Streamlining a Complex Proton Treatment Technique for a Bilateral Head and Neck Webinar (3-10-2022)

# Presenters

Presented by Legion Healthcare Partners in partnership with Varian

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# Overview

As the presenter rudely pointed out during Q&A, the presentation was not about the treatment technique itself; it just used it as a case study of various Eclipse features for streamlining treatment planning, even for complex treatment techniques.

# Treatment Technique

In both the U.S. and Europe, H&N is the core indication for proton, and H&n accounts for most proton treatments across Europe. The number of papers on H&N proton treatment has increased exponentially over the last 15 years, and many studies show significant OAR dose reduction due to the sharp penumbra. This is especially important due to close proximity OARs in H&N cases. Another benefit to protons for H&N is complete sparing of the contralateral side of the brain. Of course, proton treatments are longer, making motion management more important. But H&N typically involves little motion, and motion is easily controlled using masks.

Two popular proton treatment techniques for H&N use three fields and two PTV sub-volumes, and six fields and six PTV sub-volumes, respectively. Longer follow-up is necessary to determine the long-term advantages of more complex proton treatments, but they obviously afford lower medial and integral OAR dose, plus better robustness. Downsides of complex techniques are, of course, longer planning and treatment times, perception of error proneness, lack of planner experience, lack of tools, and limited knowledge of those tools.

With the following workflow, the entire plan took around 30 minutes, and that’s *with* the presenter’s explanations.

# Streamlining Using Templates

Naming conventions are emphasized because are important for automation, including the features covered in this presentation. But the conventions the presenter uses are not TG-263 compliant!

All templates must be created in advance.

## Structure Templates

Three structure templates are relevant:

* Targets. This is mainly for naming convention, which is important
* OARs. You must choose the OARs in the template that are relevant to the individual patient.
* Planning structures. The main ones are PTV sub-volumes, but rings and other structures can also be included.

## Support Structure Templates

To use a support structure model to segment the PTV into sub-volumes:

* Apply the support structure model by choosing the junctions of the structures in the model. The model for this example consists of four regions: upper, lower, left, and right.
* Use Boolean operations to create the PTV sub-volume geometries. For example, the left PTV sub-volume is the intersection of the PTV and the left support structure. The VOI tool limits a Boolean operation to certain slices. For instance, you can create the upper hybrid PTV on only the slices above a certain junction. This allows the upper PTV to be treated with all four left and right beams, not just the left or just the right beams.
* Delete the support structures as their higher HU can cause problems in the calculation.

## Plan Templates

Just customize some settings, including prescription, targets and range shifters for each beam, multi-field optimization, and calculation models. The plan does not need multiple isos.

## Clinical Goals Templates

Oh, cool Eclipse has built-in functionality to copy clinical goals to other plans. In RayStation, we must do this by script.

Oh that’s nice. Eclipse can show up to three clinical goals for the same structure, in the same row of the clinical goals table. RayStation always puts each goal on its own line.

## Objectives Templates

These are obviously just starting points that should be tailored to the individual patient. Tighten objectives if clinical goals are not being met, or relax them for better target coverage.

## Optimization and Evaluation

With some tedious things already taken care of, all that’s left is plan optimization and dose calculation.

Use robust optimization instead of PRVs. Set plan and field uncertainty parameters: iso shift and calibration curve error generated in the Z direction due to overlap of the upper and lower PTV sub-volumes. Uncheck the structures (mainly OARs) that robust optimization does not apply to—i.e., structures that have no objectives.

Clinical goals and DVH update throughout optimization.

An Eclipse feature that RayStation lacks is confidence bands around the DVH lines.

After optimization, compute dose using **Convert Input Data to DICOM**. You can also normalize dose.

A useful trick for visual plan evaluation is setting the lowest level of the isodose colorwash to the prescription percentage. The colored area should then approximate the target.

# Other Streamlining Techniques

A Clinical Protocol combines any number of the templates discussed. You can create this or any type of template from an existing plan. Templates are managed from the Template Manager.

The AI-RAD Companion provides OAR auto-segmentation.

Example uses of ESAPI scripting for the H&N proton example include creating planning structures, defining the slice number that separates the upper and lower PTV sub-volumes, and applying parameters to plan templates.

RapidPlan templates are based on patient anatomy, not just simple values.

# Q&A

**Q:** Did you add primal/distal margins for each beam?

**A:** Instead of using field-specific targets, I used the PTV as a base for the planning structures. The streamlined setup would be a little more complicated for field-specific PTVs.

**Q:** Did you account for LET in the overlapping fields in the midline area?

**A:** No, but that could be relevant.

**Q:** Are RapidPlan models available, or must each clinic create them?

**A:** To the presenter’s knowledge, Varian does provide some models for photon H&N, but in general, RapidPlan models are by nature clinic specific.

**Q:** Can you show CTV robustness?

**A:** The plan could just as easily have been done with CTVs instead of PTVs. A future webinar will discuss robust plan evaluation.

**Q:** Does this webinar offer CE credits?

**A:** No, they did not apply for CE credit for this webinar, but Varian does offer many CE-eligible webinars. A motion management webinar will provide MDCB CE credits.

**Q:** Did you auto-set snout positions?

**A:** No, but if you’d rather skip the air gap measurements, you can create a template plan that includes the furthest possible collision-free snout positions for the average patient.