

RAPIDPLAN KNOWLEDGE-BASED PLANNING Frequently Asked Questions

Q: What is RapidPlan?

A: RapidPlan™ knowledge-based planning is a comprehensive treatment planning tool that provides clinicians with models that are representative of clinical practice in leading institutions. These models can be used as a baseline for developing plans for intensity-modulated radiotherapy (IMRT) and volumetric modulated arc therapy (VMAT).

Q: Is RapidPlan a set of templates in Eclipse?

A: No. RapidPlan is not a set of templates in the Eclipse™ treatment planning system. RapidPlan takes into account each patient's anatomy and planning goals, adjusts the estimated dose volume histogram (DVH) and provides the optimization objectives based on each individual patient's criteria.

Q: Is RapidPlan a standalone Varian product?

A: No. RapidPlan will be provided as an integrated option in Eclipse.

Q. Are any models provided?

A: Yes. RapidPlan will contain sample models for a few anatomical sites.

Q: How many patient plans are recommended for a particular model?

A: The minimum number of plans required for model creation is 20; however, adding additional plans may help create a more robust model. Models created for certain anatomical regions, such as head and neck, may require more than the minimum number of plans. In addition, any structure that you will want to calculate a DVH estimate for will require a minimum number of 20 plans containing this structure. For example, for a head and neck model to support the calculation of the estimate of the larynx at least 20 plans are required that contain an optimized and calculated larynx volume.

Q: What methodology is used for training the models?

A: RapidPlan's proprietary algorithm is largely inspired by the methodology described in the paper, "Quantitative Analysis of the Factors Which Affect the Interpatient Organ-at-Risk Dose Sparing Variation in IMRT Plans" published in *Med Phys.* by Yuan et al from Duke University Medical Center, Durham, North Carolina.¹

The RapidPlan algorithm is based on the principles of parameterization of the structure set and dose matrices for the plans in the training set. The parameterization identifies the acceptable clinical trade-offs, including the acceptable trade-offs for target coverage and dose to the organs at risk (OARs). The parameterization analyzes the calculated DVH, the distance-to-target histogram (DTH), which is the relative geometrical relationship between the OAR and planning target volume (PTV), and the following anatomical features: relative overlap volume, relative out-of-field volume, absolute OAR volume, and absolute target volume.

In order to support simultaneous infield boost (SIB), RapidPlan utilizes a new proprietary metric and not the DTH metric as described by Yuan et al. Additionally, RapidPlan uses a different metric for handling the parts of OAR that are out of field. This approach allows for some aspects of beam geometry to be taken into account.



Q: If a model includes an inferior plan, is there a way for the algorithm to identify those plans and remove them?

A: When selecting the plans to use for model creation, it is important to select a subset of plans that represent your current clinical practice or what you strive to achieve in your clinical practice. The potential outliers will be flagged during the model training. RapidPlan offers tools to help analyze the outliers and provide recommendations on outlier correction to help determine if edits to the model are required.

Q: If we feel a plan accurately represents our clinic, how can we select this plan and add it to the knowledge database?

A: Plans can be added in the External Beam Planning function of Eclipse. An option has been added that allows the user to add a case to a RapidPlan model. Once the user selects this option, a dialogue box will display showing all of the configured models. You can tag a case and match the structures that you would like to create an estimate for to the structures that are in that model. The model automatically extracts the plan's data once you tag it, and the plan is accessible for you to review and decide if the plan should be included or excluded in the model.

Q: In addition to the total dose, do the optimization objectives transfer as well?

A: No. The optimization objectives do not transfer. The algorithm analyzes the DVH and what you have included as acceptable and approved doses from the treatment plans used to train your model, not the individual objective.

Q: Are the priorities fixed from each model or do they change depending on the patient-specific structure geometry?

A: The priority is user configurable per model. The priority can be manually defined by the user or calculated based off of the OAR estimate and target prescription.

Q: Can you use plans from other planning systems to generate the models required for RapidPlan?

A: Yes. The data that is required for model creation includes the DICOM imported plan with beam geometry, the calculated dose, and the structure set on which you want to create objectives.

Q: Can Eclipse calculate dose from other systems to help create RapidPlan models?

A: Eclipse has the capability to import dose from most treatment planning systems, therefore recalculating plans is not required. The data that is required for model creation includes the DICOM imported plan with beam geometry, the calculated dose, and the structure set on which you want to create objectives.

Q: How does the RapidPlan algorithm convert the estimated DVH to discrete planning objectives, and does the model include the weighting or priorities for those objectives?

A: The RapidPlan target objectives are set based on prescription and your user-definable coverage of the target. The OARs can be calculated based off of the estimation (this includes the priority), a percentage of the prescription, a fixed dose, a fixed volume, a fixed priority, and/or combinations of all of the above.

