

# 10 anni di Radioterapia a Taranto



*La radioterapia stereotassica extraencefalica*

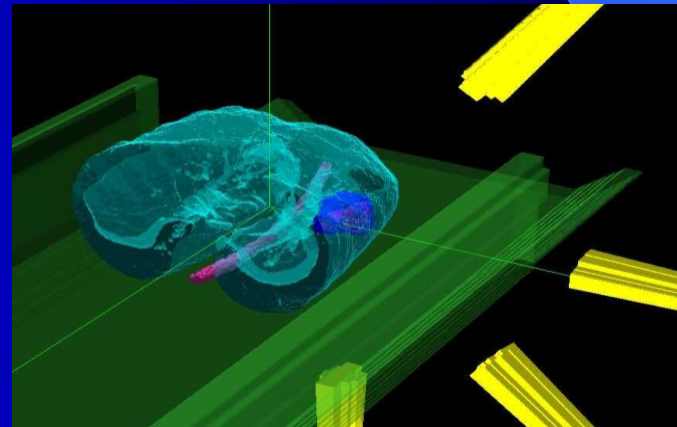
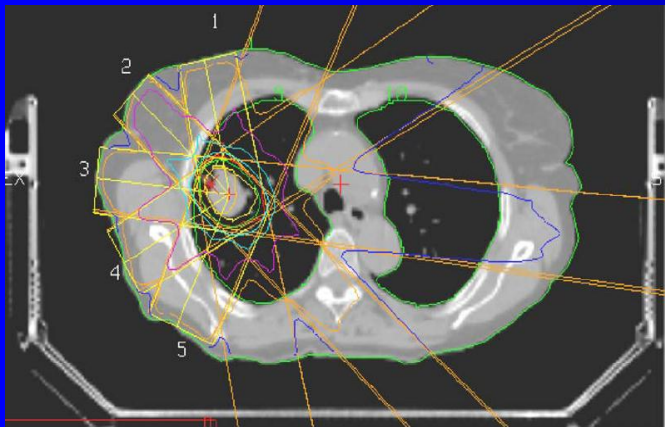
G. Spagnoletti

# Introduction

- ✦ **Standard local treatment for lung solitary metastases and tumours is surgical resection.**
- ✦ **In pts considered medically or functionally inoperable stereotactic radiotherapy is an alternative treatment.**

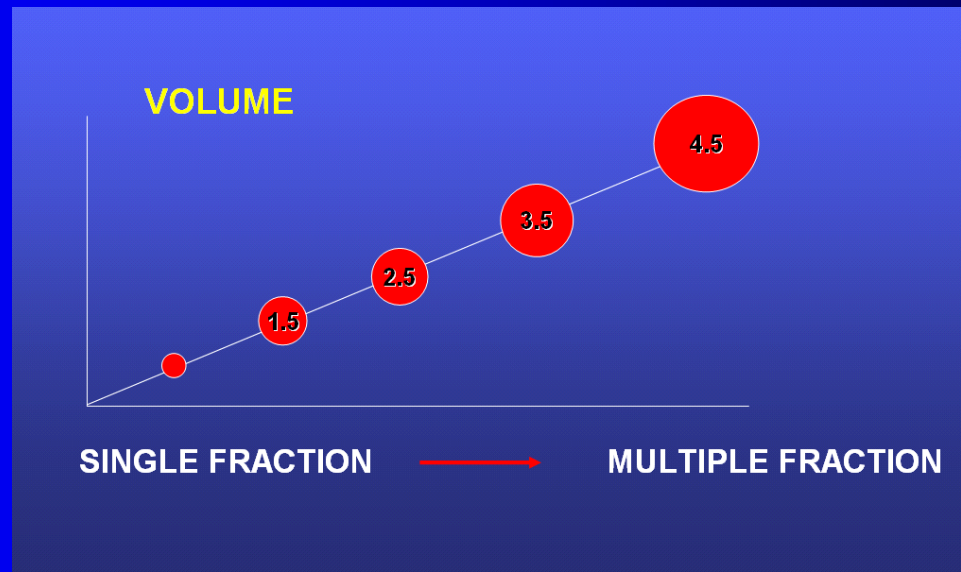
# SRT: what is it?

