



Best®

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What is New in Radiation Therapy?

Krishnan Suthanthiran

Founder/President, Best Medical International



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“A healthy person has many wishes,
but the sick person has only one.”

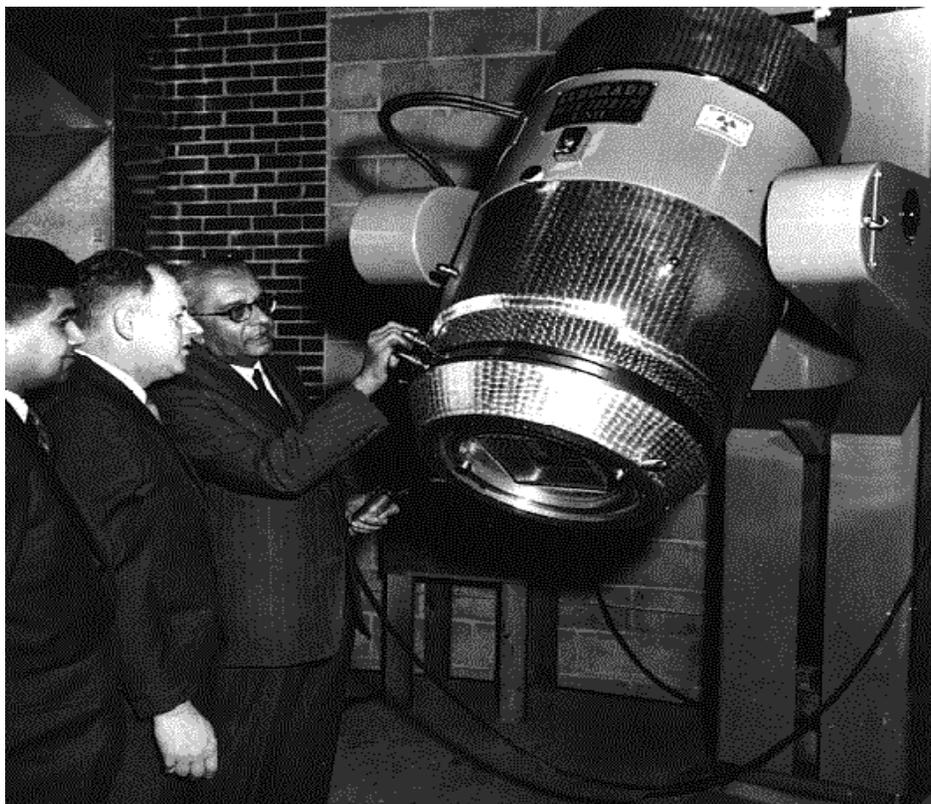
— Indian Proverb



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Don't think of Gamma as this...



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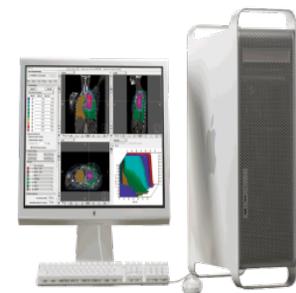
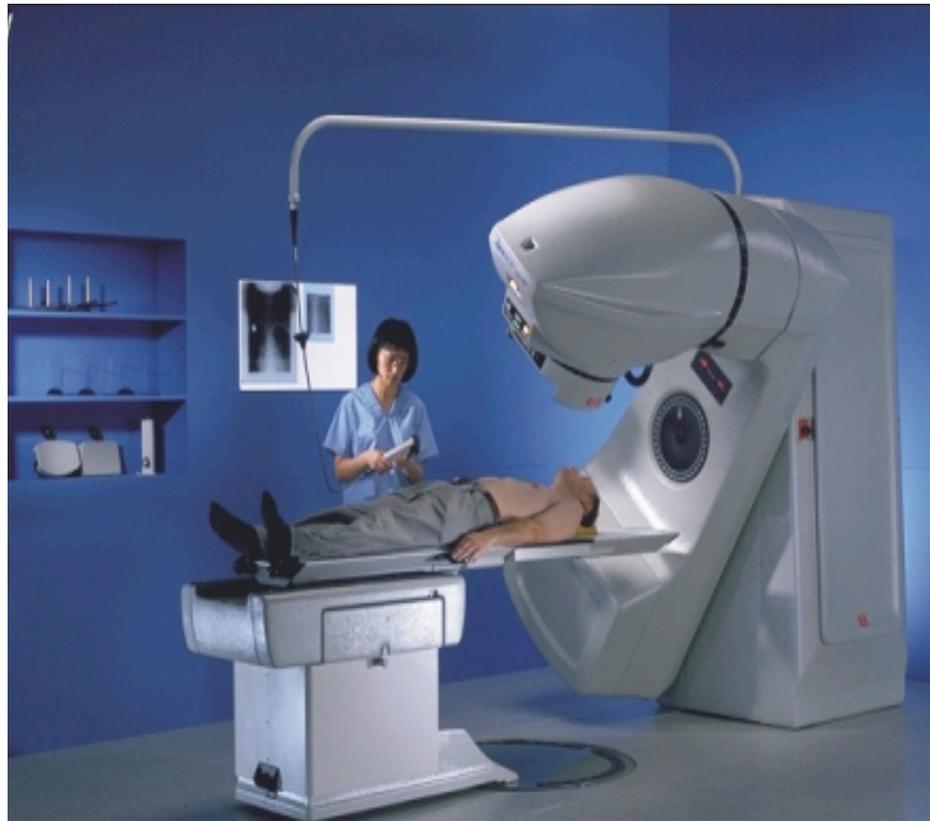
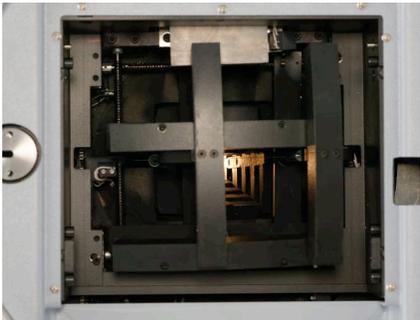
But this...



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Cancer Therapy Solutions That Work...



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- **Best[®] Theratronics Limited is a world-wide leader in the global fight against cancer**
 - BTL has over 60 years of experience designing, manufacturing, servicing and supporting gamma beam treatment units
 - We supply over 90% of world's gamma external beam teletherapy machines
 - ~ 140 employees and 100,000 sq. ft. of manufacturing space
 - Exports technology worldwide



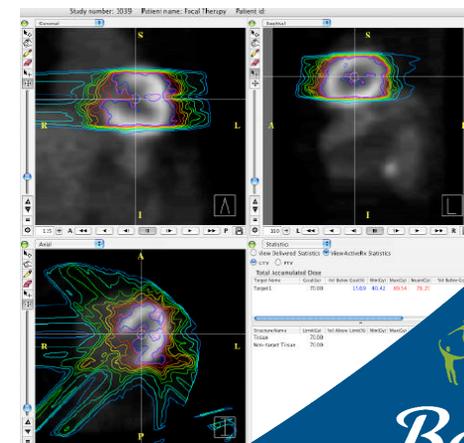
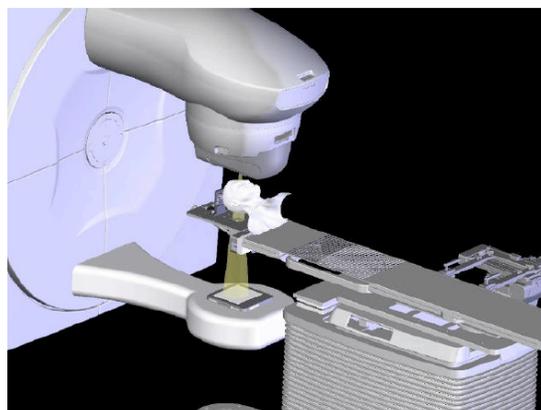
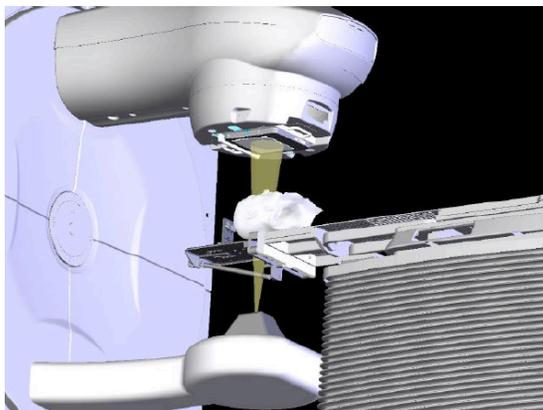
Best[®]

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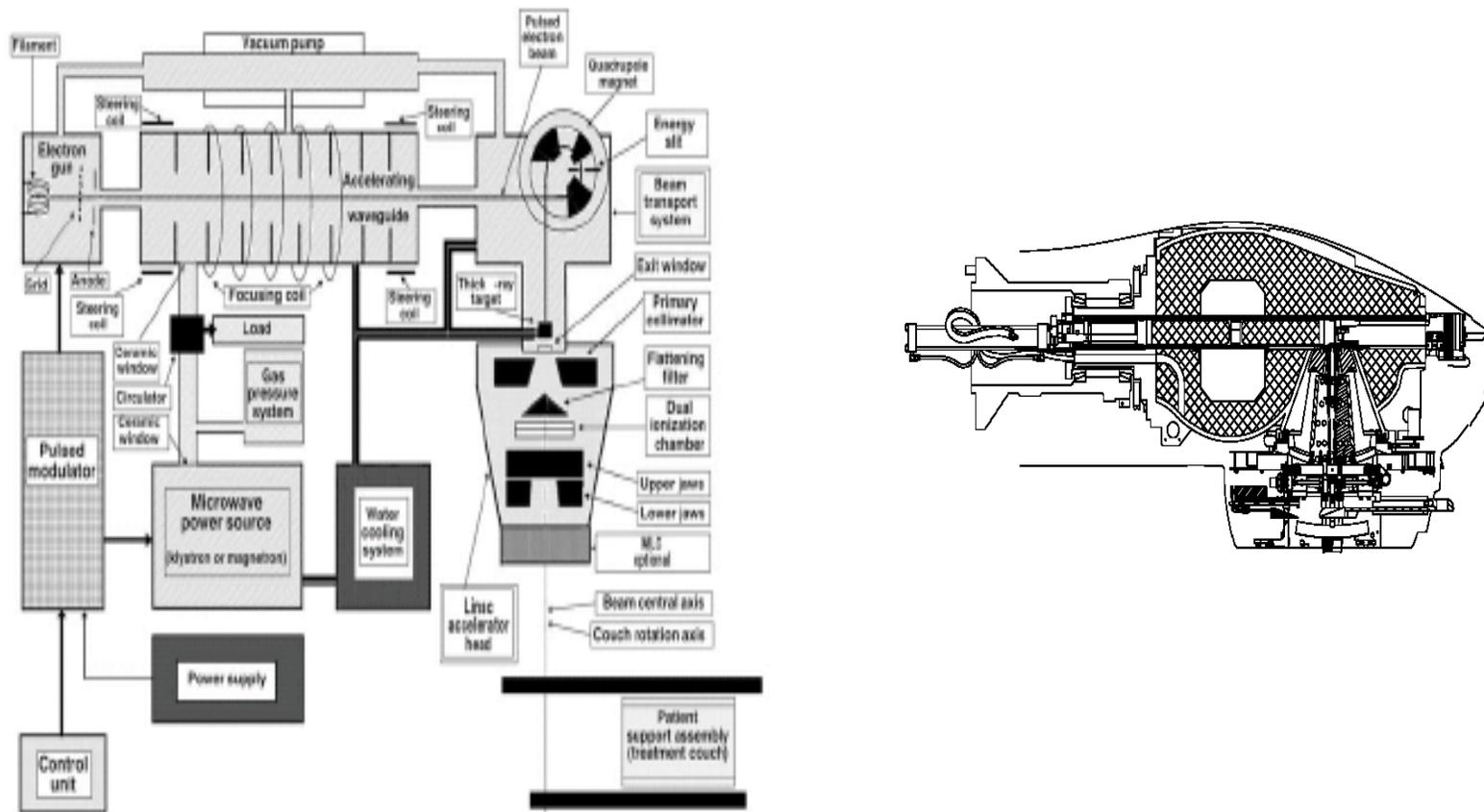
- **Proven Reliability**
 - 45,000 treatments performed worldwide every day
 - Some centers treat 100+ patients/day
 - ~ 2700 installations worldwide
- **Cost Effective**
 - Lower infrastructure demands
 - Reduced QA demands



- Taking an active role in modernizing gamma teletherapy by adding tools that will allow clinicians to precisely target tumors and reduce side effects:
 - Multi-Leaf Collimators [MLC]
 - 3D Conformal Radiation Therapy [CRT]
 - Intensity Modulated Radiation Therapy [IMRT].
 - Image Guided Radiation Therapy [IGRT].
- Cost-effective treatments delivered at much lower initial and operating costs than comparable technologies.



