

IL FISICO IN OSPEDALE

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LO SPECIALISTA IN FISICA MEDICA



LAUREA IN FISICA
3+2 anni

+

SPECIALIZZAZIONE
IN FISICA MEDICA
3 anni

=

SPECIALISTA IN
FISICA MEDICA



STUDI
e PRIVATI

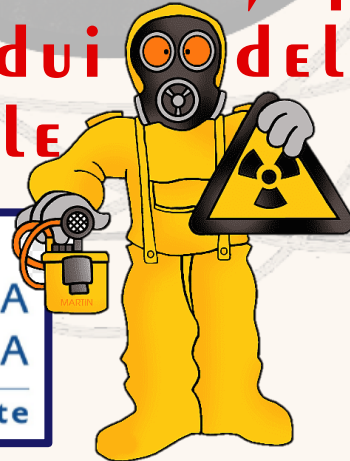


Esperto di
radioprotezione

DITTE
ambito
medico

Lo specialista in fisica medica è la figura professionale che applica i principi e le metodologie della fisica in medicina, nei settori della prevenzione, della diagnosi e della cura, al fine di assicurare la qualità delle prestazioni erogate e la prevenzione dei rischi da esposizione a RADIAZIONE per i pazienti, gli operatori e gli individui della popolazione in generale

Ma di cosa si occupa lo specialista in fisica medica (mai sentito nominare prima)?

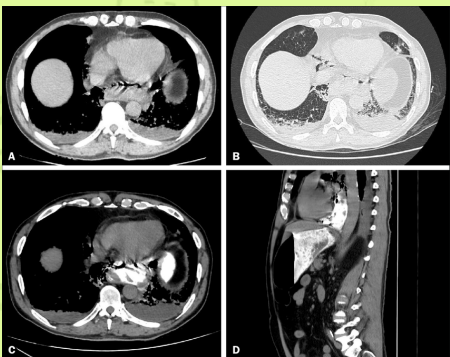


ASSOCIAZIONE ITALIANA
di FISICA MEDICA e SANITARIA
La Fisica al servizio della salute



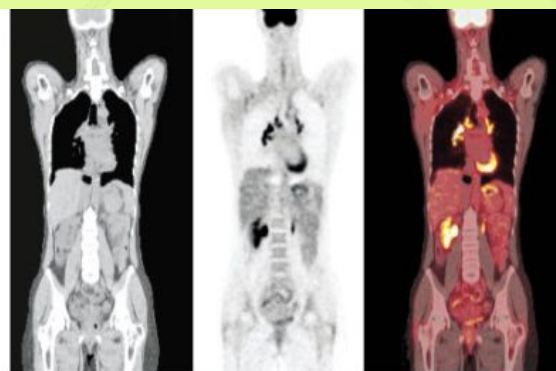
AMBITI DI LAVORO

A RADIOLOGIA



Diagnostica e
Interventistica

B MEDICINA NUCLEARE



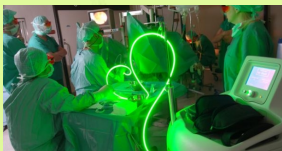
Diagnostica e Terapia

C RADIOTERAPIA

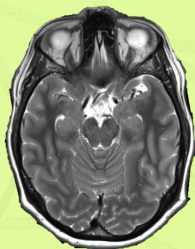


Terapia

D RADIAZIONI NON IONIZZANTI

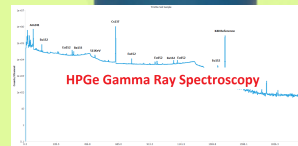


Laser



Risonanza
magnetica

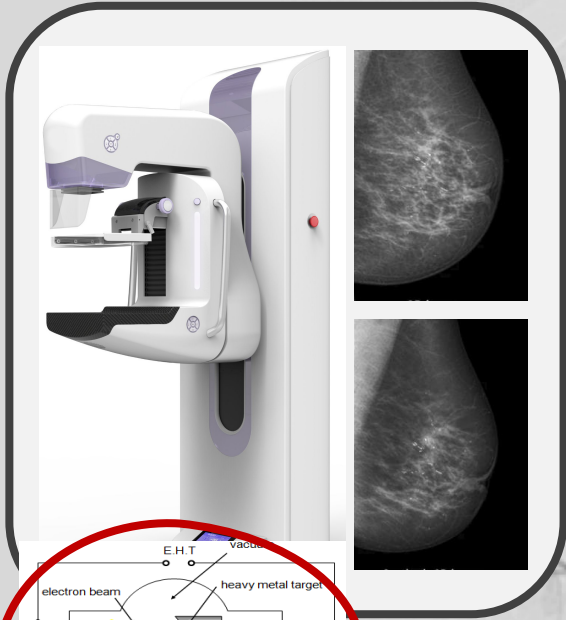
E RADIOPROTEZIONE



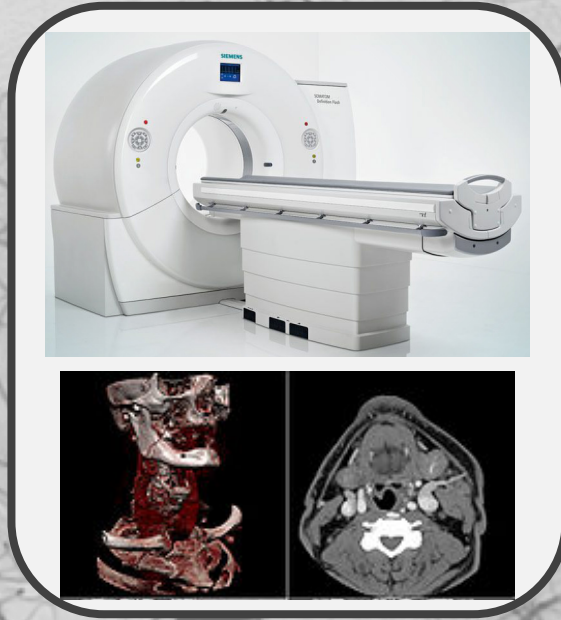


RADIODIAGNOSTICA

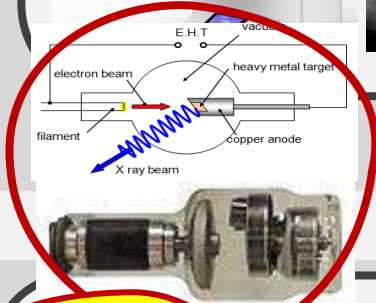
MAMMOGRAFIA



TOMOGRAFIA COMPUTERIZZAZA

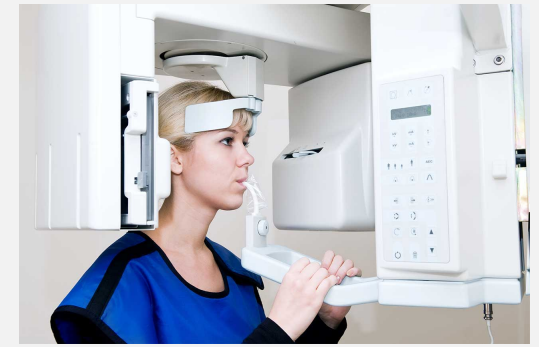


ANGIOGRAFIA



RADIOLOGIA "TRADIZIONALE" e DENTALE

TUBO RADIOGENO



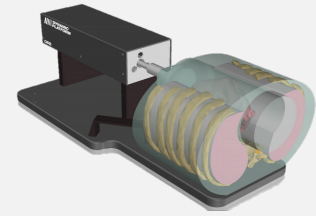
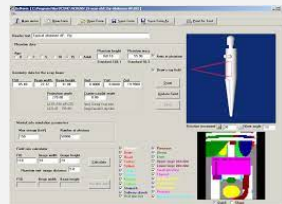
Analisi di immagini

