AbstractID: 13745 Title: A real-time graphical user interface-driven radiotherapy treatment planning simulator

Purpose: To present a stand-alone Radiotherapy Treatment Planning simulator (RTPsim) that physicists can use for interactive classroom instruction and provide to students for independent study.

Method and Materials: A PC with MATLAB programming language and the imaging toolbox is required. The RTPsim components are (1) a set of grayscale images for dose computation with regions of interest for dose area histogram analysis; (2) a double Gaussian pencil beam algorithm to create treatment fields; (3) dose distribution calculation routines for individual open or wedged beams and for a composite of weighted beams; and (4) a Graphical User Interface (GUI) to run the system with such user friendly features as command buttons to run algorithms, text or cursor variable input, list boxes for patient selection, and radio buttons for beam modifiers such as wedges.

Results: The percent depth dose (%DD) for a typical 10x10 cm 6MV beam created by pencil beams closely approximates the actual clinical data. By computing and storing a correction factor table, the %DD values match exactly. The incorporation of divergence and a low dose region beyond the geometrical field edge result in excellent agreement in calculated versus clinical data for open beam profiles. Wedged field profiles show reasonable agreement with our clinical system. Several test cases from texts were reproduced accurately for interactive teaching purposes. As an example, an RTPsim wedged tangent field breast plan comparable to a clinical plan was produced. Variations in wedge, weighting, and normalization point can be demonstrated in real time. Use of a MATLAB GUI is suitable for planning demonstration; physicists and dosimetrists found the GUI convenient and easy to use.

Conclusion: The user-friendly Radiotherapy Treatment Planning simulator can simulate a clinical treatment planning computer with sufficient accuracy and speed for interactive educational purposes and independent learning.