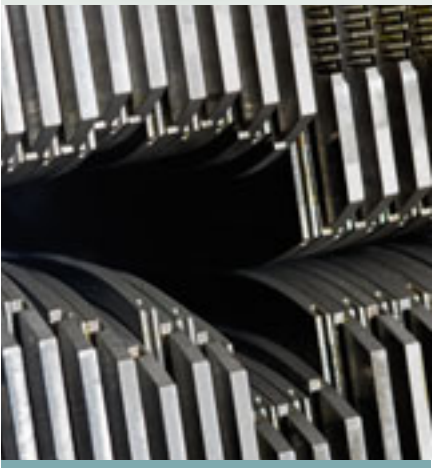

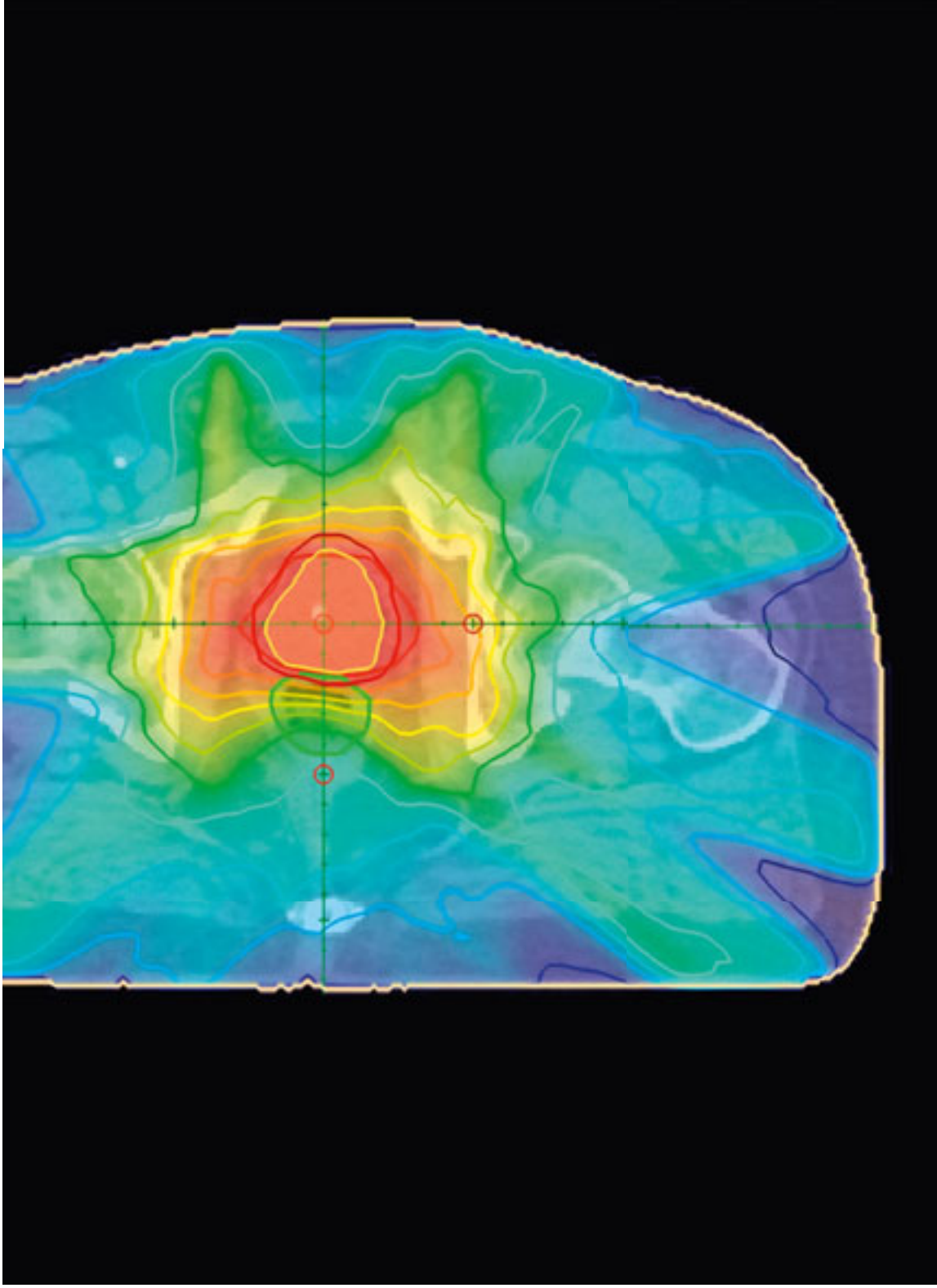

IM-RealART Solution

Replan on the spot in around seven minutes.
Fighting cancer – fast and focused.

