AbstractID: 1507 Title: Advanced image processing for an integrated 3D ultrasound system

We are developing a 3D ultrasound system for radiotherapy that can be integrated into a commercial treatment planning system and used for daily target verification in radiotherapy delivery. This system improves image quality through three advanced image acquisition and processing techniques; compounding, minimum mean square error (MMSE) reconstruction and speckle reducing anisotropic diffusion (SRAD) filtering. We coupled an articulating arm to an US transducer to spatially register the the images. Calibration of the arm and image plane were determined using a Levenberg-Marquart optimization. 3D image reconstruction was accomplished via the MMSE algorithm, which is designed to enhance image contrast and reduce speckle noise. The results of our image processing were quantified using phantoms and human prostate images. Geometric accuracy was assessed using our ADAC treatment planning system. Comparison of the three cardinal dimensions of a prostate test object in a phantom revealed agreement to within +/- 2.5 mm of the manufacturer's specifications. Spatial compounding yielded significant improvements in edge strength and speckle reduction when applied to an US images of a human prostate. Application of compounding and SRAD filtering to phantom images of a test object via the Pratt figure of merit produced significant improvements in edge strength and segmentation accuracy. These results indicate that spatial compounding and application of MMSE reconstruction and SRAD filtering may yield significant improvements in US image quality. This is especially important in the radiation therapy setting where the users of US systems are less experienced than trained sonographers.