# AbstractID: 9688 Title: Breathing-motion induced Tomotherapy dose delivery errors in the presence of beam modulation

**Purpose:** To determine breathing-motion induced Tomotherapy dose delivery errors in the presence of beam modulation.

**Methods and Materials:** Previous studies have shown that dose delivery errors are possible due to breathing motion. While these studies have systematically investigated the roles of field size, couch velocity, and breathing motion magnitude on the dose errors, they have neglected the role of intensity modulation. This study used measured breathing patterns and clinically realistic delivery parameters to simulate the breathing-motion induced errors. Modulation was included by varying the simulated delivered dose on two timescales; the short timescale simulating the 51 angular subsets that subdivide the delivered fluence patterns. A step function was used that varied the leaves open and close time every 0.4 seconds, or every 7.0°, simulating a modulation factor of 2.0. Modulation was also conducted on a longer timescale corresponding to four beam intensity directions (two of high dose and two of low dose). The earlier studies using 52 patients' breathing patterns were repeated with the addition of fluence modulation.

**Results:** The impact of breathing motion on Tomotherapy delivery results in delivery errors of greater than 10%, even for relatively small breathing motions. This is due to the subtle variation in the breathing patterns, including changes in breathing waveform and drifting. The addition of fluence modulation varied the delivered dose patterns slightly, but the magnitude of dose delivery errors was unchanged.

**Conclusions:** These results indicate that previous simulations indicating the challenges of using Tomotherapy dose delivery due to breathing motion are valid in the presence of beam modulation. Treatment planners should take care when planning treatments for mobile tumors.

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