

Electronic Compensator for Breast Treatment – Manual vs. Auto-Generated

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TO BEAT
CANCER**

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Disclosures

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- This presentation reflects my own opinions and not necessarily those of Northside Hospital
- Equipment/version:
 - Eclipse™ treatment planning v15.6
 - EZFluence v2.32

About us

NORTHSIDE Life
SPECIAL EDITION

Forsyth • Atlanta • Gwinnett • Duluth • Cherokee

- 250+ Outpatient Locations
- 21,000 Northside Employees
- 5 Hospitals in North Georgia
- 1,636 Inpatient Beds
- 3,500 Physicians On Staff

#1

Our Commitment to Patient Care

Outline

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- What is electronic compensation (eComp)
- Manual creation of eComp plans
- Automatic generation of eComp via EZFluence
- Tips and tricks
- Case studies

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What is Electronic Compensation?

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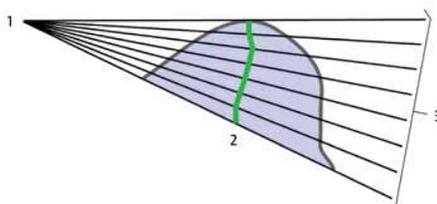
- Employed with standard tangent breast fields
- Similar effect to mechanical compensators but achieved with dynamic MLC
- Create a fluence for each field
- Delivered via sliding windows or multiple static segments
- Results in a plan customized to the patient's body outline



Irregular Surface Compensator

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- Electronic compensator designed for curved surfaces
- Specify a penetration depth at which compensation will be calculated
- Penetration depth = percentage of the penetration of the radiation along each fanline ray through the patient
- “A value close to but smaller than 50% works well for breast cases”



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Field-in-Field

- Turn on certain isodose clouds
- Manually add subfields and block those clouds
- Successively decrease the isodose level blocked
- Manually adjust weighting for desired result
- Typically 3-5 subfields
- Delivered via step-and-shoot

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Creating an eComp Plan

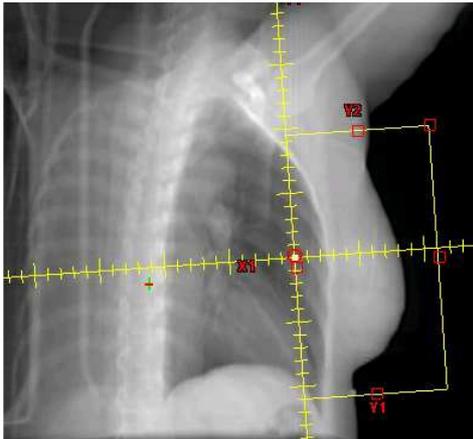
8

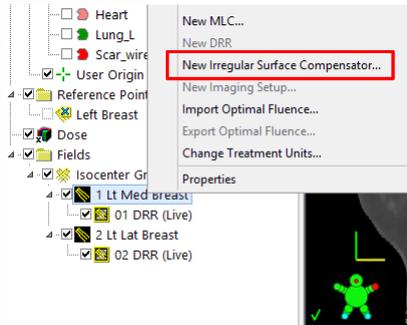
eComp Manual Creation



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- Start out with standard breast tangent fields
- Right click – New Irregular Surface Compensator





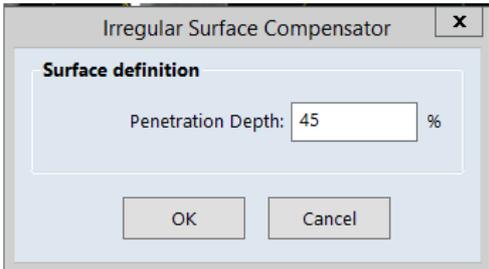
9

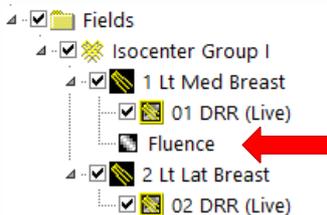
eComp Manual Creation



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- Enter Penetration depth
- Fluence is calculated

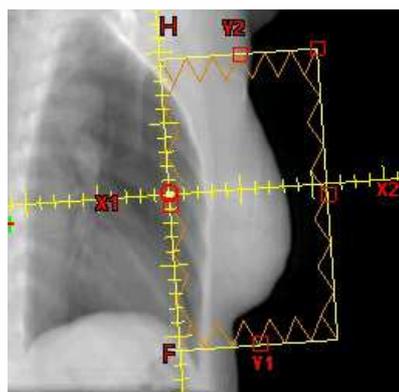
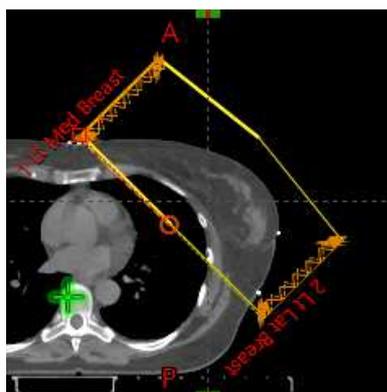




10

eComp Manual Creation

- Fluence is generated for both fields



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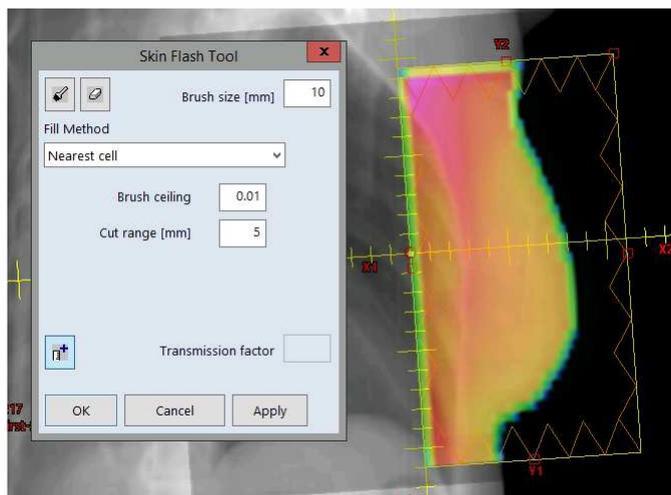
eComp Manual Creation



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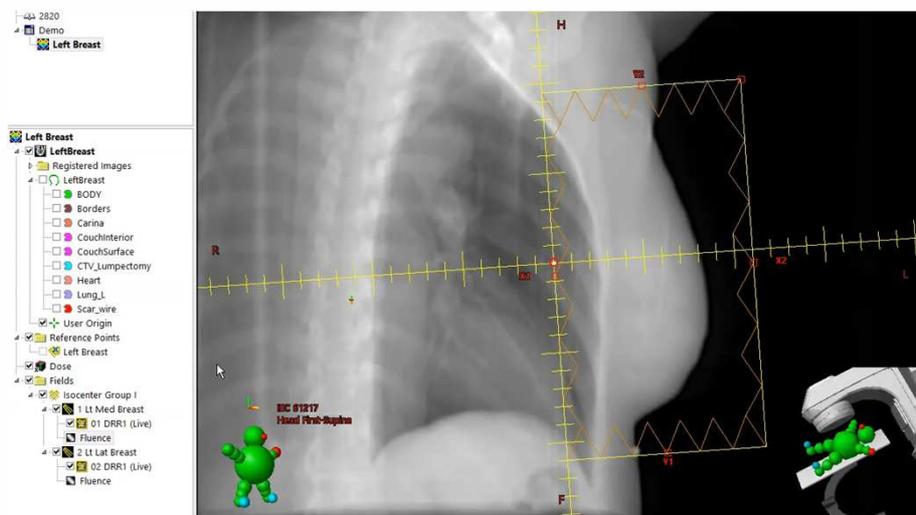
eComp Manual Creation

- Skin Flash Tool



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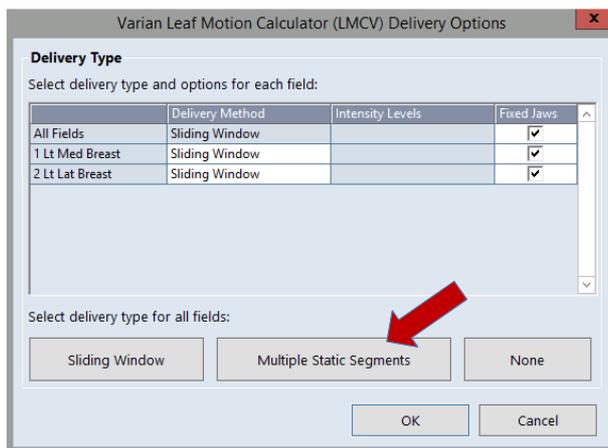
eComp Manual Creation



