AbstractID: 8338 Title: CE-IMRT 1: Quality Assurance of IMRT delivery systems - Varian

Intensity modulated radiation therapy (IMRT) using segmented or dynamic multileaf collimation (SMLC or DMLC) with Varian MLC is used to treat a wide variety of cancers, including prostate, head and neck, breast, lung, liver, brain, paraspinal, and a variety of pediatric tumors. IMRT presents special quality assurance (QA) issues for both dose calculation and delivery compared with conformal radiation therapy (3DCRT). An understanding of these issues and a well-defined QA program is essential for accurate IMRT. This presentation will highlight the important physics issues for the Varian MLC and suggest an overall QA program.

IMRT places increased demands on the treatment planning system dose calculations. Dosimetric models, while proven accurate for some treatment sites, may not be adequate as IMRT is extended to other sites. Observations are based upon discrepancies between calculations and measurements in phantom. Areas of concern, which should be reevaluated, are the simulation of interleaf transmissions and the extended source distribution, particularly when multiple peaks are present in the intensity modulation pattern. Also, scatter radiation from the MLC, often commissioned as a small fraction of the fixed MLC transmission, instead can be a significant source of dose to the target and surrounding tissues for large IMRT fields. An example will show how these parameters influence the agreement between dose calculations and measurements.

The dose delivered with IMRT is sensitive to the width of the gap defined by each leaf pair. Routine QA tests and frequencies are designed to detect mechanical sources of leaf positioning error before dose errors become significant.

Patient-specific QA checks that patient data is not mismatched or altered inadvertently. Though dose-based verification methods are available, they are tedious; their routine use for large numbers of IMRT patients is inhibitive. For this reason and due to the complexity of IMRT, patient-specific QA should be reliant on computer-based checks, utilizing software tools already developed by Varian and others.

In summary, the relationship between leaf position and dose delivery must be accurately modeled in the treatment planning and leaf sequencing software. Then it is only a matter of assuring that the leaves are in the correct position at each moment during treatment. Accurate leaf positioning is assured with complimentary MLC mechanical QA and computer-based patient specific QA, which can be integrated as an efficient and comprehensive QA program ensuring accurate dose delivery for all IMRT patients.

Educational Objectives:

1. To identify the dose calculation models and parameters, which need to be reevaluated for IMRT.
2. To identify mechanical and human sources of leaf positioning error, and methods to detect these errors.
3. To present an efficient and comprehensive QA program for IMRT.