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Varian in Radiotherapy

Accelerators and Software

Ohrid, July 27 2018

Bence Kampós
Sales Manager South-Eastern Europe

The impact of physics

- https://www.youtube.com/watch?v=ArI94Pmpudw

We set the bar higher – smaller target, life is in danger!

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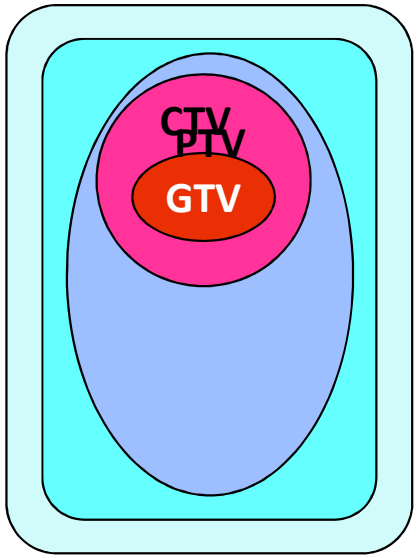
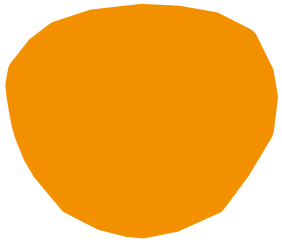
Common goal

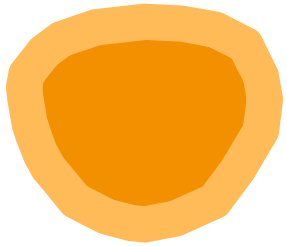


Evolution of treatment techniques

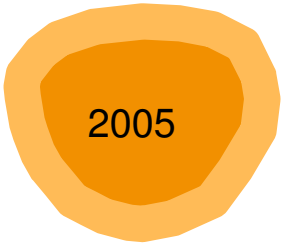
Block technique



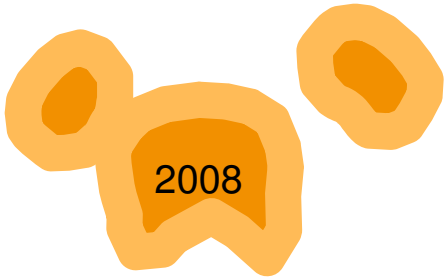
MLC & Block



IMRT



IGRT



CBCT + RapidArc™
Less than 12 minutes !!!

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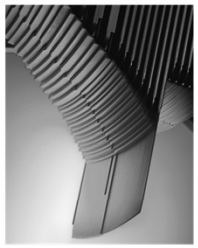
Varian's Milestones

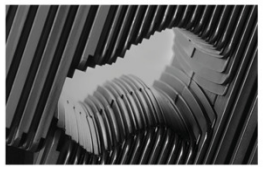
Physics' Corner
At Stanford University

"I now think the Varian Clinac is one of the most important things accomplished with the aid of electronics. One cannot put monetary value on the saving of lives, or easing of pain."

Dr. Edward Ginzton
(former Chairman and CEO)

Varian's 1st Accelerator
at Stanford University, Palo Alto





Varian's 1st MLC IMRT, Integration and Process Enhancement

1937 — 1948 — 1960 — 1980s — 1995 — 2000s

Foundation of Varian Associates
By Russell and Sigurd Varian and other scientists

Computerization of Linacs, MLCs, and 3D Planning

IGRT, Patient Positioning, Information Systems Systems Integration
R&D 100 award for the on-board imager

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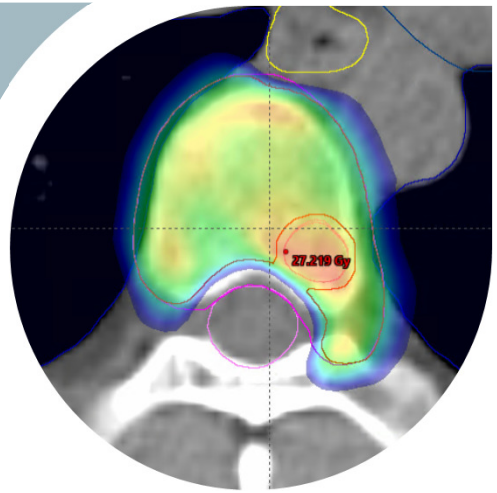
WHAT IS HIGH QUALITY RADIOTHERAPY?

Understanding the need helps us to reach the solution

OPTIMIZED DOSE DISTRIBUTION

High dose to target

Limit OAR dose



ON TARGET DELIVERY

Confidence in positional accuracy

Image Guidance

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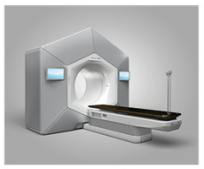
Varian's Milestones

RapidArc
Volumetric modulated arc therapy

RapidPlan
Knowledge-based planning



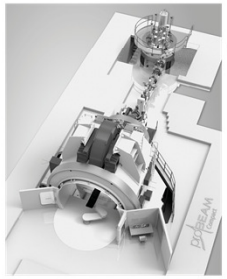
HyperArc
High-definition radiotherapy

Halcyon
A transformation in cancer treatment delivery & management

2007 2010 2013 2014 2017 20xx

TrueBeam
The new digital platform of radiotherapy

reddot design museum



ProBeam
Compact Single-Room
Proton Therapy System

Automation,
Simplification,
Cloud Solutions

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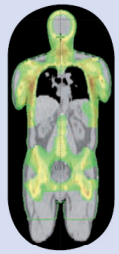
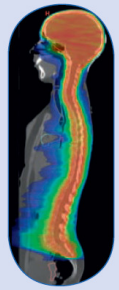
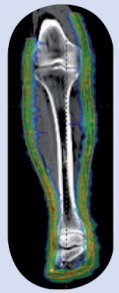
RapidArc
Extensive Clinical Application



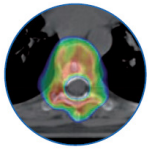
Total Bone Marrow (TBM) Irradiation
8 arcs, 4 isocenters, 590 sec



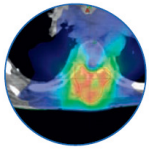
Medulloblastoma
2 arcs, 2 isocenters, 148 sec



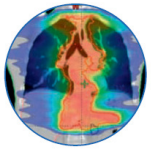
Anaplastic Skin Lymphoma
4 partial arcs, 2 isocenters, 104 sec



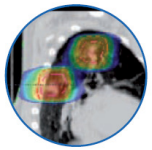
Vertebrae
1 arc, 60 sec



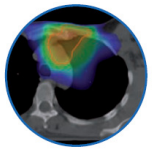
Paraspinal Lesion
1 arc, 215 sec



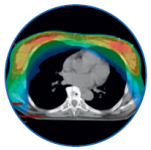
Hodgkin's Lymphoma
2 arcs, 148 sec



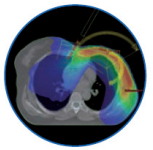
Two Lung Lesions
2 partial arcs, 92 sec



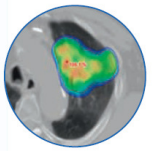
Internal Mammary Chain
1 partial arc, 32 sec



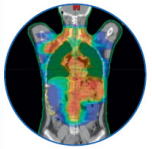
Bilateral Breast
2 arcs, 150 sec



Breast
2 partial arcs, 80 sec



Non-Small Cell Lung Carcinoma SRT
2 arcs, 210 sec



Pediatric Hodgkin's Lymphoma
2 arcs, 150 sec

Whole Abdominal Irradiation
3 arcs, 225 sec

Multiple Pelvic Nodes
2 arcs, 150 sec

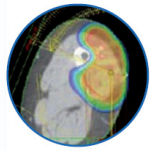
Mesothelioma
2 arcs, 150 sec

Anal Canal
2 arcs, 170 sec

Pancreas
1 arc, 74 sec

Liver
1 partial arc, 112 sec

Cervix Uteri
1 arc, 74 sec



Soft Tissue Sarcoma
3 partial arcs, 103 sec

RapidArc
The #1 Solution for
Rotational Treatments.
Bibliography, websearch!

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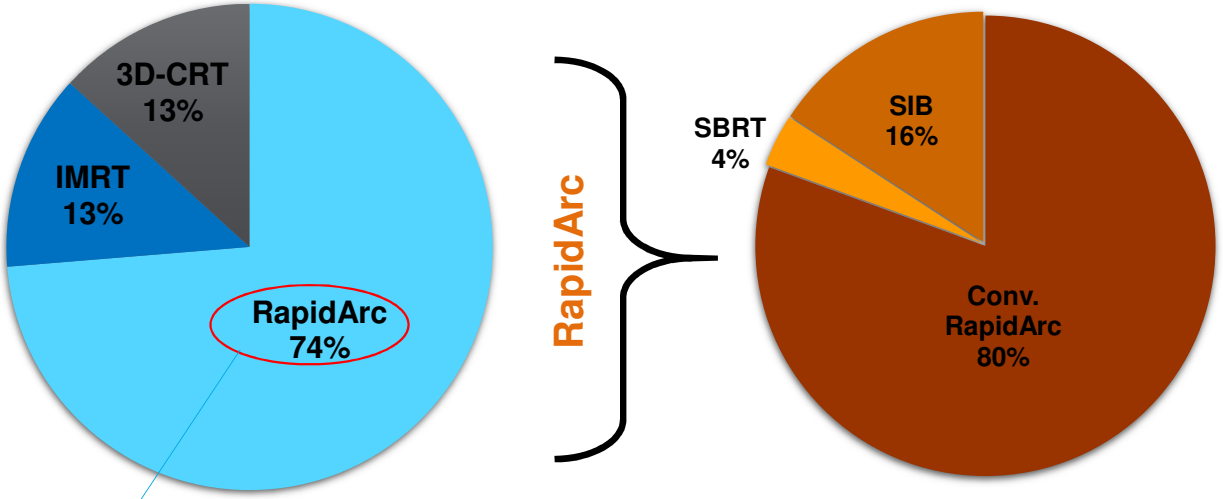
Distribution of treatment techniques in 2015 on Varian Linac



@ other users: up to 95-98%

Source: National Oncology Institute, Budapest

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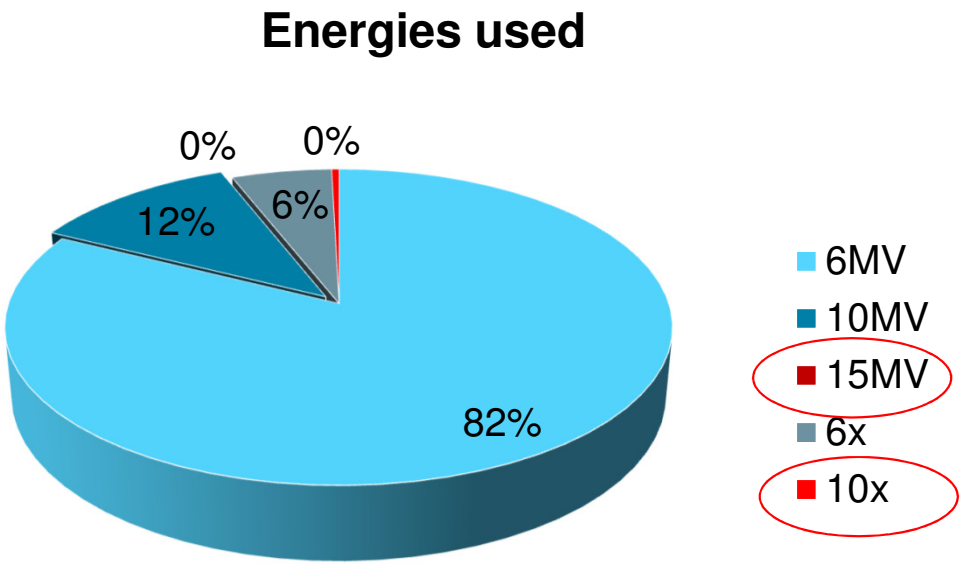
Conclusions from usage of Rapidarc



Source: National Oncology Institute, Budapest

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VMAT/Rapidarc – technically a challenge?

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WORLDWIDE CANCER BURDEN

24.6M
new cancer cases per year by 2030

$2T
global economic burden in 2010

50-60%
of patients with cancer need RT

56%
of cancers diagnosed in high income countries

10%
of patients have access to RT in low income countries

20,000+
Linacs needed by 2035, with greatest need in low and mid-income countries

Expanding global access to radiotherapy. Lancet Oncol. Vol 16, Sept.2015

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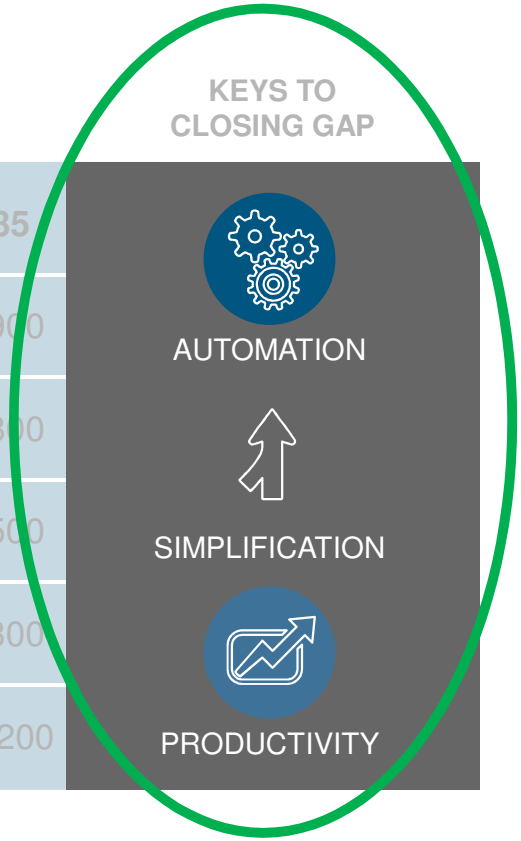
GLOBAL RADIOTHERAPY GAPS

What is Needed	2015	GAP	2035
Radiation Oncology Centers	7,700	3,200	10,900
Linear Accelerators	13,100	21,800*	21,800
Radiation Oncologists	23,200	22,300	45,500
Medical Physicists	10,000	29,300	39,300
Radiation Technologists	33,300	96,900	130,200



