AbstractID: 5672 Title: Gamma Camera Quality Assurance for Permanent Breast Seed Implantation

Objective: To assess whether a proposed SPECT device could address the requirements of resolving distributions of permanent breast brachytherapy ^{103}Pd seeds following implantation; while maintaining an acceptable imaging time to allow for correction of misplaced seeds. Method: Monte Carlo simulations of a cadmium zinc telluride crystal-based gamma camera were used to assess whether the detection of 22 keV photons emitted from the ^{103}Pd seeds was feasible. A hexagonal parallel hole collimator, hole length 38 mm, diameter 1.2 mm with 0.2 mm septa was modeled. The design of the gamma camera device was evaluated on two phantom models. The first model consisted of a simple representation of the clinical problem by simulating the breast as 8 cm diameter sphere of breast tissue containing a central, 1cm cubic distribution of 8 seeds. The second simulation presented a more accurate depiction of the clinical problem, where the breast model was based on the pre-implant CT scan of a typical breast brachytherapy patient and the activity was simulated from the patient's corresponding treatment plan. Results: The spherical phantom yielded promising results after 24 s of imaging time, where the maximum error between the center of mass of the seeds in the reconstructed image and the simulated seed location was 1.02 mm. The results from the clinically accurate simulation revealed that individual seeds could not be identified from the reconstructed images after 2 minutes of imaging. However, the strands of seeds, arranged in each needle were localized to a maximum error of 1.9 mm. Conclusion: The online gamma-camera approach to imaging the ^{103}Pd seeds is feasible for simple seed distributions. Additional improvements to the collimator design and the gamma camera orbit are required before the gamma camera device will be able to distinguish each seed in an implanted seed distribution.