AbstractID: 3536 Title: 3DUS, MRI and CT prostate volume definition: 3D evaluation of intra- and inter-modality and observer variability

**Purpose:** To produce a complete three-dimensional description of the accuracy, variability significance of differences in prostate volume estimation using 3DUS, MR and CT imaging.

**Method and Materials:** Ten patients underwent 3DUS, MR (axial FSE T2-weighted) and CT imaging 28-33d after I-125 implant (74-112 seeds, mean=93.3). MR prostate volume range was 22.6-50.8cc (mean=31.9cc). Seven experienced observers contoured prostate volumes in 2.5 mm slice increments, twice for each patient, while blind to image duplication within and between modalities. Regional trends in variability and absolute differences in volume estimation between modalities were examined in 3D.

**Results:** The average volume ratio was 1.16 for CT/MR, 0.90 for US/MR and 1.30 for CT/US. The greatest variability of CT contours occurred at the posterior and anterior portions of the mid-gland. On MR images, the overall variability was smaller, with a maximum in the anterior region. On 3DUS, high variability occurred in the anterior regions of the apex and base, while the prostate-rectum interface had the smallest variability. 3DUS contours tended to be larger than CT and MR in the anterior and posterior aspects of some patients, likely due to gland deformation by the US probe.
The average percent of surface area that was significantly different (95% confidence) was 4.1%, CT-MR; 10.7% US-MR; 6.3% CT-US. Both center-of-mass registration and larger standard deviation of CT measurements increase statistical similarity of CT to other modalities. Using seeds as fiducial markers decreases this similarity. Deformation during insertion of the trans-rectal ultrasound probe, rectum and bladder filling and breathing motion also have an effect.

**Conclusion:** Our findings suggest that improved seed recognition algorithms for 3DUS or MR, or fusion with CT may improve the accuracy of post-implant planning. Visualization of 3D trends between modalities may assist in improving the consistency of prostate delineation.