VMAT vs. DCAT for SBRT Lung Planning Webinar (8-21-2020)

# Presenter

Angel Martinez, Elekta TPS Applications Support

# Webinar Overview

The presenter first discussed Elekta offerings for SBRT in general, then discussed the merits of VMAT versus DCAT for SBRT lung planning. He ended with a demo of a DCAT plan in Monaco. The webinar largely focused on Monaco, but a lot of the information is still generalizable to other TPSs.

# Elekta Solutions for SBRT

The Versa HD can deliver simple to complex plans. It is very well integrated with Monaco, which includes Monte Carlo for both photons and electrons. Intellibeam uses smart sequencing to deliver up to six times more modulation than traditional plans. This means fewer arcs and rotations and thus shorter treatment times, maximizing patient comfort and minimizing likelihood of patient movement.

Although this doesn’t directly apply to SBRT, Versa provides a virtual leaf width of just 1 mm, which allows for more accurate MLC shapes. This comes in handy for intracranial targets.

Monaco features Class Solutions, which I gather are similar to Protocols in RayStation. Monaco comes with some of these, such as RTOG 0813.

Versa features Agility 160-leaf MLCs with 5 mm VLC and low leakage. They are ready for use when Versa is installed and come with jaw tracking, which means that the jaws are not marked at one position for the entire treatment time.

# VMAT vs. DCAT

VMAT and DCAT are different techniques that yield similar results. The most common beam setup is partial arc(s) facing the side with the lesion.

Most TPSs allow up to 180 equidistant control points, typically 2 or 4 cm apart. The limitations of fixed control points are a uniform target margin, lower modulation, and lower conformality. Monaco’s Segment Shape Optimization (SSO) provides variable control point size, which allows for better OAR sparing, more control of the dose gradient (e.g., spaces without control points receive lower dose), and fewer arcs for more efficient delivery. Even with Versa, variable control points are unique to Monaco.

Monaco’s jaw dropping also allows for more conformality and smaller fields.

Both VMAT and DCAT provide good dose gradient control, coverage, and OAR sparing.

VMAT is best for “extremely conformal dose distributions for complex target volumes.” MLC interplay can be a problem in SBRT since there are fewer fractions for MLC positions to “average out” over. More MUs would appear to increase treatment time, but this is not usually the case if you have FFF. However, VMAT can be slower because it uses more arcs. VMAT works well for complex lesions close to OARs.

(Optimized) DCAT (dynamic conformal arc therapy) is “similar to VMAT, but w/o segments dissecting the target”; this means less MLC interplay. Only Monaco + Versa provides optimization for DCAT. DCAT is useful for simpler/spherical lesions farther from OARs. It uses fewer MUs and fewer arcs than VMAT does, so treatment time is theoretically shorter. Because segments are larger, MLCs don’t “cross over” the target.

# Viewer Questions

**Q:** Does MLC width make a difference in conformality when using Monaco + Versa?

**A:** It shouldn’t, since jaw dropping can create fluence maps much smaller than the MLC width (e.g., 5 mm).

**Q:** How is MCO utilized in VMAT and DCAT planning?

**A:** You can create multiple criteria in your personalized templates (as we do with Clinical Goal templates in RayStation). Play around with constraints on “rings” around the target to try to squeeze the dose without compromising coverage?

**Q:** What is the uncertainty in Monte Carlo dose calcs?:

**A:** Monte Carlo has no uncertainty.

**Q:** Is DCAT ever used for breast?

**A:** Not really. Breast plans usually require more modulation than DCAT provides because the tumor is shaped differently, the lungs must be avoided as much as possible, and there are often nodes. DCAT works for SBRT because all the latter needs is a well-controlled dose gradient for OARs such as the liver and lung.

**Q:** When should I use a conformality cost function?When to use conformality cost func?

**A:** Conformality cost functions work well for single targets, such as a lung or prostate. Conform to a 4- or 8-cm ring around the target. Comnformality cost functions aren’t really used for SBRT, but an 8-cm ring can be useful for SRS.

**Q:** In Monaco, what is the difference between a control point and a segment?

**A:** A segment is defined by two control points: a start and an end.

**Q:** Can I control/limit MUs in VMAT/DCAT in Monaco?

**A:** You can’t put a cap on the number of MUs, but you can use sequencing parameters to help decrease the MUs. For example, try a minimum segment width of 1.5.

**Q:** Does optimization depend on the order in which the constraints are listed in Monaco?

**A:** No.

**Q:** What sequencing parameters should I use for SBRT?

**A:** That depends. For DCAT, you should use a variable dose rate and SSO. For VMAT, start with segments at 1 cm/min and proceed from there.

A viewer mentioned his success w/ treating cylindrical fields (e.g., rectal boost) w/ DCAT instead of 4fld 3D.