

LA TOMOTHERAPIA

From Revolution to Evolution

First major radiation delivery innovation in a generation

- ▣ How do you improve on an invention that represents a quantum leap over the technology it replaces?
- ▣ *Continuous Upgrades:*
 - Significant improvement in stability
 - Decreased treatment times, increased pt load
 - TomoDirect™ - major advance in flexibility

Opened October 2007

- ▣ Only IGRT patients (77418)
- ▣ 90% curative intent
- ▣ Palliative patients – retreatments/brain mets
- ▣ 60% patients prostate carcinoma
- ▣ 225 New patients
- ▣ Other patients referred to outside hospitals
- ▣ Patient volume driven by new technology

Single Center Experience

- ▣ Opened October 2007
- ▣ Version 2x

225 patients treated first year

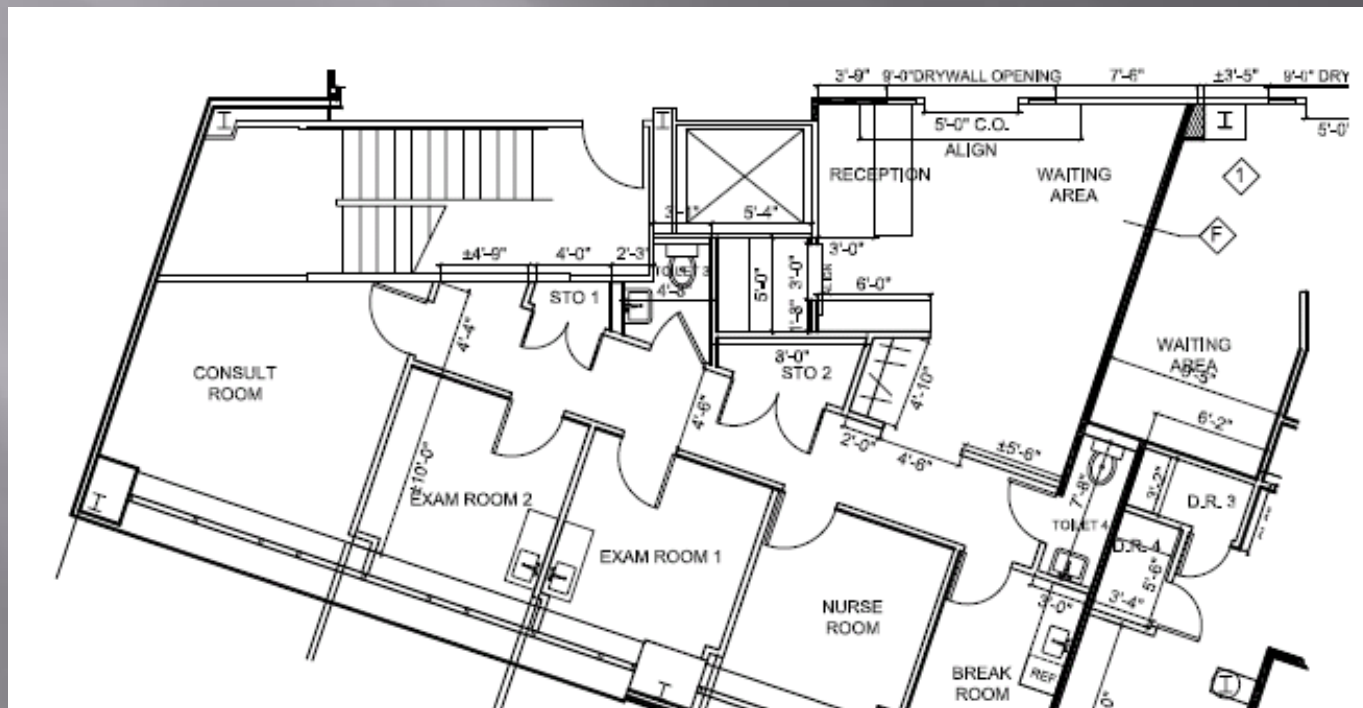
Treatment hours from 8:00 AM to 7:00 PM

No breast cancer patients treated

Sixty percent of patients prostate cancer



First floor layout



Tomo fits almost
anywhere!