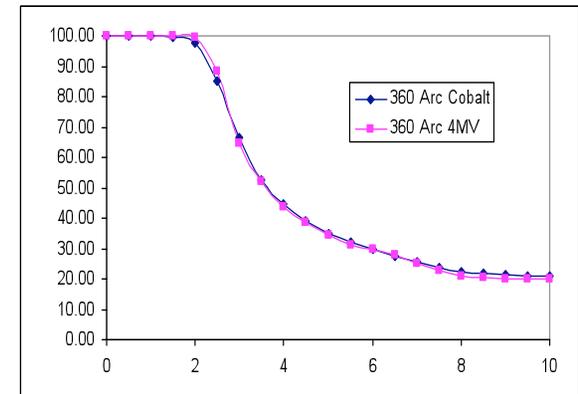
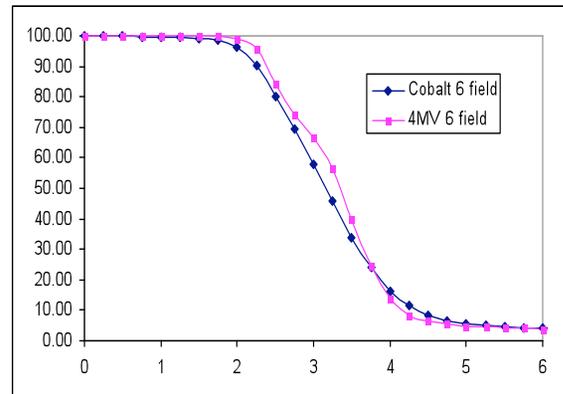
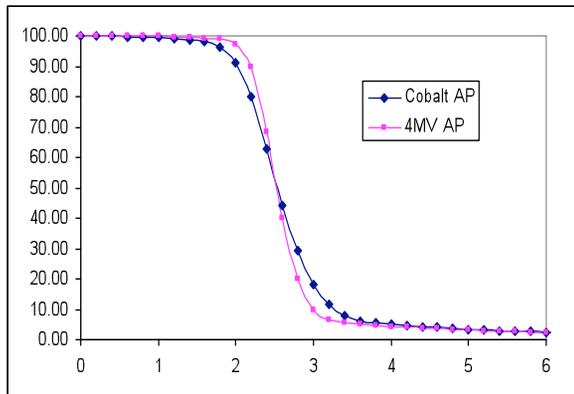
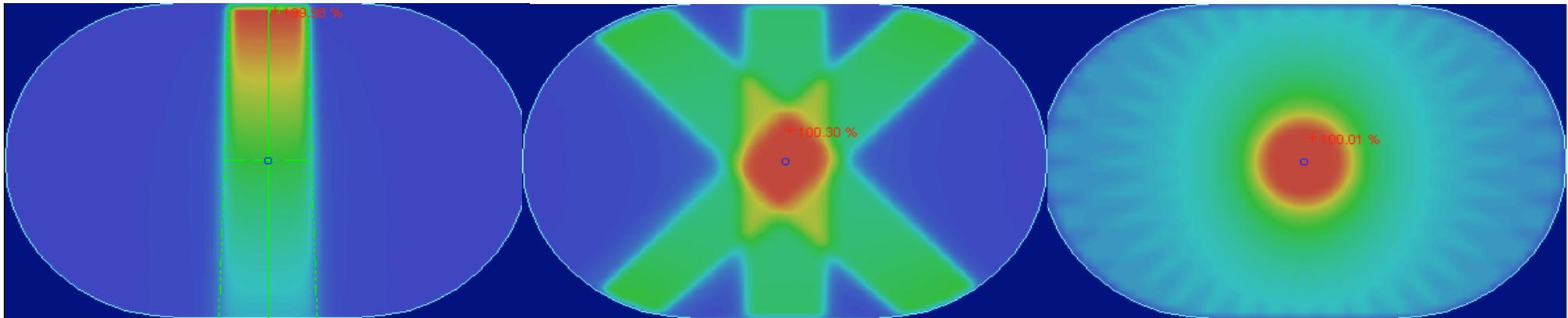
Complexity: Linear Accelerator vs Gamma Teletherapy



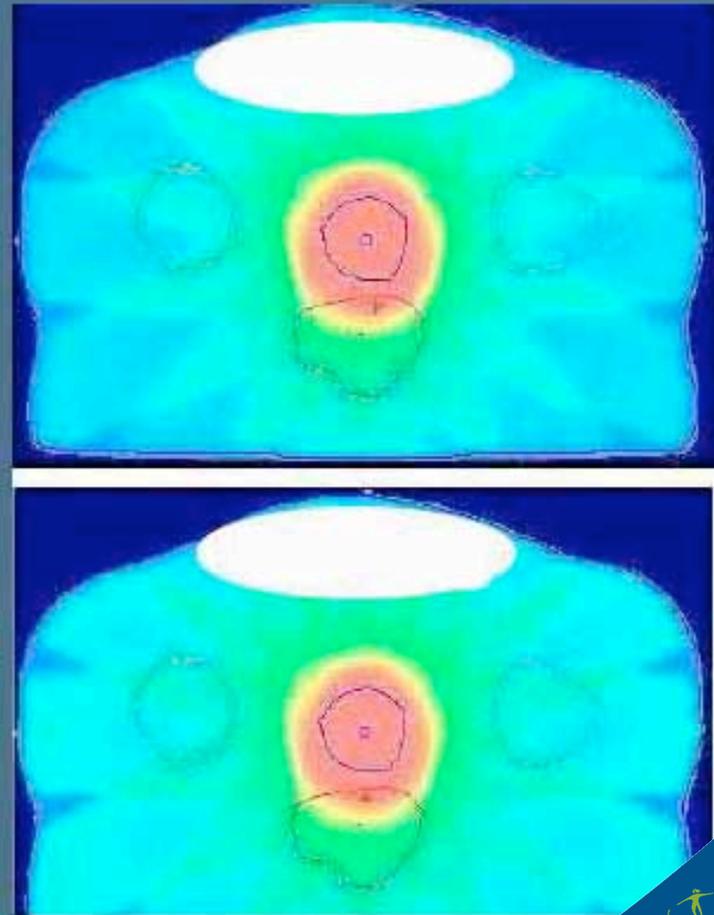
Linear accelerator

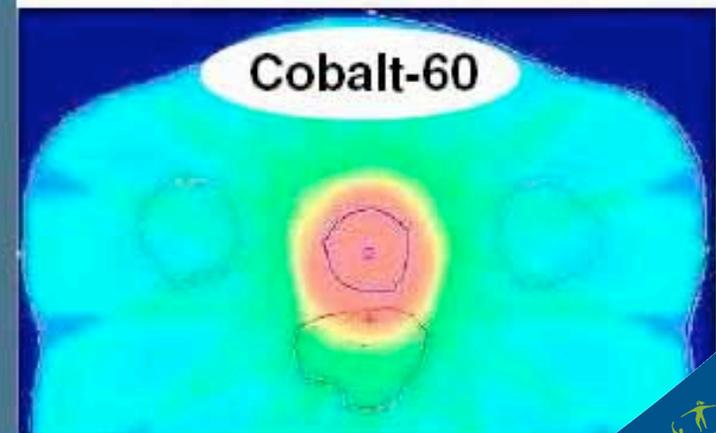
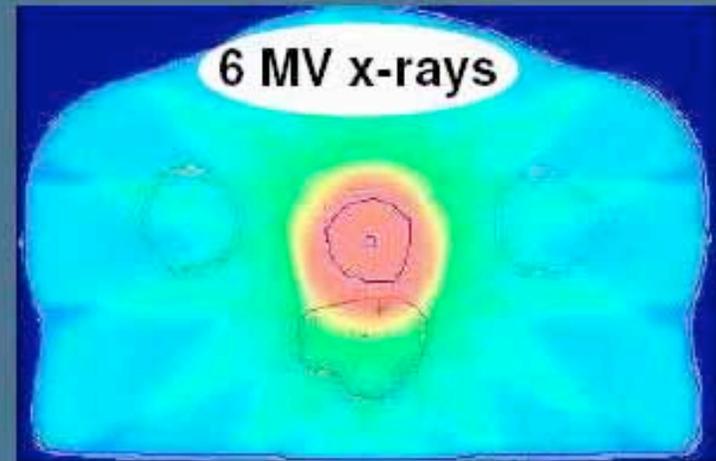


Gamma teletherapy

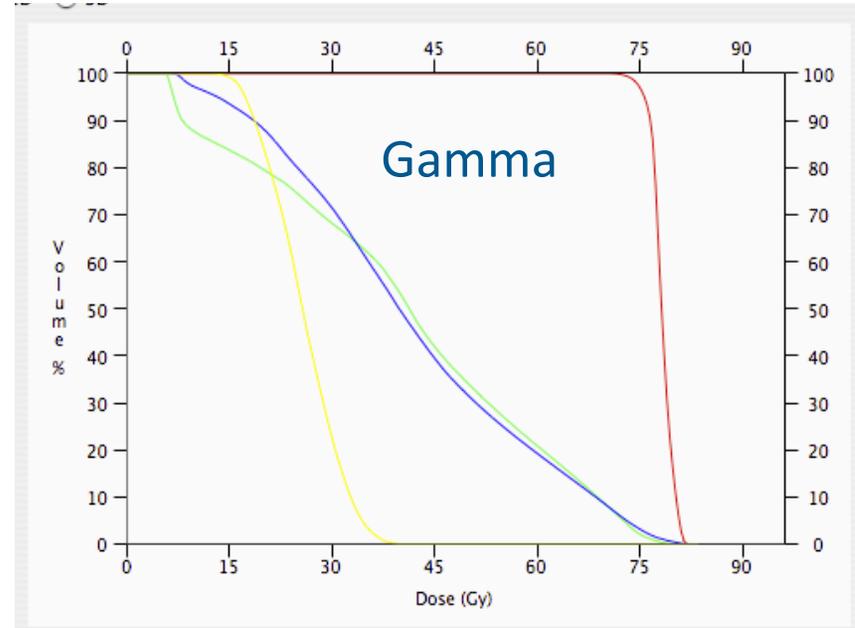
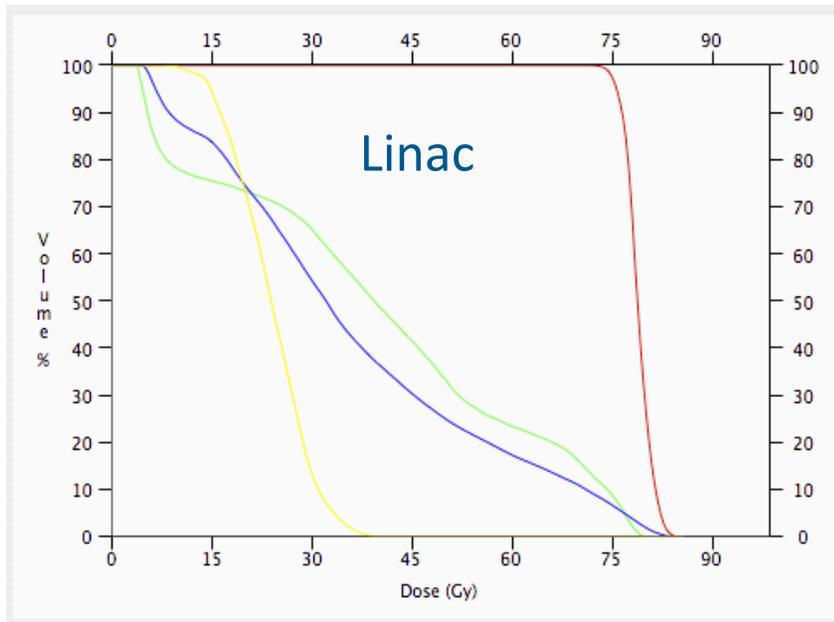


Battista, J. & Van Dyk, J., Gamma Therapy: Some myths, misconception and misperceptions, Co-Efficient 2(1): 1-4, 2000.





Dose Volume Histograms



Total Accumulated Dose

Target Name	Goal(Gy)	Vol Below Goal(%)	Min(Gy)	Max(Gy)	Mean(Gy)	Vol Below Goal(cc)	S.I
Prostate	75.60	4.89	70.21	84.76	78.65	3.03	

Structure Name	Limit(Gy)	Vol Above Limit(%)	Min(Gy)	Max(Gy)	Mean(Gy)	Vol Above Limit(cc)	S.I
Tissue	75.60	0.80	0.43	85.62	9.71	98.36	
Non-target Tissue	75.60	0.32	0.43	85.62	9.36	39.47	
Bladder	50.00	24.96	4.28	84.76	35.87	29.66	
Femoral Heads	40.00	0.04	6.85	41.10	23.61	0.03	
Rectum	50.00	33.29	3.42	80.48	38.82	15.34	

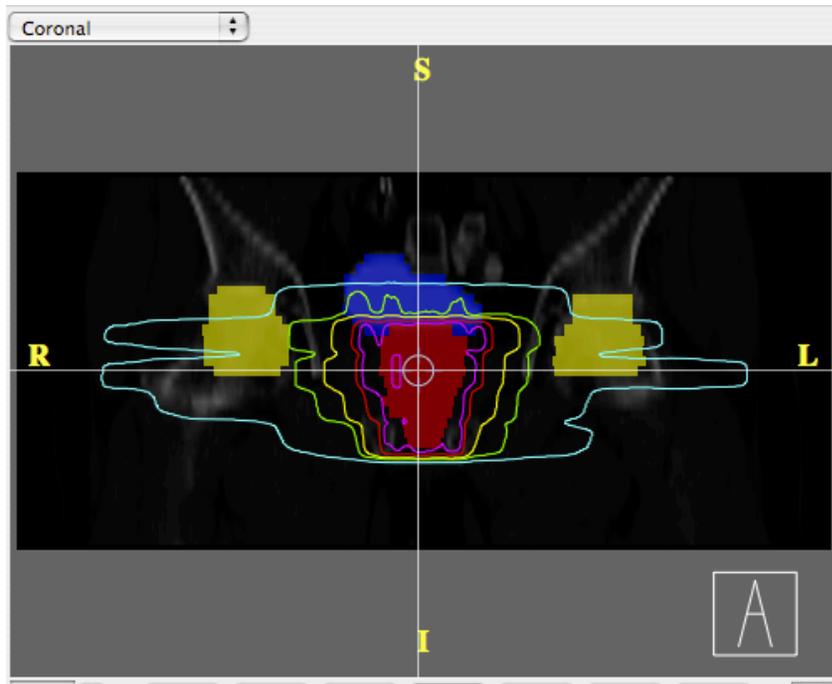
Simulated Dose

Target Name	Goal(Gy)	Vol Below Goal(%)	Min(Gy)	Max(Gy)	Mean(Gy)	Vol Below Goal(cc)	S.I
Prostate	75.60	4.83	69.75	82.28	78.01	2.99	

