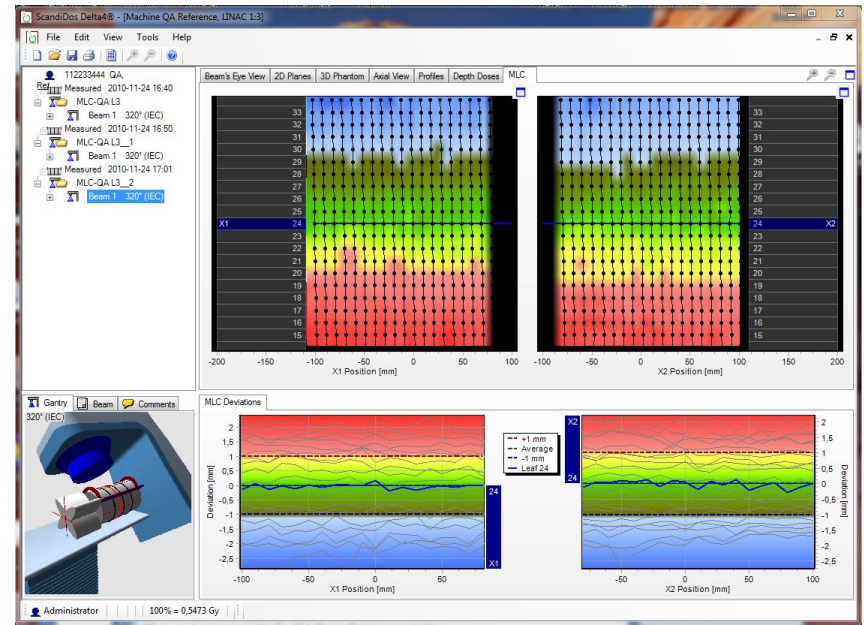
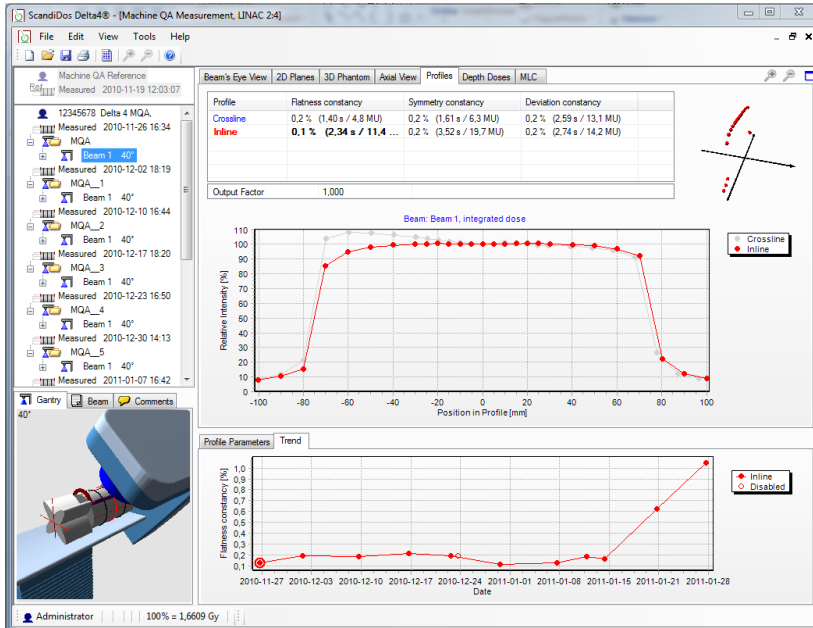


Delta^{4PT} Machine QA einschließlich Leaf Gap Bestimmung



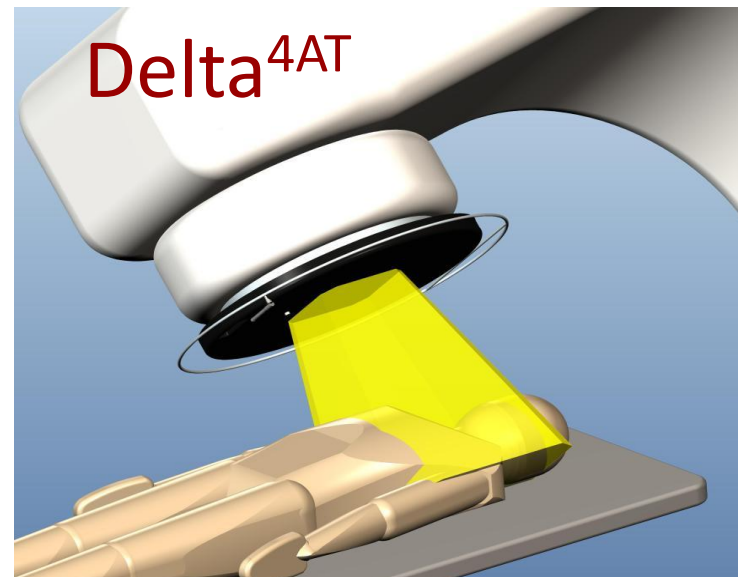
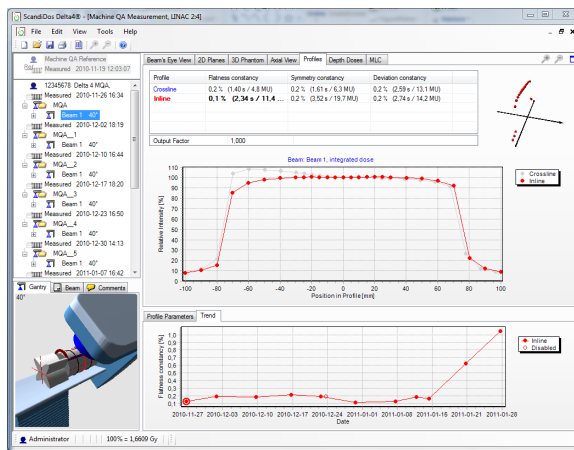
Thomas Matzen

Delta⁴ - Komplette Verifikation

Delta^{4PT}

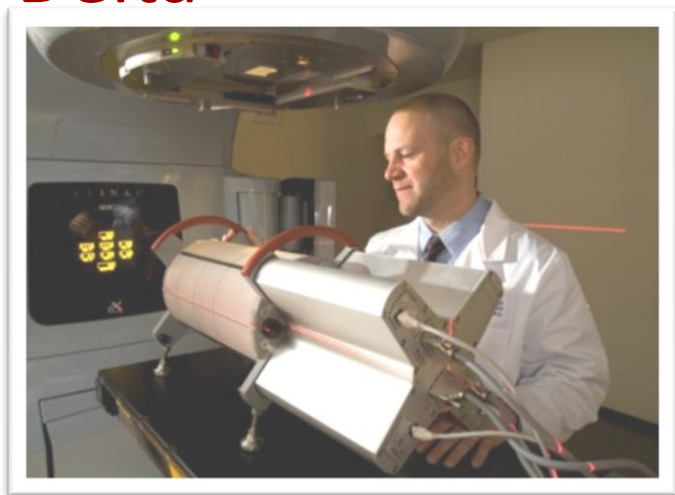


Delta^{4PT} Machine QA

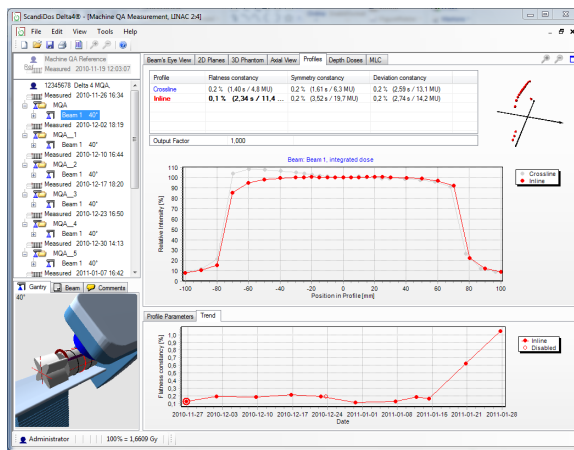
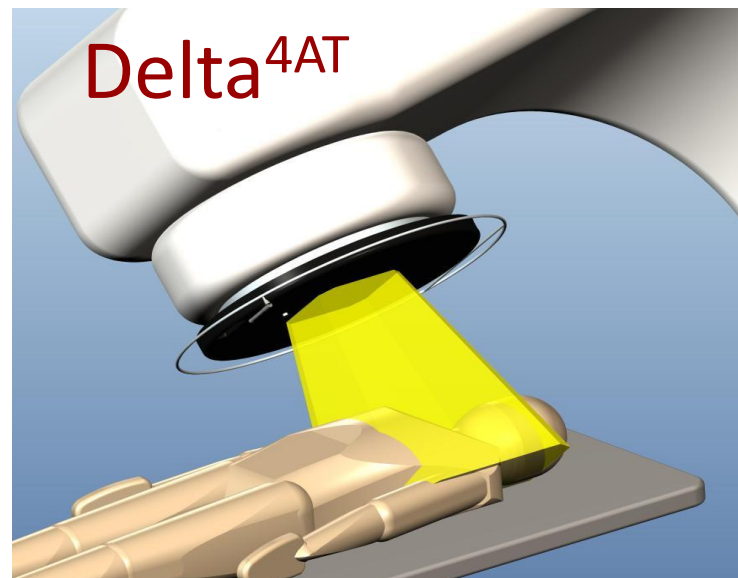


