AbstractID: 2582 Title: How Much Complexity Is Necessary for IMRT?

The key to simplifying IMRT is keeping the intensity patterns as simple as possible. Of course, any simplification of the intensity distributions might degrade the quality of the final treatment plan. A major problem is that it is hard for the dosimetrist to determine if a current iteration of a treatment plan is as good as possible. Not knowing if changing the dose constraints one more time will give a better result, it is difficult to justify simplifying the intensity pattern as part of the inverse planning process.

However, the drawbacks associated with busy intensity patterns are well known. There are basically two problems that are related, but affect the overall process in different ways. First, complex intensity patterns can increase the number of segments needed to model the distribution. This can increase multileaf collimator wear and extend treatment times. Second, complex intensity patterns can drive up monitor units with a likely increase in the leakage radiation reaching the patient's total body.

There are some delivery systems that can relatively easily handle busy intensity patterns. Examples are tomotherapy and dynamic multileaf delivery. It is not clear that these approaches avoid the basic problems that are the justification for trying to simplify the intensity patterns. This presentation argues that it is important to optimize the dose optimization process such that the quality of the dose distribution is within acceptable limits while keeping the intensity pattern as simple as possible.

There are methods for evaluating the quality of treatment plans developed during the inverse planning process. In addition to relying on previous experience in planning similar cases at your institution, it is possible to review readily available RTOG protocols to determine how a group of experts define acceptable dose volume histograms for treating a particular disease site with IMRT. There is a nasopharynx protocol and another for treating oropharynx lesions. Other RTOG protocols have been written or amended to include IMRT as an option. These additional protocols have more expanded statements of the required DVH constraints needed to accommodate the use of IMRT. The information that exists in RTOG protocols helps the dosimetrist set the dose volume constraints that must be met during the inverse IMRT planning process, and then concentrate on simplifying the intensity pattern as much as possible while staying within these stated limits.

There are a number of methods available for simplifying the intensity patterns obtained from the inverse planning process: 1) It is possible to use an inverse planning algorithm that inherently produces simple intensity patterns. 2) Some interpreter software used to model the intensity pattern reduces the number of segments and monitor units. 3) Deriving the field segments during the optimization process (Direct Apertrure Optimization) can decrease segments and

monitor units. 4) Up-front geometric aperture design reduces the number of segments that the inverse planning algorithm can use in finding an acceptable solution to the treatment planning problem.

This presentation will discuss the techniques available for simplifying the overall IMRT process.