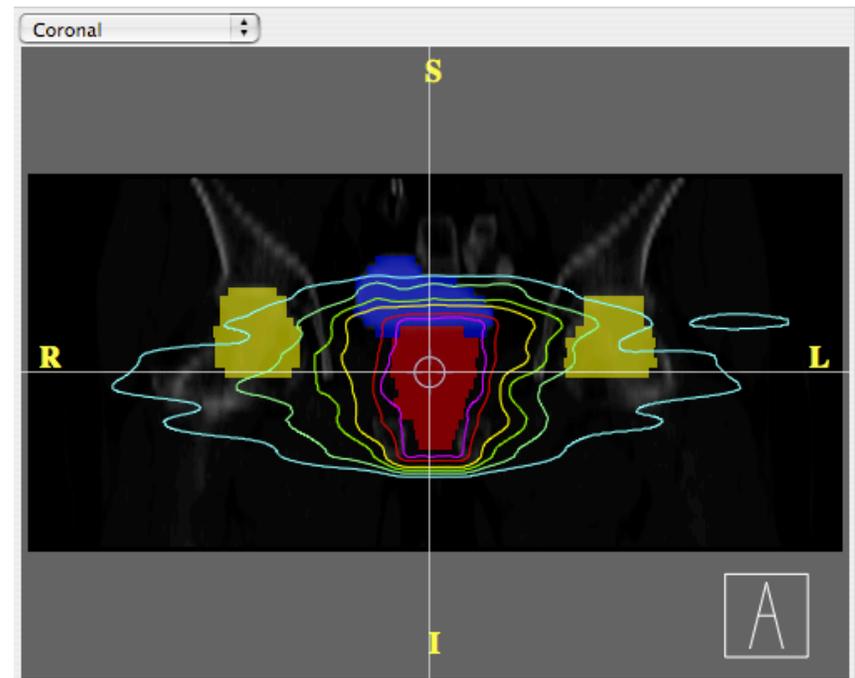
Structure Name	Limit(Gy)	Vol Above Limit(%)	Min(Gy)	Max(Gy)	Mean(Gy)	Vol Above Limit(cc)	S.I
Tissue	75.60	0.73	0.84	83.54	11.87	90.32	
Non-target Tissue	75.60	0.26	0.84	83.54	11.53	31.38	
Bladder	50.00	31.45	6.27	82.28	41.38	37.39	
Femoral Heads	40.00	0.04	11.70	40.10	25.53	0.04	
Rectum	50.00	33.92	5.43	79.78	40.15	15.64	

Prostate

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<input type="checkbox"/>	<input type="checkbox"/>	Tissue	<input type="radio"/>
<input checked="" type="checkbox"/>	<input type="checkbox"/>	Bladder	<input type="radio"/>
<input checked="" type="checkbox"/>	<input type="checkbox"/>	Femoral Heads	<input type="radio"/>
<input checked="" type="checkbox"/>	<input type="checkbox"/>	Rectum	<input type="radio"/>

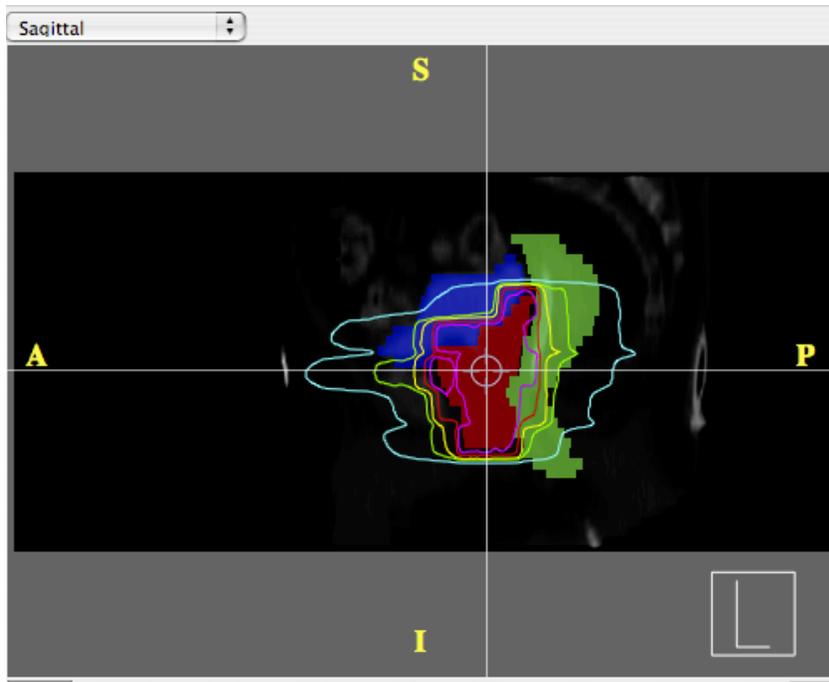


Linac

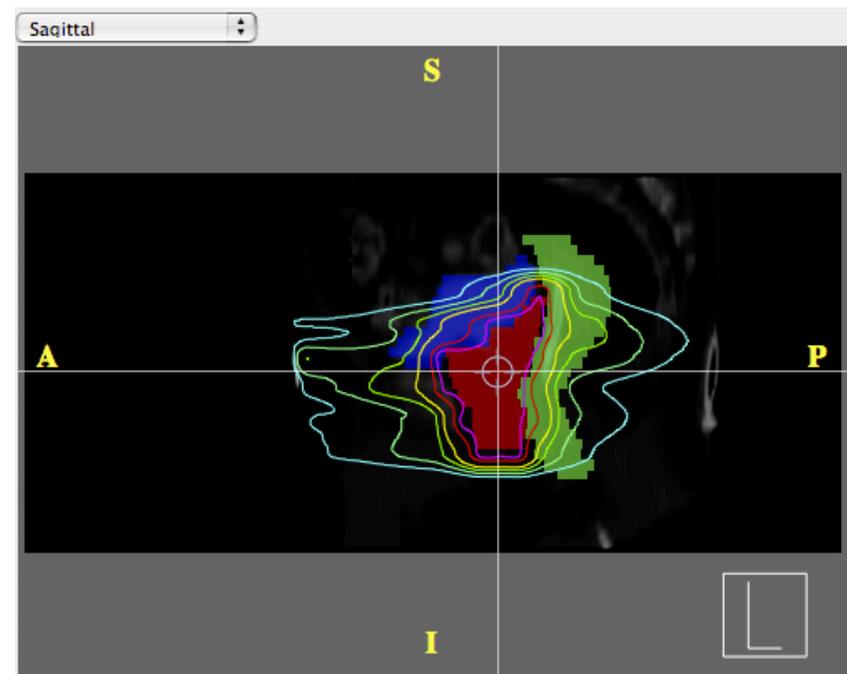


Cobalt

Prostate



Linac



Cobalt

Prostate

- The two plans are essentially equivalent
- Gamma is actually more conformal than the other plan (less nontarget tissue above target dose)
- In general, the Gamma plans tend to have less volume of sensitive structure at high dose but more volume at lower dose (subtle difference), consistent with shape of depth-dose curve

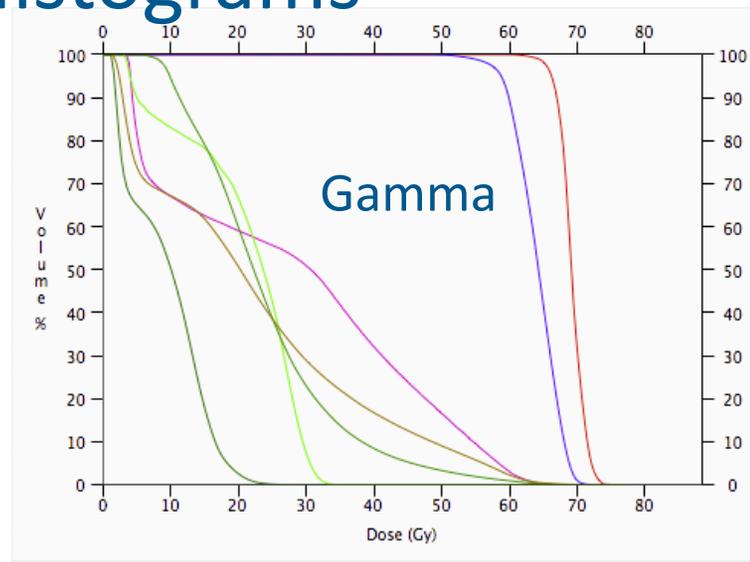
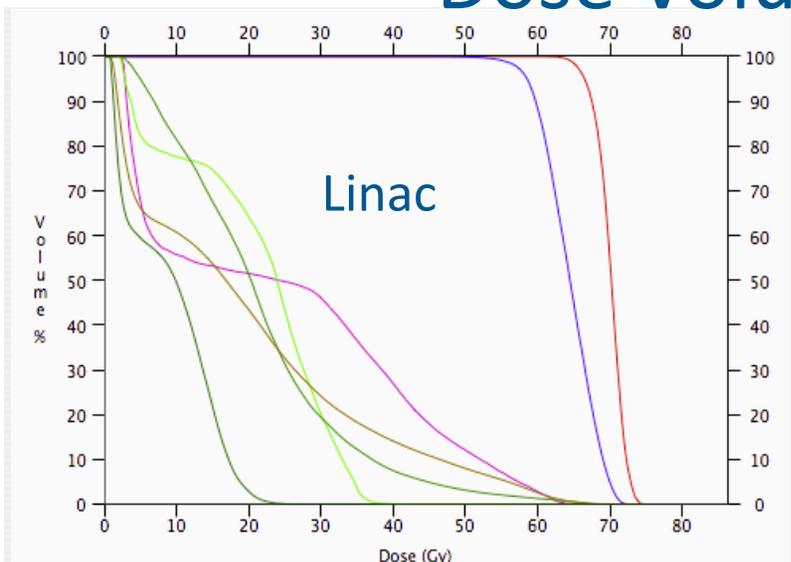
“Everyone deserves the best healthcare. Education is the most effective way to eliminate poverty and promote global understanding and peace.”

— Krishnan Suthanthiran



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Dose Volume Histograms



Target Name	Goal(Gy)	Vol Below Goal(%)	Min(Gy)	Max(Gy)	Mean(Gy)	Vol Below Goal(cc)	S.I
Target1	66.00	3.50	59.62	74.62	69.84	1.16	
Target2	50.00	0.10	45.00	73.12	64.18	0.07	

Goal(Gy)	Vol Below Goal(%)	Min(Gy)	Max(Gy)	Mean(Gy)	Vol Below Goal(cc)	S.I
66.00	4.13	59.44	75.65	68.98	1.36	
50.00	0.04	47.86	73.33	63.84	0.03	

Structure Name	Limit(Gy)	Vol Above Limit(%)	Min(Gy)	Max(Gy)	Mean(Gy)	Vol Above Limit(cc)	S.I
Tissue	66.00	0.45		74.62	7.65	66.95	
Non-target Tissue	66.00	0.06		72.75	7.23	8.32	
Esophagus	58.00		1.88	42.00	20.73		
Heart	66.00	0.41	1.88	72.00	21.17	2.11	
Lung (L)	30.00		0.38	28.88	8.66		
Lung (R)	30.00	24.09	0.75	72.75	19.27	447.01	
Ref1 ()	30.00		0.38	21.75	6.22		
Trachea	60.00	2.84	2.25	64.88	23.84	0.44	

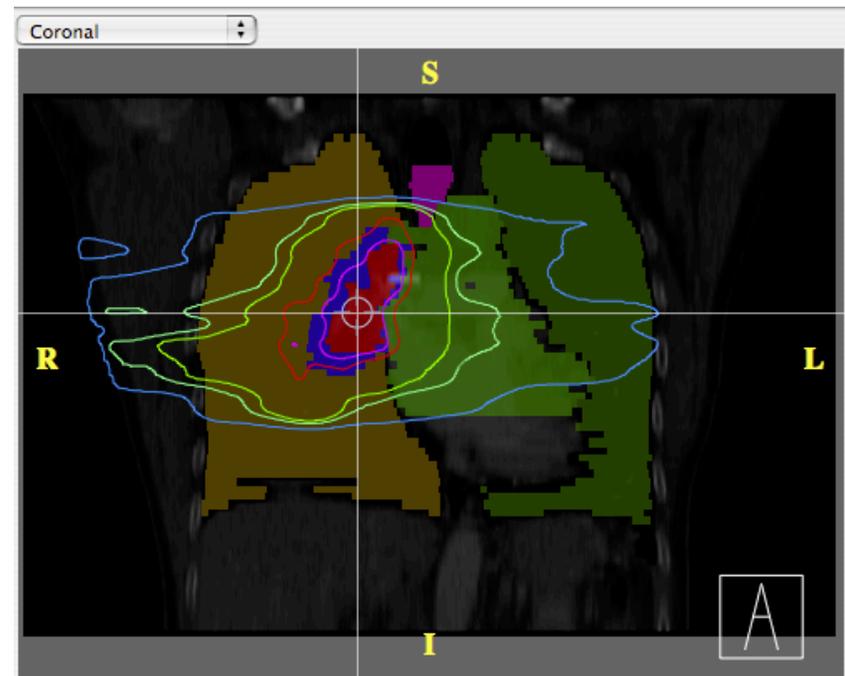
Limit(Gy)	Vol Above Limit(%)	Min(Gy)	Max(Gy)	Mean(Gy)	Vol Above Limit(cc)	S.I
66.00	0.41		76.81	8.78	60.51	
66.00	0.04		76.81	8.36	5.93	
58.00		3.09	35.51	20.75		
66.00	0.10	4.63	69.86	23.73	0.53	
30.00		0.77	28.56	9.05		
30.00	28.91	1.16	76.81	21.91	536.42	
30.00		0.39	21.61	7.32		
60.00	3.04	3.47	65.61	27.65	0.48	

Thorax

- Tissue
- Esophagus
- Heart
- Lung (L)
- Lung (R)
- Ref1 ()
- Trachea



Linac

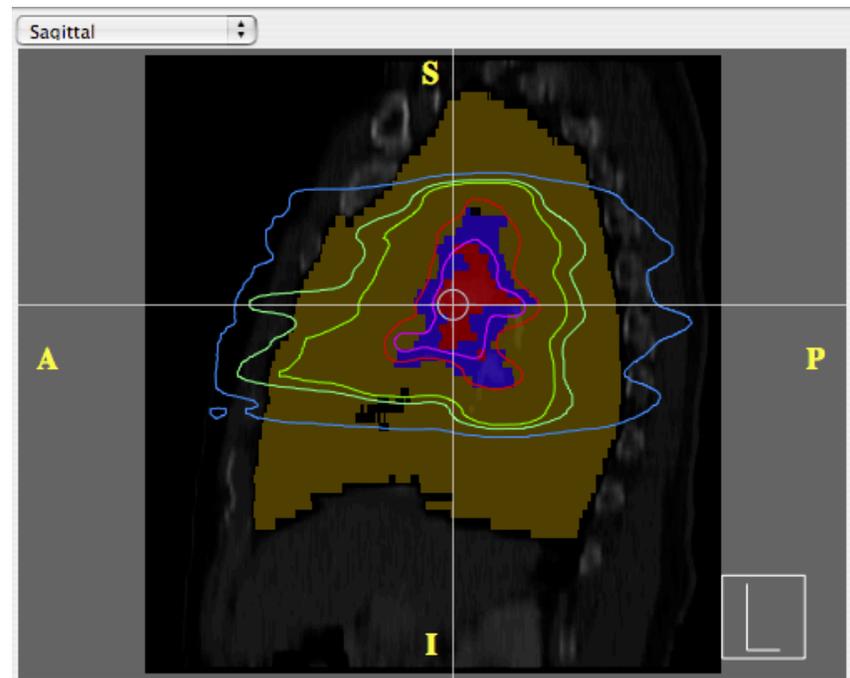


Cobalt

Thorax



Linac



Cobalt

Thorax

- The Gamma plan is arguably better than Linac plan (more conformal).
- The DVHs are otherwise extremely similar.