Development Timeline

- ▣ 1 year site location
- ▣ Selection of Tomotherapy as technology
- ▣ 8 months obtain financing/lease
- ▣ 5 months permits
- ▣ 2 months construction
- ▣ 2 weeks installation



Staffing

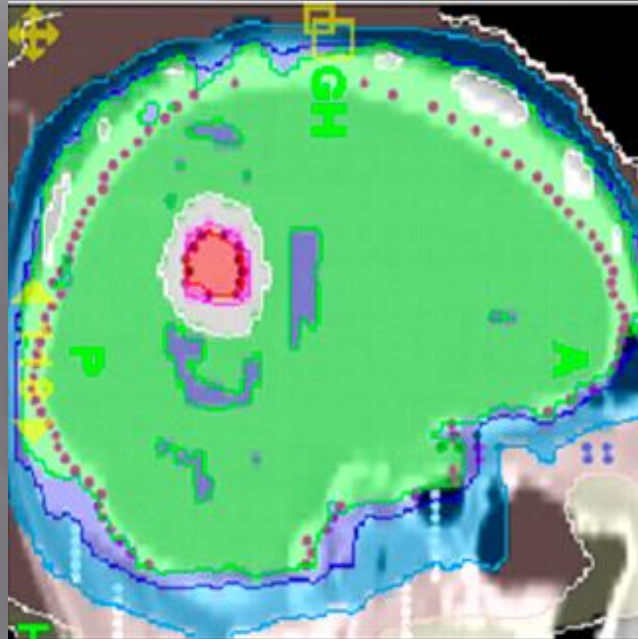
- ▣ Chief Therapist
- ▣ 3 Therapists
- ▣ 1 dosimetrist
- ▣ 0.5 physicist
- ▣ Secretary
- ▣ Biller



