



**PHILIPS**

Radiation Oncology

MRI

MRCAT Brain

# Unleash the real power of MR simulation

## MRCAT Brain

Philips MRCAT Brain clinical application allows the use of MRI as the primary imaging modality for radiotherapy planning of primary and metastatic tumors in the brain without the need for CT.

Detailed anatomical information for contouring and attenuation maps for dose calculations are both obtained from a single, submillimeter resolution 3D T1W mDIXON MR sequence. Artificial Intelligence (AI) is used for fast computation of continuous Hounsfield units directly on the MR console.

MRCAT data can be used for export to treatment planning systems for CT-equivalent<sup>1</sup> dose calculations, and for accurate patient positioning at the linac<sup>2</sup>.

Innovative Philips MRCAT Brain lets you plan radiation therapy using MRI as a single-modality solution. Within just one fast MR scan, MRCAT Brain 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 excellent soft-tissue contrast to radiotherapy (RT) planning, but it also eliminates arduous, error-prone CT-MRI registration from the process, reducing uncertainties and complexity.

#### MRI for brain radiotherapy

The use of MR soft-tissue information for tumor and OAR delineation to complement CT data is the standard of care for brain cancer patients in many institutions. There are however, drawbacks to this workflow.

Often MR diagnostic scans do not meet RT requirements. For example, diagnostic scans have slice gaps, are angulated, and are not optimized for geometric fidelity or for contrast needed for delineation. They are also not acquired in the treatment position and there can be significant time difference between the moment of diagnostic MR imaging and the delivery of the first fraction. This can lead to inconsistencies introduced during image registration and delineation steps.

#### The single scan advantage

With Philips MRCAT (MR for Calculating Attenuation) Brain, a single, dedicated mDIXON T1W scan provides information for both contouring and dose calculation for treatment planning. As anatomical and density information originate from the same scan, no image registration is required and spatial and temporal consistency are ensured.

#### Short scan time promotes patient comfort and productivity

An MR exam can cause stress for patients, especially if they are immobilized and in treatment position. The mDIXON T1W scan is accelerated by Compressed SENSE and takes just a

few minutes to complete. This promotes patient comfort by minimizing time in the scanner. Furthermore, it can boost productivity by allowing for additional sequences within the timeslot.

#### Density information directly on the MR console

As the density information is generated directly on the MR console, the resulting data is available for immediate review during the scan. This reduces the need to call patients back for repeat exams.

#### Accuracy in dose planning

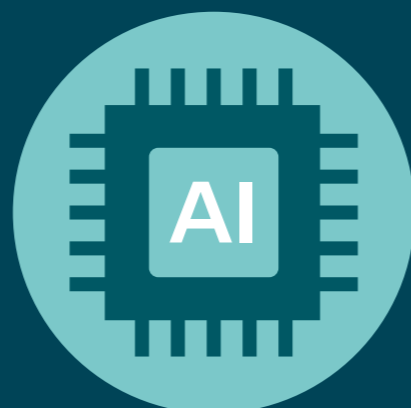
MRCAT Brain has been designed with the strict accuracy requirements of RT in mind. MRCAT image acquisition is geometrically accurate<sup>3</sup> and verification studies have shown that MRCAT-based dose plans are equivalent<sup>1</sup> to CT-based plans, promoting confidence in dose planning.

#### Seamless workflow integration

DICOM-CT conform, the MRCAT Brain dataset can be exported to treatment planning systems and used as the primary image dataset for dose calculations. You can also use the high-resolution MRCAT data for patient positioning at the Linac. Studies have shown that positioning verification is as accurate as with CT-based workflows<sup>2</sup>. As a result, you can rely solely on MR for the entire treatment planning process, removing the need for CT.

