Tomotherapy: Lucca's experience in the management of metastases

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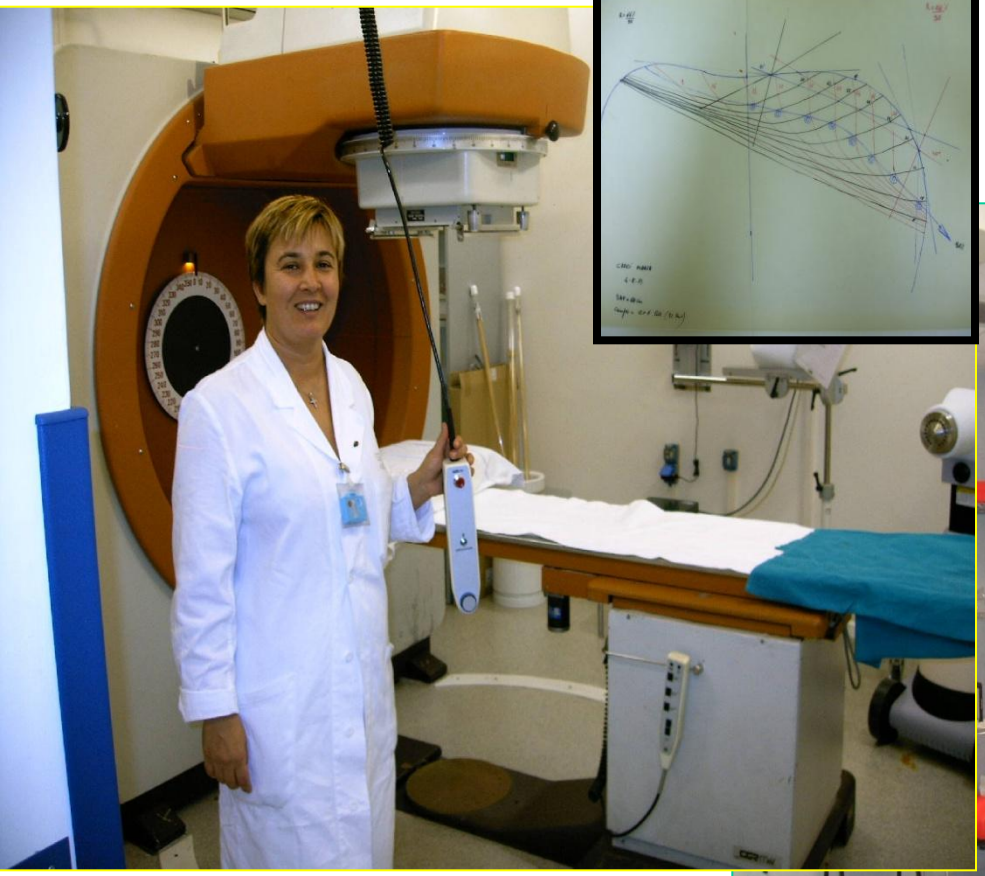
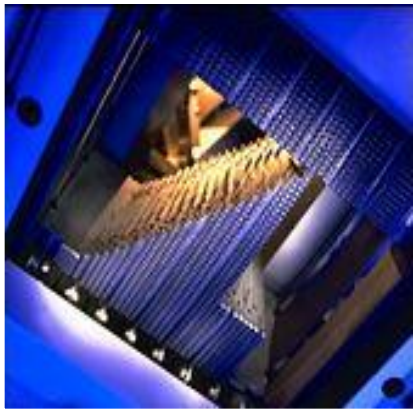
Lucca’s technological equipment





Patients selection for Tomotherapy (July 2010-October 2010)

Curative treatments (17 pts):

- HNC: 4 pts (1 reirradiation)
- Prostate cancer: 5 pts

- Thoracic neoplasms
  - thymus: 2pts
  - lung: 1pt
  - esophagus: 2pts

- Abdomen neoplasms
  - pancreas: 1pt
  - papilla di vater: 1 pt
  - cervico-vaginal local recurrence: 1pt

Palliative treatments (8 pts):

- Oligometastatic disease
  - Bone: 7pts
  - Lung: 1pt

Oligometastatic disease
(up to five localizations)

Physician focus on:

- Suitable patient

- Tumor shape
- Tumor site toward OAR

- Fractionation scheme
- PTV margin

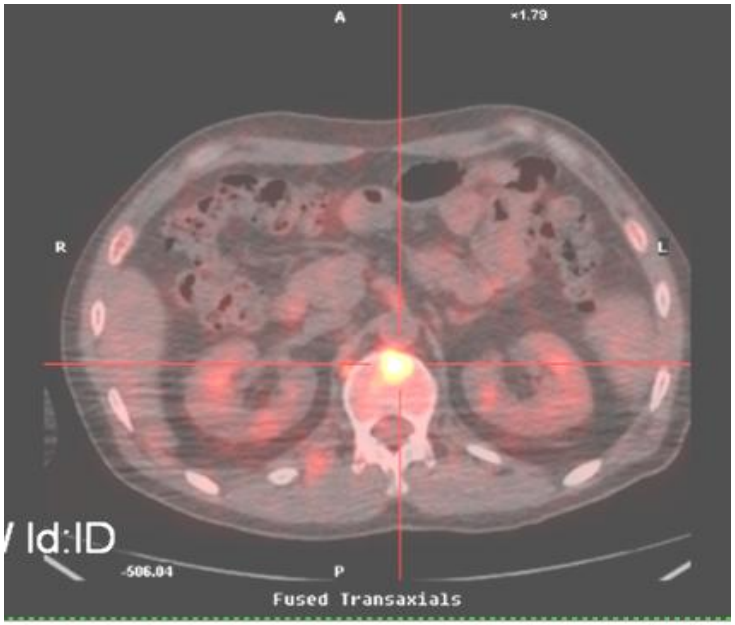
Tomotherapy answers:

- Treatment time

- Dose distribution highly conformed with steep dose gradient

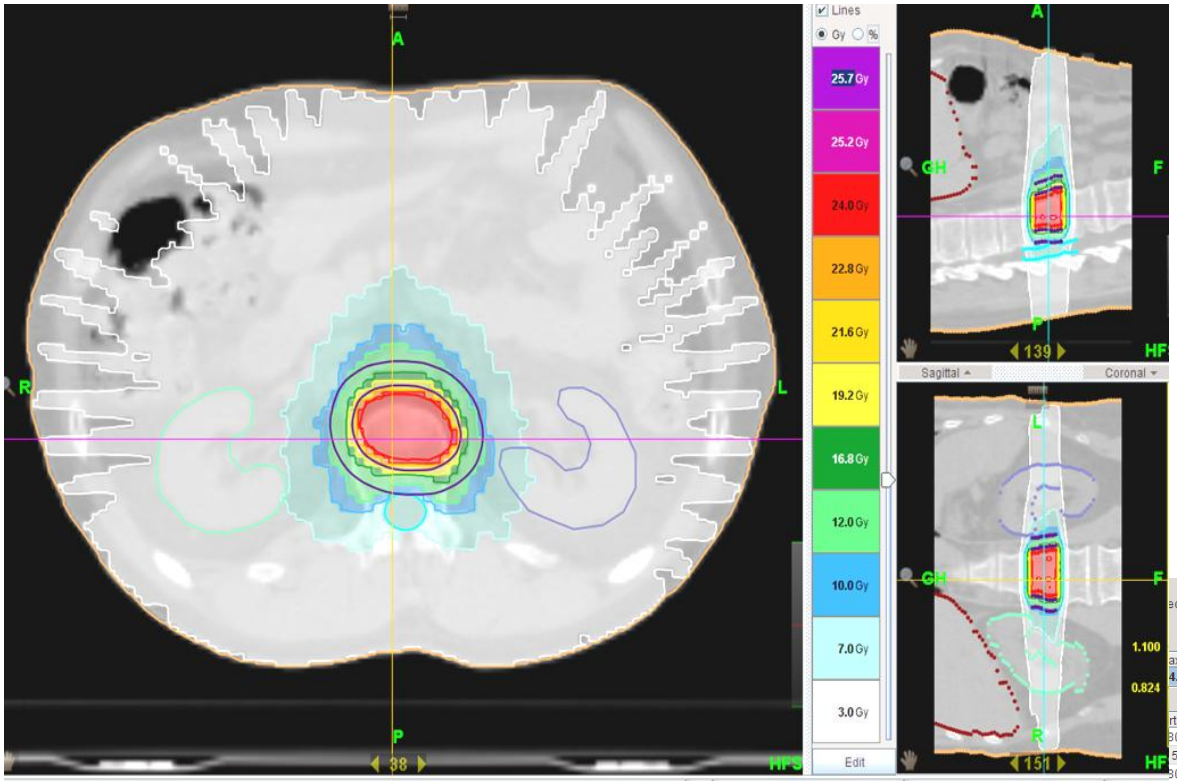
Preliminary study for bone metastases hypofractionation

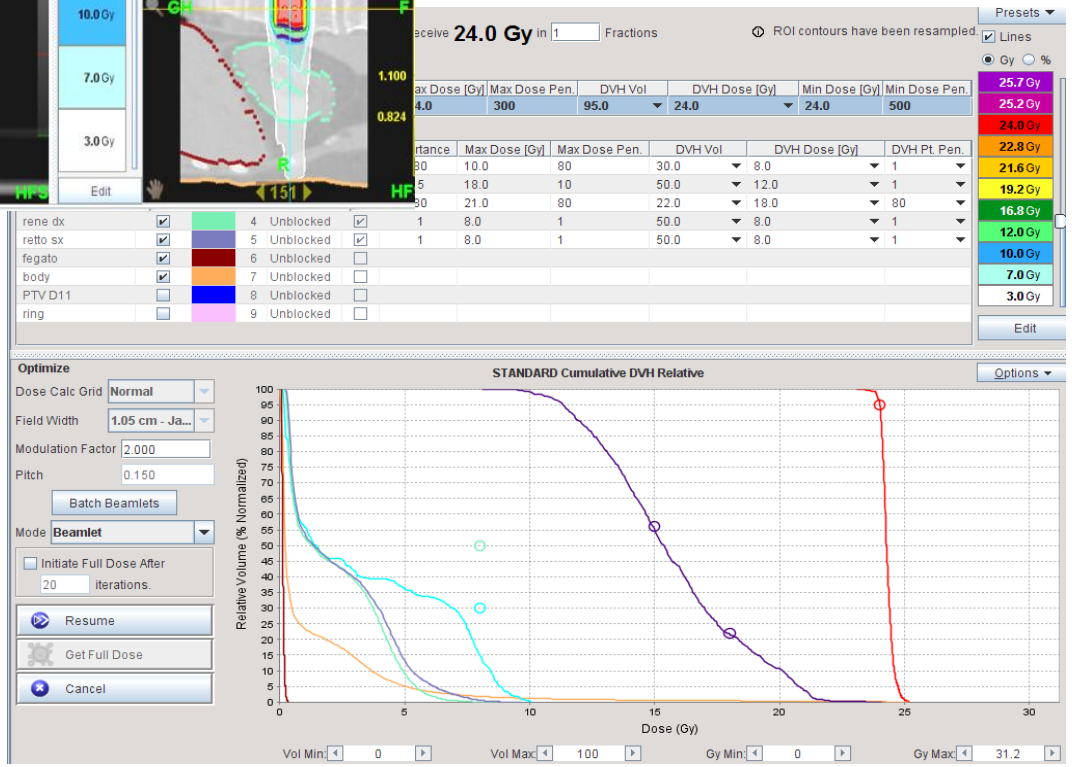
- Male 61yrs
- Primary prostate cancer
- Painful bone metastases



