

Klinische Anwendung des Delta⁴®

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Einführung

Ausstattung:

- **Bestrahlungsgeräte**

- 2 Elekta-Synergy-Linacs mit MLCi2

Integrity R 1.1

iViewGT / Cone beam CT

- Tomotherapie HiArt

- **Bestrahlungsplanung**

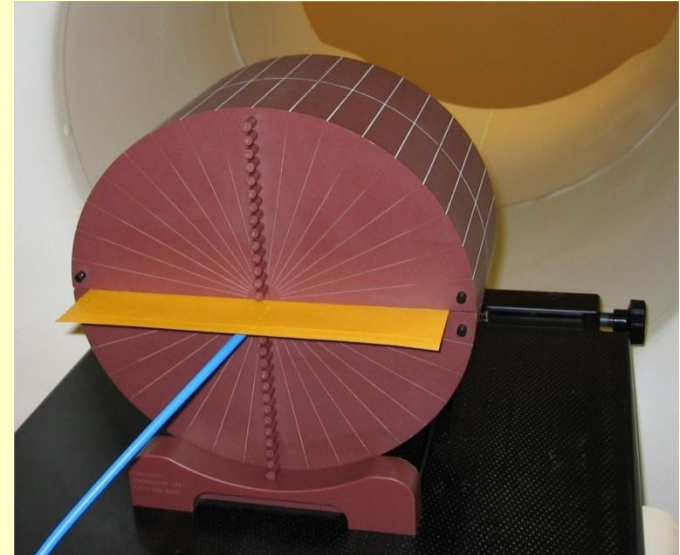
- Pinnacle 9.0 und Tomotherapie 4.0.4

- bis heute fast alle IMRT-Pläne gemessen >90 %

- VMAT- und Tomo-Pläne 100 %

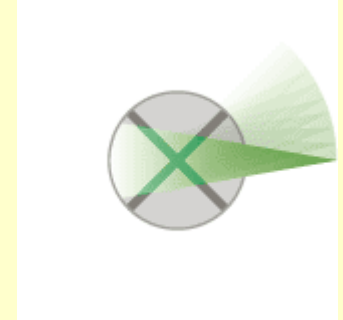
DQA on Tomotherapy

- Cheese-phantom
 - Film and point dose measurement
 - DQA spends a lot of time
 - dose calibration
 - phantom positioning for each measurement
 - film evaluation
 - film costs



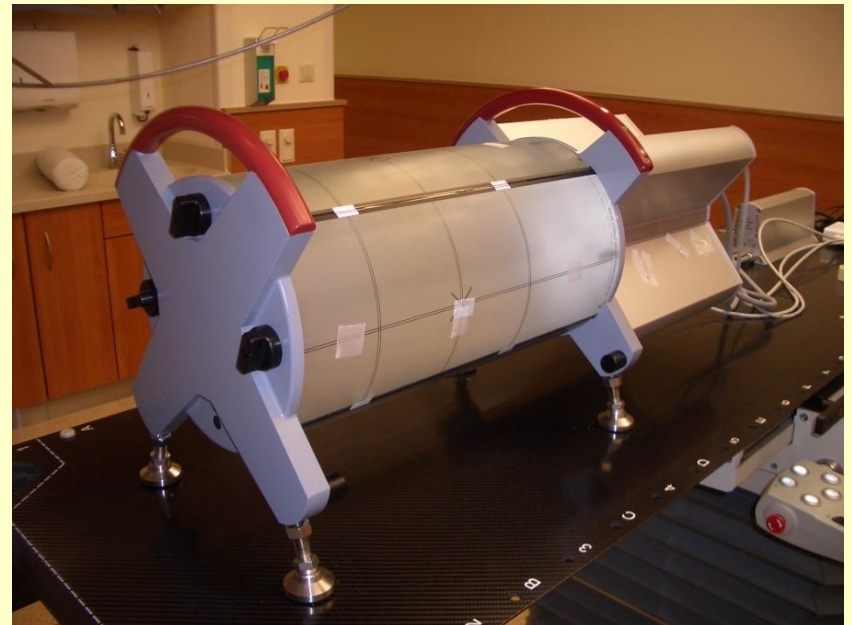
DQA on Tomotherapy

- Delta⁴® ScandiDos
 - dual orthogonal detector planes
 - 1069 p-Si detectors
1cm/0,5cm distance
 - isotropic response
 - 3D distribution in 360°
gantry rotation



Advantage:

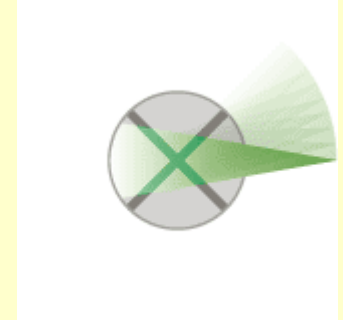
fast, precise and stable
method to verify a three-
dimensional (3D) dose
distribution



DQA on Tomotherapy

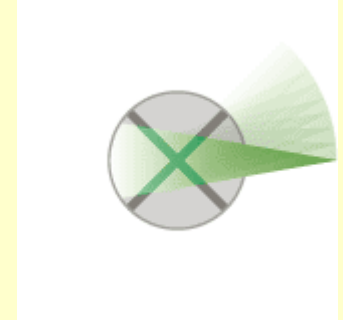
- Delta⁴® ScandiDos

- Realized first steps in april 2009
- Clinical practice for nearly all DQA pretreatment measurements since june 2009
- Over 600 DQA measurements just today
- 3D distribution in 360° gantry rotation

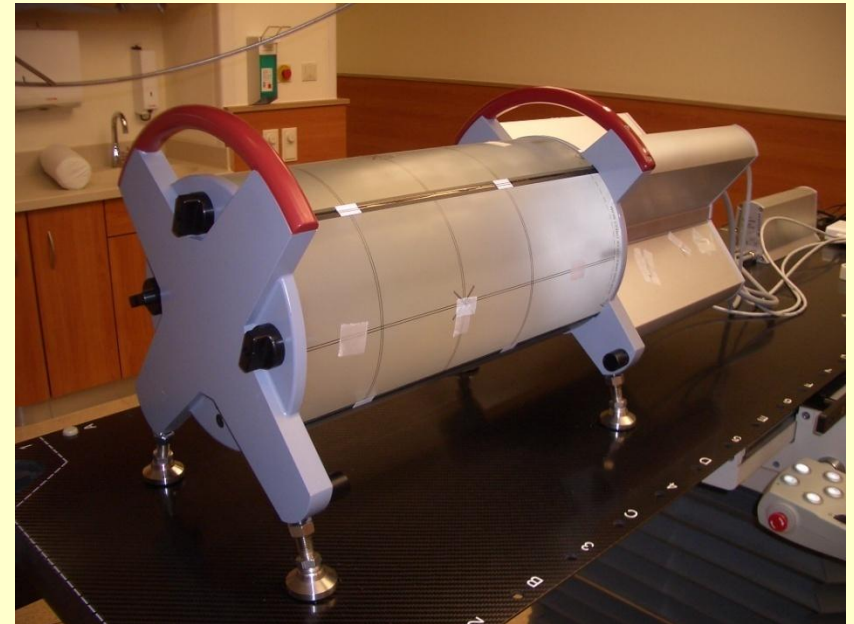


pretreatment verification - LINAC

- Delta⁴® ScandiDos



- Mit Einführung von VMAT Mitte 2011
- ca. 30-40 % aller VMAT-Pläne mit Delta⁴® verifiziert
- Tendenz steigend mit zunehmendem VMAT-Anteil

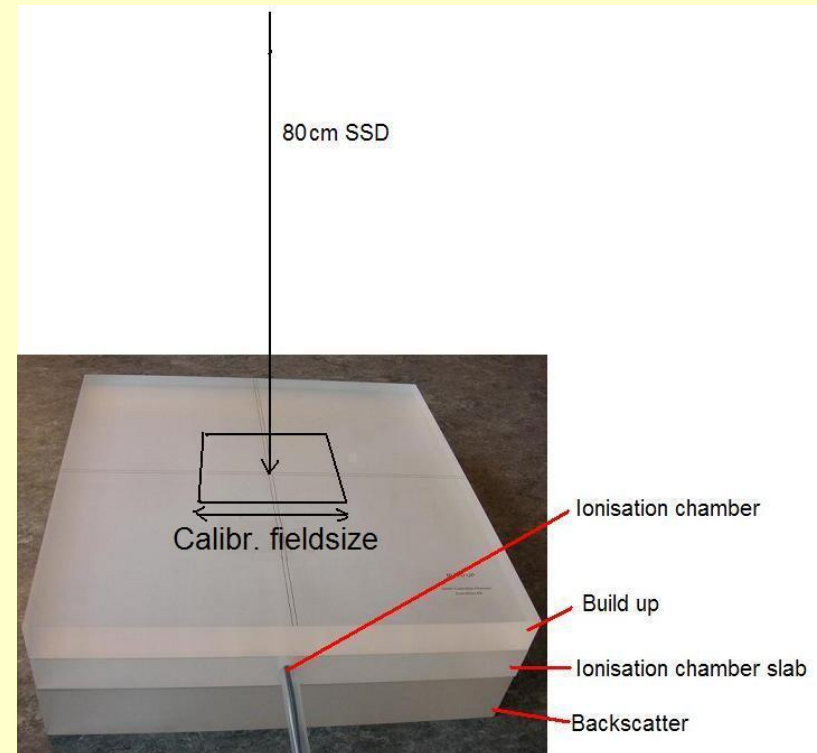


Calibration procedure

- Delta⁴ must relative calibrated in a conventional linac
 - Additional absolute calibration for use on linac
- then, it must be calibrated in the Tomotherapy Unit

First Step:

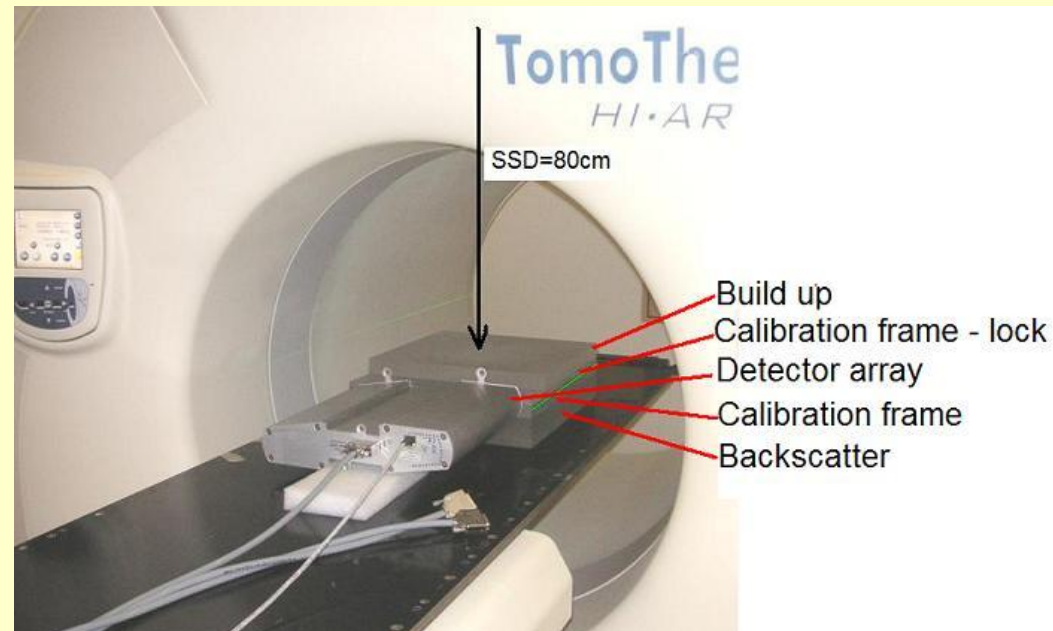
- Reference measurement
- Ionisation chamber in the calibration phantom
- Field size 20x5cm (Enter 8x8 as equivalent square field size into Delta⁴)



Calibration procedure

Second Step:

- Absolute calibration
- each wing in the calibration slab (main unit alone / two wing units together)
- same dose as during the reference measurement