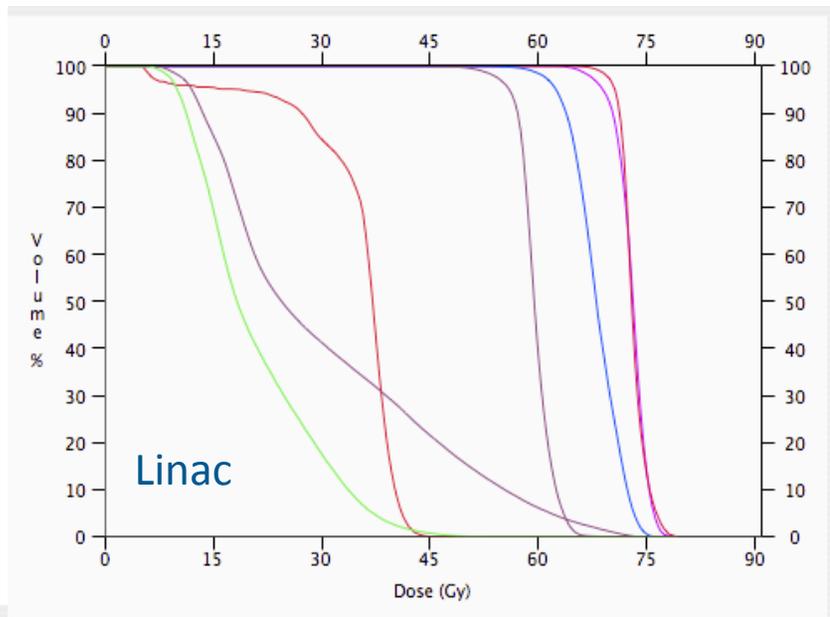
“Each time a man stands up for an ideal, or acts to improve the lot of others, or strikes out against injustice, he sends forth a tiny ripple of hope.”

— Robert F. Kennedy

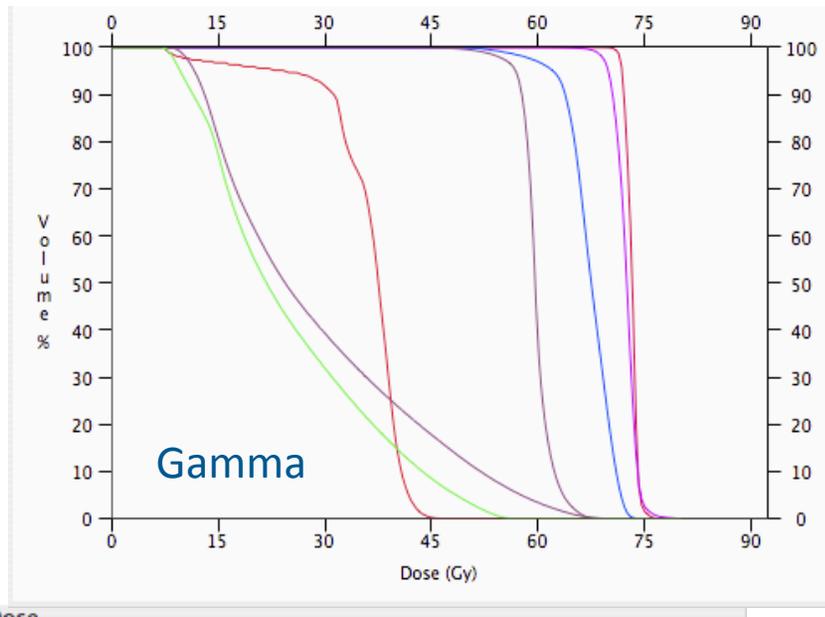


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Dose Volume Histograms



C	P	Name and Opac
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<input type="checkbox"/>	<input type="checkbox"/>	Tissue
<input type="checkbox"/>	<input type="checkbox"/>	Brain Stem
<input checked="" type="checkbox"/>	<input type="checkbox"/>	Cord
<input checked="" type="checkbox"/>	<input type="checkbox"/>	Rt Parotid
<input checked="" type="checkbox"/>	<input type="checkbox"/>	Lt Parotid
<input type="checkbox"/>	<input type="checkbox"/>	Rt Submandibula



Target Name	Goal(Gy)	Vol Below Goal(%)	Min(Gy)	Max(Gy)	Mean(Gy)	Vol Below Goal(cc)	S.
CTV3	56.00	5.07	42.86	72.22	59.34	13.70	
CTV2	63.00	6.65	49.60	77.38	67.83	10.86	
CTV1	70.00	8.39	61.11	78.97	72.69	9.37	
GTV	70.00	3.02	63.89	78.97	72.92	1.21	

Structure Name	Limit(Gy)	Vol Above Limit(%)	Min(Gy)	Max(Gy)	Mean(Gy)	Vol Above Limit(cc)	S.
Tissue	63.00	6.16		78.97	26.00	479.06	
Non-target Tissue	63.00	2.17		77.38	22.81	155.76	
Brain Stem	45.00		6.35	31.75	17.07		
Cord	40.00	11.13	4.76	46.03	34.61	2.05	
Rt Parotid	20.00	43.34	5.56	53.17	20.55	14.07	
Lt Parotid	25.00	48.89	7.14	74.21	30.19	16.48	
Rt Submandibular	15.00	98.02	13.10	56.35	29.34	11.03	
Oral Cavity	50.00	1.24	26.59	54.37	38.10	0.26	
Larynx	22.00	46.93	13.49	57.14	25.56	5.61	
Mandible	60.00	10.15	15.08	72.22	39.50	5.00	

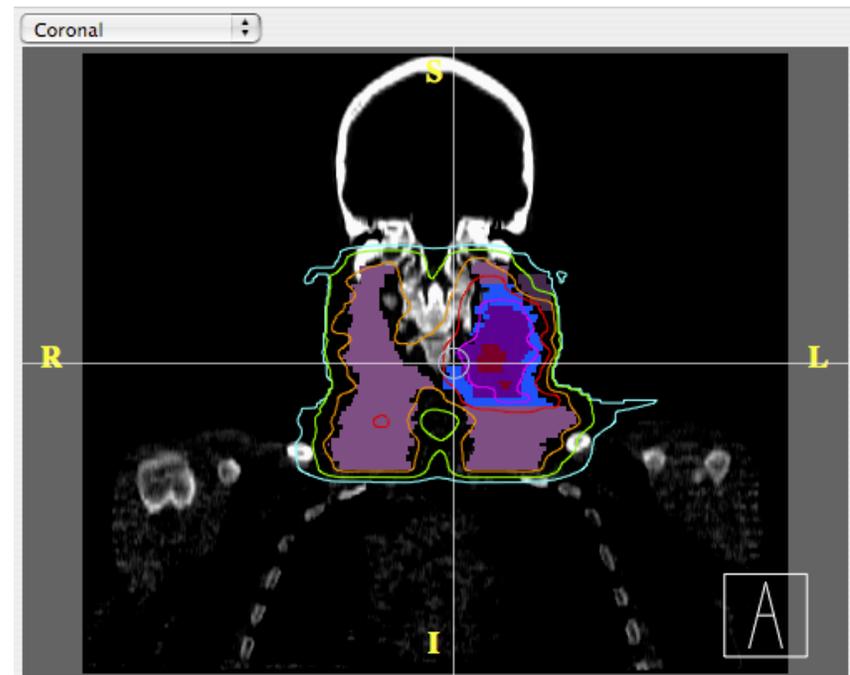
Structure Name	Goal(Gy)	Vol Below Goal(%)	Min(Gy)	Max(Gy)	Mean(Gy)	Vol Below Goal(cc)	S.
CTV3	56.00	3.33	39.29	70.16	59.52	8.99	
CTV2	63.00	6.72	43.70	74.57	67.07	10.98	
CTV1	70.00	5.87	58.13	80.18	72.17	6.56	
GTV	70.00	0.06	68.96	76.58	72.96	0.02	

Name	Limit(Gy)	Vol Above Limit(%)	Min(Gy)	Max(Gy)	Mean(Gy)	Vol Above Limit(cc)	S.
Tissue	63.00	5.57		80.18	27.76	433.08	
Non-target Tissue	63.00	1.54		79.78	24.73	110.83	
Brain Stem	45.00		8.82	33.28	19.38		
Cord	40.00	16.15	7.22	46.51	35.67	2.97	
Rt Parotid	20.00	55.21	6.82	56.53	24.84	17.92	
Lt Parotid	25.00	48.67	8.02	70.16	28.57	16.40	
Rt Submandibular	15.00	100.00	15.64	52.92	31.31	11.25	
Oral Cavity	50.00	2.17	26.06	54.93	37.87	0.46	
Larynx	22.00	75.36	15.64	51.32	30.49	9.00	
Mandible	60.00	8.31	22.45	70.56	39.31	4.10	

