Purpose: Stereotactic Body Radiation Therapy (SBRT) is a radiotherapy technique which uses high dose fractions with multiple coplanar and non-coplanar beams. Treatments are typically protracted with more fields than conventional radiation treatment schemes. The timing of field delivery may have an impact on the radiobiological results for SBRT.

Methods: In a cohort of eight SBRT patient treatments, the protraction factor (G-value), LPL, and LQL models were used to optimize field arrangements. An actual field timing delivered in the clinic (C) was included for comparison. The LPL model was used to quantify the difference in survival fractions (SF). Published data from three cell lines for non-small cell lung cancers: H460, H660, and H157 was used to acquire the model parameters. The results were displayed as (C:O)^N or (V:O)^N, where C, V, and O were the SF for the clinical (C), least favorable (V), and optimal (O) field timings respectively. N represents the number of fractions for the SBRT protocol.

Results: Results from all three models indicate that the optimal field order occurs when the fields are arranged in a triangle like pattern, where the highest dose fields are positioned centrally. Minimization of cell kill was achieved with a V-shaped orientation, although these results were not as conclusive. Results of the SF ratios demonstrated that regardless the cell type and model the triangle shape had lower cell survival fractions compared to both the C and the V arrangement. For example, the H460, with repair half-time = 1.50 h, an average ratio of (C:O)^3 = 5.8, suggesting the triangle pattern is approximately 6 times more effective than the clinical plan, after 3 fractions.

Conclusions:Rearranging field timing for a SBRT treatment so that maximal dose is deposited in the central fields of treatment may optimize cell kill and potentially affect overall treatment outcome.