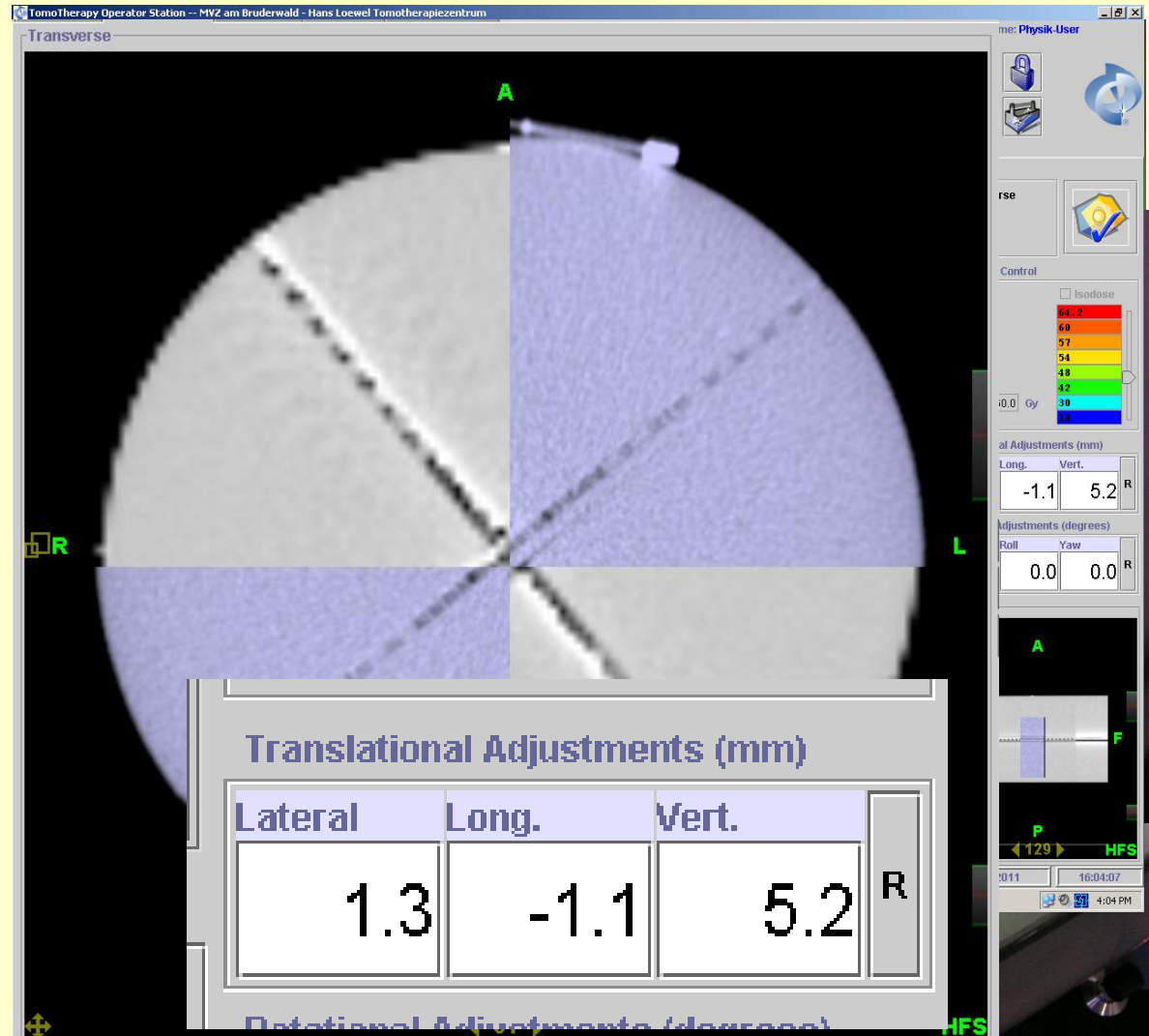
DQA process - Tomo

1. Create DQA-plan
2. Import plan from TPS
3. Set-up parameters



DQA process - Tomo

4. Positioning
5. Screw marking
6. MVCT
7. Alignment

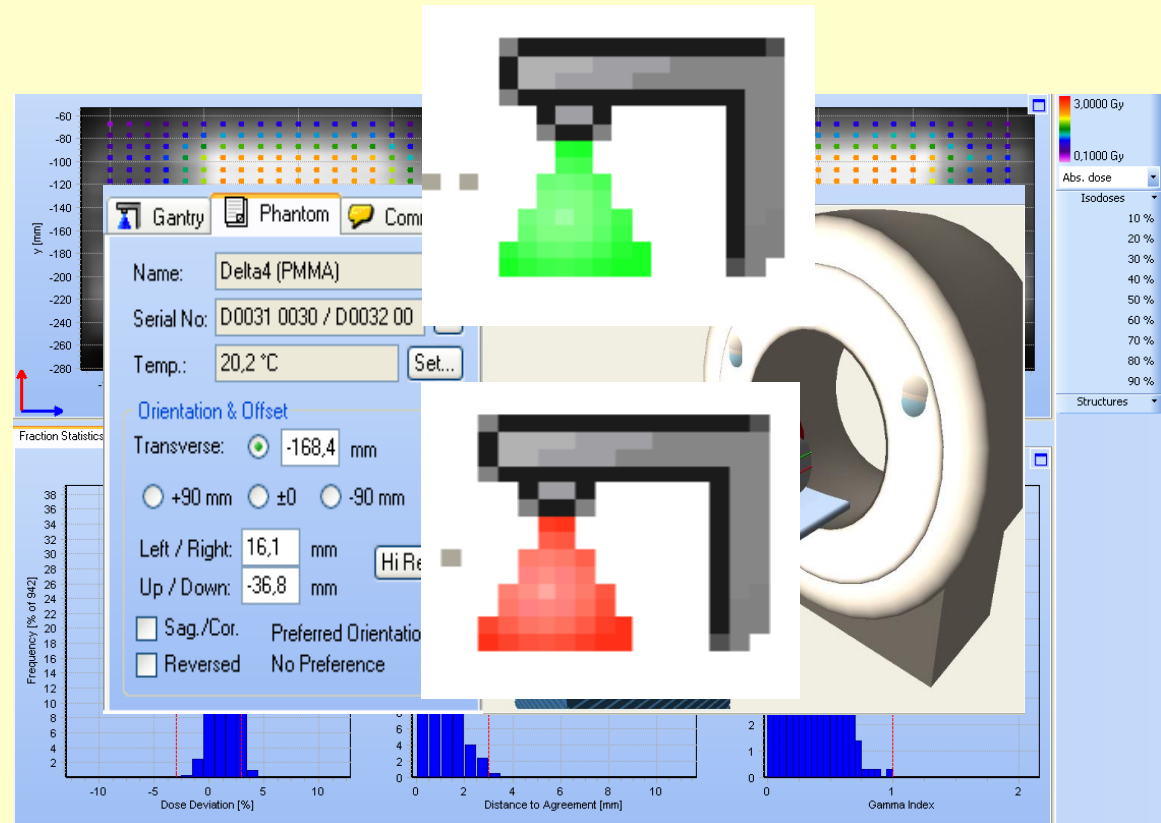


DQA process - Tomo

8. Measurement

9. Scaling & Orientation

10. Pass or Fail



DQA process

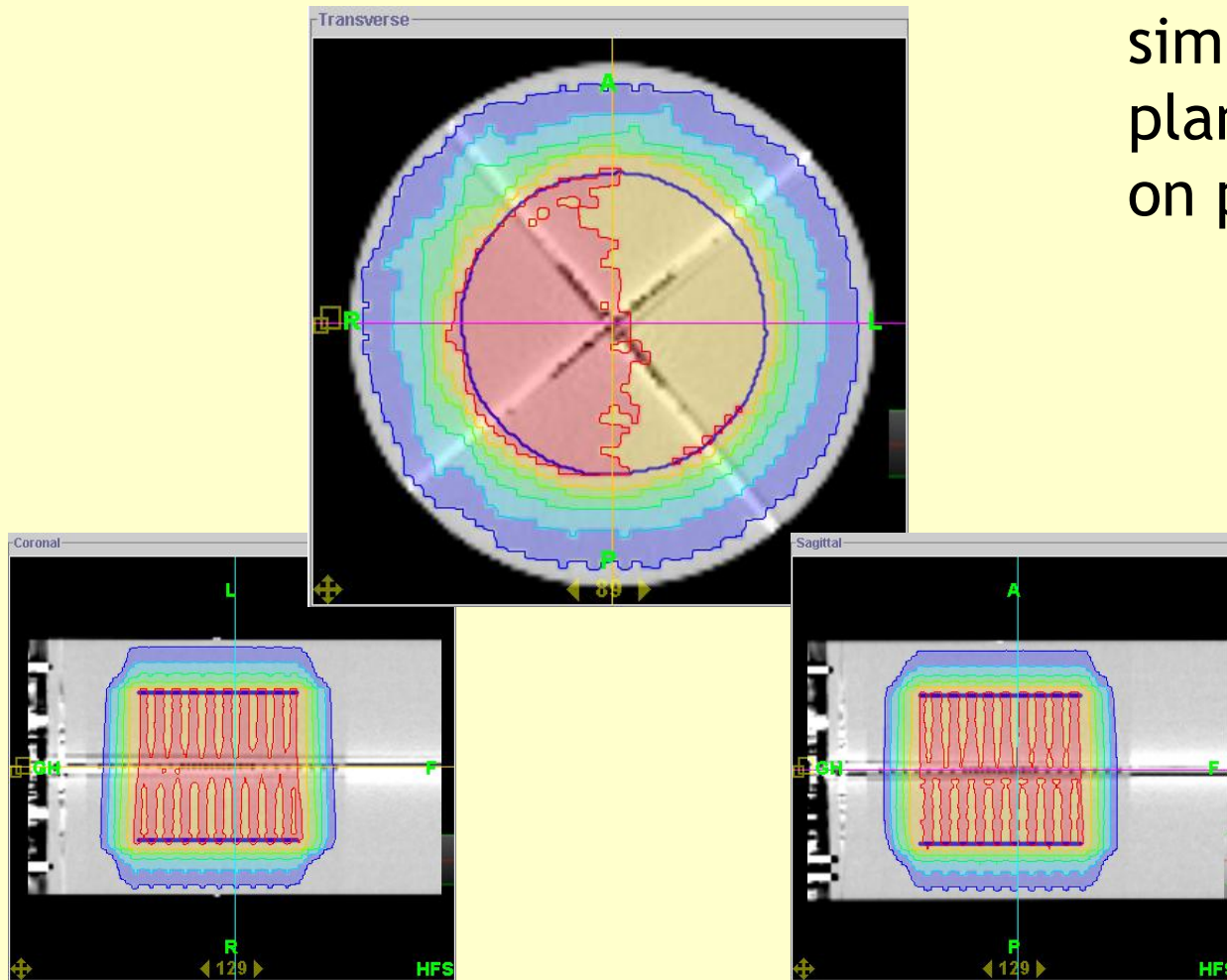
- Daily correction factor
 - Slab phantom
 - Absolute measurement after and/or before DQA