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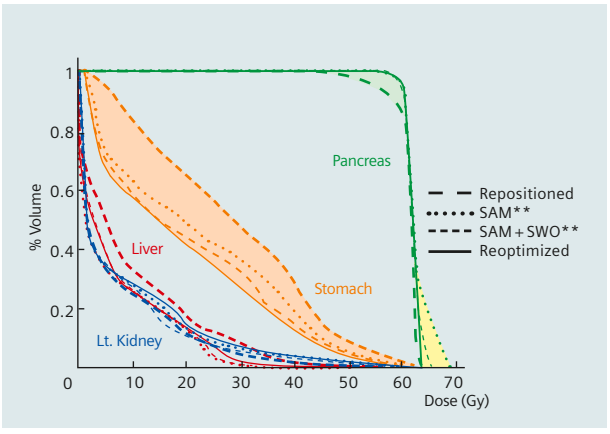
SIEMENS

Fighting cancer – fast and focused.

The philosophy behind

We are convinced that successful radiation therapy calls for the optimal resultant of speed and precision. Because speed alone at the cost of precision means to unacceptably increase the chance of affecting healthy surrounding tissue. And precision alone at the cost of speed means to lose short treatment times, high patient throughput, and a convenient patient experience out of sight.

That's why our radiation therapy solutions aim to incorporate the optimum of both, an intelligent balance of speed and precision – to help you fight cancer fast and focused.



In the pancreas case as shown here*, there are significant deviations between the original planning CT and the interfractional acquired CT due to changes in position and organ shape, resulting in an overlap of only 69% (see picture left). After replanning, the dose distribution to both target and organs at risk is drastically improved (see picture right).

When anatomy changes, you should be prepared.

Replanning with IM-RealART.

If your patient's anatomy changes during radiation therapy, how can you adjust the original therapy plan – **without drastically delaying** the treatment in course?

IM-RealART™ Solution is Siemens' **unique solution** designed for Adaptive Radiation Therapy (ART). Leveraging the capabilities of advanced key technologies from imaging to radiation, IM-RealART enables **fast and precise on-the-spot replanning:** You get up-to-the-minute information about the current tumor shape and position, related to the surrounding healthy tissue, right in the therapy room; it is possible to adapt the treatment plan prior to treatment within around **seven minutes;** and make sure you reliably hit a target that has changed and spare healthy tissue.

Do you want to stay focused on the tumor and arrange fast treatment without compromising patient safety and comfort? Then IM-RealART should be your solution of choice.

* Source: Any clinical contribution in this brochure is based on "An online replanning scheme for interfractional variations" Medical College of Wisconsin, Milwaukee, and University of Maryland School of Medicine Baltimore, Maryland, USA – Med.Phys. 35(8), August 2008

** See explanations on page 8

More than the sum of its parts: IM-RealART – adapt treatment to interfractional changes in anatomy.

Accurate imaging for precise treatment – pretreatment imaging on the spot
Don't waste time – don't demand additional ways from your patients. With a SOMATOM™ CT scanner on rails, the unique CTVision™ System provides imaging with the highest resolution and quality directly in the treatment vault, making it the gold standard imaging solution. CT scans right before scheduled fractions show interfractional changes in anatomy, organ positions, and shapes and lead to:

Intelligent planning – around seven minutes to adjust therapy
IM-RealART uses a sophisticated treatment and replanning software that enables adjustments to the treatment plan, according to movements and deformations of tumor and organs, within around seven minutes – without any changes in the patient position.

Treatment – personalized and focused on each patient
ARTISTE, our integrated imaging and therapy workflow solution, is designed specifically for ART.

Tumor shaping – turning accurate plans into precise treatment
With 160 leaves over the full field and a small leaf resolution of 5 mm at the isocenter, our 160 MLC™ Multileaf Collimator provides high conformity to the actual tumor shape. This helps optimize treatment delivery, reduce patient-on-table time, and minimize dose to surrounding healthy tissue.