*Selective irradiation in which target lesion is localized by mean of stereotactic 3D coordinates and irradiation is performed through multiple radiation beams and hypofractionated regimens*



# Improved **local control** by

- dose escalation
- altered fractionation

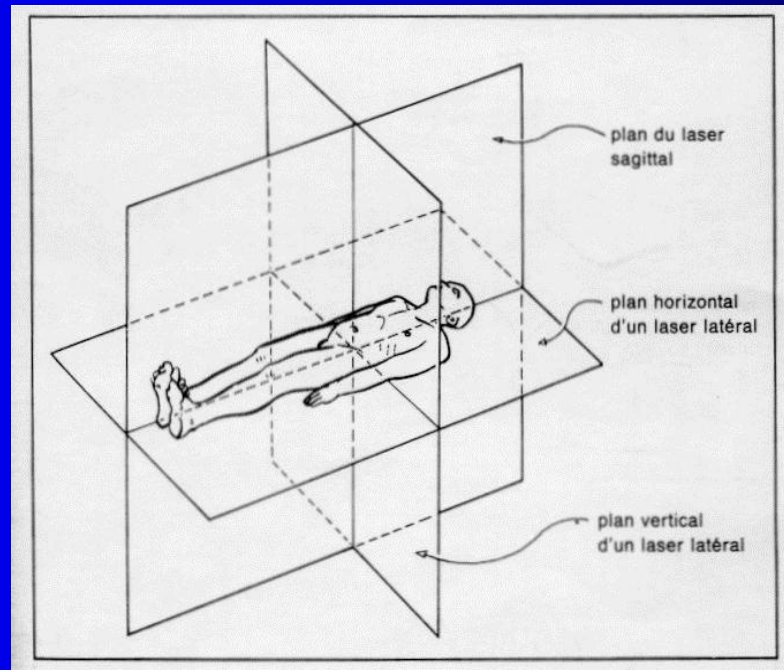


# ***STEREOTACTIC RADIATION THERAPY IN THE TREATMENT OF LUNG METASTASES AND TUMOURS OUR EXPERIENCE***

- **May 2009 - April 2012**
- **23 pts (M:8, F:15); age: 44-81 ys (mean 67.6 ys)**
- **lung or mediastinal nodes from various cancer (lung, colon/rectum, breast, etc.): 21 lesions**
- **T1-T2 NSCLC: 4 lesions**
- **minimum follow-up: 6 months (range: 6-27 months; mean: 15 months)**
- **unsuitable for surgery**



