

Purpose: To evaluate the influence of collimator rotation on the dose verification in IMRT fields.

Methods: We measured the focal spot size of Siemens linac using a narrow slit phantom placed at the isocenter. Transverse dose measurements were performed in the x (cross-plane) or y (in-plane) directions perpendicular to the radiation beam with or without collimator rotation, and we calculated dose profile penumbras. We performed the dose verification of TG-119 prostate plan and Head and Neck plan. We compared the measured dose to the calculated dose using an ionization chamber in the absorbed dose verification, MapCHECK2 in the dose distributions. We compared the results of both dose verifications with or without collimator rotation.

Results: The focal spot size in the in-plane direction is almost twice the size in the cross-plane. Each focal spot size (FWHM) was 2.8 mm and 1.4 mm, respectively. These denoted the same tendency of the effective source size in treatment planning system (Pinnacle) which was one of the parameters for beam modeling. The dose profile penumbras in-plane was larger than cross-plane. For the dose verification of TG-119 IMRT plans, the differences between absorbed dose with or without collimator rotations in field by field were within about 2%, and no differences were found for total dose both plans. In verification of dose distribution, the pass rates using gamma index (3%, 2mm) at collimator angle of 90 degree were lower than those at collimator angle of 0 degree in the H&N plan, but no significant differences were found for the prostate plan.

Conclusion: Our study shows that the focal spot shape of the Siemens linac at our institute is an ellipse. This may have a significant effect on the dose verification of the complex IMRT plan such as H&N plan with collimator rotation.