PHILIPS

Radiation Oncology

MR-only simulation

Pelvis

Unleash
the real power of
MR simulation

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the real power of MR simulation

Innovative MR-only simulation pelvis lets you plan radiation therapy for male and female pelvic cancer patients with soft-tissue tumors using MRI as a single-modality solution. Within just one MR exam, MR-only simulation provides excellent soft-tissue contrast for target and OAR delineation, and CT-like density information for dose calculations. This not only extends the benefits of MRI's outstanding soft-tissue contrast to radiotherapy planning, but it also eliminates arduous, error-prone CT-MRI registration from the process, reducing uncertainties and complexity.

Rendering CT unnecessary, MR-only simulation helps to simplify workflows and accelerate time-to-treatment for patients and staff by reducing the need to coordinate scans. What's more, it supports cost-effective radiation therapy treatment planning based on the power of MRI.

Available as a plug-in extension to Ingenia MR-RT, MR-only simulation pelvis offers fast, robust scanning protocols and embedded post-processing steps. This enables automatic generation of MRCAT (MR for Calculating ATtenuation) images with CT-like density information for dose calculations directly on the MR console.

- Benefit from MRI's **superior soft-tissue contrast**

- **Eliminate errors** introduced by MR–CT registration

- Lower costs and make MR simulation **more affordable**

- Simplify workflows and **reduce patient burden**

Experience the true potential and drive **the impact of MRI**

MR + CT based workflow

Simulation → Registration → Delineation → Dose calculation

MR-only simulation workflow

Simulation → Delineation → Dose calculation

Highly targeted planning is the foundation for success in radiation treatment. And with its superb and tunable soft-tissue contrast, MRI is emerging as an exceptional modality to visualize and support accurate delineation of targets and organs at risk. As MRI intrinsically does not provide the electron density information required for dose calculations, current planning practice typically calls for the co-registration of MR and CT images. Yet, this method puts pressure on workflows, patients and costs. Plus any uncertainties introduced during CT-MR registration follow the patient throughout their entire treatment period.

Philips MR-only simulation provides a single-modality answer:
- It delivers CT-like density information for dose calculations and soft-tissue contrast for delineation from a single MRI scan
- It uses MRI as primary imaging modality for radiotherapy planning of soft-tissue cancer in the pelvic area, which includes prostate, bladder, rectum, anus and cervix.
- It can be used for a wide range of common cancers, extending the benefits of MR-only radiotherapy planning to a broad patient base, making it an efficient and cost-effective addition to your department.
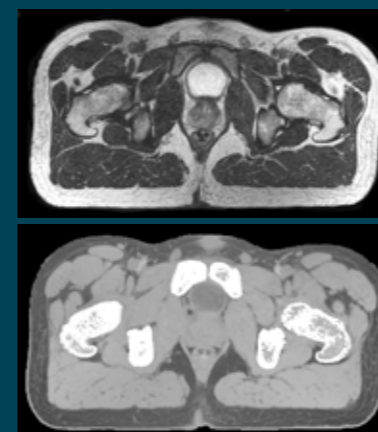
MR-only simulation

Perform dose calculations based on MR data only

T2W - Soft-tissue contrast

MR simulation

MRCAT - Density information

Delineation and MRCAT-based dose planning

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

MR-only simulation pelvis is available as an option to the Ingenia MR-RT platform. It offers fast, robust scanning protocols and embedded post-processing steps to generate MRCAT (MR for Calculating ATtenuation) images with CT-like density information for dose calculations directly on the MR console.

Robust, consistent imaging protocol
The dedicated MR-only simulation imaging protocol includes a single, high-resolution, multi-contrast mDIXON sequence as the source for MRCAT generation. This scan only takes a few minutes and is standardized to deliver consistent results. The protocol is complemented with a 3D T2W scan to provide high geometric accuracy, and high-resolution image quality to support accuracy in delineation of target and critical structures. Furthermore, the user has the flexibility to add additional protocols and modify the 3D TW2 scan in line with hospital preferences. The total imaging protocol takes less than 15 minutes, helping to reduce intra-scan motion, limiting the time the patient has to be immobilized and supporting patient throughput.
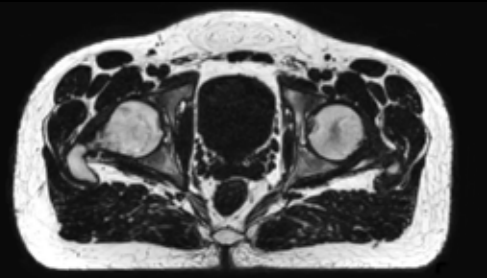

