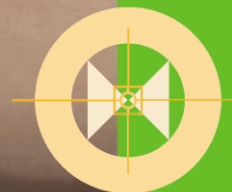




UROK 2007

**Antalya,
15 Nov. 2007**

**Axel Schiemann
Area Sales Manager RT**

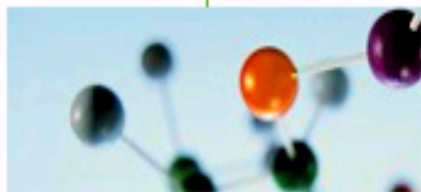


We protect, enhance and save lives

Who are we ?



Healthcare |



Molecular |

- ▶ Radiopharmaceuticals
- ▶ Research Radioisotopes & Radiochemicals
- ▶ FDG
- ▶ Molecular Technology

Advanced RadioTherapy |

- ▶ Particle Therapy
- ▶ MM50
- ▶ Image Guidance

Dosimetry

- ▶ Radiotherapy
- ▶ Diagnostics

Industrial |



E-Beam & X-Ray Irradiation |

- ▶ Sterilization
- ▶ Polymer Enhancement
- ▶ Other Applications



Scanditronix Wellhöfer => IBA Dosimetry

Scanditronix Wellhöfer is now IBA Dosimetry !

SCANDITRONIX

WELLHÖFER

Member of the IBA Group

For more information visit www.iba-dosimetry.com !

**From Pre- treatment
(IMRT) - Verification
To On-Line
Adaptive Radiotherapy**



ONE company meets all RT Dosimetry needs!

COMPASS

IMRT

**Linac &
MLC QA**

**Relative
Dosimetry**



**InVivo
Dosimetry**

**Absolute
Dosimetry**

VISICOIL



StarTrack* for Machine / routine QA

A star is born

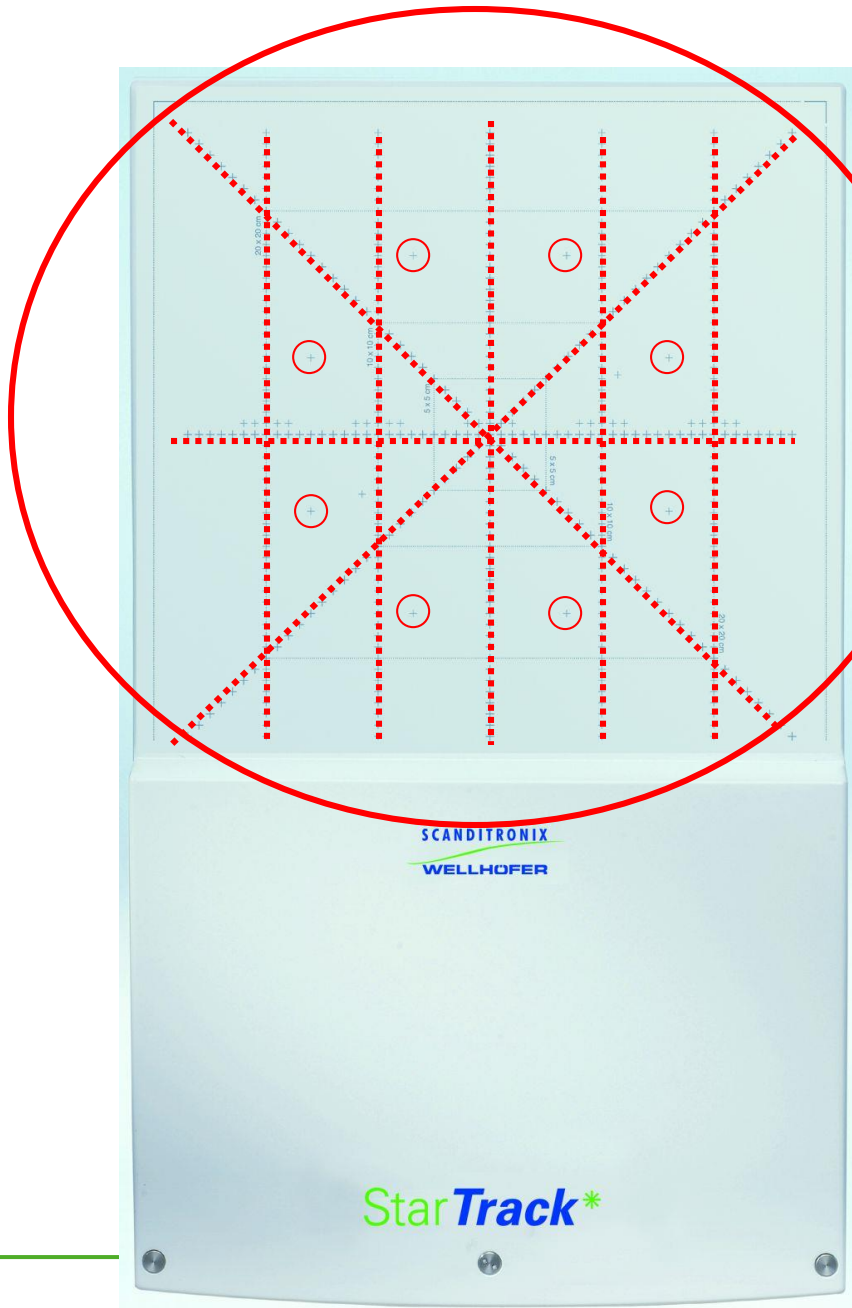


- Daily QA
- Weekly QA
- Monthly QA
- Output factor for photon and electron beams
- Energy constancy check
- Wedge Check
- MLC Check
- Symmetry, flatness for primary and diagonal axis
- Field size & penumbra

StarTrack*

□ The most accurate QA solution

- Air-vented pixel Ionization chambers
- Main axis and diagonals
- Additional rows for MLC QA
- Discrete chambers and 2 build up plates (ph,e) for energy constancy check

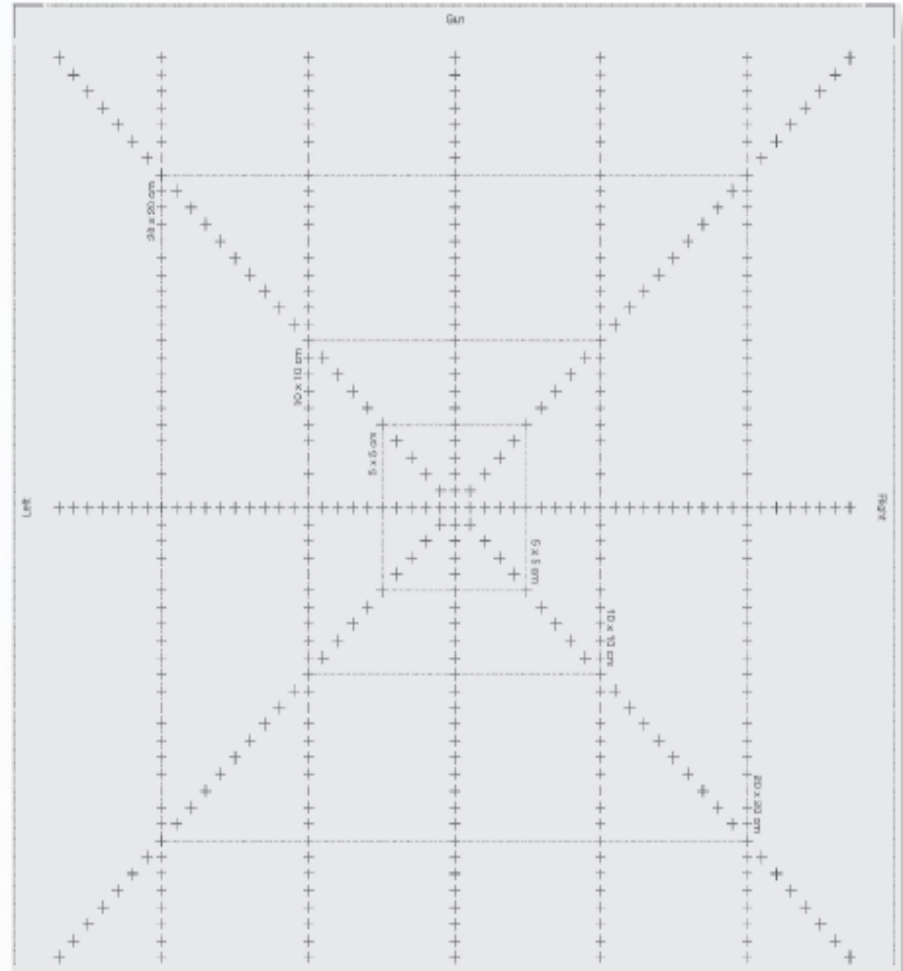


The universal QA solution !

