HexaMotion

6D Motion Management QA

Ensure Tumor Control in Moving Targets

Verify motion effects using real tumor motions
Determine which patients require motion management
Validate the complete delivery chain

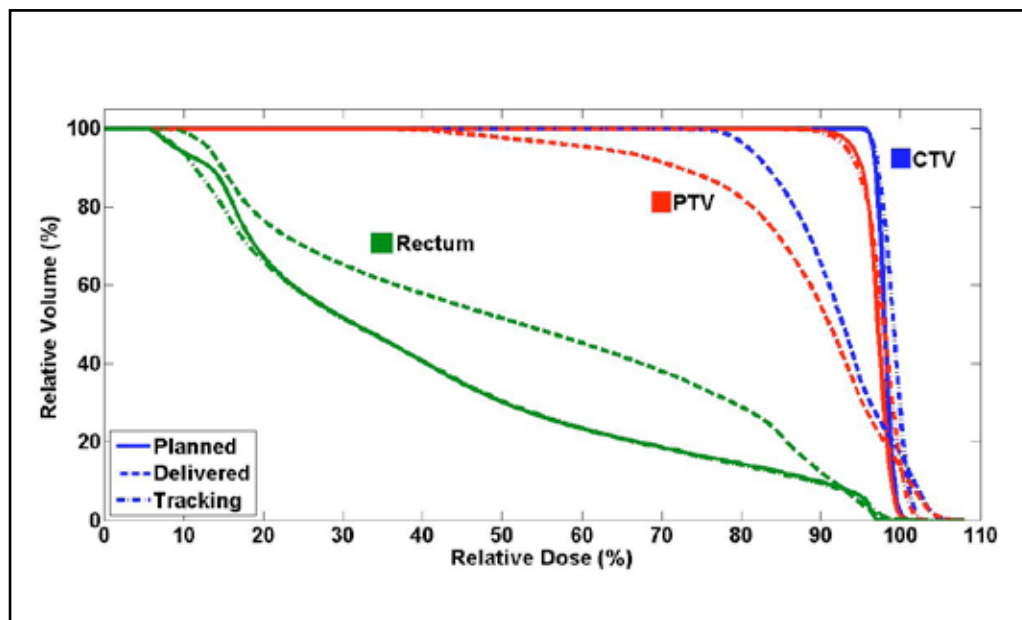Confidence based on real measurements

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Treat what you intend to treat

The tumor moves

Intra-fractional movements of the tumor can cause large geometrical errors. This is especially true for tumors in the lung and the liver, but it has been shown* that even the prostate, which is often regarded as stable, can move considerably during the treatment. If these geometrical errors are not handled correctly they can result in critical dosimetric errors.
This may result in that the tumor volume receives too little dose to achieve tumor control whilst organs at risk can receive too high dosage.

*http://www.nslhd.health.nsw.gov.au/AboutUs/media/Documents/World%20first%20prostate%20clinical%20trial%20FINAL%20281113.pdf
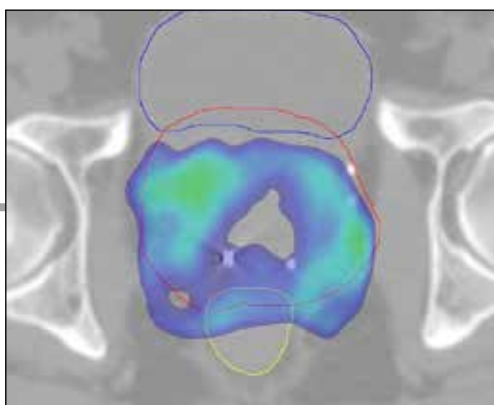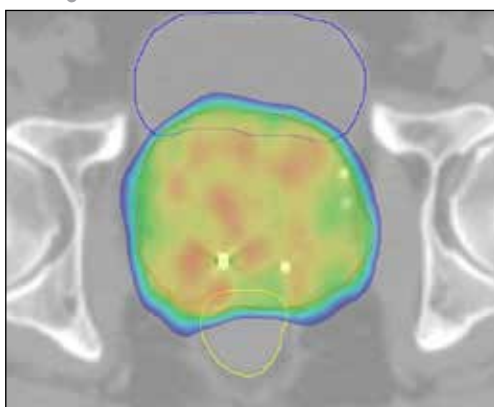

Specification

- Positioning accuracy: better than 0.5 mm
- Movement range:
  - X: +/- 40 mm
  - Y: +/- 40 mm
  - Z: +/- 40 mm
  - Roll: +/- 10° @ origin
  - Tillt: +3°/-6° @ origin
- A trolley provides easy and ergonomically handling of the system eliminating heavy lifts.
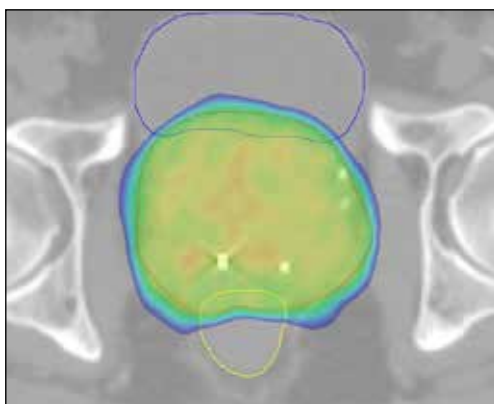
Planned

Delivered - no tracking

Delivered - with tracking

Use Real Tumor Motion

The Scandidos HexaMotion 6D motion platform accurately replicates the actual tumor motion. The QA is based on how the real tumor is moving. The motion patterns both for the tumor and the patient can be imported from your motion management system and the same movement cycle is then exactly executed with the Delta⁴ phantom. The phantom is positioned fast and within sub-millimeter accuracy.

Find when Motion Management is required

The HexaMotion 6D motion platform is used together with the Delta⁴ phantom to provide a full analysis of the dosimetric effect of tumor respiratory motion. The true delivery of the prescription dose can be studied in detail for each patient and critical structure, allowing the clinician to easily identify which patients or which groups of patients that require motion management.

Validate the complete delivery chain

The complete motion management QA process shall examine the entire delivery system, including accelerator., MLC control, the motion detection and the gating or tracking system. The HexaMotion system allows you to scrutinize:

• Monitor system start and stop
• Latencies in the delivery system
• Beam hold for anomalous conditions
• Beam hold if target exceeds threshold
• Correctness of the coordinate systems
• Baseline shifts
• End-to-end dosimetric effect

At the Northern Sydney Cancer Centre we are embarking on two novel adaptive radiotherapy trials to explicitly detect and correct target motion in real-time during prostate cancer VMAT. A programmable platform, such as the Hexamotion, that can reproduce measured target motion, is an integral component of our quality assurance program for these trials as we can measure the dose in the frame of the moving target under clinically realistic conditions.

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