



CONVEGNO PIETRO MESSORI

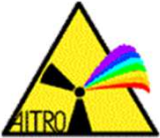
Aggiornamento per Tecnici Sanitari di Radiologia Medica e tutte le altre Professioni Sanitarie

Sabato 11 novembre 2017

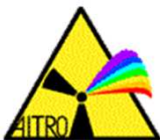
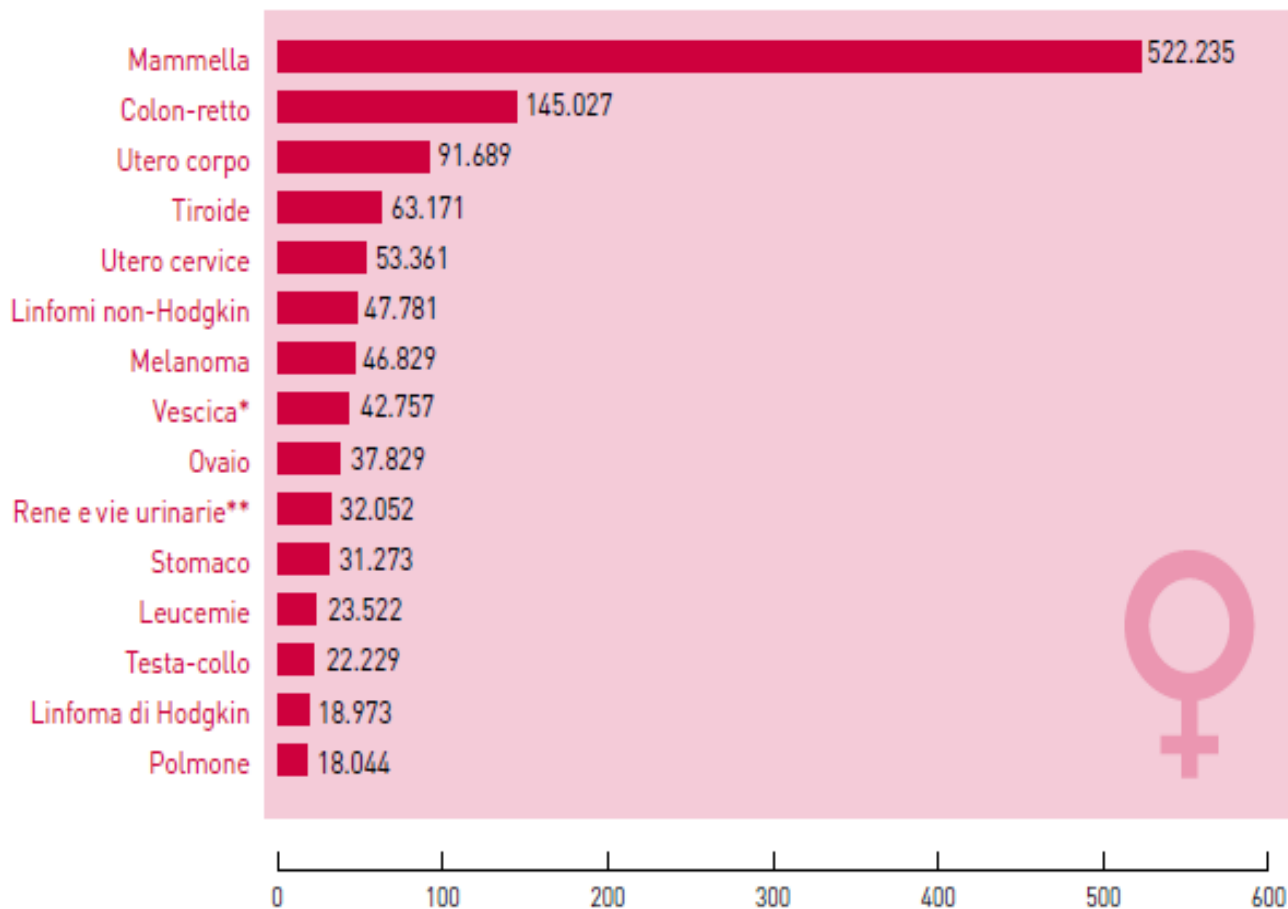
Reggio Emilia

TECNICHE DI RADIOTERAPIA NEL TUMORE DELLA MAMMELLA

D. Pasini



L'INCIDENZA DEL TUMORE DELLA MAMMELLA



CTSU

CLINICAL TRIAL SERVICE UNIT & EPIDEMIOLOGICAL STUDIES UNIT
Nuffield Department of Population Health



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home / research / Observational Studies of Breast Cancer Survivors

Observational Studies of Breast Cancer Survivors

1,000,148 women received radiotherapy

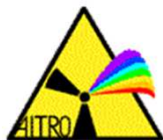
Study involved patients from 87 registries in 40 countries

Diagnosed between 1935 and 2008

53,555 had died of heart disease

Data obtained from 57 cancer registries in 22 countries

- 2 million women with breast cancer
- 53% irradiated



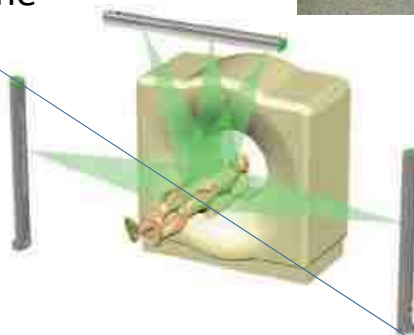
Percorso trattamento RT



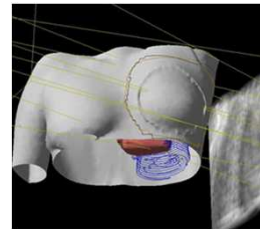
Visita di prescrizione



Simulatore tradizionale



Simulatore virtuale



Planning



Terapia

Follow up



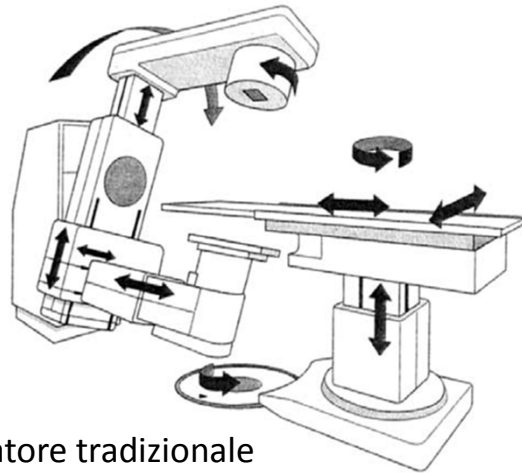


VISITA DI PRESCRIZIONE

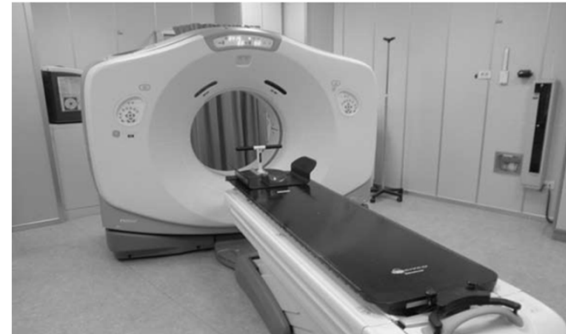
- Indicazione al trattamento radioterapico
- Intento
- Volumi, dose e frazionamento



