

Purpose

One of the main benefits in making Pre Treatment verification based on volumetric dose data is that the acceptance criteria can be based in part on clinical significance, rather than on a pure percentage dose error. Higher importance can be thus given to the dose errors in specified regions of interest.

Since 2006, the Delta⁴ array dosimeter included an option to reconstruct 3D dose distributions and DVHs. The current methodology uses TPS data in a unique way and is very accurate. The limitation however is that the TPS dose data on the sub-beam level are required, which may not be available from the VMAT or TomoTherapy TPS.

In this work, FAST-3D, a new, TPS-independent, method to calculate 3D dose distribution implemented in the Delta⁴ software was validated.

Method and Materials

FAST-3D does not require the TPS dose-data for 3D dose reconstruction. However it requires accurate dose measurement per control point. This is readily available with the Delta⁴ system, whose unique feature is discrimination between individual dose pulses, as opposed to a common but less accurate solution of integration over pre-set time intervals.

Results

The 3D method based on TPS data proved to be accurate (2%, 2mm) and useful for assessing the clinical significance of a dose discrepancy.

The new FAST-3D method is completely independent of TPS data and can be used even if the calculated dose data on the sub-beam level are missing. It is not quite as accurate as the TPS-method, but still in five of six cases studied, the Gamma analysis passing rates were > 99% at the (3%, 3mm) error level.

Conclusion

Utilizing the FAST-3D method when the full TPS data are not available will in most cases result in measured data reconstructed in 3D agreeing well with the calculations.