AbstractID: 3186 Title: Correcting LDR Spectroscopy for Fine Energy Resolution Applications

Purpose:

To use high purity Germanium spectrometry to measure output energy spectra of LDR brachytherapy seeds in order to provide better dosimetric information than what is currently available. Such spectral information can provide a platform for energy based dosimetry of LDR seeds as well as provide 'energy output' benchmarks for Monte Carlo simulation of these sources.

Method and Materials:

Low energy Germanium spectroscopy suffers from several inherent defects of the spectrum collection process. Peak energy broadening and generation of fluorescence escape peaks are two defects, both of which can complicate and contaminate measured spectra. A correction algorithm is presented to overcome these defects and reproduce the true energy spectra without detector produced artifacts and without a priori assumptions as to the internal LDR seed structures. Collection of output spectra from various LDR seeds was obtained using an n-type Germanium spectrometer. A detector response function matrix (8037 element square) was constructed via detailed MCNP Monte Carlo simulations to characterize the detection process from the detector's entrance window to particle termination, spanning interactions from 1352 keV down to 3.75 keV. The correction algorithm is based upon an iterative algorithm used in high- to moderate-energy physics, as detailed in the literature for Germanium spectroscopy. This modified algorithm in conjunction with the response matrix reconstructs the spectrum as it was prior to interaction with the detector.

Results:

Corrected results have shown excellent agreement with expected theoretical spectral outputs, and spectral peak resolutions of less than 0.5 keV have been achieved. High resolution output spectra have been catalogued for multiple seed designs. Spectral Air Kerma Strength calculations, utilizing corrected spectra, agree with NIST traceable calibrated Air Kerma Strengths to within 3%.

Conclusion:

This technique allows corrections to be made to acquired spectra thus yielding data for high resolution applications of non-energy-integrated dosimetry of LDR seeds.