

Automatic field-in-field treatment planning function for deep
inspiration breath hold left breast radiotherapy using
Raystation 2023b

Kelli Gilliland, RT(T); Patrick Wirball, BS; Jessica Li, RT(T); Nishele Lenards, PhD, CMD,
RT(R)(T), FAAMD; Ashley Hunzeker, MS, CMD; Matt Tobler, CMD, FAAMD
Medical Dosimetry Program at the University of Wisconsin-La Crosse, WI

Abstract

Breast radiotherapy treatment planning can be time consuming for the medical dosimetrist due to the manual creation of field-in-field control points to achieve dose homogeneity. Raystation 2023b includes an automatic field-in-field (AFIF) feature to assist in planning three-dimensional conformal radiation therapy (3D-CRT) treatment plans. Although AFIF is extensively researched for tools such as EZFluence, there is limited research that examines Raystation 2023b's AFIF feature on planning 3D-CRT treatments to the breast. The purpose of this study was to examine if the use of Raystation 2023b's AFIF feature reduced treatment planning time while maintaining planning metrics for left breast deep inspiration breath-hold (DIBH) radiotherapy, compared with manual field-in-field (MFIF) planning.

Ten patients with histologically confirmed left sided breast cancer were retrospectively planned with both MFIF and AFIF techniques with a prescription of 4256 cGy delivered in 16 fractions. All patients had undergone breast conserving surgery and were patients from one institution. Time to plan for each MFIF and AFIF plans were recorded along with dose to the surrounding organs at risk (OAR) and monitor units (MU) for each field.

The AFIF treatment plans were significantly more efficient than the MFIF plans ($P = 0.000$) but were associated with higher maximum doses ($P = 0.000$). All other planning metrics had no significant differences, suggesting that Raystation 2023b's AFIF tool was more efficient at planning left sided breast radiotherapy treatments without compromising the clinical target volume (CTV) coverage and OAR sparing.

Keywords: Raystation, breast cancer, 3D planning, automatic field-in-field (AFIF), planning time, deep inspiration breath hold (DIBH)

Acknowledgements

The authors would like to acknowledge Melissa Bingham, PhD, of the University of Wisconsin - La Crosse for contributions to the statistical analysis of this study.

References

1. Kim H, Kwak J, Jung J, et al. Automated field-in-field (FIF) plan framework combining scripting application programming interface and user-executed program for breast forward IMRT. *Technol Cancer Res T*. 2018;17. <http://doi.org/10.1177/1533033818810391>
2. Ferdinand S, Mondal M, Mallik S, et al. Dosimetric analysis of Deep Inspiratory Breath-hold technique (DIBH) in left-sided breast cancer radiotherapy and evaluation of pre-treatment predictors of cardiac doses for guiding patient selection for DIBH. *Tech Innov Patient Support Radiat Oncol*. 2021;17:25-31. <http://doi.org/10.1016/j.tipsro.2021.02.006>
3. Donovan E, Bleakley N, Denholm E, et al. Randomised trial of standard 2D radiotherapy (RT) versus intensity modulated radiotherapy (IMRT) in patients prescribed breast radiotherapy. *Radiother Oncol*. 2007;82(3):254-264. <http://doi.org/10.1016/j.radonc.2006.12.008>
4. Desai N, Currey A, Kelly T, Bergom C. Nationwide trends in heart-sparing techniques utilized in radiation therapy for breast cancer. *Adv Radiat Oncol*. 2019;4:246-252. <http://doi.org/10.1016/j.adro.2019.01.001>
5. Yoder T, Hsia AT, Xu Z, Stessin A, Ryu S. Usefulness of EZFluence software for radiotherapy planning of breast cancer treatment. *Med Dosim*. 2019;44:339-343. <http://doi.org/10.1016/j.meddos.2018.12.001>
6. Sheng Y, Li T, Yoo S, et al. Automatic Planning of Whole Breast Radiation Therapy Using Machine Learning Models. *Front Oncol*. 2019;9. <http://doi.org/10.3389/fonc.2019.00750>
7. Arbab M, Frame R, Alluri P, et al. Master breast radiation planning: simple guide for radiation oncology residents. *Adv Radiat Onc*. 2024;9. <http://doi.org/10.1016/j.adro.2024.101476>
8. Malato G. An introduction to the shapiro-wilk test for normality. Builtin web site. <https://builtin.com/data-science/shapiro-wilk-test>. Updated August 01, 2025. Accessed August 20, 2025.
9. Understanding the wilcoxon signed rank test. IntellectusConsulting web site. <https://www.statisticssolutions.com/free-resources/directory-of-statistical-analyses/how-to-conduct-the-wilcox-sign-test/>. Accessed August 20, 2025.
10. Hong D, Aimadeddine N, Cherukara J, et al. Benefits of 3D Optimization on Palliative Spine Cases. MD Anderson Cancer Center. 2024. Accessed March 2, 2025

<https://www.mdanderson.org/content/dam/mdanderson/documents/education-training/school-of-health-professions/research/AAMD-2024-Poster-Hong.pdf>.

11. Shao K, Du F, Qiu L, et al. A retrospective study of automatic progressive optimization for lung cancer radiotherapy plans on the Halcyon and Raystation systems. *PeerJ*. 2025(13). <http://doi.org/10.7717/peerj.19831>
12. Gumpili SP, Das AV. Sample size and its evolution in research. *J. Ophthalmol.* 2022;1(1):9-
13. http://doi.org/10.25259/IHOPEJO_3_2021
13. Faux DA and Godolphin J. Manual timing in physics experiments: Error and uncertainty. *Am J Phys.* 2019;7(2):110–115. <http://doi.org/10.1119/1.5085437>