

AbstractID: 13029 Title: Evaluation of a Thinner-Slice MVCT Scan Mode across several systems

Purpose: To evaluate the system-to-system variation in TomoTherapySM MVCT slice profiles using the existing (J4) jaw setting and a thinner (J1) jaw setting.

Method and Materials: The MVCT image slice sensitivity profile is measured using a thin, metallic disc to approximate a delta impulse function in the longitudinal direction. At each jaw setting, the slice profiles are measured for the three available couch speeds: 4mm/rotation, 8mm/rotation, and 12mm/rotation, corresponding to the Fine, Normal, and Coarse scan modes. These measurements are then repeated on 10 systems.

Results: With the current TomoTherapy factory settings for the jaw (J4), the Fine, Normal, and Coarse scan modes yield images with a full-width at half-maximum of 6.17 ± 0.38 mm, 6.89 ± 0.29 mm, and 8.02 ± 0.21 mm (mean \pm standard deviation). Using a thinner (J1) jaw setting but the same couch speeds yields slice thicknesses of 3.85 ± 0.09 mm, 5.27 ± 0.18 mm, and 7.14 ± 0.10 mm. The thinner slice profiles reduce partial volume effects and increase the contrast of the thin, metallic disc. The average contrast of the disc using the existing (J4) jaw setting is 167, 148, and 115HU for the Fine, Normal, and Coarse scan modes, respectively. Using the thinner (J1) jaw setting, the average contrast increases to 282, 192, and 137HU.

Conclusion: The thinner (J1) jaw setting consistently and significantly reduces the MVCT slice thicknesses for all three scan modes (Fine, Normal, and Coarse). The system-to-system variation is substantially smaller than the average improvement. Corresponding to the reduced slice thickness, the contrast of thin objects in the transverse plane is substantially improved. By adjusting the beam output to keep dose per pulse constant, these improvements to longitudinal resolution are achieved with no change in other imaging properties (noise, artifact, average dose).

Conflict of Interest (only if applicable):