Purpose: the dosimetric impact of Tongue-and-Groove (TG) width on MLC-defined small fields of 1cm in X/Y-jaw directions for Pinnacle Version 9.0

Methods: Open field of 5cm guidance was created using the Physics Tool of Pinnacle Version 9.0 and then the MLC leaves were placed manually for creating MLC-defined small fields of 1cm, 2cm to 1cm, 5cm as well as of 2cm, 1cm to 5cm, 1cm at the source-to-surface distance of 95cm and depth of 5cm. With the commissioned machine data of Varian 6EX, a series of test machines were simulated by changing the size of MLC TG width (no TG gap, 0.1mm, 0.25mm, 0.5mm, 0.75mm, 1.25mm, and 1.5mm). The other machine/MLC parameters were set to the commissioned values of Varian 6EX. In addition, dose grid sizes of 2mm and 4mm were used for dose calculation purpose. Mapcheck measurements were performed for the MLC-defined fields of 2x1cm to 5x1cm to compare with the calculated dose of Pinnacle Version 9.0.

Results: Regardless of MLC-defined small fields with X-direction size of 1cm, there was negligible variation of calculated dose as TG width varied from zero TG to 1.5mm. The calculated dose was very sensitive to the dose grid size and there was a good agreement of less than 3% in between measurement and calculation with the dose grid size of 2mm. However, there was over 5% discrepancy with the dose grid size of 4mm for the MLC-defined small fields. For the MLC-defined small fields with Y-direction size of 1cm, there was over 8% decrease of computed dose compared to those of small fields with X-direction size of 1cm, even though the TG width was set to zero, which was that the effective field size of MLC 5cm guidance, 1cm was identical to that of MLC 1cm guidance, 5cm. With the dose grid size of 4mm, the calculated dose was underestimated over 10% compared to that of 2mm dose grid.

Conclusions: Pinnacle Version 9.0 was insensitive to the variation of TG width from no TG to 1.5mm for MLC-defined small fields with X-direction size of 1cm. For the MLC-defined small fields with Y-direction size of 1cm, there was over 8% decrease of calculated doses compared to those of small fields with X-direction size of 1cm, even though the TG width was set to zero.