AbstractID: 9598 Title: NIST Water Calorimeter Update: Measured Dose Rate as a Function of Exposure Time

Purpose: To re-establish the primary standard of absorbed dose to water for therapy level beams using the NIST room temperature water calorimeter, heat conduction corrections need to be addressed particularly for the radiation exposure times from 60 s to 120 s range. **Method and Materials:** Measurements have been performed using the calorimeter in a ^{60}Co beam to determine the dose rate as a function of modulated shutter opening times. In previous studies, we show such a curve spanned across the irradiation time of up to an hour. In this study, we focus on the region of common standards practice of around 100 s, in order to reconnect with Domen's historical value obtained at 70 s, and to compare with other metrology institutes' (e.g. PTB's 120 s). Since our calorimeter operates with the water outside the core vessel being stirred constantly, the lateral temperature gradient can be great at the boundary defined by the vessel wall, and therefore we expect greater conduction effects. A preliminary 3D finite element model is used to study the gradient effect. **Results:** We have shown previously that the system response to the radiation exposure time strongly depends on the size of the core vessel and can be simulated qualitatively using a simplified 2D finite element model. We now examine closely the calorimeter's response at modulated shutter opening times between 60 s and 140 s range. The variation in this range is found to be about 2.5%. However, preliminary finite element simulation indicates only 0.5% variation is expected. C**onclusions:** The model study suggests that the temperature gradient alone does not account for the observed dose rate variation. Further investigations are required with a model including non-water materials. The system stability reached after the repeated cycles of exposure will also be studied both experimentally and by simulation.