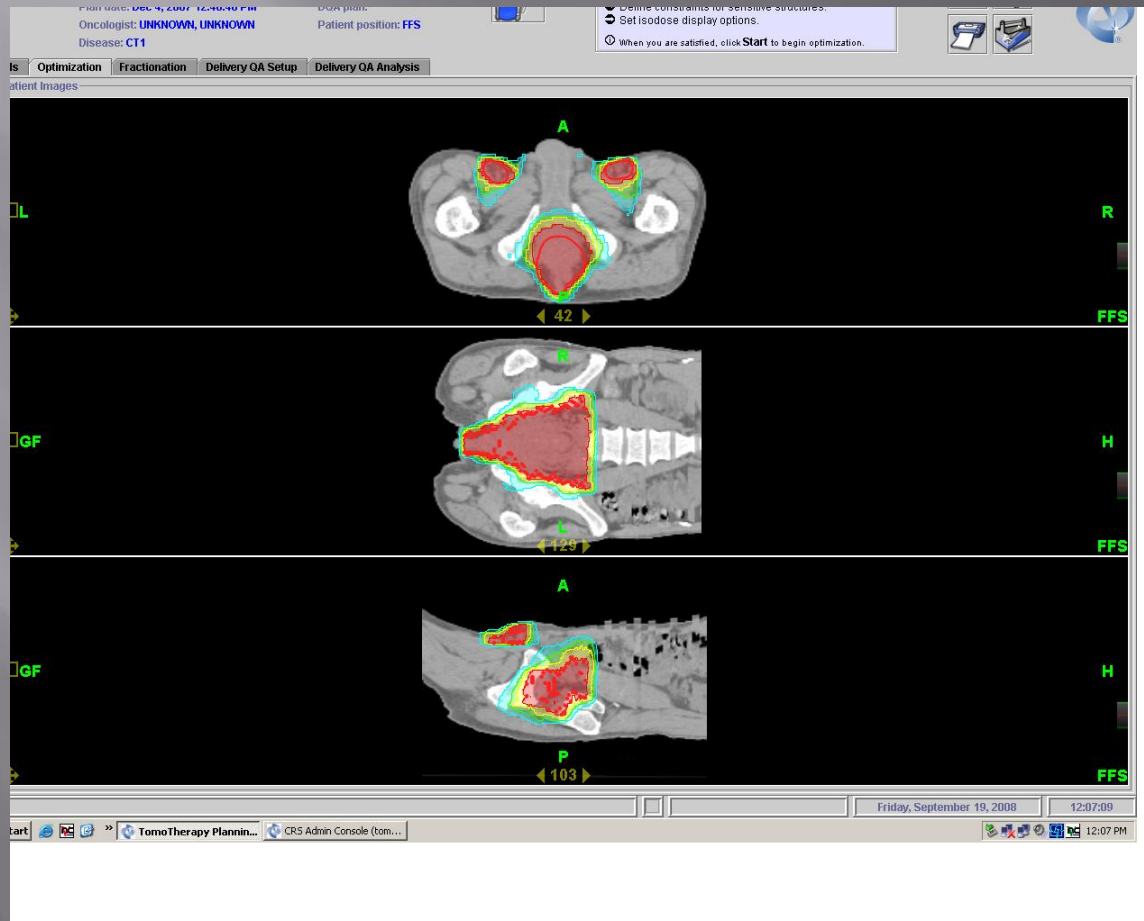
State of the Art is a moving target

- ▣ TomoDirect™
- ▣ High Performance Couch
- ▣ Dramatically improved throughput
- ▣ Increased Gantry Rotational Speed
- ▣ Planned adaptive software

Simultaneous Boost Brain

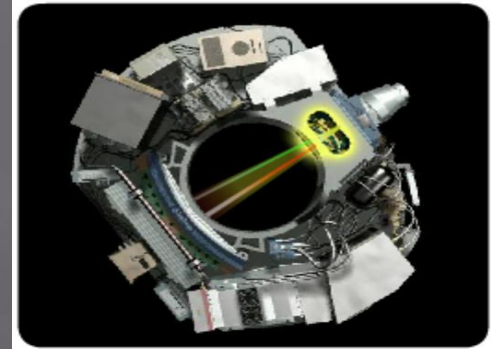
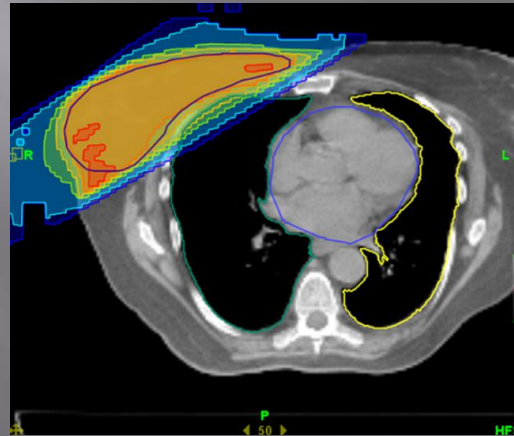
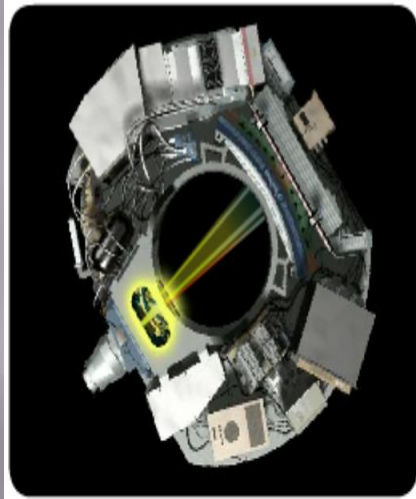


Rectal Cancer Treatment



TOMODIRECT™

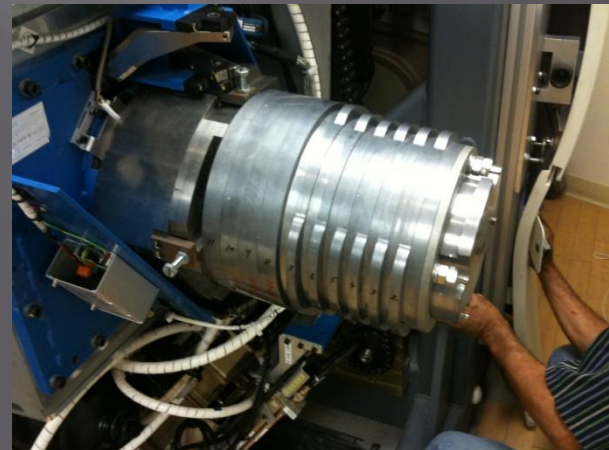
Extending the clinical application of
Tomotherapy to virtually all anatomic
sites