- 24Gy single fraction
- 20Gy single fraction
- 10Gy x 3 fr DT 30Gy

24Gy Single fraction

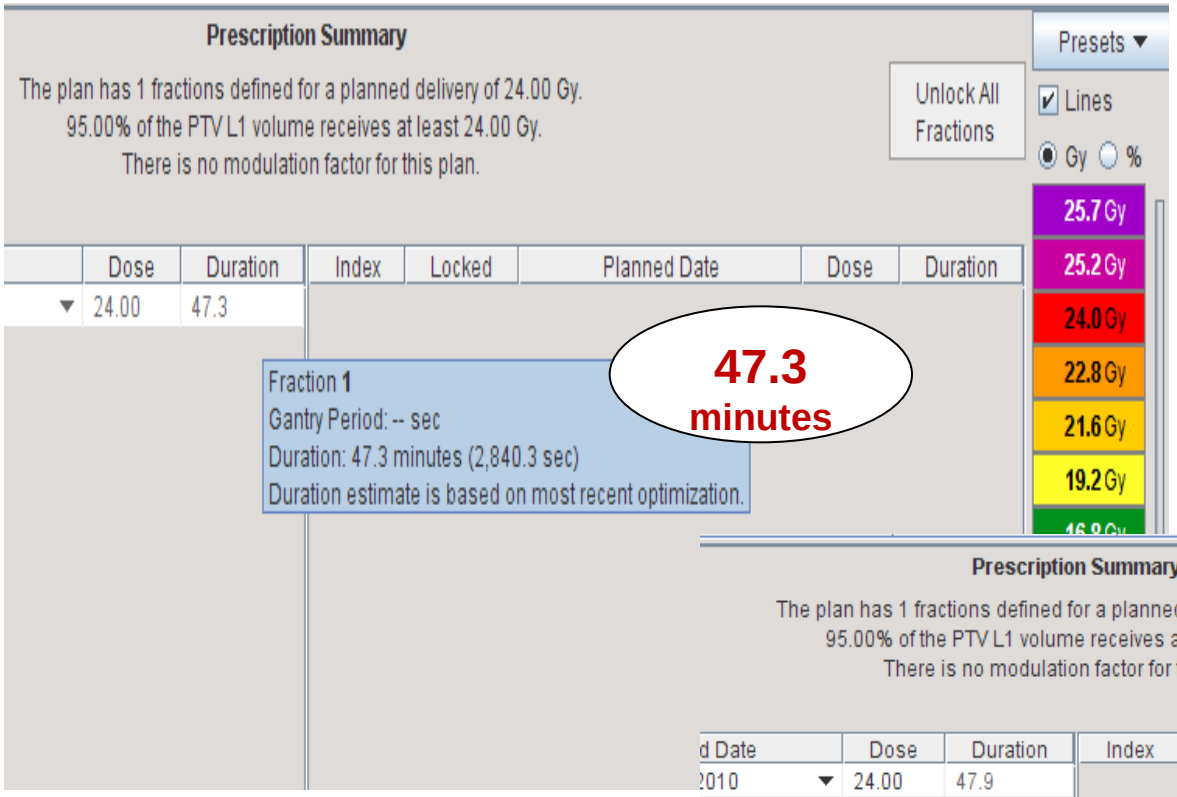


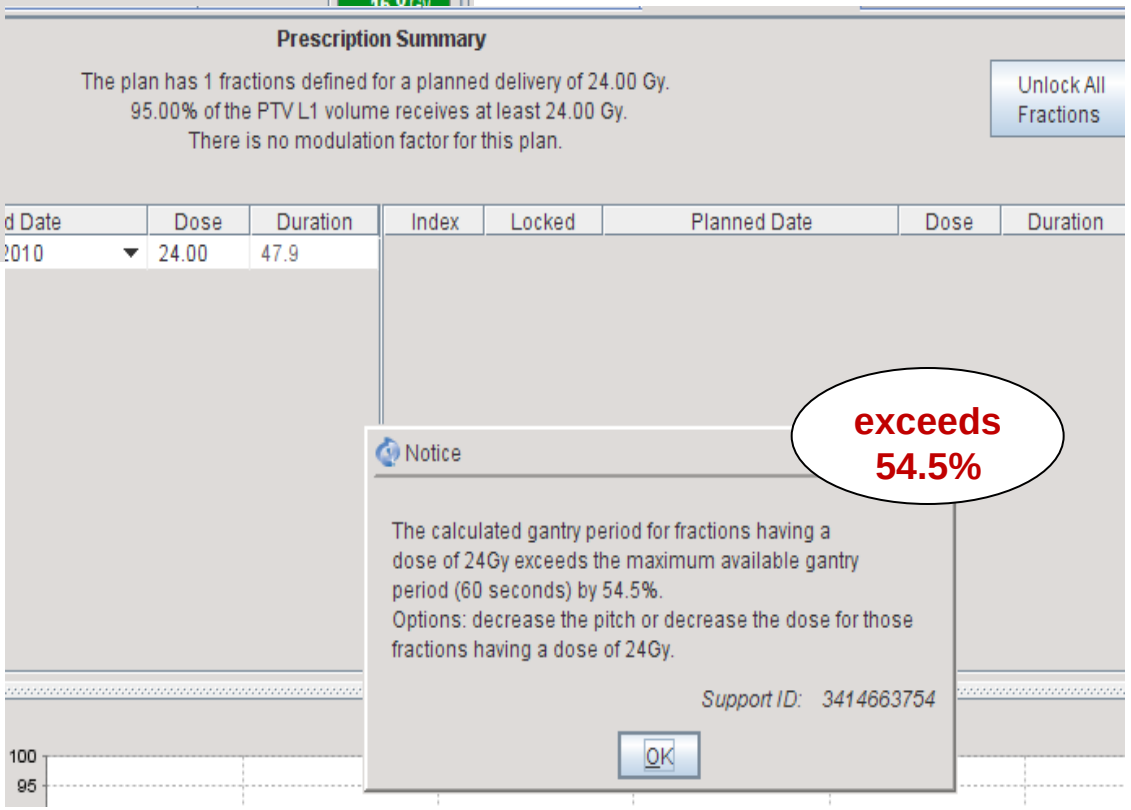


- Modulation factor ↑↑
- Field width 1 cm
- Pitch ↓↓

Highly conformed dose distribution even for:
Small target
Extremely irregular shape