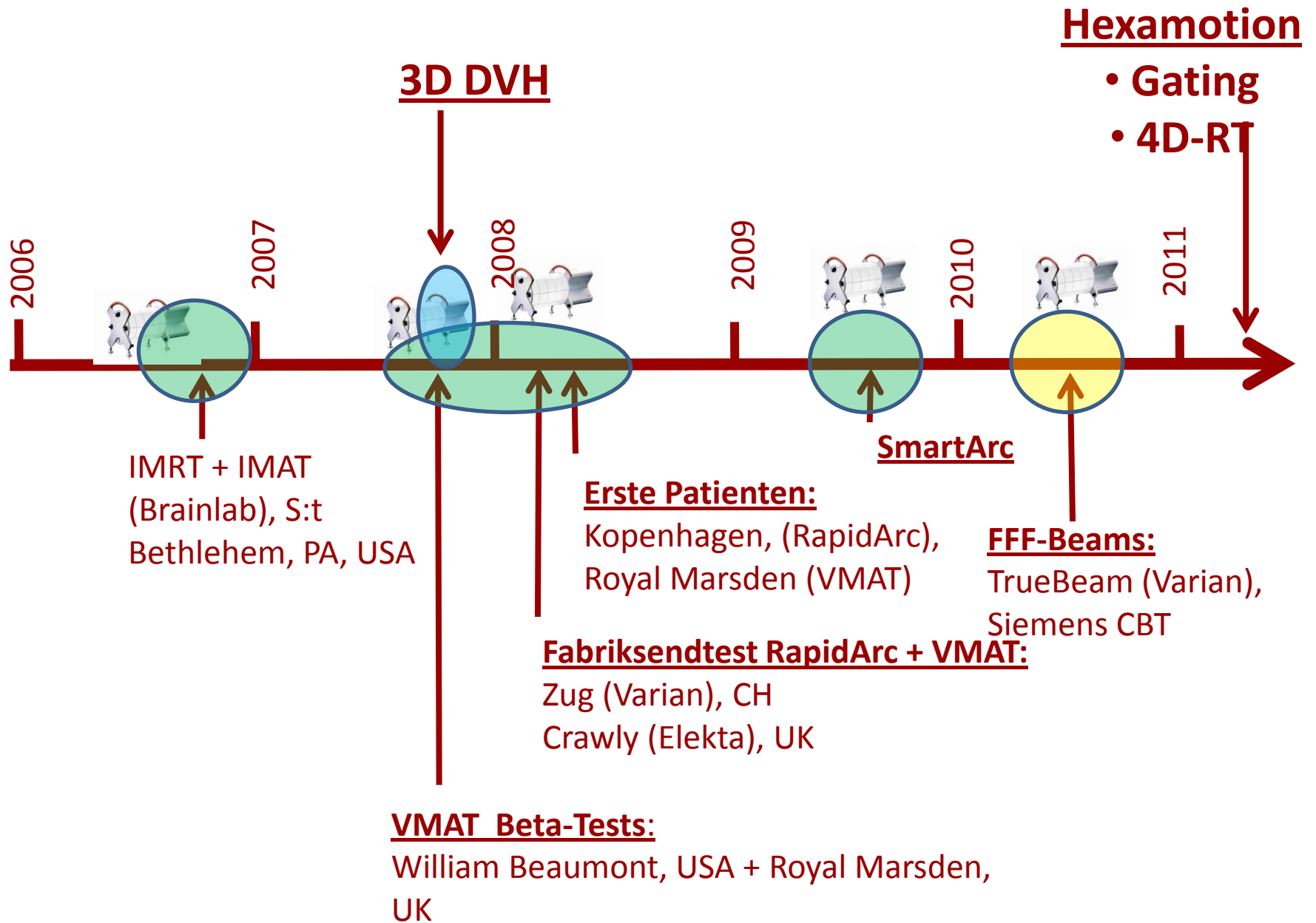
Delta⁴ - Komplette Verifikation

Delta^{4PT}



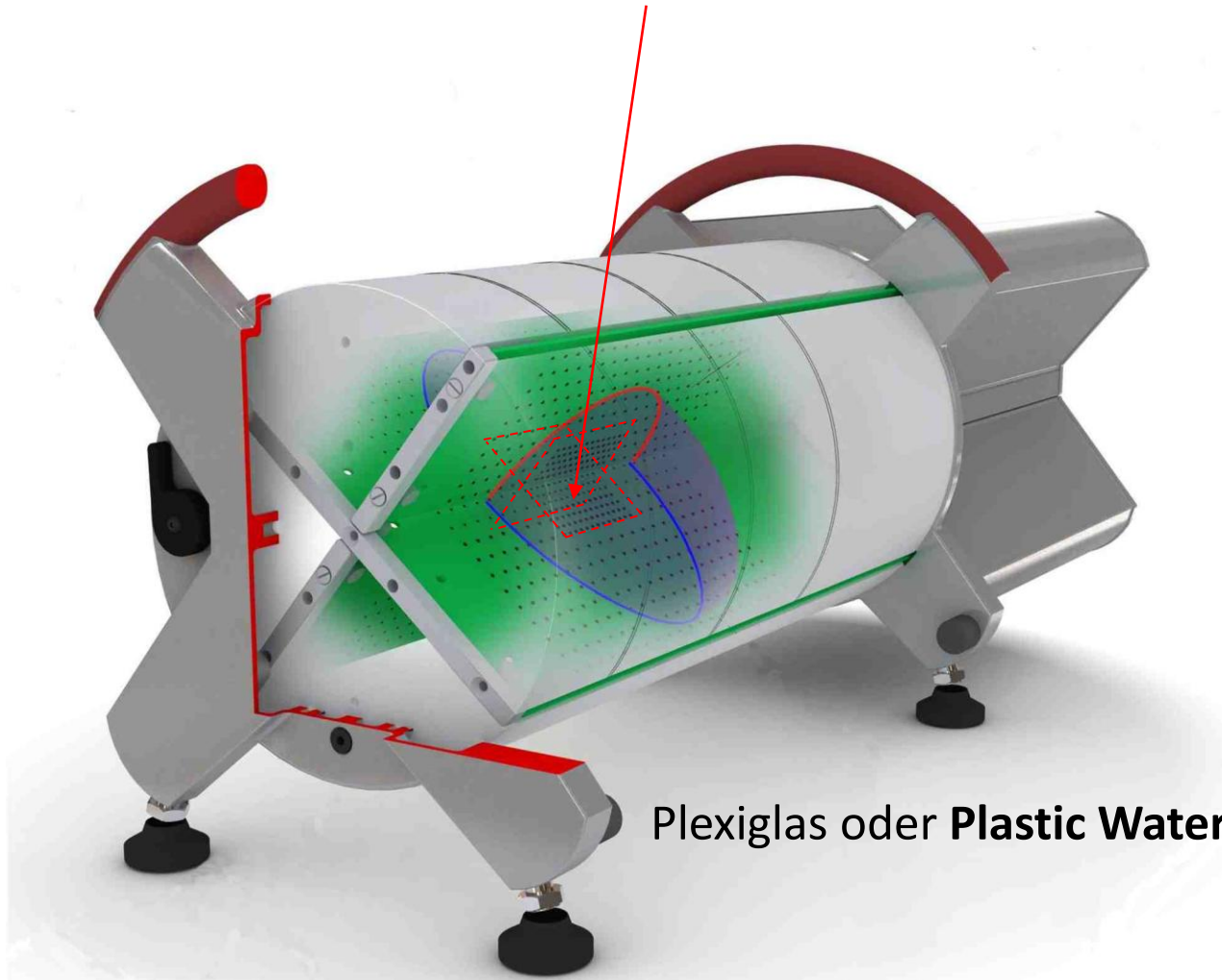
Delta^{4PT} Machine QA



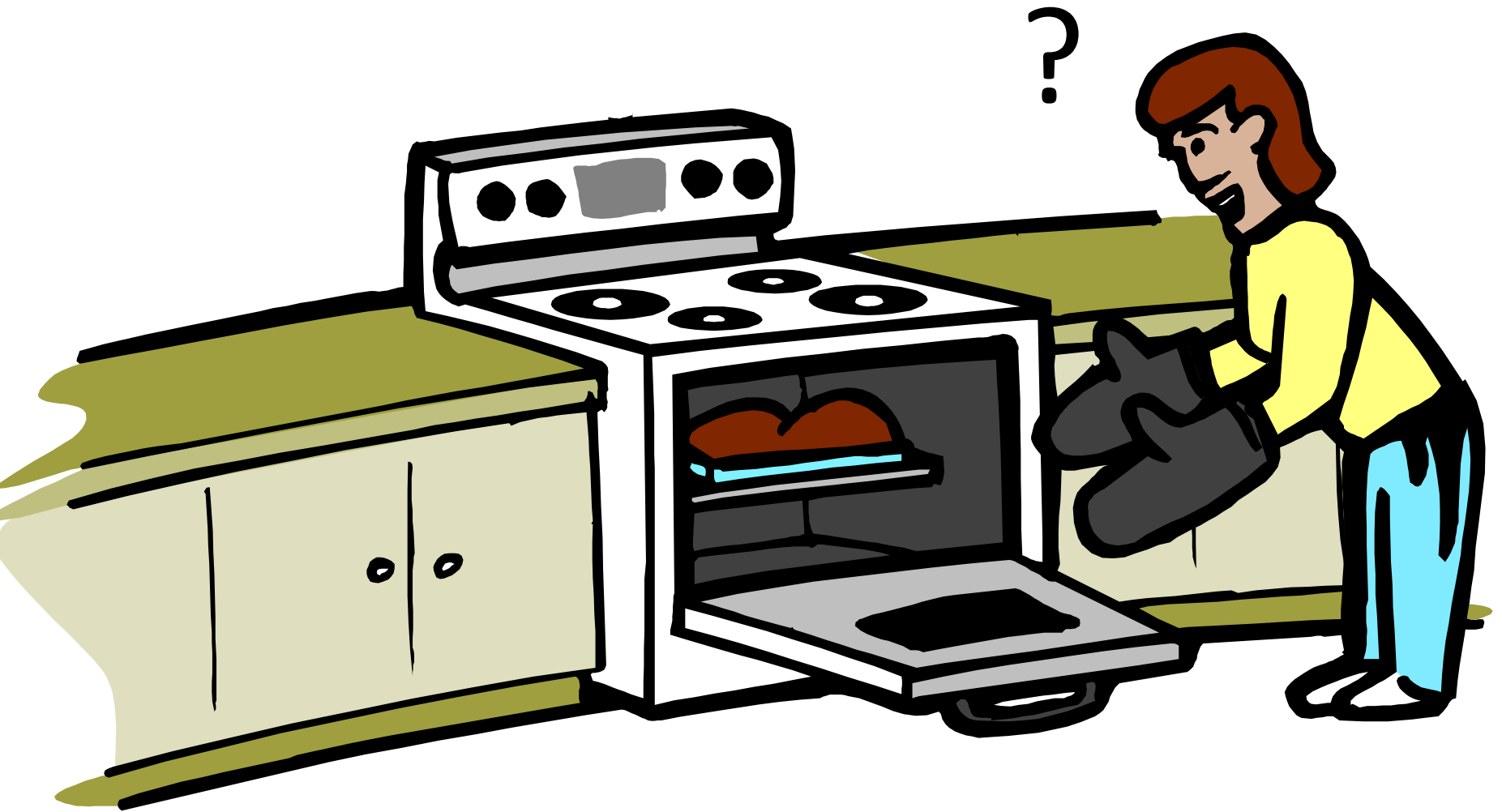


Delta^{4PT}

Zentralbereich: Ca. 300 Detektoren