**Pt is immobilized in a dedicated noninvasive stereotactic frame (Elekta SBF) using a vacuum pillow.**



## Set up margin



**Repeated patient positioning is supported by laser system attached to the SBF**

## Internal margin



**Controlled compression of abdominal wall can be employed to reduce breathing movements of the target**



## Reduction of Tumor Movement

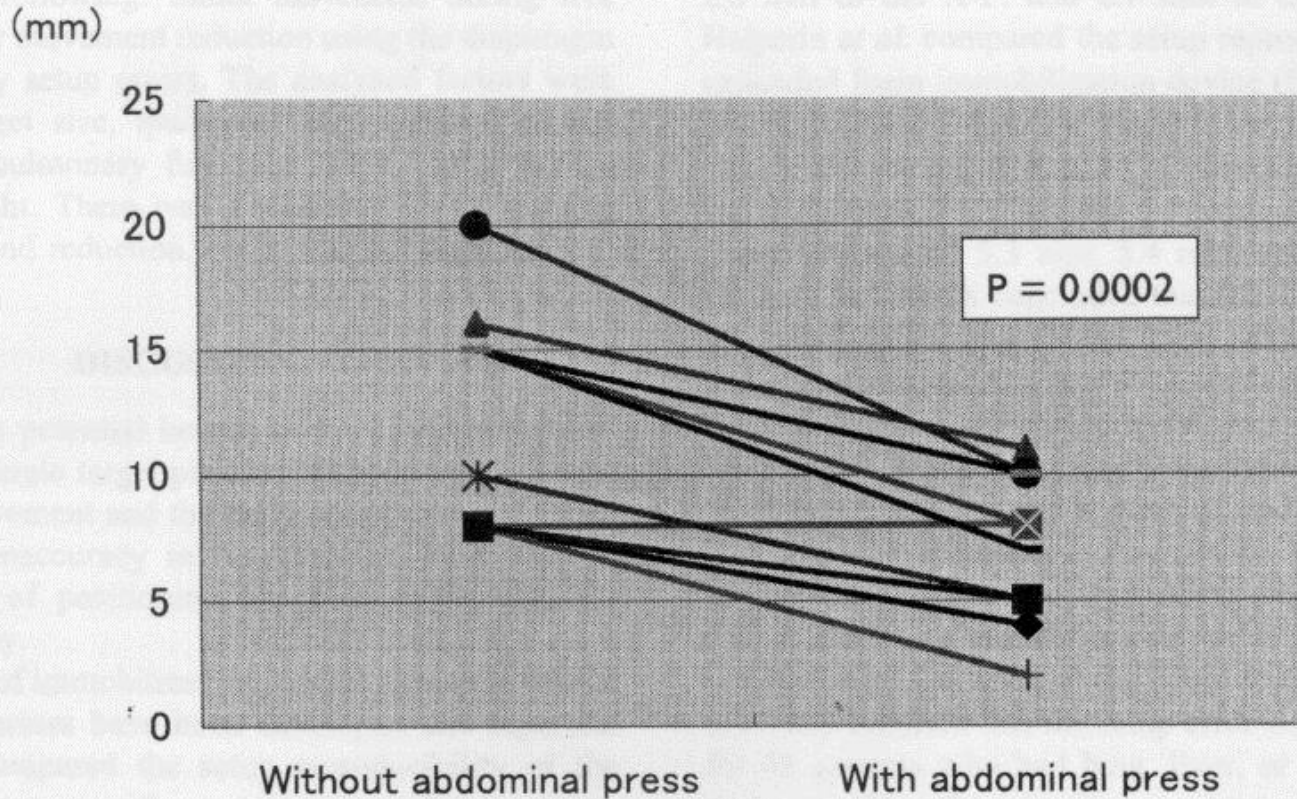


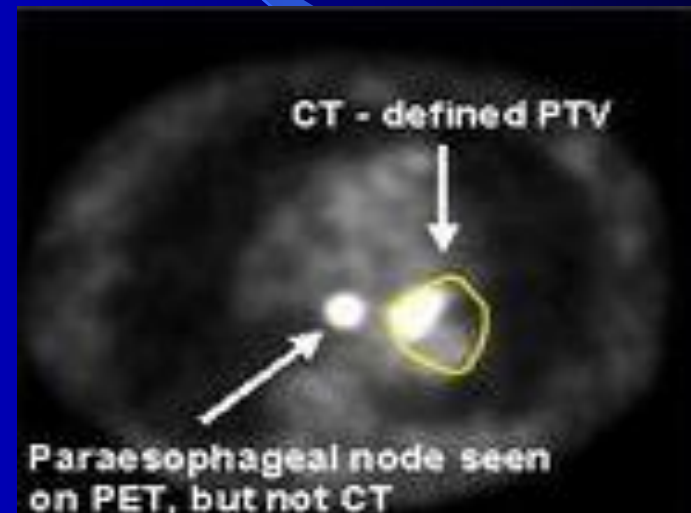
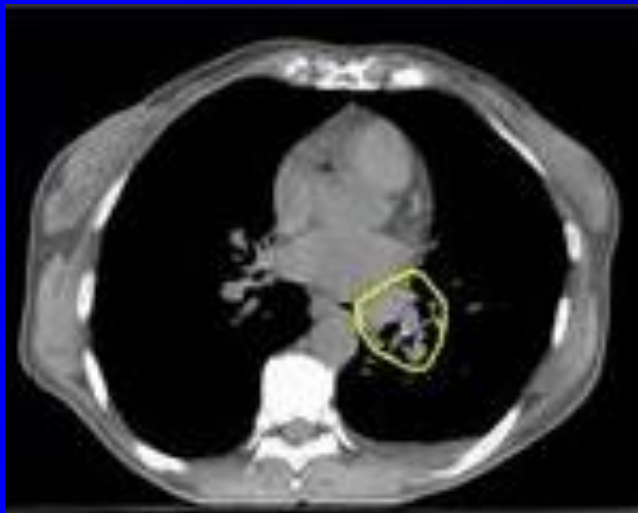
Fig. 6. Reduction of respiratory tumor movement by pressing patient's abdomen using the diaphragm control. The diaphragm control was applied to the patients whose tumor movement was 8 mm or more during free respiration. Tumor movements were reduced significantly ( $p = 0.0002$ ).

**From: Negoro, Y., IJROBP, 2001**

# Inclusion Criteria

- **Karnofsky Status > 80**
- **diameter  $\leq$  5 cm**
- **$\leq$  3 lesions**
- **controlled primitive tumour**
- **no nodal involvement**