360 mm

Large field of view imaging
A large field of view of up to 36 cm in the feet-head direction allows creation of treatment plans covering extended targets in the pelvis, for example for lymph node involvement, by providing body-outline contour and geometrically accurate MRCAT images[1].
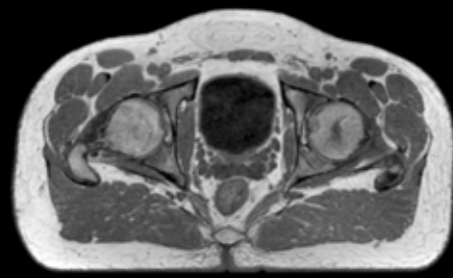
Positioning to meet your patient's preferences
The MR-only simulation imaging protocol lets you work flexibly in line with your and your patient's positioning preferences. You can image patients with their arms in the field of view, next to their body, or held on their chest. Head-first or feet-first imaging is possible, enhancing patient comfort and simplifying positioning.
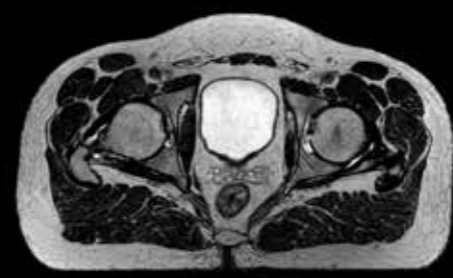
Robust, consistent imaging protocol

