Purpose: The aim of this work is to evaluate the impact of a new super-sampling dose calculation method on delivery quality assurance (DQA) results for helical tomotherapy patient plans.

Methods: Accuray's Tomotherapy treatment planning system performs its dose calculation by approximating the continuous beam of a full gantry rotation into 51 discrete beam projections, with one dose calculation per projection (TomoHD version 1.0). In a recent software release, TomoHD version 1.1, Accuray enhanced this technique by employing three dose calculation samples per projection. This 'super-sampling' methodology is meant to improve agreement between measured and calculated dose. For this study, we compare the results of the 24 patient DQA plans calculated in our clinic with the newer version of dose calculation with the previous 24 patient plans which were calculated with the older method. The plans were delivered to a SunNuclear ArcCHECK cylindrical detector array, and data were compared using a $\gamma$ evaluation, with criteria of 3%/3mm. To quantify the results, the percentage of points with $\gamma<1$ ($P_{\gamma<1}$) was calculated within the 10% isodose line for each plan. We used a pass/fail criteria of ($P_{\gamma<1}$) > 95%.

Results: 21 of 24 DQA plans (87%) calculated with the older TomoHD 1.0 algorithm passed our ($P_{\gamma<1}$) > 95% criteria, while all 24 DQA Plans (100%) generated with the TomoHD 1.1 super-sampling dose calculation passed. The average values for ($P_{\gamma<1}$) was 97.9% and 98.9% for the original and super-sampling calculation, respectively. The standard deviation for the older software was 2.1, versus 1.5 for the newer super-sampling method.

Conclusions: The increased number of samples per projection angle employed in the new TomoHD Version 1.1 software leads to a reduction in the dose discrepancies seen in patient DQA plan results. This can improve the agreement between the calculated dose and delivered dose to patients.