Experience Elekta

Human Care Makes
the Future Possible

ELEKTA

Elekta - a partner and world-leading supplier…

…of clinical solutions for
image guided radiation therapy,
stereotactic radiotherapy,
radiosurgery and brachytherapy,
as well as advanced software
systems for cancer care

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Elekta Neuroscience

Leksell Gamma Knife®
Leksell Stereotactic System®
Elekta Neuromag®

Elekta Oncology

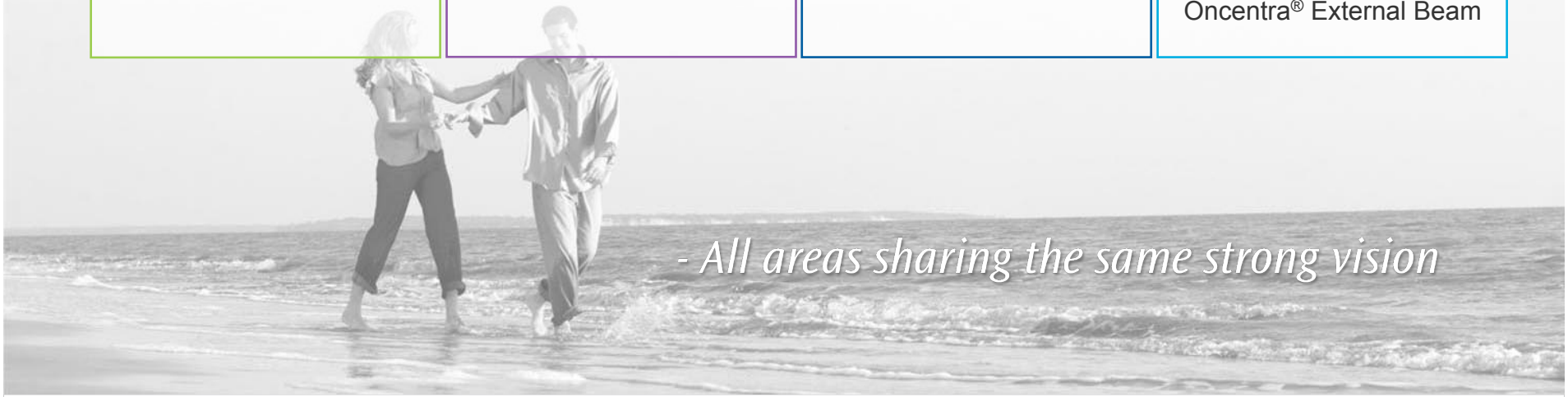
Elekta Axesse™
Elekta Synergy®
Elekta Infinity™
Elekta Precise™
Elekta Compact™

Elekta Brachytherapy

microSelectron®
Flexitron
Oncentra® Brachy Applicators

Elekta Software

MOSAIQ®
Monaco®
XiO®
METRIQ®
ANALYTIQ®
Oncentra® External Beam



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Elekta - stronger than ever

Elekta
Neuroscience

Elekta
Oncology

Elekta
Brachytherapy
Solutions

Elekta
Software

Every year…

- Close to 1,000,000 patients receive treatment with radiation therapy and radiosurgery equipment from Elekta
- Whereof 60,000 patients undergo Gamma Knife® surgery

Every day…

- 100,000 patients receive diagnosis, treatment or follow-up facilitated by software systems from Elekta companies

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Our mission, vision and values

We care for life!

Pioneer and partner in cancer care

- Long-term relationships
- Trust and responsibility
- Creativity
- Resourcefulness
- Responsiveness

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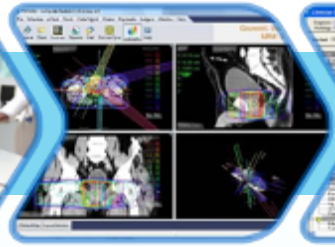
Supports the entire chain of cancer care

Patient consultation	*Diagnosis*	*Treatment Planning*	*Schedule appointments*	*Treatment delivery*	*Summary & follow up*
					
Hospital Information Systems ⋮ Automated documentation	Imaging	MONACO® XIO® Oncentra® ⋮ MOSAIQ® Data Director	Integrated Scheduling management System	Radiation Therapy Chemotherapy Surgery ⋮ SYNERGISTIQ™ ⋮ Connect any linear accelerator	Reporting ⋮ Billing ⋮ Survivorship

Data reporting, aggregation and visualization
Highly configurable, extendable rules and scripting infrastructure

Expansive set of interfaces to bridge gaps to HIS

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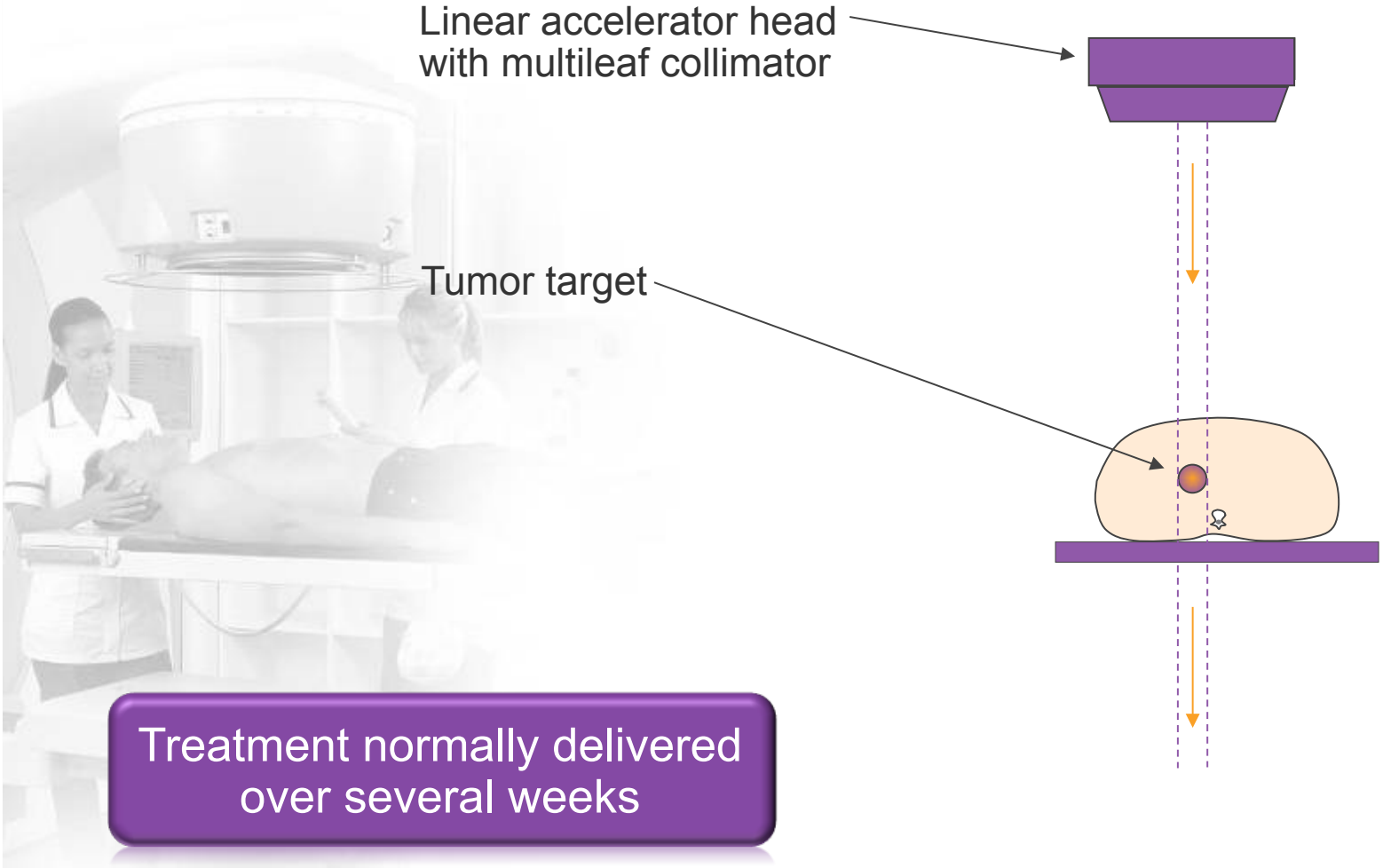
Radiation therapy - principles