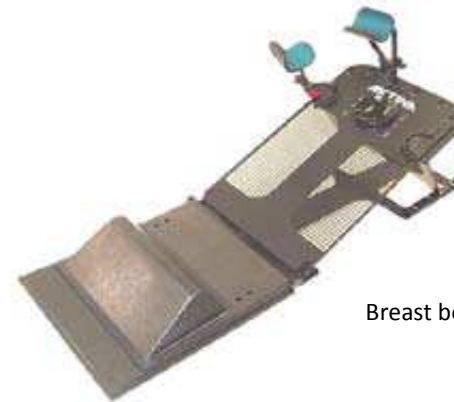
SIMULAZIONE



Simulatore tradizionale



Simulatore virtuale

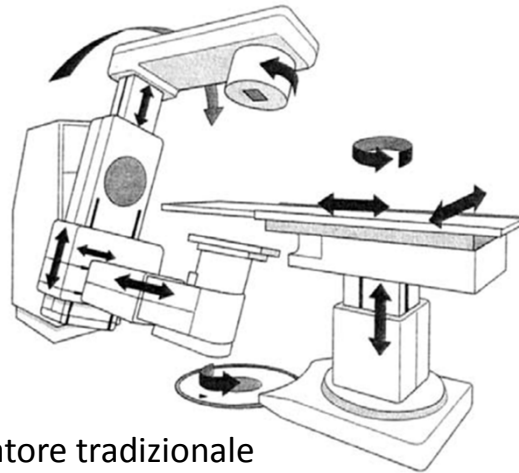


Breast board

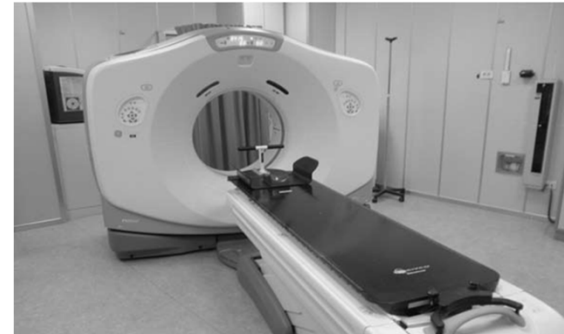
Sistemi di riposizionamento



SIMULAZIONE



Simulatore tradizionale



Simulatore virtuale



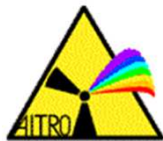
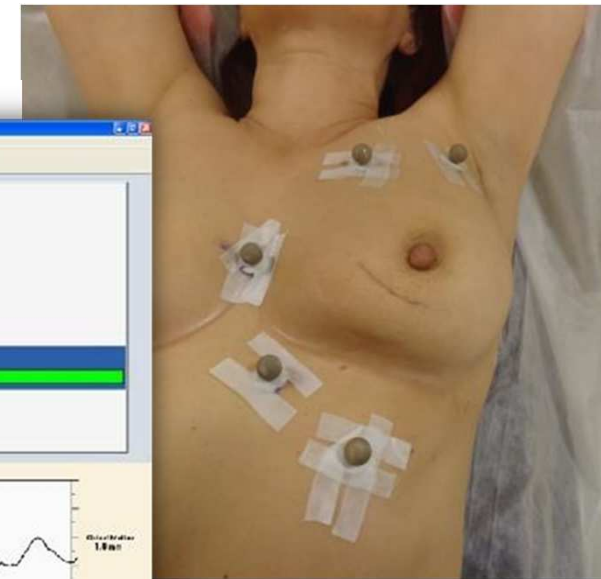
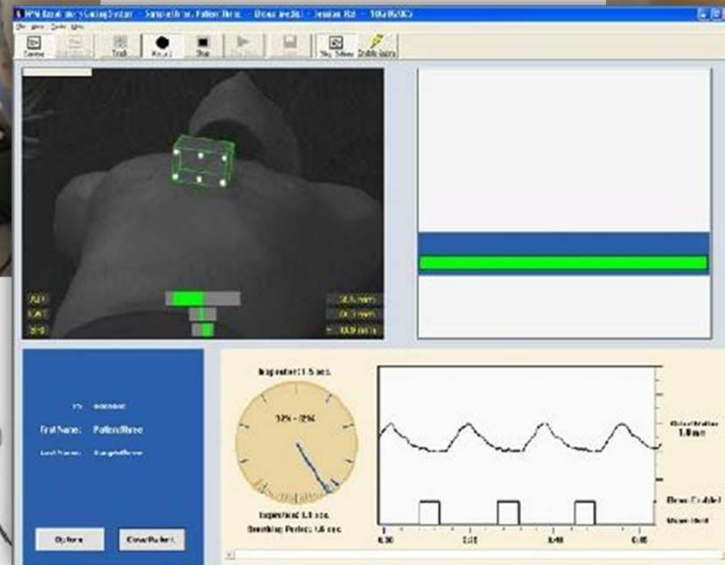
Sistemi di riposizionamento



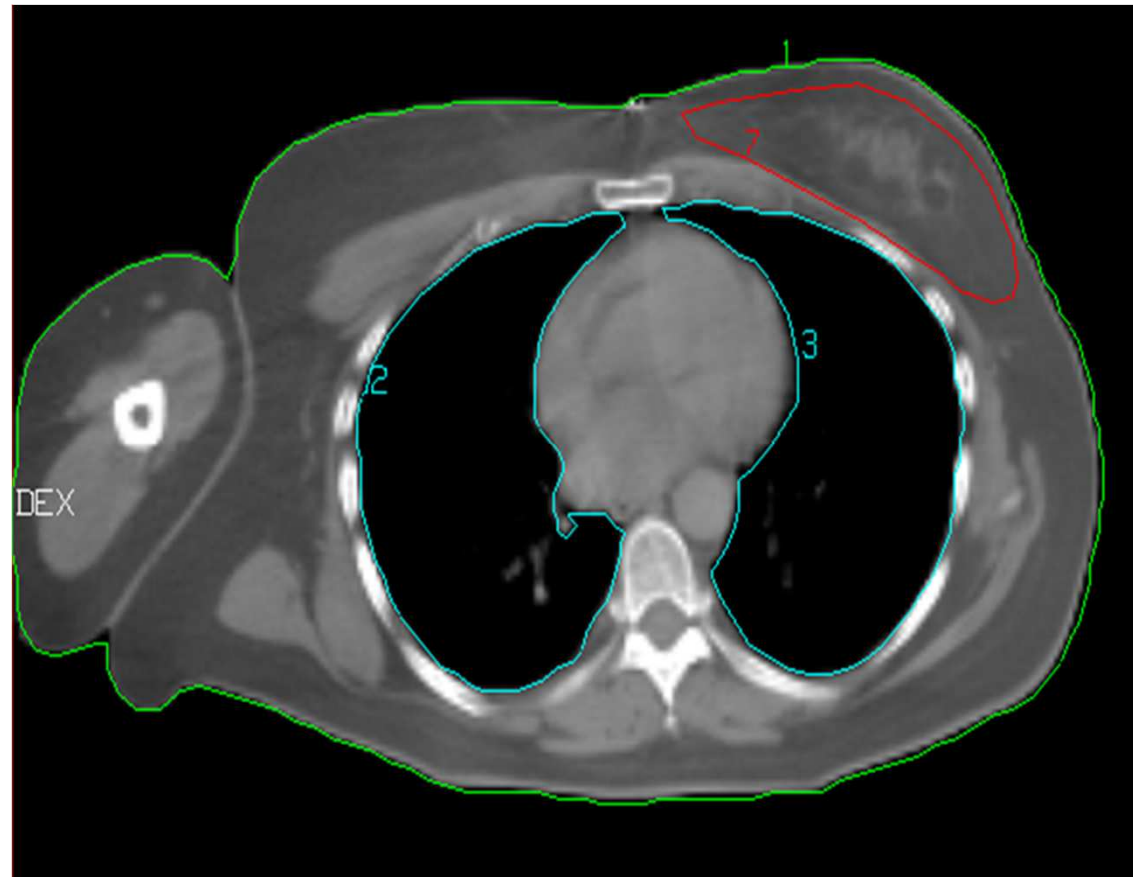
SIMULAZIONE

Nuove tecniche e tecnologie

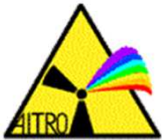
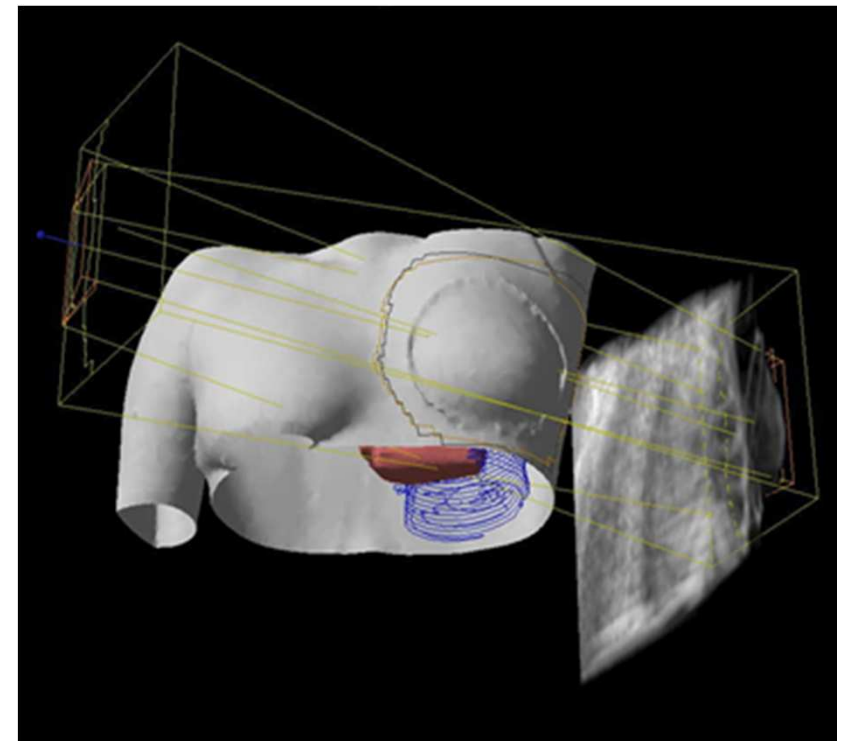
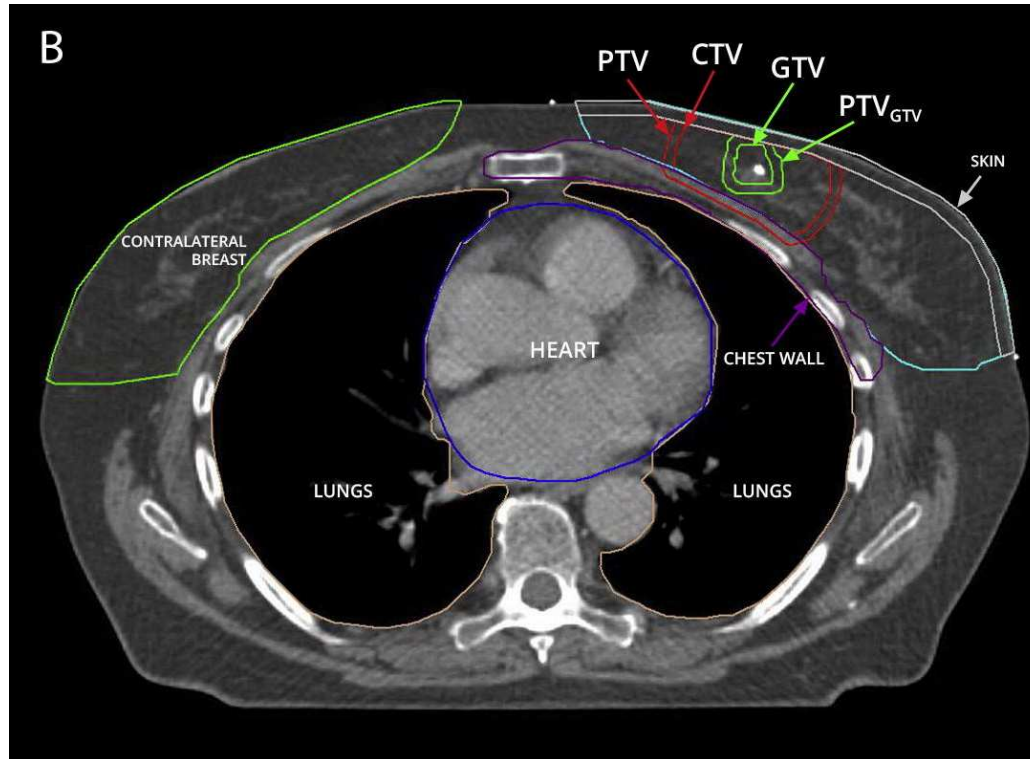
- *Deep inspiration breath hold*
- *Gating respiratorio*



