

# Radioterapia Stereotassica: DEFINIZIONE

La Radioterapia Stereotassica è una tecnica utilizzata per il trattamento di lesioni individuate attraverso **metodi stereotassici** accurati che, avvalendosi delle tre coordinate spaziali (x, y, z) consentono di erogare una **dose elevata** di radiazioni **al tumore** grazie all' **alto gradiente** di dose che si crea fra il volume bersaglio e i tessuti sani circostanti.

## MODALITA' RADIOTERAPICHE IN STEREOTASSIA

Radiochirurgia (SRS):

unica frazione e casco 'cruento'

Radioterapia stereotassica frazionata (FSRT):

più di una frazione e maschera riposizionabile

# Radiochirurgia con $\gamma$ -knife

## CALCOLO DELLA DOSE

- Si usa come isodose di riferimento quella del 50% (per avere una conformazione 3-D adeguata al target)
- All'interno del target si hanno dosi più alte e disomogenee
- All'esterno del target si ha una rapida caduta della dose
- Questo si traduce in una  $\downarrow$  degli effetti collaterali ma anche
- in una possibile  $\downarrow$  delle % di risposta nei TM infiltranti

# SRTe SRS con Linac

## CALCOLO DELLA DOSE

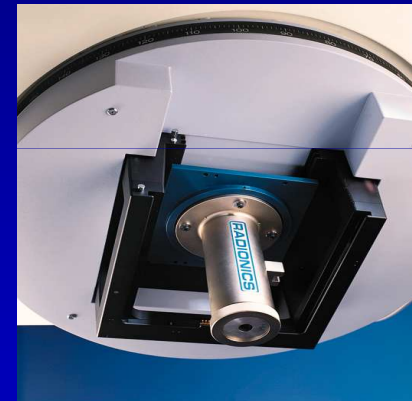
- Protocollo AAPM (Associazione Americana di Fisica Medica) e ICRU 62.
- Dose calcolata all'isocentro (normalizzazione al 100%)
- Si dichiarano  $D_{max}$ ,  $D_{media}$  e  $D_{min}$  al PTV ( $D_{Min} \geq 80\%$  per Radiochirurgia;  $\geq 90\%$  per RT Stereotassica.  $D_{Max} \leq 105\%$ )
- Prescrizione:  $GTV \rightarrow CTV \rightarrow PTV$

# Collimatori circolari

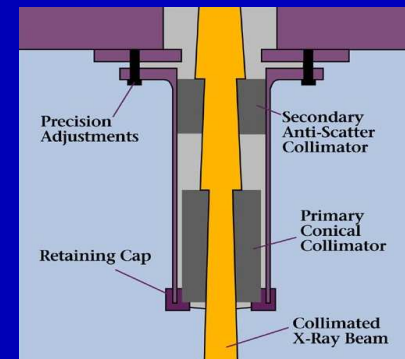
Diametro generalmente variabile tra 5 e 50 mm all'isocentro



Esempio di sistema di fissazione del collimatore terziario



Progetto di collimatore circolare per ridurre la penombra



## CONFORMAZIONE DELLA DOSE: ISOCENTRI MULTIPLI VS. UNICO



Tecnica ad archi  
policentrici con  
collimatori fissi o  $\gamma$ -knife



Tecnica conformazionale  
con schermi  
multilamellari

*da U. De  
Paula*

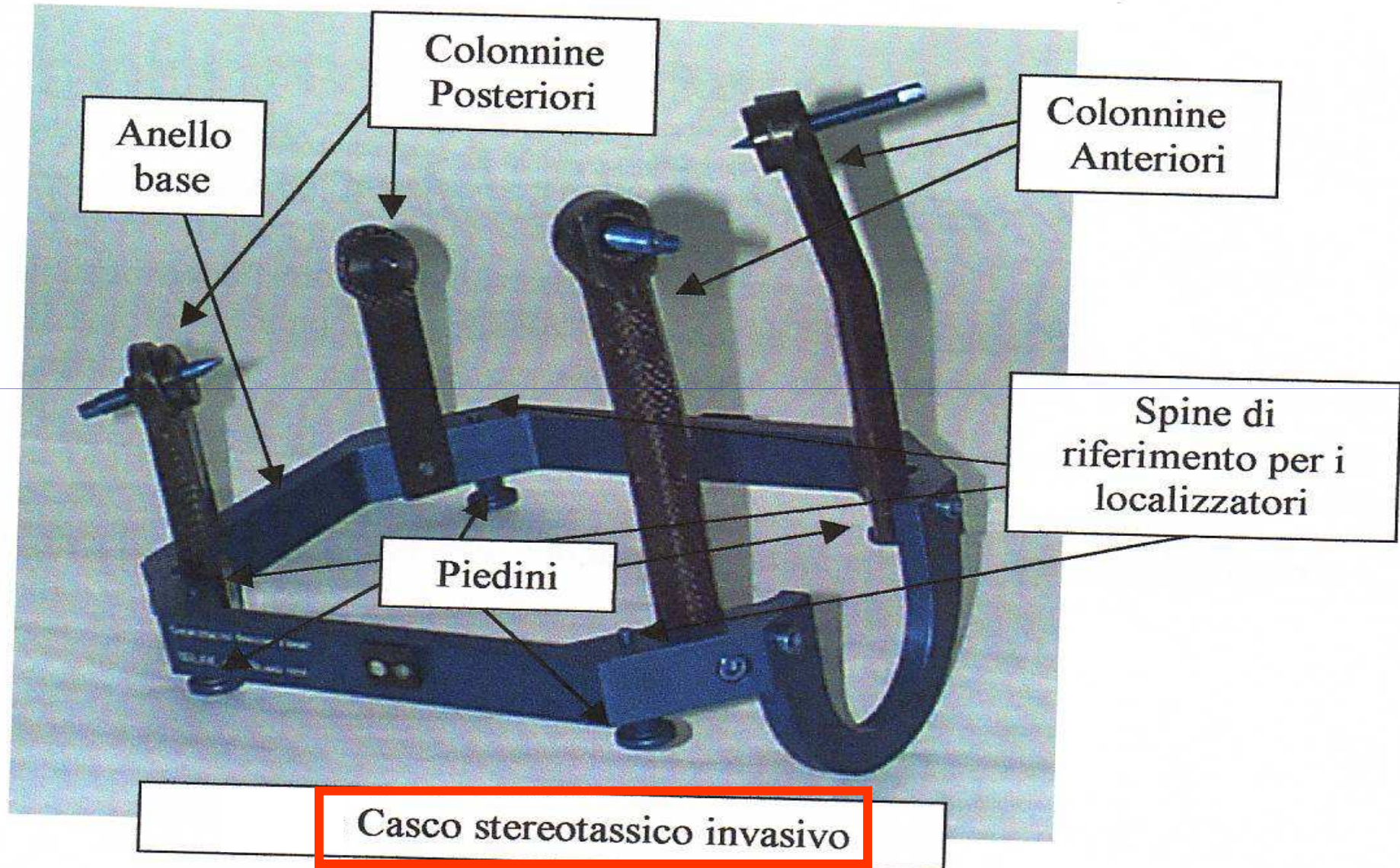
# STEREOTASSIA

PRESUPPOSTO DELLA METODICA E' CHE LA PORZIONE DI CORPO UMANO NEL CUI INTERNO ESISTE LA LESIONE ED IL "FRAME" (cornice che genera le coordinate Cartesiane) FORMINO UNA UNITA' INDISSOLUBILE CHE ESCLUDA OGNI MOBILITA' RECIPROCA

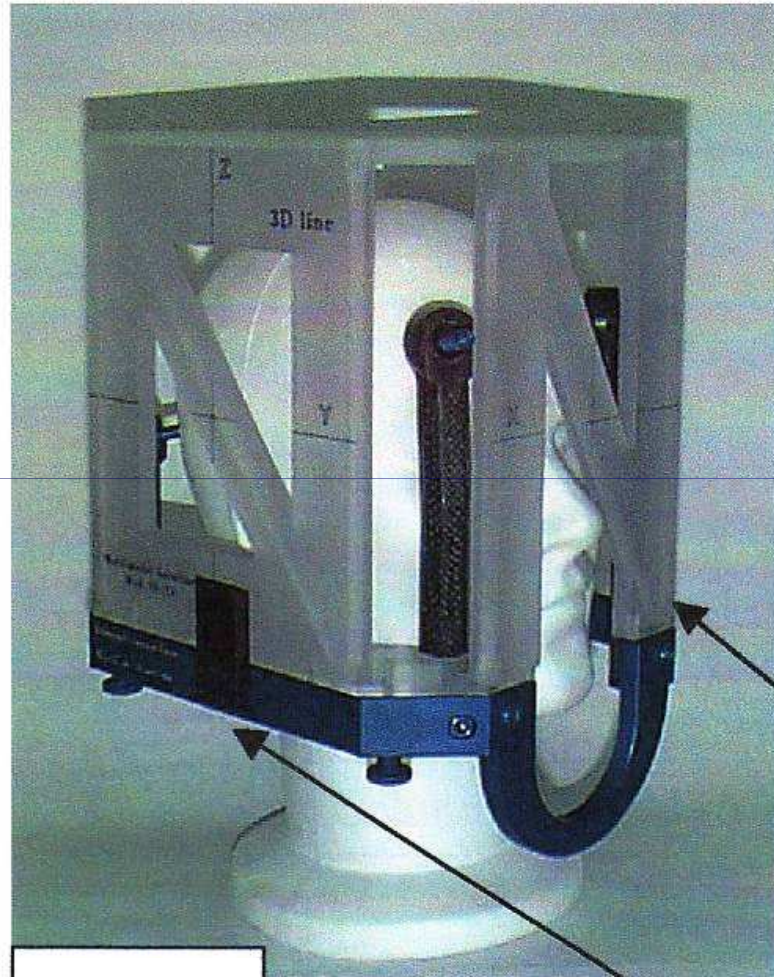
PER L'ENCEFALO QUESTO E' OTTENIBILE ATTRAVERSO LA FISSAZIONE CRUENTA CON VITI ANCORATE AL TAVOLATO CRANICO DEL CASCO STEREOTASSICO: **Radiochirurgia – SRS (12-25 Gy in frazione unica)**



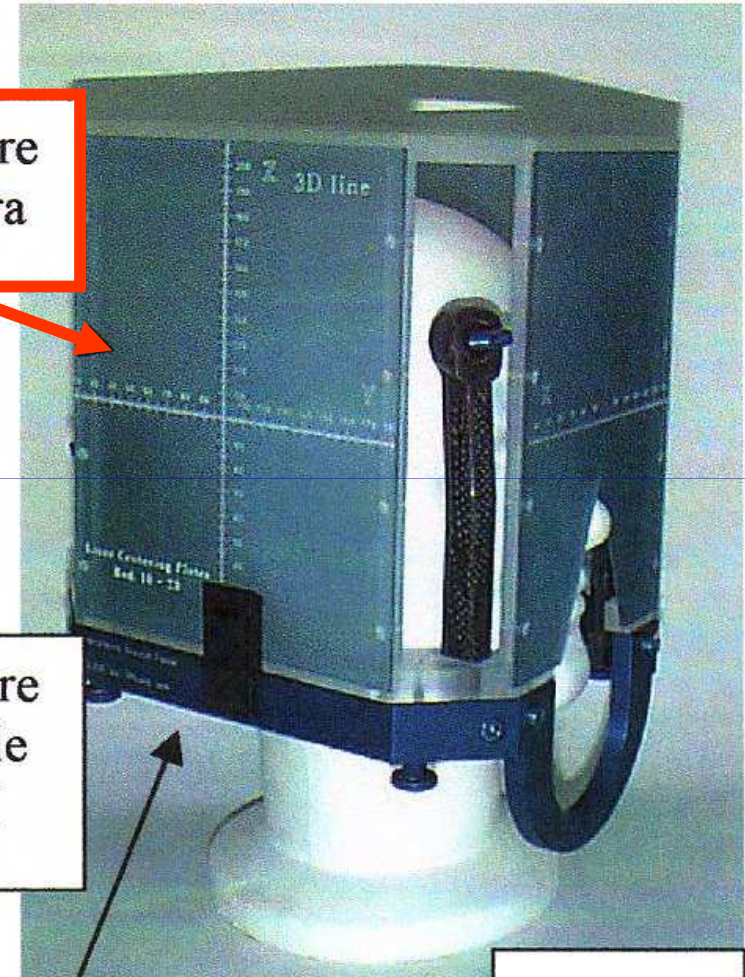
# Radiochirurgia - SRS



# Radiochirurgia - SRS



Localizzatore  
di centratura



Localizzatore  
multimodale  
TAC/RM

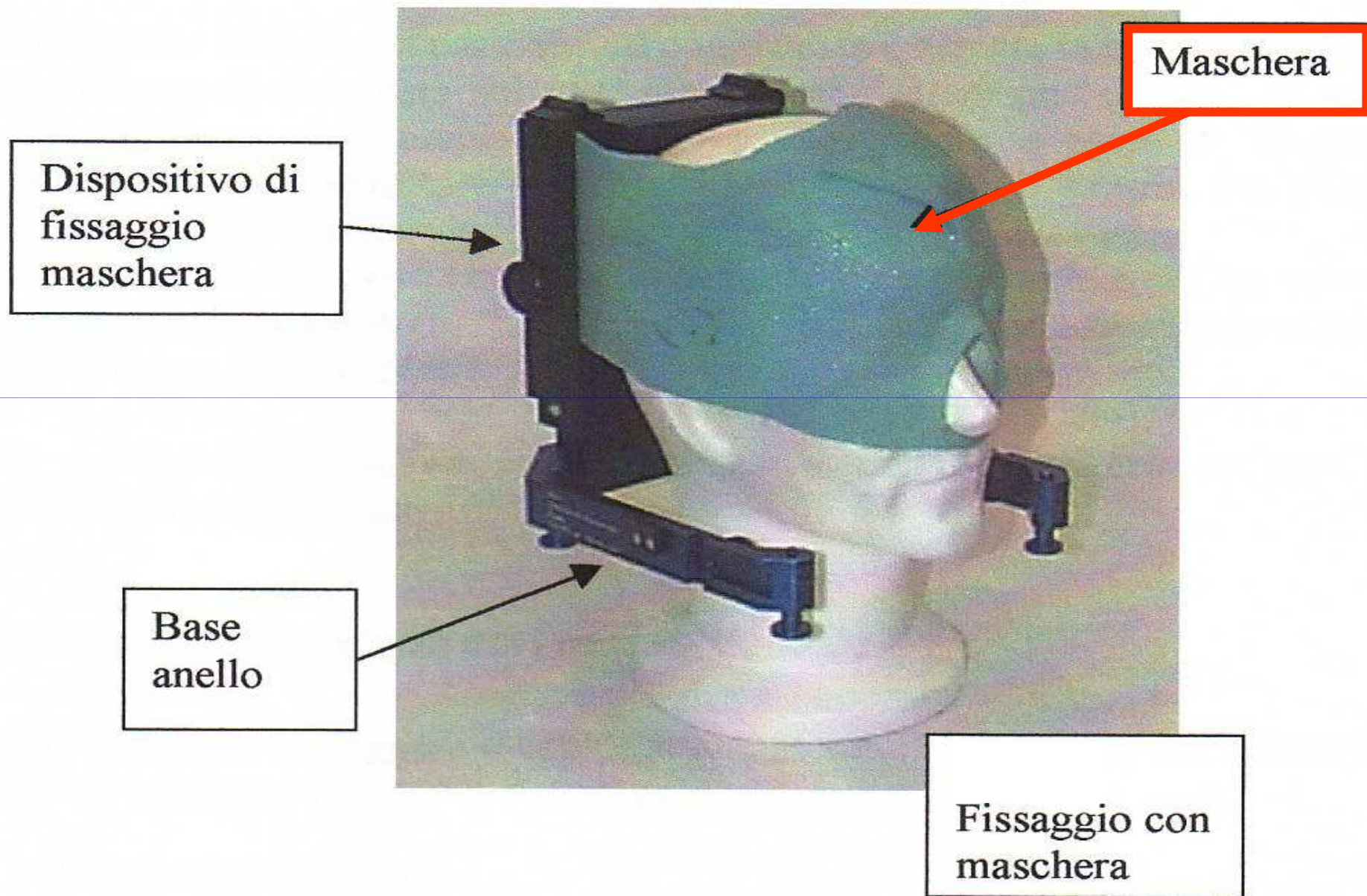
Sistema di chiusura



## STEREOTASSIA

L'IMMOBILIZZAZIONE DEL PAZIENTE E'  
OTTENIBILE ANCHE CON L'USO DI MASCHERA  
e/o MORSO PERSONALIZZATI: **Radioterapia**  
**Stereotassica Frazionata - FSRT (3-30 frazioni)**