Treatment normally delivered over several weeks

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Challenges in Radiation Therapy

- Organ movement
- Patient positioning

Creating the need for

- Target visualization at the time of treatment

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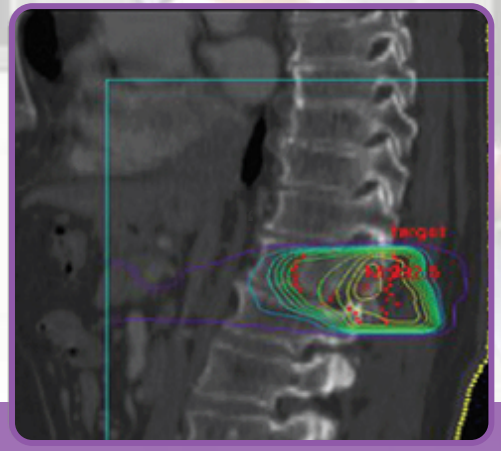
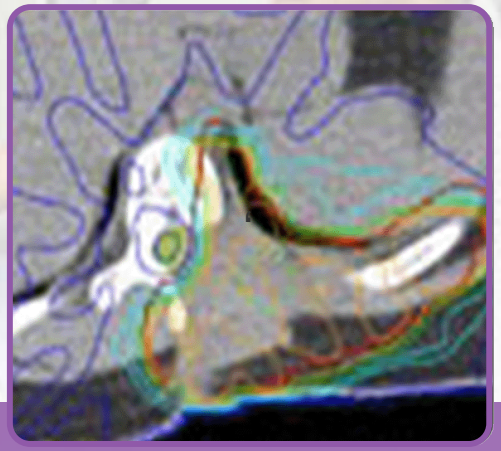
Main objectives of radiation oncology



Maximize dose to tumor



Avoid adjacent critical structures

High quality, efficient delivery

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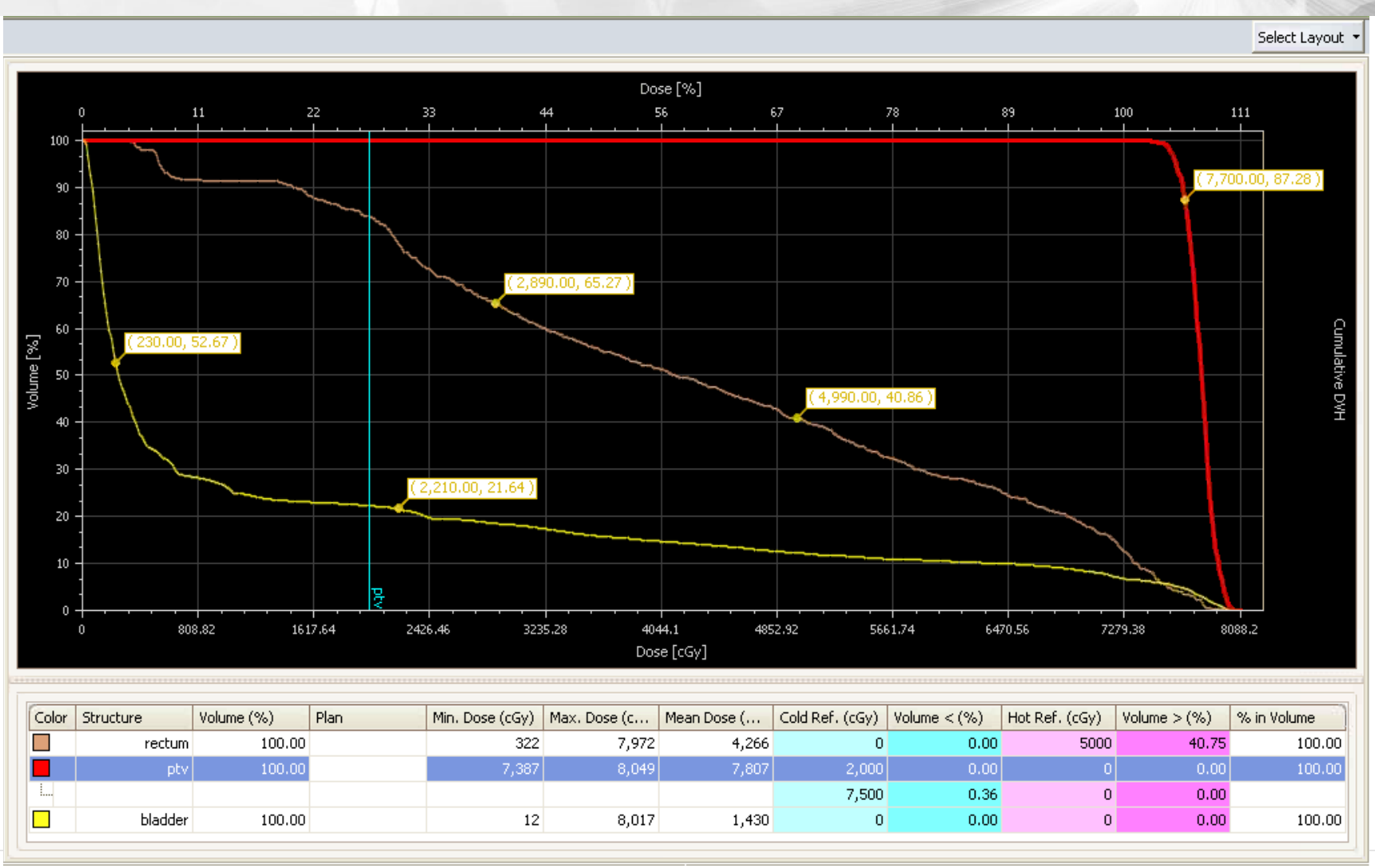
Physicists are a critical part of CA Therapy



Color	Structure	Volume (%)	Plan	Min. Dose (cGy)	Max. Dose (c...	Mean Dose (...	Cold Ref. (cGy)	Volume < (%)	Hot Ref. (cGy)	Volume > (%)	% in Volume
	rectum	100.00		322	7,972	4,266	0	0.00	5000	40.75	100.00
	ptv	100.00		7,387	8,049	7,807	2,000	0.00	0	0.00	100.00
							7,500	0.36	0	0.00	
	bladder	100.00		12	8,017	1,430	0	0.00	0	0.00	100.00