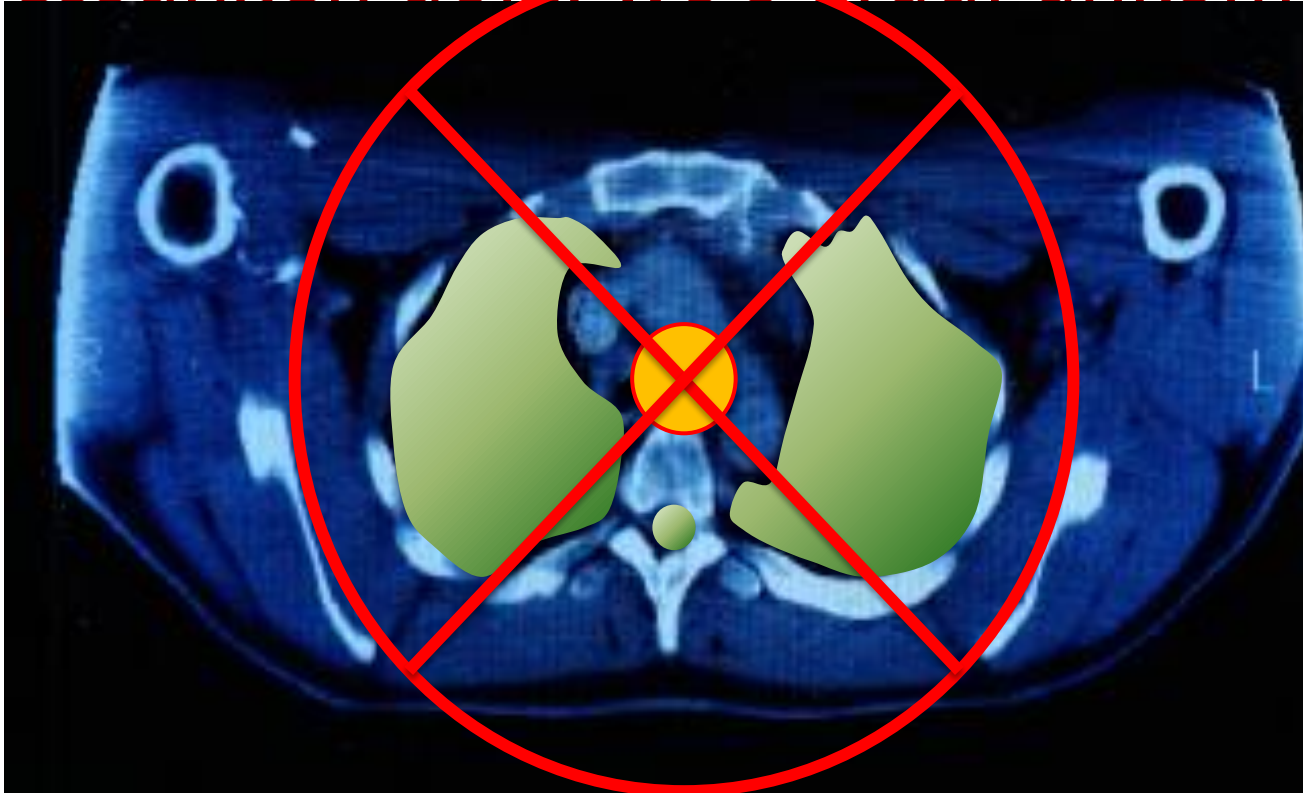


Plexiglas oder **Plastic Water**



Messung

- Messungen dort, wo's drauf ankommt

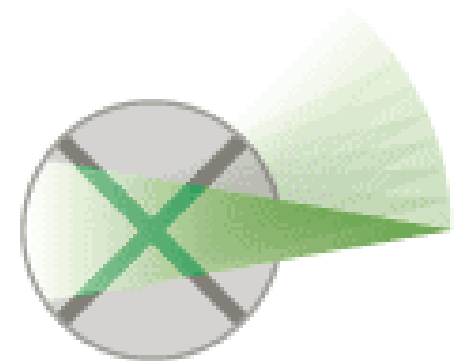


Messungen

dort, wo's drauf ankommt

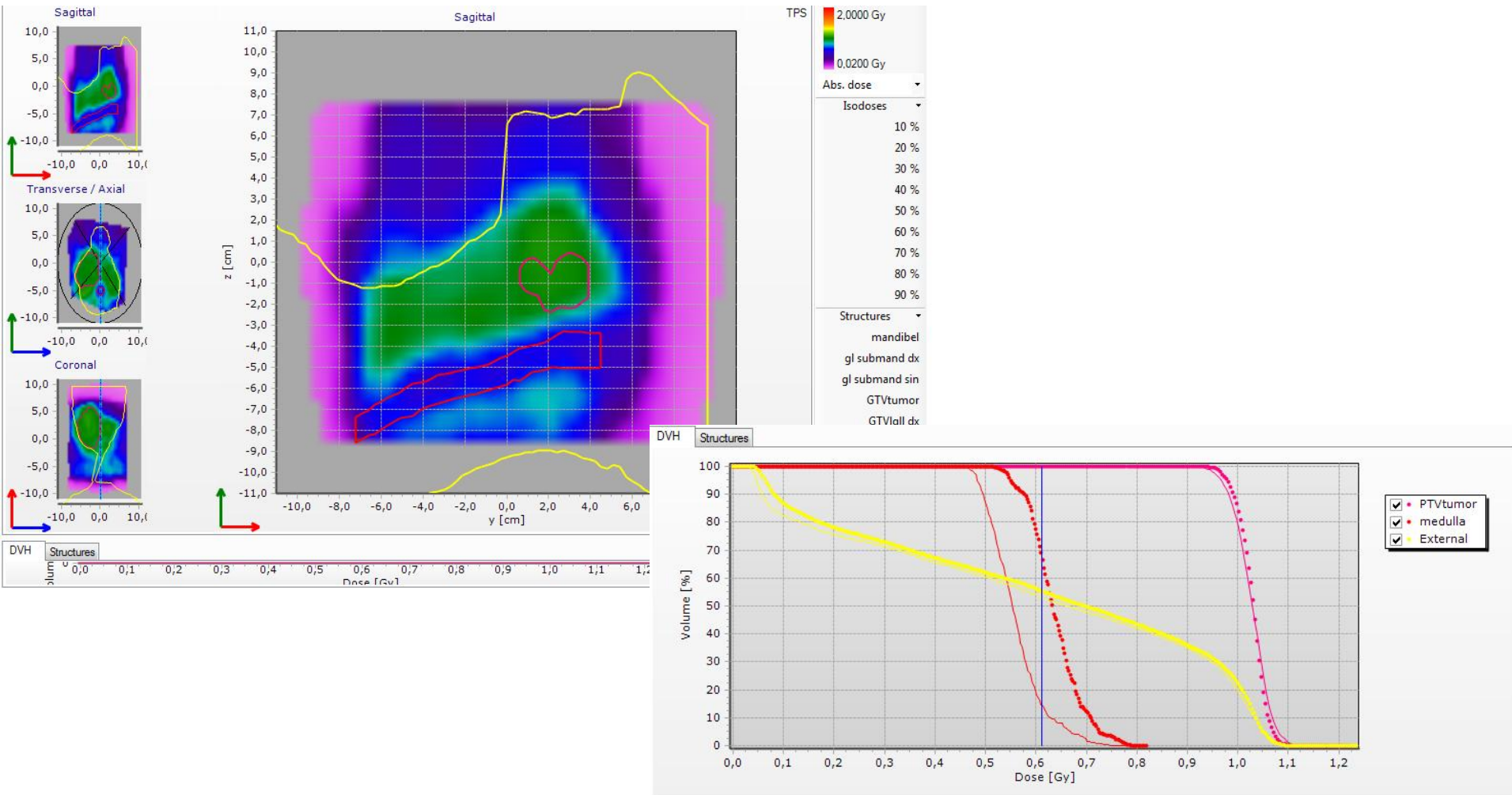
300 Detektoren* im
Zentralbereich:

- Dosis
- Homog
- Gradientenmessung in 3D



*Insgesamt: 1069

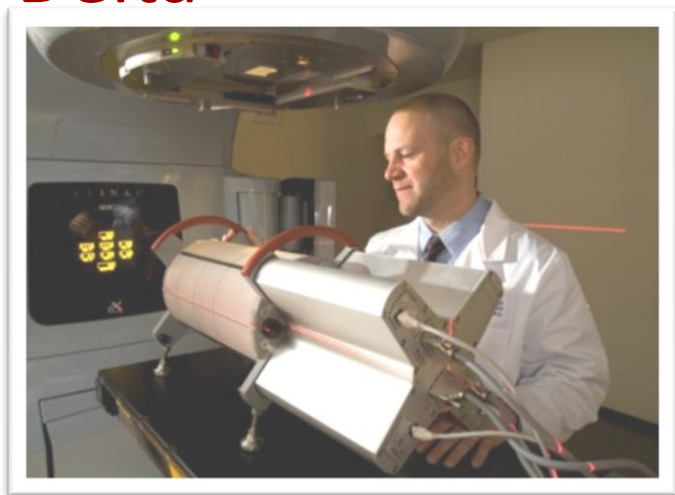
Klinische Relevanz – DVH seit 2007



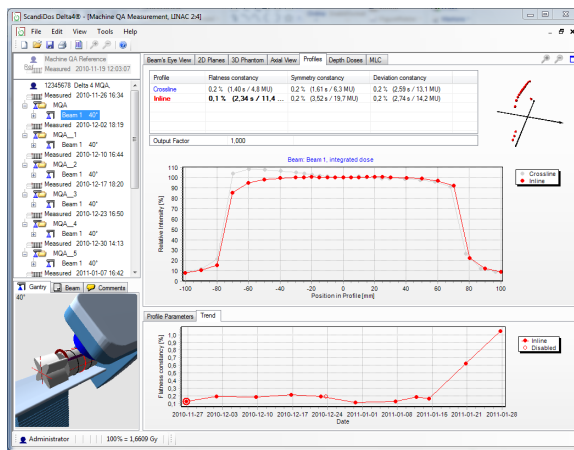


Delta⁴ - Komplette Verifikation

Delta^{4PT}

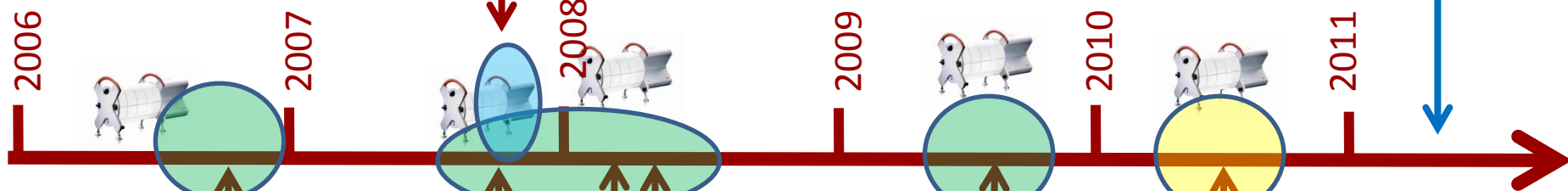


Delta^{4PT} Machine QA



3D DVH

Delta⁴AT



IMRT + IMAT
(Brainlab), S:t
Bethlehem, PA, USA

Erste Patienten:

Kopenhagen, (RapidArc),
Royal Marsden (VMAT)

Fabrikstest RapidArc + VMAT:

Zug (Varian), CH
Crawly (Elekta), UK

VMAT Beta-Tests:

William Beaumont, USA + Royal Marsden,
UK

SmartArc

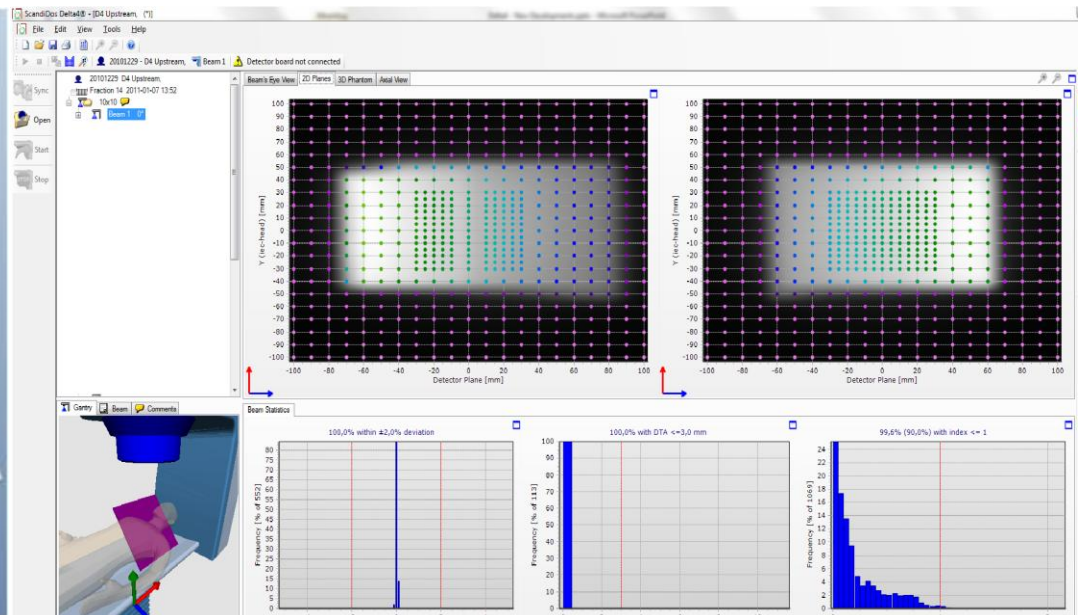
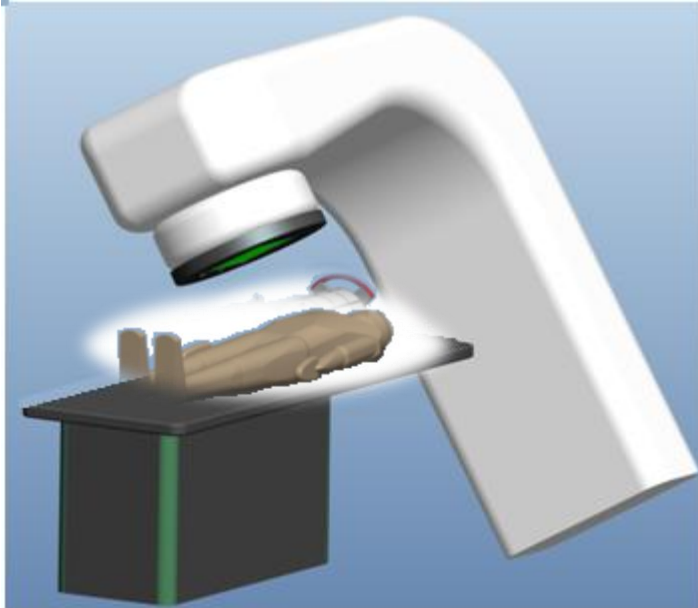
FFF-Beams:

TrueBeam (Varian),
Siemens CBT

Delta^{4AT}

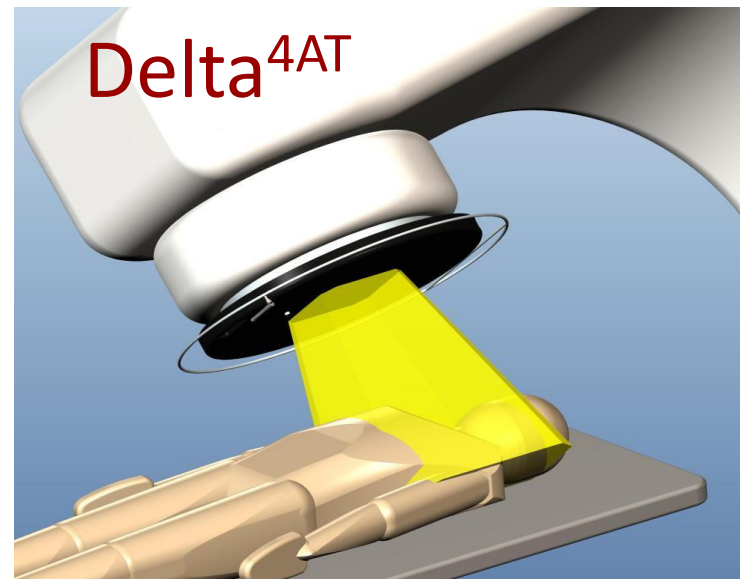
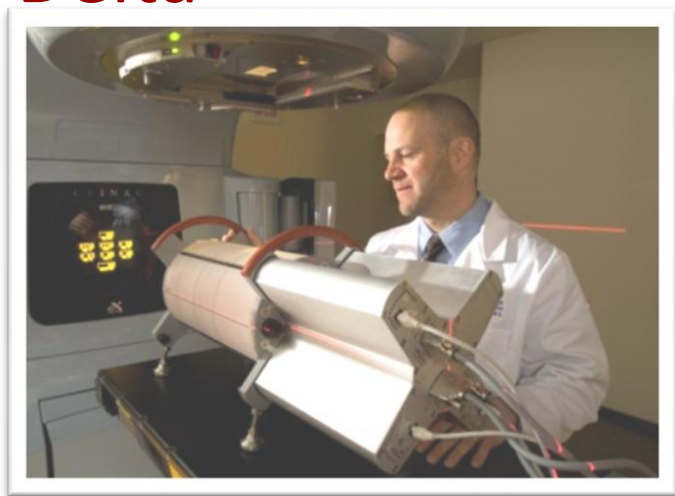
- Calibration of transmission-detector against Delta^{4PT}
- Patient dosimetry made completely in background
- Analysis as during Pre Treatment Verification

Treatment
Pre-treatment

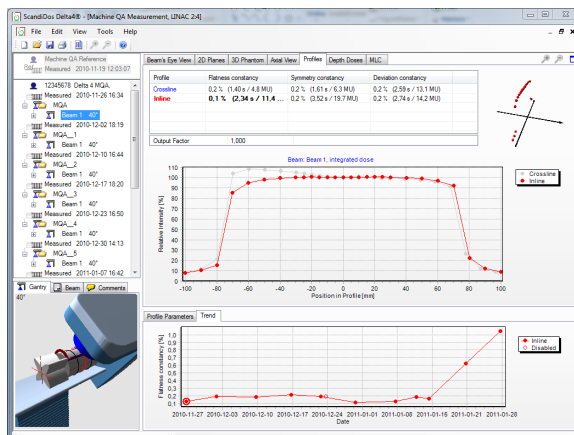


Delta⁴ - Komplette Verifikation

Delta^{4PT}

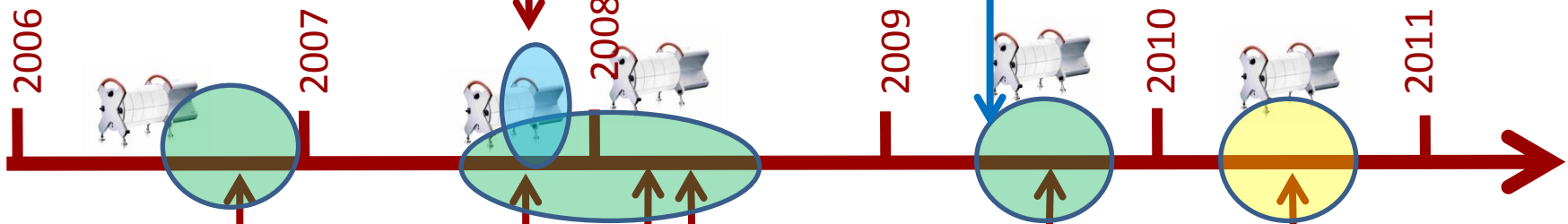


Delta^{4PT} Machine QA



3D DVH

Machine QA



IMRT + IMAT
(Brainlab), S:t
Bethlehem, PA, USA

Erste Patienten:

Kopenhagen, (RapidArc),
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Fabrikstest RapidArc + VMAT:

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UK

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TrueBeam (Varian),
Siemens CBT

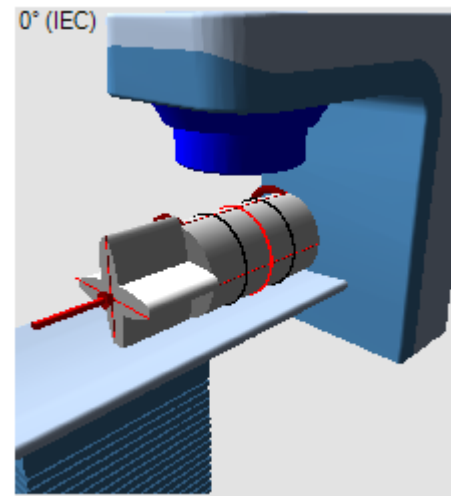
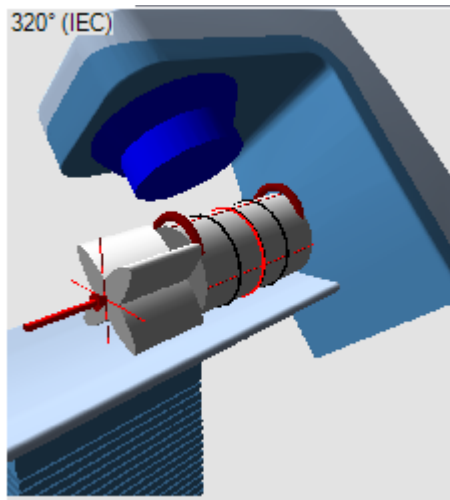
Delta⁴ Machine QA

- What is it?
- How does it work?

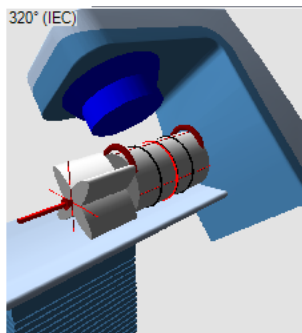


What is the Machine QA Option?

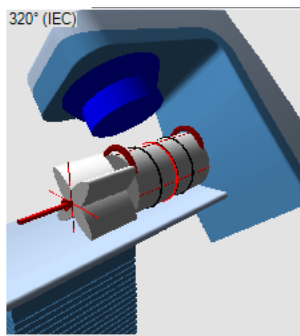
- **Beam constancy** at various gantry angles
- **MLC performance** at various gantry angles



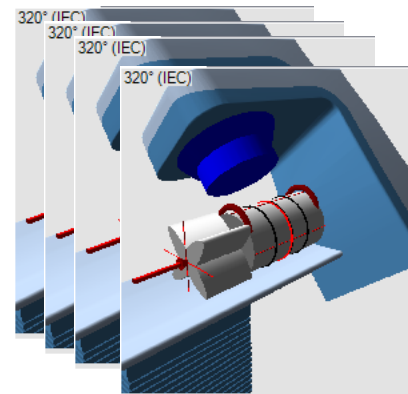
Beam constancy: How does it work?



