

# Planification de traitement en radio-oncologie



Introduction	<b>Laurent Marmy</b> Maître d'enseignement HES	Conclusion
Sommaire et Objectifs	<b>Octobre 2021</b>	Quelques exemples

# Sommaire et Objectifs

- Introduction
- Aperçu de la dosimétrie en Suisse romande
- Prérequis et but de la planification de traitement
- Déroulement du processus de planification
- Particularités et illustrations

Objectifs

## Objectifs

- Connaître le contexte de la dosimétrie en Suisse romande
- Comprendre le déroulement d'une planification de traitement
- Être capable de planifier un traitement ( lors des TP)

# Sommaire et Objectifs

- Introduction
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- Déroulement du processus de planification
- Particularités et illustrations

Objectifs



# Planification de traitement en radio-oncologie



Introduction

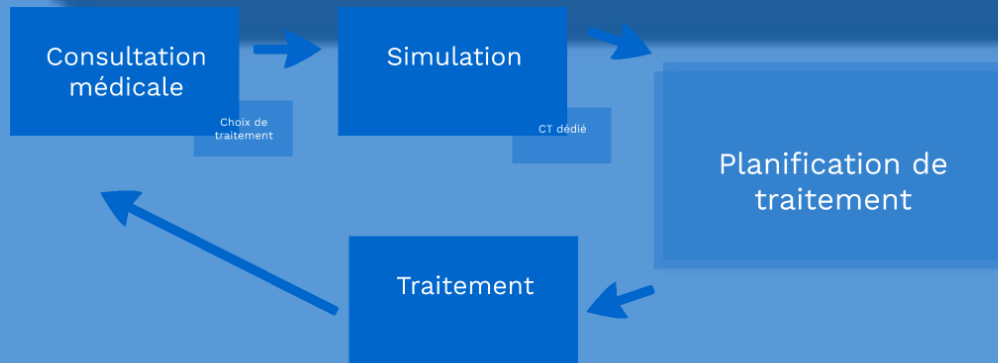
Laurent Marmy  
Maître d'enseignement HES