TomoDirect™

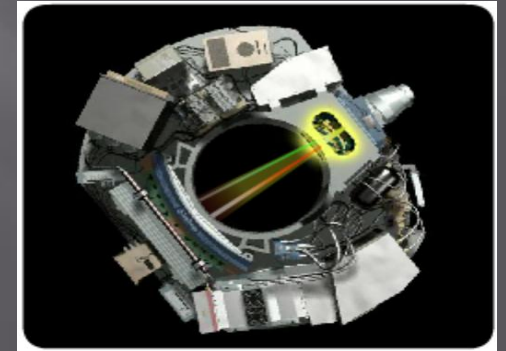
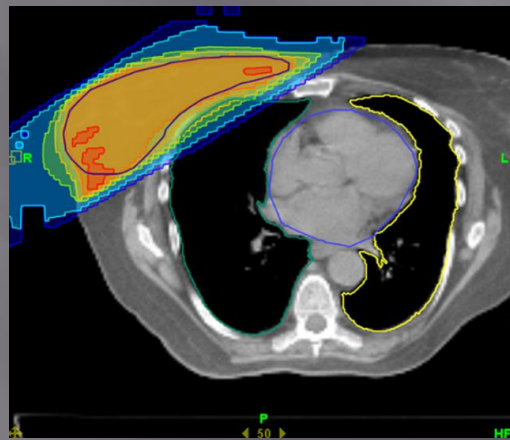
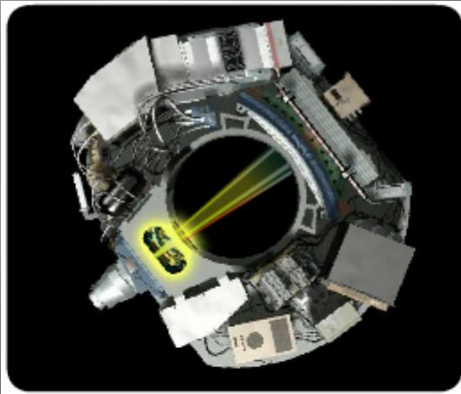
Installation of TomoDirect

- ▣ No disruption of patient treatments
- ▣ Installed over 2 consecutive weekends
- ▣ Acceptance testing done after hours
- ▣ First patients treated 2 weeks after install
- ▣ No additional therapist training
- ▣ Robust physics support



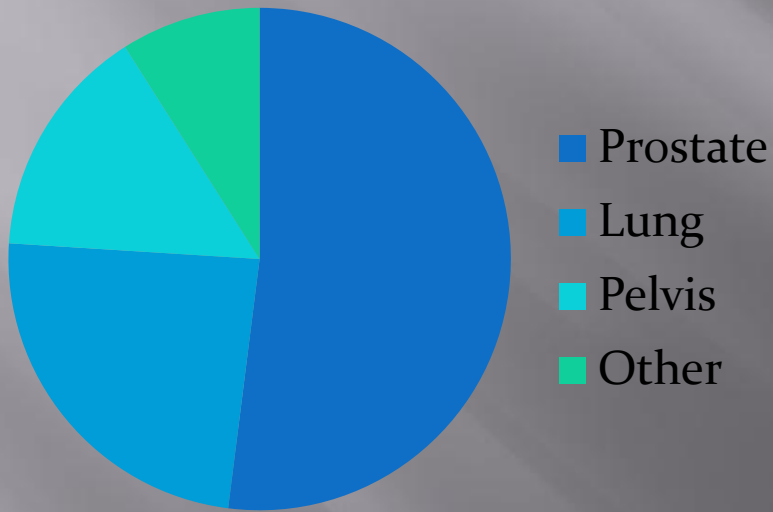
TomoDirect™

- ▣ Major advance in treatment delivery options
- ▣ Enables optimal treatment of breast cancer
- ▣ Decreased treatment time (10 min breast Rx)
- ▣ Easy of planning, reduced physics resources