StarTrack* - a real Star

■ Technical specification

- 453 plane parallel ion chambers
- Air vented
- Automated k(t,p) correction
- 5 mm spacing
- Advanced interpolation:
Fermi-Fit grid < 1mm
- Parallel read-out of all channels
- 10ms read out



□ Truly universal

- Predefinition of setup & queues
- Trend analysis / point over time
- 'Fast Track' measurement mode
- LinAc startup behaviour
- MLC and wedge check
- Energy check for electrons and photons
- Light field – radiation field congruence

OmniPro™ - Advance

Truly universal

Predefinition of setup & queues

The screenshot displays the OmniPro-Advance software interface. The main window is titled "OmniPro-Advance" and features a menu bar (File, Database, Options, Equipment, Help) and a toolbar. The left sidebar contains icons for "Index", "Setup", "Measurement & Analysis", "Data Archive", and "FactTrack".

The central area shows a test setup configuration for "Test: cusum test measurement rowstack for clinic test clinic and radiation device Linac 1". It includes a table with columns: Selection, Energy, Field Size, SSD, Setup, Gantry Angle, and Collimator Angle. The table lists various test parameters and their status (Failed, Not performed, Archived).

Below the setup table, there are tabs for "Parameters", "Results", and "Data". The "Results" tab is active, displaying a table with columns: Test, Reference, Tolerance, Result, and Status. The table is divided into two sections: "Profile: In-line" and "Profile: Crossline".

Profile: In-line Results:

Test	Reference	Tolerance	Result	Status
FieldWidth	3.39 cm	± 2 cm	4.01 cm	Failed
Center	0.23 cm	± 2 cm	0.22 cm	Passed
PenumbraLeft	0.31 cm	± 2 cm	0.29 cm	Passed
PenumbraRight	0.31 cm	± 2 cm	0.3 cm	Passed
Flatness	0.82 %	± 2 %	0.526 %	Passed
Symmetry	0.46 %	± 2 %	0.321 %	Passed

Profile: Crossline Results:

Test	Reference	Tolerance	Result	Status
FieldWidth	0.40 cm	± 2 cm	4.51 cm	Failed
Center	0 cm	± 2 cm	0 cm	Passed
PenumbraLeft	0.31 cm	± 2 cm	0.3 cm	Passed
PenumbraRight	0.3 cm	± 2 cm	0.29 cm	Passed
Flatness	0.82 %	± 2 %	0.66 %	Passed
Symmetry	0.73 %	± 2 %	0.38 %	Passed

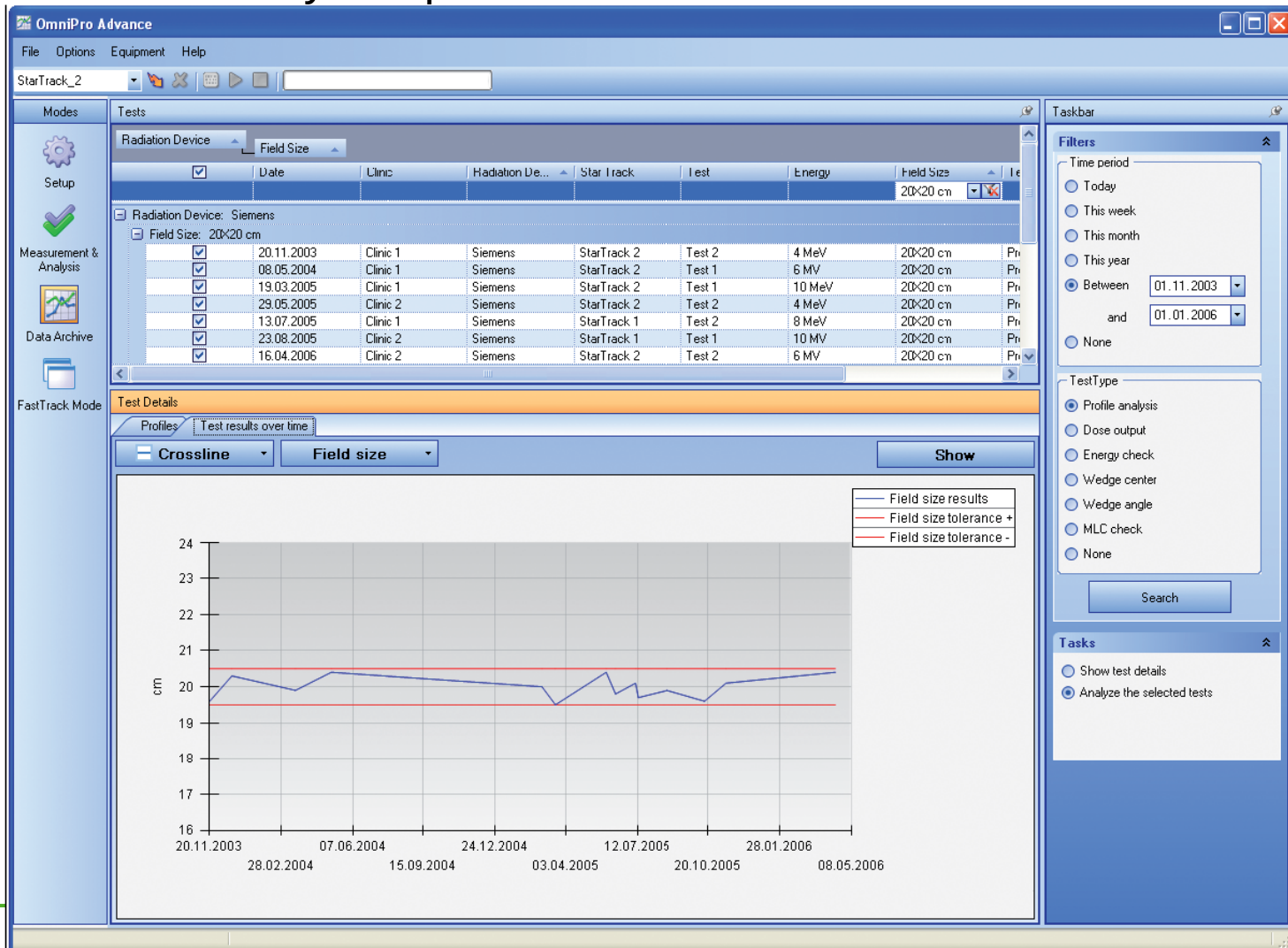
The right sidebar contains a "Tasks" section with buttons for "Archive the selected tests", "Archive all the performed tests", "Print the current test", "Print the test queue", and "Freeze the test status". Below this is a "Measurement info" section with the instruction: "1. Configure your Linac according with the setup and measure the open field".