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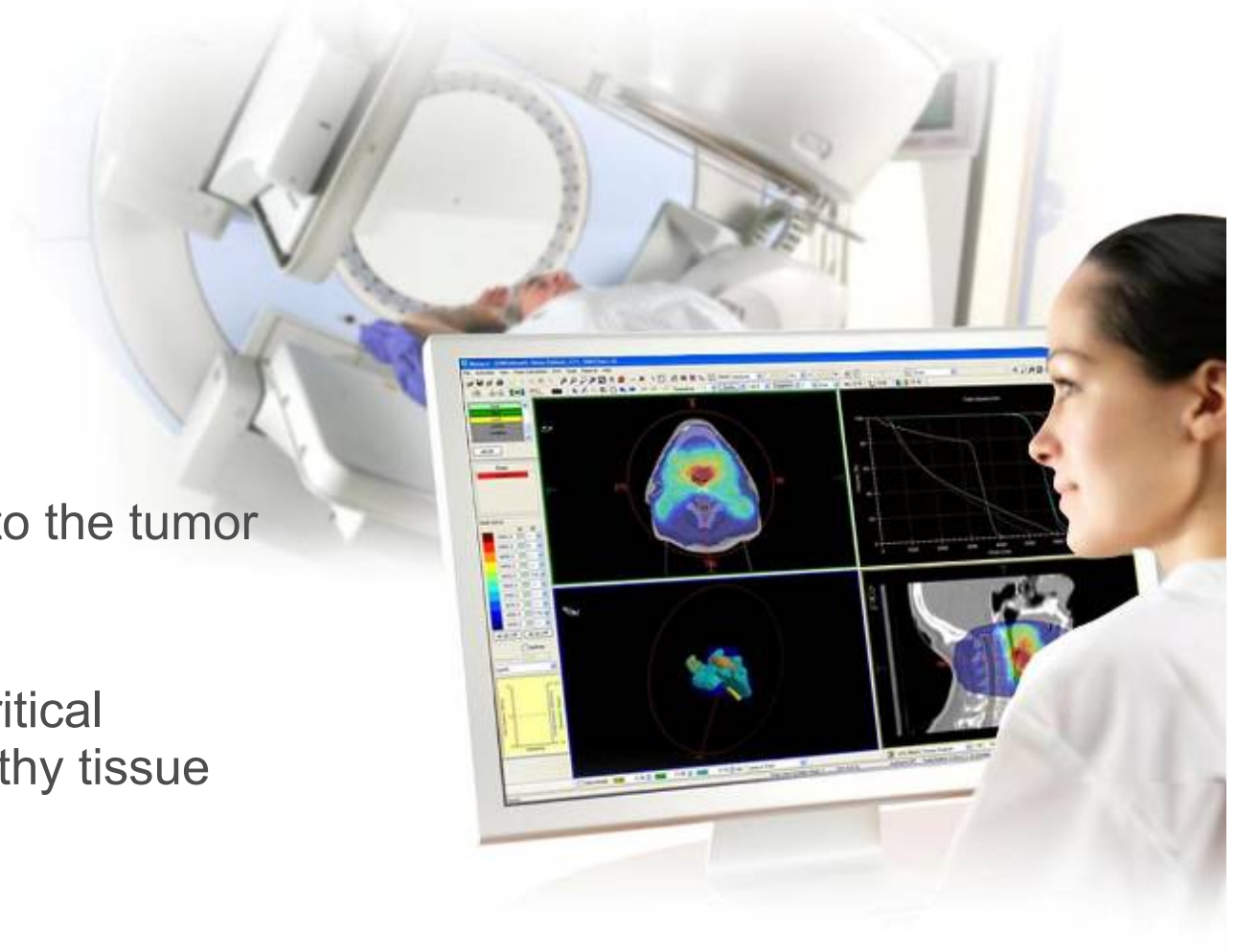
Elekta VMAT

Volumetric intensity modulated arc therapy



- Best conformance to the tumor
- Speed of treatment
- Ultra-low dose to critical structures and healthy tissue

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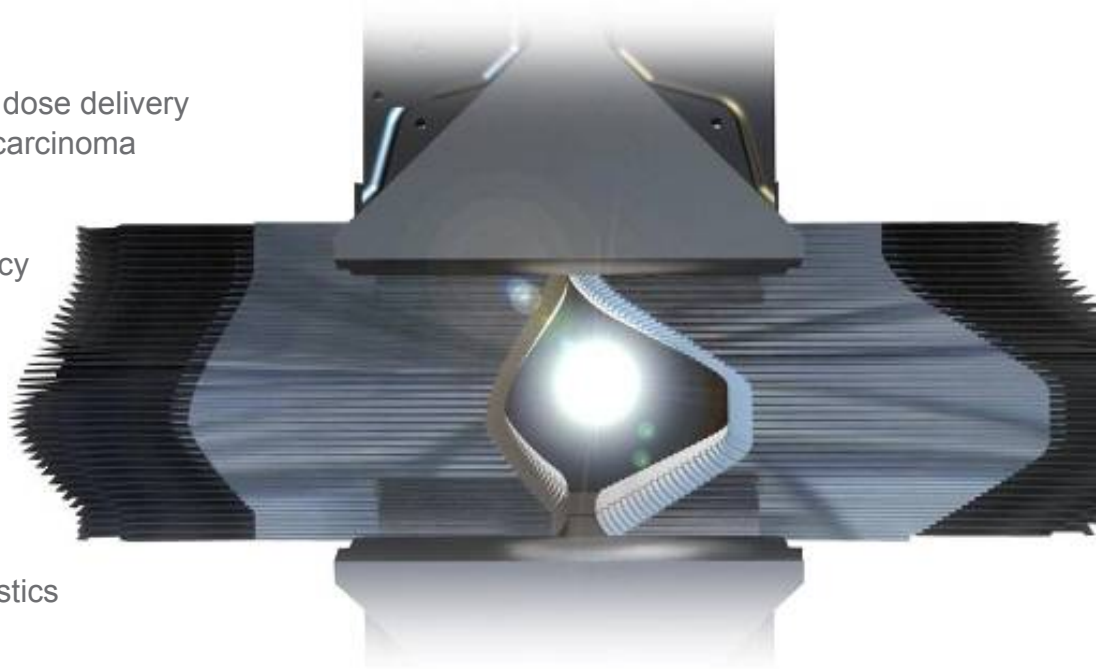
Agility™- Clinical benefits

- Patient comfort
  - Due to wide clearance
  - Important for oblique techniques; breast, head & neck
- Minimize unwanted dose
  - Due to extremely low leakage
  - Important for paediatric, secondary cancers
- Critical structure avoidance
  - Due to very tight penumbra for accurate dose delivery
  - Important for prostate, nasopharyngeal carcinoma
- Shorter treatment times
  - Due to highest speeds, with high accuracy
  - Important for lung
- Improving clinical efficiency
  - Due to optimizing VMAT treatment
  - Important for all localizations
- Facilitating clinical workflow
  - Due to optimal beam shaping characteristics
  - No need for blocks



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Clarity®

Superior soft tissue visualization

- 4D imaging platform for radiation therapy that provides
  - Accurate, structure-based IGRT
  - Safe and gentle for patients
  - Integrated clinical workflow
  - Great future potential in motion management
  - Intuitive and ease-of-use

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Trends in Cancer Therapy
The Last 30 Years…

- Stable approach to Radiation Therapy before the 90's
- Explosion of innovation then followed
  - IMRT, IGRT, ART
- Will the next phase be more innovation or consolidation?