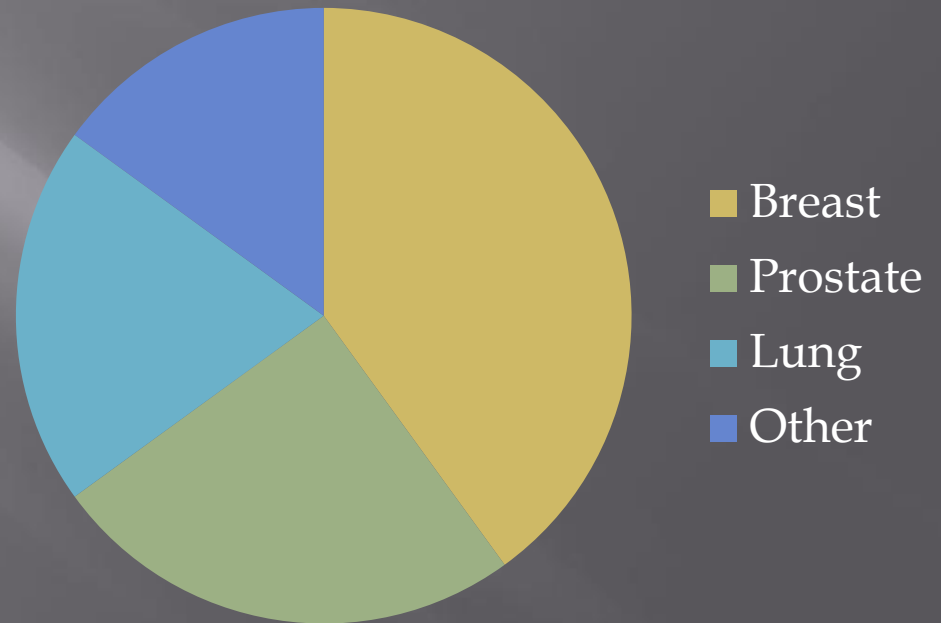


Anatomic Distribution

Helical Only



Helical & TomoDirect



IMRT

- ▣ CT guided treatment planning
- ▣ Careful beam contouring
- ▣ Reduction of dose to nearby structures
- ▣ Dynamic multi-leaf collimator
- ▣ Significantly higher costs

TomoDirect Breast TREATMENT

Planning Station

Patient: [Redacted] Plan Label: **Plan_01** User Name: kristine
 Sex: **Female** Plan Status: **Approved**
 ID: **140576** Plan Date: **Apr 12, 2010 12:31:16 PM**
 Oncologist: **Fass*Daniel** Position: **HFS**
 Disease: **CT1**

What's Next
Adjust Fractionation Schedule
 Verify the fraction count.
 If needed, adjust one or more fractions.
 Click **Final Dose**.
 When you are satisfied with the plan, click **Final Accept**.

Save

Prescription Summary
 The plan has 25 fractions defined for a planned delivery of 45.00 Gy.
 95.00% of the PTV extended volume receives at least 45.00 Gy.
 The modulation factor for this plan is 1.506.