Expanding global access to radiotherapy. Lancet Oncol. Vol 16, Sept.2015

*8,700 new machines plus 13,100 replacements = 21,800 additional machines needed

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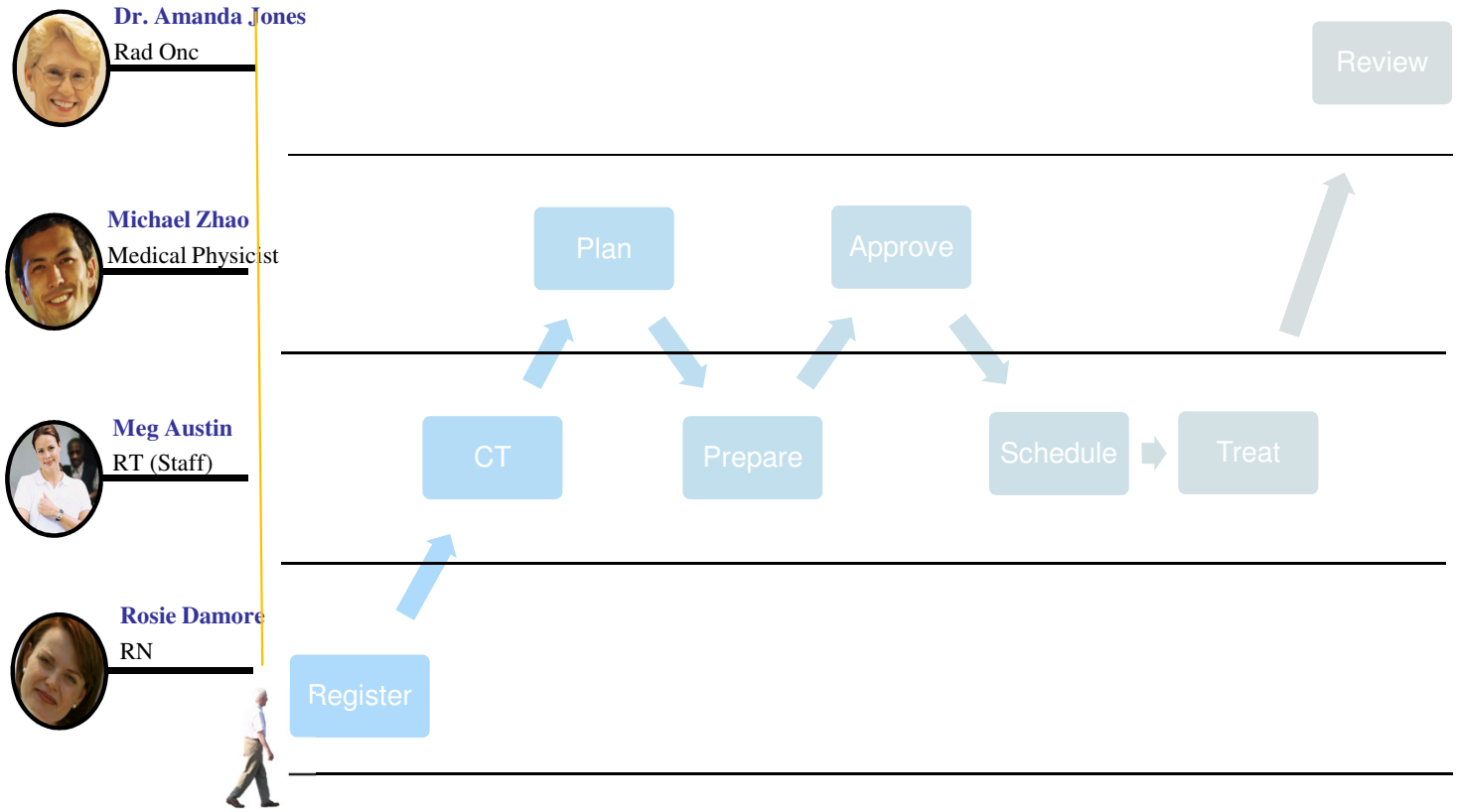
medical systems

Basic Oncology Workflow



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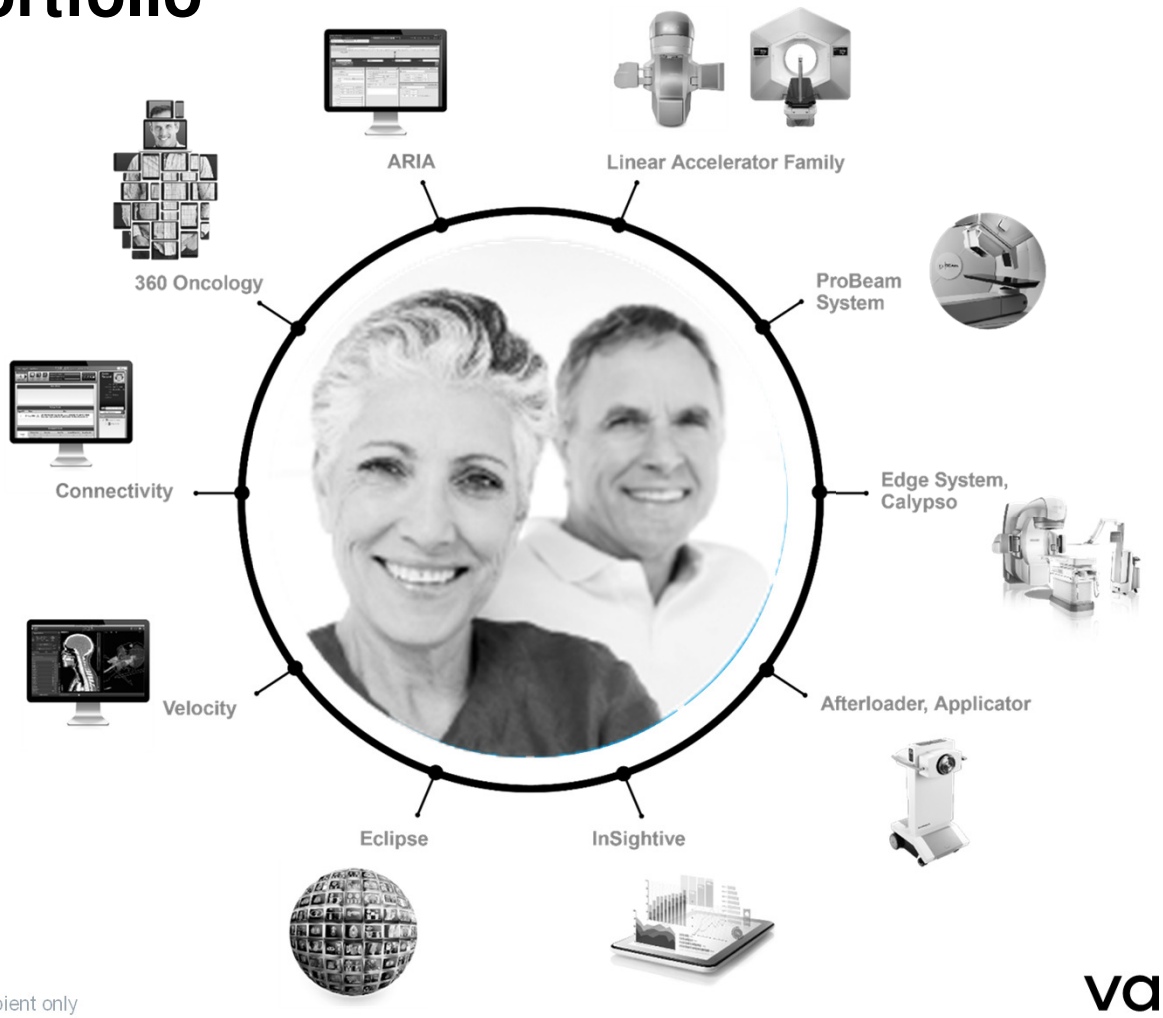
How do we help for physicists?

Tasks	Elements of Automation
Commissioning	Beam modeling locally, *Halcyon*
Daily QA	**MPC** - Automated machine performance check
Planning	**RapidPlan, HyperArc, MCO**
Workflow	**ARIA** task management, Visual Scripting
Plan QA	**Portal Dosimetry** via EPID & Eclipse
Treatment QA	**Calypso, OSMS, OBI**: Positioning, Imaging, Verification of alignment
Reliability	**Qumulate** - Cloud based big data prediction

Our patient centric portfolio

Cancer Treatment



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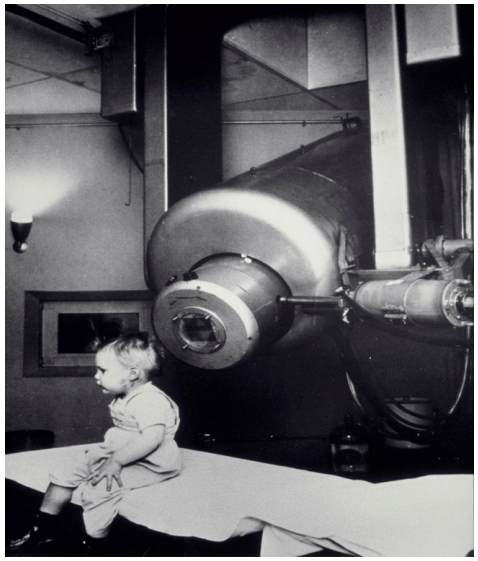
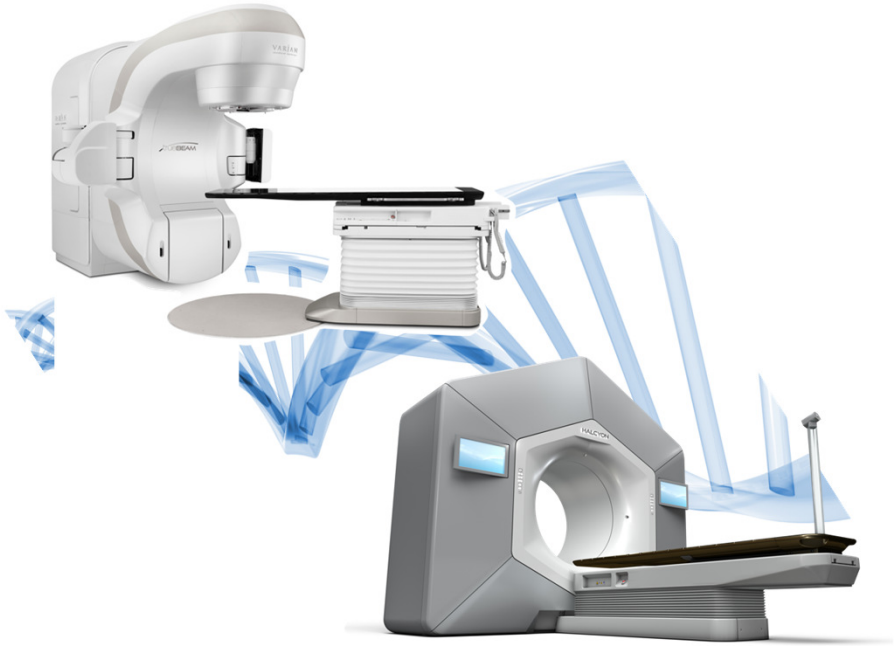
First and latest



Varian's first accelerator was designed, built, and delivered to Stanford University in **1961**



2018 - Varian TrueBeam & Halcyon

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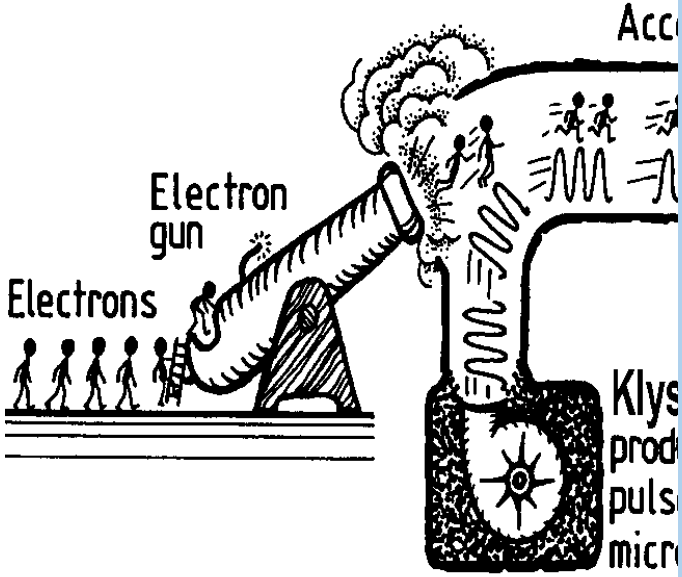
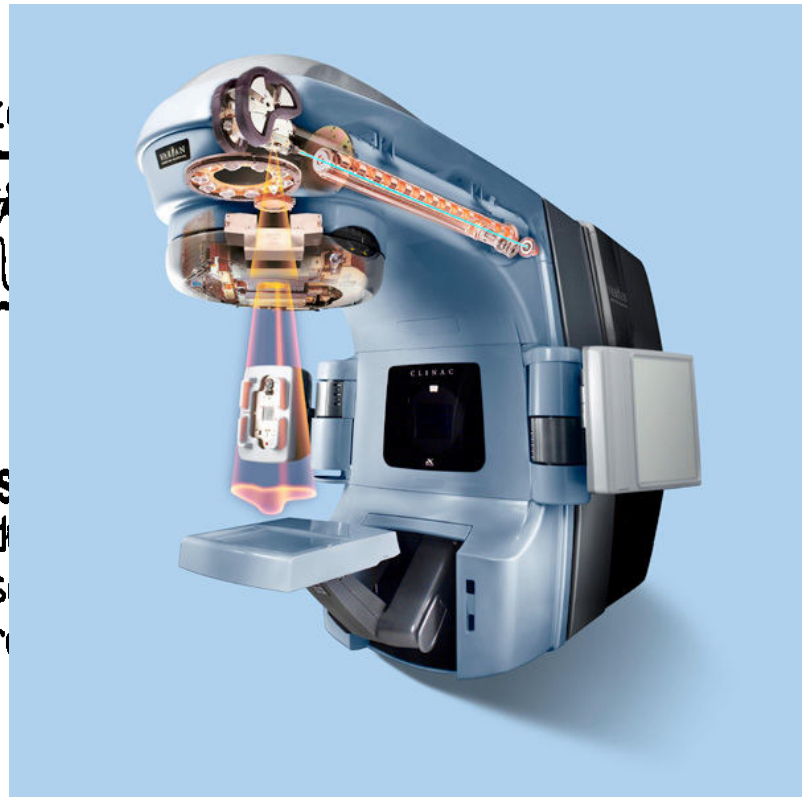
Slightly Simplified – key differences





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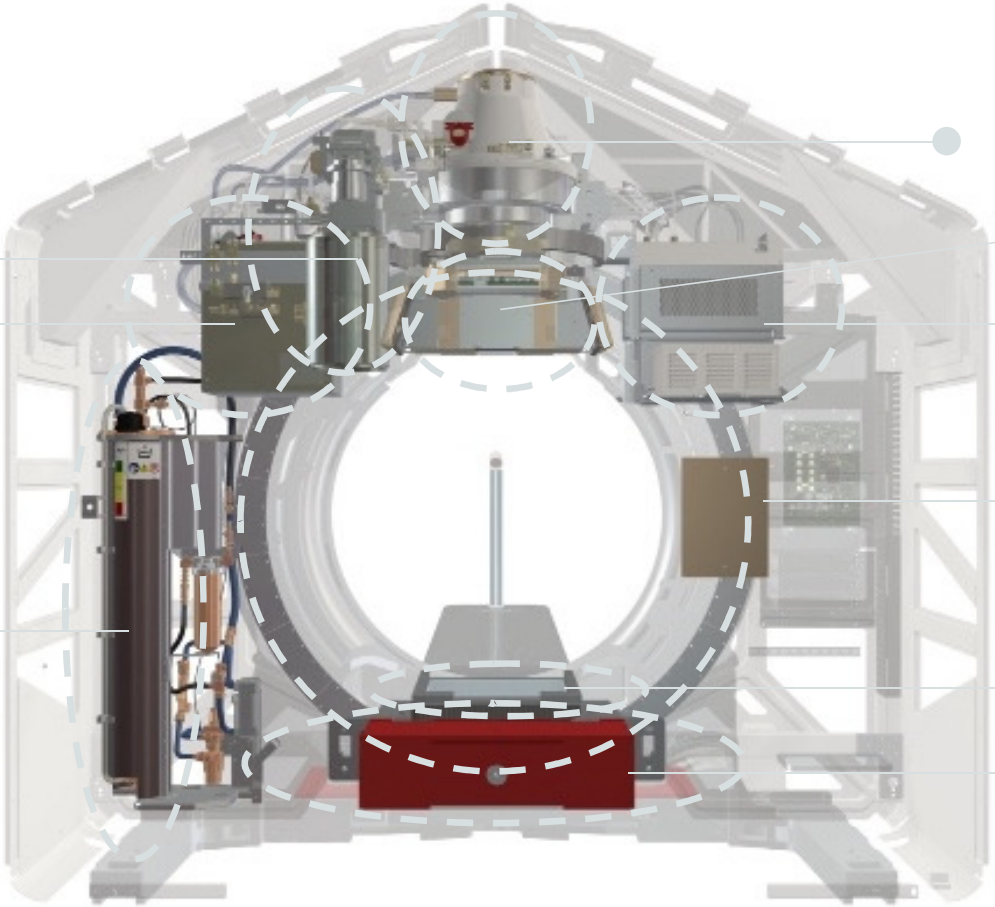
TECNNOLOGY HIGHLIGHTS