# Role of PET

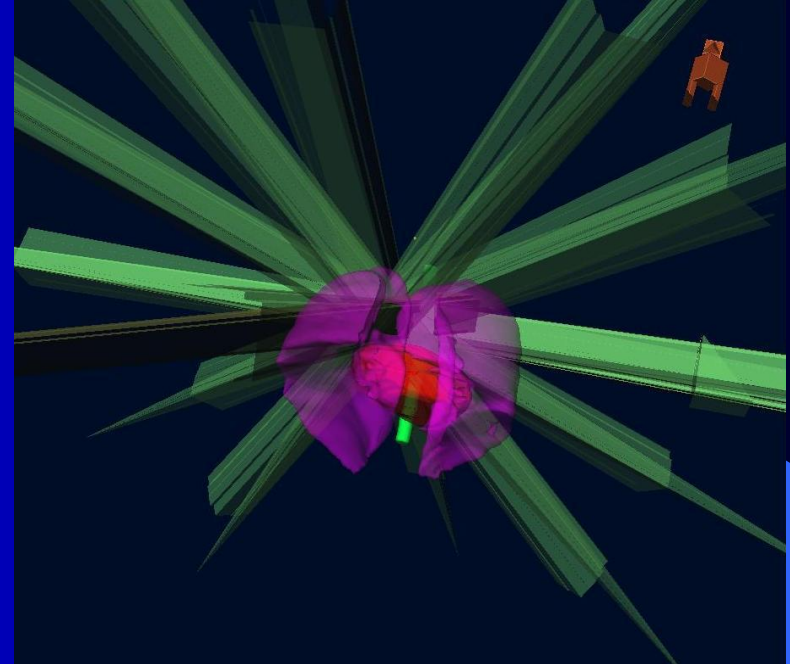
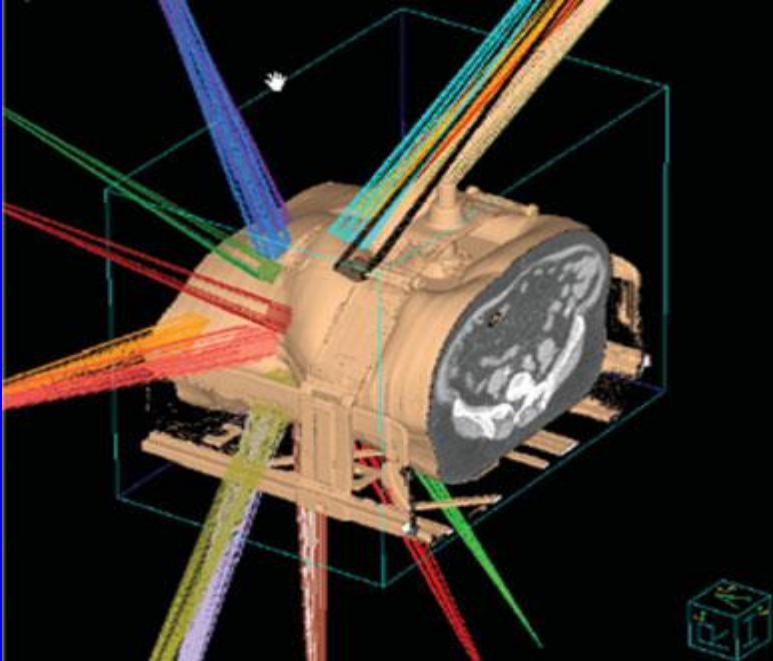


**The PET imaging data appear to complement CT information and combined with CT will result improved local control and reduced geographic miss.**

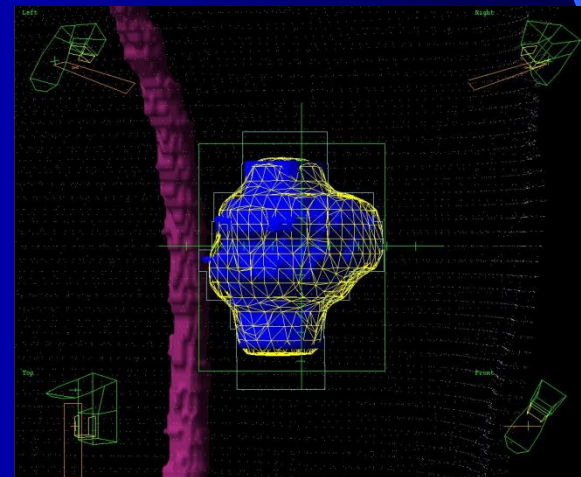
# Volumes

- **Contouring on CT slices spaced 3 mm**
- **CTV = GTV + 0.5 cm margin**
- **PTV = CTV + 5 mm in antero-posterior and latero-lateral direction  
+ 10 mm in cranio-caudal direction**
- **CTV Volumes: 1.37 - 27.48 ccm**

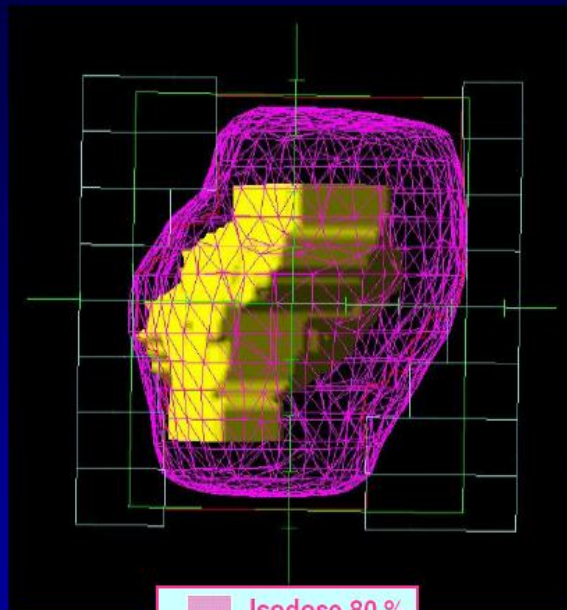
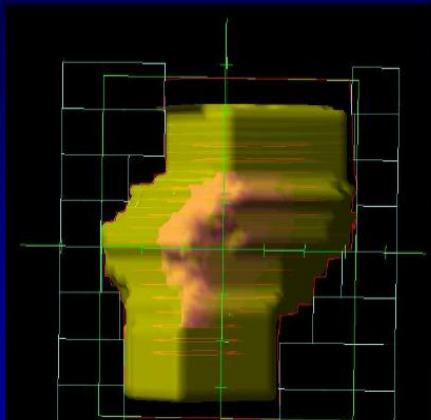
# Treatment Planning