Future trends – mainly consolidation

- Cost pressure
  - Reimbursement, expense control, throughput and operating profit
- Clinical evidence
  - Compliance with standards of care is associated with better outcomes and lower costs
- Safety
  - Many view the explosion of innovation as being detrimental to patient safety
    - E.g. users abdicating responsibility to computer control
    - The very way we think about safety is evolving
  - However, many new innovations actually improve safety e.g. R&V, IGRT
- Clinical research to develop new techniques will only be performed in 'approved centres'
  - Need to be demonstrably clinically meaningful
  - Possibly supported by innovative equipment like the MRI linac

Clinical evidence

- Eliminate actions that have no clinical benefit
  - ‘Eliminate inappropriate variability’*
- Pressure will be to create good clinical evidence
- Only clinics that are performing trials will be able to deliver non-standard techniques
  - Requires collaboration with the adjuvant therapies included in pathway
    - Surgeons, Medical Oncologist, Pharma
- Potentially slow down adoption of new technology
  - More difficult to demonstrate benefit
  - Competition will be ‘glamour technologies’ which defy logic

* The Advisory Board Company

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Pathways
Standard Operating Procedures - SOP

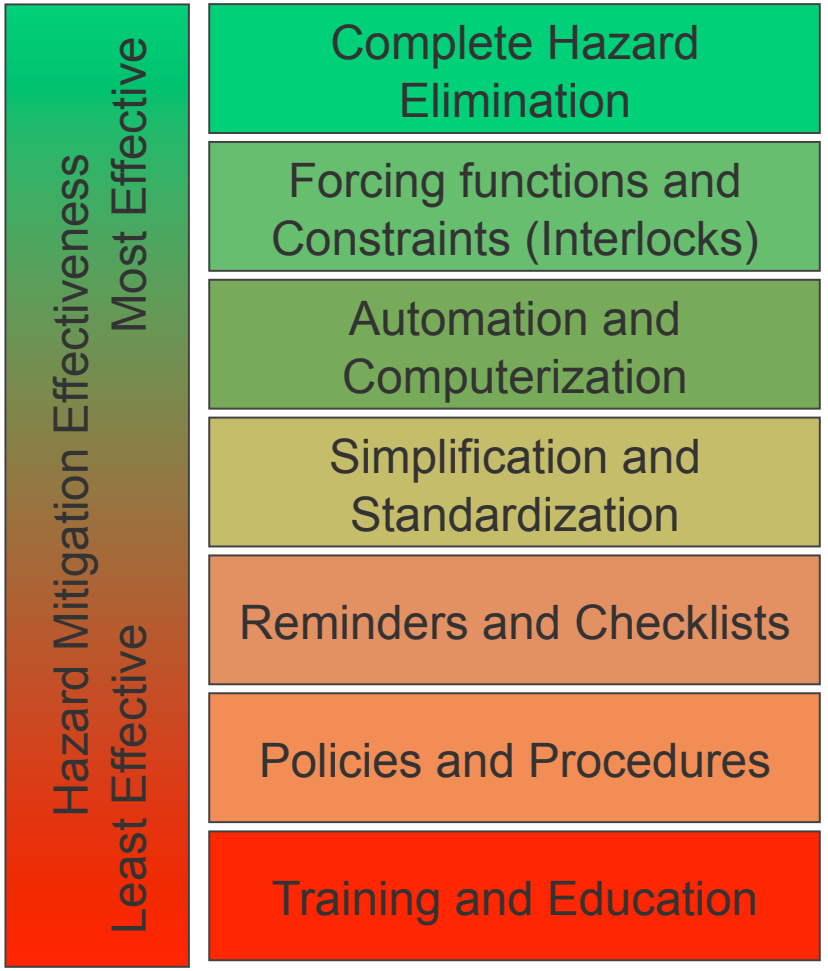
- Evidence based actions will be preferentially reimbursed
- This will result in a limited set of clinically based Pathways
  - Cover the complete process not just delivery
- The equipment design can be optimised for the execution of these Pathways
  - Workflow management will be key
  - Make it easy to follow the pathway and require justification to deviate
  - Involvement in development and delivery of the Pathways will be a key advantage

Hierarchy of Hazard mitigation

Safety experts regard processes towards the top as being most effective, and those towards the bottom to have the least impact.

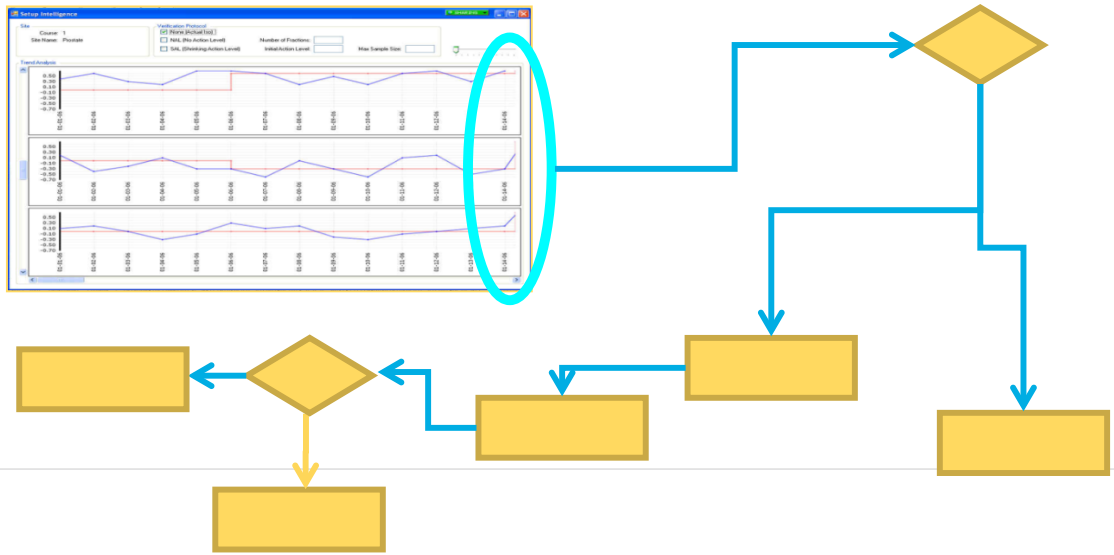
Industry endeavors to…

- Completely eliminate hazards where possible (and practical)
- Leverage those at top as much as possible (and practical)
- Minimize use of strategies at bottom



Workflow Manager - Components

- IQ Scripts
  - Ability for user to define process i.e. the content
  - Graphical Script Designer
- Automation Engine
  - Progresses the process in the absence of the user whenever possible