# Radioterapia stereotassica frazionata - FSRT



# Radioterapia stereotassica frazionata - FSRT

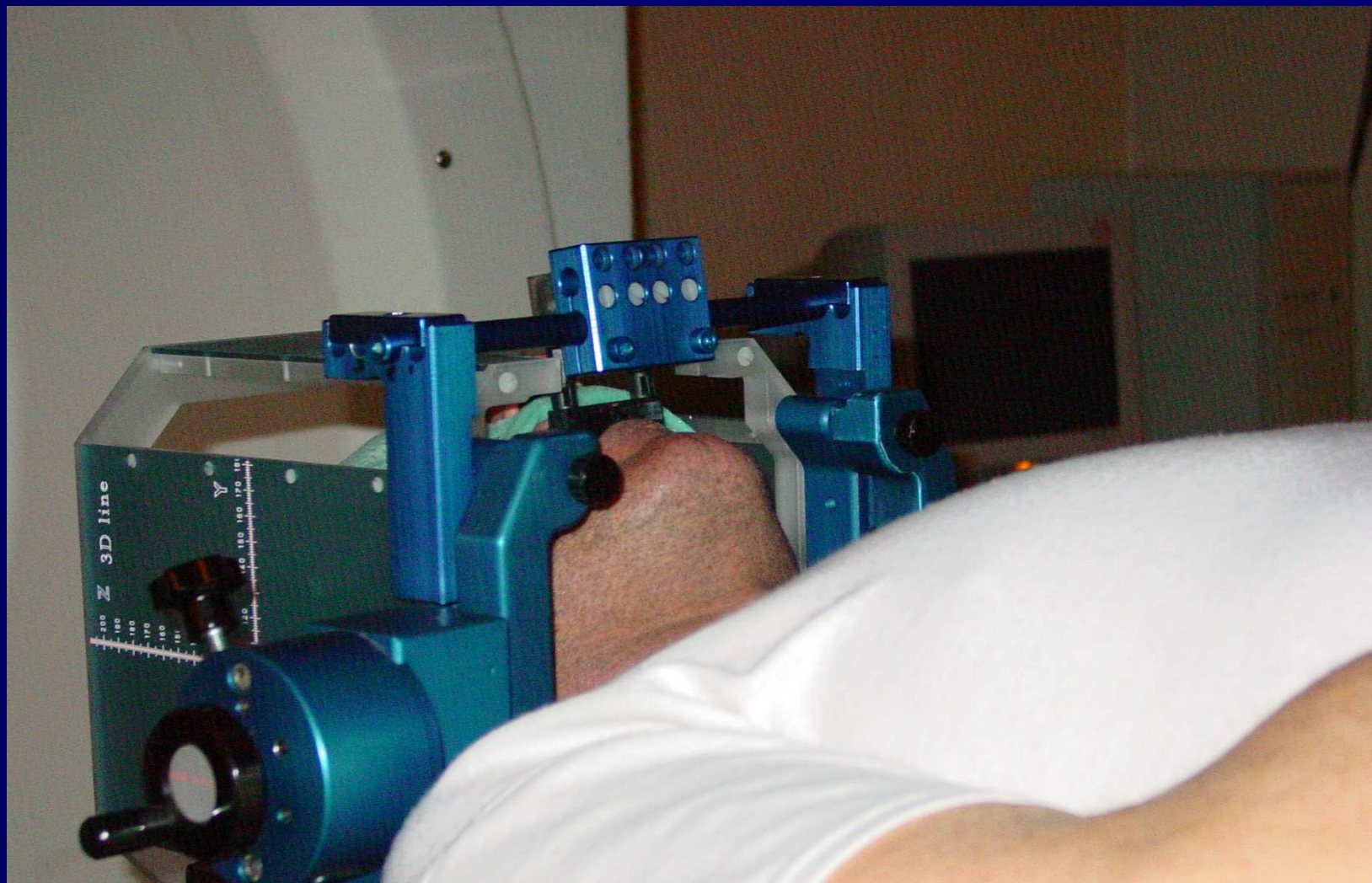
**morso**

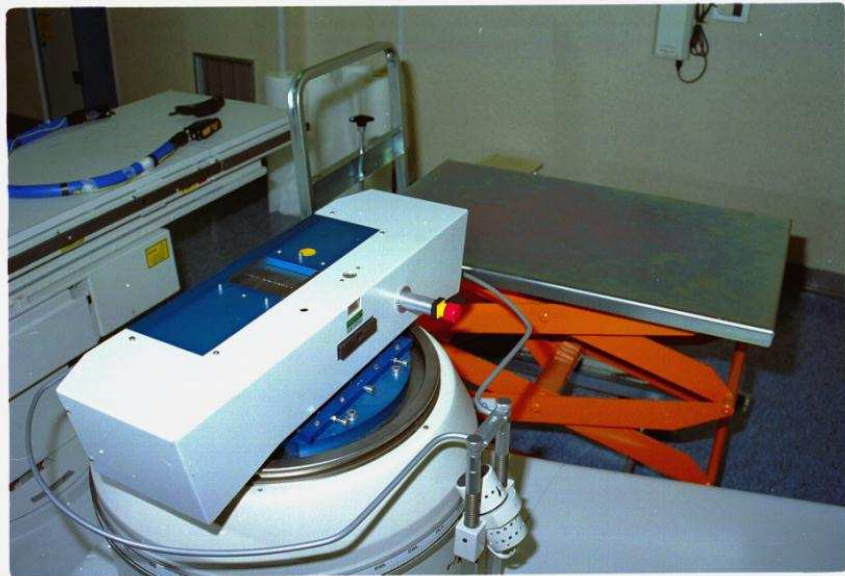
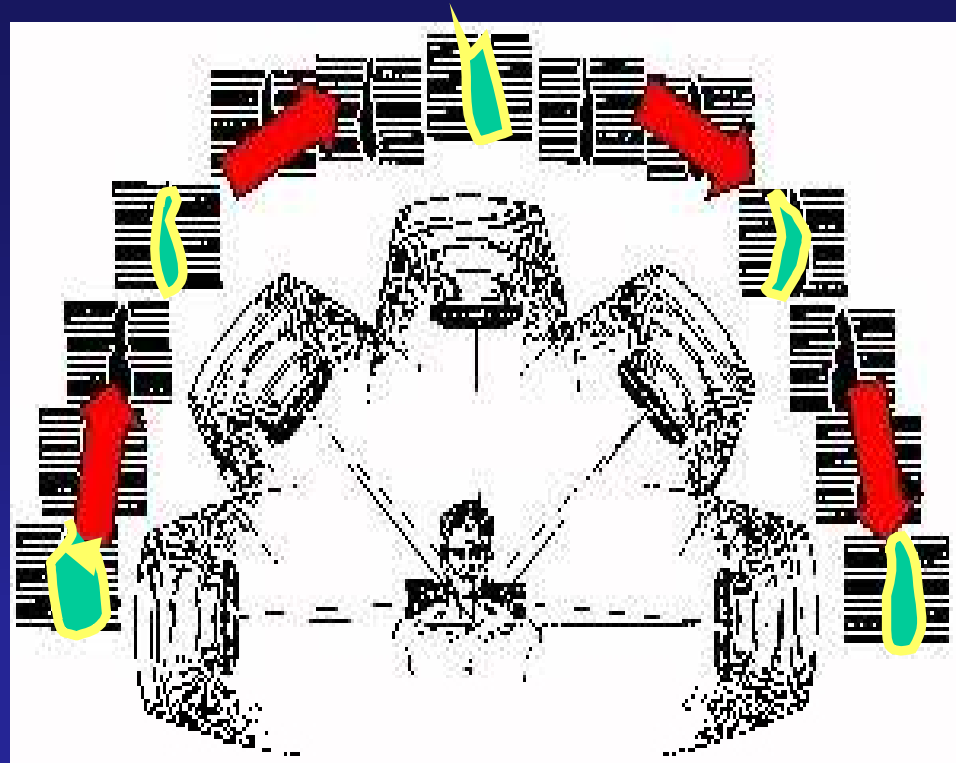


Fig. 12: Fissaggio con morso dentale per Risonanza Magnetica

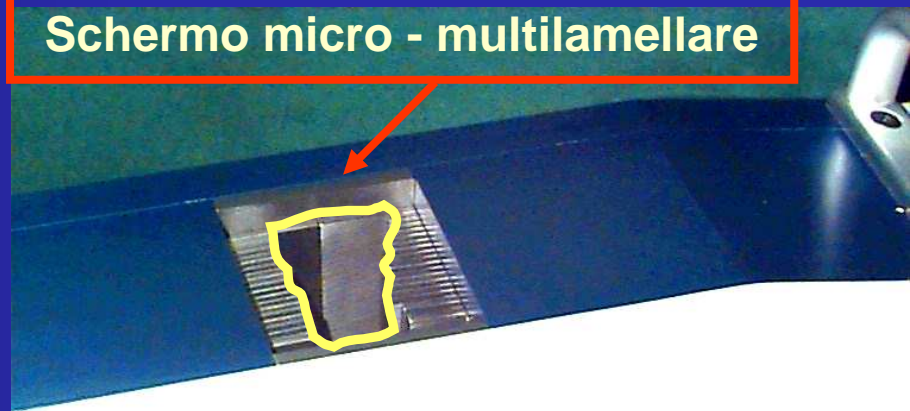
# Radioterapia stereotassica frazionata - FSRT

## Morso e Maschera





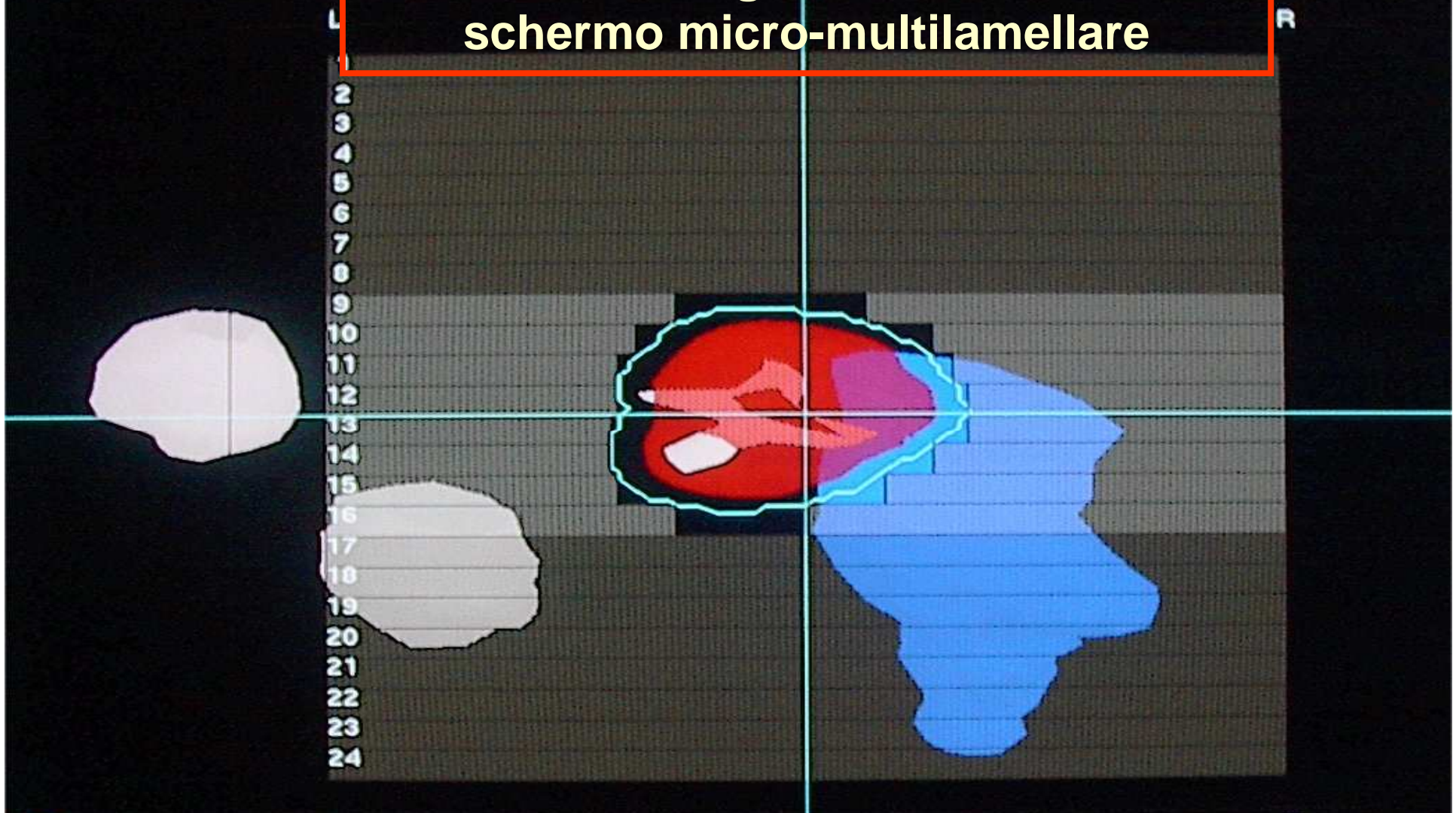
Schermo micro - multilamellare





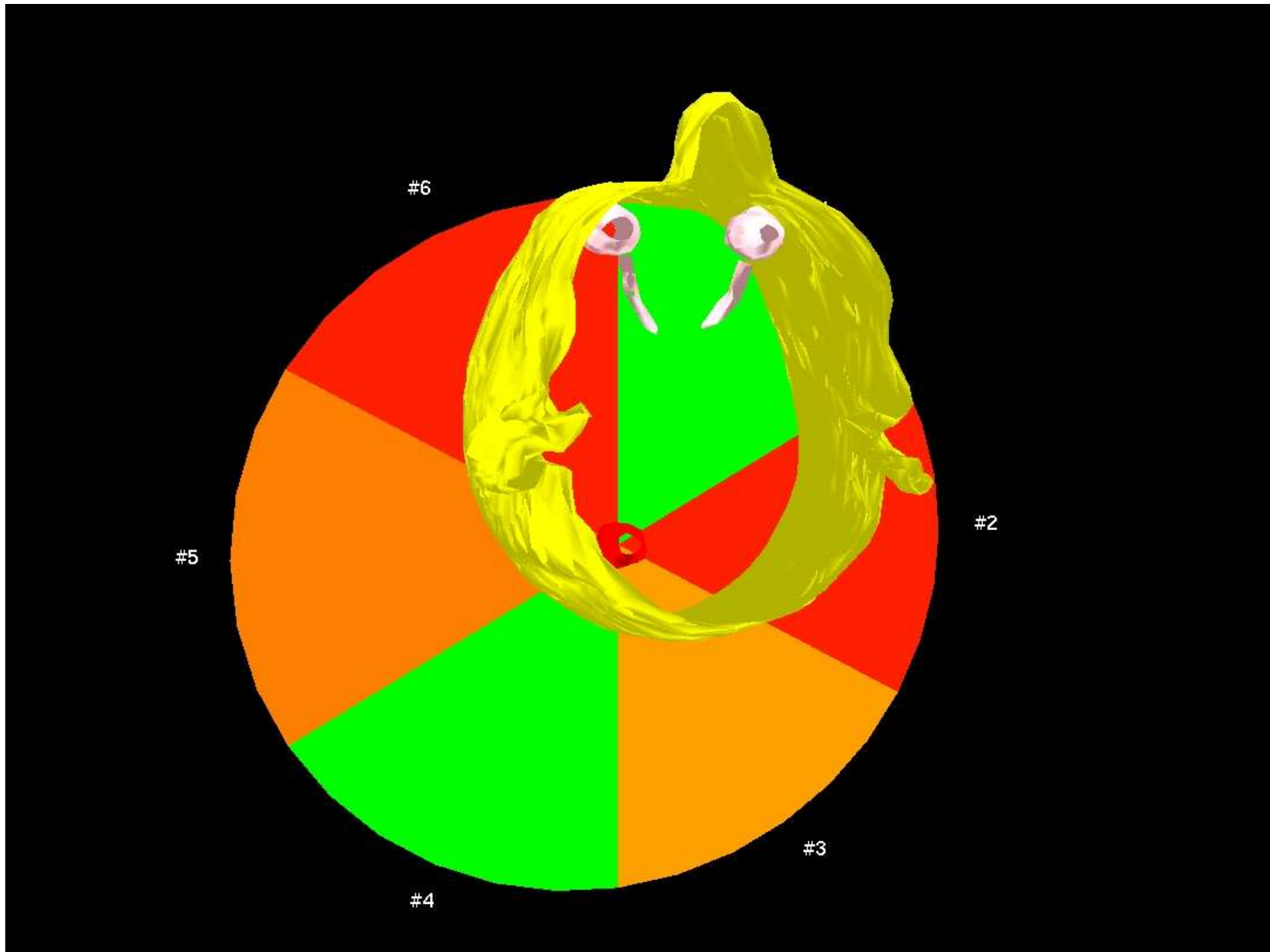
Margin : 0.3 cm  
MLC Fit mode : To Structures

