AbstractID: 13833 Title: A New Method for Quality Control of Multileaf Collimators using a 2D Ion Chamber Array

Purpose

Verification of the accuracy of multileaf collimator (MLC) leaf positioning is a vital component in a quality control program in any Radiation Therapy Department. The decline of film-based dosimetric systems reinforces the trend to use 2D detector arrays. This work introduces a new method, based on the principle of partial volume response of detectors that overcomes the problem of the somehow inferior resolution of a 2D ion chamber array.

Method and Material

The 2D array PTW-729 was used for the verification of the 82 leaf-MLC Optifocus of a Primus linear accelerator, Siemens. The partial volume response curve for each ion chamber was obtained by irradiating variable rectangular patterns, similar to that used in the Bayouth Test, so that each leaf covered a specific detector in a known proportion. Afterwards, it was developed an algorithm implemented into Matlab to predict the position of the leaf from the detector normalized response. Planes with intentionally introduced deviations of the leaf positions of ±1mm and ±2mm were irradiated upon the PTW-729 and the predicted positions were compared with those included in the planification files.

Result

It was possible to detect, and correctly quantify, all the positioning errors into leaves positioning files, with a minimum number of false errors. The results obtained with this method compare favorably with those obtained with the Bayouth test using the same radiation patterns.

Conclusion

This method provides a superior substitute for film based QA method of MLC performance, with excellent spatial resolution. It detects and correctly quantified all the positioning errors intentionally introduced. It provides and effective and easy to use tool for quantitative measurement of MLC leaf positions, without compromising resolution. It can be easy applied to other 2D array as log as they exhibit a partial volume detector response.