The Windows taskbar at the bottom shows the Start button, several open applications (Compass, latest dosmet y..., Products 2007.ppt, Compass_press..., OmniPro-Advance, StarTrack127.C...), and the system clock (12:24).

OmniPro™ - Advance

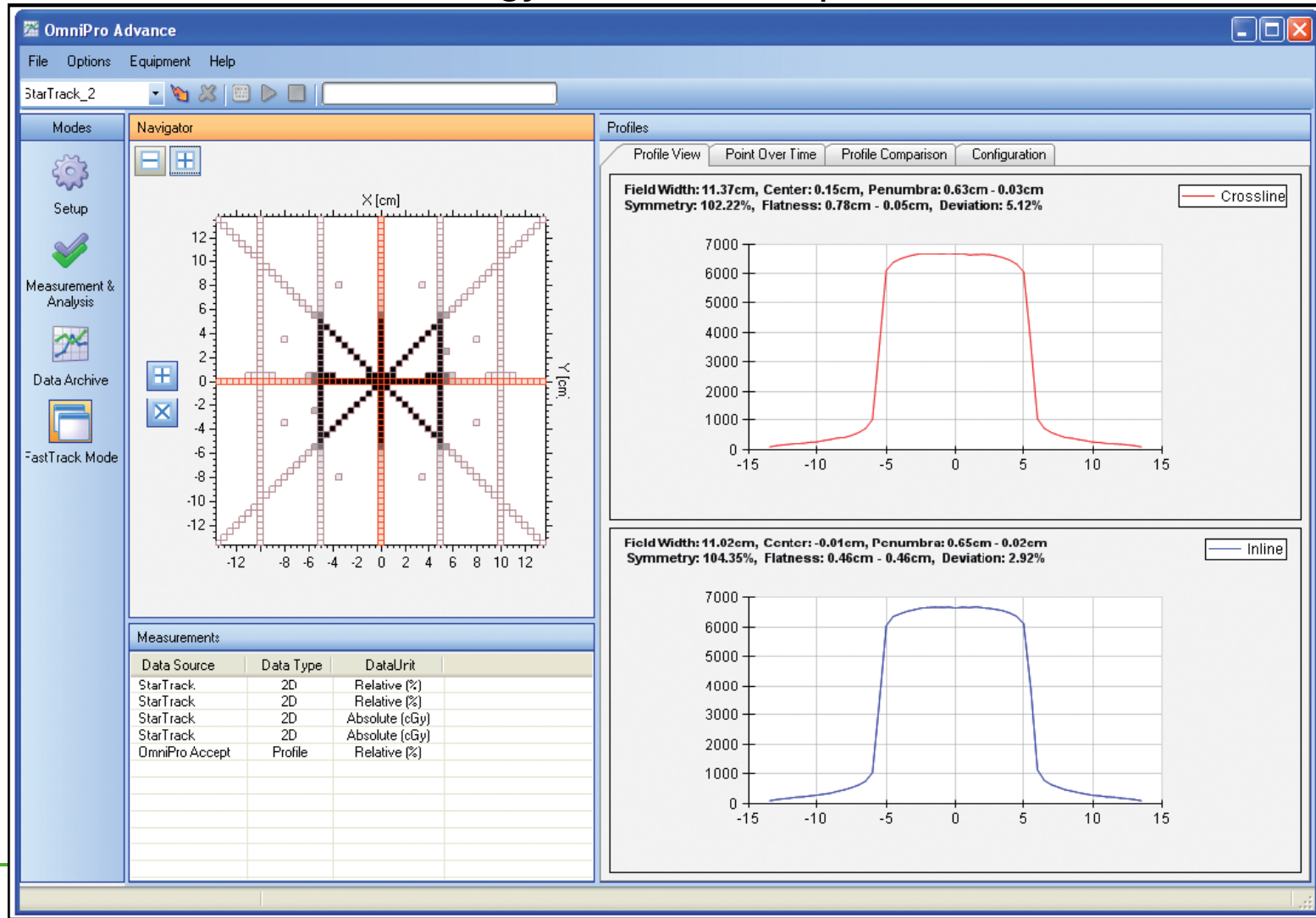
Truly universal

Trend analysis / point over time



OmniPro™ - Advance

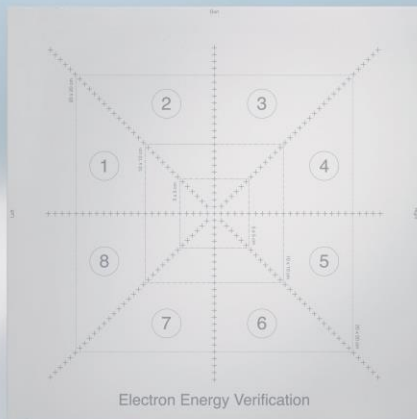
- Analyses of symmetry/ flatness & Penumbra
- Field width & Energy and dose output



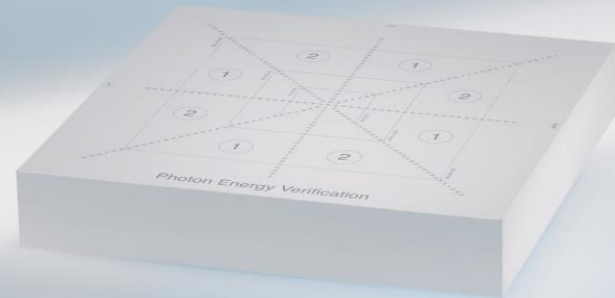
OmniPro™ - Advance

□ Truly universal

- MLC and wedge check
- Energy check for electrons and photons
- Light field – radiation field congruence



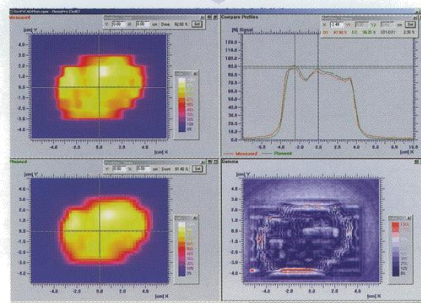
Energy verification
plate for electrons



Energy verification
plate for photons

IMRT Quality Assurance Solution

Data Import: TPS dose maps



I'mRT MatriXX

OmniPro™ I'mRT
I'mRT QA

- Real-time verification of the IMRT delivered vs calculated planar dose
- Verification of individual and integrated IMRT fields
- Advanced MLC QA
- Light vs radiation field congruence
- Linac start-up
- Real-time Linac QA
- Simultaneous inplane and crossplane beam profile adjustment

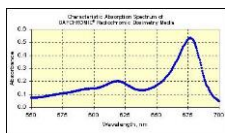
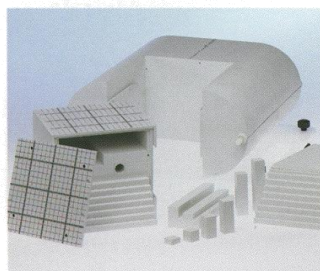
MatriXX