- Fast comparison between original planning CT and current CT
- Fast and secure decision whether replanning is necessary

- Fast and accurate modification of contours
- Immediate creation of a new treatment plan by aperture morphing and dose recalculation
- Fast data transfer of new treatment plan to ARTISTE™ Solution

- Comprehensive portfolio of image-guided and advanced treatment delivery tools
- Choose the appropriate treatment technique for each patient
- Make critical adjustments on the spot

- High leaf speed for quick adaptation to modified treatment plan – up to 4 cm / second

CTVision System

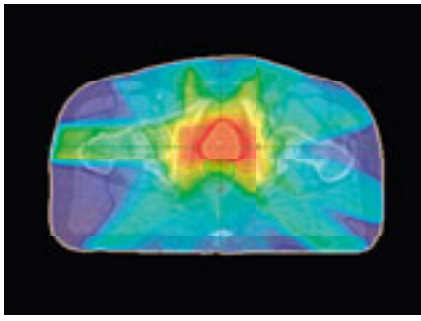
+

Intelligent treatment planning software*

ARTISTE Solution

+

160 MLC Multileaf Collimator



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IM-RealART, a unique approach to ART, impressively demonstrates how precisely the therapeutic dose can be delivered to the target – fast and focused.

*Panther RealART, a product of Prowess Inc.

IM-RealART – fast and focused all the way.

Nothing has changed → Planned treatment
- Continue treatment

Tumor position has changed significantly → Patient repositioning
- In most cases it is sufficient to reposition patient by moving the table (in some cases replanning might be the choice)

Patient verification
around 1 minute

- Take a new CT image
- Compare new image with reference image

Tumor shape has changed significantly

Replanning
around 7 minutes

Intelligent treatment planning software*

Real-time treatment planning – on the spot

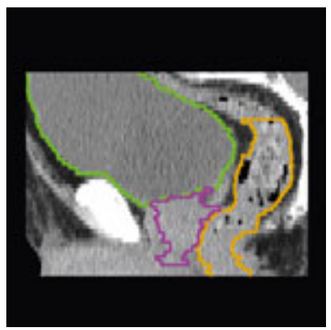
Fast contour generation	Aperture morphing	Dose distribution adaptation	New leaves
• Existing contours assist to identify shape changes of anatomical structures • Delineate new contour using drawing tablet and pen	• Stretching apertures based on relative distance from edge of tumor projection • Leaf shift based on beam's eye view (BEV)	• Segment weight optimization to enhance plan quality • Recalculation of dose distribution and Dose-Volume Histogram (DVH) • Dose review	• Transfer new plan and MLC apertures to ARTISTE • Beam conforms to changed tumor shape

*Panther RealART, a product of Prowess Inc.

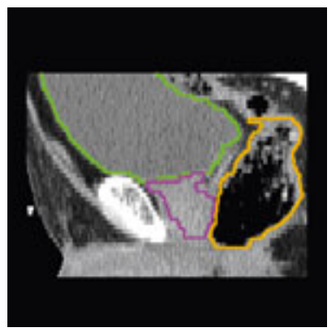
Treatment
less than 5 minutes

ARTISTE and 160 MLC

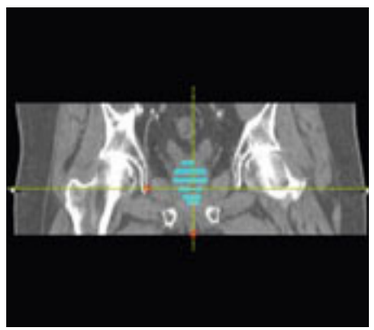
- New MLC segments download to the linear accelerator with a single click
- Fast and precise IMRT
- Possible in less than 5 minutes for all clinical fields with IM-Confident™ Plan

