AbstractID: 2221 Title: Commissioning an IMRT System for MLC delivery

The first step in commissioning an IMRT system that uses an MLC is to establish that the MLC is sufficiently accurate and reproducible. The demands for IMRT are significantly greater than for conventional treatments for which the MLC only defines the field boundary. For example, test fields composed of a series of abutting strips can detect positioning variations of 0.5 mm or less. Different tests are needed to evaluate dynamic delivery in which the leaf speeds are also regulated. Examples will be given of tests that can be used in commissioning and that can establish baseline performance for subsequent QA tests.

Once the accuracy of the MLC delivery system has been verified, attention can shift to the treatment planning system. It is useful to progress through a sequence of tests that are sensitive to different elements of the dose calculation. This talk will suggest a suite of such tests:

(a) Unmodulated fields to examine dose/MU, central axis depth dose, and off axis variation.
(b) Single fields with broad areas of uniform intensities to test the modeling of MLC transmission and basic modulation motions, while minimizing issues related to penumbra modeling and small field dosimetry.
(c) Single fields with narrow regions of uniform intensities to test the dose prediction for small fields where the modeling of penumbra and rounded leaf ends (if applicable) become important.
(d) Mock patient structures defined on geometric phantoms to test the dose prediction for simulations of clinical situations that use target and critical structure volumes drawn on geometric phantoms.
(e) Actual patient plans transferred to geometric phantoms for dosimetric testing.

Determining acceptance criteria for IMRT commissioning tests requires careful evaluation of the uncertainty in the measurement technique. Some of the tests can be made with Farmer-type ionization chambers in regions of low gradients, and so may be held to the 2% standard used for conventional treatments. Other tests involve measurement techniques (such as film) with larger inherent uncertainties, and dose distributions with high localized gradients. For some situations, acceptance criteria should be stated statistically, such as: “within the region of interest, 95% of the calculation points should agree with the measurement to within 5%, which combines the desired degree of agreement with reality (3%) with the two-sigma uncertainty in the measurement technique (4%).” Creating such a statement raises a number of non-trivial questions, which this talk will address, if not answer.

Objectives

(1) Suggest and illustrate tests to be used in commissioning an MLC system for IMRT delivery.
(2) Suggest and illustrate a sequence of tests to be used in commissioning a treatment planning system for dosimetric accuracy, where the treatment delivery uses an MLC.
(3) Suggest and illustrate criteria for acceptability for these tests.