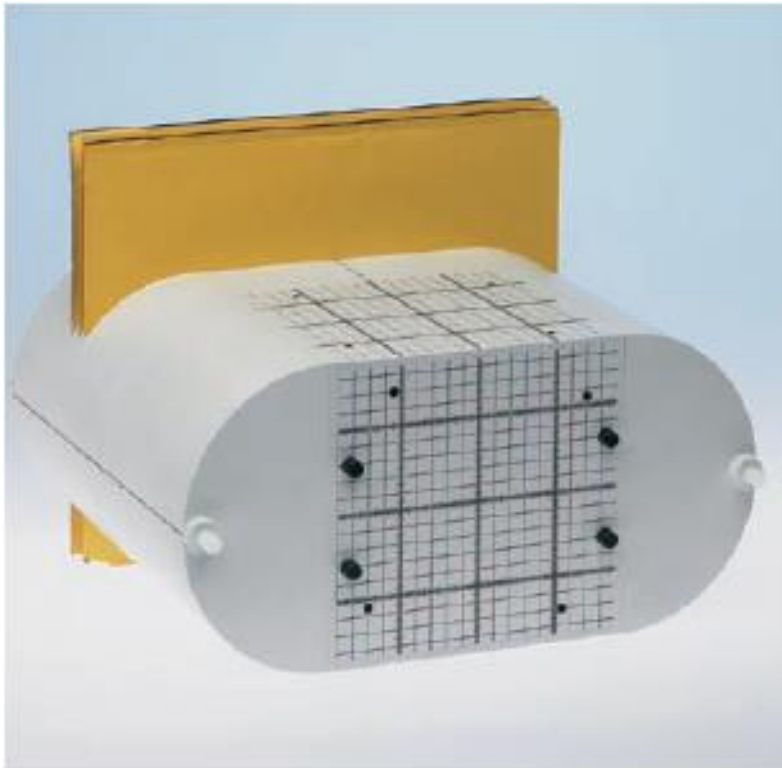
OmniPro™ I'mRT
I'mRT Phantom

- Film verification of delivered vs planned dose¹⁾
- Verification of the absolute dose²⁾
- Basic MLC QA
- Linac QA

I'mRT Phantom



Universal I'mRT Phantom



I'mRT MatriXX

„The new standard in 2D IMRT verification !“



I'mRT MatriXX

„The new standard in 2D IMRT verification !“

1020 Pixel Ionization Chambers

Sensor type: Vented parallel plate ionization chambers

Chamber dimensions: 4.5 mm, height: 5 mm,

Volume: 0.08 ccm

1024 electrometer channels onboard

parallel read out, NO deadtime

- 20 ms minimum sampling time

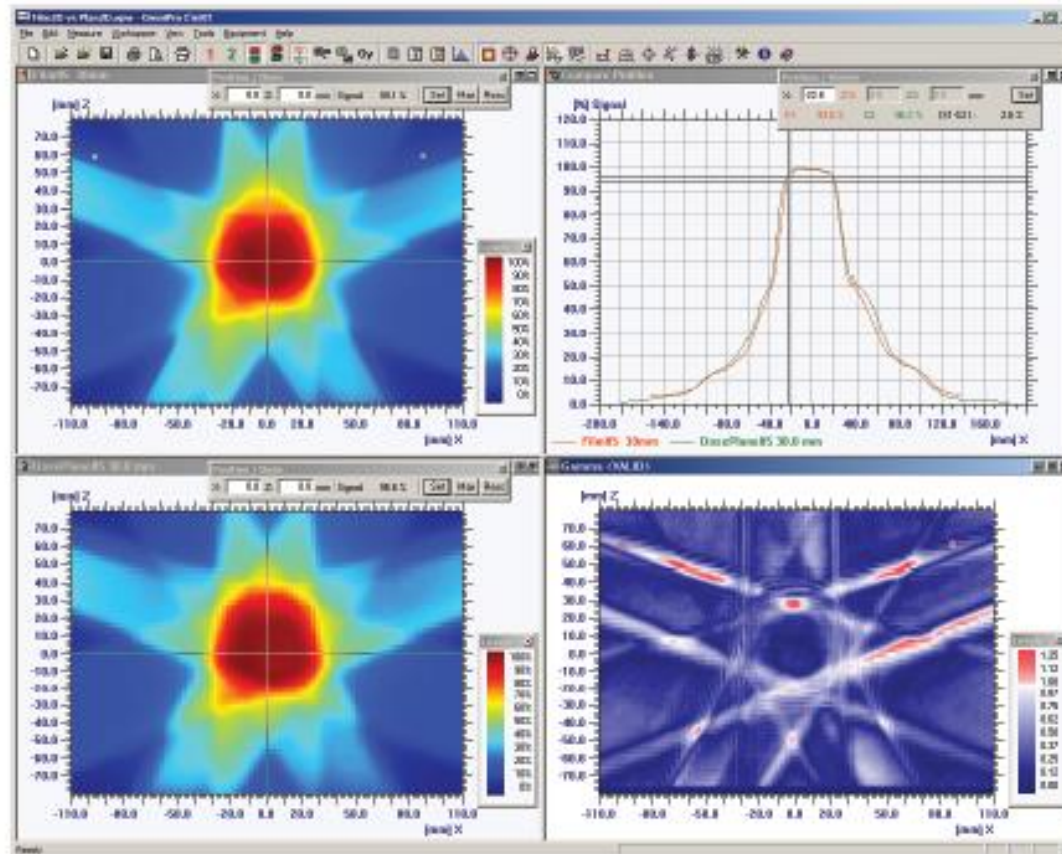
- Absorbed Dose & Dose rate
- Field Size 24.4 x 24.4 cm²
- Sensitivity 2.4 nC/Gy (Co60)



ALL integrated in: OmniPro-I'mRT

measured data

TPS data



visual comparison

1D profiles
2D isodoses

mathematical comparison

sum
difference
absolute difference
correlation
multiplication
Gamma method
discrete Gamma
division
DTA

Latest development for IMRT / IGRT verification

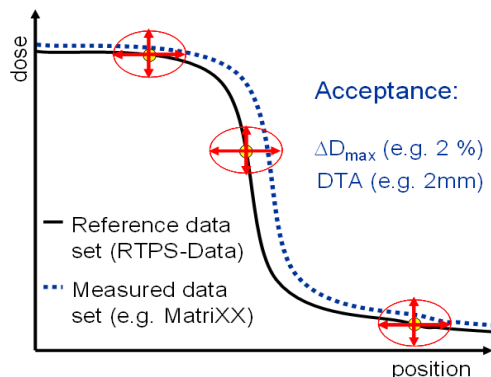
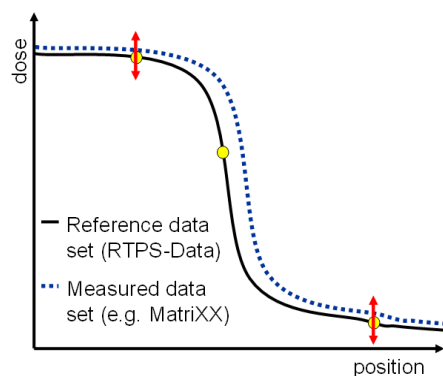
New !



Where do DOSE errors come from?

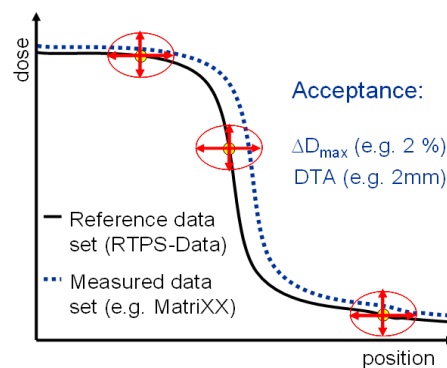
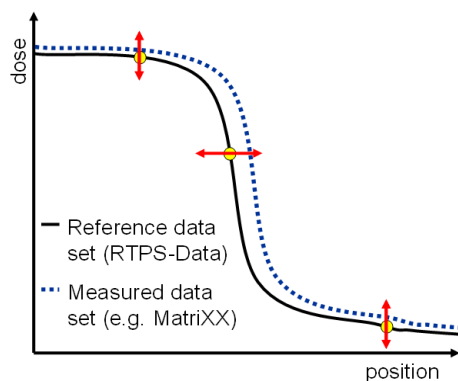
Discrepancies in the magnitude of delivered dose were attributed to a variety of conditions including the use of inappropriate data in treatment planning systems and collimator leaf positioning errors; both of which should have been detected through the institutions' quality assurance procedures.

