Why we chose Delta⁴ for the validation of Elekta VMAT

”The cylindrical geometry and detector arrangement of the Delta⁴ system provide us with the high resolution volumetric dosimetry we feel is essential for VMAT QA, and takes us a step further than would be possible with a single planar QA device. The system can be set up and operated efficiently as part of a routine VMAT QA program, and the software is an excellent comprehensive tool for data analysis.”

Martha M. Matuszak, Ph. D.
William Beaumont Hospital
Royal Oak, Michigan, USA

”We decided to purchase the Delta⁴ device for its unique combination of a cylindrical phantom with integrated, stable detector arrays in two planes plus linac pulse monitoring, allowing fast imported plan comparisons. These features should provide us with a very versatile and efficient method for verification and analysis of a batch of complex radiotherapy treatment plans during a single pre-treatment measurement session on the treatment unit.”

Jim Warrington,
Head of Radiotherapy Physics,
The Royal Marsden Hospital,
Downs Road, Sutton, UK

ScandiDos

Front page image courtesy of Elekta AB.

ScandiDos AB
Uppsala Science Park,
SE-751 83 Uppsala, Sweden
Tel: +46 (0)18-472 30 30
Fax: +46 (0)18-10 74 02
E-mail: Info@ScandiDos.com

ScandiDos, Inc.
P.O. Box 6234
Ashland, VA 23005 USA
Tel: +1 804 550 3541
Fax: +1 804 550 5751
E-mail: Sales-US@ScandiDos.com

Web: www.ScandiDos.com

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Delta⁴®

Dosimetry for Elekta VMAT

Delta⁴ makes it easy to:

- Verify the dose delivery without compromises - in 3D
- Instantly analyze and approve plans
- Analyze the clinical significance of deviations
- Find the causes of deviations

ScandiDos

Dosimetry for Elekta VMAT

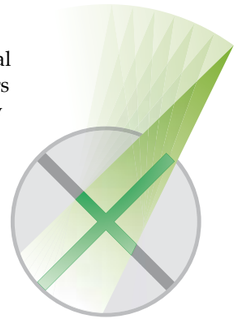
Verify the dose delivery without compromises in 3D

The Elekta VMAT treatment technique is a very sophisticated treatment technique wherein it is insufficient to make dose verification at only one point, profile, or in a single plane. Complete verification must be volumetric in 3D; including total coverage of the cross-section of the beam at all gantry angles. Instant analysis and approval requires integrated dose in fixed geometric points during the complete delivery. Thereby, the composite dose from all gantry angles is directly measured in each point.

Dose verification, especially in high gradient fields, requires real measurements with high spatial resolution in the region of interest, while dose reconstruction, calculated from measurements from outside of the region, can be used as complementary information.

Delta⁴ measures the dose with a dense grid of detectors, particularly in the region close to the isocenter. Two orthogonal detector planes with spacing as close as 5 mm between detectors in the central parts of the beam insures an accurate and directly measured dose in the region of interest.

Delta⁴'s unique volumetric dosimetry system is the only system that measures the 3D distribution in 360° gantry rotation and not simply one single plane.



Instantly analyze and approve plans

Delta⁴ is placed on the couch in order to measure in the same geometric points during the complete delivery. The complete delivery sequence is acquired with only one measurement and is immediately available for analysis. The measured dose is directly compared with the calculated data from the TPS.

With customizable acceptance criteria, you immediately see if the verification of the delivery has passed or failed.

Analyze the clinical significance of deviations

Pass and fail criteria must not be defined only by the portion of those measurement points with a gamma index exceeding 1. Rather, it must also take into account whether the deviating points are located within a critical structure. Delta⁴ uniquely uses the patient's structures when it compares the measured and the calculated phantom dose. Deviations for specific structures are shown both graphically and in DVH (Dose volume histograms).

Find the causes of deviations

When significant deviations are found, it is important to have the right tools to find the cause of the deviations in order to achieve the best result possible with a given treatment technique.

Delta⁴'s unique 4D dosimetry system measures each dose pulse individually with high accuracy. Simultaneously, the gantry angle is measured independently. The measured dose is then synchronized with the control points of the VMAT delivery, representing the dose that is delivered in a specific gantry angle. This allows you to analyze the dose delivery in arcs, in sub-arcs (groups of control points) or even per control point. If data is available from the TPS it is also possible to compare delivered dose per sub-arc with planned dose.

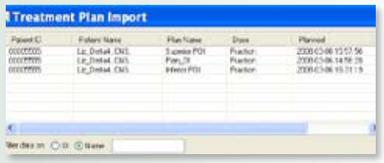
In BEV (Beams-Eye-View) the delivered dose during one control point can be compared with the expected position of each MLC leaf.

QA of Elekta VMAT...

...in less than 8 minutes

1 min

Import plan from TPS



DICOM RT Plan
Structure of the treatment

DICOM RT Dose
3D dose distribution per fraction

DICOM RT Dose
3D dose distribution per sub-ARC or control point

DICOM RT Structure
Outline of the patient structures, when refined analyis is required

5 min

Set-up and alignment

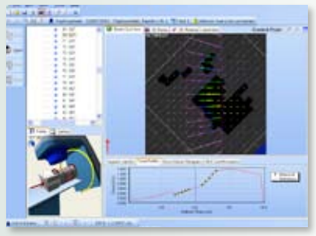
Delta⁴ Trolley eliminates heavy lifting

Leveling adjustments on Delta⁴ phantom for easy leveling.

Alignment lasers and couch motion for easy alignment

~2 min

Run complete treatment

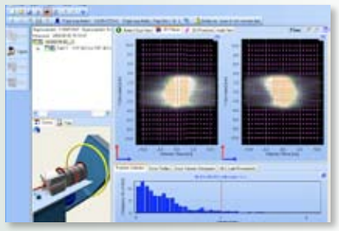


Independent beam angle reading for synchronization with the delivery sequence

Data automatically sorted as integrated dose per control point

instant

Pass or fail?



Pre set-up criteria for pass and fall using Dose deviation and/or Distance to agreement and/ or Gamma index

Green beam icon
Pass criteria is fulfilled

Red beam icon
Refine the analysis using the same measurement data; import additional TPS data if required