LINEAR ACCELERATOR

MULTI-LEAF COLLIMATOR

MAGNETRON

SOLID STATE MODULATOR

SOLID STATE MODULATOR

RING GANTRY SYSTEM

WATER COOLED SYSTEM

IMAGING PANEL

BEAM STOPPER

510(k) pending, not available for sale in some markets

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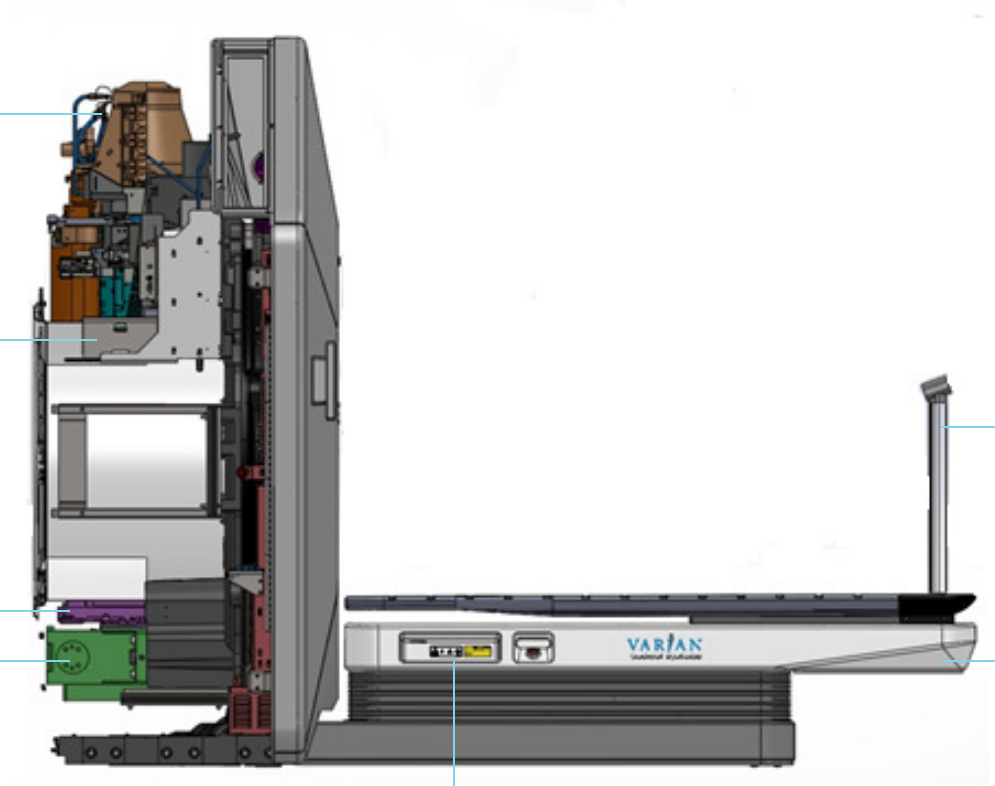
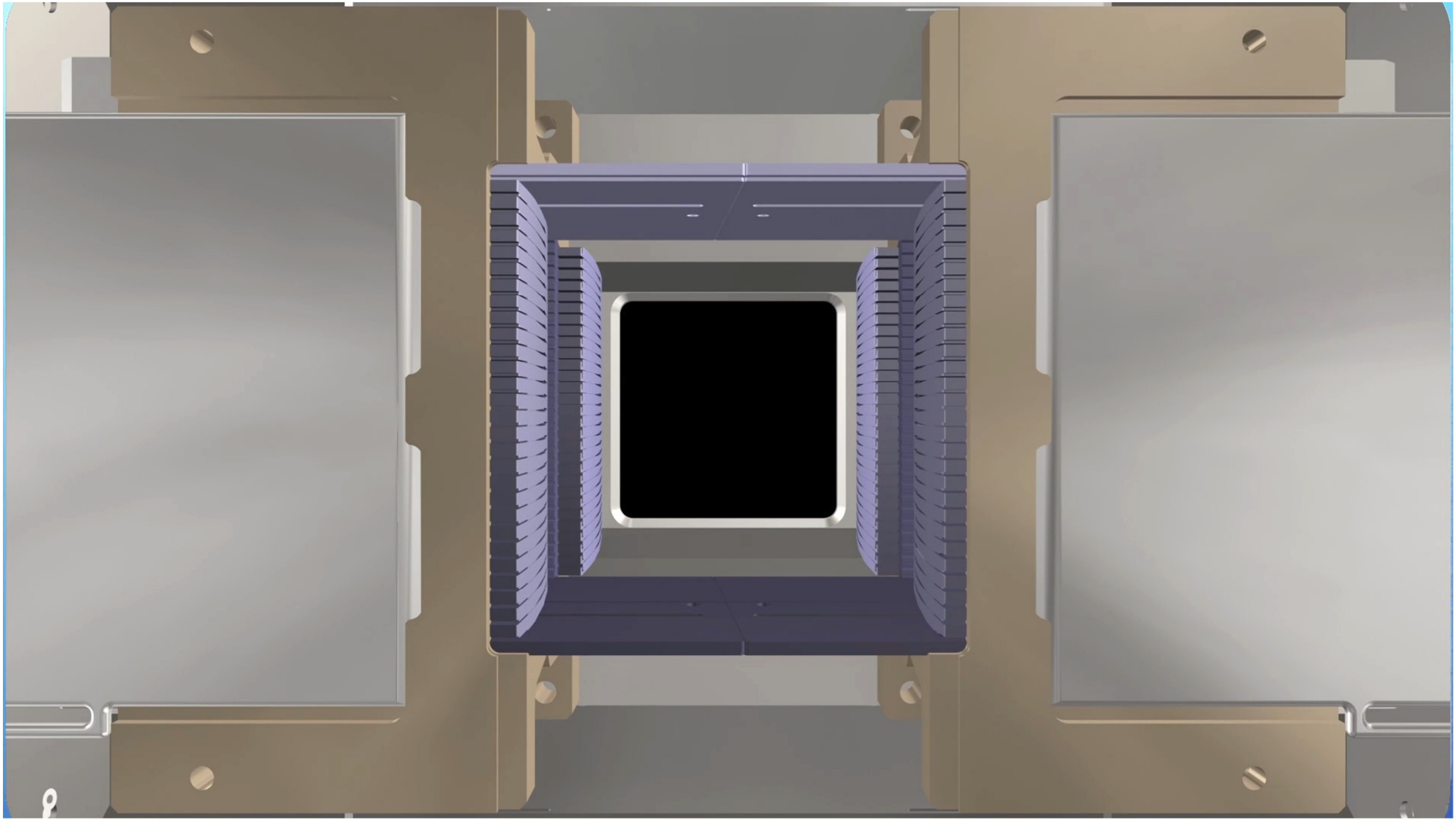
TECNNOLOGY HIGHLIGHTS



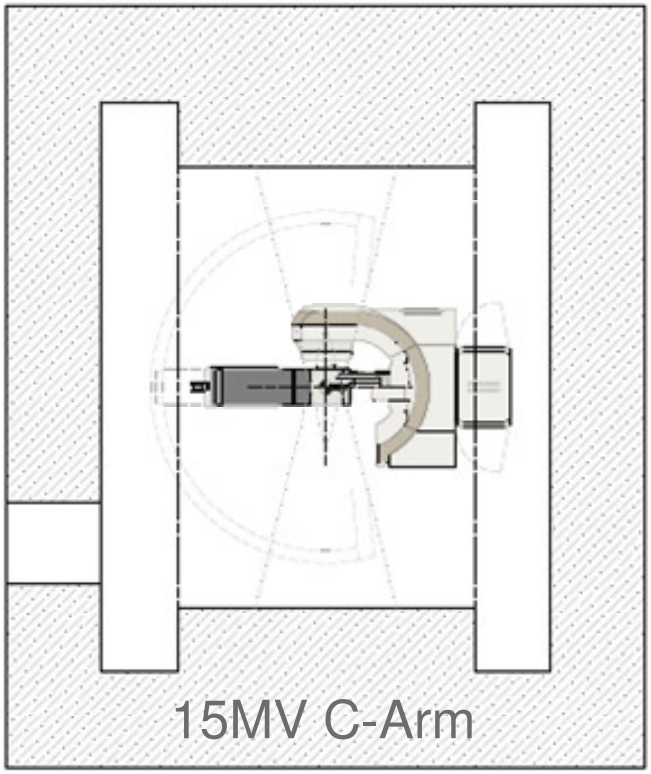
510(k) pending, not available for sale in some markets

VARIAN medical systems

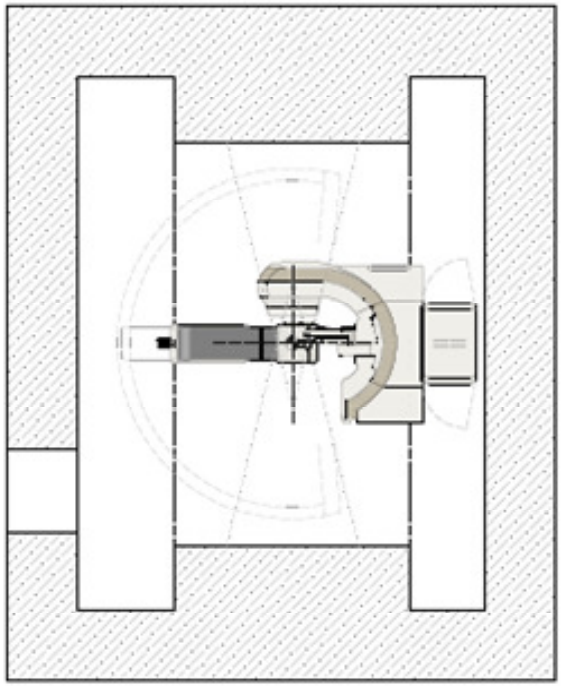


HALCYON TREATMENT ROOM REQUIREMENTS

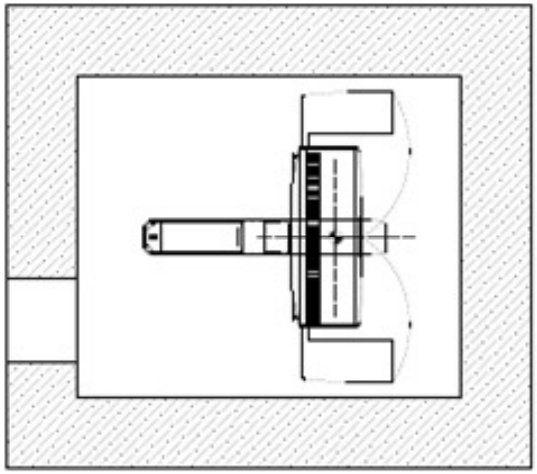
Reduced Footprint Compared to C-Arm Linear Accelerators



15MV C-Arm



6MV C-Arm



HALCYON

Work in progress, not available for sale.

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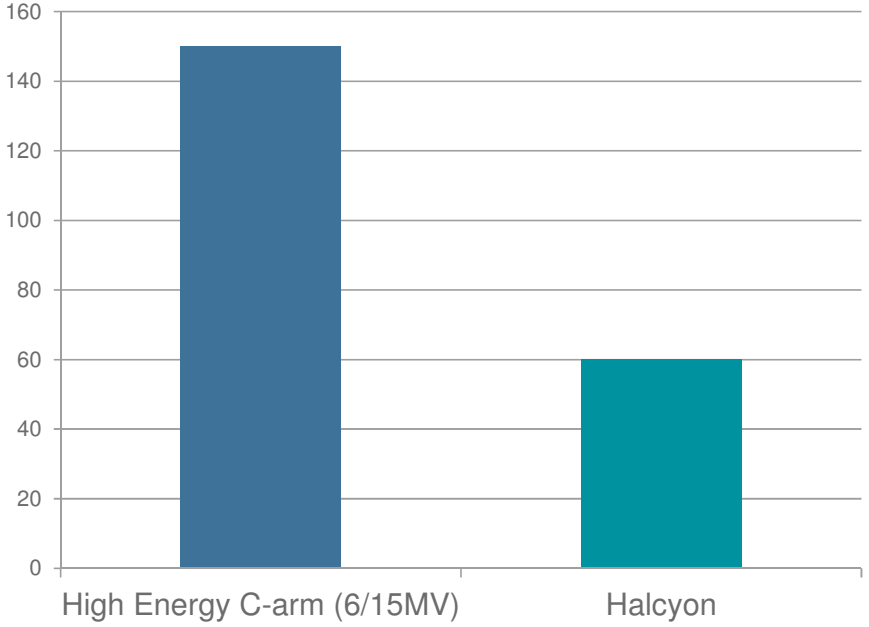
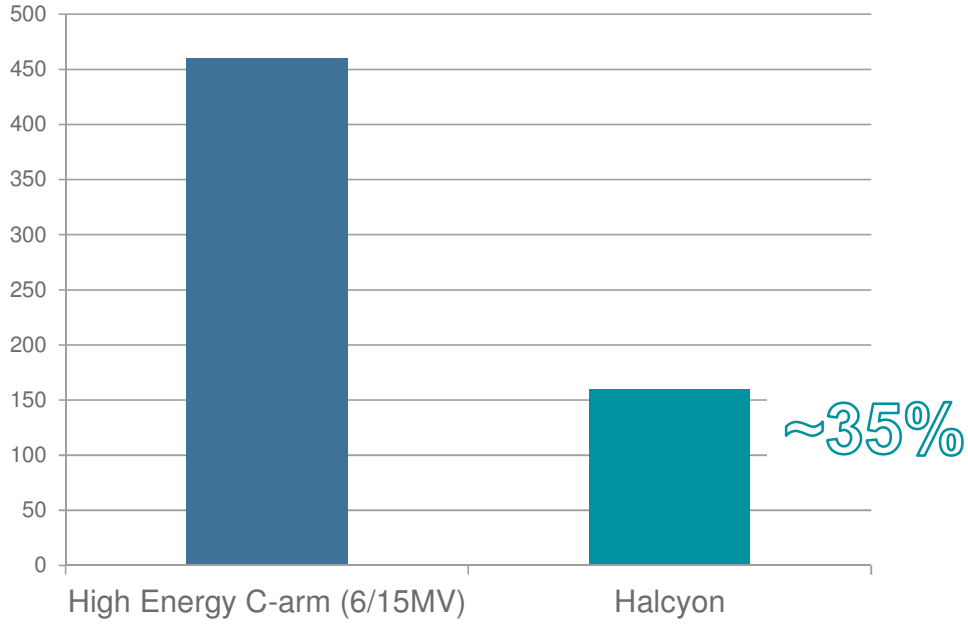
HALCYON TREATMENT ROOM REQUIREMENTS

Reduced Construction Costs – Typical Values Compared to C-Arm





Work in progress, not available for sale.