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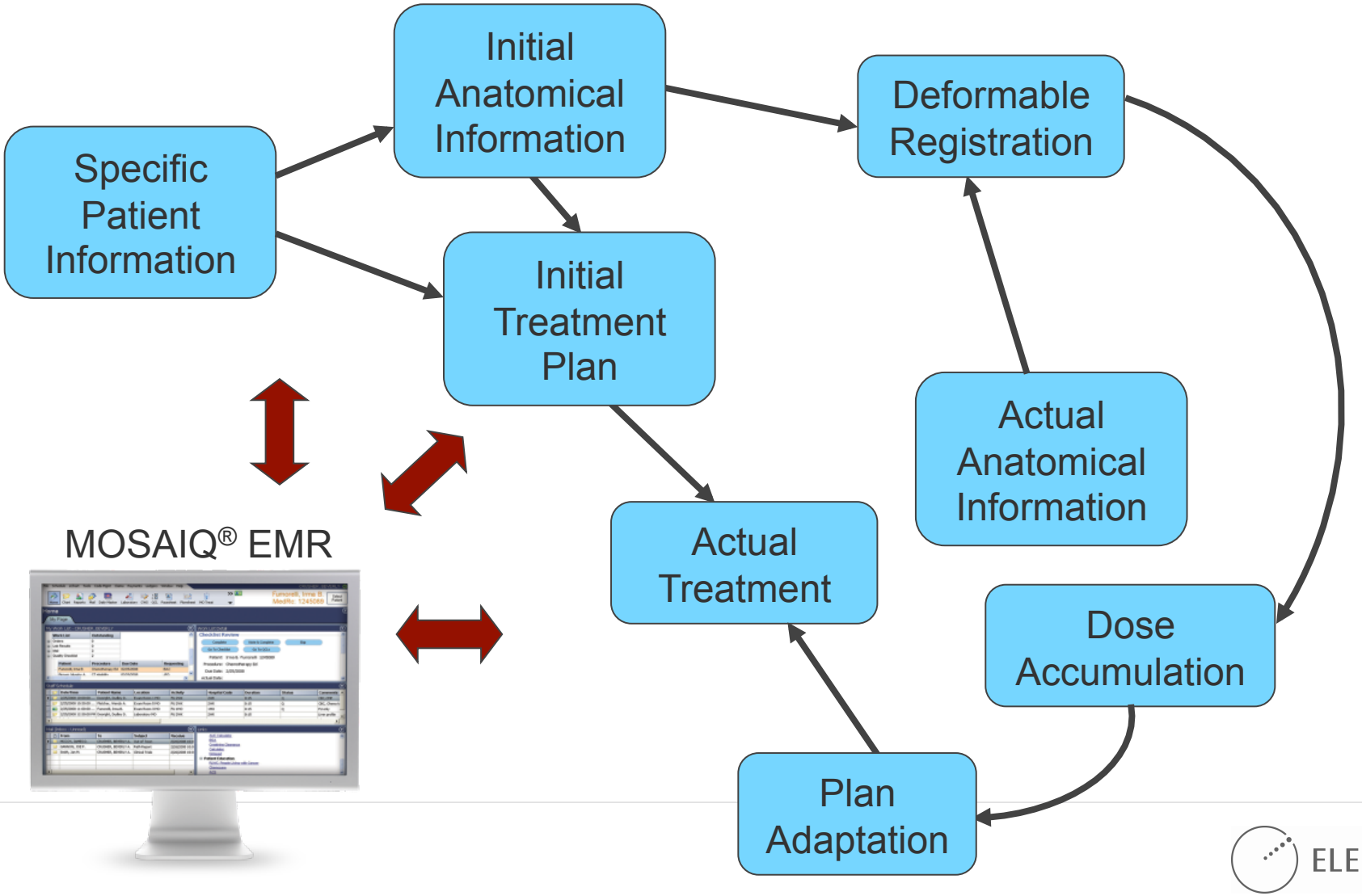
Possible future Dose-Guided Treatment Model



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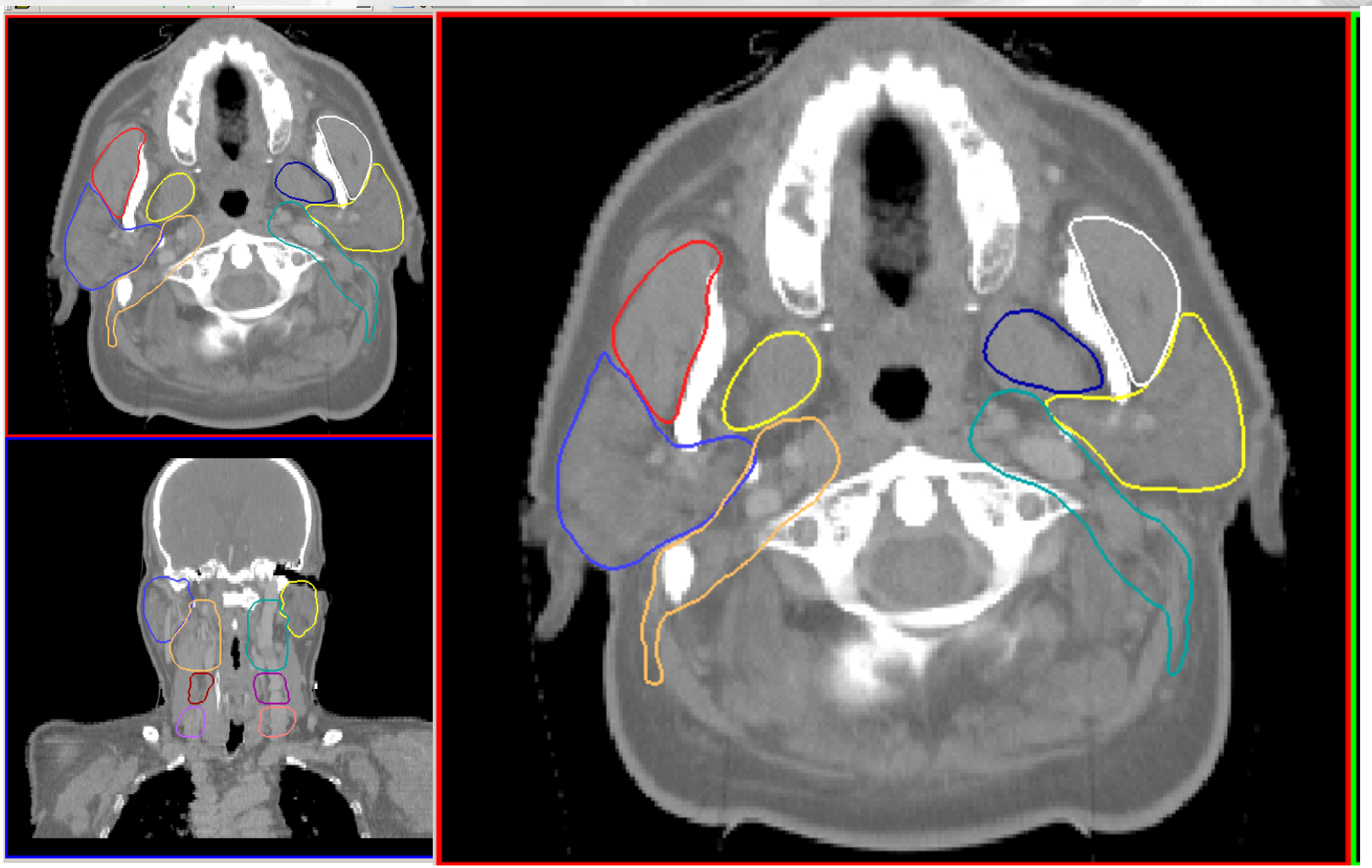
ABAS
Industry Leading Automatic Segmentation



