

The following is a study to evaluate the effectiveness of seed overlapping, partial segmentation and calcification on the UMPLAN seeds recognition program. A phantom was constructed using nonradioactive seeds (Model-6711 titanium OncoSeed™ 0.8mm diameter and 4.5mm long) that were mounted on 4 transparent acrylic plates. Two plates had seeds on a rectangular grid positioned with 10.0mm spacing in the x-direction (left-right), and 9.5mm separation in z-direction (inferior-superior). Two plates had seeds placed along wedge of angle 5° and varying seed spacing. Axial CT scans of the phantom were obtained with varying slice thickness (1 to 5mm) and without a gap between adjacent slices. Each of data sets was tested by the automatic seeds-searching routine (UMPLAN). The manual double-checks were also done for the recognized and unrecognized seeds. We report that

- (1) The seeds with transverse back-to-back separation larger than 0.5 times the slice thickness can be distinguished by this automatic routine. For side-by-side separation, the threshold is 1.0-1.5 times of slice thickness.
- (2) Partial segmentation occurs in the slicing direction. The slice thickness to unambiguously detect a 4.5mm length seed is 2-3mm. The mean position error linearly increases in the z direction and is constant in the x direction.
- (3) In the calcification-free (acrylic background) condition, the titanium seeds can be detected up to CT-number 1800 (versus the 1000 ~ 1500 calcification). However, it is possible that the CT-number of a partially segmented seed could be close to that of the calcification and therefore, be missed by the algorithm.