VARIAN medical systems

HALCYON TREATMENT PROCESS

Halcyon Simulated Treatment Process Video

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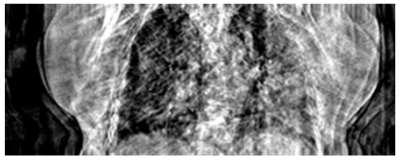
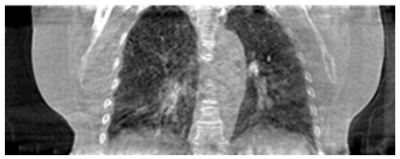
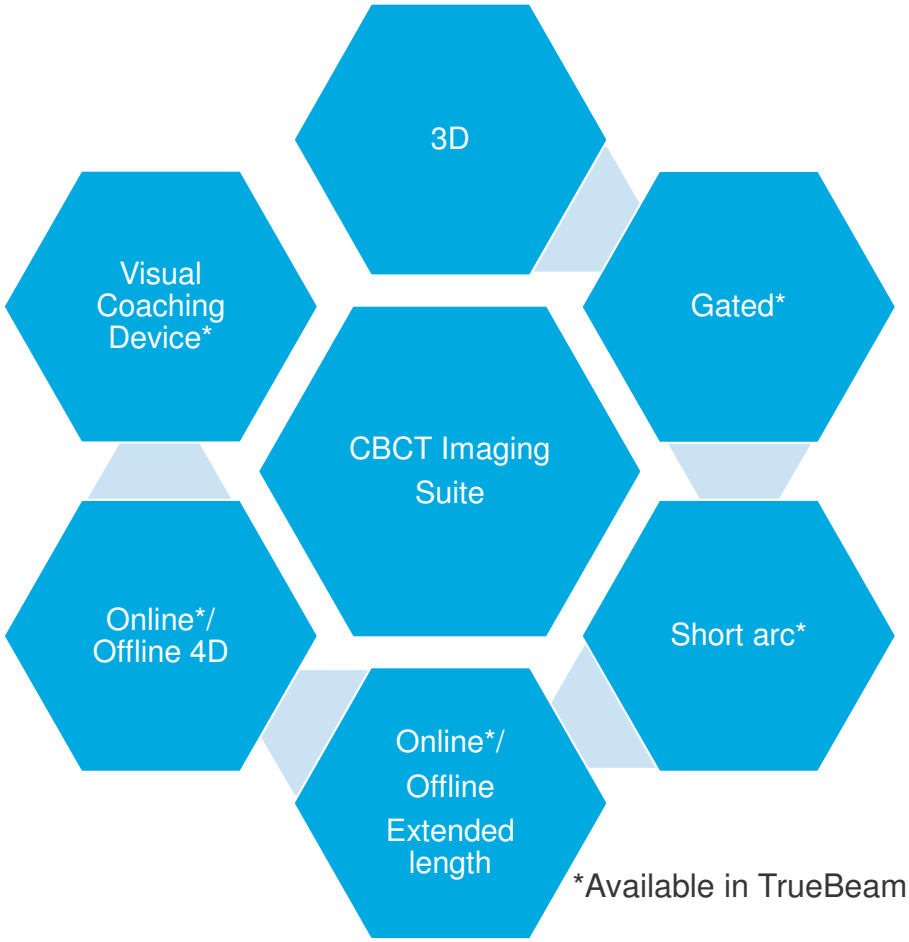
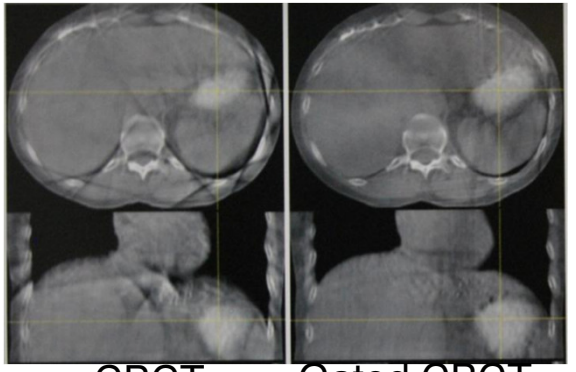
TrueBeam 2.7







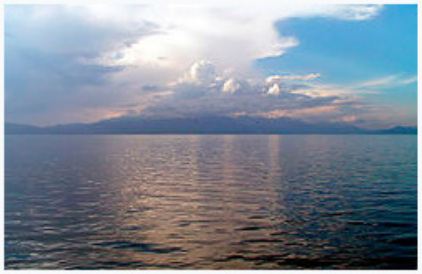


CBCT Gated CBCT

*Available in TrueBeam 2.7

Works in progress: not available for sale, subject to change.

Ohridi-tó



Ország(ok)	Macedónia Albánia
Vízgyűjtő terület	2600 km^2
Elsődleges források	víz alatti források
Elsődleges lefolyások	Fekete-Drin
Hosszúság	30,4 km
Szélesség	14,8 km
Felszíni terület	358 km^2
Átlagos mélység	155 m
Legnagyobb mélység	288 m
Víztérfogat	55,4 km^3
Part hossza	87,5 km
Tszf. magasság	693 m

Balaton

A Balaton 1989. március 17. óta Ramsari terület[1]

Ország(ok)	Magyarország
Hely	Dunántúl
Vízgyűjtő terület	5 181 km^2
Elsődleges források	Zala
Elsődleges lefolyások	Sió csatorna
Hosszúság	78[2] km
Szélesség	1,3-14 km
Felszíni terület	600[2] km^2
Átlagos mélység	3,0–3,6 m
Legnagyobb mélység	12,5 m
Víztérfogat	1,9 km^3
Part hossza	235[2] km
Tszf. magasság	104 m

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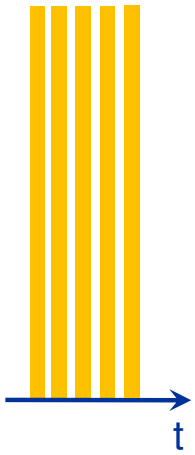
Hypofractionation, FFF beam, radiosurgery

1. **Interfactional!**

Standard-fx e.g. 40 x 2Gy = 80 Gy

2. **Inter- and Intrafractional!**



Hypo-fx e.g. 5 x 7 Gy = 35 Gy

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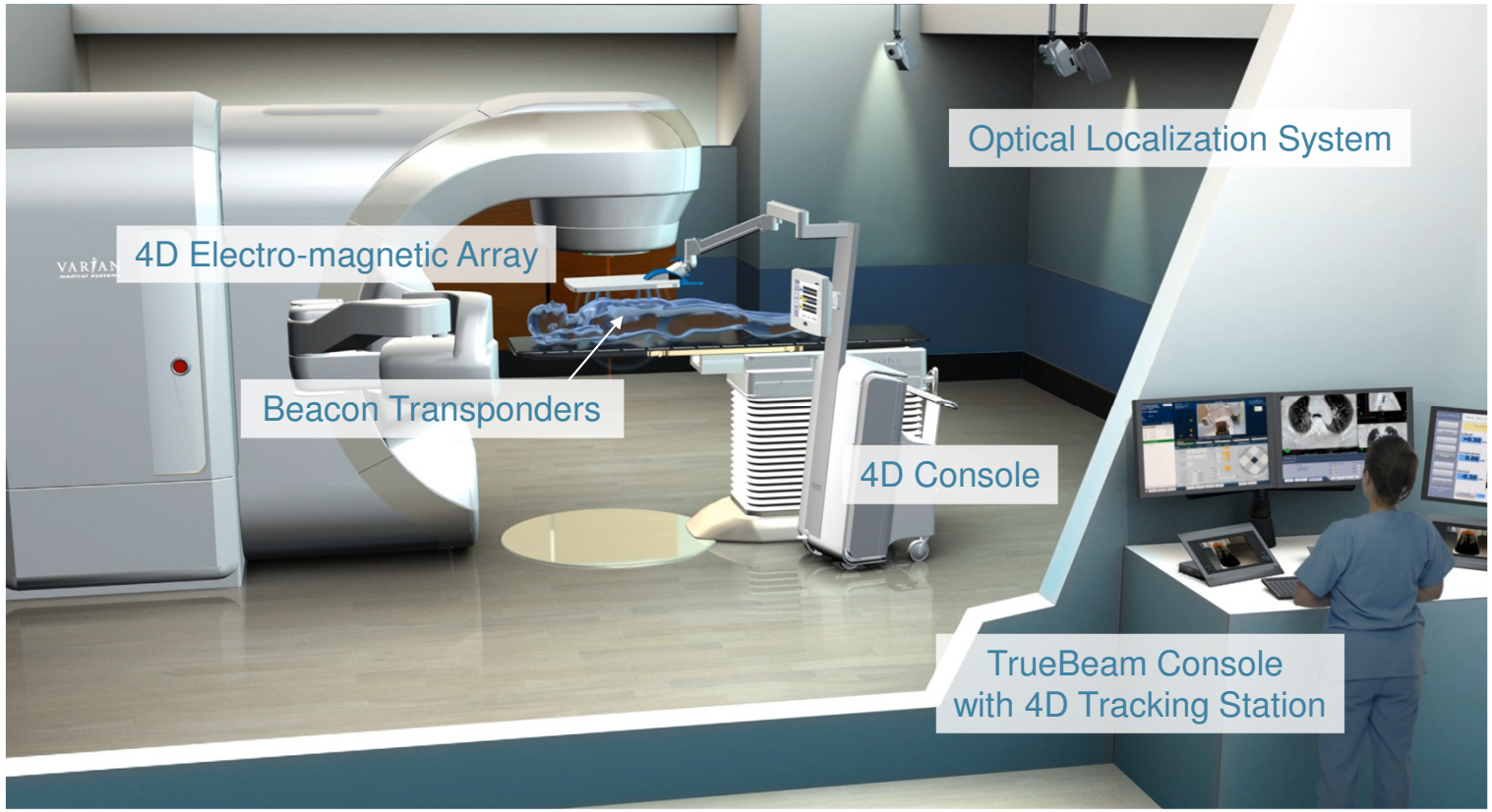
Calypso Real-time Tracking



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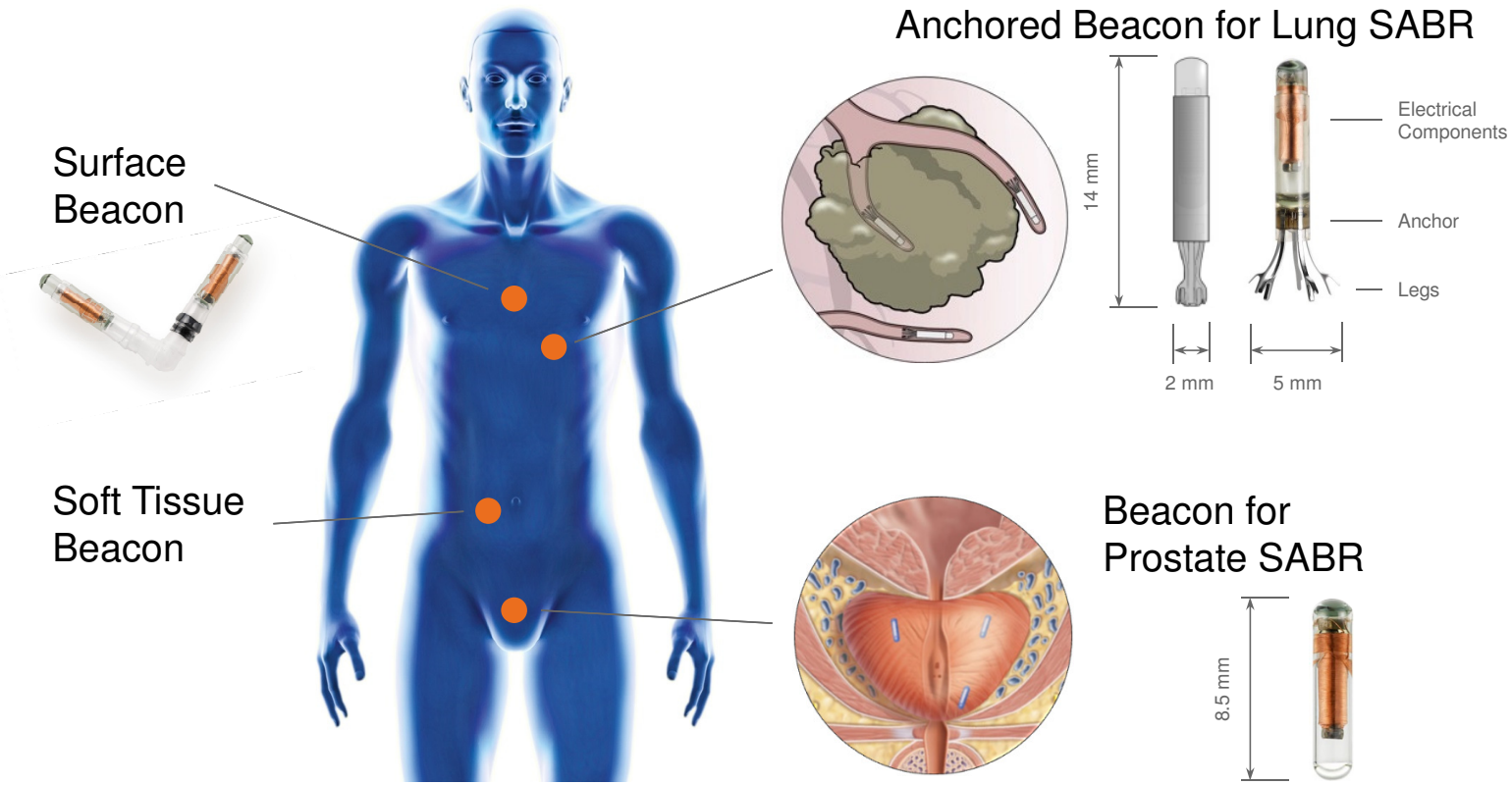
Calypso Real-Time Tracking



Beacon® Transponder Availability is Country Dependent
Check with Varian Representative