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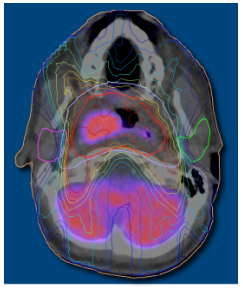
Biological- and Dose-based models

- Dose-based models look at a singular value to determine compliance (i.e. 95% coverage to the tumor)
- Biologically-based models take into consideration the volume effects of the tumor and critical structures in addition to the dose information

Serial
(small volume effect)

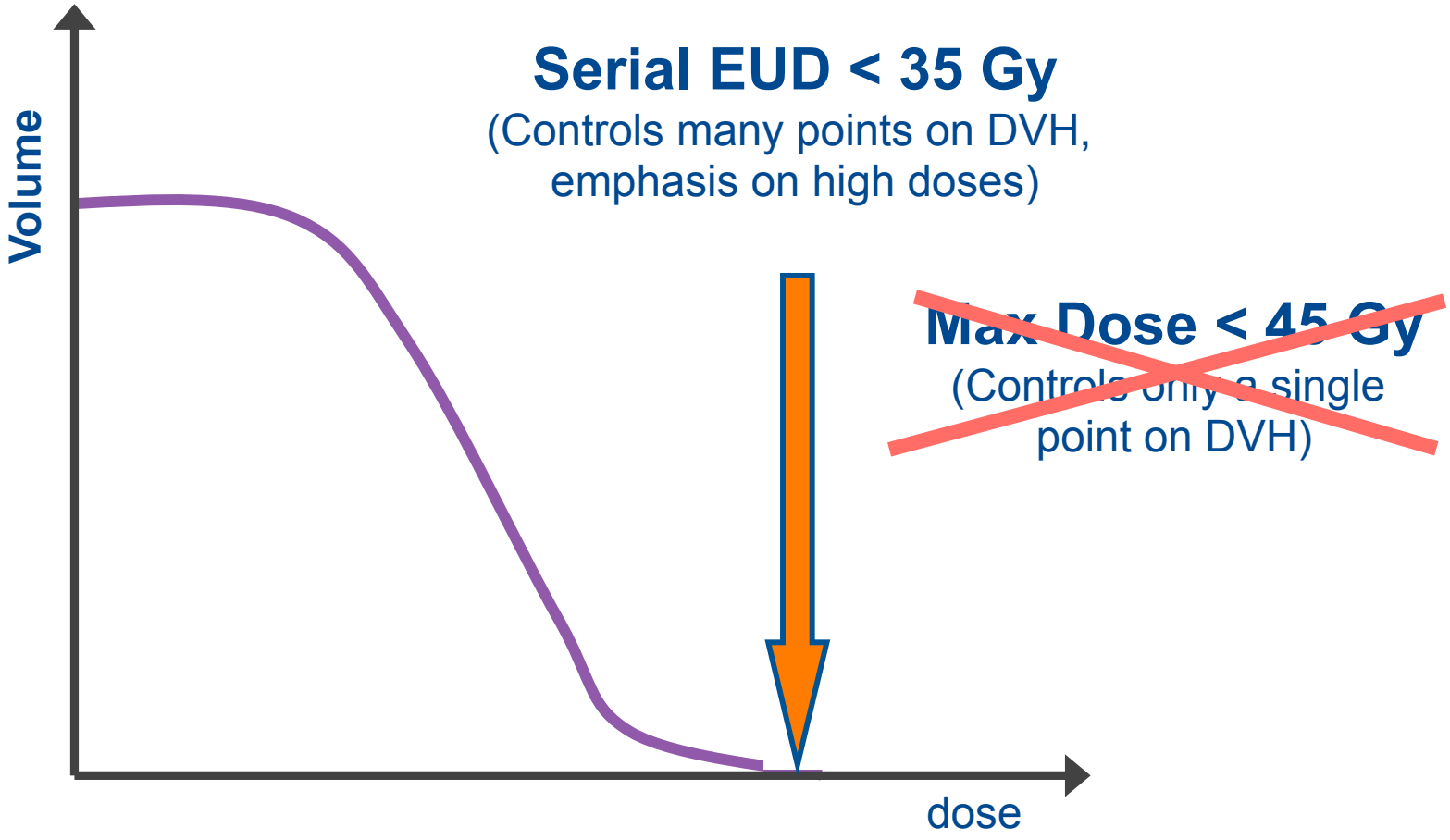
Parallel
(large volume effect)



Tumor
(sensitive to cold spots)

Biological cost functions allow us to *control the shape of the DVH…*

Biological Modeling:
Controlling the DVH Serial Tissues e.g Spinal cord



Serial EUD < 35 Gy

(Controls many points on DVH, emphasis on high doses)

~~**Max Dose < 45 Gy**~~

~~(Controls only a single point on DVH)~~

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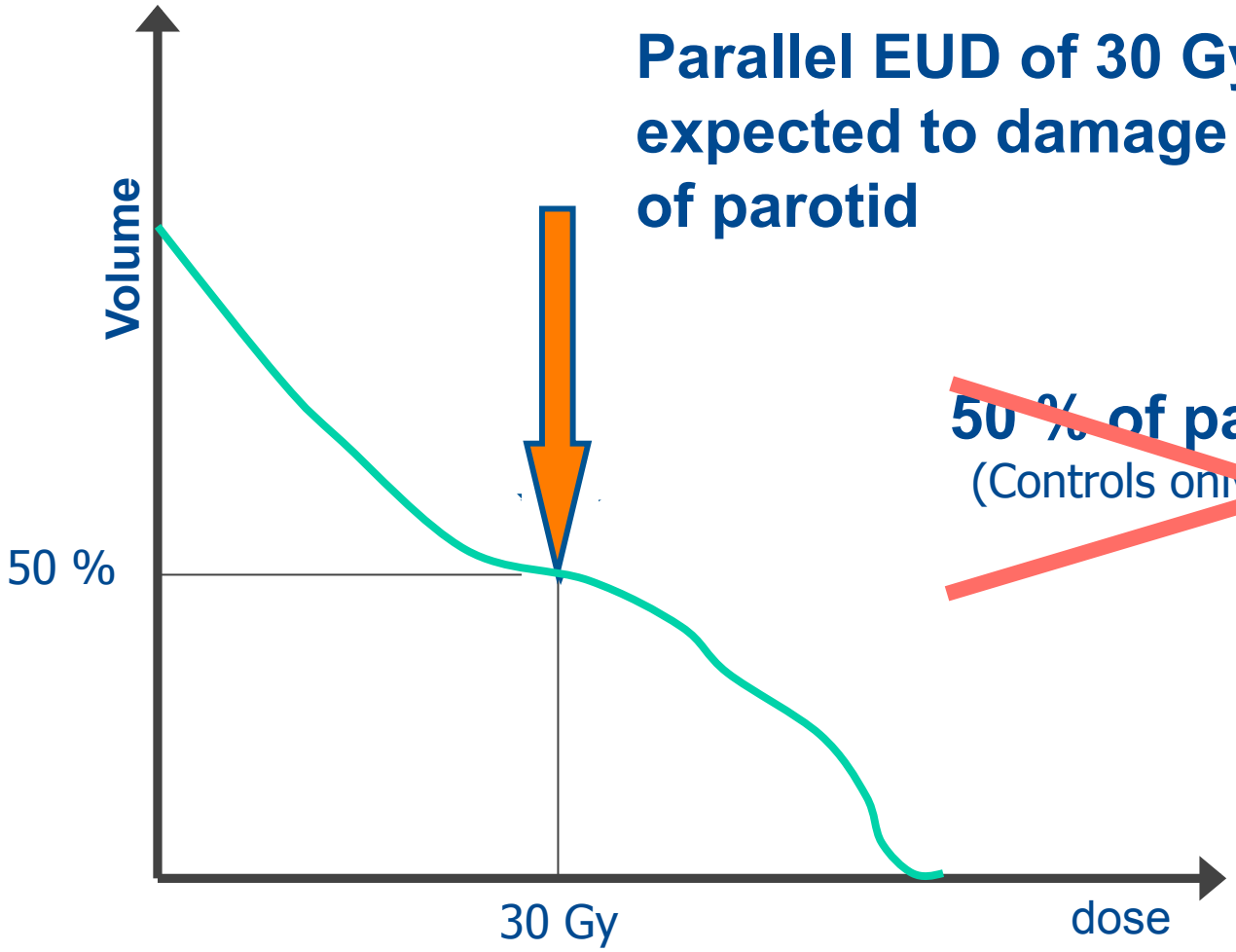
Biological Modeling:
Controlling the DVH Parallel Tissues