DQA process

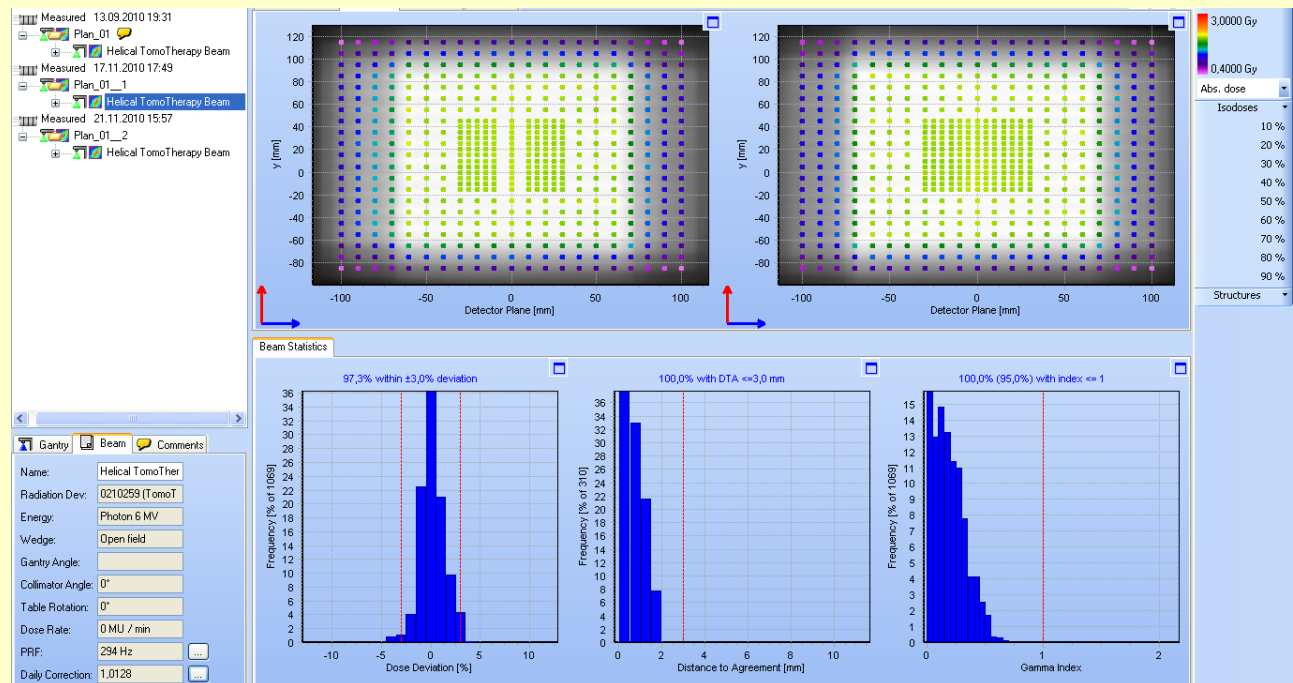
- Calibration plan

simple treatment
plan calculated
on phantom

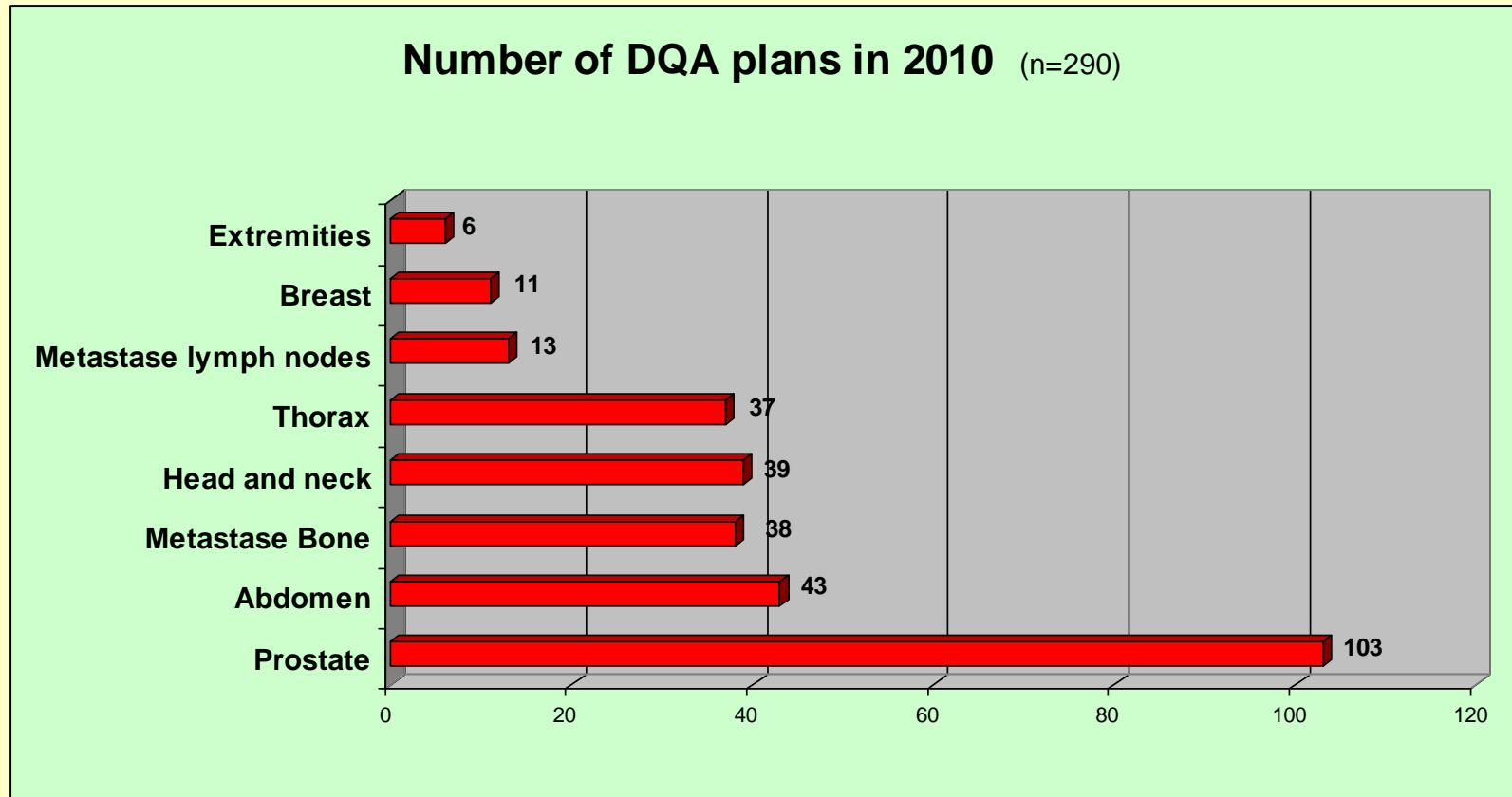


DQA process

- Calibration plan
 - measured after and/or before DQA
 - daily correction factor