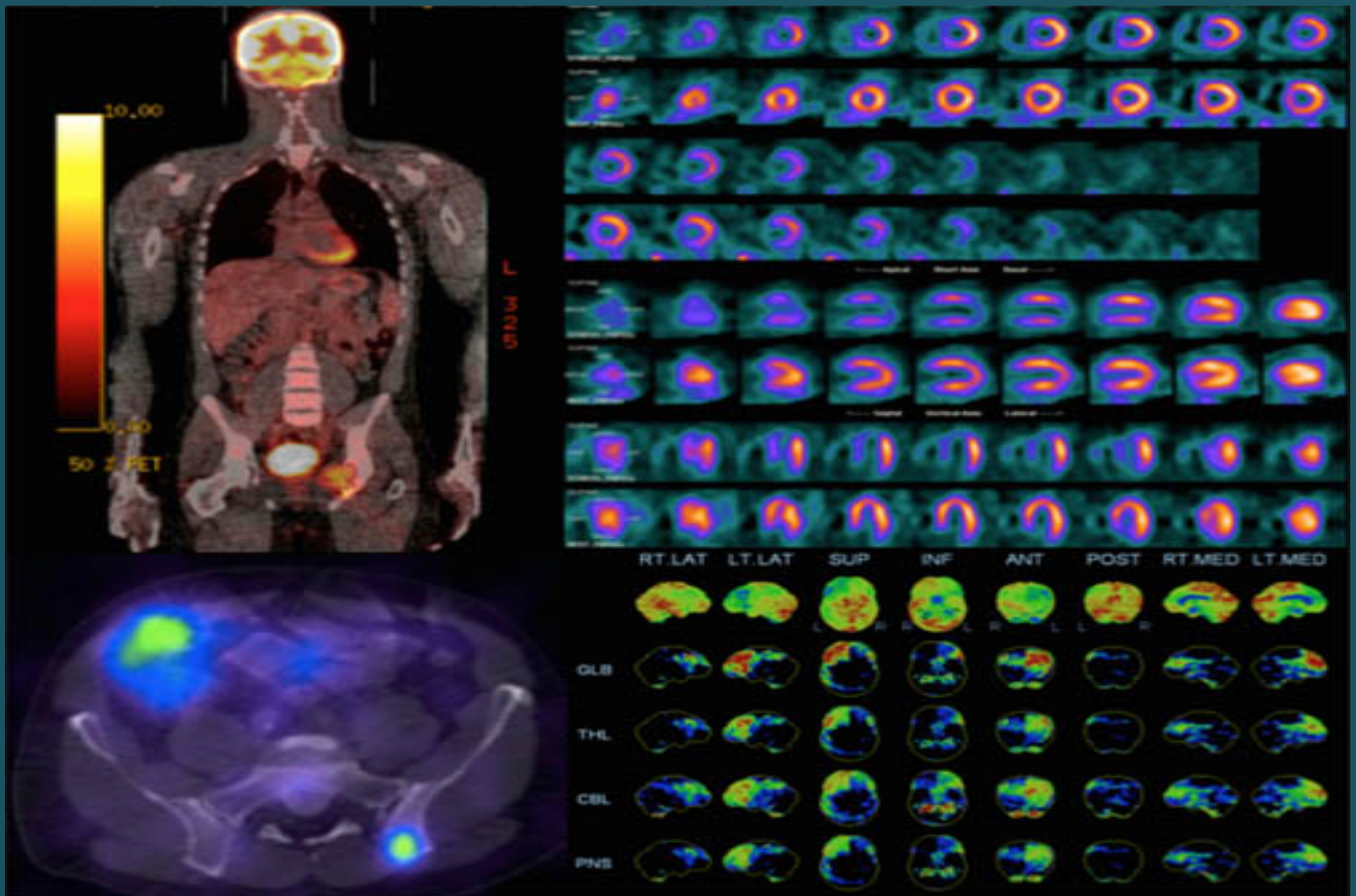
Processi di ottimizzazione della dose

Controlli di qualità sulle apparecchiature

Attività di ricerca

Valutazione di dose al paziente



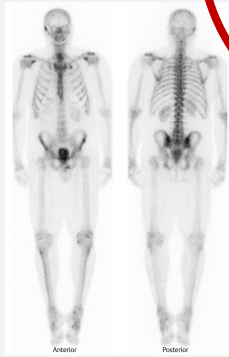


MEDICINA NUCLEARE

DIAGNOSTICA

TERAPIA

GAMMA CAMERA

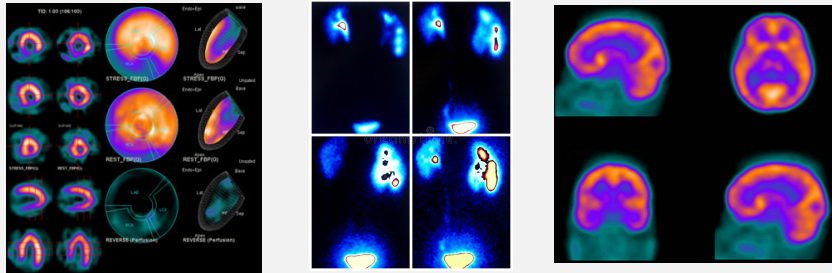
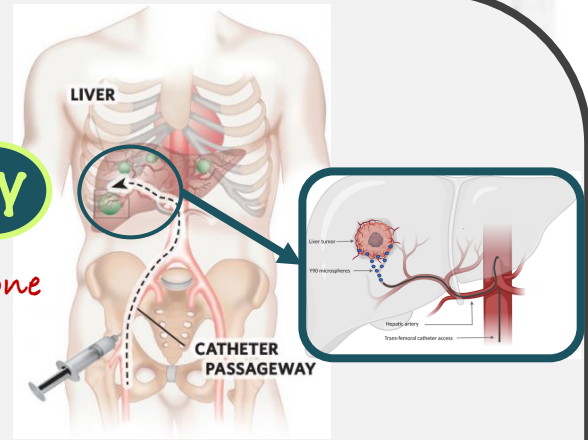


Il radiofarmaco!

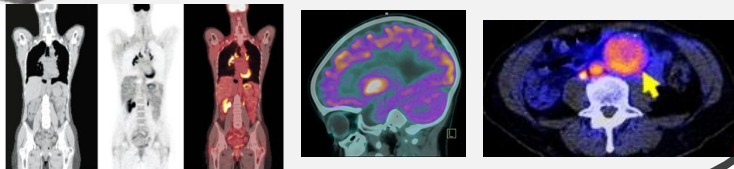
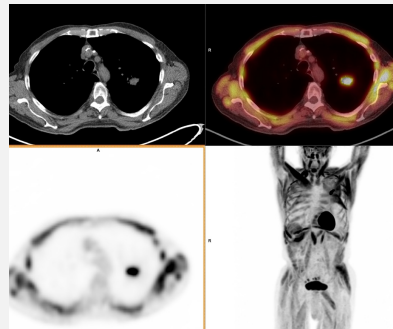
TARE

(radioembolizzazione transarteriosa)

90Y



PET (PET/CT)

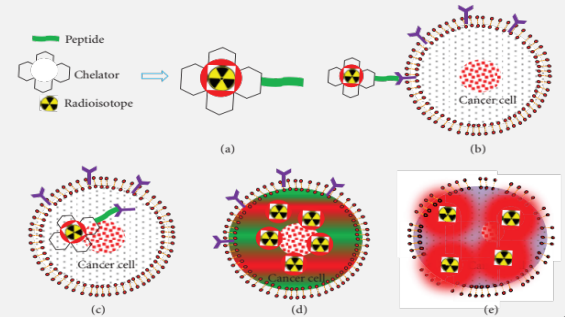


177Lu

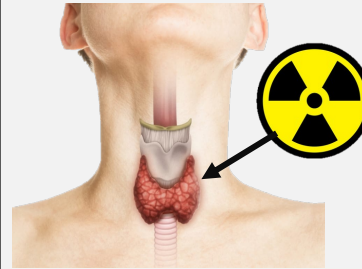
Tumori neuroendocrini

PPRT

(peptide receptor radionuclide therapy)



131I



DEGENZA PROTETTA

Calcolo personalizzato della dose

Controlli di qualità sulle apparecchiature

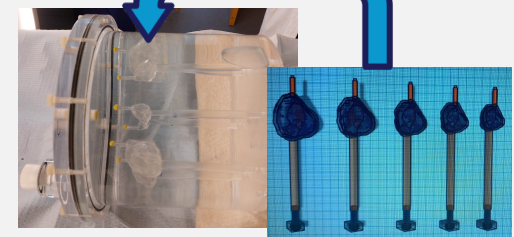
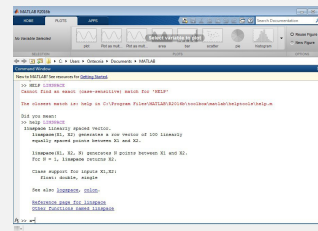
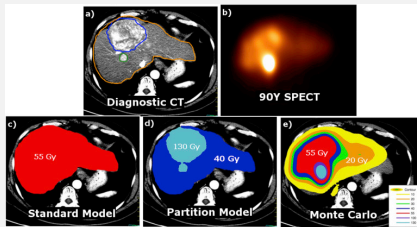
Calibrazione apparecchiature per i vari radioisotopi

Programmazione per analisi d'immagine



Attività di ricerca

Valutazione di dose al paziente





RADIOTERAPIA



**È UN TRATTAMENTO CHE IMPIEGA LE RADIAZIONI PER
DISTRUGGERE LE CELLULE TUMORALI.**

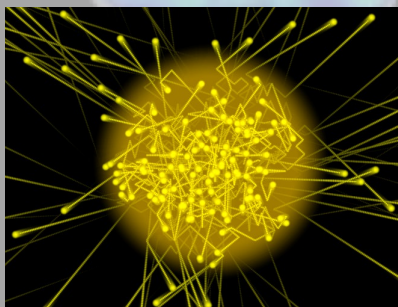
**I TRATTAMENTI DI RADIOTERAPIA SONO PIANIFICATI IN
MODO DA PROVOCARE IL MASSIMO DANNO ALLE CELLULE
TUMORALI E DI LIMITARE CONTEMPORANEAMENTE IL
DANNO AI TESSUTI SANI CIRCOSTANTI.**

**L'UTILIZZO DELLA RADIOTERAPIA PUÒ AVERE OBIETTIVI
DIVERSI:**

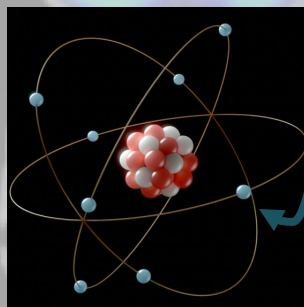
- SCOPO CURATIVO**
- SCOPO PRECAUZIONALE**
- RIDUZIONE DIMENSIONI TUMORE**
- SCOPO PALLIATIVO**