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eComp Manual Creation

- Calculate plan



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eComp Manual Creation

- Initial calculation
- After normalization

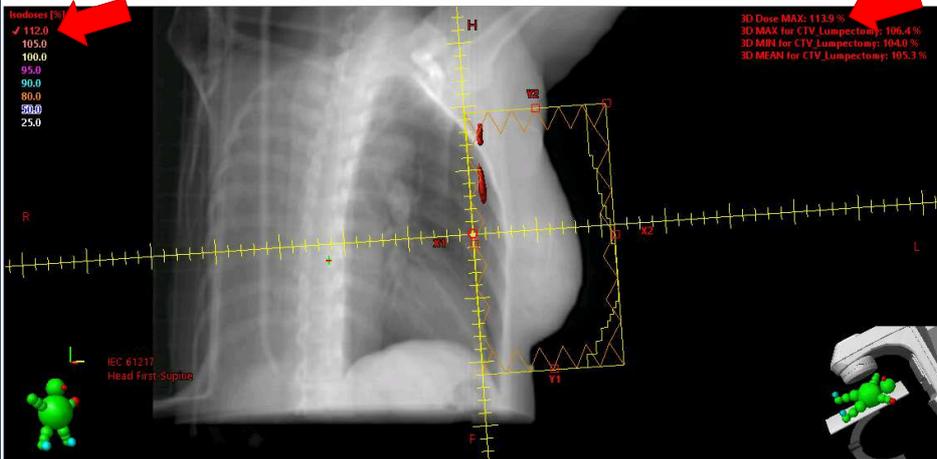


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eComp Manual Creation



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Isodoses (%)

- ✓ 112.0
- 105.0
- 100.0
- 95.0
- 90.0
- 85.0
- 80.0
- 25.0

3D Dose Stats:

- 3D Dose MAX: 113.9 %
- 3D MAX for CTV_Lumpectomy: 106.4 %
- 3D MIN for CTV_Lumpectomy: 104.0 %
- 3D MEAN for CTV_Lumpectomy: 105.3 %

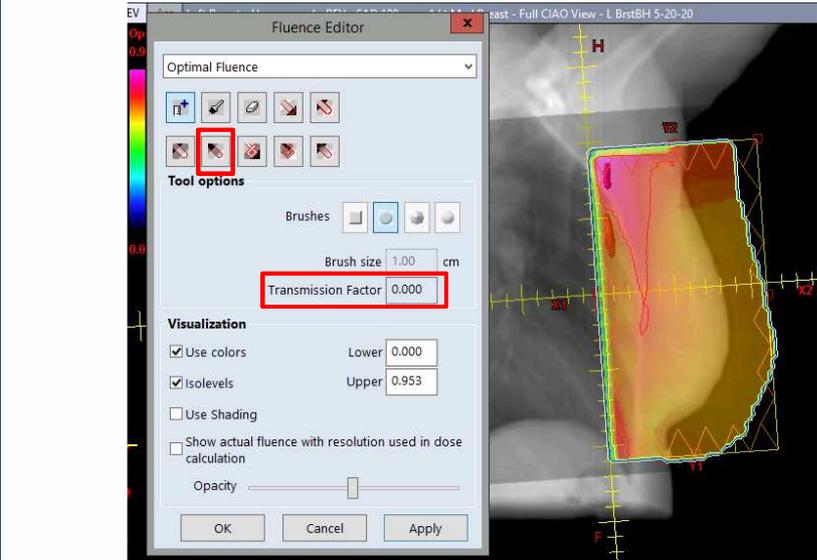
IEC 61217
Head First-Supine

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eComp Manual Creation



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Fluence Editor

Optimal Fluence

Tool options

Brushes

Brush size: 1.00 cm

Transmission Factor: 0.000

Visualization

- Use colors Lower: 0.000
- Isolevels Upper: 0.953
- Use Shading
- Show actual fluence with resolution used in dose calculation

Opacity

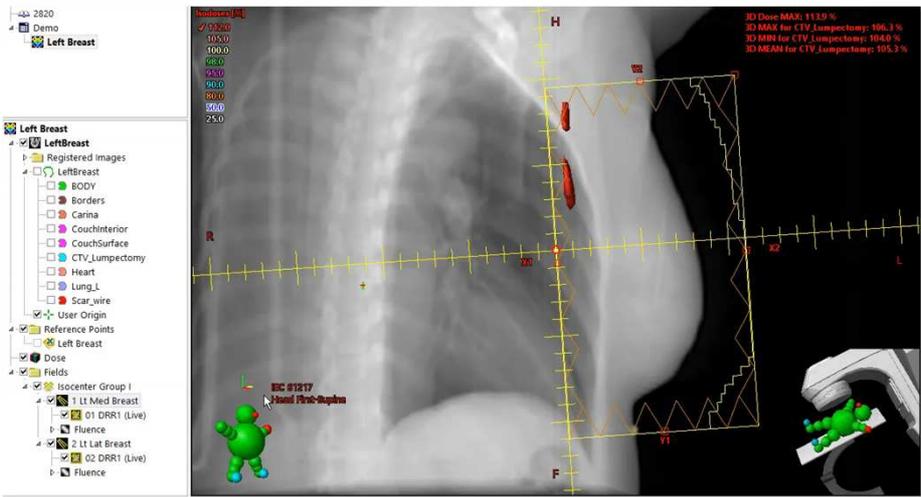
OK Cancel Apply

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eComp Manual Creation



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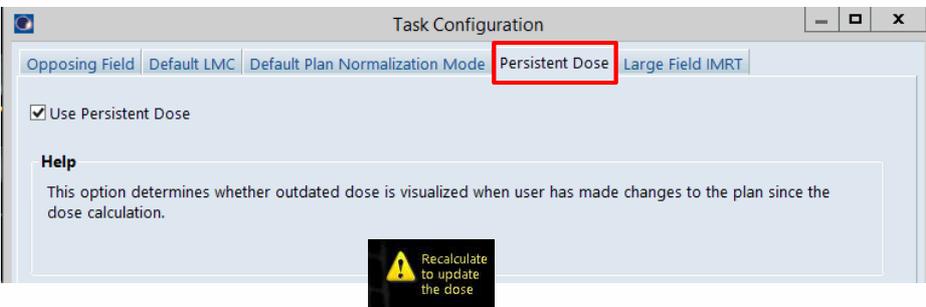
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eComp Manual Creation



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- Enable Persistent Dose feature
- System-wide setting
- Allows user to modify plan parameters and retain isodose distribution
- Tools > Task Configuration

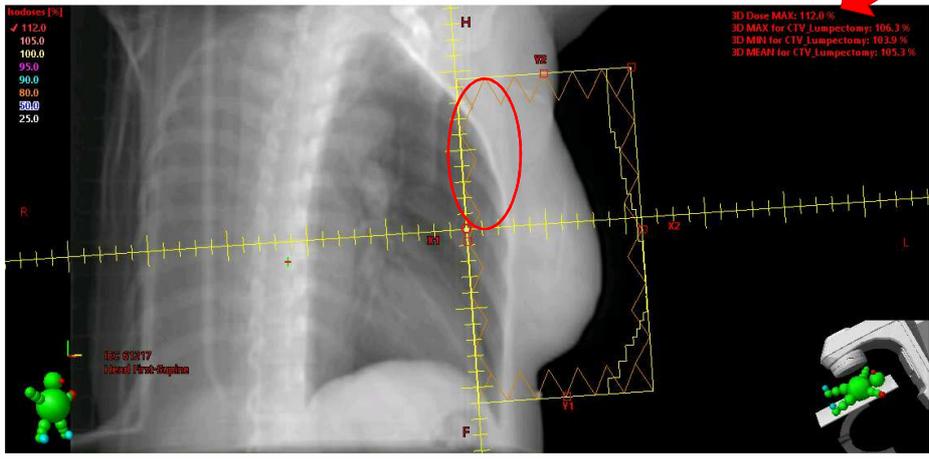


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Dose: [4]
 ✓ 112.0
 105.0
 100.0
 95.0
 90.0
 80.0
 50.0
 25.0

3D Dose MAX: 112.0 %
 3D MAX for CTV_Lumpectomy: 106.3 %
 3D MFI for CTV_Lumpectomy: 103.9 %
 3D MEAN for CTV_Lumpectomy: 105.3 %

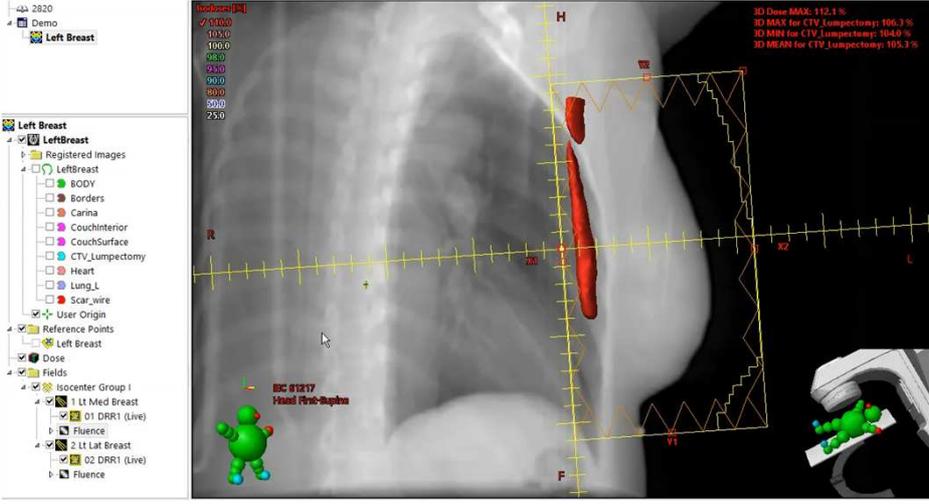
105 01217
 Head First-Right

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eComp Manual Creation



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2820
 Demo
 Left Breast

Dose: [4]
 ✓ 112.4
 105.0
 100.0
 95.0
 90.0
 80.0
 50.0
 25.0

3D Dose MAX: 112.4 %
 3D MAX for CTV_Lumpectomy: 106.3 %
 3D MFI for CTV_Lumpectomy: 104.9 %
 3D MEAN for CTV_Lumpectomy: 105.3 %