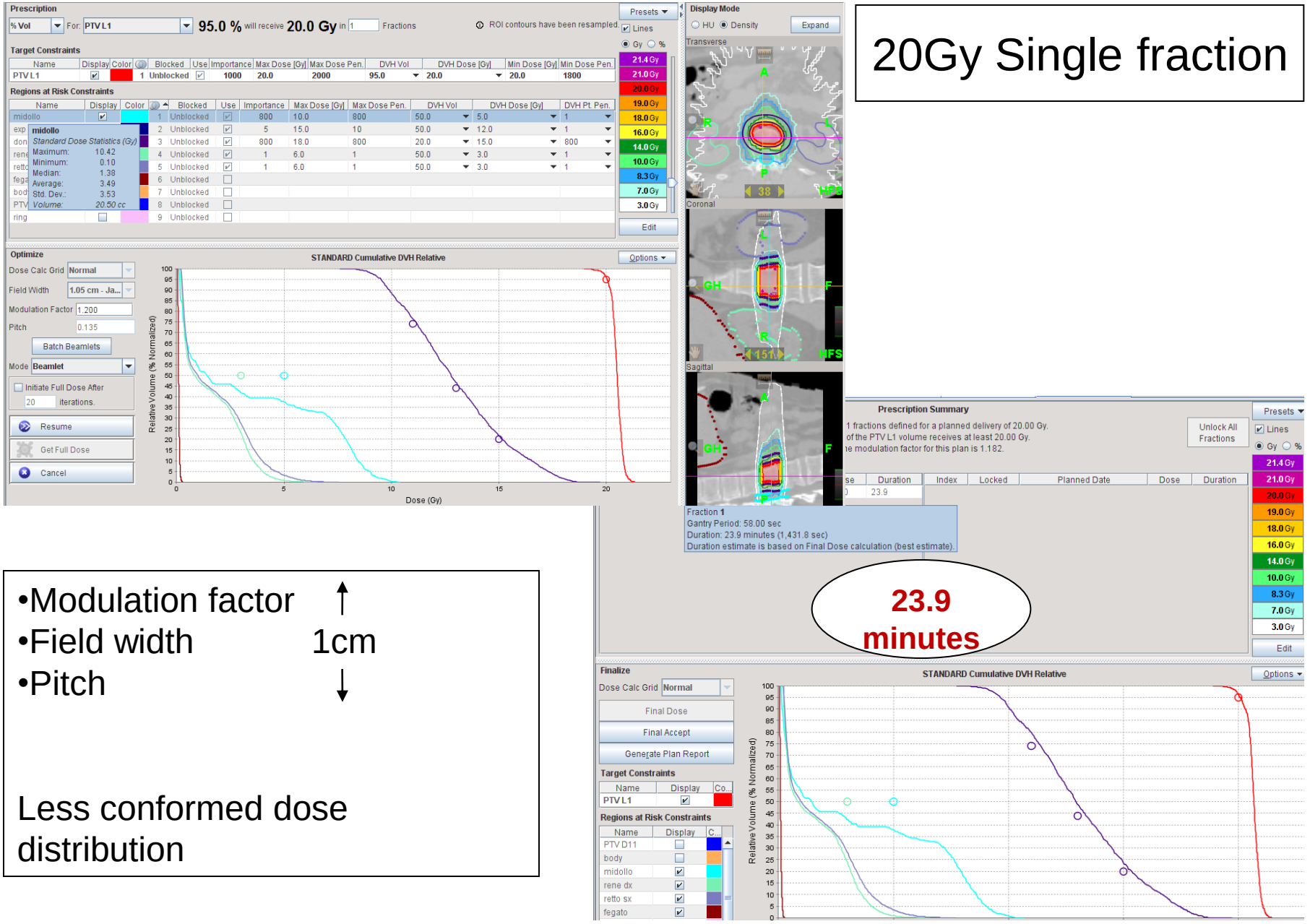
24Gy Single fraction





Slowly Gantry rotation is not enough to deliver high dose to irregular target keeping steep dose fall-off

20Gy Single fraction



- Modulation factor ↑
- Field width 1cm
- Pitch ↓

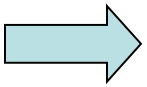
Less conformed dose distribution

Choose fractionation

- High dose per fraction

  besides 24Gy

  not achievable

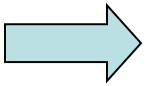


- technical Tomotherapy limits (table movement, gantry rotation time)
- coarse planning parameters (MF, FW, Pitch) reduce treatment quality

- Maximum dose per

  fraction achievable:

  16-18Gy



- compromise between ability to paint the dose around target and Tomotherapy mechanism

Lucca experience on metastases treated with Tomotherapy

July 2010-October 2010

Margins applied to GTV:

- Thorax: 6mm in each direction but 10mm CC
- Pelvis or abdomen: 6mm isotropic expansion
- Bone: 4mm isotropic expansion
- Head & neck: 3mm “isotropic” espansion

Adequate immobilization devices:

- Abdomen compression
- Vacuum cushions
- thermoplastic mask, shoulder fixator

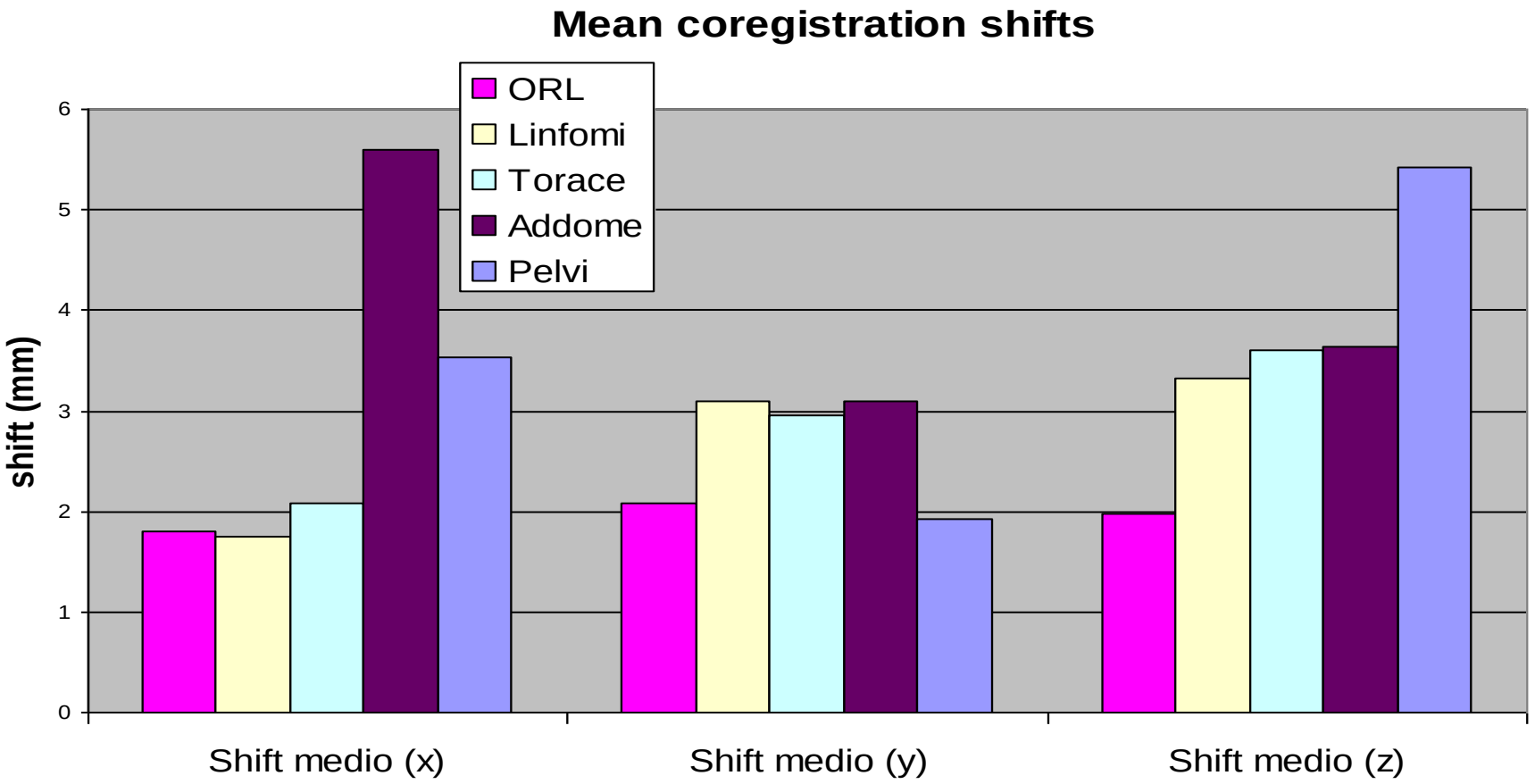
Fractionation schemes:

- Thorax 5Gy x 6 DT 30Gy: 1pt
- Bones 3Gy x 10 DT 30Gy: 2pts
  4Gy x 5 DT 20Gy: 1pt
  8Gy single fraction: 1pt
  10Gy x 3 DT 30Gy: 3pts

Mean coregistration shifts (mm): **Mean Roll correction 0.4˚**

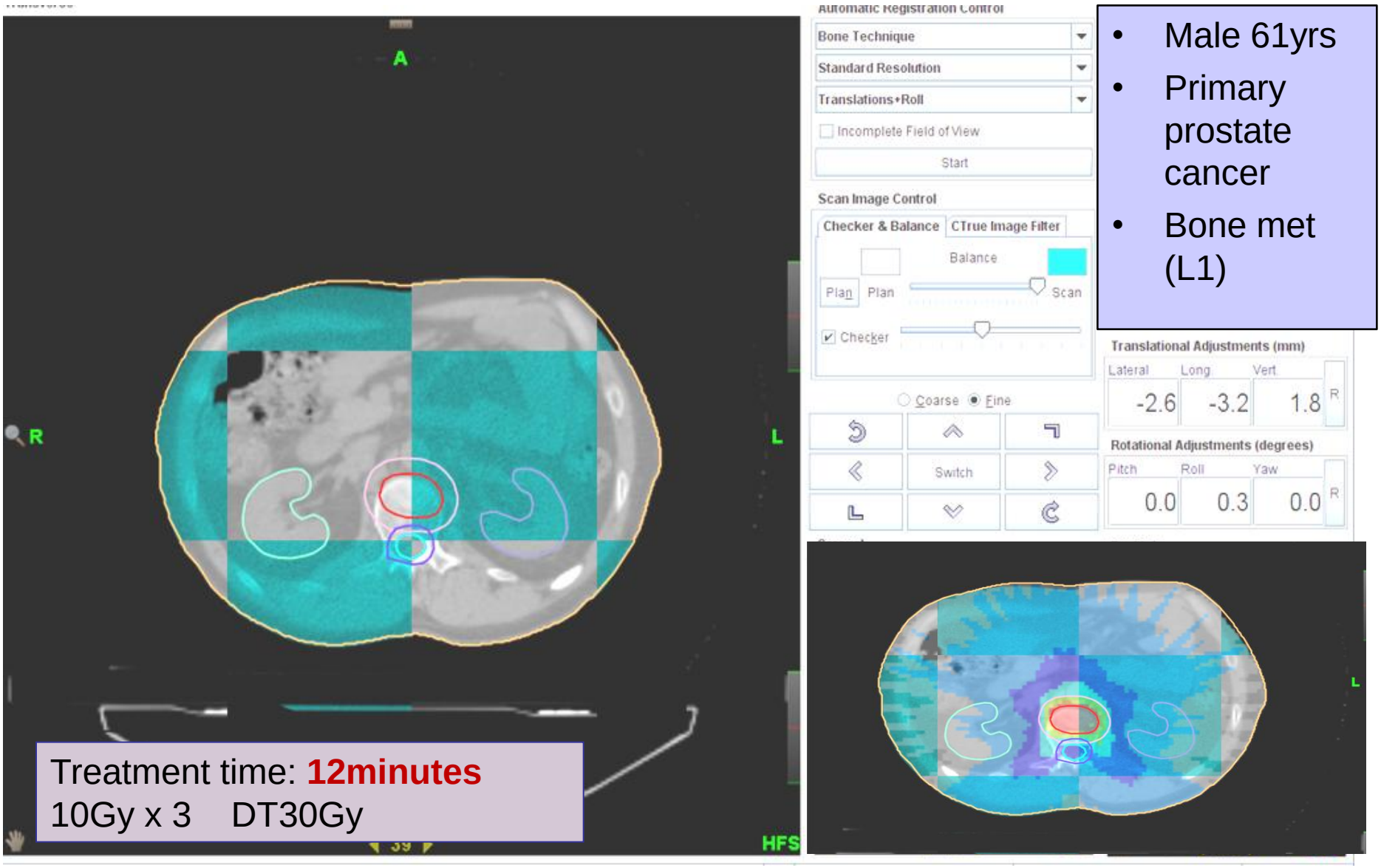
curative and palliative treatments

sites	x	y	z
thorax	2.1	2.8	3.9
bone	1.8	3.2	3.1
pelvis	2.5	1.8	5.3
abdomen	2.8	5.4	1.8