mDIXON XD FFE - Fat

mDIXON XD FFE - In Phase

mDIXON XD FFE - Water
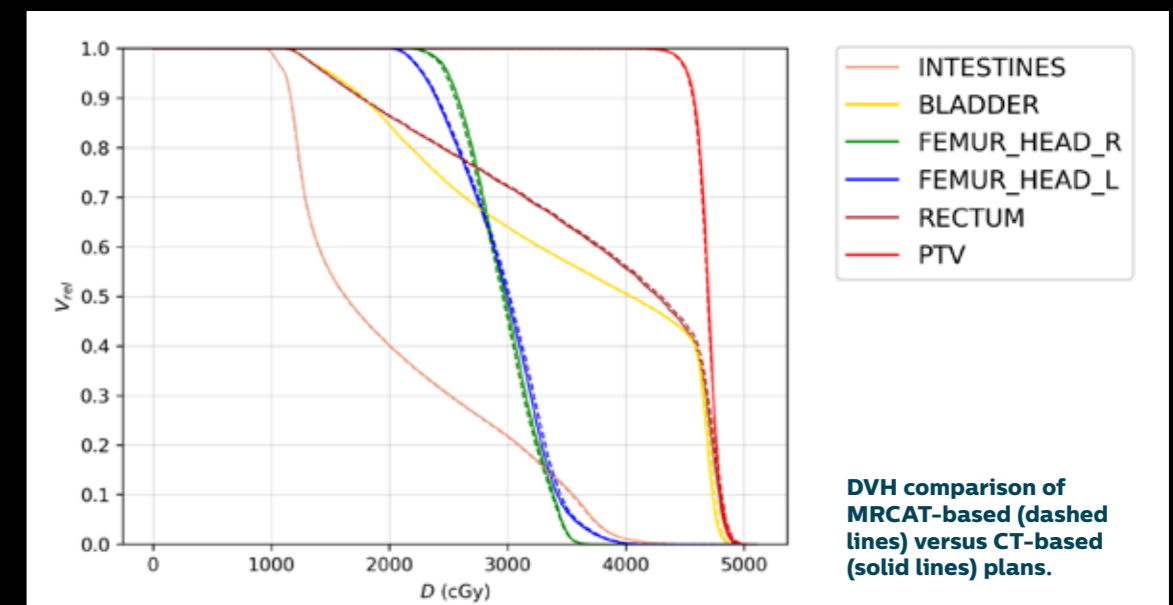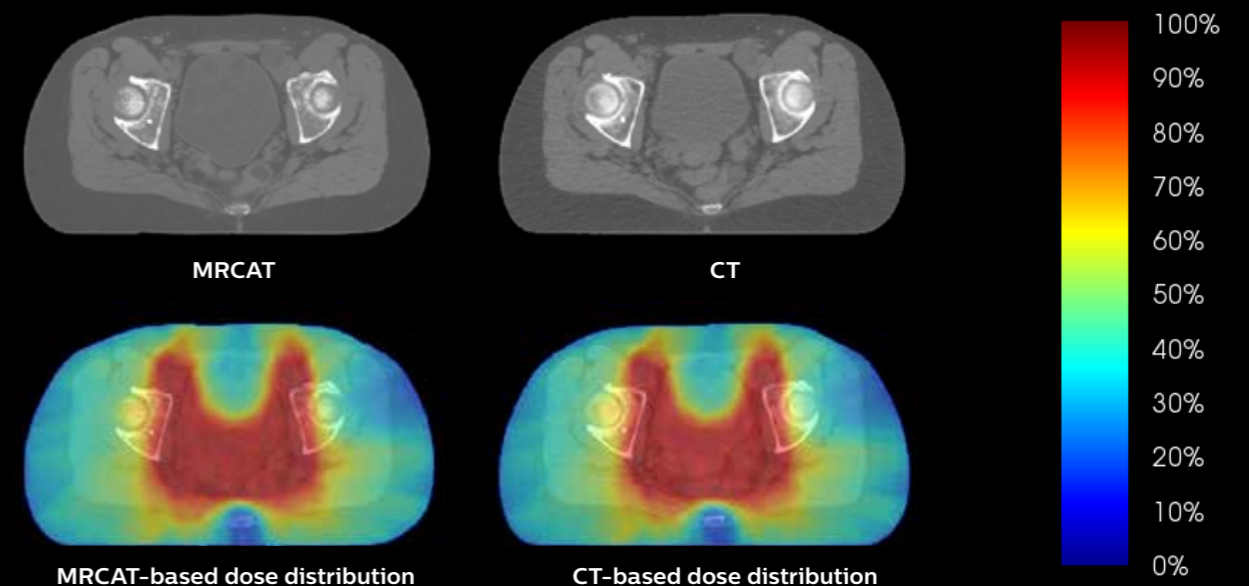
T2W 3D

Automatic generation
of synthetic CT images

MR-only simulation pelvis includes fully automated generation of MRCAT images directly on the MR console using the mDIXON scan as source. Embedded image processing runs in the background – parallel to image acquisition – which means no time is added to the scanning session. Smart, validated algorithms that make use of machine learning enable automatic tissue segmentation and assignment of continuous Hounsfield Units to deliver MRCAT images with CT-like density information for dose calculations.

Density information directly on the MR console
As the density information is generated directly on the MR console, the resulting data is available at the console for immediate review during the scan. The MRCAT reconstruction also automatically detects certain flaws in image acquisition, such as incorrect patient positioning, and alerts the user if an immediate re-scan is necessary. This potentially reduces the need to call patients back for repeat exams.

MRI as primary image set in treatment planning
The MRCAT images generated on the MR console conform to the DICOM CT standard. They can be automatically exported to your main treatment planning systems and used as the primary image dataset for dose calculations.

Accuracy in dose planning
The MR-only simulation scanning protocol and MRCAT generation algorithms have been designed with the strict accuracy requirements of RT in mind. MRCAT images have high geometric accuracy[1] and validation studies have shown that MRCAT-based dose plans are robust and as accurate as CT-based plans promoting confidence in dose planning[2].