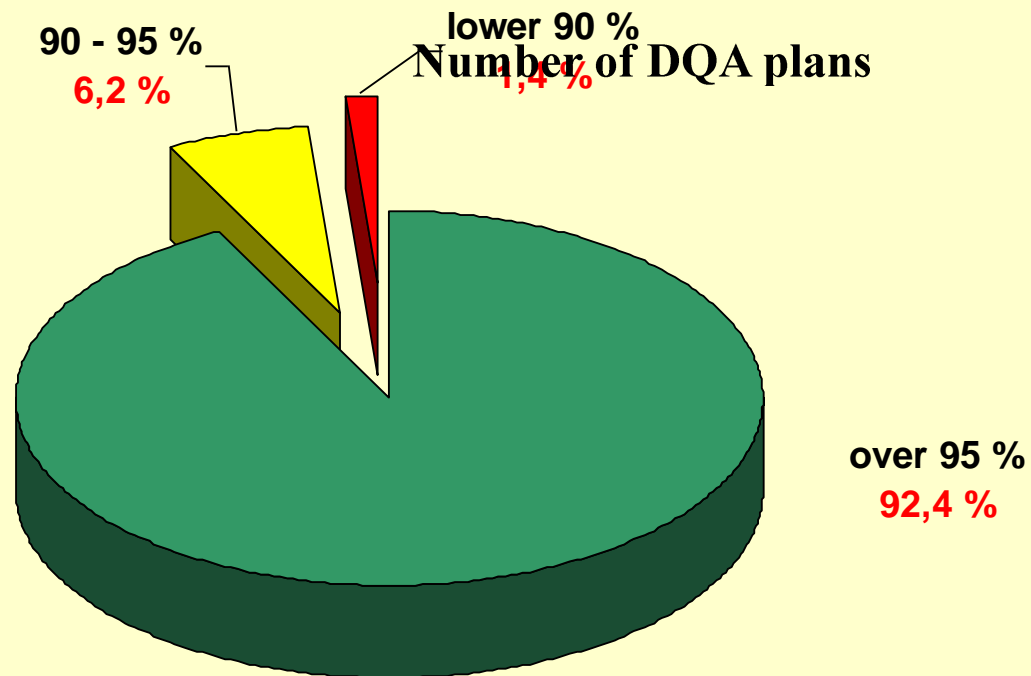


Statistics - Tomo



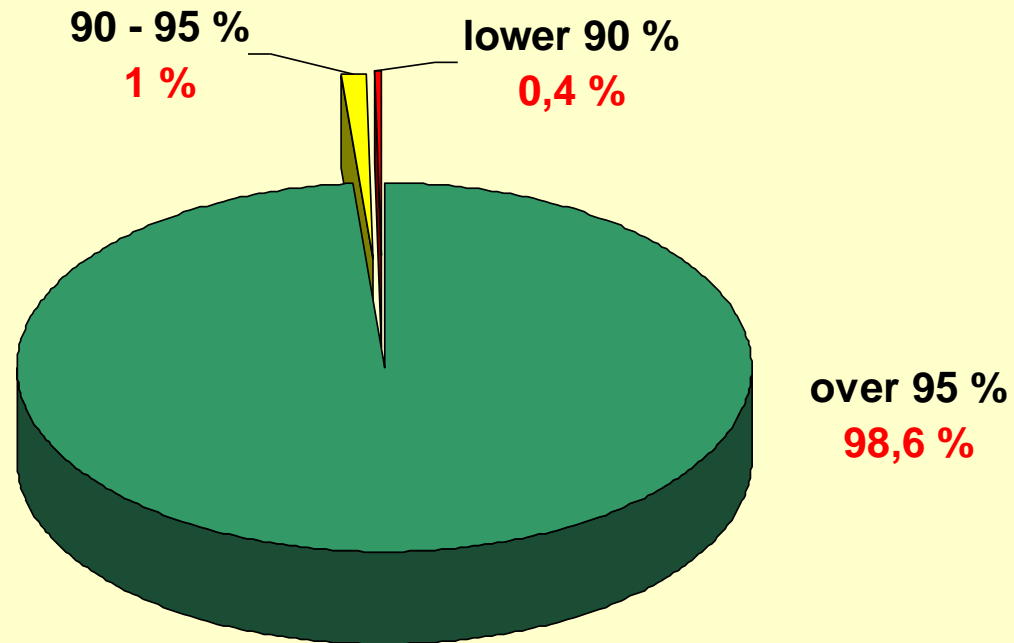
Statistics

- **Gammacriterion 95 % (3 mm / 3 %)**
 - all cases in 2010



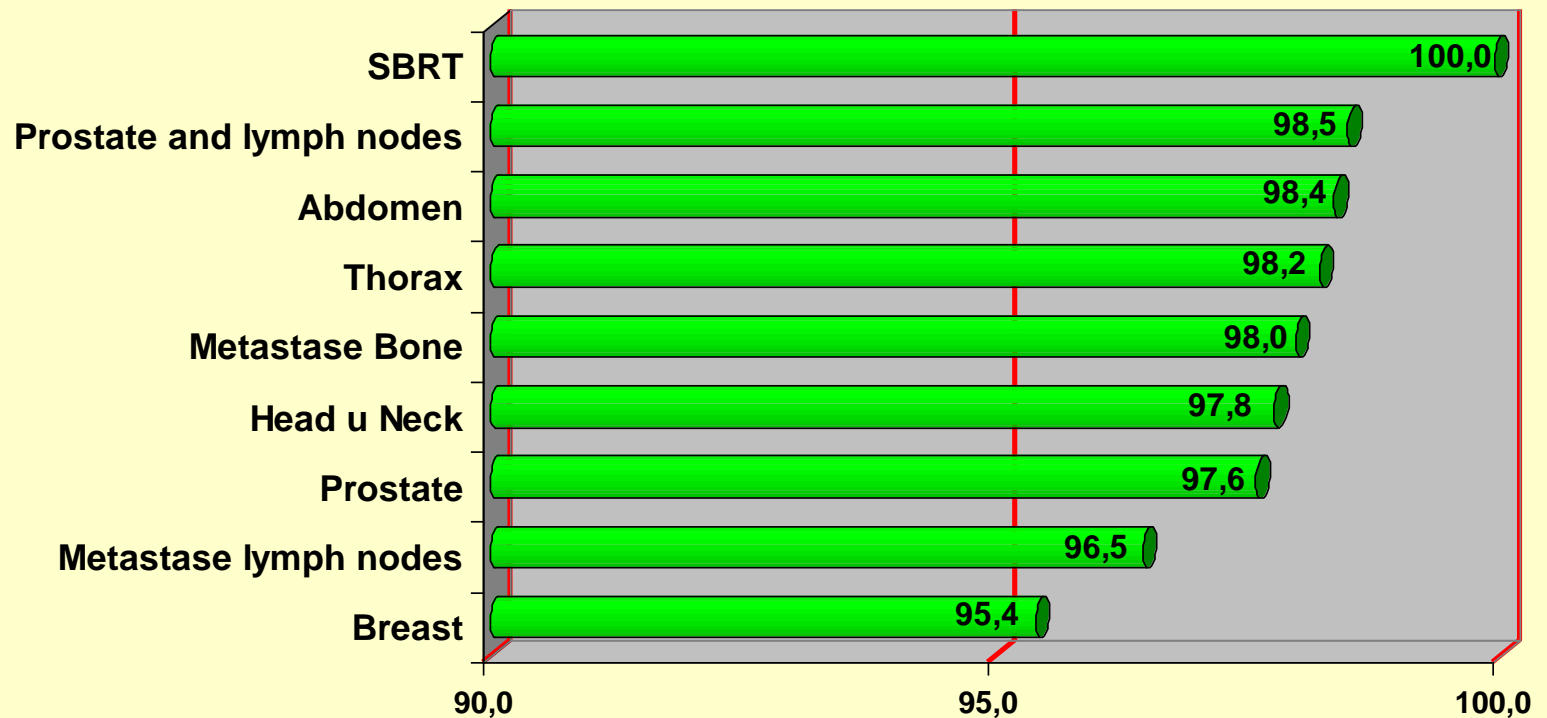
Statistics

- **Gammacriterion 95 % (4 mm / 4 %)**
 - all cases in 2010



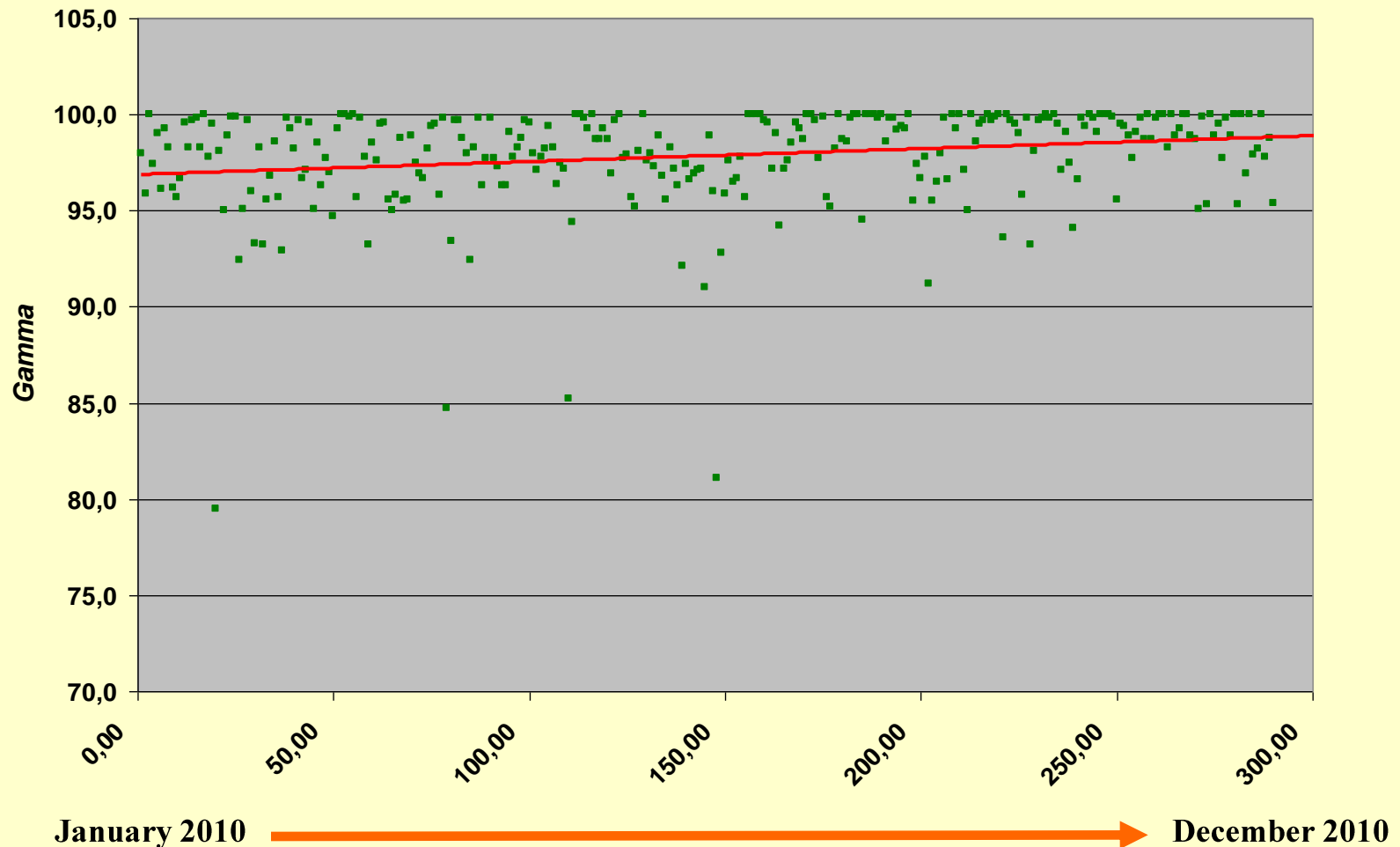
Statistics

- **Gammacriterion 95 % (3 mm / 3 %)**
 - specified by cases



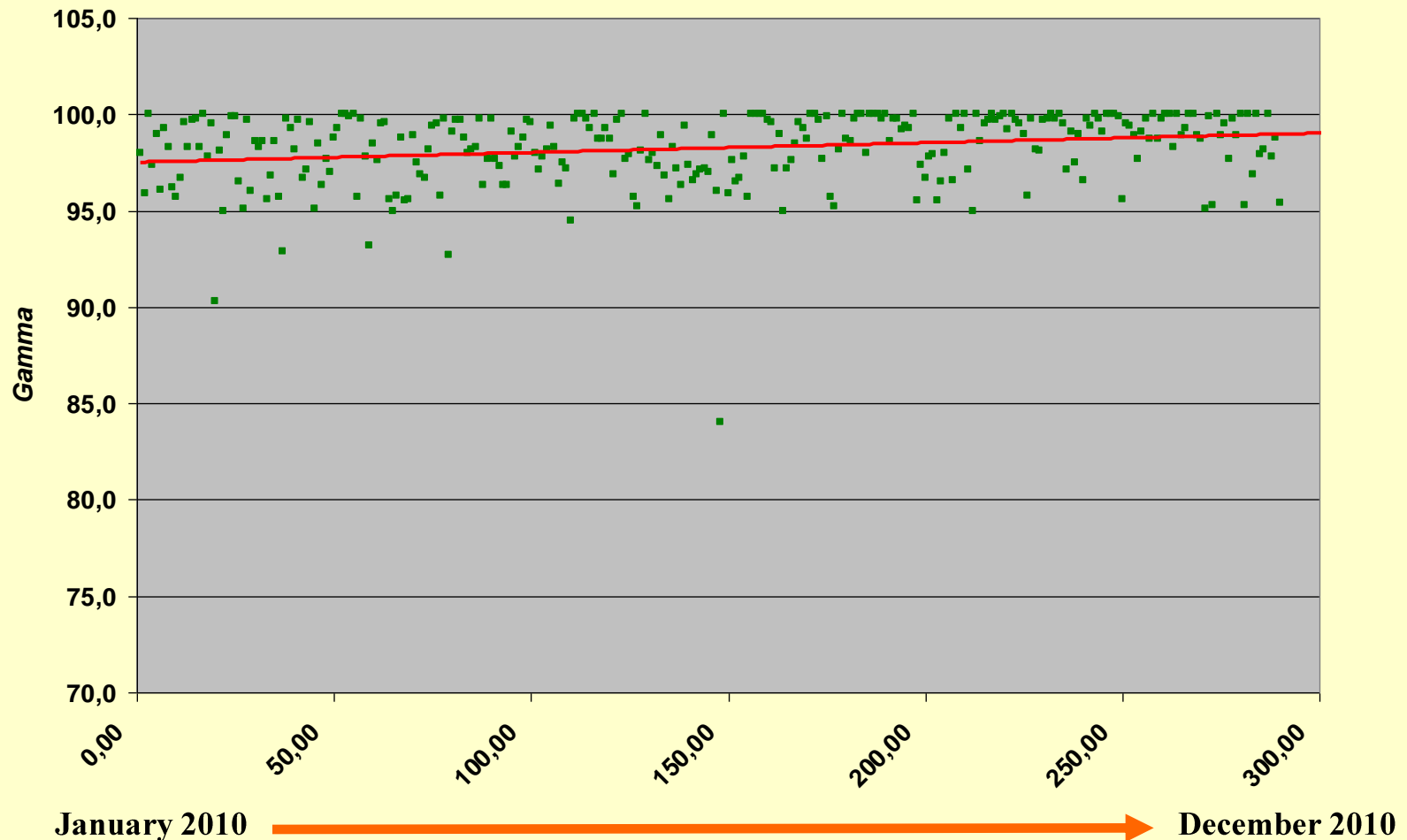
Statistics

- **Gammacriterion (3 mm / 3 %)**



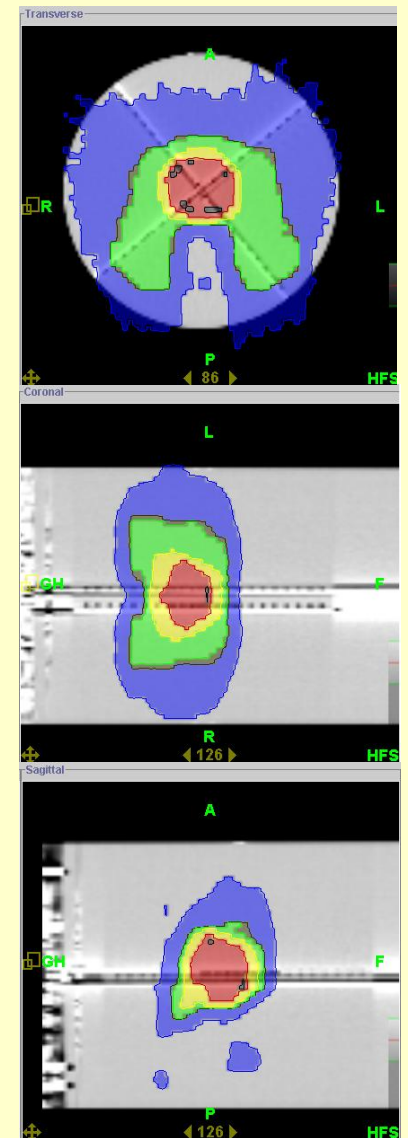
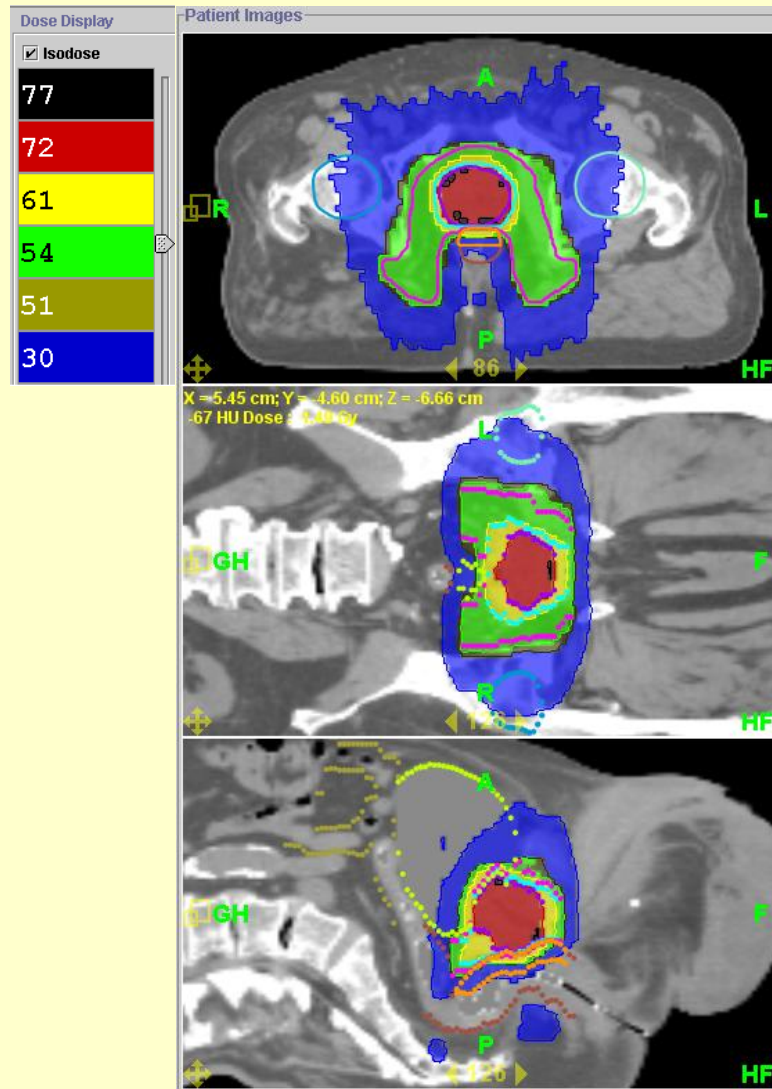
Statistics