**Volume-bersaglio circoscritto con  
schermo micro-multilamellare**

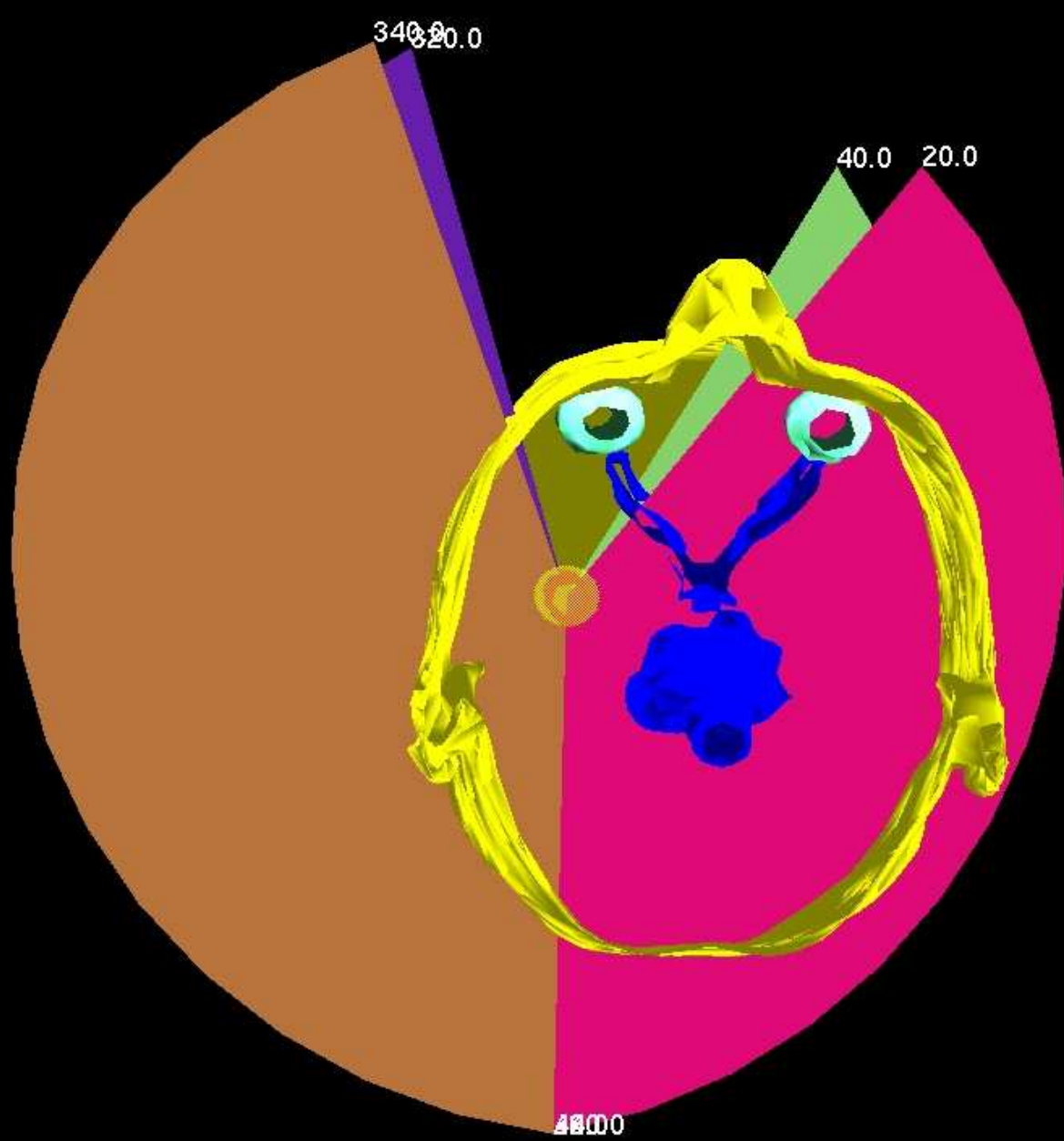


ARC # : 1  
GANTRY : 60  
COUCH : 30  
Collimator : 90

Update MLC Fit

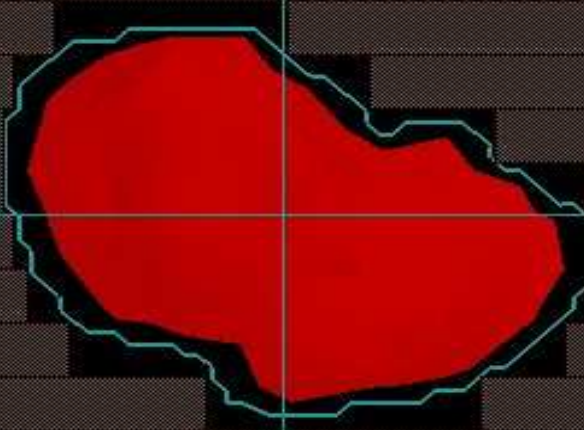








1  
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23  
24



## **METASTASI CEREBRALI**

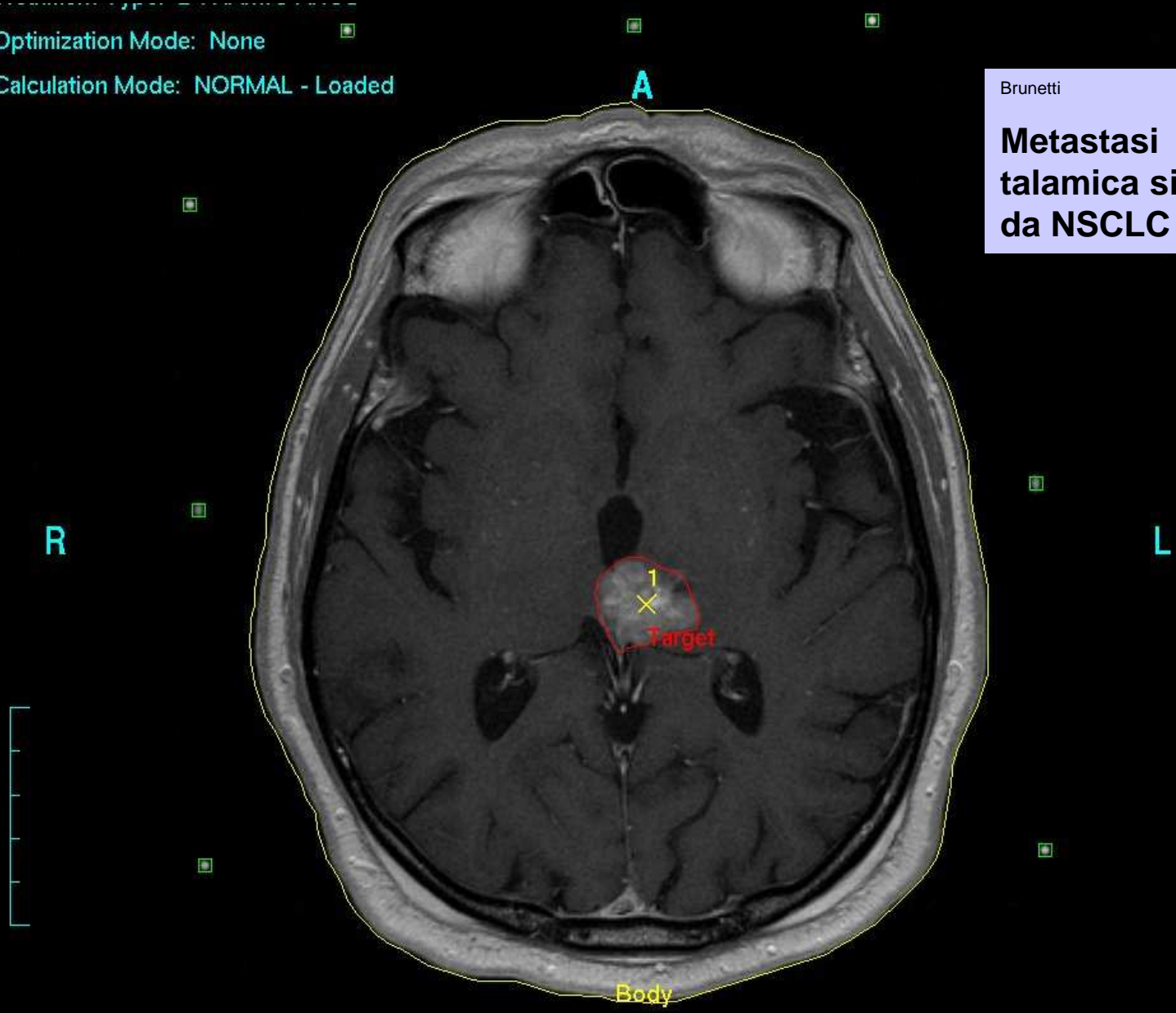
**Immagini Pre e Post  
Radioterapia Stereotassica**

Optimization Mode: None

Calculation Mode: NORMAL - Loaded

Brunetti

**Metastasi  
talamica sin.  
da NSCLC**



Optimization Mode: None

Calculation Mode: NORMAL - Loaded

A

50 [%]

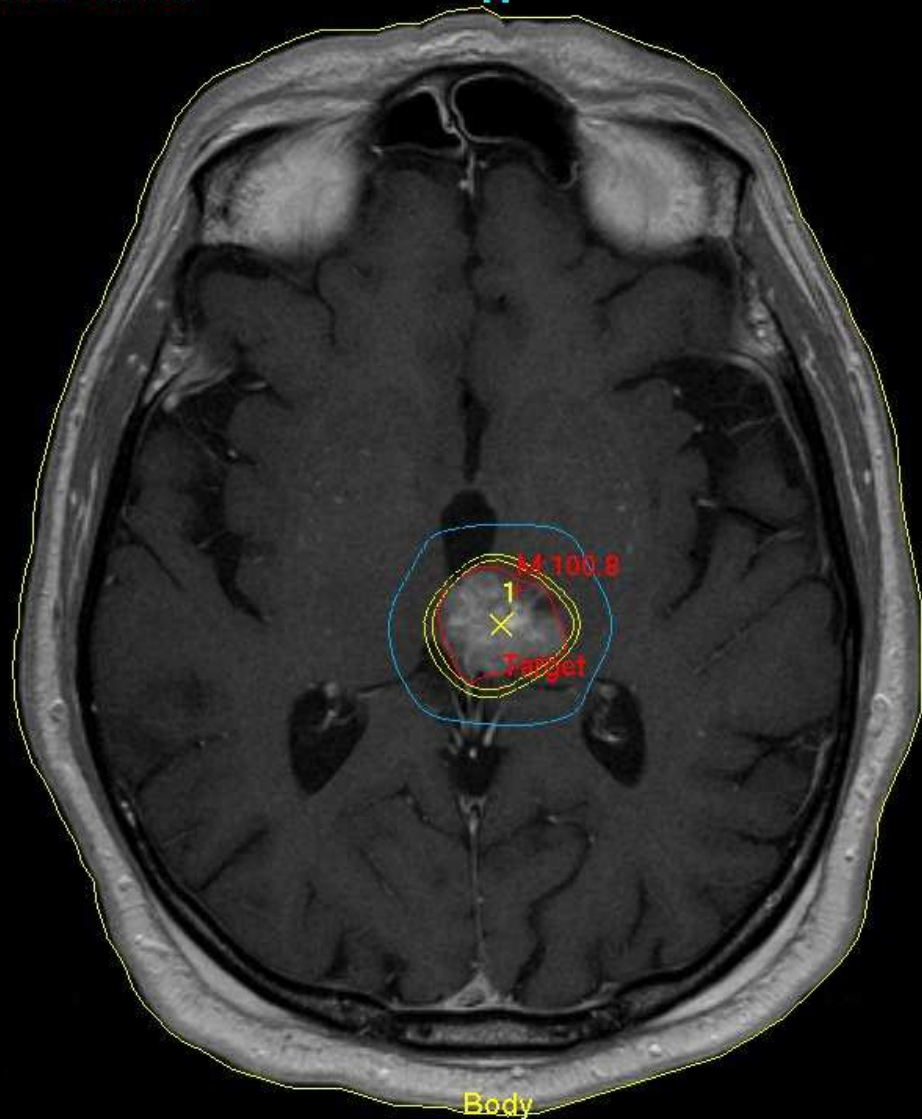
90 [%]

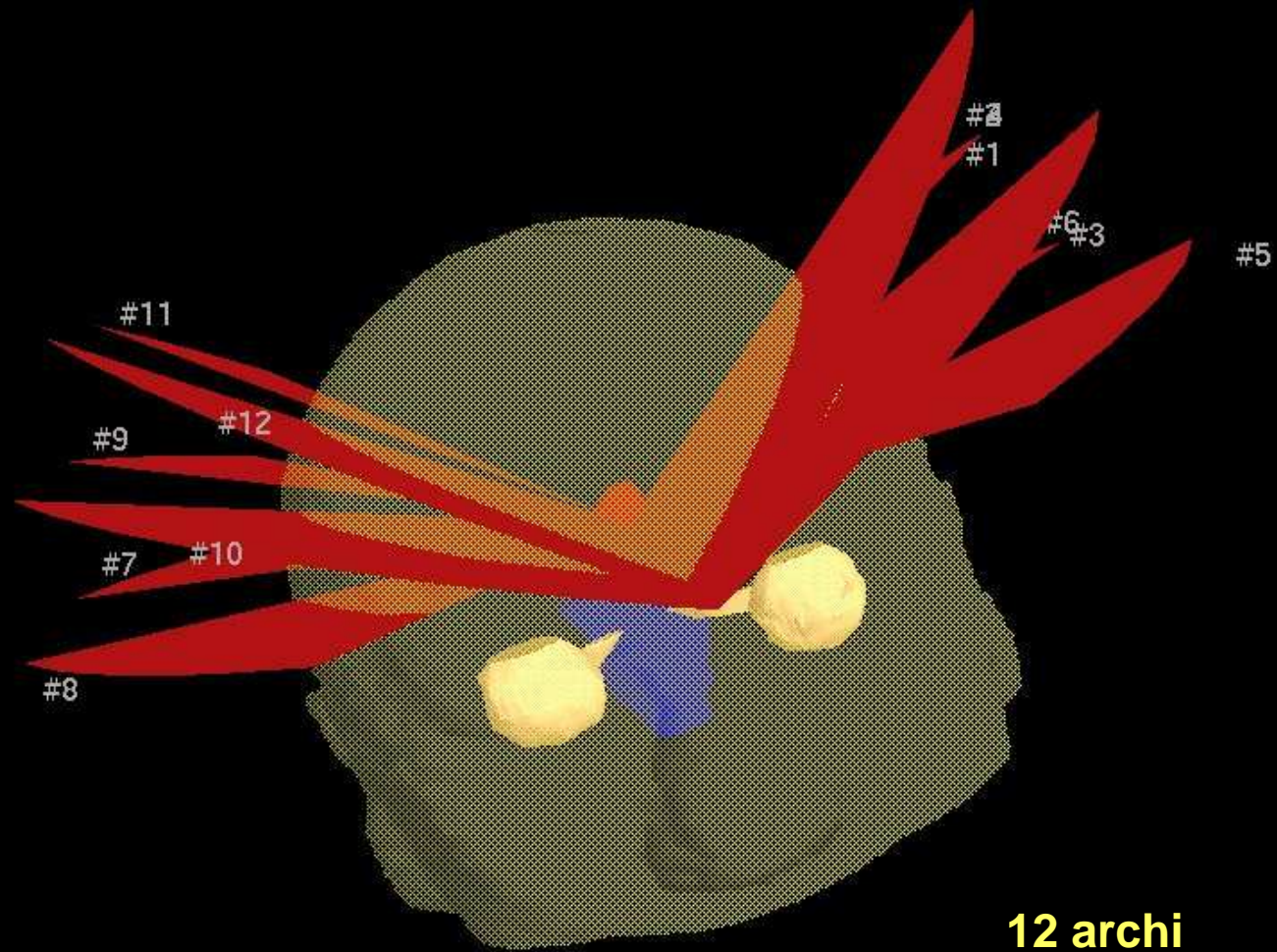
95 [%]