PLANNING: CONTOURING

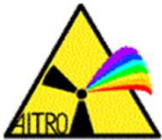
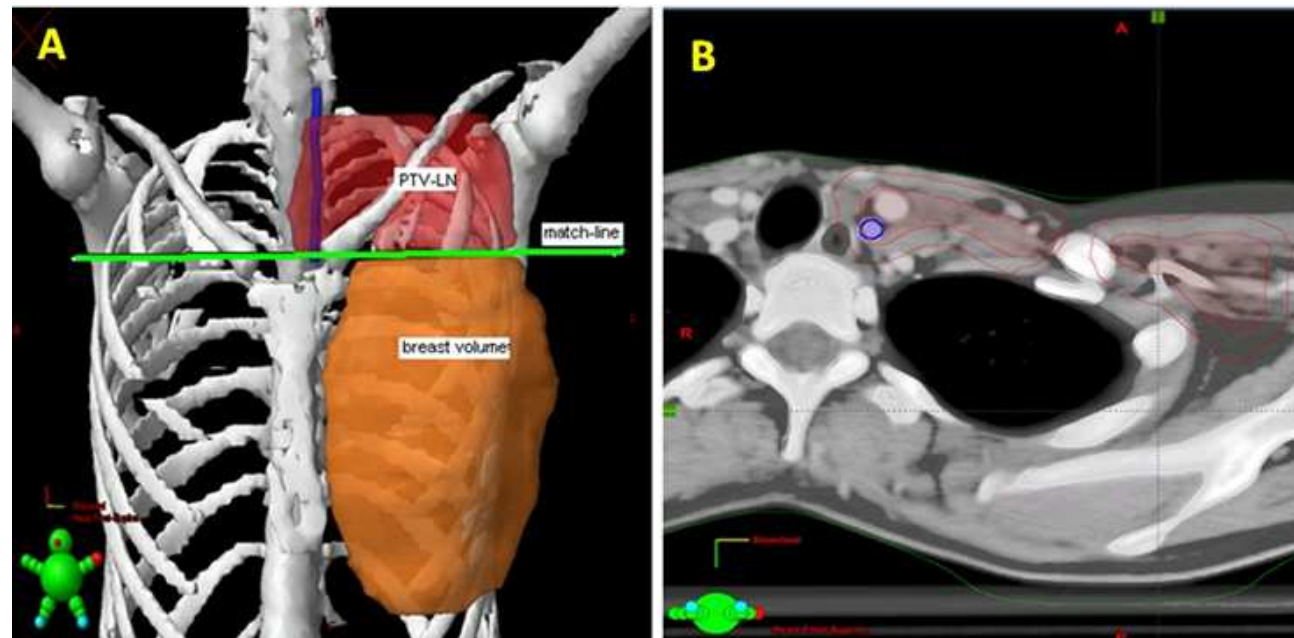


PLANNING: CONTOURING



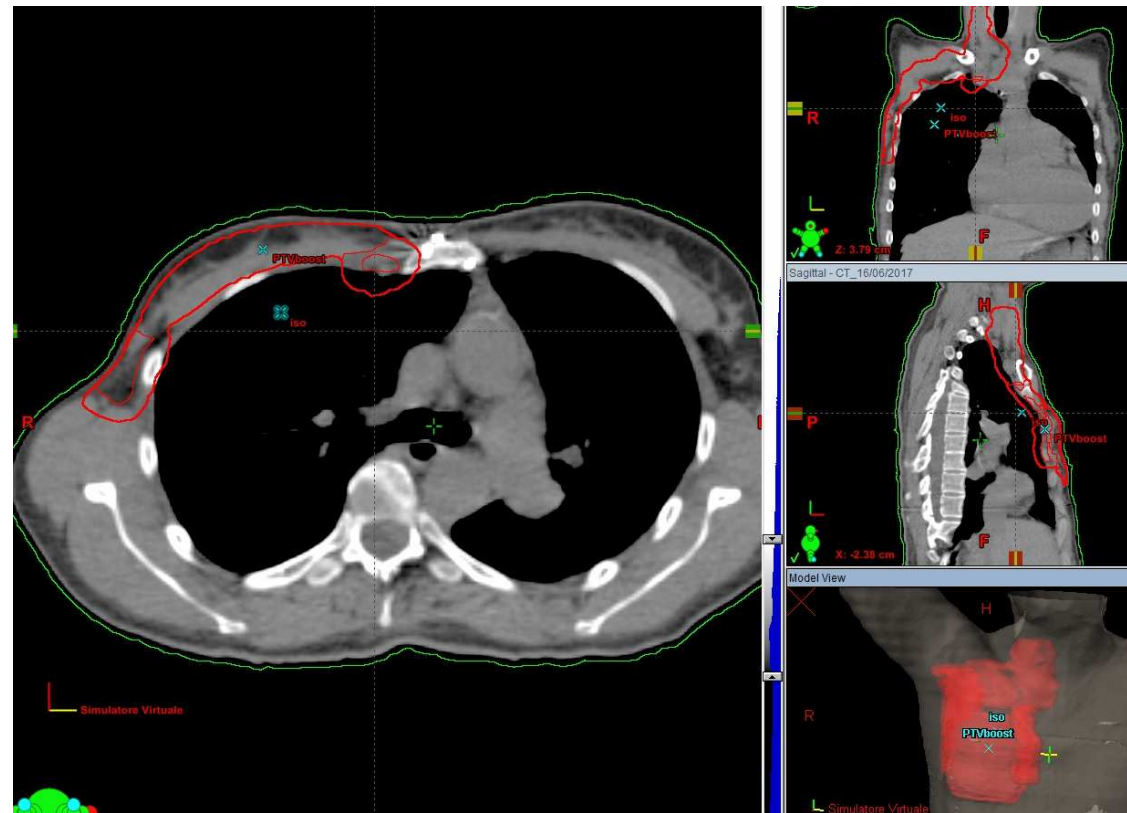
PLANNING: CONTOURING

- Mammella
- Livelli Inf: ascellari
sovraclavari



PLANNING: CONTOURING

- Mammella
- Livelli Inf: ascellari
sovracaveari
CMI



PLANNING: CONTOURING

EFFICIENZA DEL WORKFLOW: TIME FACTOR

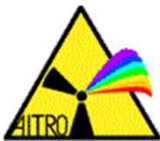
Manual delineation VS Autocontouring

Breast

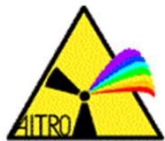
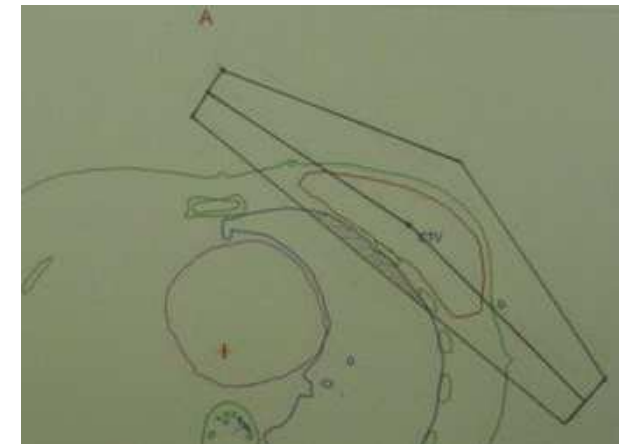
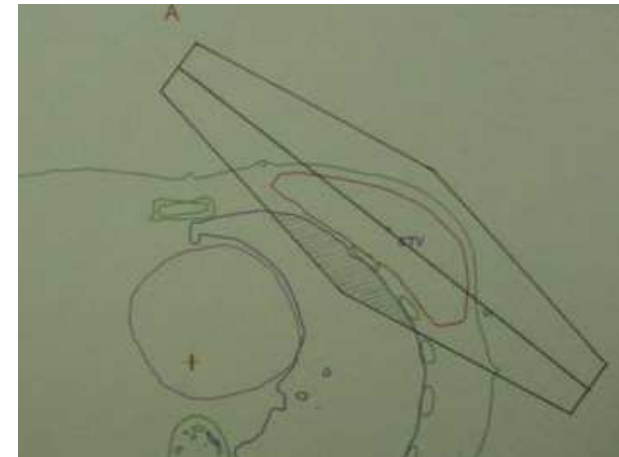
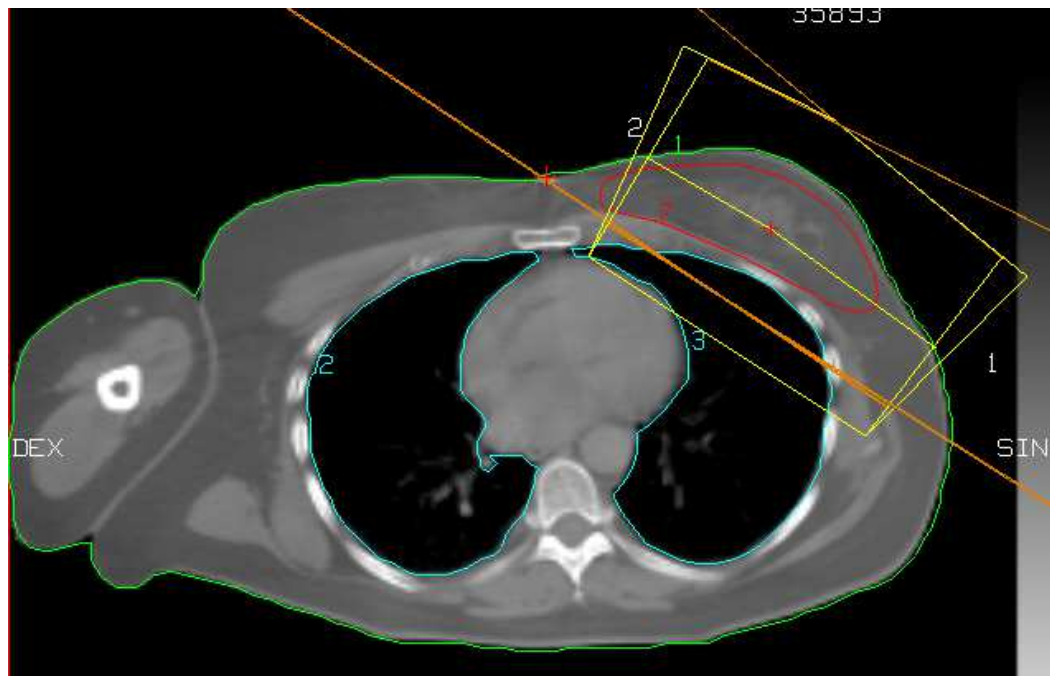
Automatic Segmentation of Whole Breast Using Atlas Approach and Deformable Image Registration

Valerie K. Reed, M.D., Wendy A. Woodward, M.D., Ph.D., Lifei Zhang, Ph.D., et al.
International Journal of Radiation Oncology Biology Physics
Volume 73, Issue 5 , Pages 1493-1500, 1 April 2009

*“The median time to edit the DEF-SEG-generated CTVwb was **12.9 min (range, 3.4–35.9)** compared with **18.6 min (range, 8.9–45.2)** to contour the CTVwb from scratch (**30% faster**, $p = 0.028$)”*