Discrepancies due to the failure of institutions to correctly model the beam penumbra with a particular planning system reflected willingness of the institutions to accept the incorrect model, as the same planning system was apparently used at other institutions with acceptable results.



Where do DTA errors come from?

The data available for analysis of the irradiated phantoms yielded an insight into the accuracy of delivery of IMRT at a cross section of North American institutions. The large failure rate of approximately 1/3 of participating institutions suggests that IMRT is not practiced uniformly across the US. The number of failures in the distance-to-agreement-measurements could indicate positioning errors but can also demonstrate failures of other types, including collimator leaf positioning error, gantry position error, or monitor unit delivery error. Anecdotal reports from the physicists performing the irradiations at participating institutions suggest that positioning errors were not the exclusive cause of the DTA discrepancies.



Planning

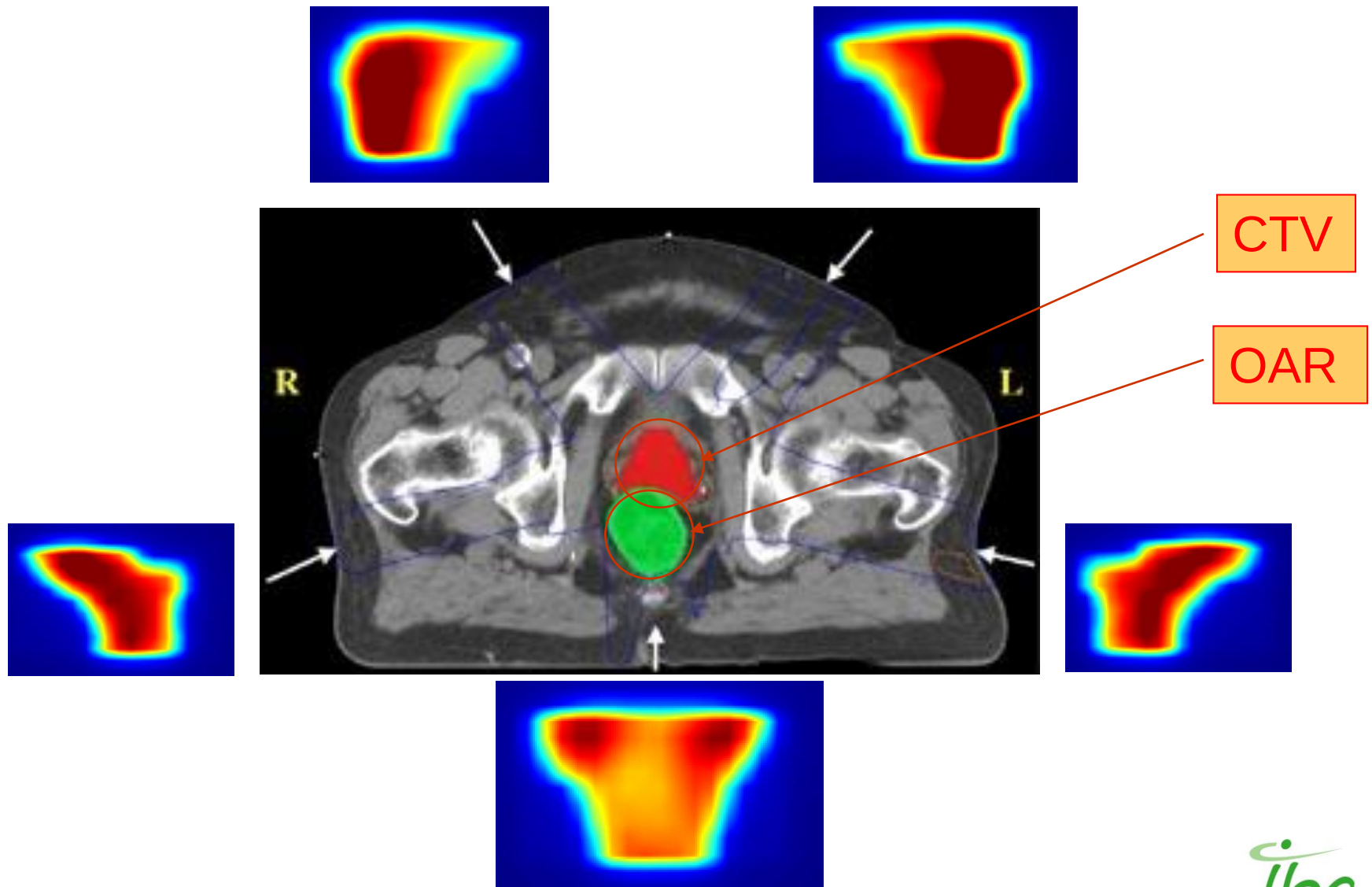


Take CT scan

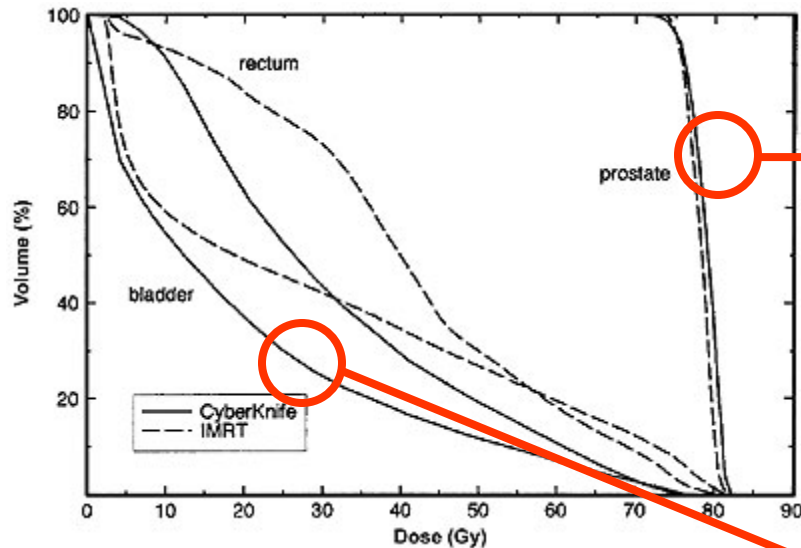


Make Planning

IMRT Plan (Prostate)



Dose-Volume Histograms



CTV (clinical target volume)

Flat, sharp high-dose fall-off (uniformity)

DVH shows percentage of organ volume exposed to a given dose

OAR (organ at risk)