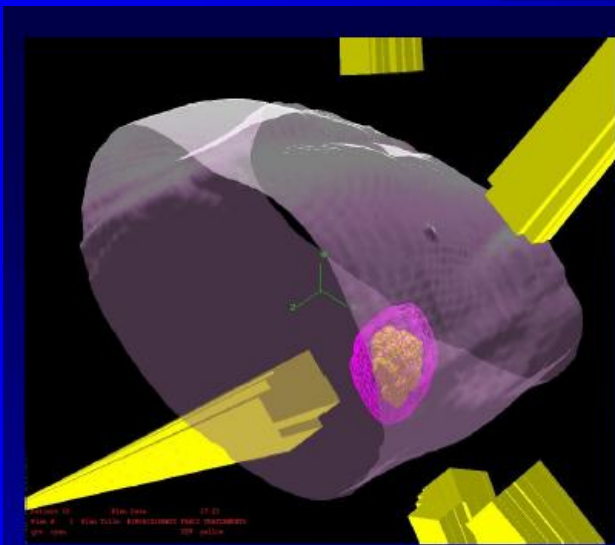
- 9-19 coplanar or 8-12 non-coplanar fields
- 6-10 MV
- 1-6 fractions specified to 80% isodose



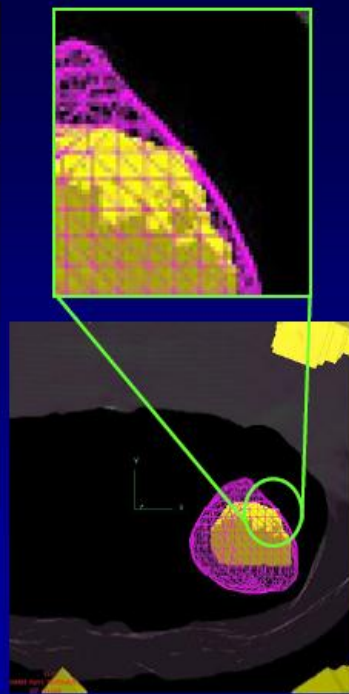
■ PTV   ■ CTV   ■ GTV



■ Isodose 80 %



■ Isodose 80 %

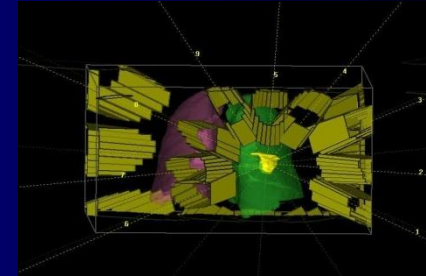
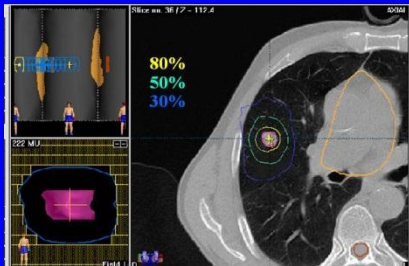


# Total Doses and Fractionation

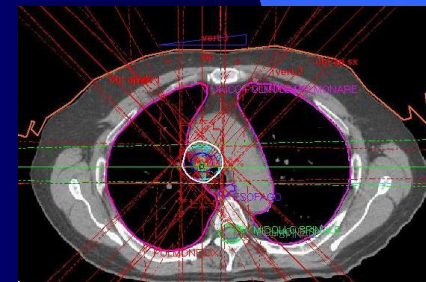
- 26-27 Gy / 1 fx
- 36 Gy / 3 fx
- 40 Gy / 5 fx
- 42 Gy / 6 fx (lesions in the immediate proximity of mediastinal vessels, <3 cm)

