



INTRODUCTION

- RayStation's Fallback Planning (FBP) uses a **dose mimicking algorithm** to generate a new radiotherapy plan from an existing plan.
- The new plan can use a **different treatment modality**, technique, or unit which facilitates contingency planning in the event of a non-paired treatment unit's downtime.
- This study **evaluated the dosimetric quality and planning speed of fallback planning** VMAT TrueBeam plans from Radixact tomotherapy plans.

METHODS

- Clinically acceptable tomotherapy plans were created in RayStation (v.2023B) for 12 patients.

4 x Lung	60 Gy / 30 fx
4 x Pelvis	60 Gy / 20 fx
4 x Liver SABR	45 Gy / 3 fx, 45 Gy / 5 fx, 54 Gy / 3 fx

- VMAT fallback plans were generated for each case.
- To simulate temporary Radixact unavailability, one (liver SABR) or two (lung and pelvis) FBP fractions were summed with the remaining tomotherapy fractions in the treatment course.
- If the fallback plan failed to meet clinical goals, it was manually re-optimized.
- The time for FBP generation and manual FBP re-optimization was recorded.
- The fallback plan evaluation workflow is shown in Figure 1.

Case	Time for FBP _{original} generation	Time for FBP modification (FBP _{modified})	Total time	All constraints met in FBP _{original} ?	All constraints met in Plan Sum?	All constraints met in FBP _{modified} ?
Liver SABR 1	3:41	1:00	4:41	No	No	Yes
Liver SABR 2	3:30	10:00	13:30	No	No	Yes
Liver SABR3	4:10	1:00	5:10	No	No	Yes
Liver SABR 4	4:50	10:00	14:50	No	No	Yes
Lung 1	3:00	N/A	3:00	Yes	Yes	N/A
Lung 2	3:04	N/A	3:04	Yes	Yes	N/A
Lung 3	4:09	9:24	13:33	No	Yes	Yes
Lung 4	2:25	6:52	9:17	No	Yes	Yes
Pelvis 1	2:04	11:49	13:53	No	Yes	Yes
Pelvis 2	2:07	9:27	11:34	No	Yes	Yes
Pelvis 3	2:36	8:34	11:10	No	Yes	Yes
Pelvis 4	2:37	8:10	10:47	No	Yes	Yes
Average	3:11	7:37	10:50			

Table 1. The timing data (min:sec) collected and clinical goals achieved for each case in the fallback plan evaluation workflow used in this study.

RESULTS

- The average time for automatic generation of the fallback plans = 3mins 11s.
- The ratio of fallback plans (FBP_{original}) which failed to meet clinical objectives = 10/12.
- For all 8 high-fractionation cases (lung and pelvis), objectives were met when fallback plans were used for only 2 fractions of a tomotherapy course (plan sum).
- For all 4 low-fractionation cases (liver SABR), at least one objective was not met if fallback plans were used for 1 fraction of a tomotherapy course.
- After modification, all fallback plans met clinical criteria, requiring an additional mean optimization time of 7mins 37s.
- Results for all cases are summarized in Table 1, and an example pelvis case is shown in Figure 2.

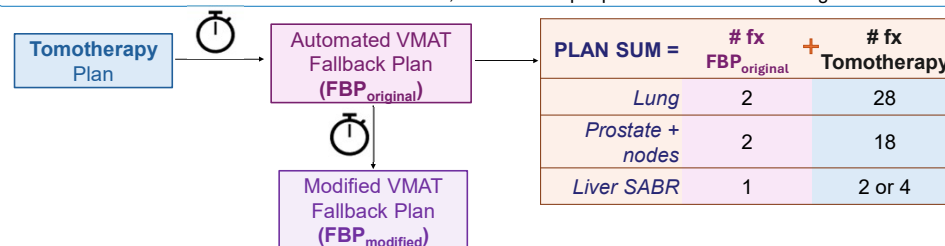


Figure 1. Fallback planning evaluation workflow. Stop-watch icons indicate where timing data was collected.

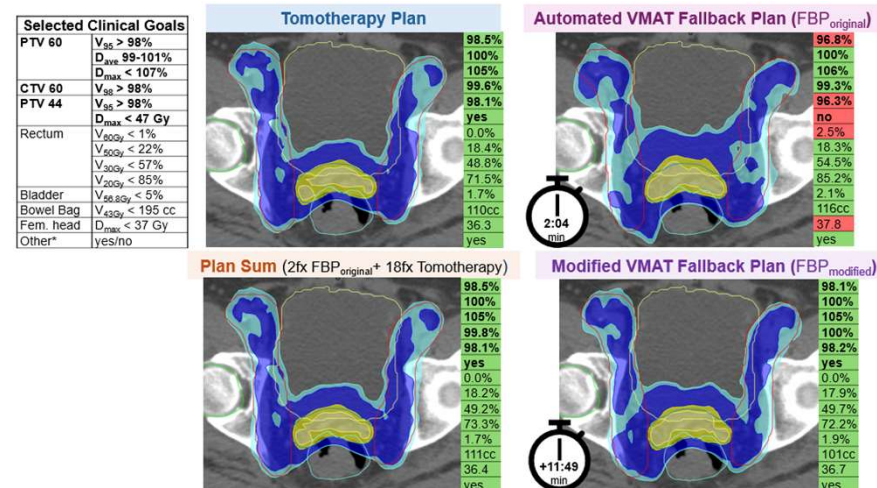


Figure 2. Example results for a pelvis (prostate + nodes) case. The values for selected clinical goals are shown for each plan (green = pass, red = fail) as well as an axial view of the dose distribution. The time to create the automatic and modified fallback plans are displayed on stop-watch icons.

CONCLUSIONS

- Fallback planning supports fast generation of contingency TrueBeam VMAT plans in the event of Radixact downtime.
- Long-course treatments may not require FBP modification if only used for a few fractions, while short-course treatments are likely to require additional post-FBP optimization.