

## AbstractID: 2482 Title: The Unappreciated Benefits of Randomness and Slow Delivery with Organ Motion

**Purpose:** Expand a groundbreaking study (C. Yu, et al., PMB 43, 91) to explore the implications for helical tomotherapy and to expand it with more exploration of random components of the organ motion function.

**Method and Materials:** Three MatLab codes were independently constructed to simulate sinusoidal motion (amplitude, scan speed, and frequency varied) superimposed upon a constant scan speed as in C. Yu, et al., PMB 43, 91. The fluence at a point in the moving target (tumor) is calculated by the amount of time that point spend in the beam (1 cm wide) assuming a constant fluence rate. These codes with varying resolutions and frames of reference are cross-checked. A resolution of 0.01 cm and 0.005 sec were found to be sufficient.

**Results:** Motion plots of points in the target are compared to the fluence profiles for a variety of parameters. Hot and cold spots in the target (dose modulations) are small for typical helical tomotherapy couch speeds with longitudinal target organ motion. The edge is blurred because the points move in and out of the beam at both sides. When cycle-to-cycle randomness is added to amplitude and frequency, these modulations are high sensitivity to these parameters. However, with multiple fractions at random phases, the modulations decrease quickly and single fraction variability is quickly averaged out.

**Conclusion:** Typically used helical tomotherapy couch speeds imply less concern for dose modulations from longitudinal tumor motion. There is still a need for a large enough PTV for edge blurring. Multiple fractions smooth out modulations that occur in a single fraction from randomly phased motion. Methods that remove this randomness may not benefit from this averaging process.