AbstractID: 8316 Title: Uniform treatment of a moving target with un-gated stationary fields.

Purpose:
To describe the mathematical formalism necessary to compute the stationary treatment field fluence for the entire respiratory cycle that delivers a uniform dose to a moving target.

Method and Materials:
The desired dose **D** to the central plane of a moving target perpendicular to a stationary radiation beam with fluence **F** can be mathematically described as **D = M*F** where **M** is a binary coefficient matrix. Our algorithm computes **M** as function of the periodic motion and determines **F** by iterative gradient descent search or linear programming. The theory was tested by analyzing a model in detail and simulating the motion on a treatment planning system by shifting the beam relative to a stationary target. A clinical moving target described in the literature as suitable for gated treatment was also analyzed. The motion was divided into phases and **M** determined, **F** optimized for a single stationary field encompassing one phase near the center of the motion, and then dose to target computed.

Results:
We have developed a matrix mathematical formalism to compute a stationary non-gated field fluence that can be optimized to treat a moving target and spare normal tissue. For the model case with comparable coverage using an integrated target, the use of a single field with the optimized fluence decreased the 40% normal tissue dose from 79% to 52% of the volume. The clinical target computed fluence gave a mean dose of 100% with 92.4%, 110.1%, and 5.2 as the minimum, maximum, and standard deviation respectively.

Conclusion:
A technique has been developed to compute the stationary treatment field fluence for the entire respiratory cycle that delivers a uniform dose to a moving target without gating. Results indicate the potential for improved normal tissue sparing while delivering a relatively uniform target dose.

Conflict of Interest (only if applicable):