Conclusion

Sommaire et  
Objectifs

Quelques  
exemples

# Parcours du patient en RO



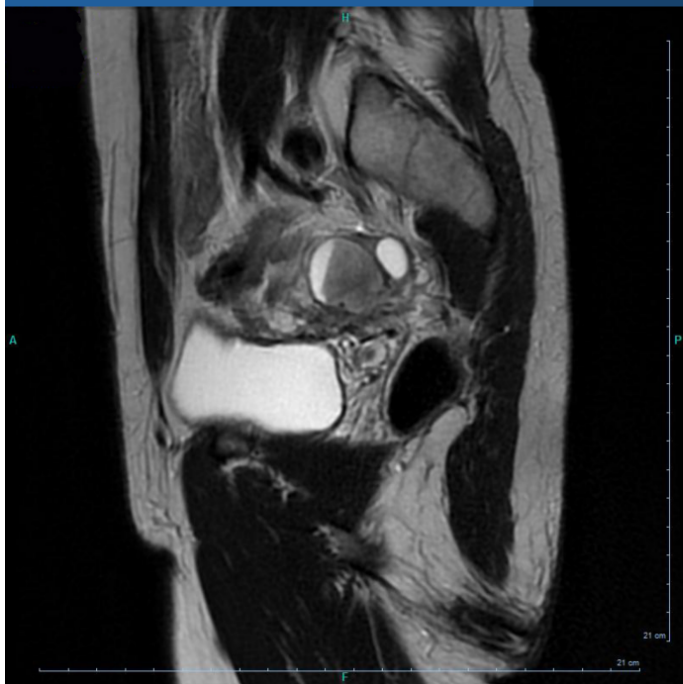
# Planification de traitement

Contexte de la Suisse romande

Bases de la planification de traitement

Processus de planification

Petit guide de la dosimétrie



## Contexte de la Suisse romande

Pratiques très  
variables

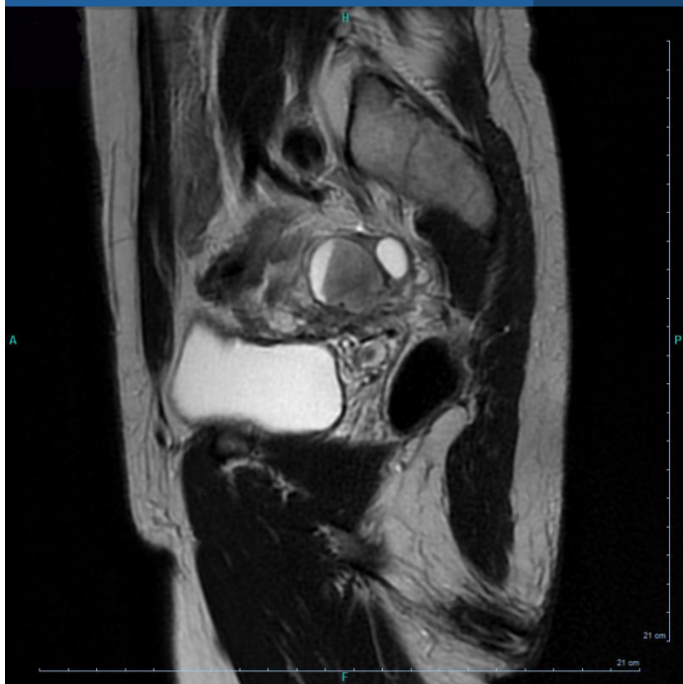
## TRM "spécialisés"

- Planification de traitement "réservée" à certains TRM (avec une formation spécifique)

## Tournus

- complet
- limité

Partage des tâches  
entre TRM et  
physiciens



## Contexte de la Suisse romande

Pratiques très  
variables

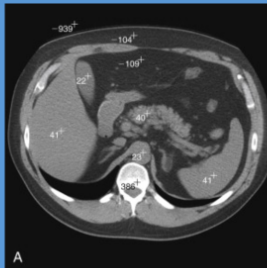
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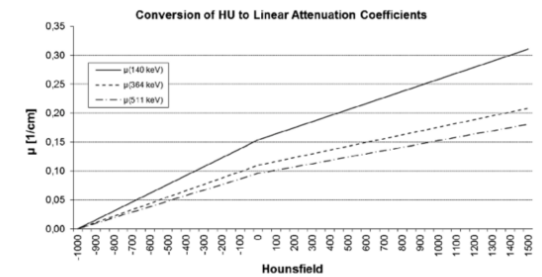
Petit guide de la dosimétrie



Images CT =  
base de calcul  
du TPS

Importance du  
positionnement et  
des contentions

Fig. 3 Bilinear conversion of Hounsfield units into linear attenuation coefficients for different photon energies. The attenuation coefficients are smaller with increasing photon energies





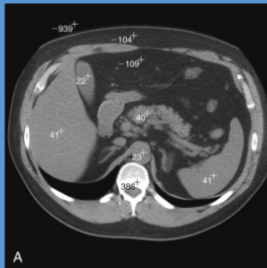
## Importance du positionnement et des contentions

- En fonction du patient
- En fonction de l'indication
- En fonction du type de tt

## Importance du positionnement et des contentions

- En fonction du patient
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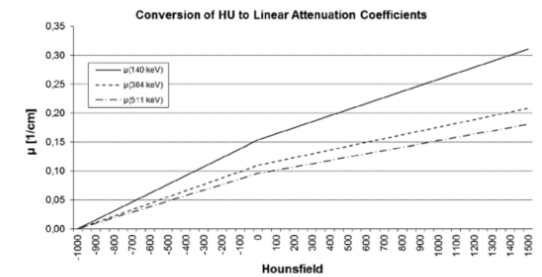
Pourquoi est-ce si important ?



Images CT =  
base de calcul  
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Importance du  
positionnement et  
des contentions

Fig. 3 Bilinear conversion of Hounsfield units into linear attenuation coefficients for different photon energies. The attenuation coefficients are smaller with increasing photon energies



# Planification de traitement

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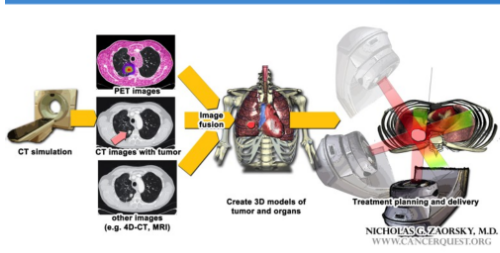
Processus de planification