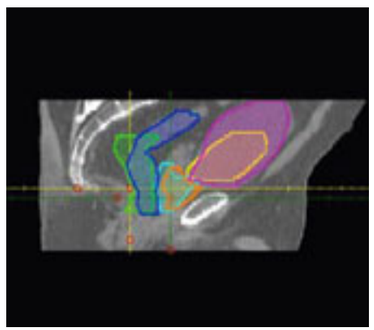


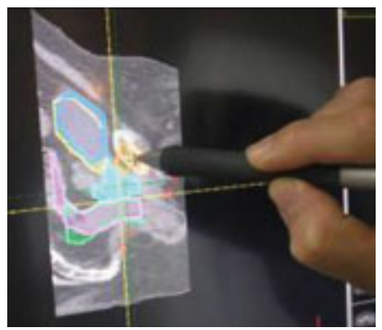
Planning CT



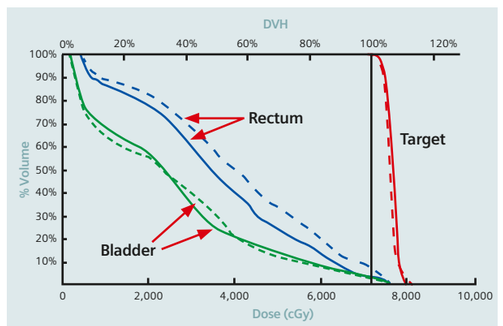
CTVision
Day 2: Original planning CT and CTVision image show an overlap of only 74%.







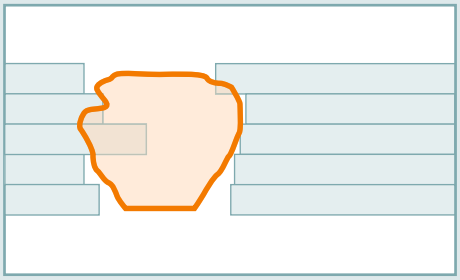
Contour generation is done quickly and easily through dropping from the original planning CT, decimating/interpolating slides with drawing tablet and pen, moving in sagittal/coronal view. Redrawing contours every day reduces delineation errors.



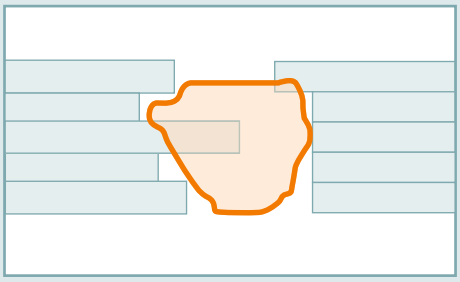
Dose-Volume Histogram (DVH) – the diagram obviously shows advantages in dose for replanning versus repositioning only (dashed line: repositioning; solid line: replanning using RealART Solution).

IM-RealART – process and the physics behind.

Using IM-RealART, five steps lead to accurate on-the-spot replanning.



Old and new segment shape



1. CT scans with CTVision
CT scans are done to compare shape and position of the anatomical structures to the original planning CT.

2. Contouring
Contour generation is very fast and easy through dropping from the original planning CT, decimating and interpolating slides with drawing tablet and pen at every fraction to reduce delineation errors.

3. Segment aperture morphing (SAM)*
SAM algorithm calculates MLC morphing based on the Beam's Eye Views (BEVs) of the new and old tumor shape. The SAM process divides the old aperture shape into a number of boundary points, each coordinate of these boundary points will then be linearly transformed from the old to the new tumor shape according to a specific formula. The new leaf position is obtained by averaging all new boundary points that are within the width of the leaf. The jaw positions are also adjusted.

4. Segment weight optimization (SWO)*
Based on the set objectives and constraints, SWO modifies the segment weights using a unique optimization algorithm. As the total dose at a voxel for a number of segments is a function of segment weights, the optimization tool is looking for a set of segment weights which fit the given objective function. Because it only uses dose distributions from the original plan, optimization can be done very fast – including dose scaling and DVH updates.

5. Data transfer to linear accelerator
The new MLC segments are transferred via Oncology Information System (OIS) to ARTISTE.

* Description based on "An online replanning scheme for interfractional variations", Medical College of Wisconsin, Milwaukee, Wisconsin, and University of Maryland School of Medicine, Baltimore, Maryland, USA – Med. Phys. 35(8), August 2008.

Benefits at a glance:

Replan on the spot

- Adapt therapy to anatomical changes
- Significantly improve dose distribution to target
- Save time

Hit the tumor, save healthy tissue

- Accurate tumor control
- Superior sparing of healthy tissue

Treat all disease sites with high precision

- Wide spectrum from Head & Neck to lung, breast, cervix, prostate …

Provide better patient experience

- No cumbersome transport to CT room
- No additional waiting time
- Reduced overall treatment time

> By adopting IM-RealART Solution from Siemens, we're able to treat patients more efficiently and more precisely. That may offer them better care because of potentially increased local control and/or reduced toxicity.