R

L

Body





Sc8/11



Met. da NSCLC

SRS 25 Gy

**RP** 80% dopo 2 mesi

L

W 2019

L 1010



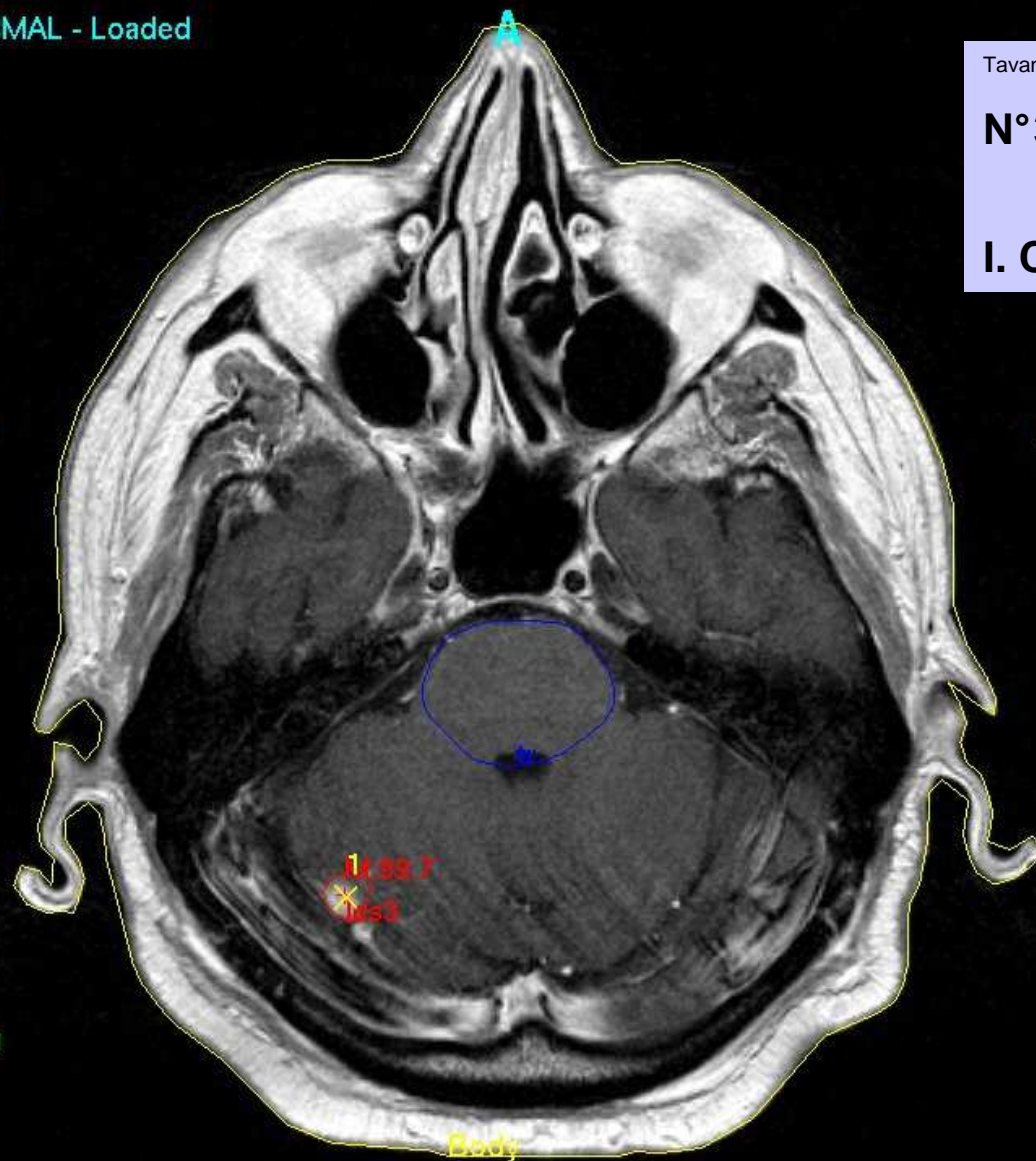
Optimization Mode: AMOA

Calculation Mode: NORMAL - Loaded

Tavanti

**N°3 metastasi da  
NSCLC**

**I. Cerebellare dx**



R

L

Body

Optimization Mode: AMOA

Calculation Mode: NORMAL - Loaded

50 [%]

85 [%]

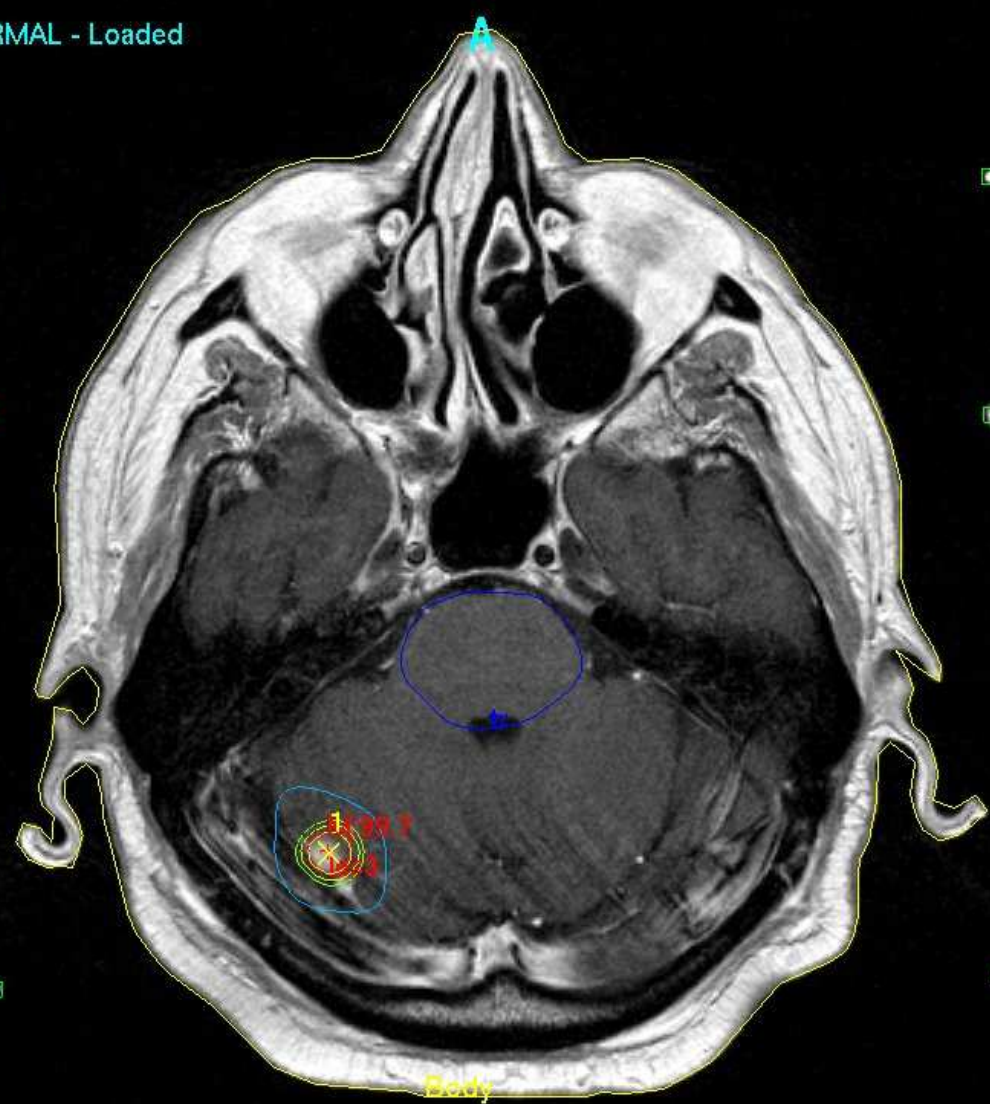
90 [%]

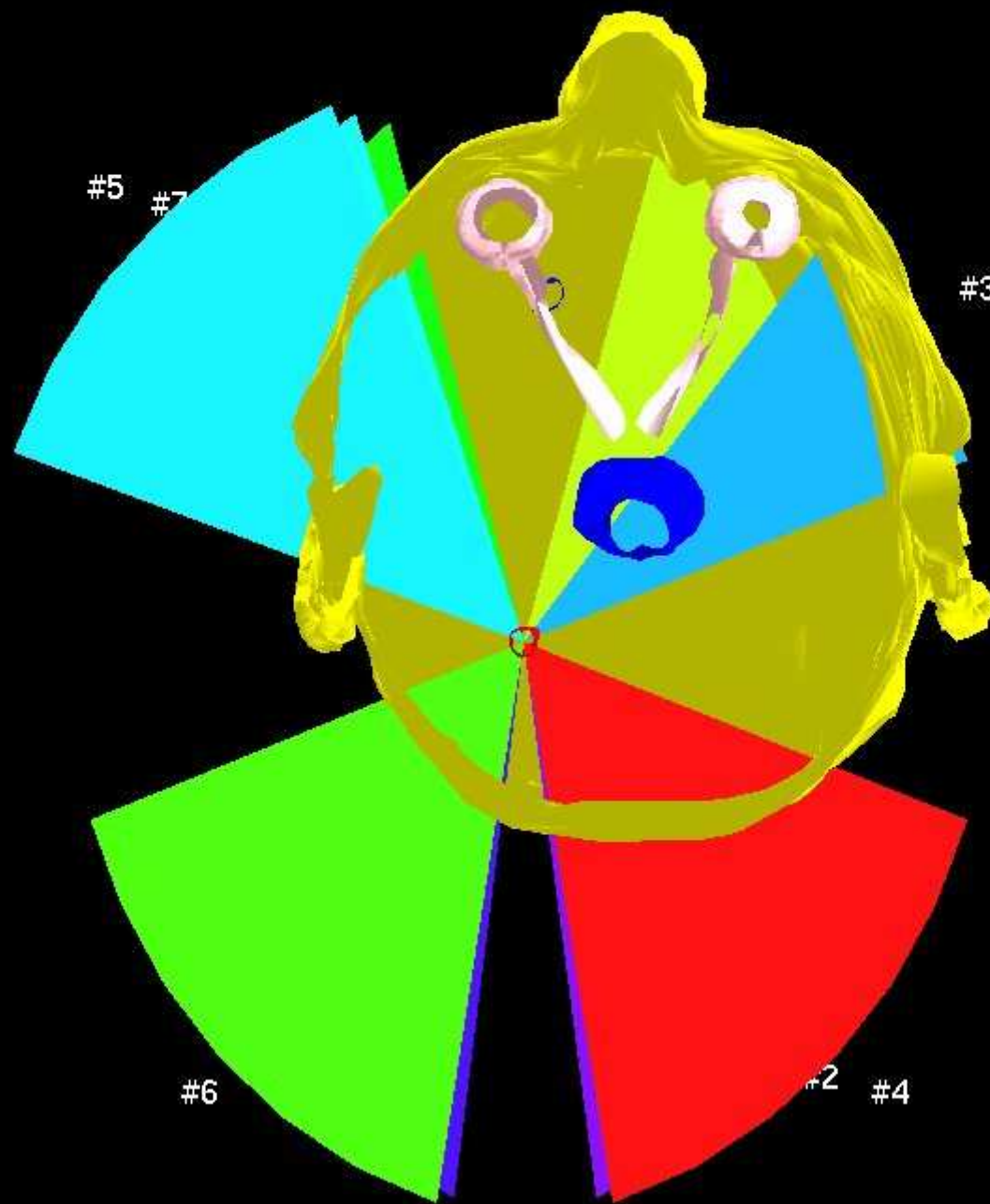
95 [%]