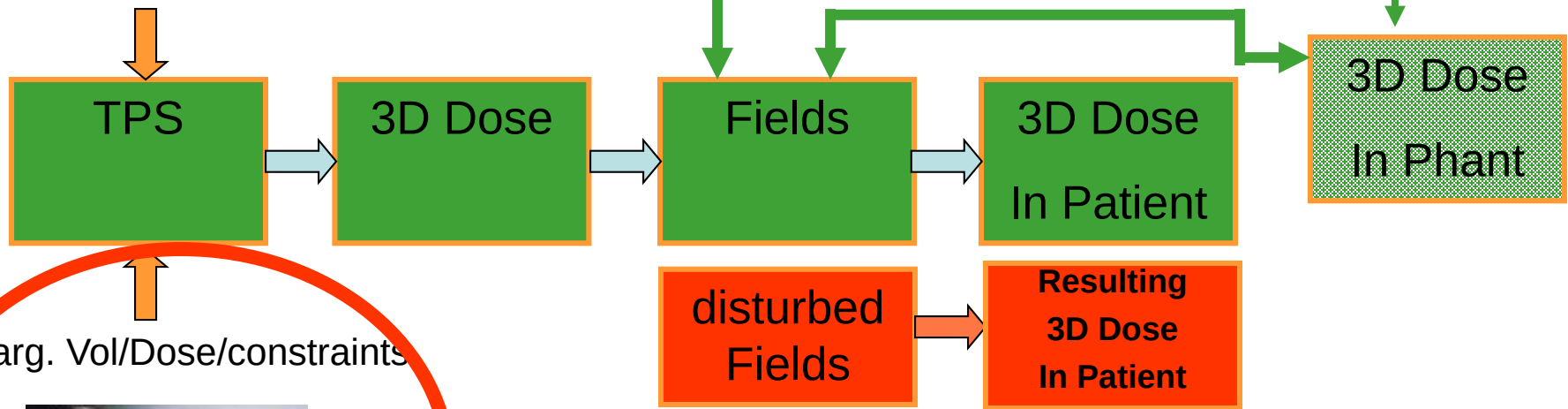
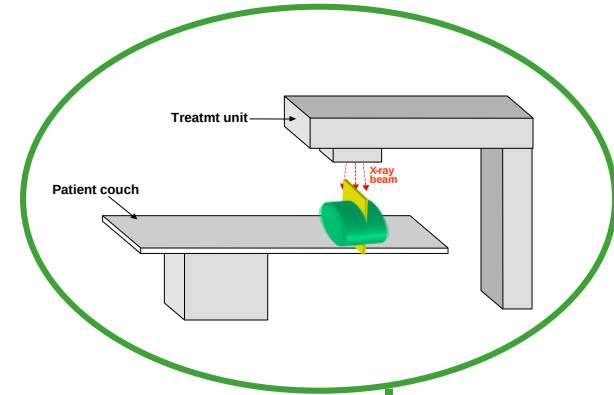
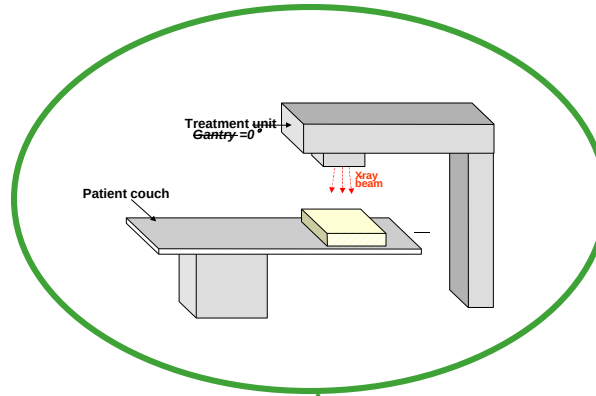
Small fraction with high dose (parallel organ), no HD (serial organ)

Patient Specific Verification – the whole story

- Prescription defines doses (DVHs) for Target Volume and OAR
- Have these goals been met ?



Patient-specific Verification ?



What is



?



Continuously **M**onitoring **P**atient **S**afety **S**ystem



What is



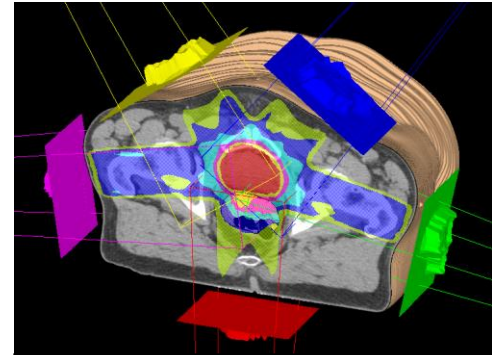
?



Transmission Detector

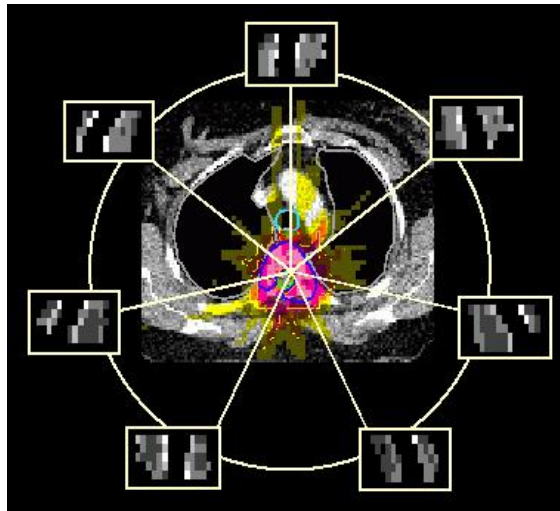
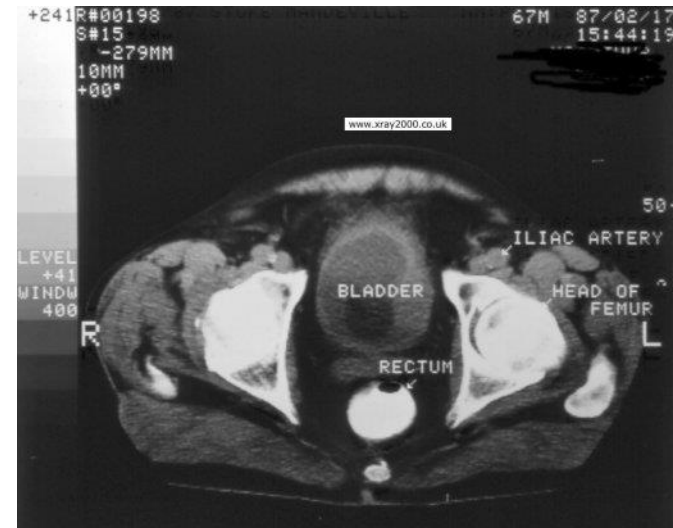
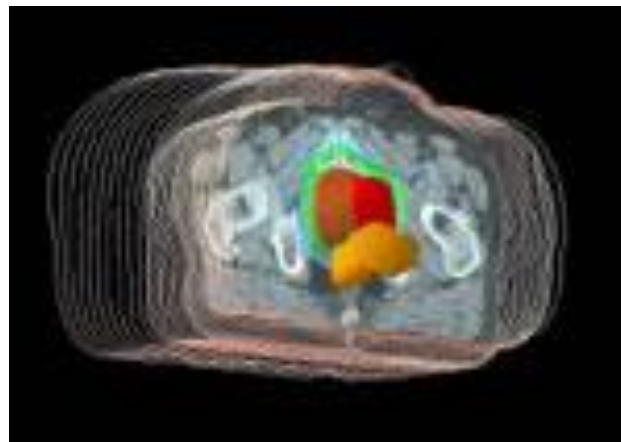


Beam model

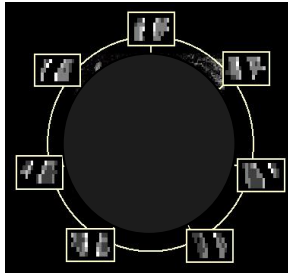


Dose engine

NOTE: all these elements are PART of COMPASS, not only the transmission detector

Take incoming **fluence**Take Patient **anatomy** CTReconstruct 3D Dose
distribution !