Parallel EUD of 30 Gy is expected to damage 50 % of parotid

~~**50 % of parotid < 30 Gy**~~
~~(Controls only a single point on DVH)~~

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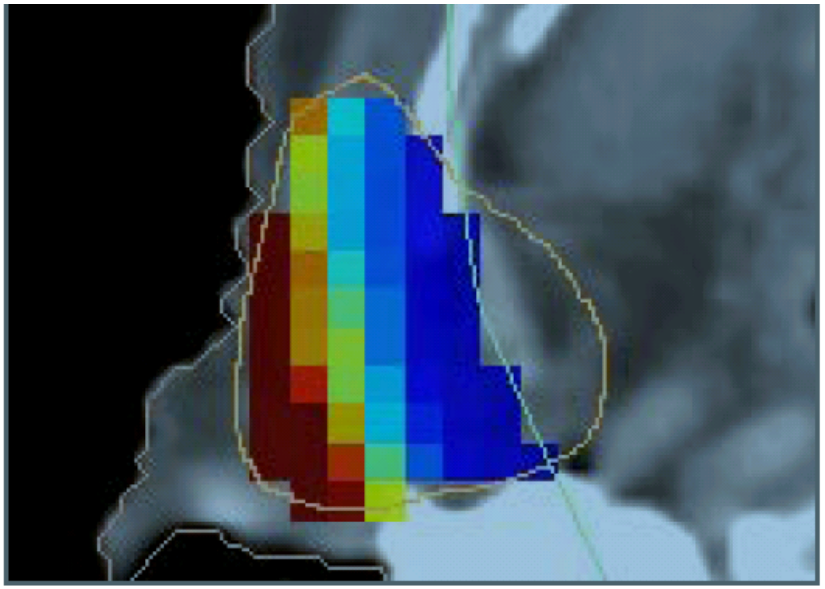
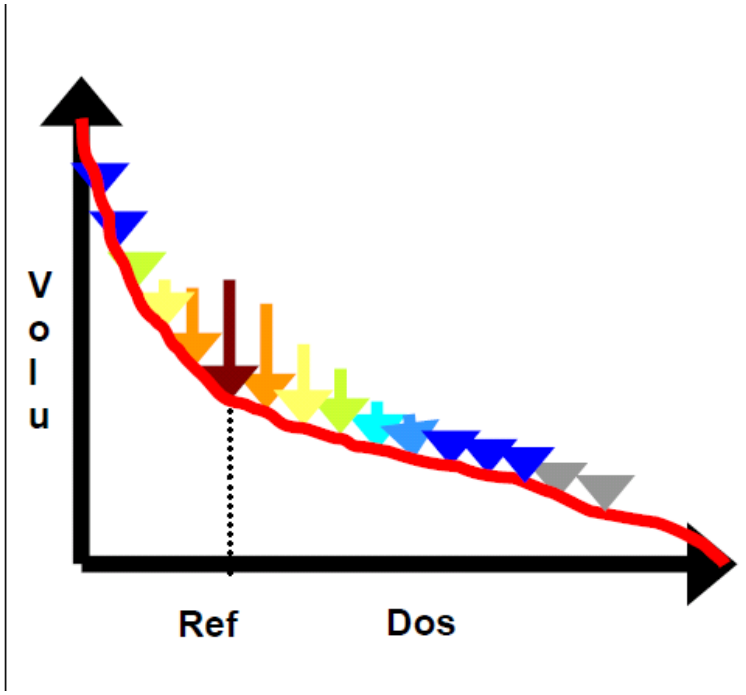
New Cost Function Visualization

- User can visualize the sensitivity analysis, detect areas of conflict





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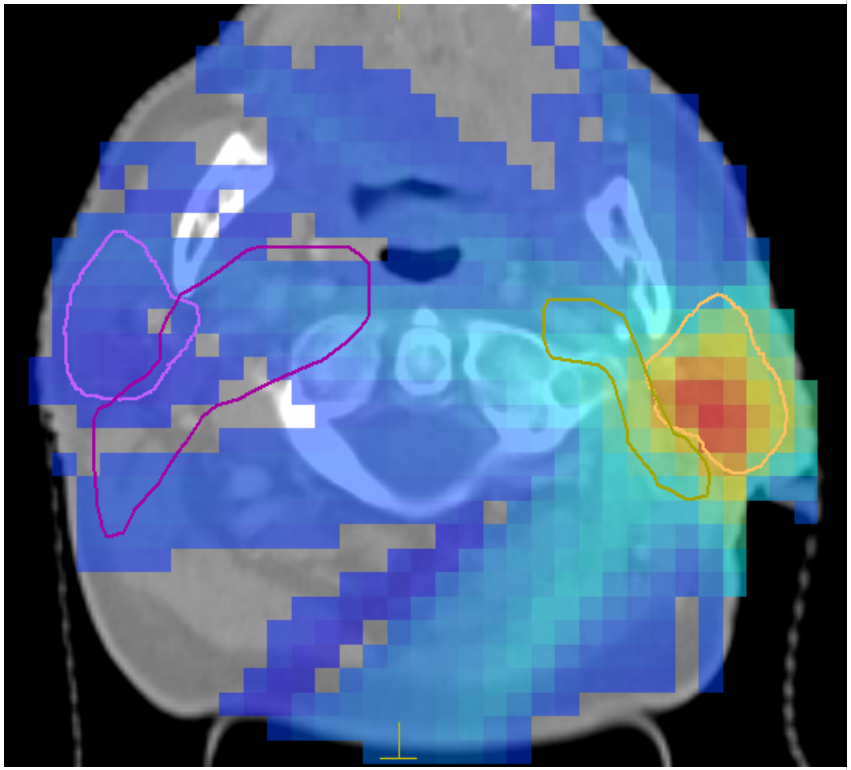
New Sensitivity Analysis Visualization