R

L

Body





**9 archi**

Sc7/16

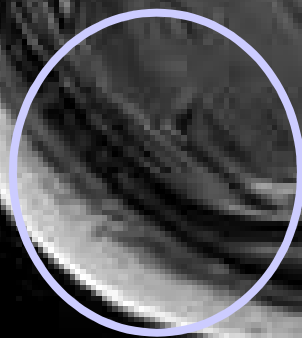
Met. da NSCLC

SRS 23 Gy

**RC** lesione cerebellare

dopo 2 mesi

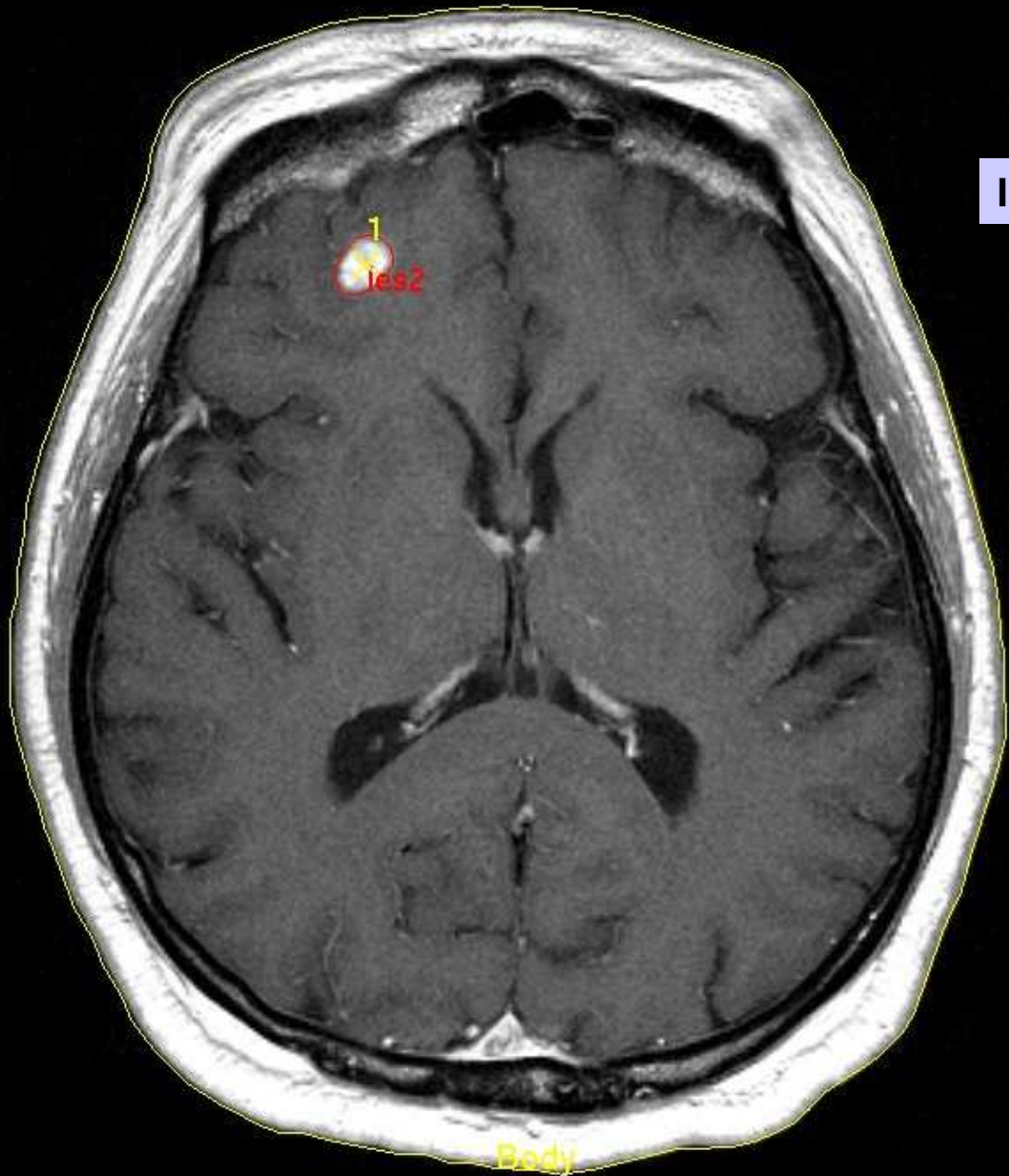
L



W 2249

L 1125

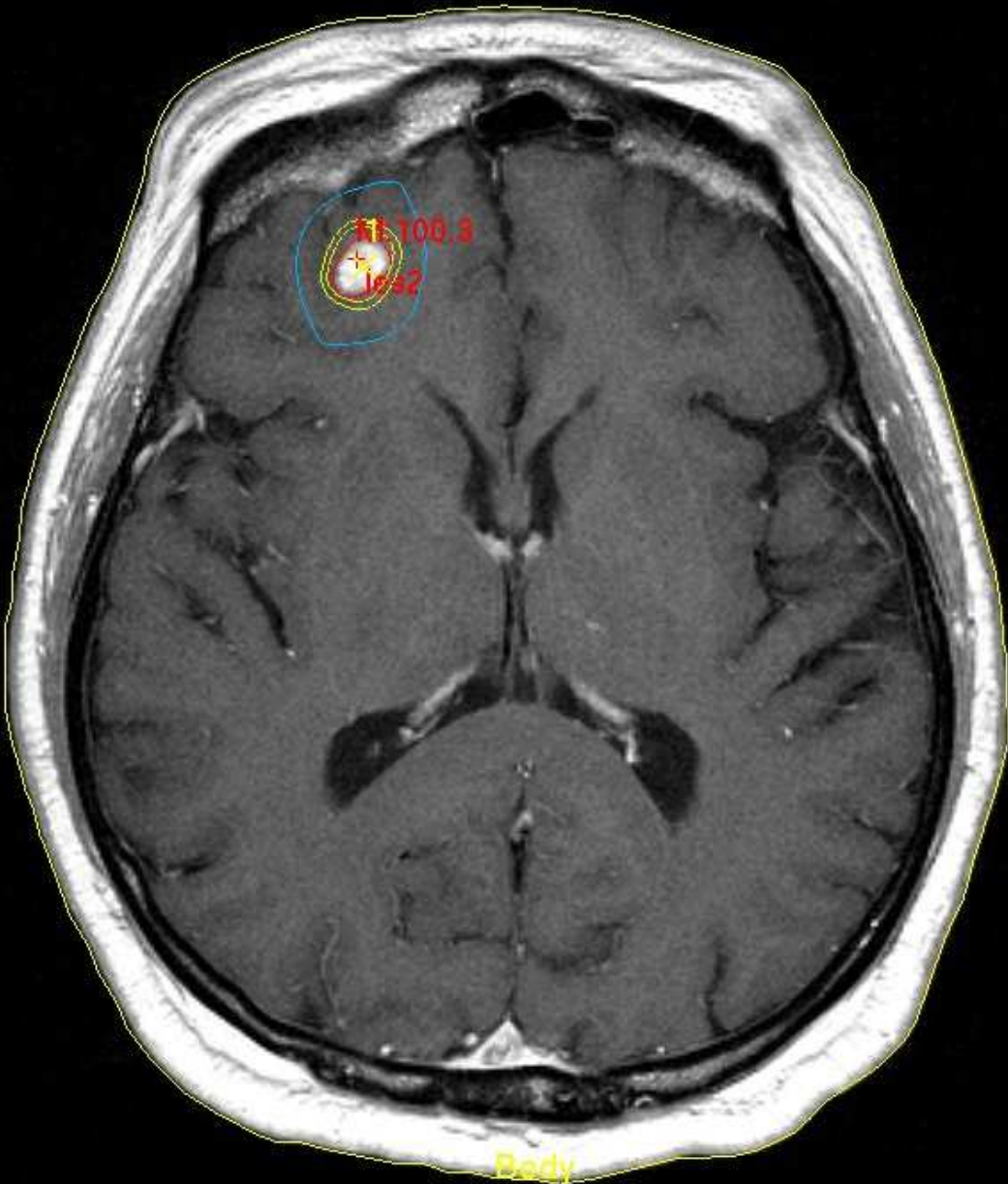
II. Fronto-basale dx



L

Body

50 [%]

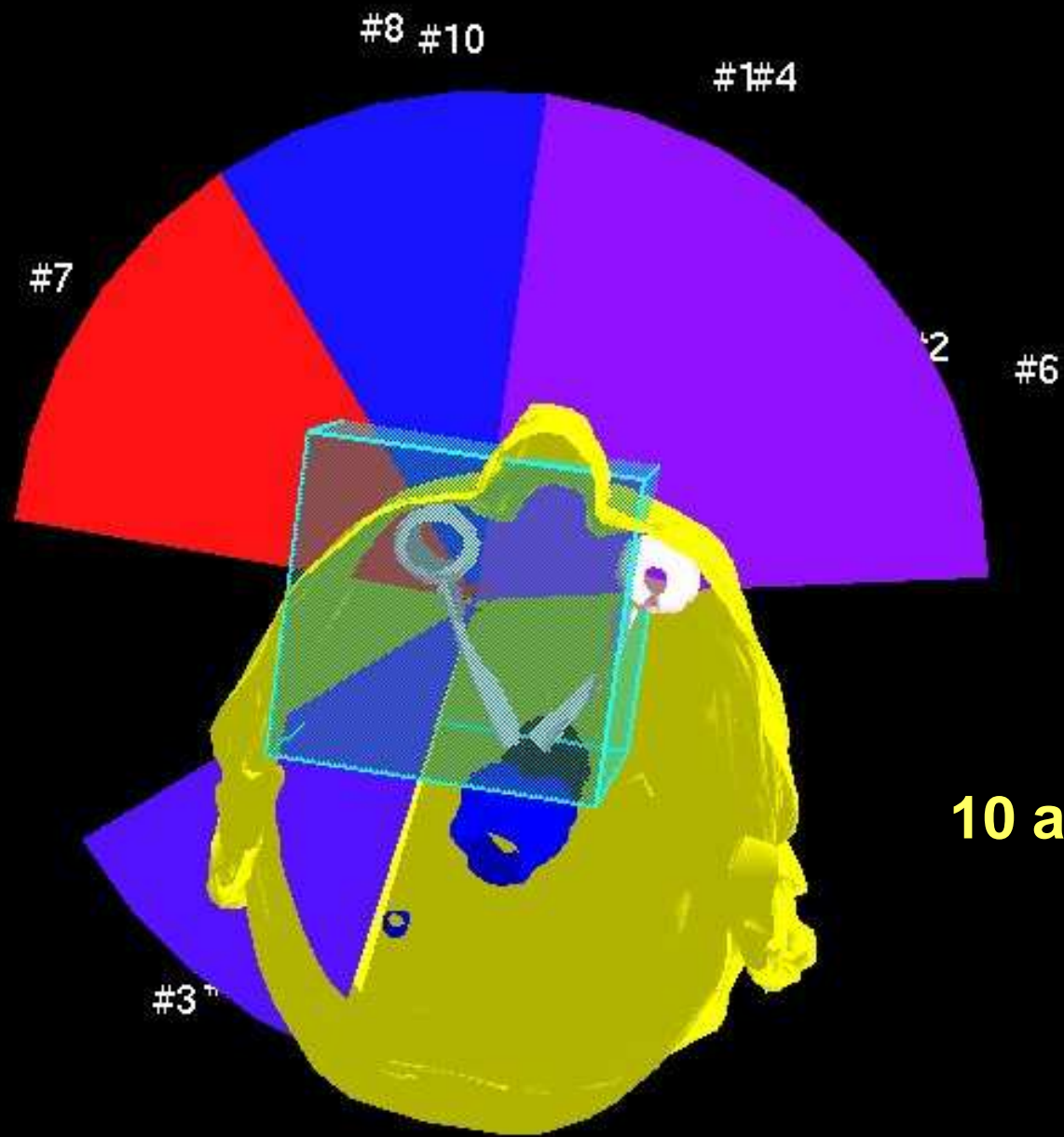


90 [%]

95 [%]

L

Body



**10 archi**

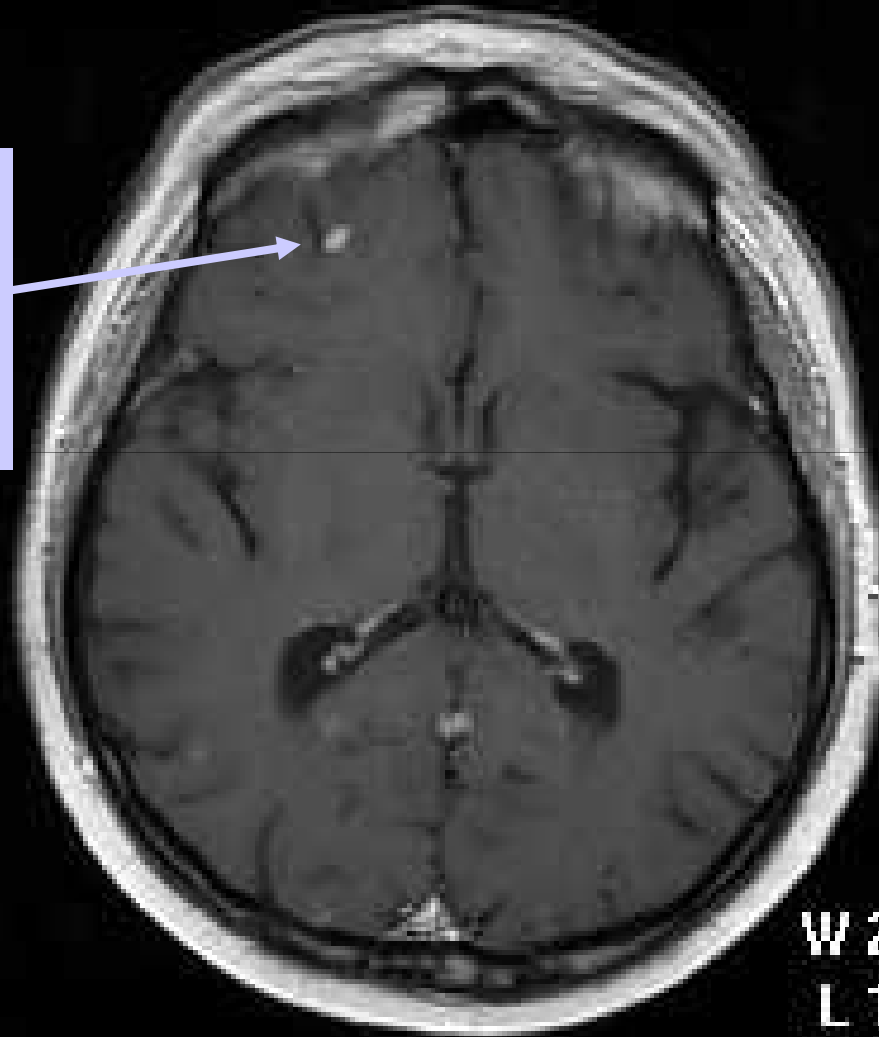
Sc7/12

Met. da NSCLC

SRS 23 Gy

**RP** lesione frontale dx

dopo 2 mesi

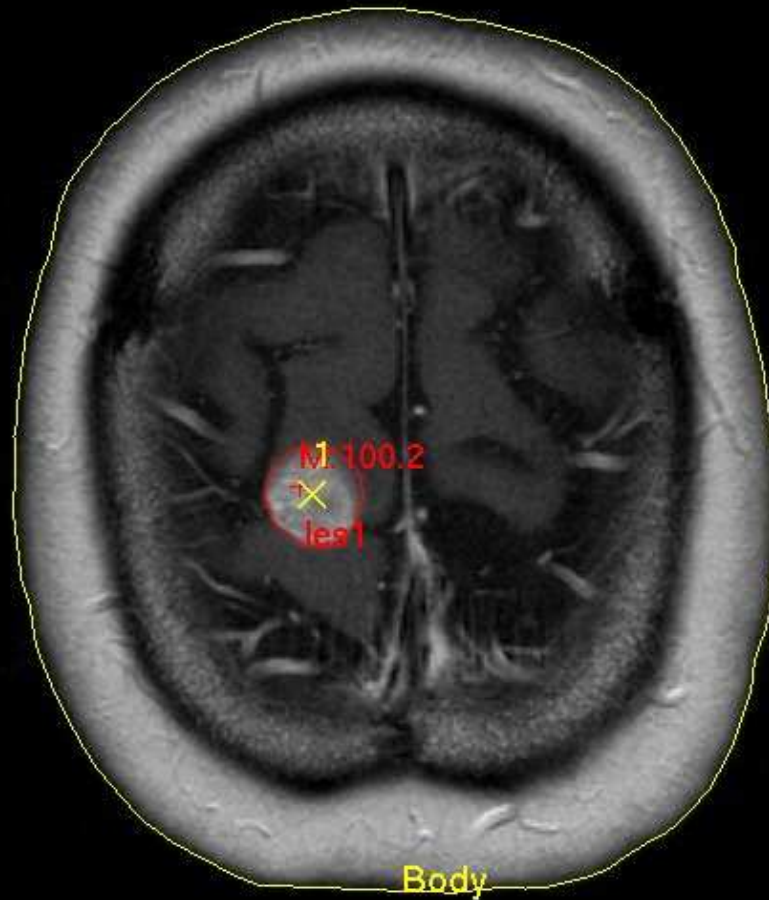


L

W 2000  
L 1000



III. Rolandica dx

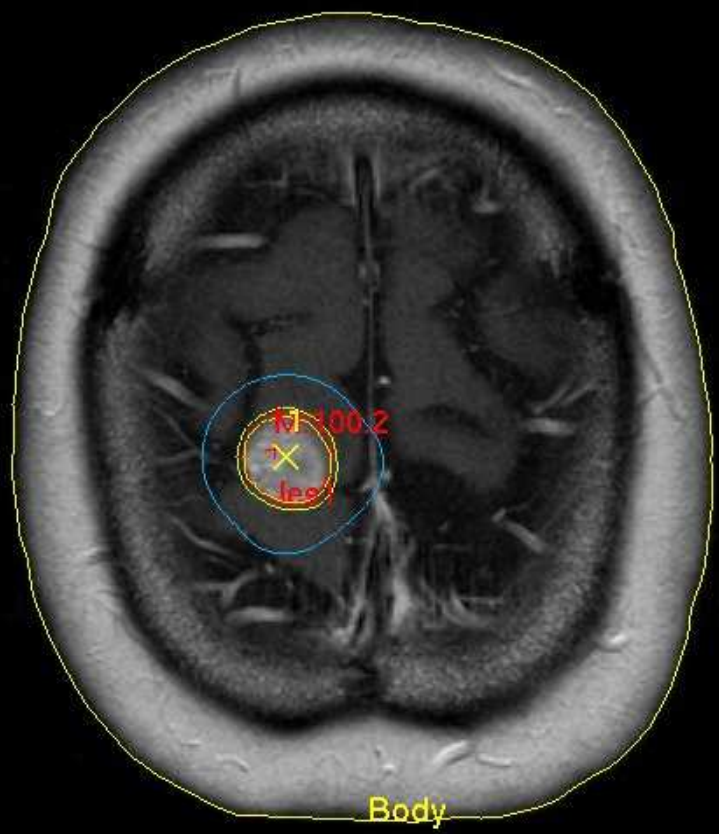


50 [%]

90 [%]

95 [%]