RADIAZIONI IMPIEGATE IN RT

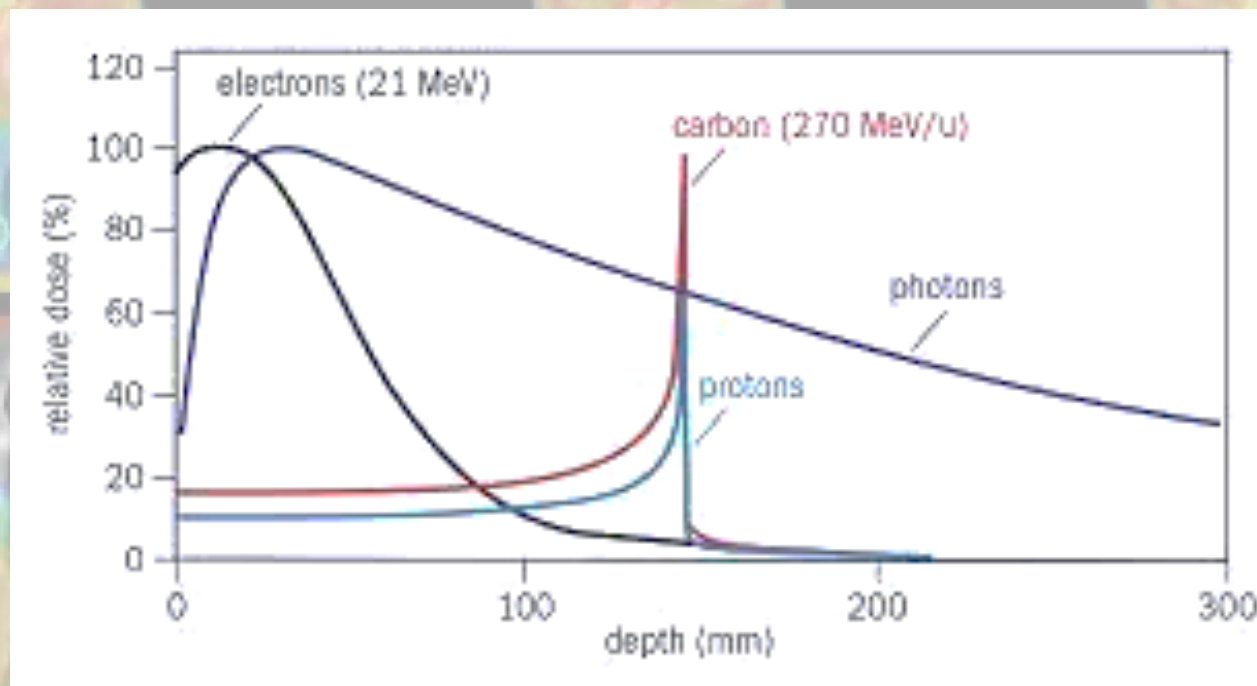
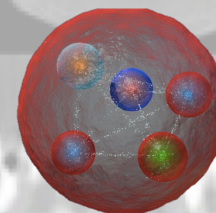
FOTONI



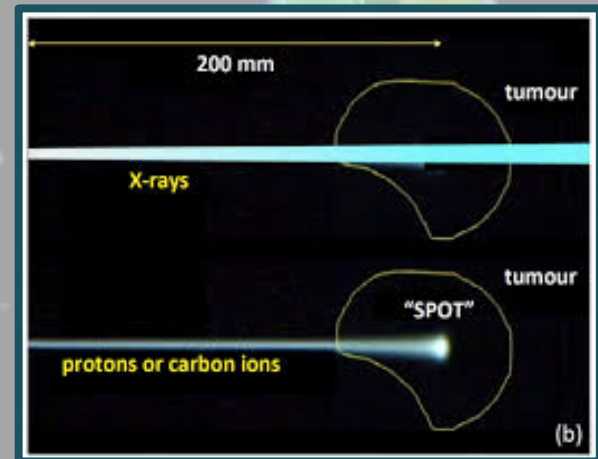
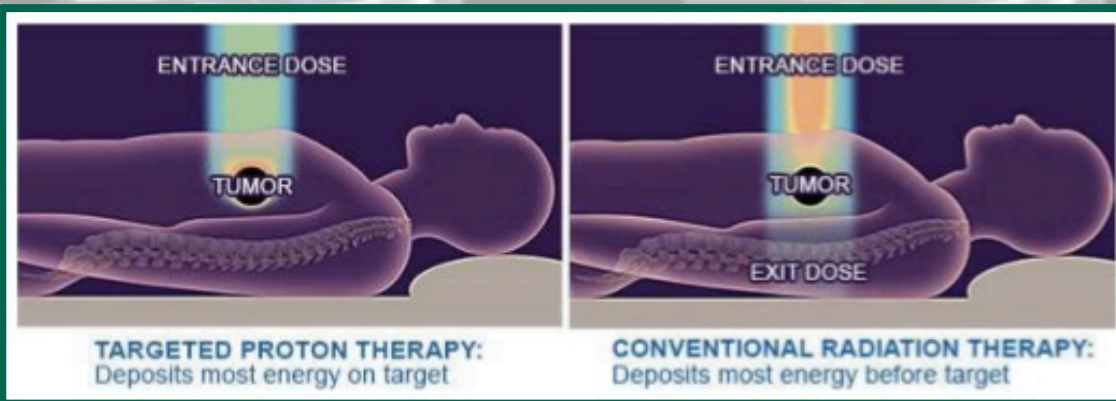
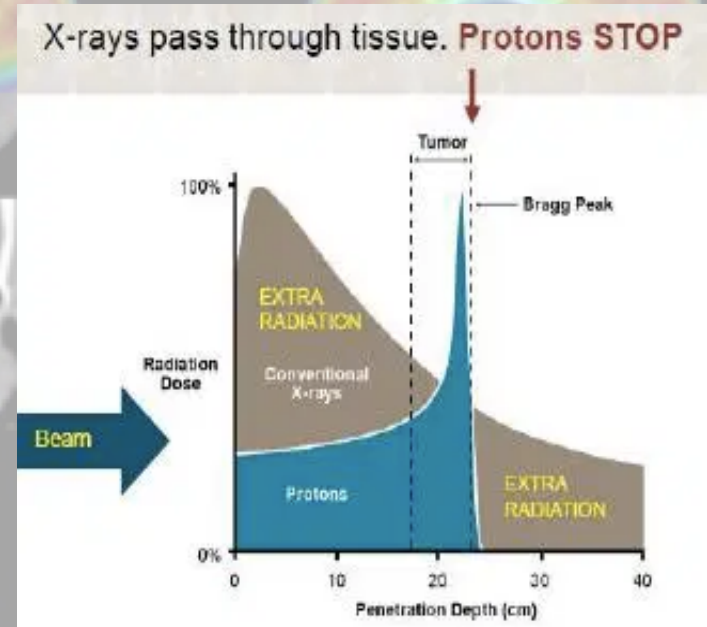
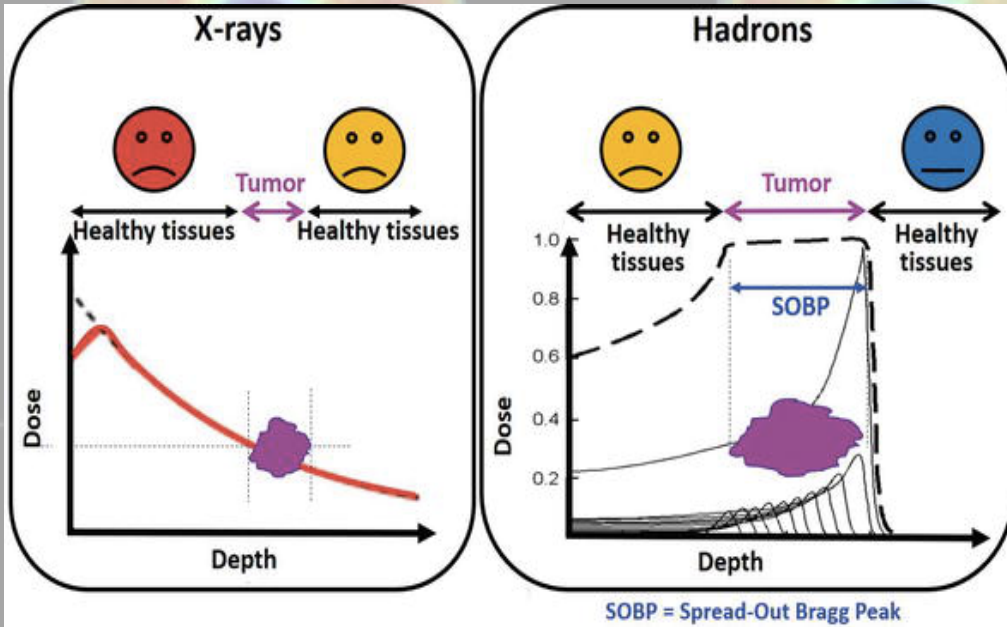
ELETTRONI



ADRONI

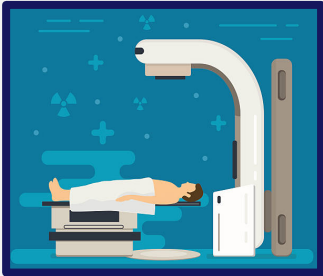


Fotoni vs Adroni (protoni, ioni carbonio, etc)



RT A FASCI ESTERNI

Acceleratore Lineare



Tomoterapia



Cyberknife



Gamma Knife



IORT (e-)

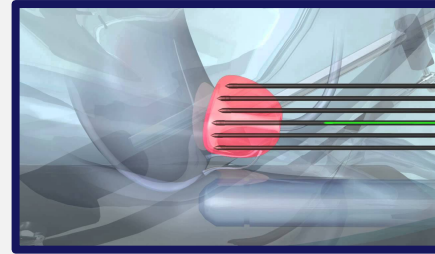


Adroterapia

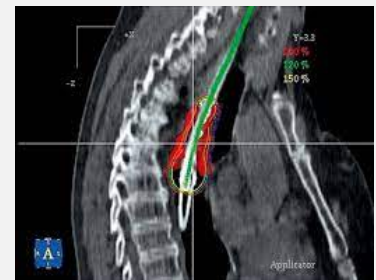
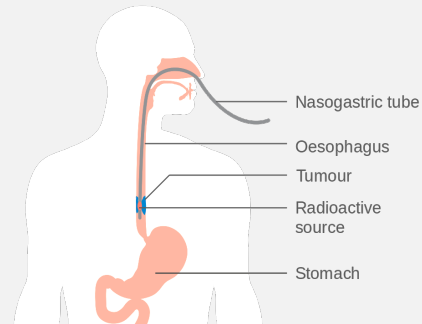
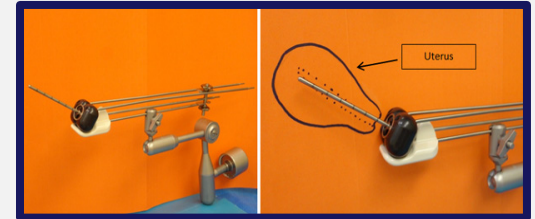
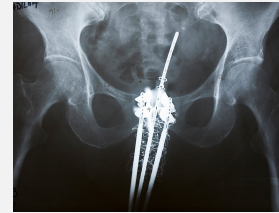


