Purpose: The goal of this work is to improve dose calculation for MapCHECK by creating more accurate dose calculation for intensity modulated radiation therapy (IMRT) quality assurance (QA).

Methods: All IMRT treatment plans and the QA dose calculations were created with ADAC treatment planning system (PINNACLE3, Version 9.0, Phillips, Madison, WI). The MapCHECK diode system (Model 1175, Sun Nuclear, Melbourne, FL) was used to do IMRT QAs. The QA dose calculations were done in the original MapCHECK phantom CT images. While each diode has a much high density, in between the diodes there is air. Using heterogeneity correction algorithm with standard CT number to electron density conversion table, the calculated dose is lower compared with measured dose (larger than 5 percent) in some IMRT cases. To improve dose calculation accuracy, we add an override layer to cover the diode and air part in MapCHECK phantom CT images, the layer is about 1.6 cmx20cmx20cm size and we set the density equal to 1.0, the new dose calculation is based on the modified CT images. MapCHECK measured and calculated dose were analyzed with commercially available MapCHECK software (Version 4.1). Comparisons are made based on the relative and absolute dose percent difference (3 percent), Gamma Index and distance to agreement.

Results: Using the unmodified MapCHECK CT images for dose calculations, 124 IMRT QA cases were analyzed. 9 cases have large differences with more than 5 percent compared with measured one. Using the improved methods based on modified density for diodes and air, all the 9 cases passed the QA with less than 3 percent dose difference between the calculated dose and measured one.

Conclusions: The improved dose calculation method for MapCHECK is easy to use and can get more accurate IMRT QA results.