# Total Doses and Fractionation

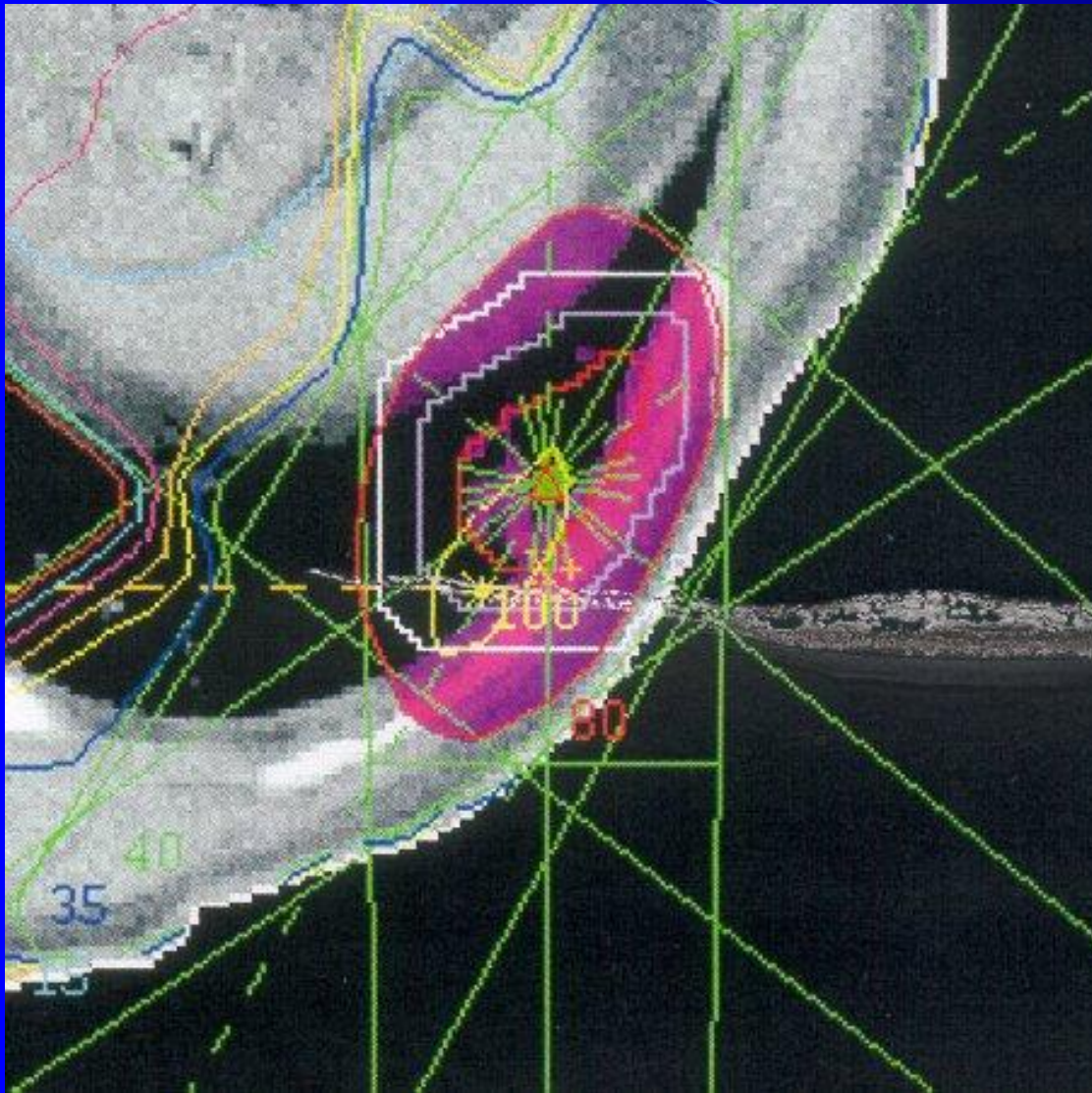
N. of lesions	Total doses(Gy)	N. of fractions
4 <sup>^</sup>	26	1
6 <sup>^</sup>	27	1
8	36	3
4 <sup>°</sup>	40	5
3 <sup>*</sup>	42	6



- <sup>^</sup> lesions  $\geq 3$  cm afar from mediastinum
- <sup>°</sup> primitive tumours
- <sup>\*</sup> lesions in the immediate proximity of mediastinal vessels ( $<3$  cm)