Validation studies have shown that MRCAT-based dose plans are robust and as accurate as CT-based plans[2]

MRCAT   CT

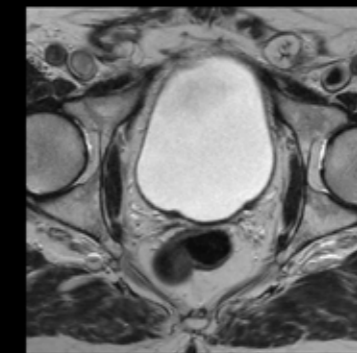MRCAT-based dose distribution   CT-based dose distribution

DVH comparison of MRCAT-based (dashed lines) versus CT-based (solid lines) plans.
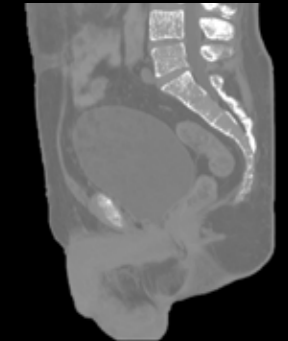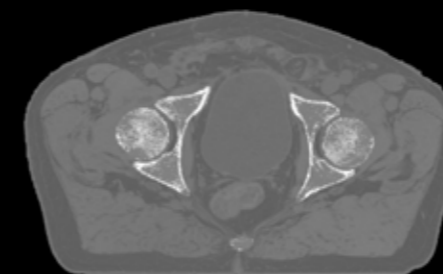
MR-only simulation
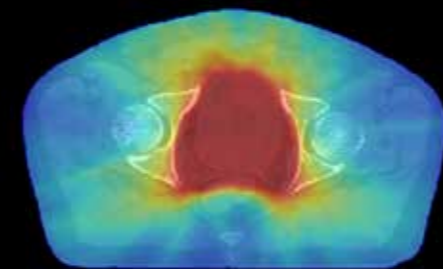## at a glance
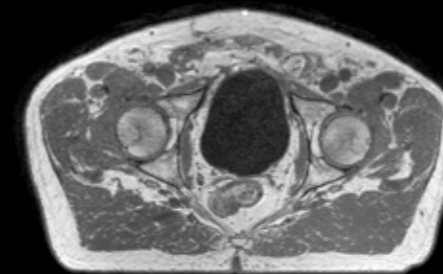
mDIXON XD FFE MRCAT source scan   T2-weighted images for target delineation. Transversal (left), sagittal (right).

MRCAT with continuous Hounsfield Units. Tranversal (left), coronal (center) and sagittal view (right).

MRCAT-based dose plan.   DRR images calculated form MRCAT in Pinnacle[3].

Images acquired on Ingenia MR-RT 1.5T

RTdrive and MR-only simulation for prostate

MR-only simulation for pelvis includes the MR-only simulation prostate clinical application – the foundation for MR-based Auto-Contouring and RTdrive MR prostate. These innovations support the automatic contour creation of the prostate and OARs. What's more, they allow you to generate treatment plans within 25 minutes[3] including simulation imaging. This reduces the number of repetitive tasks and accelerates time-to-treatment.

Patient positioning based on MR-only imaging

As this method eliminates CT from the process, patient positioning must also be performed as part of this workflow. The MR-based image sets with continuous Hounsfield units enable CBCT-based positioning based on soft-tissue contrast with a look and feel familiar from CT. You can also use MRCAT data to generate MR-based digitally reconstructed radiographs (DRRs) to allow for patient positioning using bony structure.

Committed to care

Philips is committed to delivering clinical, workflow and economic benefits to its customers – while keeping patient care and comfort at the heart of what we do.
To successfully bring MR-only simulation into your clinical routine, we recognize the need to look beyond the imaging itself – and address steps such as patient marking, position verification, and quality assurance. To this end, we offer dedicated workflow descriptions, white papers and tailored training support for radiation oncology professionals, designed to support you as you embrace this new treatment paradigm.

1 Accuracy means: MRCAT provides < ± 1 mm total geometric accuracy of image data in < 20 cm Diameter Spherical Volume (DSV). MRCAT provides < ± 2 mm total geometric accuracy of image data in < 40 cm Diameter Spherical Volume (DSV)*.
  * Limited to 32 cm in z-direction in more than 95% of the points within the volume
2 The simulated dose based on MRCAT images does not differ in 95% of the pelvic cancer patients (Gamma analysis criterion 3%/3mm realized in 99% of voxels within the PTV or exceeding 75% of the maximum dose) when compared with CT-based plan for EBRT.
3 Tested in a non-clinical environment with single Pinnacle[3] user and a 5-beam IMRT plan. Excluding time for optional manual adjustments.

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