- Spatially mapped version of the table
- User can visualize where the change in dose will occur as a result of relaxing a cost function



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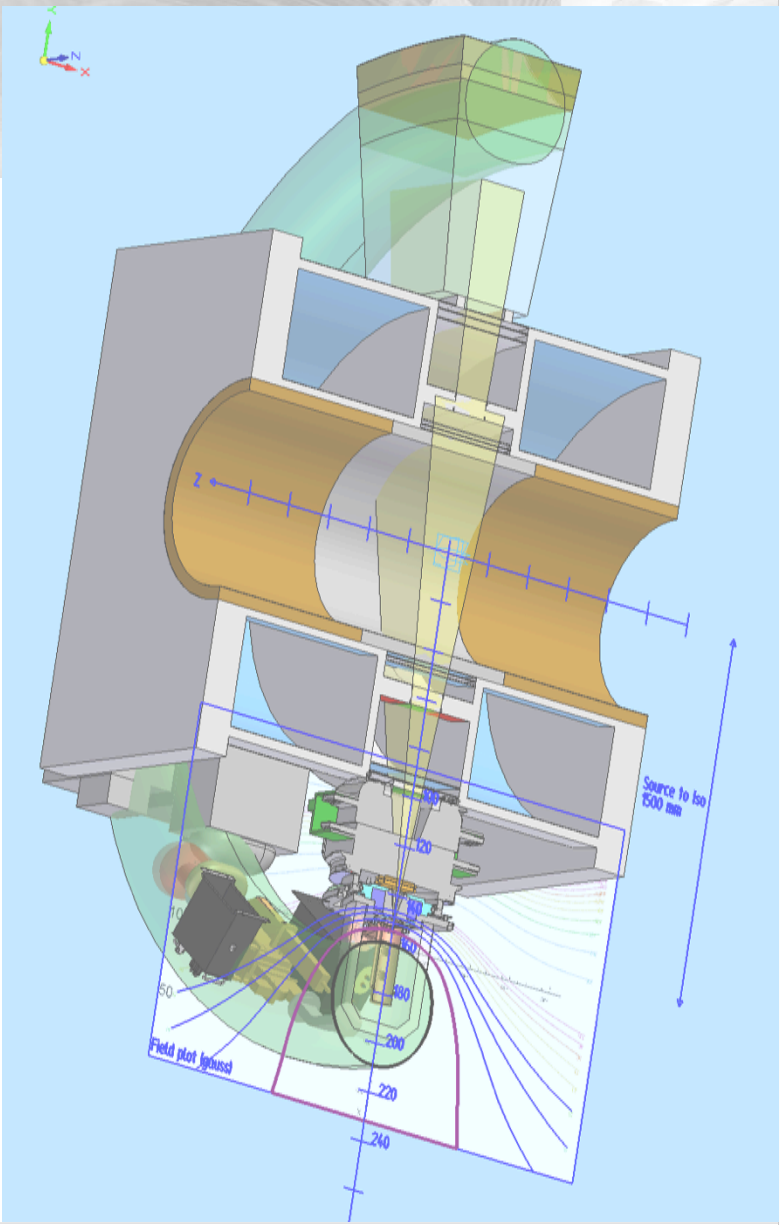
MRI linac
A tool for clinical development

- Treat the patient simultaneously with being imaged by a ‘conventional’ 1.5 T diagnostic MRI
- How to do this?
  - Mount the linac on a rotatable gantry around the MRI magnet
    - The radiation isocentre is at the centre of the MRI imaging volume
  - Modify the linac to make it compatible with the MRI
  - Modify the MRI system to
    - Minimise material in the beam path and ensure it is homogeneous
    - Minimise magnetic field at the linac



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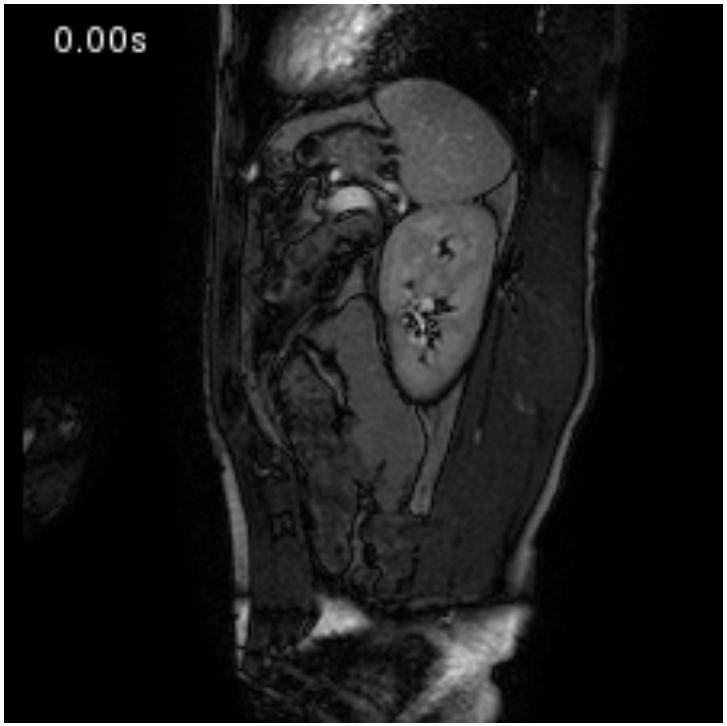
Cine MRI on MRI linac

- 2 frames per second
- Kidneys, liver and spleen can be followed in real time



Works in Progress

Courtesy UMC Utrecht

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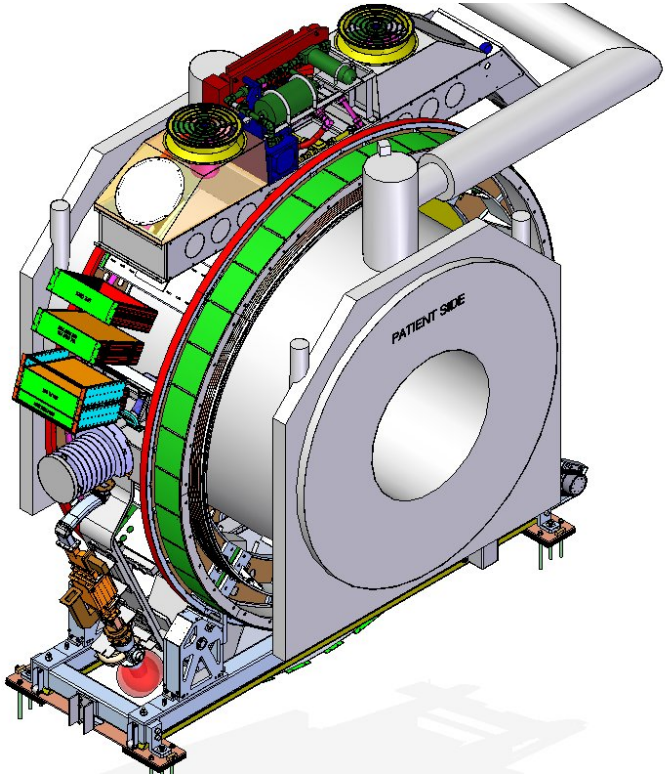
MRI linac
Continuation of technical feasibility

- Confirm operation with rotating gantry
- Confirm operation with non-magnetic MLC



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