Left Breast
 Left Breast
 Registered Images
 Left Breast
 BODY
 Borders
 Carina
 CouchInterior
 CouchSurface
 CTV_Lumpectomy
 Heart
 Lung_L
 Scar_wire
 User Origin
 Reference Points
 Left Breast
 Dose
 Fields
 Isocenter Group 1
 1 Lt Med Breast
 01 DRR1 (Live)
 Fluence
 2 Lt Lat Breast
 02 DRR1 (Live)
 Fluence

105 01217
 Head First-Right

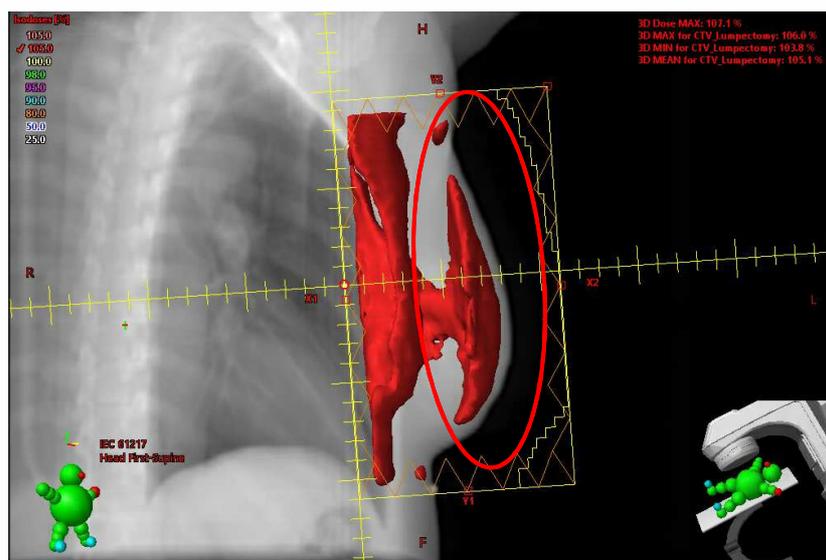
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eComp Manual Creation



4

eComp Manual Creation

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Isodoses [%]
✓ 107.0
✓ 105.0
✓ 100.0
✓ 98.0
✓ 95.0
✓ 90.0
✓ 80.0
✓ 50.0
✓ 25.0

1st Med Breast
2nd Lat Breast

Y: 3.73 cm

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Isodoses [%]
✓ 107.0
✓ 105.0
✓ 100.0
98.0
95.0
90.0
80.0
50.0
25.0

H
A
F
IEC 61217
Head First-Supine

Fluence Editor

Optimal Fluence

To options

Increase tool

Brushes

Brush size 1.00 cm

Transmission Factor 0.000

Visualization

Use colors Lower 0.000

Isolevels Upper 0.953

Use Shading

Show actual fluence with resolution used in dose calculation

Opacity

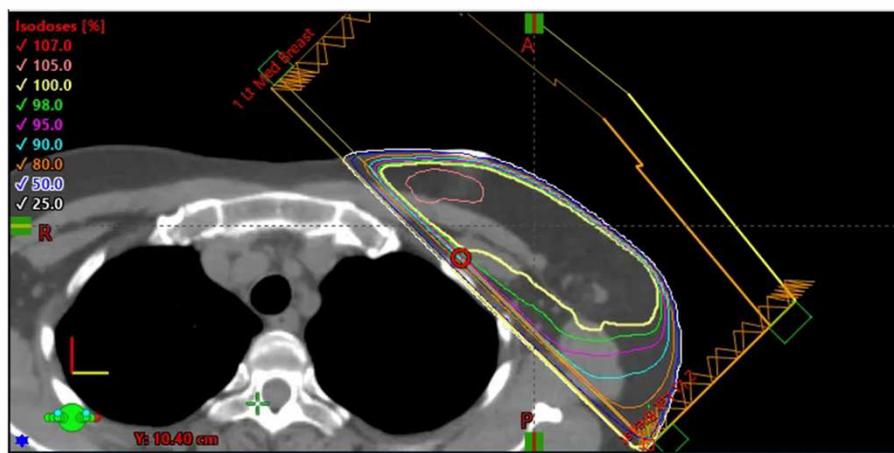
OK Cancel Apply

eComp Manual Creation



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eComp Manual Creation

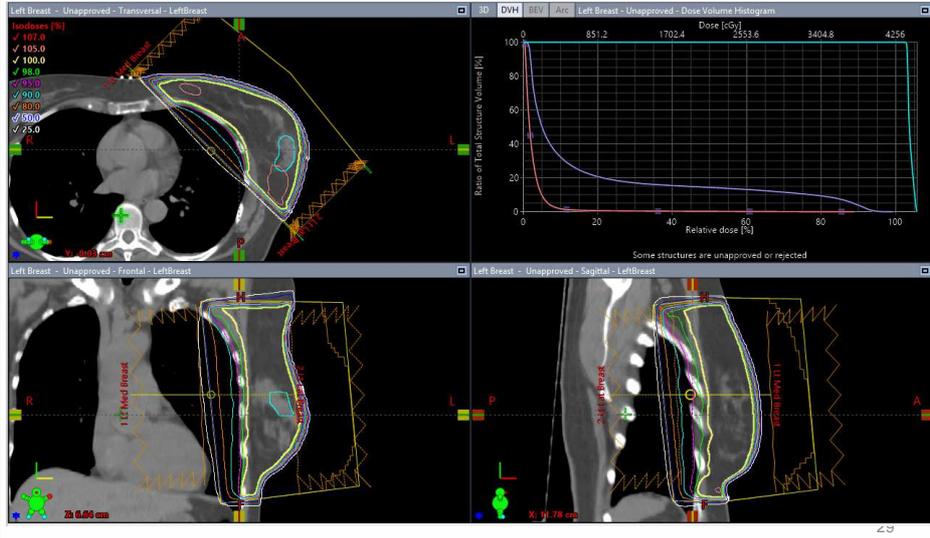


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eComp Manual Creation



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Left Breast - Unapproved - Transversal - LeftBreast

- Isodose (cGy)
- ✓ 107.0
- ✓ 105.0
- ✓ 100.0
- ✓ 98.0
- ✓ 95.0
- ✓ 90.0
- ✓ 80.0
- ✓ 75.0

Left Breast - Unapproved - Dose Volume Histogram

Dose (cGy): 851.2, 1702.4, 2553.6, 3404.8, 4256

Ratio of Total Structure Volume [%]

Relative dose [%]

Some structures are unapproved or rejected

Left Breast - Unapproved - Frontal - LeftBreast

1.12 Med Breast

25.856 cm

Left Breast - Unapproved - Sagittal - LeftBreast

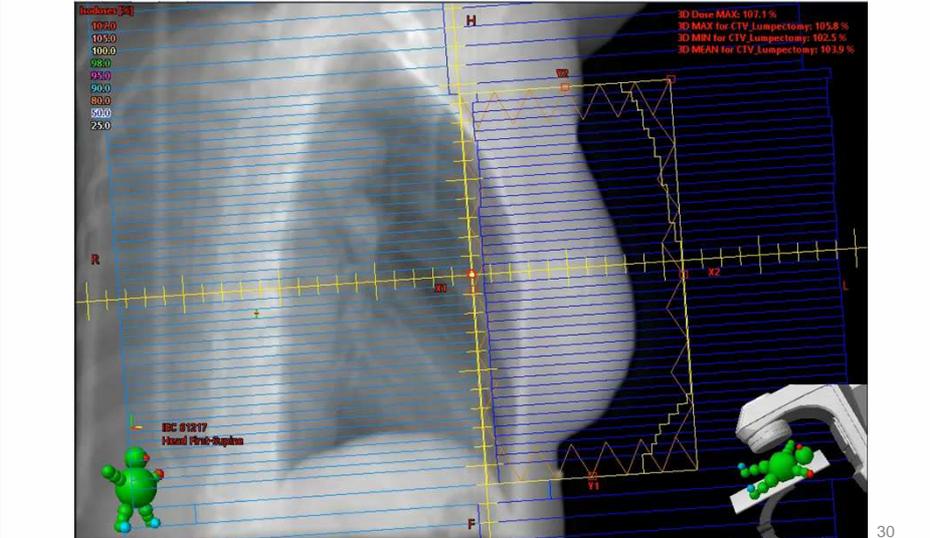
1.11 Med Breast

26.174 cm

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Isodose (cGy)

- 107.0
- 105.0
- 100.0
- 98.0
- 95.0
- 90.0
- 80.0
- 75.0

3D Max: 107.1 %

3D Max for CTV_Lumpectomy: 105.8 %

3D Min for CTV_Lumpectomy: 102.5 %

3D Mean for CTV_Lumpectomy: 103.9 %

REC 01217
Hand First-Step

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EZFluence eComp Generation

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eComp EZFluence Creation

- Automated 3D planning software by  formation
- Generates optimal fluence files and field-in-field plans
- Eclipse plugin that integrates through the scripting API
- Generates multiple plan options to choose from
- Can be used for any beam arrangement and treatment site

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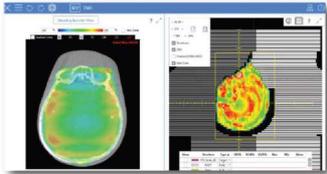
eComp EZFluence Creation



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Automated 3D Planning.
Any Site, Any Configuration.

