AbstractID: 3958 Title: Determining patient eligibility for prostate IMRT dose painting protocols: The role of image resolution, margin requirements, and intraprostatic tumor volume

Purpose:
To systematically examine the impact of margin and imaging resolution on dose painting protocols with regards to target definition and patient eligibility.

Method and Materials:
The prostate PTV was formed by expanding the clinical target volume by 1-cm. The intraprostatic tumor nodules (IPTNs) were digitized using data from Chen et al.(2000) corresponding to a >50% probability of occurrence. The IPTNs were then discretized on three different grids: $1mm^2$ (our treatment planning pixel size), $2mm^2$, and $6.6mm^2$; grid sizes reflect imaging modality resolution. 75.6Gy was prescribed to the PTV and the target dose for the IPTNs was 90Gy. Our standard rectal and bladder constraints were used with maximum dose of 91Gy to rectum and urethra. The margin on the tumor nodules was varied from 0.2 to 1.5cm.

Results:
The volumes for the IPTNs were 3.2, 4.9 and 10.2cc for the three grid sizes; CTV and PTV volumes for the whole gland were 44.2cc and 137.2cc. A typical distribution of IPTNs (4 foci), expanded with a 6mm symmetrical margin to 33cc was boosted to 90 cGy without exceeding critical organ constraints. Margins were 5mm and 5.5mm with grids applied. Once the absolute volume of the targets (IPTNs + margin) was accounted for, however, neither grid size nor margin size had an impact on the ability to escalate dose. The ratio of the boost region to the PTV volume was the determining factor. The limiting IPTNs+margin volume was 25% of the PTV volume. By relaxing the requirements to accept >90% coverage with 90Gy, acceptable plans could be achieved with IPTNs+margin volumes occupying $\leq$ 36% of the PTV volume.

Conclusion:
A simple volume-based screening method may be used to determine patient eligibility for inclusion in a clinical IPTN dose-escalation study, irrespective of the cancer-specific imaging system's resolution and required margins.