

REDUCING TREATMENT DELAYS WITH FALLBACK PLANNING IN RAYSTATION

Built upon the dose mimicking algorithm created by RaySearch, the fallback planning module allows users to automatically create contingency plans for any machines or modalities found within the department. For safety assurance, fallback plan review and approval before use of the plan is needed.

FALLBACK PLANNING

Fallback plans are generated after plan approval, based on previously created protocols.

If a machine is out of operation for any reason, fallback plans can be accessed and pushed via DicomRT to the R&V system.

BENEFITS

1. Avoid treatment disruptions. Create a contingency plan that is saved until needed, such as in the event of machine outage. The fallback plan can then be pushed to the machine for delivery. RayStation also has powerful tools in plan evaluation, which allow the user to combine treatments performed on different machines, e.g., it is possible to combine 27 fractions using a Tomotherapy machine with 3 fractions using a conventional linac and view the resulting total dose.
2. Compare efficacy of different treatment techniques.
 - a. For instances where reimbursement requirements state that the most suitable treatment plan must be utilized, fallback planning eliminates the need for an extra plan to be submitted for billing purposes.
3. Can convert between different modalities and treatment techniques, e.g. can be used to convert proton or tomotherapy plans to VMAT, IMRT or 3D-CRT.

DOSE MIMICKING ALGORITHM

Fallback plans are generated by a dose mimicking optimization that seeks to recreate or improve the dose distribution of the initial plan. The optimization penalizes dose differences relative to the initial plan both on a voxel-per-voxel level and in terms of DVH curves. Dose for OARs is only penalized if it exceeds the dose of the original plan whereas dose for targets is penalized if uniformity has deteriorated compared to original plan. The result of the dose mimicking optimization can be customized with user-specified parameters such as:

- The priority between minimization of voxel-wise dose differences and DVH curve differences
- The priority between target uniformity and sparing of OARs
- Which regions of interest that the mimicking should consider

CREATING A FALLBACK PLAN

The first step in utilizing the Fallback module is to create the desired protocols. This is a simple process that allows customization to the specific machines in use at the clinic, and defines the types of plans to “fall back” to. At the completion of any treatment plan, the fallback plans can be automatically created and will remain stored in the system until needed.

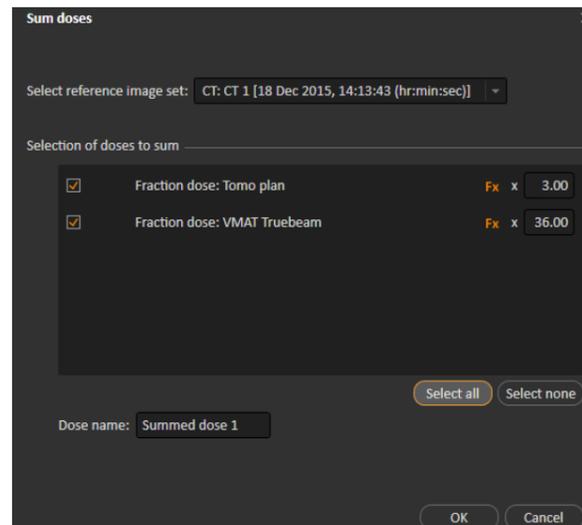
If a machine failure occurs, or a patient requires repositioning, the replanning process is already complete and the fallback plan is ready to use. New plans are housed in a separate location called “fallback plans”. The clinical goals of the initial plan are moved over to the fallback plans, allowing the user to see if the new plan meets planning objectives. It is important to note that if additional optimization is required on the fallback plan, it is possible to do so.

When the use of a fallback plan becomes necessary, the user will access the saved fallback plans, evaluate which one is most suitable, and copy it to the plan list. It is then possible to select which fraction the plan will begin at. Going forward, the plan remains in the plan list, with flexibility to modify as needed. The selected plan requires approval before it can be sent to the machine for treatment.

Once the patient is able to return to the originally planned machine, there is an option in the fallback module to “return to original plan”. It is also possible to sum the dose in plan evaluation by defining the fractions used with each treatment modality or machine.



