Conference Poster

Experimental comparison of spot, raster and line scanning and their effectiveness in mitigating tumor motion using rescanning

Author(s):
Klimpki, Grischa; Zhang, Ye; Fattori, Giovanni; Psoroulas, Serena; Weber, Damien C.; Lomax, Anthony; Meer, David

Publication Date:
2017

Permanent Link:
https://doi.org/10.3929/ethz-a-010883563

Rights / License:
In Copyright - Non-Commercial Use Permitted
Experimental comparison of spot, raster and line scanning and their effectiveness in mitigating tumor motion using rescanning

G. Klimpki¹, Y. Zhang¹, G. Fattori¹, S. Psoroulas¹, D.C. Weber¹,², A. Lomax¹ and D. Meer¹

¹Paul Scherrer Institute, Center for Proton Therapy, 5232 Villigen PSI, Switzerland
²University of Zurich, University Hospital, Rämistrasse 100, 8091 Zurich, Switzerland

INTRODUCTION

• Particle therapy centers and vendors around the world offer three different types of beam scanning:
  - spot scanning [1] (e.g. PSI, MD Anderson or IBA)
  - raster scanning [2] (e.g. HIT or Varian)
  - line scanning [3-4] (e.g. PSI or Sumitomo)
• They differ in their delivery dynamics and produce unequal interplay patterns in case of moving target irradiations.
• To compare the differences, we emulated all three scanning techniques on our Gantry 2.

RESULTS

• All three plans have identical dose-volume histograms if the target is static ($\Delta D_{V0} < 0.02\%$).
• We see this confirmed when measuring absolute dose distributions at center SOBP without moving the 2D array of ionization chambers (ICs).
• In free breathing (simulated with a programmable, sliding table), volumetric rescanning (green bars) decreases inhomogeneity inside the CTV further than layered (yellow bars), especially for LS.
• RS and LS deliver dose faster than SS saving ca. 40 and 50 sec., respectively, when rescanning six times in volumetric sequence.
• At the same time, SS and LS show comparable inhomogeneity scores [±6%]. Residual inhomogeneity for RS remains higher at ~8%.

Conclusion: LS might be a fast and effective delivery technique to treat moving targets using rescanning.

REFERENCES


Acknowledgements:
We appreciate the support of our software and electronics engineers. Furthermore, we wish to express gratitude to the Glavine and Giorgio Stefanini Foundation for partially funding this project.

Contact:
Grischa Klimpki
Doctoral Student
Center for Proton Therapy
Paul Scherrer Institute
phone: +41-56-310-5183
email: grischa.klimpki@psi.ch