RT INTERNA

BRACHITERAPIA INTERSTIZIALE



BRACHITERAPIA ENDOCAVITARIA

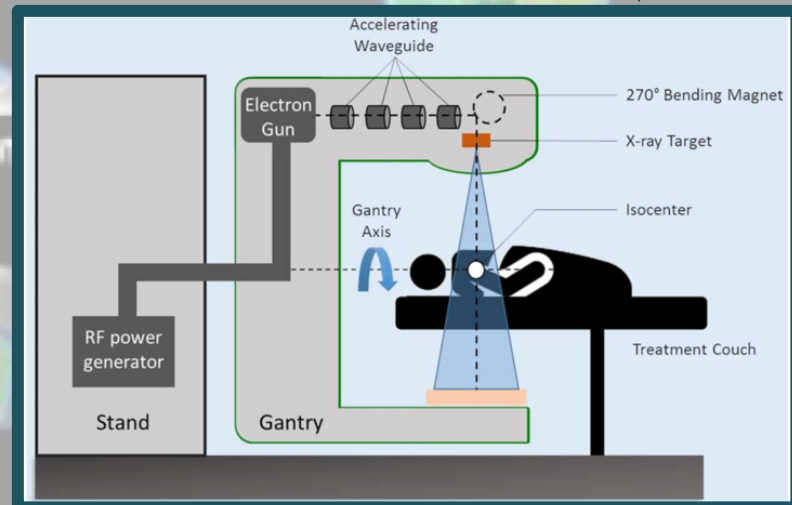
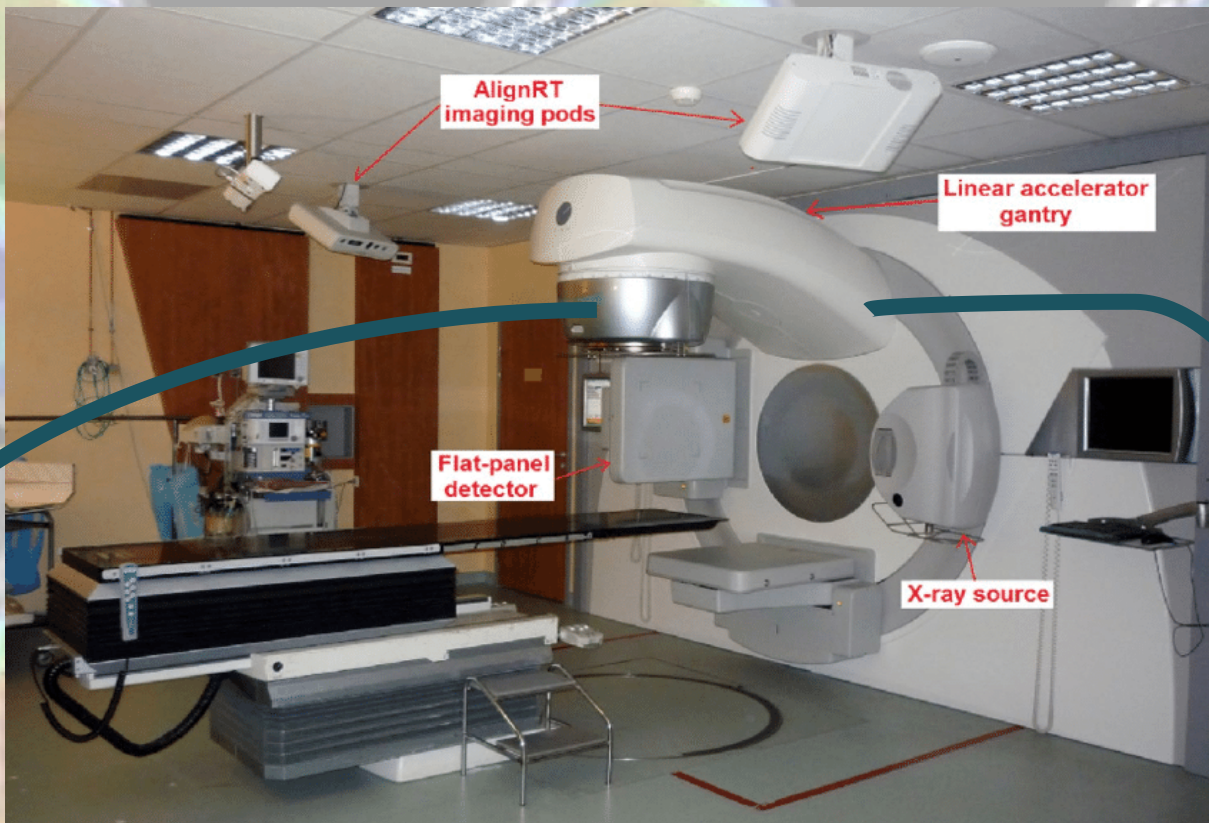


Applicatori



L'ACCELERATORE LINEARE (fotoni e elettroni)

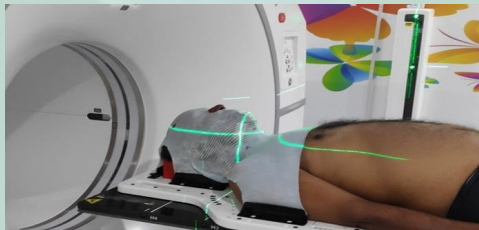




PERCORSO DEL PAZIENTE IN RT

1

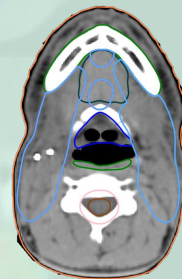
CT di centratura



Acquisizioni immagini paziente per la pianificazione e la centratura all'acceleratore

2

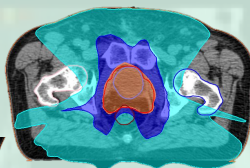
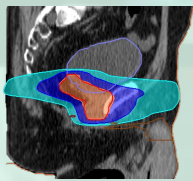
Contornamento da parte del medico



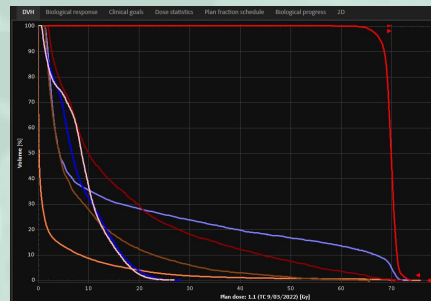
Contornamento degli organi a rischio e delineazione del target (tumore)

3

Piano di trattamento



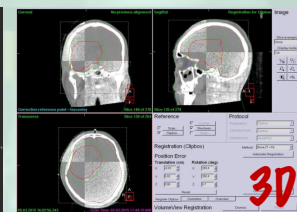
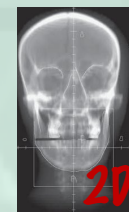
Gy
74.90
66.50
35.00
14.00



Pianificazione da parte del fisico medico

4

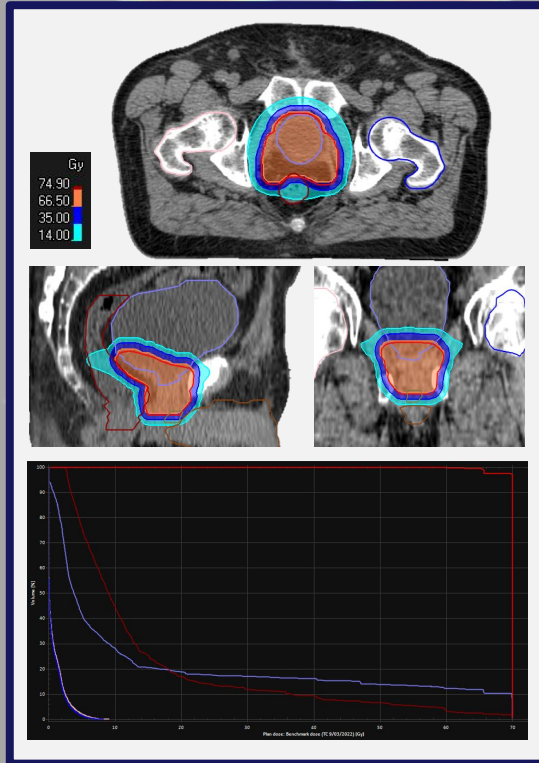
Erogazione del trattamento



Il tecnico di radiologia provvede alla centratura, al suo controllo e all'erogazione del piano

OTTIMIZZAZIONE PIANO DI TRATTAMENTO

Distribuzione ideale



"PRELIMINARI"



