AbstractID: 3701 Title: A first step toward a new national standard for direct calibrations in clinical high energy photon beams

Purpose:
Clinical reference dosimetry for high-energy photon and electron beams is based on ion-chamber calibrations in a Co-60 beam for absorbed dose to water, as prescribed in the TG-51 protocol. A complex formalism is required when converting the calibration to the beam quality of end users. Direct calibrations in clinical high-energy x-ray beams will eliminate the complexity and associated uncertainties, resulting in greater accuracy and measurement simplicity.

Method and Materials:
The current primary standard for absorbed dose is transferred through ionization chamber measurements in a Co-60 beam and is ultimately traceable to the first-generation water calorimeter developed at NIST by Domen. We are evaluating a new calorimeter with modern data acquisition in a Clinac 2100C photon beam at 6 MV and 18 MV.

Results:
To address the convection/conduction problems inherent to water calorimetry, we have devised a novel data-collection scheme with multiple cycles of radiation-induced temperature increase as a function of time; this has greatly improved the efficiency of measurements, thereby achieving greater precision. The temperature rise can be extracted by three approaches that yield consistent results; these will be described in detail in the presentation. The absorbed dose determined at 18 MV and 6 MV using the water calorimeter at selected depth along the beam axis are compared to the depth-dose curves measured with a calibrated ion chamber following the TG-51 protocol. In addition, the dependence of bridge-excitation voltage at the higher dose rate (4 Gy/min) behaves differently from that at a lower rate (1 Gy/min) in a Co-60 beam; this has been investigated in order to assess the influence of the thermistor power on measured results.

Conclusion:
We have obtained preliminary results and are moving toward a new national standard for direct calibrations in clinical beams.