Petit guide de la dosimétrie

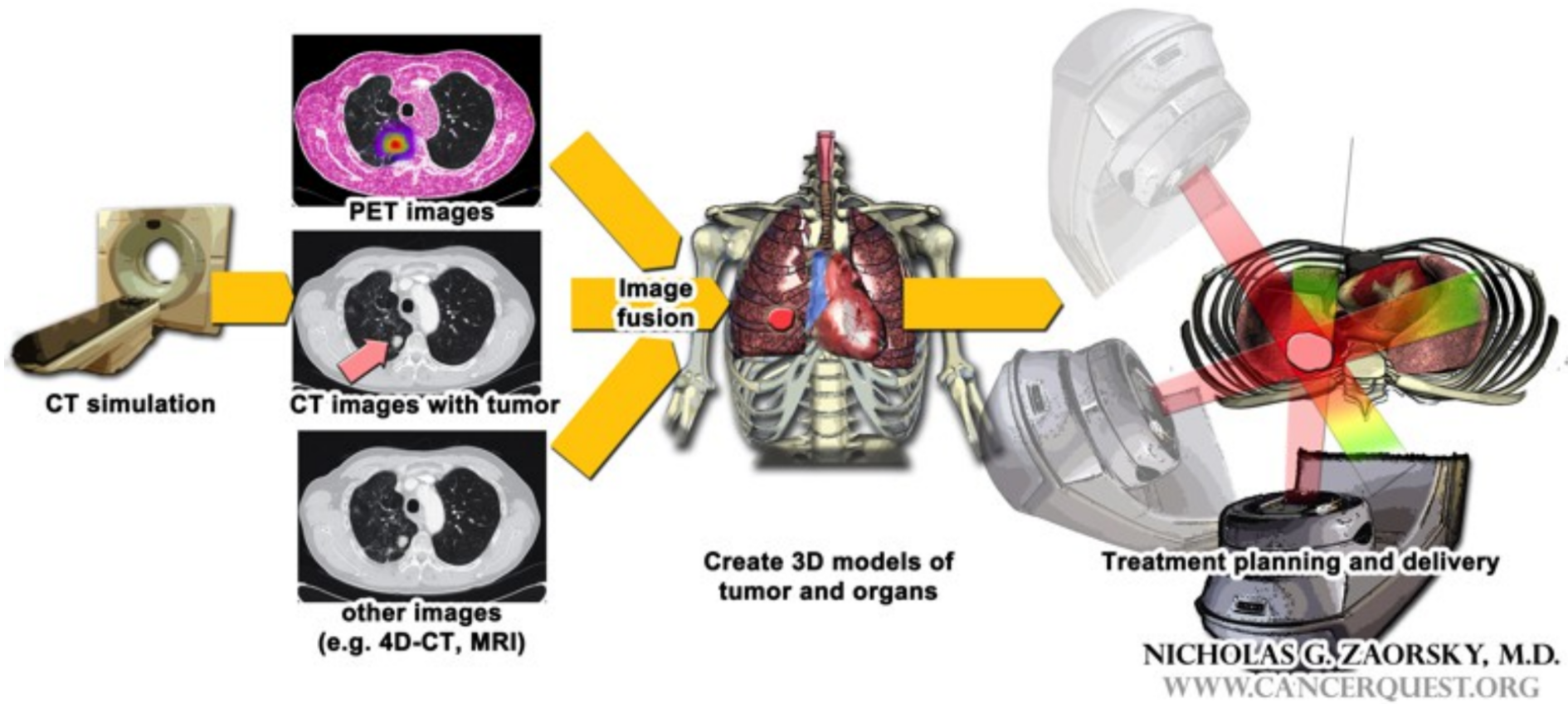
# Déroulement d'une planification de traitement

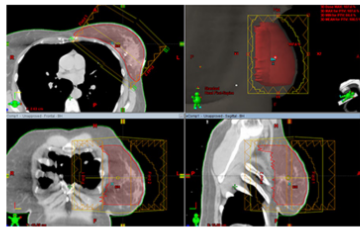
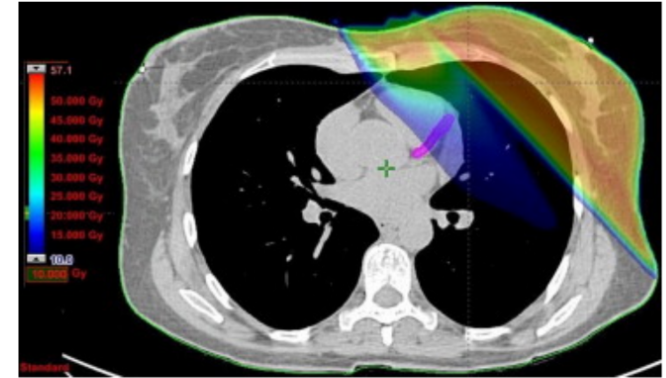
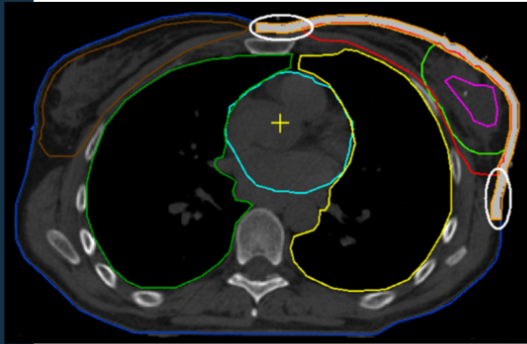
Processus