Prof. Allen Li,
Froedtert & The Medical College of Wisconsin Clinical Cancer Center, Milwaukee, Wisconsin, USA

Real-time. On the spot. IM-RealART defines ART.

IM-RealART is Siemens' integrated clinical solution that taps the full potential of Adaptive Radiation Therapy (ART). Taking interfractional changes in patient anatomy into account, it helps to optimally target the tumor throughout the complete treatment cycle – while sparing healthy surrounding tissue.

IM-RealART can be combined with Siemens' IM-Confident, which reduces IMRT treatment time possibly to less than 5 minutes. The overall effect when combining these two clinical solutions is remarkable. On the one hand, the tumor is optimally targeted every day. On the other hand, the treatment process, including replanning, requires as little time as possible. Both aspects – increasing treatment precision and accelerating workflows – are just logical parts of our mission: Fighting cancer – fast and focused.

IM-RealART – integrated from planning to treatment

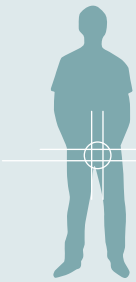
You can achieve the highest possible precision and speed when combining CTVision with ARTISTE including the 160 MLC and the Panther RealART software. Other combinations for IM-RealART are possible but fall behind in performance.

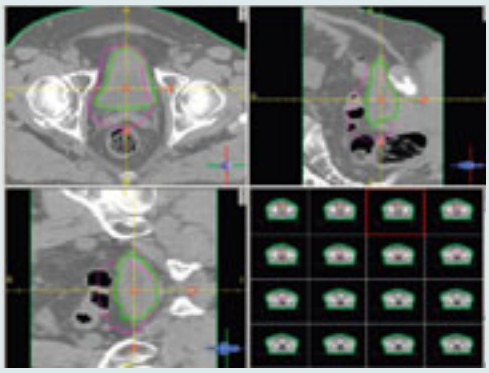
Imaging system	Linear accelerator	Replanning software
CTVision	ARTISTE with 160 MLC Multileaf Collimator	Panther RealART [1)]
CTVision	ONCOR™ Linear Accelerator with 160 MLC or OPTIFOCUS™ Multileaf Collimator	Panther RealART [1)]

With some restrictions, IM-RealART is also possible with a stand-alone CT.

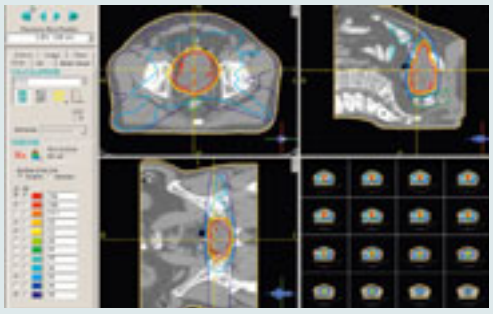
[1)] Panther RealART, a product of Prowess Inc.

Courtesy
Prof. Allen Li,
Froedtert & The Medical College of Wisconsin
Clinical Cancer Center, Milwaukee, Wisconsin, USA

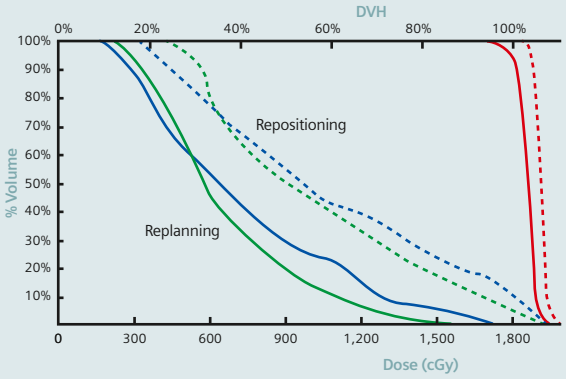




Daily bladder volume change



Dose distributions, different views and transaxial slices



Dose-Volume Histogram (DVH) – this diagram shows advantages in dose by replanning versus repositioning only (dashed line: repositioning; solid line: replanning using RealART Solution).

Clinical case – bladder carcinoma

Gender:	Male
Age:	60 years
Tumor type:	Urothelial carcinoma of bladder
Stage:	pT2 cN1 cM1

Diagnosis
High-grade urothelial carcinoma of bladder.

