AbstractID: 13897 Title: Improving patient safety through a simple independent on-line beam monitoring system

Purpose: To investigate the effectiveness of an independent on-line monitor for validation of beam delivery.
Method and Materials: An on-line beam monitoring system consisting of a spatially sensitive large area ionization chamber mounted below the MLC, has been tested to validate treatment beams. The accuracy of a beam delivery is ensured by comparing the measured ion chamber signals with the pre calculated expected values. The system performance has been evaluated by phantom treatments of 20 patients' IMRT plans for various anatomic sites, delivered in multiple fractions over a period of six months. The performance of the system has been analyzed in terms of reproducibility, dosimetry and sensitivity. The sensitivity of the system has been evaluated by introducing a number of probable errors, including errors in MLC leaves and jaw positions. The uniqueness of signals per field, in terms of a temporal signature has been investigated by calculating a statistical index between IMRT fields taken from plans of same anatomic site.
Results: The system response was reproducible to within 0.4%. The agreement between the calculation and measured signals for prostate IMRT field segments were within 1% on average, with a maximum deviation of 5%. The system response for a small geometrical segment changed by 2% for a leaf bank calibration error of 1 mm or a single leaf positioning error of 3 mm. Incorrect fields and incorrect use of wedge filters were easily identified. To date all the fields have been found to have unique temporal signature.
Conclusion: An independent simple on-line beam monitoring system has been tested for validation of beam delivery. The results of a clinical simulation study demonstrated that the system is capable of validating daily beam delivery and capturing probable errors. The system could potentially improve quality and patient safety in radiation therapy.

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