# Processus de planification



Project	Planned treatment	Max dose	Targeted homogeneity	Max dose	...	...
1	100%	100%	100%	100%	...	...
2	100%	100%	100%	100%	...	...
3	100%	100%	100%	100%	...	...
4	100%	100%	100%	100%	...	...
5	100%	100%	100%	100%	...	...
6	100%	100%	100%	100%	...	...
7	100%	100%	100%	100%	...	...
8	100%	100%	100%	100%	...	...
9	100%	100%	100%	100%	...	...
10	100%	100%	100%	100%	...	...
11	100%	100%	100%	100%	...	...
12	100%	100%	100%	100%	...	...
13	100%	100%	100%	100%	...	...
14	100%	100%	100%	100%	...	...
15	100%	100%	100%	100%	...	...
16	100%	100%	100%	100%	...	...
17	100%	100%	100%	100%	...	...
18	100%	100%	100%	100%	...	...
19	100%	100%	100%	100%	...	...
20	100%	100%	100%	100%	...	...
21	100%	100%	100%	100%	...	...
22	100%	100%	100%	100%	...	...
23	100%	100%	100%	100%	...	...
24	100%	100%	100%	100%	...	...
25	100%	100%	100%	100%	...	...
26	100%	100%	100%	100%	...	...
27	100%	100%	100%	100%	...	...
28	100%	100%	100%	100%	...	...
29	100%	100%	100%	100%	...	...
30	100%	100%	100%	100%	...	...
31	100%	100%	100%	100%	...	...
32	100%	100%	100%	100%	...	...
33	100%	100%	100%	100%	...	...
34	100%	100%	100%	100%	...	...
35	100%	100%	100%	100%	...	...
36	100%	100%	100%	100%	...	...
37	100%	100%	100%	100%	...	...
38	100%	100%	100%	100%	...	...
39	100%	100%	100%	100%	...	...
40	100%	100%	100%	100%	...	...
41	100%	100%	100%	100%	...	...
42	100%	100%	100%	100%	...	...
43	100%	100%	100%	100%	...	...
44	100%	100%	100%	100%	...	...
45	100%	100%	100%	100%	...	...
46	100%	100%	100%	100%	...	...
47	100%	100%	100%	100%	...	...
48	100%	100%	100%	100%	...	...
49	100%	100%	100%	100%	...	...
50	100%	100%	100%	100%	...	...





Pharynx	Pharyngeal constrictor	Whole organ	Symptomatic dysphagia and aspiration	Mean dose	<50	<30	Based on Series 06 of 10/17
Larynx	Whole organ	50:0%	Tongue dysfunction	10%	<4%	<2%	With chemotherapy
	Whole organ	50:0%	Aspiration	Mean dose	<4%	<2%	With chemotherapy
	Whole organ	50:0%	Edema	Mean dose	<4%	<2%	Without chemotherapy
	Whole organ	50:0%	Edema	%	<2%	<2%	Based on single studies in patients without larynx cancer
Lung	Whole organ	50:0%	Symptomatic pneumonitis	%	<30%	<2%	For combined lung Goodell observations
	Whole organ	50:0%	Symptomatic pneumonitis	Mean dose	7	5	Excludes paraneoplastic pleural effusions
	Whole organ	50:0%	Symptomatic pneumonitis	Mean dose	11	8	
	Whole organ	50:0%	Symptomatic pneumonitis	Mean dose	20	20	
	Whole organ	50:0%	Symptomatic pneumonitis	Mean dose	24	24	
Esophagus	Whole organ	50:0%	Symptomatic pneumonitis	Mean dose	27	27	
	Whole organ	50:0%	Grade 1-2 higher order esophagitis	Mean dose	<24	<24	Based on RTOG and several studies
	Whole organ	50:0%	Grade 1-2 higher order esophagitis	%	<50%	<3%	A number of studies have been included. Excludes 100% in 2 dose volume response
	Whole organ	50:0%	Grade 1-2 higher order esophagitis	%	<40%	<3%	
Heart	Pericardium	50:0%	Pericarditis	Mean dose	<2%	<1%	Based on single study
	Pericardium	50:0%	Pericarditis	%	<40%	<1%	Clearly safe with extensive based on 100% partial
	Whole organ	50:0%	Pericardium on fat	%	<10%	<1%	
	Whole organ	50:0%	Pericarditis	%	<10%	<1%	





# Déroulement d'une planification de traitement

Processus

# Planification de traitement

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Processus de planification

Petit guide de la dosimétrie

## Choix de la balisitique

- En fonction des pratiques du service
- En fonction de la localisation
- En fonction du patient, des volumes et des indications médicales, ...