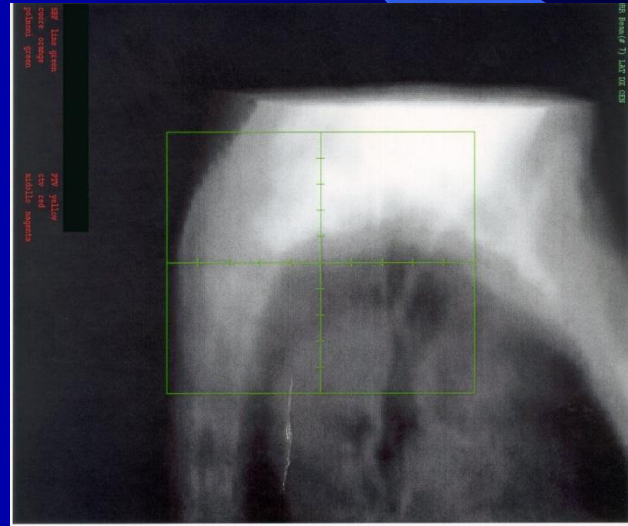
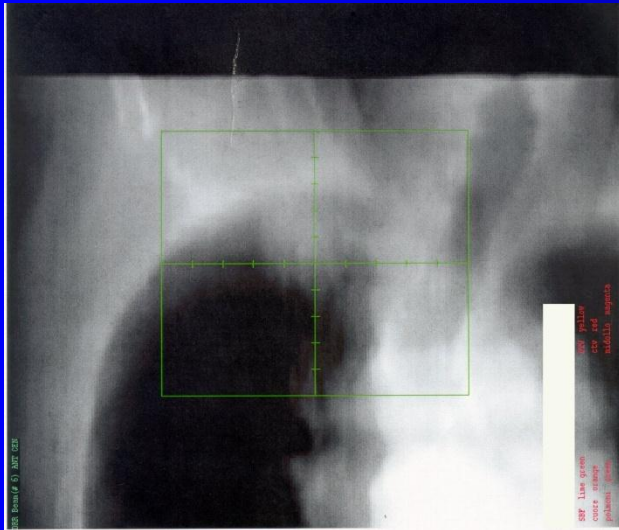
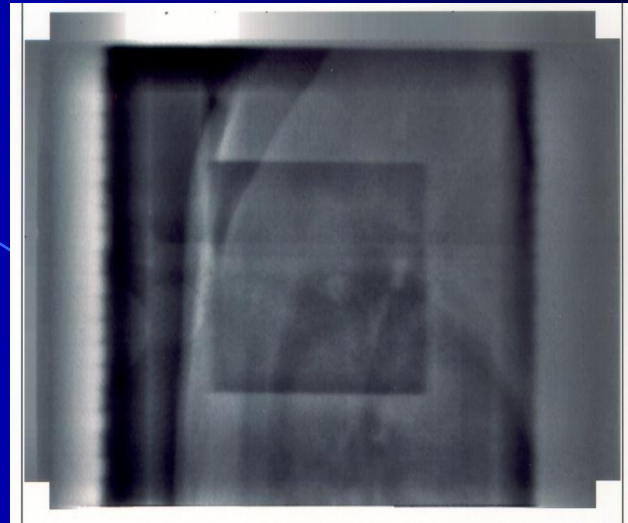
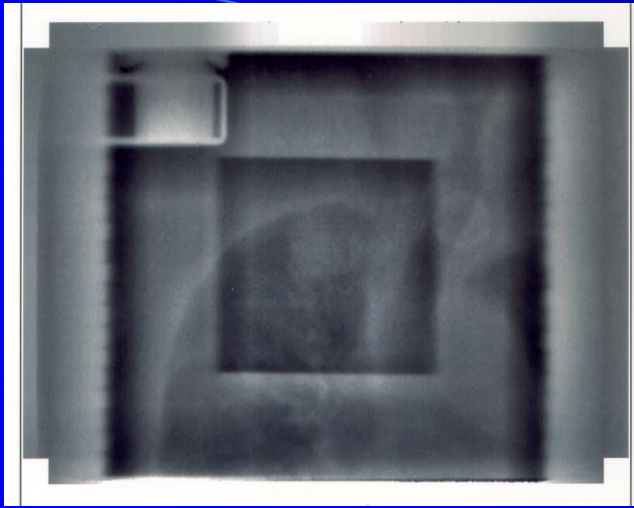
**THE USE OF MULTIPLE CONFORMED BEAMS CAN DETERMINE A RAPID DECREASE NOT ONLY OF TOTAL DOSE, BUT ALSO OF DOSE PER FRACTION. THIS EFFECT REDUCES THE RISK OF TOXICITY IN LATE REACTING TISSUES.**

# Dose Constraints

	1 fx	3 fx	5 fx	6x
<b>Lungs</b>	V7<1500cc V7.5<1000cc V8<37%	V10.5<1500cc V11.5<1000cc V11<37%	V12.5<1500cc V13.5<1000cc V13.5<37%	V13.5<1500cc V15<1000cc V15<37%
<b>Heart</b>	V16<15cc Dmax<22Gy	V24<15cc Dmax<30Gy	V32<15cc Dmax<38Gy	V34.5<15cc Dmax<38.5Gy
<b>Spinal cord</b>	V10<0.35cc V7<1.2cc Dmax<14Gy	V16<0.35cc V12<1.2cc Dmax<22.5Gy	V22<0.35cc V14.5<1.2cc Dmax<28Gy	V26.5<0.35cc V17<1.2cc Dmax<33.5Gy

# Treatment verification

- **DRR of dummy fields at  $0^{\circ}$ - $90^{\circ}$  to show isocenter position.**
- **Electric portal images (double exposure) at  $0^{\circ}$ - $90^{\circ}$  acquired on the first day of treatment to validate the set up.**
- **Daily acquisition of images of each field to verify set up accuracy and the correct position of the leaves.**