Q: Who defines the dose objectives? Can you adjust the objectives?

A: The option to include the starting optimization objectives and how the objectives are created is user definable per model. This includes the sample models that will be provided with RapidPlan. The planner still has the capability to manually add, edit, or delete objectives before and during the optimization process.



Q: What type of planning techniques does RapidPlan support?

A: RapidPlan may be used with any inverse planning technique, VMAT (RapidArc® radiotherapy technology) and/or IMRT.

Q: Can you use the same model for IMRT and VMAT?

A: Yes. The creation and validation of new models should include a subset of plans that represent your clinical practice. This includes, but is not limited to, the treatment technique you are planning to use.

Q: Does RapidPlan take ICRU 50 and 62 into account when creating the DVH?

A: Yes. The estimate is based on the knowledge included in the plans used to train the model which includes the approved calculated dose. The approved calculated dose would represent whether the plans were generated, reviewed, and approved based on clinically accepted planning objectives (e.g., ICRU 50, RTOG, etc.).

Q: Can models be developed and shared?

A: Yes. Within the configuration workspace, there will be import and export functionality. You may share your models with other sites, similar to sharing your clinical protocols using email or a file transfer service. There are no Varian restrictions on the number of models that may be created or shared with other users.

Q: How useful is RapidPlan for plans that contain multiple PTVs that vary in size, shape and location such as bilateral nodes in head and neck cases?

A: The RapidPlan estimates are based on the knowledge included in the plans that were used to train the model. It is important that the subset of plans used to train and validate the models represents your current clinical practice. A general model that supports multiple different PTVs and OARs will require a larger training set than a model supporting a single target or PTV.

Q: Can you use RapidPlan to compare different treatment techniques?

A: Yes. The user can use the DVH estimation tools to compare the results of an IMRT and VMAT plan based on an IMRT created model (model trained strictly with IMRT plans) and VMAT created model (model trained strictly with VMAT plans).

Q: Can RapidPlan be used for dynamic adaptive radiotherapy (DART)?

A: Yes. You can use RapidPlan to create an estimated DVH on the revised image set (e.g., new planning CT, CBCT). This allows you to compare the new estimated DVH with the DVH from the original plan to help with determining if the patient should be replanned.

Q: How does RapidPlan account for lung heterogeneity?

A: The creation and validation of new models should include a subset of plans that represent your clinical practice. The lung training set should be based on the lung heterogeneities you strive to achieve in your clinical practice, and should be validated with the parameters you plan on using for your lung cases, including but not limited to field geometry and calculation algorithm.

Q: Are overlapping structures an issue with RapidPlan?

A: No. Overlap is a parameter considered during parameterization. It is taken into account during the model training and when analyzing the actual case for estimation.

Q: Can the planned DVH be better than the estimated DVH?

A: Yes. The estimate is based on the knowledge included in the plans used to train the model. Based off of the data included in the plans used for your model, you may create a plan with a DVH that is better than the estimated DVH. If the planned DVH is better than the estimated DVH, this points to the data included in plans that were used in training your model and indicates that this particular type of plan was not included in the model training set. The new plan may be added to the existing model and used to retrain the model. This promotes a process of gradually improving on the consistency and quality of the plans estimated by the model.

Q: Can RapidPlan be used for cranial stereotactic radiosurgery (SRS) or extracranial stereotactic body radiation therapy (SBRT)?

A: Yes. RapidPlan is not restricted to a particular anatomical site. The creation and validation of new models should include a subset of plans that represent your clinical practice. This includes, but is not limited to, the non-coplanar beam geometries you would use in your clinical plans.

These FAQs are a helpful guide. Please consult the official Instructions for Use, user manuals and MyVarian for additional product information.

¹Med Phys. 2012 Nov; 39(11):6868-78. doi: 10.1118/1.4757927.



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Not all features or products are available in all markets.

[Intended Use Summary](#)

RapidPlan knowledge-based planning and its models are not intended to replace clinical decisions, provide medical advice or endorse any particular radiation plan or treatment procedure. The patient's medical professionals are solely responsible for and must rely on their professional clinical judgment when deciding how to plan and provide radiation therapy.

[Safety](#)

Radiation treatments may cause side effects, which, in some cases, may be serious. Severity can vary depending on the part of the body being treated. Side effects are related to the type of treatments delivered and should be discussed between the clinician and the patient.

[Medical Advice Disclaimer](#)

Varian as a medical device manufacturer cannot and does not recommend specific planning providers. Planning results will vary and individual hospitals may not achieve the gains of a specialized planning provider.

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