- Gammacriterion 3mm/3% and 4mm/4% for bad one



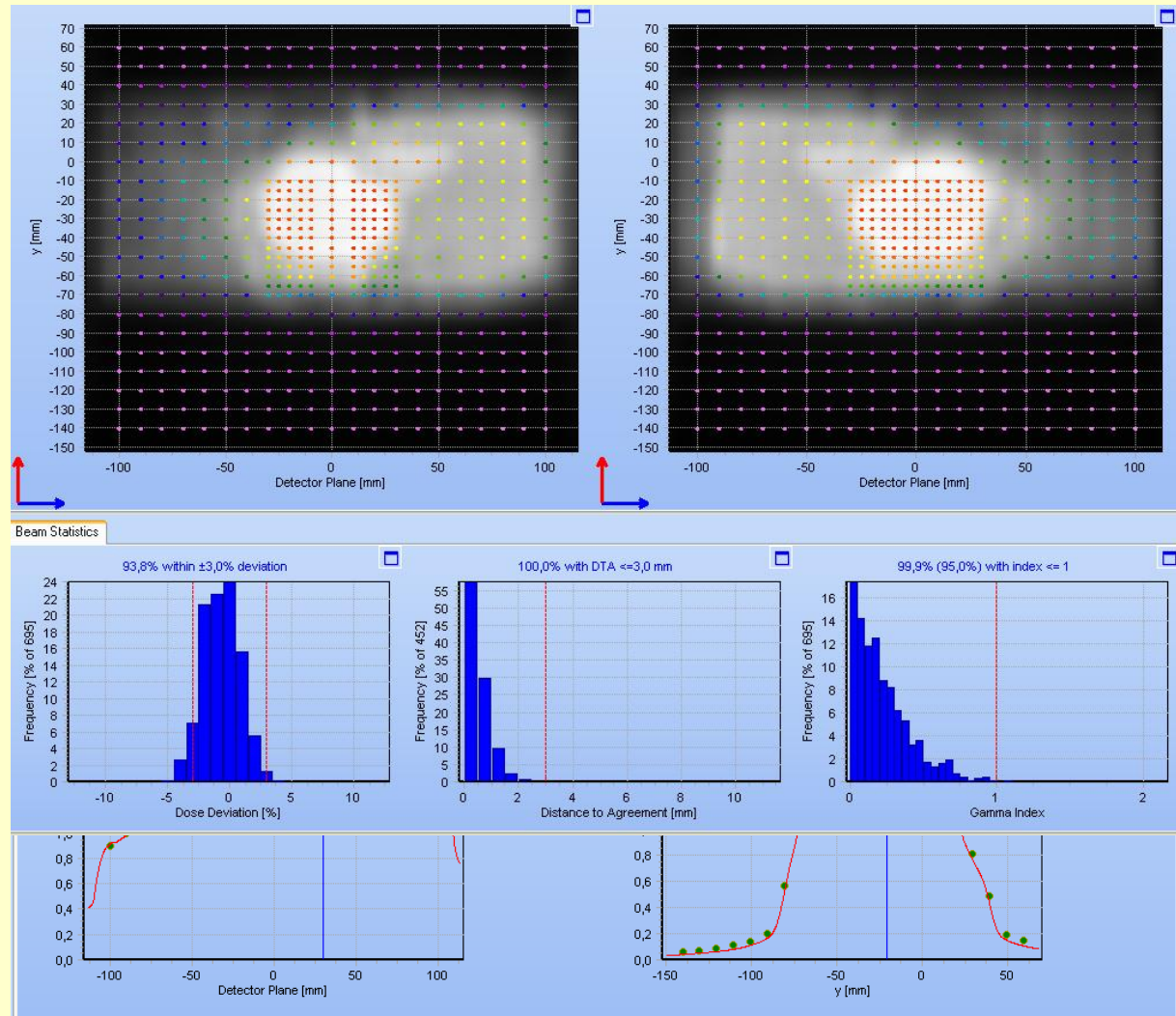
pretreatment verification

- Prostate
 - plan



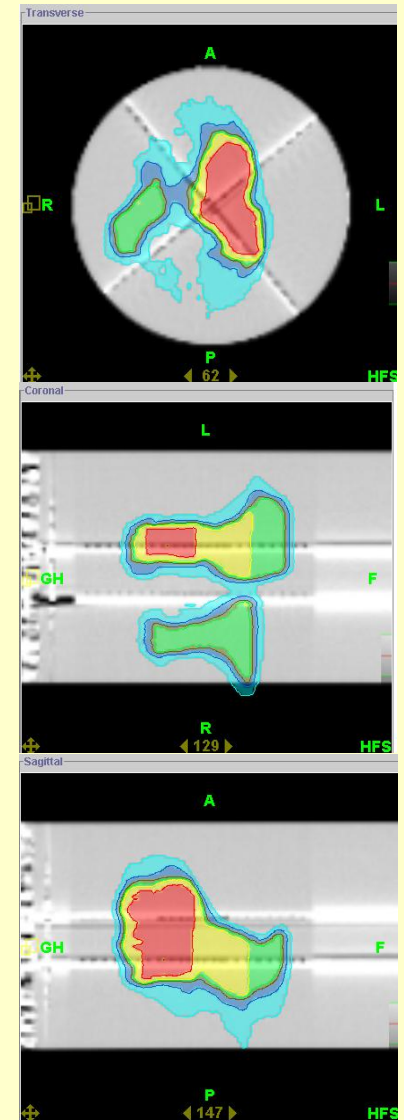
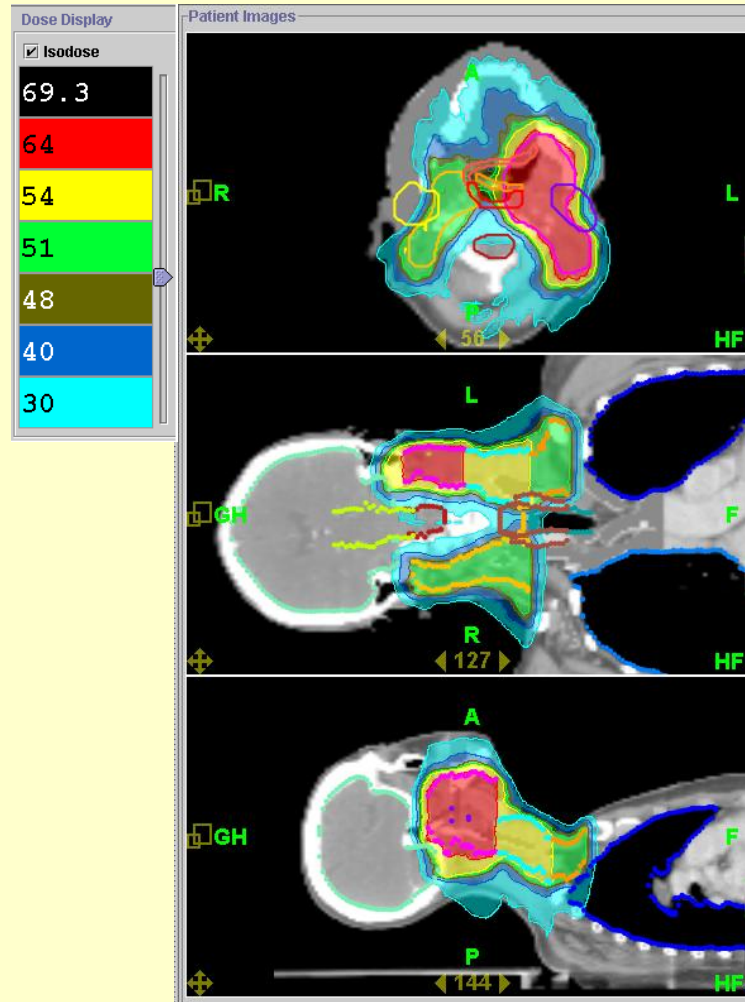
pretreatment verification