Challenge
- CTVision System provides interfractional high-resolution CT images. There are significant deviations between the original and interfractional CT images due to changes in organ position and shape. These changes – in some cases the organs overlap only about 75% – require new organ contouring and replanning.

- Radiation therapy with concurrent chemotherapy. Generated by an intelligent treatment planning software*: 6 MV, 8 beams, 40 segments, 402 MU

Solution
Intensity-Modulated Radiation Therapy (IMRT) treatment technique with ARTISTE Solution and 160 MLC Multileaf Collimator and a treatment plan optimized by an intelligent treatment planning software*.

Treatment technique:
6 MV photons with 8 gantry angles, 5 segments per beam, leading together to 40 segments.

Total MU: 402
Total given dose: 63 Gy (45 Gy to pelvis, 18 Gy IMRT boost)

Replanning is done after obtaining interfractional CT images with CTVision. The results show drastically improved dose distribution to both target and organ at risk. Comparison calculations were also done for repositioning versus replanning.

* Panther RealART, a product of Prowess Inc.

Clinical case – prostate cancer

Courtesy
Prof. Allen Li,
Froedtert & The Medical College of Wisconsin
Clinical Cancer Center, Milwaukee, Wisconsin, USA

Gender:	Male
Age:	57 years
Tumor type:	Prostate adenocarcinoma
Stage:	T1 cN0 M0

Diagnosis
Prostate adenocarcinoma, gleason score 3+3, PSA 15.

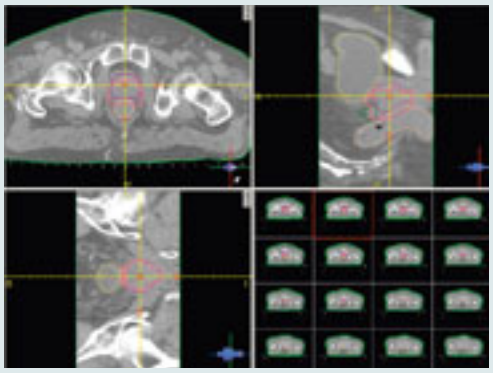
Challenge
CTVision System provides interfractional high-resolution CT images. There are significant deviations between the original and interfractional CT images due to changes in organ position and shape. These changes – in some cases the organs overlap only about 75% – require new organ contouring and replanning.

Solution
Intensity-Modulated Radiation Therapy (IMRT) treatment technique with ARTISTE Solution and 160 MLC Multileaf Collimator and a treatment plan optimized by an intelligent treatment planning software*.

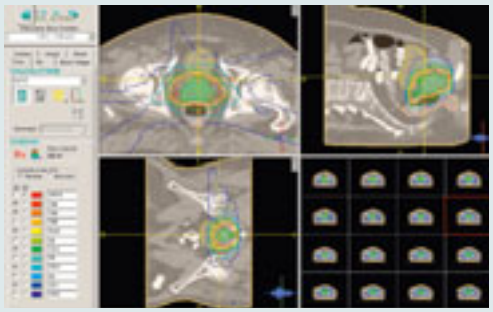
Treatment technique:
6 MV photons with 8 gantry angles, 5 segments per beam, leading together to 40 segments.

Total MU: 418
Total prescribed dose: 75.6 Gy

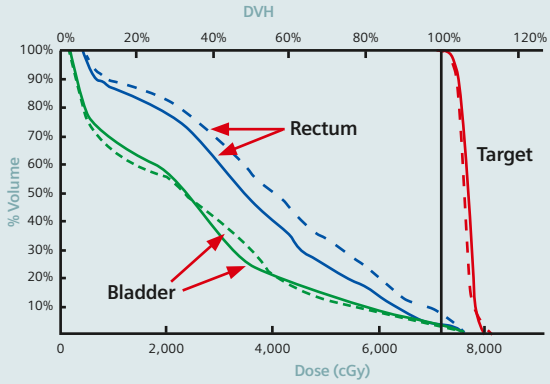
Replanning is done after obtaining interfractional CT images with CTVision. The results show drastically improved dose distribution to both target and organ at risk. Comparison calculation was also done for repositioning versus replanning. The results also show dose distribution improvements.



Daily prostate volume variation



Dose distributions, different views and transaxial slices



Dose-Volume Histogram (DVH) – the diagram obviously shows advantages in dose for replanning versus repositioning only (dashed line: repositioning – solid line: RealART replanning).

* Panther RealART, a product of Prowess Inc.

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