Purpose: On-treatment megavoltage computed tomography on Helical Tomotherapy (Accuray Inc., Sunnyvale, CA) is critical for image guided radiotherapy. A strategy was developed to assess the impact of various jaw widths on image quality and imaging dose with Tomotherapy.

Methods: A cheese phantom (Gammex RMI, Middleton, WI) made of water equivalent materials was employed in this study. Three sets of measurements were independently carried out. Firstly, in the imaging dose measurement, the phantom was placed on the couch and aligned with a stationary green laser and beam isocenter. The measurement point was 10 mm up from the center of the phantom. Three slices on either side of the middle slice were selected. Secondly, two inserts with different rows of holes of various sizes were placed inside the phantom for image contrast and resolution investigation. Lastly, twelve density inserts were placed into the outer holes in the phantom for measurement of the image value to density table (IVDT). A comparison of imaging dose, image resolution and contrast, IVDT table between different jaw configurations was performed to evaluate the imaging system.

Results: Imaging dose was 2.93 cGy with a jaw size of one mm as opposed to 1.62 cGy with a four mm jaw, both of which are below the vendor's requirement: 3 cGy. However, image quality is improved significantly with the smaller jaw. Four lines of holes can be readily identified on images using smaller jaw while only three lines visible with the larger jaw. Image contrast is similarly enhanced when reducing the jaw size. On average CT numbers are 6% higher with the smaller jaw than those obtained with the larger one.

Conclusions: Significant improvement in image quality is achieved with the smaller jaw field in Tomotherapy while the imaging dose is kept at a clinically acceptable level.