane dose calculations

Purpose: The goal of this work was to: (1) analyze the response characteristics of a commercial MOSFET system, (2) develop an accurate MOSFET calibration convention and (3) develop a TBI mid-plane dose calculation method that relies only on entrance dose measurements.

Method and Materials: Using a nominal 6 MV photon beam, MOSFET response reproducibility, linearity and stability were analyzed. A calibration coefficient was calculated for each detector using a method that relates MOSFET and ion chamber response in an acrylic jig to dose to water at an equivalent depth - calibration coefficients were verified for all MOSFETs by measuring the dose in water at various depths. We derive a simple method of calculating TBI mid-plane dose that relies only on MOSFET entrance dose measurements. The method was tested by calculating the mid-plane dose to a 30x30x30 cm^3 water tank and an anthropomorphic phantom.

Results: The detectors showed a reproducibility of ±2.0% for a dose to water at d_{max} greater than 65.0 cGy. Response linearity was excellent and a correlation between measurement reproducibility and detector response established. However, detector response did decrease as a function of accumulated dose. The dose to water at a depth of 10 cm was verified by ionization chamber measurement to be 67.3 cGy - the mean response of the 15 MOSFETs was 68.0 ± 2.0 cGy. Dose to the mid-plane of the water tank was confirmed with an ion chamber to be 50.0 cGy – using the formalism set out in this work the dose was calculated to be 51.6 cGy. For a prescribed 100.0 cGy the mid-plane dose to the anthropomorphic phantom was calculated to be 99.0 cGy.

Conclusion: The unique calibration convention and TBI mid-plane dose calculation methods were found to be accurate and easily implemented as part of any clinical TBI program.