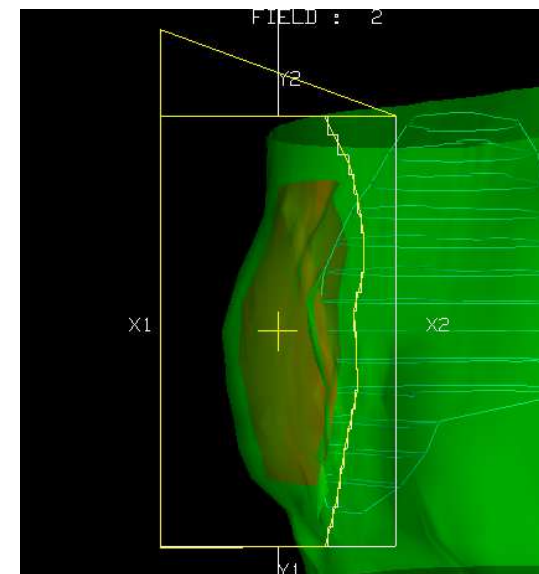
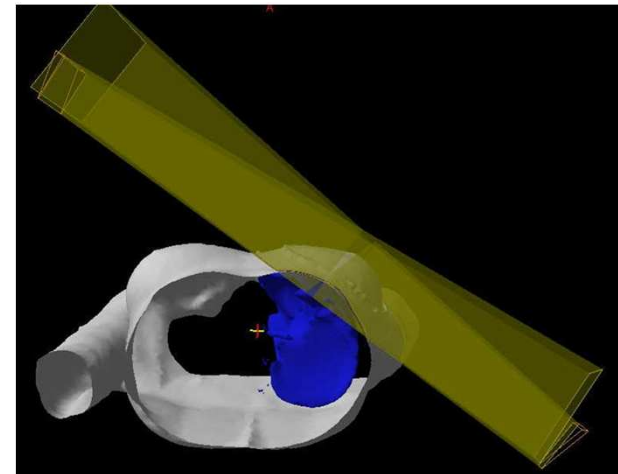
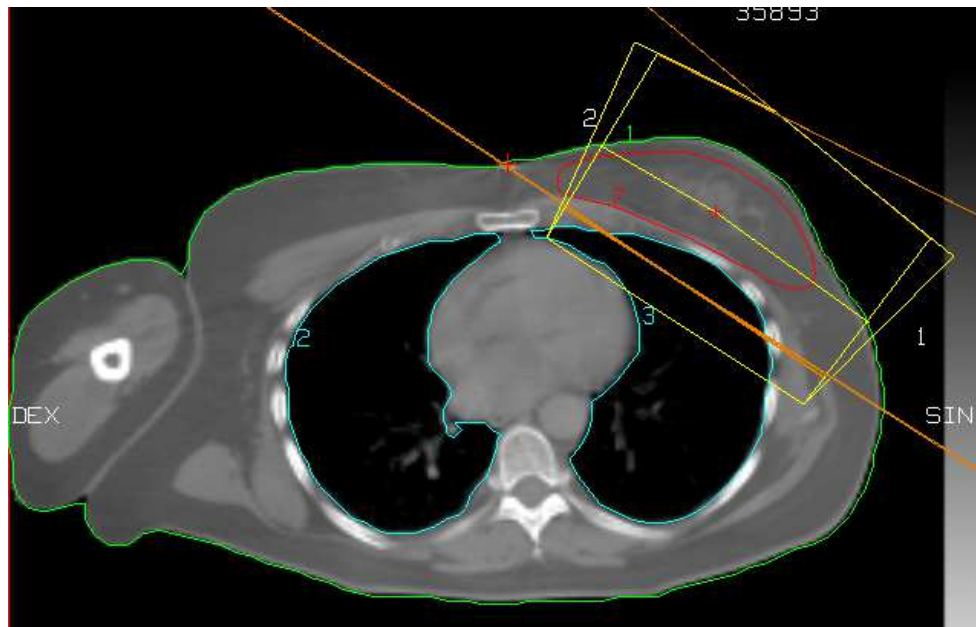


PLANNING: FIELD SET-UP

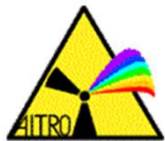


Tecnica Tangenziale

PLANNING: FIELD SET-UP



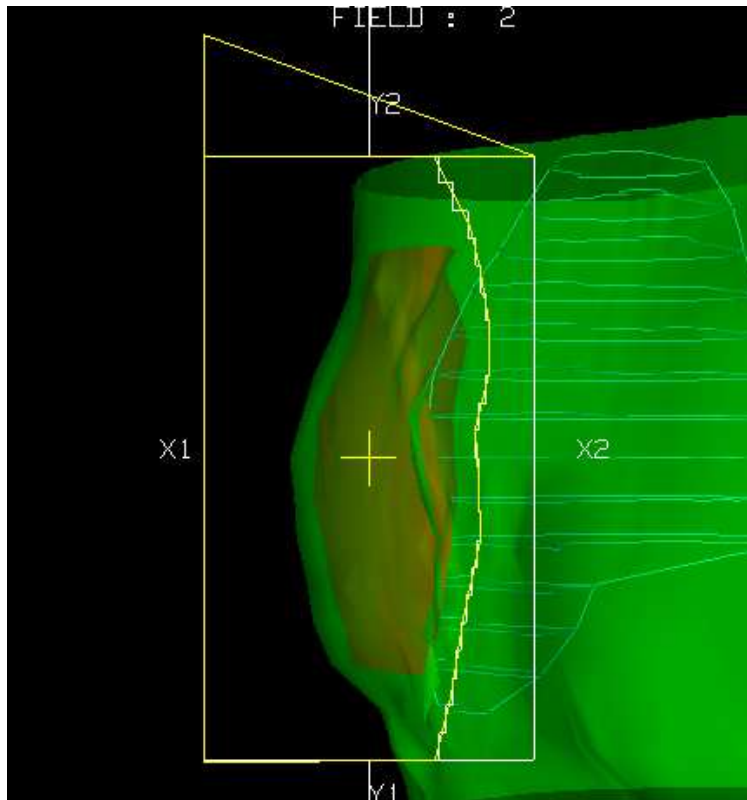
MLC



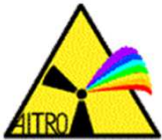
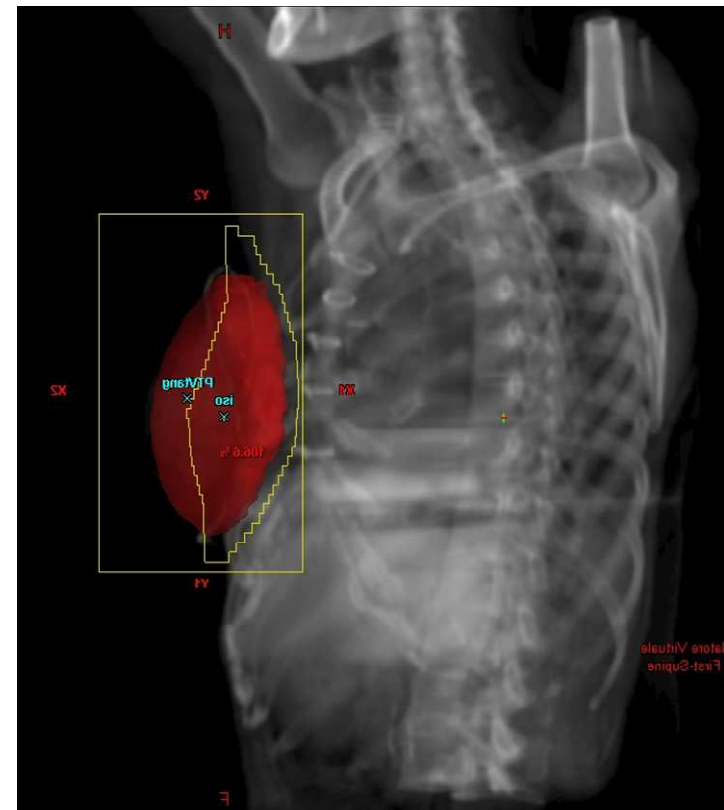
Schermature