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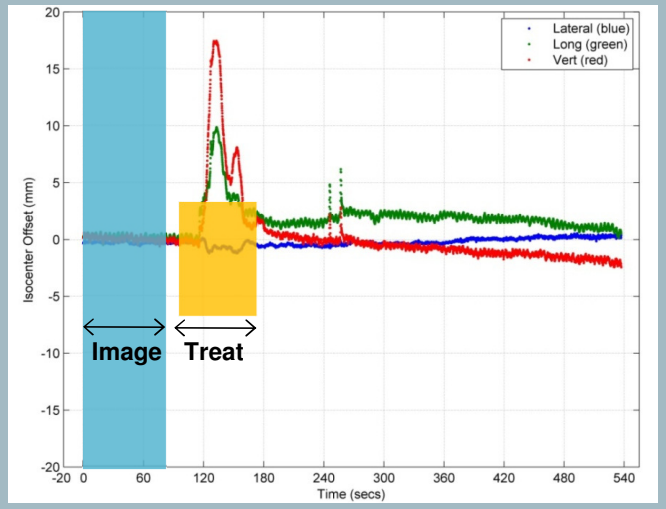
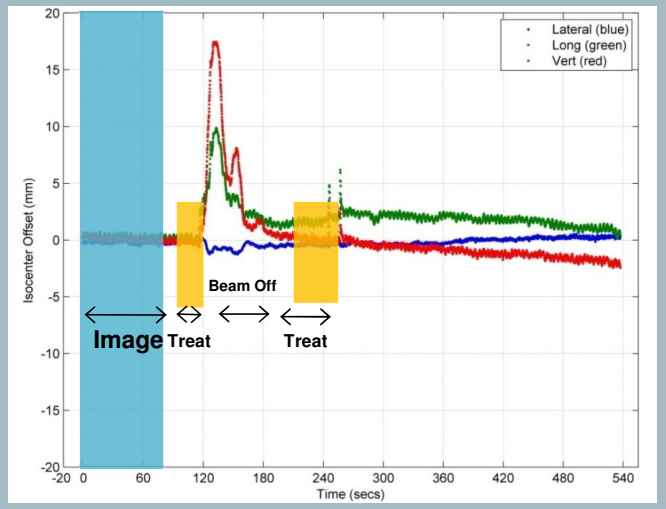
SBRT – Calypso Real-Time Tracking

- RapidArc without Calypso



- RapidArc with Calypso



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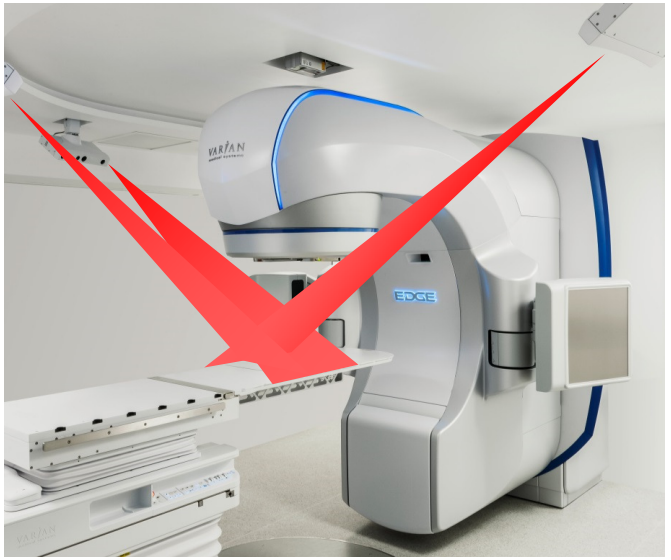
OSMS – Optical Surface Monitoring

- Brain Metastases
- Vestibular Schwannoma
- Recurrent Glioblastoma
- Trigeminal Neuralgia
- Meningiomas
- Pituitary
- ...

OSMS – Optical Surface Monitoring

- Dynamic non-invasive 3D surface matching
- In-room localization, monitoring and real-time tracking
- Continual surveillance at non-coplanar couch positions
- Automated beam-hold on detection of patient motion



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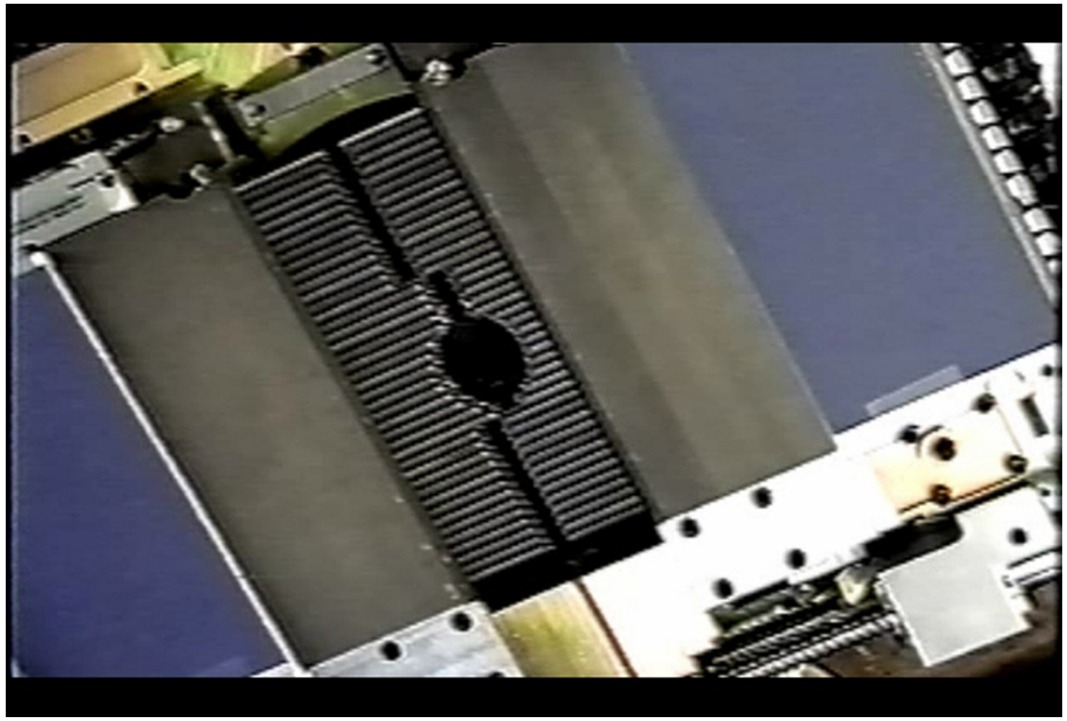
TrueBeam™
Real-time tracking



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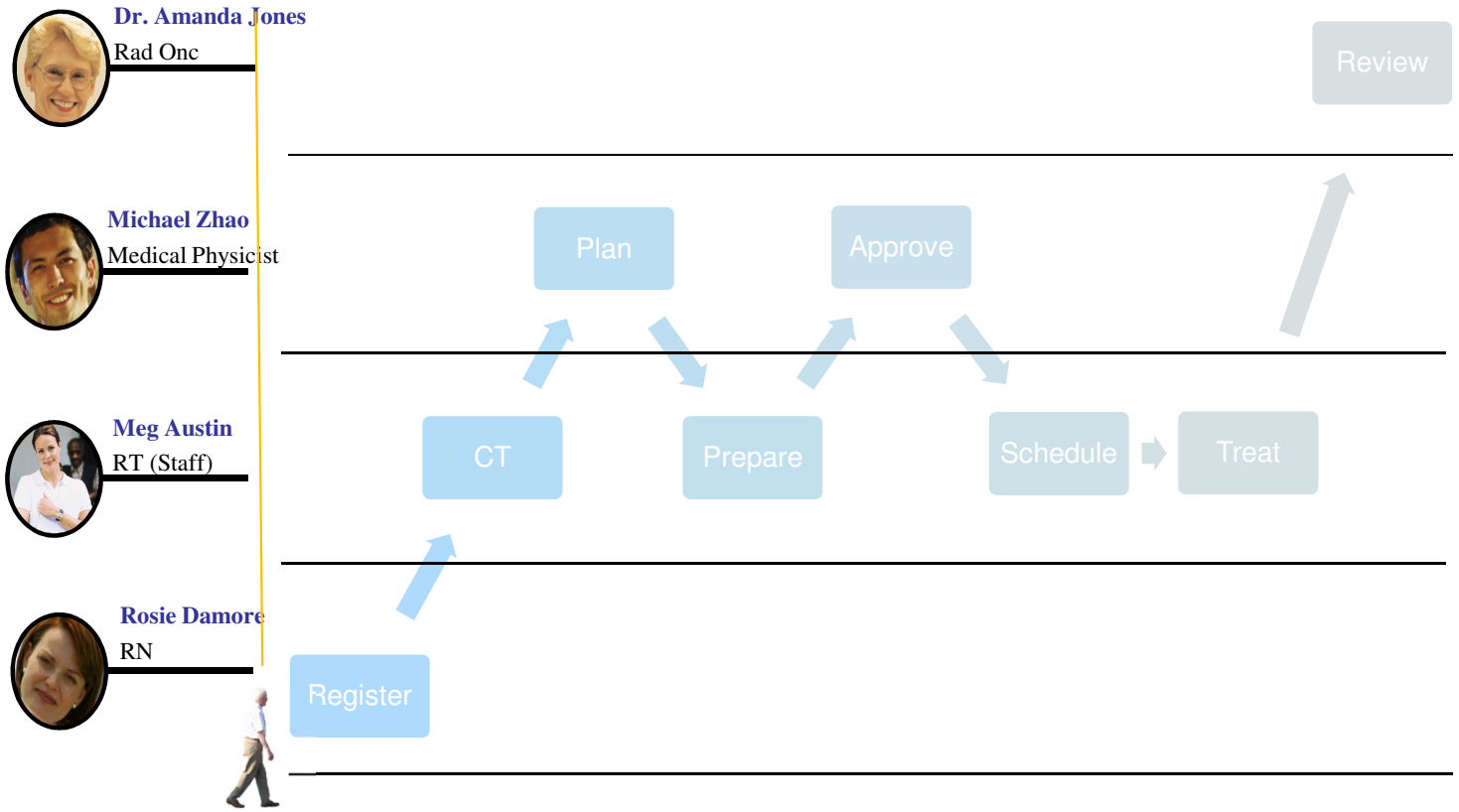
Basic Oncology Workflow



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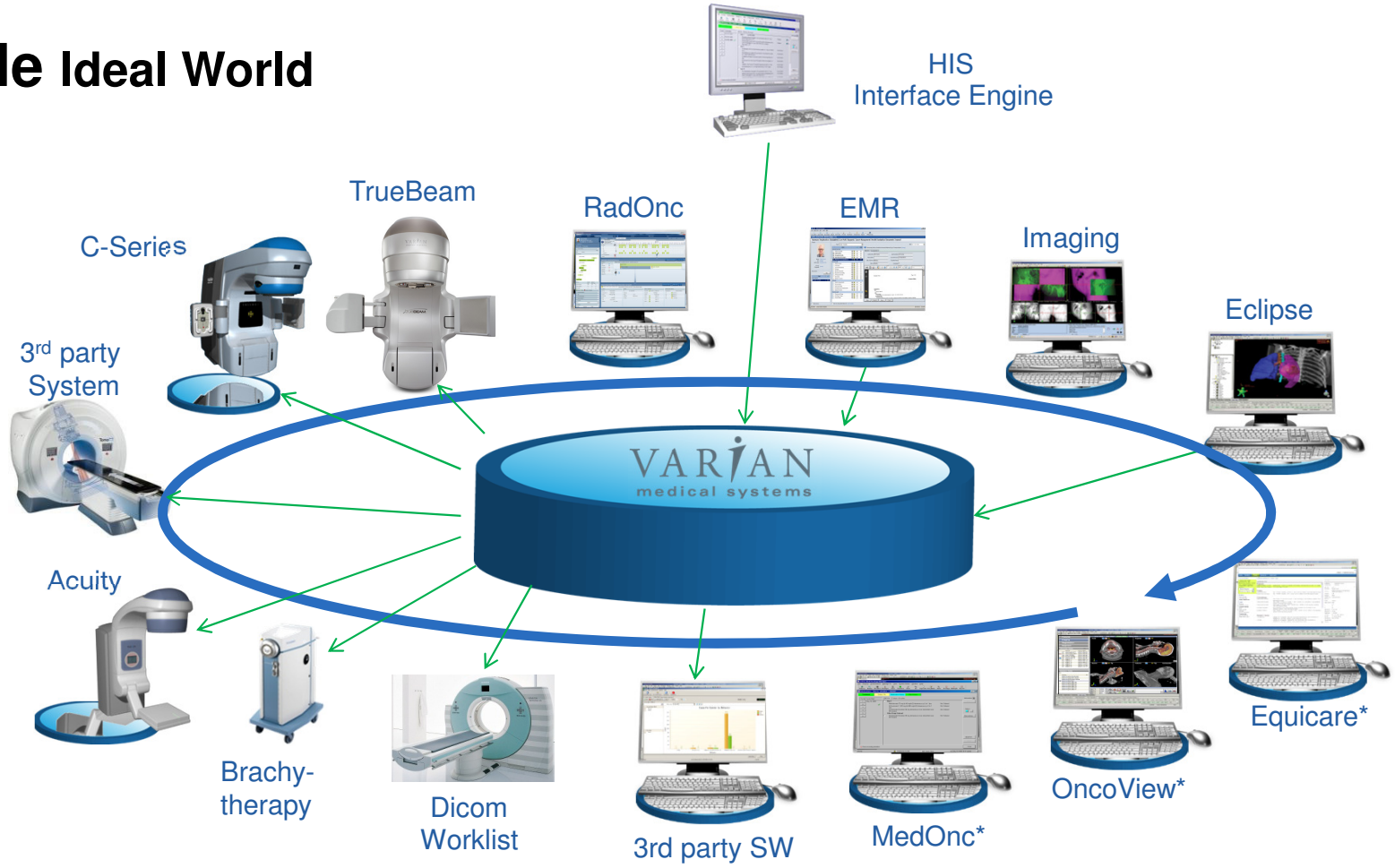
Unicode Ideal World