L



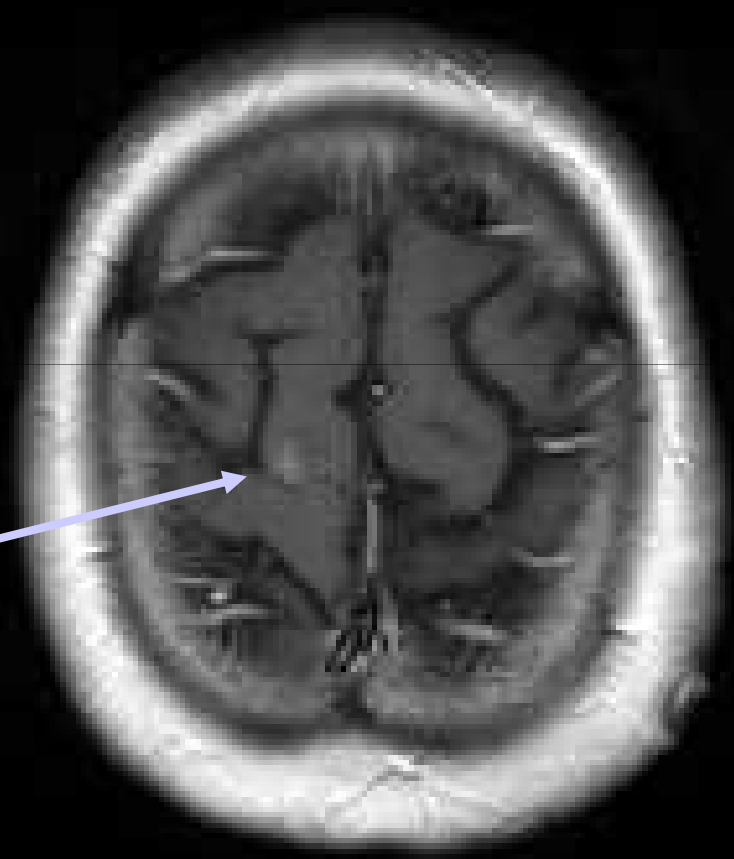
Body

**2 archi  
coplanari**

#2



Sc7/21



L

Met. da NSCLC

SRS 23 Gy

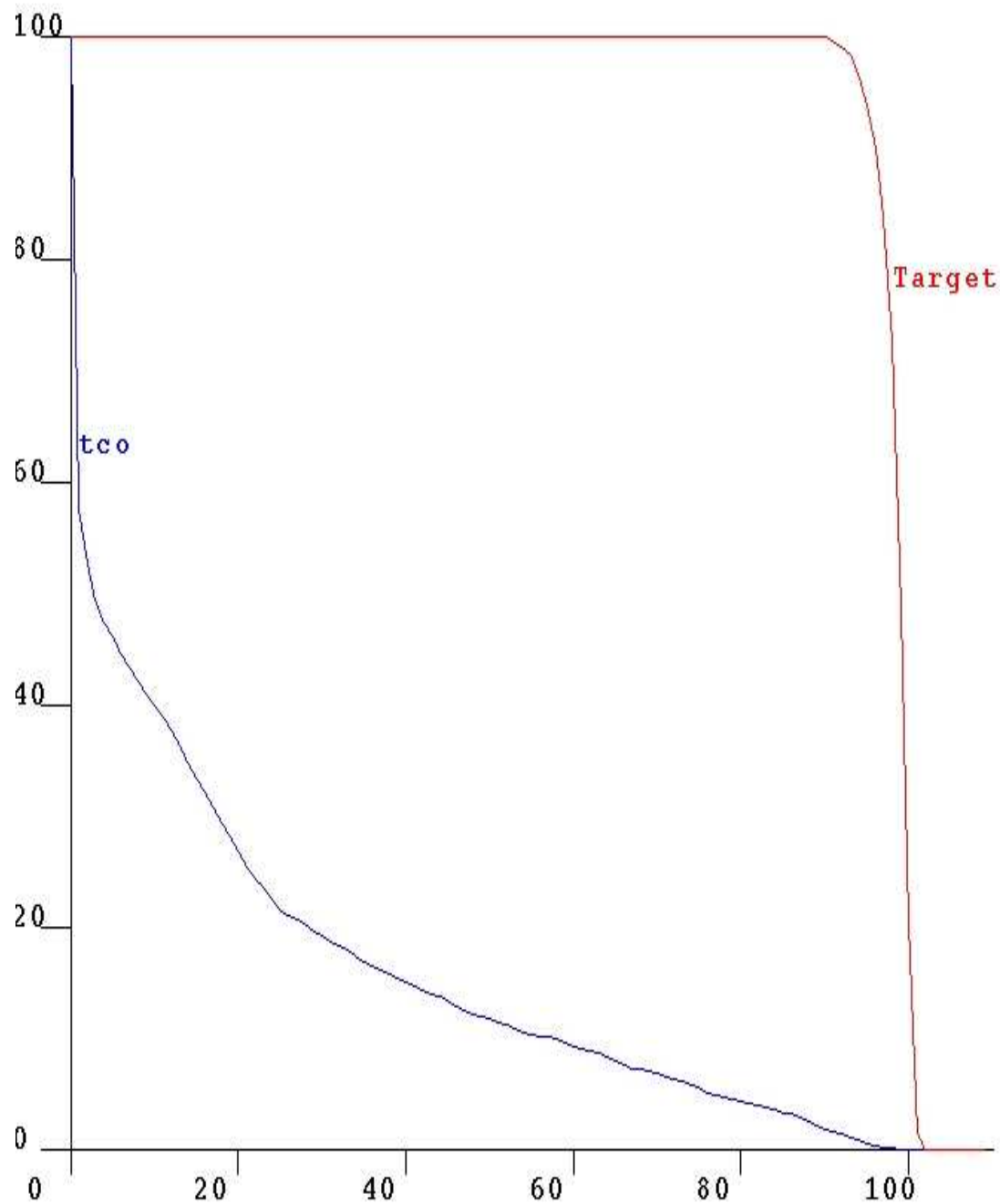
RP lesione rolandica dx

dopo 2 mesi

W 1891

L 945

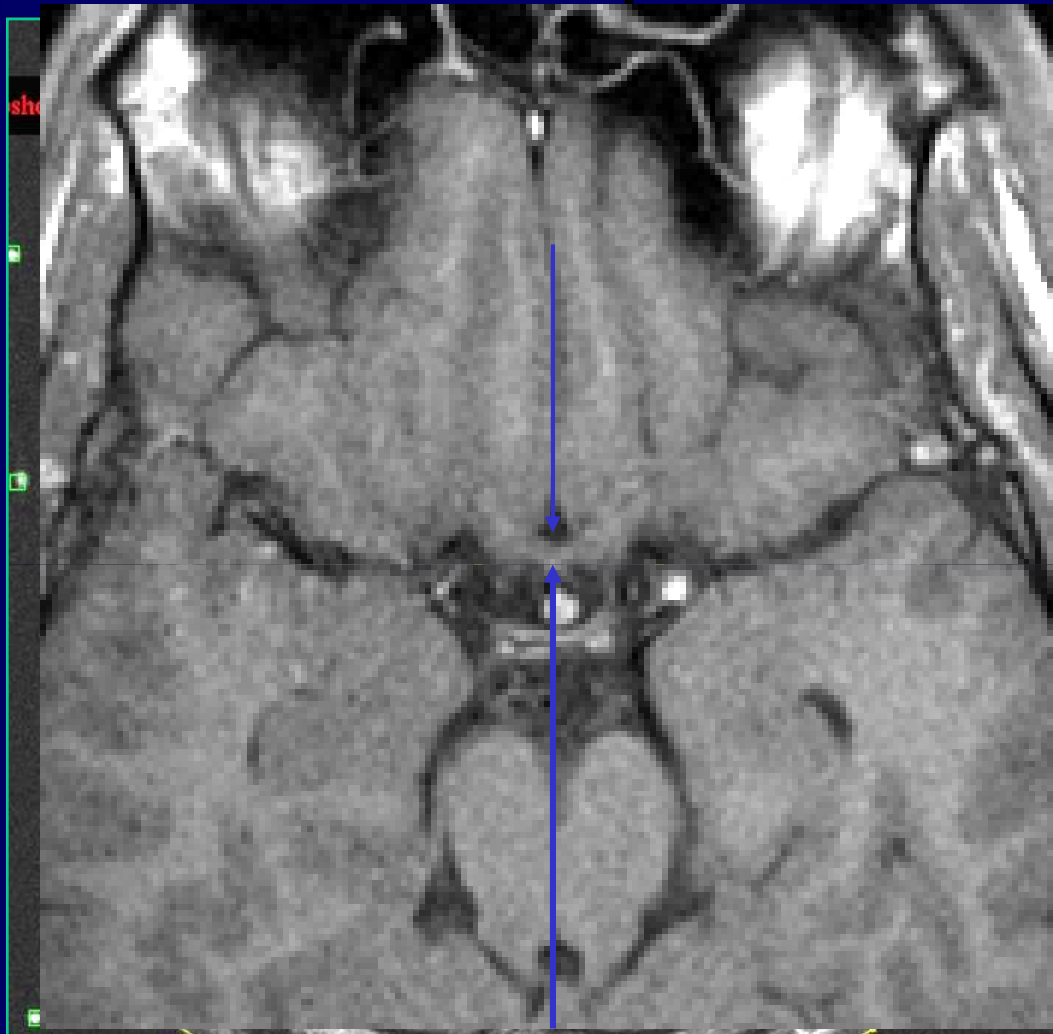
Volume %



VOI	Vol. (cc)	Area	Dose (%)		
			Max	Min	Avg.
tco	32.2	16	98	0	15
Target	3.7	99	101	87	98

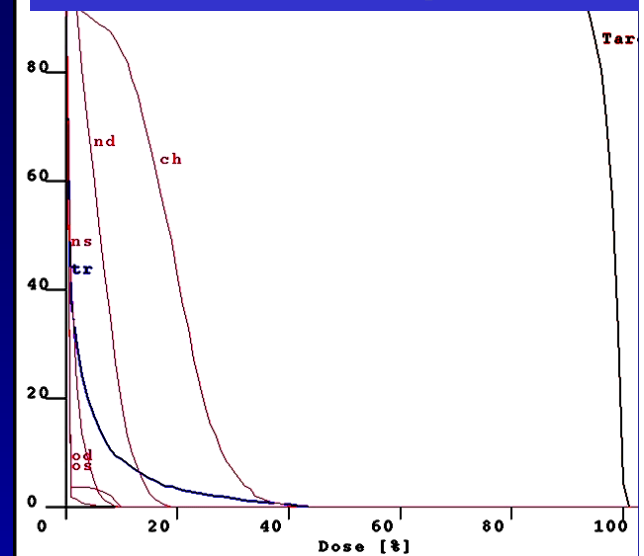
\* could be incomplete

# Adenoma ipofisario

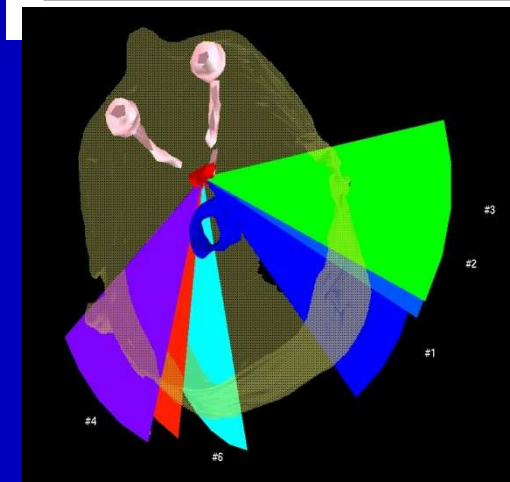


Dose chiasma - media: 17%  
massima: 41%

Dose: 20 Gy

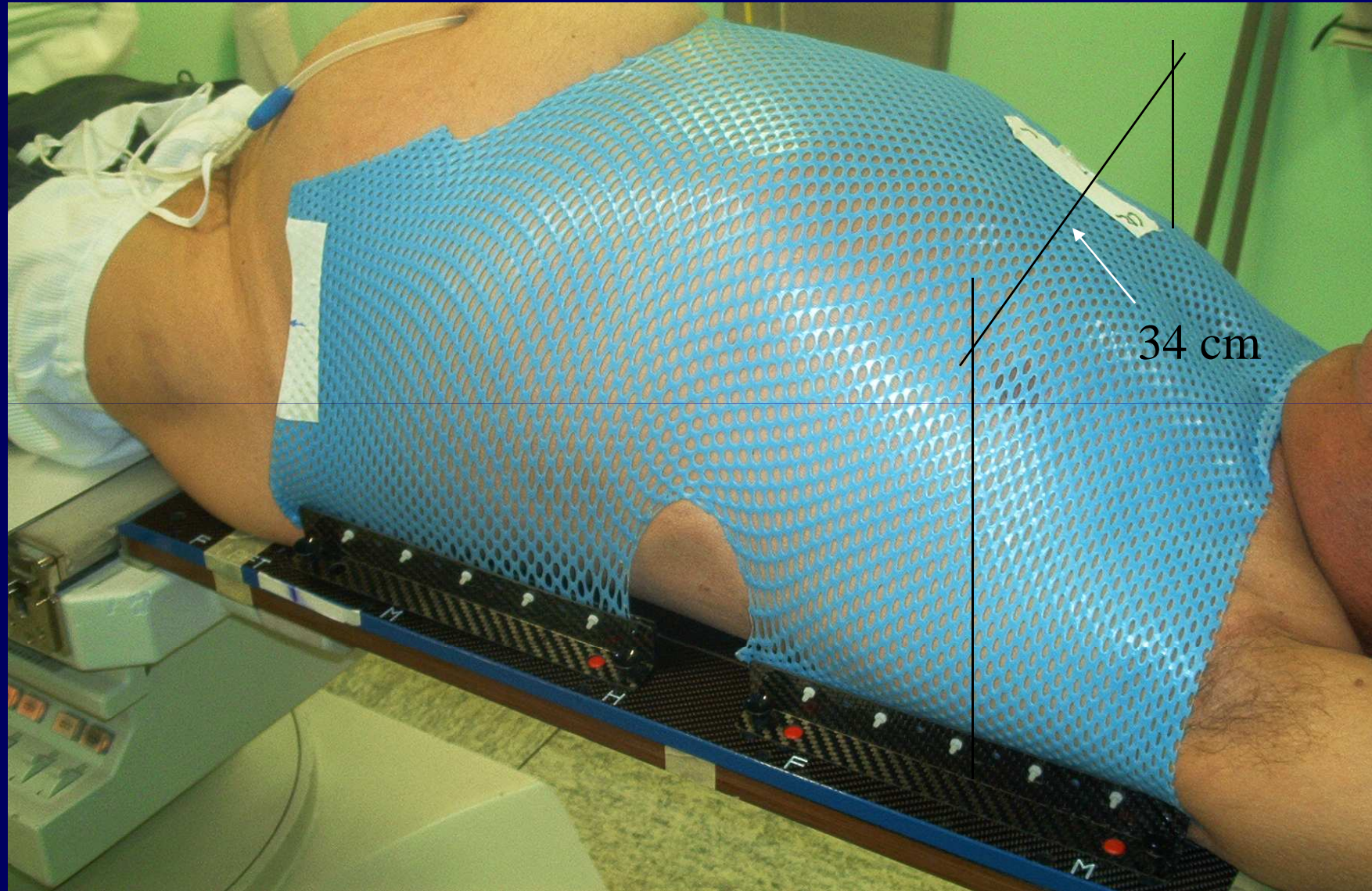


VOI	Vol. (cc)	Area	Dose (%)		
			Max	Min	Avg.
tr	26.7	3	43	0	2
<b>Target</b>	<b>0.4</b>	<b>97</b>	<b>100</b>	<b>82</b>	<b>96</b>
ch	0.1	18	41	0	17
nd	1.0	7	18	0	6
ns	1.1	1	8	0	0
od	6.6	1	9	0	0
os	6.6	1	9	0	0