Méthodologie

## Méthodologie

1. Prendre connaissance du cas
2. Regarder attentivement les coupes
3. Regarder attentivement les contours (OAR + PTV)
4. Remplir la prescription
5. Choisir la balistique
6. Planifier - évaluer - optimiser - réévaluer - ...
7. Faire valider la planification

Affichage  
Eclipse: Page  
d'accueil

# Affichage Eclipse: Page d'accueil

The screenshot displays the Eclipse user home screen for a user named Laurent. The interface is divided into three main sections:

- Patient List:** A large empty area on the left, with tabs for 'Tasks' and 'Appointments' and a date range filter set to '17.09.2019 - 17.09.2019'.
- Favorites:** A central panel containing buttons for 'External Beam Planning', 'Plan Evaluation', and 'Contouring'. A progress bar is visible with the text 'Launching External Beam Planning...' and a 'Launch' button at the bottom.
- Schedule:** A calendar view on the right for 'TrueBeam - Radiation Oncology'. The calendar shows dates from September 16 to October 20, 2019, with columns for each day of the week.

The Windows taskbar at the bottom shows the system tray with the date '14:12 17.09.2019' and the language 'FR'.

# Affichage Eclipse: Onglet planification de ttt

External Beam Planning (Administrator)

BREAST\_ONE (498599a)

Tools Window

External Beam Planning | Brachytherapy Planning | Brachytherapy 2D Entry | Plan Evaluation

ex\_lm - Unapproved - Transversal - sein\_g

ex\_lm - Unapproved - Model View - sein\_g

ex\_lm - Unapproved - Frontal - sein\_g

ex\_lm - Unapproved - Sagittal - sein\_g

balistique

Standard Head First-Supine

z: -3.75 cm

y: -4.05 cm

x: 6.91 cm

Plan Objectives	Optimization Objectives	Dose Statistics	Calculation Models	Plan Sum				
Number of Fractions	Total Dose [Gy]	Target Volume	Primary Reference Point [Volume]	Total Dose at Primary [Gy]	Relative Dose at Primary [%]	Prescribed Percentage [%]	Plan Normalization Mode	Plan Normalization Value [%]
2.000	25	50.000 ptv	point A [ptv]			100.0	100.00% covers 50.00% of Target Volume	25.1

User: Superuser Group: Service Site: Main CAP: NUM SCRL

FR 14:15 17.09.2019

# Affichage Eclipse: Onglet planification de ttt choix balistique

The screenshot displays the Eclipse External Beam Planning interface for a breast cancer case. The main window shows four views of the patient's CT scan: Transversal, BEV (Beam's Eye View), Frontal, and Sagittal. The BEV view highlights the target and organs at risk (OARs) with colored contours. The table below provides detailed parameters for the three treatment fields.

Group	Field ID	Technique	Machine/Energy	MLC	Field Weight	Scale	Gantry Rtn [deg]	Coll Rtn [deg]	Couch Rtn [deg]	Wedge	Field X [cm]	X1 [cm]	X2 [cm]	Field Y [cm]	Y1 [cm]	Y2 [cm]	X [cm]	Y [cm]	Z [cm]	Calculated SSD [cm]	MU	Ref. D [Gy]
<input checked="" type="checkbox"/>	TGE	STATIC-I	TrueBeam - 6X	Static	0.500	Varian IEC	310.0	0.0	0.0	W45R20U	11.7	+2.0	+9.7	16.9	+8.1	+8.8	6.91	-4.05	0.50	91.9	227.7	1.267
<input checked="" type="checkbox"/>	TGI	STATIC-I	TrueBeam - 6X	Static	0.300	Varian IEC	130.0	0.0	0.0	None	12.0	+10.1	+1.9	17.2	+8.7	+8.5	6.91	-4.05	0.50	91.1	68.4	0.798
<input checked="" type="checkbox"/>	TGibis	STATIC-I	TrueBeam - 15X	Static	0.200	Varian IEC	130.0	0.0	0.0	None	12.0	+10.1	+1.9	17.2	+8.7	+8.5	6.91	-4.05	0.50	91.1	40.4	0.466