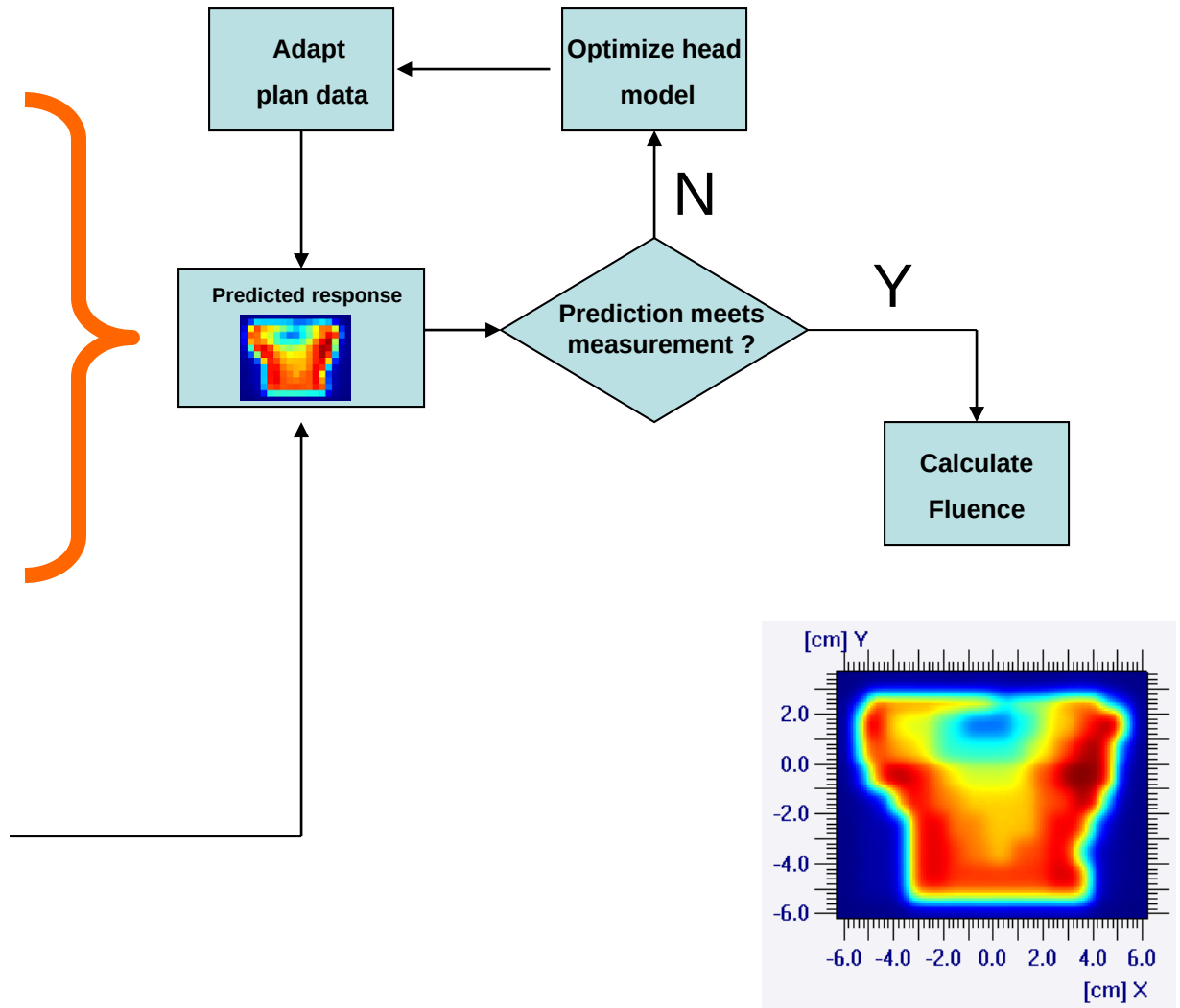
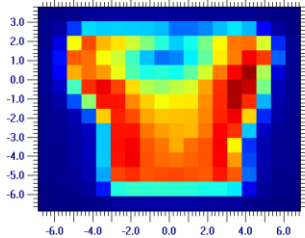
Plan data



Head Model



Measured Response



Compass Application: Patient 3D dosimetry

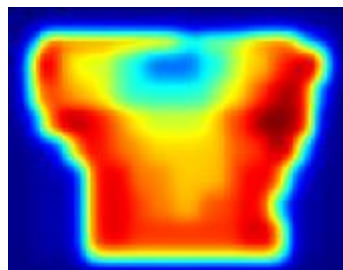
DICOM
plan



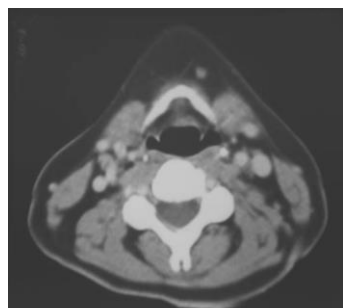
Beam model



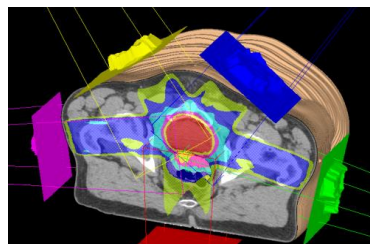
Transmission Detector



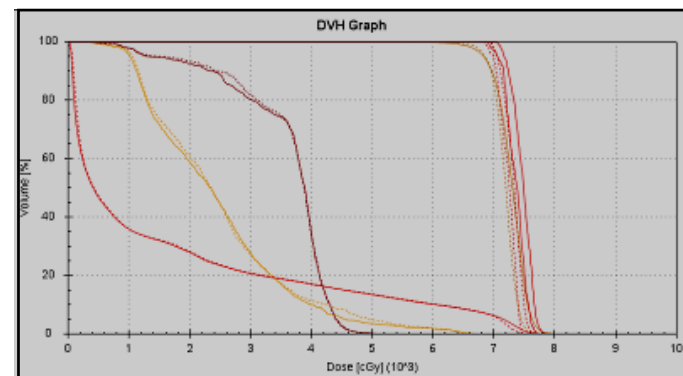
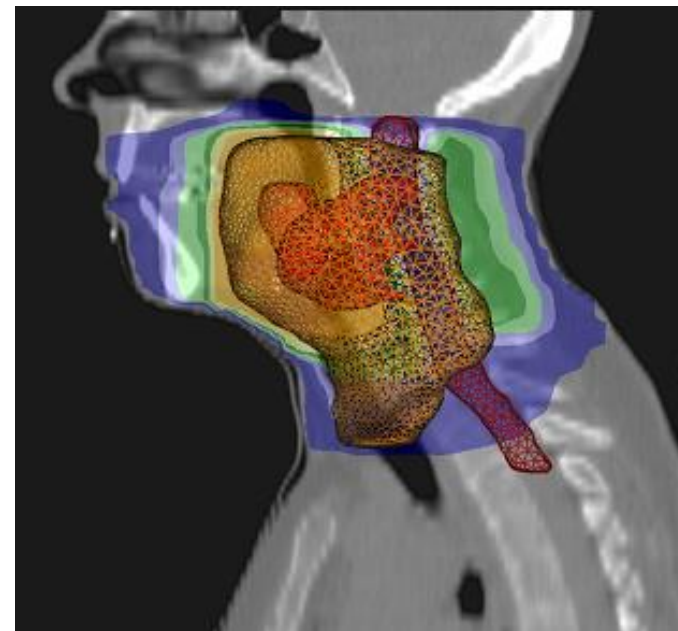
Real Fluence

