



**PHILIPS**

MR Systems

Ingenia MR-RT

MR-only sim

# Tap the real power of MR simulation

## Key advantages

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Single-modality approach to simplify workflows and eliminate cumbersome MR-CT registration

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Fast and automated approach to obtain excellent soft-tissue contrast and robust 3D density maps in one MR imaging session

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MR-only simulation into clinical practice – with smart automation and workflow routine

Today, MR has even more to offer for radiation treatment planning. Innovative MR-only simulation by Philips helps you rely on MR as a primary imaging modality for prostate cancer treatment planning.

Available as a plug-in extension to Ingenia MR-RT, MR-only simulation allows you to adopt a single-modality imaging approach that provides excellent soft-tissue contrast you trust for target delineation – plus density information for dose calculations. Fast scanning protocols and embedded post-processing steps generate MRCAT (MR for Calculating ATtenuation) images on the MR console in just a few minutes with the density information you'd expect from CT.

# Revolutionize your simulation approach in just a few minutes

## Challenges in an MR-CT simulation approach

A combined MR-CT approach can benefit radiation treatment planning. In most clinical workflows, MRI-based information on tissue characterization and tumor delineation is registered to a primary CT dataset. This provides the electron density information as input for dose calculations.

Yet this method can also put pressure on workflows, patients, and costs. CT-MR image registration also introduces uncertainties. Errors in the alignment of MR and CT images series in the treatment preparation stage propagate as a systematic geometric error following the patient throughout the entire treatment period.

## The potential of an MR-only workflow

An MR-only simulation workflow can eliminate technical, workflow and economic challenges related to the MR-CT multi-modality imaging workflow for specific tumor types and help you adopt MR for your treatment planning.

“Today’s patients first get an MR, then a CT scan – just to prepare for a radiotherapy treatment. It’s a burden on the patient and on workflows and it would be convenient if you could get rid of that. MR-only simulation is just a very practical and economical way of doing things. It’s a logical next step.”

**Uulke van der Heide, PhD, the Netherlands Cancer Institute, Amsterdam, The Netherlands**

## Clinical excellence with MR-only simulation

To successfully bring MR-only simulation into your clinical routine, we recognize the need to look beyond MR imaging – and address steps such as patient marking, position verification, and quality assurance. We can help you successfully adopt this new simulation paradigm with our workflow descriptions and tailored training support for radiation oncology professionals.

## CT-MR registration workflow

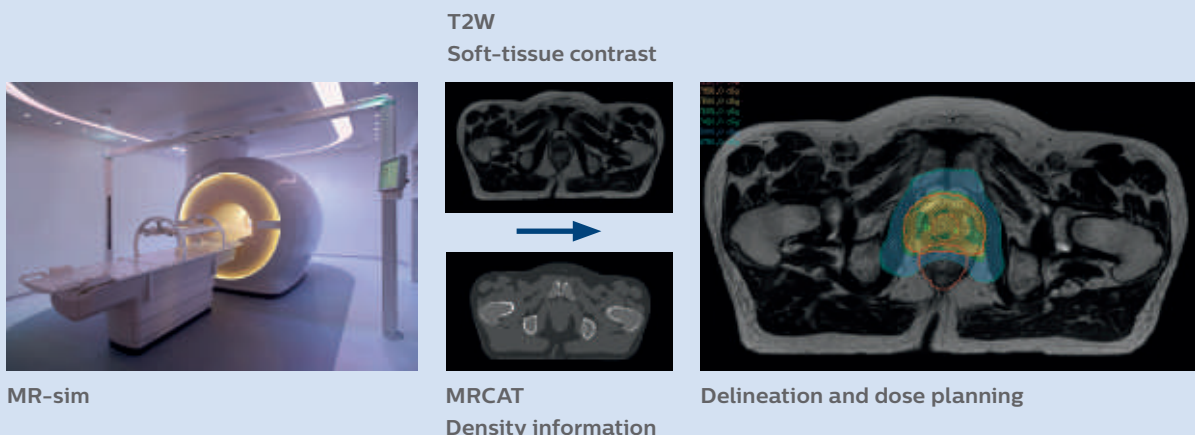


## MR-only simulation workflow



## MR-only simulation for prostate

Perform prostate dose calculations based on MR data only



# Fast, automated, and part of **your** **workflow**



MR-only simulation for prostate treatment planning is available as an option to your Ingenia MR-RT system. It provides MR images with electron density information and it's tailored to every stage of your simulation workflow.

## **1. MR-only sim imaging**

Optimized for fast and robust image acquisition, a dedicated imaging protocol provides:

- dedicated 3D MRCAT source sequence as input for generation of density information for dose calculations - obtained in just a few minutes
- anatomical information for delineation of target and critical structures
- prostate marker visualization for position verification

## **2. Embedded MRCAT generation**

Fully automated generation of MRCAT images at the MR console. The embedded image post-processing runs in the background – parallel to image acquisition – and is performed with just one push of the button. No time is added to the overall procedure.