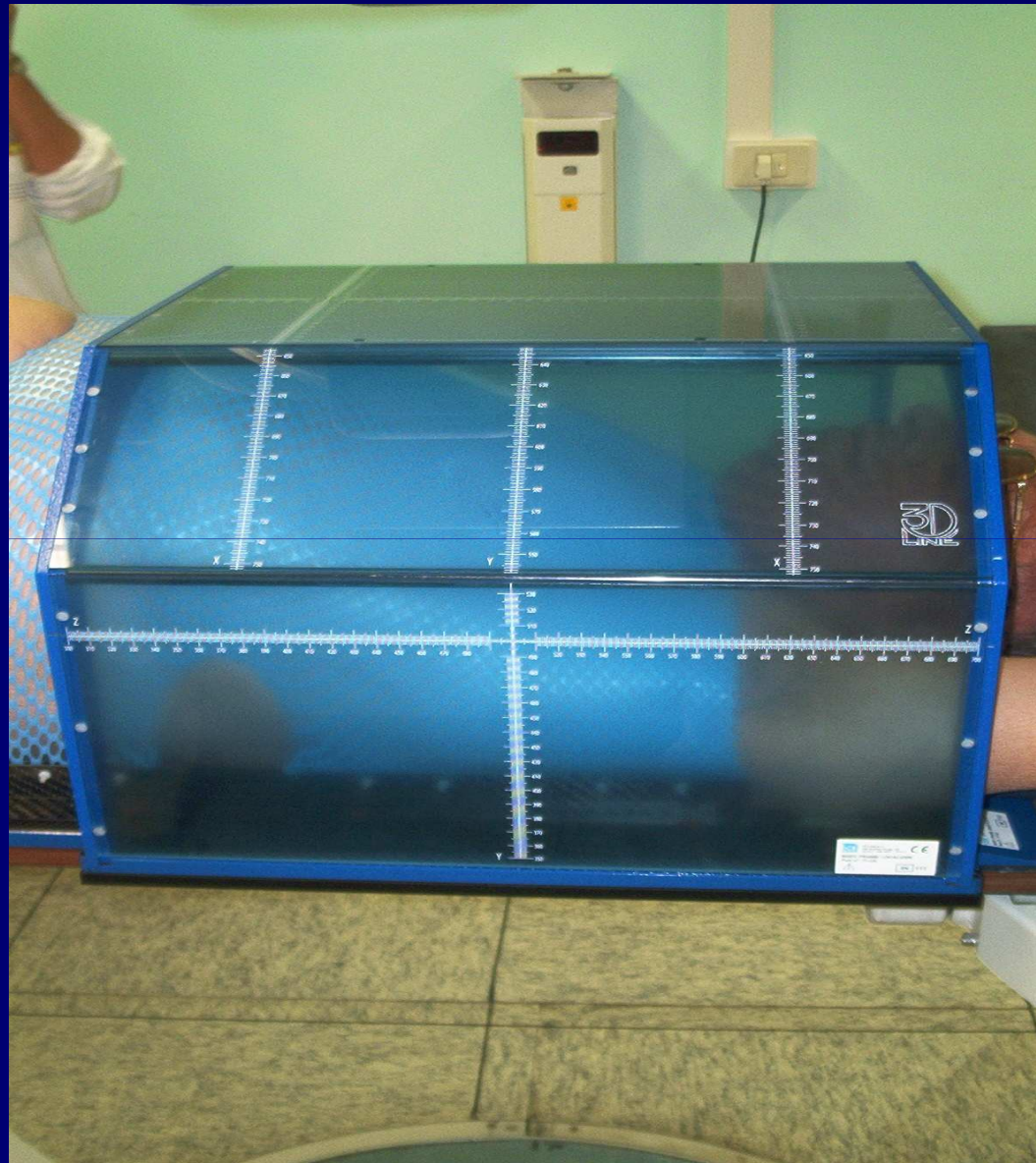
**RADIOTERAPIA STEREOTASSICA  
EXTRACRANICA ('BODY')**

# Immobilizzazione

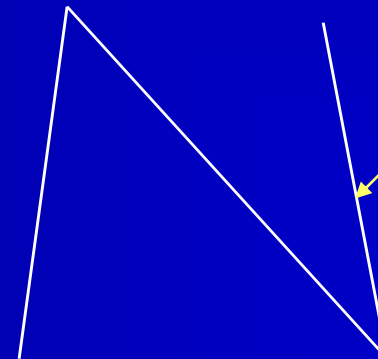
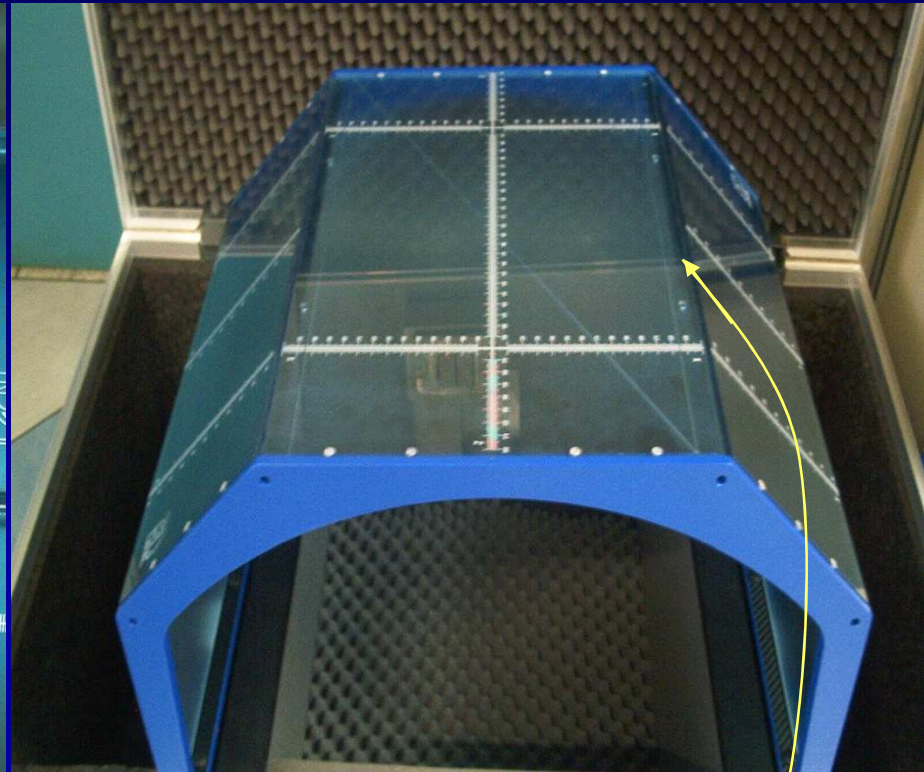
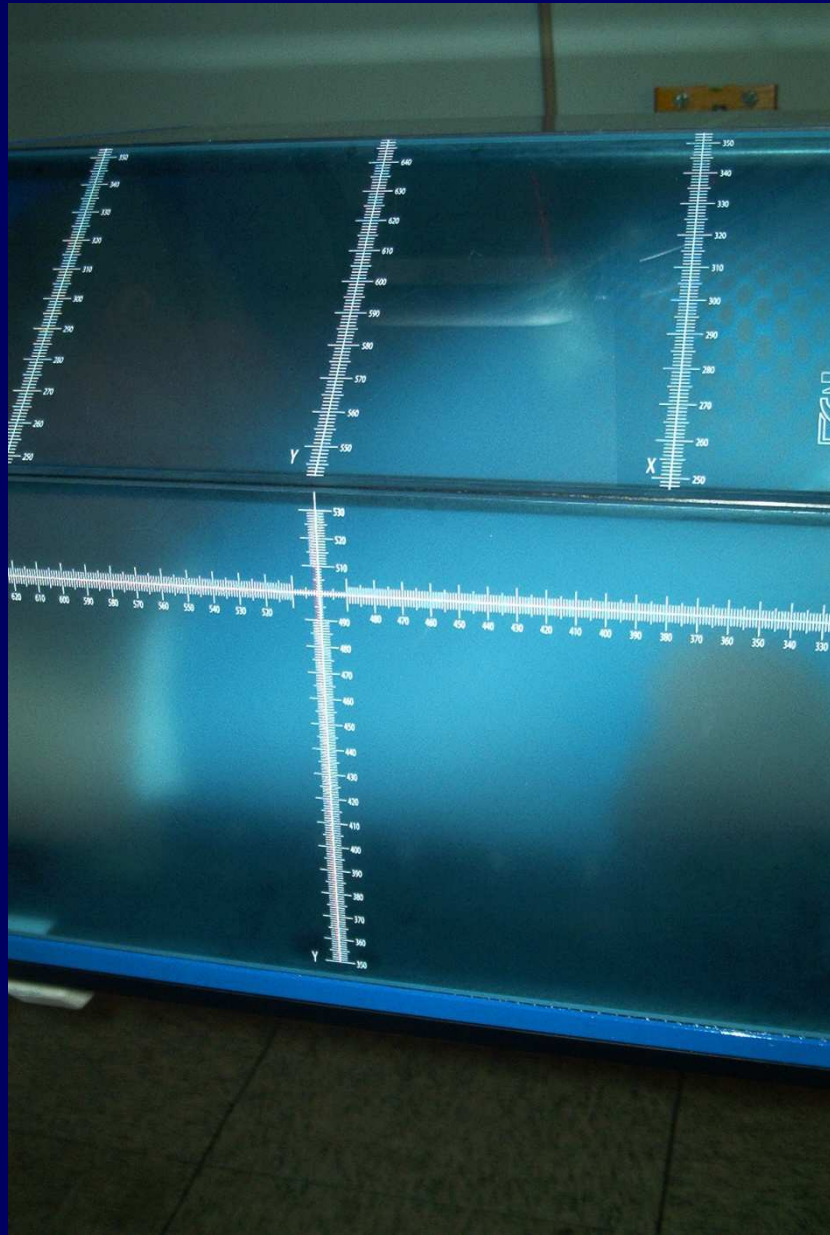


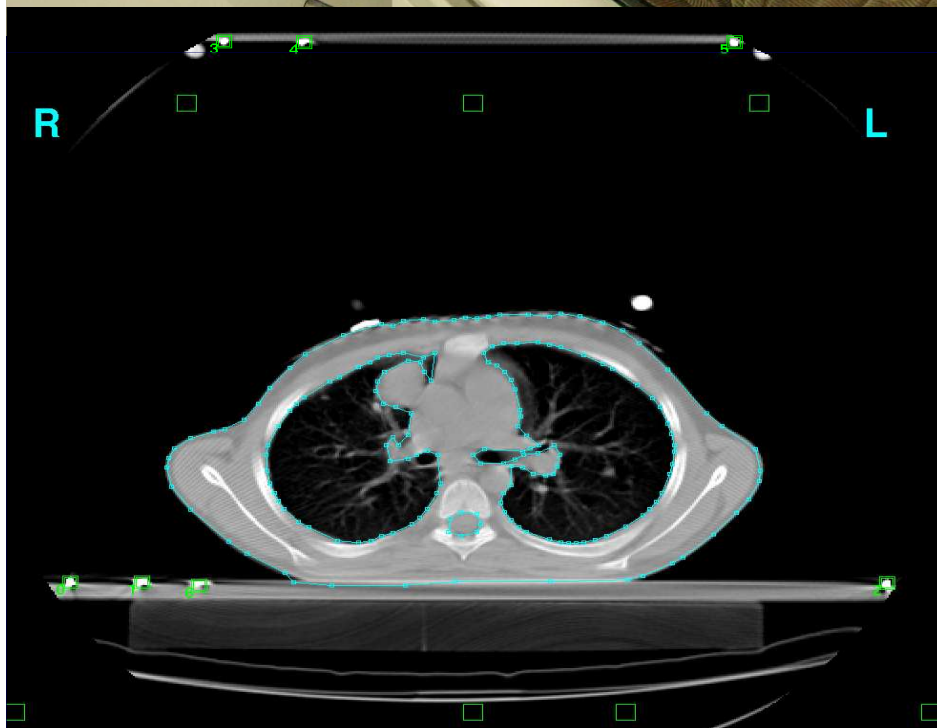


# Localizzazione con Body Frame



# Localizzazione con Body Frame





## RADIOTERAPIA STEREOTASSICA EXTRACRANICA

**“BODY FRAME”**

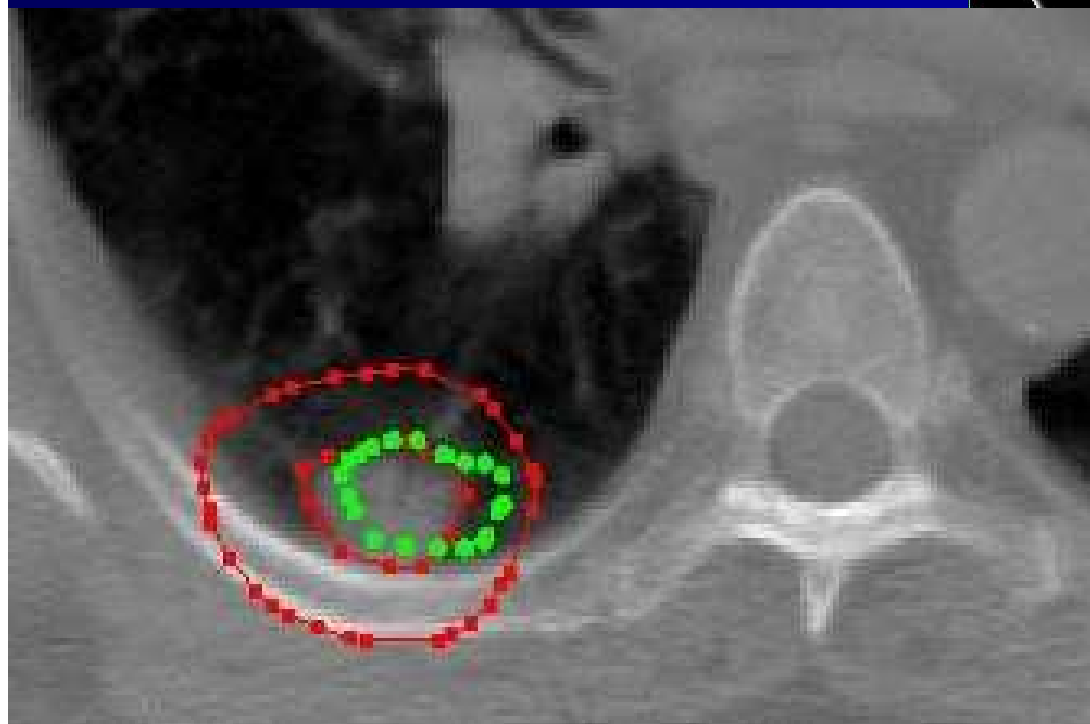
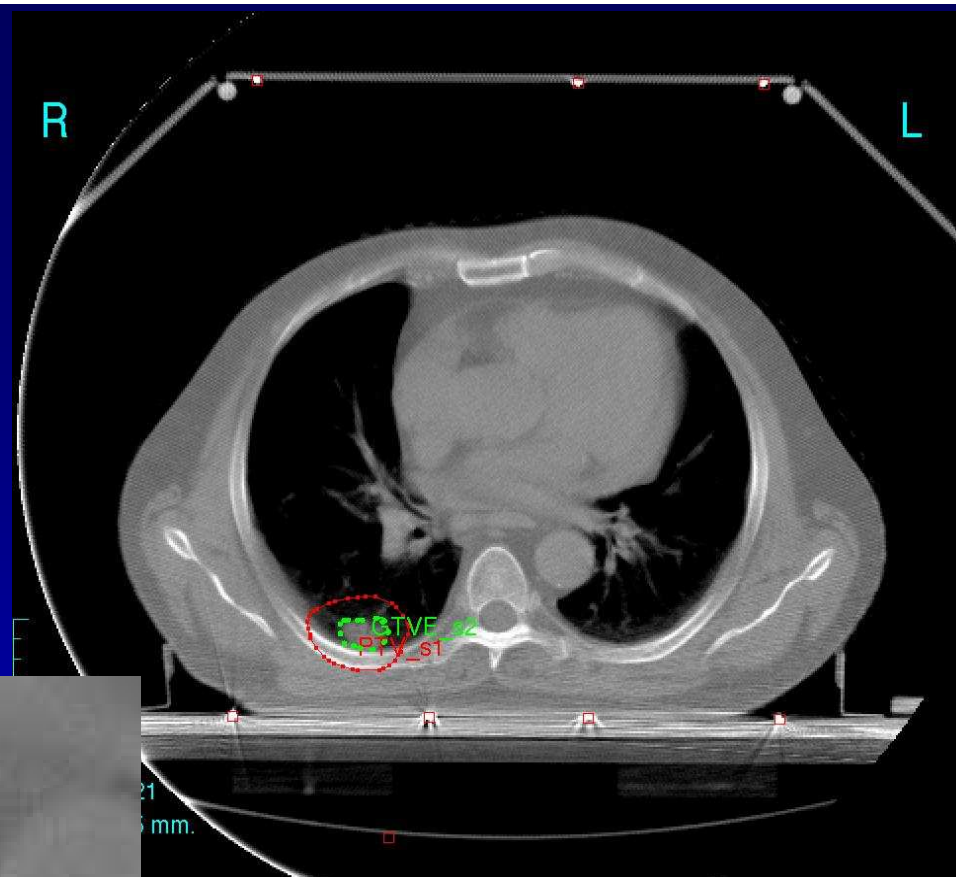
**CON FUNZIONE DI GENERATORE  
DI COORDINATE STEREOTASSICHE  
PER SEDI EXTRACRANICHE CON**

