

## Implementation of Intraoperative Source Position Reconstruction in Prostate Brachytherapy

Prostate brachytherapy is an effective therapy for early stages of prostate carcinoma. To enhance quality of implants, we are implementing an intraoperative system to visualize the brachy dose. The dose reconstruction is used to identify under-dosed regions, so that extra seeds can be optimally added. After implanting the planned seeds, three isocentric fluoroscope images are taken at 15 degree increments; seed positions are reconstructed and registered with an edema-adjusted version of the pre-implant volume study. We have identified several factors which affect the accuracy of this technique, including accuracy of the reconstruction, swelling of the prostate during the procedure, and accuracy of the registration with the volume study. To investigate the accuracy of the reconstruction, we used a phantom to measure source position reconstruction accuracy from fluoroscopic images, for which the seed position discrepancy averages 2.1 mm (range: 0.0 to 4.8 mm). Swelling of the prostate during the procedure occurs primarily in the anterior-posterior dimension, averaging 29%. To account for this, we use ultrasound to estimate the new anterior-posterior, lateral and base-apex dimensions. To register the reconstructed source positions with the volume study, a wire with radio-opaque markers is placed in the urinary catheter to locate where the urethra enters and exits the prostate. These reference points can be identified to within 3 mm. This dose evaluation technique can be repeated after additional seeds are implanted, eliminating the need for post-implant CT.