PLANNING: FIELD SET-UP

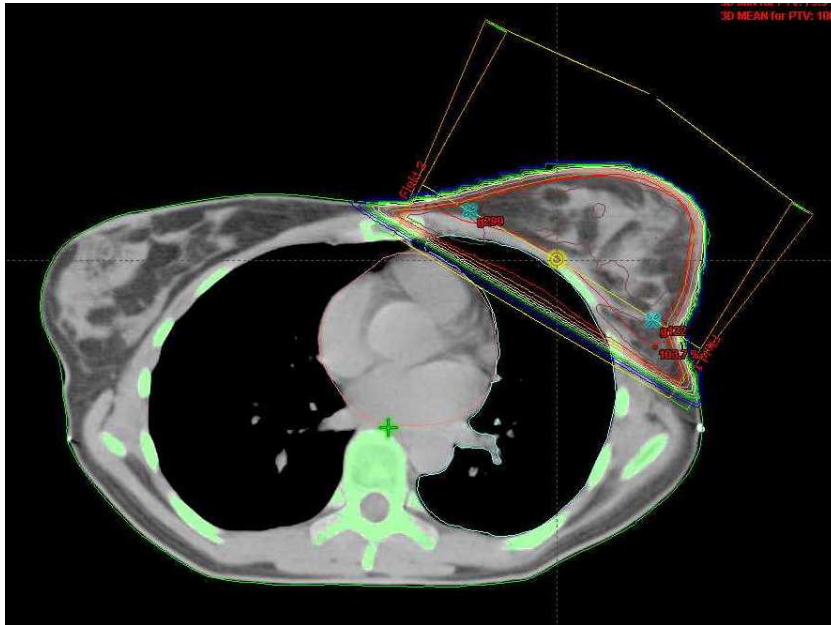
3D CRT



Field 'n field



PLANNING: CALCOLO E DISTRIBUZIONE DELLA DOSE

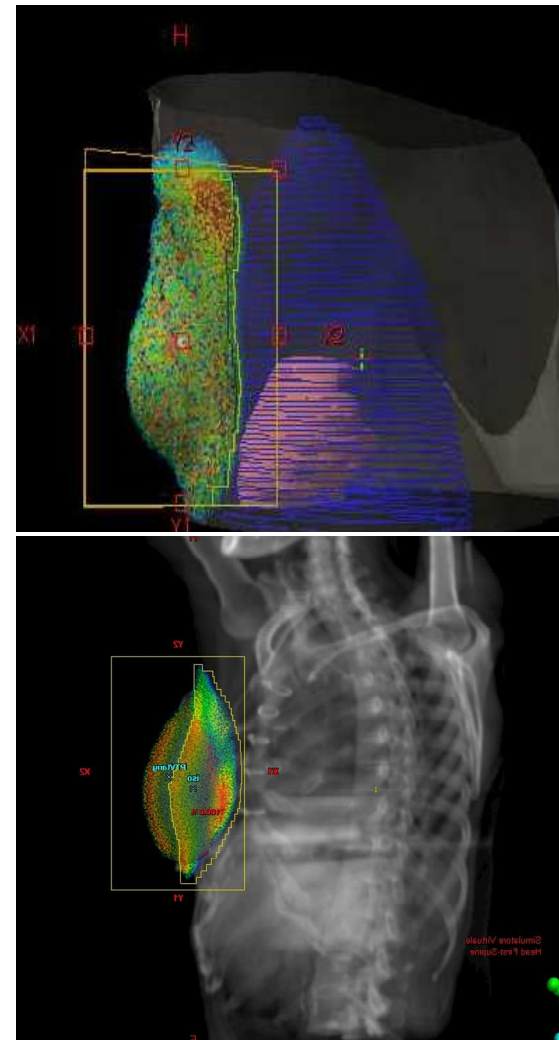
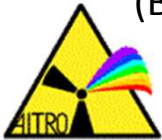


Dose: 50Gy in 25 frazioni

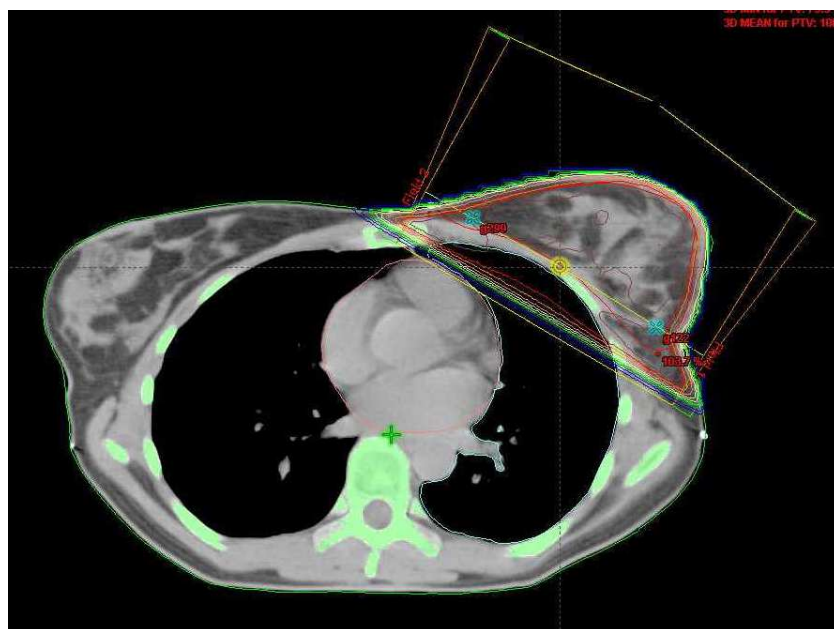
95%V \geq 95% D

5%V \leq 105% D

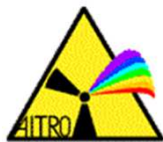
(Boost e 10Gy)



PLANNING: CALCOLO E DISTRIBUZIONE DELLA DOSE



Dose: 50Gy in 25 frazioni
95%V \geq 95% D
5%V \leq 105% D



Definizione constraints

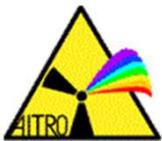
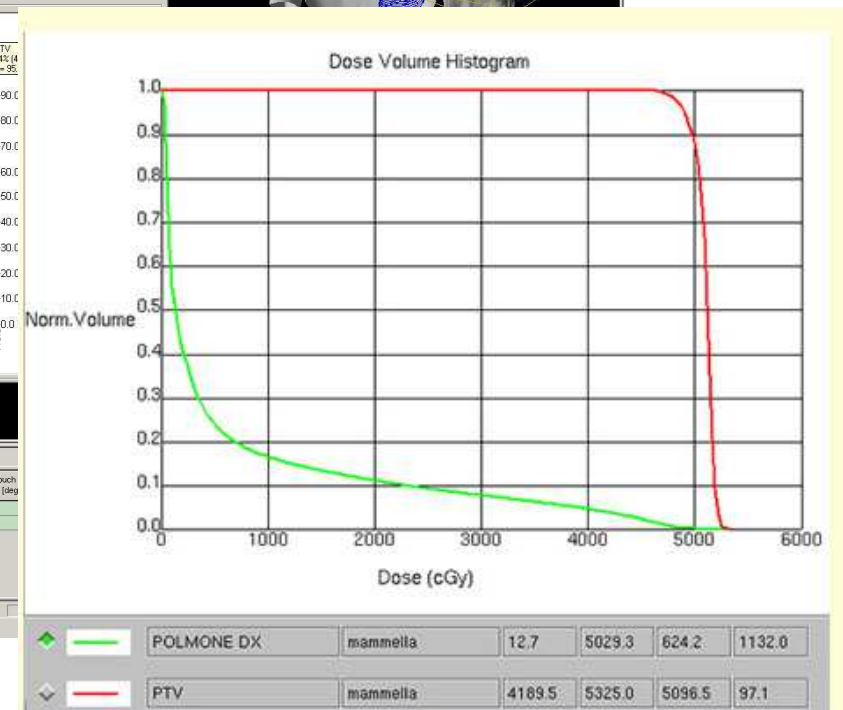
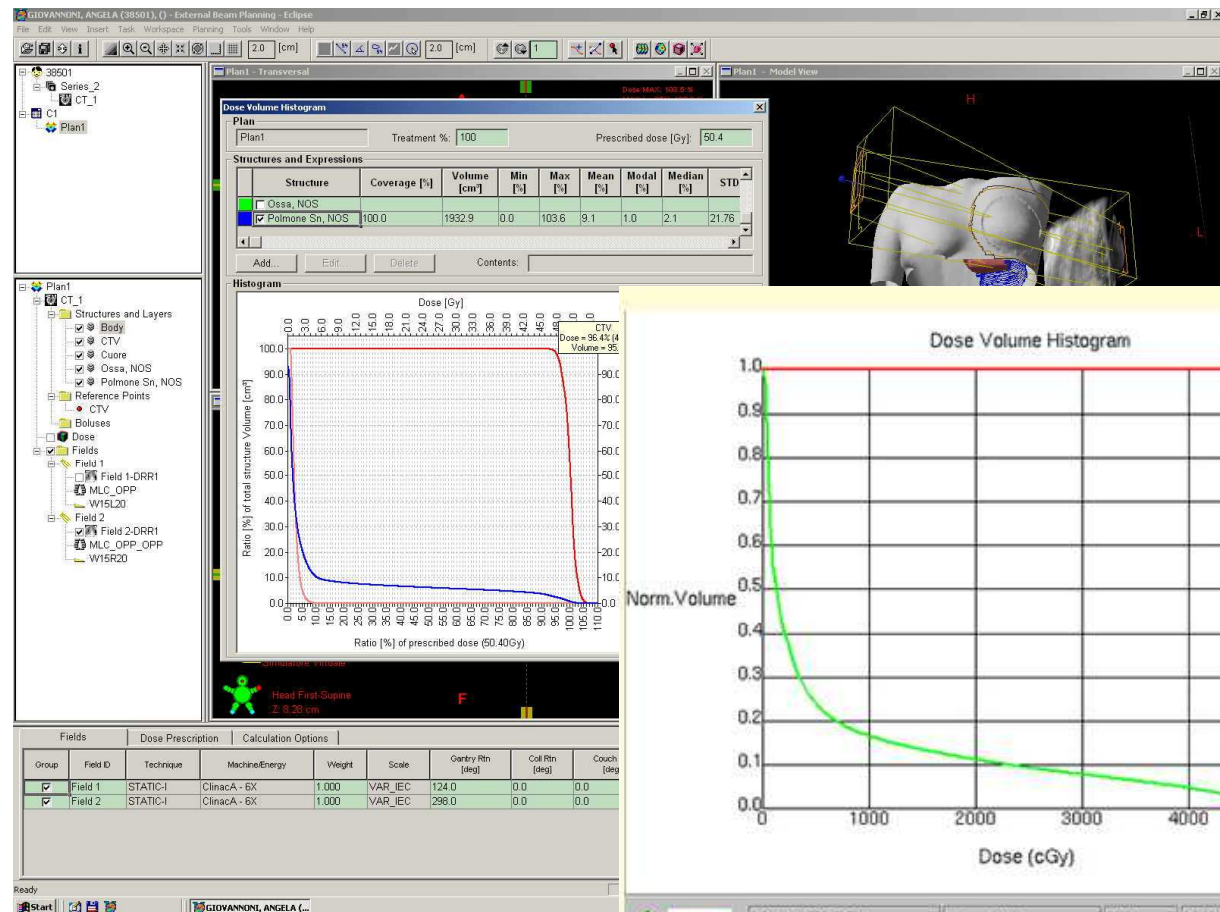
Table II. Constraints for organs at risk in adjuvant radiotherapy of early breast cancer.

Organ at risk	Normofractionation 2 Gy per fraction/ 5 fractions/week
LADCA	$V_{20\text{Gy}} = 0\%$
Heart	$V_{20\text{Gy}} = 10\%, V_{40\text{Gy}} = 5\%$
Ipsilateral lung	$V_{20\text{Gy}} = 25\%$ (exclusive periclavicular LN) $V_{20\text{Gy}} = 35\%$ (inclusive periclavicular LN) Mean dose < 18 Gy
Spinal cord	Max. 45 Gy
Plexus brachialis	Max. 54 Gy
Maximal dose of CTV	107% = 53.5 Gy
Maximal dose outside PTV	54 Gy

CTV, clinical target volume; LADCA, left anterior descending coronary artery; LN, lymph nodes; PTV, planning tumor volume.

