

AbstractID: 1504 Title: Prostate Brachytherapy Seed Localization By Fluoroscopy/Ultrasound Fusion: Algorithms and Analysis

Fluoroscopy/Ultrasound fusion is used during LDR prostate brachytherapy to localize seeds while the patient is in the treatment position. This allows the implant to be evaluated and “cold spots” to be corrected at the time of treatment delivery. To localize the seeds, several point markers (visible in both ultrasound and fluoroscopy) are inserted into the patient. A minimum of 4 markers are needed and marker types are described. A four step procedure is used to determine the 3D coordinates of the seeds: (1) the 3D ultrasound coordinates of the markers are determined, (2) three fluoroscopy images of the prostate (containing seeds and markers) are taken at arbitrary orientations and the 2D coordinates of the seeds and markers are estimated in each image, (3) an initial estimate for the projection geometry of each fluoroscopy image is estimated from the 3D-2D marker correspondences, (4) iteratively (4a) and (4b) are executed until convergence, where (4a) the existing projection geometry is used to match the 2D seeds between the three images and (4b) the newly matched seeds (and the existing matched markers) are used to re-estimate the projection geometry. After convergence, the 3D seeds are reconstructed. Errors in localizing the 2D seeds and markers will propagate to uncertainty in the 3D seed positions. This uncertainty is represented by a 3D covariance matrix for each seed. The effect of this uncertainty on the calculated dose is determined. The calculations are validated statistically by simulation and results using clinical data are presented.