Purpose: To investigate the dosimetric effect of different linac commissioning data on the stereotactic body radiation therapy (SBRT) of small lung tumors.

Methods: Small-sized scanning ion chambers such as CC13 and CC04 (IBA Dosimetry) are commonly used to collect beam data for TPS commissioning. However, their volume-averaging effect is non-negligible. Their dosimetric effect on the SBRT of lung tumors was investigated by commissioning the TPS (Pinnacle ver. 9.0) using CC13 and CC04 scanned beam data and compared with the beam model using a diode scanned beam data. Treatment plans were generated for 6 SBRT of lung tumors using each beam model, with a dose grid of 4x4x4 mm3. An additional plan for each case was generated using the diode model with a dose grid of 2x2x2 mm3 and served as the standard. Six to eight conformal coplanar fields using 6 MV photon beams were used for all the plans. PTV volumes ranged from 15.7 cc to 86.1 cc, with the average dimensions ranged from 2.2 cm to 5.2 cm. Important dosimetric parameters, including target coverage, conformal index, and normal structure sparing, were evaluated. Differences of more than 5% were considered significant.

Results: Significant differences were seen among plans with different beam models. Differences in PTV coverage of up to 10% were seen, and differences in conformal indices were up to 23%. Significant differences were also seen in normal organ sparing, including the lung and chest wall. In general, the smaller the PTV was, the larger the difference. Dose grid of 4x4x4 mm3 was found to be adequate, resulting in less than 3% difference in most cases when compared with the standard.

Conclusions: For SBRT of lung tumors, it is important to minimize the volume-averaging effect of the beam data used for TPS commissioning to ensure consistent results.