PLANNING: CALCOLO E DISTRIBUZIONE DELLA DOSE

DVH
Dose Volume Histogram

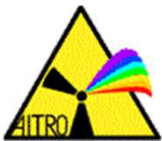
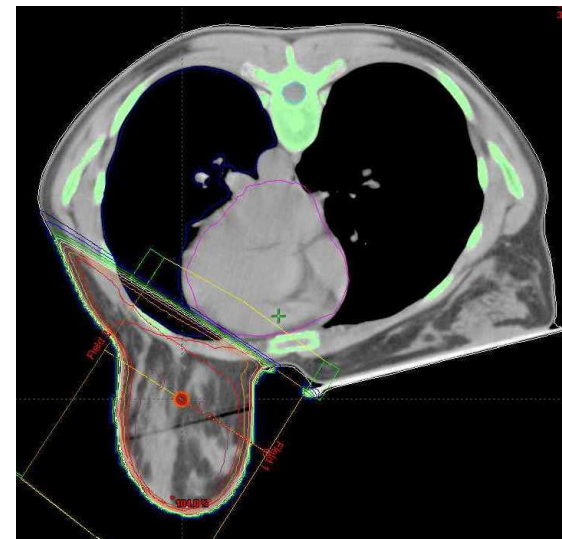
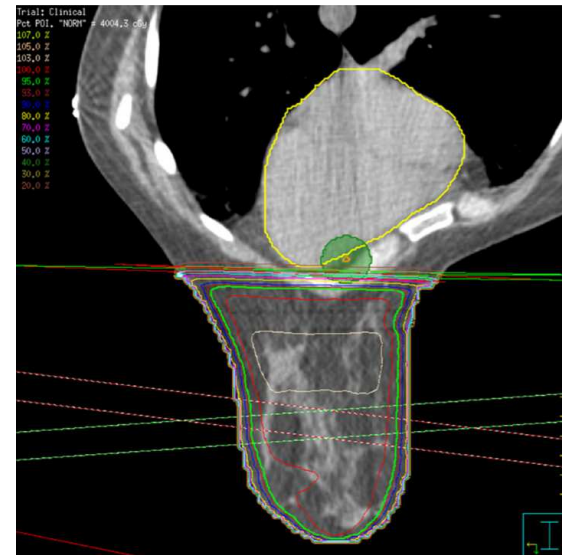


PLANNING: CALCOLO E DISTRIBUZIONE DELLA DOSE



Phase III randomised trial

The UK HeartSpare Study (Stage IB): Randomised comparison of a voluntary breath-hold technique and prone radiotherapy after breast conserving surgery



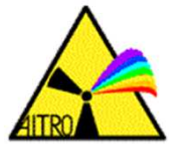
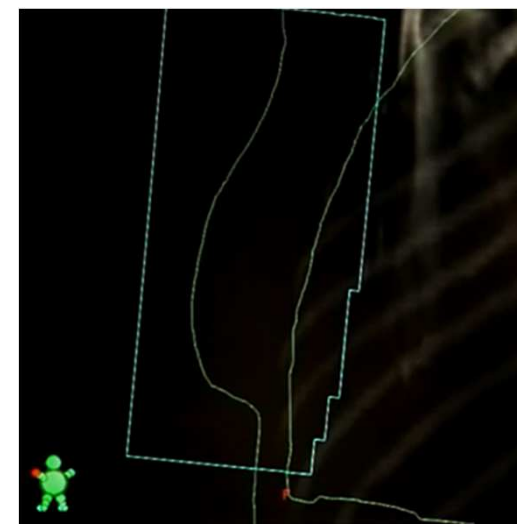
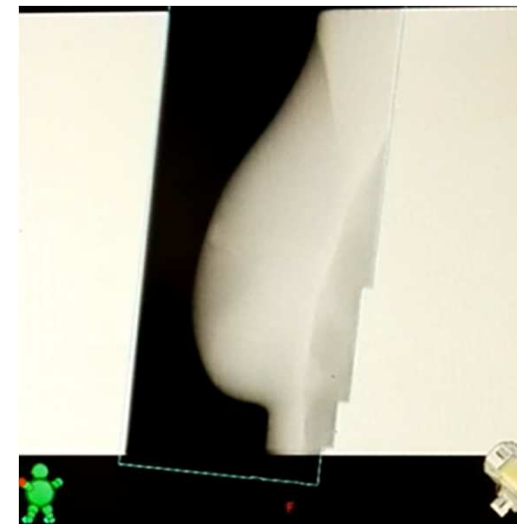
TRATTAMENTO



Garanzia di riproducibilità!!

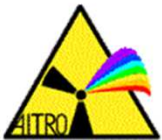
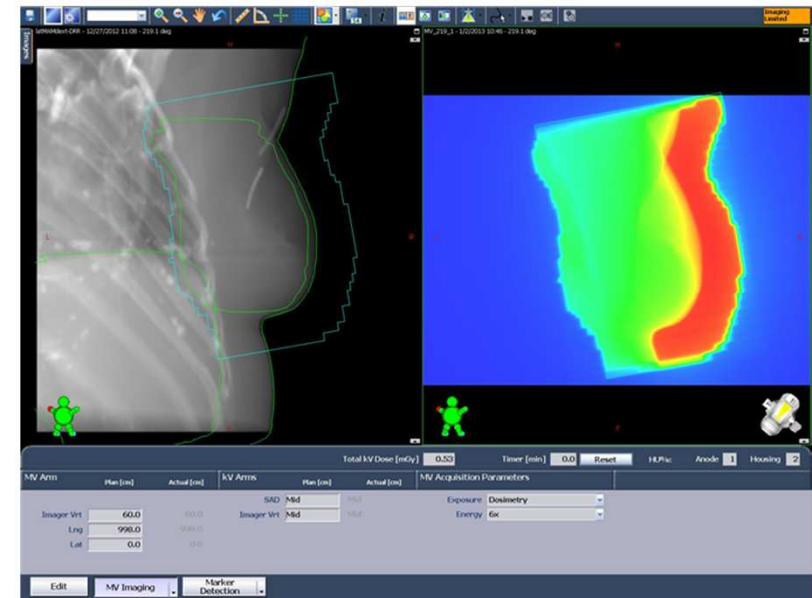
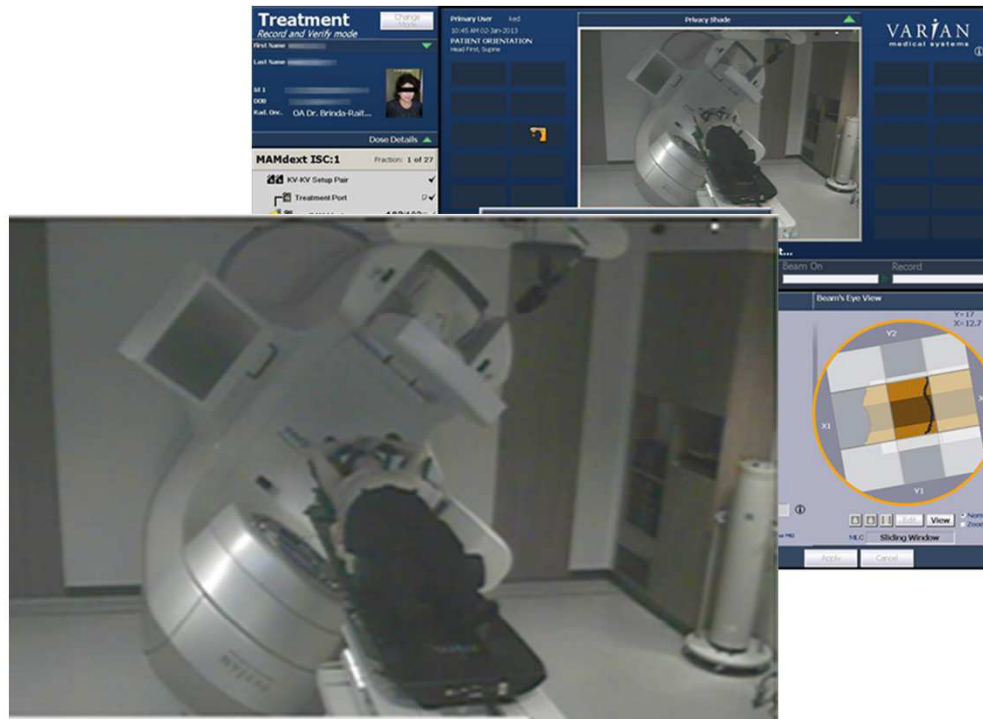


IGRT Image Guided Radiation Therapy



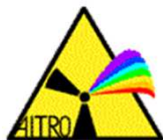
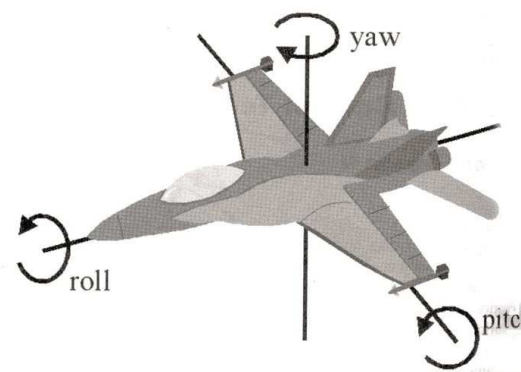
IGRT