*English only

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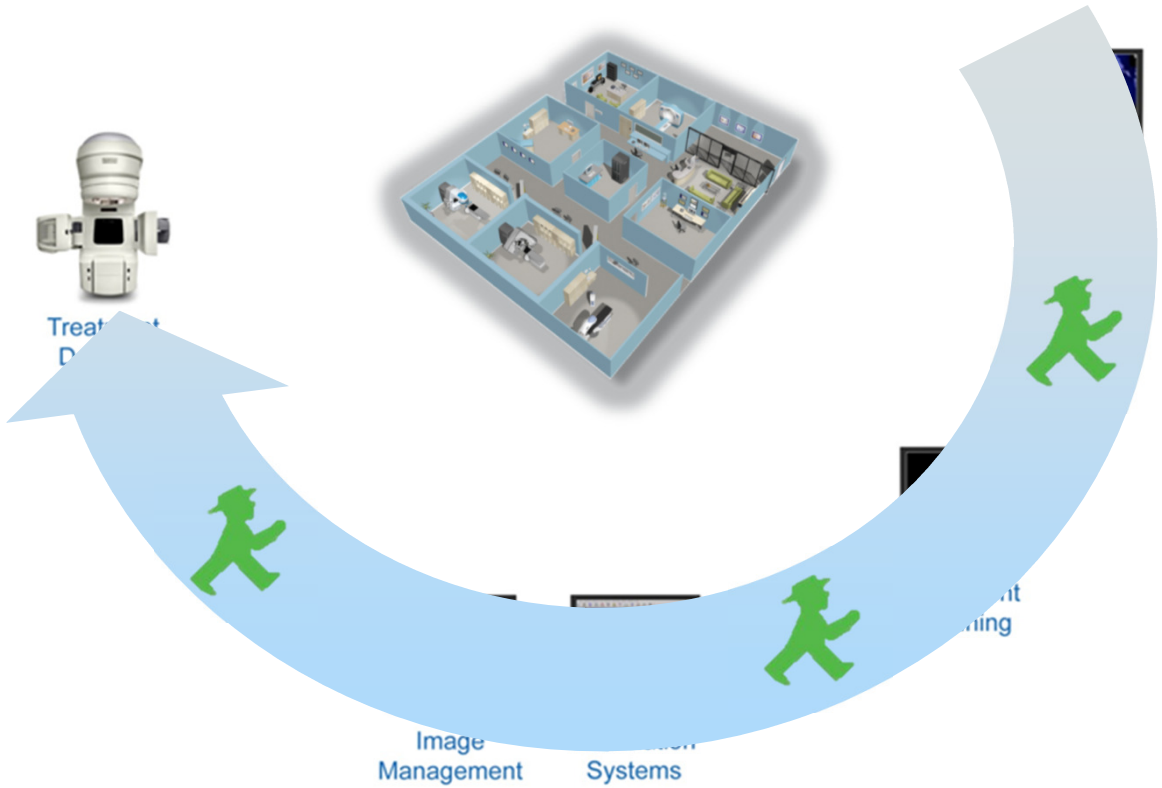
Oncology Components Workflow



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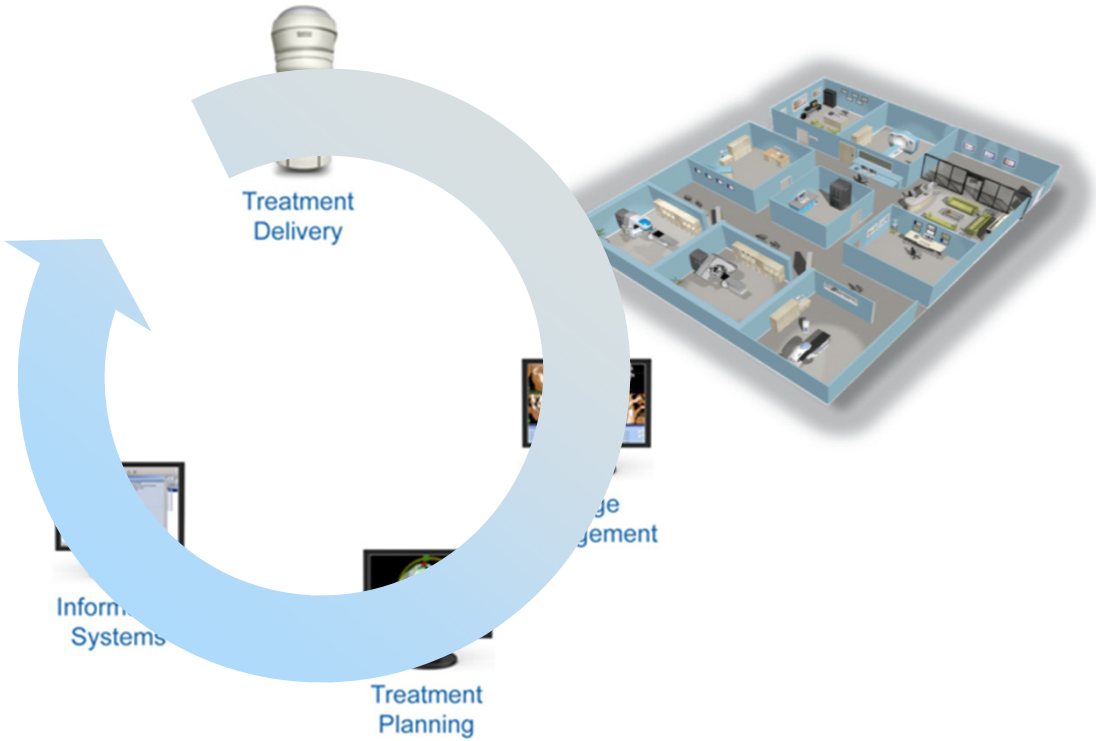
Adaptive Radiotherapy Workflow



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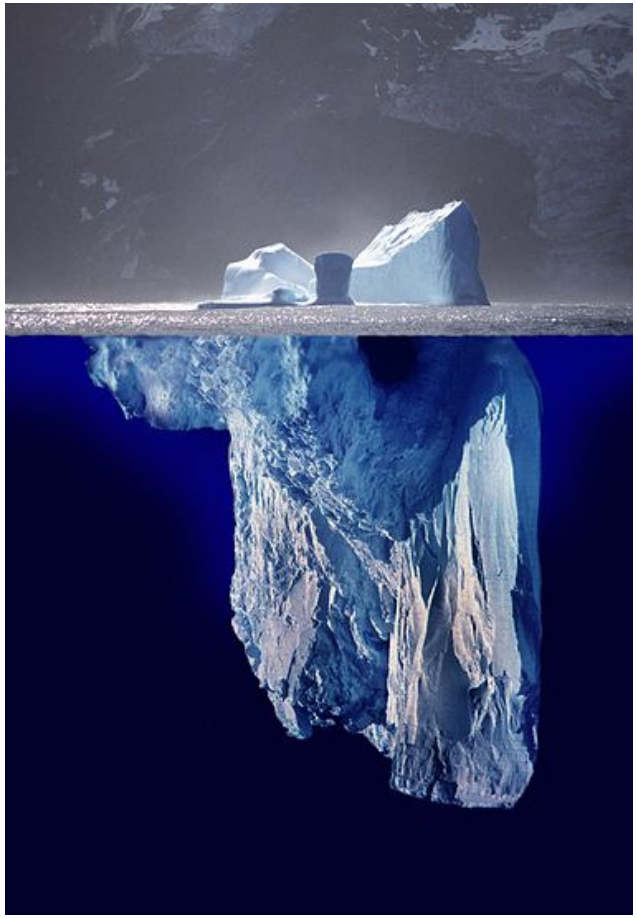

TrueBeam – „Best in Klas” LINAC

Eclipse – „Best in Klas” TPS
ARIA – „Best in Klas” OIS

RapidPlan
Insightive
Velocity
Hyperarc
MCO

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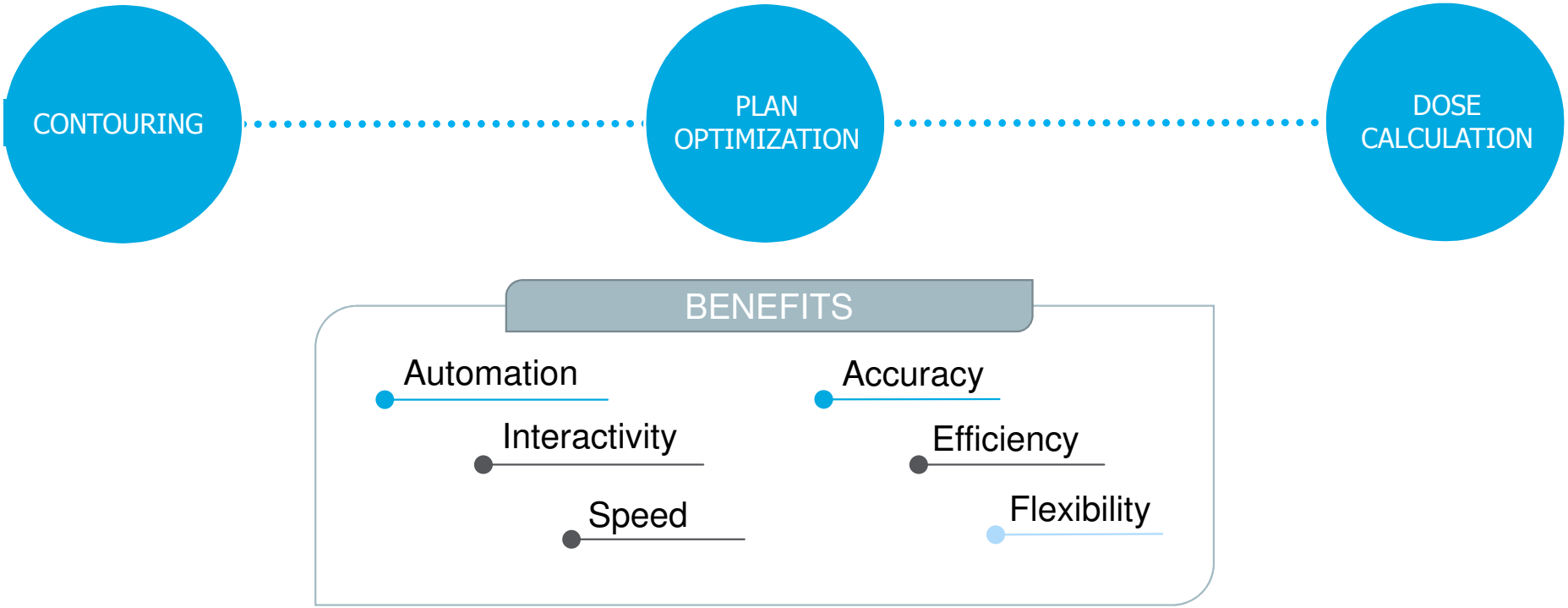
Planning Workflow Improvements – Eclipse 13.7 → 15.5

New solutions for customers needs



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Planning Workflow Improvements – SmartSegmentation

New solutions for customers needs

KNOWLEDGE BASED

Automatic contouring based on expert case selection

CONTOUR REVIEW

Manual contouring tools
Anatomy Atlas

NEW IN 15.1

Multi-atla support

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Planning Workflow Improvements – RapidPlan™

New solutions for customers needs

MODEL BASED

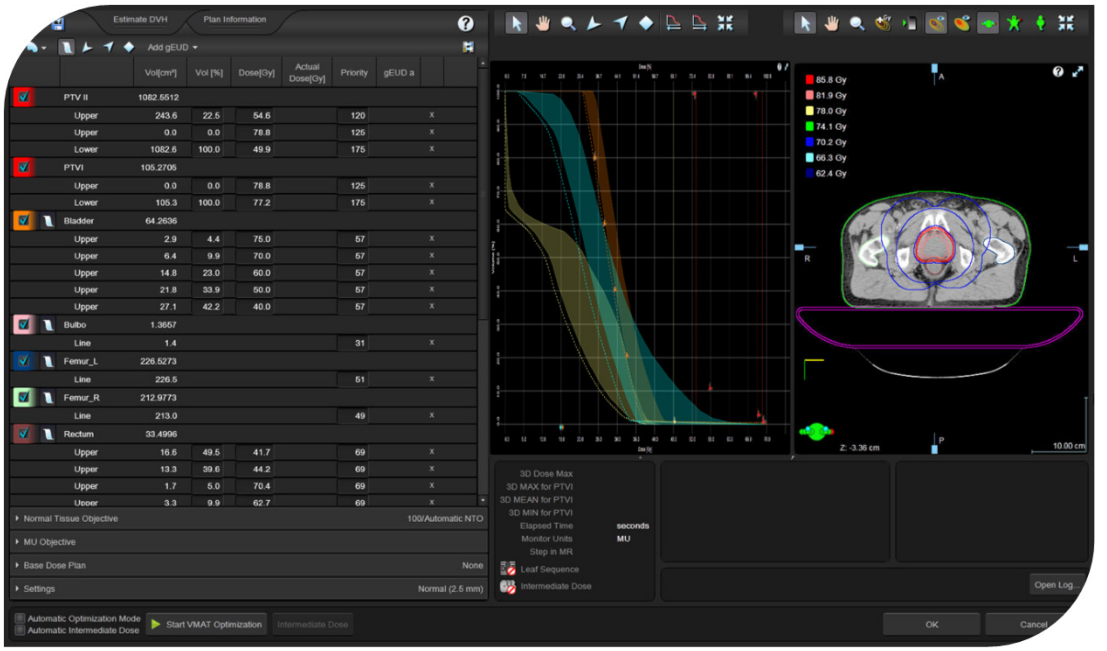
DVH Estimation of Optimization Objectives

BENEFITS

Increase Consistency, Quality and Efficiency

NEW IN 15.5

HyperArc Model



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Planning Workflow Improvements – RapidPlan™

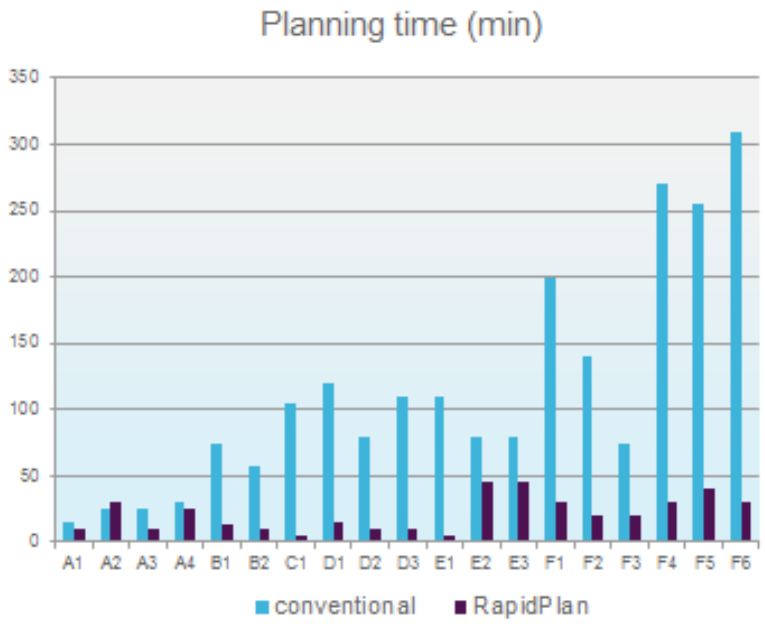
New solutions for customers needs

BENEFITS

Increase Consistency, Quality and Efficiency

Prostate
Conventional vs. RapidPlan™

	Manual	RapidPlan™
Time	114 ± 86 min	21 ± 13 min
Equivalent or better	40%	90%
Better	10%	60%



Courtesy, Royal Surrey County Hospital NHS Foundation, Guilford, UK
Data source on file