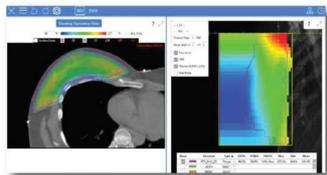
All FIF and E-comp plans automated for any beam arrangement.



Whole brain FIF plans generated with EZFluence offer a homogeneous dose distribution in seconds.



EZFluence works with any beam arrangement to automate even the most complicated 3D plans.



Increase coverage while minimizing the V105% of the breast with EZFluence. Optimal fluences and FIF segments are generated based on your patient's anatomy and the tangents provided.



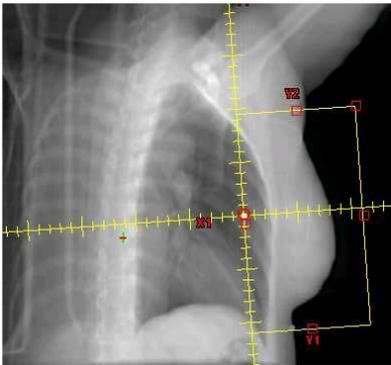
The 3D planning workspace features slider bars which allow for easy beam weighting changes on the fly.



eComp EZFluence Creation



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Isodoses [%]

- ✓ 107.0
- ✓ 105.0
- ✓ 100.0
- ✓ 98.0
- ✓ 95.0
- ✓ 90.0
- ✓ 80.0
- ✓ 50.0
- ✓ 25.0

Target Volume: 100.0 cc

Weight: 0.48 cm

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eComp EZFluence Creation

Fluences are generated...

Rx Doses

Prescription Doses:

Whole Target Rx Dose [cGy]: 4256

CTV_Lumpectomy Rx Dose [cGy]: 4256

Apply

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eComp EZFluence Creation

DVH Selection

Boost

Max dose: 132.5% Apply

Dose: 132.5% Apply

Boost Ratio: 2.000

Margin (cm): 0.25

Max # of Segments: 3

RTG 1005 Constraints (Gy / F)

Breast PTV Eval

PTV_BVALLZ

D25% = 100% 100%

D50% = 100% 102%

Mean = 115% 100%

Lumpectomy PTV Eval

CTV_Lumpectomy

V100% = 100% 100%

Heart

D25% = 100.0% 296.0%

V100.0% = 0.0% 3%

Mean = 320.0% 80.0%

Opposed Lung

Lung_L

V100.0% = 20% 16%

V80.0% = 31% 24%

V40.0% = 10% 5%

Contralateral Lung

Structure	Type	D95%	V100%	V95%	Max	Min	Mean
PTV_BVALLZ	Target	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%
CTV_Lumpectomy	Boost	102.4%	100.0%	102%	104.6%	101.0%	104.0%
Body	Body	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%
Heart	Organ	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%
Lung_L	Organ	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%
Borders	N/A						

Opposed Field Weight Adjustment:

Maintain < 100% Dose Push Chestwall Coverage

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eComp EZFluence Creation

The screenshot shows the EZFluence software interface. On the left is the 'Fluence Snapshot' panel with options like 'Export Fluence', 'Generate Field in Field', and 'Show Max Dose'. The center displays a cross-sectional CT scan of a breast with a color-coded dose distribution. On the right, the 'DVH Selection' panel has radio buttons for 'Max dose: 105.0%' and 'D95: 99.0%', with 'Max dose' selected. Below it is a DVH graph showing 'Rate of Total Structure Volume (%)' vs 'Relative dose (%)'. The 'Boost' panel has 'Max dose: 132.0%' selected. A table at the bottom lists structures and their DVH parameters.

Show	Structure	Type	A	D95%	V100%	V105%	Max	Min	Mean
	PTV_BVAL_EZ	Target	-	99.1%	91.1%	0.0% (Std)	105.0%	91.3%	102.7%
	CTV_Lumpectomy	Boost	-	103.4%	100.0%	0.0% (Std)	104.6%	103.9%	104.0%
	BCD	Body	-	-	-	-	-	-	-
	Heart	At risk	-	-	-	-	-	-	-
	Lung_L	At risk	-	-	-	-	-	-	-
	Borders	N/A	-	-	-	-	-	-	-

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eComp EZFluence Creation

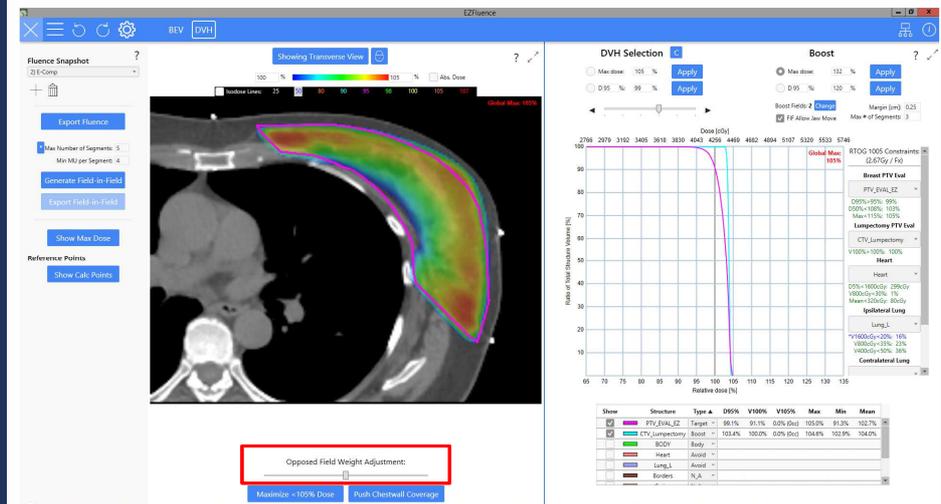
This screenshot is similar to the one above but with different highlights. In the 'DVH Selection' panel, both 'Max dose: 105.0%' and 'D95: 99.0%' are highlighted with red boxes. At the bottom of the interface, two buttons are highlighted with red boxes: 'Maximum <105% Dose' and 'Push Chestwall Coverage'.

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eComp EZFluence Creation



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Opposed Field Weight Adjustment:

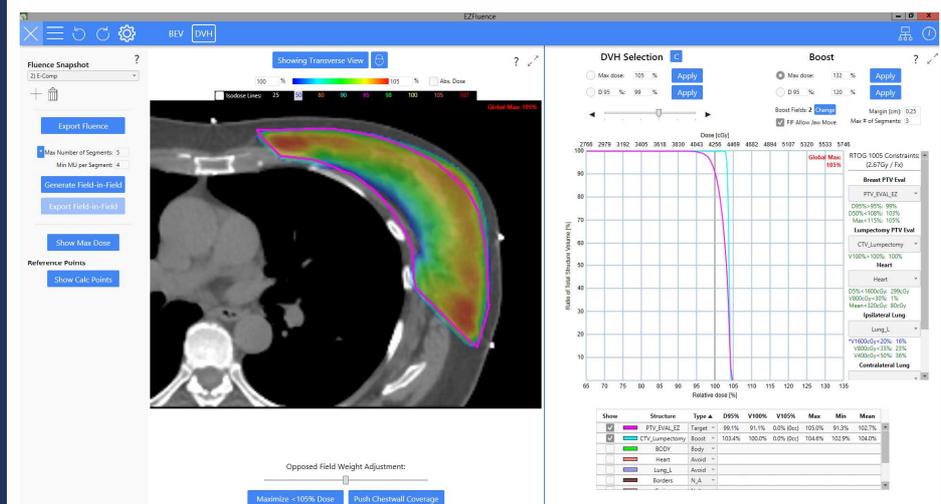
Maximize <100% Dose Push Chestwall Coverage

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eComp EZFluence Creation



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Opposed Field Weight Adjustment:

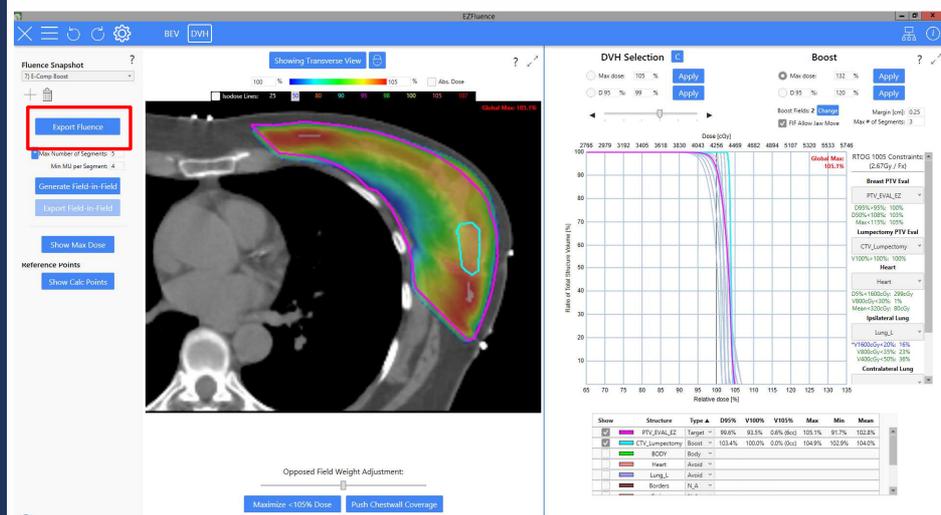
Maximize <100% Dose Push Chestwall Coverage

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eComp EZFluence Creation



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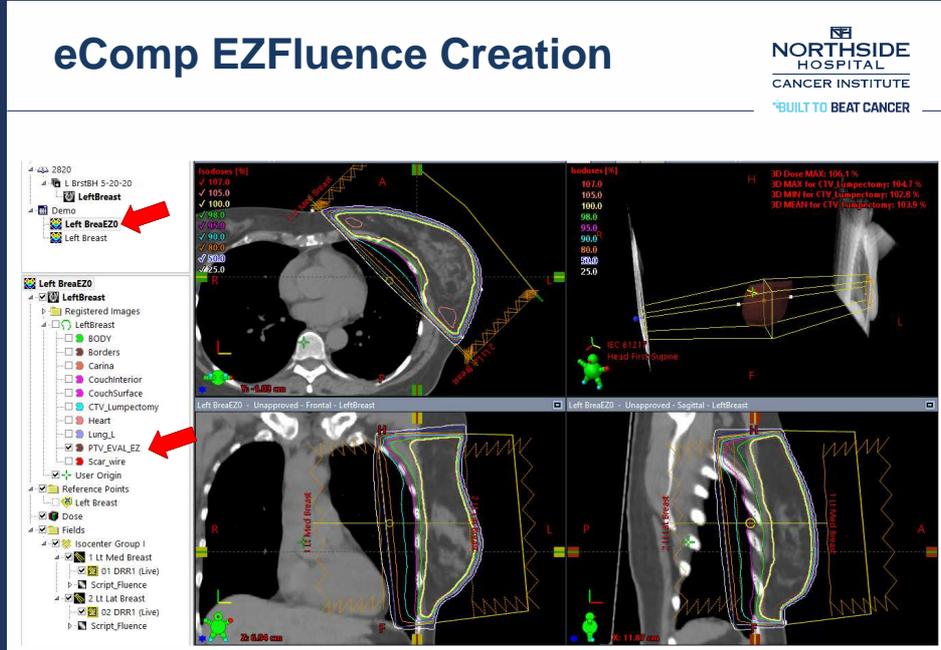
Show	Structure	Type	D95%	V100%	V105%	Max	Min	Mean
<input checked="" type="checkbox"/>	PTV_EVAL_EZ	Target	100%	92.5%	82%	105.1%	97.7%	102.8%
<input checked="" type="checkbox"/>	CTV_Lumpectomy	Boost	102.4%	100.0%	92%	104.9%	102.9%	104.0%
<input checked="" type="checkbox"/>	BODY	Body						
<input checked="" type="checkbox"/>	Heart	Organ						
<input checked="" type="checkbox"/>	Lung.L	Organ						
<input checked="" type="checkbox"/>	Borders	N/A						

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eComp EZFluence Creation



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2820

- L BrstBH 5-20-20
- LeftBreast
- Left BreEZ0
- Left Breast

Left BreEZ0

- LeftBreast
- Registered Images
- LeftBreast
- BODY
- Borders
- Carina
- CouchInterior
- CouchSurface
- CTV_Lumpectomy
- Heart
- Lung.L
- PTV_EVAL_EZ
- Scar_wire
- User Origin
- Reference Points
- Left Breast
- Dose
- Isocenter Group 1
- 1 Lt Med Breast
- 01 DRR1 (Live)
- Script_Fluence
- 2 Lt Lat Breast
- 02 DRR1 (Live)
- Script_Fluence

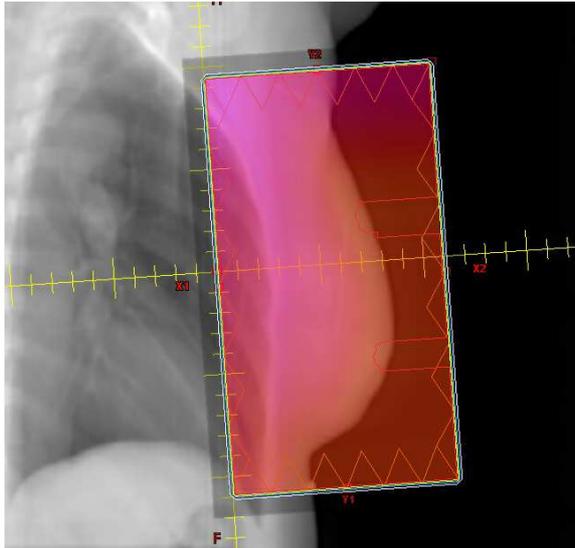


3D Dose MAC: 100.1%
3D MAX for CTV_Lumpectomy: 104.7%
3D MIN for CTV_Lumpectomy: 102.6%
3D MATH for CTV_Lumpectomy: 103.9%

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eComp EZFluence Creation

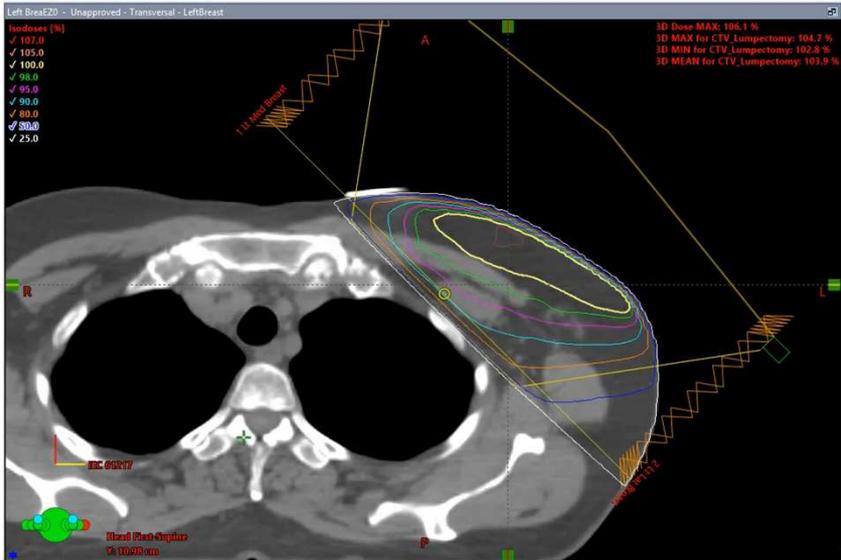
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eComp EZFluence Creation

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Left Breast EZ - Unapproved - Transverse - Left Breast

Fluence (W)

- ✓ 107.0
- ✓ 105.0
- ✓ 100.0
- ✓ 95.0
- ✓ 90.0
- ✓ 80.0
- ✓ 50.0
- ✓ 25.0

3D Dose MAX: 106.1 %

3D MAX for CTV_Lumpectomy: 104.7 %

3D MIN for CTV_Lumpectomy: 102.5 %

3D MEAN for CTV_Lumpectomy: 103.9 %

Head (Plan Origin) 16 10:50 am

Comparison



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Left BreastEZO - Unapproved - Transversal - LeftBreast

Isodoses [%]

- ✓ 107.0
- ✓ 105.0
- ✓ 100.0
- ✓ 98.0
- ✓ 95.0
- ✓ 90.0
- ✓ 80.0
- ✓ 50.0
- ✓ 25.0

3D OAR: MAX: 106.1 %

3D MAX for CTV_Lumpectomy: 104.7 %

3D MIN for CTV_Lumpectomy: 102.8 %

3D MEAN for CTV_Lumpectomy: 103.9 %



IEC 61207

Heart (Risk: 0.01 cm)

Left BreastM - Unapproved - Transversal - LeftBreast

Isodoses [%]

- ✓ 107.6
- ✓ 105.0
- ✓ 100.0
- ✓ 98.0
- ✓ 95.0
- ✓ 90.0
- ✓ 80.0
- ✓ 50.0
- ✓ 25.0

3D OAR: MAX: 107.1 %

3D MAX for CTV_Lumpectomy: 105.8 %

3D MIN for CTV_Lumpectomy: 102.5 %

3D MEAN for CTV_Lumpectomy: 103.9 %



IEC 61207

Heart (Risk: 0.01 cm)