Head & Neck

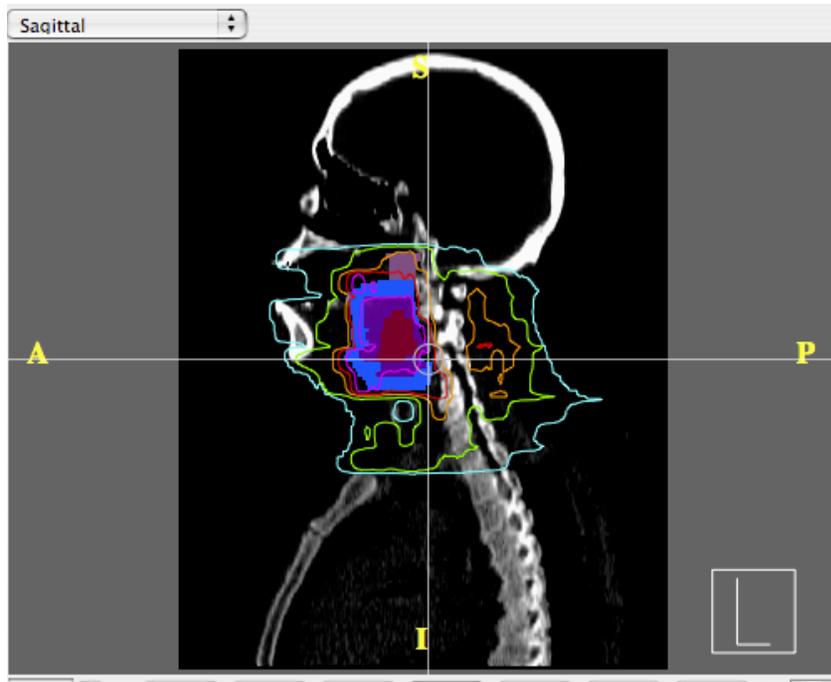


Linac

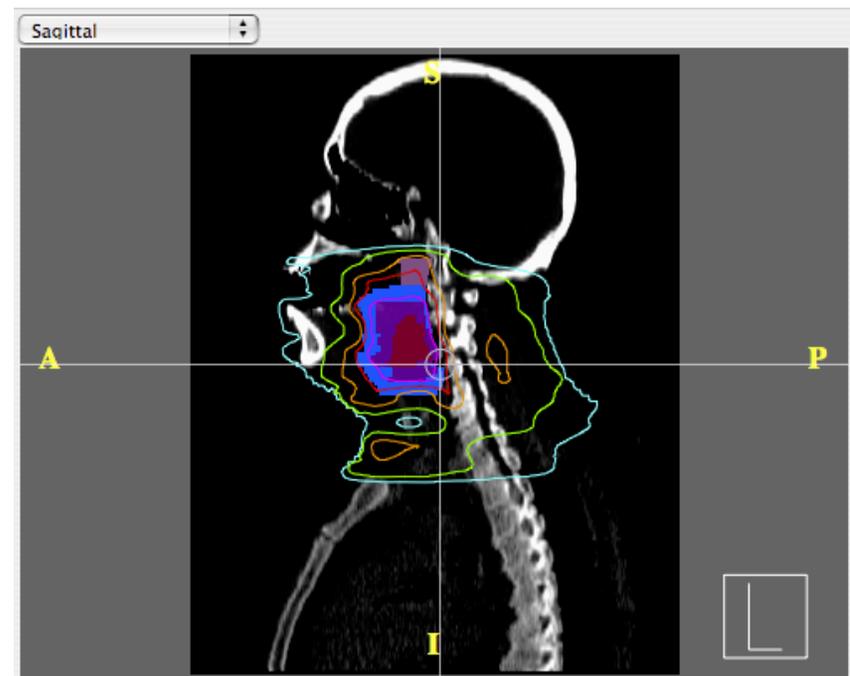


Cobalt

Head & Neck



Linac

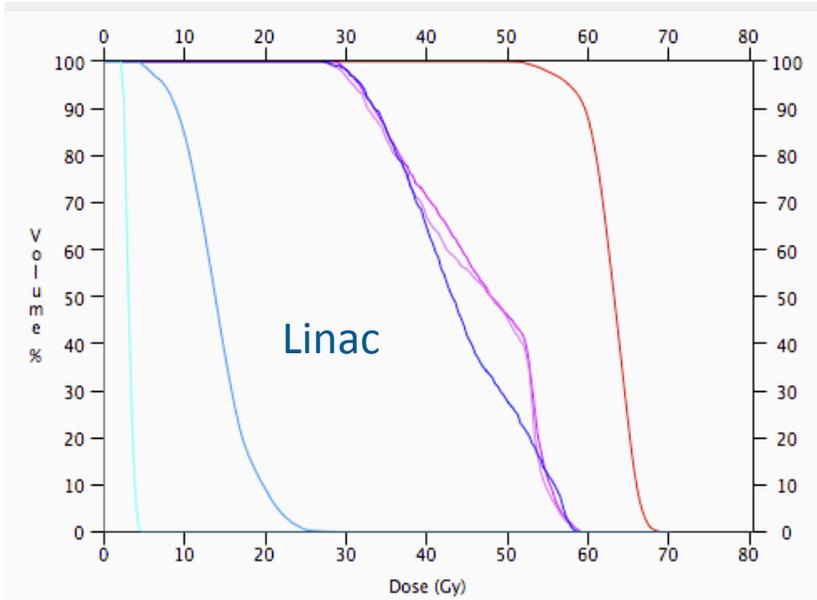


Cobalt

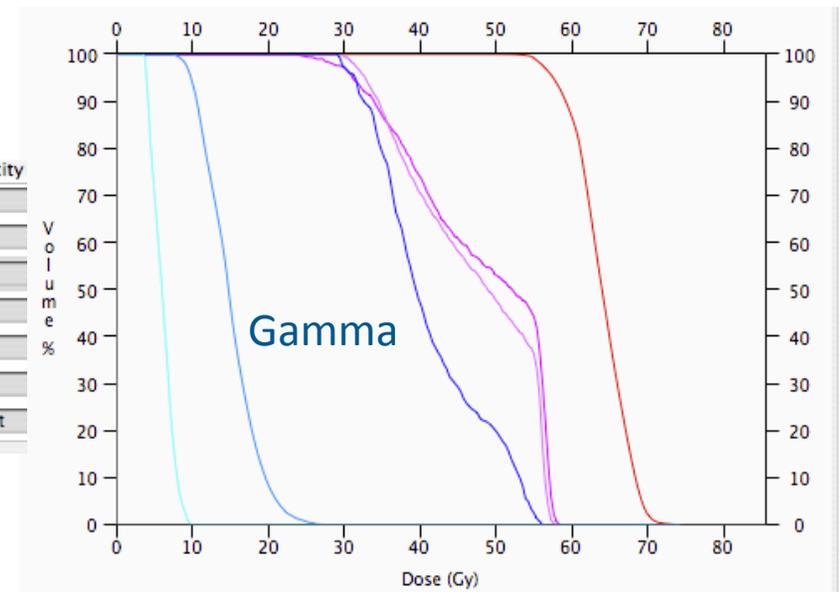
Head & Neck

- The DVHs are comparable for all examples and all are clinically quite good.
- Note that the Gamma plan is more conformal than the Linac plan (less non-target tissue over target dose).

Dose Volume Histograms



	C	P	Name and Opacity
<input checked="" type="checkbox"/>	<input type="checkbox"/>		Optic nerve (R)
<input checked="" type="checkbox"/>	<input type="checkbox"/>		Optic nerve (L)
<input type="checkbox"/>	<input type="checkbox"/>		Orbit (L)
<input type="checkbox"/>	<input type="checkbox"/>		Orbit (R)
<input checked="" type="checkbox"/>	<input type="checkbox"/>		Brain stem
<input checked="" type="checkbox"/>	<input type="checkbox"/>		Spinal cord
<input type="checkbox"/>	<input type="checkbox"/>		Tissue Equivalent



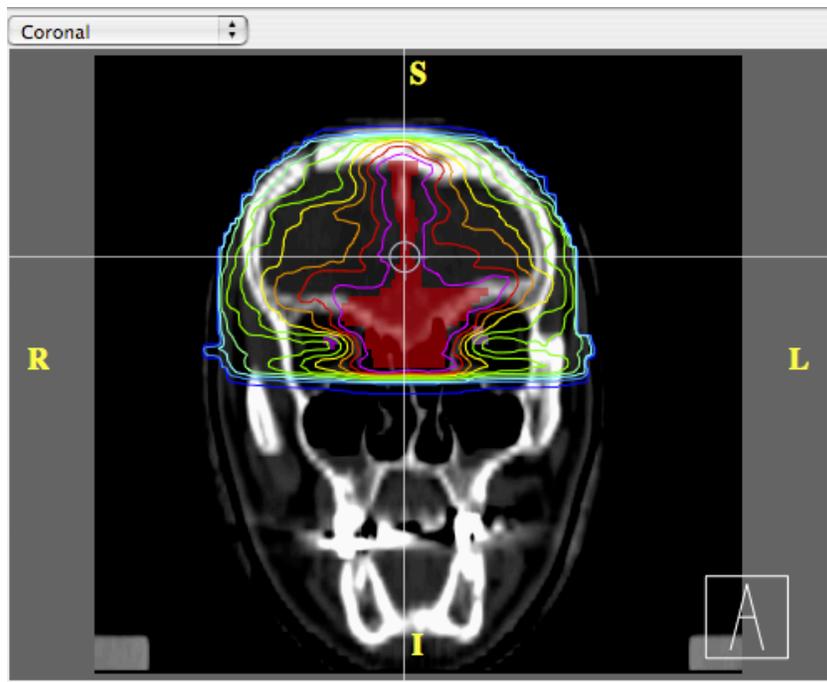
Target Name	Goal(Gy)	Vol Below Goal(%)	Min(Gy)	Max(Gy)	Mean(Gy)	Vol Below Goal(cc)	S
target	57.60	4.88	47.77	69.89	62.71	5.16	

Structure Name	Limit(Gy)	Vol Above Limit(%)	Min(Gy)	Max(Gy)	Mean(Gy)	Vol Above Limit(cc)	S
Tissue	57.60	5.35		69.89	16.11	152.25	
Non-target Tissue	57.60	1.89		68.84	14.31	51.75	
chiasma	55.00	12.27	27.04	58.65	43.83	0.09	
Optic nerve (R)	50.00	46.08	28.45	59.00	45.98	0.51	
Optic nerve (L)	50.00	45.36	27.04	59.00	45.34	0.49	
Orbit (L)	40.00	20.06	7.38	48.12	32.79	1.70	
Orbit (R)	40.00	20.04	8.78	48.82	32.41	1.68	
Brain stem	45.00		4.21	30.91	13.84		
Spinal cord	40.00		2.11	4.21	2.93		
Tissue Equivalent	12.00	100.00	14.05	46.36	25.27	1.99	

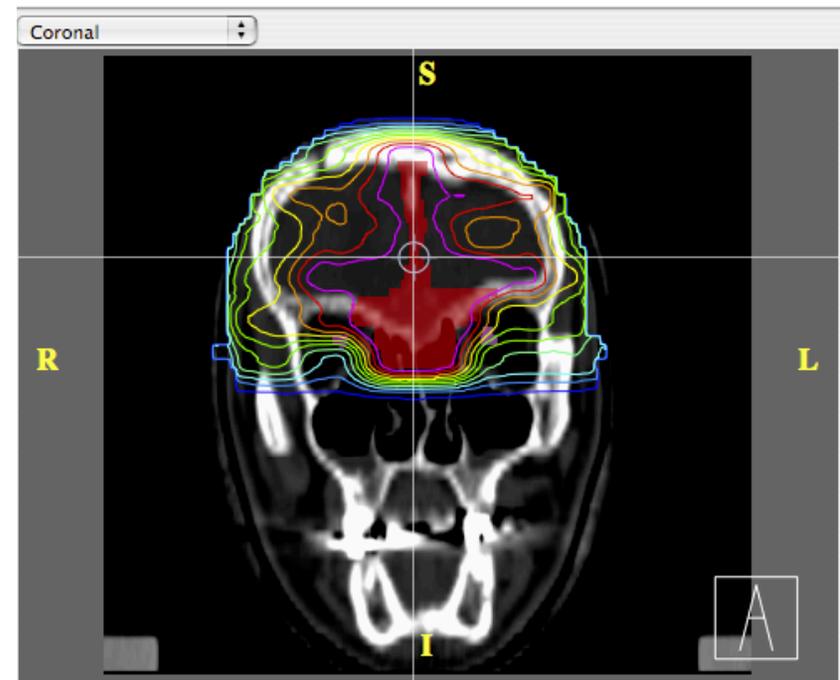
Goal(Gy)	Vol Below Goal(%)	Min(Gy)	Max(Gy)	Mean(Gy)	Vol Below Goal(cc)	S
57.60	5.17	49.42	74.32	63.69	5.46	

Limit(Gy)	Vol Above Limit(%)	Min(Gy)	Max(Gy)	Mean(Gy)	Vol Above Limit(cc)	S
57.60	6.38	1.11	74.32	18.36	181.31	
57.60	2.96	1.11	74.32	16.61	81.11	
55.00	2.44	28.99	55.74	41.08	0.02	
50.00	53.05	23.41	58.34	47.67	0.59	
50.00	47.69	29.36	57.60	46.87	0.52	
40.00	8.20	11.15	48.68	28.68	0.69	
40.00	23.91	10.41	48.68	31.38	2.00	
45.00		7.06	27.50	14.74		
40.00		3.34	9.66	5.82		
12.00	100.00	17.09	44.22	30.38		

Meningioma



Linac



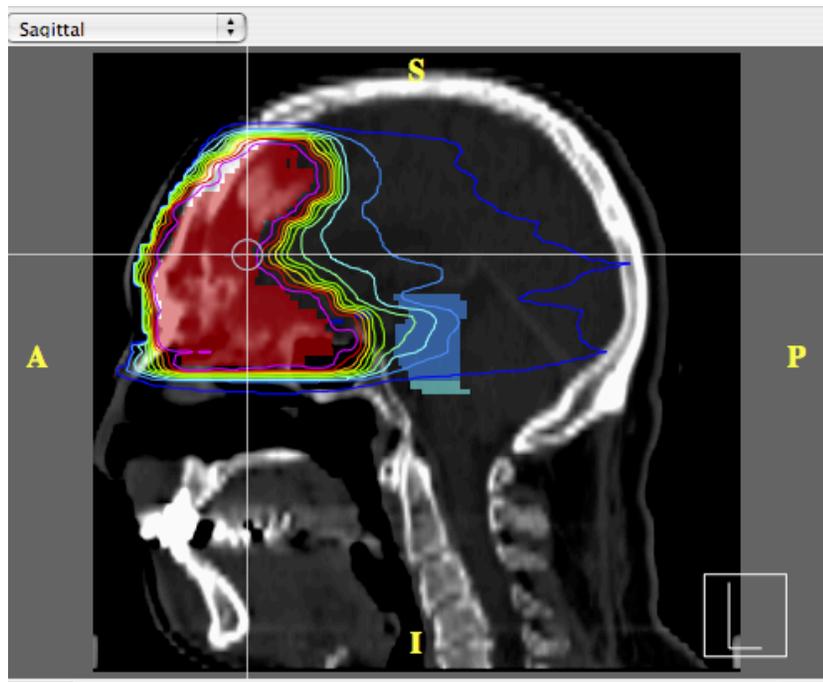
Cobalt

Meningioma

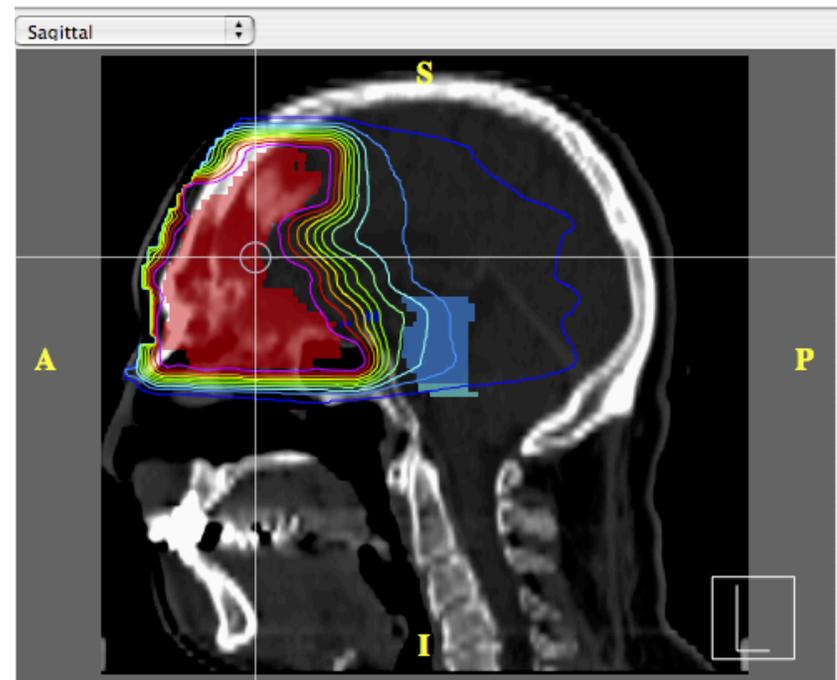


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Cobalt

Meningioma

- DVH for the two techniques are essentially the same.