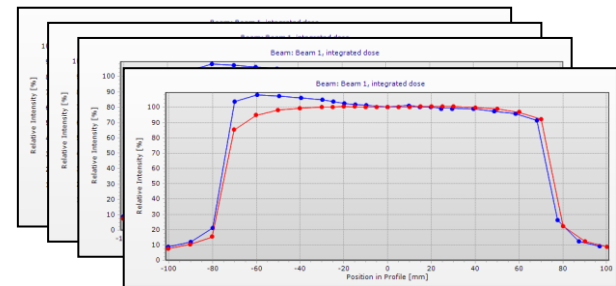
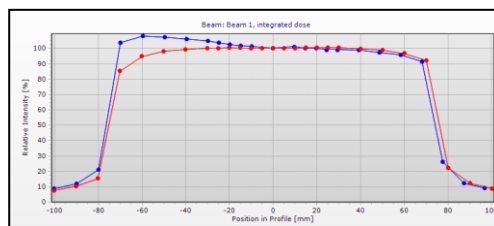
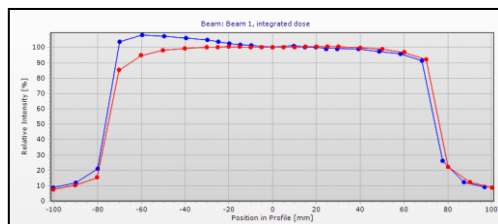
Day 1:
reference measurement



Day 2:
constancy check



Day n:
constancy check

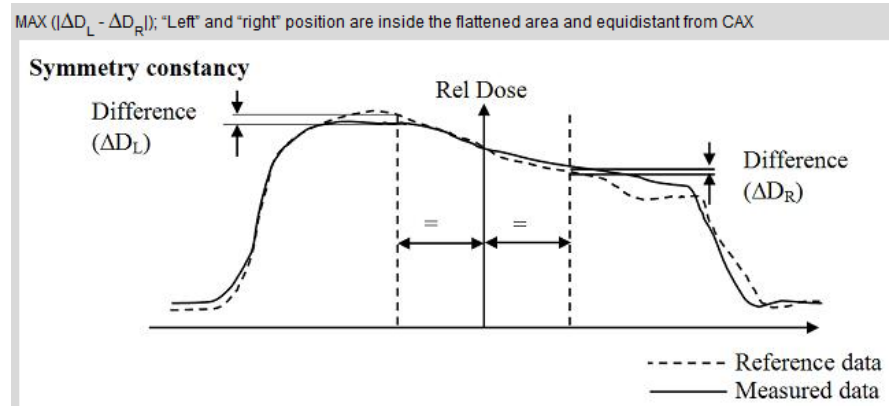


Comparison

Comparison

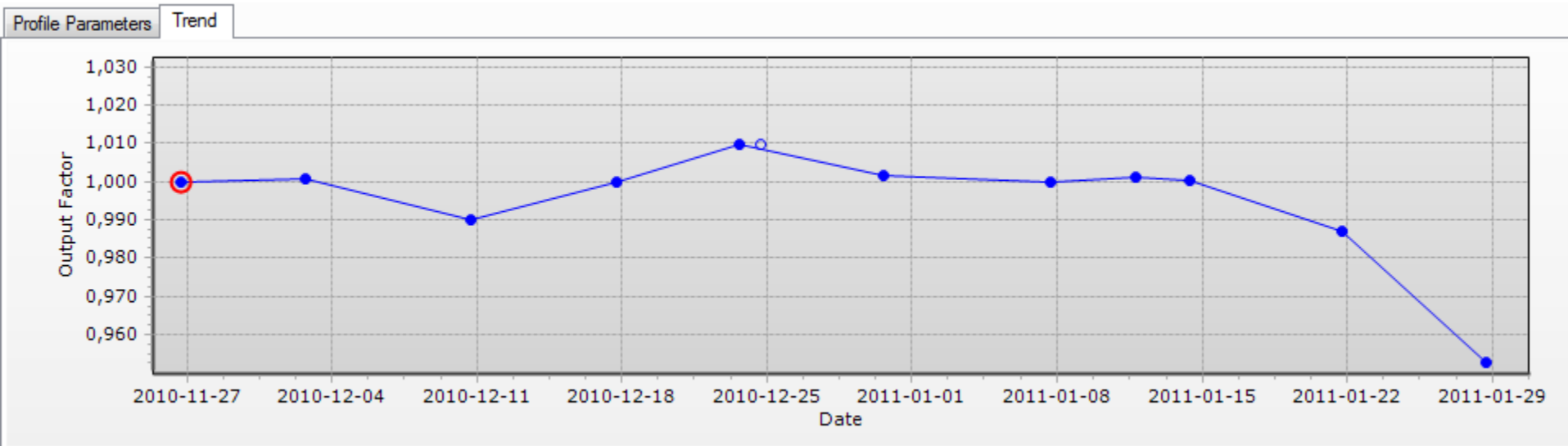
Beam constancy

- Flatness constancy
- Symmetry constancy
- Deviation constancy



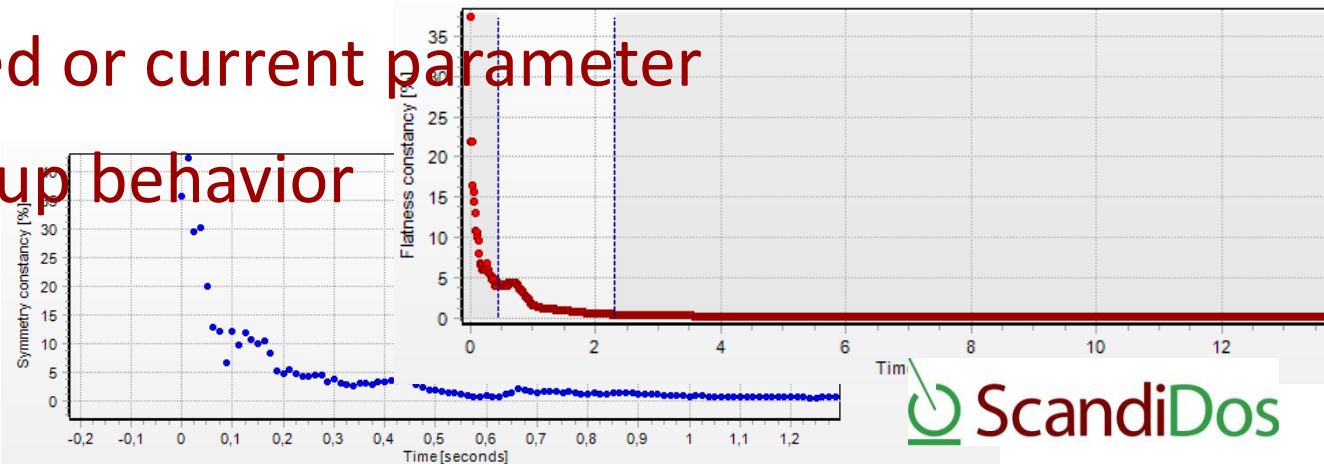
Beam constancy

- Flatness, symmetry, deviation constancy
- Beam output



Beam constancy

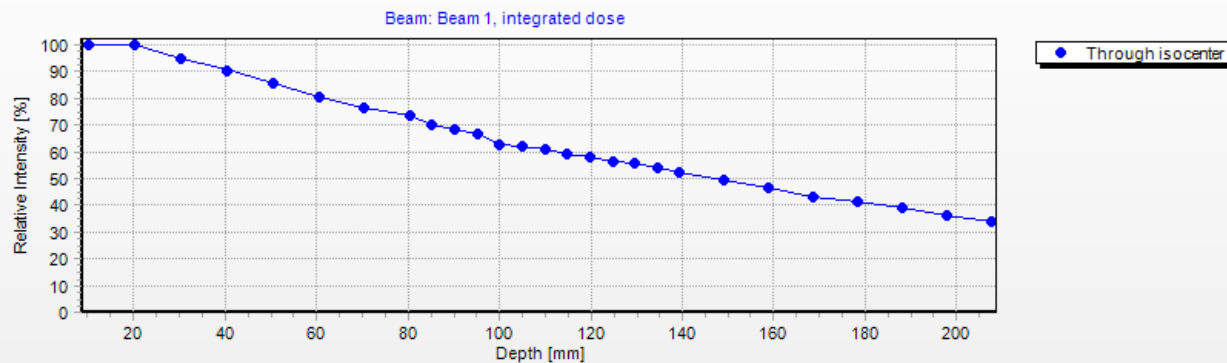
- Flatness, symmetry constancy
- Beam output
- Intra-beam stability check with highest time resolution
 - Each dose pulse is measured individually
 - View any parameter in MU or time
 - Accumulated or current parameter
 - Beam start up behavior



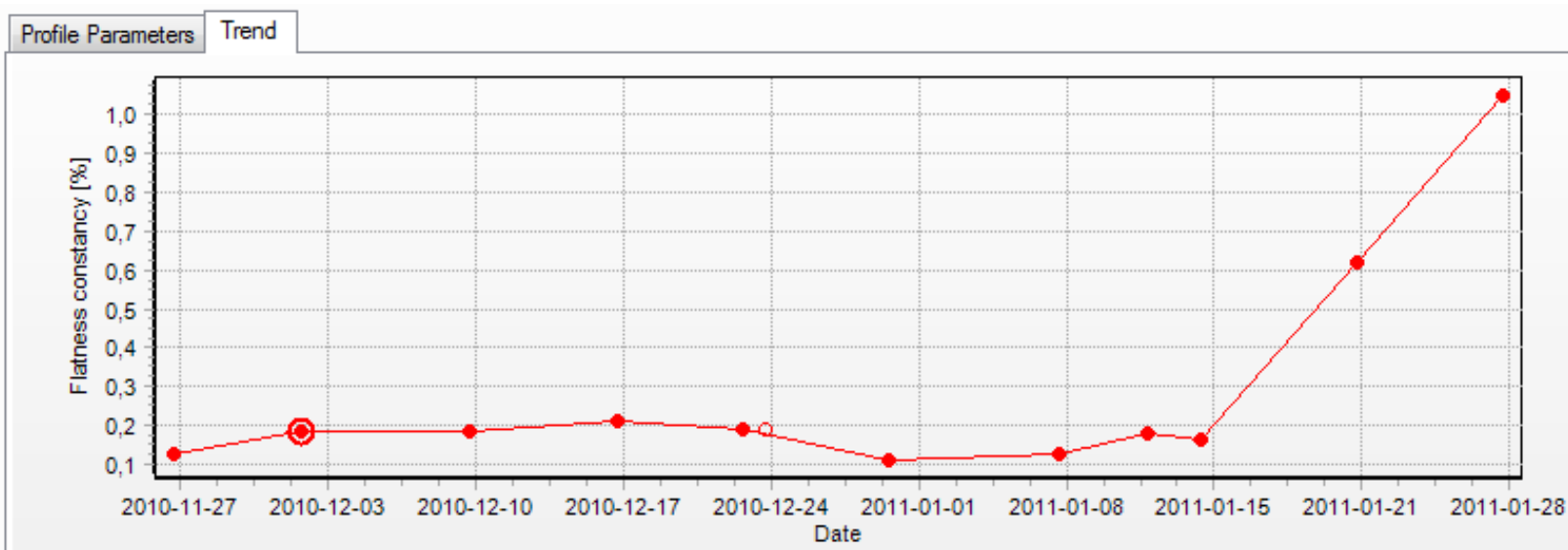
Beam constancy

- Flatness, symmetry, deviation constancy
- Beam output
- Intra-beam stability check
- Energy constancy
 - R50, D100, D200, R50, D200/D100