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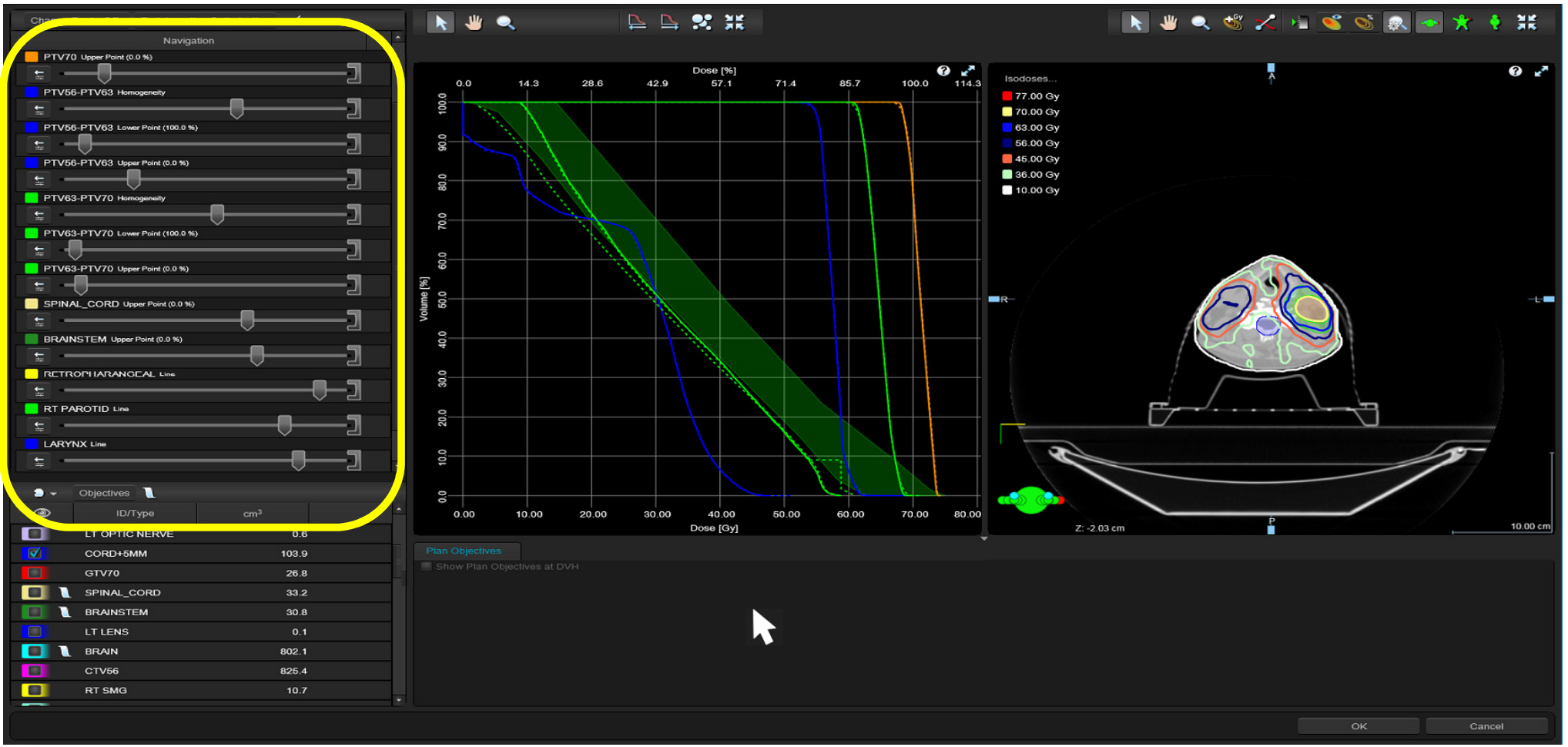

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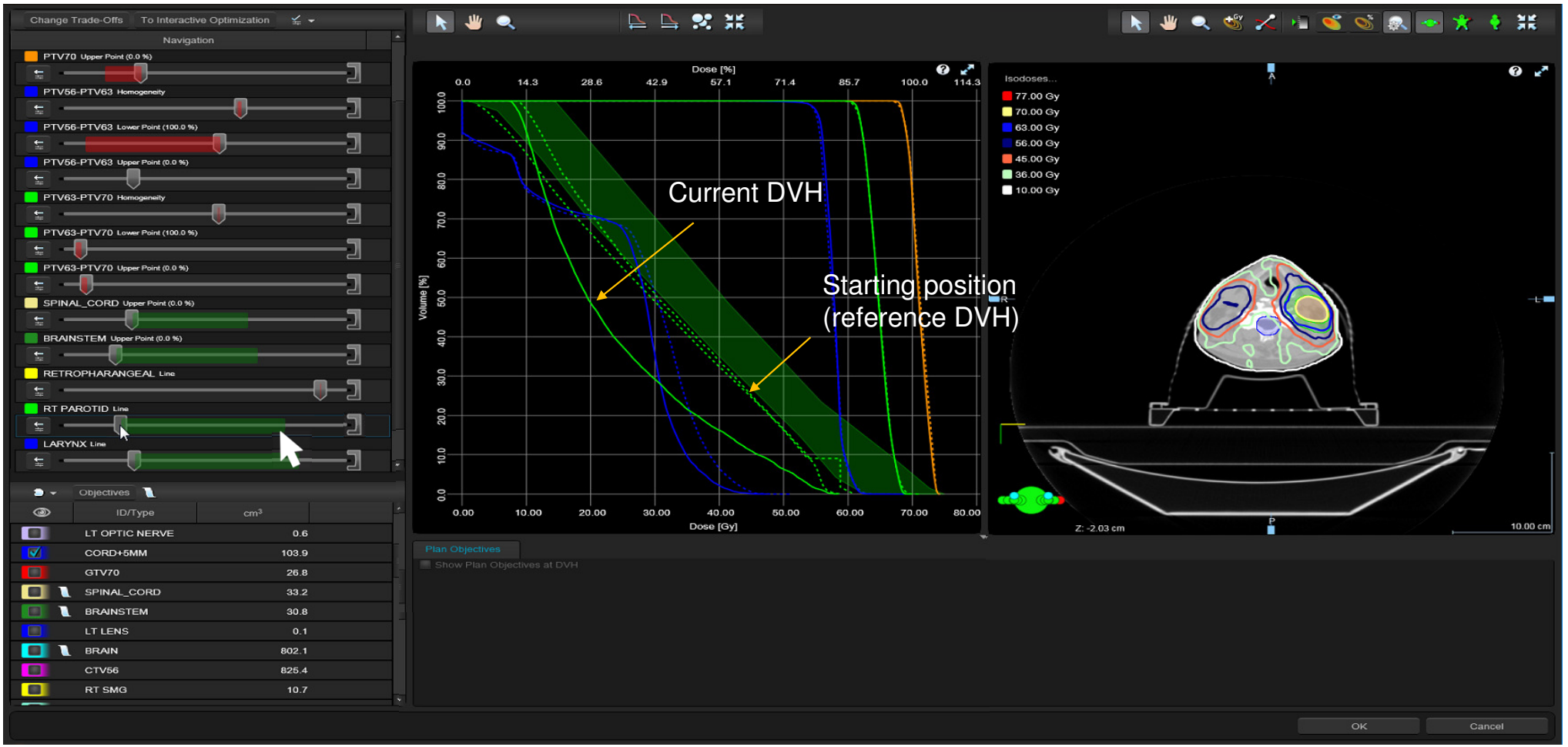

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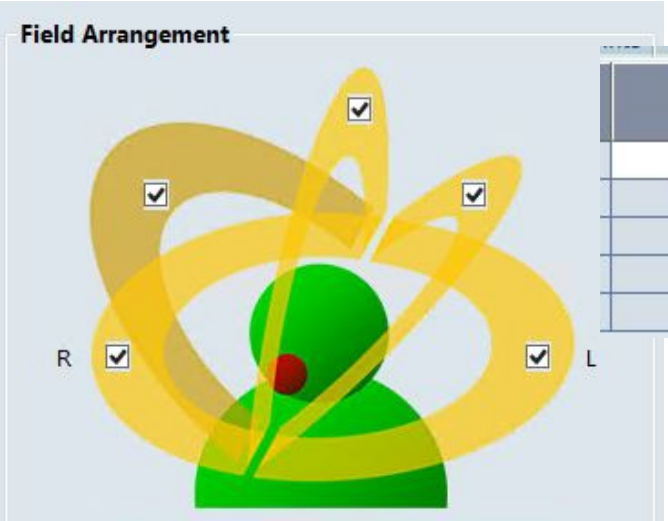
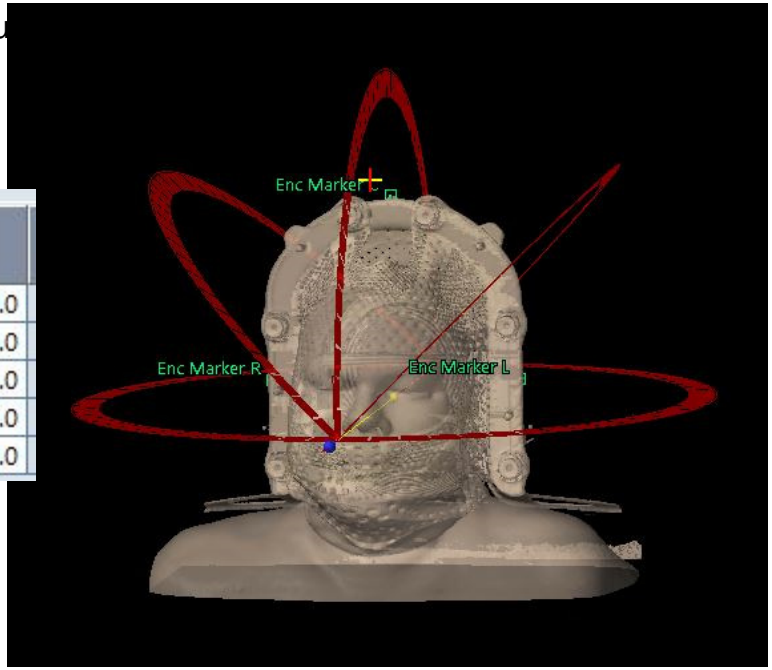
HyperArc

HyperArc Plan Creation Wizard

- Automatic Arc Trajectory Selection
  - Planner can optionally uncheck one of the arcs in case they prefer another setu



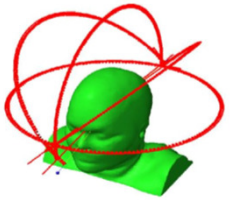
Gantry Rtn [deg]	Coll Rtn [deg]	Couch Rtn [deg]
0.0	0.0	0.0
180.1 CW 179.9	15.0	0.0
179.9 CCW 0.0	15.0	315.0
0.0 CCW 180.1	15.0	45.0
180.1 CW 0.0	18.0	90.0



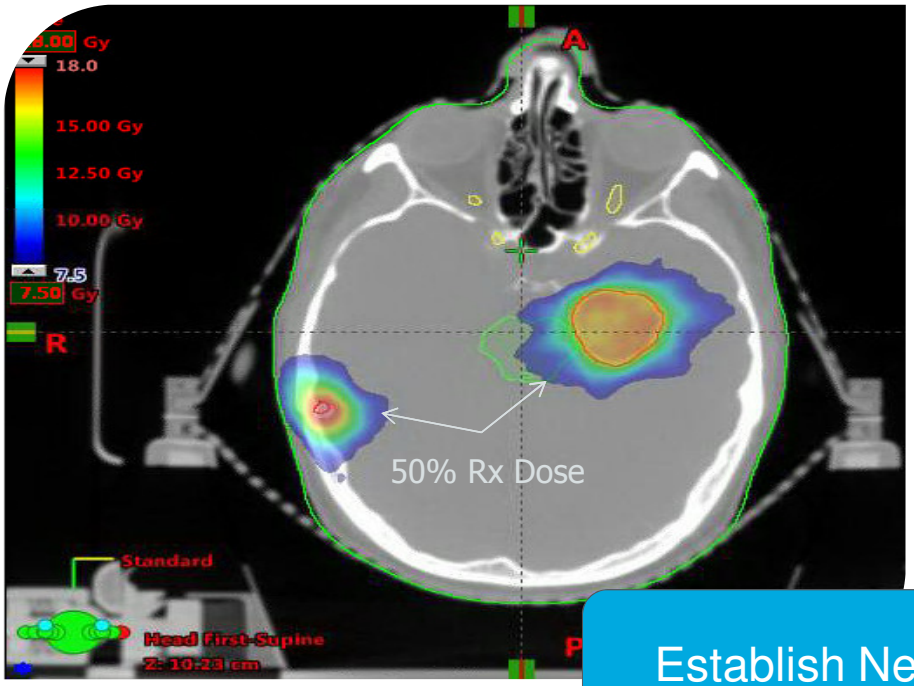
HyperArc

High definition RT

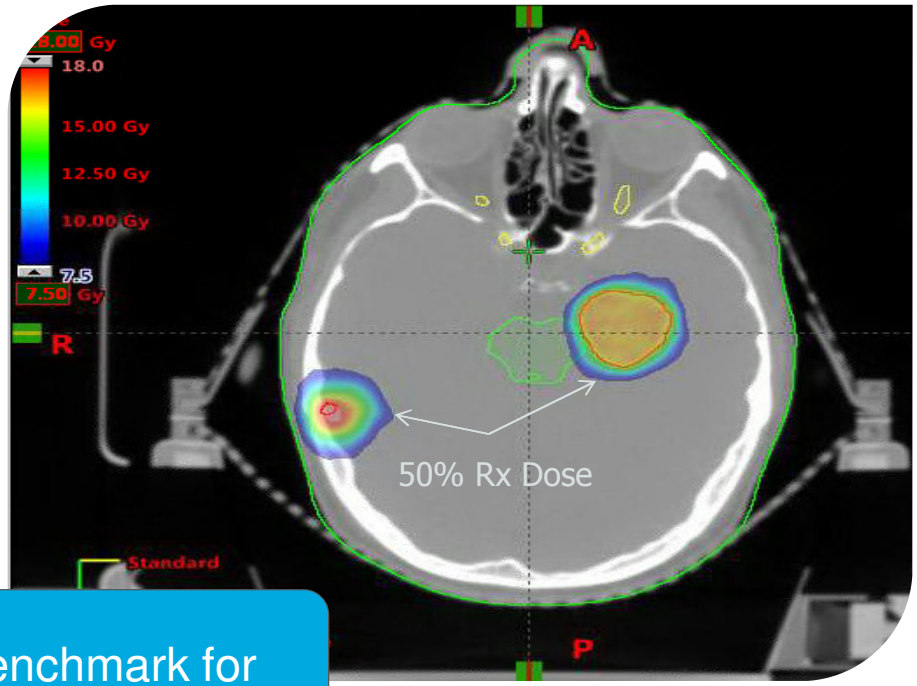
HyperArc™



Coplanar RapidArc SRS



HyperArc



Establish New Benchmark for Compact Dose

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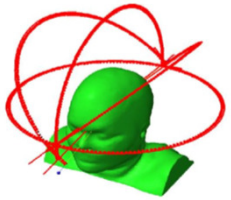
HyperArc

High definition RT

HyperArc™



Automation and Efficiency	Safety	Quality
• Simple, automated path selection tool with automatic isocenter placement, beam geometry setup and collimator rotation	• Automatic collision check	• Improved optimization process

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How do we help for physicists?