- prostate
 - results



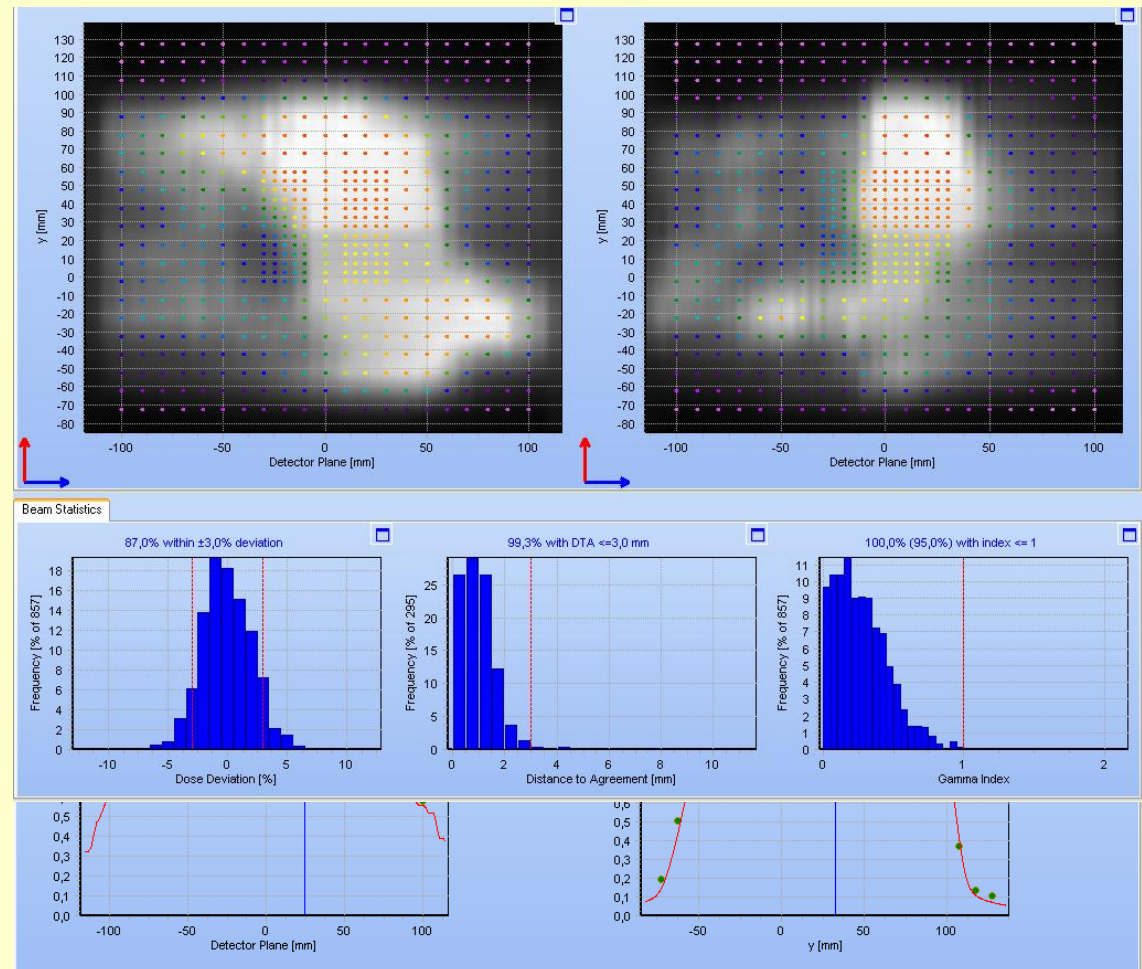
pretreatment verification

- head and neck
 - plan



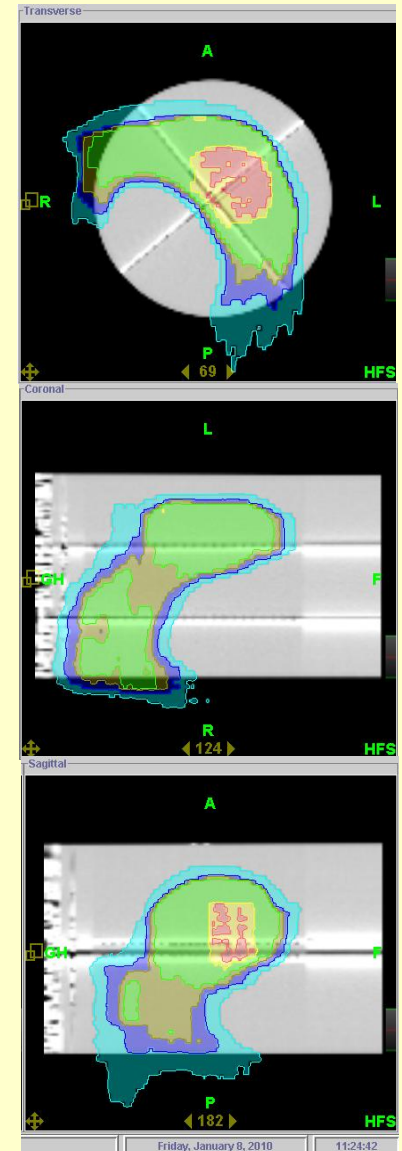
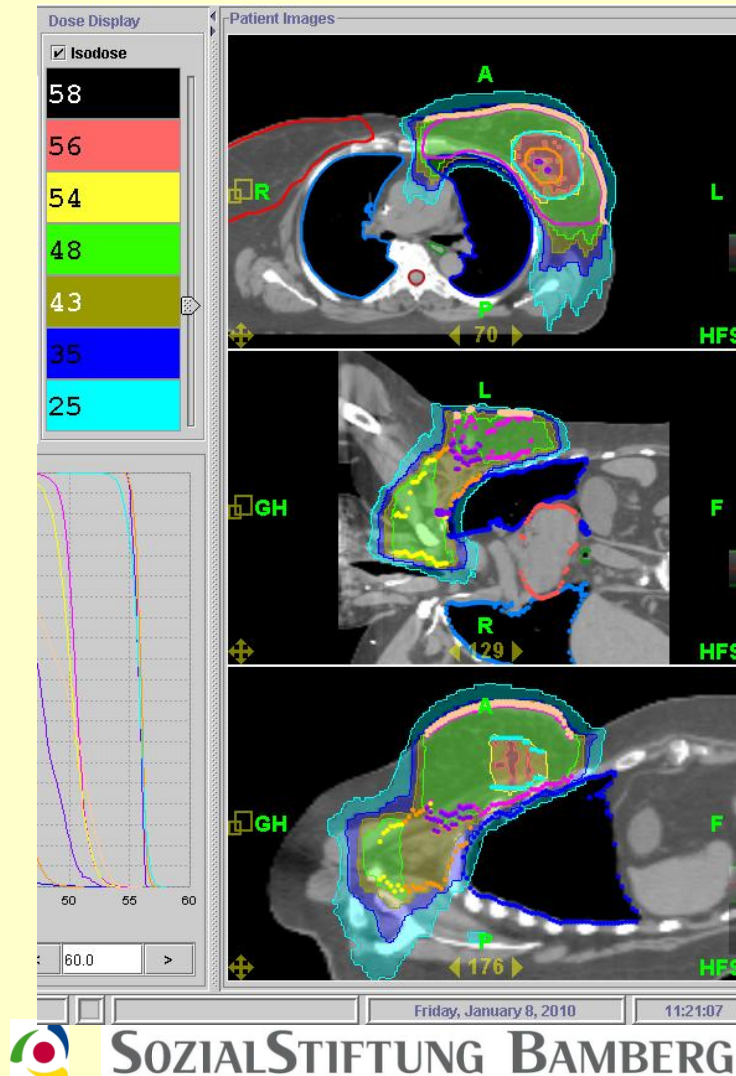
pretreatment verification