Depth Dose	R50 constancy	D100 constancy	D200 constancy	D200/D100 constancy	
Through isocenter	0,1 mm (2,42 s / 12,1 MU)	-0,1 % (1,14 s / 3,2 MU)	0,0 % (0,97 s / 2,1 MU)	0,002 (0,07 s / 0,0 MU)	



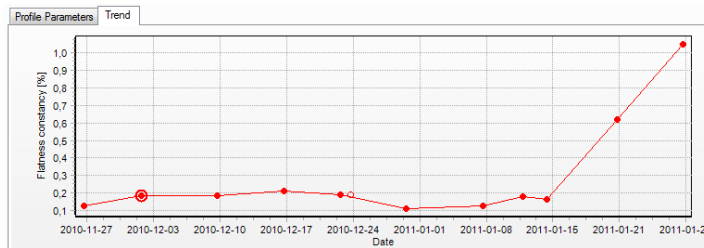
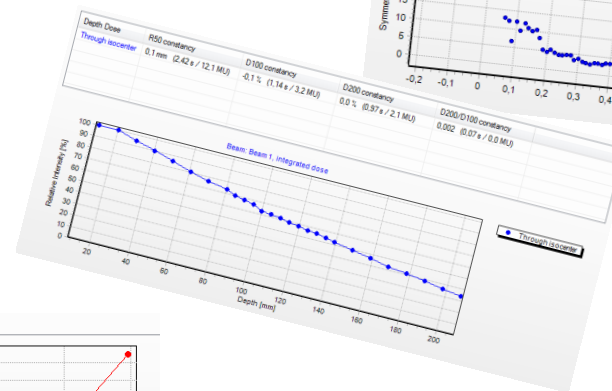
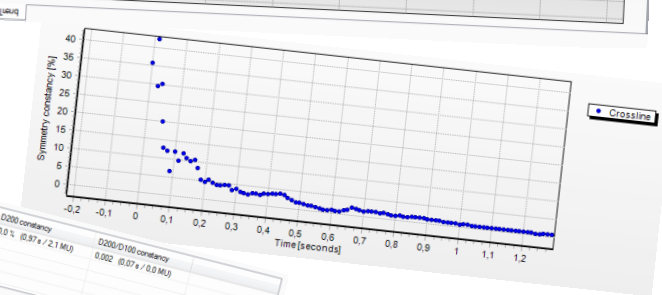
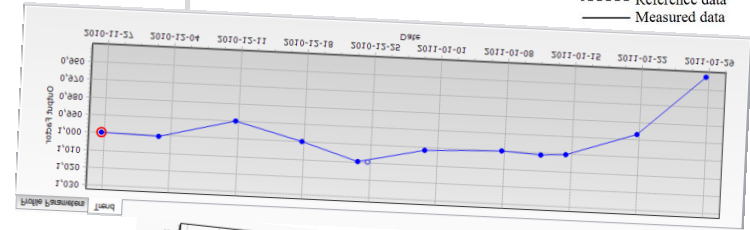
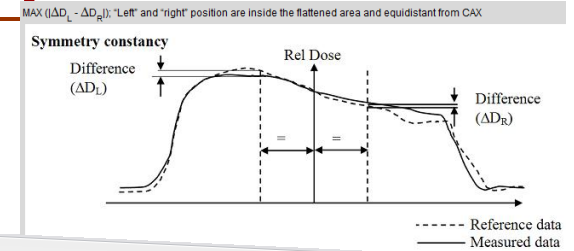
Beam constancy



- Trend tracking
 - Track any parameter over time
 - Click on any point to view complete measurement

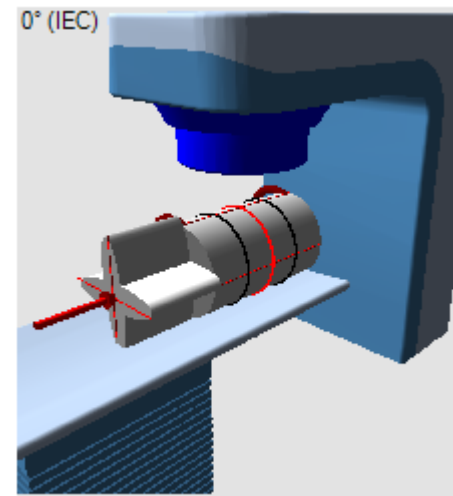
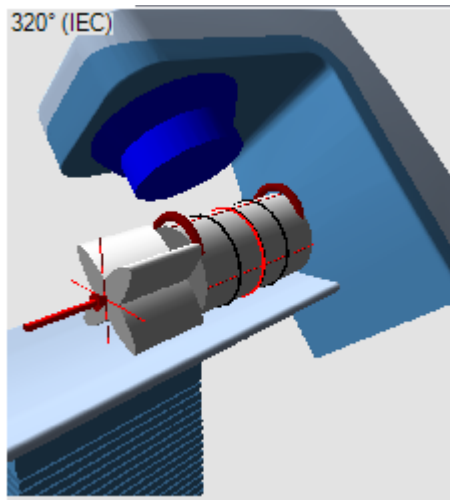
Beam constancy

- Flatness, symmetry constancy
- Beam output
- Intra-beam stability check
- Energy constancy
- Trend tracking

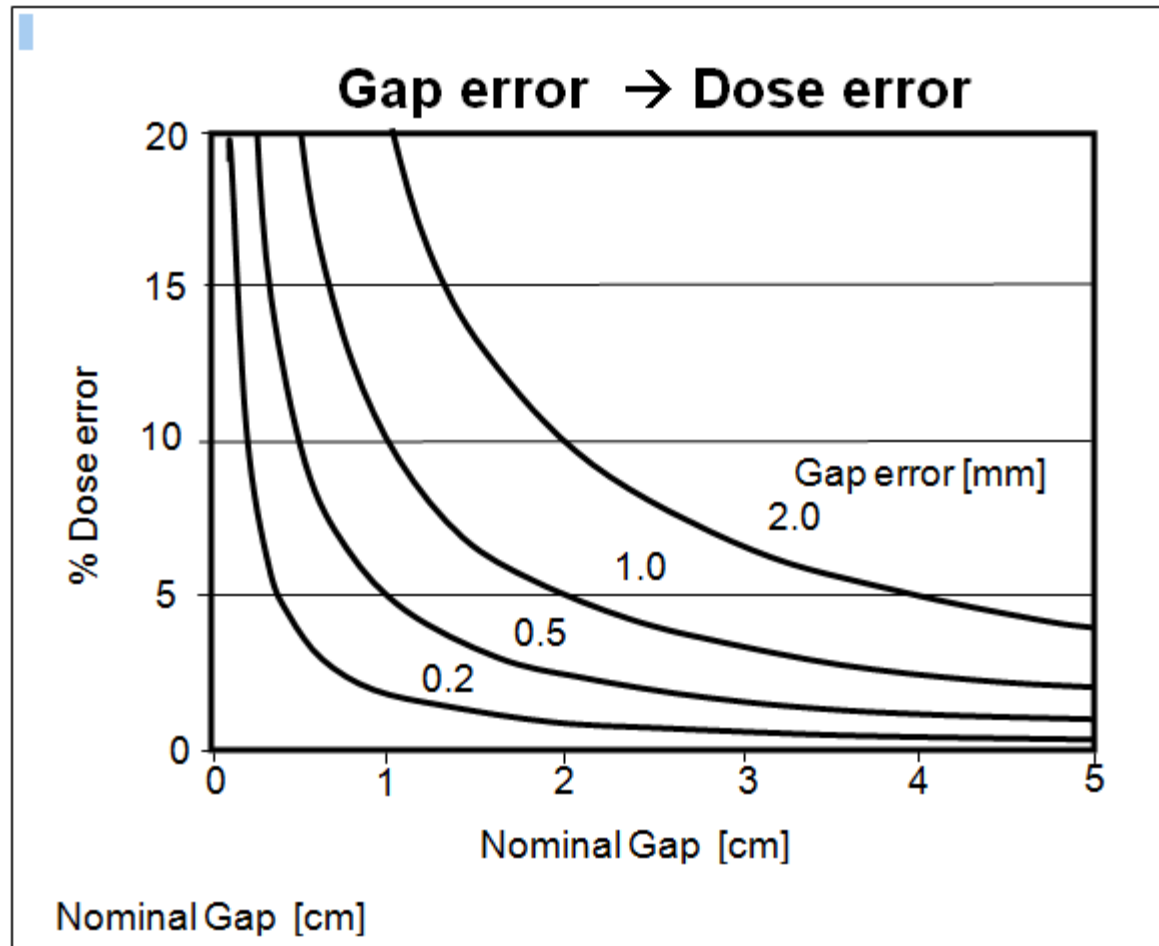


What is the Machine QA Option?