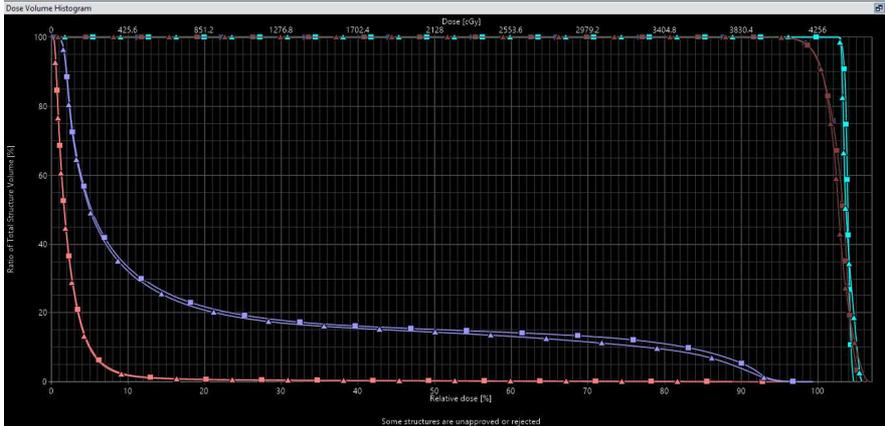
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Comparison



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Dose Volume Histogram

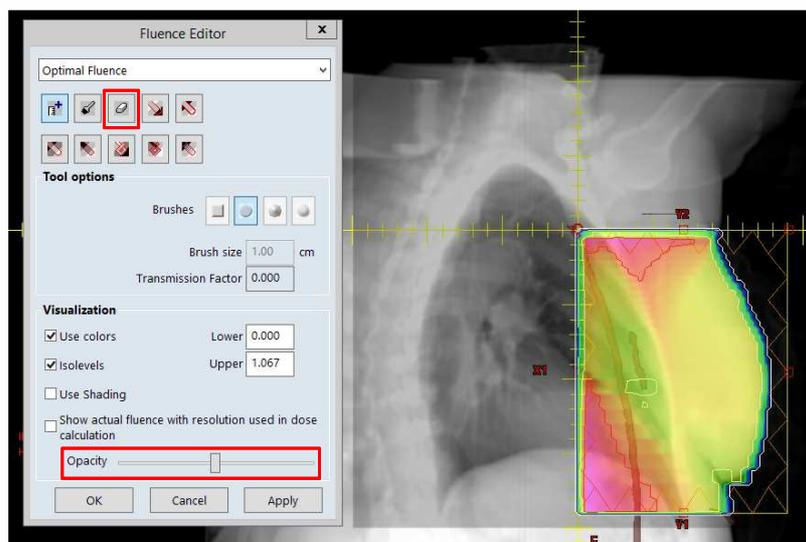


Some structures are unapproved or rejected

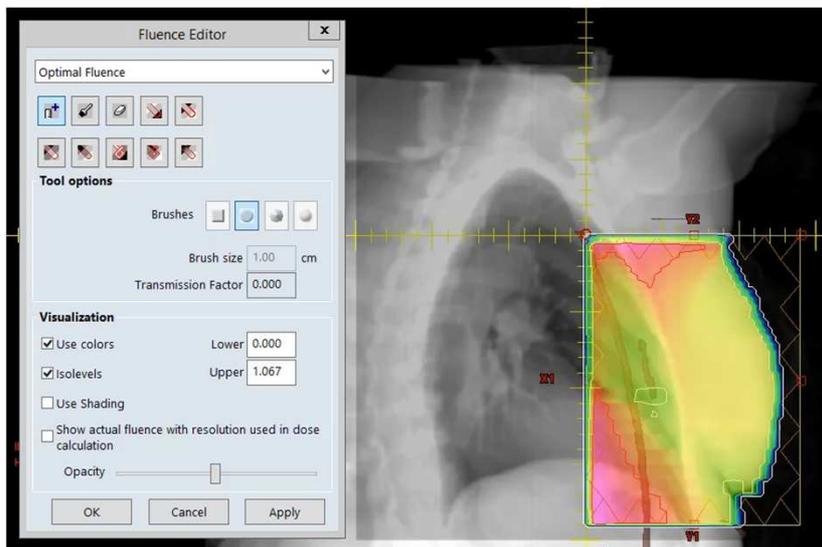
Structure	Reference Points	Dose Statistics	Approval Status	Plan	Course	Volume [cm ³]	Dose Cover [%]	Sampling Coars [%]	Min Dose [%]	Max Dose [%]	Mean Dose [%]
PTV_EVAL_EZ			Unapproved	Left BreastEZO	Demo	1039.5	100.0	100.0	91.5	106.1	102.9
PTV_EVAL_EZ			Unapproved	Left BreastM	Demo	1039.5	100.0	100.0	88.4	107.1	102.7
Lung_L			Unapproved	Left BreastEZO	Demo	1621.7	100.0	100.0	0.7	99.4	18.9
Lung_L			Unapproved	Left BreastM	Demo	1621.7	100.0	100.0	0.6	99.5	17.8
Heart			Unapproved	Left BreastEZO	Demo	474.2	100.0	100.0	0.3	96.3	2.7
Heart			Unapproved	Left BreastM	Demo	474.2	100.0	100.0	0.3	89.0	2.6
CTV_Lumpectomy			Unapproved	Left BreastEZO	Demo	11.1	100.0	100.0	102.8	104.7	103.9
CTV_Lumpectomy			Unapproved	Left BreastM	Demo	11.1	100.0	100.0	102.5	105.8	103.9

Tips and Tricks

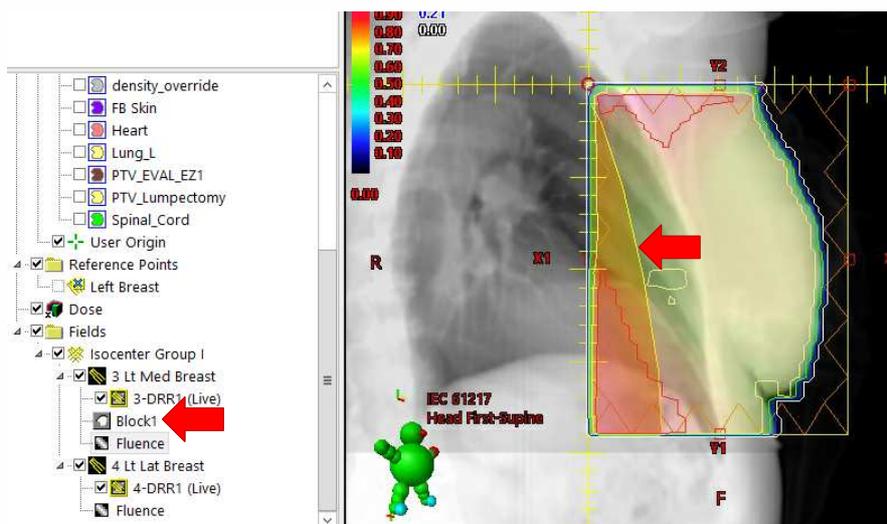
Blocking



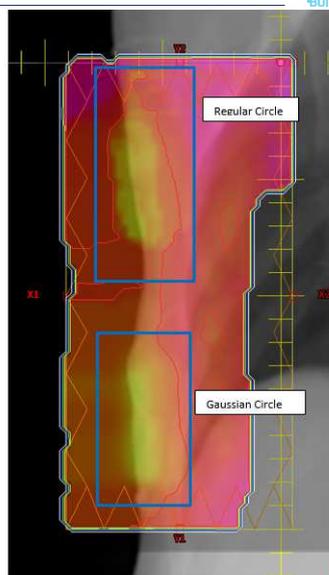
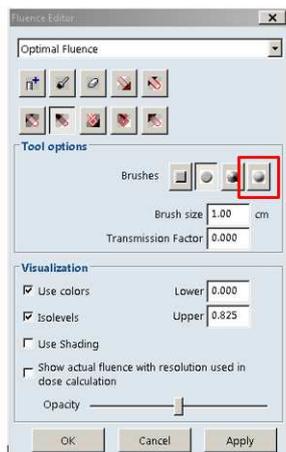
Blocking



Blocking



Advanced Fluence Editing – Manual



Advanced Fluence Editing – EZFluence

The screenshot shows the EZFluence software interface. The 'BEV' (Beam's Eye View) tab is selected and highlighted with a red box. The interface includes:

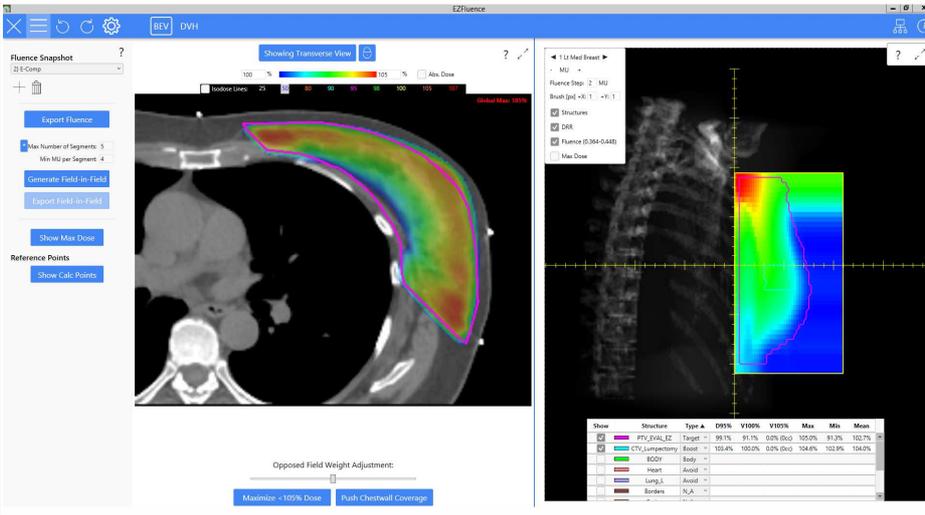
- Fluence Snapshot:** A central CT scan image showing a cross-section of the chest with a color-coded fluence distribution. A 'Global Max: 100%' label is visible.
- DVH Selection:** A graph showing Relative Dose (Structure Volume %) vs. Relative dose (%). The x-axis ranges from 65 to 135, and the y-axis from 40 to 100. A curve shows the dose distribution for a selected structure.
- Boost:** Settings for boosting, including 'Max dose: 132 %' and 'Apply' buttons.
- RTG 1003 Constraints:** A list of constraints for various structures, including:

Structure	Type	D95%	V100%	V105%	Max	Min	Mean
PTV_EVAL_EZ	Target	96.7%	81.1%	0.0% (0.0)	105.0%	81.3%	102.7%
CTV_Lungptomy	Boost	103.4%	100.0%	0.0% (0.0)	104.4%	102.4%	104.4%
ROD	Body	-	-	-	-	-	-
Heart	Avoid	-	-	-	-	-	-
Lung_L	Avoid	-	-	-	-	-	-
Spine	RoA	-	-	-	-	-	-
- Opposed Field Weight Adjustment:** A slider at the bottom with buttons for 'Maximize ~100% Dose' and 'Push Chestwall Coverage'.

Mixed Energies - EZFluence



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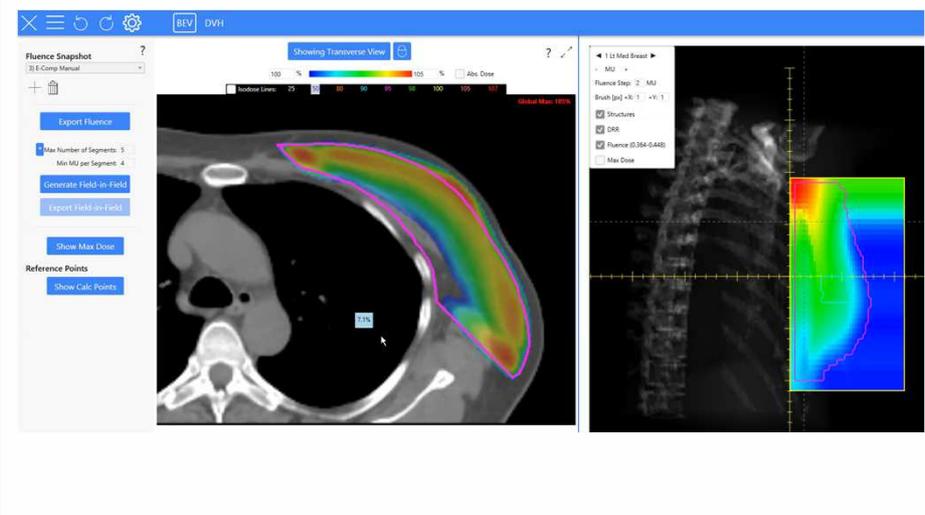


Show	Structure	Type	DS%	V100%	V105%	Max	Min	Mean
<input checked="" type="checkbox"/>	PTV_EVAL_EZ	Target	99.1%	81.1%	0.0% (0.0)	102.0%	81.2%	102.7%
<input checked="" type="checkbox"/>	CTV_Lungprimary	Boost	101.4%	100.0%	0.0% (0.0)	104.8%	101.8%	104.0%
<input checked="" type="checkbox"/>	NSOP	Body	-	-	-	-	-	-
<input checked="" type="checkbox"/>	Heart	Avoid	-	-	-	-	-	-
<input checked="" type="checkbox"/>	Lung_L	Avoid	-	-	-	-	-	-
<input checked="" type="checkbox"/>	Spine	Sp	-	-	-	-	-	-

Mixed Energies - EZFluence



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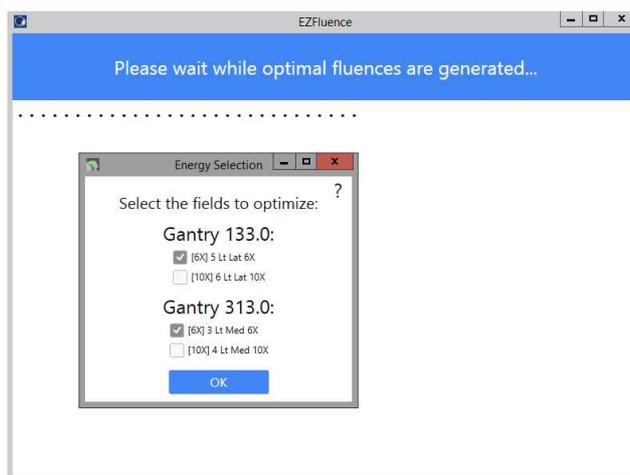


Show	Structure	Type	DS%	V100%	V105%	Max	Min	Mean
<input checked="" type="checkbox"/>	PTV_EVAL_EZ	Target	99.1%	81.1%	0.0% (0.0)	102.0%	81.2%	102.7%
<input checked="" type="checkbox"/>	CTV_Lungprimary	Boost	101.4%	100.0%	0.0% (0.0)	104.8%	101.8%	104.0%
<input checked="" type="checkbox"/>	NSOP	Body	-	-	-	-	-	-
<input checked="" type="checkbox"/>	Heart	Avoid	-	-	-	-	-	-
<input checked="" type="checkbox"/>	Lung_L	Avoid	-	-	-	-	-	-
<input checked="" type="checkbox"/>	Spine	Sp	-	-	-	-	-	-

Mixed Energies - Manual

- Create irregular surface compensator for both energies independently
- Edit each independently
- OR...
- Start with low energy first
- Edit as much as you can
- Copy/paste and change energy
- Continue editing
- OR...
- Leave the higher energy as open/wedged only
- Create fluence for only the lower energy

Mixed Energies - EZFluence



Mixed Energies - EZFluence

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2) E-Comp

Showing Transverse View

100 % 105 % Abs. Dose

Isodose Lines: 25 50 80 90 95 98 100 105 108 Global Max 106.1%

Adjustable Field Weightings

1.000	1.000
[EQ] 5 Lt Lat 6X*	[10Q] 6 Lt Lat 10Q*
1.000	1.000
[EQ] 3 Lt Med 6X*	[10Q] 4 Lt Med 10Q*

Export Fluence

Max Number of Segments: 5

Min MU per Segment: 4

Generate Field-in-Field

Export Field-in-Field

Show Max Dose

Reference Points

Show Calc Points

Matchlines – Manual

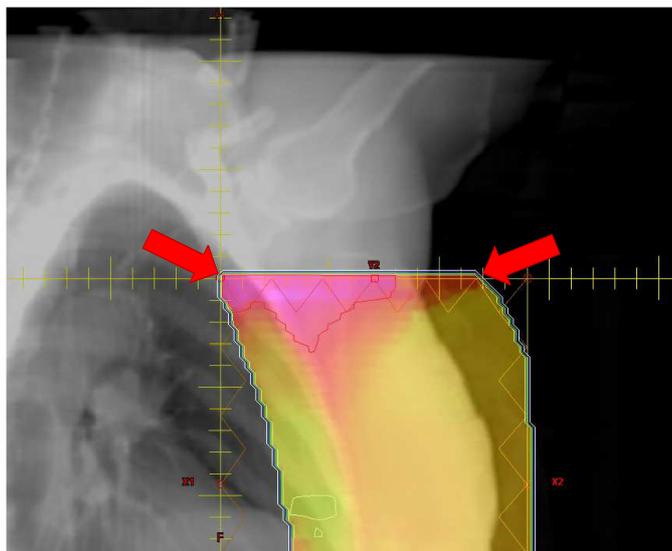
**NORTHSIDE HOSPITAL
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Showing Transverse View