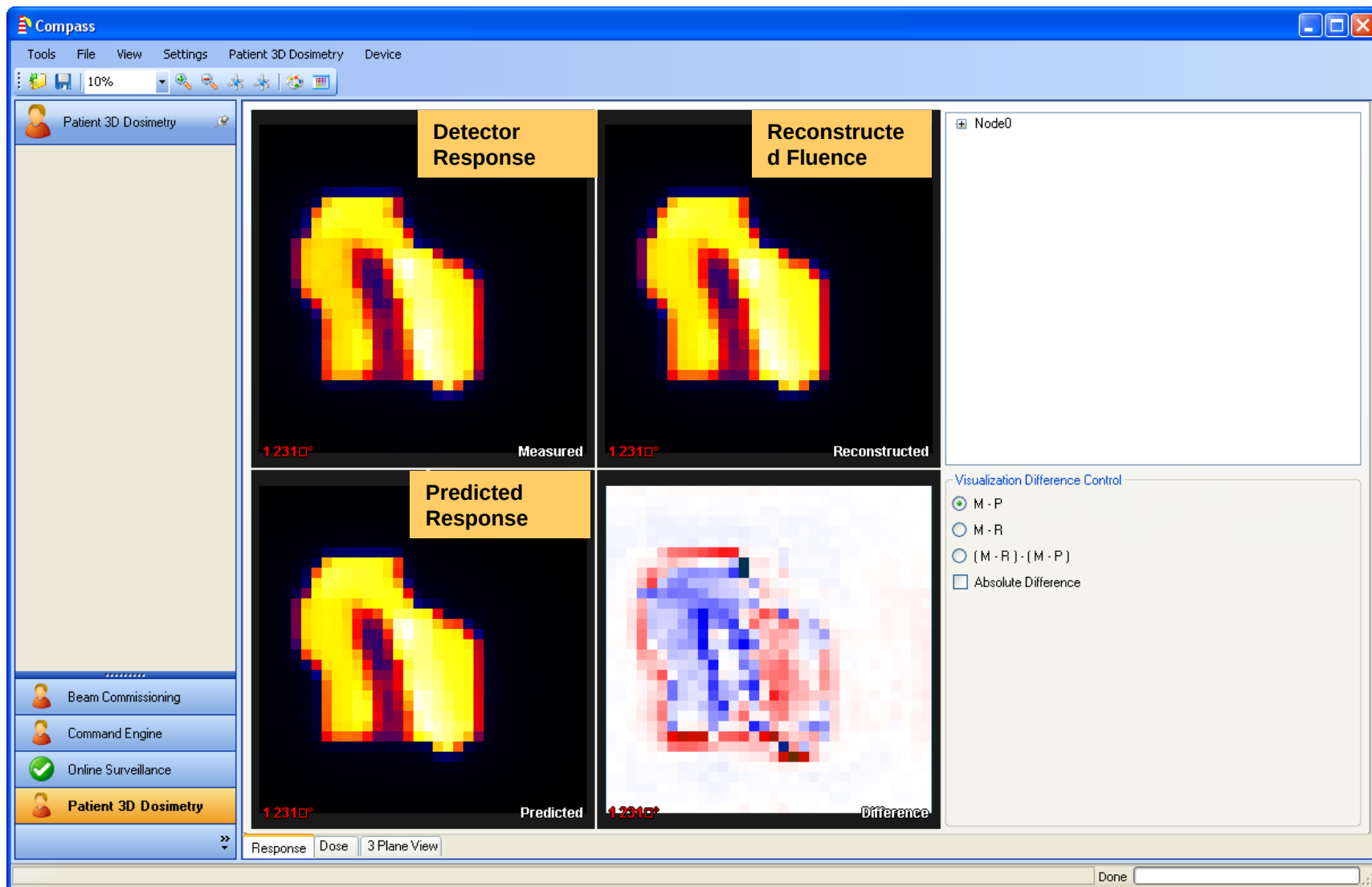


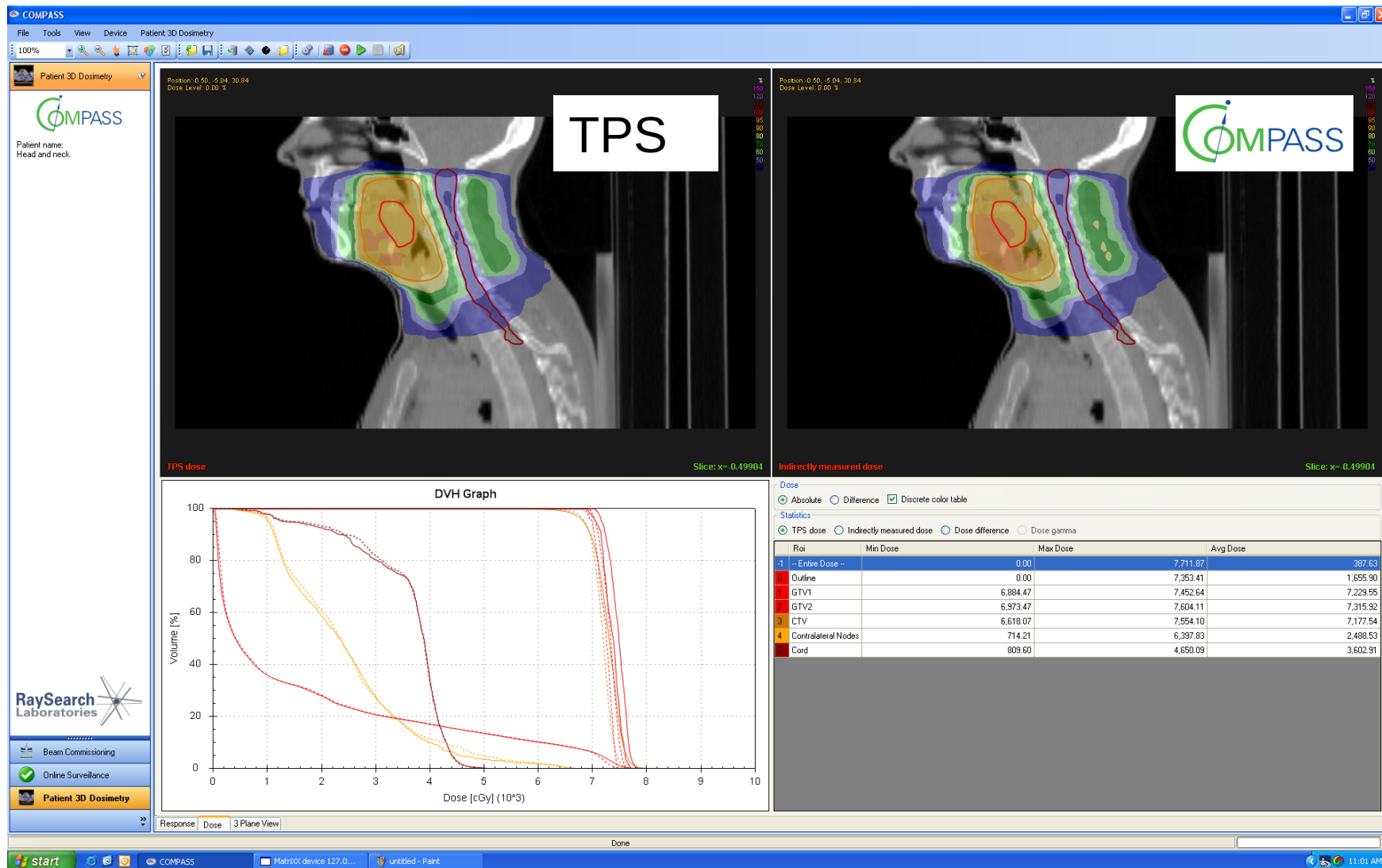
CT



Dose engine









Compass, Visicoil & IGRT / Adaptive Radiotherapy



COMPASS



Visicoil

Iba
Dosimetry



Iba



COntinuously **M**onitoring **PA**tient **S**afety **S**ystem



□ VISICOIL

- Implantable gold marker
- 99,8% purity
- Length 1to 6cm
- 0,35mmØ, 075mmØ, 1,1mmØ
dependent on imager (Kv, Mv, Sim, CT, MRI)
- No migration due to coil structure
- Only 2 markers needed instead of 3-4 spherical or seed type markers



Thank you...