Image Guided Radiation Therapy

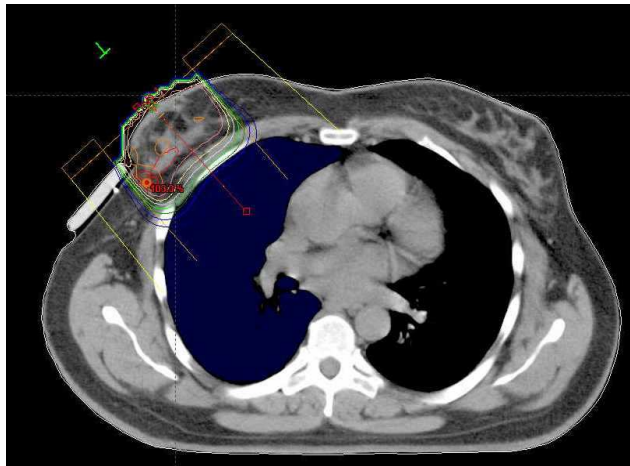


IGRT Image Guided Radiation Therapy

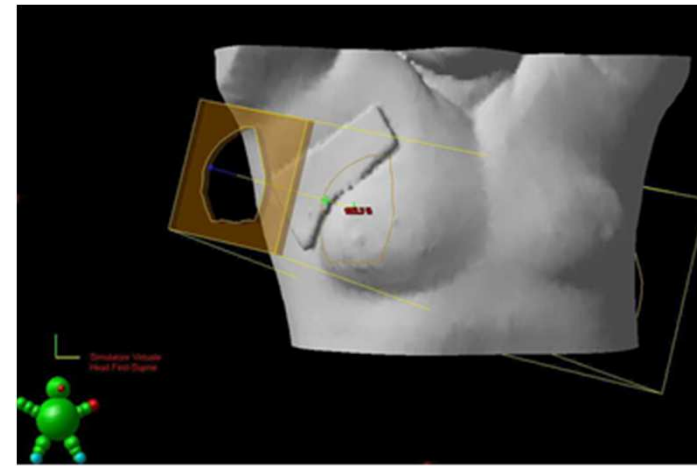
Riallineamento
Lettino 6DoF



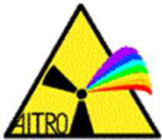
BOOST ELETTRONI



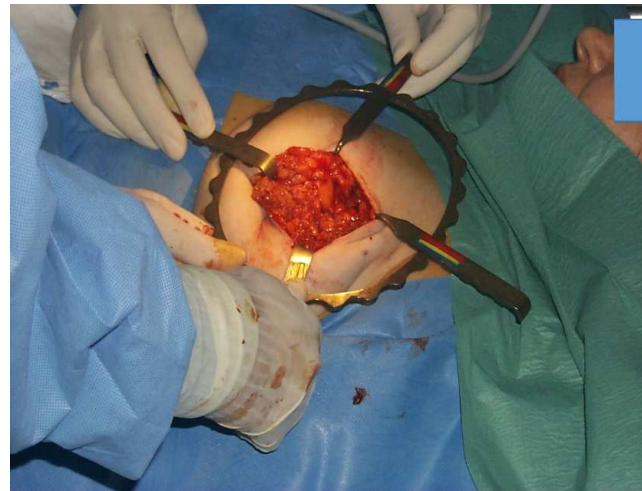
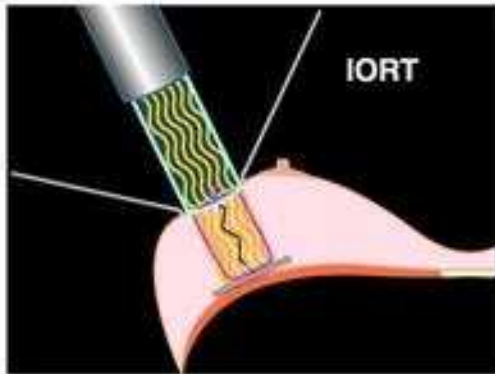
Rappresentazione su scansione assiale della distribuzione di dose della tecnica con fasci ad elettroni per un trattamento sulla mammella.



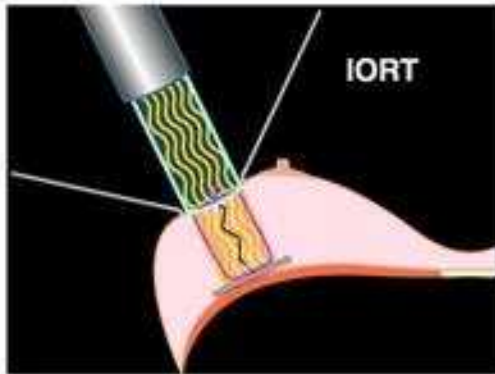
Rappresentazione 3D, con visualizzazione dell'incidenza. Fascio conformato per mezzo di protezioni in lega inserite sui collimatori



RADIOTERAPIA INTRAOPERATORIA (IORT)

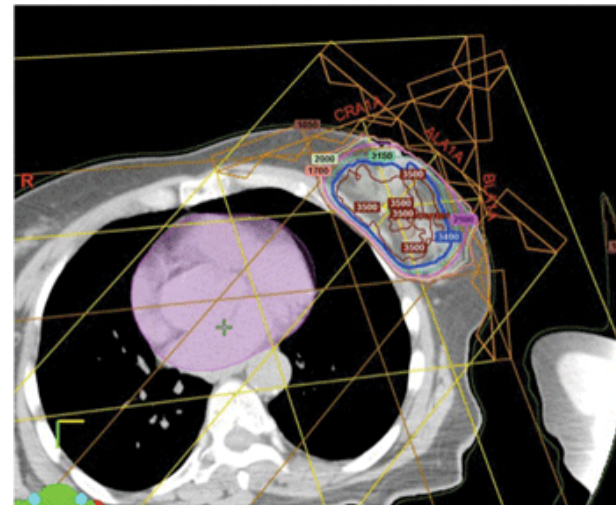
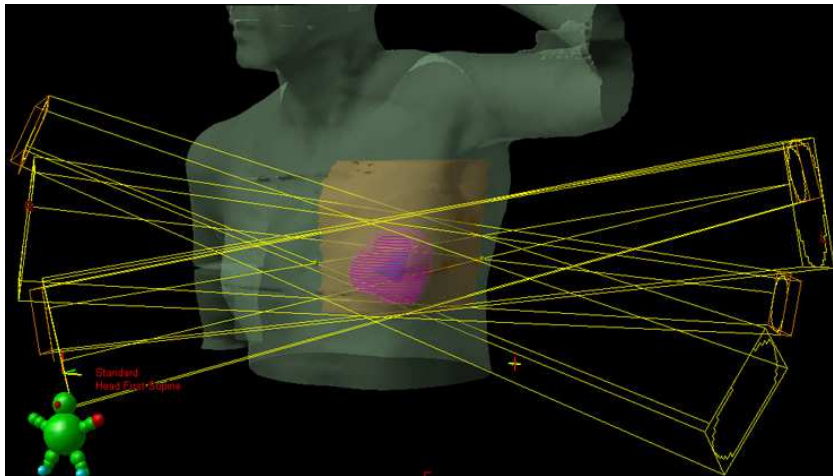


RADIOTERAPIA INTRAOPERATORIA (IORT)

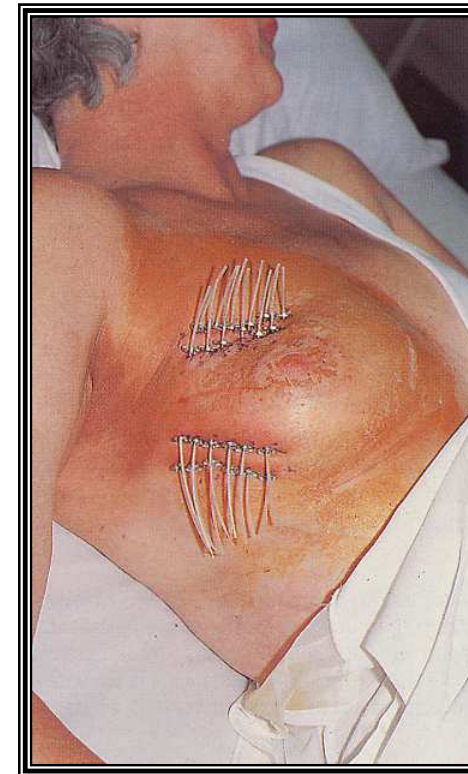
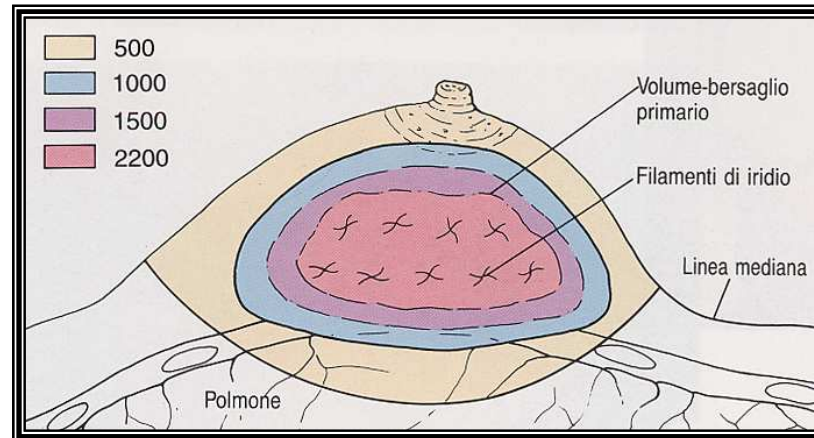


PARTIAL BREAST IRRADIATION (PBI)

New radiation modalities have been recently developed in early breast cancers particularly accelerated partial breast irradiation (APBI). Among all techniques of radiotherapy, 3D-conformal APBI and intraoperative radiotherapy (IORT) are the main modalities of radiotherapy used.



BRACHITERAPIA

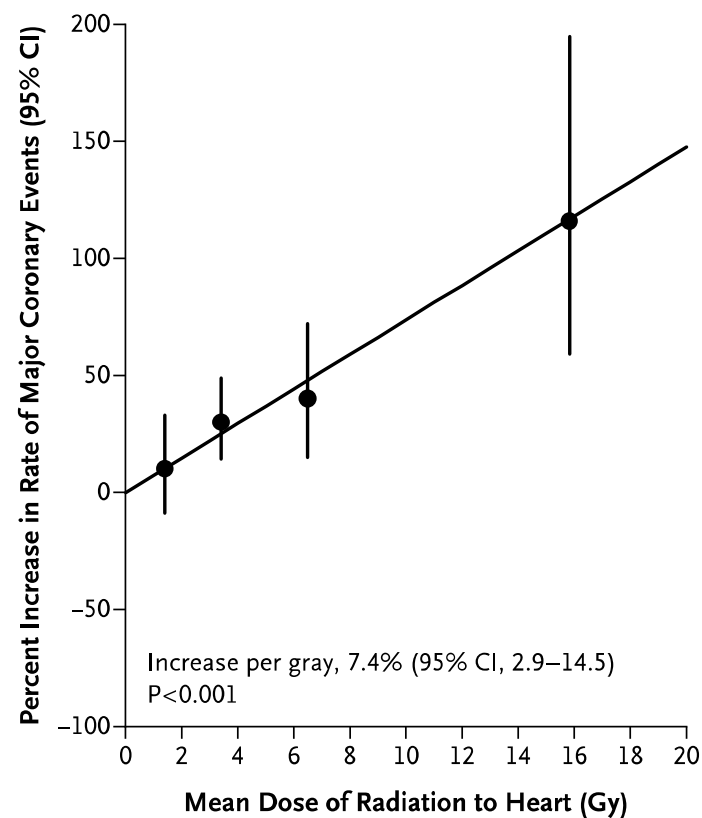
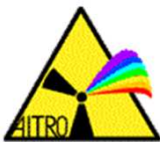


IL PROBLEMA DELLA TOSSICITA' CARDIACA

Table 3. Percentage Increase in the Rate of Major Coronary Events per Gray, According to Time since Radiotherapy.