Tasks	Elements of Automation
Commissioning	Beam modeling locally, *Halcyon*
Daily QA	**MPC** - Automated machine performance check
Planning	**RapidPlan, HyperArc, MCO**
Workflow	**ARIA** task management, Visual Scripting
Plan QA	**Portal Dosimetry** via EPID & Eclipse
Reliability	**Qumulate** - Cloud based big data prediction

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MPC Workflow

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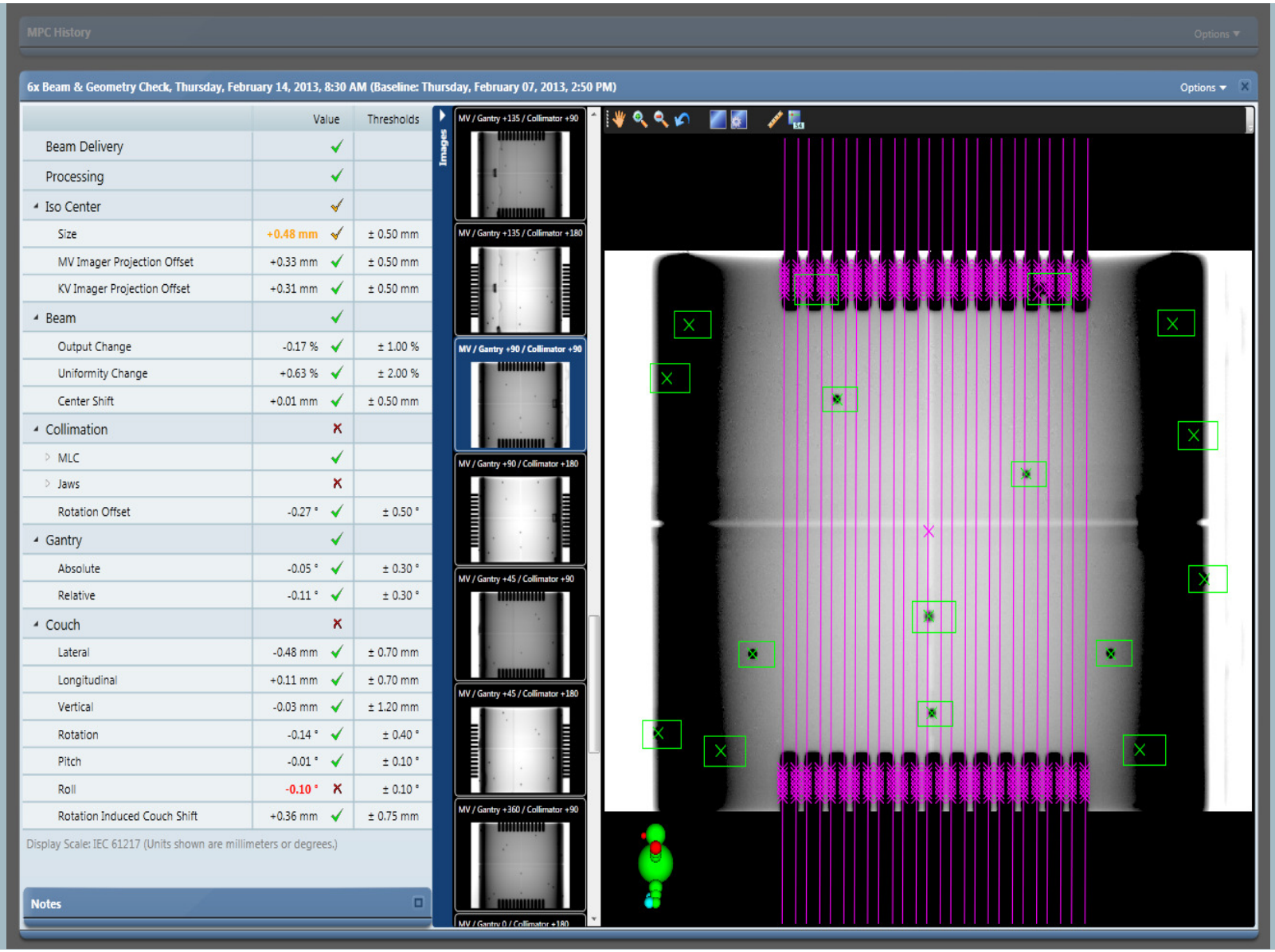
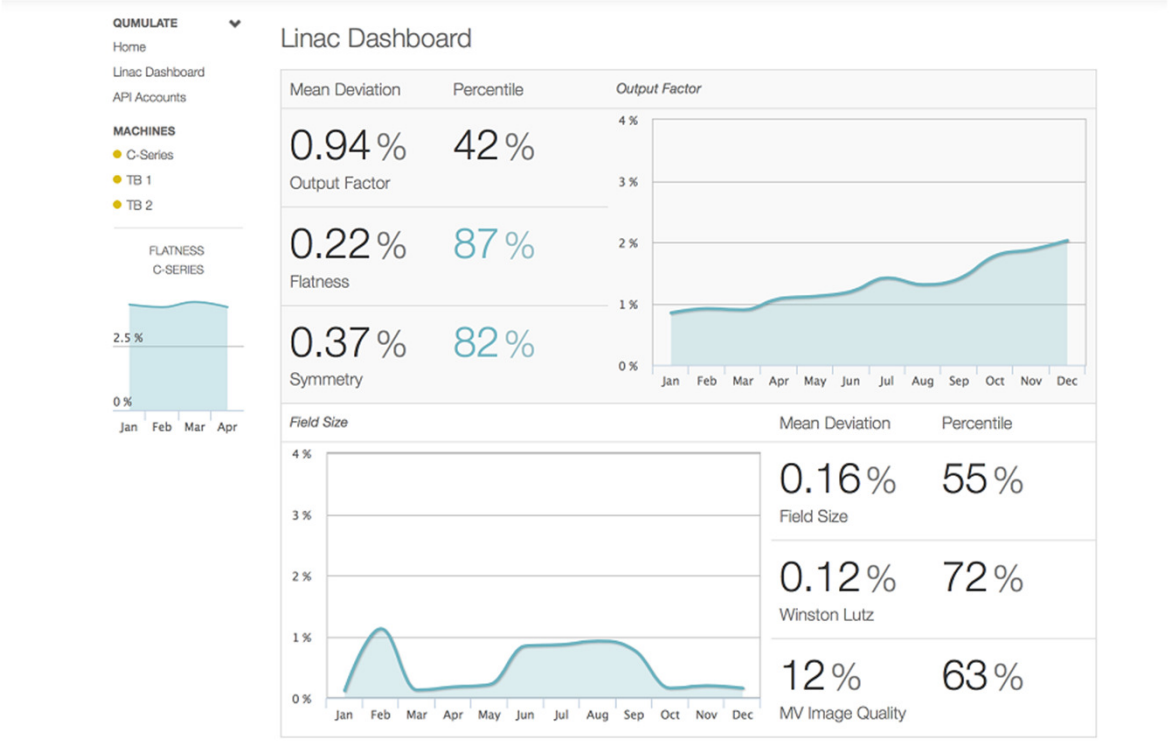

MPC History
Options
6x Beam & Geometry Check, Thursday, February 14, 2013, 8:30 AM (Baseline: Thursday, February 07, 2013, 2:50 PM)
Options
Value
Thresholds
Beam Delivery
Processing
Iso Center
Size +0.48 mm ± 0.50 mm
MV Imager Projection Offset +0.33 mm ± 0.50 mm
KV Imager Projection Offset +0.31 mm ± 0.50 mm
Beam
Output Change -0.17 % ± 1.00 %
Uniformity Change +0.63 % ± 2.00 %
Center Shift +0.01 mm ± 0.50 mm
Collimation
MLC
Jaws
Rotation Offset -0.27 ° ± 0.50 °
Gantry
Absolute -0.05 ° ± 0.30 °
Relative -0.11 ° ± 0.30 °
Couch
Lateral -0.48 mm ± 0.70 mm
Longitudinal +0.11 mm ± 0.70 mm
Vertical -0.03 mm ± 1.20 mm
Rotation -0.14 ° ± 0.40 °
Pitch -0.01 ° ± 0.10 °
Roll -0.10 ° ± 0.10 °
Rotation Induced Couch Shift +0.36 mm ± 0.75 mm
Display Scale: IEC 61217 (Units shown are millimeters or degrees.)
Notes
Images
MV / Gantry +135 / Collimator +90
MV / Gantry +135 / Collimator +180
MV / Gantry +90 / Collimator +90
MV / Gantry +90 / Collimator +180
MV / Gantry +45 / Collimator +90
MV / Gantry +45 / Collimator +180
MV / Gantry +360 / Collimator +90
MV / Gantry 0 / Collimator +180

Qumulate



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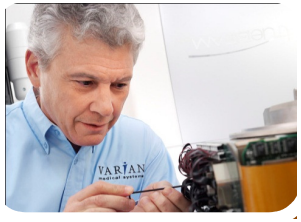
Varian Services Vision

Predictive

Proactive

Reactive



Fix potential problems before a customer is affected

Varian is developing the technology to fulfill our services vision

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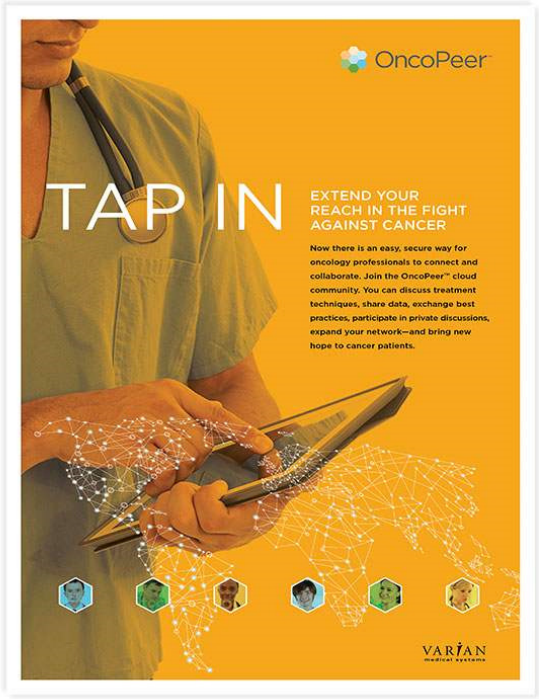
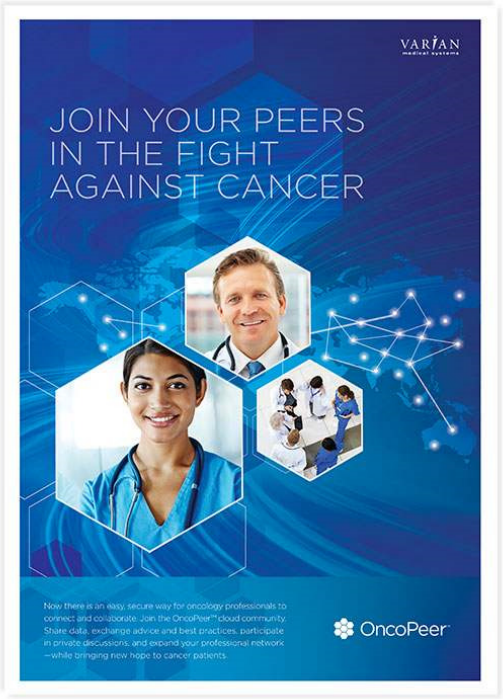
OncoPeer





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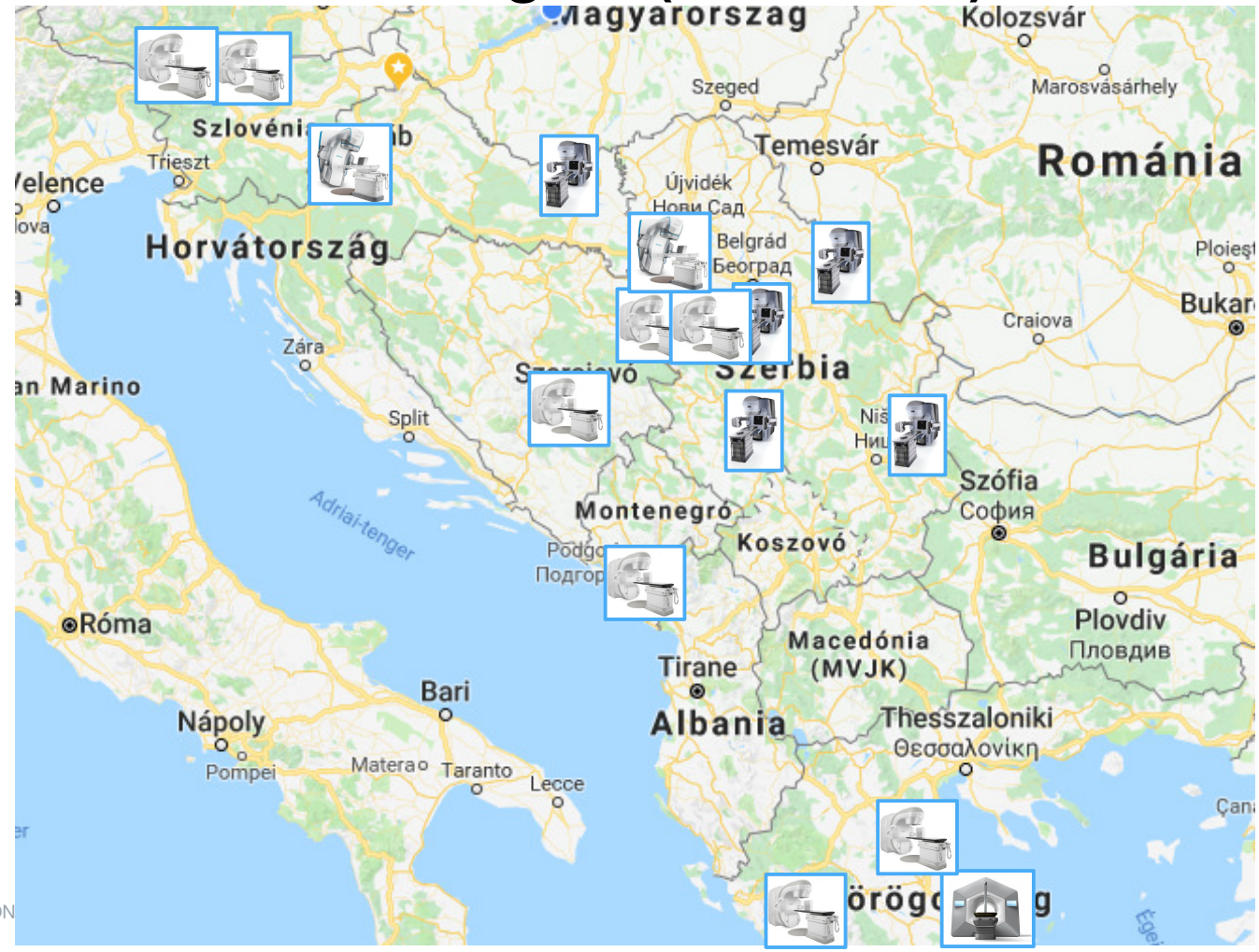
Varian today – a snapshot

Global Leader in radiation therapy	**$2.5B*** FY17 revenues	**7,750** medical linear accelerators	**>25** worldwide training centers
A focused cancer company			
4,600+ software installs	**60+** proton therapy rooms	**6,400+** employees	**50%**** international order mix

* Varian FY 17, excluding Imaging Components.
** YTD thru Fiscal 3rd quarter 2017 Gross Orders, excluding North America

Improvements in the region (2017-2018)



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(Thank You)


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