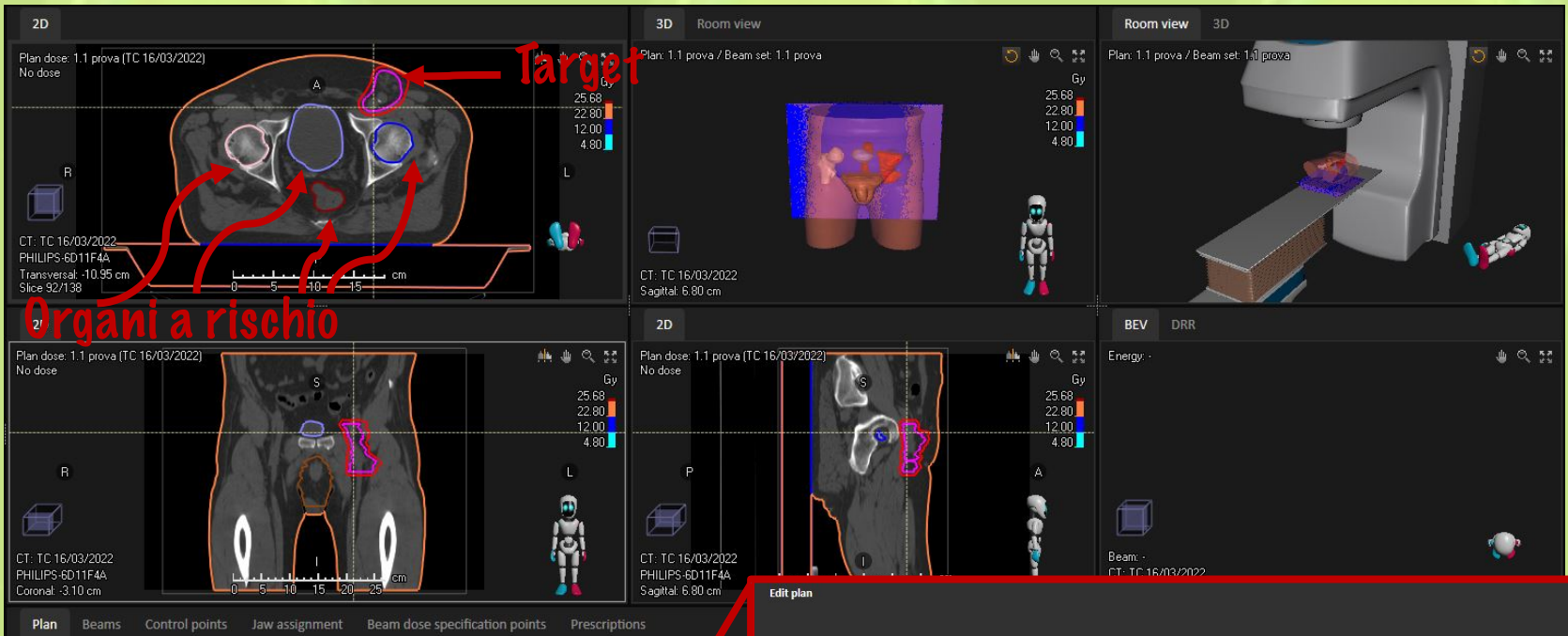
Occorre scegliere:

- Energia fascio di radiazione;
- Tecnica del trattamento;
- Angolazione del/i campo/i di radiazione.

Organi a rischio:

- vescica
- retto
- teste femorali

A



Name	Image set	Position	Machine	Fractions	Modality	Treatment technique
1.1 prova	TC 16/03/2022	HFS	LIN 2	12	Photons	VMAT

Edit plan

Treatment plan

Name: Planned by:

Planning image set: Comment:

Patient treatment position: **TC di centratura**

Beam sets

1.1 prova

Name: Number of fractions: **Numero di frazioni**

Modality: **Radiazione**

Treatment technique: **Tecnica**

Treatment machine:

Comment:

Create setup beams

Setup beam isocenters:

- Treatment beam isocenters
- Localization point
- Custom

Treatment site	Prescription type	Prescribed dose	Prima
PTV1.1	Median dose (D50%)	2.00 Gy x 12 fx = 24.00 Gy	Yes

Dose al target

Add beam [X]

Information

Name: Treatment machine: LIN 2 [10 Feb 2022, 14:00:07 (hr:min:sec)]

Description: [MV]

Beam set: 1.1 prova

Isocenter

Name: Color:

Copy coordinates from: Center of ROI:

POI position: REF Center of image set

Right-Left [cm]: Inf-Sup [cm]: Post-Ant [cm]:

Machine angles

Gantry start [deg]: Collimator [deg]:

Gantry stop [deg]:

Clockwise gantry rotation

Couch angles

Rotation [deg]:

Bolus

Dose specification point

Right-Left [cm]: Inf-Sup [cm]: Post-Ant [cm]:

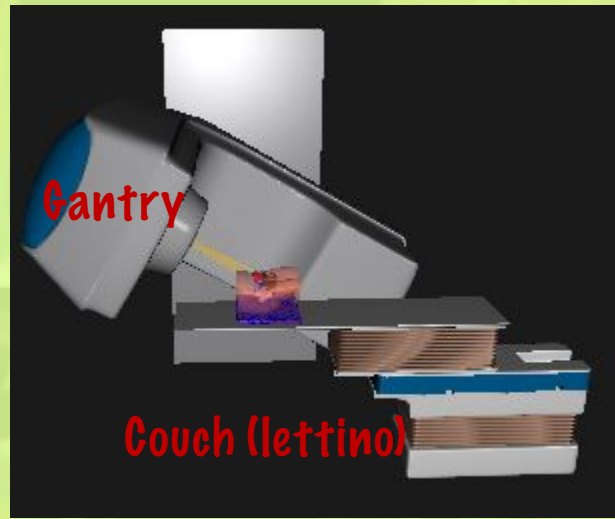
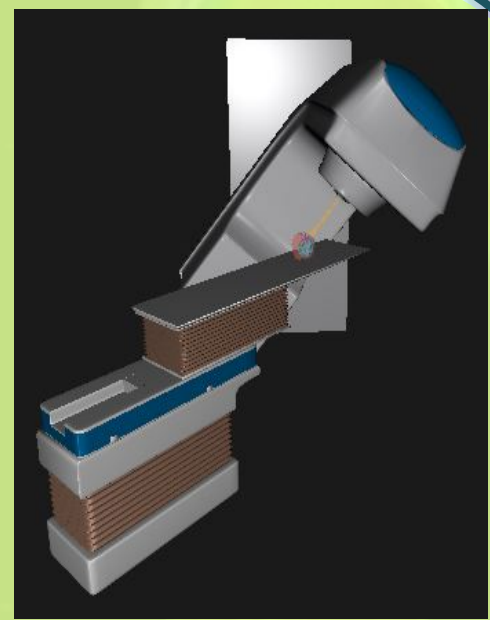
Energia

Isocentro

Angolo/i del gantry

Collimatore

Angolo del lettino





2D

Plan dose: 1.1 prova (TC 16/03/2022)
No dose

CT: TC 16/03/2022
PHILIPS-6D11F4A
Transversal: -10.35 cm
Slice 94/138

3D Room view

Plan: 1.1 prova / Beam set: 1.1 prova

CT: TC 16/03/2022
Sagittal: 8.91 cm

Room view 3D

Plan: 1.1 prova / Beamset: 1.1 prova

2D

Plan dose: 1.1 prova (TC 16/03/2022)
No dose

CT: TC 16/03/2022
PHILIPS-6D11F4A
Coronal: -0.75 cm

2D

Plan dose: 1.1 prova (TC 16/03/2022)
No dose

CT: TC 16/03/2022
PHILIPS-6D11F4A
Sagittal: 8.91 cm

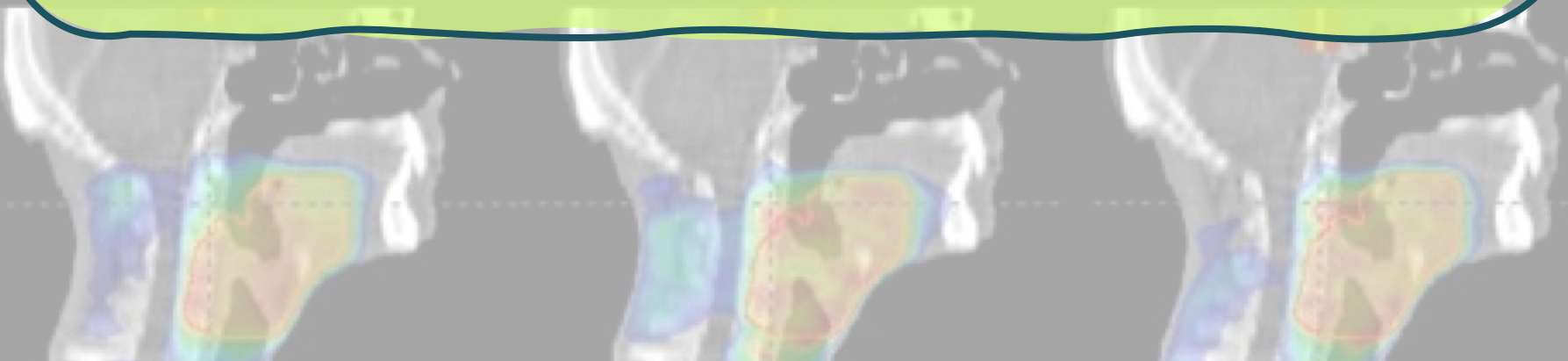
BEV DRR

Beam: 2
CT: TC 16/03/2022
Segment: 1/181

Plan **Beams** Control points Jaw assignment Beam dose specification points Prescriptions

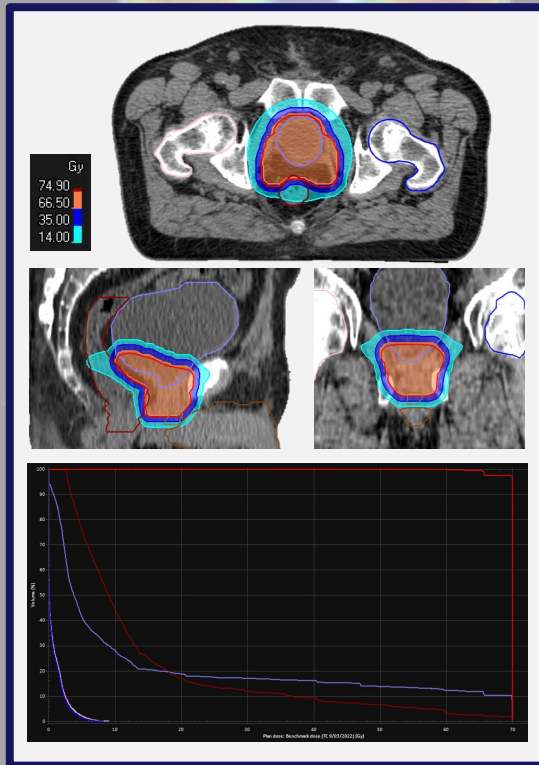
- + 🗑️ 📄 ✖️
Load template... Copy from... Patient setup... Create bolus... Renumber beams... Save as template...