- IMRT treatments of equivalent quality to those from 6/10MV linacs are theoretically achievable with Gamma units on the sites studied
- Gamma plans are at least as conformal as a Linac plan
- Gamma plans tend to be more homogeneous than the Linac plans
- Gamma has high uniformity of dose within the target (variability in hot/cold spots)
- With rare exceptions IMRT plans planned with Gamma from a Co-60 Tx unit are excellent
- They are more than appropriate for clinical delivery in a treatment slot of 15 minutes or less (including setup)
- The vast majority of cases - prostate, lung, head/neck brain & breast – can be treated without concern for plan quality as compared to a Linac-based IMRT delivery

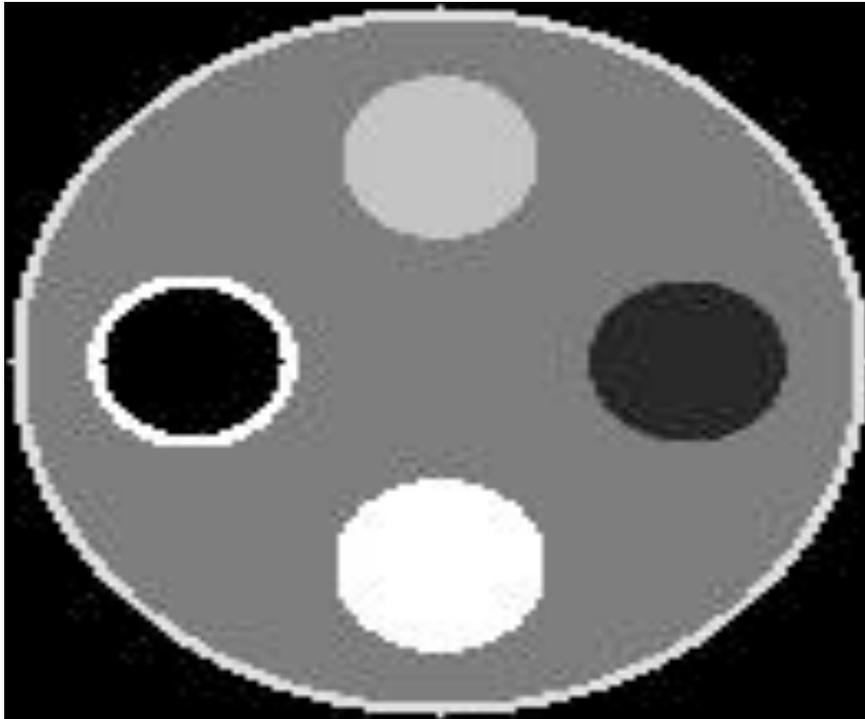


“If you want to walk fast, walk alone.
If you want to walk far, walk together.”

— African Proverb



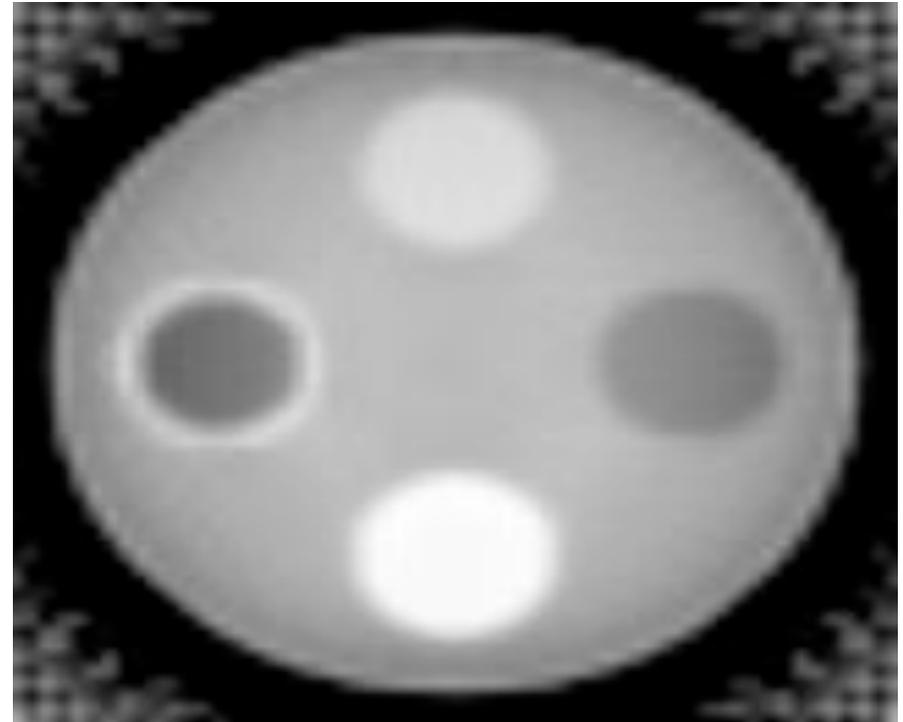
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3 cm cylinders in water: CT

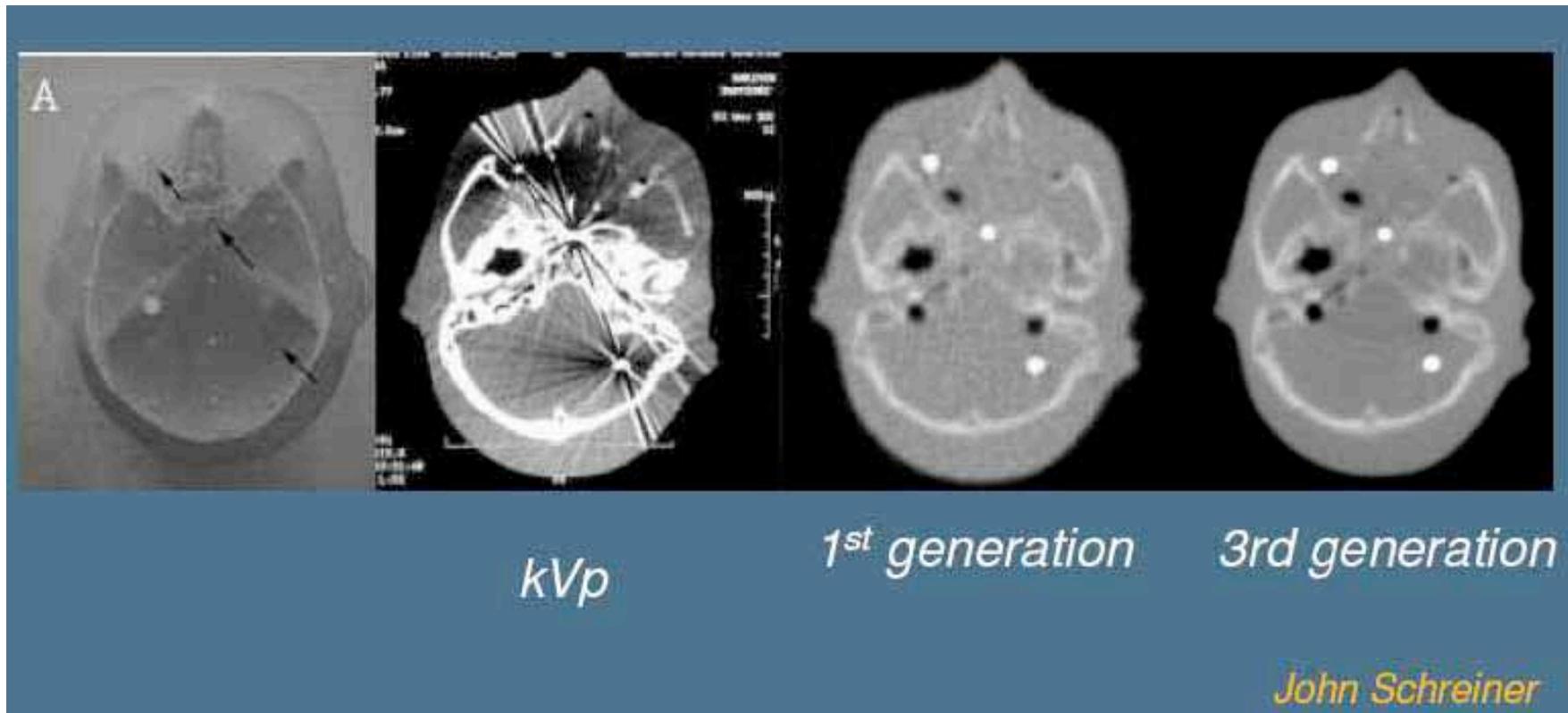
(computer simulation: 0.25 cm² pixels)

Schriener et al. (continuing studies)



3 cm cylinders in water: MVCT





**“I believe the power of our message
can trump governments and resistance
to positive change.”**

— Krishnan Suthanthiran



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Q: What is better than Cyber, Rapid, SRS or Tomo?

A: Best® Gamma Teletherapy™ ...it's a game changer

For more than 50 years, Best® Gamma Teletherapy™ Systems (Theratrons) have provided low-cost dependable service, delivering more than **one billion** cancer treatments around the world.



Theratron® Equinox™



Best® nomosSTAT™



Best® CORVUS™

Best® Gamma Teletherapy™ Systems

Can be equipped or upgraded with the latest IMRT, IGRT and SRS technologies including:

- Multi-leaf collimator (MLC) for IMRT
- nomosSTAT™ Serial Tomotherapy
- CORVUS™ Treatment Planning Systems with forward and inverse planning
- kV (single or dual detector) or MV imaging-based IGRT solutions

- Operate on 115 V AC or 230 V AC single phase, 2 kVA and require no special cooling
- Can be operated on a generator or solar power

These upgrades cost significantly less than comparable Linac based solutions with lower operating costs!

We have a number of financing options with low investment and monthly payments.

An Independent Comment

For more than 40 years, Linac manufacturers have been mimicking Theratrons (Best[®] Gamma Teletherapy[™] Systems) worldwide. Many of the newest technologies, costing a few to several million dollars, are using energies similar to Cobalt-60 energy (approximately 3.5 MeV), providing treatment for 4–30 patients per 8-hour day. Best[®] Gamma Teletherapy[™] Systems offer the same treatment for a fraction of the cost and still treat 30–40 patients per 8-hour day, with significantly lower operating costs.

Krishnan Suthanthiran



Best[®]

healthcare for everyone

**“CURE Foundation is a non-profit,
non-governmental, private organization
committed to reducing the cost of
healthcare and education.”**

**– Krishnan Suthanthiran
Founder/President**

“A healthy person has many wishes, but the sick person has only one.” — Indian Proverb



GLOBAL 2020

USA 2020

“Everyone deserves the best healthcare. Education is the most effective way to eliminate poverty and promote global understanding and peace.”

— Krishnan Suthanthiran

“World population is increasing by more than 100 million per year. To meet the needs of our aging and growing population, CURE Foundation is committed to making quality healthcare affordable and accessible globally.”

— Krishnan Suthanthiran



“The CURE Foundation plans to set up more than 1000 cancer centers worldwide during the next ten years, starting in 2010, to significantly reduce the cost of cancer diagnosis and treatment. We will be partnering with existing hospitals, international agencies, public and private institutions and government.”

— Krishnan Suthanthiran

CURE Foundation's aim is to:

- Reduce the cost of healthcare worldwide by 30 percent or more
- Launch the CURE Total Health™ Program
- Increase transparency through CURE Proactive Healthcare™
- Establish:
 - Express/mobile clinics and medical centers as non-profit, private, non-governmental organizations that are self sustaining
 - CURE U.S. Health Corps
 - CURE International Health Corps
 - CURE Global Institute
 - CURE Global Standard of Care
 - CURE Global Purchasing Organization
 - CURE Global Insurance



Best[®] Total Solutions[™]

Integrated Solutions for Prostate Cancer Management



Best[®]

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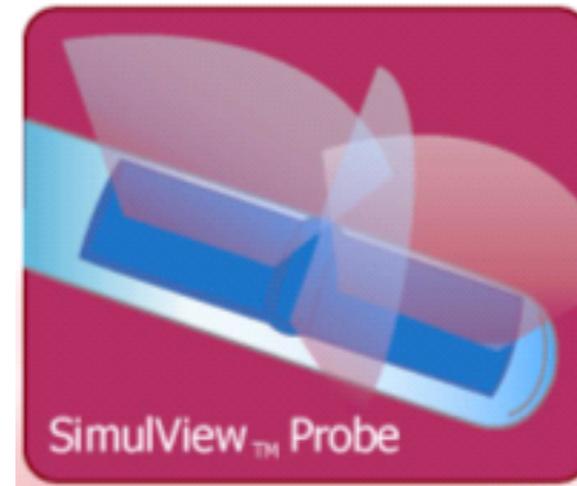
Sonalis Manufacturing



Imagine having the ability to...