# Affichage Eclipse: Onglet planification de ttt Evaluation du plan

Isocentre

The screenshot displays the Eclipse External Beam Planning interface for a breast treatment plan. The main window shows four views: Transversal, Frontal, Sagittal, and a Dose Volume Histogram (DVH). The DVH plot shows the Ratio of Total Structure Volume (%) on the y-axis (0 to 100) and Relative dose (%) on the x-axis (0 to 100). A red curve represents the target (PTV) and a blue curve represents an organ at risk (OAR). The DVH plot includes the text "Some structures are unapproved or rejected".

At the bottom of the interface, there is a table with the following columns: Structure, Approval Status, Plan, Course, Volume [cm<sup>3</sup>], Dose Cover [%], Sampling Cover [%], Min Dose [%], Max Dose [%], and Mean Dose [%].

Structure	Approval Status	Plan	Course	Volume [cm <sup>3</sup> ]	Dose Cover [%]	Sampling Cover [%]	Min Dose [%]	Max Dose [%]	Mean Dose [%]
BODY	Unapproved	grrr def	Cl	15327.3	100.0	99.9	0.0	108.9	10.5
ptv	Unapproved	grrr def	Cl	507.4	100.0	100.0	90.6	108.4	100.0
POUMON G	Unapproved	grrr def	Cl	949.0	100.0	100.0	1.1	102.4	18.5
Coeur	Unapproved	grrr def	Cl	361.3	100.0	100.0	2.0	99.4	10.6
MOELLE	Unapproved	grrr def	Cl						
ctv	Unapproved	grrr def	Cl						
Poumon D	Unapproved	grrr def	Cl						



## C'est quoi un isocentre ?

---

iso = même

--> "qui a le même centre"

et alors ? ça veut dire quoi ?

intersection de l'axe des faisceaux



# Quelles sont les coordonnées de l'isocentre ?

External Beam Planning (Administrator)

PROSTATE, ONE (4232954)

Tools Window

Registration External Beam Planning Brachytherapy Planning Brachytherapy 2D Entry Plan Evaluation