- head and neck
 - results



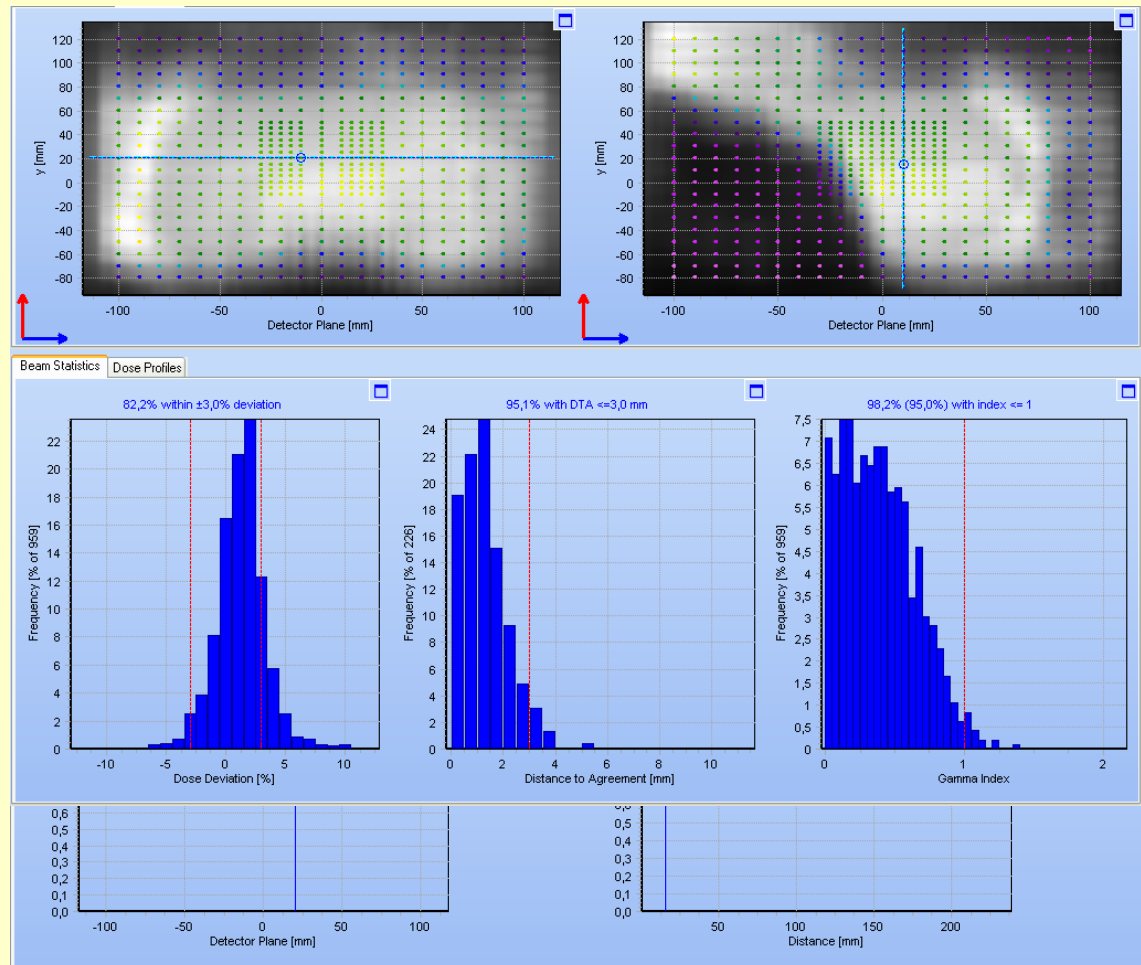
pretreatment verification

- breast cancer
 - plan



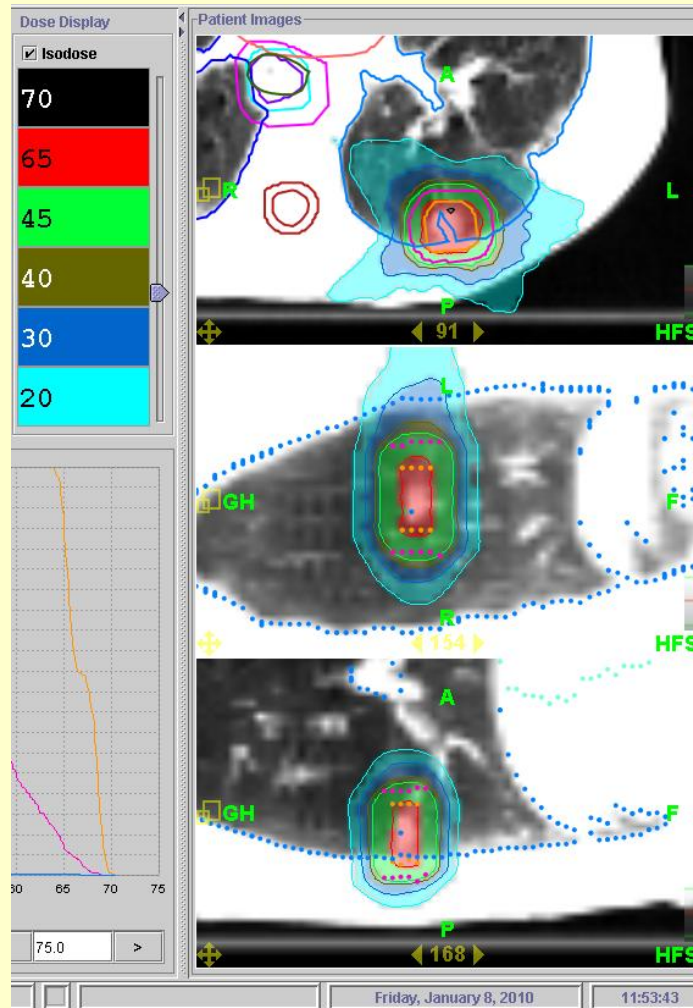
pretreatment verification

- breast cancer
 - results



pretreatment verification

- stereotactic body radiotherapy (SBRT)
 - plan



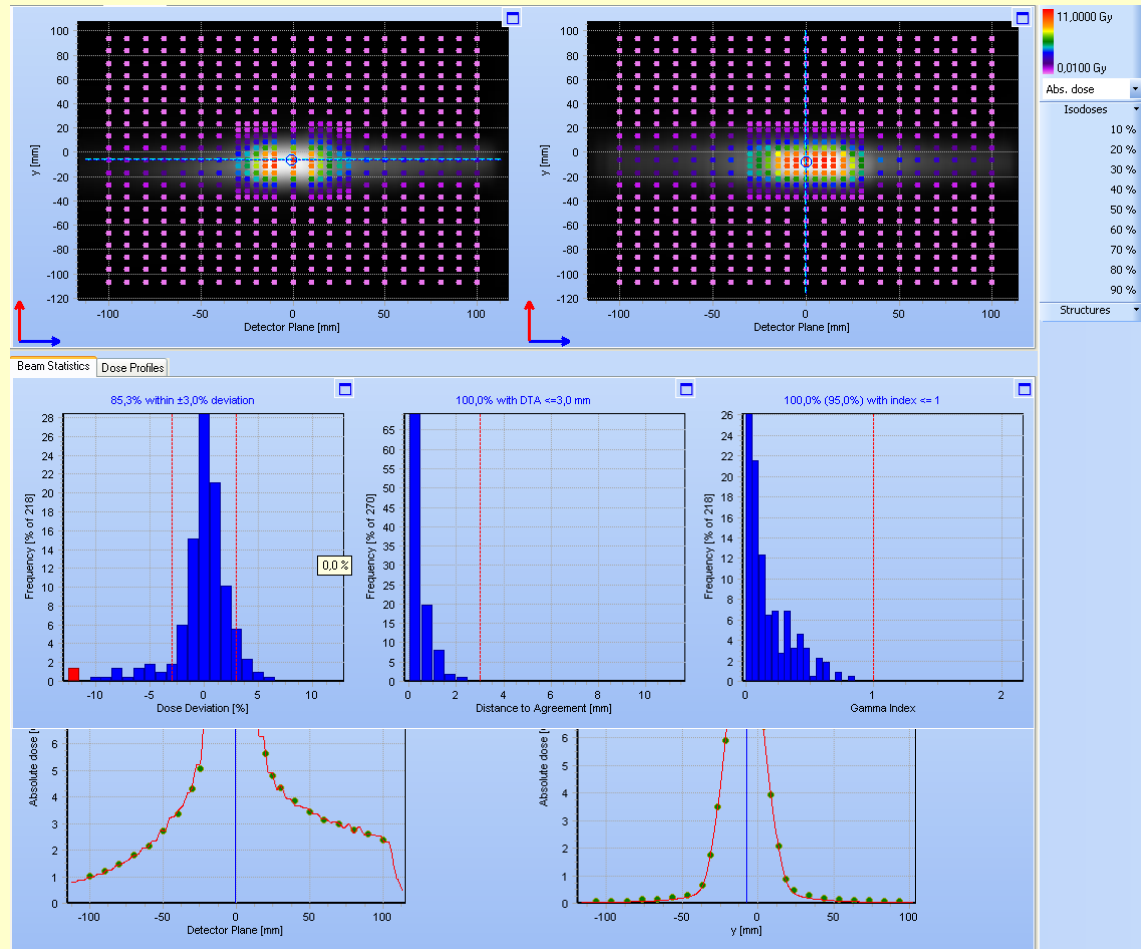
pretreatment verification

- stereotactic body radiotherapy (SBRT)