- Precisely locate cancerous lesions within the body
- Plan ultra-conformal treatments using “dose sculpting” technologies
- Accurately guide treatments to these lesion sites in real-time
- Have an integrated system of products that exchange data seamlessly and ties all elements of diagnosis, planning and treatment in One Total Solution

US Image Guidance – Sonalis Simulview

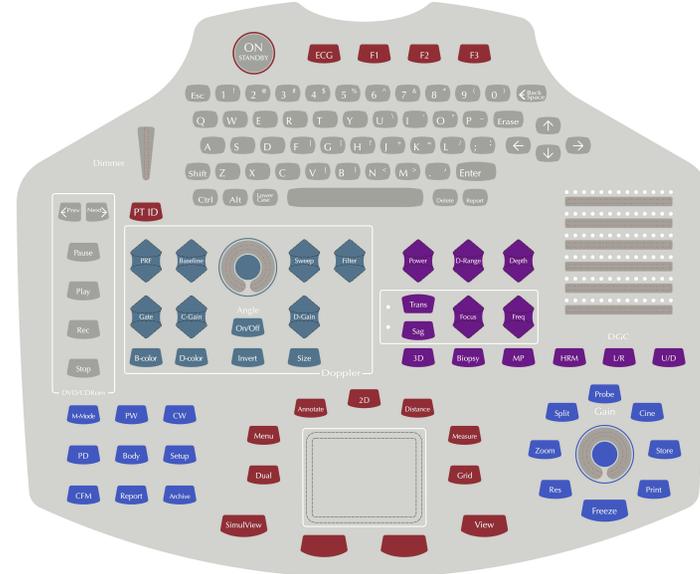


- Simultaneous bi-plane viewing of target
- 14 cm Length of View in Sagittal
- Precise US image-based targeting & localization for biopsies and implants
- Other probes: breast, lap, curved array

Sonalis Keyboard Update



Old traditional style keyboard design



New antimicrobial sealed keyboard with SensiFoil™ technology

Integrated Imaging Solutions

Integrated Pathology Data Displays

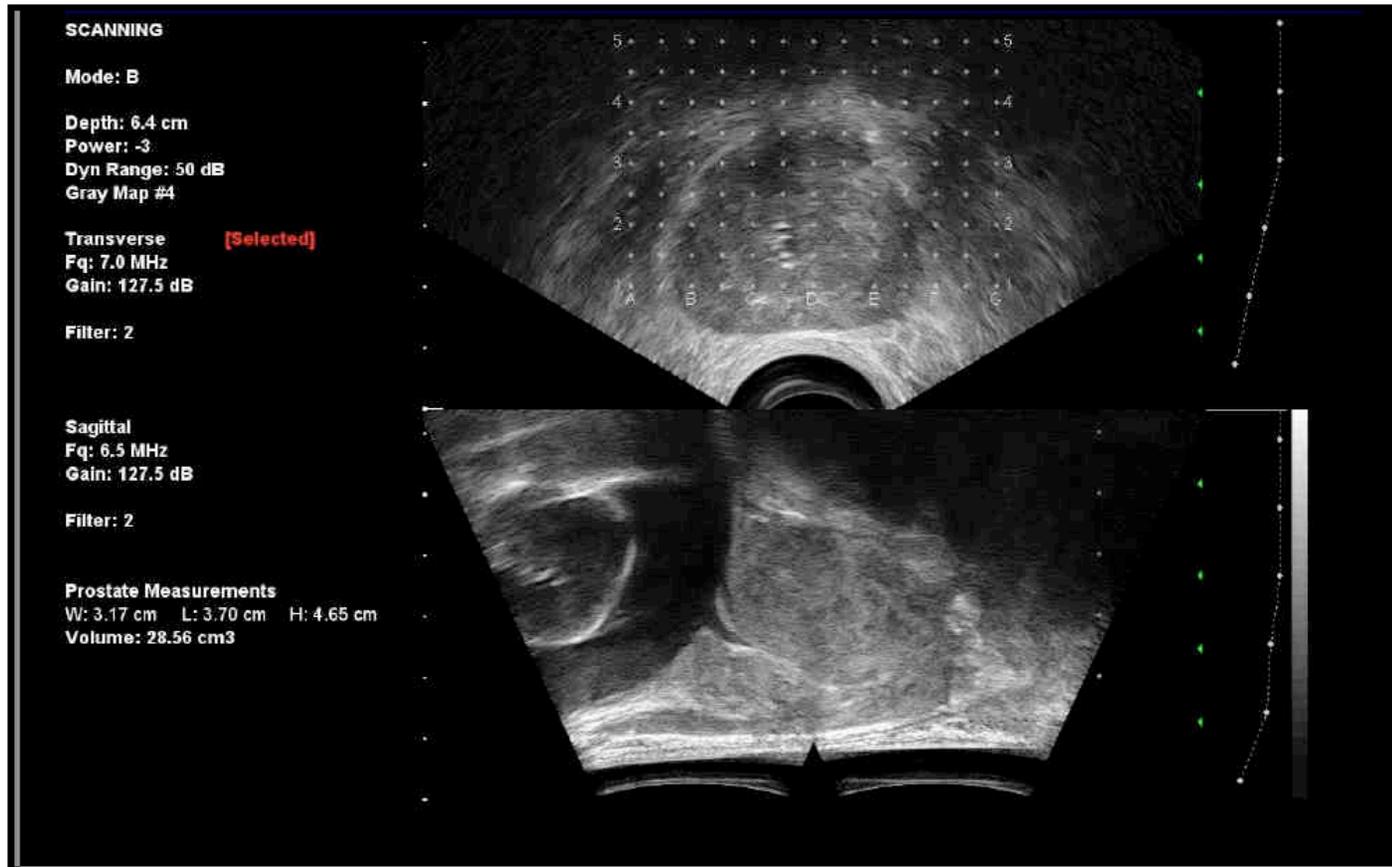
Sample ID: 21: D-3-A
Gleason: 6

Integrated Dosimetry Displays

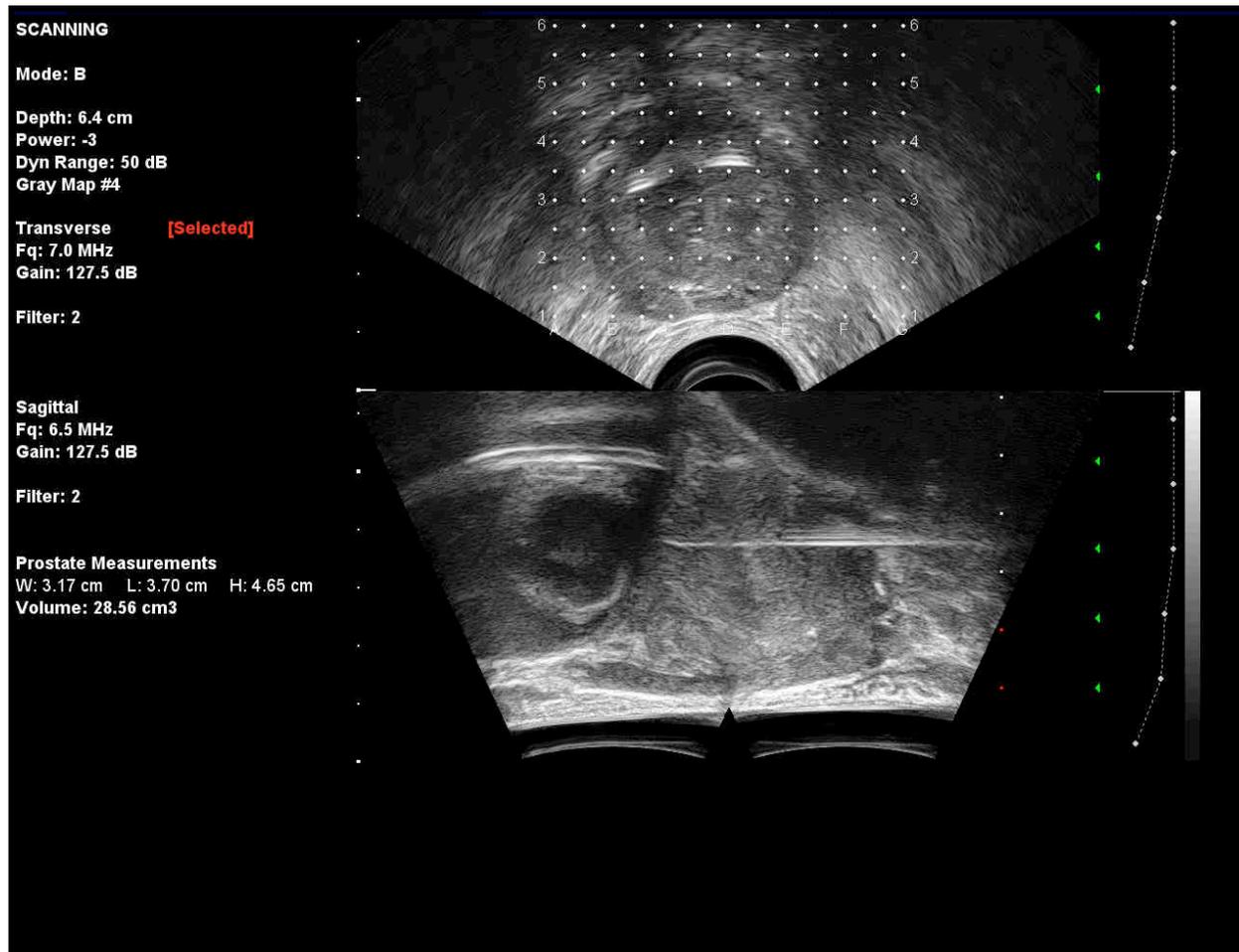
Sample ID 21: D-3-A
Gleason: 6

Superior Imaging
Simultaneous Bi-Plane Viewing

Real-time Fluoro-US Image Fusion



SimulView Image with Balloon in Bladder, Seminal Vesicles, Urethra and Bulb Clearly Visible