Fractionation

Index	Locked	Planned Date	Dose	Duration	Index	Locked	Planned Date	Dose	Duration
1	<input type="checkbox"/>	April 12, 2010	1.80	4.5	16	<input type="checkbox"/>	May 03, 2010	1.80	4.5
2	<input type="checkbox"/>	April 13, 2010	1.80	4.5	17	<input type="checkbox"/>	May 04, 2010	1.80	4.5
3	<input type="checkbox"/>	April 14, 2010	1.80	4.5	18	<input type="checkbox"/>	May 05, 2010	1.80	4.5
4	<input type="checkbox"/>	April 15, 2010	1.80	4.5	19	<input type="checkbox"/>	May 06, 2010	1.80	4.5
5	<input type="checkbox"/>	April 16, 2010	1.80	4.5	20	<input type="checkbox"/>	May 07, 2010	1.80	4.5
6	<input type="checkbox"/>	April 19, 2010	1.80	4.5	21	<input type="checkbox"/>	May 10, 2010	1.80	4.5
7	<input type="checkbox"/>	April 20, 2010	1.80	4.5	22	<input type="checkbox"/>	May 11, 2010	1.80	4.5
8	<input type="checkbox"/>	April 21, 2010	1.80	4.5	23	<input type="checkbox"/>	May 12, 2010	1.80	4.5
9	<input type="checkbox"/>	April 22, 2010	1.80	4.5	24	<input type="checkbox"/>	May 13, 2010	1.80	4.5
10	<input type="checkbox"/>	April 23, 2010	1.80	4.5	25	<input type="checkbox"/>	May 14, 2010	1.80	4.5
11	<input type="checkbox"/>	April 26, 2010	1.80	4.5					

Finalize
 Dose Calc Grid: **Normal**
 Final Dose: [Field]
 Final Accept: [Field]
 Generate Plan Report: [Button]

Target Constraints

Name	Display	Co...
PTV extender	<input type="checkbox"/>	[Color]

Regions at Risk Constraints

Name	Display	Co...
cord	<input checked="" type="checkbox"/>	[Color]
Rt Lung	<input checked="" type="checkbox"/>	[Color]
Lt Lung	<input checked="" type="checkbox"/>	[Color]
R breast PTV	<input checked="" type="checkbox"/>	[Color]
Boost	<input checked="" type="checkbox"/>	[Color]
L Breast	<input checked="" type="checkbox"/>	[Color]
Couch	<input type="checkbox"/>	[Color]
Heart	<input checked="" type="checkbox"/>	[Color]
External	<input type="checkbox"/>	[Color]

STANDARD Cumulative DVH Relative

Relative Volume (% Normalized) vs Dose (Gy)

Vol Min: 0 Vol Max: 100 Gy Min: 0 Gy Max: 58.5

Display Mode
 HU Density
 Gy %
 Edit

Transverse
 Coronal
 Sagittal

Monday, April 12, 2010 12:39:20

Start CRS Admin Console (tom... Planning Station TomoTherapy DQA Station E:\ 12:39 PM

Supine Helical Treatment

Planning Station

Patient: [Redacted] Plan Label: **Plan_01** User Name: kristine
 Sex: **Female** Plan Status: **Approved**
 ID: 99374 Plan Date: Jan 15, 2009 11:34:36 AM
 Oncologist: Fass*Daniel Position: HFS
 Disease: CT1

What's Next
 Define Prescription and Rx Constraints
 Define the plan Prescription.
 Define Target and RAR Constraints.
 Set isodose display options.
 When you are finished, click **Start** to begin optimization.

Contouring | **ROIs** | **Plan Settings** | **Beam Angles** | **Optimization** | **Fractionation**

Prescription
 % Vol For: Rt Breast 99.0 % will receive 45.0 Gy in 2

Target Constraints

Name	Display	Color	Blocked	Use	Importance	Max Dose [Gy]	Max Dose Pen	DVH Vol	DVH Dose [Gy]	Min Dose [Gy]	Min Dose Pen
Rt Bre	<input checked="" type="checkbox"/>	Red	1 Unblocket	<input checked="" type="checkbox"/>	200	45.0	200	99.0	45.0	45.0	200

