

AbstractID: 5868 Title: A Complexity Metric for Quantitative Triage of IMRT QA

Purpose: Our IMRT planning system can develop highly conformal plans with good dose homogeneity and avoidance of normal structures. As dose goals become more demanding the fluences which deliver the plans become more complex and the dose calculation becomes less accurate. Simple plans can be verified by a monitor unit calculation but complex cases can only be reliably confirmed by an ion chamber in phantom. An algorithm has been developed to quantitatively score the complexity of an IMRT plan, indicating to the physicist which cases can be verified with an MU calculation, which plans must be measured with an ion chamber, and where in the plan they should be measured.

Method and Materials: Fluence patterns for each IMRT field are exported from the planning system. A complexity score, based on intensity gradient in the direction of leaf motion, is developed for each leaf pair in the plan. The calculation has been run on a number of test cases to examine the correlation between complexity score and accuracy of the dose calculation. Among the cases evaluated are several prostate plans with very little modulation, head and neck plans, and a phantom case that was manufactured to exhibit regions of high and low complexity.

Results: All of the prostate plans, measured to better than 1% dose accuracy, had complexity scores below 100. In the simple region of the phantom plan the dose calculation agreed to within 2% of measurement and the complexity score ranged from 10 to 30. In the complex region of this plan the measured dose was 12% low and the complexity score ranged from 200 to 450.

Conclusion: An algorithm has been developed which will allow us to direct the majority of our QA time towards difficult plans and confidently verify simple plans with an MU calculation.