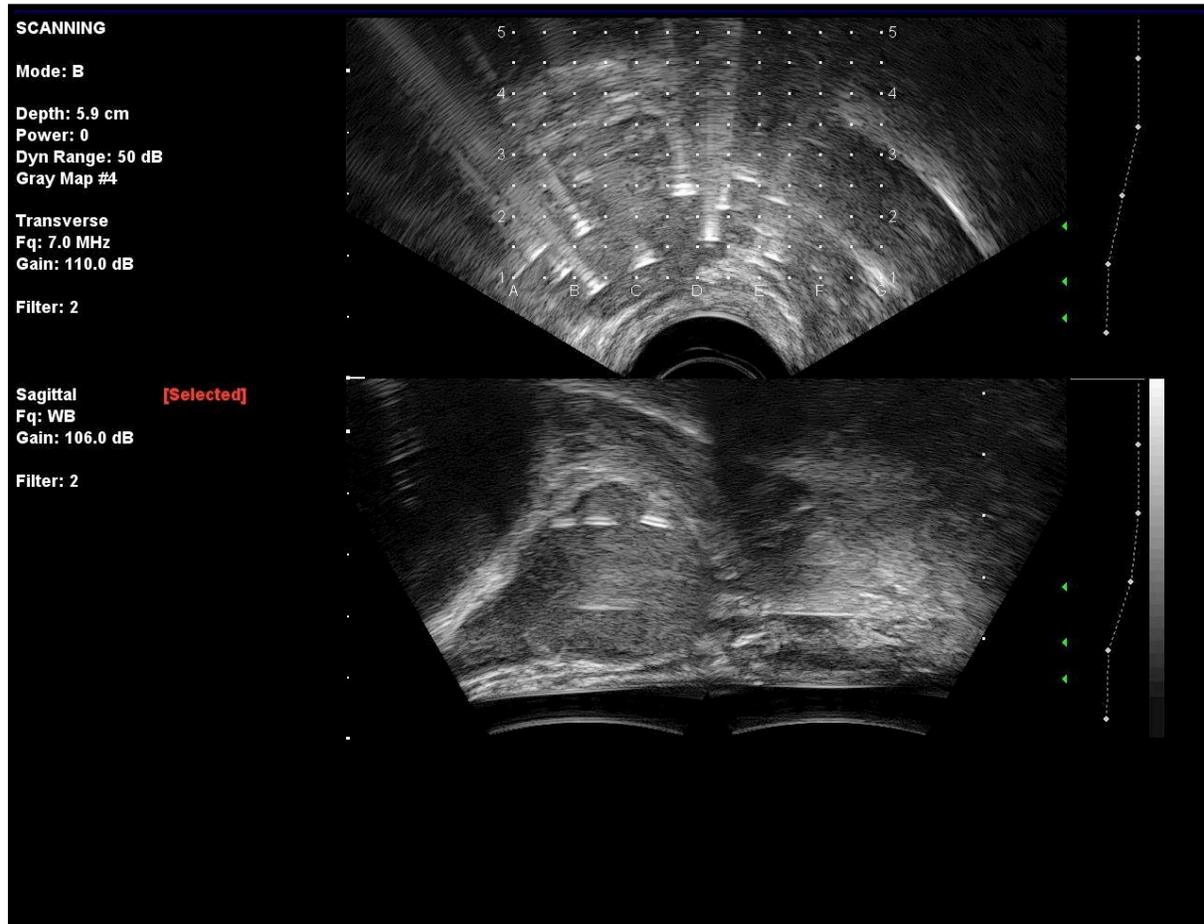


SimulView Image Resolving Entire Length of Implant Needle

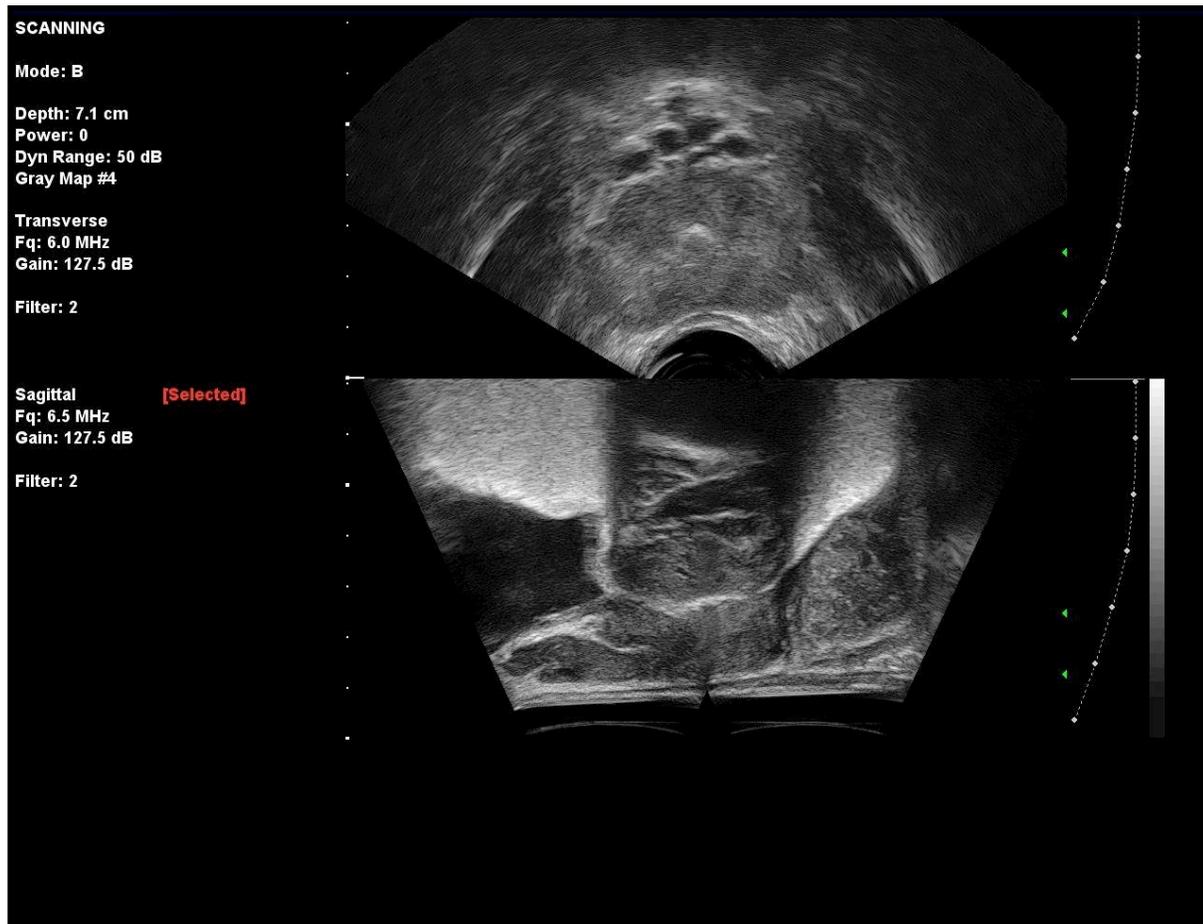


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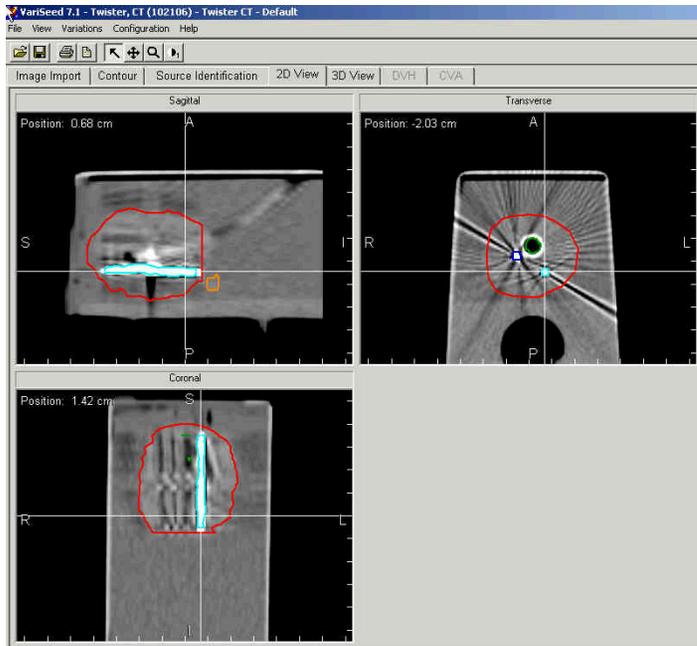
healthcare for everyone



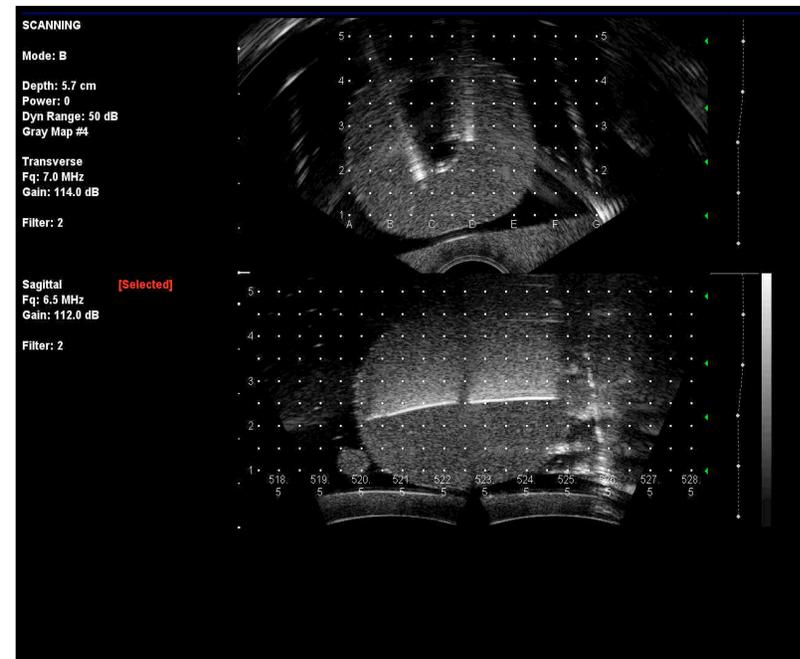
SimulView Image Resolving Seed Train



SimulView Image without Catheter Resolving Venus Plexus, Urethra, Seminal Vesicles and Bulb



CT Image Resolving a Single Fiducial Marker



Sonalis Image Resolving Two Fiducial Markers



MediBoard

The PC keyboard for medical environments



healthcare for everyone

MediBoard without Mousepad

- Integrated numeric keypad
- Keyboard with 105 keys
- Antimicrobial surface
- Viruses & bacteria don't have a chance
- Plug & Play - no installation needed
- Can be fully disinfected without disconnecting



MediBoard with Mousepad

- Integrated numeric keypad
- Keyboard with 90 keys
- Antimicrobial surface
- Viruses & bacteria don't have a chance
- Plug & Play - no installation needed
- Can be fully disinfected without disconnecting



Fluoro-US Imaging Integration

- Remanufactured OEC 9xxx series C-Arms
- Affordable imaging solutions for prostate brachytherapy

Future Directions:

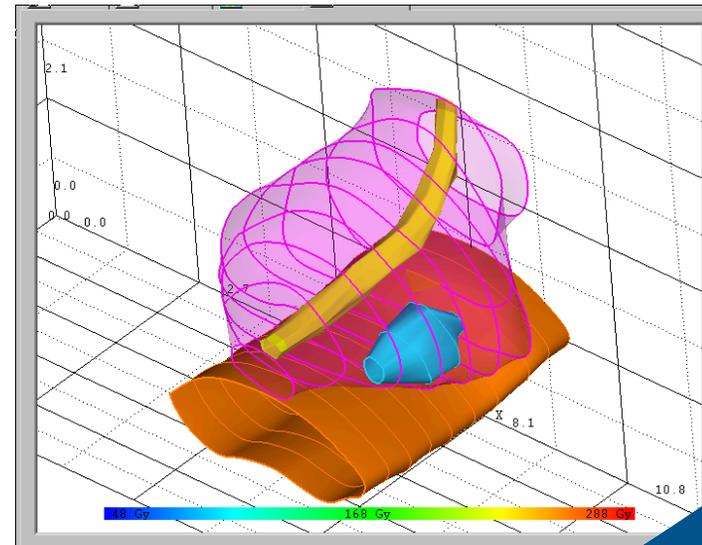
- R&D underway to develop US-Fluoro fused OR Dosimetry solutions
 - Stereo Images
 - Limited angle CT reconstruction techniques



- Laptop based TPS
 - Concurrent 2D/3D Visualization
 - Easy to use GUI workflow
 - Planning templates



- Future Directions:
 - Pathology mapping/
octant dosimetry
 - Integrated data flows
between pathology
and treatment planning





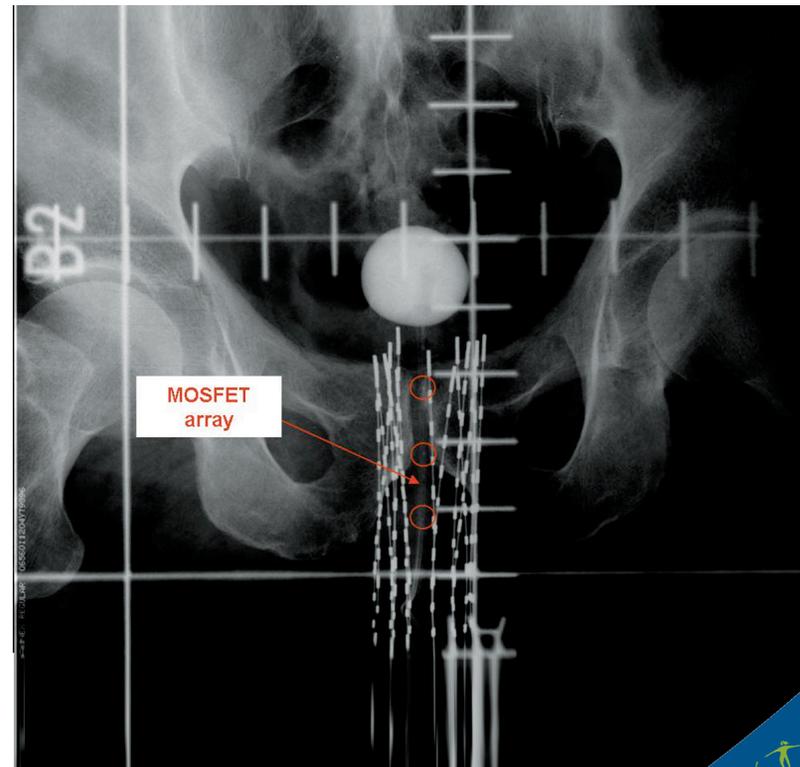
MOSFET Dosimeters

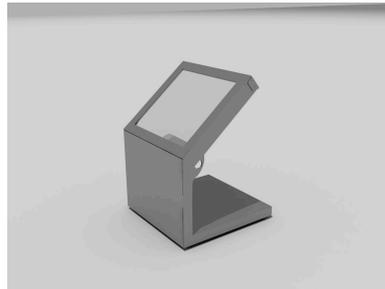
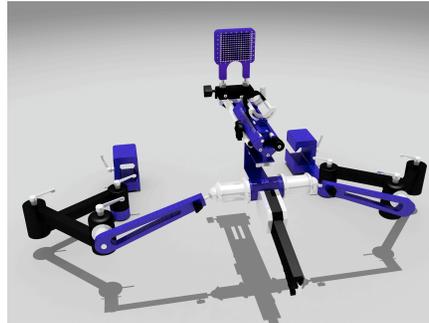
mobileMOSFET Wireless & Portable Dosimeter
Dose Verification Systems



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- The first and only commercially available combination that allows for the real-time quality assurance of all brachytherapy procedures, without a significant investment in extra time
- The Linear Array is used for various HDR applications such as prostate and gynecological Brachytherapy using model TN-252LA5
- When placed on the surface of the breast, the array can also validate MammoSite[™] treatments





- We also manufacture a complete line of other products required for the brachytherapy procedure including well-chambers, chairs, stepper/stabilizers, shielding blocks
- We also manufacture a broad line of loose and stranded fiducial markers

Total Solutions[®]

Best[®]
healthcare for everyone

Best's Prostate Brachytherapy product portfolio includes not only radioactive sources but also a complete line of Patient Positioning, Treatment Planning, Guidance, Delivery and Verification products. This breadth of product portfolio is unmatched in the industry.

Multi-Modality Image Fusion Overlays (MRS/PET)

Real Time OR – Dosimetry Overlays

TPSB Support – Pathology Mapping

TRUS Biopsy

Application Software Upgrades

Laparoscopic Probes

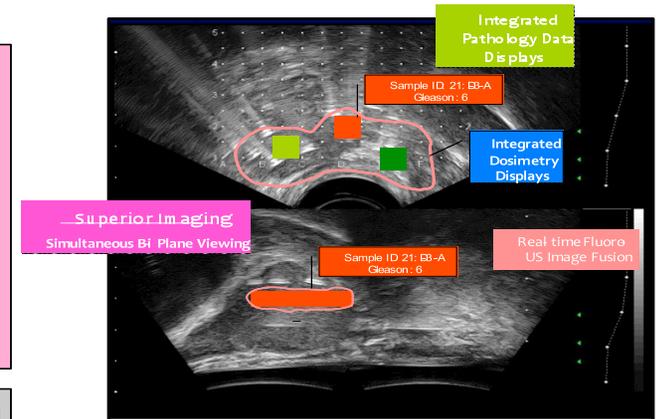
Breast SimulView

Biopsy End-Fire

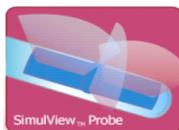
Probe Development

Hardware Improvements – Better Imaging

Sonalis SimulView Imaging Technology Platform



**Integrated Imaging
Displays**



Integrated Imaging Displays



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- Total Solutions™ is a collection of “best-in-class” products *manufactured* by members of the Team Best family of companies
 - This breadth of product portfolio is unmatched in the industry
- The Total Solutions™ includes several cutting edge products such as the Sonalis ultrasound which are being upgraded to support advanced capabilities required for delivering focal therapies
- Best also has Total Solutions™ for external beam based treatments for prostate as well as other cancers

Thank you

Acknowledgements and special thanks to:

- Jake Van Dyk
- Jerry Battista
- John Schreiner
- Paul Ravindran

“Life is a gift from our parents. Our career is the outcome of what we do with the gift. We can look at every obstacle as an opportunity or every opportunity as an obstacle. Who we are, what we are, and where we are have a lot to do with the choices we have made and the ones we did not. We are born to live, and live to enjoy and cherish our gift.”

— Krishnan Suthanthiran



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7643 Fullerton Road, Springfield, VA 22153
phone 703 451 2378 800 336 4970 www.teambest.com

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