AbstractID: 1142 Title: Absolute Active Radiometric Calorimeter Calibration of Low Energy Brachytherapy Sources

The calibration of low energy brachytherapy sources has historically been performed by means of an in-air measurement technique. The current in-air calibration method is performed at the National Institute of Standards and Technology (NIST) using a Wide Angle Free Air Chamber (WAFAC). This paper discussed advances made in calorimetric calibration of I-125 and Pd-103 brachytherapy sources. We have previously presented the details of the construction of a cryogenic calorimeter and initial measurements made with the instrument. The work reported here describes significant advances in calorimeter design and measurement theory. These advances include the incorporation of high temperature superconducting thermometers, active temperature control servo loops, improved source positioning techniques, and direct measurement of source power by means of the electrical substitution method. These improvements translate into an instrument that will be capable of temperature control to within approximately 10 μK and with energy resolution of approximately 20 nW. In addition, design improvements are discussed which will allow the calorimeter to measure both total source energy and emitted energy (that energy which is not absorbed by the source itself) in terms of power. The ability to directly measure the source power provides an absolute measurement in terms of fundamental units (J/s). The ability to differentiate between emitted and total energy further enhances the usefulness of the calorimeter in terms of clinical significance and source specification. The results of the initial measurements presented here will be compared with NIST-traceable air kerma strength measurements by means of Monte Carlo calculations.