AbstractID: 8177 Title: A Clinical Example of the Helical Tomotherapy Thread Effect: Robustness Discussion

Purpose: A previous study explained why pitches of 0.86/n, where n is an integer, will provide the best junctioning of a helically delivered and diverging beam. The previous treatment was theoretical and based on unmodulated examples. In this study, a clinically relevant case of a palliative lung treatment with arm blocking that was artificially extended in order to test limits, was used to test the 0.86/n pitches and explore a deeper understanding.
Method and Materials: The thread effect ripples were measured in the middle of the PTV for a large number of sequential pitches on a TomoTherapy planning station for the situations of no arm blocking and for very large arm blocks that extend +/- 15cm in order to create a very modulated sinogram. A typical 2.5cm beam was used. The patient was anonymous.
Results: The 0.86/n pitches were observed to be the best choices in both cases for minimizing the thread effect.
Conclusion: By using a simplified analysis, one can easily appreciate that the reason for this robustness was that the complexity of the sinogram modulations were periodic in phase with the gantry rotation, and the 1/n factor is the result of an integral over n gantry rotations. Since most structures that cause such complexity are larger than the beam width times the pitch in length, most sinograms will be complex in this fashion, and the p=0.86/n relation is expected to be rather robust for most clinical situations. It is recommended that TomoTherapy treatments use the proper pitches of 0.86/n if there is no other reason not to.