RayStation can create fallback plans for the following techniques; 3DCRT, IMRT, VMAT and Tomotherapy plans. Additionally, the fallback plans can mimic the dose of any type of plan, even imported dose files.



THE CLINICAL REALITY IN ONE LATIN AMERICAN CENTER

Clinica El Rosario in Colombia experiences a high volume of clinical and research activities along with a fluctuating patient population. Machine breakdowns are not uncommon, resulting in the need for replanning. There is also an increased push toward hypofractionation which translates into a higher number of patients treated per month. Machine breakdown is a tremendous obstacle, as replacement parts can sometimes take up to a month to reach the clinic.

Clinica El Rosario touts the convenience of utilizing one TPS, RayStation, as opposed to previously using multiple TPS's simultaneously. The clinic uses Atlas based segmentation which replaced their prior contouring method which took 60 minutes for therapists, and 20 minutes for the physicians with multiple TPS's.

Using RayStation alone, a single doctor can perform Atlas based segmentation in 15 minutes, greatly reducing the burden upon already limited clinical resources.

Prior to having two machines, when a machine failure occurred, the clinic had to send patients elsewhere for their scheduled treatments. Once the clinic had two machines, they could transfer patients to their other machine, which was beneficial, but manually re-planning was very time consuming, resulting in "the worst work week of the year" according to staff.

Clinica El Rosario's clinical set-up

- Two LINACS (3D and IMRT treatments)
- 35 patients treated per day, per machine
- One radiation oncologist
- Two medical physicists
- Constant trend toward hypofractionation

Two machines and fallback planning dramatically improved the scenario for staff and for patients, with less stress on the care team and significantly reduced treatment interruption for the patient. "Fallback planning effectively reduces the gap that a machine failure can produce, one of the many reasons why RayStation is a very rich, powerful and resourceful TPS", says Dr. Cabal, citing fallback planning as the most important RayStation license the clinic has.

"We are very happy with the dose mimicking algorithm to create an IMRT acceptable plan for a Siemens linac when initially planned on Tomotherapy."

NEW FUNCTIONALITY

RayStation 13A, released in the spring of 2023, will include the ability to have different density support structures per beam set. This will allow for varying couchtops between delivery systems to be considered in dose calculation.

CONCLUSION:

Fallback planning is a tool for creating additional plans to be used in a contingency situation, enabling a patient to be treated on another machine, possibly with a different modality and/or treatment technique, in case the original machine is unavailable. It can drastically reduce planning time in emergency situations when a machine is down, allowing the patient's treatment to continue, and reducing stress on clinical staff.

- Fallback planning uses a dose mimicking function to replicate a given plan, but for a different machine or treatment modality.
- Plans of any modality, including proton and Tomotherapy plans, can be replicated using photon plans like 3D-CRT, IMRT, or VMAT.
- Fallback plans are automatically generated after plan approval based on previously created protocols.
- No user interaction is required as this is a fully automated plan creation process. If needed, the created fallback plans can be manually modified after the automatic generation.
- Fallback plans can be compared and evaluated using a number of visual tools (DVH curves, dose differences, etc.).
- A fallback plan can be approved and used for delivery in future fractions. It is also possible to convert back to the original plan.
- With dose summation tools, two plans can be combined using their delivered fractions so that actual composite dose can be visualized on the patient data set.

DIFFERENTIAL FACTOR

Atlas based auto segmentation, protocols, and fallback combined save 70% of planning efforts when a machine failure occurs within the department.



“ Fallback planning effectively reduces the gap that a machine failure can produce, one of the many reasons why RayStation is a very rich, powerful and resourceful TPS.”

Gonzalo Cabal, PhD., Medical Physicist, Clinica El Rosario



REFERENCES

1] Gonzalo Cabal, PhD; Fallback planning in RayStation: a promising tool for developing countries, RaySearch User Meeting Presentation, Miami, FL, December 11, 2021

For more information or to book a demo,
visit www.raysearchlabs.com