autolm - Unapproved - Transversal - CT MOO

autolm - Unapproved - Model View - CT MOO

autolm - Unapproved - Frontal - CT MOO

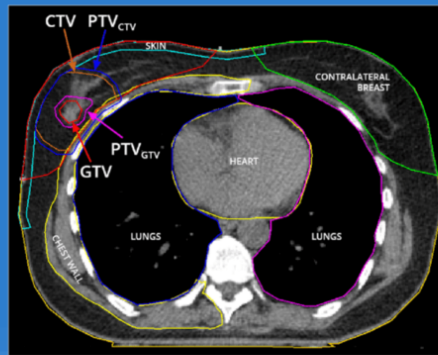
autolm - Unapproved - Sagittal - CT MOO

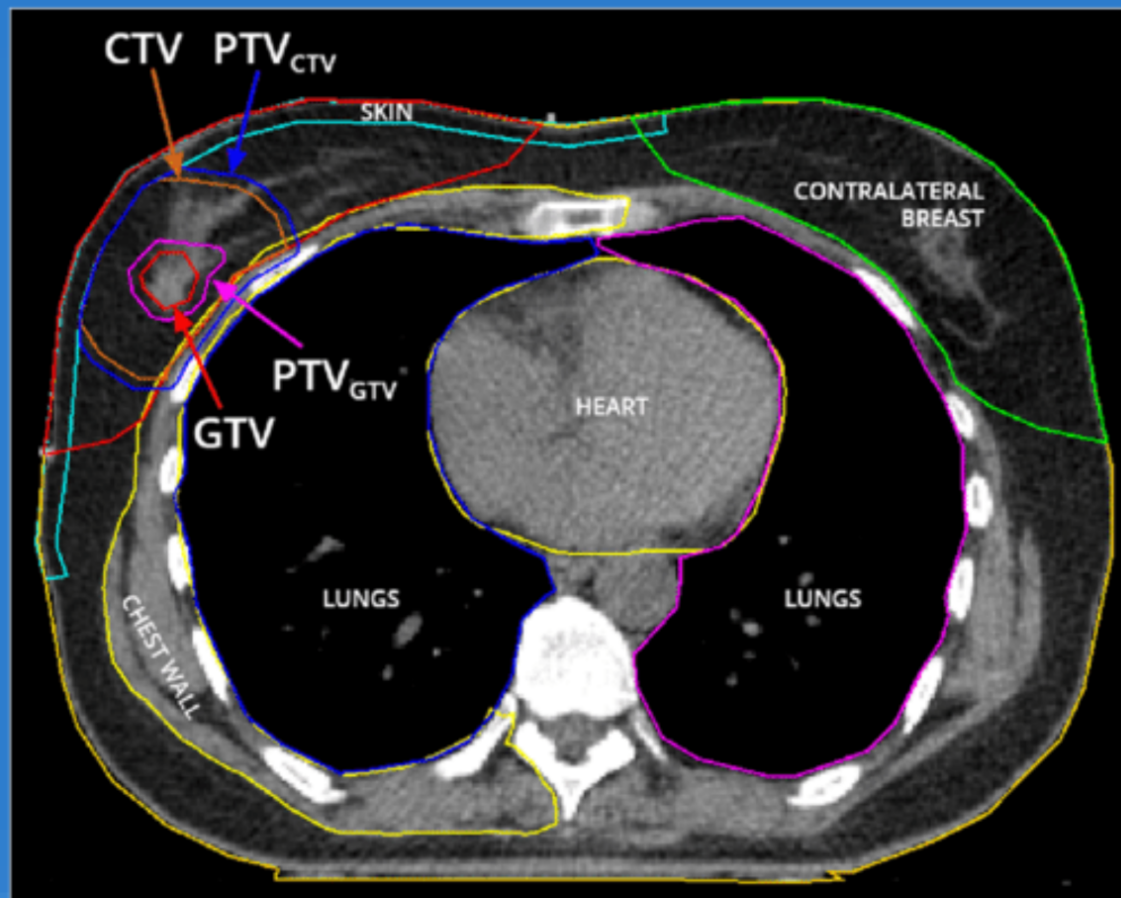
Field Alignments  Plan Objectives  Optimization Objectives Dose Statistics Calculation Models Plan Sum

Technique	Machine/Energy	MLC	Field Weight	Scale	Gantry Rtn [deg]	Coll Rtn [deg]	Couch Rtn [deg]	Wedge	Field X [cm]	X1 [cm]	X2 [cm]	Field Y [cm]	Y1 [cm]	Y2 [cm]	X [cm]	Y [cm]	Z [cm]	Calculated SSD [cm]	MU	Ref. D [Gy]
RTIC-1	TrueBeam - 15X	Static	1.000	Varian IEC	7.1	271.0	0.0	None	7.1	+3.3	+3.8	8.1	+3.6	+4.5	0.07	1.03	-0.07	89.7	45.6	0.541
RTIC-1	TrueBeam - 15X		1.000	Varian IEC	91.3	0.0	0.0	None	7.1	+3.8	+3.3	9.2	+3.8	+5.4	0.07	1.03	-0.07	83.6	53.4	0.743
RTIC-1	TrueBeam - 15X		1.000	Varian IEC	147.0	0.0	0.0	None	7.1	+3.8	+3.3	9.2	+3.8	+5.4	0.07	1.03	-0.07	87.7	46.7	0.588
RTIC-1	TrueBeam - 15X		1.000	Varian IEC	207.9	0.0	0.0	None	7.1	+3.8	+3.3	9.2	+3.8	+5.4	0.07	1.03	-0.07	88.3	45.9	0.573
RTIC-1	TrueBeam - 15X		1.000	Varian IEC	253.5	0.0	0.0	None	7.1	+3.8	+3.3	9.2	+3.8	+5.4	0.07	1.03	-0.07	85.3	51.2	0.693

Balistique & iso

## Balistique & iso





# Quelles sont les coordonnées de l'isocentre ?

External Beam Planning (Administrator)

PROSTATE, ONE (4232954)

Tools Window

Registration External Beam Planning Brachytherapy Planning Brachytherapy 2D Entry Plan Evaluation

autolm - Unapproved - Transversal - CT MOO

autolm - Unapproved - Model View - CT MOO

autolm - Unapproved - Frontal - CT MOO

autolm - Unapproved - Sagittal - CT MOO

Standard Head First-Supine

Z: 0.00 cm

Y: 0.67 cm

X: 0.77 cm

Field Alignments  Plan Objectives  Optimization Objectives Dose Statistics Calculation Models Plan Sum