Dummy orthogonal portal films were obtained before each session in order to assess isocenter position

# **STEREOTACTIC RADIATION THERAPY IN THE TREATMENT OF LUNG METASTASES AND TUMOURS OUR EXPERIENCE**

**Lesions**

**LC (%)\***

**25**

**24/25 (96%)**

**\*Absence of progression in the irradiated  
volume**

**Follow up: 6-27 months; mean f.u.: 15 months.**

**11 patients relapsed in distant sites  
(controlateral lung: 4 pts, brain: 5 pts,  
abdomen: 2 pt)**

# Toxicity

- **No acute or late clinical complications**
- **In 18/23 patients CT examination revealed radiological signs of radiotherapy pneumonitis/fibrosis**

What's new in Foggia?

IGRT

(CBCT / ExacTrac)

# Image Guided Stereotactic Radiotherapy

- **New way of thinking...**
- **Localizer not needed**
- **Patient setup based on daily images**
- **Can “see” exactly how the patient sets up in relation to the planning CT**
- **Can adjust for pitch, tilt and roll (either manually or robotically)**



# Elekta Synergy



# CBCT

- Fusion with planning CT
- Can precisely match tumor volumes and critical structures in 6 dimensions.



# BodyFix Setup

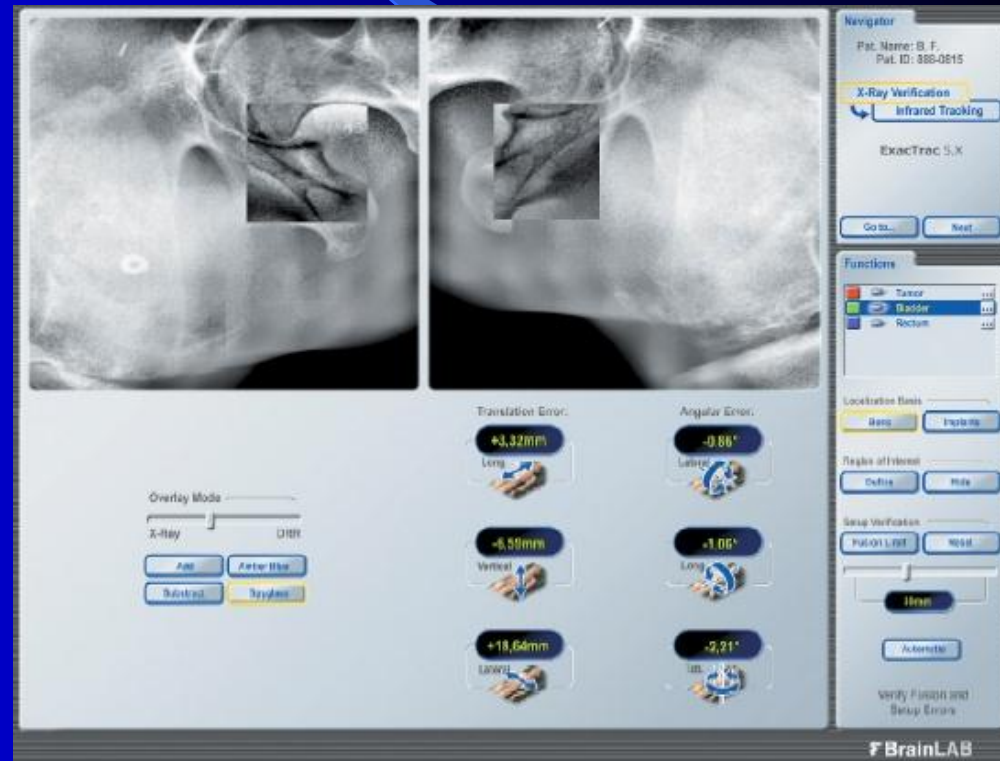


# BrainLab Exactrac



# BrainLab Exactrac

- Orthogonal Images (oblique)
- Match Bony Anatomy
- Internal Fiducial Markers
- External Fiducial Markers
- 6d Treatment Couch



# Frameless SRT



Snap Verification enables intra-fraction IGRT verification flexibility throughout treatment, including detecting organ and patient motion or mechanical inaccuracies.

# Frameless SRT



Integrated optical infrared patient tracking monitors the patient in real-time, enabling continuous position monitoring and tumor motion management and ensuring IGRT accuracy throughout treatment.

# Conclusions

- **Stereotactic Body Radiotherapy/ Radiosurgery is a safe and practical option to treat inoperable lung metastases and tumours**
- **Local control rate is high and the treatment is well-tolerated**
- **New technologies enable more precise and less time-consuming treatments**
- **Further studies are needed to define optimal dose and fractionation.**



**Thanks for  
your attention**