Site	Mean Shifts (mm) (x)	Mean Shifts (mm) (y)	Mean Shifts (mm) (z)
Pelvi	3,5	1,9	5,4
ORL	1,8	2,1	2,0
Linfomi	1,8	3,1	3,3
Torace	2,1	3,0	3,6
Addome	5,6	3,1	3,6

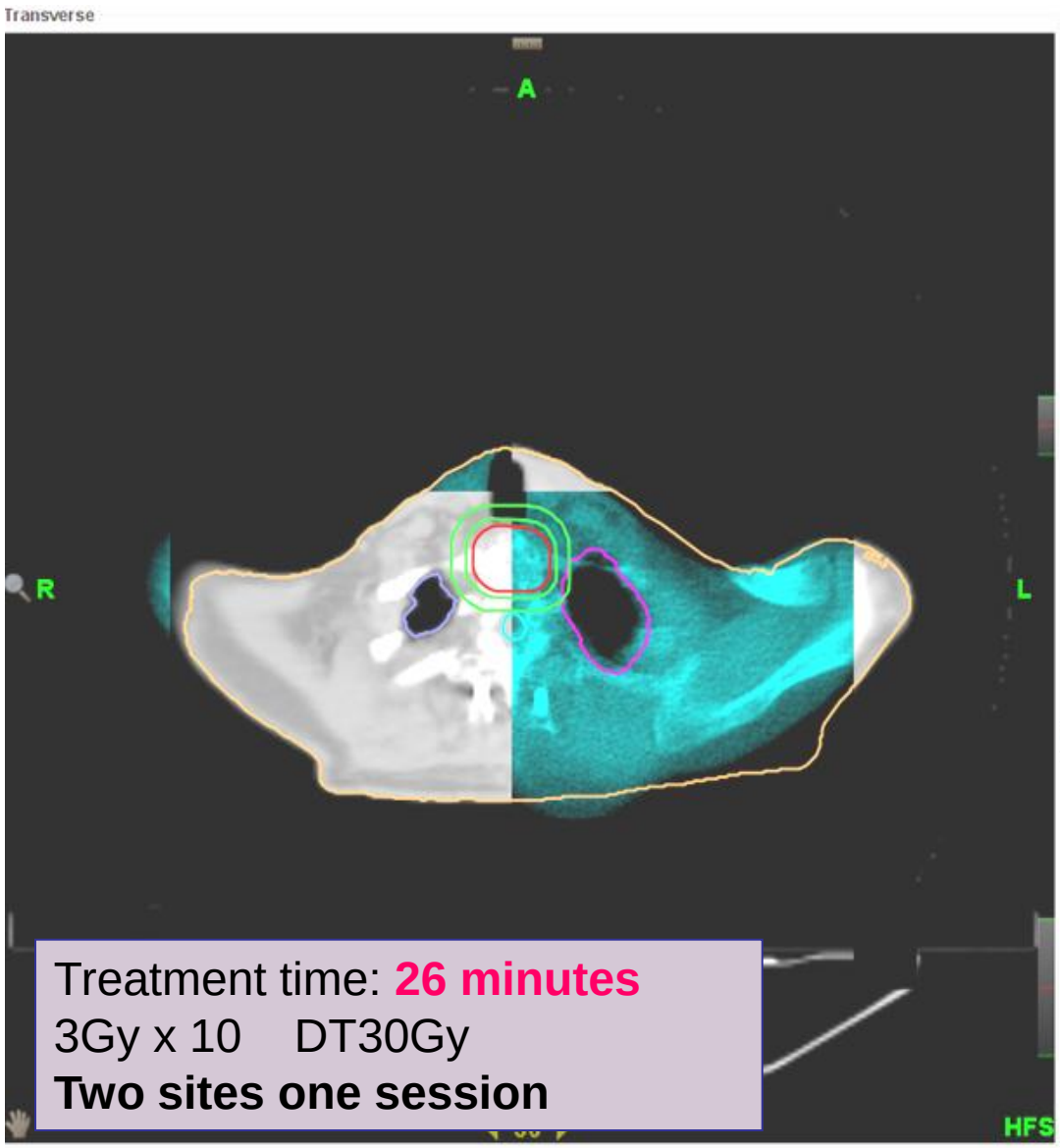
Bone target #1

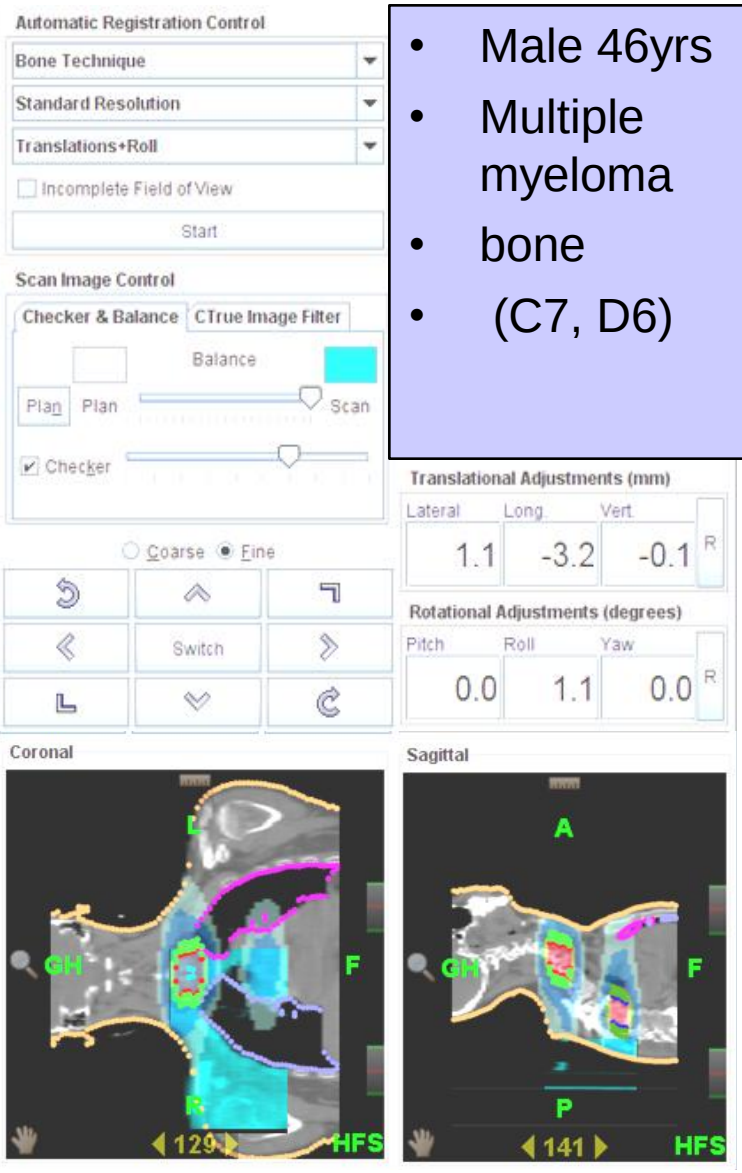


- Male 61yrs
- Primary prostate cancer
- Bone met (L1)