No.	👁️	Name	Description	Isocenter [cm] Name	R-L	I-S	P-A	SSD [cm] To surface	To skin	Energy [MV]	Gantry start [deg]	Gantry stop [deg]	Rotation	Coll. [deg]	Couch [deg] Rotation	No. of segm	MU/fx	Del. time [sec]	Bolus
1	👁️	1	1	1.1 prova 1	9.38	-10.05	-0.28	89.02	89.02	6	120.0	300.0	Counterclockwise	0.0	0.0	0	0.00		(None)
2	👁️	2	2	1.1 prova 1	9.38	-10.05	-0.28	93.18	93.18	6	300.0	120.0	Clockwise	90.0	0.0	0	0.00		(None)



OTTIMIZZAZIONE PIANO DI TRATTAMENTO

Distribuzione ideale



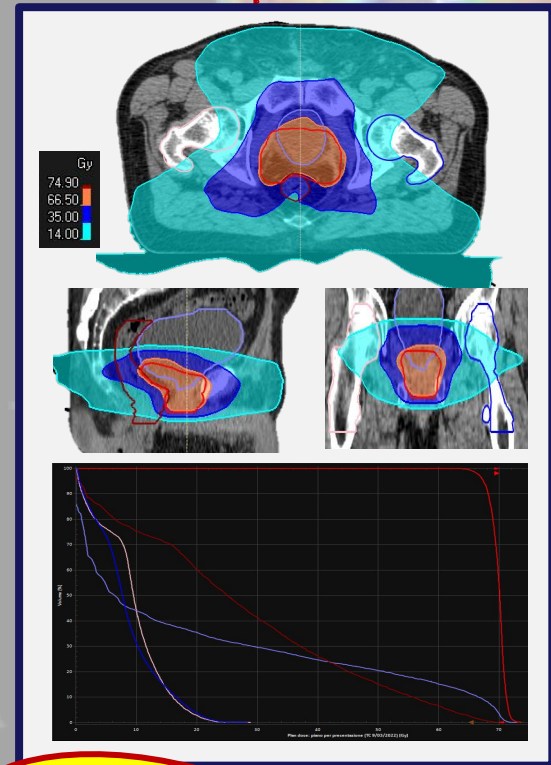
"PRELIMINARI"

Occorre scegliere:

- Energia fascio di radiazione;
- Tecnica del trattamento;
- Angolazione del/i campo/i di radiazione.

STARTING POINT

Punto di partenza



Organi a rischio:

- vescica
- retto
- teste femorali



Mi sembrano due distribuzioni molto differenti....

Ci penso io!

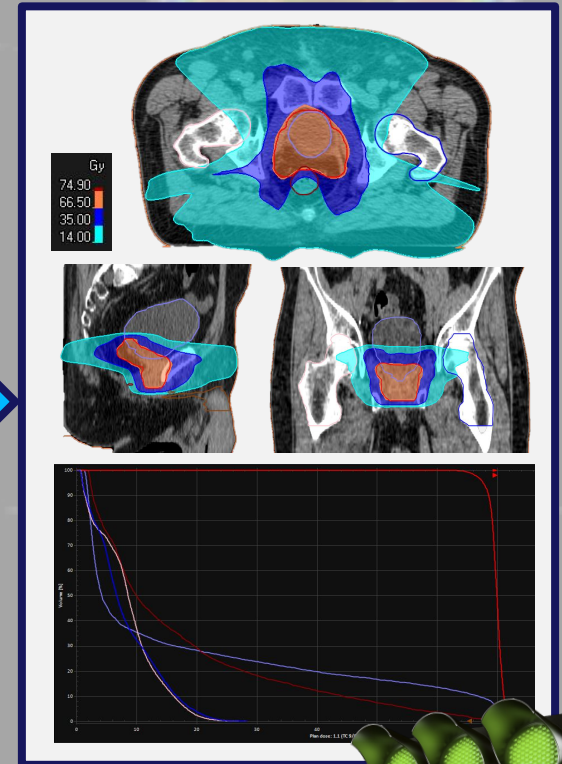
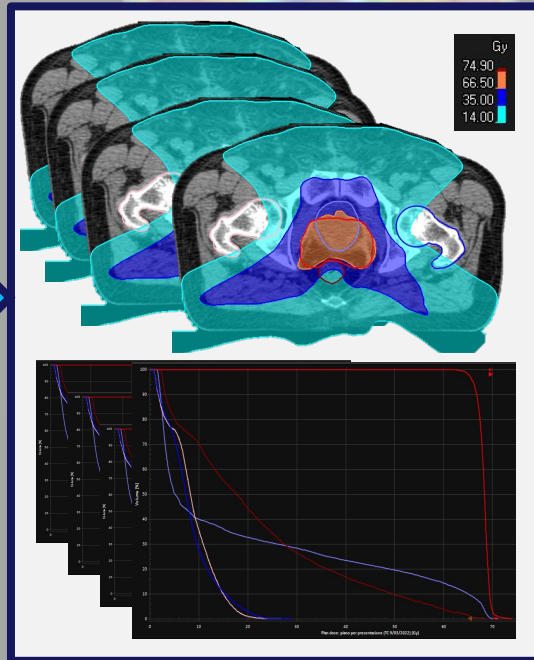
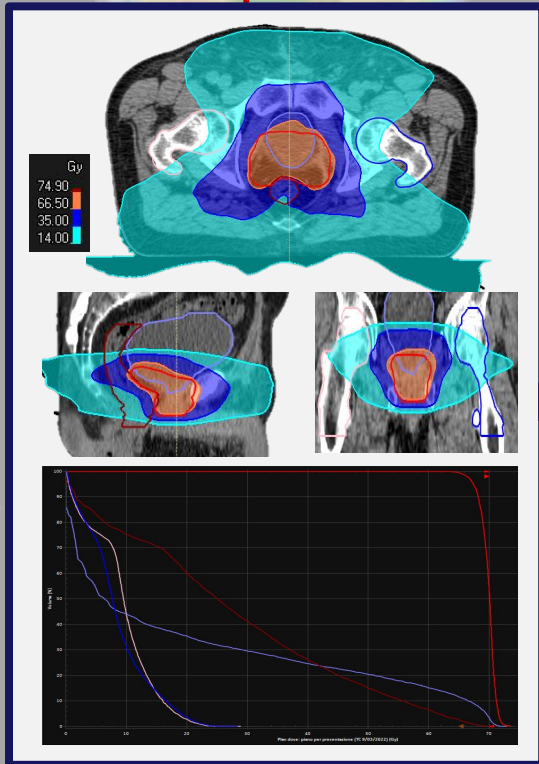


STARTING POINT

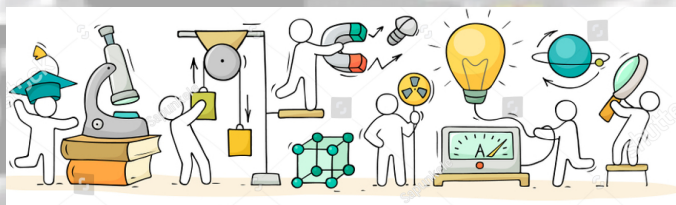
Punto di partenza

Processo di ottimizzazione

Risultato finale



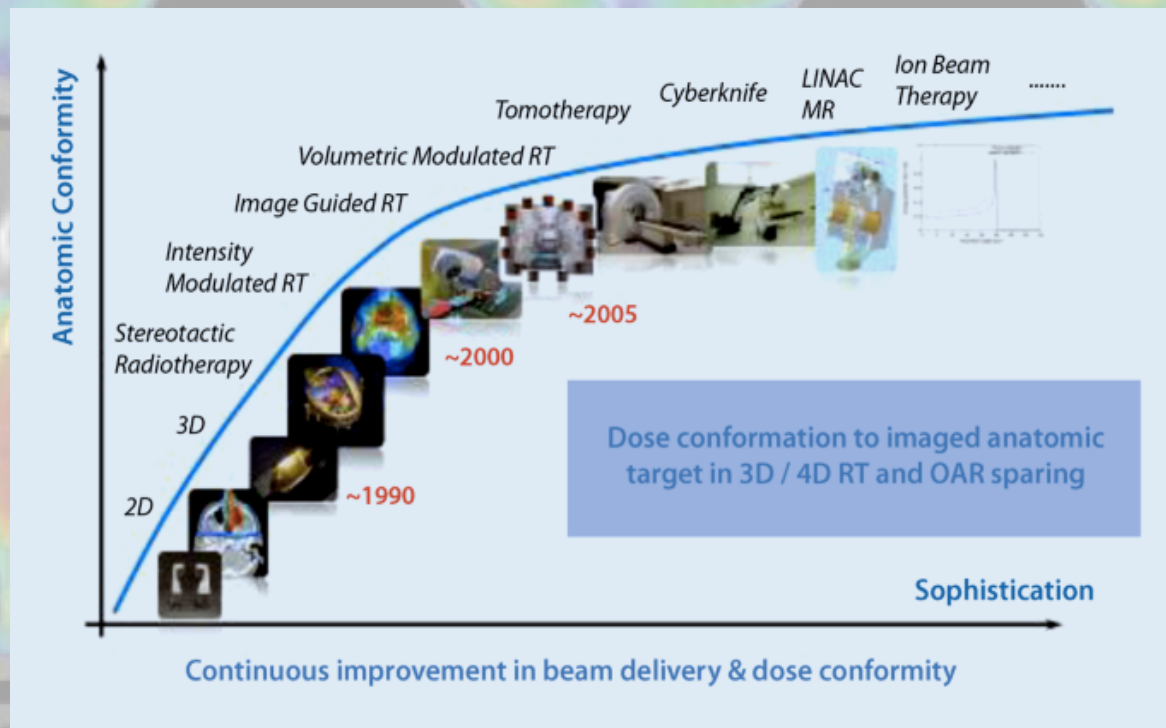
Processo Elaborativo!



