Title: IMRT Dose Delivery Error from Radiation Field Offset (RFO) Inaccuracy

The Radiation Field Offset (RFO) is the difference between X(radiation) and X(light) for a MLC. In the conventional use of a MLC as a block substitute, a RFO affects only the dose to a target volume boundary. A block margin is chosen large enough to accommodate such a delivery error. In contrast, leaf edges in IMRT are projected into the interior of a target volume, and no block margin can accommodate such a delivery error.

An IMRT system must incorporate a RFO by decreasing all leaf gaps, e.g., X(right)-X(left). We analyze dosimetric consequences of incorporating an inaccurate RFO into an IMRT system.

Method:
We derive an analytic method of estimating a dose error from a RFO inaccuracy. To test the theory, we deliberately incorporate an inaccurate RFO into MLC sequence files. A phantom is irradiated with these fields. Dose errors are measured with ion chamber and compared with the theory.

Results:
A dose error from an RFO inaccuracy increases for a field with small MLC segments, i.e., $X(right) - X(left)$ small. For an IMRT plan comprised of many fields, each with small MLC segments, a target volume dose error is approximately uniform. For Varian 6MV, Varian Mark II MLC, and CORVUS IMRT plans, a fractional target dose error can be as large as 3.5% per mm in RFO inaccuracy.