Treatment time: **12minutes**
10Gy x 3 DT30Gy

Bone target #2

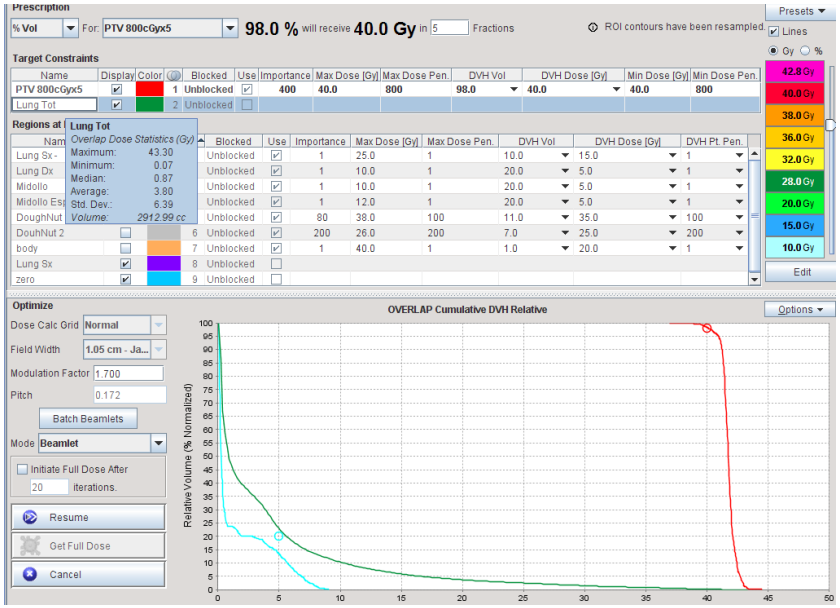




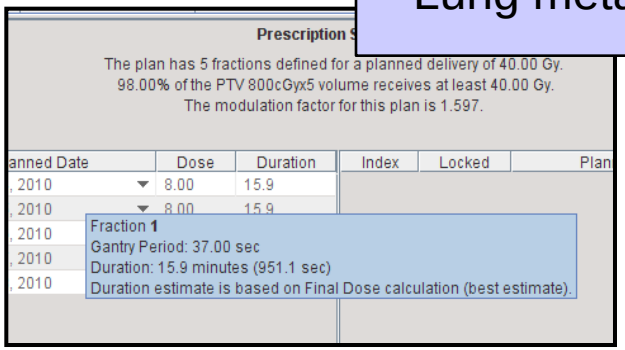
- Male 46yrs
- Multiple myeloma
- bone
- (C7, D6)

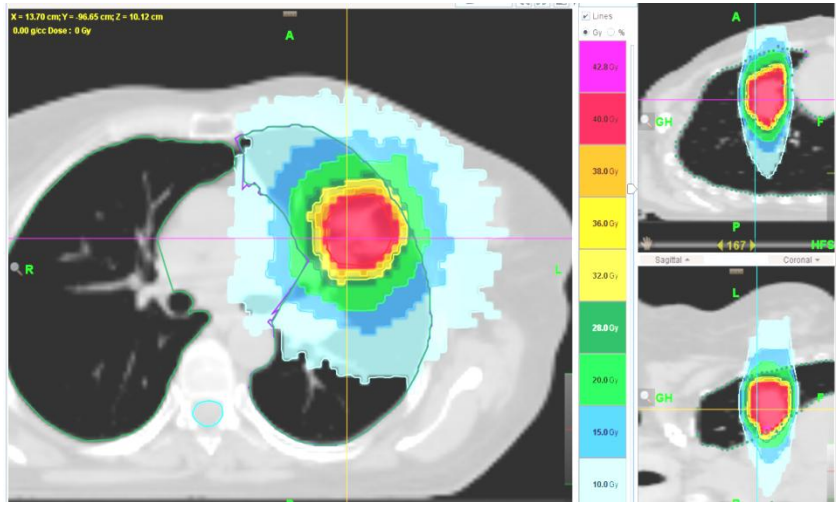
Treatment time: **26 minutes**
3Gy x 10 DT30Gy
Two sites one session