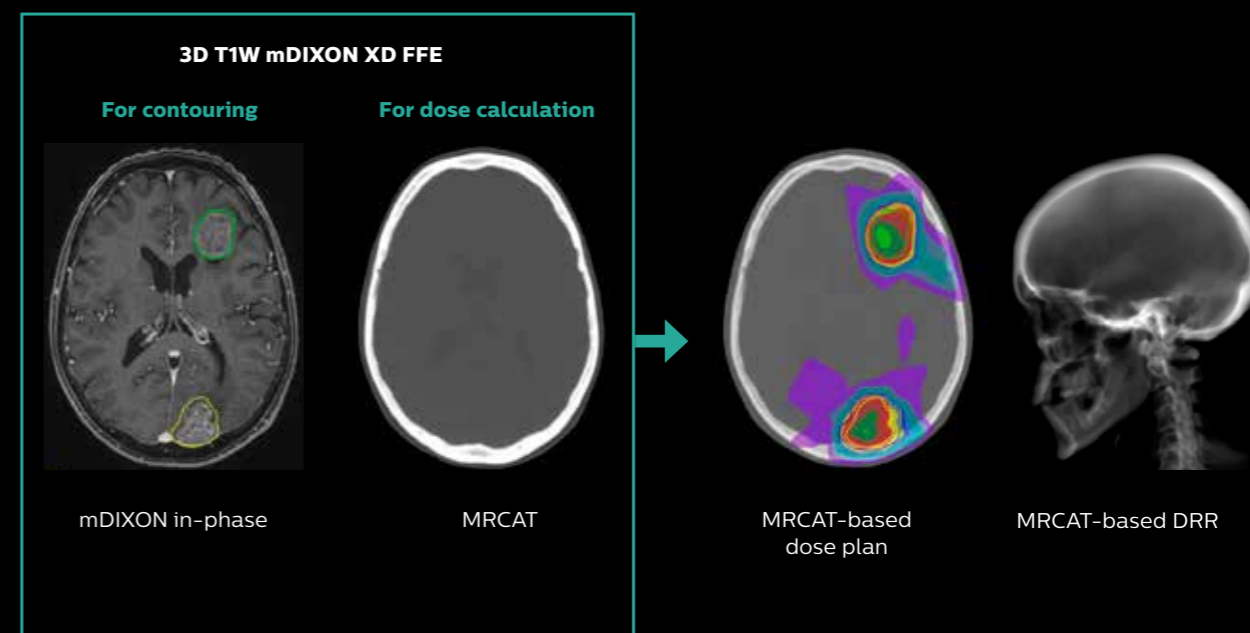
#### Automatic generation of synthetic CT images using AI

MRCAT Brain uses Artificial Intelligence (AI) for fast computation of MRCAT attenuation maps based on the mDIXON T1W scan. MRCAT generation takes place right on the MR console and provides continuous Hounsfield units for CT-like image appearance

