AbstractID: 9328 Title: Errors in Dose Reconstructed from Exit Fluence Due to Patient Anatomical Variations

Purpose:
To test the basic tenets of exit-fluence-based dose reconstruction by measuring incident fluence variability and by determining the error introduced by incorrectly attributing measured patient-induced exit fluence deviations to incident fluence deviations.

Method and Materials:
Fluence reproducibility of a Varian linac's 6 and 18 MV beams is measured for open fields, MLC test fields, and a sample complex patient field using an aS1000 EPID. Both short- and long-term reproducibility are measured, using a method designed to separate fluence and detector variability. To demonstrate potential pitfalls of attributing patient-related fluence deviations to incident fluence variations, EPID images are calculated using a Monte Carlo-based algorithm for both the original patient anatomy and for a variant anatomy in which the patient's rectum is filled with air. Deviations between the computed exit images are used to derive entrance fluence 'corrections', which are then used in the Monte Carlo-based algorithm to reconstruct the patient dose.

Results:
For MLC test fields and the complex patient field, measured fluence variability is <2%. Comparison of the planned, actual and reconstructed doses finds that the difference between the planned and actual dose is substantially smaller than the difference between the reconstructed and actual dose. The uncorrected original planned dose is a better estimator of the actual dose than the reconstructed dose.

Conclusion:
Attributing measured exit fluence variations to incorrect incident fluence delivery appears to be both unjustified and incorrect. Assigning patient-induced exit fluence deviations to incident-fluence deviations increases the error in patient dose estimation. Dose reconstruction breaks down when its basic premise is violated, that is, when fluence deviations are caused by anatomical changes instead of fluence delivery variations.

Conflict of Interest:
This work was supported in part by Varian Medical Systems.