**IMAGING**

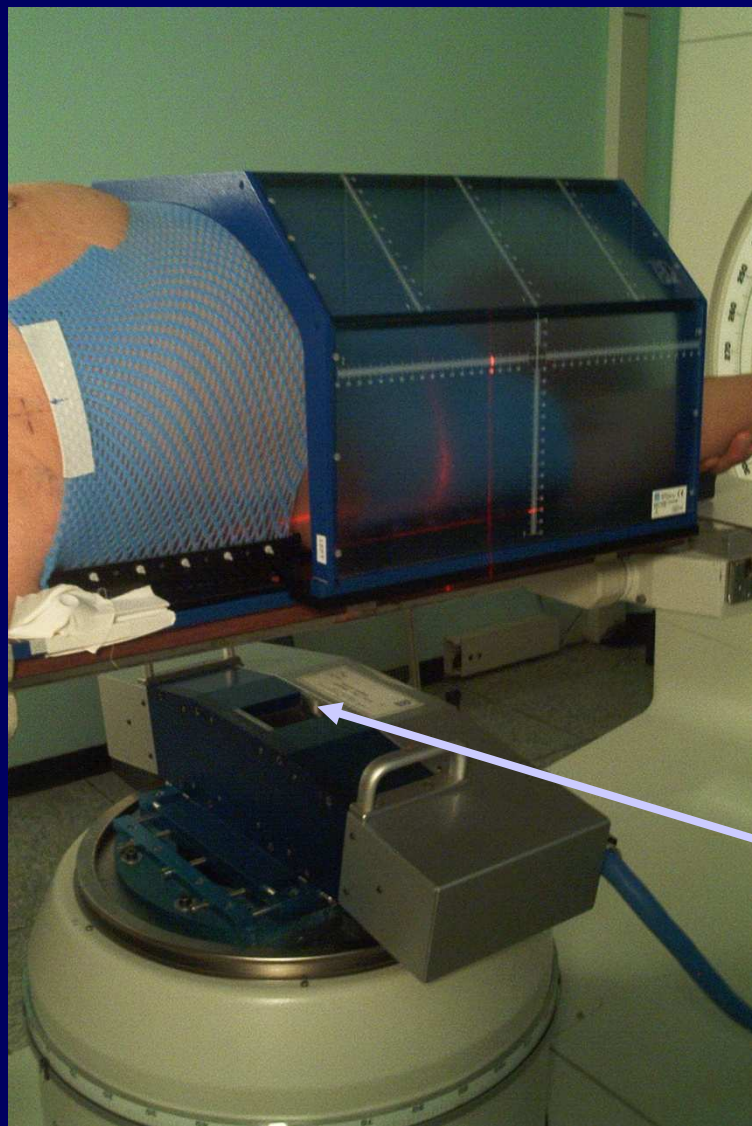
**TC – RM – PET**

C.G. 65 anni, PSK 90,  
metastasi polmonare  
da carcinoma del colon

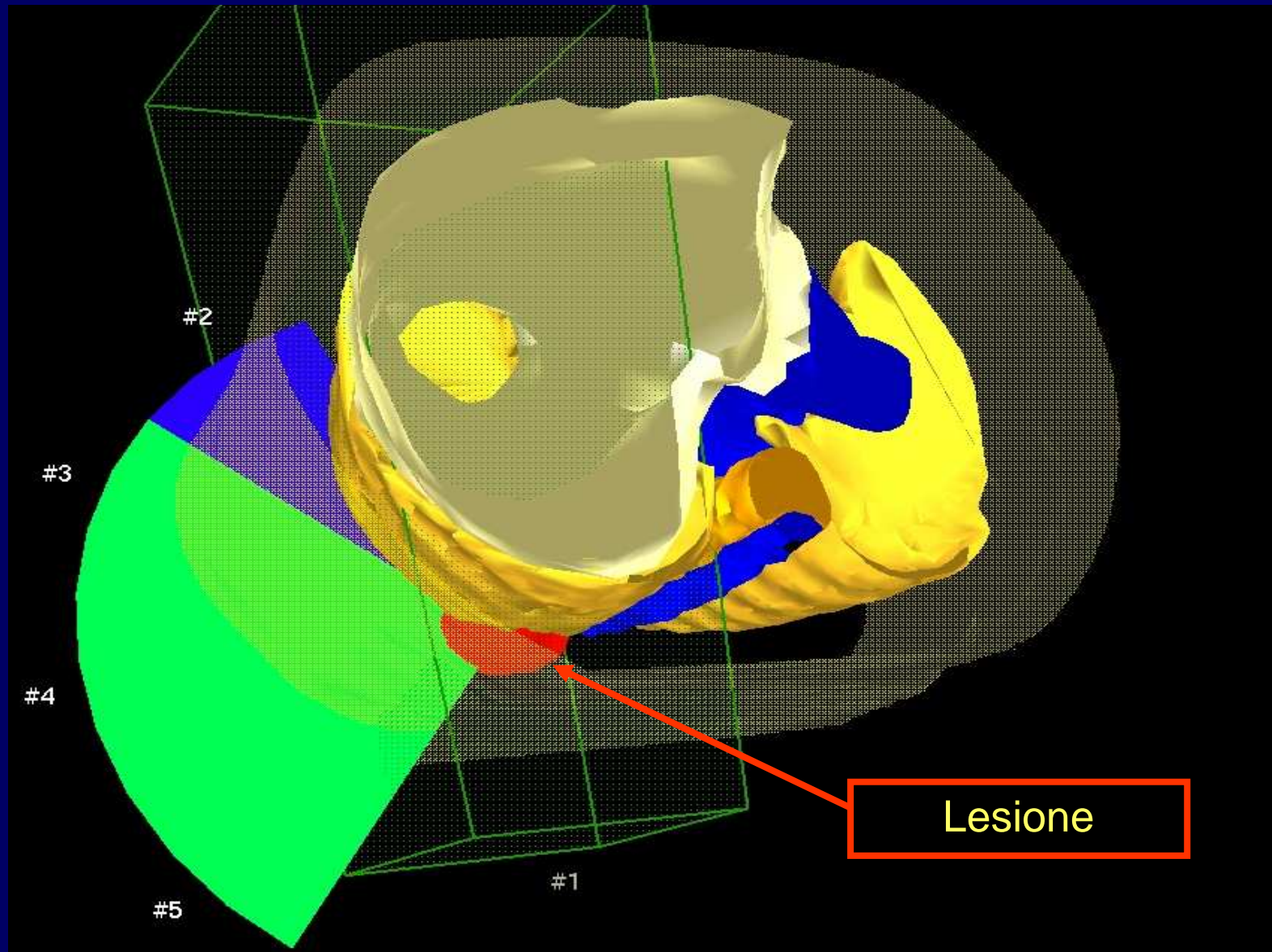
4 archi dinamici e 1  
campo fisso coplanari

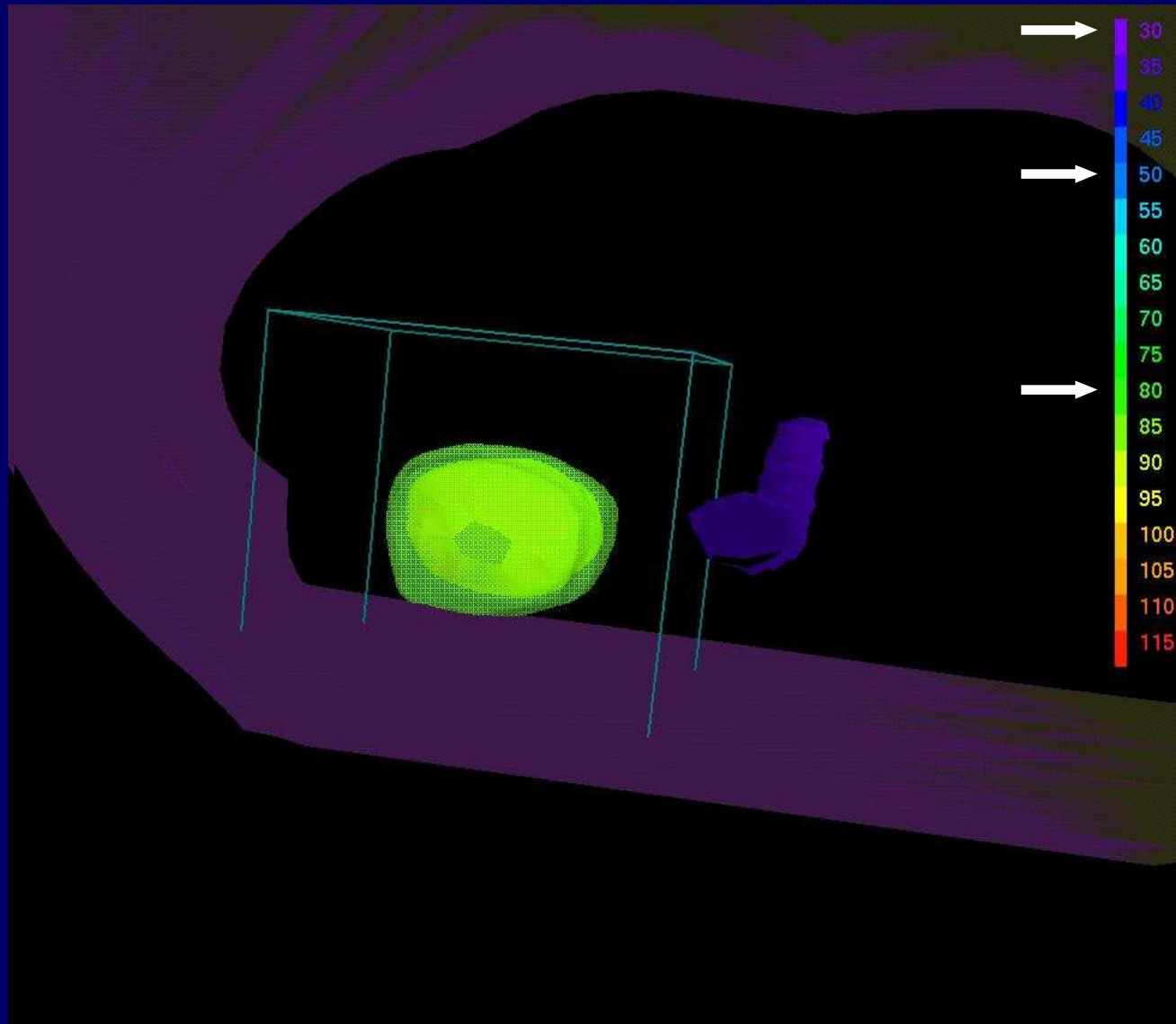


# Terapia



Schermo micro-multilamellare

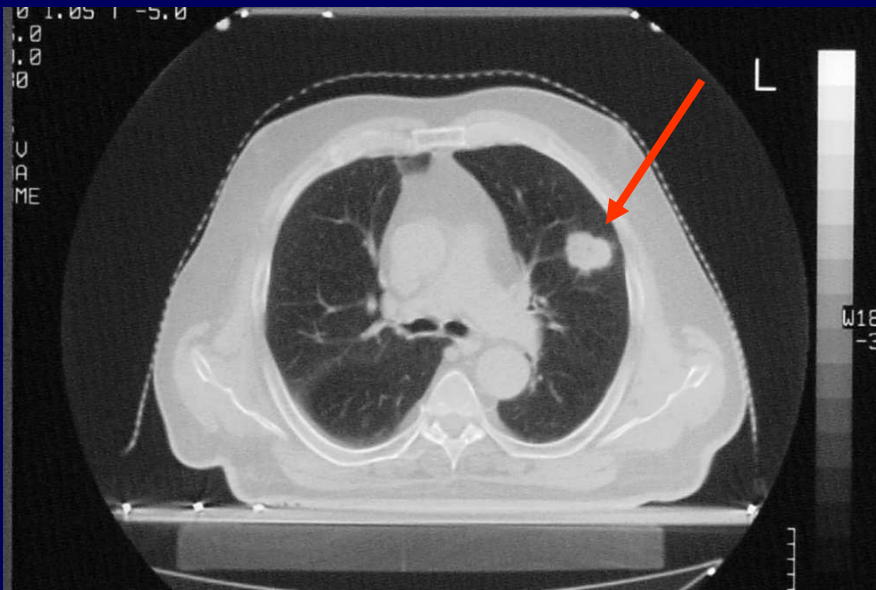




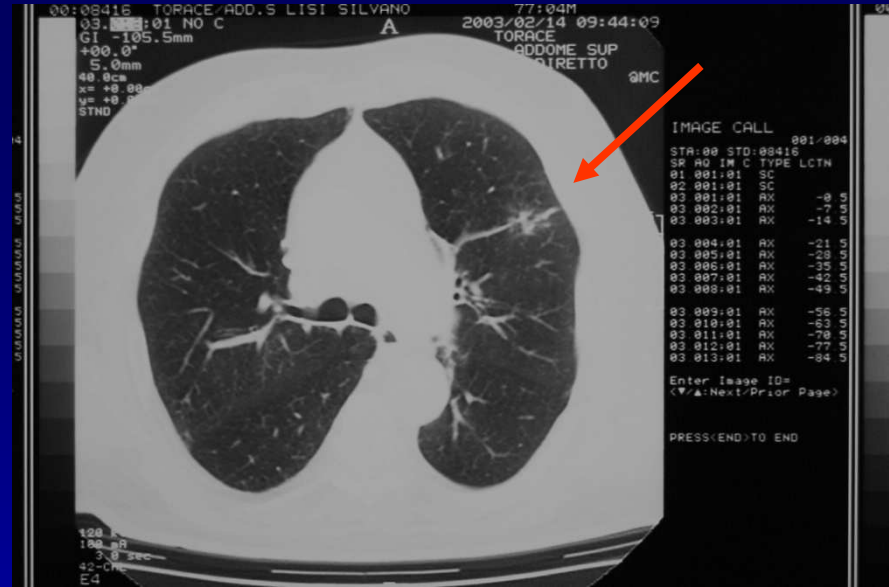
**RADIOTERAPIA STEREOTASSICA EXTRACRANICA**

# Immagini Pre e Post Radioterapia Stereotassica

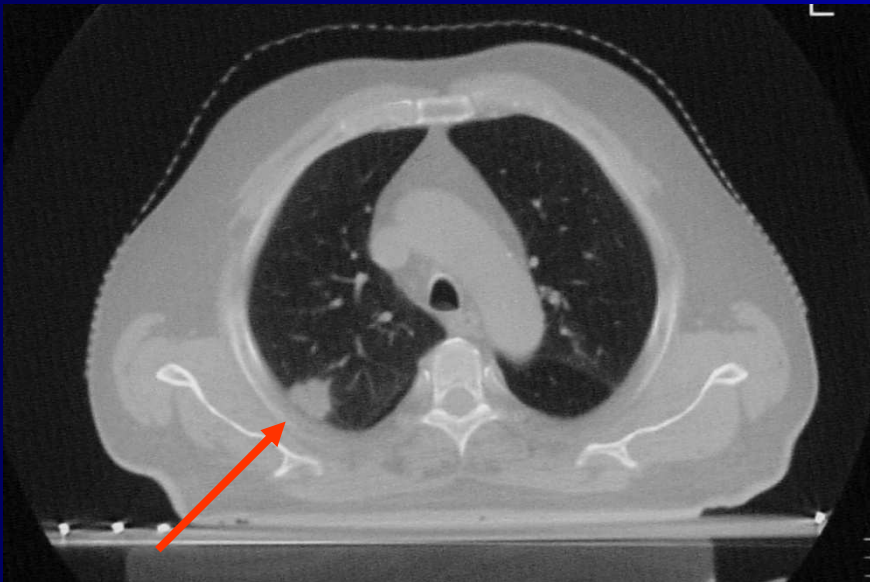




TC pre - trattamento



Controllo 2 m dopo la RT stereot.



B.O. 70 anni,  
PSK 100

M1 LA da K Retto-sigma: Linf. pararenale sn.  $\varnothing$  1.5 x 2.5 cm

- pT3N2 stadio C2 Duke
- 9/00 R.A.R. + CT adiuv.
- 6/02 recidiva nodale: CT II linea + RT LA (2 → 50 Gy)
- 5/03 nuova P LA