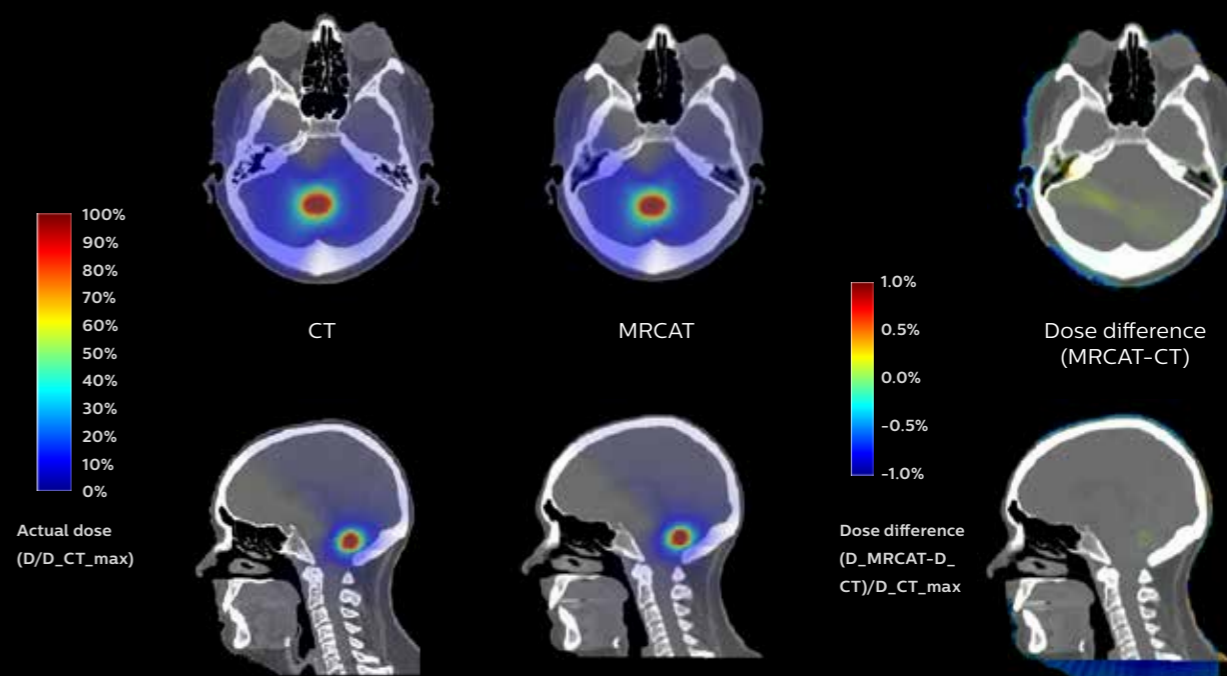


## MRCAT Brain at a glance

### Single scan approach



Validation studies have shown that MRCAT-based dose plans are robust and as accurate as CT-based plans<sup>2</sup>



## MRCAT Brain

Anatomy supported	Primary and metastatic tumors in the brain, including post-operative cases
Compatibility MR system	Ingenia 1.5T and 3.0T MR-RT, Ingenia Ambition 1.5T MR-RT and Ingenia Elition 3.0T MR-RT
Imaging protocol	Single, submillimeter resolution 3D T1W mDIXON XD FFE scan The MRCAT Brain scan is powered by Compressed SENSE. Typical scan time at 1.5T: 2:56 min. Typical scan time at 3.0T: 2:37 min. The MRCAT Brain scan is standardized and fixed for consistent MRCAT generation results The MRCAT Brain scan can be acquired and used before or after contrast agent administration
Coil configuration	Flex L coils in combination with Posterior coil AI-based computation of density maps Running parallel to image acquisition on the MR console
Computing system	Runs on dedicated high-performance GPU hardware
Density maps	Continuous Hounsfield units for CT-like image appearance
Export to treatment planning systems	MRCAT images are DICOM conform (CT)
Position verification	MRCAT Brain data can be used to generate MR-based digitally reconstructed radiographs (DRRs) for accurate <sup>2</sup> patient positioning at the Linac
Geometric accuracy – essential performance	<ul style="list-style-type: none"> <li>MRCAT provides <math>&lt; \pm 1</math> mm total geometric accuracy of image data in <math>&lt; 20</math> cm Diameter Spherical Volume (DSV).</li> <li>MRCAT provides <math>&lt; \pm 2</math> mm total geometric accuracy of image data in <math>&lt; 40</math> cm Diameter Spherical Volume (DSV)*</li> </ul>
CT equivalent dose plan/robustness	MRCAT-based dose plans are robust and as accurate as CT-based plans <sup>1</sup>



1 The mean dose in the PTV does not differ more than 1% in MRCAT-based plans as compared to CT-based plans for 95% of the patient cases 2 Accurate means: MRCAT-based DRRs are within 1 mm accuracy compared to CT-based DRRs for 95% of cases; 3 Accurate means: MRCAT image acquisition provides  $< \pm 1$  mm geometric accuracy of image data in  $< 20$  cm Diameter Spherical Volume (DSV) and  $< \pm 2$  mm 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

