

AbstractID: 8822 Title: Longitudinal resolution of the TomoTherapy® MVCT image and potential improvements

**Purpose:** To quantify the longitudinal resolution of the TomoTherapy® MVCT image and evaluate potential improvements to the resolution.

**Method and Materials:** The image slice sensitivity profile is measured using a thin-disc method to approximate a delta impulse function in the longitudinal direction. The sensitivity profile is measured for several different helical pitches and beam widths. In addition, the clinical image longitudinal resolution is limited not only by the image slice sensitivity profile, but also by the image spacing. For a constant image slice profile (constant helical pitch and beam width), the image spacing is varied to investigate the impact of image spacing.

**Results:** With the current TomoTherapy® factory settings for the jaw and the default image pitches (Fine, Normal, and Coarse corresponding to 4, 8, and 12 mm of couch translation per gantry rotation), the slice sensitivity profiles are measured to have a full-width at half-maximum of 6, 7, and 8 mm for the Fine, Normal, and Coarse pitches, respectively. Reducing the jaw-width by an amount corresponding to a 3 mm decrease in the field-width at isocenter, and keeping the same couch speeds of 4, 8, and 12 mm/rot, results in slice sensitivity profiles with a full-width at half-maximum of 4, 5, and 7 mm. Finally, using the thin jaw setting and “Normal” pitch (8 mm/rot), images are reconstructed at the default 4 mm interval as well as at a smaller interval of 2 mm. The sagittal and coronal images are observed to have a significantly improved resolution using the smaller image interval.

**Conclusion:** The TomoTherapy® system currently offers users a balance between imaging speed and image quality. However, a thinner jaw setting and reduced image spacing result in significantly improved longitudinal resolution for TomoTherapy® MVCT images, yielding improved image quality at the same scanning speed.