Description	Robust	Weight	Value	EUD [Gy]
PTV1.1			0.4316	
Min DVH 70.00 Gy to 98% volume		100.00	0.0154	
Max DVH 74.90 Gy to 2% volume		100.00	0.0000	
Max dose 77.00 Gy		100.00	0.0000	
Max dose 65.00 Gy		25.00	0.0110	
Uniform dose 70.00 Gy		500.00	0.1737	
Dose fall-off [H]70.00 Gy [L]14.00 Gy, Low dose distance 4.00 cm		1.00	7.2996E-4	
Max EUD	Plan	■ Femur_Head_R	Max EUD 7.00 Gy, Parameter A 1	1.00 0.0213 9.28
Max EUD	Plan	■ Femur_Head_L	Max EUD 7.00 Gy, Parameter A 1	1.00 0.0081 8.41
Max EUD	Plan	■ Bladder1	Max EUD 10.00 Gy, Parameter A 1	1.00 0.0219 13.31
Max EUD	Plan	■ PenileBulb1	Max EUD 44.00 Gy, Parameter A 1	1.00 0.0041 50.31
Max EUD	Plan	■ Rectum1	Max EUD 12.00 Gy, Parameter A 1	1.00 0.1755 23.24

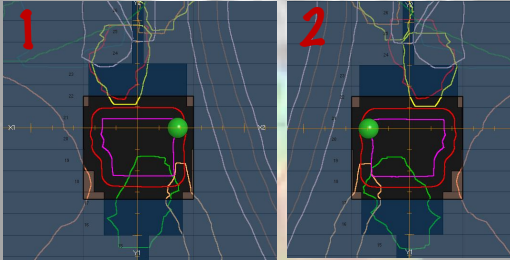
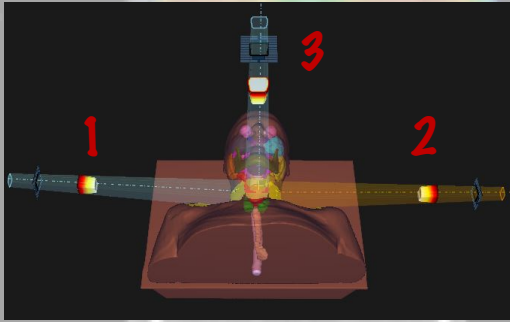
TECNICHE DI RADIOTERAPIA

EVOLUZIONE DELLA RADIOTERAPIA CON FASCI DI FOTONI



L'impiego delle tecniche di trattamento più avanzate oggi disponibili nella radioterapia moderna con fasci di fotoni, con particolare riferimento all'IMRT nelle sue varie forme (a campi fissi, VMAT, tomoterapia) e alla radioterapia stereotassica, permette di ottenere distribuzioni di dose che si conformano in maniera molto accurata rispetto al/ai target.

3D-CRT (3D conformal radiation therapy)

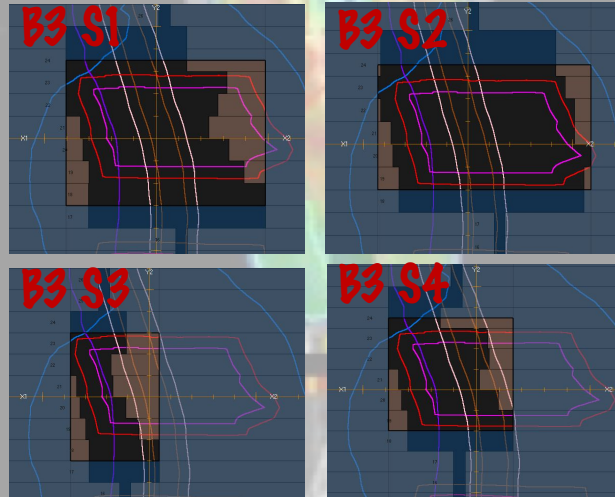
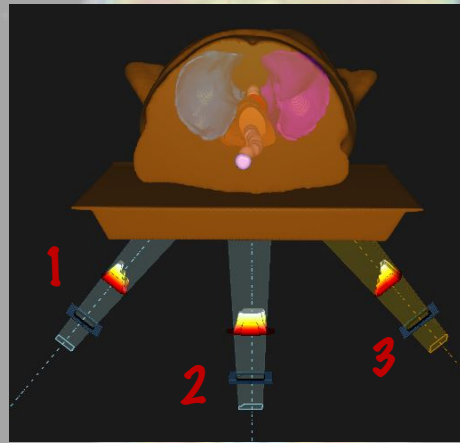


Gantry fisso.



Lamelle multileaf ferme.

IMRT (Intensity modulated radiation therapy)

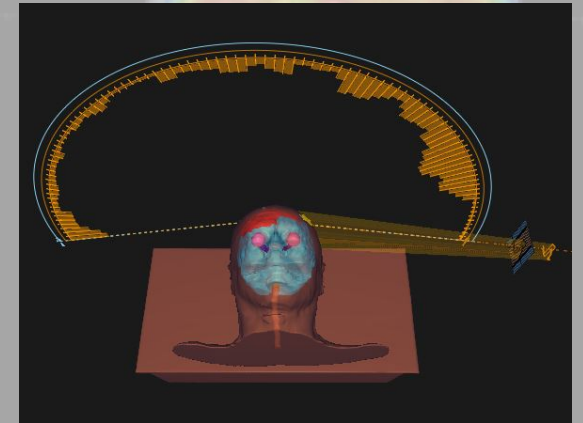


Gantry fisso.

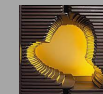


Lamelle multileaf in movimento.

VMAT (Volumetric modulated arc therapy)



Gantry in movimento.



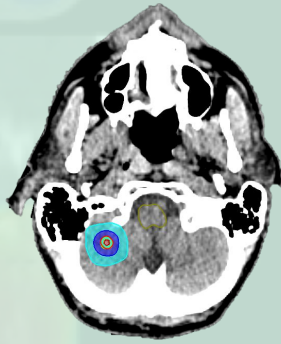
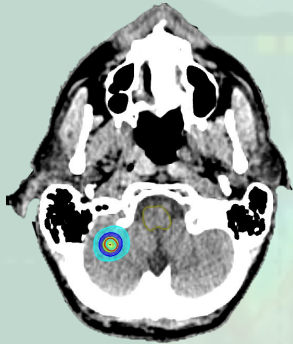
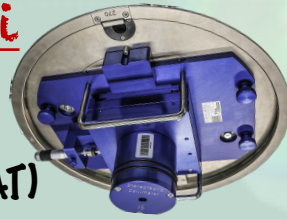
Lamelle multileaf in movimento.

TECNICHE SPECIALI

SRS con/senza coni cilindrici
(stereotassi cranica)

con Coni

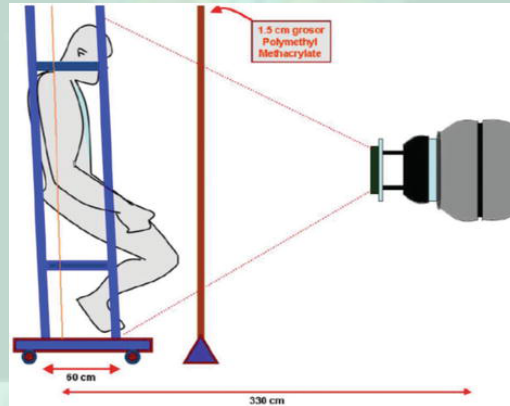
con MLC (VMAT)



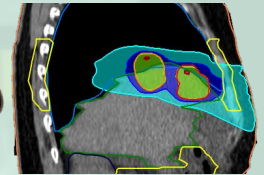
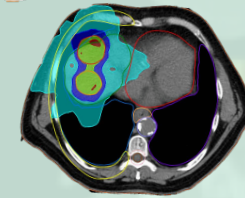
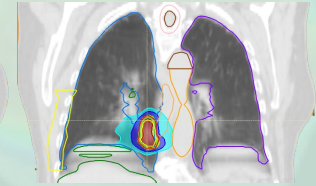
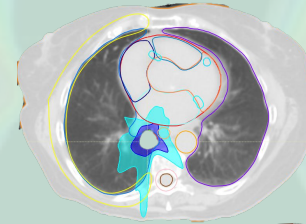
TSEI
(total skin electron irradiation)



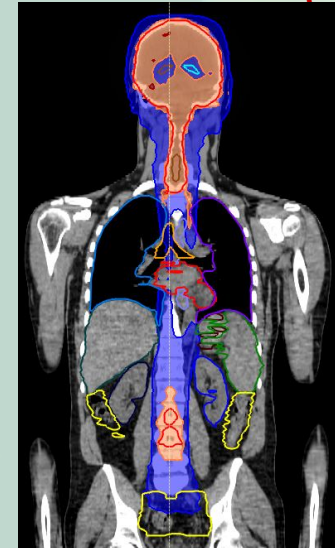
TBI
(total body irradiation)



SBRT
(stereotassi extra-cranica)