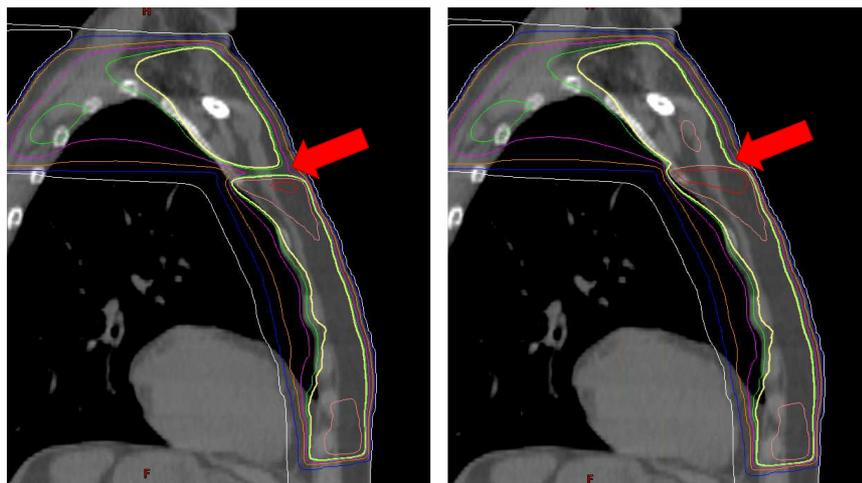
100 % 105 % Abs. Dose

Isodose Lines: 25 50 80 90 95 98 100 105 108 Global Max 106.1%

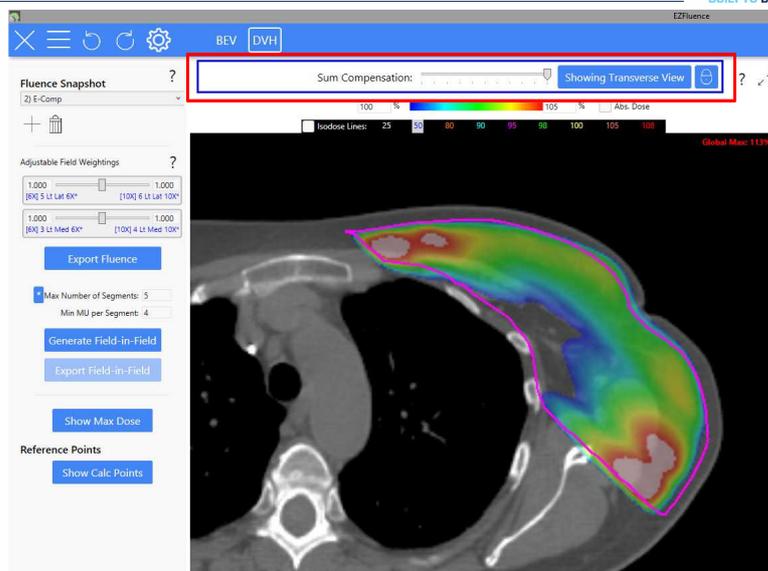
Matchlines – Manual



Matchlines – Manual



Matchlines – EZFluence

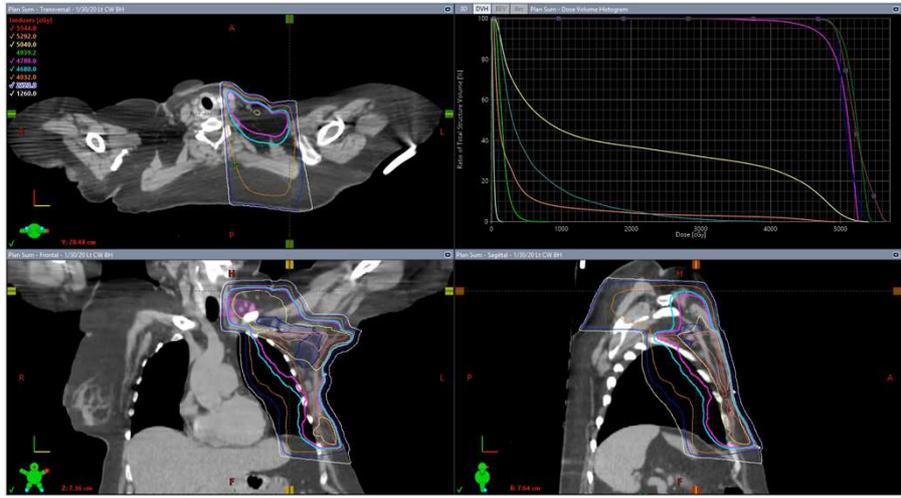


Case Studies

Case Studies



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Plan Summary: 1/25/2011 Case 811

- ✓ 5242.0
- ✓ 5242.0
- ✓ 5242.0
- ✓ 4318.2
- ✓ 4400.0
- ✓ 4412.0
- ✓ 3266.0
- ✓ 1100.0

Plan Summary: 1/25/2011 Case 811

Plan Summary: 1/25/2011 Case 811

Plan Summary: 1/25/2011 Case 811

97.28 cm

2.2 cm

6.764 cm

Plan Summary: 1/25/2011 Case 811

Rate of Total Absorbed Volume (%)

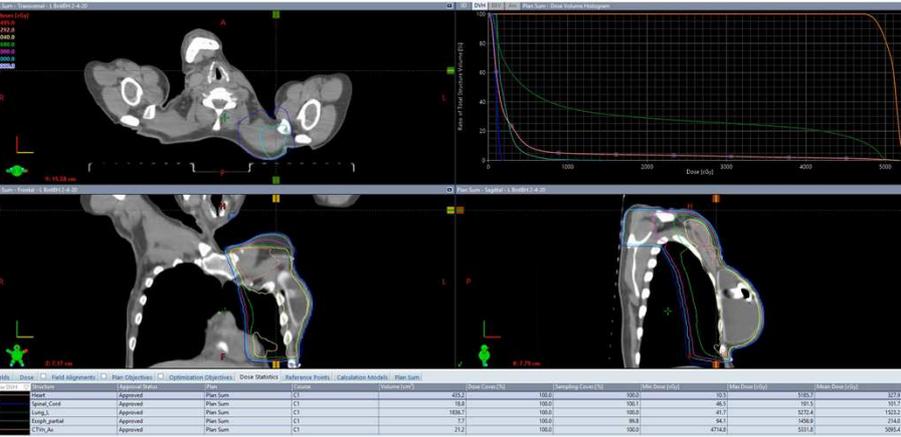
Dose (Gy)

65

Case Studies



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Plan Summary: 1/25/2011 Case 811

- ✓ 5242.0
- ✓ 5242.0
- ✓ 5242.0
- ✓ 4318.2
- ✓ 4400.0
- ✓ 4412.0
- ✓ 3266.0
- ✓ 1100.0

Plan Summary: 1/25/2011 Case 811

Plan Summary: 1/25/2011 Case 811

Plan Summary: 1/25/2011 Case 811

97.28 cm

2.2 cm

6.764 cm

Plan Summary: 1/25/2011 Case 811

Rate of Total Absorbed Volume (%)

Dose (Gy)

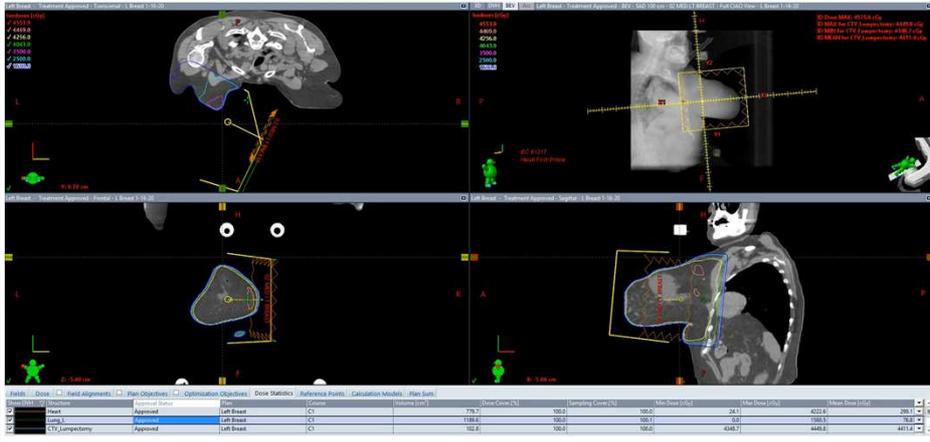
Structure	Plan Sum	Optimization	Reference Point	Calculation Method	Plan Sum	Plan Sum (%)	Sampling Error (%)	Min Dose (Gy)	Max Dose (Gy)	Avg Dose (Gy)
Heart	432.2	100.0	100.0	100.0	432.2	100.0	0.0	0.0	432.2	432.2
Spinal Cord	188.7	100.0	100.0	100.0	188.7	100.0	0.0	0.0	188.7	188.7
Lung, L	57.1	100.0	100.0	100.0	57.1	100.0	0.0	0.0	57.1	57.1
Lung, R	57.1	100.0	100.0	100.0	57.1	100.0	0.0	0.0	57.1	57.1
ESOPH, M	31.2	100.0	100.0	100.0	31.2	100.0	0.0	0.0	31.2	31.2

66

Case Studies



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Objective	Value	Unit	Weight	Priority	Constraint
Peak	778.7	100.0	100.0	24.1	402.6
TV20	1188.6	100.0	100.0	58	108.3
TV Compensatory	50.8	100.0	100.0	408.1	441.2

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Conclusion



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- Electronic compensator generates conformal 3D breast plans
- Manually creating these plans is doable for any center with Eclipse TPS
- EZFluence makes the process faster
 - Big time savings!
 - Reduction in repetitive, at times monotonous editing
 - Also reduces the need for expertise, therefore raising overall plan quality

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Thank You