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[1] dose calculations, and for accurate patient positioning at the linac[2].

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. This can lead to inconsistencies introduced during image registration and delineation steps.

There can also be a significant time difference between the moment of diagnostic MR imaging and delivery of the first fraction. During this time gap the tumor's shape may have changed significantly, outdating the plan and negatively affecting treatment quality.

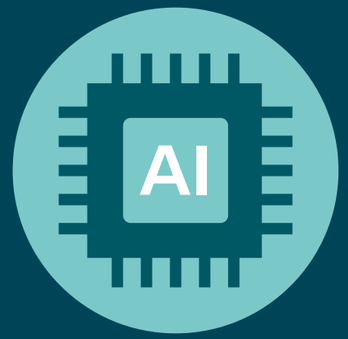
The single scan advantage
With Philips MRCAT (MR for Calculating ATtenuation) Brain, a single, fast mDIXON T1W scan provides information for both contouring and dose calculation for treatment planning. As anatomical and density information originate from the same scan, no image registration is required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

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 potentially 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[3] and verification studies have shown that MRCAT-based dose plans are equivalent[1] to CT-based plans, promoting confidence in dose planning.

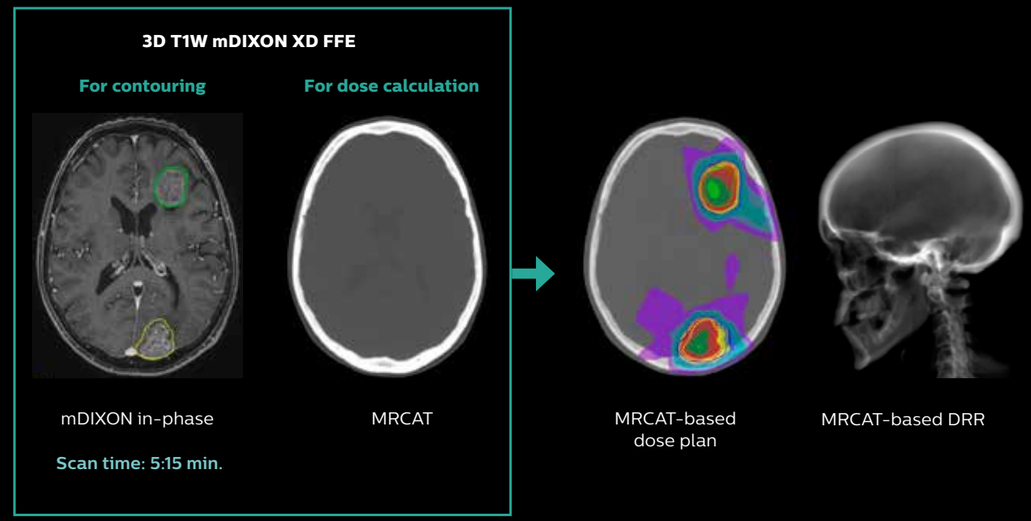
Seamless workflow integration
DICOM-CT conform, the MRCAT Brain dataset can be exported to treatment planning systems and used as the primary image dataset for dose calculations. You can also use the high-resolution MRCAT data for patient positioning at the Linac. Studies have shown that positioning verification is as accurate as with CT-based workflows[2]. 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

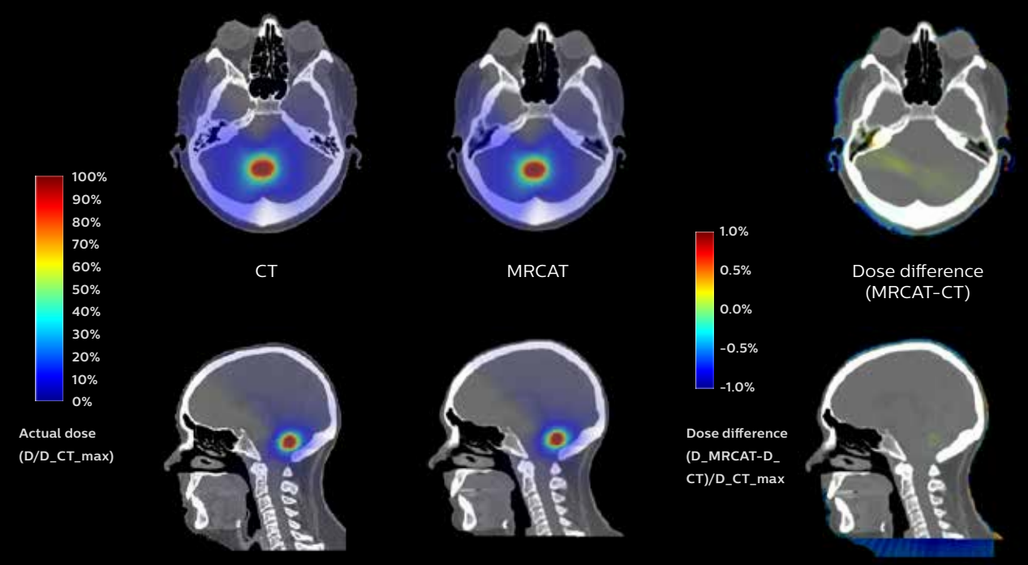


MRCAT Brain at a glance

Single scan approach



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



Images acquired on Ingenia MR-RT 1.5T

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 takes just a few minutes
	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[2] patient positioning at the Linac
Geometric accuracy – essential performance	• 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)*
CT equivalent dose plan/robustness	MRCAT-based dose plans are robust and as accurate as CT-based plans[1]

1 The mean dose in the PTV based on CT based plans does not differ more than 1% when simulated on MRCAT images as compared to when simulated on CT images 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 < ± 1 mm geometric accuracy of image data in < 20 cm Diameter Spherical Volume (DSV) and < ± 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

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