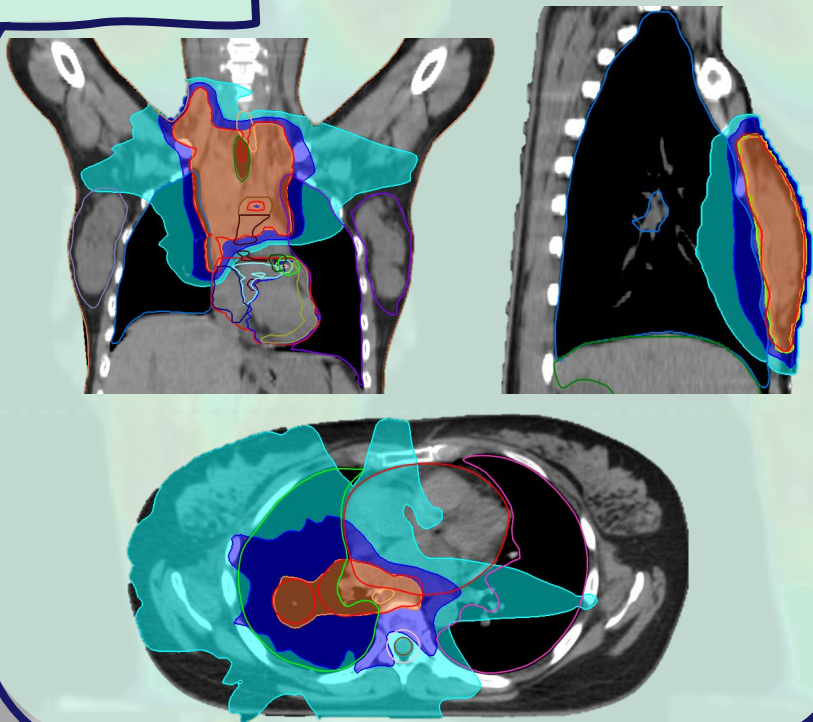


CSI
(irradiazione cranio-spinale)

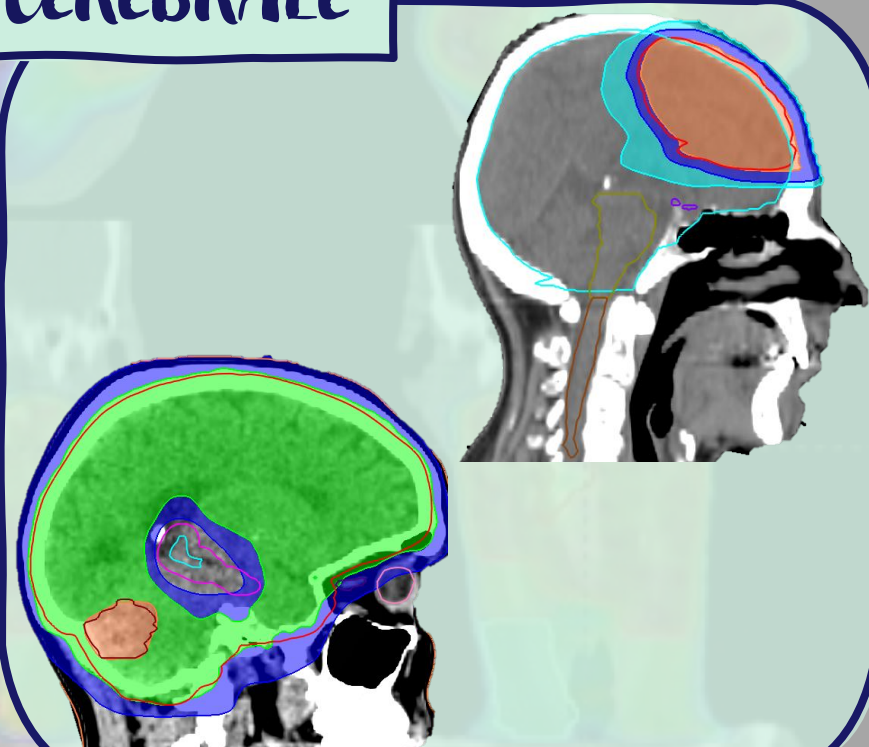


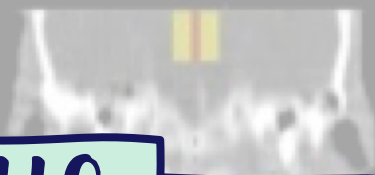
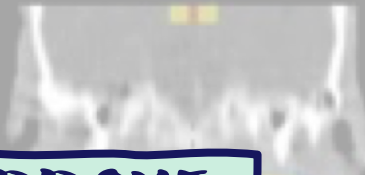
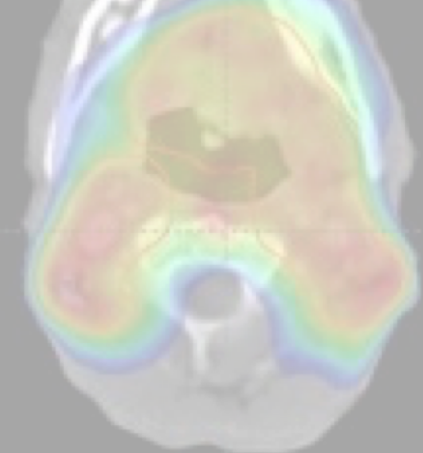
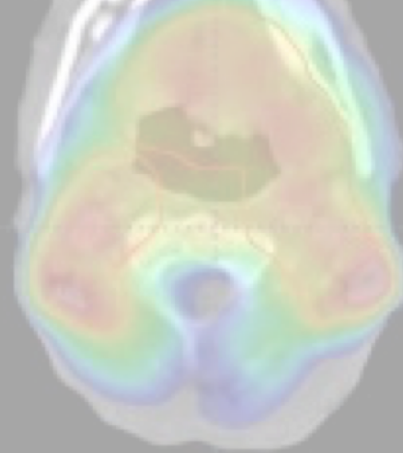
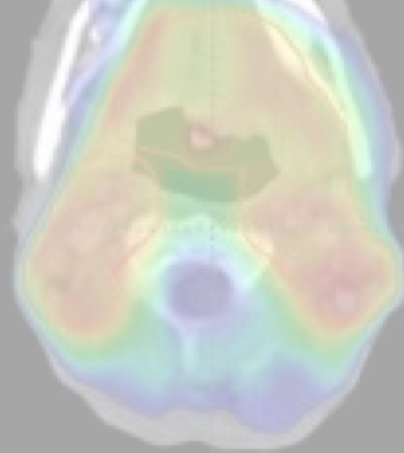
DISTRETTI ANATOMICI

TORACE

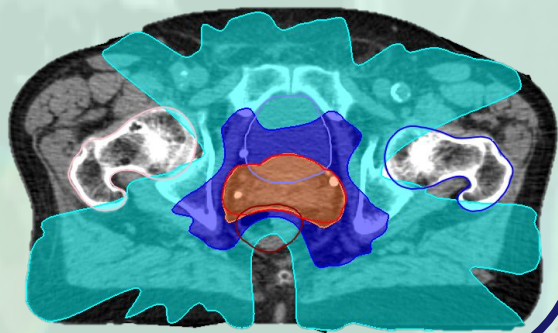
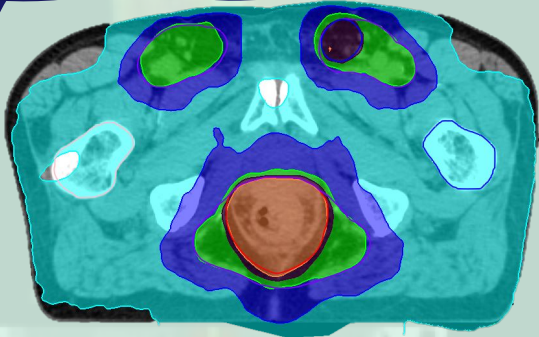


CEREBRALE

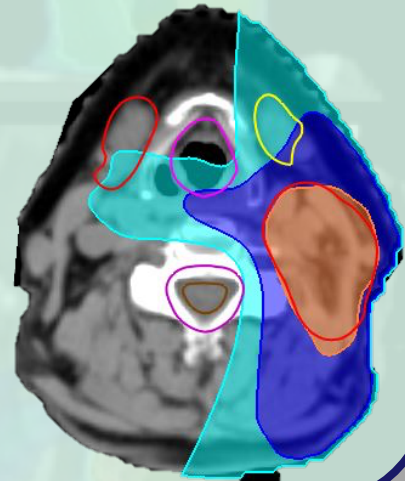
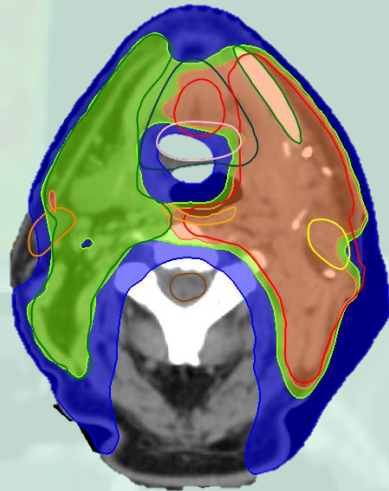




ADDOME



TESTA & COLLO



Cooperazione

Entusiasmo

Team Working

Curiosità

Radioterapista



Tecnico di Radiologia



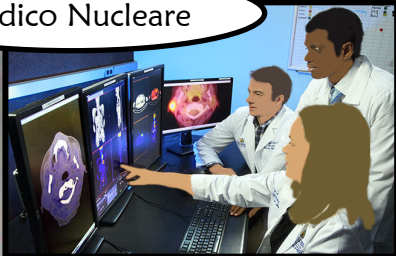
Fisici Medici



Radiologo



Medico Nucleare



Ditte

Università

Ingegneri