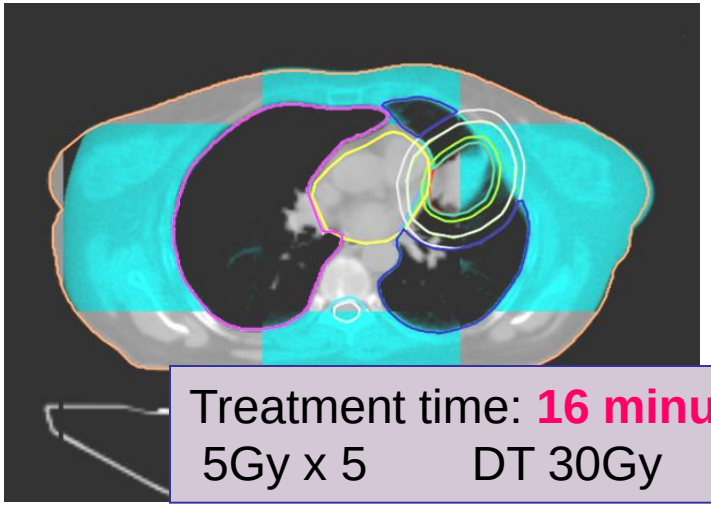
Lung metastases



- Female 52yrs
- Primary colorectal cancer
- Lung metastases



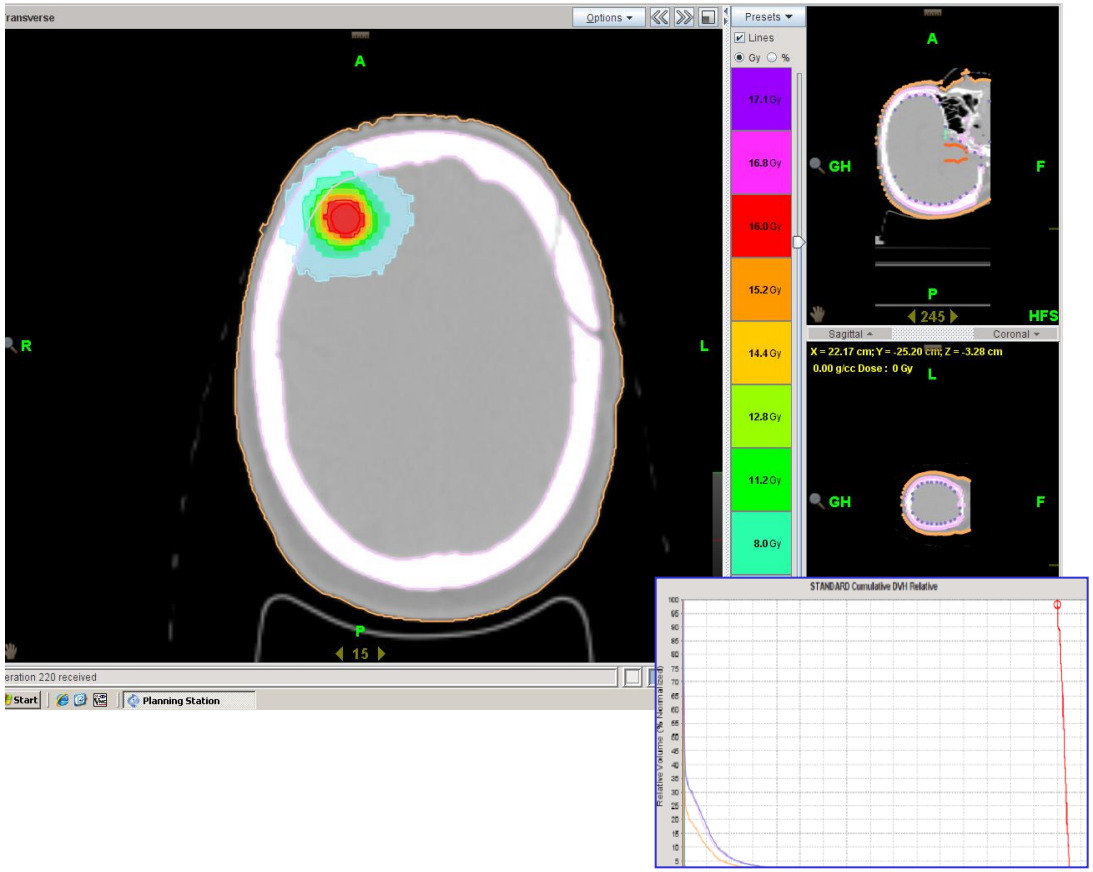




Treatment time: **16 minutes**
5Gy x 5 DT 30Gy

Cranial stereotactic RT

- Male 48 yrs
- Primary lung cancer
- Prior RTWB
- relapse after 26 months
- single metastases
- 16Gy single fraction

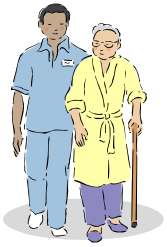


- Modulation factor ↑↑
- Field width 1cm
- Pitch ↓

Extremely high conformed dose distribution

Treatment time: **13 minutes**

Traditional Sim and Treat Workflow



patient

Immobilize and Scan patient

Transfer data to planning system

Import data for physician to define fields and/or contour

Patient now waits to be treated

Physician returns to review plan

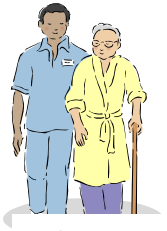
Transfer plan data to R&V system

plan data in R&V system

Import, assign and register DRR's

Therapist: "**How much longer???**"

Physicist may check plan and R& V System



Bring patient in the room

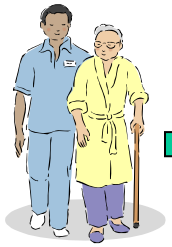
Setup patient for treatment

Take X-rays to verify patient position

Physician reviews verification X-ray

Patient can now be treated!

StatRT™
Sim and Treat Workflow



Bring patient in the room

Immobilize and Scan patient on the TomoTherapy Hi-Art System

Contour Structures

Planner quickly optimizes plan

Physician approves Plan

Treat!

Scan, plan, and treat in as little as 30 minutes

STAT RT

A software for rapid intensity-modulated treatment planning, enabling conformal radiation treatment plans to be generated on megavoltage computed tomography (MVCT) scans.

MVCT
as CT simulation → treatment planning → treatment delivery

STAT RT allow to acquire scans, plan and deliver treatment in the same session within one hour.

Thake home messages

PROs

- High dose conformity and dose gradient with excellent PTV coverage and adequate OAR sparing regardless of complexity
- Simultaneous treatment of multiple target in the same session
- SIB (WB+SRT)
- Re-treatment near critical structures
- Avoidance of junctions (up to 160cm)

CONs

- Treatment time could be to long even for fit patients
- Not reliable for dose per fraction higher than 18Gy

no way is too long for a man who knows where he wants to go…

… and who is very thirsty