Technique	Machine/Energy	MLC	Field Weight	Scale	Gantry Rtn [deg]	Coll Rtn [deg]	Couch Rtn [deg]	Wedge	Field X [cm]	X1 [cm]	X2 [cm]	Field Y [cm]	Y1 [cm]	Y2 [cm]	X [cm]	Y [cm]	Z [cm]	Calculated SSD [cm]	MU	Ref. D [Gy]
RTIC-1	TrueBeam - 15X	Static	1.000	Varian IEC	7.1	271.0	0.0	None	7.1	+3.3	+3.8	8.1	+3.6	+4.5	0.07	1.03	-0.07	89.7	45.6	0.541
RTIC-1	TrueBeam - 15X		1.000	Varian IEC	91.3	0.0	0.0	None	7.1	+3.8	+3.3	9.2	+3.8	+5.4	0.07	1.03	-0.07	83.6	53.4	0.743
RTIC-1	TrueBeam - 15X		1.000	Varian IEC	147.0	0.0	0.0	None	7.1	+3.8	+3.3	9.2	+3.8	+5.4	0.07	1.03	-0.07	87.7	46.7	0.588
RTIC-1	TrueBeam - 15X		1.000	Varian IEC	207.9	0.0	0.0	None	7.1	+3.8	+3.3	9.2	+3.8	+5.4	0.07	1.03	-0.07	88.3	45.9	0.573
RTIC-1	TrueBeam - 15X		1.000	Varian IEC	253.5	0.0	0.0	None	7.1	+3.8	+3.3	9.2	+3.8	+5.4	0.07	1.03	-0.07	85.3	51.2	0.693

Balistique & iso

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intersection de l'axe des faisceaux



# Affichage Eclipse: Onglet planification de ttt Evaluation du plan

Isocentre

The screenshot displays the Eclipse External Beam Planning interface for a breast treatment plan. The main window shows a 3D visualization of the patient's anatomy with the treatment plan overlaid. The plan includes two fields: Field 1 (MLC) and Field 2 (MLC). The DVH (Dose-Volume Histogram) window shows the dose distribution for the target and organs at risk. The table below provides a summary of the plan's parameters.

Structure	Approval Status	Plan	Course	Volume [cm <sup>3</sup> ]	Dose Cover [%]	Sampling Cover [%]	Min Dose [%]	Max Dose [%]	Mean Dose [%]
BODY	Unapproved	grrr def	Cl	15327.3	100.0	99.9	0.0	108.9	10.5
ptv	Unapproved	grrr def	Cl	507.4	100.0	100.0	90.6	108.4	100.0
POUMON G	Unapproved	grrr def	Cl	949.0	100.0	100.0	1.1	102.4	18.5
Coeur	Unapproved	grrr def	Cl	361.3	100.0	100.0	2.0	99.4	10.6
MOELLE	Unapproved	grrr def	Cl						
ctv	Unapproved	grrr def	Cl						
Poumon D	Unapproved	grrr def	Cl						

# Affichage Eclipse: Onglet planification de ttt choix balistique

The screenshot displays the Eclipse External Beam Planning software interface. The main window shows a 4-view CT scan of a breast (Transversal, BEV, Frontal, and Sagittal). The interface includes a menu bar, a toolbar, and a left-hand panel with a tree view of the plan. The bottom of the window features a table with field parameters and a status bar.

Group	Field ID	Technique	Machine/Energy	MLC	Field Weight	Scale	Gantry Rtn [deg]	Coll Rtn [deg]	Couch Rtn [deg]	Wedge	Field X [cm]	X1 [cm]	X2 [cm]	Field Y [cm]	Y1 [cm]	Y2 [cm]	X [cm]	Y [cm]	Z [cm]	Calculated SSD [cm]	MU	Ref. D [Gy]
<input checked="" type="checkbox"/>	TGE	STATIC-I	TrueBeam - 6X	Static	0.500	Varian IEC	310.0	0.0	0.0	W45R20U	11.7	+2.0	+9.7	16.9	+8.1	+8.8	6.91	-4.05	0.50	91.9	227.7	1.267
<input checked="" type="checkbox"/>	TGI	STATIC-I	TrueBeam - 6X	Static	0.300	Varian IEC	130.0	0.0	0.0	None	12.0	+10.1	+1.9	17.2	+8.7	+8.5	6.91	-4.05	0.50	91.1	68.4	0.798
<input checked="" type="checkbox"/>	TGibis	STATIC-I	TrueBeam - 15X	Static	0.200	Varian IEC	130.0	0.0	0.0	None	12.0	+10.1	+1.9	17.2	+8.7	+8.5	6.91	-4.05	0.50	91.1	40.4	0.466