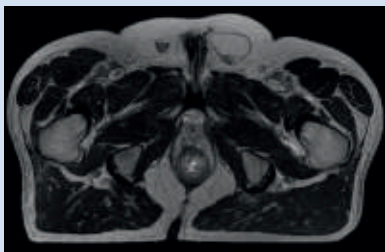
Smart, validated algorithms enable automatic tissue characterization of five tissue types; air, fat, water, cortical bone, and spongy bone. Subsequent bulk-density assignment provides MRCAT images with CT-based density information.

## **3. Export for treatment planning**

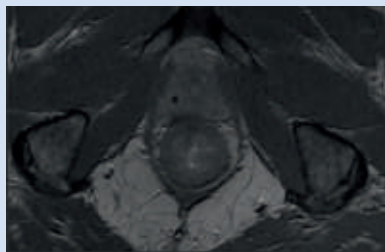
The MRCAT images conform to DICOM and can be automatically exported, like CT images, to main treatment planning systems (TPS). You can use this information as the primary image dataset for dose calculations and to generate MR-based digitally reconstructed radiographs (DRRs).



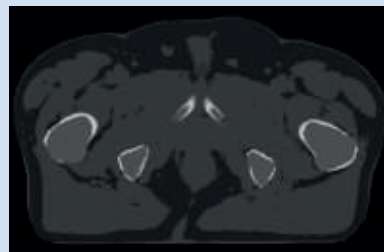
# MR-only simulation at a glance



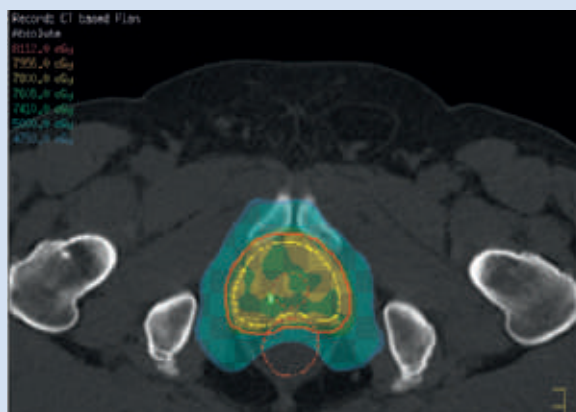
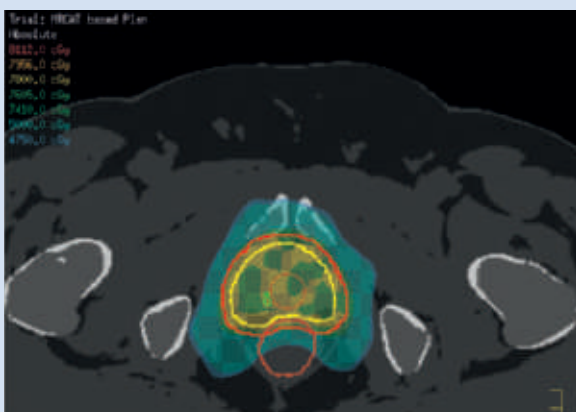
T2-weighted images for target delineation



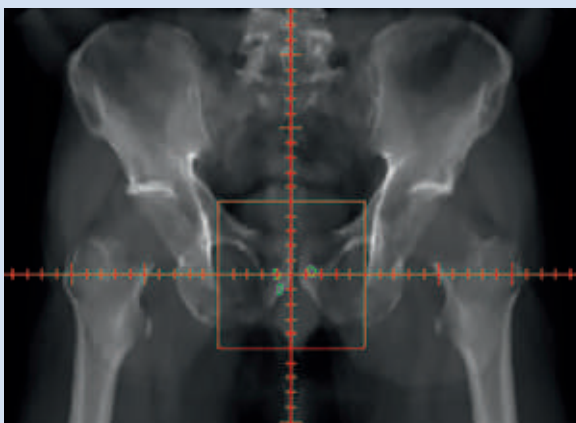
Prostate marker visualization scan



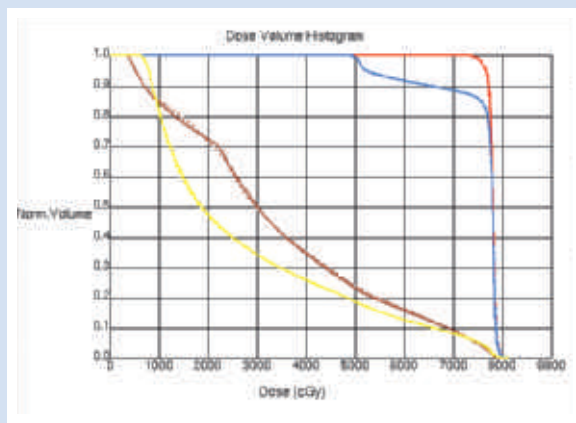
MRCAT image with density information



Dose plan based on MRCAT (left) and CT (right) calculated in Pinnacle<sup>3</sup>



DRR image calculated from MRCAT in Pinnacle<sup>3</sup> including visualization of prostate markers (in green)



DVH comparison MRCAT-based (solid lines) versus CT-based (dotted lines) plans. PTV78 (red), PTV50 (blue), rectum (brown), and bladder (yellow)

Images acquired on the Ingenia MR-RT 1.5T  
Total scanning duration: 12 minutes.

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Please visit [www.philips.com/mr-rt](http://www.philips.com/mr-rt)  
[healthcare@philips.com](mailto:healthcare@philips.com)