Regions at Risk Constraints

Name	Display	Color	Blocked	Use	Importance	Max Dose [Gy]	Max Dose Pen	DVH Vol	DVH Dose [Gy]	DVH Pt. Pen
Mediastinum	<input type="checkbox"/>	Brown	5 Unblockec	<input checked="" type="checkbox"/>	10	15.0	10	30.0	5.0	10
Couch	<input type="checkbox"/>	Orange	8 Unblockec	<input type="checkbox"/>						
Heart	<input checked="" type="checkbox"/>	Green	4 Unblockec	<input checked="" type="checkbox"/>	50	15.0	50	30.0	5.0	50
Cord	<input type="checkbox"/>	Blue	6 Unblockec	<input checked="" type="checkbox"/>	10	8.0	10	20.0	5.0	10
Rt Lung	<input checked="" type="checkbox"/>	Cyan	1 Unblockec	<input checked="" type="checkbox"/>	50	40.0	50	10.0	10.0	50
Lt Lung	<input type="checkbox"/>	Magenta	3 Unblockec	<input checked="" type="checkbox"/>	50	10.0	50	10.0	10.0	50
Lt Breast	<input type="checkbox"/>	Pink	2 Unblockec	<input checked="" type="checkbox"/>	50	10.0	50	5.0	5.0	50
AVD	<input type="checkbox"/>	Yellow	7 Directiona	<input checked="" type="checkbox"/>	1	45.0	1	50.0	40.0	1

Optimize
 Dose Calc Grid: Normal
 Field Width: Not Set
 Modulation Factor: 2.700
 Pitch: 0.287
 Mode: Terma
 Start
 Get Full Dose
 Cancel

STANDARD Cumulative DVH Relative

Display Mode
 HU Density
 Gy %
 Transverse
 Coronal
 Sagittal

Retrieving Archive Girolamo* Cathy_patient.xml. Tuesday, April 13, 2010 12:34:16

TomoDirect contouring

Planning Station

Patient: [Redacted] Plan Label: **Plan_03** User Name: kristine
DOB: [Redacted] Plan Status: **Unapproved**
Sex: **Female** Plan Date: **Apr 13, 2010 11:47:52 AM**
ID: 28827 Position: **HFP**
Oncologist: **Fass*Daniel**
Disease: **CT2**

What's Next
Verify Optimization
Click **Resume**, and then click **Get Full Dose** to complete the optimization, OR
Adjust constraints as necessary, then click **Resume** to continue optimizing

Save

Contouring ROIs Plan Settings Beam Angles Optimization Fractionation

Transverse

Options Presets

Lines
 Gy %

47.7 Gy
45.0 Gy
42.8 Gy
40.5 Gy
36.0 Gy
31.5 Gy

Edit

Iteration 27 received

Tuesday, April 13, 2010 15:38:56

Start Planning Station CRS Admin Console (tom... 3:38 PM

Advantages of TomoDirect (breast)

- ▣ Treatment in supine position
- ▣ Decreased planning effort
- ▣ Decreased dose to contra-lateral structures
- ▣ Ability to code for 3D conformal treatment
- ▣ Increased throughput

Advantages of Helical Treatment

- ▣ Simultaneous tumor bed boost
- ▣ Treatment of regional nodes
- ▣ Facilitates prone treatment
- ▣ Perfect for partial breast plans

Supine Helical Treatment

Planning Station

Patient: [Redacted] Plan Label: **Plan_01** User Name: kristine
 Sex: **Female** Plan Status: **Approved**
 ID: **99374** Plan Date: **Jan 15, 2009 11:34:36 AM**
 Oncologist: **Fass*Daniel** Position: **HFS**
 Disease: **CT1**

What's Next
 Define Prescription and Rx Constraints
 Define the plan Prescription.
 Define Target and RAR Constraints.
 Set isodose display options.
 When you are finished, click **Start** to begin optimization.

Contouring | **ROIs** | **Plan Settings** | **Beam Angles** | **Optimization** | **Fractionation**

Prescription
 % Vol For: **Rt Breast** **99.0 %** will receive **45.0 Gy** in 2

Target Constraints

Name	Display	Color	Blocked	Use	Importance	Max Dose [Gy]	Max Dose Pen	DVH Vol	DVH Dose [Gy]	Min Dose [Gy]	Min Dose Pen
Rt Bre	<input checked="" type="checkbox"/>	■	1 Unblockec	<input checked="" type="checkbox"/>	200	45.0	200	99.0	45.0	45.0	200

