

AbstractID: 8644 Title: Improved accuracy and potentially faster CyberKnife Synchrony treatments by tightening constraints

Purpose:

To improve the accuracy and delivery time of CyberKnife Synchrony treatments.

Method and Materials:

The CyberKnife Synchrony system enables state of the art tumor tracking and targeting during stereotactic lung treatments. Unfortunately, for difficult cases some CyberKnife users have resorted to turning off all except one fiducial and loosening whatever constraints necessary to somehow complete every treatment. Is it possible to do better? We have discovered that ironically, judiciously tightening certain constraints can improve the correlation model and hence possibly decrease treatment time, while improving delivery accuracy. When tracking a single fiducial, the CyberKnife system has no way to realize when it has missed the fiducial and falsely locked to something else. This essentially can fill the correlation model with corrupted results that cause the algorithm to miss even worse on subsequent images.

Alternatively, for these difficult cases if we still use multiple fiducials, loosen only the necessary parameters, while keeping the "Extraction Confidence Level" and "dxAB" threshold reasonably tight, the algorithm can determine when it has false locked. In this presentation we outline a simple procedure whereby the user can give the algorithm a "hint", and hence salvage some of the potential misses to improve the correlation model rather than degrading it with corrupted estimates.

Results:

We present the values of parameters which enabled us to continue the treatments using at least three fiducials in selected case studies.

Conclusion:

The CyberKnife Synchrony system provides the tools to achieve unparalleled accuracy in delivering radiation to moving targets. However, the parameter set is so flexible and treatments are so intensely interactive, that attaining the full potential of the system is very dependent on the skill level and dedication of the staff.