- results

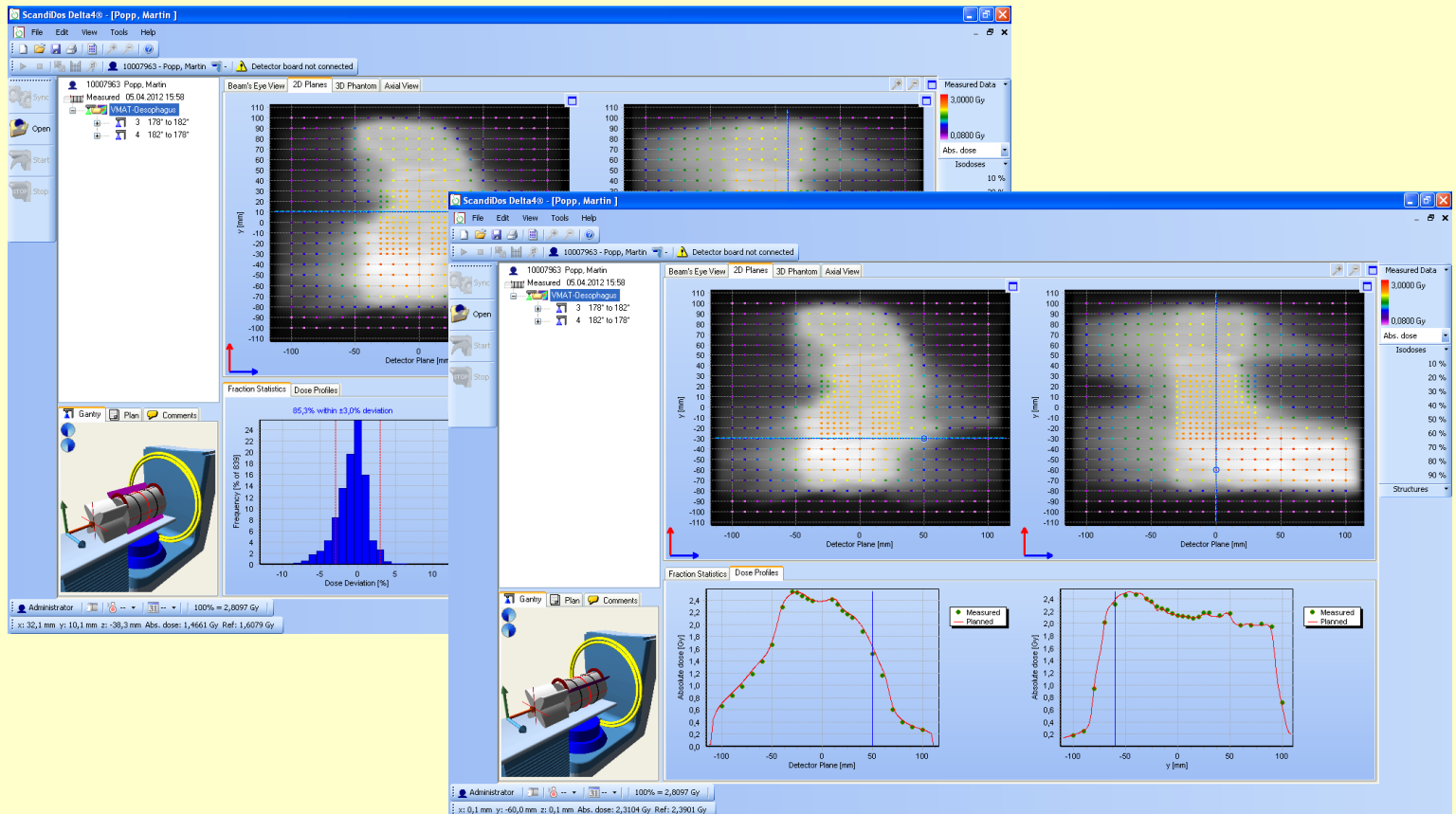
- Treatment dose measurement

- Increasing spatial resolution



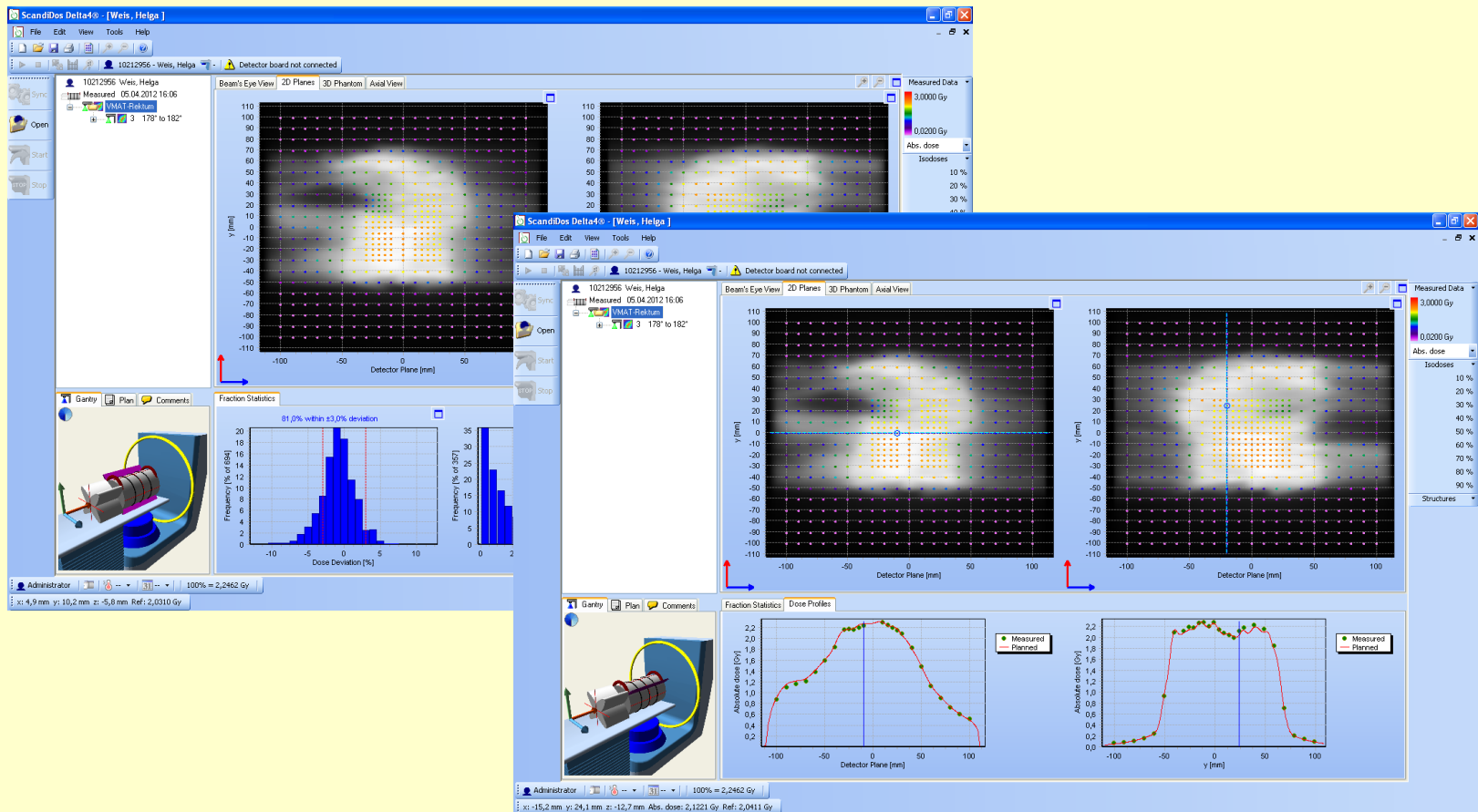
pretreatment verification

- Oesophagus-VMAT
 - results



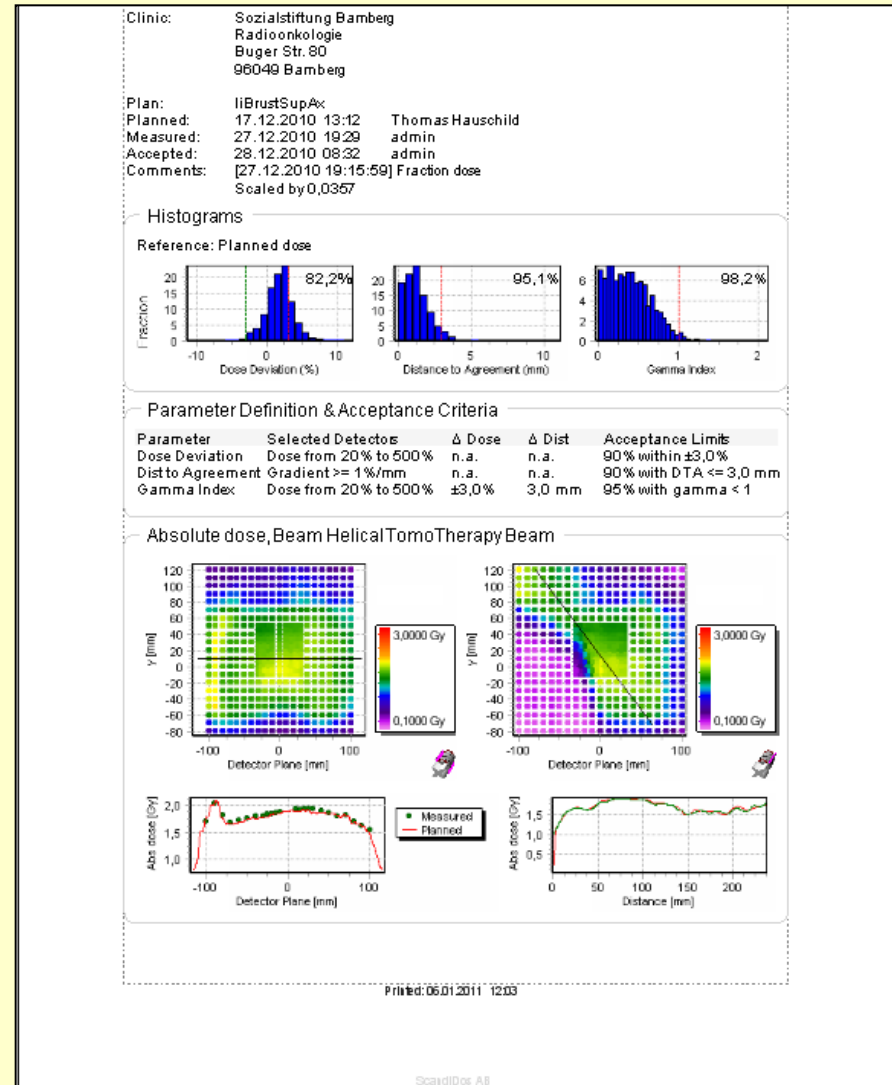
pretreatment verification

- Rektum-VMAT
 - results



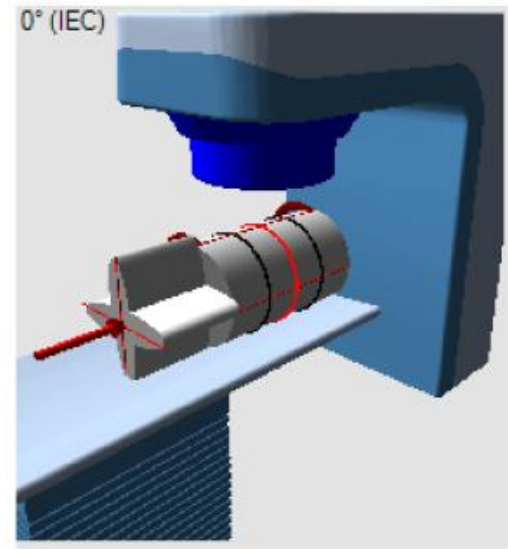
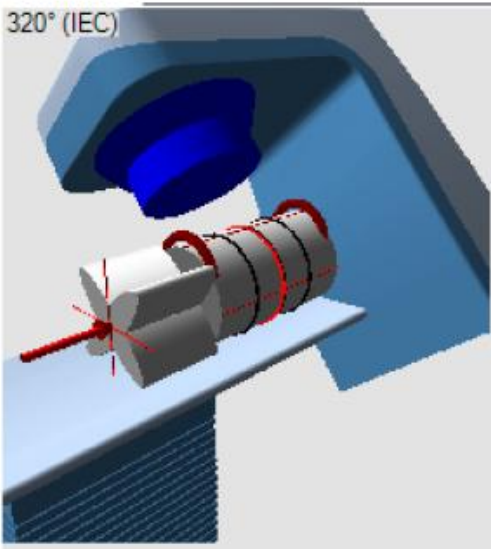
pretreatment verification

- documentation
 - pdf-print document
 - adapt to the patient folder (MOSAIQ)



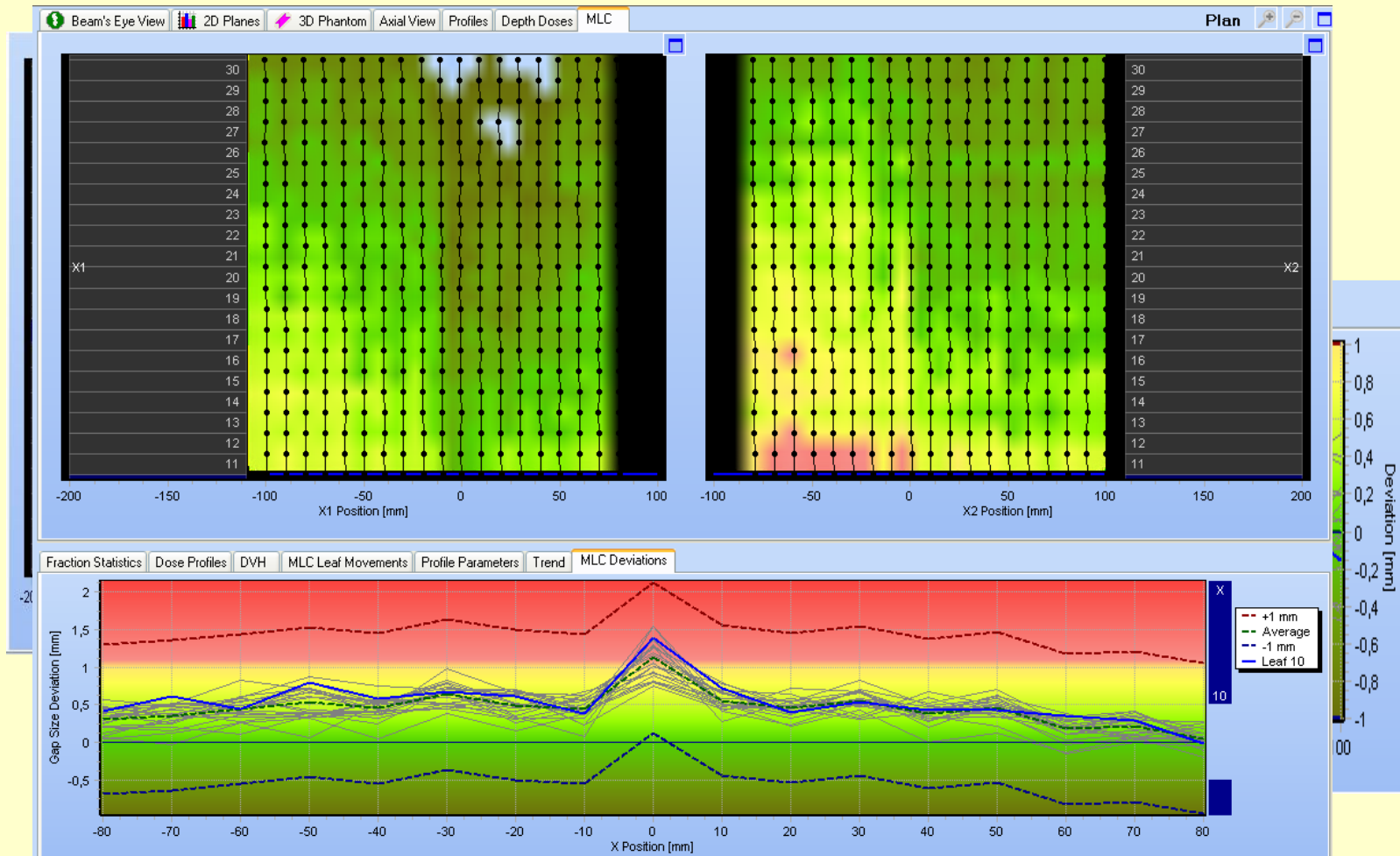
Maschinen-QA

- Beam constancy and MLC Performance
 - at various gantry angles



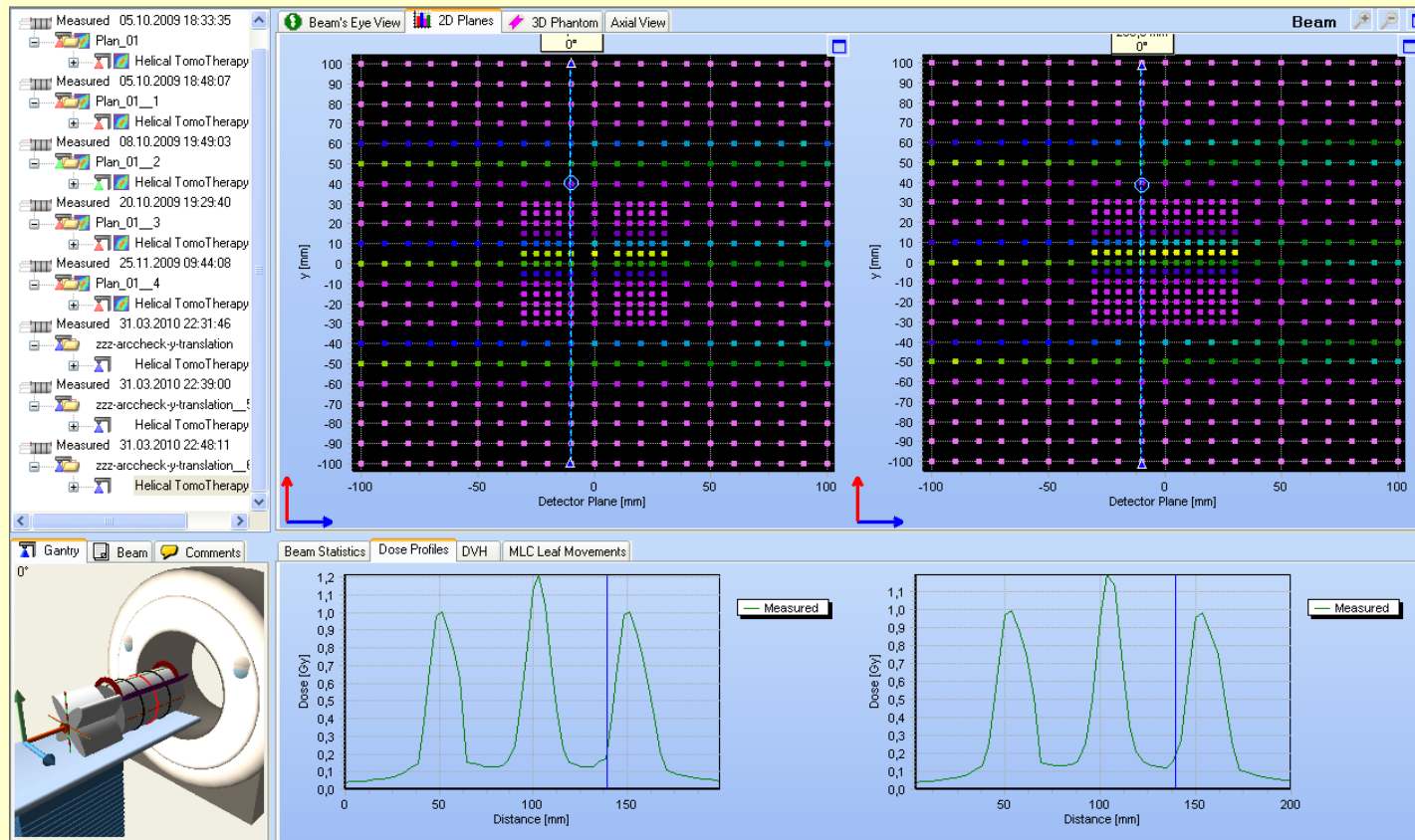
Maschinen-QA

- Picket fence



Maschinen-QA

- Tischvorschub an Tomo



by Thomas Hauschild

conclusion

- Easy to perform DQA-plans
- Phantom positioning on the treatment table in a few minutes
- Correction of machine performance with calibration plan is recommended (Tomotherapy)
- Position of dose distribution at phantom - regional centered dose distributions
- Spatial resolution - possibility of merging two plans
- Handling - manual fine tuning
- Results
 - Delta⁴ - over 93% of measurements in 2010 with more than 95% of measuring points with Gamma Index 3%/3mm (over 500 measurements) (over 99% of measurements in the last 4 month)
- fast, precise and stable method to verify a three-dimensional (3D) dose distribution - in consideration of the number of measurements a cost efficiency DQA method





Thank you for your attention!