Regions at Risk Constraints

Name	Display	Color	Blocked	Use	Importance	Max Dose [Gy]	Max Dose Pen	DVH Vol	DVH Dose [Gy]	DVH Pt. Pen
Mediastinum	<input type="checkbox"/>	■	5 Unblockec	<input checked="" type="checkbox"/>	10	15.0	10	30.0	5.0	10
Couch	<input type="checkbox"/>	■	8 Unblockec	<input type="checkbox"/>						
Heart	<input checked="" type="checkbox"/>	■	4 Unblockec	<input checked="" type="checkbox"/>	50	15.0	50	30.0	5.0	50
Cord	<input type="checkbox"/>	■	6 Unblockec	<input checked="" type="checkbox"/>	10	8.0	10	20.0	5.0	10
Rt Lung	<input checked="" type="checkbox"/>	■	1 Unblockec	<input checked="" type="checkbox"/>	50	40.0	50	10.0	10.0	50
Lt Lung	<input type="checkbox"/>	■	3 Unblockec	<input checked="" type="checkbox"/>	50	10.0	50	10.0	10.0	50
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AVD	<input type="checkbox"/>	■	7 Directiona	<input checked="" type="checkbox"/>	1	45.0	1	50.0	40.0	1

Optimize
 Dose Calc Grid: **Normal**
 Field Width: **Not Set**
 Modulation Factor: **2.700**
 Pitch: **0.287**
 Mode: **Terma**
 Initiate Full Dose After: **20** iterations.
 Start | Get Full Dose | Cancel

STANDARD Cumulative DVH Relative

Display Mode
 HU | Density
 Gy | %
 Transverse
 Coronal
 Sagittal

Isodose Legend

- 47.2 Gy
- 45.0 Gy
- 42.8 Gy
- 40.5 Gy
- 36.0 Gy
- 31.5 Gy

Retrieving Archive Girolamo* Cathy_patient.xml. Tuesday, April 13, 2010 12:34:16

TomoDirect Breast TREATMENT

Planning Station

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 Sex: **Female** Plan Status: **Approved**
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Heart	<input checked="" type="checkbox"/>	[Color]
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STANDARD Cumulative DVH Relative

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 Gy %
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Advantages of TomoDirect (breast)

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- ▣ Increased throughput

Radiation following mastectomy

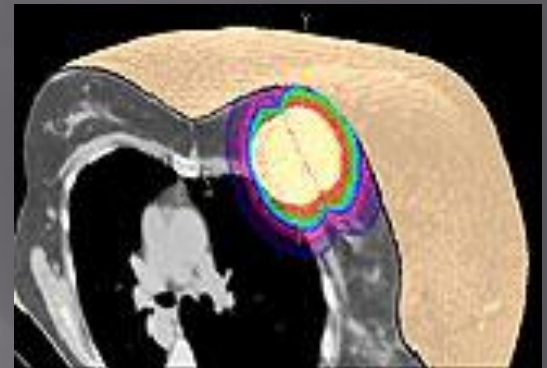
- ▣ Indicated in patients with multiple positive nodes and/or large primary tumors.
- ▣ Improves survival 15 %
- ▣ Needs to be coordinated with reconstruction.

Accelerated Breast Radiation

- ▣ Shorter overall treatment time (3 weeks)
- ▣ Large Canadian study confirms efficacy
- ▣ Questions remain as to long term cosmetic results
- ▣ Excellent for older patients and those with no access to treatment facilities

Partial Breast Irradiation

- ▣ Unproven technique
- ▣ Used for low risk women
- ▣ Higher rate of local relapse
- ▣ Studies ongoing
- ▣ Helical Tomo perfect



Advantages of Helical Treatment Breast Cancer

- ▣ Simultaneous tumor bed boost
- ▣ Treatment of regional nodes
- ▣ Facilitates prone treatment
- ▣ Perfect for partial breast plans
- ▣ Treatment of bilateral breast cancer

Conclusions

- ▣ Tomotherapy® remains the most advanced platform for the delivery of IGRT available
- ▣ Continuous upgrades have resulted in improved workflow and user satisfaction
- ▣ TomoDirect™ enables optimal treatment of breast cancer and is a must have for single accelerator sites
- ▣ Single unit can easily treat 45 patients in a normal treatment day

YES WE CAN



