

AbstractID: 5449 Title: Calibration of a Cobalt-60 Irradiator for Stereotactic Radiosurgery Following the AAPM TG51 Protocol

Purpose: Compare calibration of the Leksell Gamma Knife according to the American Association of Physicists in Medicine Task Groups 21 and 51 protocols.

Materials and Methods: The Gamma Knife calibration phantom (The Phantom Laboratory, Inc., Salem, NY) is designed to fill with water and support an Exradin (Standard Imaging, Inc., Middleton, WI), model A-16, ionization chamber positioned at its center. The phantom and chamber assembly was mounted in a Leksell stereotactic ring. The location of chamber's sensitive volume was determined using computed tomography and the Leksell fiducial frame. The chamber-phantom assembly was attached to the 18 mm helmet in the Gamma Knife by the stereotactic ring.

The phantom's geometry allowed radiation beams from each of the 201 Gamma Knife cobalt-60 sources to converge along an 8 cm path to the ionization chamber's sensitive volume. This is equivalent to the arrangement by which one calibrates the Gamma Knife using the manufacturer-supplied polystyrene phantom.

Results: The phantom could be attached to the Gamma Knife so that the ionization chamber was reproducibly positioned at the convergence of the beams. Because of the phantom's design, either trunnions or automatic patient positioning system could attach the phantom. Comparisons using different phantoms and protocols resulted in the following calibration ratios for TG-21 in the polystyrene sphere phantom, TG-21 in the water phantom and TG-51 in the water phantom, respectively: 1.00, 1.010, 0.996. Transmission measurements using a block of identical material indicate that the phantom's 2mm plastic shell would result in an error of approximately 0.6% if ignored.

Conclusions: Calibration of the Gamma Knife can be performed in liquid water using the AAPM TG-51 protocol, thereby eliminating any uncertainties with respect to the composition of the polystyrene from. Calibration values for the Gamma Knife that were obtained using the three methods for our phantoms agree to within 1.4%.