At present, the primary standard at NPL for the measurement of absorbed dose in high energy photon and electron beams is a graphite calorimeter. However, the quantity of interest in radiotherapy is absorbed dose to water. NPL is therefore developing a new absorbed dose standard based on water calorimetry.

A water calorimeter has been designed and built which operates at 4 °C, with temperature control being provided by a combination of liquid and air cooling. The sealed glass inner vessel of the calorimeter has been designed to minimise the effect of non-water materials on the measurement of absorbed dose. In particular, great care was taken in the design and construction of the temperature sensing thermistor probes such that glass is the only material in contact with the water inside the vessel.

Measurements using photons and electrons with the calorimeter inner vessel filled with hydrogen saturated ultra-pure water, showed no variation in calorimeter response with total dose within the measurement uncertainties. The effect on the measured temperature rise of the calorimeter vessel was insignificant, whilst the effect of the temperature sensing probes required a 0.1 % correction.

The initial tests have confirmed the feasibility of the calorimeter design although further work is required before the calorimeter can be used as a primary standard. Future work will focus on improving the temperature sensing system, and making measurements of the heat defect.

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