Time since Radiotherapy*	No. of Case Patients	No. of Controls	Increase in Rate of Major Coronary Events (95% CI)† % increase/Gy
0 to 4 yr	206	328	16.3 (3.0 to 64.3)
5 to 9 yr	216	296	15.5 (2.5 to 63.3)
10 to 19 yr	323	388	1.2 (-2.2 to 8.5)
≥20 yr	218	193	8.2 (0.4 to 26.6)
0 to ≥20 yr	963	1205	7.4 (2.9 to 14.5)

Per ogni Gy di dose media al cuore c'è un rischio pari al 7.4% di sviluppare un evento cardiaco



Darby SC et al, NEJM 368:987-998, 2013

SIMULAZIONE

Nuove tecniche e tecnologie

- *Deep inspiration breath hold*

- *Gating respiratorio*



Free CT simulation



DIBH CT simulation



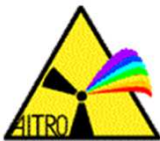
When using gating in left tangential breast irradiation?

Campione: 100 pazienti / 200 PT



	Basal.MHD	Mean.Heart.Dose.Basal	Mean.Heart.Dose.Gated	Gated.MHD
Min	0.000	0.8661	0.5111	0.0000
1st Qu.	0.405	1.9640	1.2394	0.0000
Median	1.010	2.8843	1.7587	0.0000
Mean	1.039	3.1246	1.7423	0.1636
3rd Qu.	1.565	3.9931	2.2075	0.0000
Max.	3.560	9.2537	4.7672	1.6500

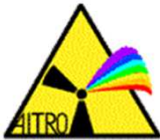
Coefficients name	β value	P-val - Pr(> t)
Intercept	0.92151	2.27e-11
V _{31,5} Lung Basal	-4.20188	0.000299
Mean Basal CT Heart Dose	0.54065	1.29e-13
Basal MHD	-0.44137	0.000748

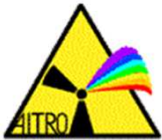
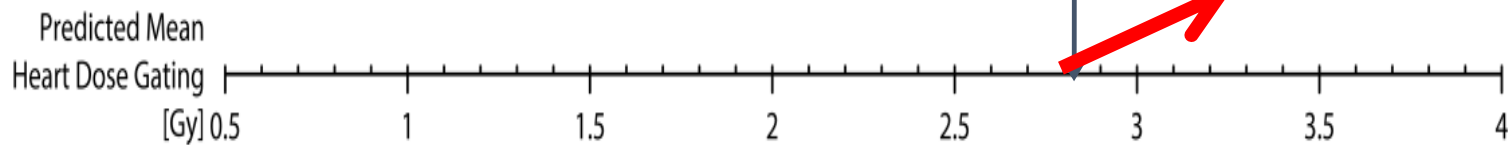
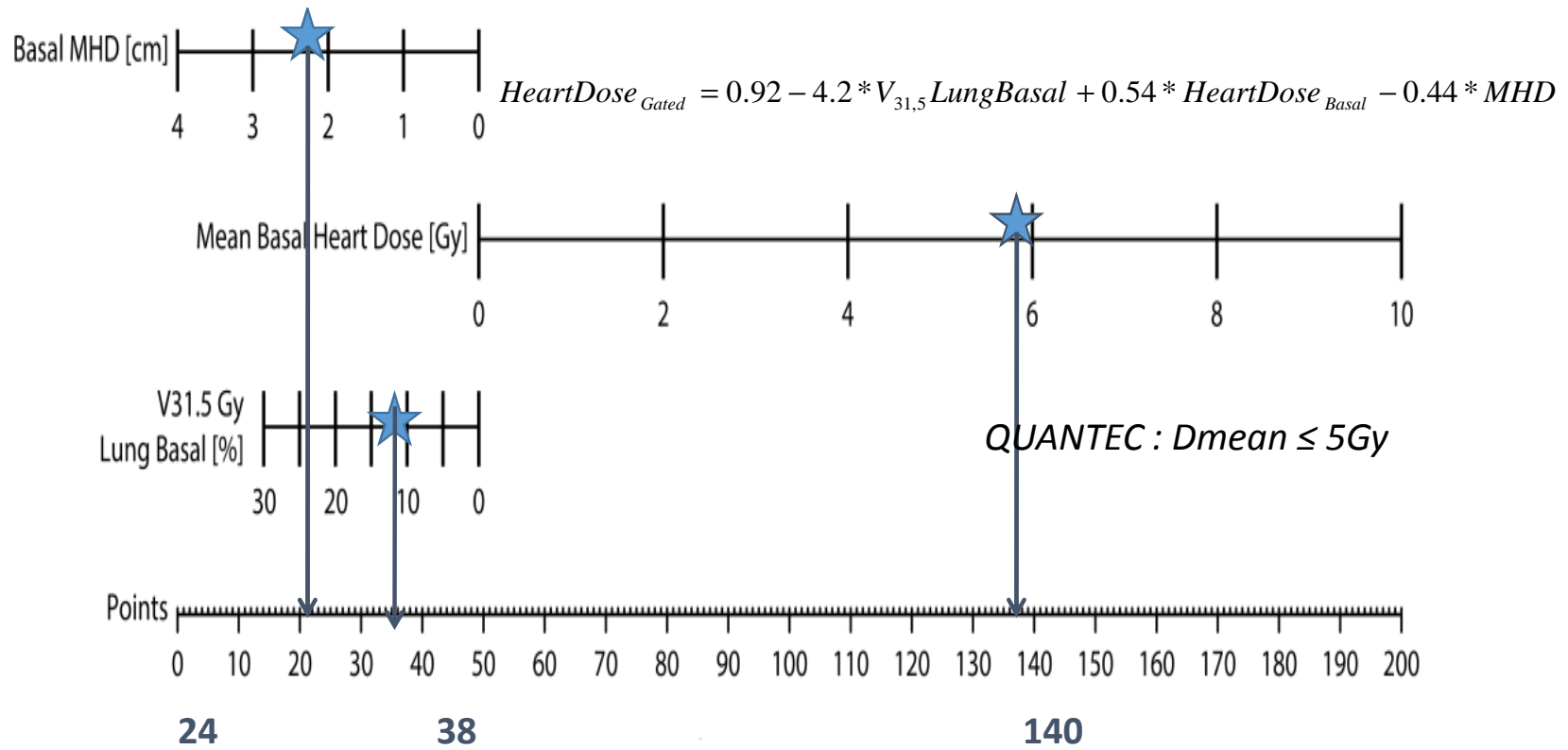


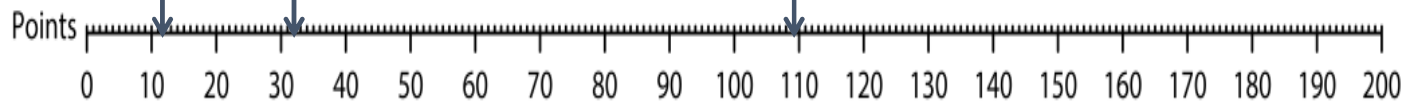
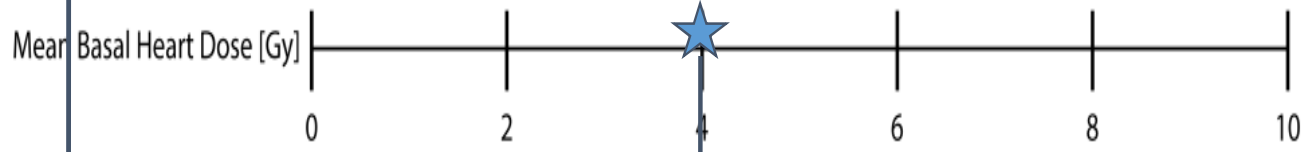
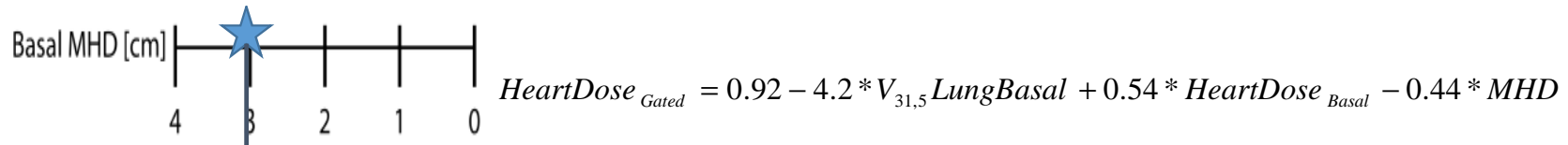
$$HeartDose_{Gated} = 0.92 - 4.2 * V_{31,5} LungBasal + 0.54 * HeartDose_{Basal} - 0.44 * MHD$$

Variabili note:

- MHD basale
- Dose media cuore basale
- $V_{31,5}$ polmonare







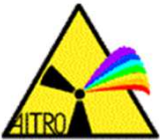
12 **32** **108**



CONTROLLO TOSSICITA' CUTANEA

L'ambulatorio infermieristico

- Gestione tossicità cutanea
- Medicazioni
- Educazione e training



ASPETTI PSICO-RELAZIONALI

Umanizzazione del trattamento radioterapico:

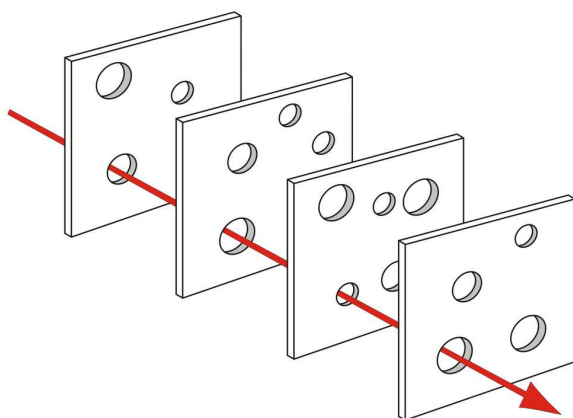
Spiegare le procedure

Ascoltare

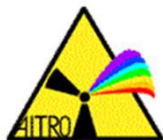
Gestire il disagio e l'ansia



“Prendersi cura con un sorriso”



Modello di Reason



Grazie per l'attenzione!

