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
Dosimetry for TomoTherapy®

Verify the dose delivery without compromises in 3D

The TomoTherapy Hi-Art® treatment approach 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 beam angles. Instant analysis and approval require 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 or the reference point. Two orthogonal detector planes, with spacing as close as 5 mm between the detectors in the central parts of the beam, insures that the dose is measured accurately and directly in the region of interest. Delta4 measures the dose distribution directly in the sagittal and coronal planes. The data is uniquely acquired in one single measurement, which guarantees that the two planes are exactly matched geometrically.

Delta4 has an isotropic response, which is essential for TomoTherapy dose measurements. Delta4’s unique volumetric dosimetry system is the only system that measures 3D distribution in 360° gantry rotation and not simply one single flat or wrapped plane.

Process flow in Tomo Therapy QA

Import plan from TPS

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

Isocenter or reference point

Select the position most suitable for the location of the target volume or OAR
**Instantly analyze and approve plans**

Delta^4 is placed on the couch in order to measure the same geometric points throughout the 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.

Optionally you can export the simultaneously measured sagittal and coronal dose to the Hi-Art treatment planning system.

**Analyze the clinical significance of deviations**

Pass and fail criteria must not be defined only by the portion of those measured points with a gamma index exceeding 1. Rather it must also take into account whether the deviating points are located within a critical structure.

Delta^4 uniquely overlays the structures graphically with the measured dose distribution, thus showing if deviations are of clinical significance.

Delta^4 can synchronize the measurement and the beam rotation so that dose distributions can be analyzed per beamlet. If the 3D-DVH option is used, the dose distribution can be viewed in full 3D including dose per structure. The benefit is that the integrated data can be analyzed based on clinical relevance which is unique for Delta^4.

**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.

Delta^4’s unique 4D analysis tools include dose deviations, distance to agreement (DTA), Gamma index and the reproducibility of the delivery sequence. DTA and Gamma analysis is performed in 3D and even the whole dose distribution can be shifted in 3 dimensions.

The measurement can be divided into 3D dose per beamlet. This makes it possible to analyze the cause of discrepancy between the plan and the measurement in a unique way. It enhances the understanding of the functionality and the possibilities of the therapy system.
Why we chose Delta⁴ for the validation of TomoTherapy®

“With the current push to generate very precise dose distributions in all three spatial dimensions, the Delta4 system is an innovative device for addressing volumetric delivery quality assurance for highly conformal treatment modalities such as the TomoTherapy HiART. The geometry, dual orthogonal detector planes, and nature of the dosimeters enhance the applicability of the Delta4 system to special treatment techniques such as SBRT. The capability of measuring high dose per fraction treatments and verifying the radiation delivery from non-coplanar angles sets the system apart from single measurement plane devices.”

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