- **Beam constancy** at various gantry angles
- **MLC performance** at various gantry angles

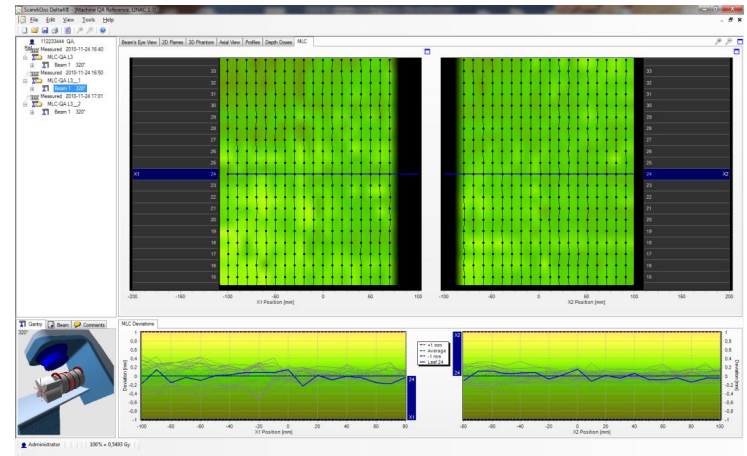


MLC Performance check



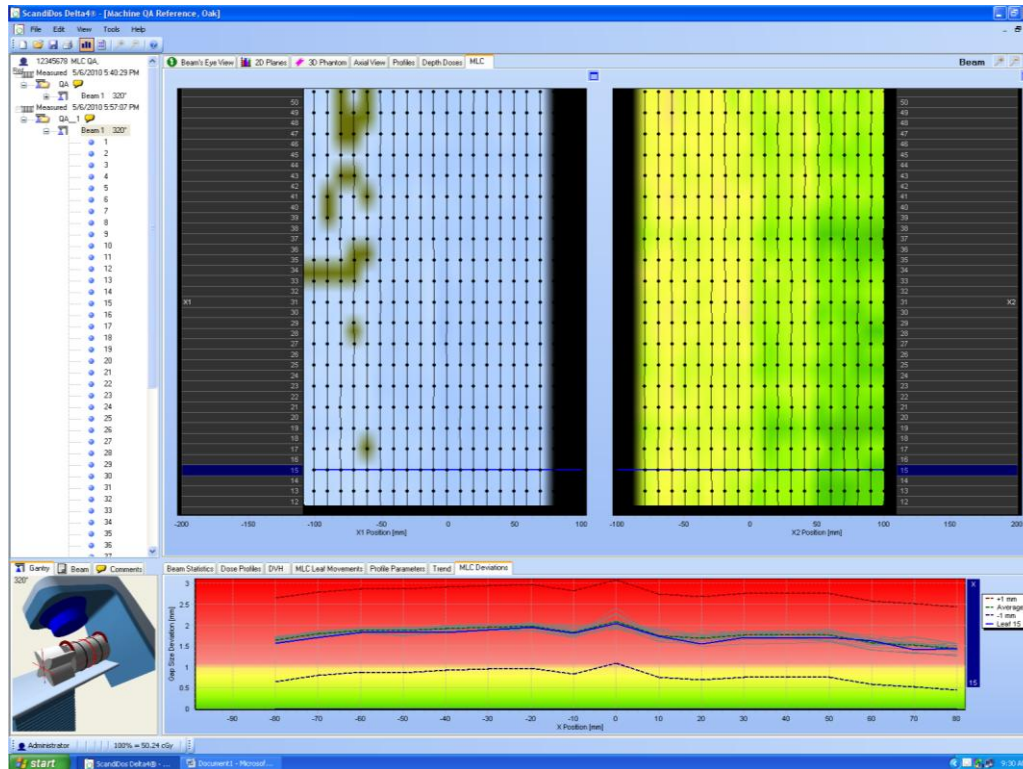
MLC performance

- Picket fence test in different gantry positions
 - Test gravity impact on the MLC
 - Dosimetric leaf gap
 - Movement reproducibility
 - Uniformity of movement over the leaf banks



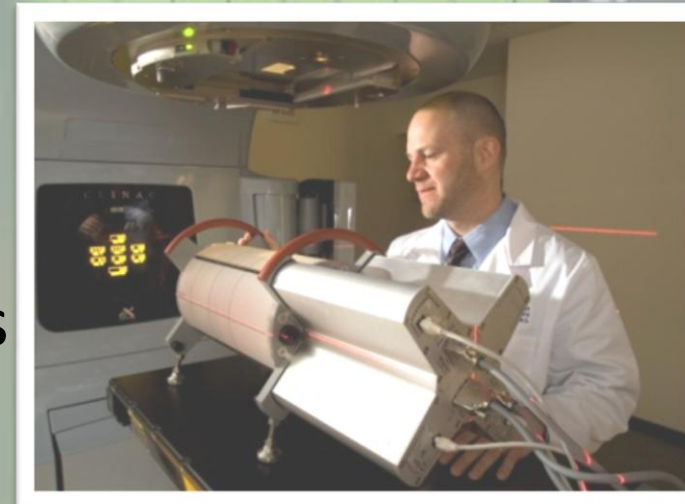
MLC performance: Dosimetric leaf gap

“My MLC gap deviation graph appears to cluster the data within approximately ± 0.2 mm, but it is located between 1.5 and 2.0 mm gap size deviation (average 1.75 mm). I am thinking this may have to do with the Varian leaf’s rounded edges. This is handled in treatment planning with a parameter the ‘Dosemetric Leaf Gap’. Our (previous measured) and clinically used value for the DLG is 1.7 mm (6X).”



Summary

- Advanced machine QA in a few minutes
- QA at various gantry angles:
 - Energy and output constancy
 - Beam stability
 - MLC Performance
- Film-free picket fence test
- Long-term effects and trends

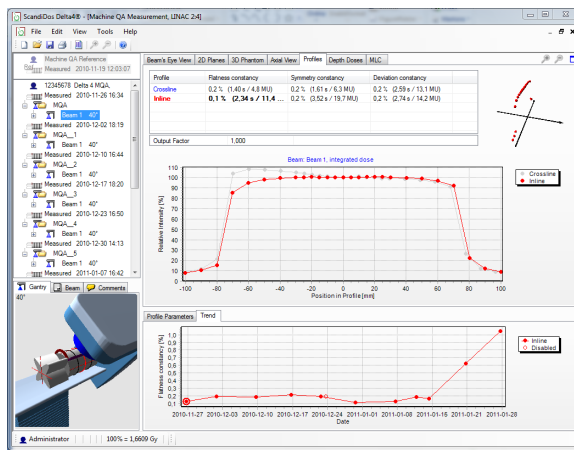
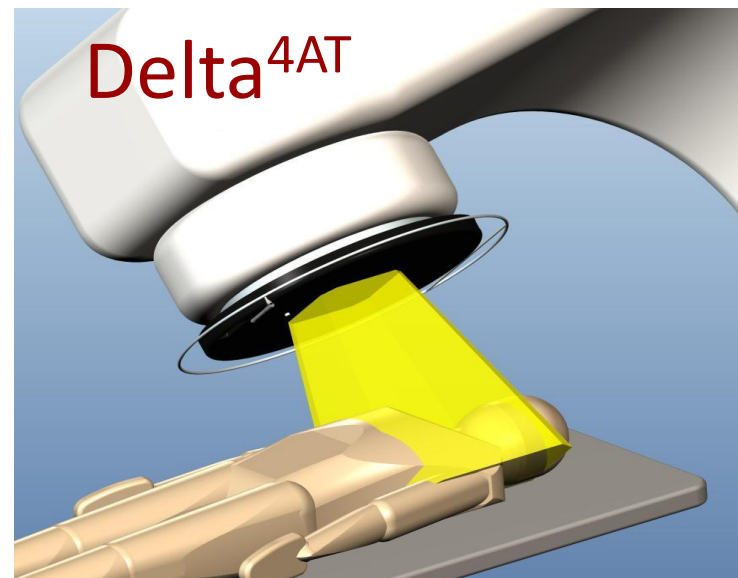


Delta⁴ - Komplette Verifikation

Delta^{4PT}



Delta^{4PT} Machine QA



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